# AM3163 – Filter Bank

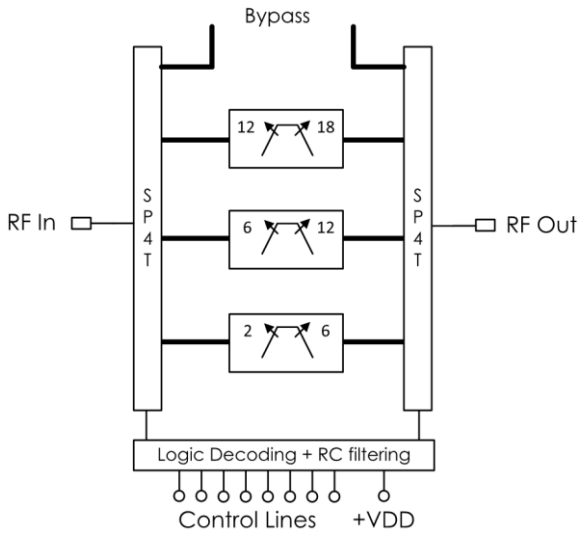
## Digitally Tunable 2 to 18 GHz Bandpass

**AM3163 is a digitally tunable bandpass filter bank covering the 2 GHz to 18 GHz frequency range.** The device provides three separate tunable filter bands with 16 low-pass and 16 high-pass tuning states for independent control of both the center frequency and bandwidth. The filter bank has integrated switches with a 20 GHz bypass path. AM3163 is packaged in a 6mm QFN package and operates over the -40C to +85C temperature range. Its small size, weight, and power consumption make it an attractive choice for demanding applications requiring low SWaP components.

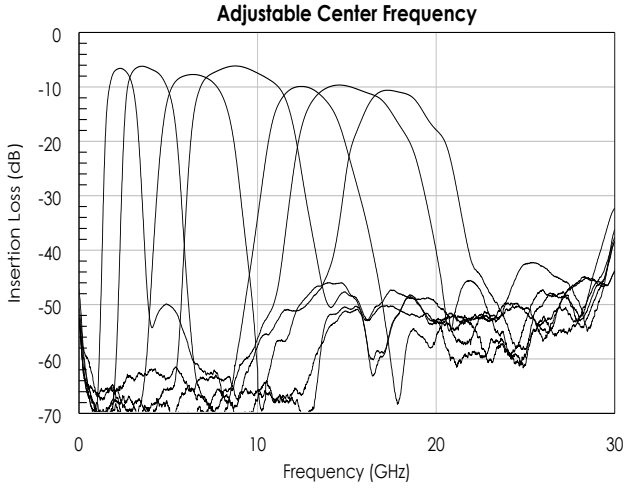
### FEATURES

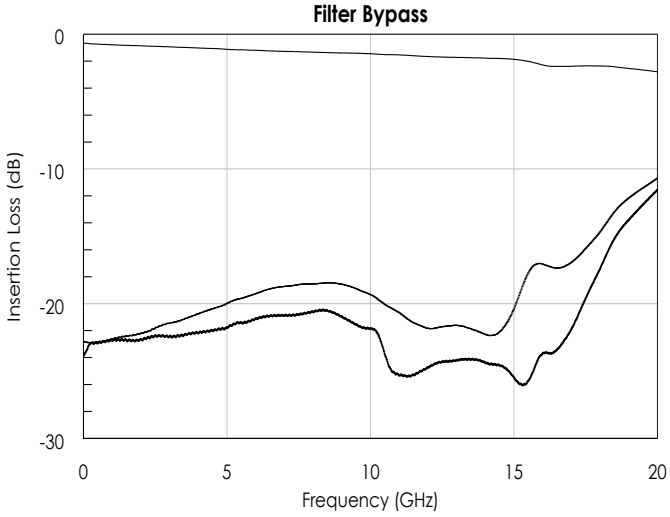
- 2 to 18 GHz Digitally Tunable Bandpass Filter Bank
- Internal SP4T Switches
- Integrated Control Line Filtering
- Independent LP and HP control
- +3.3V to +5.0V Supply
- 8 dB typical Insertion Loss
- 20 GHz Filter Bypass Path
- +39 dBm Input IP3
- +26 dBm Input P1dB
- -40C to +85C Operation
- 6mm QFN

