# MAATSS0021

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

Rev. V1

### Features

- 0.5 dB Attenuation Steps to 15.5 dB
- Ultra Low DC Power Consumption
- Low Intermodulation Product: +45 dBm IP3
- Tape and Reel Packaging Available
- Temperature Stability: +/-0.15 dB from -40°C to +85°C
- Lead-Free SOIC-16 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- 260°C Reflow Compatible
- RoHS* Compliant Version of AT-280

### Description

M/A-COM's MAATSS0021 is a 5-bit, 0.5-dB step GaAs MMIC digital attenuator in a lead-free SOIC-16 surface mount plastic package. The MAATSS0021 is ideally suited for use where high accuracy, fast switching, very low power consumption and low intermodulation products are required at a low cost.

Typical applications include radio and cellular equipment, wireless LANS, GPS equipment and other gain/level control circuits.

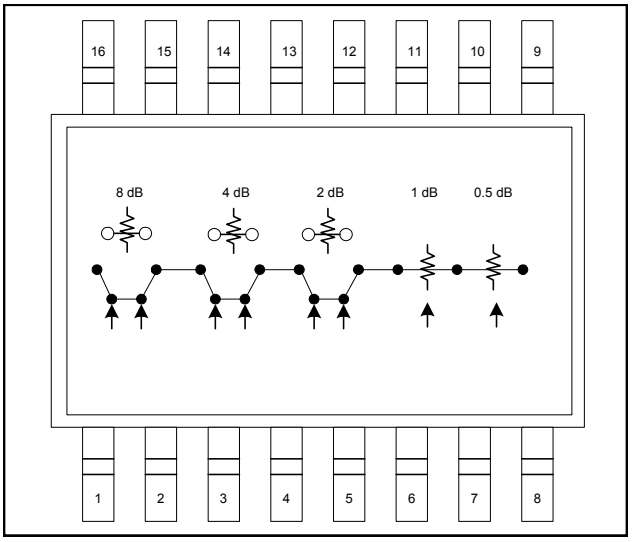
The MAATSS0021 is fabricated with a monolithic GaAs MMIC using a mature 1-micron process. The process features full chip passivation for increased performance and reliability.

### Ordering Information [1]

| Part Number | Package |
|---|---|
| MAATSS0021 | Bulk Packaging |
| MAATSS0021TR-3000 | 3000 piece reel |
| MAATSS0021SMB | Sample Board |

1. Reference Application Note M513 for reel size information.

### Functional Schematic




### Pin Configuration

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

### Absolute Maximum Ratings [2,3]

| Parameter | Absolute Maximum |
|---|---|
| Input Power:<br>0.05 GHz<br>0.5 - 2.0 GHz | <br>+27 dBm<br>+34 dBm |
| Control Voltage | -8.5 V $\leq V_C \leq$ +5 V |
| Operating Temperature | -40°C to +85°C |
| Storage Temperature | -65°C to +150°C |

