

## Features

- Attenuation: 0.5 dB Steps to 31.5 dB
- Low DC Power Consumption
- Plastic SOIC, Wide Body, SMT Package
- Integral TTL Driver
- 50 ohm Impedance
- Test Boards are Available
- Tape and Reel Packaging Available
- Lead-Free SOW-24 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS\* Compliant Version of AT65-0107

## Description

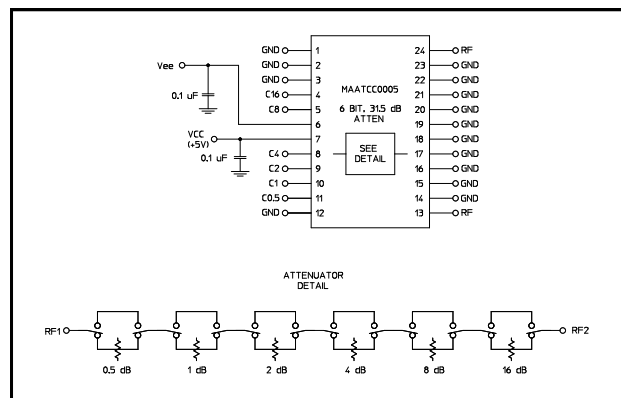
M/A-COM's MAATCC0005 is a GaAs FET 6-bit digital attenuator with a 0.5 dB minimum step size and a 31.5 dB total attenuation range. This device is in a SOIC-24 wide body, plastic surface mount package. The MAATCC0005 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required.

## Ordering Information

| Part Number   | Package           |
|---------------|-------------------|
| MAATCC0005    | Bulk Packaging    |
| MAATCC0005TR  | 1000 piece reel   |
| MAATCC0005-TB | Sample Test Board |

Note: Reference Application Note M513 for reel size information.

## Schematic with Off-Chip Components



## Pin Configuration

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1       | GND      | 13      | RF       |
| 2       | GND      | 14      | GND      |
| 3       | GND      | 15      | GND      |
| 4       | C16      | 16      | GND      |
| 5       | C8       | 17      | GND      |
| 6       | Vee      | 18      | GND      |
| 7       | Vcc      | 19      | GND      |
| 8       | C4       | 20      | GND      |
| 9       | C2       | 21      | GND      |
| 10      | C1       | 22      | GND      |
| 11      | C0.5     | 23      | GND      |
| 12      | GND      | 24      | RF       |

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

## Digital Attenuator 31.5 dB, 6-Bit, TTL Driver, DC-2.0 GHz

Rev. V4

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

| Parameter   | Test Conditions  | Frequency               | Units         | Min  | Typ   | Max                      |
|---|--|-------------------------|---------------|------|-------|--------------------------|
| Insertion Loss  | —  | DC - 1.0 GHz            | dB            | —    | 3.1   | 3.6                      |
|   |  | DC - 2.0 GHz            | dB            | —    | 3.6   | 4.2                      |
| Attenuation Accuracy  | Any Bit or Combination of Bits                             | DC - 2.0 GHz            | dB            | —    | —     | $\pm(.3 +4\%$ of atten.) |
| VSWR  | Full Range   | DC - 2.0 GHz            | Ratio         | —    | 1.8:1 | 2:1                      |
| Switching Speed   | 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<br>0.5 - 2.0 GHz | dBm           | —    | +21   | —                        |
|   |  |                         | dBm           | —    | +29   | —                        |
| Input $IP_3$  | Two-tone inputs up to +5 dBm                               | 50 MHz<br>0.5-2.0 GHz   | dB            | —    | +35   | —                        |
|   |  |                         | dB            | —    | +48   | —                        |
| $V_{CC}^1$  | —  | —                       | V             | 4.75 | 5.0   | 5.25                     |
| $V_{EE}^1$  | —  | —                       | V             | -8.0 | -5.0  | -4.75                    |
| $V_{IL}$<br>$V_{IH}$  | LOW-level input voltage<br>HIGH-level input voltage        | —                       | V             | 0.0  | —     | 0.8                      |
|   |  | —                       | V             | 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<br>Per TTL Input Pin) | $V_{CC} = \text{Max}$ , $V_{ctrl} = V_{CC} - 2.1\text{ V}$ | —                       | mA            | —    | —     | 1.0                      |
| IEE   | $V_{EE}$ min to max, $V_{in} = V_{IL}$ or $V_{IH}$         | —                       | mA            | -1.0 | -0.2  | —                        |

