MAAV-011013

Voltage Variable Attenuator
5 - 45 GHz

Rev. V1

Features

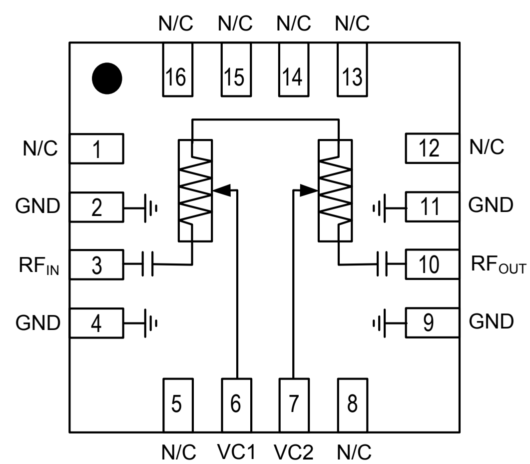
- 5 - 45 GHz Frequency Range
- 1.5 dB Insertion Loss @ 20 GHz
- >30 dB Attenuation Range
- High Linearity, 30 dBm IIP3
- Lead-Free 3 mm, 16-Lead QFN Package
- RoHS* Compliant

Description

The MAAV-011013 is a voltage variable attenuator with analog control and greater than 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.

Functional Block Diagram



Pin Configuration[3,4]

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

3. It is recommended to connect unused pins to ground.
4. The exposed pad centered on the package bottom must be connected to RF, DC and thermal ground.

Ordering Information[1,2]

Part Number	Package
MAAV-011013-TR0500	500 Part Reel
MAAV-011013-TR1000	1000 Part Reel
MAAV-011013-001SMB	Sample Board

1. Reference Application Note M513 for reel size information.
2. All sample boards include 5 loose parts.

* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

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 and V_C2 = -2 V)	5.9 -15.5 GHz 17.6 - 20 GHz 20 - 30 GHz 30 - 34 GHz 37 - 40 GHz	dB	—	1.5 1.5 2.5 2.5 3.0	4.0 4.0 6.0 6.5 7.0
Attenuation (V_C1 and V_C2 = 0 V)[5]	5.9 - 8.5 GHz 10 - 11.7 GHz 12.75-15.35 GHz 17.6 - 20 GHz 20 - 30 GHz 30 - 34 GHz 37 - 40 GHz	dB	22.5 27.5 29.5 31.0 33.5 31.0 30.0	25.0 32.0 35.0 35.0 39.0 37.0 36.0	—
Input P1dB[6]	5 - 25 GHz 25 - 40 GHz	dBm	24 20	25 22	—
IIP3 (any attenuation)	P_{IN} = 12 dBm/tone @ 5.0 - 15.0 GHz P_{IN} =12 dBm/tone @ 15.0 - 26.5 GHz P_{IN} =12 dBm/tone @ 26.5 - 40.0 GHz	dBm	29.0 27.5 27.0	31.0 30.0 31.0	—
IIP3 (V_C1=V_C2=-2 V)	P_{IN} = 12 dBm/tone @ 5 - 40 GHz	dBm	—	42	—
Input Return Loss (any attenuation)	—	dB	—	10	—
Output Return Loss (any attenuation)	—	dB	—	10	—

5. To increase attenuation from minimum attenuation state (V_C1 = -2 V and V_C2 = -2 V) to max attenuation state (V_C1 = 0 V and V_C2 = 0 V), V_C1 increases to full range prior to adjusting V_C2.
6. Guaranteed on MACOM Sample Board only

Absolute Maximum Ratings[7,8]

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

7. Exceeding any one or combination of these limits may cause permanent damage to this device.
8. MACOM does not recommend sustained operation near these survivability limits.

