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MAAD-007083

Digital Attenuator, 31.0 dB, 5-Bit, TTL Driver, DC - 6.0 GHz

Rev. V5

Features

- Attenuation: 1.0 dB Steps to 31 dB
- High Accuracy to 6 GHz
- Small Footprint, JEDEC Package
- Integral TTL driver
- 50 ohm impedance
- Test boards are available
- Tape and Reel Packaging Available
- Lead-Free CSP-1 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- 260°C Reflow Compatible
- RoHS* Compliant Version of AT90-0001

Description

M/A-COM's MAAD-007083-000100 is a GaAs FET 5-bit digital attenuator with an integral TTL driver. Step size is 1.0 dB providing 31 dB total attenuation range. This device is in a 32 lead FQFP-N surface mount package. Due to superior grounding techniques this digital attenuator offers superior performance to 6 GHz. The MAAD-007083-000100 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required.

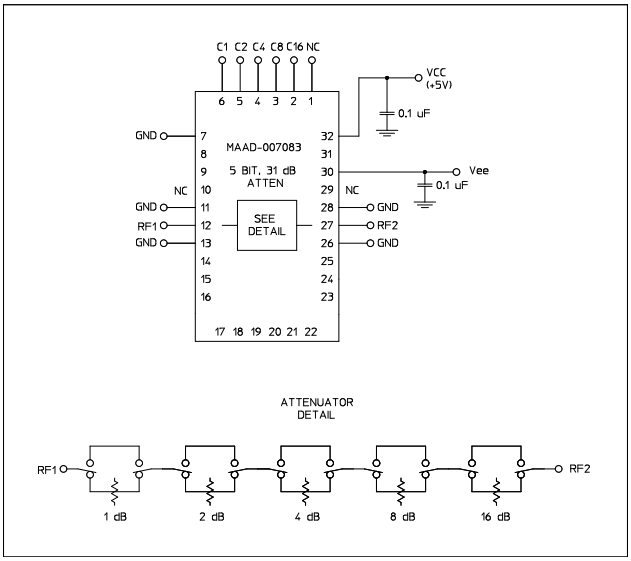
Ordering Information

Part Number	Package
MAAD-007083-000100	Bulk Packaging
MAAD-007083-0001TR	1000 piece reel
MAAD-007083-0001TB	Sample Test Board

Note: Reference Application Note M513 for reel size information.

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

Functional Schematic



Pin Configuration[1]

Pin No.	Function	Pin No.	Function
1	NC	17	NC
2	C16	18	NC
3	C8	19	NC
4	C4	20	NC
5	C2	21	NC
6	C1	22	NC
7	GND	23	NC
8	NC	24	NC
9	NC	25	NC
10	NC[2]	26	GND
11	GND	27	RF2
12	RF1	28	GND
13	GND	29	NC[2]
14	NC	30	-Vee
15	NC	31	NC
16	NC	32	+Vcc

1. The exposed pad centered on the package bottom must be connected to RF and DC ground. (For PQFN Packages)
2. Pins 10 and 29 must be isolated.

Digital Attenuator, 31.0 dB, 5-Bit, TTL Driver, DC - 6.0 GHz

Rev. V5

Electrical Specifications: T_A = 25°C, Z_0 = 50Ω, Vcc = 5.0V, Vee = -5.0V

Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Insertion Loss	—	DC - 2.0 GHz DC - 4.0 GHz DC - 6.0 GHz	dB dB dB	— — —	2.5 3.3 5.0	3.1 3.8 5.8
Attenuation Accuracy	1 to 24 dB Bits 25 to 31 dB Bits	DC - 6.0 GHz DC - 6.0 GHz	dB dB	— —	— —	±(0.3 +4% of atten.) ±(0.3 +5% of atten.)
VSWR	Full Range	DC - 2.0 GHz DC - 6.0 GHz	Ratio Ratio	— —	1.4:1 1.7:1	1.7:1 2.4:1
1 dB Compression	— —	50 MHz 0.5 - 6.0 GHz	dBm dBm	— —	+22 +24	— —
Input IP2	Two tone inputs to +5 dBm	50 MHz 0.5 - 6.0 GHz	dBm dBm	— —	+43 +60	— —
Input IP3	Two-tone inputs up to +5 dBm	50 MHz 0.5-6.0 GHz	dB dB	— —	+37 +48	— —
Vcc Vee	— —	— —	V V	4.75 -8.0	5.0 -5.0	5.25 -4.75
Switching Speed	50% Cntl to 90%/10% RF 10% to 90% or 90% to 10%	— —	ns ns	— —	25 15	— —
V_{IL} V_{IH}	LOW-level input voltage HIGH-level input voltage	— —	V V	0.0 2.0	- -	0.8 5.0
Iin (Input Leakage Current)	Vin = Vcc or GND	—	uA	-1.0	-	1.0
Icc (Quiescent Supply Current)	Vcntrl = Vcc or GND	—	uA	—	250	400
ΔIcc[3] (Additional Supply Current Per TTL Input Pin)	Vcc = Max, Vcntrl = Vcc - 2.1V	—	mA	—	—	1.0
Iee	Vee min to max, Vin = V_{IL} or V_{IH}	—	mA	-1.0	-0.2	-
Thermal Resistance θjc	—	—	°C/W	—	15	—

