

Features

- 5 Bits, 0.5 dB Steps
- Excellent Accuracy
- Single Positive Control (+3 V to +5 V)
- QSOP-16 (SSOP-16) Package

Description

M/A-COM's MAATSS0001 is a 0.5 dB step GaAs MMIC digital attenuator with 15.5 dB attenuation range in a low cost 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 MAATSS0001 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 MAATSS0001 is fabricated using M/A-COM's GaAs 1.0 micron process. The process features full chip passivation for increased performance and reliability.

Ordering Information¹

| Part Number | Package |
|---------------|-------------------|
| MAATSS0001 | Bulk Packaging |
| MAATSS0001TR | 1000 piece reel |
| MAATSS0001SMB | Sample Test Board |

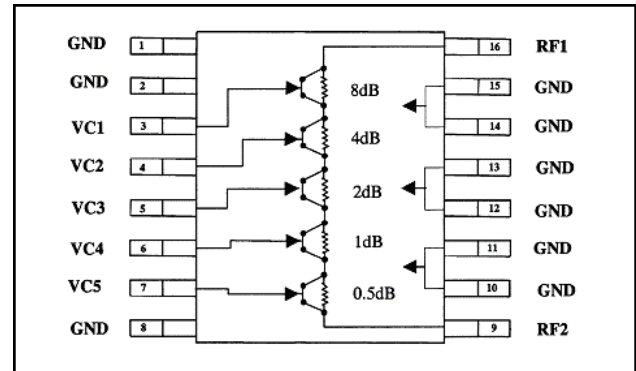
1. Reference Application Note M513 for reel size information.

Absolute Maximum Ratings²

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

2. Exceeding any one or combination of these limits may cause permanent damage to this device.

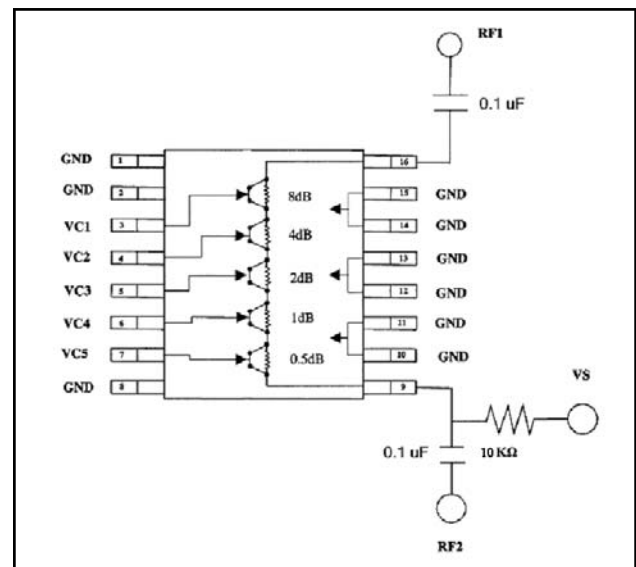
Functional Schematic



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



1

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.

PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

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Electrical Specifications: $T_A = 25\text{ }^\circ\text{C}$, $Z_0 = 50\ \Omega$, $V_s = +5\text{ V}$, $V_c = 0\text{ V} / 5\text{ V}$

| 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 | 1.9:1 |
| Accuracy | Any State | 0.5 - 0.8 GHz 0.8 - 1.8 GHz 1.8 - 2.2 GHz 2.2 - 2.5 GHz | | $\pm (0.3 + 4\% \text{ atten setting})$ $\pm (0.3 + 3\% \text{ atten setting})$ $\pm (0.3 + 6\% \text{ atten setting})$ $\pm (0.3 + 8\% \text{ atten setting})$ | | |
| Step Change | Any State | 0.5 - 1.8 GHz | dB | 0.3 | — | 0.8 |
| | | 1.8 - 2.2 GHz | dB | 0.2 | — | 0.9 |
| | | 2.2 - 2.5 GHz | dB | 0.1 | — | 1.0 |
| Attenuation Range | — | 0.5 - 2.5 GHz | dB | 14.3 | 15.5 | — |
| 1 dB Compression Input Power | +3 V +5 V | 0.5 - 2.5 GHz | dBm | 19 | 25 | — |
| | | 0.5 - 2.5 GHz | dBm | 22 | 30 | — |
| IP3 | Two tones, $P_{in} \leq +5\text{ dBm/tone}$ +3 V +5 V | 0.5 - 2.5 GHz | dBm | 34 | 36 | — |
| | | 0.5 - 2.5 GHz | dBm | 43 | 46 | — |
| Trise, Tfall | 10/90% or 90/10% RF | — | μS | — | 2 | — |
| Ton, Toff | 50% CNTL to 90/10% RF | — | μS | — | 2 | — |
| Transients | In Band | — | mV | — | 62 | — |
| Control Current | +3 V +5 V | — | μA | — | — | 40 |
| | | — | μA | — | — | 40 |