Handling Procedures

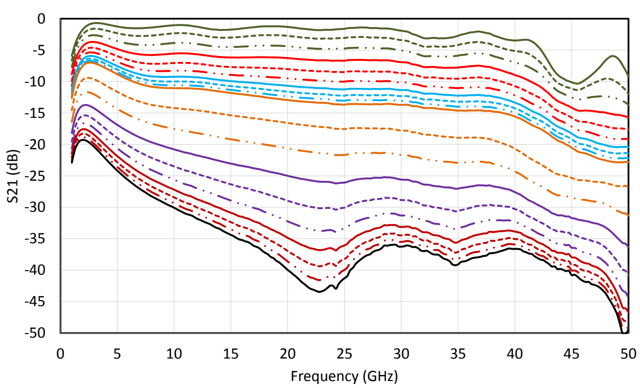
The following precautions should be observed to avoid damage:

Static Sensitivity

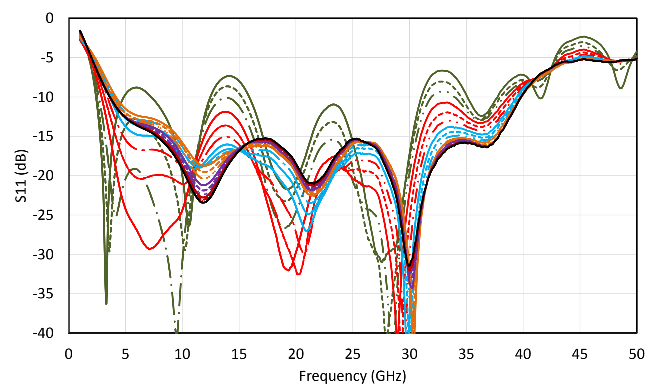
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these HBM Class 1A devices.

Typical Performance Curves: @ +25°C

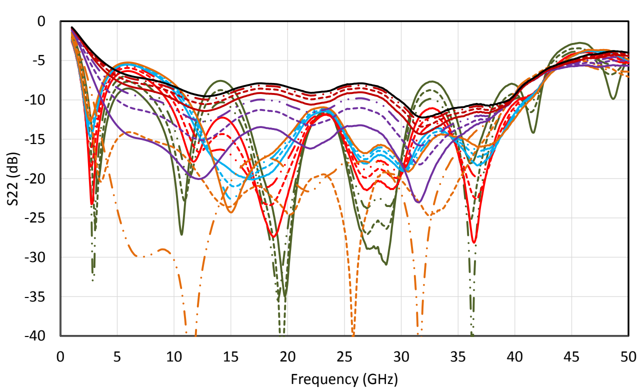
Gain



Input Return Loss



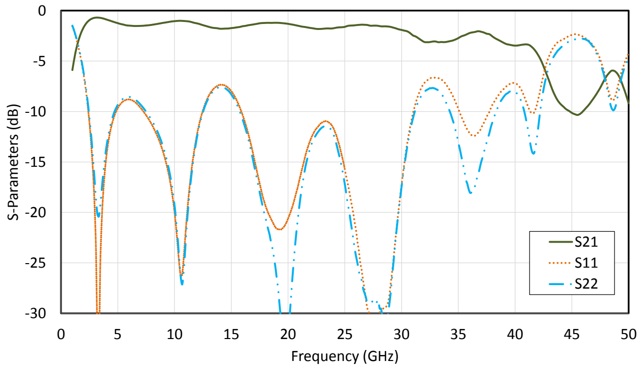
Output Return Loss



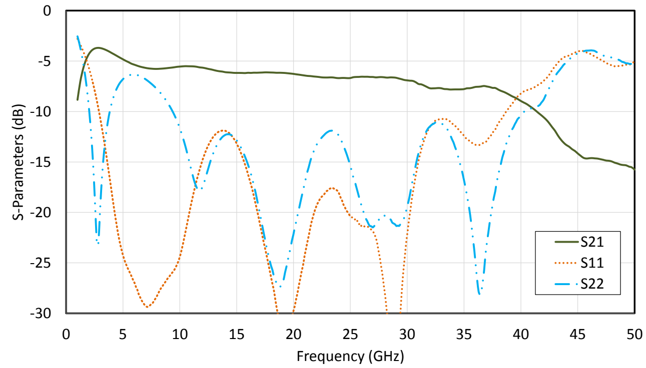
VC1=-2V, VC2=-2V
VC1=-0.8V, VC2=-2V
VC1=-0.7V, VC2=-2V
VC1=-0.6V, VC2=-2V
VC1=-0.5V, VC2=-2V
VC1=-0.4V, VC2=-2V
VC1=-0.3V, VC2=-2V
VC1=-0.2V, VC2=-2V
VC1=-0.1V, VC2=-2V
VC1=0V, VC2=-2V
VC1=0V, VC2=-0.8V
VC1=0V, VC2=-0.7V
VC1=0V, VC2=-0.6V
VC1=0V, VC2=-0.5V
VC1=0V, VC2=-0.4V
VC1=0V, VC2=-0.3V
VC1=0V, VC2=-0.2V
VC1=0V, VC2=-0.1V
VC1=0V, VC2=0V

