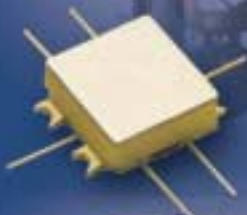


rf & microwave components and systems



SPECTRUM
MICROWAVE INC.
A Spectrum Control Business

Introducing the **NEW** Spectrum Microwave, Inc.



There is a new leader and source for your RF & microwave systems and components ... **Spectrum Microwave**. Combining the people, products and technologies from **FSY Microwave**, **Salisbury Engineering**, **Q-Bit**, **Magnum Microwave**, **Radian Technologies** and **Amplifonix** into a single organization poised to provide a wide range of microwave solutions.

Spectrum Microwave offers a worldwide network of sales, distribution and manufacturing locations that gives us a responsive local presence in North America, Europe and Asia.

We've assembled an experienced engineering team that will help you select the right standard product or design a custom solution for your specific application. Our expanded product line now ranges from sophisticated microwave systems and integrated assemblies to advanced control components to ceramic filters and antennas. This diverse array of products includes technologies to satisfy both low cost commercial and high performance military applications.

filter & antenna products



- Lumped element and cavity filters
- BTS filters and tower mounted amplifiers
- Waveguide and tubular filters
- Ceramic bandpass filters and duplexers
- Patch antenna elements and assemblies

integrated microwave systems



- Switchable filter bank assemblies
- Filtered low noise amplifiers
- Frequency multipliers
- Microwave synthesizers
- Couplers
- Integrated microwave sub-assemblies

frequency control components



- Power Amplifiers
- Hybrid and modular amplifiers
- RF mixers
- Local oscillator doublers
- Voltage controlled oscillators (VCOs)
- Dielectric resonator oscillators (DROs)

rf & microwave components and systems

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Patch Antennas & Assemblies

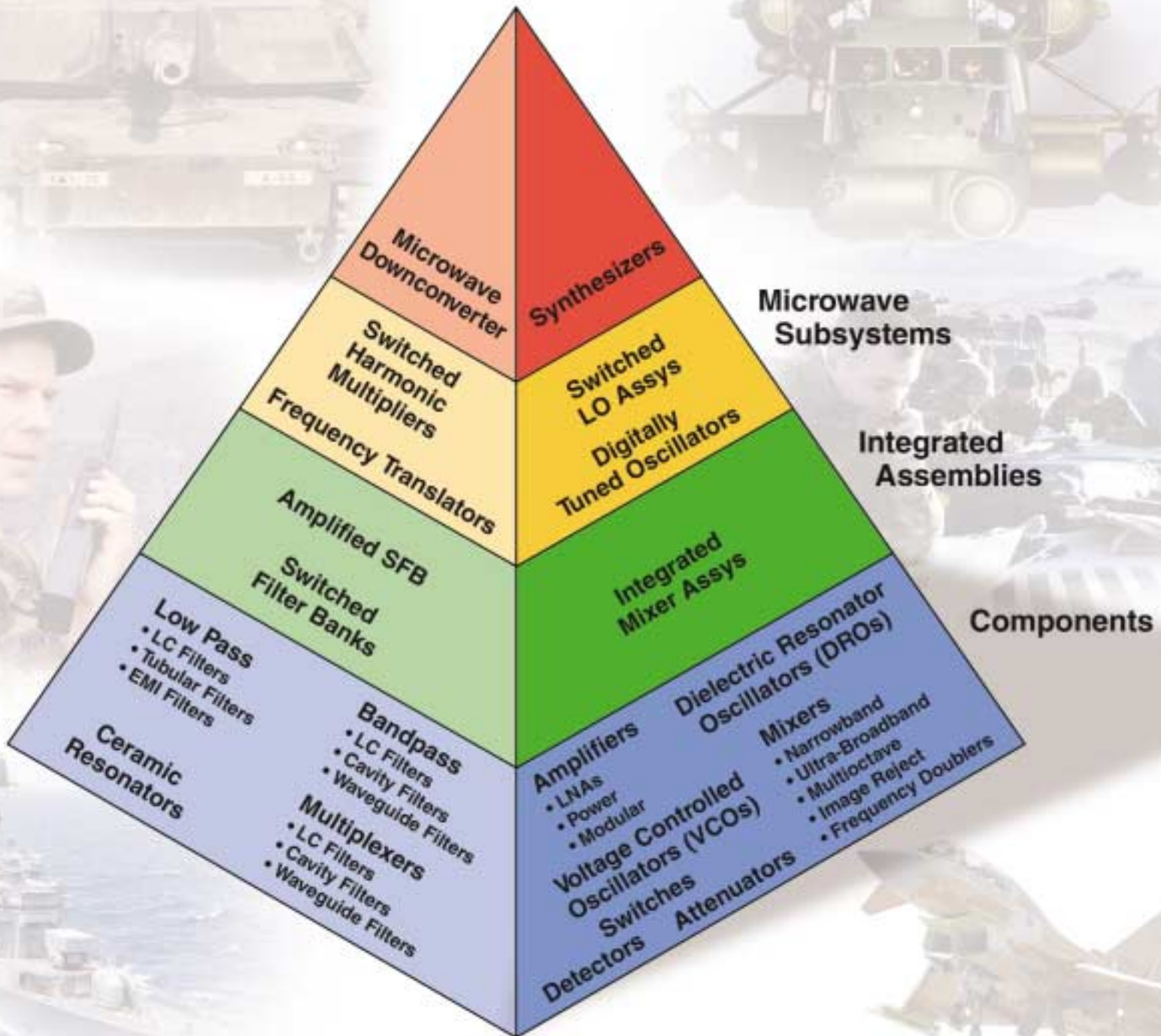
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|-------------------------------------|--------|
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ISO 9001 CERTIFIED

QS 9000 CERTIFIED





RF & Microwave Solutions

Design expertise ... from the component level to sophisticated microwave subsystems



RF & Microwave Components and Systems Selection Guide

FREQUENCY CONTROL COMPONENTS

| | RF & Microwave Amplifiers | RF & Microwave Mixers | VCOs & DROs | Attenuators, Detectors, Switches, Limiting & Limiter Amps |
|------------------------------------|---|---|---|--|
| |  |  |  |  |
| Applications | Military and wireless communications, medical, test and measurement, avionics, and radars | Military and wireless communications, medical, test and measurement, avionics, and radars | Military and wireless communications, medical, test and measurement, avionics, and radars | Military and wireless communications, medical, test and measurement, avionics, and radars |
| Features / Benefits | <ul style="list-style-type: none"> Guaranteed Low Phase Noise Amplifiers High Reverse Isolation 25dB above forward gain stage in single stage Amps MIL-STD-883 screening available Features Broadband and narrowband response Wide dynamic ranges Custom packaging available Low cost packages available High performance-High reliability designs | <ul style="list-style-type: none"> Types - Multioctave - Narrowband - Ultra-broadband - Image reject - Frequency doublers Design flexibility Wide variety of package options available Standard product and customization services available MIL-STD-883 screening available | <ul style="list-style-type: none"> Guaranteed Low Phase Noise Design flexibility Drop in, surface mount and connectorized packaging options Standard product and customization services available Integration with other components available MIL-STD-883 screening available Features Custom packaging available High performance-High reliability designs | <ul style="list-style-type: none"> Attenuators RF, digital and Analog DC to 2.5 GHz Digital - tuning sensitivity from 0.1 dB to 63.5 dB Analog - maximum attenuation of 40 dB Detectors Threshold and Analog 10 MHz to 2 GHz Threshold thermally compensated, accurate RF measurement controlled with external resistor or an external voltage Analog - video output proportional to the input power |
| Performance Characteristics | <ul style="list-style-type: none"> Frequency range 0.5 MHz to 6 GHz Typical Gain as high as 37 dB LNA Noise Figures as low as 0.9 dB | <ul style="list-style-type: none"> Frequency range 0.5 MHz to 26.5 GHz | <ul style="list-style-type: none"> Frequency range 25 MHz to 18 GHz | <ul style="list-style-type: none"> Switches GaAs and Pin Diode DC to 3 GHz Pin Diode - many package configurations with up to 8 throws Limiting/Limiter Amps 5 MHz to 3000 MHz |
| | Pages 19-20 www.specwave.com/amp | Pages 21-22 www.specwave.com/mixer | Pages 23-24 www.specwave.com/vco www.specwave.com/dro | Pages 25-26 www.specwave.com/ads |

Filter Application Key:



Bandpass



Highpass



Lowpass



Band reject



Duplex



Multiplex

RF & Microwave Components and Systems Selection Guide

| MICROWAVE FILTERS | | | | |
|--|--|--|--|--|
| | Ceramic Resonators | Bandpass Filters & Duplexers Ceramic Resonator Type | Bandpass Filters & Duplexers Monoblock Type | Lumped Element Filters |
| Applications |  |  |  |  |
| | Wireless equipment, voltage controlled oscillators, clock oscillators, automotive electronics, and HDD | Cellular base station transceivers, land mobile radios, satellite transceivers, modems, CATV infrastructure, and GPS modules | Cellular base station transceivers, land mobile radios, satellite transceivers, modems, CATV infrastructure, and GPS modules | Commercial and military communication systems, Avionics, radars, IF & RF, point to point, E-911, Base stations CDMA, PCS, WLL, IMT-2000, MMDS |
| |  |  |  |  |
| Features / Benefits | <ul style="list-style-type: none"> ■ Design flexibility Custom sizes available ■ Rugged construction Easy handling and assembly ■ Easy installation Surface or tab mounting Tape and reel packaging ■ Features Low frequency drift vs. temperature High Q Wide frequency range 1/4 and 1/2 wave coaxial designs Dielectric constant: 20 - 90 | <ul style="list-style-type: none"> ■ Easy installation Surface mount or thru-hole mounting Tape and reel packaging ■ Design flexibility Available in 2-10 poles Notch filters available ■ Features Low frequency drift vs. temperature High Q Excellent isolation between transmit and receive frequencies Tape and reel available | <ul style="list-style-type: none"> ■ Easy installation Surface mount Tape and reel packaging ■ Design flexibility Smaller size Lower cost Low profile ■ Features Low frequency drift vs. temperature High Q Excellent isolation between transmit and receive frequencies Tape and reel available | <ul style="list-style-type: none"> ■ Easy installation Reflow solderable available ■ Design flexibility Smallest size Leaded and surface mount Low profile PC mount Connectorized Tape and reel available ■ Features Excellent size/performance ratio Wide range of transfer functions available Hermetically sealed packages available ■ Performance 8% to 100% bandwidth Lowest cost IF filter alternative |
| | Performance Characteristics | <ul style="list-style-type: none"> ■ Frequency range 400 MHz to 5 GHz ■ Q range 200 - 35,000 ■ Temperature stability ±5 ppm/°C ■ Temperature range -55°C to +125°C ±0.3% from -20°C to +80°C ■ Frequency tolerance range ±0.5% <p>Pages 27-28 www.specwave.com/cr</p> | <ul style="list-style-type: none"> ■ Frequency range 400 MHz to 5 GHz standard Other frequencies available (consult factory) Custom specifications available ■ Q range 400 - 2,000 ■ Impedance 50 Ω and 75 Ω ■ Temperature stability ±5 ppm/°C ■ Temperature range -30°C to +85°C <p>Pages 48-50, 55-56 www.specwave.com/resband</p> | <ul style="list-style-type: none"> ■ Frequency range 300 MHz to 5.8 GHz standard Custom specifications available ■ Q range 100 - 1200 ■ Impedance 50 Ω and 75 Ω ■ Temperature stability ±5 ppm/°C ■ Temperature range -30°C to +85°C <p>Pages 51-54, 57-60 www.specwave.com/monoband</p> |
| <p>Filter Application Key:</p>  Bandpass  Highpass  Lowpass  Band reject  Duplex  Multiplex | | | | |

RF & Microwave Components and Systems Selection Guide

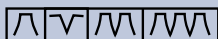
MICROWAVE FILTERS

Cavity Filters

- Interdigital • Combine
- Ceramic Loaded • Helical



Avionics, military, base stations, test instrumentation, and communications



- **Design flexibility**
Easily duplexed
Wide range of configurations
- **Features**
Wide range of bandwidths to 100%
Excellent temperature stability
Low loss
High peak power
Low IMD designs available
Very high selectivity

- **Filter attributes**
Bandpass:
60 MHz - 40 GHz
Band Reject:
60 MHz - 20 GHz
Duplexer/Multiplexer:
60 MHz - 40 GHz

Pages 39-41
www.specwave.com/cavity

Waveguide Filters



Avionics, digital radios, repeaters, Point to Point, transmit filters, and satellite communications



- **Design flexibility**
Flanges or connectorized
- **Performance**
0.1 to 20% bandwidth
Extremely low loss
High power handling
Extremely low loss
High power capacity

- **Filter attributes**
Bandpass:
2 GHz - 40 GHz
Lowpass:
2 GHz - 40 GHz
Band Reject:
2 GHz - 40 GHz
Duplexer:
2 GHz - 40 GHz

Pages 42-43
www.specwave.com/waveg

Tubular Filters



Instrumentation, medical, and high power harmonic rejection



- **Design flexibility**
Rapid prototyping
- **Features**
Low loss
High power handling
Low cost
Broad stop band characteristics

- **Filter attributes**
Bandpass:
30 MHz - 5 GHz
Lowpass:
30 MHz - 20 GHz

Pages 44-45
www.specwave.com/tubular

Suspended Substrate Filters



ECM, ECCM, ELINT, and ultra broadband receivers



- **Design flexibility**
Ideal for multiplexing
- **Features**
Multi-octave bandwidths
High selectivity
Low profile

- **Filter attributes**
Bandpass:
2 GHz - 20 GHz
Highpass:
2 GHz - 20 GHz
Lowpass:
300 MHz - 20 GHz
Band Reject:
2 GHz - 20 GHz
Duplexer/Multiplexer:
2 GHz - 20 GHz

Pages 46-47
www.specwave.com/substrate

Filter Application Key:



Bandpass



Highpass



Lowpass



Band reject



Duplex



Multiplex

Applications











Features / Benefits

Performance Characteristics

RF & Microwave Components and Systems Selection Guide

| | | BASE STATION PRODUCTS | | MICROWAVE SUBSYSTEMS & ASSEMBLIES | |
|--|---------------------|---|---|---|--|
| | | Filters & Duplexers | Custom Assemblies | Microwave Subsystems | Switched Filter Banks |
| | |  |  |  |  |
| Applications | | WCDMA, WLL, GSM, PCS, AMPS, UMTS, and IMT-2000 | PCS, Cellular, GSM, UMTS, AMPS, CDMA, GPRS, WiMax, ISM, DCS, MMDS, WLAN | GPS positioning systems, airborne and ground radars, test verification sets, microwave sources for test sets and radio communication systems | Communication and navigation systems, microwave receiver front ends (including preselection and amplification), radar and electronic warfare assemblies |
| | |  |  | |  |
| | Features / Benefits |  Combiners  Power Dividers  Delay Line Assemblies  Duplexers/LNA Assemblies | <ul style="list-style-type: none"> ■ Design flexibility The integration of filter-based products with critical microwave devices (for example: switches, power dividers, amplifiers, ferrites, etc.) is an alternative to several individual components which may be larger, more costly and exhibit lower performance than our multifunction assemblies ■ Features Integration improves performance and reduces cost and size Rack mount packages for test systems | <ul style="list-style-type: none"> ■ Non-Linear frequency devices ■ Reduced Size ■ Enhanced performance by utilizing optimized filters ■ Minimized mismatches and ripple through tuning and impedance match control | <ul style="list-style-type: none"> ■ Enhanced system performance Filter optimization into switch manifolds Improved amplitude ripple Improved phase response Lower overall amplitude losses or better noise figure performance Reduced size ■ Reduces processing cost through less: Less documentation Fewer incoming inspections Easier implementation Less maintenance |
| Performance Characteristics | |  Band Reject or Notch Filters  Multicouplers | <ul style="list-style-type: none"> ■ Filter based assemblies including Receiver multicouplers Tx combiners Duplexer/Filter/LNA Tower top amplifiers Base station combiner assemblies Feed forward amplifiers Delay lines Receivers | <ul style="list-style-type: none"> ■ Passbands DC to 20 GHz ■ Rejections DC to 50 GHz | <ul style="list-style-type: none"> ■ Passbands DC to 26 GHz ■ Rejections DC to 40 GHz |
| | | Pages 64-69 www.specwave.com/base | Pages 64-69 www.specwave.com/base | Pages 70-88 www.specwave.com/integrated | Pages 71-76 www.specwave.com/sfb |
| Filter Application Key:  Bandpass  Highpass  Lowpass  Band reject  Duplex  Multiplex | | | | | |

RF & Microwave Components and Systems Selection Guide

| | | MICROWAVE SUBSYSTEMS & ASSEMBLIES | | | ANTENNAS | | |
|-------------------------|--|--|---|--|---|--|---|
| | | Frequency Multipliers | Microwave Synthesizers | Filtered Low Noise Amplifiers | Patch Antenna Elements & Assemblies | | |
| Applications | |  |  |  |  | | |
| | | Test and measurement equipment, radio communication systems, and radar equipment | Test and measurement equipment, and radio communication | GPS Receivers (L1, L1/L2, L1/L5) | GPS, GlobalStar, Inmarsat, ISM, SDARS | | |
| | | | |  | | | |
| Features / Benefits | | <ul style="list-style-type: none"> Low spurious Low Phase Noise Integral voltage regulation Designed to meet MIL-spec requirements | <ul style="list-style-type: none"> Low Phase Noise Low spurious Hermetically sealed packages Designed to meet MIL-spec requirements | <ul style="list-style-type: none"> Integrated filters for excellent rejection Rugged form factor suitable for harsh environments Hermetically sealed packages Designed to meet MIL-Spec requirements | <ul style="list-style-type: none"> Design flexibility Various size configurations: · 13 mm x 13 mm x 3 mm · 16 mm dia. x 6 mm · 18 mm x 18 mm x 4 mm · 25 mm x 25 mm x 4 mm · 27 mm x 27 mm x 6 mm · 37 mm x 37 mm x 4 mm · 50 mm x 50 mm x 3 mm Designed for optimal performance on customer ground plane Easy installation Surface mount Silver plated electrode and probe Performance Low frequency drift vs. temperature Low return loss Offset single-point feeding method | | |
| | | <ul style="list-style-type: none"> Less than 120 nsec switching speeds 100 MHz to 24 GHz passbands | <ul style="list-style-type: none"> Frequency Range 100 MHz to 18 GHz Spurious <-55 dBc Tuning speeds Sub-microsecond | <ul style="list-style-type: none"> Excellent noise figure of 1.6 dB typical Standard gain values from 14 to 45 dB | <ul style="list-style-type: none"> Frequency range 1 GHz to 3 GHz Custom frequencies available upon request Impedance Determined by design Environmental Determined by material Right and left hand polarization | | |
| | | <p>Pages 83-87 www.specwave.com/multiplier</p> | <p>Page 88 www.specwave.com/synthesizer</p> | <p>Pages 78-80 www.specwave.com/lna</p> | <p>Pages 89-91 www.specwave.com/patch</p> | | |
| Filter Application Key: | |  Bandpass |  Highpass |  Lowpass |  Band reject |  Duplex |  Multiplex |



Microwave Engineering Expertise

The new Spectrum Microwave offers an extensive design library including the combined efforts of our engineers from FSY Microwave, Salisbury Engineering, Q-Bit, Magnum Microwave, Radian Technologies and Amplifonix. This talented staff of engineering professionals comes from a diverse set of design backgrounds including system, amplifier, filter, receiver, oscillator, and synthesizer experience.

We have designed components performing over the full military temperature ranges as well as for space and other hostile environments. Our operating frequency range stretches from the low end of the frequency spectrum up to 50 GHz.

Advanced Design Technology

Our engineers prefer to design using proven circuits and approaches, but they also explore the use of more exotic methods.

Spectrum Microwave conducts internal research and development programs that attempt to exploit new technologies. Some examples include MEMS RF switches, high speed

Schottky and silicon PIN level limiting, GaAs PIN diode switching, and high-speed direct frequency synthesizers. We also have demonstrated stopband performance to 40 GHz and ripple reduction in switched filter banks through control of impedance transitions between switches and filters.

World Class Quality

Spectrum Microwave applies the principles of Spectrum Control's Quality Management System to deliver the world class quality and consistency that our customers demand. The efficiencies gained from our manufacturing procedures enable us to cost effectively produce small volume custom products and high run standard products. We monitor critical phases of the production process with data logging technology. Our engineers are integrally involved throughout the process, ensuring the quality required of our ISO9001 and QS9000 certifications.



www.specwave.com

Testing and Verification

Integral to finding solutions to frequency control problems is the ability to test for compliance. In order to successfully test these complex designs, we have invested heavily in high-performance test equipment including Agilent PNA network analyzers with calibrated performance to 50 GHz, low-phase noise signal generators, an Agilent ES5500 phase noise measurement system, and additional in-house environmental test equipment.

Using this equipment, we have measured the vibration-induced phase noise modulation performance of systems and components employing narrow-band filtering. Our ability to conduct such a wide range of tests in-house allows for a faster turnaround of your complete design solution.

In-House Environmental Testing

| Test | MIL-STD-883 | | MIL-STD-202 | |
|---------------------------|-------------|----------------|-------------|-----------|
| | Method | Condition | Method | Condition |
| Vibration | - | - | 204 | G |
| Thermal Shock | - | - | 107 | A-1 |
| Immersion | 1016 | - | 104 | A |
| Salt Spray | 1001 | - | 101 | B |
| Moisture Resistance | 1002 | II | 106 | - |
| Mechanical Shock | 2004 | - | 213 | I |
| Barometric Pressure | 3001 | - | 105 | C |
| Resistance to Solder Heat | - | - | 210 | B |
| Terminal Strength | - | - | 211 | A |
| Contact Resistance | - | - | 307 | - |
| Life | - | - | 108 | D |
| Durability | - | - | - | - |
| Solderability | - | - | 208 | - |
| Internal Visual | 2017 | - | - | - |
| Stabilization Bake | 1008 | 24 hrs@150°C | - | - |
| Temperature Cycle | 1010 | -65°C to 150°C | - | - |
| Constant Acceleration | 2001 | 5000 G y1 | - | - |
| Hermetic Seal | 1014 | A and C | - | - |
| Burn In | 1015 | 168 hrs@85°C | - | - |
| External Visual | 2009 | - | - | - |

Unique In-House Testing Capabilities

- Phase noise testing
- MIL-PRF-38534 Class H
- ESS – environmental stress screening
- Analytical circuit design
- Surge testing and power handling
- EN testing for European requirements
- All screening performed on-site
- All group testing performed on-site

| Test | Method | MIL-STD |
|--------------------------------|---------------------------------------|---------|
| AC Voltage Drop | AC measurement across the terminals | 202 |
| Insertion Loss | Per MIL-STD-1344 with or without load | 202 |
| Insertion Loss at temperatures | -55°C to 125°C | 202 |
| DPA Filter | Per Mil-C-123 | 202 |
| DPA Capacitor | DPA to Mil-C-123 | 202 |
| Steady State Life | Test Method 1005 | 883 |
| Die Shear Strength | Test Method 2019 | 883 |



rf & microwave solutions development



specification development

Our application specialists and design engineers will assist your team at every stage of the wireless product design process. Beginning with the conceptual model and progressing through the final test, we have the knowledge and experience to help you identify and avoid potential development problems early in the design process. Our many years of experience and breadth of product line allow us to troubleshoot designs and provide solutions to optimize your microwave system.

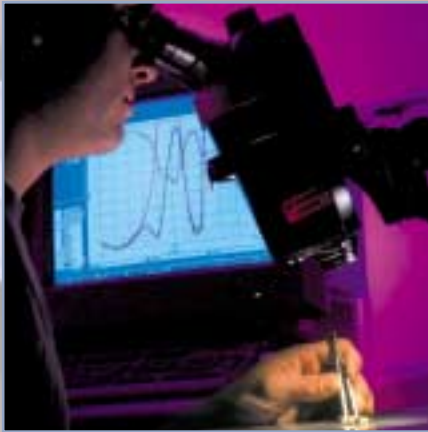


simulation & design

Spectrum Microwave uses the most advanced simulation technology for a comprehensive microwave system review. Our engineering teams apply filter synthesis software to model and design both components and integrated sub-systems. We subsequently verify and qualify these designs using sophisticated test equipment, methodology and software. Through our simulation expertise and the early involvement of our engineers in your development process, we will reduce overall design cycle time to meet your needs for a faster time-to-market.



ISO 9001
CERTIFIED
QS 9000
CERTIFIED



prototyping

We have consistently invested in the technology and equipment to provide our customers with quick-turn prototypes. Enhancing our response time is our ability to rapidly design and manufacture test and pre-production fixturing to insure consistent results. We apply these electrical and mechanical aspects into a prototype build to demonstrate the product's performance and manufacturability.



testing

All Spectrum Microwave wireless products are 100% tested for key electrical characteristics. In order to provide the most accurate and specific test procedures, our engineering staff has developed custom and automated test equipment that is positioned at critical points in our manufacturing operation. We administer our test procedures for not only prototypes, but for each and every wireless product we manufacture. This focus on quality and reliability is part of the commitment we make to our customers.



manufacturing

Spectrum Microwave offers the world class manufacturing necessary to deliver the Six Sigma reliability our customers demand. We are a vertically integrated manufacturer utilizing multiple locations for in-house capabilities ranging from producing ceramic antenna elements and RF filters, to ceramic resonators and capacitors. As a testament to our quality commitment, our facilities and processes are ISO9001 and QS9000 certified.



logistics

Integral to any company's success today is effective inventory and logistics management. Spectrum Microwave is ready to partner with its customers to help achieve this goal. Our flexible and global manufacturing system allows us to quickly ramp-up production and meet your fast-track program delivery requirements. We utilize tools such as schedule sharing that enable us to manage our production system to meet your anticipated requirements.

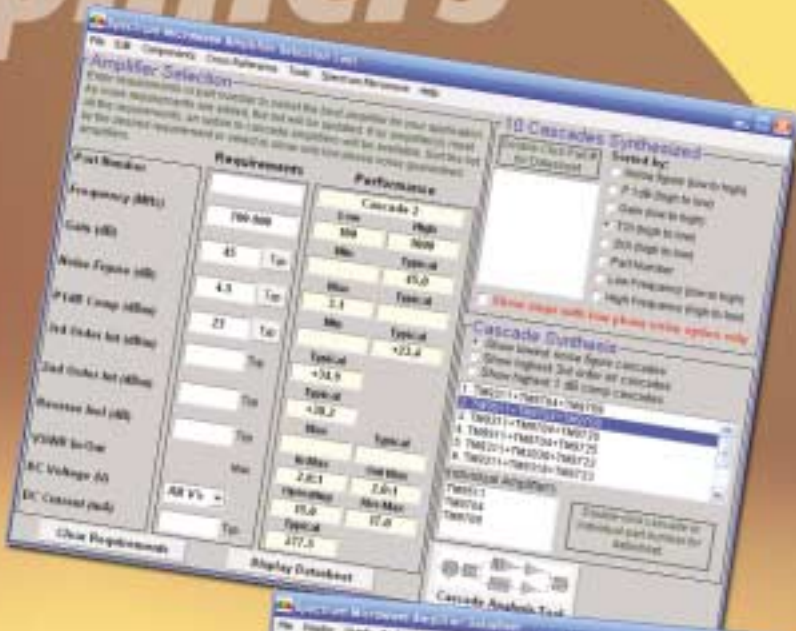
Cascade Design Suite



An innovative microwave design engineering software tool, download the most current version at www.specwave.com/cascade

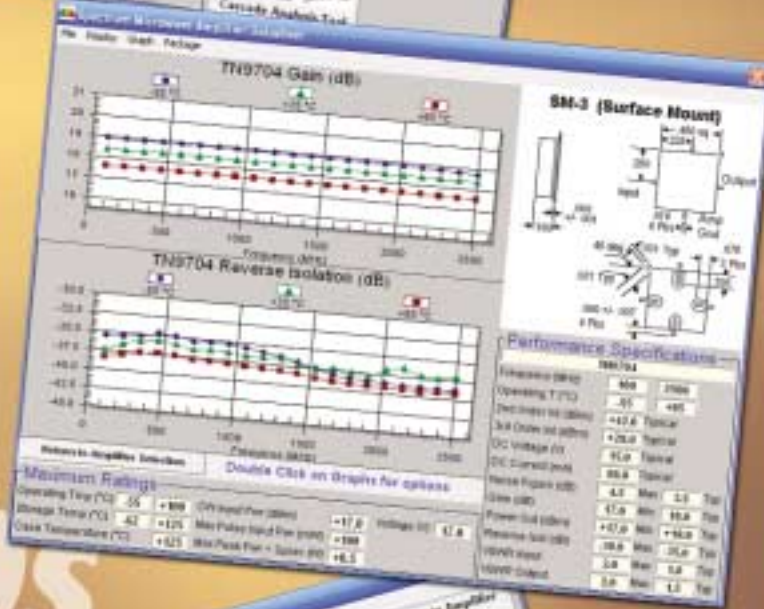
control
products

Amplifiers



Catalog Search

- Over 750 datasheets on amplifiers, mixers, oscillators, detectors, limiters, limiting amps, attenuators and switches
- Industry's best part number cross reference for Avantek-Avnet, Cougar, M/A-COM, Watkins- Johnson/Stellex, Phoenix Microwave, Vari-L and Motorola
- Submit an RFQ for a custom design
- Review datasheets for each selected component
- Search entire Spectrum Microwave product line
- Save information as a spreadsheet for export to another software program



System Simulator

- Optimize your design by viewing individual component contribution to overall system performance
- Quickly evaluate trade-offs in component selection and their impact on system performance (eg. gain, noise and power)
- Efficiently visualize your block diagram concept



VCOs

Mixers



Amplifonix • FSY Microwave
 Magnum Microwave • Q-Bit
 Radian Technologies • Salisbury Engineering



rf & microwave component & system solutions @ specwave.com

- Learn about all of Spectrum Microwave's products
- Updated versions of more than 900 product datasheets
- Most current version of Cascade Design Suite
- Reference tools and White Papers
- Create a custom design project per your individual specifications





SPECTRUM CONTROL INC.

**a control products
systems company**

Spectrum Microwave is a wholly owned subsidiary of Spectrum Control. Founded in 1968, Spectrum Control is a solutions-oriented company designing and manufacturing products to suppress or eliminate Electromagnetic Interference (EMI). Over time, Spectrum Control has evolved into a world leader in the design and manufacture of control products and systems used to condition, regulate and govern electronic performance.

Spectrum products are used in virtually all industries worldwide including telecommunications, medical, government, military, aerospace, computer and industrial controls. In addition, we've secured preferred supplier status with many of the leading OEMs around the world.

Spectrum Control has established a worldwide sales, manufacturing and distribution network that provides our customers with responsive, time critical service. Our global reach gives us a presence in North America, Europe and Asia. This commitment to supporting our customers' logistical requirements is further evidenced by our recent opening of a new manufacturing plant in Guang Dong, China.

Spectrum offers world class manufacturing capable of satisfying the most demanding production schedules. Our flexible manufacturing system allows us to quickly ramp-up production to meet fast track program delivery requirements. All Spectrum Control facilities and processes are ISO9001 certified.

Spectrum Microwave



RF & Microwave Components, Modules & Systems

- Amplifiers & mixers
- VCOs & DROs
- Microwave filters
- Switched filter banks
- Integrated microwave subsystems
- Ceramic filters & resonators
- Patch antennas & assemblies

www.specwave.com

Signal & Power Integrity Group



EMI & Surge Components & Modules

- Discrete EMI filters
- Filtered arrays and interconnects
- Surface mount inductors & capacitors
- ESD/EFT protected connectors
- Power entry & power line filters
- Military/multisection filters
- Gaskets & shielding

www.specemc.com

Power Management Systems Group



Power Distribution & Remote Management Systems

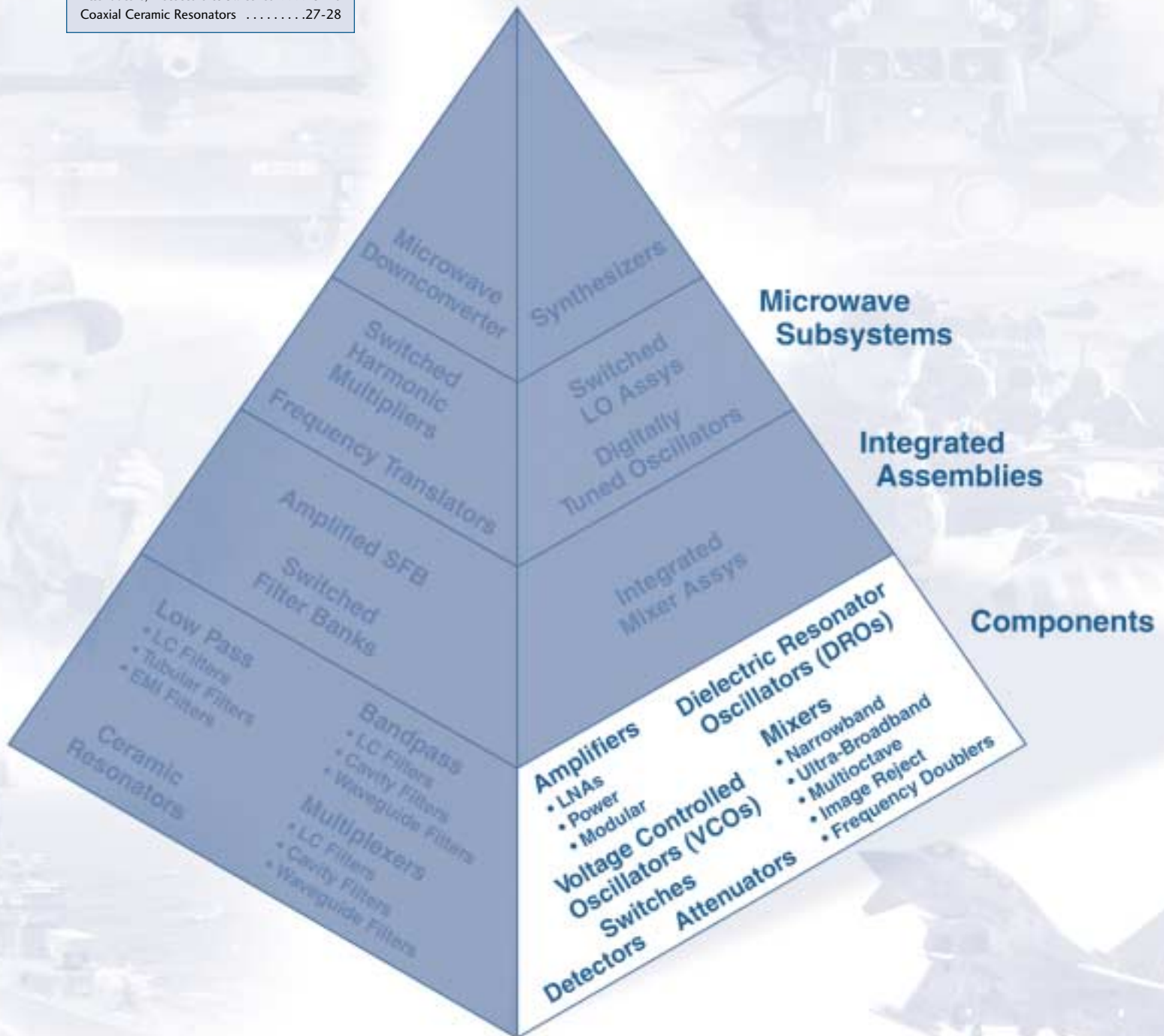
- AC/DC power distribution units
- Remote reboot & power management systems
- Circuit protection panels
- Custom AC & DC power assemblies
- AC power distribution strips

www.specpower.com

www.spectrumcontrol.com

Frequency Control Components

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| Dielectric Resonator Oscillators (DROs) | 24 |
| Attenuators, Detectors & Switches | 25-26 |
| Coaxial Ceramic Resonators | 27-28 |



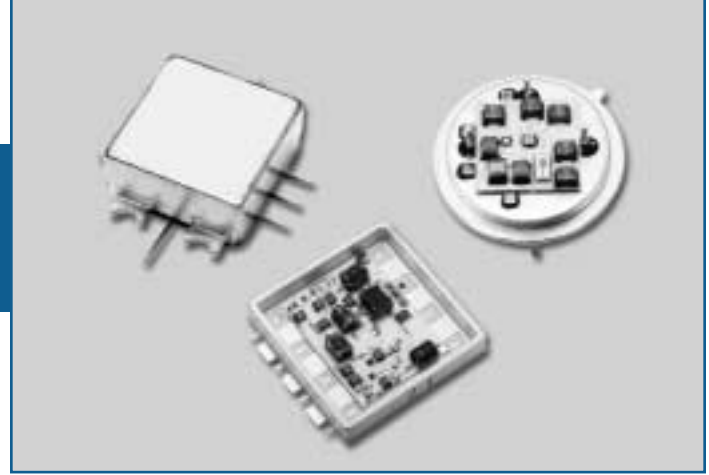
Amplifiers

- LNAs • Power Amps
- Driver Amps • Broadband Amps

Spectrum Microwave's hybrid amplifier product line (formerly Q-Bit and Amplifonix) covers frequency ranges from 0.5 MHz to 6 GHz. These amplifiers are available in many industry standard surface mount, drop-in and connectorized housings, and are well suited for military, CATV, medical and telecommunication and commercial markets. Spectrum amplifiers provide a wide dynamic range with high linearity and are a cost effective solution.

