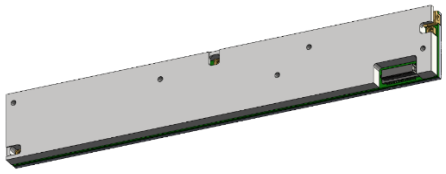
AM9029 – Wideband Downconverter

1.0 GHz to 18 GHz Wideband Miniature Tuner Module

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

- Fully integrated tuner module provides high dynamic range coverage of 1.0 GHz to 18 GHz
- 3.8GHz final IF, configured to operate with ~5 Gsps ADC
- Multiple tuners can be configured to work together for coherent operation and N-channel applications



AM9029 is a high-performance tuner module covering the 1.0 GHz to 18 GHz frequency range. The AM9029 supports an instantaneous bandwidth of 2 GHz, with a center frequency of 3.8 GHz. The super-heterodyne tuner module 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. Includes sub-octave preselectors, low-noise pre-amplifiers, PLL synthesizers, frequency converters, power and control line filtering, and integrated SPI control are included. Interfacing to the tuner is accomplished by simply providing an RF input, DC voltages, frequency reference, SPI control, and connecting to the ADC

FEATURES

- 1.0 GHz to 18 GHz Frequency Range
- 2 GHz Bandwidth
- 3.8 GHz IF Output Frequency
- Sub-Octave Preselector
- Calibration Input Port
- 14 dB Noise Figure, +2 dBm IIP3
- +5.0V and +3.3V DC Operation
- 6.5 W Max Power Consumption
- -40C to +85C Operation
- 5.1" x 0.77" (129 x 19.5 mm)

Note: This is an overview version of the AM9029 datasheet. Contact MMIC Sales for the full datasheet: MMICsales@mrcy.com.

CONTENTS

REVISION HISTORY

Date	Revision	Notes
November 10, 2022	**0.1**	Preliminary Release.
November 1, 2023	0.2	Mechanical and spec changes
March 4, 2024	0.3	Miscellaneous updates
September 9, 2024	1	Changed to Mercury brand
February 2, 2025	2	Spec table changes
April 8, 2025	3	Mechanical drawings
May 3, 2025	3.1	Document format changes
January 5, 2026	3.2	Added Recommended Footprint Changed connector type to 55056-005J (smooth bore) and removed bullet row from "Required Components" table

PART ORDERING DETAILS

Part Number	Description
AM9029	Stand-alone Tuner Module
AM9029-EVAL	Single Channel AM9029 on Evaluation Board
AM9029-EVAL-2CH	Dual Channel AM9029 on Evaluation Board

Note: Eval boards include low-dropout regulators, reference distribution circuitry, and control circuitry. All that is required for operation is an input signal, a reference, and a Windows computer for the USB control of the evaluation board. See "Evaluation PC Board" section for more details. The output may be driven into a spectrum analyzer or directly into an ADC. Contact Mercury for ADC recommendations.

SPECIFICATIONS

Absolute Maximum Ratings

	Testing Conditions	Min	Maximum
RF Input Power	No damage		+20dBm
+5.0 VDC Supply			+5.5 V
+3.3 VDC Supply			+3.6 V
Operating Temperature		-40 C	+85 C
Storage Temperature Range		-50 C	+125 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		+70 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			0.6 A	
+3.3 VDC Current			1.06 A	
Power Dissipated			6.5W	
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)

