



# Digital Attenuator, 30 dB, 4-Bit, TTL Driver, DC - 2 GHz

V 3.00

AT-233

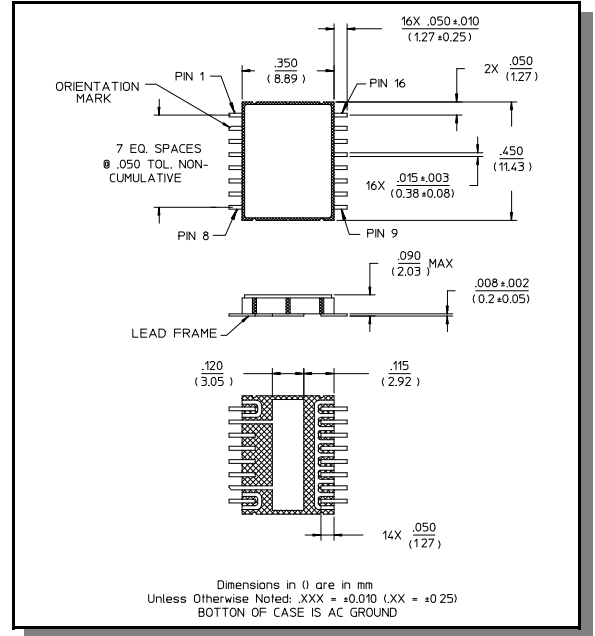
## Features

- Attenuation: 2 dB Steps to 30 dB<sup>2</sup>
- Temperature Stability:  $\pm 0.18$  dB from  $-55^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  Typical
- Low DC Power Consumption
- Hermetic Surface Mount Package
- Integral TTL Driver
- 50 Ohm Nominal Impedance

## Description

M/A-COM's AT-233 is a GaAs FET 4-Bit digital attenuator with a 2 dB minimum step size and 30 dB total attenuation. This attenuator and integral TTL driver is in a hermetically sealed ceramic 16-lead surface mount package. The AT-233 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. Environmental screening is available. Contact the factory for information.

## CR-12



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

| Parameter                         | Test Conditions                          | Frequency     | Units  | Min | Typ | Max   |
|-----------------------------------|--|---------------|--|-----|-----|-------|
| Reference Insertion Loss          |  | DC - 0.5 GHz  | dB   | —   | —   | 2.3   |
|                                   |  | DC - 1.0 GHz  | dB   | —   | —   | 2.65  |
|                                   |  | DC - 2.0 GHz  | dB   | —   | —   | 2.8   |
| Attenuation Accuracy <sup>3</sup> | Any Single Bit                           | DC - 1.0 GHz  | $\pm (0.2 + 3\% \text{ of attenuation setting in dB})$ dB  |     |     |       |
|                                   |  | DC - 2.0 GHz  | $\pm (0.2 + 3\% \text{ of attenuation setting in dB})$ dB<br>or $\pm 0.45$ dB, whichever is greater  |     |     |       |
|                                   | Any Combination of Bits                  | DC - 1.0 GHz  | $\pm (0.20 + 3\% \text{ of attenuation setting in dB})$ dB   |     |     |       |
|                                   |  | DC - 2.0 GHz  | $\pm (0.25 + 4\% \text{ of attenuation setting in dB})$ dB<br>or $\pm 0.45$ dB, whichever is greater |     |     |       |
| VSWR                              |  | DC - 2.0 GHz  | Ratio  | —   | —   | 1.7:1 |
| Trise, Tfall                      | 10% to 90%                               | —             | ns   | —   | 10  | —     |
| Ton, Toff                         | 50% Control to 90/10% RF                 | —             | ns   | —   | 30  | —     |
| Transients                        | In-Band (peak-peak)                      | —             | mV   | —   | 35  | —     |
| 1 dB Compression <sup>4</sup>     | Input Power                              | 0.05 GHz      | dBm  | —   | +20 | —     |
|                                   |  | 0.5 - 2.0 GHz | dBm  | —   | +28 | —     |
| Input IP3 <sup>4</sup>            | For two tone input power<br>Up to +5 dBm | 0.05 GHz      | dBm  | —   | +40 | —     |
|                                   |  | 0.5 - 2.0 GHz | dBm  | —   | +50 | —     |
| Input IP2 <sup>4</sup>            | For two-tone input power<br>Up to +5 dBm | 0.05 GHz      | dBm  | —   | +45 | —     |
|                                   |  | 0.5 - 2.0 GHz | dBm  | —   | +68 | —     |

1. All specifications apply when operated with bias voltages of +5V or  $V_{CC}$  and  $-5.0\text{V}$  to  $-8.0\text{V}$  for  $V_{EE}$ , and 50 Ohm impedance at all ports unless otherwise specified.
2. Above reference insertion loss.
3. This attenuator is guaranteed monotonic.
4.  $V_{EE} = -5\text{V}$  for the typical numbers given.

