

Features

- Non-Magnetic Laminate Module
- 3T Frequency of 127.74 MHz
- For 50 Ω Source Impedance
- Noise Figure: 0.25 dB
- Gain: 28 dB
- Input Resistance: 1.5 Ω
- Output Impedance: 50 Ω
- Output VSWR: 1.17:1
- Single Voltage Bias: 10 V, 9 mA
- Integrated Active Bias Circuit
- Unconditionally Stable, $k > 1$
- RoHS* Compliant

Applications

- MRI Applications
- Medical
- RF Measurement
- Current Sensor

Description

The MAAL-011237 is a high dynamic range, single stage MMIC LNA module that includes all necessary RF matching elements. The only external component necessary is one bypass capacitor. This LNA module provides excellent low noise performance, low input impedance, and high gain characteristics suitable for multi-channel coil 3T MRI applications.

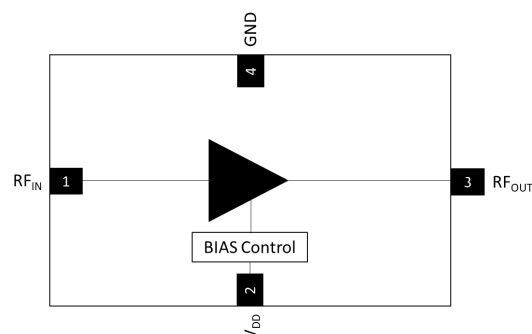
This low noise amplifier has an integrated active bias circuit to minimize variations over temperature and process.

Integrated ESD protection results in a Class 2 HBM rating.

The 0.6" x 0.4" module uses a nonmagnetic laminate with EPIG plating and all nonmagnetic components.

Other frequencies and impedances available upon request.

Functional Block Diagram



Pin Configuration¹

Pin #	Pin Name
1	RF _{IN}
2	V _{DD}
3	RF _{OUT}
4	GND

1. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information^{2,3}

Part Number	Description
MAAL-011237-0G3TR1	100 piece reel, 127.74 MHz
MAAL-011237-0G3TR5	500 piece reel, 127.74 MHz
MAAL-011237-0C3TR1	100 piece reel, 123.1 MHz
MAAL-011237-0C3TR5	500 piece reel, 123.1 MHz
MAAL-011237--0G3SMB	Sample Board, 127.74 MHz
MAAL-011237-0C3SMB	Sample Board, 123.1 MHz

2. Reference Application Note M513 for reel size information.

3. PPR sample boards contain magnetic SMT components.

* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

Pin Descriptions

Pin #	Name	Description
1	RF _{IN}	RF Input, DC blocked in module, ESD protection diodes on pin
2	V _{DD}	Supply Voltage, ESD protection diodes on pin
3	RF _{OUT}	RF Output, DC blocked in module, ESD protection diodes on pin
4	GND	Ground

DC Electrical Specifications: V_{DD} = +10 V, T_C = 25°C

Parameter	Test Conditions	Units	Min.	Typ.	Max.
DC Current I _{DD} (I _{DS} + I _{BIAS})	P _{IN} = -30 dBm	mA	—	8	12.5

Electrical Specifications:

V_{DD} = 10 V, T_C = +25°C, Z_{LOAD} & Z_{SOURCE} = 50 Ω, Tuned for 3T (F₀ = 127.74 MHz)

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Bandwidth	Centered at 127.74 MHz	MHz	—	1	—
Noise Figure	-	dB	—	0.25	—
Gain	-	dB	26.0	28	—
Input Impedance ⁴	Real Z _{in} Imaginary Z _{in}	Ohms	— -2.0	1.5 0	2.0 2.0
Output Return Loss	-	dB	—	22	—
Reverse Isolation	-	dB	—	60	—
Output IP3	P _{OUT} = 0 dBm per tone, 1 MHz & 100 KHz spacing	dBm	—	26	—
Output P1dB	-	dBm	—	17	—

4. Imaginary Z_{in} with test fixture at 78 mm "Delay Dist." of RF input port and 1 Velocity Factor Port Extensions added.