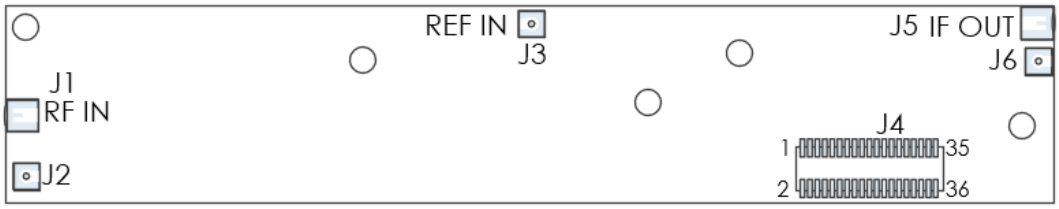
Param	Notes	Min	Typical	Max
Frequency Range	Heterodyne Path	1.0 GHz		18 GHz
Instantaneous Bandwidth			2.0 GHz	
IF Center Frequency			3.8 GHz	
Tune Frequency Range		2 GHz		19 GHz
Tuning Step Size			25 MHz	
Frequency Reference	External 100 MHz (note 2)	-2dBm (0.5Vpp)	+6 dBm	+13.5dBm (3Vpp)
Input IP3			+2 dBm	
Input IP2			+50 dBm	
Noise Figure			14 dB	
Image Rejection			80 dB	
IF Rejection	Stopband Relative to Passband		80 dB	
LO Radiation	Measured at Antenna In		-80 dBm	
Gain			25 dB +/-3dB	
Gain Control Range	(Note 1)		38 dB in 1dB steps	
Tuning Speed			100 µs	500 µs
SSB Phase Noise	1 kHz Offset		-90 dBc/Hz	
	10 kHz Offset		-100 dBc/Hz	
	100 kHz Offset		-100 dBc/Hz	
	1 MHz Offset		-106 dBc/Hz	
	10 MHz Offset		-127 dBc/Hz	

Note 1: Additional gain control beyond calibrated gain, in 1 dB steps.

Note 2: External reference input impedance is 50 Ohms. Tolerant of sine wave or square wave input. Reference waveform may affect spurious and phase noise performance

MODULE CONNECTOR AND PIN DEFINITIONS

Module Connector Layout



Connector	Name	Function
J1	RF IN	1 to 18 GHz RF Input Edge Launch Connector (optional)
J2	RF IN	1 to 18 GHz RF Input Vertical Launch Connector
J3	REF IN	100 MHz Reference Input Signal
J4	PWR/CTL	Reference, Power, and Control Multi-pin Connector
J5	IF OUT	3.75 GHz IF Output Edge Launch Connector (optional)
J6	IF OUT	3.75 GHz IF Output Vertical Launch Connector

Required Component List

Connector	Mating Connector Par Number	Manufacturer
J2, J3, J6	55057-005J	Southwest Microwave
J4	DF12NB(4.0)-36DP-0.5V(51)	Hirose

Required Component List (Continued)

