MAADSS0019

Digital Attenuator, 15 dB, 4-Bit, Single Control 2 - 6 GHz

Rev. V3

Features

- Integrated e/d Logic on chip
- Positive Single Control
- Insertion Loss 1.9 dB @ 6 GHz
- IP3: 42 dBm typical @ 2 GHz
- 1 dB Attenuation Steps to 15 dB
- Lead-Free 3 mm 16-Lead PQFN Package
- Halogen-Free "Green" Mold Compound
- RoHS* Compliant and 260°C Re-flow Compatible

Description

The MAADSS0019 is a 4-bit, 1-dB step GaAs MMIC digital attenuator in a lead-free 3 mm 16 lead PQFN surface mount plastic package.

The MAADSS0019 is ideally suited for use where high accuracy, very low power consumption and low intermodulation products are required. Typical applications include radio, cellular, wireless LANs, GPS equipment and other gain / level control circuits.

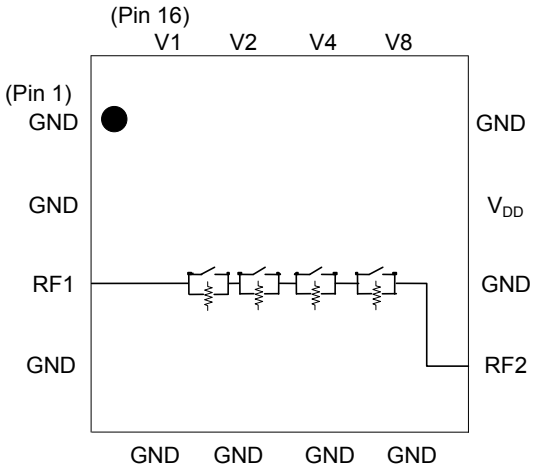
The MADSS0019 is part of a digital attenuator family. This family includes 4, 5 and 6 bit attenuators with 0.5, 1 or 2 dB steps and up to 31.5 range.

Ordering Information[1,2]

Part Number	Package
MAADSS0019TR	1000 piece reel
MAADSS0019SMB	Sample Board 2 - 6 GHz Tuning

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

Functional Schematic[3]



3. Blocking capacitors are required on all RF ports

Pin Configuration

Pin No.	Function	Pin No.	Function
1	Ground	9	RF In/Out
2	Ground	10	Ground
3	RF In/Out	11	V_{DD}
4	Ground	12	Ground
5	Ground	13	V8 (8 dB Bit)
6	Ground	14	V4 (4 dB Bit)
7	Ground	15	V2 (2 dB Bit)
8	Ground	16	V1 (1 dB Bit)
		17[4]	Ground

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

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

Electrical Specifications[5]: T_A = +25°C, V_{DD} = 5 V, Z_0 = 50 Ω

Parameter	Test Conditions	Units	Min.	Typ.	Max.
Reference Insertion Loss	2.4 GHz 4.0 GHz 6.0 GHz	dB	—	1.3 1.8 1.9	1.8 3.0 3.0
Attenuation Accuracy	2.0 - 5.0 GHz 5.0 - 6.0 GHz	± (0.3 dB + 3% of attenuation setting in dB) dB ± (0.5 dB + 3% of attenuation setting in dB) dB			
VSWR	2.0 - 6.0 GHz	Ratio	—	1.4:1	—
T_{RISE}, T_{FALL}	10% to 90% RF, 90% to 10% RF	ns	—	50	—
T_{ON}, T_{OFF}	50% Control to 90% RF, 50% Control to 10% RF	ns	—	50	—
Transients	In Band	mV	—	75	—
1 dB Compression	Input Power, 2.0 GHz	dBm	—	25	—
IP2	2.0 - 6.0 GHz Measured Relative to Input (for two-tone Input Power up to +5 dBm)	dBm	—	80	—
IP3	2.0 - 6.0 GHz Measured Relative to Input (for two-tone Input Power up to +5 dBm)	dBm	—	42	—
I_C	V_C = 5 V	µA	—	15	25
I_{DD}	V_{DD} = 5 V	µA	—	170	300

5. External DC blocking capacitors are required on all RF ports. Loss varies at 0.003 dB/°C.

Truth Table[6]

VC1	VC2	VC4	VC8	Attenuation (dB)
0	0	0	0	Reference IL
1	0	0	0	1
0	1	0	0	2
0	0	1	0	4
0	0	0	1	8
1	1	1	1	15

6. 0 = 0 ± 0.2 V, 1 = 2.8 to 5.0 V

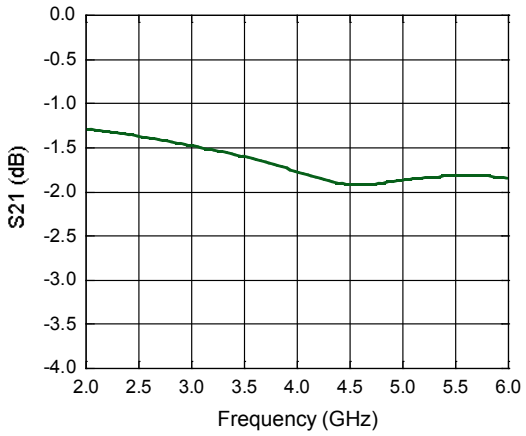
Absolute Maximum Ratings[7,8]

Parameter	Absolute Maximum
Input Power 50 MHz 500 - 6000 MHz	 +27 dBm +33 dBm
Control Voltage	-0.5 V ≤ V_C ≤ 5.5 V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +150°C

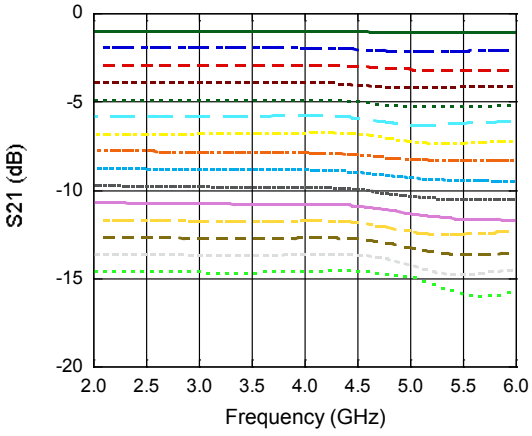
7. Exceeding any one or combination of these limits may cause permanent damage to this device.
8. MACOM does not recommend sustained operation near these survivability limits.