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

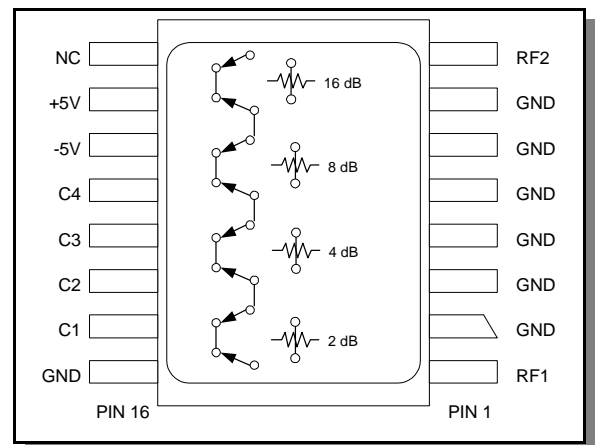
| Parameter                    | Test Conditions  | Frequency | Units         | Min        | Typ    | Max        |
|------------------------------|--|-----------|---------------|------------|--------|------------|
| $V_{CC}$                     |  | —         | V             | 4.5        | 5.0    | 5.5        |
| $V_{EE}$                     |  | —         | V             | -8.0       | —      | -5.0       |
| $I_{CC}$                     | $V_{CC} = 4.5$ to $5.5$ V<br>$V_{ctl} = 0$ to $0.8$ V, or $V_{CC} - 2.1$ V to $V_{CC}$ | —         | mA            | —          | —      | 4.0        |
| $I_{EE}$                     | $V_{EE} = -5.0$ to $-8.0$ V  | —         | mA            | —          | —      | 1.0        |
| $V_{ctl}$                    | Logic 0 (TTL)<br>Logic 1 (TTL)   | —<br>—    | V<br>V        | 0.0<br>2.0 | —<br>— | 0.8<br>5.0 |
| Input Leakage Current (Low)  | 0 to 0.8 V   | —         | $\mu\text{A}$ | —          | —      | 1.0        |
| Input Leakage Current (High) | 2.0 to 5.0 V   | —         | $\mu\text{A}$ | —          | —      | 1.0        |

Absolute Maximum Ratings <sup>5</sup>

| Parameter                                   | Absolute Maximum           |
|---|----------------------------|
| Max Input Power<br>0.5 GHz<br>0.5 - 2.0 GHz | +27 dBm<br>+34 dBm         |
| Supply Voltages<br>$V_{CC}$<br>$V_{EE}$     | +5.5 V<br>-8.5 V           |
| Control Voltage                             | -0.5 V to $V_{CC} + 0.5$ V |
| Operating Temperature                       | -55°C to +125°C            |
| Storage Temperature                         | -65°C to +150°C            |

5. Operation of this device above any one of these parameters may cause permanent damage.

Functional Schematic (Top View)



Truth Table

| Control Inputs |    |    |    |             |
|----------------|----|----|----|-------------|
| C4             | C3 | C2 | C1 | Attenuation |
| 0              | 0  | 0  | 0  | Reference   |
| 0              | 0  | 0  | 1  | 2 dB        |
| 0              | 0  | 1  | 0  | 4 dB        |
| 0              | 1  | 0  | 0  | 8 dB        |
| 1              | 0  | 0  | 0  | 16 dB       |
| 1              | 1  | 1  | 1  | 30 dB       |

0 = TTL Low      1 = TTL High

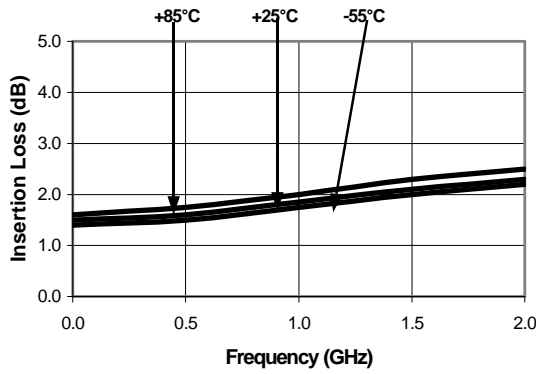
Specifications subject to change without notice.

- North America: Tel. (800) 366-2266
- Asia/Pacific: Tel.+81-44-844-8296, Fax +81-44-844-8298
- Europe: Tel. +44 (1344) 869 595, Fax+44 (1344) 300 020

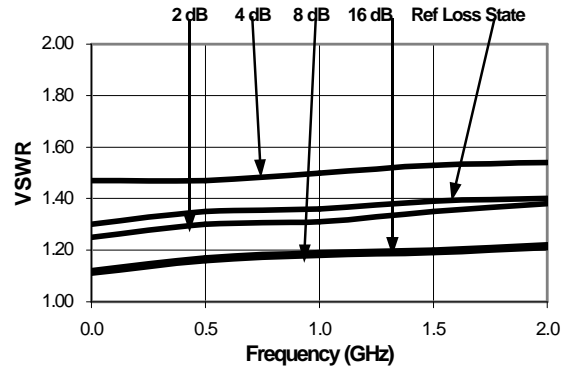
Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

Typical Performance Curves

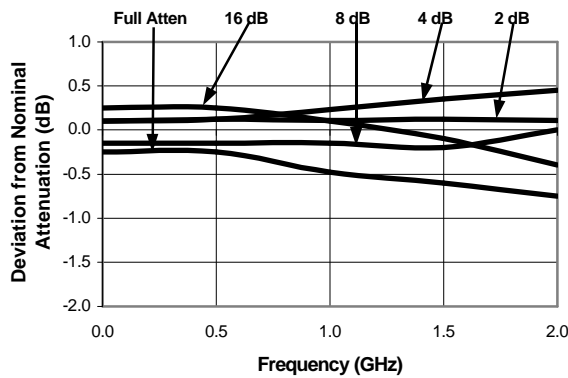
Ref. Insertion Loss vs. Frequency



VSWR vs. Frequency



Attenuation Accuracy vs. Frequency



Ordering Information <sup>6</sup>

| Part Number | Package |
|-------------|---------|
| AT-233 PIN  | CR-12   |

6. Contact the factory for standard or custom screening requirements

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