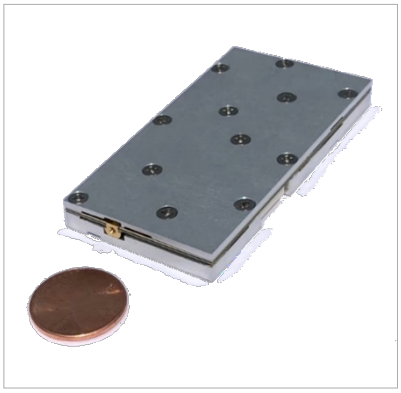
AM9017 – Tuner Mini Module

0.1 GHz to 18 GHz Wideband Miniature Tuner Module

High performance and low SWaP (size, weight and power)

- A complete high dynamic range miniature tuner module covering the 0.1 GHz to 18 GHz frequency range
- Multiple tuner sets can be configured to work together for coherent operation and N-channel applications
- Includes sub-octave pre-selectors, pre-amplifiers, local oscillators, frequency converters, power and control line filtering, a temperature sensor and a control FPGA



AM9017 is a fully integrated mini-module comprised of MMIC and MCM devices that provide a complete high-dynamic-range miniature tuner module covering the 0.1 GHz to 18 GHz frequency range. The super-heterodyne tuner is designed for high performance and low size, weight, and power (low SWaP) and is easily mounted to a host circuit board for use in multi-channel receiver applications. Sub-octave preselectors, pre-amplifiers, local oscillators, frequency converters, power and control line filtering, a temperature sensor and a control FPGA are included. The analog IF output frequency is centered at 1 GHz with a 500 MHz bandwidth. Multiple tuner sets can be configured to work together for coherent operation and N-channel applications. Interfacing to the tuner is accomplished by simply providing an RF input, DC voltages, frequency reference, SPI control, and routing the IF output.

FEATURES

- 0.1 GHz to 18 GHz Frequency Range
- 500 MHz Bandwidth
- 1 GHz IF Output Frequency
- Sub-Octave Preselection
- 15 dB Noise Figure, +3 dBm IIP3
- +5.0V and +3.3V DC Operation
- 3.7 W Power Consumption
- -40C to +85C Operation
- 1.38" x 2.69" x 0.26" (35.1 x 68.2 x 6.7 mm)

CONTENTS

REVISION HISTORY

Date	Revision	Notes
March 14, 2019	0	Preliminary Release.
May 29, 2019	1	Initial Release.
August 29, 2019	2	General Corrections.
October 3, 2019	3	Corrected power consumption, Added tuning speed and phase noise.
November 11, 2019	4	Added 1st LO lock detect pin.
December 10, 2019	5	Updated power consumption specification.
January 4, 2021	6	Added multi-channel evaluation boards.
June 24, 2024	7	Changed to Mercury branding. No content changes.

SPECIFICATIONS

Absolute Maximum Ratings

	Minimum	Maximum
RF Input Power		+20 dBm
Operating Temperature	-40 C	+85 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

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

Recommended Operating Conditions

	Minimum	Typical	Maximum
Operating Case Temperature	-40 C		+85 C

DC Electrical Characteristics

(T = 25 °C unless otherwise specified)

Param	Testing Conditions	Min	Typical	Max
+5 VDC Supply		+4.8 V	+5.0 V	+5.2 V
+3.3 VDC Supply		+3.2 V	+3.3 V	+3.5 V
+5 VDC Current			0.024 A	
+3.3 VDC Current			1.090 A	
Power Dissipated			3.72 W	
Logic Level Low		0 V		+0.8 V
Logic Level High		+2.0 V		+3.5 V

RF Performance[1]