### FUNCTIONAL DIAGRAM




### CHARACTERISTIC PERFORMANCE



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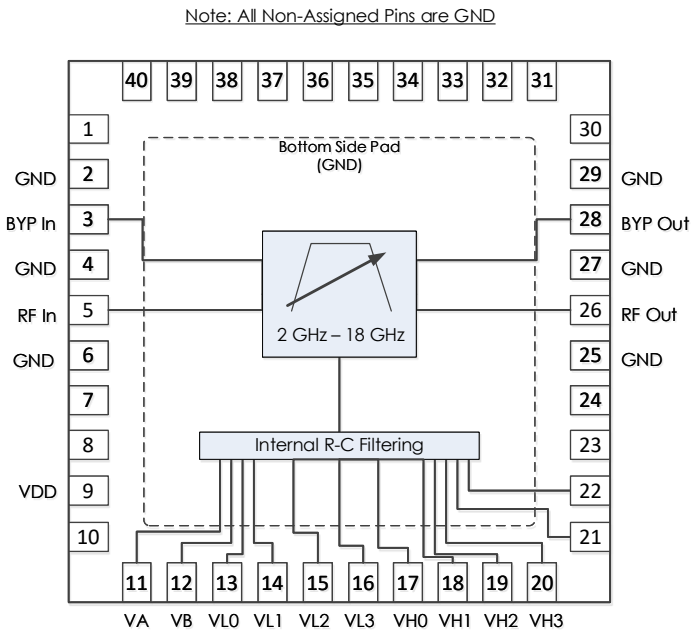
## REVISION HISTORY

| Date | Revision | Notes |
|---|---|---|
| August 26, 2020 | 1 | Initial Release. |
| May 4, 2021 | 2 | Updated diagrams. |
| March 11, 2024 | 2.1 | Corrected Pin 16 description in Pin Layout. |
| June 20, 2024 | 3 | Changed to Mercury branding. No content changes. |
| May 29, 2025 | 4 | Corrected Moisture Sensitivity Level |

## PIN LAYOUT AND DEFINITIONS




| Pin | Name | Function |
|---|---|---|
| 1-2 | GND | Ground – Common |
| 3 | BYP In | Filter Bypass Input Side – 50 Ohms – DC Coupled, External DC Blocking Cap Required |
| 4 | GND | Ground – Common |
| 5 | RF In | RF Input – 50 Ohms – DC Coupled, External DC Blocking Cap Required |
| 6-8 | GND | Ground – Common |
| 9 | VDD | DC Power Input |
| 10 | GND | Ground – Common |
| 11 | VA | Switch Control A |
| 12 | VB | Switch Control B |
| 13 | VL0 | Low Pass Filter Control Bit 0 (LSB) |
| 14 | VL1 | Low Pass Filter Control Bit 1 |
| 15 | VL2 | Low Pass Filter Control Bit 2 |
| 16 | VL3 | Low Pass Filter Control Bit 3 (MSB) |
| 17 | VH0 | High Pass Filter Control Bit 0 (LSB) |
| 18 | VH1 | High Pass Filter Control Bit 1 |
| 19 | VH2 | High Pass Filter Control Bit 2 |
| 20 | VH3 | High Pass Filter Control Bit 3 (MSB) |
| 21-25 | GND | Ground – Common |
| 26 | RF Out | RF Output – 50 Ohms – DC Coupled, External DC Blocking Cap Required |
| 27 | GND | Ground – Common |
| 28 | BYP Out | Filter Bypass Output Side – 50 Ohms – DC Coupled, External DC Blocking Cap Required |
| 29-40 | GND | Ground – Common |
| Bottom Pad | GND | Ground – Common |

## SPECIFICATIONS

### Absolute Maximum Ratings

| | Minimum | Maximum |
|---|---|---|
| Supply Voltage | -0.3 V | +8.0 V |
| RF Input Power | | +27 dBm |
| Operating Junction Temperature | -40 C | +150 C |
| Storage Temperature Range | -50 C | +150 C |

**Note:** Any device operation beyond the Absolute Maximum Ratings may result in permanent damage to the device. The values listed in this table are extremes and do not imply functional operation of the device at these or any other conditions beyond what is listed under Recommended Operating Conditions. Any part subjected to conditions outside of what is recommended for an extended amount of time may suffer from reliability concerns.

### Handling Information

| | Minimum | Maximum |
|---|---|---|
| Storage Temperature Range (Recommended) | -50 C | +125 C |
| Moisture Sensitivity Level | MSL 3 | |

Mercury products are electrostatic sensitive.
Follow safe handling practices to avoid damage.

### Recommended Operating Conditions

| | Minimum | Typical | Maximum |
|---|---|---|---|
| Supply Voltage | +3.0 V | +5.0 V | +5.2 V |
| Operating Case Temperature | -40 C | | +85 C |
| Operating Junction Temperature | -40 C | | +125 C |

### Timing Characteristics

| Switching Time | Minimum | Typical | Maximum |
|---|---|---|---|
| Switching Speed | | 40 ns | |
| Band Tuning Speed | | 400 ns | |

### DC Electrical Characteristics

(T = 25 °C unless otherwise specified)

| Param | Testing Conditions | Min | Typical | Max |
|---|---|---|---|---|
| DC Supply Voltage | | +3.0 V | +5.0 V | +5.2 V |
| DC Supply Current | VDD = +5.0 V | | 6 mA | |
| Power Dissipated | VDD = +5.0 V | | 30 mW | |
| Logic Level Low | | -0.1 V | | +0.5 V |
| Logic Level High | | +2.0 V | | +VDD V |

