

## Digital Attenuator 30 dB, 4-Bit, TTL Driver, DC - 3 GHz

Rev. V5

### Features

- Attenuation: 2 dB Steps to 30 dB
- Low DC Power Consumption
- Integral TTL Driver
- 50 Ω Impedance
- Temperature Stability:  
±0.18 dB from -55°C to +85°C
- Lead-Free SO-16 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS\* Compliant Version of AT65-0233

### Description

The MAATCC0006 is a GaAs FET 4-bit digital attenuator with a 2 dB minimum step size and a 30 dB total attenuation range. This device is in a SOIC-16 plastic surface mount package.

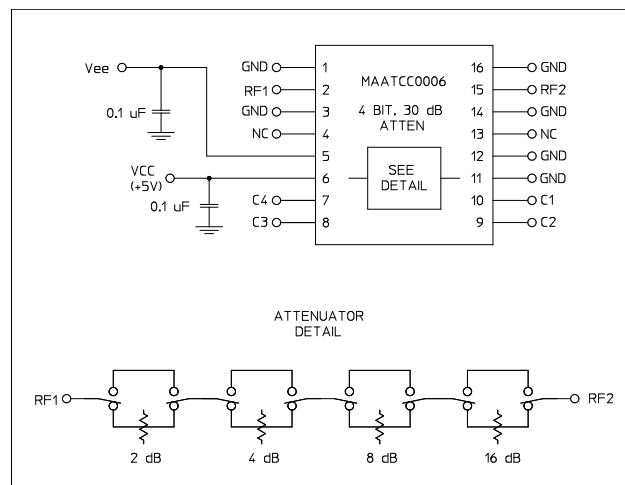
The MAATCC0006 is ideally suited for use where accuracy, fast speed, very low power consumption is required. Typical applications include dynamic range setting in precision receiver circuits and other gain/leveling control circuits.

### Ordering Information<sup>1</sup>

| Part Number   | Package           |
|---------------|-------------------|
| MAATCC0006    | Bulk Packaging    |
| MAATCC0006TR  | 1000 piece reel   |
| MAATCC0006-TB | Sample Test Board |

1. Reference Application Note M513 for reel size information.

### Schematic with Off-Chip Components or Functional Block Diagram



### Pin Configuration

| Pin # | Function        | Pin # | Function        |
|-------|-----------------|-------|-----------------|
| 1     | GND             | 9     | C2              |
| 2     | RF1             | 10    | C1              |
| 3     | GND             | 11    | GND             |
| 4     | NC <sup>2</sup> | 12    | GND             |
| 5     | Vee             | 13    | NC <sup>2</sup> |
| 6     | Vcc             | 14    | GND             |
| 7     | C4              | 15    | RF2             |
| 8     | C3              | 16    | GND             |

2. NC = No Connection

\* Restrictions on Hazardous Substances, compliant to current RoHS EU directive.

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### Electrical Specifications: $T_A = 25^\circ\text{C}$

| Parameter   | Test Conditions  | Units         | Min.                       | Typ.       | Max.  |
|---|--|---------------|----------------------------|------------|-------|
| Insertion Loss  | DC - 0.5 GHz   | dB            | —                          | 1.7        | 2.0   |
|   | DC - 2.0 GHz   |               |                            | 2.3        | 2.7   |
|   | DC - 3.0 GHz   |               |                            | 2.6        | 3.1   |
| Attenuation Accuracy  | Any Bit or Combination of Bits<br>DC - 3.0 GHz             | dB            | ± (.4 + 8% of attenuation) |            |       |
| VSWR  | Full Range<br>DC - 3.0 GHz                                 | Ratio         | —                          | —          | 1.7:1 |
| Trise, Tfall<br>Ton, Toff<br>Transients                             | 10% to 90%   | ns            | —                          | 10         | 50    |
|   | 50% Cntl to 90%/10% RF                                     | ns            |                            | 30         | 150   |
|   | In-Band  | mV            |                            | 35         | —     |
| 1 dB Compression  | Input Power<br>0.05 GHz<br>0.5 - 3.0 GHz                   | dBm           | —                          | +20<br>+28 | —     |
| Input $IP_3$  | Two-tone inputs up to +5 dBm<br>0.05 GHz<br>0.5 - 3.0 GHz  | dBm           | —                          | +40<br>+50 | —     |
| Input $IP_2$  | Two-tone inputs up to +5 dBm<br>0.05 GHz<br>0.5 - 3.0 GHz  | dBm           | —                          | +45<br>+68 | —     |
| VCC   | —  | V             | 4.5                        | 5.0        | 5.5   |
| VEE   | —  | V             | -8.0                       | -5.0       | -4.75 |
| $V_{IL}$  | LOW-level input voltage<br>HIGH-level input voltage        | V             | 0.0                        | —          | 0.8   |
| $V_{IH}$  |  |               | 2.0                        | —          | 5.0   |
| $I_{in}$ (Input Leakage Current)                                    | $V_{in} = V_{CC}$ or GND                                   | $\mu\text{A}$ | -1.0                       | —          | 1.0   |
| $I_{cc}$<br>(Quiescent Supply Current)                              | $V_{ctrl} = V_{CC}$ or GND                                 | $\mu\text{A}$ | —                          | 250        | 400   |
| $\Delta I_{cc}$<br>(Additional Supply Current Per TTL<br>Input Pin) | $V_{CC} = \text{Max}$ , $V_{ctrl} = V_{CC} - 2.1\text{ V}$ | mA            | —                          | —          | 1.0   |
| IEE   | VEE min to max, $V_{in} = V_{IL}$ or $V_{IH}$              | mA            | -1.0                       | -0.2       | —     |

