Features

- 19 dB flat Broadband Gain to 3.25 GHz
- Low Noise Figure:
  - 1.3 dB @ 1.2 GHz
  - 1.6 dB @ 3.25 GHz
- High Linearity OIP3:
  - 38 dBm @ 1.2 GHz
  - 35 dBm @ 3.25 GHz
- Internal Matching to 50 Ω
- Single Voltage Bias: 3 - 5 V
- Integrated Active Bias Circuit
- Current Adjustable 20 - 120 mA
- Lead-Free 3 mm 12-Lead Ceramic QFN Package
- RoHS* Compliant
- Power Down Option

Description

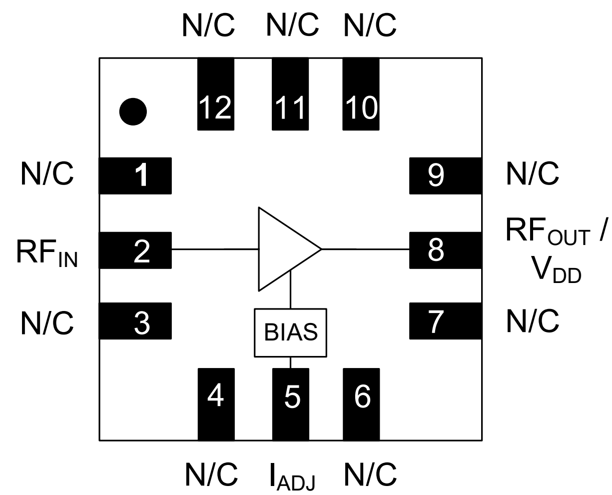
The MAAM-011229-CQ3 is a broadband high dynamic range, single stage MMIC LNA assembled in a lead-free 3 mm 12 lead ceramic QFN package. The amplifier is internally matched to provide flat gain and excellent return losses to 3.25 GHz without any external matching components. Use of external matching could extend usable frequency range beyond 4 GHz.

This low noise amplifier has an integrated active bias circuit allowing direct connection to 3 V or 5 V bias and minimizing variations over temperature and process. The bias current can be adjusted with an optional external resistor, so the user can customize the power consumption to fit the application. I_{ADJ} pin can be utilized as an enable pin to power the device up and down during operation.

Ordering Information

Part Number	Package
MAAM-011229-CQ3	bulk

Functional Block Diagram



Pin Configuration[1,2]

Pin #	Pin Name	Description
1, 3, 4, 6, 7, 9 - 12	N/C	No Connection
2	RF_{IN}	RF Input
5	I_{ADJ}	Bias Current Adjust
8	RF_{OUT} / V_{DD}	RF Output / Drain Voltage
13	Pad[2]	Ground

1. MACOM recommends connecting all No Connection (N/C) pins to ground.
2. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

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

Electrical Specifications: V_{DD} = 5 V, +25°C, Z_0 = 50 Ω, Typical Application Circuit

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	0.05 - 3.25 GHz 4 GHz	dB	17.0 —	19.0 18.5	—
Noise Figure	0.05 - 1.2 GHz 1.2 - 3.25 GHz 4 GHz	dB	—	1.3 1.6 2.0	— 2.2 —
Input Return Loss	0.05 - 3.25 GHz	dB	—	16	—
Output Return Loss	0.05 - 3.25 GHz	dB	—	14	—
Output IP3	P_{IN} = -15 dBm per tone, 6 MHz spacing 0.05 - 1.2 GHz 1.2 - 3.25 GHz	dBm	—	38 35	—
Output IP2	P_{IN} = -15 dBm per tone, 6 MHz spacing 0.05 - 1.2 GHz 1.2 - 3.25 GHz	dBm	—	40 36	—
Output P1dB	0.05 - 1.2 GHz 1.2 - 3.25 GHz	dBm	—	20 19	—
Current	I_{DD}	mA	—	80	115

Absolute Maximum Ratings[3,4,5]

Parameter	Absolute Maximum
RF Input Power CW	4 dBm
V_{DD}	7 V
Storage Temperature	-55°C to +150°C
Operating Temperature	-40°C to +85°C
Junction Temperature[6]	+150°C

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. MACOM does not recommend sustained operation near these survivability limits.
5. Operating at nominal conditions with $T_J \leq 150°C$ will ensure MTTF > 1 x 10^6 hours.