Features

- High reverse isolation
- Low phase noise performance
- Screening to MIL-STD-883
- Industry standard package options
- Over 500 standard products available



Applications

- Military communication systems
- Avionics
- Radar systems
- Telecommunication base stations
- Medical devices
- Test and measurement

Typical Performance Characteristics

Frequency Range 0.5 MHz to 6 GHz

Gain 8 dB to 29 dB typ

Noise Figure from <1 dB to 4 dB

Operating Temperature -40°C to +85°C typ

Higher Power Amplifiers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency Range (MHz) | Gain - typ (dB) | Power: 1 dB Compression - typ (dBm) | Noise - typ (dB) | Rev. Isolation - typ (dB) | IP3 - typ (dBm) | IP2 - typ (dBm) | Power Supply DC - typ |
|-------------|-----------------------|-----------------|-------------------------------------|------------------|---------------------------|-----------------|-----------------|-----------------------|
| QBS-368 | 2400 - 2450 | 32.0 | 46.0 | - | - | 55.0 | - | 15.0 |
| QBS-230 | 800 - 960 | 39.0 | 43.0 | - | -50.0 | 53.0 | - | 12.5 |
| QBS-367 | 2400 - 2450 | 32.0 | 42.0 | - | -50.0 | 52.0 | - | 13.0 |
| QBS-227 | 860 - 910 | 42.0 | 39.0 | - | -60.0 | 49.0 | - | 24.0 |
| BXMP1004 | 50 - 250 | 31.0 | 33.5 | 3.5 | -38.0 | 43.0 | 63.0 | 15.0 |
| BXMP1008 | 50 - 250 | 17.0 | 33.5 | 5.6 | -20.0 | 43.0 | 63.0 | 15.0 |
| QBS-158 | 800 - 960 | 21.5 | 33.0 | 2.5 | -24.0 | 50.0 | - | 14.0 |
| QBS-2561 | 800 - 2000 | 24.0 | 33.0 | - | -35.0 | 47.0 | - | 15.0 |
| BXMP1001 | 0.5 - 35 | 22.0 | 32.0 | 3.7 | -27.0 | 49.0 | 93.0 | 24.0 |
| BXMP1003 | 5 - 35 | 22.0 | 32.0 | 3.7 | -27.0 | 49.0 | 93.0 | 24.0 |

Low Noise Amplifiers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency Range (MHz) | Gain - typ (dB) | Power: 1 dB Compression - typ (dBm) | Noise - typ (dB) | Rev. Isolation - typ (dB) | IP3 - typ (dBm) | IP2 - typ (dBm) | Power Supply DC - typ |
|-------------|-----------------------|-----------------|-------------------------------------|------------------|---------------------------|-----------------|-----------------|-----------------------|
| QBH-8713 | 890 - 915 | 15.8 | 27.0 | 1.0 | -21.0 | 42.0 | - | 15.0 |
| QBH-2003 | 800 - 960 | 20.0 | 18.0 | 1.0 | - | 30.0 | - | 5.0 |
| TR9755 | 800 - 1200 | 26.0 | 14.0 | 1.0 | -38.0 | 25.0 | 40.0 | 5.0 |
| TR9770 | 800 - 1200 | 25.0 | 14.0 | 1.0 | -38.0 | 25.0 | 40.0 | 15.0 |
| TM3086 | 1400 - 1600 | 16.0 | 19.0 | 1.0 | -22.0 | 33.0 | 42.0 | 15.0 |
| TR9756 | 1200 - 1700 | 27.0 | 15.0 | 1.0 | -38.0 | 26.0 | 40.0 | 5.0 |
| TR9771 | 1200 - 1700 | 27.0 | 15.0 | 1.0 | -38.0 | 26.0 | 40.0 | 15.0 |
| QBH-8756 | 1850 - 1910 | 22.5 | 20.0 | 1.0 | -40.0 | 35.0 | - | 15.0 |
| QBH-2001 | 1800 - 2200 | 13.0 | 17.0 | 1.0 | - | 32.0 | - | 5.0 |
| QBH-8714 | 800 - 825 | 16.0 | 27.0 | 1.1 | -21.0 | 41.0 | - | 15.0 |

Amplifiers

Higher Gain Amplifiers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency Range (MHz) | Gain - typ (dB) | Power: 1 dB Compression - typ (dBm) | Noise - typ (dB) | Rev. Isolation - typ (dB) | IP3 - typ (dBm) | IP2 - typ (dBm) | Power Supply DC - typ |
|-------------|-----------------------|-----------------|-------------------------------------|------------------|---------------------------|-----------------|-----------------|-----------------------|
| QBS-227 | 860 - 910 | 42.0 | 39.0 | | -60.0 | 49.0 | | 24.0 |
| QBS-230 | 800 - 960 | 39.0 | 43.0 | | -50.0 | 53.0 | - | 12.5 |
| TR9666 | 10 - 1000 | 37.0 | 15.5 | 3.5 | -52.0 | 25.0 | 31.0 | 15.0 |
| TM6683 | 10 - 250 | 34.0 | -1.0 | 2.0 | -47.5 | 10.0 | 9.0 | 5.0 |
| TR5853 | 100 - 300 | 33.5 | 22.5 | 1.8 | -37.0 | 36.0 | 45.0 | 15.0 |
| TM6719 | 5 - 500 | 33.0 | 9.0 | 1.7 | -42.0 | 20.0 | 36.0 | 15.0 |
| TR6535 | 10 - 400 | 32.5 | 22.0 | 1.8 | -36.0 | 37.0 | 48.0 | 15.0 |
| TM3046 | 5 - 200 | 32.0 | 3.0 | 3.0 | -42.0 | 16.0 | 26.0 | 5.0 |
| TM7203 | 5 - 250 | 32.0 | 8.0 | 3.0 | -40.0 | 18.0 | 30.0 | 15.0 |
| TR3044 | 200 - 300 | 32.0 | 21.0 | 1.8 | -37.5 | 33.0 | 45.0 | 15.0 |

Lower Power Amplifiers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency Range (MHz) | Gain - typ (dB) | Power: 1 dB Compression - typ (dBm) | Noise - typ (dB) | Rev. Isolation - typ (dB) | IP3 - typ (dBm) | IP2 - typ (dBm) | Power Supply DC - typ |
|-------------|-----------------------|-----------------|-------------------------------------|------------------|---------------------------|-----------------|-----------------|-----------------------|
| TM9266 | 10 - 2000 | 17.0 | 14.5 | 4.5 | -26.0 | 27.5 | 43.0 | 15.0 |
| TM3059 | 450 - 950 | 25.0 | 14.5 | 3.5 | -30.0 | 27.0 | 34.0 | 5.0 |
| TM6607 | 5 - 500 | 15.0 | 14.5 | 5.0 | -19.0 | 24.0 | 34.0 | 24.0 |
| TM5544 | 10 - 500 | 12.5 | 14.5 | 2.5 | -15.5 | 27.0 | 33.0 | 5.0 |
| TM5519 | 5 - 500 | 15.0 | 14.5 | 2.3 | -18.0 | 29.0 | 39.0 | 5.0 |
| TM7381 | 20 - 250 | 24.5 | 14.5 | 2.2 | -31.0 | 27.0 | 32.0 | 15.0 |
| TM6112 | 10 - 200 | 16.4 | 14.5 | 2.0 | -20.0 | 28.0 | 38.0 | 15.0 |
| TM9336 | 100 - 2300 | 17.5 | 14.0 | 4.5 | -30.0 | 25.0 | 35.0 | 15.0 |
| TM3094 | 50 - 2000 | 19.5 | 14.0 | 4.0 | -35.0 | 27.0 | 46.0 | 5.0 |
| TM9522 | 5 - 1500 | 20.5 | 14.0 | 5.0 | -30.0 | 25.0 | 42.0 | 15.0 |

High Reverse Isolation Amplifiers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency Range (MHz) | Gain - typ (dB) | Power: 1 dB Compression - typ (dBm) | Noise - typ (dB) | Rev. Isolation - typ (dB) | IP3 - typ (dBm) | IP2 - typ (dBm) | Power Supply DC - typ |
|-------------|-----------------------|-----------------|-------------------------------------|------------------|---------------------------|-----------------|-----------------|-----------------------|
| QBH-172 | 1 - 100 | 15.0 | 16.0 | 3.3 | -27.0 | 31.0 | 45.0 | 15.0 |
| QBH-105 | 5 - 300 | 12.2 | 8.0 | 3.0 | -27.0 | 22.0 | 30.0 | 15.0 |
| QBH-155 | 5 - 300 | 15.0 | 22.0 | 6.2 | -26.0 | 37.0 | 50.0 | 15.0 |
| QBH-102 | 5 - 500 | 12.3 | 21.0 | 7.0 | -23.0 | 34.0 | 49.0 | 15.0 |
| QBH-132 | 15 - 700 | 14.8 | 16.0 | 6.5 | -27.0 | 29.0 | 39.0 | 15.0 |
| QBH-171 | 10 - 150 | 13.5 | 27.0 | 7.0 | -25.0 | 40.0 | 50.0 | 15.0 |
| QBH-137 | 10 - 200 | 12.7 | 21.0 | 3.5 | -25.0 | 37.0 | 48.0 | 15.0 |
| QBH-8719 | 30 - 145 | 21.5 | 25.0 | 2.5 | -32.0 | 40.0 | 51.0 | 15.0 |
| QBH-8115 | 30 - 145 | 21.5 | 25.0 | 2.5 | -32.0 | 40.0 | 51.0 | 15.0 |
| QBH-5847 | 30 - 1000 | 9.0 | 10.0 | 4.8 | -22.0 | 23.0 | 33.0 | 15.0 |

Low Phase Noise Amplifiers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency Range (MHz) | Gain - typ (dB) | 1 dB Comp. - typ (dBm) | Noise - typ (dB) | Supply (DC) (mA) | | Residual Phase Noise - typ (dBc/Hz) | | | | |
|-------------|-----------------------|-----------------|------------------------|------------------|------------------|-----|-------------------------------------|-------|--------|---------|-------|
| | | | | | | | 100 Hz | 1 kHz | 10 kHz | 100 kHz | 1 MHz |
| TM5155PM | 5-300 | 15 | 22 | 5.0 | 15 | 85 | -162 | -175 | -178 | -178 | -178 |
| TM6155PM | 300-1000 | 12.5 | 19.5 | 4.0 | 15 | 50 | -160 | -174 | -177 | -177 | -177 |
| TM9119PM | 10-1000 | 7 | 21 | 8.5 | 15 | 100 | -165 | -172 | -177 | -179 | -179 |
| TM5125PM | 5-125 | 20.5 | 24 | 2.0 | 15 | 80 | -162 | -175 | -176 | -176 | -176 |
| TM5138PM | 5-150 | 15 | 24.5 | 2.7 | 15 | 88 | -158 | -163 | -176 | -176 | -176 |
| TM5834PM | 10-100 | 19.7 | 27.5 | 3.5 | 15 | 135 | -162 | -172 | -176 | -176 | -176 |
| TM5103PM | 5-300 | 11.5 | 23 | 5.0 | 15 | 85 | -160 | -168 | -175 | -177 | -178 |
| TM5137PM | 10-200 | 12.7 | 22.5 | 3.5 | 15 | 75 | -165 | -170 | -175 | -178 | -178 |
| TM5325PM | 5-125 | 20.5 | 24 | 2.0 | 12 | 85 | -170 | -175 | -175 | -176 | -175 |
| TM5338PM | 5-150 | 15 | 25 | 2.7 | 12 | 88 | -162 | -172 | -175 | -178 | -178 |

Mixers

Spectrum Microwave's hybrid mixer product line (formerly Magnum Microwave) covers frequency ranges from 0.5 MHz to 26.5 GHz. Available in many industry standard surface mount, drop-in and connectorized housings, these mixers are ideal for high reliability applications. Spectrum mixers are offered in both double or triple balanced configurations for a broad frequency response. Additionally, other diode-based versions include frequency doublers to 20 GHz, Image Reject and I/Q Modulators to 16 GHz.

Features

- Industry standard package options
- Standard and custom designs available
- Double and triple balanced designs
- Over 150 standard designs available



Applications

- Mixers for multioctave, narrowband, ultra-broadband requirements
- Military communication systems
- Avionics
- Radar systems
- Phase detectors

Typical Performance Characteristics

Mixer Frequency Range 0.5 MHz to 26.5 GHz
 Frequency Doubler Frequency Range 5 MHz to 20 GHz
 Image Reject & I/Q Modulator
 Frequency Range 5 MHz to 16 GHz
 LO Power from +7 to 23 dBm
 Conversion Loss from 5.5 to 10 dB typ
 Operating Temperature -40°C to +85°C typ

RF Mixers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency (MHz) RF | Frequency (MHz) LO | Frequency (MHz) IF | LO Pwr (dBm) | CL (dB) | Package Style |
|-------------|--------------------|--------------------|--------------------|--------------|---------|---------------|
| M53T | 10-1500 | 10-1500 | DC-800 | +7 | 7.0 | TO-8 |
| M56T | 10-1500 | 10-1500 | DC-800 | +13 | 6.5 | TO-8 |
| M57T | 10-1500 | 10-1500 | DC-1000 | +23 | 7.5 | TO-8 |
| M6xT | 1000-2000 | 1000-2000 | DC-1000 | +7 to +23 | 8.0 | TO-8 |
| M73T | 800-2400 | 800-3500 | DC-1500 | +7 | 9.0 | TO-8 |
| M24T | 1-3400 | 1-3400 | 1-2000 | +10 | 8.0 | TO-8 |

Communication Band (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency (GHz) RF | Frequency (GHz) LO | Frequency (GHz) IF | LO Pwr (dBm) | CL (dB) | Package Style |
|--------------|--------------------|--------------------|--------------------|--------------|---------|--------------------|
| MC5xMS-5&14 | 3.5-12.0 | 3.5-12.0 | DC-4.0 | +7 to +18 | 7.0 | Microstrip Carrier |
| MC5xSMx-7&14 | 3.5-15.0 | 3.5-15.0 | DC-4.0 | +7 to +18 | 7.5 | Surface Mount |
| MC5xMS-7&15 | 3.5-15.0 | 3.5-15.0 | DC-4.0 | +7 to +18 | 7.5 | Microstrip Carrier |
| MC134MS-3&14 | 17.0 to 24.0 | 15.0 to 26.0 | DC-4.0 | +10 | 8.5 | Microstrip Carrier |
| MC13xN-3 | 17.0 to 24.0 | 15.0 to 26.0 | DC-4.0 | +10 | 8.5 | SMA Connect. |

Octave Band Mixers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency (GHz) RF | Frequency (GHz) LO | Frequency (GHz) IF | LO Pwr (dBm) | CL (dB) | Package Style |
|-------------|--------------------|--------------------|--------------------|--------------|---------|---------------|
| MO4xxG | 4.0-8.0 | 3.5-8.5 | DC-2.0 | +7 to +19 | 8.5 | SMA Connect. |
| MO4xxN | 4.0-8.0 | 3.5-8.5 | DC-2.0 | +7 to +19 | 6.7 | SMA Connect. |
| MO6xxG | 6.0-12.5 | 5.0-15.0 | DC-2.5 | +7 to +19 | 8.8 | SMA Connect. |
| MO6xxN | 6.0-12.5 | 5.0-15.0 | DC-2.5 | +7 to +19 | 5.5 | SMA Connect. |

Mixers

Ultra Broadband Mixers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency (GHz) RF | Frequency (GHz) LO | Frequency (GHz) IF | LO Pwr (dBm) | CL (dB) | Package Style |
|--------------|--------------------|--------------------|--------------------|--------------|---------|--------------------|
| MM9xMS-14 | 2.0-18.0 | 2.0-18.0 | 2.0-5.0 | +10 to +21 | 8.0 | SMA Connect. |
| MM9xxG-40 | 0.5-18.0 | 0.5-18.0 | DC-0.3 | +7 to +19 | 7.0 | SMA Connect. |
| MM9xxG-21 | 2.0-18.0 | 2.0-18.0 | DC-0.6 | +7 to +10 | 8.5 | SMA Connect. |
| MM9xxG-3 | 2.0-18.0 | 2.0-18.0 | .01-4.0 | +10 to +21 | 7.3 | SMA Connect. |
| MM9xxL-1 | 2.0-18.0 | 2.0-18.0 | .01-4.0 | +10 to +21 | 7.3 | SMA Connect. |
| MM9xxL-15 | 2.0-18.0 | 2.0-18.0 | 2.0-8.0 | +10 to +21 | 8.5 | SMA Connect. |
| MM9xxG-2 | 2.0-18.0 | 2.0-18.0 | 1.0-12.0 | +10 to +21 | 7.0 | SMA Connect. |
| MM9xxN-1 | 2.0-19.0 | 2.0-19.0 | 1.0-9.0 | +10 to +21 | 8.0 | SMA Connect. |
| MM9xMS-6&-15 | 2.0-19.0 | 2.0-19.0 | 1.0-9.0 | +10 to +21 | 8.0 | Microstrip Carrier |
| MM9xMS-1&-17 | 1.8-20.0 | 1.8-20.0 | DC-0.8 | +7 to +18 | 7.2 | Microstrip Carrier |
| MM134xG-1 | 1.5-26.5 | 1.5-26.5 | DC-1.25 | +9 | 9.5 | SMA Connect. |

Multi-Octave Band Mixers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency (GHz) RF | Frequency (GHz) LO | Frequency (GHz) IF | LO Pwr (dBm) | CL (dB) | Package Style |
|----------------|--------------------|--------------------|--------------------|--------------|---------|--------------------|
| MM4xxG-10 | 2.0-8.0 | 2.0-8.0 | DC-1.5 | +7 to +19 | 6.7 | SMA Connect. |
| MM4xxL-10 | 2.0-8.0 | 2.0-8.0 | DC-1.5 | +7 to +19 | 6.7 | SMA Connect. |
| MM4xSMx-10&-14 | 2.0-8.0 | 2.0-8.0 | DC-1.5 | +7 to +18 | 8.0 | Surface Mount |
| MM4xxG-1 | 2.0-8.0 | 2.0-8.0 | .01-4.0 | +10 to +21 | 7.3 | SMA Connect. |
| MM4xxG | 2.0-8.0 | 2.0-8.0 | 2.0-6.0 | +10 to +21 | 7.3 | SMA Connect. |
| MM4xxL | 2.0-8.0 | 2.0-8.0 | 2.0-6.0 | +10 to +21 | 7.3 | SMA Connect. |
| MM4xxN-1 | 1.5-9.0 | 1.5-9.0 | .01-4.5 | +10 to +21 | 8.0 | SMA Connect. |
| MM4xMS&-15 | 1.5-9.0 | 1.5-9.0 | .01-4.0 | +10 to +21 | 6.5 | Microstrip Carrier |
| MM4xMS-10&-17 | 2.0-9.0 | 2.0-9.0 | DC-1.5 | +7 to +18 | 8.0 | Microstrip Carrier |
| MM6xxG-10 | 2.0-12.0 | 2.0-12.0 | DC-1.5 | +7 to +19 | 7.5 | SMA Connect. |
| MM6xxL-10 | 2.0-12.0 | 2.0-12.0 | DC-1.5 | +7 to +19 | 7.5 | SMA Connect. |
| MM8xMS-3&-14 | 5.0-15.0 | 3.0-17.0 | DC-2.0 | +7 to +14 | 8.5 | Microstrip Carrier |
| MM9xSMx&-14 | 6.0-18.0 | 6.0-18.0 | DC-2.5 | +7 to +13 | 6.9 | Surface Mount |
| MM9xxL | 6.0-18.0 | 6.0-18.0 | DC-3.0 | +7 to +19 | 7.0 | SMA Connect. |
| MM9xxN | 6.0-18.0 | 6.0-18.0 | DC-3.0 | +7 to +19 | 7.0 | SMA Connect. |
| MM9xxG-30 | 6.0-18.0 | 4.0-18.0 | DC-4.0 | +7 to +19 | 6.5 | SMA Connect. |
| MM9xxN-11 | 6.0-18.0 | 4.0-18.0 | DC-4.5 | +7 to +19 | 7.0 | SMA Connect. |
| MM9xxG | 6.0-18.0 | 6.0-18.0 | 1.5-8.0 | +10 to +21 | 7.7 | SMA Connect. |
| MM9xMS-3&-13 | 4.0-20.0 | 4.0-20.0 | DC-4.0 | +7 to +18 | 8.5 | Microstrip Carrier |

I/Q Mixer/Modulators & Image Reject Mixers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency (GHz) RF | Frequency (GHz) LO | Frequency (GHz) IF | LO Pwr (dBm) | CL (dB) | Package Style |
|-------------|--------------------|--------------------|--------------------|--------------|---------|--------------------|
| MIQ2xMS-1 | 1.4-2.8 | 1.4-2.8 | DC-0.5 | +10 to +17 | 6.0 | Microstrip Carrier |
| MIQ2xMS-2 | 1.9-4.2 | 1.9-4.2 | DC-0.5 | +10 to +17 | 6.0 | Microstrip Carrier |
| MIQ3xMS-3 | 3.0-6.0 | 3.0-6.0 | DC-0.3 | +10 to +17 | 6.5 | Microstrip Carrier |
| MIQ5xMS-1 | 5.6-9.0 | 5.6-9.0 | DC-0.5 | +10 to +17 | 5.0 | Microstrip Carrier |
| MIQ5xSMD-1 | 5.6-9.0 | 5.6-9.0 | DC-0.5 | +10 to +17 | 5.0 | Surface Mount |
| MIQ6xMS-1 | 5.5-13.5 | 5.5-13.5 | DC-0.5 | +10 to +17 | 5.3 | Microstrip Carrier |
| MIQ6xSMD-1 | 5.5-13.5 | 5.5-13.5 | DC-0.5 | +10 to +17 | 5.3 | Surface Mount |
| IRM5xMS-1 | 5.6-9.0 | 5.6-9.0 | .05-.09 | +10 to +17 | 5.0 | Microstrip Carrier |

Frequency Doublers (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency (GHz) Input | Frequency (GHz) Output | LO Power (dBm) | CL (dB) | Package Style |
|-------------|-----------------------|------------------------|----------------|---------|--------------------|
| FD34H-1 | 0.005-2.8 | 0.01-5.6 | +11 | 13.0 | Flatpak |
| FD34SM-1 | 0.005-2.8 | 0.01-5.6 | +11 | 13.0 | Surface Mount |
| FD9xxN-1 | 1.5-10.0 | 3.0-20.0 | +11 to +17 | 12.5 | SMA Connect. |
| FD9xMS1 | 2.0-10.0 | 4.0-20.0 | +11 to +17 | 13.0 | Microstrip Carrier |
| FD9xSMx-1 | 2.0-10.0 | 4.0-20.0 | +11 to +17 | 13.0 | Surface Mount |

VCOs

Spectrum Microwave's line of Voltage Controlled Oscillators (VCOs) features standard designs from a library of components designed by Radian Microwave, Magnum Microwave and Amplifonix. Frequency ranges from 25 MHz to 18 GHz.

Features

- Excellent linearity
- Low phase noise specified
- Available in industry standard packages
- Custom housings and specifications available
- Screening to MIL-STD-883B available
- Over 80 standard products available



Applications

- Transmitters and receivers
- Local oscillators
- Military and avionic electronics
- Synthesizers
- Test and measurement systems
- Telecommunications

Typical Performance Characteristics

Frequency Range..... 25 MHz to 18 GHz
 Tuning bandwidth from 20% to 70%
 Output Power +7 to +10 dBm
 Operating Temperature..... -40°C to +85°C typ

RF Band (Example parts. See databook or specwave.com for full list)

| SMV2 Part Number | TO-8 Part Number | Frequency Range (MHz) | Power Output (dBm) | Phase* Noise (dBc/Hz) | Bias Volt. (V) | Bias Cur. (mA) | Temp. Bands (°C) | Tuning Range (V) |
|------------------|------------------|-----------------------|--------------------|-----------------------|----------------|----------------|------------------|------------------|
| HV17SM-22 | HV17T-2 | 25-50 | +10 | -121 | +15 | 30 | -55 to +100 | 0 to +15 |
| HV17SM-12 | HV17T-1 | 50-100 | +10 | -120 | +15 | 30 | -55 to +100 | 0 to +20 |
| HV27SM-62 | HV27T-6 | 75-150 | +10 | -125 | +15 | 30 | -55 to +100 | 0 to +20 |
| HV27SM-112 | HV27T-11 | 100-200 | +10 | -125 | +15 | 25 | -55 to +100 | 0 to +20 |
| HV37SM-82 | HV37T-8 | 150-300 | +10 | -110 | +15 | 30 | -55 to +100 | 0 to +20 |
| HV37SM-112 | HV37T-11 | 200-400 | +10 | -123 | +15 | 15 | -55 to +100 | 0 to +20 |
| HV37SM-72 | HV37T-7 | 300-600 | +10 | -110 | +15 | 30 | -55 to +100 | 0 to +25 |
| HV47SM-12 | HV47T-1 | 400-800 | +10 | -105 | +15 | 30 | -55 to +100 | 0 to +25 |
| HV47SM-72 | HV47T-7 | 500-1000 | +10 | -103 | +15 | 30 | -55 to +100 | 0 to +20 |

* Note: Phase Noise at 50 kHz offset

Microwave Band (Example parts. See databook or specwave.com for full list)

| SMV2 Part Number | TO-8 Part Number | Frequency Range (MHz) | Power Output (dBm) | Phase* Noise (dBc/Hz) | Bias Volt. (V) | Bias Cur. (mA) | Temp. Bands (°C) | Tuning Range (V) |
|------------------|------------------|-----------------------|--------------------|-----------------------|----------------|----------------|------------------|------------------|
| HV66SM-12 | HV66T-1 | 1500-2500 | +10 | -105 | +15 | 50 | -55 to +85 | 0 to +20 |
| HV87SM-42 | HV87T-4 | 2000-4000 | +10 | -100 | +15 | 50 | -55 to +85 | 0 to +20 |
| HVA87SM-32 | HVA87T-3 | 2600-5200 | +12 | -92 | +15 | 100 | -40 to +85 | 0 to +18 |
| HV83SM-12 | HV83T-1 | 3500-4500 | +10 | -93 | +15 | 50 | -55 to +85 | 0 to +20 |
| HV83SM-22 | HV83T-2 | 4000-5000 | +10 | -92 | +15 | 50 | -55 to +85 | 0 to +20 |
| HVA107SM-12 | HVA107T-1 | 4000-8000 | +7 | -90 | +15 | 86 | 0 to +65 | 0 to +20 |
| HV93SM-12 | HV93T-1 | 4700-6000 | +7 | -90 | +15 | 65 | -55 to +85 | 0 to +20 |
| HVA103SM-12 | HVA103T-1 | 5500-7000 | +10 | -87 | +15 | 75 | -30 to +65 | 0 to +21 |

* Note: Phase Noise at 50 kHz offset

Optional Clock Recovery (Example parts. See databook or specwave.com for full list)

| SMV2 Part Number | TO-8 Part Number | Frequency Range (MHz) | Power Output (dBm) | Phase* Noise (dBc/Hz) | Bias Volt. (V) | Bias Cur. (mA) | Temp. Bands (°C) | Tuning Range (V) |
|------------------|------------------|-----------------------|--------------------|-----------------------|----------------|----------------|------------------|------------------|
| HV71SM-32 | HV71T-3 | 2488 | +9 | -87 | +12 | 75 | 0 to +85 | +4 to +8 |
| HV71SM-142 | HV71T-14 | 2666 | +8 | -87 | +15 | 75 | -30 to +65 | +4 to +8 |
| HVA121SM-12 | HVA121T-1 | 9958 | +8 | -80 | +15 | 100 | 0 to +85 | +3 to +7 |
| HVA121SM-22 | HVA121T-2 | 10650 | +8 | -80 | +15 | 100 | 0 to +85 | +3 to +7 |
| HVA131SM-52 | HVA131T-5 | 12450 | +10 | -85 | +15 | 100 | 0 to +85 | +3 to +7 |

* Note: Phase Noise at 50 kHz offset

DROs

Spectrum Microwave's stabilized oscillator products (formerly Magnum Microwave) provides engineers designing microwave radio links, transponders and synthesizers the high performance that is required for today's systems. These Dielectric Resonator Oscillators (DROs) provide high frequency stability with low phase noise while minimizing power drain.

Features

- Free running, mechanically tuned
- AFC voltage tunable
- Phase locked, internal and external reference
- Hermetically sealed housings



Applications

- LMDS
- Fiber optic clock recovery
- Radio links
- Satellite terminals
- Synthesizers

Typical Performance Characteristics

Frequency Range 2 GHz to 21 GHz
 Tuning bandwidth up to +/- 25 MHz
 Operating Temperature -40°C to +85°C typ

Free Running, Mechanically Tuned (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency Range (GHz) | Mech Tuning BW (MHz) | Power Output (dBm) | Phase Noise @ 100kHz offset | | | | Operating Temp (°C) |
|------------------------|-----------------------|----------------------|--------------------|-----------------------------|---------|----------|----------|---------------------|
| | | | | 2.5 (GHz) | 6 (GHz) | 12 (GHz) | 20 (GHz) | |
| MDR2100-xxxxx | 2.5-6.0 6.0-21.0 | ±10 ±20 | +10 | -130 | -124 | -118 | -113 | -20 to +65 |
| Moisture Sealed | | | | | | | | |
| MDR2560-xxxxx | 4.5-16.0 | ±10 | +10 | -125 | -122 | -117 | -111 | -40 to +85 |

AFC Voltage Tunable (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency Range (GHz) | Mech Tuning BW (MHz) | Power Output (dBm) | Phase Noise @ 100kHz offset | | | | Operating Temp (°C) |
|--|-----------------------|----------------------|--------------------|-----------------------------|---------|----------|----------|---------------------|
| | | | | 2.5 (GHz) | 6 (GHz) | 12 (GHz) | 20 (GHz) | |
| MDR3100-xxxxx | 2.5-6.0 6.0-21.0 | ±10 ±20 | +10 | -128 | -122 | -116 | -108 | -20 to +65 |
| For Fiber Optic Clock Recovery Applications | | | | | | | | |
| MDR3001-02 | 9.95328 | ±25 | +11 | | | -110 | | -10 to +80 |
| MDR3001-03 | 10.667 | | | | | | | |

Phase Locked, Internal Reference (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency Range (GHz) | Mech Tuning BW (MHz) | Power Output (dBm) | Phase Noise @ 100kHz offset | | | | Operating Temp (°C) |
|------------------------------|-----------------------|----------------------|--------------------|-----------------------------|---------|----------|----------|---------------------|
| | | | | 2.5 (GHz) | 6 (GHz) | 12 (GHz) | 20 (GHz) | |
| MDR5100-xxxxx | 3.0-6.0 6.0-21.0 | ±10 ±20 | +13 | -120 | -120 | -114 | -105 | -20 to +65 |
| For LMDS Applications | | | | | | | | |
| MDR5530-xxxxx | 9.0-13.0 | | +17 | | | -110 | | -40 to +85 |

Phase Locked, External Reference (Example parts. See databook or specwave.com for full list)

| Part Number | Frequency Range (GHz) | Mech Tuning BW (MHz) | Power Output (dBm) | Phase Noise @ 100kHz offset | | | | Operating Temp (°C) |
|---------------|-----------------------|----------------------|--------------------|-----------------------------|---------|----------|----------|---------------------|
| | | | | 2.5 (GHz) | 6 (GHz) | 12 (GHz) | 20 (GHz) | |
| MDR6100-xxxxx | 3.0-6.0 6.0-21.0 | ±10 ±20 | +13 | -124 | -120 | -114 | -105 | -20 to +65 |

Attenuators, Detectors & Switches

Attenuators

Spectrum Microwave's Attenuator products are offered in both Digital and Voltage Variable configurations. Formerly the product line from Amplifonix, Digital Attenuators are available in frequency ranges from 10 to 2000 MHz. Integrated TTL drivers simplify system integration. Choose either PIN Diode or GaAs FET based switching, depending upon switching speed requirements. Digital attenuation steps are available from 0.1 dB to 63.5 dB. When voltage variable gain control is required, Voltage Variable Attenuators (VVAs) are available in frequency ranges from 5 to 2000 MHz.

Features

- Digital attenuation values from 0.1 dB to 63.5 dB
- Digital attenuators with 4, 5 or 7 steps
- Switching speeds as low as 20 ns
- Analog attenuation values from 15 to 40 dB
- TTL Control

Digital Attenuators

| Part Number | Frequency Range (MHz) | | Steps | Attenuation Range (dB) | | Insertion Loss (dB) | | Switching Speed (μs) | Control | Package Type | Power - typ | |
|-------------|-----------------------|------|-------|------------------------|------|---------------------|------|----------------------|---------|--------------|-------------|------|
| | Low | High | | Typ. | Max. | Typ. | Max. | | | | (DC) | (mA) |
| TAN6007 | kHz | 50 | 4 | 2 to 30 | 1.5 | 2.0 | 0.03 | TTL | SG-4 | ±5 | 3 | |
| TAD5006 | 10 | 150 | 4 | 2 to 30 | 2.5 | 3.3 | 10 | TTL | DP-5 | +5 | 22 | |
| TAD5007 | 10 | 150 | 4 | 3 to 45 | 2.5 | 3.3 | 10 | TTL | DP-5 | +5 | 25 | |
| TAN6008 | 50 | 500 | 4 | 2 to 30 | 2.0 | 3.3 | 0.03 | TTL | SG-4 | ±5 | 3 | |
| TAD6006 | 50 | 500 | 4 | 2 to 30 | 2.2 | 3.0 | 0.02 | TTL | DP-11 | ±5 | 3 | |
| TAD6005 | 50 | 300 | 5 | 1 to 31 | 3.0 | 4.0 | 0.03 | TTL | DP-5 | +5/-12 | 3/4 | |
| TAD2104 | 10 | 2000 | 5 | 1 to 31 | 6.5 | 8.5 | 0.02 | TTL | DP-5 | +5/-12 | 5/8 | |
| TAD5008 | 50 | 250 | 5 | 2 to 62 | 4.2 | 5.5 | 2.5 | TTL | DP-5 | +5 | 10 | |
| TAD5009 | 50 | 250 | 7 | 0.1 to 12.7 | 3.0 | 4.2 | 2.5 | TTL | DP-8 | +5 | 10 | |
| TAD5010 | 50 | 250 | 7 | 0.5 to 63.5 | 6.0 | 7.5 | 10 | TTL | DP-8 | +5 | 25 | |

Voltage Variable (Analog) Attenuators

| Part Number | Frequency Range (MHz) | | Insertion Loss | | Attenuation (dB) | | VSWR Max. | Control Voltage (Volts) | Control Current (mA) | Power Supply - typ | |
|-------------|-----------------------|------|----------------|------|------------------|------|-----------|-------------------------|----------------------|--------------------|------|
| | Low | High | Typ. | Max. | Typ. | Max. | | | | (DC) | (mA) |
| TG9015 | 5 | 1000 | 2.0 | 2.5 | 20 | 15 | 2.0:1 | 0 to -10 | 0 to 7 | 15 | 7 |
| TG9005 | 0.1 | 1400 | 2.0 | 2.5 | 26 | 25 | 2.0:1 | 0 to +15 | 0 to 7.5 | 15 | 10 |
| TG9001 | 5 | 2000 | 2.9 | 2.5 | 34 | 18 | 2.0:1 | 0 to +15 | 0 to 6.5 | 15 | 10 |
| TG9006 | 5 | 1600 | 2.0 | 2.5 | 34 | 18 | 2.0:1 | 0 to +12 | 0 to 6.5 | 12 | 10 |
| TG9025 | 5 | 2000 | 2.0 | 3.0 | 33 | 20 | 2.0:1 | 0 to +15 | 0 to 7 | 15 | 10 |
| TG9030 | 100 | 2000 | 2.5 | 3.5 | 40 | 25 | 2.2:1 | 0 to +15 | 0 to 10 | 15 | 10 |



Applications

- Military communication systems
- Avionics
- Radar systems
- Medical devices
- Test and measurement systems

Typical Performance Characteristics

Frequency Range DC to 2000 MHz

Attenuation Ranges from 0.1 dB to 63.5 dB

Insertion Loss as low as 1.5 dB

Attenuators, Detectors & Switches

Detectors

Spectrum Microwave produces temperature compensated detectors, which operate from 10 MHz to 2 GHz. Analog/Level Detectors convert a range of RF input powers (typically from -20 dBm to +10 dBm) to a corresponding DC output voltage level. Threshold Detectors, using an external resistor or threshold voltage, output a TTL compatible signal when the RF level exceeds the preset threshold.

Features

- Wide bandwidths
- Fast switching speeds
- Low VSWR

Threshold Detectors

| Part Number | Frequency Range (MHz) | | Input Flatness - typ (dB) | Input Operation (dBm) | | VSWR In/Out Max. | Power (DC) (mA) | |
|-------------|-----------------------|------|---------------------------|-----------------------|------|------------------|-----------------|----|
| | Low | High | | Typ. | Max. | | | |
| TMJ9904 | 10 | 2000 | ±1.0 | -20 | +10 | 2.2:1 | +15 | 5 |
| TMJ9902 | 10 | 2000 | ±0.7 | -10 | +10 | 2.0:1 | +15 | 12 |
| PLJ9962 | 100 | 2000 | ±1.0 | -10 | +10 | 2.0:1 | +15 | 12 |

Analog Level Detectors

| Part Number | Frequency Range (MHz) | | Detected Voltage - typ (mV) | Input Flatness - typ (dBm) | Tangential Sensitivity | | VSWR In/Out Max. | Power (DC) (mA) | |
|-------------|-----------------------|------|-----------------------------|----------------------------|------------------------|------|------------------|-----------------|----|
| | Low | High | | | Typ. | Max. | | | |
| TMJ9910 | 10 | 1000 | 120 | ±1.0 | -45 | 40 | 1.7:1 | +15 | 5 |
| TMJ9911 | 10 | 2000 | 120 | ±1.0 | -45 | 40 | 1.7:1 | +15 | 12 |
| LNJ9901 | 20 | 2000 | 120 | ±0.3 | -38 | - | 2.2:1 | +15 | 12 |

Switches

Spectrum Microwave's line of SPST to SP8T Switches (formerly Amplifonix) range in frequencies from DC to 3000 MHz. We offer both Pin Diode and GaAs designs for both high speed applications as well as higher isolation requirements.

Applications (Detectors & Switches)

- Military communication systems
- Avionics
- Radar systems
- Medical devices
- Test and measurement systems

Typical Performance Characteristics

Frequency Range 10 MHz to 2 GHz
 Output Power 5 to 12 mA
 VSWR..... 1.7 to 2.2:1

Features

- Fast switching speeds
- High isolation

Typical Performance Characteristics

Frequency Range DC to 3000 MHz
 Switching Speed (GaAs) 6-40 ns
 Isolation..... 40 to 70 dB

Switches - PIN Diode

| Part Number | Type (Throws) | Frequency Range (MHz) | | Insertion Loss | | Isolation - typ | Switching Speed (µs) | Termination | Control | Package | Power (DC) (mA) | |
|-------------|---------------|-----------------------|------|----------------|------|-----------------|----------------------|-------------|---------|---------|-----------------|----|
| | | Low | High | Typ. | Max. | | | | | | | |
| TWM5000 | SPST | 10 | 1500 | 1.2 | 1.7 | 50 | 0.15 | 50 Ohms | TTL | T-5 | 5 | 5 |
| TWD5001 | SPDT | 10 | 1000 | 1.0 | 2.0 | 45 | 3 | 50 Ohms | TTL | DP-3 | 15 | 15 |
| TWD5015 | SPDT | 20 | 1000 | 1.2 | 2.0 | 45 | 0.7 | 50 Ohms | TTL | DP-3 | 5 | 15 |

Switches - GaAs

| Part Number | Type (Throws) | Frequency Range (MHz) | | Insertion Loss - typ (dB) | | Isolation - typ (dB) | Switching Speed (µs) | VSWR - typ | Termination | Control | Package |
|-------------|---------------|-----------------------|------|---------------------------|-----|----------------------|----------------------|------------|-------------|---------|---------|
| | | Low | High | | | | | | | | |
| TWP2214 | SPST | DC | | 3000 | 0.8 | 50 | 6 | 1.25:1 | 50 | 0/-5V | FP-12 |
| TWK2213 | SPST | DC | | 3000 | 0.7 | 40 | 10 | 1.15:1 | 50 | 0/-5V | T-2 |
| TWP2209 | SPST | DC | | 3000 | 1 | 40 | 6 | 1.25:1 | 50 | 0/-5V | FP-7 |

Coaxial Ceramic Resonators

Features

- Available in 2 mm to 12 mm sizes standard
- Easy handling and assembly
- Wide frequency range (400 MHz to 5 GHz)
- Available with and without tabs
- Frequency tolerance to $\pm 0.5\%$
- Temperature stable (± 5 ppm/ $^{\circ}\text{C}$)
- High Q (200 to 800)
- Available in tape and reel. (Specs vary based on frequency and cross section per EIA-481 standards.) Please consult the factory for specifications.
- RoHS compliant

Part Numbering System

Example: **CRF3-0445B-QST**

| CR | F | 3 | - | 0445 | A | - | Q | S | T |
|-----------------------|---|----------------------------------|---|--------------------|------------------------------------|---|------------------------------|-------------------|---|
| Series | Resonator Cross Section | Dielectric Constant | | Resonant Frequency | Frequency Tolerance | | Wavelength Type | Plating Type | Mounting Type |
| CR-Ceramic Resonators | B = 2 mm C = 3 mm D = 4 mm F = 6 mm L = 12 mm | 1 = K 21 2 = K 37 3 = K 90 | | f_0 (MHz) | A = 0.5% B = 1.0% C = Custom | | Q = 1/4 wave H = 1/2 wave | Thick Film Silver | T = Mounting tab Blank = No tab S = Surface Mount |

CR Calculations*

| Type | Calculates Length from Frequency ℓ (cm) from f_0 (GHz) | Calculates Characteristic Impedance Z_0 from OD, ID, and K | Calculates Input Impedance Z_{in} | Calculates the Equivalent L-C Network that would replace the Inductor at f_0 L-C Equivalent Network |
|-------------|---|---|--|--|
| $\lambda/4$ | $\ell = \frac{30 \text{ cm} \cdot \text{GHz}}{\sqrt{K}} \frac{1}{4f_0}$ | $Z_0 \approx \frac{\eta_0}{2\pi} \frac{1}{\sqrt{K}} \ln \left(\frac{1.079 \cdot \text{OD}}{\text{ID}} \right)$ | $Z_{in} \approx Z_0 \left[\frac{\pi}{4Q} + j \tan \left(\frac{\pi}{2} \frac{f}{f_0} \right) \right]$ | $L_{eq} = \frac{4Z_0}{\pi\omega_0}$ $C_{eq} = \frac{\pi}{4\omega_0 Z_0}$ |
| $\lambda/2$ | $\ell = \frac{30 \text{ cm} \cdot \text{GHz}}{\sqrt{K}} \frac{1}{2f_0}$ | | $Z_{in} \approx Z_0 \left[\frac{\pi}{2Q} + j \cot \left(\pi \frac{f}{f_0} \right) \right]$ | $L_{eq} = \frac{2Z_0}{\pi\omega_0}$ $C_{eq} = \frac{\pi}{2\omega_0 Z_0}$ |

* Where $30 \text{ cm} \cdot \text{GHz}$ is the free space propagation velocity, K is the dielectric constant, $\eta_0 = 377\Omega$ is the intrinsic impedance of free space, 1.079 is *normalized equivalent diameter* of a square 'coaxial' inductor, Q is the Q-factor of the CR and the "low-loss assumption" is applied. The CR may be replaced by an equivalent parallel L-C circuit with the values described.