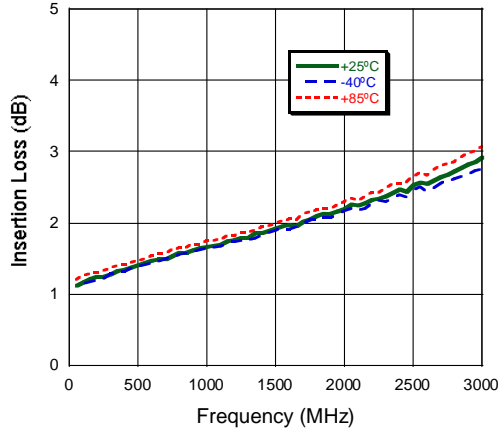
Truth Table ²

| 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 |

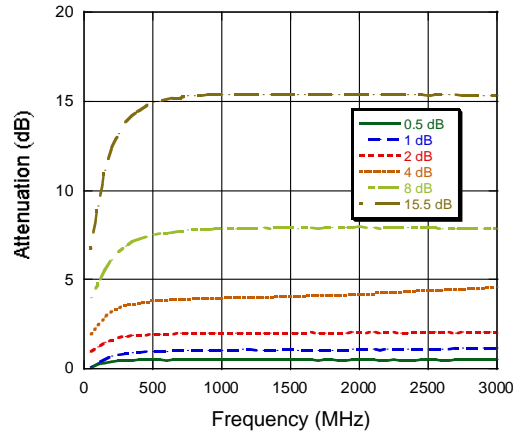
1. 0 = 0.0 V \pm 0.2 V,
1 = $V_s = 5.0\text{ V} \pm 0.2\text{ V}$