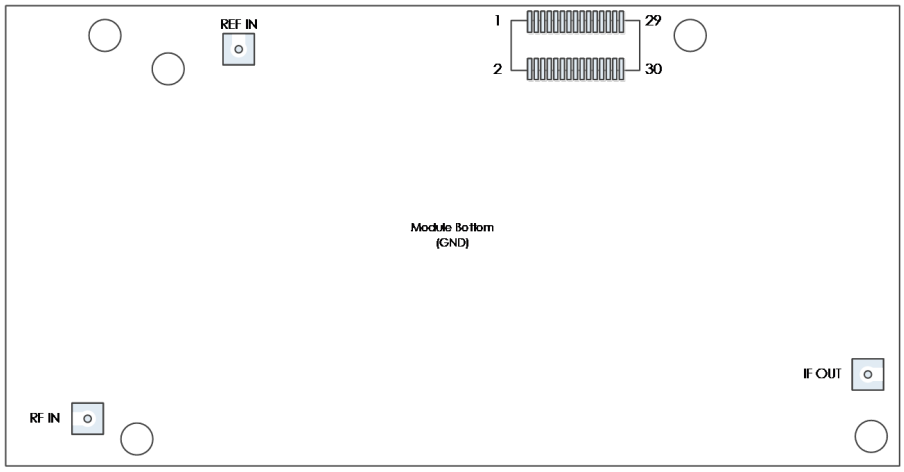
(T = 25 °C unless otherwise specified)

Param	Testing Conditions	Min	Typical	Max
Frequency Range		0.1 GHz		18 GHz
Bandwidth			500 MHz	
Tune Frequency Range		0.35 GHz		17.75 GHz
Frequency Reference	External Reference Required		100 MHz, 0 dBm	
Input IP3			+3 dBm	
Noise Figure			15 dB	
Image Rejection		70 dB		
IF Rejection		70 dB		
LO Leakage			-100 dBm	
Gain[1]			8 dB	
Gain Control / Attenuation Range[1]			60 dB (1dB Steps)	
Tuning Speed			100 us	
Phase Noise	1 kHz Offset		-90 dBc/Hz	
	10 kHz Offset		-100 dBc/Hz	
	100 kHz Offset		-100 dBc/Hz	
	1 MHz Offset		-118 dBc/Hz	
	10 MHz Offset		-132 dBc/Hz	

Note 1: Uncalibrated gain varies approximately 14 to 20 dB. Attenuators are adjusted for optimum performance with a gain of approximately 8 dB. It is anticipated that the customer will provide a final IF filter and IF driver stage with approximately 22dB of gain following the tuner to drive an A/D converter. Mercury can provide a recommended component for this driver stage.

CONNECTOR AND PIN DEFINITIONS

Host Board Connector Layout:



Connector	Name	Function
J1	RF IN	0.1 to 18 GHz RF Input
J2	IF OUT	1.0 GHz IF Output
J3	REF IN	100-MHz Reference Input Signal
J4	PWR/CTL	Power and Control Multi-pin Connector