Handling Procedures

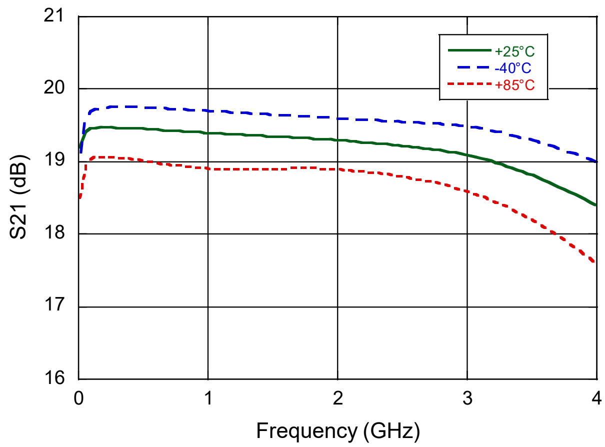
Please observe the following precautions to avoid damage:

Static Sensitivity

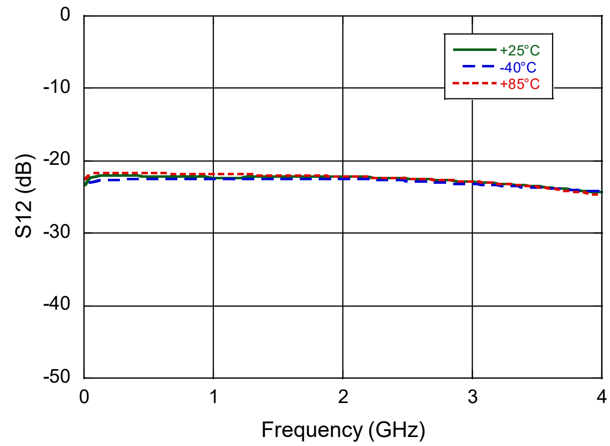
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM class 1B, CDM class C3 devices.

