

AM9035A

18 GHz to 44 GHz Frequency Extender

AM9035A is a downconverter module that provides frequency coverage from 18 GHz to 44 GHz. This connectorized module is designed for high performance and low size, weight, and power (low SWaP) and is intended to complement existing RF receivers, or ultrawideband direct digitizers. The analog IF output frequency is centered at 4 GHz with a 2 GHz instantaneous bandwidth.

This module includes sub-octave preselector filters, pre-amplifiers, a local oscillator, frequency converters, variable attenuators, power and control line filtering, and a control FPGA. Interfacing to the tuner is accomplished by simply providing a DC voltage, external 100 MHz frequency reference, and SPI control.

FEATURES

- 18 GHz to 44 GHz Frequency Range
- 2 GHz Instantaneous Bandwidth
- 4 GHz Fixed IF Output Frequency
- 14 dB Noise Figure, +4 dBm IIP3
- +6.0V DC Supply voltage
- 9 W Power Consumption
- -20°C to +71°C Operation
- Sub-Octave Preselection
- 0.1-18 GHz bypass path
- Integrated LO
- 3.7" x 3.3" x 0.7"



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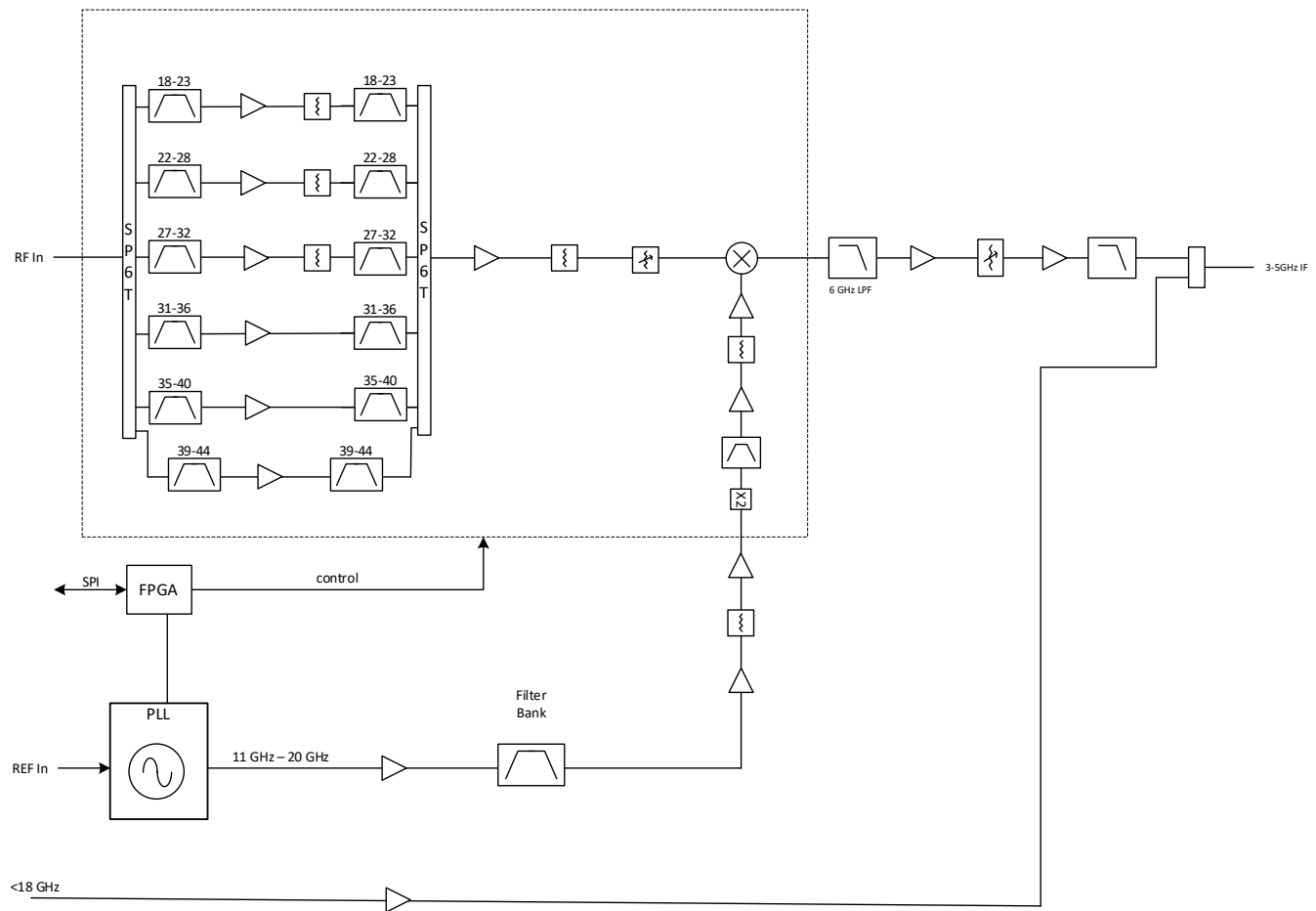
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REVISION HISTORY