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

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

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

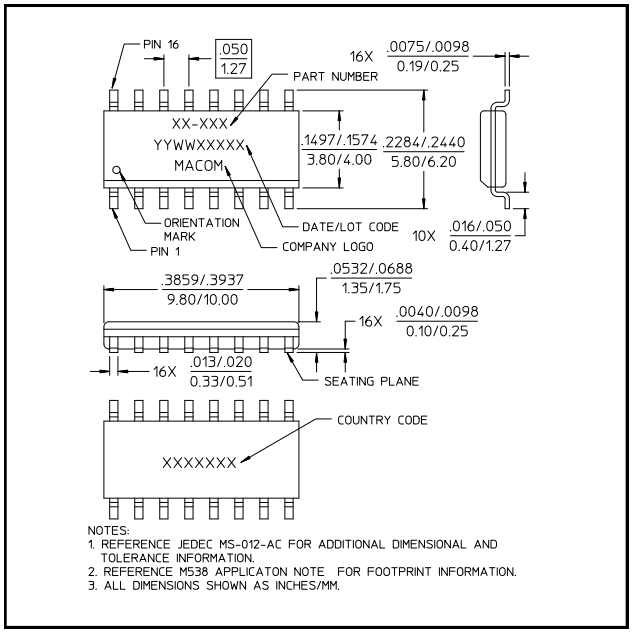
Rev. V1

### Electrical Specifications: $T_A$ = 25°C, $Z_0$ = 50 Ω

| Parameter | Test Conditions | Units | Min | Typ | Max |
|---|---|---|---|---|---|
| Reference Insertion Loss | DC - 0.1 GHz<br>DC - 0.5 GHz<br>DC - 1.0 GHz<br>DC - 2.0 GHz | dB<br>dB<br>dB<br>dB | —<br>—<br>—<br>— | 1.1<br>1.3<br>1.5<br>1.8 | —<br>—<br>—<br>2.0 |
| Attenuation Accuracy [4] | DC - 2.0 GHz | ± (0.30 dB +3% of Attenuation Setting in dB) dB | | | |
| VSWR | (Any state) | Ratio | — | 1.5:1 | — |
| Trise, Tfall | 10% to 90% RF, 90% to 10% RF | nS | — | 12 | — |
| Ton, Toff | 50% Control to 90% RF, 50% Control to 10% RF | nS | — | 18 | — |
| Transients | In Band | mV | — | 30 | — |
| 1 dB Compression | Input Power, 0.05 GHz<br>Input Power, 0.5 - 2.0 GHz | dBm<br>dBm | —<br>— | 22<br>27 | —<br>— |
| $IP_2$ | 0.05 GHz<br>0.5 - 2.0 GHz<br>Measured Relative to Input Power<br>(for two-tone input power up to +5 dBm) | dBm<br>dBm | —<br>— | 53<br>68 | —<br>— |
| $IP_3$ | 0.05 GHz<br>0.5 - 2.0 GHz<br>Measured Relative to Input Power<br>(for two-tone input power up to +5 dBm) | dBm<br>dBm | —<br>— | 40<br>45 | —<br>— |

4. Attenuation acccuracy specifications apply with negative bias control and low inductance grounding.

### Lead-Free SOIC-16†




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

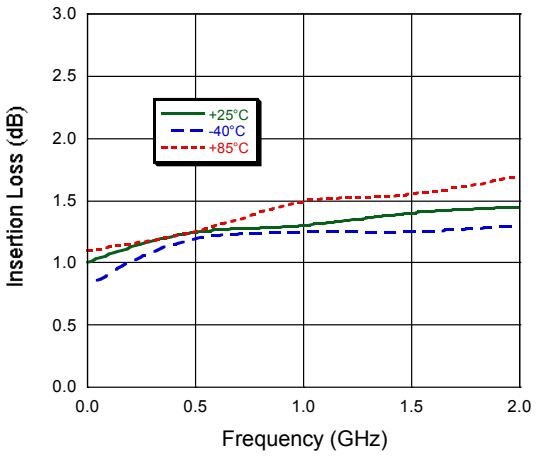
### Truth Table

| Control Inputs | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $\overline{VC5}$ | $\overline{VC4}$ | $\overline{VC3}$ | VC3 | $\overline{VC2}$ | VC2 | $\overline{VC1}$ | VC1 | Atten. |
| 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | Refer-ence |
| 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0.5 dB |
| 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 dB |
| 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 2 dB |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 4 dB |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 8 dB |
| 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 15.5 dB |

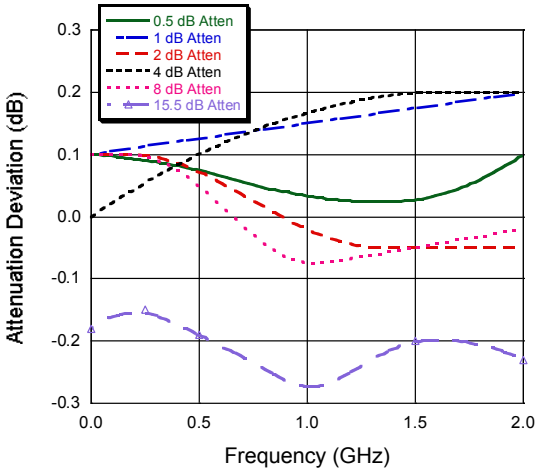
0 = Vin Low = 0 V = 0 to –0.2 V @ 20 µA maximum
1 = Vin High = -5 V at 20 µA to -8 V at 20 µA maximum

## Typical Performance Curves

***Insertion Loss***




***Attenuation Accuracy***




***VSWR***