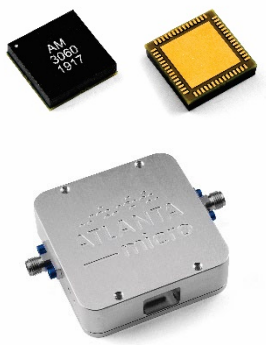
AM3060 – Filter Bank

Digitally Tunable Bandpass 0.32 – 6.5 GHz

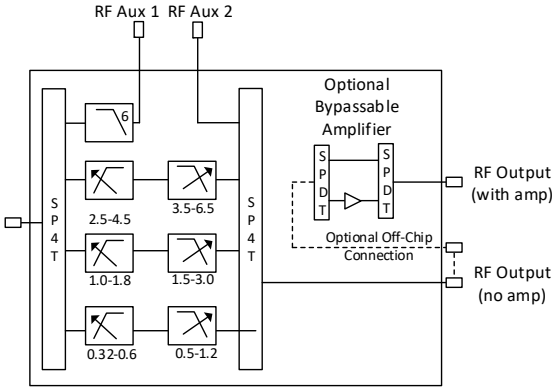


The AM3060 is a miniature digitally tunable filter bank covering the 320 MHz to 6500 MHz frequency range with adjustable bandwidth in a 12.5mm x 12.5mm package. The device provides a bypassable amplifier stage and ports for a filter bypass path. AM3060 is an excellent front-end for a broadband receiver or transceiver providing the ultimate flexibility of center frequency and bandwidth adjustment while offering high dynamic range and small size, weight, and power consumption (low SWAP).

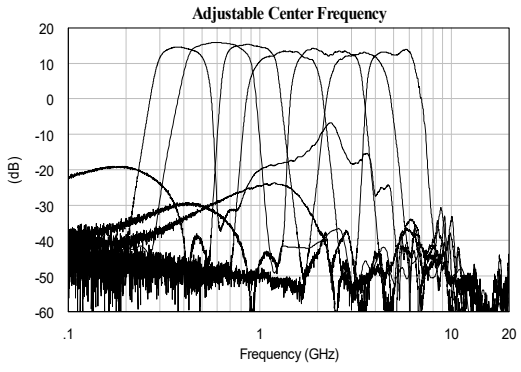
FEATURES

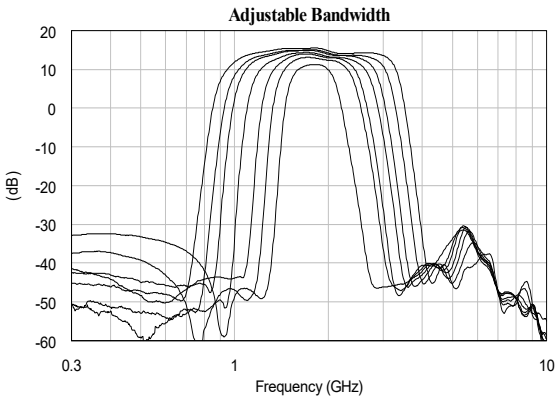
- Digitally Tunable Bandpass Filters
- Independent LP and HP Control
- 4-bit Control
- 14 dB Gain, Amplifier Enabled
- 6 dB Insertion Loss, Amplifier Bypassed
- +40 dBm Input IP3, Amplifier Bypassed
- +3.0V to +5.0V Control
- 12.5mm QFN Package
- -40C to +85C Operation

FUNCTIONAL DIAGRAM



CHARACTERISTIC PERFORMANCE





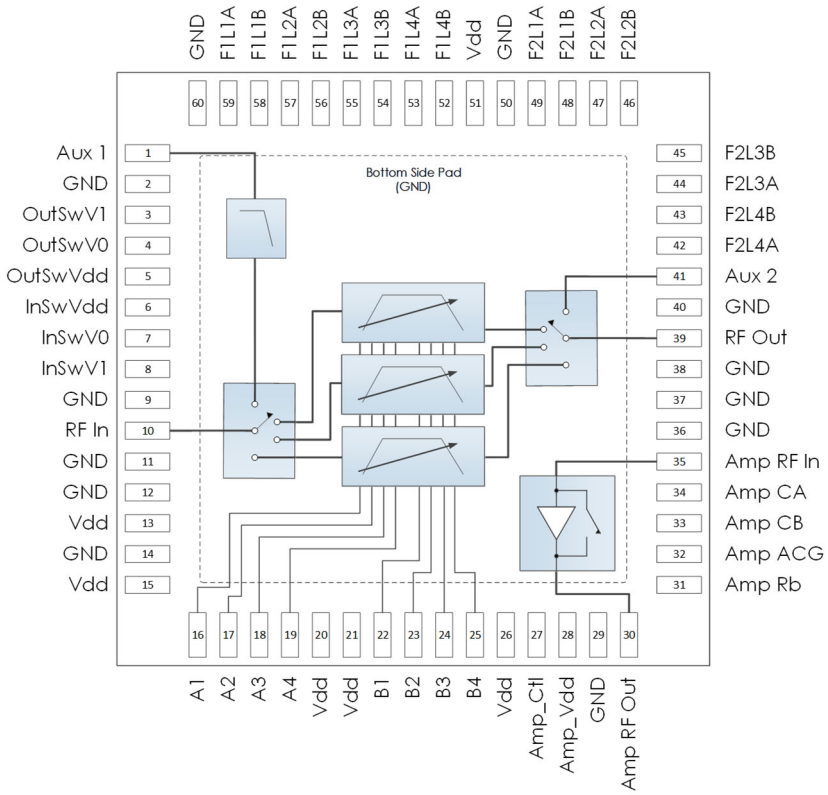
*Note: Band 2 shown

CONTENTS

REVISION HISTORY

Date	Revision	Notes
March 7, 2018	10	Pinout Table Corrected.
September 11, 2018	11	Notes Added to Specifications Section.
April 4, 2019	12	Updated to new datasheet format. More comprehensive part data included.
July 24, 2019	13	Typo in Pinout Table corrected. Note added to Typical Application. Added information about new connectorized module.
September 26, 2019	14	Updated Maximum RF Input Power.
June 11, 2021	14.1	Added extra notes to pinout table and Typical Application.
July 19, 2021	14.2	Corrected pin out in table (pins 44, 45 swapped).
June 13, 2024	15	Changed to Mercury branding. No content changes.