Date	Revision	Notes
December 7, 2023	1.0	Preliminary Release.
January 10, 2024	1.1	Adjusted power consumption spec.
May 20, 2024	1.2	Updated mechanical outline.
June 10, 2024	1.3	Updated mechanical drawings.
August 15, 2024	1.4	Added new photo.
August 19, 2024	2	Changed to Mercury branding. No content changes.
October 1, 2024	2.1	Minor formatting and power consumption
April 10, 2025	2.2	Added absolute max for logic pins

BLOCK DIAGRAM



Preselector Band	Frequency Range	L0 Range
Bypass	0.1 – 18 GHz	N/A
1	18 – 23 GHz	22 – 26 GHz
2	22 – 28 GHz	27 – 31 GHz
3	27 – 32 GHz	32 – 35 GHz
4	31 – 36 GHz	28 – 31 GHz
5	35 – 40 GHz	32 – 35 GHz
6	39 – 44 GHz	34 – 40 GHz

SPECIFICATIONS

Absolute Maximum Ratings

	Testing Condition	Minimum	Maximum
RF Input Power	Continuous Wave		+24 dBm
+6.0 VDC Supply			
Operating Temperature	Case temp	-40 C	+85 C
Storage Temperature Range		-40 C	+125 C
Allowed Voltage	Pins 1-10		+3.75 V

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.



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

Recommended Operating Conditions

	Minimum	Typical	Maximum
Operating Case Temperature	-20 C		+71 C

DC ELECTRICAL CHARACTERISTICS

(T = 25 °C unless otherwise specified)

Parameter	Testing Cond	Min	Typical	Max
+6 VDC Supply		+5.5 V	+6.0 V	+6.3 V
+6 VDC Current			1.5 A	
Power Dissipated	Pin 15 = +6.0V, Pin 11 = +6.0V		9 W	
Logic Level Low		0 V		+0.8 V
Logic Level High		+2.0 V		+3.5 V

