



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

AT-220

V3.00

## Features

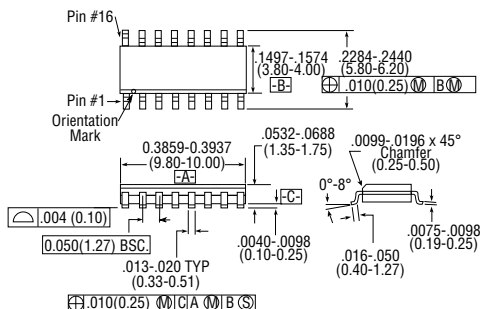
- Attenuation 2-dB Steps to 30 dB
- High Accuracy +/-3%
- Temperature Stability +/-0.15 dB from -40°C to +85°C
- Low Intermodulation Product: +50 dBm IP<sub>3</sub>
- Low DC Power Consumption: 50 mW
- Low Cost SOIC 16 Plastic Package
- Tape and Reel Packaging Available<sup>1</sup>

## Description

M/A-COM's AT-220 is a 4-bit, 2-dB step GaAs MMIC digital attenuator in a low cost SOIC 16-lead surface mount plastic package. The AT-220 is ideally suited for use where high accuracy, fast switching, very low power consumption and low intermodulation products are required. Typical applications include radio and cellular equipment, wireless LANs, GPS equipment and other Gain/Level Control circuits.

The AT-220 is fabricated with a monolithic GaAs MMIC using a mature 1-micron process. The process features full chip passivation for increased performance and reliability.

## SO-16



16-Lead SOP outline dimensions  
Narrow body .150  
(All dimensions per JEDEC No. MS-012-AC, Issue C)  
Dimensions in ( ) are in mm.  
Unless Otherwise Noted: .xxx = ± 0.010 (.xx = ± 0.25)  
.xx = ± 0.02 (.x = ± 0.5)

## Ordering Information

| Part Number | Package                      |
|-------------|------------------------------|
| AT-220 PIN  | SOIC 16-Lead Plastic Package |
| AT-220TR    | Forward Tape & Reel          |
| AT-220RTR   | Reverse Tape & Reel          |

## Electrical Specifications, T<sub>A</sub> = 25°C

| Parameter                               | Test Conditions <sup>2</sup>                             | Unit | Min.   | Typ.  | Max |
|---|--|------|--|-------|-----|
| Reference Insertion Loss                | DC - 0.1 GHz   | dB   |  | 1.2   | 1.4 |
|   | DC - 0.1 GHz   | dB   |  | 1.5   | 1.7 |
|   | DC - 1.0 GHz   | dB   |  | 1.6   | 1.8 |
|   | DC - 2.0 GHz   | dB   |  | 1.8   | 2.1 |
| Attenuation Accuracy <sup>3</sup>       | DC - 1.0 GHz<br>DC - 2.0 GHz                             | dB   | ±(0.15 dB + 3% of Attenuation Setting in dB)<br>±(0.30 dB + 3% of Attenuation Setting in dB) |       |     |
| VSWR                                    |  |      |  | 1.2:1 |     |
| Trise, Tfall<br>Ton, Toff<br>Transients | 10% to 90% RF, 90% to 10% RF                             | nS   |  | 12    |     |
|   | 50% Control to 90% RF, 50% Control to 10% RF             | nS   |  | 18    |     |
|   | In Band  | mV   |  | 25    |     |
| 1 dB<br>Compression                     | Input Power<br>0.05 GHz                                  | dBm  |  | 20    |     |
|   | Input Power<br>0.5 - 2.0 GHz                             | dBm  |  | 28    |     |
| IP <sub>2</sub>                         | Measured Relative<br>to Input Power<br>0.05 GHz          | dBm  |  | 45    |     |
|   | (For two-tone Input Power Up to +5 dBm)<br>0.5 - 2.0 GHz | dBm  |  | 68    |     |
| IP <sub>3</sub>                         | Measured Relative<br>to Input Power<br>0.05 GHz          | dBm  |  | 40    |     |
|   | (For two-tone Input Power Up to +5 dBm)<br>0.5 - 2.0 GHz | dBm  |  | 50    |     |

1. Refer to "Tape and Reel Packaging" Section, or contact factory.
2. All measurements at 1 GHz in a 50Ω system, unless otherwise specified.
3. Attenuation accuracy specifications apply with negative bias control and low inductance grounding.

Specifications Subject to Change Without Notice.

M/A-COM, Inc.

