

## Features

- 5 Bits, 0.5 dB Steps
- Excellent Accuracy
- Single Positive Control (+3 V to +5 V)
- Lead-Free QSOP-16 (SSOP-16) Package
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- 260°C Reflow Compatible
- RoHS\* Compliant Version of MAATSS0001

## Description

M/A-COM's MAATSS0017 is a 0.5 dB step GaAs MMIC digital attenuator with 15.5 dB attenuation range in a lead-free QSOP-16 (SSOP-16) package. It requires external DC blocking capacitors on the RF ports, positive supply voltage and five individual bit control voltages.

The MAATSS0017 is particularly suited where high attenuation accuracy, low insertion loss and low intermodulation products are required. Typical applications include base stations, wireless data, and wireless local loop gain level control circuits.

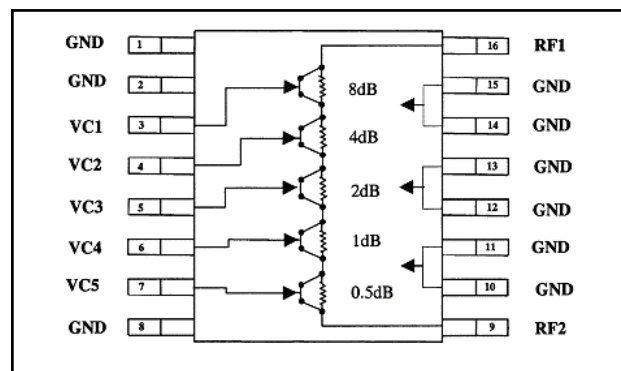
The MAATSS0017 is fabricated using M/A-COM's GaAs 1.0 micron process. The process features full chip passivation for increased performance and reliability.

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

| Part Number   | Package           |
|---------------|-------------------|
| MAATSS0017    | Bulk Packaging    |
| MAATSS0017TR  | 1000 piece reel   |
| MAATSS0017SMB | Sample Test Board |

1. Reference Application Note M513 for reel size information.

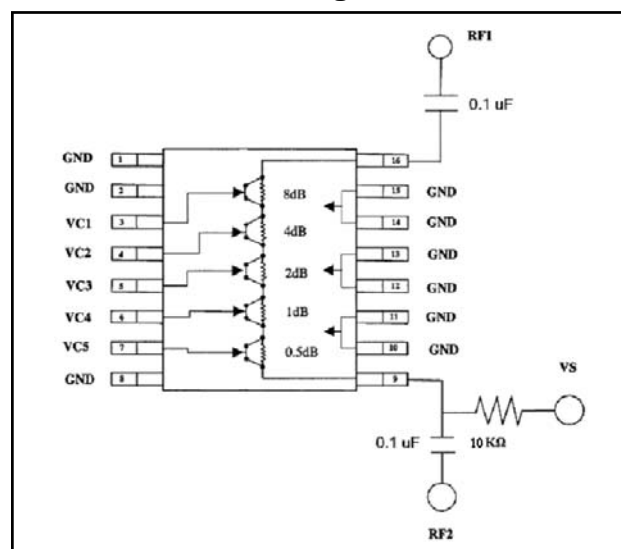
## Functional Schematic



## Pin Configuration

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1       | GND      | 9       | RF2      |
| 2       | GND      | 10      | GND      |
| 3       | VC1      | 11      | GND      |
| 4       | VC2      | 12      | GND      |
| 5       | VC3      | 13      | GND      |
| 6       | VC4      | 14      | GND      |
| 7       | VC5      | 15      | GND      |
| 8       | GND      | 16      | RF1      |

