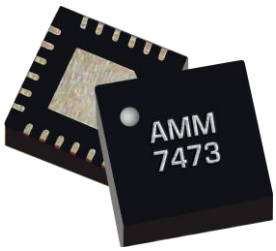
0.4 - 27 GHz Surface Mount Amplifier AMM-7473PSM

1. Device Overview



1.1 General Description

The AMM-7473PSM is a high-linearity, low noise distributed amplifier that can provide +25 dBm output power across its 400 MHz to 27 GHz band and features excellent gain flatness. The AMM-7473PSM can serve either as a linear signal amplifier, or as a saturated driver amplifier for H- or S-diode mixers. Additionally, the AMM-7473PSM incorporates an internal choke inductor which eliminates the need for an external bias tee.

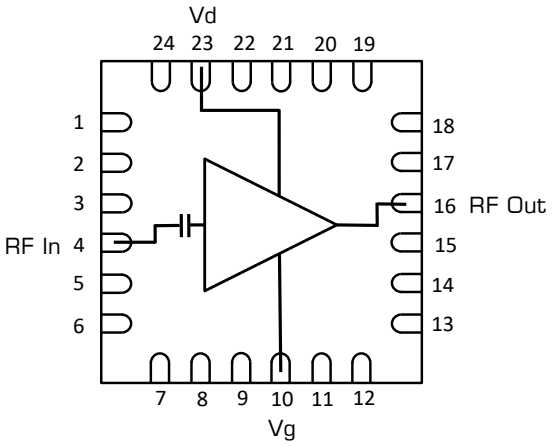
1.2 Features

- +25 dBm output power
- 17 dB gain
- Gain flatness
- No external bias tee required
- .s2p S-Parameters: AMM-7473PSM

1.3 Applications

- Mobile test and measurement equipment
- Radar and satellite communications
- Driver amplifier H & S – diode mixers

1.4 Functional Block Diagram



1.5 Part Ordering Options[1]

Part Number	Description	Package	Green Status	Product Lifecycle	Export Classification
AMM-7473PSM	4x4 mm Surface Mount	QFN	**RoHS**	Released	EAR99
EVB-AMM-7473P	Connectorized Evaluation Fixture	EVAL	**RoHS**	Released	EAR99

[1] Refer to our website for a list of definitions for terminology presented in this table.

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Table of Contents

Revision History

Revision Code	Revision Date	Comment
-	August 2022	Initial Release

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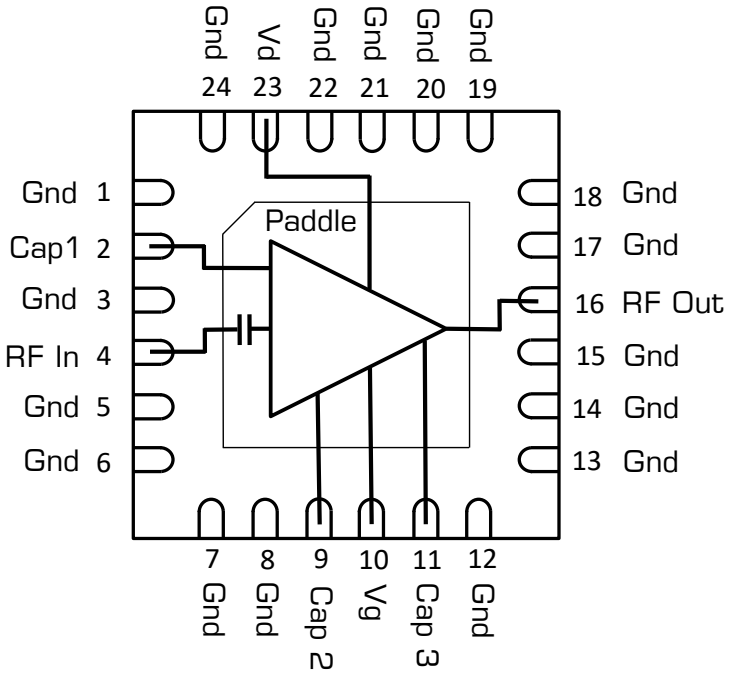
2. AMM-7473 Port Configurations and Functions

2.1 AMM-7473PSM Port Diagram

A port diagram of the AMM-7473PSM QFN package is shown below (X-ray view from the top). The pin functions are detailed in section 2.2 of this datasheet.



