

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

Rev. V5

Features

- Attenuation: 1 dB steps to 15 dB
- Temperature Stability: ± 0.18 dB from –55°C to +85°C Typical
- Low DC Power Consumption
- Hermetic Surface Mount Package
- Integral TTL Driver
- 50 Ohms Nominal Impedance
- Lead-Free CR-11 Package
- 260°C Reflow Compatible
- RoHS* Compliant

Description

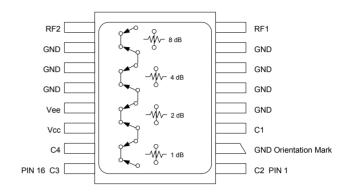
M/A-COM's AT-213-PIN is a 4-bit, 1 dB step digital attenuator in a hermetically sealed ceramic 16-lead surface mount package. The AT-213-PIN is ideally suited for use where high accuracy, fast switching, very low power consumption and low intermodulation products are required. Typical applications include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

Ordering Information

Part Number	Package
AT-213-PIN	Bulk Packaging

Note: Reference Application Note M513 for reel size information.

Functional Schematic



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.

AT-213-PIN



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

Rev. V5

Electrical Specifications: $T_A = -55$ °C to +85°C¹

Parameter	Test Conditions	Frequency	Units	Min	Тур	Max
Reference Insertion Loss	_	DC - 0.5 GHz DC - 1.0 GHz DC - 2.0 GHz DC - 3.0 GHz	dB dB dB dB	_ _ _	_ _ _	1.7 1.9 2.2 2.5
Attenuation Accuracy ²	Any Single Bit Any Combination of Bits	DC - 2.0 GHz DC - 3.0 GHz DC - 2.0 GHz DC - 3.0 GHz	± (0.15 dB +3% of atten setting in dB) dB ± (0.2 dB +3% of atten setting in dB) dB Or ± 0.4 dB, whichever is greater ± (0.2 dB +3% of atten setting in dB) dB ± (0.2 dB +3% of atten setting in dB) dB Or ± 0.4 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 Input Power	0.05 GHz 0.5 - 3.0 GHz	dBm dBm	_	+22 +28	_
Input IP3	For two-tone Input Power Up to +5 dBm	0.05 GHz 0.5 - 3.0 GHz	dBm dBm	_	+40 +50	_
Input IP2	For two-tone Input Power Up to +5 dBm	0.05 GHz 0.5 - 3.0 GHz	dBm dBm	_	+45 +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
lee	Vee = -5.0 to -8.0V	_	mA	_	_	1.0
Vctl Vctl	Logic 0 (TTL) Logic 1 (TTL)	=	V V	0.0 2.0	_	0.8 5.0
Input Leakage Current (Low)	0 to 0.8V	_	μA	_	_	1.0
Input Leakage Current (High)	2.0 to 5.0V	_	μA	_	_	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.



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

Rev. V5

Absolute Maximum Ratings 3,4

Parameter	Absolute Maximum	
Max Input Power 0.5 GHz 0.5 - 3.0 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 ≤ V _{CC} - V _{EE} ≤ 14.5V	
Vin ⁵	-0.5V ≤ Vin ≤ V _{CC} + 0.5V	
Operating Temperature	-55°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.

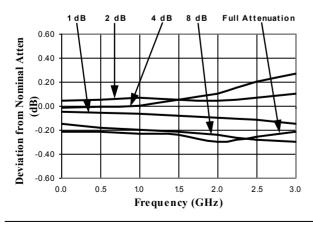
Handling Procedures

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.

Attenuation Accuracy vs. Frequency



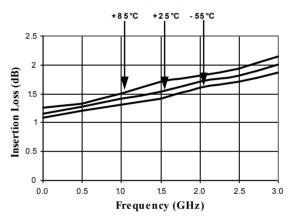
Truth Table (Digital Attenuator)

	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		

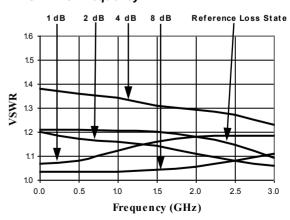
0 = TTL Low; 1 = TTL High

Typical Performance Curves

Ref. Insertion Loss vs. Frequency



RF1 VSWR vs. Frequency



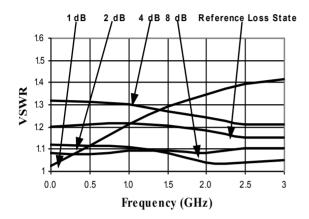


Digital Attenuator 15.0 dB, 4-Bit, TTL Driver, DC-3.0 GHz

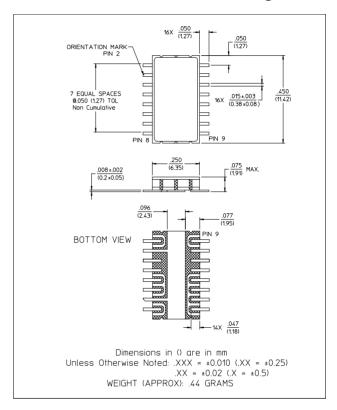
Rev. V5

Typical Performance Curves

RF2 VSWR vs. Frequency



Lead-Free, CR-11 Ceramic Package[†]



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

AT-213-PIN



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

Rev. V5

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.