3. The 16 dB bit is connected to two driver input pins, so ΔIcc needs to be calculated based on 6 TTL inputs.

Truth Table (Digital Attenuator)

C16	C8	C4	C2	C1	Attenuation
0	0	0	0	0	Loss, Reference
0	0	0	0	1	1 dB
0	0	0	1	0	2 dB
0	0	1	0	0	4 dB
0	1	0	0	0	8 dB
1	0	0	0	0	16 dB
1	1	1	1	1	31 dB

0 = TTL Low; 1 = TTL High

Absolute Maximum Ratings[4,5]

Parameter	Absolute Maximum
Input Power 0.05 GHz 0.5 - 6.0 GHz	 +27 dBm +34 dBm
Vcc	-0.5V ≤ Vcc ≤ +7.0V
Vee	-8.5V ≤ Vee ≤ +0.5V
Vcc - Vee	-0.5V ≤ Vcc - Vee ≤ 14.5V
Vin[6]	-0.5V ≤ Vin ≤ Vcc + 0.5V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C

4. Exceeding any one or combination of these limits may cause permanent damage to this device.
5. MACOM does not recommend sustained operation near these survivability limits.
6. Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

Handling Procedures

Please observe the following precautions to avoid damage:

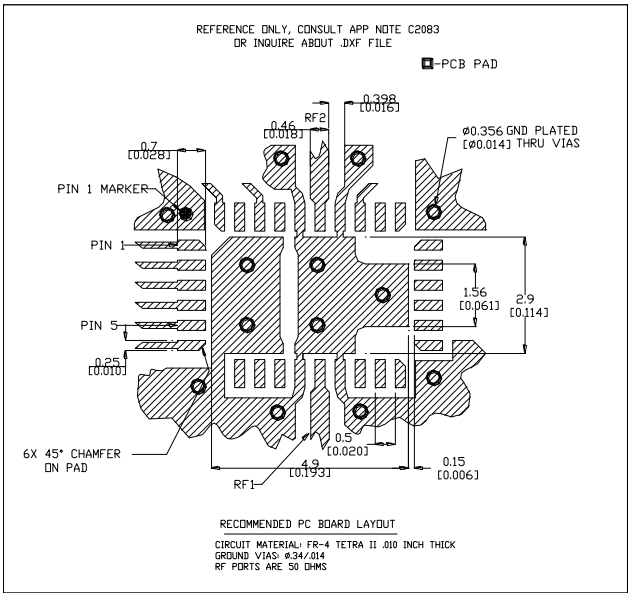
Static Sensitivity

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.

Moisture Sensitivity

The MSL rating for this part is defined as Level 2 per IPC/JEDEC J-STD-020. Parts shall be stored and/or baked as required for MSL Level 2 parts.

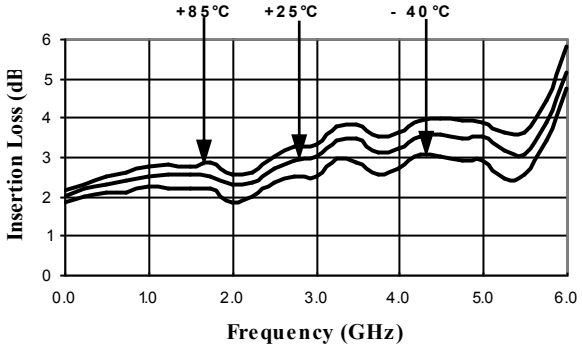
Recommended PCB Configuration[7]



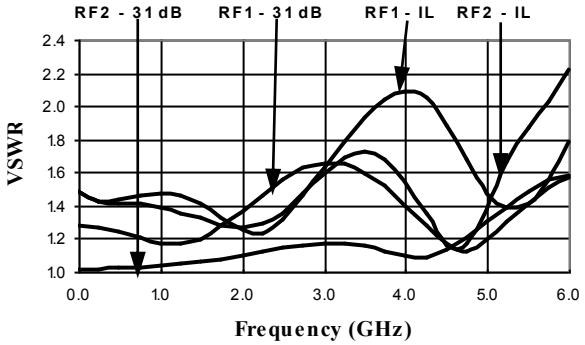
7. Application Note S2083 is available at www.macom.com