### RF Performance

(T = 25 °C unless otherwise specified)

| Param | Testing Conditions | Min | Typical | Max |
|---|---|---|---|---|
| Frequency Range | | 2 GHz | | 18 GHz |
| Insertion Loss | f = 2 GHz | | -7.1 dB | |
| | f = 4 GHz | | -6.3 dB | |
| | f = 6 GHz | | -7.7 dB | |
| | f = 9 GHz | | -6.2 dB | |
| | f = 12 GHz | | -7.2 dB | |
| | f = 15 GHz | | -9.8 dB | |
| | f = 18 GHz | | -11 dB | |
| Return Loss | | | -12 dB | |
| Input IP3 | VDD = +5.0 V | | +39 dBm | |
| Input P1dB | VDD = +5.0 V | | +26 dBm | |

**Note:** OIP3 was measured at 10 MHz input tone spacing.

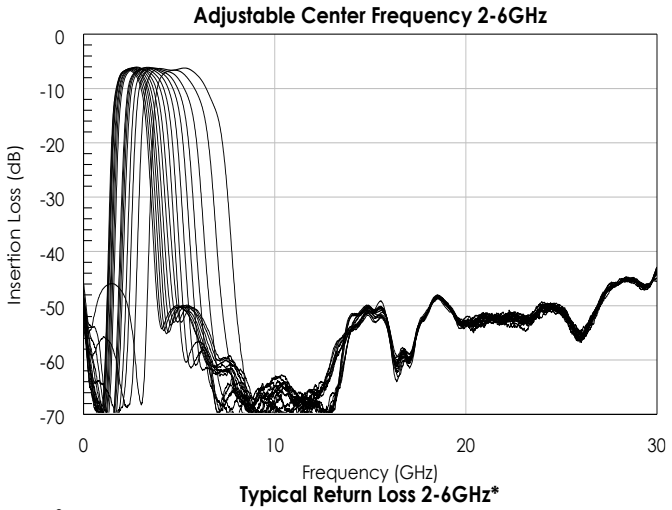
## STATE TABLE

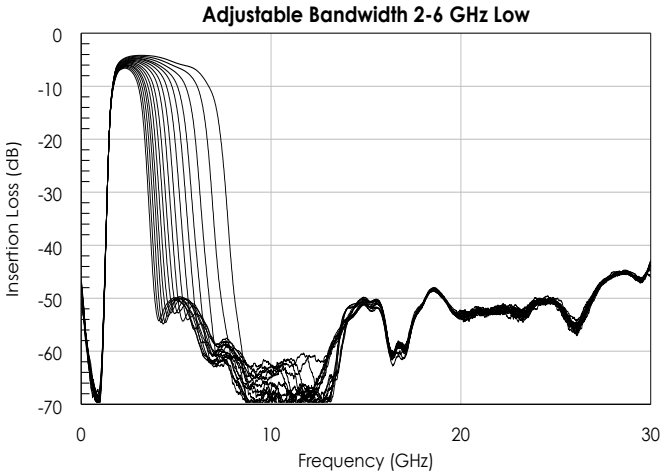
| VA | VB | Filter Band |
|---|---|---|
| Low | Low | Bypass State |
| High | High | Band 1 – 2.0 to 6.0 GHz |
| Low | High | Band 2 – 6.0 to 12 GHz |
| High | Low | Band 3 – 12 to 18 GHz |

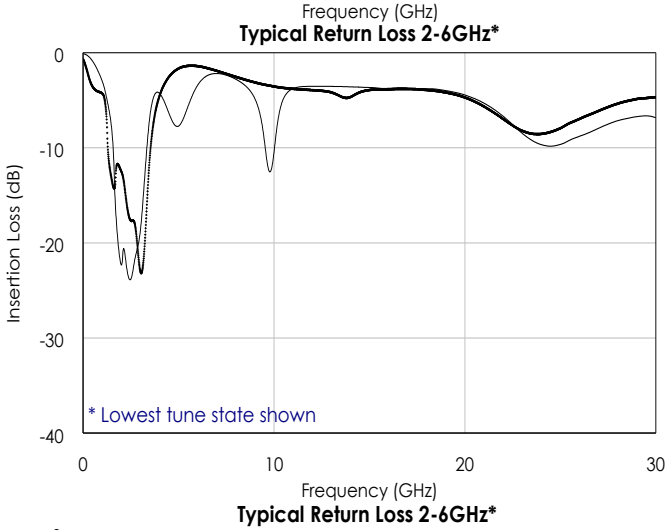
| High Pass Filter Typical Cutoff Frequencies (GHz) | | | | | | |
|---|---|---|---|---|---|---|
| VH3 | VH2 | VH1 | VH0 | Band 1 | Band 2 | Band 3 |
| Low | Low | Low | Low | 1.7 | 5.1 | 11 |
| Low | Low | Low | High | 1.8 | 5.2 | 11.1 |
| Low | Low | High | Low | 1.85 | 5.3 | 11.2 |
| Low | Low | High | High | 1.9 | 5.3 | 11.4 |
| Low | High | Low | Low | 1.92 | 5.4 | 11.4 |
| Low | High | Low | High | 1.96 | 5.5 | 11.5 |
| Low | High | High | Low | 2 | 5.7 | 11.7 |
| Low | High | High | High | 2.1 | 5.9 | 12 |
| High | Low | Low | Low | 2.4 | 5.8 | 11.8 |
| High | Low | Low | High | 2.44 | 6 | 12 |
| High | Low | High | Low | 2.5 | 6.3 | 12.3 |
| High | Low | High | High | 2.6 | 6.5 | 12.7 |
| High | High | Low | Low | 2.8 | 6.8 | 12.8 |
| High | High | Low | High | 3 | 7.3 | 13.4 |
| High | High | High | Low | 3.3 | 8.1 | 14.2 |
| High | High | High | High | 3.9 | 9.1 | 15.8 |

