## Digital Attenuator 50 dB, 6-Bit, TTL Driver, DC-2.0 GHz

Rev. V3

32 dB

16 dB

### Features

- Attenuation: 1 dB Steps to 50 dB
- Low DC Power Consumption
- Integral TTL Driver
- 50 ohm Impedance
- Test Boards are Available
- Tape and Reel Packaging Available
- Lead-Free SOW-24 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- 260°C Reflow Compatible
- RoHS\* Compliant Version of AT65-0106

#### GND O 24 -O RF GND O--O GND 2 Vee O 23 MAAD-007086 -000100 GND O-З 22 -O GND C32 O-4 21 -O GND 0.1 uE 6 BIT, 50 dB C16 O 20 -O GND ATTEN 19 -O GND -O GND 18 SEE C8 C 17 O GND DETAIL C4 O 16 -O GND C2 O 10 15 -O GND C1 O 14 -O GND 11 GND O 12 13 -O RF ATTENUATOR DETAIL

8 dB

Schematic with Off-Chip Components

## Description

M/A-COM's MAAD-007086-000100 is a GaAs FET 6-bit digital attenuator with a 1 dB minimum step size and a 50 dB total attenuation range. This device is in a SOW-24, wide body plastic surface mount package. The MAAD-007086-000100 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required.

## **Ordering Information**

Part Number	Package
MAAD-007086-000100	Bulk Packaging
MAAD-007086-0001TR	1000 piece reel
MAAD-007086-0001TB	Sample Test Board

Note: Reference Application Note M513 for reel size information.

## **Pin Configuration**

4 dB

2 dB

1 dB

Pin No.	Function	Pin No.	Function	
1	GND	13	RF	
2	GND	14	GND	
3	GND	GND 15		
4	C32	16	GND	
5	C16	17	GND	
6	6 V <sub>EE</sub> 18		GND	
7	V <sub>CC</sub> 19		GND	
8	C8	20	GND	
9	C4 21		GND	
10	D C2 22		GND	
11	C1	23	GND	
12	GND	24	RF	

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

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## Digital Attenuator 50 dB, 6-Bit, TTL Driver, DC-2.0 GHz

Rev. V3

## Electrical Specifications: $T_A = 25^{\circ}C$ , $Z_0 = 50\Omega$

Parameter	Test Conditions	Frequency	Units	Min	Тур	Мах
Insertion Loss	—	DC - 2.0 GHz dB — 4.2		4.2	4.7	
Attenuation Accuracy	Individual Bits 1-2-4-8-16-32 dB Any Combination of Bits 3 to 15 dB Any Combination of Bits 17 to 31 dB Any Combination of Bits 32 to 50 dB	mbination of Bits 3 to 15 dB DC - 2.0 GHz nbination of Bits 17 to 31 dB DC - 2.0 GHz				$\pm$ (.3 +3% of atten setting) $\pm$ (.5 +5% of atten setting) $\pm$ (.3 +3% of atten setting) $\pm$ (.5 +7% of atten setting)
VSWR	Full Range	DC - 2.0 GHz	Ratio	_	1.8:1	2:1
Switching Speed <sup>1</sup>	50% Cntl to 90%/10% RF 10% to 90% or 90% to 10%			75 20	150 50	
1 dB Compression			dBm dBm	—	+21 +24	—
Input IP <sub>3</sub>	Two-tone inputs up to +5 dBm @ 0 dB Attenuation	50 MHz 0.5-2.0 GHz	dB dB		+35 +48	
Vcc Vee			V V	4.75 -8.0	5.0 -5.0	5.25 -4.75
V <sub>IL</sub> V <sub>IH</sub>	LOW-level input voltage HIGH-level input voltage	— V 0.0 – — V 2.0 –		_	0.8 5.0	
lin (Input Leakage Current)	Vin = V <sub>CC</sub> or GND	_	— uA -1.0 —		1.0	
Icc (Quiescent Supply Current)	Vcntrl = V <sub>CC</sub> or GND	_	uA	—	250	400
∆lcc (Additional Supply Current Per TTL Input Pin)	$V_{CC}$ = Max, Vcntrl = $V_{CC}$ - 2.1 V	_	mA		_	1.0
IEE	VEE min to max, Vin = $V_{IL}$ or $V_{IH}$	_	mA	-1.0	-0.2	—
Thermal Resistance $\theta_{JA}$	PCB mount on FR4 material, copper trace, still air at +25°C	—	°C/W	—	60-80	_