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

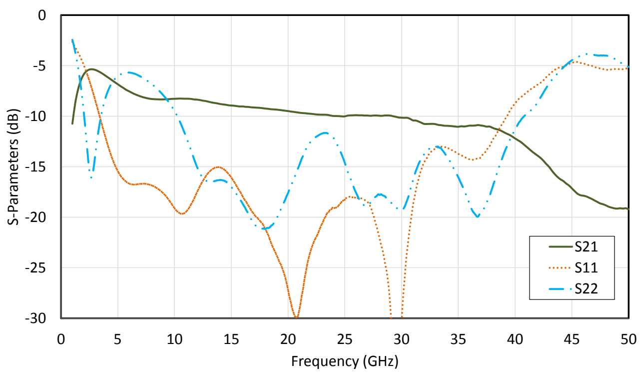
S-Parameters V_C1 = -2.0 V, V_C2 = -2.0 V



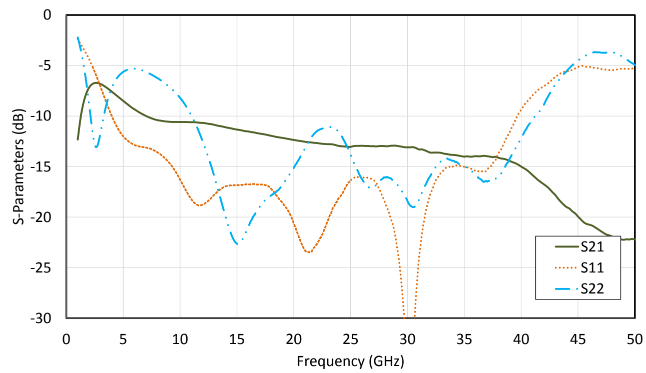
S-Parameters V_C1 = -0.6 V, V_C2 = -2.0 V



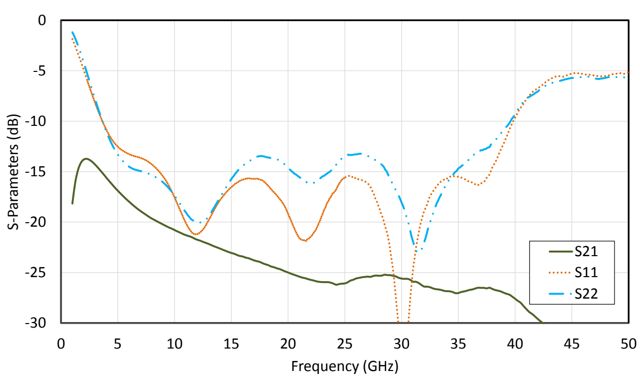
S-Parameters V_C1 = -0.4 V, V_C2 = -2.0 V