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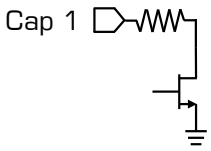
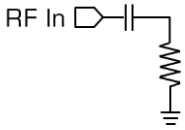
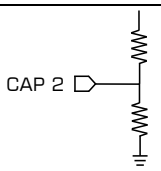
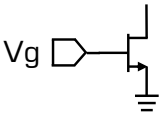
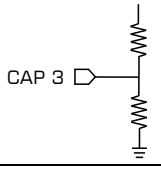
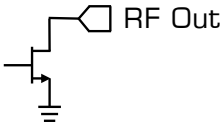
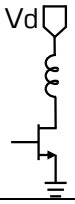
2.2 AMM-7473PSM Port Functions

Pin	Function	Description	Equivalent Circuit for Package
2	Cap 1	Pin 2 allows the user to attach additional off chip bypass capacitance to provide adequate low frequency AC grounding termination to the input matching network. The value should be at least 100 nF.	
4	RF Input	Pin 4 is the RF Input port of the amplifier die. It is internally DC blocked and RF matched to 50 Ω. RF input pad is GSG with 150 µm pitch.	
9	Cap 2	Pin 9 is connected to internal bias circuitry and should be AC grounded through an off-chip bypass capacitor. The value should be at least 100 nF. This pin should not be directly connected to ground.	
10	Vg	Pin 10 provides a required negative bias which controls the power supply currents to the amplifier. More negative voltages decrease supply current. **Apply gate bias voltage Vg before applying drain power supply.**	
11	Cap 3	Pin 11 is connected to internal bias circuitry and should be AC grounded through an off-chip bypass capacitor. The value should be at least 100 nF. This pin should not be directly connected to ground.	
16	RF Output	Pin 16 is the RF Output port of the amplifier. It is DC coupled, and RF matched to 50 Ω. An external DC blocking capacitor is required.	
23	Vd	Pin 23 provides the main power supply for the amplifier. **Apply gate bias voltage Vg before applying drain power supply.**	
1,3, 5-8, 12-15, 17-22, 24, Paddle	Gnd	These pins should be connected to ground. Package ground paddle must be connected to a DC/RF ground potential with high thermal and electrical conductivity.	

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3. Specifications

3.1 Absolute Maximum Ratings

The Absolute Maximum Ratings indicate limits beyond which damage may occur to the device. If any one of these limits are exceeded, the device may become inoperable or have a reduced lifetime.

Parameter	Maximum Rating	Units
Drain Supply Voltage (Vd)	+10	V
Drain Current (RF Applied)	550	mA
Gate Voltage (Vg)	+0.5	V
RF Input Power	+18	dBm
Operating Temperature for MTTF > 1E6 hours	-55 to +85	°C
Storage Temperature	-65 to +150	°C
θ_{Jc}, Junction to Case Thermal Resistance	23	°C/W
Max Junction Temperature for MTTF > 1E6 hours	175	°C
Max Power Dissipation for MTTF of 1E6 hours at 85°C Baseplate Temperature	3.9	W

3.2 Package Information

Parameter	Details	Rating
Weight	AMM-7473PSM	0.05 g

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3.3 Recommended Operating Condition

Datasheet operating parameters are taken and guaranteed using constant voltage biasing with T_A = 25 °C, Vd = 7 V, Idq = 150 mA, and 50 Ω matched input and output. Adjust Vg from –1 V to -0.5 V max to achieve Idq = 150 mA typical. Operation with Vd = 5 V and lower Idq will provide comparable gain and NF to Vd = 7 V but with lower power consumption and linearity.