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**Digital Attenuator, 30 dB, 4-Bit**

**AT-220**

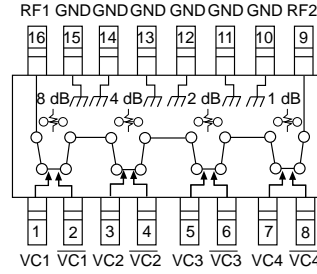
V3.00

**Absolute Maximum Ratings<sup>1</sup>**

| Parameter                  | Absolute Maximum |
|----------------------------|------------------|
| Max. Input Power<br>50 MHz | +27 dBm          |
| 500-2000 MHz               | +34 dBm          |
| Control Voltage            | +5V, -8.5V       |
| Operating Temperature      | -40°C to +85°C   |
| Storage Temperature        | -65°C to +150°C  |

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

**Functional Schematic**



**Pin Configuration**

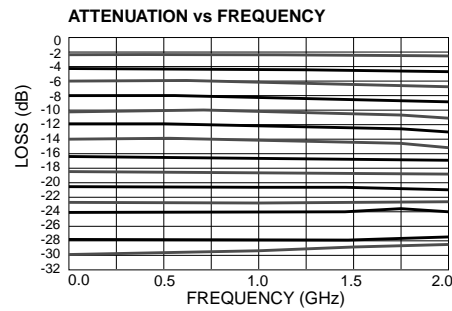
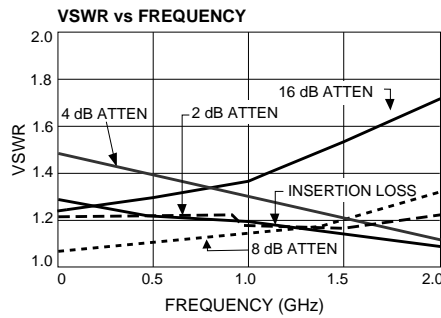
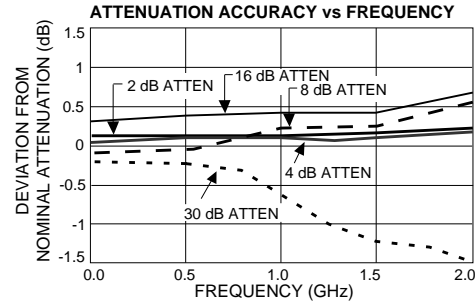
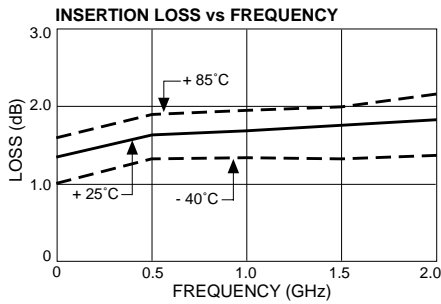
| Pin | Description      | Pin No. | Description |
|-----|------------------|---------|-------------|
| 1   | VC1              | 9       | RF2         |
| 2   | $\overline{VC1}$ | 10      | GND         |
| 3   | VC2              | 11      | GND         |
| 4   | $\overline{VC2}$ | 12      | GND     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

**Truth Table**

| Control Inputs   |     |                  |     |                  |     |                  |     | Attenuation (dB) |
|------------------|-----|------------------|-----|------------------|-----|------------------|-----|------------------|
| $\overline{VC4}$ | VC4 | $\overline{VC3}$ | VC3 | $\overline{VC2}$ | VC2 | $\overline{VC1}$ | VC1 |                  |
| 1                | 0   | 1                | 0   | 1                | 0   | 1                | 0   | Reference        |
| 0                | 1   | 1                | 0   | 1                | 0   | 1                | 0   | 2 dB             |
| 1                | 0   | 0                | 1   | 1                | 0   | 1                | 0   | 4 dB             |
| 1                | 0   | 1                | 0   | 0                | 1   | 1                | 0   | 8 dB             |
| 1                | 0   | 1                | 0   | 1                | 0   | 0                | 1   | 16 dB            |
| 0                | 1   | 0                | 1   | 0                | 1   | 0                | 1   | 30 dB            |

"0" = Vin Low, Vin Low = 0V, "1" = Vin High, Vin High = -5V  
 "0" = 0 to -0.2V @ 20µA Max  
 "1" = -5V @ 10 µA typ to -8V @ 200 µA Max

**Typical Performance**



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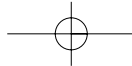
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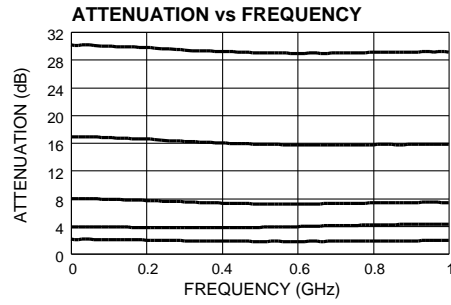
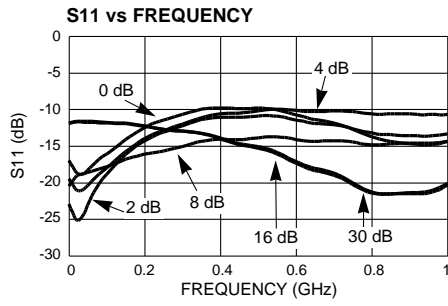


# Digital Attenuator, 30 dB, 4-Bit

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## Swept Data Characterized in 75 Ohms



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