

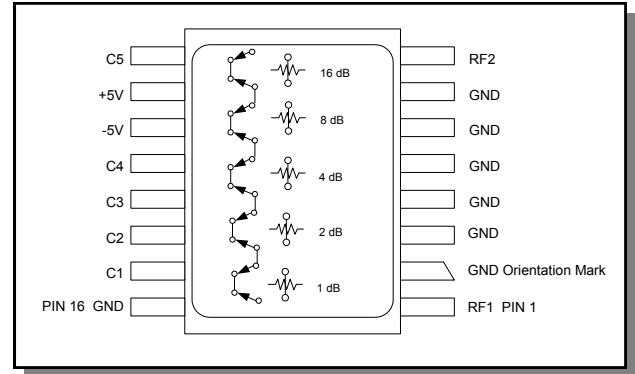
## Features

- Attenuation: 1 dB steps to 31 dB
- Temperature Stability:  $\pm 0.18$  dB from  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  Typical
- Low DC Power Consumption
- Surface Mount Package
- Integral TTL Driver
- Low Cost/High Performance
- 50 Ohm Nominal Impedance
- Lead-Free CR-12 Package
- $260^{\circ}\text{C}$  Reflow Compatible
- RoHS\* Compliant

## Description

M/A-COM's AT20-0263 is a GaAs FET 5-bit digital attenuator with a 1 dB minimum step size and 31 dB total attenuation. This attenuator and integral TTL driver is in a ceramic 16-lead surface mount package. The AT20-0263 is ideally suited for use where accuracy, fast switching, very low power consumption and low intermodulation products are required. Typical applications include dynamic range setting in precision receiver circuits and other gain/leveling control circuits. Available with enhanced performance as fully hermetic version. Environmentally screenable as P/N AT-263-PIN.

## Functional Schematic



## Pin Configuration

| Pin No. | Function | Pin No. | Function |
|---------|----------|---------|----------|
| 1       | RF1      | 9       | C5       |
| 2       | GND      | 10      | +5V      |
| 3       | GND      | 11      | -5V      |
| 4       | GND      | 12      | C4       |
| 5       | GND      | 13      | C3       |
| 6       | GND      | 14      | C2       |
| 7       | GND      | 15      | C1       |
| 8       | RF2      | 16      | GND      |

The metal bottom of the case must be connected to RF and DC ground.

## Ordering Information

| Part Number | Package        |
|-------------|----------------|
| AT20-0263   | Bulk Packaging |

Note: Reference Application Note M513 for reel size information.

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

## Digital Attenuator 31.0 dB, 5-Bit, TTL Driver, DC-2.0 GHz

Rev. V5

### Electrical Specifications: $T_A = 25^\circ\text{C}^1$

| Parameter                         | Test Conditions  | Frequency                                    | Units  | Min         | Typ               | Max               |
|-----------------------------------|--|--|--|-------------|-------------------|-------------------|
| Reference Insertion Loss          | —  | DC - 0.5 GHz<br>DC - 1.0 GHz<br>DC - 2.0 GHz | dB<br>dB<br>dB   | —<br>—<br>— | 2.0<br>2.2<br>2.5 | 2.4<br>2.8<br>3.0 |
| Attenuation Accuracy <sup>2</sup> | Any Single Bit<br>Any Combination of Bits                      | DC - 1.0 GHz<br>DC - 2.0 GHz                 | ± (0.25 +3% of atten setting in dB) dB<br>± (0.25 +3% of atten setting in dB) dB or ± 0.4 dB, whichever is greater |             |                   |                   |
| VSWR                              | —  | DC - 2.0 GHz                                 | Ratio  | —           | —                 | 1.6:1             |
| Trise, Tfall                      | 10% to 90%   | —  | ns   | —           | 50                | —                 |
| Ton, Toff                         | 50% Control to 90/10% RF                                       | —  | ns   | —           | 150               | —                 |
| Transients                        | In-Band (peak-peak)  | —  | mV   | —           | 50                | —                 |
| 1 dB Compression                  | Input Power<br>Input Power                                     | 0.05 GHz<br>0.5 - 2.0 GHz                    | dBm<br>dBm   | —<br>—      | +20<br>+28        | —<br>—            |
| Input IP3                         | For two-tone Input Power<br>Up to +5 dBm                       | 0.05 GHz<br>0.5 - 2.0 GHz                    | dBm<br>dBm   | —<br>—      | +40<br>+48        | —<br>—            |
| Input IP2                         | For two-tone Input Power<br>Up to +5 dBm                       | 0.05 GHz<br>0.5 - 2.0 GHz                    | dBm<br>dBm   | —<br>—      | +45<br>+68        | —<br>—            |
| Vcc                               | —  | —  | V  | 4.5         | 5.0               | 5.5               |
| Vee                               | —  | —  | V  | -8.0        | —                 | -5.0              |
| Icc                               | Vcc = 4.5 to 5.5V<br>Vctl = 0 to 0.8V, or Vcc –<br>2.1V to Vcc | —  | mA   | —           | —                 | 5.0               |
| Iee                               | Vee = -5.0 to -8.0V  | —  | mA   | —           | —                 | 1.0               |