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

| Parameter                                | Absolute Maximum  |
|--|---|
| Input Power<br>0.05 GHz<br>0.5 - 3.0 GHz | +27 dBm<br>+34 dBm                                      |
| $V_{CC}$                                 | $-0.5\text{ V} \leq V_{CC} \leq +7.0\text{ V}$          |
| $V_{EE}$                                 | $-8.5\text{ V} \leq V_{EE} \leq +0.5\text{ V}$          |
| $V_{CC} - V_{EE}$                        | $-0.5\text{ V} \leq V_{CC} - V_{EE} \leq 14.5\text{ V}$ |
| $V_{in}^5$                               | $-0.5\text{ V} \leq V_{in} \leq V_{CC} + 0.5\text{ V}$  |
| 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 applied prior to power supply.

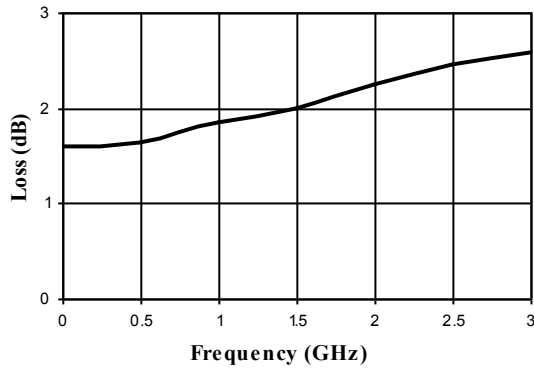
### Truth Table (Digital Attenuator)<sup>6</sup>

| C1 | C2 | C3 | C4 | Attenuation     |
|----|----|----|----|-----------------|
| 0  | 0  | 0  | 0  | Loss, Reference |
| 1  | 0  | 0  | 0  | 2.0 dB          |
| 0  | 1  | 0  | 0  | 4.0 dB          |
| 0  | 0  | 1  | 0  | 8.0 dB          |
| 0  | 0  | 0  | 1  | 16.0 dB         |
| 1  | 1  | 1  | 1  | 30.0 dB         |