Typical Performance Curves @ 5 V, 80 mA, Z_0 = 50 Ω

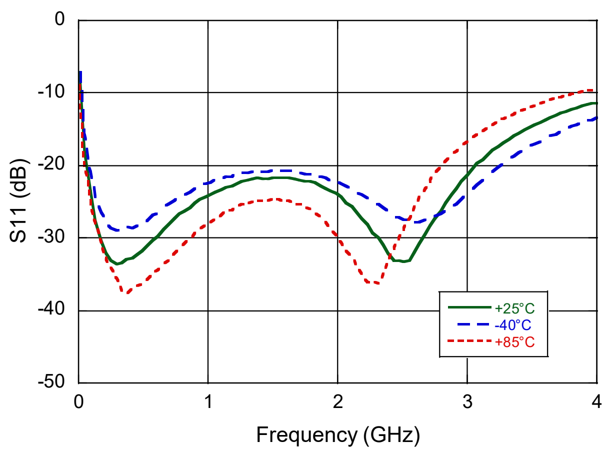
Gain



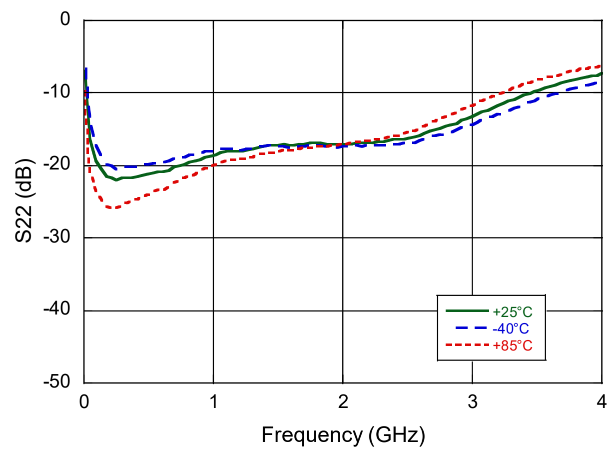
Isolation



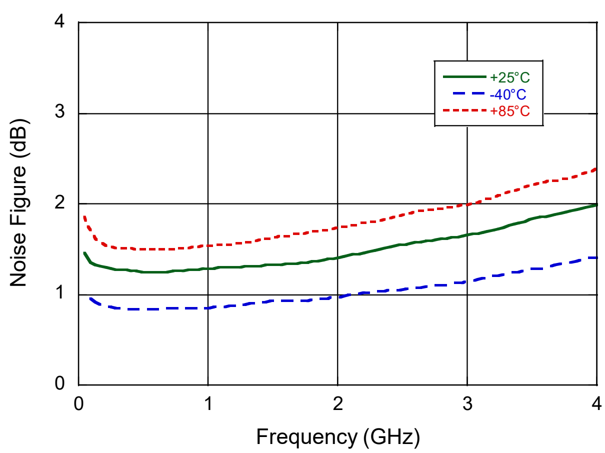
Input Return Loss



Output Return Loss

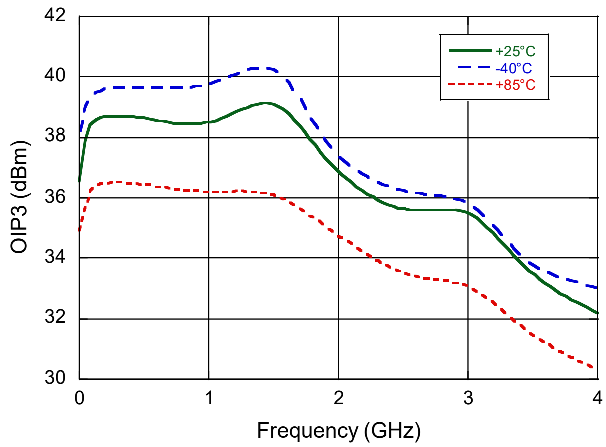


Noise Figure

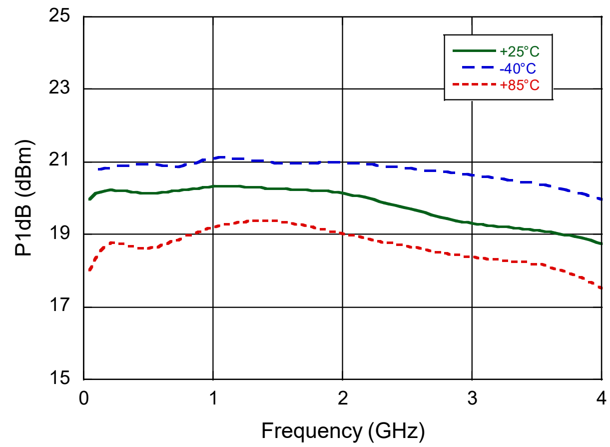


Typical Performance Curves @ 5 V, 80 mA , Z_0 = 50 Ω

IP3



P1dB

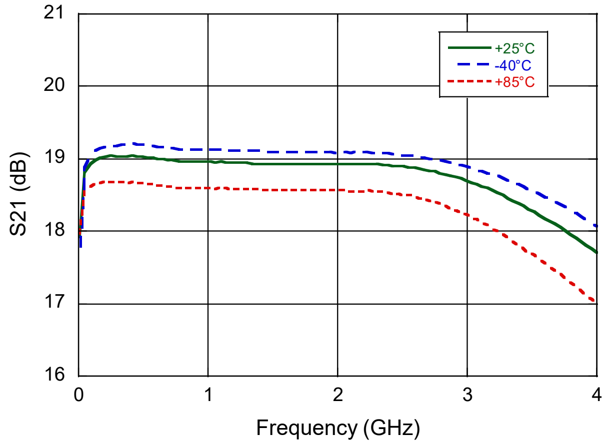


Electrical Specifications: V_{DD} = 3 V, +25ºC, Z_0 = 50 Ω, Typical Application Circuit

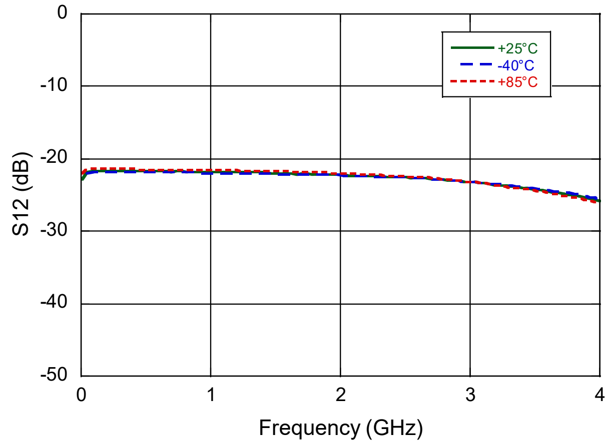
Parameter	Test Conditions	Units	Min.	Typ.	Max.
Gain	0.05 - 3.25 GHz 4 GHz	dB	—	18.5 17.5	—
Noise Figure	0.05 - 1.2 GHz 1.2 - 3.25 GHz 4 GHz	dB	—	1.3 1.6 1.9	—
Input Return Loss	0.05 - 3.25 GHz	dB	—	16	—
Output Return Loss	0.05 - 3.25 GHz	dB	—	12	—
Output IP3	P_{IN} = -15 dBm per tone, 6 MHz spacing 0.05 - 1.2 GHz 1.2 - 3.25 GHz	dBm	—	32 30	—
Output IP2	P_{IN} = -15 dBm per tone, 6 MHz spacing 0.05 - 1.2 GHz 1.2 - 3.25 GHz	dBm	—	42 33	—
Output P1dB	0.05 - 1.2 GHz 1.2 - 3.25 GHz	dBm	—	17.0 15.5	—
Current	I_{DD}	mA	—	45	—