3.4 Supply Sequencing Requirements

Turn-on Procedure if required biases are unknown:

1) Apply -1 V to Vg.
2) Apply desired Vd.
3) Increase Vg voltage towards -0.5 V until Id = 150 mA.
4) Apply RF input power.

Turn-on Procedure if required biases are known:

1) Apply desired Vg (previously determined to produce 150 mA Idq).
2) Apply desired Vd.
3) Apply RF input power.

Turn-off Procedure:

1) Turn off RF input power.
2) Turn off Vd.
3) Turn off Vg.

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3.5 Electrical Specifications

Unless otherwise specified, electrical specifications apply at T_A=+25°C, Vd = 7 V, Idq=150 mA (where Idq is the drain current with no RF applied), Vg set as required to achieve Idq = 150 mA in a 50 Ω system.

Min and Max limits apply only to our connectorized units and are guaranteed at T_A=+25°C

Parameter	Test Conditions	Frequency	Min	Typical	Units
Saturated Output Power	Vd = 7 V, Vg set to achieve Idq = 150 mA, Pin = +15 dBm	0.4 GHz – 27 GHz	+23	+25	dBm
Input Power for Saturation	Vd = 7 V, Vg set to achieve Idq = 150 mA	0.4 GHz – 27 GHz		+11	dBm
Small Signal Gain	Vd = 7 V, Vg set to achieve Idq = 150 mA, Pin = -20 dBm	0.4 GHz – 20 GHz	14	17	dB
		20 GHz – 27 GHz	12	15	
Input Return Loss		0.4 GHz – 27 GHz	9		
Output Return Loss			8		
Reverse Isolation				40	
Noise Figure		2 GHz – 5 GHz		2.9	
		5 GHz – 15 GHz		1.8	
		15 GHz – 27 GHz		3.6	
Input IP3	Vd = 7 V, Vg set to achieve Idq = 150 mA, Pin = -15 dBm per tone, 10 MHz tone spacing	0.4 GHz – 27 GHz		18	dBm
Output IP3		0.4 GHz – 27 GHz		34	
DC Supply Quiescent Current (Idq)	Vd = 7 V, Vg = -0.65 V, no RF input applied			150	mA

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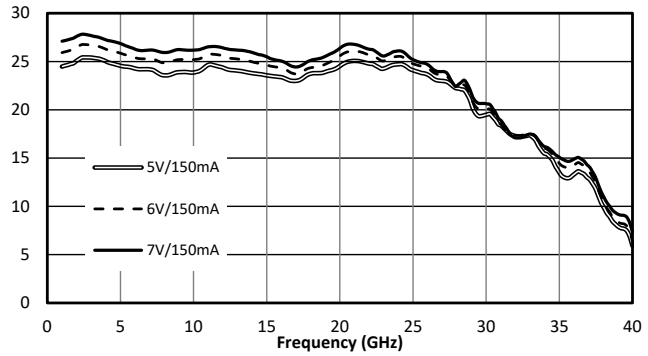
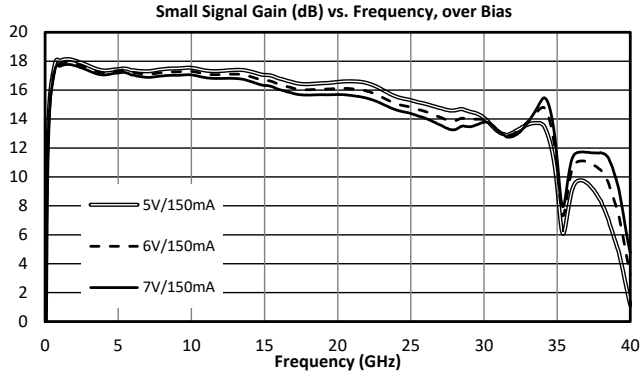
3.6 AMM-7473PSM Typical Performance Plots

