Voltage Variable Attenuator
5.8 - 16 GHz

Features

- 5.8 - 16 GHz Frequency Range
- 2.0 dB Insertion Loss @ 10 GHz
- >30 dB Attenuation Range
- High Linearity, 30 dBm IIP3
- Lead-Free 3 mm, 16-Lead QFN Package
- RoHS* Compliant

Applications

- Cellular

Description

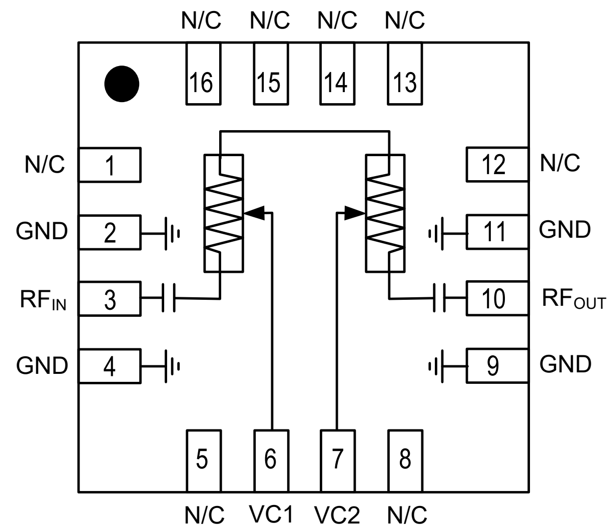
The MAAT-010521-L1 is a voltage variable attenuator with analog control and >30 dB of attenuation. Excellent linearity is maintained over the full attenuation range. The attenuation level is set by two control voltages of 0 to -2 V. This device is assembled in a lead free 3 mm 16 lead PQFN plastic package.

Applications include transceivers for cellular infrastructure.

Ordering Information

Part Number	Package
MAAT-010521-L1TR05	500 Part Reel
MAAT-010521-L1TR1K	1000 Part Reel
MAAT-010521-L1BSMB	Sample Board

Functional Block Diagram



Pin Configuration[1,2]

Pin #	Function
1, 5, 8, 12 - 16	No Connection
2, 4, 9, 11	Ground
3	RF Input
6	V_C1
7	V_C2
10	RF Output

1. It is recommended to connect 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: T_A = +25°C, Z_0 = 50 Ω, P_{IN} = -10 dBm

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss (V_{C1} = V_{C2} = -2 V)	5.8 - 7.1 GHz 7.1 - 8.5 GHz 10.0 - 12.0 GHz 12.7 - 15.4 GHz	dB	—	2.0 1.8 2.0 2.4	4.0
Attenuation (V_{C1} = V_{C2} = 0 V)[3]	5.8 - 7.1 GHz 7.1 - 8.5 GHz 10.0 - 12.0 GHz 12.7 - 15.4 GHz	dB	—	26.0 28.0 33.5 37.0	—
Dynamic Range	5.8 - 7.1 GHz 7.1 - 8.5 GHz 10.0 - 12.0 GHz 12.7 - 15.4 GHz	dB	— — — 31.8	24.0 26.0 32.5 35.0	—
Input P1dB[4]	5.8 - 15.4 GHz	dBm	20.0	23.0	—
IIP3	P_{IN} = 10 dBm/tone @ 5.8 - 15.4 GHz V_{C1} = 0 V & V_{C2} > -0.8 V V_{C1} ≤ 0 V & V_{C2} ≤ -0.8 V V_{C1} = V_{C2} = -2 V	dBm	27.8 29.0 32.0	29.0 30.5 38.0	—
Input Return Loss	—	dB	—	10.0	—
Output Return Loss	—	dB	—	10.0	—

3. To increase attenuation from minimum attenuation state (VC1 = -2 V and VC2 = -2 V) to maximum attenuation state (VC1 = 0 V and VC2 = 0 V), VC1 increases to full range prior to adjusting VC2. Typical attenuation measured on MACOM Sample Board in state : VC1 = 0 V & VC2 = -0.8 V is 20.5 dB for 12.7 - 15.4 GHz band.
4. Guaranteed on MACOM Sample Board only.

