AM3152 – Filter Bank

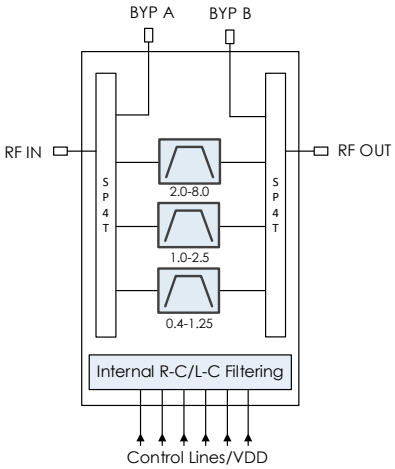
Digitally Tunable 0.4 to 8 GHz Bandpass

AM3152 is a miniature digitally tunable bandpass filter bank covering the 0.4 to 8 GHz frequency range. The device exhibits 3 filter bands each with 256 discrete tune states and a low-loss filter bypass path contained in a 6mm QFN package. AM3152 is an excellent front-end for a receiver providing both low insertion loss and valuable flexibility for tuning center frequency and bandwidth. Its small size, weight, and power consumption make it an attractive choice for demanding application requiring low SWaP components.

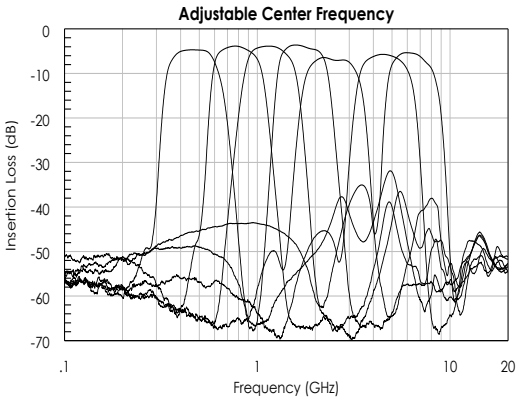
FEATURES

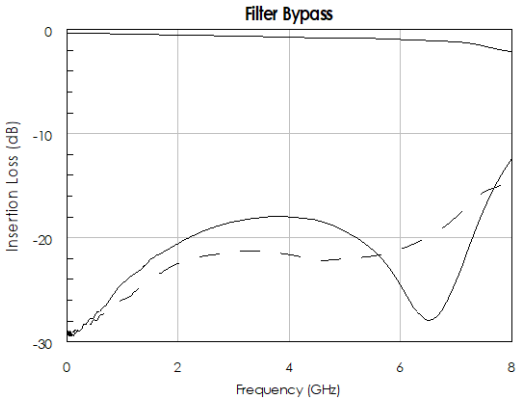
- Digitally Tunable Bandpass Filter
- Integrated Control Line Filtering
- 4.5 dB Insertion Loss
- 8 GHz Filter Bypass Path
- +3.3V to +5.0V Supply
- +3.3V to +5.0V Control
- 6mm QFN Package
- -40C to +85C Operation

FUNCTIONAL DIAGRAM



CHARACTERISTIC PERFORMANCE



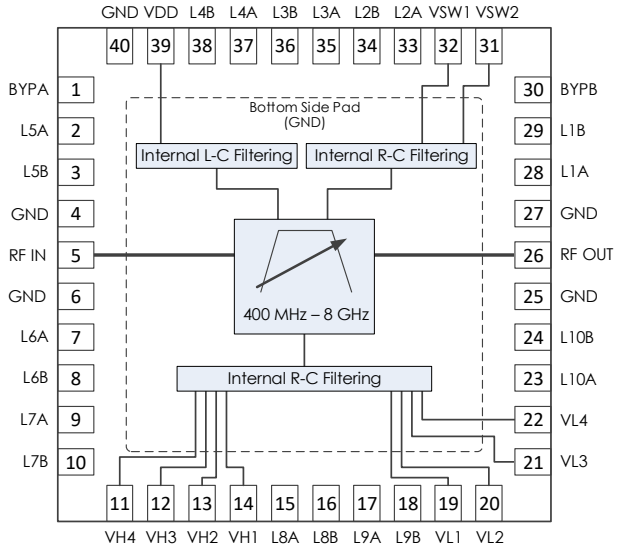


CONTENTS

REVISION HISTORY

Date	Revision	Notes
March 30, 2020	0	Preliminary Release
July 13, 2020	0.1	Updated plots, cutoff frequencies, and RF performance
July 21, 2020	1	Initial Release
November 16, 2020	1.1	Updated state table
August 12, 2022	2	Updated Power Handling
July 17, 2023	2.1	Updated capacitor labels in Typical Application
November 14, 2023	2.2	Obsolete Part# in Typical Application Replaced
May 10, 2024	3	Changed to Mercury branding. No content changes.
June 7, 2024	3.1	Updated pin labels in Typical Application