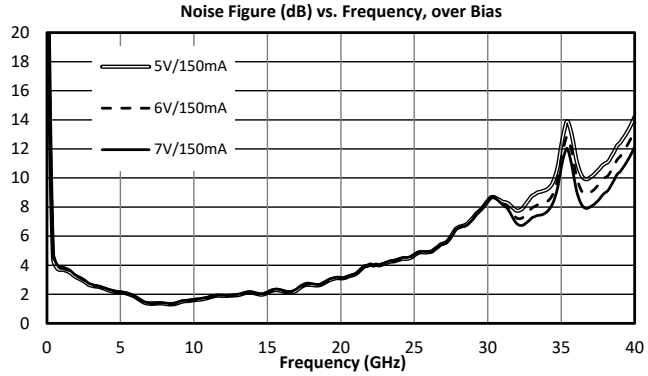
Psat (dBm) vs. Frequency, over Bias



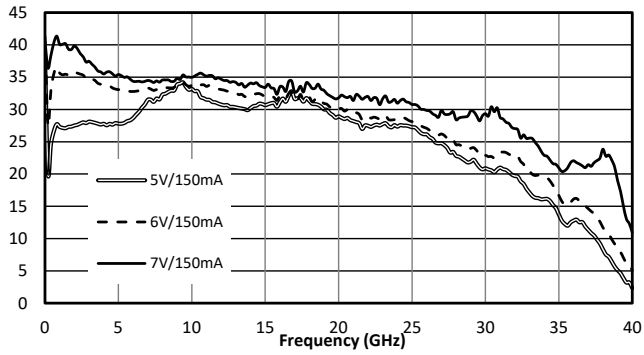
Small Signal Gain (dB) vs. Frequency, over Bias



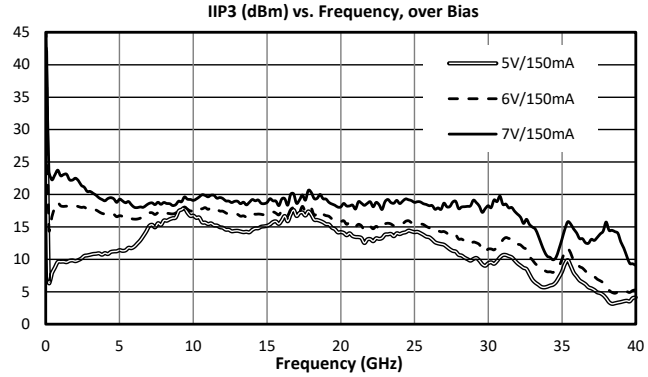
Noise Figure (dB) vs. Frequency, over Bias