PIN LAYOUT AND DEFINITIONS

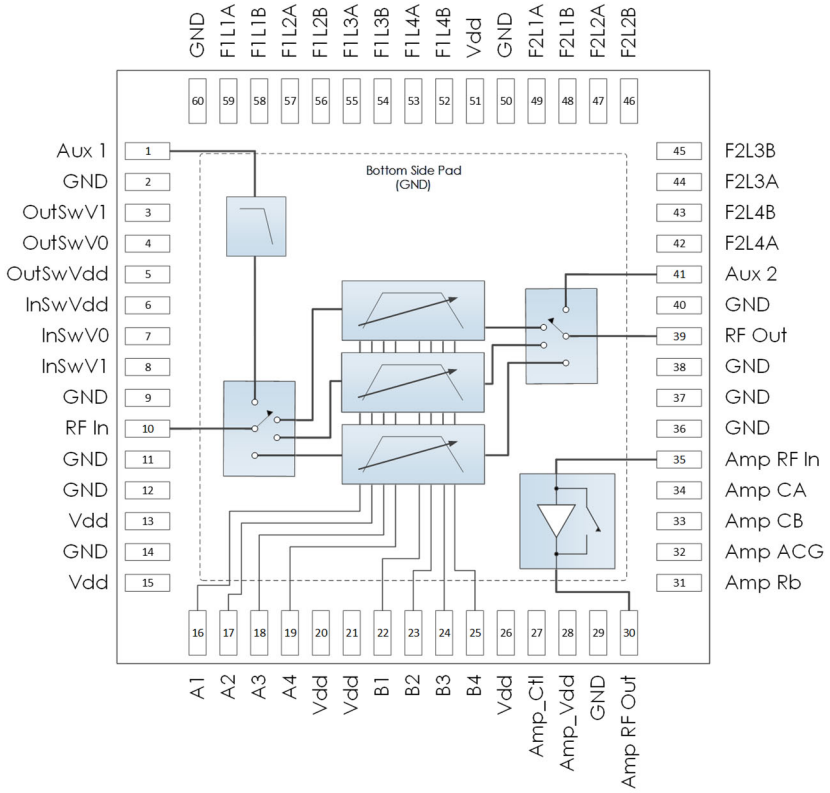


Pin	Name	Function
1	RF Aux 1	Optional DC to 6.5 GHz RF port – Pin 41 Return* - 50 Ohms – DC Coupled, External Blocking Capacitor Required
2	GND	Ground – Common
3	OutSwV1	Filter Band Select 1 – Can connect to pin 8, but filter independently
4	OutSwV0	Filter Band Select 0 – Can connect to pin 7, but filter independently
5	OutSwVdd	DC Power Input for Switch 1 – Filter independent from pin 6**
6	InSwVdd	DC Power Input for Switch 2 – Filter independent from pin 5**
7	InSwV0	Filter Band Select 0 – Can connect to pin 4, but filter independently
8	InSwV1	Filter Band Select 1 – Can connect to pin 3, but filter independently
9	GND	Ground – Common
10	Presel RF In	Preselector Filter Bank RF Input Port - 50 Ohms – DC Coupled, External Blocking Capacitor Required
11, 12	GND	Ground – Common
13	Vdd	DC Power Input**
14	GND	Ground – Common
15	Vdd	DC Power Input**
16	A1	Highpass Filter Control Bit 1
17	A2	Highpass Filter Control Bit 2
18	A3	Highpass Filter Control Bit 3
19	A4	Highpass Filter Control Bit 4
20, 21	Vdd	DC Power Input.** Filter pins independently

*Can be used for external filtering or connected to return pin through a coupling capacitor for a filter bypass path.

**Pins 5,6,13,15,20,21,26, and 51 must be driven by the same voltage source. Each line should be individually filtered.

PIN LAYOUT AND DEFINITIONS (CONTINUED)



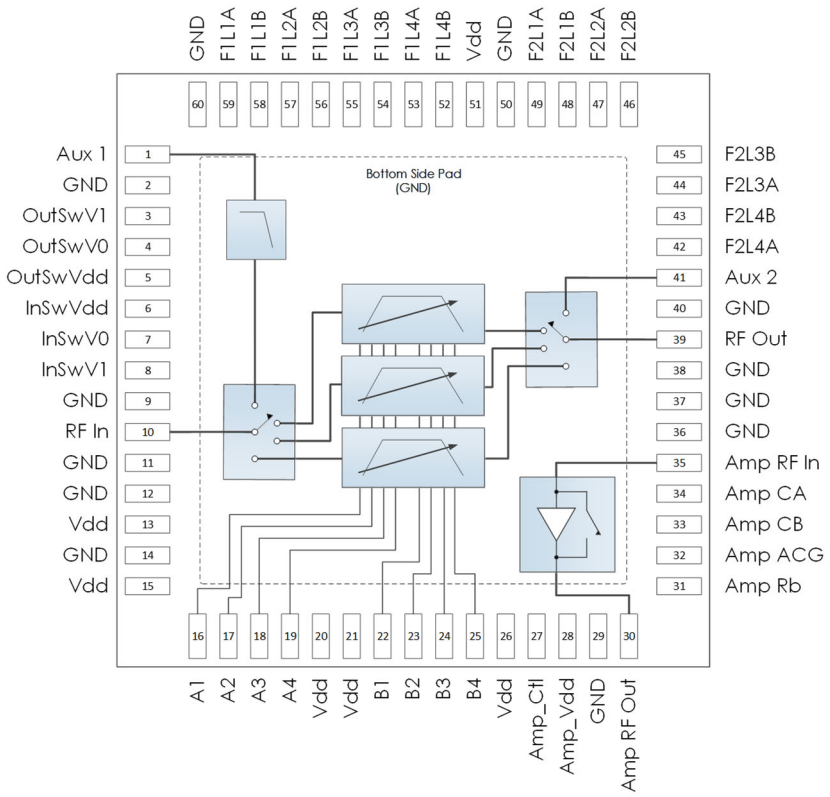
Pin	Name	Function
22	B1	Lowpass Filter Control Bit 1
23	B2	Lowpass Filter Control Bit 2
24	B3	Lowpass Filter Control Bit 3
25	B4	Lowpass Filter Control Bit 4
26	Vdd	DC Power Input**
27	Amp_Ctl	Preamplifier Path Control – See state table for control information.
28	Amp_Vdd	DC Power Input for Amplifier
29	GND	Ground – Common
30	Amp RF Out / Vd	Amplifier Output and DC Power Input – 50 Ohms – DC Coupled, External DC Block Required.***
31	Amp Rb	Amplifier Bias Setting – Leave open for normal operation or add a do not install resistor to ground.
32	Amp ACG	Amplifier AC Ground – connect 0.1µF capacitor to ground.
33	Amp CB	External Capacitor Connection 1 - 50 Ohms – Connect to pin 34 through a 0201 0.1µF capacitor keeping connections as short as possible.
34	Amp CA	External Capacitor Connection 2 - 50 Ohms – Connect to pin 33 through a 0201 0.1µF capacitor keeping connections as short as possible.
35	Amp RF In	Amplifier Input Port – 50 Ohms – DC Coupled, External DC Block Required
36 - 38	GND	Ground – Common
39	Presel RF Out	Preselector Filter Bank RF Output Port - 50 Ohms – DC Coupled, External Blocking Capacitor Required

