RF & MICROWAVE PRODUCT CATALOG

The Strongest Link to RF & Microwave Components

narda
microwave-east

an L3 communications company

Catalog 31

July 1, 1954
The Narda Corporation was incorporated. Narda introduces bolometers and hires its first employee; by December, sales exceeded $10,000 a month.

1959
Narda is now housed in four buildings in Mineola; 700 products are offered and 125 people are employed.

1961
Narda moves into its new 40,000 sq. ft. building in Plainview; the company catalog requires 170 pages.

1965
Narda acquires Microline product line from Sperry Rand Corp.

1967
Narda's first officially listed quotation on the American Stock Exchange; breaks ground for new facility in Melville, NY; new products include Model 4016 Ku-Band Miniature Coupler; Model 3074 Precision Reflectometer Coupler, and Model 445 RF Power Bridge.

1968
Narda doubles its space with its new building in Melville; computers come to Narda...sales growth demands a more sophisticated production scheduling system - including computer-controlled milling and drilling machines.

1969
World's first solid-state swept frequency generator introduced at IEEE show; Model 8100 Surveyor recognized by the I-R Competition as one of the 100 most significant industrial products developed in the U.S.

1978
Narda components are being supplied to ITT, Westinghouse, IBM, Sanders, Raytheon, General Dynamics, Northrop for integration in sophisticated weapons systems...Toshiba and Sharp use Narda Radiation Monitors...Narda's isotropic probes are used by the FAA, EPA, US Department of Labor, The office of Telecommunications and the military in the US and throughout the world.

1979
In its 25th year, Narda introduces the world's first 6-18 GHz low noise amplifier.

1981
Arthur J. Levitt, Jr., Chairman of the American Stock Exchange, addresses shareholders and employees at Narda's new 150,000 sq. ft. headquarters in Hauppauge.

1983
Loral Corporation acquires Narda in exchange for stock valued at $45,000,000. Narda continues to develop high performance safety products and components for military systems.

1989
Narda introduces the Nardalert Personal Monitor.

1993
Narda expands lines to meet growing needs of wireless communications; introduces 72000 Series VSWR Monitors (CATS).

1994
Lockheed Martin acquires Loral but Narda name survives and sales are strong.

1998
A group of former Loral executives purchase ten divisions of former Loral Corp. - including Narda - and form L-3 Communications.

1999
L-3 purchases the former W&G Safety Test Solutions operation in Germany from Wavetek and combines those products with Narda's safety products under the Narda Safety Test Solutions name.

2000
Low cost offshore manufacturing facility opens.

2004
Narda celebrates 50 years of leadership in RF and Microwave Technology.

2006
Narda Safety Test Solutions introduces NBM Series broadband survey meter.

2009
Narda Safety Test Solutions introduces SRM 3006 selective survey meter.

2010
Narda introduces new generation of Integrated Microwave Assemblies, utilizing proprietary multilayer printed board technology.

435 Moreland Road • Hauppauge New York 11788
TEL : (631)231-1700 • FAX : (631)231-1711
www.nardamicrowave.com • E-MAIL : nardaeast@L-3com.com

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The New Narda Catalog

With more than a half century of experience in the design, development and production of high performance RF components, RF Sub-Systems and Instruments, superior performance and long-term reliability has been and continues to be synonymous with the brand. Our complete and expanded product lines appear in this 2010 edition, collectively representing the world's most comprehensive RF and Microwave products catalog. In addition to full product specifications and outline drawings, our application notes and technical articles will help guide your product selections. As has always been the case, our local and factory based Sales Engineering and Customer Support Professionals are always available to provide the personalized assistance that you expect.

Ordering Information

The information in this catalog will, in most cases, be sufficient for you to select a particular Narda product. When additional technical information is required, or for pricing and delivery information, our website contains an actively updated list of our worldwide local representative offices. Visit www.nardamicrowave.com or www.narda-sts.us (for RF Safety Instruments) and click on the REPS or Contacts tabs as appropriate. While the factory can be contacted at 631-231-1700, or by email at Nardaeast@L-3com.com we very much appreciate on the involvement of our local representation in meeting your needs. Please see the important note just below for our customers located outside the United States.

Note: *For technical assistance and pricing and delivery for our customers residing outside the United States, our International Sales representatives are the single point of contact for our customers and all inquiries should be routed through those International Sales organizations accordingly. For those few regions where we are not represented, direct contact to the factory is acceptable, per the contact information above.*

When placing your order, please include the Narda model number, the frequency range of operation and the name of the product as it appears in the catalog. For example: **Model Number 4779-10 DC-18 GHz. 10 dB Fixed Attenuator.** As Narda can only guarantee the performance stated in the catalog, for the purchase of a catalog part, any non-standard features that may be required should be clearly identified on the purchase order. When such non-standard features are required, a dialog with Narda Sales engineering must take place to insure that there are no misunderstandings as to what is being provided, and of course to find the best method of achieving the non-standard feature that is desired.

Submitting Purchase Orders

Domestic United States Originated orders may be submitted by phone, or by fax or email on your Standard Purchase order Form directly to the factory or to the attention of your local representative. In either case, all orders should show the Narda Factory information below as the formal supplier of the goods to be purchased. Please see the note below regarding order placement for our International Customers.

Narda Microwave-East and L-3 Company

435 Moreland Road

Hauppauge, NY 11788

631-231-1700 (Phone)

631-231-1711 (by Fax)

nardaeast@L-3com.com (for components based products)

nardasts@L-3.com (for RF Safety Instruments)

Note: *For those purchase orders submitted from our International Customers, your order placement should be to the submitted to and in the name of the authorized Sales organization for your geographical area, or directly to the factory when Representation is not present in your area.*

Domestic Terms

Net 30 days, Ex-works, subject to credit approval unless otherwise specified. Shipments shall be C.O.D when made to unrated firms, unless credit account has been established or, when advance payment has been received. All major credit cards are accepted.

Export Terms

Full payment in advance of shipment by wire transfer, major credit card or via irrevocable Letter of credit confirmed by a United States bank. All prices are Ex-works unless otherwise specified.

Shipping Information

All sales are considered Ex-works unless otherwise specified. Any damage incurred during shipment should be settled between the customer and the carrier. Shipments from the point of origin will normally be made by Parcel Post, UPS, Federal Express, or Air Freight. Narda Microwave-East will choose the most appropriate means of transportation when carrier or method has not been otherwise specified.

Additional Information

Delivery on all items quoted stock is subject to prior sale, a quotation indicating an IN STOCK status cannot guarantee that said STOCK is available at the time of order. Quotations, Pro Forma Invoices Destination prices and shipping information required for pro-forma invoices or FAS, CIF or C&F quotations or importation assistance can be quickly obtained from your local Sales Representative or from the factory directly as necessary.

Payment of Invoices

US Currency Payments:

Send check to:

L-3 Communications Corporation

Narda Microwave-East

P.O. Box 13598

Newark, New Jersey 07188-0598

Send wire to:

JPMorgan Chase Bank, NA

1 Bank One Plaza

Chicago, Illinois 60673

ABA No. 071000013

Account No. 1039486

SWIFT Code No. CHASUS33

(L-3 Communications, Narda Microwave-East)

Euro Payments:

Send check or wire to:

Bank of America (Branch 6008)

26 Elmfield Road

Bromley, Kent BR1 1WA

United Kingdom

Account No. 600825572018

Sort Code No. 165050

IBAN No. GB36BOFA16505025572018

SWIFT Code No. BOFAGB22

(L-3 Communications, Narda Microwave-East)

Certificate of Conformance

A Certificate of Conformance is supplied with our packing list for all shipments this certification states the following:

"This material was produced in accordance with all applicable drawings and specifications and meets the contractually applicable quality specifications. All inspections and/or tests have been performed using equipment calibrated in accordance with the requirements of ANSI/ NCSL Z540-1. Documentary evidence in the form of the test data and/ or reports and inspection records are on file and available for

examination. Narda Microwave-East components and instruments are mercury free. Mercury is neither utilized nor present in our component or Instrument products, production processes or inventory locations."

Test Data Availability

Hard Copy test data as applicable and as available per device type and testing methods may be purchased for an additional 25.00 per unit. Test data requests must be requested at the time of order and an associated line item(s) with the applicable test data fee should be within the body of your ordering document. After the fact requests for test data are normally not acceptable.

Change Orders and Cancellations

Change Orders regarding price, delivery or any conditions not specified on the original order will be considered in effect after mutual agreement has been affirmed in writing between the customer and Narda Microwave-East. Cancellation of any accepted order shall only be accepted with the written consent of the factory. All cancellations will be dependent upon customer's agreement to satisfy all charges incurred by Narda Microwave-East in the performance of the order. Narda Microwave-East will endeavor to promptly "stop work" upon written notification of a cancellation request.

Repairs/Returns and Calibration Services

Repairs and recalibration of Narda Components and Instruments require that the product is returned to the factory. Before returning any component or instrument, the Narda Customer Service must be contacted such that a Return Material Authorization (RMA) may be issued for the return and subsequent repair or re-calibration of the goods. When requesting an RMA, you will asked to provide the model number, serial number and as much information as possible about the nature of the difficulty or reason for return. Once a repair or return has been approved, a RMA number will be assigned, this RMA number should be clearly denoted on the shipping container for routing on arrival. Estimates of repair and or calibration charges are provided to the customer before any work is done, unless otherwise directed. Returns must be shipped prepaid to:

Narda - an L-3 Communications Company

435 Moreland Road

Hauppauge, NY 11788

PLEASE PLACE RMA REFERENCE NUMBER ON THE OUTSIDE SHIPPING PACKAGNG

Application Engineering

Convenient local support is provided through Sales Representatives. They are well equipped to provide you with any product assistance you may require and to assist you with your special requirements and applications. In cases where special needs are to be met with special or catalog derivative solutions, the Narda factory shall assign special five digit model numbers so that variations on catalog performance or outline drawings may be properly documented. Additional costs and or lead times are normally associated with special product development and delivery.

Product and Price Changes

Although all information in this catalog was current at the time of publication, our continuing product improvement program requires that we must reserve the right to change specifications and or pricing without notice. ***The minimum acceptable purchase order amount is $100.00.***

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About Us - The Narda Story

Started in 1953, Narda Microwave-East is one of the ten original business units of L-3 Communications, a multi-billion dollar electronics company serving the military and commercial communication markets. For over 50 years, Narda has developed and manufactured state-of-the-art RF and microwave components, integrated microwave assemblies, subsystems and RF Safety Instrumentation. The company has positioned itself and maintains its position as a technology leader by offering advanced products in the frequency range of DC to 100 GHz for both commercial and military applications.

We maintain the world's largest inventory of RF and microwave components and instruments for rapid delivery of our products to our customer base. Products manufactured at our production facilities include PIN diode switches, switch filter banks, couplers, power dividers, attenuators, and RF mechanical switches that are suitable for a myriad of RF applications.

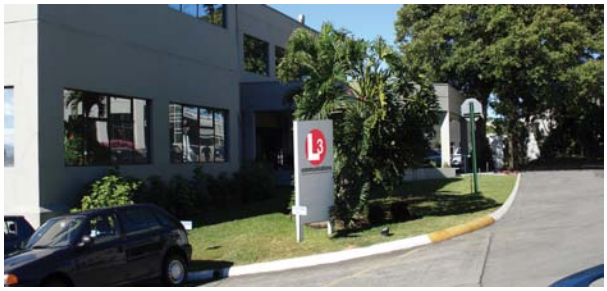
Narda also offers custom developed Integrated Microwave Assemblies (IMA's) which integrate and combine active and passive components. These products are typically custom designs for specific customer functionality requirements and include the integration of switches, filters, oscillators, synthesizers, amplifiers and many other components as required.

In addition to our custom and COTS components and IMA's, Narda manufactures our full line of RF Safety Instrumentation that characterizes RF levels for RF workers and the general public.

Facilities

With our 150,000 square-foot Hauppauge, NY and 20,000 square-foot offshore facilities, and our dedicated team of sales, design, production, and quality professionals, the Narda brand continues to be recognized as a trusted and field proven choice for custom or catalog off-the-shelf RF components and instrumentation. All product design/prototyping, production control and procurement originate at the Hauppauge facility while manufacturing and test utilize the NY and offshore production resources. In addition to its standard production and test environments, clean room manufacturing facilities are maintained at both manufacturing locations. Additional combined capability highlights are described in the following page.

Narda Microwave-East 150,000 square foot facility in Hauppauge, NY.



Offshore manufacturing facility.

Engineering Design Tools

- Advanced Design and Simulation Software Packages
- High Frequency Structure Simulator
- Component Synthesis Software, Design and System Budget Calculators
- 40 and 60 GHz Vector Network Analyzers with converter group delay module

Special Process Manufacturing

- Photo Etch of Substrate Circuitry
- Laser Seal (NY Facility)
- Sputtering (Gold Germanium)
- Vacuum Deposition
- Paint and Seal
- Environmental Testing Facilities

Test and Measurement Capabilities

- Production in Process Testing DC to 50 GHz
- ATE Suite for Instrument Calibration Services
- IM Test Capability
- Classified and Non-Classified Designated Test Areas

Quality Assurance Management

The Quality Assurance System at Narda is in full conformance with ISO-9001:2000. Originally certified in 1996 to ISO 9001:1994, Narda's registration was upgraded to the ISO 9001:2000 version of the standard in May 2003. We received our AS-9100 certification in the summer of 2009. Our Quality System's heritage is based upon MIL-Q-9858 and MIL-I-45208. The company also complies with the workmanship standards in MIL-STD-454, and maintains a calibration system to ANSI/NCSL Z540-1-1994. Narda's QA System is approved by over 100 companies including most of the major top tier defense and commercial equipment providers. A bulletined highlight of our quality system components appears below.

- ISO 9001 - 2000 Certified
- AS 9100 Certified
- Assists in Supplier Management
- Reliability Engineering
- Over 50 Internal Audits Performed Annually by Trained Auditors
- Audit Results Reviewed by ISO Management
- Soldering is performed and inspected by IPC Certified individuals
- Plating is verified by XRF technology
- Product Conformance Testing
- Design Verification
- Special Environmental testing performed in house, or at approved external facilities
- First Article and Group B Services
- In Process Inspection
- Verification Testing
- Documented ESD Control Plan

Design and Drafting

- Manufacturing Engineering
- Dedicated Design Center (CAD/CAM)
- Mechanical Design
- Layout

Material Control and Procurement Systems

Production and material is controlled by the Narda ERP System (Visual Manufacturing) and by a set of defined procedures maintained by department management. The Visual system allows traceability of material throughout the manufacturing process as well as providing historical data via the Visual Manufacturing database. The material flow sequence can be loosely broken up into (3) discrete sections; Front Office (Sales and Contracts), manufacturing operations, and back office (shipping and accounting).

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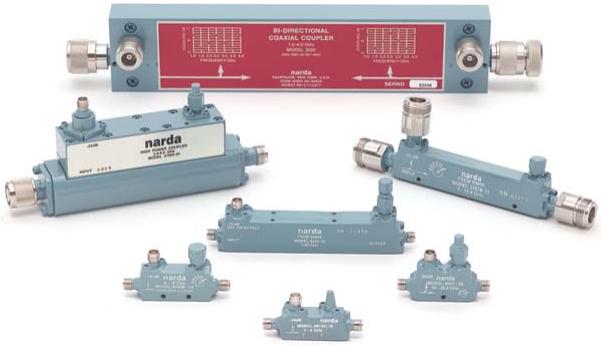
Catalog Products

We build our catalog products to an industry forecast and inventory over 1000 different models. Most models are in stock, and if not, are available on a defined schedule.

- **Couplers**
- **Power Dividers & Hybrids**
- **PIN Switches**
- **Mechanical Switches**
- **Attenuators**
- **Terminations**
- **Additional Passive Components**
- **PIN Limiters**

Couplers



- **Millimeter Wave Ultra-Broadband Couplers**
  - **Models covering 18 to 40 GHz, 1 to 40 GHz and 1 to 60 GHz**
- **Miniature SMA Couplers**
  - **.5 to 26.5 GHz, octave, multi-octave and maximally flat models**
- **Type N Broadband Directional Couplers**
  - **.25 to 12.4 GHz, octave, multi-octave and maximally flat models**
- **Type N Dual Directional Reflectometer Couplers**
  - **Multi-octave bands from .05 to 8 GHz**
  - **High power, high directivity**
- **High Power Directional Couplers**
  - **Covering 2 to 8 GHz, 2 to 18 GHz, 6 to 18 GHz bands**
  - **Power levels to 1000 W CW**
- **Economical Couplers for Cellular and PCS Applications**

Power Dividers & Hybrids

- **Wireless Band Power Dividers/Combiners**
  - **800 to 2500 MHz, 2-way to 16-way modules**
- **SMA 3-Way Power Dividers**
- **SMA 2-Way and 4-Way Power Dividers**
  - **Octave, multi-octave units in .5 to 26.5 GHz bandwidths**
- **Multi-Octave Type N Power Dividers**
  - **2 to 8 GHz, 6 to 8 GHz and 2 to 18 GHz bandwidths**
- **Ultra-Broadband SMA Power Dividers**
  - **.5 to 6 GHz, .5 to 18 GHz bandwidths, 2, 4, 8-way**
- **SMA and Type N Multi-Octave 90 and 180 Hybrids**
- **Specialized Devices for High Power Dividing and Combining Operations**

Overview of RF and Microwave Components

PIN Switches

- PIN Switches
  - 0.5 to 18 GHz
  - SPST to SP6T, transfer
  - Reflective and absorptive
  - Integral drivers
- High-Speed Switched Bit Attenuators
- Switched Filter Banks
- Custom Switches
  - Up to 26.5 GHz
  - SPST to SP25T
  - High power switches
  - Full military specifications
  - Mil Std 883 screened

Mechanical Switches

- SEM Series – Stocked Electro Mechanical Switches
  - DC to 18 GHz
  - SPST to SP6T, transfer
  - Reflective and absorptive
  - Integral drivers
- Standard Custom Switches
  - DC to 26.5 GHz
  - SP2T to SP12T, transfer
  - Wide range of options

Attenuators

- Type N Fixed Coaxial Attenuators
  - Frequency range: DC to 18 GHz
  - Power: 2 or 5 W (average)
  - Choice of attenuation values up to 50 dB
- Miniature Fixed Attenuators
  - Frequency range: DC to 40 GHz
  - SMA and 2.9 mm connectors
  - Attenuation: up to 60 dB
- Type N High & Medium Power Attenuators
  - Frequency range: DC to 18 GHz
  - Attenuation: up to 30 dB
  - Power: up to 150 W average
- Thumbwheel & Panel Mount Step Attenuators
  - Frequency range: DC to 18 GHz
  - Type N or SMA female connectors
  - Attenuation: up to 69 dB
  - 1 dB or 10 dB Increments
- Low Cost Step Attenuators
  - Frequency range: DC to 2.5 GHz
  - Attenuation: 0 to 10 dB 1 dB steps, 0 to 50 dB 1 dB steps, 0 to 70 dB 10 dB steps

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- Variable Attenuators
  - Frequency range: 4 to 26 GHz
  - Connectors: SMA or Type N
  - Attenuation: up to 35 dB

Terminations

- Millimeter Wave Ultra-Broadband Couplers
  - Frequency range: DC to 50 GHz
  - Connector 2.9 mm
- SMA Coaxial Fixed Termination
  - Frequency range: DC to 26.5 GHz
  - Power: up to 10 W average
- Type N Coaxial Fixed Termination
  - Frequency range: DC to 18 GHz
  - Power: up to 500 W average

Additional Passive Components


Circulators & Isolators


DC Blocks


Adaptors


Phase Shifters

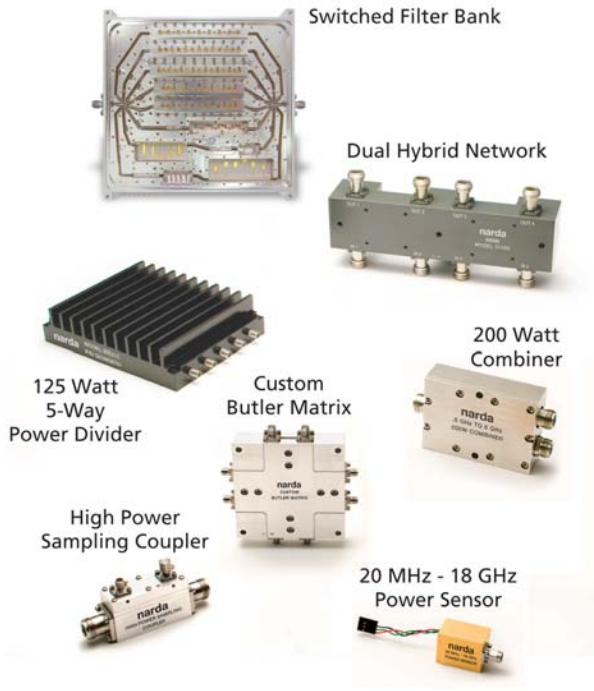

Detectors


Standard Gain Horns

PIN Limiters

- Narrowband and Wideband Versions
- Frequencies up to 18 GHz
- Up to 600W of Pulsed Power
- Fast Recovery Time
- Small Size
- Available as a Stand Alone Part or in an Integrated Assembly

Custom Engineered Components & Networks



In addition to providing off-the-shelf catalog products, Narda has been supporting customers for decades with custom-engineered solutions. The most mutually beneficial solution (for the customer and Narda alike) is the selection of a catalog product; however, we continue to support our customers when special models are required. It is not always practical to provide a custom product for a small-quantity and one-time requirement. Product specifications that involve a reasonable first-order quantity and follow-up potential are welcomed.

Environmental Performance

Environmental specifications for Stripline Directional Couplers, Attenuators, and Power Dividers as applicable.

Parameter	Specification
Operating Temperature	-54 to +105°C
Storage Temperature	-55 to +125°C
Humidity	Per MIL-STD-202F, Method 103B, Condition B (96 hours at 95% R.H.)
Shock	Per MIL-STD-202F, Method 213B, Condition J (30G, 11 msec)
Altitude	Per MIL-STD-202F, Method 105G, Condition B (50,000 ft)
Vibration	Per MIL-STD-202F, Method 204D, Condition B (.06" double amplitude or 15G, whichever is less)
Thermal Shock	Per MIL-STD-202F, Method 107D, Condition A (5 cycles)

Note: This is an exclusive listing. Where otherwise noted in the catalog, the above environmental performance may not apply. Not applicable for those products designed for commercial applications. Many of our catalog off-the-shelf (COTS) products have the ability to withstand considerably more stringent environments. If you have special environmental requirements, please contact the Sales Department at Narda.

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Narda Safety Test Solutions is recognized as the world leader in non-ionizing radiation safety equipment. The company holds more than 95% of the patents in the industry. Products are now available to accurately measure electromagnetic fields from a few Hertz to over 100 GHz, as well as, static magnetic fields. RF personal monitors cover 100 kHz to 100 GHz and area monitors detect energy from 50 Hz to 100 GHz.

User Support

Narda-STS User Support Includes:

- **Equipment and application consultation by our worldwide sales network**
- **Repair and calibration service**
- **Expert advice on standards and recent developments**
- **Training and measurement services**

Just Power-On and Measure

Simple operation is critical when you need dependable results. This requires device technology that simplifies the complex measurements found in EMF (Electro-Magnetic Field) applications. With any device you purchase from Narda-STS, the basic principle is: Just Power-On and Measure.

Quality and Compliance

All Narda-STS measurement products are built for use under demanding environmental conditions. Rugged construction enables them to stand up to high-level fields even as they weather the physical punishment often encountered in onsite locations.

Quality and adherence to international standards are reflected in the CE mark that appears on every Narda-STS product and the ISO 9001-compliant production facilities in Italy, Germany and the US where all equipment is manufactured. All Narda-STS products are calibrated to comply with the country-specific standards of their users.

RF Radiation Safety Training

Narda-STS can provide unequaled educational materials and training for your company. You will find public seminars and courses that address different industries as well as custom corporate training programs using live instruction or CD-,VCR-, and DVD- based content.

Products

Low Frequency-DC Static Fields (0 Hz) To 400 kHz

Like all Narda-STS equipment, the low frequency product line delivers excellent measurement reliability. All instrument functions were designed for direct and reliable testing. Precision measurements of low frequency fields are required in the following industries:

- Power Generation and Delivery (50/60 Hz)
- Electric Railway Lines
- Smelting Furnaces
- Welding Systems
- Medical Systems (e.g., MRI)

THM1176 - This product measures static magnetic fields as well as modulated magnetic fields up to 1 kHz. Ideally suited for medical device and MRI measurements, the sensor can be supplied with or without a PDA to display readings on. Either way, software is provided for direct readout on Net books and computers.

EHP-50C - Designed for high precision measurement of E and ? fields from 5 Hz to 100 kHz. This field analyzer can operate in a data logging mode or with the supplied software, through a 10m fiber optic cable to display real-time spectrum information on a PC. With it's wide dynamic range and exceptional accuracy, ELF/VLF fields are easily measured.

ELT-400 - The first low frequency measurement device that can be used by engineering and safety personnel. This new system measures the magnetic field required for certification of products destined for Europe. Safety personnel can use the ELT-400 to verify magnetic field limits recommended by the new IEEE C95.6 standard.

EFA-200 and EFA-300 - The EFA-200 (Magnetic only) and EFA-300 (Electric and Magnetic) set the testing standard for low frequency devices. These units offer exceptional accuracy and overall performance for testing occupational exposures to ELF/VLF frequencies.

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RF and MICROWAVE - 100 kHz to 100 GHz

Narrowband Meters

EHP-200 - A stand-alone solution for measurements of fields from 9 kHz to 30 MHz is the new EHP-200. This fiber-optically isolated sensor measures both E and H fields over a wide dynamic range and displays them on a computer through a 10-meter cable. This design allows repeatable field measurements thanks to the supplied non-metallic stand, and theEHP-200 also features excellent accuracy.

SRM-3006 - Narda's second generation narrowband meter features a full color display, built-in GPS and a frequency range of 9 kHz to 6 GHz. This system is outstanding for determining FCC 5% boundaries and detecting low level signals that broadband equipment can't distinguish.

Broadband Meters

8500 Series - Features digital meters and dual-field probes. The 8513 is excellent for measurements on heat sealers and vinyl welders, while the 8511 covers a wider frequency range for testing most semiconductor systems.

NBM Series - Narda's new NBM series of meters and probes provide unequalled performance for broadband measurements. Either the NBM-520 or -550 meters can be used with11 different E or H field probes. This revolutionary system features rugged, lightweight design with incredible displays and intelligent probes.

PERSONAL MONITORS

Narda offers two families of RF/microwave personal monitors- The RadMan and Nardalert XT series. These products perform similar tasks in different ways.

RadMan - The RadMan offers broad frequency coverage for both the electric (E) and magnetic (H) fields. Utilizing dipoles (E) and loops (H) with diode-based detection and a housing that allows isotropic detection (when used off the body), this system can be used as more than a monitor. When operating it off the body, its isotropic features allow you to make field strength measurements. Coupled to the optional ESM-TS software and cable package, real-time readings can be displayed on a computer. We also offer the ESM-30 which adds a data logging capability. For utility workers, Narda offers the ESM-30, ELF-Immune model. This unit incorporates special coatings to allow proper RF field detection even while immersed in a 125 kV/m powerline (50/60 Hz) frequency field. Narda recommends the RadMan to technicians and engineers for off-body use.

Nardalert XT - The Nardalert XT series was recognized by R&D Magazine as one of the 100 most significant new designs of 2002. Nardalert monitors employ three different detectors, a surface charge sensor, dipole and thermocouple elements. These detectors give the Nardalert a very wide frequency range of operation - 100 kHz to 100 GHz. Updated electronics provide the user with instant knowledge of field levels, thanks to its top-mounted LEDs and audible and/or vibration alarms. The Nardalert XT also has data logging and ELF-Immune models. There is also a high power model to accommodate RF safety clothing. All models allow alarms to be varied through optional software and the rate of data logging can be changed on models with that feature. The Nardalert XT has perfected the RF personal monitor making it an exceptional monitor for wearing on the body. An optional climber pouch keeps it on the body and its sensor technology allows true RMS average detection, even in the presence of pulse-modulated signals.

AREA MONITORS

SMARTS II - The SMARTS II monitors feature wideband operation (2 MHz to 100 GHz) that is ideally suited to high power, indoor applications, such as satellite uplink amplifier rooms, industrial process machines employing high power RF, and military system test stands.

2600 System - For outdoor applications, the Narda 2600 system is alone in its field. At a height of only 29 inches, and a weight of just 11 lbs., this wireless system can be mounted outdoors for power or communication. Solar panels provide all the energy it needs and the standard GSM modem provides wireless communication capability. With this new design, outdoor environments can be continuously measured down to 1 V/m. When fields that exceed the owner-set threshold are detected, the 2600 can be programmed to call pre-set phone numbers and/or modems to transfer historical field readings. Available sensors include 20 Hz to 3 kHz, 500kHz to 3 GHz and 1 MHz to 18 GHz.

Narrowband Systems

Narda-STS can also supply designs based on the upcoming 8060 Series of narrowband monitors. *Contact the factory for more details.*

For detailed RF Safety information, refer to your local sales representative or visit www.narda-sts.us.

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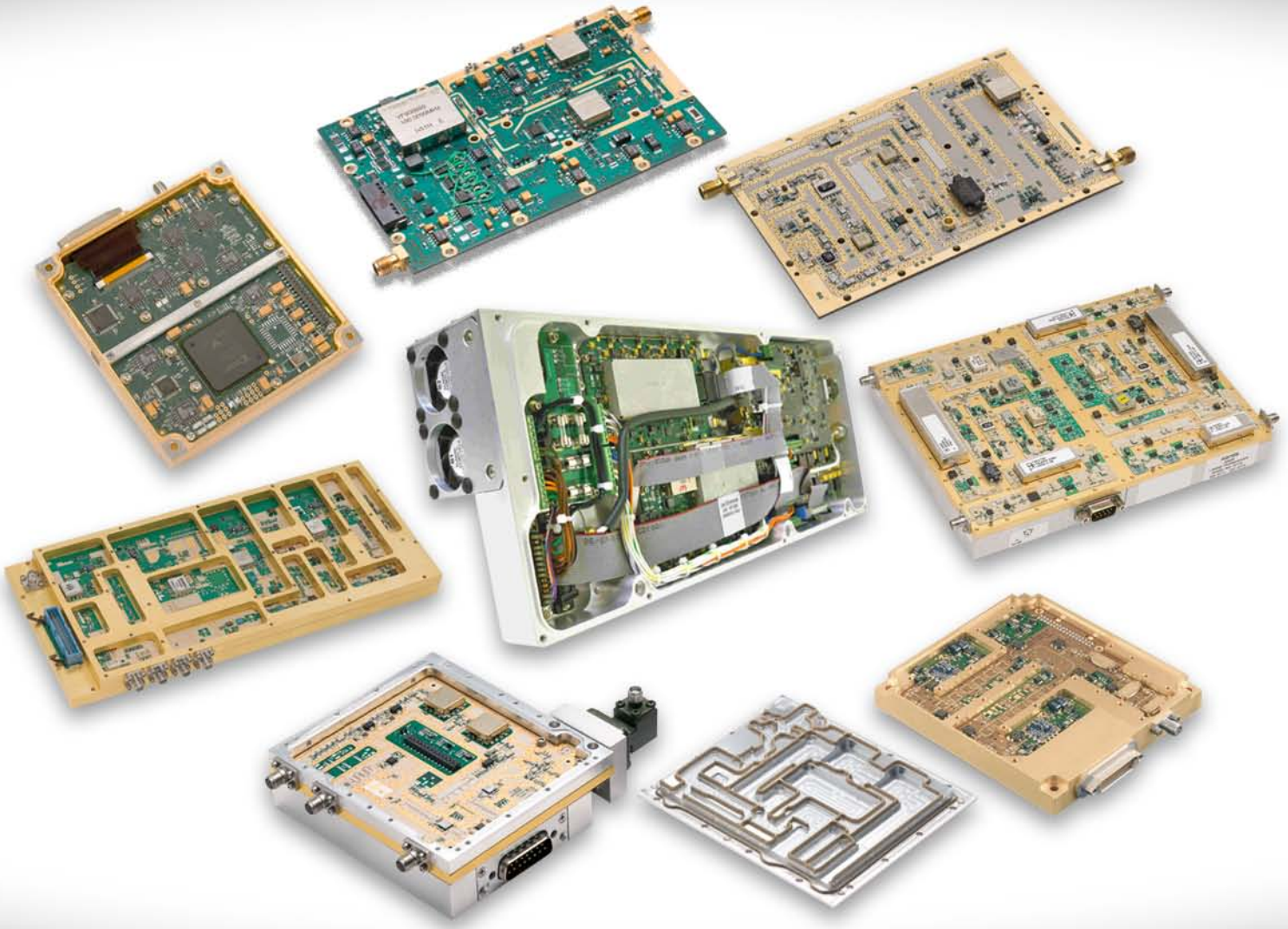
INTEGRATED MICROWAVE ASSEMBLIES



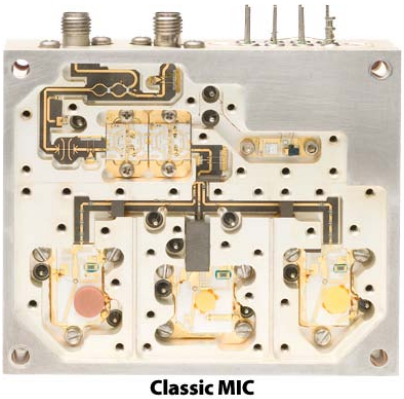
narda
microwave-east

an L3 communications company

Integrated Microwave Assemblies (IMA's)

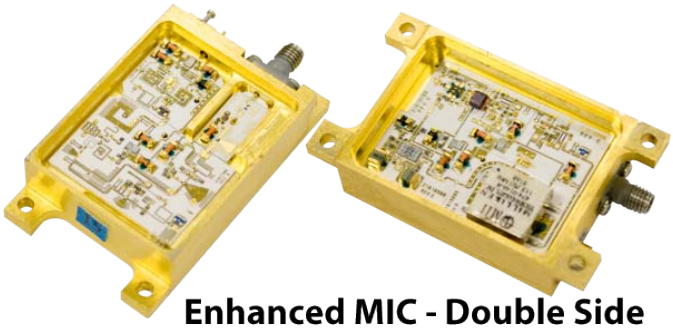
Narda has been a pioneer in the design and manufacture of *Integrated Microwave Assemblies (IMAs)* for more than 30 years.

Narda's first IMAs were **Classic MICs** and were designed for EW receivers. These products created multi-functional performance by combining individual circuits fabricated on alumina carriers in a precisely machined aluminum package. Many of these MICs are still in service and in production today.



Classic MIC

Narda enhanced this capability creating doubled sided configuration which allowed the use of more functions in a smaller space and also configurations which took advantage of soft board carriers in addition to the traditional alumina substrates. These **enhanced MICs** are offered today for the integration of simple IMAs assemblies of several circuit functions. Combinations of switches, amplifiers, filters and passive components are typical.



Enhanced MIC - Double Side

Enhanced MIC
Mixture of soft boards/Alumnia circuits

In the last few years, Narda has further advanced the state-of-the-art in these products by replacing the MIC approaches with its new **MMC (multilayer microwave circuitry)** technology. **MMC** uses multilayered PC boards to interconnect microwave devices (MIC, SMT, or MMIC configurations) with bias circuits and digital processing components. Complex Integrated Microwave Assemblies (IMAs) are constructed using a single multilayer board with the microwave circuitry on the top side and the control circuitry, conditioning and DSP circuits on the bottom. Connections from top to bottom are made with VIA holes as appropriate.

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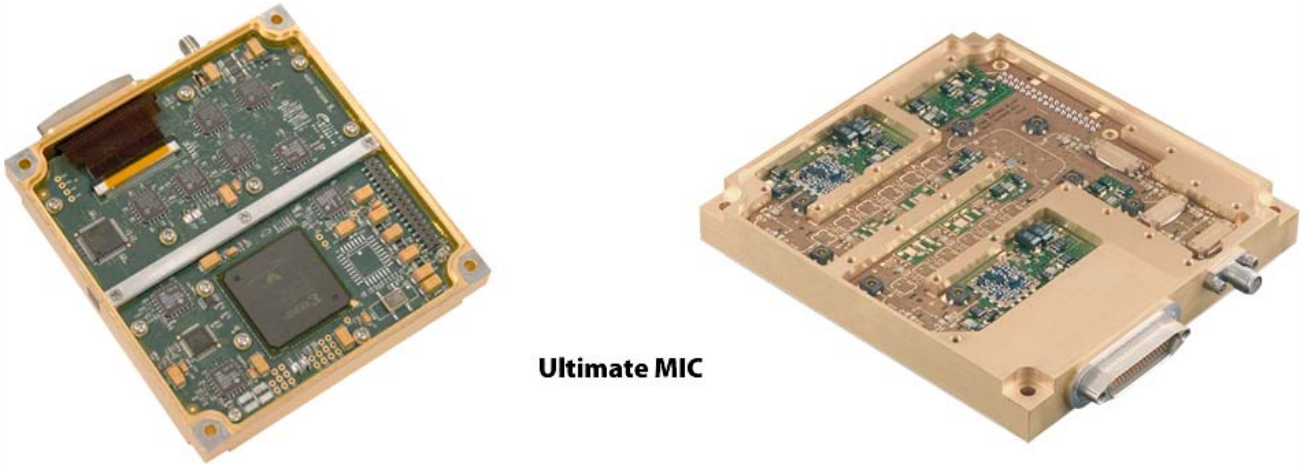
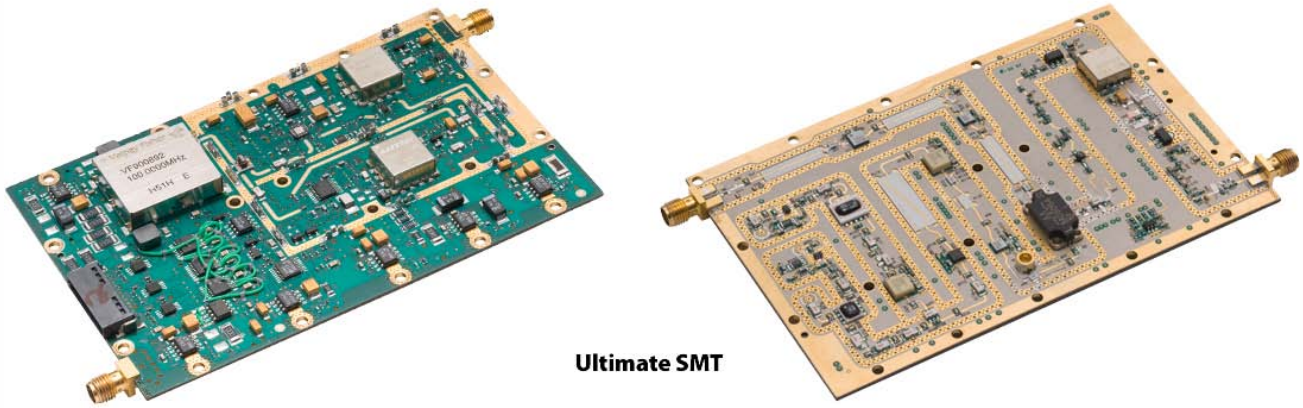
Narda's new Ultimate **MIC™** are examples of products that use this **MMC** technology to combine microwave hybrid manufacturing with digital devices to produce levels of performance in footprints unrivaled by conventional techniques.



Ultimate MIC

Narda's **Ultimate SMT™** use the **MMC** technology to combine standard SMT components with devices that are assembled using microwave integrated circuit (MIC) chip and wire techniques again resulting in small, low-cost yet high-performance subsystems.



Ultimate SMT

Today Narda produces IMA products that operate in the 500 MHz to 50 GHz frequency range and come in two basic types of product.

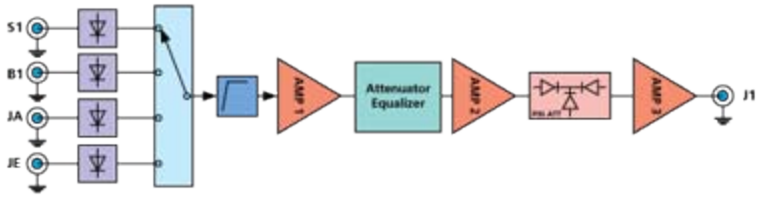
IMA Modules

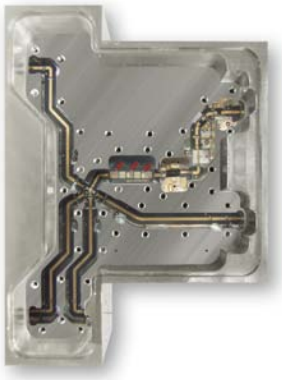
These products are supercomponents which integrate two or more microwave component into a functional assembly. Typical products are:

- **DROs/Phased-locked DROs**
- **Frequency synthesizers**
- **Arbitrary Waveform Generators**
- **Special Amplifiers**
- **SATCOM Up/Down Converter Modules**
- **LNAs and SSPAs**
- **PIN Switch Assemblies**
- **Switched filter banks**

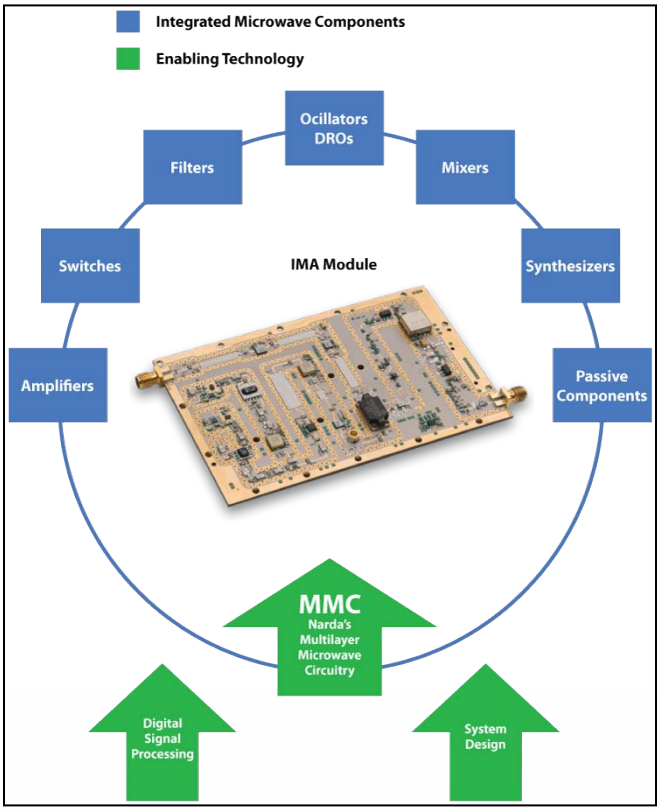
Integrated Microwave Assemblies (IMA's)

The basic Integrated Microwave Assemblies which combine a few RF assemblies are built using **Narda's Enhanced MIC** approach. An example is shown below.





Narda's **MMC** technology allows the creation of more complex high performance IMA modules with tightly controlled I/O locations and unusually small form factors facilitating integration into complex next level assemblies. This **MMC** capability coupled with DSP technology, microwave component design competence and complex circuit design experience yields the ultimate in device realization.



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Integrated Microwave Assemblies (IMA's)

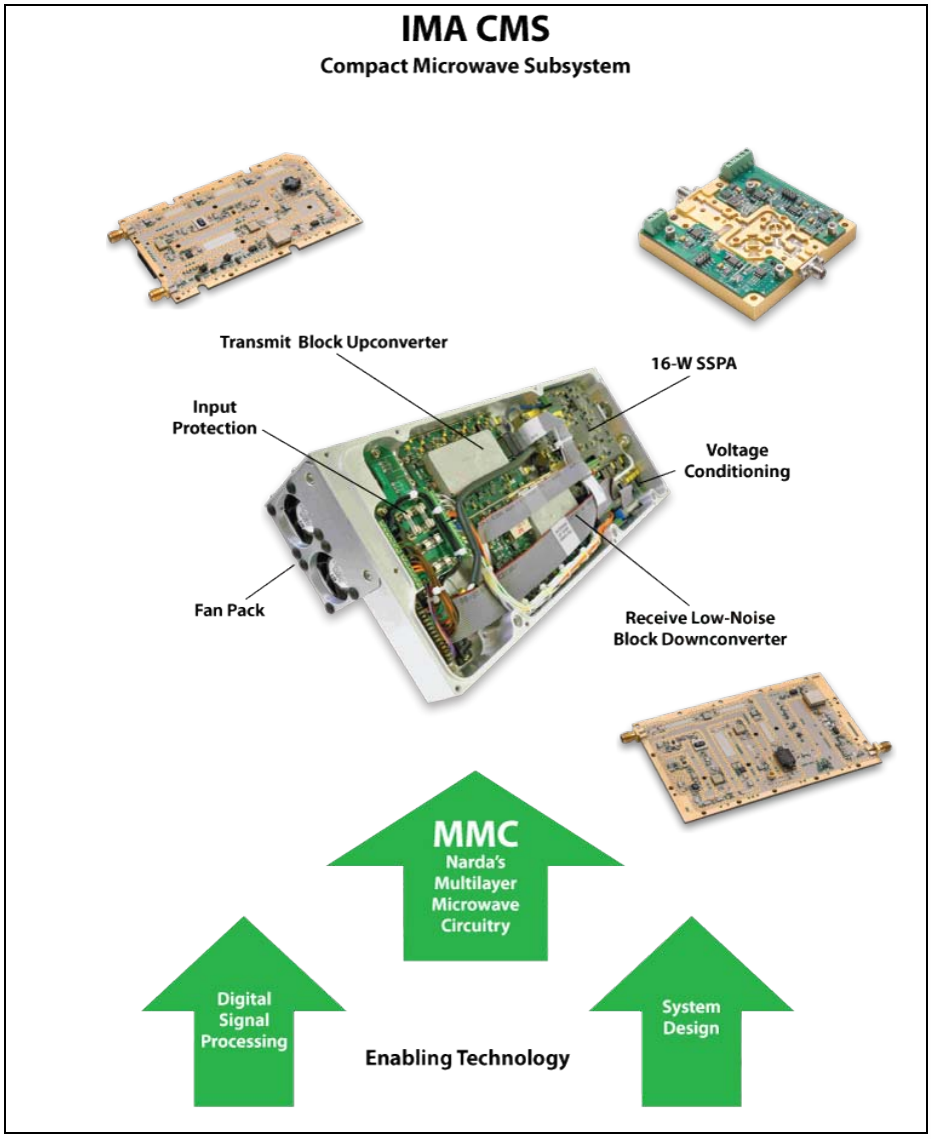
IMA CMS – Compact Microwave Subsystems

Narda's **CMS** products are higher level multifunctional assemblies often performing a complete subsystem task. These products incorporate combinations of its IMA modules with related processing, power sources, cooling and mechanical enclosures. Representative **CMS** products include:

- **Complex Frequency Sources**
- **Transceivers**
- **Up/Down Converters**

Narda's **CMS** products offer state-of-the-art performance and size because of the key core technologies employed.

- **Unique and powerful MMC integration technology**
- **Comprehensive design capability covering all type of microwave devices**
- **Complete understanding of higher level integration with strong in-house DSP and system engineering**



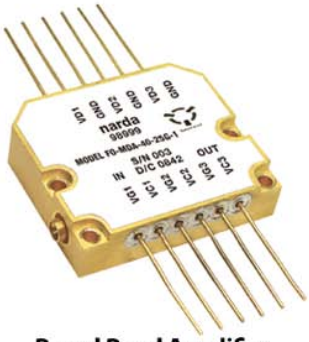
The production of reliable, high performance IMA modules and subsystems requires considerable resources and effort with the right combination of process, tools, and talent. Narda, with over 55 years of RF and microwave experience, has these resources, and can offer IMAs manufactured in state-of-the-art facilities that continually provide the standards of reliability and performance that exemplify the Narda name. Narda looks forward to serving your IMA needs as they arise. Please contact your local Narda Sales professional for additional information.

IMA Modules

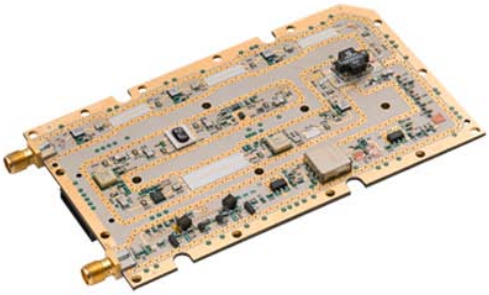
Dual Phase Locked PLDRO

X Band SATCOM Synthesizer

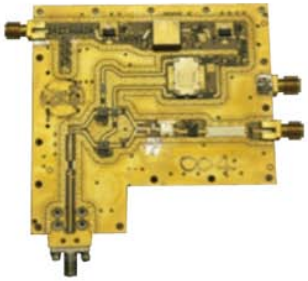
Programmable Frequency Source



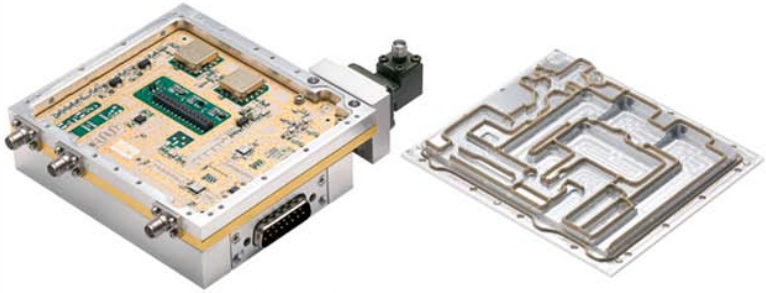
Broad Band Amplifier



Ku Band Block Down Converter

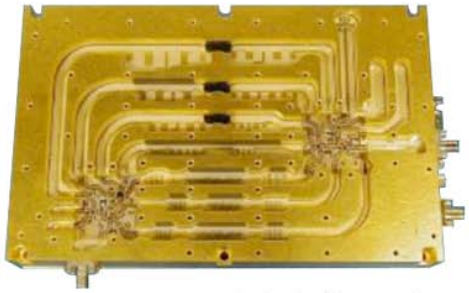


Ka Band Block Down Converter

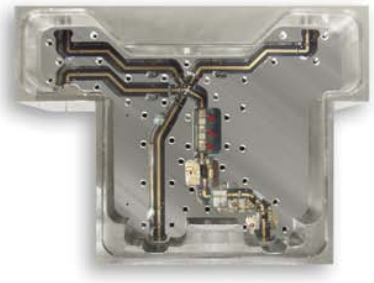


Ka Band Block Down Converter

Ku Band SSPA



10 MHz to 20 GHz Switched Filter Bank



Simple IMA

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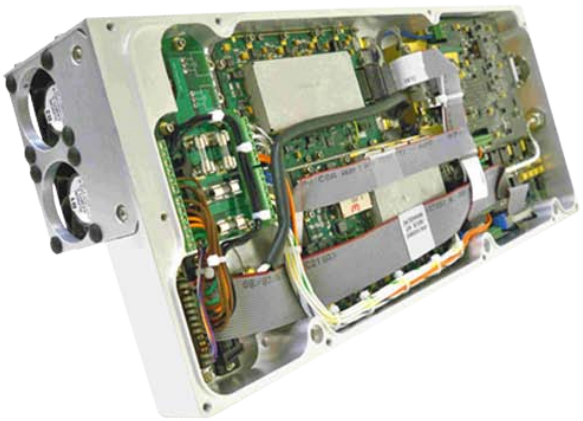
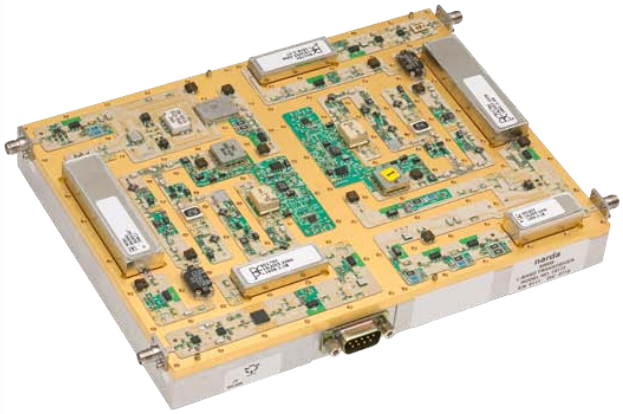
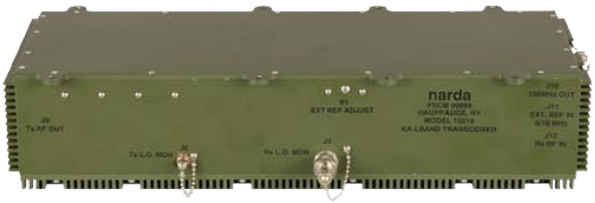
IMA CMS — Compact Microwave Subsystems



Ka Band SATCOM Transceiver



70 MHz to L Band Transceiver



L Band to Ka Band Transceiver

SATCOM Quad Band Up/Down Converter

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PASSIVE COMPONENTS

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an L3 communications company

Table of Contents

High Power Components

DIRECTIONAL COUPLERS, HYBRIDS, TERMINATIONS AND ATTENUATORS

Narda offers a broad range of high power passive products which are widely used in power test equipment and for military systems requirements. Many of the Narda high power passive products are available as catalog-stock items and are described in the appropriate section of this catalog. Special high power products are also available in which Narda has an established design it manufactures in reasonable quantity but, due to the unique or limited requirements, the product is only produced on a custom- order basis.

Important facets of Narda high power passive products are drawn from:

Power Test Facility: The high power test laboratory at Narda's Hauppauge facility provides the resources to perform both Narrowband and Broadband testing for new product development, our customers' special testing requirements, and our own total quality programs.

Environmental Testing and Quality Assurance: The Narda high power product can be tested on the premises under the rigors of most severe MIL-SPEC requirements. Routine in-house tests include temperature-cycling, thermal shock, and random vibration. As a supplement to our in-house capabilities, Narda has well established relationships with several local area **Certified** Environmental Laboratories.

Narda's Quality Assurance Program meets the requirements of ISO 90001-2000.

From a flight-qualified high power product for a complicated EW System to an unconventional device to handle extraordinarily high microwave power for a commercial transmitter, Narda has the resources to meet your high power passive product requirements.

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HIGH POWER PASSIVE COMPONENTS

MODEL NO./ DESCRIPTION	FREQUENCY RANGE	AVG PWR RATING	CONN
Attenuators			
752 Series	DC-3 MHz	5 W	N
765 Series	DC-5 GHz	50 W	N
769 Series	DC-6 GHz	150 W	N
776C Series	DC-18 GHz	50W	N
4776 Series	DC-18 GHz	4.5W	SMA
Directional Couplers			
3000-30	225 MHz-460 MHz	500 W @30 dB	N
3001	460 MHz-950 MHz	200 W@10 dB	N
		500 W@20/30 dB	N
3002	950 MHz-2 GHz	200 W@10 dB	N
		500 W @20/30 dB	N
3003	2 GHz-4 GHz	200 W@10 dB	N
		500 W@20/30 dB	N
3004	4 GHz-10 GHz	200 W @10 dB	N
		500 W@20/30 dB	N
3045C	7 GHz-12.4 GHz	100 W	N
4196-20	6 GHz-18 GHz	100 W	SMA
30300D	820 MHz-960 MHz	500 W CW	N
30470	820 MHz-960 MHz	500 W CW	N
30600	820-980 MHz	500 W	N
27000	2 GHz-18 GHz	400 W	N
27001A	6 GHz-18 GHz	400 W	N
27002	2 GHz-8 GHz	400 W	N
27003	2 GHz-18 GHz	400 W	TNC
27004A	6 GHz-18 GHz	400 W	TNC
27005	2 GHz-8 GHz	400 W	TNC
27002SC	2 GHz-8 GHz	1000 W	SC
27005SC	2 GHz-8 GHz	1000 W	SC90°
Quadrature Hybrids (Power Splitters)			
3322	820 MHz-980 MHz	500 W	N
3032	950 MHz-2 GHz	200 W	N
3033B	1.7 GHz-4.2 GHz	200 W	N
4096	6 GHz-18 GHz	125 W	SMA
4306	6 GHz-18 GHz	75 W	SMA
Terminations			
369BNM	700 MHz-18 GHz	175 W	NN
368BNM	2 GHz-18 GHz	500 W	N

Environmental Performance for Selected Passive Products

Applicable to the following products: Stripline Directional Couplers, Attenuators, Power Dividers

Parameter	Specification
Operating Temperature	-54 to +105°C
Storage Temperature	-55 to +125°C
Humidity	Per MIL-STD-202F, Method 103B, Condition B (96 hours at 95% R.H.)
Shock	Per MIL-STD-202F, Method 213B, Condition J (30G, 11 msec)
Altitude	Per MIL-STD-202F, Method 105G, Condition B (50,000 feet)
Vibration	Per MIL-STD-202F, Method 204D, Condition B (.06" double amplitude or 15G, whichever is less)
Thermal Shock	Per MIL-STD-202F, Method 107D, Condition A (5 cycles)

Note: This is an exclusive listing. Where otherwise noted in the catalog, the above environmental performance may not apply. Not applicable for those products designed for commercial applications. Many of our catalog off-the-shelf (COTS) products have the ability to withstand considerably more stringent environments. If you have special environmental requirements, please contact the Sales Department at Narda.

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ADAPTERS

Quick Reference Guide

Frequency Range (GHz)	Connector	Model No.
Adapters		
DC-26.5	3.5mm-F to 3.5mm-F	69
DC-26.5	3-5mm-M to 3.5mm-M	70
DC-26.5	3.5mm-M to 3.5mm-F	71
DC-18	SMA-F to Type N-M	55
DC-18	SMA-M to Type N-M	56
DC-18	SMA-M to Type N-F	57
DC-18	SMA-F to Type N-F	58
DC-18	SMA-F to SMA-F	59
DC-18	SMA-M to SMA-M	60B
DC-18	SMA-M to SMA-F	61B
DC-18	Type N-M to Type N-M	76
DC-18	Type N-F to Type N-F	77

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SMA (M/F) and 3.5mm (M/F) Gender Changing (DC to 18 GHz, DC to 26.5 GHz)

Features

- Low VSWR
- Stainless Steel Precision Connectors

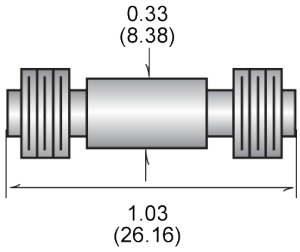
Models

- 59, 60B, 61B, 69, 70, 71

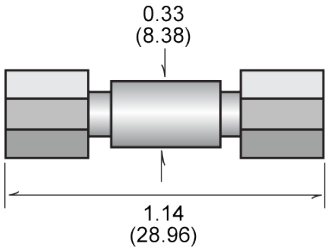
Model	59	60B	61B
Connector	SMA-F to SMA-F	SMA-M to SMA-M	SMA-F to SMA-M
Low Frequency (GHz)	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0
VSWR (max) DC-18 GHz	1.25:1	1.25:1	1.25:1
VSWR (max) 18-26.5 GHz	1.3:1	1.3:1	1.3:1
Maximum Weight (gr)	15	15	15
Maximum Weight (oz)	0.5	0.5	0.5

Model	69	70	71
Connector	3.5mm-F to 3.5mm-F	3.5mm-M to 3.5mm-M	3.5mm-F to 3.5mm-M
Low Frequency (GHz)	DC	DC	DC
High Frequency (GHz)	26.5	26.5	26.5
VSWR (max) DC-18 GHz	1.25:1	1.25:1	1.25:1
VSWR (max) 18-26.5 GHz	1.30:1	1.30:1	1.30:1
Maximum Weight (gr)	15	15	15
Maximum Weight (oz)	0.5	0.5	0.5

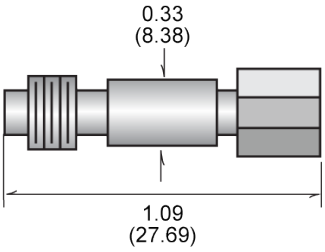
SMA (M/F) and 3.5mm (M/F) Gender Changing (DC to 18 GHz, DC to 26.5 GHz)



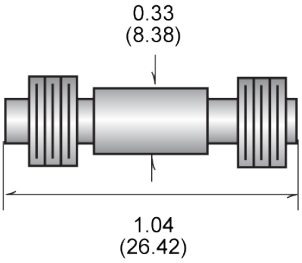
Model 59
SMA-F to SMA-F



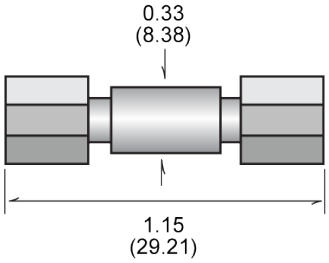
Model 60B
SMA-M to SMA-M



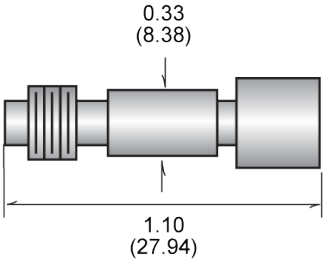
Model 61B
SMA-F to SMA-M



Model 69
3.5mm-F to 3.5mm-F

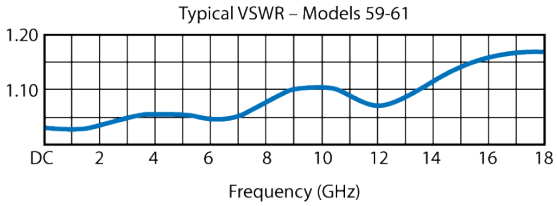


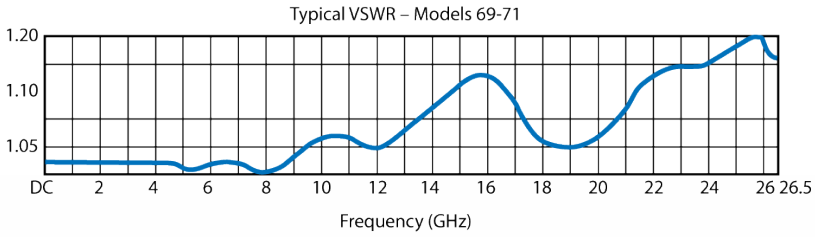
Model 70
3.5mm-M to 3.5mm-M



Model 71
3.5mm-F to 3.5mm-M

All dimensions are max. unless otherwise specified. Dimensions in parentheses are in millimeters.





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Type N (M/F) to SMA (M/F) (DC to 18 GHz) (Between Series Gender Changing)

Features

- Low VSWR
- Stainless Steel Precision Connectors

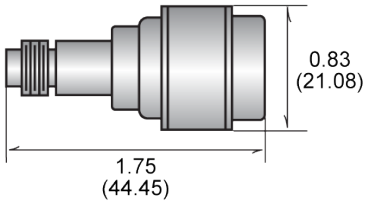
Models

- 55, 56, 57, 58, 76, 77

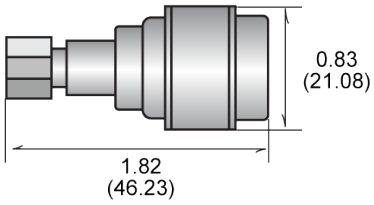
Model	55	56	57
Connector	SMA-F to N-M	SMA-M to N-M	SMA-M to N-F
Low Frequency (GHz)	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0
VSWR (max)	1.25	1.25	1.25
Maximum Weight (oz)	1.5	2	1.5
Maximum Weight (gr)	43	57	43

Model	58	76	77
Connector	SMA-F to N-F	N-M to N-M	N-F to N-F
Low Frequency (GHz)	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0
VSWR (max)	1.25	1.20	1.20
Maximum Weight (oz)	1	2.5	2.5
Maximum Weight (gr)	28	71	71

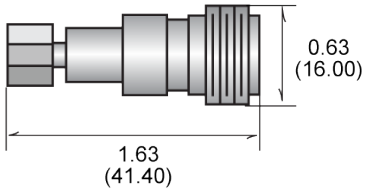
Type N (M/F) to SMA (M/F) (DC to 18 GHz) (Between Series Gender Changing)



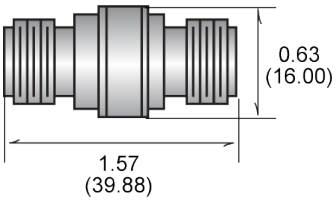
Model 55
SMA-F to N-M



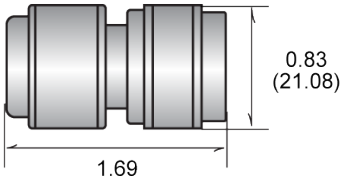
Model 56
SMA-M to N-M



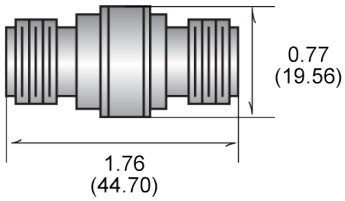
Model 57
SMA-M to NF



Model 58
SMA-F to N-M

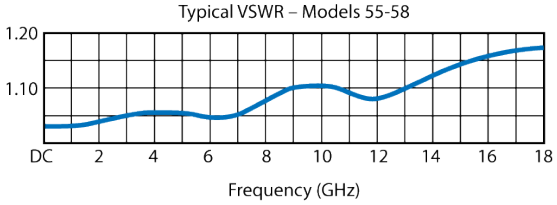


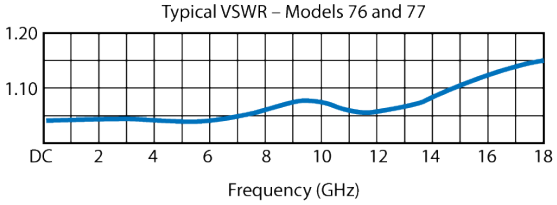
Model 76
N-M to N-M



Model 77
NF to NF

All dimensions are max. unless otherwise specified. Dimensions in parentheses are in millimeters.





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ATTENUATORS

narda
microwave-east

an L3 communications company

Find the following attenuator groups at the end of this introduction:

Attenuators Fixed
Attenuators Step
Attenuators Variable

Parameter	Specification
Operating Temperature	-54 to +105°C
Storage Temperature	-55 to +125°C
Humidity	Per MIL-STD-202F, Method 103B, Condition B (96 hours at 95% R.H.)
Shock	Per MIL-STD-202F, Method 213B, Condition J (30G, 11 msec)
Altitude	Per MIL-STD-202F, Method 105G, Condition B (50,000 ft)
Vibration	Per MIL-STD-202F, Method 204D, Condition B (.06" double amplitude or 15G, whichever is less)
Thermal Shock	Per MIL-STD-202F, Method 107D, Condition A (5 cycles)

***Applicable to: Stripline Directional Couplers, Attenuators, Power Dividers**

Note: This is an exclusive listing. Where otherwise noted in the catalog, the above environmental performance may not apply. Not applicable for those products designed for commercial applications. Many of our catalog off-the-shelf (COTS) products have the ability to withstand considerably more stringent environments. If you have special environmental requirements, please contact the Sales Department at Narda.

Coaxial attenuators are used in every type of equipment involving the transmission, control, or measurement of microwave energy. To meet the needs of system designers, original equipment manufacturers, and laboratory users, our variety of devices offers an almost limitless combination of physical and electrical performance characteristics.

Narda offers attenuators for frequency bands from DC to 40 GHz, with a choice of attenuation values from 0 to 69 dB, average power ratings from 0.5 to 150 watts, and flatness specifications to ±0.2 dB. Variable attenuators encompassing many combinations of bandwidth, attenuation range, accuracy, power handling capability, and physical dimensions are also available.

Attenuators for Systems Applications

The most common applications for coaxial attenuators in microwave systems are in transmitters and receivers. In these, and similar applications, the characteristics that are usually of principal concern are:

a. amount or range of attenuation
b. flatness with frequency
c. average and peak power-handling capability
d. temperature characteristics, and
e. size and weight

Fixed Attenuators

Fixed attenuators are used in systems for two broad classes of service. One is in a calibration channel to establish a known signal level; flatness over the required frequency range is important here. In the second type of service, the device is used for impedance matching or as a buffer to prevent interaction between two devices. For this type of service, low VSWR is the important factor.

The variety of fixed attenuators for these applications is shown in this catalog. Although these attenuators cover most requirements for frequency range and flatness, the practical rule, where cost is a factor, is to specify only the range and tolerances that are required. Since these attenuators are manufactured by thin-film deposition, savings resulting from unique specifications will not be significant for single units or small quantities, but should be considered for large quantities.

Variable Attenuators

Variable attenuators for systems applications (and some OEM and laboratory applications) fall into four general categories: lossy wall attenuators, low loss cutoff attenuators, step (or turret) attenuators and

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voltage-controllable attenuators. The general operating principles and characteristics of each of these types are described below.

Lossy Wall Attenuators

Figure 1 shows a section of the lossy wall attenuator. The construction is basically stripline with a section of the outer conducting wall replaced by a section of lossy material with high dielectric and magnetic dissipation factors. Microwave power flowing through this dielectric material is attenuated as a result of loss, allowing low variation of attenuation with frequency. Attenuation is varied by mechanically varying the location of the lossy material with respect to the fixed center conductor. In practice, the outer walls are displaced in such a way that the physical length of the transmission line is constant. Various coaxial line geometries are employed to provide gradual variation of attenuation with mechanical movement and to achieve the required flatness with frequency.

Limitations of available lossy materials restrict the usefulness of these attenuators to above 2 GHz, although they can be used with degraded performance to 1 GHz. Because the dissipation of energy in these lossy materials tends to be frequency sensitive, selection of a lossy wall attenuator usually involves a tradeoff of attenuation, bandwidth and flatness versus frequency range and size. For example, assuming one available model provides 90 dB of attenuation at 16 GHz, with a design center from 15.7 to 16.3 GHz. The same unit can be used in X-band, but with attenuation reduced to about 50 dB. These units have moderate power-handling capability since attenuation is achieved through dissipation of power as heat in the walls. Narda lossy-wall attenuators can easily handle an average power of as much as 10 watts and peak power to 5 kW.

In general, lossy-wall attenuators have low insertion loss (usually less than 1 dB), low VSWR, and relatively flat attenuation characteristics over the design band. Attenuation is directly proportional to the length of the center conductor between the lossy material. Consequently, the designer concerned about space limitations can safely estimate that a 40 dB unit will be approximately twice the size of 20 dB unit.

Lossy wall attenuators are ideally suited for use as buffers in front of a local oscillator or power source, where the requirement is for a minimum of 10 dB of attenuation with capability for precise tuning. Common applications are in surveillance, and in radar reflection augmenters, where each of many local oscillators must be trimmed a few dB.

For these and similar applications, the lossy wall attenuator offers cost and size advantages over other types of variable attenuators.

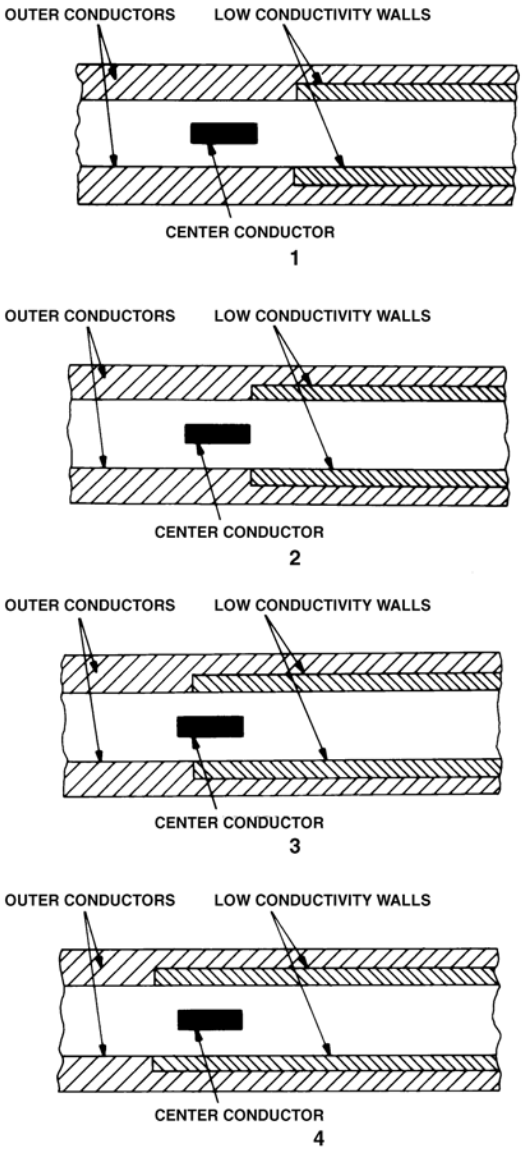

Figure 1. Transverse section of lossy wall attenuator at various stages of attenuation: (1) minimum attenuation; (2) small attenuation; (3) high attenuation; (4) maximum attenuation.

Step (Or Turret) Attenuators

For applications demanding both broadband flatness and adjustability over ranges from 0 to 69 dB, Narda

has a number of stepping-type attenuators that utilize the flatness characteristics of thin-film fixed attenuators. The turret attenuator, Narda Model 745/4745 Series, is a typical example, using fixed attenuators mechanically arranged to permit successive stepping in discrete increments. Typically, these units are offered with switching in 10 or 1 dB increments and may be cascaded to provide the desired attenuation range with resettability of better than 0.05 dB. Because of the inherent broadband characteristics of the thin-film, step attenuators afford excellent flatness from DC to above 18 GHz.

Narda turret attenuators have a specified repeatability of 0.05 dB; in practice this figure is usually better than 0.02 dB. Life of the Narda turret attenuators can be expected to be in excess of one million steps.

Comparison Of Variable Attenuators

The suitability of several types of variable attenuators can be evaluated from Figure 2 . The performance characteristics given are for Narda attenuators.

Original Equipment Applications

For the original equipment designer, the ideal attenuator is likely to be a panel-mountable unit continuously variable from 0 to 69 dB, with maximum flatness over a wide frequency range. Since the present state-of-the-art is unable to provide devices with this combination of characteristics, equipment designers must choose a practical alternative. A step attenuator with a continuously variable attenuator to serve as a fill-in vernier between incremental steps over restricted frequency ranges will usually suffice.

Laboratory Applications

The selection of attenuators for use in the development laboratory is generally the easiest of the specification tasks. Because bench testing requirements may vary considerably from project to project, the objective in specifying attenuators for these applications will normally be to provide for the broadest possible range of project requirements. Characteristics involved in this concept of versatility will be:

a. broad bandwidth
b. large attenuation range
c. high accuracy
d. longevity of connectors

Variable Attenuators for the Laboratory

The wide range of testing requirements usually dictates a selection of variable attenuators that remain flat over at least an octave, and frequently over several octaves. For this reason, the step attenuator represents a more practical choice than the low-loss, continuously-variable attenuator. Typical of step attenuators designed for bench test applications are the Narda Models 700/4700 Series. This series provides 0 to 60 dB attenuation in 10 dB steps; 0 to 9 and 0 to 69 dB attenuation in 1 dB steps. The series also includes effective zero-loss positions to permit full signal input to the load, providing convenient reference levels without removing the units from the setup. These units are usable as freestanding models, or in panel-mount configurations with behind-the-panel connectors.(Panel- mounting hardware is supplied as an accessory where applicable.)

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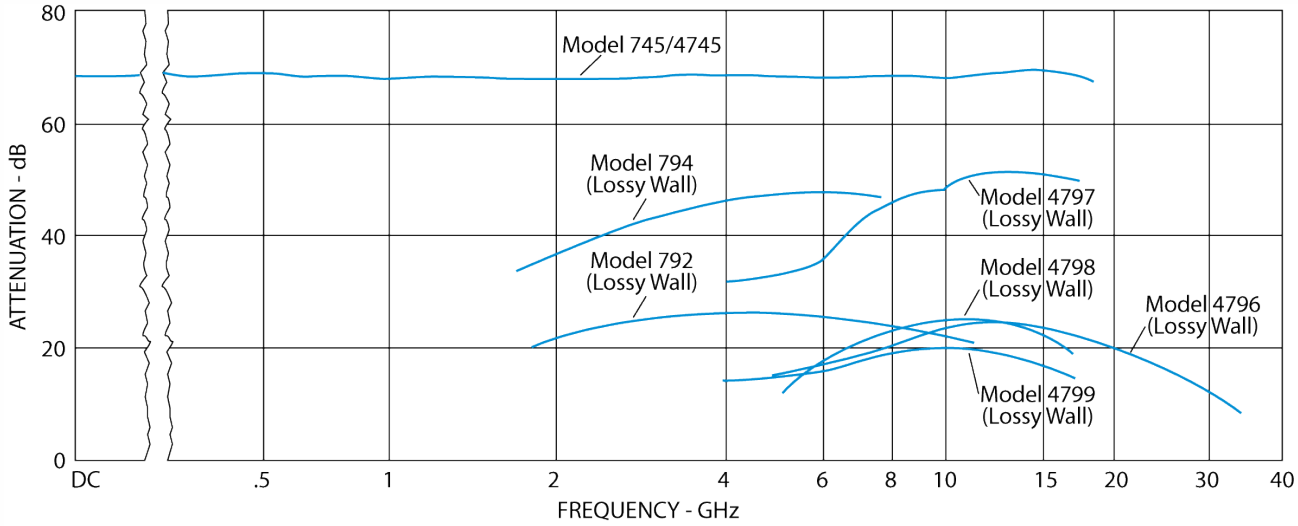

Figure 2. Attenuation vs. Frequency of Variable Attenuators

Fixed Attenuators for Laboratory Setups

Fixed attenuators for laboratory service are available with various levels of calibration accuracy.

The Attenuator Series, Model 777C for example, is available in eight standard attenuation values from 3 to 60 dB and is calibrated at DC, 4, 8, 10 and 12.4 GHz. Model 779 is available in 15 (standard) attenuation values from 1 to 60 dB and is calibrated at DC, 4, 8, 12.4 and 18 GHz. Attenuation certification for this series of attenuators is recorded at each frequency to the nearest .05 dB.

The accuracy characteristics of these units are best suited to the standards laboratory, where they can be used under controlled conditions, rather than on the bench where other factors may cancel out the advantages to be gained from precise calibration and accuracy. For bench service, a more practical choice is the Narda 757C which covers the DC to 12.4 GHz band, has an average power capacity of 2 watts and is accurate to 0.3 dB; or the Narda 779 for DC to 18 GHz.

The design and performance of Narda attenuators are suited to many high-reliability applications. In such cases, economical selection of attenuators can be achieved with Narda's assistance when the customer defines the requirement and application. Application-specific qualification inspections can be performed. This applies to both fixed and variable attenuators.

Connector Longevity

This is especially important in laboratory use, as worn or damaged connectors cause errors in attenuation and high VSWR. While many manufacturers supply stainless steel connectors on their better quality attenuators to provide longer life, all Narda standard line attenuators have stainless steel connectors.

User-Manufacturer Consultation

Manufacturers of microwave components are often in a position to make recommendations regarding the selection of attenuators for particular applications. Narda offers consultation on any systems, original equipment or laboratory requirements and is prepared to assist in evaluating or specifying either catalog-listed or custom-designed attenuators for all application requirements.

Theory and Practice of Attenuation Measurements

In the use and design of microwave components it is often necessary to consider their insertion loss or attenuation characteristics. Insertion loss is the ratio of the power delivered to a matched load by a matched generator before and after the insertion of a component into the line. Insertion loss is actually a combination of two losses: mismatch loss (reflective) and attenuation (dissipative).

Mismatch loss is the ratio of power that would be absorbed by the device if it were perfectly matched to the actual power absorbed by the device with its mismatch in impedance. Attenuation is the ratio of power into a component to the power out under matched conditions, and represents the actual power dissipated within the component. Where a component is perfectly matched to the line and load,

the mismatch loss is zero and insertion loss is the same as attenuation.

The expression is the same for all three losses but the variables have different significance for each case. For insertion loss, P1 is the power at the load before insertion of the component in the line and P2 is the power after insertion. In the case of attenuation, P1 is the power into the component and P2 is the power out.

In practice, the insertion loss is usually of primary interest. It is good practice to provide a well matched generator and load. An attenuator with low VSWR is commonly used to obtain good source and load match.

Methods Of Measurement

Modern technique for measuring loss and return loss (or VSWR) on microwave attenuators utilizes two classes of network analyzers, scalar and vector. The choice depends upon the application and the form of data desired. Both are in use at Narda. Features of each are summarized:

Scalar Network Analyzer

- **Provides magnitude, in dB, for example**
- **Interval microprocessor quickly plots graphs, automatically compensating for instrumentation frequency response.**
- **Frequency range presently to 60 GHz**

Vector Network Analyzer (Also called Automatic Network Analyzer, or ANA)

- **Provides magnitude and angle of all S-parameters**
- **Plots graphs or prints tabular data under software control**
- **High-resolution error-corrected measurements, against attenuation standards traceable to NIST.**
- **Frequency range to 60 GHz.**

Data on individual attenuators can be supplied (for a nominal fee) upon request. For fixed attenuators, this is normally in tabular form as attenuation and two-ended VSWR vs. frequency, taken with an ANA. Resolution is 0.01 dB, and in hundredths for VSWR.

In addition to microwave measurement, insertion loss can be measured at DC. The attenuator under test is placed between precise resistive terminations, and the dB value calculated from the drop-in load voltage read on a high-resolution digital voltmeter. Accuracy of DC attenuation is as follows:

Attenuation	Maximum Error
to 10 dB	0.009 dB
to 40 dB	0.015 dB
50 dB	0.035 dB
60 dB	0.090 dB

The DC attenuator measurement can be used as a check on ANA data; correlation with results at 45 MHz is typically within 0.03 dB.

Software utilized for tabulated data on the ANA extends dynamic range at high frequency through multiple measurement averaging. As a result, typical day to day repeatability of SMA-type attenuators up to 18 GHz is:

Attenuation Value	Repeatability
to 50 dB	0.05 dB
60 dB	0.33 dB

NOTE: For all applicable Narda Attenuators, Narda can supply **standard** test data for a nominal fee.

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Quick Reference Guide

Type N (M/F) DC to 3 GHz, 5 Watt

Features

- Extremely Low Frequency Sensitivity
- Very Low VSWR
- Designed to Meet Environmental Requirements of MIL-A-3933E
- Medium Power Rating
- Minimum Phase Response and Group Delay

Models

- 752-3, 752-6, 752-10, 752-20, 752-30

Model	752-3	752-6	752-10	752-20	752-30
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	3.0	3.0	3.0	3.0	3.0
Attenuation dB (Nominal)	3	6	10	20	30
Attenuation dB (Deviation)	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3
Power Input (Max Avg.) in W	5	5	5	5	5
Power Input (Max Peak) in kW	0.3	0.3	0.3	0.3	0.3
VSWR (max)	1.20:1	1.20:1	1.20:1	1.20:1	1.20:1
Maximum Weight (gr)	105	105	105	105	105
Maximum Weight (oz)	3.7	3.7	3.7	3.7	3.7
Special Notes:	A	A	A	A	A

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power coefficient: 0.0005 dB/dB/watt
Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 752-10

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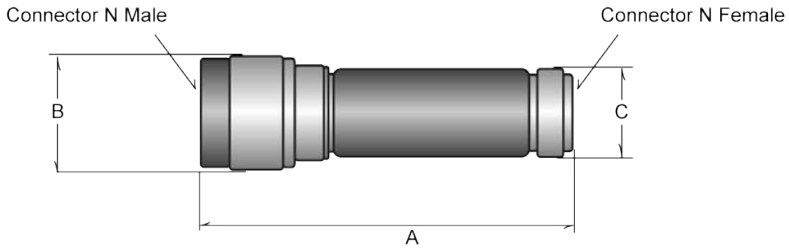
Type N (M/F) DC to 3 GHz, 5 Watt



Outline Drawings For Models : 752-3, 752-6, 752-10, 752-20, 752-30

Units	A	B	C
752-3 , 752-6, 752-10, 752-20, 752-30			
in.	2.70	.85	.65
mm	68.58	21.59	16.51

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing

Type N (M/F) DC to 6 GHz, 2 Watt

Features

- Extremely Low Frequency Sensitivity
- Very Low VSWR
- Designed to Meet Environmental Requirements of MIL-A-3933E
- Medium Power Rating
- Minimum Phase Response and Group Delay

Models

- 773-3, 773-6, 773-10, 773-20, 773-30, 773-40

Model	773-3	773-6	773-10
Low Frequency (GHz)	DC	DC	DC
High Frequency (GHz)	6.0	6.0	6.0
Attenuation dB (Nominal)	3	6	10
Attenuation dB (Deviation DC-3)	+/- 0.3	+/- 0.3	+/- 0.3
Attenuation dB (Deviation 3-6)	+/- 0.5	+/- 0.5	+/- 0.5
Power Input (Max Avg.) in W	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2
VSWR (max) 3-6 GHz	1.25	1.25	1.25
Maximum Weight (gr)	68	68	68
Maximum Weight (oz)	2.4	2.4	2.4
Special Notes:	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient; 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 777C-10.

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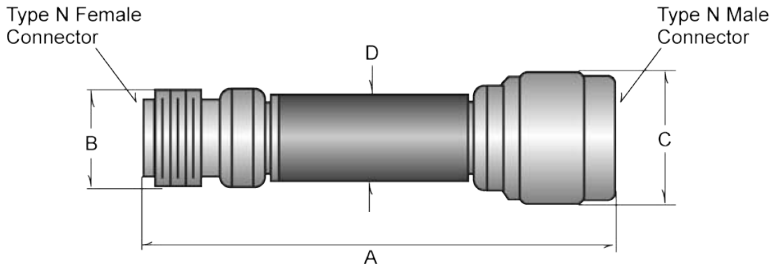
Type N (M/F) DC to 6 GHz, 2 Watt

Model	773-20	773-30	773-40
Low Frequency (GHz)	DC	DC	DC
High Frequency (GHz)	6.0	6.0	6.0
Attenuation dB (Nominal)	20	30	40
Attenuation dB (Deviation DC-3)	+/- 0.3	+/- 0.3	+/- 0.5
Attenuation dB (Deviation 3-6)	+/- 0.5	+/- 0.5	+/- 1.0
Power Input (Max Avg.) in W	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2
VSWR (max) 3-6 GHz	1.25	1.25	1.25
Maximum Weight (gr)	68	68	68
Maximum Weight (oz)	2.4	2.4	2.7
Special Notes:	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient; 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 777C-10.



Outline Drawings For Models : 773-3, 773-6, 773-10, 773-20, 773-30, 773-40

Units	A	B	C	D
773-3 , 773-6, 773-10, 773-20, 773-30, 773-40				
in.	2.66	0.63	0.83	0.50
mm	67.56	16.00	21.08	12.70

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

Type N (M/F) DC to 12.4 GHz, 2 Watt

Features

- Extremely Low Frequency Sensitivity
- Very Low VSWR
- Designed to Meet Environmental Requirements of MIL-A-3933E
- Medium Power Rating
- Minimum Phase Response and Group Delay

Models

- 777C-3, 777C-6, 777C-10, 777C-20, 777C-30, 757C-3, 757C-6, 757C-10, 757C-20, 757C-30

Model	777C-3	777C-6	777C-10	777C-20	777C-30
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	12.4	12.4	12.4	12.4	12.4
Attenuation dB (Nominal)	3	6	10	20	30
Attenuation dB (Deviation DC-6)	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.5
Attenuation dB (Deviation 6-12.4)	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.75
Power Input (Max Avg.) in W	2	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15	1.15
VSWR (max) 4-12.4 GHz	1.20	1.20	1.20	1.20	1.25
Maximum Weight (gr)	82	82	82	82	82
Maximum Weight (oz)	2.9	2.9	2.9	2.9	2.9
Special Notes:	A , B	A , B	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient; 0.0005 dB/dB/watt
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 777C-10.

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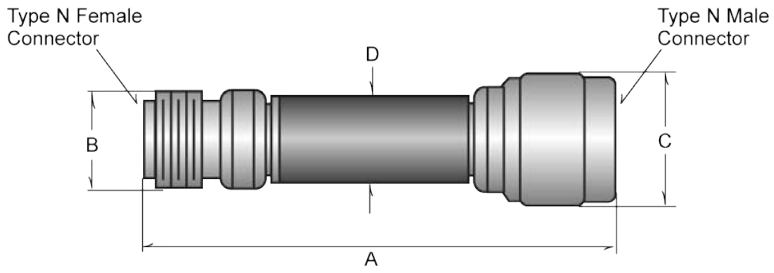
Type N (M/F) DC to 12.4 GHz, 2 Watt

Model	757C-3	757C-6	757C-10	757C-20	757C-30
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	12.4	12.4	12.4	12.4	12.4
Attenuation dB (Nominal)	3	6	10	20	30
Attenuation dB (Deviation DC-6)	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.5
Attenuation dB (Deviation 6-12.4)	+/- 0.3	+/- 0.3	+/- 0.5	+/- 0.5	+/- 1.0
Power Input (Max Avg.) in W	2	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.20	1.20	1.20	1.20	1.20
VSWR (max) 4-12.4 GHz	1.25	1.25	1.25	1.25	1.25
Maximum Weight (gr)	82	82	82	82	82
Maximum Weight (oz)	2.9	2.9	2.9	2.9	2.9
Special Notes:	A , B	A , B	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient; 0.0005 dB/dB/watt
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 777C-10.



Outline Drawings For Models : 777C-3, 777C-6, 777C-10, 777C-20, 777C-30, 757C-3, 757C-6, 757C-10, 757C-20, 757C-30

Units	A	B	C	D
777C-3 , 777C-6, 777C-10, 777C-20, 777C-30, 757C-3, 757C-6, 757C-10, 757C-20, 757C-30				
in.	2.66	0.63	0.83	0.50
mm	67.56	16.00	21.08	12.70

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing

Type N (M/F) DC to 18 GHz, 2 Watt

Features

- Extremely Low Frequency Sensitivity
- Very Low VSWR
- Designed to Meet Environmental Requirements of MIL-A-3933E
- Medium Power Rating
- Minimum Phase Response and Group Delay

Models

- 779-1, 779-2, 779-3, 779-4, 779-5, 779-6, 779-7, 779-8, 779-9, 779-10, 779-20, 779-30, 779-40, 779-50

Model	779-1	779-2	779-3	779-4	779-5
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0	18.0
Attenuation dB (Nominal)	1	2	3	4	5
Attenuation dB (Deviation DC-12.4)	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3
Attenuation dB (Deviation 12.4-18)	+/- 0.4	+/- 0.4	+/- 0.3	+/- 0.4	+/- 0.4
Power Input (Max Avg.) in W	2	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15	1.15
VSWR (max) 4-12.4 GHz	1.30	1.30	1.30	1.30	1.30
VSWR (max) 12.4-18 GHz	1.40	1.40	1.40	1.40	1.40
Maximum Weight (gr)	82	82	82	82	82
Maximum Weight (oz)	2.9	2.9	2.9	2.9	2.9
Special Notes:	A , B , C	A , B , C	A , B	A , B , C	A , B , C

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient; 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 777C-10.
C: Non-standard attenuation values are available on a custom order basis. Minimum order quantity may apply. Consult factory for details.

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Type N (M/F) DC to 18 GHz, 2 Watt

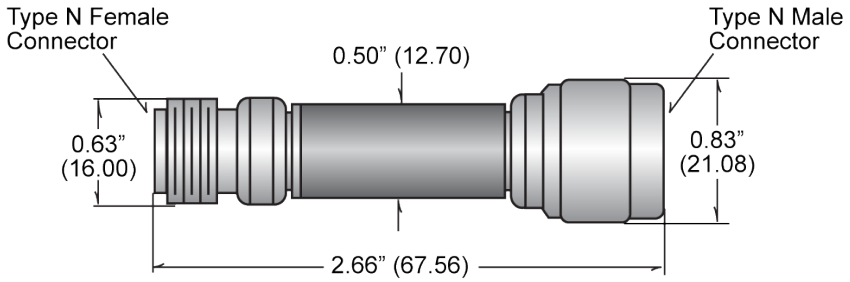
Model	779-6	779-7	779-8	779-9	779-10
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0	18.0
Attenuation dB (Nominal)	6	7	8	9	10
Attenuation dB (Deviation DC-12.4)	+/- 0.3	+/- 0.4	+/- 0.4	+/- 0.4	+/- 0.3
Attenuation dB (Deviation 12.4-18)	+/- 0.3	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5
Power Input (Max Avg.) in W	2	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15	1.15
VSWR (max) 4-12.4 GHz	1.30	1.30	1.30	1.30	1.30
VSWR (max) 12.4-18 GHz	1.40	1.40	1.40	1.40	1.40
Maximum Weight (gr)	82	82	82	82	82
Maximum Weight (oz)	2.9	2.9	2.9	2.9	2.9
Special Notes:	A , B	A , B , C	A , B , C	A , B , C	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient; 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 777C-10.
C: Non-standard attenuation values are available on a custom order basis. Minimum order quantity may apply. Consult factory for details.

Model	779-20	779-30	779-40	779-50
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0
Attenuation dB (Nominal)	20	30	40	50
Attenuation dB (Deviation DC-12.4)	+/- 0.5	+/- 0.8	+/- 1.25	+/- 1.25
Attenuation dB (Deviation 12.4-18)	+/- 0.7	+/- 1.00	+/- 1.60	+/- 1.60
Power Input (Max Avg.) in W	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15
VSWR (max) 4-12.4 GHz	1.30	1.30	1.30	1.30
VSWR (max) 12.4-18 GHz	1.40	1.40	1.40	1.40
Maximum Weight (gr)	82	82	82	82
Maximum Weight (oz)	2.9	2.9	2.9	2.9
Special Notes:	A , B	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient; 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 777C-10.
C: Non-standard attenuation values are available on a custom order basis. Minimum order quantity may apply. Consult factory for details.

Type N (M/F) DC to 18 GHz, 2 Watt



Outline Drawing for Models: 779-1, 779-2, 779-3, 779-4, 779-5, 779-6, 779-7, 779-8, 779-9, 779-10, 779-20, 779-30, 779-40, 779-5

Notes:

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2.92 mm (M/F) DC to 40 GHz, 2.0 Watt - 6.0 Watt

Features

- Flat Frequency Response
- Low VSWR
- Designed to Meet Environmental Requirements of MIL-A-3933
- Precision Stainless Steel SMA Connectors

Models

- 4768-3, 4768-6, 4768-10, 4768-20, 4777-3, 4777-6, 4777-10, 4777-20

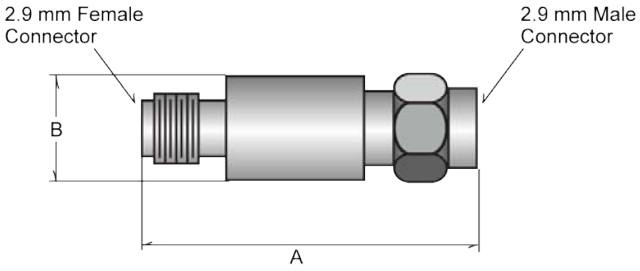
Model	4768-3	4768-6	4768-10	4768-20
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	40.0	40.0	40.0	40.0
Attenuation dB (Nominal)	3	6	10	20
Attenuation dB (Deviation DC-26.5)	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5
Attenuation dB (Deviation 26.5-40)	+/- 0.8	+/- 0.8	+/- 0.8	+/- 0.8
Power Input (Max Avg.) in W	2.0	2.0	2.0	2.0
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2
VSWR (max)	1.40	1.40	1.40	1.40
Maximum Weight (gr)	7.5	7.5	7.5	7.5
Maximum Weight (oz)	0.25	0.25	0.25	0.25
Special Notes:	A , B	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 4768-10.

2.92 mm (M/F) DC to 40 GHz, 2.0 Watt - 6.0 Watt

Model	4777-3	4777-6	4777-10	4777-20
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	40.0	40.0	40.0	40.0
Attenuation dB (Nominal)	3	3	10	20
Attenuation dB (Deviation DC-26.5)	+/-0.5	+/-0.5	+/-0.5	+/-0.5
Attenuation dB (Deviation 26.5-40)	+/- 0.8	+/-0.8	+/- 0.8	+/-0.8
Power Input (Max Avg.) in W	6.0	4.0	3.3	3.0
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2
VSWR (max)	1.40:1	1.40:1	1.40:1	1.40:1
Maximum Weight (gr)	15	15	15	15
Maximum Weight (oz)	0.53	0.53	0.53	0.53
Special Notes:	A , B	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 4768-10.



Outline Drawings For Models : 4768-3, 4768-6, 4768-10, 4768-20

Units	A	B
4768-3 , 4768-6, 4768-10, 4768-20		
in.	1.02	.39
mm	25.91	9.91

Notes:

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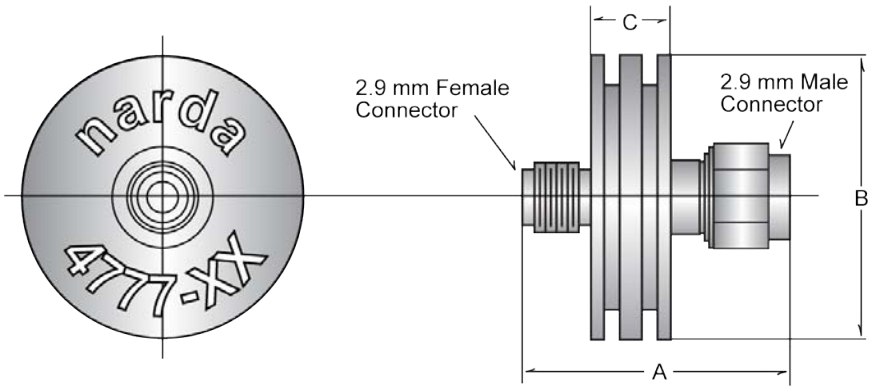
2.92 mm (M/F) DC to 40 GHz, 2.0 Watt - 6.0 Watt



Outline Drawings For Models : 4777-3, 4777-6, 4777-10, 4777-20

Units	A	B	C
4777-3 , 4777-6, 4777-10, 4777-20			
in.	1.02	1.00	0.29
mm	25.91	25.40	7.37

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.
Tolerances: +/-.02.

SMA (M/F) DC to 6 GHz, 2 Watt

Features

- Flat Frequency Response
- Low VSWR
- 2 Watt Rating
- Designed to Meet Environmental Requirements of MIL-A-3933
- Precision Stainless Steel SMA Connectors

Models

- 4772-3, 4772-6, 4772-10, 4772-20, 4772-30

Model	4772-3	4772-6	4772-10	4772-20	4772-30
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	6.0	6.0	6.0	6.0	6.0
Attenuation dB (Nominal)	3	6	10	20	30
Attenuation dB (Deviation)	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.5
Power Input (Max Avg.) in W	2	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.25	1.25	1.25	1.25	1.25
VSWR (max) 4-6 GHz	1.40	1.40	1.40	1.40	1.40
VSWR (max) 4-12.4 GHz	N/A	N/A	N/A	N/A	N/A
Maximum Weight (gr)	14	14	14	14	14
Maximum Weight (oz)	0.5	0.5	0.5	0.5	0.5
Special Notes:	A , B	A , B	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 4772-10.

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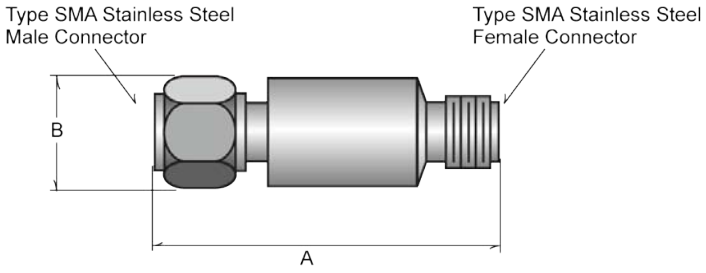
SMA (M/F) DC to 6 GHz, 2 Watt



Outline Drawings For Models : 4772-3, 4772-6, 4772-10, 4772-20, 4772-30

Units	A	B
4772-3 , 4772-6, 4772-10, 4772-20		
in.	1.24	0.38
mm	31.50	9.65
4772-30		
in.	1.49	0.38
mm	37.85	9.65

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (M/F) DC to 12.4 GHz, 2 Watt

Features

- Flat Frequency Response
- Low VSWR
- 2 Watt Rating
- Designed to Meet Environmental Requirements of MIL-A-3933
- Precision Stainless Steel SMA Connectors

Models

- 4778-3, 4778-6, 4778-10, 4778-20, 4778-30

Model	4778-3	4778-6	4778-10	4778-20	4778-30
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	12.4	12.4	12.4	12.4	12.4
Attenuation dB (Nominal)	3	6	10	20	30
Attenuation dB (Deviation)	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3
Power Input (Max Avg.) in W	2	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15	1.35
VSWR (max) 4-12.4 GHz	1.30	1.30	1.30	1.30	1.35
Maximum Weight (gr)	14	14	14	14	14
Maximum Weight (oz)	0.5	0.5	0.5	0.5	0.5
Special Notes:	A , B	A , B	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/?Power Coefficient: 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 4772-10.

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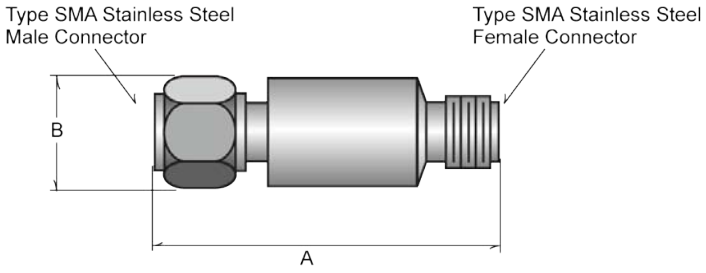
SMA (M/F) DC to 12.4 GHz, 2 Watt



Outline Drawings For Models : 4778-3, 4778-6, 4778-10, 4778-20, 4778-30

Units	A	B
4778-3 , 4778-6, 4778-10, 4778-20		
in.	1.24	0.38
mm	31.50	9.65
4778-30		
in.	1.49	0.38
mm	37.85	9.65

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (M/F) DC to 18 GHz, 2 Watt

Features

- Flat Frequency Response
- Low VSWR
- 2 Watt Rating
- Designed to Meet Environmental Requirements of MIL-A-3933
- Precision Stainless Steel SMA Connectors

Models

- 4779-1, 4779-2, 4779-3, 4779-4, 4779-5, 4779-6, 4779-7, 4779-8, 4779-9, 4779-10, 4779-11, 4779-12, 4779-13, 4779-14, 4779-15, 4779-16, 4779-17, 4779-18, 4779-19, 4779-20, 4779-30, 4779-40, 4779-50, 4779-60

Model	4779-1	4779-2	4779-3	4779-4	4779-5
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0	18.0
Attenuation dB (Nominal)	1	2	3	4	5
Attenuation dB (Deviation DC-12.4)	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3
Attenuation dB (Deviation 12.4-18)	+/- 0.4	+/- 0.4	+/- 0.3	+/- 0.3	+/- 0.3
Power Input (Max Avg.) in W	2	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15	1.15
VSWR (max) 4-12.4 GHz	1.30	1.30	1.30	1.30	1.30
Maximum Weight (gr)	14	14	14	14	14
Maximum Weight (oz)	0.5	0.5	0.5	0.5	0.5
Special Notes:	A , B , C	A , B , C	A , B	A , B , C	A , B , C

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 4772-10.
C: Standard attenuation values are typically available from stock in the following attenuation values: 3 dB, 6 dB, 10 dB, 20 dB, 30 db. Non-standard attenuation values are available on a custom order basis. Minimum order quantity may apply. Consult factory for details.

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SMA (M/F) DC to 18 GHz, 2 Watt

Model	4779-6	4779-7	4779-8	4779-9	4779-10
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0	18.0
Attenuation dB (Nominal)	6	7	8	9	10
Attenuation dB (Deviation DC-12.4)	+/- 0.3	+/- 0.4	+/- 0.4	+/- 0.4	+/- 0.3
Attenuation dB (Deviation 12.4-18)	+/- 0.3	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5
Power Input (Max Avg.) in W	2	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15	1.15
VSWR (max) 4-12.4 GHz	1.30	1.30	1.30	1.30	1.30
Maximum Weight (gr)	14	14	14	14	14
Maximum Weight (oz)	0.5	0.5	0.5	0.5	0.5
Special Notes:	A , B	A , B , C	A , B , C	A , B , C	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 4772-10.
C: Standard attenuation values are typically available from stock in the following attenuation values: 3 dB, 6 dB, 10 dB, 20 dB, 30 db. Non-standard attenuation values are available on a custom order basis. Minimum order quantity may apply. Consult factory for details.

Model	4779-11	4779-12	4779-13	4779-14	4779-15
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0	18.0
Attenuation dB (Nominal)	11	12	13	14	15
Attenuation dB (Deviation DC-12.4)	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5
Attenuation dB (Deviation 12.4-18)	+/- 0.6	+/- 0.6	+/- 0.6	+/- 0.6	+/- 0.6
Power Input (Max Avg.) in W	2	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15	1.15
VSWR (max) 4-12.4 GHz	1.30	1.30	1.30	1.30	1.30
Maximum Weight (gr)	14	14	14	14	14
Maximum Weight (oz)	0.5	0.5	0.5	0.5	0.5
Special Notes:	A , B , C	A , B , C	A , B , C	A , B , C	A , B , C

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 4772-10.
C: Standard attenuation values are typically available from stock in the following attenuation values: 3 dB, 6 dB, 10 dB, 20 dB, 30 db. Non-standard attenuation values are available on a custom order basis. Minimum order quantity may apply. Consult factory for details.

SMA (M/F) DC to 18 GHz, 2 Watt

Model	4779-16	4779-17	4779-18	4779-19	4779-20
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0	18.0
Attenuation dB (Nominal)	16	17	18	19	20
Attenuation dB (Deviation DC-12.4)	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5
Attenuation dB (Deviation 12.4-18)	+/- 0.6	+/- 0.6	+/- 0.6	+/- 0.6	+/- 0.6
Power Input (Max Avg.) in W	2	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15	1.15
VSWR (max) 4-12.4 GHz	1.30	1.30	1.30	1.30	1.30
Maximum Weight (gr)	14	14	14	14	14
Maximum Weight (oz)	0.5	0.5	0.5	0.5	0.5
Special Notes:	A , B , C	A , B , C	A , B , C	A , B , C	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 4772-10.
C: Standard attenuation values are typically available from stock in the following attenuation values: 3 dB, 6 dB, 10 dB, 20 dB, 30 db. Non-standard attenuation values are available on a custom order basis. Minimum order quantity may apply. Consult factory for details.

Model	4779-30	4779-40	4779-50	4779-60
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0
Attenuation dB (Nominal)	30	40	50	60
Attenuation dB (Deviation DC-12.4)	+/- 0.8	+/- 1.2	+/- 1.2	+/- 1.2
Attenuation dB (Deviation 12.4-18)	+/- 1.0	+/- 1.5	+/- 1.5	+/- 1.5
Power Input (Max Avg.) in W	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15
VSWR (max) 4-12.4 GHz	1.35	1.35	1.35	1.35
Maximum Weight (gr)	14	14	14	14
Maximum Weight (oz)	0.5	0.5	0.5	0.5
Special Notes:	A , B	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.
B: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 4772-10.
C: Standard attenuation values are typically available from stock in the following attenuation values: 3 dB, 6 dB, 10 dB, 20 dB, 30 db. Non-standard attenuation values are available on a custom order basis. Minimum order quantity may apply. Consult factory for details.

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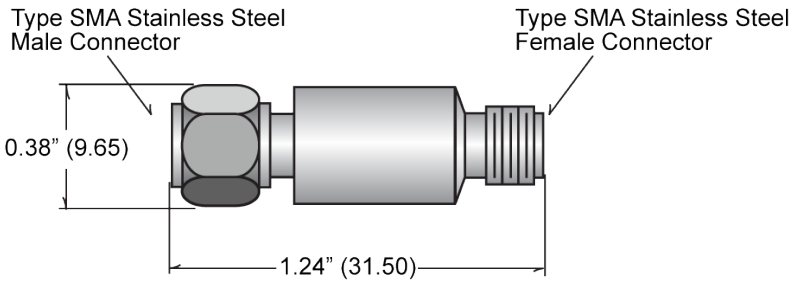
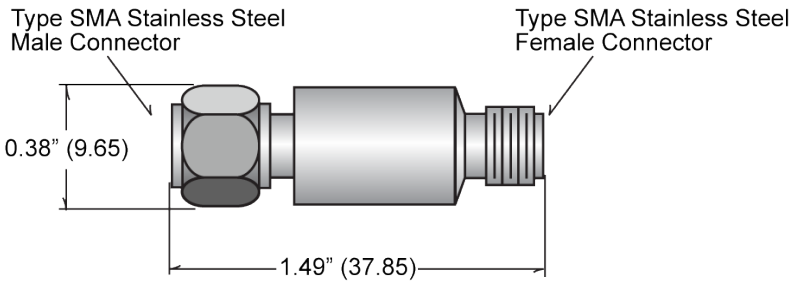
SMA (M/F) DC to 18 GHz, 2 Watt



Outline Drawing for Models:
4779-1, 4779-2, 4779-3, 4779-4, 4779-5, 4779-6, 4779-7, 4779-8, 4779-9, 4779-10, 4779-11, 4779-12, 4779-13, 4779-14, 4779-15, 4779-16, 4779-17, 4779-18, 4779-19, 4779-20, 4779-30

Notes:
Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.



Outline Drawing for Models:
4779-40, 4779-50, 4779-60

Notes:
Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

Miniature SMA (M/F) DC to 18 GHz, 2 Watt

Features

- Flat Frequency Response
- Low VSWR - Precision Stainless Steel SMA Connectors
- 2 Watt Rating
- Designed to Meet Environmental Requirements of MIL-A-3933
- Small - 380 mil Diameter Body

Models

- 4782-3, 4782-6, 4782-10, 4782-20, 4780-3, 4780-6, 4780-10, 4780-20

Model	4782-3	4782-6	4782-10	4782-20
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0
Attenuation dB (Deviation)	+/- 0.3	+/- 0.3	+/- 0.4	+/- 0.5
Attenuation dB (Nominal)	3	6	10	20
Power Input (Max Avg.) in W	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15
VSWR (max) 4-12.4 GHz	1.30	1.30	1.30	1.30
VSWR (max) DC-6 GHz	N/A	N/A	N/A	N/A
VSWR (max) 12.4-18 GHz	1.50	1.50	1.50	1.50
Maximum Weight (oz)	0.5	0.5	0.5	0.5
Maximum Weight (gr)	14	14	14	14

Model	4780-3	4780-6	4780-10	4780-20
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	6.0	6.0	6.0	6.0
Attenuation dB (Deviation)	+/- 0.4	+/- 0.4	+/- 0.4	+/- 0.5
Attenuation dB (Nominal)	3	6	10	20
Power Input (Max Avg.) in W	2	2	2	2
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	N/A	N/A	N/A	N/A
VSWR (max) 4-12.4 GHz	N/A	N/A	N/A	N/A
VSWR (max) DC-6 GHz	1.20	1.20	1.20	1.20
VSWR (max) 12.4-18 GHz	N/A	N/A	N/A	N/A
Maximum Weight (oz)	0.5	0.5	14	0.5
Maximum Weight (gr)	14	14	0.5	14

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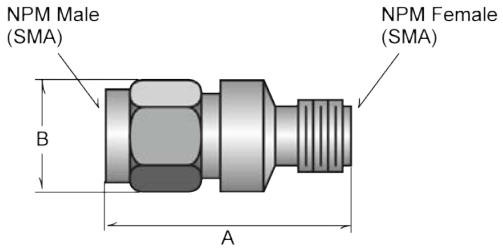
Miniature SMA (M/F) DC to 18 GHz, 2 Watt



Outline Drawings For Models : 4782-3, 4782-6, 4782-10, 4782-20, 4780-3, 4780-6, 4780-10, 4780-20

Units	A	B
4782-3 , 4782-6, 4782-10, 4780-3, 4780-6, 4780-10		
in.	.88	.40
mm	22.35	10.16
4782-20 , 4780-20		
in.	.95	.40
mm	24.13	10.16

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (M/F) DC to 6.0 GHz, 4.5 Watt - 8.0 Watt

Features

- Exceptional Power Handling
- Extremely Small Size and Light Weight
- Excellent Phase Response - Minimum Group Delay
- Designed to Meet Environmental Requirements of MIL-A-3933

Models

- 4774-3, 4774-6, 4774-10, 4774-20, 4774-30

Model	4774-3	4774-6	4774-10	4774-20	4774-30
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	6.0	6.0	6.0	6.0	6.0
Attenuation dB (Nominal)	3	6	10	20	30
Attenuation dB (Deviation)	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.5
Power Input (Max Avg.) in W	8.0	5.5	4.5	4.5	4.5
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.25	1.25	1.25	1.25	1.25
VSWR (max) 4-6 GHz	1.40	1.40	1.40	1.40	1.40
Maximum Weight (oz)	0.5	0.5	0.5	0.5	0.5
Maximum Weight (gr)	14	14	14	14	14

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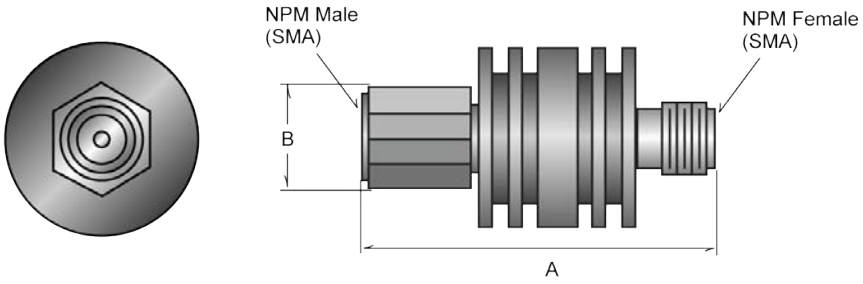
SMA (M/F) DC to 6.0 GHz, 4.5 Watt - 8.0 Watt



Outline Drawings For Models : 4774-3, 4774-6, 4774-10, 4774-20, 4774-30

Units	A	B
4774-3 , 4774-6, 4774-10, 4774-20		
in.	1.28	0.63
mm	32.51	16.00
4774-30		
in.	1.49	0.63
mm	37.85	16.00

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (M/F) DC to 12.4 GHz, 4.5 Watt - 8.0 Watt

Features

- Exceptional Power Handling
- Extremely Small Size and Light Weight
- Excellent Phase Response - Minimum Group Delay
- Designed to Meet Environmental Requirements of MIL-A-3933

Models

- 4775-3, 4775-6, 4775-10, 4775-20, 4775-30

Model	4775-3	4775-6	4775-10	4775-20	4775-30
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	12.4	12.4	12.4	12.4	12.4
Attenuation dB (Nominal)	3	6	10	20	30
Attenuation dB (Deviation)	+/- 0.3	+/- 0.3	+/- 0.3	+/- 0.5	+/- 0.8
Power Input (Max Avg.) in W	8.0	5.5	4.5	4.5	4.5
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.25	1.25	1.25	1.25	1.25
VSWR (max) 4-6 GHz	1.25	1.25	1.25	1.25	1.25
VSWR (max) 6-12.4 GHz	1.30	1.30	1.30	1.30	1.30
Maximum Weight (oz)	0.5	0.5	0.5	0.5	0.5
Maximum Weight (gr)	14	14	14	14	14

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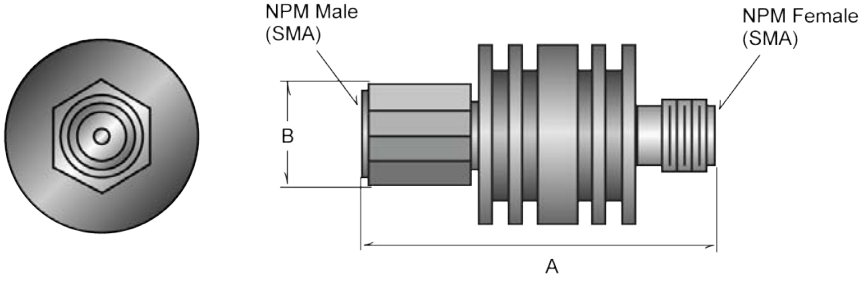
SMA (M/F) DC to 12.4 GHz, 4.5 Watt - 8.0 Watt



Outline Drawings For Models : 4775-3, 4775-6, 4775-10, 4775-20, 4775-30

Units	A	B
4775-3 , 4775-6, 4775-10, 4775-20		
in.	1.24	0.63
mm	31.50	16.00
4775-30		
in.	1.49	0.63
mm	37.85	16.00

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (M/F) DC to 18 GHz, 4.5 Watt - 8.0 Watt

Features

- Exceptional Power Handling
- Extremely Small Size and Light Weight
- Excellent Phase Response - Minimum Group Delay
- Designed to Meet Environmental Requirements of MIL-A-3933

Models

- 4776-3, 4776-6, 4776-10, 4776-20, 4776-30, 4776-40, 4776-50, 4776-60

Model	4776-3	4776-6	4776-10	4776-20
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0
Attenuation dB (Nominal)	3	6	10	20
Attenuation dB (Deviation)	+/-0.3	+/-0.3	+/-0.5	+/-0.7
Power Input (Max Avg.) in W	8.0	5.5	4.5	4.5
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15
VSWR (max) 4-6 GHz	1.25	1.25	1.25	1.25
VSWR (max) 6-12.4 GHz	1.30	1.30	1.30	1.30
VSWR (max) 12.4-18 GHz	1.35	1.35	1.35	1.35
Maximum Weight (oz)	0.5	0.5	0.5	0.5
Maximum Weight (gr)	14	14	14	14

Model	4776-30	4776-40	4776-50	4776-60
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0	18.0
Attenuation dB (Nominal)	30	40	50	60
Attenuation dB (Deviation)	+/-1.0	+/-1.0	+/-1.0	+/-1.5
Power Input (Max Avg.) in W	4.5	4.5	4.5	4.5
Power Input (Max Peak) in kW	0.2	0.2	0.2	0.2
VSWR (max) DC-4 GHz	1.15	1.15	1.15	1.15
VSWR (max) 4-6 GHz	1.25	1.25	1.25	1.25
VSWR (max) 6-12.4 GHz	1.30	1.30	1.30	1.30
VSWR (max) 12.4-18 GHz	1.35	1.35	1.35	1.35
Maximum Weight (oz)	0.5	0.5	0.5	0.5
Maximum Weight (gr)	14	14	14	14

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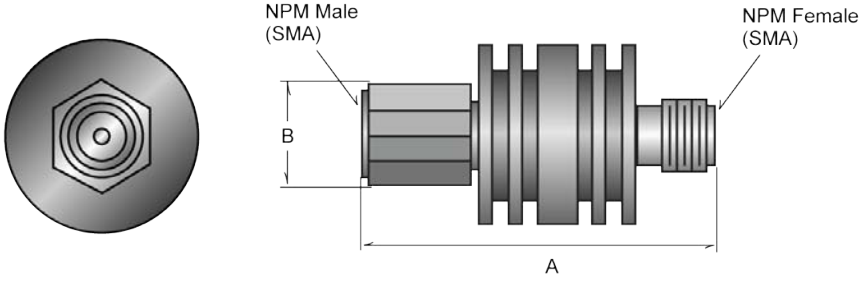
SMA (M/F) DC to 18 GHz, 4.5 Watt - 8.0 Watt



Outline Drawings For Models : 4776-3, 4776-6, 4776-10, 4776-20, 4776-30, 4776-40, 4776-50, 4776-60

Units	A	B
4776-3 , 4776-6		
in.	1.24	.63
mm	31.50	16.00
4776-10 , 4776-20		
in.	1.24	.63
mm	25.4	16.00
4776-30 , 4776-40, 4776-50, 4776-60		
in.	1.49	.63
mm	37.85	16.00

Type N (M/F) DC to 5 GHz, 20 Watt - 50 Watt

Features

- Designed to Meet Environmental Requirements of MIL-A-3933

Models

- 766-3, 766-6, 766-10, 766-20, 766-30, 765-3, 765-6, 765-10, 765-20

Model	766-3	766-6	766-10	766-20	766-30
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	4.0	4.0	4.0	4.0	4.0
Attenuation dB (Nominal)	3	6	10	20	30
Attenuation dB (Deviation DC-3)	+/-0.25	+/-0.25	+/-0.25	+/-0.25	+/-0.75
Attenuation dB (Deviation 3-5)	N/A	N/A	N/A	N/A	N/A
Attenuation dB (Deviation 3-4)	+/-0.50	+/-0.50	+/-0.50	+/-0.50	+/-0.75
Power Input (Max Avg.) in W	20	20	20	20	20
Power Input (Max Peak) in kW	1	1	1	1	1
VSWR (max) DC-1 GHz	1.10	1.10	1.10	1.10	1.10
VSWR (max) 1-4 GHz	1.15	1.15	1.15	1.15	1.35
VSWR (max) 3-5 GHz	N/A	N/A	N/A	N/A	N/A
Maximum Weight (gr)	159	159	159	159	159
Maximum Weight (oz)	5.6	5.6	5.6	5.6	5.6
Special Notes:	A , B	A , B	A , B	A , B	A , B

Special Notes:
A: Power ratings for horizontal operation at +25°C derate linearly to 5 watts at +125°C
B: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.

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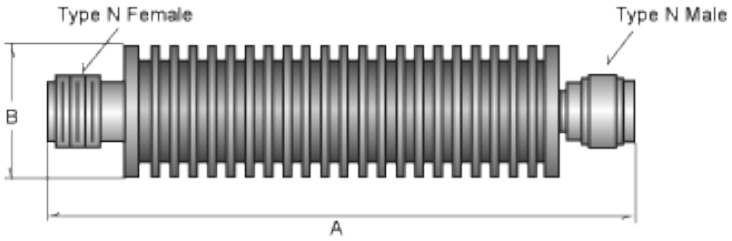
Type N (M/F) DC to 5 GHz, 20 Watt - 50 Watt

Model	765-3	765-6	765-10	765-20
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	5.0	5.0	5.0	5.0
Attenuation dB (Nominal)	3	6	10	20
Attenuation dB (Deviation DC-3)	+/- 0.30	+/- 0.30	+/-0.30	+/- 0.30
Attenuation dB (Deviation 3-5)	+/-0.50	+/-0.50	N/A	N/A
Attenuation dB (Deviation 3-4)	N/A	N/A	N/A	N/A
Power Input (Max Avg.) in W	50	50	50	50
Power Input (Max Peak) in kW	2	2	2	2
VSWR (max) DC-1 GHz	N/A	N/A	N/A	N/A
VSWR (max) 1-4 GHz	N/A	N/A	N/A	N/A
VSWR (max) 3-5 GHz	1.30	1.30	N/A	N/A
Maximum Weight (gr)	440	440	440	440
Maximum Weight (oz)	15.5	15.5	15.5	15.5
Special Notes:	A	A	B	B

Special Notes:
A: Power ratings for horizontal operation at +25°C derate linearly to 5 watts at +125°C
B: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.

Type N (M/F) DC to 5 GHz, 20 Watt - 50 Watt



Outline Drawings For Models : 766-3, 766-6, 766-10, 766-20, 766-30, 765-3, 765-6, 765-10, 765-20

Units	A	B
766-3 , 766-20, 766-30		
in.	3.07	1.52
mm	77.98	38.61
766-6 , 766-10		
in.	3.07	1.52
mm	76.2	38.61
765-3 , 765-6, 765-10, 765-20		
in.	6.99	1.64
mm	177.55	41.66

Notes:

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Type N (M/F) DC to 11 GHz, 20 Watt - 50 Watt

Features

- Designed to Meet Environmental Requirements of MIL-A-3933

Models

- 768-3, 768-6, 768-10, 768-20, 768-30, 766-3, 766-6

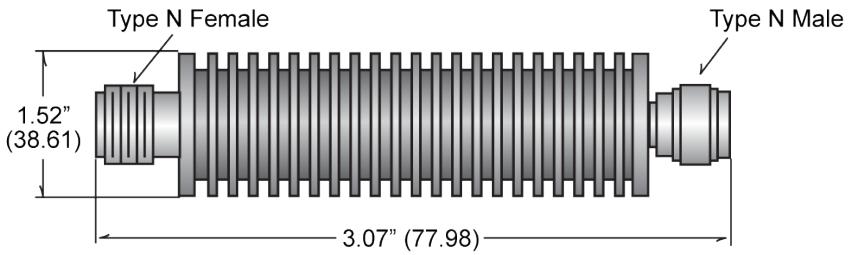
Model	768-3	768-6	768-10	768-20
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	11.0	11.0	11.0	11.0
Attenuation dB (Nominal)	3	6	10	20
Attenuation dB (Deviation DC-3)	+/-0.25	+/-0.25	+/-0.25	+/-0.25
Attenuation dB (Deviation 3-6)	+/-0.50	+/-0.50	+/-0.50	+/-0.50
Attenuation dB (Deviation 6-11)	+/-0.75	+/-0.75	+/-0.75	+/-0.75
Power Input (Max Avg.) in W	20	20	20	20
Power Input (Max Peak) in kW	1	1	1	1
VSWR (max) DC-1 GHz	1.10	1.10	1.10	1.10
VSWR (max) 1-4 GHz	1.15	1.15	1.15	1.15
VSWR (max) 4-6 GHz	1.20	1.20	1.20	1.20
VSWR (max) 6-11 GHz	1.30	1.30	1.30	1.30
Maximum Weight (gr)	159	159	159	159
Maximum Weight (oz)	5.6	5.6	5.6	5.6
Special Notes:	A , B , C	A , B , C	A , B , C	A , B , C

Special Notes:
A: Power ratings for horizontal operation at + 25°C derate linearly to 5 watts at + 125°C
B: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.
C: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 776C-10.

Type N (M/F) DC to 11 GHz, 20 Watt - 50 Watt

Model	768-30	766-3	766-6
Low Frequency (GHz)	DC	DC	DC
High Frequency (GHz)	11.0	4.0	4.0
Attenuation dB (Nominal)	30	3	6
Attenuation dB (Deviation DC-3)	+/-0.25	+/-0.25	+/-0.25
Attenuation dB (Deviation 3-6)	+/-0.50	N/A	N/A
Attenuation dB (Deviation 6-11)	+/-0.75	N/A	N/A
Power Input (Max Avg.) in W	20	20	20
Power Input (Max Peak) in kW	1	1	1
VSWR (max) DC-1 GHz	1.10	1.10	1.10
VSWR (max) 1-4 GHz	1.15	1.15	1.15
VSWR (max) 4-6 GHz	1.20	N/A	N/A
VSWR (max) 6-11 GHz	1.35	N/A	N/A
Maximum Weight (gr)	159	159	159
Maximum Weight (oz)	5.6	5.6	5.6
Special Notes:	A , B , C	A , B , C	A , B , C

Special Notes:
A: Power ratings for horizontal operation at + 25°C derate linearly to 5 watts at + 125°C
B: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.
C: Ordering information: Specify model number and add dash number suffix for attenuation in dB. For example: 776C-10.



Outline Drawings For Models: 768-3, 768-6, 768-10, 768-20, 768-30, 766-3, 766-6, 766-10, 766-30

Notes:
Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

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Type N (M/F) DC to 18 GHz, 20 Watt - 50 Watt

Features

- Designed to Meet Environmental Requirements of MIL-A-3933

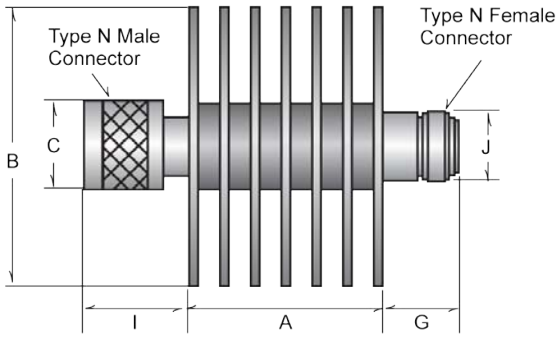
Models

- 776C-10, 776C-20, 776C-30

Model	776C-10	776C-20	776C-30
Low Frequency (GHz)	DC	DC	DC
High Frequency (GHz)	18.0	18.0	18.0
Attenuation dB (Nominal)	10	20	30
Attenuation dB (Deviation)	+/- 0.5	+/- 0.75	+/- 1.0
Power Input (Max Avg.) in W	50	50	50
Power Input (Max Peak) in kW	1	1	1
VSWR (max) DC-4 GHz	1.30	1.30	130
VSWR (max) 4-12.4 GHz	1.40	1.35	1.35
VSWR (max) 12.4-15 GHz	1.50	1.40	1.40
VSWR (max) 15-18 GHz	1.50	1.50	1.50
Maximum Weight (gr)	340	340	340
Maximum Weight (oz)	12	12	12
Special Notes:	A , B	A , B	A , B

Special Notes:
A: Power ratings for horizontal operation at +25°C derate linearly to 5 watts at 125°C
B: Temperature Coefficient: 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.

Type N (M/F) DC to 18 GHz, 20 Watt - 50 Watt

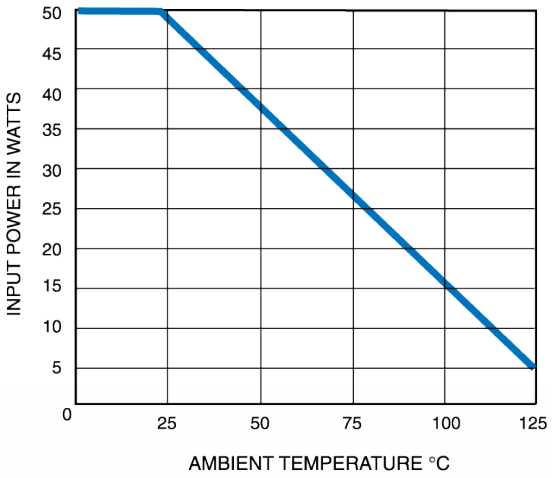


Outline Drawings For Models : 776C-10, 776C-20, 776C-30

Units	A	B	C	G	I	J
776C-10 , 776C-20, 776C-30						
in.	1.82	2.60	0.84	0.75	0.96	0.64
mm	46.23	66.04	21.34	19.05	24.38	16.26

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.