PIN LAYOUT AND DEFINITIONS



Pin	Name	Function
1	BYPA	Filter Bypass Input Side – 50 Ohms – DC Coupled, External DC Block Required
2	L5A	L5 Connection A
3	L5B	L5 Connection B
4	GND	Ground – Common
5	RF IN	RF Input – 50 Ohms – DC Coupled, External DC Block Required
6	GND	Ground – Common
7	L6A	L6 Connection A
8	L6B	L6 Connection B
9	L7A	L7 Connection A
10	L7B	L7 Connection B
11	VH4	Highpass Filter Control Bit 4 (MSB)
12	VH3	Highpass Filter Control Bit 3
13	VH2	Highpass Filter Control Bit 2
14	VH1	Highpass Filter Control Bit 1 (LSB)
15	L8A	L8 Connection A
16	L8B	L8 Connection B
17	L9A	L9 Connection A
18	L9B	L9 Connection B
19	VL1	Lowpass Filter Control Bit 1 (LSB)
20	VL2	Lowpass Filter Control Bit 2

Pin	Name	Function
21	VL3	Lowpass Filter Control Bit 3
22	VL4	Lowpass Filter Control Bit 4 (MSB)
23	L10A	L10 Connection A
24	L10B	L10 Connection B
25	GND	Ground – Common
26	RF OUT	RF Output– 50 Ohms – DC Coupled, External DC Block Required
27	GND	Ground – Common
28	L1A	L1 Connection A
29	L1B	L1 Connection B
30	BYPB	Filter Bypass Output Side – 50 Ohms – DC Coupled, External DC Block Required
31	VSW2	Switch Control 2
32	VSW1	Switch Control 1
33	L2A	L2 Connection A
34	L2B	L2 Connection B
35	L3A	L3 Connection A
36	L3B	L3 Connection B
37	L4A	L4 Connection A
38	L4B	L4 Connection B
39	VDD	DC Power Input
40	GND	Ground – Common

SPECIFICATIONS

Absolute Maximum Ratings

	Minimum	Maximum
Supply Voltage	-0.3 V	+6.0 V
RF Input Power (Continuous Wave)		+30 dBm
Operating Junction Temperature	-40 C	+150 C
Storage Temperature Range	-55 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 1	

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

***Note:** Operating the AM3152 at VDD levels below +5.0V can cause corner frequencies to shift low by up to 2%. It is recommended to use +5.0V when possible. Control voltage level does not affect filter corner frequencies.

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		10 mA	
Power Dissipated	VDD = +5.0 V		50 mW	
Logic Level Low		-0.1 V		0.5 V
Logic Level High		+2.0 V		+VDD
Logic Drive Level	VSWx/VHx/VLx = +5.0V	200 µA		

***Note:** Operating the AM3152 at VDD levels below +5.0V can cause corner frequencies to shift low by up to 2%. It is recommended to use +5.0V when possible. Control voltage level does not affect filter corner frequencies.

Timing Characteristics

Param	Min	Typical	Max
Band Switching Speed		130 ns	
Band 1 Tuning Speed		430 ns	
Band 2 Tuning Speed		420 ns	
Band 3 Tuning Speed		970 ns	

Note: Timing characteristics measured from 50% control to 90% RF.

