

AM9011-1 – Tuner Chipset

2 MHz to 6 GHz Miniature Tuner Chipset

STATUS: NOT FOR NEW DESIGNS

AM9011-1 is a set of surface mount QFN components that can be integrated to provide a complete high dynamic range miniature tuner covering the 2-MHz to 6-GHz frequency range. The receive tuner components are designed for high performance and low size, weight, and power (low SWaP) applications and are mounted to a printed circuit board as surface mount devices. Sub-octave preselectors, amplification, frequency converters, IF and anti-aliasing filtering, local oscillators, and a frequency reference generator are included. The analog IF output frequency is centered at 60 MHz with an 80-MHz instantaneous bandwidth. For sampling applications, additional anti-aliasing filtering is not required for sample rates at 230 Msps or above. Multiple tuner chipsets can be configured to work together for coherent operation and N-channel applications.

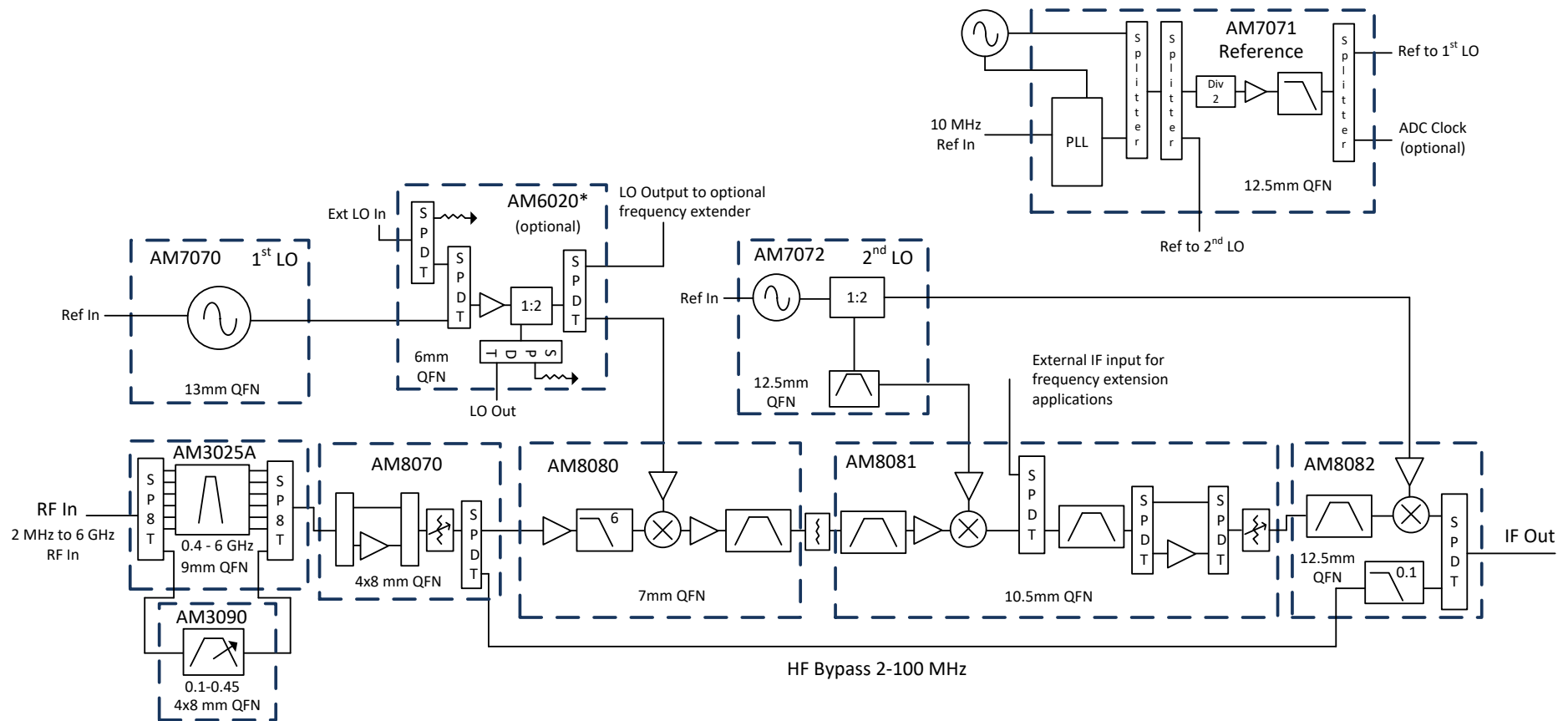
Features

- 2 MHz to 6 GHz
- 80-MHz bandwidth
- 60-MHz IF Output Frequency
- Sub-octave Preselection
- 13 dB Noise Figure
- +3 dBm IIP3
- +5.0V, +3.3V, and +21V DC Supplies
(+1.8V if recommended A/D is used)
- 3.4W Power Consumption (including optional A/D circuitry)
- Surface Mount QFN components
- -40C to +85C Operation