S-Parameters V_C1 = -0.1 V, V_C2 = -2.0 V

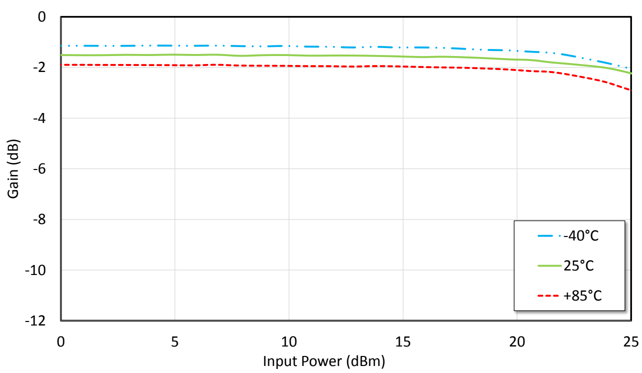


S-Parameters V_C1 = 0 V, V_C2 = -0.6 V

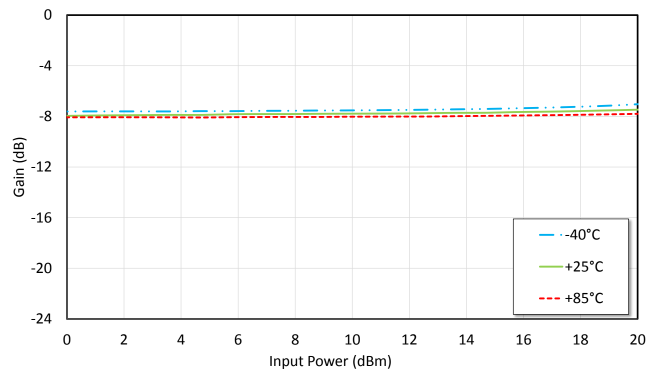


Typical Performance Curves: Power Gain, Freq. 16 GHz

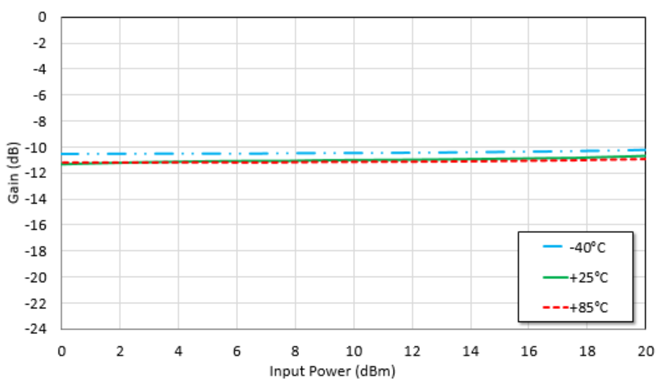
Power Gain @ V_C1 = -2.0 V, V_C2 = -2.0 V



Power Gain @ V_C1 = -0.4 V, V_C2 = -2.0 V

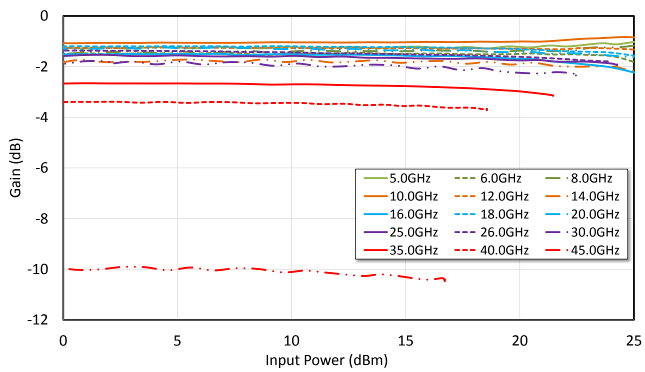


Power Gain @ V_C1 = 0 V, V_C2 = -2.0 V

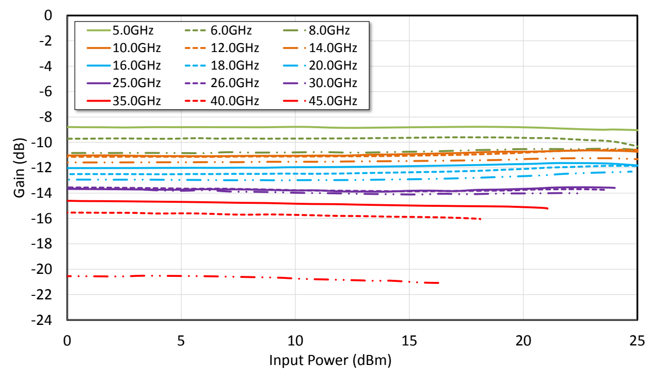


Typical Performance Curves: Power Gain @ +25°C

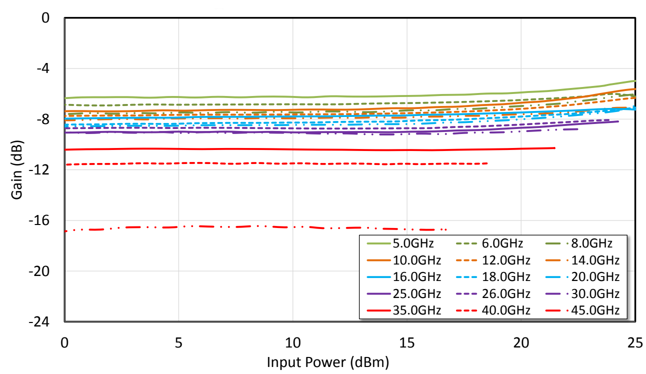
Power Gain @ V_C1 = -2.0 V, V_C2 = -2.0 V