Recommended Operating Conditions

Parameter	Symbol	Unit	Min.	Typ.	Max.
RF Input Power	P_{IN}	dBm	—	-30	-10
DC Supply	V_{DD}	V	5	10	11
Junction Temperature ^{7,8}	T_J	°C	—	—	+150
Operating Temperature ⁹	T_C	°C	0	—	+70

Absolute Maximum Ratings^{5,6}

Parameter	Symbol	Unit	Min.	Max.
RF Input CW Power	P_{IN}	dBm	—	36
RF Input Power, 6% Duty Cycle	P_{IN}	dBm	—	42
DC Supply	V_{DD}	V	—	12
Junction Temperature ^{7,8}	T_J	°C	—	+160
Operating Temperature ⁹	T_C	°C	-40	+85
Storage Temperature	—	°C	-55	+150

5. Exceeding any one or combination of these limits may cause permanent damage to this device.

6. MACOM does not recommend sustained operation near these survivability limits.

7. Operating at nominal conditions with $T_J \leq +150^\circ\text{C}$ will ensure MTTF > 1×10^6 hours.

8. Junction Temperature (T_J) = $T_C + \Theta_{JC} * (V * I)$. Typical thermal resistance (Θ_{JC}) = 97°C/W .

a) For $T_C = +25^\circ\text{C}$,
 $T_J = 34^\circ\text{C}$ @ 10 V, 9 mA

b) For $T_C = +70^\circ\text{C}$,
 $T_J = 79^\circ\text{C}$ @ 10 V, 9 mA

9. Operating temperature is defined at the back of device paddle.

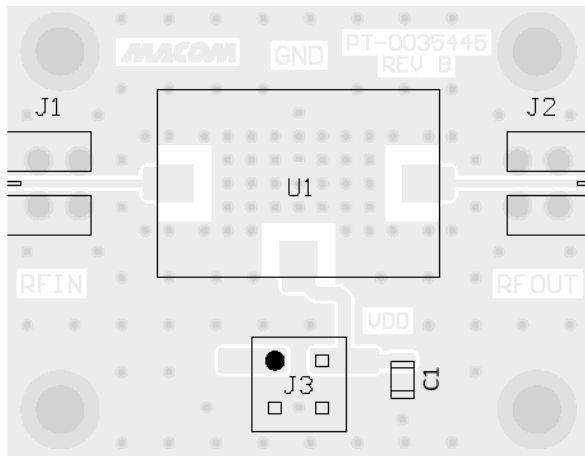
Handling Procedures

Please observe the following precautions to avoid damage:

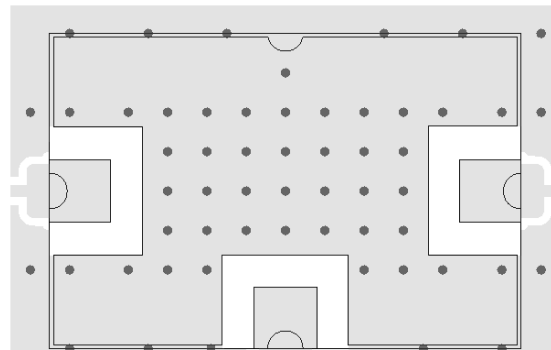
Static Sensitivity

These electronic devices are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 2 devices.

