

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

**MAAD-007083-000100  
V2**

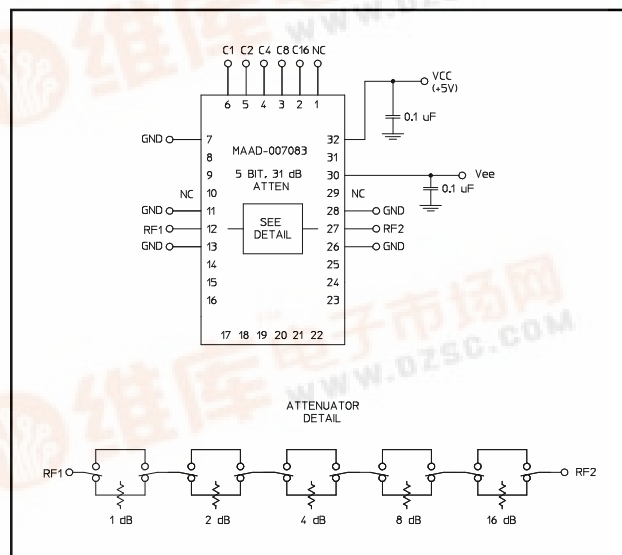
**Features**

- 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.

**Functional Schematic**



**Pin Configuration<sup>1</sup>**

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 <sup>2</sup>	26	GND
11	GND	27	RF2
12	RF1	28	GND
13	GND	29	NC <sup>2</sup>
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.

**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.

Note: Die quantity varies.

\* Restrictions on Hazardous Substances, European Union Directive

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**Electrical Specifications:  $T_A = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $V_{cc} = 5.0\text{V}$ ,  $V_{ee} = -5.0\text{V}$**

Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Insertion Loss	—	DC - 2.0 GHz	dB	—	2.5	3.1
		DC - 4.0 GHz	dB	—	3.3	3.8
		DC - 6.0 GHz	dB	—	5.0	5.8
Attenuation Accuracy	1 to 24 dB Bits	DC - 6.0 GHz	dB	—	—	$\pm(0.3 +4\% \text{ of atten.})$
	25 to 31 dB Bits	DC - 6.0 GHz	dB	—	—	$\pm(0.3 +5\% \text{ of atten.})$
VSWR	Full Range	DC - 2.0 GHz	Ratio	—	1.4:1	1.7:1
		DC - 6.0 GHz	Ratio	—	1.7:1	2.4:1
1 dB Compression	—	50 MHz	dBm	—	+22	—
		0.5 - 6.0 GHz	dBm	—	+24	—
Input IP2	Two tone inputs to +5 dBm	50 MHz	dBm	—	+43	—
		0.5 - 6.0 GHz	dBm	—	+60	—
Input IP3	Two-tone inputs up to +5 dBm	50 MHz	dB	—	+37	—
		0.5-6.0 GHz	dB	—	+48	—
V <sub>cc</sub>	—	—	V	4.75	5.0	5.25
V <sub>ee</sub>	—	—	V	-8.0	-5.0	-4.75
Switching Speed	50% Cntl to 90%/10% RF 10% to 90% or 90% to 10%	—	ns	—	25	—
		—	ns	—	15	—
V <sub>IL</sub>	LOW-level input voltage	—	V	0.0	-	0.8
V <sub>IH</sub>	HIGH-level input voltage	—	V	2.0	-	5.0
I <sub>in</sub> (Input Leakage Current)	V <sub>in</sub> = V <sub>cc</sub> or GND	—	uA	-1.0	-	1.0
I <sub>cc</sub> (Quiescent Supply Current)	V <sub>cntrl</sub> = V <sub>cc</sub> or GND	—	uA	—	250	400
$\Delta I_{cc}^3$ (Additional Supply Current Per TTL Input Pin)	V <sub>cc</sub> = Max, V <sub>cntrl</sub> = V <sub>cc</sub> - 2.1V	—	mA	—	—	1.0
I <sub>ee</sub>	V <sub>ee</sub> min to max, V <sub>in</sub> = V <sub>IL</sub> or V <sub>IH</sub>	—	mA	-1.0	-0.2	-
Thermal Resistance $\theta_{jc}$	—	—	$^\circ\text{C/W}$	—	15	—

3. The 16 dB bit is connected to two driver input pins, so  $\Delta I_{cc}$  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<sup>4,5</sup>**