Derating Curve, Horizontal Operation
Models 776C-10, -20, -30

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Type N (M/F) DC to 6 GHz, 150 Watt

Features

- High Power (150 watts average)
- 3, 6, 10, 20, and 30 dB Versions
- Designed to Meet Environmental Requirements of MIL-A-3933

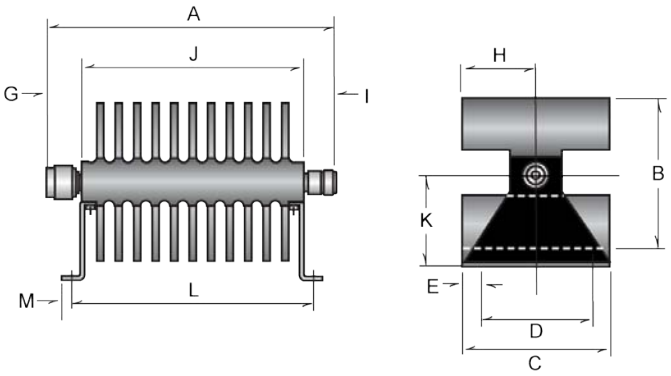
Models

- 769-3, 769-6, 769-10, 769-20, 769-30

Model	769-3	769-6	769-10	769-20	769-30
Low Frequency (GHz)	DC	DC	DC	DC	DC
High Frequency (GHz)	6.0	6.0	6.0	6.0	6.0
Attenuation dB (Nominal)	3	6	10	20	30
Attenuation dB (Deviation DC-2)	+/-0.4	+/-0.4	+/-0.4	+/-0.5	+/-0.5
Attenuation dB (Deviation 2-6)	+/-0.75	+/-0.75	+/-0.75	+/-1.0	+/-1.0
Power Input (Max Avg.) in W	150	150	150	150	150
Power Input (Max Peak) in kW	3	3	3	3	3
VSWR (max) DC-6 GHz	1.35	1.35	1.35	1.35	1.35
Weight (max) in kg	1.5	1.5	1.5	1.5	1.5
Weight (max) in lbs	3.3	3.3	3.3	3.3	3.3
Special Notes:	A , B	A , B	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt
B: Specify model number and add dash number suffix for attenuation in dB. For example: 769-3

Type N (M/F) DC to 6 GHz, 150 Watt

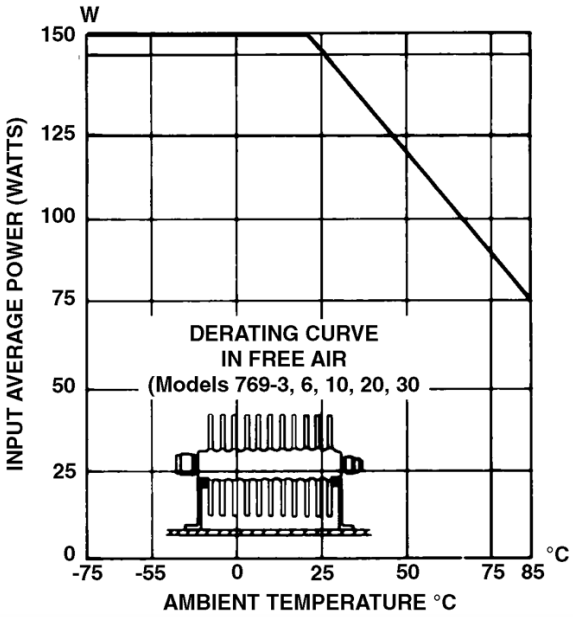


Outline Drawings For Models : 769-3, 769-6, 769-10, 769-20, 769-30

Units	A	B	C	D	E	G	H	I	J	K	L	M
769-3 , 769-6, 769-10, 769-20, 769-30												
in.	7.31	4.20	4.20	3.00	0.60	0.88	2.10	0.75	5.68	2.50	6.16	0.28
mm	185.67	106.68	106.68	76.20	15.24	22.35	53.34	19.05	144.27	63.50	156.46	7.11

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.



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Type N (M/F) DC to 18, 2 Watt Precision Attenuator Sets

Features

- Calibrations Traceable to NIST
- Extremely Low Frequency Sensitivity
- Designed to Meet Environmental Requirements of MIL-A-3933

Models

- 118A/4, 119A/4, 120A/4

Model	118A/4	119A/4	120A/4
Frequency Range (GHz)	DC-12.4	DC-12.4	DC-18
Attenuators	1 each 3, 6, 10, 20 dB values of Model 777C	1 each 3, 6, 10, 20 dB values of Model 757C	1 each 3, 6, 10, 20 dB values of Model 779
Absolute Calibration Sensitivity Accuracy per 10 dB Step	0.05	0.05	0.05
Average Power (Watts)	2	2	2
Special Notes:	A , B	A , B	A , B

Special Notes:
A: Temperature Coefficient 0.0006 dB/dB/°C; Power Coefficient: 0.0005 dB/dB/watt.
B: Specify model number and add dash number suffix for attenuation in dB. For example: 769-3.

CERTIFICATE OF CALIBRATION

SERIAL NUMBERS 02264 — *L-3 COMMUNICATIONS – NARDA*
DATE: 6/18/2009 — *HAUPPAUGE, NEW YORK*
ATTENUATORS -- MODEL 779
PRECISION CALIBRATED ATTENUATOR SET 120 A/4
INSERTION LOSS MEASURED IN 50 OHM SYSTEMS @ 20° ± 1° CELSIUS

SERIAL NUMBER	NOM. VALUE	DC RESISTANCE IN OHMS			INSERTION LOSS dB SOURCE / LOAD VSWR				
		MALE TO GND	FEMALE TO GND	FEMALE TO MALE	DC	1.0 GHz ≤ 1.05	2.0 GHz ≤ 1.05	3.0 GHz ≤ 1.05	4.0 GHz ≤ 1.05
04808	3 dB	50.18	50.28	16.06	2.80	2.85	2.85	2.85	2.90
05502	6 dB	51.10	50.05	23.85	6.05	6.05	6.05	6.05	6.05
09210	10 dB	49.89	50.85	52.03	9.95	10.00	10.00	10.00	10.00
06335	20 dB	50.04	49.31	80.90	19.85	19.85	19.90	19.90	19.90

SERIAL NUMBER	NOM. VALUE	INSERTION LOSS dB SOURCE / LOAD VSWR							
		5.0 GHz ≤ 1.05	6.0 GHz ≤ 1.05	7.0 GHz ≤ 1.05	8.0 GHz ≤ 1.05	9.0 GHz ≤ 1.05	10.0 GHz ≤ 1.05	11.0 GHz ≤ 1.05	12.4 GHz ≤ 1.05
04808	3 dB	2.90	2.95	2.95	2.95	3.00	3.05	3.05	3.10
05502	6 dB	6.05	6.05	6.05	6.05	6.05	6.00	5.95	6.00
09210	10 dB	10.05	10.05	10.05	10.10	10.10	10.15	10.15	10.20
06335	20 dB	19.90	19.90	19.90	19.90	19.90	19.95	19.95	19.95

SERIAL NUMBER	NOM. VALUE	INSERTION LOSS dB SOURCE / LOAD VSWR						
		13.0 GHz ≤ 1.05	14.0 GHz ≤ 1.05	15.0 GHz ≤ 1.05	16.0 GHz ≤ 1.05	17.0 GHz ≤ 1.05	18.0 GHz ≤ 1.05	
04808	3 dB	3.10	3.15	3.20	3.20	3.20	3.25	
05502	6 dB	6.00	5.95	5.90	5.90	5.90	5.80	
09210	10 dB	10.25	10.25	10.30	10.15	10.20	10.25	
06335	20 dB	19.95	19.90	19.95	20.00	20.00	19.90	

Note: Sample calibration plackard supplied with kits.

SMA (M/F) DC-6 GHz 5 Watts

Features

- For Commercial Wireless Applications
- Fixed Attenuators with 5 W Average Power Rating

Models

- AF-SMA-6-5-3, AF-SMA-6-5-6, AF-SMA-6-5-10, AF-SMA-6-5-20

Model	AF-SMA-6-5-3	AF-SMA-6-5-6	AF-SMA-6-5-10	AF-SMA-6-5-20
Frequency Range (GHz)	DC-6	DC-6	DC-6	DC-6
Average Power (W)	5	5	2	5
Attenuation dB (Nominal)	3	6	10	20
VSWR (max) DC-1 GHz	1.1:1	1.1:1	1.1:1	1.1:1
VSWR (max) 1-3 GHz	1.2:1	1.2:1	1.2:1	1.2:1
VSWR (max) 3-5 GHz	1.3:1	1.3:1	1.3:1	1.3:1
VSWR (max) 5-6 GHz	1.35:1	1.35:1	1.35:1	1.35:1
Connector Type	Type SMA Male/Type SMA Female	Type SMA Male/Type SMA Female	Type SMA Male/Type SMA Female	Type SMA Male/Type SMA Female

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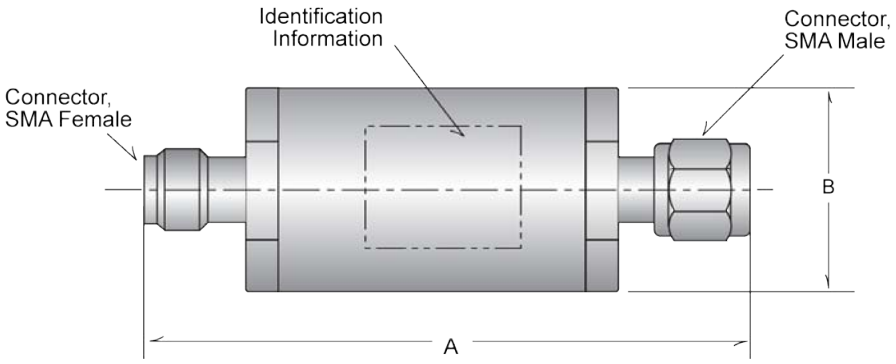
SMA (M/F) DC-6 GHz 5 Watts



Outline Drawings For Models : AF-SMA-6-5-3, AF-SMA-6-5-6, AF-SMA-6-5-10, AF-SMA-6-5-20

Units	A	B
AF-SMA-6-5-3 , AF-SMA-6-5-6, AF-SMA-6-5-10, AF-SMA-6-5-20		
in.	1.85	0.63
mm	46.99	16.00

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.
Connectors mate without interference per MIL-STD-348.

Quick Reference Guide

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Type N Female DC to 18 GHz, 0 to 9 dB in 1dB Increment

Features

- Broadband DC-18 GHz
- Small Size
- Precision Construction/High Reliability
- Precision 1 dB steps
- Panel Mount or Stand Alone (See note A)

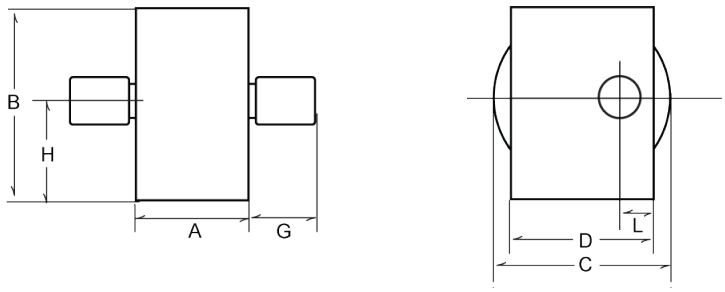
Models

- 741

Model	741
Low Frequency (GHz)	DC
High Frequency (GHz)	18.0
Attenuation Range	0-9 dB in 1 dB Steps
Step 1 Deviation (0dB)	+/- 0.5
Step 2 Deviation (1dB)	+/- 0.5
Step 3 Deviation (2dB)	+/- 0.5
Step 4 Deviation (3dB)	+/- 0.5
Step 5 Deviation (4dB)	+/- 0.5
Step 6 Deviation (5dB)	+/- 0.5
Step 7 Deviation (6dB)	+/- 0.5
Step 8 Deviation (7dB)	+/- 0.5
Step 9 Deviation (8dB)	+/- 0.5
Step 10 Deviation (9dB)	+/- 0.5
Resettability per Drum (dB)	< 0.05
VSWR (max)	1.50
Impedance (Ohms)	50
Temperature Stability (dB / dB / Deg Celcius)	0.2
Power Peak (kW at duty of cycle of 0.0001)	0.2
Average Power (W)	2
Connector Type	Type N Female
Special Notes:	A , B

Special Notes:
A: A list of materials supplied, and installation instructions for rack mounting brackets for rack mounting kit (purchased separately) Part Number **43017200** appears at the end of the step attenuators section (after Model series 745 and 4745). The typical cutout for each attenuator type for the rack mount configuration appears with the outline drawings that follow.
B: Rack Mounting Kit accommodates all attenuator series housings.

Type N Female DC to 18 GHz, 0 to 9 dB in 1dB Increment



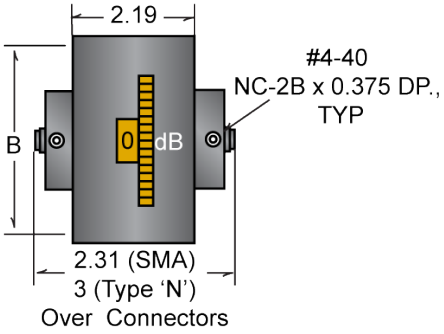
Outline Drawings For Models : 741

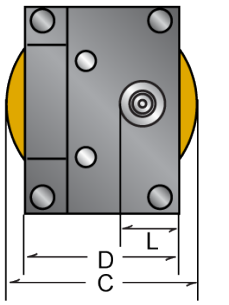
Units	A	B	C	D	G	H	L
741							
in.	1.125	1.875	1.750	1.437	0.781	0.938	0.312
mm	28.575	47.625	44.45	36.500	19.837	23.825	7.925

Notes:

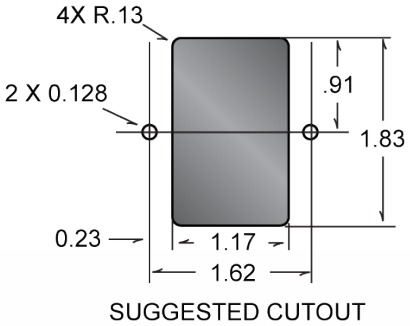
Unless otherwise specified dimensions are max. and for reference only. Connectors are made without interference per MIL-STD-348. Contact the factory for detailed specifications and outline drawing.

Typical Rack Mount Configurations For 741 and 4741 Thumb Wheel Step Attenuators





TYPICAL SINGLE AND DUAL STAND ALONE



SUGGESTED CUTOUT

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*Requires Mounting Kit, Part No. 43017200.

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Type N Female DC to 18 GHz, 0 to 60 dB in 10 dB Increment

Features

- Broadband DC-18 GHz
- Small Size
- Precision Construction/High Reliability
- Precision 10 dB steps, to 60 dB
- Panel Mount or Stand Alone (See note A)

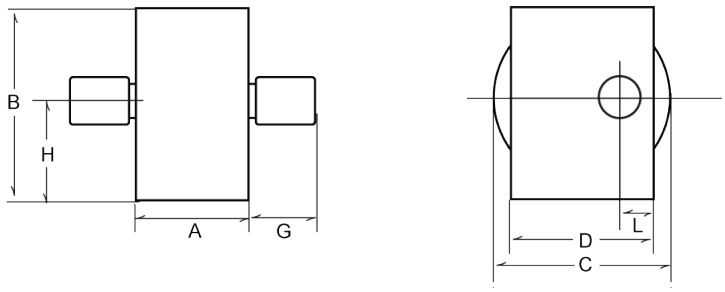
Models

- 743-60

Model	743-60
Low Frequency (GHz)	DC
High Frequency (GHz)	18.0
Attenuation Range	0-60 dB in 10 dB Steps
Step 1 Deviation (0dB)	0.5
Step 2 Deviation (10dB)	+/- 0.5
Step 3 Deviation (20dB)	+/- 0.7
Step 4 Deviation (30dB)	+/- 0.9
Step 5 Deviation (40dB)	+/- 1.0
Step 6 Deviation (50dB)	+/- 1.3
Step 7 Deviation (60dB)	+/- 1.5
Resettability per Drum (dB)	< 0.05
VSWR (max)	1.50
Impedance (Ohms)	50
Temperature Stability (dB / dB / Deg Celcius)	0.0001
Power Peak (kW at duty of cycle of 0.0001)	0.2
Average Power (W)	2
Connector Type	Type N Female
Special Notes:	A , B

Special Notes:
A: A list of materials supplied, and installation instructions for rack mounting brackets for rack mounting kit (purchased separately) Part Number **43017200** appears at the end of the step attenuators section (after Model series 745 and 4745). The typical cutout for each attenuator type for the rack mount configuration appears with the outline drawings that follow.
B: Rack Mounting Kit accommodates all attenuator series housings.

Type N Female DC to 18 GHz, 0 to 60 dB in 10 dB Increment



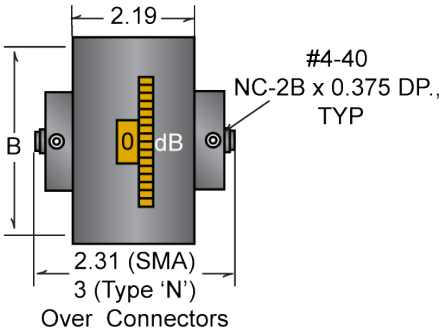
Outline Drawings For Models : 743-60

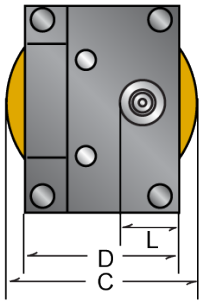
Units	A	B	C	D	G	H	L
743-60							
in.	1.437	1.875	1.750	1.437	0.781	0.938	0.312
mm	36.500	47.625	44.450	36.500	19.837	23.825	7.925

Notes:

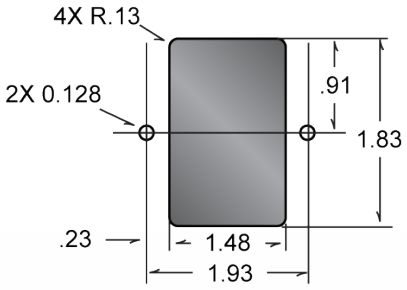
Unless otherwise specified dimensions are max. and for reference only. Connectors are made without interference per MIL-STD-348. Contact the factory for detailed specifications and outline drawing.

Typical Rack Mount Configurations
For 743-60 and 4743-60 Thumb Wheel Step Attenuators





TYPICAL SINGLE AND
DUAL STAND ALONE



TYPICAL PANEL CUTOUT SINGLE*

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Type N Female DC to 18 GHz, 0 to 69 dB in 1 and 10dB Increment

Features

- **Broadband DC-18 GHz**
- **Small Size**
- **Precision Construction/High Reliability**
- **Precision 1 and 10 dB steps**
- **Panel Mount or Stand Alone (See note A)**

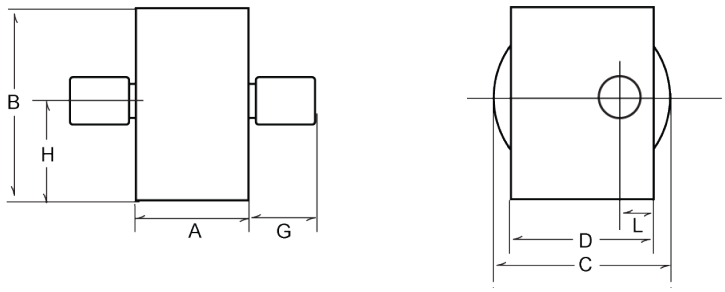
Models

- **745-69**

Model	745-69
Low Frequency (GHz)	DC
High Frequency (GHz)	18.0
Attenuation Range	0-69 dB in 1 dB AND 10 dB steps
Step 1 Deviation (0dB)	1.0
Steps 1-9 Deviation (1-9dB)	+/- 0.5
Step 10-19 Deviation (10-19dB)	+/- 1.0
Step 20-29 Deviation (20-29dB)	+/- 1.4
Step 30-39 Deviation (30-39dB)	+/- 1.2
Step 40-49 Deviation (40-49dB)	+/- 1.5
Step 50-59 Deviation (50-59dB)	+/- 1.9
Step 60-69 Deviation (60-69dB)	+/- 2.0
Resettability per Drum (dB)	< 0.05
VSWR (max) DC-12.4 GHz	1.50
VSWR (max) 12.4-18 GHz	1.65
Impedance (Ohms)	50
Temperature Stability (dB / dB / Deg Celcius)	0.0001
Power Peak (kW at duty of cycle of 0.0001)	0.2
Average Power (W)	2
Connector Type	Type N Female
Special Notes:	A , B

Special Notes:
A: A list of materials supplied, and installation instructions for rack mounting brackets for rack mounting kit (purchased separately) Part Number **43017200** appears at the end of the step attenuators section (after Model series 745 and 4745). The typical cutout for each attenuator type for the rack mount configuration appears with the outline drawings that follow.
B: Rack Mounting Kit accommodates all attenuator series housings.

Type N Female DC to 18 GHz, 0 to 69 dB in 1 and 10dB Increment



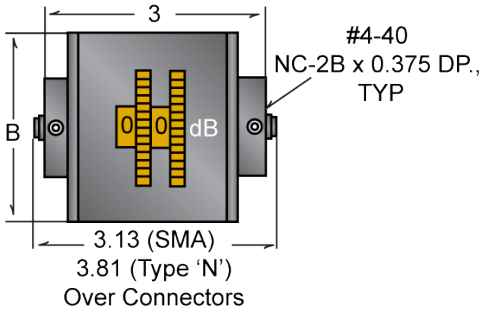
Outline Drawings For Models : 745-69

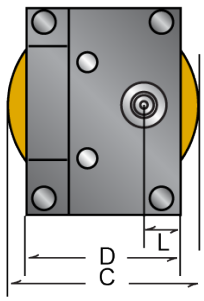
Units	A	B	C	D	G	H	L
745-69							
in.	2.25	1.875	1.75	1.437	2.25	0.938	0.312
mm	57.15	47.625	44.45	36.500	57.15	23.825	7.925

Notes:

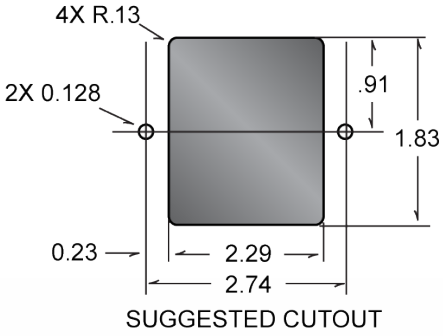
Unless otherwise specified dimensions are max. and for reference only. Connectors are made without interference per MIL-STD-348. Contact the factory for detailed specifications and outline drawing.

Typical Rack Mount Configurations
For 745-69 and 4745-69 Thumb Wheel Step Attenuators





TYPICAL SINGLE AND DUAL STAND ALONE



SUGGESTED CUTOUT

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*Requires Mounting Kit, Part No. 43017200.

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SMA Female DC to 18 GHz, 0 to 9 dB in 1dB Increment

Features

- Broadband DC-18 GHz
- Small Size
- Precision Construction/High Reliability
- Precision 1 dB steps, to 9 dB
- Panel Mount or Stand Alone (See note A)

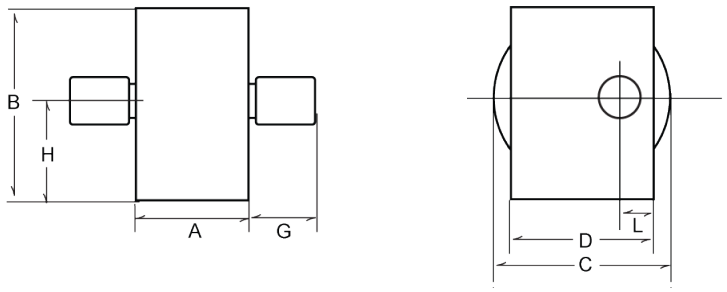
Models

- 4741

Model	4741
Low Frequency (GHz)	DC
High Frequency (GHz)	18.0
Attenuation Range	0-9 dB in 1 dB Steps
Step 1 Deviation (0dB)	+/- 0.5
Step 3 Deviation (2dB)	+/- 0.5
Step 2 Deviation (1dB)	+/- 0.5
Step 4 Deviation (3dB)	+/- 0.5
Step 5 Deviation (4dB)	+/- 0.5
Step 6 Deviation (5dB)	+/- 0.5
Step 7 Deviation (6dB)	+/- 0.5
Step 8 Deviation (7dB)	+/- 0.5
Step 9 Deviation (8dB)	+/- 0.5
Resettability per Drum (dB)	< 0.05
VSWR (max)	1.50
Impedance (Ohms)	50
Temperature Stability (dB / dB / Deg Celcius)	0.0001
Average Power (W)	2
Power Peak (kW at duty of cycle of 0.0001)	0.2
Connector Type	Type SMA Female
Special Notes:	A , B

Special Notes:
A: A list of materials supplied, and installation instructions for rack mounting brackets for rack mounting kit (purchased separately) Part Number **43017200** appears at the end of the step attenuators section (after Model series 745 and 4745). The typical cutout for each attenuator type for the rack mount configuration appears with the outline drawings that follow.
B: Rack Mounting Kit accommodates all attenuator series housings.

SMA Female DC to 18 GHz, 0 to 9 dB in 1dB Increment



Outline Drawings For Models : 4741

Units	A	B	C	D	G	H	L
4741							
in.	1.125	1.875	1.750	1.437	0.437	0.938	0.312
mm	28.575	47.625	44.450	36.500	11.100	23.825	7.925

Notes:

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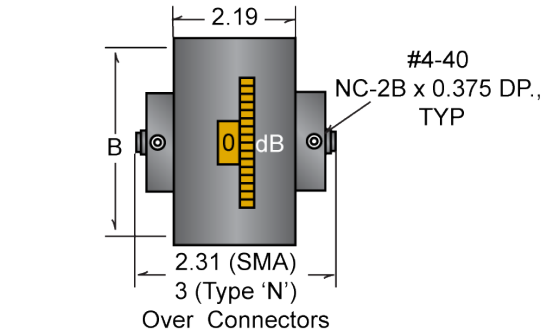
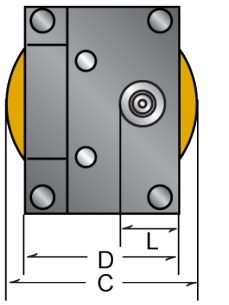
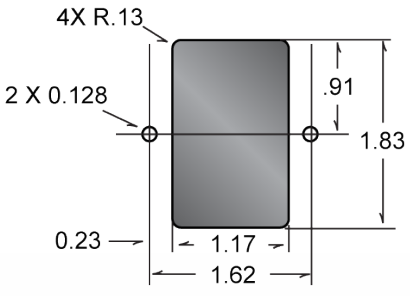
Typical Rack Mount Configurations For 741 and 4741 Thumb Wheel Step Attenuators





TYPICAL SINGLE AND DUAL STAND ALONE



SUGGESTED CUTOUT

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*Requires Mounting Kit, Part No. 43017200.

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SMA Female DC to 18 GHz, 0 to 60 dB in 10 dB Increment

Features

- Broadband DC-18 GHz
- Small Size
- Precision Construction/High Reliability
- Precision 10 dB steps, to 60 dB
- Panel Mount or Stand Alone (See note A)

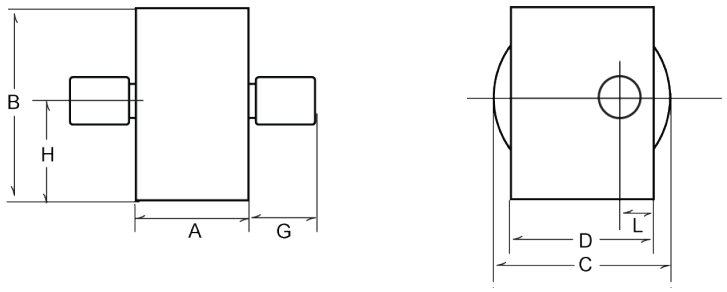
Models

- 4743-60

Model	4743-60
Low Frequency (GHz)	DC
High Frequency (GHz)	18.0
Attenuation Range	0-60 dB in 10 dB Steps
Step 1 Deviation (0dB)	0.5
Step 2 Deviation (10dB)	+/- 0.5
Step 3 Deviation (20dB)	+/- 0.7
Step 4 Deviation (30dB)	+/- 0.9
Step 5 Deviation (40dB)	+/- 1.0
Step 6 Deviation (50dB)	+/- 1.3
Step 7 Deviation (60dB)	+/- 1.5
Resettability per Drum (dB)	< 0.05
VSWR (max)	1.50
Impedance (Ohms)	50
Temperature Stability (dB / dB / Deg Celcius)	0.0001
Average Power (W)	2
Power Peak (kW at duty of cycle of 0.0001)	0.2
Connector Type	Type SMA Female
Special Notes:	A , B

Special Notes:
A: A list of materials supplied, and installation instructions for rack mounting brackets for rack mounting kit (purchased separately) Part Number **43017200** appears at the end of the step attenuators section (after Model series 745 and 4745). The typical cutout for each attenuator type for the rack mount configuration appears with the outline drawings that follow.
B: Rack Mounting Kit accommodates all attenuator series housings.

SMA Female DC to 18 GHz, 0 to 60 dB in 10 dB Increment



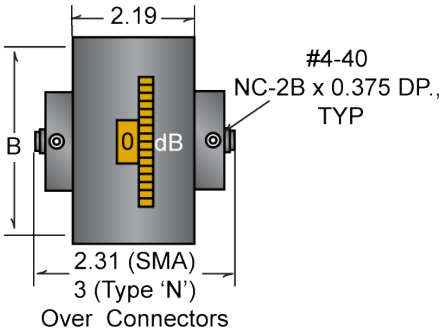
Outline Drawings For Models : 4743-60

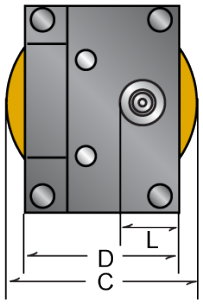
Units	A	B	C	D	G	H	L
4743-60							
in.	1.437	1.875	1.750	1.437	0.437	0.938	0.312
mm	36.500	47.625	44.450	36.500	11.100	23.825	7.925

Notes:

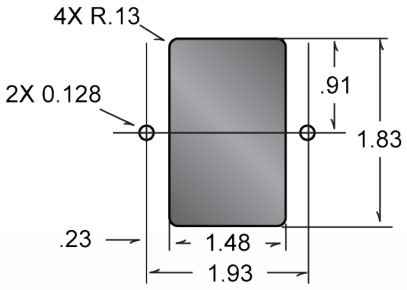
Unless otherwise specified dimensions are max. and for reference only. Connectors are made without interference per MIL-STD-348. Contact the factory for detailed specifications and outline drawing.

Typical Rack Mount Configurations
For 743-60 and 4743-60 Thumb Wheel Step Attenuators





TYPICAL SINGLE AND
DUAL STAND ALONE



TYPICAL PANEL CUTOUT SINGLE*

Unless otherwise specified dimensions are max. and for reference only.
*Requires Mounting Kit, Part No. 43017200.

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SMA Female DC to 18 GHz, 0 to 69 dB in 1 and 10dB Increment

Features

- Broadband DC-18 GHz
- Small Size
- Precision Construction/High Reliability
- Precision 1 and 10 dB steps, to 69 dB
- Panel Mount or Stand Alone (See note A)

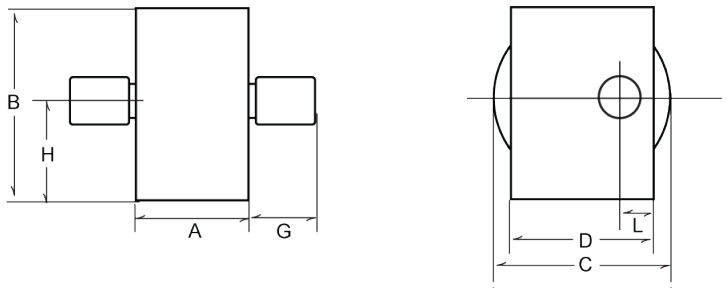
Models

- 4745-69

Model	4745-69
Low Frequency (GHz)	DC
High Frequency (GHz)	18.0
Attenuation Range	0-69 dB in 1 dB and 10 dB steps
Step 1 Deviation (0dB)	1.0
Steps 1-9 Deviation (1-9dB)	+/- 0.5
Step 10-19 Deviation (10-19dB)	+/- 1.0
Step 20-29 Deviation (20-29dB)	+/- 1.4
Step 30-39 Deviation (30-39dB)	+/- 1.2
Step 40-49 Deviation (40-49dB)	+/- 1.5
Step 50-59 Deviation (50-59dB)	+/- 1.9
Step 60-69 Deviation (60-69dB)	+/- 2.0
Resettability per Drum (dB)	< 0.05
VSWR (max)	1.50
Impedance (Ohms)	50
Temperature Stability (dB / dB / Deg Celcius)	0.0001
Average Power (W)	2
Power Peak (kW at duty of cycle of 0.0001)	0.2
Connector Type	Type SMA Female
Special Notes:	A , B

Special Notes:
A: A list of materials supplied, and installation instructions for rack mounting brackets for rack mounting kit (purchased separately) Part Number **43017200** appears at the end of the step attenuators section (after Model series 745 and 4745). The typical cutout for each attenuator type for the rack mount configuration appears with the outline drawings that follow.
B: Rack Mounting Kit accommodates all attenuator series housings.

SMA Female DC to 18 GHz, 0 to 69 dB in 1 and 10dB Increment



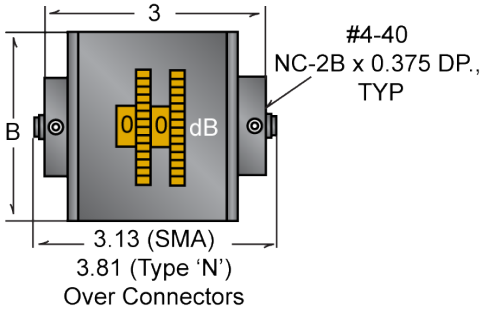
Outline Drawings For Models : 4745-69

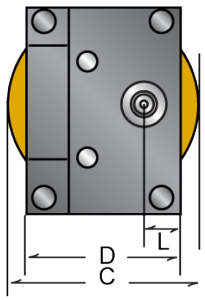
Units	A	B	C	D	G	H	L
4745-69							
in.	2.250	1.875	1.750	1.437	0.437	0.938	0.312
mm	57.150	47.625	44.450	36.500	11.100	23.825	7.925

Notes:

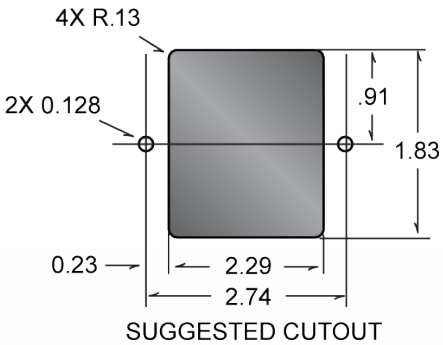
Unless otherwise specified dimensions are max. and for reference only. Connectors are made without interference per MIL-STD-348. Contact the factory for detailed specifications and outline drawing.

Typical Rack Mount Configurations
For 745-69 and 4745-69 Thumb Wheel Step Attenuators





TYPICAL SINGLE AND DUAL STAND ALONE



SUGGESTED CUTOUT

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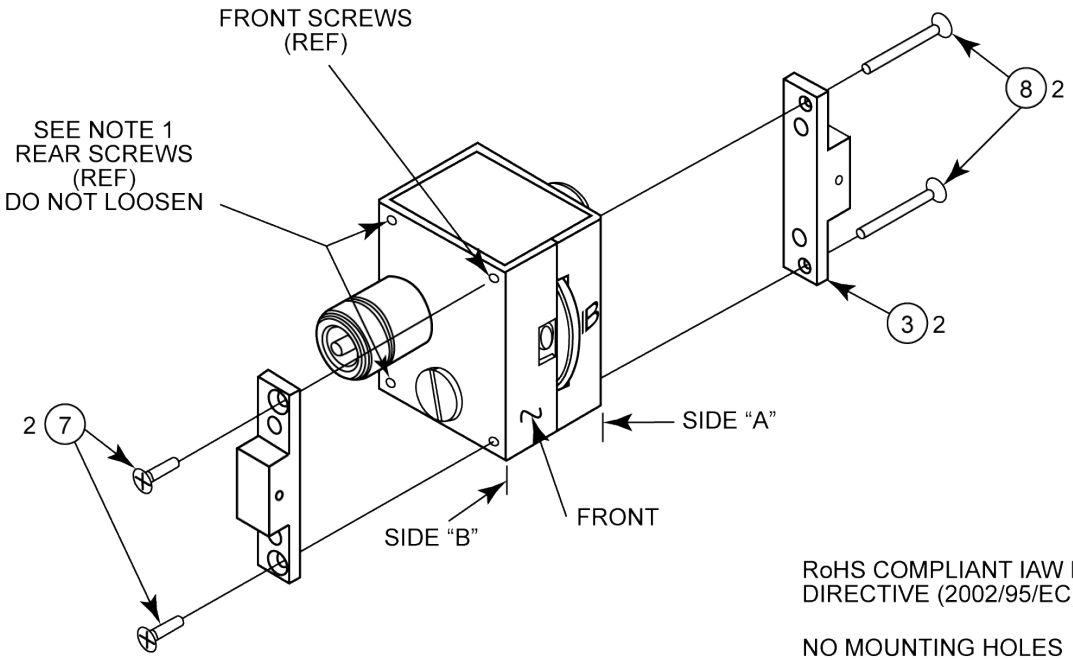
SMA Female DC to 18 GHz, 0 to 69 dB in 1 and 10dB Increment

Panel Mounting Brackets Installation
FOR OLDER DEVICES WITHOUT MOUNTING HOLES



RoHS COMPLIANT IAW EU DIRECTIVE (2002/95/EC)

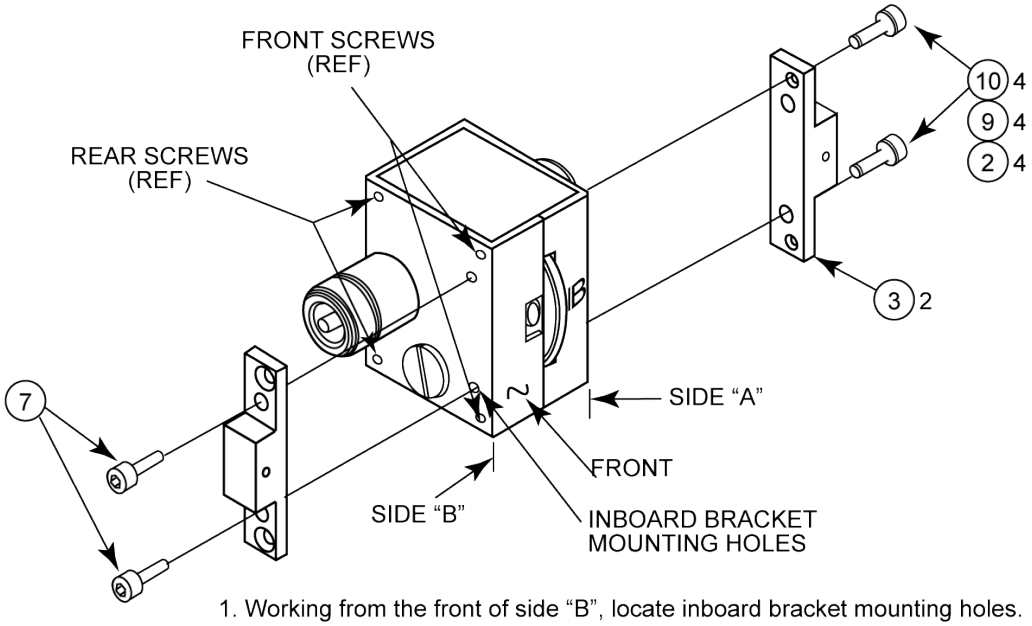
NO MOUNTING HOLES
(MODEL 4741 SHOWN)

This drawing gives instructions for installation of panel mounting brackets on a model 741, 4741, 743, 4743, 745, 4745, thumbwheel turret attenuator.

1. Working: from the front of side "A", remove the two FRONT screws, P/N 70152016. NO NOT loosen or otherwise disturbe the two rear screws.
2. Install mounting bracket, item 3 using two, item 8 flat head screw as shown on side "A".
3. Install mounting bracket, item 3 using two, item 7 flat head screws as shown on side "B".
4. Make sure mounting brackets are flush with front of unit.

SMA Female DC to 18 GHz, 0 to 69 dB in 1 and 10dB Increment

Panel Mounting Brackets Installation
FOR NEWER DEVICES WITH MOUNTING HOLES



1. Working from the front of side "B", locate inboard bracket mounting holes.
2. Install bracket, item 3 using screw, item 9, lock washer, item number 10 and flat washer 6. carefully insert the screw assembly through the inboard/mounting holes on the bracket and into the inboard screw holes on the housing.
3. Make sure the bracket is flush with hte front of the unit and tighten the screws.
4. Repeat above steps for "A" side.

List of Materials Supplied With Mounting Kit Part Number 43017200

FIND NO.	IDENT. NO.	NOMENCLATURE OR DESCRIPTION	QTY TO USE FOR MODEL(S) 741, 4741, 743 and 4743	QTY TO USE FOR MODEL(S) 745 AND 4745
10	535338136	LOCKWASHER, #6	4	4
9	70152019	SCR, SOCKET HD. #632 X 3/8 L.	4	4
8	551959020	SCR, FLAT #4-40 X 7/8 LG.	2	-
8	551959019	SCR, FLAT HD. #4-40 X 3/4 LG.	-	2
7	551959015	SCR, FLAT HD. #4-40 X 3/8 LG.	2	-
7	551959022	SCR, FLAT HD. #4-40 X 1 1/4 L.	-	2
3	42452200	BRACKET MOUTNING	2	2
2	515795805	WASHER, FLAT #6	4	4

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SMA (F) DC-2.5 GHz

Features

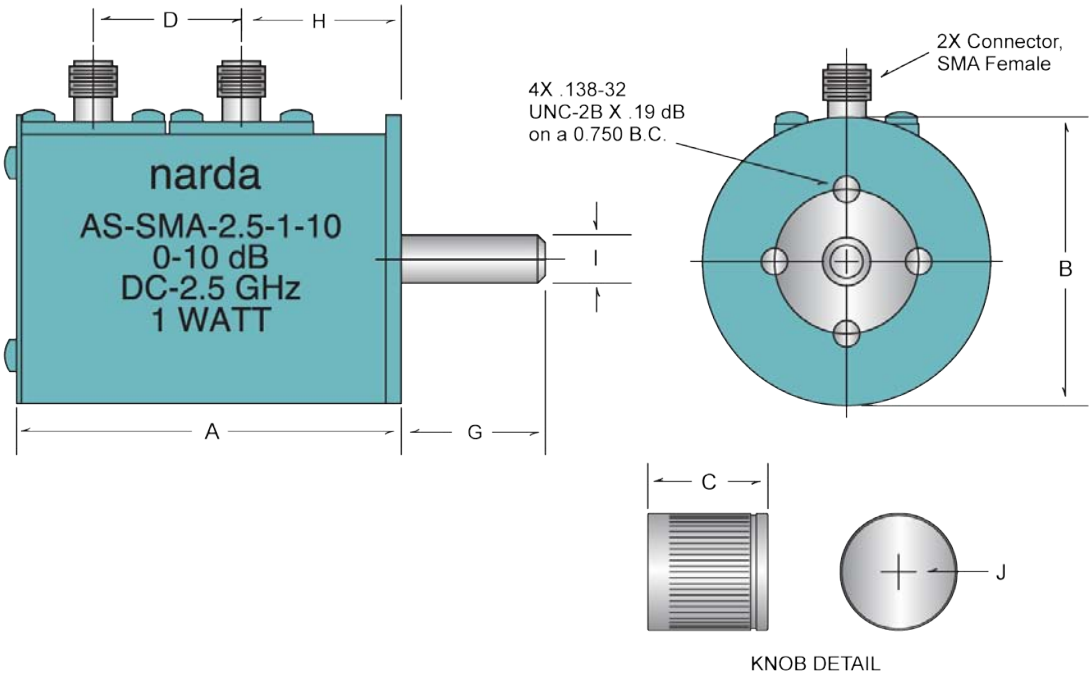
- For Commercial Wireless Applications

Models

- AS-SMA-2.5-1-10, AS-SMA-2.5-1-50, AS-SMA-2.5-1-70, AS-SMA-2.5-2-1

Model	AS-SMA-2.5-1-10	AS-SMA-2.5-1-50	AS-SMA-2.5-1-70	AS-SMA-2.5-2-1
Frequency Range (GHz)	DC-1.1 / 1.1-2.5	DC-0.5 / 0.5-1.0 / 1.0-2.5	DC-1.0 / 1.0-2.0 / 2.0-2.5 GHz	DC-1.1 / 1.1-2.5
Average Power (W)	1	1	1	2
Attenuation Range	0-10 dB in 1 dB Steps	0-50 dB in 1 dB Steps	0-70 dB in 10 dB Steps	0-1 dB in 0.1 dB Steps
VSWR (max)	1.25:1 / 1.5:1	1.2:1 / 1.4:1 / 1.5:1	1.2:1 / 1.4:1 / 1.5:1	1.2:1 / 1.4:1
Connector Type	Type SMA Female	Type SMA Female	Type SMA Female	Type SMA Female

SMA (F) DC-2.5 GHz



Outline Drawings For Models : AS-SMA-2.5-1-10

Units	A	B	C	D	G	H	I	J
AS-SMA-2.5-1-10								
in.	2.00	0.150	0.630	0.770	0.750	0.830	0.250	0.610
mm	50.80	3.810	16.002	19.558	19.050	21.082	6.350	15.494

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.
Connectors mate without interference per MIL-STD-348.

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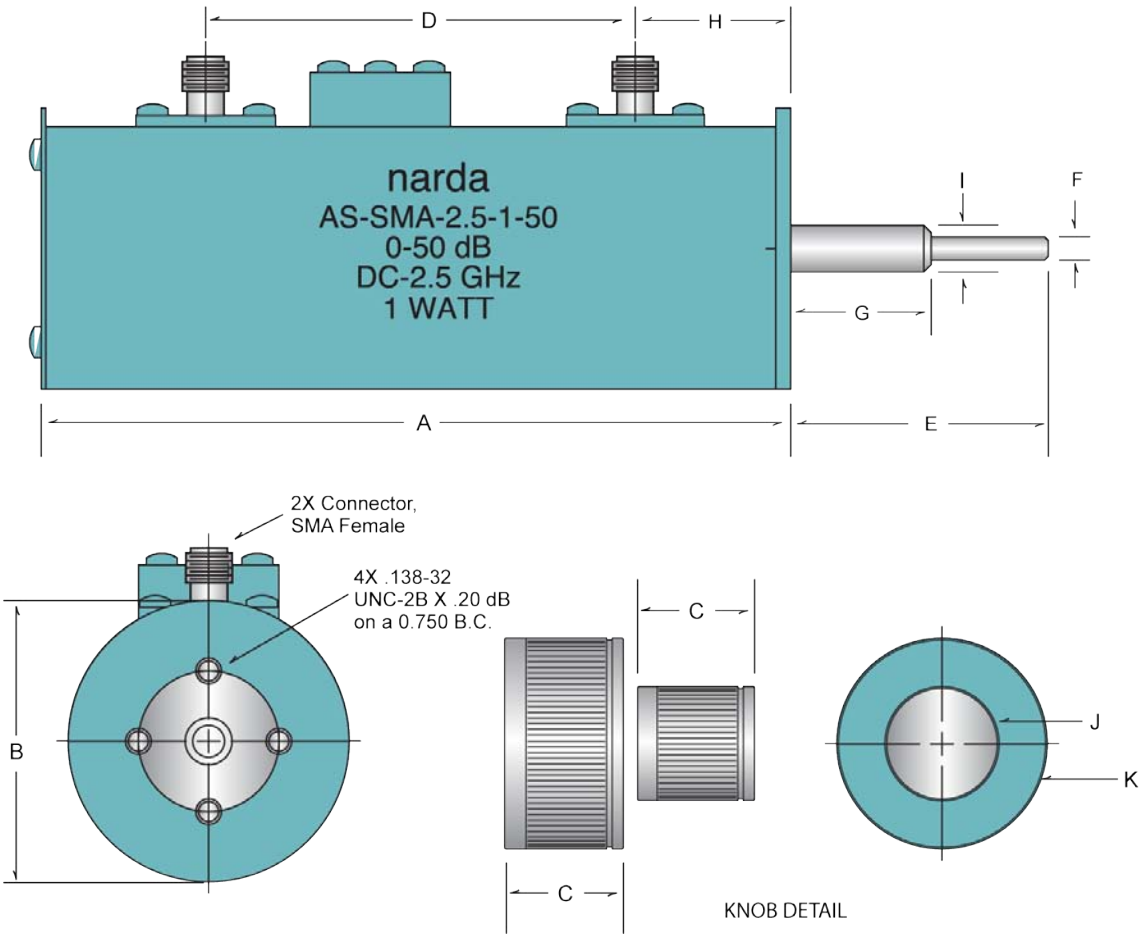
SMA (F) DC-2.5 GHz



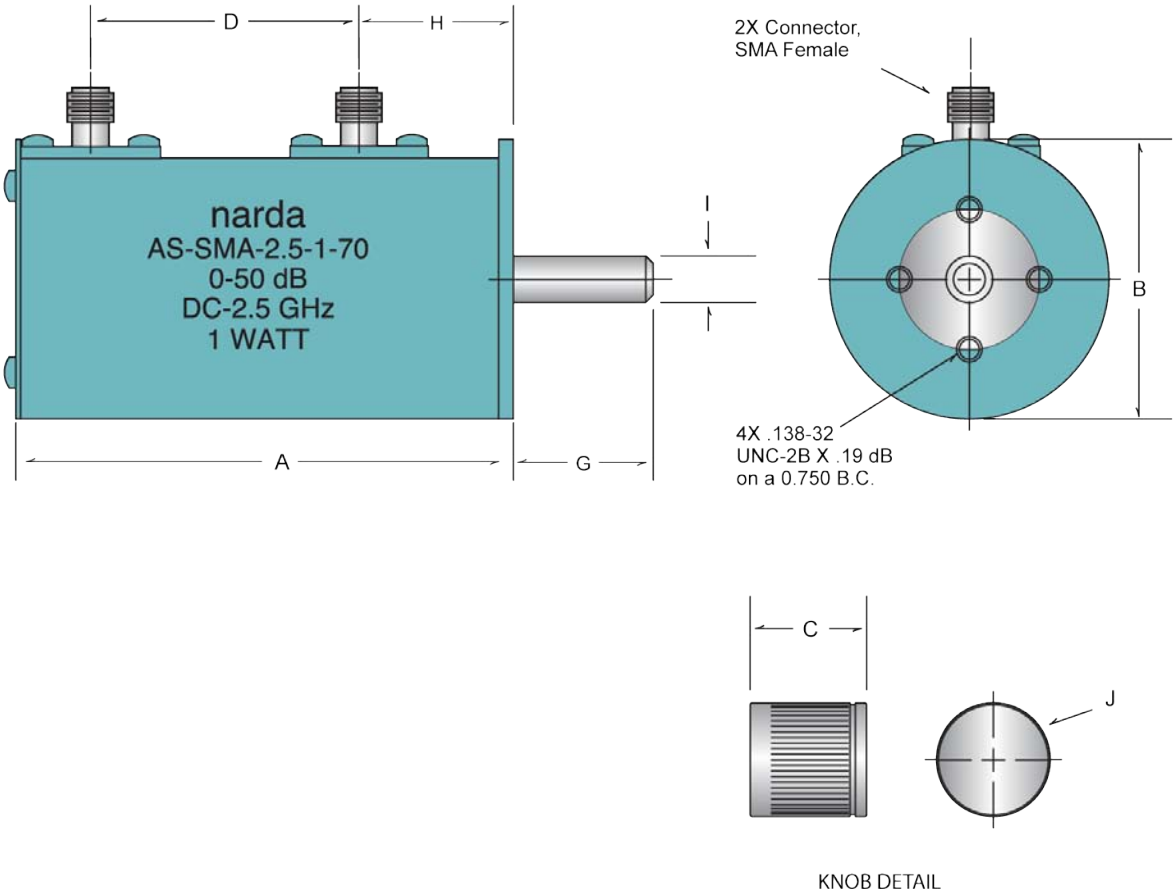
Outline Drawings For Models : AS-SMA-2.5-1-50

Units	A	B	C	D	E	F	G	H	I	J	K
AS-SMA-2.5-1-50											
in.	4.00	1.50	0.630	2.290	1.380	0.125	0.750	0.830	0.250	0.610	1.13
mm	101.60	38.10	16.002	58.166	35.052	3.175	19.050	21.082	6.350	15.494	28.70

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.
Connectors mate without interference per MIL-STD-348.

SMA (F) DC-2.5 GHz



Outline Drawings For Models : AS-SMA-2.5-1-70

Units	A	B	C	D	G	H	I	J
AS-SMA-2.5-1-70								
in.	2.67	1.50	0.63	1.44	0.75	0.83	0.25	0.61
mm	67.82	38.10	16.00	36.58	19.05	21.08	6.35	15.49

Notes:

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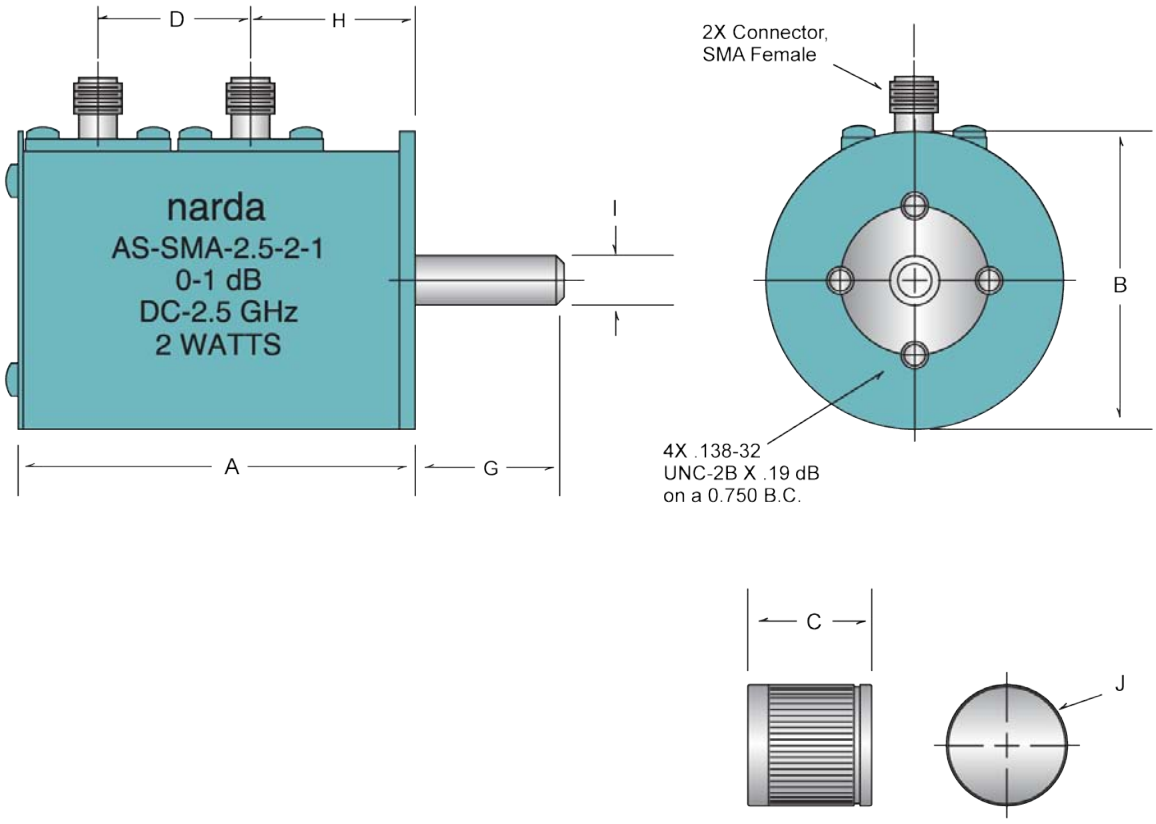
SMA (F) DC-2.5 GHz



Outline Drawings For Models : AS-SMA-2.5-2-1

Units	A	B	C	D	G	H	I	J
AS-SMA-2.5-2-1								
in.	2.00	1.50	0.63	0.77	0.75	0.83	0.250	0.61
mm	50.80	38.10	16.00	19.56	19.05	21.08	6.350	15.49

Notes:

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Connectors mate without interference per MIL-STD-348.

Quick Reference Guide

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Miniature SMA and 3.5 mm (F) 4.0 to 26.5 GHz

Features

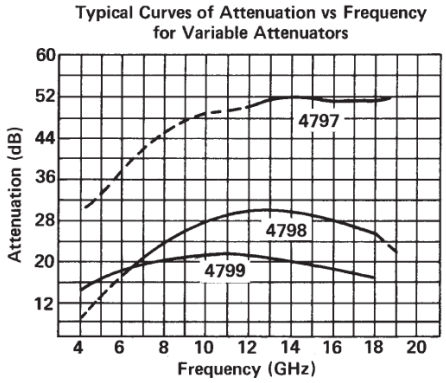
- Usable from 4 to 33 GHz
- Low Minimum Insertion Loss
- Small Size, Lightweight
- Operational to 105°C without Degradation (125°C storage)
- Excellent for Communications (narrow bandwidth)
- MIL Environment Versions Available, Contact Factory for Details

Models

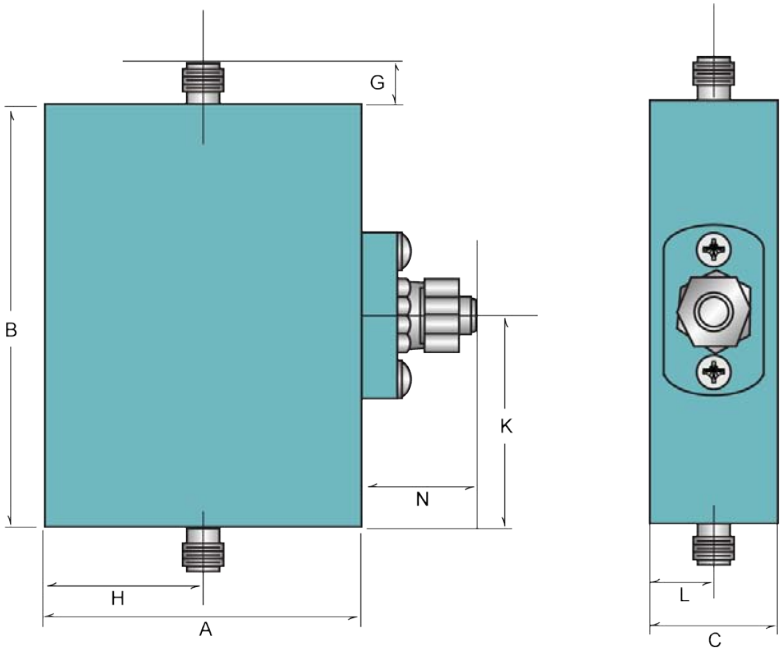
- 4797, 4798, 4799, 4796

Model	4797	4798	4799	4796
Low Frequency (GHz)	12.4	7.0	4.0	7.0
High Frequency (GHz)	18.0	18.0	18.0	26.5
Attenuation Range dB (Min)	45	20	15	15
Power Input (Max Avg.) in W	10	5	5	5
Power Input (Max Peak) in kW	3	3	3	1.4
VSWR (max)	1.3	1.7	-	1.7
VSWR (max) 4-7 GHz	-	-	1.5	-
VSWR (max) 7-18 GHz	-	-	1.3	-
Insertion Loss dB (max)	1.0	0.6	-	-
Insertion Loss dB (max) 4.0-12.4 GHz	-	-	0.7	-
Insertion Loss dB (max) 7-12.4 GHz	-	-	-	0.7
Insertion Loss dB (max) 12.4-18 GHz	-	-	1.0	-
Insertion Loss dB (max) 12.4-26.5 GHz	-	-	-	1.5
Frequency Sensitivity dB	+/- 1.5	+/- 3.5	-	+/- 3.0
Frequency Sensitivity dB (max) 8-12.4 GHz	-	-	+/- 0.5	-
Frequency Sensitivity dB (max) 12.4-18 GHz	-	-	+/- 2.0	-
Connector Type	Type SMA Female	Type SMA Female	Type SMA Female	3.5 mm Female
Maximum Weight (gr)	340	57	213	213
Maximum Weight (oz)	12	2	7.5	7.5

Miniature SMA and 3.5 mm (F) 4.0 to 26.5 GHz



Refer to the above curve for model numbers 4797, 4798 and 4799.



Outline Drawings For Models : 4797

Units	A	B	C	G	H	K	L	N
				4797				
in.	2.25	2.188	.906	.375	.375	1.625	.453	.906
mm	57.15	55.575	23.012	9.525	9.525	41.275	11.506	23.012

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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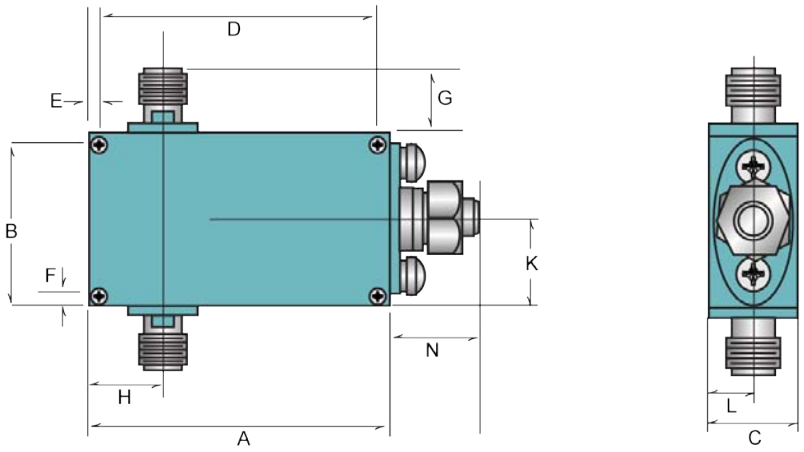
Miniature SMA and 3.5 mm (F) 4.0 to 26.5 GHz



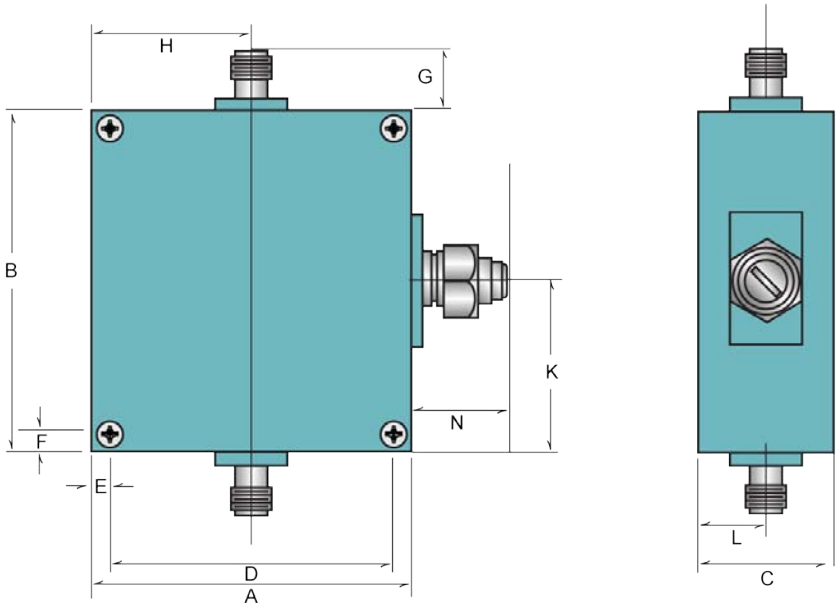
Outline Drawings For Models : 4798

Units	A	B	C	D	E	F	G	H	K	L	N
4798											
in.	1.75	1.0	.50	1.75	.063	.063	.375	.375	.50	.25	.50
mm	44.45	25.4	12.70	44.45	1.600	1.600	9.525	9.525	12.70	6.35	12.70

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

Miniature SMA and 3.5 mm (F) 4.0 to 26.5 GHz



Outline Drawings For Models : 4799

Units	A	B	C	D	E	F	G	H	K	L	N
4799											
in.	2.25	2.28	.906	2.063	.094	.094	1.188	.375		.453	.625
mm	57.15	57.91	23.012	52.400	2.388	2.388	30.175	9.525		11.506	15.875

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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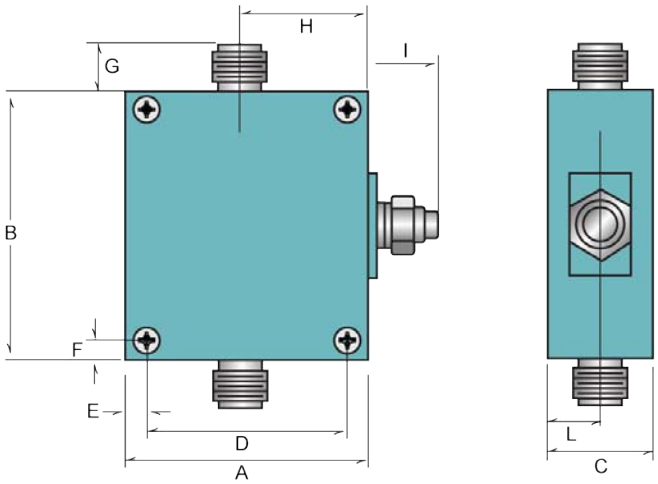
Miniature SMA and 3.5 mm (F) 4.0 to 26.5 GHz



Outline Drawings For Models : 4796

Units	A	B	C	D	E	F	G	H	I	L
4796										
in.	2.063	2.375	.829	2.063	.094	.094	1.188	1.188	.625	.50
mm	52.400	60.325	21.057	52.400	2.388	2.388	30.175	30.175	15.875	12.70

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

Broad Band Type N 2.0 to 12.4 GHz

Features

- Smooth, Continuous Operation Over Full Range
- Duo-Dial Drive for Easier Resetting and Positive Locking
- High Attenuation Over a Broad Frequency Range
- Designed for Panel Mounting

Models

- 791F (M/F), 792F (M/F)

Model	791F (M/F)	792F (M/F)
Low Frequency (GHz)	2.0	2.0
High Frequency (GHz)	12.4	12.4
Attenuation Range	N/A	N/A
Attenuation Range (2 - 2.5 GHz)	0-35	0-17.5
Attenuation Range (2.5 - 12.4 GHz)	0-37.5	0-20
Power Input (Max Avg.) in W	10	10
Power Input (Max Peak) in kW	5	5
VSWR (max)	1.30	1.30
Insertion Loss dB (max)	1.5	1.0
Maximum Weight (oz)	92.8	40.0
Weight (max) in kg	2.63	1.13
Special Notes:	A , B , C	A , B , C

Special Notes:
A: Connectors are Type N stainless steel.
B: All units are supplied with a female input connector and your choice of output.
C: Specify "M" for male output connector (ie 791FM) and "F" for female output connector (ie 791FF)

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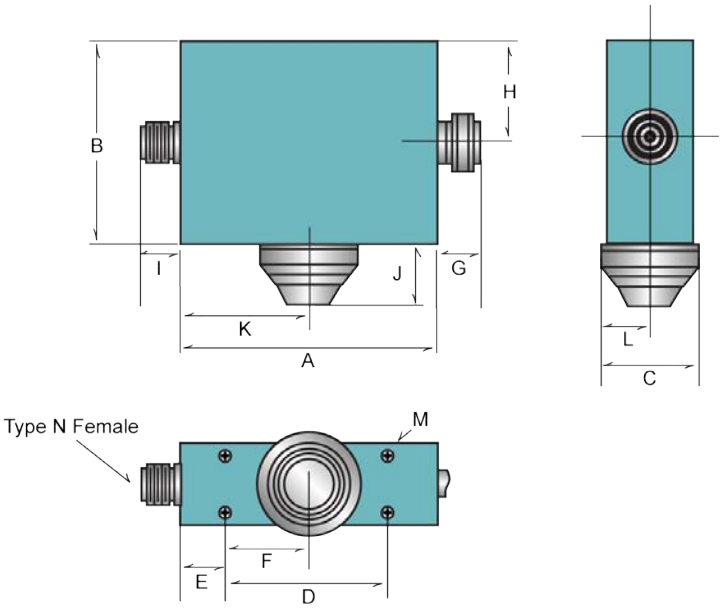
Broad Band Type N 2.0 to 12.4 GHz



Outline Drawings For Models : 791F (M/F), 792F (M/F)

Units	A	B	C	D	E	F	G	H	I	J	K	L	M (Dia.)
791F (M/F)													
in.	9.19	5.63	4.61	2.82	8.750	4.39	1.000	.51	.75	.78	4.61	.78	.92
mm	233.43	143.00	117.09	71.63	222.250	111.51	25.400	12.95	19.05	19.81	117.09	19.81	23.37
792F (M/F)													
in.	5.01	4.01	2.51	2.15	4.375	2.20	0.875	.45	.75	1.13	4.61	.92	.250
mm	127.25	101.85	63.75	54.61	111.125	55.88	22.225	11.43	19.05	28.70	117.09	23.37	6.350

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

Calibrated Variable Attenuators

Features

- Smooth, Continuous Operation Over Full Range
- Duo-Dial Drive for Easier Resetting and Positive Locking
- High Attenuation Over a Broad Frequency Range
- Designed for Panel Mounting

Models

- 793FM, 794FM

Model	793FM	794FM
Low Frequency (GHz)	4.0	4.0
High Frequency (GHz)	8.0	8.0
Attenuation Range	0-20	0-40
Power Input (Max Avg.) in W	10	10
Power Input (Max Peak) in kW	5	5
VSWR (max)	1.25	1.25
Insertion Loss dB (max)	0.5	0.5
Accuracy dB	+/-1.0	N/A
Accuracy dB (max) 0-30 dB	N/A	+/- 2.0
Accuracy dB (max) 30-40 dB	N/A	+/- 2.5
Maximum Weight (oz)	43.2	90.7
Weight (max) in kg	1.23	3.20
Special Notes:	A	A

Special Notes:
A: Connectors are Type N stainless steel. All units are supplied with a female input connector and male output connector.

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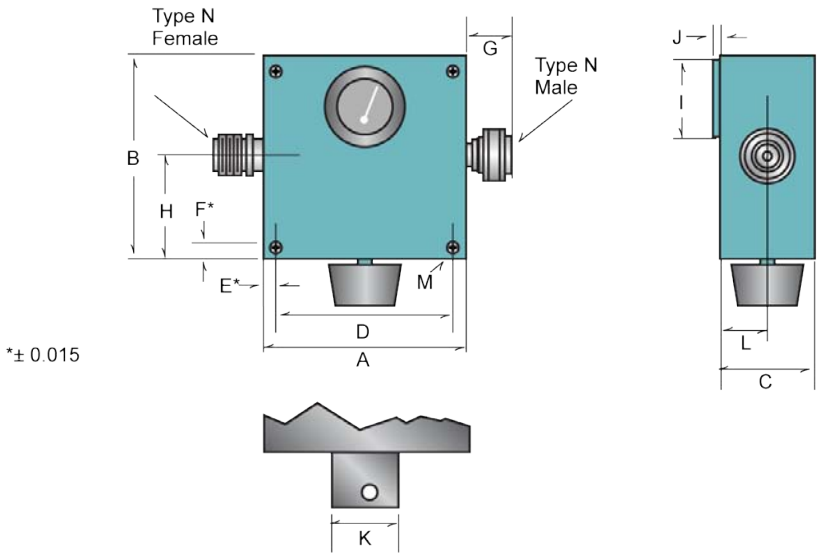
Calibrated Variable Attenuators



Outline Drawings For Models : 793FM, 794FM

Units	A	B	C	D	E	F	G	H	I	J	K	L	M (Dia.)
793FM													
in.	4.83	4.29	.16	2.42	4.50	3.968	2.23	.16	1.44	.03	1.49	.77	.171
mm	122.68	108.97	4.06	61.47	114.30	100.787	56.64	4.06	36.58	0.76	37.85	19.56	4.343
794FM													
in.	8.51	5.24	.16	2.42	4.5000	3.968	2.23	.79	1.44	.03	1.49	.77	.171
mm	216.15	133.10	4.06	61.47	114.3000	100.787	56.64	20.07	36.58	0.76	37.85	19.56	4.343

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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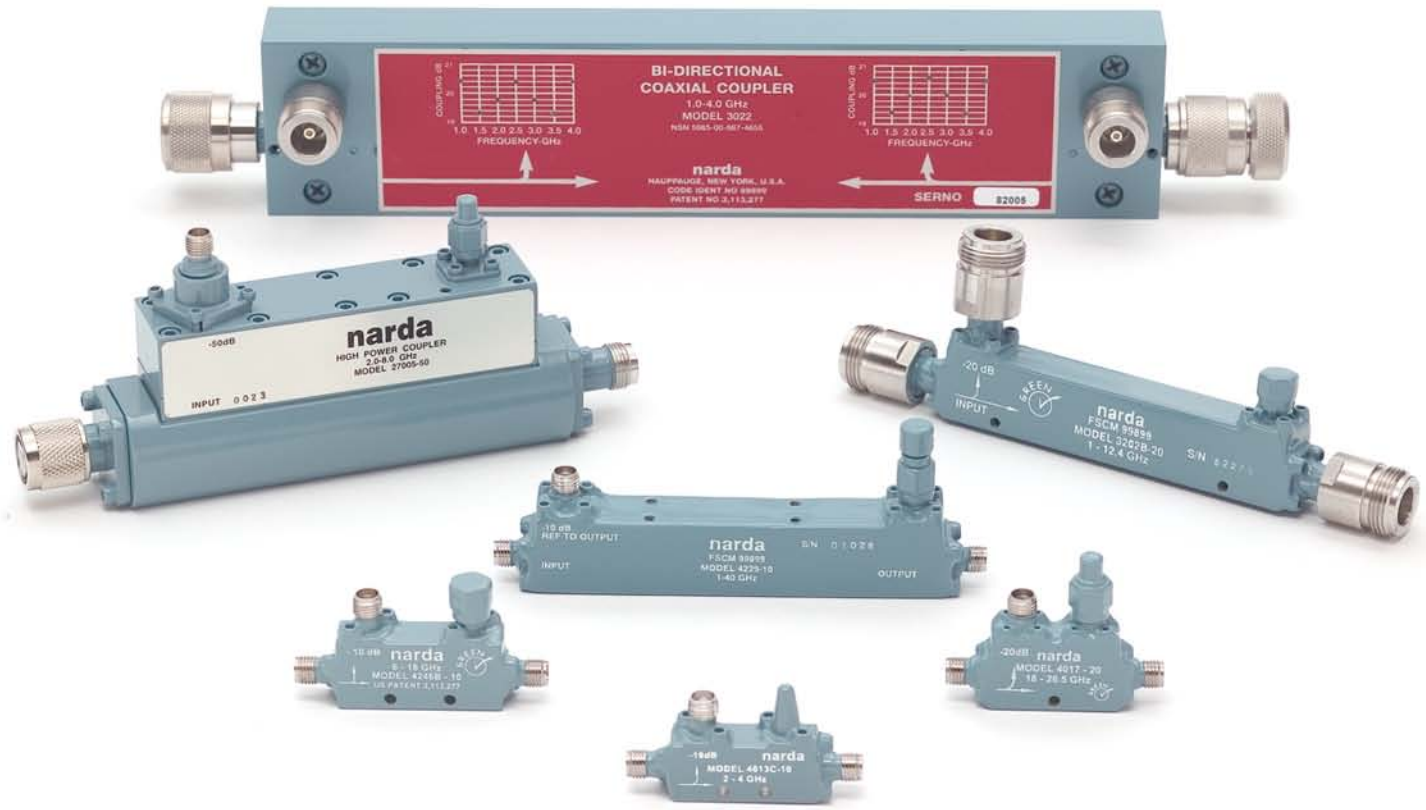
COUPLERS



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an L3 communications company

Quick Reference Guide

Environmental Performance for Selected Passive Products*

Parameter	Specification
Operating Temperature	-54 to +105°C
Storage Temperature	-55 to +125°C
Humidity	Per MIL-STD-202F, Method 103B, Condition B (96 hours at 95% R.H.)
Shock	Per MIL-STD-202F, Method 213B, Condition J (30G, 11 msec)
Altitude	Per MIL-STD-202F, Method 105G, Condition B (50,000 ft)
Vibration	Per MIL-STD-202F, Method 204D, Condition B (.06" double amplitude or 15G, whichever is less)
Thermal Shock	Per MIL-STD-202F, Method 107D, Condition A (5 cycles)

***Applicable to Stripline Directional Couplers, Attenuators, Power Dividers**

Note: This is an exclusive listing. Where otherwise noted in the catalog, the above environmental performance may not apply. Not applicable for those products designed for commercial applications. Many of our catalog off-the-shelf (COTS) products have the ability to withstand considerably more stringent environments. If you have special environmental requirements, please contact the Sales Department at Narda.

In today's microwave practice, the directional coupler has become a virtually indispensable measurement tool. It provides a simple, convenient, accurate means for sampling microwave energy without moving parts and without the need for adjustments. Unlike other methods of power sampling involving probes or coupling loops, the directional coupler also provides the important capability of separating forward from reflected power. By selecting energy traveling only in one direction, accurate VSWR measurements can be made automatically, eliminating the mechanical motion needed with a slotted line. Attenuation measurements also become more accurate when directional couplers are used since reflection errors are eliminated.

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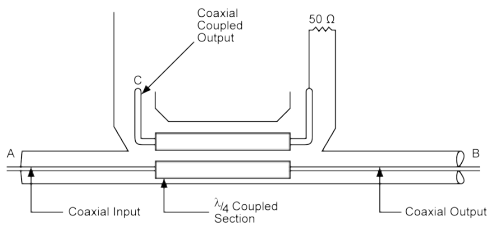

Figure 1. Diagram of a typical coaxial directional coupler

The basic construction of a coupled-line directional coupler can be seen in in the figure above, which illustrates a typical coaxial-line, microwave directional coupler such as might be used for microwave applications. It consists of two parallel striplines coupled over a length of approximately one-quarter wavelength. The mainline input (A) and output (B) coaxial lines are connected to one stripline; the other stripline is terminated in Z_O at one end, and is connected to the coupled output port through a coaxial line (C). The two sections, referred to respectively as the main and auxiliary lines, are separated from each other except for the coupling area, through which energy is unidirectionally coupled from the main line to the auxiliary line. A typical Narda coaxial coupler is shown in Figure 2.

Figure 2: Internal view of a typical coaxial coupler

In operation, energy is fed into end A of the main line. Most of this energy will appear at the output end B. Some fraction of the energy, however, will appear at the output of the auxiliary line C, depending upon the amount of coupling provided in the design of the unit. Energy applied to end B of the main line will appear at A, but practically none of this energy will appear at the auxiliary output C. The degree of discrimination in the auxiliary line between energy flowing in the B to A direction and energy flowing in the A to B direction is the directivity of the coupler. Directivity is calculated as the ratio of the forward to reverse coupling, expressed in dB. Since the intention is to ensure that a minimum of reflected energy reaches the load on the auxiliary line, the ideal directional coupler will have an infinite value of directivity. The amount of coupling desired for forward power, however, will vary with the application. Consequently, coupling values from 3 dB to beyond 70 dB are frequently encountered.

Types Of Directional Couplers

Although a wide variety of configurations and packages have been built, most directional couplers fall into a relatively small number of well-defined types according to the intended service and sampling capabilities. **Typical categories are**: waveguide or coaxial, single- or dual-directional units, and combination types.

Coaxial directional couplers are offered for use at frequencies from 10 MHz to 60 GHz, and can be obtained with any of the standard or precision miniature coaxialconnectors. Dual directional couplers, which permit simultaneous sampling of both forward and reflected energy, consist essentially of two directional couplers connected back to back in a single package and are available for coaxial systems. The picture above shows high directivity directional couplers.

In addition, as special-order devices, a number of combination types are available, such as those which include couplers combined with detectors, and referred to as directional detectors. For some applications, couplers are designed without the internal termination in the secondary line, permitting the user to terminate that line either with an absorbing load of his selection or with a detector, as desired.

Selection Features

Published specifications for directional couplers usually include coupling, directivity, insertion loss, main line and auxiliary line VSWR, bandwidth,

frequency sensitivity and power handling capability. These and other terms commonly used in specifying coupler characteristics are defined below.

Coupling Coefficient - The ratio in dB of the incident power fed into the main port, to the coupled port power when all ports are terminated by reflectionless terminations. Some Narda couplers are principally used for power leveling, and the coupling coefficient of these couplers is expressed as the ratio in dB of the main-line power output to the power output at an auxiliary port.

Directivity - The ratio in dB of the power output at an auxiliary port, when power is transmitted in the preferred direction, to the power output at the same auxiliary port when the same amount of power is transmitted in the opposite direction. Reflectionless terminations are connected to all ports.

Insertion Loss - The change in load power, due to the insertion of a component in a transmission system, reflectionless terminations being connected to the ports of the inserted component. Note: This definition is different from the definition previously used to specify Narda couplers. See text for further explanation.

Residual VSWR - The standing wave ratio measured by a reflectometer coupler terminated by a reflectionless termination, and fed from a nonreflecting generator. (Directivity or return loss expressed as a VSWR.)

Bandwidth - The range of frequencies within which performance, with respect to some characteristic, falls within specific limits.

Frequency Sensitivity (or Flatness) - The maximum peak-to-peak variation in coupling coefficient that may be expected over a specified frequency band.

Tracking - The maximum change in the difference of the coupling coefficient ratio of two couplers, i.e., auxiliary port sampling incident power. The relative importance of each of these characteristics will, of course, vary with the particular application. It should be noted that some of these characteristics tend to conflict; for example, it is difficult to obtain both flatness over a broad bandwidth and high directivity. Selection of a coupler for each application thus requires evaluating the major performance parameters in terms of the intended service.

Coupling Coefficient

Narda directional couplers are offered in a choice of convenient standard and non-standard coupling values. While the standard coupling values of 6,10, 20, and 30 dB are most common, several catalog models are available in alternative coupling values (13 or 16 dB, for example), including devices that provide up to 60 dB of coupling. As is the case with the majority of our family of passive products, special models are available if they are required. Since our ability to provide a special coupler will be gated by the particulars of the requirement (volume factors, cost factors, etc.), we will often recommend the use of a standard-value coupler in conjunction with a fixed precision attenuator attached to the coupled port. With this configuration, any number of non-standard coupling values can be achieved very cost effectively.

The choice of the specific value of coupling coefficient will usually depend upon the power levels involved. Where auxiliary (coupled) output is used to feed a measuring device, the coupling must provide adequate signal levels without overloading the equipment. It must be remembered, also, that any coupler takes power out of the main line, the magnitude of this drain being dependent upon the amount of coupling between the main and auxiliary lines. A 20 dB coupler will thus reduce the transmitted power by 1 percent. In specifying coupling coefficient, therefore, it may be necessary to consider the amount of power loss that can be tolerated in the portion of the system following the coupler.

Coupling coefficient is measured with an absolute accuracy of +/- 0.1 dB per 10 dB. Flatness is measured to an accuracy of +/- 0.05 dB relative to other points.

Directivity

In power measurements, the degree to which the auxiliary line is isolated from the load is of particular importance where high measurement accuracy is required. In power measuring application, where the absolute magnitude of the sample is the significant value, reverse coupling into the auxiliary line will alter the magnitude of this sample, with resulting measurement error. Errors from reflected power can be severe when the directivity is not adequate. In reflectometry, where the VSWR of a test piece is measured, accuracy is closely dependent upon the directivity of the coupler used. Here the effect of poor directivity is to introduce a residual reflection which adds to or subtracts from the reflected energy of the device. The graph below shows a typical directivity

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curve for Narda Models 3292 and 5292 Broadband High Directivity Couplers.

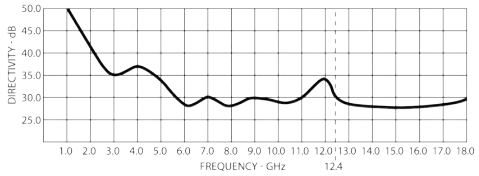

Figure 4. Typical directivity curve for Models 3292/5292 Broadband High Directivity Couplers

Insertion Loss

The term "insertion loss" has the same significance with respect to directional couplers as for other components in a microwave system. That is, it describes the loss resulting from the insertion of the device into a transmission system. Narda couplers now carry two insertion loss specifications: insertion loss, in accordance with the industry standard definition (see selection features previously described); and insertion loss (excluding coupled power). This latter term allows for some ambiguity in characterizing couplers with coupling coefficients less than 15 dB. It is calculated value based on what the insertion loss would be if no power were coupled to the auxiliary port or ports. The insertion loss “excluding coupled power” specification is given in this catalog (where applicable) for reference only.

Voltage Standing Wave Ratio (VSWR)

In waveguide couplers, where coupling between main and auxiliary line is accomplished through holes or slots, VSWR can be held to very low levels, often no greater than that resulting from a typical flange mismatch. In coaxial couplers, the proximity effects, end effects, and capacitive effects from the coupling bars employed generally result in higher values of VSWR. The major source of high VSWR in coaxial couplers, however, is usually found in the connectors employed. The particular structure of standard coaxial connectors introduces an appreciable amount of reflection. Consequently, where the application requires minimum reflection back into the main line, precision laboratory connectors are required.

Bandwidth

For laboratory applications, it is customary to select couplers with as broad a bandwidth as possible, simply because broad bandwidth affords greater flexibility in handling the changing day-to-day measurement tasks. Where bandwidth is under consideration it should be noted, however, that broad frequency range is usually accompanied by reduced directivity and increased VSWR. For very narrow bandwidths it is possible to maintain coupling coefficient to within 0.1 dB of nominal value and to achieve directivities over 40 dB. Where the coupler is required to operate over an octave frequency band the coupling tolerance may have to be increased. Thus, when a choice is possible, it is best to specify the narrowest bandwidth compatible with the application requirements.

Frequency Sensitivity

Directional couplers are available in single and multi-section design. Single (1/4 λ) section couplers exhibit frequency response similar to that shown in Curve A, graph below.

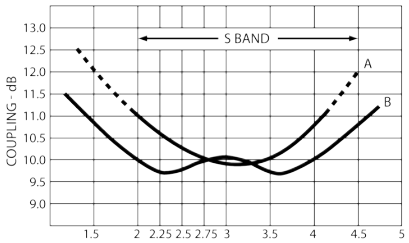

Figure 5. Typical response curves of single and multi-section directional couplers. *Curve A* represents 1/4µ *Curve B* represents maximally flat response curve.

The multi-section type couplers exhibit a flat frequency response over their frequency range as shown in Curve B. Where a band of frequencies must be sampled, as in swept-frequency measurements, the “flatness” or frequency sensitivity of the coupler is of major importance. Manufacturers differ in the method of specifying frequency sensitivity. In some instances, variation of coupling with frequency is expressed as the deviation from the nominal value; in others, as the excursion around the mean value of coupling over the range. Where couplers are to be used over a band of frequencies, manufacturers may provide a calibration chart showing the actual coupling as specified frequencies across the band. The Narda Model 3040 Series Maximally Flat Directional Couplers have a flatness specification of ±0.25 dB over an extended band and are, in addition, calibrated at five points within the octave

Power Rating

Power ratings for directional couplers are usually specified for both CW power and peak pulse power,

in both the forward and reverse directions. These ratings represent the maximum levels at which the unit can operate without altering its characteristics.

NOTE: For applicable Narda Couplers, Narda can supply standard test data for a nominal fee.

Applications

Power Measurements

Although the directional coupler finds a variety of uses as a power "splitter," in many applications it is used as a calibrated power sampler in a measurement system. Among its most common applications is the measuring or monitoring of microwave power. Because it can sample transmission line power by a definite known amount, accurate measurements can be conveniently made without interrupting operation of the system. The accuracy of measurement with a given detector-meter combination will depend upon the accuracy of sampling, that is, upon the absolute magnitude of the coupling. With the coupling coefficient known, the meter may be calibrated to provide a direct indication of power at the input to the coupler. (The figure below is an example of such an application.)

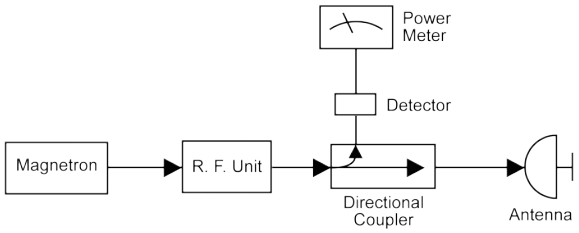

Figure 6. Directional couplers and power meters used for measuring power in the microwave portion of a radar system

Frequency Measurements

The directional coupler is especially useful in measuring or monitoring frequency in operating systems since it permits measurements without disrupting operation. It is generally not practical to insert a resonant cavity wavemeter in the transmission line of an operating system because this device will reject power either at the resonant frequency or at frequencies above and below resonance, depending on the type of meter used. The requirement for uninterrupted operation, without interference from the measuring device, is met by using a resonant cavity wavemeter or a direct reading counter in conjunction with a directional coupler.

Signal Leveling

In swept frequency measurements, some form of signal leveling is virtually mandatory. Although sweep generators are available with leveled outputs, an external closed loop method of leveling is usually necessary to eliminate uncertainties introduced by cables and other components between the generator and the test piece. Such a leveling loop can be conveniently arranged through the use of a directional coupler and detector.

Reflection Coefficient Measurements

The ability of swept-frequency techniques to provide broadband plots of microwave reflection characteristics (in a fraction of the required for point-by-point measurements) affords obvious advantages. Speed and convenience are provided where testing time and costs are important considerations. Recognition of these advantages led to continuing refinement of swept-frequency reflectometer systems. As a result, a choice of swept-frequency techniques is now available for measuring reflection coefficient and VSWR in coaxial components, providing both the accuracy demanded for laboratory work and the speed and efficiency required for production-line testing.

Recent improvements in coupler design and manufacturing techniques have significantly increased the accuracy of coaxial reflectometry. Today's reflectometer couplers provide directivities as much as an order of magnitude greater than previously obtainable and permit reflection measurements with accuracies equal to that of the slotted line.

In applications such as production-line testing, the reflectometer is the preferred method of measuring reflection coefficient, VSWR and impedance since this method offers advantages of speed and convenience over conventional slotted-line techniques. For reflectometry applications, the dual directional coupler, incorporating two auxiliary outputs, permits the simultaneous sampling of incident and reflected power.

Purpose and Use of Equipments

Reflectometer couplers offer a significant cost savings over microwave vector network analyzers for production test stations and monitoring VSWR during environmental testing. The test set-up consists of a sweep generator, matching attenuator or isolator, scalar network analyzer, and a precision laboratory

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reflectometer coupler (Narda 3090 Series, 3020A, 3022, 3024 Dual Couplers and 3292 Broadband Couplers). Data can be stored in an electronic file or plotted for a paper copy. The reflectometer is excellent for detecting intermittent problems while a unit is under environmental test.

Principles of Reflectometer Operation

The reflectometer coupler consists of two precision air-line directional couplers, with rigid structure enclosing the two couplers to ensure protection for the critical parts of the coupling mechanism. The coupled line impedances have been perfectly balanced.

Discontinuities where the transmission line connects to the coupling mechanism and at bead supports are designed for broadband impedance match to achieve the desired high directivity. Since the twin couplers are effectively positioned back-to-back, a portion of the RF microwave power applied to the input port is coupled out of the incident power port at a level 10 dB down from the applied power level. The remainder of applied power appears at the main line output port and is applied to the load. Coupling variations (also referred to as frequency sensitivity) between the main line input and coupled incident output ports are calibrated at five discrete frequencies within the octave bandwidth and vary not more than +/-1.0 dB from the nominal 20 dB coupling value.

Coaxial Dual Directional Coupler

The ability of a dual directional coupler to provide an accurate measure of incident or reflected power is enhanced by the tracking between the incident and reflected output ports. Therefore, the coupling variation of frequency sensitivity of the reflected output port should ideally be identical to that of the incident output port. RF power applied to the load is reflected to some degree depending on load characteristics, thereby resulting in a voltage standing wave ratio (VSWR) which is reflected back to the main line output port. This reflected power is coupled out of the reflected output port at a level 10 dB down from the reflected power level at the load. Since the tracking of the forward and reverse ports is held to a total of 0.3 dB, the coupling variation at the reflected output port closely follows that of the incident output port.

In addition to exhibiting excellent tracking characteristics, the dual directional coupler also features as high a directivity as possible. Directivity can be expressed as the ratio of power being coupled out of the reflected port, with the main line output terminated by a precision termination, to the power being coupled out of the incident port. If a portion of the incident power is coupled out of the reflected output port it essentially adds, randomly, to the reflected power from the load, thereby introducing an error. Likewise, if a portion of the reflected power appears at the incident output port, it adds to the normal incident coupled power. Therefore, a true measure of incident and reflected power for accurate determination of reflection coefficient and VSWR depends on coupler directivity; the higher the directivity, the more accurate the measurement. As previously mentioned, the reflectometer coupler exhibits a directivity of 45 dB minimum at L-band.

The single-ended coupler is a single air-line directional coupler for use in measuring transmission gain or loss characteristics in a swept measurement setup with the reflectometer coupler, or for use in RF power measurement setups. Besides exhibiting similar high directivity to the reflectometer coupler, in each of the five bands, thecoupled output port (10 dB) of this device also provides tracking (0.3 dB) with respect to the incident port of the reflectometer set. As a result, simultaneous measurement of reflection coefficient and transmission gain or loss characteristics is possible in a single swept measurement system.

Design Theory

A coaxial directional coupler has the general appearance of a section of coaxial line, with the addition of a second parallel section of line and with one end terminated (per the figure below).

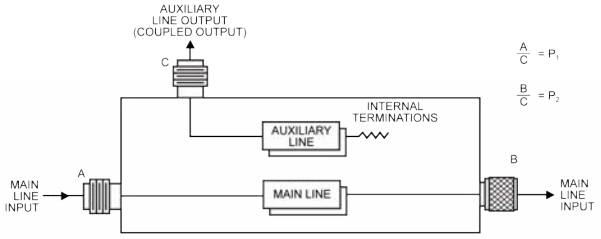

Figure 9. Single-Ended Coaxial Directional Coupler

These two sections are known as the main and auxiliary lines. The two lines are internally separated from each other; the amount of spacing between lines determines the amount of RF energy that may be transferred from the main line to the auxiliary line. In operation, assume that energy is fed into port A of the main line. Most of this energy will appear at output port B of the main line. However, a fraction of this energy (determined by coupling value) will also appear at the coupled port C, of the auxiliary line.

A dual-directional coaxial coupler, such as the reflectometer coupler, consists essentially of two single- ended couplers connected back-to-back. Perhaps the most important characteristic of the directional coupler (and the one from which its name originates) is its directivity.

Directivity and Coupling

Directivity means that energy entering output port B of the main line will appear at input port A, but practically none of the energy will appear at coupled output port C of the auxiliary line. This characteristic has wide application in the measurement of RF microwave power. The coupling of a directional coupler, therefore, is the ratio of the power fed into input port A of the main line to the power appearing at output port C of the auxiliary line; it is usually expressed in decibel (dB) and is calculated in the same manner as any other form of attenuation.

Directivity is a measure of isolation obtainable at coupled port C with power being fed into the main line at output port B. Directivity is calculated in the same manner as previously indicated, except that the values of P1 and P2 refer, respectively, to the power at the auxiliary line output port C with power at the main line input port A, and the power at auxiliary output port C with the same power input at main line output port B. Since the intention is to have as little reflected energy as possible coupled out of port C, the values of directivity are usually high (25 to 40 dB), while the coupling values may range from as low as 10 dB to more than 30 dB.

A directional coupler is a very useful device for ensuring that an absolute minimum of energy in the reverse direction (such as reflected energy due to a load mismatch) reaches the detector or other device at port C of the auxiliary line. In a dual-directional coupler, reflected energy should appear at coupled output port-D.

Confusion exists in many quarters as to why a considerable main-line VSWR does not interfere with the ability of a reflectometer coupler to measure low reflections. The following explanation should end this confusion... Please refer to the following figure.

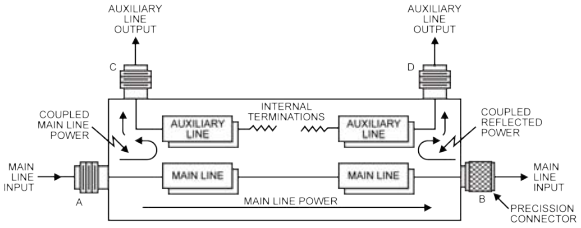

Figure 10. Dual Coaxial Directional Coupler

Power flow into test port B is coupled directly to auxiliary line output port D with minimal reflections.

When using a coupler as a reflectometer, the directivity path includes only the connector (i.e., APC-7) and the transmission line to the decoupled port. When a signal is reflected from the test piece into port B, this reflected power will be coupled into the auxiliary line and will appear at the output port D. The VSWR of the reflected power is affected only by the output reflections on the main line.

Main-line VSWR is affected by the input connector, and by reflections all along the line, to the output connector. However, the main-lineVSWRdoes not basically affect the above measurement at the coupled port because the major factors which contribute to the main line output VSWR are outside the path of the reflected power.

Main-line power is transmitted into the test port (B) direction towards the test piece. Ideally, any power that is coupled to the auxiliary line is absorbed by the internal termination. The main-line VSWR does not come into play when a measurement is made in the coupled direction. Thus, the main-line VSWR could be, for example, 1.20, but if the directivity is greater than 40 dB, a measurement can be made to better than 1.02 at the coupled port.

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2.92mm (F) 1 to 40 GHz 20W and 30W

Features

- Low Frequency Sensitivity
- High Directivity
- 2.92mm Connectors
- Models 4018-10 and 4018-20 Designed for MIL Environments

Applications

- EW Systems Radar (35 GHz Band Equipment)
- Millimeter Communications (38GHz Band Radio)
- OEM Test Equipment

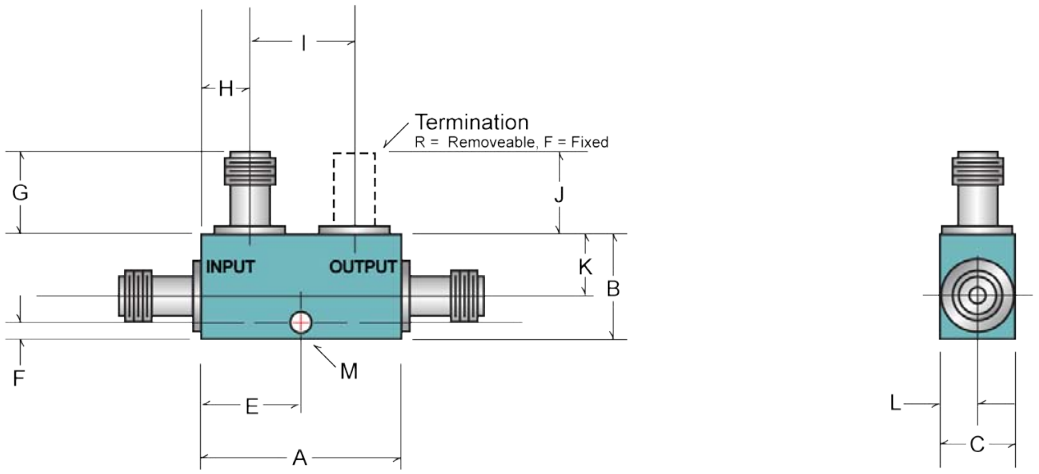
Models

- 4018-10, 4018-20, 4229-10

Model	4018-10	4018-20	4229-10
Low Frequency (GHz)	18.0	18.0	1.0
High Frequency (GHz)	40.0	40.0	40.0
Coupling dB	10 +/- 1.25	20 +/- 1.25	10 +/- 1.5
Minimum Directivity (dB)	12	12	12
True Insertion Loss (dB)	2.0	1.45	2.4
VSWR Maximum for Primary Line	1.9:1	1.9:1	1.7:1
VSWR Maximum for Secondary Line	1.9:1	1.9:1	1.75:1
Frequency Sensitivity dB (max)	+/- 0.8	+/- 0.8	+/- 1.0
Average Power (W)	30	30	20
Peak Power (kW)	3	3	3
Maximum Weight (gr)	28	28	90
Maximum Weight (oz)	1	1	3.2
Special Notes:	A	A	A

Special Notes:
A: Frequency Sensitivity is included in coupling.

2.92mm (F) 1 to 40 GHz 20W and 30W



Outline Drawings For Models : 4018-10, 4018-20

Units	A	B	C	E	F	G	H	I	J	K	L	M (Dia.)	Termination
4018-10 , 4018-20													
in.	1.10	0.645	0.415	0.55	0.113	0.38	0.27	0.564	0.90	0.395	0.207	0.104	R
mm	27.94	16.383	10.541	13.97	2.870	9.65	6.86	14.326	22.86	10.033	5.258	2.642	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface. All holes are thru unless noted as tapped.
Dimension:
D: +/- 0.01"
M: +/-0.004"/-0.002"
N: +/-0.01"

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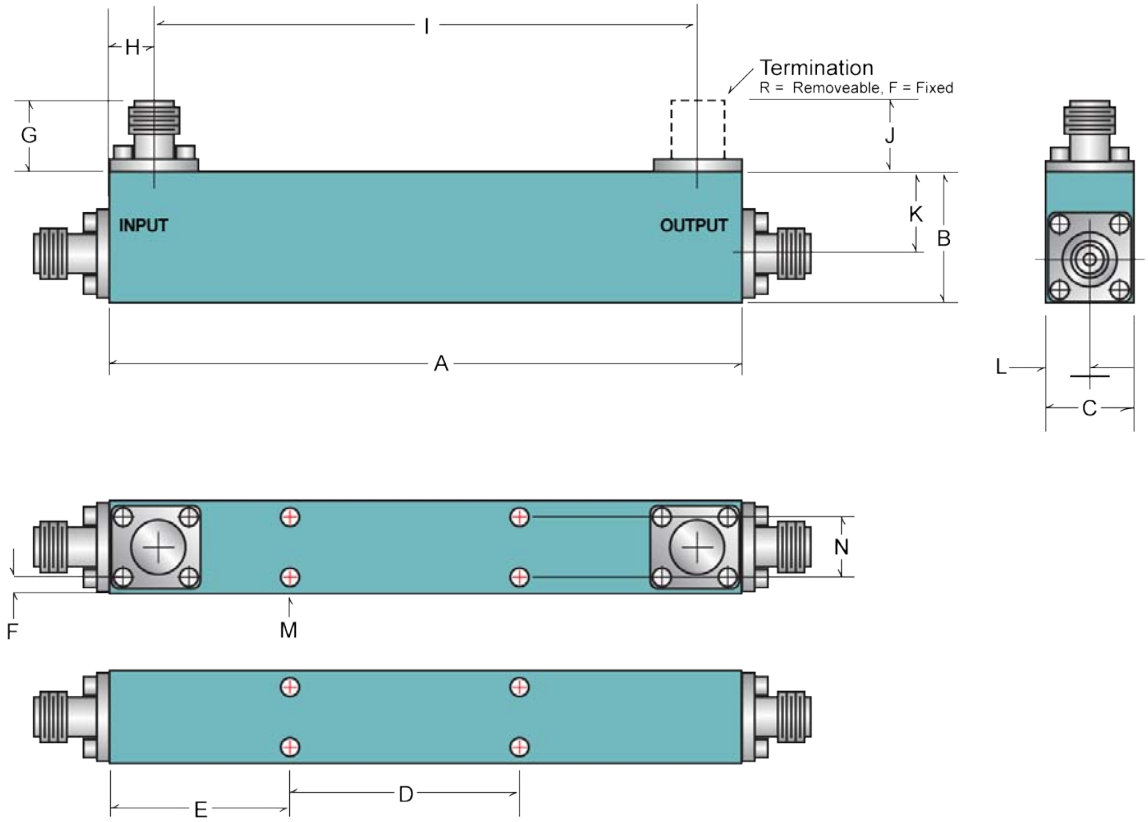
2.92mm (F) 1 to 40 GHz 20W and 30W



Outline Drawings For Models : 4229-10

Units	A	B	C	D	E	F	G	H	I	J	K	L	M (Dia.)	N	Termination
4229-10															
in.	3.60	0.73	0.53	1.25	1.00	0.11	0.38	0.26	3.00	0.90	0.47	0.26	Tap-1	0.30	F
mm	91.44	18.54	13.46	31.75	25.40	2.79	9.65	6.60	76.20	22.86	11.94	6.60		7.62	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Tap-1: #.112-40 UNC-2B x .25 DP min.
Dimension:
D: +/- 0.01"
M: +/-0.004"/-0.002"
N: +/-0.01"

2.92mm (F) 1.7 to 26.5 GHz 20W and 30W

Features

- Ultra-Broadband
- Low Return Loss
- Excellent Flatness
- Superior Directivity
- Designed for MIL Environments

Models

- 4247B-10, 4247-20, 4017C-10, 4017-20, 4227-16

Model	4247B-10	4247-20	4017C-10	4017-20	4227-16
Low Frequency (GHz)	6.0	6.0	18.0	18.0	1.7
High Frequency (GHz)	26.5	26.5	26.5	26.5	26.5
Coupling dB	10 +/- 1	20 +/- 1	10 +/- 1	20 +/- 1	16 +/- 1.5
DIrectivity dB (1.7 - 12.4)	N/A	N/A	N/A	N/A	15
Directivity dB (12.4 - 26.5)	N/A	N/A	N/A	N/A	12
Minimum Directivity (dB)	12	13	12	13	N/A
Insertion Loss, Coupled Power Excluded (dB)	0.9	0.7	0.9	0.7	0.80
True Insertion Loss (dB)	1.5	0.8	1.5	0.8	0.90
VSWR Maximum for Primary Line	1.5	1.45	1.5	1.45	1.45
VSWR Maximum for Secondary Line	1.5	1.45	1.5	1.45	1.45
Frequency Sensitivity (dB Max)	+/- 0.75	+/- 0.8	+/- 0.75	+/- 0.8	+/- 1.0
Average Power (W)	30	30	30	30	20
Peak Power (kW)	0.2	0.2	0.2	0.2	0.2
Maximum Weight (gr)	28	28	28	28	54
Maximum Weight (oz)	1.0	1.0	1.0	1.0	1.9
Special Notes:	A	A	A	A	A

Special Notes:
A: Frequency Sensitivity is included in coupling.

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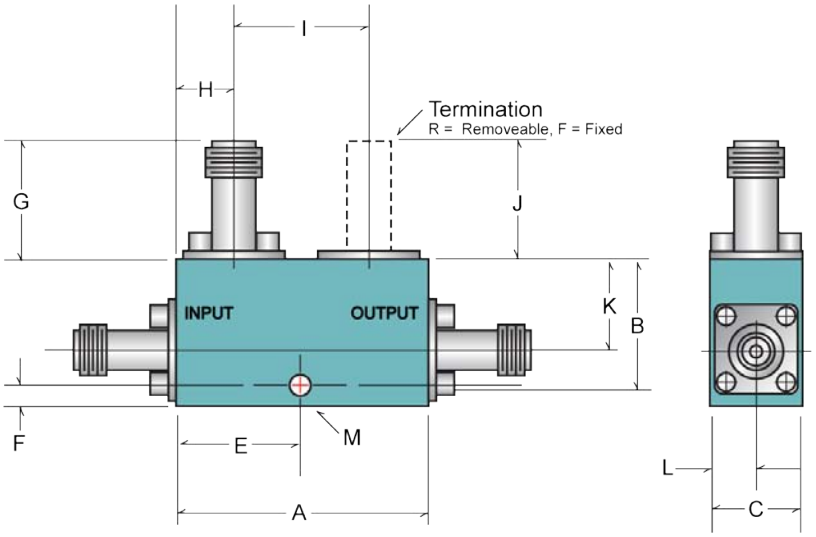
2.92mm (F) 1.7 to 26.5 GHz 20W and 30W



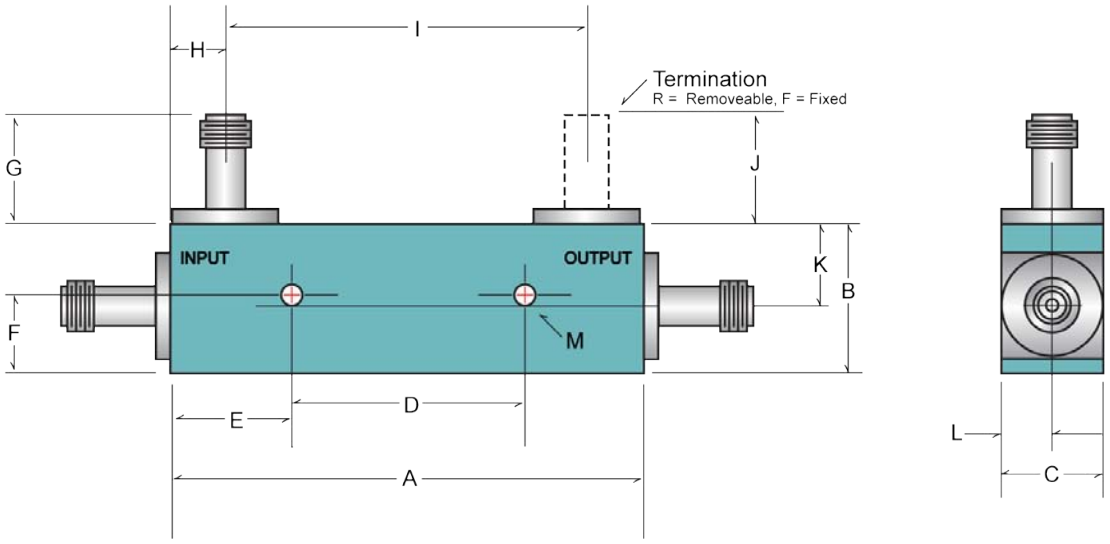
Outline Drawings For Models : 4247B-10, 4247-20, 4017C-10, 4017-20

Units	A	B	C	E	F	G	H	I	J	K	L	M (Dia.)	Termination
4247B-10 , 4247-20													
in.	1.06	0.625	0.38	0.53	0.093	0.38	0.25	0.56	0.90	0.375	0.19	0.104	R
mm	26.92	15.875	9.65	13.46	2.362	9.65	6.35	14.22	22.86	9.525	4.83	2.642	
4017C-10 , 4017-20													
in.	1.06	0.63	0.38	0.53	0.093	0.38	0.25	0.56	0.90	0.40	0.19	0.104	R
mm	26.92	16.00	9.65	13.46	2.362	9.65	6.35	14.22	22.86	10.16	4.83	2.642	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface. All holes are thru unless noted as tapped.
Dimension M: +/-0.004"/-0.002"

2.92mm (F) 1.7 to 26.5 GHz 20W and 30W



Outline Drawings For Models : 4227-16

Units	A	B	C	D	E	F	G	H	I	J	K	L	M (Dia)	Termination
4227-16														
in.	2.404	0.688	0.50	1.078	0.663	0.344	0.38	0.25	1.904	0.90	0.344	0.25	Tap-1	F
mm	61.062	17.475	12.70	27.381	16.840	8.738	9.65	6.35	48.362	22.86	8.738	6.35		

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension D: +/-0.015"
Tap-1: #2-56NC-2 X 1/8 DP.

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SMA (F) 0.5 to 18 GHz 50 Watt

Features

- Multi-Octave Frequency Coverage from 0.5 to 18 GHz
- Flat Frequency Response
- Small and Lightweight
- Operational to 105°C without Degredation (125°C Storage)
- Designed for MIL Environments

Models

- 4011C-10, 4011C-20, 4012C-6, 4012C-10, 4012C-20, 4012C-30, 4013C-6, 4013C-10, 4013C-20, 4013C-30, 4014C-6, 4014C-10, 4014C-20, 4014C-30, 4015C-6, 4015C-10, 4015C-20, 4015C-30, 4055-6, 4055-10, 4055-20, 4055-30, 4016D-6, 4016D-10, 4016C-20, 4016C-30, 4216-10, 4216-20

Model	4011C-10	4011C-20	4012C-6	4012C-10	4012C-20
Low Frequency (GHz)	0.5	0.5	1.0	1.0	1.0
High Frequency (GHz)	1.0	1.0	2.0	2.0	2.0
Coupling dB	10 +/- 1.25	20 +/- 1.25	6 +/- 1.00	10 +/- 1.25	20 +/- 1.25
Minimum Directivity (dB)	25	25	25	25	27
Insertion Loss, Coupled Power Excluded (dB)	0.20	0.20	0.20	0.20	0.20
True Insertion Loss (dB)	0.80	0.80	1.80	0.90	0.20
VSWR Maximum for Primary Line	1.15	1.15	1.15	1.10	1.10
VSWR Maximum for Secondary Line	1.15	1.15	1.15	1.10	1.10
Frequency Sensitivity (dB Max)	+/- 0.75	+/- 0.75	+/- 0.6	+/- 0.75	+/- 0.75
Power Input (Watts) Max	50	50	50	50	50
Reflected Power (Avg.) in Watts Max	5	50	2	5	50
Peak Power (Kw)	3	3	3	3	3
Maximum Weight (gr)	37	34	26	26	26
Maximum Weight (oz)	1.3	1.2	0.9	0.9	0.9
Special Notes:	A	A	A	A	A

Special Notes:
A: Frequency Sensitivity is included in coupling.

SMA (F) 0.5 to 18 GHz 50 Watt

Model	4012C-30	4013C-6	4013C-10	4013C-20	4013C-30
Low Frequency (GHz)	1.0	2.0	2.0	2.0	2.0
High Frequency (GHz)	2.0	4.0	4.0	4.0	4.0
Coupling dB	30 +/- 1.25	6 +/- 1.00	10 +/- 1.25	20 +/- 1.25	30 +/- 1.25
Minimum Directivity (dB)	27	22	22	22	22
Insertion Loss, Coupled Power Excluded (dB)	0.20	0.20	0.20	0.20	0.20
True Insertion Loss (dB)	0.20	1.80	0.80	0.20	0.20
VSWR Maximum for Primary Line	1.10	1.15	1.15	1.15	1.15
VSWR Maximum for Secondary Line	1.10	1.15	1.15	1.15	1.15
Frequency Sensitivity (dB Max)	+/- 0.75	+/- 0.60	+/- 0.75	+/- 0.75	+/- 0.75
Power Input (Watts) Max	50	50	50	50	50
Reflected Power (Avg.) in Watts Max	50	2	3	50	50
Peak Power (Kw)	3	3	3	3	3
Maximum Weight (gr)	26	18	18	18	18
Maximum Weight (oz)	0.9	0.6	0.6	0.6	0.6
Special Notes:	A	A	A	A	A

Special Notes:
A: Frequency Sensitivity is included in coupling.

Model	4014C-6	4014C-10	4014C-20	4014C-30	4015C-6
Low Frequency (GHz)	4.0	4.0	4.0	4.0	7.0
High Frequency (GHz)	8.0	8.0	8.0	8.0	12.4
Coupling dB	6 +/- 1.00	10 +/- 1.25	20 +/- 1.25	30 +/- 1.25	6 +/- 1.00
Minimum Directivity (dB)	18	20	20	20	15
Insertion Loss, Coupled Power Excluded (dB)	0.25	0.25	0.25	0.25	0.40
True Insertion Loss (dB)	2.00	1.00	0.30	0.25	2.00
VSWR Maximum for Primary Line	1.25	1.25	1.25	1.25	1.30
VSWR Maximum for Secondary Line	1.25	1.25	1.25	1.25	1.30
Frequency Sensitivity (dB Max)	+/- 0.6	+/- 0.75	+/- 0.75	+/- 0.75	+/- 0.5
Power Input (Watts) Max	50	50	50	50	50
Reflected Power (Avg.) in Watts Max	2	5	50	50	2
Peak Power (Kw)	3	3	3	3	3
Maximum Weight (gr)	18	18	18	18	23
Maximum Weight (oz)	0.6	0.6	0.6	0.6	0.7
Special Notes:	A	A	A	A	A

Special Notes:
A: Frequency Sensitivity is included in coupling.

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SMA (F) 0.5 to 18 GHz 50 Watt

Model	4015C-10	4015C-20	4015C-30	4055-6	4055-10
Low Frequency (GHz)	7.0	7.0	7.0	7.5	7.5
High Frequency (GHz)	12.4	12.4	12.4	16.0	16.0
Coupling dB	10 +/- 1.25	20 +/- 1.00	30 +/- 1.00	6 +/- 1.10	10 +/- 1.50
Minimum Directivity (dB)	17	17	17	12	12
Insertion Loss, Coupled Power Excluded (dB)	0.40	0.30	0.30	0.60	0.60
True Insertion Loss (dB)	1.00	0.35	0.30	2.00	1.00
VSWR Maximum for Primary Line	1.30	1.25	1.25	1.35	1.35
VSWR Maximum for Secondary Line	1.30	1.25	1.25	1.40	1.40
Frequency Sensitivity (dB Max)	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.6	+/- 0.75
Power Input (Watts) Max	50	50	50	50	50
Reflected Power (Avg.) in Watts Max	5	50	50	2	5
Peak Power (Kw)	3	3	3	2	2
Maximum Weight (gr)	23	23	23	23	23
Maximum Weight (oz)	0.7	0.7	0.7	0.7	0.7
Special Notes:	A	A	A	A , B	A , B

Special Notes:
A: Frequency Sensitivity is included in coupling.
B: Special-order devices. Minimum quantity may apply.

Model	4055-20	4055-30	4016D-6	4016D-10	4016C-20
Low Frequency (GHz)	7.5	7.5	12.4	12.4	12.4
High Frequency (GHz)	16.0	16.0	18.0	18.0	18.0
Coupling dB	20 +/- 1.25	30 +/- 1.25	6 +/- 1.00	10 +/- 1.00	20 +/- 1.00
Minimum Directivity (dB)	15	15	15	15	15
Insertion Loss, Coupled Power Excluded (dB)	0.50	0.50	0.55	0.55	0.50
True Insertion Loss (dB)	0.50	0.50	2.00	1.10	0.55
VSWR Maximum for Primary Line	1.35	1.35	1.35	1.35	1.30
VSWR Maximum for Secondary Line	1.40	1.40	1.45	1.40	1.40
Frequency Sensitivity (dB Max)	+/- 0.75	+/- 0.75	+/- 0.5	+/- 0.5	+/- 0.5
Power Input (Watts) Max	50	50	50	50	50
Reflected Power (Avg.) in Watts Max	50	50	2	5	50
Peak Power (Kw)	2	2	1	1	1
Maximum Weight (gr)	23	23	20	20	23
Maximum Weight (oz)	0.7	0.7	0.7	0.7	0.8
Special Notes:	A , B	A , B	A	A	A

Special Notes:
A: Frequency Sensitivity is included in coupling.
B: Special-order devices. Minimum quantity may apply.

SMA (F) 0.5 to 18 GHz 50 Watt

Model	4016C-30	4216-10	4216-20
Low Frequency (GHz)	12.4	0.5	0.5
High Frequency (GHz)	18.0	8.0	8.0
Coupling dB	30 +/- 1.00	10 +/- 1.50	20 +/- 1.50
Minimum Directivity (dB)	15	15	14
Insertion Loss, Coupled Power Excluded (dB)	0.50	N/A	N/A
True Insertion Loss (dB)	0.55	1.40	0.80
VSWR Maximum for Primary Line	1.30	1.40	1.30
VSWR Maximum for Secondary Line	1.40	1.40	1.30
Frequency Sensitivity (dB Max)	+/- 0.5	N/A	N/A
Power Input (Watts) Max	50	50	50
Reflected Power (Avg.) in Watts Max	50	5	50
Peak Power (Kw)	1	3	3
Maximum Weight (gr)	23	60	60
Maximum Weight (oz)	0.8	2.1	2.1
Special Notes:	A , B	A	A

Special Notes:
A: Frequency Sensitivity is included in coupling.
B: Special-order devices. Minimum quantity may apply.

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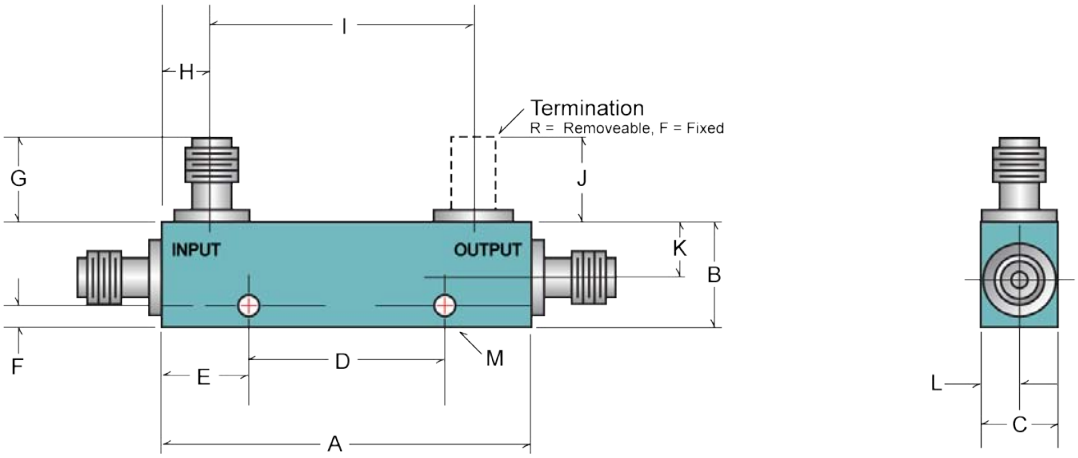
SMA (F) 0.5 to 18 GHz 50 Watt



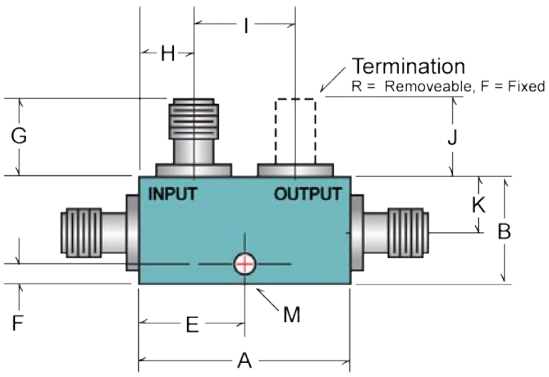
Outline Drawings For Models : 4011C-10, 4011C-20, 4012C-6, 4012C-10, 4012C-20, 4012C-30, 4013C-6, 4013C-10, 4013C-20, 4013C-30

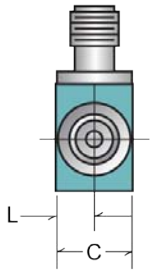
Units	A	B	C	D	E	F	G	H	I	J	K	L	M (Dia.)	Termination
4011C-10														
in.	3.06	0.58	0.42	1.50	0.78	0.11	0.38	0.27	2.52	0.47	0.34	0.21	0.104	R
mm	77.72	14.73	10.67	38.10	19.81	2.79	9.65	6.86	64.01	11.94	8.64	5.33	2.642	
4011C-20														
in.	3.04	0.55	0.42	1.75	0.65	0.11	0.38	0.27	2.52	0.47	0.30	0.21	0.104	R
mm	77.22	13.97	10.67	44.45	16.51	2.79	9.65	6.86	64.01	11.94	7.62	5.33	2.642	
4012C-6 , 4012C-10, 4012C-20														
in.	1.82	0.55	0.42	0.938	0.44	0.11	0.38	0.27	1.28	0.47	0.30	0.21	0.104	R
mm	46.23	13.97	10.67	23.825	11.18	2.79	9.65	6.86	32.51	11.94	7.62	5.33	2.642	
4012C-30														
in.	1.82	0.58	0.42	0.938	0.44	0.11	0.38	0.27	1.28	0.47	0.34	0.21	0.104	R
mm	46.23	14.73	10.67	23.825	11.18	2.79	9.65	6.86	32.51	11.94	8.64	5.33	2.642	
4013C-6 , 4013C-10, 4013C-20														
in.	1.20	0.55	0.42	0.344	0.43	0.11	0.38	0.27	0.66	0.47	0.30	0.21	0.104	R
mm	30.48	13.97	10.67	8.738	10.92	2.79	9.65	6.86	16.76	11.94	7.62	5.33	2.642	
4013C-30														
in.	1.20	0.59	0.42	0.344	0.43	0.11	0.38	0.27	0.66	0.47	0.35	0.21	0.104	R
mm	30.48	14.99	10.67	8.738	10.92	2.79	9.65	6.86	16.76	11.94	8.89	5.33	2.642	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface. All holes are thru unless stated as tapped.
Dimension:
D: +/-0.015"
M: +/- 0.004"/-0.002"

SMA (F) 0.5 to 18 GHz 50 Watt





Outline Drawings For Models : 4014C-6, 4014C-10, 4014C-20, 4014C-30, 4015C-6, 4015C-10, 4015C-20, 4015C-30, 4055-6, 4055-10, 4055-20, 4055-30, 4016D-6, 4016D-10, 4016C-20, 4016C-30

Units	A	B	C	E	F	G	H	I	J	K	L	M (Dia.)	Termination
4014C-6 , 4014C-10, 4014C-20, 4015C-6, 4015C-10, 4015C-20, 4055-30, 4016D-6, 4016D-10													
in.	1.04	0.55	0.42	0.52	0.11	0.38	0.27	0.50	0.81	0.30	0.21	0.104	R
mm	26.42	13.97	10.67	13.21	2.79	9.65	6.86	12.70	20.57	7.62	5.33	2.642	
4014C-30													
in.	1.04	0.58	0.42	0.52	0.11	0.38	0.27	0,5	0.81	0.34	0.21	0.104	R
mm	26.42	14.73	10.67	13.21	2.79	9.65	6.86	0.000	20.57	8.64	5.33	2.642	
4015C-30													
in.	1.04	0.67	0.42	0.52	0.11	0.38	0.27	0.50	0.81	0.43	0.21	0.104	R
mm	26.42	17.02	10.67	13.21	2.79	9.65	6.86	12.70	20.57	10.92	5.33	2.642	
4055-6 , 4055-10													
in.	1.04	0.67	0.42	0.52	0.11	0.38	0.27	0.50	0.81	0.30	0.21	0.104	R
mm	26.42	17.02	10.67	13.21	2.79	9.65	6.86	12.70	20.57	7.62	5.33	2.642	
4055-20													
in.	1.04	0.55	0.42	0.52	0.11	0.38	0.27	0.50	0.81	0.43	0.21	0.104	R
mm	26.42	13.97	10.67	13.21	2.79	9.65	6.86	12.70	20.57	10.92	5.33	2.642	
4016C-20 , 4016C-30													
in.	1.05	0.55	0.45	0.55	0.15	0.40	0.30	0.50	0.85	0.30	0.25	0.15	R
mm	26.67	13.97	11.43	13.97	3.81	10.16	7.62	12.70	21.59	7.62	6.35	3.81	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface. All holes are thru unless stated as tapped.
Dimension:
D: +/-0.010"
M: +/- 0.004"/-0.002"

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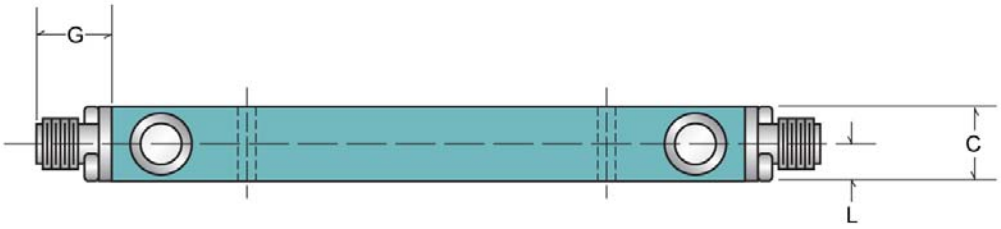
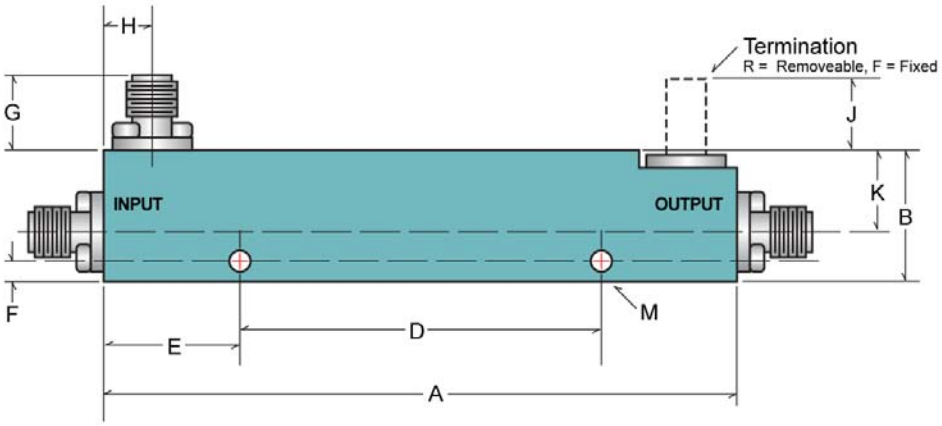
SMA (F) 0.5 to 18 GHz 50 Watt





Outline Drawings For Models : 4216-10, 4216-20

Units	A	B	C	D	E	F	G	H	J	K	L	M (Dia.)	Termination
4216-10 , 4216-20													
in.	3.51	0.74	0.42	2.00	0.76	0.11	0.38	0.27	0.40	0.46	0.21	0.104	R
mm	89.15	18.80	10.67	50.80	19.30	2.79	9.65	6.86	10.16	11.68	5.33	2.642	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface. All holes are thru unless stated as tapped.
Dimension:
D: +/-0.010"
M: +/- 0.004"/-0.002"

SMA (F) 0.5 GHz to 18 GHz, Miniature Stripline (Maximally Flat +/- 0.5dB) 50 Watt

Features

- Multi-Octave Frequency Coverage from 0.5 to 18 GHz
- Flat Frequency Response
- Small and Lightweight
- Operational to 105°C without Degradation (125° Storage)
- Designed for MIL Environments

Models

- 4242-6, 4242-10, 4242-20, 4243-6, 4243B-10, 4243-20, 4244-6, 4244-10, 4244-20, 4244-30, 4245B-6, 4245B-10, 4245B-20, 4245B-30, 4246B-6, 4246B-10, 4246B-20, 4246B-30

Model	4242-6	4242-10	4242-20	4243-6	4243B-10
Low Frequency (GHz)	0.5	0.5	0.5	1.0	1.0
High Frequency (GHz)	2.0	2.0	2.0	3.5	3.5
Nominal Coupling (dB)	6	10	20	6	10
Minimum Directivity (dB)	22	22	22	20	23
Insertion Loss, Coupled Power Excluded (dB)	0.35	0.35	0.35	0.35	0.35
True Insertion Loss (dB)	2.00	0.90	0.40	2.00	0.90
VSWR Maximum for Primary Line	1.20	1.20	1.20	1.20	1.20
VSWR Maximum for Secondary Line	1.20	1.20	1.20	1.20	1.20
Maximum Frequency Sensitivity (dB)	+/-0.5	+/-0.5	+/-0.5	+/-0.3	+/-0.5
Maximum Deviation from Nominal (dB)	+/-1.0	+/-1.0	+/-1.0	+/-1.0	+/-1.0
Average Power (W)	50	50	50	50	50
Peak Power (kW)	3	3	3	3	3
Maximum Weight (gr)	71	71	71	41	41
Maximum Weight (oz)	2.5	2.5	2.5	1.5	1.5
Special Notes:	A , B	A , B	A	A , B	A

Special Notes:
A: Frequency Sensitivity included in coupling value.
B: Special-order devices. Minimum quantity may apply.