PCB Layout



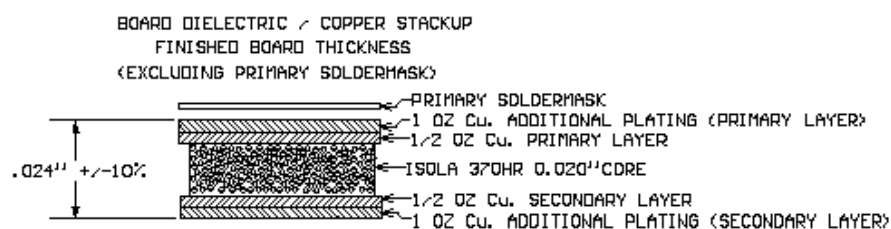
Recommended PCB Land Pattern



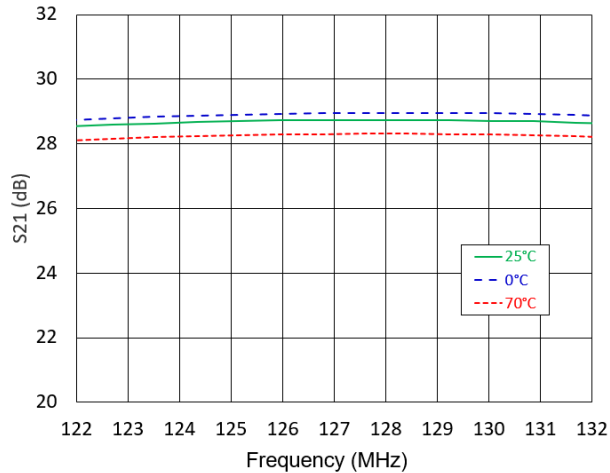
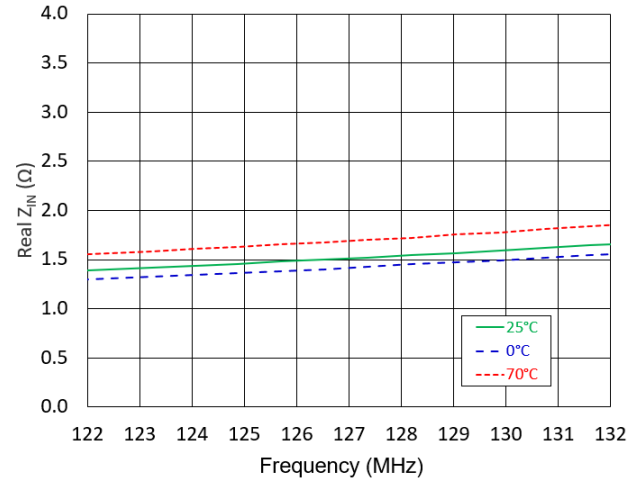