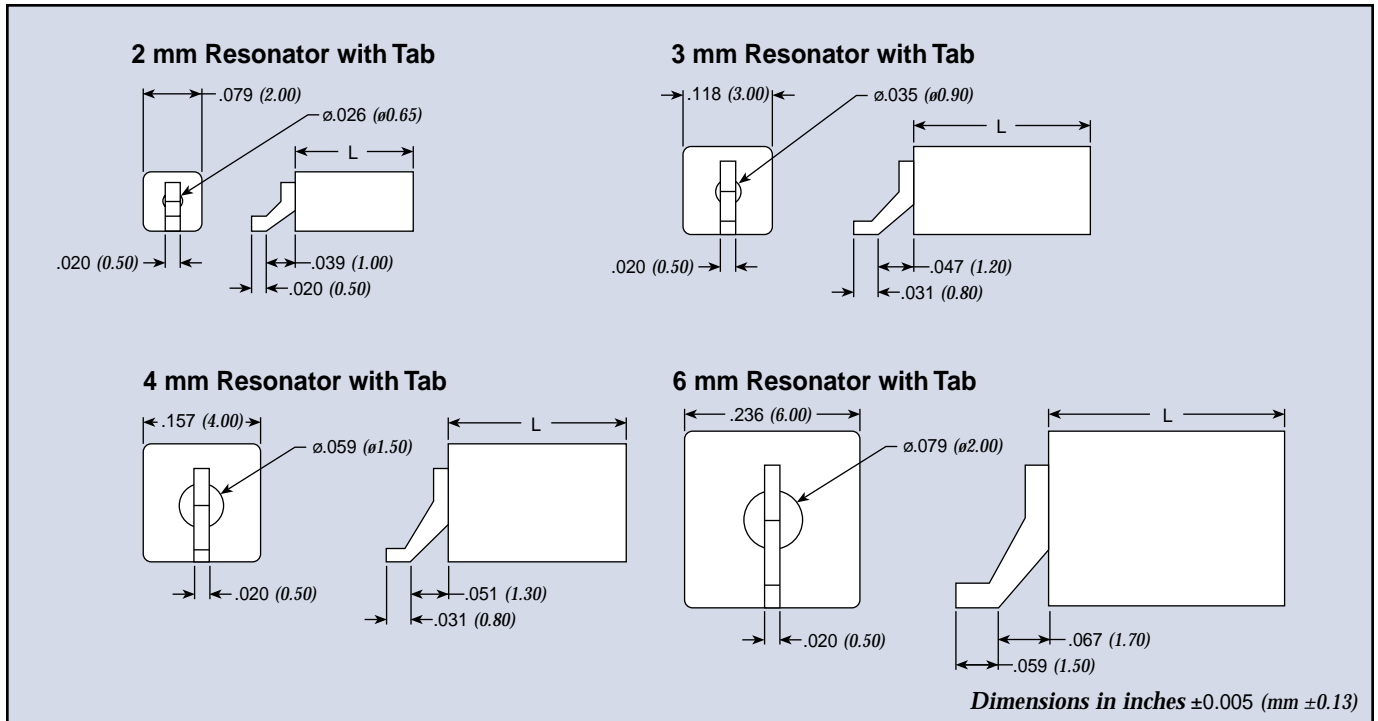


Applications

- Dielectric Filters
- Oscillators (DRO/VCO)
- GPS and car navigation systems
- HDTV, DBS, CS and CATV tuners
- Home security equipment
- UFH (LC) coupled amplifiers

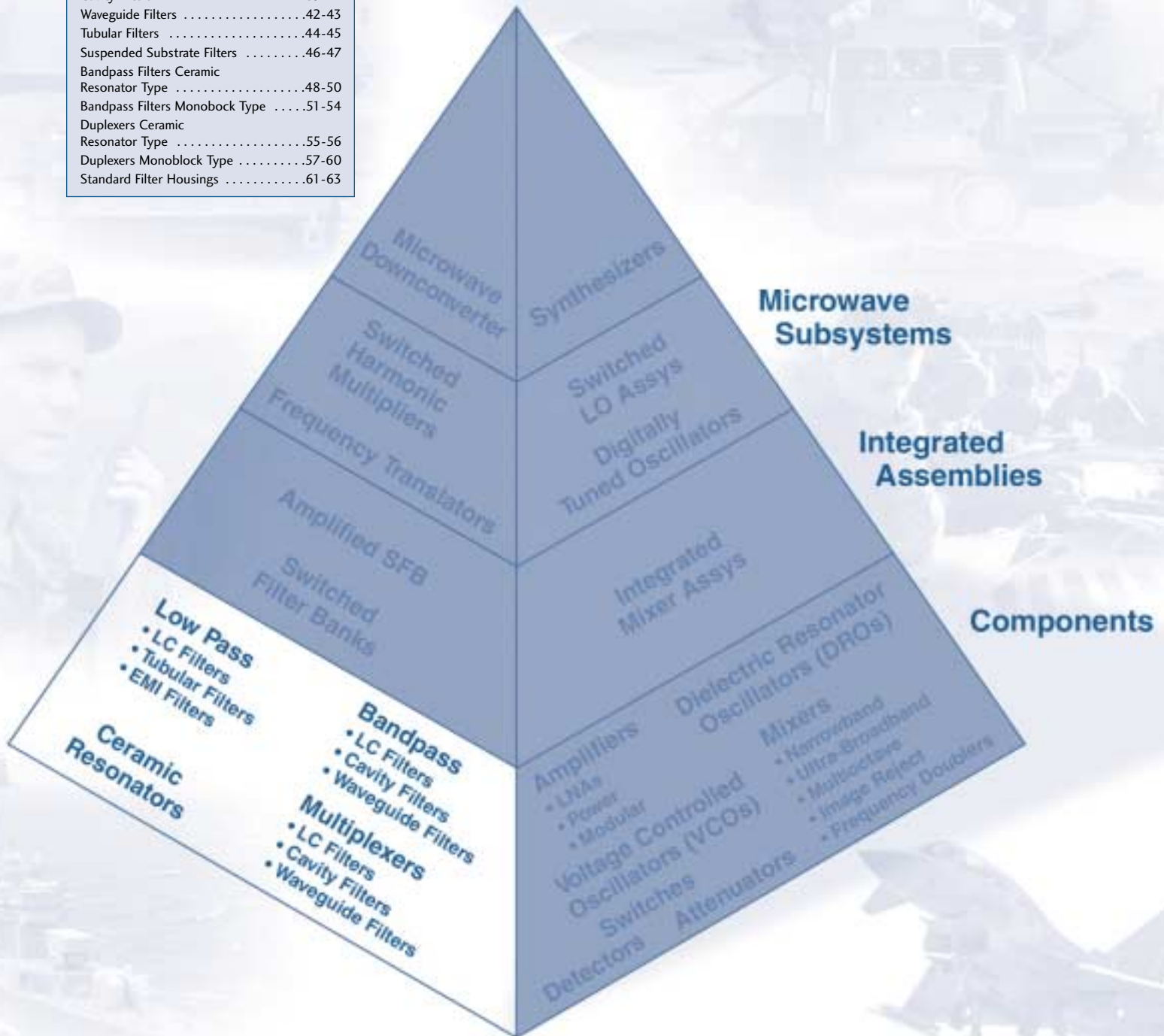
Coaxial Ceramic Resonators

Reference Outlines

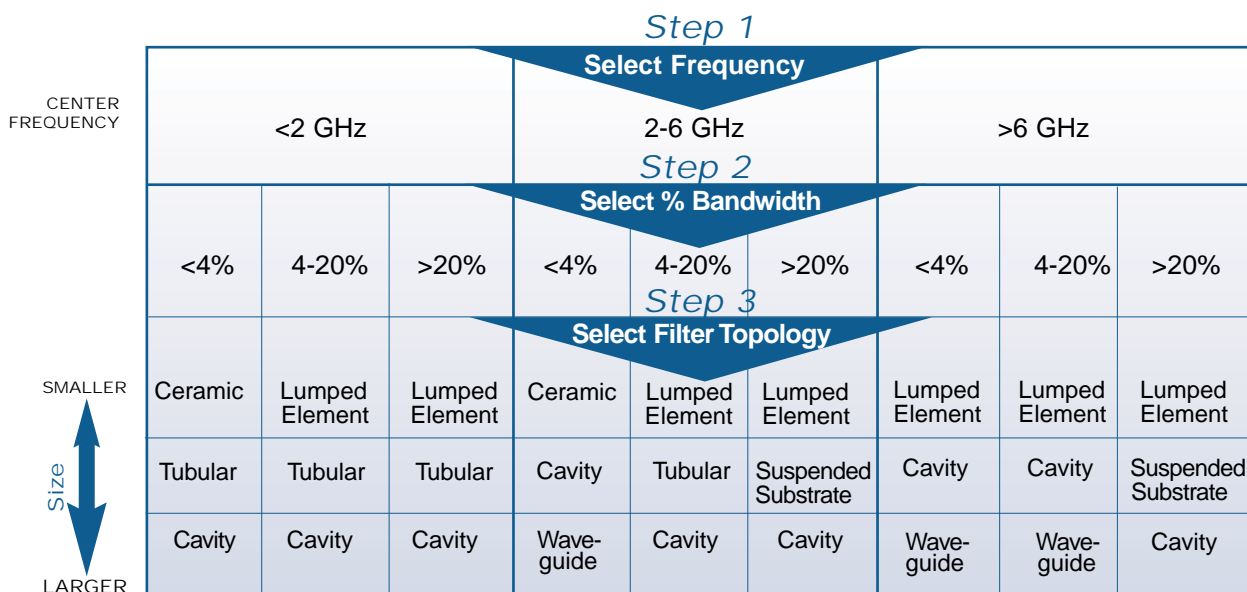


Custom Microwave Filters

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Filter Topology Selection - Bandpass \wedge



STANDARD CENTER FREQUENCIES FROM 10 kHz - 40 GHz (Typical 2 - 13 poles)

| Series | Filter Topology | Size* | Range of 3dB Center Freq (f _c) | Power Rating** | Page # |
|--------|-------------------------------------|--------------------|--|----------------|--------|
| BA | Tubular | 1/4" Dia.x L | 140 MHz - 6 GHz | 3 Watts CW | 44 |
| BC | Tubular | 1/2" Dia.x L | 50 MHz - 3.5 GHz | 20 Watts CW | 44 |
| BE | Tubular | 1 1/8" Dia.x L | 30 MHz - 1.0 GHz | 200 Watts CW | 44 |
| BR | Lumped Element | 5/8" x 3/4" x L | 1 MHz - 120 MHz | 10 Watts CW | 36 |
| BM | Lumped Element | 3/8" x 3/8" x L | 1 MHz - 6 GHz | 3 Watts CW | 36 |
| BS | Lumped Element | 1/4" x 1/2" x 1/2" | 10 MHz - 5 GHz | 3 Watts CW | 36 |
| BT | Lumped Element | 0.6" dia. x 0.35" | 10 MHz - 2 GHz | 3 Watts CW | 36 |
| C | Cavity (comblne, Interdigital) | Consult Factory | 500 MHz - 2.5 GHz | 10 Watts CW | 39 |
| C | Cavity (comblne, Interdigital) | 3/4" x 3/4" x L | 2.5 GHz - 5 GHz | 10 Watts CW | 39 |
| C | Cavity (comblne, Interdigital) | 1/2" x 1/2" x L | 5 GHz - 40 GHz | 10 Watts CW | 39 |
| WG | Waveguide | Consult Factory | 1 GHz - 40 GHz | 200 Watts CW | 42 |
| CS | Ceramic Dielectric Resonator Filter | Consult Factory | 400 MHz - 3 GHz | 3 Watts CW | 48 |
| SS | Suspended Substrate | Consult Factory | 2 GHz - 26.5 GHz | 10 Watts CW | 44 |

* L depends on cutoff frequency and complexity

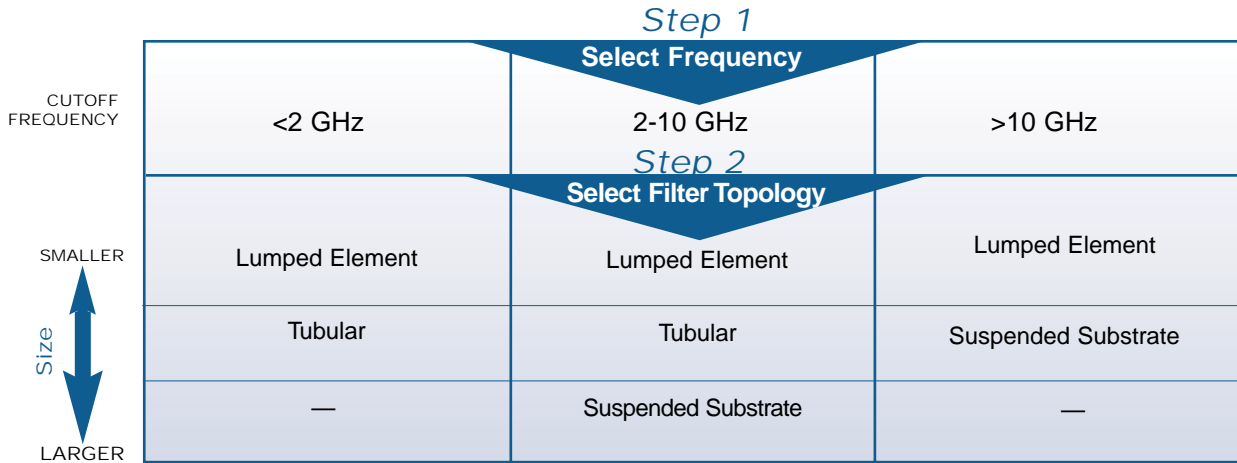
** When quoted by factory

% Bandwidth: Bandwidth divided by the center frequency.

Bandwidth: The width of the passband of a bandpass filter is usually expressed as the frequency difference between lower and upper relative 3 dB points.

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Filter Topology Selection - Lowpass 7



STANDARD LOWPASS FROM 1 kHz - 18 GHz (Typical 3 - 25 elements)

| Series | Filter Topology | Size* | Range of 3dB Cutoff Freq (f_c) | Power Rating** | Page # |
|--------|---------------------|--------------------|------------------------------------|----------------|--------|
| LA | Tubular | 1/4" Dia.x L | 150 MHz - 10 GHz | 5 Watts CW | 44 |
| LC | Tubular | 1/2" Dia.x L | 50 MHz - 5 GHz | 10 Watts CW | 44 |
| LE | Tubular | 1 1/8" Dia.x L | 30 MHz - 1.0 GHz | 40 Watts CW | 44 |
| LR | Lumped Element | 5/8" x 3/4" x L | 500 kHz - 500 MHz | 10 Watts CW | 36 |
| LM | Lumped Element | 3/8" x 3/8" x L | 5 MHz - 10 GHz | 3 Watts CW | 36 |
| LS | Lumped Element | 1/4" x 1/2" x 1/2" | 10 MHz - 5 GHz | 3 Watts CW | 36 |
| LT | Lumped Element | 0.6" dia. x 0.35" | 10 MHz - 2 GHz | 3 Watts CW | 36 |
| SS | Suspended Substrate | Consult Factory | 300 MHz - 40 GHz | 10 Watts CW | 46 |

* L depends on cutoff frequency and complexity

** When quoted by factory

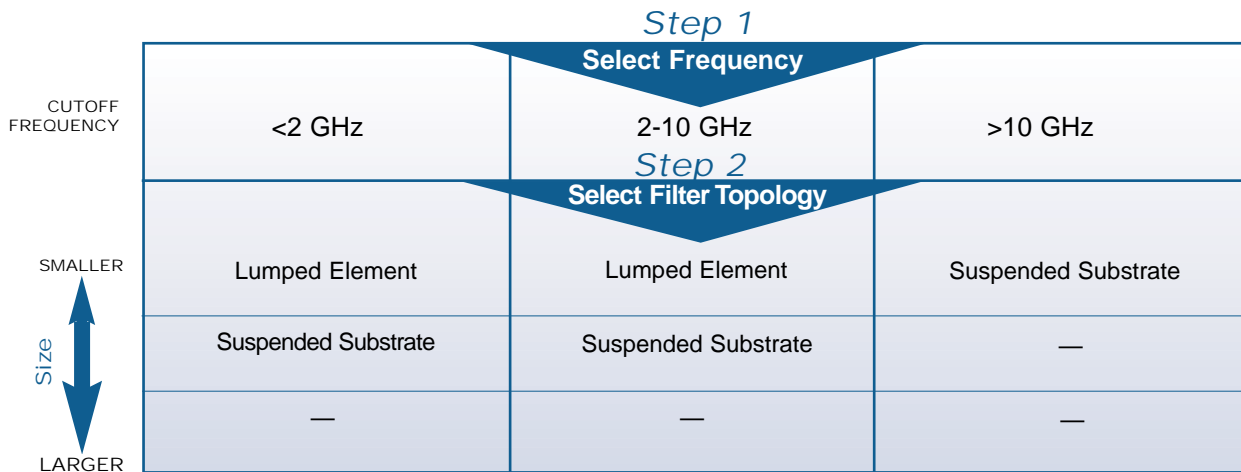
Typical VSWR and IL correlations to Frequency

| Cutoff Freq. (f_c) | VSWR | Max I.L. |
|------------------------|----------------------------|------------------------|
| 1 kHz - 600 kHz | 1.5:1 Max. up to 0.9 f_c | 1 Max. dB @ $f_c/2$ |
| 600 kHz - 20 MHz | 1.5:1 Max. up to 0.9 f_c | 0.75 Max. dB @ $f_c/2$ |
| 20 MHz - 7 GHz | 1.5:1 Max. up to 0.9 f_c | 0.5 Max. dB @ $f_c/2$ |
| 7 GHz - 10 GHz | 1.8:1 Max. up to 0.9 f_c | 0.5 Max. dB @ $f_c/2$ |

Standard Lowpass Filter Family - Page 44

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Filter Topology Selection - Highpass Γ



STANDARD HIGHPASS FROM 5 kHz - 0.4 GHz (3 - 25 elements)

| Series | Filter Topology | Size* | Range of 3dB Cutoff Freq (f_c) | Power Rating** | Page # |
|--------|---------------------|--------------------|------------------------------------|----------------|--------|
| HR | Lumped Element | 5/8" x 3/4" x L | 1 MHz - 250 MHz | 5 Watts CW | 36 |
| HM | Lumped Element | 3/8" x 3/8" x L | 5 MHz - 400 MHz | 3 Watts CW | 36 |
| HS | Lumped Element | 1/4" x 1/2" x 1/2" | 10 MHz - 5 GHz | 3 Watts CW | 36 |
| SS | Suspended Substrate | Consult Factory | 2 GHz - 26.5 GHz | 10 Watts CW | 46 |

* L depends on cutoff frequency and complexity

** When quoted by factory

Typical VSWR and IL correlations to Frequency

| Cutoff Freq. (f_c) | Max I.L. |
|------------------------|--------------------|
| 5 kHz - 600 kHz | 1.3 dB @ 2 x f_c |
| 600 kHz - 20 MHz | 0.9 dB @ 2 x f_c |
| 20 MHz - 400 MHz | 0.6 dB @ 2 x f_c |

| # of elements | VSWR |
|---------------|-------------------------------------|
| 3 - 7 | 1.5:1 Max. @ 1.25 f_c to 10 f_c |
| 9 - 25 | 1.5:1 Max. @ 1.15 f_c to 10 f_c |

Note: to 10 GHz maximum

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Filter Topology Selection - Band Reject ∇

| REJECT FREQUENCY | Step 1 Select Frequency | | |
|-------------------------------|----------------------------------|------------------------------|---------------------|
| | <2 GHz | 2-6 GHz | >6 GHz |
| Size ↑ SMALLER ↓ LARGER | Step 2 Select Filter Topology | | |
| | Lumped Element | Lumped Element | Cavity |
| | Ceramic | Cavity & Suspended Substrate | Suspended Substrate |
| | Cavity | Waveguide | Waveguide |

STANDARD BAND REJECT FROM 10 kHz - 40 GHz (Typical 2 - 13 poles)

| Series | Filter Topology | Size* | Range of 3dB Reject Freq (f_R) | Power Rating** | Page # |
|--------|-------------------------------------|--------------------|------------------------------------|----------------|--------|
| NR | Lumped Element | 5/8" x 3/4" x L | 1 MHz - 120 MHz | 10 Watts CW | 36 |
| NM | Lumped Element | 3/8" x 3/8" x L | 1 MHz - 6 GHz | 3 Watts CW | 36 |
| NS | Lumped Element | 1/4" x 1/2" x 1/2" | 10 MHz - 5 GHz | 3 Watts CW | 36 |
| NT | Lumped Element | 0.6" dia. X 0.35" | 10 MHz - 2 GHz | 3 Watts CW | 36 |
| C | Cavity (comblne, Interdigital) | Consult Factory | 500 MHz - 2.5 GHz | 10 Watts CW | 39 |
| C | Cavity (comblne, Interdigital) | 3/4" x 3/4" x L | 2.5 GHz - 5 GHz | 10 Watts CW | 39 |
| C | Cavity (comblne, Interdigital) | 1/2" x 1/2" x L | 5 GHz - 40 GHz | 10 Watts CW | 39 |
| WG | Waveguide | Consult Factory | 1 GHz - 40 GHz | 200 Watts CW | 42 |
| CS | Ceramic Dielectric Resonator Filter | Consult Factory | 400 MHz - 3 GHz | 3 Watts CW | 48 |
| SS | Suspended Substrate | Consult Factory | 2 GHz - 26.5 GHz | 10 Watts CW | 46 |

* L depends on cutoff frequency and complexity

** When quoted by factory

Check out our latest web site tools @ www.specwave.com

Filter Design Considerations

At Spectrum Microwave, we select the smallest filter type to satisfy our customer's performance parameters. In most cases, the size of a unit is limited by the insertion loss or power handling requirements. In addition, trade-offs between the various electrical and mechanical parameters must be considered when determining the most efficient topology for a given application. Following is a brief discussion of some common trade-offs:

Insertion Loss vs Size

The unloaded Q of the filter elements determines the insertion loss of a given filter. Inherently, the Q of the filter elements is proportional to their size. As a result larger filters tend to exhibit lower insertion loss.

Insertion Loss vs Stopband Rejection

Additional stopband rejection is achieved by adding additional filter sections. Each section that is added also increases insertion loss which implies that more rejection comes at the expense of higher insertion loss.

Passband Flatness vs Stopband Rejection

As the number of sections is increased, the passband edges round off due to the effects of finite Q. This causes more amplitude variation over the passband. Therefore, more rejection comes at the expense of degraded passband flatness.

Stopband Rejection vs Group Delay Variation

Each additional filter section not only increases the absolute value of the group delay, but the variation of the group delay over the passband as well. Higher rejection comes at the expense of increased passband group delay variation.

These trade-offs, as well as others, must be considered when selecting the appropriate filter topology for a given application. Our experienced engineering team will determine the optimal solution for the requirement based on our customer's inputs and priorities.

Unloaded Q vs Passband Performance

The lack of sufficient unloaded Q in a filter can have a significant effect not just on insertion loss, but on the filter's passband flatness as well. Figure 1 below illustrates the passband amplitude response of an "X" dB ripple Chebyshev bandpass filter with infinite unloaded Q. The ripple level is determined by the reflective (VSWR) losses in the filter and is determined strictly by the Chebyshev transfer function chosen.

FIGURE 1

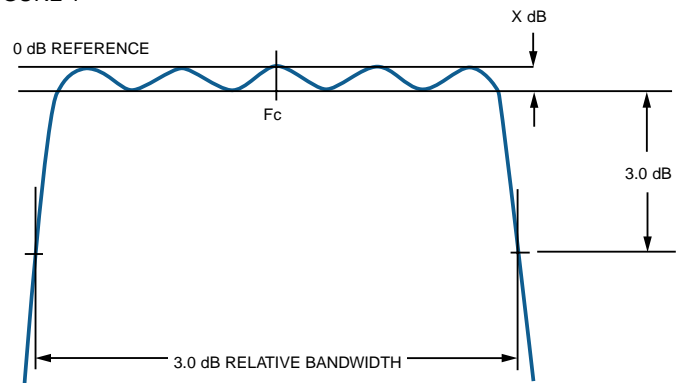
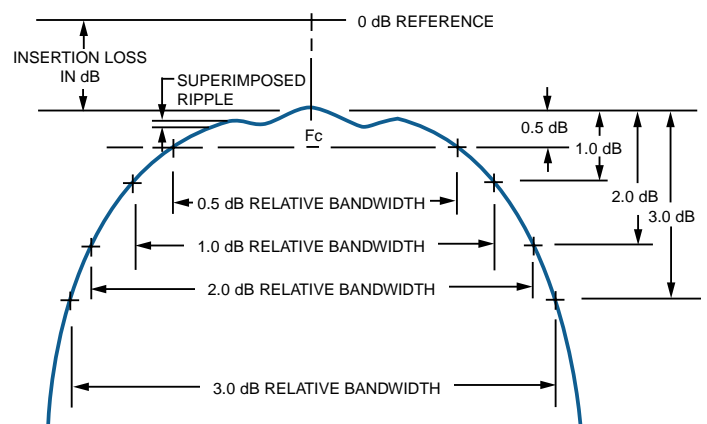
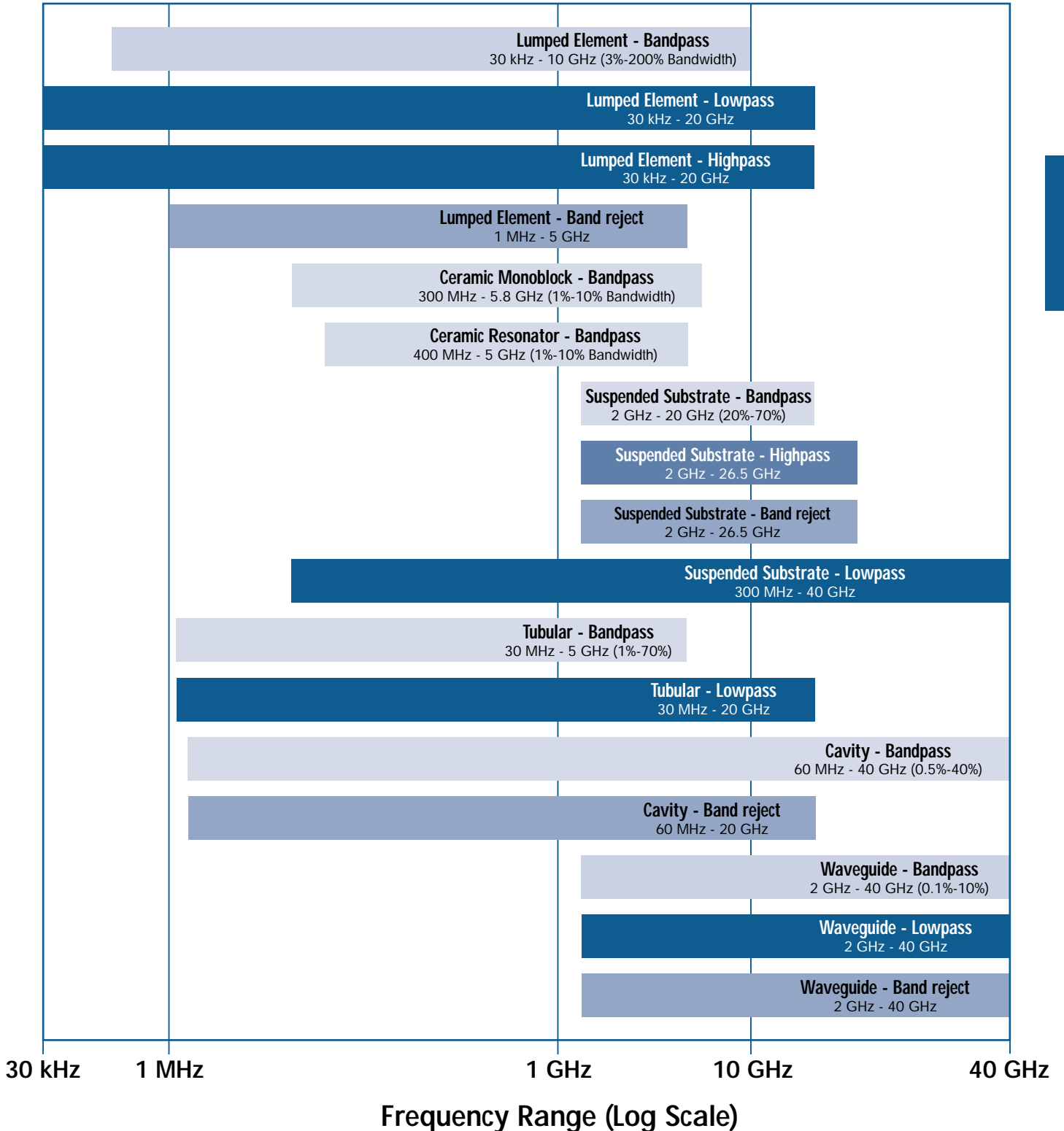


Figure 2 shows the passband amplitude response of the same filter with finite unloaded Q. This response, to varying degrees, is what is typically seen in practice. The rounding of the passband near the band edges is due strictly to the dissipative losses in the filter. This rounding is even more pronounced with small percentage bandwidth filters. The ripple of the transfer function is superimposed on the amplitude response. It is clearly evident that specifying a passband flatness or relative bandwidth is more definitive than specifying a ripple or VSWR bandwidth. At Spectrum Microwave, we will select the most appropriate filter topology and mechanical configuration to maximize unloaded Q, based on customer requirements.

FIGURE 2



Filter Topology Frequency Ranges



Lumped Element Filters

LC/Discrete/Chip and Wire

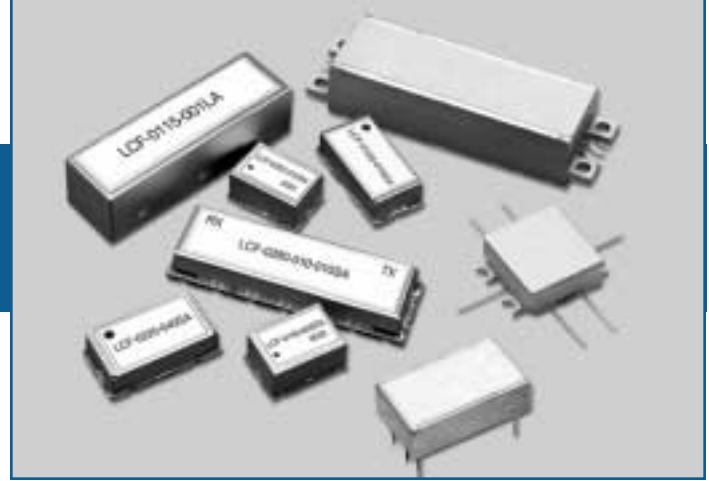
Lumped element filters consist of discrete capacitors and inductors soldered to a substrate in various schematic configurations. These compact designs are particularly suitable for applications where size is critical. This topology is suitable for lowpass, highpass, bandpass, bandstop and multiplexing applications

Features

- Small size, low profile
- Leaded, surface mount, PC mount and connectorized
- Wide range of transfer functions
- 30 kHz to 20 GHz

Applications






- Military Communications
- IFF
- E-911
- CATV
- Base stations















Typical Performance Characteristics

- Bandwidth* 3% to 200%
- Q factor* up to 400
- Impedance* 50 Ohm standard
- Temperature Range* -55 to 85°C
- Temperature Stability* ± 5 ppm typ
- Shock* 30 G
- Vibration* 10 G
- Humidity* 0-95%
- Power* 1-15 W typ
- Packaging Options* Coaxial connectors, Axial/radial feed-thru, Wide variety of connectors

Filter Frequency Ranges

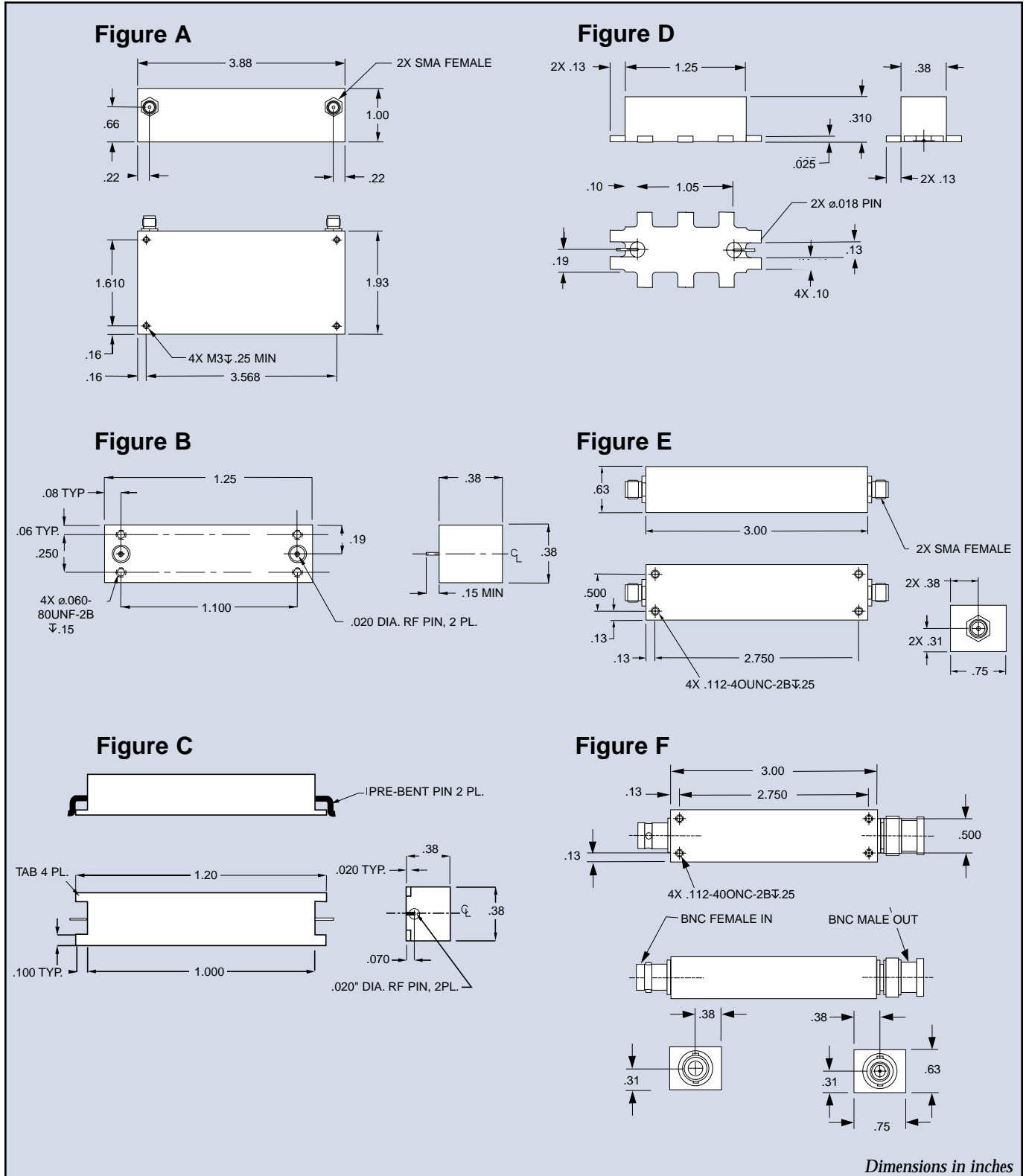
- Bandpass*  30 kHz - 10 GHz
- Highpass*  30 kHz - 20 GHz
- Lowpass*  30 kHz - 20 GHz
- Band reject*  1 MHz - 5 GHz
- Duplexer/Multiplexer*  30 kHz - 8 GHz

Custom Part Number Examples (Typical part numbers, consult factory for additional designs)

| Part Number | Topology | Passband (MHz) | Insertion Loss (dB) (max.) | VSWR (max.) | Attenuation (dB @ MHz) | Size (inches) ex connectors | Comments | Reference Outlines |
|------------------|---|-------------------------|----------------------------|-------------|-------------------------|-----------------------------|---|--------------------|
| LR411-9SS-EHP-X |  | 225 to 400 | 0.55 | 1.35:1 | 60 @ 450-4000 | 1.00 x 3.88 x 1.93 | Lowpass; avg pwr 150W @ CW, 450W @ peak | A |
| LM23G-13SSM |  | 6,000 to 22,000 | 1.0 | 1.5:1 | 40 @ 28,000 to 40,000 | 0.40 x 0.40 x 0.60 | High frequency, Lowpass filter | |
| BM10.7-0.72-3PP |  | 10.7 | 4.0 | 1.5:1 | 55 @ DC-8 | 0.38 x 0.38 x 1.25 | | B |
| BM21.4-1.04-6PP |  | 20.88 to 21.92 | 3.0 | 1.5:1 | 60 @ 19.76 & 23.04 | 0.40 x 0.63 x 1.75 | | |
| BM800-65-5XPXP-S |  | 775 to 825 | 4.0 | 1.5:1 | 50 @ DC-685 | 0.38 x 0.38 x 1.00 | Drop in filter with axial pins | C |
| BS1401-670-3X |  | 1,217 to 1,585 | 0.5 | 1.25:1 | 10 @ 900 & 1900 | 0.21 x 0.50 x 1.00 | Surface mount | |
| HM1955-8SS-E |  | 2,000 to 18,000 | 1.5 | 1.8:1 | 60 @ DC-1500 | 0.45 x 0.70 x 1.75 | Elliptic bandpass filter | |
| BS4700-800-7 |  | 4,400 to 5,000 | 3.0 | 1.4:1 | 60 @ 5600 | 0.31 x 0.38 x 1.25 | Surface mount | D |
| BR70-14-7ESS |  | 61-79 | 2.5 | 1.5:1 | 40 @ DC-57,784 & 84-110 | 0.63 x 0.75 x 3.00 | Elliptic bandpass filter | E |
| NR76.75-10-4BBM |  | DC to 70 & 83.5 to 200 | 3.0 | 1.5:1 | 50 @ 76.5 | 0.63 x 0.75 x 4.00 | Band reject filter for NMR | F |
| HR450-11BBM |  | 540-750 | 0.5 | 1.5:1 | 80 @ DC - 250 | 0.63 x 0.75 x 2.00 | Highpass for NMR, 100W avg pwr, 300W peak | |
| NR98-40-7SS |  | DC to 76 & 122 to 1,000 | 2.1 | 1.5:1 | 35 @ 88-108 | 0.63 x 0.75 x 3.00 | Band reject for FM frequencies | |

Lumped Element Filters

Reference Outlines (Standard LC filter housing on page 61)



Lumped Element Filters

Design Considerations

Transfer Functions

Numerous types of transfer functions are achievable using lumped element designs. The most efficient solution is selected for each application. By varying the capacitive and inductive coupling between sections, Spectrum Microwave can produce symmetric or asymmetric all-pole responses.

High Q Structures

Pole-placed and linear phase/group delay equalized responses are also reliable. The achievable unloaded Q's for these structures can be as high as 400. The Q for a particular design depends upon the inductor size, core material, and frequency of operation. Broad stopband performance can be achieved by suppressing parasitic resonances via careful component selection and through the use of proprietary design practices.

Power Handling

For high power applications, large air wound inductors and high voltage capacitors are used. Proprietary design techniques and careful component selection ensure minimal temperature drift, and in many cases temperature coefficients of less than 5 ppm/°C are achievable. Both miniature and standard designs are available with either coaxial connectors or axial/radial feed-thrus for direct circuit board installation. Several surface finishes, including silver, nickel, and gold are available depending upon specific customer requirements.

Multiplexing

In many instances, especially in broad passband or non-contiguous multiplexing applications, the lumped element topology can be easily integrated with other topologies to maximize performance in the smallest possible package volume.

Cavity Filters

- Interdigital • Comblin
- Ceramic Loaded • Helical

These TEM mode filters consist of inductively coupled short circuited stub resonators. Cavity filters are high Q structures for high selectivity, with very low passband insertion loss, which is important for receiver front end or high power transmit applications. In addition, the filter's steep attenuation skirts are ideal for separation of closely spaced signals. By using resonators that are less than 45 degrees in electrical length, the upper frequency limit of the stopband may be extended, yielding improved ultimate attenuation.

Features

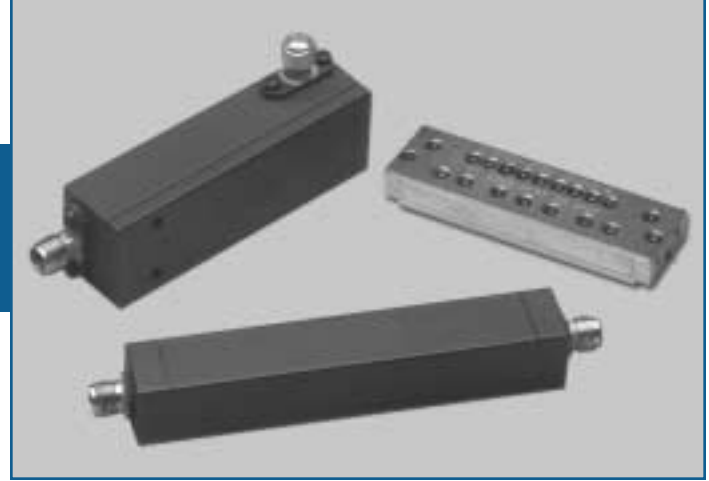
- Low loss
- Very high selectivity
- Wide range of bandwidths - 0.5% to 70%
- High peak power
- Excellent temperature stability
- Low IMD designs available

Applications

- Avionics
- Military
- Base stations
- Test instrumentation
- Communications






Some cavity filter applications can be fulfilled with Hi-Rel packaged ceramic filters, consult factory, see page 48 for more details


















Typical Performance Characteristics

Q Factor..... up to 5000
Impedance..... 50 Ohms standard
Temperature Range..... -55 to 85°C
Temperature Stability..... ±5 ppm typ
Shock..... 10 G
Vibration..... 20 G
Humidity..... 0-95%
Power Range..... 15 W - 2 KW typ
Packaging Options..... Various options available

Filter Frequency Ranges

Bandpass  60 MHz - 40 GHz
Band reject  60 MHz - 20 GHz
Duplexer/Multiplexer  60 MHz - 40 GHz

Custom Part Number Examples (Typical part numbers, consult factory for additional designs)

| Part Number | Topology | Passband (MHz) | Insertion Loss dB (max.) | VSWR | Attenuation (dBc @ MHz) | Size (inches) ex connectors | Comments | Reference Outlines |
|--------------------|---|------------------|--------------------------|--------|---|-----------------------------|--|--------------------|
| C1220-65-13SS-F |  | 1200 to 1240 | 4.0 | 1.4:1 | 115 @1150 & 1290 | 1.00 x 1.50 x 4.00 | Change in group delay <=12 nsec over bandwidth | |
| C1182.5-65-13SS-F |  | 1162.5 to 1202.5 | 4.0 | 1.4:1 | 115 @1125 and 1252 | 1.00 x 1.50 x 4.00 | Change in group delay <=12 nsec over bandwidth | |
| C1030-27-3SS |  | 1025 to 1035 | 1.0 | 1.5:1 | 45 from DC to 930 and 1130 to 5000 | .75 x 1.75 x 2.25 | | |
| C1090-27-3SS |  | 1084 to 1096 | 1.0 | 1.5:1 | 45 from DC to 990 and 1190 to 4000 | .75 x 1.75 x 2.25 | Peak power handling is 3KW | |
| C1307.5-220-5NN |  | 1215 to 1400 | 0.25 | 1.2:1 | 30 @ 1090 & 40 @ 1030 | 1.00 x 2.25 x 3.75 | | |
| C3000-2070-17SS-LP |  | 2000 to 4000 | 0.5 | 1.35:1 | 55 @ 10 to 1700 & 4400 to 18000 | .75 x 1.00 x 5.25 | | |
| C5818-30-6XPXP |  | 5808 to 5828 | 4.0 | 1.5:1 | 50 min. @ 5777 & 5858 | .58 x .88 x 4.00 | | A |
| C2250-140-8SS |  | 2200 to 2300 | 0.5 | 1.25:1 | 100 min. from 1750 to 1850 & 2025 to 2120 | 1.60 x 1.25 x 10.95 | 13 nsec max over passband | B |
| C1600-6-6SS |  | 1597 to 1603 | 2.8 | 1.5:1 | 60 min. from 1591.5 & 1608.5 | 1.50 x 5.60 x 3.15 | Differential group delay 150nsec max over passband | C |
| C11850-2000-8SS |  | 10950 to 12750 | 2.0 | 1.4:1 | 20 @ 13110 | .50 x .50 x 2.50 | Change in group delay <=12nsec over passband | |
| C6137.5-520-10SS |  | 5850 to 6425 | 1.0 | 1.25:1 | 100 @5235 & 7040 | .50 x .75 x 3.50 | Max group delay = 1.0nsec over any 40MHz segment | |
| C14250-544-7SMSM |  | 14000 to 14500 | 2.0 | 1.5:1 | 80 @ 13050 | .50 x .50 x 1.40 | | |
| C34300-13000-10KMK |  | 28600 to 40000 | 2.0 | 2.0:1 | 55 @10000 to 24310 | .50 x .50 x 1.10 | | |
| C22250-9000-13KK |  | 18000 to 26500 | 1.0 | 1.5:1 | 32 @ 15304 to 17041 | .50 x .60 x 1.56 | | |
| C19600-5200-6SS |  | 17500 to 21700 | .5 | 1.7:1 | 40 @ DC to 12GHz | .50 x .50 x 1.10 | | |

Cavity Filters

Reference Outlines

Figure A

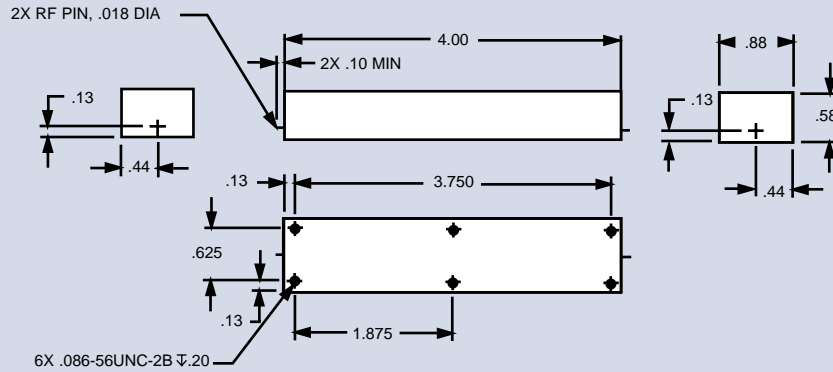


Figure B

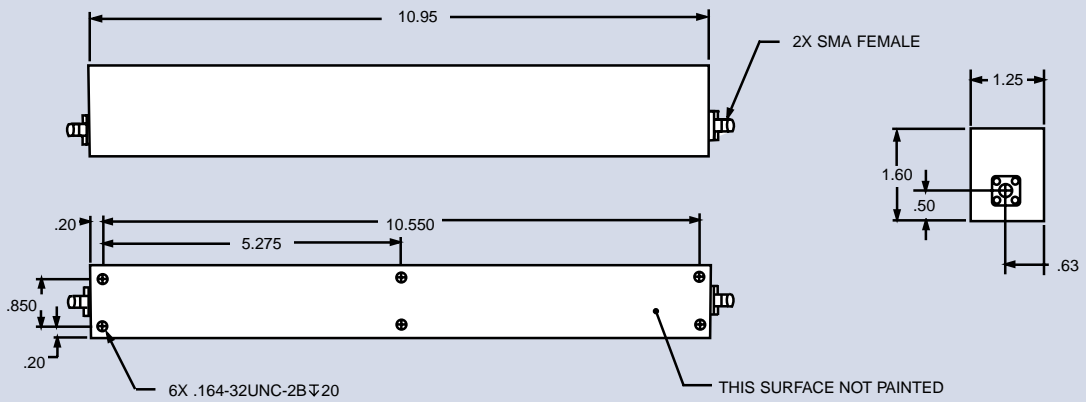
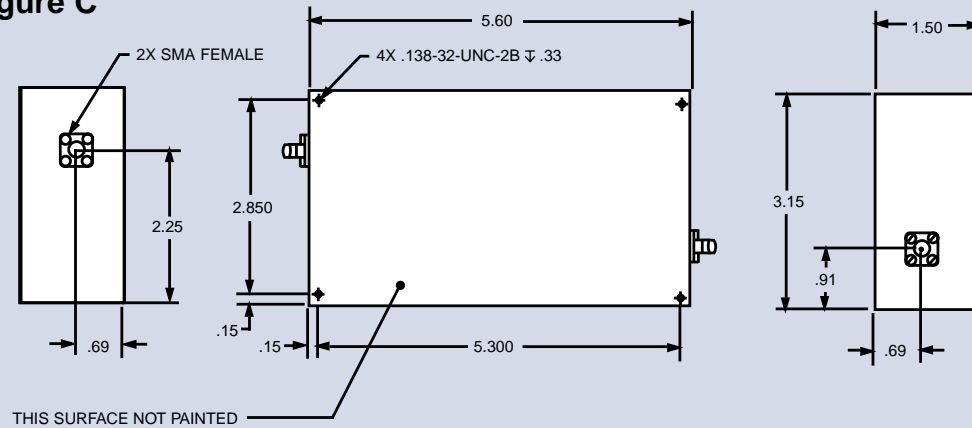


Figure C



Dimensions in inches

Cavity Filters

Design Considerations

Spectrum Microwave has researched the suppression of intermodulation products in high power filters. Through careful process control and component selection, we have devised specialized design techniques to satisfy these requirements.

