

Electronics

### Digital Attenuator 50.0 dB, 6-Bit, TTL Driver, DC-2.0 GHz



- Attenuation: 1 dB steps to 50 dB
- Temperature Stability: ± 0.18 dB from –40°C to +85°C Typical
- Low DC Power Consumption
- Surface Mount Package
- Integral TTL Driver
- High Intercept Point
- Low Cost/High Performance
- 50 Ohm Nominal Impedance
- Lead-Free CR-13 Package
- 260°C Reflow Compatible

#### Description

M/A-COM's AT20-0106 is a GaAs FET 6-bit digital attenuator with a 1 dB minimum step size and 50 dB total attenuation. This attenuator and integral TTL driver is in a ceramic 24-lead surface mount package. The AT20-0106 is ideally suited for use where accuracy, fast switching, low power consumption and low intermodulation products are required. Typidynamic applications include cal 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-106-PIN.

#### **Ordering Information**

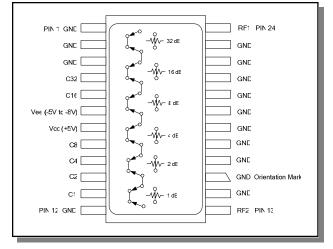
Part Number	Package		
AT20-0106-PIN	Bulk Packaging		
AT20-0106-TR	1000 piece reel		
AT20-0106-TB	Sample Test Board		

Note: Reference Application Note M513 for reel size information. Note: Die quantity varies.

# Functional Schematic

**RoHS** 

Compliant



#### **Pin Configuration**

Pin No.	Function	Pin No.	Function	
1	GND	13	RF2	
2	GND	14	GND	
3	GND	15	GND	
4	C32	16	GND	
5	C16	17	GND	
6	Vee (-5V to -8V)	18	GND	
7	Vcc (+5V)	19	GND	
8	C8	20	GND	
9	C4	21	GND	
10	C2	22	GND	
11	C1	23	GND	
12	GND	24	RF1	

The metal bottom of the case must be connected to  $\mathsf{RF}$  and  $\mathsf{DC}$  ground.

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

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AT20-0106

**V7** 

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# RoHS Compliant



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#### **Electrical Specifications:** T<sub>A</sub> = 25°C<sup>1</sup>

Parameter	Parameter Test Conditions		Units	Min	Тур	Max
Reference Insertion Loss	-	DC - 0.5 GHz DC - 1.0 GHz DC - 2.0 GHz	dB dB dB		3.5 3.9 4.2	3.8 4.2 4.6
Attenuation Accuracy <sup>2</sup>	Any Single Bit Any Combination of Bits (For attenuation to 26 dB) Any Combination of Bits (For attenuation 27 to 50 dB)	DC - 2.0 GHz DC - 2.0 GHz DC - 1.5 GHz	dB dB dB	<ul> <li>± (0.3 +4% of atten. setting)</li> <li>± (0.4 +4% of atten. setting)</li> <li>± (0.5 +5% of atten. setting)</li> </ul>		
VSWR	—	0.05 - 0.10 GHz 0.101 - 2.0 GHz	Ratio Ratio	_	_	2.0:1 1.8:1
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 Input Power	0.05 GHz 0.5 - 2.0 GHz	dBm dBm		+20 +28	
Input IP3	For two-tone Input Power Up to +5 dBm	0.05 GHz 0.5 - 2.0 GHz	dBm dBm	_	+34 +46	
Input IP2	For two-tone Input Power Up to +5 dBm	0.05 GHz 0.5 - 2.0 GHz	dBm dBm	—	+75 +79	
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	—	—	6.0
lee	Vee = -5.0 to -8.0V	_	mA	—	—	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.

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

Parameter	Absolute Maximum		
Max Input Power 0.5 GHz 0.5 - 2.0 GHz	+27 dBm +34 dBm		
Supply Voltages Vcc Vee	+5.5V -8.5V		
Control Voltage 5	-0.5V to Vcc +0.5V		
Operating Temperature	-40°C to +125°C		
Storage Temperature	-65°C to +150°C		

3. 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**

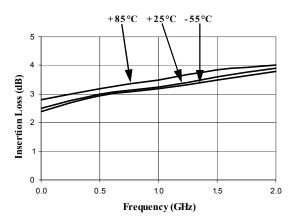
Please observe the following precautions to avoid damage:

#### **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.

#### **Typical Performance Curves**

#### Insertion Loss vs. Frequency



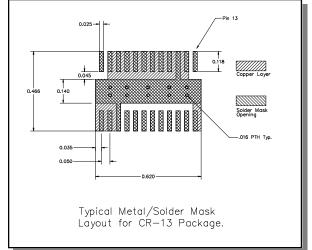
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# Recommended PCB Configuration

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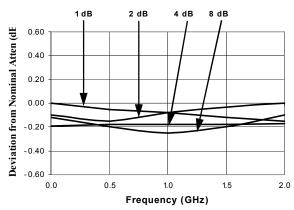


## Truth Table (Digital Attenuator)

Control Inputs						
C6	C5	C4	C3	C2	C1	Attenuation
0	0	0	0	0	0	Reference
0	0	0	0	0	1	1 dB
0	0	0	0	1	0	2 dB
0	0	0	1	0	0	4 dB
0	0	1	0	0	0	8 dB
0	1	0	0	0	0	16 dB
1	0	0	0	0	0	32 dB
1	1	1	1	1	1	63 dB

0 = TTL Low; 1 = TTL High

#### Attenuation Accuracy vs. Frequency



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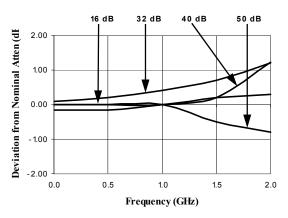
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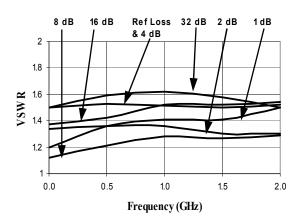
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#### **Typical Performance Curves**

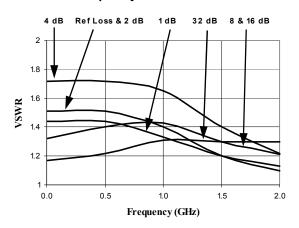
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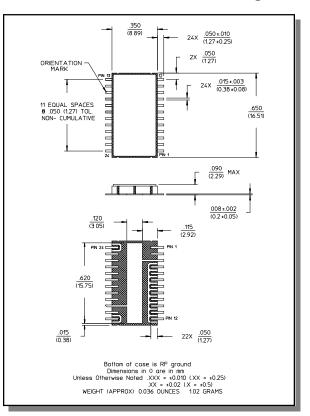
#### RF2 VSWR vs. Frequency



RF1 VSWR vs. Frequency



#### Lead-Free, CR-13 Ceramic Package<sup>†</sup>



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