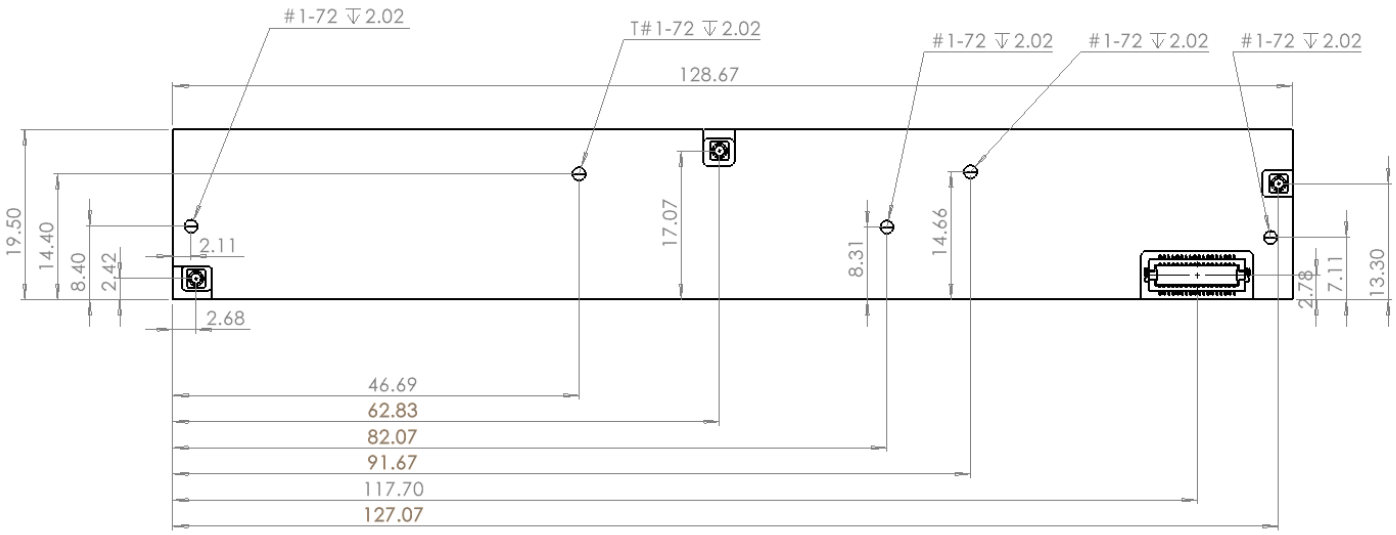
J4 Pin #	J4 Pin Name	J4 Pin Function
1 - 4	+5.5 V	+5.5V DC Power Input
5 - 8	GND	Ground – Common
9 - 14	+3.8 V	+3.8V DC Power Input
15 - 20	GND	Ground – Common
21	NC	No connect
22	POP	Power On Pin – Active High. Low Logic Turns Off Tuner
23	CMD_CSn	SPI Bus Select Line for Sending Tuner Commands – Active Low
24	PROG CSn1	SPI Bus Select Line to Allow On-Board Programming Updates – Active Low
25	LD	Lock Detect – logic level high = locked, low = unlocked
26	SPI MOSI	SPI Bus Data Input to Master Controller

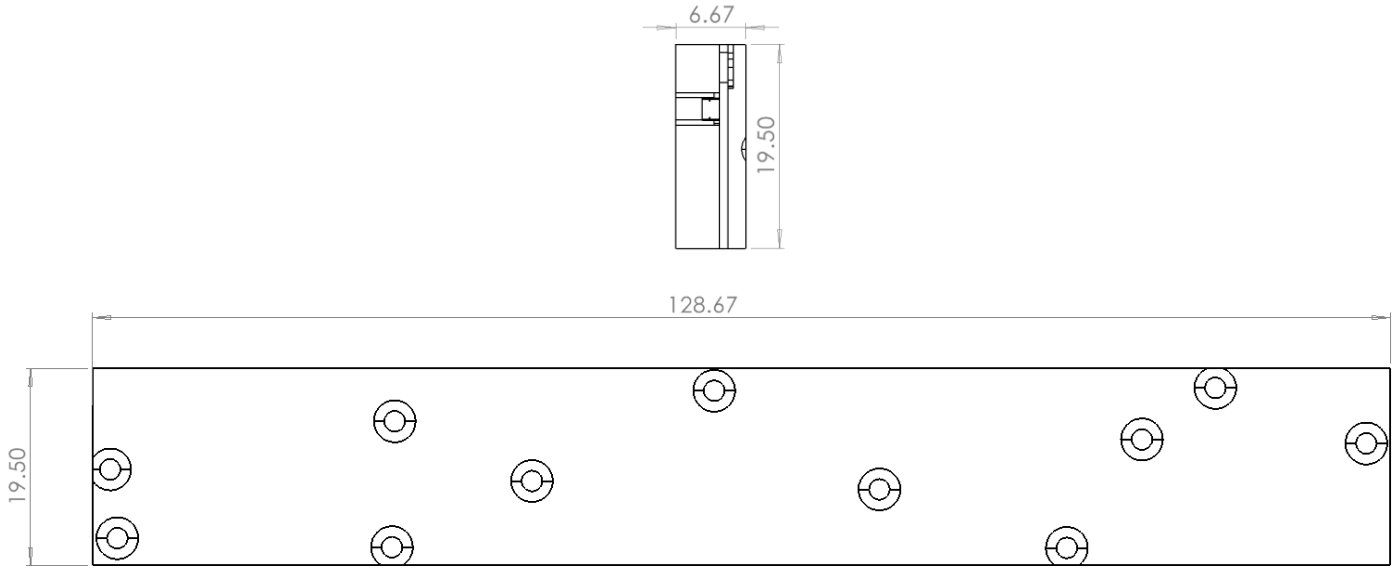
J4 Pin #	J4 Pin Name	J4 Pin Function
27	SYNC2	Tuner LO2 Sync Line for Coherency
28	SPI MISO	SPI Bus Data Output to Master Controller
29	JTAG TMS	JTAG TMS
30	SPI_CLK	SPI Bus Clock Input
31	JTAG_TCK	JTAG TCK
32	TRIGGER	
33	JTAG_TDI	JTAG TDI
34	SYNC1	Tuner LO1 Sync Line for Coherency
35	JTAG_TDO	JTAG TDO
36	NC	No Connect