Typical Performance Curves

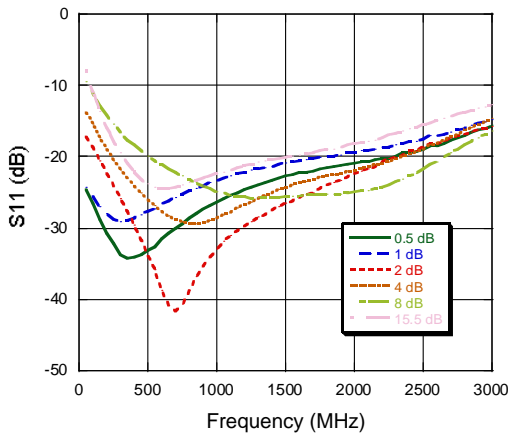
Insertion Loss



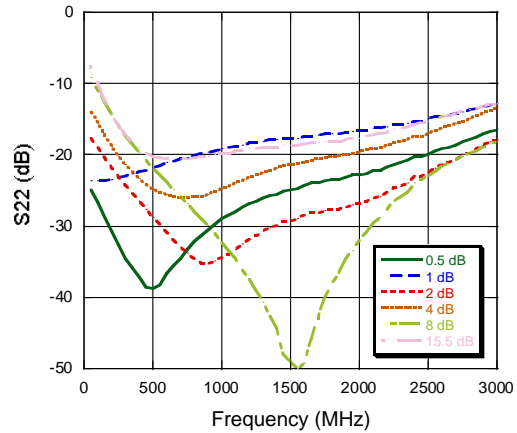
Attenuation at Major Bits



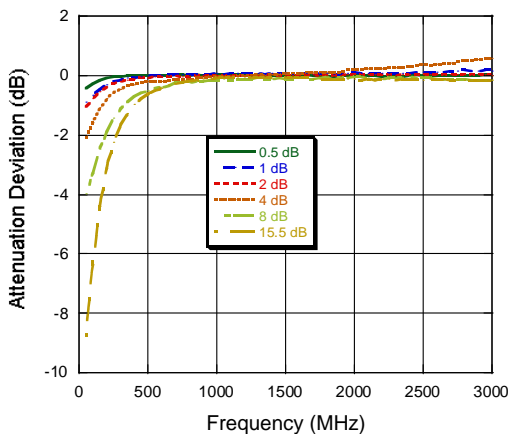
Input Return Loss



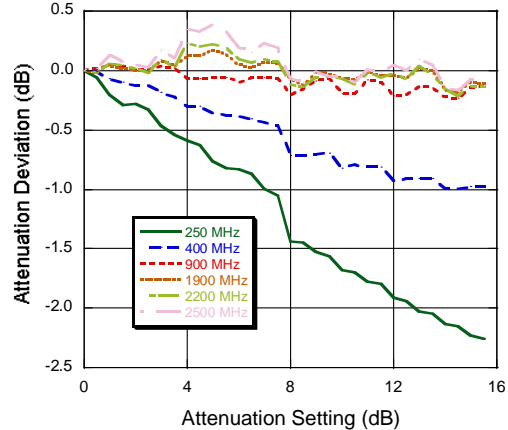
Output Return Loss



Attenuation Accuracy

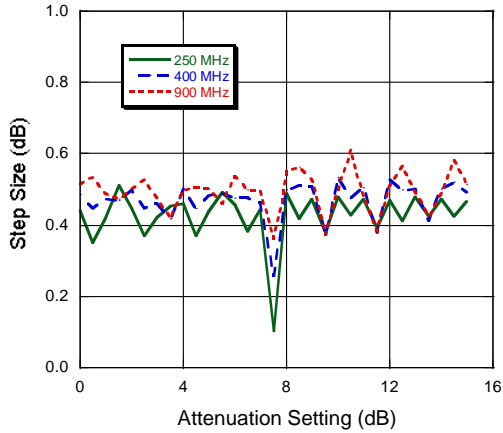


Attenuation Accuracy vs. Setting

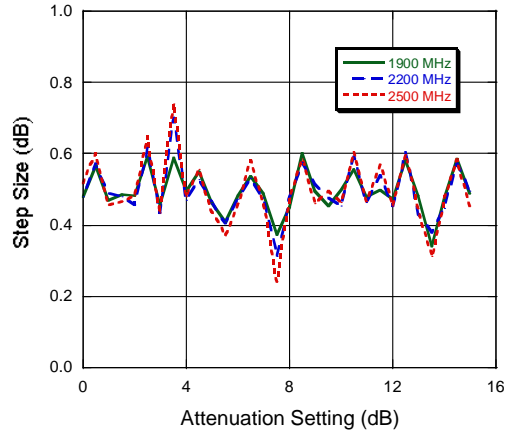


Typical Performance Curves

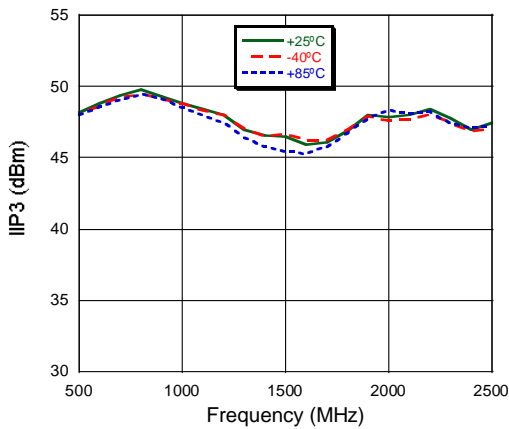
Step size (low frequency)



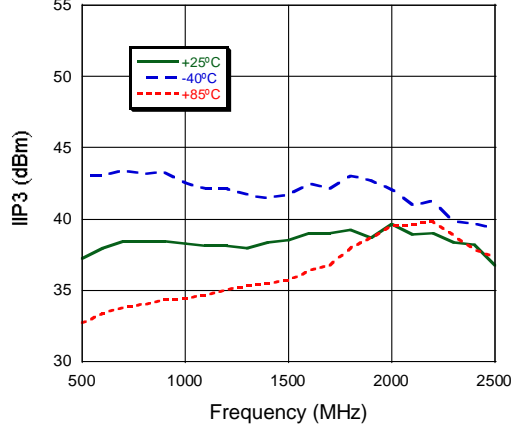
Step size (high frequency)