*Can be used for external filtering or connected to return pin through a coupling capacitor for a filter bypass path.

**Pins 5,6,13,15,20,21,26, and 51 must be driven by the same voltage source. Each line should be individually filtered.

***Voltage on pin 30 must be less than the voltage on pin 28. See application circuit for recommended connection.

PIN LAYOUT AND DEFINITIONS (CONTINUED)



Pin	Name	Function
40	GND	Ground – Common
41	RF Aux 2	Optional DC to 6.5 GHz RF port – Pin 1 Return* - 50 Ohms – DC Coupled, External Blocking Capacitor Required.
42	F2L4A	Filter 2 L4 Connection A
43	F2L4B	Filter 2 L4 Connection B
44	F2L3A	Filter 2 L3 Connection A
45	F2L3B	Filter 2 L3 Connection B
46	F2L2B	Filter 2 L2 Connection B
47	F2L2A	Filter 2 L2 Connection
48	F2L1B	Filter 2 L1 Connection B
49	F2L1A	Filter 2 L1 Connection A
50	GND	Ground – Common
51	Vdd	DC Power Input**
52	F1L4B	Filter 1 L4 Connection B
53	F1L4A	Filter 1 L4 Connection A
54	F1L3B	Filter 1 L3 Connection B
55	F1L3A	Filter 1 L3 Connection A
56	F1L2B	Filter 1 L2 Connection B
57	F1L2A	Filter 1 L2 Connection A
58	F1L1B	Filter 1 L1 Connection B
59	F1L1A	Filter 1 L1 Connection A
60	GND	Ground – Common
Bottom Pad	GND	Ground – Common

*Can be used for external filtering or connected to return pin through a coupling capacitor for a filter bypass path.

SPECIFICATIONS

Absolute Maximum Ratings

	Minimum	Maximum
Amplifier Voltage		+ 3.6 V
Supply Voltage	-0.3 V	+6 V
RF Input Power		+27 dBm (pin 10) +25 dBm (pin 35)
Operating Junction Temperature	-40 C	+150 C
Storage Temperature Range	-50C	+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. Devices subjected to conditions outside of what is recommended for extended periods may affect device reliability.

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
Amplifier Voltage	+3.1 V	+3.3 V	+3.5 V
Supply Voltage	+2.7 V	+5.0 V	+5.2 V
Operating Case Temperature	-40 C		+85 C
Operating Junction Temperature	-40 C		+125 C

DC Electrical Characteristics

(T = 25 °C unless otherwise specified)

Param	Testing Conditions	Min	Typical	Max
Amplifier Voltage (Vamp)		+3.1 V	+3.3 V	+3.5 V
Supply Voltage (V_{dd})		+2.7 V	+5.0 V	+5.2 V
DC Amplifier Current			60 mA	
DC Supply Current	VDD = +5.0 V		10 mW	
Power Dissipated	Amplifier Enabled		0.25 W	
	Amplifier Bypassed		0.05 W	
Logic Level Low		-0.1 V		+0.4 V
Logic Level High		+2.2 V		+VDD V

RF Performance

(T = 25 °C unless otherwise specified)

Param	Testing Conditions	Min	Typical	Max
Frequency Range		2 GHz		6500 MHz
Filter Range		320 MHz		6500 MHz
Gain	Amplifier Enabled		14 dB	
Insertion Loss	Amplifier Bypassed		6 dB	
Noise Figure	Amplifier Enabled		7 dB	
	Amplifier Bypassed		6 dB	
Input IP3	Amplifier Enabled		+14 dBm	
	Amplifier Bypassed		+40 dBm	
Input IP2	Amplifier Enabled		+50 dBm	
	Amplifier Bypassed		+70 dBm	
Input Return Loss			10 dB	
Output Return Loss			10 dB	

State Tables

Out/InSwV1	Out/InSwV0	Selected Filter Band
Low	Low	Band 2 – 1.0 to 3.0 GHz
Low	High	Band 3 – 2.5 to 6.5 GHz
High	Low	Band 1 – 0.32 to 1.2 GHz
High	High	Band 0 – Bypass

Amp_Ctl	Amplifier State
Low	6.00
High	6.07

Out/InSwV1	Out/InSwV0	Selected Filter Band
Low	Low	Band 2 – 1.0 to 3.0 GHz
Low	High	Band 3 – 2.5 to 6.5 GHz
High	Low	Band 1 – 0.32 to 1.2 GHz
High	High	Band 0 – Bypass

High Pass Filter Typical Cutoff Frequencies (GHz)						
A4	A3	A2	A1	Band 1	Band 2	Band 3
Low	Low	Low	Low	0.330	1.00	2.50
Low	Low	Low	High	0.332	1.01	2.53
Low	Low	High	Low	0.338	1.02	2.56
Low	Low	High	High	0.341	1.03	2.59
Low	High	Low	Low	0.354	1.06	2.61
Low	High	Low	High	0.359	1.08	2.64
Low	High	High	Low	0.373	1.10	2.70
Low	High	High	High	0.381	1.12	2.74
High	Low	Low	Low	0.443	1.14	2.85
High	Low	Low	High	0.448	1.16	2.93
High	Low	High	Low	0.463	1.20	3.06
High	Low	High	High	0.473	1.25	3.20
High	High	Low	Low	0.508	1.37	3.26
High	High	Low	High	0.531	1.47	3.47
High	High	High	Low	0.618	1.60	3.84
High	High	High	High	0.717	1.82	4.36