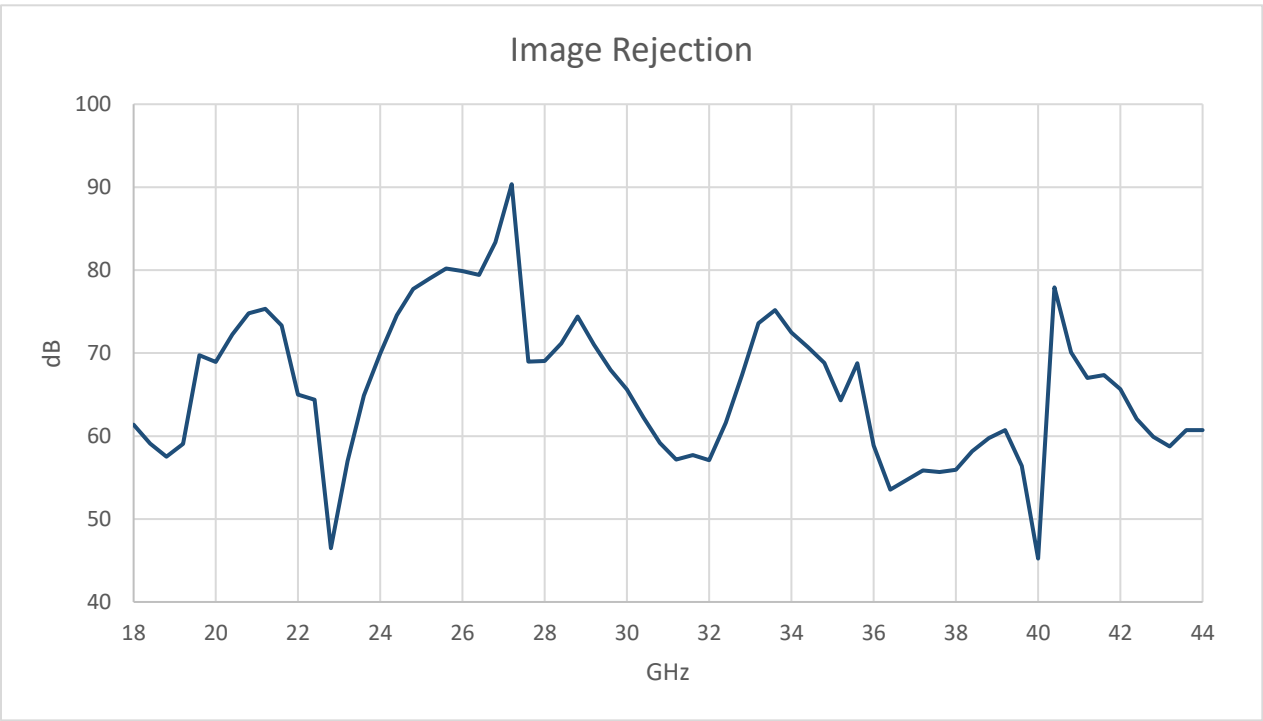
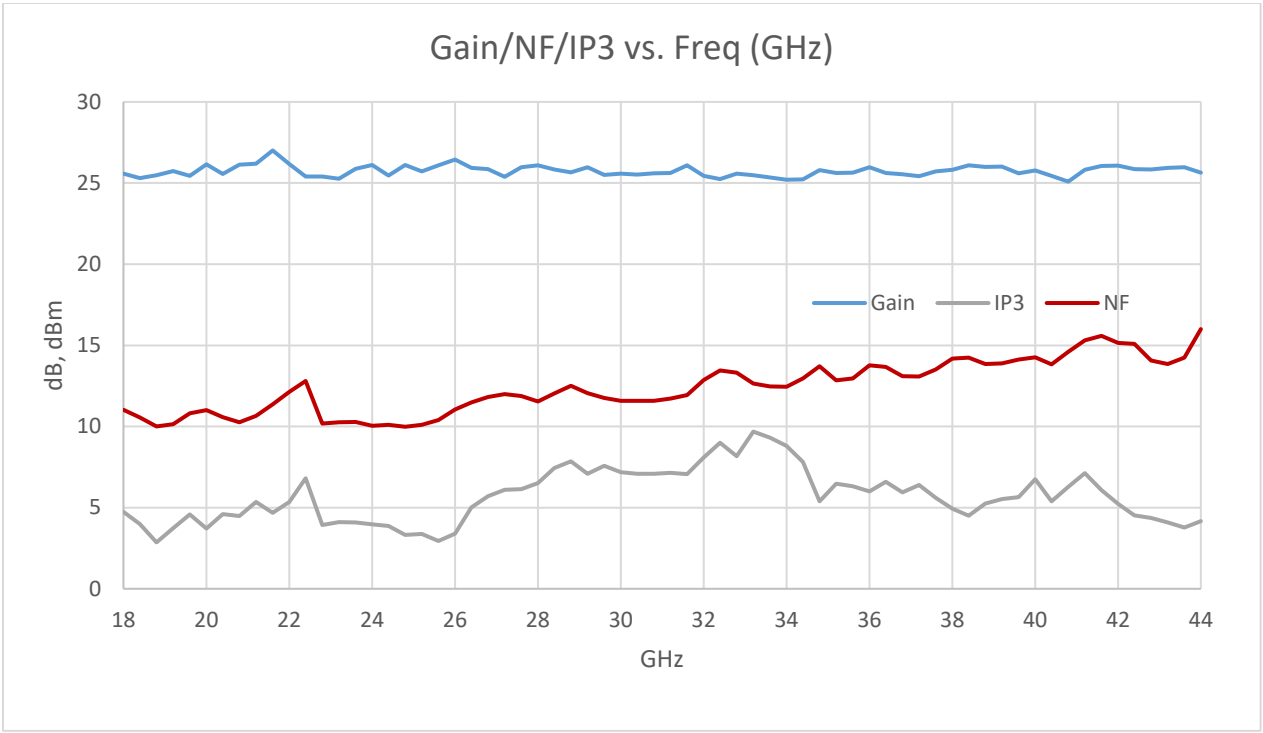
RF PERFORMANCE

(T = 25 °C unless otherwise specified)

Parameter	Notes	Min	Typical	Max
Frequency Range	Heterodyne Path	18 GHz		44 GHz
Instantaneous Bandwidth			2 GHz	
IF Center Frequency			4 GHz	
Tune Frequency Range		18 GHz		44 GHz
Tuning Step Size			400 MHz	
Frequency Reference	External 100 MHz	-2dBm	+4 dBm	+10dBm
Input IP3		0 dBm	+4 dBm	
Input IP2			+50 dBm	
Noise Figure			14 dB	
Image Rejection		40 dB	65 dB	
IF Rejection			80 dB	
LO Radiation	Measured at Antenna In		-75 dBm	
LO Leakage	Measured at IF Output		-60 dBm	
Gain			25 dB +/-2dB	
Gain Control			30 dB in 1 dB steps	
Tuning Speed			300 μ s	
Phase Noise	1 kHz Offset		-80 dBc/Hz	
	10 kHz Offset		-95 dBc/Hz	
	100 kHz Offset		-95 dBc/Hz	
	1 MHz Offset		-110 dBc/Hz	
	10 MHz Offset		-130 dBc/Hz	

