

## Features

- Attenuation 1-dB Steps to 15 dB
- High Accuracy
- Low Intermodulation Product: +50 dBm IP3
- Low DC Power Consumption: 50  $\mu$ W
- SOIC-16 Plastic Package
- Tape and Reel Packaging Available
- Temperature Stability  $\pm 0.15$  dB:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

## Description

M/A-COM's AT-210 is a 4-bit, 1-dB step GaAs MMIC digital attenuator in a low cost SOIC 16-lead surface mount plastic package. The AT-210 is ideally suited for use where high accuracy, fast switching, very low power consumption and low intermodulation products are required. Typical applications include radio, cellular, and wireless LANs, GPS equipment and other Gain/Level Control circuits.

The AT-210 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<sup>1</sup>

| Part Number | Package                      |
|-------------|------------------------------|
| AT-210 PIN  | SOIC 16-Lead Plastic Package |
| AT-210TR    | Tape & Reel                  |

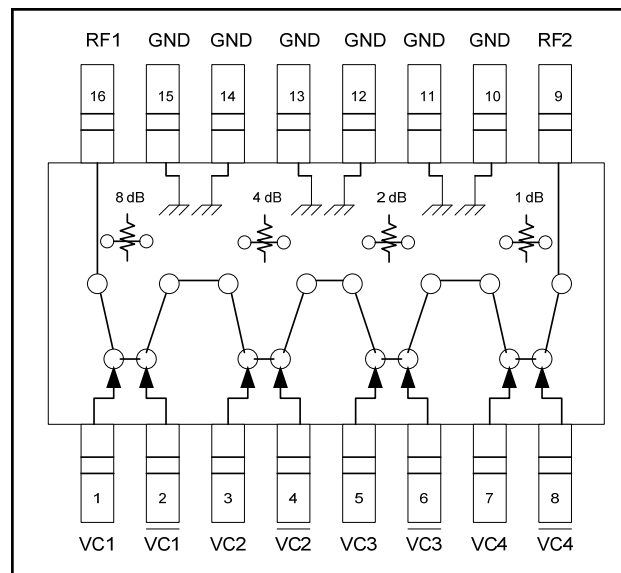
1. Reference Application Note M513 for reel size information.

## Absolute Maximum Ratings<sup>2,3</sup>

| Parameter                              | Absolute Maximum                                |
|----------------------------------------|-------------------------------------------------|
| Input Power:<br>50 MHz<br>500-2000 MHz | +27 dBm<br>+34 dBm                              |
| Control Voltage                        | $-8.5\text{ V} \leq V_C \leq 5\text{ V}$        |
| Operating Temperature                  | $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$  |
| Storage Temperature                    | $-65^{\circ}\text{C}$ to $+150^{\circ}\text{C}$ |

- 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.

## Functional Schematic



## Pin Configuration

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

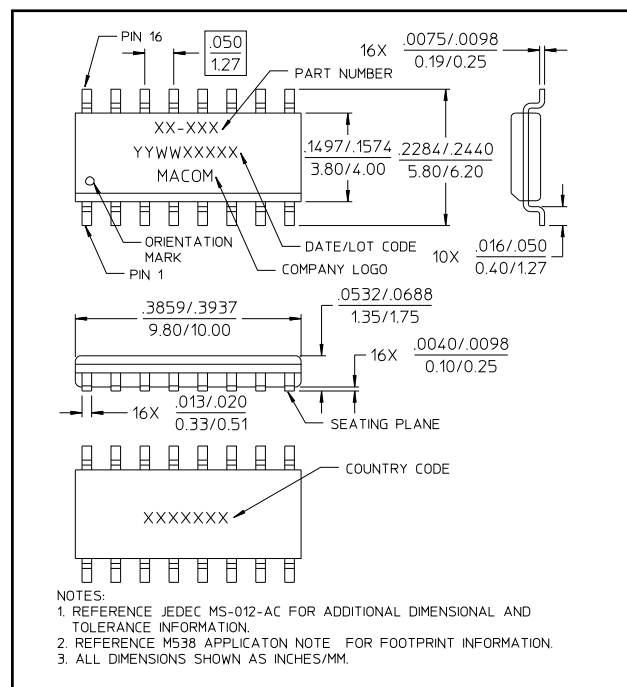
## Digital Attenuator, 15 dB, 4-Bit DC - 2.0 GHz