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SMA (F) 0.5 GHz to 18 GHz, Miniature Stripline (Maximally Flat +/- 0.5dB) 50 Watt

Model	4243-20	4244-6	4244-10	4244-20	4244-30
Low Frequency (GHz)	1.0	2.0	2.0	2.0	2.0
High Frequency (GHz)	3.5	8.0	8.0	8.0	8.0
Nominal Coupling (dB)	20	6	10	20	30
Minimum Directivity (dB)	23	20	20	20	20
Insertion Loss, Coupled Power Excluded (dB)	0.35	0.50	0.35	0.35	0.40
True Insertion Loss (dB)	0.40	2.20	0.90	0.40	0.40
VSWR Maximum for Primary Line	1.20	1.30	1.25	1.25	1.25
VSWR Maximum for Secondary Line	1.20	1.30	1.25	1.25	1.25
Maximum Frequency Sensitivity (dB)	+/-0.4	+/-0.4	+/-0.5	+/-0.4	+/-0.5
Maximum Deviation from Nominal (dB)	+/-1.0	+/-1.0	+/-1.0	+/-1.0	+/-1.0
Average Power (W)	50	50	50	50	50
Peak Power (kW)	3	3	3	3	3
Maximum Weight (gr)	41	29	29	29	35
Maximum Weight (oz)	1.5	1	1	1	1.3
Special Notes:	A	A	A	A	A

Special Notes:
A: Frequency Sensitivity included in coupling value.
B: Special-order devices. Minimum quantity may apply.

Model	4245B-6	4245B-10	4245B-20	4245B-30	4246B-6
Low Frequency (GHz)	4.0	4.0	4.0	4.0	6.0
High Frequency (GHz)	12.4	12.4	12.4	12.4	18.0
Nominal Coupling (dB)	6	10	20	30	6
Minimum Directivity (dB)	16	16	15	15	15
Insertion Loss, Coupled Power Excluded (dB)	0.50	0.50	0.50	0.50	0.80
True Insertion Loss (dB)	2.20	1.20	0.60	0.50	2.50
VSWR Maximum for Primary Line	1.30	1.30	1.30	1.30	1.40
VSWR Maximum for Secondary Line	1.30	1.30	1.30	1.30	1.40
Maximum Frequency Sensitivity (dB)	+/-0.4	+/-0.4	+/-0.5	+/-0.5	+/-0.5
Maximum Deviation from Nominal (dB)	+/-1.0	+/-1.0	+/-1.0	+/-1.0	+/-1.0
Average Power (W)	50	50	50	50	50
Peak Power (kW)	3	3	3	3	3
Maximum Weight (gr)	21	21	24	24	25
Maximum Weight (oz)	0.7	0.7	0.8	0.8	0.9
Special Notes:	A	A	A	A	A , B

Special Notes:
A: Frequency Sensitivity included in coupling value.
B: Special-order devices. Minimum quantity may apply.

SMA (F) 0.5 GHz to 18 GHz, Miniature Stripline (Maximally Flat +/- 0.5dB) 50 Watt

Model	4246B-10	4246B-20	4246B-30
Low Frequency (GHz)	6.0	6.0	6.0
High Frequency (GHz)	18.0	18.0	18.0
Nominal Coupling (dB)	10	20	30
Minimum Directivity (dB)	15	12	12
Insertion Loss, Coupled Power Excluded (dB)	0.60	0.60	0.60
True Insertion Loss (dB)	1.20	0.70	0.60
VSWR Maximum for Primary Line	1.40	1.40	1.40
VSWR Maximum for Secondary Line	1.40	1.40	1.40
Maximum Frequency Sensitivity (dB)	+/-0.5	+/-0.5	+/-0.5
Maximum Deviation from Nominal (dB)	+/-1.0	+/-1.0	+/-1.0
Average Power (W)	50	50	50
Peak Power (kW)	3	3	3
Maximum Weight (gr)	25	25	25
Maximum Weight (oz)	0.9	0.9	0.9
Special Notes:	A , B	A , B	A , B

Special Notes:
A: Frequency Sensitivity included in coupling value.
B: Special-order devices. Minimum quantity may apply.

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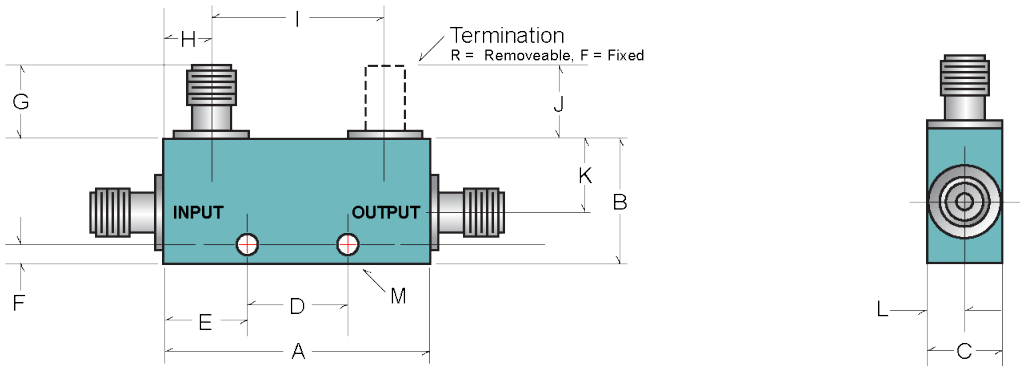
SMA (F) 0.5 GHz to 18 GHz, Miniature Stripline (Maximally Flat +/- 0.5dB) 50 Watt



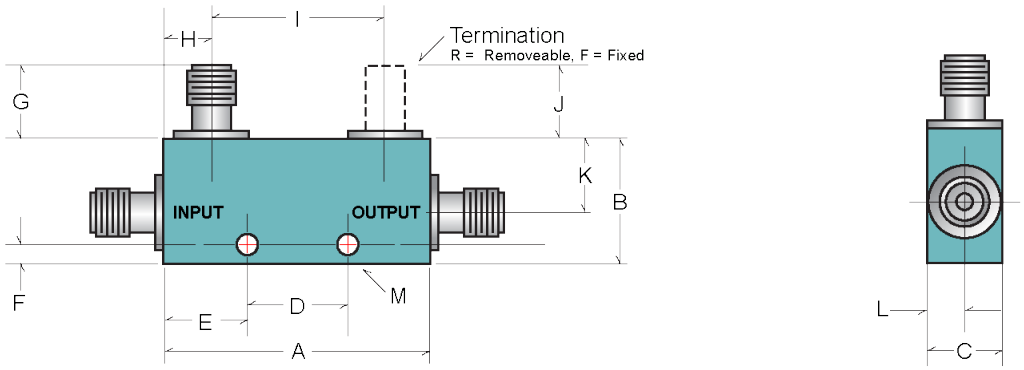
Outline Drawings For Models : 4242-6, 4242-10, 4242-20, 4243-6, 4243B-10, 4243-20, 4244-6, 4244-10, 4244-20, 4244-30

Units	A	B	C	D	E	F	G	H	I	J	K	L	M (Dia.)	Termination
4242-6 , 4242-10														
in.	3.54	1.04	0.42	1.84	0.85	0.36	0.38	0.27	3	0.81	0.77	0.21	0.146	F
mm	89.92	26.42	10.67	46.74	21.59	9.14	9.65	6.86	76.2	20.57	19.56	5.33	3.708	
4242-20														
in.	4.04	1.04	0.42	2.50	0.77	0.16	0.38	0.27	3.50	0.81	0.77	0.21	0.146	R
mm	102.62	26.42	10.67	63.50	19.56	4.06	9.65	6.86	88.90	20.57	19.56	5.33	3.708	
4243-6														
in.	2.92	0.67	0.42	1.969	0.48	0.15	0.38	0.27	2.384	0.81	0.34	0.21	0.146	F
mm	74.17	17.02	10.67	50.013	12.19	3.81	9.65	6.86	60.554	20.57	8.64	5.33	3.708	
4243B-10														
in.	2.92	0.67	0.42	1.969	0.48	0.15	0.38	0.27	2.384	0.81	0.34	0.21	0.146	R
mm	74.17	17.02	10.67	50.013	12.19	3.81	9.65	6.86	60.554	20.57	8.64	5.33	3.708	
4243-20														
in.	2.92	0.85	0.42	1.75	0.59	0.16	0.38	0.27	2.384	0.81	0.50	0.21	0.146	R
mm	74.17	21.59	10.67	44.45	14.99	4.06	9.65	6.86	60.554	20.57	12.70	5.33	3.708	
4244-6 , 4244-10, 4244-20														
in.	1.81	0.67	0.42	0.875	0.47	0.15	0.38	0.27	1.274	0.81	0.34	0.21	0.146	R
mm	45.97	17.02	10.67	22.225	11.94	3.81	9.65	6.86	32.360	20.57	8.64	5.33	3.708	
4244-30														
in.	2.12	0.82	0.42	0.875	0.11	0.15	0.38	0.27	1.584	0.81	0.34	0.21	0.104	R
mm	53.85	20.83	10.67	22.225	2.79	3.81	9.65	6.86	40.234	20.57	8.64	5.33	2.642	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/-0.015"
M: +/- 0.005"
I: +/-0.020"

SMA (F) 0.5 GHz to 18 GHz, Miniature Stripline (Maximally Flat +/- 0.5dB) 50 Watt



Outline Drawings For Models : 4245B-6, 4245B-10, 4245B-20, 4245B-30, 4246B-6, 4246B-10, 4246B-20, 4246B-30

Units	A	B	C	D	E	F	G	H	I	J	K	L	M (Dia.)	Termination
4245B-6 , 4245B-10, 4245B-20, 4245B-30														
in.	1.26	0.56	0.42	0.375	0.44	0.11	0.38	0.27	0.719	0.81	0.34	0.21	0.104	R
mm	32.00	14.22	10.67	9.525	11.18	2.79	9.65	6.86	18.263	20.57	8.64	5.33	2.642	
4246B-6 , 4246B-10, 4246B-30														
in.	1.40	0.66	0.42	0.50	0.45	0.11	0.38	0.27	0.86	0.81	0.39	0.21	0.104	R
mm	35.56	16.76	10.67	12.70	11.43	2.79	9.65	6.86	21.84	20.57	9.91	5.33	2.642	
4246B-20														
in.	1.40	0.66	0.42	0.50	0.45	0.11	0.38	0.27	0.86	0.81	0.39	0.21	0.104	F
mm	35.56	16.76	10.67	12.70	11.43	2.79	9.65	6.86	21.84	20.57	9.91	5.33	2.642	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/-0.015"
M: +/- 0.004"/-0.002"
I: +/-0.020"

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Type N (F) and SMA (F) 0.5 to 18 GHz 20 Watt (Broadband)

Features

- Flat Frequency Response
- Small Size and Lightweight
- Very Low, Fine Grain Ripple
- Designed for MIL Environments

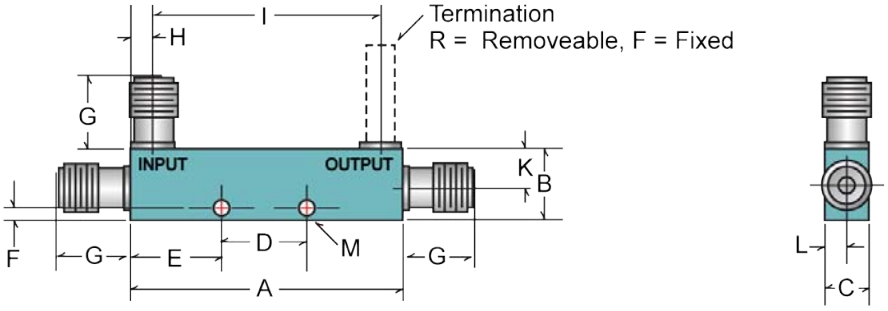
Models

- 4226-10, 4226-20

Model	4226-10	4226-20
Nominal Coupling (dB)	10	20
Directivity dB (0.5-12.4)	15	15
Directivity dB (12.4-18)	12	12
Insertion Loss, Coupled Power Excluded (dB)	0.85	0.85
Insertion Loss True (max)	1.5	0.9
VSWR Maximum for Primary Line	1.5	1.5
VSWR Maximum for Secondary Line	1.5	1.5
Frequency Sensitivity (dB Max)	+/- 1.0	+/- 1.0
Maximum Deviation from Nominal (dB)	+/- 1.0	+/- 1.0
Average Power (W)	20	20
Peak Power (kW)	3	3
Connector	SMA	SMA
Maximum Weight (gr)	97	97
Maximum Weight (oz)	3.4	3.4
Special Notes:	A , B	A , B

Special Notes:
A: 4226 Series coupling excludes frequency sensitivity from coupling variation specification.
B: Nominal Coupling is referenced to the output port.

Type N (F) and SMA (F) 0.5 to 18 GHz 20 Watt (Broadband)



Outline Drawings For Models : 4226-10, 4226-20

Units	A	B	C	D	E	F	G	H	I	K	L	M (dia.)	Connector	Termination
4226-10 , 4226-20														
in.	4.44	0.77	0.57	2.906	0.77	0.38	0.38	0.27	3.90	0.50	0.28	Tap-1	SMA	R
mm	112.78	19.56	14.48	73.812	19.56	9.65	9.65	6.86	99.06	12.70	7.11			

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/- 0.015
I: +/- 0.020
Tap 1: 4-44- NC 2B Tapped Holes 1/8 DP Both Sides.

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Type N (F) and SMA (F) 1 to 12.4 GHz 20 Watt (Broadband)

Features

- Flat Frequency Response
- Small Size and Lightweight
- Very Low, Fine Grain Ripple
- Designed for MIL Environments

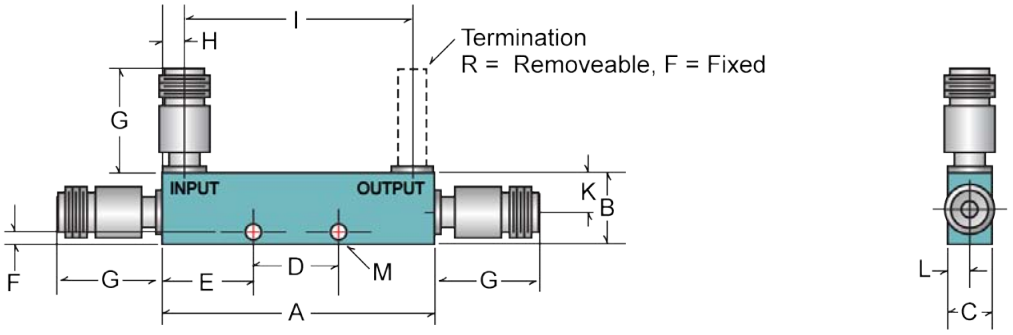
Models

- 4202B-6, 4202B-10, 4202B-20, 3202B-10, 3202B-20

Model	4202B-6	4202B-10	4202B-20	3202B-10	3202B-20
Nominal Coupling (dB)	6	10	20	10	20
Directivity dB (1-8)	15	15	15	15	15
Directivity dB (8-12.4)	12	12	15	12	15
Insertion Loss, Coupled Power Excluded (dB)	0.75	0.70	0.70	0.70	1.00
Insertion Loss True (max)	2.00	1.30	0.75	1.30	1.05
VSWR Maximum for Primary Line	1.35	1.35	1.35	1.35	1.35
VSWR Maximum for Secondary Line	1.50	1.50	1.50	1.50	1.50
Frequency Sensitivity (dB Max)	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5
Maximum Deviation from Nominal (dB)	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5	+/- 1.5
Average Power (W)	20	20	20	20	20
Peak Power (kW)	3	3	3	3	3
Connector	SMA	SMA	SMA	N	N
Maximum Weight (gr)	80	83	83	128	128
Maximum Weight (oz)	2.8	2.9	2.9	4.5	4.5
Special Notes:	A , B	A , B	A , B	A , B	A , B

Special Notes:
A: Nominal Coupling is referenced to the output port.
B: Frequency Sensitivity included in coupling value.

Type N (F) and SMA (F) 1 to 12.4 GHz 20 Watt (Broadband)



Outline Drawings For Models : 4202B-6, 4202B-10, 4202B-20, 3202B-10, 3202B-20

Units	A	B	C	D	E	F	G	H	I	K	L	M (DIA.)	Connector	Termination
4202B-6 , 4202B-10														
in.	3.24	0.88	0.57	1.12	1.00	0.17	0.38	0.27	2.717	0.48	0.28	0.104	SMA	R
mm	82.30	22.35	14.48	28.45	25.40	4.32	9.65	6.86	69.012	12.19	7.11	2.642		
4202B-20														
in.	3.48	0.73	0.56	0.58	2.319	0.11	0.38	0.27	2.943	0.44	0.28	0.104	SMA	R
mm	88.39	18.54	14.22	14.73	58.903	2.79	9.65	6.86	74.752	11.18	7.11	2.642		
3202B-10														
in.	3.24	0.88	0.57	1.12	1	0.17	1.1	0.27	2.717	0.48	0.28	0.104	N	R
mm	82.30	22.35	14.48	28.45	25.4	4.32	27.9	6.86	69.012	12.19	7.11	2.642		
3202B-20														
in.	3.48	0.73	0.56	0.58	2.319	0.11	1.1	0.27	2.943	0.44	0.28	0.104	N	R
mm	88.39	18.54	14.22	14.73	58.903	2.79	27.9	6.86	74.752	11.18	7.11	2.642		

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/- 0.015
M: +/- 0.004"/-0.002"
I +/1 .020

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Type N (F) and SMA (F) 1 to 18 GHz 20 Watt (Broadband)

Features

- Flat Frequency Response
- Small Size and Lightweight
- Very Low, Fine Grain Ripple
- Designed for MIL Environments

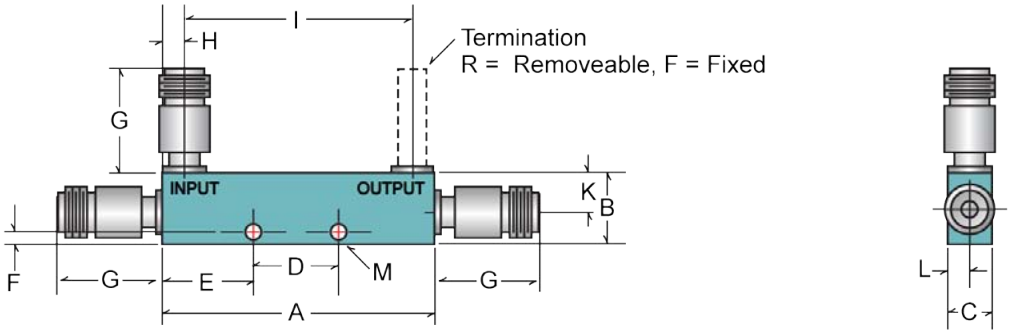
Models

- 4222-16, 3222-16

Model	4222-16	3222-16
Nominal Coupling (dB)	16	16
Directivity dB (1-12.4)	15	15
Directivity dB (12.4-18)	12	12
Insertion Loss, Coupled Power Excluded (dB)	0.80	0.80
Insertion Loss True (max)	0.90	0.90
VSWR Maximum for Primary Line	1.40	1.40
VSWR Maximum for Secondary Line	1.50	1.50
Frequency Sensitivity (dB Max)	+/- 0.5	+/- 0.5
Maximum Deviation from Nominal (dB)	+/- 1.0	+/- 1.0
Average Power (W)	20	20
Peak Power (kW)	3	3
Connector	SMA	N
Maximum Weight (gr)	65	96
Maximum Weight (oz)	2.3	3.4
Special Notes:	A , B	A , B

Special Notes:
A: Nominal Coupling is referenced to the output port.
B: Frequency Sensitivity included in coupling value.

Type N (F) and SMA (F) 1 to 18 GHz 20 Watt (Broadband)



Outline Drawings For Models : 4222-16, 3222-16

Units	A	B	C	D	E	F	G	H	I	K	L	M (dia.)	Connector	Termination
4222-16														
in.	3.51	0.73	0.54	2.00	0.75	0.37	0.38	0.27	2.969	0.44	0.27	Tap-1	SMA	R
mm	89.15	18.54	13.72	50.80	19.05	9.40	9.65	6.86	75.413	11.18	6.86			
3222-16														
in.	3.51	0.73	0.54	2.00	0.75	0.37	1.23	0.27	2.969	0.44	0.27	Tap-1	N	R
mm	89.15	18.54	13.72	50.80	19.05	9.40	31.24	6.86	75.413	11.18	6.86			

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/- 0.015"
M: +0.004"/-0.002"
I: +/- 0.020"
Tap 1: 4-44- NC 2B Tapped Holes 1/8 DP Both Sides.

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Type N (F) and SMA (F) 2 to 18 GHz 20 Watt (Broadband)

Features

- Flat Frequency Response
- Small Size and Lightweight
- Very Low, Fine Grain Ripple
- Designed for MIL Environments

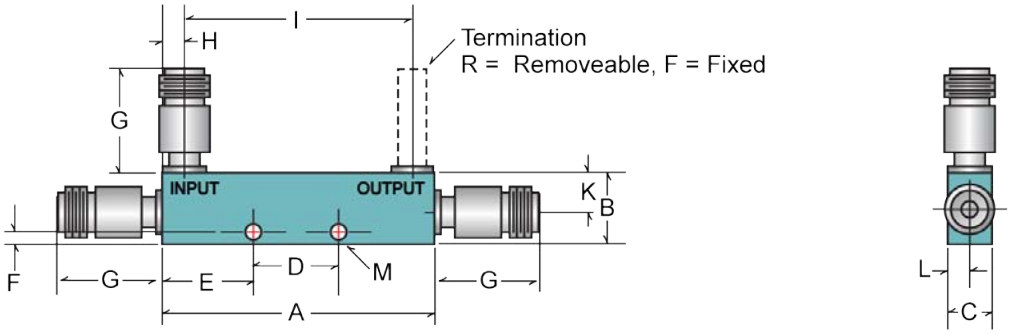
Models

- 4203-6, 4203-10, 4203-16, 3203-16

Model	4203-6	4203-10	4203-16	3203-16
Nominal Coupling (dB)	6	10	16	16
Directivity dB (2-12.4)	15	15	15	15
Directivity dB (12.4-18)	12	12	12	12
Insertion Loss, Coupled Power Excluded (dB)	0.90	0.90	0.65	0.85
Insertion Loss True (max)	2.00	1.40	0.80	1.00
VSWR Maximum for Primary Line	1.40	1.35	1.35	1.40
VSWR Maximum for Secondary Line	1.40	1.50	1.40	1.40
Frequency Sensitivity (dB Max)	+/- 0.5	+/- 0.5	+/- 0.5	+/- 0.5
Maximum Deviation from Nominal (dB)	+/- 1.0	+/- 1.0	+/- 1.0	+/- 1.0
Average Power (W)	20	20	20	20
Peak Power (kW)	3	3	3	3
Connector	SMA	SMA	SMA	N
Maximum Weight (gr)	59	55	51	96
Maximum Weight (oz)	2.0	2.2	1.8	3.4
Special Notes:	A	A	A	A

Special Notes:
A: Nominal Coupling is referenced to the output port.

Type N (F) and SMA (F) 2 to 18 GHz 20 Watt (Broadband)



Outline Drawings For Models : 4203-6, 4203-10, 4203-16, 3203-16

Units	A	B	C	D	E	F	G	H	I	K	L	M (dia.)	Connector	Termination
4203-6 , 4203-10														
in.	2.16	0.89	0.56	1.125	0.52	0.45	0.38	0.27	1.615	0.50	0.28	Tap-1	SMA	R
mm	54.86	22.61	14.22	28.575	13.21	11.43	9.65	6.86	41.021	12.70	7.11			
4203-16														
in.	2.12	0.73	0.56	0.958	0.58	0.36	0.38	0.27	1.584	0.43	0.28	Tap-2	SMA	R
mm	53.85	18.54	14.22	24.333	14.73	9.14	9.65	6.86	40.234	10.92	7.11			
3203-16														
in.	2.12	0.73	0.56	0.958	0.58	0.36	1.23	0.27	1.584	0.43	0.28	Tap-2	N	R
mm	53.85	18.54	14.22	24.333	14.73	9.14	31.24	6.86	40.234	10.92	7.11			

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/- .015"
M: +0.004"/-0.002"
I: +/- 0.020"
Tap 1: 4-44- NC 2B Tapped Holes 1/8 DP Both Sides.
Tap 2: 2-56 NC-2B Tapped Holes 1/8 DP Both Sides.

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SMA (F) 6 to 18 GHz 20db 100 Watt (High Power Directional)

Features

- Broadband (6-18 GHz, High Directivity)
- Excellent Frequency Flatness
- Operates at 85°C Ambient
- Designed for MIL Environments

Applications

- EW Systems
- 100 Watt TWT Power Monitor Circuits, BIT Circuits, Jammers
- Test Equipment/ATE
- Power Amplifier Controls
- Radar-Transmitter Circuits
- 100 Watt Miniature Stripline Design

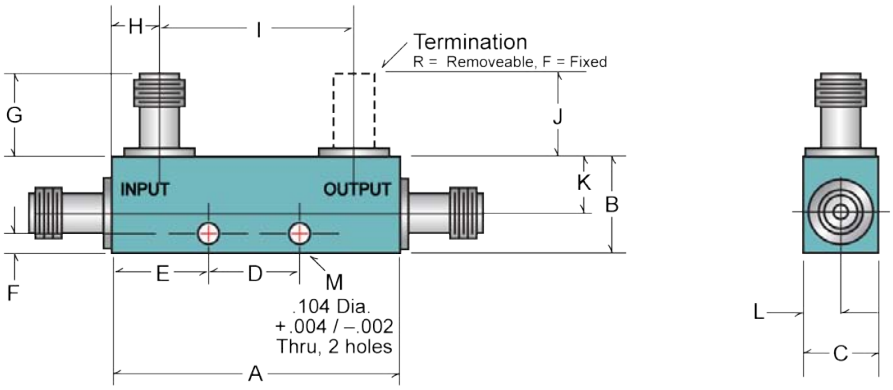
Models

- 4196-20

Model	4196-20
Low Frequency (GHz)	6.0
High Frequency (GHz)	18.0
Nominal Coupling (dB)	20
Maximum Deviation from Nominal (dB)	+/-1.0
Minimum Directivity (dB)	15
Insertion Loss, Coupled Power Excluded (dB)	0.55
True Insertion Loss (dB)	0.6
VSWR Maximum for Primary Line	1.5:1
VSWR Maximum for Secondary Line	1.5:1
Maximum Frequency Sensitivity (dB)	+/-0.6
Average Power (W)	100
Peak Power (kW)	3
Maximum Weight (oz)	.88
Maximum Weight (gr)	25
Special Notes:	A , B

Special Notes:
A: Frequency Sensitivity is included in Coupling Variation
B: 100 watts power handling when mounted to customer supplied heat sink (+85 Degrees Celsius Max Housing Temperature).

SMA (F) 6 to 18 GHz 20db 100 Watt (High Power Directional)



Outline Drawings For Models : 4196-20

Units	A	B	C	D	E	F	G	H	I	J	K	L	M (Dia.)	Termination
4196-20														
in.	1.40	0.661	0.415	0.5	0.45	0.114	0.375	0.27	0.86	0.812	0.391	0.207	0.104	R
mm	35.56	16.789	10.541	12.7	11.43	2.896	9.525	6.86	21.84	20.625	9.931	5.258	2.642	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface. All holes are thru unless stated as tapped.
Dimension:
D: +/-0.015"
M: +0.004"/-0.002"

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Type N, TNC and SMA 2 to 18 GHz 400W (High Power)

Features

- High Performance Design
- 400 Watt Average (3 to 5kW Peak Rating)
- Low Loss, Air Dielectric
- Operation to 85°C without Degradation
- TNC or Type N Connector

Applications

- Measurement of High Power RF Signals
- Reliable Monitoring of TWT High Power Amplifiers
- Testing of EW Systems with High RF Power Output

Models

- 27000, 27001A, 27002, 27003, 27004A, 27005

Model	27000	27001A	27002
Low Frequency (GHz)	2.0	6.0	2.0
High Frequency (GHz)	18.0	18.0	8.0
Coupling dB	30,40,50 dB +/-1.4 dB	30,40,50 dB +/-1.0 dB	30,40,50 dB +/-1.0 dB
Frequency Sensitivity dB	+/-1.0 dB	+/-0.7 dB	+/-0.5 dB
Power Handling (Avg. in W)	400	400	400
Power Handling (Peak in kW)	3	3	5
Directivity dB (2-8 GHz)	12	N/A	16
Directivity dB (8-15 GHz)	12	12	N/A
Directivity dB (15-18 GHz)	10	10	N/A
Insertion Loss (max)	0.5 dB	0.5 dB	0.25 dB
Absolute Calibration Accuracy dB (per 10 dB step)	N/A	N/A	N/A
VSWR Main Line (Max)	1.4:1	1.4:1	1.3:1
VSWR Branch Line (Max)	1.6:1	1.6:1	1.4:1
Connectors (Main Line Input)	Type N Male	Type N Male	Type N Male
Connectors (Main Line Output)	Type N Female	Type N Female	Type N Female
Connectors (Coupled Output)	Type N Female	Type N Female	Type N Female
Maximum Weight (gr)	425	425	425
Special Notes:	A , B , C	A , B , C	A , B , C

Special Notes:
A: All models are available by Special Order. Minimum quantities may apply.
B: See Model Series 27002SC and 27005SC for 1 kW CW SC connector model.
C: ORDERING INFORMATION: Specify model number and add dash number suffix for nominal coupling in dB. For example: 27000-30.

Type N, TNC and SMA 2 to 18 GHz 400W (High Power)

Model	27003	27004A	27005
Low Frequency (GHz)	2.0	6.0	2.0
High Frequency (GHz)	18.0	18.0	8.0
Coupling dB	30,40,50 dB +/-1.4 dB	30,40,50 dB +/-1.0 dB	30,40,50 dB +/-1.0 dB
Frequency Sensitivity dB	+/-1.0 dB	+/-0.7 dB	+/-0.5 dB
Power Handling (Avg. in W)	400	400	400
Power Handling (Peak in kW)	3	3	5
Directivity dB (2-8 GHz)	12	N/A	16
Directivity dB (8-15 GHz)	12	12	N/A
Directivity dB (15-18 GHz)	10	10	N/A
Insertion Loss (max)	0.5 dB	0.5 dB	0.25 dB
Absolute Calibration Accuracy dB (per 10 dB step)	N/A	N/A	N/A
VSWR Main Line (Max)	1.4:1	1.4:1	1.3:1
VSWR Branch Line (Max)	1.6:1	1.6:1	1.4:1
Connectors (Main Line Input)	Type TNC Male	Type TNC Male	Type TNC Male
Connectors (Main Line Output)	Type TNC Female	Type TNC Female	Type TNC Female
Connectors (Coupled Output)	Type SMA Female	Type SMA Female	Type SMA Female
Maximum Weight (gr)	425	425	425
Special Notes:	A , B , C	A , B , C	A , B , C

Special Notes:
A: All models are available by Special Order. Minimum quantities may apply.
B: See Model Series 27002SC and 27005SC for 1 kW CW SC connector model.
C: ORDERING INFORMATION: Specify model number and add dash number suffix for nominal coupling in dB. For example: 27000-30.

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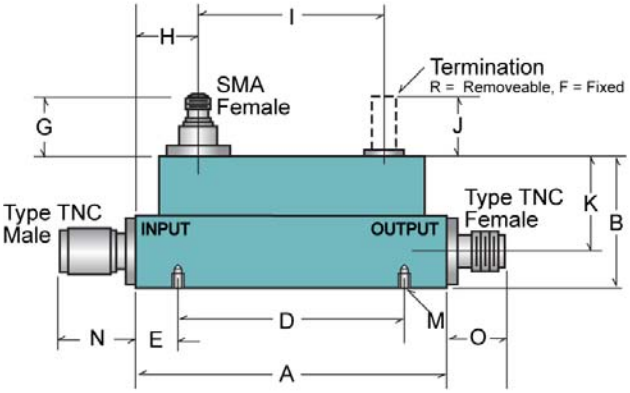
Type N, TNC and SMA 2 to 18 GHz 400W (High Power)



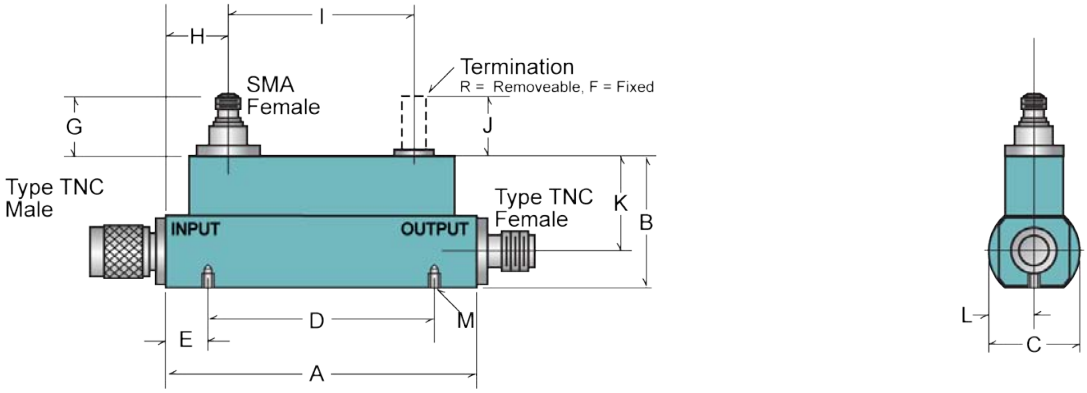
Outline Drawings For Models : 27000, 27001A, 27002

Units	A	C	C	D	E	G	H	I	J	K	L	M (Dia.)	N	O	Termination
27000 , 27001A															
in.	4.094	1.716	1.2	3	0.547	1.175	0.821	2.464	0.688	1.247	0.60	Tap-1	1.175	0.735	R
mm	103.988	43.586	30.5	76.2	13.894	29.845	20.853	62.586	17.475	31.674	15.24		29.845	18.669	
27002															
in.	4.094	1.716	1.2	3.00	0.547	1.175	0.821	2.464	0.688	1.247	0.60	Tap-1	1.175	0.735	R
mm	103.988	43.586	30.5	76.20	13.894	29.845	20.853	62.586	17.475	31.674	15.24				

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/-0.015"
C: +/-0.032"
Type N Calibrated
Tap-1: #6-32NC-2B X 3/16 DP

Type N, TNC and SMA 2 to 18 GHz 400W (High Power)



Outline Drawings For Models : 27003, 27004A, 27005

Units	A	B	C	D	E	G	H	I	J	K	L	M (Dia.)	N	O	Termination
27003 , 27004A															
in.	4.094	1.716	1.2	3.00	0.547	0.863	0.821	2.464	0.688	1.247	0.60	Tap-1	0.89	0.749	R
mm	103.988	43.586	30.5	76.20	13.894	21.920	20.853	62.586	17.475	31.674	15.24		22.61	19.025	
27005															
in.	4.094	1.716	1.2	3.00	0.547	0.863	0.821	2.464	0.688	1.247	0.60	Tap-1	0.89	0.749	R
mm	103.988	43.586	30.5	76.20	13.894	21.920	20.3	62.586	17.475	31.674	15.24		22.61	19.025	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/-0.015"
C: +/-0.032"
Type N Calibrated
Tap-1: #6-32NC-2B x 3/16 DP

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Type SC/Type N and SMA 2 to 8 GHz 1KW (High Power)

Features

- 1kW CW Operation
- SC Main Line Connectors
- 2-8 GHz Operation (Usable 1.5 to 10 GHz)

Applications

- Power Tube Test Stands
- EW Systems
- Satellite Communication Transmitters
- Power Monitoring

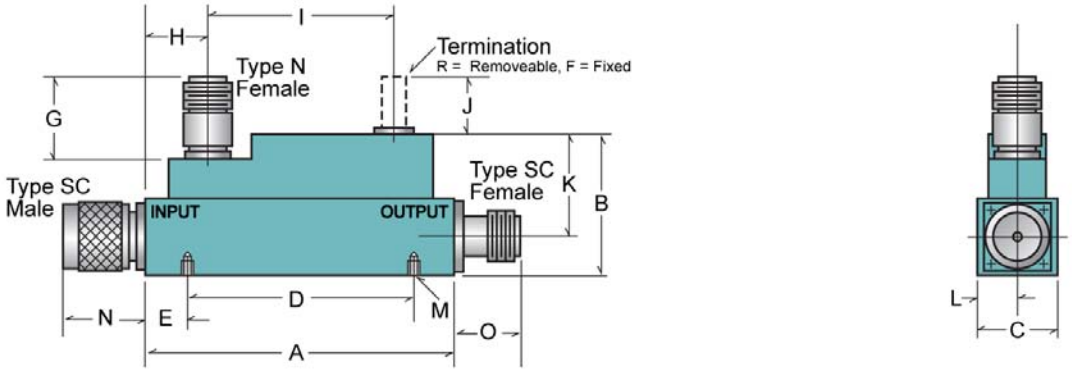
Models

- 27002SC-40,50,60, 27005SC-40,50,60

Model	27002SC-40,50,60	27005SC-40,50,60
Nominal Coupling (dB)	40,50,60	40,50,60
Frequency Sensitivity dB	+/- 1.0	+/- 1.0
Maximum Deviation from Nominal (dB)	+/-1.5	+/-1.5
Minimum Directivity (dB)	N/A	14
Insertion Loss, Coupled Power Excluded (dB)	0.25	0.25
Insertion Loss True (max)	0.25	0.25
VSWR Maximum for Primary Line	1.5:1	1.5:1
VSWR Maximum for Secondary Line	1.5:1	1.5:1
Average Power (kW)	1.0	1.0
Peak Power (kW)	12.0	12.0
Maximum Weight (oz)	24	24
Maximum Weight (gr)	681	681
Primary Line-Input	SC Male	SC Male
Primary Line-Output	SC Female	SC Female
Secondary Line	N Female	SMA Female
Special Notes:	A , B , C , D , E	A , B , C , D , E

Special Notes:
A: CONNECTORS:
PRIMARY LINE: Input - SC Male, Output - SC Female
SECONDARY LINE: Model 27002SC - N Female, Model 27005SC - SMA Female
B: Non-standard coupling values in the range of -40 dB to -60 dB are available, contact factory for details.
C: Frequency Sensitivity is included in coupling deviation specification
D: All models are available by Special Order. Minimum quantities may apply.
E: See Model 27000 Series for type N and TNC versions High Power Couplers.

Type SC/Type N and SMA 2 to 8 GHz 1KW (High Power)



Outline Drawings For Models : 27002SC-40,50,60, 27005SC-40,50,60

Units	A	B	C	D	E	G	H	I	J	K	L	M (Dia.)	N	O	Termination
27002SC-40,50,60															
in.	4.094	1.716	1.2	3.00	0.547	1.86	0.821	2.464	0.688	1.247	0.60	Tap-1	1.094	0.875	R
mm	103.988	43.586	30.5	76.20	13.894	47.24	20.853	62.586	17.475	31.674	15.24		27.788	22.225	
27005SC-40,50,60															
in.	4.10	1.75	1.20	3.00	0.55	1.90	0.85	2.50	0.70	1.25	0.60	Tap-1	1.094	0.875	R
mm	104.14	44.45	30.48	76.20	13.97	48.26	21.59	63.50	17.78	31.75	15.24		27.788	22.225	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/-0.015"
C: +/-0.032"
Type N Calibrated
Tap-1: #6-32NC-2B x 3/16 DP

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Type N (F) 0.225 to 10 GHz 200W/500W (Calibrated)

Features

- High Directivity
- Ruggedized Construction
- Low VSWR
-

Models

- 3000-10, 3000-20, 3000-30, 3001-10, 3001-20, 3001-30, 3002-10, 3002-20, 3002-30, 3003-10, 3003-20, 3003-30, 3004-10, 3004-20, 3004-30

Model	3000-10	3000-20	3000-30	3001-10	3001-20
Low Frequency (GHz)	0.2	0.2	0.2	0.5	0.5
High Frequency (GHz)	0.5	0.5	0.5	1.0	1.0
Nominal Coupling (dB)	10	20	30	10	20
Minimum Directivity (dB)	30	30	30	30	30
Insertion Loss, Coupled Power Excluded (dB)	0.20	0.20	0.20	0.20	0.20
True Insertion Loss (dB)	0.70	0.20	0.20	0.70	0.20
VSWR Maximum for Primary Line	1.10	1.10	1.10	1.15	1.15
VSWR Maximum for Secondary Line	1.15	1.15	1.15	1.15	1.15
Calibration (Freq GHz)	0.225, 0.280, 0.350, 0.410	0.225, 0.280, 0.350, 0.410	0.225, 0.280, 0.350, 0.410	0.460, 0.580, 0.700, 0.825, 0.950	0.460, 0.580, 0.700, 0.825, 0.950
Absolute Calibration Accuracy dB (per 10 dB step)	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1
Maximum Deviation from Nominal (dB)	+/- 1.2	+/- 1.2	+/- 1.2	+/- 1.2	+/- 1.2
Power Incident (Watts)	200	500	500	200	500
Pwr Reflected (Watts)	50	500	500	50	500
Peak Power (kW)	10	10	10	10	10
Maximum Weight (lbs)	1.8	1.8	1.8	1.2	1.2
Maximum Weight (kg)	0.82	0.82	0.82	0.54	0.54
Special Notes:	A	A	A	A	A

Special Notes:
A: ORDERING INFORMATION: Specify model number and add dash number suffix for nominal coupling in dB. For example: 3004-20.

Type N (F) 0.225 to 10 GHz 200W/500W (Calibrated)

Model	3001-30	3002-10	3002-20	3002-30	3003-10
Low Frequency (GHz)	0.5	1.0	1.0	1.0	2.0
High Frequency (GHz)	1.0	2.0	2.0	2.0	4.0
Nominal Coupling (dB)	30	10	20	30	10
Minimum Directivity (dB)	30	30	30	30	25
Insertion Loss, Coupled Power Excluded (dB)	0.20	0.20	0.20	0.20	0.20
True Insertion Loss (dB)	0.20	0.20	0.70	0.20	0.70
VSWR Maximum for Primary Line	1.15	1.15	1.15	1.15	1.15
VSWR Maximum for Secondary Line	1.15	1.15	1.15	1.15	1.20
Calibration (Freq GHz)	0.460, 0.580, 0.700, 0.825, 0.950	0.950, 1.21, 1.47, 1.73, 2.00	0.950, 1.21, 1.47, 1.73, 2.00	0.950, 1.21, 1.47, 1.73, 2.00	2.0, 2.5, 3.0, 3.5, 4.0
Absolute Calibration Accuracy dB (per 10 dB step)	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1
Maximum Deviation from Nominal (dB)	+/- 1.2	+/- 1.2	+/- 1.2	+/- 1.2	+/- 1.2
Power Incident (Watts)	500	200	500	500	200
Pwr Reflected (Watts)	500	50	500	500	50
Peak Power (kW)	10	10	10	10	10
Maximum Weight (lbs)	1.8	1.0	1.0	1.0	1.0
Maximum Weight (kg)	0.82	0.45	0.45	0.45	0.45
Special Notes:	A	A	A	A	A

Special Notes:
A: ORDERING INFORMATION: Specify model number and add dash number suffix for nominal coupling in dB. For example: 3004-20.

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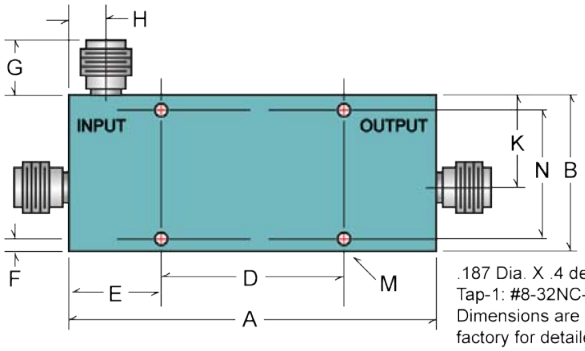
Type N (F) 0.225 to 10 GHz 200W/500W (Calibrated)

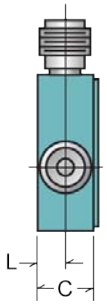
Model	3003-20	3003-30	3004-10	3004-20	3004-30
Low Frequency (GHz)	2.0	2.0	4.0	4.0	4.0
High Frequency (GHz)	4.0	4.0	10.0	10.0	10.0
Nominal Coupling (dB)	20	30	10	20	30
Minimum Directivity (dB)	27	27	4-8 GHz:20, 8-10 GHz:17	4-8 GHz:20, 8-10 GHz:17	4-8 GHz:20, 8-10 GHz:17
Insertion Loss, Coupled Power Excluded (dB)	0.20	0.20	0.20	0.20	0.20
True Insertion Loss (dB)	0.20	0.20	0.85	0.25	0.20
VSWR Maximum for Primary Line	1.15	1.15	1.20	1.20	1.20
VSWR Maximum for Secondary Line	1.20	1.20	1.30	1.30	1.30
Calibration (Freq GHz)	2.0, 2.5, 3.0, 3.5, 4.0	2.0, 2.5, 3.0, 3.5, 4.0	4.0, 5.5, 7.0, 8.5, 10.0	4.0, 5.5, 7.0, 8.5, 10.0	4.0, 5.5, 7.0, 8.5, 10.0
Absolute Calibration Accuracy dB (per 10 dB step)	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1
Maximum Deviation from Nominal (dB)	+/- 1.2	+/- 1.2	+/- 1.6*	+/- 1.6*	+/- 1.6*
Power Incident (Watts)	500	500	500	500	500
Pwr Reflected (Watts)	500	500	50	500	500
Peak Power (kW)	10	10	10	10	10
Maximum Weight (lbs)	1.0	1.0	1.1	1.1	1.1
Maximum Weight (kg)	0.45	0.45	0.50	0.50	0.50
Special Notes:	A	A	A , B , C	A , B , C	A , B , C

Special Notes:
A: ORDERING INFORMATION: Specify model number and add dash number suffix for nominal coupling in dB. For example: 3004-20.
B: Model 3004 Series is available on a Special-Order basis. Minimum quantities may apply.
C: Model 3004 has frequency sensitivity of +/- 1.2 dB from mean coupling, which may deviate from the nominal by +/- 0/4 dB.

Type N (F) 0.225 to 10 GHz 200W/500W (Calibrated)



.187 Dia. X .4 deep (Min.)
Tap-1: #8-32NC-2B
Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.



Outline Drawings For Models : 3000-10, 3000-20, 3000-30, 3001-10, 3001-20, 3001-30, 3002-10, 3002-20, 3002-30, 3003-10, 3003-20, 3003-30, 3004-10, 3004-20, 3004-30

Units	A	B	C	D	E	F	G	H	K	L	M (Dia.)	N
3000-10 , 3000-20, 3000-30												
in.	10.68	2.13	0.89	3.00	1.50	0.20	0.76	0.5	1.26	0.44	Tap-1	1.687
mm	271.27	54.10	22.61	76.20	38.10	5.08	19.30	12.7	32.00	11.18		42.850
3001-10 , 3001-20												
in.	6.25	2.13	0.89	3.00	1.50	0.20	0.76	0.50	1.26	0.44	Tap-1	1.687
mm	158.75	54.10	22.61	76.20	38.10	5.08	19.30	12.70	32.00	11.18		42.850
3001-30 , 3002-10, 3002-20, 3003-10, 3003-30												
in.	4.10	2.13	0.89	1.09	1.50	0.20	0.76	0.50	1.26	0.44	Tap-1	1.687
mm	104.14	54.10	22.61	27.69	38.10	5.08	19.30	12.70	32.00	11.18		42.850
3002-30												
in.	4.10	2.13	0.89	1.09	1.50	0.20	0.75	0.50	1.44	0.45	Tap-1	1.70
mm	104.14	54.10	22.61	27.69	38.10	5.08	19.05	12.70	36.58	11.43		43.18
3004-10 , 3004-20, 3004-30												
in.	5.10	2.13	0.89	2.00	1.50	0.20	0.76	0.50	1.26	0.44	Tap-1	1.687
mm	129.54	54.10	22.61	50.80	38.10	5.08	19.30	12.70	32.00	11.18		42.850

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/-0.015"
N: +/-0.015"

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Type N (M/F) 0.92 to 12.4 GHz (Maximally Flat Calibrated)

Features

- High Power Capability
- Low Loss, Superior Directivity
- +/- 0.25 dB Frequency Sensitivity
- Permanent Nameplate Calibrations

Models

- 3042B-10, 3042B-20, 3042B-30, 3043B-10, 3043B-20, 3043B-30, 3045C-10, 3045C-20, 3045C-30

Model	3042B-10	3042B-20	3042B-30	3043B-10	3043B-20
Low Frequency (GHz)	0.9	0.9	0.9	1.7	1.7
High Frequency (GHz)	2.2	2.2	2.2	4.2	4.2
Nominal Coupling (dB)	10	20	30	10	20
Minimum Directivity (dB)	20	20	20	20	20
Insertion Loss, Coupled Power Excluded (dB)	0.20	0.20	0.20	0.20	0.20
True Insertion Loss (dB)	0.70	0.20	0.20	0.75	0.75
VSWR Maximum for Primary Line	1.10	1.10	1.10	1.15	1.15
VSWR Maximum for Secondary Line	1.20	1.20	1.20	1.20	1.20
Frequency Sensitivity dB	+/- 0.25	+/- 0.25	+/- 0.25	+/- 0.25	+/- 0.25
Maximum Deviation from Nominal (dB)	+/- 0.5	+/- 0.5	+/- 0.5	+/-0.5	+/- 0.5
Calibration (Freq GHz)	0.92, 1.24, 1.50, 1.88, 2.2	0.92, 1.24, 1.50, 1.88, 2.2	0.92, 1.24, 1.50, 1.88, 2.2	1.7, 2.325, 2.95, 3.575, 4.2	1.7, 2.325, 2.95, 3.575, 4.2
Absolute Calibration Accuracy dB (per 10 dB step)	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1	+/-0.1
Power Incident (Watts)	200	200	200	200	200
Pwr Reflected (Watts)	50	200	200	50	200
Peak Power (kW)	10	10	10	10	10
Maximum Weight (kg)	0.6	0.6	0.6	0.5	0.5
Maximum Weight (lbs)	1.25	1.25	1.25	1.0	1.0
Special Notes:	A	A	A	A	A

Special Notes:
A: Frequency Sensitivity included in coupling value.

Type N (M/F) 0.92 to 12.4 GHz (Maximally Flat Calibrated)

Model	3043B-30	3045C-10	3045C-20	3045C-30
Low Frequency (GHz)	1.7	7.0	7.0	7.0
High Frequency (GHz)	4.2	12.4	12.4	12.4
Nominal Coupling (dB)	30	10	20	30
Minimum Directivity (dB)	20	15	15	15
Insertion Loss, Coupled Power Excluded (dB)	0.20	0.35	0.35	0.35
True Insertion Loss (dB)	0.70	1.0	0.40	0.20
VSWR Maximum for Primary Line	1.15	1.25	1.25	1.25
VSWR Maximum for Secondary Line	1.20	1.30	1.30	1.30
Frequency Sensitivity dB	+/- 0.25	+/- 0.25	+/- 0.25	+/- 0.25
Maximum Deviation from Nominal (dB)	+/-0.5	+/-0.5	+/-0.5	+/- 0.5
Calibration (Freq GHz)	1.7, 2.325, 2.95, 3.575, 4.2	7.0, 8.0, 9.0, 10.0, 11.0, 12.0	7.0, 8.0, 9.0, 10.0, 11.0, 12.0	7.0, 8.0, 9.0, 10.0, 11.0, 12.0
Absolute Calibration Accuracy dB (per 10 dB step)	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1
Power Incident (Watts)	200	100	100	100
Pwr Reflected (Watts)	200	10	100	10
Peak Power (kW)	10	2	2	2
Maximum Weight (kg)	0.5	0.4	0.4	0.4
Maximum Weight (lbs)	1.0	0.8	0.8	0.8
Special Notes:	A	A	A	A

Special Notes:
A: Frequency Sensitivity included in coupling value.

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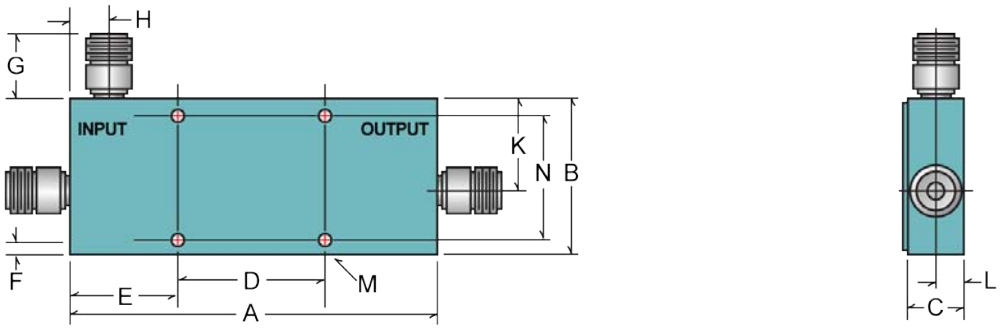
Type N (M/F) 0.92 to 12.4 GHz (Maximally Flat Calibrated)



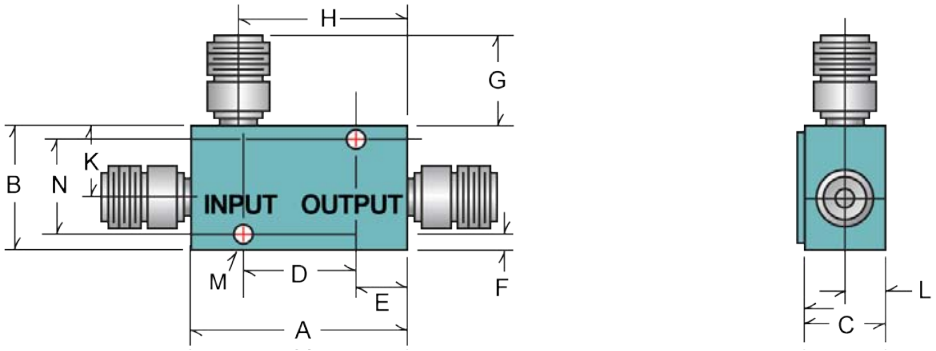
Outline Drawings For Models : 3042B-10, 3042B-20, 3042B-30, 3043B-10, 3043B-20, 3043B-30

Units	A	B	C	D	E	F	G	H	K	L	M (Dia.)	N
3042B-10 , 3042B-20, 3042B-30, 3043B-20												
in.	6.12	2.12	0.88	3.00	1.50	0.19	0.75	0.50	1.26	0.44	Tap-1	1.688
mm	155.45	53.85	22.35	76.20	38.10	4.83	19.05	12.70	32.00	11.18		42.875
3043B-10 , 3043B-30												
in.	4.09	2.12	0.88	1.09	1.50	0.19	0.75	0.50	1.26	0.44	Tap-1	1.688
mm	103.89	53.85	22.35	27.69	38.10	4.83	19.05	12.70	32.00	11.18		42.875

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/-0.015"
N: +/-0.015"
Tap-1: #8-32NC by 0.400 Deep Farside.

Type N (M/F) 0.92 to 12.4 GHz (Maximally Flat Calibrated)



Outline Drawings For Models : 3045C-10, 3045C-20, 3045C-30

Units	A	B	C	D	E	F	G	H	K	L	M (Dia.)	N
3045C-10 , 3045C-20, 3045C-30												
in.	2.50	1.47	0.88	1.125	1.125	0.19	0.75	1.90	0.87	0.44	Tap-1	1.093
mm	63.50	37.34	22.35	28.575	28.575	4.83	19.05	48.26	22.10	11.18		27.762

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/-0.015"
N: +/-0.015"
Tap 1: #8-32 NC-2B .40 DP Tapped (2 Holes) Farside.

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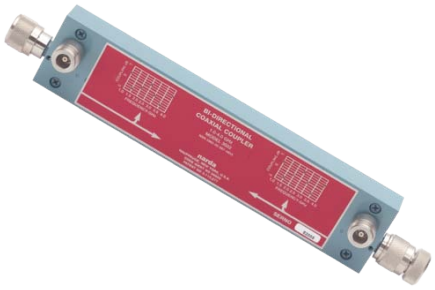
Type N (M/F) 0.05 to 8 GHz 500 Watt (High Power Calibrated Dual 20dB)



Features

- Exceptional High Directivity for Reflectometry Measurements
- Broadband Frequency Coverage
- Bilatereal Male and Female Output Ports
- Low VSWR
- High Power
-

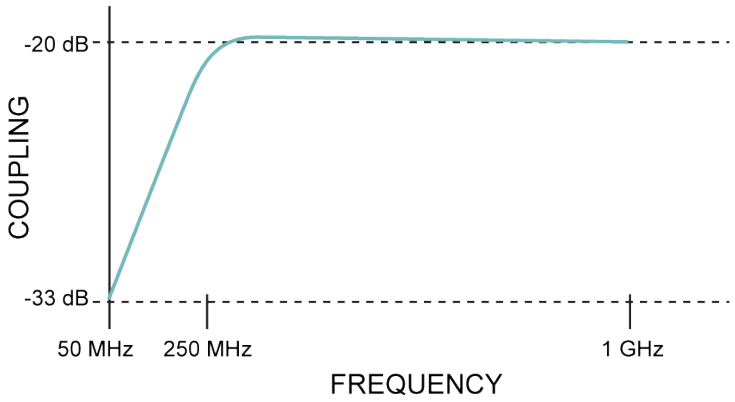
Models

- 3020A, 3022, 3024

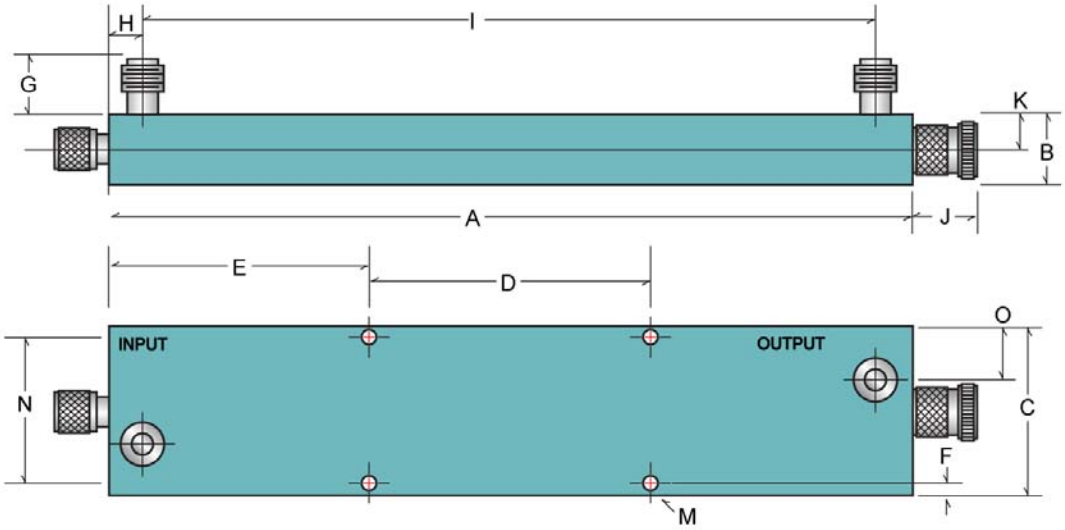
Model	3020A	3022	3024
Low Frequency (GHz)	0.05	1.0	4.0
High Frequency (GHz)	1.0	4.0	8.0
Nominal Coupling (dB)	20*	20	20
Minimum Directivity (dB)	35	30 (1-3 GHz) 27 (3-4 GHz)	25
VSWR Primary Line power	1.05	1.15	1.15
Equivalent Residual VSWR (max)	1.04	1.09	1.12
Absolute Calibration Accuracy dB (per 10 dB step)	+/-0.1	+/-0.1	+/-0.1
Insertion Loss	0.2	0.3	0.6
Tracking dB	0.3	0.3	0.3
Maximum Deviation from Nominal (dB)	+/-1.0 from 250-1000 MHz	+/-1.0	+/-1.0
Power AVG (Incident in W)	500	500	500
Power AVG (Reflected in W)	500	500	500
Peak Power (kW)	10	10	10
Weight (max) in lbs	2.4	1.9	1.6
Weight (max) in kg	1.1	0.7	0.7
Special Notes:	A , B , C , D	C , D	C , D

Special Notes:
A: Coupling from 250 MHz to 50 MHz increases from 20 dB to 33 dB
B: Model 3020A is usable down to 10 MHz; coupling will typically be 42-46 dB at this frequency.
C: Accessories supplied with all units above: 1 male short, 1 female short
D: PRIMARY CONNECTORS: 1 female, 1 male, Type N
SECONDARY CONNECTORS: 2 female, Type N

Type N (M/F) 0.05 to 8 GHz 500 Watt (High Power Calibrated Dual 20dB)



Model 3020A



Outline Drawings For Models : 3020A

Units	A	B	C	D	E	F	G	H	I	J	K	M (Dia.)	N	O
3020A														
in.	13.19	0.88	2.44	4.00	3.72	0.16	0.16	0.75	0.50	1.25	0.44	Tap-1	2.13	0.75
mm	335.03	22.35	61.98	101.60	94.49	4.06	4.06	19.05	12.70	31.75	11.18		54.10	19.05

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
All Dimensions except A: +/-0.030"
Tap-1: #8-32, UNR by 0.4 Deep Farside.

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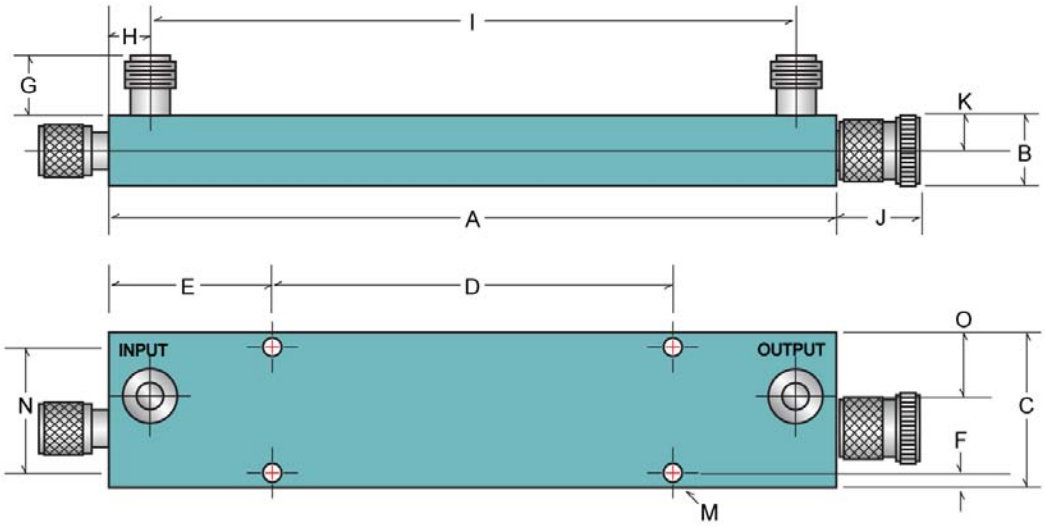
Type N (M/F) 0.05 to 8 GHz 500 Watt (High Power Calibrated Dual 20dB)



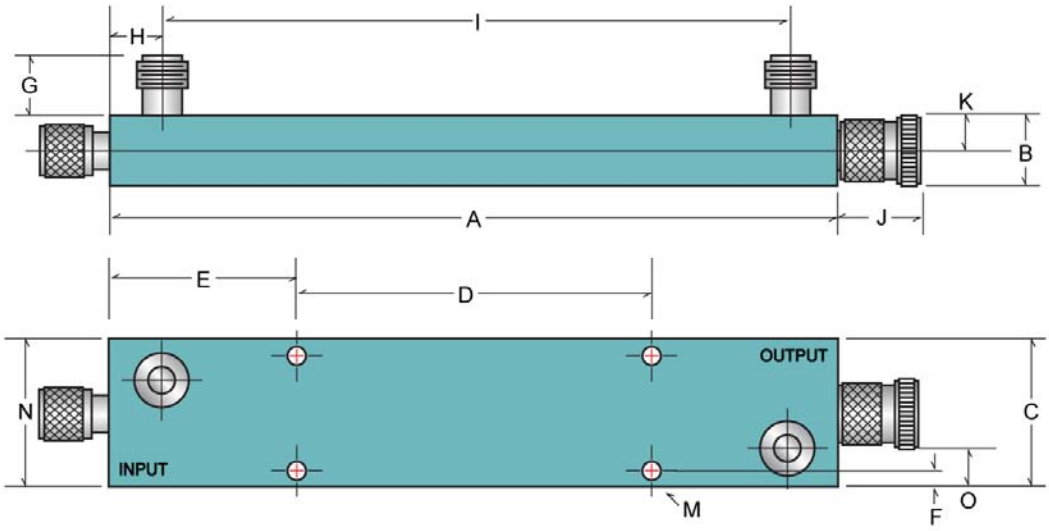
Outline Drawings For Models : 3022

Units	A	B	C	D	E	F	G	H	I	J	K	M (Dia.)	N	O
3022														
in.	10.63	0.88	1.88	4.88	2.87	0.16	0.75	0.50	7.88	1.25	0.44	Tap-1	2.13	0.75
mm	270.00	22.35	47.75	123.95	72.90	4.06	19.05	12.70	200.15	31.75	11.18		54.10	19.05

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
All Dimensions except A: +/-0.030"
Tap-1: #8-32, UNR by 0.4 Deep Farside.

Type N (M/F) 0.05 to 8 GHz 500 Watt (High Power Calibrated Dual 20dB)



Outline Drawings For Models : 3024

Units	A	B	C	D	E	F	G	H	I	J	K	M (Dia.)	N	O
3024														
in.	8.50	0.88	1.75	4.00	2.25	0.19	0.75	0.625	7.25	1.12	0.44	Tap-1	1.38	0.47
mm	215.90	22.35	44.45	101.60	57.15	4.83	19.05	15.875	184.15	28.45	11.18		35.05	11.94

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
All Dimensions except A: +/-0.030"
Tap-1: #8-32, UNR by 0.4 Deep Farside.

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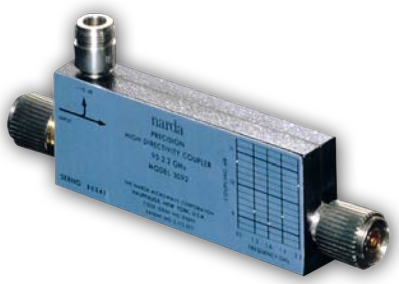
7 mm/Type N 0.95 to 18 GHz Precision High Directivity 5 Watt 10dB



Features

- Exceptionally High Directivity
- Extended Octaves
- Precision Connectors
- Increased Dynamic Range
- Allows Swept Measurements with High Accuracy

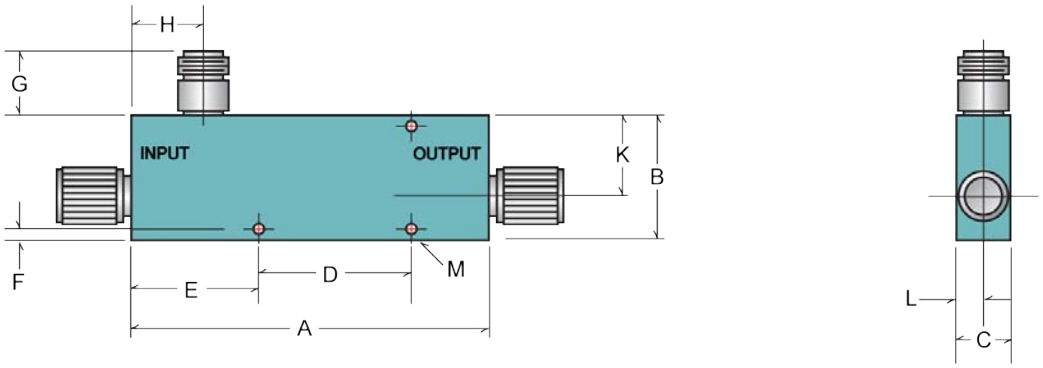
Models

- 3092, 3093, 3094, 3095, 3096

Model	3092	3093	3094	3095	3096
Low Frequency (GHz)	0.95	1.7	3.7	7.0	7.0
High Frequency (GHz)	2.2	4.2	8.3	12.4	18.0
Nominal Coupling (dB)	10	10	10	10	10
Minimum Directivity (dB)	45	42	37	33	25
VSWR Primary Line power	1.10	1.10	1.20	1.20	1.25
VSWR Maximum for Secondary Line	1.10	1.10	1.20	1.25	1.30
Absolute Calibration Accuracy dB	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1	+/- 0.1
Power in W (AVG. dB)	5*	5*	5*	5*	5*
Maximum Weight (oz)	13	11	20	14	15
Maximum Weight (gr)	369	312	567	397	425
Special Notes:	A , B , C	A , B , C	A , B , C	A , B , C	A , B , C

Special Notes:
A: Primary input and output connectors are 7 mm.
Secondary line connectors are Type N female.
B: *Power rating of 5 watts into an open circuited load (VSWR = inifinite)
C: NOTE: All units are available on a Custom-Order basis. Minimum quantities may apply.

7 mm/Type N 0.95 to 18 GHz Precision High Directivity 5 Watt 10dB



Outline Drawings For Models : 3092, 3093, 3094, 3095, 3096

Units	A	B	C	D	E	F	G	H	K	L	M (Dia.)
3092											
in.	4.69	1.76	0.76	3.00	0.51	0.2	0.76	0.76	1.12	0.38	Tap-1
mm	119.13	44.70	19.30	76.20	12.95	5.1	19.30	19.30	28.45	9.65	
3093 , 3094											
in.	7.58	1.76	0.76	5.00	0.89	0.20	0.76	0.76	1.12	0.38	Tap-1
mm	192.53	44.70	19.30	127.00	22.61	5.08	19.30	19.30	28.45	9.65	
3095											
in.	5.05	1.40	0.88	3.00	0.89	0.20	0.76	0.63	0.81	0.44	Tap-1
mm	128.27	35.56	22.35	76.20	22.61	5.08	19.30	16.00	20.57	11.18	
3096											
in.	5.24	1.51	0.88	3.732	0.76	0.22	0.76	0.91	0.81	0.44	Tap-1
mm	133.10	38.35	22.35	94.793	19.30	5.59	19.30	23.11	20.57	11.18	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension:
D: +/-0.015"
N: +/-0.015"
Tap-1: #6-32 NC-2B TH'D x 3/8 DP (Far Side).

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Type N and 7mm 1 to 18 GHz 5 Watt 13dB (Broadband High Directivity)

Features

- **Broadband Frequency Coverage from 1 to 18 GHz in a Single Unit**
- **High Directivity**
- **Increased Dynamic Range**
- **Flat Frequency Response**

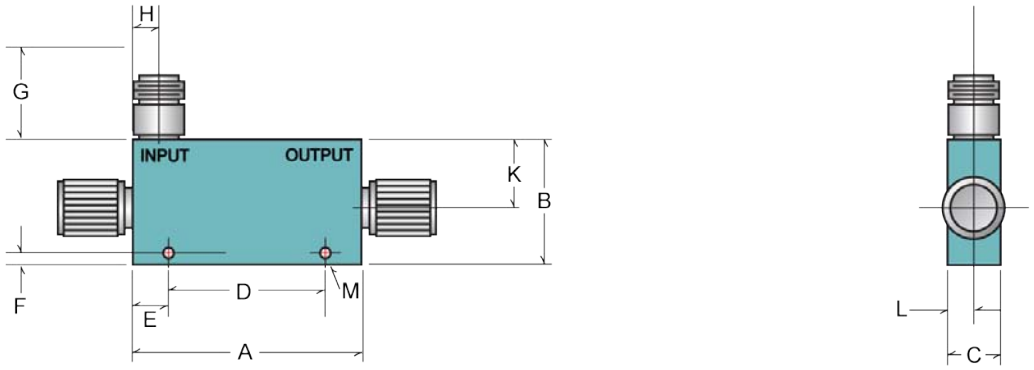
Models

- **3292-1, 3292-2, 5292**

Model	3292-1	3292-2	5292
Low Frequency (GHz)	1.0	1.0	1.0
High Frequency (GHz)	18.0	18.0	18.0
Nominal Coupling dB (1.5-18 GHz)	13 (+/- 1)*	13 (+/- 1)*	13 (+/- 1)*
Directivity dB (1-8)	27	27	28
Directivity dB (8-18)	25	25	26
VSWR Maximum for Primary Line	1.35	1.35	1.30
VSWR Maximum for Secondary Line	1.40	1.40	1.30
Frequency Sensitivity dB (max) 1-1.5	4	4	4
Frequency Sensitivity dB (max) 1.5-18	+/- 1.5	+/- 1.5	+/- 1.5
Connectors (Primary Line Input)	Type N Male	Type N Female	Precision 7 mm
Connectors (Primary Line Output)	Type N Female	Type N Male	Precision 7 mm
Options Available	-02	-02	-01/-02
Maximum Weight (oz)	12	12	12
Maximum Weight (gr)	340	340	340
Special Notes:	A , B , C , D , E	A , B , C , D , E	A , B , C , D , E

Special Notes:
A: *Refer to Typical Coupling Curve on next page for frequency range 1-1.5 GHz.
B: Nominal Coupling is defined as average coupling over the designated frequency range (MAX. COUPLING + MIN. COUPLING)÷2
C: Standard Version (all models) has N Female, Coupled-Output Port.
All units are available on a Custom-Order basis. Minimum quantities may apply.
D: OPTIONS:
-01 Precision Stainless Steel Type N Female Connector on the secondary line.
-02 Precision Stainless Steel SMA Female Connector on the secondary line.
E: POWER RATING: 5 W average, 100 W peak.

Type N and 7mm 1 to 18 GHz 5 Watt 13dB (Broadband High Directivity)

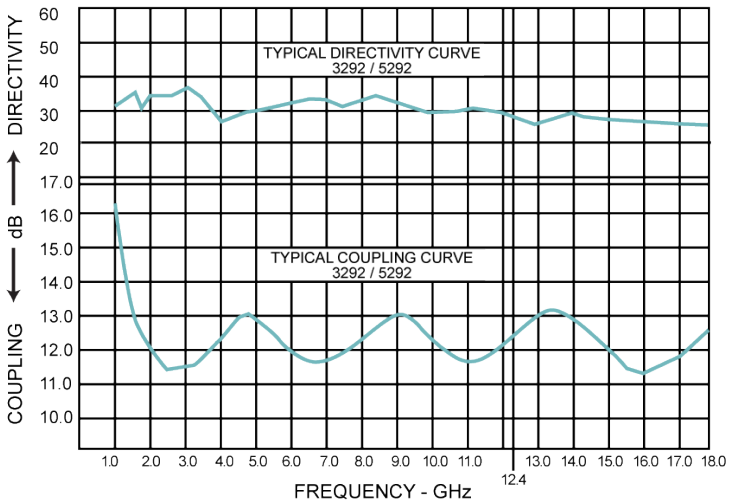


Outline Drawings For Models : 3292-1, 3292-2, 5292

Units	A	B	C	D	E	F	G	H	K	L	M (Dia.)
3292-1 , 3292-2, 5292											
in.	3.19	1.79	0.76	2.25	0.47	0.19	1.59	0.38	0.99	0.38	Tap-1
mm	81.03	45.47	19.30	57.15	11.94	4.83	40.39	9.65	25.15	9.65	

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Dimension D: +/-0.015"
Tap-1: #8-32 NC-2B Tapped Hole



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Type N (F) 0.82 to 2.1 GHz 100W/500W

Features

- For Commercial Wireless Applications
- Complete Series: 10 dB, 20 dB, 30 dB Coupling Values
- High Directivity 25 dB Typical
- Low Intermodulation (IM) Designs

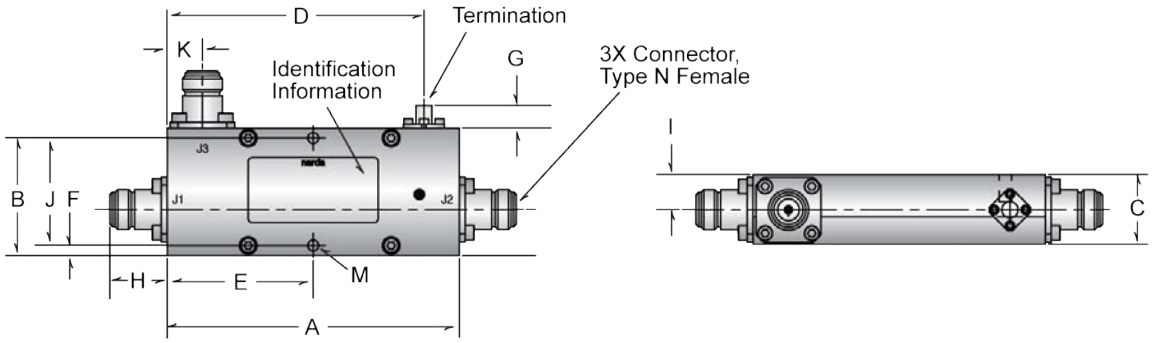
Models

- 3151-10, 3151-20, 3151-30, 3161-10, 3161-20, 3161-30

Model	3151-10	3151-20	3151-30
Connector Type	Type N Female	Type N Female	Type N Female
Frequency Range (GHz)	.820-.980	.820-.980	.820-.980
Frequency Sensitivity dB (max)	+/-0.15	+/-0.2	+/-.2
Coupling dB (max)	10+/-1.0	20+/-1.0	30+/-1.0
Minimum Directivity (dB)	20	30	30
Insertion Loss dB (max)	0.9	0.2	0.15
VSWR Maximum for Primary Line	1.15:1	1.07:1	1.07:1
VSWR Maximum for Secondary Line	1.15:1	1.10:1	1.10:1
Average Power (Watts)	100	500	500
Reflected Power (Avg.) in Watts	5	50	50
Maximum Weight (gr)	510	510	390

Model	3161-10	3161-20	3161-30
Connector Type	Type N Female	Type N Female	Type N Female
Frequency Range (GHz)	1.7-2.1	1.7-2.1	1.7 - 2.1
Frequency Sensitivity dB (max)	+/-.3	+/-.3	+/-.3
Coupling dB (max)	10+/-1.0	20+/-1.0	30+/-1.0
Minimum Directivity (dB)	20	30	20
Insertion Loss dB (max)	0.7	0.2	0.15
VSWR Maximum for Primary Line	1.15:1	1.15:1	1.15:1
VSWR Maximum for Secondary Line	1.20:1	1.20:1	1.20:1
Average Power (Watts)	100	500	500
Reflected Power (Avg.) in Watts	5	50	50
Maximum Weight (gr)	390	390	390

Type N (F) 0.82 to 2.1 GHz 100W/500W



Outline Drawings For Models : 3151-10, 3151-20, 3151-30

Units	A	B	C	D	E	F	G	H	I	J	K	M (Dia.)
3151-10 , 3151-20, 3151-30												
in.	4.50	1.96	1.07	3.96	2.25	0.16	0.40	0.88	0.54	1.65	0.55	0.166
mm	114.30	49.78	27.18	100.58	57.15	4.06	10.16	22.35	13.72	41.91	13.97	4.216

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Connectors mate without interference per MIL-STD-348. Finish: Chem Film IAW MIL-C5541 CL3, Clear.

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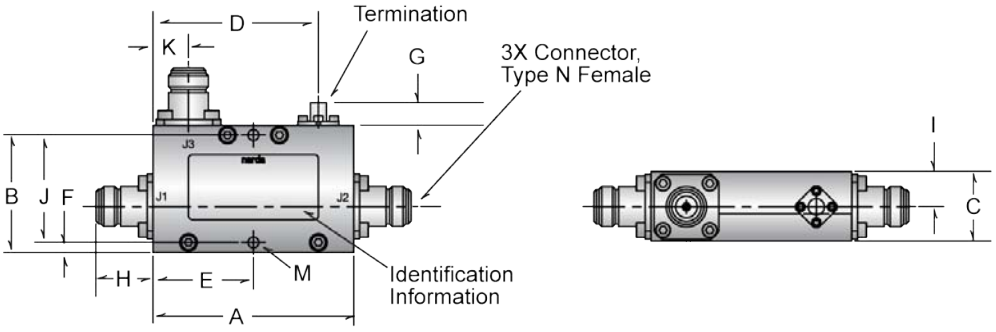
Type N (F) 0.82 to 2.1 GHz 100W/500W



Outline Drawings For Models : 3161-10, 3161-20, 3161-30

Units	A	B	C	D	E	F	G	H	I	J	K	M (Dia.)
3161-10 , 3161-30												
in.	3.09	1.96	1.07	2.55	1.55	0.16	0.40	0.88	0.54	1.65	0.55	0.166
mm	78.49	49.78	27.18	64.77	39.37	4.06	10.16	22.35	13.72	41.91	13.97	4.216
3161-20												
in.	3.09	1.96	1.07	2.55	2.25	0.16	0.40	0.88	0.54	1.65	0.55	0.166
mm	78.49	49.78	27.18	64.77	57.15	4.06	10.16	22.35	13.72	41.91	13.97	4.216

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Connectors mate without interference per MIL-STD-348. Finish: Chem Film IAW MIL-C-5541 CL3, Clear.

Type N (F) 0.7 to 2.5 GHz 500 Watt 30db

Features

- For Commercial Wireless Applications
- High Directivity 20 dB
- Low Intermodulation (IM) Design

Models

- 3171-30

Model	3171-30
Connector Type	Type N Female
FrequencyRange (GHz)	0.7-2.5
Coupling dB (max) 0.7-2.5 GHz	30+/-1.0
Coupling dB (max) 0.82-98 GHz	33+/-1.6
Coupling dB (max) 1.8-2.2 GHz	32+/-3.0
Minimum Directivity (dB)	20
Insertion Loss dB (max)	0.15
VSWR Maximum for Primary Line	1.15:1
VSWR Maximum for Secondary Line	1.20:1
Average Power (Watts)	500
Reflected Power (Avg.) in Watts	50
Maximum Weight (gr)	400

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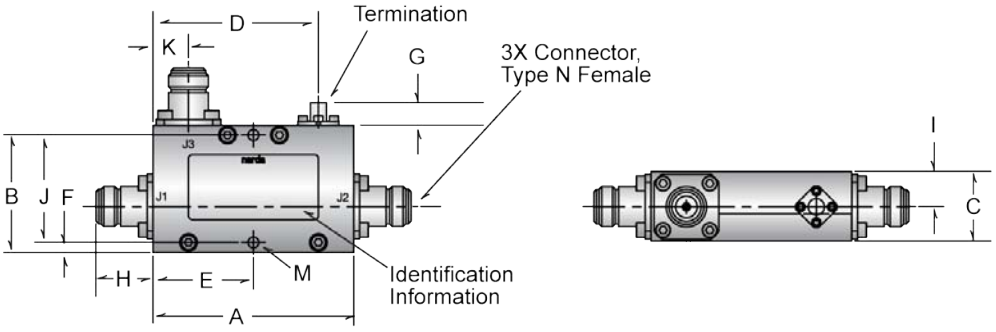
Type N (F) 0.7 to 2.5 GHz 500 Watt 30db



Outline Drawings For Models : 3171-30

Units	A	B	C	D	E	F	G	H	I	J	K	M (Dia.)
3171-30												
in.	3.09	1.96	1.07	2.55	1.55	0.16	0.40	0.88	0.54	1.65	0.55	0.166
mm	78.49	49.78	27.18	64.77	39.37	4.06	10.16	22.35	13.72	41.91	13.97	4.216

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Connectors mate without interference per MIL-STD-348. Finish: Chem Film IAW MIL-C-5541 CL3, Clear.

SMA (F) 0.82 to 2.1 GHz 50 Watt

Features

- For Commercial Wireless Applications
- Complete Series: 10 dB, 20 dB, 30 dB Coupling Values
- High Directivity 25 dB Typical
- Low Intermodulation (IM) Designs

Models

- 4151-10, 4151-20, 4151-30, 4161-10, 4161-20, 4161-30

Model	4151-10	4151-20	4151-30
Connector Type	Type SMA Female	Type SMA Female	Type SMA Female
Frequency Range (GHz)	.820-.980	.820-.980	.820-.980
Frequency Sensitivity dB	+/-0.15	+/-0.15	+/-0.3 db
Coupling dB (max)	10 +/-1.0	20 +/-1.0	30 +/-1.0
Minimum Directivity (dB)	20	25	20
Insertion Loss dB (max)	0.9	0.2	0.15
VSWR Maximum for Primary Line	1.15:1	1.12:1	1.12:1
VSWR Maximum for Secondary Line	1.15:1	1.12:1	1.12:1
Average Power (Watts)	50	50	50
Reflected Power (Avg.) in Watts	5	50	50
Maximum Weight (gr)	420	420	420

Model	4161-10	4161-20	4161-30
Connector Type	Type SMA Female	Type SMA Female	Type SMA Female
Frequency Range (GHz)	1.7-2.1	1.7-2.1	1.7-2.1
Frequency Sensitivity dB	+/-0.3	+/-0.3	+/-0.3
Coupling dB (max)	10+/-1.0	20 +/-1.0	30 +/-1.0
Minimum Directivity (dB)	20	20	20
Insertion Loss dB (max)	0.7	0.2	0.15
VSWR Maximum for Primary Line	1.15:1	1.15:1	1.15:1
VSWR Maximum for Secondary Line	1.20:1	1.20:1	1.20:1
Average Power (Watts)	50	50	50
Reflected Power (Avg.) in Watts	5	50	500
Maximum Weight (gr)	280	280	280

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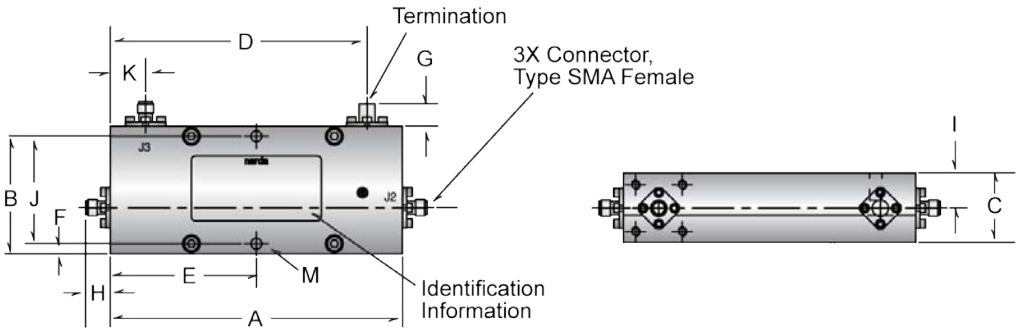
SMA (F) 0.82 to 2.1 GHz 50 Watt

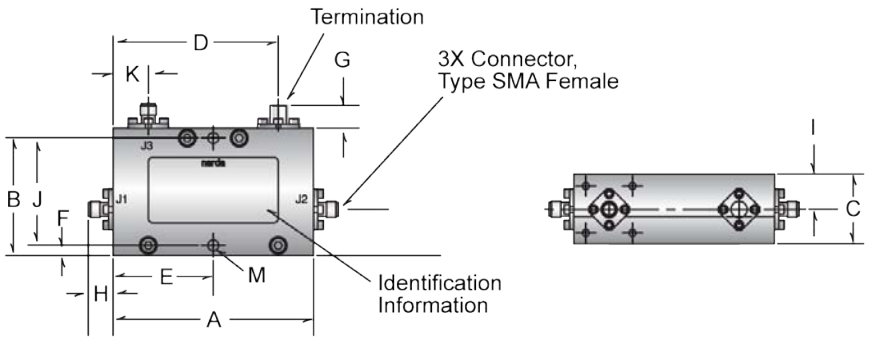


Outline Drawings For Models : 4151-10, 4151-20, 4151-30

Units	A	B	C	D	E	F	G	H	I	J	K	M (Dia.)
4151-10 , 4151-20, 4151-30												
in.	4.50	1.96	1.07	3.96	2.25	0.16	0.40	0.38	0.54	1.65	0.55	0.166
mm	114.30	49.78	27.18	100.58	57.15	4.06	10.16	9.65	13.72	41.91	13.97	4.216

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Connectors mate without interference pre MIL-STD-348. Finish: Chem Film IAW MIL-C-5541 CL3, Clear.



Outline Drawings For Models : 4161-10, 4161-20, 4161-30

Units	A	B	C	D	E	F	G	H	I	J	K	M (Dia.)
4161-10 , 4161-20, 4161-30												
in.	3.09	1.96	1.07	2.55	1.55	0.16	0.40	0.38	0.54	1.65	0.55	0.166
mm	78.49	49.78	27.18	64.77	39.37	4.06	10.16	9.65	13.72	41.91	13.97	4.216

Notes:

Dimensions are maximum unless otherwise noted and allow for 0.020" paint buildup per surface.
Connectors mate without interference pre MIL-STD-348. Finish: Chem Film IAW MIL-C-5541 CL3, Clear.

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DC BLOCKS

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Frequency Range (GHz)	Connector	Model No.
DC Blocks and Audio Interference Suppressors		
0.5-18	SMA	4563
0.15-18	SMA	4564
0.085-45.0	SMA	4566
0.01-12.4	Type N	562

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Type N, SMA and 2.92mm, 85 kHz. to 45 GHz Inside and Inside/Outside

Features

- Broadband Frequency Ranges of 85 kHz to 45 GHz
- Suppresses DC thru 100 kHz Leakage from External Signal Sources
- Low Insertion Loss
- Small Size, Light Weight

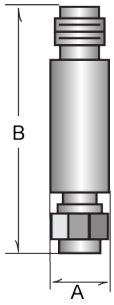
Models

- 562, 4563, 4564

Model	562	4563	4564
Low Frequency (GHz)	0.01	0.5	0.15
High Frequency (GHz)	12.4	18.0	18.0
VSWR (max)	-	1.35	1.35
VSWR (max) 0.02-12.4 GHz	1.3	N/A	N/A
VSWR (max) .01-.02 GHz	N/A	N/A	N/A
Insertion Loss dB (max)	-	-	0.35
Insertion Loss dB (max) 10 MHz-11 GHz	0.5	-	-
Insertion Loss dB (max) 11.0-12.4 GHz	1.0	-	-
Insertion Loss dB (max) 50 MHz-1.5 GHz	-	1.5	-
Insertion Loss dB (max) 1.5-18 GHz	-	0.5	-
Voltage Breakdown (Vdc)	100V	150V	150V
Type	Inside/Outside	Inside/Outside	Inside
Connector	Type N Male/ Type N Female	Type SMA Male/ Type SMA Female	Type SMA Male/ Type SMA Female
Special Notes:	A , B	A , B	A , B

Special Notes:
A: Weight is 10 grams max.
B: Maximum average power is 10 Watts max.

Type N, SMA and 2.92mm, 85 kHz. to 45 GHz Inside and Inside/Outside

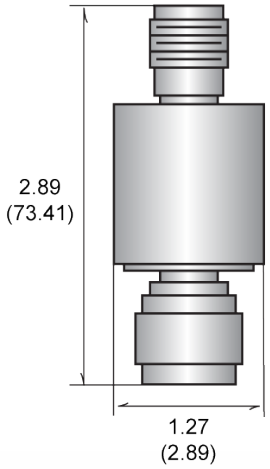


Outline Drawings For Models : 4563, 4564

Units	A	B
4563 , 4564		
in.	0.38	1.55
mm	9.65	39.37

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.



Model 562

Dimensions are maximum and for reference only. Dimensions in parentheses are in millimeters. Contact the factory for detailed specifications and outline drawing.

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DETECTORS

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Frequency Range (GHz)	Connector	Model No.
0.01-18	SMA	4506
0.01-18	SMA, BNC	4503A
0.01-18	Type N	503A

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SMA (M/F) 0.01 to 18 GHz Negative Polarity Zero Bias Schottky Detector

Features

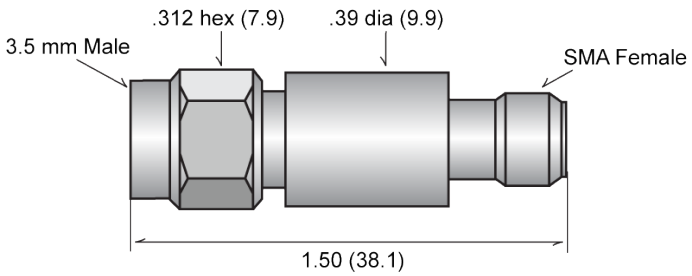
- Zero Biased Detectors
- Excellent Sensitivity, Rugged
- Matched Detector; Good VSWR Characteristics

Models

- 4506

Model	4506
FrequencyRange (GHz)	0.01-18
Flatness dB (0.01-18.0)	+/-0.5
VSWR (0.01-18.0 GHz)	1.5:1
Sensitivity (mV/mW)	500
Capacitance	30pf
Polarity	Negative
Special Notes:	A

Special Notes:
A: Sensitivity is referenced to -20 dBm maximum



Model 4506

Dimensions are maximum and for reference only. Dimension in parentheses is in millimeters. Contact the factory for detailed specifications and outline drawing.

Type N (M) and SMA (M) to BNC (F) 0.01 to 18 GHz Pos/Neg Polarity Zero-Bias Schottky Detector

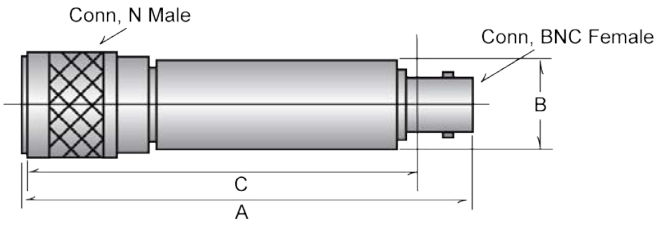
Features

- Broadband Coverage
- Flat Frequency Response
- High Sensitivity
- Field-Replaceable Diode
- Negative or Positive Output Available

Models

- 503A, 503A-03, 4503A, 4503A-03

Model	503A	503A-03	4503A	4503A-03
FrequencyRange (GHz)	.01-18	.01-18	.01-18	.01-18
Flatness dB	+/- 0.6	+/- 0.6	+/- 0.6	+/- 0.6
Sensitivity (mV/?W)	0.5	0.5	0.5	0.5
VSWR (max)	< 1.6	< 1.6	< 1.6	< 1.6
Input Power (max) ?W	100	100	100	100
Polarity	Negative	Positive	Negative	Positive
Connectors (Input)	Type N-Male	Type N-Male	SMA-Male	SMA-Male
Connectors (Output)	BNC-Female	BNC-Female	BNC-Female	BNC-Female



Outline Drawings For Models : 503A, 503A-03

Units	A	B	C
503A , 503A-03			
in.	3.25	0.65	2.83
mm	82.55	16.51	71.88

Notes:

All dimensions are max. unless otherwise specified.

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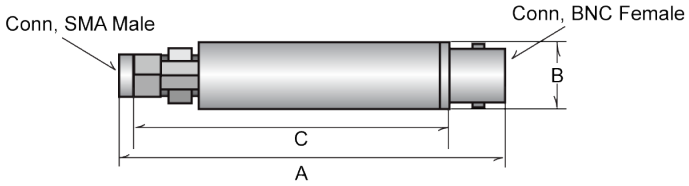
Type N (M) and SMA (M) to BNC (F) 0.01 to 18 GHz Pos/Neg Polarity Zero-Bias Schottky Detector

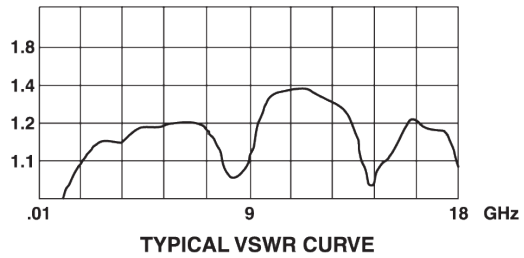


Outline Drawings For Models : 4503A, 4503A-03

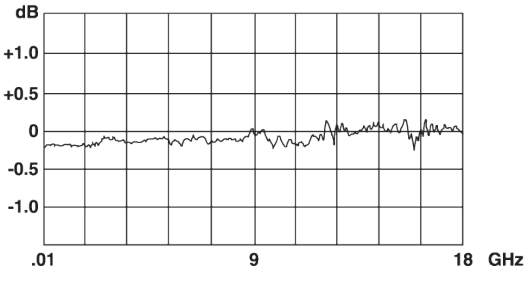
Units	A	B	C
4503A , 4503A-03			
in.	2.89	.55	2.43
mm	73.41	13.97	61.72

Notes:

All dimensions are max. unless otherwise specified.

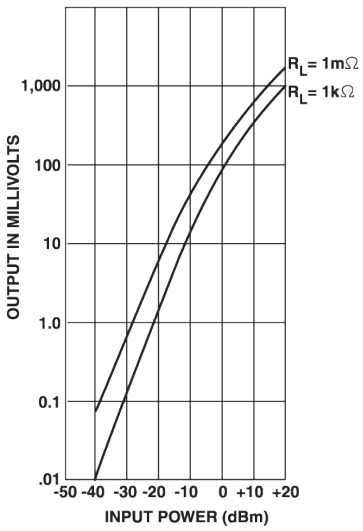


TYPICAL VSWR CURVE



TYPICAL RESPONSE CURVE

TYPICAL DETECTOR SENSITIVITY
MODELS 503A, 4503A



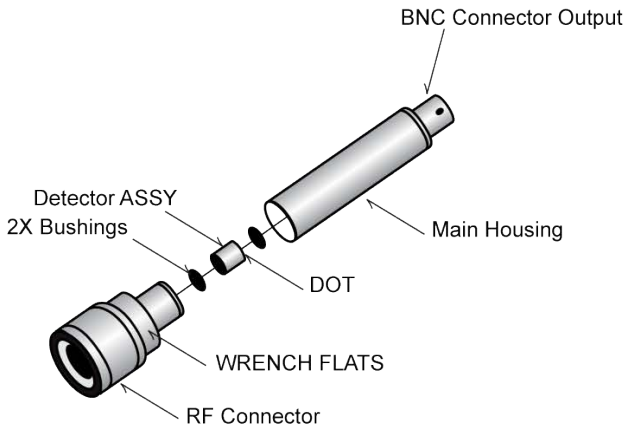
Replacement Diode Elements for Schottky Detectors

Models

- **4829, 4829-03**

Model	4829	4829-03
Replacement for Detector Model	503A, 4503A	503A-03, 4503A-03
Special Notes:	A	A

Special Notes:
A: Not to be used for 4506 Series.



Field Diode Replacement Procedure

Using approved ESD guidelines:
1. Hold Detector by main housing (side with BNC connector). Unscrew RF Input connector by applying a wrench to flats provided.
2. Remove detector assembly.
3. Insert bushings into each assembly.
4. Insert replacement diode into RF connector side - dot should be facing out.
5. Reassemble the connector and hand tighten.

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ISOLATORS & CIRCULATORS

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SMA (F) 2.0 to 26.5 GHz Isolators

Models

- **4913, 4914, 4915, 4946, 4916, 4917**

Model	4913	4914	4915
Low Frequency (GHz)	2.0	4.0	7.0
High Frequency (GHz)	4.0	8.0	10.0
Isolation dB (min)	18	18	20
Loss (dB max)	0.5	0.5	0.4
VSWR (max)	1.30:1	1.30:1	1.25:1
Peak Power (Watts) Fwd & Rev	50	50	10
Avg Power (Fwd) in Watts	25	15	5
Avg Power (Rev) in Watts	1*	1*	1*
Temp Range (in Deg. Celsius)	0 to +55	-20 to +65	-20 to +65
Special Notes:	A	A	A

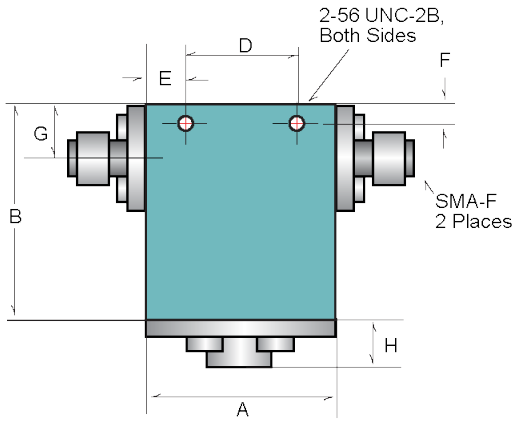
Special Notes:
A: *Limited by termination power handling capacity.

Model	4946	4916	4917
Low Frequency (GHz)	8.0	11.0	18.0
High Frequency (GHz)	18.0	18.0	26.5
Isolation dB (min)	16	20	17
Loss (dB max)	0.6	0.5	0.6
VSWR (max)	1.45:1	1.25:1	1.40:1
Peak Power (Watts) Fwd & Rev	15	20	10
Avg Power (Fwd) in Watts	5	5	3
Avg Power (Rev) in Watts	1*	1*	1*
Temp Range (in Deg. Celsius)	-20 to +65	-20 to +65	-20 to +65
Special Notes:	A	A	A

Special Notes:
A: *Limited by termination power handling capacity.

Narda Microwave-East does not offer any custom variants of Isolators and Circulators.
For custom configurations please contact Narda Microwave-West.

SMA (F) 2.0 to 26.5 GHz Isolators



Outline Drawings For Models : 4915, 4946, 4916, 4917

Units	A	B	D	E	F	G	H
4915							
in.	0.50	0.63	0.375	0.06	0.16	0.25	0.17
mm	12.70	16.00	9.525	1.52	4.06	6.35	4.32
4946 , 4916							
in.	0.63	0.80	0.50	0.07	0.25	0.25	0.17
mm	16.00	20.32	12.70	1.78	6.35	6.35	4.32
4917							
in.	0.50	0.66	0.38	0.06	0.18	0.25	0.17
mm	12.70	16.76	9.65	1.52	4.57	6.35	4.32

Notes:

Dimension for H is nominal.
TOL: .xx +\- .02 .xxx +\- .010

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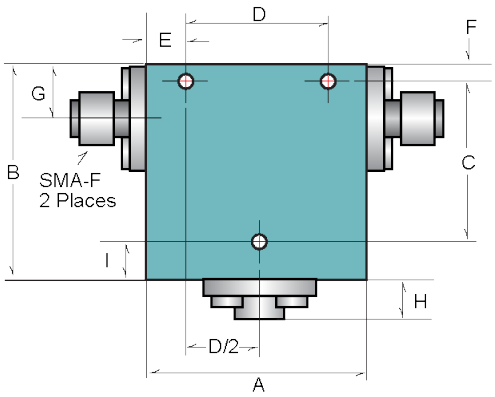
SMA (F) 2.0 to 26.5 GHz Isolators



Outline Drawings For Models : 4913, 4914

Units	A	B	C	D	D/2	E	F	G	H	I
4913										
in.	1.60	1.65	1.10	1.00	0.50	0.30	0.25	0.25	0.17	0.30
mm	40.64	41.91	27.94	25.40	12.70	7.62	6.35	6.35	4.32	7.62
4914										
in.	1.00	1.00	0.60	0.75	0.375	0.13	0.25	0.25	0.17	0.15
mm	25.40	25.40	15.24	19.05	9.525	3.30	6.35	6.35	4.32	3.81

Notes:

Mounting Hole Dimensions:
Model 4913: 4-40 UNC-2B, Both Sides
Model 4914: 2-56 UNC-2B, Both Sides

SMA (F) 2.0 to 26.5 GHz Circulators

Models

- **4923, 4924, 4925**

Model	4923	4924	4925
Low Frequency (GHz)	2.0	4.0	7.0
High Frequency (GHz)	4.0	8.0	12.4
Isolation dB (min)	18	20	20
Loss (dB max)	0.5	0.4	0.4
VSWR (max)	1.30:1	1.25:1	1.25:1
Peak Power (Watts) Fwd & Rev	50	50	25
Avg Power (Fwd) in Watts	25	15	10
Avg Power (Rev) in Watts	25	15	10
Temp Range (in Deg. Celsius)	0 to +55	-20 to +65	-20 to +65

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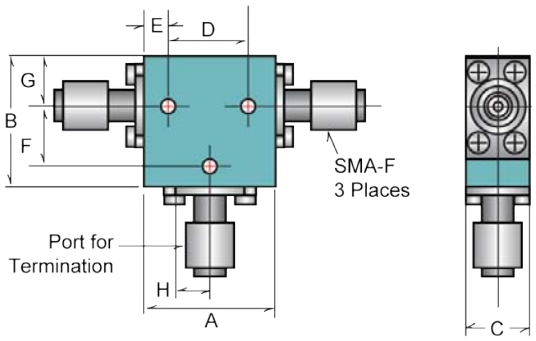
SMA (F) 2.0 to 26.5 GHz Circulators



Outline Drawings For Models : 4923, 4924, 4925

Units	A	B	C	D	E	F	G	H
4923								
in.	1.60	1.65	0.75	1.00	0.30	1.10	0.25	0.17
mm	40.64	41.91	19.05	25.40	7.62	27.94	6.35	4.32
4924								
in.	1.60	1.65	0.60	0.75	0.425	1.10	0.25	0.17
mm	40.64	41.91	15.24	19.05	10.795	27.94	6.35	4.32
4925								
in.	0.85	1.00	0.63	0.60	0.13	0.60	0.25	0.17
mm	21.59	25.40	16.00	15.24	3.30	15.24	6.35	4.32

Notes:

Dimension for H is nominal.
TOL: .xx +\- .02 .xxx +\- .010

Mounting Hole Dimensions:
Model 4923: 4-40 UNC-2B x .18 Deep, 3 Places, Both Sides
Models 4924 & 4925: 2-56 UNC-2B x .18 Deep, 3 Places, Both Sides

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PHASE SHIFTERS

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Frequency Range (GHz)	Connector	Model No.
3.5-12.4	Type N	3753B
1-5	Type N	3752
3-18	SMA	4572B

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Type N (F) 1 to 12.4 GHz 200W Precision Control Phase Shifters

Features

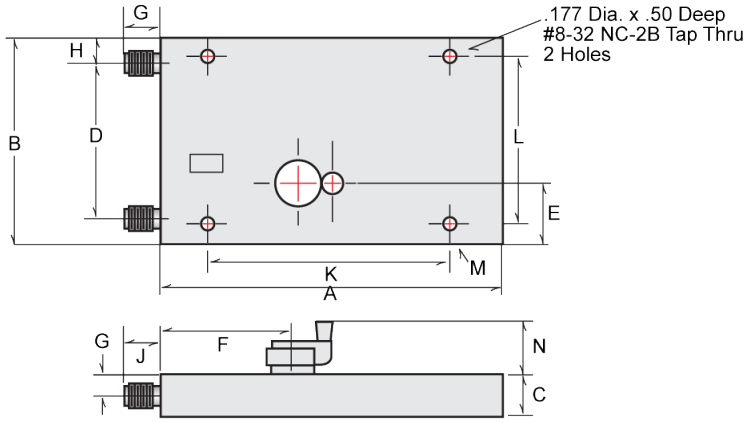
- Broadband Coverage - 180° Phase Shift at Minimum Frequency
- Low VSWR
- +/- 0.5°/GHz Accuracy with Digital Dial Readout

Models

- 3752, 3753B

Model	3752	3753B
Low Frequency (GHz)	1.0	3.5
High Frequency (GHz)	5.0	12.4
Minimum Phase Shift	180 Deg. at 1 GHz	180 Deg. at 3.5 GHz
Average Power (W)	200	200
Peak Power (kW)	5	5
Insertion Loss dB (max)	0.5	0.7
VSWR (max)	1.25	N/A
VSWR (Max) 3.5-10 GHz	N/A	1.35
VSWR (max) 10-12.4 GHz	N/A	1.4
Accuracy (in Deg./GHz)	+/-0.5	+/-0.5
Weight (max) in lbs	4.5	3.3
Weight (max) in kg	2.05	1.5

Type N (F) 1 to 12.4 GHz 200W Precision Control Phase Shifters



Outline Drawings For Models : 3752, 3753B

Units	A	B	C	D	E	F	G	H	J	K	L	M (Dia.)	N
3752													
in.	9.03	5.53	1.12	4.13	1.56	3.75	0.56	0.68	0.75	6.00	5.13	0.177	1.50
mm	229.36	140.46	28.45	104.90	39.62	95.25	14.22	17.27	19.05	152.40	130.30	4.496	38.10
3753B													
in.	6.72	4.69	1.28	3.50	1.59	1.13	0.75	0.58	1.22	4.50	4.31	0.177	1.50
mm	170.69	119.13	32.51	88.90	40.39	28.70	19.05	14.73	30.99	114.30	109.47	4.496	38.10

Notes:

All dimensions are max. unless otherwise specified.

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SMA (M/F) 3 to 18 GHz 30 Watt Phase Trimmer

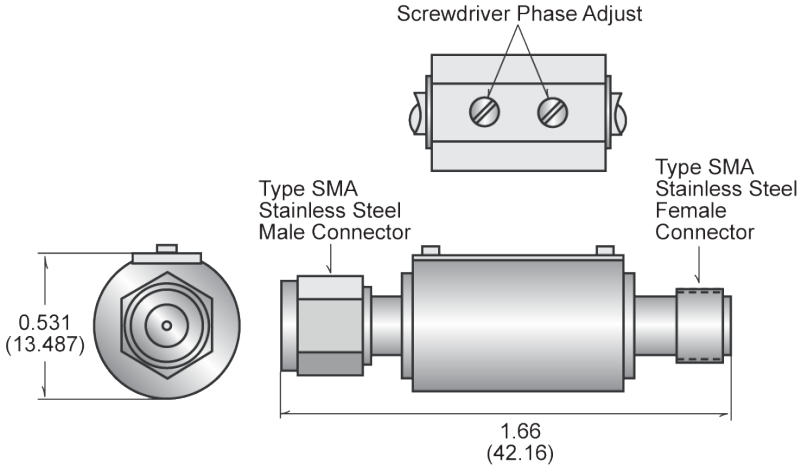
Features

- Broadband Frequency Coverage from 3 to 18 GHz
- Extremely Small Size and Lightweight
- Ruggedized Construction
- Operational from -54° to +100°C*
- Fixed Length Phase Shifter
- Power Level = 30 Watts CW max (+25°C)
- *Derate to 0 Watts @ 125°C

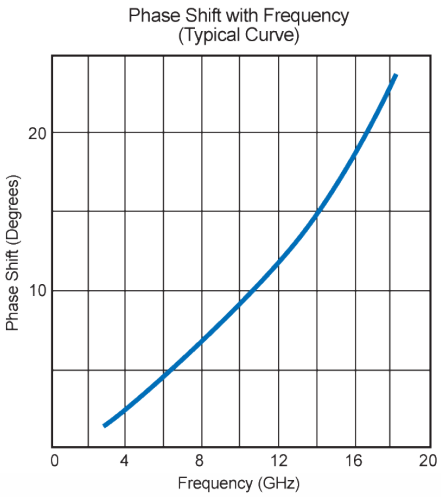
Models

- 4572B

Model	4572B
Low Frequency (GHz)	3.0
High Frequency (GHz)	18.0
Insertion Loss dB (max)	0.4
Phase Shift Adjustment Range	+/- 2° @ 3 GHz, > 20° @ 18 GHz
Linearity	+/- 2° 3-12.4 GHz +/- 5° 12.4-18 GHz
VSWR (max)	1.35
Maximum Weight (oz)	0.64
Maximum Weight (gr)	19



Model 4572B



All dimensions are max. unless otherwise specified. Dimensions in parentheses are in millimeters.

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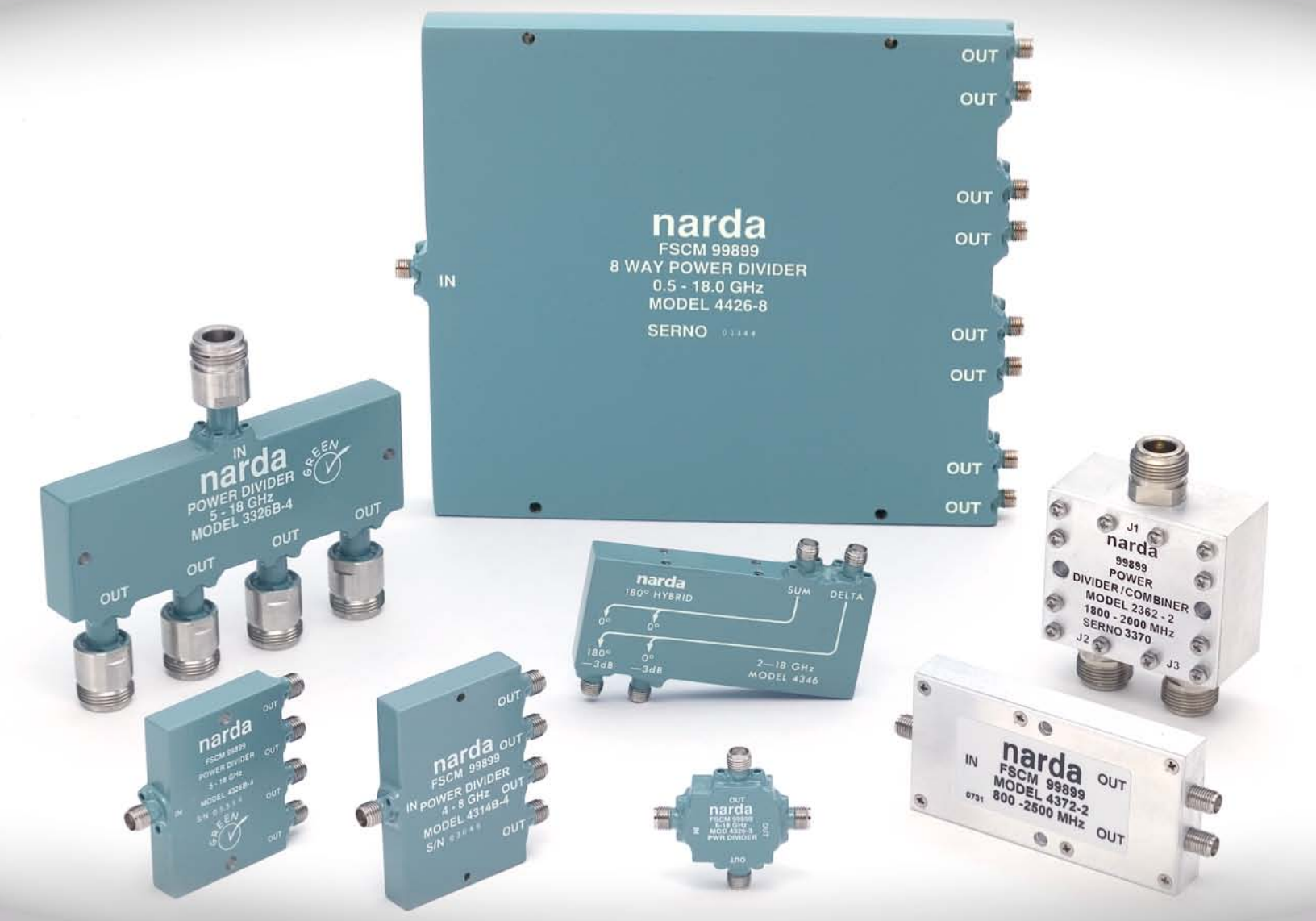
POWER DIVIDERS & HYBRIDS



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Quick Reference Guide

Frequency Range (GHz)	Connector	Model No.
Power Dividers		
10-45	2.9 mm	4428C
18-40	2.9 mm	4318
10-33	2.92 mm	4328B
2.0-26.5	2.92 mm	4327C
18-26.5	2.92 mm	4317
0.5-18	SMA	4426
2-18	Type N	3456
2-18	SMA	4456
0.5-6	SMA	4426LB
5-18	SMA	4326B
6-18	SMA	4096
6-18	SMA	4306
6-18	SMA	4326
12-18	SMA	4316
8-12.4	SMA	4315
2-8	SMA	4324
2-8	Type N	3324
2-6	SMA	4323
4-8	SMA	4314
6-8	Type N	3326B
2-4	SMA	4313
0.8-2.2	SMA	4325
0.5-8.0	SMA	4436
0.5-2.5	SMA	4322
0.5-2.0	SMA	4321
1-2	SMA	4312
0.5-1.0	SMA	4311
Low-Cost Power Dividers		
0.8-1.0	SMA	4152
.8-2.5	Type N	3372A
0.8-2.5	SMA	4372A
1.9-2.5	SMA	4162
Hybrids		
2-18	SMA	4356B
2-18	SMA	4346
6-18	SMA	4336
6-18	SMA	4096
7.5-16	SMA	4065
2-8	SMA	4333

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Frequency Range (GHz)	Connector	Model No.
2-8	SMA	4343
4-8	SMA	4034C
1.7-4.2	Type N	3033B
2-4	SMA	4033C
0.5-8	SMA	4358
0.820-0.980	Type N	3322
0.95-2.0	Type N	3032
1-2	SMA	4032C
0.5-1.0	SMA	4031C
0.25-0.5	SMA	4030C

Introduction

Traditionally, both coupled-line 3 dB couplers and in-phase Wilkinson dividers have been used for power diving and combining. For a given application, however, the differences between the two make one type more desirable than the other.

90° Hybrids

A 90° Hybrid (Hybrid Junction) is a network having the electrical characteristics of a 3 dB directional coupler whose branch line is not terminated. The four terminal network can be considered to have two pairs of terminals called conjugate pairs. In most packages, each conjugate pair is located on either side of the device (Figure 1). The two terminals that make up the conjugate pair are isolated from each other. Therefore, power flowing into one terminal of the pair does not appear at its conjugate, but is equally divided between the terminals of the opposite conjugate pair. When used as a power divider, any one of the four terminals can be used as the input. With the conjugate port of the input terminated in 50 ohms, the two outputs at the opposite conjugate pair will be of equal amplitude and in quadrature (90° apart in phase).

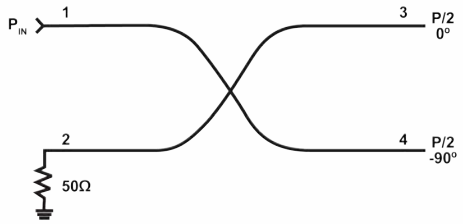

Figure 1 Multi-Octave Hybrid, Ports 1 & 2 Comprise a Conjugate Pair, Ports 3 & 4 Comprise a Conjugate Plan

The primary advantage of the hybrid junction is its power handling capability. Since the isolated port (conjugate of the input port) is terminated externally, the only limitations to power handling are heat generated by the internal dissipation losses and the power handling capability of the external termination. As stripline losses are typically low, hybrid junctions can be designed to handle up to 500 Watts average power in special versions. Another advantage of the hybrid junction is that it maintains its quadrature relationship over the full operating frequency range of the device. This characteristic is highly desirable in Polar Frequency Discrimination and Circularly Polarized antenna circuits.

180° Hybrids

A signal applied to the sum port of the 180° hybrid provides output signals of equal amplitude and phase at the output ports. A signal applied to the delta port provides output signals of equal amplitude but 180° out of phase with each other (Figure 2). Narda Broadband 180 Degree Hybrids are ideal for use as power dividers, combiners, balanced mixers, image rejection mixers, antenna feed networks, matrix amplifiers and switching networks.

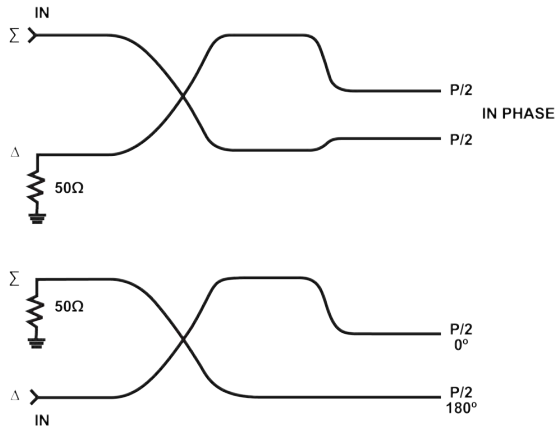

Figure 2 Signal Flow Diagram 180° Hybrid

In-Phase Power Divider

An in-phase Wilkinson power divider is a network with one input and N outputs equal in amplitude whose phase relationship is zero degrees. In some applications, such as phased arrays and certain EMC interferometer receiving systems, this characteristic is a necessity.

A distinct advantage of the in-phase power divider is its superior amplitude balance when compared to the amplitude balance of a hybrid junction. Examples which take advantage of this superior performance are illustrated in Figures 3 and 4. Since the output ports track so closely, one port of the divider is fed back to the swept signal generator to provide a very flat amplitude response at the point of measurement.

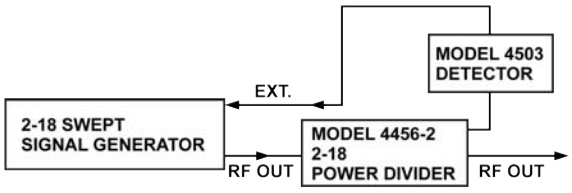

Figure 3. An example using a power divider in a leveling loop application requiring superior amplitude and phase balance.

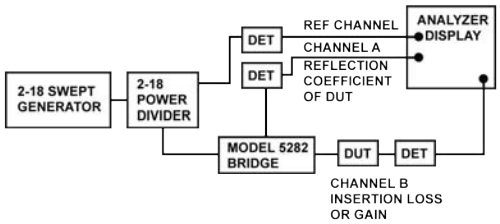

Figure 4. A ratio measurement system is an example in the use of the excellent tracking characteristcs of the divider in a ration measurement system.

As the output ports of the divider are identical, and one of these outputs is used to provide amplitude correction information to the swept generator, the ideal case provides a constant RF output level to the unit under test. When this is the case, measurement of reflection coefficient and insertion loss of a device may be made with a swept signal generator in the unleveled mode. Any inadvertent variation of the power output control of the swept signal generator would have no effect on the measurement.(It should be noted, however, that in both of the cases depicted in Figures 3 and 4, there is a nominal 3dB power loss of the input signal).

Using Hybrids and In-Phase Power Dividers as Power Combiners

Both the in-phase power divider and the hybrid junction can be used as power combiners. If the relationship of the input signals when the device is used as a combiner is the same as the relationship of the output signals present when the device is used as a divider, there is a minimal power loss through the device. For example, a 90° hybrid with equal amplitude signals in quadrature placed on the inputs to one conjugate pair will result in no signal at one of the terminals of the opposite conjugate pair and the sum of the signals at the other terminal. Due to the fact that the inputs, when used as a combiner, were at the same relationship as the outputs would have been if the device was used as a divider (one signal in, two signals out at equal amplitude 90° apart) the power loss is minimal. In other cases, the combination losses will vary with the relationship of the signals, and the combined power level achieved in combination will be degraded.

In a similar manner, the in-phase power divider can be used as a power combiner. In this case, however, as the power handling capability of the in-phase power divider is limited by the power handling capability of the internal resistor(s) of the device, the input power level of each of the combined signals must not exceed 1W/N watts (where N is the number of inputs). For example, when using a 4-way power divider as a combiner, the maximum power level into each of the output ports of the divider cannot exceed 0.25 Watts or 1W/N=4. If, however, the input signals are phase and amplitude coherent (same frequency, equal amplitude), the internal resistor of the in-phase power divider does not dissipate energy, and the power level of the inputs can be as high as the full-rated power used as a divider, divided by N. (In this example, a 4-way device rated as a divider at 50 Watts, could handle 4 signals of 12.5 Watts if the signals were frequency- and amplitude-coherent).

In applications for the combination of 2 or more transmit signals into single antenna communications networks, Narda does provide designs that can handle multiple signal inputs at elevated RF power levels. Power level handling, where the sum of the input signal power of each of the input ports closely matches the maximum forward power when used as a divider, is readily achievable with the proper resistor selection. Using this design approach, custom broadband high frequency devices, as well as narrow band products geared toward the cellular markets, are available.

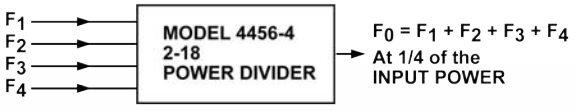

Figure 5. Illustrates the use of the divider as a combiner. **See page 40 for expanded illustration.**

General Definitions

Since performance characteristics of in-phase power dividers are specified in a number of ways, the following definitions of terms are applicable to all

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Narda in-phase power dividers that appear in this catalog.

Frequency - The frequency range over which the power divider must meet specifications listed.

Amplitude Balance - The maximum peak to peak amplitude difference in dB between the output ports of the power divider over the specified frequency range.

Phase Balance - The maximum peak-to-peak difference in phase, in degrees, between the output ports of the power divider over the specified frequency range.

Isolation - The difference in dB that the signal level measured at one output port is below the signal level into the adjacent output port, with the input port terminated in 50 ohms. Isolation is measured between adjacent ports since this is the most severe condition.

VSWR, Input - The maximum VSWR of the power divider over its specified frequency range, looking into the common port, with all other ports terminated in 50 ohms.

VSWR, Output - The maximum VSWR of the power divider over its specified frequency range, looking into any one of the outpurt ports with all other ports terminated in 50 ohms.

Insertion Loss - The ratio in dB of the net difference between the power input and the sum of the output power expressed as:

$$\text{Insertion Loss} = 10_{\log}\frac{P_1 + P_2 + \ldots . P_n}{P_{input}}$$

Average Power - The maximum power that may be applied to the common or input port with the output ports terminated in a load with the VSWRs listed.

NOTE: For applicable Narda Power Dividers and Hybrids, Narda can supply **standard** test data for a nominal fee.

Environmental Performance for Selected Passive Products*

Parameter	Specification
Operating Temperature	-54 to +105°C
Storage Temperature	-55 to +125°C
Humidity	Per MIL-STD-202F, Method 103B, Condition B (96 hours at 95% R.H.)
Shock	Per MIL-STD-202F, Method 213B, Condition J (30G, 11 msec)
Altitude	Per MIL-STD-202F, Method 105G, Condition B (50,000 ft)
Vibration	Per MIL-STD-202F, Method 204D, Condition B (.06" double amplitude or 15G, whichever is less)
Thermal Shock	Per MIL-STD-202F, Method 107D, Condition A (5 cycles)

*Applicable to: Stripline Directional Couplers, Attenuators, Power Dividers

Note: This is an exclusive listing. Where otherwise noted in the catalog, the above environmental performance may not apply. Not applicable for those products designed for commercial applications. Many of our catalog off-the-shelf (COTS) products have the ability to withstand considerably more stringent environments. If you have special environmental requirements, please contact the Sales Department at Narda.