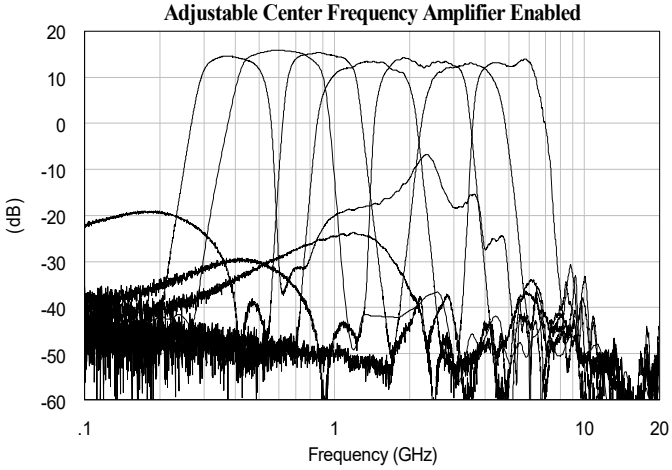
State Tables (Continued)

Low Pass Filter Typical Cutoff Frequencies (GHz)						
A4	A3	A2	A1	Band 1	Band 2	Band 3
Low	Low	Low	Low	0.493	1.50	3.50
Low	Low	Low	High	0.503	1.55	3.60
Low	Low	High	Low	0.518	1.59	3.68
Low	Low	High	High	0.530	1.65	3.79
Low	High	Low	Low	0.552	1.70	3.89
Low	High	Low	High	0.567	1.78	4.04
Low	High	High	Low	0.587	1.84	4.15
Low	High	High	High	0.604	1.92	4.31
High	Low	Low	Low	0.661	2.00	4.54
High	Low	Low	High	0.690	2.10	4.74
High	Low	High	Low	0.731	2.20	4.97
High	Low	High	High	0.767	2.33	5.22
High	High	Low	Low	0.850	2.49	5.47
High	High	Low	High	0.915	2.67	5.84
High	High	High	Low	1.032	2.86	6.22
High	High	High	High	1.200	3.12	6.75

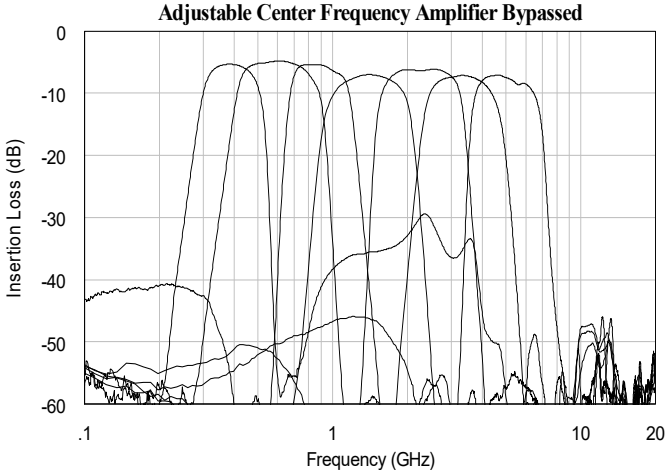
TYPICAL PERFORMANCE

(T = 25 °C and Amplifier Bypassed unless otherwise specified. Only some states shown for simplicity.)

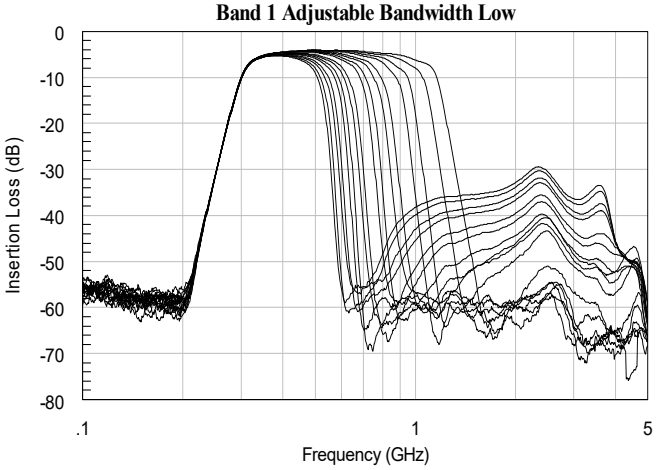
Adjustable Center Frequency Amplifier Enabled



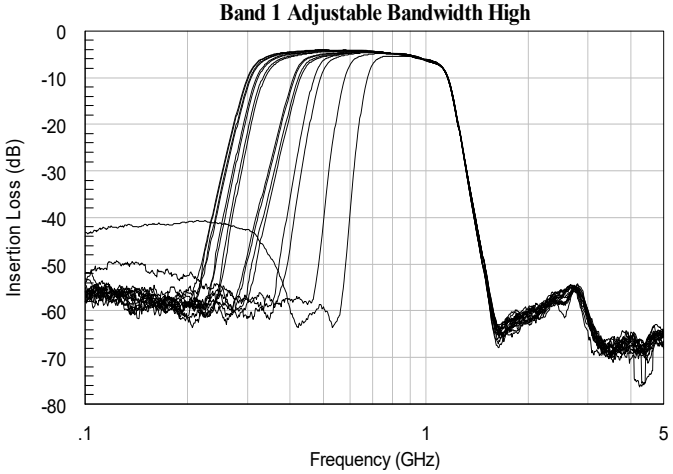
Adjustable Center Frequency Amplifier Bypassed