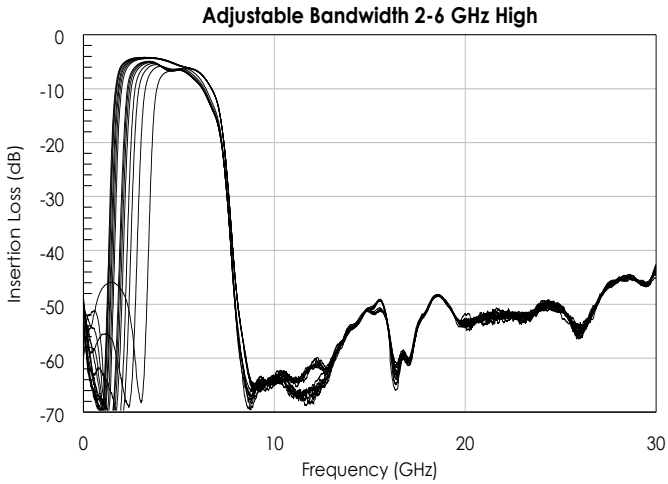
| Low Pass Filter Typical Cutoff Frequencies (GHz) | | | | | | |
|---|---|---|---|---|---|---|
| VL3 | VL2 | VL1 | VL0 | Band 1 | Band 2 | Band 3 |
| Low | Low | Low | Low | 2.9 | 7.8 | 13.8 |
| Low | Low | Low | High | 3 | 8 | 13.9 |
| Low | Low | High | Low | 3.1 | 8.1 | 14.1 |
| Low | Low | High | High | 3.2 | 8.3 | 14.4 |
| Low | High | Low | Low | 3.3 | 8.6 | 14.5 |
| Low | High | Low | High | 3.4 | 8.8 | 14.9 |
| Low | High | High | Low | 3.5 | 9 | 15.2 |
| Low | High | High | High | 3.7 | 9.1 | 15.4 |
| High | Low | Low | Low | 3.9 | 9.2 | 15.7 |
| High | Low | Low | High | 4.1 | 9.5 | 16 |
| High | Low | High | Low | 4.3 | 9.8 | 16.2 |
| High | Low | High | High | 4.5 | 10.1 | 16.6 |
| High | High | Low | Low | 4.8 | 10.6 | 16.7 |
| High | High | Low | High | 5.1 | 11 | 17.2 |
| High | High | High | Low | 5.6 | 11.6 | 18 |
| High | High | High | High | 6.3 | 12.3 | 19.6 |