Very High Power Handling as Combiner with Two Non-Coherent Signals

Features

- Wireless Communications PCS and Cellular
- Coverage
- Wireless Broadband - 500 to 2500 MHz
- 2-Way
- High Isolation
- Excellent Phase and Amplitude Balance
- IP 65 Seal

Models

- 2372A-2

Model	2372A-2
FrequencyRange (GHz)	0.5 - 2.5
VSWR Input (max) 0.5-0.7 GHz	2.25:1
VSWR Input (max) 0.7-2.5 GHz	1.5:1
VSWR Output (max)	1.4:1
Insertion Loss dB (max) 0.5-0.7 GHz	0.6
Insertion Loss dB (max) 0.7-2.5 GHz	0.4
Isolation dB (min) 0.5-0.7 GHz	13
Isolation dB (min) 0.7 GHz-2.5 GHz	18
Phase Balance in degrees (max) 0.5-2.5 GHz	+/-.5, Typ.
Amplitude Balance (max dB)	+/-0.25
Input Power (W) Any Load Condition	200
Input Power (W) Max Load VSWR 2.0:1	220
Input Power (W) Max Load VSWR 1.2:1	250
Special Notes:	A , B , C

Special Notes:
A: All ports are terminated in 50 ohms when not in use.
B: Insertion loss does not include the ideal 2-way split of 3.01 dB.
C: When used as a combiner, each input can handle half the total CW power. For example, under any load condition, each combiner input port is rated for 100W max. Case temperature should be maintained at or below +85°C. Power must be derated linearly to 0% of full power at +125°C case temperature.

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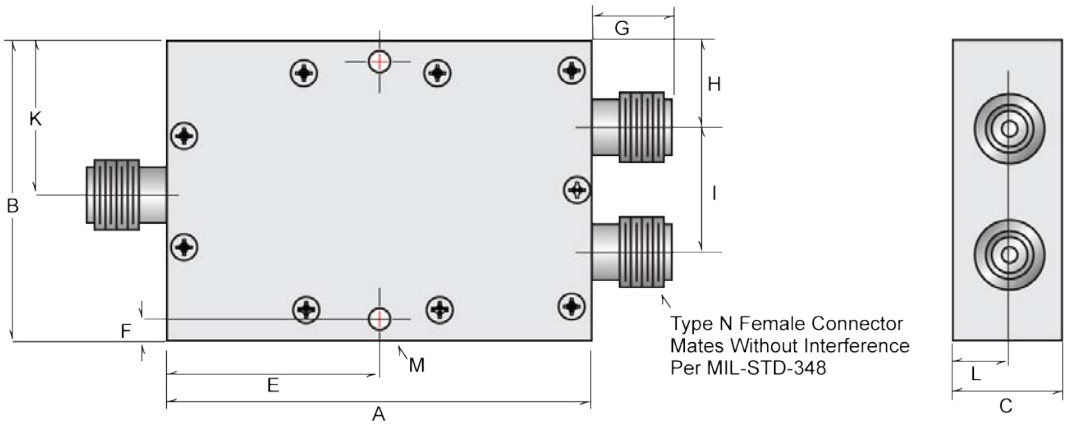
Very High Power Handling as Combiner with Two Non-Coherent Signals



Outline Drawings For Models : 2372A-2

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
2372A-2											
in.	3.50	2.50	1.00	1.75	0.20	0.447	0.75	1.00	1.25	0.50	0.22
mm	88.90	63.50	25.40	44.45	5.08	11.354	19.05	25.40	31.75	12.70	5.59

Notes:

TOL:
xx +/- .02
xxx +/- .005
All dimensions are max. unless otherwise specified and are for reference only.
Finish: Tri-alloy plate per MIL-C-1455.

SMA (F) 3-Way Divider 2-6 GHz 1 Watt

Features

- True 3-Way Power Dividers
- Octave Band Frequency Coverage
- Small Size
- High Isolation Between Output Ports
- Designed for MIL Environments

Models

- 4323-3

Model	4323-3
Low Frequency (GHz)	2.0
High Frequency (GHz)	6.0
VSWR Input (max) 2.0-3.0 GHz	2.0:1
VSWR Input (max) 3.0-5.0 GHz	1.5:1
VSWR Input (max) 5.0-6.0 GHz	2.0:1
VSWR Output (max)	1.5:1
Insertion Loss dB (2.0-3.0 GHz)	0.9
Insertion Loss dB (3.0-5.0 GHz)	0.5
Insertion Loss dB (5.0-6.0 GHz)	0.9
Isolation dB (min) 2.0-3.0 GHz	13
Isolation dB (min) 3.0-5.0 GHz	15
Isolation dB (min) 5.0-6.0 GHz	12
Amplitude Balance (max dB)	0.4
Phase Avg (Balance in Deg.)	8
Phase Avg (Power in Watts)	1
Maximum Weight (gr)	27
Maximum Weight (oz)	.96
Special Notes:	A

Special Notes:
A: Power Rating into Infinite VSWR Load.

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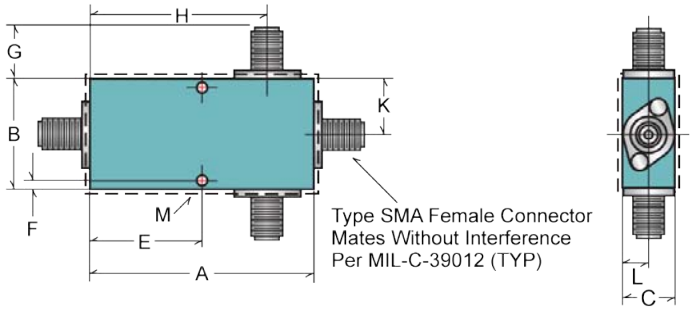
SMA (F) 3-Way Divider 2-6 GHz 1 Watt



Outline Drawings For Models : 4323-3

Units	A	B	C	E	F	G	H	K	L	M (Dia.)
4323-3										
in.	1.60	0.80	0.38	0.78	0.08	0.38	1.22	0.40	0.19	Tap #1
mm	40.64	20.32	9.65	19.81	2.03	9.65	30.99	10.16	4.83	

Notes:

Tap-1: #2-56 NC-2B THD x .18 DP (Farside) 2 Holes.
Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

SMA (F) 3-Way Divider 6-18 GHz 1 Watt

Features

- True 3-Way Power Dividers
- Octave Band Frequency Coverage
- Small Size
- High Isolation Between Output Ports
- Designed for MIL Environments

Models

- 4326-3

Model	4326-3
Low Frequency (GHz)	6.0
High Frequency (GHz)	18.0
VSWR Input (max) 6.0-7.5 GHz	2.0:1
VSWR Input (max) 7.5-15.6 GHz	1.5:1
VSWR Input (max) 15.6-18.0 GHz	2.0:1
VSWR Output (max) 7.0-17.0 GHz	1.5:1
VSWR Output (max) 17.0-18.0 GHz	2.0:1
Insertion Loss (6.0-17.0 GHz)	0.9
Insertion Loss (17.0-18.0 GHz)	1.2
Isolation dB (min) 6.0-7.0 GHz	14
Isolation dB (min) 7.0-17.0 GHz	15
Isolation dB (min) 17.0-18.0 GHz	12
Amplitude Balance (max dB)	0.5
Phase Avg (Balance in Deg.)	10
Average Power (Watts)	1
Maximum Weight (gr)	18
Maximum Weight (oz)	.63
Special Notes:	A

Special Notes:
A: Power Rating into 2 to 1 VSWR Load.

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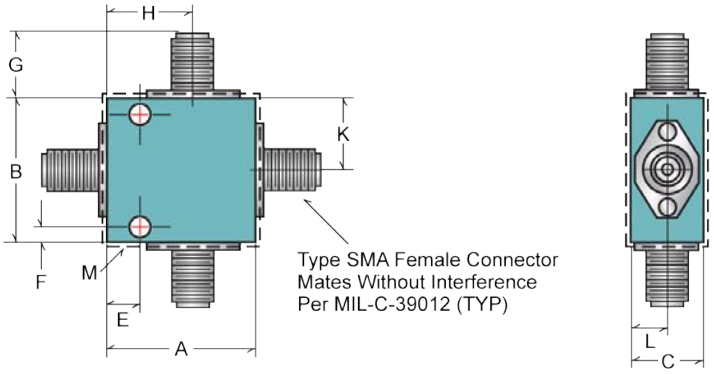
SMA (F) 3-Way Divider 6-18 GHz 1 Watt



Outline Drawings For Models : 4326-3

Units	A	B	C	E	F	G	H	K	L	M (Dia.)
4326-3										
in.	0.81	0.80	0.38	0.18	0.08	0.38	0.47	0.40	0.19	Tap-1
mm	20.57	20.32	9.65	4.57	2.03	9.65	11.94	10.16	4.83	

Notes:

Tap-1: #2-56 NC-2B THD x 3/16 DP (Farside) 2 Holes.
Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

2.92mm (F) 2-Way/4-Way 10 to 45 GHz

Features

- 40 GHz, 2.9 mm Coaxial
- Connector Power Divider
- Ultra Broadband, Multi-Octave
- Superior Phase & Amplitude Balance
- Designed for MIL Environments

Models

- 4428C-2, 4318-4

Model	4428C-2	4318-4
Low Frequency (GHz)	10.0	18.0
High Frequency (GHz)	45.0	40.0
Band Segment (in GHz)	10-18 / 18-26.5 / 26.5-40 / 40-45	18-40
VSWR (max)	1.5:1 / 1.7:1 / 1.9:1 / 1.9:1	1.9:1
Insertion Loss dB (max)	0.6 / 0.9 / 1.6 / 1.9	1.7
Isolation dB (min)	20 / 17 / 14 / 13	16
Amplitude Balance (max dB)	0.3 / 0.5 / 0.8 / 0.8	1.0
Phase Balance (Max in Deg.)	5° / 6° / 12° / 12°	10°
Average Power (W)	1*	0.5*
Maximum Weight (gr)	20	40
Maximum Weight (oz)	0.71	1.41
Special Notes:	A	A

Special Notes:
A: Power Rating based on a load VSWR of 3 to 1. If load is 1.2 to 1, maximum power is 3W CW.

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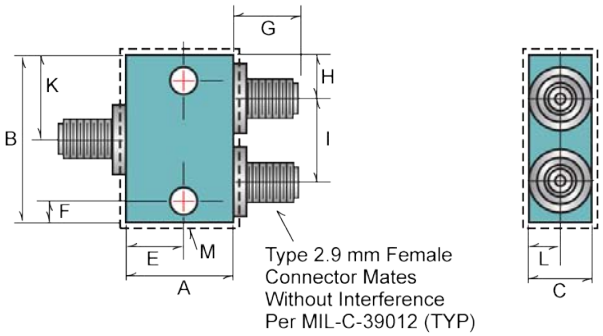
2.92mm (F) 2-Way/4-Way 10 to 45 GHz

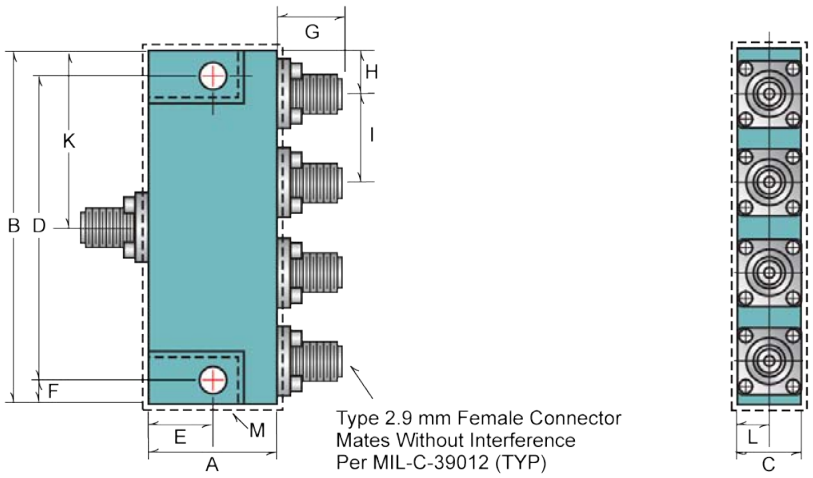


Outline Drawings For Models : 4428C-2

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4428C-2											
in.	0.60	1.00	0.38	0.30	0.10	0.38	0.25	0.50	0.50	0.19	0.11
mm	15.24	25.40	9.65	7.62	2.54	9.65	6.35	12.70	12.70	4.83	2.79

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.



Outline Drawings For Models : 4318-4

Units	A	B	C	D	E	F	G	H	I	K	L	M (Dia.)
4318-4												
in.	0.74	2.00	0.41	1.72	0.37	0.14	0.38	0.25	0.50	1.00	0.19	0.15
mm	18.80	50.80	10.41	43.69	9.40	3.56	9.65	6.35	12.70	25.40	4.83	3.81

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

SMA (F) and 2.92mm (F) 2-Way/4-Way 0.5 to 33 GHz 30 Watt (Multi-Octave)

Features

- Broadband Frequency Coverage from 0.5 to 33 GHz
- Excellent Phase and Amplitude Tracking
- Low Input VSWR
- High Isolation Between Output Ports
- Precision SMA or 2.92 mm Connectors
- Designed for MIL Environments

Models

- 4321B-2, 4325-2, 4322-2, 4324-2, 4326B-2, 4456-2, 4327C-2, 4328B-2, 4321C-4, 4322-4, 4325-4, 4324-4, 4326B-4, 4456-4

Model	4321B-2	4325-2	4322-2	4324-2	4326B-2
Low Frequency (GHz)	0.5	0.8	0.5	2.0	5.0
High Frequency (GHz)	2.0	2.2	2.5	8.0	18.0
Frequency Range (GHz)	0.5-2.0	0.8-2.2	0.5-2.5	2-4 / 4-8	5-12.4 / 12.4-18
VSWR Input	1.25:1	1.25:1	1.35:1	1.35:1	1.35:1 / 1.4:1
VSWR Output	1.15:1	1.15:1	1.15:1	1.35:1 / 1.25:1	1.30:1 / 1.35:1
Insertion Loss (max)	0.6	0.6	0.3	0.2 / 0.5	0.40 / 0.6
Isolation dB (min)	22	23	18	20	19 / 20
Amplitude Balance (max dB)	0.2	0.2	0.2	0.2	0.2
Phase Balance (Max in Deg.)	2.0	2.0	2.0	3.0 / 4.0	3.0 / 6.0
Avg. Power in Watts (A)	30	30	30	30	30
Avg. Power in Watts (B)	20	20	10	10	10
Avg. Power in Watts (C)	3	3	1	1	1
Connector Type	Type SMA Female	Type SMA Female	Type SMA Female	Type SMA Female	Type SMA Female
Maximum Weight (gr)	30	30	55	35	20
Maximum Weight (oz)	1.1	1.1	2.0	1.2	0.7
Special Notes:	A	A	A	A	A

Special Notes:
A: Average Power Rating into a load VSWR of (A) 1.2 to 1, (B) 2 to 1 and (C) ∞VSWR.

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SMA (F) and 2.92mm (F) 2-Way/4-Way 0.5 to 33 GHz 30 Watt (Multi-Octave)

Model	4456-2	4327C-2	4328B-2	4321C-4	4322-4
Low Frequency (GHz)	2.0	1.7	10.0	0.5	0.5
High Frequency (GHz)	18.0	26.5	33.0	2.0	2.5
Frequency Range (GHz)	2-8 / 8-18	1.7-2 / 2-18 / 18-26.5	10.0-33.0	0.5-2.0	0.5-2.5
VSWR Input	1.3:1 / 1.4:1	1.5:1 / 1.4:1 / 1.7:1	1.5:1	1.45:1	1.45:1
VSWR Output	1.25:1 / 1.4:1	1.5:1 / 1.35:1 / 1.5:1	1.5:1	1.30:1	1.25:1
Insertion Loss (max)	0.5 / 1.2	1.1 / 1.4 / 2.4	1.5	1.3	0.7
Isolation dB (min)	20 / 19	19 / 21 / 16	15	20	20
Amplitude Balance (max dB)	0.2 / 0.3	0.3	0.5	0.3	0.3
Phase Balance (Max in Deg.)	3.0 / 6.0	6.0 / 10	6.0 (10-18 GHz) / 12.0 (18-33 GHz)	4.0	4.0
Avg. Power in Watts (A)	30	30	30	30	30
Avg. Power in Watts (B)	10	10	10	10	10
Avg. Power in Watts (C)	1	2	1	1	1
Connector Type	Type SMA Female	2.92 mm Female	2.92 mm Female	Type SMA Female	Type SMA Female
Maximum Weight (gr)	38	50	22	80	165
Maximum Weight (oz)	1.4	1.8	0.8	2.9	5.8
Special Notes:	A	A	A , B	A	A

Special Notes:
A: Average Power Rating into a load VSWR of (A) 1.2 to 1, (B) 2 to 1 and (C) ∞VSWR.
B: Custom-order basis. Minimum quantity may apply.

SMA (F) and 2.92mm (F) 2-Way/4-Way 0.5 to 33 GHz 30 Watt (Multi-Octave)

Model	4325-4	4324-4	4326B-4	4456-4
Low Frequency (GHz)	0.8	2.0	5.0	2.0
High Frequency (GHz)	2.2	8.0	18.0	18.0
Frequency Range (GHz)	0.8-2.2	2.0-8.0	5.0-18.0	2.0-18.0
VSWR Input	1.25:1	1.45:1	1.60:1 (5-6 GHz) / 1.50:1 (6-18 GHz)	1.40:1 (2-8 GHz) / 1.50:1 (8-18 GHz)
VSWR Output	1.20:1	1.35:1	1.40:1	1.40:1
Insertion Loss (max)	0.9	0.9	0.5 (5-6 GHz) / 0.9 (6-18 GHz)	1.0 (2-8 GHz) / 1.8 (8-18 GHz)
Isolation dB (min)	22	18	18 (5-6 GHz) / 19 (6-18 GHz)	20 (2-8 GHz) / 18 (8-18 GHz)
Amplitude Balance (max dB)	0.3	0.4	0.3 (5-6 GHz) / 0.5 (6-18 GHz)	0.4 (2-8 GHz) / 0.8 (8-18 GHz)
Phase Balance (Max in Deg.)	3.0	4.0	3.0 (5-6 GHz) / 6.0 (6-18 GHz)	6.0 (2-8 GHz) / 10 (8-18 GHz)
Avg. Power in Watts (A)	30	30	30	30 (2-8 GHz) / 30 (8-18 GHz)
Avg. Power in Watts (B)	10	10	10	10 (2-8 GHz) / 10 (8-18 GHz)
Avg. Power in Watts (C)	1	1	1	1 (2-8 GHz) / 1 (8-18 GHz)
Connector Type	Type SMA Female	Type SMA Female	Type SMA Female	Type SMA Female
Maximum Weight (gr)	80	120	60	120
Maximum Weight (oz)	2.9	4.3	2.2	4.3
Special Notes:	A	A	A	A

Special Notes:
A: Average Power Rating into a load VSWR of (A) 1.2 to 1, (B) 2 to 1 and (C) ∞VSWR.
B: Custom-order basis. Minimum quantity may apply.

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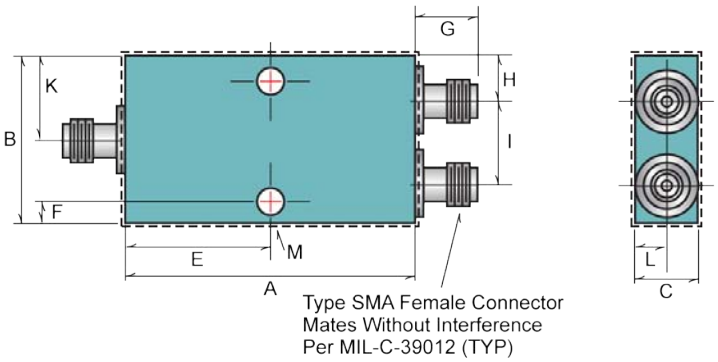
SMA (F) and 2.92mm (F) 2-Way/4-Way 0.5 to 33 GHz 30 Watt (Multi-Octave)



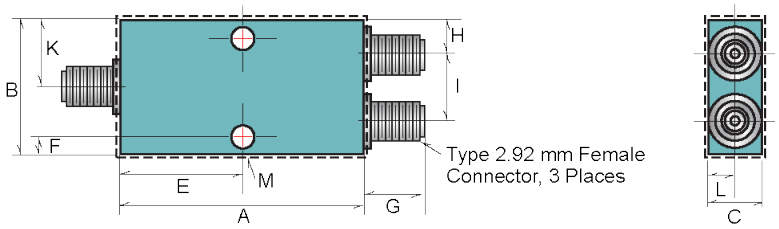
Outline Drawings For Models : 4321B-2, 4325-2, 4322-2, 4324-2, 4326B-2, 4456-2

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4321B-2											
in.	1.20	1.34	0.34	0.60	0.10	0.38	0.10	1.15	0.67	0.19	0.11
mm	30.48	34.04	8.64	15.24	2.54	9.65	2.54	29.21	17.02	4.83	2.79
4325-2											
in.	1.20	1.04	0.34	0.60	0.10	0.38	0.10	0.50	0.67	0.19	0.11
mm	30.48	26.42	8.64	15.24	2.54	9.65	2.54	12.70	17.02	4.83	2.79
4322-2											
in.	1.56	1.70	0.38	0.78	0.10	0.38	0.60	0.50	0.85	0.19	0.11
mm	39.62	43.18	9.65	19.81	2.54	9.65	15.24	12.70	21.59	4.83	2.79
4324-2											
in.	1.69	1.00	0.38	0.84	0.09	0.38	0.25	0.50	0.50	0.19	0.11
mm	42.93	25.40	9.65	21.34	2.29	9.65	6.35	12.70	12.70	4.83	2.79
4326B-2											
in.	0.75	1.00	0.38	0.38	0.09	0.38	0.25	0.50	0.50	0.19	0.11
mm	19.05	25.40	9.65	9.65	2.29	9.65	6.35	12.70	12.70	4.83	2.79
4456-2											
in.	1.75	1.00	0.38	0.88	0.15	0.38	0.25	0.50	0.50	0.19	0.15
mm	44.45	25.40	9.65	22.35	3.81	9.65	6.35	12.70	12.70	4.83	3.81

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

SMA (F) and 2.92mm (F) 2-Way/4-Way 0.5 to 33 GHz 30 Watt (Multi-Octave)



Outline Drawings For Models : 4327C-2, 4328B-2

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4327C-2											
in.	2.00	1.00	0.38	1.00	0.15	0.38	0.25	0.50	0.50	0.19	0.15
mm	50.80	25.40	9.65	25.40	3.81	9.65	6.35	12.70	12.70	4.83	3.81
4328B-2											
in.	0.75	1.00	0.38	0.38	0.10	0.38	0.25	0.50	0.50	0.19	0.11
mm	19.05	25.40	9.65	9.65	2.54	9.65	6.35	12.70	12.70	4.83	2.79

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

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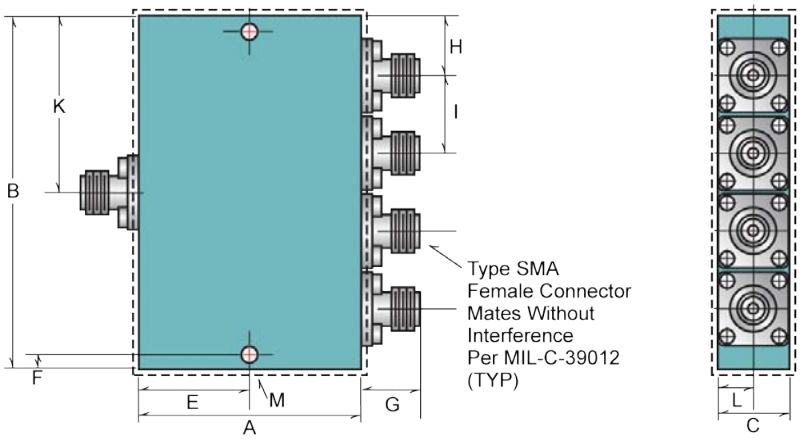


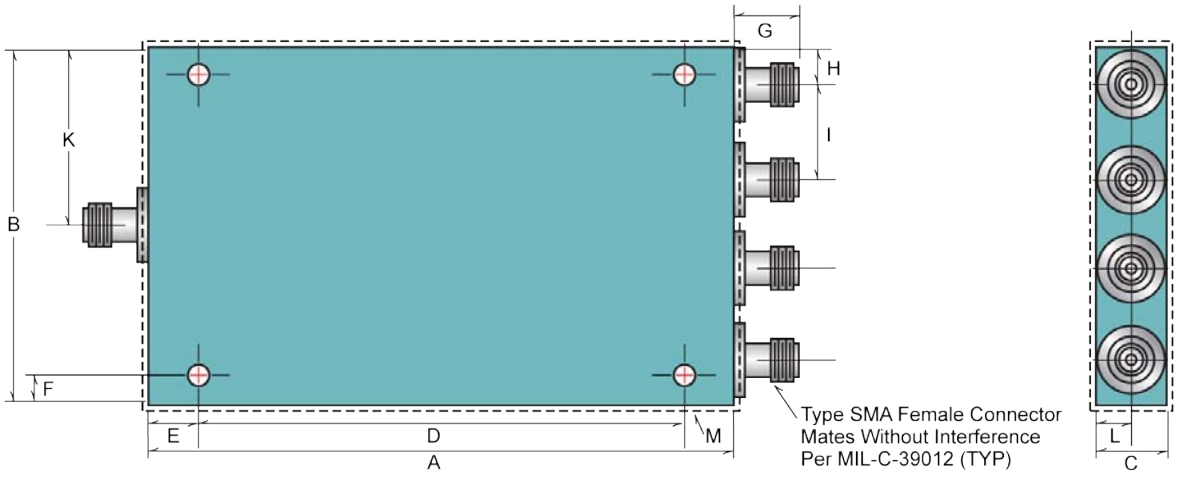
Outline Drawings For Models : 4321C-4, 4325-4, 4324-4, 4326B-4, 4456-4

Units	A	B	C	E	F	G	H	I	K	L	M
4321C-4											
in.	2.11	1.077	0.38	1.06	0.10	0.38	0.50	0.5.	1.67	0.19	0.11
mm	53.59	27.356	9.65	26.92	2.54	9.65	12.70	12.70	42.42	4.83	2.79
4325-4											
in.	2.11	1.077	.38	1.06	0.10	0.41	0.44	0.50	1.17	0.19	0.11
mm	53.59	27.356	9.65	26.92	2.54	10.41	11.18	12.70	29.72	4.83	2.79
4324-4 , 4456-4											
in.	3.45	1.94	0.38	1.72	0.13	0.38	0.22	0.50	0.97	0.19	0.15
mm	87.63	49.28	9.65	43.69	3.30	9.65	5.59	12.70	24.64	4.83	3.81
4326B-4											
in.	1.42	1.94	0.38	0.71	0.13	0.38	0.22	0.50	0.97	0.19	0.15
mm	36.07	49.28	9.65	18.03	3.30	9.65	5.59	12.70	24.64	4.83	3.81

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

SMA (F) and 2.92mm (F) 2-Way/4-Way 0.5 to 33 GHz 30 Watt (Multi-Octave)



Outline Drawings For Models : 4322-4

Units	A	B	C	D	E	F	G	H	I	K	L	M (Dia.)
4322-4												
in.	3.05	3.00	0.38	2.76	0.15	0.12	0.38	0.55	0.70	1.50	0.19	0.13
mm	77.47	76.20	9.65	70.10	3.81	3.05	9.65	13.97	17.78	38.10	4.83	3.30

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

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SMA (F) and 2.92mm (F) 2-Way 0.5 to 26.5 GHz 30 Watt (Octave Band)

Features

- Operation to 26.5 GHz
- Excellent Phase and Amplitude Tracking
- High Isolation Between Output Ports
- Small Size
- Operational Temperature Range: -55°C to +85°C
- Designed for MIL Environments

Models

- 4311B-2, 4312B-2, 4313B-2, 4314B-2, 4315-2, 4316-2, 4317C-2

Model	4311B-2	4312B-2	4313B-2	4314B-2
Low Frequency (GHz)	0.5	1.0	2.0	4.0
High Frequency (GHz)	1.0	2.0	4.0	8.0
VSWR Input (max)	1.25:1	1.25:1	1.30:1	1.35:1
VSWR Output (max)	1.15:1	1.15:1	1.20:1	1.25:1
Insertion Loss (max)	0.4	0.35	0.45	0.6
Isolation dB (min)	22	20	20	20
Amplitude Balance (max dB)	0.2	0.2	0.2	0.2
Phase Balance (Max in Deg.)	2.0	2.0	2.0	2.0
Avg. Power in Watts (A)	30	30	30	30
Avg. Power in Watts (B)	20	20	20	20
Avg. Power in Watts (C)	3	3	3	3
Connector Type	Type SMA Female	Type SMA Female	Type SMA Female	Type SMA Female
Maximum Weight (gr)	30	23	20	20
Maximum Weight (oz)	1.1	0.9	0.8	0.8
Special Notes:	A	A , B	A , B	A , B

Special Notes:
A: Average Power Rating into a load VSWR of (A) 1.2 to 1, (B) 2 to 1 and (C) ∞VSWR.
B: Connectors: All models provided with SMA (Female) connectors except Model 4317C-2 which uses a 2.92 mm (Female) connector.

SMA (F) and 2.92mm (F) 2-Way 0.5 to 26.5 GHz 30 Watt (Octave Band)

Model	4315-2	4316-2	4317C-2
Low Frequency (GHz)	8.0	12.0	18.0
High Frequency (GHz)	12.4	18.0	26.5
VSWR Input (max)	1.35:1	1.40:1	2.00:1
VSWR Output (max)	1.30:1	1.35:1	2.00:1
Insertion Loss (max)	0.5	0.7	1.0
Isolation dB (min)	20	19	15
Amplitude Balance (max dB)	0.2	0.3	0.5
Phase Balance (Max in Deg.)	3.0	6.0	12.0
Avg. Power in Watts (A)	30	30	30
Avg. Power in Watts (B)	10	10	10
Avg. Power in Watts (C)	1	1	1
Connector Type	Type SMA Female	Type SMA Female	2.92 mm Female
Maximum Weight (gr)	20	20	22
Maximum Weight (oz)	0.8	0.8	0.8
Special Notes:	A , B	A , B	A , B

Special Notes:
A: Average Power Rating into a load VSWR of (A) 1.2 to 1, (B) 2 to 1 and (C) ∞VSWR.
B: Connectors: All models provided with SMA (Female) connectors except Model 4317C-2 which uses a 2.92 mm (Female) connector.

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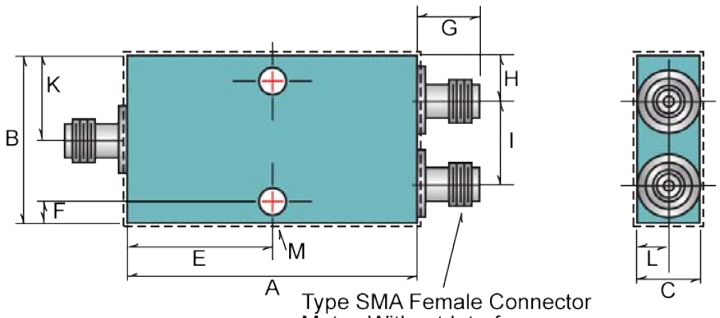
SMA (F) and 2.92mm (F) 2-Way 0.5 to 26.5 GHz 30 Watt (Octave Band)



***Model 4317C-2 uses 2.92mm Female Connectors**

Outline Drawings For Models : 4311B-2, 4312B-2, 4313B-2, 4314B-2, 4315-2, 4316-2, 4317C-2

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4311B-2											
in.	1.20	1.34	0.38	0.60	0.10	0.38	0.35	0.50	0.67	0.19	0.11
mm	30.48	34.04	9.65	15.24	2.54	9.65	8.89	12.70	17.02	4.83	2.79
4312B-2											
in.	0.88	1.26	0.38	0.44	0.10	0.38	0.38	0.50	0.63	0.50	0.10
mm	22.35	32.00	9.65	11.18	2.54	9.65	9.65	12.70	16.00	12.70	2.54
4313B-2 , 4314B-2											
in.	0.88	1.01	0.38	0.44	0.10	0.38	0.25	0.50	0.55	0.19	0.10
mm	22.35	25.65	9.65	11.18	2.54	9.65	6.35	12.70	13.97	4.83	2.54
4315-2											
in.	0.75	1.00	0.38	0.38	0.10	0.38	0.25	0.50	050	0.19	0.10
mm	19.05	25.40	9.65	9.65	2.54	9.65	6.35	12.70	1270.000	4.83	2.54
4316-2											
in.	0.75	1.00	0.38	0.38	0.10	0.38	0.25	0.50	0.50	0.19	0.10
mm	19.05	25.40	9.65	9.65	2.54	9.65	6.35	12.70	12.70	4.83	2.54
4317C-2											
in.	0.60	1.00	0.38	0.30	0.10	.0.38	0.25	0.50	0.50	0.19	0.10
mm	15.24	25.40	9.65	7.62	2.54	0.0000	6.35	12.70	12.70	4.83	2.54

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

SMA (F) and 2.92mm (F) 4-Way 0.5 to 26.5 GHz 30 Watt (Octave Band)

Features

- Operation to 26.5 GHz
- Excellent Phase and Amplitude Tracking
- High Isolation Between Output Ports
- Small Size
- Operational Temperature Range: -55°C to +85°C
- Designed for MIL Environments

Models

- 4311C-4, 4312C-4, 4313C-4, 4314B-4, 4315-4, 4316-4

Model	4311C-4	4312C-4	4313C-4
Low Frequency (GHz)	0.5	1.0	2.0
High Frequency (GHz)	1.0	2.0	4.0
VSWR Input (max)	1.45:1	1.40:1	1.35:1
VSWR Output (max)	1.30:1	1.25:1	1.35:1
Insertion Loss (max)	0.9	0.8	0.6
Isolation dB (min)	22	20	20
Amplitude Balance (max dB)	0.3	0.3	0.3
Phase Balance (Max in Deg.)	3.0	3.0	3.0
Avg. Power in Watts (A)	30	30	30
Avg. Power in Watts (B)	10	10	10
Avg. Power in Watts (C)	1	3	1
Connector Type	Type SMA Female	Type SMA Female	Type SMA Female
Maximum Weight (gr)	80	56	56
Maximum Weight (oz)	2.9	2.0	2.0
Special Notes:	A	A	A

Special Notes:
A: Average Power Rating into a load VSWR of (A) 1.2 to 1, (B) 2 to 1 and (C) ∞VSWR.

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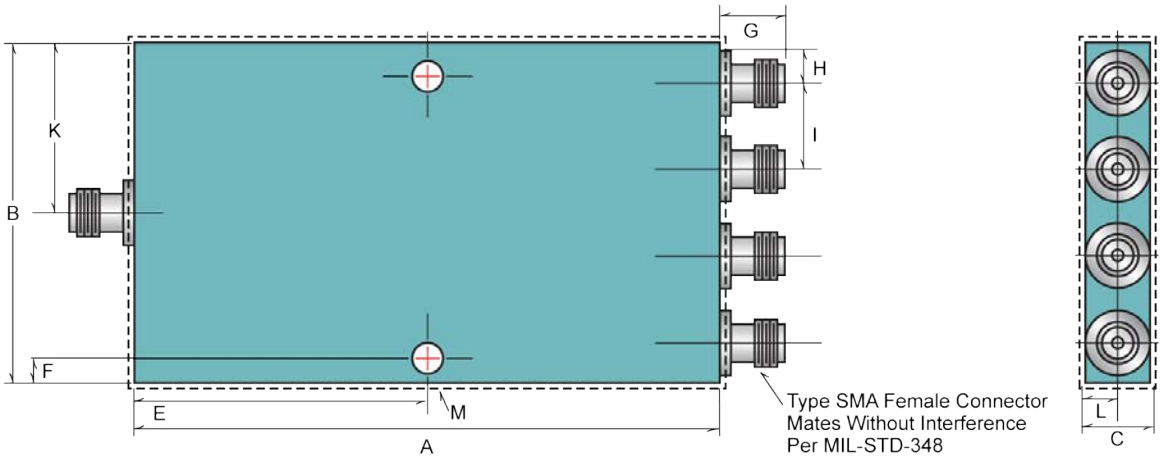
SMA (F) and 2.92mm (F) 4-Way 0.5 to 26.5 GHz 30 Watt (Octave Band)

Model	4314B-4	4315-4	4316-4
Low Frequency (GHz)	4.0	8.0	12.0
High Frequency (GHz)	8.0	12.4	18.0
VSWR Input (max)	1.45:1	1.45:1	1.5:1
VSWR Output (max)	1.35:1	1.35:1	1.4:1
Insertion Loss (max)	0.5	0.8	1.5
Isolation dB (min)	20	18	18
Amplitude Balance (max dB)	0.3	0.4	0.5
Phase Balance (Max in Deg.)	3.0	4.0	6.0
Avg. Power in Watts (A)	30	30	30
Avg. Power in Watts (B)	20	10	10
Avg. Power in Watts (C)	3	1	1
Connector Type	2.92 mm Female	Type SMA Female	Type SMA Female
Maximum Weight (gr)	75	2.2	60
Maximum Weight (oz)	2.7	60	2.2
Special Notes:	A	A	A

Special Notes:
A: Average Power Rating into a load VSWR of (A) 1.2 to 1, (B) 2 to 1 and (C) ∞VSWR.

SMA (F) and 2.92mm (F) 4-Way 0.5 to 26.5 GHz 30 Watt (Octave Band)



Outline Drawings For Models : 4311C-4, 4312C-4, 4313C-4, 4314B-4, 4315-4, 4316-4

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4311C-4											
in.	2.11	2.34	0.38	1.06	0.10	0.38	0.42	0.50	1.17	0.19	0.10
mm	53.59	59.44	9.65	26.92	2.54	9.65	10.67	12.70	29.72	4.83	2.54
4312C-4											
in.	1.44	2.26	0.38	0.72	0.10	0.38	0.38	0.50	1.13	0.19	0.10
mm	36.58	57.40	9.65	18.29	2.54	9.65	9.65	12.7	28.70	4.83	2.54
4313C-4											
in.	1.44	2.26	0.38	0.72	0.10	0.38	0.38	0.19	1.13	0.19	0.10
mm	36.58	57.40	9.65	18.29	2.54	9.65	9.65	4.83	28.70	4.83	2.54
4314B-4											
in.	1.50	2.26	0.38	0.75	0.10	0.38	0.38	0.50	1.13	0.19	0.10
mm	38.10	57.40	9.65	19.05	2.54	9.65	9.65	12.7	28.70	4.83	2.54
4315-4 , 4316-4											
in.	1.42	1.94	0.38	0.71	0.126	0.38	0.22	0.50	0.97	0.19	0.15
mm	36.07	49.28	9.65	18.03	3.200	9.65	5.59	12.7	24.64	4.83	3.81

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing. All mounting holes are thru unless otherwise specified.

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Type N (F) 2-Way 2 to 18 GHz 30 Watt (Multi-Octave)

Features

- Precision, Multi-Octave Units Cover 2-8 GHz and 6-18 GHz
- Excellent Phase and Amplitude Tracking
- Low Input VSWR
- High Isolation Between Output Ports
- Designed for MIL Environments

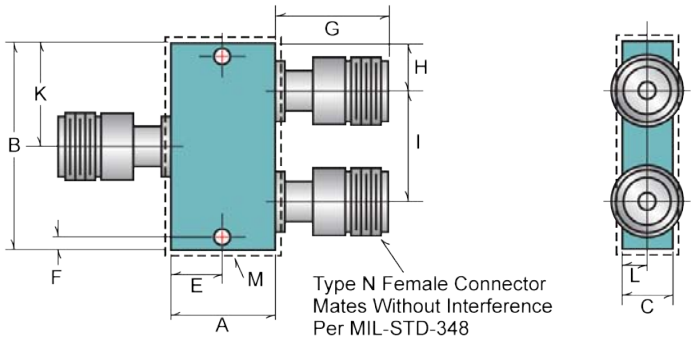
Models

- 3324-2, 3326B-2, 3456B-2

Model	3324-2	3326B-2	3456B-2
Low Frequency (GHz)	2.0	6.0	2.0
High Frequency (GHz)	8.0	18.0	18.0
Band Segment (in GHz)	2-4 GHz / 4-8 GHz	6-12.4 / 12.4-18	2-8 / 8-18
VSWR Input (max)	1.35:1	1.60:1 / 1.50:1	1.50:1
VSWR Output	1.25:1	1.50:1	1.40:1
Insertion Loss dB (max)	0.7	0.6 / 1.10	0.7 / 1.40
Isolation dB (min)	20	20 / 17	20 / 19
Amplitude Balance (max dB)	0.20 / 0.30	0.20 / 0.30	0.3 / 0.5
Phase Balance (Max in Deg.)	3 / 4	3.4 / 3.6	6, 9
Avg. Power (W) Max Load VSWR 1.2	30	30	30
Avg. Power (W) Max Load VSWR 2.0	10	10	10
Maximum Weight (oz)	5.0	4.8	7.1
Maximum Weight (gr)	140	135	200
Special Notes:	A	A , B	A

Special Notes:
A: Connector: Type N Female all ports.
B: Custom order basis. Minimum quantity may apply.

Type N (F) 2-Way 2 to 18 GHz 30 Watt (Multi-Octave)

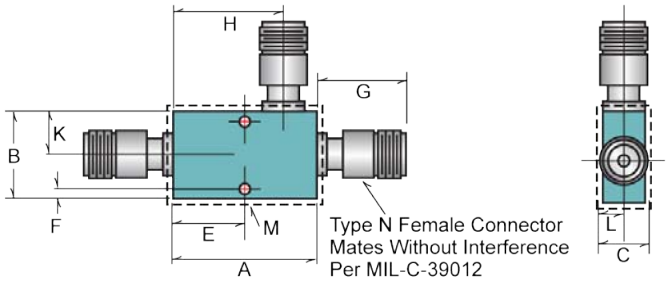


Outline Drawings For Models : 3324-2, 3326B-2

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
3324-2											
in.	1.70	2.00	0.52	0.84	0.13	1.26	0.45	1.10	1.00	0.26	0.14
mm	43.18	50.80	13.21	21.34	3.30	32.00	11.43	27.94	25.40	6.60	3.56
3326B-2											
in.	1.00	2.00	0.52	0.50	0.13	1.26	0.45	1.10	1.00	0.26	0.14
mm	25.40	50.80	13.21	12.70	3.30	32.00	11.43	27.94	25.40	6.60	3.56

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing. All mounting holes are thru unless otherwise specified.



Outline Drawings For Models : 3456B-2

Units	A	B	C	E	F	G	H	K	L	M (Dia.)
3456B-2										
in.	2.11	1.25	0.58	1.07	0.14	1.56	1.63	0.63	0.29	0.15
mm	53.59	31.75	14.73	27.18	3.56	39.62	41.40	16.00	7.37	3.81

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing. All mounting holes are thru unless otherwise specified.

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Type N (F) 4-Way 2 to 18 GHz 30 Watt (Multi-Octave)

Features

- Precision, Multi-Octave Units Cover 2-8 GHz and 6-18 GHz
- Excellent Phase and Amplitude Tracking
- Low Input VSWR
- High Isolation Between Output Ports
- Designed for MIL Environments

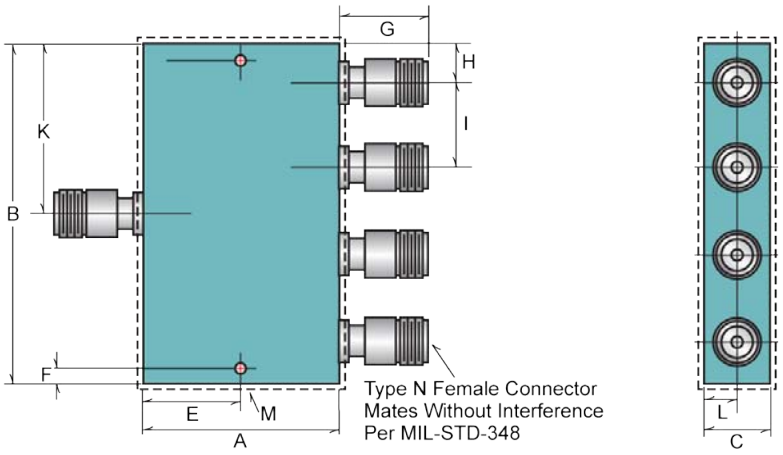
Models

- 3324-4, 3326B-4

Model	3324-4	3326B-4
Low Frequency (GHz)	2.0	6.0
High Frequency (GHz)	8.0	18.0
VSWR Input (max)	1.45:1	1.50:1
VSWR Output	1.35:1	1.50:1
Insertion Loss dB (max)	0.9	2.0
Isolation dB (min)	18	18
Amplitude Balance (max dB)	0.4	0.5
Phase Balance (Max in Deg.)	7	7
Avg. Power (W) Max Load VSWR 1.2	30	30
Avg. Power (W) Max Load VSWR 2.0	10	10
Maximum Weight (oz)	9.7	8.9
Maximum Weight (gr)	275	250
Special Notes:	A	A , B

Special Notes:
A: Connector: Type N Female all ports.
B: Custom order basis. Minimum quantity may apply.

Type N (F) 4-Way 2 to 18 GHz 30 Watt (Multi-Octave)



Outline Drawings For Models : 3324-4, 3326B-4

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
3324-4											
in.	3.44	4.30	0.52	1.72	0.19	1.23	0.50	1.10	2.16	0.26	0.14
mm	87.38	109.22	13.21	43.69	4.83	31.24	12.70	27.9	54.86	6.60	3.56
3326B-4											
in.	1.42	4.31	0.52	0.71	0.19	1.23	0.51	1.10	2.16	0.26	0.14
mm	36.07	109.47	13.21	18.03	4.83	31.24	12.95	27.94	53.3	5.1	3.56

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

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SMA (F) 2-Way/4-Way/8-Way 0.5 to 18 GHz 30 Watt (Ultra-Broadband)

Features

- Low Input VSWR
- High Isolation Between Output Ports
- Special Narrow Band Versions Available for Communications Requirements
- Temperature Range: -54° to +85°C (Operational at 105°C)
- Designed for MIL Environments

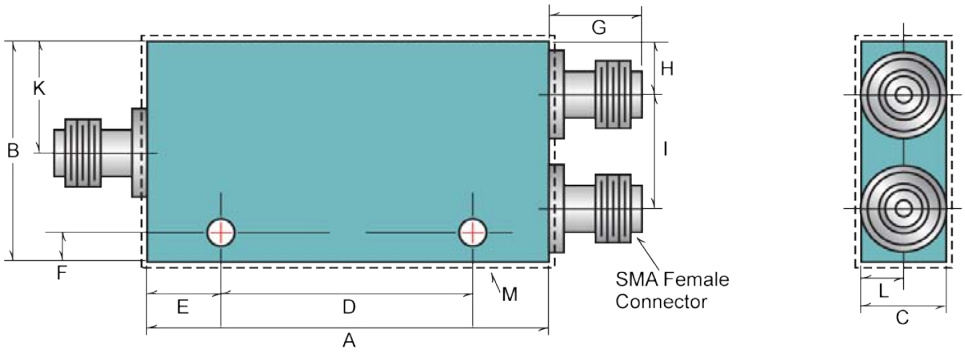
Models

- 4426-2, 4426-4, 4426-8

Model	4426-2	4426-4	4426-8
Low Frequency (GHz)	0.5	0.5	0.5
High Frequency (GHz)	18.0	18.0	18.0
VSWR Input (max)	1.50:1	1.60:1	1.70:1
VSWR Output (max)	1.45:1	1.45:1	1.50:1
Insertion Loss dB (.5-8 GHz)	0.8	1.8	3.5
Insertion Loss dB (8-18 GHz)	1.7	3.8	6.5
Isolation dB (min)	19	16	–
Isolation dB (min) 0.5-2.0 GHz	–	–	14
Isolation dB (min) 2.0-18 GHz	–	–	18
Amplitude Balance dB (.5-8 GHz)	0.3	0.5	0.8
Amplitude Balance dB (8-18 GHz)	0.6	1.2	1.4
Phase Bal. in Deg (Max) .5-8	4.0	8.0	10.0
Phase Bal. in Deg. (Max) 8-18	8.0	14.0	18.0
Avg. Power (W) Max Load VSWR 1.2 GHz	30	30	30
Avg. Power (W) Max Load VSWR 2.0 GHz	10	10	10
Avg. Power (W) Max Load VSWR Infinite	1	1	1
Maximum Weight (oz)	6.4	20	38
Weight (max) in kg	0.18	.57	1.1
Special Notes:	A	A	A

Special Notes:
A: See Model 4436 Series for commercial grade and broadband power dividers.

SMA (F) 2-Way/4-Way/8-Way 0.5 to 18 GHz 30 Watt (Ultra-Broadband)



Outline Drawings For Models : 4426-2

Units	A	B	C	F	E	F	G	H	I	K	L	M (Dia.)
4426-2												
in.	5.88	1.00	0.52	3.50	1.187	0.125	0.375	0.25	0.50	0.50	0.26	0.14
mm	149.35	25.40	13.21	88.90	30.150	3.175	9.525	6.35	12.70	12.70	6.60	3.56

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

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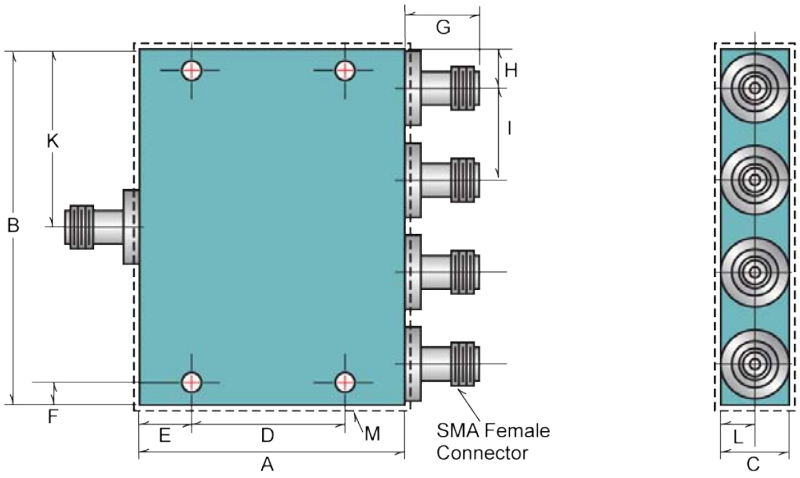
SMA (F) 2-Way/4-Way/8-Way 0.5 to 18 GHz 30 Watt (Ultra-Broadband)



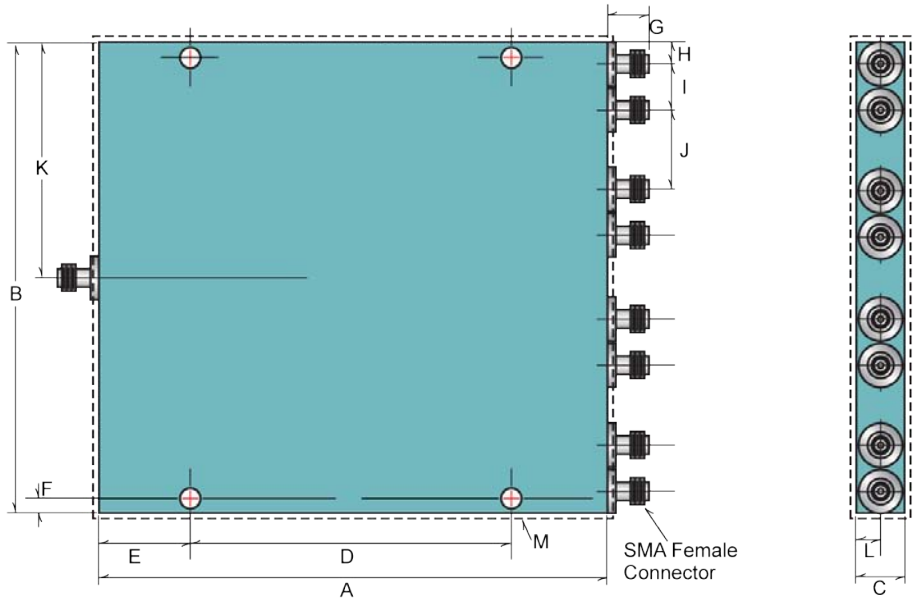
Outline Drawings For Models : 4426-4

Units	A	B	C	D	E	F	G	H	I	K	L	M (Dia.)
4426-4												
in.	6.24	2.95	0.52	3.75	1.37	0.13	0.38	0.25	0.50	1.48	0.26	0.14
mm	158.50	74.93	13.21	95.25	34.80	3.30	9.65	6.35	12.70	37.59	6.60	3.56

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

SMA (F) 2-Way/4-Way/8-Way 0.5 to 18 GHz 30 Watt (Ultra-Broadband)



Outline Drawings For Models : 4426-8

Units	A	B	C	D	E	F	G	H	I	J	K	L	M (Dia.)
						4426-8							
in.	6.38	6.00	0.52	4.00	1.19	0.13	0.38	0.13	0.50	1.67	3.00	0.26	0.14
mm	162.05	152.40	13.21	101.60	30.23	3.30	9.65	3.30	12.70	42.42	76.20	6.60	3.56

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

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SMA (F) 2-Way/4-Way/8-Way 0.5 to 6 GHz 30 Watt (Ultra-Broadband)

Features

- Low Input VSWR
- High Isolation Between Output Ports
- Special Narrow Band Versions Available for Communications Requirements
- Temperature Range: -54° to +85°C (Operational at 105°C)
- Designed for MIL Environments

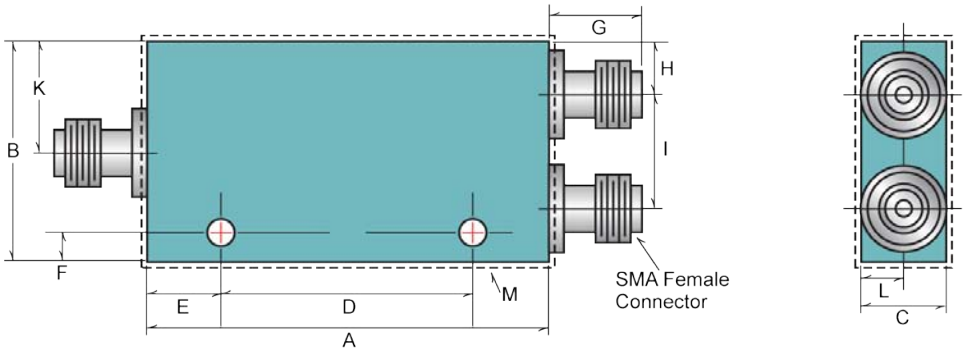
Models

- 4226LB-2, 4226LB-4, 4226LB-8

Model	4226LB-2	4226LB-4	4226LB-8
Low Frequency (GHz)	0.5	0.5	0.5
High Frequency (GHz)	6.0	6.0	6.0
VSWR Input (max)	1.50:1	1.60:1	1.70:1
VSWR Output (max)	1.40:1	1.45:1	1.50:1
Insertion Loss dB (.5-6 GHz)	0.9	1.	3.5
Isolation dB (min)	19	16	14
Amplitude Balance dB (.5-6 GHz)	0.3	0.5	0.8
Phase Bal. (max) in Deg (.5-6 GHz)	4.0	8.0	10.0
Avg. Power (W) Max Load VSWR 1.2 GHz	30	30	30
Avg. Power (W) Max Load VSWR 2.0 GHz	10	10	10
Avg. Power (W) Max Load VSWR Infinite	1	1	1
Maximum Weight (oz)	38	38	38
Weight (max) in kg	0.18	.55	1.1
Special Notes:	A	A	A

Special Notes:
A: For commercial-grade broadband power dividers see model numbers 4436-2, 4436-3, 4436-4, and 4436-8

SMA (F) 2-Way/4-Way/8-Way 0.5 to 6 GHz 30 Watt (Ultra-Broadband)



Outline Drawings For Models : 4226LB-2

Units	A	B	C	D	E	F	G	H	I	K	L	M (Dia.)
4226LB-2												
in.	5.88	1.00	0.52	3.50	1.187	0.125	0.375	0.25	0.50	0.50	0.26	0.14
mm	149.35	25.40	13.21	88.90	30.150	3.175	9.525	6.35	12.70	12.70	6.60	3.56

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

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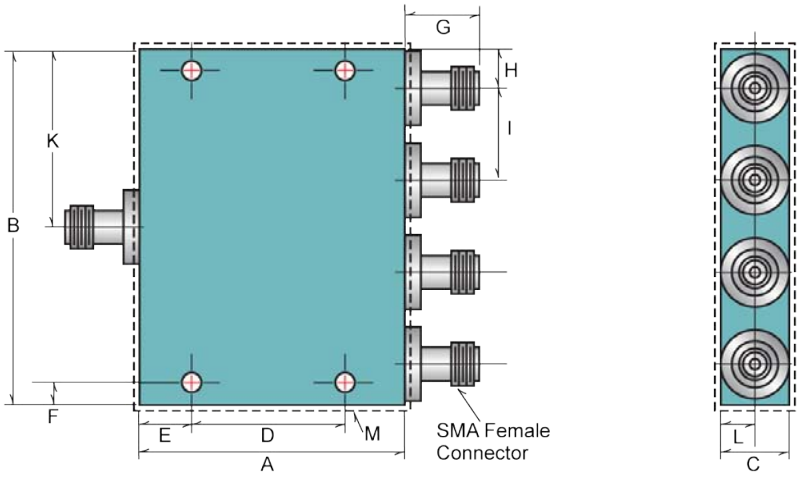
SMA (F) 2-Way/4-Way/8-Way 0.5 to 6 GHz 30 Watt (Ultra-Broadband)



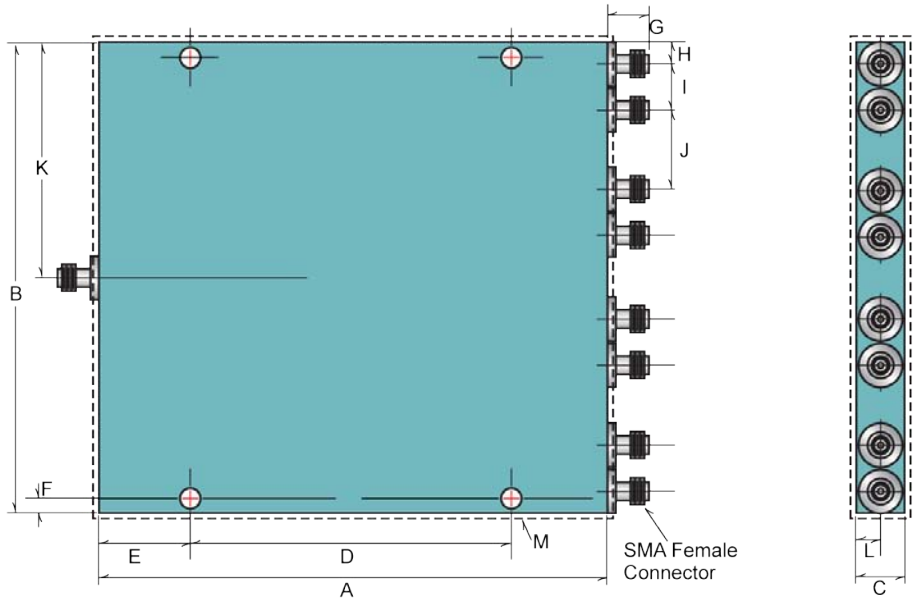
Outline Drawings For Models : 4226LB-4

Units	A	B	C	D	E	F	G	H	I	K	L	M (Dia.)
4226LB-4												
in.	6.24	2.95	0.52	3.75	1.37	0.13	0.38	0.25	0.50	1.48	0.26	0.14
mm	158.50	74.93	13.21	95.25	34.80	3.30	9.65	6.35	12.70	37.59	6.60	3.56

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

SMA (F) 2-Way/4-Way/8-Way 0.5 to 6 GHz 30 Watt (Ultra-Broadband)



Outline Drawings For Models : 4226LB-8

Units	A	B	C	D	E	F	G	H	I	J	K	L	M (Dia.)
4226LB-8													
in.	6.38	6.00	0.52	4.00	1.19	0.13	0.38	0.13	0.50	1.67	3.00	0.26	0.14
mm	162.05	152.40	13.21	101.60	30.23	3.30	9.65	3.30	12.70	42.42	76.20	6.60	3.56

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

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SMA (F) 2/3/4/8 Way 0.5 GHz to 8 GHz 0.5 Watt (Broadband, Commercial)

Features

- 0°C to +70°C Operation
- Microstrip Construction
- Humidity 95% Non-Condensing
- Suitable for Commercial Applications
- Perform to 0.5 GHz with Minor Degredation

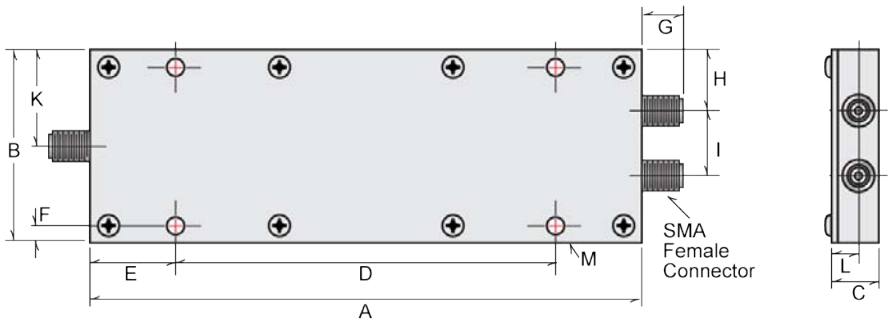
Models

- 4436-2, 4436-3, 4436-4, 4436-8

Model	4436-2	4436-3	4436-4	4436-8
Frequency Range (GHz)	0.5-0.7 0.7-6.0 6.0-8.0	0.5-0.7 0.7-6.0 6.0-8.0	0.5-0.7 0.7-6.0 6.0-8.0	0.5-0.7 0.7-6.0 6.0-8.0
VSWR Input (max)	1.8:1 1.35:1 1.5:1	2.0:1 1.65:1 2.0:1	2.5:1 1.6:1 1.8:1	2.6:1 1.75:1 2.25:1
VSWR Output (max)	1.5:1 1.25:1 1.35:1	1.6:1 1.5:1 1.5:1	1.5:1 1.4:1 1.5:1	1.75:1 1.5:1 1.85:1
Insertion Loss dB (max)	1.3 1.0 1.5	.75 1.5 2.2	1.5 3.0 4.5	2.0 5.0 8.0
Isolation dB (min)	12 20 18	12 17 15	12 17 15	12 17 15
Phase Balance (Max in Deg.)	10 6 10	12 10 12	10 8 10	15 13 16
Power Input (Watts)	0.5	0.5	0.5	0.5
Peak Power (kW)	1.5	1.5	1.5	1.5
Maximum Weight (oz)	3.9	4.8	10.2	22.9
Maximum Weight (gr)	110	135	290	650
Special Notes:	A , B , C	A , B , C	A , B , C	A , B , C

Special Notes:
A: Insertion Loss is in addition to the theoretical (ideal) split loss.
B: All ports are terminated in 50 ohms when not in use.
C: Insertion Loss is measured as a composite average of all three outputs.

SMA (F) 2/3/4/8 Way 0.5 GHz to 8 GHz 0.5 Watt (Broadband, Commercial)

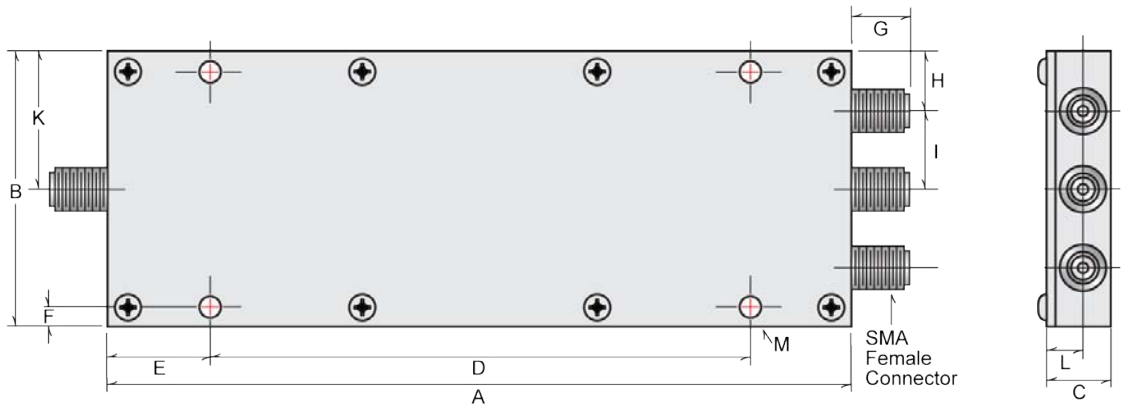


Outline Drawings For Models : 4436-2

Units	A	B	C	D	E	F	G	H	I	K	L	M (Dia.)
4436-2												
in.	5.0	1.50	0.50	2.95	0.65	0.13	0.28	0.50	0.50	0.75	0.22	0.14
mm	127.0	38.10	12.70	74.93	16.51	3.30	7.11	12.70	12.70	19.05	5.59	3.56

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.



Outline Drawings For Models : 4436-3

Units	A	B	C	D	E	F	G	H	I	K	L	M (Dia.)
4436-3												
in.	5.00	1.75	0.44	3.45	0.65	0.38	0.28	0.38	0.50	0.75	0.22	0.14
mm	127.00	44.45	11.18	87.63	16.51	9.65	7.11	9.65	12.70	19.05	5.59	3.56

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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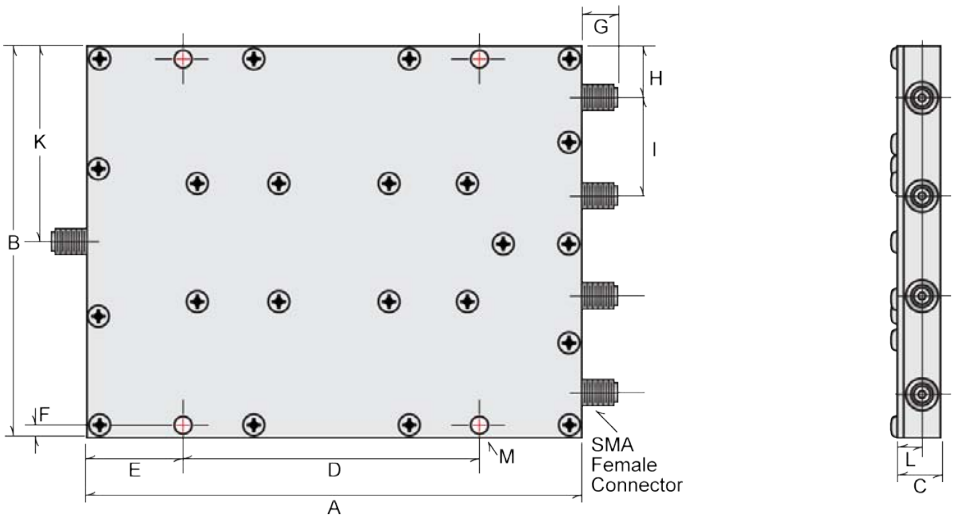
SMA (F) 2/3/4/8 Way 0.5 GHz to 8 GHz 0.5 Watt (Broadband, Commercial)



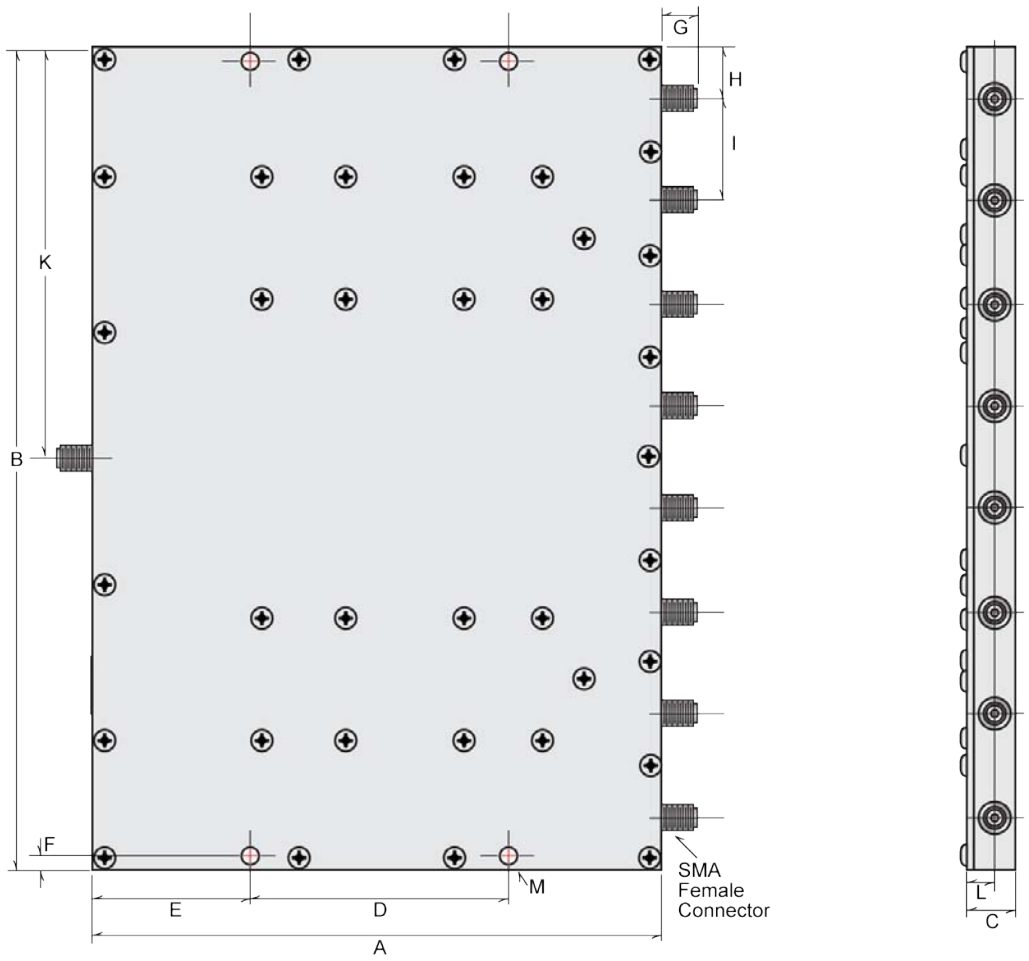
Outline Drawings For Models : 4436-4

Units	A	B	C	D	E	F	G	H	I	K	L	M (Dia.)
4436-4												
in.	5.00	4.00	0.44	3.00	1.00	0.12	0.28	0.50	1.00	2.00	0.22	0.14
mm	127.00	101.60	11.18	76.20	25.40	3.05	7.11	12.70	25.40	50.80	5.59	3.56

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (F) 2/3/4/8 Way 0.5 GHz to 8 GHz 0.5 Watt (Broadband, Commercial)



Outline Drawings For Models : 4436-8

Units	A	B	C	D	E	F	G	H	I	K	L	M (Dia.)
4436-8												
in.	5.50	8.00	0.44	2.50	1.50	0.12	0.28	0.50	1.00	4.00	0.22	0.14
mm	139.70	203.20	11.18	63.50	38.10	3.05	7.11	12.70	25.40	101.60	5.59	3.56

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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SMA (F), Type N - 2-Way 6 to 18 GHz (High Power)

Features

- 75 W CW Capability into Severe Mismatch
- 75 W CW Capability at Elevated Ambient Temperatures of 85° C
- Small, 0.7 sq. in. Package
- Flight Qualified, MIL Environment Qualified Versions

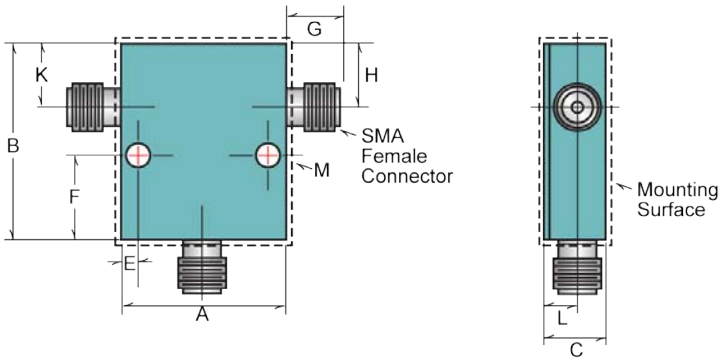
Models

- 4306-2, 3306-2

Model	4306-2	3306-2
Low Frequency (GHz)	6.0	6.0
High Frequency (GHz)	18.0	18.0
Insertion Loss dB (max)	0.8 (6.0-14.0 GHz) 1.0 (14.0-18.0 GHz)	1.2 (6-10 GHz) 1.5 (10-18 GHz)
Isolation dB (min)	17	15
VSWR Input	1.75:1	1.8:1
VSWR Output	1.65:1	1.7:1
Amplitude Balance (max dB)	+/-0.2	0.5
Phase Balance (Max in Deg.)	10	12
Average Power (W)	75*	100*
Connector	SMA	Type N
Maximum Weight (oz)	1.5	13
Maximum Weight (gr)	43	369
Special Notes:	A	A

Special Notes:
A: *Power Rating into 2 to 1 VSWR load.
Power Rating is based upon maximum case temperature of the power divider not exceeding 85°C.

SMA (F), Type N - 2-Way 6 to 18 GHz (High Power)

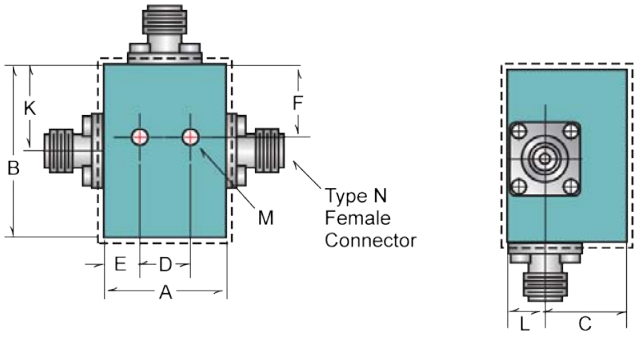


Outline Drawings For Models : 4306-2

Units	A	B	C	E	F	G	H	K	L	M (Dia.)
4306-2										
in.	0.75	0.90	0.40	0.11	0.39	0.25	0.30	0.38	0.17	0.10
mm	19.05	22.86	10.16	2.79	9.91	6.35	7.62	9.65	4.32	2.54

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant buid up per surface. Contact the factory for detailed specifications and outline drawing.



Outline Drawings For Models : 3306-2

Units	A	B	C	D	E	F	K	L	M (Dia.)
3306-2									
in.	1.25	1.50	0.88	0.50	0.375	0.72	0.88	0.37	0.25
mm	31.75	38.10	22.35	12.70	9.525	18.29	22.35	9.40	6.35

Notes:

Dimensions are nominal and for reference only. Add .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

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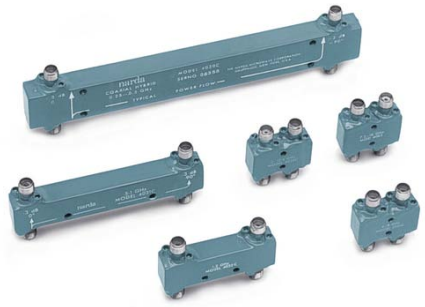
90-Degree 0.25 to 16 GHz (Mini Hybrids)



Features

- Complete Frequency Range - 250 MHz to 16 GHz
- Smallest Units Available
- Isolation to 30 dB (min) for L Band
- Rigid Construction Resists Shock and Vibration
- Operational to 105°C without Degradation (125°C storage)
- Designed for MIL Environments

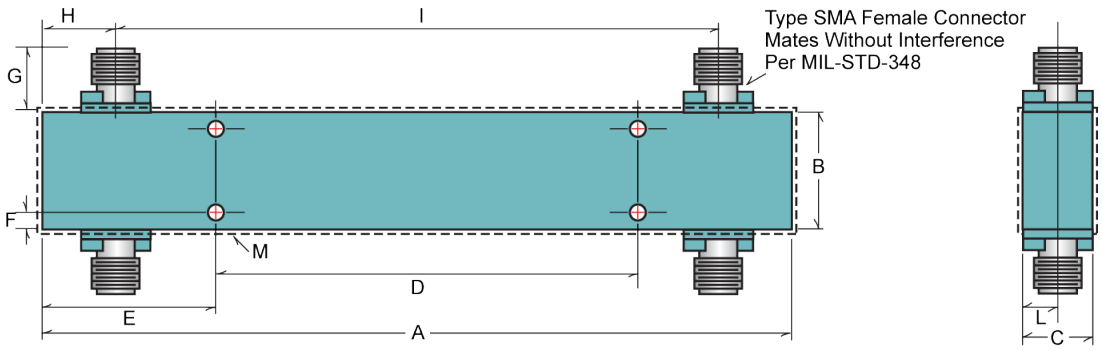
Models

- 4030C, 4031C, 4032C, 4033C, 4034C, 4065

Model	4030C	4031C	4032C
Low Frequency (GHz)	0.25	0.5	1.0
High Frequency (GHz)	0.5	1.0	2.0
Nominal Coupling (dB)	3	3	3
Insertion Loss dB (max)	0.2	0.2	0.2
VSWR (max)	1.25:1	1.25:1	1.10:1
Isolation dB (min)	25	20	30
Amplitude Balance (max dB)	+/-0.6	+/-0.6	+/-0.6
Phase Balance (Max in Deg.)	5	5	5
Average Power (W)	50	50	50
Peak Power (kW)	5	5	5
Connector	SMA Female	SMA Female	SMA Female
Maximum Weight (gr)	85	40	24
Maximum Weight (oz)	3.0	1.4	0.85

Model	4033C	4034C	4065
Low Frequency (GHz)	2.0	4.0	7.5
High Frequency (GHz)	4.0	8.0	16.0
Nominal Coupling (dB)	3	3	3
Insertion Loss dB (max)	0.2	0.3	0.6
VSWR (max)	1.20:1	1.25:1	1.35:1
Isolation dB (min)	22	20	15
Amplitude Balance (max dB)	+/-0.6	+/-0.6	+/-0.6
Phase Balance (Max in Deg.)	5	10	10
Average Power (W)	50	50	30
Peak Power (kW)	5	5	5
Connector	SMA Female	SMA Female	SMA Female
Maximum Weight (gr)	17	17	20
Maximum Weight (oz)	0.60	0.60	0.70

90-Degree 0.25 to 16 GHz (Mini Hybrids)

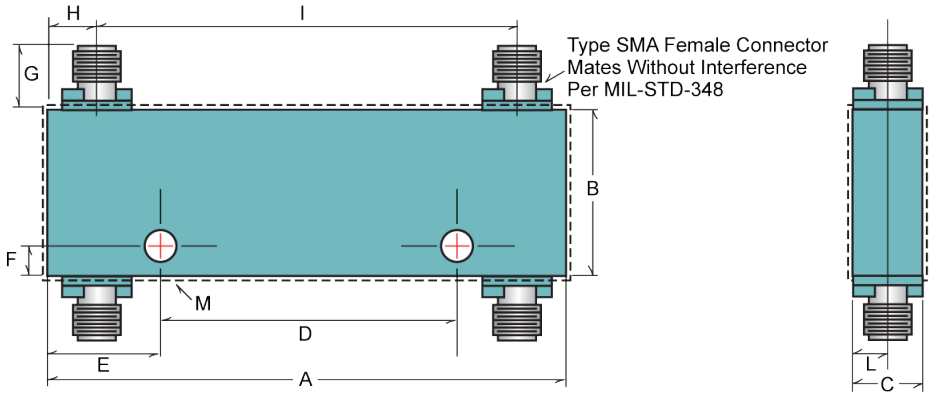


Outline Drawings For Models : 4030C

Units	A	B	C	D	E	F	G	H	I	L	M
4030C											
in.	5.80	0.70	0.42	4.00	0.90	0.516	0.38	0.44	4.00	0.21	0.125
mm	147.32	17.78	10.67	101.6	22.86	13.106	9.65	11.18	101.60	5.33	3.175

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant buid up per surface. Contact the factory for detailed specifications and outline drawing.



Outline Drawings For Models : 4031C, 4032C

Units	A	B	C	D	E	F	G	H	I	L	M (Dia.)
4031C											
in.	3.06	0.51	0.38	1.375	0.84	0.10	0.38	0.593	2.56	0.19	0.125
mm	77.72	12.95	9.65	34.925	21.34	2.54	9.65	15.062	65.02	4.83	3.175
4032C											
in.	1.78	0.50	0.38	1.375	0.84	0.10	0.38	0.593	2.56	0.19	0.125
mm	45.21	12.70	9.65	34.925	21.34	2.54	9.65	15.062	65.02	4.83	3.175

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant buid up per surface. Contact the factory for detailed specifications and outline drawing.

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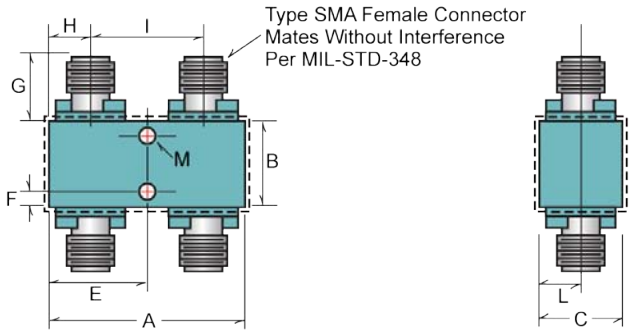
90-Degree 0.25 to 16 GHz (Mini Hybrids)



Outline Drawings For Models : 4033C, 4034C, 4065

Units	A	B	C	E	F	G	H	I	L	M (Dia.)
4033C										
in.	1.16	0.51	0.38	0.58	0.09	0.38	0.25	0.66	0.19	0.104
mm	29.46	12.95	9.65	14.73	2.29	9.65	6.35	16.76	4.83	2.642
4034C										
in.	1.00	0.50	0.38	0.58	0.09	0.38	0.25	0.66	0.19	0.104
mm	25.40	12.70	9.65	14.73	2.29	9.65	6.35	16.76	4.83	2.642
4065										
in.	1.00	0.58	0.38	0.50	0.09	0.38	0.25	0.50	0.19	0.104
mm	25.40	14.73	9.65	12.70	2.29	9.65	6.35	12.70	4.83	2.642

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant buid up per surface. Contact the factory for detailed specifications and outline drawing.

90-Degree SMA (F) 6 to 18 GHz 125 Watt (High Power)

Features

- Broadband - 6 to 18 GHz
- 125 Watts Average Power Handling at 85°C
- Superior Phase Balance
- Small, 1.25 sq. in. Package
- Designed for MIL Environments

Applications

- EW System - Power Splitter for Antenna Feeds, Jammers
- Radar - Monopulse, Butler Matrix, and Rothman Array Antenna Feeds
- Communications

Models

- 4096

Model	4096
Low Frequency (GHz)	6.0
High Frequency (GHz)	18.0
Nominal Coupling (dB)	3.0
VSWR (max)	1.4:1
Insertion Loss dB (max)	0.75
Isolation dB (min)	17
Amplitude Balance (max dB)	+/-0.6
Phase Balance (Max in Deg.)	90° +/- 0.7
Average Power (W)	125W CW**
Peak Power (kW)	3.0**
Maximum Weight (oz)	1.1
Maximum Weight (gr)	32
Connector	SMA Female
Special Notes:	A

Special Notes:
A: * Special-order unit. Minimum quantity may apply.
** Mounted to a heat sink (+85° C max. housing temperature.)
Also refer to Model 4196-20 High Power Coupler.

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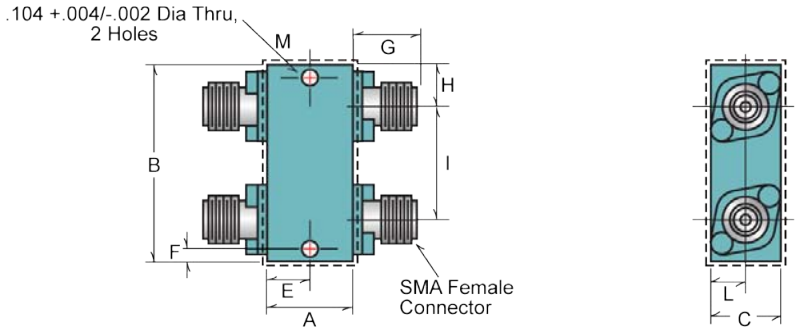
90-Degree SMA (F) 6 to 18 GHz 125 Watt (High Power)



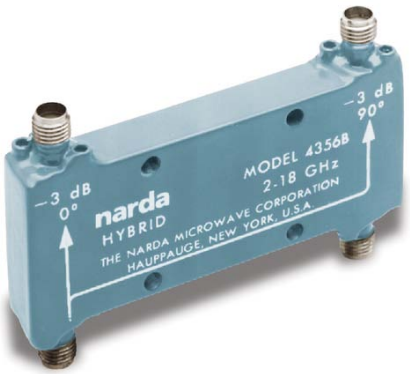
Outline Drawings For Models : 4096

Units	A	B	C	E	F	G	H	I	L	M (Dia.)
					4096					
in.	1.00	1.05	0.375	0.50	0.25	0.375	0.25	0.75	0.187	0.104
mm	25.40	26.67	9.525	12.70	6.35	9.525	6.35	19.05	4.750	2.642

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant buid up per surface. Contact the factory for detailed specifications and outline drawing.

90-Degree SMA (F) 2 to 18 GHz 30 Watt (Ultra-Broadband)



Features

- Smallest Size and Weight
- Multi-Octave Bandwidth
- Excellent Phase Balance
- Low VSWR
- High Isolation
- Rigid Construction Resists Shock and Vibration
- Operational to 105°C without Degradation (125°C storage)
- Designed for MIL Environments

Models

- 4356B

Model	4356B
Low Frequency (GHz)	2.0
High Frequency (GHz)	18.0
VSWR (max)	1.5:1
Insertion Loss dB (max) 2.0-8.0 GHz	0.6
Insertion Loss dB (max) 8.0-18.0 GHz	1.0
Isolation dB (min) 2.0-8.0 GHz	20
Isolation dB (min) 8.0-18.0 GHz	17
Amplitude Balance (max dB)	+/- 0.75
Phase Balance (Max in Deg.)	7
Average Power (W)	30
Peak Power (kW)	3
Maximum Weight (oz)	2.3
Maximum Weight (gr)	65

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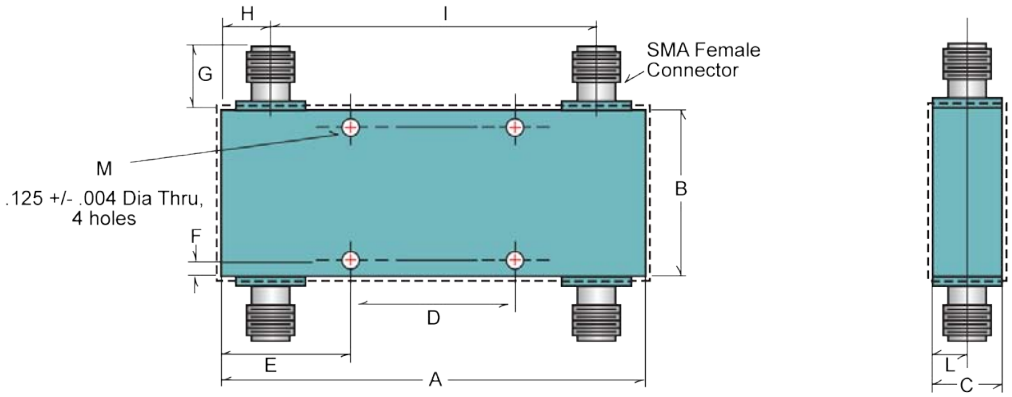
90-Degree SMA (F) 2 to 18 GHz 30 Watt (Ultra-Broadband)



Outline Drawings For Models : 4356B

Units	A	B	C	D	E	F	G	H	I	L	M (Dia.)
4356B											
in.	2.70	1.06	0.38	1.027	0.84	0.10	0.38	0.25	2.20	0.19	0.125
mm	68.58	26.92	9.65	26.086	21.34	2.54	9.65	6.35	55.88	4.83	3.175

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant buid up per surface. Contact the factory for detailed specifications and outline drawing.

180-Degree SMA (F) 2 to 18 GHz 30 Watt (Ultra-Broadband)

Features

- Smallest Size and Weight
- Multi-Octave Bandwidth
- Excellent Phase Balance
- Low VSWR
- High Isolation
- Rigid Construction Resists Shock and Vibration
- Operational to 105°C without Degradation (125°C storage)
- Designed for MIL Environments

Models

- 4346

Model	4346
Low Frequency (GHz)	2.0
High Frequency (GHz)	18.0
Nominal Coupling (dB)	3.0
VSWR (max)	1.6:1
Insertion Loss (max)	2.30
Isolation dB (min)	18
Amplitude Balance (max dB)	+/- 0.8
Phase Bal. (in Deg.) 2.0-2.5 GHz	15
Phase Bal. (in Deg.) 2.5-18 GHz	12
Average Power (W)	30
Peak Power (kW)	3
Maximum Weight (oz)	2.89
Maximum Weight (gr)	82
Connector	SMA Female

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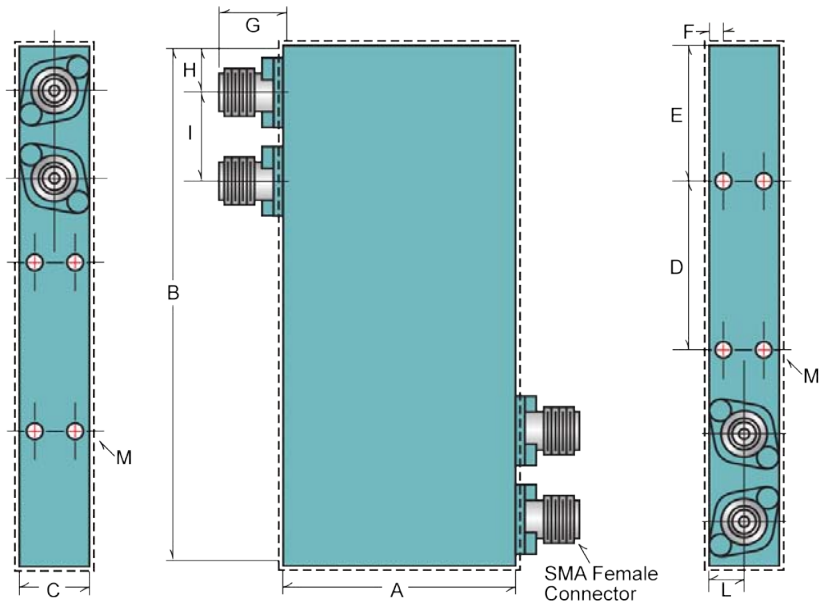
180-Degree SMA (F) 2 to 18 GHz 30 Watt (Ultra-Broadband)



Outline Drawings For Models : 4346

Units	A	B	C	D	E	F	G	H	I	L	M (Dia.)
4346											
in.	1.35	3.04	0.40	1.00	0.77	0.20	0.37	0.25	0.52	0.20	Tap-1
mm	34.29	77.22	10.16	25.40	19.56	5.08	9.40	6.35	13.21	5.08	

Notes:

Tap-1: #4-40 UNC-2B x 1/4 DP, 8 Holes.
Dimensions are nominal and for reference only. Allow .020 for sealant buid up per surface. Contact the factory for detailed specifications and outline drawing.

90-Degree SMA (F) .5 to 8 GHz 30 Watt (Multi-Octave)

Features

- Excellent Phase Balance
- 500 MHz to 8 GHz Range
- High Isolation
- Low Insertion Loss
- SMA Connectors
- Designed for MIL Environments

Models

- 4358

Model	4358
Low Frequency (GHz)	0.5
High Frequency (GHz)	8.0
Nominal Coupling (dB)	3
VSWR (max)	1.5:1
Insertion Loss dB (max)	1.2
Isolation dB (min)	15
Amplitude Balance (max dB)	+/- .75
Phase Balance (Max in Deg.)	12
Average Power (W)	30
Peak Power (Kw)	3
Maximum Weight (oz)	8.0
Maximum Weight (gr)	227
Special Notes:	A , B

Special Notes:
A: *Special-order unit. Minimum quantity may apply.
B: NOTE: Custom order models are available upon request. Consult the factory.

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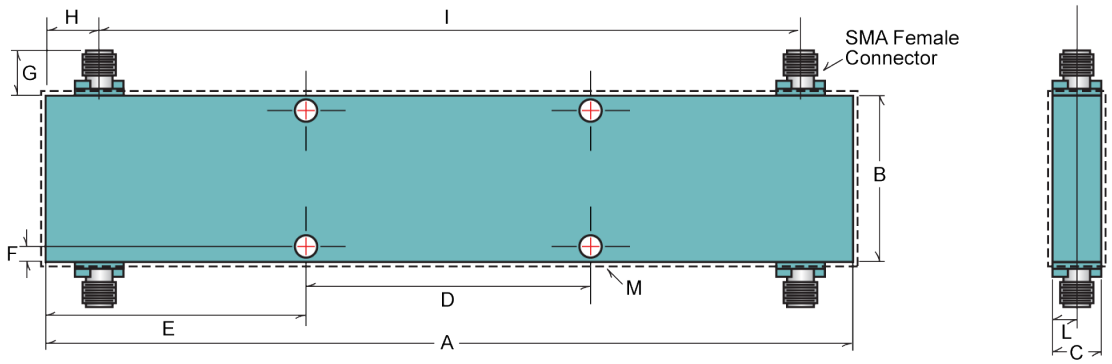
90-Degree SMA (F) .5 to 8 GHz 30 Watt (Multi-Octave)



Outline Drawings For Models : 4358

Units	A	B	C	D	E	F	G	H	I	L	M (Dia.)
4358											
in.	7.00	1.50	0.40	2.50	2.25	1.182	0.37	0.45	6.10	0.20	0.157
mm	177.80	38.10	10.16	63.50	57.15	30.023	9.40	11.43	154.94	5.08	3.988

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant buid up per surface. Contact the factory for detailed specifications and outline drawing.

90-Degree SMA (F) 2 to 18 GHz 30 Watt (Multi-Octave)

Features

- Smallest Size and Weight
- Multi-Octave Bandwidth
- Excellent Phase Balance
- Low VSWR
- High Isolation
- Rigid Construction Resists Shock and Vibration
- Operational to 105°C without Degradation 125°C Storage
- Designed for MIL Environments

Models

- 4333, 4336

Model	4333	4336
Low Frequency (GHz)	2.0	6.0
High Frequency (GHz)	8.0	18.0
Nominal Coupling (dB)	3	3
VSWR (max)	1.40:1	1.50:1
Insertion Loss (max)	0.75dB	0.85dB
Isolation dB (min)	24	14
Amplitude Balance (max dB)	+/- 0.50	+/- 0.70
Phase Balance (Max in Deg.)	+/- 5	+/- 6
Average Power (W)	30	30
Peak Power (kW)	3	5
Maximum Weight (oz)	2.7	1.0
Maximum Weight (gr)	75	28

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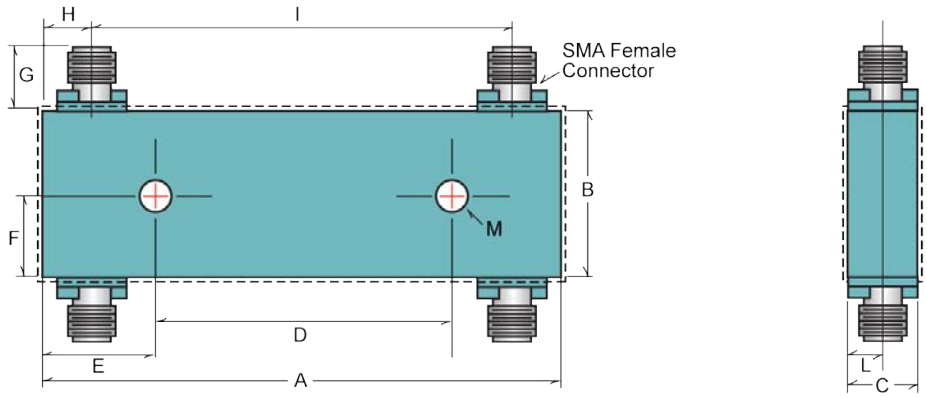
90-Degree SMA (F) 2 to 18 GHz 30 Watt (Multi-Octave)



Outline Drawings For Models : 4333, 4336

Units	A	B	C	D	E	F	G	H	I	L	M (Dia.)
4333											
in.	2.71	0.86	0.58	1.561	0.57	0.43	0.375	0.25	2.20	0.19	0.104
mm	68.83	21.84	14.73	39.649	14.48	10.92	9.525	6.35	55.88	4.83	2.642
4336											
in.	1.25	0.804	0.38	0.375	0.44	0.40	0.375	0.23	0.80	0.19	0.104
mm	31.75	20.422	9.65	9.525	11.18	10.16	9.525	5.84	20.32	4.83	2.642

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant buid up per surface. Contact the factory for detailed specifications and outline drawing.

180-Degree SMA (F) 2 to 8 GHz 30 Watt (Multi-Octave)

Features

- Smallest Size and Weight
- Multi-Octave Bandwidth
- Excellent Phase Balance
- Low VSWR
- High Isolation
- Rigid Construction Resists Shock and Vibration
- Operational to 105°C without Degradation 125°C Storage
- Designed for MIL Environments

Models

- 4343

Model	4343
Low Frequency (GHz)	2.0
High Frequency (GHz)	8.0
Nominal Coupling (dB)	3
VSWR (max)	1.50
Insertion Loss (max)	1.30 dB
Isolation dB (min)	17
Amplitude Balance (max dB)	+/- 0.50
Phase Balance (Max in Deg.)	+/- 10.0
Average Power (W)	30
Peak Power (kW)	3
Maximum Weight (oz)	2.2
Maximum Weight (gr)	62

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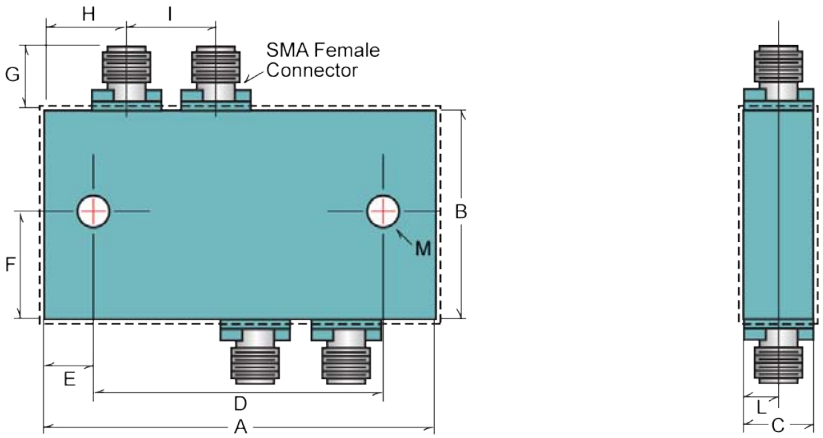
180-Degree SMA (F) 2 to 8 GHz 30 Watt (Multi-Octave)



Outline Drawings For Models : 4343

Units	A	B	C	D	E	F	G	H	I	L	M (Dia.)
4343											
in.	3.20	1.16	0.38	2.578	0.31	0.58	0.38	0.47	0.53	0.19	0.146
mm	81.28	29.46	9.65	65.481	7.87	14.73	9.65	11.94	13.46	4.83	3.708

Notes:

Dimensions are nominal and for reference only. Allow for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

90-Degree Type N (F) 0.82 to 4.2 GHz (High-Power)

Features

- Broadband Coverage
- Signal Isolation Over a Complete Band
- Low VSWR
- Flat Frequency Response
- 200 Watt Power Handling
- Cellular Band 500W Model 3322
- Models 3322 and 3033B Designed for MIL Environments

Models

- 3322, 3032, 3033B

Model	3322	3032	3033B
Low Frequency (GHz)	0.82	0.95	1.7
High Frequency (GHz)	0.98	2.0	4.2
Nominal Coupling (dB)	3	3	3
VSWR (max)	1.25:1	1.20:1	1.25:1
Insertion Loss dB (max)	0.20	0.30	0.35
Isolation dB (max)	20	20	20
Amplitude Balance (max dB)	+/-0.25	+/-0.25	+/-0.25
Phase Balance (Max in Deg.)	90° +/- 5°	90° +/- 5°	90° +/- 5°
Average Power (W)	500	200	200
Peak Power (kW)	10	5	5
Weight (max) in lbs	2.0	1.50	1.00
Weight (max) in kg	0.9	0.68	0.50
Special Notes:	B	B	A , B

Special Notes:
A: Custom order models available upon request. Consult the factory.
B: See model numbers 369BNM and 368BNM for High Power N Male Termination, normally required for typical dividing or combining function.

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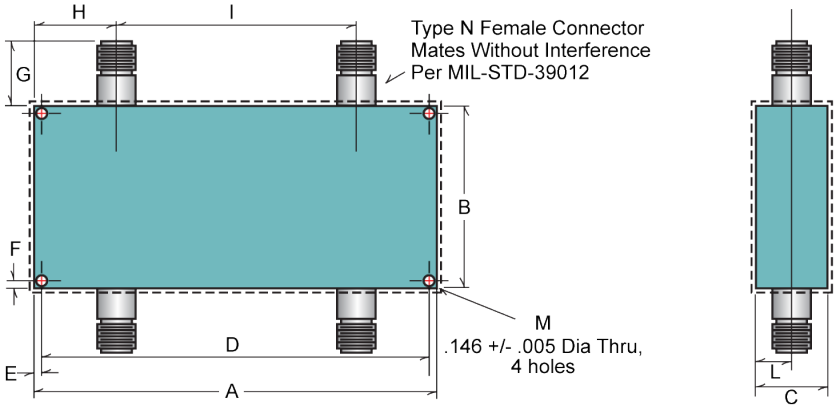
90-Degree Type N (F) 0.82 to 4.2 GHz (High-Power)

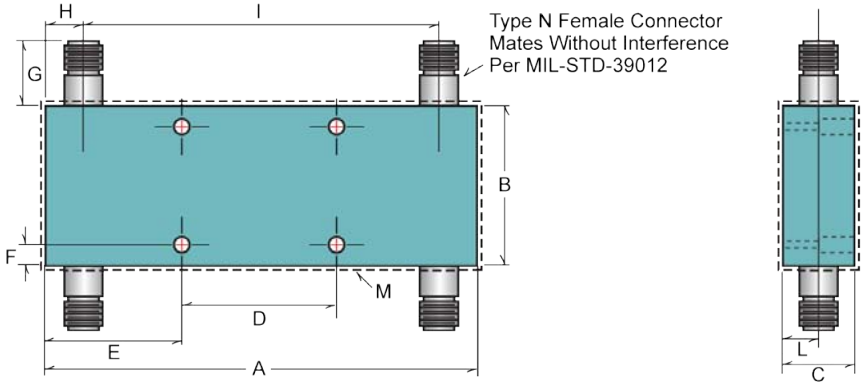


Outline Drawings For Models : 3322

Units	A	B	C	D	E	F	G	H	I	L	M (Dia.)
3322											
in.	5.51	2.60	1.06	5.21	0.15	0.15	0.88	1.10	3.30	0.53	0.146
mm	139.95	66.04	26.92	132.33	3.81	3.81	22.35	27.9	83.82	13.46	3.708

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.



Outline Drawings For Models : 3032

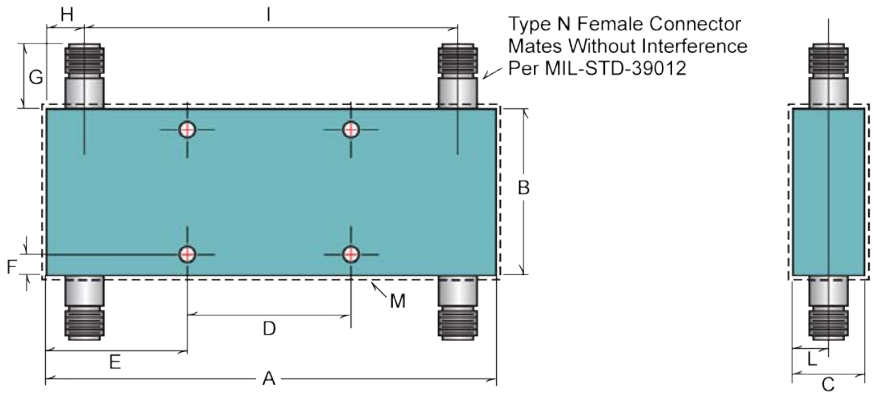
Units	A	B	C	D	E	F	G	H	I	L	M (Dia.)
3032											
in.	5.50	2.11	0.88	2.00	0.38	0.25	0.75	0.38	4.75	0.44	Tap-1
mm	139.70	53.59	22.35	50.80	9.65	6.35	19.05	9.65	120.65	11.18	

Notes:

Tap 1: #8-32 NC-2, .375 Min THD Depth.

Dimensions are nominal and for reference only. Allow .020 for sealant buidup per surface. Contact the factory for detailed specifications and outline drawing.

90-Degree Type N (F) 0.82 to 4.2 GHz (High-Power)



Outline Drawings For Models : 3033B

Units	A	B	C	D	E	F	G	H	I	L	M (Dia.)
3033B											
in.	4.00	2.11	0.88	1.375	1.31	0.25	0.75	0.47	3.06	0.44	0.199
mm	101.60	53.59	22.35	34.925	33.27	5.1	19.05	11.94	77.72	11.18	5.055

Notes:

Dimensions are nominal and for reference only. Allow .020 for sealant build up per surface. Contact the factory for detailed specifications and outline drawing.

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Type N (F) 0.8 to 2.0 GHz 80W/100W (High Power Combiners Wireless Bands)

Features

- Wireless Communications PCS and Cellular Coverage
- Wireless Broadband - 800 to 2500 MHz
- 2-Way thru 16-Way Models
- High Isolation
- Excellent Phase and Amplitude Balance
-

Models

- 30402, 30403, 30373, 2362-2, 2362-3, 2362-4

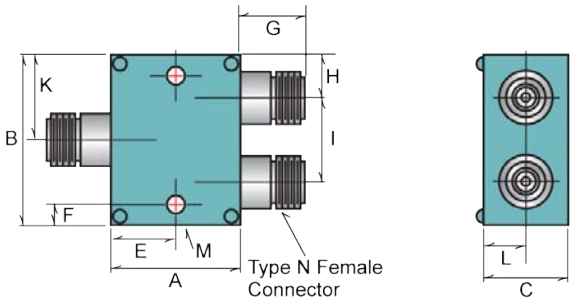
Model	30402	30403	30373
N-Way	2	3	4
Low Frequency (GHz)	0.820	0.820	0.820
High Frequency (GHz)	0.915	0.915	0.915
VSWR Input	1.3:1	1.3:1	1.3:1
VSWR Output	1.2:1	1.2:1	1.2:1
Insertion Loss dB (max), Excluding Combination Loss	0.5	0.6	0.6
Insertion Loss dB (max), Including Combination Loss	3.5	5.4	6.6
Isolation dB (min)	20	20	20
Amplitude Balance (max dB)	0.2	0.2	0.2
Phase Balance (Max in Deg.)	+/- 3.0	+/- 5.0	+/- 3.0
Average Power (Combiner)	40 W	27 W	25 W
Peak Power (Combiner)	1.3 kW	1 kW	.75 kW
Average Power (Divider)	80 W	80 W	100 W
Peak Power (Divider)	3 kW	3 kW	3 kW
Maximum Weight (oz)	4.9	8.1	10.9
Maximum Weight (gr)	140	230	310
Special Notes:	A	A	A

Special Notes:
A: Case temperature must be limited to 85° C maximum. Cooling fan may be required.

Type N (F) 0.8 to 2.0 GHz 80W/100W (High Power Combiners Wireless Bands)

Model	2362-2	2362-3	2362-4
N-Way	2	3	4
Low Frequency (GHz)	1.8	1.8	1.8
High Frequency (GHz)	2.0	2.0	2.0
VSWR Input	1.3:1	1.3:1	1.3:1
VSWR Output	1.2:1	1.2:1	1.2:1
Insertion Loss dB (max), Excluding Combination Loss	0.5	0.6	0.8
Insertion Loss dB (max), Including Combination Loss	3.5	5.4	6.9
Isolation dB (min)	20	20	20
Amplitude Balance (max dB)	0.2	0.2	0.2
Phase Balance (Max in Deg.)	+/- 6.0	+/- 10.0	+/- 6.0
Average Power (Combiner)	40 W	27 W	25 W
Peak Power (Combiner)	1.3 kW	1.3 kW	.75 kW
Average Power (Divider)	80 W	80 W	100 W
Peak Power (Divider)	3 kW	3 kW	3 kW
Maximum Weight (oz)	4.9	8.1	10.9
Maximum Weight (gr)	140	230	310
Special Notes:	A	A	A

Special Notes:
A: Case temperature must be limited to 85° C maximum. Cooling fan may be required.



Outline Drawings For Models : 30402

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
30402											
in.	1.50	2.00	1.00	0.75	0.25	0.38	0.50	1.00	1.00	0.50	0.20
mm	38.10	50.80	25.40	19.05	6.35	9.65	12.70	25.40	25.40	12.70	5.08

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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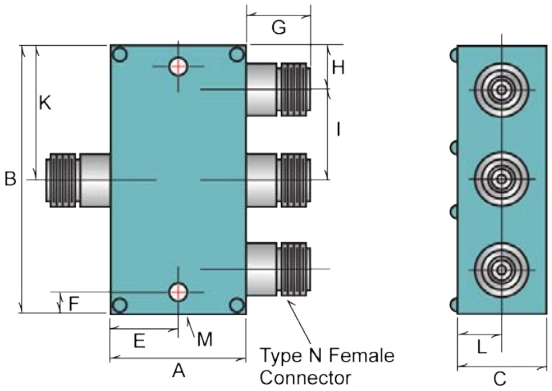
Type N (F) 0.8 to 2.0 GHz 80W/100W (High Power Combiners Wireless Bands)

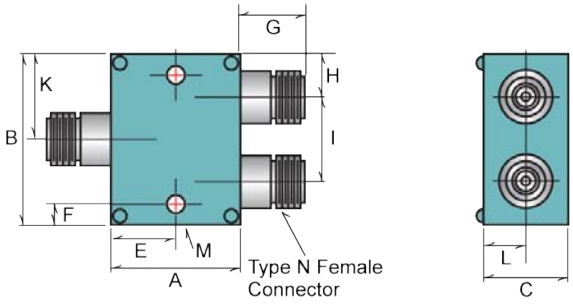


Outline Drawings For Models : 30403

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
30403											
in.	1.50	3.00	1.00	0.75	0.25	0.38	0.50	1.00	1.50	0.50	0.20
mm	38.10	76.20	25.40	19.05	6.35	9.65	12.70	25.40	38.10	12.70	5.08

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.



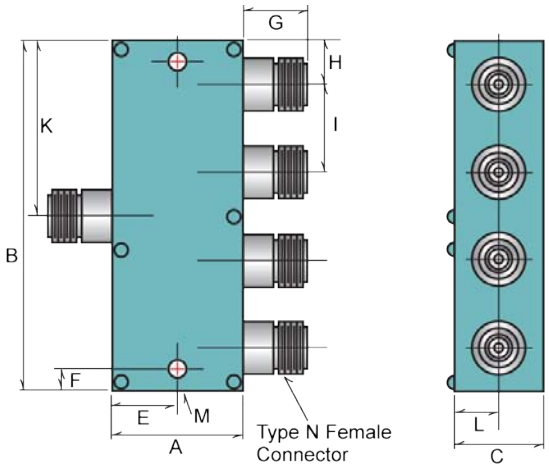
Outline Drawings For Models : 2362-2

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
2362-2											
in.	1.80	2.10	1.05	0.90	0.20	0.38	0.50	1.00	1.05	0.53	0.20
mm	45.72	53.34	26.67	22.86	5.08	9.65	12.70	25.40	26.67	13.46	5.08

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

Type N (F) 0.8 to 2.0 GHz 80W/100W (High Power Combiners Wireless Bands)

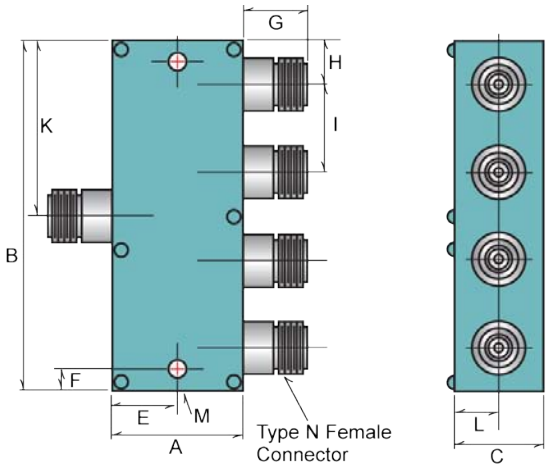


Outline Drawings For Models : 30373

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
30373											
in.	1.50	4.00	1.00	0.75	0.25	0.38	0.50	1.00	2.00	0.50	0.20
mm	38.10	101.60	25.40	19.05	6.35	9.65	12.70	25.40	50.80	12.70	5.08

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.



Outline Drawings For Models : 2362-4

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
2362-4											
in.	2.05	4.17	1.05	1.03	0.20	0.38	0.50	1.04	2.09	0.53	0.20
mm	52.07	105.92	26.67	26.16	5.08	9.65	12.70	26.42	53.09	13.46	5.08

Notes:

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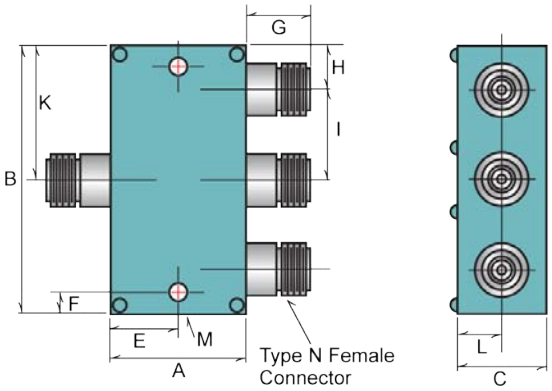
Type N (F) 0.8 to 2.0 GHz 80W/100W (High Power Combiners Wireless Bands)



Outline Drawings For Models : 2362-3

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
2362-3											
in.	2.05	3.15	1.05	1.02	0.20	0.38	0.5	1.05	1.57	0.53	0.20
mm	52.07	80.01	26.67	25.91	5.08	9.65	12.7	26.67	39.88	13.46	5.08

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

Type N (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)

Features

- Wireless Communications PCS and Cellular Coverage
- Broadband - 0.8 to 2.5 GHz
- Complete Series - 2-Way thru 6-Way Models
- High Isolation ≥ 20 dB, Typical ≥ 26 dB Isolation
- Excellent Phase and Amplitude Balance

Models

- 3372A-2, 3372A-3, 3372A-4, 3372A-6

Model	3372A-2	3372A-3	3372A-4	3372A-6
N-Way	2	3	4	6
Low Frequency (GHz)	0.8	0.8	0.8	0.8
High Frequency (GHz)	2.5	2.5	2.5	2.5
Band Segment (in GHz)	0.8-1.0/1.0-2.5	0.8-2.5	0.8-1.0/1.0-2.5	0.8-2.5
Insertion Loss dB (max)	0.3/0.5	0.8	0.8/1.0	0.8
Isolation dB (min)	22	15	18	18
VSWR Input (max)	1.35:1	1.6:1	1.4:1	1.7:1 / 1.5:1
VSWR Output (max)	1.30:1	1.5:1	1.35:1	1.5:1 / 1.6:1
Amplitude Balance (max dB)	0.2	0.5	0.3	0.5 / 0.7
Phase Balance (Max in Deg.)	3°	8°	6°	8° / 10°
Input Power (W) Max Load VSWR 1.2:1	30	30	30	30
Input Power (W) Max Load VSWR 2.0:1	5	5	5	5
Input Power (W) Max Load VSWR Infinite	0.5	0.5	0.5	0.5
Maximum Weight (oz)	7.7	20.1	22.9	59.9
Maximum Weight (gr)	220	570	650	1.7 Kg

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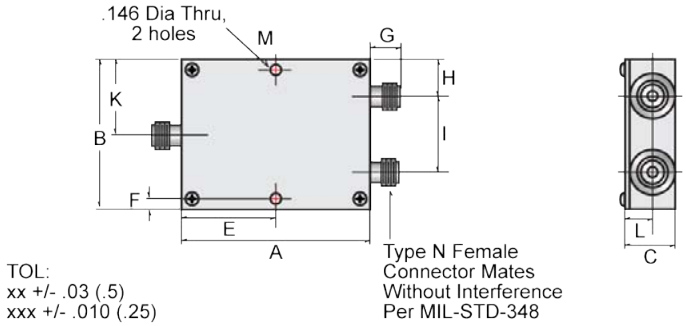
Type N (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)

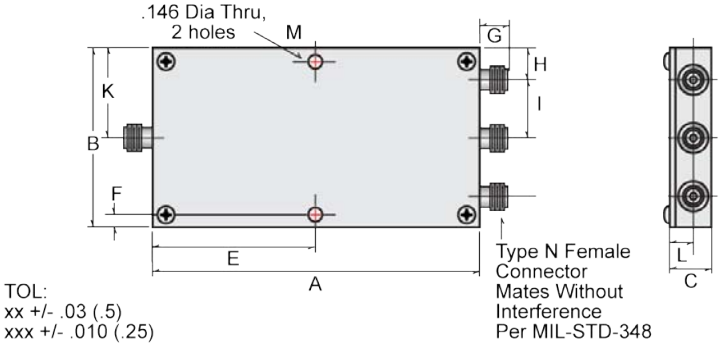


Outline Drawings For Models : 3372A-2

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
3372A-2											
in.	2.50	2.00	1.00	1.25	0.15	0.38	0.50	1.00	1.00	0.50	0.146
mm	63.50	50.80	25.40	31.75	3.81	9.65	12.70	25.40	25.40	12.70	3.708

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.



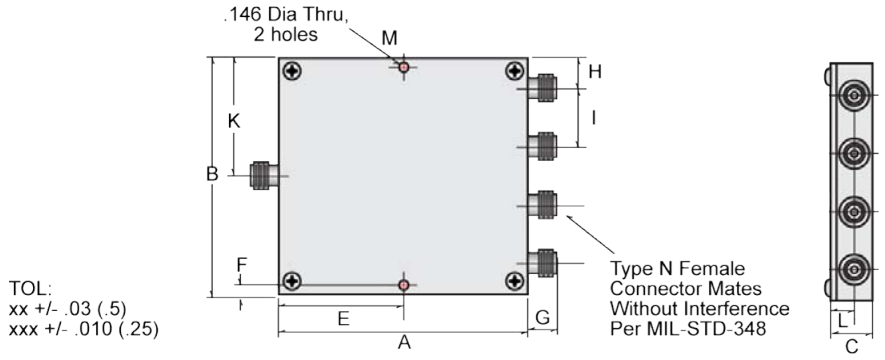
Outline Drawings For Models : 3372A-3

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
3372A-3											
in.	5.50	3.00	1.00	2.75	0.15	0.38	0.50	1.00	1.50	0.50	0.146
mm	139.70	76.20	25.40	69.85	3.81	9.65	12.70	25.40	38.10	12.70	3.708

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

Type N (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)

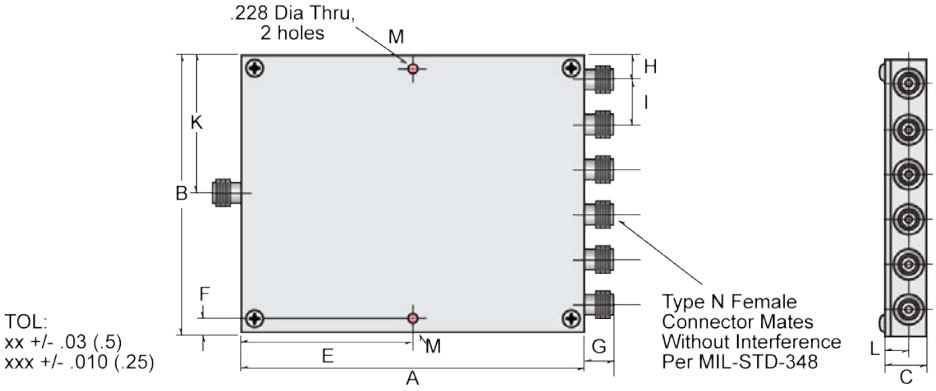


Outline Drawings For Models : 3372A-4

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
3372A-4											
in.	4.20	4.00	1.00	2.15	0.15	0.38	0.15	1.00	2.00	0.50	0.15
mm	106.68	101.60	25.40	54.61	3.81	9.65	3.81	25.40	50.80	12.70	3.81

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.



Outline Drawings For Models : 3372A-6

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
3372A-6											
in.	7.40	6.00	1.00	3.70	0.30	0.38	0.50	1.00	3.00	0.50	0.23
mm	187.96	152.40	25.40	93.98	7.62	9.65	12.70	25.40	76.20	12.70	5.84

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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SMA (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)

Features

- Wireless Communications PCS and Cellular Coverage
- Broadband - .08-2.5 GHz
- Complete Series - 2-Way thru 16-Way Models
- High Isolation ≥ 20 dB, Typical ≥ 26 dB Isolation
- Excellent Phase and Amplitude Balance

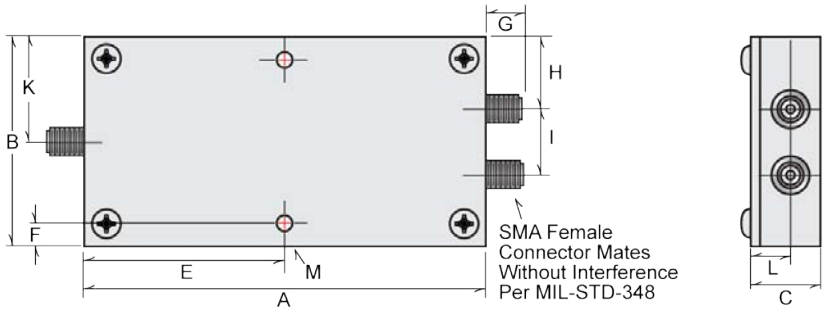
Models

- 4372A-2, 4372A-3, 4372A-4, 4372A-6, 4162-8, 4162-16, 4152-8, 4152-16

Model	4372A-2	4372A-3	4372A-4	4372A-6
N-Way	2	3	4	6
Low Frequency (GHz)	0.8	0.8	0.8	0.8
High Frequency (GHz)	2.5	2.5	2.5	2.5
Band Segment (GHz)	0.8-1.0 / 1.0-2.5	0.8-2.5	0.8-2.5	0.8-1.0 / 1.0-2.5
Insertion Loss dB (max)	0.3 / 0.5	0.8	0.8	0.8 / 1.0
Isolation dB (min)	22	15	22	18
VSWR Input (max)	1.35:1	1.6:1	1.4:1	1.7:1 / 1.8:1
VSWR Output (max)	1.30:1	1.5:1	1.35:1	1.5:1 / 1.6:1
Amplitude Balance (max dB)	0.2	0.5	0.3	0.5 / 0.7
Phase Balance (Max in Deg.)	3°	8°	6°	8° / 10°
Input Power (W) Max Load VSWR 1.2:1	30	30	30	30
Input Power (W) Max Load VSWR 2.0:1	5	5	5	5
Input Power (W) Max Load VSWR Infinite	0.5	0.5	0.5	0.5
Maximum Weight (oz)	3.5	6.0	8.8	17.6
Maximum Weight (gr)	100	170	250	500

SMA (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)

Model	4162-8	4162-16	4152-8	4152-16
N-Way	8	16	8	16
Low Frequency (GHz)	1.9	1.9	0.8	0.8
High Frequency (GHz)	2.5	2.5	1.0	1.0
Band Segment (GHz)	1.9-2.5	1.9-2.5	0.8-1.0	0.8-1.0
Insertion Loss dB (max)	1.1	1.2	0.8	1.5
Isolation dB (min)	22	19	20	20
VSWR Input (max)	1.5:1	1.6:1	1.3:1	1.3:1
VSWR Output (max)	1.4:1	1.4:1	1.3:1	1.3:1
Amplitude Balance (max dB)	0.5	0.8	0.4	0.6
Phase Balance (Max in Deg.)	6°	10°	6°	10°
Input Power (W) Max Load VSWR 1.2:1	30	30	30	30
Input Power (W) Max Load VSWR 2.0:1	5	5	5	5
Input Power (W) Max Load VSWR Infinite	0.5	0.5	0.5	0.5
Maximum Weight (oz)	17.6	17.6	29.9	29.9
Maximum Weight (gr)	500	500	850	850



Outline Drawings For Models : 4372A-2

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4372A-2											
in.	3.10	1.05	0.5	1.55	0.15	0.30	0.55	0.50	0.80	0.25	0.15
mm	78.74	26.67	12.7	39.37	3.81	7.62	13.97	12.70	20.32	6.35	3.81

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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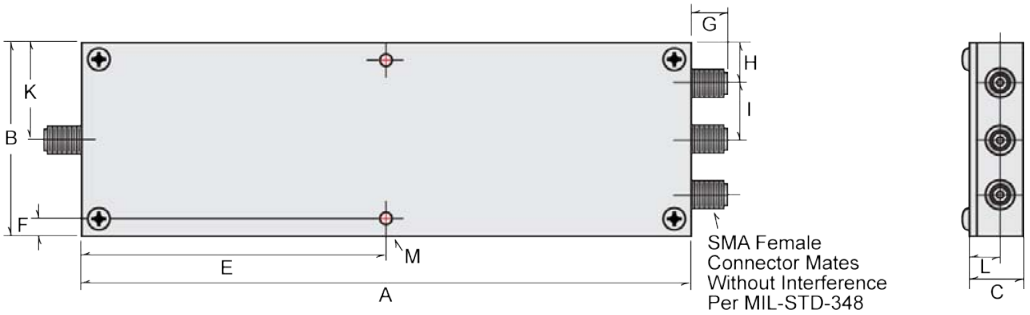
SMA (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)

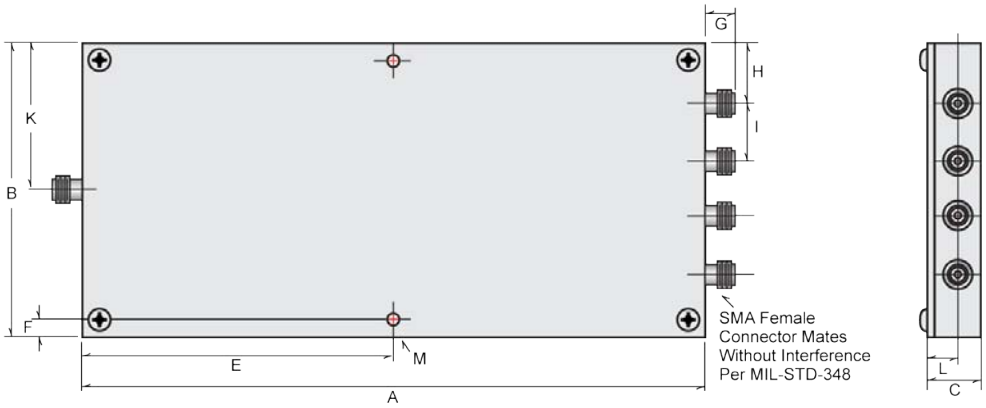


Outline Drawings For Models : 4372A-3

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4372A-3											
in.	5.50	1.75	0.50	2.75	0.15	0.30	0.40	0.50	0.90	0.25	0.15
mm	139.70	44.45	12.70	69.85	3.81	7.62	10.16	12.70	22.86	6.35	3.81

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.