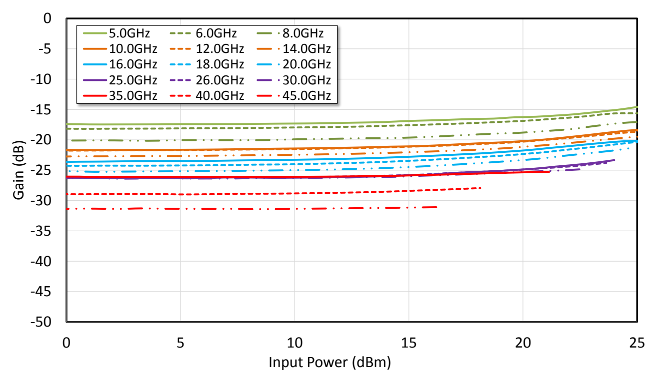
Power Gain @ V_C1 = 0 V, V_C2 = -2.0 V



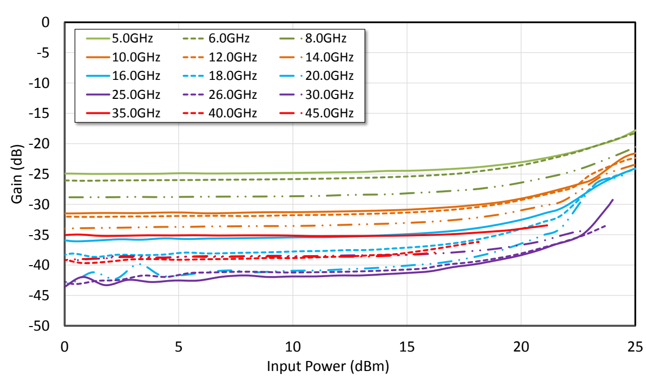
Power Gain @ V_C1 = -0.4 V, V_C2 = -2.0 V



