

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.

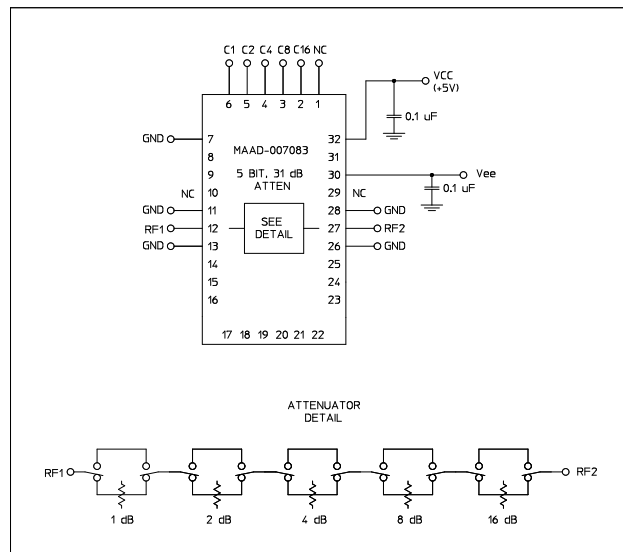
Ordering Information

| 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 Configuration¹

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

| 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 _{cc} | — | — | V | 4.75 | 5.0 | 5.25 |
| V _{ee} | — | — | 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 _{IL} | LOW-level input voltage | — | V | 0.0 | - | 0.8 |
| V _{IH} | HIGH-level input voltage | — | V | 2.0 | - | 5.0 |
| I _{in} (Input Leakage Current) | V _{in} = V _{cc} or GND | — | uA | -1.0 | - | 1.0 |
| I _{cc} (Quiescent Supply Current) | V _{cntrl} = V _{cc} or GND | — | uA | — | 250 | 400 |
| ΔI_{cc}^3 (Additional Supply Current Per TTL Input Pin) | V _{cc} = Max, V _{cntrl} = V _{cc} - 2.1V | — | mA | — | — | 1.0 |
| I _{ee} | V _{ee} min to max, V _{in} = V _{IL} or V _{IH} | — | mA | -1.0 | -0.2 | - |
| Thermal Resistance θ_{jc} | — | — | $^\circ\text{C/W}$ | — | 15 | — |

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

Absolute Maximum Ratings^{4,5}

| Parameter | Absolute Maximum |
|------------------------------------------|-------------------------------------------------------|
| Input Power 0.05 GHz 0.5 - 6.0 GHz | +27 dBm +34 dBm |
| V _{cc} | $-0.5\text{V} \leq V_{cc} \leq +7.0\text{V}$ |
| V _{ee} | $-8.5\text{V} \leq V_{ee} \leq +0.5\text{V}$ |
| V _{cc} - V _{ee} | $-0.5\text{V} \leq V_{cc} - V_{ee} \leq 14.5\text{V}$ |
| V _{in} ⁶ | $-0.5\text{V} \leq V_{in} \leq V_{cc} + 0.5\text{V}$ |
| Operating Temperature | -40°C to $+85^\circ\text{C}$ |
| Storage Temperature | -65°C to $+125^\circ\text{C}$ |

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.

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

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Handling Procedures

Please observe the following precautions to avoid damage:

Static Sensitivity

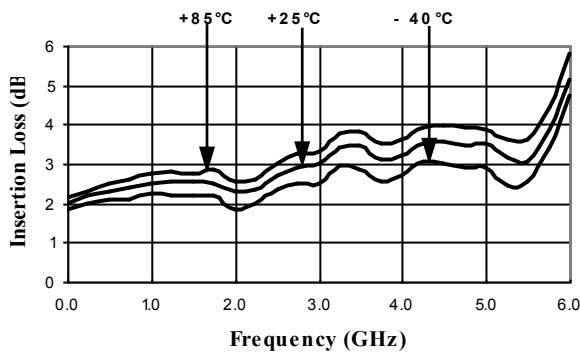
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Moisture Sensitivity

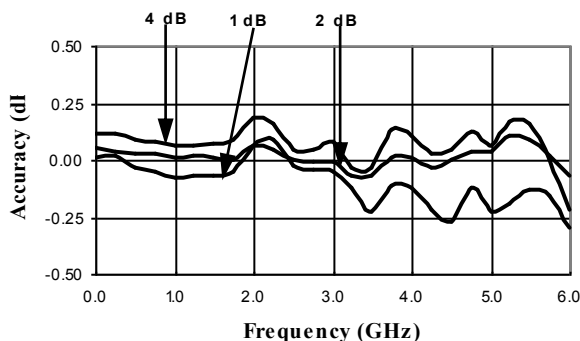
The MSL rating for this part is defined as Level 2 per IPC/JEDEC J-STD-020. Parts shall be stored and/or baked as required for MSL Level 2 parts.

