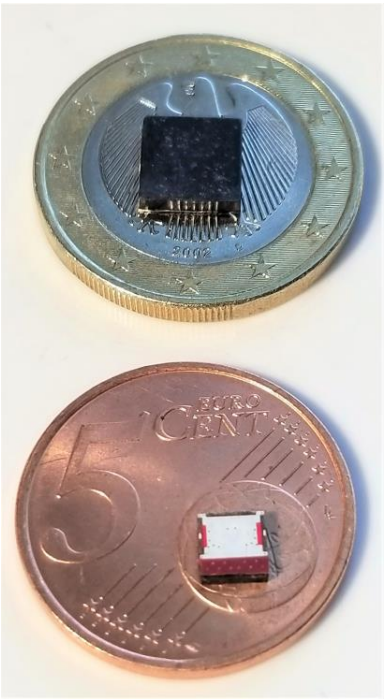
POLE/ZERO INTEGRATED MICROWAVE FILTER SERIES

IMF™ Tunable Bandpass and Notch Filters

Typical Applications

- Designed for applications where extremely small size, ultra-fast tuning speeds, and high performance are required, such as:
  - Military Radios
  - Military Radar
  - Electronic Warfare (EW)
  - SATCOM—On-The-Move (SOTM)
  - RF Front Ends
  - Commercial Communications



Description

Pole/Zero's new IMF™ Series of digitally tunable Bandpass and Notch Filters are available in multiple frequency bands across the 1.5 GHz to 24 GHz frequency range.

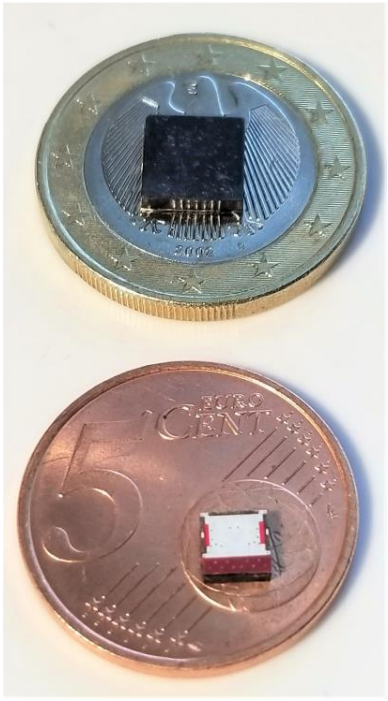
- Performance capabilities include: Phase Noise: -145 dBc/Hz @ 10 kHz offset; Pin: +30dBm (10%BW); IIP3: +35 dBm min. +40 dBm typ.; Insertion Loss: 3.4 dB avg. for 10% BW; Selectivity: 20 dBc @ fc ± 10% (4% BW); +5V @ 20 µA Typical DC Power or +3.3V @ 2 mA typ.
- Ultra-fast tune times of <100 ns via GPIO Tuning Control (0V OFF, +5V ON) of 16 discrete tunable steps.
- Pole/Zero's proprietary design produces filter performance that sets our product apart from the competition.
- Package sizes are as small as 4.1 x 4.1 x 1.5 mm QFN Packages for >10 GHz Bandpass Filters, 7 x 7 x 2 mm QFN Packages for >10 GHz Notch Filters, and <10 GHz Bandpass Filters; all operating over the -40C to +85C range.
- IMF™ demo loaner, mounted on evaluations boards, are available at no cost. Please contact Pole/Zero for more information:
  Email support@polezero.com

This document is not restricted.

Integrated Microwave Filter (IMF™)
1.5 GHz to 24 GHz Bandpass and Notch Filters
Preliminary

Bandpass Filter Features

Frequency Coverage	1.5 GHz to 24 GHz (Multiple Bands)
Input/Output Impedance:	50 Ω
Inband Input/Output VSWR:	1.4:1 typ., 2:1 max
Insertion Loss: (BW% Dependent)	3.4 dB typ. for 10% BW
3 dB Bandwidth:	4% to 10%
Ultimate Attenuation:	40 dB typ. @ 2 x f_o
Phase Noise:	-150 dBc/Hz typ.
Inband RF Power Handling: (BW% Dependent)	+30 dBm for 10% BW (input)
Out of Band RF Power Handling:	+36 dBm (input)
IIP3 (input):	+35 dBm (min) / 40 dBm typ.
Tuning Control:	+5 V GPIO or 3.3V SPI
Tuning Speed (0 dBm input):	500 ns typ. < 6 GHz, and 100 ns > 6 GHz
DC Power:	+5V @ 200 µA or 3.3V @ 750 µA typ.
Operating Temperature:	-40 to +85 °C
Size:	1.5 to 6 GHz: 10 x 10 x 6 mm 6 to 10 GHz: 7 x 7 x 2 mm >10 GHz: 4.1 x 4.1 x 1.5 mm



Interface and Control for Bandpass and Notch Filters:

General Information

Depending upon the SPI or GPIO control options and the frequency range of interest, the IMF™ requires a +5 V supply or a +3.3V supply. This supply voltage should be adequately filtered as noise present on this pin will influence the RF signal purity.