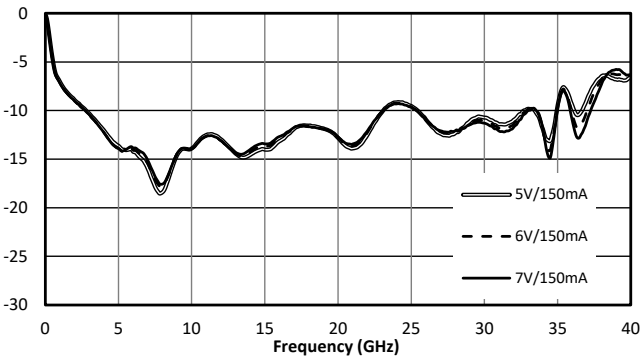
OIP3 (dBm) vs. Frequency, over Bias



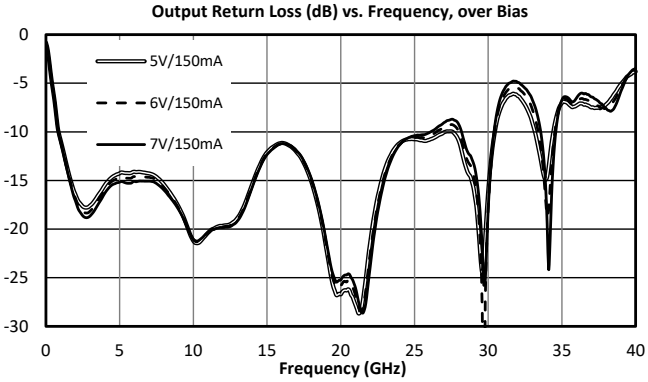
IIP3 (dBm) vs. Frequency, over Bias



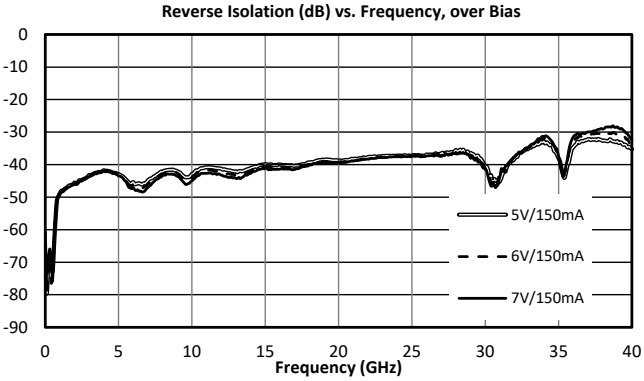
Input Return Loss (dB) vs. Frequency, over Bias



Output Return Loss (dB) vs. Frequency, over Bias



Reverse Isolation (dB) vs. Frequency, over Bias



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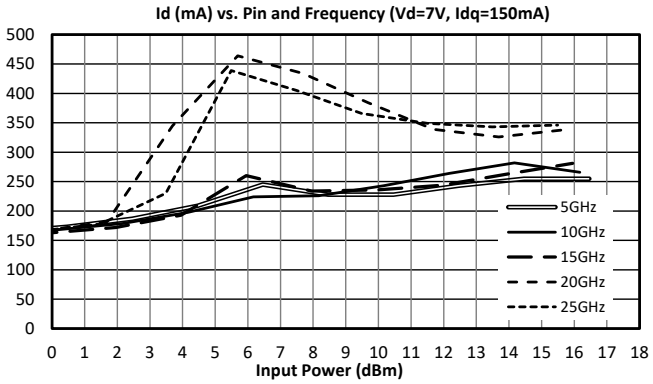

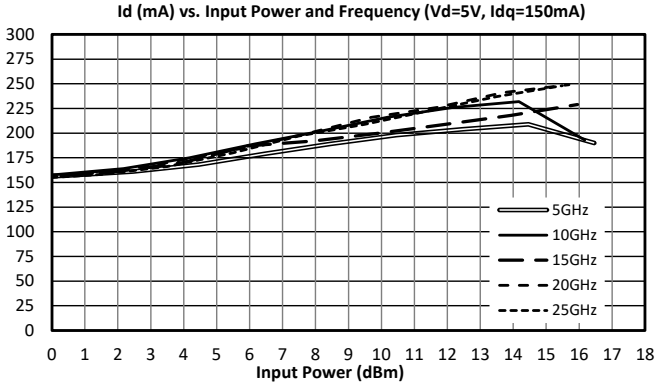

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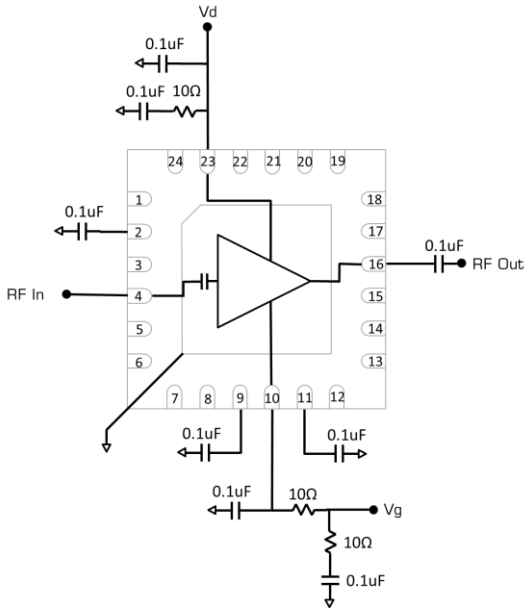
4. Application Information

4.1 Application Circuit

Below is the recommended application circuit for the AMM-7473PSM. All external components are 0201 (Imperial) sized surface mount components.