Power Gain @ V_C1 = 0 V, V_C2 = -0.6 V

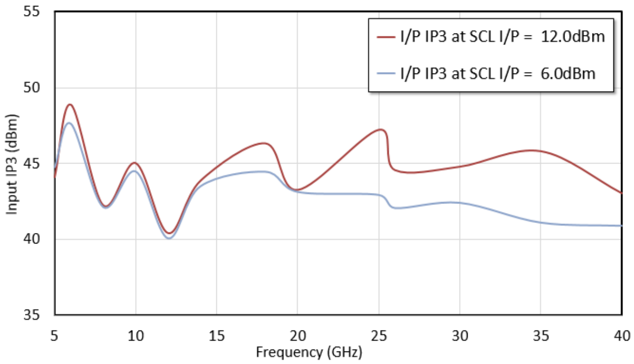


Power Gain @ V_C1 = 0 V, V_C2 = 0 V

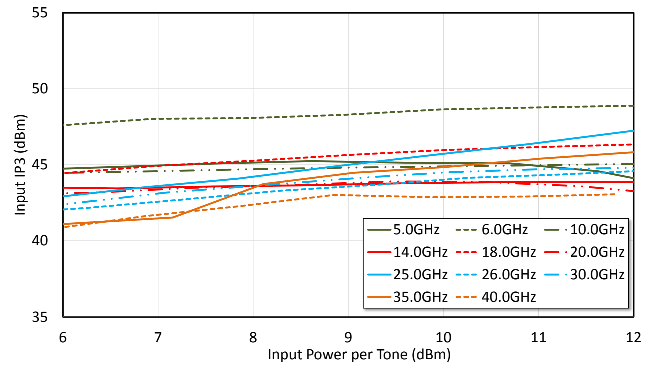


Typical Performance Curves: Input IP3

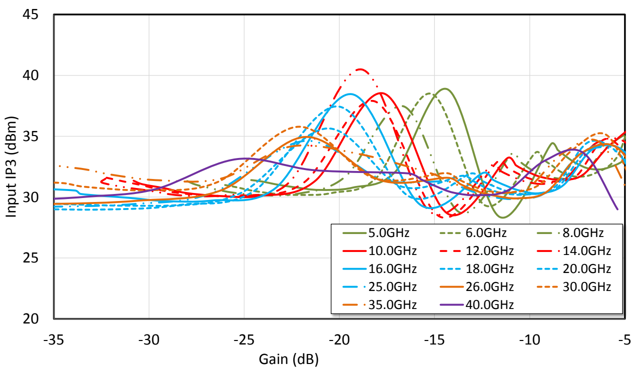
Input IP3 vs. Frequency @ V_C1 = -2.0 V, V_C2 = -2.0 V



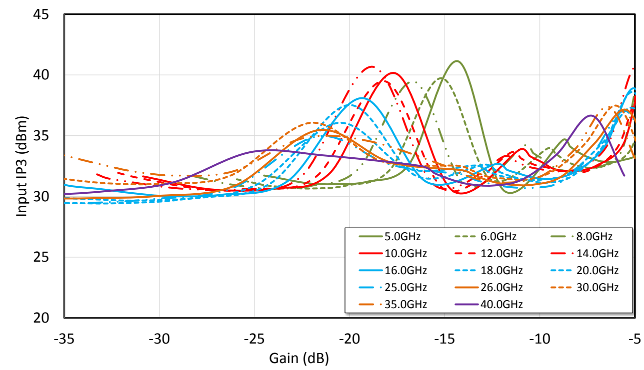
Input IP3 vs. SCL Input Power @ V_C1 = -2.0 V, V_C2 = -2.0 V



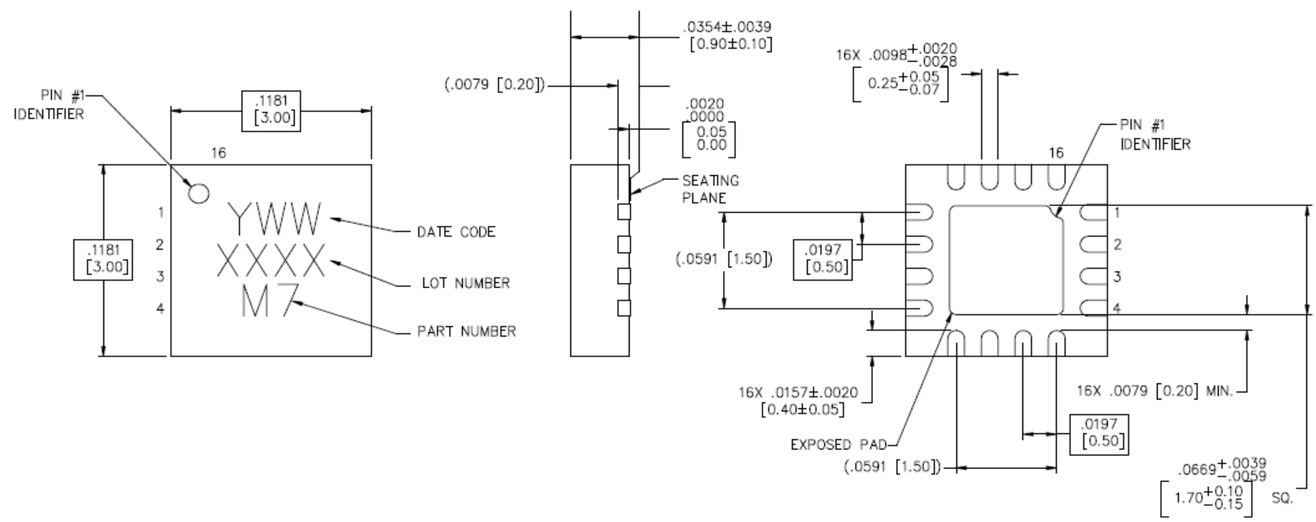
Input IP3 vs. Attenuation, SCL P_{IN} = 6 dBm



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.