Digital Interface Information

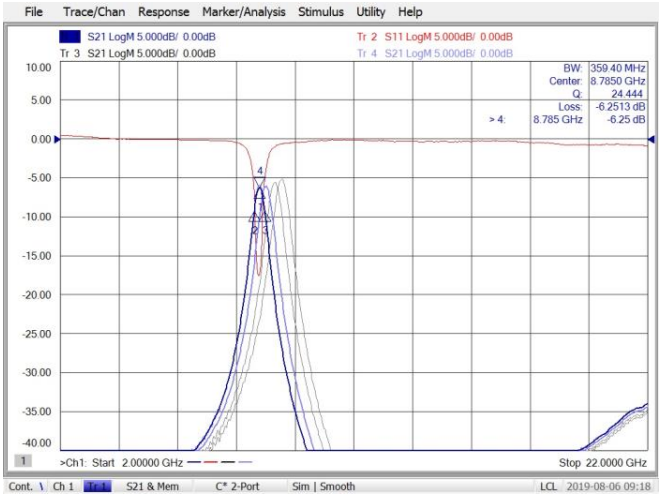
The digital tuning control interface is GPIO: 0, +5V > 4GHz. GPIO or SPI 0, +3.3V < 4GHz.

Document # 1267429 Rev x 9-11-2020

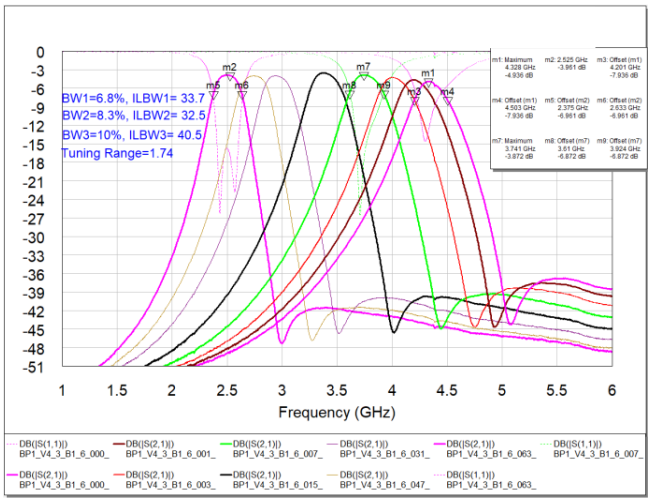
This document is not restricted.

Integrated Microwave Filter (IMF™)
1.5 GHz to 24 GHz Bandpass and Notch Filters
Preliminary

Measured Bandpass Filter Performance:

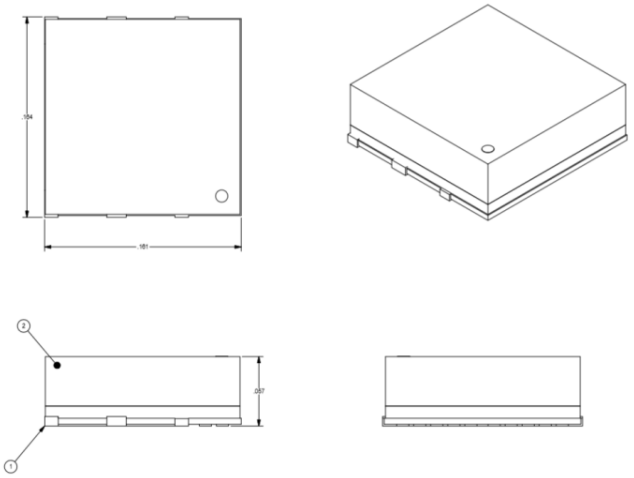


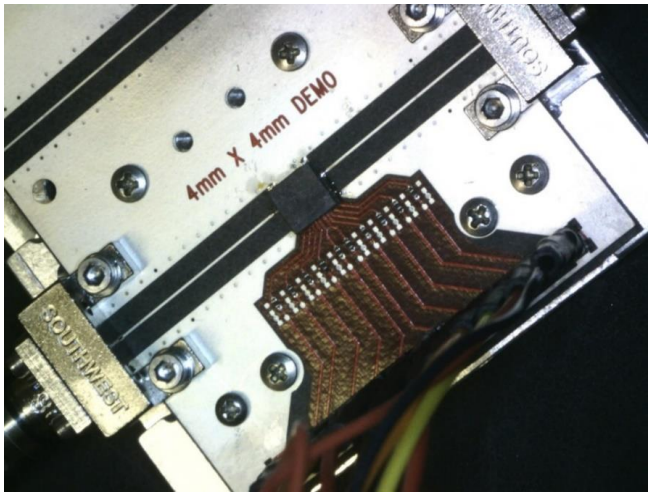
8.8 GHz to 9.4 GHz 4% Bandpass Filter



2.4 GHz to 4.3 GHz 8% Bandpass Filter

Mechanical Details: <u>Consult Pole/Zero for drawing files and PWB Mismatch</u>





Pinout & Ratings

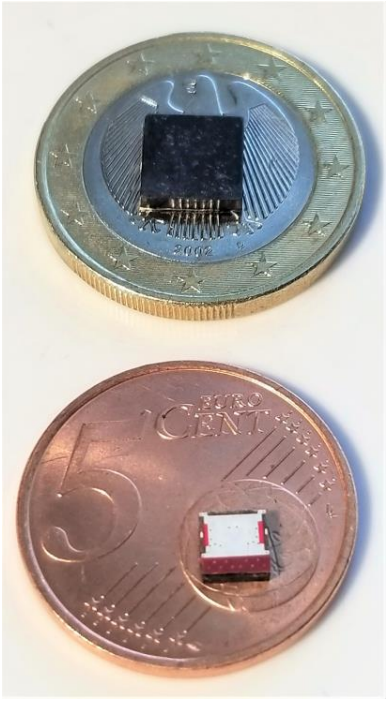
Pin #	Label	Description	Maximum Ratings
	RFIN	Input RF signal	30V pk RF
	VREF	Reference voltage, 5V Typ.	10
	VCTL1-4	+5V Control Voltage (LSB)	+10
	VCTL1-8	+3.3V Control Voltage (LSB)	+4

Preliminary Package Markings: TBD

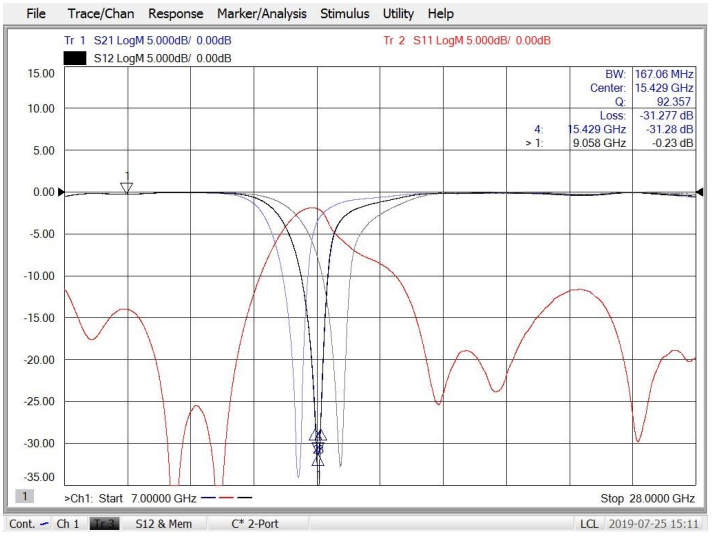
Integrated Microwave Filter (IMF™)
1.5 GHz to 24 GHz Bandpass and Notch Filters
Preliminary

Notch Filter Features

Frequency Coverage (Multiple Bands):	1.5 GHz to 24 GHz
Input/Output Impedance:	50 Ω
Inband Input/Output VSWR:	1.4:1 typ, 2:1 max
Insertion Loss: (BW dependent)	1.5 dB typ.
3 dB Bandwidth:	14%
Pass Band RF Power Handling:	24 dBm
Notch RF Power Handling:	10dBm
IIP3 (input):	+40 dBm typ.
Tuning Control:	+5 V GPIO or 3.3V SPI
Tuning Speed (0 dBm input):	500 ns typ. < 6 GHz, and 100 ns > 6 GHz
DC Power:	+5V @ 200 µA or 3.3V @ 2mA typ.
Operating Temperature:	-40 to +85 °C
Size:	1.5 to 6 GHz: 10 x 10 x 6 mm > 6 GHz: 7 x 7 x 2 mm



Measured Notch Filter Performance:



14.6 GHz to 16.6 GHz Notch Filter

This document is not restricted.

Label	Start Frequency (GHz)	Stop Frequency (GHz)	Approx IL(dB)	Approx %BW	Notes	Ratio
B5_V1_SN1	2.79	3.71	6.4	5	165MHz Constant BW	1.329749104
B8_V1_SN1	3.89	6.23	8.5	4.5		1.601542416
PZTS4G3V1L	12	16	4	8.2		1.333333333
PZTS4G3V6 SN1	20	23.6	4.325	7.28	Board 1	1.18
PZTS4G3V6 SN2	20.35	23.8	4.5	8	Board4 SN99	1.16953317
Board 3	20.35	24.3	4.6	7.6		1.194103194
B4_V1_SN1	2.8	4	6.5	5	180 MHz Constant BW	1.428571429
B4_V1_SN2	2.775	3.675	6.3	4.7	B4_V1_SN2	1.324324324
B4_V1_SN3	2.775	3.675	6	5.1	B4_V1_SN3	1.324324324
Demo 3.1-3.5 #4	2.93	3.79	6.3	4.5	B5_V3_SN4	1.293515358
Demo 8.9-9.8GHz SN99	8.9	9.8	5	6		1.101123596