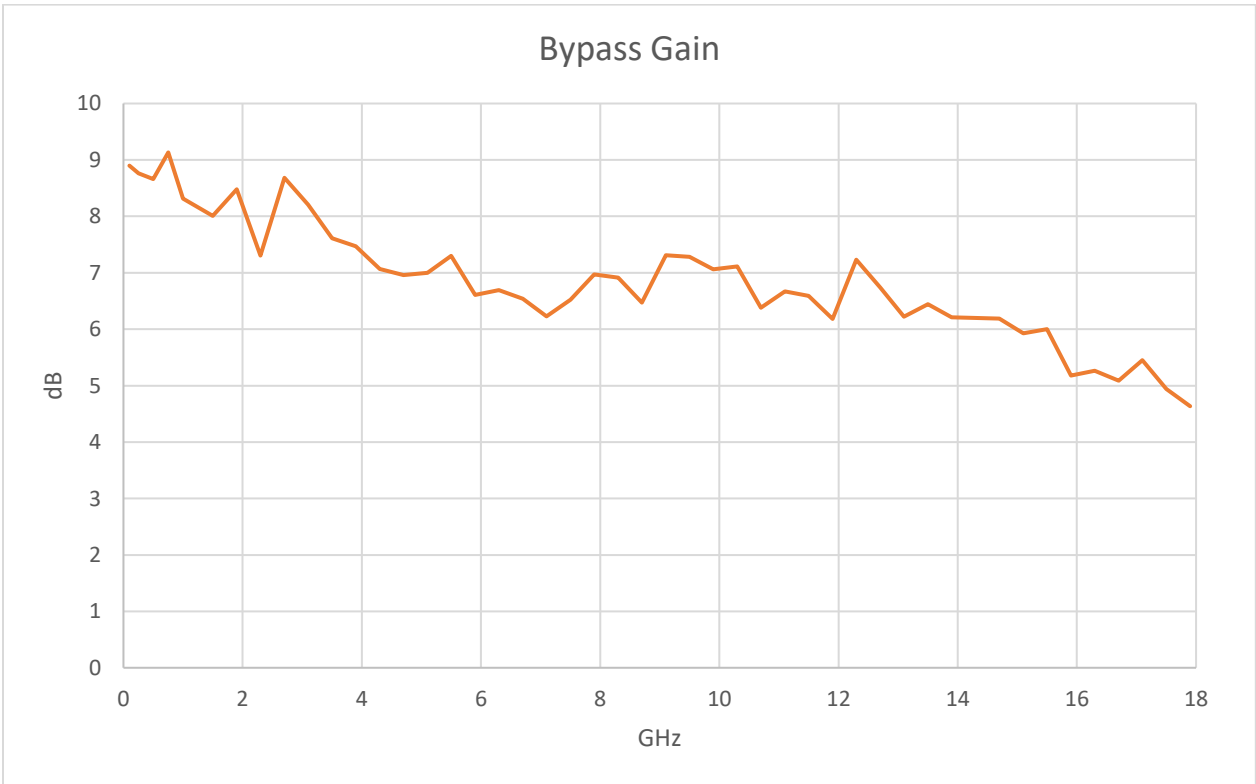
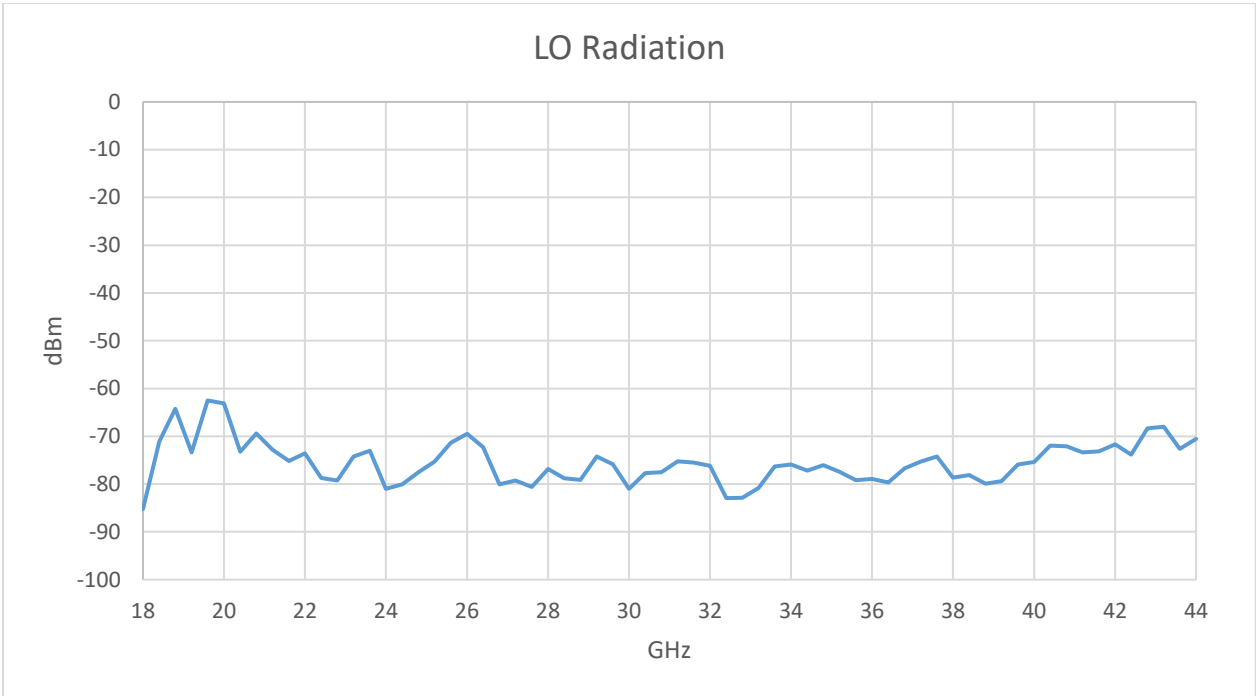
TYPICAL PERFORMANCE