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Functional Diagram



* Note: AM6020 is an optional component to support LO distribution functions

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Specifications

Specification	Minimum	Typical	Maximum
RF Input:			
Frequency Range	2 MHz		6 GHz
Bandwidth		80 MHz	
Tune Frequency Range	60 MHz		5960 MHz
Gain to IF Out (note 1)		3 dB	
Noise Figure		13 dB	
Input IP3		+3 dBm	
Input IP2 (100MHz – 6GHz)		+50 dBm	
Image Rejection		80 dB	
IF Rejection		80 dB	
LO Leakage		-100 dBm	
Gain Control / Attenuation Range		50 dB (1dB steps)	
Input Level			+17 dBm
Attenuation Switching Speed			10 us
Sub-octave preselectors	100 MHz		6 GHz
Preselector Switching Speed			15 us
Tuning Speed		50 us	100 us
Phase Noise – 1 kHz		-90 dBc/Hz	
10 kHz		-98 dBc/Hz	
100 kHz		-98 dBc/Hz	
1 MHz		-109 dBc/Hz	
10 MHz		-135 dBc/Hz	
Tune Step Size		5 MHz	
External 10-MHz Input	-2 dBm		+10 dBm
+5V DC Supply Level	+4.80V	+5.0V	+5.2V
+5V DC Supply Current		110 mA	
+3.3V DC Supply Level	+3.20V	+3.3V	+3.5V
+3.3V DC Supply Current		720 mA	
+21V DC Supply Level	+20.0V	+21.0V	+24.0V
+21V DC Supply Current		3 mA	5 mA
+1.8V Current for AD9642		200mA	
Power Consumption		3.4 W	

Specification	Minimum	Typical	Maximum
Operating Temperature	-40 C		+85 C
Storage Temperature	-50 C		+125 C
2 to 100 MHz Bypass:			
Frequency Range	2 MHz		100 MHz
Noise Figure		12 dB	
Input IP3		+8 dBm	
Input IP2		+50 dBm	
Gain Control / Attenuation Range		30 dB (1 dB steps)	
Attenuation Switching Speed			10 us
Input Level			+17 dBm

Notes:

1. The gain from RF input to IF output is specified as post calibrated gain. Atlanta Micro recommends leveling the gain across frequency to approximately 3 dB for optimum dynamic range. There is adequate gain control provide this gain leveling in addition to 50 dB of gain control.

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Chipset Part Descriptions

6GHz Tuner Components:

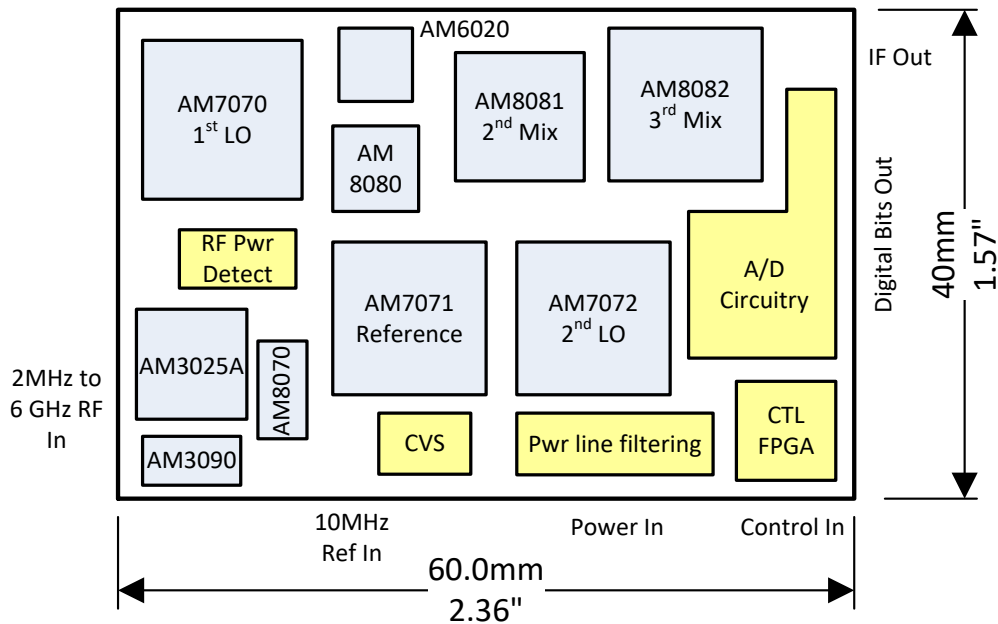
Part Number	Description	Dimensions
AM3025A	0.4-6 GHz Preselector	9mm x 9mm x 1.9mm
AM3090	0.1-0.45 GHz Preselector	4mm x 8mm x 1.0mm
AM8070	6GHz Gain Control	4mm x 8mm x 1.0mm
AM8080	Low Band 1 st Converter	7mm x 7mm x 1.0mm
AM8081	Low Band 2nd Converter	10.5mm x 10.5mm x 2.7mm
AM8082	Low Band 3rd Converter	12.5mm x 12.5mm x 3.0mm
AM7070	1st LO	13mm x 13mm x 2.7mm
AM7071	Reference	12.5mm x 12.5mm x 3.0mm
AM7072	2nd LO	12.5mm x 12.5mm x 3.0mm
AM6020*	LO Distribution Switch	6.0 mm x 6.0mm x 1.0mm

* Note: AM6020 is an optional component for LO distribution functions. It can be replaced by an amplifier such as AM1053 if LO distribution to multiple tuners is not required.

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Potential Chipset Layout (not to scale):



Recommended Customer Provided Components (Highlighted in yellow):

Only major components are listed. For details on all recommended parts including passives and FPGA code, contact Atlanta Micro for a reference design.