Size and Materials

Pseudo elliptic designs can be used to reduce the number of sections required to meet a specified attenuation response. This reduction in the number of sections results in a smaller filter with lower passband loss. Similar techniques can also be used to provide passband group delay equalization or increase attenuation over a specified stopband region.

To reduce weight and minimize passband loss, Spectrum Microwave cavity filters are generally machined from lightweight aluminum alloys and plated with a high purity silver. Proprietary design techniques are used to ensure minimal temperature drift. Spectrum Microwave has designed and manufactured cavity filters with temperature drifts of less than 1 ppm/°C.

Multiplexing

For systems that share a common antenna, such as Tx/Rx communications systems, multiplexers can be formed by combining these bandpass structures to a common port. Both contiguous and non-contiguous multiplexers are available. In addition, by combining two or more filters at both input and output ports, devices with two or more passbands are achievable.

Comblines Structures

Comblines structures are used for bandwidths between 0.2% and 70%. Depending upon the particular specifications, combline filters can provide stopbands that extend beyond 10 times the center frequency. Additionally, these structures can be made extremely compact and are generally considered to be one of the most versatile topologies for use at microwave frequencies.

Interdigital Structures

For very wide passband applications, interdigital structures are used. Interdigital filters provide a geometrically symmetric amplitude response for wideband applications, whereas combline responses become increasingly asymmetric as the percent bandwidth increases. The quarter wavelength resonators used in interdigital filters, however, result in a decrease in upper stopband performance.

High selectivity, low loss bandstop filters are realized by coupling tub resonators to a common transmission line at 90° intervals.

Waveguide Filters

Waveguide bandpass filters consist of half wavelength resonant cavities coupled by capacitive or inductive irises. These extremely high Q structures provide very low passband loss and steep attenuation skirts. Spectrum Microwave designs and manufactures waveguide filters in the frequency range 2 to 40GHz, with peak power level ratings as high as 50 KW. The TE₁₀ mode, the dominant mode in rectangular waveguide, is utilized in most designs.

Features

- 0.1 to 20% bandwidths
- Extremely low loss
- High power handling
- High power capacity

Applications






- Avionics
- Digital radios
- Repeaters
- Point to Point
- Transmit filters
- Satellite communications








Typical Performance Characteristics

Q Factor..... up to 20000
Temperature Range -55 to 85°C
Temperature Stability..... as low as 1 ppm
Shock..... 10 G
Vibration..... 20 G
Humidity..... 0-95%
Power Range..... 20 W - 50 KW
Packaging Options Waveguide Flanges,
 Connectorized

Filter Frequency Ranges

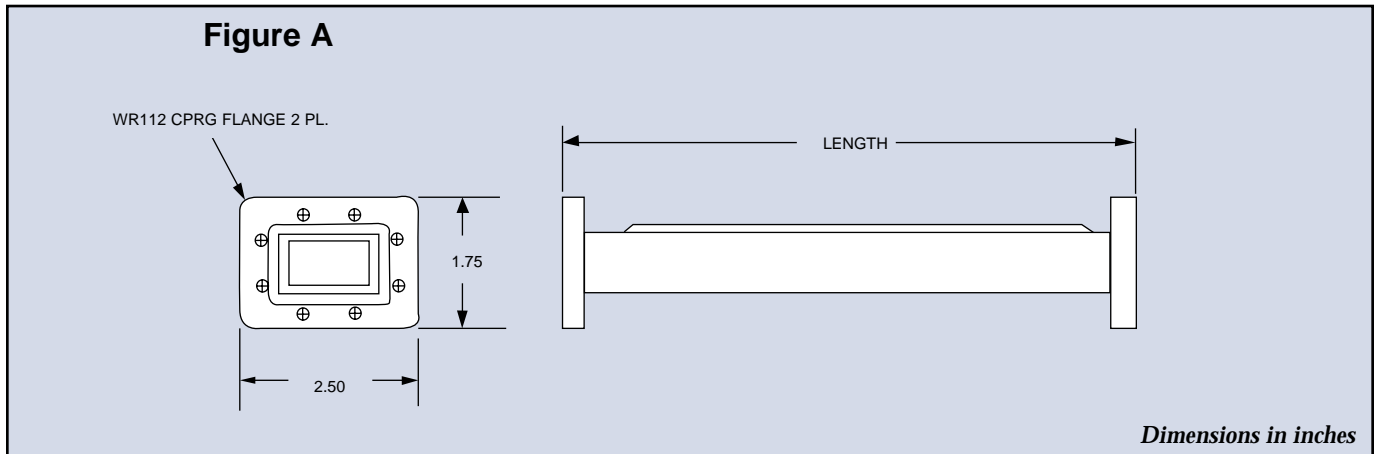
Bandpass  2 GHz - 40 GHz
Lowpass  2 GHz - 40 GHz
Band reject  2 GHz - 40 GHz
Duplexer/Multiplexer   2 GHz - 40 GHz

Custom Part Number Examples (Typical part numbers, consult factory for additional designs)

| Part Number | Topology | Passband (GHz) | Insertion Loss (dB) (max.) | VSWR (max.) | Attenuation (dBc min @ GHz) | Length (inches) ex connectors | Comment | Reference Outline |
|----------------|---|----------------|----------------------------|-------------|-----------------------------|-------------------------------|--|-------------------|
| W8150-550-11FF |  | 7.9 to 8.4 | 0.5 | 1.4:1 | 55 @ 7.2 to 7.75 | 12.00 | Satellite communications, material = WR112 | A |
| LW28.0G-13FF |  | 18.0 to 26.5 | 1.0 | 1.5:1 | 45 @ 35 to 55 | 12.00 | Point to point, material = WR42 | |
| W29150-360-5FF |  | 29.0 to 29.3 | 1.5 | 1.5:1 | 50 @ 28.3 to 28.6 | 2.23 | Digital radio, material = WR28 | |
| W5300-53-5FF |  | 5.285 to 5.315 | 0.4 | 1.2:1 | 60 @ 5.2 and 5.4 | 0.90 | Power = 250W peak, material = WR159 | |
| W7.5G-0.66-7FF |  | 7.25 to 7.75 | 0.6 | 1.3:1 | 30 @ DC to 6.6 | 9.65 | Material = WR122 | |

Waveguide Filters

Reference Outline



Design Considerations

Bandpass filters can be realized with percent bandwidths ranging between 0.1 to 20 percent. For very narrowband, low loss requirements, circular waveguide can be used. The dominant mode for circular waveguide is the TE₁₁ mode. Additionally, circular waveguide is utilized for dual mode designs.

Depending upon the bandwidth, either inductive irises or inductive posts are used to control coupling between each cavity. Pseudo elliptic designs can be used to reduce the size and insertion loss or to equalize the group delay. Waveguide multiplexers can be produced by connecting several waveguide filters to a common port. Waveguide bandstop filters can be achieved by placing several shortcircuited cavities at intervals of three-quarters wavelength along the waveguide body.

By using several adjacent high and low impedance sections, a corrugated waveguide lowpass filter can be designed. This type of filter can be designed to have a wide passband and a wide stopband for power in the TE₁₀ mode. Suppression of higher order modes can be achieved by using a waffle iron structure. Waffle iron lowpass filters can be designed to suppress up to the 5th harmonic and beyond.

Materials

Material selection for a waveguide filter depends upon the specific requirements. Copper is generally used, but for wide temperature ranges and narrowband applications invar is used to guarantee frequency stability. Aluminum can also be used for lightweight applications. All Spectrum Microwave waveguide filters are available with either waveguide flanges or coaxial connectors. Sealed versions are available for pressurized applications.

Tubular Filters

Spectrum Microwave tubular filters provide relatively high unloaded Q's in a moderate package size. Due to their mechanical configuration, tubular filters have inherently broad stopbands with very high attenuation levels. Element and housing size determine the upper stopband frequency limits. This topology is best suited for bandpass and lowpass structures.

Features

- Low loss
- High power handling
- Low cost
- Broad stop band characteristics
- Rapid prototyping

Applications



- Instrumentation
- Medical
- High power harmonic rejection













Typical Performance Characteristics

Frequency Range 30 MHz to 20 GHz
 Q Factor up to 2000
 Temperature Range -55 to 85°C
 Temperature Stability as low as 1 ppm
 Shock 30 G
 Vibration 10 G
 Humidity 0-95%
 Power Range 20 W - 50 KW typ
 Packaging Options Connectorized, PC mount

Filter Frequency Ranges

Bandpass  30 MHz - 5 GHz
 Lowpass  30 MHz - 20 GHz

Custom Part Number Examples (Typical part numbers, consult factory for additional designs)

| Part Number | Topology | Passband (MHz) | Insertion Loss (dB) (max.) | VSWR (max.) | Attenuation (dBc min. @ MHz) | Size (in inches) ex connectors | Comment |
|-----------------|---|----------------|----------------------------|-------------|------------------------------|--------------------------------|-------------------------------------|
| BC1200-600-6SS |  | 950 to 1450 | 0.5 | 1.5:1 | 30 @ 600 and 1800 | 0.50 dia X 4.50 | |
| LE410-21NN-HP |  | 225 to 400 | 0.5 | 1.25:1 | 44 @ 450 and 1200 | 1.13 dia X 18.35 | 600 watts power at CS |
| LA4.5G-9SMS |  | DC to 4000 | 0.5 | 1.4:1 | 25 @ 5600MHz, 60dBc @ 7200 | 0.25 dia X 3.07 | Lowpass |
| BC1345-130-8SSM |  | 1290 to 1400 | 4.0 | 1.5:1 | 225 @ 1226MHz, 45dBc @ 1464 | 0.50 dia X 5.25 | |
| BC1030-30-4SS |  | 1010 | 3.0 | 1.5:1 | 50 @ 955MHz and 1105 | 0.50 dia X 4.00 | 3dB BW = 30 MHz, IFF |
| BE151-30-8BB |  | 151 | 2.5 | 1.5:1 | | 1.125 dia X 12.25 | 3dB BW = 30 MHz, NMR |
| BA2250-200-6SS |  | 2200 TO 2300 | 1.7 | 1.3:1 | 48 @ 2000 and 2500 | 0.25 dia X 3.65 | Passband phase linearity ±3 degrees |
| LC139-7BBM |  | DC TO 125 | 1.4 | 1.5:1 | | 0.50 dia X 6.00 | Aviation radio |
| BD256-36-8SS |  | 242-270 | 1.75 | 1.5:1 | 60 @ 290 | 0.75 dia X 7.00 | Military Communications |
| BE470-18-8BBM |  | 470 | 2.5 | 1.5:1 | 80 @ 440 and 500 | 1.125 dia X 12.25 | 3dB BW = 18MHz, NMR |

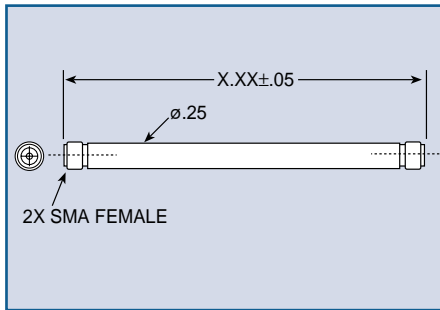
Standard Coaxial Lowpass Filters from DC - 8 GHz

| Passband (MHz) | Passband I.L. (Max dB) | Passband VSWR (Max) | 25 dB Min Stopband (GHz) | 60 dB Min Stopband (GHz) | Part # (Female/Male SMA's) | Part # (Female/Male Type N's) |
|----------------|------------------------|---------------------|--------------------------|--------------------------|----------------------------|-------------------------------|
| DC-500 | 0.5 | 1.4:1 | 0.70 | 0.90 | LC550-11SSM | LC550-11NNM |
| DC-750 | 0.5 | 1.4:1 | 1.05 | 1.35 | LC780-11SSM | LC780-11NNM |
| DC-1000 | 0.5 | 1.4:1 | 1.40 | 1.80 | LC1.1G-11SSM | LC1100-11NNM |
| DC-1300 | 0.5 | 1.4:1 | 1.82 | 2.34 | LC1400-11SSM | LC1400-11NNM |
| DC-1500 | 0.5 | 1.4:1 | 2.10 | 2.70 | LC1700-11SSM | LC1700-11NNM |
| DC-2000 | 0.5 | 1.4:1 | 2.80 | 3.60 | LC2.2G-11SSM | LC2.2G-11NNM |
| DC-3000 | 0.5 | 1.4:1 | 4.20 | 5.40 | LC3.2G-11SSM | LC3.2G-11NNM |
| DC-4000 | 0.5 | 1.4:1 | 5.60 | 7.20 | LA4.5G-9SSM | LA4.5G-9NNM |
| DC-5000 | 0.5 | 1.4:1 | 7.00 | 9.00 | LA5.5G-11SSM | LA5.5G-11NNM |
| DC-6000 | 0.5 | 1.4:1 | 8.40 | 10.80 | LA6.6G-9SSM | LA6.6G-9NNM |
| DC-7000 | 0.5 | 1.4:1 | 9.80 | 12.60 | LA7.7G-11SSM | LC7.7G-11NNM |
| DC-8000 | 0.5 | 1.4:1 | 11.20 | 14.40 | LA8.8G-11SSM | LA8.8G-11NNM |

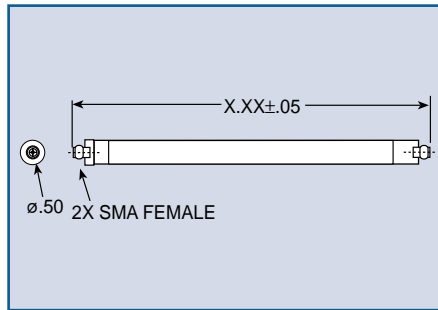
Tubular Filters

Reference Outline (Standard tubular filter housing on page 61)

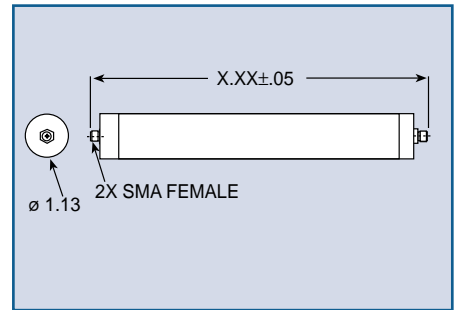
1/4" diameter



1/2" diameter



1 1/8" diameter



Design Considerations

Tubular bandpass filters can be designed with percent bandwidths ranging from 1 to 70 percent. They consist of a series of semi-lumped lowpass sections, capacitively coupled, using dielectric spacers.

Tubular lowpass filters consist of high and low impedance, semi-lumped elements supported by a dielectric tape in a cylindrical housing. These lowpass filters are ideal for harmonic suppressions and rejection of out of band noise. They can be designed to handle power levels in excess of 1000 watts.

Connectors

All of Spectrum Microwave's tubular filters are available with various types of connectors or PC pins. They can be installed in place of an existing cable run or can be bulkhead or fuse clip mounted.

While this topology has been in existence for almost four decades, there are certain frequency ranges and applications where the tubular filter is the best alternative in terms of electrical performance and size.

Additionally, the standardized component structure allows for quick turn-around times with small quantity deliveries.

Suspended Substrate Filters

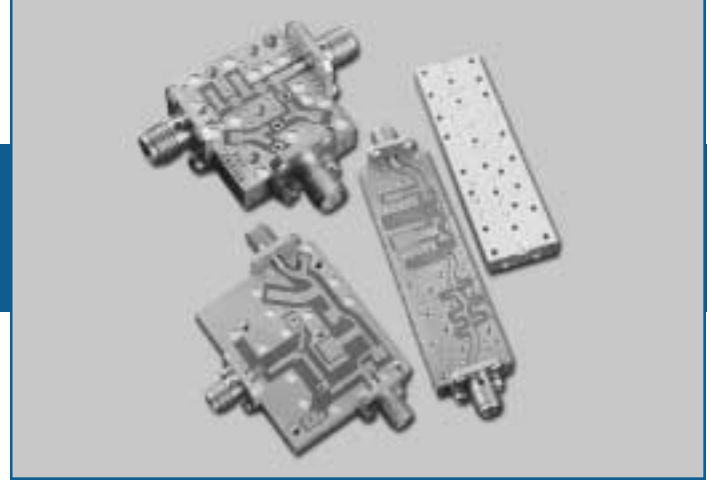
Suspended substrate stripline is similar to standard stripline circuits with the exception that most of the dielectric surrounding the circuit is removed to increase the structure's unloaded Q. This increase in unloaded Q results in lower passband loss than conventional stripline filters. In addition, the lack of dielectric surrounding the circuit makes the filter less sensitive to ambient temperature variations.

Features

- Multi-octave bandwidths
- High selectivity
- Low profile

Applications





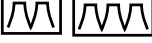
- ECM
- ECCM
- ELINT
- Ultra broadband receivers






Typical Performance Characteristics

Temperature Range -55 to 85°C
 Temperature Stability ±5 ppm typ
 Impedance 50 ohms standard
 Shock 10 G
 Vibration 20 G
 Humidity 0-95%
 Power Range 20 W - 100 W
 Packaging Options Connectorized, Drop-in

Filter Frequency Ranges

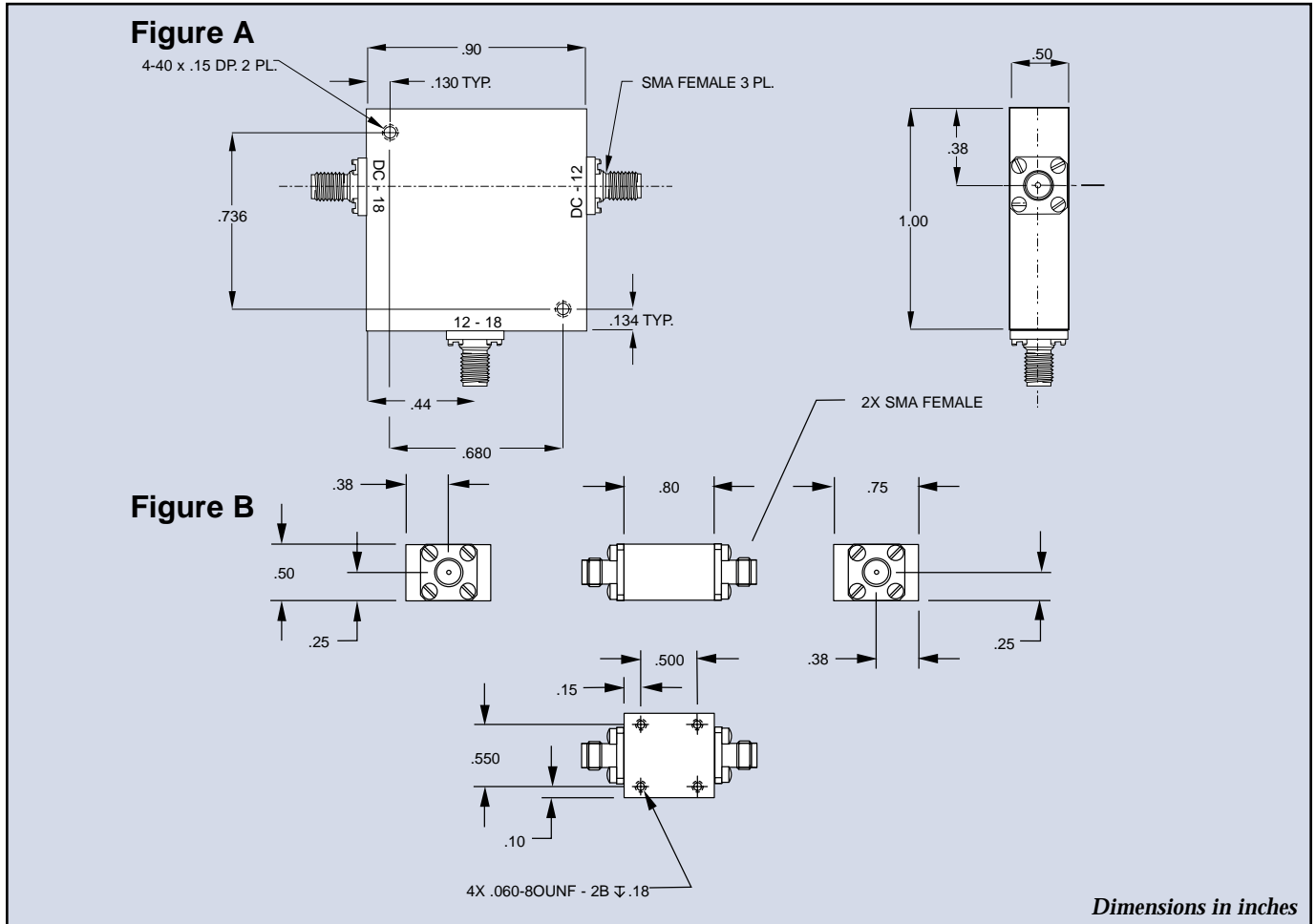
Bandpass  2 GHz - 20 GHz
 Highpass  2 GHz - 26.5 GHz
 Lowpass  300 MHz - 40 GHz
 Band reject  2 GHz - 26.5 GHz
 Duplexer/Multiplexer  2 GHz - 20 GHz

Custom Part Number Examples (Typical part numbers, consult factory for additional designs)

| Part Number | Topology | Passband (GHz) | Insertion Loss (dB max) | VSWR (max) | Attenuation (dBc @ GHz) | Size (inches) ex connectors | Comment | Reference Outlines |
|-------------|---|------------------------------|-------------------------|--------------|--------------------------|-----------------------------|---|--------------------|
| DP12.0G-SS |  | Ch1: DC-11.4 Ch2: 12.6-18 | Ch1&2: 1:0 | Ch1&2: 1:0 | 50 @DC to 10.2 | 0.50 x 1.00 x 0.90 | duplexer, Crossover = 4.5dB IL @ 12GHz | A |
| DP4G-17SS |  | Ch1: DC-3.8 Ch2: 4.2-4.8 | Ch1&2: 0.75 | Ch1&2: 1.5:1 | 55 @ DC to 3.4, 4.6-8 | 0.50 x 1.31 x 1.60 | duplexer, Crossover = 4.5dB @ 4GHz | |
| LP18000-SS |  | DC to 18 | 1.0 | 1.2:1 | 60 @ 19.5 to 26 | .50 x .75 x .50 | Lowpass | B |

Suspended Substrate Filters

Reference Outlines



Design Considerations

A basic suspended substrate stripline filter consists of an etched copper clad dielectric board secured in air between silver plated, machined housings. To ensure proper support and suppress RF leakage, internal walls are also used to secure the board at various intervals within the housing.

Suspended substrate filters can be supplied with either coaxial connectors or axial/radial feed-thrus for installation onto a circuit board or for drop-in MIC applications.

The photo-etched circuitry ensures consistency and repeatability from unit to unit. This topology is suitable for lowpass, highpass, bandpass, bandstop and multiplexing applications in both broadband and narrowband filters. Suspended substrate is currently used in many active EW systems involved ELINT, ECM, and ECCM.

The broad range of achievable impedance values make suspended substrate particularly suitable for highpass and lowpass filters. Broadband bandpass filters and multiplexers can be constructed by cascading highpass and lowpass filters together. The simple, repeatable printed circuit design and small number of parts result in an easily producible unit well suited for high volume manufacturing.

The Cauer/pole-placed transfer functions used in many of the suspended substrate designs result in highly selective, low insertion loss devices. In addition, the compact structure and the flexibility of the printed circuit technology make suspended substrate designs particularly well suited for integrated assemblies.

Couplers, power dividers, and amplitude equalizers can be readily realized in suspended substrate. The printed circuit board configuration naturally lends itself to integration with other topologies, as well as to the direct integration of active components.

Bandpass Filters Ceramic Resonator Type

Features

- Temperature stable (± 5 ppm/ $^{\circ}\text{C}$)
- Temperature range (-30°C to $+85^{\circ}\text{C}$)
- High Q factor (400 to 2000)
- Low insertion loss
- Wide frequency range (400 MHz to 6 GHz)
- High frequency and mechanical stability
- Notch filters available
- Surface mount and thru-hole mount
- Available in 2 to 10 poles
- Available with 2 mm to 6 mm resonators
- 50 Ohm standard, 75 Ohm impedance available
- Custom designs available
- Available in tape and reel packaging (Specs vary based on the size of the part). Please consult the factory for specifications.
- Sealed packages available
- Compliant to MIL Specs
- Compliant to RoHS Specs

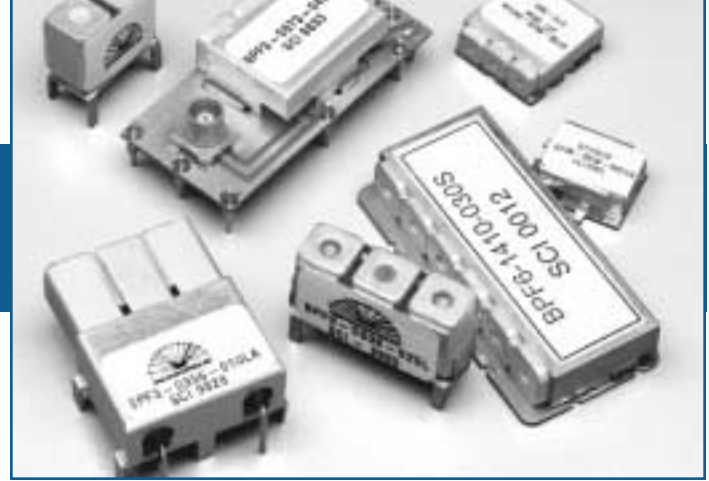
Commercial Applications

- Cellular base station transceivers
- Satellite transceivers
- GPS and car navigation equipment
- Land mobile radios
- CATV
- Modems
- Wireless LANs

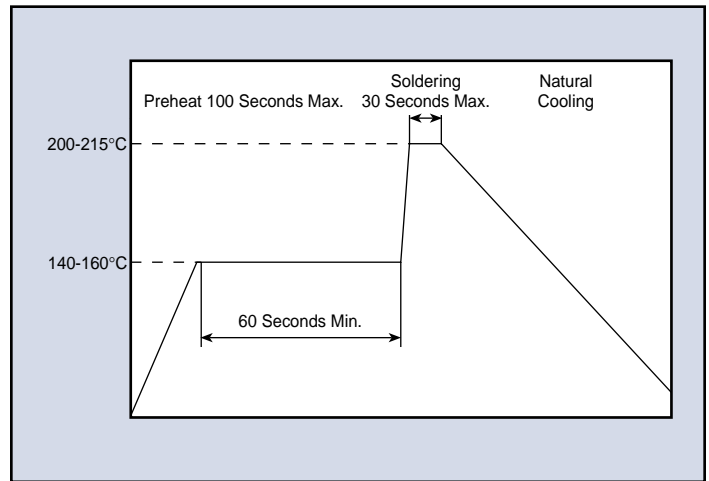
Part Numbering System

Example: **BPC3-0881-025SC**

| BP | C | 3 | - | 0881 | - | 025 | S | C |
|------------------|--|-----------------|---|------------------------|---|-----------------|---------------------------------|---------------------|
| Class | Resonator Cross Section | Number of Poles | | Center Frequency (MHz) | | Bandwidth (MHz) | Mounting Type | Series |
| Bandpass Filters | B = 2 mm C = 3 mm D = 4 mm F = 6 mm | 2 to 7 standard | | Use 4 digits | | Use 3 digits | L = Leaded S = Surface Mount | Assigned by factory |



Recommended Temperature Profile for Soldering



Military Applications

- GPS
- IFF
- RX & TX Communications
- Data Links
- Land mobile radios

Bandpass Filters Ceramic Resonator Type

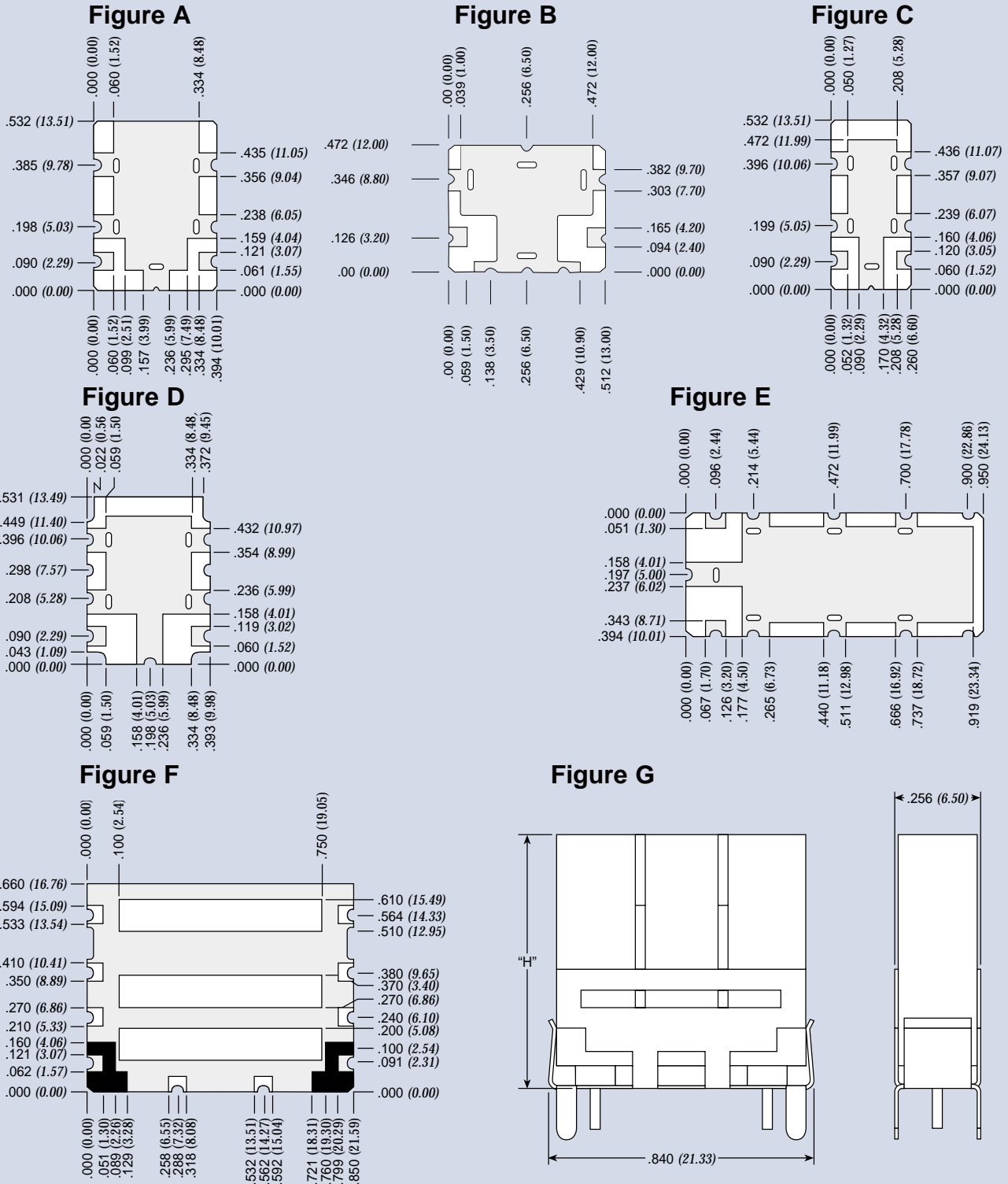
Custom Part Number Examples (Typical part numbers, consult factory for additional designs)

| Application | SCI Part Number | Center Frequency (MHz) | 3dB Bandwidth (MHz) | Number of Poles | Insertion Loss (dB) | Passband Ripple (dB) | VSWR | Attenuation (dBc @ MHz) | Reference Outlines |
|-------------|-----------------|------------------------|---------------------|-----------------|---------------------|----------------------|-------|------------------------------|--------------------|
| CATV * | BPF3-0445-001LA | 445.25 | ±3.75 | 3 | 4.5 | 0.25 | 2:1 | 18 @ 439.45, 451.05 | G |
| CATV * | BPC3-0445-001SB | 445.25 | ±3.75 | 3 | 8.1 | 0.25 | 2:1 | 15 @ 4.39.25, 451.25 | E |
| CATV * | BPF3-0547-001LA | 547.25 | ±3.75 | 3 | 5.5 | 0.25 | 2:1 | 18 @ 541.45, 553.05 | G |
| DSF | BPD5-0767-072SA | 767.0 | ±36.0 | 5 | 4.0 | 2.0 | 2:1 | 28 @ 677, 857 | F |
| E-Amps | BPC3-0836-025SC | 836.5 | ±12.5 | 3 | 2.6 | 1.0 | 2:1 | 12 @ 804, 869 | D |
| DSF | BPD4-0859-038SA | 859.0 | ±19.5 | 4 | 3.0 | 2.0 | 2:1 | 20 @ 789, 929 | F |
| E-Amps | BPC3-0881-025SC | 881.5 | ±12.5 | 3 | 2.6 | 1.0 | 2:1 | 12 @ 849, 914 | D |
| DSF | BPD3-0883-0255A | 883.0 | ±12.5 | 3 | 2.6 | 1.0 | 2:1 | 25 @ 793, 973 | F |
| DSF | BPD3-0888-033SA | 888.5 | ±16.5 | 3 | 3.0 | 1.0 | 2:1 | 25 @ 798.5, 978.5 | F |
| GSM | BPC3-0902-025SC | 902.5 | ±12.5 | 3 | 2.6 | 1.0 | 2:1 | 12 @ 870, 93.05 | D |
| ISM | BPC2-0915-026SC | 915.0 | ±13.0 | 2 | 2.2 | 1.0 | 2:1 | 23 @ 837.15 18 @ 992.5 | C |
| GSM | BPC3-0947-025SC | 947.5 | ±12.5 | 3 | 2.6 | 1.0 | 2:1 | 12 @ 915, 980 | D |
| GPS | BPC2-1575-002SC | 1575.42 | ±1.0 | 2 | 1.2 | 0.3 | 2:1 | 16 @ 1435.42 14 @ 1715.42 | C |
| PCS | BPC3-1880-060SC | 1880.0 | ±30.0 | 3 | 2.2 | 1.0 | 2:1 | 15 @ 1780, 1980 | D |
| PCS | BPC4-1960-060SC | 1960.0 | ±30.0 | 4 | 2.5 | 0.7 | 1.5:1 | 42 @ 1830 20 @ 2060 | B |
| ISM | BPC4-2442-084SB | 2442.0 | ±42.0 | 4 | 2.5 | 1.0 | 1.7:1 | 4 @ 2042, 2842 | B |

Notes: * All CATV parts are 75 Ohm standard.
Consult the factory for custom filter designs.

Bandpass Filters Ceramic Resonator Type

Reference Outlines



Note: See sales drawing for detailed specifications on each part.

Dimensions in inches ±0.012 (mm ±0.3)

Bandpass Filters Monoblock Type

Spectrum Microwave monoblock filters provide an economical means of satisfying many bandpass applications. We have a wide range of standards to meet your specifications. Monoblock filters are an excellent substitute for ceramic resonator type filters where cost and size are critical requirements. Monoblocks often replace SAW filters for those applications that require improved performance. Monoblocks are an ideal solution for mid to high volume order requirements.