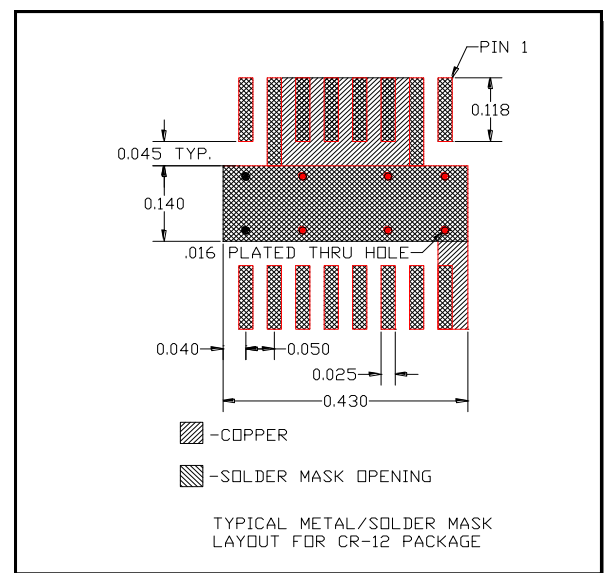
- All specifications apply when operated with bias voltages of +5V for Vcc and -5.0V for Vee.
- This attenuator is guaranteed monotonic.

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

| Parameter                                   | Absolute Maximum                                  |
|---|---|
| Max Input Power<br>0.5 GHz<br>0.5 - 2.0 GHz | +27 dBm<br>+34 dBm                                |
| V <sub>CC</sub>                             | -0.5V ≤ V <sub>CC</sub> ≤ +7.0V                   |
| V <sub>EE</sub>                             | -8.5V ≤ V <sub>EE</sub> ≤ +0.5V                   |
| V <sub>CC</sub> - V <sub>EE</sub>           | -0.5V ≤ V <sub>CC</sub> - V <sub>EE</sub> ≤ 14.5V |
| V <sub>in</sub> <sup>5</sup>                | -0.5V ≤ V <sub>in</sub> ≤ V <sub>CC</sub> + 0.5V  |
| Operating Temperature                       | -40°C to +125°C                                   |
| Storage Temperature                         | -65°C to +150°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.

### Recommended PCB Configuration



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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.

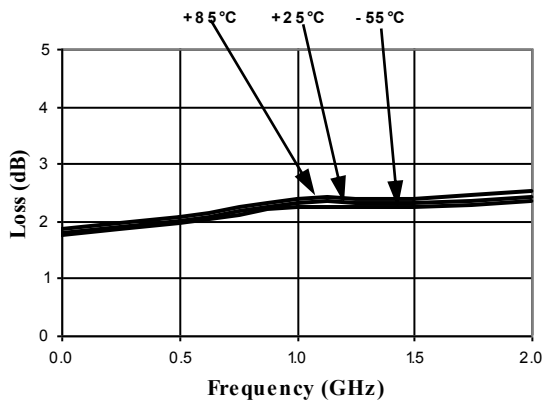
## Truth Table (Digital Attenuator)

| Control Inputs |    |    |    |    | Attenuation |
|----------------|----|----|----|----|-------------|
| C5             | C4 | C3 | C2 | C1 |             |
| 0              | 0  | 0  | 0  | 0  | Reference   |
| 0              | 0  | 0  | 0  | 1  | 1 dB        |
| 0              | 0  | 0  | 1  | 0  | 2 dB        |
| 0              | 0  | 1  | 0  | 0  | 4 dB        |
| 0              | 1  | 0  | 0  | 0  | 8 dB        |
| 1              | 0  | 0  | 0  | 0  | 16 dB       |
| 1              | 1  | 1  | 1  | 1  | 31 dB       |