Part	Manufacturer/ Description	Part Number
CVS	Crystek / 500 MHz Crystal Oscillator	CVS575SX-500.000
A/D Circuitry	Analog Devices / A/D Converter (Requires driver circuit with ~20 dB gain)	AD9642
CTL FPGA	Lattice / MachX02 FPGA	LCMX02-4000ZE-3MG132I

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Pin Definitions

AM3025A

Pin Number	Name	Function
1	Vcc	+3.3V to +5.0V DC Power Input
2	GND	Ground - Common
3	RF 1	RF Port 1 - 2 MHz to 6 GHz – 50 ohms – DC coupled. External AC coupling capacitor required.
4 – 5	GND	Ground - Common
6	RF Aux 1	Optional 2 MHz to 6 GHz RF port that can be used for external filtering or connected to Pin 13 for a filter bypass path. 50 ohms – DC coupled, do not ground. Leave open or use DC block.
7 – 12	GND	Ground - Common
13	RF Aux 2	Optional 2 MHz to 6 GHz RF port that can be used for external filtering or connected to Pin 6 for a filter bypass path. 50 ohms – DC coupled, do not ground. Leave open or use DC block.
14 – 15	GND	Ground - Common
16	RF 2	RF Port 2 - 2 MHz to 6 GHz – 50 ohms – DC coupled. External AC coupling capacitor required.
17	GND	Ground - Common
18	Vcc	+3.3V to +5.0V DC Power Input
19	Band Sel A_2#	Complement of Filter Band Select A_2
20	Band Sel A_2	Filter Band Select A_2
21	Band Sel A_1#	Complement of Filter Band Select A_1
22	Band Sel A_1	Filter Band Select A_1
23	Band Sel A_0#	Complement of Filter Band Select A_0
24	Band Sel A_0	Filter Band Select A_0

AM3090

Pin Number	Name	Function
1	L6A	External Inductor L6 Connection
2	L6B	External Inductor L6 Connection
3	L2A	External Inductor L2 Connection
4	L2B	External Inductor L2 Connection
5	L5A	External Inductor L5 Connection

6	L5B	External Inductor L5 Connection
7	GND	Ground - Common
8	L4A	External Inductor L4 Connection
9	L4B	External Inductor L4 Connection
10	L1A	External Inductor L1 Connection
11	L1B	External Inductor L1 Connection
12	GND	Ground - Common
13	L3A	External Inductor L3 Connection
14	L3B	External Inductor L3 Connection
15	GND	Ground - Common
16	RF 1	RF Port 1 - 50 ohms, DC coupled. External AC coupling capacitor required.
17	GND	Ground - Common
18	L7A	External Inductor L7 Connection
19	L7B	External Inductor L7 Connection
20	GND	Ground - Common
21	VDD_SW1	+5.0V DC Power Input
22	CTL_SW1	Control Line for Switch 1
23	VDD_HPF	+5.0V DC Power Input
24	HPF_A	Highpass Filter Control Bit A
25	HPF_B	Highpass Filter Control Bit B
26	HPF_C	Highpass Filter Control Bit C
27	HPF_D	Highpass Filter Control Bit D
28	VDD_SW2	+5.0V DC Power Input
29	CTL_SW2	Control Line for Switch 1
30	VDD_LPF	+5.0V DC Power Input
31	LPF_A	Lowpass Filter Control Bit A
32	LPF_B	Lowpass Filter Control Bit B
33	LPF_C	Lowpass Filter Control Bit C
34	LPF_D	Lowpass Filter Control Bit D
35	GND	Ground - Common
36	GND	Ground - Common
37	RF 2	RF Port 2 – 50 ohms, DC coupled. External AC coupling capacitor required.
38	GND	Ground - Common
39	L8A	External Inductor L8 Connection
40	L8B	External Inductor L8 Connection

AM6020 (optional)

Pin Number	Name	Function
1-7	GND	Ground – Common
8	LO Out 2B	LO Output – 50 ohms – External DC blocking capacitor required.
9	GND	Ground – Common
10	Sw2Vdd	+3.3V DC supply for switch 2
11	Sw2CTL	Control line for switch 2
12	GND	Ground – Common
13	LO Out 2A	LO Output – 50 ohms – External DC blocking capacitor required.
14-17	GND	Ground – Common
18	LO Out 1A	LO Output – 50 ohms – External DC blocking capacitor required.
19	GND	Ground – Common
20	Sw1Vdd	+3.3V DC supply for switch 1
21	Sw1CTL	Control line for switch 1
22	GND	Ground – Common
23	LO Out 1B	LO Output – 50 ohms – External DC blocking capacitor required.
24	GND	Ground – Common
25	AmpVdd2	LO driver amp bias line #2. Connect to +3.3V through a DC filter. 62mA typical.
26	AmpVdd1	LO driver amp bias line #1. Connect to +3.3V through a DC filter. 31mA typical.
27	ExtLOSwVdd	+3.3V DC supply for external LO input switch
28	ExtLOSwCTL	Control line for external LO input switch
29	GND	Ground – Common
30	Term	50 ohm termination port – Connect 50 ohm termination to ground.
31	ExtLOIn	External LO Input – 50 ohms – External DC blocking capacitor required.
32	GND	Ground – Common
33	IntLOSwVdd	+3.3V DC supply for internal LO switch
34	IntLOSwCTL	Control line for internal LO switch
35-36	GND	Ground – Common
37	LOIn	Primary LO Input port – 50 ohms – External DC blocking capacitor required.
38-40	GND	Ground – Common
Case GND	CG	Ground - Common