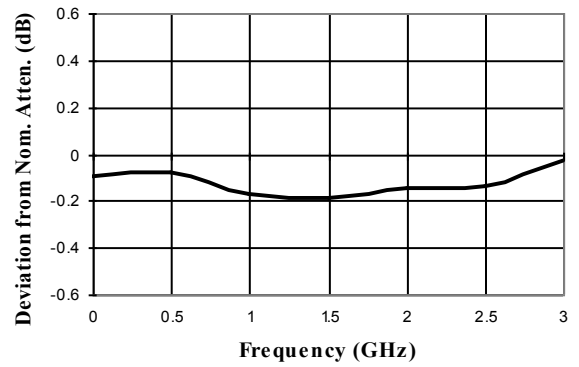
6. 0 = TTL Low; 1 = TTL High

## Typical Performance Curves

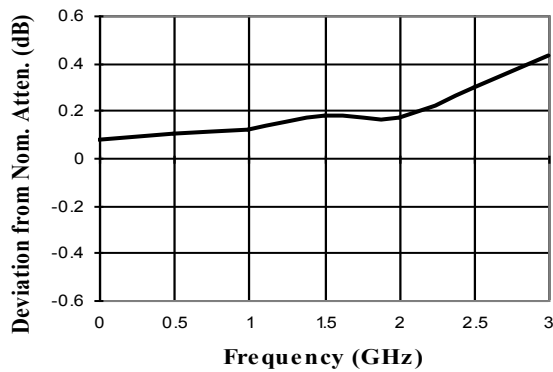
**Typical Insertion Loss (dB)**



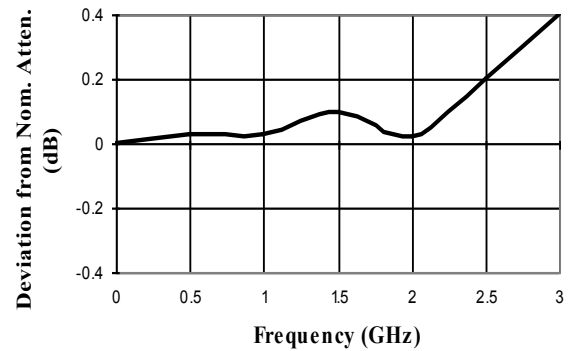
**Attenuation Accuracy, 2 dB**



**Attenuation Accuracy, 4 dB**

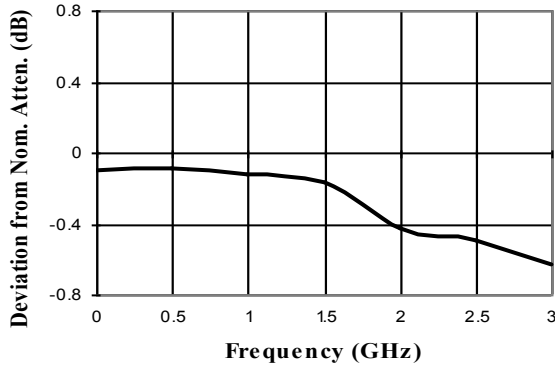


**Attenuation Accuracy, 8 dB**

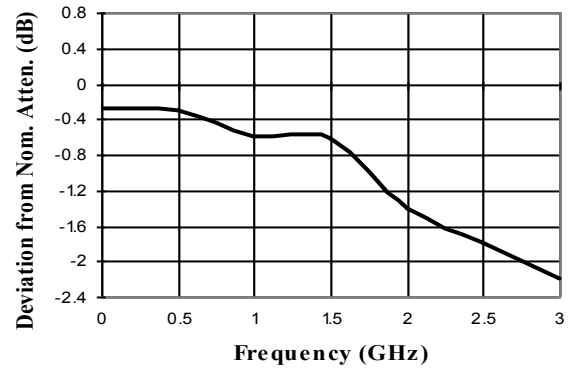


## Typical Performance Curves

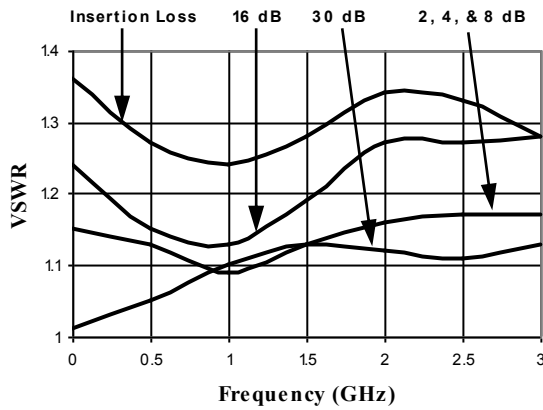