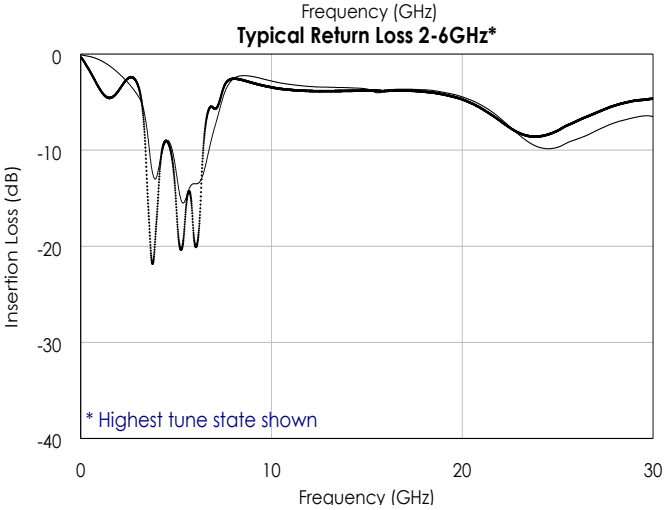
## TYPICAL PERFORMANCE



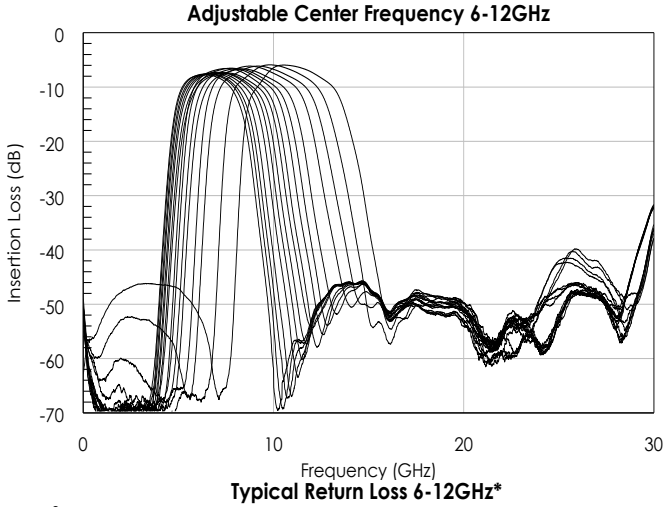



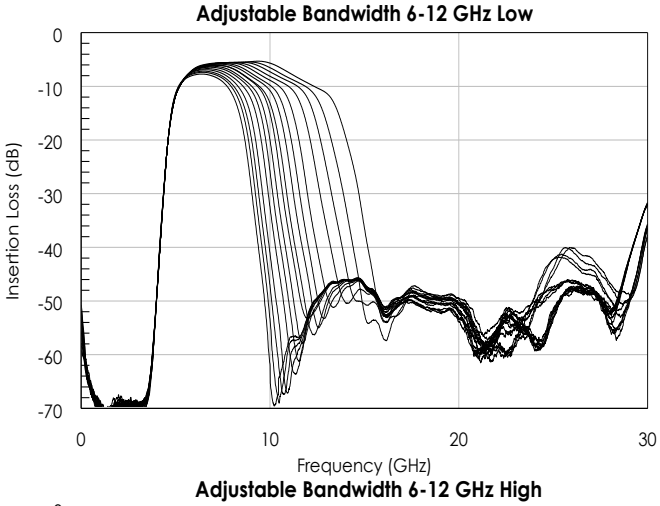

*Typical values shown for lowest tuned frequency (control bits 0000) or highest tuned frequency (control bits 1111).