## Recommended Configuration



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

**ADVANCED:** Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.  
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**Electrical Specifications:  $T_A = 25\text{ }^{\circ}\text{C}$ ,  $Z_0 = 50\text{ }\Omega$ ,  $V_S = +5\text{ V}$ ,  $V_C = 0\text{ V} / 5\text{ V}$**

| Parameter                        | Conditions                                  | Frequency     | Units                                   | Min. | Typ.  | Max. |
|----------------------------------|---|---------------|---|------|-------|------|
| Insertion Loss (reference state) | —   | 0.5 - 1.8 GHz | dB                                      | —    | 1.9   | 2.2  |
|                                  |   | 1.8 - 2.2 GHz | dB                                      | —    | 2.2   | 2.5  |
|                                  |   | 2.2 - 2.5 GHz | dB                                      | —    | 2.5   | 2.8  |
| VSWR                             | Any State                                   | 0.5 - 2.5 GHz | Ratio                                   | —    | 1.6:1 | —    |
| Accuracy                         | Any State                                   | 0.5 - 0.8 GHz | $\pm (0.3 + 4\% \text{ atten setting})$ |      |       |      |
|                                  |   | 0.8 - 1.8 GHz | $\pm (0.3 + 3\% \text{ atten setting})$ |      |       |      |
|                                  |   | 1.8 - 2.2 GHz | $\pm (0.3 + 6\% \text{ atten setting})$ |      |       |      |
|                                  |   | 2.2 - 2.5 GHz | $\pm (0.3 + 8\% \text{ atten setting})$ |      |       |      |
| Attenuation Range                | —   | 0.5 - 2.5 GHz | dB                                      | 14.3 | 15.5  | —    |
| 1 dB Compression Input Power     | +3 V  | 0.5 - 2.5 GHz | dBm                                     | —    | 25    | —    |
|                                  | +5 V  | 0.5 - 2.5 GHz | dBm                                     | —    | 30    | —    |
| IP3                              | Two tones, $P_{in} \leq +5\text{ dBm/tone}$ | +3 V          | dBm                                     | —    | 36    | —    |
|                                  |   | +5 V          | dBm                                     | —    | 46    | —    |
|                                  |   | 0.5 - 2.5 GHz | dBm                                     | —    | 46    | —    |
| Trise, Tfall                     | 10/90% or 90/10% RF                         | —             | $\mu\text{S}$                           | —    | 2     | —    |
| Ton, Toff                        | 50% CNTL to 90/10% RF                       | —             | $\mu\text{S}$                           | —    | 2     | —    |
| Transients                       | In Band                                     | —             | mV                                      | —    | 62    | —    |
| Control Current                  | +3 V  | —             | $\mu\text{A}$                           | —    | —     | 40   |
|                                  | +5 V  | —             | $\mu\text{A}$                           | —    | —     | 40   |

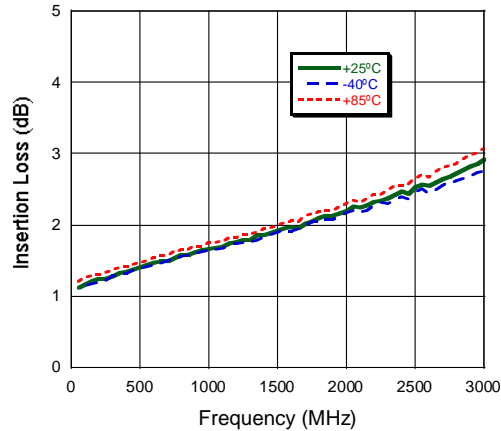
## Truth Table <sup>2</sup>

| Control Inputs |     |     |     |     |                  |
|----------------|-----|-----|-----|-----|------------------|
| VC5            | VC4 | VC3 | VC2 | VC1 | Attenuation (dB) |
| 1              | 1   | 1   | 1   | 1   | Reference        |
| 0              | 1   | 1   | 1   | 1   | 0.5 dB           |
| 1              | 0   | 1   | 1   | 1   | 1 dB             |
| 1              | 1   | 0   | 1   | 1   | 2 dB             |
| 1              | 1   | 1   | 0   | 1   | 4 dB             |
| 1              | 1   | 1   | 1   | 0   | 8 dB             |

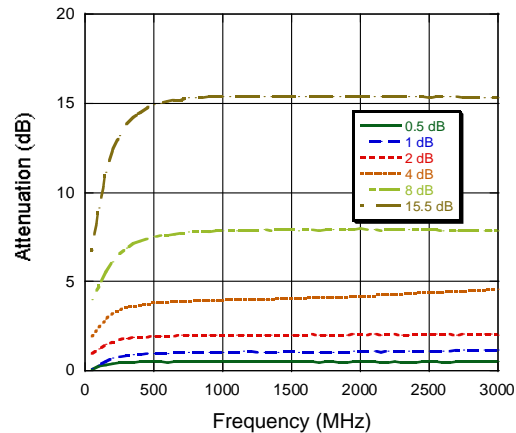
2. 0 = 0.0 V  $\pm$  0.2 V,  
1 =  $V_S = 5.0\text{ V} \pm 0.2\text{ V}$