AM7070

Pin Number	Name	Function
1	PFD_CS _n	CS _n line for PFD SPI bus
2	PFD_MOSI	MOSI line for PFD SPI bus
3-5	GND	Ground – Common
6	PFD_SCLK	Clock line for PFD SPI bus
7	PFD_MISO/LD	MISO line for PFD SPI bus OR lock detect bit. Typically configured as Lock Detect.
8	+21V	+21V input pin. <5 mA typical
9	+3.3V	+3.3V input pin. 140mA typical
10-17	GND	Ground – Common
18	+5V	+5V input pin. 60mA typical
19-31	GND	Ground – Common
32	REF In	250 MHz Reference input. +6dBm nominal
33-56	GND	Ground – Common
57	LO Out	7.6 – 13.5 GHz RF Output. -10dBm typical, -13dBm min
58-68	GND	Ground – Common
Case GND	CG	Ground – Common

AM7071

Pin Number	Name	Function
1	500MHz Out	500 MHz RF Output. +0 dBm typical
2-3	GND	Ground – Common
4	500 MHz PLL Out	500 MHz Output from PLL. This pin is connected to pin 5 for normal operation
5	500 MHz In	500 MHz Input. Input pin for an external 500 MHz or the 500 MHz PLL output from pin 4. This pin is connected to pin 4 for normal operation.
6-24	GND	Ground – Common
25	+3.3V_250 MHz	+3.3V input that powers the 250 MHz generation circuitry
26-30	GND	Ground – Common
31	250 MHz Out A	250 MHz RF Output. +9 dBm typical. Terminate with 50 ohms if not used. DC coupled.
32-35	GND	Ground – Common
36	250 MHz Out B	250 MHz RF Output. +9 dBm typical. Terminate with 50 ohms if not used. DC coupled.
37	GND	Ground – Common

38	Lock Detect	Lock Detect output indicator for 500 MHz PLL
39	Clk	Clock input for PLL SPI bus
40	MOSI	MOSI input for PLL SPI bus
41	CSn	CSn input for PLL SPI bus
42	+3.3V PLL	+3.3V input that powers the 500 MHz PLL. This pin can be left open if providing an external 500 MHz to pin 5 instead of using the PLL output from pin 4.
43-45	GND	Ground – Common
46	10 MHz Ref In	Input for 10 MHz reference. -4 dBm (0.4Vp-p) minimum
47-52	GND	Ground – Common
53	Vtune Out	Output tune voltage from PLL. Connect to tune line for external 500 MHz VCO.
54-55	GND	Ground – Common
56	500 MHz VCO In	RF Input from external 500 MHz VCO
57-60	GND	Ground – Common
Case GND	CG	Ground – Common

AM7072

Pin Number	Name	Function
1	500MHz In	500 MHz RF Input. +0 dBm typical. DC coupled.
2-30	GND	Ground – Common
31	2500 MHz Out	2500 MHz RF Output. +1 dBm typical.
32-42	GND	Ground – Common
43	10 GHz Out	10 GHz RF Output. +1 dBm typical
44-49	GND	Ground – Common
50	+5V	+5V input, 52 mA typical
51	GND	Ground – Common
52	+3.3V	+3.3V input, 105mA typical
53-60	GND	Ground – Common
Case GND	CG	Ground - Common

AM8070

Pin Number	Name	Function
1	GND	Ground - Common
2	SA_Vdd	+3.3V supply for Step Attenuator. Needs a single stage Ferrite Bead and Capacitor filter.
3	SA_1dB	Control line for Step Attenuator 1dB attenuation
4	SA_2dB	Control line for Step Attenuator 2dB attenuation
5	SA_4dB	Control line for Step Attenuator 4dB attenuation
6	SA_8dB	Control line for Step Attenuator 8dB attenuation
7	SA_16dB	Control line for Step Attenuator 16dB attenuation
8	GND	Ground - Common
9	C1	RF Bypass Capacitor Connection 1
10	C2	RF Bypass Capacitor Connection 1
11	GND	Ground - Common
12	Amp In	Amplifier RF Input, 50 ohms - DC coupled – DC blocking capacitor required
13-16	GND	Ground - Common
17	CTL	Amplifier / Bypass control. Logic high = amplifier enabled. Logic low = amplifier bypassed
18-19	GND	Ground - Common
20	Vdd1	+3.3V DC Supply
21-22	GND	Ground - Common
23	Amp Out	Amplifier RF Output and Bias Port – 50 ohms - AC coupling cap required
24-25	GND	Ground - Common
26	SA In	Step Attenuator RF Input. This pin receives its input from pin 23 after a DC blocking capacitor. DC coupled.
27	ACG1	AC Ground 1. Connect 0.1uF capacitor to ground.
28	ACG2	AC Ground 2. Connect 0.1uF capacitor to ground.
29	ACG3	AC Ground 3. Connect 0.1uF capacitor to ground.
30	ACG4	AC Ground 4. Connect 0.1uF capacitor to ground.
31	ACG5	AC Ground 5. Connect 0.1uF capacitor to ground.
32	ACG6	AC Ground 6. Connect 0.1uF capacitor to ground.
33	GND	Ground - Common
34	SwOut 1	Switch RF Output 1. 50 ohms - DC coupled – DC blocking capacitor required
35	Sw Vdd	+3.3V DC supply for the output RF switch
36	SwCtrl	Control line selects RF output path between bypass and RF converter paths
37	GND	Ground - Common
38	SwOut 2	Switch RF Output 2. 50 ohms - DC coupled – DC blocking capacitor required
39-40	GND	Ground - Common