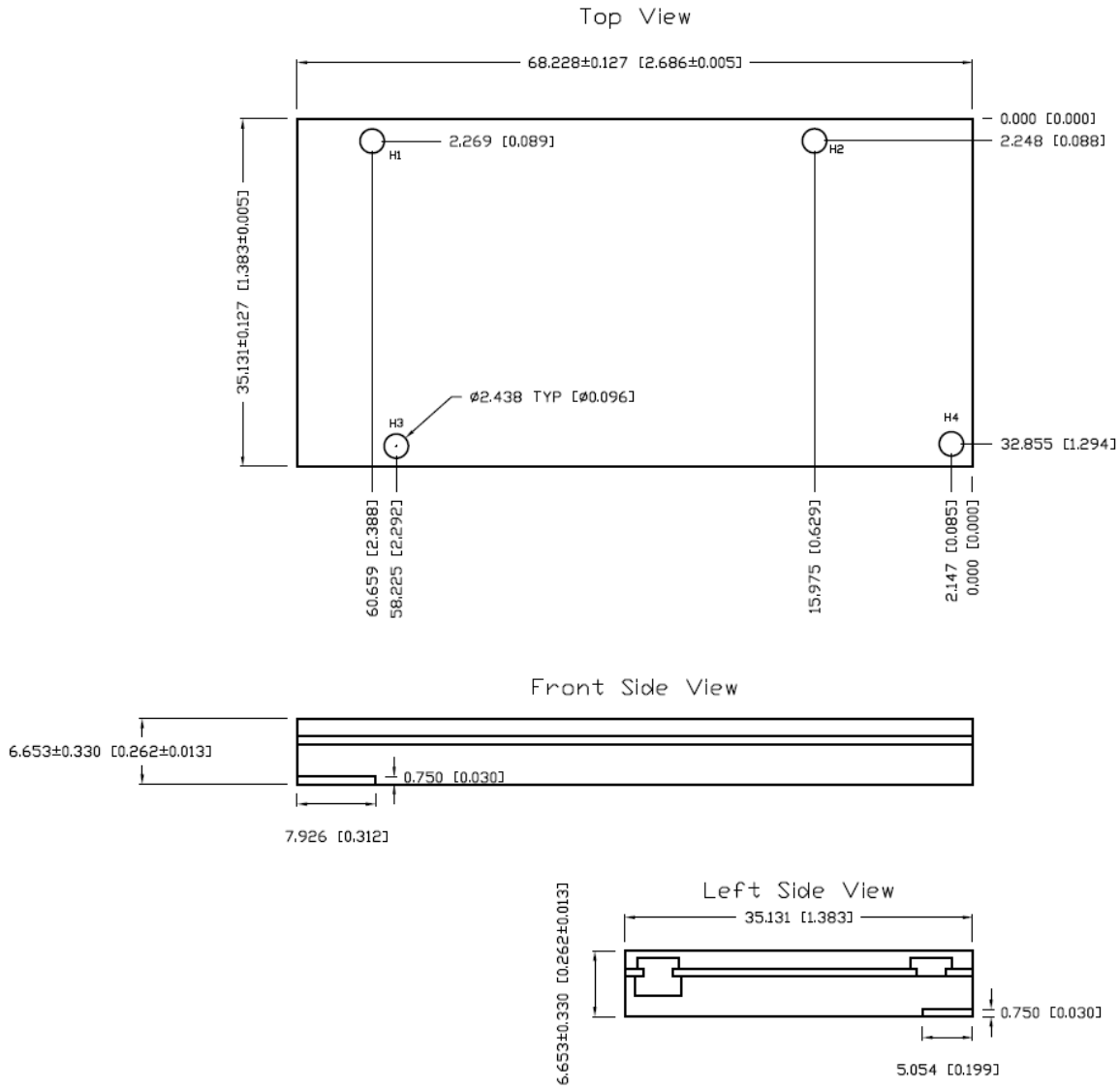
J6 Pin	J6 Name	J6 Pin Function
1 - 6	+3.3 V	+3.3V DC Power Input
7	GND	Ground – Common
8	+3.3 V	+3.3V DC Power Input
9 - 15	GND	Ground – Common
16	+5.0 V	+5.0V DC Power Input
17	LD	Lock Detect – logic level high = locked, low = unlocked
18	+5.0 V	+5.0V DC Power Input
19	JTAG_TDI	JTAG TDI
20	GND	Ground – Common
21	JTAG_TDO	JTAG TDO
22	JTAG_TCK	JTAG TCK
23	SCLK	SPI Bus Clock Input

J6 Pin	J6 Name	J6 Pin Function
24	JTAG_TMS	JTAG TMS
25	PROG_CSN	SPI Bus Select Line to Allow On-Board Programming Updates – Active Low
26	MISO	SPI Bus Data Output to Master Controller
27	CMD_CSN	SPI Bus Select Line for Sending Tuner Commands – Active Low
28	MOSI	SPI Bus Data Input from Master Controller
29	POP	Power On Pin – Active High. Low Logic Turns Off Tuner
30	SYNC	Tuner LO Sync Line for Coherency

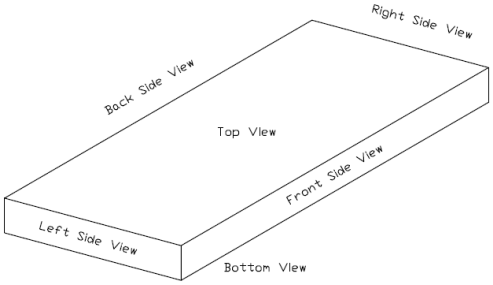
***Note:** Contact Mercury for an API that describes the software interface and commands necessary to control the tuner.

