

## Features

- Attenuation: 0.5 dB Steps to 15.5 dB
- Low DC Power Consumption
- Integral TTL Driver
- 50 ohm Impedance
- Test Boards are Available
- Tape and Reel Packaging Available
- Lead-Free SOW-16 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS\* Compliant Version of AT65-0283

## Description

M/A-COM's MAAD-007084-000100 is a GaAs FET 5-bit digital attenuator with integral TTL driver. Step size is 0.5 dB providing a 15.5 dB total attenuation range. This device is in a SOW-16 plastic surface mount package. The MAAD-007084-000100 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required.

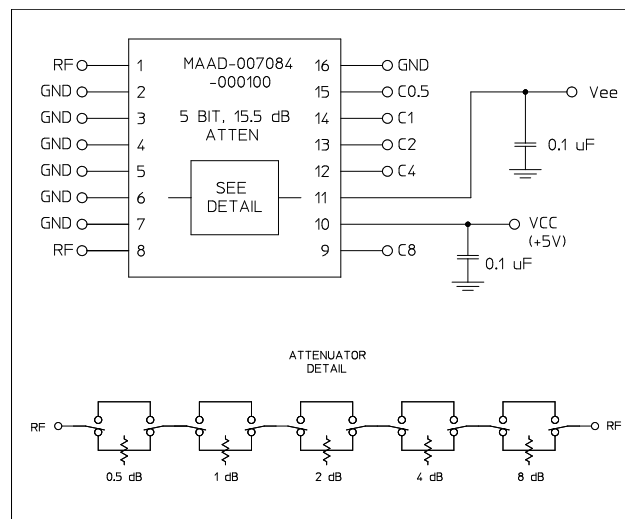
## Ordering Information

| Part Number        | Package           |
|--------------------|-------------------|
| MAAD-007084-000100 | Bulk Packaging    |
| MAAD-007084-0001TR | 1000 piece reel   |
| MAAD-007084-0001TB | Sample Test Board |

Note: Reference Application Note M513 for reel size information.

Note: Die quantity varies.

## Schematic with Off-Chip Components



## Pin Configuration

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1       | RF       | 9       | C8       |
| 2       | GND      | 10      | Vcc      |
| 3       | GND      | 11      | Vee      |
| 4       | GND      | 12      | C4       |
| 5       | GND      | 13      | C2       |
| 6       | GND      | 14      | C1       |
| 7       | GND      | 15      | C0.5     |
| 8       | RF       | 16      | GND      |

## Truth Table (Digital Attenuator)

| C8 | C4 | C2 | C1 | C0.5 | Attenuation     |
|----|----|----|----|------|-----------------|
| 0  | 0  | 0  | 0  | 0    | Loss, Reference |
| 0  | 0  | 0  | 0  | 1    | 0.5 dB          |
| 0  | 0  | 0  | 1  | 0    | 1.0 dB          |
| 0  | 0  | 1  | 0  | 0    | 2.0 dB          |
| 0  | 1  | 0  | 0  | 0    | 4.0 dB          |
| 1  | 0  | 0  | 0  | 0    | 8.0 dB          |
| 1  | 1  | 1  | 1  | 1    | 15.5 dB         |

0 = TTL Low; 1 = TTL High

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

## Digital Attenuator 15.5 dB, 5-Bit, TTL Driver, DC - 2.0 GHz

Rev. V3

### Electrical Specifications: $T_A = 25^\circ\text{C}$ , $Z_0 = 50\Omega$

| Parameter   | Test Conditions  | Frequency     | Units | Min  | Typ   | Max                              |
|---|--|---------------|-------|------|-------|----------------------------------|
| Insertion Loss  | —  | DC - 1.0 GHz  | dB    | —    | 2.5   | 2.7                              |
|   |  | DC - 2.0 GHz  | dB    | —    | 2.7   | 3.0                              |
| Attenuation Accuracy  | Any Bit<br>Any Combination of Bits   | DC - 2.0 GHz  | dB    | —    | —     | $\pm(.3 +4\% \text{ of atten})$  |
|   |  | DC -2.0 GHz   | dB    | —    | —     | $\pm (.3 +6\% \text{ of atten})$ |
| VSWR  | Full Range   | DC - 2.0 GHz  | Ratio | —    | 1.5:1 | 2:1                              |
| Switching Speed <sup>1</sup>  | 50% Cntl to 90%/10% RF<br>10% to 90% or 90% to 10%                               | —             | ns    | —    | 75    | 150                              |
|   |  | —             | ns    | —    | 20    | 50                               |
| 1 dB Compression  | —  | 50 MHz        | dBm   | —    | +21   | —                                |
|   |  | 0.5 - 2.0 GHz | dBm   | —    | +29   | —                                |
| Input IP <sub>3</sub>   | Two-tone inputs up to +5 dBm   | 50 MHz        | dB    | —    | +35   | —                                |
|   |  | 0.5-2.0 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                            |
| V <sub>IL</sub><br>V <sub>IH</sub>                                    | LOW-level input voltage<br>HIGH-level input voltage                              | —             | V     | 0.0  | —     | 0.8                              |
|   |  | —             | 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><br>(Quiescent Supply Current)                         | V <sub>cntrl</sub> = V <sub>CC</sub> or GND                                      | —             | uA    | —    | 250   | 400                              |
| $\Delta I_{CC}^2$<br>(Additional Supply Current<br>Per TTL Input Pin) | V <sub>CC</sub> = Max, V <sub>cntrl</sub> = V <sub>CC</sub> - 2.1 V              | —             | 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  | —                                |

- Decoupling capacitors (.01  $\mu\text{F}$ ) are required on power supply lines.
- For calculating  $\Delta I_{CC}$ , the number of TTL input pins is 6.

