MAAD-010305

Digital Attenuator, 1-Bit, 15 dB, 75 Ω
DC - 1.1 GHz

Rev. V1

Features

- Single 15-dB Step
- Insertion Loss: 0.3 dB @ 1.1 GHz
- 75 Ω Impedance
- 2.5 to 5.0 Volt Operation
- Positive or Negative Voltage Control
- Lead-Free SOT-25 Package
- Halogen-Free “Green” Mold Compound
- RoHS* Compliant and 260°C Reflow Compatible

Description

The MAAD-010305 is a 1-bit, 15-dB step GaAs MMIC digital attenuator in a lead-free SOT-25, 5 lead surface mount plastic package.

The MAAD-010305 is fabricated as a monolithic GaAs integrated circuit using a mature pHEMT process. The process features full chip passivation for performance and reliability.

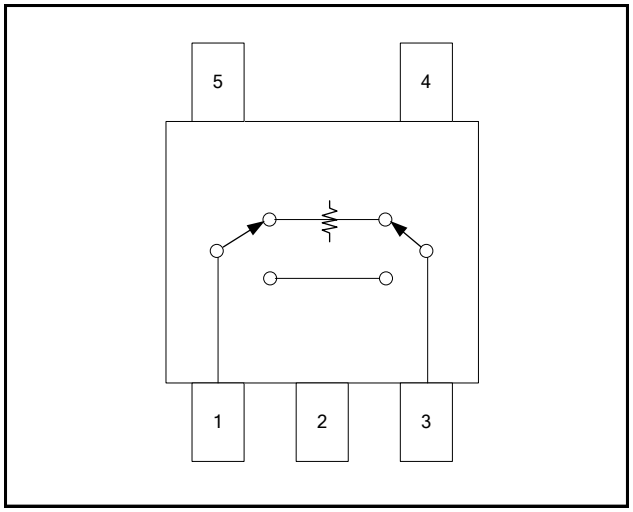
This device is ideally suited for use where high accuracy, very low power consumption and low intermodulation products are required.

Ordering Information [1,2]

Part Number	Package
MAAD-010305-TR1000	1000 piece reel
MAAD-010305-TR3000	3000 piece reel
MAAD-010305-001SMB	Sample Board

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

Functional Schematic



Pin Configuration

Pin No.	Function
1	RF Input Port
2	Ground
3	RF Output Port
4	V1
5	V2

* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

Electrical Specifications[3]: T_A = 25°C, V_C = +2.5 Volts, Z_0 = 75 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Insertion Loss (Reference State)	1.1 GHz	dB	—	0.3	0.45
Attenuation	1.1 GHz	dB	14.6	15.1	15.6
Input Return Loss	DC - 1.1 GHz	dB	—	14	—
Output Return Loss	DC - 1.1 GHz	dB	—	14	—
Input IP3	1.1 GHz Insertion Loss State Attenuation State	dBm	— —	46 46	— —
P1dB	1.1 GHz Insertion Loss State Attenuation State	dBm	— —	20 20	— —
CTB	157 Channels, P_{IN} = 35 dBmV/ch.	dBc	—	70	—
CSO	157 Channels, P_{IN} = 35 dBmV/ch.	dBc	—	66	—
Trise, Tfall	10% to 90% RF, 90% to 10% RF	ns	—	15	—
Ton, Toff	50% Control to 90% RF, 50% Control to 10% RF	ns	—	20	—
Transients	In-band	mV	—	20	—
Control Current	—	µA	—	—	5

3. For positive voltage control, external DC blocking capacitors are required on all RF ports (pins 1, 2 and 3).

Absolute Maximum Ratings [4,5]

Parameter	Absolute Maximum
Input Power	+21 dBm
Control Voltage	8 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

