



24.125 GHz, K-Band FMCW Radar Sensor

Description:

Model SSD-24307-2216M-A1 is a single-transmit, dual-receive ranging sensor that can be used in CW, FSK, or FMCW modes. The sensor uses a 24 GHz voltage controlled oscillator with a high quality PLL IC to generate the desired signal with an internal reference signal of 100 MHz to cover the frequency range of 24.00 to 24.25 GHz. This sensor has an analog TX power control, but digital TX power controls are available upon request. The RX to IF gain is digitally controlled and adjustable over a range of 40 dB nominally. The sensor operates on 3.3V logic inputs.



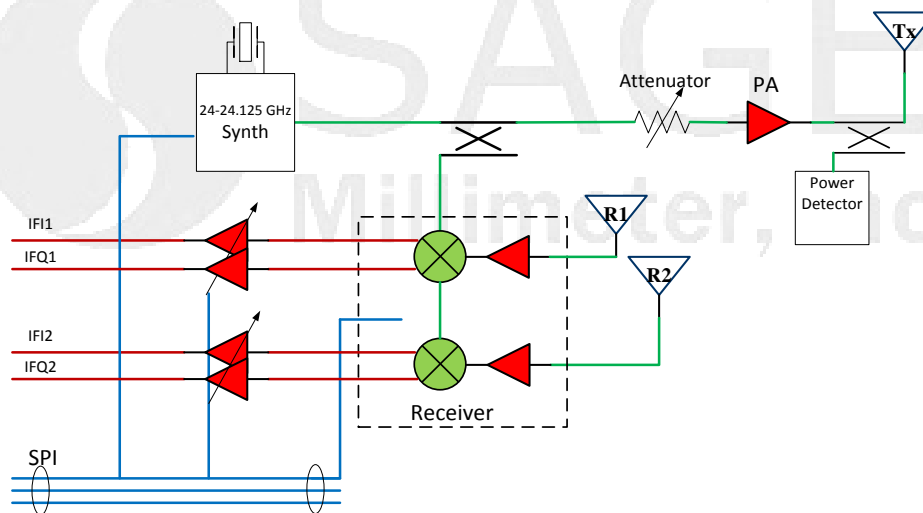
Features:

- 24.125 GHz FMCW Operation
- Isolated, High-Gain Tx and Rx Antennas
- Superior Phase Noise Performance
- Fast Sweep Time for Lower Phase Noise Effects
- Dual Channel Receiver for Angular Discrimination
- I/Q Receiver Outputs for Direction Discrimination
- Integrated Low Noise IF Pre-amplifier
- Digitally Controlled Integrated IF Variable Gain Amplifier
- Analog Controlled Transmit Power Attenuator

Applications:

- Traffic Management Systems
- FMCW Radar Sensing Systems
- FSK Radar Sensing Systems
- Stationary Target Measuring Systems
- True Ranging Systems
- Moving Target Direction and Speed Sensing Systems
- 2D, 3D and 4D Radar Systems

Block Diagram:





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Electrical Specifications:

Parameter	Minimum	Typical	Maximum
Antenna			
Antenna Bandwidth		1,000 MHz @ VSWR <2:1	
Antenna Gain, Tx		22 dBi	
Antenna Gain, Rx		16 dBi	
Antenna Beamwidth, Tx		12°(H) x 12°(V)	
Antenna Beamwidth, Rx		12°(H) x 50°(V)	
Antenna Side Lobes, Tx		-20 dBc @ Elevation & Azimuth > ±20°	
Antenna Side Lobes, Rx		-20 dBc @ Elevation & Azimuth > ±20°	
Transmitter			
Transmit Frequency	24.000 GHz	24.125 GHz	24.250 GHz
Frequency Stability		-0.04 MHz/°C	
Output Power, EIRP	+12 dBm		+27 dBm
Phase Noise		-70 dBc/Hz @ 1 kHz PLL Locked -75 dBc/Hz @ 10 kHz PLL Locked -75 dBc/Hz @ 100 kHz PLL Locked	
FMCW Sweep Time	50 us		
Receiver			
Receiver Noise Figure			17 dB, SSB @ 100 kHz
IF Gain Range	21 dB		64 dB
IF, low <i>f</i> cutoff		50 Hz	
IF Bandwidth		1,000 kHz	
Receiver I/Q Channel		Channel One and Two	
Receiver I/Q Phase Δ		±10°	
Receiver I/Q Amplitude Δ		±2 dB	
IF Frequency Range	DC		1,000 kHz
IF Offset Voltage		-0.5 V _{DC}	
Frequency Stability		±5 ppm	
Power Stability		- 0.03 dB/°C	
Operating Temperature	-25°C		+60°C
Supply Voltage	+5.0 V _{DC}	+5.5 V _{DC}	+6.0 V _{DC}
Supply Current		280 mA	



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Mechanical Specifications:

Item	Specification
IF Interface Port	IRISO IMSA-98558, Connector #1
TX Output Power Control Port	IRISO IMSA-98558, Connector #1
RX Gain Control Port	IRISO IMSA-98558, Connector #2
FMCW Control Ports	IRISO IMSA-98558, Connector #2
DC Bias Port	IRISO IMSA-98558, Connector #1
Material	Housing: Aluminum; Antenna: Microwave Substrate
Finishing	Housing: Chem Film; Antenna: Gold Plated
Weight	4.4 Oz
Outline	SD-MK-2216D

Analog Connector Pin Description:

Pin #	Description	Comment	Minimum	Typical	Maximum
1	NC	No Connection			
2	VCC	+5.5V	+5.0 V	+5.5 V	+6.0 V
3	GND	Ground			
4	NC	No Connection			
5	GND	Ground			
6	Q1	Analog out	-1.5 V		+1.5 V
7	GND	Ground			
8	I1	Analog out	-1.5 V		+1.5 V
9	GND	Ground			
10	I2	Analog out	-1.5 V		+1.5 V
11	GND	Ground			
12	Q2	Analog out	-1.5 V		+1.5 V
13	GND	Ground			
14	Attenuator	Analog In	0.0 V		+3.3 V
15	GND	Ground			
16	NC	No Connection			
17	GND	Ground			
18	Detector	Analog out	0.01 V	+0.10 V	+0.20 V
19	GND	Ground			
20	NC	No Connection			
21	NC	No Connection			
22	NC	No Connection			



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Digital Connector Pin Description:

Pin #	Description	Comment	Min (V)	Max (V)
1	TX ATT CS	Transmit attenuator CS*	NA	NA
2	PLL Enable	Enable ADF4159	0.0 V	+3.3 V
3	NC	No Connection		
4	VCO enable	VCO Enable*	0.0 V	+5.0 V
5	GND	Ground		
6	NC	No Connection		
7	SPI CS RX	BGT24MR2 Chip select	0.0 V	+3.3 V
8	MUX TX	MUX out of ADF4159	0.0 V	+3.3 V
9	GND	Ground		
10	NC	No Connection		
11	SPI CS TX	LE of ADF4159	0.0 V	+3.3 V
12	SPI CS POTI	Potentiometer Chip Select	0.0 V	+3.3 V
13	GND	No Connection		
14	SPI MOSI	SPI DATA	0.0 V	+3.3 V
15	GND	Ground		
16	SPI CLK	SPI Clock	0.0 V	+3.3 V
17	GND	Ground		
18	TX Data	ADF4159 TX Data	0.0 V	+3.3 V
19	GND	Ground		
20	NC	No Connection		
21	GND	Ground		
22	GND	Ground		