Plot is representative AM9035A unit set in nominal gain state (25 dB)



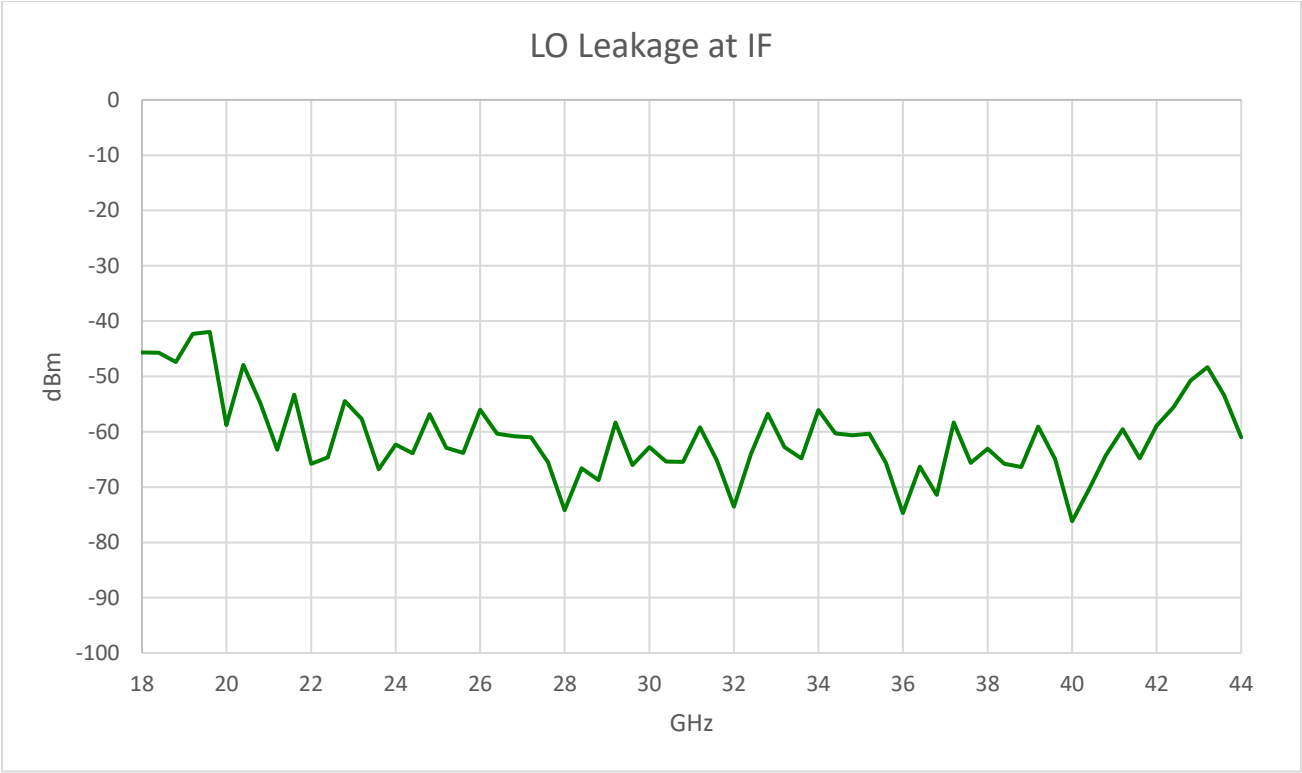
TYPICAL PERFORMANCE (CONTINUED)

Plot is representative AM9035A unit set in nominal gain state (25 dB)



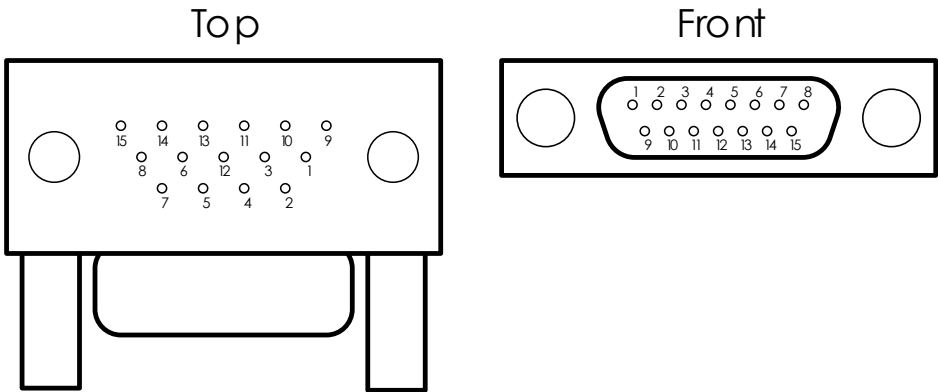
TYPICAL PERFORMANCE (CONTINUED)

