

AM3151 – Filter Bank

Digitally Tunable 20 to 360 MHz Highpass

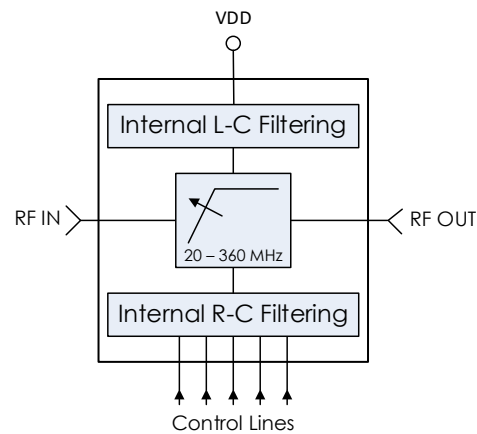
Description

AM3151 is a digitally tunable highpass filter covering the 20 MHz to 360 MHz frequency range. The filter provides 32 selectable highpass cutoff states with 5 digital control bits. The tunable highpass filter can be combined with one of Atlanta Micro's tunable lowpass filters to provide a flexible bandpass filter solution. AM3151 is packaged in a 6mm QFN package and operates over the -40C to +85C temperature range.

Features

- Digitally Tunable Highpass Filter
- Integrated Control Line Filtering
- +3.3V to +5.0V Supply
- 1.8 dB Insertion Loss
- +41 dBm Input IP3
- +65 dBm Input IP2
- 6mm QFN Package
- -40C to +85C Operation

Functional Diagram



Characteristic Performance

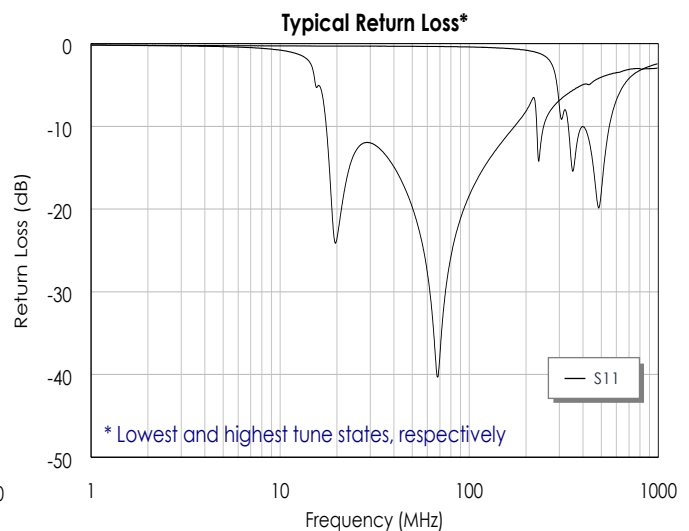
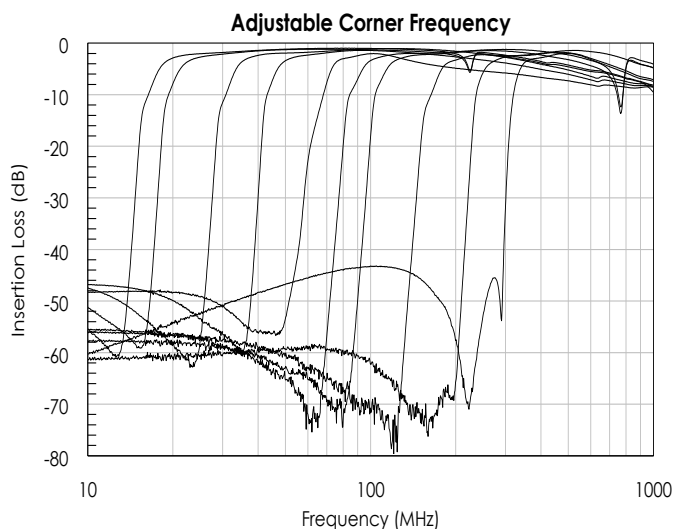