## TYPICAL PERFORMANCE (CONTINUED)

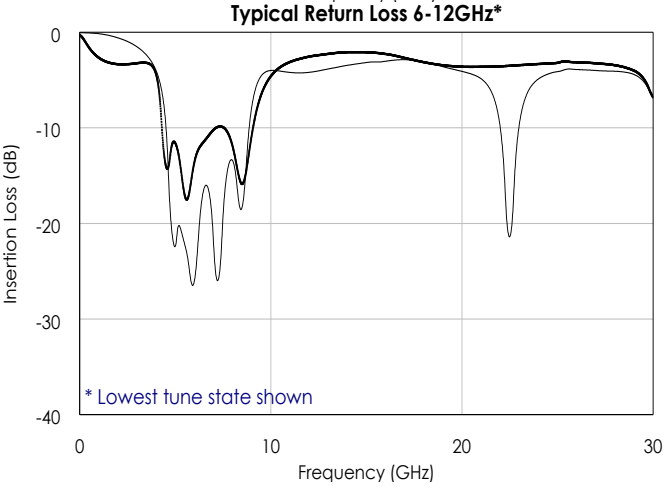
**Adjustable Center Frequency 6-12GHz**



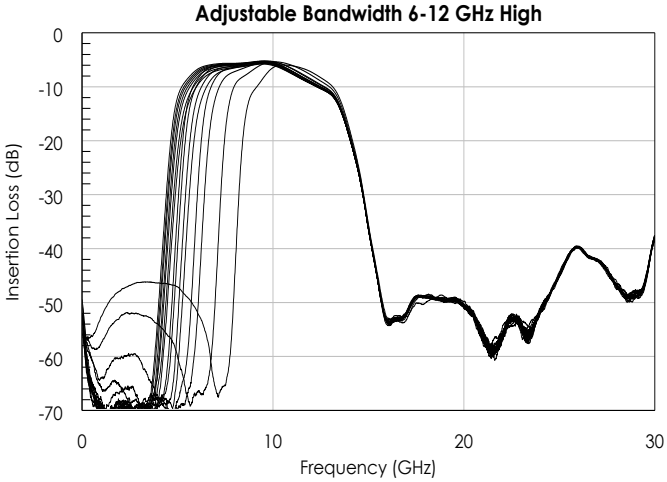

**Adjustable Bandwidth 6-12 GHz Low**



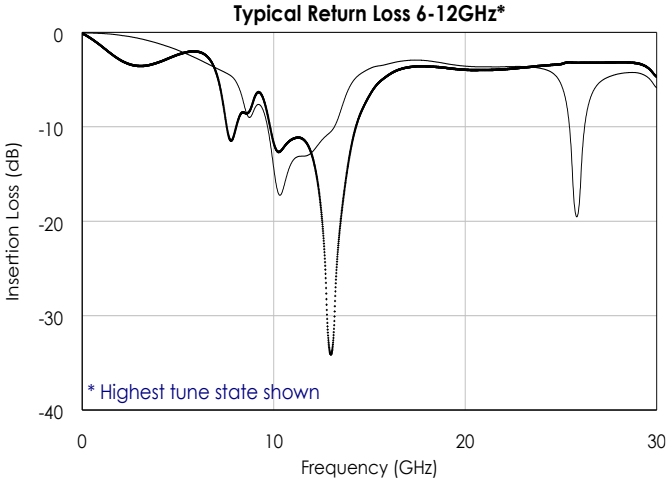

**Typical Return Loss 6-12GHz***




**Adjustable Bandwidth 6-12 GHz High**




**Typical Return Loss 6-12GHz***

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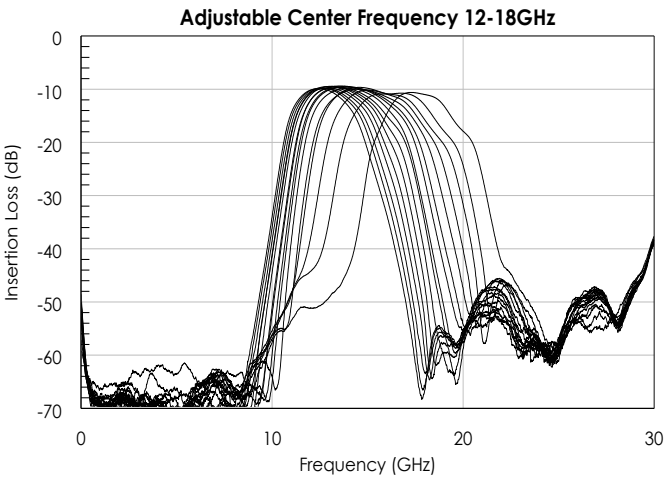
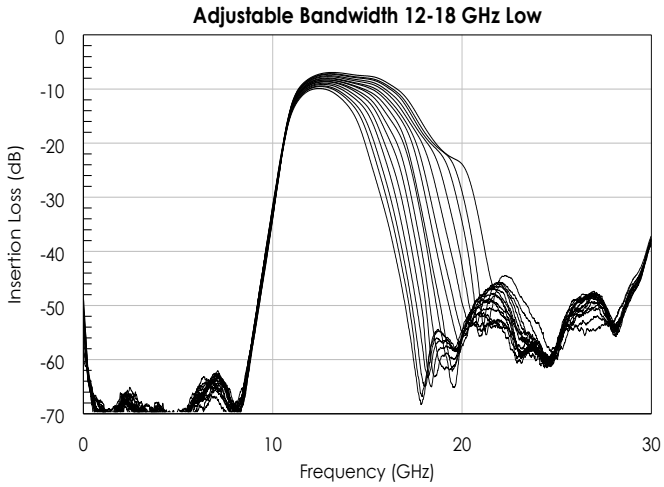
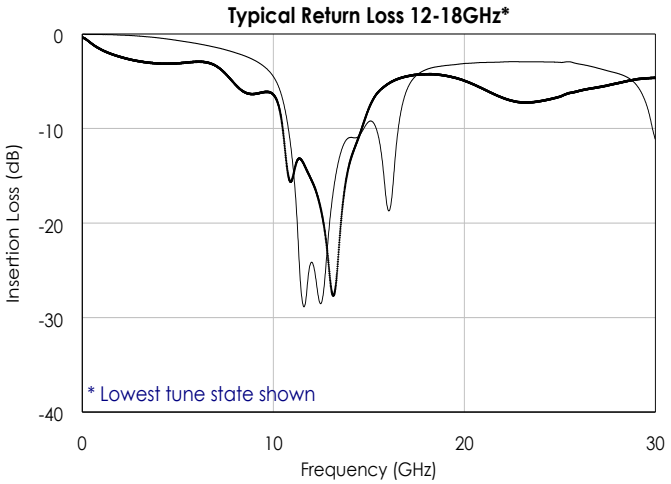
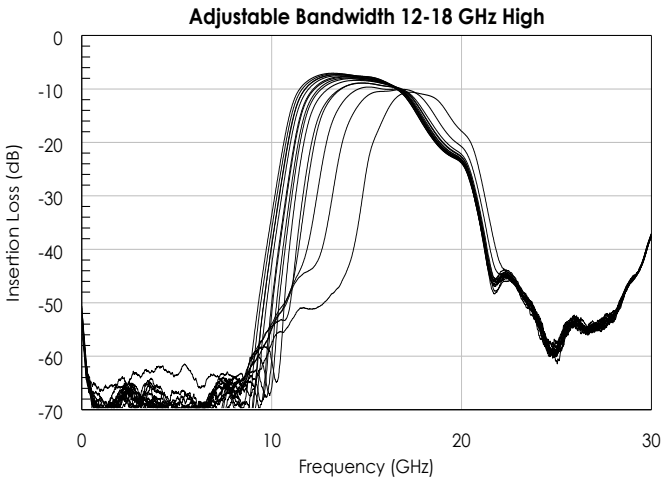
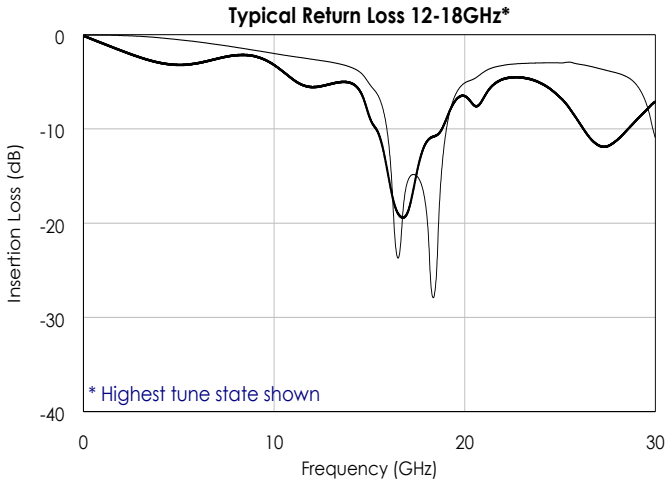
## TYPICAL PERFORMANCE (CONTINUED)