MECHANICAL DETAILS

Mechanical Drawing



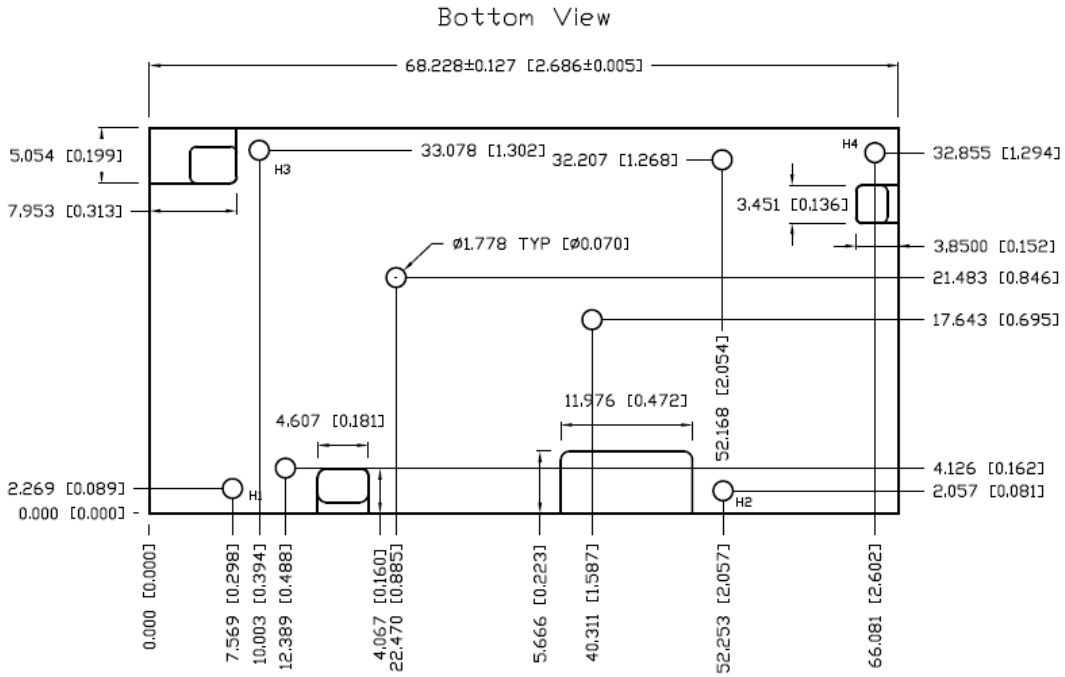
Optional End Launch RF Connectors for RF In and REF In. Contact factory for details.

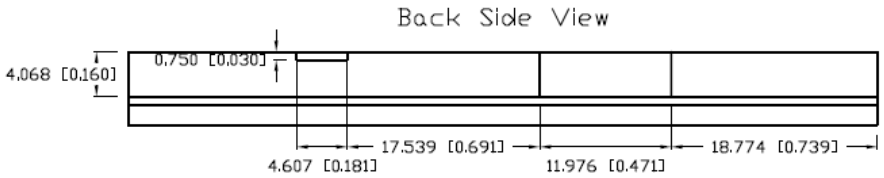


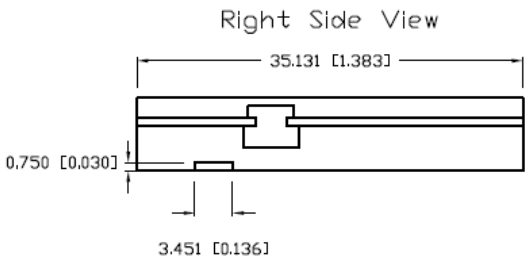
Notes
1. Dimension Units: millimeters [inches]
2. Holes H1, H2, H3, and H4 are through holes threaded where module meets PCB. Thread diameter is standard 2-56 thread from the top down.
3. All holes visible in Top View are countersunk 2-56 screw locations
4. All holes visible in Bottom View except H1 - H4 are threaded 2-56 screw holes with a depth of 2.500mm [0.098 in]

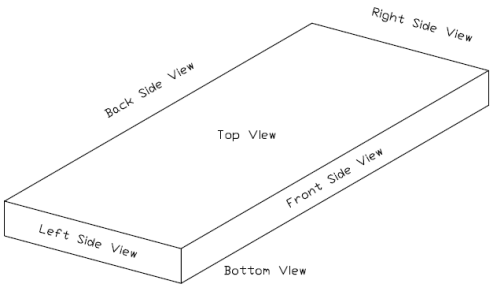
MECHANICAL DETAILS (CONTINUED)

Mechanical Drawing (continued)