1. Decoupling capacitors (.1  $\mu\text{F}$ ) are required on Power Supply lines.

### Absolute Maximum Ratings<sup>2,3</sup>

| Parameter                                     | Absolute Maximum                                      |
|---|---|
| Max. Input Power<br>0.05 GHz<br>0.5 - 2.0 GHz | +27 dBm<br>+34 dBm                                    |
| $V_{CC}$                                      | $-0.5\text{V} \leq V_{CC} \leq +7.0\text{V}$          |
| $V_{EE}$                                      | $-8.5\text{V} \leq V_{EE} \leq +0.5\text{V}$          |
| $V_{CC} - V_{EE}$                             | $-0.5\text{V} \leq V_{CC} - V_{EE} \leq 14.5\text{V}$ |
| $V_{in}^4$                                    | $-0.5\text{V} \leq V_{in} \leq V_{CC} + 0.5\text{V}$  |
| Operating Temperature                         | $-40^\circ\text{C}$ to $+85^\circ\text{C}$            |
| Storage Temperature                           | $-65^\circ\text{C}$ to $+125^\circ\text{C}$           |

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

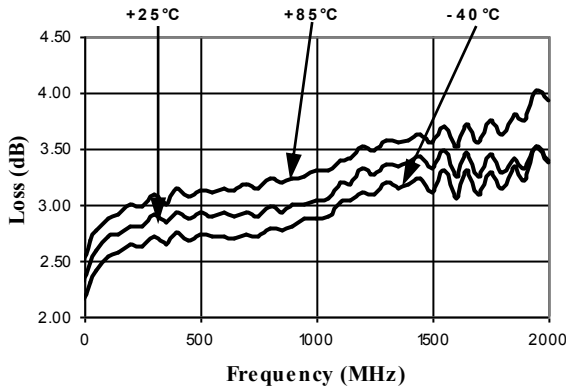
## Truth Table (Digital Attenuator)

| C16 | C8 | C4 | C2 | C1 | C0.5 | Attenuation     |
|-----|----|----|----|----|------|-----------------|
| 0   | 0  | 0  | 0  | 0  | 0    | Loss. Reference |
| 0   | 0  | 0  | 0  | 0  | 1    | 0.5 dB          |
| 0   | 0  | 0  | 0  | 1  | 0    | 1.0 dB          |
| 0   | 0  | 0  | 1  | 0  | 0    | 2.0 dB          |
| 0   | 0  | 1  | 0  | 0  | 0    | 4.0 dB          |
| 0   | 1  | 0  | 0  | 0  | 0    | 8.0 dB          |
| 1   | 0  | 0  | 0  | 0  | 0    | 16.0 dB         |
| 1   | 1  | 1  | 1  | 1  | 1    | 31.5 dB         |