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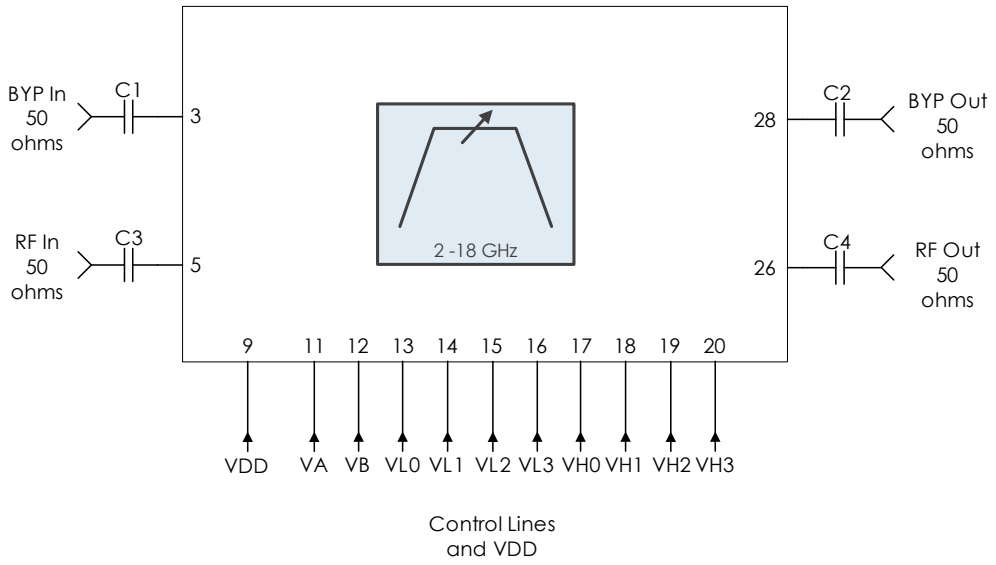
## TYPICAL APPLICATION