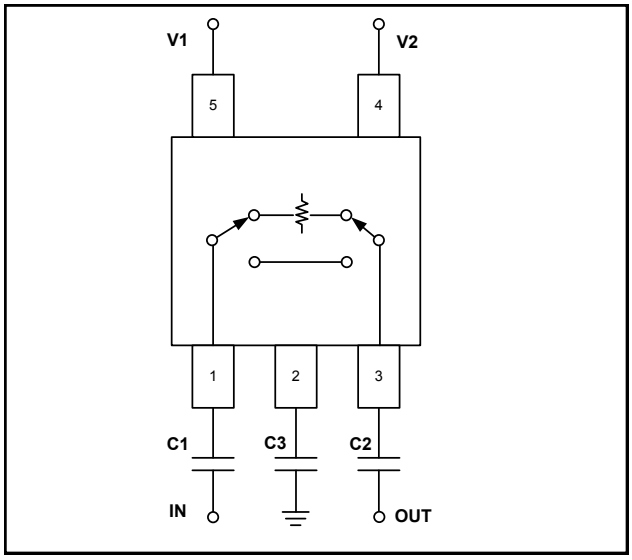
4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. M/A-COM Technology Solutions does not recommend sustained operation near these survivability limits.

Truth Table

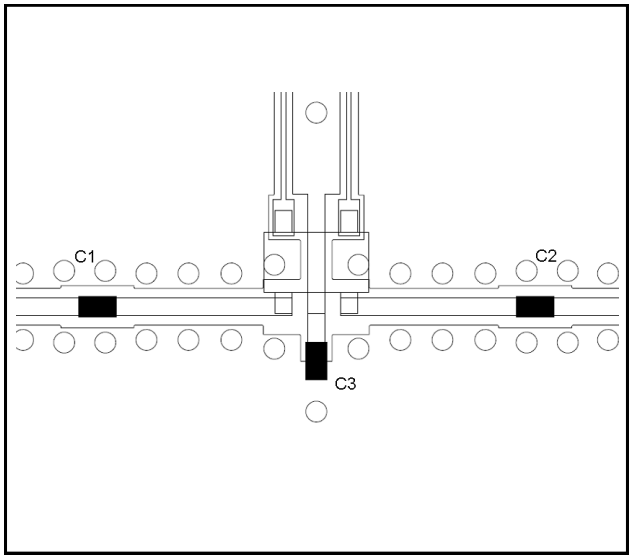
Mode (Control)	V1	V2	Attenuation
Positive [6]	0 ± 0.2V +2.5V to +5V	+2.5V to +5V 0 ± 0.2V	15 dB Reference State
Negative [7]	0 ± 0.2V -2.5V to -5V	-2.5V to -5V 0 ± 0.2V	Reference State 15 dB

6. External DC blocking capacitors are required as noted.
7. If negative control is used, DC blocking capacitors are not required on RF ports and ground.

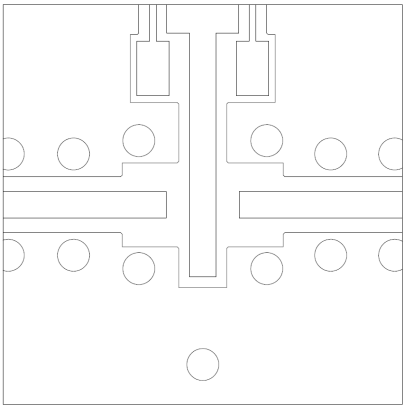
Positive Control Voltage Schematic



Recommended PCB Layout



PCB Land Pattern



Plated Vias are .024 diameter

Handling Procedures

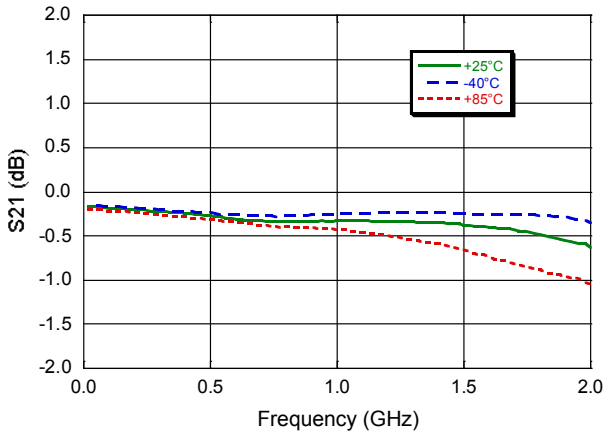
Please observe the following precautions to avoid damage:

Static Sensitivity

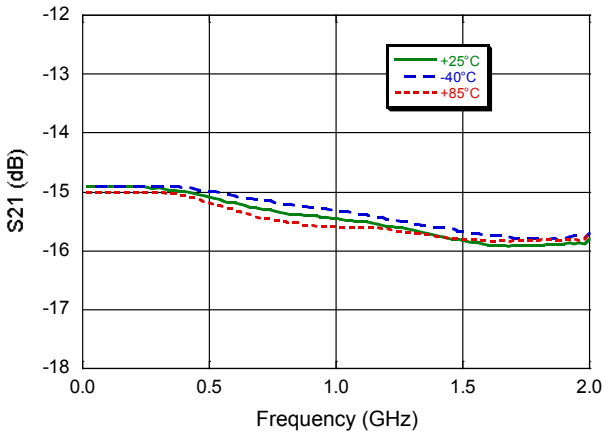
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance Curves with C1,C2,C3 = 0.01 µF, positive or negative mode (control)

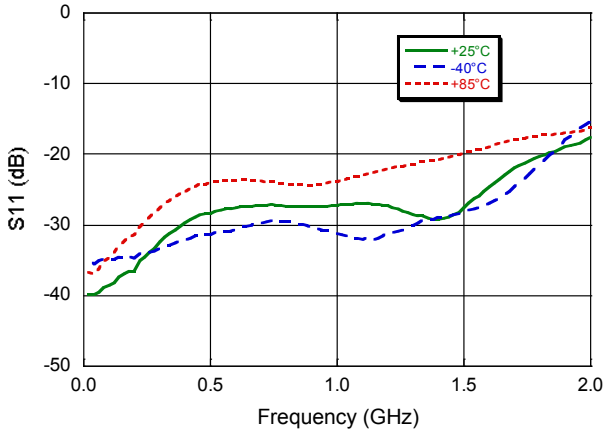
Insertion Loss



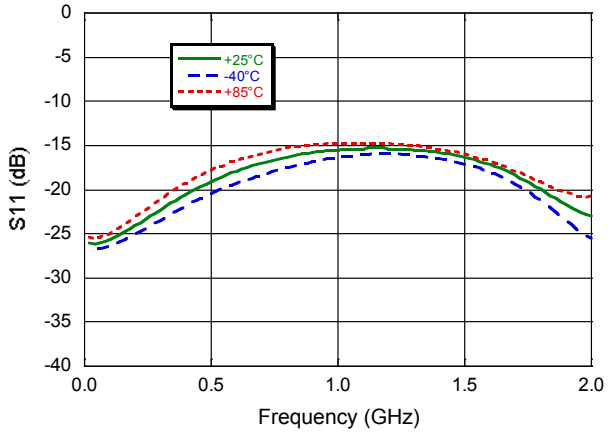
Relative Attenuation



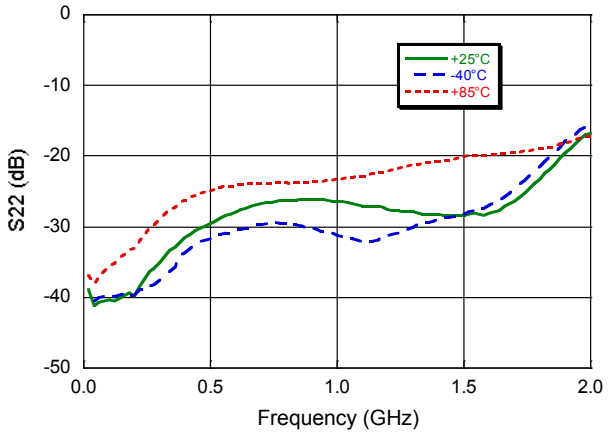
Input Return Loss



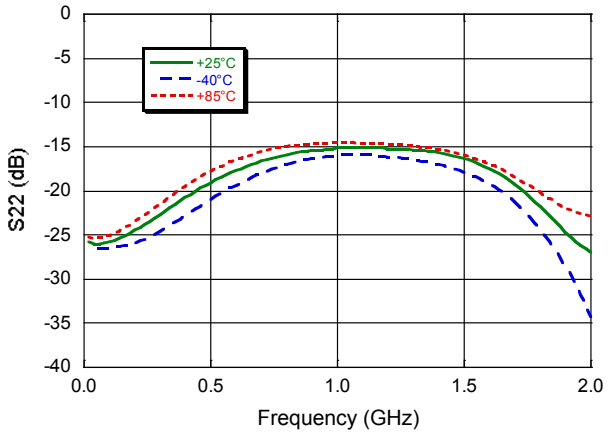
Input Return Loss_Full Attenuation