Plot is representative AM9035A unit set in nominal gain state (25 dB)



CONNECTOR AND PIN DEFINITIONS

Micro-D (ITT Cannon MDM-15PCBRP)



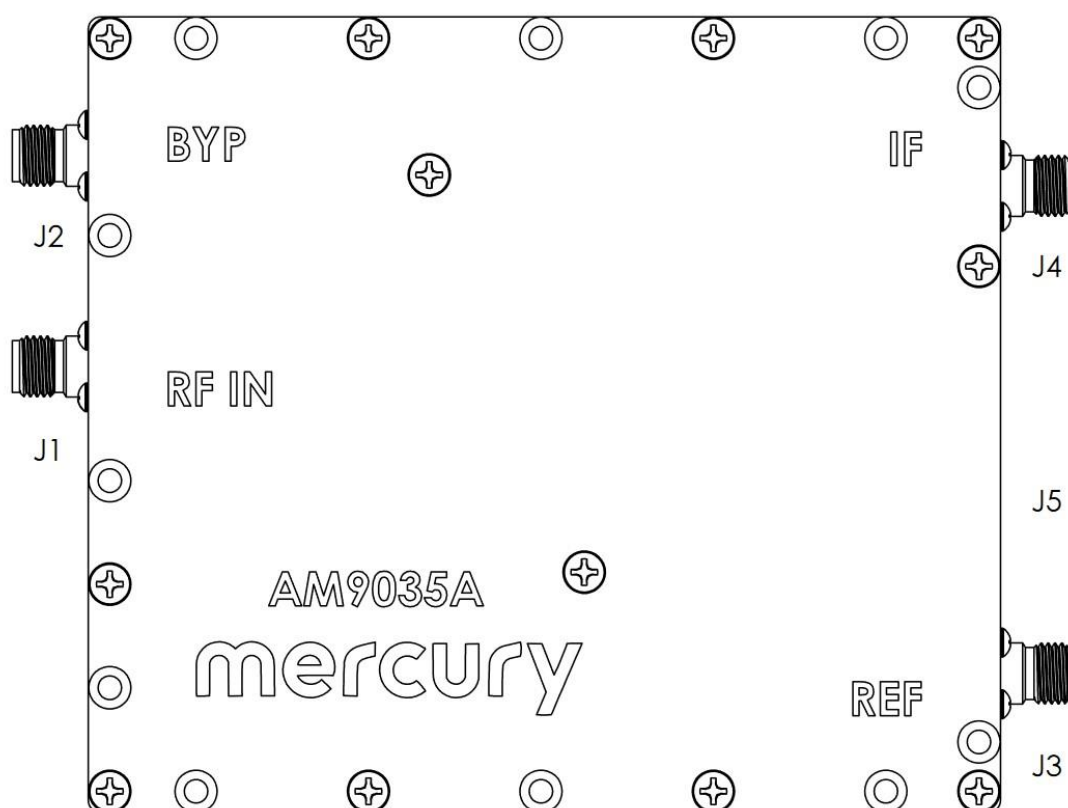
Connector	Name	Function
J1	RF In	18 to 44 GHz Input, AC coupled, 2.4mm
J2	Bypass In	2 to 18 GHz Input, bypass to IF output, 2.92mm
J3	REF IN	100-MHz Reference Input Signal, 0 dBm, 2.92mm
J4	IF Out	IF output, 4 GHz, 2.92mm
J5	PWR/CTL	Power and Control Multi-pin Connector, Micro-D

J5 Pin #	J5 Pin Name	J5 Pin Function
1	SCLK	SPI Bus Clock Input (3.3V)
2	MOSI	SPI Bus Data Input from Master Controller
3	MISO	SPI Bus Data Output to Master Controller (3.3V)
4	CMD_CSN	SPI Bus Select Line for Sending Tuner Commands Active Low (3.3V)
5	PROG_CSN	SPI Bus Select Line to Allow On-Board Programming Updates – Active Low (3.3V)
6 - 9	N/C	Spare
10	POP	Power On Pin – Active High. Low Logic Turns Off module
11	+6V	+6VDC Supply
12	GND	Ground – common
13	GND	Ground – common
14	GND	Ground – common
15	+6V	+6VDC supply voltage

CONNECTOR AND PIN DEFINITIONS (CONTINUED)