RF Performance

(T = 25 °C unless otherwise specified)

Param	Testing Conditions	Min	Typical	Max
Frequency Range		0.4 GHz		8 GHz
Insertion Loss	Band 1		-4 dB	
	Band 2		-3.8 dB	
	Band 3		-6 dB	
Return Loss			-12 dB	

STATE TABLES

SW2	SW1	Filter Band
Low	Low	Bypass State
Low	High	Band 1 – 0.4 to 1.25 GHz
High	Low	Band 2 – 1.0 to 2.5 GHz
High	High	Band 3 – 2.0 to 8.0 GHz

STATE TABLES (continued)

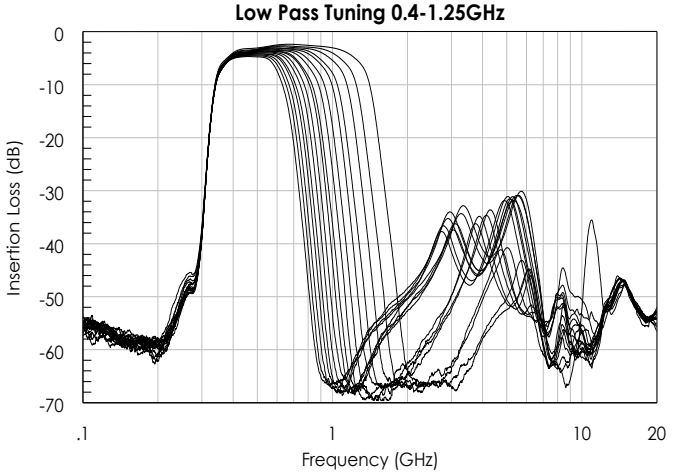
High Pass Filter Typical Cutoff Frequencies (GHz)						
VH4	VH3	VH2	VH1	Band 1	Band 2	Band 3
Low	Low	Low	Low	0.4	0.94	2.0
Low	Low	Low	High	0.41	0.95	2.01
Low	Low	High	Low	0.42	0.97	2.07
Low	Low	High	High	0.43	0.98	2.09
Low	High	Low	Low	0.45	1.0	2.19
Low	High	Low	High	0.47	1.03	2.21
Low	High	High	Low	0.49	1.06	2.3
Low	High	High	High	0.50	1.09	2.35
High	Low	Low	Low	0.51	1.17	2.77
High	Low	Low	High	0.53	1.18	2.85
High	Low	High	Low	0.56	1.21	3.06
High	Low	High	High	0.6	1.25	3.18
High	High	Low	Low	0.64	1.37	3.63
High	High	Low	High	0.69	1.4	3.88
High	High	High	Low	0.76	1.47	4.65
High	High	High	High	0.85	1.56	5.19

Low Pass Filter Typical Cutoff Frequencies (GHz)						
VL4	VL3	VL2	VL1	Band 1	Band 2	Band 3
Low	Low	Low	Low	0.53	1.37	3.0
Low	Low	Low	High	0.54	1.41	3.02
Low	Low	High	Low	0.55	1.45	3.12
Low	Low	High	High	0.56	1.47	3.2
Low	High	Low	Low	0.57	1.51	3.38
Low	High	Low	High	0.59	1.53	3.47
Low	High	High	Low	0.62	1.59	3.63
Low	High	High	High	0.66	1.64	3.76
High	Low	Low	Low	0.75	1.7	4.14
High	Low	Low	High	0.78	1.79	4.31
High	Low	High	Low	0.82	1.91	4.53
High	Low	High	High	0.87	1.98	4.76
High	High	Low	Low	0.92	2.08	5.47
High	High	Low	High	1.02	2.15	5.95
High	High	High	Low	1.15	2.29	6.7
High	High	High	High	1.25	2.4	8.0

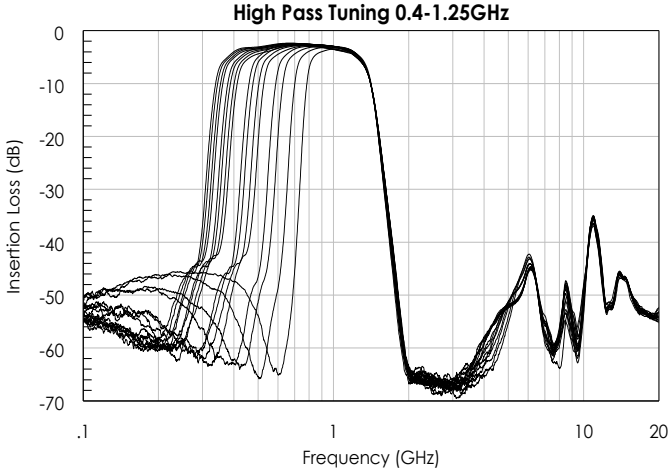
Note: State Table cutoff frequencies measured with VDD = 5.0V.