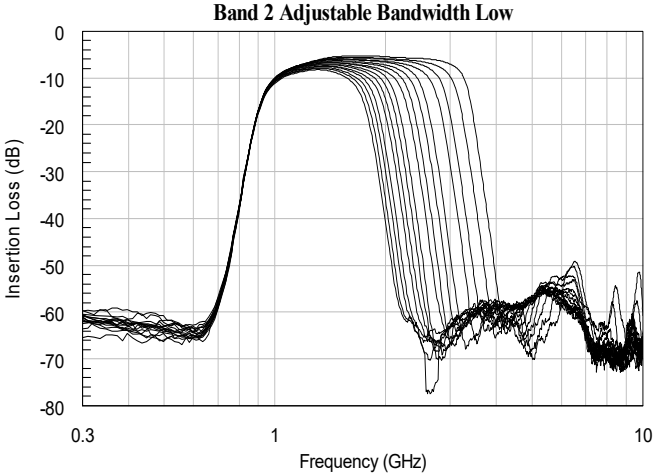
Band 1 Adjustable Bandwidth Low



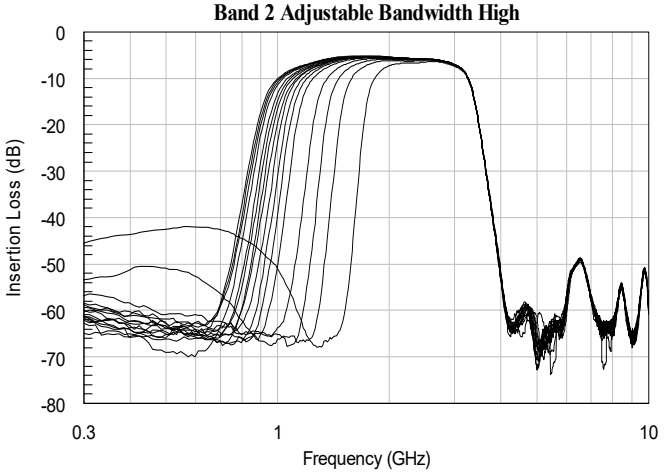
Band 1 Adjustable Bandwidth High



Band 2 Adjustable Bandwidth Low

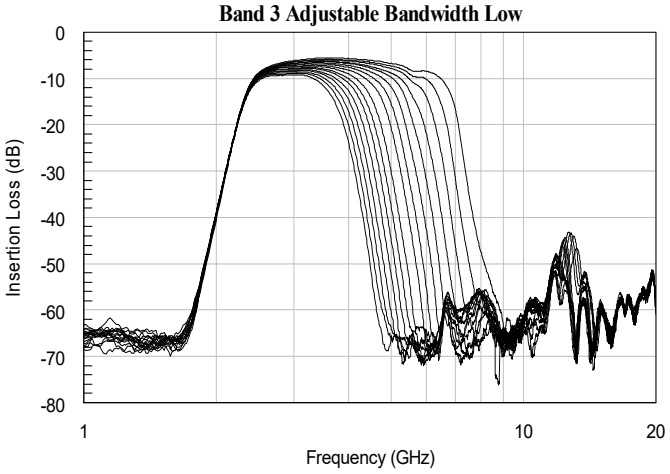


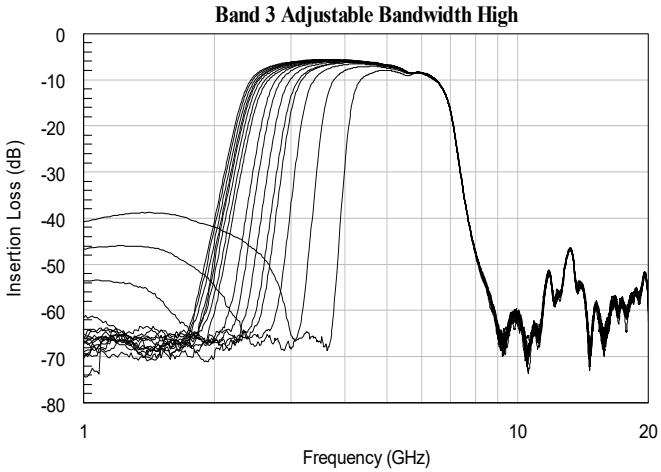
Band 2 Adjustable Bandwidth High

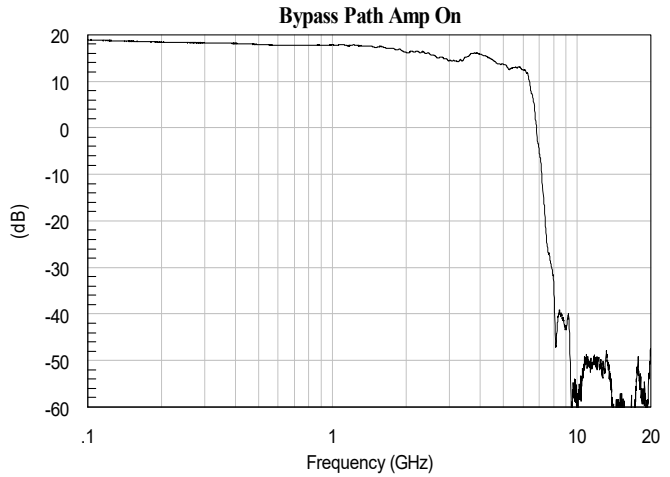


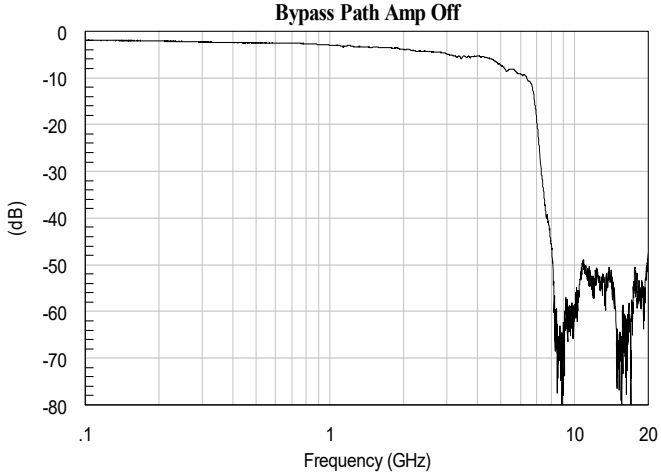
TYPICAL PERFORMANCE (CONTINUED)

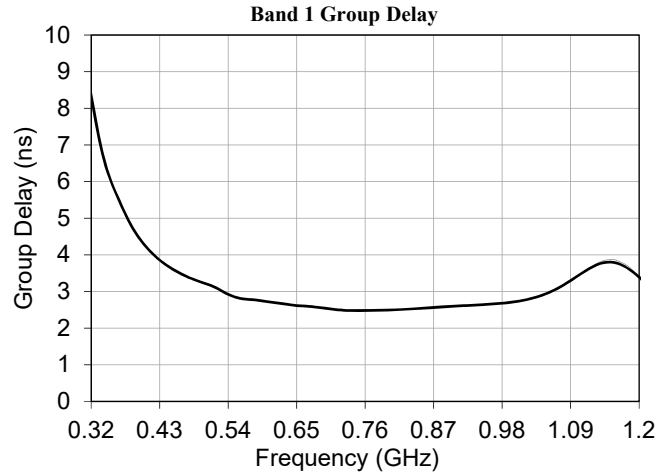
T = 25 °C and Amplifier Bypassed unless otherwise specified. Only some states shown for simplicity.)