### Absolute Maximum Ratings<sup>3,4</sup>

| Parameter                                     | Absolute Maximum                                      |
|---|---|
| Max. Input Power<br>0.05 GHz<br>0.5 - 2.0 GHz | +27 dBm<br>+34 dBm                                    |
| V <sub>CC</sub>                               | $-0.5\text{V} \leq V_{CC} \leq +7.0\text{V}$          |
| V <sub>EE</sub>                               | $-8.5\text{V} \leq V_{EE} \leq +0.5\text{V}$          |
| V <sub>CC</sub> - V <sub>EE</sub>             | $-0.5\text{V} \leq V_{CC} - V_{EE} \leq 14.5\text{V}$ |
| V <sub>in</sub> <sup>5</sup>                  | $-0.5\text{V} \leq V_{in} \leq V_{CC} + 0.5\text{V}$  |
| Operating Temperature                         | -40°C to +85°C  |
| Storage Temperature                           | -65°C to +125°C                                       |

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

### Handling Procedures

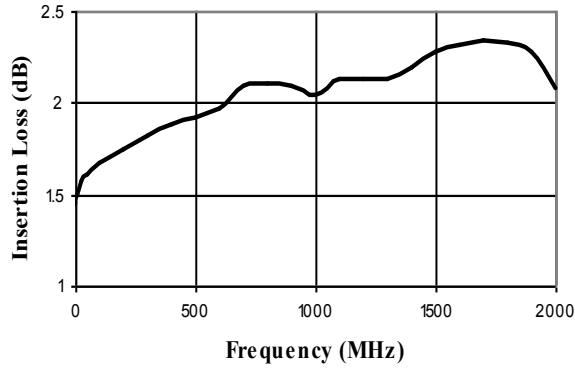
Please observe the following precautions to avoid damage:

### Static Sensitivity

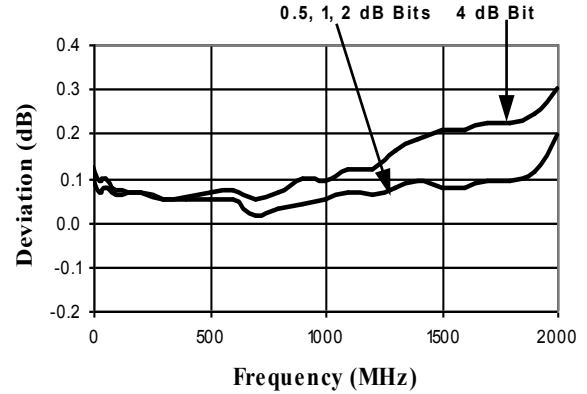
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

## Typical Performance Curves

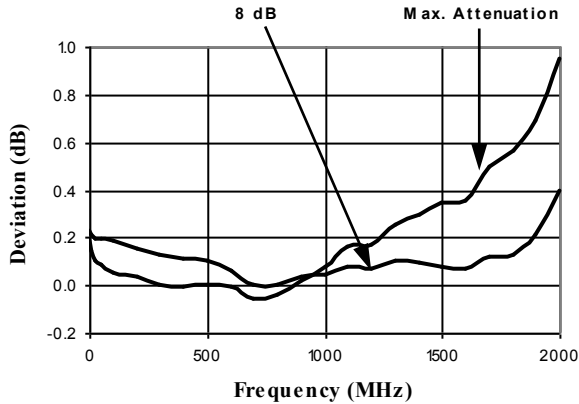
### Insertion Loss



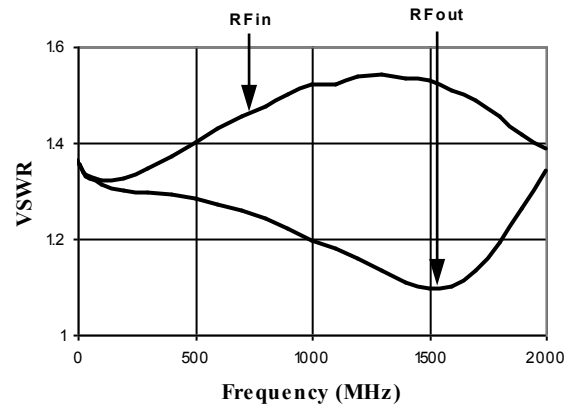
### Attenuation Accuracy 0.5, 1, 2, and 4 dB Bits