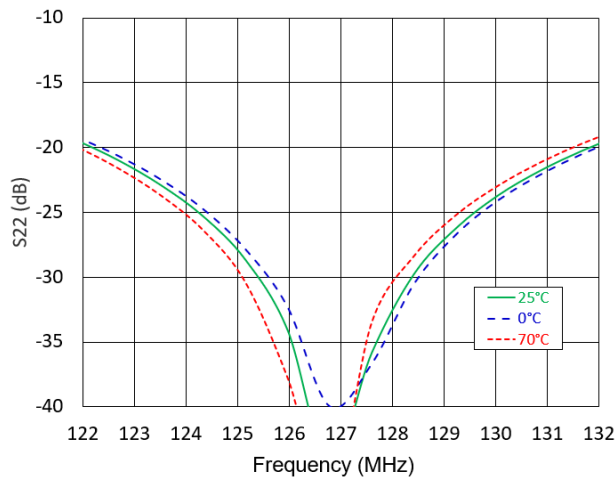
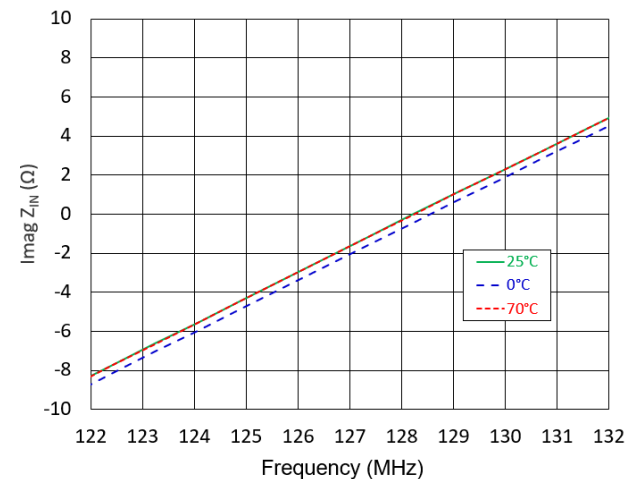
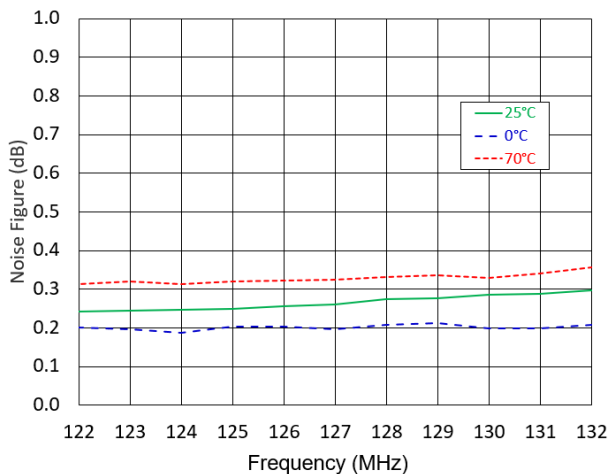
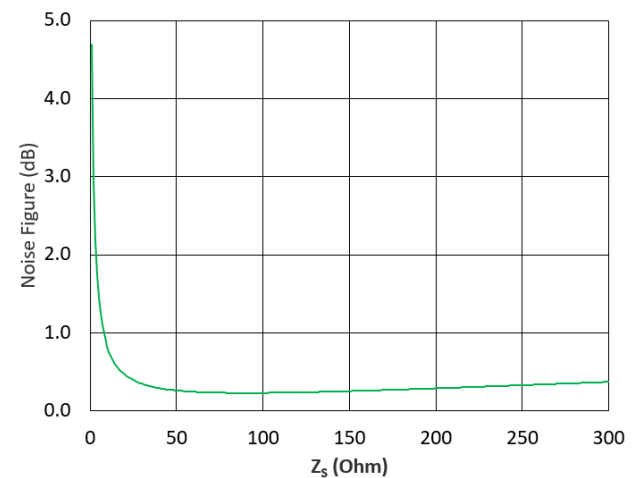
Part List

