

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

Rev. V10

Features

- 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
- RoHS* Compliant

Description

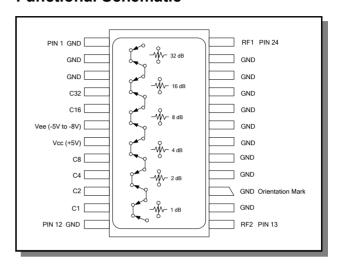
M/A-COM's AT20-0106 is a GaAs FET 6-bit digital attenuator with a 1 dB minimum step size and 50 dB total attenuation. This attenuator and integral TTL driver is in a ceramic 24-lead surface mount package. The AT20-0106 is ideally suited for use where accuracy, fast switching, low power consumption and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

Functional Schematic



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 RF and DC ground.

^{*} Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

AT20-0106



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

Rev. V10

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

Parameter	ameter 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 ²	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	\pm (0.3 +4% of atten. setting) \pm (0.4 +4% of atten. setting) \pm (0.5 +5% of atten. setting)		setting)
VSWR	SWR —		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	ompression Input Power Input Power		dBm dBm	_	+20 +28	_
Input IP3	out IP3 For two-tone Input Power Up to +5 dBm		dBm dBm	_	+34 +46	_
Input IP2	Input IP2 For two-tone Input Power Up to +5 dBm		dBm dBm	_	+45 +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	lee Vee = -5.0 to -8.0V		mA	_	_	1.0

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



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

Rev. V10

Absolute Maximum Ratings ^{3,4}

Parameter	Absolute Maximum		
Max Input Power 0.05 GHz 0.5 - 2.0 GHz	+27 dBm +34 dBm		
V _{CC}	-0.5V ≤ V _{CC} ≤ +7.0V		
V _{EE}	-8.5V ≤ V _{EE} ≤ +0.5V		
V _{CC} - V _{EE}	$-0.5V \le V_{CC} - V_{EE} \le 14.5V$		
Vin ⁵	-0.5V ≤ Vin ≤ V _{CC} + 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

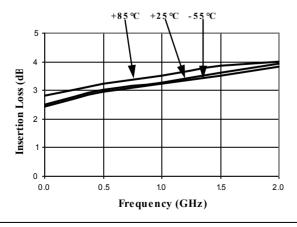
Please observe the following precautions to avoid damage:

Static Sensitivity

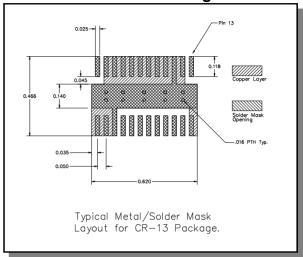
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance Curves

Insertion Loss vs. Frequency



Recommended PCB Configuration

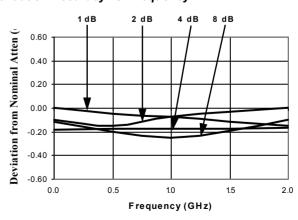


Truth Table (Digital Attenuator)

Control Inputs						
C6	C5	C4	С3	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



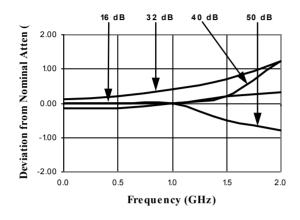


Digital Attenuator 50.0 dB, 6-Bit, TTL Driver, DC-2.0 GHz

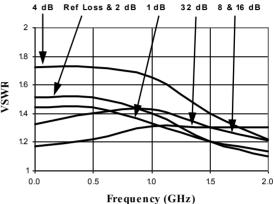
Rev. V10

Typical Performance Curves

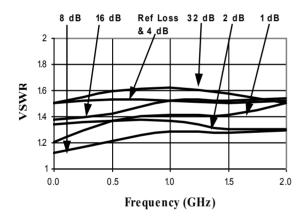
Attenuation Accuracy vs. Frequency



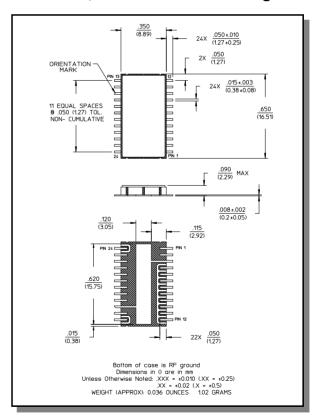
RF1 VSWR vs. Frequency



RF2 VSWR vs. Frequency



Lead-Free, CR-13 Ceramic Package[†]



Reference Application Note M538 for lead-free solder reflow recommendations.

AT20-0106



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

Rev. V10

M/A-COM Technology Solutions Inc. All rights reserved.

Information in this document is provided in connection with M/A-COM Technology Solutions Inc ("MACOM") products. These materials are provided by MACOM as a service to its customers and may be used for informational purposes only. Except as provided in MACOM's Terms and Conditions of Sale for such products or in any separate agreement related to this document, MACOM assumes no liability whatsoever. MACOM assumes no responsibility for errors or omissions in these materials. MACOM may make changes to specifications and product descriptions at any time, without notice. MACOM makes no commitment to update the information and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to its specifications and product descriptions. No license, express or implied, by estoppels or otherwise, to any intellectual property rights is granted by this document.

THESE MATERIALS ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, EITHER EXPRESS OR IMPLIED, RELATING TO SALE AND/OR USE OF MACOM PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, CONSEQUENTIAL OR INCIDENTAL DAMAGES, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. MACOM FURTHER DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. MACOM SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS, WHICH MAY RESULT FROM THE USE OF THESE MATERIALS.

MACOM products are not intended for use in medical, lifesaving or life sustaining applications. MACOM customers using or selling MACOM products for use in such applications do so at their own risk and agree to fully indemnify MACOM for any damages resulting from such improper use or sale.