Absolute Maximum Ratings[5,6]

Parameter	Absolute Maximum
Input Power	30 dBm
Voltage (RF pins)	30 V
Voltage (control pins)	+1 V to -6 V
Storage Temperature	-55°C to +150°C
Case Temperature	-40°C to +85°C

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.

Handling Procedures

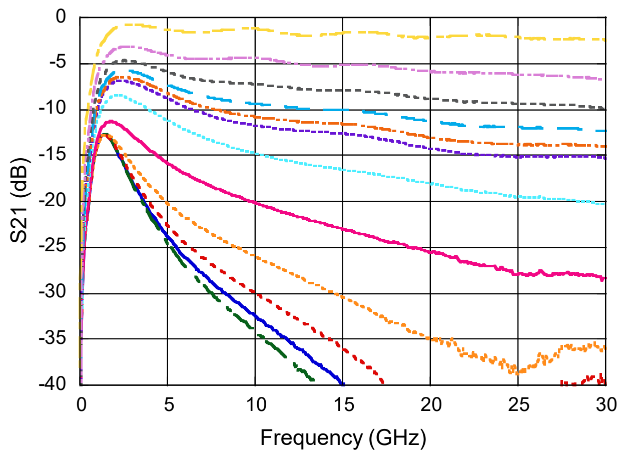
The following precautions should be observed to avoid damage:

Static Sensitivity

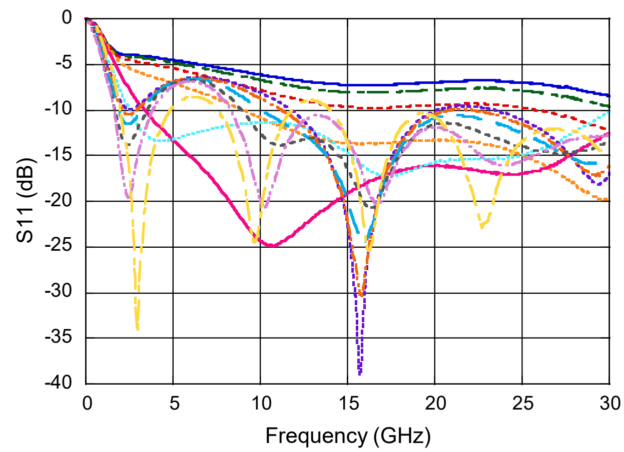
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1A devices.