Typical Performance Curves

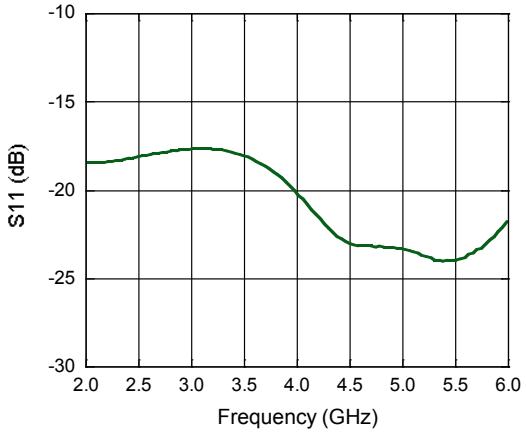
Insertion Loss



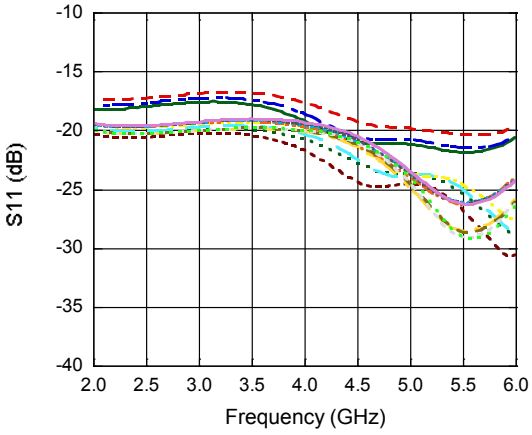
Relative Attenuation across all states



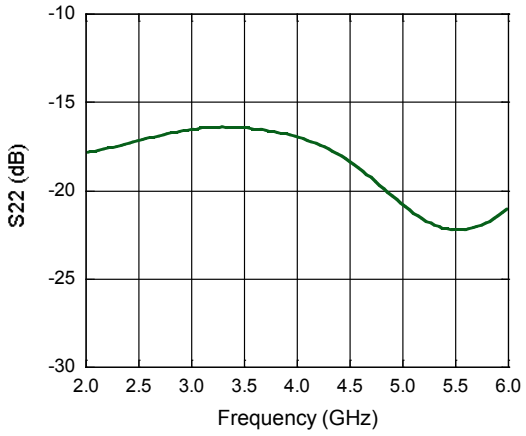
Input Return Loss, Insertion Loss State



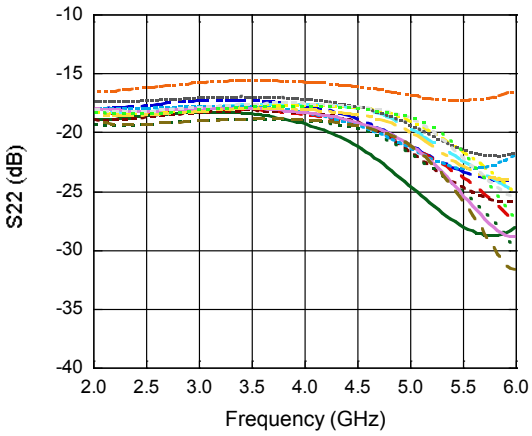
Input Return Loss, across all attenuation states



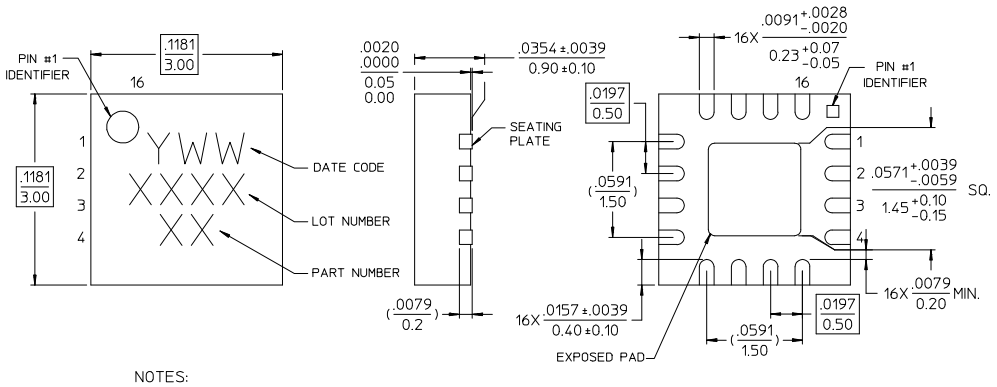
Output Return Loss, Insertion Loss State



Output Return Loss, across all attenuation states



Lead Free 3 mm 16-Lead PQFN †



† Reference Application Note S2038 for lead-free solder reflow recommendations.
Meets JEDEC moisture sensitivity level 1 requirements.
Plating is 100% matte tin over copper.

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.