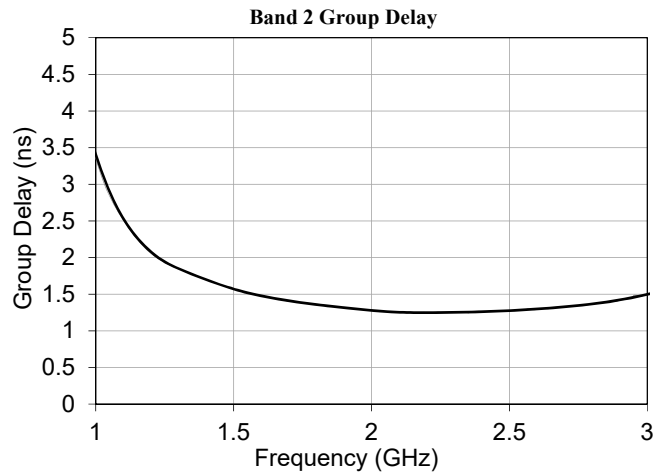












TYPICAL PERFORMANCE (CONTINUED)

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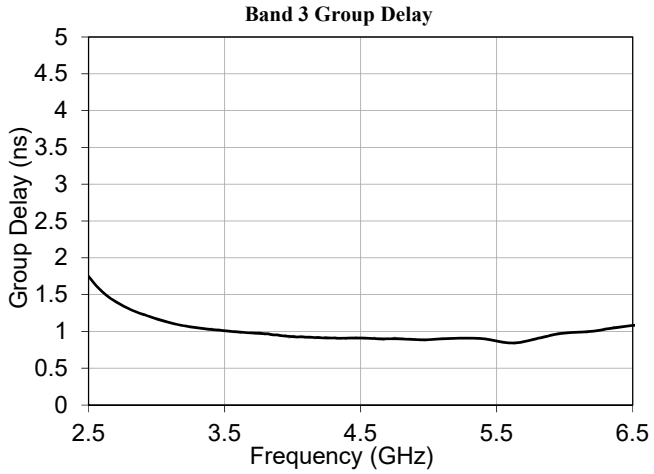
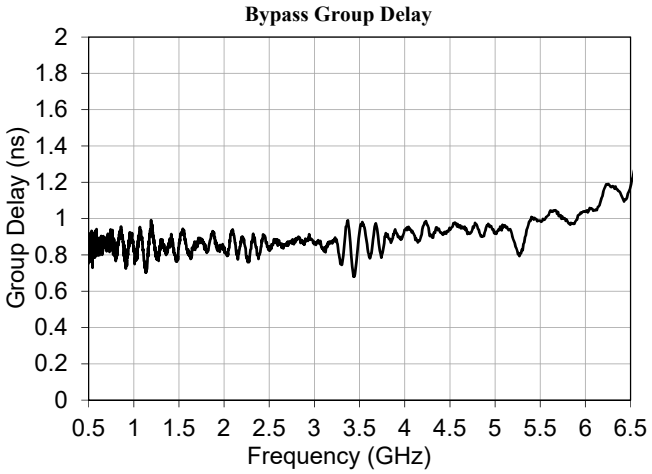
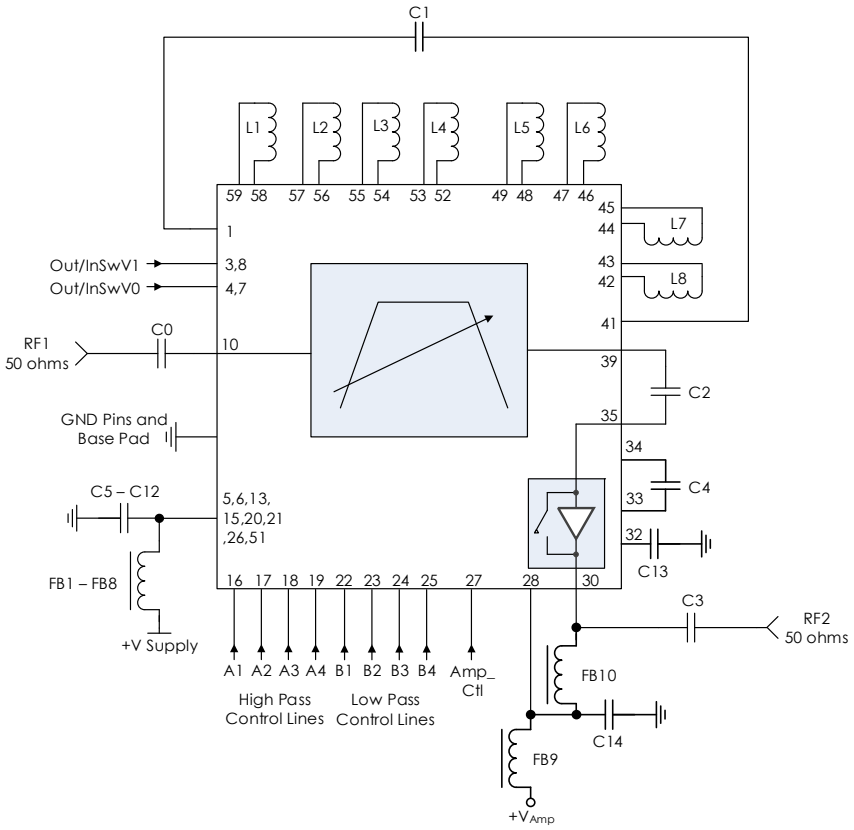