Typical Performance Curves: @ +25°C

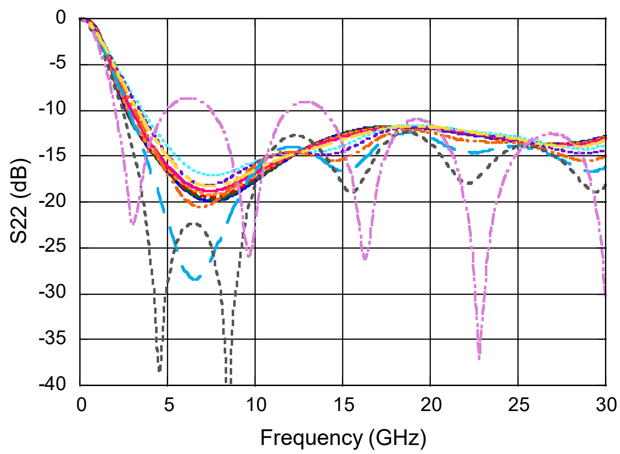
Gain

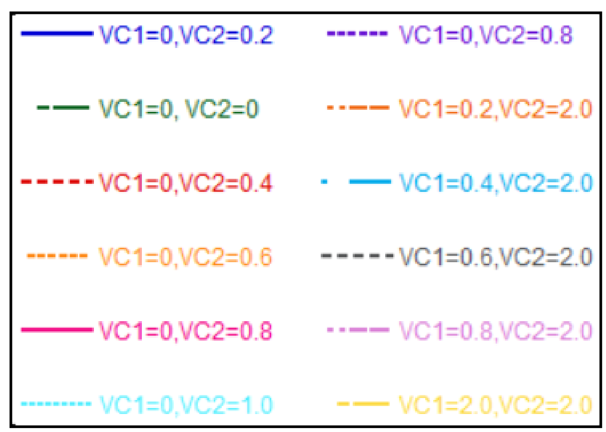


Input Return Loss

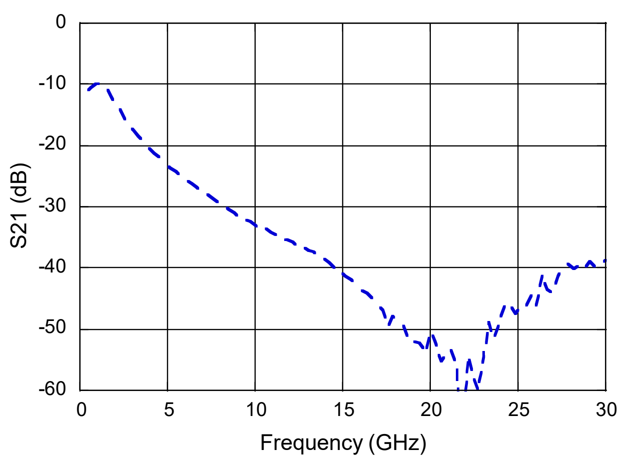


Output Return Loss



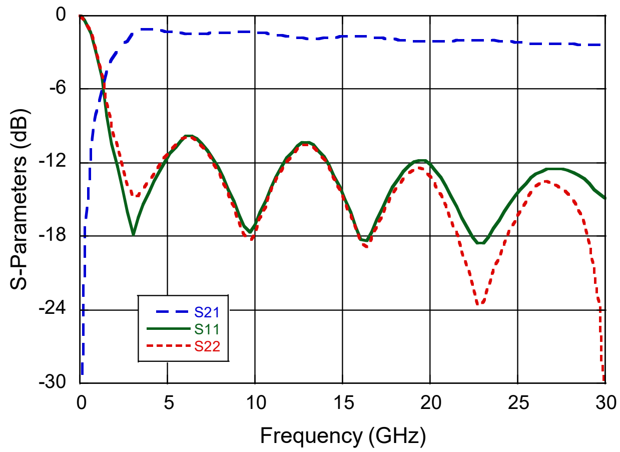


Dynamic Range

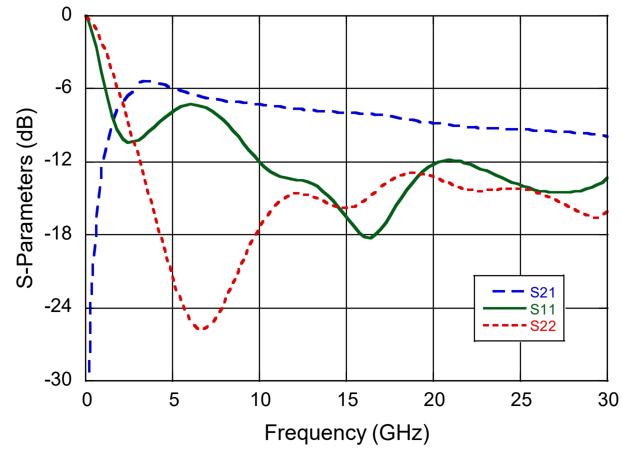


