

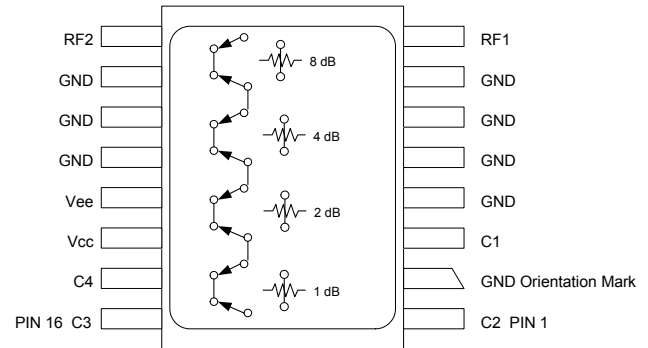
## Features

- Attenuation: 1 dB steps to 15 dB
- 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 Ohms Nominal Impedance
- Lead-Free CR-11 Package
- $260^{\circ}\text{C}$  Reflow Compatible
- RoHS\* Compliant

## Description

M/A-COM's AT-213-PIN is a 4-bit, 1 dB step digital attenuator in a hermetically sealed ceramic 16-lead surface mount package. The AT-213-PIN is ideally suited for use where high accuracy, fast switching, very low power consumption and low intermodulation products are required. Typical applications include dynamic range setting in a precision receiver circuits and other gain/leveling control circuits. Environmental screening is available. Contact the factory for information.

## Functional Schematic



## Ordering Information

Part Number	Package
AT-213-PIN	Bulk Packaging

Note: Reference Application Note M513 for reel size information.

## Pin Configuration

Pin No.	Function	Pin No.	Function
1	C2	9	RF2
2	GND	10	GND
3	C1	11	GND
4	GND	12	GND
5	GND	13	Vee
6	GND	14	Vcc
7	GND	15	C4
8	RF1	16	C3

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

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

## Digital Attenuator 15.0 dB, 4-Bit, TTL Driver, DC-3.0 GHz

Rev. V5

### Electrical Specifications: $T_A = -55^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ <sup>1</sup>

Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Reference Insertion Loss	—	DC - 0.5 GHz	dB	—	—	1.7
		DC - 1.0 GHz	dB	—	—	1.9
		DC - 2.0 GHz	dB	—	—	2.2
		DC - 3.0 GHz	dB	—	—	2.5
Attenuation Accuracy <sup>2</sup>	Any Single Bit	DC - 2.0 GHz DC - 3.0 GHz	$\pm (0.15 \text{ dB} + 3\% \text{ of atten setting in dB}) \text{ dB}$ $\pm (0.2 \text{ dB} + 3\% \text{ of atten setting in dB}) \text{ dB}$ Or $\pm 0.4 \text{ dB}$ , whichever is greater			
	Any Combination of Bits	DC - 2.0 GHz DC - 3.0 GHz	$\pm (0.2 \text{ dB} + 3\% \text{ of atten setting in dB}) \text{ dB}$ $\pm (0.2 \text{ dB} + 3\% \text{ of atten setting in dB}) \text{ dB}$ Or $\pm 0.4 \text{ dB}$ , whichever is greater			
VSWR	—	—	Ratio	—	—	1.6:1
Trise, Tfall	10% to 90%	—	ns	—	9	—
Ton, Toff	50% Control to 90/10% RF	—	ns	—	40	—
Transients	In-Band (peak-peak)	—	mV	—	30	—
1 dB Compression	Input Power	0.05 GHz	dBm	—	+22	—
	Input Power	0.5 - 3.0 GHz	dBm	—	+28	—
Input IP3	For two-tone Input Power Up to +5 dBm	0.05 GHz	dBm	—	+40	—
		0.5 - 3.0 GHz	dBm	—	+50	—
Input IP2	For two-tone Input Power Up to +5 dBm	0.05 GHz	dBm	—	+45	—
		0.5 - 3.0 GHz	dBm	—	+68	—
Vcc	—	—	V	4.5	5.0	5.5
Vee	—	—	V	-8.0	—	-5.0
Icc	Vcc = 4.5 to 5.5V Vctl = 0 to 0.8V, or Vcc – 2.1V to Vcc	—	mA	—	—	4.0
Iee	Vee = -5.0 to -8.0V	—	mA	—	—	1.0
Vctl Vctl	Logic 0 (TTL)	—	V	0.0	—	0.8
	Logic 1 (TTL)	—	V	2.0	—	5.0
Input Leakage Current (Low)	0 to 0.8V	—	$\mu\text{A}$	—	—	1.0
Input Leakage Current (High)	2.0 to 5.0V	—	$\mu\text{A}$	—	—	1.0

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

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

Parameter	Absolute Maximum
Max Input Power 0.5 GHz 0.5 - 3.0 GHz	+27 dBm +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	-55°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.