Parameter	Absolute Maximum
Max. Input Power 0.05 GHz 0.5 - 6.0 GHz	+27 dBm +34 dBm
V <sub>cc</sub>	-0.5V $\leq$ V <sub>cc</sub> $\leq$ +7.0V
V <sub>ee</sub>	-8.5V $\leq$ V <sub>ee</sub> $\leq$ +0.5V
V <sub>cc</sub> - V <sub>ee</sub>	-0.5V $\leq$ V <sub>cc</sub> - V <sub>ee</sub> $\leq$ 14.5V
V <sub>in</sub> <sup>6</sup>	-0.5V $\leq$ V <sub>in</sub> $\leq$ V <sub>cc</sub> + 0.5V
Operating Temperature	-40 $^\circ\text{C}$ to +85 $^\circ\text{C}$
Storage Temperature	-65 $^\circ\text{C}$ to +125 $^\circ\text{C}$

4. Exceeding any one or combination of these limits may cause permanent damage to this device.  
5. M/A-COM 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**

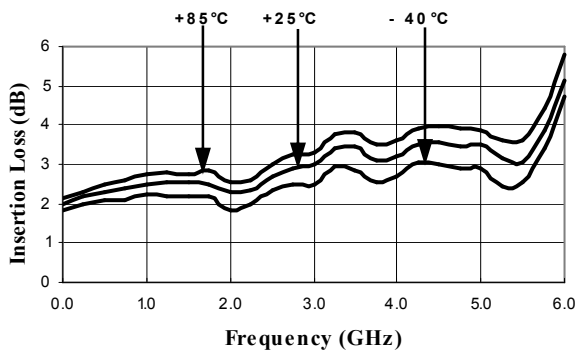
Please observe the following precautions to avoid damage:

**Static Sensitivity**

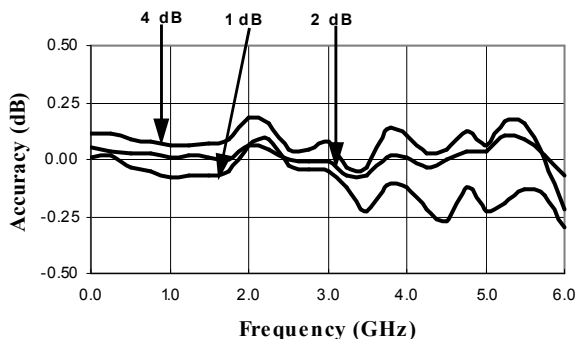
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