Features

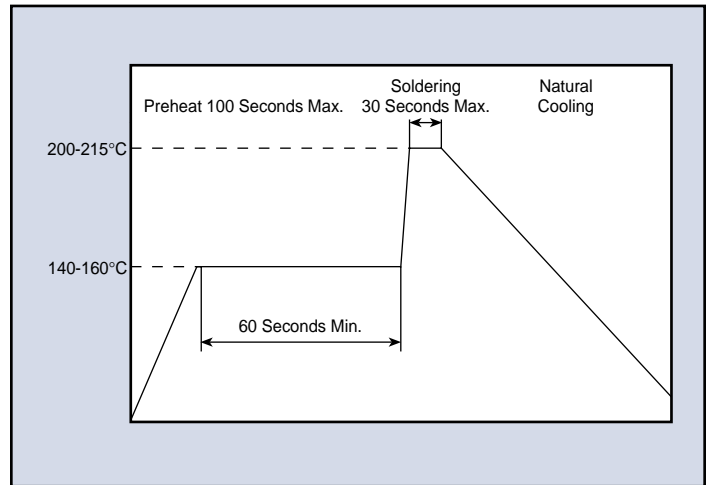
- Low profile
- Low cost
- Surface mount
- Available in 2 to 5 poles
- Low insertion loss
- Available in tape and reel packaging (Specifications vary based on the size of the part, please consult factory).
- Compliant to RoHS Specs

Applications

- Military personal communications (hand held radios, GPS equipment)
- GPS and car navigation equipment
- Cellular base station transceivers
- Satellite transceivers



Recommended Temperature Profile for Soldering



Typical Performance Characteristics

Temperature Range -30 to 85°C
Frequency Range 300 MHz to 5.8 GHz
Temperature Stability ±5 ppm
Q Factor 100 to 1,200
Impedance 50 Ohm standard

Part Numbering System

Example: **MBC3-0881-025SA**

| MB | C | 3 | - | 0881 | - | 025 | S | A |
|------------------------|----------------------------------|---|---|------------------------|---|-----------------|-------------------|---------------------|
| Class | Height | Number of Poles | | Center Frequency (MHz) | | Bandwidth (MHz) | Mounting Type | Series |
| MB = Monoblock Filters | B = 2 mm C = 3 mm D = 4 mm | 2 to 5 standard (For additional poles consult factory) | | Use 4 digits | | Use 3 digits | S = Surface Mount | Assigned by factory |

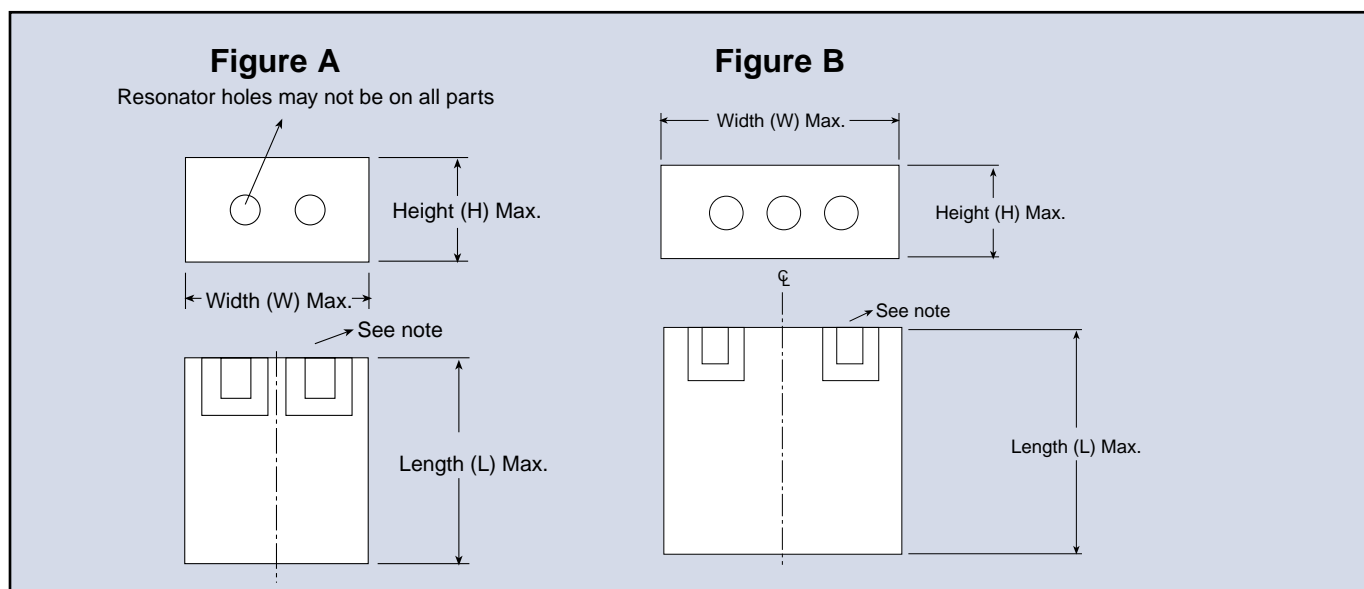
Bandpass Filters Monoblock Type

Custom Part Number Examples (Typical part numbers, consult factory for additional designs)

| Part Number | Application | Center Frequency (MHz) | 3 dB Bandwidth (MHz) | # of Poles | Insertion Loss (dB) | Return Loss (dB) | Attenuation (dB@MHz) | L (mm) | W (mm) | H (mm) | Reference Outlines |
|-----------------|-------------|------------------------|----------------------|------------|---------------------|------------------|--|--------|--------|--------|--------------------|
| MBD4-0836-025SA | CDMA | 836 | 25 | 4 | 2.1 | 12 | 38 @ 686, 34 @ 804 | 8.90 | 6.95 | 3.83 | C |
| MBF4-0850-042SA | TDMA | 850 | 44 | 4 | 3 | 10 | 40 @ 700 | 12.12 | 14.65 | 5.89 | C |
| MBF4-0881-025SA | AMPS | 891.5 | 25 | 4 | 1.1 | 12 | 40 @ 729-754 | 14.61 | 12.12 | 5.89 | I |
| MBD2-0915-013SA | GSM | 915 | 26 | 2 | 2 | 10 | 30 @ 710 | 8.79 | 7.89 | 4.50 | A |
| MBJ5-1030-010SA | TCAS | 1030 | 10 | 5 | 2.5 | 10 | 18 @ 1000 35 @ 1100 | 13.72 | 53.85 | 9.20 | E |
| MBH4-1030-006SA | TCAS | 1030 | 6 | 4 | 1.7 | 12 | 15 @ 1005 18 @ 1055 | 10.74 | 33.58 | 7.85 | H |
| MBK1-1033-001SA | TCAS | 1033 | 1 | 1 | 1.4 | 16 | 3 @ 1027, 1039 | 11.57 | 11.57 | 10.87 | D |
| MBL3-1034-003SA | TCAS | 1034 | 3 | 3 | 1 | 15 | 7 @ 1013, 7 @ 1034 +/-21 | 11.15 | 81.66 | 20.86 | F |
| MBJ3-1090-006SA | TCAS | 1090 | 6 | 3 | 1 | 13 | 40 @ 970 | 41.60 | 10.21 | 12.89 | G |
| MBH4-1090-006SA | TCAS | 1090 | 6 | 4 | 2 | 12 | 20 @ 1060, 1120 55 @ 1120, 1210 | 10.11 | 33.58 | 7.85 | C |
| MBH4-1090-006SB | TCAS | 1090 | 6 | 4 | 2.8 | 12 | 30 @ 1065, 1115 | 10.11 | 33.58 | 7.85 | C |
| MBK1-1095-001SA | TCAS | 1095 | 1 | 1 | 1.4 | 16 | 18 @ 1000; 35 @ 1100 | 11.57 | 11.57 | 10.11 | D |
| MBE2-1227-020SB | GPS-L2 | 1227 | 20 | 3 | 1.5 | 10 | 19 @ 1367, 31 @ 1087 | 10.99 | 11.75 | 4.50 | B |
| MBE2-1227-020SA | GPS-L2 | 1227 | 20 | 2 | 1.5 | 10 | 7 @ 1192, 1262 | 10.92 | 7.89 | 4.50 | A |
| MBE3-1542-034SA | Inmarsat | 1542 | 34 | 3 | 2.2 | 10 | 14 @ 1475; 32 @ 1650 | 8.75 | 11.75 | 4.50 | B |
| MBH4-1542-018SA | Inmarsat | 1542 | 18 | 4 | 1.7 | 12 | 25 @ 1460, 1626; 40 @ 1710 | 6.68 | 33.58 | 7.85 | C |
| MBG4-1555-060SA | Inmarsat | 1555 | 60 | 4 | 1.5 | 12 | 25 @ 1460; 55 @ 1210; 20 @ 1626; 40 @ 1710 | 6.68 | 33.58 | 7.85 | C |
| MBE2-1575-020SA | GPS-L1 | 1575 | 20 | 3 | 1.8 | 10 | 7 @ 1575 +/-35; 7 @ 1540, 1610 | 7.89 | 11.75 | 4.50 | B |
| MBB2-1575-004SA | GPS-L1 | 1575 | 4 | 2 | 1.5 | 11 | 50 @ 849; 45 @ 1850; 15 @ 1710; 42 @ 2400 | 4.10 | 4.00 | 2.00 | A |
| MBB2-1575-004SB | GPS-L1 | 1575 | 4 | 2 | 0.65 | 16 | 40 @ 900 | 5.08 | 3.90 | 1.90 | A |
| MBH4-1575-002SA | GPS-L1 | 1575 | 2 | 4 | 1 | 15 | 17 @ 1525, 1625 | 7.06 | 33.58 | 7.85 | C |
| MBE2-1575-011SA | GPS-L1 | 1575 | 11 | 2 | 1.5 | 15 | 7 @ 1505, 20 @ 1625 | 7.83 | 9.15 | 4.45 | A |
| MBH4-1643-017SA | Inmarsat | 1643 | 35 | 4 | 1.5 | 12 | 30 @ 1545 | 33.58 | 6.63 | 7.85 | C |
| MBE3-1643-034SA | Inmarsat | 1643 | 34 | 3 | 2.2 | 10 | 30 @ 1576; 24 @ 1751 | 7.29 | 11.75 | 4.50 | B |
| MBC3-1960-060SA | PCS | 1960 | 60 | 3 | 1.9 | 11 | 15 @ 1742; 26 @ 2274 | 6.47 | 7.89 | 2.72 | B |
| MBD3-1950-060SA | WCDMA Tx | 1950 | 60 | 4 | 1 | 17 | 38 @ 1840, 27 @ 2060 | 6.95 | 5.41 | 3.83 | C |
| MBF4-1960-060SA | PCS | 1960 | 60 | 4 | 1.6 | 10.5 | 30 @ 1780-1840, 30 @ 2080-2140 | 14.61 | 5.08 | 5.89 | I |
| MBD4-2140-060SA | WCDMA Rx | 2140 | 60 | 4 | 1.3 | 14 | 56 @ 1980, 35 @ 2300 | 6.95 | 5.41 | 3.83 | C |
| MBD4-2140-090SA | WCDMA | 2140 | 90 | 4 | 1.3 | 13 | 47 @ 1833-1993, 10 @ 1920-1980 | 6.95 | 5.08 | 3.83 | A |

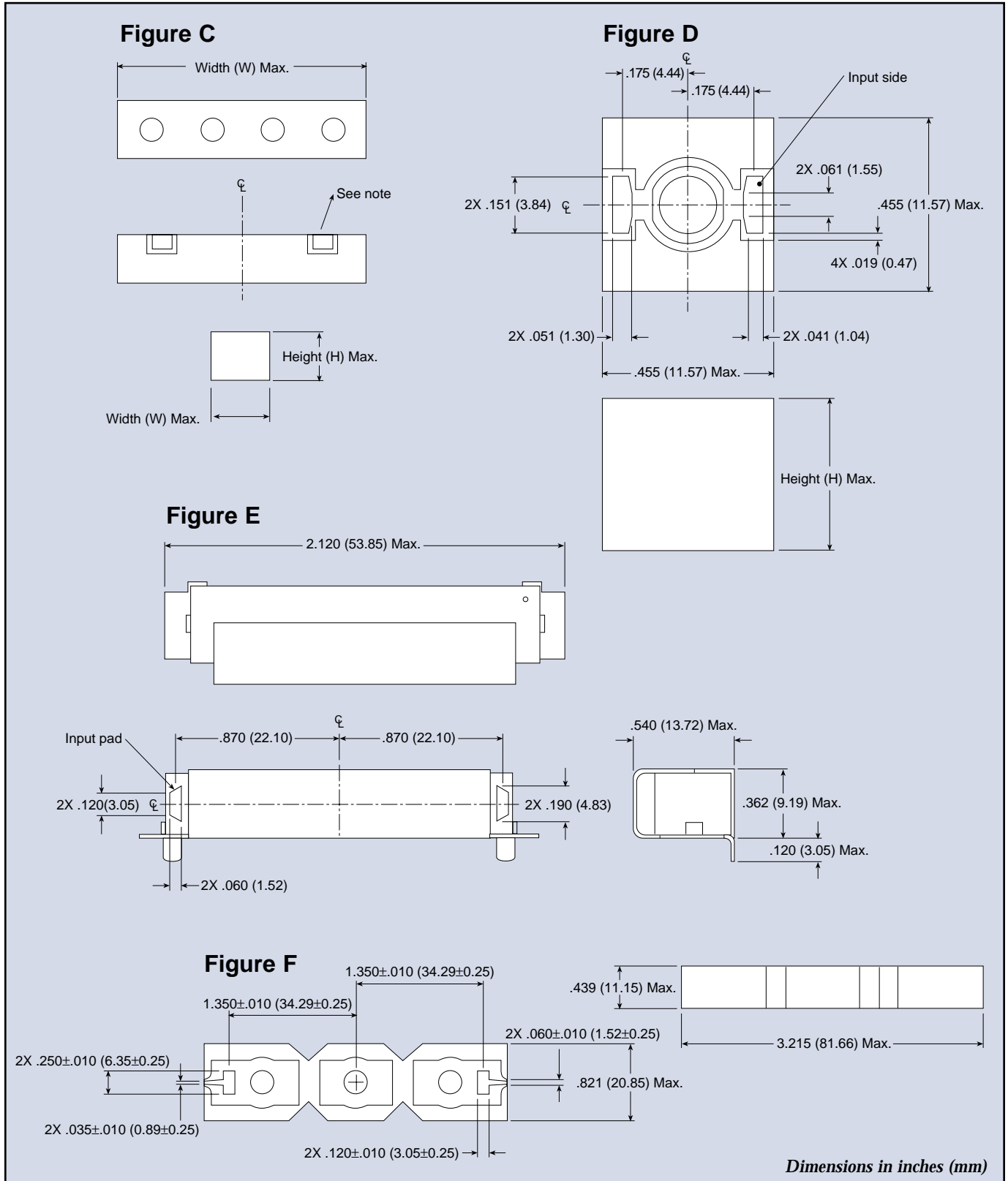
Note: Consult the factory for custom filter designs.

Reference Outlines



Bandpass Filters Monoblock Type

Reference Outlines



Bandpass Filters Monoblock Type

Reference Outlines

Bandpass Filters Monoblock Type

Figure G

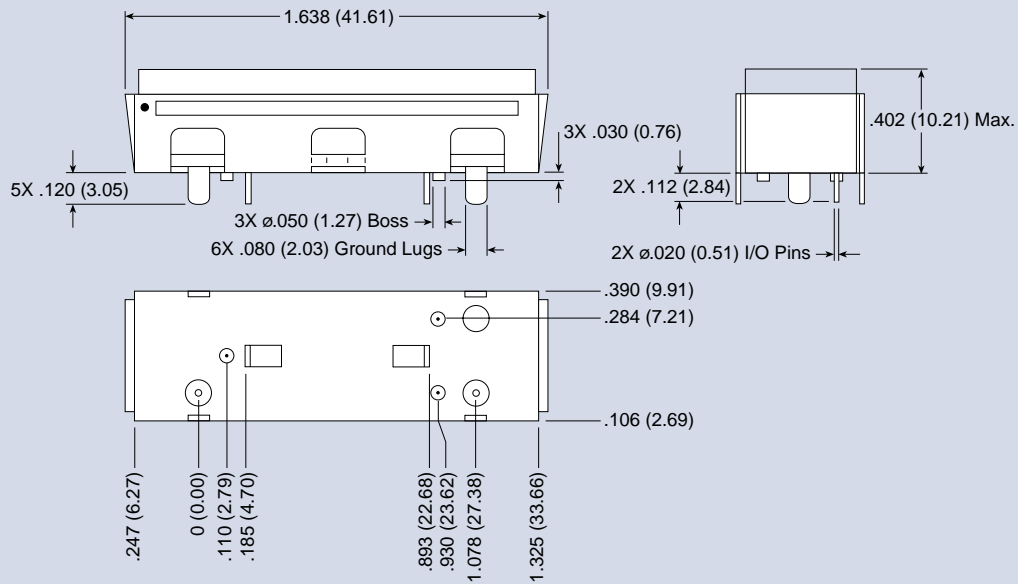


Figure H

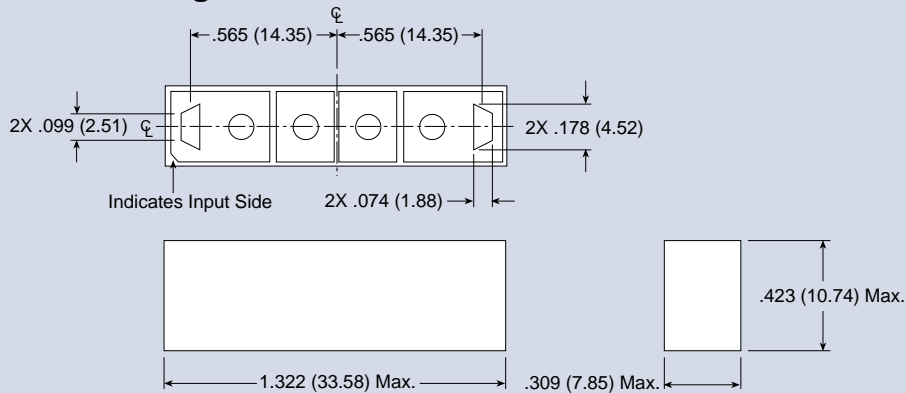
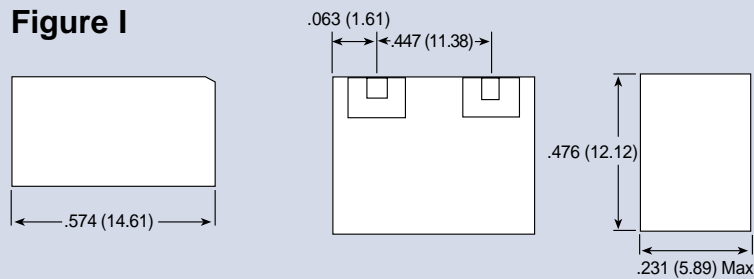


Figure I



Dimensions in inches (mm)

Duplexers Ceramic Resonator Type

Features

- Temperature stable (± 5 ppm/ $^{\circ}\text{C}$)
- Temperature range (-30°C to $+85^{\circ}\text{C}$)
- High Q factor
- Wide standard frequency range
400 MHz to 6 GHz
- Custom designs available
- Surface mount
- Available in 2 to 10 poles
- 50 Ohm standard, 75 Ohm impedance available
- Excellent isolation between transmit and receive frequencies
- Available with different size resonators
- Available in tape and reel packaging
(Specs vary based on the size of the part).
Please consult the factory for specifications.
- Compliant to RoHS Specs

Applications

- Cellular base station transceivers
- Satellite transceivers
- GPS and car navigation equipment
- Land mobile radios
- CATV
- Modems
- Wireless LANs

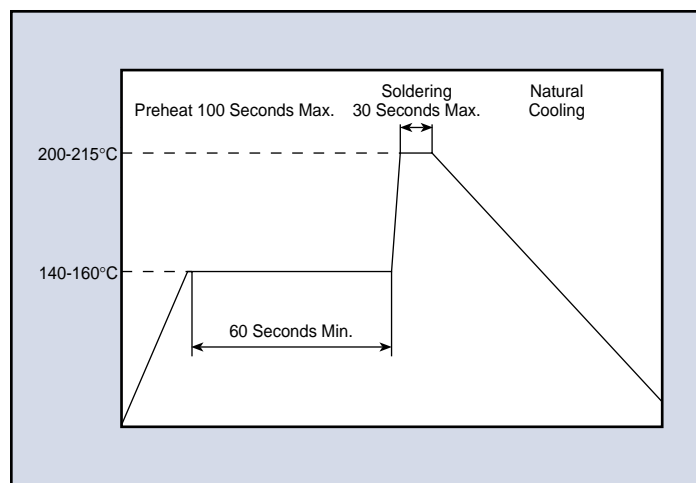
Part Numbering System

Example: **DPC7T0836R0881A**

| <u>DP</u> | <u>C</u> | <u>7</u> | <u>T0836</u> | <u>R0881</u> | <u>A</u> |
|-----------------|--|-----------------|---|--|-------------------------------|
| Class | Resonator Cross Section | Number of Poles | Transmit Center Frequency (MHz) Use 4 digits | Receive Center Frequency (MHz) Use 4 digits | Series Assigned by factory |
| Duplexer Filter | B = 2 mm C = 3 mm D = 4 mm F = 6 mm | | | | |



Recommended Temperature Profile for Soldering



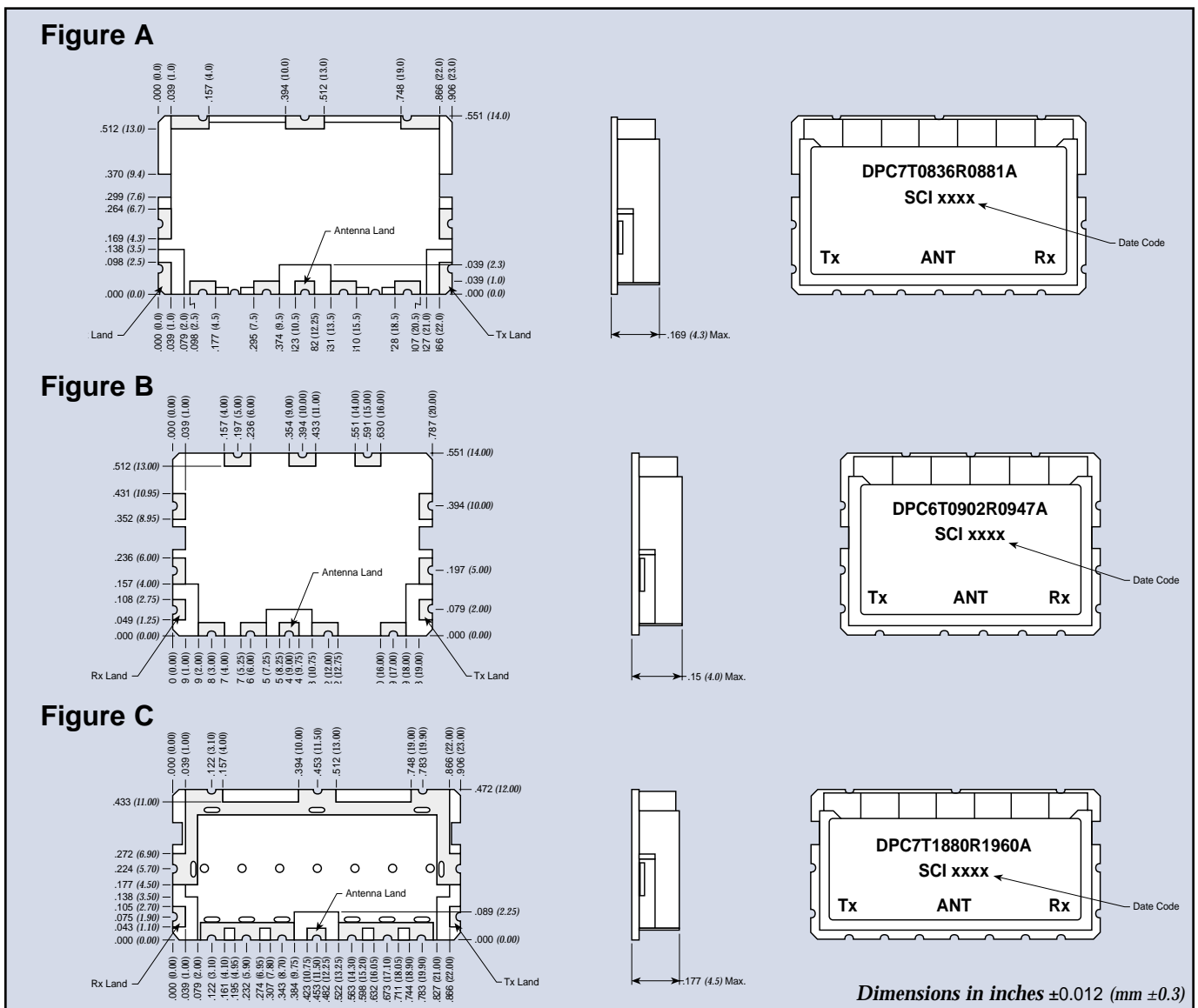
Duplexers Ceramic Resonator Type

Custom Part Number Examples (Typical part numbers, consult factory for additional designs)

| Application | SCI Part Number | | Center Frequency (MHz) | 3 dB Bandwidth (MHz) | Number of Poles | Insertion Loss (dB) | Ripple (dB) | VSWR | Attenuation (dB @ MHz) | Reference Outlines |
|-------------|-----------------|----|------------------------|----------------------|-----------------|---------------------|-------------|-------|------------------------|--------------------|
| E-Amps | DPC7T0836R0881A | Tx | 836.5 | ±12.5 | 3 | 2.6 | 1.9 | 1.7:1 | RX: 40 @ 849, 824 | A |
| | | Rx | 881.5 | ±12.5 | 4 | 3.7 | 1.3 | 1.8:1 | TX: 50 @ 894, 869 | |
| GSM | DPC6T0902R0947A | Tx | 902.5 | ±12.5 | 3 | 2.4 | 1.2 | 1.7:1 | RX: 32 @ 915, 890 | B |
| | | Rx | 947.5 | ±12.5 | 3 | 3.2 | 1.3 | 1.8:1 | TX: 30 @ 960, 935 | |
| PCS | DPC7T1880R1960A | Tx | 1880.0 | ±30.0 | 3 | 2.6 | 1.7 | 1.8:1 | RX: 25 @ 1910, 1850 | C |
| | | Rx | 1960.0 | ±30.0 | 3 | 3.5 | 1.8 | 1.8:1 | TX: 22 @ 1990, 1930 | |

Note: Consult the factory for custom duplexer designs.

Reference Outlines



Duplexer Monoblock Type

Spectrum Microwave monoblock filters provide an economical means of satisfying many applications. We have a wide range of standards to meet your specifications. Monoblock filters are an excellent substitute for ceramic resonator type filters where cost and size are critical requirements.

Features

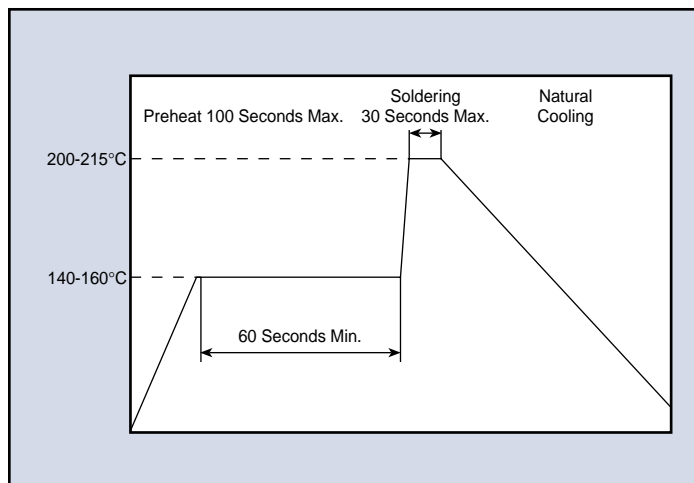
- Low insertion loss
- Low cost
- Surface mount
- Low profile
- Available in tape and reel packaging (Specifications vary based on the size of the part, please consult factory).
- Compliant to RoHS Specs

Applications

- Military personal communications (hand held radios, GPS equipment)
- GPS and car navigation equipment
- Cellular base station transceivers



Recommended Temperature Profile for Soldering



Typical Performance Characteristics

| | |
|------------------------------------|--------------------|
| <i>Temperature Range</i> | -30 to 85°C |
| <i>Frequency Range</i> | 300 MHz to 5.8 GHz |
| <i>Temperature Stability</i> | ±5 ppm |
| <i>Q Factor</i> | 100 to 1,200 |
| <i>Impedance</i> | 50 Ohm standard |

Part Numbering System

Example: **MDC8T0836R0881A**

| | | | | | |
|---------------------|--|-----------------|---------------------------------|--------------------------------|---------------------|
| MD | C | 8 | T0836 | R0881 | A |
| | | | | | |
| Class | Height | Number of Poles | Transmit Center Frequency (MHz) | Receive Center Frequency (MHz) | Series |
| Monoblock Duplexers | B = 2 mm C = 3 mm D = 4 mm F = 6 mm | | Use 4 digits | Use 4 digits | Assigned by factory |

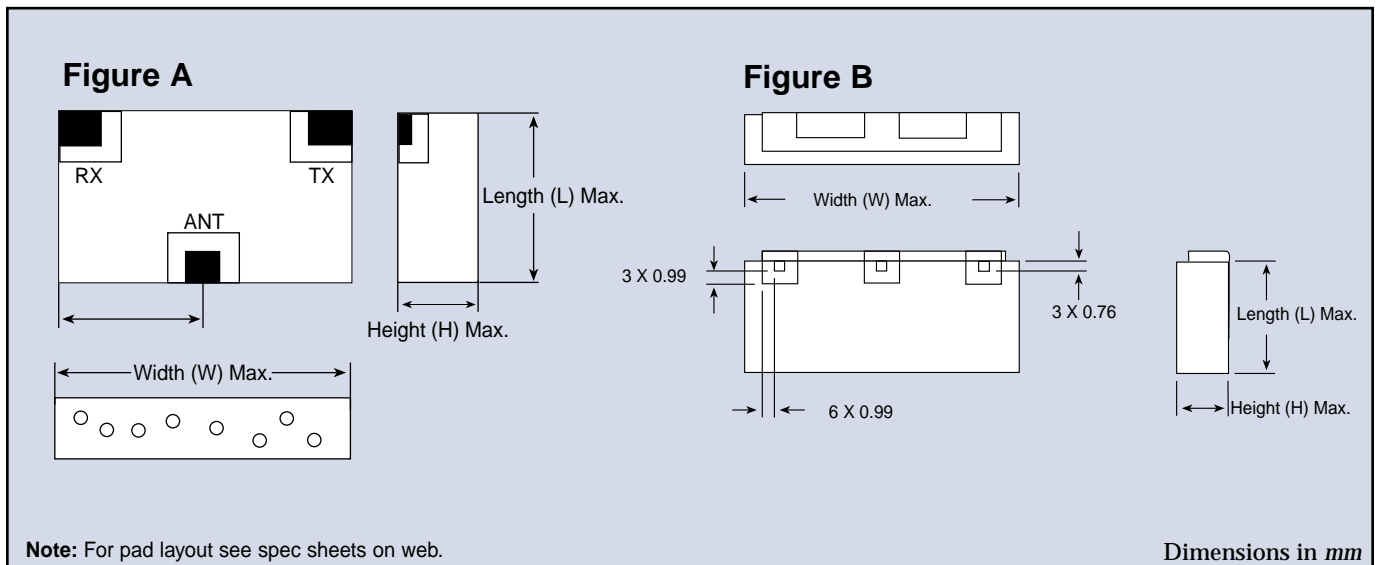
Duplexer Monoblock Type

Standard Parts List

| Part Number | Application | Center Frequency (MHz) | 3dB Bandwidth (MHz) | # of Poles | Insertion Loss (dB) | Return Loss (dB) | Attenuation (dB@MHz) | L (mm) | W (mm) | H (mm) | Reference Outline |
|------------------|-------------|------------------------|---------------------|------------|---------------------|------------------|--|--------|--------|--------|-------------------|
| MDD7T813R858SA | GSM | 813.5/858.5 | 15 | 7 | 2.2/3.1 | 10.5 | Minimum isolation 49 @ 836 | 21.34 | 8.70 | 4.00 | B |
| MDD7T813R858SB | AMPS | 813.5/858.5 | 15 | 7 | 2.2/3.1 | 10.5 | Minimum isolation 47 @ 836 | 21.34 | 8.70 | 4.00 | B |
| MDF9T0836R0881A | AMPS | 836 /881 | 25 | 9 | 2.5/4 | 11 | 46 @ 869-894 & 30 @ 650-824 | 12.67 | 33.53 | 6.50 | G |
| MDE8T0836R0881A | Cellular | 836.5 /881.5 | 25 | 8 | 3.0/4.2 | 10 | 38 @ 869-893;45 @ 824-849 | 8.95 | 21.59 | 4.25 | D |
| MDD8T0836R0881A | CDMA | 836.5 /881.5 | 25 | 8 | 2.4/3.3 | 13 | 42 @ 869-894 & 57 @ 824-849 | 8.70 | 21.34 | 4.00 | B |
| MDD8T0836R0881B | CDMA | 836.5 /881.5 | 25 | 8 | 2.8/3.6 | 12 | 40 @ 869-894 & 55 @ 824-849 | 8.97 | 15.70 | 3.40 | E |
| MDD7T0836R0881SA | CDMA | 836.5/881.5 | 25 | 7 | 2.4/3.3 | 13 | Rejection @ Tx band: 60, @ Rx band: 44 | 21.34 | 8.70 | 4.00 | B |
| MDD5T0942R097A | GSM | 942/897 | 35 | 5 | 3.5/3.5 | 10 | 44.2 @ Tx band, 37.4 @ Rx band | 8.00 | 21.34 | 4.00 | B |
| MDE8T1227R1575SA | GPS | 1227/1575 | 30 | 8 | 1.1/1.0 | 10 | L1: 16 @ 1500, L2: 16 @ 1152 | 16.00 | 7.00 | 4.80 | J |
| MDE4T1227R1575A | GPS | 1227 /1575 | 2 | 4 | 2.5 | 10 | 30 @ 1127, 1475 | 8.46 | 23.16 | 4.47 | A |
| MDFCT1542R1643A | Inmarsat | 1542 /1643 | 34 | 12 | 1.5 | 10 | 65 @ 1626; 60 @ 1529 | 6.84 | 40.01 | 5.59 | E |
| MDB7T1765R1855A | PCS Band | 1765 /1815 | 30 | 7 | 3.0/3.2 | 9 | 39 @ 1840-1870;57 @ 1750-1780 | 6.25 | 12.52 | 2.05 | E |
| MDE8T1822R1727SA | DCS | 1822.5/1727.5 | 35 | 8 | 1.7/1.75 | 12.5 | Rejection @ Tx band: 51.5, @ Rx band: 47.5 | 23.80 | 5.91 | 4.50 | M |
| MDE8T1842R1747A | DCS | 1842/1747 | 75 | 8 | 2.5/3.0 | 10 | 46.5 @ Tx band, 33.5 @ Rx band | 5.91 | 23.80 | 4.60 | F |
| MDEAT1880R1960B | PCS CDMA | 1880 /1960 | 60 | 10 | 3.7/4.0 | 10 | 45 @ 1930-1990; 51 @ 1850-1910 | 5.64 | 22.91 | 4.60 | F |
| MDE9T1880R1960B | PCS | 1880 /1960 | 60 | 9 | 3.2/4.0 | 10 | 40 @ 1930-1990;48 @ 1850-1910 | 5.65 | 17.90 | 4.50 | B |
| MDEBT1880R1960A | PCS | 1880 /1960 | 60 | 11 | 3.4/3.4 | 11 | 38 @ 1930-1990 & 40 @ 1590-1780 | 5.95 | 28.20 | 4.90 | C |
| MDE4T1880R1960SA | PCS | 1880/1960 | 60 | 4 | 3/3.1 | 10 | Rejection @ Tx band: 53, @ Rx band: 45 | 19.79 | 5.40 | 4.50 | K |
| MDB6T1950R2140A | WCDMA | 1950 /2140 | 60 | 6 | 1.4/2.0 | 10.5 | 45 @ 2110-2170 & 50 @ 1920-1980 | 5.30 | 9.80 | 1.85 | D |
| MDB8T1950R2140SA | W-CDMA | 1950/2140 | 60 | 8 | 1.3/1.5 | 15.5 | Rejection @ Tx band: 54, @ Rx band: 46 | 7.00 | 5.25 | 1.70 | N |
| MDE8T1960R1880SA | PCS | 1960/1880 | 60 | 8 | 3.9/3.9 | 10.5 | Rejection @ Tx band: 40.5, @ Rx band: 30.5 | 23.80 | 5.52 | 4.50 | M |
| MDE8T2140R1950SA | W-CDMA | 2140/1950 | 60 | 8 | 1.3/1.3 | 12.5 | Rejection @ Tx band: 55.5, @ Rx band: 55.5 | 23.80 | 5.52 | 4.50 | M |

Note: Consult the factory for custom filter designs.

Reference Outlines



Duplexer Monoblock Type

Reference Outlines

Figure C

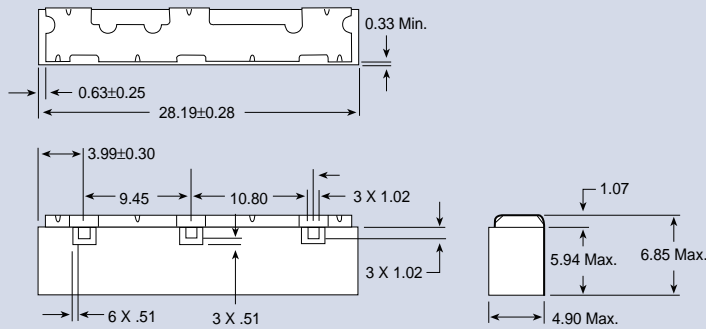


Figure D

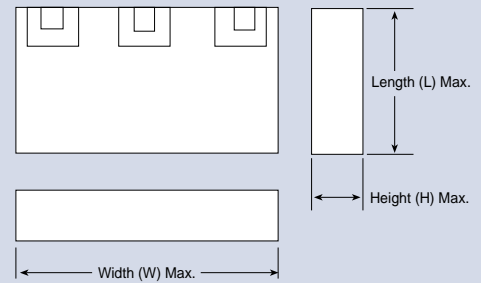


Figure E

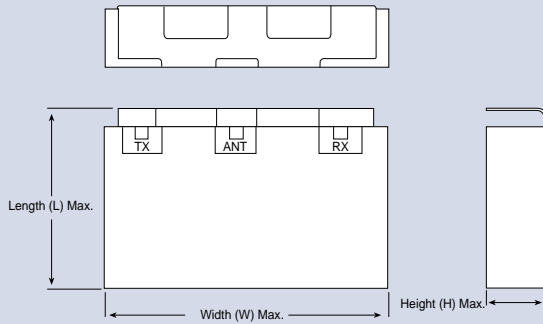


Figure F

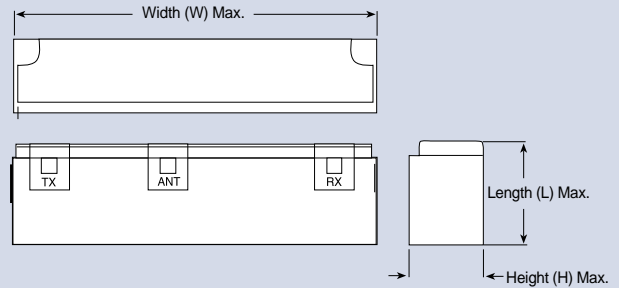
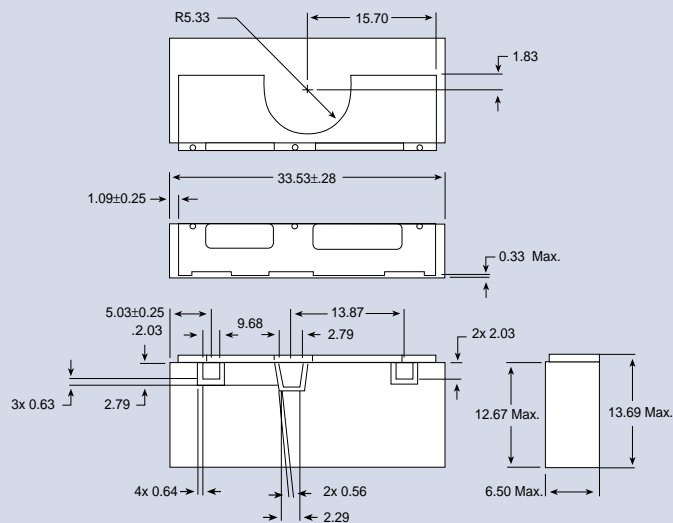


Figure G



Note: For pad layout see spec sheets on web.

Dimensions in *mm*

Duplexer Monoblock Type

Duplexer Monoblock Type

Reference Outlines

Figure I

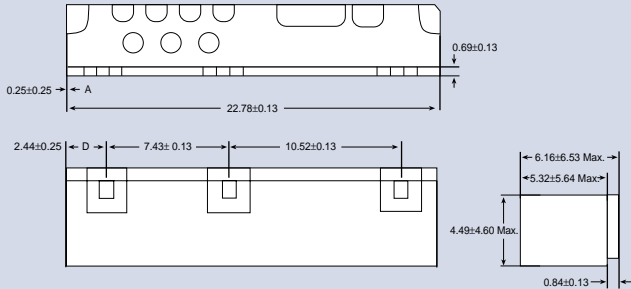


Figure J

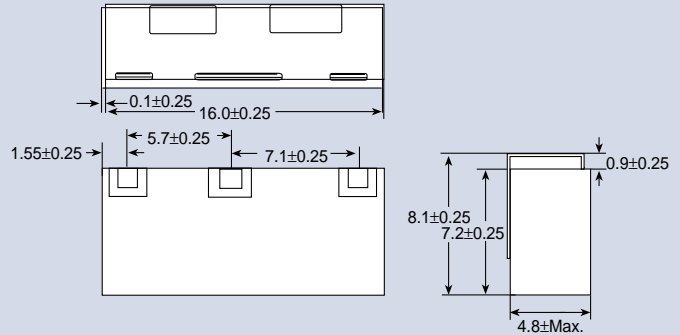


Figure K

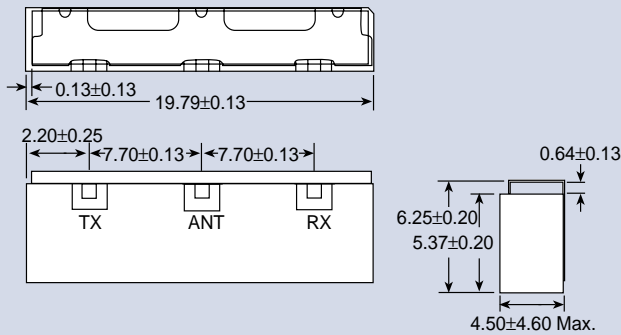


Figure L

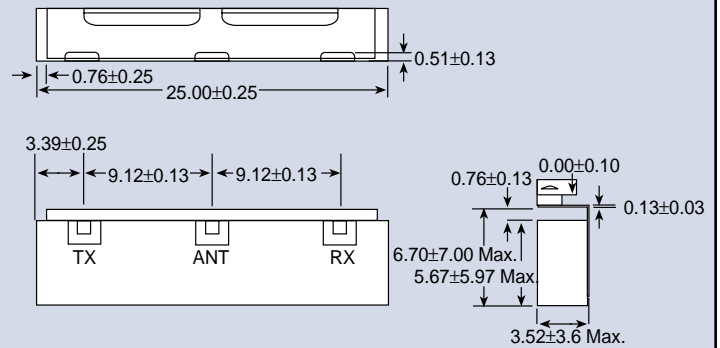


Figure M

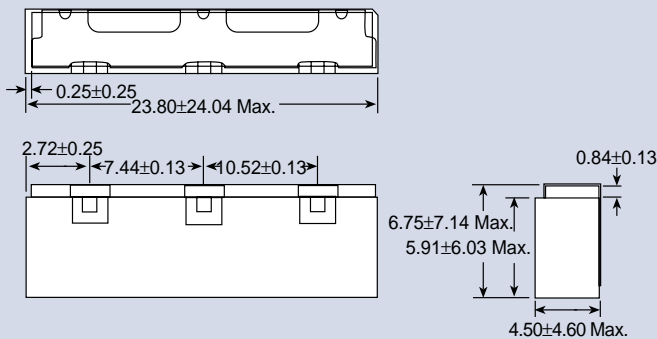
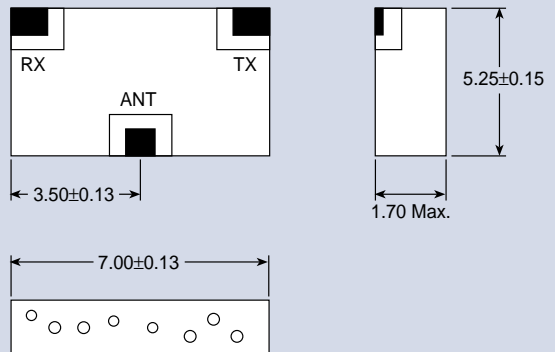


Figure N



Dimensions in mm

Standard Filter Housings

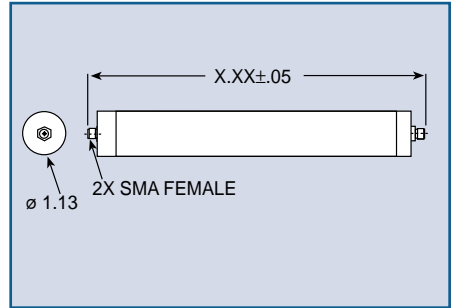
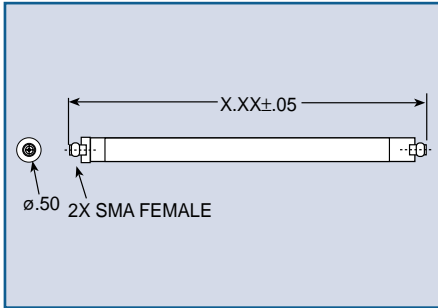
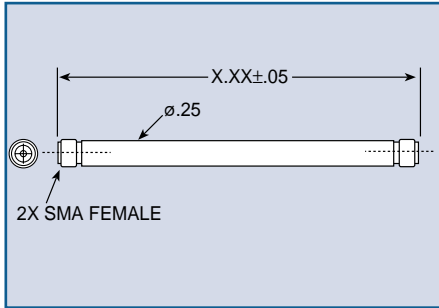
Tubular Filters

1/4" diameter

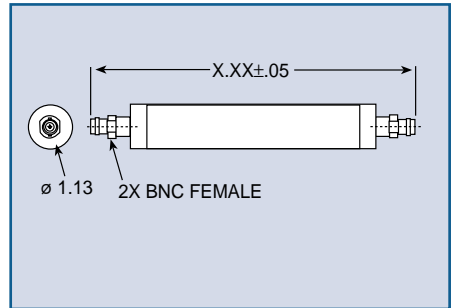
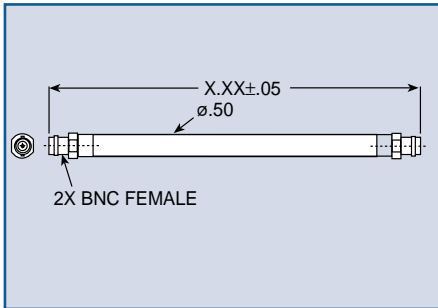
1/2" diameter