## 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.

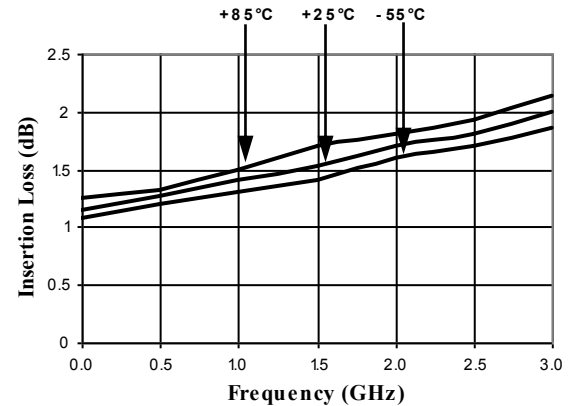
## Truth Table (Digital Attenuator)

Control Inputs				
C4	C3	C2	C1	Attenuation
0	0	0	0	Reference
0	0	0	1	1 dB
0	0	1	0	2 dB
0	1	0	0	4 dB
1	0	0	0	8 dB
1	1	1	1	15 dB

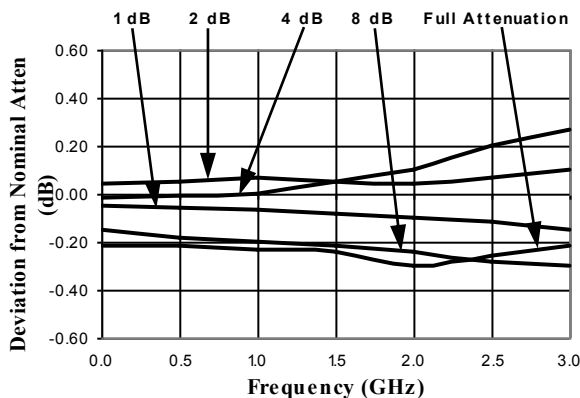
0 = TTL Low; 1 = TTL High

## Typical Performance Curves

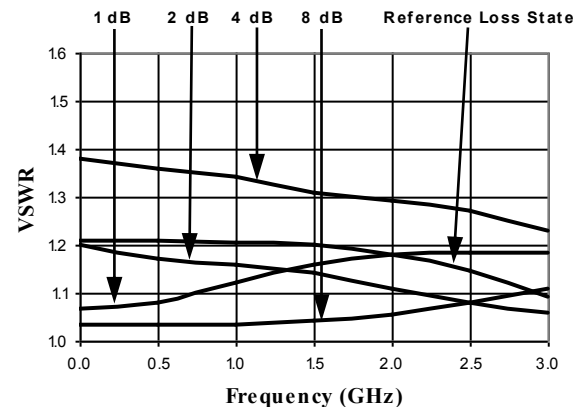
### Ref. Insertion Loss vs. Frequency



### Attenuation Accuracy vs. Frequency

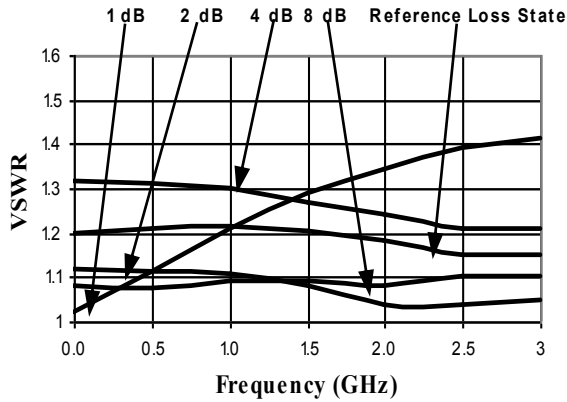


### RF1 VSWR vs. Frequency

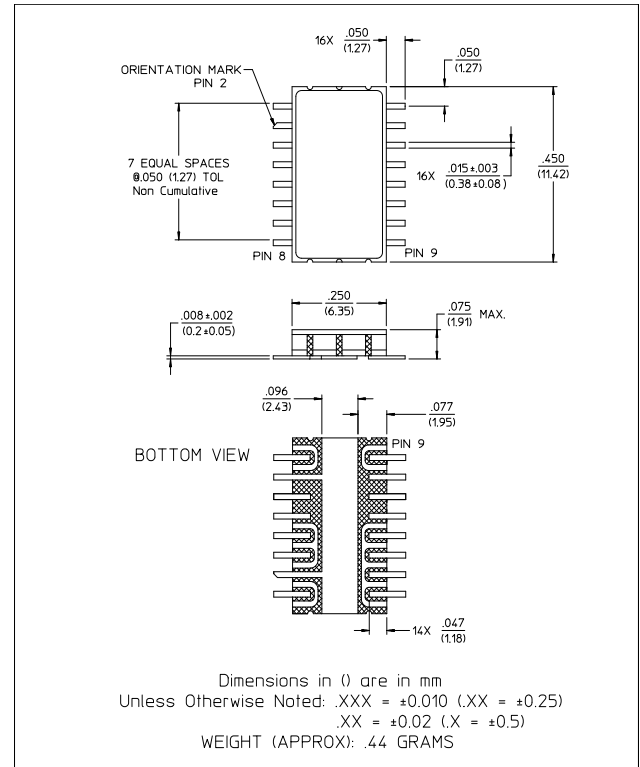


## Typical Performance Curves

RF2 VSWR vs. Frequency



## Lead-Free, CR-11 Ceramic Package<sup>†</sup>



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

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