Typical Performance Curves: S-Parameters @ +25°C

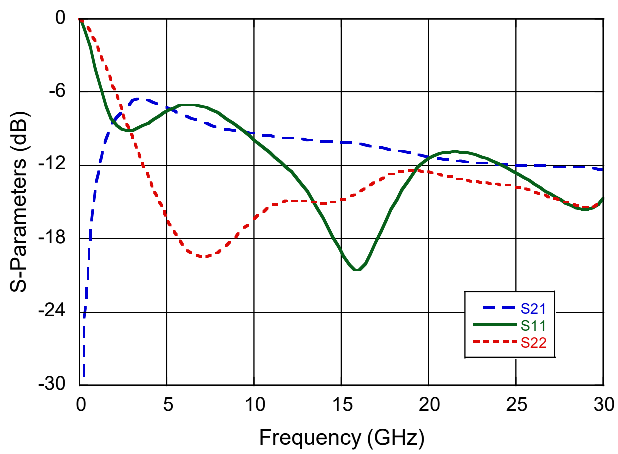
S-Parameters V_{C1} = -2.0 V, V_{C2} = -2.0 V



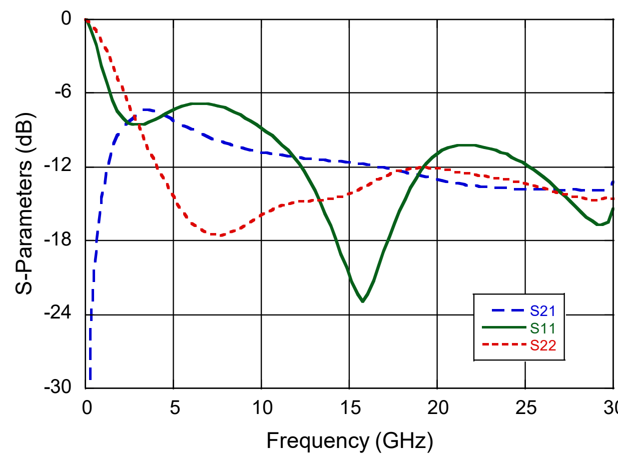
S-Parameters V_{C1} = -0.6 V, V_{C2} = -2.0 V



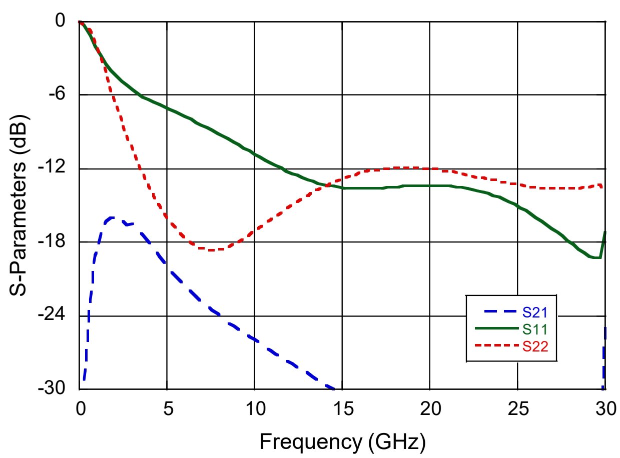
S-Parameters V_{C1} = -0.4 V, V_{C2} = -2.0 V