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Revision History

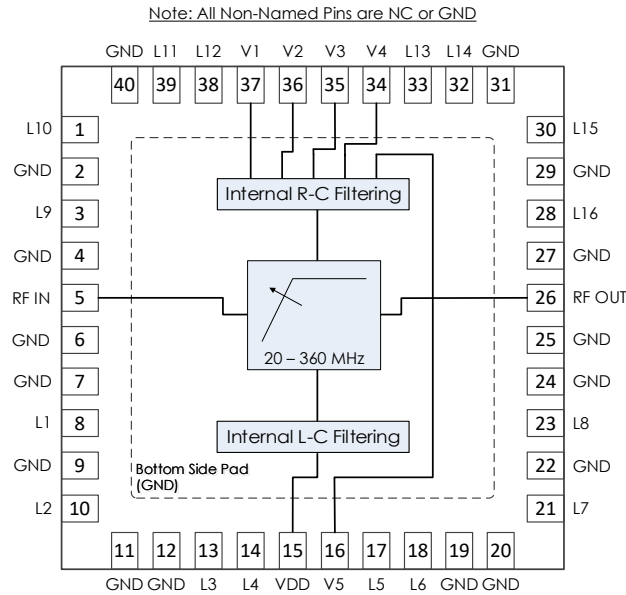
Date	Revision Number	Notes
April 2, 2020	1	Initial Release
April 17, 2020	2	Recommended Component List corrected.
June 29, 2020	3	Updated RF Performance
July 8, 2020	4	Added Timing Characteristics
January 12, 2021	5	Added control bits current drive requirements.

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Pin Layout and Definitions



Pin Number	Pin Name	Pin Function
1	L10	L10 Connection
2	GND	Ground – Common
3	L9	L9 Connection
4	GND	Ground - Common
5	RF IN	RF Input – 50 Ohms – DC Coupled, External DC Block Required
6-7	GND	Ground – Common
8	L1	L1 Connection
9	GND	Ground – Common
10	L2	L2 Connection
11-12	GND	Ground – Common
13	L3	L3 Connection
14	L4	L4 Connection
15	VDD	DC Power Input
16	V5	Low Pass Filter Control Bit E (MSB)
17	L5	L5 Connection
18	L6	L6 Connection
19-20	GND	Ground – Common
21	L7	L7 Connection
22	GND	Ground – Common
23	L8	L8 Connection
24-25	GND	Ground – Common
26	RF OUT	RF Output – 50 Ohms – DC Coupled, External DC Block Required
27	GND	Ground – Common
28	L16	L16 Connection
29	GND	Ground – Common
30	L15	L15 Connection

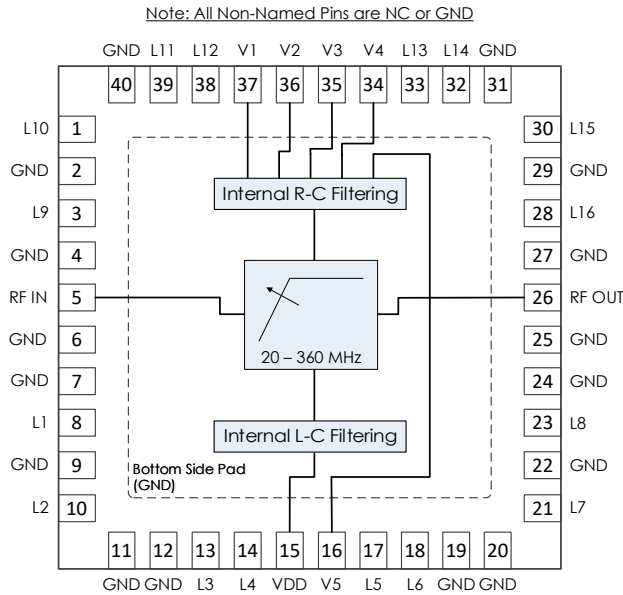
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Pin Layout and Definitions (continued)



Pin Number	Pin Name	Pin Function
31	GND	Ground – Common
32	L14	L14 Connection
33	L13	L13 Connection
34	V4	Low Pass Filter Control Bit D
35	V3	Low Pass Filter Control Bit C
36	V2	Low Pass Filter Control Bit B
37	V1	Low Pass Filter Control Bit A (LSB)
38	L12	L12 Connection
39	L11	L11 Connection
40	GND	Ground – Common
Bottom Pad	GND	Ground – Common