TYPICAL APPLICATION



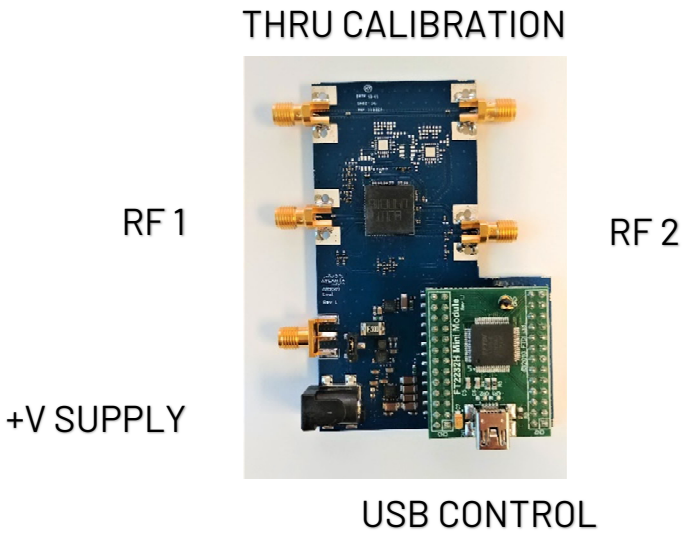
Recommended Component List (or Equivalent)

Part	Value	Part Number	Manufacturer
C0 – C4	0.1 µF	0201BB104KW160	Passives Plus
C5-C14	0.1 µF	C1005X7R1H104K050BB	TDK
FB1-10		MMZ1005A222E	TDK
L1, L4	13 nH	0402HP-13NXGLW	Coilcraft
L2, L3	9.0 nH	0402HP-9N0XGLW	Coilcraft
L5, L8	5.6 nH	0402HP-5N6XGLW	Coilcraft
L6, L7	6.2 nH	0402HP-6N2XGLW	Coilcraft

Notes:

1. RC filtering on the control lines is recommended to prevent digital noise from coupling to RF path.
   a. Select control line RC filter values based on desired logic source decoupling and switching speed
   b. Out/InSwV0/1 may be tied together but should be filtered independently.
2. AM3060 should have at least 8mils of spacing before the ground plane to minimize parasitic capacitance. If a thinner stackup is desired the ground plane should be cutout below the RF critical pins and any components such as DC blocks/chokes (pin 1, 10, 30, 33, 34, 35, 39, 41-49, 52-59).

EVALUATION PC BOARD



PART ORDERING DETAILS

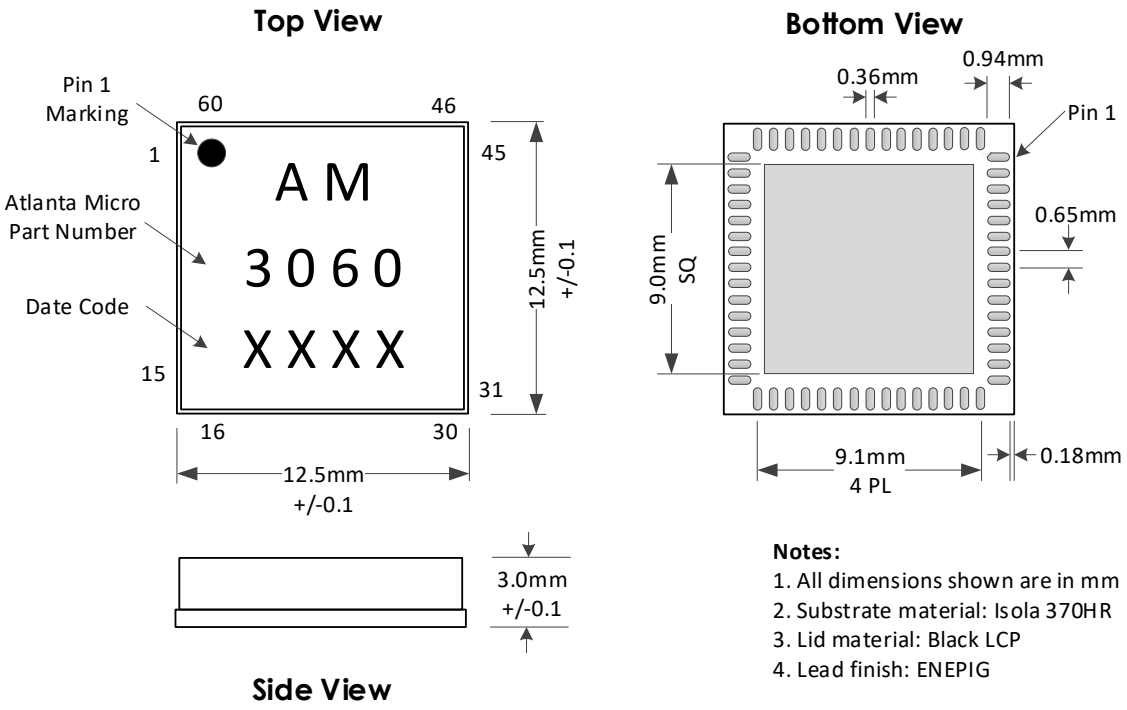
Part Number	Description
AM3060	12.5mm 60 Lead QFN
AM3060 Eval	AM3060 IC on PCB with Thru Cal, USB Control, and SMA, Header Pin, or Barrel Voltage Input
AM3060-M	AM3060 in 2.10"x2.10"x0.65" RF-Shielded Module with USB Control, Power via USB or External Pin, Integrated Filter Bypass (no 6 GHz LPF), and Field Replaceable SMA Connectors

RELATED PARTS

Part Number	Description
AM3023B	100 MHz to 6 GHz Switched Sub-Octave Filter Bank
AM3024B	100 MHz to 6 GHz Switched Sub-Octave Filter Bank
AM3025A	400 MHz – 6.5 GHz Switched Sub-Octave Filter Bank
AM3089	2 GHz to 18 GHz Switched Analog Tuned Filter Bank
AM3063	6 GHz to 18 GHz Digitally Tunable Bandpass Filter Bank
AM3064	1 GHz to 6.5 GHz Digitally Tunable Bandpass Filter Bank
AM3065	6 GHz to 12 GHz Digitally Tunable Bandpass Filter
AM3066	18 GHz to 26.5 GHz Digitally Tunable Bandpass Filter Bank
AM3090	100 MHz to 450 MHz Digitally Tunable Bandpass Filter