S-Parameters V_{C1} = -0.2 V, V_{C2} = -2.0 V

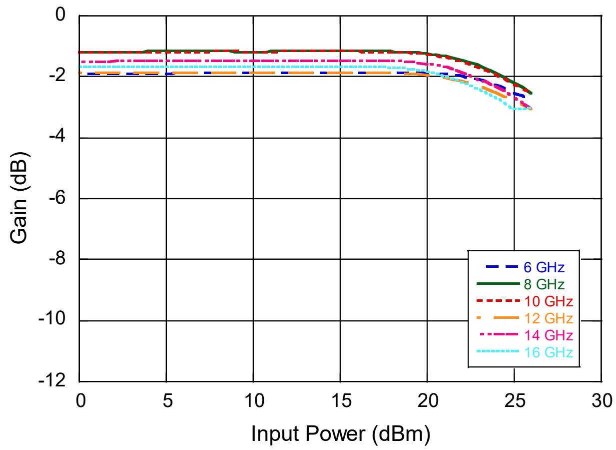


S-Parameters V_{C1} = 0 V, V_{C2} = -0.6 V

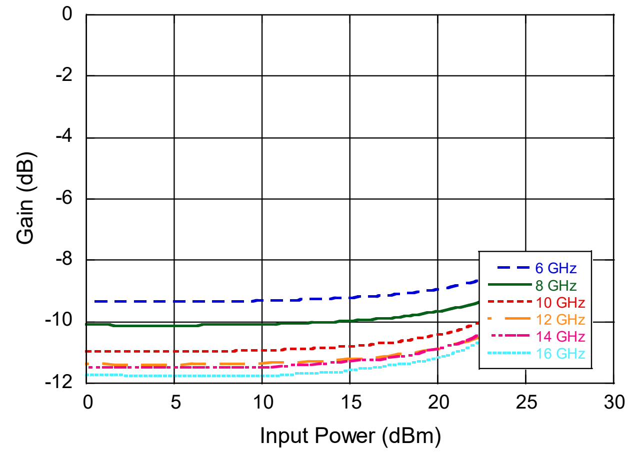


Typical Performance Curves: Power Gain @ +25°C

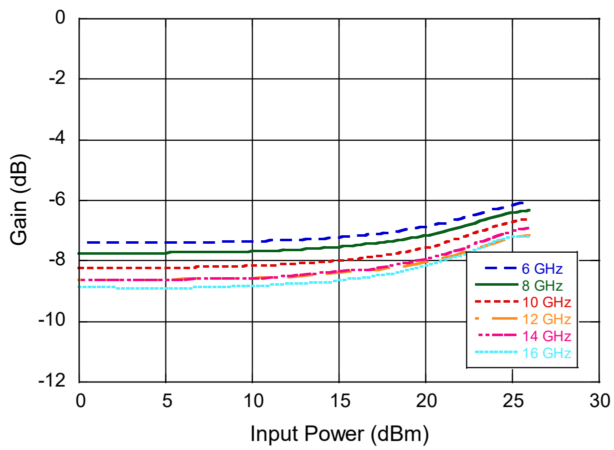
Power Gain @ V_{C1} = -2.0 V, V_{C2} = -2.0 V



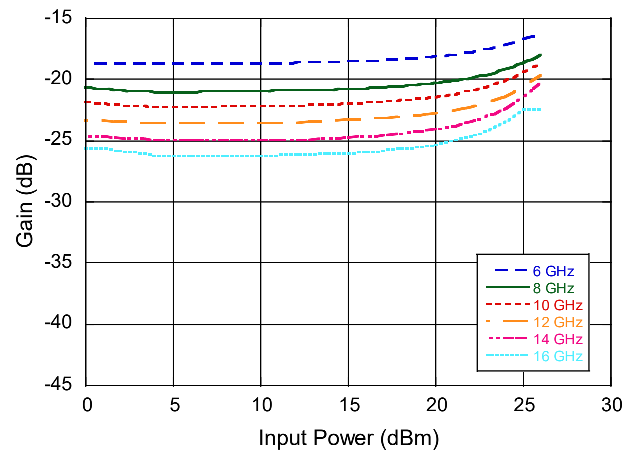
Power Gain @ V_{C1} = 0 V, V_{C2} = -2.0 V



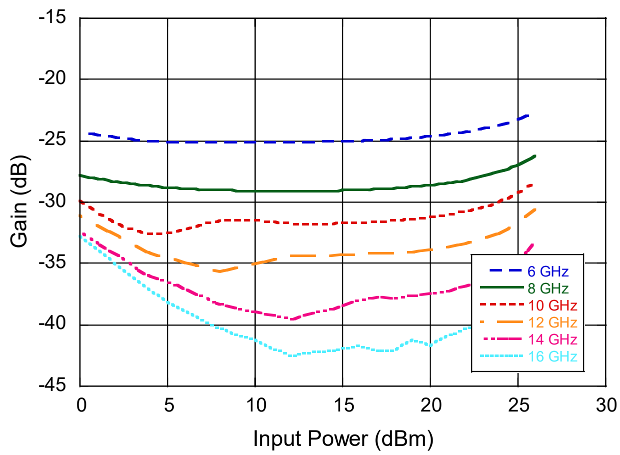
Power Gain @ V_{C1} = -0.4 V, V_{C2} = -2.0 V