1 1/8" diameter

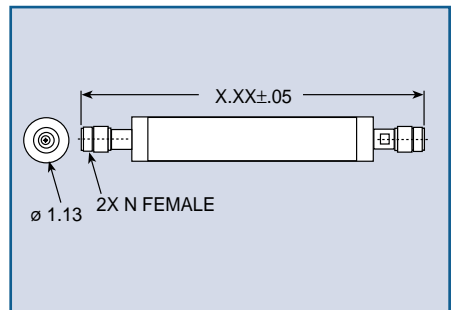
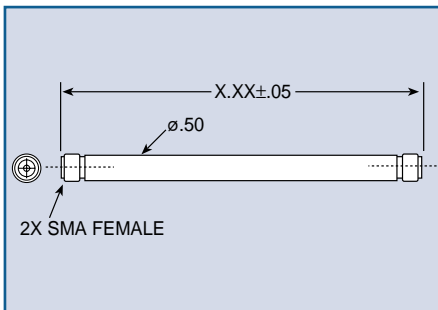
SMA Connectors



BNC Connectors



N Connectors



Standard Filter Housings

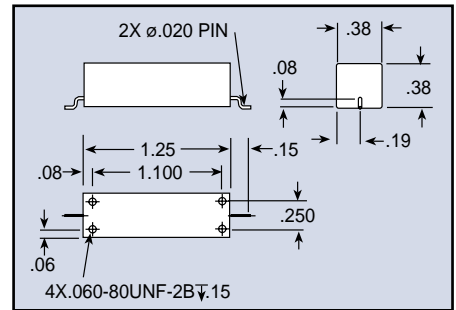
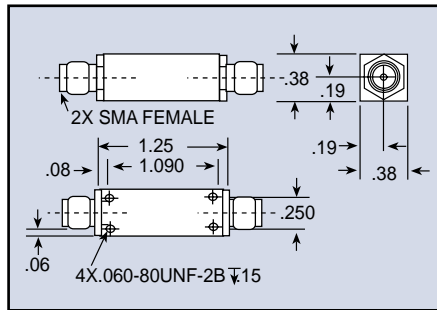
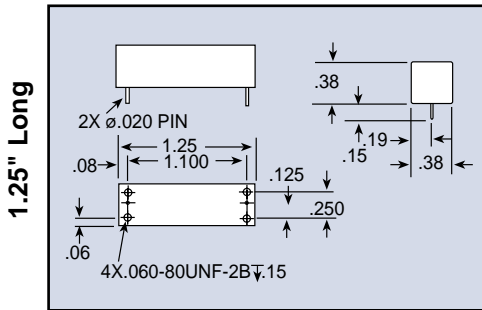
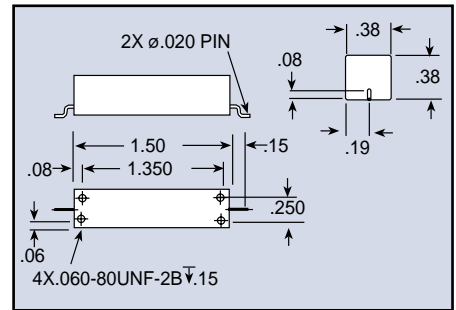
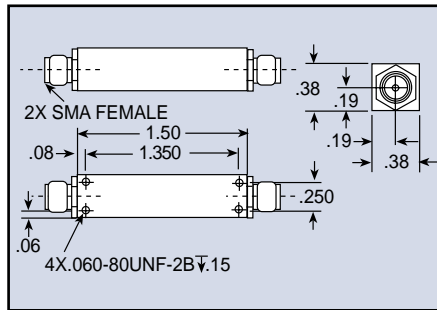
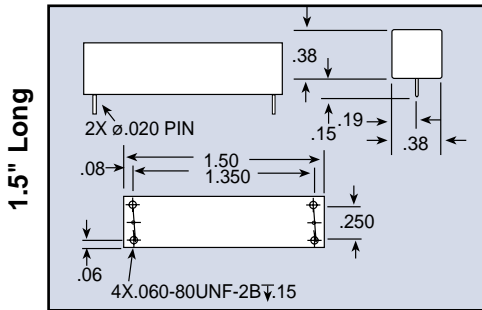
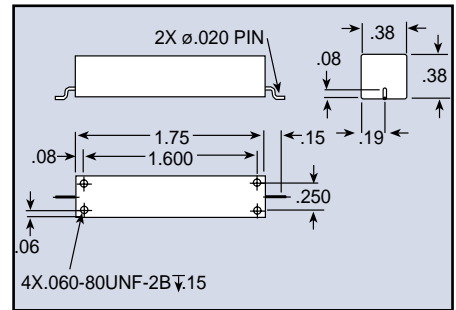
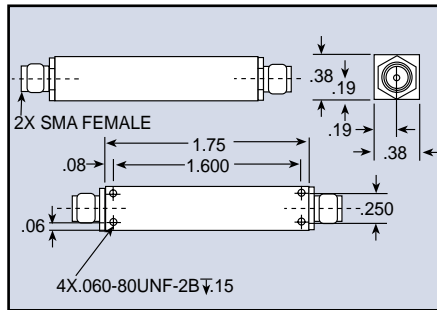
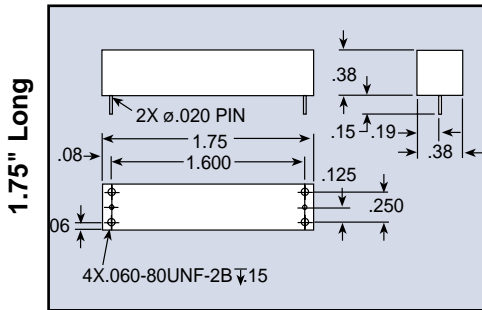
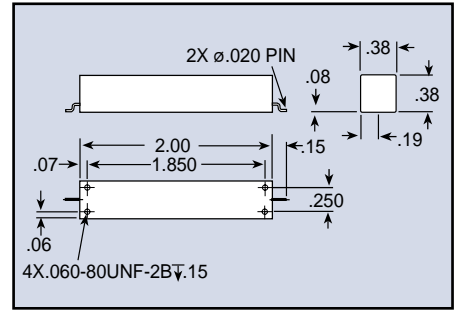
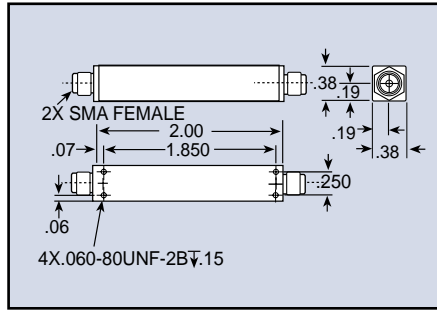
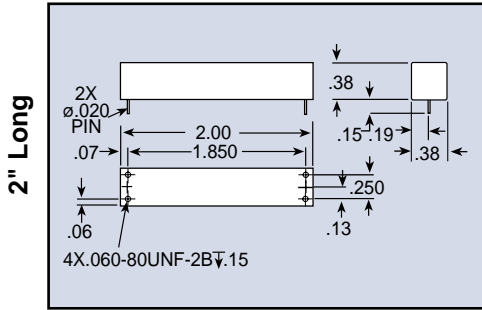
Standard Filter Housings

Lumped Element Filters

PC Pin Packages

SMA Connector Packages

Coaxial Pin Packages

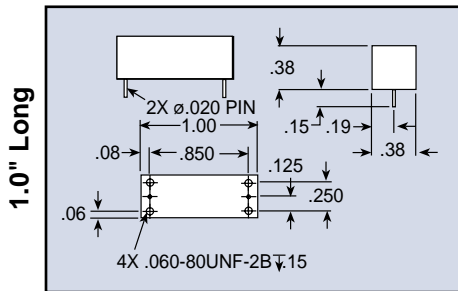


Standard Filter Housings

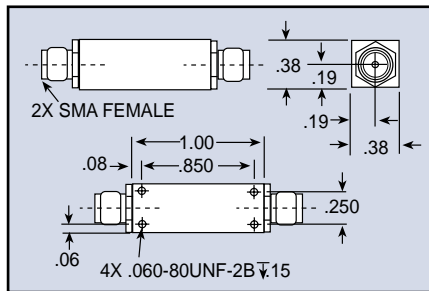
Standard Filter Housings

Lumped Element Filters

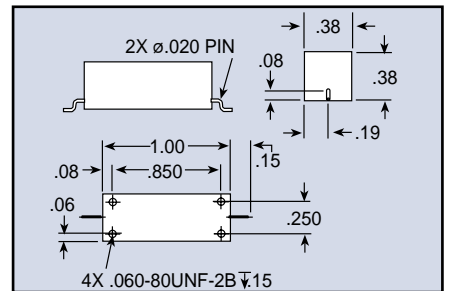
PC Pin Packages



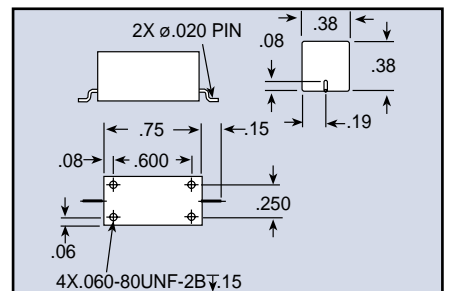
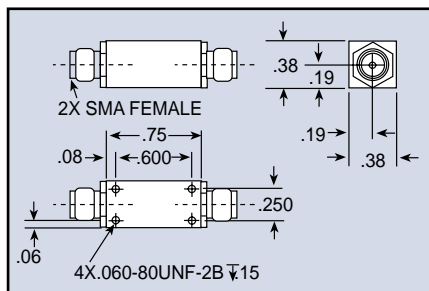
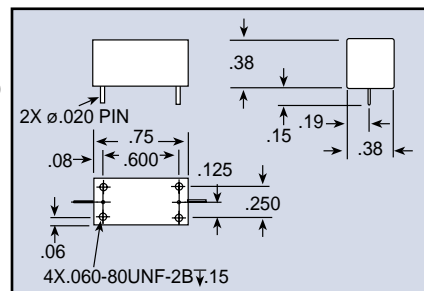
SMA Connector Packages



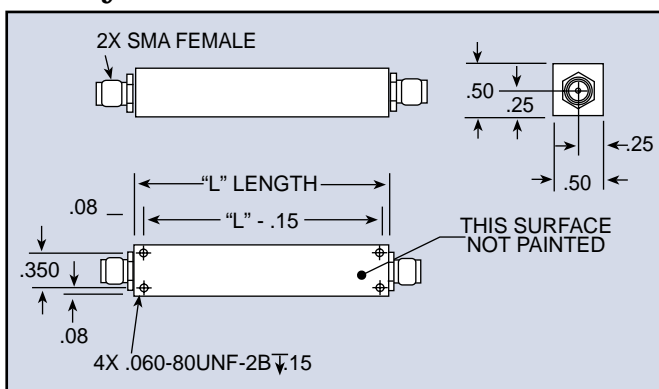
Coaxial Pin Packages



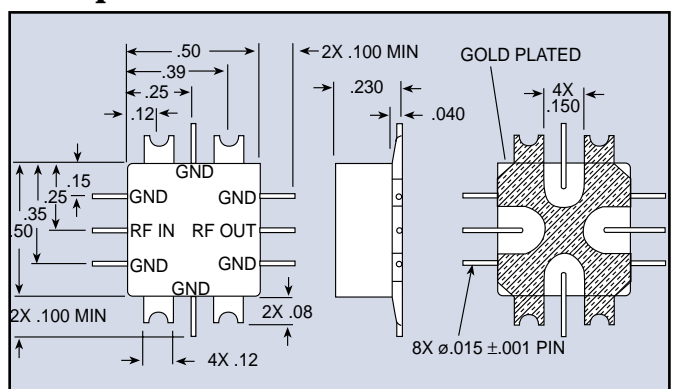
0.75" Long



Cavity Filters



Surface Mount Lumped Element Filters



Standard Filter Housings

Base Station Products

Custom Base Station and Wireless Filter Products and Subsystems

Spectrum Microwave offers a variety of standard and custom filter products and subsystems, whether for existing systems or for the implementation of new systems at existing cell sites.

Spectrum Microwave works closely with its customers, from the initial RFQ stage through prototype development, in order to provide its customers with the most size and cost efficient solution possible. We take steps to ensure that sufficient performance margin is "designed in" for reliable operation under full environmental conditions.



Once a product is qualified, we can utilize any one of our many global manufacturing centers to minimize cost and ensure sufficient product throughput to the customer.

The basic building block for these subsystems usually consists of a filter or duplexer/multiplexer, integrated with other active or passive components such as low noise amplifiers (LNAs), power dividers/combiners, directional couplers, isolators, bias tees, and VSWR monitors.

Filters

| Application | Product Type | Part# | Passband (MHz) | Max. Insertion Loss (dB) | Min. Return Loss (dB) | Attenuation Frequency (dB @ MHz) | Size LxWxH (inches) | Comments |
|--------------|---|----------------------|--|--------------------------|-----------------------|--|-----------------------------|----------------------------------|
| DCS | Filter | 80626 | 1805-1850 | 0.5 | 20 | 70 @ DC-1745 70 @ 1910-1960 | 3.96 x 5.90 x 1.97 | 80 Watts CW |
| AMPS | Filter | 80303 | 825-835 A band Receive | 1.50 | 17 | 43 @ DC-823 43 @ 837-1500 | 12.20 x 6.20 x 3.00 | |
| AMPS | Filter | 80243 | 869 - 891.5 | 1.25 | 17 | 70 @ 896-940 60 @ 940-2300 | 12.20 x 6.20 x 3.00 | |
| AMPS | A band Transmit Filter B band Receive | 80237 | 835 - 849 | 1.50 | 17 | 60 @ DC-815, 45 @ 851-869 20 @ 845.25-846.25 | 12.20 x 6.20 x 3.00 | |
| AMPS | Filter | C840-847.5A | 835 - 845 | 2.00 | 15 | 43 @ DC-833 & 851-1100 | 19.00 x 2RU Standard RMT | |
| AMPS | B band Receive Filter B band Transmit | 846.5 - 849 80116 | 880-894 | 1.00 | 17 | 70 @ 835-849, 45 @ 869-878 & 896-2000 | 15.80 x 8.00 x 3.60 | 256 Watts CW, 8KW PEP |
| EGSM | Filter - Receive | 80305 | 880 - 915 | 1.50 | 15 | 60 @ DC-840 23 @ 840-850 65 @ 925-2450 | 6.69 x 3.35 x 2.36 | 1 Watt CW |
| AMPS | Filter - Transmit | 80120 | 869 - 894 | 0.35 | 18 | 58 @ 824-849 | 6.00 x 3.50 x 4.00 | 400 Watts CW, 3600 Watts PEP |
| ISM | Notch Filter | 80222-S | From 2332.5-2334.4 & from 2343-2344.9 | 2.00 | 15 | 25 @ 2336.2-2341 | 5.90 x 5.90 x 2.20 | 0.5 Watts |
| AMPS | Receive Filter Dual bandpass | 80304 | 825-835, 845-846.5 | 1.60 | 15 | 42 @ DC-822, 40 @ 847.3-1100 | 19.00 x 2RU STANDARD RMT | |
| UHF | Lowpass Filter | LR180-11SS-EHP | 100 to 163 | 0.50 | 17 | 70 @ 200 to 317 | 6.00 x 1.00 x 1.00 | 50 Watts avg, 200 Watts peak |
| UHF | Lowpass Filter | LR411-9SS-EHP-X | 225 to 400 | 0.55 | 17 | 60 @ 450 to 4000 | 3.88 x 1.93 x 1.00 | 150 Watts avg, 450 Watts Peak |
| Cellular-GSM | Lowpass Filter | LC1100-9NMN | 750 to 1000 | 0.25 | 15 | 50 @ 2250 to 7000 | 0.50 x 5.93 dia. (T.T.) | |
| PCS | Lowpass Filter | LC2060-13SS | 1250 to 2000 | 0.80 | 14 | 45 @ 2500 to 7000, 35 @ 7000 to 10000 | 0.50 dia. x 3.50 (T.T.) | 50 Watts CW |

Duplexer/Multiplexer Filters

Spectrum Microwave's years of experience designing filter based solutions for the telecommunication market and our capabilities to offer valued-added integrated products will provide you with answers that you need. Limited tower space, continued regulatory pressures and public opinion shape the requirements of designers.

Additionally, network operators continue to search for substantial cost savings by reducing cell sites and capital equipment. Efficient utilization of wireless components is a must and having Spectrum Microwave as your design partner will allow you to exceed customer expectations.

Base Station Products

Duplexer/Multiplexer Filters

| Application | Product Type | Part# | Passband (MHz) | Max. Insertion Loss (dB) | Min. Return Loss (dB) | Min. Isolation (dB) | Size LxWxH (inches) | Comments |
|-------------|------------------|------------------|--|---|-----------------------|-------------------------|----------------------|---|
| AMPS | Duplexer | 80137 | Ch1: 869 - 894 Ch2: 824 - 849 | 0.70 | 17 | 75 | 11.00 x 8.38 x 2.13 | 500 W CW, 8KW PEP |
| AMPS/PCS | Duplexer | 80376-N | Ch1: 824 - 894 Ch2: 1850 - 1910 | 0.25 | 18 | 60 | 4.90 x 4.60 x 2.25 | AMPS: 300 Watts average, 5kWatts PEP, PCS: 150 Watts average, 5KW PEP |
| AMPS/PCS | Duplexer | 80432 | Ch1: 824 - 896 Ch2: 1850 - 1990 | 0.2 | 20 | 45 | 7.85 x 6.63 x 1.28 | AMPS: 500 Watts CW, 40kWatts PIP, PCS: 250 Watts CW, 20 kW PIP |
| AMPS/PCS | Duplexer | 80432-NH | Ch 1: 824 - 896 Ch 2: 1850 -1990 | 0.2 | 23 | 45 | 7.85 x 6.63 x 1.28 | Power AMPS: 500 Watts CW, PCS: 250 Watts CW |
| AMPS/PCS | Duplexer | DP1325-SS | Ch1: 800 - 900 Ch2: 1750 - 2000 | Ch1: 0.5 Ch2: 0.7 | 15 | 25 | 0.40 x 0.60 x 1.50 | 1 Watt CW |
| GSM/DCS | Duplexer | DP1382.5-SS | Ch1: 921 - 960 Ch2: 1805 -1880 | Ch1: 0.5 Ch2: 0.7 | 15 | 25 | 0.40 x 0.60 x 1.50 | 1 Watt CW |
| UMTS/DCS | Duplexer | 80787 | Ch1: 2110-2170 Ch2: 1805-1850 | 0.5 | 20 | 50 | 2.00 x 5.00 x 6.00 | Passive IM products: -110 dBm min with two + 43 tones |
| GSM | Duplexer | 80625A | Ch 1: 824 - 849 Ch 2: 869 - 894 | 0.5 | 20 | 60 | 4.97 x 7.10 x 4.00 | 3rd Order IM = -100dBm min (2x25 Watt tones) |
| DCS | Duplexer | 80093 | Tx: 1805 - 1880 Rx: 1710 - 1785 | 1.00 | 15 | 75 | 8.59 x 6.96 x 2.06 | 200 Watts CW, 2.5KW PEP |
| GSM | Duplexer | 80310 | Rx: 890 - 915 Tx: 935 - 960 | 0.50 | 17 | | 8.50 x 6.50 x 2.75 | 100 Watts CW, 625 PEP |
| PCS | Duplexer | 80132-A | Tx: 1930 - 1945 Rx: 1850 - 1865 | 0.75 | 18 | 75 | 4.10 x 2.00 x 1.50 | 25 Watts CW |
| PCS | Duplexer | 80132-B | Tx: 1950 - 1965 Rx: 1870 - 18850 | 0.75 | 18 | 75 | 4.10 x 2.00 x 1.50 | 25 Watts CW |
| PCS | Duplexer | 80132-C | Tx: 1975 - 1990 Rx: 1895 - 1910 | 0.75 | 18 | 75 | 4.10 x 2.00 x 1.50 | 25 Watts CW |
| PCS | Duplexer | 80307 | Rx: 1850 - 1910 Tx: 1930 - 1990 | 0.75 | 18 | Tx: 75 Rx: 70 | 8.59 x 6.96 x 2.06 | 200 Watts CW, 2.5KW PEP |
| Tetra | Duplexer | 80514-A | Tx: 390 to 395 Rx: 380 to 385 | 1.5 | 14 | 75 | 11.80 x 3.94 x 6.25 | Power Rating: 25 Watts CW, 60 Watts PEP |
| Tetra | Duplexer | 80514-B | Tx: 395 to 400 Rx: 385 to 390 | 1.5 | 14 | 75 | 11.80 x 3.94 x 6.25 | Power Rating: 25 Watts CW, 60 Watts PEP |
| Tetra | Duplexer | 80514-C | Tx: 420 to 425 Rx: 410 to 415 | 1.5 | 14 | 75 | 11.80 x 3.94 x 6.25 | Power Rating: 25 Watts CW, 60 Watts PEP |
| Tetra | Duplexer | 80514-D | Tx: 425 to 430 Rx: 415 to 420 | 1.5 | 14 | 75 | 11.80 x 3.94 x 6.25 | Power Rating: 25 Watts CW, 60 Watts PEP |
| Tetra | Duplexer | 80514-E | Tx: 460 to 465 Rx: 450 to 455 | 1.5 | 14 | 75 | 11.80 x 3.94 x 6.25 | Power Rating: 25 Watts CW, 60 Watts PEP |
| Tetra | Duplexer | 80514-F | Tx: 465 to 470 Rx: 455 to 460 | 1.5 | 14 | 75 | 11.80 x 3.94 x 6.25 | Power Rating: 25 Watts CW, 60 Watts PEP |
| ISM | Duplexer | DP2412-2457-6ENN | Ch1: 2401 to 2423 Ch2: 22451 to 2473 | 1.5 | 18 | 80 | 5.50 x 6.40 x 1.90 | Input power 2 Watts Max CW |
| ISM | Duplexer | DP2421-2462-8ESS | Ch1: 2408 - 2434 Ch2: 2449-2475 | 2 | 15 | 80 | 4.95 x 4.95 x 1.33 | Power Rating 5 Watts CW |
| ISM | Duplexer | 80671 | Ch1: 5730 - 5764 Ch2: 5811 - 5845 | 1.8 | 16 | 80 | 4.15 x 3.40 x 1.28 | Power Rating 25 Watts CW |
| UMTS | Duplexer | 80539-N | Tx: 2110 to 2170 Rx: 1920 to 1980 | 1 | 14 | 80 | 4.80 x 4.65 x 1.38 | Power Rating of 100 Watts CW 400 Watts PEP |
| ISM | Duplexer Ceramic | 80221 | Tx: 935-940 Rx: 896-901 | Tx: 1.00 Rx: 1.75 | 18,15 | Tx to ANT: 50 | | 120 Watts CW, 480 Watts PEP |
| UMTS | Duplexer | 80786 | Tx: 2110 - 2170 Rx: 1920-1980 | 0.5 Typical, 1.0 max 17 | 80 | | 6.30 x 5.70 x 2.40 | 500 Watts CW, 8KW PEP |
| PCS | Triplexer | 80579-L | Rx:1866.25 - 1868.75 Tx1: 1945.625 - 1946.875 Tx2: 1948.125 - 1949.375 | Rx: 1.5 Max Tx1: 1.5 Max Tx2: 1.5 Max | Rx: 20 Tx: 18 | 20 from Channel-Channel | 10.00 x 8.00 x 1.70 | Ultimate Rejection is 60 dB up to 6000 MHz |
| ISM | Triplexer | 80675 | Ch1: 2401 - 2423 Ch2: 2426 - 2448 Ch3: 2451 - 2473 | 3.5 Max | 18 | 50 all channels | 12.75 x 10.85 x 1.83 | Passband flatness 2.75 max all channels |

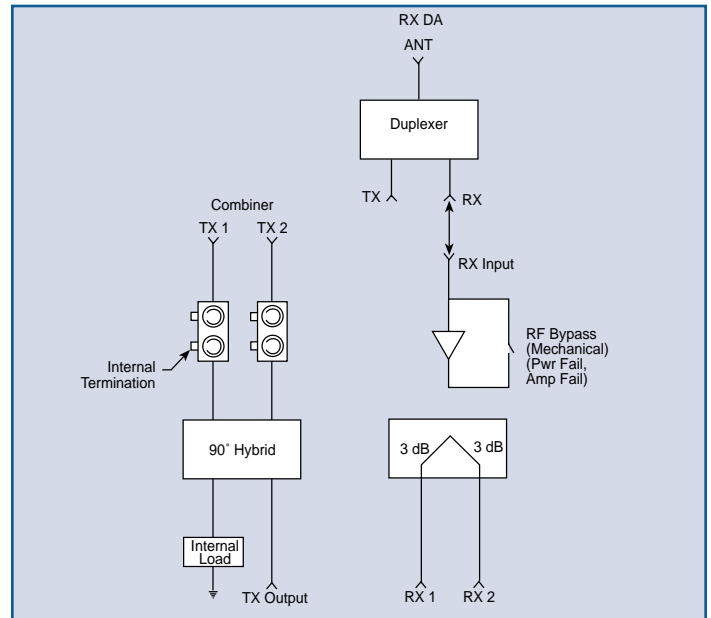
Base Station Products

Receiver Multicouplers

Receiver multicouplers allow the operation of more than one receiver to operate with a single antenna, while realizing the same performance as using a single dedicated antenna for each receiver. Typically, a net gain is realized at each receiver port while the signal to noise ratio is minimized.

Spectrum Microwave offers receiver multicouplers for both analog and digital communications systems that can be easily expanded to up to 32 channels. They typically include a preselector filter, LNA, bias tee, power divider(s), DC power and VSWR monitors. These assemblies can be designed to be integrated within the base station or as a stand alone sub-system to connect with the base station at the cell site.

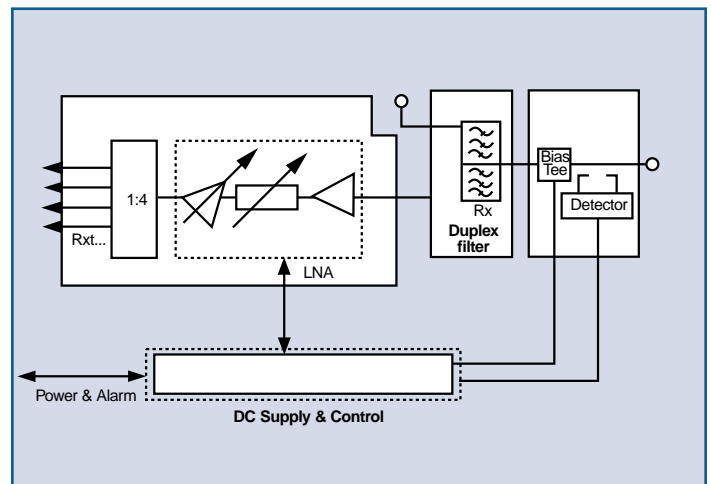
When the preselector filter is replaced with a duplexer, the assembly can be easily modified to incorporate transmit combining capability via the Tx port of the duplexer.



LNA/Filter-Duplexer Assemblies

LNA/Filter assemblies are utilized to provide amplification of weak receive signals while minimizing noise figure and transmitter interference. These assemblies can be in the base station or as a Tower Mounted Amplifier (TMA).

Spectrum Microwave specializes in developing custom, application specific assemblies for its customers. These LNA assemblies can incorporate single or multistage amplification, single or redundant branching, with various types of biasing options and alarm circuitry. The type and location of the preselector filtering in the assemblies is optimized to minimize the overall noise figure while providing the appropriate frequency selectivity.

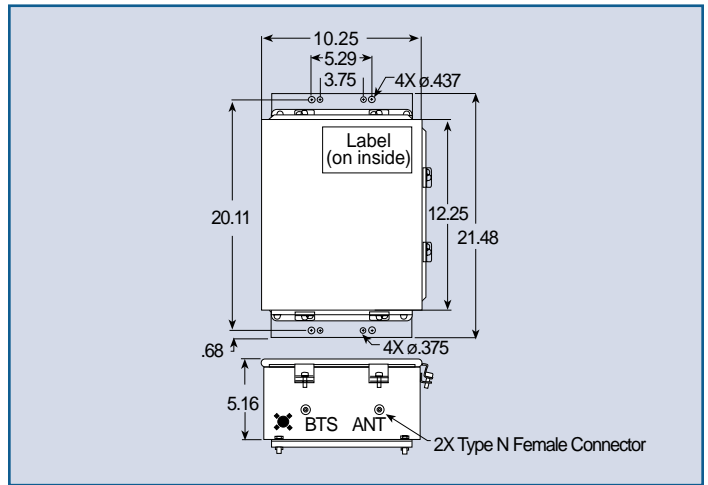


Base Station Products

Tower Mounted Amplifiers

Tower Mounted Amplifiers are often utilized to overcome downline coaxial cable losses and to improve receiver sensitivity. They can also be used to extend base station coverage in repeater applications.

The typical Spectrum Microwave TMA assembly includes preselector filtering (or duplexing), amplifier/bypass circuitry, bias tee, and lightning/impulse suppressors. The units can be housed in either standard NEMA rated, or custom enclosures and are designed to withstand even the harshest, salt air environments.

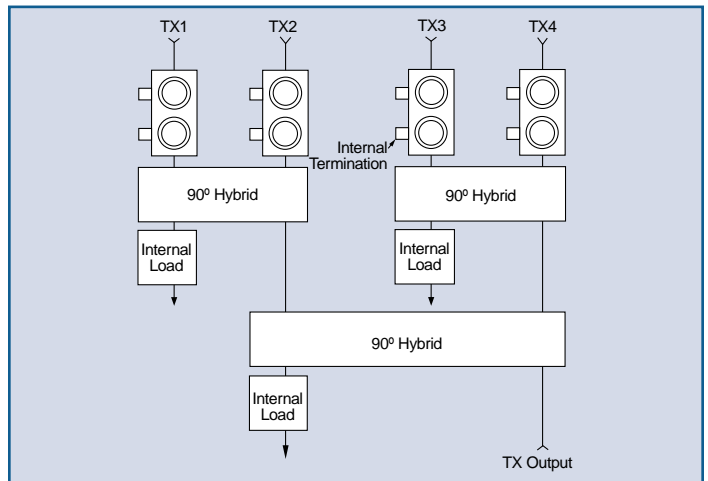
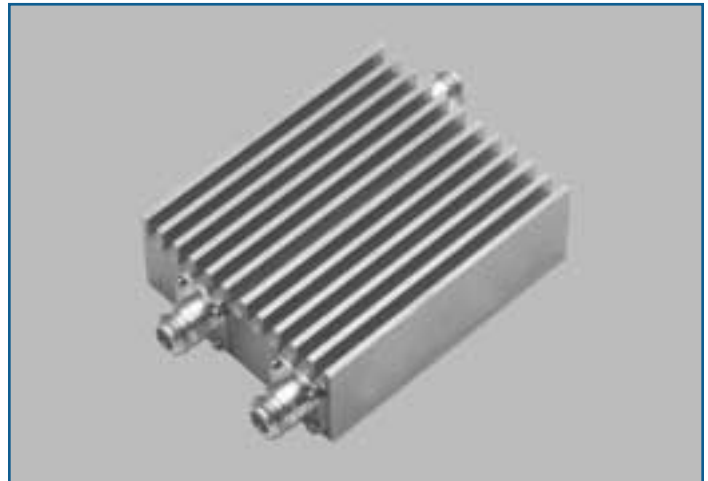


Transmit Combiners

Transmit combiners allow the operation of two or more transmitters with a single antenna while providing isolation between the combined transmitters. Spectrum Microwave manufactures two basic types of combiners, cavity and hybrid types.

Cavity type combiners are constructed of single or dual narrow bandpass cavities, usually integrated with single or dual stage isolators. The advantages of this approach are lower insertion loss, additional filtering and high isolation. Some disadvantages include limited channel spacing and capability, as well as large size.

Hybrid type combiners are typically realized using a 3 dB branch line configuration, and are also usually integrated with single or dual stage isolators. In some instances, a conventional "Wilkinson" type of construction is also utilized. The advantages of this type of combiner include having no minimum channel spacing requirements, relatively compact size and easy expandability. The major disadvantage is higher insertion loss.



Base Station Products

Directional Couplers

Directional couplers can be used to sample or inject signals throughout the base station. They can be supplied as stand alone products or integrated into various filter products and sub-systems. The coupled port(s) are typically connected to detectors and alarm circuitry when utilized for power or VSWR monitoring. Additionally, built in test (BIT) signals can be injected via the coupled port(s) for system self test monitoring.

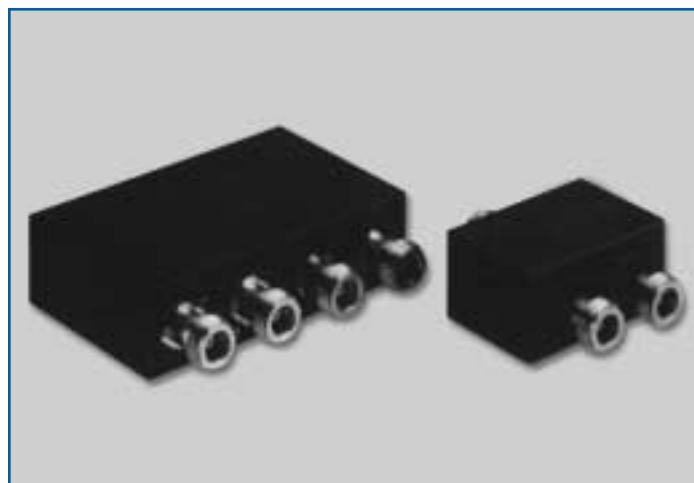
Spectrum Microwave directional couplers feature high directivity, low passive Intermodulation, and are designed for specific frequency bands and coupling values to minimize complexity and cost. Both single and dual directional units are available.



Power Dividers/Combiners

Power dividers/combiners are passive components that split an input signal into two or more identical outputs (in both phase and amplitude), or combine two or more separate signals into a common port. A typical application would be splitting the output from a LNA and distributing the signal to various receivers.

Spectrum Microwave offers both low and high power units for use as stand alone products or for integration into other filter products and sub-systems. Because these components are custom designed for specific frequency bands and power levels, size, complexity and cost can be minimized.



Power Dividers/Couplers/Combiners

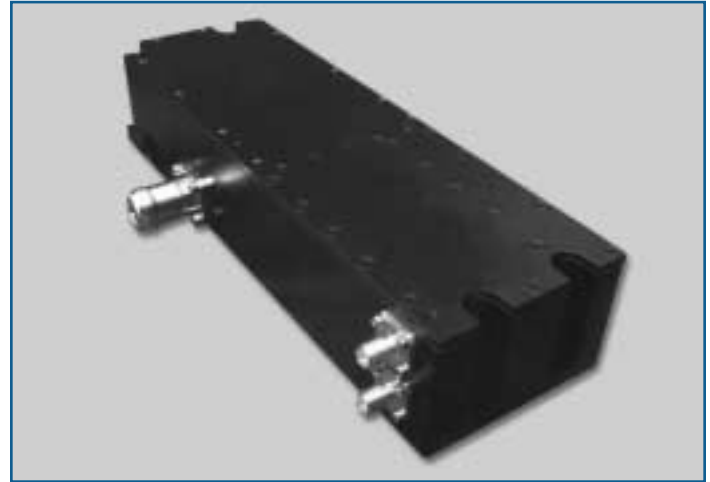
| Application | Product Type | Part# | Passband (MHz) | Max. Insertion Loss (dB) | Min. Return Loss (dB) | Min. Isolation (dB) | Size LxWxH (inches) | Comments |
|-------------|-------------------------------|-----------|----------------|--------------------------|-----------------------|---------------------|---------------------|---|
| Cellular | Power Divider/Combiner, 2 Way | 80119-2 | 800 - 900 | 0.40 | 19 | 25 | 1.50 x 2.25 x 1.06 | Max. Amp. Balance 0.15dB, Max. Phase Balance 1° |
| Cellular | Power Divider/Combiner, 4 Way | 80119-4 | 800 - 900 | 0.70 | 19 | 22 | 2.50 x 4.00 x 1.13 | Max. Amp. Balance 0.15dB, Max. Phase Balance 3° |
| PCS | Power Divider/Combiner, 2 Way | 80117-2 | 1850 - 1990 | 0.20 | 19 | 25 | 1.50 x 2.25 x 1.13 | Max. Amp. Balance 0.15dB, Max. Phase Balance +/- 2° |
| PCS | Power Divider/Combiner, 4 Way | 80117-4 | 1850 - 1990 | 0.40 | 19 | 30 | 2.50 x 4.00 x 1.13 | Max. Amp. Balance 0.15dB, Max. Phase Balance +/- 3° |
| ISM | Combiner | 80192-937 | 912 - 963 | 0.55 | 18 | 22 | 4.43 x 3.74 x 1.50 | 60W CW |
| ISM | Coupler Dual direction | 80130-2 | 800 -960 | 0.15 | 18 | | 3.00 x 1.75 x 1.25 | Forward coupling: 50 +/-0.25, Reverse coupling: 40 +/-0.25, 300W CW, Directivity: 22dB min. |

Base Station Products

Delay Line Assemblies

Delay Line Assemblies are used in high power feed forward amplifier applications. The assemblies typically consist of a delay line filter, one or two couplers, and an isolator. The directional couplers are used for sampling and feed forward injection of the signal to provide the amplifier manufacturer with cancellation of the Intermodulation products generated by the power amplifier. By integrating the components within an assembly, losses associated with interconnects are minimized, overall costs are reduced and product reliability is increased.

Spectrum Microwave has designed and manufactured custom configured units for GSM-1800, PCS-1900 and UMTS applications.



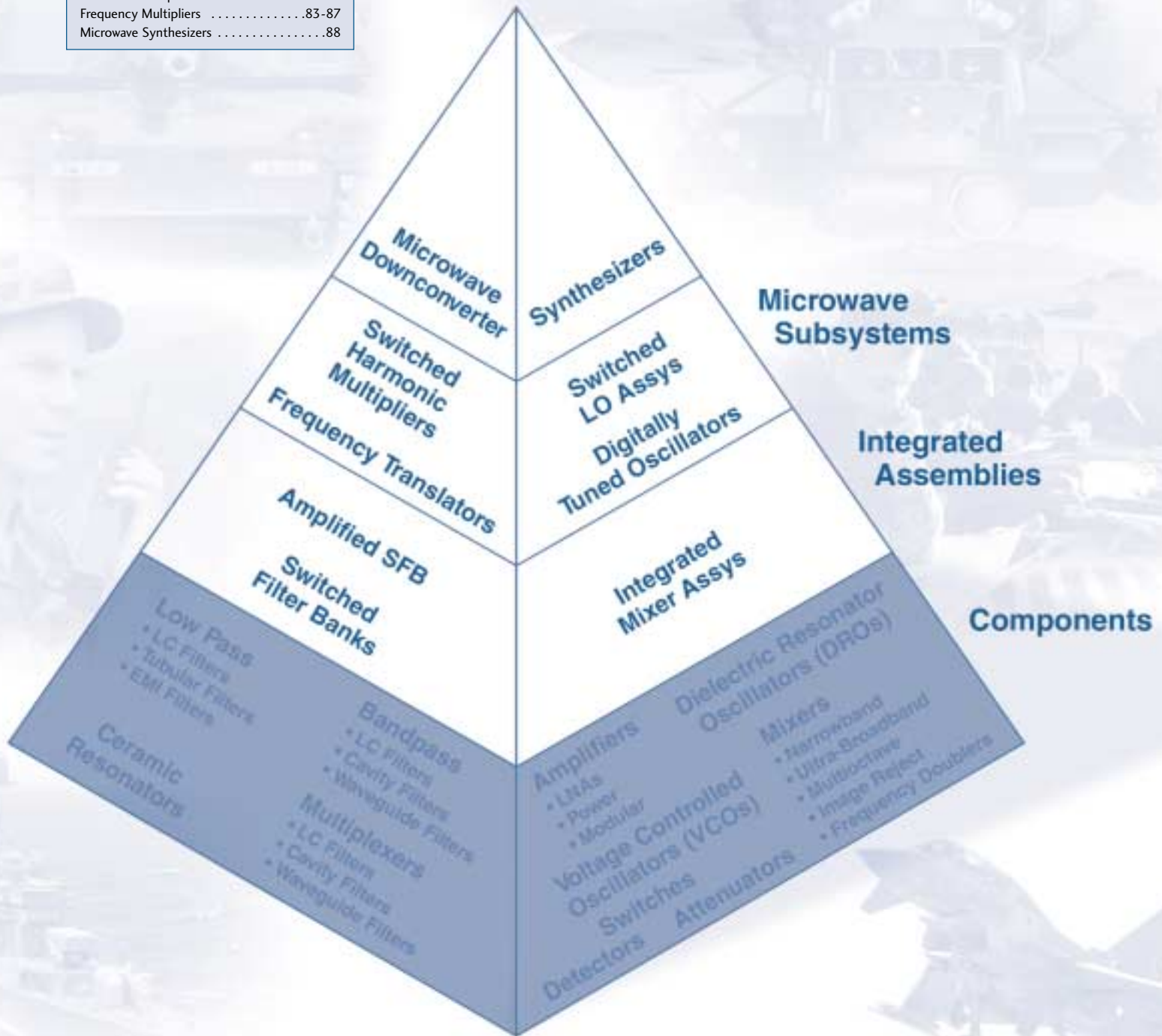
Cross-Band Couplers

While technically a duplexer or triplexer, cross-band couplers are specifically designed to allow base station cosite operation with the use of a common feeder cable (feeder sharing). An example would be to allow the combining of GSM1800 and UMTS base station outputs onto a single feeder cable. At the antenna end, a second unit would be utilized to separate the two bands to the TMA or antenna as required. Tri-band units (cross-band triplexers) are also available for combining three services onto a single feeder cable.

Spectrum Microwave cross-band couplers are specifically designed to provide extremely low insertion loss, low passive intermodulation distortion, and high band to band isolation. Critical attention is also given to peak power handling ability, since multiple channels from different base stations are being combined. Additionally, most units are available with DC bypass circuitry to allow for TMA biasing via the RF feeder cable. Both indoor and outdoor units are available.

Microwave Subsystems & Assemblies

| Section Index | Page |
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| Digitally Tuned Oscillators (DTOs) | 77 |
| GPS Low Noise Amplifiers | 78-80 |
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Switched Filter Banks

7 Channel Bank

RF Preselector

Passband 100 - 7000 MHz
Stopbands to 20 GHz

Spectrum Microwave's 7-channel RF preselector filter provides seven selectable RF filter channels over a wide frequency range with ultimate rejections out to 20 GHz. Modular construction allows customization of band splits to provide continuous overlapping band performance.