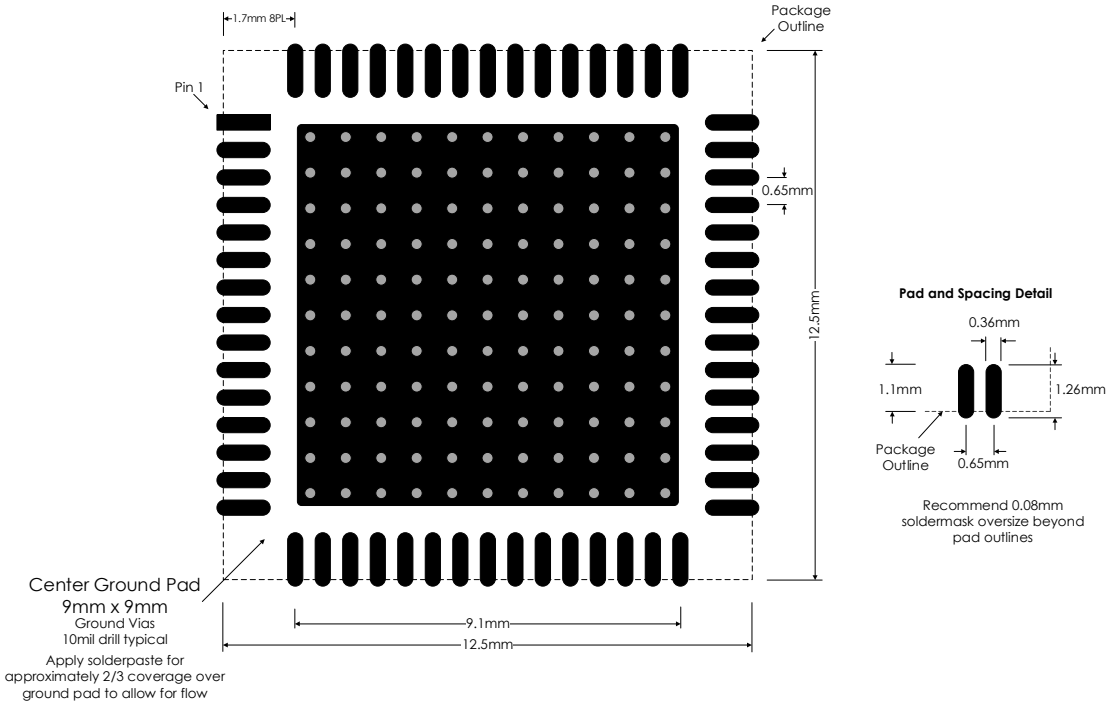
12.5MM 60 LEAD QFN DETAILS

Package Drawing



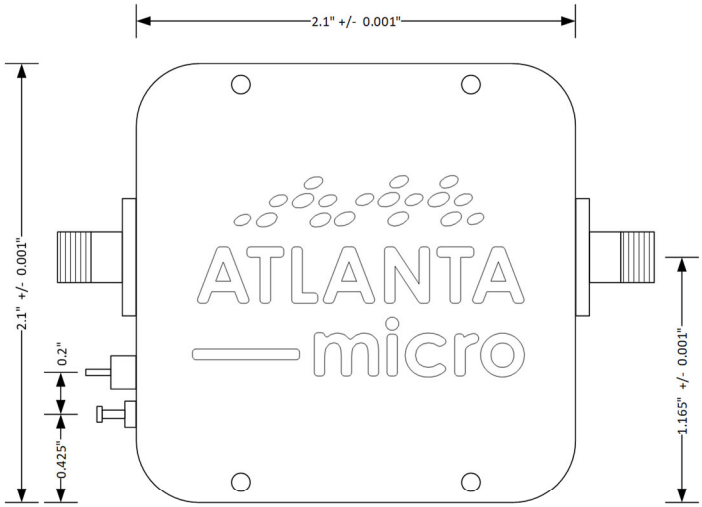
Notes:
1. All dimensions shown are in mm
2. Substrate material: Isola 370HR
3. Lid material: Black LCP
4. Lead finish: ENEPIG

Recommended Footprint

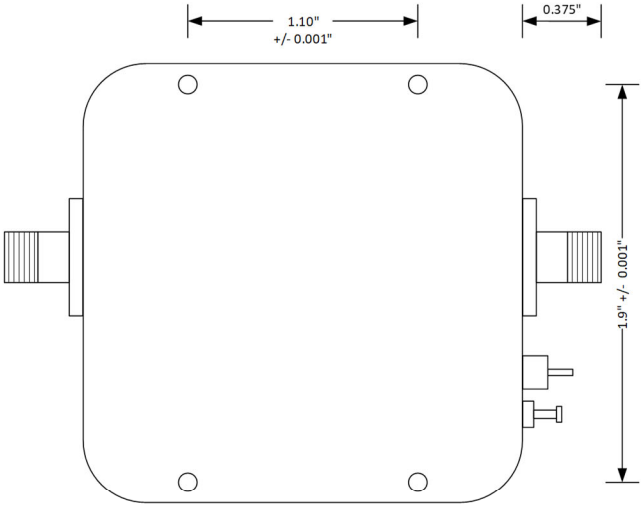


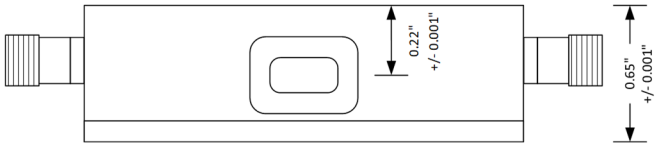
RF SHIELDED MODULE DETAILS

Top View



Bottom View





Front View

Notes:
1. All dimensions shown are in inches
2. Module material: Aluminum
3. Mounting Holes: 4-40 threaded on top side
4. RF I/O Interface: SMA
5. Control via Mini-USB
6. Power via Mini-USB or optional external pin

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).

CONFLICT MATERIALS: Mercury does not knowingly use materials that are sourced from the Democratic Republic of Congo (DRC) or any other known conflict regions. Mercury's supply chain is comprised of sources that are both environmentally and socially responsible. We periodically review this requirement with our vendors to ensure continued compliance.

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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