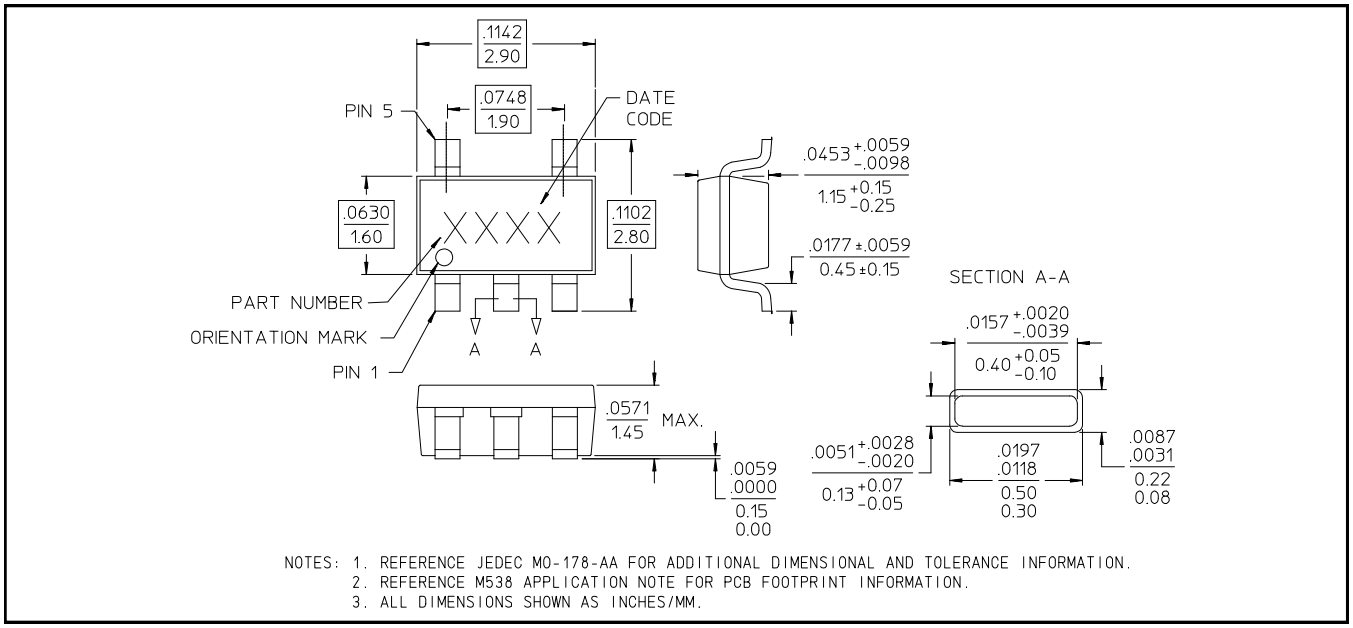
Output Return Loss



Output Return Loss_Full Attenuation



Lead-Free SOT-25†



NOTES: 1. REFERENCE JEDEC MO-178-AA FOR ADDITIONAL DIMENSIONAL AND TOLERANCE INFORMATION.
2. REFERENCE M538 APPLICATION NOTE FOR PCB FOOTPRINT INFORMATION.
3. ALL DIMENSIONS SHOWN AS INCHES/MM.

† Reference Application Note M538 for lead-free solder reflow recommendations.
Plating is 100% matte tin over copper.