The individual channels can be configured over a wide range of frequencies from 100 MHz to 7000 MHz. Channels 1 thru 6 are miniature lumped element bandpass filters while Channel 7 is an interdigital cavity filter. This low-profile filter bank provides excellent low-ripple passband performance while suppressing ultimate rejections by >70 dB out to 20 GHz. The filter bank is powered by +5V, -12V DC applied to external bias pins mounted on the sides of the unit.

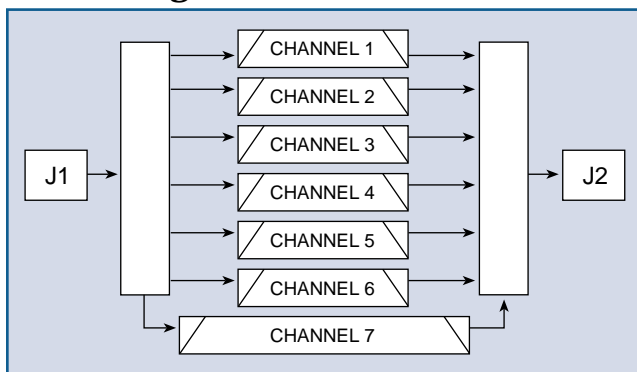
Features

- 70 dB min ultimate rejections to 20 GHz
- High linearity (IP3 +44 dBm min)
- No heater 500 mW power max
- Fast switching speed 200 nsec max
- Low video feedthru 1.5mV max
- VME compatible package 0.35 in max
- Lightweight housing 4.5 oz max

Dimensions and Connections

TBD L x 3.10" W x 0.35" H excluding SMA connectors and control pins. Final length depends upon customer requirements for filter performance.

Block Diagram

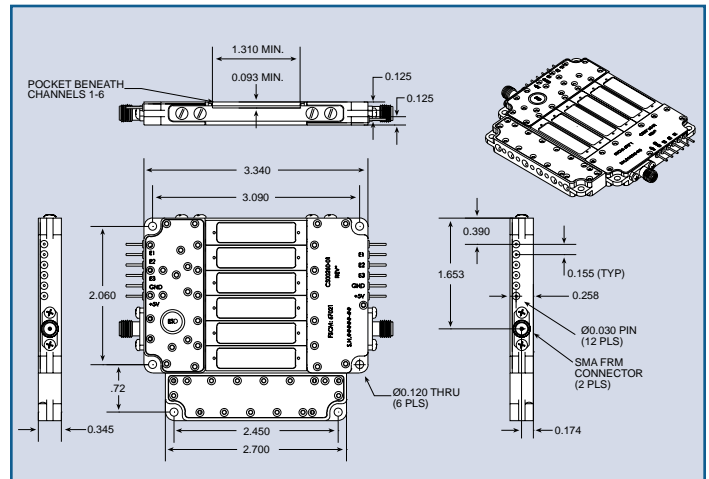


Typical Performance Characteristics

| | |
|---|-----------------------|
| Frequency Range | 100 to 7000 MHz |
| Switching Speed | 400 nsec max |
| Input 1 dB Compression..... | +15 dBm min |
| Amplitude Ripple (over 500 MHz BW)..... | +/-0.5 dB |
| Third Order Intercept..... | +44 dBm min |
| VSWR..... | 1.8:1 max |
| Insertion Loss | 6 dB max |
| Switching Type..... | TTL |
| DC Power..... | 5V@150 mA, -12V@60 mA |
| Temperature Range..... | -10°C to +65°C |

All specifications above measured at 25°C

Dimensions



Switched Filter Banks

5 Channel Bank (High Freq.)

Microwave Preselector Filter

Passband 3 - 20 GHz
Stopbands to 26 GHz

Spectrum Microwave's 5-channel microwave preselector filter provides five selectable filter channels over a wide frequency range with ultimate rejections out to 26 GHz. Modular construction allows customization of band splits to provide continuous overlapping band performance.

The individual channels can be configured over a wide range of frequencies from 3 GHz to 20 GHz. The channels are Chebychev interdigital bandpass cavity filters. This low-profile filter bank provides excellent low-ripple passband performance while providing ultimate rejections of >70 dB out to 26 GHz. The filter bank is powered by +5 V, -12V DC applied to external bias pins mounted on the sides of the unit.

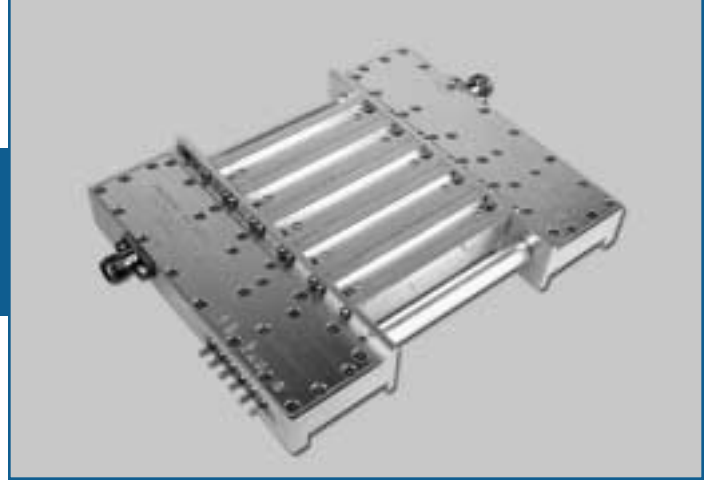
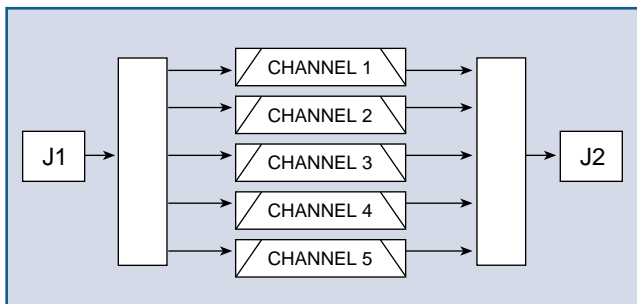
Features

- 70 dB min ultimate rejections to 26 GHz
- No warmup time
- No heater 1.1 W power max
- Fast tuning speed 400 nsec max
- Low video feedthru
- VME compatible package height 0.35 in max
- Lightweight housing 7.1 oz max

Dimensions and Connections

TBD L x 3.10" W x 0.35" H excluding SMA connectors and control pins. Final length depends upon customer requirements for filter performance.

Block Diagram

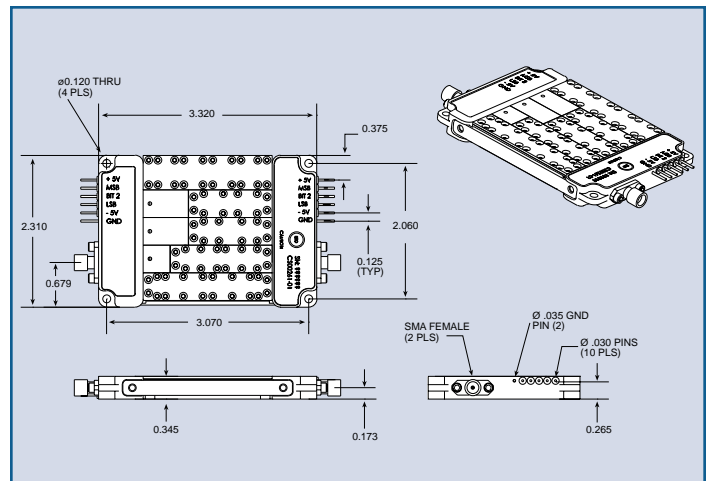


Typical Performance Characteristics

| | |
|-------------------------------------|----------------------|
| <i>Frequency Range</i> | 3 to 20 GHz |
| <i>Switching Speed</i> | 400 nsec max |
| <i>Input 1 dB Compression</i> | +15 dBm min |
| <i>Amplitude Ripple</i> | +/-0.5 dB |
| <i>Group Delay Variation</i> | <2 nsec |
| <i>Third Order Intercept</i> | +40 dBm min |
| <i>VSWR</i> | 1.8:1 max |
| <i>Insertion Loss</i> | 8 dB max |
| <i>Switching Type</i> | TTL |
| <i>DC Power</i> | 5V@150 mA, -5V@65 mA |
| <i>Temperature Range</i> | -10°C to +65°C |

All specifications above measured at 25°C

Dimensions



Switched Filter Banks

5 Channel Bank (Low Freq.)

Wide Band 5 Channel Filter Bank

Passband 1 - 3 GHz

Spectrum Microwave's 310-020227-001 filter bank provides five selectable filter channels over a wide range of operation in a relatively small package.

One compact unit covers a wide range of frequencies, typically 1 GHz to 3 GHz. Channels 1 through 5 are miniature lumped element bandpass filters with electrical specifications completely customizable by the end user. This relatively small filter bank provides a minimum of 30 dB of isolation in between non-selected passbands and 40 dB stopbands.

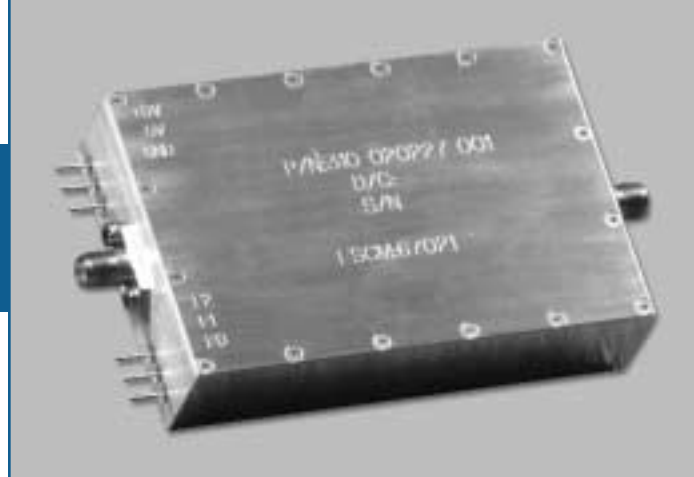
The filter bank is powered by $\pm 5V$ DC applied to external bias pins mounted on the end of the unit. A grounding terminal is also provided. Three control pins provide TTL selection of the desired operating band.

Features

- Small Physical Package (5.2 in³ max)
- High Power Handling +25 dBm min
- Wide Band Operation
- High Speed 395 nsec max
- Low Video Feedthru 1.2 mV max
- Low Insertion Loss 3 dB max
- High Isolation
- Excellent IMD Suppression

Dimensions and Connections

3.25" L x 2.125" W x 0.750" H excluding SMA connectors and control pins.

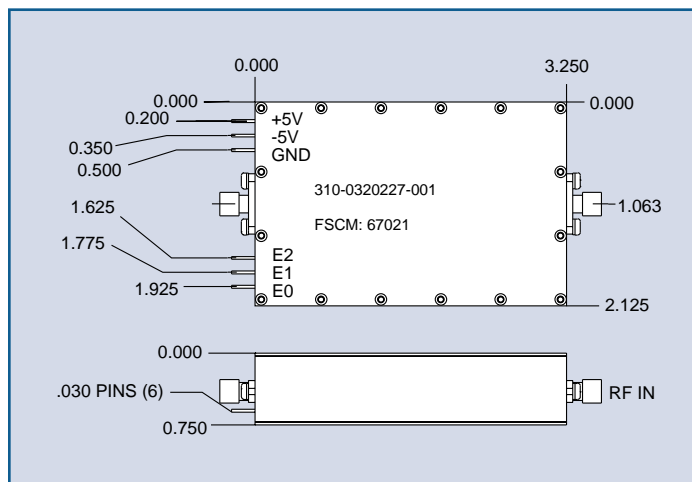


Typical Performance Characteristics

| | |
|-------------------------------------|-------------------------------------|
| <i>Frequency (GHz)</i> | 1.0 - 1.3 (CH1) |
| | 1.3 - 1.6 (CH2) |
| | 1.6 - 1.9 (CH3) |
| | 1.9 - 2.2 (CH4) |
| | 2.2 - 2.5 (CH5) |
| <i>Switching Speed</i> | 395 nsec on max 174 nsec off max |
| <i>Input 1 dB Compression</i> | +25 dBm min |
| <i>Second Order Intercept</i> | +70 dBm min |
| <i>Third Order Intercept</i> | +45 dBm min |
| <i>VSWR</i> | 1.8:1 max |
| <i>Insertion Loss</i> | 3 dB max |
| <i>Switching Type</i> | TTL |
| <i>DC Power</i> | 5V@150 mA max, -5V@1.5 mA max |
| <i>Temperature Range</i> | -40°C to +85°C |

All specifications above measured at 25°C

Dimensions



Switched Filter Banks

2 Channel Bank

RF/IF Preselector

Passband 1 - 2000 MHz
Stopband to 18 GHz

Spectrum Microwave's 310-020226-001 filter bank provides two selectable RF filter channels over a wide frequency range with ultimate rejections out to 18 GHz.

Two individual channels can be customized over a wide range of frequencies, typically 1 MHz to 2000 MHz. Channels 1 and 2 are miniature lumped element bandpass filters. This relatively small filter bank provides excellent passband performance while providing ultimate rejections by 50 dB max out to 18 GHz.

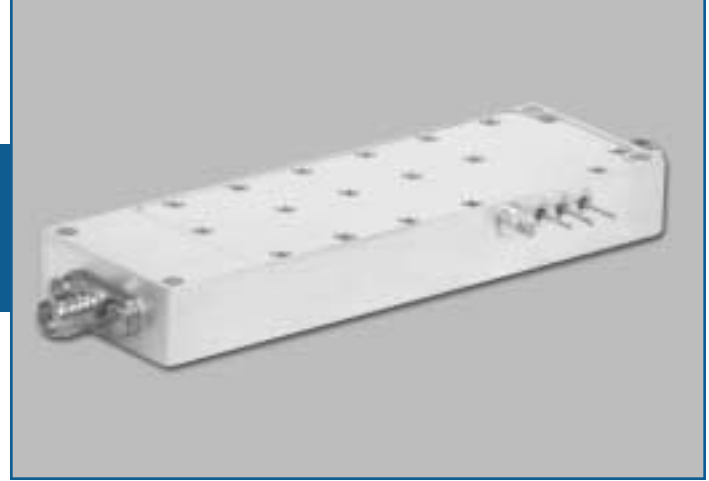
The filter bank is powered by +5V DC applied to an external bias pin mounted on the side of the unit. A grounding terminal is also provided. One control pin provides TTL selection of the desired operating channel. The unit is bi-directional with SMA field removable connectors.

Features

- 50 dB min Ultimate Rejections to 18 GHz
- Low Insertion Loss 2.7 dB max
- Wide Band Operation
- High Speed 160 nsec max
- Low Video Feedthru 1.5 mV max
- Small Physical Package (1.74 in³ max)
- Aluminum Housing

Dimensions and Connections

3.50" L x 1.10" W x 0.45" H excluding SMA connectors and control pins.

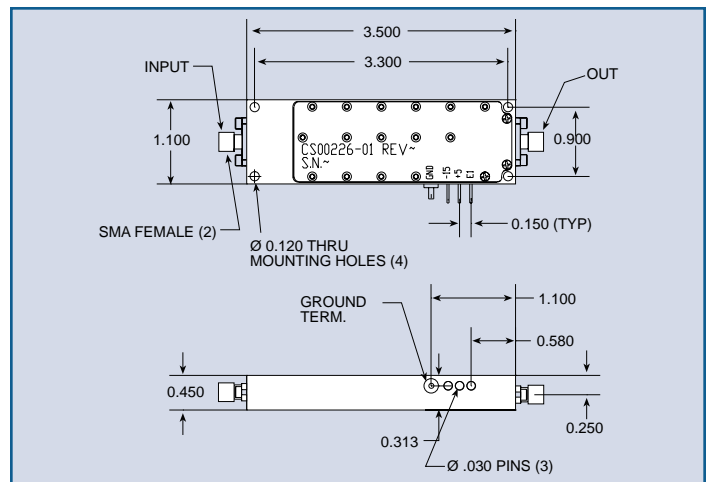


Typical Performance Characteristics

| | |
|-------------------------------------|------------------|
| <i>Frequency (MHz)</i> | 300 - 600 (CH1) |
| | 400 - 500 (CH2) |
| <i>Switching Speed</i> | 160 nsec on max |
| | 104 nsec off max |
| <i>Input 1 dB Compression</i> | +15 dBm min |
| <i>Second Order Intercept</i> | +73 dBm min |
| <i>Third Order Intercept</i> | +39 dBm min |
| <i>VSWR</i> | 1.8:1 max |
| <i>Insertion Loss</i> | 2.7 dB max |
| <i>Switching Type</i> | TTL |
| <i>DC Power</i> | +5V@1.5 mA |
| <i>Temperature Range</i> | -40°C to +85°C |

All specifications above measured at 25°C

Dimensions



Isolated Switched Filter Banks

1000 MHz Center Frequency

The 310-020372-001 Isolated Switched Filter Bank provides the system designer with a compact, two-channel selectable filter suitable for IF filtering.

Input and output isolators present a consistent 50 Ohm load to driving and load impedances. A pair of SPDT RF PIN diode switches routes incoming signals to one of two possible filter paths. One path filters to an 85 MHz bandwidth while the other filters to a 50 MHz bandwidth.

As the highly selective filters do not inherently exhibit good return loss, the isolators improve the VSWR performance and preserve the filtering transfer function irrespective of driving and source impedances. As an additional benefit, the Filter Bank exhibits 40 dB of reverse isolation.

Features

- Dual Selectable Bandwidths (85 and 50 MHz)
- Isolated RF input and output
- Low Passband Ripple 0.25 dB
- Lightweight aluminum housing
- 40 dB Reverse Isolation
- Wide operating temperature range
- Internal voltage regulation
- Conduction cooled
- Fast switching 400 nsec max

Dimensions and Connections

Isolated RF Input J1
Isolated RF Output J2

6.50" L x 1.75" W x 1.00" H excluding connectors

Chassis is machined aluminum with a silver plate finish and is non-hermetic.

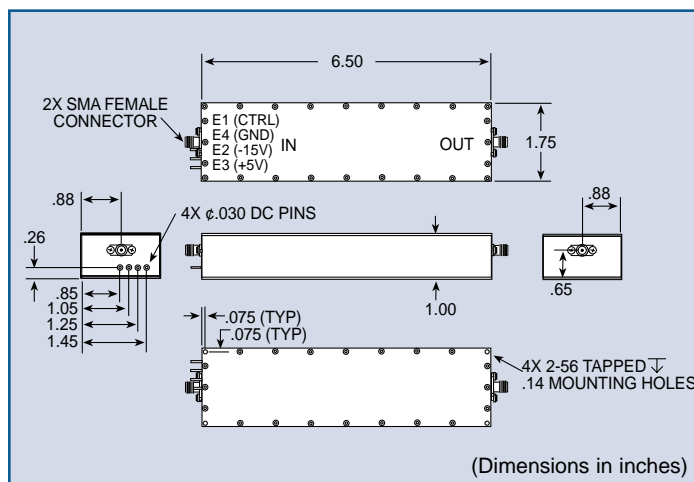


Typical Performance Characteristics

| | |
|----------------------------------|---|
| <i>Center Frequency</i> | 1000 MHz |
| <i>Filter #1 Bandwidth</i> | 85 MHz (1dBc) |
| <i>Filter #2 Bandwidth</i> | 50 MHz (1dBc) |
| <i>Insertion Loss</i> | 7 dB max |
| <i>VSWR</i> | 1.7:1 max (over 85% of dB Bandwidth) |
| <i>Passband Ripple</i> | 0.25 dB |
| <i>Switching Speed</i> | 400 nsec max |
| <i>DC Power</i> | +5V @ 100mA typ -15V @ 40mA typ |
| <i>Temperature Range</i> | -10°C to +65°C |
| <i>Weight</i> | 8 oz. |

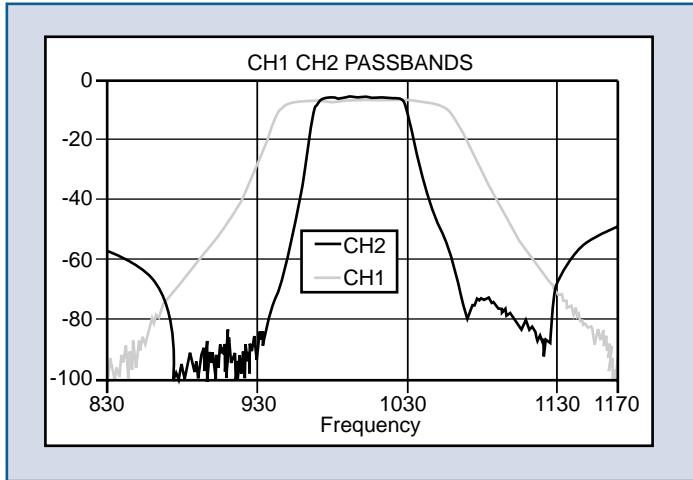
All specifications above measured at 25°C

Dimensions



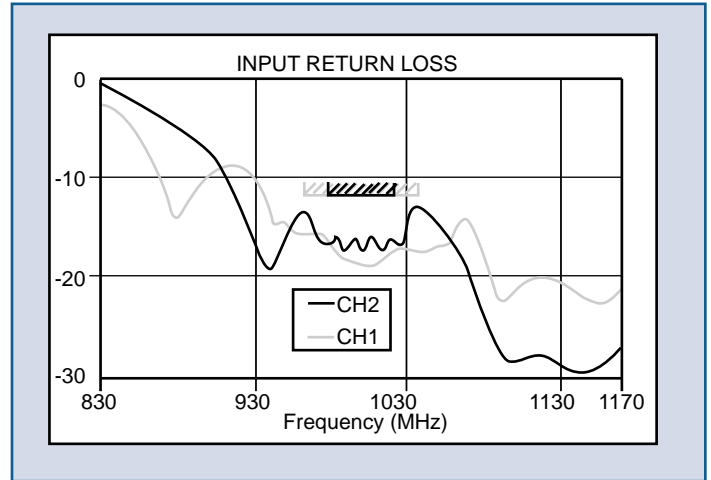
Isolated Switched Filter Banks

Figure 1



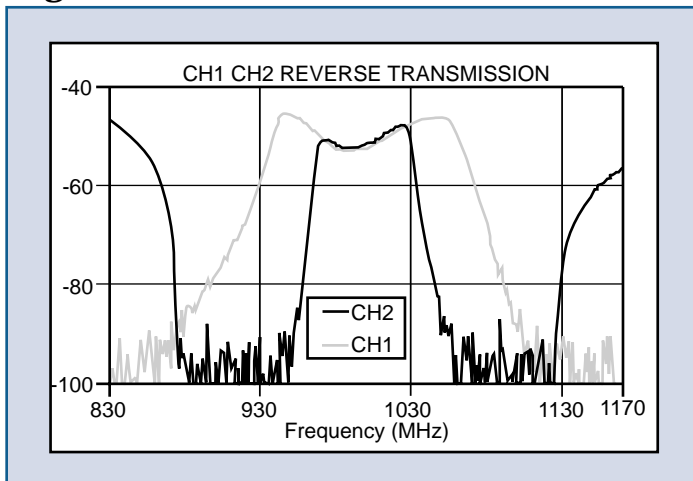
Channel 1 and Channel 2 Passband Transmission Response

Figure 2



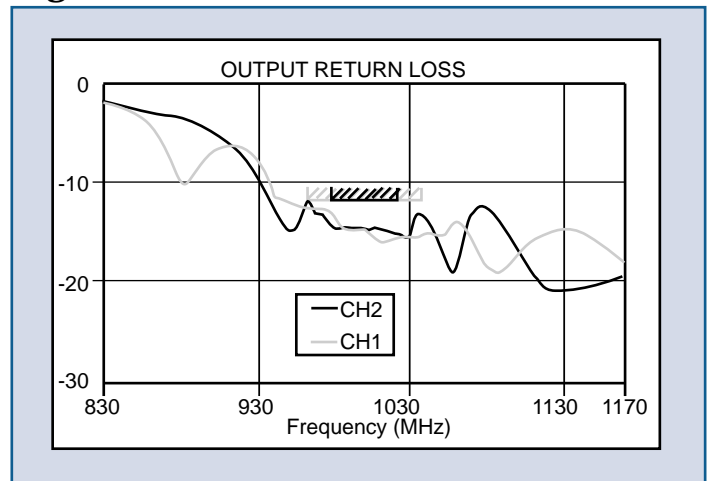
Channel 1 and Channel 2 Input Return Loss Response

Figure 3



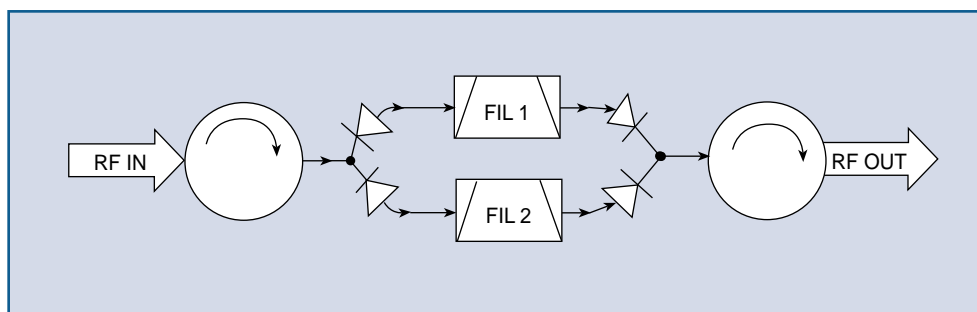
Channel 1 and Channel 2 Reverse Transmission Response

Figure 4



Channel 1 and Channel 2 Output Return Loss Response

Block Diagram



Digitally Tuned Oscillators (DTOs)

Spectrum Microwave offers a complete line of Digitally Tuned Oscillators (DTO). These custom designed assemblies consist of a select number of sub-band VCOs covering customer specific frequency ranges between 2GHz and 18GHz. The sub-band RF outputs are selectively switched to a common RF output port. Sufficient sub-band overlap insures full band coverage. Digital tuning is via a 16 bit, parallel input word. Several bits are used for selecting the desired sub-band and 12 to 14 bits are used for frequency tuning.

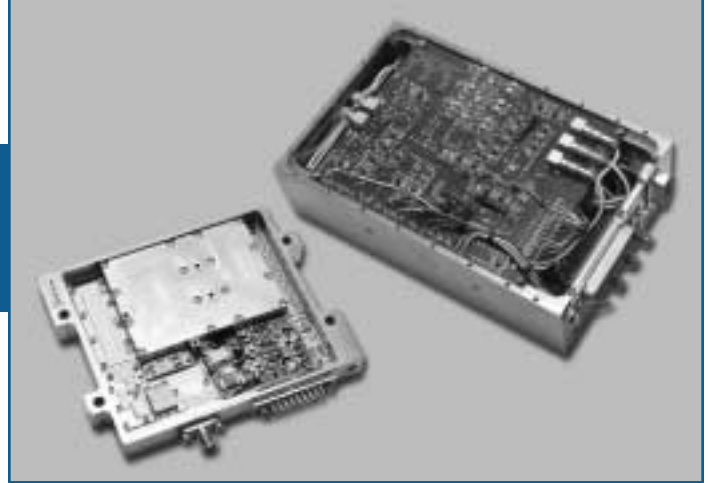
Silicon semiconductors are used to provide the best possible phase noise and post tuning drift performance. Hybrid MIC technology reduces overall package size and helps ensure overall system reliability. Fast settling time and excellent spectral purity make Spectrum DTOs ideal for simulators and other EW applications.

Key Features

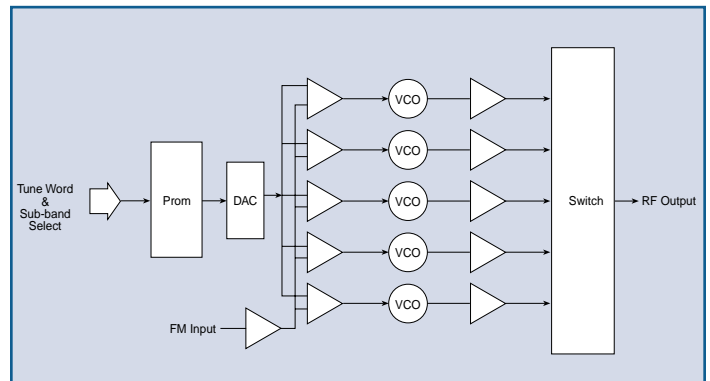
- Fast settling time (< 1 msec)
- Wide frequency range (2-18 GHz)
- Low post tuning drift (<4 MHz @ 1 msec)
- Low spurious output (< -60 dBc)
- Harmonics (-25 dBc max)
- Excellent phase noise performance (<-65 dBc/Hz @ 100 kHz)
- Low residual FM (<-20 dBc @ 100 kHz)
- RF output power (+10 to +16 dBm)
- High reliability for military applications
- Output connectors (customer specified)

Optional Features

- Power output status indicator
- Phase locked module with phase lock indicator
- Internal heater for frequency stability over temperature
- Analog FM input



Block Diagram



GPS Low Noise Amplifier

For GPS Applications

1227 MHz/1575 MHz

This series of Low Noise Amplifiers provides a filtered, low-noise gain solution ideal for applications where higher reliability is critical. These filtered low noise amplifiers are designed to reduce out-of-band interference while achieving high dynamic range.

A single ceramic filter or pair of diplexed ceramic filters with 3-pole responses select only the desired GPS signals while the low noise gain stage maintains the receiving system's sensitivity.

The LNA rejects undesired signals by at least 40 dB at 1050, 1410, and 1710 MHz. See the graphs on Page 79 for return loss, rejections, and insertion gain of a typical unit.

The preamplifier is powered by DC voltage applied to the center conductor of the output connector. Optionally, the unit can be powered through an external DC bias connector.

Features and Benefits

- Noise figure 1.6 dB typical
- Double-diplexed preamp filters
- Lightweight aluminum housing
- Dual band (L1 and L2) and single band (L1) performance
- Coaxial and external bias options
- Environmental sealing available
- Application specific packages available
- Suitable for new L2-C signals
- L5 configurations available upon request



Typical Performance Specifications

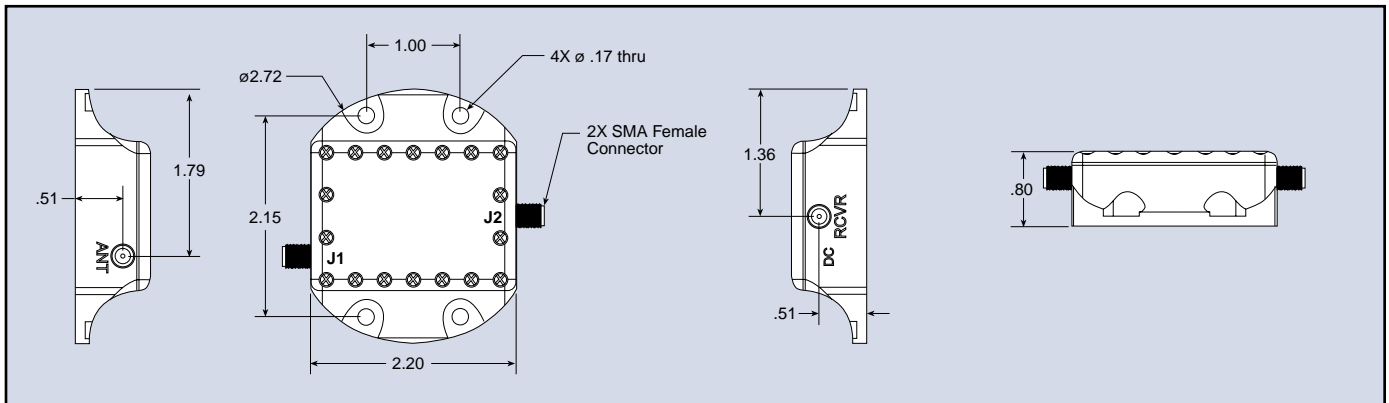
| | |
|-------------------------|--------------------------------|
| Frequency | 1575.42 MHz (L1) |
| | 1227.60 MHz (L2) |
| Bandwidth | 30 MHz min |
| Noise figure | 2.0 dB max |
| | 1.6 dB typ |
| VSWR | 1.5:1 max |
| Gain | 14, 26, 34 and 45 dB |
| Gain Flatness | +/-0.5 dB |
| Rejection | 40 dB @ 1050, 1410, 1710 MHz |
| Bias | Coaxial, Line or External Bias |
| Temperature Range | -40°C to +71°C |

All specifications above measured at 25°C

Dimensions and Connections

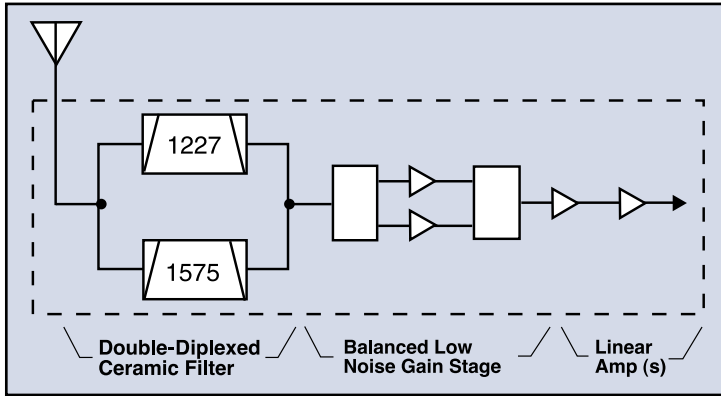
- Antenna port J1
 - Receiver port J2
 - External bias J3 (optional)
 - SMA type female connectors
 - 2.20"ø x 0.80"H excluding connectors
 - Optional Bias cable is available to simplify testing and evaluation (P/N A020-0560)
- Chassis is machined aluminum with a nickel plate finish.

Dimensions (inches)



GPS Low Noise Amplifier

Block Diagram (L1/L2)



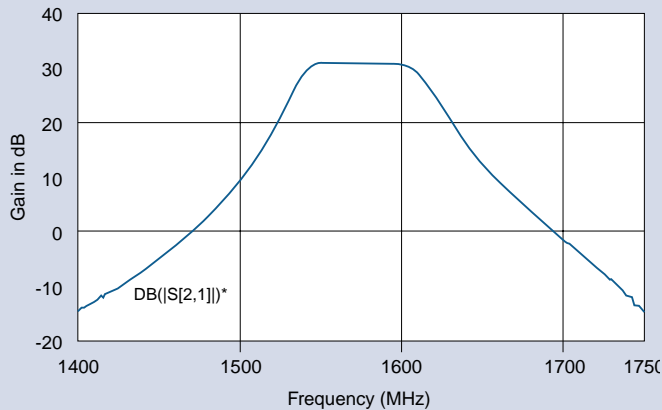
Noise Figures (L1)

| GPS Band | Freq (MHz) | NF (dB) |
|----------|------------|---------|
| L1 | 1565 | 1.60 |
| | 1575 | 1.60 |
| | 1585 | 1.60 |

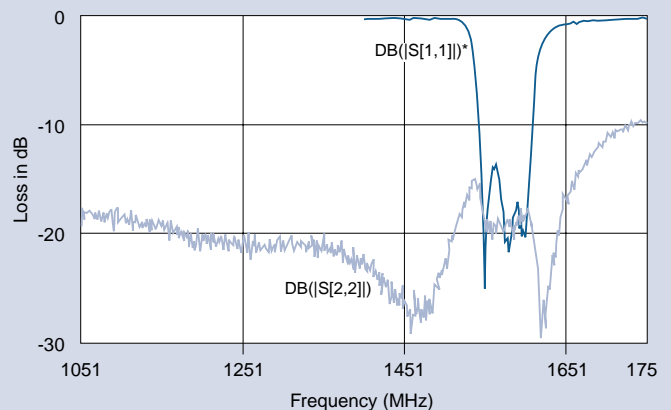
Noise Figures (L1/L2)

| GPS Band | Freq (MHz) | NF (dB) |
|----------|------------|---------|
| L2 | 1217 | 1.53 |
| | 1227 | 1.44 |
| | 1237 | 1.35 |
| L1 | 1565 | 1.58 |
| | 1575 | 1.60 |
| | 1585 | 1.48 |

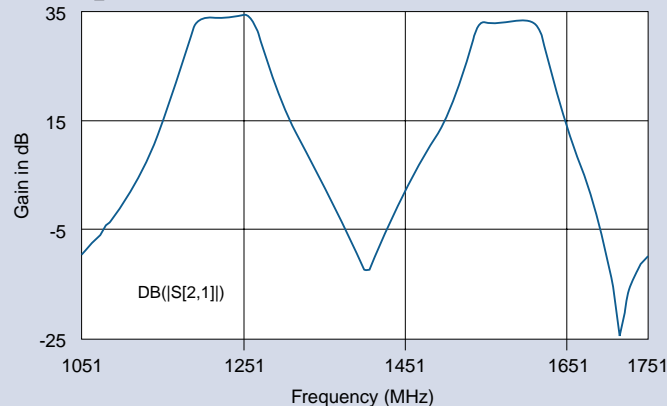
Amplifier Gain (L1)



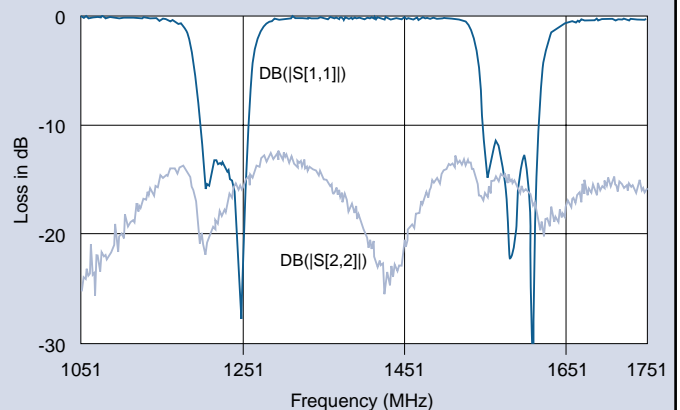
Return Loss (L1)



Amplifier Gain (L1/L2)



Return Loss (L1/L2)



GPS Low Noise Amplifier

Ordering Information (L1)

| Part Number | Gain | Noise Figure (max) | Power | Bias |
|----------------|----------------|--------------------|----------|----------------|
| 310-024103-021 | 14 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Ext Bias, MR01 |
| 310-024105-011 | 26 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Coaxial Bias |
| 310-024105-021 | 26 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Ext Bias, MR01 |
| 310-024107-021 | 34 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Ext Bias, MR01 |
| 310-024109-011 | 45 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Coaxial Bias |

Note: See outline drawing on page 78 for standard package dimensions.

Ordering Information (L1/L2)

| Part Number | Gain | Noise Figure (max) | Power | Bias |
|----------------|----------------|--------------------|-----------|----------------|
| 310-025103-011 | 14 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Coaxial Bias |
| 310-025103-012 | 14 dB+/-2.0 dB | 2.0 dB | 16-32 VDC | Coaxial Bias |
| 310-025103-021 | 14 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Ext Bias, MR01 |
| 310-025103-022 | 14 dB+/-2.0 dB | 2.0 dB | 16-32 VDC | Ext Bias, MR01 |
| 310-025105-011 | 26 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Coaxial Bias |
| 310-025105-012 | 26 dB+/-2.0 dB | 2.0 dB | 16-32 VDC | Coaxial Bias |
| 310-025105-021 | 26 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Ext Bias, MR01 |
| 310-025105-022 | 26 dB+/-2.0 dB | 2.0 dB | 16-32 VDC | Ext Bias, MR01 |
| 310-025107-011 | 34 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Coaxial Bias |
| 310-025107-012 | 34 dB+/-2.0 dB | 2.0 dB | 16-32 VDC | Coaxial Bias |
| 310-025107-021 | 34 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Ext Bias, MR01 |
| 310-025107-022 | 34 dB+/-2.0 dB | 2.0 dB | 16-32 VDC | Ext Bias, MR01 |
| 310-025109-011 | 45 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Coaxial Bias |
| 310-025109-012 | 45 dB+/-2.0 dB | 2.0 dB | 16-32 VDC | Coaxial Bias |
| 310-025109-021 | 45 dB+/-2.0 dB | 2.0 dB | 5-16 VDC | Ext Bias, MR01 |
| 310-025109-022 | 45 dB+/-2.0 dB | 2.0 dB | 16-32 VDC | Ext Bias, MR01 |

Note: See outline drawing on page 78 for standard package dimensions.

S-parameters for this model are available on our web site.

LNA parameters include noise data.

Harmonic Multiplier

100 to 2600 MHz Multiplier

The 310-027023-01 Harmonic Multiplier provides the system designer with a compact, low phase noise building block for Reference Oscillator multiplication applications.

A linear amplifier drives a step recovery diode thereby multiplying an input 100 MHz clock signal by a factor of 26. A pair of 3-pole ceramic Bandpass filters and a pair of linear driver amplifiers improves the spurious response.

This unit exhibits very little degradation of input reference signals, multiplying to the desired output frequency while only degrading the input phase noise performance by 30 dB. Please consult the factory for other available configurations.

Features

- Low Spurious -60 dBc to 6 GHz max
- Buffered Input
- Low Phase noise floor -130 dBc/Hz at 10 kHz
- Lightweight aluminum housing
- SMP style connectors
- Wide operating temperature range
- Integral voltage regulation
- Conduction cooled

Dimensions and Connections

LO Input J1
LO Output #1 J2

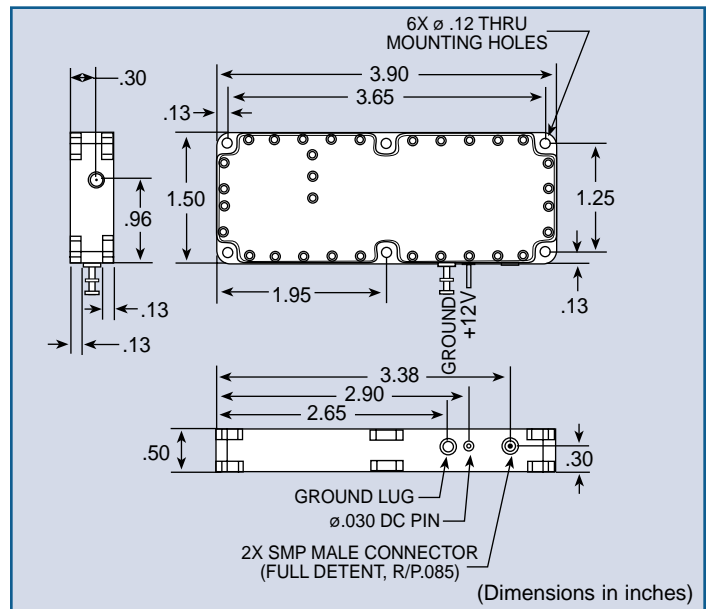
5.80" L x 2.00" W x 0.41" H excluding connectors
Chassis is machined aluminum with a silver plate finish and is non-hermetic.