**Attenuation Accuracy, 16 dB**



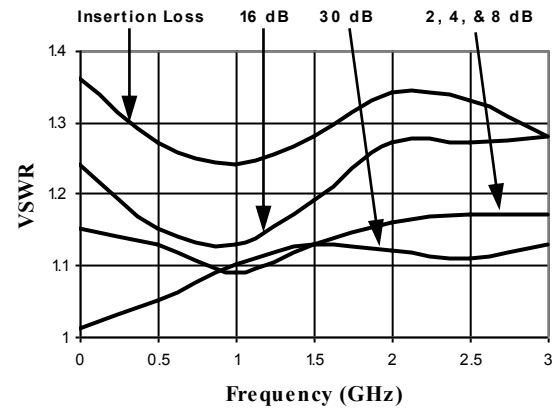
**Attenuation Accuracy, 30 dB**



**Typical RF1 VSWR**



**Typical RF2 VSWR**



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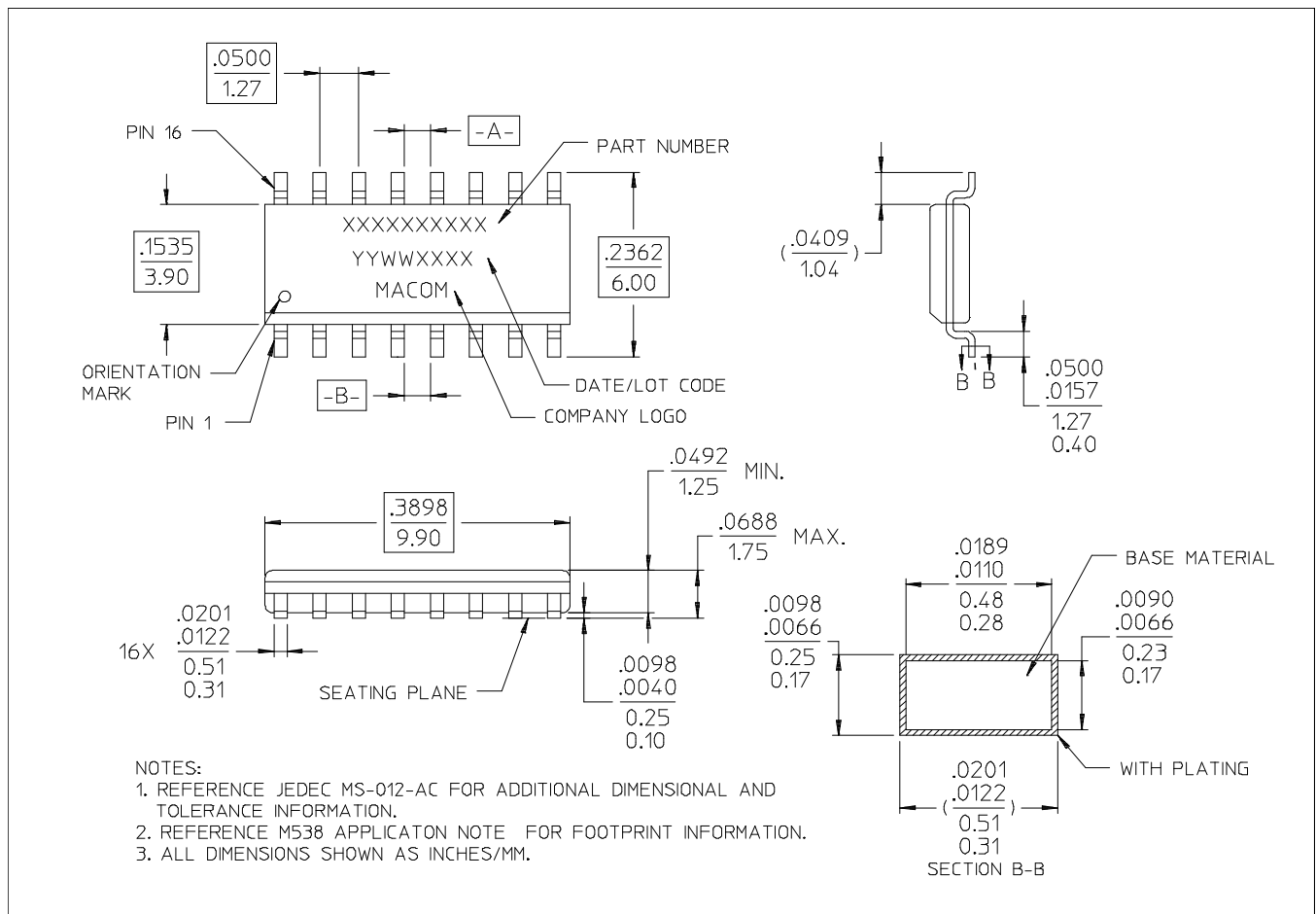
### Handling Procedures

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.

### Lead-Free, SOIC-16<sup>†</sup>



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

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