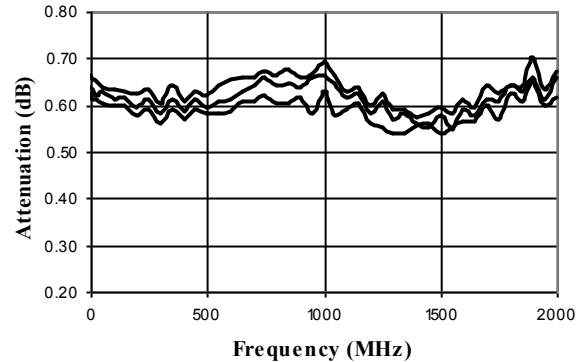
0 = TTL Low; 1 = TTL High

## Typical Performance Curves

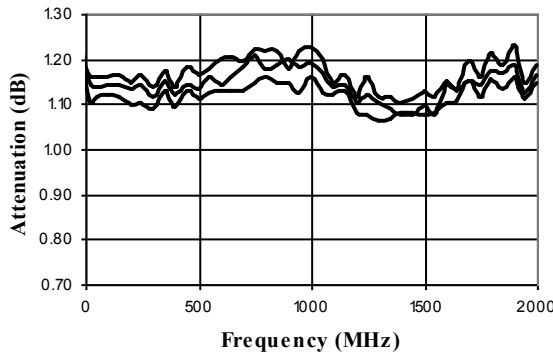
### Loss vs. Temperature



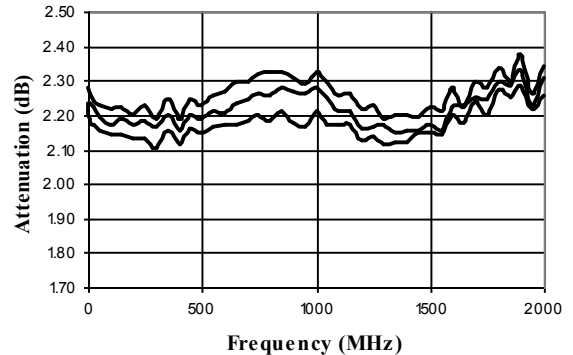
### 0.5 dB Bit vs. Temperature



### 1 dB Bit vs. Temperature

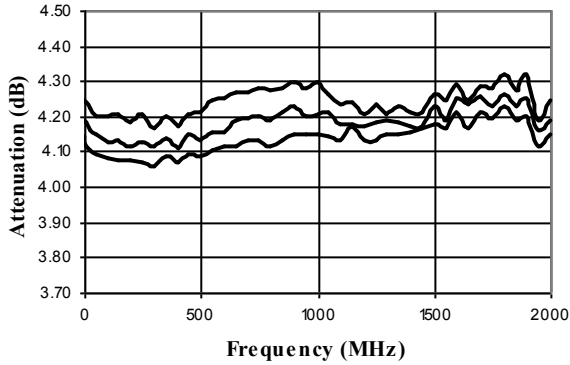


### 2 dB Bit vs. Temperature

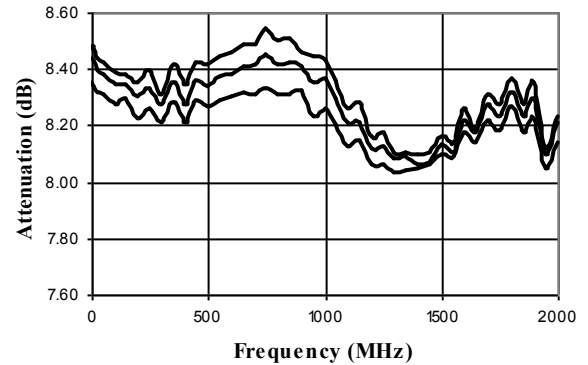


## Typical Performance Curves

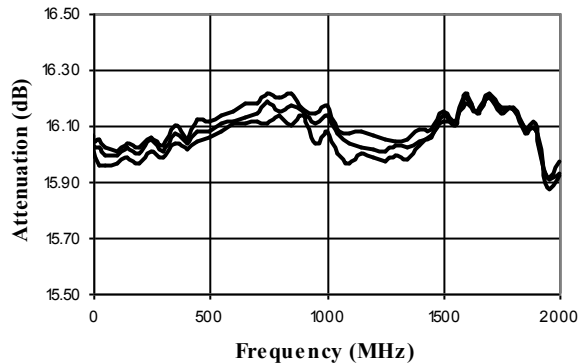