## Typical Performance Curves

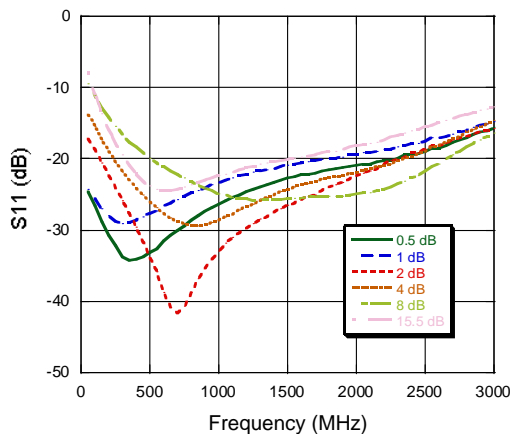
**Insertion Loss**



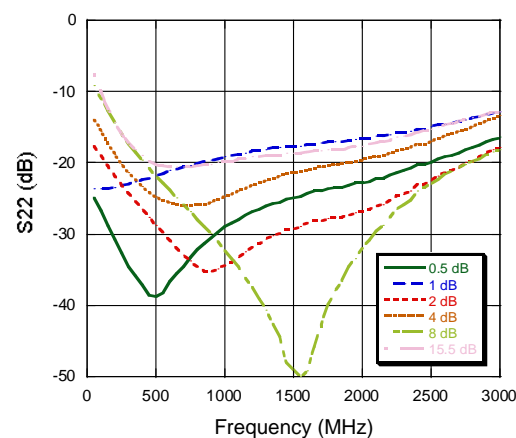
**Attenuation at Major Bits**



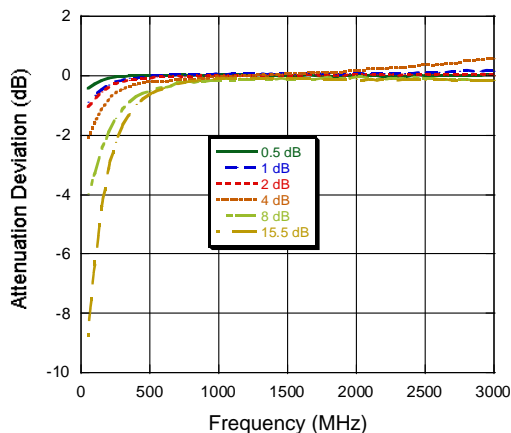
**Input Return Loss**



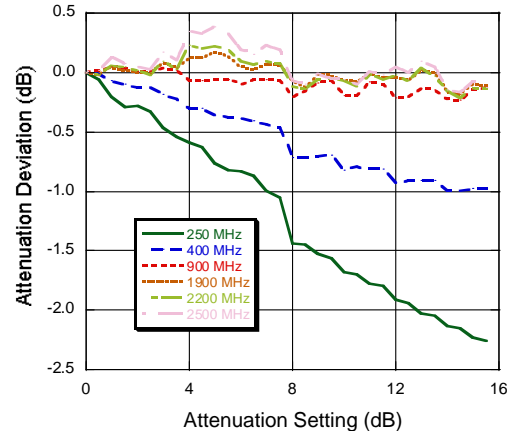
**Output Return Loss**



**Attenuation Accuracy**

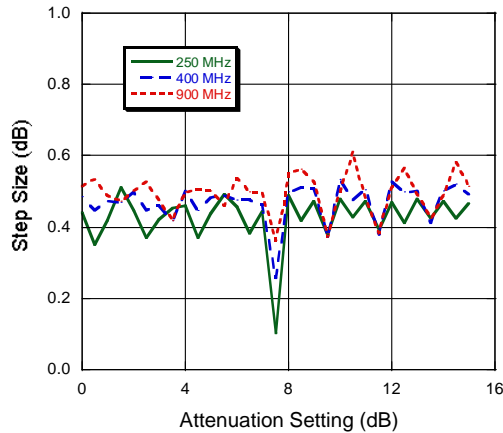