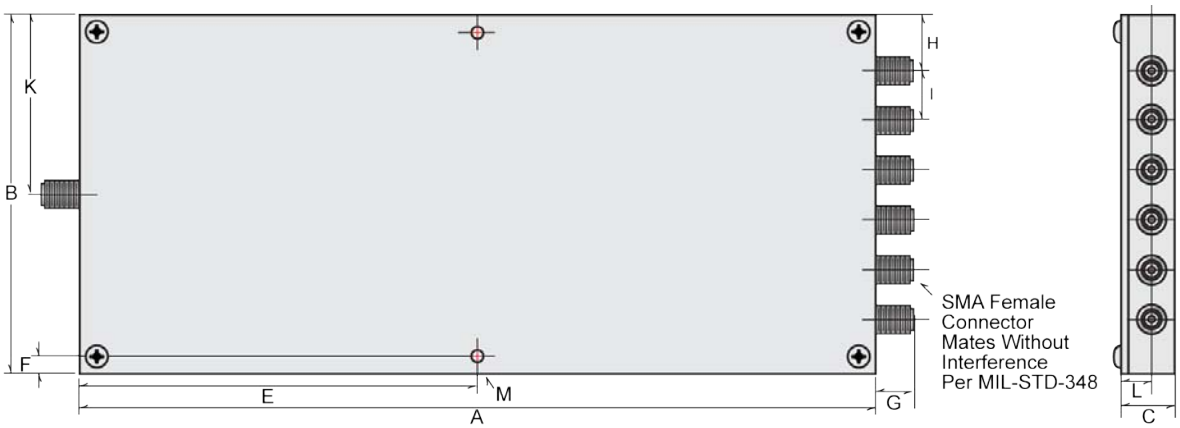
Outline Drawings For Models : 4372A-4

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4372A-4											
in.	5.45	2.60	0.50	2.75	0.15	0.30	0.55	0.50	1.30	0.25	0.15
mm	138.43	66.04	12.70	69.85	3.81	7.62	13.97	12.70	33.02	6.35	3.81

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)



Outline Drawings For Models : 4372A-6

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4372A-6											
in.	8.00	3.60	0.50	4.00	0.15	0.30	0.55	0.50	1.80	0.25	0.15
mm	203.20	91.44	12.70	101.60	3.81	7.62	13.97	12.70	45.72	6.35	3.81

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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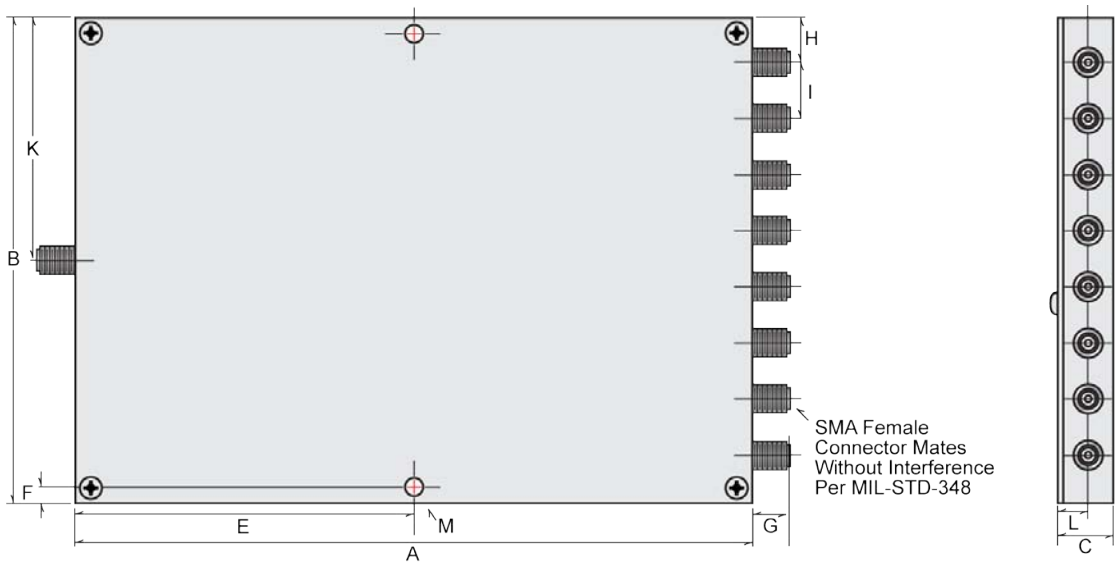
SMA (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)



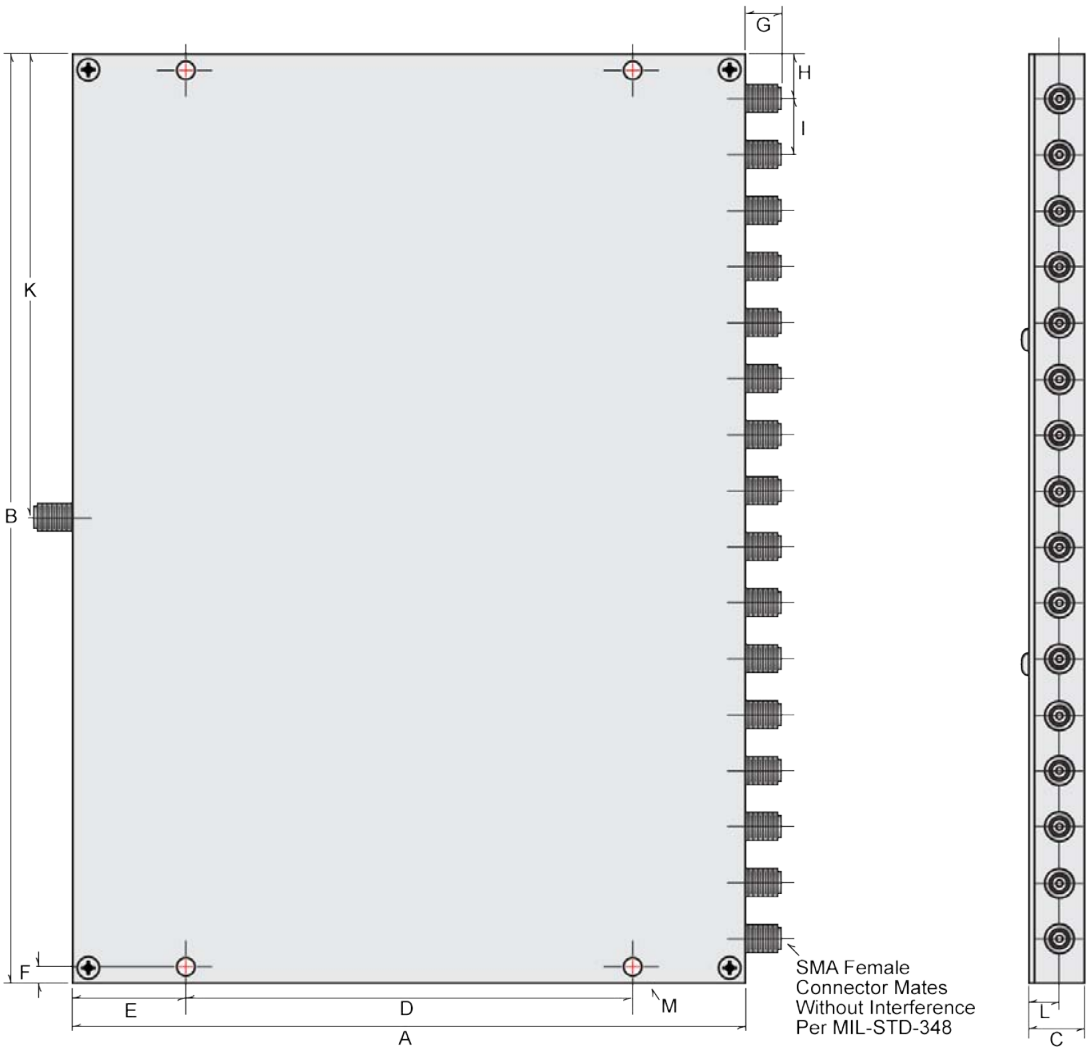
Outline Drawings For Models : 4152-8

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4152-8											
in.	6.00	4.30	0.50	3.00	0.15	0.30	0.40	0.50	2.15	0.25	0.15
mm	152.40	109.22	12.70	76.20	3.81	7.62	10.16	12.70	54.61	6.35	3.81

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)



Outline Drawings For Models : 4152-16

Units	A	B	C	D	E	F	G	H	I	K	L	M (Dia.)
4152-16												
in.	6.00	8.30	0.50	1.00	4.00	0.15	0.30	.040	0.50	4.15	0.25`	0.15
mm	152.40	210.82	12.70	25.40	101.60	3.81	7.62	1.016	12.70	105.41	6.350	3.81

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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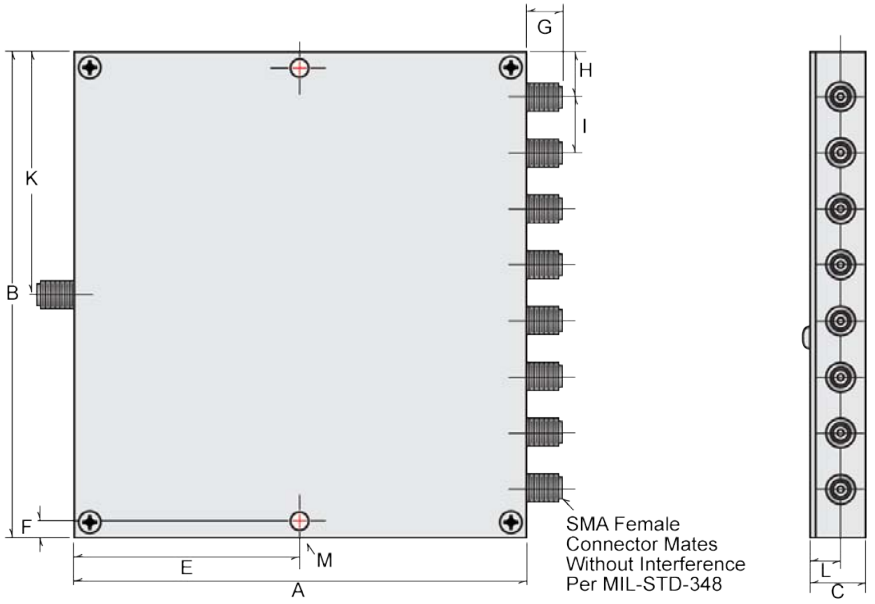
SMA (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)



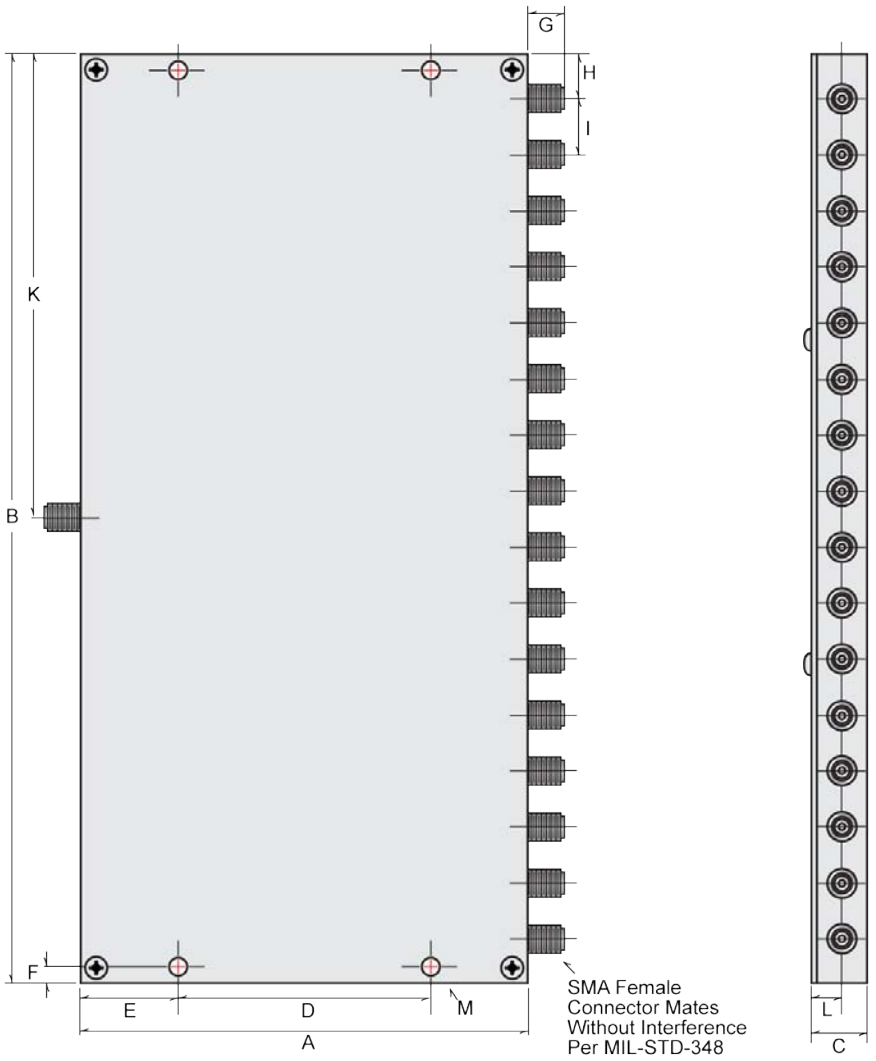
Outline Drawings For Models : 4162-8

Units	A	B	C	E	F	G	H	I	K	L	M (Dia.)
4162-8											
in.	4.00	4.30	0.50	2.00	0.15	0.30	0.40	0.50	2.15	0.25	0.15
mm	101.60	109.22	12.70	50.80	3.81	7.62	10.16	12.70	54.61	6.35	3.81

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (F) 0.8 to 2.5 GHz 30 Watt (Wireless Applications)



Outline Drawings For Models : 4162-16

Units	B	C	D	E	F	G	H	I	K	L	M
4162-16											
in.	4.00	8.30	0.50	2.25	0.90	0.15	0.30	0.40	0.50	4.15	0.25	0.15
mm	101.60	210.82	12.70	57.15	22.86	3.81	7.62	10.16	12.70	105.41	6.35	3.81

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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TERMINATIONS

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microwave-east

an L3 communications company

Quick Reference Guide

Frequency Range (GHz)	Connector	Model No.
DC-50	2.4 mm	6378M
DC-40	2.9 mm	4388M
DC-26.5	SMA	4380M
DC-18	SMA	4370DM
DC-18	SMA	4379BM
DC-18	SMA	4378BM
DC-18	SMA	4375GM
DC-18	Type N	378NM
DC-18	Type N	370BNM
DC-18	Type N	379BNM
DC-18	Type N	377BNM
DC-18	Type N	375BNM
DC-18	Type N	374BNM
0.7-18	Type N	369BNM
2-18	Type N	367NM
2-18	Type N	368BNM
DC-12.4	Type N	376BNM
DC-8	SMA	4377BM

Types of Terminations

Narda offers a large variety of coaxial and waveguide terminations and dummy loads which meet the requirements of all microwave measurement systems and most other applications for high quality loads. The many types of coaxial fixed terminations range from small ½ watt instrument loads to 500 watt loads to terminate high power transmitters. Medium power loads (10 to 40 watts with low VSWR) are used in many system and measurement applications. High power dummy loads with cooling fins of unique design provide optimum dissipation of large amounts of microwave power.

Criteria for Selecting Terminations

Criteria which should be evaluated for selecting terminations, whether fixed or tuneable, are frequency range, power handling capabilities, reflection coefficient, connectors and cost.

Frequency Range

Narda coaxial terminations are generally available in two types: a resistive matched load which offers an excellent impedance match to 50 ohms over the DC 12.4, 18, 26.5 or 50 GHz range; and an absorptive load which offers superior VSWR performance in the 0.7 or 2 to 18 GHz range but does not operate down to DC.

Power Handling

Terminations are rated according to the amount of power they can dissipate at a specific ambient temperature. These parameters are included in the basic electrical specifications. A termination which is used at a higher power level or higher ambient temperature than it is rated may either burn out or suffer irreversible changes from excessive heat which it fails to dissipate. When terminations are to be used at higher ambient temperatures than specified, the maximum power handling capability must be decreased in accordance with a derating curve. Derating curves are available for most series of terminations.

In most applications, heat leaves the termination by convection and/or radiation. Low and medium power loads (up to 200 W) do not rise to a temperature for which radiation is the major factor. Terminations in this power range, therefore, are designed with appropriate fin surfaces, in a manner to pass air freely around and through the fins. For higher power levels, up to the kilowatt range, radiation is predominant. Fins and external surfaces are designed to radiate heat away from the load. All high power loads and many medium power loads rise to a temperature too hot to touch, and may rise to a level where special safety precautions are required. Above these power levels, liquid cooling is used.

Terminations Used with Adapters

It would seem simple enough to select a termination for either waveguide or coaxial use and to add an adapter, but this is a practice which should be discouraged. The introduction of an adapter between the main transmission line and the termination adds

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physical discontinuities and, therefore, increases the reflections of main line power. Also, may adapters cannot handle power in the 100-500 watt range.

The type of connector should be suitable to mate with the transmission line or device to be terminated. Narda offers a complete line of terminations in SMA, N, 2.9, and 3.5 mm, with average power ratings from 0.5 to 2000 watts. Terminations with the popular N and SMA connectors are widely used in commercial and military systems as well as in bench test applications.

Reflection Coefficient (VSWR)

Reflection, as measured in VSWR (voltage standing wave ratio), is a measure of the return loss, or proportion of incident power that is reflected. The value required for a particular application is determined by the maximum allowable load VSWR of a generator, or by the accuracy required for a measurement.

2.92 mm (M) DC to 40 GHz 2 Watt (Low Power)

Features

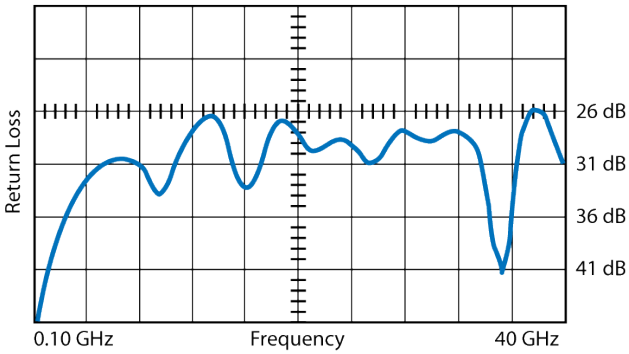
- DC-50 GHz
- Miniature Size
- Low VSWR
- SMA Compatible (2.92 mm only)

Models

- 4388M

Model	4388M
Low Frequency (GHz)	DC
High Frequency (GHz)	40.0
Average Power (W)	2.0
Peak Power (kW)	0.2
VSWR (max)	1.20
Impedance (Ohms)	50
Maximum Weight (oz)	0.16
Maximum Weight (gr)	4.5
Special Notes:	A

Special Notes:
A: Dimensions in parentheses are in millimeters and for reference only.



Typical Performance Curve
Model 4388M

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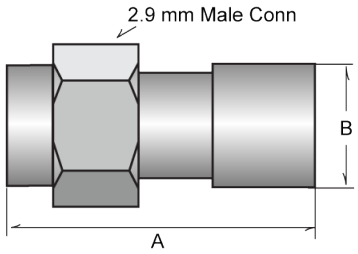
2.92 mm (M) DC to 40 GHz 2 Watt (Low Power)



Outline Drawings For Models : 4388M

Units	A	B
4388M		
in.	.75	.28
mm	19.05	7.11

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (M) and 3.5 mm (M) DC to 26.5 GHz (Low/Medium Power)

Features

- Low VSWR
- Operation to 26.5 GHz
- 10W, 5W and .5W models

Models

- 4377BM, 4370DM, 4379BM, 4378BM, 4375GM, 4380M

Model	4377BM	4370DM	4379BM
Low Frequency (GHz)	DC	DC	DC
High Frequency (GHz)	8.0	18.0	18.0
Average Power (W)	5.0	0.5	0.5
Peak Power (kW)	2	1	1
VSWR (max) DC-8 GHz	1.05 + .015f*	N/A	N/A
VSWR (max) DC-18 GHz	N/A	1.05 + .010f*	1.05 + .005f*
VSWR (max) 18-26.5 GHz	N/A	N/A	N/A
Maximum Weight (oz)	3.0	0.1	0.1
Maximum Weight (gr)	85	3	3
Connector Type	Type SMA Male	Type SMA Male	Type SMA Male
Special Notes:	A	A	A

Special Notes:
A: f* = Frequency in GHz.

Model	4378BM	4375GM	4380M
Low Frequency (GHz)	DC	DC	DC
High Frequency (GHz)	18.0	18.0	26.5
Average Power (W)	5.0	10.0	0.5
Peak Power (kW)	2	2	1
VSWR (max) DC-8 GHz	N/A	N/A	N/A
VSWR (max) DC-18 GHz	1.05 + .015f*	1.05 + .015f*	1.05 + .0075f*
VSWR (max) 18-26.5 GHz	N/A	N/A	1.25
Maximum Weight (oz)	3.0	4.0	0.2
Maximum Weight (gr)	85	115	6
Connector Type	Type SMA Male	Type SMA Male	3.5 mm Male
Special Notes:	A	A	A

Special Notes:
A: f* = Frequency in GHz.

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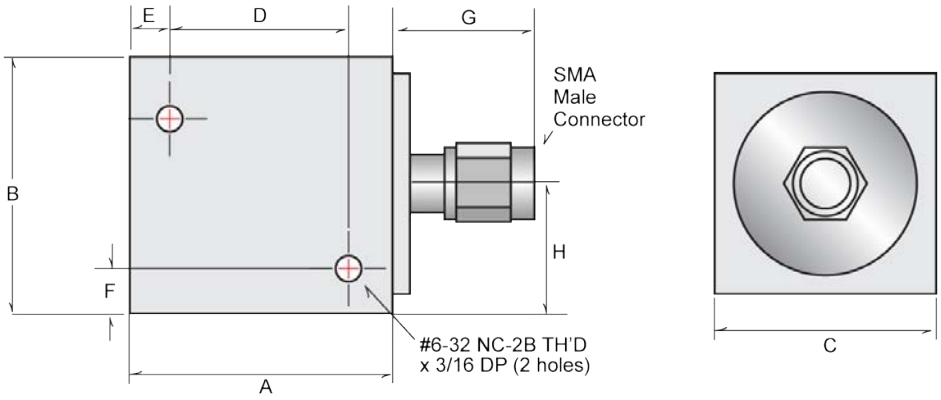
SMA (M) and 3.5 mm (M) DC to 26.5 GHz (Low/Medium Power)

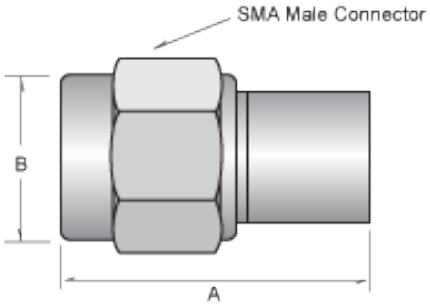


Outline Drawings For Models : 4377BM, 4378BM

Units	A	B	C	D	E	F	G	H
4377BM , 4378BM								
in.	1.125	1.00	1.00	.812	.187	.187	.60	.50
mm	28.575	25.40	25.40	20.625	4.750	4.750	15.24	12.70

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.



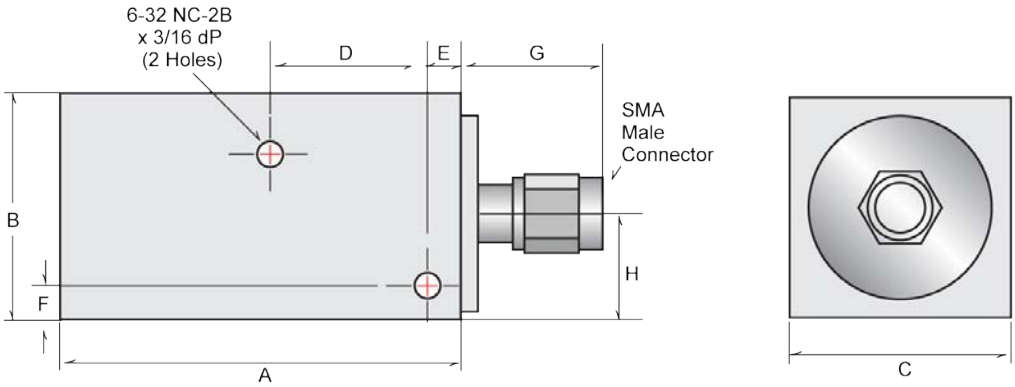
Outline Drawings For Models : 4370DM, 4379BM

Units	A	B
4370DM , 4379BM		
in.	.75	.31
mm	19.05	7.87

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

SMA (M) and 3.5 mm (M) DC to 26.5 GHz (Low/Medium Power)

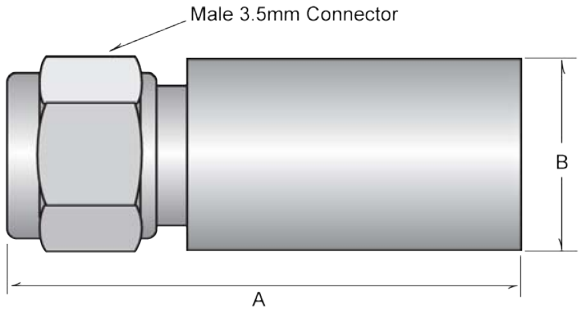


Outline Drawings For Models : 4375GM

Units	A	B	C	D	E	F	G	H
4375GM								
in.	2.00	1.0	1.00	.812	.187	.187	.50	.50
mm	50.80	25.4	25.40	20.625	4.750	4.750	12.70	12.70

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.



Outline Drawings For Models : 4380M

Units	A	B
4380M		
in.	1.02	.40
mm	25.91	10.16

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing.

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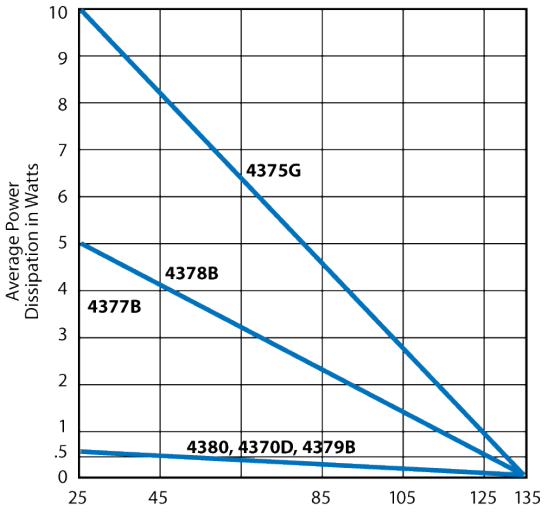
SMA (M) and 3.5 mm (M) DC to 26.5 GHz (Low/Medium Power)



Derating Curve

Type N (M) DC to 18 GHz (Low/Medium Power)

Features

- Low VSWR
- Broadband
- Medium Power, Superior Performance 40W, 20W, 10W, 5W, and 1W Models

Models

- 376BNM, 378NM, 370BNM, 379BNM, 377BNM, 375BNM, 374BNM, 367NM

Model	376BNM	378NM	370BNM	379BNM
Low Frequency (GHz)	DC	DC	DC	DC
High Frequency (GHz)	12.4	18.0	18.0	18.0
Average Power (W)	40	1	5	5**
Peak Power (kW)	7.5	1	2	2
VSWR (max)	1.10 + .025f*	1.04 + .003f*	1.05 + .015f*	1.05 + .010f*
Maximum Weight (oz)	10	3	3	3
Maximum Weight (gr)	283	85	85	85
Special Notes:	A , B	A , B	A , B	A , B

Special Notes:
A: f* denotes frequency in GHz.
B: Power rating is specified at 25° and free air convection at atmospheric (760mm) pressure. Derate power capability linearily from stated value at 25°C to 0 watts at 135°C.

Model	377BNM	375BNM	374BNM	367NM
Low Frequency (GHz)	DC	DC	DC	2.0
High Frequency (GHz)	18.0	18.0	18.0	18.0
Average Power (W)	5**	10	20	40
Peak Power (kW)	2	5	5	5
VSWR (max)	1.05 + .005f*	1.05 + .015f*	1.05 + .015f*	1.07 + .005f*
Maximum Weight (oz)	3	3	5	9
Maximum Weight (gr)	85	85	142	255
Special Notes:	A , B	A , B	A , B	A , B

Special Notes:
A: f* denotes frequency in GHz.
B: Power rating is specified at 25° and free air convection at atmospheric (760mm) pressure. Derate power capability linearily from stated value at 25°C to 0 watts at 135°C.

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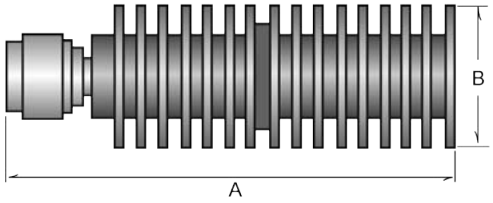
Type N (M) DC to 18 GHz (Low/Medium Power)



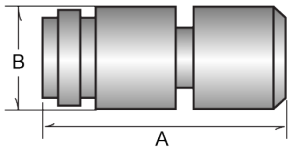
Outline Drawings For Models : 376BNM, 374BNM, 367NM

Units	A	B
376BNM		
in.	5.07	1.66
mm	128.78	42.16
374BNM		
in.	2.44	1.28
mm	61.98	32.51
367NM		
in.	7.57	1.78
mm	192.28	45.21

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing. For Typical VSWR Curves proceed to the end of this section.

Type N (M) DC to 18 GHz (Low/Medium Power)



Outline Drawings For Models : 378NM, 370BNM, 379BNM, 377BNM

Units	A	B
378NM		
in.	1.88	.72
mm	47.75	18.29
370BNM , 379BNM, 377BNM		
in.	1.67	.72
mm	42.42	18.29

Notes:

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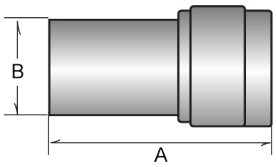
Type N (M) DC to 18 GHz (Low/Medium Power)



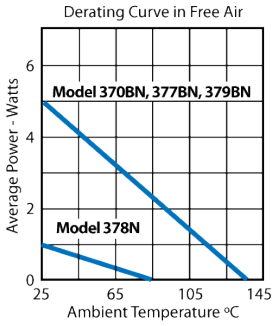
Outline Drawings For Models : 375BNM

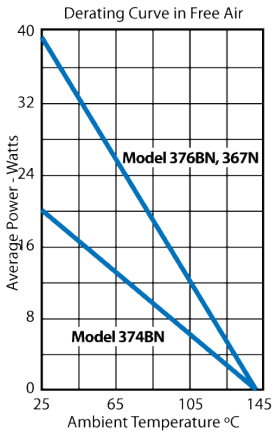
Units	A	B
	375BNM	
in.	1.61	0.70
mm	40.89	17.78

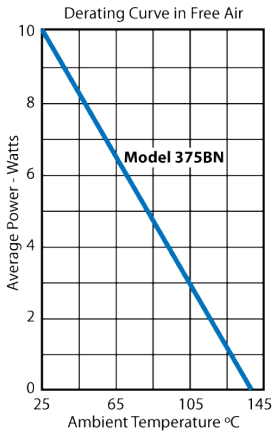
Notes:

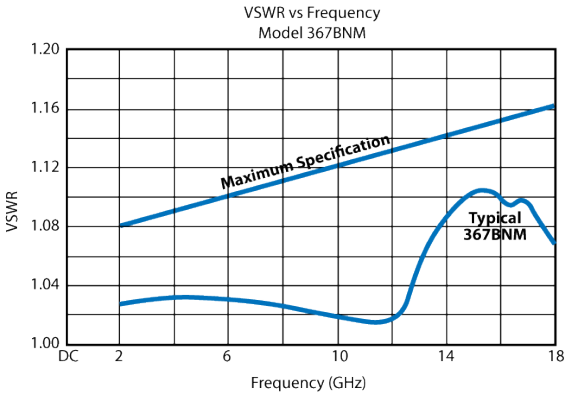
Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing. For Typical VSWR Curves proceed to the end of this section.

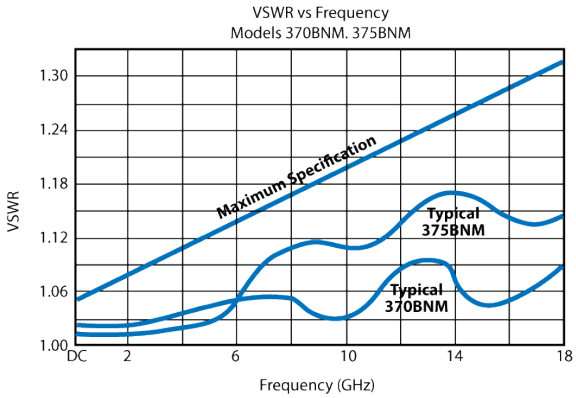
Type N (M) DC to 18 GHz (Low/Medium Power)

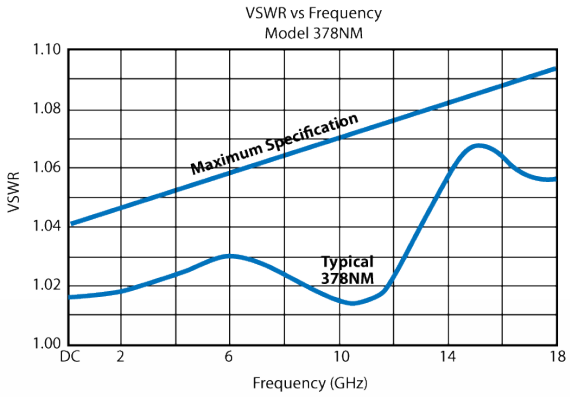












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Type N 0.7 to 18 GHz (High Power)

Features

- Low VSWR
- Broadband
- High Power, 500 Watts Capability
- Precision Type N Connectors

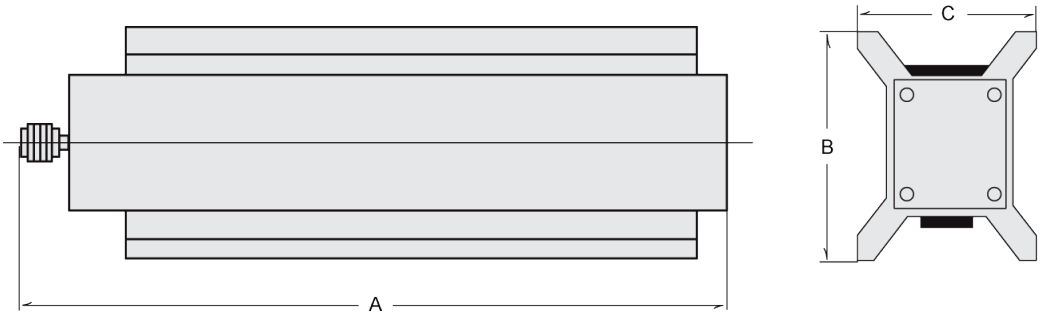
Models

- 369BNM, 368BNM

Model	369BNM	368BNM
Low Frequency (GHz)	0.7	2.0
High Frequency (GHz)	18.0	18.0
Average Power (W)	175	500
Peak Power (kW)	10	5
VSWR (max) 0.7-1 GHz	1.20	N/A
VSWR (max) 1-9 GHz	1.10	N/A
VSWR (max) 9-18 GHz	1.20	N/A
VSWR (max) 2-3 GHz	N/A	1.40
VSWR (max) 3-12.4 GHz	N/A	1.30
Weight (max) in lbs	N/A	N/A
Weight (max) in kg	N/A	N/A
Special Notes:	A , B	A , B

Special Notes:
A: Connectors: Type N, other connector configurations on special order.
B: Important Note: Power rating is specified at 25° and free air convection at atmospheric (760mm) pressure. Derate power capability linearly from stated value at 25° C to 0 watts at 170° C for Model 369 and 200° C for Model 368 Series.

Type N 0.7 to 18 GHz (High Power)



Outline Drawings For Models : 368BNM

Units	A	B	C
368BNM			
in.	13.02	3.88	3.09
mm	330.71	98.55	78.49

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing. See the following page for typical VSWR curves.

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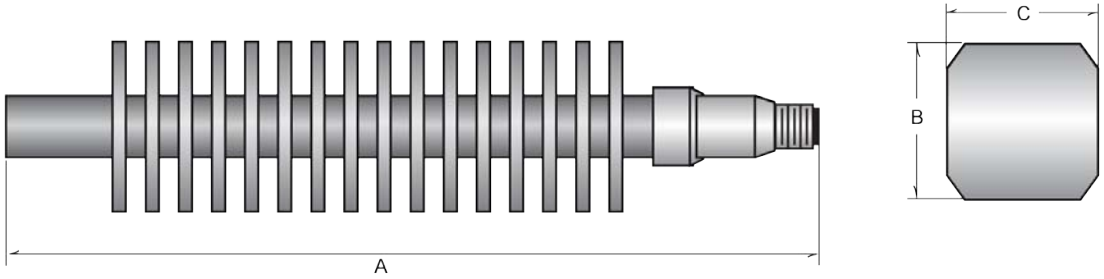
Type N 0.7 to 18 GHz (High Power)

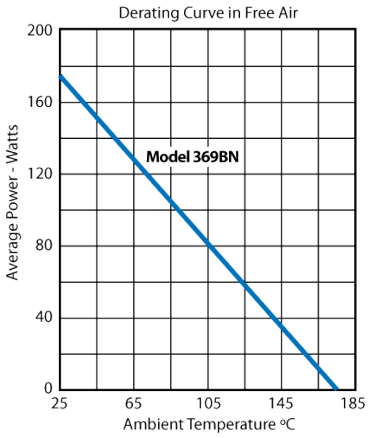


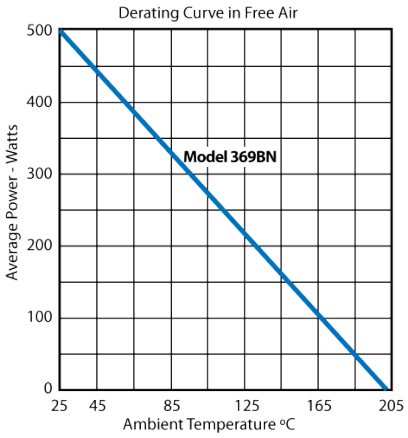
Outline Drawings For Models : 369BNM

Units	A	B	C
	369BNM		
in.	13.02	2.40	2.40
mm	330.71	60.96	60.96

Notes:

Unless otherwise specified dimensions are max. and for reference only. Contact the factory for detailed specifications and outline drawing. See typical VSWR curves below.





Typical Performance Curves

Type N (M) DC-6 GHz 2W through 100W

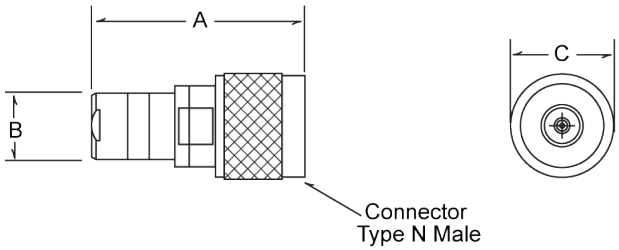
Features

- For Commercial Wireless Applications
- 1 Watt to 100 Watts Average Power
- Excellent VSWR Performance
- Average Power Handling DC-6 GHz @ 1 W to
- 100 W, DC-18 GHz @ 1 W

Models

- T-N-17-6-2, T-N-17-6-5, T-N-17-6-35, T-N-17-6-50, T-N-17-6-100

Model	T-N-17-6-2	T-N-17-6-5	T-N-17-6-35	T-N-17-6-50	T-N-17-6-100
VSWR (max) 3-6 GHz	1.2:1	1.2:1	1.25:1	1.25:1	1.35:1
Average Power (W)	2W average @ +25° C	5W average @ +25° C	35W average @ +25° C	50W average @ +25° C	100W average @ +25° C
Impedance (Ohms)	50	50	50	50	50
Connectors (RF)	Type N Male	Type N Male	Type N Male	Type N Male	Type N Male
Frequency Range (GHz)	DC-6	DC-6 GHz	DC-6 GHz	DC-6	DC-6



Outline Drawings For Models : T-N-17-6-2

Units	A	B	C
T-N-17-6-2			
in.	1.63	0.50	0.81
mm	41.40	12.70	20.57

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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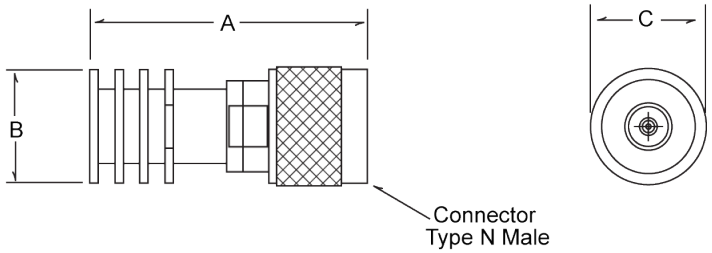
Type N (M) DC-6 GHz 2W through 100W

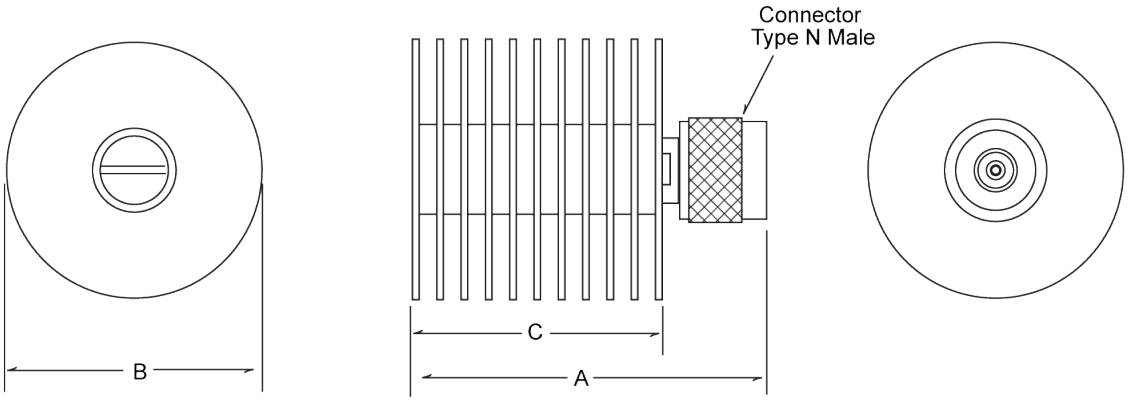


Outline Drawings For Models : T-N-17-6-5

Units	A	B	C
T-N-17-6-5			
in.	1.91	0.78	0.81
mm	48.51	19.81	20.57

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.



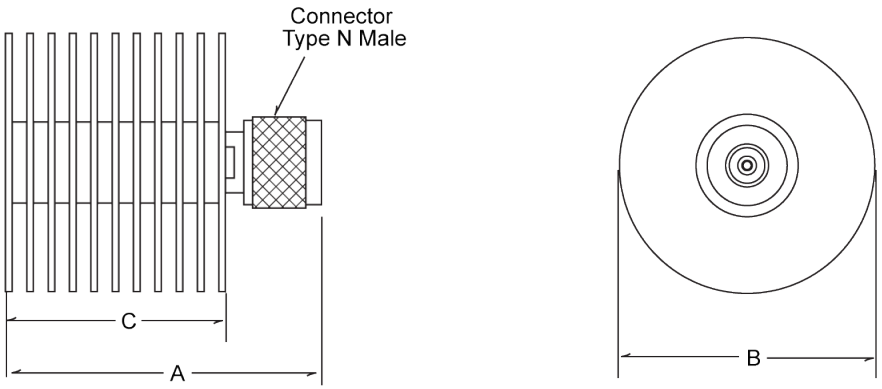
Outline Drawings For Models : T-N-17-6-35

Units	A	B	C
T-N-17-6-35			
in.	2.81	2.00	1.94
mm	71.37	50.80	49.28

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

Type N (M) DC-6 GHz 2W through 100W



Outline Drawings For Models : T-N-17-6-50

Units	A	B	C
T-N-17-6-50			
in.	2.81	2.25	1.94
mm	71.37	57.15	49.28

Notes:

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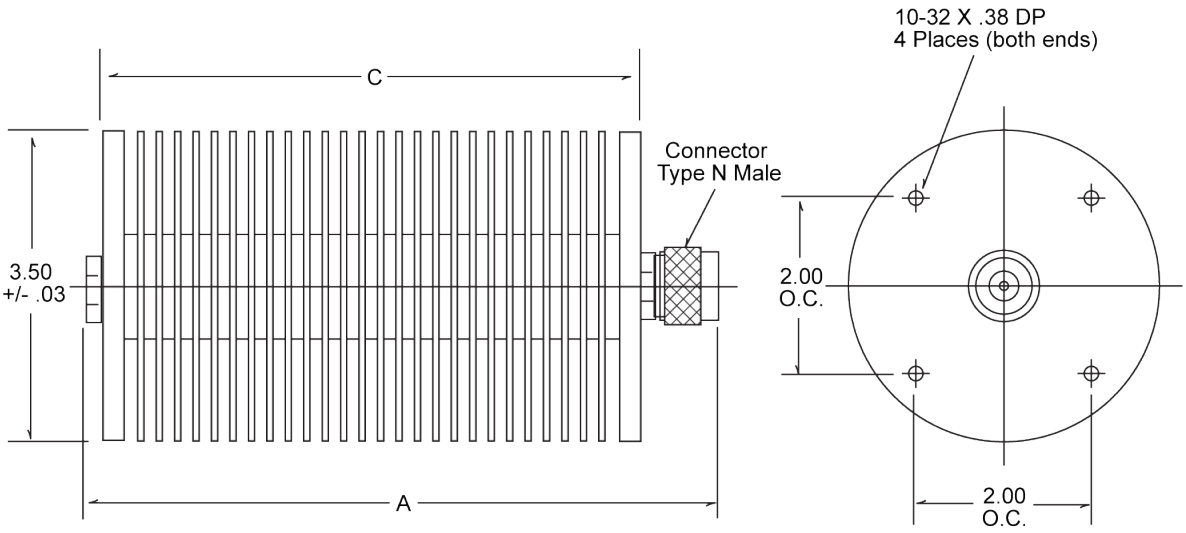
Type N (M) DC-6 GHz 2W through 100W



Outline Drawings For Models : T-N-17-6-100

Units	A	C
	T-N-17-6-100	
in.	7.22	6.13
mm	183.39	155.70

Notes:

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WAVEGUIDE

narda
microwave-east

an L3 communications company

Frequency Range (GHz)*	Model No.
Coaxial to Waveguide Adapters - Type N	
2.60-3.95	614A
3.95-5.95	613A
5.85-8.20	612A
8.20-12.4	601A
12.4-18.0	609
Coaxial to Waveguide Adapters - SMA, 3.5 mm and 2.9 mm	
5.85-8.2	4602
8.21-12.4	4601
12.4-18.0	4609
18.0-26.5	4608B
26.5-40	V4607
Standard Gain Horns	
2.60-3.95	644
3.95-5.85	643
5.4-8.20	642
8.20-12.4	640
12.4-18.0	639
18.0-26.5	638
26.5-40.0	V637

*For Band Designation, see table below.

Band Designations

Band (GHz)	Waveguide Size	Band Letters and Codes In Use
1.12 - 1.7	WR-650	D, L
1.7 - 2.6	WR-430	D, LS, M, R
2.6 - 3.95	WR-284	S
3.95 - 5.85	WR-187	C, G, H
5.4 - 8.2	WR-137	A, C, G, J, XB, XN
7.05 - 10	WR-112	B, H, W, XB, XL
8.2 - 12.4	WR-90	X, XS
12.4 - 18	WR-62	G, Ku, P, U, Y
18 - 26.5	WR-42	K
26.5 - 40	WR-28	A, Ka, R, T, U, Y

As an ISO9001: 2000 company, each Narda waveguide product is manufactured to L-3 Communications' Quality Assurance Program. Test and measurement staff use the latest automatic network analysis equipment which includes several systems that operate to 40 and 50 GHz. The high power test facility provides both broadband, high continuous wave (CW) power and peak power test capability under the most severe environmental conditions. Power test capability to 15 kW peak and 150 W CW are also available. Narda's test facilities and expertise in manufacturing and design ensures the delivery of an exceptional microwave product.

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Quick Reference Guide

Waveguide to Type N Female 2.6 to 18 GHz

Features

- Low VSWR
- Low Insertion Loss
- Lightweight

Models

- 614A, 613A, 612A, 601A, 609

Model	614A	613A	612A	601A	609
Low Frequency (GHz)	2.6	3.95	5.85	8.20	12.4
High Frequency (GHz)	3.95	5.85	8.20	12.4	18.0
Band	S*	C*	XN*	X*	Ku*
Waveguide Size	WR-284	WR-187	WR-137	WR-90	WR-62
Flange Type	Cover	Cover	Cover	Cover	Cover
Flange (Equivalent to)	UG-584/U	UG-407/U	UG-441/U	UG-135/U	UG-419/U
VSWR (max)	1.25	1.25	1.35	1.25	1.50
Weight (max) in lbs	1.30	0.30	0.30	0.10	0.25
Weight (max) in kg	2.80	0.50	0.50	0.25	0.10
Connector	Type N	Type N	Type N	Type N	Type N
Special Notes:	A	A	A	A	A

Special Notes:
A: *For a complete listing of all band letters and codes in use, refer to Band Designation Table on the following page.

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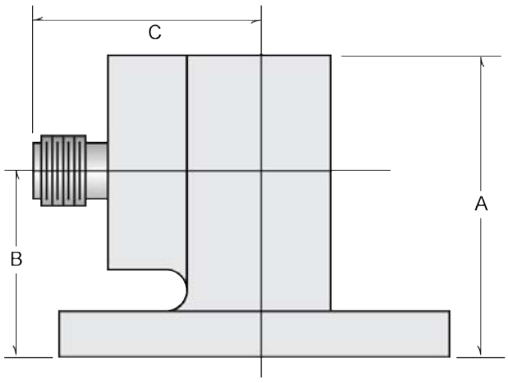
Waveguide to Type N Female 2.6 to 18 GHz

Band (GHz)	Waveguide Size	Band Letters And Codes In Use
1.12-1.7	WR-650	D, L
1.7-2.6	WR-430	D, LS, M, R
2.6-3.95	WR-284	S
3.95-5.85	WR-187	C, G, H
5.4-8.2	WR-137	A, C, G, J, XB, XN
7.05-10	WR-112	B, H, W, XB, XL
8.2-12.4	WR-90	X, XS
12.4-18	WR-62	G, Ku, P, U, Y
18-26.5	WR-42	K
26.5-40	WR-28	A, ,Ka, R, T, U, Y

Band Designation Table

Waveguide to Type N Female 2.6 to 18 GHz



Outline Drawings For Models : 614A, 613A, 612A, 601A, 609

Units	A	B	C
614A			
in.	2.52	1.66	1.75
mm	64.01	42.16	44.45
613A			
in.	2.02	1.36	1.52
mm	51.31	34.54	38.61
612A			
in.	1.77	1.25	1.52
mm	44.96	31.75	38.61
601A			
in.	1.22	0.80	1.52
mm	30.99	20.32	38.61
609			
in.	1.48	1.10	1.34
mm	37.59	27.94	34.04

Notes:

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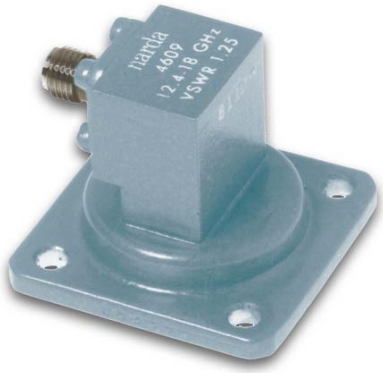
Waveguide to SMA, 3.5mm and 2.92 mm Female 5.85 to 40 GHz



Features

- Low VSWR
- Low Insertion Loss
- Lightweight
- Precision Coaxial Connectors Either SMA, 3.5mm or 2.9mm

Models

- 4602, 4601, 4609, 4608B, V4607

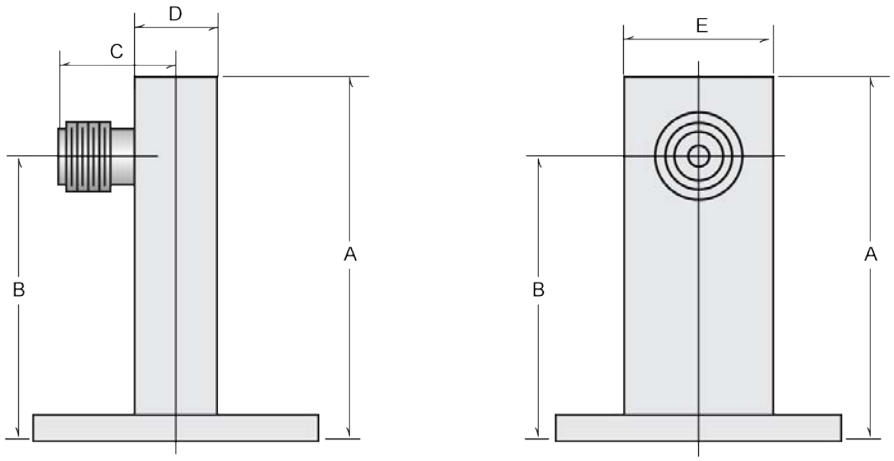
Model	4602	4601	4609	4608B	V4607
High Frequency (GHz)	5.85	8.2	12.4	18.0	26.5
Low Frequency (GHz)	8.2	12.4	18.0	26.5	40.0
Band	C*	X*	Ku*	K*	Ka*
Waveguide Size	WR-137	WR-90	WR-62	WR-42	WR-28
Flange Type	Cover	Cover	Cover	Cover	Cover
Flange (Equivalent to)	UG-441/U	UG-135/U	UG-418/U	UG-595/U	UG-599/U
VSWR (max)	1.1	1.25	1.25	1.25	1.20
Maximum Weight (oz)	6	4.0	4.0	4.0	2
Maximum Weight (gr)	171	113	113	113	60
Connector	Type SMA-F	Type SMA-F	Type SMA-F	Type 3.5mm F	2.92 mm F
Special Notes:	A	A	A	A	A

Special Notes:
A: *For a complete listing of all band letters and codes in use, refer to Band Designation Table on the following page.

Waveguide to SMA, 3.5mm and 2.92 mm Female 5.85 to 40 GHz

Band (GHz)	Waveguide Size	Band Letters And Codes In Use
1.12-1.7	WR-650	D, L
1.7-2.6	WR-430	D, LS, M, R
2.6-3.95	WR-284	S
3.95-5.85	WR-187	C, G, H
5.4-8.2	WR-137	A, C, G, J, XB, XN
7.05-10	WR-112	B, H, W, XB, XL
8.2-12.4	WR-90	X, XS
12.4-18	WR-62	G, Ku, P, U, Y
18-26.5	WR-42	K
26.5-40	WR-28	A, ,Ka, R, T, U, Y

Band Designation Table



Outline Drawings For Models : 4602

Units	A	B	C	D	E
4602					
in.	2.65	2.03	1.13	0.81	0.360
mm	67.31	51.56	28.70	20.57	9.144

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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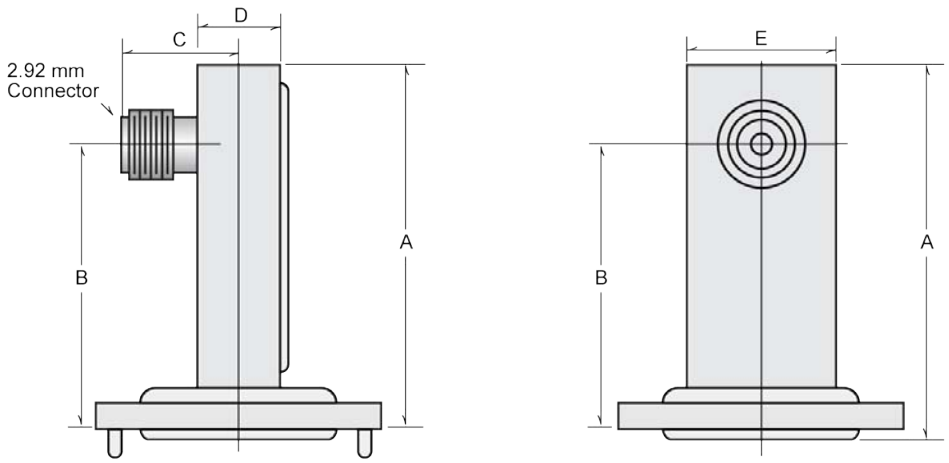
Waveguide to SMA, 3.5mm and 2.92 mm Female 5.85 to 40 GHz



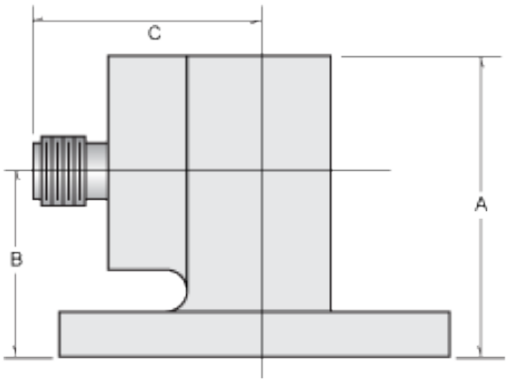
Outline Drawings For Models : V4607

Units	A	B	C	D	E
V4607					
in.	1.49	1.23	0.55	0.22	0.36
mm	37.85	31.24	13.97	5.59	9.14

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

Waveguide to SMA, 3.5mm and 2.92 mm Female 5.85 to 40 GHz



Outline Drawings For Models : 4601, 4609, 4608B

Units	A	B	C
4601			
in.	1.22	0.80	0.83
mm	30.99	20.32	21.08
4609			
in.	1.02	0.77	0.71
mm	25.91	19.56	18.03
4608B			
in.	1.01	0.75	0.77
mm	25.65	19.05	19.56

Notes:

Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

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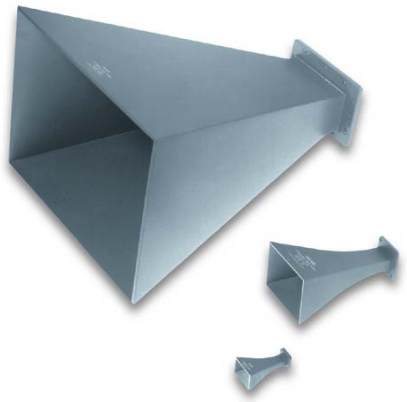
Quick Reference Guide

Standard Gain Horns 2.60 to 40 GHz



Features

- Primary Standard of Antenna Gain
- 7 Models Cover from 2.60 GHz to 40 GHz

Models

- 644, 643, 642, 640, 639, 638, V637

Model	644	643	642	640
Low Frequency (GHz)	2.6	3.95	5.4	8.2
High Frequency (GHz)	3.95	5.9	8.2	12.4
Band	S*	C*	XN*	X*
Waveguide Size	WR-284	WR-187	WR-137	WR-90
Input Cover Flange Equivalent	UG-584/U	UG-407/U	UG-441/U	UG-135/U
VSWR (max)	1.15	1.15	1.15	1.15
Weight (max) in lbs	6	2.30	1	0.50
Weight (max) in kg	2.80	1.10	0.50	0.23
Special Notes:	A , B	A , B	A , B	A , B

Special Notes:
A: *For a complete listing of all band letters and codes in use, refer to Band Designation Table.

Patterns for all models in this series conform to the following description: Beam width in E and H plane varies from 23° at the highest frequency to 34° at the lowest frequency. Side lobes in the H plane are all more than 20 dB down. First side lobes in the E plane are 13 dB down, second side lobes are 18 dB down and all other E plane lobes are more than 20 dB down.

Gain at Mid Frequency; 16.5 dB (with reference to isotropic radiation) variation is 1.5 dB over total band about the mid band value.

See Waveguide Flange Data on the following pages for flange detail.
B: See Standard Gain Horns Charts at the end of this section.

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Standard Gain Horns 2.60 to 40 GHz

Model	639	638	V637
Low Frequency (GHz)	12.4	18.0	26.5
High Frequency (GHz)	18.0	26.5	40.0
Band	KU*	K*	V*
Waveguide Size	WR-62	WR-42	WR-28
Input Cover Flange Equivalent	UG-419/U	UG-595/U	UG-599/U
VSWR (max)	1.15	1.15	1.15
Weight (max) in lbs	0.20	0.20	0.10
Weight (max) in kg	0.10	0.10	0.05
Special Notes:	A , B	A , B	A

Special Notes:
A: *For a complete listing of all band letters and codes in use, refer to Band Designation Table.

Patterns for all models in this series conform to the following description: Beam width in E and H plane varies from 23° at the highest frequency to 34° at the lowest frequency. Side lobes in the H plane are all more than 20 dB down. First side lobes in the E plane are 13 dB down, second side lobes are 18 dB down and all other E plane lobes are more than 20 dB down.

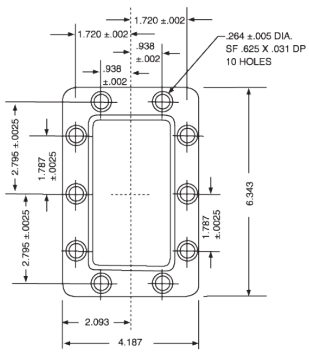
Gain at Mid Frequency; 16.5 dB (with reference to isotropic radiation) variation is 1.5 dB over total band about the mid band value.

See Waveguide Flange Data on the following pages for flange detail.
B: See Standard Gain Horns Charts at the end of this section.

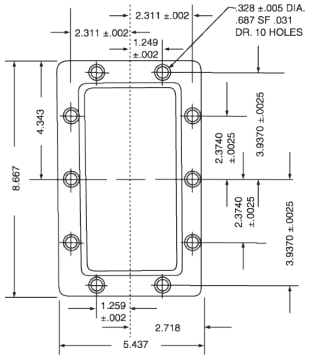
Band (GHz)	Waveguide Size	Band Letters And Codes In Use
1.12-1.7	WR-650	D, L
1.7-2.6	WR-430	D, LS, M, R
2.6-3.95	WR-284	S
3.95-5.85	WR-187	C, G, H
5.4-8.2	WR-137	A, C, G, J, XB, XN
7.05-10	WR-112	B, H, W, XB, XL
8.2-12.4	WR-90	X, XS
12.4-18	WR-62	G, Ku, P, U, Y
18-26.5	WR-42	K
26.5-40	WR-28	A, ,Ka, R, T, U, Y

Band Designation Table

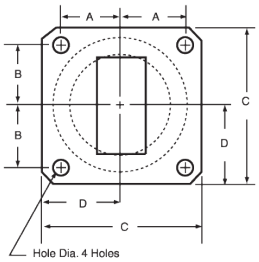
Standard Gain Horns 2.60 to 40 GHz



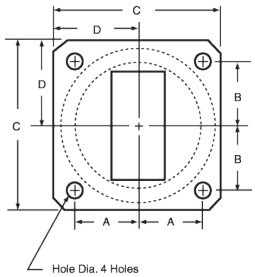
LS BAND



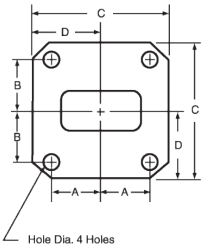
L BAND



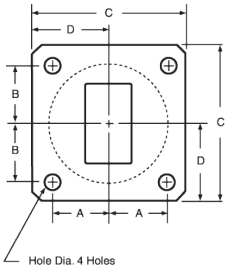
X BAND



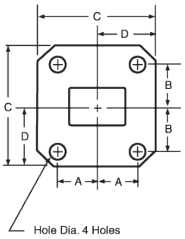
XB BAND



K BAND

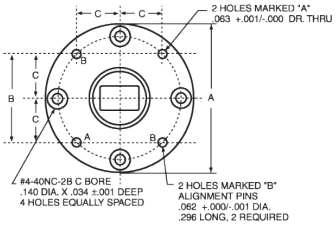


KU BAND



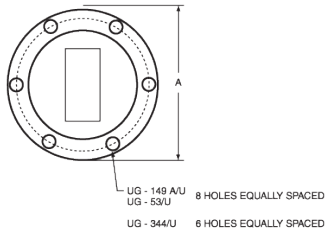
V BAND

BAND*	TYPE	A	B	C	D	HOLE DIA.
X	UG-39/U	.640	.610	1.625	.813	.169
XB	UG-51/U	.737	.676	1.875	.938	.169
K	UG-595/U	.320	.335	.875	.438	.116
KU	UG-419/U	.478	.497	.313	.656	.144
V	UG-599/U	.250	.265	.750	.375	.116



K, V, Q, M, E BAND

BAND*	TYPE	A	B	C
K	UG-425/U	1.125	.937	.331
V	UG-381/U	1.125	.937	.331
Q	UF-383/U	1.125	.937	.331
M	UF-385/U	.75	.562	.199
E	UG-387/U	.75	.562	.199



XN, C, S BAND

BAND*	TYPE	A	HOLE DIA.
S	UG-53/U	5.313	.257
C	UG-149A/U	3.625	.199

Waveguide Flange Data.
For a complete listing of all band letters and codes in use, refer to the Band Designation Table.

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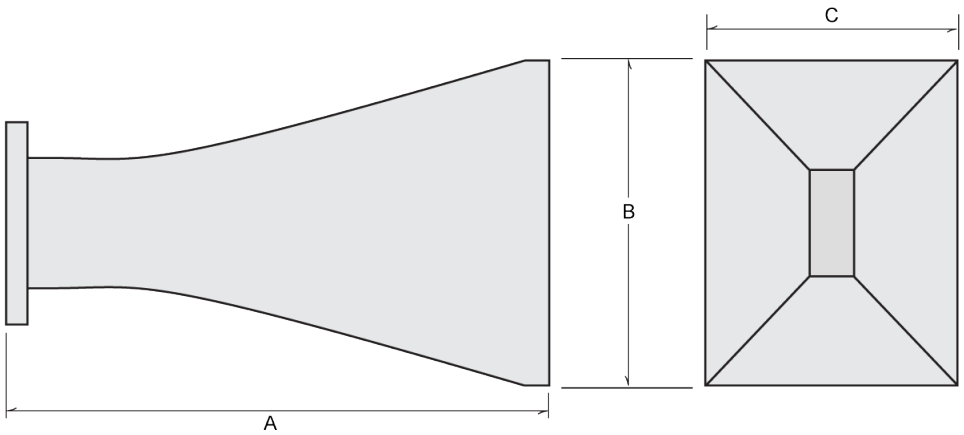
Standard Gain Horns 2.60 to 40 GHz



Outline Drawings For Models : 644, 643, 642, 640, 639, 638, V637

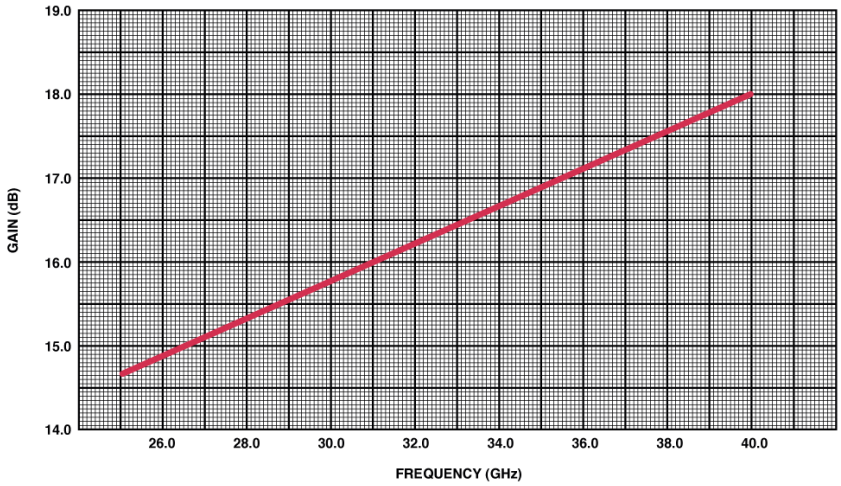
Units	A	B	C
644			
in.	15.82	9.52	7.16
mm	401.83	241.81	181.86
643			
in.	10.47	6.34	4.80
mm	265.94	161.04	121.92
642			
in.	7.76	4.67	3.53
mm	197.10	118.62	89.66
640			
in.	5.06	3.09	2.34
mm	128.52	78.49	59.44
639			
in.	3.48	2.20	1.73
mm	88.39	55.88	43.94
638			
in.	2.57	1.51	1.16
mm	65.28	38.35	29.46
V637			
in.	1.76	1.06	.82
mm	44.70	26.92	20.83

Notes:

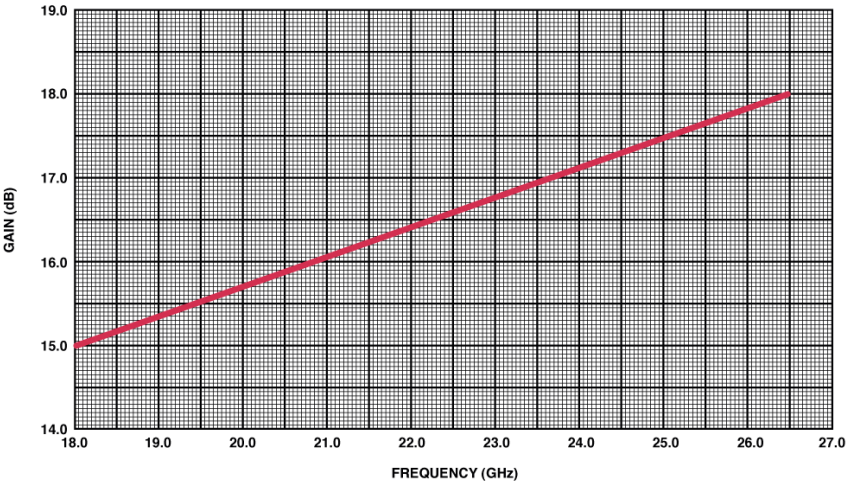
Dimensions are maximum and for reference only. Contact the factory for detailed specifications and outline drawing.

Standard Gain Horns 2.60 to 40 GHz

ABSOLUTE GAIN CALIBRATION
NARDA MODEL V637 STANDARD GAIN HORN



ABSOLUTE GAIN CALIBRATION
NARDA MODEL 638 STANDARD GAIN HORN



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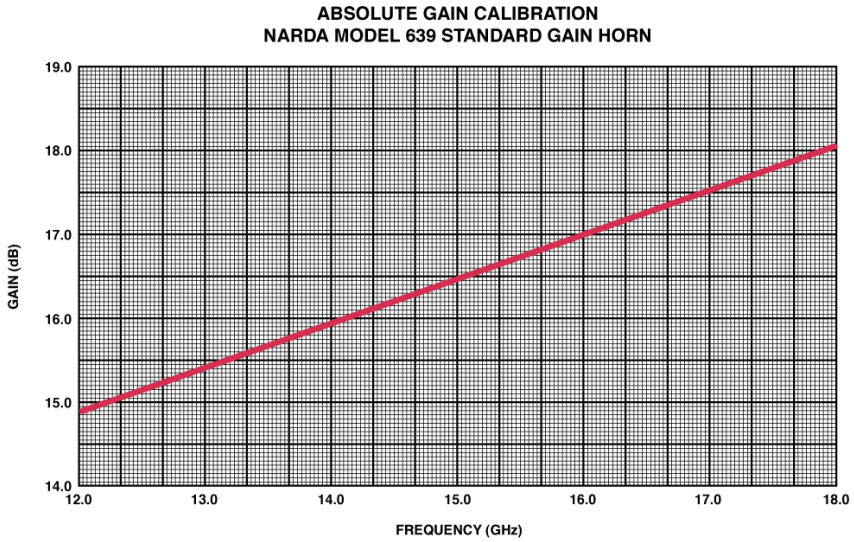
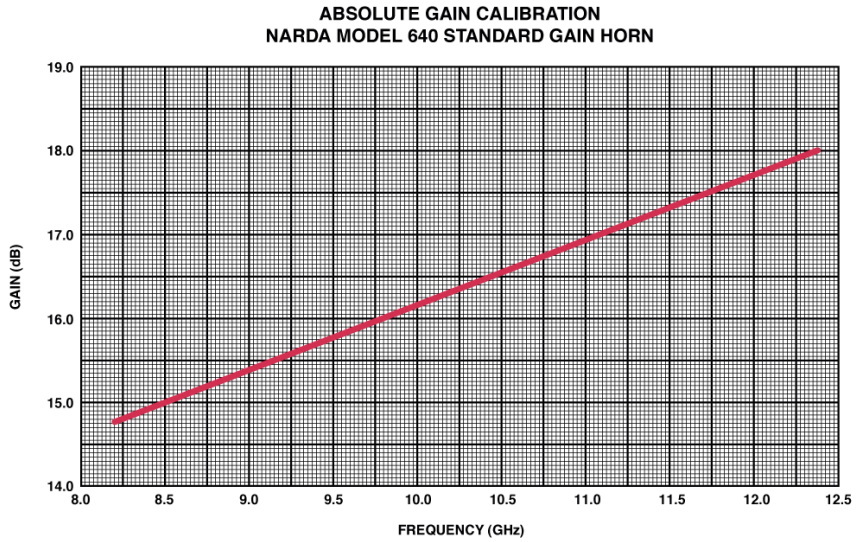
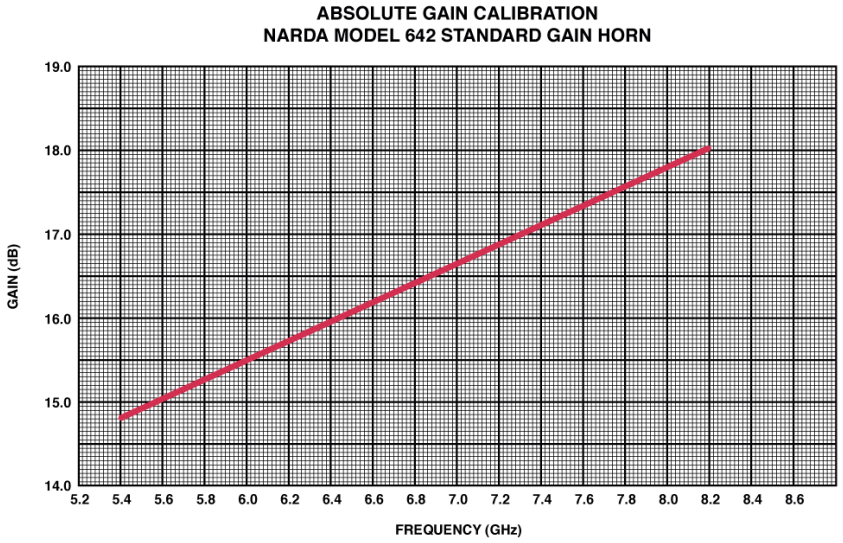
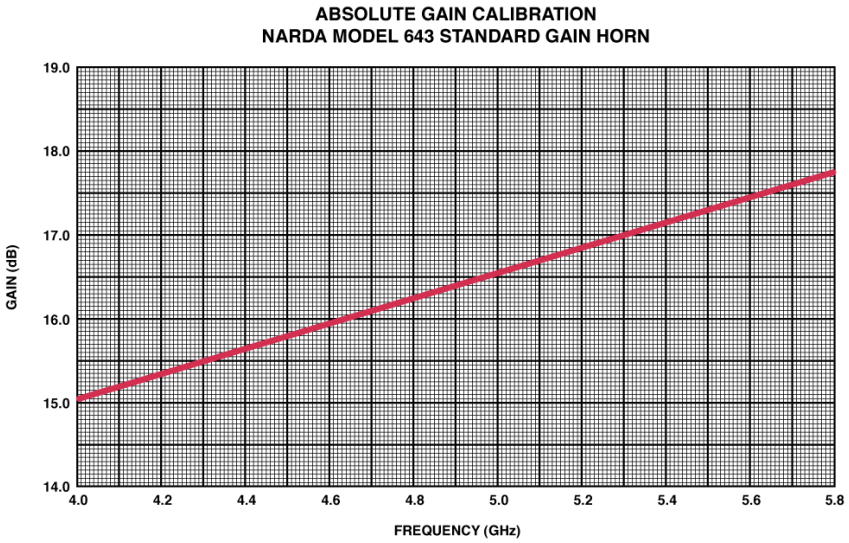
Standard Gain Horns 2.60 to 40 GHz





Standard Gain Horns 2.60 to 40 GHz





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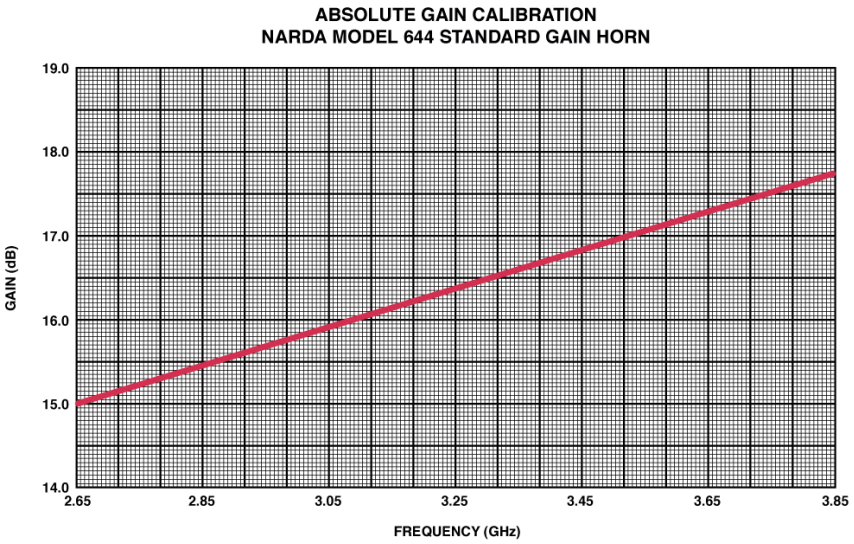

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RF SWITCHING PRODUCTS

narda
microwave-east

an L3 communications company

Table of Contents

Narda offers a complete line of RF/microwave electromechanical switches: stocked SEMs, standard custom-part, and one-of-a-kind custom.

All Narda switches offer exceptional reliability and performance. A unique actuator design enables Narda to guarantee operation of one-million to two-million cycles per switch position without noticeable performance degradation. This means:

No intermittent contacts in RF or indicator circuits

Operating reliability is complemented by RF specifications that equal or exceed industry standards.

The unique design of the coil and solenoid allows the solenoid to be actuated more than one million cycles.

These switches can also include a self-termination technique that does not require a separate RF cavity. All switches are designed to meet MIL-S-3928 are are fully compatible with both military and commercial logic integrated circuits.

After assembly, switches are tested for VSWR, insertion loss, and isolation. Individual switches are then cycled in each position in accordance with Narda's comprehensive test procedures to assure trouble-free operation. Before shipping, final testing is performed. In addition to electrical and mechanical testing, the switches are tested at greater than 10 megohms, 500 volts for DC resistance between the switch body, the terminal, and indicator circuitry.

Narda electromagnetic switches are available in single pole double throw (SPDT) through single pole twelve throw (SP12T), as well as transfer switch configurations. Standard options include four activation modes, 50-ohm terminations, and TTL logic circuits.

SEM models have either SMA or Type N connectors, indicator circuitry, solder-control terminals, 12, 24 or 28 Vdc actuating voltage, and a typical switching speed of 15 ms. TTL models include suppression diodes. Polarity is common positive for all pulse-latching models.

Custom-part switches and one-of-a-kind switches designed and manufactured to your specific requirements benefit from the same rigorous standards and environment maintained for our SEM switch line.

SEMs - Standard, Stocked Switches

Narda has brought its most popular custom switches into the mainstream by making them standard, stocked catalog products that are always available when you need them. These **S**tocked **E**lectro**M**echanical switches - or SEM switches - are the definitive answer to most switch requirements.

With more than forty distinct models, Narda's SEM switches address applications in many industries: ATE, satellite communications, wireless communications, avionics, and military (Radar/EW/communications and commercial test equipment).

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Standard, Custom Switches

Narda custom switches range from single-pole, double-throw configurations (SPDT) to single-pole, twelve-throw (SP12T) units, plus transfer switches.

Options include four different activation modes, all popular RF connector types, all common operating voltages, frequencies up to 26.5 GHz, and such special options as built-in 50-ohm terminations, self de-energizing circuits, indicator circuits, TTL logic circuits, MOSFET drivers and BCD decoders.

With this wide assortment of options, almost all requirements can be satisfied without resorting to the development of one-of-a-kind switches. If you have unique specifications. however, Narda is ready to design a switch that will precisely meet each of your parameters.

Extensive implementation of manufacturing and quality procedures, along with shop flow travelers, ensure that each step of the manufacturing process is completed correctly. Registration to ISO9001:2000 reflects our commitment to serving customers throughout the world.

Assemblies

In many instances, it may be advantageous to have Narda incorporate a specified switch into a Narda-designed assembly of high performance products, such as filters, amplifiers, power dividers, and couplers.

Like Narda switches, these assemblies will satisfy your most rigid performance requirements and will be manufactured, assembled, inspected and tested under the guidance and regulation of a quality assurance organization without industry equal.

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Quick Reference Guide

Glossary

SP2T – A single-pole, double-throw switch has one input port and two selectable output ports.

Multiposition Switch – A multiposition switch has one input port and more than two selectable output ports. Unlike some switches, Narda models can be switched directly to any one of the available output positions without sequencing through intervening positions.

Transfer Switch – A transfer switch has two independent paths that operate simultaneously in one of two selected positions.

Failsafe – The switch moves to the closed position when the actuating voltage is applied and always returns to a predetermined position when the voltage is removed.

Latching – Also called Pulse Latching, the switch remains in a preselected position whenever the actuating voltage is removed or interrupted and holds that preselected position until a voltage is applied to another position. This configuration must be pulse-controlled with a pulse width of 20 ms to 100 ms duration. Standard polarity is common positive.

Normally Open – All output ports of the switch are disconnected from the input port until a voltage is applied to a selected position.

Terminated Units – Each unused or open output RF port is internally terminated in a 50-ohm resistive load (1W CW max.).

TTL – Selected position of the switch is controlled by a TTL Logic High. The switch requires only nominal +28 Vdc (additional 5 Vdc is not required).

TTL Logic Voltage Level:
Low 0 to 0.8 Vdc High 2.5 to 5.0 Vdc
TTL Logic Input Current:
Low 0 mA High 1.6 mA max. @ 3.85 Vdc

TTL Units – Transistor-Transistor-Logic circuitry enables the status of the switch to be controlled by the level of TTL logic input.

Suppression Diodes – Fast-recovery silicon rectifiers (diodes) connected in parallel with the coils of the switch to suppress any transient voltage that may be generated by the coils.

Indicator Circuitry – A set of internally mounted contacts that allows external monitoring of switch RF status. Some switch series include a steering diode drive due to the electronic indicator.

Solder Terminal – A turret terminal is standard on all switches.

Self De-energizing Circuitry – With this option, a set of internally mounted contacts or electronically generated pulses disconnects the driver voltage as soon as RF contact has been made. This option is only available with latching type switches. Suppression diodes must be specified with this option.

Common Specifications:

- **RF Impedance: 50 ohms nominal**
- **Actuating Voltage: 28 Vdc**
- **Switching Time: 15 ms (max.)**
- **Switching Sequence: Break Before Make**
- **Operating Ambient Temp.: -35°C to +70°C**
- **Operating Life: 1 million cycles/position**
- **Designed to meet MIL-S-3928**

SEM Series Index

SEM No.	TYPE	FREQUENCY RANGE GHz	CONNECTOR	ACTUATION	TERMINATION 50 OHMS	INDICATOR CIRCUITRY	SUPPRESSION DIODES	TTL LOGIC	SELF DE-ENERGIZING CIRCUIT
020	SPDT	DC TO 18	SMA	FAILSAFE, 28V					
020-12	SPDT	DC TO 18	SMA	FAILSAFE, 12V					
020-24	SPDT	DC TO 18	SMA	FAILSAFE, 24V					
020L	SPDT	DC TO 18	SMA	LATCHING, 28V					
123	SPDT	DC TO 18	SMA	FAILSAFE, 28V		✔			
123D	SPDT	DC TO 18	SMA	FAILSAFE, 28V		✔	✔	✔	
123T	SPDT	DC TO 18	SMA	FAILSAFE, 28V	✔	✔			
123L	SPDT	DC TO 18	SMA	LATCHING, 28V		✔	✔		
123LT	SPDT	DC TO 18	SMA	LATCHING, 28V	✔	✔	✔		
123LD	SPDT	DC TO 18	SMA	LATCHING, 28V		✔	✔	✔	
123DT	SPDT	DC TO 18	SMA	FAILSAFE, 28V	✔	✔	✔	✔	
123LDT	SPDT	DC TO 18	SMA	LATCHING, 28V	✔	✔	✔	✔	✔
123LDT-24	SP2T	DC TO 18	SMA	LATCHING, 24V	✔	✔	✔	✔	✔
123N	SPDT	DC TO 12.4	N	FAILSAFE, 28V		✔			
123DN	SPDT	DC TO 12.4	N	FAILSAFE, 28V		✔	✔	✔	
124	SPDT	DC TO 26.5	SMA	FAILSAFE, 28V		✔			
133	SP3T	DC TO 18	SMA	NORMALLY OPEN, 28V		✔			
133D	SP3T	DC TO 18	SMA	NORMALLY OPEN, 28V		✔	✔	✔	
133DT	SP3T	DC TO 18	SMA	NORMALLY OPEN, 28V	✔	✔	✔	✔	
133LT	SP3T	DC TO 18	SMA	LATCHING, 28V	✔	✔			
133T	SP3T	DC TO 18	SMA	NORMALLY OPEN, 28V	✔	✔			
143	SP4T	DC TO 18	SMA	NORMALLY OPEN, 28V		✔			
143D	SP4T	DC TO 18	SMA	NORMALLY OPEN, 28V		✔	✔	✔	
143DT	SP4T	DC TO 18	SMA	NORMALLY OPEN, 28V	✔	✔	✔	✔	
143DT-24	SP4T	DC TO 18	SMA	NORMALLY OPEN, 24V	✔	✔	✔	✔	
143T	SP4T	DC TO 18	SMA	NORMALLY OPEN, 28V	✔	✔			
153	SP5T	DC TO 18	SMA	NORMALLY OPEN, 28V		✔			
066	SP6T	DC TO 18	SMA	NORMALLY OPEN, 28v					
163	SP6T	DC TO 18	SMA	NORMALLY OPEN, 28V		✔			
163D	SP6T	DC TO 18	SMA	NORMALLY OPEN, 28V		✔	✔	✔	
163DT	SP6T	DC TO 18	SMA	NORMALLY OPEN, 28V	✔	✔	✔	✔	
163LD	SP6T	DC TO 18	SMA	LATCHING, 28V		✔	✔	✔	✔
163LDT-24	SP6T	DC TO 18	SMA	LATCHING, 24V	✔	✔	✔	✔	✔
163T	SP6T	DC TO 18	SMA	NORMALLY OPEN, 28V	✔	✔			
XSEM323	TRANSFER	DC TO 18	SMA	NORMALLY OPEN, 28V		✔			
XSEM323D	TRANSFER	DC TO 18	SMA	NORMALLY OPEN, 28V		✔	✔	✔	
XSEM323L	TRANSFER	DC TO 18	SMA	LATCHING, 28V		✔			
XSEM323LD	TRANSFER	DC TO 18	SMA	LATCHING, 28V		✔	✔	✔	
XSEM323LD-24	TRANSFER	DC TO 12.4	SMA	LATCHING, 24V		✔	✔	✔	

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SP2T SMA (F) DC-18 GHz

Features

- 16 Stock Models in SP2T Series
- Standard Features Include:Latching Models, Failsafe Models,TTL Logic Control, Indicator Circuits

Models

- SEM020, SEM020-12, SEM020-24, SEM020L, SEM123, SEM123D, SEM123T, SEM123L, SEM123LT, SEM123LD, SEM123DT, SEM123LDT, SEM123LDT-24

Model	SEM020	SEM020-12	SEM020-24	SEM020L	SEM123
Features	SP2T (SMA), Failsafe	SP2T (SMA), Failsafe	SP2T (SMA), Failsafe	SP2T (SMA), Pulse Latching	SP2T (SMA)
Actuating Current	160mA @28Vdc & 25°C	275mA @12Vdc & 25°C	200 mA @24 Vdc & 25°C	200mA @28Vdc & 25°C	160mA @28Vdc & 25°C
Frequency Range (GHz)	DC-18	DC-18	DC-18	DC-18	DC-18
Insertion Loss dB (max) DC-3 GHz	0.2	0.2	0.2	0.2	0.2
Insertion Loss dB (max) 3-8 GHz	0.3	0.3	0.3	0.3	0.3
Insertion Loss dB (max) 8-12.4 GHz	0.4	0.4	0.4	0.4	0.4
Insertion Loss dB (max) 12.4-18 GHz	0.5	0.5	0.5	0.5	0.5
VSWR (max) DC-3 GHz	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1
VSWR (max) 3-8 GHz	1.3:1	1.3:1	1.3:1	1.3:1	1.3:1
VSWR (max) 8-12.4 GHz	1.4:1	1.4:1	1.4:1	1.4:1	1.4:1
VSWR (max) 12.4-18 GHz	1.5:1	1.5:1	1.5:1	1.5:1	1.5:1
Isolation dB (min) DC-3 GHz	80	80	80	80	80
Isolation dB (min) 3-8 GHz	70	70	70	70	70
Isolation dB (min) 8-12.4 GHz	60	60	60	60	60
Isolation dB (min) 12.4-18 GHz	60	60	60	60	60
Actuation	Failsafe, 28V	Failsafe, 12V	Failsafe, 24V	Latching, 28V	Failsafe, 28V
Indicator Circuitry	N/A	N/A	N/A	N/A	Included
Suppression Diodes	N/A	N/A	N/A	N/A	N/A
TTL Logic	N/A	N/A	N/A	N/A	N/A

SP2T SMA (F) DC-18 GHz

Model	SEM123D	SEM123T	SEM123L	SEM123LT	SEM123LD
Features	SP2T (SMA), Failsafe, Indicator Ckt., TTL*, Suppression Diode	SP2T (SMA), Failsafe, Terminated, Indicator Ckt.	SP2T (SMA), Pulse Latching Indicator Ckt.	SP2T (SMA), Pulse Latching, Terminated, Indicator Ckt.	SP2T (SMA), Pulse Latching Indicator Ckt., TTL*
Actuating Current	160mA @28Vdc & 25°C	280mA @28Vdc & 25°C	200mA @28Vdc & 25°C	280mA @28Vdc & 25°C	200mA @28Vdc & 25°C
Frequency Range (GHz)	DC-18	DC-18	DC-18	DC-18	DC-18
Insertion Loss dB (max) DC-3 GHz	0.2	0.2	0.2	0.2	0.2
Insertion Loss dB (max) 3-8 GHz	0.3	0.3	0.3	0.3	0.3
Insertion Loss dB (max) 8-12.4 GHz	0.4	0.4	0.4	0.4	0.4
Insertion Loss dB (max) 12.4-18 GHz	0.5	0.5	0.5	0.4	0.5
VSWR (max) DC-3 GHz	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1
VSWR (max) 3-8 GHz	1.3:1	1.3:1	1.3:1	1.3:1	1.3:1
VSWR (max) 8-12.4 GHz	1.4:1	1.4:1	1.4:1	1.4:1	1.4:1
VSWR (max) 12.4-18 GHz	1.5:1	1.5:1	1.5:1	1.5:1	1.5:1
Isolation dB (min) DC-3 GHz	80	80	80	80	80
Isolation dB (min) 3-8 GHz	70	70	70	70	70
Isolation dB (min) 8-12.4 GHz	60	60	60	60	60
Isolation dB (min) 12.4-18 GHz	60	60	60	60	60
Actuation	Failsafe, 28V	Failsafe, 28V	Latching, 28V	Latching, 28V	Latching, 28V
Indicator Circuitry	Included	Included	Included	Included	Included
Suppression Diodes	Included	N/A	N/A	N/A	N/A
TTL Logic	Included	N/A	N/A	N/A	Included
Special Notes:	A	N/A	N/A	N/A	A

Special Notes:
A: 1. Selected switch position is controlled by TTL Logic.
2. Switch requires only nominal +28 Vdc for coils (additional 5 Vdc is not required).
3. TTL LOGIC LEVEL: Low 0 to .8 Vdc, High 2.5 to 5.0 Vdc
4. TTL LOGIC INPUT CURRENT: Low 0 mA, High 1.6 mA max @ 3.85 Vdc

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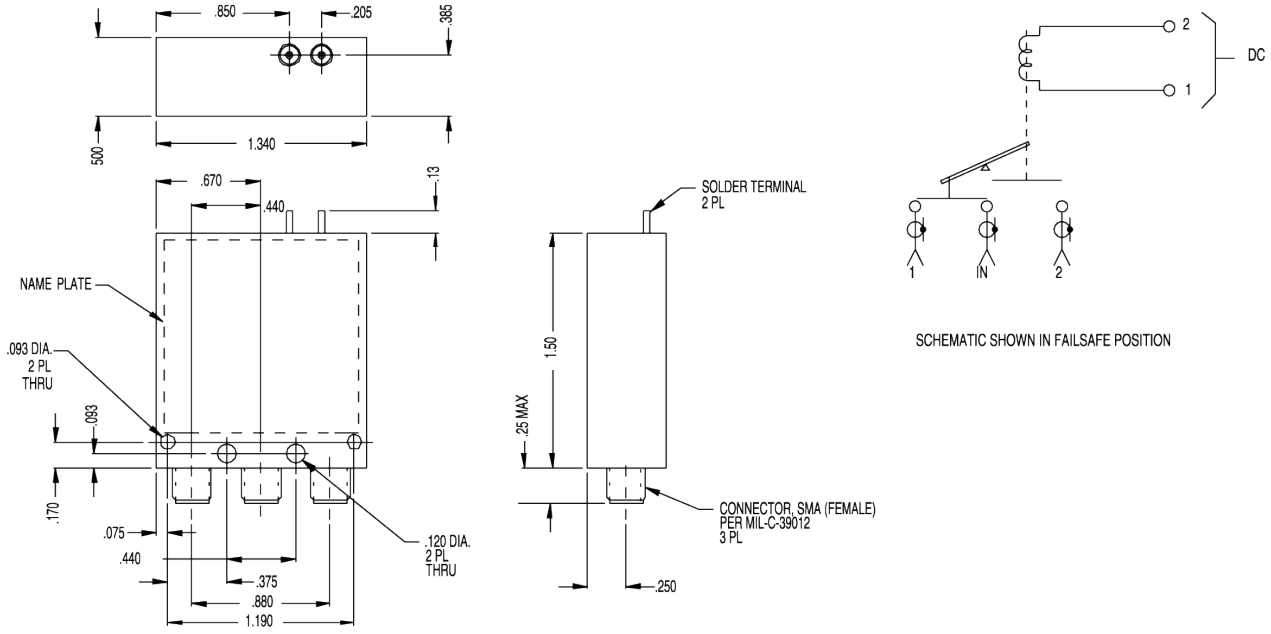
SP2T SMA (F) DC-18 GHz

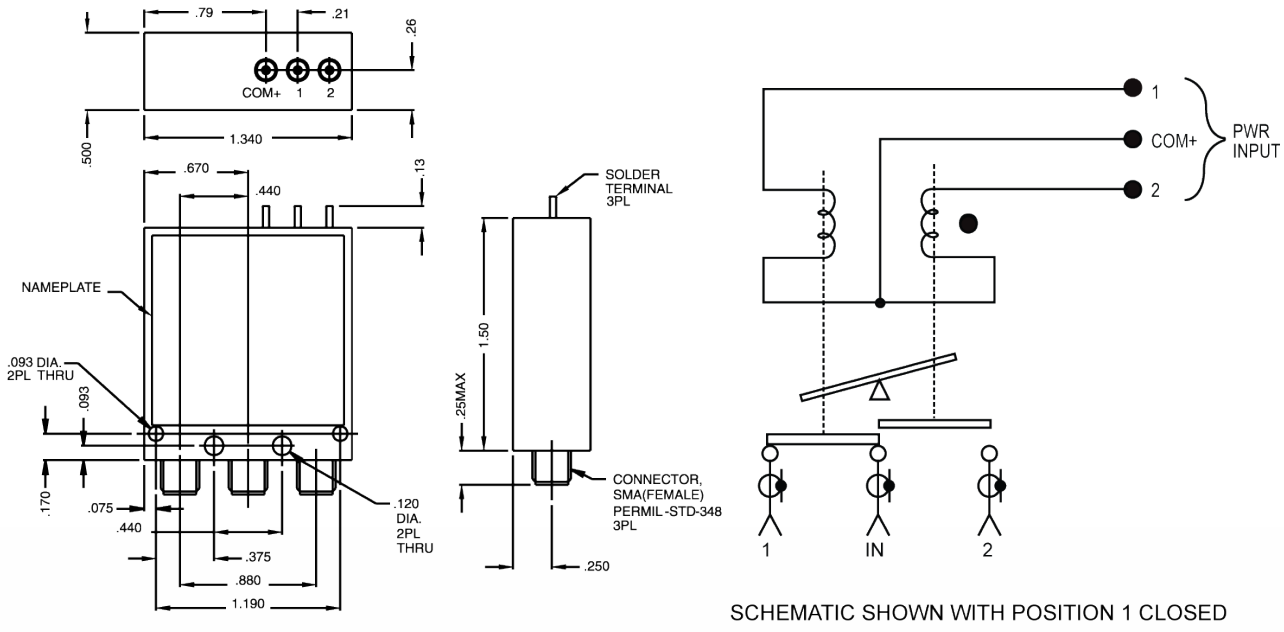
Model	SEM123DT	SEM123LDT	SEM123LDT-24
Features	SP2T (SMA), Failsafe, Terminated Indicator Ckt., Suppression Diode, TTL*	SP2T (SMA), Terminated Indicator Ckt., Suppresion Diode, TTL*	SP2T (SMA), Pulse Latching Indicator Ckt., Suppresion Diode, TTL*
Actuating Current	280mA @28Vdc & 25°C	280mA @28Vdc & 25°C	325mA @24Vdc & 25°C
Frequency Range (GHz)	DC-18	DC-18	DC-18
Insertion Loss dB (max) DC-3 GHz	0.2	0.2	0.2
Insertion Loss dB (max) 3-8 GHz	0.3	0.3	0.3
Insertion Loss dB (max) 8-12.4 GHz	0.4	0.5	0.5
Insertion Loss dB (max) 12.4-18 GHz	0.5	0.5	0.5
VSWR (max) DC-3 GHz	1.2:1	1.2:1	1.2:1
VSWR (max) 3-8 GHz	1.3:1	1.3:1	1.3:1
VSWR (max) 8-12.4 GHz	1.4:1	1.4:1	1.4:1
VSWR (max) 12.4-18 GHz	1.5:1	1.5:1	1.5:1
Isolation dB (min) DC-3 GHz	80	80	80
Isolation dB (min) 3-8 GHz	70	70	70
Isolation dB (min) 8-12.4 GHz	60	60	60
Isolation dB (min) 12.4-18 GHz	60	60	60
Actuation	Failsafe, 28V	Latching, 28V	Latching, 24V
Indicator Circuitry	Included	Included	Included
Suppression Diodes	Included	Included	Included
TTL Logic	Included	Included	Included
Special Notes:	N/A	A	N/A

Special Notes:
A: 1. Selected switch position is controlled by TTL Logic.
2. Switch requires only nominal +28 Vdc for coils (additional 5 Vdc is not required).
3. TTL LOGIC LEVEL: Low 0 to .8 Vdc, High 2.5 to 5.0 Vdc
4. TTL LOGIC INPUT CURRENT: Low 0 mA, High 1.6 mA max @ 3.85 Vdc

SP2T SMA (F) DC-18 GHz



SEM020, SEM020-12, SEM020-24



SEM020L

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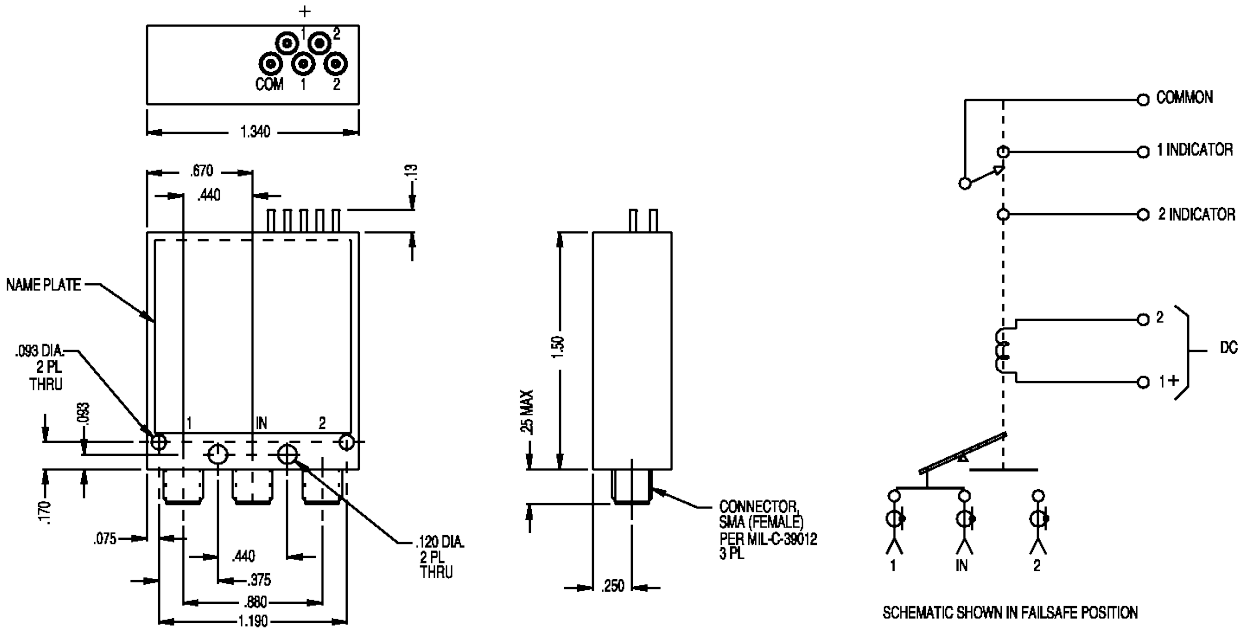
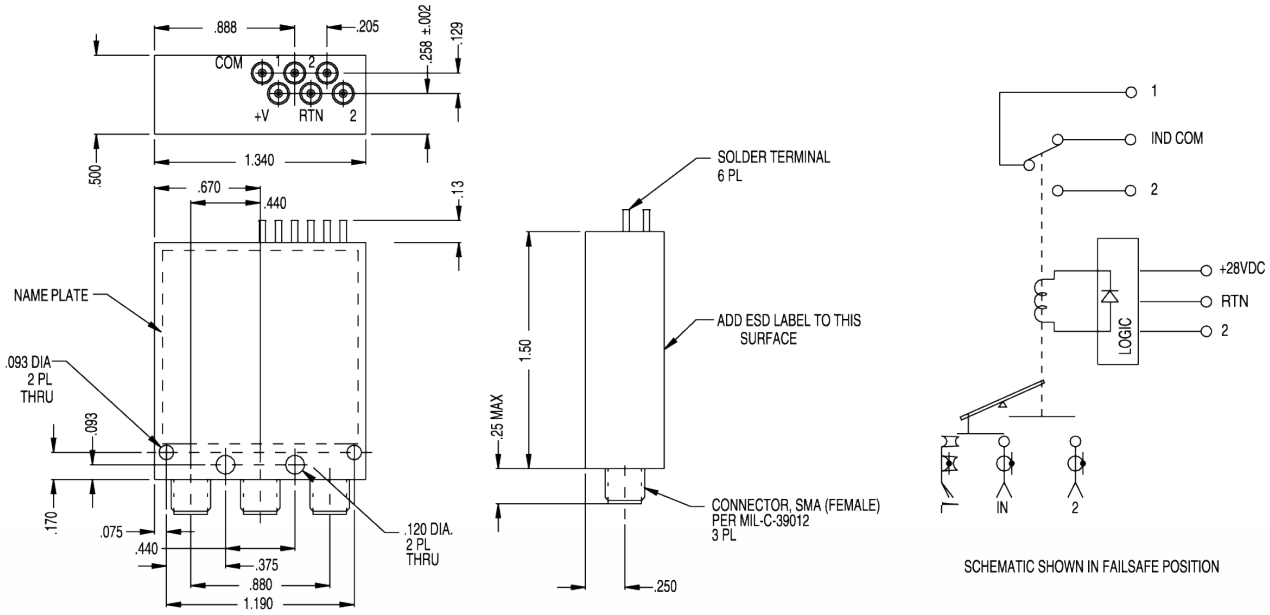
SP2T SMA (F) DC-18 GHz

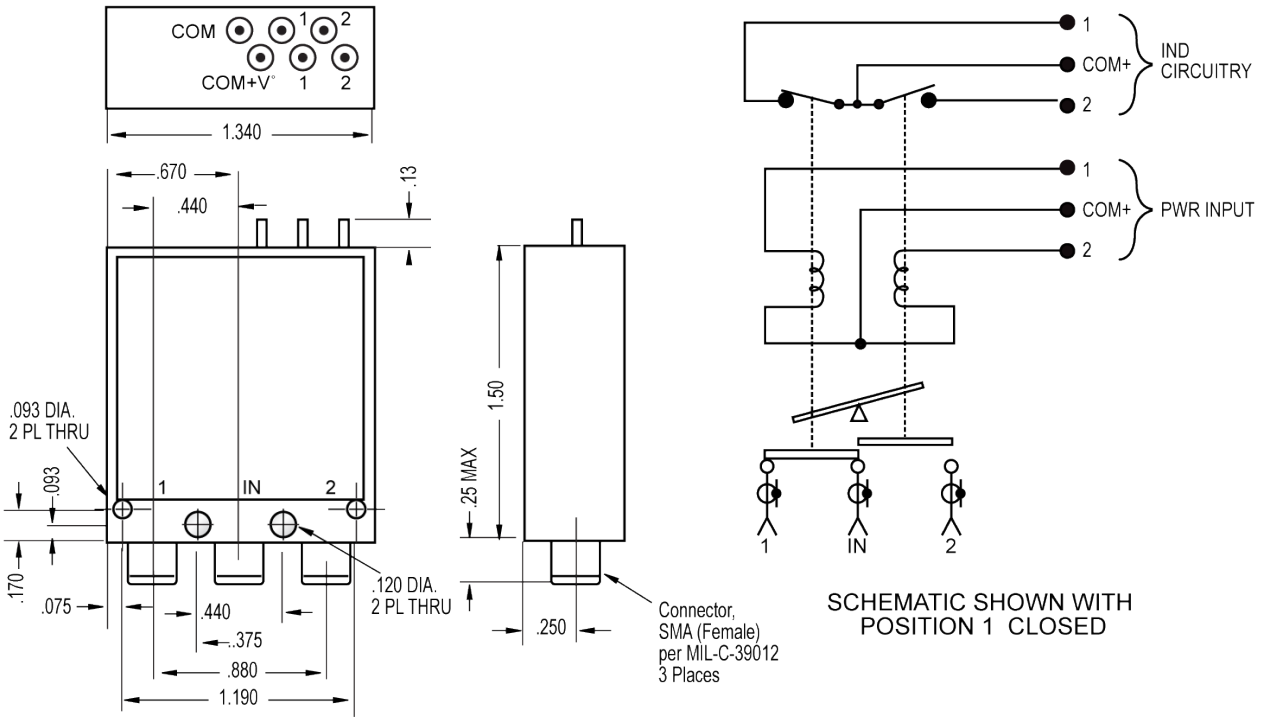


SEM123

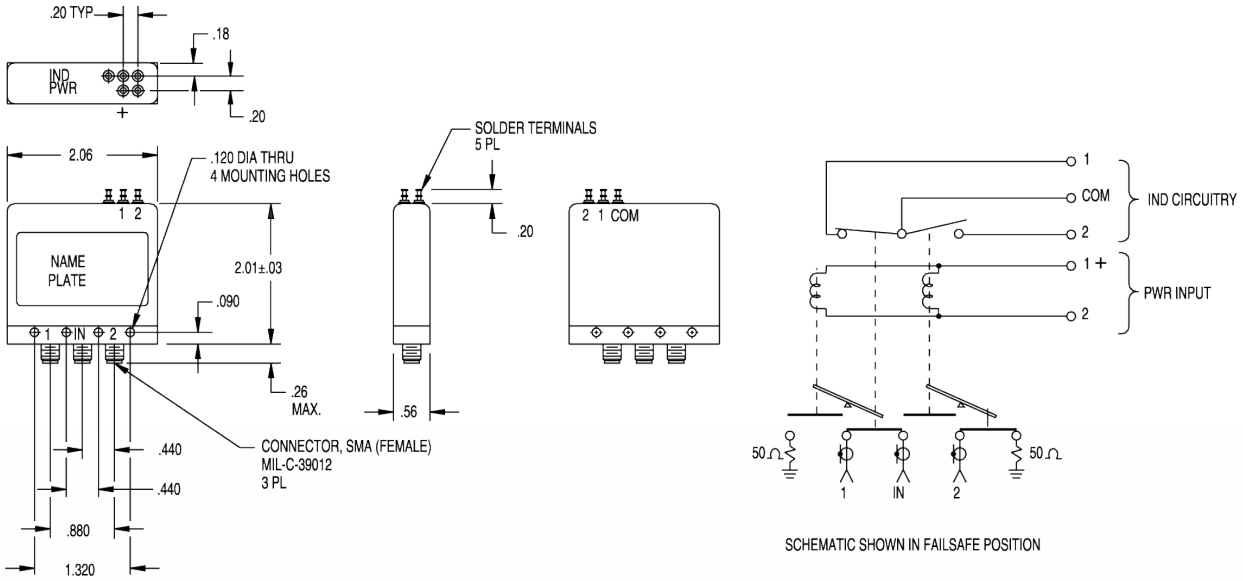


SEM123D

SP2T SMA (F) DC-18 GHz



SEM123L



SEM123T

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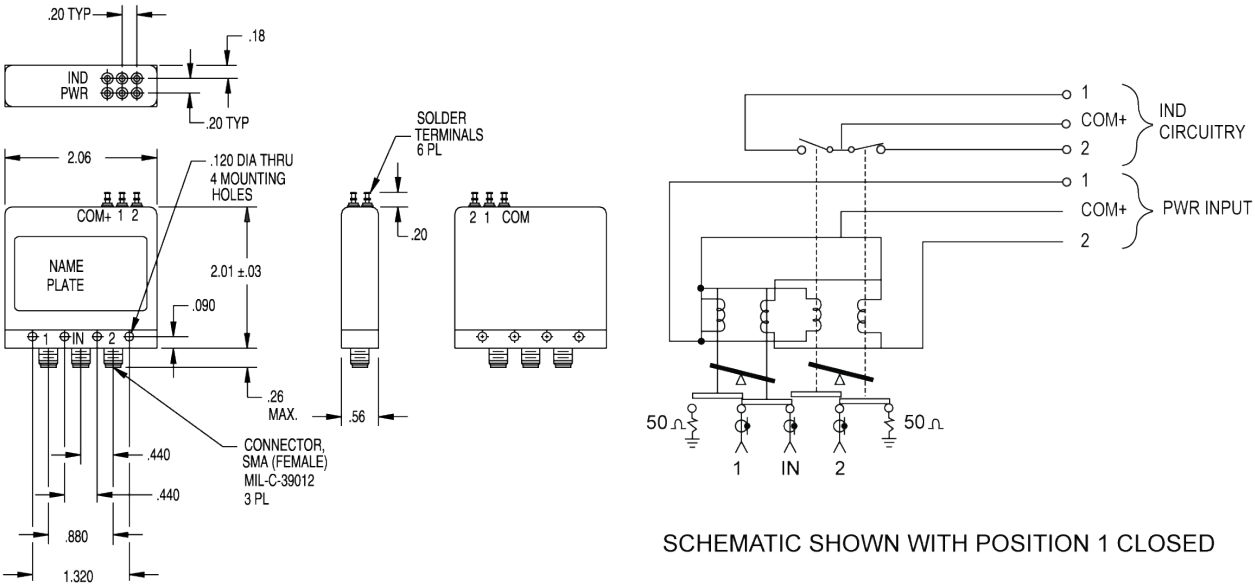
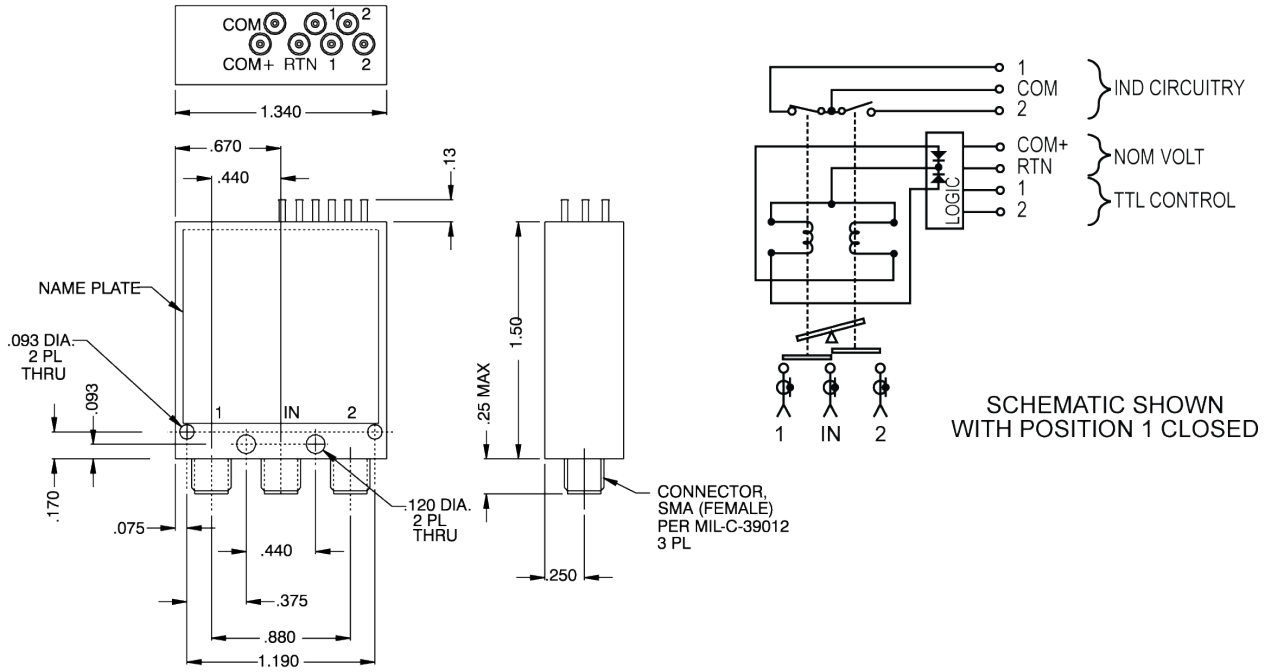
SP2T SMA (F) DC-18 GHz



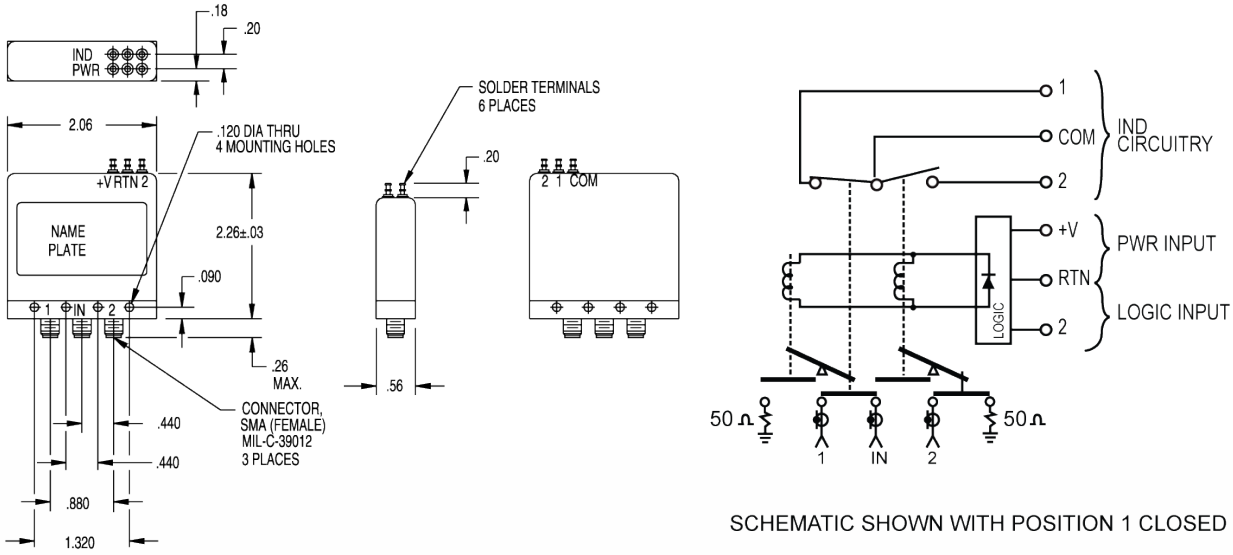
SCHEMATIC SHOWN WITH POSITION 1 CLOSED

SEM123LT

SP2T SMA (F) DC-18 GHz



SEM123LD



SEM123DT

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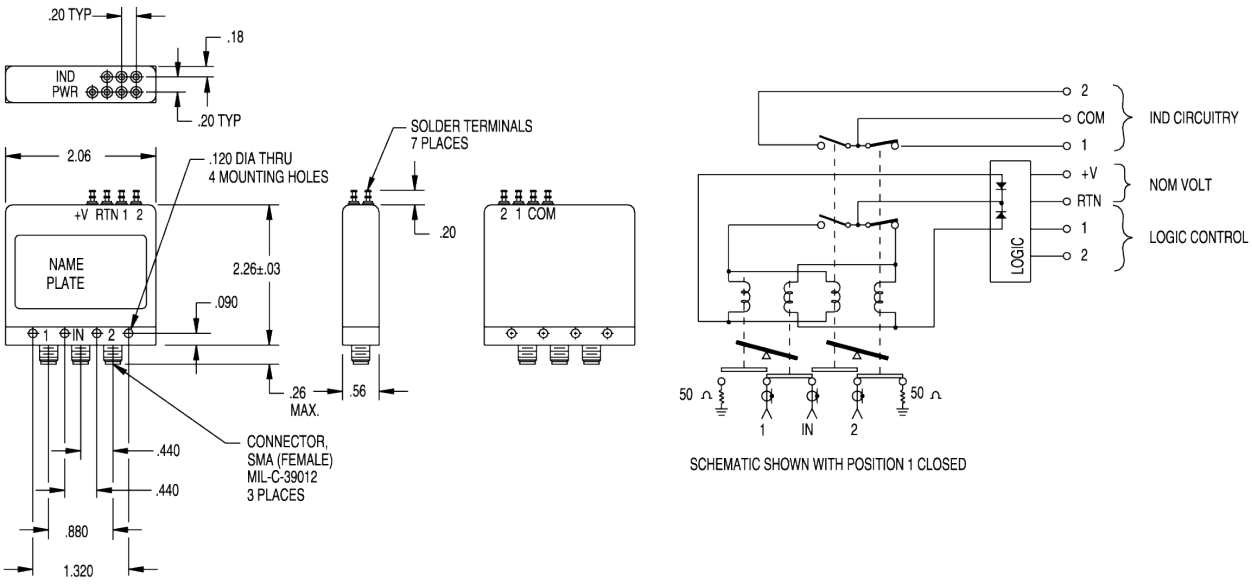
SP2T SMA (F) DC-18 GHz



SEM123LDT, SEM123LDT-24

SP2T Type N (F) DC-12.4 GHz

Features

- Type N Connectors

Models

- SEM123N, SEM123DN

Model	SEM123N	SEM123DN
Features	SP2T (N), Failsafe, Indicator Ckt	SP2T (N), Failsafe, Indicator Ckt., TTL*, Suppression Diode
Actuating Current	180mA @28Vdc & 25°C	180mA @28Vdc & 25°C
Frequency Range (GHz)	DC-12.4	DC-12.4
Insertion Loss dB (max) DC-3 GHz	0.2	0.2
Insertion Loss dB (max) 3-8 GHz	0.35	0.35
Insertion Loss dB (max) 8-12.4 GHz	0.5	0.5
VSWR (max) DC-3 GHz	1.2:1	1.2:1
VSWR (max) 3-8 GHz	1.35:1	1.35:1
VSWR (max) 8-12.4 GHz	1.5:1	1.5:1
VSWR (max) 12.4-18 GHz	N/A	N/A
Isolation dB (min) DC-3 GHz	80	80
Isolation dB (min) 3-8 GHz	70	70
Isolation dB (min) 8-12.4 GHz	60	60
Actuation	Failsafe, 28V	Failsafe, 28V
Indicator Circuitry	Included	Included
Suppression Diodes	N/A	Included
TTL Logic	N/A	Included
Special Notes:	N/A	A

Special Notes:
A: 1. Selected switch position is controlled by TTL Logic.
2. Switch requires only nominal +28 Vdc for coils (additional 5 Vdc is not required).
3. TTL LOGIC LEVEL: Low 0 to .8 Vdc, High 2.5 to 5.0 Vdc
4. TTL LOGIC INPUT CURRENT: Low 0 mA, High 1.6 mA max @ 3.85 Vdc

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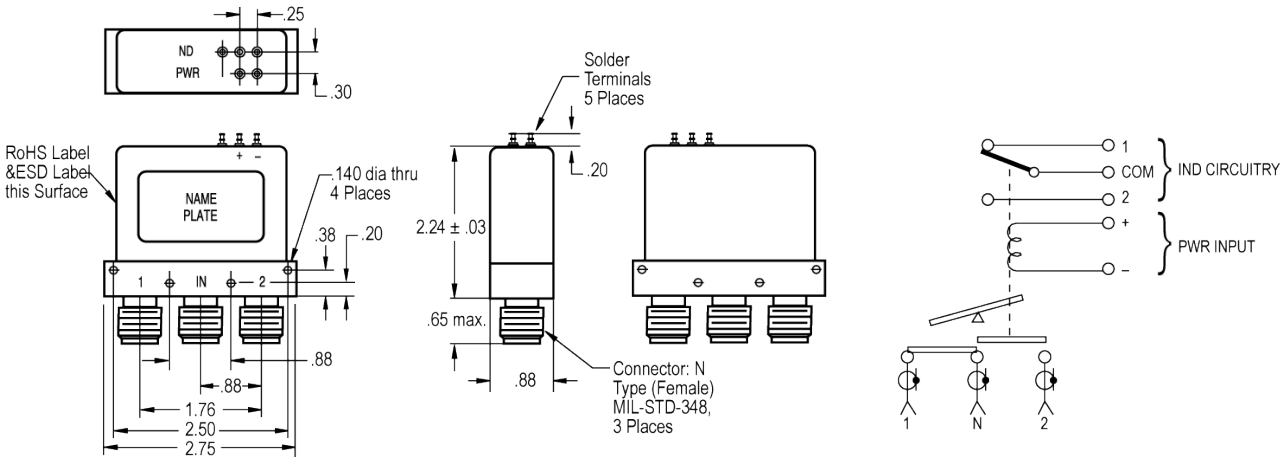
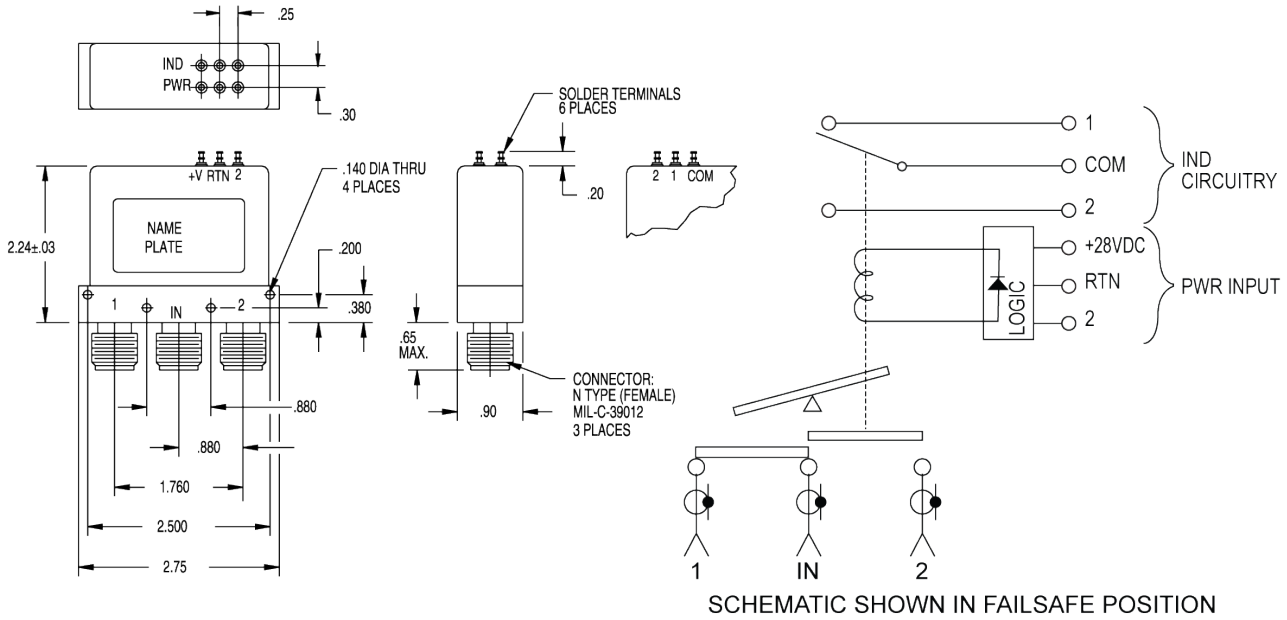
SP2T Type N (F) DC-12.4 GHz



SEM123N



SEM123DN

SP2T SMA (F) DC-26.5 GHz

Features

- SMA Connectors

Models

- SEM124

Model	SEM124
Features	SP2T (SMA), Failsafe, Indicator Ckt.
Actuating Current	160mA @28Vdc & 25°C
Frequency Range (GHz)	DC-26.5
Insertion Loss dB (max) DC-3 GHz	0.2
Insertion Loss dB (max) 3-8 GHz	0.3
Insertion Loss dB (max) 8-12.4 GHz	0.4
Insertion Loss dB (max) 12.4-18 GHz	0.5
Insertion Loss db (max) 18-26.5 Ghz	0.7
VSWR (max) DC-3 GHz	1.2:1
VSWR (max) 3-8 GHz	1.3:1
VSWR (max) 8-12.4 GHz	1.4:1
VSWR (max) 12.4-18 GHz	1.5:1
Isolation dB (min) DC-3 GHz	80
Isolation dB (min) 3-8 GHz	70
Isolation dB (min) 8-12.4 GHz	60
Isolation dB (min) 12.4-18 GHz	60
Actuation	Failsafe, 28V
Indicator Circuitry	Included

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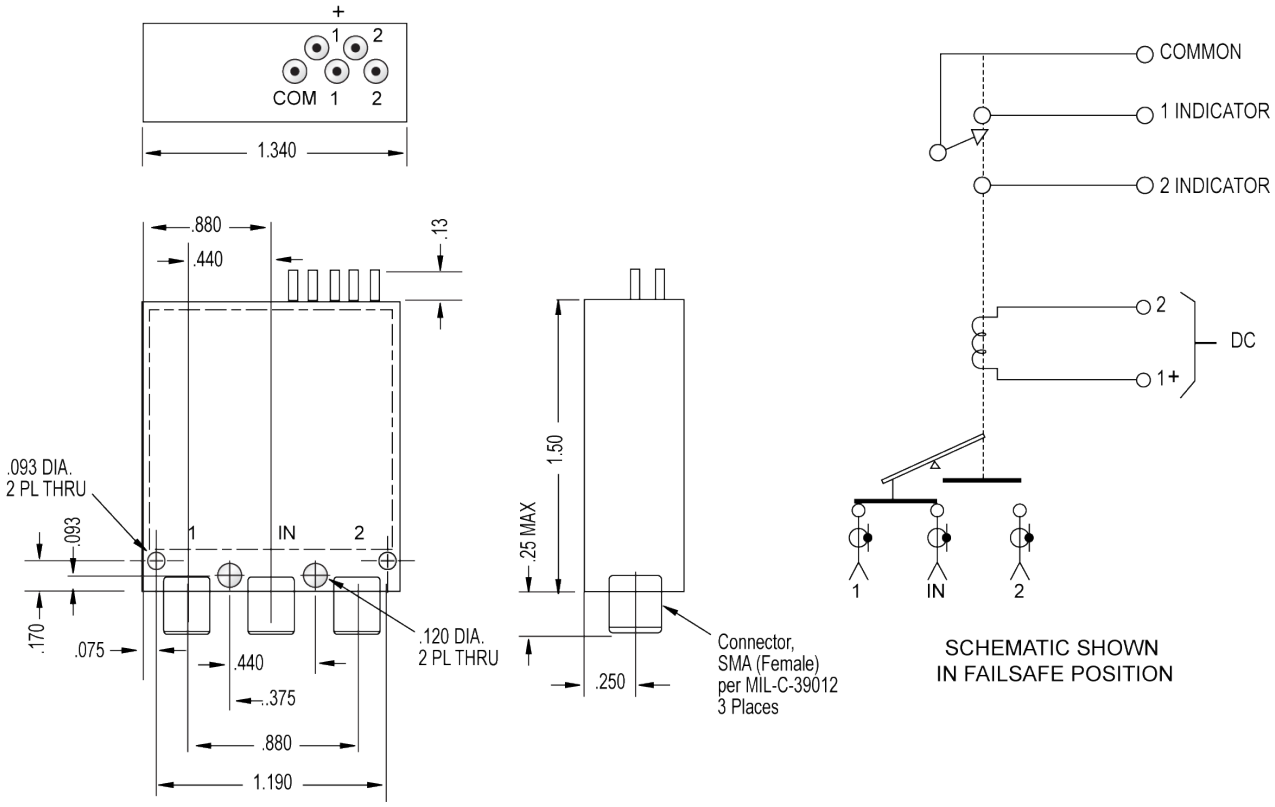
SP2T SMA (F) DC-26.5 GHz



SEM124

SP3T SMA (F) DC-18 GHz

Features

- Five Models In Stock in 3 Position Series
- Standard Features Include:
- Normally Open and Latching Models
- TTL Logic Control, Suppression Diodes
- All Models Supplied with Indicator Circuits