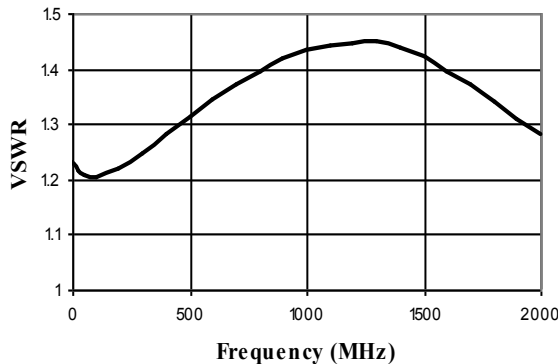
### Attenuation Accuracy 8 dB Bit and Max. Attenuation



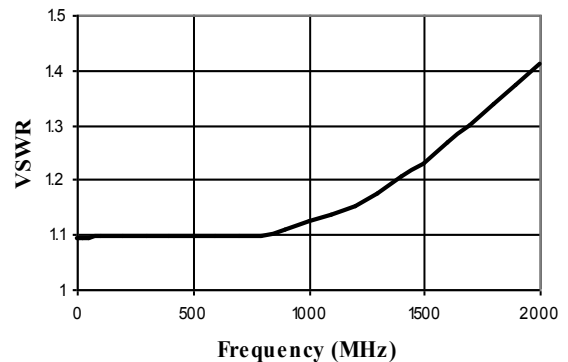
### VSWR @ Insertion Loss



### VSWR RF OUT 0.5, 1, 2, and 4 dB Bits



### VSWR RF IN 0.5, 1, 2, 4, 8 dB Bits and Max. Attenuation

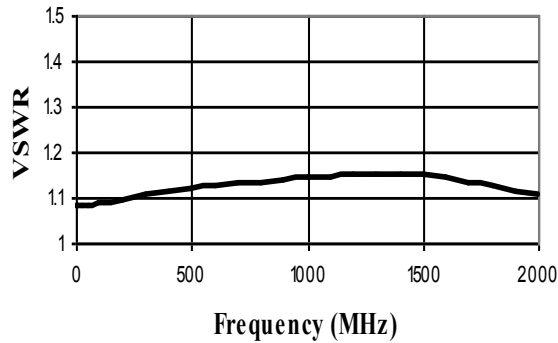


**Digital Attenuator**  
**15.5 dB, 5-Bit, TTL Driver, DC - 2.0 GHz**

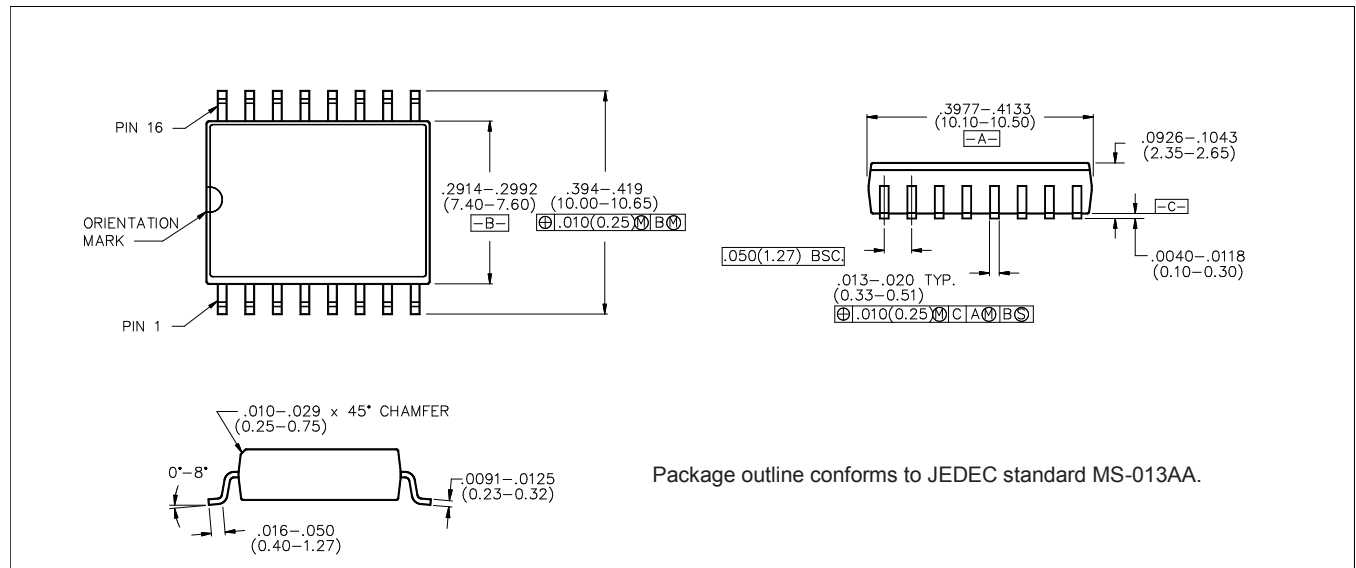
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## Typical Performance Curves

*VSWR RF OUT 8 dB Bit and Max. Attenuation*



## Lead-Free, SOW-16<sup>†</sup>



<sup>†</sup> Reference Application Note M538 for lead-free solder reflow recommendations.

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