Case GND	CG	Ground – Common
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AM8080

Pin Number	Name	Function
1-11	GND	Ground – Common
12	RF In	20 MHz – 6 GHz RF Input. DC coupled.
13	GND	Ground – Common
14	AmpRb	Bias selection pin for the input amplifier. Ground for 3.3V/35mA operation.
15	GND	Ground – Common
16	AmpOut	Input Amplifier output. Provide amplifier bias on this pin through a RF choke. After the choke connect this pin to a DC block and then to pin 18.
17	GND	Ground – Common
18	LPFln	Low pass filter input. Receives its input from pin 16 through after the RF choke and DC block.
19-23	GND	Ground – Common
24	RF Out	7.57 GHz RF Output. AC Coupled
25	GND	Ground – Common
26	7.57FilterIn	RF Input to 7.57 GHz filter. AC coupled. This pin gets its input from pin 27 after a RF choke.
27	Amp2Out	7.57 GHz RF output from second amplifier. The amplifier bias is provided on this pin through a RF choke. After the choke connect this pin to pin 26. DC coupled.
28-29	GND	Ground – Common
30	Amp2In	RF Input for 7.57GHz amplifier. This pin gets its input from pin 30 after a DC blocking capacitor.
31	MixRFOut	Output from mixer RF port. Connect to a DC blocking capacitor and then to pin 30
32-33	GND	Ground – Common
34	LODriveVdd2	LO driver amp bias line #2. Connect to +3.3V through a DC filter. 62mA typical.
35	GND	Ground – Common
36	LODriveVdd1	LO driver amp bias line #1. Connect to +3.3V through a DC filter. 31mA typical.
37-38	GND	Ground – Common
39	LO_In	LO Input pin. 7.6 – 13.4 GHz RF input. AC coupled. +0dBm nominal.
40-48	GND	Ground – Common
Case GND	CG	Ground – Common

AM8081

Pin Number	Name	Function
1	RF In	7.57 GHz RF Input. DC coupled
2-3	GND	Ground – Common
4	Amp1Rb	Connect to GND for +3.3V/35mA operation.
5	GND	Ground – Common
6	Amp1Out	RF output for Amp1. The amplifier bias is provided to this pin through a RF choke. After the choke connect to a DC blocking capacitor and then to pin 7.
7	MixRFIn	RF input for the mixer. This pin receives its input after the DC block connected to pin 6. DC coupled.
8-9	GND	Ground – Common
10	LODriveVdd2	LO driver amp bias line #2. Connect to +3.3V through a DC filter. 62mA typical.
11	GND	Ground – Common
12	LODriveVdd1	LO driver amp bias line #1. Connect to +3.3V through a DC filter. 31mA typical.
13	LO_In	LO Input. 10 GHz, AC coupled. +0 dBm nominal.
14	GND	Ground – Common
15	SwVdd	+3.3V supply for Auxiliary IF selection switch. Needs a single stage Ferrite Bead and Capacitor filter.
16	SwCtrl	Control line for Auxiliary IF selection switch. Needs a single stage R-C filter.
17	SA_1dB	Control line for Step Attenuator 1dB attenuation
18	SA_2dB	Control line for Step Attenuator 2dB attenuation
19	SA_4dB	Control line for Step Attenuator 4dB attenuation
20	SA_8dB	Control line for Step Attenuator 8dB attenuation
21	SA_16dB	Control line for Step Attenuator 16dB attenuation
22	SA_Vdd	+3.3V supply for Step Attenuator. Needs a single stage Ferrite Bead and Capacitor filter.
23	GND	Ground – Common
24	RF Out	2.44 GHz RF Output. DC coupled.
25	GND	Ground – Common
26	Amp2Ctrl	Control line for bypassable amplifier. Needs a single stage R-C filter. Controls both RF path selection and amplifier power.
27	Amp2SwVdd	+3.3V supply for bypassable amplifier selection switch. This voltage needs to be connected through a RF choke to pin 34 to power the bypassable amplifier. +3.3V operation (Amp2Rb is open).
28-29	GND	Ground – Common
30	SA_In	Step Attenuator RF Input. This pin receives its input from pin 34 after a DC blocking capacitor. DC coupled.
31-33	GND	Ground – Common

34	Amp2Out	RF Output from bypassable amplifier. Needs to have an RF choke (ferrite bead and capacitor) that receives its voltage from pin 27. After the choke this pin is connected through a DC blocking capacitor to pin 30. DC coupled.
35-36	GND	Ground – Common
37	AuxIFIn	Auxiliary 2.44 GHz IF Input. DC coupled.
38-39	GND	Ground – Common
40	Amp2Rb	Leave this pin unconnected (open) for +3.3V/65mA operation.
41-48	GND	Ground – Common
Case GND	CG	Ground – Common