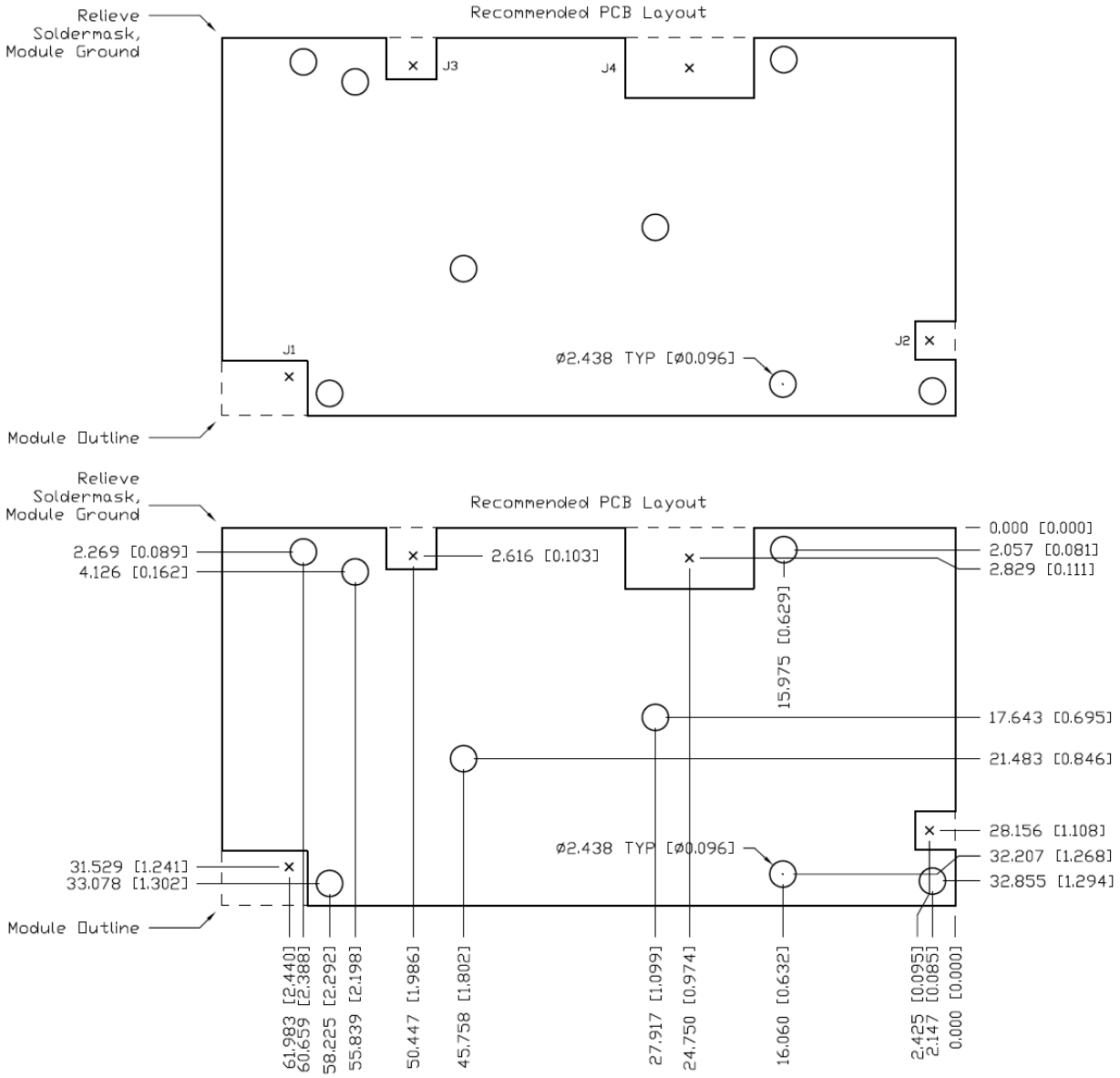




Notes
1. Dimension Units: millimeters [inches]
2. Holes H1, H2, H3, and H4 are through holes threaded where module meets PCB. Thread diameter is standard 2-56 thread from the top down.
3. All holes visible in Top View are countersunk 2-56 screw locations
4. All holes visible in Bottom View except H1 - H4 are threaded 2-56 screw holes with a depth of 2.500mm [0.098 in]

MECHANICAL DETAILS (CONTINUED)