1. Decoupling capacitors (.01µF) are required on power supply lines.

## Absolute Maximum Ratings<sup>2,3</sup>

Parameter	Absolute Maximum		
Max. Input Power 0.05 GHz 0.5 - 2.0 GHz	+27 dBm +34 dBm		
V <sub>CC</sub>	$-0.5 V \leq V_{CC} \leq +7.0 V$		
V <sub>EE</sub>	$-8.5 \text{V} \leq \text{V}_{\text{EE}} \leq +0.5 \text{V}$		
$V_{CC}$ - $V_{EE}$	$-0.5V \le V_{CC} - V_{EE} \le 14.5V$		
Vin <sup>4</sup>	$-0.5V \le Vin \le V_{CC} + 0.5V$		
Operating Temperature	-40°C to +85°C		
Storage Temperature	-65°C to +125°C		

2. 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.

#### 2

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## 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.

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## Digital Attenuator 50 dB, 6-Bit, TTL Driver, DC-2.0 GHz

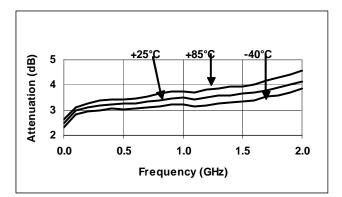
## **Truth Table (Digital Attenuator)**

C32	C16	C8	C4	C2	C1	Attenuation
0	0	0	0	0	0	Loss, 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	0	0	1	0	50 dB

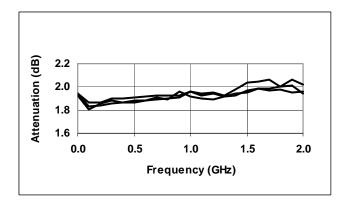
0 = TTL Low; 1 = TTL High

## **Typical Performance Curves**

#### Insertion Loss vs. Temperature



#### 2 dB Attenuation Variation from -40°C to +85°C



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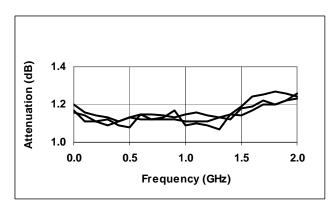
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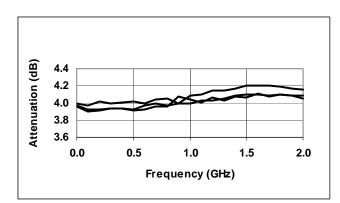
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1 dB Attenuation Variation from -40°C to +85°C



#### 4 dB Attenuation Variation from -40°C to +85°C



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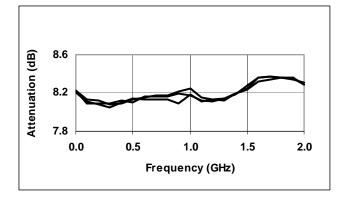
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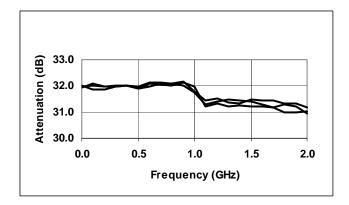
## Digital Attenuator 50 dB, 6-Bit, TTL Driver, DC-2.0 GHz

### **Typical Performance Curves**

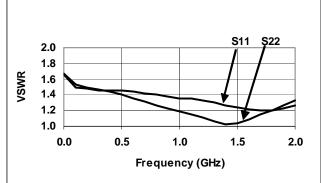
#### 8 dB Attenuation Variation from -40°C to +85°C



32 dB Attenuation Variation from -40°C to +85°C



Reference Loss VSWR (S11, S22)