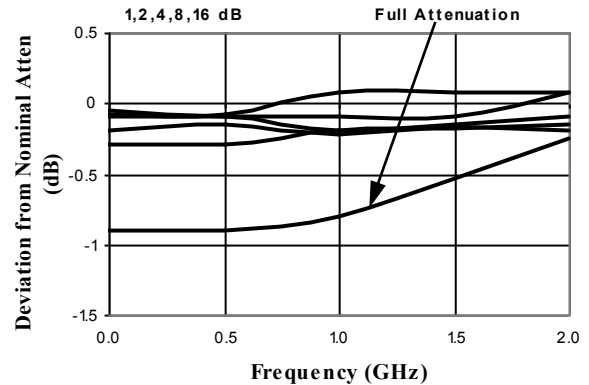
0 = TTL Low; 1 = TTL High

## Typical Performance Curves

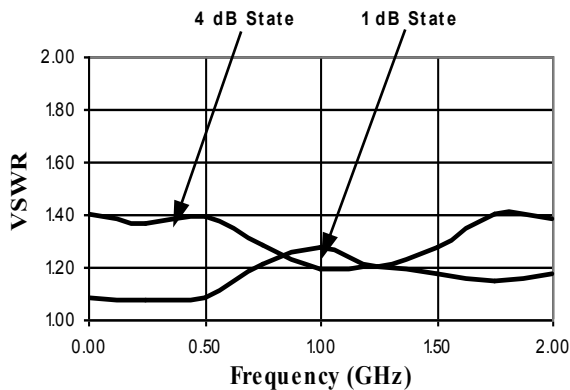
*Ref. Insertion Loss vs. Frequency*



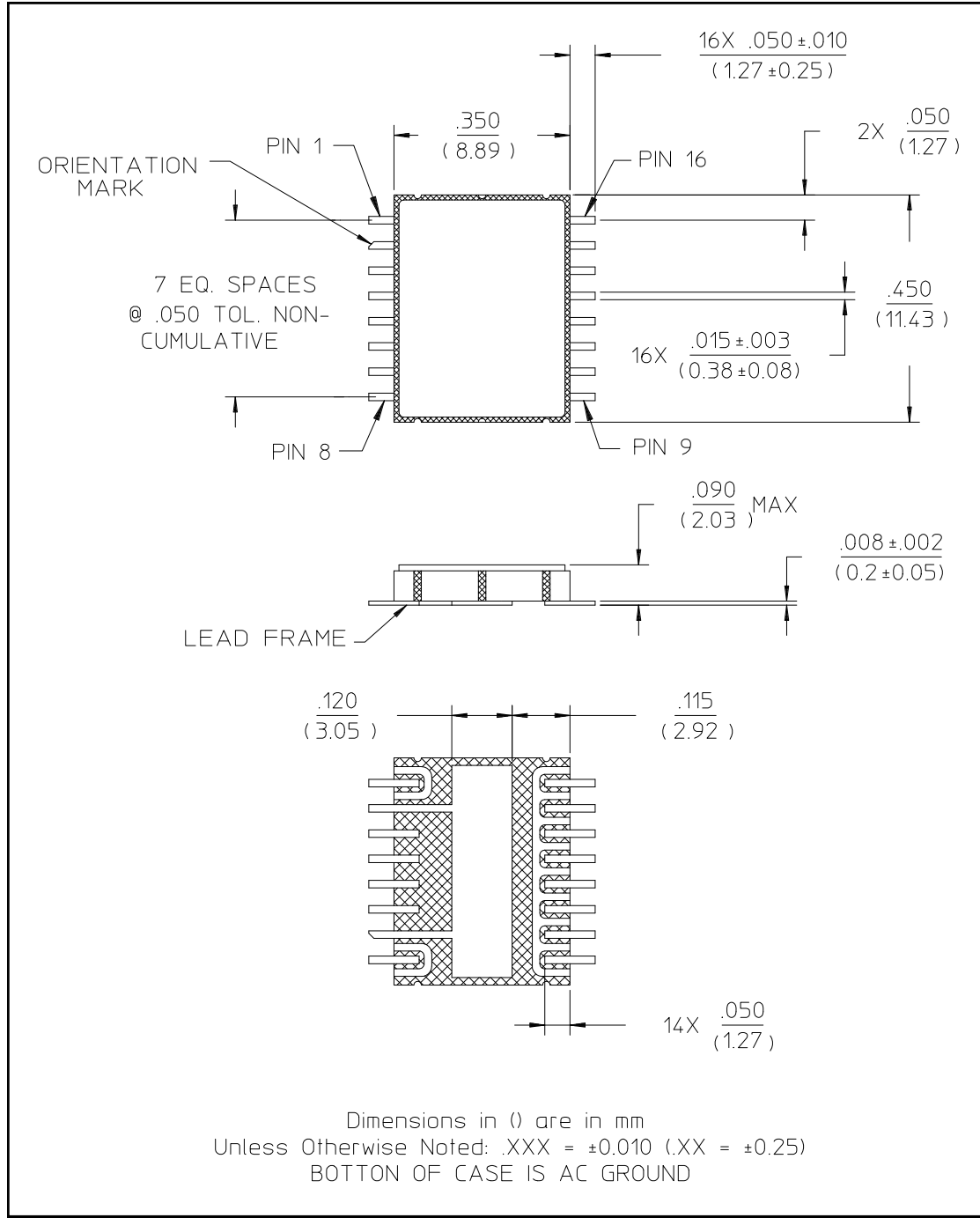
*Attenuation Accuracy vs. Frequency*



*VSWR vs. Frequency*



## Lead-Free CR-12 Ceramic Package<sup>†</sup>



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

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