Typical Performance Curves @ 3 V, 45 mA, Z_0 = 50 Ω

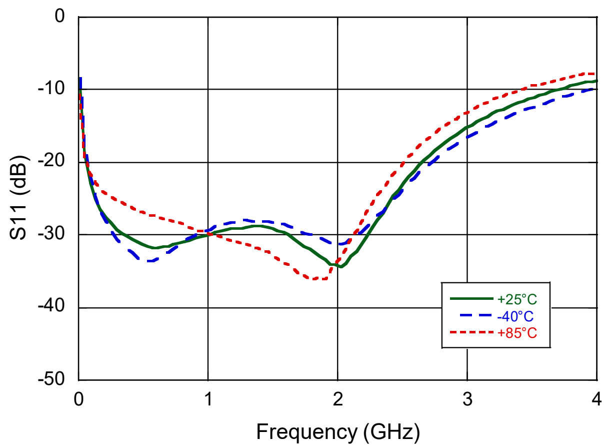
Gain



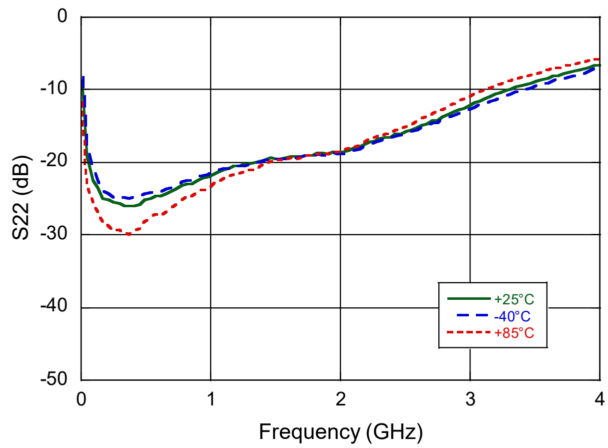
Isolation



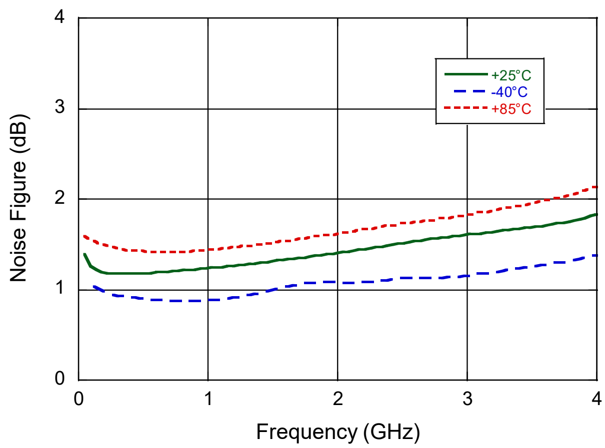
Input Return Loss



Output Return Loss

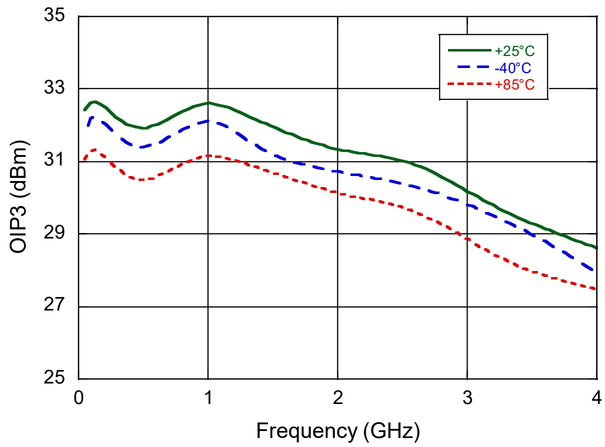


Noise Figure

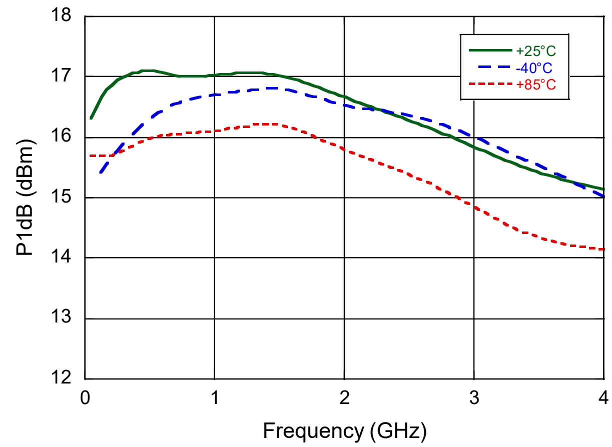


Typical Performance Curves @ 3 V, 45 mA, Z_0 = 50 Ω

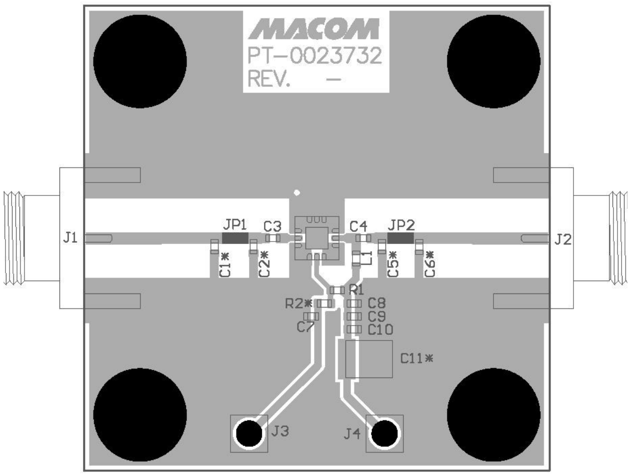
IP3



P1dB



Sample Board

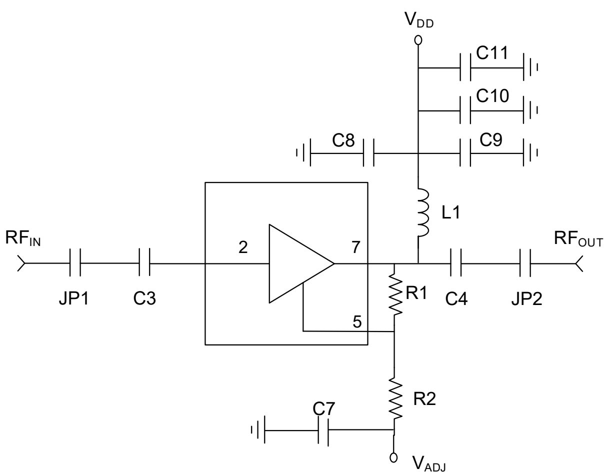


Sample Board Parts List[6]

Component	Value	Package
C1, C2, C5, C6, C11	DNP	—