Typical Performance Curves

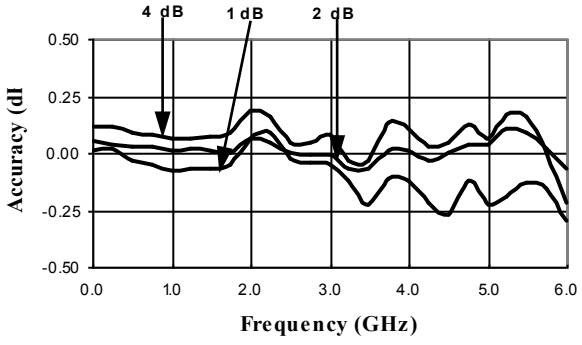
Insertion Loss vs. Frequency



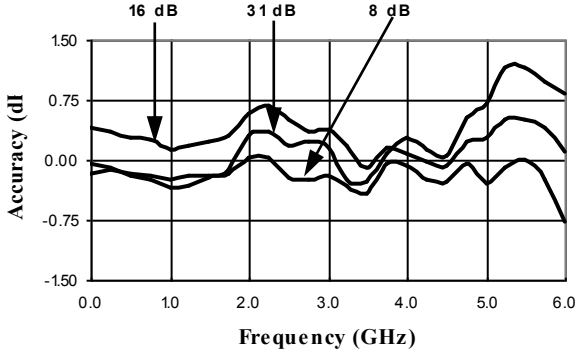
VSWR vs. Frequency



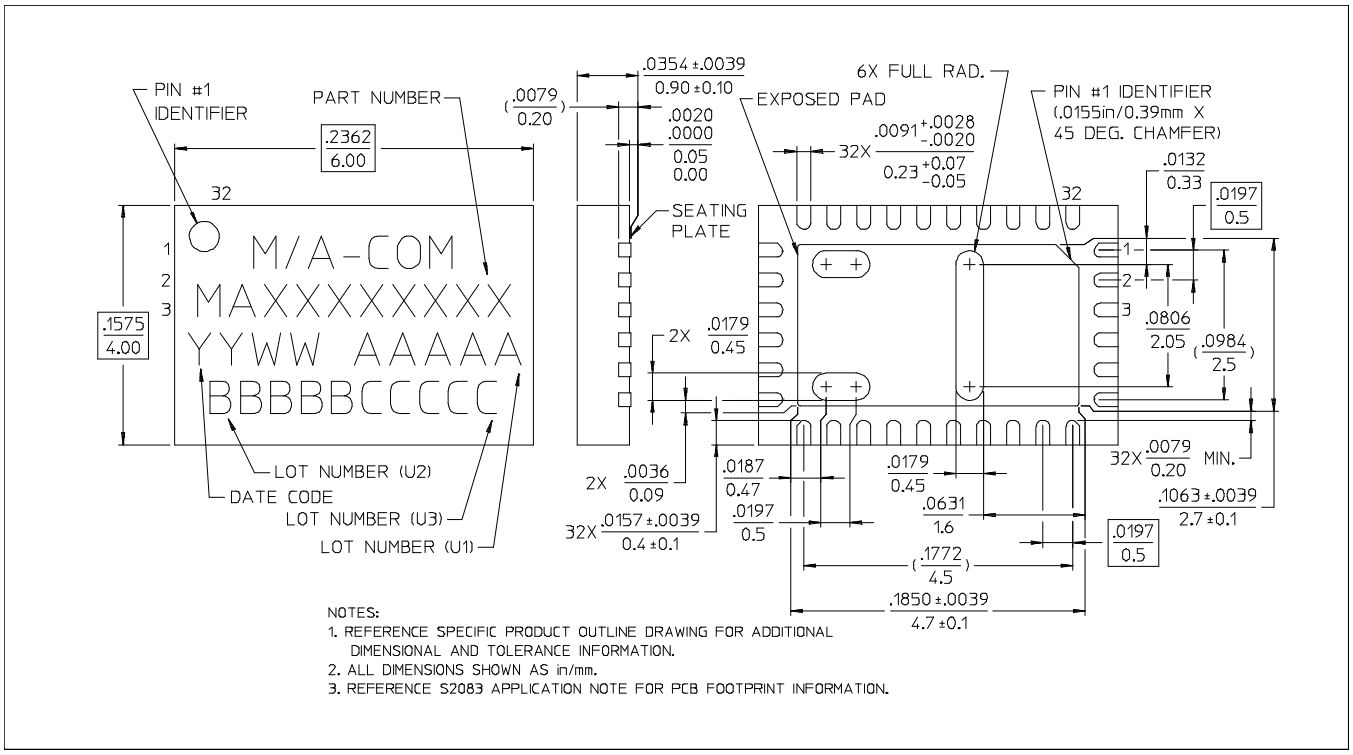
Accuracy (dB) vs. Frequency



Accuracy (dB) vs. Frequency



CSP-1, Lead-Free 4 x 6 mm, 32-lead PQFN†



† Reference Application Note M538 for lead-free solder reflow recommendations.