AM8082

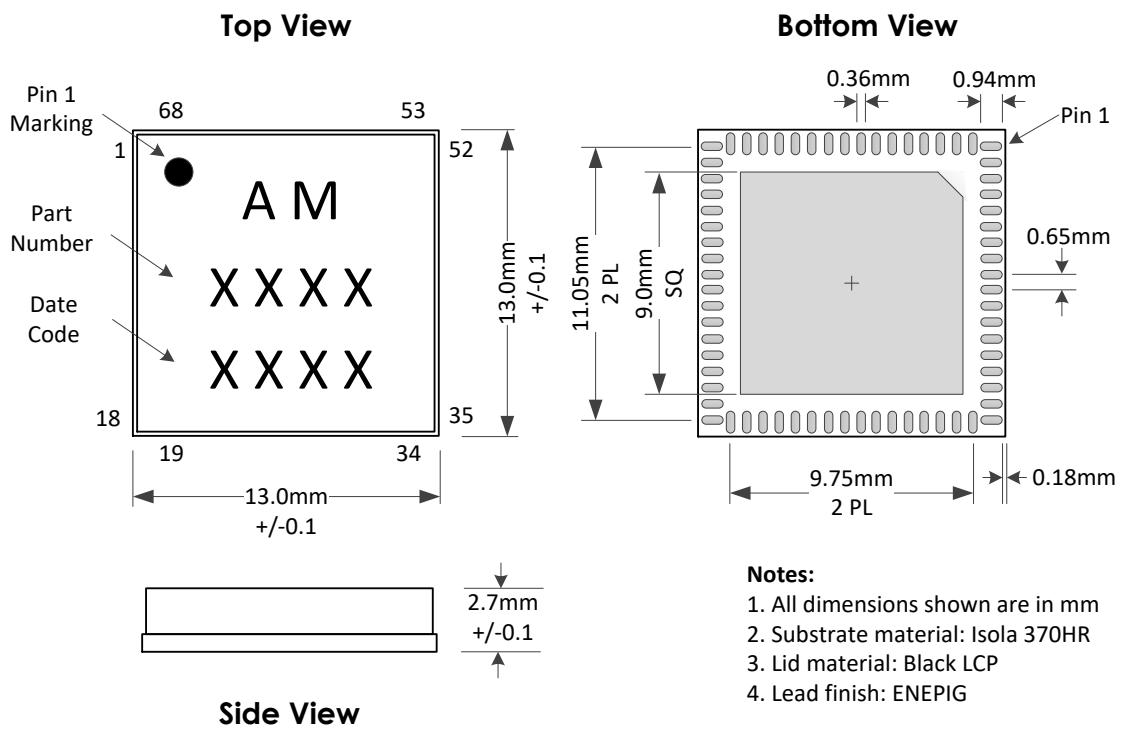
Pin Number	Name	Function
1-6	GND	Ground – Common
7	RF In	2.44 GHz RF Input. AC coupled.
8-15	GND	Ground – Common
16	LO In	2.5 GHz LO Input. +0 dBm nominal. AC Coupled.
17-29	GND	Ground – Common
30	SwCtrl	Control line selects between RF path from pin 60 and RF path from pin 7.
31	+3.3V	Voltage for amplifier and RF switch. 65 mA typical.
32-45	GND	Ground – Common
46	RF Out	20-100 MHz RF Output. AC Coupled
47-59	GND	Ground – Common
60	LowBandIn	Low Band RF Input. 2-100 MHz operation.
Case GND	GND	Ground – Common