C3, C4, C7, C9	1000 pF	0402
C8	47 pF	0402
C10	0.1 µF	0402
JP1, JP2	0 Ω	0402
R1, R2	DNP	0402
L1	Ferrite Bead[7]	0402

6. Typical application.
7. Murata, part number BLM15HD182SN.

Sample Board Schematic



Bias Table[8]

I	V_{DD} = 5 V		V_{DD} = 3 V	
(mA)	R1	R2 > GND	R1	R2 > GND
20	—	820 Ω	—	2.0 kΩ
45	—	2.1 kΩ	—	5.1 kΩ
60	—	2.7 kΩ	—	—
80	*Typical application without R1 or R2*		5.0 kΩ	—
100	12 kΩ	—	2.4 kΩ	—
120	5 kΩ	—	not recommended	

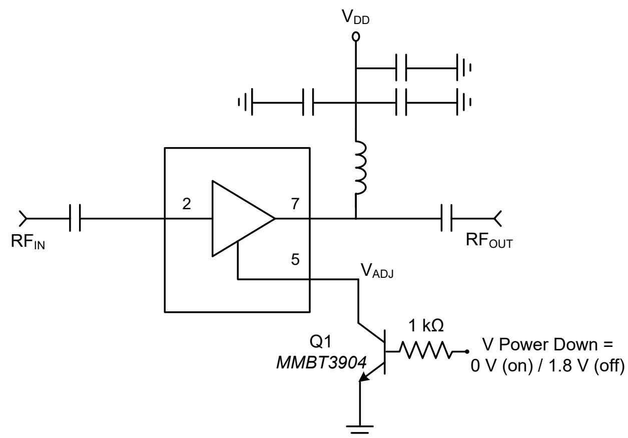
8. J3 on sample board may be used to facilitate a ground or V_{ADJ} connection.