Rev. V4

**Electrical Specifications:**  $T_A = 25^\circ\text{C}$ ,  $V_C = 0\text{ V} / -5\text{ V}$ ,  $Z_0 = 50\ \Omega$

| Parameter                         | Test Conditions                                                             | Frequency                    | Units                                                                                    | Min. | Typ. | Max. |
|-----------------------------------|-----------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------|------|------|------|
| Insertion Loss (Reference state)  |                                                                             | DC - 0.1 GHz                 | dB                                                                                       | —    | 0.9  | —    |
|                                   |                                                                             | DC - 0.5 GHz                 | dB                                                                                       | —    | 1.3  | 1.5  |
|                                   |                                                                             | DC - 1.0 GHz                 | dB                                                                                       | —    | 1.5  | 1.8  |
|                                   |                                                                             | DC - 2.0 GHz                 | dB                                                                                       | —    | 2.0  | —    |
| Attenuation Accuracy <sup>4</sup> |                                                                             | DC - 1.0 GHz<br>DC - 2.0 GHz | ± (0.15 dB + 3% of Atten Setting in dB) dB<br>± (0.30 dB + 3% of Atten Setting in dB) dB |      |      |      |
| VSWR                              |                                                                             |                              | Ratio                                                                                    | —    | 1.4  | —    |
| Trise, Tfall                      | 10% to 90% RF, 90% to 10% RF                                                | —                            | nS                                                                                       | —    | 10   | —    |
| Ton, Toff                         | 50% Control to 90% RF,<br>50% Control to 10% RF                             | —                            | nS                                                                                       | —    | 15   | —    |
| Transients                        | In-Band                                                                     | —                            | mV                                                                                       | —    | 18   | —    |
| 1 dB Compression                  | Input Power<br>Input Power                                                  | 0.05 GHz                     | dBm                                                                                      | —    | 22   | —    |
|                                   |                                                                             | 0.5 - 2.0 GHz                | dBm                                                                                      | —    | 28   | —    |
| IP <sub>2</sub>                   | Measured Relative to Input Power<br>(For two-tone input power up to +5 dBm) | 0.05 GHz                     | dBm                                                                                      | —    | 49   | —    |
|                                   |                                                                             | 0.5 - 2.0 GHz                | dBm                                                                                      | —    | 72   | —    |
| IP <sub>3</sub>                   | Measured Relative to Input Power<br>(For two-tone input power up to +5 dBm) | 0.05 GHz                     | dBm                                                                                      | —    | 45   | —    |
|                                   |                                                                             | 0.5 - 2.0 GHz                | dBm                                                                                      | —    | 50   | —    |
| Control Current                   | V <sub>C</sub>   = 5 V                                                      |                              | µA                                                                                       | —    | 10   | 20   |

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

SOIC-16<sup>†</sup>

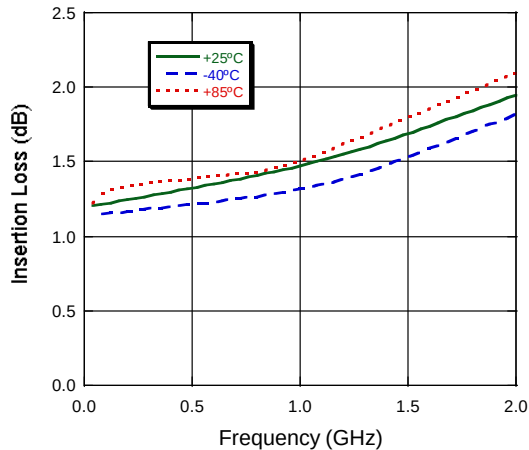
### Truth Table <sup>5</sup>

| Control Inputs   |     |                  |     |                  |     |                  |     |                  |
|------------------|-----|------------------|-----|------------------|-----|------------------|-----|------------------|
| $\overline{VC4}$ | VC4 | $\overline{VC3}$ | VC3 | $\overline{VC2}$ | VC2 | $\overline{VC1}$ | VC1 | Attenuation (dB) |
| 1                | 0   | 1                | 0   | 1                | 0   | 1                | 0   | Reference state  |
| 0                | 1   | 1                | 0   | 1                | 0   | 1                | 0   | 1 dB             |
| 1                | 0   | 0                | 1   | 1                | 0   | 1                | 0   | 2 dB             |
| 1                | 0   | 1                | 0   | 0                | 1   | 1                | 0   | 4 dB             |
| 1                | 0   | 1                | 0   | 1                | 0   | 0                | 1   | 8 dB             |
| 0                | 1   | 0                | 1   | 0                | 1   | 0                | 1   | 15 dB            |

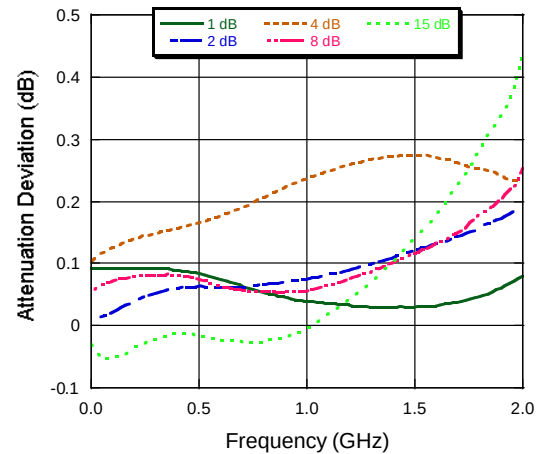
5. 0 = -0.2 V to 0 V, 1 = -8 V to -5 V.

## Typical Performance Curves

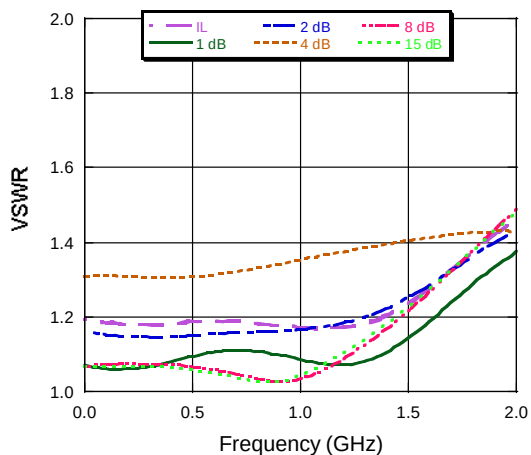
**Insertion Loss**



**Attenuation Accuracy**



**VSWR**



**Attenuation**