Interfacing Connector Details

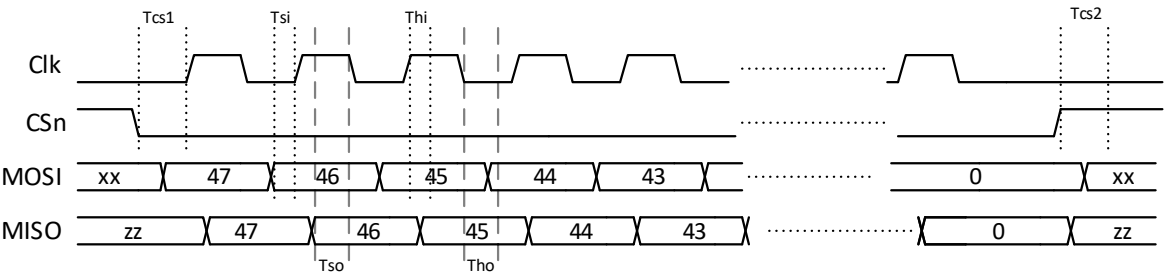
- J1 is a Southwest Microwave 0.9mm connector (internal) with external flange mount 2.4mm adapter.
Part#: 145310-00SF
- J2 – J4 are Southwest Microwave 0.9mm connectors (internal) with external flange mount 2.92mm adapter.
Part#: 105310-01SF
- J5 is a 15 pin Micro-D.
Part#: ITT-Cannon MDM-15PCBRP



CONTROL DETAILS

The AM9035A is controlled over a serial peripheral interface to an integrated FPGA. The SPI interface consists of 5 control lines: SCLK, CMD_CSn, PROG_CSn, MOSI (Master Out – Slave In), and MISO (Master In – Slave Out). The user system controlling the tuner is always the master device. CMD_CSn is the chip select line used for control/query messages, and PROG_CSn is reserved for programming only. The command structure is based upon a 48-bit word, where the upper *M* bits indicate the command type, and the lower *N* bits indicate the various parameter values.

Timing Diagram



Control Word Diagram

Specification	Minimum	Typical	Maximum
SPI Clock Frequency			20 MHz
Tcs1(TCSn to rising clk edge)	15 ns		
Ts	7 ns		
Th	2 ns		
Tcs2	25 ns		

At a minimum, command messages will include the following:

Tuner_Status – read back status information such as PLL Lock, temperature, error conditions

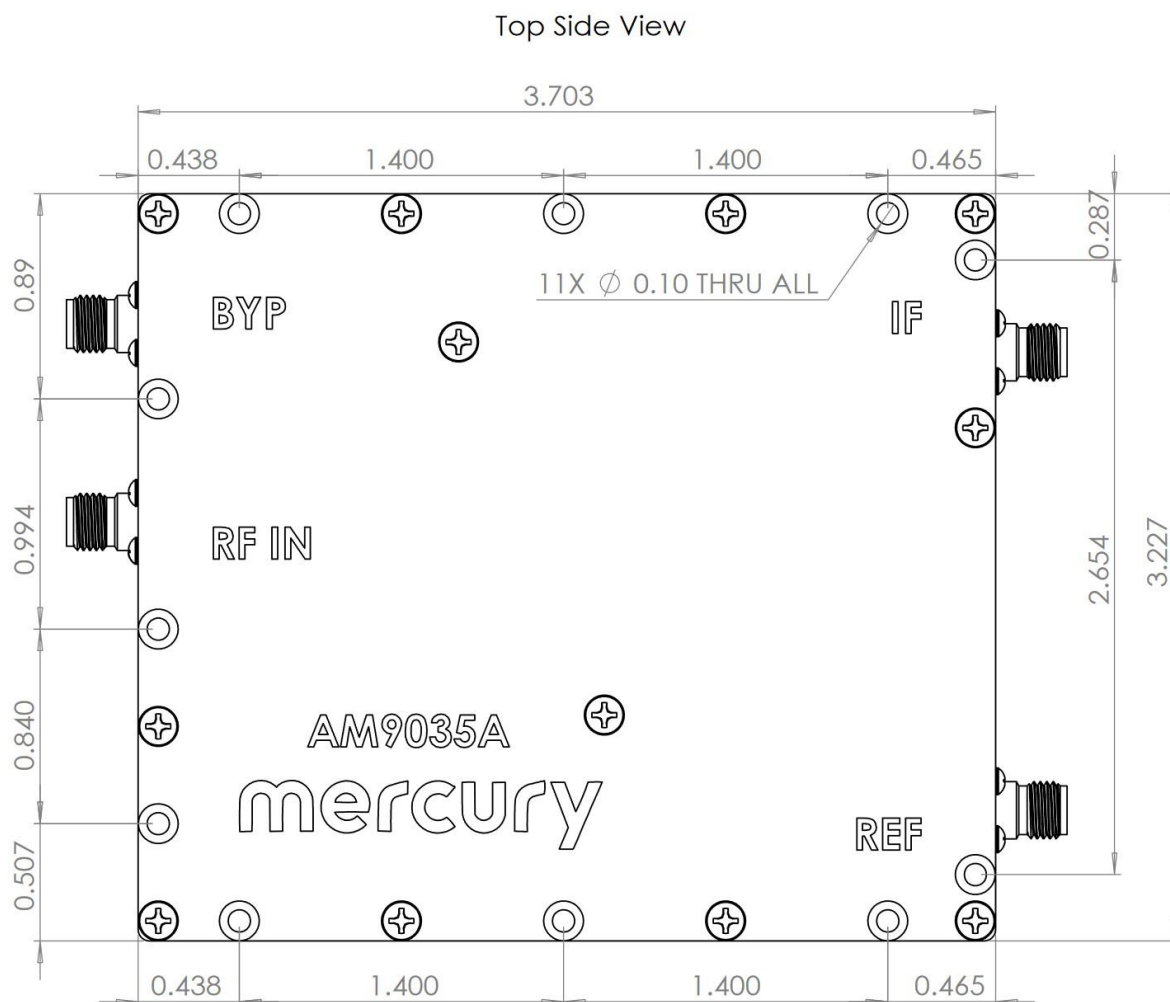
Tuner_Read – read back information such as hardware ID, serial number, firmware revision, etc.