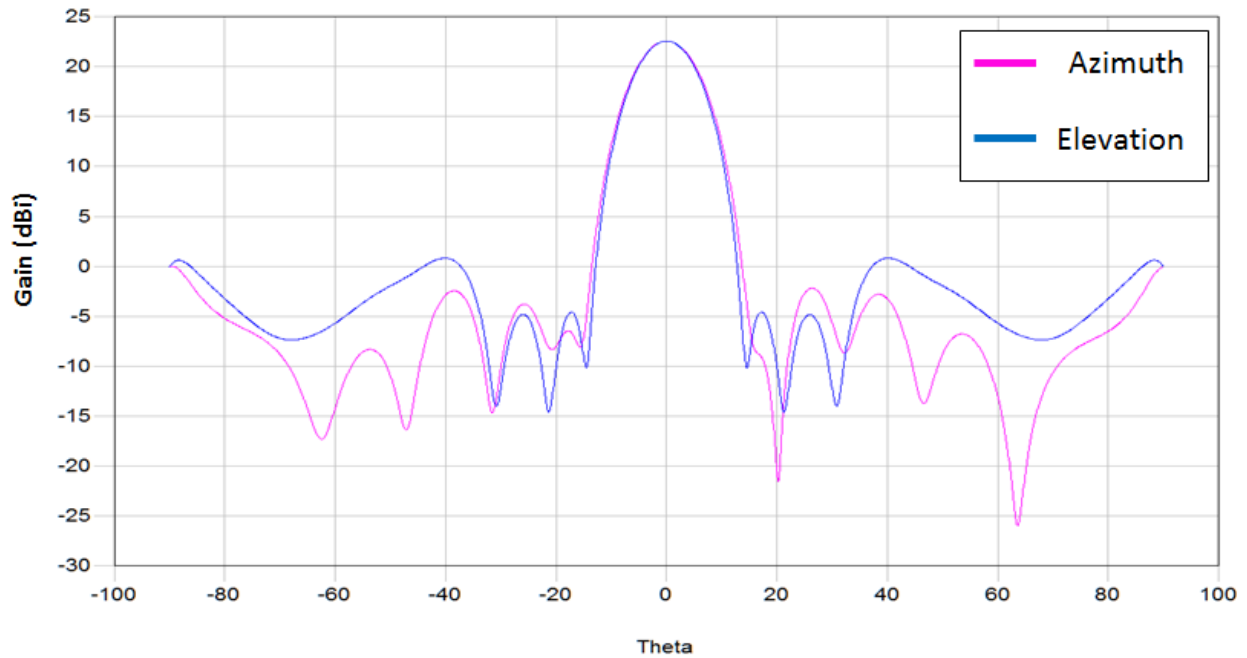
* This option is standard for this model and only available for selected models.