Models

- SEM133, SEM133D, SEM133DT, SEM133LT, SEM133T

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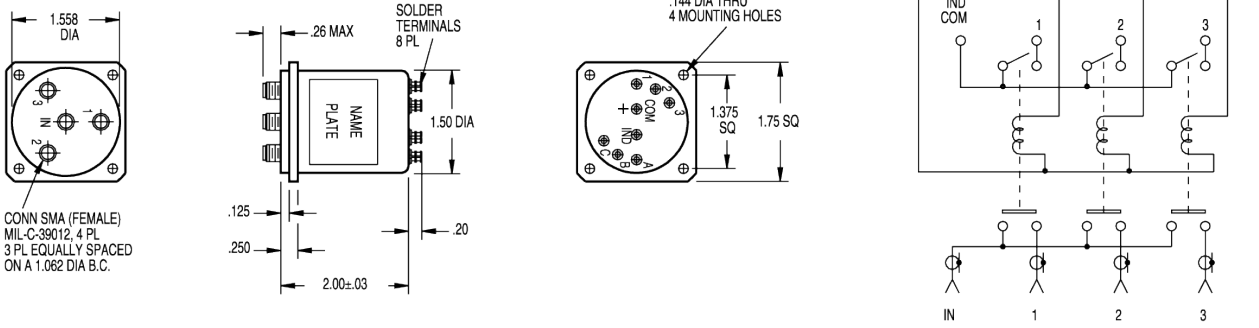
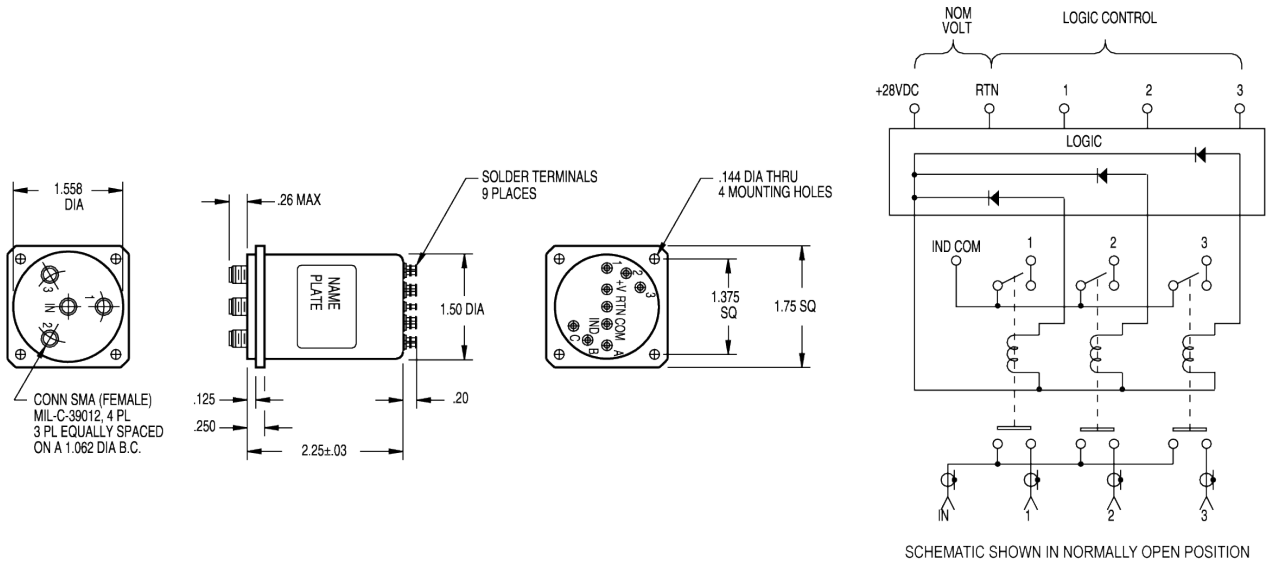
SP3T SMA (F) DC-18 GHz

Model	SEM133	SEM133D	SEM133DT	SEM133LT	SEM133T
Features	SP3T (SMA), Normally Open, Indicator Ckt	SP3T (SMA), TTL*, Suppression Diode, Indicator Ckt	SP3T (SMA), Normally Open, Terminated, TTL*, Suppression Diodes, Indicator Ckt	SP3T (SMA), Pulse Latching, Terminated, Indicator Ckt	SP3T (SMA), Normally Open, Terminated, Indicator Ckt
Actuating Current	140mA @28Vdc & 25°C	140mA @28Vdc & 25°C	180mA @28Vdc & 25°C	300mA @28Vdc & 25°C	140mA @28Vdc & 25°C
Frequency Range (GHz)	DC-18	DC-18	DC-18	DC-18	DC-18
Insertion Loss dB (max) DC-3 GHz	0.2	0.2	0.2	0.2	0.2
Insertion Loss dB (max) 3-8 GHz	0.3	0.3	0.3	0.3	0.3
Insertion Loss dB (max) 8-12.4 GHz	0.4	0.4	0.4	0.4	0.4
Insertion Loss dB (max) 12.4-18 GHz	0.5	0.5	0.5	0.5	N/A
VSWR (max) DC-3 GHz	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1
VSWR (max) 3-8 GHz	1.3:1	1.3:1	1.3:1	1.3:1	1.3:1
VSWR (max) 8-12.4 GHz	1.4:1	1.4:1	1.4:1	1.4:1	1.4:1
VSWR (max) 12.4-18 GHz	1.5:1	1.5:1	1.5:1	1.5:1	1.5:1
Isolation dB (min) DC-3 GHz	80	80	80	80	80
Isolation dB (min) 3-8 GHz	70	70	70	70	70
Isolation dB (min) 8-12.4 GHz	60	60	60	60	60
Isolation dB (min) 12.4-18 GHz	60	60	60	60	60
Actuation	Normally Open, 28V	Normally Open, 28V	Normally Open, 28V	Latching, 28V	Normally Open, 28V
Indicator Circuitry	Included	Included	Included	Included	Included
Termination 50 OHMS	N/A	N/A	Included	Included	Included
Suppression Diodes	N/A	Included	Included	N/A	N/A
TTL Logic	N/A	Included	Included	N/A	N/A

SP3T SMA (F) DC-18 GHz



SEM133



SEM133D

1. Selected switch position is controlled by TTL Logic.
2. Switch requires only nominal +28 Vdc for coils (additional 5 Vdc is not required).
3. TTL LOGIC LEVEL: Low 0 to .8 Vdc, High 2.5 to 5.0 Vdc
4. TTL LOGIC INPUT CURRENT: Low 0 mA, High 1.6 mA max @ 3.85 Vdc

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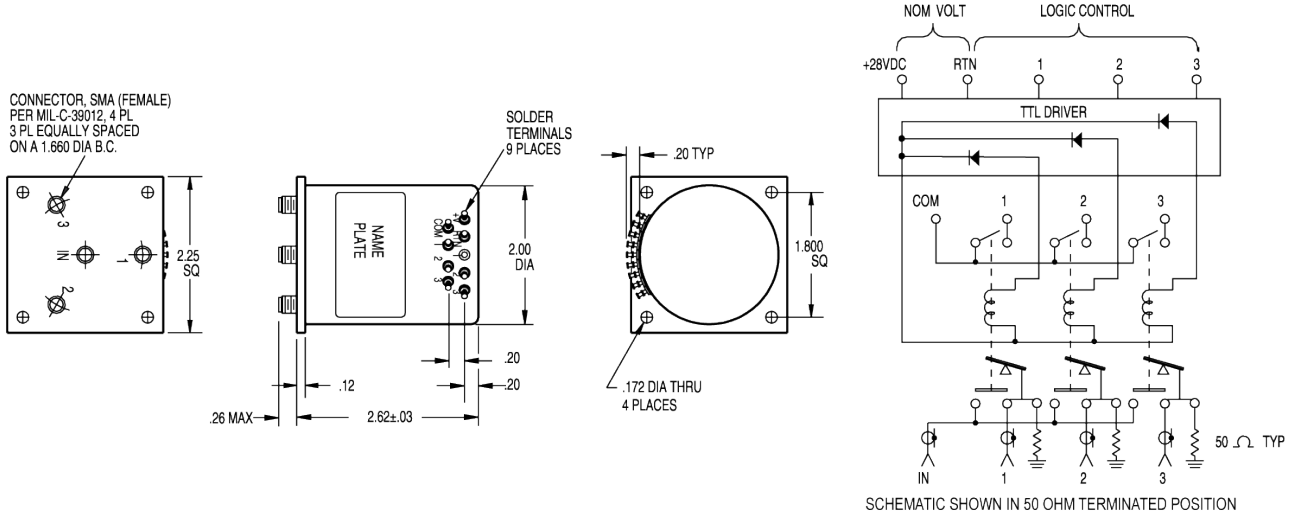
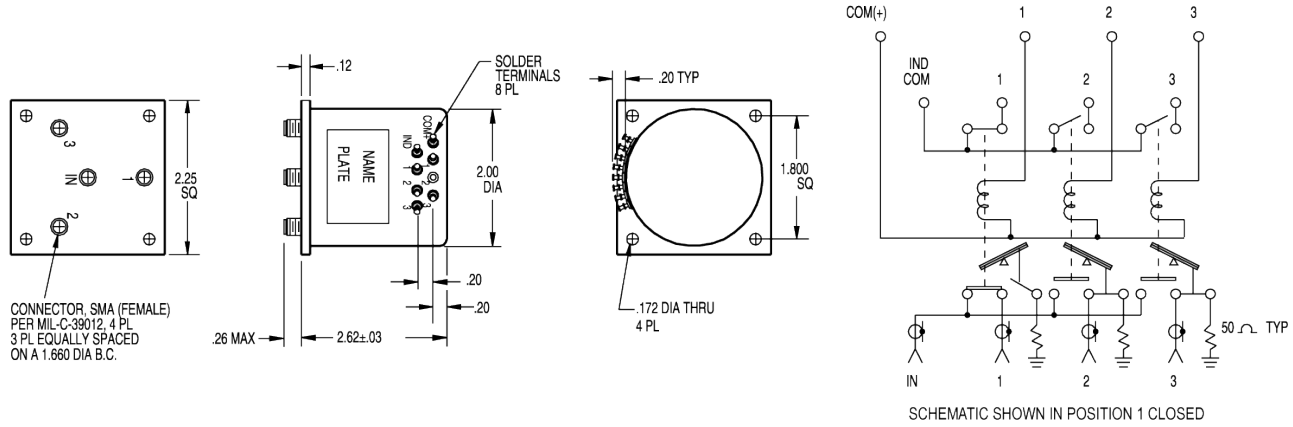
SP3T SMA (F) DC-18 GHz



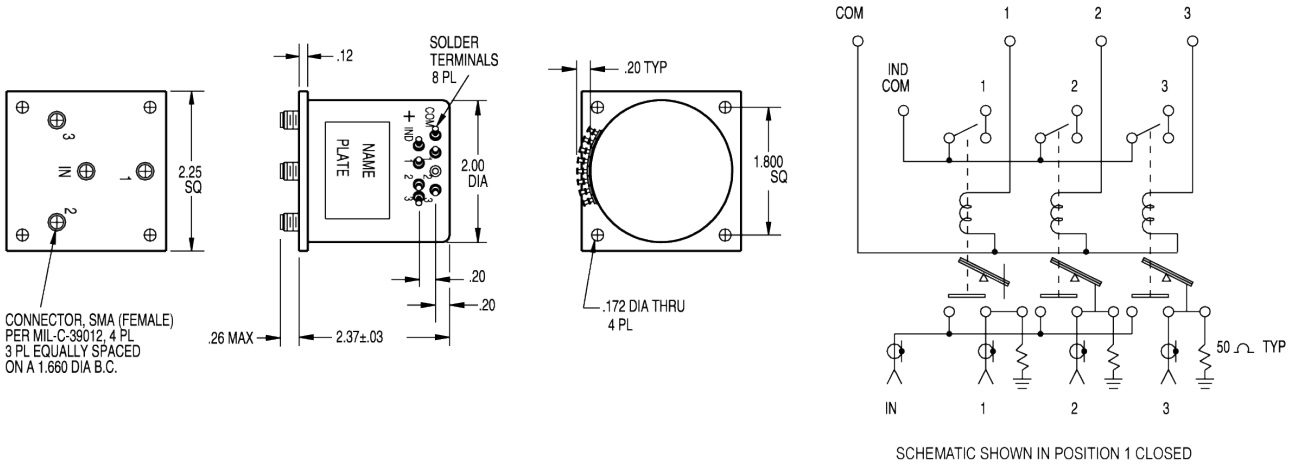
SEM133DT

1. Selected switch position is controlled by TTL Logic.
2. Switch requires only nominal +28 Vdc for coils (additional 5 Vdc is not required).
3. TTL LOGIC LEVEL: Low 0 to .8 Vdc, High 2.5 to 5.0 Vdc
4. TTL LOGIC INPUT CURRENT: Low 0 mA, High 1.6 mA max @ 3.85 Vdc



SEM133LT

SP3T SMA (F) DC-18 GHz



SEM133T

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SP4T SMA (F) DC-18 GHz

Features

- Normally Open
- Indicator Circuitry Included

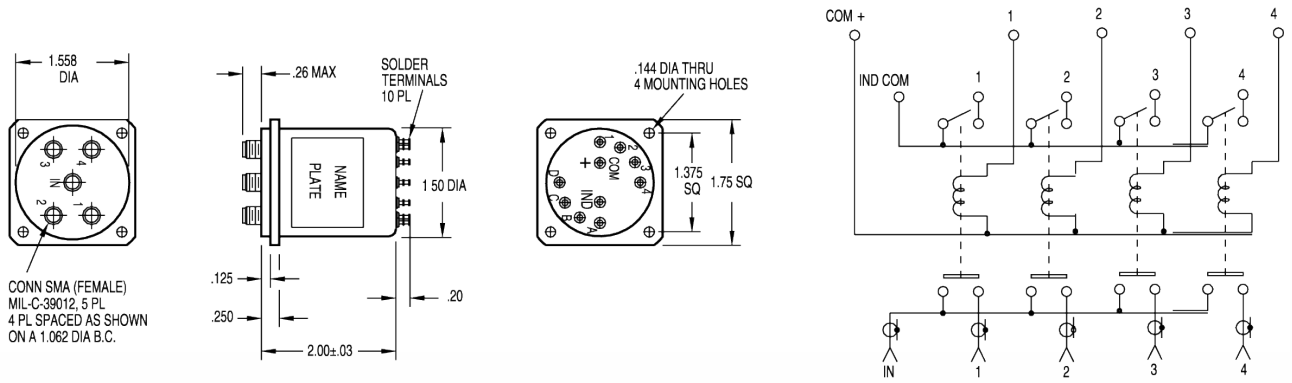
Models

- SEM143, SEM143D, SEM143DT, SEM143DT-24, SEM143T

SP4T SMA (F) DC-18 GHz

Model	SEM143	SEM143D	SEM143DT	SEM143DT-24	SEM143T
Actuating Current	140mA @28Vdc & 25°C	140mA @28Vdc & 25°C	140mA @28Vdc & 25°C	160mA @24Vdc & 25°C	140mA @28Vdc & 25°C
Frequency Range (GHz)	DC-18	DC-18	DC-18	DC-18	DC-18
Insertion Loss dB (max) DC-3 GHz	0.2	0.2	0.2	0.2	0.2
Insertion Loss dB (max) 3-8 GHz	0.3	0.3	0.3	0.3	0.3
Insertion Loss dB (max) 8-12.4 GHz	0.4	0.4	0.4	0.4	0.4
Insertion Loss dB (max) 12.4-18 GHz	0.5	0.5	0.5	0.5	0.5
VSWR (max) DC-3 GHz	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1
VSWR (max) 3-8 GHz	1.3:1	1.3:1	1.3:1	1.3:1	1.3:1
VSWR (max) 8-12.4 GHz	1.4:1	1.4:1	1.4:1	1.4:1	1.4:1
VSWR (max) 12.4-18 GHz	1.5:1	1.5:1	1.5:1	1.5:1	1.5:1
Isolation dB (min) DC-3 GHz	80	80	80	80	80
Isolation dB (min) 3-8 GHz	70	70	70	70	70
Isolation dB (min) 8-12.4 GHz	60	60	60	60	60
Isolation dB (min) 12.4-18 GHz	60	60	60	60	60
Actuation	28V	28V	28V	24V	28V
Termination 50 OHMS	N/A	N/A	Included	Included	Included
Suppression Diodes	N/A	Included	N/A	Included	Included
TTL Logic	N/A	Included	Included	Included	N/A
Special Notes:	N/A	A	N/A	A	A

Special Notes:
A: 1. Selected switch position is controlled by TTL Logic.
2. Switch requires only nominal +28 Vdc for coils (additional 5 Vdc is not required).
3. TTL LOGIC LEVEL: Low 0 to .8 Vdc, High 2.5 to 5.0 Vdc
4. TTL LOGIC INPUT CURRENT: Low 0 mA, High 1.6 mA max @ 3.85 Vdc



SEM143

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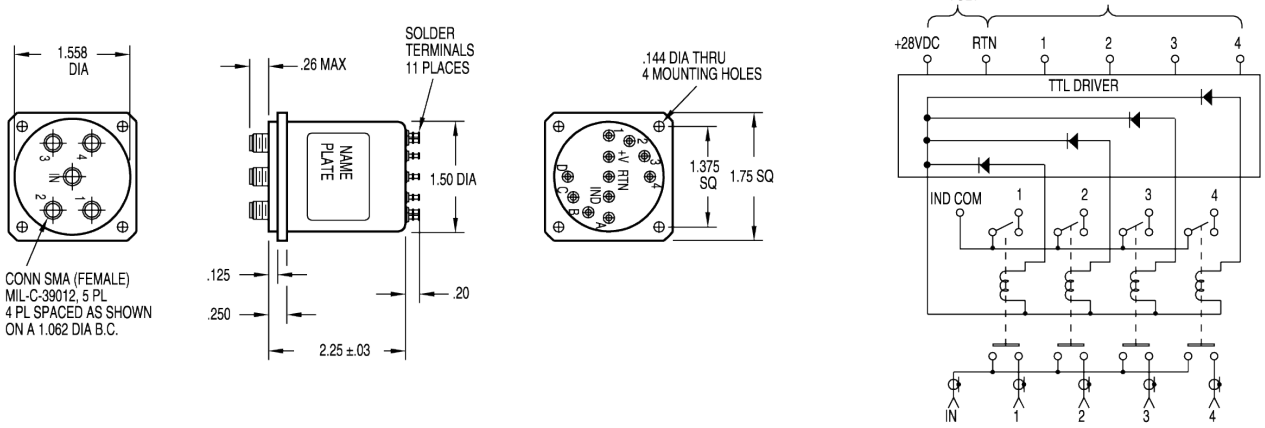
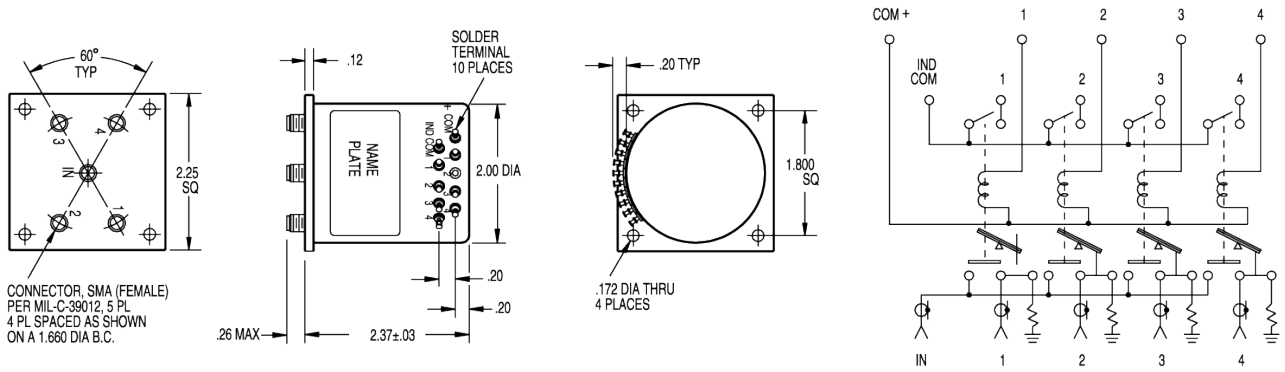
SP4T SMA (F) DC-18 GHz

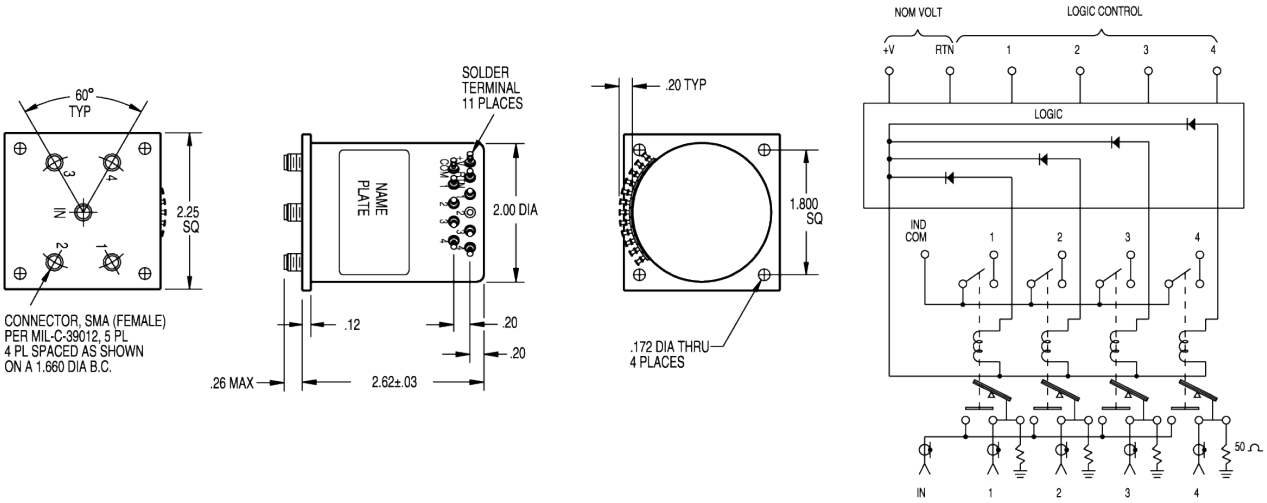


SEM143D



SEM143T

SP4T SMA (F) DC-18 GHz



SEM143DT, SEM143DT-24

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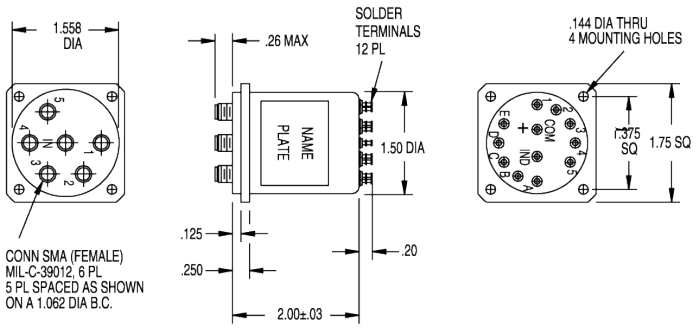
SP5T SMA (F) DC-18 GHz

Models

- **SEM153**

Model	SEM153
Features	SP5T (SMA), Normally Open, Indicator Ckt.
Actuating Current	140mA @28Vdc & 25°C
Frequency Range (GHz)	DC-18
Insertion Loss dB (max) DC-3 GHz	0.2
Insertion Loss dB (max) 3-8 GHz	0.3
Insertion Loss dB (max) 8-12.4 GHz	0.4
Insertion Loss dB (max) 12.4-18 GHz	0.5
VSWR (max) DC-3 GHz	1.2:1
VSWR (max) 3-8 GHz	1.3:1
VSWR (max) 8-12.4 GHz	1.4:1
VSWR (max) 12.4-18 GHz	1.5:1
Isolation dB (min) DC-3 GHz	80
Isolation dB (min) 3-8 GHz	70
Isolation dB (min) 8-12.4 GHz	60
Isolation dB (min) 12.4-18 GHz	60
Actuation	Normally Open, 28V
Indicator Circuitry	Included

SP5T SMA (F) DC-18 GHz



SCHEMATIC SHOWN IN NORMALLY OPEN POSITION

SEM153

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SP6T SMA (F) DC-18 GHz

Features

- DC-18 GHz
- Seven Models from Stock
- Standard Features Include:Failsafe and Latching Models,TTL Logic Control, Suppression Diodes Indicator Circuits Provided With All Models

Models

- SEM066, SEM163, SEM163D, SEM163T, SEM163DT, SEM163LD, SEM163LDT-24

SP6T SMA (F) DC-18 GHz

Model	SEM066	SEM163	SEM163D	SEM163T
Features	SP6T (SMA), Normally Open, Minature	SP6T (SMA), Normally Open, Indicator Ckt.	SP6T (SMA), Normally Open, TTL*, Suppresion Diode, Indicator Ckt.	SP6T (SMA), Normally Open, Terminated, Indicator Ckt
Actuating Current	160 mA @28 Vdc & 25°C	140mA @28Vdc & 25°C	140mA @28Vdc & 25°C	140mA @28Vdc & 25°C
Frequency Range (GHz)	DC-18	DC-18	DC-18	DC-18
Insertion Loss dB (max) DC-3 GHz	0.2	0.2	0.2	0.2
Insertion Loss dB (max) 3-8 GHz	0.3	0.3	0.3	0.3
Insertion Loss dB (max) 8-12.4 GHz	0.4	0.4	0.4	0.4
Insertion Loss dB (max) 12.4-18 GHz	0.5	0.5	0.5	0.5
VSWR (max) DC-3 GHz	1.2:1	1.2:1	1.2:1	1.2:1
VSWR (max) 3-8 GHz	1.3:1	1.3:1	1.3:1	1.3:1
VSWR (max) 8-12.4 GHz	1.4:1	1.4:1	1.4:1	1.4:1
VSWR (max) 12.4-18 GHz	1.5:1	1.5:1	1.5:1	1.5:1
Isolation dB (min) DC-3 GHz	80	80	80	80
Isolation dB (min) 3-8 GHz	60	70	70	70
Isolation dB (min) 8-12.4 GHz	70	60	60	60
Isolation dB (min) 12.4-18 GHz	60	60	60	60
Actuation	Normally Open, 28V	Normally Open, 28V	Normally Open, 28V	Normally Open, 28V
Indicator Circuitry	N/A	Included	Included	Included
Termination 50 OHMS	N/A	N/A	N/A	Included
Suppression Diodes	N/A	N/A	Included	N/A
TTL Logic	N/A	Included	Included	N/A
Special Notes:	N/A	N/A	A	N/A

Special Notes:
A: 1. Selected switch position is controlled by TTL Logic.
2. Switch requires only nominal +28 Vdc for coils (additional 5 Vdc is not required).
3. TTL LOGIC LEVEL: Low 0 to .8 Vdc, High 2.5 to 5.0 Vdc
4. TTL LOGIC INPUT CURRENT: Low 0 mA, High 1.6 mA max @ 3.85 Vdc

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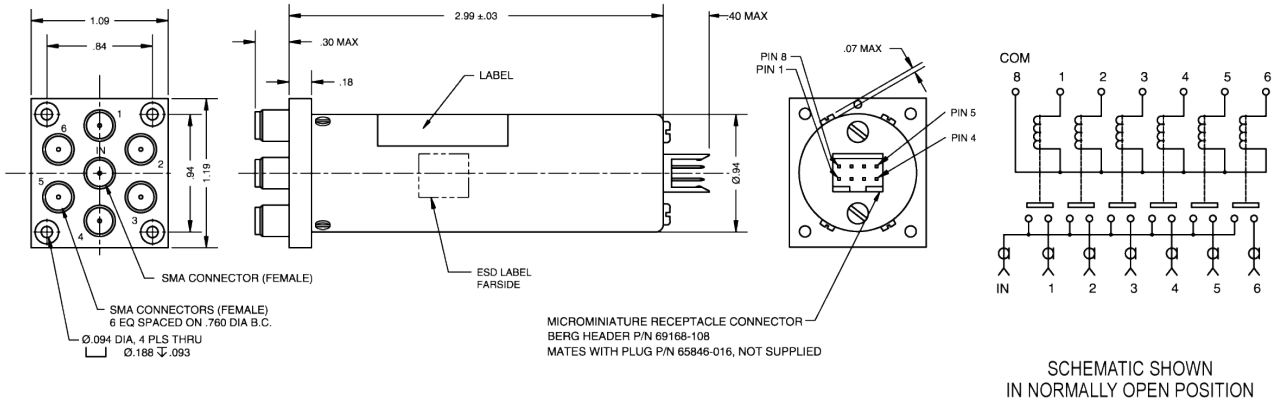
SP6T SMA (F) DC-18 GHz

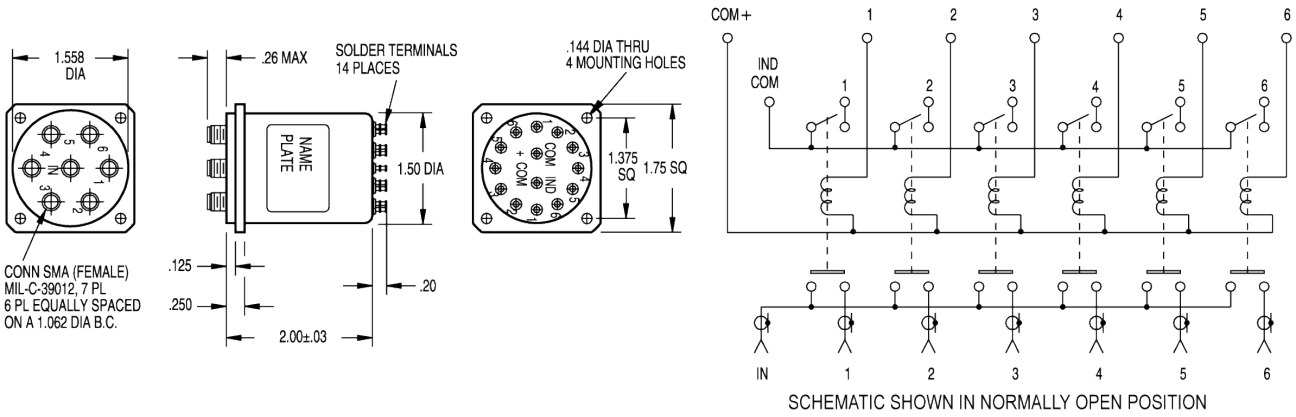
Model	SEM163DT	SEM163LD	SEM163LDT-24
Features	SP6T (SMA), Normally Open, Terminated, TTL*, Suppression Diode, Indicator Ckt.	SP6T (SMA), Pulse Latching, TTL*, Suppresion Diode, Self De-Energizing, Indicator Ckt.	SP6T (SMA), Pulse Latching, Indicator Ckt., Self De-Energizing
Actuating Current	140mA @28Vdc & 25°C	600mA @28Vdc & 25°C	250mA @28Vdc & 25°C
Frequency Range (GHz)	DC-!8	DC-18	DC-18
Insertion Loss dB (max) DC-3 GHz	0.2	0.2	0.2
Insertion Loss dB (max) 3-8 GHz	0.3	0.3	0.3
Insertion Loss dB (max) 8-12.4 GHz	0.4	0.4	0.4
Insertion Loss dB (max) 12.4-18 GHz	0.5	0.5	0.5
VSWR (max) DC-3 GHz	1.2:1	1.2:1	1.2:1
VSWR (max) 3-8 GHz	1.3:1	1.3:1	1.3:1
VSWR (max) 8-12.4 GHz	1.4:1	1.4:1	1.4:1
VSWR (max) 12.4-18 GHz	1.5:1	1.5:1	1.5:1
Isolation dB (min) DC-3 GHz	80	80	80
Isolation dB (min) 3-8 GHz	70	70	70
Isolation dB (min) 8-12.4 GHz	60	60	60
Isolation dB (min) 12.4-18 GHz	60	60	60
Actuation	Normally Open 28V	Latching, 28V	Latching, 24V
Indicator Circuitry	Included	Included	Included
Termination 50 OHMS	Included	N/A	N/A
Suppression Diodes	Included	Included	N/A
TTL Logic	Included	Included	N/A
Special Notes:	A	A	N/A

Special Notes:
A: 1. Selected switch position is controlled by TTL Logic.
2. Switch requires only nominal +28 Vdc for coils (additional 5 Vdc is not required).
3. TTL LOGIC LEVEL: Low 0 to .8 Vdc, High 2.5 to 5.0 Vdc
4. TTL LOGIC INPUT CURRENT: Low 0 mA, High 1.6 mA max @ 3.85 Vdc

SP6T SMA (F) DC-18 GHz



SEM066



SEM163

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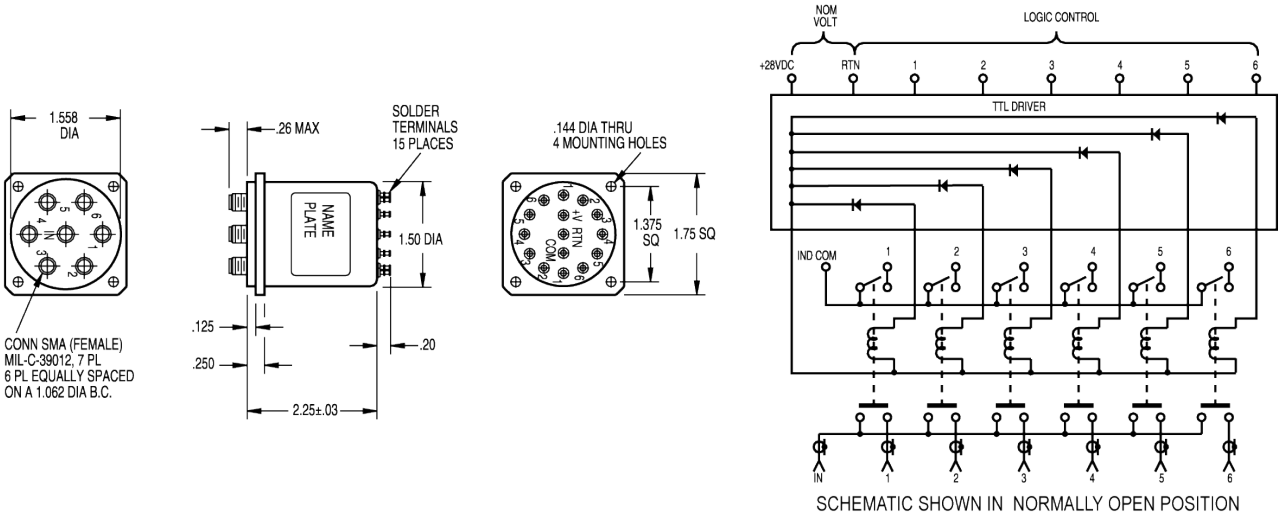
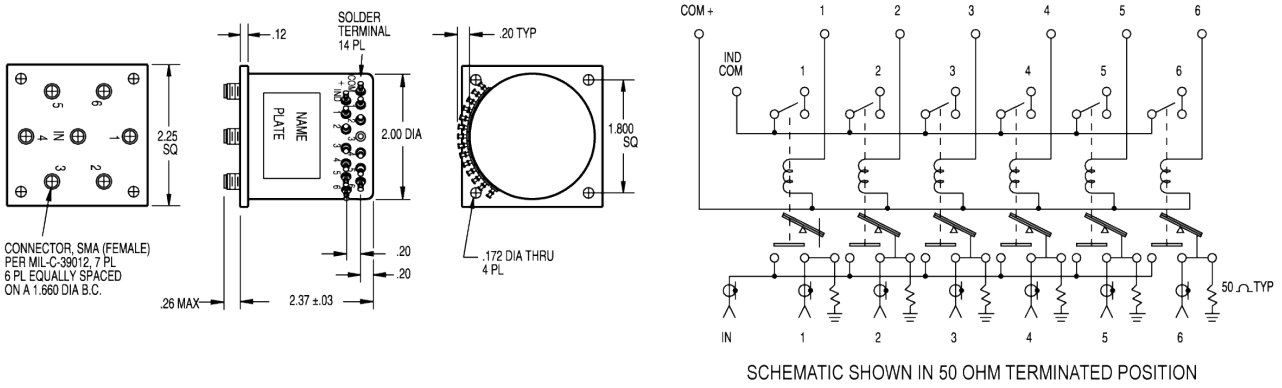
SP6T SMA (F) DC-18 GHz

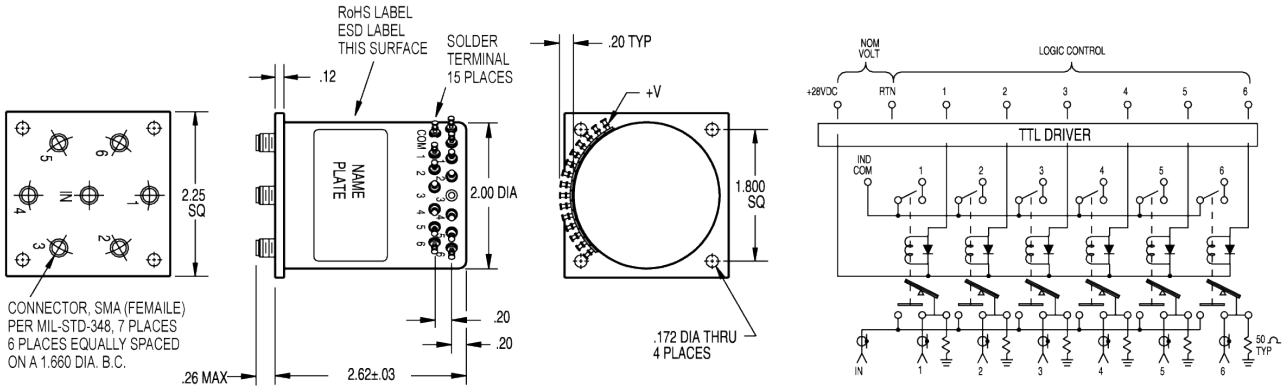


SEM163D



SEM163T

SP6T SMA (F) DC-18 GHz



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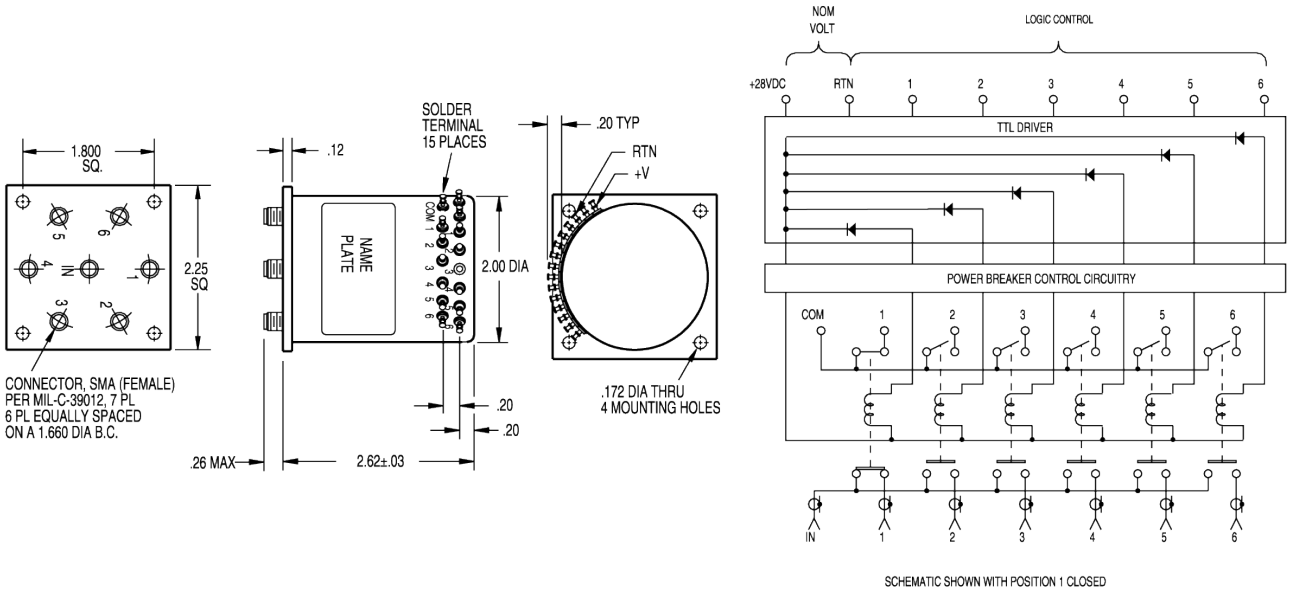

SCHEMATIC SHOWN WITH POSITION 1 CLOSED

SEM163LD

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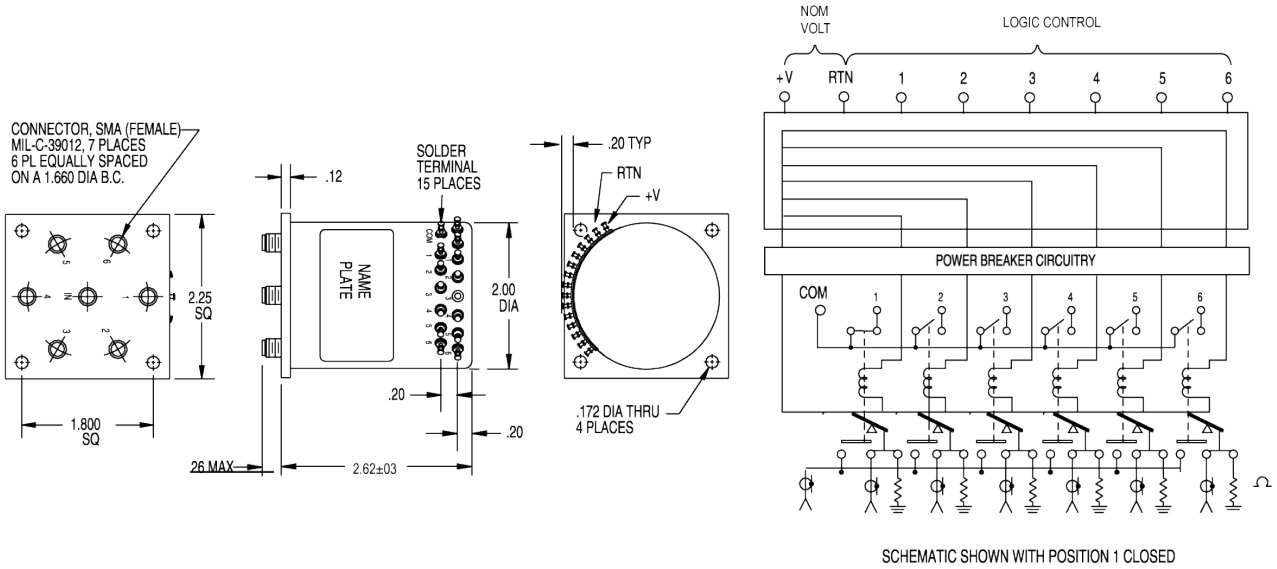
SP6T SMA (F) DC-18 GHz



SCHEMATIC SHOWN WITH POSITION 1 CLOSED

SEM163LDT-24

2P2T (Transfer) SMA (F) DC-18 GHz

Features

- Failsafe and Latching Models
- TTL Logic Control
- Suppression Diodes
- Indicator Circuits

Models

- XSEM323, XSEM323D, XSEM323L, XSEM323LD, XSEM323LD-24

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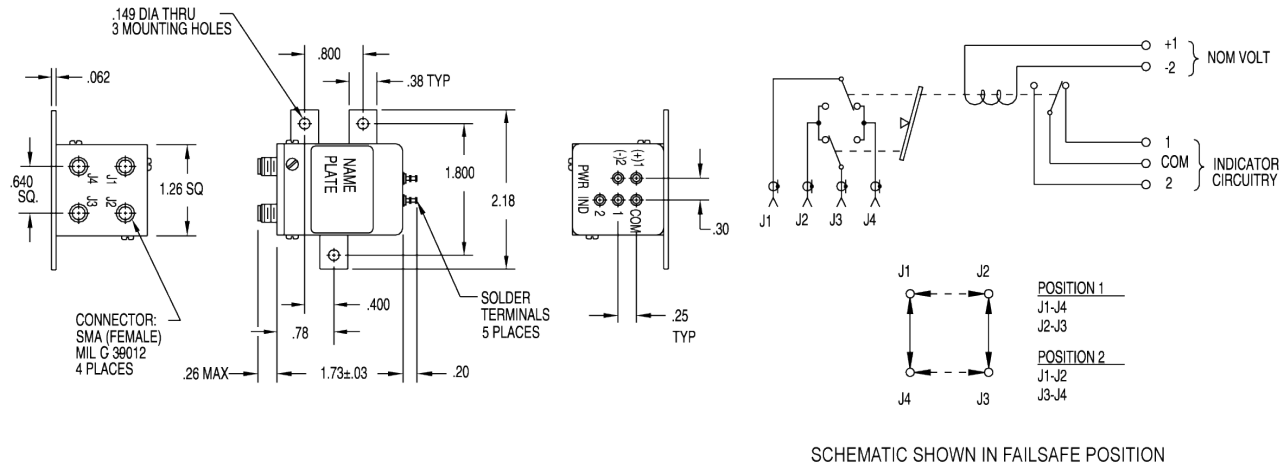
2P2T (Transfer) SMA (F) DC-18 GHz

Model	XSEM323	XSEM323D	XSEM323L	XSEM323LD	XSEM323LD-24
Features	Transfer (SMA), Failsafe, Indicator Ckt.	Transfer (SMA), Failsafe, TTL*, Suppression Diodes, Indicator Ckt.	Transfer (SMA), Pulse Latching, Indicator Ckt.	Transfer (SMA), Pulse Latching, TTL*	Transfer (SMA), Pulse Latching, TTL*
Actuating Current	280 mA @28 Vdc & 25°C	280 mA @28 Vdc & 25°C	200 mA @28 Vdc & 25°C	200 mA @28 Vdc & 25°C	275mA @24 Vdc & 25°C
Frequency Range (GHz)	DC-18	DC-18	DC-18	DC-18	DC-18
Insertion Loss dB (max) DC-3 GHz	0.2	0.2	0.2	0.2	0.2
Insertion Loss dB (max) 3-8 GHz	0.3	0.3	0.3	0.3	0.3
Insertion Loss dB (max) 8-12.4 GHz	0.4	0.4	0.4	0.4	0.4
Insertion Loss dB (max) 12.4-18 GHz	0.5	0.5	0.5	0.5	0.5
VSWR (max) DC-3 GHz	1.2:1	N/A	1.2:1	1.2:1	1.2:1
VSWR (max) 3-8 GHz	1.3:1	1.4:1	1.3:1	1.3:1	1.3:1
VSWR (max) 8-12.4 GHz	1.4:1	1.3:1	1.4:1	1.4:1	1.4:1
Isolation dB (min) DC-3 GHz	80	80	80	80	80
Isolation dB (min) 3-8 GHz	70	70	70	70	70
Isolation dB (min) 8-12.4 GHz	60	60	60	60	60
Isolation dB (min) 12.4-18 GHz	60	60	60	60	60
Type	N/A	Transfer	Transfer	Transfer	Transfer
Actuation	N/A	N/A	Latching, 28V	Latching, 28V	Latching, 24V
Indicator Circuitry	Included	Included	Included	N/A	N/A
Suppression Diodes	N/A	Included	N/A	Included	N/A
TTL Logic	N/A	Included	N/A	Included	Included
Special Notes:	N/A	A	N/A	A	A

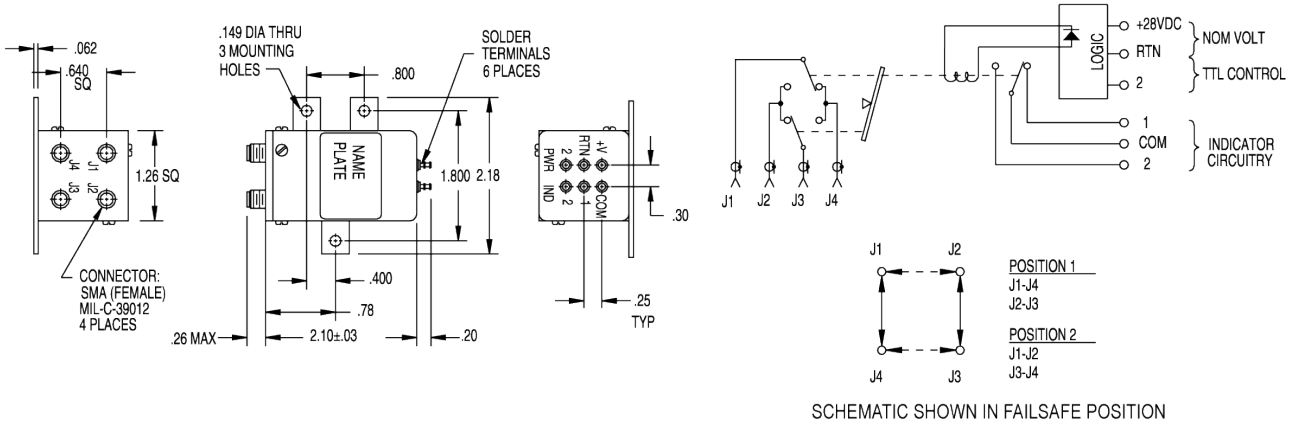
Special Notes:
A: 1. Selected switch position is controlled by TTL Logic.
2. Switch requires only nominal +28 Vdc for coils (additional 5 Vdc is not required).
3. TTL LOGIC LEVEL: Low 0 to .8 Vdc, High 2.5 to 5.0 Vdc
4. TTL LOGIC INPUT CURRENT: Low 0 mA, High 1.6 mA max @ 3.85 Vdc

2P2T (Transfer) SMA (F) DC-18 GHz



SCHEMATIC SHOWN IN FAILSAFE POSITION

XSEM323



SCHEMATIC SHOWN IN FAILSAFE POSITION

XSEM323D

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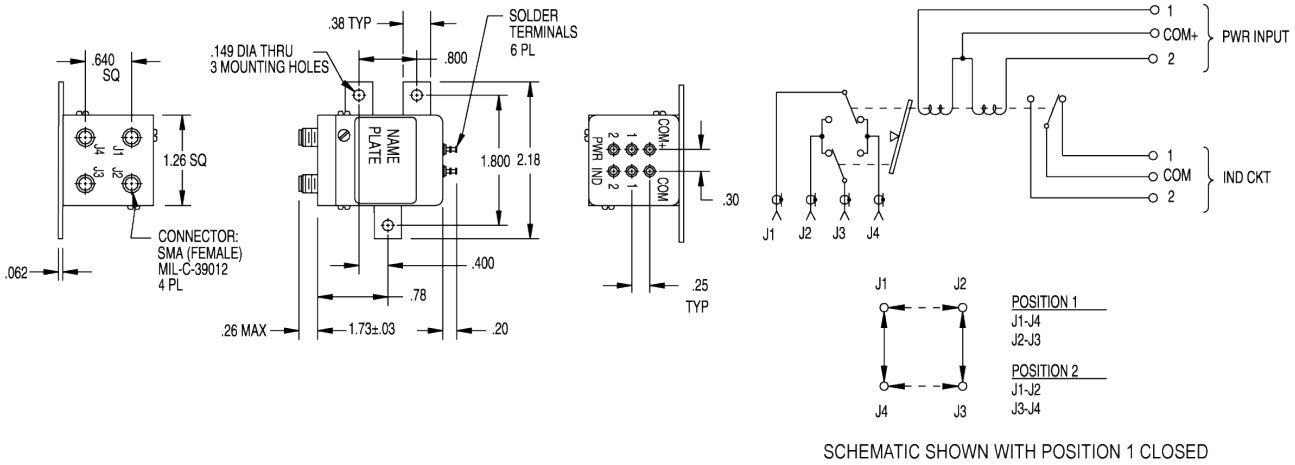
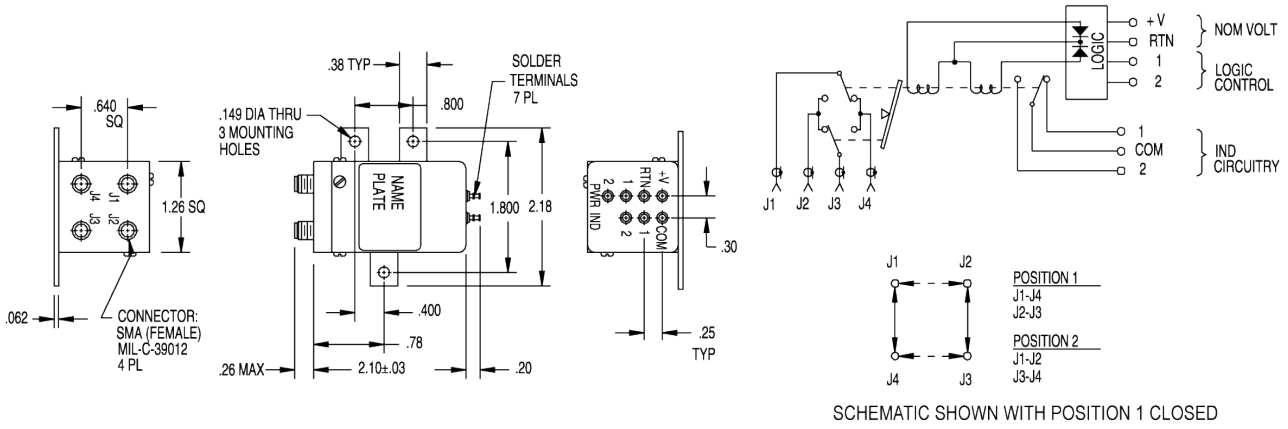
2P2T (Transfer) SMA (F) DC-18 GHz



SCHEMATIC SHOWN WITH POSITION 1 CLOSED

XSEM323L



SCHEMATIC SHOWN WITH POSITION 1 CLOSED

XSEM323LD, XSEM323LD-24

Quick Reference Guide

Custom may now be Standard

We believe your first choice should be Narda's standard SEM switch series even if you have always ordered custom-part switches. Narda has more standard switches than any company in the industry.

But, if standard still won't do...

It's easy to determine the number of a custom-pick Narda switch that will correctly satisfy your intended application. Simply use the Part Number Charts on the following page. Referring to these charts, sequentially select the desired switch characteristics and options from Group 1 through Group 9. (The terms used here are defined in the Glossary). Within each group, select the number or letter representing the desired configuration or feature and record it in the manner shown by the typical part number on the chart. (The open boxes below are provided to assist you in using the part numbering process).

Note that the last digit in part number Group 1 is indicative of envelope size and requires reference to the individual specifications and drawings in this catalog.

Select only one character from each part number group except for the Group 3 options. In Group 3, you many select as many options as applicable.

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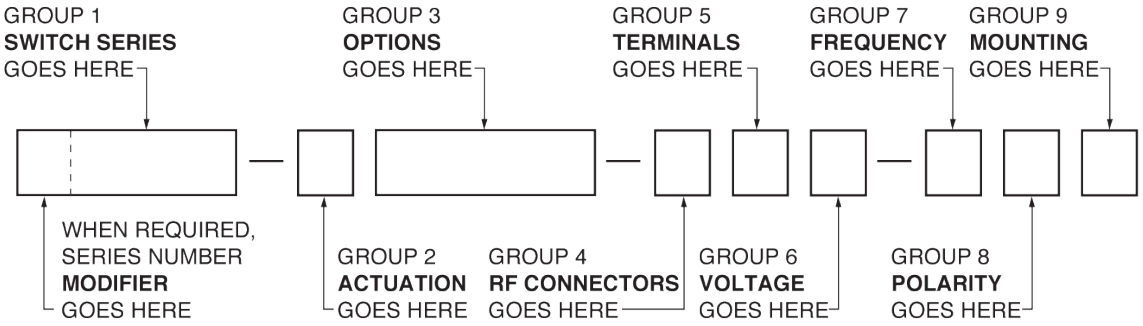
In Group 1, four items identified as “series number modifiers” call for further explanation:
6XXX - If a matrix-type switch is required, precede the selected series number with modifier number "6" (for example, specify 6080 for an eight-position matrix switch).

8XXX - If you are able to configure a required switch from the features and options listed here, but will be imposing your own design or test specification, precede the selected series number with modifier number "8" to indicate to us that our standard switch may require special treatment.

9XXX - When a deviation from a standard design is required (for example, painted housing instead of black anodized), precede the selected series number with the number "9." Then contact your Narda Regional Sales Manager.

To confirm that desired options are available for the selected switch series, please refer to the individual switch specifications in this section. Any other question that may arise in determining the proper part number should be addressed to your Narda Regional Sales Manager.



Part Number Charts

GROUP 1 — SWITCH SERIES

022 - SPDT	062 - SP6T
023 - SPDT	063 - SP6T
025 - SPDT	073 - SP7T
026 - SPDT	075 - SP7T
030 - SP3T	083 - SP8T
032 - SP3T	085 - SP8T
033 - SP3T	091 - SP9T
036 - SP3T	093 - SP9T
040 - SP4T	100 - SP10T
042 - SP4T	101 - SP10T
043 - SP4T	103 - SP10T
046 - SP4T	110 - SP11T
050 - SP5T	120 - SP12T
052 - ST5T	130 - Transfer
053 - SP5T	132 - Transfer
056 - SP5T	136 - Transfer
060 - SP6T	150 - 2-SPDT
	156 - 2-SPDT

6XXX - Matrix Switches
8XXX - Customer Specification
9XXX - Modified Standard

GROUP 3 — OPTIONS

0 - None
1 - 50-Ohm Terminations
2 - Indicator Circuitry
3 - Suppression Diodes
4 - TTL Logic High*
5 - Other (Specify)††
7 - Self-De-energizing Circuitry*
V - MOSFET Driver*
Y - BCD TTL Decoder*

GROUP 5 — TERMINALS

1 - Solder (standard)
2 - Power Connector/ Fast Disconnect (standard MIL)
3 - Power Connector/ Fast Disconnect (standard "D")
4 - Solder (loop)
5 - Other (Specify)††
S - Side Mounted Terminals

GROUP 7 — FREQUENCY

0 - DC - 1 GHz
1 - DC - 3 GHz
2 - DC - 8 GHz
3 - DC - 12.4 GHz
4 - DC - 18 GHz
6 - DC - 26.5 GHz
8 - DC - 6 GHz
7 - Other (Specify)††

GROUP 9 — MOUNTING

0 - Standard Mounting Holes
1 - Bracket
2 - Flange
3 - Other (Specify)††

TYPICAL PART NUMBER†

022	—	B	1234	—	A	1	C	—	6	C	0

GROUP 2 — ACTUATION

A - Failsafe
B - Latching**
C - Latching Reset
D - Normally Open
DA- Normally Open Failsafe to Position 1

GROUP 4 — RF CONNECTORS

A - SMA
D - N
E - TNC
G - Other (Specify)††

GROUP 6 — VOLTAGE

B - 12 Vdc
C - 24 Vdc
D - 28 Vdc
E - 48 Vdc
G - Other (Specify)††
H - 15 Vdc
I - 18 Vdc

GROUP 8 — POLARITY

A - Common Plus
B - Common Minus
C - Not Relevant to Application for Switches with Logic

* If this option is selected, suppression diodes (option 3) must also be selected.

** Requires pulse control of duration 30 to 100 ms unless self-de-energizing circuitry option is chosen. Self-de-energizing circuitry is recommended for multi-throw switches.

† Sample part number identifies: SPDT switch, latching, 50-ohm termination, indicator circuitry suppression diodes, TTL logic, SMA connectors, solder terminals, 24 Vdc, DC-26.5 GHz, polarity not relevant.

†† Consult the factory if "Other" is specified in any field.

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Glossary

The following glossary defines the various options and features available on Narda switches.

SPDT Switch - A single-pole, double-throw switch has one input port and two selectable output ports.

Multiposition Switch - A multiposition switch has one input port and more than two selectable output ports. Standard Narda switches offer up to 12 outputs operating from a single input. Unlike some switch designs, Narda multiposition models can be switched directly to any one of the available output positions without sequencing through any intervening positions.

Transfer Switch (DPDT) - A transfer switch has two independent paths that operate simultaneously in either of two selected positions.

Failsafe - a mode of operation in which the switch moves to the closed position when the actuating voltage is applied and always returns to a predetermined position when the voltage is removed.

Hot Switching - a mode of operation where a high power RF signal is continually applied to the RF contacts while the switch is changing positions. Should this mode of operation be necessary, specify a Make-Before-Break (MBB) type of actuation. It must be noted that switch life is a factor in this type of operation (1 Watt max). Contact Narda for more information.

Latching - Also called pulsed latching, a mode of operation in which the switch remains in a preselected position whenever the actuating voltage is removed or interrupted and holds that preselected position until a voltage is applied to another position. Latching switches specified without self de-energizing circuitry require pulse control, with pulse duration of 30 to 100 milliseconds.

Latching Reset - A mode of operation in which the switch remains in the pre-selected position whenever the actuating voltage is removed or interrupted. However, switching to a new position cannot occur until a voltage has been applied to the reset terminal to open all closed switching positions. This reset mode then permits random selection of any desired switch position and guarantees clean break-before-make switching.

Normally Open - A mode of operation in which all output ports of the switch are disconnected from the input port until a voltage is applied to maintain a selected position. The switch returns to its open position with the removal of voltage.

Normally Open Failsafe to Position 1 - In this mode of operation, (available only on multiposition switches), Position 1 is always closed until another switch position has been selected.

Make Before Break (MBB) - The make-before-break switch configuration is used in applications where RF power must remain “on” during switching. Also known as “hot switching.” See above.

50-Ohm Termination - With this option, each unused or open output RF port is internally terminated in a 50-ohm resistive load. 1 W CW per position max.; 5 W CW max input total per switch.

Indicator Circuitry - With the indicator circuitry option, a set of internally mounted contacts allow external monitoring of switch RF status. Some series require a steering diode 1:24:1 VSWR max.

Suppression Diodes - With this option, fast-recovery silicon recitifiers (diodes) are connected in parallel with the coils of the switch to suppress any transient voltage generated by the coils.

TTL - Selected position of the switch is controlled by a TTL Logic High. The switch requires only nominal +28 Vdc (additional 5 Vdc is not required).

TTL Logic Voltage Level: Low 0 to 0.8 Vdc
High 2.5 to 5.0 Vdc
TTL Logic Input Current: Low 0 mA
High 1.6 mA max. @ 3.85 Vdc

TTL Logic, High Input - Completely contained within the switch housing, this Transistor-Transistor-Logic driver circuitry enables the status of the switch to be controlled by the high level of the TTL logic input.

Manual Activator - With this option specified, the RF switch position can only be selected manually. Narda does not offer this as a standard.

Manual Override Activator - With the manual override option, each RF position of the switch can be selected either electrically or manually. Narda does not offer this as a standard.

Self De-energizing Circuitry - With this option, a set of internally mounted contacts or electronically generated pulses disconnects the driver voltage as soon as RF contact has been made. This option is only available with latching type switches. Suppression diodes must be specified with this option.

Power-Handling Capability (Watts CW) - Several factors determine the power-handling capability of a given switch design. A general indication of power capability versus frequency.

BCD TTL Decoder - Completely contained within the switch housing, BCD logic circuitry establishes compatibility of the switch with binary logic inputs.

MOSFET Driver - Completely contained within the switch housing, the MOSFET driver establishes compatibility of the switch with external CMOS (15 Vdc) control logic. This type of driver can be controlled by any DC voltage from 3 Vdc up to 15 Vdc. A MOSFET circuit is switched with voltage and requires virtually no current. Also, it does not require a separate +5 Vdc power supply.

Standard Solder Terminal - The standard solder terminal offered with switches is a gold-plated, double-turret terminal. (See illustration on following page)

Solder (Loop) Terminal - As an option, Narda offers a glass-to-metal loop-type solder terminal. (See illustration on following page)

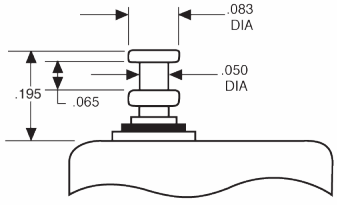
Power Connector/Fast Disconnect - The standard power connectors offered with Narda switches are specified on the individual data sheets in this catalog. Narda switches can also be supplied with other power connectors specified by the customer.

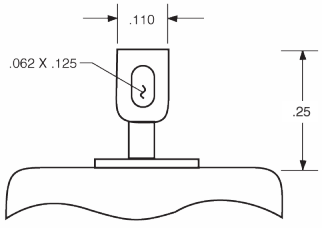
Polarity - Either common-plus polarity or common-minus polarity must always be specified when ordering the following switches:

Latching
Latching Reset
Latching with Self De-energizing Circuitry
Latching Reset with Self De-energizing Circuitry
Make Before Break
Normally Open with Suppression Diodes
Failsafe with Suppression Diodes
Normally Open Failsafe to Position 1 with Suppression Diodes
Indicators

Polarity is not relevant to application for switches listed as follows:
Normally Open – No Options
Failsafe – No Options, except for XSEM323 or 130 Series
Switches with TTL logic driver, BCD decoder or MOSFET driver

Actuator Voltage - Standard Narda DC actuating voltages are 12, 15, 18, 24, 28 and 48. When other voltages are required, contact your Narda Regional Sales Manager for instructions.





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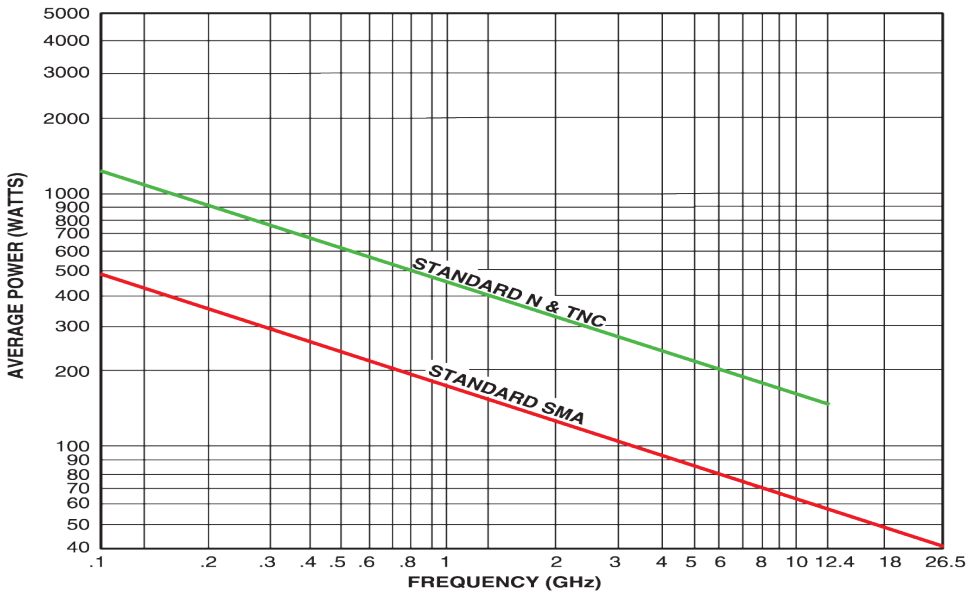
Power Handling Capability



Power Handling Capability of Narda Switches vs. Frequency for Common RF Connectors (for 25°C ambient temperature, matched 50-ohm systems, sea level and cold switching)

For VSWR above 1.1:1, Derate Power Handling Capability as shown:

VSWR	***Derating Factor***
1.5:1	*.94*
2.0:1	*.88*
2.5:1	*.83*
3.0:1	*.78*
3.5:1	*.73*
4.0:1	*.70*

Cross Reference Index

CUSTOM PART NO.	SEM NO.	TYPE	FREQUENCY RANGE GHz	CONNECTOR	ACTUATION	TERMINATION 50 OHMS	INDICATOR CIRCUITRY	SUPPRESSION DIODES	TTL LOGIC	SELF DE-ENERGIZING CIRCUIT
025-A0-A1D-4C0	020	SPDT	DC TO 18	SMA	FAILSAFE, 28V					
025-A0-A1B-4C0	020-12	SPDT	DC TO 18	SMA	FAILSAFE, 12V					
025-A0-A1C-4C0	020-24	SPDT	DC TO 18	SMA	FAILSAFE, 24					
025-B0-A1D-4A0	020L	SPDT	DC TO 18	SMA	LATCHING, 28V					
025-A2-A1D-4C0	123	SPDT	DC TO 18	SMA	FAILSAFE, 28V		✓			
025-A234-A1D-4C0	123D	SPDT	DC TO 18	SMA	FAILSAFE, 28V		✓	✓	✓	
026-A12-A1D-4C0	123T	SPDT	DC TO 18	SMA	FAILSAFE, 28V		✓			
025-B23-A1D-4A0	123L	SPDT	DC TO 18	SMA	LATCHING, 28V		✓	✓		
026-B123-A1D-4A0	123LT	SPDT	DC TO 18	SMA	LATCHING, 28V	✓	✓	✓		
025-B234-A1D-4C0	123LD	SPDT	DC TO 18	SMA	LATCHING, 28V		✓	✓	✓	
026-A1234-A1D-4C0	123DT	SPDT	DC TO 18	SMA	FAILSAFE, 28V	✓	✓	✓	✓	
026-B12347-A1D-4C0	123LDT	SPDT	DC TO 18	SMA	LATCHING, 28V	✓	✓	✓	✓	✓
026-B12347-A1C-4C0	123LDT-24	SP2T	DC TO 18	SMA	LATCHING, 24V	✓	✓	✓	✓	✓
023-A2-D1D-3A0	123N	SPDT	DC TO 12.4	N	FAILSAFE, 28V		✓			
023-A234-D1D-3C0	123DN	SPDT	DC TO 12.4	N	FAILSAFE, 28V		✓	✓	✓	
025-A2-A1D-6C0	124	SPDT	DC TO 26.5	SMA	FAILSAFE, 28V		✓			
030-D2-A1D-4A2	133	SP3T	DC TO 18	SMA	NORMAL OPEN, 28V		✓			
030-D234-A1D-4C2	133D	SP3T	DC TO 18	SMA	NORMAL OPEN, 28V		✓	✓	✓	
032-D1234-A1D-4C2	133DT	SP3T	DC TO 18	SMA	NORMAL OPEN, 28V	✓	✓	✓	✓	
032-B12-A1D-4A2	133LT	SP3T	DC TO 18	SMA	LATCHING, 28V	✓	✓			
032-D12-A1D-4A2	133T	SP3T	DC TO 18	SMA	NORMAL OPEN, 28V	✓	✓			
040-D2-A1D-4A2	143	SP4T	DC TO 18	SMA	NORMAL OPEN, 28V		✓			
040-D234-A1D-4C2	143D	SP4T	DC TO 18	SMA	NORMAL OPEN, 28V		✓	✓	✓	
042-D1234-A1D-4C2	143DT	SP4T	DC TO 18	SMA	NORMAL OPEN, 28V	✓	✓	✓	✓	
042-D1234-A1C-4C2	143DT-24	SP4T	DC TO 18	SMA	NORMAL OPEN, 24V	✓	✓	✓	✓	
042-D12-A1D-4A2	143T	SP4T	DC TO 18	SMA	NORMAL OPEN, 28V	✓	✓			
050-D2-A1D-4A2	153	SP5T	DC TO 18	SMA	NORMAL OPEN, 28V		✓			
066-D0-A2D-4C2	066	SP6T	DC TO 18	SMA	NORMAL OPEN, 28V					
060-D2-A1D-4A2	163	SP6T	DC TO 18	SMA	NORMAL OPEN, 28V		✓	✓		
060-D234-A1D-4C2	163D	SP6T	DC TO 18	SMA	NORMAL OPEN, 28V		✓	✓	✓	
062-D1234-A1D-4C2	163DT	SP6T	DC TO 18	SMA	NORMAL OPEN, 28V	✓	✓	✓	✓	
062-B2347-A1D-4C2	163LD	SP6T	DC TO 18	SMA	LATCHING, 28V		✓	✓	✓	✓
062-D12-A1D-4A2	163T	SP6T	DC TO 18	SMA	LATCHING, 28V	✓	✓			
062-B12347-A1C-4C2	163LDT-24	SP6T	DC TO 18	SMA	LATCHING, 24V	✓	✓	✓	✓	✓
130-A2-A1D-4A1	XSEM 323	TRANSFER	DC TO 18	SMA	FAILSAFE, 28V		✓			
130-A234-A1D-4C1	XSEM 323D	TRANSFER	DC TO 18	SMA	FAILSAFE, 28V		✓	✓	✓	
130-B23-A1D-4A1	XSEM 323L	TRANSFER	DC TO 18	SMA	LATCHING, 28V		✓	✓		
130-B234-A1D-4C1	XSEM 323LD	TRANSFER	DC TO 18	SMA	LATCHING, 28V		✓	✓	✓	
130-B234-A1C-4C1	XSEM-323LD-24	TRANSFER	DC TO 12.4	SMA	LATCHING, 24V		✓	✓	✓	

If part number is an SEM, proceed to SEM section.

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Selecting an SPDT Switch:

The following pages describe a wide range of SPDT and 2-SPDT switches, presenting specifications, outline drawings and typical schematics for each model in this group. Important distinctions among these models are noted here to help the user select the correct switch for a specific application:

022 & 026
Two different SPDT switches with terminations. Frequency range up to 26.5 GHz with SMA connectors. Series 022 offers two externally mounted terminations. Series 026 is available with two internal terminations (refer to outline drawings for details).

023
A SPDT switch available with TNC, and Type-N connectors. Frequency range up to 12.4 GHz.

023 with termination
Similar to standard 023 switch, but also offers internal 50-ohm terminations.

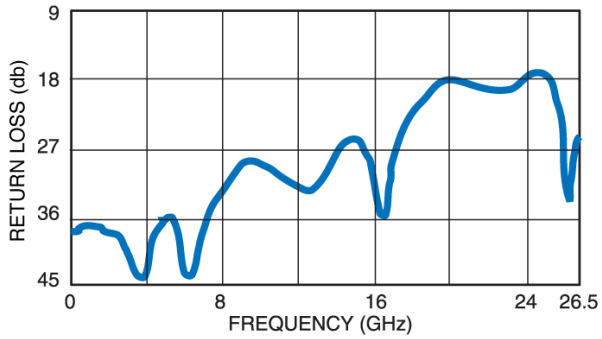
025
High Performance, high reliability, low cost SPDT switch. Frequency range up to 26.5 GHz.

150
Two SPDT switches in a single package. Frequency range up to 26.5 GHz with SMA connectors.

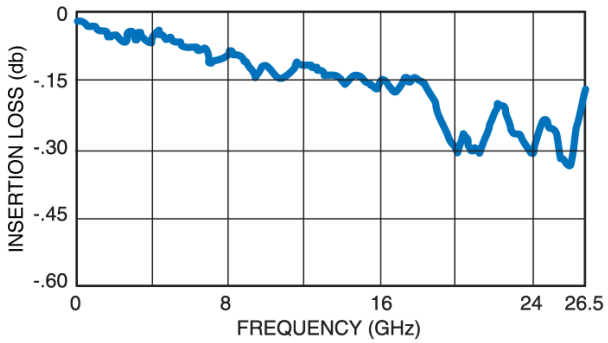
156 Miniature
Miniature Two independent SPDT switches in a single package. Frequency range up to 26.5 GHz with SMA connectors.

PCSW11799
PC Board mountable SPDT switch, DC - 8 GHz

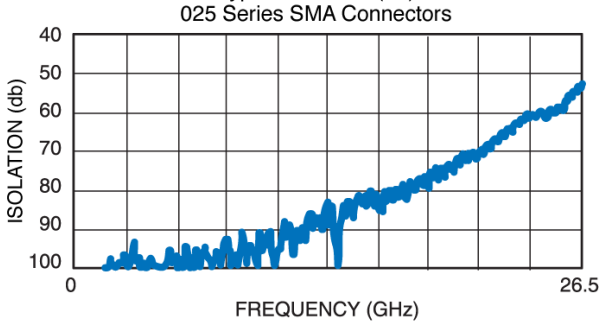
Typical Return Loss (db)
025 Series SMA Connectors



Typical Insertion Loss (db)
025 Series SMA Connectors



Typical Isolation (db)
025 Series SMA Connectors



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Hermetic PC Board-Mountable Electromechanical Switch

Features

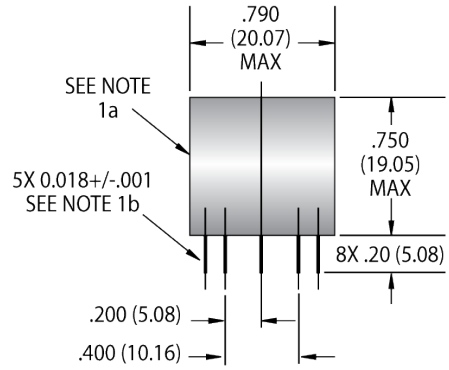
- Miniature
- Fully Hermetic
- Operational Over Full Military Environments
- 12 Vdc and 28 Vdc Models

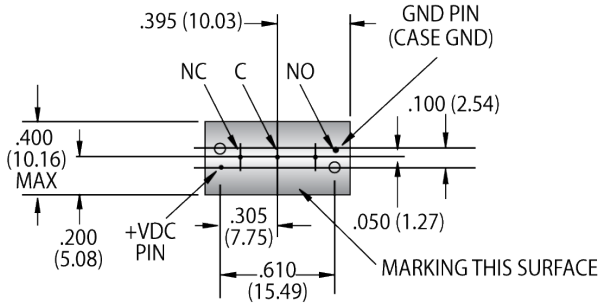
Models

- PCSW11799-12, PCSW11799-28

Model	PCSW11799-12	PCSW11799-28
Frequency Range (GHz)	DC-8	DC-8
VSWR (max) DC-4 GHz	1.4:1	1.4:1
VSWR (max) 4-8 GHz	1.5:1	1.5:1
Insertion Loss dB (max) DC-4 GHz	0.4	0.4
Insertion Loss dB (max) 4-8 GHz	0.8	0.8
Isolation dB (min) DC-4 GHz	45	45
Isolation dB (min) 4-8 GHz	40	40
RF Impedance (nominal)	50 Ohms	50 Ohms
Actuating Voltage	+12 VDC +/-0.5 VDC	+28 VDC +/-0.5 VDC
Switching Time	20 msec @ 25°C	20 msec @ 25°C
Switching Sequence	Break Before Make	Break Before Make
Operating Mode	Failsafe	Failsafe
Housing	Hermetic Package (Metal to Metal)	Hermetic Package (Metal to Metal)
Power Handling (cold switching)	50 W (max)	50 W (max)
Phase Match	+/- 2.0° (Unit to Unite COM-NC and Unit to Unit COM-NO)	+/- 2.0° (Unit to Unite COM-NC and Unit to Unit COM-NO)
Operating Temperature	-35°C to +75°C	-35°C to +75°C
Storage Temperature	-55°C to +85°C	-55°C to +85°C
Soldering Temperature (max)	280°C	280°C
Humidity	100% RH (with Condensation)	100% RH (with Condensation)
Vibration (operational, chatter free)	10 g's sine @ 55-2000 Hz	10 g's sine @ 55-2000 Hz
Shock	30 g's @ 11 msec, 1/2 sine	30 g's @ 11 msec, 1/2 sine
Altitude	Sea Level to 50,000 feet	Sea Level to 50,000 feet

Hermetic PC Board-Mountable Electromechanical Switch





TOL:
XX +/- .02
XXX +/- .005
NOTES:
1. FINISH:
a) HOUSING GOLD PLATE
b) RF/DC GOLD PLATE

PCSW11799

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Series 022 (External Termination) - SPDT / DC-26.5 GHz / SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28 Vdc
- Actuating Current*: 280 mA (max)
- Switching Time: 15 ms (max)
- Switching Sequence: Break Before Make
- Operating Mode*: Failsafe
- Operating Ambient Temperature: -25°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Freq Range (GHz)	DC-3	3-8	8-12.4	12.4-18	18-24	24-26.5
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.6:1	1.7:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5	0.6	0.7
Isolation (Min dB)	80	70	60	60	50	45

Options Available

GROUP 2 ACTUATION
- A - FAILSAFE
- B - LATCHING
- D - NORM OPEN

GROUP 3 OPTIONS
- 1 - 50-OHM TERMINATION
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER

GROUP 4 RF CONNECTORS
- A - SMA
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS
- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE
- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY
- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 3 - DC - 12.4 GHz
- 4 - DC - 18 GHz
- 5 - DC - 18.5 GHz
- 6 - DC - 26.5 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY
- A - COMMON PLUS
- B - COMMON MINUS
- C - NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING
- 0 - STANDARD MOUNTING HOLES
- 3 - OTHER (SPECIFY)

NOTE: See Series 026 for internal terminations.

Switch Height (A) for Selected Options

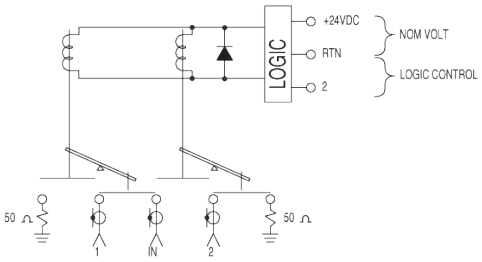
DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
1.67	A, B, D	1,3
2.01	A, D	1,2,3
2.01	B	1,2,3,7
2.26	A, D	1,2,3,4, or 5,V
2.26	B	1,2,3,4 or 5,7,V
2.26**	A,D	1,2,3,4 or 5,V
2.26**	B	1,2,3,4, or 5,7,V

* Specifications for 28 Vdc, Failsafe configuration.

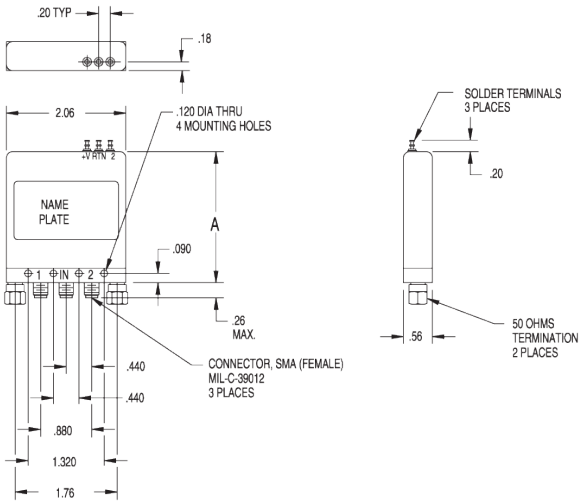
** Dimension for switches with Standard Narda Power Connector M24308/3-1 mating with M24308/2-1.

Series 022 (External Termination) - SPDT / DC-26.5 GHz / SMA

Typical Schematic and Outline Drawing



SCHEMATIC SHOWN IN FAILSAFE POSITION



SERIES 022 SWITCH WITH EXTERNAL TERMINATIONS

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Series 023 SPDT / DC-12.4 GHz / N, TNC

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Failsafe: 180 mA (max)
- Actuating Current* Latching: 200 mA (max)
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Mode*: Failsafe
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4
VSWR (Max)	1.2:1	1.35:1	1.5:1
Insertion Loss (Max dB)	0.2	0.35	0.5
Isolation (Min dB)	80	70	60

Options Available

GROUP 2 ACTUATION

- A - FAILSAFE
- B - LATCHING
- D - NORM OPEN

GROUP 3 OPTIONS

- 0 - NONE
- 1 - 50-OHM TERMINATION
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER

GROUP 4 RF CONNECTORS

- D - N
- E - TNC
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 3 - DC - 12.4 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C- NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

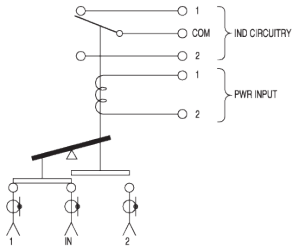
DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
2.00	A, D	0,3,4 or 5,V
2.00	B	0,3,4 or 5,V
2.24**	B	2,3,4, or 5,7,V
2.24**	A, D	2,3,4 or 5,V

* Specifications for 28 Vdc, 25°C

** Dimension for switches with Standard Narda Power Connector MS3113H-10-6P mating with MS3116E-10-6S

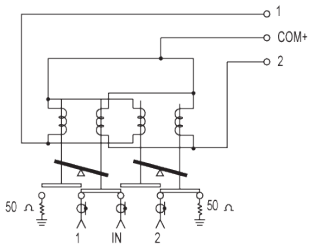
Series 023 SPDT / DC-12.4 GHz / N, TNC

Typical Schematics



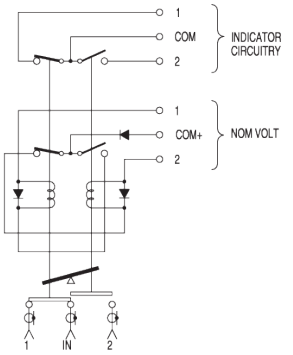
SCHEMATIC SHOWN IN FAILSAFE POSITION

Failsafe SPDT switch with indicator circuitry. (A2)



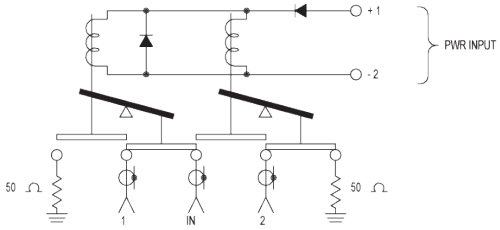
SCHEMATIC SHOWN WITH POSITION 1 CLOSED

Latching common plus SPDT terminated switch. (B1)



SCHEMATIC SHOWN WITH POSITION 1 CLOSED

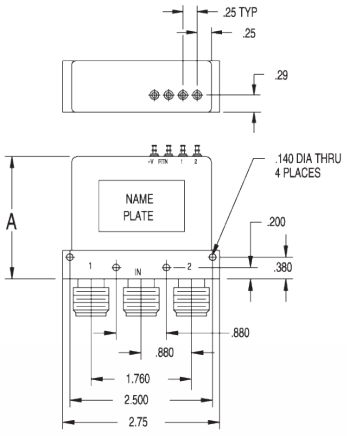
Latching, common plus SPDT switch with indicator circuitry, self de-energizing circuitry & suppression diodes. (B237)



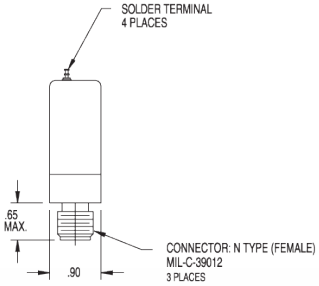
SCHEMATIC SHOWN IN FAILSAFE POSITION

Failsafe SPDT terminated switch with suppression diodes. (A13)

Typical Outline Drawings



NOTE: Switches with side-mounted terminals must have the letter “S” added to the terminal designation in Group 5.



EXAMPLE: “1 S” means switch with solder terminals located on the side of the can.

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Series 025 - SPDT / DC-26.5 GHz / SMA

Features

- RF Impedance: 50ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Failsafe: 160mA (max)
- Actuating Current* Latching: 200mA (max)
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Mode*: Failsafe & Latching
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 2 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4	12.4-18	18-26.5
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.7:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5	0.7
Isolation (Min dB)	80	70	60	60	50

Options Available

GROUP 2 ACTUATION

A - FAILSAFE
B- LATCHING

GROUP 3 OPTIONS

0 - NONE
2 - INDICATOR CIRCUITRY
3 - SUPPRESSION DIODES
4 - TTL LOGIC HIGH
7- SELF DE-ENERGIZING CIRCUITRY
9 - OTHER (SPECIFY)

GROUP 4 RF CONNECTORS

A - SMA
G - OTHER (SPECIFY)

GROUP 5 TERMINALS

1 - SOLDER (STANDARD)
3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
4 - SOLDER LOOP
5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

B - 12 VDC
C - 24 VDC
D - 28 VDC
E - 48 VDC
G - OTHER (SPECIFY)
H - 15 VDC
I - 18 VDC

GROUP 7 FREQUENCY

0- DC - 1 GHz
1 - DC - 3 GHz
2 - DC - 8 GHz
3 - DC - 12.4 GHz
4 - DC - 18 GHz
6 - DC - 26.5 GHz
7 - OTHER (SPECIFY)

GROUP 8 POLARITY

A - COMMON PLUS
B - COMMON MINUS
C - NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

0 - STANDARD MOUNTING HOLES
3 - OTHER (SPECIFY)

Switch Height (A) For Selected Options

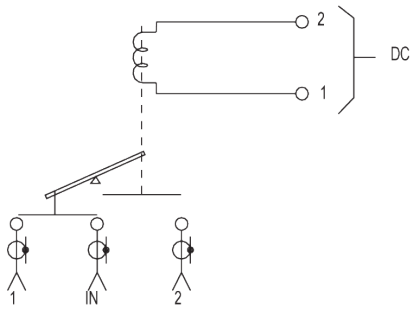
DIM A ±.03	GROUP 5 TERMINAL
1.5	1
2.1**	3

* Specifications for 28 Vdc, Ø25

** Dimension for switches with Standard Narda Power Connector M24308/3-1 mating with M24308/1-1

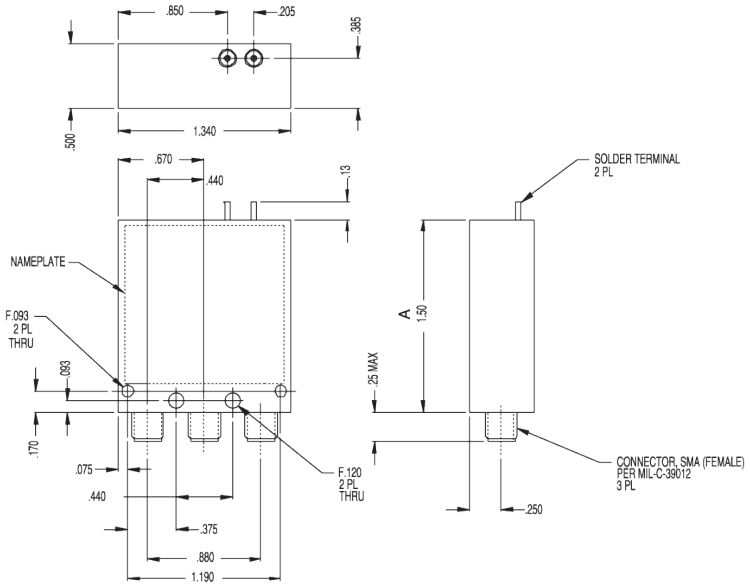
Series 025 - SPDT / DC-26.5 GHz / SMA

Typical Schematic



SCHEMATIC SHOWN IN FAILSAFE POSITION

Typical Outline Drawing



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Series 026 (Internal Termination)

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage: 28Vdc
- Actuating Current Failsafe: 280 mA (max)
- Actuating Current Latching: 200 mA (max)
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Mode: Failsafe
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Freq Range (GHz)	DC-3	3-8	8-12.4	12.4-18	18-24	24-26.5
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.6:1	1.7:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5	0.6	0.7
Isolation (Min dB)	80	70	60	60	50	45

Options Available

GROUP 2 ACTUATION
- A - FAILSAFE
- B - LATCHING
- D - NORM OPEN

GROUP 3 OPTIONS
- 1 - 50-OHM TERMINATION
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER

GROUP 4 RF CONNECTORS
- A - SMA
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS
- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE
- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY
- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 3 - DC - 12.4 GHz
- 4 - DC - 18 GHz
- 5 - DC - 18.5 GHz
- 6 - DC - 26.5 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY
- A - COMMON PLUS
- B - COMMON MINUS
- C - NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING
- 0 - STANDARD MOUNTING HOLES
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

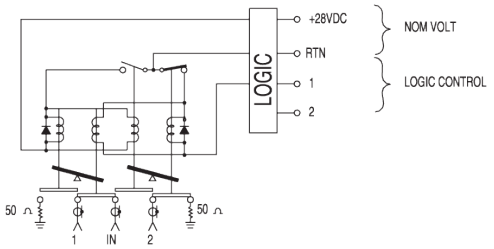
DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
1.67	A, B, D	1,3
2.01	A, D	1,2,3
2.01	B	1,2,3,7
2.26	A, D	1,2,3,4, or 5,V
2.26	B	1,2,3,4 or 5,7,V
2.26**	A,D	1,2,3,4 or 5,V
2.26**	B	1,2,3,4 or 5,7,V

** Dimension for switches with Standard Narda Power Connector M24308/3-1 mating with M24308/2-1.

NOTE: Series 022 is offered with external terminations (see page 240)

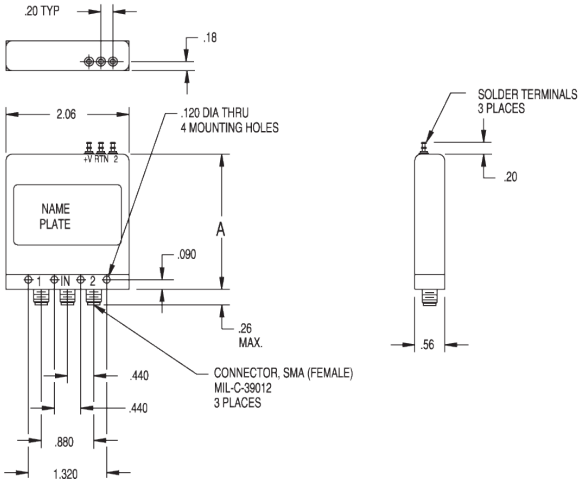
Series 026 (Internal Termination)

Typical Schematic and Outline Drawing



SCHEMATIC SHOWN WITH POSITION 1 CLOSED

LATCHING WITH SELF DE-ENERGIZING CIRCUITRY



SERIES 026 SWITCH WITH INTERNAL TERMINATIONS.

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Series 150 - 2-SPDT / DC-26.5 GHz / SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Failsafe: 280 mA (max)
- Actuating Current* Latching: 400 mA (max)
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Freq Range (GHz)	DC-3	3-8	8-12.4	12.4-18	18-24	24-26.5
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.6:1	1.70:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5	0.6	0.7
Isolation (Min dB)	80	70	60	60	50	45

Options Available

GROUP 2 ACTUATION

- A - FAILSAFE
- B - LATCHING
- D - NORM OPEN

GROUP 3 OPTIONS

- 0 - NONE
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER

GROUP 4 RF CONNECTORS

- A - SMA
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT STANDARD
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 3 - DC - 12.4 GHz
- 4 - DC - 18 GHz
- 5 - DC - 18.5 GHz
- 6 - DC - 26.5 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C- NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 1 - BRACKET
- 2 - FLANGE
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

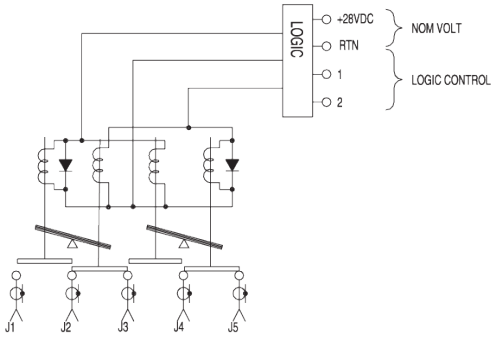
DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
1.67	A, B, D	3
2.01	A, D	2,3
2.01	B	2,3,7
2.26**	A, D	2,3,4, or 5,V
2.26**	B	2,3,4 or 5,7V

* Specifications for 28 Vdc, 25°C

** Dimension for switches with Standard Narda Power Connector M24308/3-1 mating with M24308/2-1.

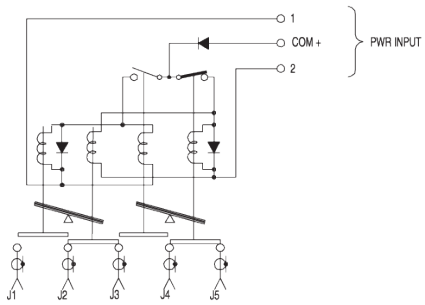
Series 150 - 2-SPDT / DC-26.5 GHz / SMA

Typical Schematics



SCHEMATIC SHOWN WITH POSITION 1 CLOSED

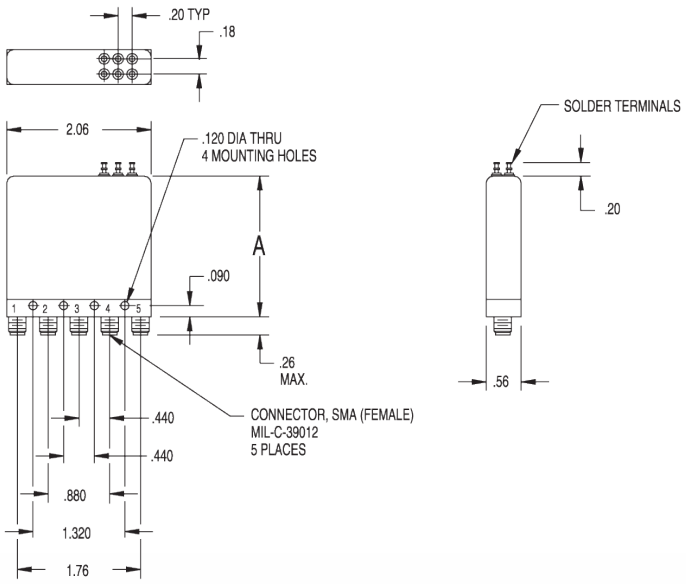
Latching 2-SPDT switch with TTL logic high and suppression diodes. (B34)



SCHEMATIC SHOWN WITH POSITION 1 CLOSED

Latching 2-SPDT switch with suppression diode and self cutoff (B37).

Typical Outline Drawing



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Series 156 - 2-SPDT / DC-26.5 GHz / SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 12 Vdc
- Actuating Current* Failsafe: 420 mA (max)/ switch
- 840 mA max @12 VDC and 25°C
- Switching Time: 30ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Freq Range (GHz)	DC-3	3-8	8-12.4	12.4-18	18-26.5
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.9:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5	0.8
Isolation (Min dB)	80	70	60	60	45

Options Available

GROUP 2 ACTUATION
- D - NORM OPEN

GROUP 3 OPTIONS
- 0 - NONE
- 3 - SUPPRESSION DIODES
- 9 - OTHER (SPECIFY)

GROUP 4 RF CONNECTORS
- A - SMA
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS
- 2 - STAMDARD POWER CONNECTOR

GROUP 6 VOLTAGE
- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

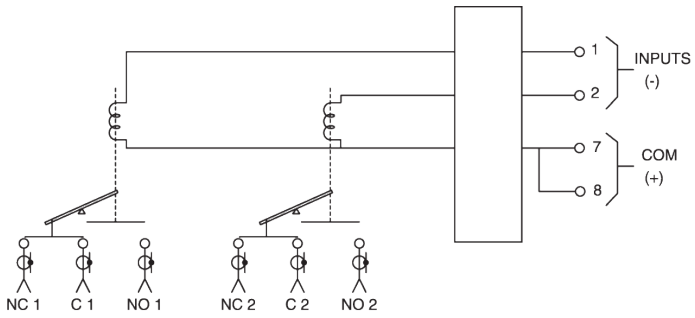
GROUP 7 FREQUENCY
- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC - 8 GHz
- 3 - DC - 12 GHz
- 4 - DC - 18 GHz
- 6 - DC - 26.5 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY
- A - COMMON PLUS
- B - COMMON MINUS
- C- NOT RELEVANT TO APPLICATION

GROUP 9 MOUNTING
- 2 - FLANGE

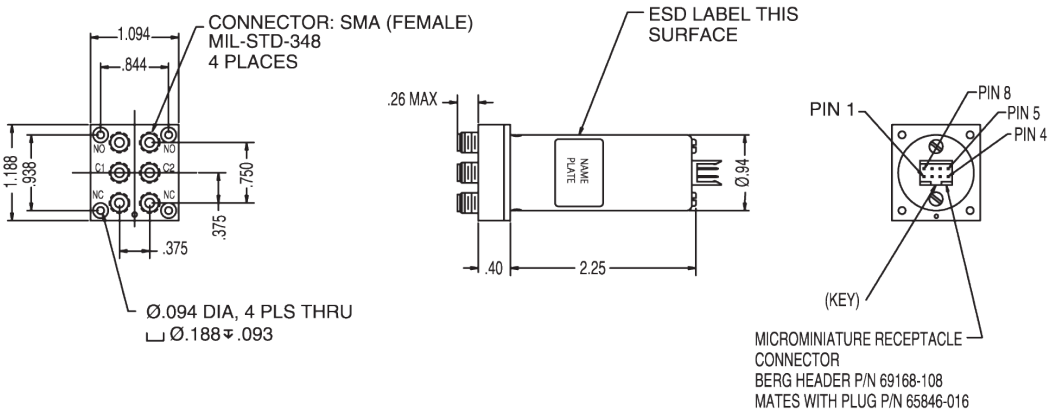
Series 156 - 2-SPDT / DC-26.5 GHz / SMA

Typical Schematic



SCHEMATIC SHOWN IN FAILSAFE POSITION

Typical Outline Drawing



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Selecting a Multiposition Switch

The following pages describe a wide range of multiposition switches (SP3T-SP12T), presenting outline drawings, specifications and typical schematics for each model in the group. Important distinctions among these models are noted here to help you select the correct switch for a specific application.

3 - 6 Position

030-060
Small SP3T-SP6T switches offering frequency range up to 26.5 GHz with SMA connectors. Normally Open actuation. Termination option not available.

032-062
Smallest available multiposition (SP3T-SP6T) switches offering Latching actuation and termination option. Slightly larger than 030-060 series. Frequency range up to 18 GHz with SMA connectors.

033-063
Larger SP3T-SP6T switches to be specified when N or TNC connectors are required. Frequency range up to 12.4 GHz. Available with terminations.

036-066
Miniature SP3T-SP6T switches offering frequency range up to 26.5 GHz with SMA connectors. Normally Open only. No terminations.

7 - 8 Position

073-093
A larger 7- or 8-position switch to be specified when N or TNC connectors are required. Frequency range up to 10 GHz. Available with terminations.

075-085
Smaller version of 073-083 series (refer to outline drawings for details). Frequency range up to 18GHzwithSMAconnectors. Available with terminations.

9 - 10 Position

091-101
The switch to specify when the application requires 9 or 10 positions and frequency range up to 18GHzwithSMAconnectors. Available with terminations.

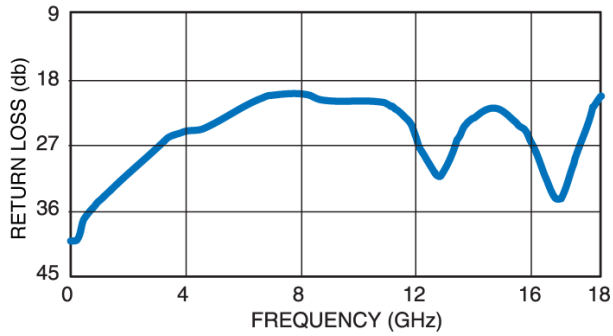
093-103
Larger 9- to 10-position switch to be specified when N or TNC connectors are required. Frequency range up to 12.4 GHz. Available with terminations.

11 - 12 Position

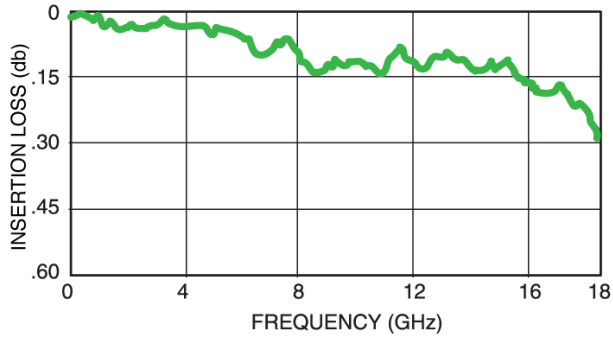
110-120
The switch to order when 11 or 12 positions are required. Frequency range up to 12.4 GHz with SMA connectors. Available with terminations.

Multi-Position Switches

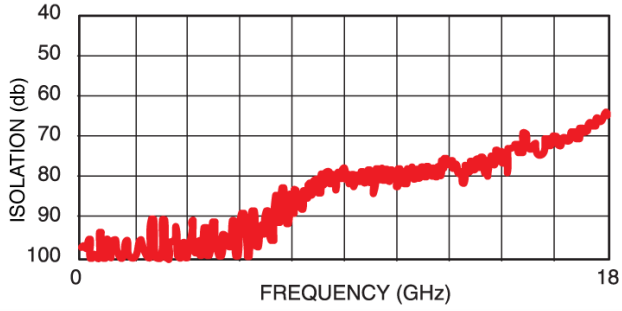
Typical Return Loss (db)
060 Series SMA Connectors



Typical Insertion Loss (db)
060 Series SMA Connectors



Typical Isolation (db)
060 Series SMA Connectors



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Series 030-060 - SP3T-SP6T / DC-26.5 GHz SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Normally Open: 140 mA (max)
- Actuating Current* DA: 280 mA (max)
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4	12.4-18	18-26.5
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.8:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5	0.8
Isolation (Min dB)	80	70	60	60	50

Options Available

GROUP 2 ACTUATION

- D - NORM OPEN
- DA - NORM OPEN FAILSAFE TO POSITION 1

GROUP 3 OPTIONS

- 0 - NONE
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER
- Y - BCD TTL DECODER

GROUP 4 RF CONNECTORS

- A - SMA
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SPECIFY)
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC-1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 3 - DC - 12.4 GHz
- 4 - DC - 18 GHz
- 5 - DC - 26.5 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C- NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 2 - FLANGE
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

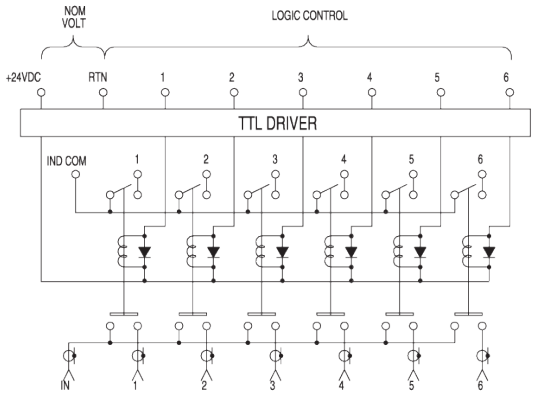
DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
1.56	D	0
2.00	D, DA	2,3
2.25	D, DA	2,3,4 or 5,Y,V
2.50**	D, DA	2,3,4, or 5,Y,V

* Specifications for 28 Vdc, 25°C

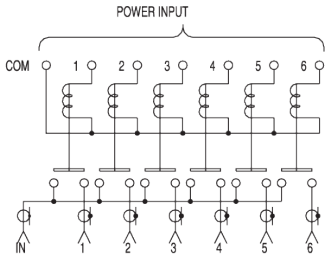
** Dimension for switches with Standard Narda Power Connector MS3112E-14-15P mating with MS3116E-14-15S.
Exception: switches with options: 4-TTL Logic High, V-Mosfet Driver, Y-BCD Decoder use Power Connector MS3112E-14-18P Mating with MS3116E-14-18S.

Series 030-060 - SP3T-SP6T / DC-26.5 GHz SMA

Typical Schematics

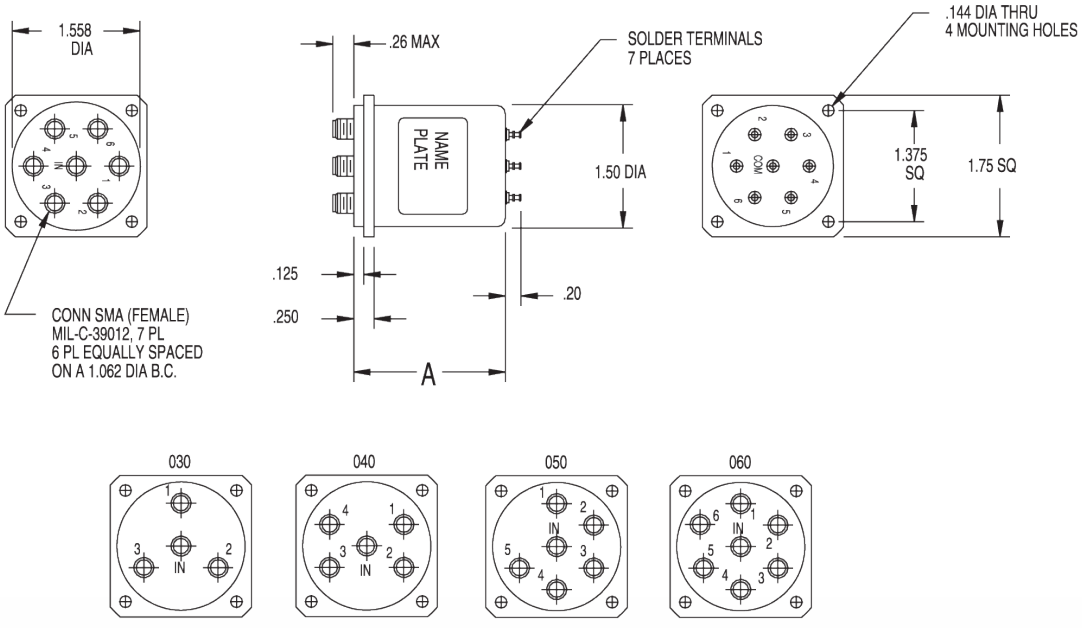


Normally Open SP6T switch with indicator circuitry, suppression diodes & TTL high logic driver. (D234)



Normally Open SP6T switch. (D0)

Typical Outline Drawing



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Series 032-062 - SP3T-SP6T / DC-18 GHz SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Normally Open: 160mA
- Actuating Current* Latching: (n)1 x 100 mA
- Actuating Current* DA: 2 x 160 mA
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4	12.4-18
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5
Isolation (Min dB)	80	70	60	60

Options Available

GROUP 2 ACTUATION

- B - LATCHING
- C - LATCHING RESET
- D - NORM OPEN
- DA - NORM OPEN FAILSAFE TO POSITION 1

GROUP 3 OPTIONS

- 0 - NONE
- 1 - 50-OHM TERMINATION
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER
- Y - BCD TTL DECODER

GROUP 4 RF CONNECTORS

- A - SMA
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 3 - DC - 12.4 GHz
- 4 - DC - 18 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C - NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 1 - BRACKET
- 2 - FLANGE
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
2.12	D, DA	0,3
2.37	B, C	3,7
2.37	D, DA	2,3
2.62	B, C	2,3,4, or 5,7,Y,V
2.62	D, DA	2,3,4 or 5,Y,V
2.96**	B, C	2,3,4 or 5,7,Y,V
2.96**	D, DA	2,3,4 or 5,Y,V

* Specifications for 28 Vdc, 25°C

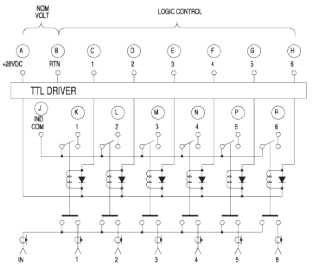
** Dimension for switches with Standard Narda Power Connector MS3112E-14-15P mating with MS3112E-14-15S.

Exceptions: Switches with options: 4-TTL Logic High, V-Mosfet Driver, Y-BCD Decoder use power connector MS3112E-14-18P mating with MS3116E-14-18S.

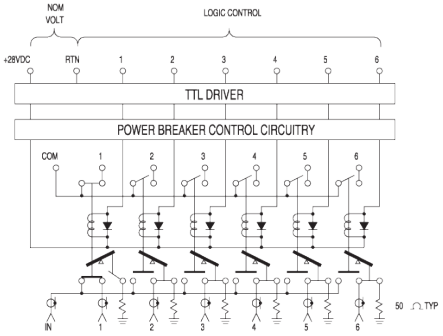
[1] n= # of positions

Series 032-062 - SP3T-SP6T / DC-18 GHz SMA

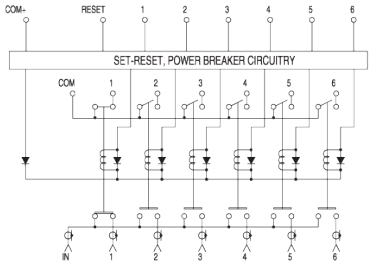
Typical Schematics



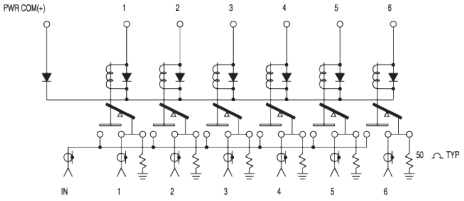
Normally Open SP6T switch with TTL driver indicator and suppression diodes. (D234)



Latching SP6T switch with TTL driver, indicator circuitry, self de-energizing circuitry, suppression diodes and 50-ohm termination. Shown in position 1. (B12347)

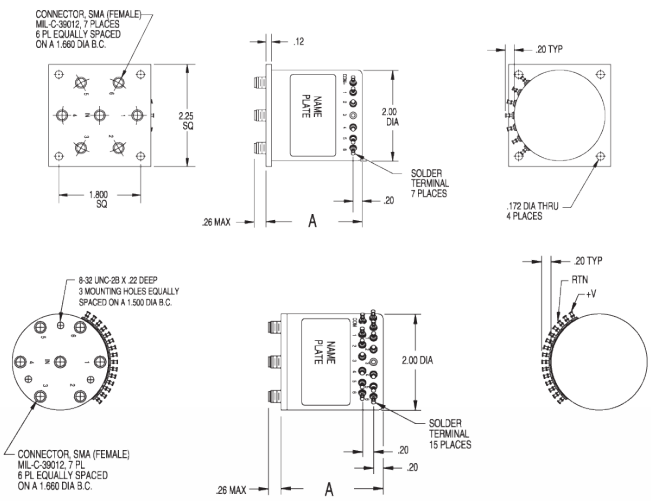


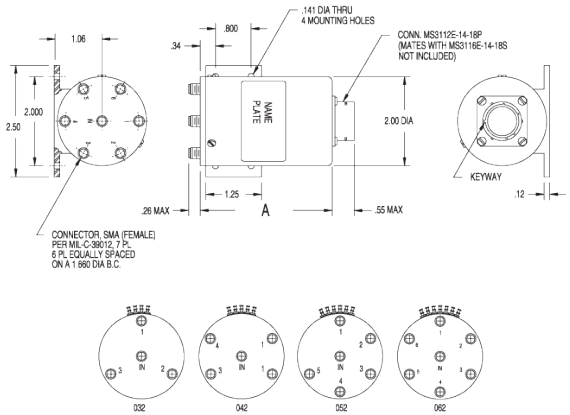
Latching SP6T switch with self de-energizing circuitry, reset function, indicators and suppression diodes. Shown in position 1 (common plus). (B237)



Normally Open, common plus SP6T switch with suppression diodes and 50-ohm termination on each unused position. (D13)

Typical Outline Drawings





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Series 033-063 - SP3T-SP6T / DC-12.4 GHz N, TNC

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Normally Open: 140 mA (max)
- Actuating Current* Latching: (n)1 x 100 mA
- Actuating Current* DA: 350 mA
- Switching Time: 20ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4
VSWR (Max)	1.2:1	1.35:1	1.5:1
Insertion Loss (Max dB)	0.2	0.35	0.5
Isolation (Min dB)	80	70	60

Options Available

GROUP 2 ACTUATION

- B - LATCHING
- C - LATCHING RESET
- D - NORM OPEN
- DA - NORM OPEN FAILSAFE TO POSITION 1

GROUP 3 OPTIONS

- 0 - NONE
- 1 - 50-OHM TERMINATION
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER
- Y - BCD TTL DECODER

GROUP 4 RF CONNECTORS

- D - N
- E - TNC
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC - 8 GHz
- 3 - DC - 12.4 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C- NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 1 - BRACKET
- 2 - FLANGE
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
2.20	D, DA	0,3
2.46	B, C	3,7
2.46	D, DA	2,3
2.88	B, C	2,3,7
3.08**	B, C	2,3,4 or 5,7,Y
3.08**	D, DA	2,3,4 or 5,Y

* Specifications for 28 Vdc, 25°C

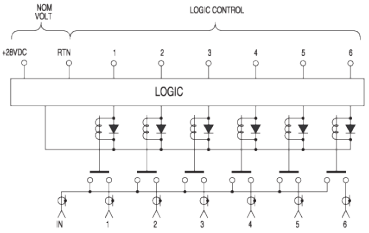
** Dimension for switches with Standard Narda Power Connector MS3112E-14-15P mating with MS3112E-14-15S.

Exception: Switches with options: 4-TTL Logic High, V-Mosfet Driver, Y-BCD Decoder use power connector MS3112E-14-18P mating with MS3116E-14-18S.

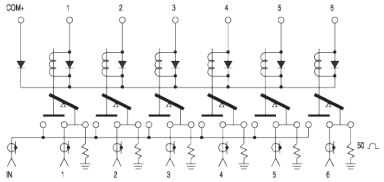
[1] n = # of positions

Series 033-063 - SP3T-SP6T / DC-12.4 GHz N, TNC

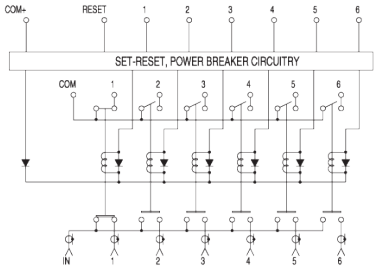
Typical Schematics



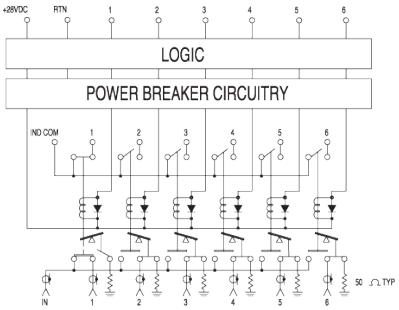
Normally Open SP6T switch with TTL driver and suppression diodes. (D34)



Normally Open, common plus SP6T switch with suppres - sion diodes and 50-ohm.

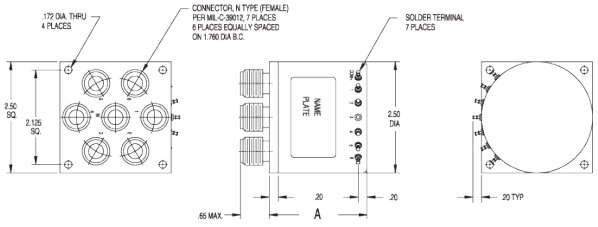


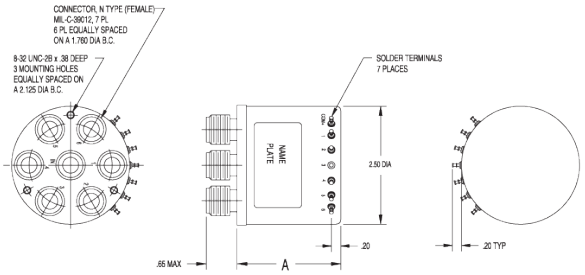
Latching common plus SP6T switch with self de-energizing circuitry, reset function, indicators and suppression diodes. Shown in position 1. (B237)

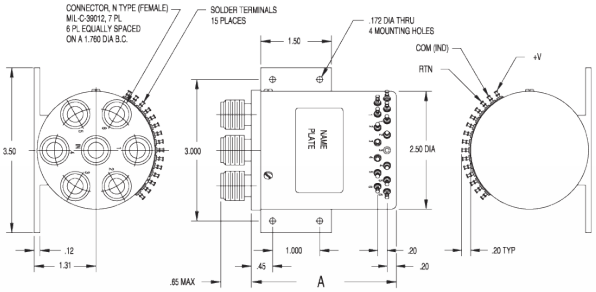


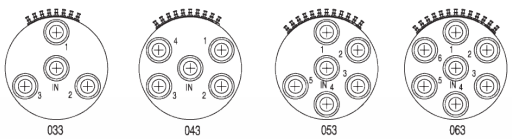
Latching SP6T switch with TTL driver, indicator circuitry, self de-energizing circuitry, suppression diodes and 50-ohm ter- mination. Shown in position 1. (B12347)

Typical Outline Drawings









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Series 036-066 - SP3T-SP6T / DC-26.5 GHz SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Normally Open: 160 mA (max)
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
-
- * Specifications for 28 Vdc, 25°C
- **Standard Power Connector is Berg P/N 69168-108, mates with P/N 65846-016 (not supplied)

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4	12.4-18	18-26.5
VSWR (Max)	1.15:1	1.25:1	1.35:1	1.45:1	1.9:1
Insertion Loss (Max dB)	0.15	0.25	0.35	0.45	0.9
Isolation (Min dB)	85	75	65	65	45

Options Available

GROUP 2 ACTUATION

- D - NORM OPEN
- DA - FAILSAFE IN POSITION 1

GROUP 3 OPTIONS

- 0 - NONE
- 3 - SUPPRESSION DIODES
- 9 - OTHER (SPECIFY)

GROUP 4 RF CONNECTORS

- A - SMA
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 2 - STANDARD POWER CONNECTOR

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC - 8 GHz
- 3 - DC - 12.4 GHz
- 4 - DC - 18 GHz
- 6 - DC - 26.5 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

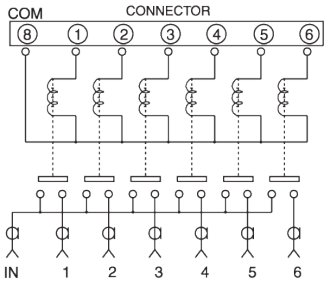
- A - COMMON PLUS
- B - COMMON MINUS
- C - NOT RELEVANT TO APPLICATION

GROUP 9 MOUNTING

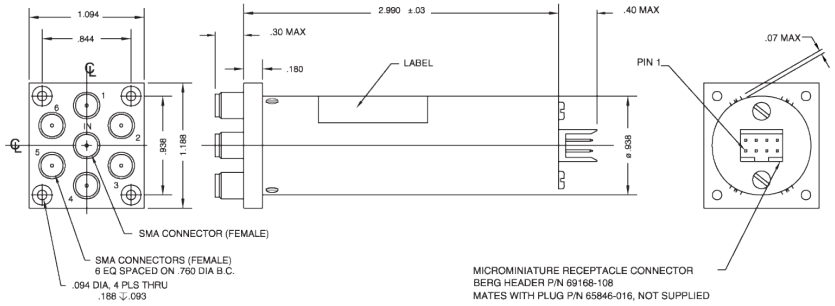
- 2- FLANGE

Series 036-066 - SP3T-SP6T / DC-26.5 GHz SMA

Typical Schematic



Typical Outline Drawing



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Series 073-083 - SP7T-SP8T / DC-10 GHz N, TNC

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Normally Open: 160 mA (max)
- Actuating Current*Latching: (n)1 x 100 mA
- Actuating Current*DA: 350 mA
- Switching Time: 20ms (max)
- Switching Sequence: Break Before Make
- Operating Mode*: Normally Open
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-10
VSWR (Max)	1.2:1	1.35:1	1.5:1
Insertion Loss (Max dB)	0.2	0.35	0.5
Isolation (Min dB)	80	70	60

Options Available

GROUP 2 ACTUATION

- B - LATCHING
- C - LATCHING RESET
- D - NORM OPEN
- DA - NORM OPEN FAILSAFE TO POSITION 1

GROUP 3 OPTIONS

- 0 - NONE
- 1 - 50-OHM TERMINATION
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER
- Y - BCD TTL DECODER

GROUP 4 RF CONNECTORS

- D - N
- E - TNC
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC - 8 GHz
- 3 - DC - 10 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C - NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 1 - BRACKET
- 2 - FLANGE
- 3 - OTHER (SPECIFY)

Switch Height (A) For Selected Options

DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
2.20	D, DA	0,3
3.07	B, C	2,3,7
3.07	D, DA	2,3
3.07**	B, C	2,3,4, or 5,7,Y
3.07**	D, DA	2,3,4 or 5,Y

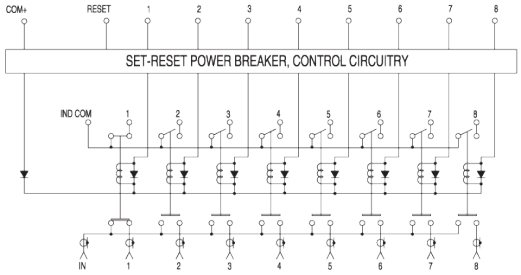
* Specifications for 28 Vdc, 25°C

** Dimension for switches with Standard Narda Power Connector MS3112E-16-26P mating with MS3112E-16-26S.

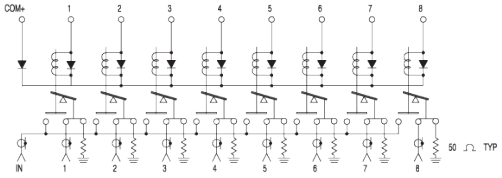
[1] n = # of positions

Series 073-083 - SP7T-SP8T / DC-10 GHz N, TNC

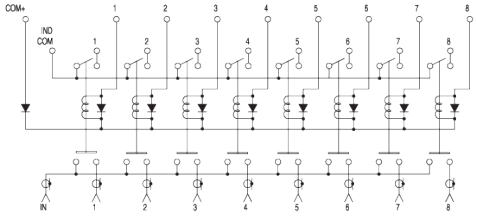
Typical Schematics



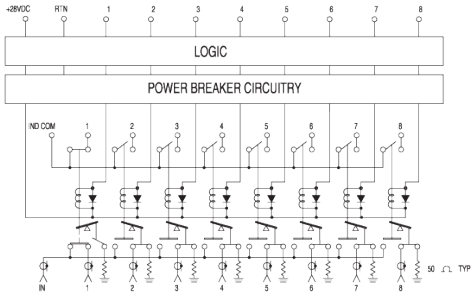
Latching SP8T switch with self de-energizing circuitry, reset function, indicators and suppression diodes. Shown in position 1 (common plus). (B237)



Normally Open SP8T switch with suppression diodes and 50-ohm termination on each unused position. (D13)

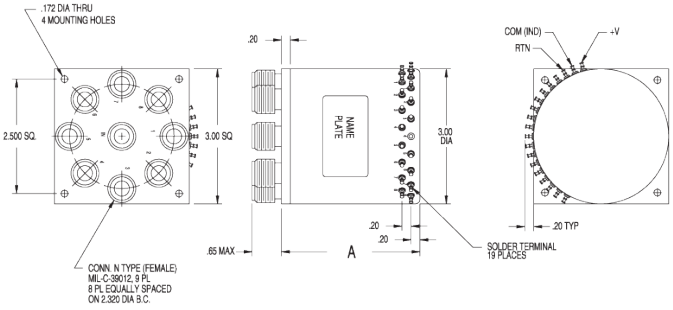


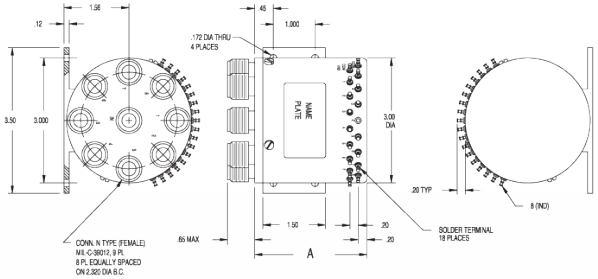
Normally Open SP8T switch with indicator circuitry and suppression diodes (common plus). (D23)

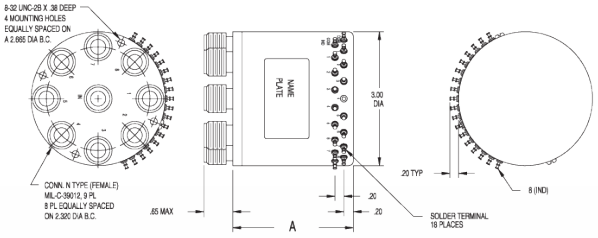


Latching SP8T switch with TTL driver, indicator circuitry, suppression diodes and 50-ohm termination. Shown in position 1. (B12347)

Typical Outline Drawings







NOTE: For 073 switches eliminate position 8.