Power Gain @ V_{C1} = 0 V, V_{C2} = -0.6 V

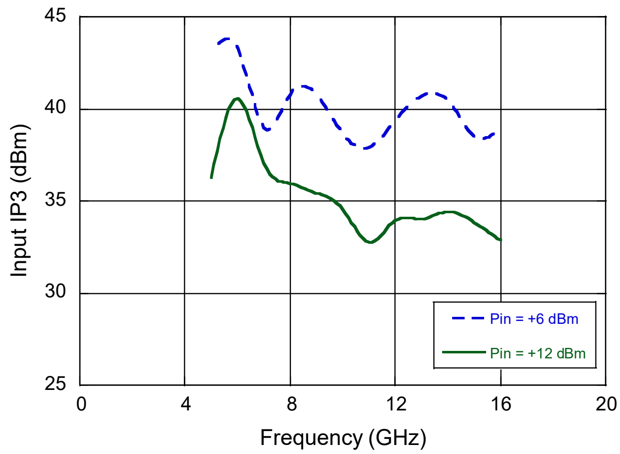


Power Gain @ V_{C1} = 0 V, V_{C2} = 0 V

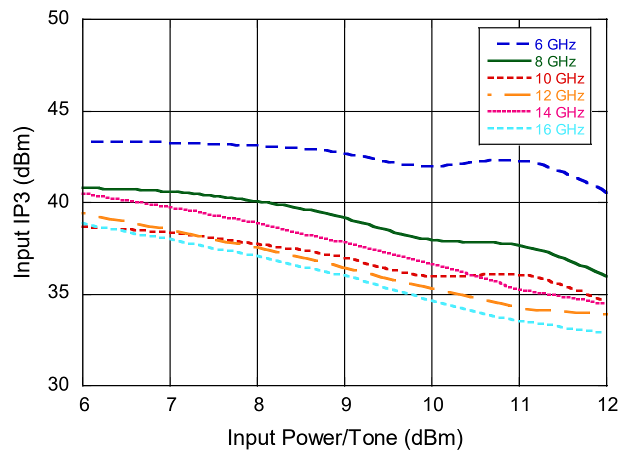


Typical Performance Curves: Input IP3

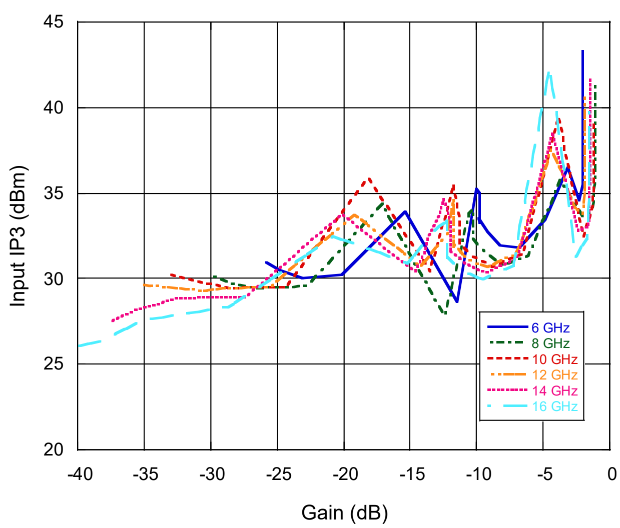
Input IP3 vs. Frequency
@ V_{C1} = -2.0 V, V_{C2} = -2.0 V