Part	Value	Case Style
C1	1 μ F	0805

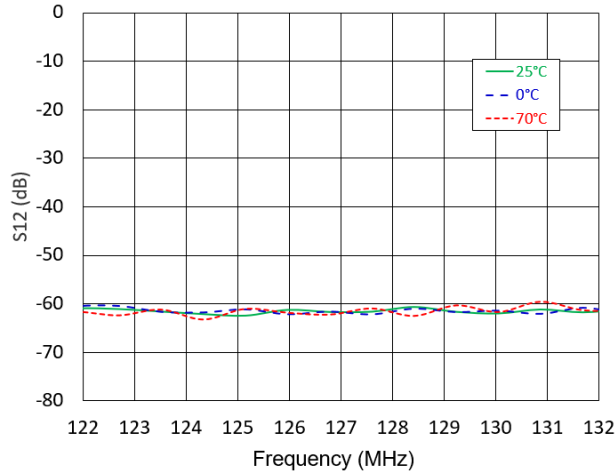
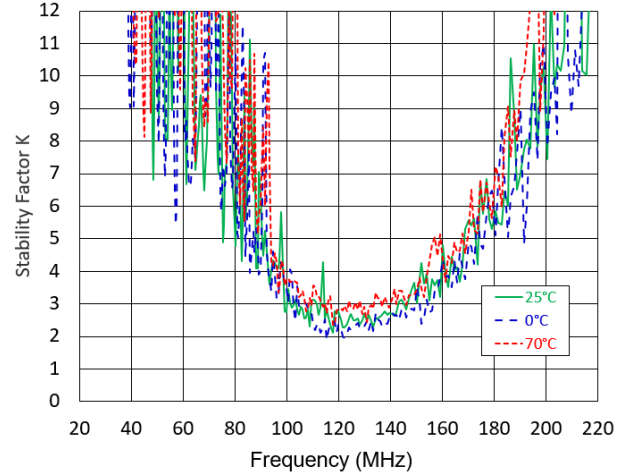
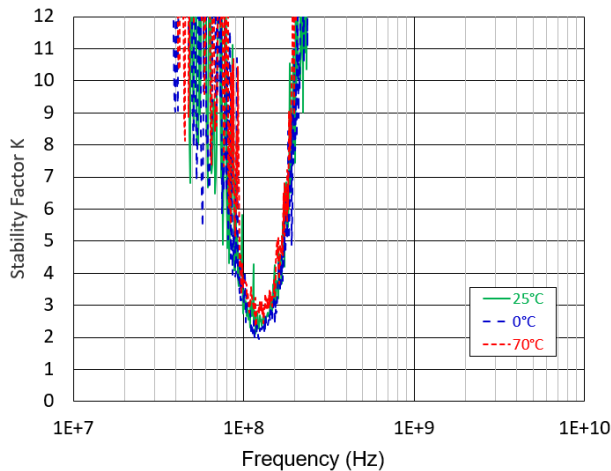
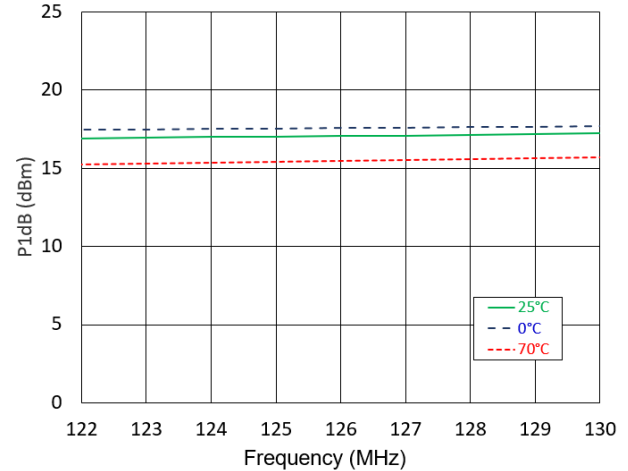
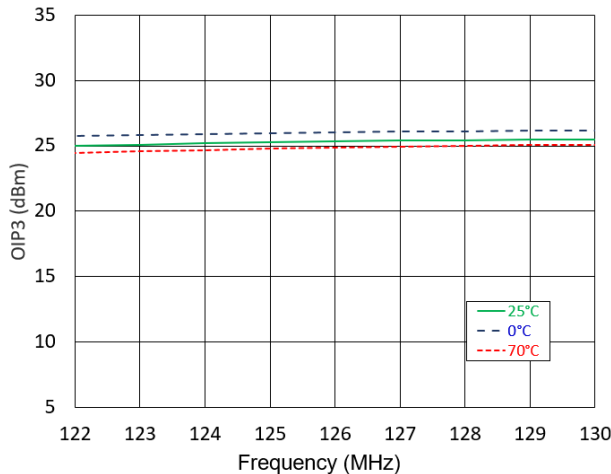
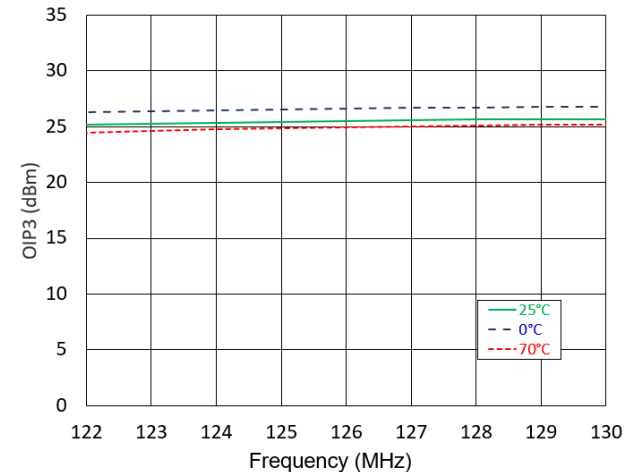
PCB Layout Stack-UP