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Specifications

Absolute Maximum Ratings

	Minimum	Maximum
Supply Voltage	-0.3 V	+6.0 V
RF Input Power		+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 3	



Atlanta Micro 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

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DC Electrical Characteristics

(T = 25 °C unless otherwise specified)

Parameter	Testing Conditions	Minimum	Typical	Maximum
DC Supply Voltage		+3.0 V	+5.0 V	+5.2 V
DC Supply Current	VDD = +5.0 V		5 mA	
Power Dissipated	VDD = +5.0 V		25 mW	
Logic Level Low		-0.1 V		+0.5 V
Logic Level High		+2.0 V		+VDD V
Logic Current Drive	V _x = 3.3V	100 μA		
	V _x = 5V	200 μA		

RF Performance

(VDD = +5.0V, T = 25 °C unless otherwise specified)

Parameter	Testing Conditions	Minimum	Typical	Maximum
Frequency Range		20 MHz		360 MHz
Insertion Loss	Lowest Tune State		-1.5 dB	
	Highest Tune State		-2.1 dB	
Return Loss	Lowest Tune State		-15.5 dB	
	Highest Tune State		-10.5 dB	
Input IP3			+41 dBm	
Input IP2			+64 dBm	

Timing Characteristics

(VDD = +5.0V, T = 25 °C unless otherwise specified)

Parameter	Minimum	Typical	Maximum
Tuning Speed, Rise ¹ (Out of Band → In Band)		200 ns	
Tuning Speed, Fall ² (In Band → Out of Band)		250 ns	
Settling Time, Rise ³ (Out of Band → In Band)		1 μs	5.7 μs ⁴
Settling Time, Fall ³ (In Band → Out of Band)			500 ns

NOTES:

1. Tuning speed rise defined by 50% CTL to 90% RF.
2. Tuning speed fall defined as 50% CTL to 10% RF.
3. Settling time error band defined to be within 1% of steady state value.
4. 5.7μs settling time only observed in one switching instance, when switching from 0XXXX to 1XXXX where the signal went from out of band to in band. Signal was just outside of 1% error band for a long time before finally settling within the 1% band. All other switching metrics settled within 1μs.

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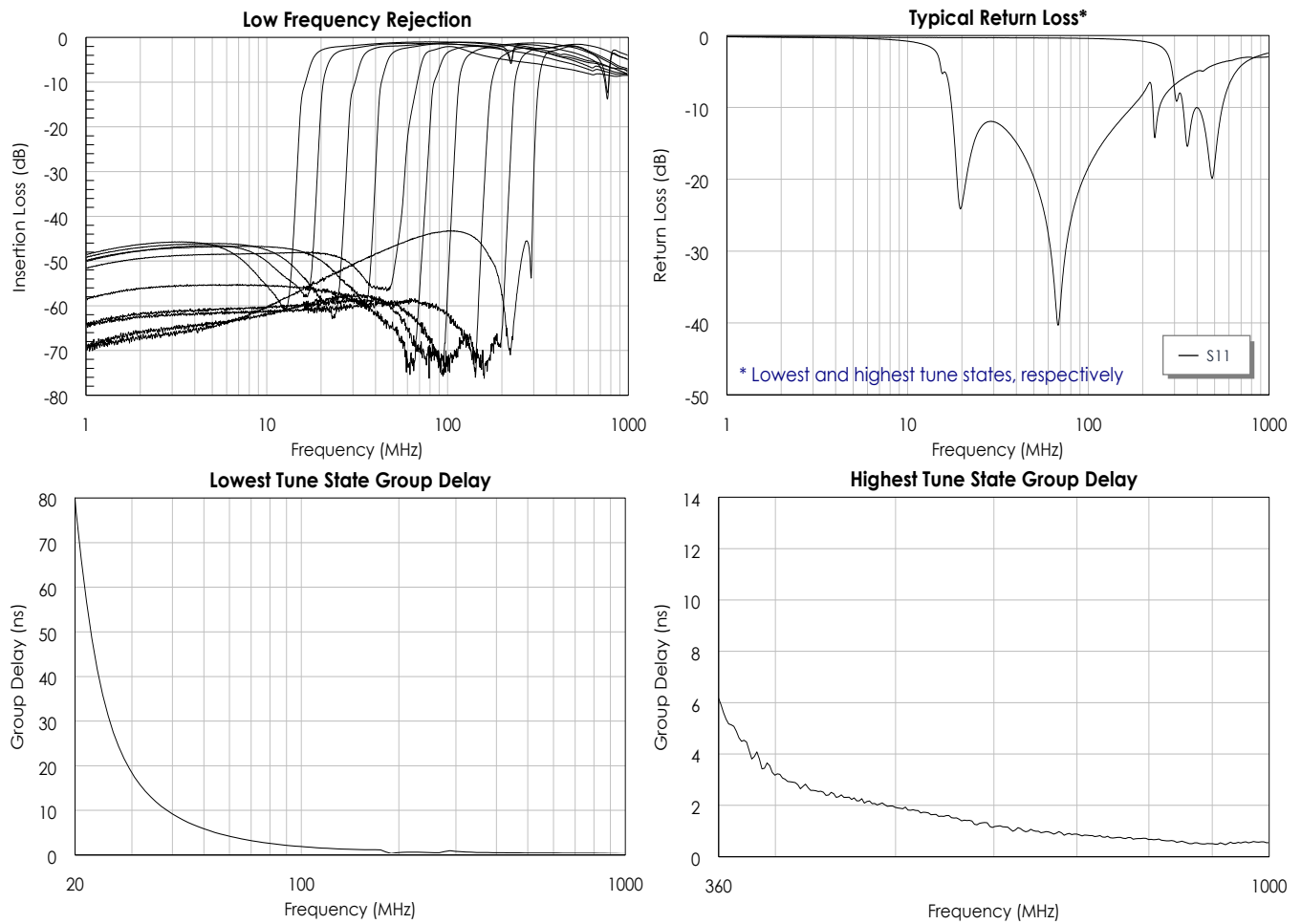
State Table