**4 dB Bit vs. Temperature**



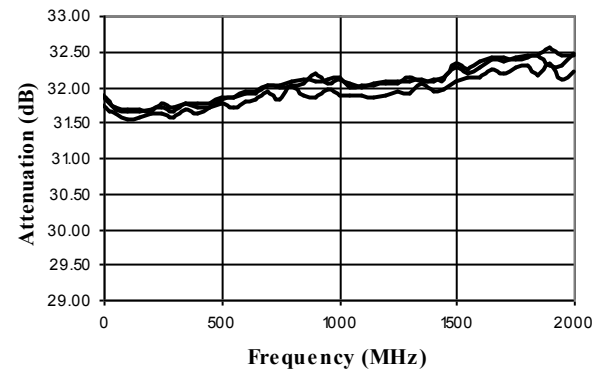
**8 dB Bit vs. Temperature**



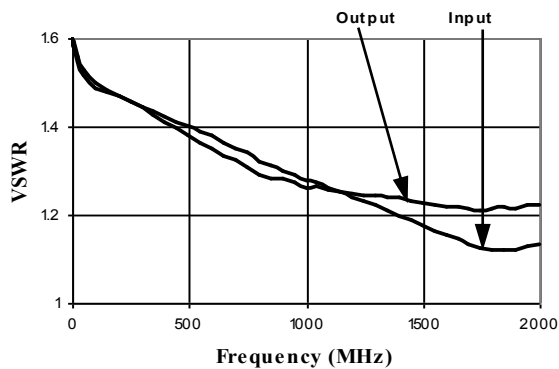
**16 dB Bit vs. Temperature**



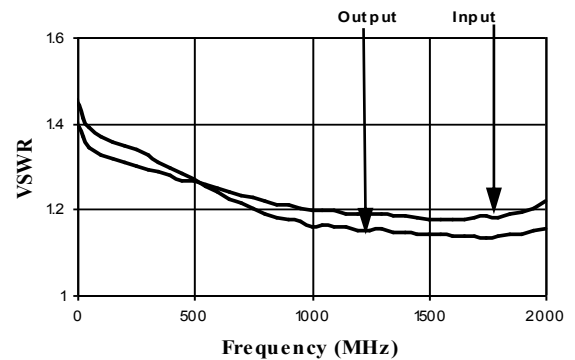
**Max Attenuation vs. Temperature**



**VSWR @ Insertion Loss**

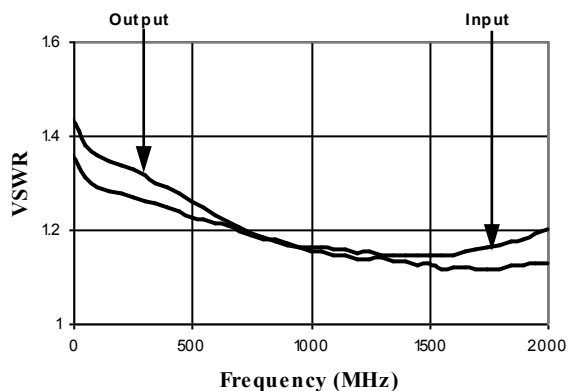


**VSWR, 0.5 dB Bit**

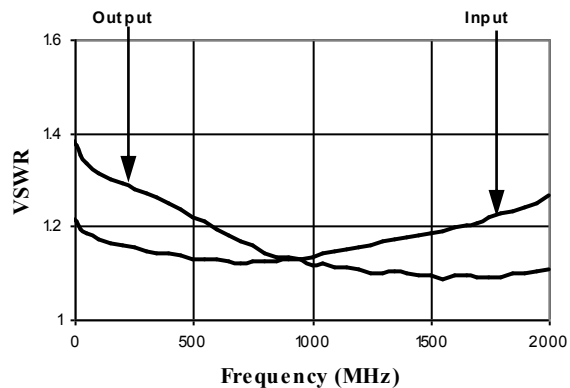


## Typical Performance Curves

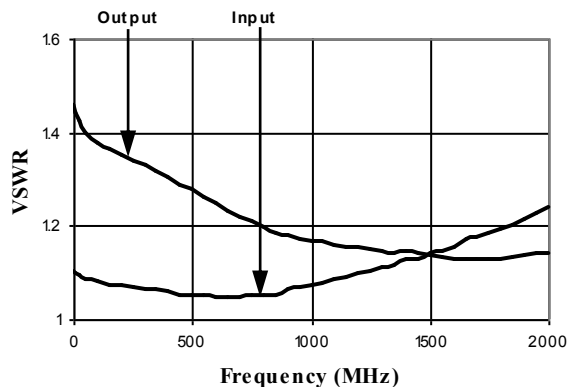