4.2 Bypassing Circuitry

The bypass capacitors on Cap1,2 and 3 (pins 2, 9 and 11) provide an AC ground to internal circuits on the chip. To prevent disruption of the internal biasing circuits or outright damage to the chip, these pins should not be DC coupled to ground. The value should be at least 100 nF to provide adequate AC grounding. Additional 100 nF bypass capacitors should be added to the Vd and Vg lines to stabilize the amplifier and prevent power supply feedback to other parts on the board. A 10 Ω series resistor on the Vg line is also preferred to ensure stable operation across all potential operating conditions. It is recommended to use a broadband capacitor on the RF Out pin to minimize high frequency insertion loss. For more detailed information or specific use recommendations, contact support@markimicrowave.com.

4.3 Power Supply and Biasing Circuitry

An internal choke inductor eliminates the need for an external bias tee at the RF Output Port. The main power supply is provided through Vd (pin 23). The power supply should be designed to provide a low noise, constant voltage supply with between 150 and 450 mA. For linear signal operation the current should remain fixed at 150 mA. For saturated LO driver operation the current consumption will increase and depend on operating conditions including input power, frequency, temperature, and bias/power supply voltages. Current should be limited to 450 mA by reducing Vg (more negative) or Vd.

The network attached to the Vg pin should have an impedance of not more than 500 Ω. The current leaving the Vg pin will vary with RF input drive level and can reach up to 1 mA when the amplifier is being used as an LO driver. This could cause an un-intended increase in Vg (less negative) if the Vg pin is being supplied by a high impedance network.

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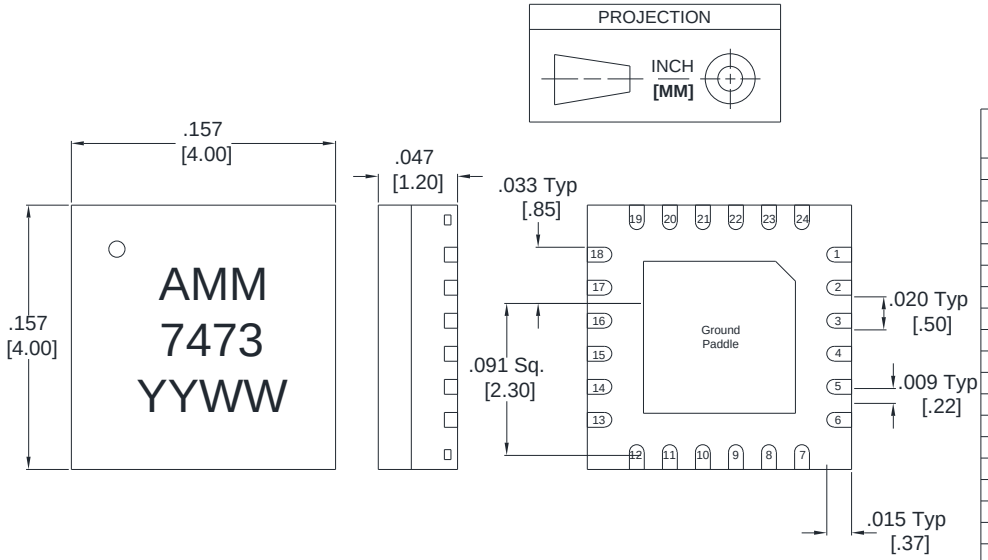
5. Mechanical Data