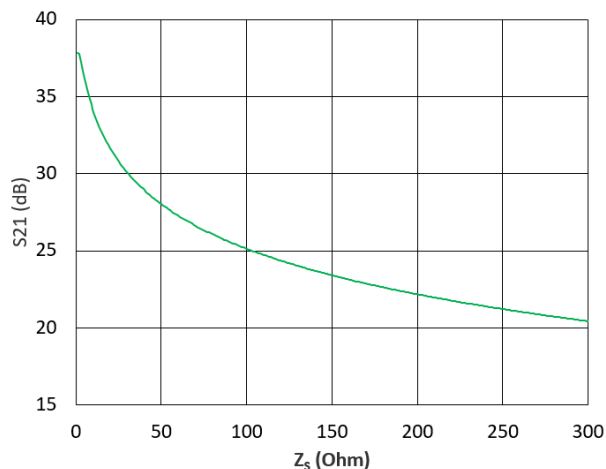
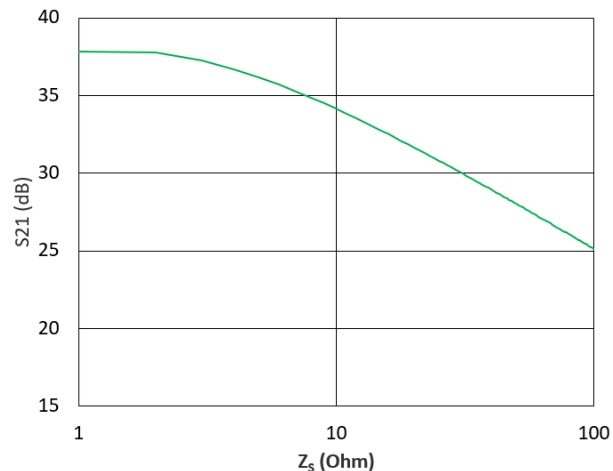
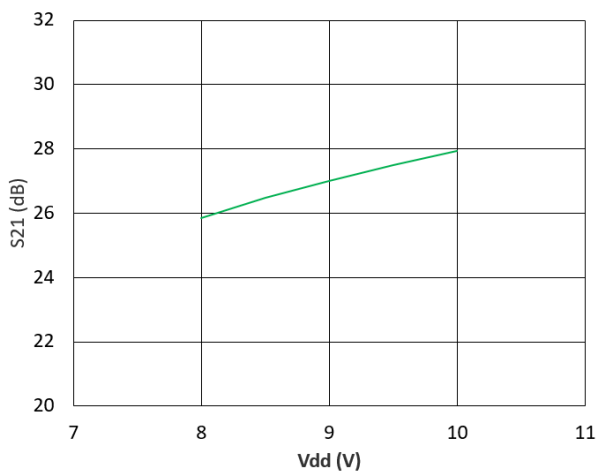
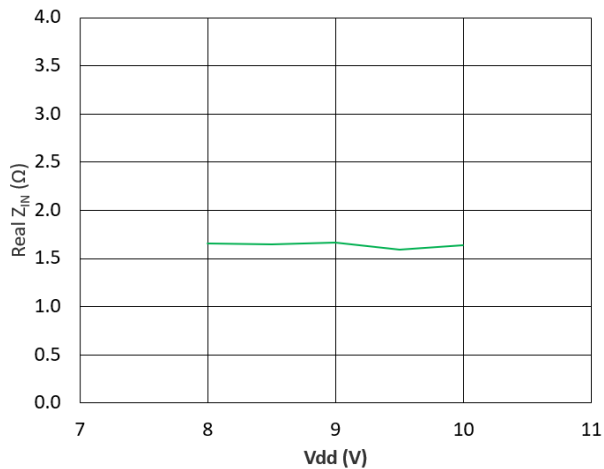
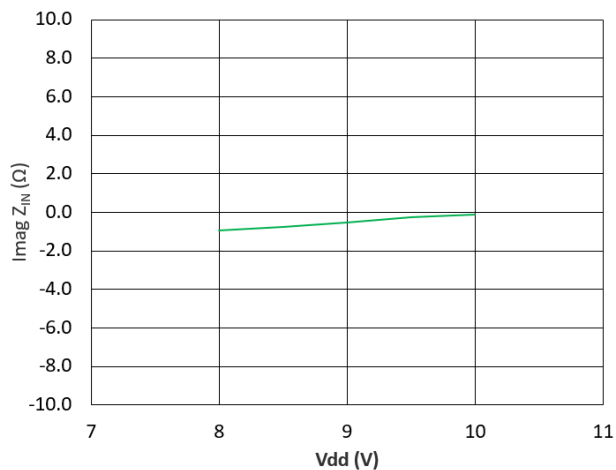
Typical Performance Curves