TYPICAL PERFORMANCE

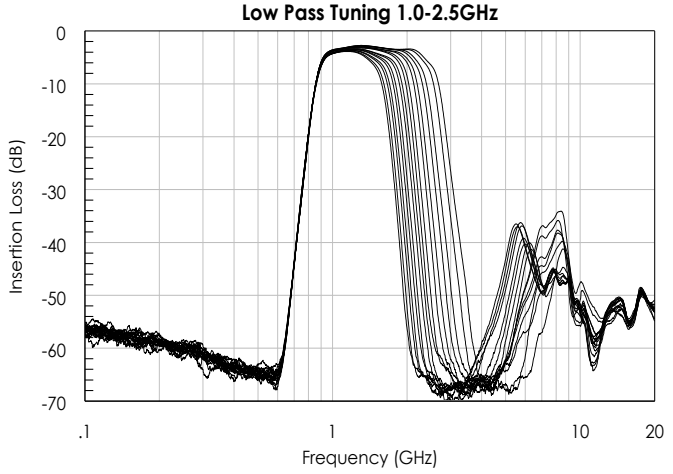
Low Pass Tuning 0.4-1.25GHz



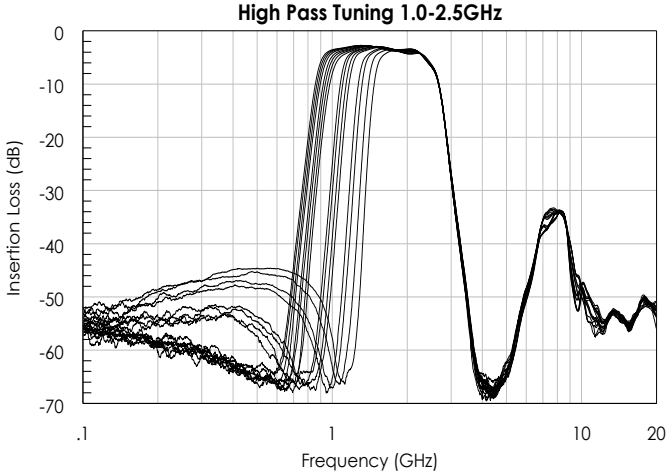
High Pass Tuning 0.4-1.25GHz



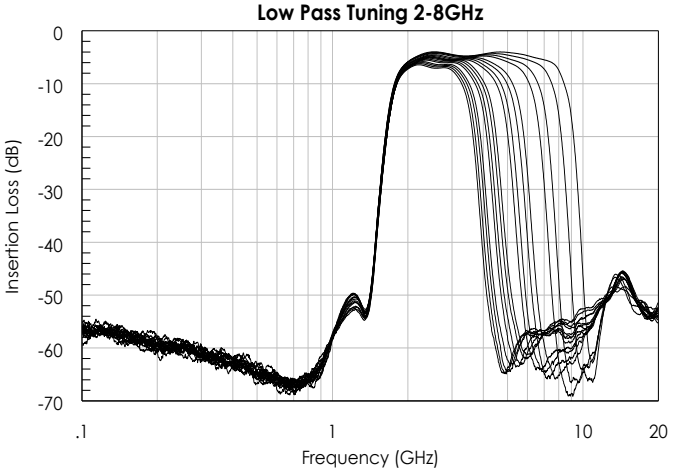
Low Pass Tuning 1.0-2.5GHz



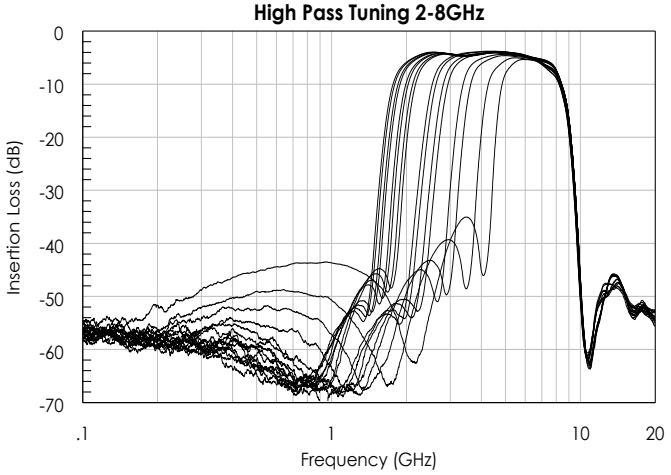
High Pass Tuning 1.0-2.5GHz



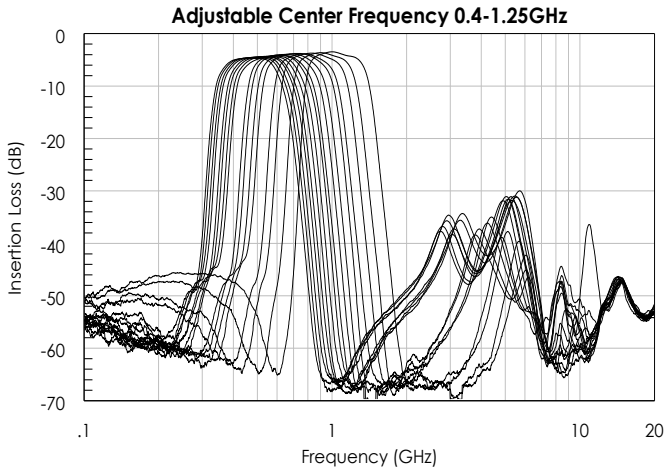
Low Pass Tuning 2-8GHz

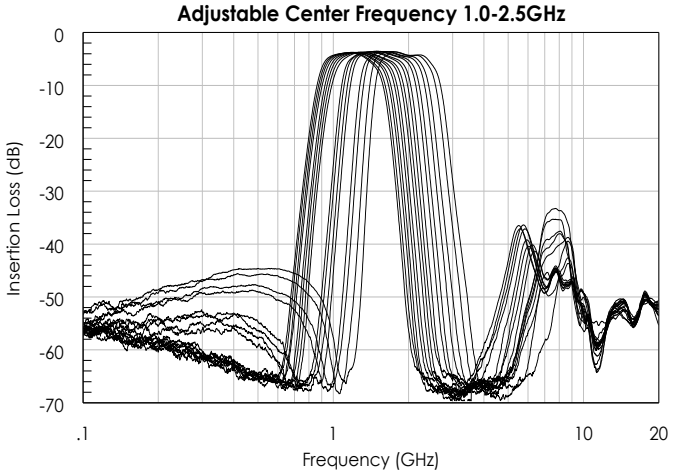


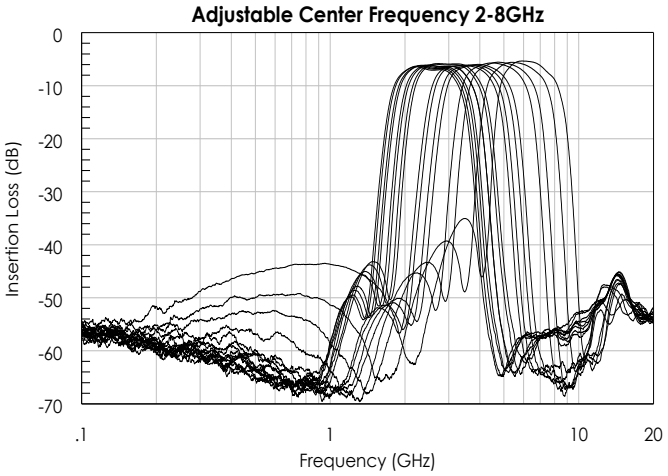
High Pass Tuning 2-8GHz



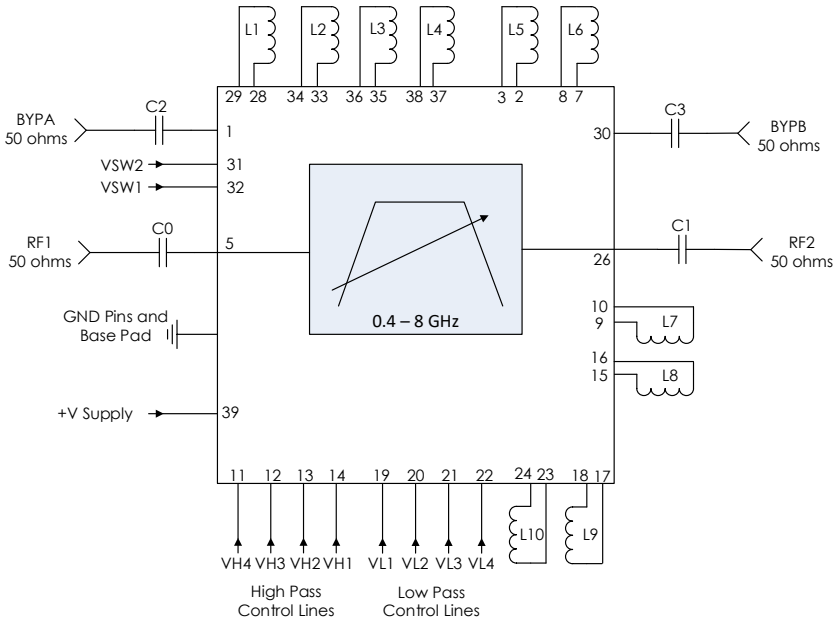
TYPICAL PERFORMANCE







TYPICAL APPLICATION



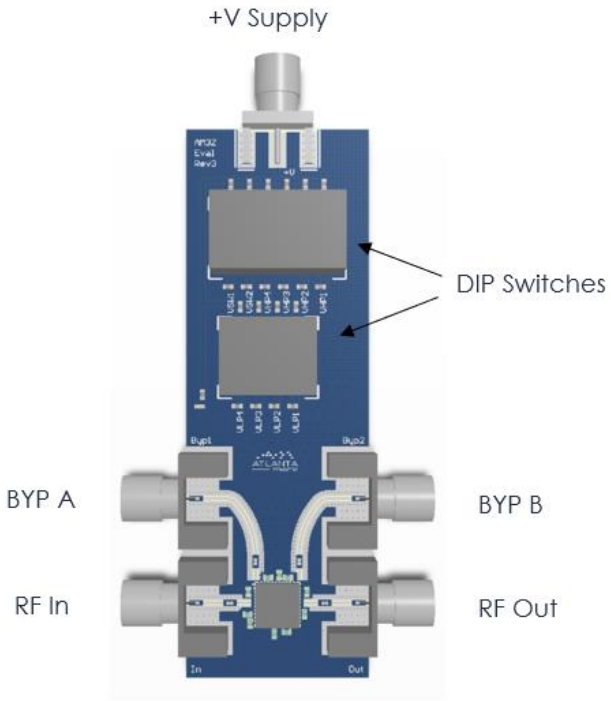
Recommended Component List (or Equivalent)