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Series 075-085 - SP7T-SP8T / DC-18 GHz SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Normally Open: 160 mA (max)
- Actuating Current* Latching: (n)1 x 100 mA
- Actuating Current* DA: 350 mA
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4	12.4-16	16-18
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.7:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.55	0.7
Isolation (Min dB)	80	70	60	60	55

Options Available

GROUP 2 ACTUATION

- B - LATCHING
- C - LATCHING RESET
- D - NORM OPEN
- DA - NORM OPEN FAILSAFE TO POSITION 1

GROUP 3 OPTIONS

- 0 - NONE
- 1 - 50-OHM TERMINATION
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER
- Y - BCD TTL DECODER

GROUP 4 RF CONNECTORS

- A - SMA
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 3 - DC - 12.4 GHz
- 4 - DC - 18 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C- NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 1 - BRACKET
- 2 - FLANGE
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
2.10	D, DA	0,3
2.50	B, C	2,3,7
2.50	D, DA	2,3
2.91**	B, C	2,3,4, or 5,7,Y,V
2.91**	D, DA	2,3,4 or 5,Y,V

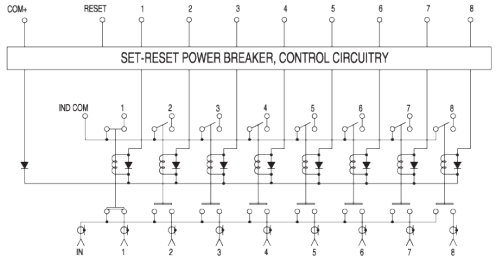
* Specifications for 28 Vdc, 25°C

** Dimension for switches with Standard Narda Power Connector MS3112E-16-26P mating with MS3116E-16-26S.

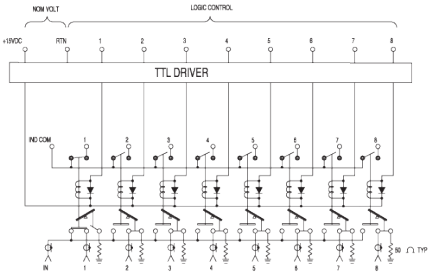
[1] n = # of positions

Series 075-085 - SP7T-SP8T / DC-18 GHz SMA

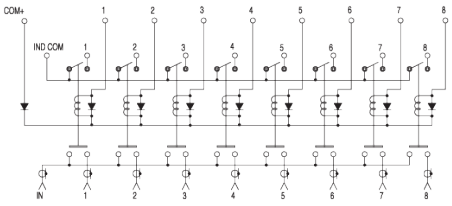
Typical Schematics



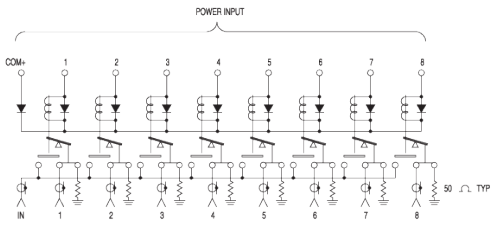
Latching SP8T switch with self de-energizing circuitry, reset, indicators and suppression diodes. Shown in position 1 (common plus). (B23)



Latching SP8T switch with TTL driver, indicator circuitry, self de-energizing circuitry, suppression diodes and 50-ohm ter ¯ mination. Shown in position 1. (B12347)

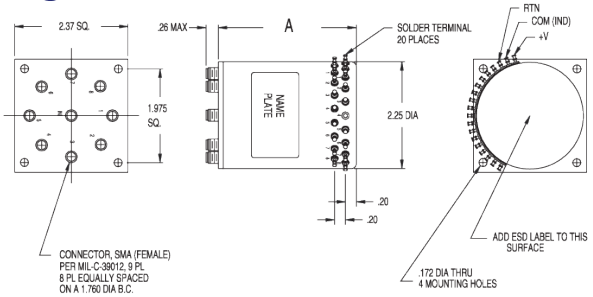


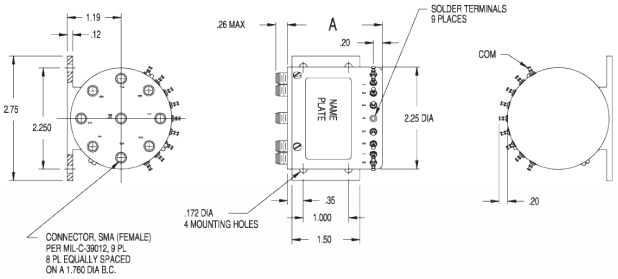
Normally Open SP8T switch with indicator circuitry and suppression diodes (common plus). (D23)

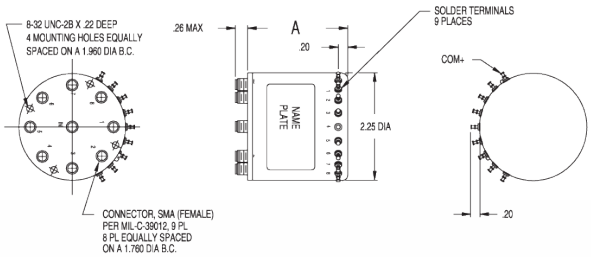


Normally Open SP8T switch with suppression diodes and 50-ohm termination on each unused position (common plus). (D13)

Typical Outline Drawings







NOTE: For 075 Series Switches, eliminate position 8.

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Series 091-101 (Normally Open and Normally Open with Termination)
SP9T-SP10T / DC-18 GHz SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28 Vdc
- Actuating Current* Normally Open: 160 mA (max)
- Actuating Current*DA: 350 mA
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4	12.4-15.5	15.5-18
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.7:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5	0.7
Isolation (Min dB)	80	70	60	60	55

Options Available

GROUP 2 ACTUATION

- D - NORM OPEN
- DA - NORM OPEN FAILSAFE TO POSITION 1

GROUP 3 OPTIONS

- 0 - NONE
- 1 - 50-OHM TERMINATION
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER
- Y - BCD TTL DECODER

GROUP 4 RF CONNECTORS

- A - SMA
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 3 - DC - 12.4 GHz
- 4 - DC - 18 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C - NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 1 - BRACKET
- 2 - FLANGE
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

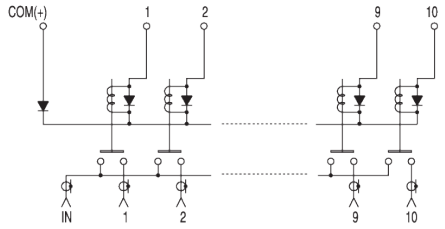
DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
2.10	D, DA	1,3
2.50	D, DA	1,2,3
2.91**	D, DA	1,2,3,4 OR 5,Y,V

* Specifications for 28 Vdc, 25°C

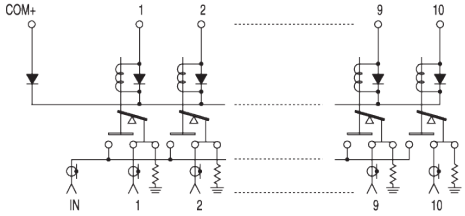
** Dimension for switches with Standard Narda Power Connector MS3112E-16-26P mating with MS3116E-16-26S.

Series 091-101 (Normally Open and Normally Open with Termination)
SP9T-SP10T / DC-18 GHz SMA

Typical Schematics

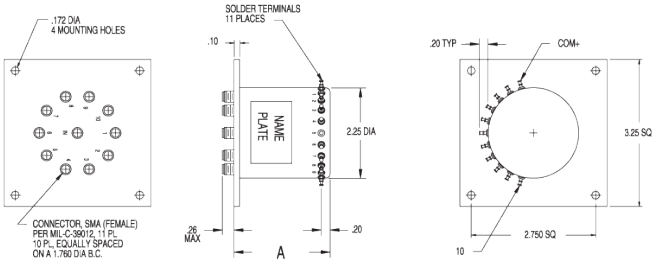


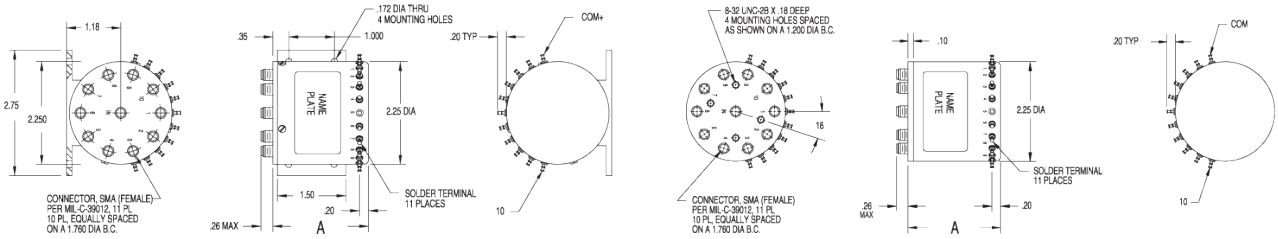
Normally Open SP10T switch with suppression diodes. Shown in position 1 (common plus). (D3)



Normally Open SP10T switch with suppression diodes and 50-ohm termination on each unused position (common plus). (D13)

Typical Outline Drawings





NOTE: For 091 Series Switches, eliminate position 10.

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Series 091-101 (Latching and Latching with Termination)
SP9T-SP10T / DC-18 GHz SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28 Vdc
- Actuating Current* Latching: (n)1 x 100 mA (max)
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4	12.4-15.5	15.5-18
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.7:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5	0.7
Isolation (Min dB)	80	70	60	60	55

Options Available

GROUP 2 ACTUATION

B - LATCHING
C - LATCHING RESET

GROUP 3 OPTIONS

0 - NONE
1 - 50-OHM TERMINATION
2 - INDICATOR CIRCUITRY
3 - SUPPRESSION DIODES
4 - TTL LOGIC HIGH
7 - SELF-DE-ENERGIZING CIRCUITRY
9 - OTHER (SPECIFY)
V - MOSFET DRIVER
Y - BCD TTL DECODER

GROUP 4 RF CONNECTORS

A - SMA
G - OTHER (SPECIFY)

GROUP 5 TERMINALS

1 - SOLDER (STANDARD)
2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
4 - SOLDER LOOP
5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

B - 12 VDC
C - 24 VDC
D - 28 VDC
E - 48 VDC
G - OTHER (SPECIFY)
H - 15 VDC
I - 18 VDC

GROUP 7 FREQUENCY

0 - DC - 1 GHz
1 - DC - 3 GHz
2 - DC -8 GHz
3 - DC - 12.4 GHz
4 - DC - 18 GHz
7 - OTHER (SPECIFY)

GROUP 8 POLARITY

A - COMMON PLUS
B - COMMON MINUS
C- NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

0 - STANDARD MOUNTING HOLES
1 - BRACKET
2 - FLANGE
3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
2.10	D, DA	1,3
2.60	B, C	1,2,3,7
2.60	D, DA	1,2,3
2.98**	B, C	1,2,3,4, or 5,7,Y
2.98**	D, DA	1,2,3,4 or 5,Y

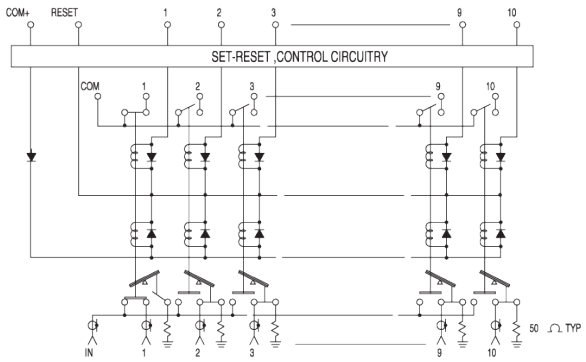
* Specifications for 28 Vdc, 25°C

** Dimension for switches with Standard Narda Power Connector MS3112E-16-26P mating with MS3116E-16-26S.

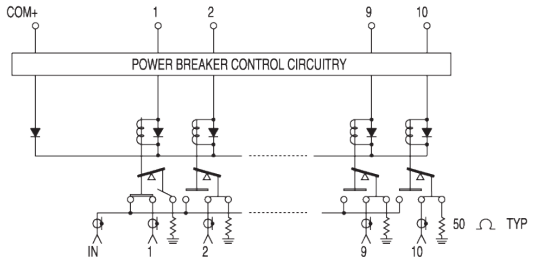
1 n = # of positions

Series 091-101 (Latching and Latching with Termination)
SP9T-SP10T / DC-18 GHz SMA

Typical Schematics

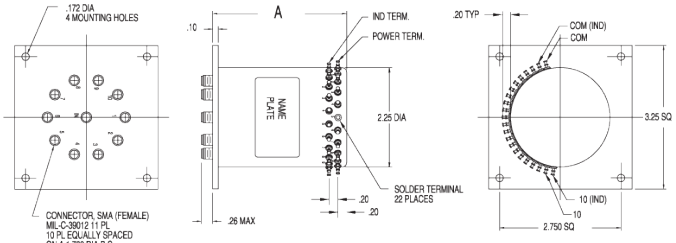


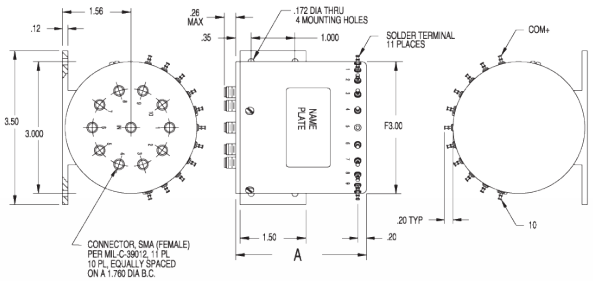
Latching SP10T switch with reset function, self de-energizing circuitry and suppression diodes. Shown in position 1 (common plus). (C1237)

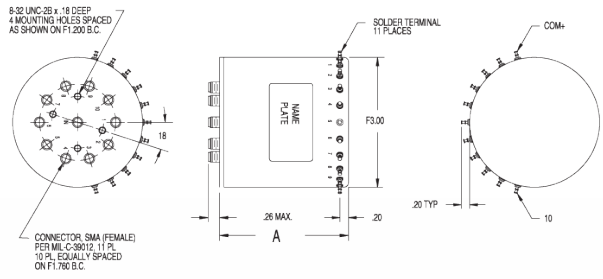


Latching, SP10T switch with reset functions, self de-energizing circuitry, suppression diodes and 50-ohm termination on each unused position. Shown in position 1 (common plus). (B137)

Typical Outline Drawings







NOTE: For 091 Series Switches, eliminate position 10.

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Series 093-103 - SP9T-SP10T / DC-8 GHz T, TNC

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Normally Open: 180 mA (max)
- Actuating Current* Latching: (n)1 x 100 mA
- Actuating Current* DA: 400 mA
- Switching Time: 20ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8
VSWR (Max)	1.3:1	1.5:1
Insertion Loss (Max dB)	0.3	0.5
Isolation (Min dB)	80	70

Options Available

GROUP 2 ACTUATION

- B - LATCHING
- C - LATCHING RESET
- D - NORM OPEN
- DA - NORM OPEN FAILSAFE TO POSITION 1

GROUP 3 OPTIONS

- 0 - NONE
- 1 - 50-OHM TERMINATION
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER
- Y - BCD TTL DECODER

GROUP 4 RF CONNECTORS

- D - N
- E - TNC
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C- NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 1 - BRACKET
- 2 - FLANGE
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
2.40	D, DA	0,3
3.28	B, C	2,3,7
3.28	D, DA	2,3
3.28**	B, C	2,3,4, or 5,7,Y
3.28**	D, DA	2,3,4 or 5,Y

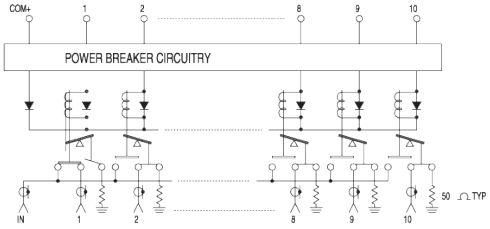
* Specifications for 28 Vdc, 25°C

** Dimension for switches with Standard Narda Power Connector MS3112E-16-26P mating with MS3116E-16-26S.

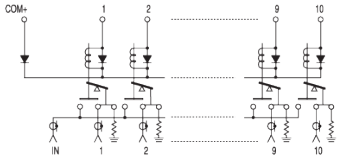
[1] n = # of positions

Series 093-103 - SP9T-SP10T / DC-8 GHz T, TNC

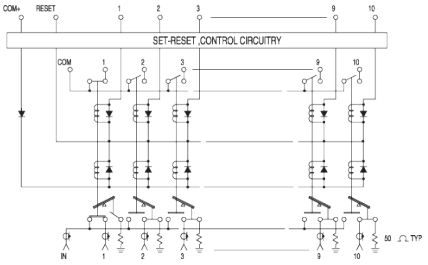
Typical Schematics



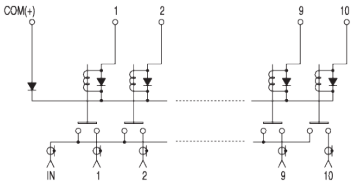
Latching SP10T switch with self de-energizing circuitry, control circuitry, suppression diodes and 50-ohm termination. Shown in position 1 (common plus). (B137)



Normally Open SP10T switch with suppression diodes and 50-ohm termination on each unused position (common plus). (D13)

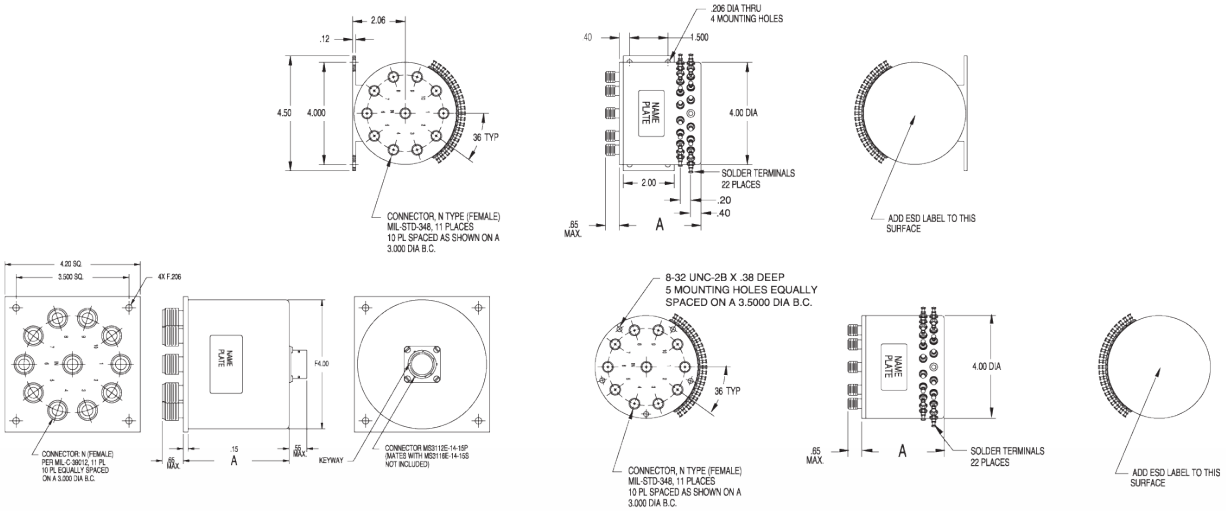


Latching SP10T switch with self de-energizing circuitry, reset dunction indicators and suppression diodes. Shown in position 1 (common plus). (B1237)



Normally Open SP10T switch suppression diodes (common plus). (D3)

Typical Outline Drawings



NOTE: For 093 Series Switches, eliminate position 10.

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Series 110-120 - SP11T-SP12T / DC-12.4 SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28 Vdc
- Actuating Current* Normally Open: 180 mA (max)
- Actuating Current*Latching: (n)1 x 100 mA
- Actuating Current*DA: 400 mA
- Switching Time: 15ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4
VSWR (Max)	1.2:1	1.4:1	1.8:1
Insertion Loss (Max dB)	0.2	0.35	0.7
Isolation (Min dB)	80	70	60

Options Available

GROUP 2 ACTUATION

- B - LATCHING
- C - LATCHING RESET
- D - NORM OPEN
- DA - NORM OPEN FAILSAFE TO POSITION 1

GROUP 3 OPTIONS

- 0 - NONE
- 1 - 50-OHM TERMINATION
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER
- Y - BCD TTL DECODER

GROUP 4 RF CONNECTORS

- A - SMA

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 3 - DC - 12.4 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C- NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 1 - BRACKET
- 2 - FLANGE
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
2.35	D, DA	0,3
2.70	B, C	2,3,7
2.70	D, DA	2,3
2.91**	B, C	2,3,4, or 5,7,Y
2.91**	D, DA	2,3,4 or 5,Y

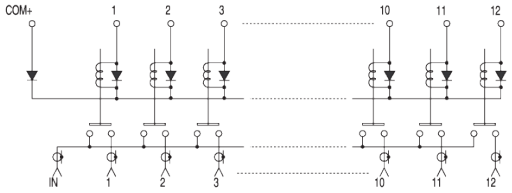
* Specifications for 28 Vdc, 25°C

** Dimension for switches with Standard Narda Power Connector MS3112E-16-26P mating with MS3116E-16-26S.

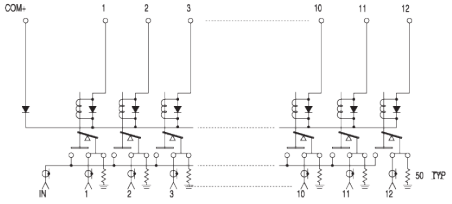
1 n = # of positions

Series 110-120 - SP11T-SP12T / DC-12.4 SMA

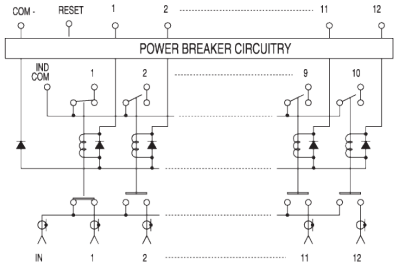
Typical Schematics



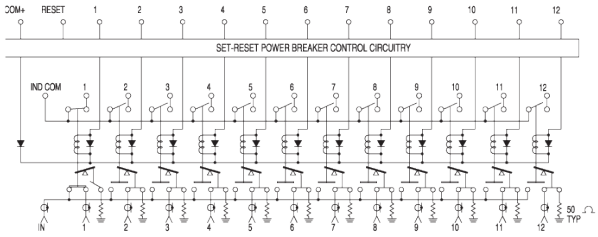
Normally Open SP12T switch with suppression diodes (com - mon plus). (D3)



Normally Open SP12T switch with suppression diodes and 50-ohm termination on each unused position (common plus). (D13)

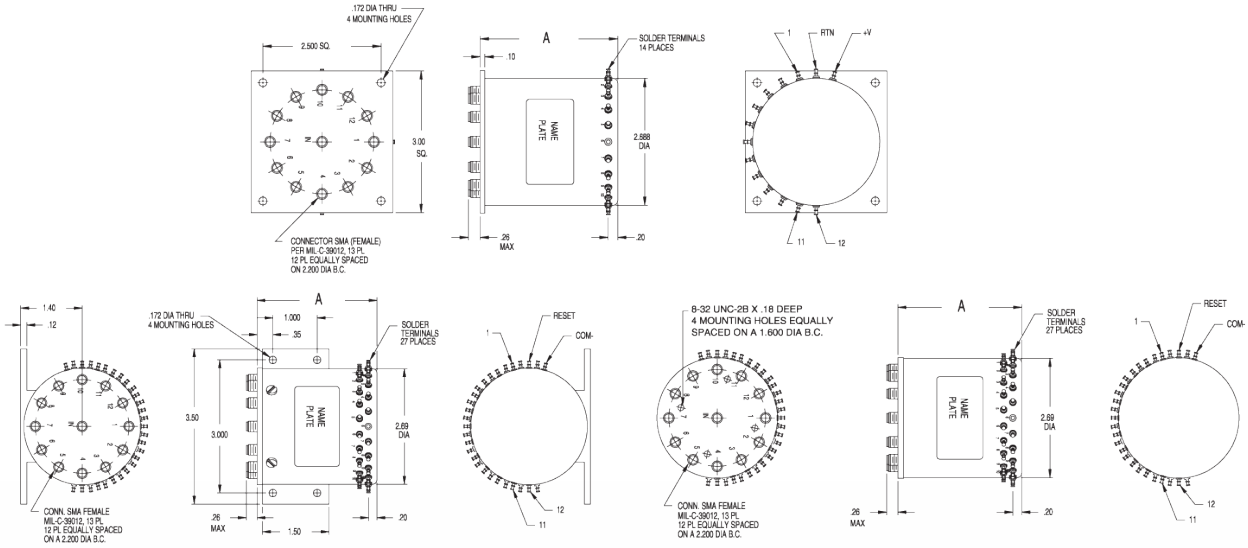


Latching SP12T switch with self de-energizing circuitry, reset function, indicators and suppression diodes. Shown in position 1 (common negative). (C237)



Latching SP12T switch with self de-energizing circuitry, reset function, indicators, suppression diodes and 50-ohm termination. Shown in position 1 (common plus). (C1237)

Typical Outline Drawings



NOTE: For 110 Series Switches, eliminate position 12.

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Selecting a Transfer Switch

The following pages describe several types of transfer switches (DPDT) offered by Narda. Important distinctions among these models are noted here to help the user select the correct switch for a specific application:

130

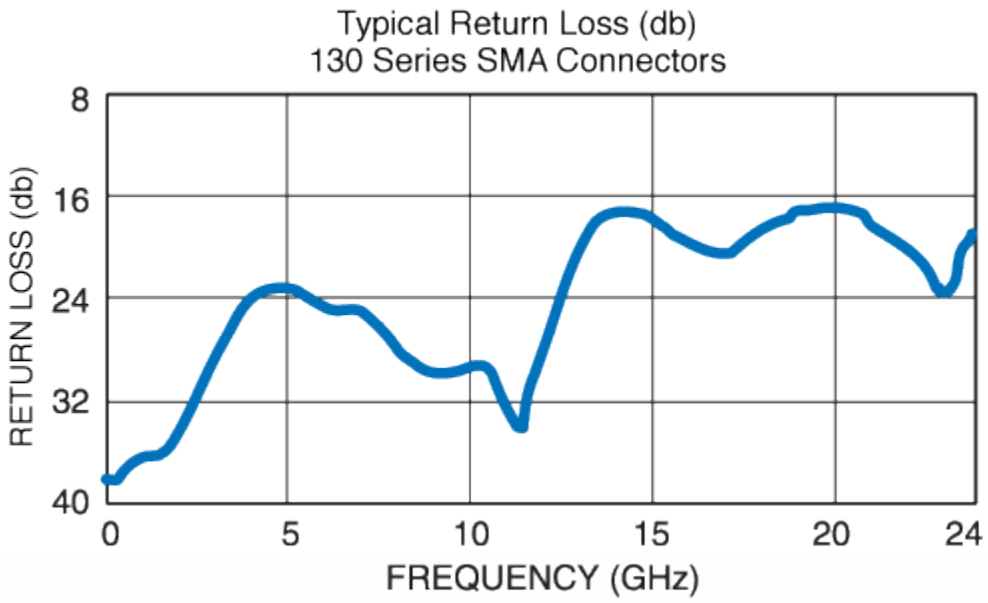
Basic high-performance DPDT transfer switch. Frequency range up to 26.5 GHz with SMA connectors.

132

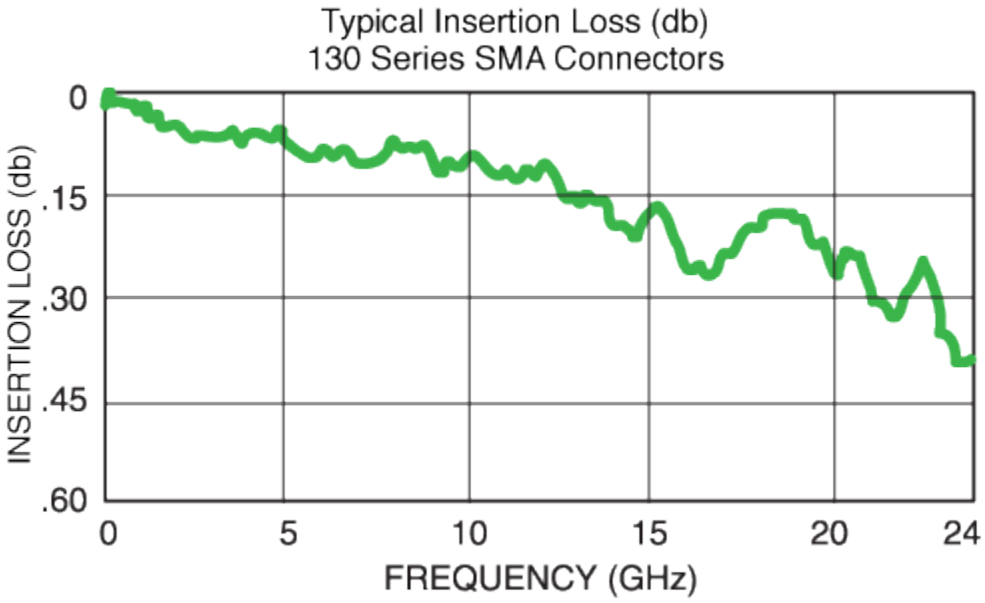
DPDT switch available with either TNC or N connectors. Handles greater RF power than the 130 series. Frequency range up to 12.4 GHz.

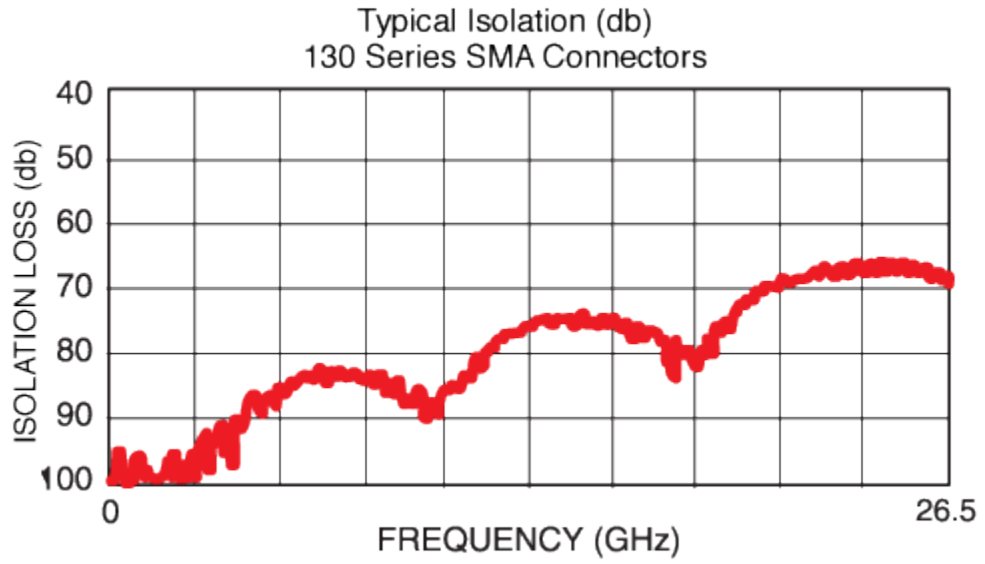
136

Smallest DPDT switch available. Frequency range up to 26.5 GHz with SMA connectors.



Transfer Switches





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Series 130 DPDT / DC-26.5 GHz / SMA

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28Vdc
- Actuating Current* Failsafe: 280 mA (max)
- Actuating Current* Latching: 350 mA (max)
- Switching Time: 15 ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4	12.4-18	18-26.5
SWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.7:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5	0.7
Isolation (Min dB)	80	70	60	60	50

Options Available

GROUP 2 ACTUATION

- A - FAILSAFE
- B - LATCHING

GROUP 3 OPTIONS

- 0 - NONE
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET DRIVER

GROUP 4 RF CONNECTORS

- A - SMA
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - **POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC - 8 GHz
- 3 - DC - 12.4 GHz
- 4 - DC - 18 GHz
- 5 - DC - 18.5 GHz
- 6 - DC - 26.5
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C- NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 1 - BRACKET
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

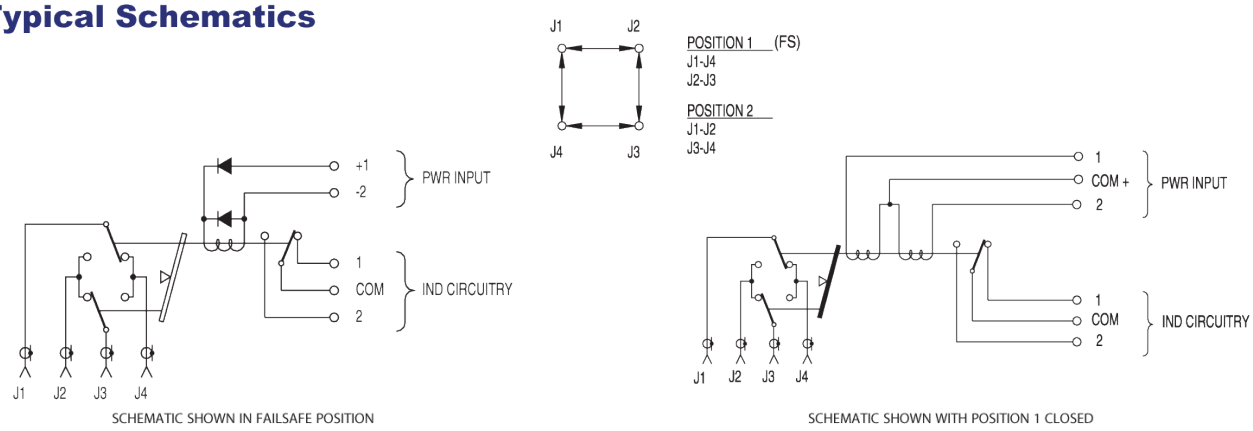
DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
1.73	A, D	0,2,3
1.73	B	0,2
2.10	A, D	2,3,4 or 5,V
2.10	B	2,3,4, or 5,7,V
2.50**	B	2,3,4 or 5,7,V
2.50**	A,D	2,3,4 or 5,V

* Specifications for 28 Vdc, 25°C

** Dimension for switches with Standard Narda Power Connector MS3112E-12-8P mating with MS3116E-12-8S.

Series 130 DPDT / DC-26.5 GHz / SMA

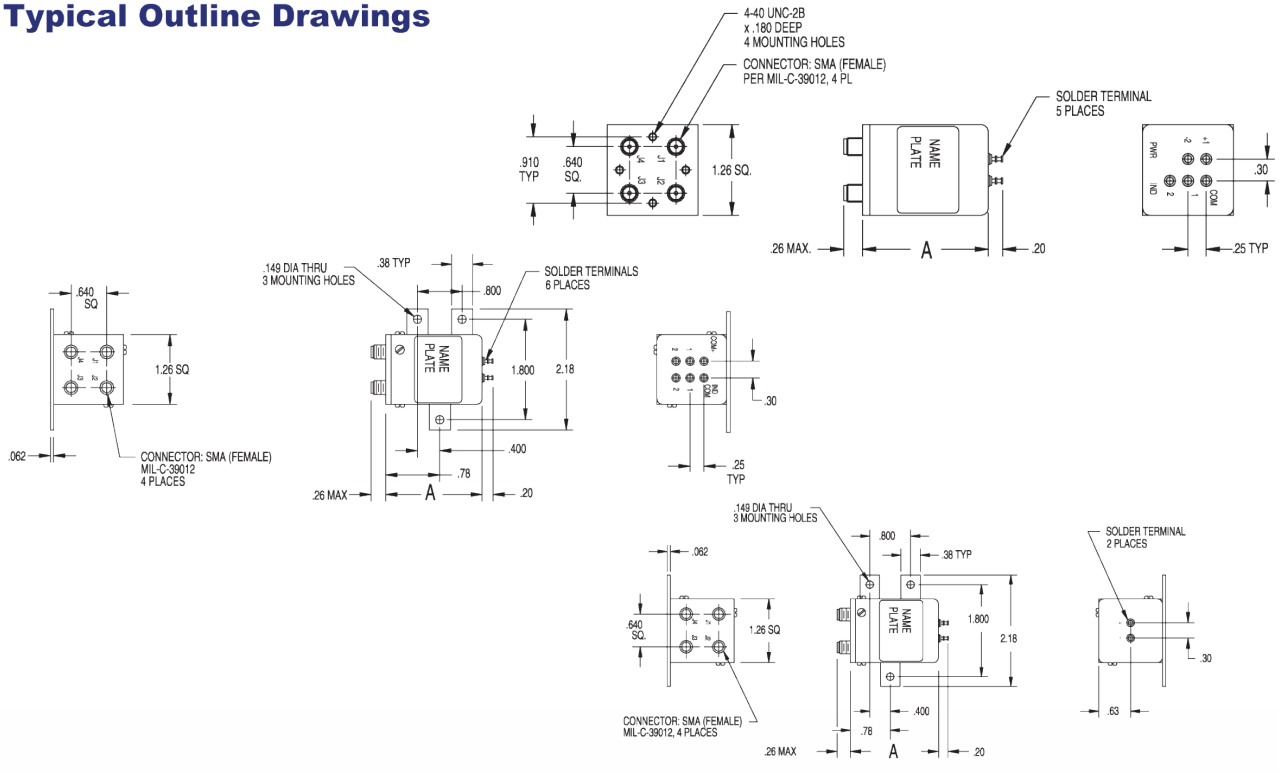
Typical Schematics



Failsafe DPDT switch with indicator circuitry and suppression diode, common plus. (A23)

Latching, common plus DPDT switch with indicator circuitry. (B2)

Typical Outline Drawings



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Series 132 - DPDT / DC-12.4 GHz TNC, N

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 28 Vdc
- Actuating Current* Failsafe: 360 mA (max)
- Actuating Current* Latching: 360 mA (max)
- Switching Time: 20 ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

Series 132 - DPDT / DC-12.4 GHz TNC, N

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4
VSWR (Max)	1.2:1	1.35:1	1.5:1
Insertion Loss (Max dB)	0.2	0.35	0.5
Isolation (Min dB)	80	70	60

Options Available

GROUP 2 ACTUATION

- A - FAILSAFE
- B - LATCHING

GROUP 3 OPTIONS

- 0 - NONE
- 2 - INDICATOR CIRCUITRY
- 3 - SUPPRESSION DIODES
- 4 - TTL LOGIC HIGH
- 7 - SELF-DE-ENERGIZING CIRCUITRY
- 9 - OTHER (SPECIFY)
- V - MOSFET

GROUP 4 RF CONNECTORS

- A - SMA
- D - N
- E - TNC
- G - OTHER (SPECIFY)

GROUP 5 TERMINALS

- 1 - SOLDER (STANDARD)
- 2 - ** POWER CONNECTOR, FAST DISCONNECT (STANDARD)
- 3 - POWER CONNECTOR, FAST DISCONNECT (SUB MIN "D")
- 4 - SOLDER LOOP
- 5 - OTHER (SPECIFY)

GROUP 6 VOLTAGE

- B - 12 VDC
- C - 24 VDC
- D - 28 VDC
- E - 48 VDC
- G - OTHER (SPECIFY)
- H - 15 VDC
- I - 18 VDC

GROUP 7 FREQUENCY

- 0 - DC - 1 GHz
- 1 - DC - 3 GHz
- 2 - DC -8 GHz
- 3 - DC - 12.4 GHz
- 7 - OTHER (SPECIFY)

GROUP 8 POLARITY

- A - COMMON PLUS
- B - COMMON MINUS
- C- NOT RELEVANT TO APPLICATION OR SWITCHES WITH LOGIC

GROUP 9 MOUNTING

- 0 - STANDARD MOUNTING HOLES
- 1 - BRACKET
- 3 - OTHER (SPECIFY)

Switch Height (A) for Selected Options

DIM A ±.03	GROUP 2 ACTUATION	GROUP 3 OPTIONS
2.13	A, D	0,2,3,4 or 5,V
2.13	B	0,2,3,4 or 5,7,V
2.63**	B	0,2,3,4 or 5,7,V
2.63**	A, D	0,2,3,4, or 5,V

* Specifications for 28 Vdc, 25°C

** Dimension for switches with Standard Narda Power Connector MS3112E-12-8P mating with MS3116E-12-8S.

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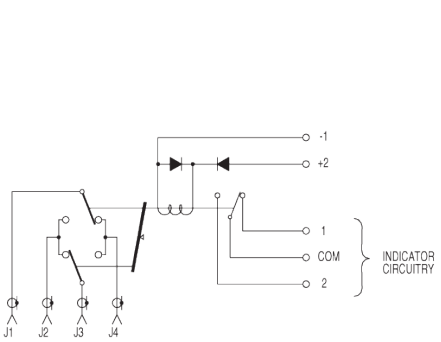
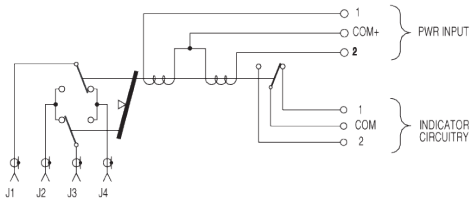
Series 132 - DPDT / DC-12.4 GHz TNC, N

Typical Schematics



SCHEMATIC SHOWN IN FAILSAFE POSITION

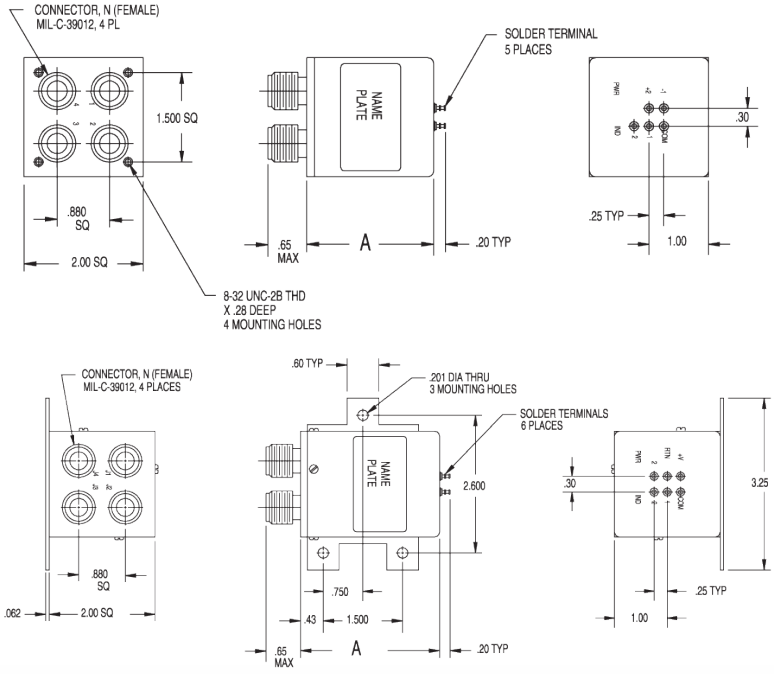
Failsafe DPDT switch with indicator circuitry and suppression diode (common plus). (A23)



SCHEMATIC SHOWN WITH POSITION 1 CLOSED

Latching, common plus DPDT switch with indicator circuitry. (B2)

Typical Outline Drawings



Series 136 DPDT / DC-26.5 GHz

Features

- RF Impedance: 50 ohms nominal
- Actuating Voltage*: 12 Vdc
- Actuating Current Failsafe: 650 mA (max)
- Actuating Current*Latching: 775 mA (max)
- Switching Time: 20 ms (max)
- Switching Sequence: Break Before Make
- Operating Ambient Temperature: -35°C to +70°C
- Operating Life: 1 Million Cycles per Position
- Designed to Meet MIL-S-3928

RF Performance

Frequency Range (GHz)	DC-3	3-8	8-12.4	12.4-18	18-26.5
VSWR (Max)	1.2:1	1.3:1	1.4:1	1.5:1	1.7:1
Insertion Loss (Max dB)	0.2	0.3	0.4	0.5	0.7
Isolation (Min dB)	80	70	60	60	50

Options Available

GROUP 2 ACTUATION

A - FAILSAFE
B - LATCHING

GROUP 3 OPTIONS

0 - NONE
3 - SUPPRESSION DIODES
9 - OTHER (SPECIFY)

GROUP 4 RF CONNECTORS

A - SMA
G - OTHER (SPECIFY)

GROUP 5 TERMINALS

1 - STANDARD POWER CONNECTOR

GROUP 6 VOLTAGE

B - 12 VDC
C - 24 VDC
D - 28 VDC
E - 48 VDC
G - OTHER (SPECIFY)
H - 15 VDC
I - 18 VDC

GROUP 7 FREQUENCY

0 - DC - 1 GHz
1 - DC - 3 GHz
2 - DC - 8 GHz
3 - DC -12 GHz
4 - DC -18 GHz
6 - DC -26.5 GHz
7 - OTHER (SPECIFY)

GROUP 8 POLARITY

A - COMMON PLUS
B - COMMON MINUS
C - NOT RELEVANT TO APPLICATION

GROUP 9 MOUNTING

2 - FLANGE

Switch Height (A) for Selected Options

DIM A ±.03	GROUP 5 TERMINAL
1.5	1
2.1**	3

* Specifications for 28 Vdc, 25˚C

** Dimension for switches with Standard Narda Power Connector M24308/3-1 mating with M24308/1-1

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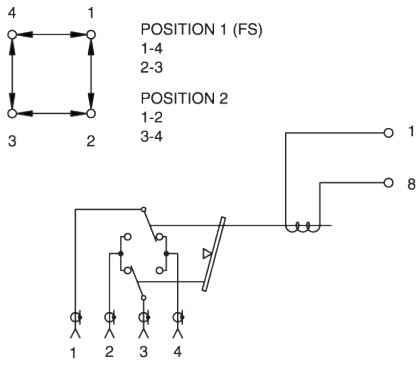
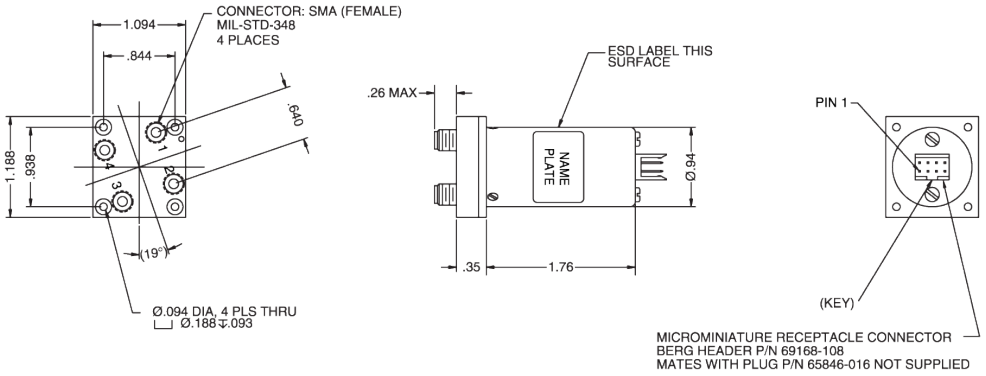
Series 136 DPDT / DC-26.5 GHz

Typical Schematic



SCHEMATIC SHOWN IN FAILSAFE POSITION

Typical Outline Drawing



Quick Reference Guide

Over its half century of operation, Narda has designed and developed countless microwave devices including a wide variety of couplers, amplifiers, filters, power dividers/combiners and switches. A large percentage of these units have been custom-designed to satisfy unique and demanding applications. Many have significantly stretched the state-of-the-art in microwave design.

When a switch requirement cannot be satisfied by one of Narda's SEM designs or custom-part switch with the numerous available options, chances are excellent that a special device can be designed and built on a tight schedule and at reasonable cost. A standard or custom switch can even be integrated with other microwave devices to create high-performance assemblies or subassemblies. Such designs may, for example, incorporate optical coupling between the logic control and power circuitry, using an infrared emitting diode with a silicon photo detector.

Narda welcomes a challenge and invites you to discuss your unique requirements.

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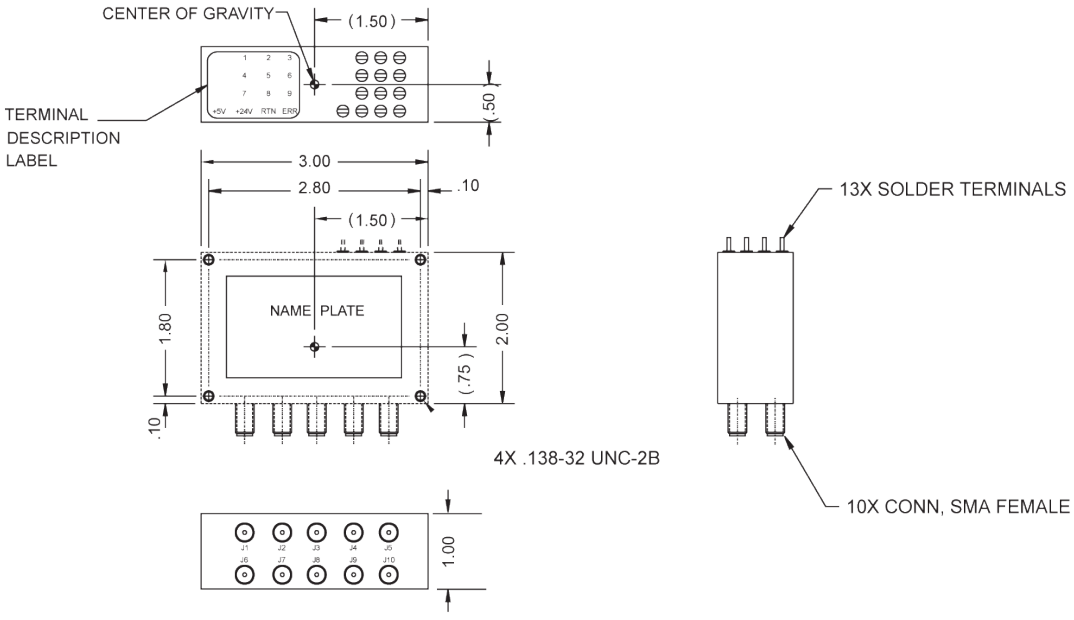
Custom Electro-Mechanical Matrix Switch

Features

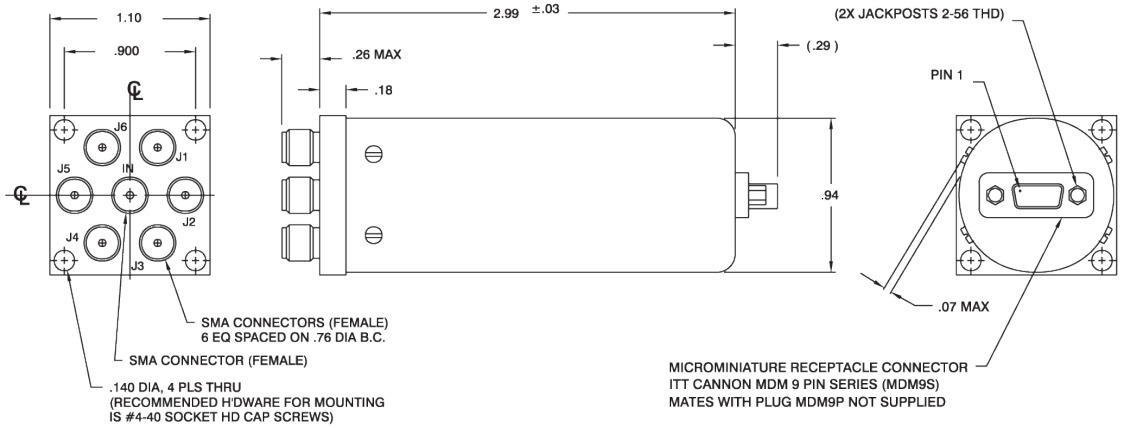
- 3 in, 5 out



Ultra-Miniature Custom Electro-Mechanical Switch

Features

- Multi-Position Switch



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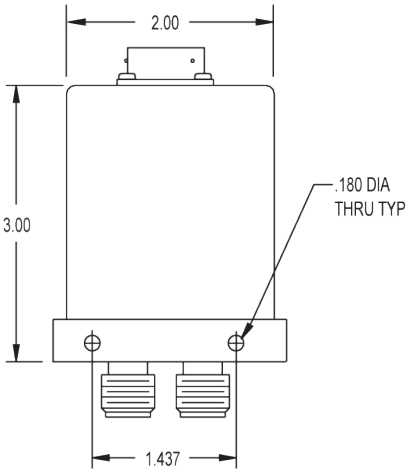
Latching SP3T Electro-Mechanical Switch

Features

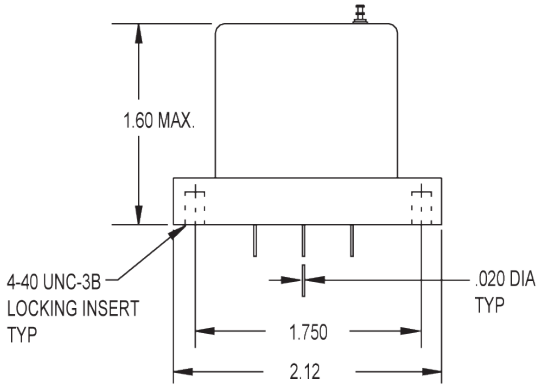
- SC Connectors
- Indicators
- Logic
- Automatic Power Breakers
- Capable of > 2.4 kW CW and 5 kW pulse
- RF Handling



Failsafe SPDT Electro-Mechanical Switch

Features

- PC Board-Mount (.020 DIA PINS)
- Special Mounting Configuration



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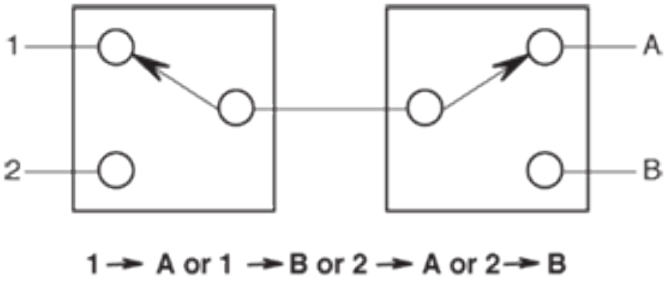
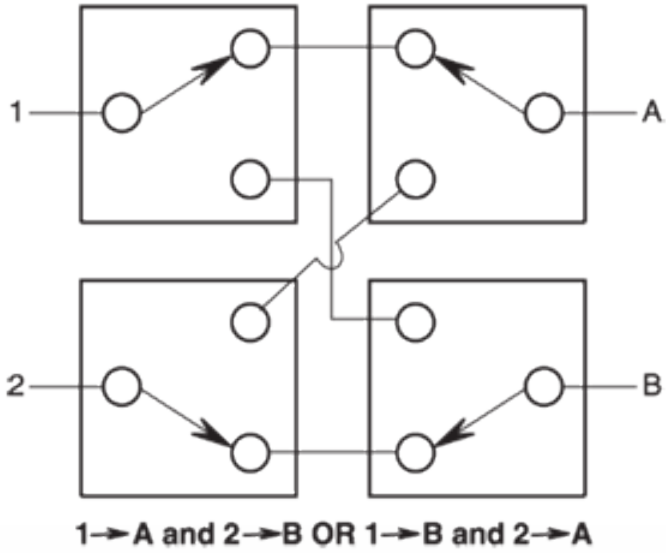
Matrix Switches



Blocking Matrix

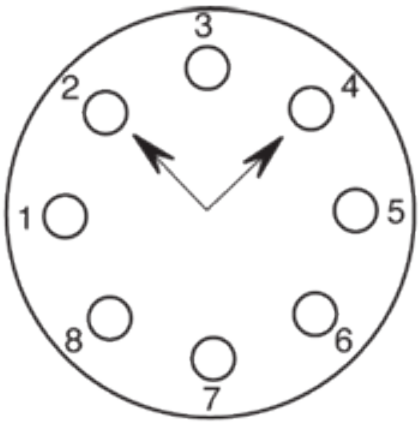
Any 1 In, Any 1 Out. Other inputs/outputs cannot simultaneously be used.



Non-Blocking Matrix

Any Input to Any Output - Simultaneously: 2 Input/2 Output Example.

Matrix Switches



ANY 1 INPUT/ANY 1 OUTPUT

Standard Multiposition Matrix Switch - 6XXX - Up to 12 Positions

8-Position Blocking Matrix

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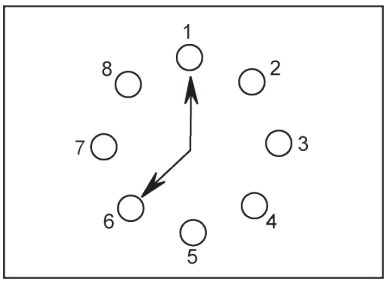
Multiposition BLOCKING Matrix Switches - SMA, TNC, N, SC, BNC

Features

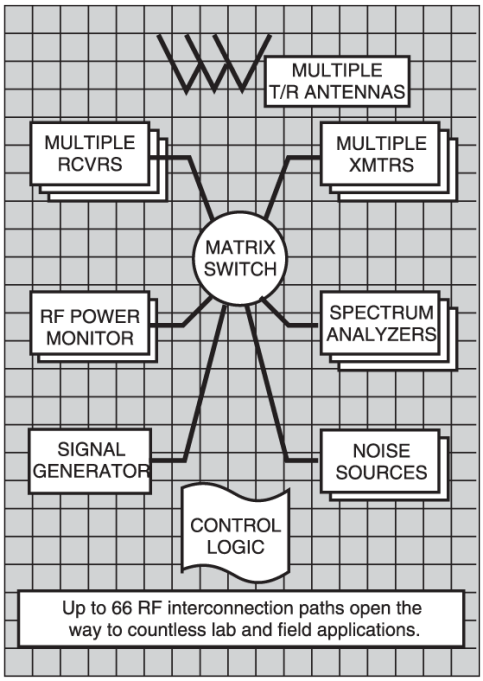
- 3 to 12 Input/Output Channels
- 3 to 66 Selectable RF Paths
- Guaranteed to 1,000,000 Cycles per Position
- Latching Reset or Normally Open
- 15-20 millisecond Switching Speed
- Internal Termination of all Unused Ports*
- Operating Temperature from -35?o +70°C
- Solder Terminals or Power Connector
- Indicator Circuits*
- TTL Logic*
- BCD Control*

Finally, for both laboratory use and critical operational deployment, the RF system designer's ultimate switching device — the logic-controlled MATRIX switch from Narda.

Wtih a single high-performance switch, it's now easy to channel multiple transmit and/or receive antennas to and from a variety of filters, amplifiers, spectrum analyzers, transmitters and so on....up to 12 separate devices, interconnected in up to 66 different ways.



Sample RF connection (1-6 port) for 6080 series matrix switch.



*Optional features.

NOTE: specifications will vary depending on switch series. For more information contact Narda marketing.

Multiposition BLOCKING Matrix Switches - SMA, TNC, N, SC, BNC

MATRIX SWITCH SELECTION GUIDE — BLOCKING MATRIX SWITCH

NO. OF INPUT/OUTPUT CHANNELS *	SWITCH SERIES	OPERATING MODE	RF CONNECTOR
3	6030 6032 6033 6034	D D,C D,C D,C	SMA SMA N,TNC SC
4	6040 6042 6043 6044	D D,C D,C D,C	SMA SMA N,TNC SC
5	6050 6052 6053 6054	D D,C D,C D,C	SMA SMA N,TNC SC
6	6060 6062 6063 6064	D D,C D,C D,C	SMA SMA N,TNC SC
7	6075	D,C	SMA
8	6085	D,C	SMA
9	6095	D,C	SMA
10	6101	D,C	SMA
11	6120	D,C	SMA
12	6120	D,C	SMA

* These switches are Blocking Matrices and only have 1 In and 1 Out at any time.
Consult Factory for frequency range of the 6XXX switch.

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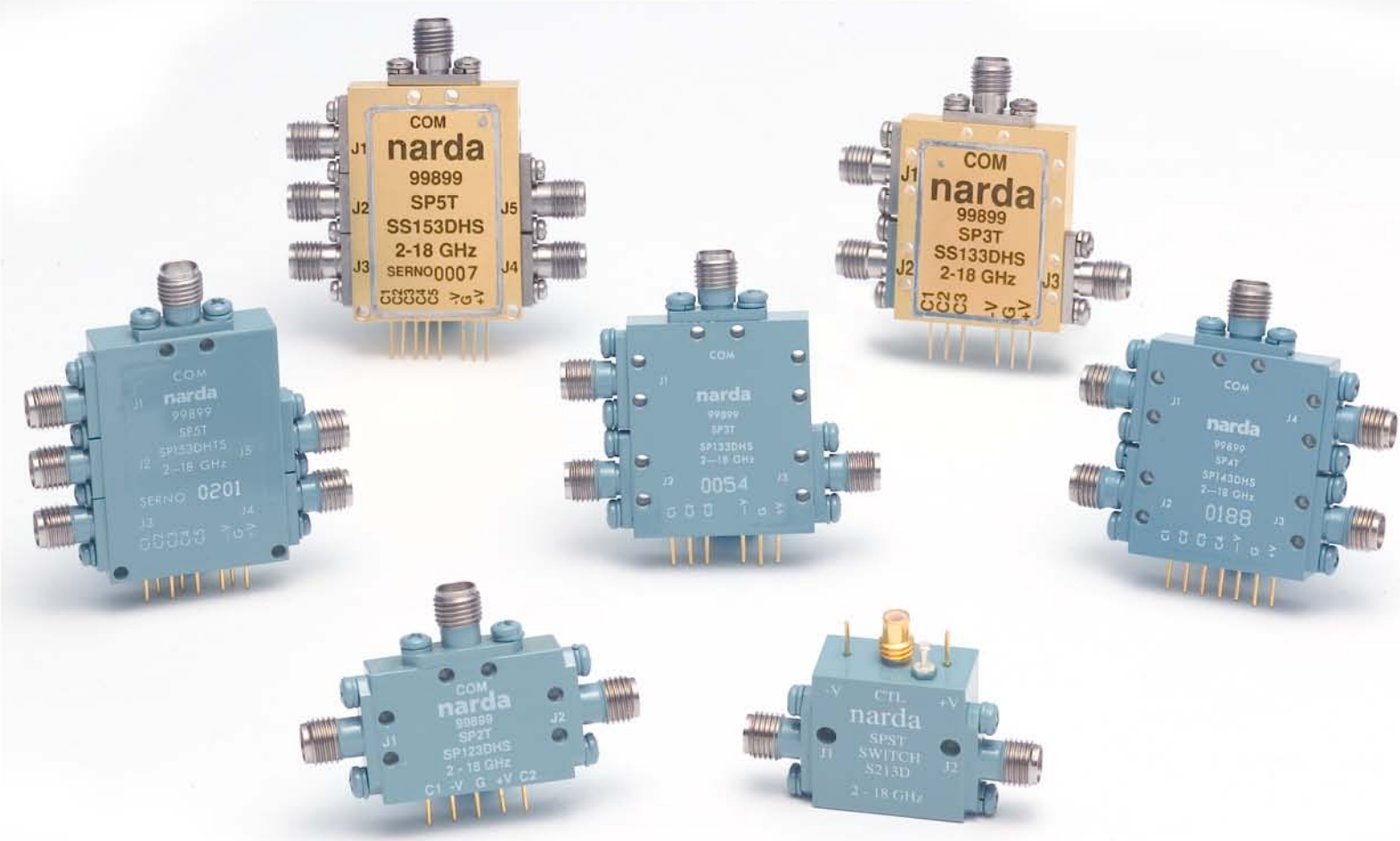
SOLID STATE SWITCH PRODUCTS



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Quick Reference Guide

RF and Microwave PIN Control Products Application and Selection

A Guide to Help Designers Make the Best Selection When Specifying Switches, Attenuators, Phase Shifters and Limiters

- **Fundamental PIN Diode Switches**
- **Primary Design Parameters**
- **Application-Specific Considerations**
- **A Glossary of Key PIN Diode Terms**

Introduction

RF and microwave components based on PIN diodes have been essential tools in the designer's toolkit for decades, and with good reason: their unique characteristics make them the best choice for a wide variety of control applications, such as switches, attenuators, phase shifters, limiters, and modulators.

PIN diodes are fundamentally similar to standard diodes, but have an RF impedance that is determined by an externally- supplied bias current. Their versatility makes them excellent building blocks in a wide variety of configurations within each product category, which allows diverse system requirements to be served. In short, the PIN diode enables all systems – from the least complex to the most sophisticated – to achieve their intended missions, while requiring very little space, power, or cost.

There are many resources that provide both practical and theoretical information about PIN diode theory, characteristics, and incorporation in modules and subsystem designs. However, practical information about choosing the proper PIN-diode-based product for a specific application is conspicuously absent. “RF and Microwave PIN Control Product Application and Selection” has been created to fill this void. It includes basic discussions of PIN diode characteristics, the most commonly used PIN-diode-based products, and the trade-offs encountered in designing products around them. The merits of various types of control products within a specific category (analog and digital attenuators, for example) are discussed as well.

PIN-Diode Switches

Switches that control the path of RF power from very low frequencies through the low millimeter-wave range are the most common application for PIN diodes. The level of DC bias applied to the diode determines its impedance. In the case of a PIN diode mounted in series with a transmission line, when the bias changes the impedance from a low value to a high value, the circuit acts as a switch. That is, the switch is in the “on” state when forward biased (low impedance), and in the “off” state when zero or reverse biased (high impedance). The attenuation

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produced by the diode switch is called insertion loss (Il) when the switch is in the “on” state, and isolation when in the “off” state.

In a simple SPST PIN diode switch (Figure 1), the diode can be either series or shunt connected. The series-connected PIN diode configuration can provide reasonably low insertion loss over a multi-octave frequency range, but with lower power-handling capability. Design and fabrication are also simpler because no holes are required in the circuit board to mount shunt diodes.

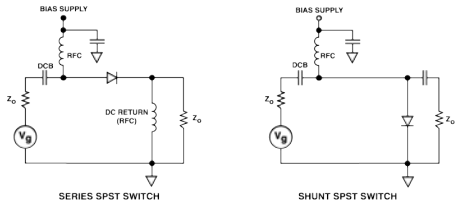

Figure 1

In series diode switches, insertion loss is dependent on the series resistance of the PIN diode while isolation is primarily dependent on the junction capacitance. These parameters are determined by the forward bias current and reverse bias voltage, respectively.

The shunt-connected PIN diode configuration optimizes high isolation and low loss across a wide frequency range (up to several octaves), and can handle higher power levels because the diodes are mounted directly to the housing. The shunt switch is “on” when the diode is zero or reversed biased, and off when forward biased (the opposite of the series switch).

The insertion loss of a shunt-connected diode at a given frequency is primarily dependent on its junction capacitance (Cj), while the isolation provided by the diode is dependent on its series resistance (Rs) when the diode is forward biased. A combination series-shunt topology is also used and provides very wideband performance, high speed, and moderate power-handling ability and insertion loss.

Multi-throw switches can be configured in two ways to achieve improved performance (Figure 2a). In the first method, PIN diodes series-connected to the common junction and the diodes in the “on’ port are forward-biased while the remaining diodes are reverse-biased. The result is a low-loss path for the “on” port and minimal loading by the "off" ports.

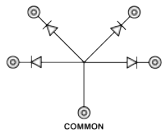

Figure 2a - Shunt Diodes Located Quarter Wave Length from Common Junction

In the second method (Figure 2b), shunt-connected PIN diodes are placed one-quarter wavelength from the common junction, and the selected diodes of the “on” port are reverse-biased while the “off” ports are forward-biased. The result in this case is an electrical short across each “off” transmission line, and the quarter-wavelength spacing transforms the shorts to open circuits at the junction.

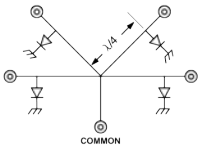

Figure 2b - Series Diodes at Common Junction

These techniques are optimized through prudent choice of transmission line impedances while keeping stray reactance low, resulting in a switch with acceptably low insertion loss and VSWR, and a 3:1 bandwidth.

While it is possible to achieve isolation somewhat greater than 40 dB with a single PIN diode (either series or shunt-connected) at lower microwave frequencies, it is typically necessary at higher frequencies to increase the number of switch elements by using additional series-mounted and shunt-connected PIN diodes in each arm.

The isolation elements of a switch (series or shunt diodes) are usually spaced a quarter wavelength apart. This results in a value of isolation 6 dB greater than the sum of the isolation that is provided by each pair of diodes. This structure can be repeated several times to achieve greater than 90 dB isolation.

KEY PIN DIODE SWITCH PARAMETERS

Insertion loss, isolation, switching speed, and power handling ability are typically the parameters used to describe switch performance. However, there are other key parameters.

Video Leakage

The spurious signals at the switch’s RF ports when there is no RF signal present are collectively called video leakage. The switch driver produces these

signals, specifically at the leading edge of the voltage spike provided for high-speed switching. There can actually be video spikes of ±10 VDC present in a system with a 50-ohm impedance, although ±1.5 to ±3.0 VDC is more common. Most of the RF energy in the video spike is below 200 MHz but in very-high-speed, broadband switches, there can be appreciable RF energy (-60 to -50 dBm) produced – as high as 1 GHz. High-pass filters can reduce the level of low-band video leakage components, but signals within the passband of the switch (in-band video leakage) cannot be filtered out. In-band video leakage can be reduced only by using a switch with a slower switching speed or by very carefully tailoring the drive waveform to suit the particular type of PIN diode being used.

Harmonics and Distortion

PIN diodes, like all diodes, are nonlinear in their response characteristics, and as a result produce harmonics and intermodulation distortion (IMD) products. Fortunately, these products are usually at very low levels in a PIN diode switch because the diodes themselves are either in a saturated, forward-biased condition or are reversed-biased. The minority carrier lifetime of the diode determines the level of IMD. A PIN diode switch's IMD performance is usually described by its third-order output intercept point (OIP). Good OIP performance for typical PIN switches ranges from +35 dBm to +45 dBm. The level of harmonics and IMD varies widely among devices, so it is important to read the manufacturer's specifications for these parameters for every model considered.

Minority Carrier Lifetime

This specification is very important from the perspective of both diode and circuit design. Carrier lifetime (TL) is a property of the semiconductor material, and when the PIN diode is forward biased, injection of electrons and holes occurs from the N+ and P+ contacts respectively. These carriers have a finite lifetime, and the average time before they recombine is the carrier lifetime. Recombination takes place through interaction between the crystal lattice and impurities in the "I" region and P+ and N+ regions of the diode. The carrier lifetime in a PIN diode controls the switching speed, i.e., the time required to switch the diode from a low-impedance forward bias state to a high-impedance reverse bias state. This transition is the slower of the two transitions in a switching application since the driver circuit is attempting to remove stored charge from the PIN diode.

Switching speed and minority carrier lifetime are directly related. To visualize their interaction, it helps to examine the relationship of minority carrier lifetime and its forward and reverse current ratio (If/Ir) in the following equation:

Trr=TL log (1 + If / Ir)

where

Trr is the diode's switching speed (commonly referred to as "reverse recovery time"), and TL is the minority carrier lifetime

This equation describes the dependence of switching time on the minority carrier lifetime and the "If/Ir" ratio.

Switching Speed

Rise Time And Fall Time: These parameters, fundamental to many designs, are actually composed of several subsets, each one defining the time required for switching to take place between two states in the switch response (Figure 3a). Rise time is defined as the period between full "off" and full "on," specifically from 10 percent of this condition to 90 percent of the square-law-detected RF power. Conversely, fall time is the period between 90 percent of full "on" to 10 percent of full "off." Rise time and fall time do not include driver propagation delays.

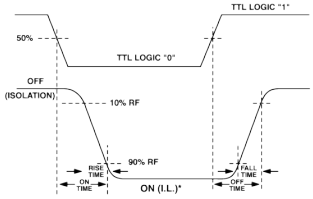

Figure 3a - Detected RF Power

Modulation On Time and Off Time: The time lapse between 50 percent of full input control signal from the driver to 90 percent of the square-law-detected RF power when the device is switched from full "off" to full "on" is called the "on" time. The "off" time begins when the 50 percent point of control signal occurs, to the point when it achieves 10 percent of its square-law detected RF power and the unit is switched from full "on" to full "off." On and off times include driver propagation delays. This is sometimes referred to as "Modulation Time."

Connotation (port-to-port switching time) (Figure 3b), sometimes referred to as "Commutation Time," is the period from when the RF power level at the off-going port falls to 10 percent of its original level to the

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time the RF power in the on-going port rises to 90 percent of its final value. In high-speed, reflective switches, commutation time is typically slightly longer than “on” or “off” time. **For absorptive switches, please consult the factory.**

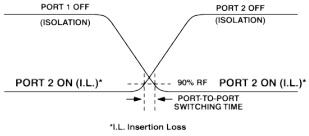

Figure 3b - Switching Speed Characteristics

All specifications for on/off time in this catalog are for the modulation mode.

PERFORMANCE TRADE-OFFS

The design of any subsystem invariably requires trade-offs in one or more areas of performance. Optimizing a design for one performance parameter often occurs at the expense of another. Such is the case with PIN diode switches.

Power vs. Frequency

Junction capacitance can be reduced in order to ensure low loss at higher operating frequencies. For a given switching speed, junction capacitance can be lowered by decreasing the area of the diode. This increases the diode’s thermal impedance, producing a reduction in power-handling ability.

Power vs. Switching Speed

To optimize power-handling ability, the diode’s junction area must be large (hence lower thermal impedance). This increases the diode’s junction capacitance, resulting in higher insertion loss, lower isolation (in a series switch configuration), and usually smaller bandwidths. To maintain low capacitance, the diode’s “I” region thickness must be increased to compensate for the increase in capacitance caused by the increased junction area. The increased length of the “I” region raises the minority carrier lifetime, which increases switching speed. An added benefit of increasing the diode’s junction area is a reduction in its forward-biased resistance, improving isolation in a shunt switch.

Frequency and Bandwidth

For a shunt configuration, the insertion loss (in dB) caused by the diode is given by:

10 log [1+2(Z0FCj)2] **for reverse bias**

As the diode's capacitance increases, the switch’s insertion loss increases dramatically.

For a shunt configuration, the switch isolation in dB is given by:

20 log[1+ZR/02s] **for forward bias**

where

Z0 is the circuit's characteristic impedance
F is the RF frequency of interest
Cj is the diode's junction capacitance
Rs is the diode's forward-biased resistance

REFLECTIVE SWITCHES

A reflective switch is one in which the incident power at the “off” port is reflected back to the source as a result of the impedance mismatch presented by the PIN diode. In contrast, an absorptive switch is designed to present a 50-ohm impedance in the “off” state, and to absorb incident power.

Typical reflective switches (Figure 4) include the previously-described SPST series configuration, and an all-shunt arrangement, with its inherently higher power-handling ability and switching speed. The operating bandwidth of the switch is determined by the blocking capacitors selected, the bias circuitry, and the diode’s reverse-bias capacitance. Reducing the diode's shunt resistance increases isolation in this type of switch. This reduction is achieved either by increasing the current or decreasing the diode's overall resistance. In addition, by adding a fourth shunt diode, isolation can be increased, which is accompanied by an increase in insertion loss, but with little impact on power handling and switching speed.

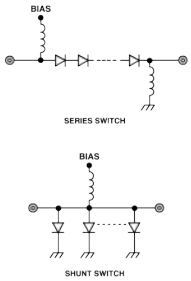

Figure 4 - Reflective Spst Switch

Multi-Throw Reflective Switches

Taking this design to a multi-throw configuration (Figure 5), the low insertion loss at the “on” port must be isolated from the high insertion loss at the “off” port with a series PIN diode. Isolation at the “off” port is a function of frequency and diode capacitance, and isolation will increase as the capacitance of the series diode decreases. However, increased

bandwidth (lower capacitance) comes at the expense of reduced power-handling ability. The number of throws can be extended in this type of switch, limited only by the diode's junction capacitance and the physical size limitations of the switch.

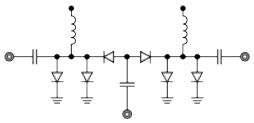

Figure 5 - Reflective SPDT Switch

Absorptive Switches

Multi-throw absorptive switches typically employ the series-shunt approach (Figure 6). The required 50-ohm terminating impedance is achieved by the series combination of the diode and terminating resistance to ground. This type of termination has good high-frequency characteristics, but power-handling ability is limited by the ability of the diodes and resistors to dissipate RF power. In addition, absorptive switches typically exhibit somewhat slower switching speeds. These types of switches are usually not absorptive at their common port (in the “all-off” state) but can be made absorptive for special applications.

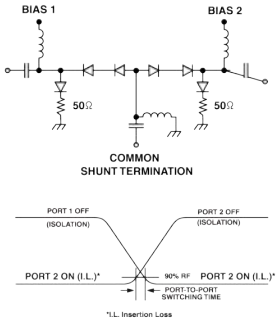

Figure 6 - Reflective SPDT Switches

Transmit/Receive (T/R) Switches

T/R switches are used to switch a single feedline between a transmitter and receiver and can benefit greatly from PIN diode switch technology. They are more reliable, faster, and more rugged than their electromechanical counterparts. The basic T/R switch consists of a PIN diode connected in series with the transmitter and a shunt diode connected one-quarter wavelength away from the antenna in the direction of the receiver section (Figure 7). Of course, quarter-wavelength spacing is not practical at low frequencies, so quarter-wavelength lumped elements can be used instead. In T/R switches, the trade-off is between achieving low loss for the receiver path and high power-handling ability for the transmitter path.

When the switch transfers the feedline to the transmitter, each diode becomes forward biased. The series diode appears as a low impedance to the signal approaching the antenna, and the shunt diode shorts the receiver’s antenna terminals to prevent overload. Transmitter insertion loss and receiver isolation are dependent on the diode resistance. In the receive condition, the diodes are zero or reverse-biased, and present a low (shunt) capacitance which creates a low-loss path between the antenna and receiver. The “off” (transmitter) port is isolated from this path by the high-impedance series diode.

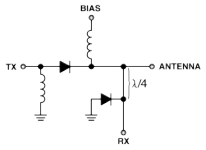

Figure 7 - T/R Switch

A WORD ON DRIVERS

A PIN diode switch will perform only as well as its driver allows. The driver must be capable of supplying the necessary reverse bias voltage in order to achieve the desired diode capacitance, and must source or sink the bias currents required to drive the diodes to their rated forward bias resistance. In addition, fast switching requires the transition time between driver output levels to be as short as possible. Relatively high voltage “spikes” are also required to remove charge from forward-biased diodes and speed up their switching time.

From the user’s perspective, the important parameters are:

- **Switching speed and repetition rate**
- **Number of switch throws**
- **Number of control lines (i.e., one line per throw or integral switch logic decoders)**
- **Logic sense (Ø = low-loss state is typical)**
- **Custom hybrid flatpack or printed circuit board implementation**
- **Driver integral to switch assembly or mounted separately. High-speed switch driver circuits are usually built as hybrid (chip and wire) circuits to reduce size and increase speed, and are mounted next to the RF section.**

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PIN Diode Attenuators

INTRODUCTION

PIN diode attenuators range from simple seriesconnected or shunt-connected diodes acting as a lossy reflective switch to more complex structures that maintain a good input match across the full dynamic range of the attenuator. PIN diode attenuator circuits are used extensively in automatic gain control (AGC) and RF leveling applications

Although other methods are available for providing AGC, such as varying the gain of the RF amplifier, the PIN diode approach results in lower power drain, less frequency pulling, and lower RF signal distortion. Lower attenuator distortion is achieved using diodes with thicker "I" regions and long carrier lifetimes.

In an attenuator, the resistance characteristics of the diode are exploited not only at their extreme high and low values as switches, but also at values in between. Thus, PIN diode attenuators tend to produce less distortion than amplifiers but more than switches. The resistance characteristic of a PIN diode when forward biased depends on the "I" region thickness, carrier lifetime, and hole and electron mobilities. A PIN diode with a thin "I" region will operate at lower forward bias currents than a PIN diode with a thick "I" region, but the latter diode will generate less distortion. Careful selection of diode "I" layer thickness can yield a good compromise between attenuator speed, distortion, linearity, and power-handling ability. In addition, it is easier to linearize the driver for thicker diodes.

NOTES ON ATTENUATOR PERFORMANCE

Understanding how the following parameters affect performance makes it easier to choose the best type of attenuator for a particular application.

Phase Shift and Attenuation

A PIN diode attenuator's phase shift varies as the attenuation level changes. This is a result of stray PIN diode reactance vs. bias level, or (in the case of a switched-bit attenuator) the different lengths of the transmission paths connecting the diodes that are being switched in or out. It can never be entirely eliminated. However, attenuators can be designed to reduce phase shift to a very low level, especially over narrow bandwidths.

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IMD and Harmonics

Every PIN-diode-based device generates some level of harmonics and intermodulation products because diodes are non-linear devices. In this regard, switched-bit attenuators outperform analog voltage variable attenuators (VVAs) because switched-bit attenuators are basically just PIN diode switches. That is, their diodes are biased either fully on or fully off.

Power-Handling Ability

An attenuator's power-handling ability is dictated by its design, bias conditions, and switching speed. Generally speaking, faster VVAs handle less power, especially at low frequencies. An attenuator's maximum operating power level is defined as the amount of power required to cause 1 dB attenuation compression. At or near the 1 dB compression point, the attenuator will produce its highest levels of IMD and harmonics. Generally, the faster diodes will handle less power at lower frequencies because of the compression point's dependence on "I" layer thickness. The attenuator's survival rating is dictated by the diodes' survival rating. As might be expected, attenuator power-handling specifications vary considerably and can be tailored to the needs of a specific application.

Monotonicity

This is a required attribute of any type of attenuator, regardless of the application. Without a monotonic attenuation relationship to the analog or digital control commands, the attenuator's accuracy and other characteristics can never be optimal. Non-monotonic behavior can be exhibited by switched-bit attenuators as a result of uncompensated internal VSWR interaction, and in digitally-controlled analog attenuators with errors in digital calibration toward the band edges.

Mean Attenuation

This parameter is the average of maximum and minimum values of attenuation over a given frequency range for a given control signal. It is of particular importance in wideband analog VVAs, as

they typically have a parabolic attenuation vs. frequency response, and the minimum- to-maximum attenuation vs. frequency at higher levels can be as large as 5 dB in multi-octave designs.

Attenuation Flatness

The attenuation variation from the mean attenuation over a given frequency range for a given attenuation value is called attenuation flatness, and is expressed in dB.

Attenuation Accuracy

This parameter is the maximum deviation of the mean attenuation from the nominal value of the programmed attenuation, expressed in dB.

Comparison of Attenuator Characteristics

Parameter	Switched-Bit	Digitally-Linearized Analog
Switching Speed	Very high (20 ns)	Moderate (> 100 ns)
Attenuation accuracy	High	Highest
Attenuation flatness with frequency	Beat	Moderate
Power handling	High	Moderate
Operating frequency bandwidth	Broad (two to three octaves)	Moderate (1 octave)
Resolution	High (1 dB)	Highest (0.25 dB)
Calibration	Fixed	Selectable within unit
Coat	High	Moderate
Survival and compression power	High	Moderate

DIGITALLY-LINEARIZED ANALOG ATTENUATORS VS SWITCHED-BIT ATTENUATORS

There are dozens of possible attenuator configurations, each one with its own unique characteristics that make it better suited for one application over another.

Digitally-Linearized Analog Attenuators

Other than switched-bit types, all attenuators are essentially analog devices. There are as many analog attenuator configurations as there are system applications that require them. This guide covers only digitally-linearized analog attenuators, shunt-mounted diode arrays, and switched-bit attenuators, because they are the most common and versatile types.

Typical VVAs contain from one to four shunt-mounted diodes (Figure 8a). Adjusting the bias current changes the resistance of the PIN diodes, reflecting more of the RF signal, which produces the desired attenuation.

This approach is similar to a reflective switch because it presents a poor match at the input and output ports. Most VVAs of this type are built in pairs and mounted between 3-dB hybrids (Figure 8b). The reflected RF power is absorbed by the termination at the hybrid's isolated port, presenting a good match at the VVA's input and output ports.

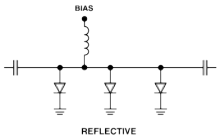

Figure 8a - Reflective

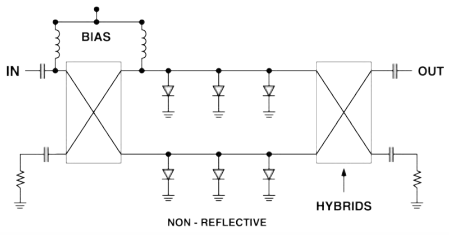

Figure 8b - Non-Reflective

An analog driver/linearizer or a digital driver (D/A converter with EPROM) can then be used to calibrate and linearize the VVA's attenuation vs. control signal response.

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Digitally-Controlled Switched-Bit Attenuators

When broadband, ultra-fast-switching performance is needed, the digitally-controlled switched-bit attenuator is the only solution. It excels in attenuation accuracy and flatness over broad frequency ranges, and its switching speed is equivalent to a high-speed PIN diode switch (25 ns or better). Its only disadvantages are higher insertion loss and higher cost.

The digitally-controlled attenuator's topology is based on switching fixed attenuator pads in or out of the RF path using PIN diode SPDT switches. It uses one control bit per attenuator pad, and attenuation step size is determined by the lowest attenuator pad value. The total attenuation range is the sum of all the attenuator pads.

As stated earlier, attenuators are designed to match the requirements of specific applications. When the application requires fast switching speed combined with high power-handling ability (as in electronic warfare systems, for example), the switched-bit attenuator is the optimum choice (Figure 9). It employs one or more pairs of SP2T switches, with a low-loss connection between one pair of outputs, and a fixed attenuator between the other outputs. The diodes are switched between their forward-biased and reverse-biased states, which gives the attenuator higher switching speed.

The switched-bit attenuator achieves low, consistent VSWR performance throughout its dynamic range, and its power-handling ability (i.e., compression point and IMD) is also higher than that of an analog VVA because it uses PIN diode switches.

Of course, like all attenuator types, the switched-bit attenuator has some disadvantages. Its smallest attenuation step size at microwave frequencies is limited to about 0.5 dB because of VSWR interaction among the various high-loss and low-loss transmission paths and their associated bias circuits. This interaction also causes attenuation ripple, which can cause slight degradations in monotonicity. These errors are usually less than about ±0.5 dB.

Finally, the switched-bit attenuator is a comparatively complex RF circuit with more components, and is usually more expensive. These considerations aside, the high speed and power handling abilities of the switched-bit attenuator make it appealing for demanding applications.

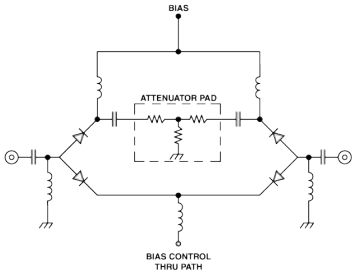

Figure 9

Glossary

Absorptive Device – A device in which the specified VSWR is maintained and all power is absorbed in the device during the high-loss state.

Accuracy/Linearity – In voltage-variable attenuators, the variation of the mean attenuation from the best straight line of attenuation vs. control signal transfer function.

Analog Attenuator – A unit in which attenuation level is controlled either by an applied current in a driverless unit or by a voltage in a unit with a driver. Attenuation level is continuously variable.

Attenuation Accuracy – The deviation of mean attenuation from the nominal attenuation value at a specified temperature (usually room temperature).

Bias – The control voltage or current signals supplied to a unit that provide proper operation for devices without integral drivers.

Carrier Suppression – The minimum ratio of carrier output power to the translated carrier output power in a phase shifter operated as a frequency translator.

Commutation – With all other ports set to isolation, one port is switched from insertion loss to isolation, while another port is switched from isolation to insertion loss. This specification applies only to multi-throw switches.

Digitally-Controlled Voltage-Variable Attenuator (VVA) – An analog attenuator with an integral driver in which control inputs are logic bits. Attenuation is not continuously adjusted, but is selected in steps. The steps are defined by the number of bits employed by the device, the maximum attenuation of the unit, and the logic levels applied to it.

Driver – The circuit used to convert analog or logic command signals to the bias conditions needed to execute control of active devices.

Fall Time – A measure of switching speed represented by the time between the 90 percent and 10 percent points of the detected RF power, when

the unit is switched from insertion loss (on) to isolation (off).

Insertion Loss – The difference, measured in dB, between input power level and output power level when the unit is in a low-loss condition.

Isolation – The difference, measured in dB, between input power level and output power level when a unit is in a high-loss condition.

Mean Attenuation – The average attenuation over an attenuator's range of operating frequencies.

Modulation – With all other ports set to isolation, one port is repeatedly switched on and off.

Modulation Bandwidth – The maximum repetition rate at which a device can be switched.

Monotonicity – As control input level is increased, attenuation level continuously increases. At no point in the range does an increase in control input cause a decrease in attenuation at any frequency or value of attenuation.

Off Time – A measure of switching speed represented by the time between the 50 percent point of input control pulse to the 10 percent point of detected RF power, when the unit is switched from insertion loss (on) to isolation (off).

On Time – A measure of switching speed represented by the time between the 50 percent point of input control pulse to the 90 percent point of detected RF power, when the unit is switched from isolation (off) to insertion loss (on).

Operating Frequency Range – The band of frequencies over which the product must operate and deliver specified performance.

Operating Power – The maximum power over which a unit will achieve specified performance.

Operating Temperature Range – The temperature range over which a unit will achieve specified performance.

Phase And Amplitude Matching – The maximum range of values within which all phase or amplitudes are controlled over a specified frequency range. Usually referenced to one port and measured from port-to-port or unit-to-unit.

Phase Shift – The difference in electrical phase of a signal from the input of the device to its output. Measured as absolute insertion phase, or with respect to a given state. In a phase shifter, the difference in phase angle of an RF signal at a given frequency and phase-shift setting. Referenced to the emitted signal at the same frequency with the phase shifter set to 0 degrees phase shift.

Reflective Device – A device in which the incident power is reflected back to the source when the port is in the high-loss state.

Rise Time – A measure of switching speed represented by the time between the 10 percent and 90 percent points of the detected RF power, when the unit is switched from isolation (off) to insertion loss (on).

Sideband Suppression – The minimum ratio of any sideband output power to the translated carrier output power when a phase shifter is operated as a frequency translator.

Survival Power – The maximum RF power level to which a unit can be subjected without permanent performance degradation or failure.

Temperature Coefficient – The average rate of change in phase shift (degree phase shift/°C) or attenuation change (dB/°C) over the entire operating temperature range of the unit.

Translation Rate – When a digital phase shifter is used as a frequency translator, the clock rate divided by the number of steps determines the translation rate and hence the maximum frequency translation. When "N" equals the number of phase bits, the number of phase steps is equal to 2N.

VVA Linearity – In a voltage-variable attenuator, the variation from straight-line attenuation vs. control signal level.

Description of Super-Slim High Performance Drop-In PIN Switches, 0.5-18 GHz and 2-18 GHz

Features

▪ Reflective and Absorptive ▪ SPST thru SP6T plus Transfer ▪ High Speed ▪ High Isolation - up to 80 dB ▪ Low Insertion Loss ▪ Super-Slim Packages ▪ Drop-In Applications ▪ Integral TTL Drivers ▪ Hermetically Sealed ▪ Full Mil Environmental

Description

The super-slim series of broadband, hermetically sealed switches offers fast switching speed and low insertion loss in very compact packages. Both 0.5 to 18 GHz and 2 to 18 GHz models are available. The switches are gold plated and have removable SMA

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connectors for use in drop-in applications. Superior RF performance is achieved over the entire bandwidth due to the use of selected PIN diodes and optimum RF circuit designs.

All models include integral drivers with reverse voltage protection. The drivers are TTL compatible and are tailored to each RF circuit to give optimum switching performance.

The small size, high speed, broad bandwidth and low insertion loss make these switches ideal for EW systems, automatic test equipment, and simulators.

Description of High Performance PIN Switches, 2-18 GHz

Features

▪ Reflective and Absorptive ▪ SPST through SP4T ▪ High Speed – 15 nsec. ▪ High Isolation – up to 80 dB ▪ Low Insertion Loss ▪ Small Package Size ▪ Integral TTL Drivers ▪ Hermetically Sealed

Description

The performance series of 2 to 18 GHz hermetically sealed switches offers fast switching speed and low insertion loss in compact packages. These switches use the identical circuits employed in Narda's top-of-the-line Super Slim Series. They are ideal for connector applications where the absolutely thinnest profile is not required. All models include integral drivers with reverse voltage
protection. The drivers are TTL compatible and are tailored to each RF circuit to give optimum switching performance.

The small size, high speed, broad bandwidth and low insertion loss make these switches ideal for EW systems, automatic test equipment, and simulators.

Description of Value Series PIN Switches, 2-18 GHz

Features

▪ SPST through SP4T and Transfer ▪ Integral TTL Drivers ▪ Hermetically Sealed

Description

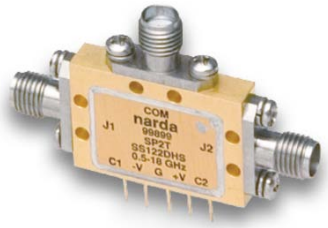
Narda Value Series PIN switches provide a lower cost alternative to the super slim and performance series. They are ideal for many applications where miniature size and state-of-the-art performance are not required. The circuits are well proven since they are derived from and similar to those used in the Super Slim Series.

General Specifications	
TTL Control Logic	Logic 0 (0-0.8V, 1.6 mA max sink @ 0.4V) = Insertion Loss Logic 1 (2.0-5.5V, 40µA max source @ 2.4V) = Isolation
Transfer Switches (Super Slim Series)	XSS323CDHS Logic 0: J1-J4 and J2-J3 at Insertion Loss Logic 1: J1-J2 and J4-J3 at Insertion Loss
Transfer Switches (High Performance Series)	XSP323DHS Logic 0: J1-J4 and J2-J3 at Insertion Loss Logic 1: J2-J2 and J4-J3 at Insertion Loss
Transfer Switches (Value Series)	XSV323DS Logic 0: J1-J2 and J3-J4 at Insertion Loss Logic 1: J1-J4 and J2-J3 at Insertion Loss
Switching Time	T on = 50% TTL to 90% of RF voltage T off = 50% TTL to 10% of RF voltage
Switching Rate (max PRF @ 50% duty cycle)	Super Slim, High Performance Reflective Models: **5 MHz** High Performance Absorptive Models: **2 MHz** Value Series Models: **1 MHz**
Driver	Reverse voltage protected
Survival Power (25˚C) (Super Slim Models SS213DHS/ SS213DHS-80)	1.5w CW, 20w Peak (1 sec max. pulse width, 7 1/2% duty cycle)
Survival Power (25˚C) (All Other Models)	1.0w CW, 20w Peak (1 sec max. pulse width, 5% duty cycle) Derate linearly to 50% at +95˚C

Options
▪ **Very Low Loss Video Leakage, Inverted TTL Logic Control, BCD Decoder Driver, Package Configuration, Over Voltage Protection**

Environmental Specifications	
Temperature	Operating: -54°C to +95°C Storage: -65°C to +125°C
Humidity	Per-MIL-STD-202F, method 103B, condition B (96 hours at 95% R.H.)
Shock	Per-MIL-STD-202F, method 213B, condition B (75G, 6 msec)
Altitude	Per-MIL-STD-202F, method 105C, condition B (50,000 feet)
Vibration	Per-MIL-STD-202F, method 204D, condition B (.06" double amplitude or 15G, whichever is less).
Thermal Stock	Per-MIL-STD-202F. method 107D, condition A (5 cycles)

SPST-SP6T SMA(F) Drop In 0.5 to 18 GHz Reflective (Super Slim Series)



Features

- **REFLECTIVE**
- SPST thru SP6T
- High Speed
- High Isolation - up to 80 dB
- Low Insertion Loss
- Super-Slim Packages
- Drop-in Applications
- Integral TTL Drivers
- Hermetically Sealed
- Full Mil Environmentals

Models

- SS212DHS, SS122DHS, SS132DHS, SS142DHS, SS152DHS, SS162DHS

Model	SS212DHS	SS122DHS	SS132DHS
Type	SPST	SP2T	SP3T
Switching Time (ns)	15	20	20
Insertion Loss dB (max) 0.5-2 GHz	1.1	1.5	1.5
Insertion Loss dB (max) 2-4 GHz	1.3	1.5	1.6
Insertion Loss dB (max) 4-8 GHz	1.6	2.0	2.0
Insertion Loss dB (max) 8-12 GHz	2.1	2.4	2.5
Insertion Loss dB (max) 12-18 GHz	2.6	2.9	3.0
VSWR (max) 0.5-2 GHz	1.6:1	1.8:1	1.8:1
VSWR (max) 2-4 GHz	1.7:1	1.9:1	1.9:1
VSWR (max) 4-8 GHz	1.8:1	1.9:1	1.9:1
VSWR (max) 8-12 GHz	1.9:1	2.0:1	2.0:1
VSWR (max) 12-18 GHz	2.0:1	2.0:1	2.0:1
Isolation dB (min) 0.5-2 GHz	70	70	70
Isolation dB (min) 2-4 GHz	70	75	75
Isolation dB (min) 4-8 GHz	70	70	70
Isolation dB (min) 8-12 GHz	70	65	65
Isolation dB (min) 12-18 GHz	70	60	60
Power Supply Requirements (mA@+5V)	50	90	90
Power Supply Requirements (mA@-12V to -15V)	50	60	60

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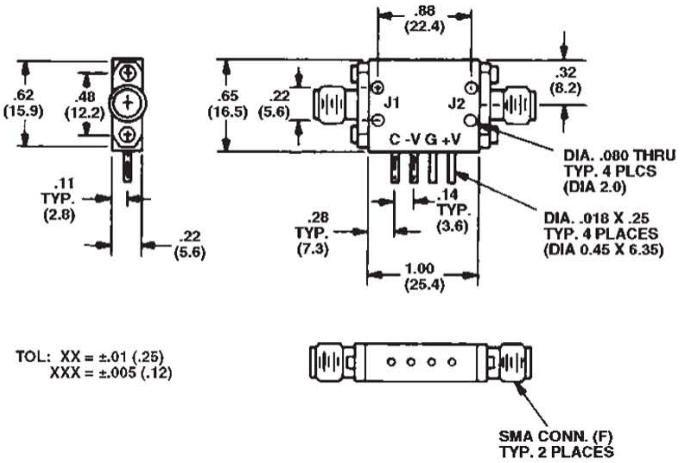
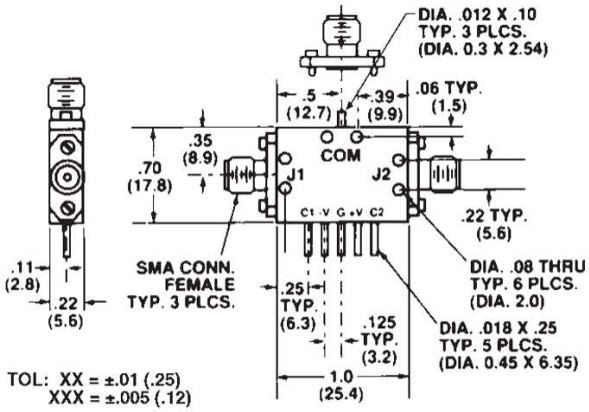
SPST-SP6T SMA(F) Drop In 0.5 to 18 GHz Reflective (Super Slim Series)

Model	SS142DHS	SS152DHS	SS162DHS
Type	SP4T	SP5T	SP6T
Switching Time (ns)	20	20	20
Insertion Loss dB (max) 0.5-2 GHz	1.6	2.0	2.0
Insertion Loss dB (max) 2-4 GHz	1.6	2.0	2.0
Insertion Loss dB (max) 4-8 GHz	2.1	2.5	2.5
Insertion Loss dB (max) 8-12 GHz	2.6	3.0	3.0
Insertion Loss dB (max) 12-18 GHz	3.2	3.6	3.6
VSWR (max) 0.5-2 GHz	1.8:1	1.8:1	1.8:1
VSWR (max) 2-4 GHz	1.9:1	1.9:1	1.9:1
VSWR (max) 4-8 GHz	1.9:1	2.0:1	2.0:1
VSWR (max) 8-12 GHz	2.0:1	2.0:1	2.0:1
VSWR (max) 12-18 GHz	2.0:1	2.0:1	2.0:1
Isolation dB (min) 0.5-2 GHz	70	70	70
Isolation dB (min) 2-4 GHz	75	70	70
Isolation dB (min) 4-8 GHz	70	70	70
Isolation dB (min) 8-12 GHz	65	65	65
Isolation dB (min) 12-18 GHz	60	60	60
Power Supply Requirements (mA@+5V)	110	220	260
Power Supply Requirements (mA@-12V to -15V)	70	90	100



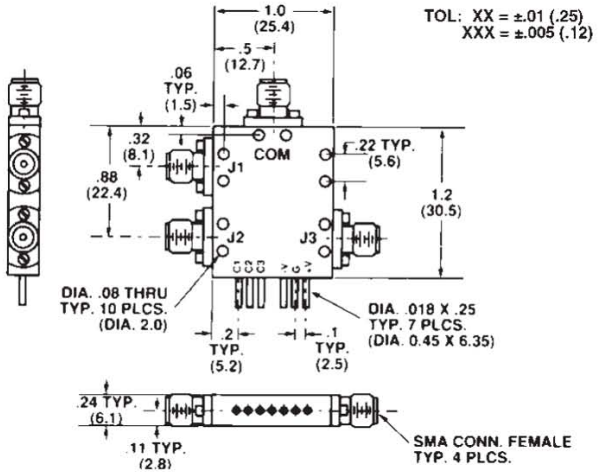
SS212DHS



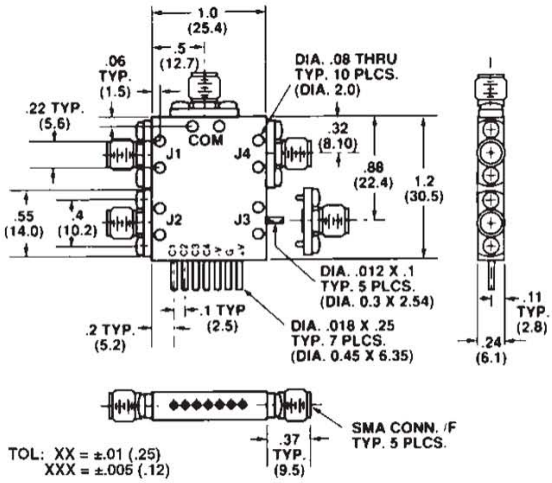
SS122DHS

Dimensions in parentheses are in millimeters and for reference only.

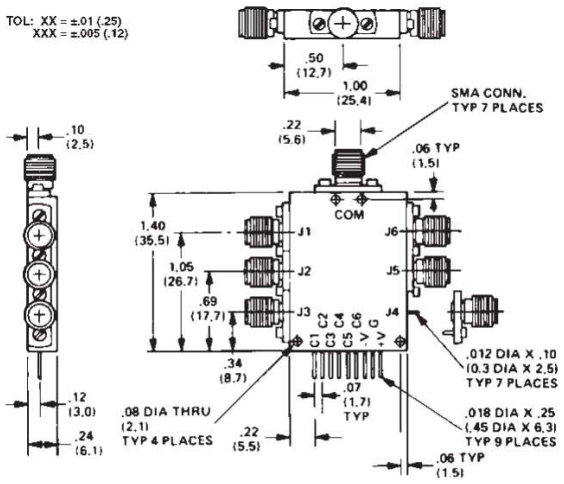
SPST-SP6T SMA(F) Drop In 0.5 to 18 GHz Reflective (Super Slim Series)



SS132DHS



SS142DHS



SS162DHS

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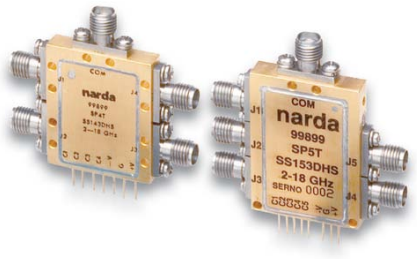
SPST-SP6T SMA(F) Drop In 2.0 to 18 GHz Reflective (Super Slim)



Features

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- Drop-in Applications
- Integral TTL Drivers
- Hermetically Sealed
- Full Mil Environmentals

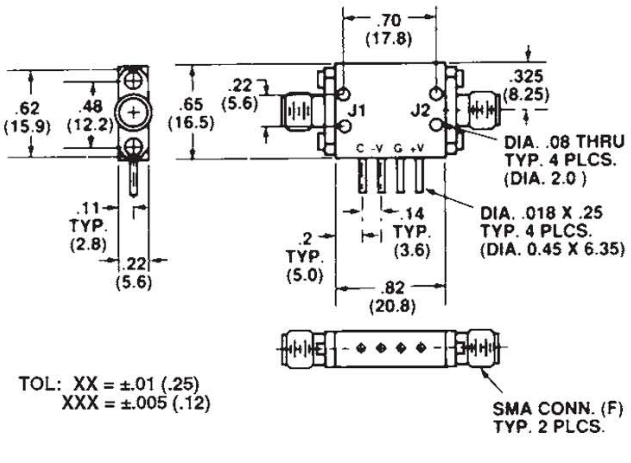
Models

- SS213DHS, SS213DHS-80, SS123DHS, SS123DHS-80, SS133DHS, SS143DHS, SS153DHS, SS163DHS

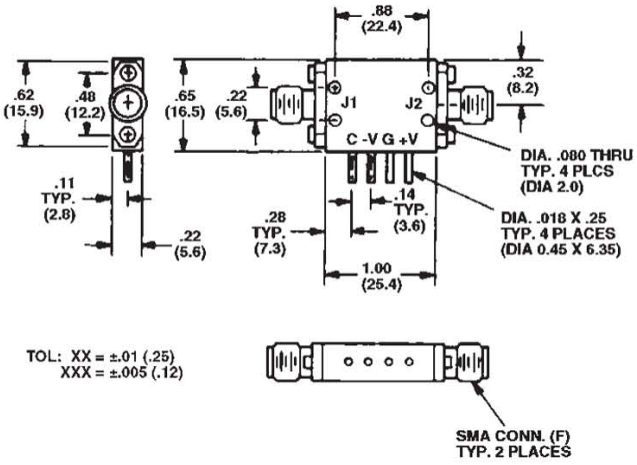
Model	SS213DHS	SS213DHS-80	SS123DHS	SS123DHS-80
Type	SPST	SPST	SP2T	SP2T
Switching Time (ns)	15	15	15	15
Insertion Loss dB (max) 2-4 GHz	1.2	1.3	1.5	1.5
Insertion Loss dB (max) 4-8 GHz	1.4	1.5	2.0	1.9
Insertion Loss dB (max) 8-12 GHz	1.9	1.9	2.4	2.2
Insertion Loss dB (max) 12-18 GHz	2.4	2.5	2.9	2.9
VSWR (max) 2-4 GHz	1.8:1	1.8:1	1.9:1	1.8:1
VSWR (max) 4-8 GHz	1.9:1	1.9:1	1.9:1	1.9:1
VSWR (max) 8-12 GHz	1.9:1	2.0:1	2.0:1	2.0:1
VSWR (max) 12-18 GHz	2.0:1	2.0:1	2.0:1	2.0:1
Isolation dB (min) 2-4 GHz	50	80	75	80
Isolation dB (min) 4-8 GHz	65	80	70	80
Isolation dB (min) 8-12 GHz	60	80	65	80
Isolation dB (min) 12-18 GHz	60	80	60	80
Power Supply Requirements (mA@+5V)	50	60	90	90
Power Supply Requirements (mA@-12V to -15V)	50	40	60	60
Outline Drawing	1	2	3	3

SPST-SP6T SMA(F) Drop In 2.0 to 18 GHz Reflective (Super Slim)

Model	SS133DHS	SS143DHS	SS153DHS	SS163DHS
Type	SP3T	SP4T	SP5T	SP6T
Switching Time (ns)	15	15	20	20
Insertion Loss dB (max) 2-4 GHz	1.5	1.6	2.0	2.0
Insertion Loss dB (max) 4-8 GHz	2.0	2.1	2.5	2.5
Insertion Loss dB (max) 8-12 GHz	2.5	2.6	3.0	3.0
Insertion Loss dB (max) 12-18 GHz	3.0	3.0	3.6	3.6
VSWR (max) 2-4 GHz	1.9:1	1.9:1	1.9:1	1.9:1
VSWR (max) 4-8 GHz	1.9:1	1.9:1	2.0:1	2.0:1
VSWR (max) 8-12 GHz	2.0:1	2.0:1	2.0:1	2.0:1
VSWR (max) 12-18 GHz	2.0:1	2.0:1	2.0:1	2.0:1
Isolation dB (min) 2-4 GHz	75	75	70	70
Isolation dB (min) 4-8 GHz	70	70	70	70
Isolation dB (min) 8-12 GHz	65	65	65	65
Isolation dB (min) 12-18 GHz	60	60	60	60
Power Supply Requirements (mA@+5V)	90	110	220	250
Power Supply Requirements (mA@-12V to -15V)	60	70	90	100
Outline Drawing	4	5	6	7



SS213DHS



SS213DHS-80

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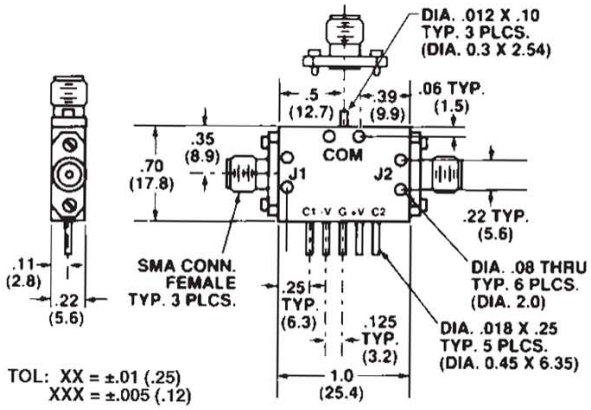
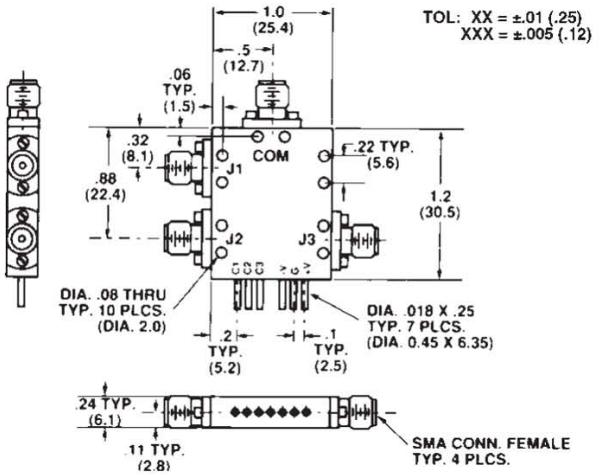
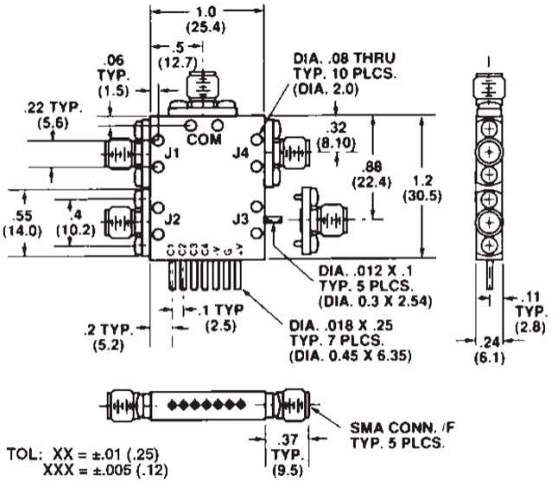
SPST-SP6T SMA(F) Drop In 2.0 to 18 GHz Reflective (Super Slim)



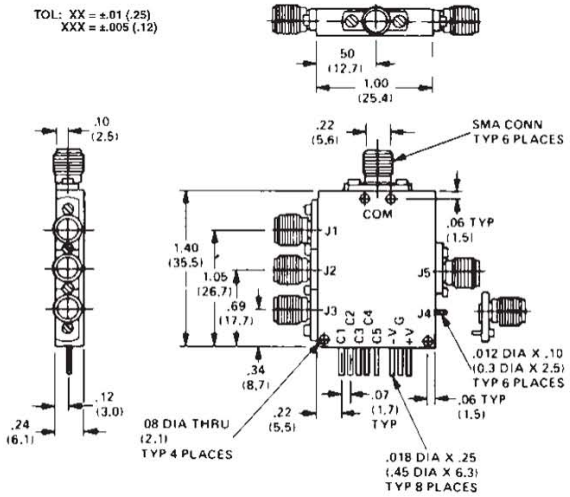
SS123DHS, SS123DHS-80



SS133DHS



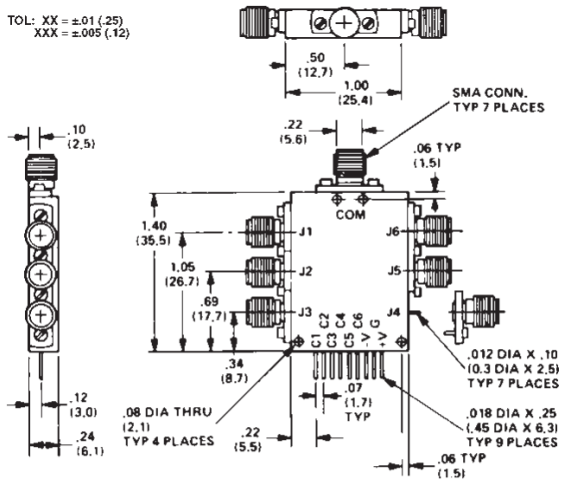
SS143DHS



SS153DHS

Dimensions in parentheses are in millimeters and for reference only.

SPST-SP6T SMA(F) Drop In 2.0 to 18 GHz Reflective (Super Slim)



SS163DHS

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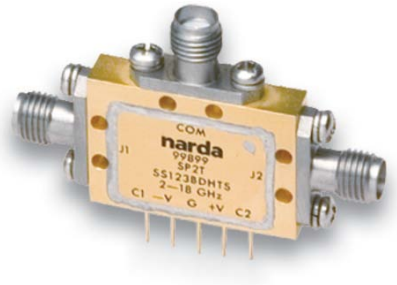
SPST-SP6T SMA(F) Drop In 2.0 to 18 GHz Absorptive (Super Slim)



Features

- **ABSORPTIVE**
- SPST thru SP6T
- High Speed
- High Isolation - up to 80 dB
- Low Insertion Loss
- Super-Slim Packages
- Drop-in Applications
- Integral TTL Drivers
- Hermetically Sealed
- Full Mil Environmentals

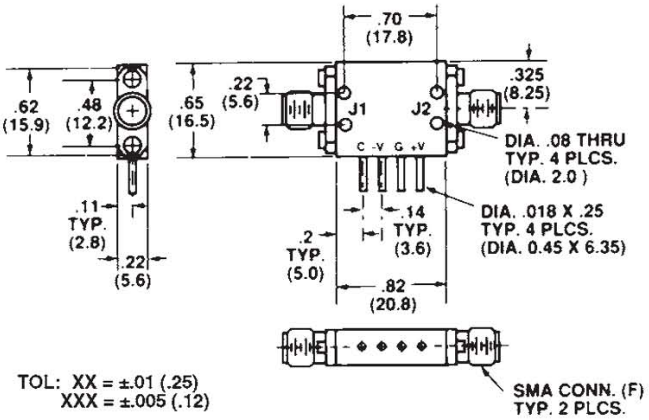
Models

- SS213BDHTS, SS123BDHTS, SS133BDHTS, SS143BDHTS, SS153BDHTS, SS163BDHTS

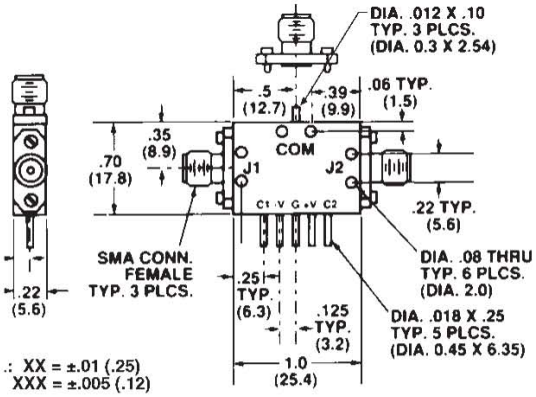
Model	SS213BDHTS	SS123BDHTS	SS133BDHTS
Type	SPST	SP2T	SP3T
Switching Time (ns) 2-4 GHz	20	20	20
Switching Time (ns) 4-8 GHz	20	20	20
Switching Time (ns) 8-12 GHz	20	20	20
Switching Time (ns) 12-16 GHz	25	25	25
Switching Time (ns) 16-18 GHz	25	25	25
Insertion Loss dB (max) 2-4 GHz	1.5	1.6	1.8
Insertion Loss dB (max) 4-8 GHz	1.7	1.8	2.0
Insertion Loss dB (max) 8-12 GHz	2.1	2.5	2.7
Insertion Loss dB (max) 12-16 GHz	2.5	2.9	3.2
Insertion Loss dB (max) 16-18 GHz	2.5	2.9	3.2
VSWR (max) 2-4 GHz	1.9:1	1.9:1	1.9:1
VSWR (max) 4-8 GHz	1.9:1	1.9:1	1.9:1
VSWR (max) 8-12 GHz	1.9:1	1.9:1	1.9:1
VSWR (max) 12-16 GHz	2.0:1	2.0:1	2.0:1
VSWR (max) 16-18 GHz	2.0:1	2.0:1	2.0:1
Isolation dB (min) 2-4 GHz	65	65	65
Isolation dB (min) 4-8 GHz	60	65	65
Isolation dB (min) 8-12 GHz	55	60	60
Isolation dB (min) 12-16 GHz	50	55	50
Isolation dB (min) 16-18 GHz	50	55	45
Power Supply Requirements (mA@+5V)	40	60	105
Power Supply Requirements (mA@-12V to -15V)	60	60	75

SPST-SP6T SMA(F) Drop In 2.0 to 18 GHz Absorptive (Super Slim)

Model	SS143BDHTS	SS153BDHTS	SS163BDHTS
Type	SP4T	SP5T	SP6T
Switching Time (ns) 2-4 GHz	20	25	25
Switching Time (ns) 4-8 GHz	20	25	25
Switching Time (ns) 8-12 GHz	20	25	25
Switching Time (ns) 12-16 GHz	25	25	25
Switching Time (ns) 16-18 GHz	25	25	25
Insertion Loss dB (max) 2-4 GHz	1.8	2.2	2.2
Insertion Loss dB (max) 4-8 GHz	2.0	2.7	2.7
Insertion Loss dB (max) 8-12 GHz	2.7	3.2	3.2
Insertion Loss dB (max) 12-16 GHz	3.2	3.8	3.8
Insertion Loss dB (max) 16-18 GHz	3.2	3.8	3.8
VSWR (max) 2-4 GHz	1.9:1	1.9:1	1.9:1
VSWR (max) 4-8 GHz	1.9:1	2.0:1	2.0:1
VSWR (max) 8-12 GHz	1.9:1	2.0:1	2.0:1
VSWR (max) 12-16 GHz	2.0:1	2.0:1	2.0:1
VSWR (max) 16-18 GHz	2.0:1	2.0:1	2.0:1
Isolation dB (min) 2-4 GHz	65	65	65
Isolation dB (min) 4-8 GHz	65	65	65
Isolation dB (min) 8-12 GHz	60	60	60
Isolation dB (min) 12-16 GHz	50	50	50
Isolation dB (min) 16-18 GHz	45	50	50
Power Supply Requirements (mA@+5V)	105	220	250
Power Supply Requirements (mA@-12V to -15V)	75	90	100



SS213BDHTS



SS123BDHTS

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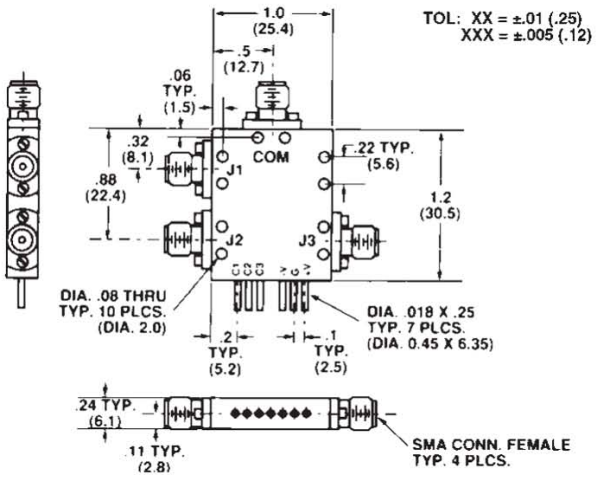
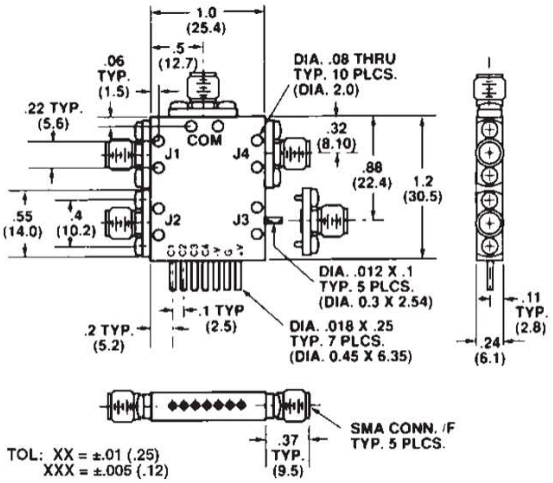
SPST-SP6T SMA(F) Drop In 2.0 to 18 GHz Absorptive (Super Slim)

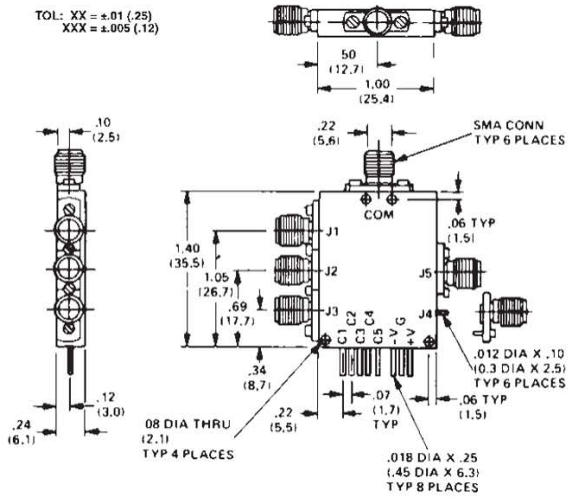


SS133BDHTS

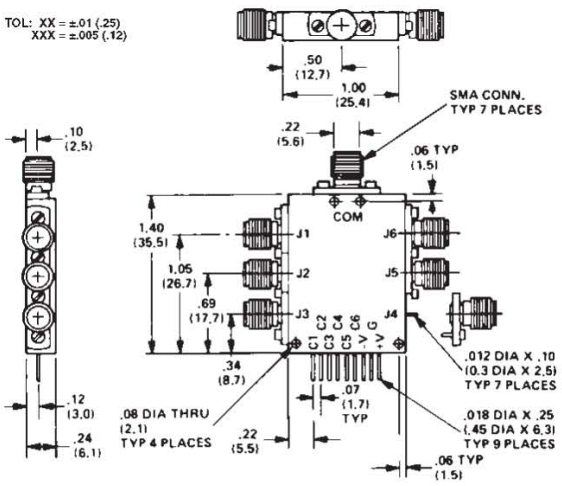


SS143BDHTS

Dimensions in parentheses are in millimeters and for reference only.



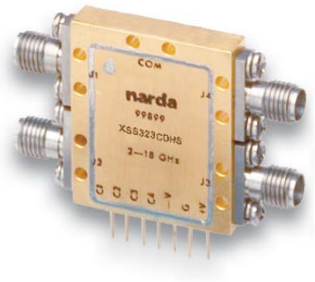
SS153BDHTS



SS163BDHTS

Dimensions in parentheses are in millimeters and for reference only.

2P2T (Transfer) SMA(F) Drop In 2-18 GHz Reflective (Super Slim)



Features

- **REFLECTIVE**
- 2P2T Transfer
- High Speed
- High Isolation - up to 80 dB
- Low Insertion Loss
- Super-Slim Packages
- Drop-in Applications
- Integral TTL Drivers
- Hermetically Sealed
- Full Mil Environmentals

Models

- XSS323CDHS

Model	XSS323CDHS
Type	XFER
Switching Time (ns)	50
Insertion Loss dB (max) 2-4 GHz	1.8
Insertion Loss dB (max) 4-8 GHz	2.2
Insertion Loss dB (max) 8-12 GHz	2.1
Insertion Loss dB (max) 12-18 GHz	2.6
VSWR (max) 2-4 GHz	1.8:1
VSWR (max) 4-8 GHz	1.9:1
VSWR (max) 12-18 GHz	2.0:1
VSWR (max) 8-12 GHz	2.0:1
Isolation dB (min) 2-4 GHz	70
Isolation dB (min) 4-8 GHz	70
Isolation dB (min) 8-12 GHz	60
Isolation dB (min) 12-18 GHz	55
Power Supply Requirements (mA@+5V)	80
Power Supply Requirements (mA@-12V to -15V)	80

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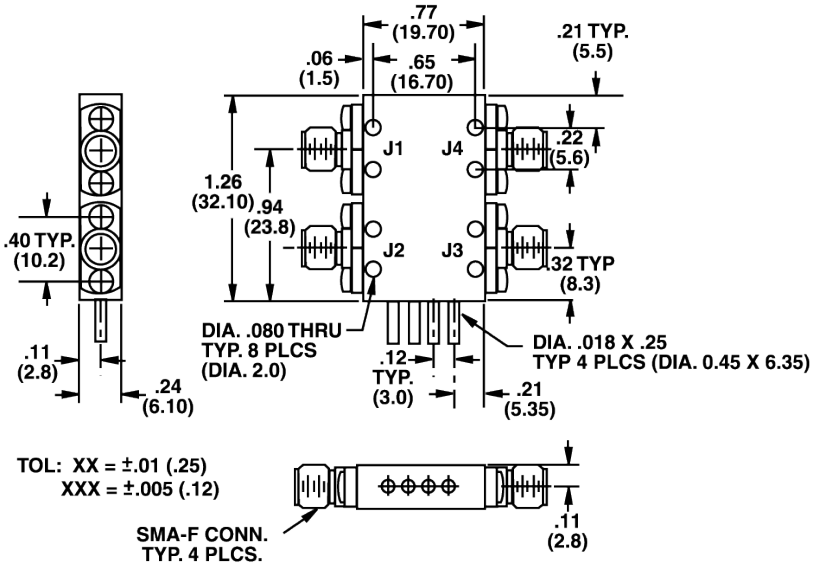
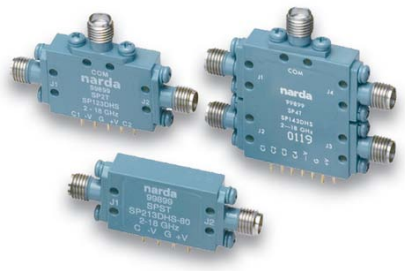
2P2T (Transfer) SMA(F) Drop In 2-18 GHz Reflective (Super Slim)



XSS323CDHS

Dimensions in parentheses are in millimeters and for reference only.

SPST-SP6T SMA(F) 2-18 GHz Reflective (High Performance Series)



Features

- REFLECTIVE

Models

- SP213DHS, SP213DHS-80, SP123DHS, SP123DHS-80, SP133DHS, SP143DHS, SP153DHS, SP163DHS

Model	SP213DHS	SP213DHS-80	SP123DHS	SP123DHS-80
Type	SPST	SPST	SP2T	SPDT
Switching Time (ns)	15	15	15	15
Insertion Loss dB (max) 2-12 GHz	1.9	1.9	2.4	2.2
Insertion Loss dB (max) 12-18 GHz	2.4	2.5	2.9	2.9
VSWR (max) 2-18 GHz ON	1.9:1	1.9:1	1.9:1	2.0:1
VSWR (max) 2-18 GHz OFF	2.0:1	2.0:1	2.0:1	2.0:1
Isolation dB (min) 2-12 GHz	50	70	65	80
Isolation dB (min) 12-18 GHz	60	80	60	80
Power Supply Requirements (mA@+5V)	50	50	90	90
Power Supply Requirements (mA@-12V to -15V)	60	50	60	60

Model	SP133DHS	SP143DHS	SP153DHS	SP163DHS
Type	SP3T	SP4T	SP5T	SP6T
Switching Time (ns)	15	15	20	20
Insertion Loss dB (max) 2-12 GHz	2.6	2.6	3.0	3.0
Insertion Loss dB (max) 12-18 GHz	3.0	3.0	3.6	3.6
VSWR (max) 2-18 GHz ON	1.9:1	1.9:1	2.0:1	2.0:1
VSWR (max) 2-18 GHz OFF	2.0:1	2.0:1	2.0:1	2.0:1
Isolation dB (min) 2-12 GHz	65	65	65	65
Isolation dB (min) 12-18 GHz	60	60	60	60
Power Supply Requirements (mA@+5V)	110	110	220	250
Power Supply Requirements (mA@-12V to -15V)	70	70	90	100

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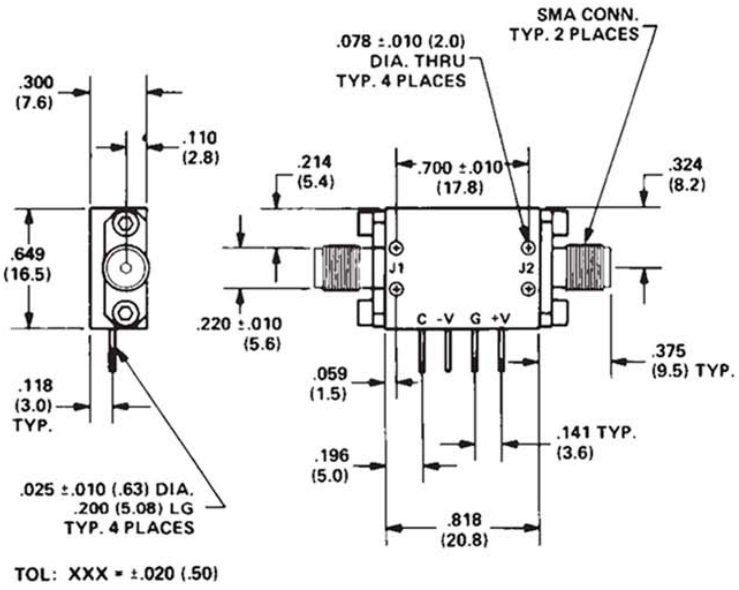
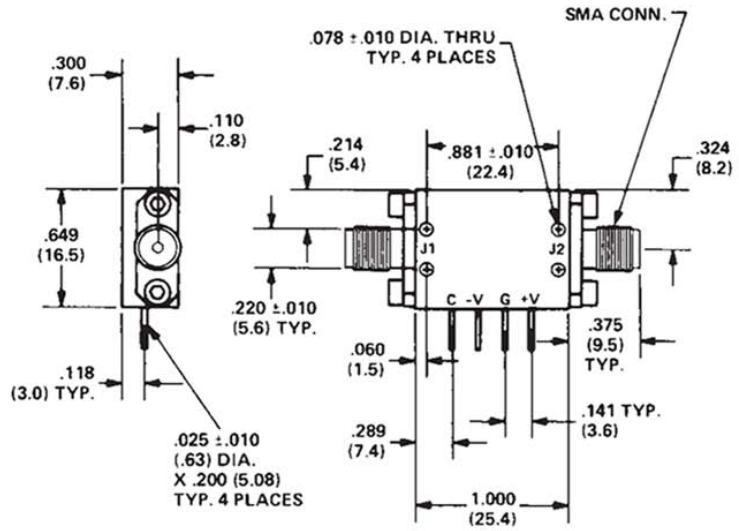
SPST-SP6T SMA(F) 2-18 GHz Reflective (High Performance Series)



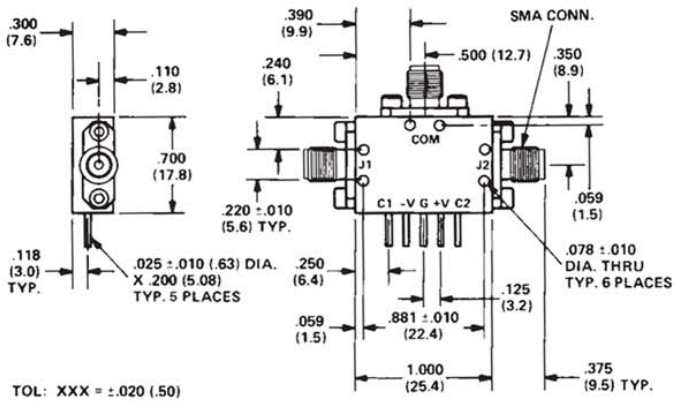
SP213DHS



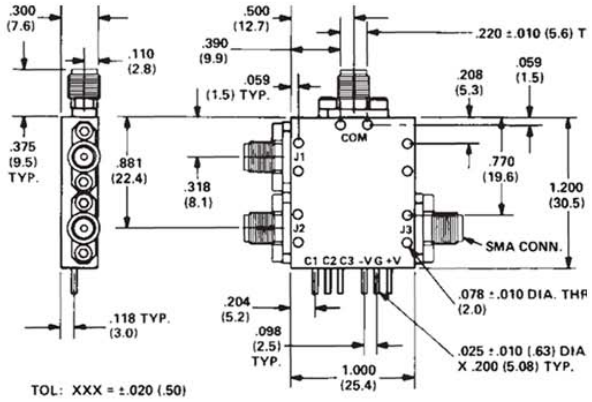
SP213DHS-80

Dimension in parentheses are in millimeters and for reference only. Contact the factory for detailed specifications and outline drawing.