5.1 AMM-7473PSM Package Outline Drawing



Pin #	Config A
1	GND
2	CAP 1
3	GND
4	RF In
5	GND
6	GND
7	GND
8	GND
9	CAP 2
10	Vg
11	CAP 3
12	GND
13	GND
14	GND
15	GND
16	RF Out
17	GND
18	GND
19	GND
20	GND
21	GND
22	GND
23	Vd
24	GND

1) Substrate material is LCP
2) I/O Leads and Die Paddle is (from base to finish):
    a. Ni: 0.5 um MIN
    b. Pd: 0.02 um MIN
    c. Au: 0.05 um MAX

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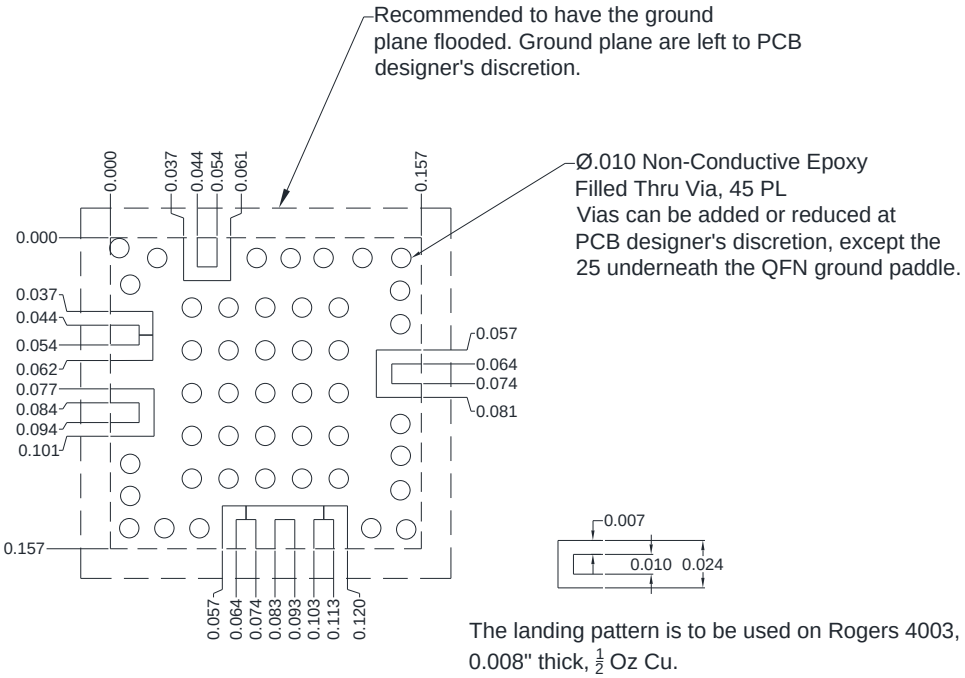
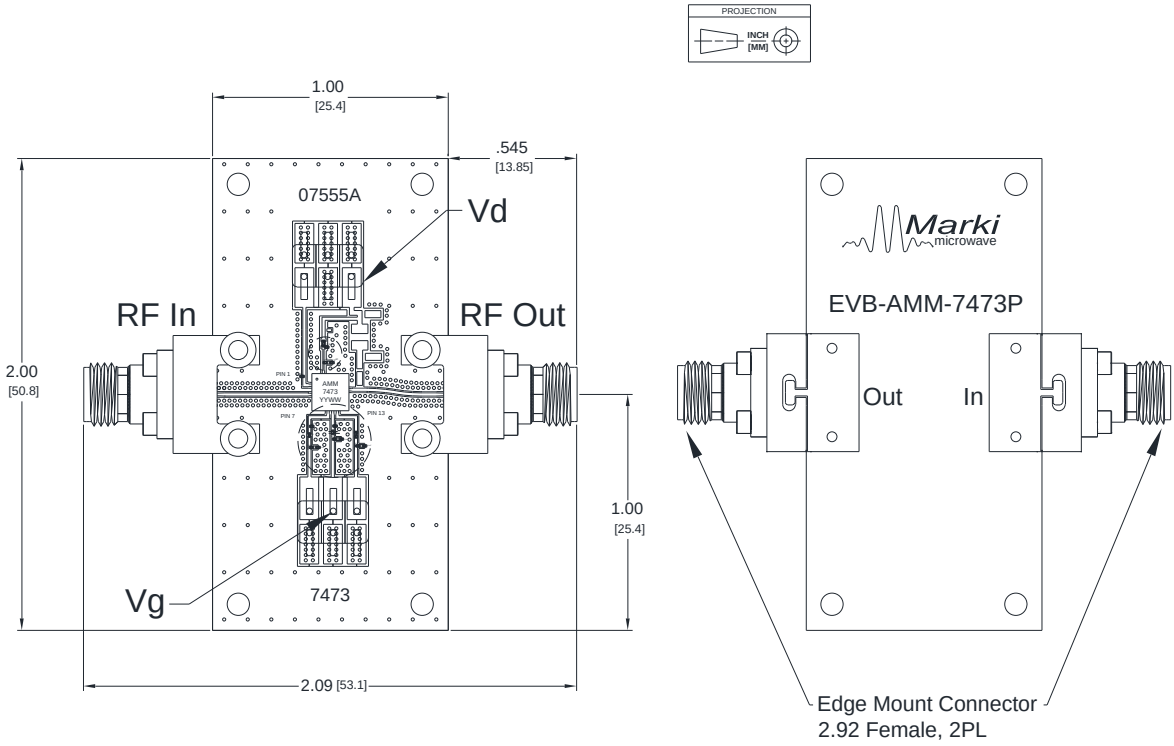
5.2 AMM-7473PSM Recommended Landing Pattern