<sup>4</sup> 

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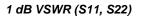
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Frequency (GHz)

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2.0

1.8

1.6

1.4

1.2

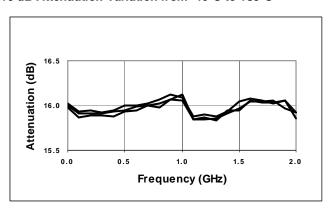
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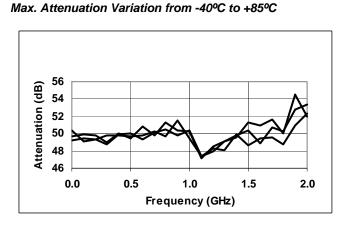
VSWR

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S11



### 16 dB Attenuation Variation from -40°C to +85°C





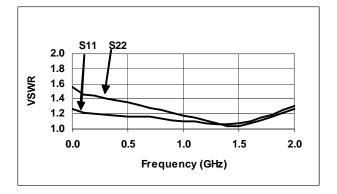
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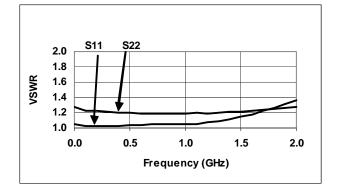
## **Digital Attenuator** 50 dB, 6-Bit, TTL Driver, DC-2.0 GHz

### **Typical Performance Curves**

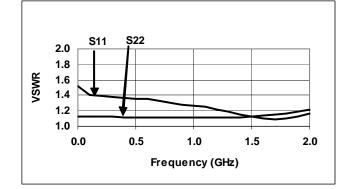
2 dB VSWR (S11, S22)



8 dB VSWR (S11, S22)



32 dB VSWR (S11, S22)



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Frequency (GHz)

S22

0.5

S11

2.0

1.8

1.6

1.4

1.2

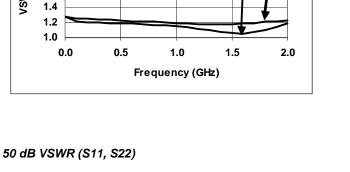
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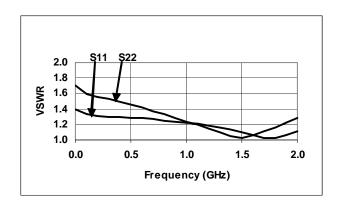
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VSWR

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#### 4 dB VSWR (S11, S22)

16 dB VSWR (S11, S22)

2.0

1.8

1.6

VSWR



Rev. V3

Ş22

S11

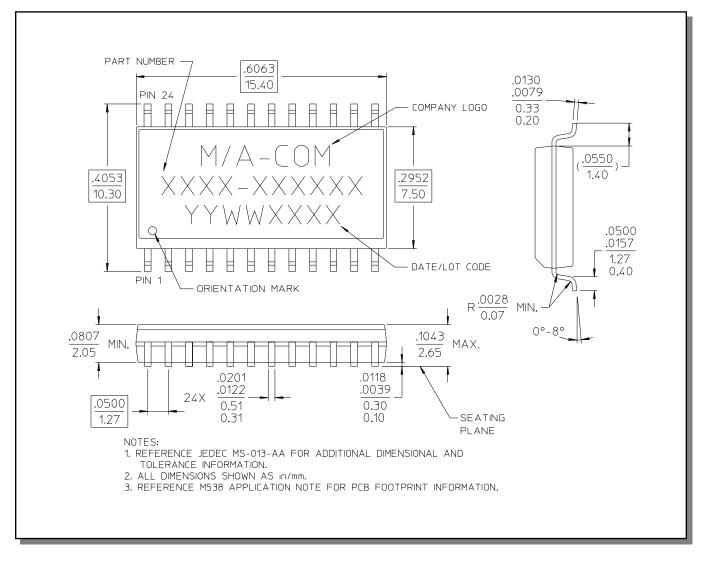
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## **Digital Attenuator** 50 dB, 6-Bit, TTL Driver, DC-2.0 GHz

## Lead-Free, SOW-24<sup>†</sup>



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

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