Typical Performance Curves

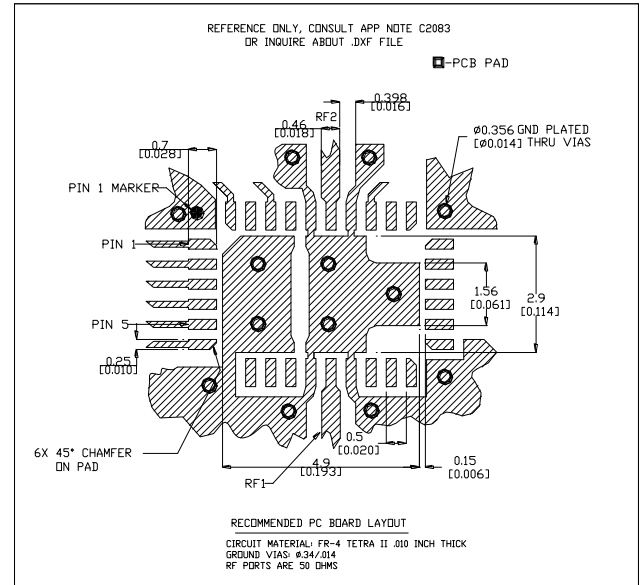
Insertion Loss vs. Frequency



Accuracy (dB) vs. Frequency

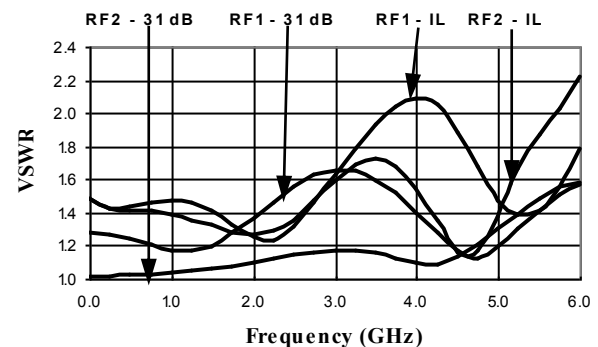


Recommended PCB Configuration⁷

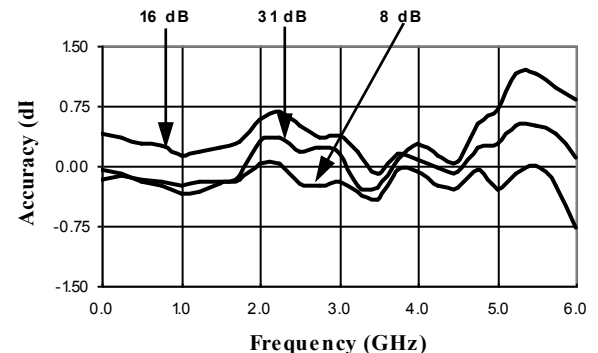


7. Application Note S2083 is available at www.macom.com

VSWR vs. Frequency



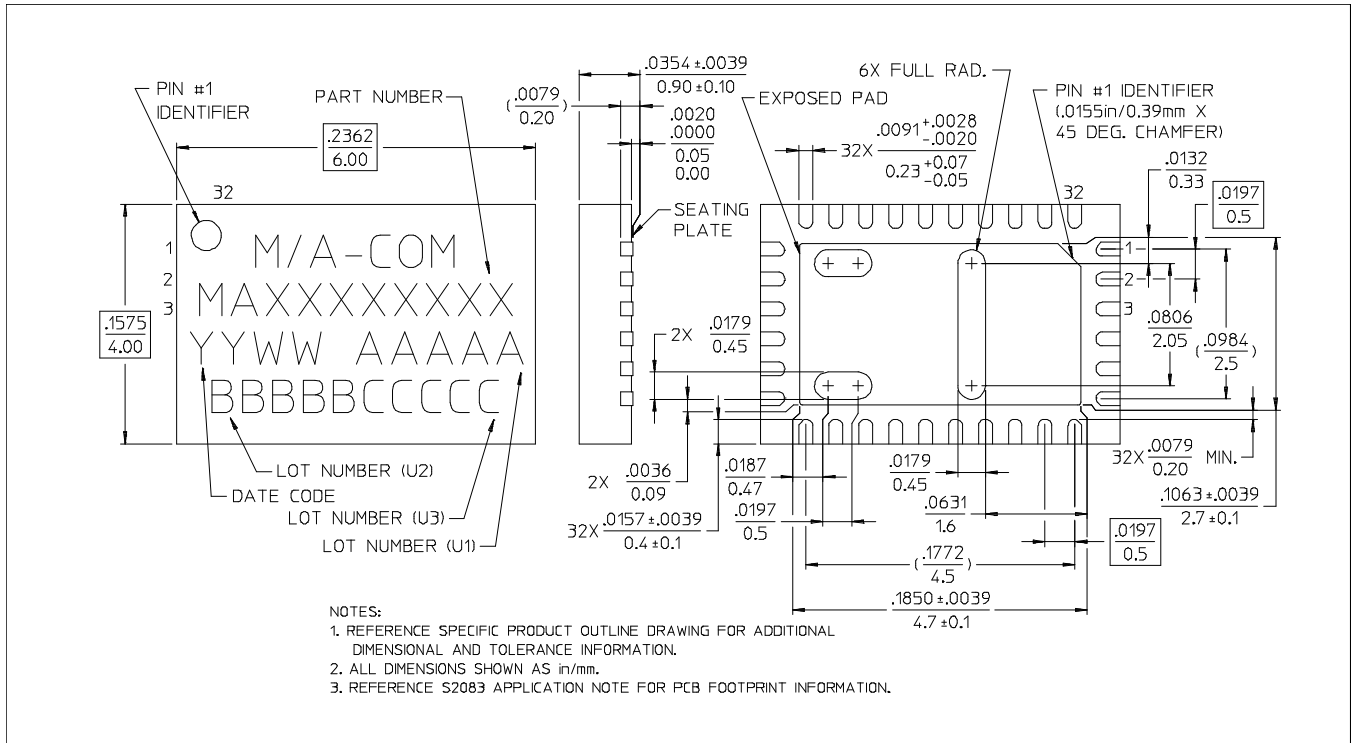
Accuracy (dB) vs. Frequency



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

Rev. V5

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



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

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