Typical Performance Characteristics

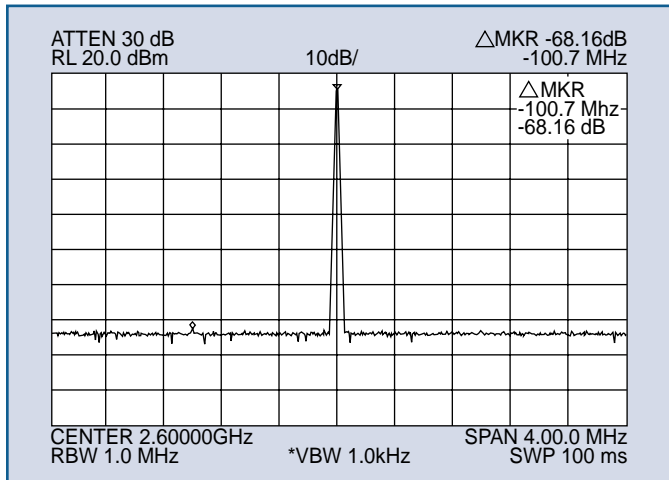
| | |
|---|-----------------------|
| <i>Input Frequency</i> | 100 MHz |
| <i>Input Level</i> | +10 dBm +/-0.1 dBm |
| <i>Output Frequency</i> | 2600 MHz |
| <i>Output Level</i> | +17 dBm +/-2 dBm |
| <i>VSWR</i> | 2.0:1 |
| <i>Spurious</i> | 60 dBc (to 6 GHz) |
| <i>Phase Noise Degradation</i> | 1.7 dB |
| | (above 28.3 dB ideal) |
| <i>DC Power</i> | +12V @ 500 mA typ |
| <i>Temperature Range</i> | -40°C to +85°C |
| <i>Weight</i> | 4.8 oz max |
| All specifications above measured at 25°C | |

Dimensions



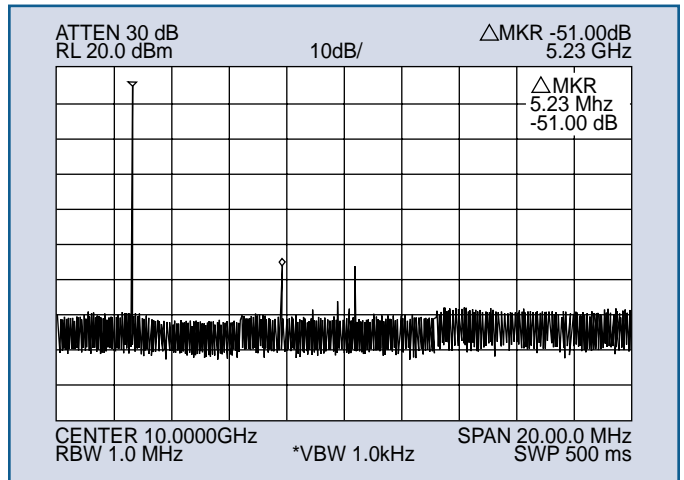
Harmonic Multiplier

Figure 1



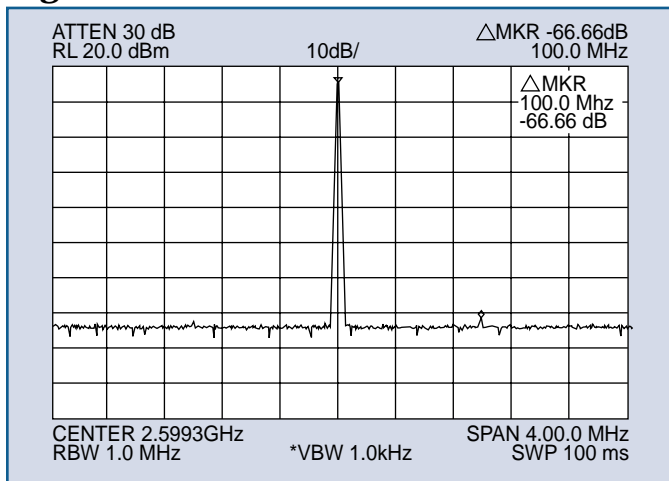
Multiplier Spectral Purity (Close Spectrum @ 25°C)

Figure 2



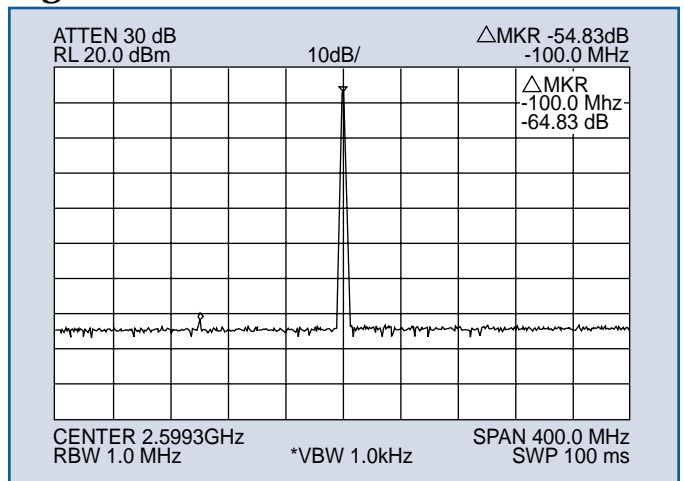
Multiplier Spectral Purity (Wide Spectrum @ 25°C)

Figure 3



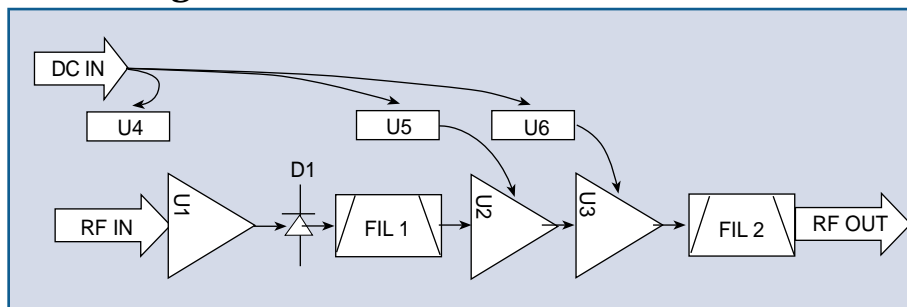
Multiplier Spectral Purity (Close Spectrum @ -40°C)

Figure 4



Multiplier Spectral Purity (Close Spectrum @ +85°C)

Block Diagram



Frequency Multipliers

Local Oscillator Divider

2.0 – 4.5 / 0.4 – 2.0 GHz prescaler

The 310-027015-001 LO divider provides the system designer with a compact, fast-switching building block for LO division applications.

Cascades of solid-state prescalers provide frequency division by a factor of 2, 4 or 8. Each of the prescaler chains is followed by a filter to improve the spurious response and an amplitude corrector to achieve flat frequency response. Operating band is selected using two band select control pins.

A NULL mode is available to disable the module's output. Solid-state MMIC switches provide high-speed selection of the desired operating band.

Features

- Low Spurious -60 dBc max
- 140 nanosecond switching speed
- High output drive level +10 dBm
- Aluminum housing
- SMP style connectors
- Div 2, Div 4, and Div 8 Modes
- Null output mode

Dimensions and Connections

LO Input J1

LO Output J2

2.00" L x 1.50" W x 0.45" H excluding connectors

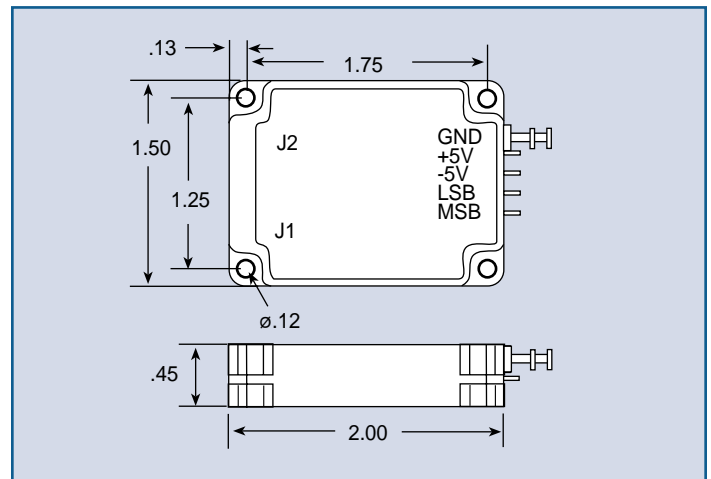


Typical Performance Characteristics

| | |
|--------------------------------------|------------------|
| <i>Input Frequency</i> | 2.0 - 4.5 GHz |
| <i>Input Level</i> | +4 dBm +/-2 dBm |
| <i>Output Frequency</i> | 0.4 - 2.0 GHz |
| <i>Output Level</i> | +10 dBm +/-2 dBm |
| <i>Input VSWR</i> | 1.5:1 max |
| <i>Switching Speed</i> | 140 nsec max |
| <i>Phase Noise Improvement</i> | 6 dB min |
| <i>DC Power</i> | +5V@280 mA typ |
| <i>Temperature Range</i> | 0°C to +75°C |
| <i>Weight</i> | 1.2 oz |

All specifications above measured at 25°C

Dimensions



Frequency Multipliers

Local Oscillator Doubler

4.5 – 9.0 GHz
 9.0 – 18.0 GHz

The 310-027014-001 Mid-Band multiplier provides the system designer with a compact, fast-switching building block for LO multiplication applications.

An internal solid-state multiplier provides frequency multiplication by a factor of 2. Three selective internal bandpass filters improve the spurious response. Operating band is selected using two band select control pins.

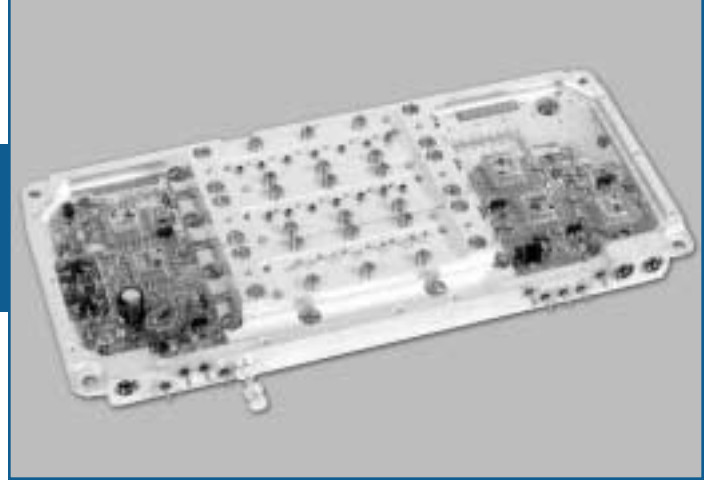
An integral 2-way output switch allows routing of the multiplied input LO signal to other modules based upon the state of an output control line. A NULL mode is available to disable the module's output.

Features

- Low Spurious -60 dBc max
- Fast 110 nanosecond switching speed
- High output drive level +10 dBm
- Aluminum housing
- SMP style connectors
- 2 Programmable outputs
- Null output mode

Dimensions and Connections

LO Input J1
 LO Output #1 J2
 LO Output #2 J3
 5.00" L x 2.20" W x 0.55" H excluding connectors



Typical Performance Characteristics

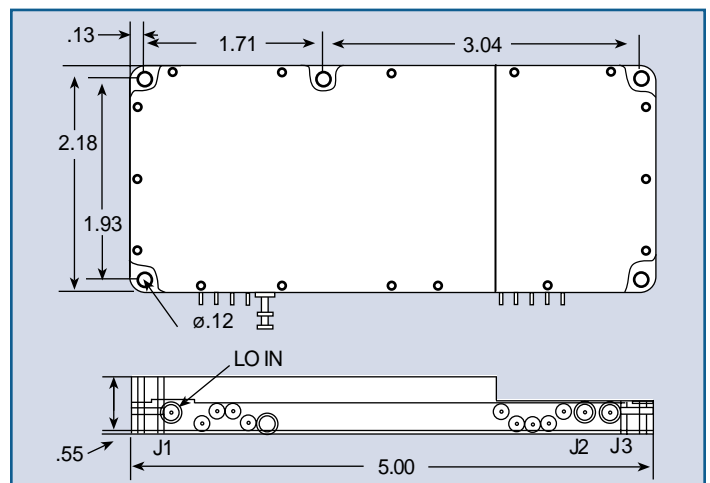
| | |
|--------------------------------------|------------------|
| <i>Input Frequency</i> | 2.25 - 4.5 GHz |
| <i>Input Level</i> | +4 dBm +/-2 dBm |
| <i>Output Frequency</i> | 4.5 - 9.0 GHz |
| <i>Output Level</i> | +10 dBm +/-2 dBm |
| <i>Input VSWR</i> | 1.5:1 max |
| <i>Switching Speed</i> | 110 nsec max |
| <i>Phase Noise Degradation</i> | 7 dB typ |
| <i>DC Power</i> | +5V@260 mA typ |
| | -5V@10 mA typ |

Temperature Range..... 0°C to +75°C

Weight..... 10.5 oz

All specifications above measured at 25°C

Dimensions



Frequency Multipliers

Local Oscillator Doubler

4.5 – 9.0 GHz
9.0 – 18.0 GHz

The 310-027004-002 High-Band LO Multiplier provides the system designer with a compact, fast-switching building block for LO multiplication applications.

An internal solid-state multiplier provides frequency multiplication by a factor of 2. Three selective internal bandpass filters improve the spurious response. Operating band is selected using two band select control pins.

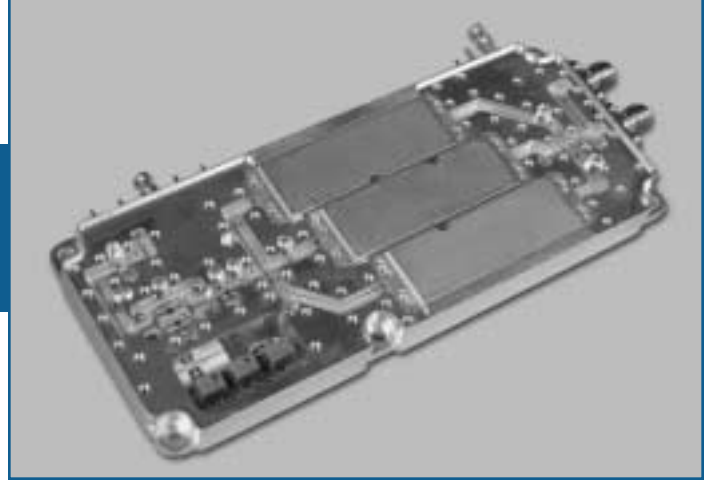
A NULL mode is available to disable the module's output. Solid-state PIN diode switches provide high-speed selection of the desired operating band. An auxiliary sample port allows external signal monitoring.

Features

- Low Spurious -60 dBc max
- Fast 190 nanosecond switching speed
- High output drive level +7 dBm
- Aluminum housing
- SMPstyle connectors
- Three-Band functionality
- Null output mode

Dimensions and Connections

LO Input J1
LO Output J2
LO Sample J3
4.80" L x 1.98" W x 0.43" H excluding connectors

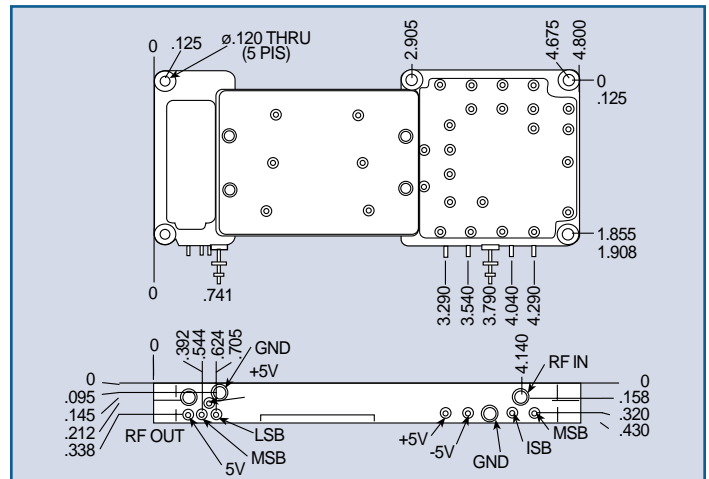


Typical Performance Characteristics

| | |
|--------------------------------------|---------------------------------|
| <i>Input Frequency</i> | 4.5 - 9.0 GHz |
| <i>Input Level</i> | +10 dBm +/- 2 dBm |
| <i>Output Frequency</i> | 9.0 - 18.0 GHz |
| <i>Output Level</i> | +8 dBm +/- 2 dBm |
| <i>Input VSWR</i> | 1.5:1 max |
| <i>Switching Speed</i> | 190 nsec max |
| <i>Phase Noise Degradation</i> | 7 dB max |
| <i>DC Power</i> | +5V@250 mA typ -5V@30 mA typ |
| <i>Temperature Range</i> | 0°C to +75°C |
| <i>Weight</i> | 7.5 oz |

All specifications above measured at 25°C

Dimensions



Frequency Multipliers

Local Oscillator Doubler/Tripler

1.0-1.5 GHz
 2.0-4.5 GHz

The 310-027013-001 LO Multiplier provides the system designer with a compact, fast-switching building block for Local Oscillator multiplication applications.

A pair of internal solid-state multipliers provides frequency multiplication by a factor of 2 or 3 depending upon the state of two band control lines. Internal four-channel bandpass filtering improves the spurious response.

An integral 3-way output switch routes the multiplied input LO signal to other modules based upon the states of two output control lines. A NULL mode is available to disable the module's output.

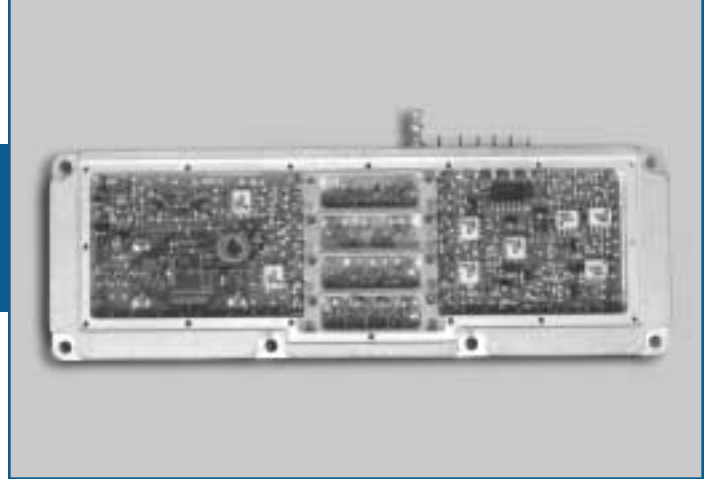
Features

- Low Spurious -67 dBc max
- Fast 90 nanosecond switching speed
- Programmable X2 and X3 Multiplication
- Aluminum housing
- SMP style connectors
- 3 Programmable outputs
- Null output mode

Dimensions and Connections

| | |
|--------------|----|
| LO Input | J1 |
| LO Output #1 | J2 |
| LO Output #2 | J3 |
| LO Output #3 | J4 |

5.80" L x 2.00" W x 0.41" H excluding connectors
 Chassis is machined aluminum with a silver plate finish and is non-hermetic.

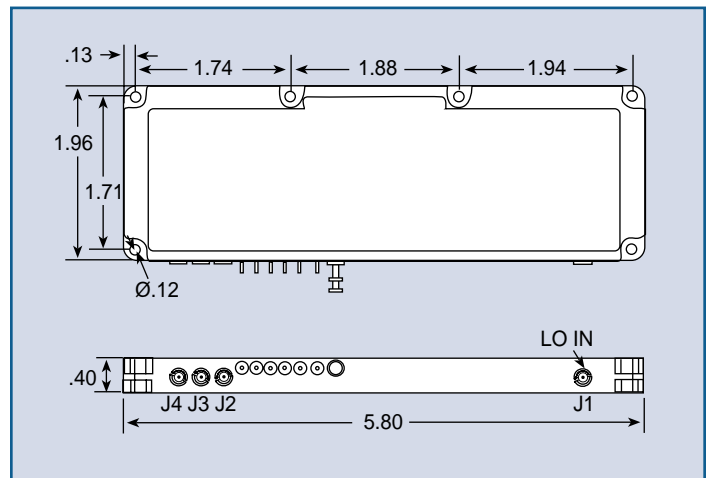


Typical Performance Characteristics

| | |
|--------------------------------------|--|
| <i>Input Frequency</i> | 1.0-1.5 GHz |
| <i>Input Level</i> | +7.5 dBm +/- 2 dBm |
| <i>Output Frequency</i> | 2.0 - 4.5 GHz |
| <i>Output Level</i> | +5 dBm +/- 1.5 dBm |
| <i>Input VSWR</i> | 1.5:1 max |
| <i>Switching Speed</i> | 90 nsec max |
| <i>Phase Noise Degradation</i> | 7 dB (max in X2 mode) 11dB (max in X3 mode) |
| <i>DC Power</i> | +5V@300 mA typ -5V@10 mA typ |
| <i>Temperature Range</i> | 0°C to +75°C |
| <i>Weight</i> | 4.5 oz |

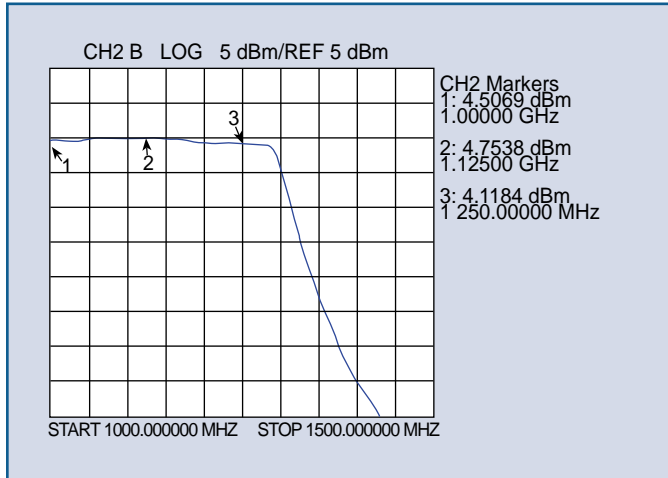
All specifications above measured at 25°C

Dimensions



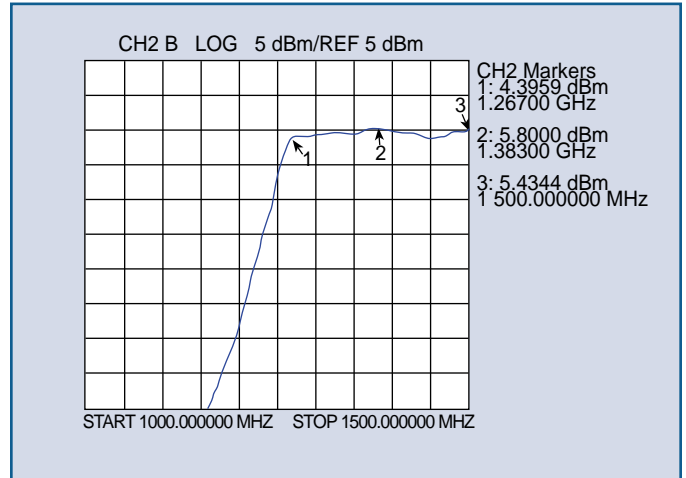
Frequency Multipliers

Channel 1



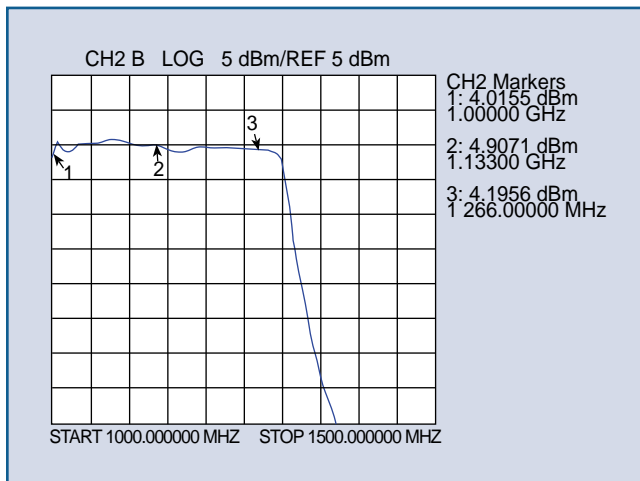
Doupler Output Power Flatness (2000-2500 MHz Output)

Channel 2



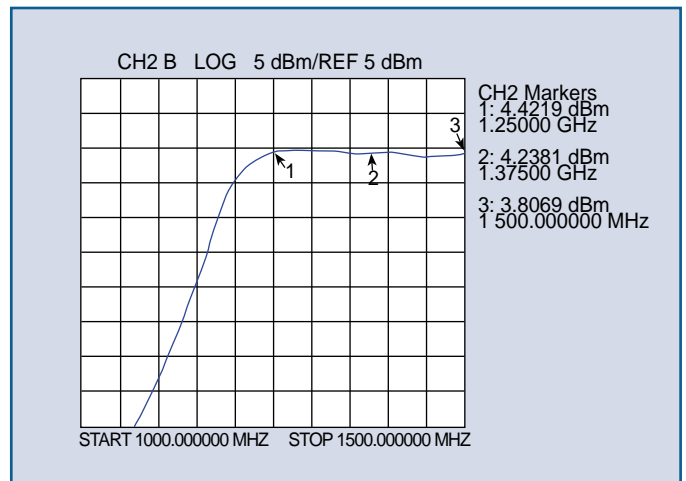
Doupler Output Power Flatness (2500-3000 MHz Output)

Channel 3



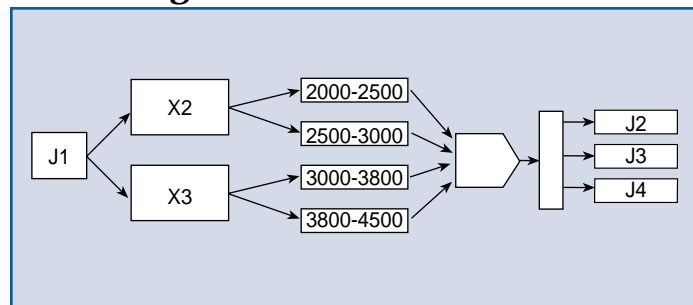
Tripler Output Power Flatness (3000-3800 MHz Output)

Channel 4



Tripler Output Power Flatness (3800-4500 MHz Output)

Block Diagram



Synthesizers

This programmable signal source is completely self-contained with an internal TCXO reference. The synthesizer can be either parallel loaded through the TTL control port or set up to power on at a predetermined frequency. This source is suitable for use in dedicated test setups or as a component of a production system.

Features

- 1 MHz steps
- DDS driven direct synthesis
- <75 Watts
- VME compatible
- Power \approx +10 dBm
- Low phase noise
- Low spurious (-65 dBc max)
- Parallel TTL control
- 0°C to 70°C operating range
- Shielded design
- Internal frequency reference

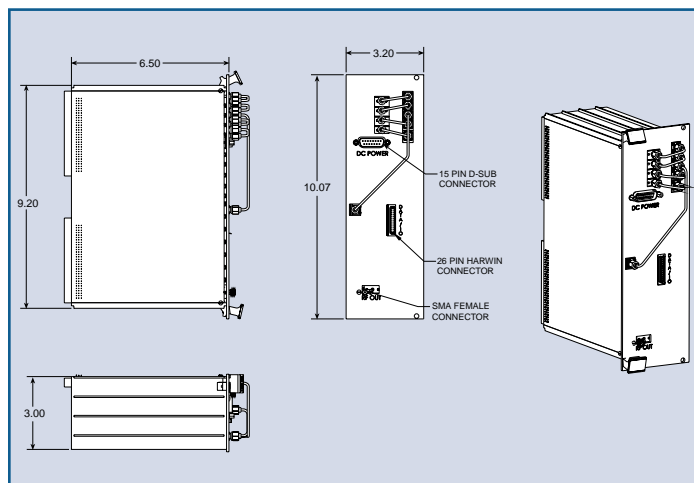
Dimensions and Connections

10.0"L x 6.5"W x 5.0"H

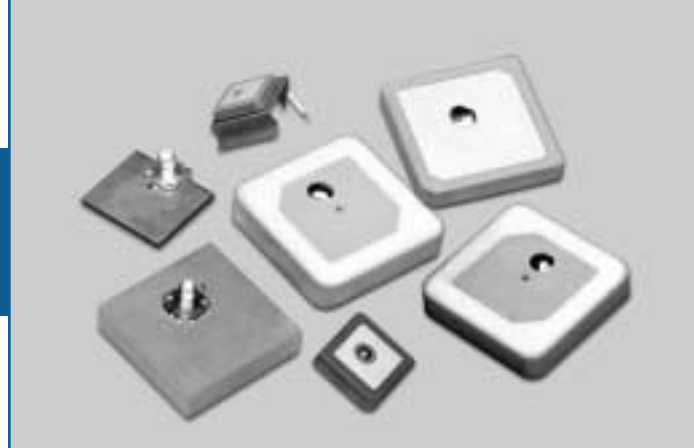


Typical Performance Characteristics

| | |
|---|--------------------------------|
| <i>Frequency</i> | 10 MHz to 18 GHz |
| <i>Frequency Resolution</i> | 1 MHz |
| <i>Power Output</i> | +10 dBm +/-3 dB |
| <i>RF Output Impedance</i> | 50 ohm |
| <i>RF Output Accuracy</i> | <+/-25ppm max. +/-10ppm typ |
| <i>RF Output SSB Phase Noise</i> | <1.2 degrees RMS |
| <i>Phase Noise @10 kHz Offset</i> | -82 dBc/Hz |
| <i>Phase Noise @100 kHz Offset</i> | -90 dBc/Hz |
| <i>Phase Noise @1 MHz Offset</i> | -100 dBc/Hz |
| <i>Phase Noise @10 MHz Offset</i> | -122 dBc/Hz |
| <small>(Integrated from 10 kHz to 10 MHz)</small> | |
| <i>Harmonics</i> | <-15 dBc |
| <i>Spurious (offset>10MHz)</i> | <-55 dBc |
| <i>Spurious (offset<10MHz)</i> | -65 dBc typ |
| <i>Switching speed (to within 0.1 dB radian of final frequency)</i> | 1 μ sec max |
| <i>Reference Output Frequency</i> | 100 MHz |
| <i>Reference Output Amplitude</i> | +7 dBm +/-1 dB |
| <i>Control</i> | 15-bit TTL |
| <i>Power Supply</i> | +8V@5.0A, -8V@1.0A, +12V@1.68A |
| All specifications above measured at 25°C | |



Patch Antenna Elements & Assemblies



As wireless communications become ever more pervasive in our daily lives, engineers are trying to design products that add functionality and communications to an increasing assortment of devices. GPS is one of the more well known applications leveraging satellite communication. Increasingly satellite radio has expanded its penetration and will continue to do so in the coming years. Bluetooth and short range wireless applications such as RFID continue to grow and are poised to change the way business perform their operations.

In the near future, we anticipate an explosion of sensor systems that will wirelessly enable customers and provide information anywhere at any time. Engineers designing these systems consistently look for elegant antenna solutions that are invisible to the customer are cost effective to utilize. Patch antennas are increasingly selected as the antenna to use in GPS, Inmarsat, Globalstar, Satellite Radio and ISM applications.

Applications

- Satellite Radio
- GPS
- Satellite Modems
- Bluetooth
- Wireless LANs

Features

- Temperature stable (-40°C to +105°C)
- Low return loss
- Uniform dielectric constant
- Wide frequency range (900 MHz to 5.8 GHz)
- Offset single-point feeding method
- Design flexibility
 - 28 mm x 28 mm x 6 mm
 - 25 mm x 25 mm x 4 mm
 - 18 mm x 18 mm x 4 mm
 - 16 mm diameter x 6 mm
 - 13 mm x 13 mm x 3 mm
- Custom designs available
- Silver plated electrode and probe
- Surface mount
- 50 Ohm impedance

Custom Part Number Examples (Typical part numbers, consult factory for additional designs)

| Application | Part # | Polarization | Center Frequency (MHz) | 2:1 VSWR Bandwidth (MHz) | Gain (dB) | Tested Ground Plane (mm) | Reference Outlines |
|-----------------|-----------------|--------------|------------------------|--------------------------|-----------|--------------------------|--------------------|
| GPS | PA25-1575-008SA | RHCP | 1575 | 20 | 2.5 | 35X35 | B |
| GPS | PA25-1579-008SA | RHCP | 1579 | 20 | 2.5 | 35X35 | B |
| GPS-military | PA25-1227-008SA | RHCP | 1227 | 20 | 0.0 | 60X60 | B |
| GPS | PA18-1580-010SA | RHCP | 1580 | 15 | 0.0 | 50X50 | C |
| GPS | PA13-1580-005SA | RHCP | 1580 | 8 | 2.5 | 30X30 | D |
| Globalstar | PA25-1615-025SA | LHCP | 1615 | 125 | 3.0 | 70X70 | B |
| Globalstar | PA37-2492-050SA | LHCP | 2492 | 150 | 4.0 | 40X40 | |
| Iridium | PA25-1621-025SA | RHCP | 1621 | 25 | 4.0 | 60X60 | B |
| Inmarsat | PA25-1542-025SA | RHCP | 1542 | 25 | 4.0 | 60X60 | B |
| Inmarsat | PA25-1643-025SA | RHCP | 1643 | 25 | 4.0 | 60X60 | B |
| Inmarsat | PA45-1592-175SA | RHCP | 1592 | 175 | 5.0 | 60X60 | F |
| Satellite Radio | PA20-2338-025SA | LHCP | 2338 | 60 | 4.0 | 35X35 | E |
| Satellite Radio | PA28-2345-025SA | LHCP | 2345 | 60 | 4.0 | 45X45 | A |
| Satellite Radio | PA25-2350-025SA | LHCP | 2350 | 60 | 4.0 | 45X45 | B |
| ISM | PA37-2450-150SA | RHCP or LHCP | 2450 | 150 | 4.0 | 40X40 | |

Patch Antenna Elements & Assemblies

Reference Outlines

Figure A

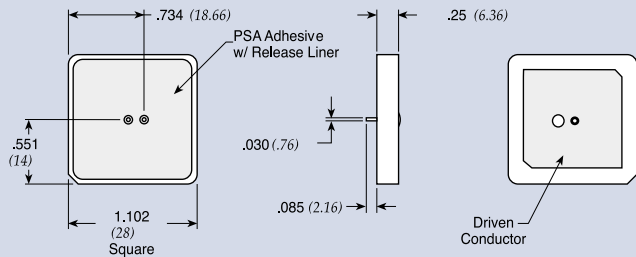


Figure B

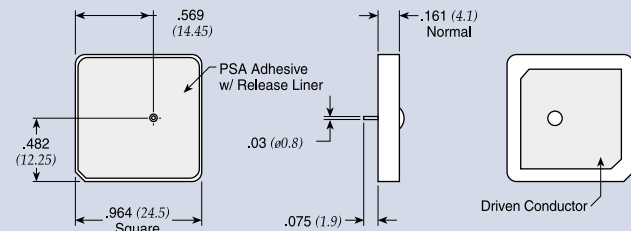


Figure C

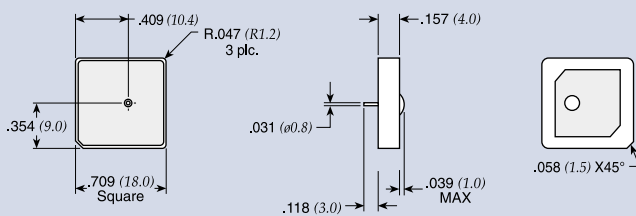


Figure D

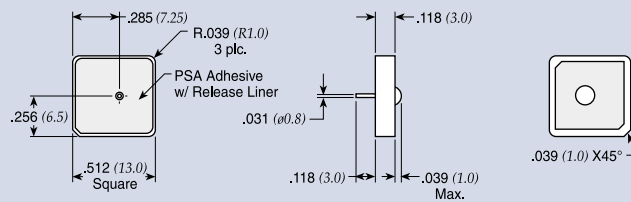


Figure E

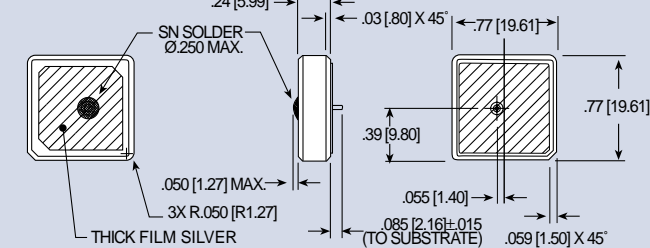
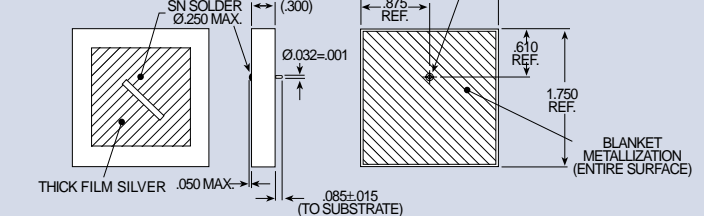


Figure F



Dimensions in inches (mm)

Note: See sales drawing for detailed specifications on each part.

Patch Antenna Elements & Assemblies

Ground Plane:

During the design process, consideration must be given to the size and configuration of the ground plane. The ground plane has substantial effects on the performance of the antenna. These effects include frequency shift, gain, axial ratio and radiation pattern.

Element Size:

The amount of space available for the antenna element determines not only the material required but also the related performance that can be expected. The element size relates to the material that will be selected, the shape of the element, and the metallization pattern. Each of these has a substantial effect on electrical performance.

Assembly Configuration:

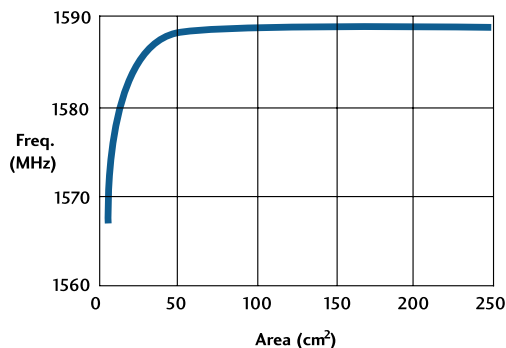
The final assembly configuration also affects element performance. The position of other components, etc. affects the overall performance of the element.

The items mentioned above are areas in which Spectrum Microwave's engineering staff can assist in developing an optimized antenna element to fit your needs.

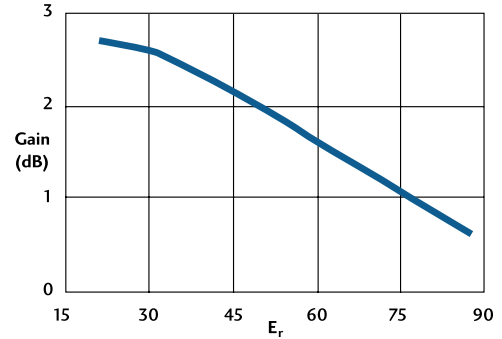
System Solutions

- Design support for your entire system to help optimize not only antenna performance but system performance.
- Our engineering staff will assist in selecting optimized components to insure maximum performance and reliability.
- We offer a wide range of related products to support antenna performance including monoblock and discrete bandpass filters, duplexers and resonators.
- We also offer value-added services such as PCB/ground plane assemblies, bracket assemblies and connectorized assemblies.

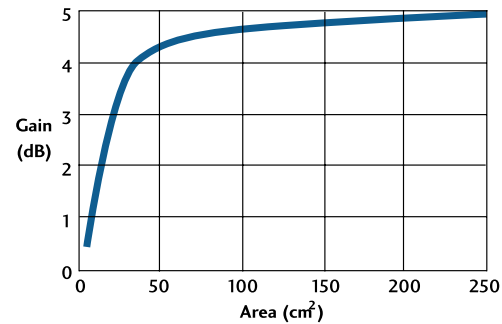
Here are some key relationships in graphical form outlining the effects of the mechanical changes on electrical performances.



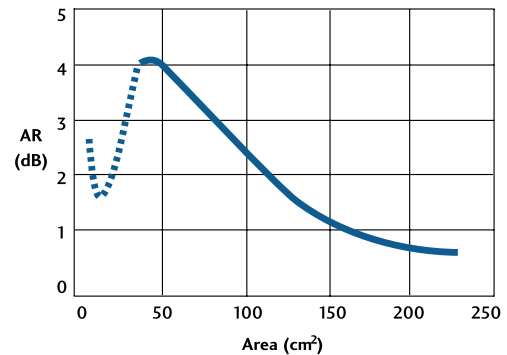
Center frequency vs. ground plane size (25 mm patch)



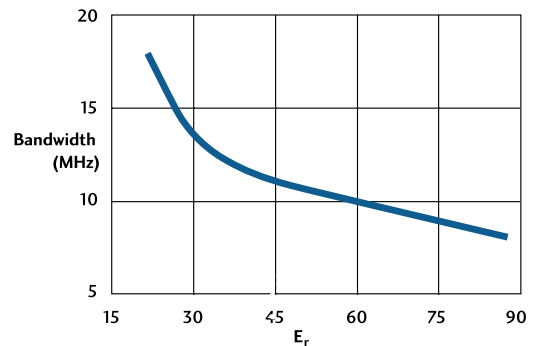
Gain vs. Dielectric Constant (f=1575 MHz)



Gain vs. ground plane size (25 mm patch)



Axial Ratio vs. ground plane size (25 mm patch optimized for 35 mm ground plane)



10 dB return loss bandwidth vs. dielectric constant (f = 1575 MHz).



spectrum microwave

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Hansastrasse 6
91126 Schwabach, Germany
Phone: (49)-9122-795-0
Fax: (49)-9122-795-58

ASIA/PACIFIC RIM

Spectrum Control Electronics
(Dong Guan) Co. LTD.
2/F, No. 37 South Gong Ye Da Dao
Qiatou Town, Dong Guan Municipality
China
Phone: (011)-86-769-33-7791
Fax: (011)-86-769-33-7760



SPECTRUM CONTROL INC.

corporate headquarters

8031 Avonia Road
Fairview, Pennsylvania 16415
Phone: 814-474-2207
Fax: 814-474-2208

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- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения «JONHON», а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов «FORSTAR».



JONHON

«JONHON» (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

«FORSTAR» (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: ocean@oceanchips.ru

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А