Recommended PCB Footprint



Required Host Board Connectors		
Designator	Part Number	Manufacturer
J1, J2, J3	55057-003J	Southwest Microwave
J4	DF12NB(4.0)-30DP-0.5V(51)	Hirose Electric

Notes
1. Dimension Units: millimeters [inches]
2. X demarcates center of connectors, see recommended connectors

PART ORDERING DETAILS

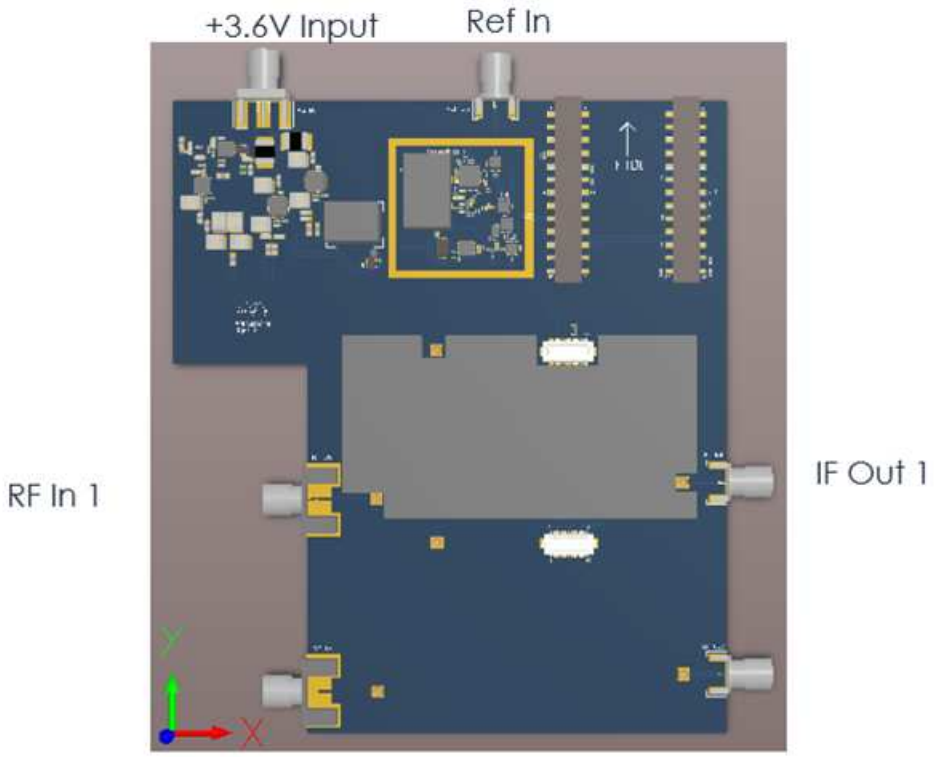
There are 3 different evaluation board configurations in addition to the standalone AM9017. All evaluation boards come with the specified number of AM9017 and Windows GUI control software and a user's guide. The ordering options are:

EVALUATION BOARD ORDERING DETAILS

Part Number	Description
AM9017	Stand-alone Tuner Module
AM9017EVAL	Single Channel AM9017 Eval Board
AM9017EVAL-2CH	Dual Channel AM9017 Eval Board
AM9017EVAL-4CH	Quad Channel AM9017 Eval Board

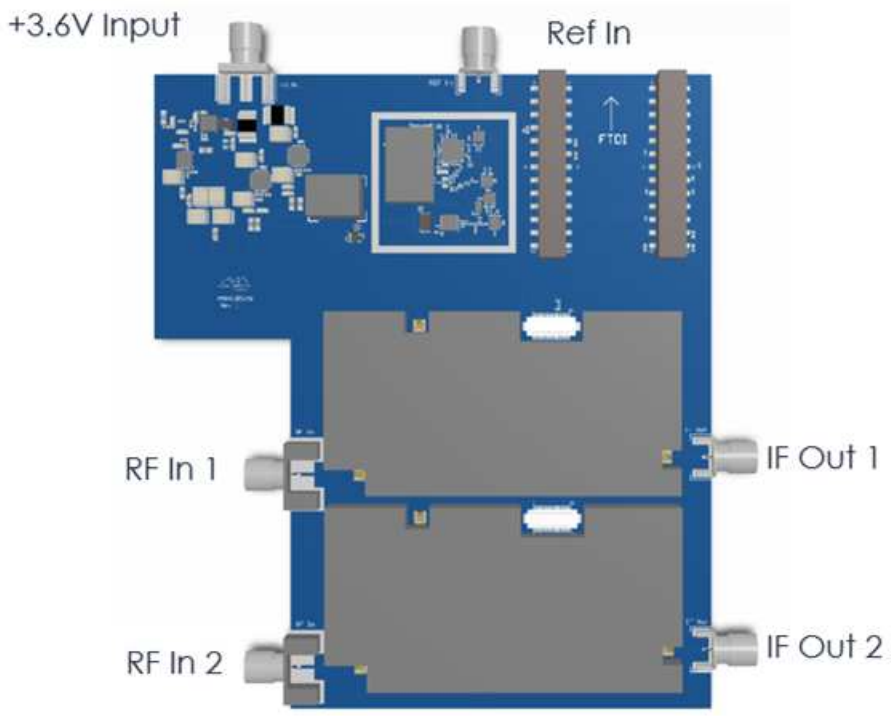
.