Set_Freq – set tune frequency

Set_Atten – set user attenuation

MECHANICAL DETAILS

Mechanical Drawing

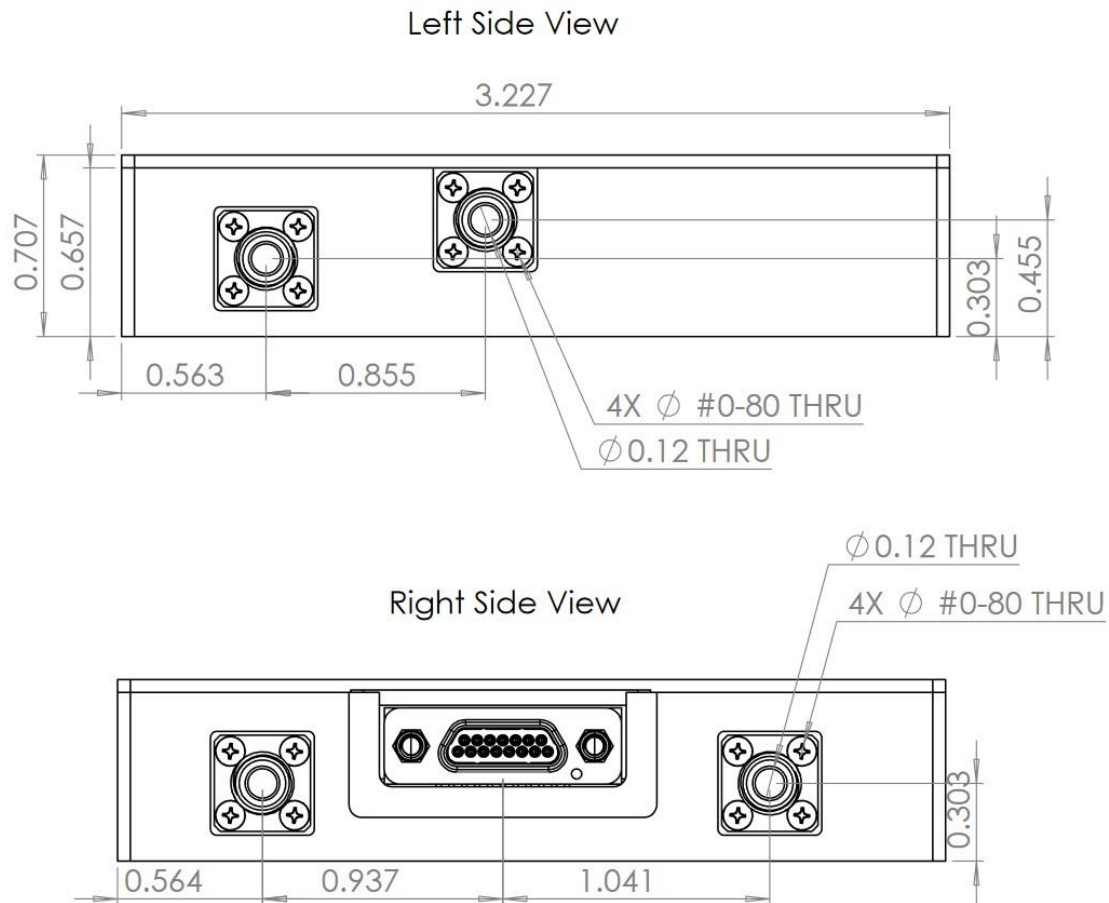


Notes:

1. All dimensions are in inches.
2. Dimensioned screw holes indicate #2-56 screw holes to be used for mounting to an external enclosure or device.

MECHANICAL DETAILS (CONTINUED)

Mechanical Drawing (Continued)



Note: All dimensions are in inches.



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