**VSWR, 1 dB Bit**



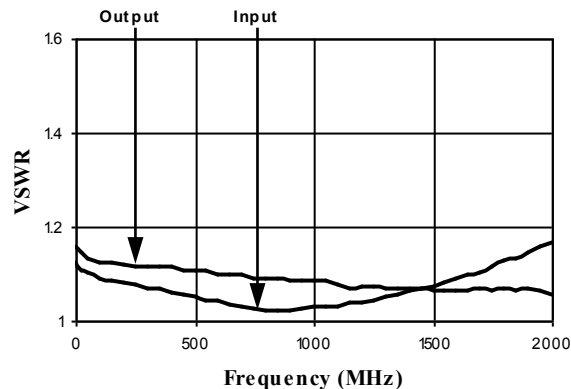
**VSWR, 2 dB Bit**



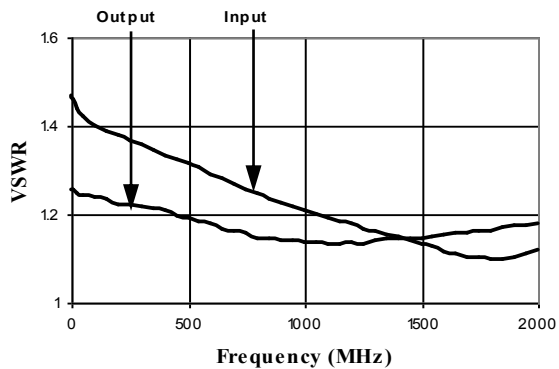
**VSWR, 4 dB Bit**



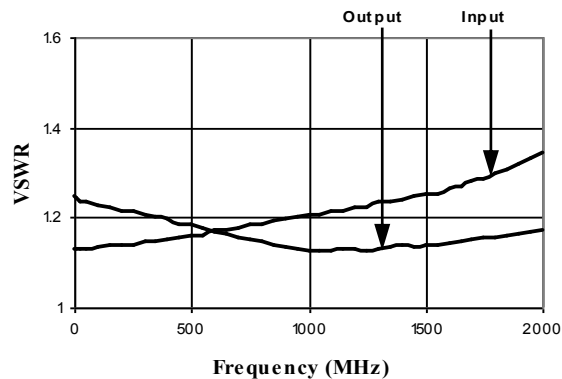
**VSWR, 8 dB Bit**



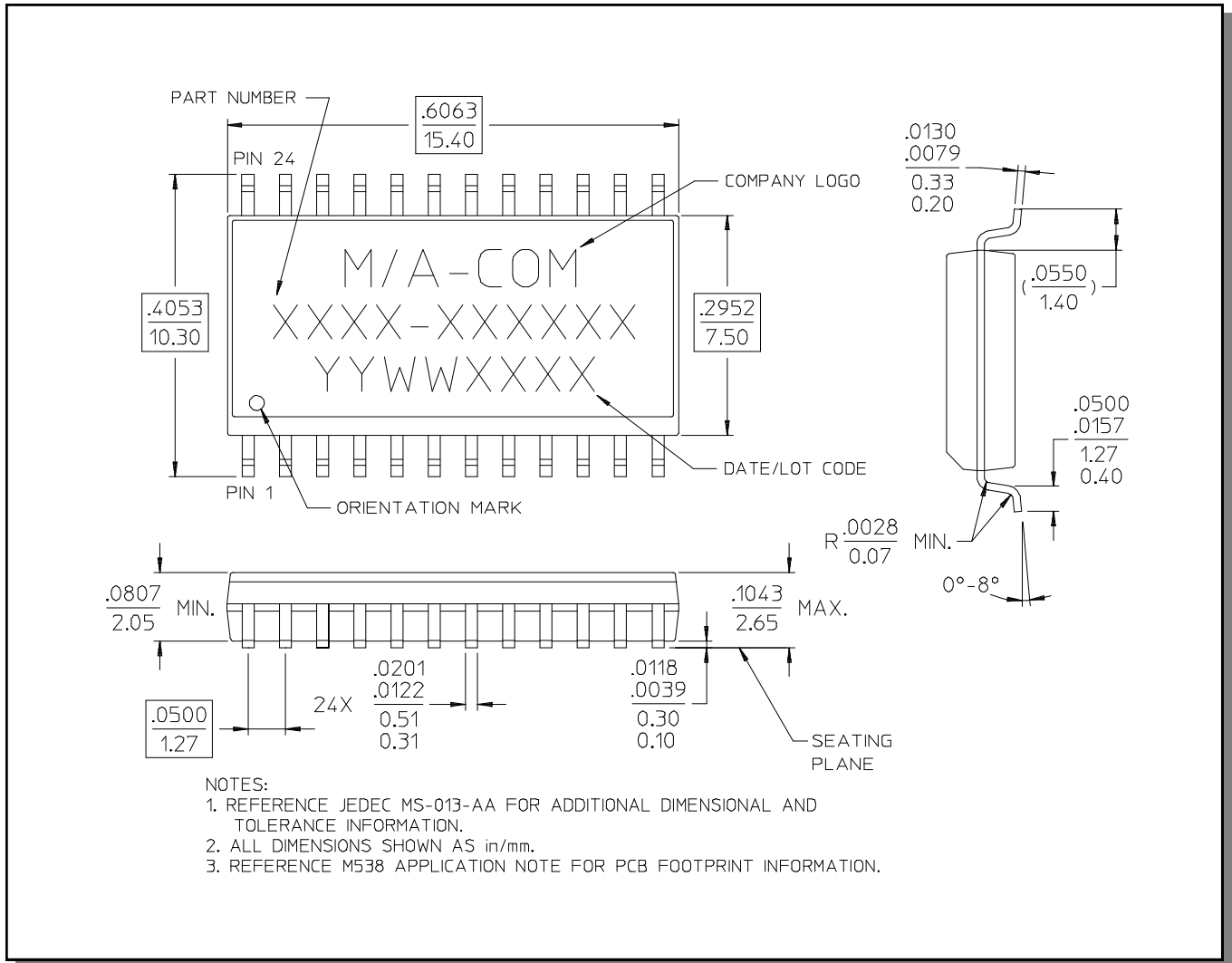
**VSWR, 16 dB Bit**



**VSWR, Maximum Attenuation**



**Lead-Free, SOW-24<sup>†</sup>**



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

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