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MCM Package Details

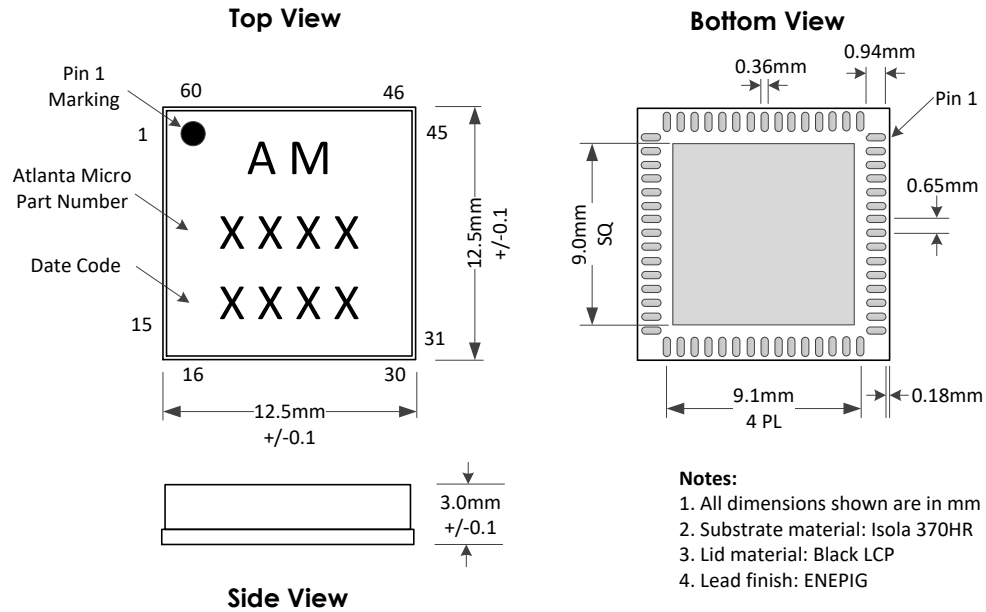
AM7070 13mm QFN, 68 pins



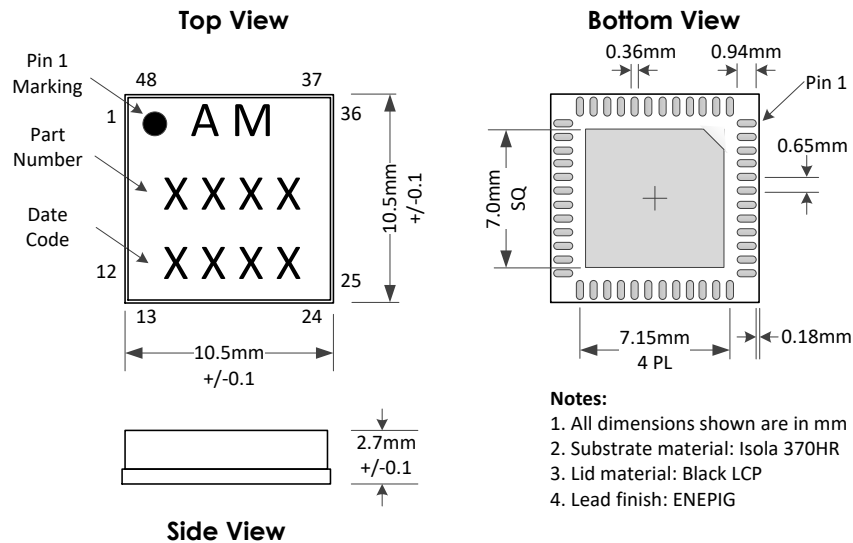
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AM7071, AM7072, AM8082 12.5mm QFN, 60 pins