Gain

Real Z_{IN}

Output Return Loss

Imaginary Z_{IN}

Noise Figure

Noise Figure vs Source Impedance, Z_s @25C


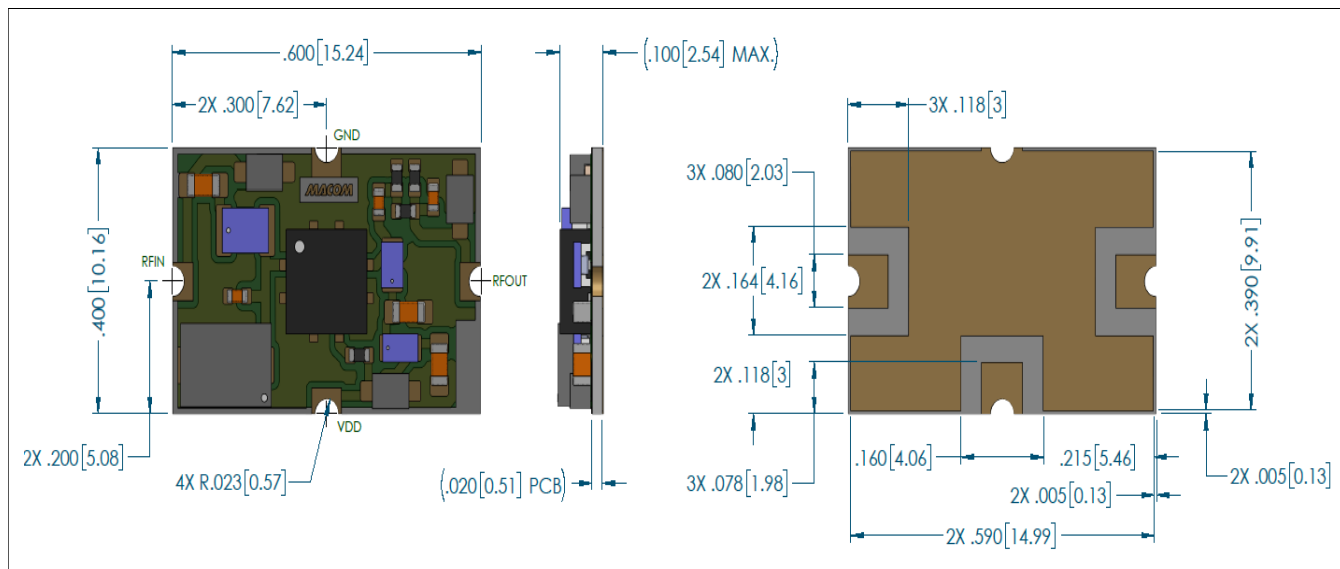
Typical Performance Curves

Reverse Isolation

Stability Factor K

Stability Factor K to 10 GHz

P1dB

OIP3 ($P_{out} = 0$ dBm / Tone, 100 kHz spacing)

OIP3 ($P_{out} = 0$ dBm / Tone, 1 MHz spacing)


Typical Performance Curves

Gain vs Source Impedance, Z_S @25C

Gain vs Source Impedance, Z_S in Log Scale @25C

Gain vs Vdd @25C

Real Z_{IN} vs Vdd @25C

Imaginary Z_{IN} vs Vdd @25C


Pb - Free Non-Magnetic Laminate Package



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