**Attenuation Accuracy vs. Setting**

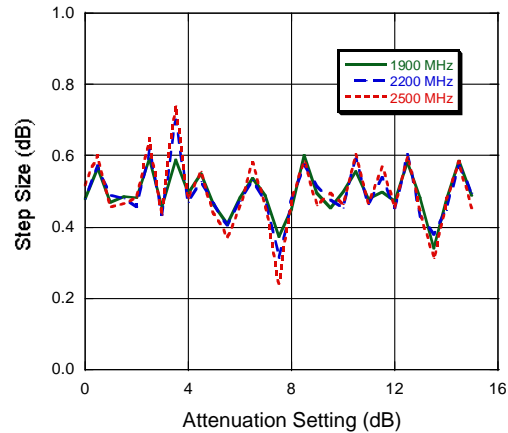


## Typical Performance Curves

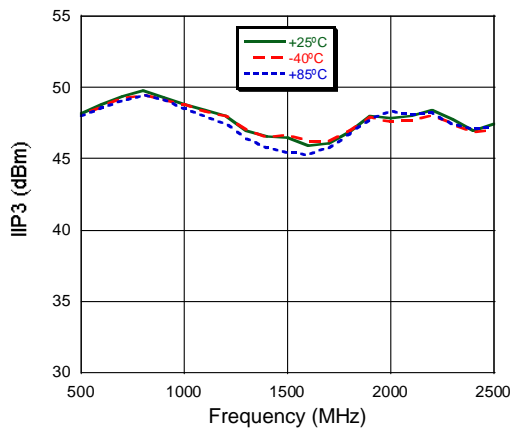
**Step size (low frequency)**



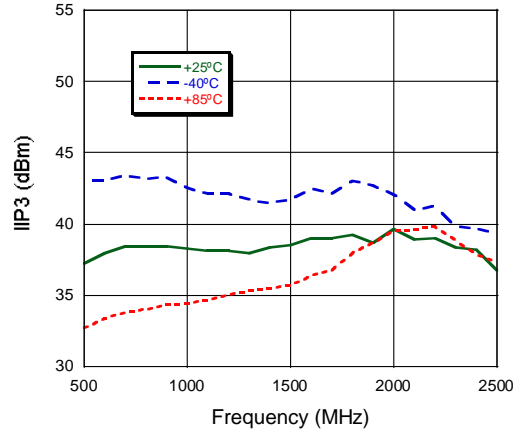
**Step size (high frequency)**



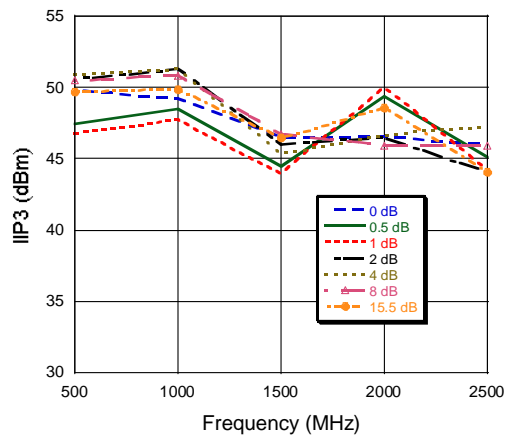
**IIP3, +5 V, at 0 dB Attenuation Setting**



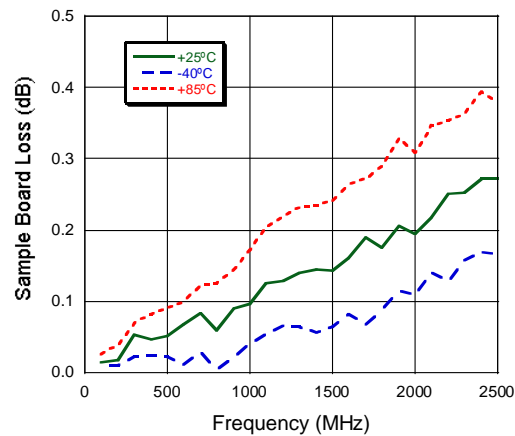
**IIP3, +3 V, at 0 dB Attenuation Setting**