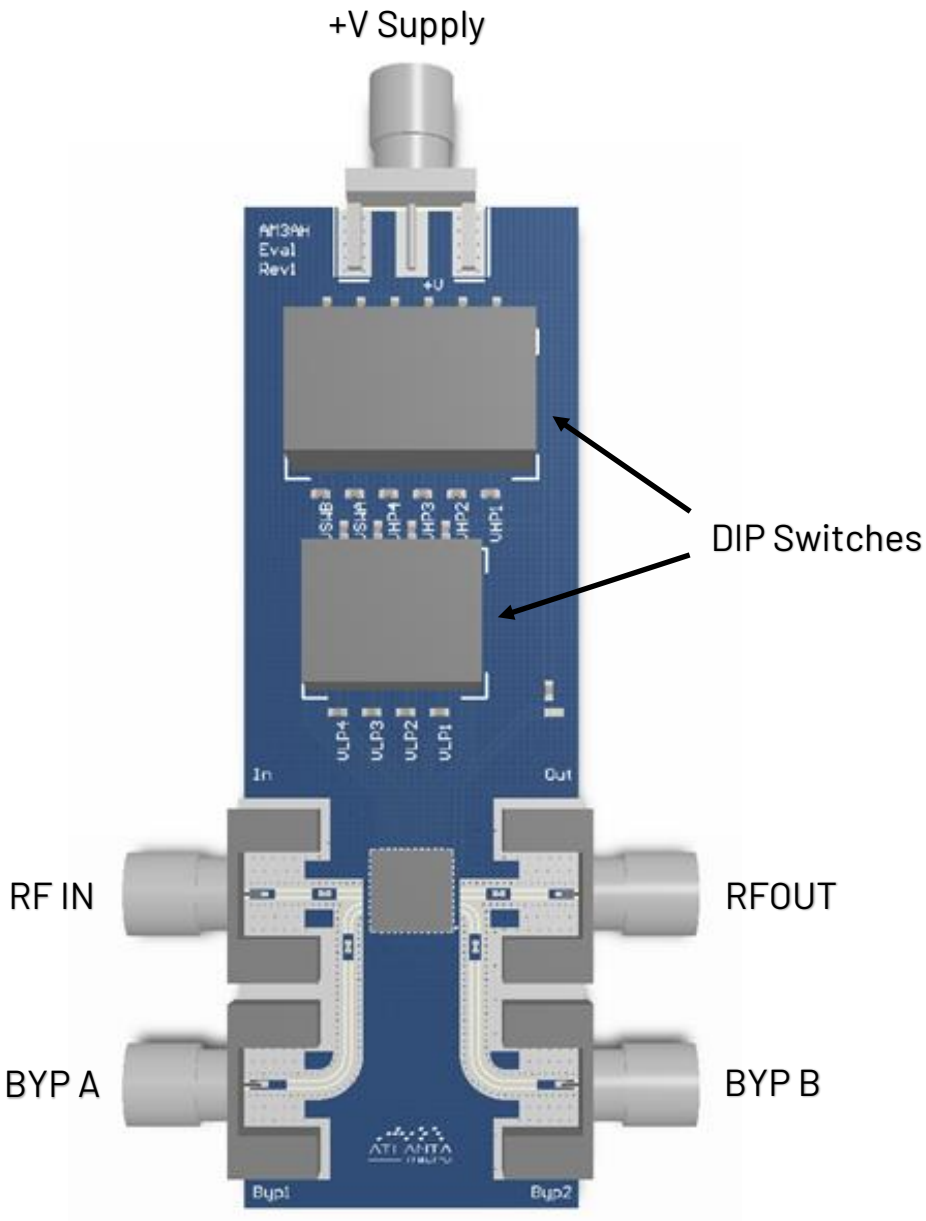

## RECOMMENDED COMPONENT LIST (OR EQUIVALENT)

| Part | Value | Part Number | Manufacturer |
|---|---|---|---|
| C1-C4 | 0.1 µF | 0201BB104KW160 | Passives Plus |

**Notes:**

1. DC blocking capacitors should be high performance, low-loss, broadband capacitors for optimum performance.
2. VDD and control lines filtered internally providing high frequency isolation.

## EVALUATION PC BOARD




## RELATED PARTS

| Part Number | | Description |
|---|---|---|
| AM3152 | 0.4 GHz to 8 GHz | Digitally Tunable Bandpass Filter |
| AM3066 | 12 GHz to 26.5 GH | Digitally Tunable Bandpass Filter |

## COMPONENT COMPLIANCE INFORMATION

**RoHS:** Mercury Systems, Inc. hereby certifies that all products comply with the EC Directive 2011/65/EC on the Restriction of Hazardous Substances, commonly known as EU-RoHS 6 and 10. All products supplied by Mercury shall be compliant with the European Directive 2011/65/EC based on the following substance list.

| Substance List | Allowable Maximum Concentration |
|---|---|
| Lead (Pb) | <1000 PPM (0.1% by weight) |
| Mercury (Hg) | <1000 PPM (0.1% by weight) |
| Cadmium (Cd) | <75 PPM (0.0075% by weight) |
| Hexavalent Chromium (CrVI) | <1000 PPM (0.1% by weight) |
| Polybrominated Biphenyls (PBB) | <1000 PPM (0.1% by weight) |
| Polybrominated Diphenyl ethers (PBDE) | <1000 PPM (0.1% by weight) |
| Decabromodiphenyl Deca BDE | <1000 PPM (0.1% by weight) |
| Bis (2-ethylheyl) Phthalate (DEHP) | <1000 PPM (0.1% by weight) |
| Butyl Benzyl Phthalate (BBP) | <1000 PPM (0.1% by weight) |
| Dibutyl Phthalate (DBP) | <1000 PPM (0.1% by weight) |
| Diisobutyl Phthalate (DIBP) | <1000 PPM (0.1% by weight) |

**REACH:** Mercury Systems, Inc. neither uses nor intentionally adds any of the substances considered to be a Substance of Very High Concern (SVHC) as defined by the EU Regulation (EC) No. 1907-2006 on Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH).

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**Mercury takes its responsibility as a global partner seriously and will use due diligence within our supply chain to ensure all standards are met to the best of our knowledge.**

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