E	D	C	B	A	Typical Cutoff Frequency (MHz)
H	L	L	L	L	19
H	L	L	L	H	19
H	L	L	H	L	20
H	L	L	H	H	20
H	L	H	L	L	23
H	L	H	L	H	23
H	L	H	H	L	24
H	L	H	H	H	25
H	H	L	L	L	35
H	H	L	L	H	36
H	H	L	H	L	38
H	H	L	H	H	39
H	H	H	L	L	50
H	H	H	L	H	53
H	H	H	H	L	64
H	H	H	H	H	76
L	L	L	L	L	100
L	L	L	L	H	100
L	L	L	H	L	103
L	L	L	H	H	105
L	L	H	L	L	121
L	L	H	L	H	124
L	L	H	H	L	131
L	L	H	H	H	136
L	H	L	L	L	193
L	H	L	L	H	196
L	H	L	H	L	209
L	H	L	H	H	215
L	H	H	L	L	260
L	H	H	L	H	272
L	H	H	H	L	316
L	H	H	H	H	355

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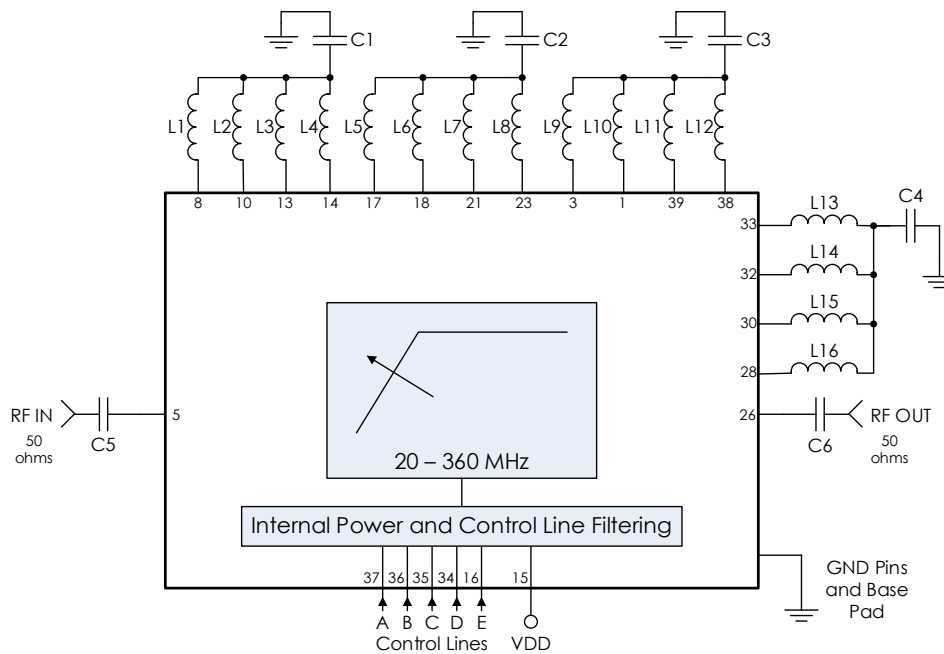
Typical Performance