**Typical Performance Curves**

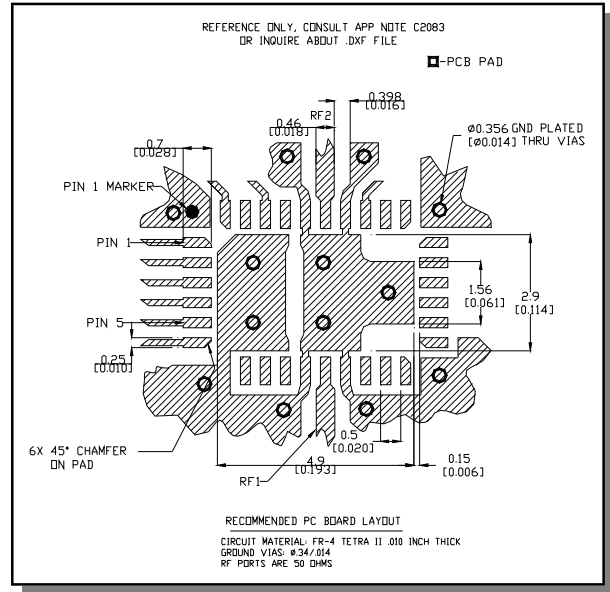
**Insertion Loss vs. Frequency**



**Accuracy (dB) vs. Frequency**

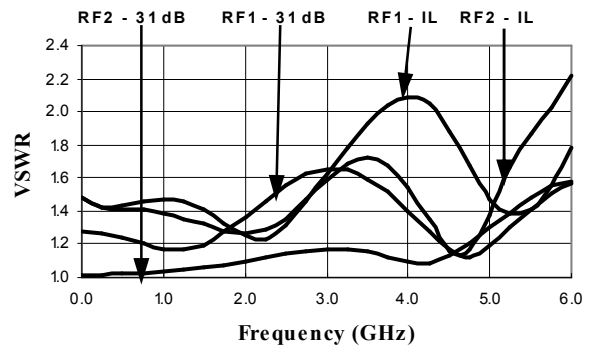


**Recommended PCB Configuration<sup>7</sup>**

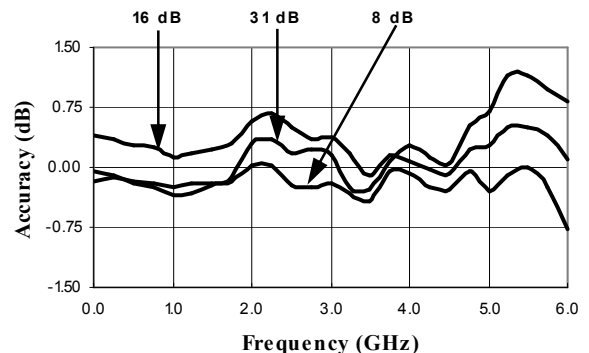


7. Application Note S2083 is available on line at [www.macom.com](http://www.macom.com)

**VSWR vs. Frequency**



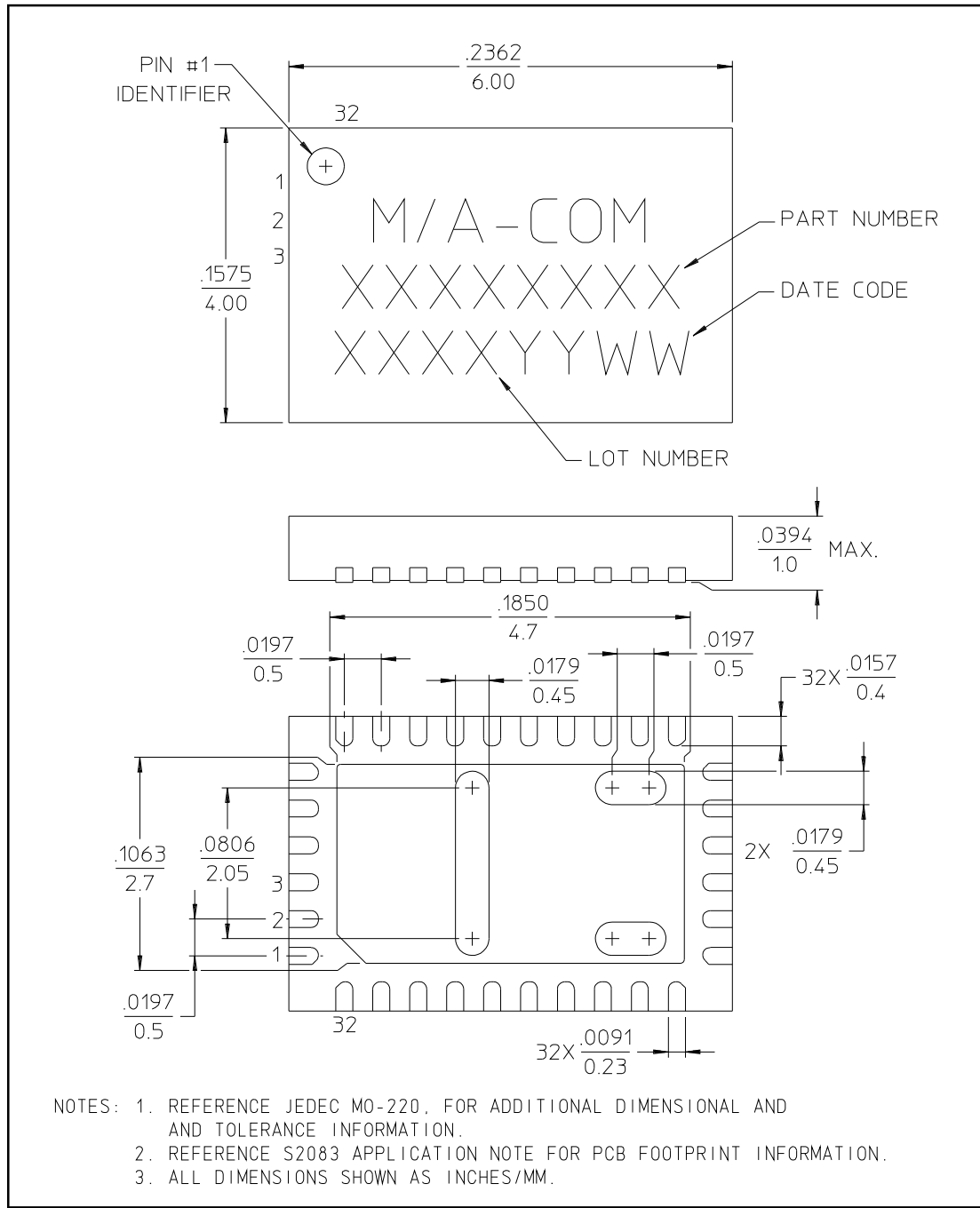
**Accuracy (dB) vs. Frequency**



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



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