AM9017 Single Channel Eval (AM9017EVAL)



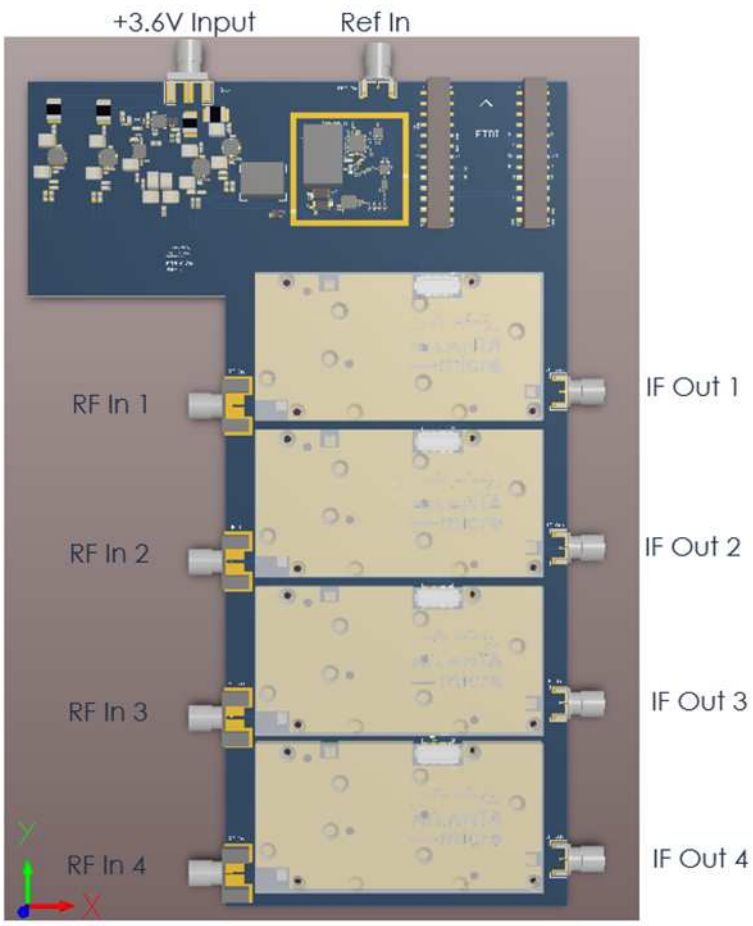
NOTE: Includes one AM9017 Tuner Module.

AM9017 Dual Channel Eval (AM9017EVAL-2CH)



NOTE: Includes two AM9017 Tuner Modules. Tuners can be controlled independently or configured for coherent operation.

AM9017 Quad Channel Eval (AM9017EVAL-4CH)



NOTE: Includes four AM9017 Tuner Modules. Tuners can be controlled independently or configured for coherent operation.

Corporate Headquarters

50 Minuteman Road
Andover, MA 01810 USA
+1 978.967.1401 tel
+1 866.627.6951 tel
+1 978.256.3599 fax

International Headquarters
Mercury International
Avenue Eugène-Lance, 38
PO Box 584
CH-1212 Grand-Lancy 1
Geneva, Switzerland
+41 22 884 5100 tel

Learn more
Visit: mrcy.com
For pricing details, contact: MMICsales@mrcy.com
For technical details, contact: MMICsupport@mrcy.com