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

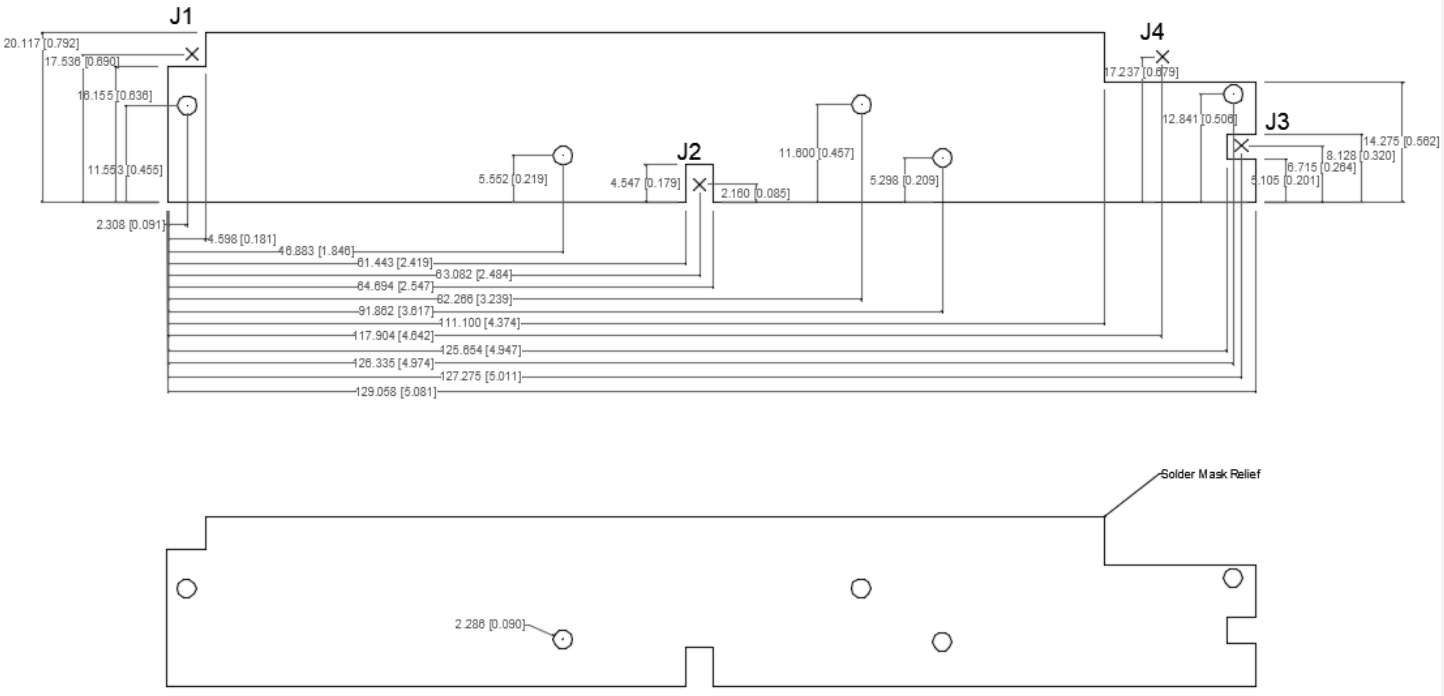
MECHANICAL DETAILS

Mechanical Drawing





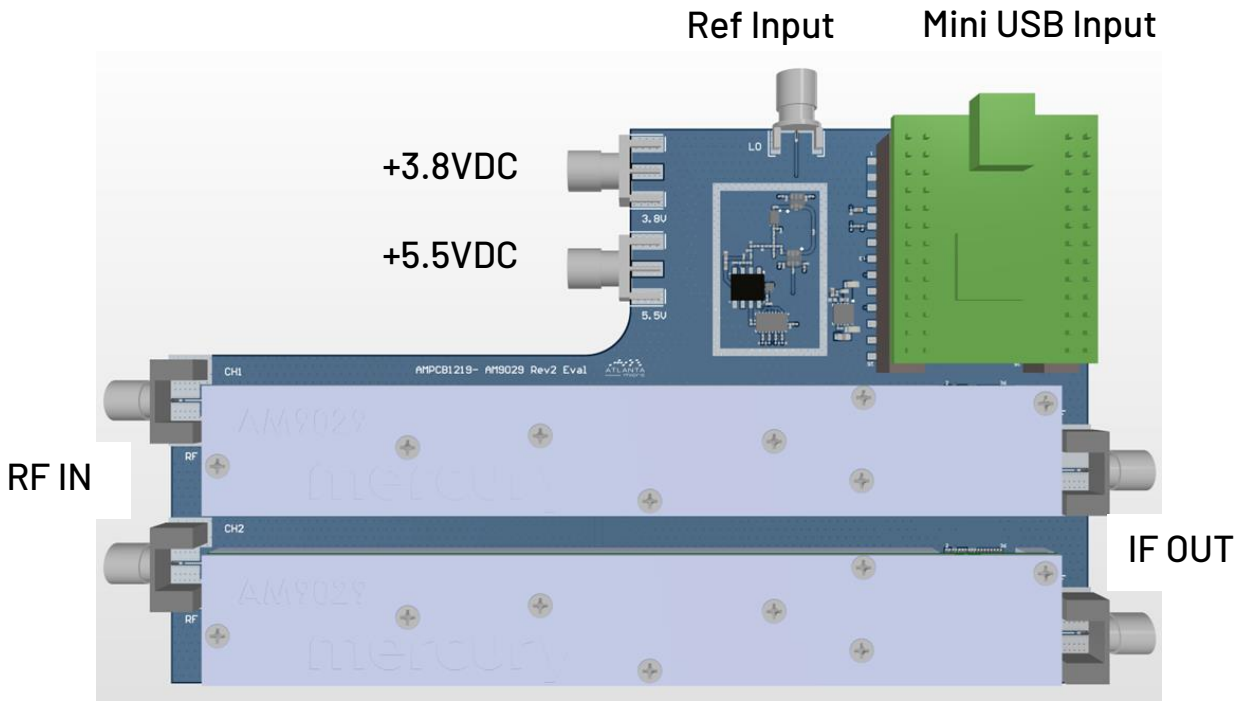
Recommended Footprint



Required Connectors		
Designator	Part Number	Manufacturer
J1, J2, J3	55057-005J	Southwest Microwave
J4	DF12NB(4.0)-36DP-0.5V(51)	Hirose Electric

1Footprints for these connectors should follow manufacturer's recommendations.

EVALUATION PC BOARD



***Note 1:** Evaluation board supports up to two tuners to test phase coherent operation if desired.

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