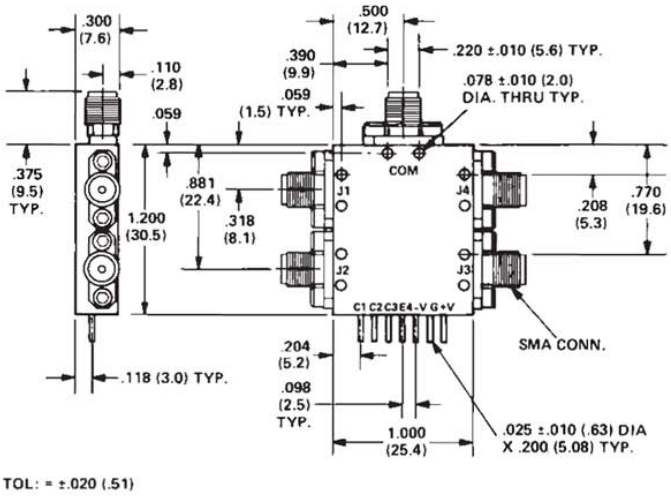
SPST-SP6T SMA(F) 2-18 GHz Reflective (High Performance Series)



SP123DHS & SP123DHS-80



SP133DHS



SP143DHS

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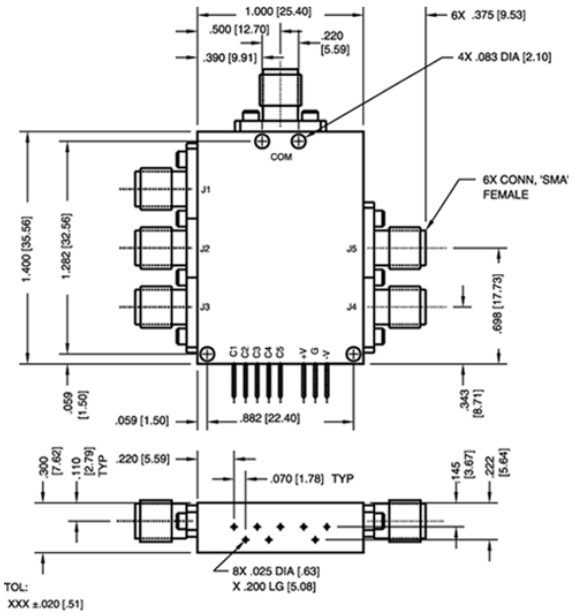
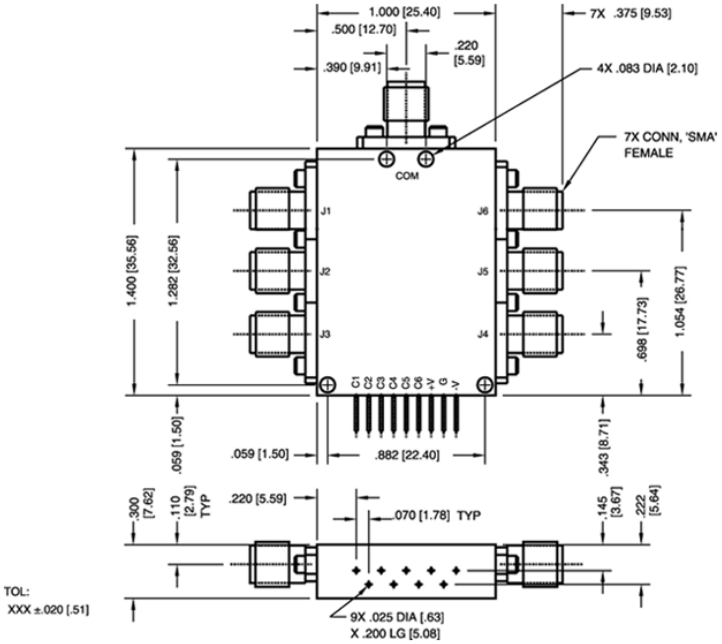
SPST-SP6T SMA(F) 2-18 GHz Reflective (High Performance Series)



SP153DHS



SP163DHS

Dimensions in parentheses are in millimeters and for reference only. Contact the factory for detailed specifications and outline drawing.

2P2T (Transfer) SMA(F) 2-18 GHz Reflective (High Performance)

Features

- REFLECTIVE

Models

- XSP323DHS

Model	XSP323DHS
Type	XFER
Switching Time (ns)	50
Insertion Loss dB (max) 2-12 GHz	2.8
Insertion Loss dB (max) 12-18 GHz	3.4
Isolation dB (min) 2-12 GHz	60
Isolation dB (min) 12-18 GHz	65
VSWR (max) 2-12 GHz	2.0:1
VSWR (max) 12-18 GHz	2.0:1
Power Supply Requirements (mA@+5V)	90
Power Supply Requirements (mA@-12V to -15V)	80

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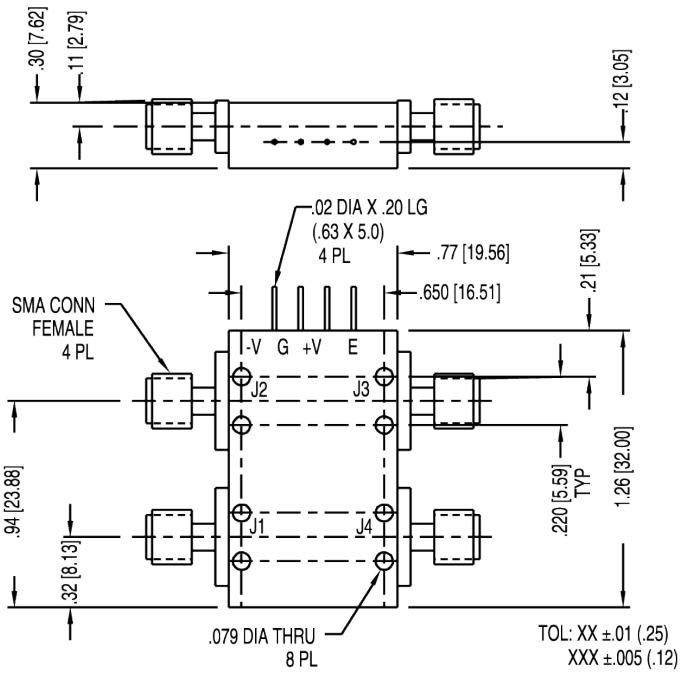
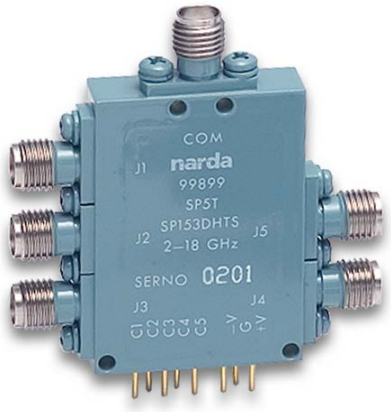
2P2T (Transfer) SMA(F) 2-18 GHz Reflective (High Performance)



XSP323DHS

Dimensions in parenthesis are in millimeters and for reference only.

SPST-SP6T SMA(F) 2-18 GHz Absorptive (High Performance)



Features

- **ABSORPTIVE**

Models

- **SP213DHTS, SP213DHTS-80, SP123DHTS, SP133DHTS, SP143DHTS, SP153DHTS, SP163DHTS**

Model	SP213DHTS	SP213DHTS-80	SP123DHTS	SP133DHTS
Type	SPST	SPST	SP2T	SP3T
Switching Time (ns)	25	25	25	25
Insertion Loss dB (max) 2-12 GHz	2.1	2.1	2.5	2.7
Insertion Loss dB (max) 12-18 GHz	2.5	2.6	2.9	3.2
VSWR (max) 2-12 GHz	1.9:1	1.9:1	1.9:1	1.9:1
VSWR (max) 12-18 GHz	2.0:1	2.0:1	2.0:1	2.0:1
Isolation dB (min) 2-12 GHz	55	70	60	60
Isolation dB (min) 12-18 GHz	50	80	55	45
Power Supply Requirements (mA@+5V)	40	50	60	105
Power Supply Requirements (mA@-12V to -15V)	60	60	60	75

Model	SP143DHTS	SP153DHTS	SP163DHTS
Type	SP4T	SP5T	SP6T
Switching Time (ns)	25	25	25
Insertion Loss dB (max) 2-12 GHz	2.7	3.2	3.2
Insertion Loss dB (max) 12-18 GHz	3.2	3.8	3.8
VSWR (max) 2-12 GHz	1.9:1	2.0:1	2.0:1
VSWR (max) 12-18 GHz	2.0:1	2.0:1	2.0:1
Isolation dB (min) 2-12 GHz	60	60	60
Isolation dB (min) 12-18 GHz	45	50	50
Power Supply Requirements (mA@+5V)	105	220	250
Power Supply Requirements (mA@-12V to -15V)	75	90	100

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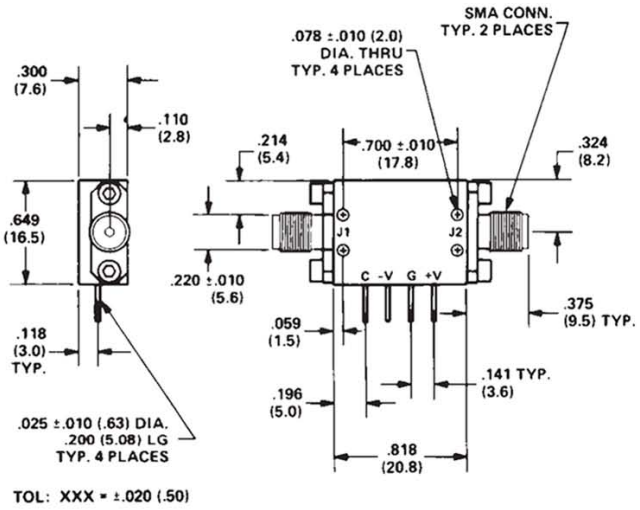
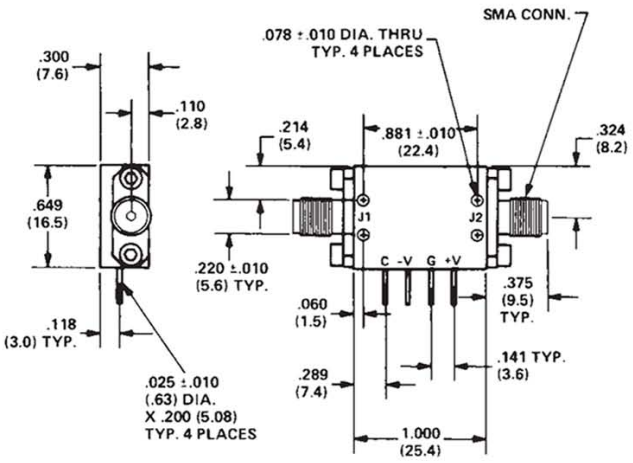
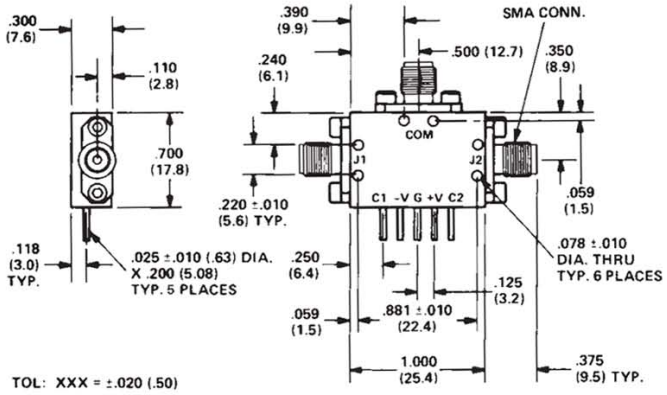
SPST-SP6T SMA(F) 2-18 GHz Absorptive (High Performance)



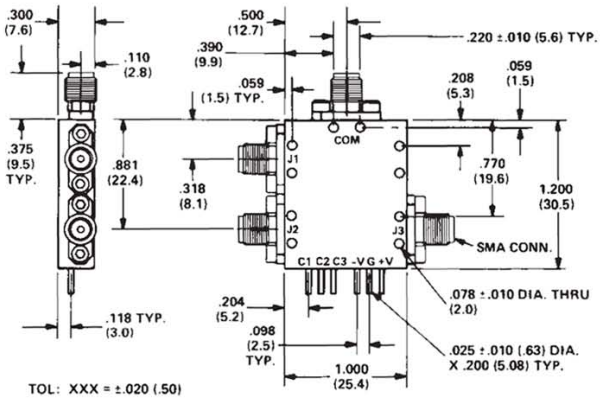
SP213DHTS



SP213DHTS-80



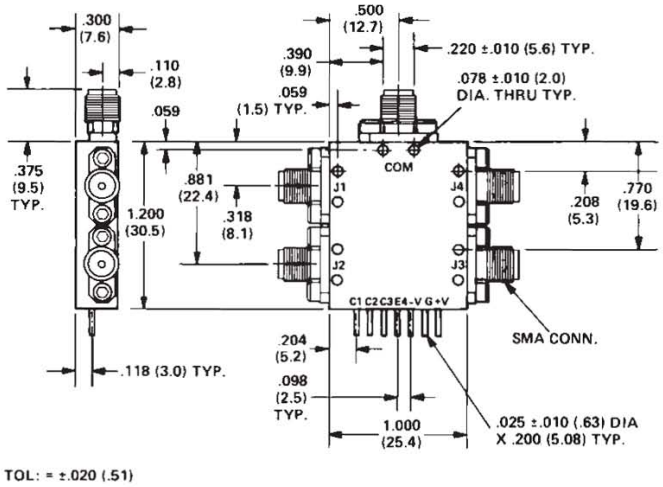
SP123DHTS



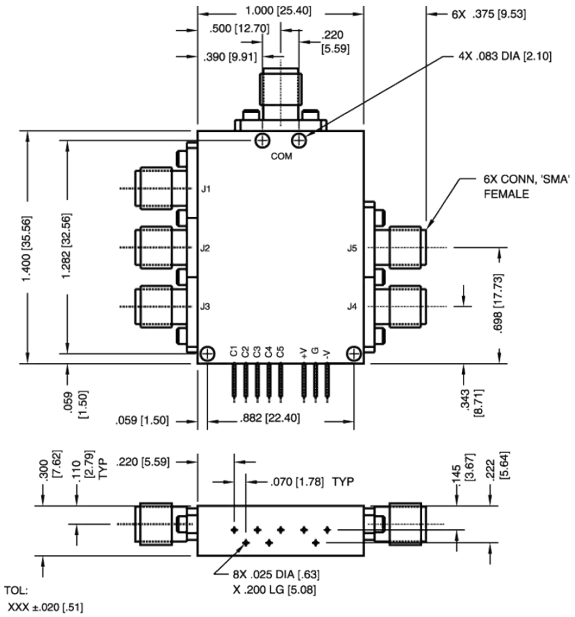
SP133DHTS

Dimensions in parenthesis are in millimeters and for reference only.

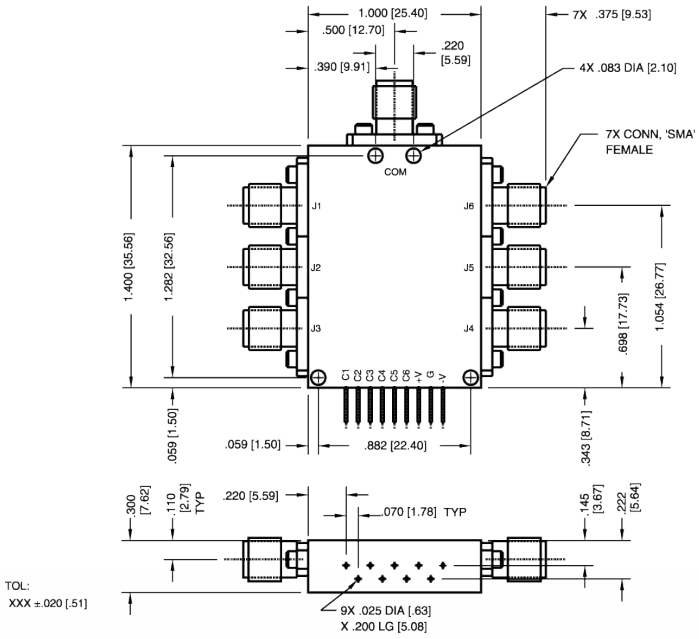
SPST-SP6T SMA(F) 2-18 GHz Absorptive (High Performance)



SP143DHTS



SP153DHTS



SP163DHTS

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SPST-SP4T SMA(F) 2-18 GHz Reflective (Value Series)

Features

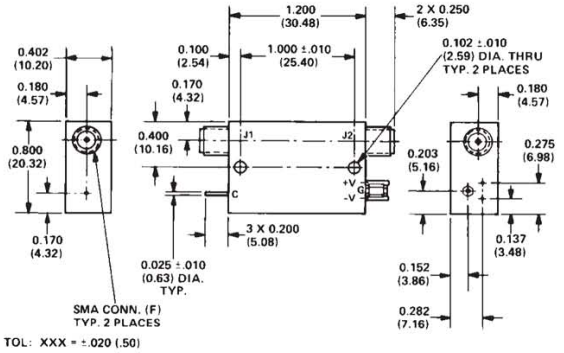
- REFLECTIVE

Models

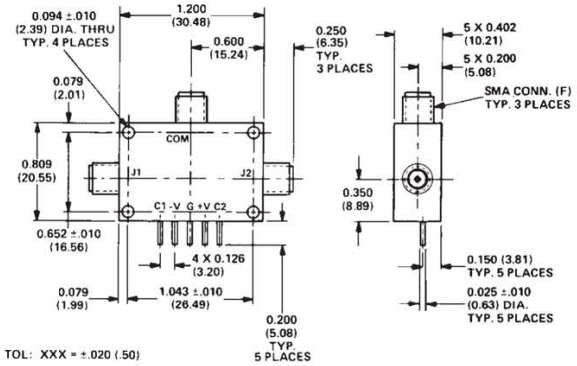
- SV213DS, SV123DS, SV133DS, SV143DS

Model	SV213DS	SV123DS	SV133DS	SV143DS
Type	SPST	SP3T	SP3T	SP4T
Switching Time (ns)	50	50	50	50
Insertion Loss dB (max) 2-12 GHz	2.0	2.5	2.7	2.7
Insertion Loss dB (max) 12-18 GHz	2.5	3.0	3.1	3.1
VSWR (max) 2-12 GHz	2.0:1	2.0:1	2.0:1	2.0:1
VSWR (max) 12-18 GHz	2.0:1	2.0:1	2.0:1	2.0:1
Isolation dB (min) 2-12 GHz	50	50	50	50
Isolation dB (min) 12-18 GHz	50	50	50	50
Power Supply Requirements (mA@+5V)	50	90	105	105
Power Supply Requirements (mA@-12V to -15V)	60	60	75	75

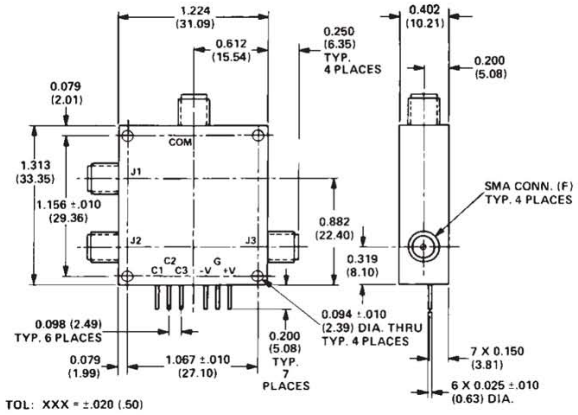
SPST-SP4T SMA(F) 2-18 GHz Reflective (Value Series)



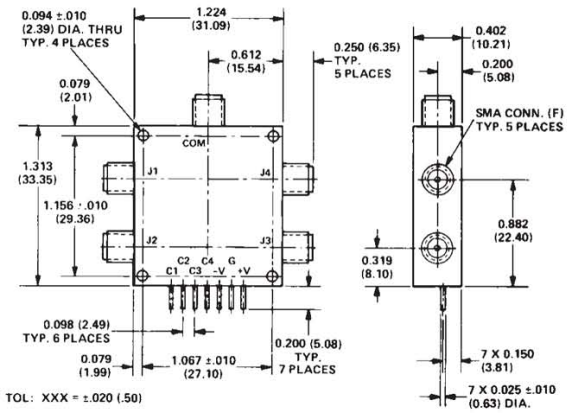
SV213DS



SV123DS



SV133DS



SV143DS

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2P2T (Transfer) SMA(F) 2-18 GHz Reflective (Value)

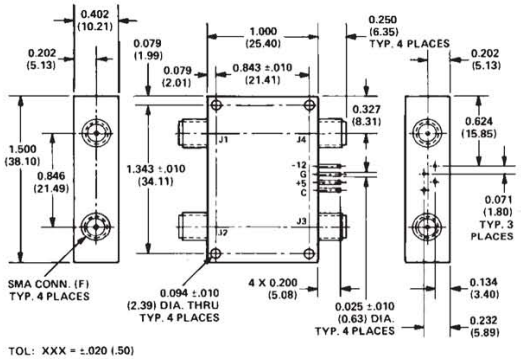
Features

- REFLECTIVE

Models

- XSV323DS

Model	XSV323DS
Type	2P2T
Switching Time (ns)	50
Insertion Loss dB (max) 2-12 GHz	3.0
Insertion Loss dB (max) 12-18 GHz	3.4
VSWR (max) 2-12 GHz	2.0:1
VSWR (max) 12-18 GHz	2.0:1
Isolation dB (min) 2-12 GHz	50
Isolation dB (min) 12-18 GHz	50
Power Supply Requirements (mA@+5V)	80
Power Supply Requirements (mA@-12V to -15V)	80



XSV323DS

SPST-SP4T SMA(F) 2-18 GHz Absorptive (Value)

Features

- **ABSORPTIVE**

Models

- **SV213DTS, SV123DTS, SV133DTS, SV143DTS**

Model	SV213DTS	SV123DTS	SV133DTS	SV143DTS
Type	SPST	SPDT	SP3T	SP4T
Switching Time (ns)	50	50	50	50
Insertion Loss dB (max) 2-12 GHz	2.3	2.7	2.8	2.8
Insertion Loss dB (max) 12-18 GHz	2.8	3.0	3.3	3.3
VSWR (max) 2-12 GHz	2.0:1	2.0:1	2.0:1	2.0:1
VSWR (max) 12-18 GHz	2.0:1	2.0:1	2.0:1	2.0:1
Isolation dB (min) 2-12 GHz	60	60	60	60
Isolation dB (min) 12-18 GHz	45	50	45	45
Power Supply Requirements (mA@+5V)	40	60	105	105
Power Supply Requirements (mA@-12V to -15V)	60	60	75	75

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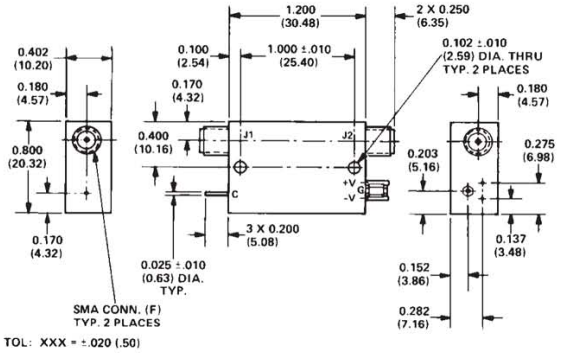
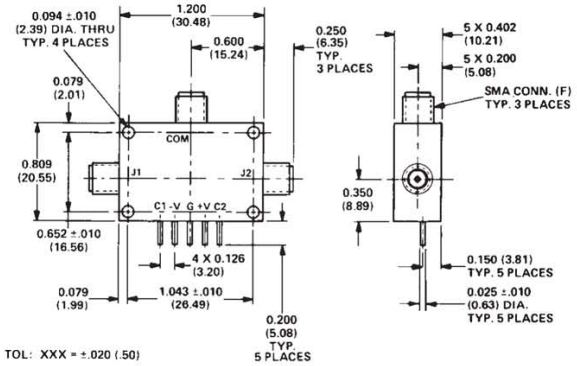
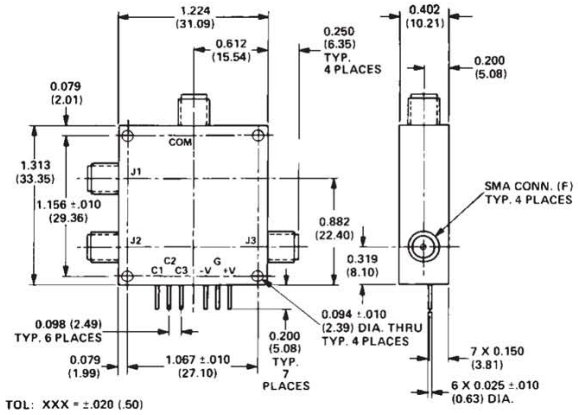
SPST-SP4T SMA(F) 2-18 GHz Absorptive (Value)



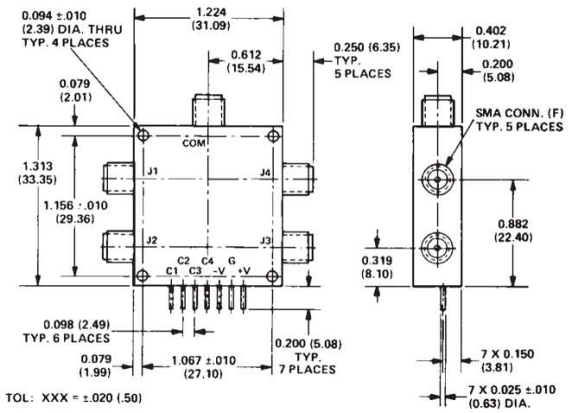
SV213DTS



SV123DTS



SV133DTS



SV143DTS

SPST-SP2T SMA(F) 2-18 GHz Reflective Miniature Series

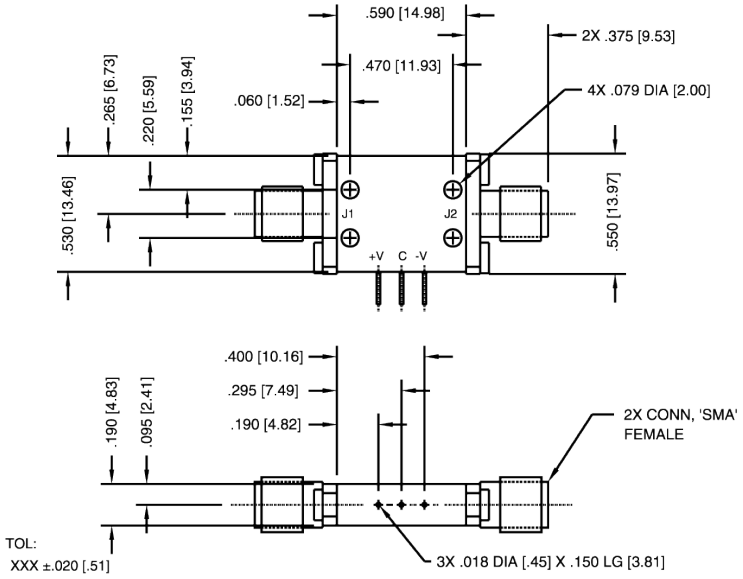
Features

- REFLECTIVE

Models

- SM213DHS, SM213DHS-60, SM123DHS

Model	SM213DHS	SM213DHS-60	SM123DHS
Type	SPST	SPST	SPDT
Switching Time (ns)	25	25	25
Insertion Loss dB (max) 2-12 GHz	1.7	1.9	2.3
Insertion Loss dB (max) 12-18 GHz	2.1	2.4	2.9
VSWR (max) 2-12 GHz	1.8:1	1.8:1	1.8:1
VSWR (max) 12-18 GHz	1.8:1	1.8:1	1.8:1
Isolation dB (min) 2-12 GHz	45	60	50
Isolation dB (min) 12-18 GHz	45	60	50
Power Supply Requirements (mA@+5V)	50	50	60
Power Supply Requirements (mA@-12V)	40	40	40



SM213DHS

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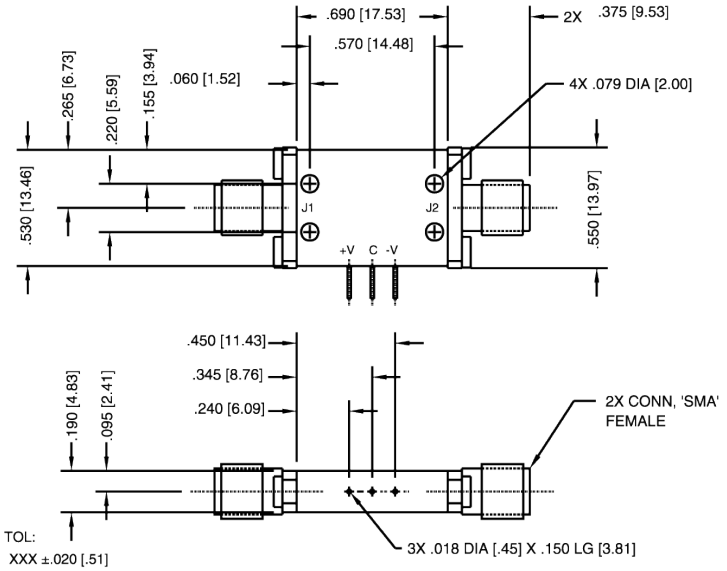
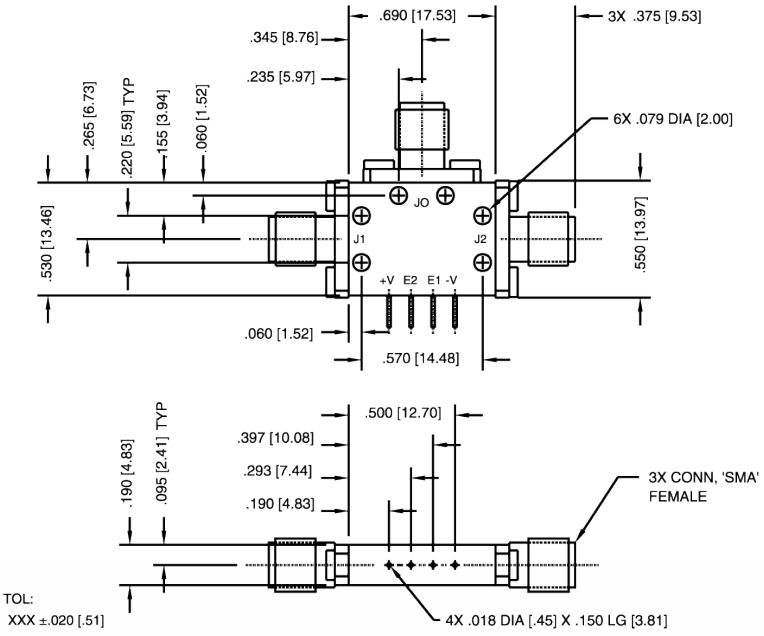
SPST-SP2T SMA(F) 2-18 GHz Reflective Miniature Series



SM213DHS-60



SM123DHS

SP2T SMA(F) 2-18 GHz Absorptive

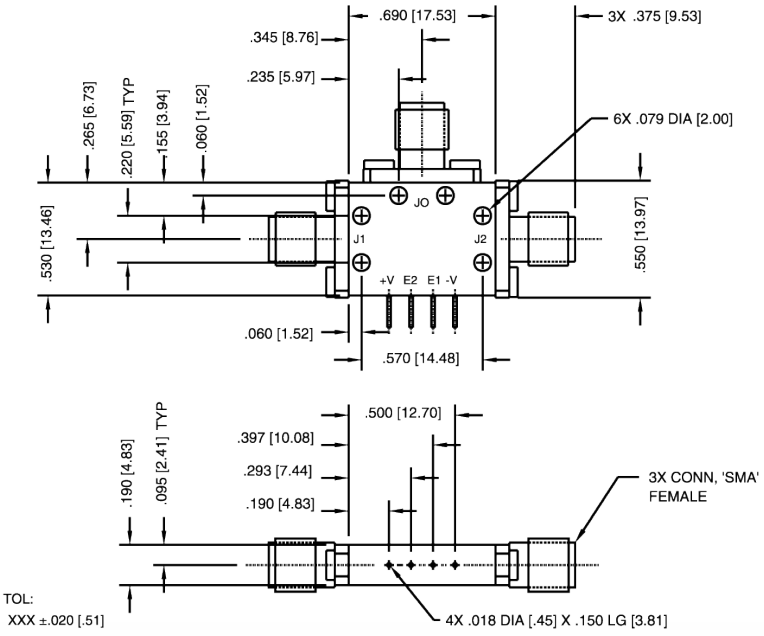
Features

- ABSORPTIVE

Models

- SM123DHTS

Model	SM123DHTS
Type	SPDT
Switching Time (ns)	25
Insertion Loss dB (max) 2-12 GHz	2.3
Insertion Loss dB (max) 12-18 GHz	2.9
VSWR (max) 2-12 GHz	1.8:1
VSWR (max) 12-18 GHz	1.8:1
Isolation dB (min) 2-12 GHz	50
Isolation dB (min) 12-18 GHz	50
Power Supply Requirements (mA@+5V)	60
Power Supply Requirements (mA@-12V)	40



SM123DHTS

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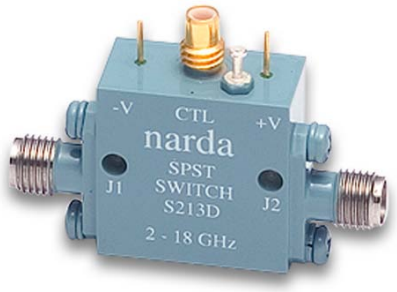
SPST-SP2T SMA(F) 2-18 GHz Reflective



Features

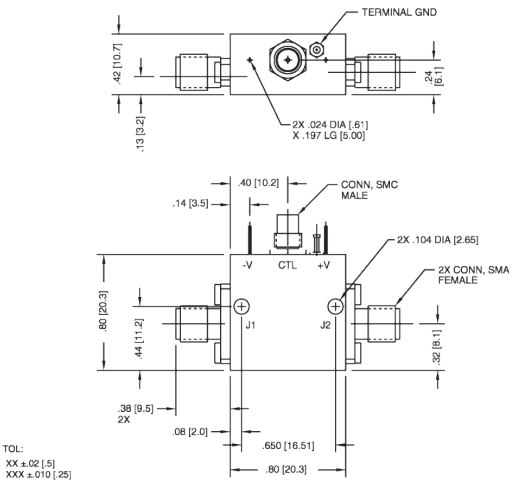
- REFLECTIVE

Models

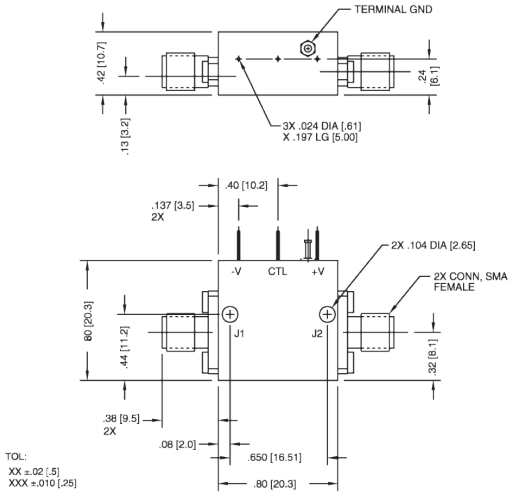
- S213D, S213D-04, S123BD

Model	S213D	S213D-04	S123BD
Type	SPST	SPST	SP2T
Switching Time (ns)	10	10	50
Insertion Loss dB (max) 2-4 GHz	1.0	1.0	1.5
Insertion Loss dB (max) 4-8 GHz	1.2	1.2	1.7
Insertion Loss dB (max) 8-12 GHz	1.5	1.5	2.0
Insertion Loss dB (max) 12-18 GHz	2.0	2.0	2.5
VSWR (max) 2-4 GHz	1.7:1	1.7:1	1.75:1
VSWR (max) 4-8 GHz	1.7:1	1.7:1	1.75:1
VSWR (max) 8-12 GHz	1.7:1	1.7:1	1.75:1
VSWR (max) 12-18 GHz	1.7:1	1.7:1	2.0:1
Isolation dB (min) 2-4 GHz	55	55	60
Isolation dB (min) 4-8 GHz	60	60	60
Isolation dB (min) 8-12 GHz	60	60	60
Isolation dB (min) 12-18 GHz	60	60	55
Power Supply Requirements (mA@+5V)	100	100	100
Power Supply Requirements (mA@-12V to -15V)	50	50	50
Outline Drawing	1	2	3

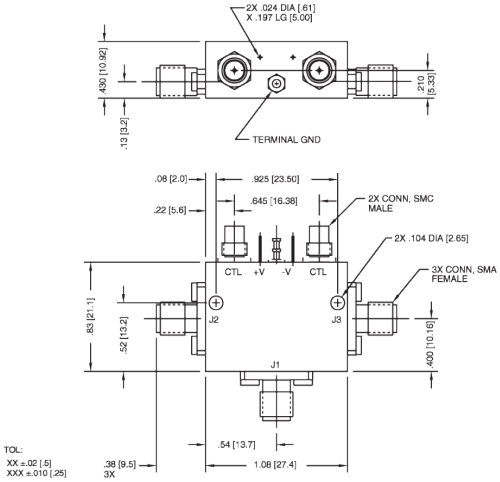
SPST-SP2T SMA(F) 2-18 GHz Reflective



S213D



S213D-04



S123BD

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Quick Reference Guide

Narda offers a range of Multi-Throw PIN Diode switches. These units are designed to customer requirements and can include SPST to SP30T, absorptive or reflective switch. These devices can also be configured with additional microwave components such as: amplifiers, limiters, attenuators, couplers, power dividers, filters, etc. The following are examples of units we have previously provided.

SP9T

SP10T

SP16T

SP18T

SP25T

Multi-Throw Product Capability

Features

▪ Very High Speed ▪ Precise Attenuation over Frequency Band ▪ Small Package Size ▪ Low Insertion Loss ▪ Hermetically Sealed

Applications

▪ Wide-Band EW Systems ▪ Radar and Phased Array Systems ▪ Wide-Band Instruments and Test Systems (ATE) ▪ Options Available Based On Standard Designs ▪ Different Attenuation Range ▪ Performance Optimized over a Narrower Bandwidth

Description

These miniature, high speed digitally controlled switchedbit attenuators are designed for operation over multi-octave bandwidths. Attenuation levels are guaranteed to be monotonic and selectable using standard TTL logic circuitry.

All models are hermetically sealed and are specified to operate over the full temperature range. All attenuators are equipped with removable RF connectors and are suitable for drop-in applications.

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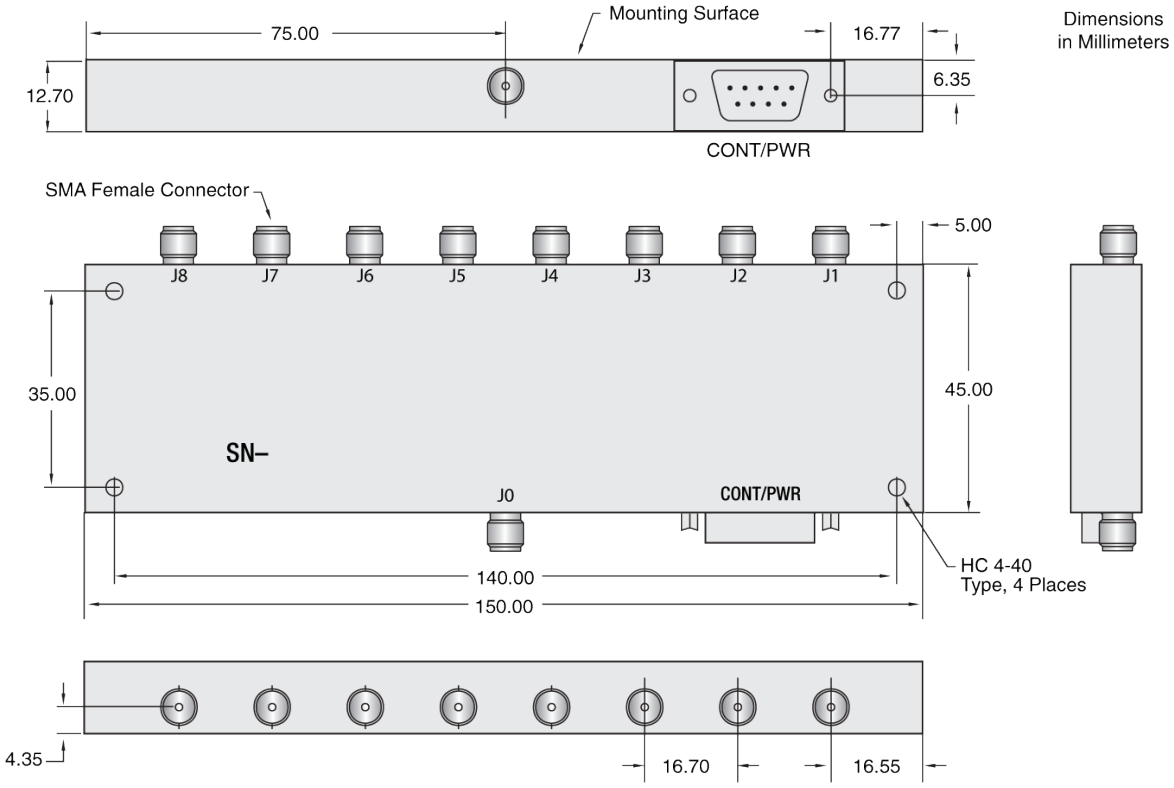
Multi-Throw PIN Diode Switches

Type	SP8T	SP10T	SP12T	SP18T	SP25T
Frequency Range GHz	1 to 18	1 to 18	6 to 18	.020 to 4	.5 to 18
Switching time - ns	50	500	700	3500	2000
Insertion Loss max 1-12 GHz	4.5	4.3	5	6.7@.020, 9.2@ 4	3.5 @ .5, 7.5@18
Insertion Loss max 12-18 GHz	5	5.6	7		
VSWR max	2.2:1	2.2:1	2.2:2	2.0:1	2.25:1
Isolation mim dB	60	60	60	60	60
Power Handling - mW	200	500	200	200	
Power Supply Requirements					
mA@-12V to -15V	270	300	350	300	220ma@5V, 45ma@-12V
Outline Drawing	1	2	3	4	5
Notes			3	1	2

1. Built in coupler and amplifier
2. Built in output coupler
3. Amplitude matched

REFLECTIVE MODELS AVAILIABLE

Multi-Throw PIN Diode Switches



PIN	1	2	3	
	0	0	0	J0 TO J1
	0	0	1	J0 TO J2
	0	1	0	J0 TO J3
	0	1	1	J0 TO J4
	1	0	0	J0 TO J5
	1	0	0	J0 TO J6
	1	1	0	J0 TO J7
	1	1	1	J0 TO J8
6	-12			
7	GND			
8	+5V			

Outline 1

SP8T

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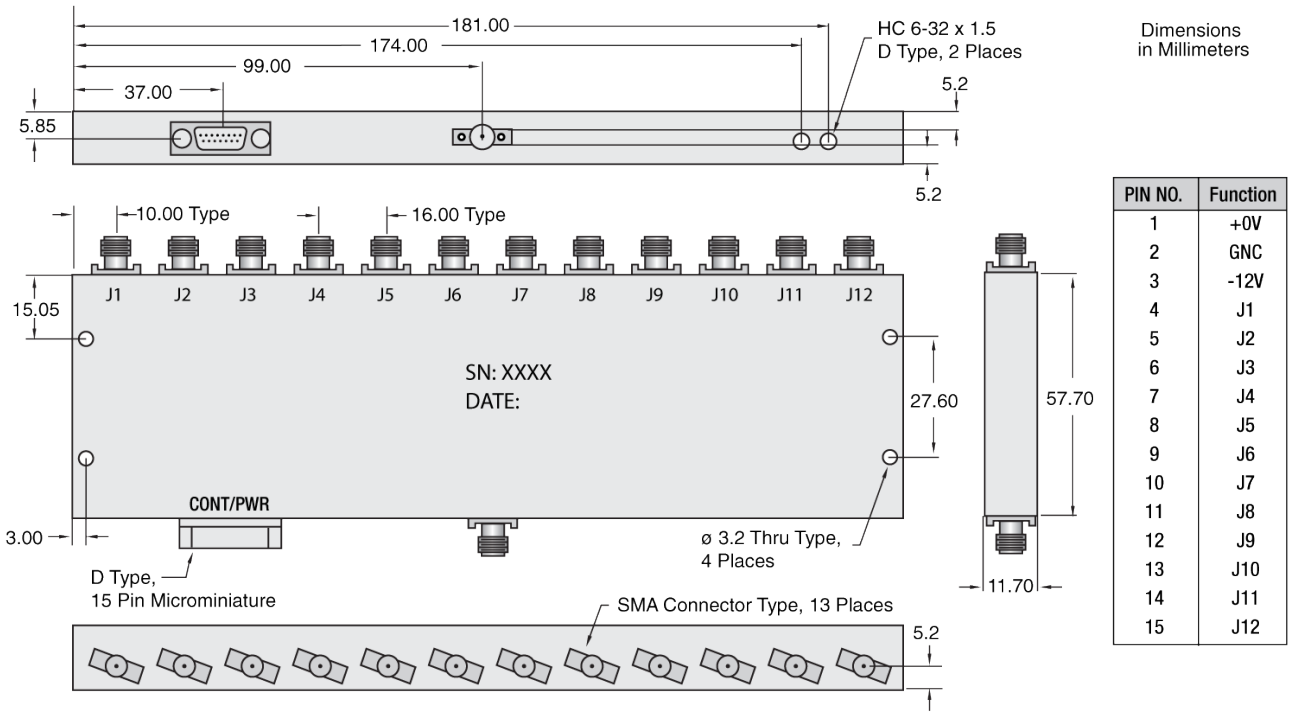
Multi-Throw PIN Diode Switches

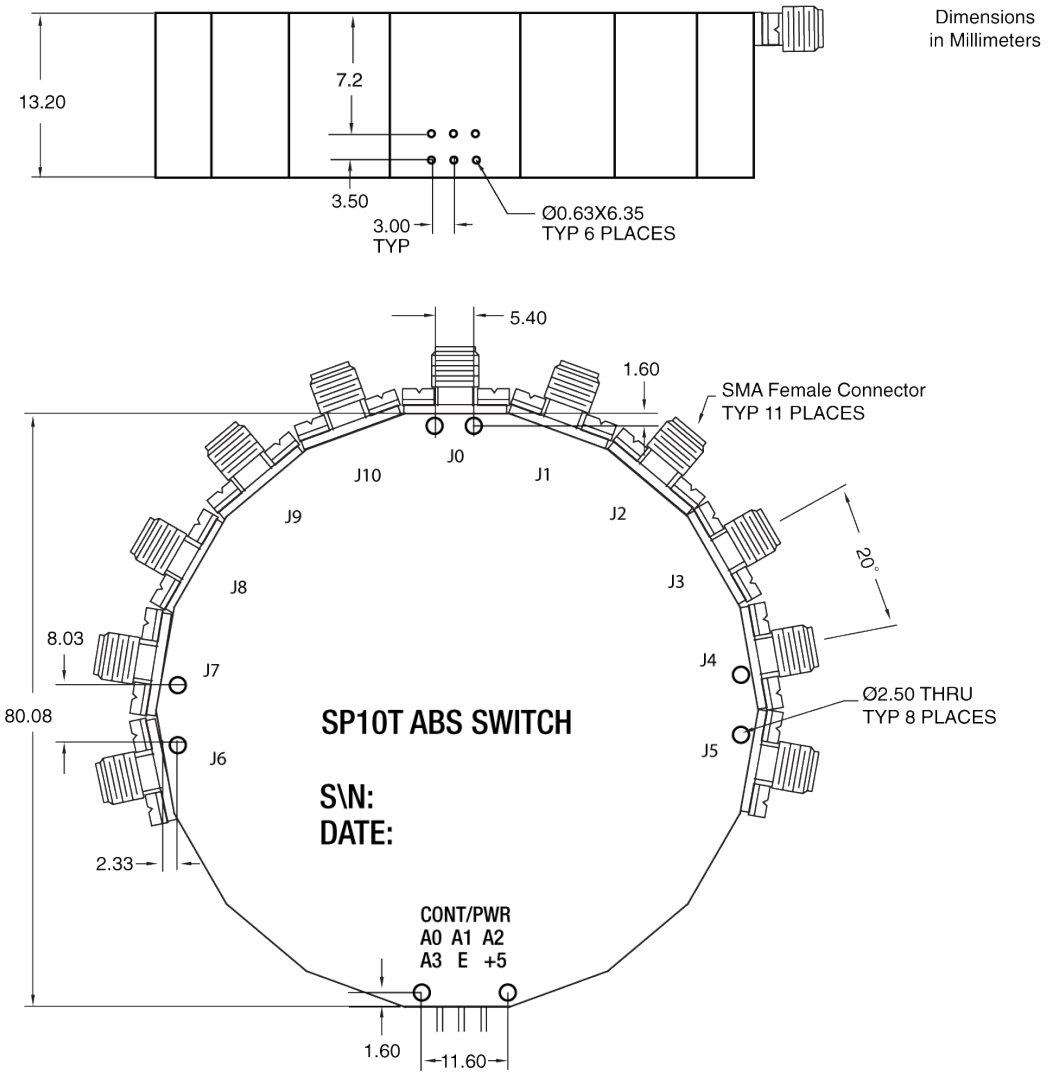


PIN NO.	Function
1	+0V
2	GNC
3	-12V
4	J1
5	J2
6	J3
7	J4
8	J5
9	J6
10	J7
11	J8
12	J9
13	J10
14	J11
15	J12

Outline 2

SP10T

Multi-Throw PIN Diode Switches



Outline 4

SP12T

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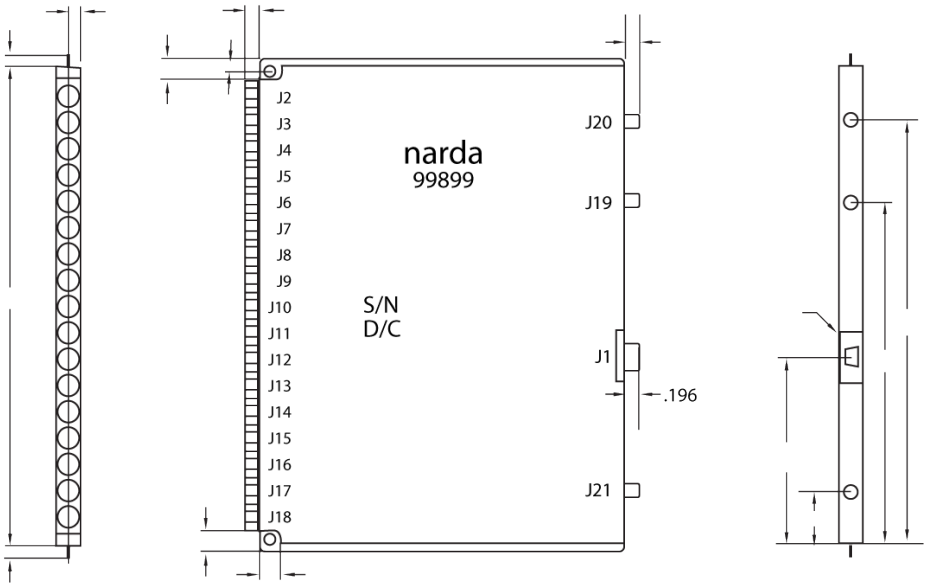
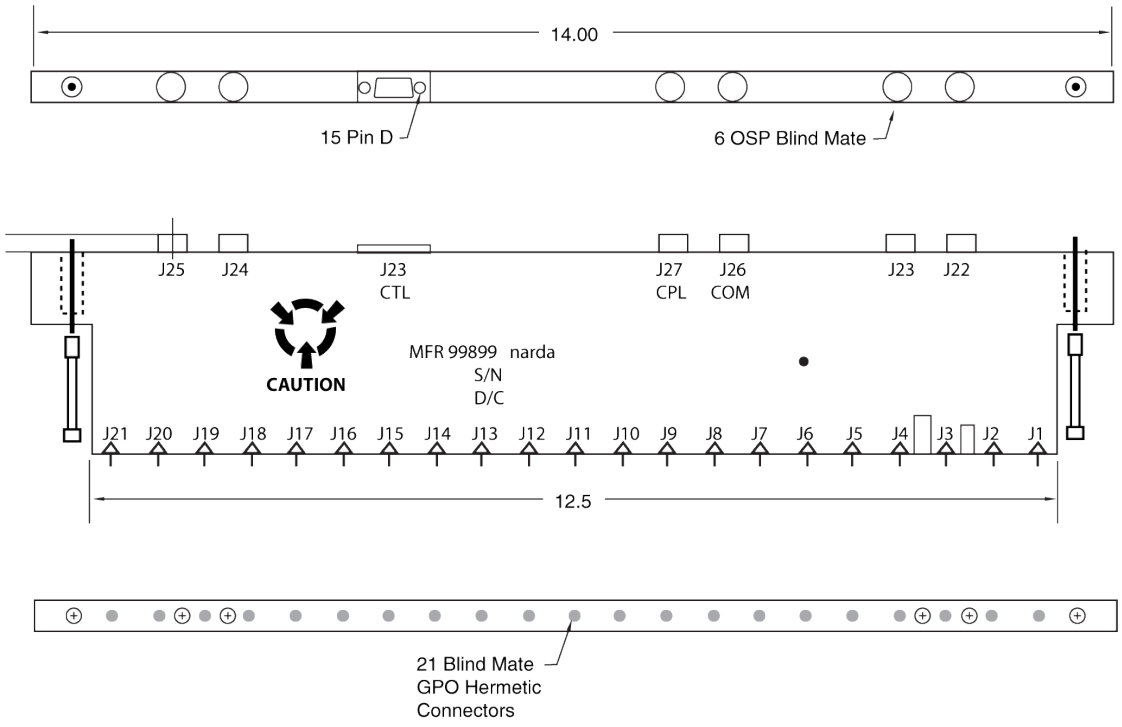
Multi-Throw PIN Diode Switches



Outline 3

SP18T

Multi-Throw PIN Diode Switches



Outline 5

SP25T

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Quick Reference Guide

Narda offers a range of high power switches for communications and radar systems. Their design is based on shunt or series-shunt topology, utilizing special materials for power dissipation. These switches feature a special driver with TTL control. The driver is capable of supplying reverse bias of up to -100 V and forward current up to 150 ma. The switches handle pulse widths up to 10 µsec with up to 12% duty cycle.

The high power switches are designed to customer specifications, including the package configuration and are available in different hermetically sealed packages with SMA or TNC connectors. This section shows examples of some of the many high power switches that Narda has supplied. The operating frequency is typically a 25% bandwidth within the stated frequency range.

Please contact the factory for your special requirements.

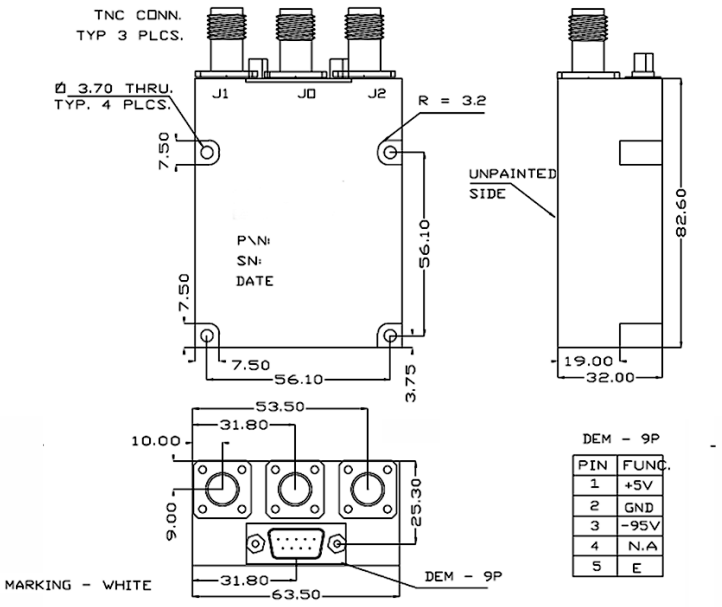
High Power Switches

Features

- Custom Designs
- High CW Power - up to 150 W
- High Peak Power - up to 600 W
- Reflective
- SPST through SP6T

Examples of Custom Designs

FUNCTION	FREQUENCY RANGE (GHz)	SWITCHING TIME (µsec)	CW POWER	PEAK POWER	PULSE WIDTH	OUTLINE DRAWING
SPDT	30 M - 500 M	10	150 W	250 W		1
SPDT	1.2 - 1.4	20	15 W	150 W	100 µ	2
SPDT	3.1 - 3.5	.400	25 W	250 W	100 µ	3
SPDT	1.01 - 1.11	2	5 W	500 W	2 µ	4
SP3T	.200 - .800	50	2 W	10 W	50 µ	5
SP6T	4.4 - 5		5 W			6



Outline Drawing 1

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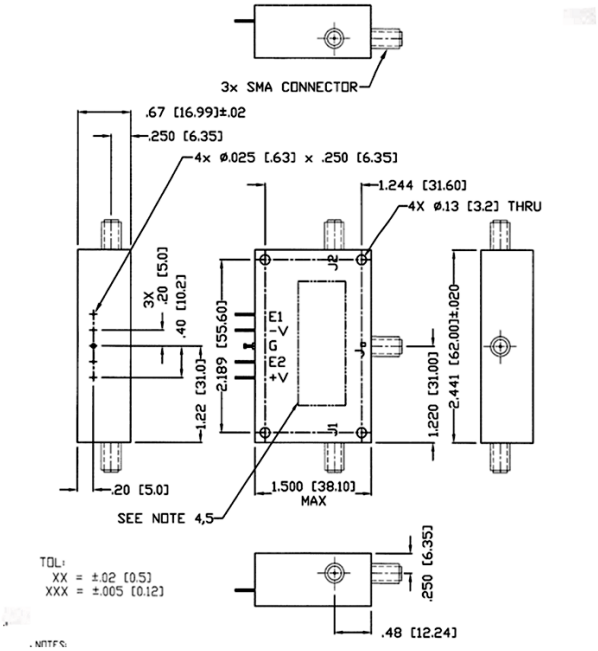
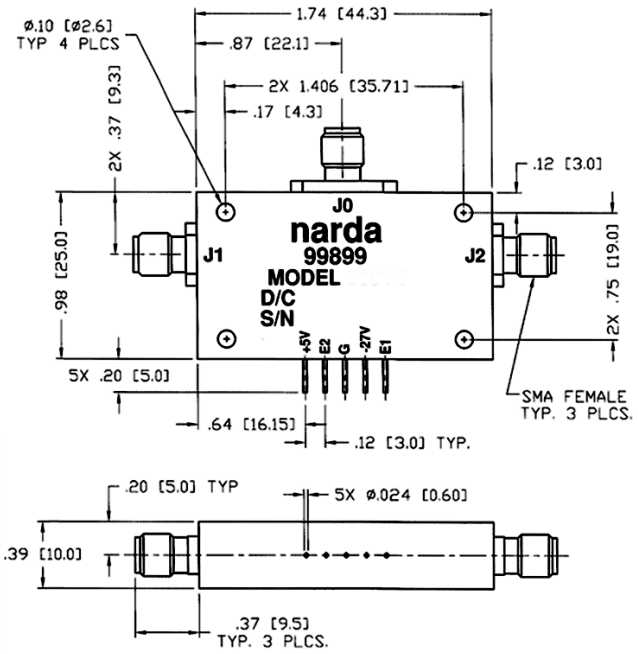
High Power Switches

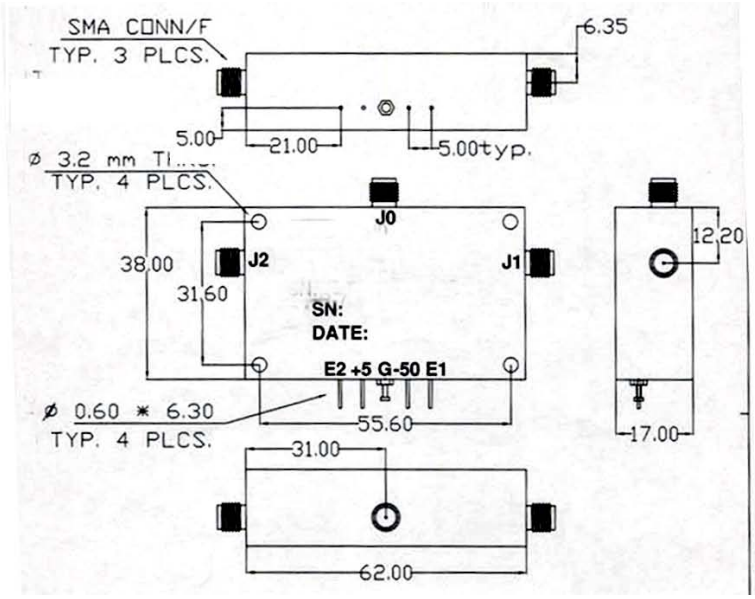


Outline Drawing 2

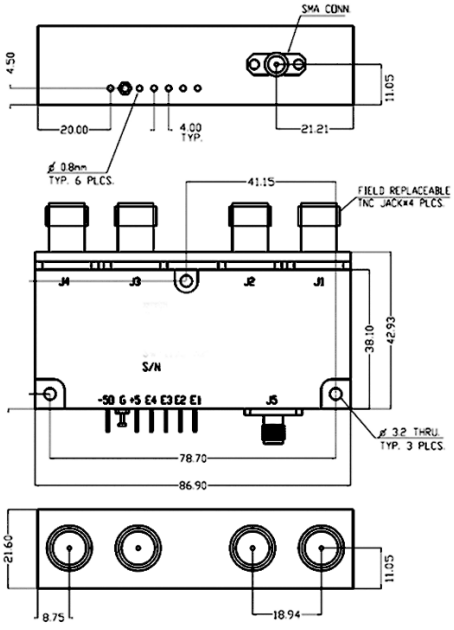


Outline Drawing 3

High Power Switches



Outline Drawing 4



Outline Drawing 5

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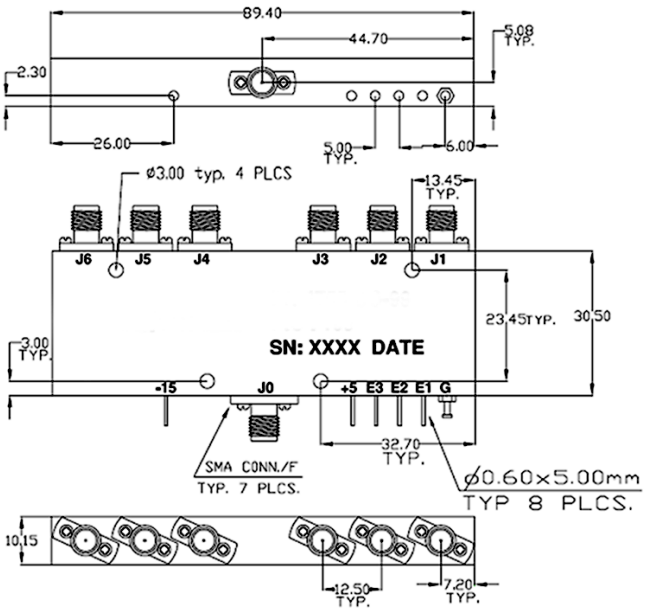
High Power Switches



Outline Drawing 6

Quick Reference Guide

Options
Low Video Leakage
Inverted TTL Logic Control
BCD Decoder Driver
Package Configuration

Environmental Specifications	
Temperature	Operating: -54°C to +95°C Storage: -65°C to +125°C
Humidity	Per-MIL-STD-202F, method 103B, condition B (96 hours at 95% R.H.)
Shock	Per-MIL-STD-202F, method 213B, condition B (75G, 6 msec)
Altitude	Per-MIL-STD-202F, method 105C, condition B (50,000 feet)
Vibration	Per-MIL-STD-202F, method 204D, condition B (.06" double amplitude or 15G, whichever is less).
Thermal Stock	Per-MIL-STD-202F. method 107D, condition A (5 cycles)

Digitally Controlled Attenuators (DCAS) vs Voltage Variable Attenuators (VVAs)

A VVAs allows the user to select any value within its rated attenuation range – the user has full analog control. Most VVAs operate by changing the bias current of the series and shunt PIN diodes that form attenuator pads. This design approach leads to significant errors in attenuation level over the operating bandwidth. The most demanding system requirements can only be met by using a look-up table to correct for these errors.

DCAs provide very precise attenuation levels in digital (binary)increments. They have extremely fast switching speeds compared to VVAs – typically ten to twenty times faster. These switched bit attenuators combine one or more tandem pairs of SPDT PIN diode switches with a zero loss connection between one pair of outputs and a fixed attenuator inserted in the other. The PIN diodes are simply switched between their forward and reverse states, rather than being used as variable attenuators. Very high speed PIN diodes and control circuitry are used to operate all the bits in parallel.

The major disadvantages of DCAs versus VVAs are: the minimum practical attenuation level, higher cost due to more complex circuits, somewhat higher insertion loss, and the potential for video leakage due to the high speed switches. The smallest practical Least Significant Bit (LSB) is about 0.5 dB. Video filters can often be incorporated into the DCA to satisfy specific leakage requirements.

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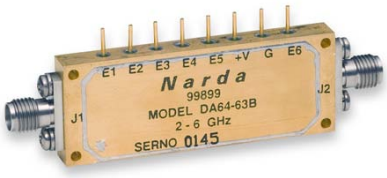
High Speed Switched BIT Attenuators



Features

- Guaranteed Monotonicity
- Power Handling: +23 dbm
- Contol Input: True TTL Gate

Models

- DA14-25, DA24-15, DA34-7, DA64-63B, DA74-81, DA84-64, DA13-25, DA26-15, DA36-7, DA66-63

Model	DA14-25	DA24-15	DA34-7	DA64-63B	DA74-81
Frequency Range (GHz)	2-6	2-6	2-6	2-6	2-6
Attenuation Range (dB)	25	1	7	63	81
Insertion Loss dB (max)	2.0	2.5	3.2	4.3	5.5
VSWR (max)	1.8:1	1.8:1	1.8:1	2.0:1	2.0:1
Number of Bits	1	2	3	6	7
Least Significant Bit (LSB)	25 dB	5 dB	1 dB	1 dB	1 dB
Accuracy of Mean Attenuation (dB)	+/-0.5	+/-0.3	+/-0.3	0 to 31 +/-0.5, >31 to 63 +/-1.0	0 to 21 +/- 0.5, 22 to 41 +/- 1.0, 42 to 81 +/-1.5
Attenuation Flatness (dB)	+/-1.0	0 to 10 +/-0.3, 10 to 15 +/-0.9	+/-0.4	0 to 15 +/-0.5, 15 to 32 +/-0.75, 32 to 63 +/-1.0	0 to 21 +/-0.5, 22 to 41 +/-0.75, 42 to 81 +/-1.0
Switching Time (ns)	30 (50% TTL to 10%/ 90% RF)	30 (50% TTL to 10%/90% RF)	30 (50% TTL to 10%/ 90% RF)	30	500
Rise and Fall Time	15 nSec	15 nSec	15 nSec	10 nSec	-
Switch Rate	4.0 MHz	4.0 MHz	4.0 MHz	4.0 MHz	0.5 MHz
Control Logic	'1' = I.L., '0' = Atten.	'1' = I.L., '0' = Atten.	'1' = I.L., '0' = Atten.	'1' = I.L., '0' = Atten.	'1' = I.L., '0' = Atten.
Power Supply Voltage	+5V +/-2% @ 110 ma, -12V +/-5% @ 60ma	+5V@ 110ma, -12V@75ma	+5V +/-2% @ 180ma, -12V +/-2% @130ma	+5V +/-2%@350ma	+5V +/-2%@400ma
Special Notes:	A	B	C	D	I

Special Notes:
A: Pin Designations: E1 = 25 dB, +V = +5V, -V = -12V, G = Ground
B: Pin Designations: E1 = 5 dB, E2 = 10 dB, +V = +5V, -V = -12V, G = Ground
C: Pin Designations: E1 = 1 dB, E2 = 2 dB, E3 = 4 dB, +V = +5V, G = Ground
D: Pin Designations: E1 = 1 dB, E2 = 2 dB, E3 = 4 dB, E4 = 8 dB, E5 = 16 dB, E6= 32 dB, +V = +5V, -V = -12V, G = Ground
E: Pin Designations: E1 = 1 dB, E2 = 2 dB, E3 = 4 dB, E4 = 8 dB, E5 = 10 dB, E6= 20 dB, E7= 40 dB, +V = +5V, -V = -12V, G = Ground

High Speed Switched BIT Attenuators

Model	DA84-64	DA13-25	DA26-15	DA36-7	DA66-63
Frequency Range (GHz)	2-6	2-18	6-18	6-18	6-18
Attenuation Range (dB)	63.75	25	15	7	63
Insertion Loss dB (max)	6.5	2.6	4.5	6.5	13
VSWR (max)	2.0:1	2.0:1	2.0:1	2.0:1	2.0:1
Number of Bits	8	1	2	2	6
Least Significant Bit (LSB)	0.25 dB	25 dB	5 dB	5 dB	1 dB
Accuracy of Mean Attenuation (dB)	0 to 21 +/-0.5, 22 to 41 +/-1.0 dB, 42 to 63.75 +/-1.5	+/-0.5	+/-1	+/-0.5	+/-0.5
Attenuation Flatness (dB)	0 to 21 dB +/-0.5, 22 to 63.75 +/-0.75, 42 to 81 dB +/-1.0	+/-1.5	+/-0.6 @5, +/-1.0 @10, +/-1.5 @15	+/-0.6 @5, +/-1.0 @10, +/-1.5 @15	0.75
Switching Time (ns)	500	30	30	30	30
Rise and Fall Time	-	15 nSec	15 nSec	15 nSec	15 nSec
Switch Rate	0.4 MHz	4.0 MHz	4.0 MHz	4.0 MHz	4.0 MHz
Control Logic	'1' = I.L., '0' = Atten.	'1' = I.L., '0' = Atten.	'1' = I.L., '0' = Atten.	'1' = I.L., '0' = Atten.	'1' = I.L., '0' = Atten.
Power Supply Voltage	+5V +/-2%@450ma	+5V +-2% @60ma, -12V +-5% @60ma	+5V +-2% @60ma, -12V +-5% @60ma	+5V +-2% @200ma, -12V +-5% @150ma	+5V +-2% @200ma, -12V +-5% @150ma
Special Notes:	F	A	B	G	H

Special Notes:
A: Pin Designations: E1 = 25 dB, +V = +5V, -V = -12V, G = Ground
B: Pin Designations: E1 = 5 dB, E2 = 10 dB, +V = +5V, -V = -12V, G = Ground
C: Pin Designations: E1 = 1 dB, E2 = 2 dB, E3 = 4 dB, +V = +5V, G = Ground
D: Pin Designations: E1 = 1 dB, E2 = 2 dB, E3 = 4 dB, E4 = 8 dB, E5 = 16 dB, E6= 32 dB, +V = +5V, -V = -12V, G = Ground
E: Pin Designations: E1 = 0.25 dB, E2 = 0.5 dB, E3 = 1 dB, E4 = 2 dB, E5 = 4 dB, E6= 8 dB, E7 = 16 dB, E8 = 32 dB, G = Ground
F: Pin Designations: E1 = 1 dB, E2 = 2 dB, E3 = 4 dB, +V = +5V, -V = -12V, G = Ground
G: Pin Designations: E1 = 1 dB, E2 = 2 dB, E3 = 4 dB, E4 = 8 dB, E5 = 10 dB, E6= 32 dB, +V = +5V, -V = -12V, G = Ground
H: Pin Designations: E1 = 1 dB, E2 = 2 dB, E3 = 4 dB, E4 = 8 dB, E5 = 10 dB, E6= 20 dB, E7= 40 dB, +V = +5V, -V = -12V, G = Ground

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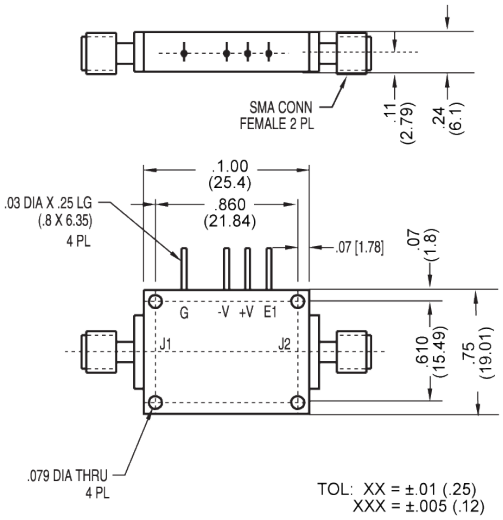
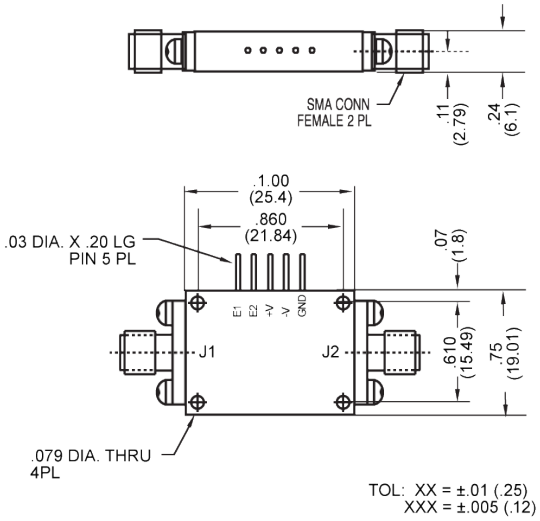
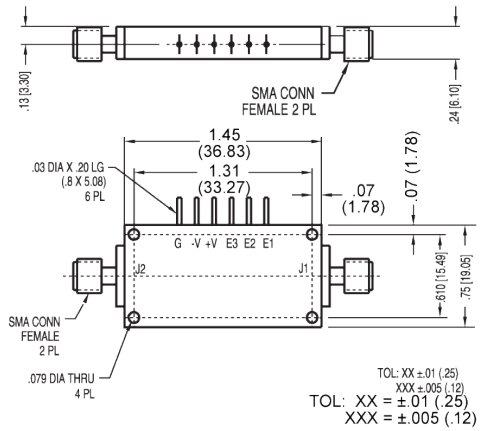
High Speed Switched BIT Attenuators



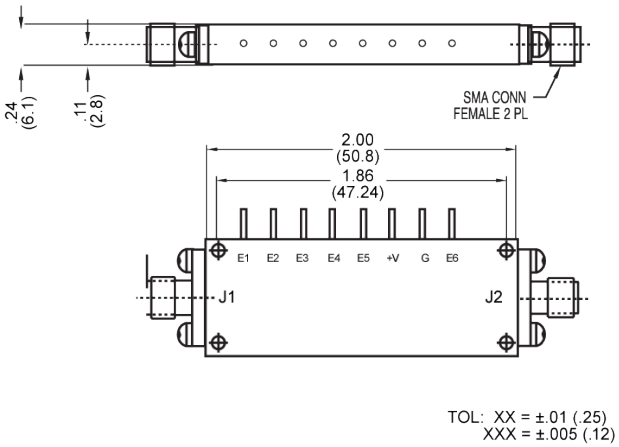
DA14-25, DA13-25



DA24-15, DA26-15



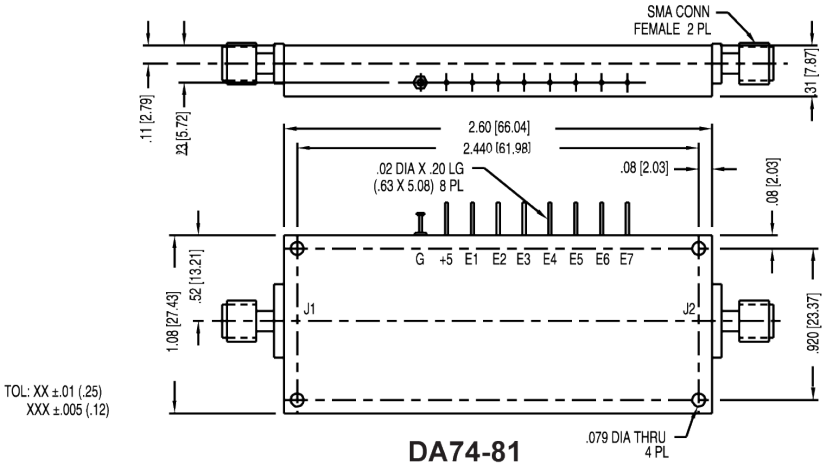
DA34-7, DA36-7



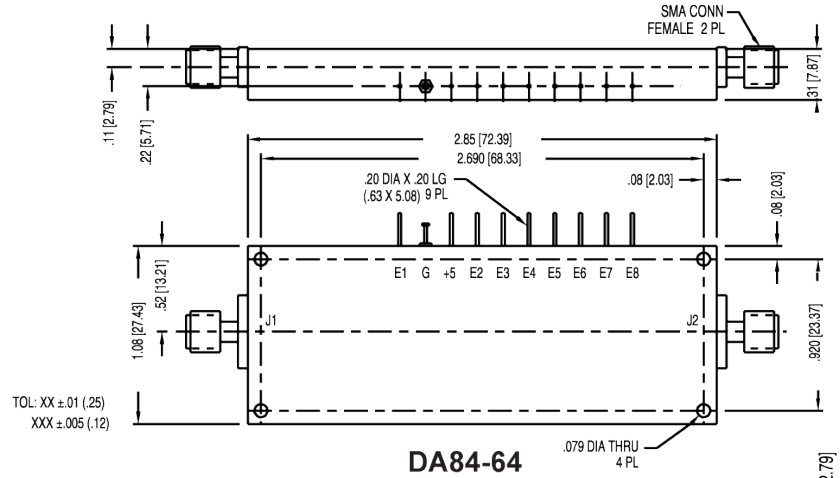
DA64-63B

Dimensions in parenthesis are in millimeters and for reference only.

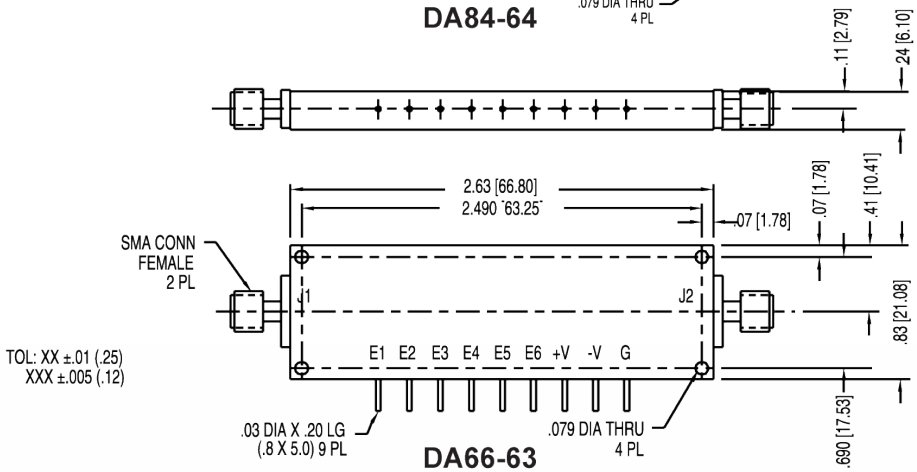
High Speed Switched BIT Attenuators



DA74-81



DA84-64



DA66-63

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Quick Reference Guide

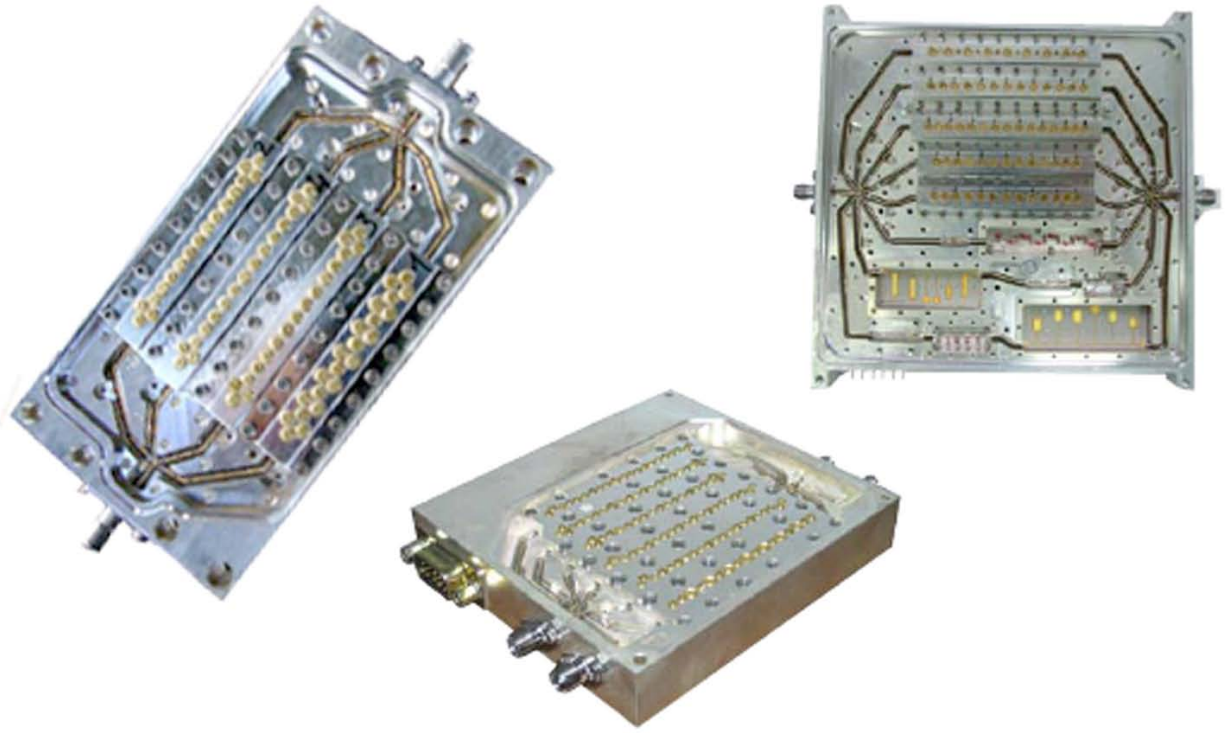
Narda Microwave has been providing various types of Switched Filter banks to commercial and military customers. These are customized products designed to meet specific customers requirements. The main features of this product line are:

1. Fast Switching
2. Low Loss
3. Temperature Stability
4. Excellent Rejection

The following filter technologies are being used:

1. Cavity Combline
2. Lumped Elements
3. Printed Filters

The following are samples of switched filter banks:



Switched Filter Banks 1 to 6 GHz, 8 Channels

Features

- Filters Implements by: Cavity, Lumped Elements and Printed Filters
- 8 Channels
- Frequency range: 1 to 6 GHz

CHANNEL	PASS BAND GHz	INSERTION LOSS dB	REJECTION GHz			
			25 dB	35 dB	40 dB	50 dB
1	0.95 to 1.55	6	0 to 0.77		1.85 to 1.95	2.9 to 3.5
2	1.45 to 2.35	6	0 to 1.0	2.5 to 2.59	2.6 to 3.4	1.05 to 1.15
3	2.25 to 3.15	6	0 to 1.0		3.4 to 4.2	1.05 to 1.15
4	3.05 to 3.95	6	0 to 1.0		4.2 to 4.5	1.05 to 1.15
5	3.85 to 4.25	6	0 to 1.0	4.45 to 5.15	2.8 to 3.1	1.05 to 1.15
6	4.15 to 4.85	6	0 to 1.0	5.05 to 5.55	5.05 to 5.55	1.05 to 1.15
7	4.75 to 5.45	6	0 to 1.0	6.0 to 18.0	6.0 to 18.0	1.05 to 1.15
8	5.35 to 6.05	6	0 to 1.0	7.5 to 18.0	7.5 to 18.0	1.05 to 1.15

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Switched Filter Banks 6 to 18 GHz, 6 Channels

Features

- 6 Channels
- Frequency Range: 6 to 18 GHz

CHANNEL	PASS BAND GHz	INSERTION LOSS dB	REJECTION GHz	
			60 dB	20 dB
1	5.75 to 8.25	6.5	0.5 to 4.2 & 11.5 to 18.0	9.0 to 11.0
2	7.75 to 10.25	6.5	0.5 to 5.2 & 13.4 to 22.0	11.0 to 13.0
3	9.75 to 12.25	6.5	0.5 to 6.2 & 15.4 to 22.0	13.0 to 15.0
4	11.75 to 14.25	6.5	0.5 to 8.6 & 16.4 to 22.0	9.0 to 11.0 & 15.0 to 16.4
5	13.75 to 16.2	6.5	0.5 to 10.6 & 18.4 to 22.0	11.0 to 13.0
6	15.75 to 18.25	7.0	0.5 to 12.6	13.0 to 15.0

Cavity Type Switched Filter bank 6 to 18 GHz, 4 Channels

Applications

- Cavity Type Filter
- 4 Channels
- Frequency Range: 6 to 18 GHz

CHANNEL	PASS BAND GHz	INSERTION LOSS dB	REJECTION dBc	
			± 2 GHz	± 1 GHz
1	6.6 to 9.8	4.6	45 to 50	28 to 32
2	9.4 to 12.6	4.6	45 to 50	28 to 32
3	12.2 to 15.4	4.6	45 to 50	28 to 32
4	14.8 to 18.0	4.6	45 to 50	28 to 32

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Narda offers PIN diode based limiters supporting up to 600W of pulsed power. The limiters can be supplied as stand alone devices, or as integrated assemblies that include the limiter and other microwave components such as: switches, attenuators, filters, amplifiers, etc.

DEFINITION OF PARAMETERS

Recovery Time:

The time period from the end of a high power pulse to the point where the insertion loss value has returned to within 3 dB of the quiescent loss state.

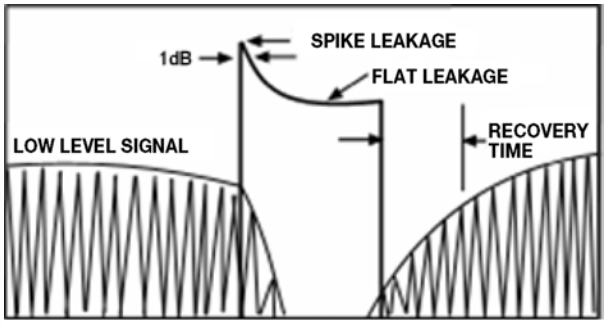
Spike Language:

After pulsed high power is applied, the limiter will momentarily pass significantly more power than when it is totally saturated. This power rise is seen as a spike on the leading edge of the leakage pulse. The rise time of the high power pulse and the turn-on time of the diode determine the spike's amplitude. The spike is defined by its energy content, i.e., in ergs.

The formula for calculating the spike leakage is as follows:

SPIKE LEAKAGE (ERGS) = t_s x P_s x 10^7

where t_s equals spike width at the half-power point in seconds, and P_s equals maximum spike amplitude in watts.



Power Handling

Two important considerations for defining the required power handling of a limiter are:

- **Peak Pulsed Power: for narrow pulses, equated to an equivalent CW power by multiplying the Peak Power by the Duty Cycle. For pulses exceeding 10 microseconds, Peak Power is considered CW**
- **Source VSWR: When is it fully turned on, the Limiter short circuits across the transmission line, and 90% incident power is reflected back towards the source**

Any mismatch at the source reflects power back toward the limiter, resulting in standing waves. In a correct limiter-source phase relationship, the maximum current point occurs at the input diode, causing the diode to dissipate a greater level of power than incident power. For a source VSWR of up to 2.0:1, an approximate maximum effective power can be achieved by multiplying the source VSWR by the incident power.

The following formula applies for source VSWRs over 2.0:1:

where:

- **PA = actual power**
- **PS = source power**
- **PF_L = load (limiter) power factor 0.96 typical**
- **PF_S = source power factor**

CONSIDERATIONS IN USING LIMITERS

- **The difference between the flat leakage and the 0.1 dB compression point is typically between 10 and 13 dBm, but may vary according to limiter type**
- **Noise of 10 dBm may be generated following the start of limiter compression. However, limiters can and usually do exhibit signs of limiter compression at 0 dBm.**
- **Limiters dissipate approximately 8% of incident power as heat. Therefore, all limiters should be attached to a heatsink whose temperature does not exceed the maximum rated ambient temperature.**
- **Limiters are inherently broadband components. Band limitation results from DC return are required by some limiter designs. Limiters with bandwidths of up to 10:1 are relatively simple, while those with bandwidths exceeding 10:1 are progressively more complex and costly.**

CAUTION! Limiters are NOT bidirectional components! They have a defined input and output; reverse installation will damage the component.

Limiters Series Broadband

Features

- Broadband 1 to 18 GHz
- Connectorized and Drop-In Modules
- High-Power Ratings
- Fast Recovery Time
- Small Size

Wideband Limiters Series

Narda offers a wide range line of PIN diode based limiters. The Wideband limiters, that are part of this line, cover up to 1 to 18 GHz in one band. They support power handling of up to 6000 watts of pulsed power.

The limiters were designed to meet severe environmental conditions for airborne as well as for other applications.

Examples of Custom Designs

MODEL	LIM-101	LIM-201				LIM-301			
Frequency Range (GHz)*	1-18	2-18				2-18			
		2-4	4-8	8-12	12-18	2-4	4-8	8-12	12-18
Insertion Loss, dB max	2.5	1.0	1.4	1.8	2.3	1.3	1.8	2.2	2.7
V.S.W.R, max	2.0:1	1.7:1	1.9:1		2.0:1	1.7:1	1.9:1		2.0:1
Input Power, Watts max (CW)	2	1				3			
Input Power, Watts max (Peak)	150					500			
Pulse Width, µSec max	1								
Duty Cycle, % max	1	0.1							
Flat Leakage, mWatts max	100	150	130			150	130		
Recovery Time, nSec max	200	100				200			
Operating Temperature Range, °C max	-55 to +95	-30 to +85							
Other Environmental Conditions	See Environmental Specifications								
Outline	1								
Connectors (Removable Input/Output)	SMA (Female)								

Environmental Specifications

ENVIRONMENTAL RATINGS

Parameter	Specification
Operating Temperature Range	Examples of Custom Designs
Non-Operating Temperature Range	-55°C to +95°C
Humidity	RTCA/DO-160D, Category B Sec. 6.3.2. RH Operating 95% @ 60°C
Shock	RTCA/DO-160D, Section 7 Category B
Vibration	RTCV/DO-160D Category R or R2 Sec conde, Section 8, Par. 8.7.2 Fig 8-1 & 8-4. Curve C & C1, G rms 4.12 & 5.83. Random 30 min at performance level and 3 hours at endurance level for each axis.
Altitude	(70,000 ft.)
Temp. Cycling	MIL-STD-202F, Method 107D, Cond. A, 5 cycles

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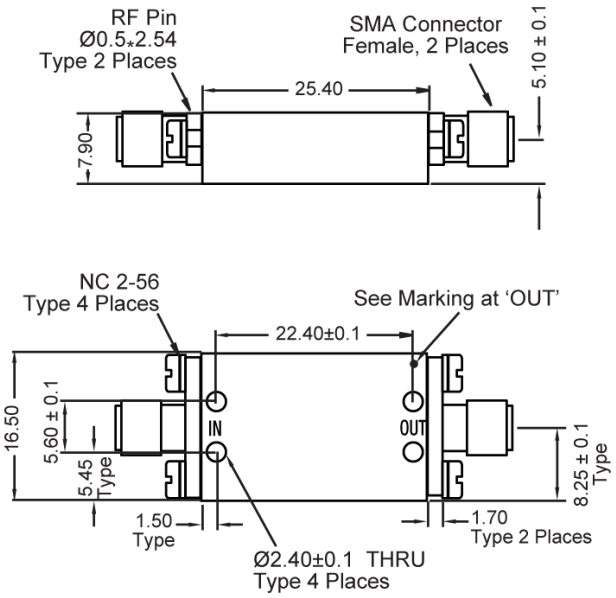
Limiters Series Broadband

DIMENSIONS AND WEIGHT

Dimensions in millimeters



Weight (Approx.)
Connectorized: 11 gr.
Without Connectors: 7.5 gr.

Outline 1

Limiters Series Narrowband

Features

- Narrow Band -25% of the Frequency
- Connectorized and Drop-In Modules
- High-Power Ratings
- Fast Recovery Time
- Small Size

Narda offers a wide range line of PIN diode based limiters. The Narrowband limiters, that are part of this line, cover typically 25% frequency band within the frequency range of up to 18 GHz. They support power handling of up to 400 watts of puised power. Since each unit is unique, the part number will be assigned at the time of the order.

The limiters were designed to meet severe environmental conditions for airborne as well as for other applications.

Examples of Custom Designs

MODEL	Custom Series	Custom Series	Custom Series
Frequency Range (GHz)*	1.0 - 2.0	1.2 - 1.4	3.1 - 3.5
Insertion Loss, dB max	0.8	0.7	1.0
V.S.W.R, max	1.5:1	1.3:1	
Input Power, Watts max (CW)	40	32	25
Input Power, Watts max (Peak)	400	300	250
Pulse Width, µSec max	10	20	50
Duty Cycle, % max	10		
Flat Leakage, mWatts max	100		32
Recovery Time, nSec max	400		350
Operating Temperature Range, °C max	-30 to +75	-30 to +85	-40 to +75
Other Environmental Conditions	See Environmental Specifications		
Outline	1	2	1
Connectors (Removable Input/Output)	SMA (Female)		

Custom Series = Model Number To Be Assigned.

* = 25% Bandwidth

MODEL	Custom Series	Custom Series	Custom Series
Frequency Range (GHz)	8.4 - 9.6	8 - 12	1.28 - 1.4
Insertion Loss, dB max	2.0	2.2	0.6
V.S.W.R, max	2.0:1	1.8:1	1.5:1
Input Power, Watts max (CW)	15	5	30
Input Power, Watts max (Peak)	315	50	300
Pulse Width, µSec max	20	10	25
Duty Cycle, % max	5.0	10	13
Flat Leakage, mWatts max	64	100	32
Recovery Time, nSec max	500		200 (From 50W input peak power of 1dB of small signal gain)
Operating Temperature Range, °C max	-20 to +70	-40 to +85	-30 to +85
Outline	1		3
Connectors (Removable Input/Output)	SMA (Female)		

Custom Series = Model Number To Be Assigned.

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Limiters Series Narrowband

Examples of Custom Designs

MODEL	Custom Series
Frequency Range (GHz)	10 - 15
Insertion Loss, dB max	2.0
V.S.W.R, max	1.8:1
Input Power, Watts max (CW)	20
Input Power, Watts max (Peak)	50
Pulse Width, µSec max	1
Duty Cycle, % max	0.1
Flat Leakage, mWatts max	32
Recovery Time, nSec max	400
Operating Temperature Range, °C max	-30 to +75
Other Environmental Conditions	See Environmental Conditions
Outline	1
Connectors (Removable Input/Output)	SMA (Female)

Custom Series = Model Number To Be Assigned.

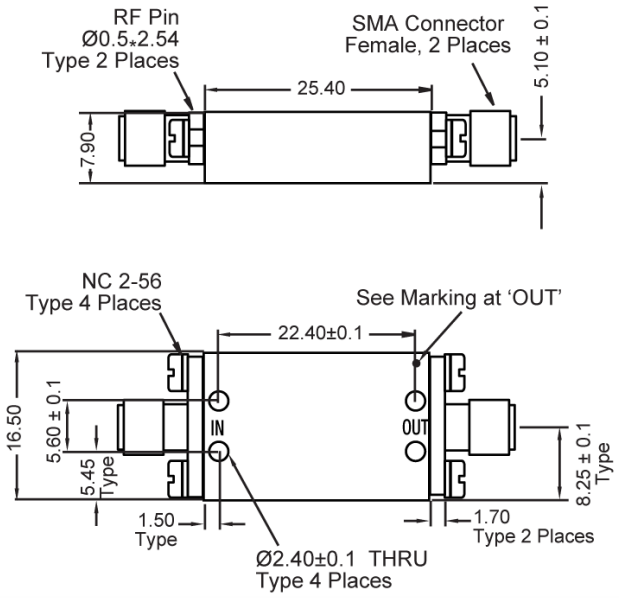
Environmental Specifications

ENVIRONMENTAL RATINGS

Parameter	Specification
Operating Temperature Range	Examples of Custom Designs
Non-Operating Temperature Range	-55°C to +95°C
Humidity	RTCA/DO-160D, Category B Sec. 6.3.2. RH Operating 95% @ 60°C
Shock	RTCA/DO-160D, Section 7 Category B
Vibration	RTCV/DO-160D Category R or R2 Sec conde, Section 8, Par. 8.7.2 Fig 8-1 & 8-4. Curve C & C1, G rms 4.12 & 5.83. Random 30 min at performance level and 3 hours at endurance level for each axis.
Altitude	(70,000 ft.)
Temp. Cycling	MIL-STD-202F, Method 107D, Cond. A, 5 cycles

DIMENSIONS AND WEIGHT

Dimensions in millimeters

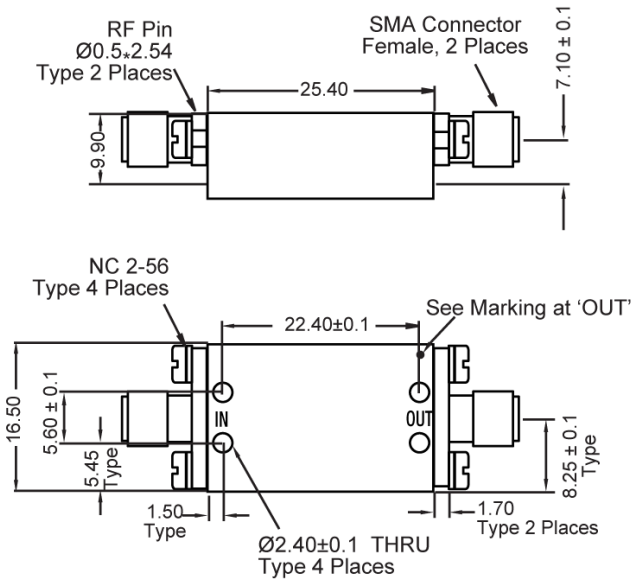


Weight (Approx.)
Connectorized: 11 gr.
Without Connectors: 7.5 gr.

Outline 1

Limiters Series Narrowband

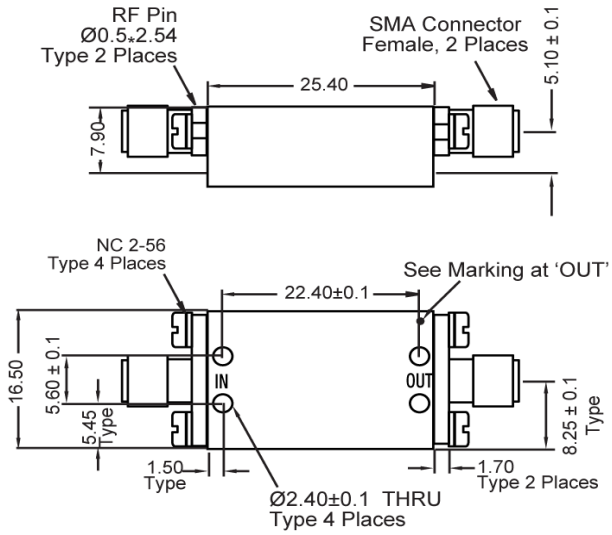
Dimensions in millimeters



Weight (Approx.)
Connectorized: 13 gr.
Without Connectors: 9.5 gr.

Outline 2

Dimensions in millimeters



Weight (Approx.)
Connectorized: 11 gr.
Without Connectors: 7.5 gr.

Outline 3

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POWER METERS & MONITORS

narda
microwave-east

an L3 communications company

Table of Contents

General

Power measurements at RF and microwave frequencies may be divided into low, medium and high power levels. At low levels power is measured directly using diode or thermocouple detection elements. At medium (1 Watt) power levels an attenuator is inserted between the source and detector. For high power measurements, or when power is measured “in-line” a directional coupler is used to sample a portion of the power being developed. Accurate power measurements depend not only on the accuracy of the detection element itself but more importantly on the total measurement uncertainty of all the components (adapters, couplers, cables, etc.) that are used to make the measurement.

Design Of The Detector

The power absorbed by a mount when connected to a “perfect” 50 ohm source is, by definition, true power. Any power reflected due to the VSWR (Voltage Standing Wave Ratio) of the mount, any variation in the amount of reflected or absorbed power with frequency, and any variation in the conversion efficiency of the mount with frequency are accounted for in the calibration factor. Calibration factor is the ratio of the measured (or indicated) power at a given frequency to the true (or actual) power which would be delivered from a perfect 50 ohm source. A detector’s ability to measure power accurately is based on the design of the complete structure. Power that is reflected due to the VSWR and power that is absorbed into the walls and connections within the mount all degrade the efficiency and accuracy of the detector.

Mismatch Uncertainty

When making power measurements, if the VSWR of both source and detector are not equal to 1.0:1 (which is impossible), there can be additional power reflected due to the impedence mismatch. This leads to a potential source of measurement error called mismatch uncertainty. From the example to the right it can be seen that an accurate power measurement depends on the VSWR of the source and the detector. A simple method to improve the accuracy of this measurement is to use a high quality, low VSWR attenuator such as the Narda Model 779 or 4779 Series Attenuators. Readings would be adjusted by the amount of attenuation added. Mismatch uncertainties become more complex when performing reflected power measurements. On the right is the method for calculating these uncertainties. What can be rapidly seen from the equation is that directivity is the most critical value when performing reflected power measurements on a low reflection device. Conversly, the source VSWR will be the most critical factor when measuring devices with a high reflection. The figure on the right depicts the effects of directivity on a reflection measurement. When measuring a device with a reflection value of approximately 25 dBr (1.12:1 VSWR), the uncertainty of your measurement would be reasonable only if your measurement directivity is at least 35 dB. The example on the right depicts how overall accuracy degrades as the real return loss value approaches the directivity value. While it's not a significant error for 5 or 10 dBr, it becomes significant at 20 dBr and critical at 25 dBr. A general rule that can be employed is you'll need at least 10 dB more in directivity than the value of return loss you are testing for, in order to obtain accurate results. The Narda Model 8450 specifies a minimum of 30 dB directivity therefore, it's accurate to measure cellular systems where the antennas are typically specified at a 1.4:1 VSWR (15.5 dBr).

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Power Meter Measurement Uncertainty

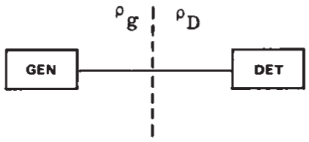
The Mismatch Uncertainty for this measurement in dB is:

$$M_{\mu dB} = 20 \log (1 \pm \rho_g \rho_D)$$

where: M_μ = mismatch uncertainty (maximum) in dB.

ρ_g = Generator Reflection Coefficient, RHO.

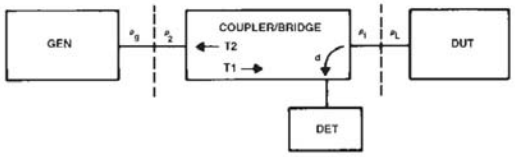
ρ_D = Load (Detector) Reflection Coefficient, RHO.



Reflection Measurement Uncertainty

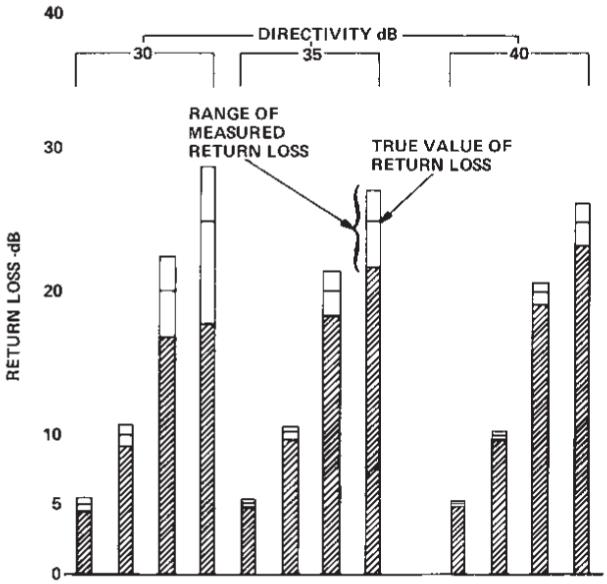
A typical reflection measurement set-up is shown below. The measurement uncertainty of this set up, in terms of a measurement of a reflection coefficient, RHO is:

$$M\mu = d \pm \frac{(\rho_g T_1 T_2 + \rho_1)}{(1 - \rho_g \rho_2)} \rho_L^2$$



" Through transmission of coupler/bridge $= 10 \left(\frac{-\text{Ins. Loss in dB}}{20}\right)$

" Directivity of coupler/bridge $= 10 \left(\frac{-\text{Directivity in dB}}{20}\right)$



Quick Reference Guide

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8400 Series Portable Power Meter

Features

- Compact, Portable
- Interchangeable Mounts
- Accurate to 26.5 GHz
- Field Replaceable Elements
- Rugged Design for Field Service

Models

- 8420, 8421, 8422

Model	8420	8421	8422
Frequency Range (GHz)	.01 to 12.4	.01 to 12.4	.01 to 12.4
Measurement Range	1 µ to 1 mW	10 µ to 10 mW	10 µ to 10 mW
Overload (CW) in mW	3	30	300
Overload (Peak) in W	0.1	3	30
VSWR (max)	1.5:1	1.5:1	1.5:1
Connector	Type N Male	Type N Male	Type N Male
Replacement Element	818A	819A	820A
Special Notes:	A	A	A

Special Notes:
A: Frequency sensitivity all models +/- 0.5 dB
Model 8427 VSWR, 50 MHz to 22 GHz - 1.5:1, 75 MHz to 20 GHz - 1.3:1
Mates with SMA

8400 Series Portable Power Meter

Description

The 8400 Series Mini-Power Meter is an inexpensive, portable and battery operated power measurement system. Consisting of the model 8441 power meter, the model 8440-01 extension cable and one or more of the 842X series of power mounts, this system allows accurate measurements at frequencies up to 26.5 GHz1. Each 842X series power mount measures power over a 30 dB dynamic range and utilizes thermocouple based detection for trueRMSaveraged results, even with pulse modulated signals. Field service technicians have long used the 8400 series because of it's rugged cast aluminum housing, high accuracy and simple operation. Supplied in it's own cushioned carrying case, the 8400 series is small enough to be carried to remote transmitter measurement areas, yet accurate enough to be used to set output levels for communication systems. Each power mount is color coded to denote it's measurement range and the meter is supplied with corresponding color coded scales to simplify actual readings. Additionally, the model 8441 has a dBm to mW conversion chart mounted on it's rear panel, to allow conversions of measured levels.

Specifications

The Model 8441 Meter is a universal meter that can be used with 842X Series Power Mounts. The meter movement and front panel switches are protected by the shape of the cast aluminum housing that contains an easily accessible separate battery compartment. Readings are displayed on it's 1.5 inch (3.8cm) analog meter movement. Power mounts may be mounted directly on top of the model 8441 or through the Model 8440-01 extension cable. A complete operation and maintenance manual is supplied, along with a padded carrying case that houses the meter, ext. cable and one power mount.

1 Previously available as a Model 8401 system. Units should now be ordered stating separate meter, extension cable and power mount part numbers.

Meter Type Size Scales	D'Arsonval 1.5 in (3.8 cm) 3, Color Coded
Dynamic Range	30 dB
Scale Ranges	0.1, 1.0, 10 mW
Scale Multipliers	x0.1, x1.0, x10
Battery Type Life	6.0V (2 ea.) NEDA 1410M 500 Hrs.
Size	4.7" x 2.7" x 1.75" 11.75 x 6.67 x 4.45 cm
Weight	1.3 lb., 0.6 kg
Accessories Supplied	Manual, Batteries and Carrying Case

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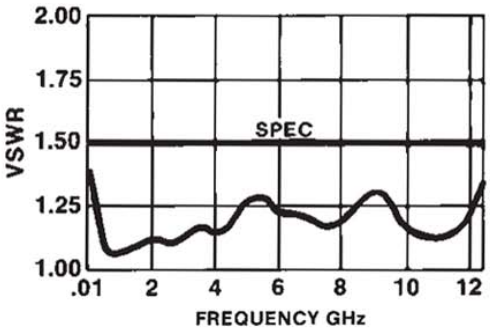
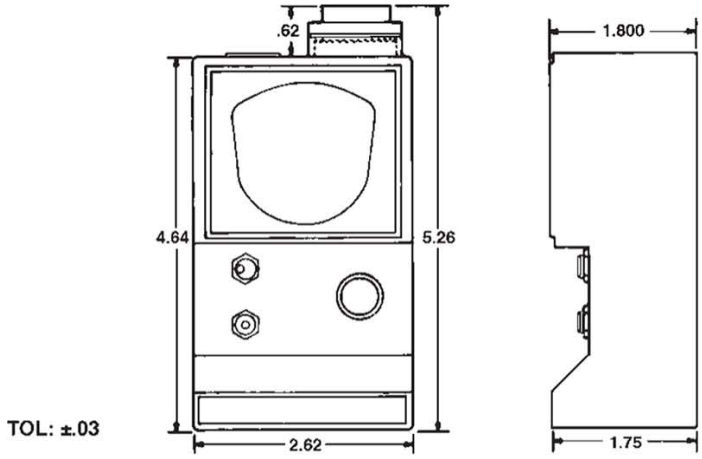
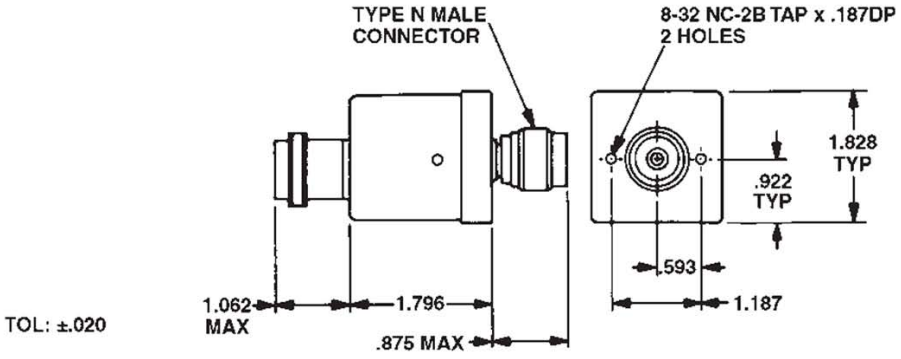
8400 Series Portable Power Meter



Typical VSWR Performance



Outline Drawing for Model 8441



Mount Outline Drawing for Models 8420, 8421, 8422

Broadband Power Sensor

Features

- RF Input and DC Voltage Outputs
- The impedance of the RF input is matched into 50 ohms
- Power conversion is accomplished with a pair of thermocouple elements

Models

- 8423

Model	8423
Frequency Range (GHz)	.01-18.5
Input Power CW, Typical (mW)	10
Input Power CW, Max* (mW)	30
Sensitivity (mV/mW)	30
Input Power Pulse, Max* (W)	.32
Dynamic Range	30 dB
Temperature Coefficient	<+/-0.1%/°C
Operating Temperature	-40°C to +80°C
VSWR (max)	1.75:1 (.01 to .02 GHz), 1.5:1 (.02 to 10 GHz), 1.6:1 (10 to 18.5 GHz)
Connector	SMA Male (input), 4 Pin Female (output)
Special Notes:	A , B , C , D

Special Notes:
A: *Max CW must be handled for 1 second minimum. Max pulse power, with shape of 5W/usec must be handled for a duration of 5usec (at 25°C).
B: Output range is based on an RF input level of +10 mW, and a temperature of 20°C. The allowable voltage range at a constant input level for any single unit must be held within 2.2dB.
C: Linearity must be verified at 9.5 GHz, over the input power range from +10 dBm to -10 dBm at 20°C.
D: Output Connector Berg 78211-004
Pin 1: Positive Polarity, Pin 2: Ground, Pin 3: Negative Polarity, Pin 4: Not Used.
Input Connector per MIL-C-39012D.

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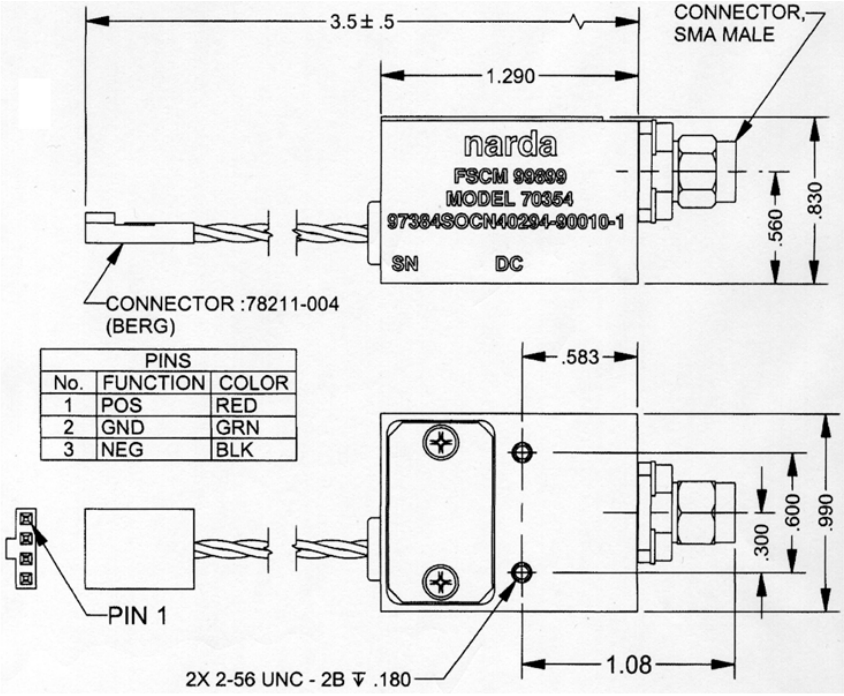
Broadband Power Sensor



Outline Drawing for Model 8423
Connector mates without interference per MIL-STD-348. Finish: Gold Plate Over Nickel.
Tolerances: +/-.005

Type N (M) and 3.5 mm (M) Integrated Thermocouple and Diode Power Monitors

Features

- Broadband Frequency Coverage
- High Level Outputs
- Simplifies System Designs
- Excellent Stability, Accuracy
- Low Cost

Models

- 426B, 427B, 460B, 462B, 466B, 4491

Model	426B	427B	460B
Low Frequency (GHz)	0.01	0.01	0.01
High Frequency (GHz)	12.4	12.4	12.4
Detection	TRUE RMS AVERAGE	TRUE RMS AVERAGE	TRUE RMS AVERAGE
Dynamic Range	30 dB*	30 dB*	30 dB*
Measurement Range	0.1 uW to 100 mW	1.0 uW to 1.0 mW	1.0 uW to 1.0 mW
Overload (CW) in mW	300 mW	3.0 mW	3.0 mW
Overload (Peak) in W	30W	0.1W	0.1W
Replacement Element	820A	818A	818A
Output Connector	15 PIN MS3116A-14-15P (Mates with MS3116A-14-15S, Narda P/N 30931302)	15 PIN MS3116A-14-15P (Mates with MS3116A-14-15S, Narda P/N 30931302)	185 PIN MS3116A-14-18P (Mates with MS3116A-14-18S, Narda P/N 30931301)
Input Connector	Type "N" Male	Type "N" Male	Type "N" Male
Input VSWR (max)	1.5:1	1.5:1	1.5:1
Zero Offset (Typical)	.005%/Deg.C. on lease sensitive range, 10dB higher on each lower range	.005%/Deg.C. on lease sensitive range, 10dB higher on each lower range	.005%/Deg.C. on lease sensitive range, 10dB higher on each lower range
Linearity	2% of full scale	2% of full scale	2% of full scale
Special Notes:	A	A	A

Special Notes:
A: *Units can be configured for two or three 10 dB ranges for a single 20 dB or 30 dB range.

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Type N (M) and 3.5 mm (M) Integrated Thermocouple and Diode Power Monitors

Model	462B	466B	4491
Low Frequency (GHz)	0.01	0.01	0.1
High Frequency (GHz)	12.4	12.4	26.5
Detection	TRUE RMS AVERAGE	TRUE RMS AVERAGE	TRUE RMS AVERAGE
Dynamic Range	30 dB*	20 dB*	30 dB*
Measurement Range	100 uW to 100 mW	1 uW to 100 mW	10 uW to 10 mW
Overload (CW) in mW	300 mW	300 mW	30 mW
Overload (Peak) in W	30W	30W	5.0W
Replacement Element	820A	820A	4813
Output Connector	185 PIN MS3116A-14-18P (Mates with MS3116A-14-18S, Narda P/N 30931301)	185 PIN MS3116A-14-18P (Mates with MS3116A-14-18S, Narda P/N 30931301)	185 PIN MS3116A-14-18P (Mates with MS3116A-14-18S, Narda P/N 30931301)
Input Connector	Type "N" Male	Type "N" Male	3.5 male
Input VSWR (max)	1.5:1	1.5:1	1.20:1
Zero Offset (Typical)	.005%/Deg.C. on lease sensitive range, 10dB higher on each lower range	.005%/Deg.C. on lease sensitive range, 10dB higher on each lower range	.005%/Deg.C. on lease sensitive range, 10dB higher on each lower range
Linearity	2% of full scale	2% of full scale	2% of full scale
Special Notes:	A	A	A , B

Special Notes:
A: *Units can be configured for two or three 10 dB ranges for a single 20 dB or 30 dB range.
B: VSWR Input 1.5:1 (50 MHz to 22 GHz)
1.3:1 (75 MHz to 20 GHz)

Type N (M) and 3.5 mm (M) Integrated Thermocouple and Diode Power Monitors

Description

Narda integrated power monitors are complete, integrated power measurement subsystems which provide an output signal proportional to their RF input level. A system designer need only supply DC power to the RF power monitor for it to measure RMS average power levels. Measurements can be made over the designer's choice of 20 or 30 dB dynamic range with repeatable, accurate performance. All units are designed to operate in hostile RF environments and are sealed to reduce emissions of, and susceptibility to, stray RF signals. Input connectors are precision type "N" or 3.5mm connectors that comply with MIL-C-39012, and output connections are through a MIL-C-26284 type connector for environmental and EMC considerations. This design feature allows these units to be mounted close to high power output stages while maintaining accurate output readings. These power monitors operate from a wide range of supply voltages. Single ended supplies of either 24 to 36 VDC unregulated, or dual supply voltages of 12 to 18 VDC regulated are acceptable for all thermo couple monitors. However special versions are available to match system supply voltages. These devices may be used as either constant current of constant voltage devices. In a system where variations of the resistance of the DC wiring may be encountered (such as through the slip rings of a rotating antenna system), or where the length of wire would cause a voltage reduction, a constant current source is desirable since any resistance, or resistance fluctuation would not affect the accuracy of the remote readout. In a system where the remote readout might be a high impedance device, such as a PC based data acquisition card the most desirable configuration is a constant voltage source. The choice of either a constant current or constant voltage configuration does not require any change or modification of the internal circuitry of the power monitor. Either configuration is obtained by proper wiring of the external circuitry. The supplied operation and maintenance manual contains numerous examples of external wiring configurations that may be employed.

Environmental Specifications

Temperature Range	Operating -55˚ to +85˚C
Humidity	0 to 99% (Non-condensing)
Altitude	0 to 30,000 ft.

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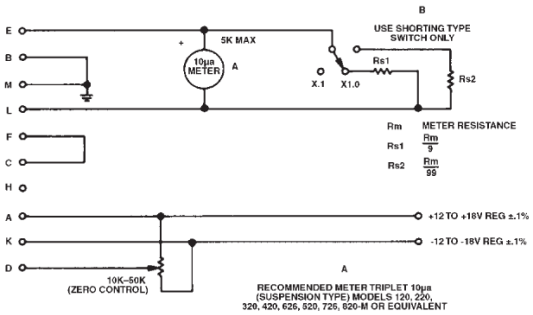
Type N (M) and 3.5 mm (M) Integrated Thermocouple and Diode Power Monitors

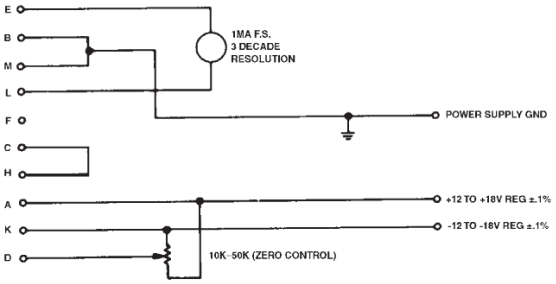
Typical Interconnection Diagrams



Constant Current Dual Supply, 3 Ranges

In this external wiring configuration, the RMS power monitors will generate a 0 to 100 mV output for each 10 dB range (x.1, x1, x10).

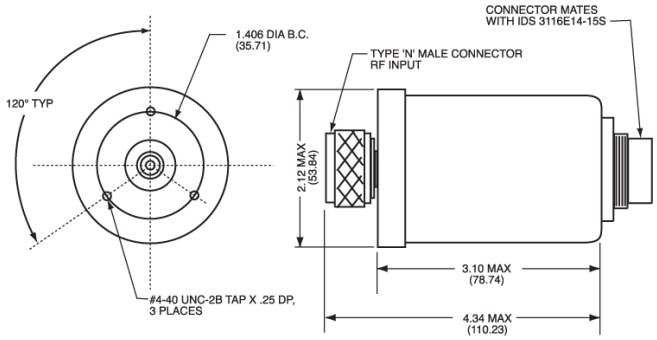
If the switch is left in the x.1 range, the RMS monitors will generate 0 to 1V and 0 to 10 V if operated in the x1 and x10 power ranges, respectively.



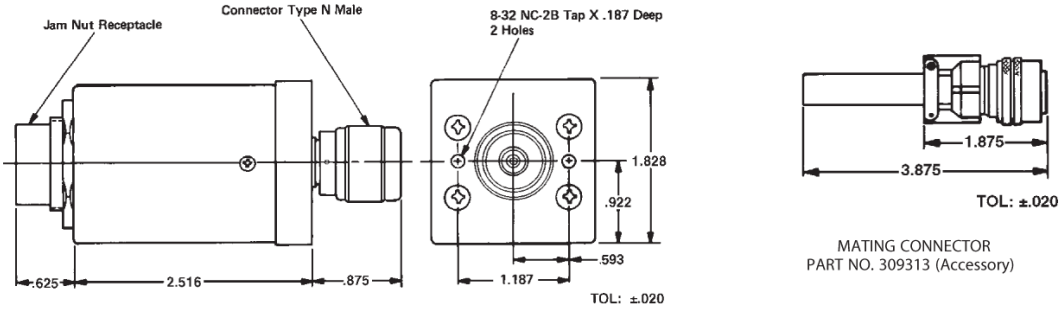
Constant Current Dual Supply Connection Single Range

In this external wiring configuration, the RMS power monitor will generate up to 1 mA of current. When operated in the most sensitive range it will generate 0 to 10 µA, mid range and 0 to 100 µA and in the least sensitive range 0 to 1 mA.

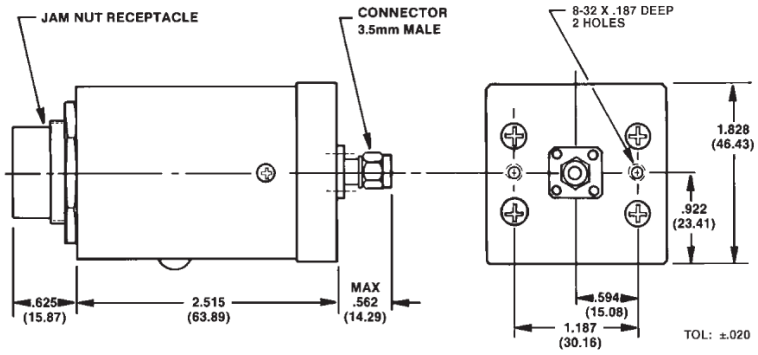
Type N (M) and 3.5 mm (M) Integrated Thermocouple and Diode Power Monitors



Dimension are maximum and for reference only. Dimensions in parentheses are in millimeters. Contact the factory for detailed specifications and outline drawing.



Dimension are maximum and for reference only. Dimensions in parentheses are in millimeters. Contact the factory for detailed specifications and outline drawing.



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Narda warrants each product of its manufacture to be free from any defect in material and workmanship for a period of one year from date of shipment to, and return by, the original purchaser. In the case of electromechanical RF switches, the aforementioned warranty covers one year or the number of operations, whichever comes first. All warranty returns, however, must first be authorized by a factory office representative.

The limit of liability under this warranty shall be to repair or replace any product, or part thereof, which proves to be defective after inspection by Narda. This warranty shall not apply to any Narda product that has been disassembled, modified, physically or electrically damaged or any product that has been subjected to conditions exceeding the applicable specifications or ratings.

Narda shall not be liable for any direct or consequential injury, loss or damage incurred through the use, or the inability to use, any Narda product.

Narda reserves the right to make design changes to any Narda product without incurring any obligation to make the same changes to previously purchased units.

This warranty is the full extent of obligation and liability assumed by Narda with respect to any and all Narda products. Narda neither makes, nor authorizes any person to make, any other guarantee or warranty concerning Narda products.

VSWR vs. Return Loss

VSWR	RET LOSS (dB)	VSWR	RET LOSS (dB)	VSWR	RET LOSS (dB)
17.391	1.0	1.208	20.5	1.020	40.0
11.610	1.5	1.196	21.0	1.019	40.5
8.724	2.0	1.184	21.5	1.018	41.0
6.997	2.5	1.173	22.0	1.017	41.5
5.848	3.0	1.162	22.5	1.016	42.0
5.030	3.5	1.152	23.0	1.015	42.5
4.419	4.0	1.143	23.5	1.014	43.0
3.946	4.5	1.135	24.0	1.013	43.5
3.570	5.0	1.127	24.5	1.013	44.0
3.263	5.5	1.119	25.0	1.012	44.5
3.010	6.0	1.112	25.5	1.011	45.0
2.796	6.5	1.106	26.0	1.011	45.5
2.615	7.0	1.099	26.5	1.010	46.0
2.458	7.5	1.094	27.0	1.010	46.5
2.323	8.0	1.088	27.5	1.009	47.0
2.204	8.5	1.083	28.0	1.008	47.5
2.100	9.0	1.078	28.5	1.008	48.0
2.007	9.5	1.074	29.0	1.008	48.5
1.925	10.0	1.069	29.5	1.007	49.0
1.851	10.5	1.065	30.0	1.007	49.5
1.785	11.0	1.062	30.5	1.006	50.0
1.725	11.5	1.058	31.0	1.006	50.5
1.671	12.0	1.055	31.5	1.006	51.0
1.622	12.5	1.052	32.0	1.005	51.5
1.577	13.0	1.049	32.5	1.005	52.0
1.536	13.5	1.046	33.0	1.005	52.5
1.499	14.0	1.043	33.5	1.004	53.0
1.464	14.5	1.041	34.0	1.004	53.5
1.433	15.0	1.038	34.5	1.004	54.0
1.404	15.5	1.036	35.0	1.004	54.5
1.377	16.0	1.034	35.5	1.004	55.0
1.352	16.5	1.032	36.0	1.003	55.5
1.329	17.0	1.030	36.5	1.003	56.0
1.308	17.5	1.029	37.0	1.003	56.5
1.288	18.0	1.027	37.5	1.003	57.0
1.270	18.5	1.025	38.0	1.003	57.5
1.253	19.0	1.024	38.5	1.003	58.0
1.237	19.5	1.023	39.0	1.002	58.5
1.222	20.0	1.021	39.5	1.002	59.0

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