**IIP3, +5 V, vs. Attenuation Setting**



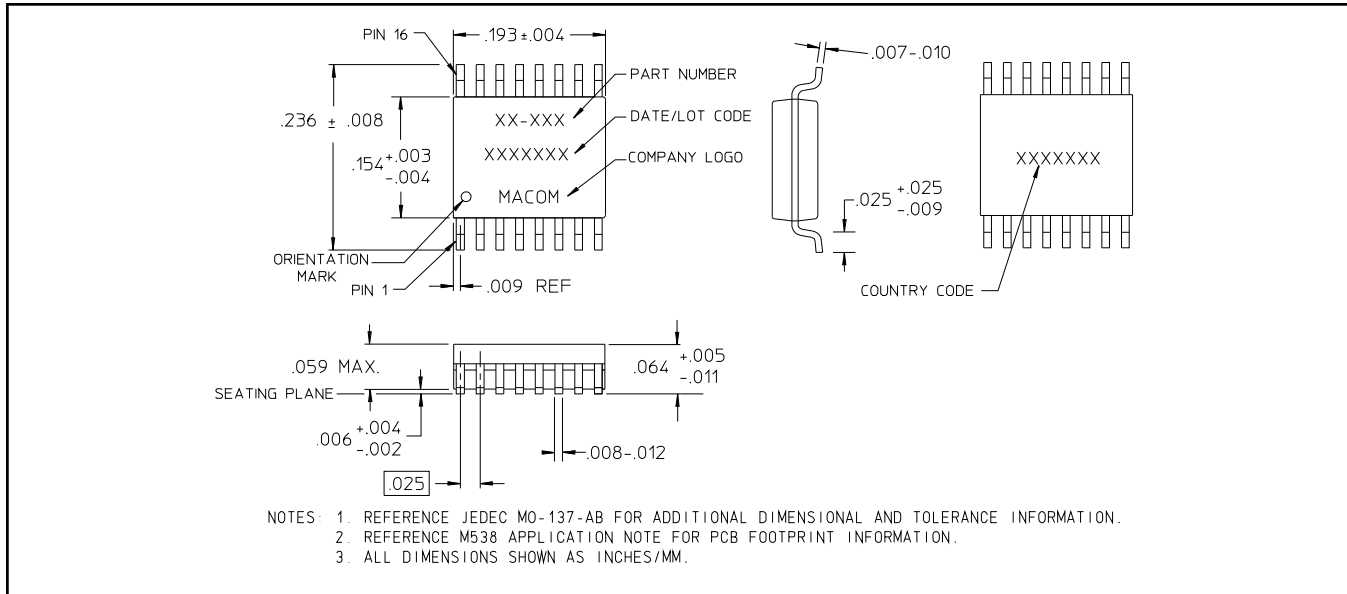
**Sample Board Loss**



# Digital Attenuator, 5-Bit, 15.5 dB 400 - 2500 MHz

Rev. V2

### Lead-Free QSOP-16 (SSOP-16)<sup>†</sup>



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

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

| Parameter             | Absolute Maximum |
|-----------------------|------------------|
| Input Power           | +34 dBm          |
| Voltage               | +7 V             |
| Operating Temperature | -40°C to +85°C   |
| Storage Temperature   | -65°C to +125°C  |

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. M/A-COM does not recommend sustained operation near these survivability limits.

## Operating Instructions

The MAATSS0017 is designed to operate with 5 V logic levels. The difference between +3 V and +5 V operation is minimal for small signal performance. IIP<sub>3</sub>, however, is a strong function of voltage. +3 V is the minimum voltage at which the product will reliably operate.

The MAATSS0017 requires a parallel interface that allows the user to enter a 5 bit digital word. Each state increments the attenuation by 0.5 dB giving a total range of 15.5 dB.

The MAATSS0017 is not internally DC blocked. This means that the device requires DC blocking capacitors on the RF1 and RF2 ports. M/A-COM recommends 0.1 uF to allow for the entire frequency range to be utilized. Higher frequency applications can use smaller value capacitors as DC blocks.

For application information concerning this and other M/A-COM products, please visit our website at [www.macom.com](http://www.macom.com), where information including soldering profiles, reliability procedures, and S-parameter data can be found.

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