Note: Additional pins may be added or defined in soldermask to help with self-alignment of the package during assembly.

5.3 EVB-AMM-7473P Outline Drawing



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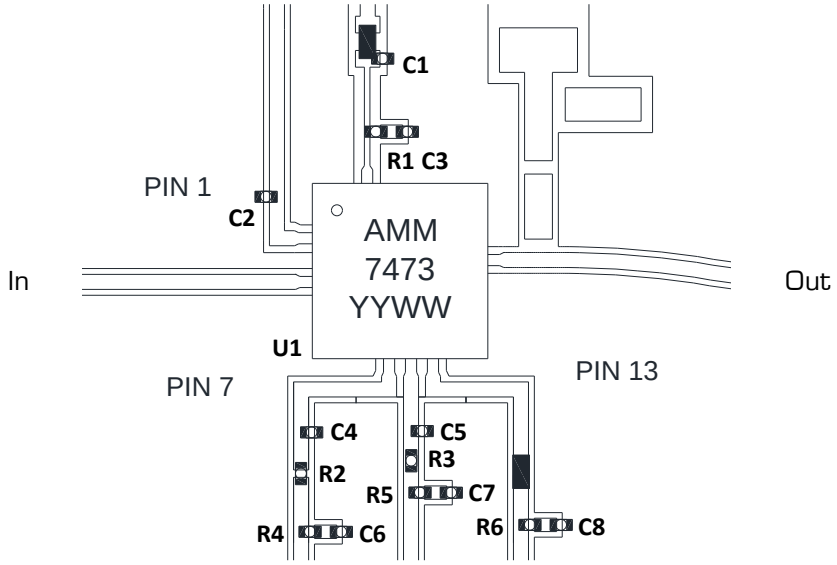
5.4 EVB-AMM-7473P Bill of Materials



Reference	Part Number	Manufacturer	Description	Qty
In, Out	1492-04A-5	Southwest	Connector, Edge Mount, 2.9mm F	2
C1-C8	GRM033R61A104ME15D	Murata	0201 Cap Cer 0.1 µF 10V X5R	8
R1-R6	ERJ-1GEJ100C	Panasonic	0201 Res 10Ω 5% 1/20W	6
U1	AMM-7473PSM	Marki	0.4-27GHz, 25 dBm Amplifier	1

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