Part	Value	Part Number	Manufacturer
C0 – C3	0.1 uF	0201BB104KW160	Passive Plus
L1	2.0 nH	0402DC-2N0XJRU	Coilcraft
L2	2.8 nH	0402DC-2N8XJRU	Coilcraft
L3, L5	5.1 nH	0402DC-5N1XGRU	Coilcraft
L4	6.7 nH	0402DC-6N7XGRU	Coilcraft
L6, L8	12 nH	0402DC-12NXGRU	Coilcraft
L7	20 nH	0402DC-20NXGRU	Coilcraft
L9	6.6 nH	0402DC-6N6XGRU	Coilcraft
L10	4.7 nH	0402DC-4N7XGRU	Coilcraft

Notes:

1. VDD and Control Lines filtered internally providing high frequency isolation.
2. DC blocking capacitors should be high performance, low-loss, broadband capacitors for optimum performance.
3. L4 may be replaced with the same 6.6 nH inductor as L9 to reduce BOM complexity/unique parts.

EVALUATION PC BOARD



RELATED PARTS

Part Number		Description
AM3156	0.4 GHz to 8 GHz	Digitally Tunable Bandpass Filter (AM3152 + Inductors in 10mm QFN Package)
AM3060	.32 GHz to 6.5 GHz	Digitally Tunable Bandpass Filter
AM3150	30 MHz to 550 MHz	Digitally Tunable Low Pass Filter
AM3151	20 MHz to 360 MHz	Digitally Tunable High Pass Filter
AM3153	6 GHz to 26.5 GHz	Digitally Tunable Bandpass Filter

COMPONENT COMPLIANCE INFORMATION

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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)

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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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