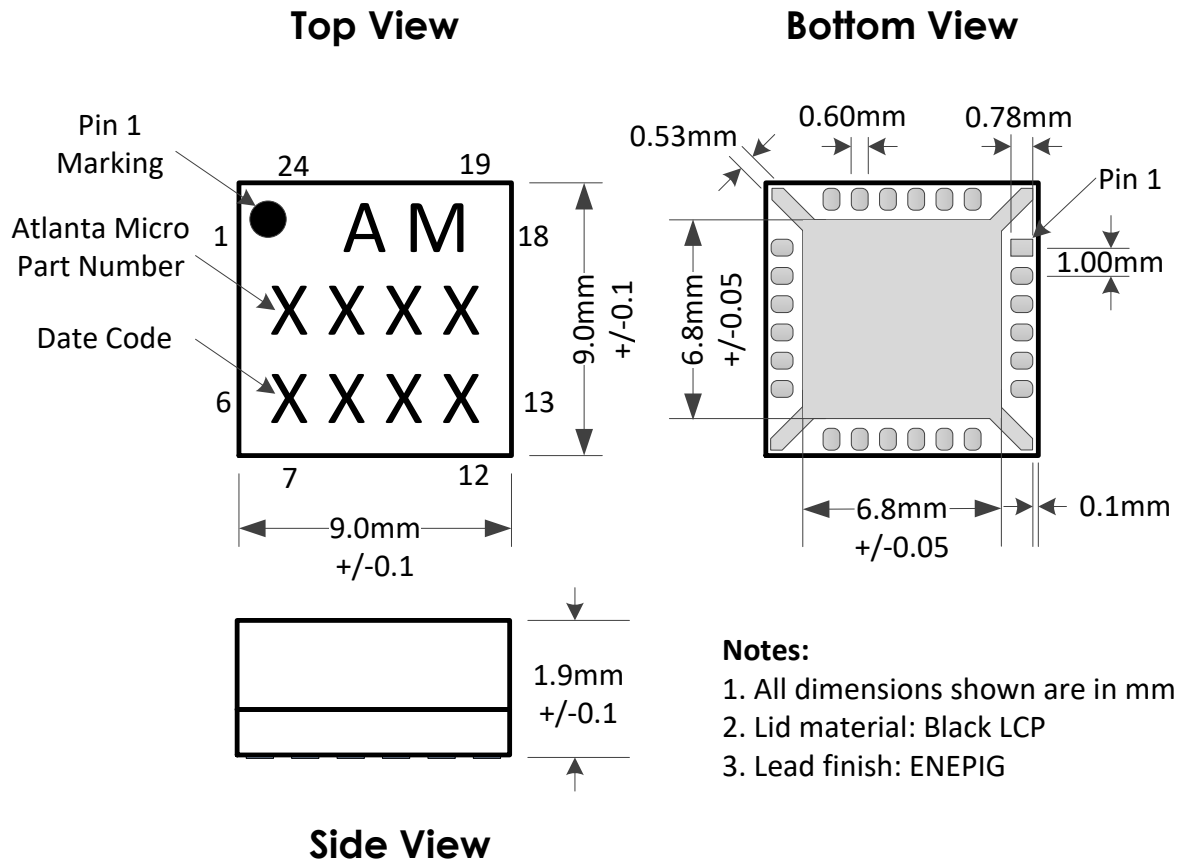
AM8081: 10.5mm QFN



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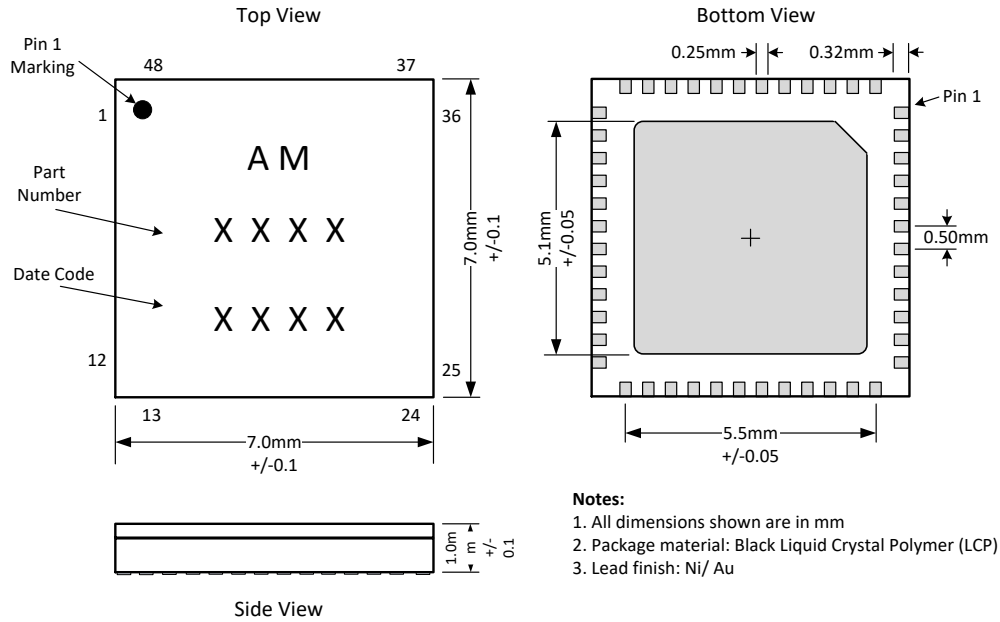
AM3025A: 9mm QFN, 24 pins



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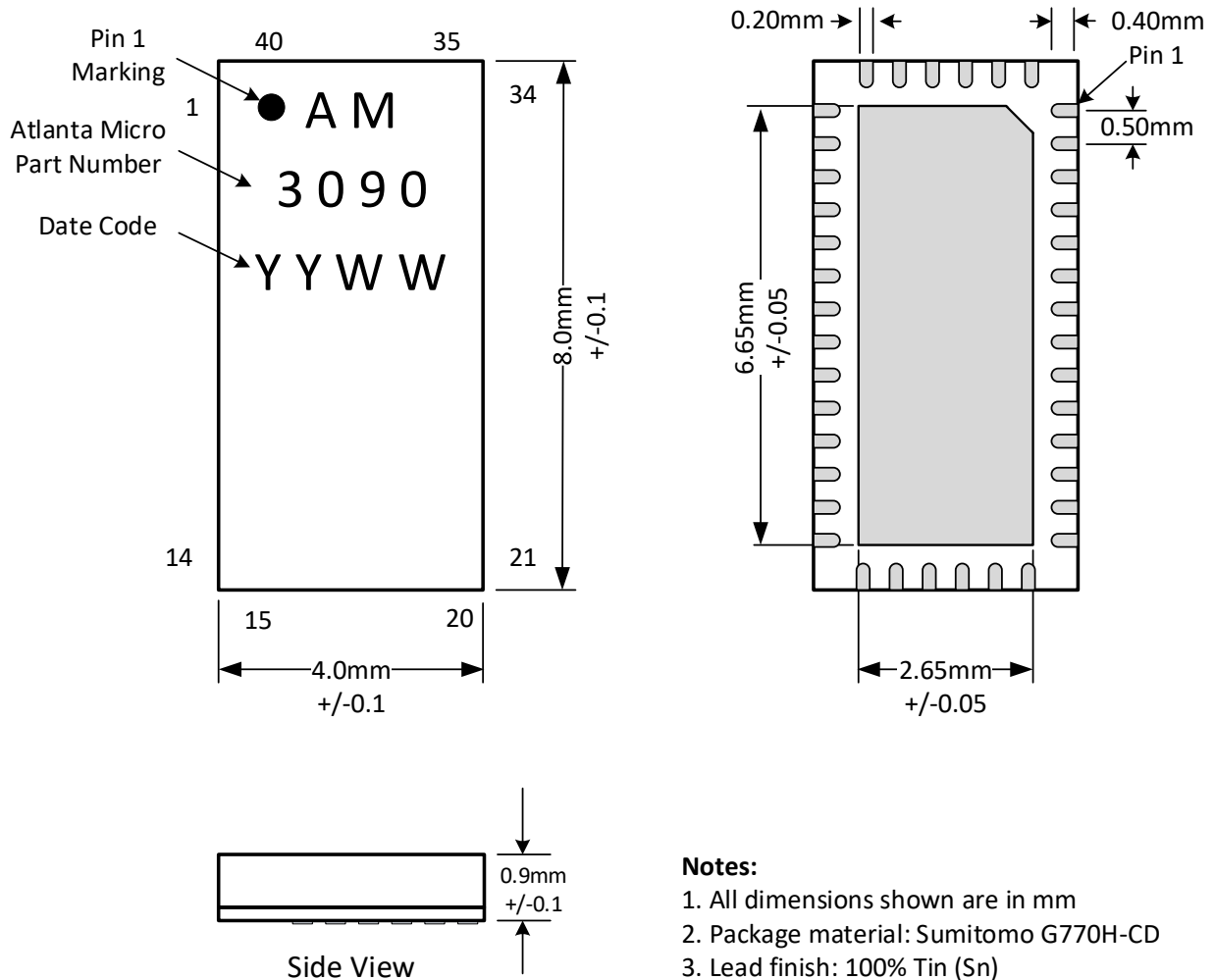
AM8080: 7mm QFN, 48 pins



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AM3090 and AM8070: 4 x 8mm QFN, 40 pins



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AM6020: 6mm QFN, 40 pins