Current Adjust Options

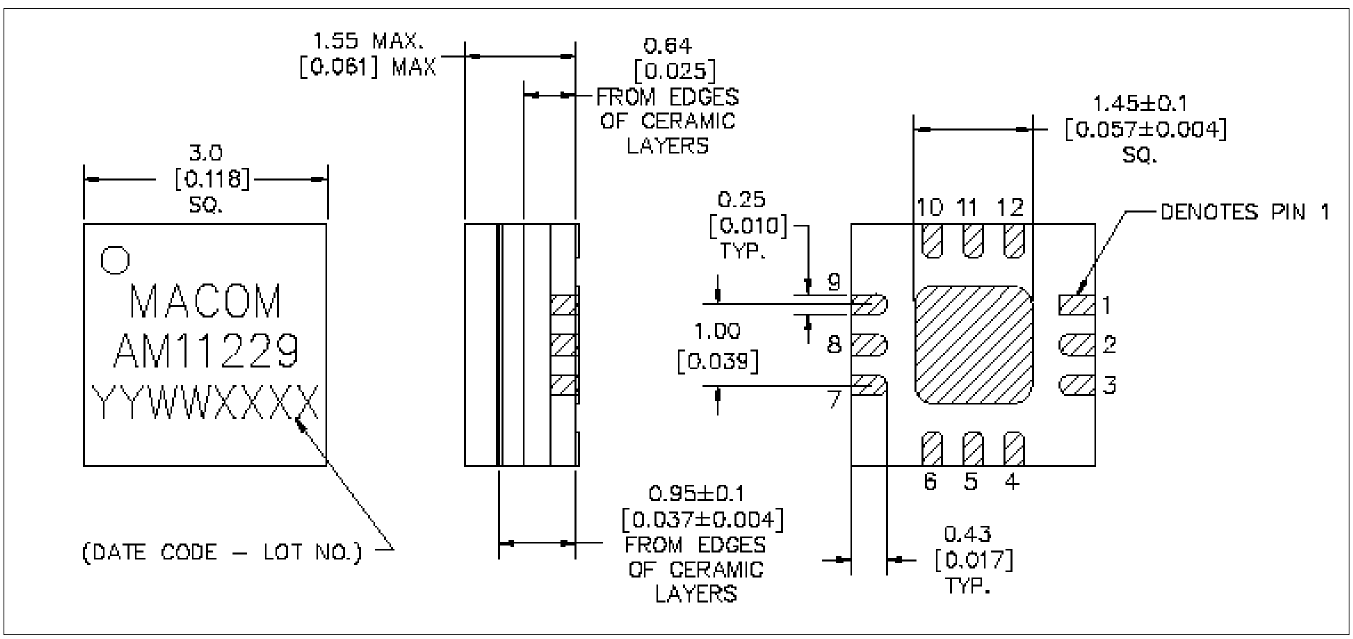
The I_{ADJ} (pin 5) of MAAM-011229 may be used to adjust the DC operating current by placing either R1 or R2 as shown the sample board schematic. Placing resistor R2 to ground will reduce the current from typical application level. When using R2 to reduce current do not place (DNP) R1. To increase current from typical application circuit install resistor R1 and connect to V_{DD}.

Power Down Option

The I_{ADJ} (pin 5) of MAAM-011229-CQ3 may be used to power down and turn on the amplifier. The critical characteristics of the power down circuit are that it presents a low impedance to DC ground in the off mode and that it presents a high impedance (much greater than 5 kΩ) in the on mode. The single very low cost MMBT3904 NPN switching transistor (available from many suppliers) may be added externally along with a 1 kΩ resistor to provide this function. The time from when voltage on the I_{ADJ} pin (V_{ADJ}) goes HIGH to the time RF reaches 90% of final amplitude is 444 ns. The total turn-on time, however, from change of power down signal is 1.18 µs (736 ns of this time is consumed in time for MMBT3904 to transition). Alternate choice for switching transistor could reduce total turn-on time. Total turn off time is 392 ns.



Lead-Free 3 mm 12-Lead QFN Ceramic Package†



† Plating is ENEPIG
Reference Application Note S2083 for surface mount instructions for QFN packages