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Typical Application



Recommended Component List (or equivalent):

Part	Value	Part Number	Manufacturer
C1, C2	47 μ F	GRM21BR61A476ME15L	Murata
C3, C4	10 μ F	GCM21BR71A106KE22K	Murata
C5, C6	0.1 μ F	0201BB104KW160	Passives Plus
L1-L8	390 nH	0805HP-391XGRB	Coilcraft
L9, L11, L14, L16	39 nH	0603HP-39NXGEU	Coilcraft
L10, L12, L13, L15	56 nH	0603HP-56NXGEU	Coilcraft

Notes:

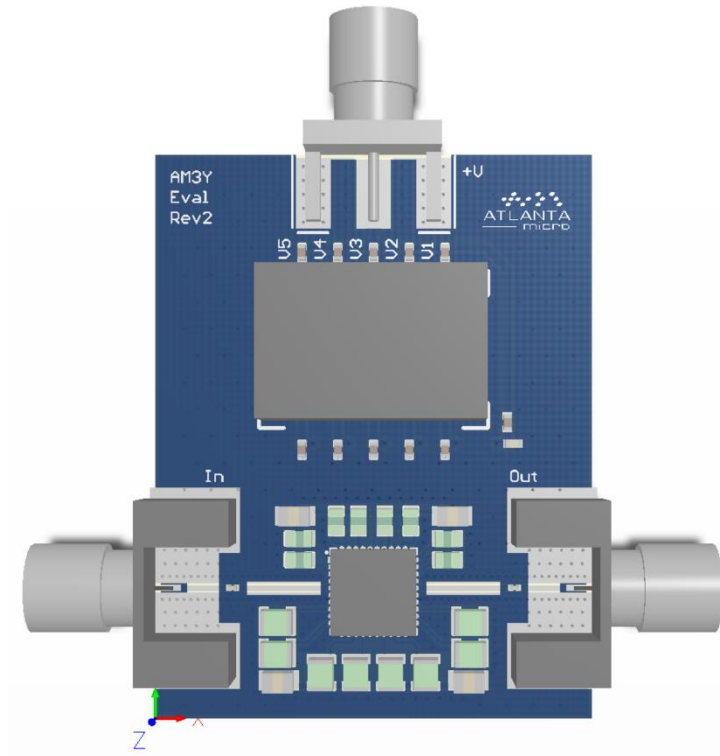
1. DC blocking capacitors should be high performance, low-loss, broadband capacitors for optimum performance.
2. VDD and control lines filtered internally providing high frequency isolation.
3. RC time constant is 20ns for control lines.

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Evaluation PC Board



Related Parts

Part Number	Description
AM3031	1.0 GHz to 1.8 GHz Digitally Tunable Highpass Filter
AM3032	2.5 GHz to 4.5 GHz Digitally Tunable Highpass Filter
AM3033	100 MHz to 225 MHz Digitally Tunable Highpass Filter
AM3036	330 MHz to 700 MHz Digitally Tunable Highpass Filter
AM3041	6.0 GHz to 10.0 GHz Digitally Tunable Highpass Filter
AM3108	12.0 GHz to 18.0 GHz Digitally Tunable Highpass Filter
AM3109	18.0 GHz to 26.5 GHz Digitally Tunable Highpass Filter
AM3150	30 MHz to 550 MHz Digitally Tunable Lowpass Filter

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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-ethylhexyl) 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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