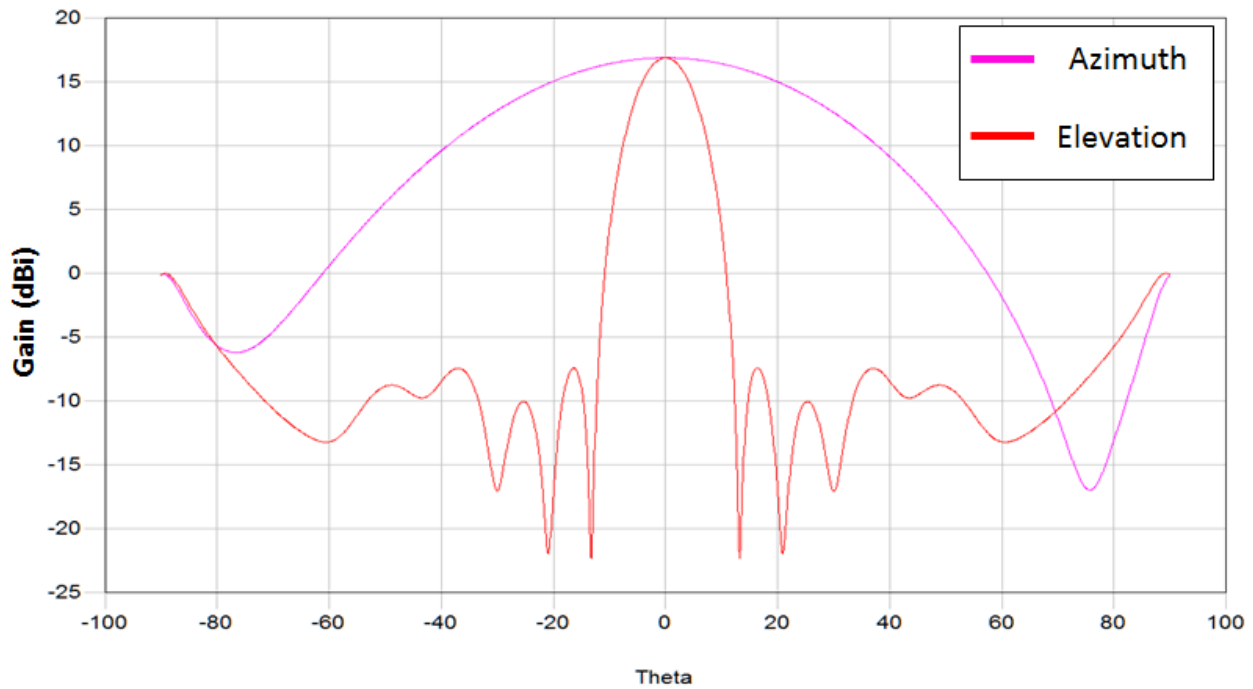


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TX Antenna Pattern



RX Antenna Pattern

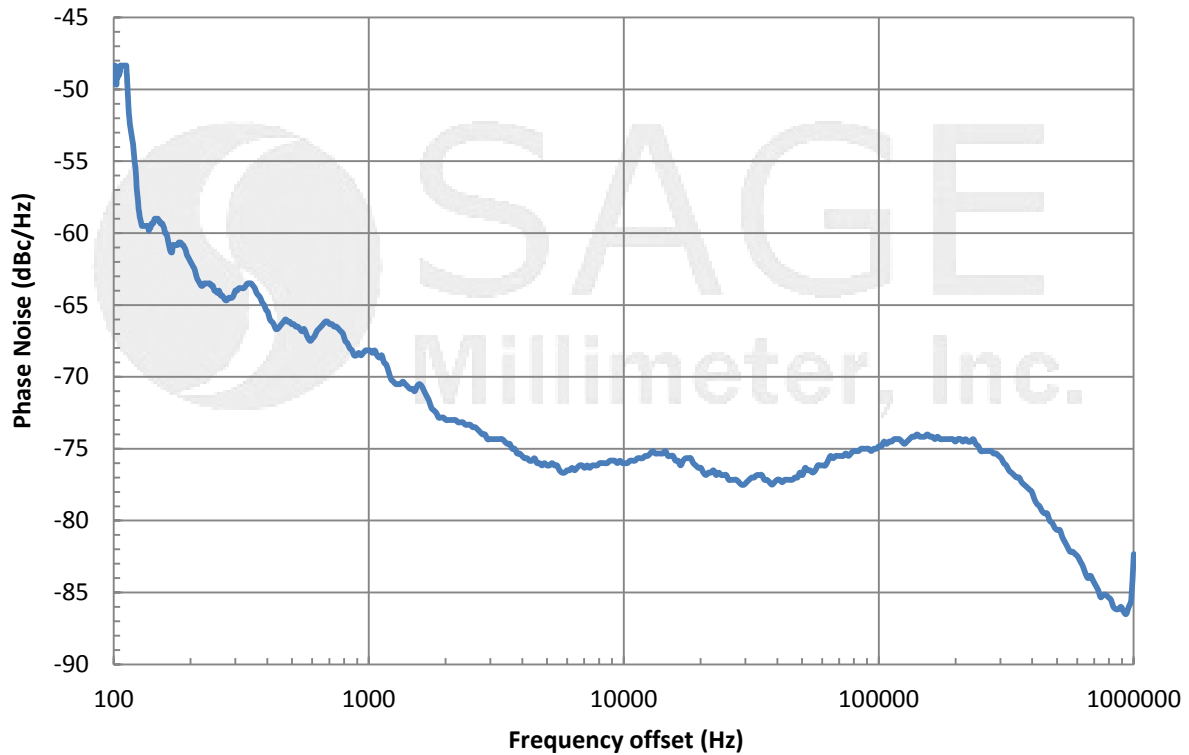




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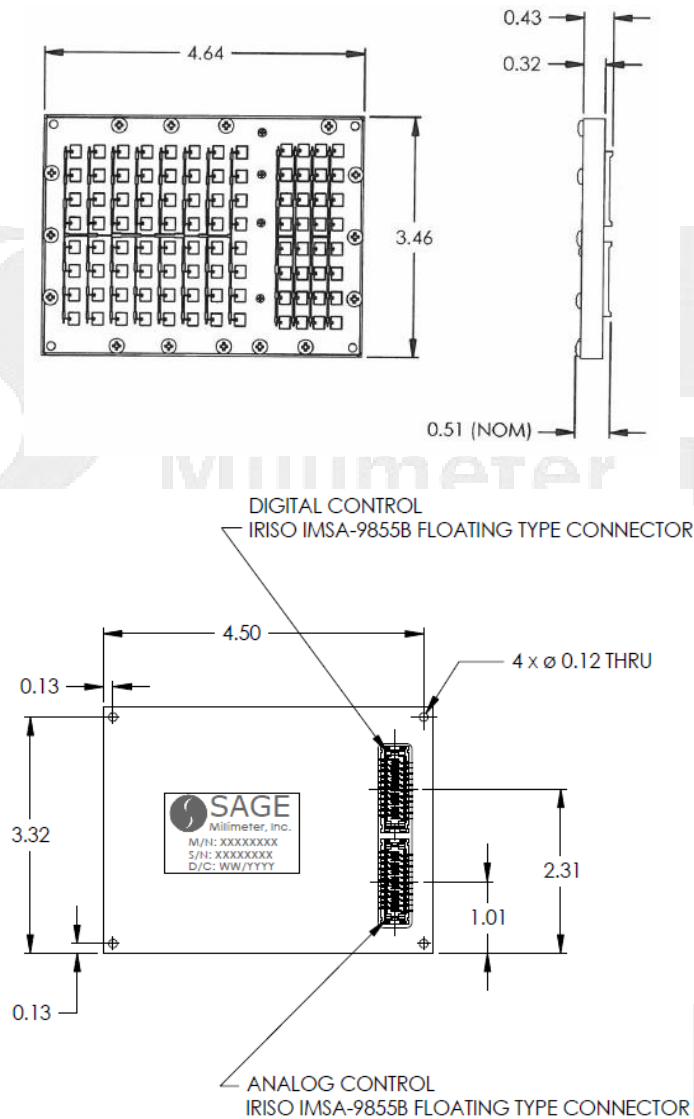
Measured Phase Noise Plot:

Typical Phase Noise (24.125 GHz)



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Mechanical Outline: (Unless otherwise specified, all dimensions are in inches [mm])



Interface: (subject to changes) 2x IRISO Connectors, Floating Type Model IMSA-9855B, 22 poles

Note:

- Some data presented are simulated. Actual data may vary unit to unit.
- SAGE Millimeter, Inc. reserves the right to change the information presented without notice.

Caution:

- The device is static sensitive. Always follow ESD rules when working with the device.
- Wrong bias or reverse bias on the sensor will damage the device.
- Exceeding absolute maximum ratings shown will damage the device. Use additional heatsink or fan if necessary.