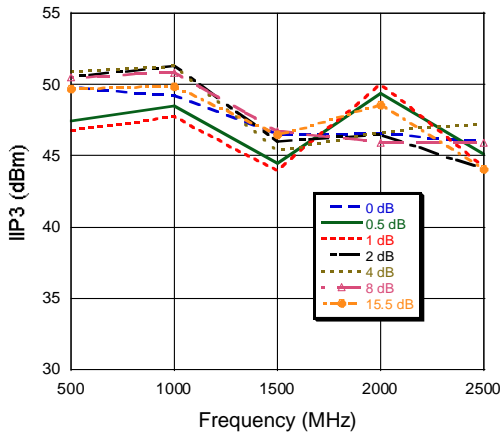
IIP3, +5 V, at 0 dB Attenuation Setting



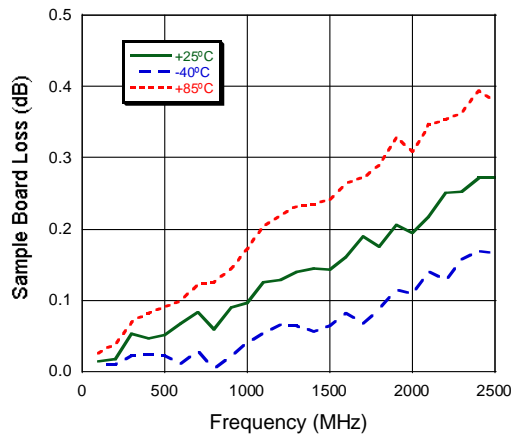
IIP3, +3 V, at 0 dB Attenuation Setting



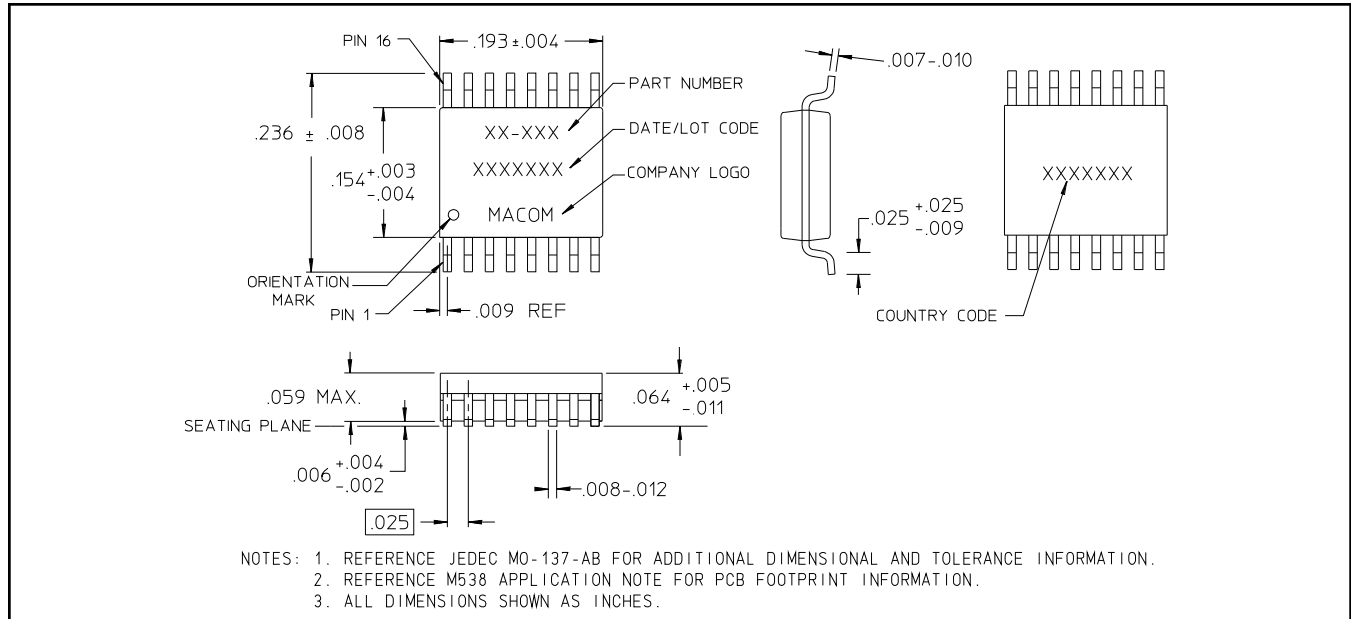
IIP3, +5 V, vs. Attenuation Setting



Sample Board Loss



QSOP-16 (SSOP-16)



Operating Instructions

The MAATSS0001 is designed to operate with 5 V logic levels. The difference between +3 V and +5 V operation is minimal for small signal performance. IIP3, however, is a strong function of voltage. +3 V is the minimum voltage at which the product will reliably operate.

The MAATSS0001 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 MAATSS0001 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, where information including soldering profiles, reliability procedures, and S-parameter data can be found.