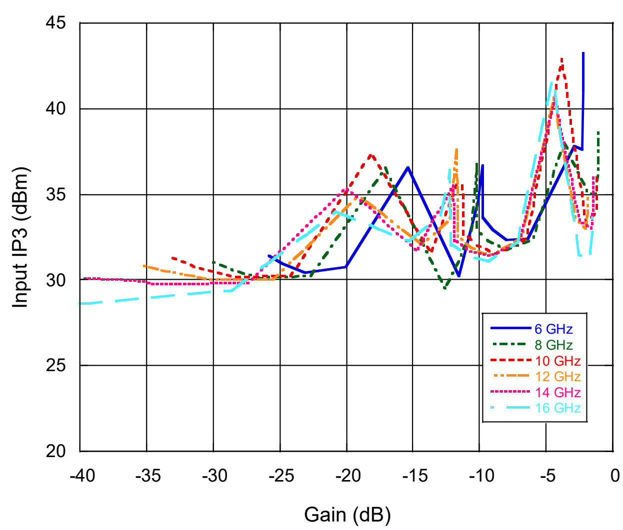
Input IP3 vs. SCL Input Power
@ V_{C1} = -2.0 V, V_{C2} = -2.0 V



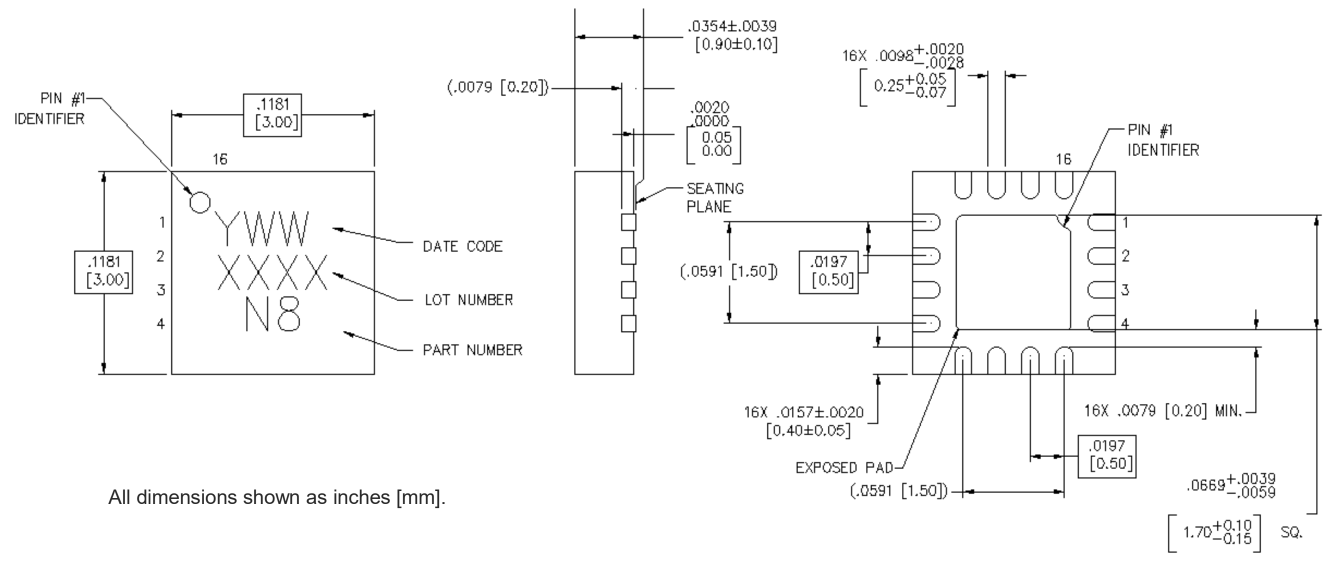
Input IP3 vs. Attenuation, SCL P_{IN} = 6 dBm



Input IP3 vs. Attenuation, SCL P_{IN} = 12 dBm



Lead-Free 3 mm 16-Lead PQFN†



All dimensions shown as inches [mm].

† Reference Application Note S2083 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is NiPdAuAg.