

Digital Attenuator

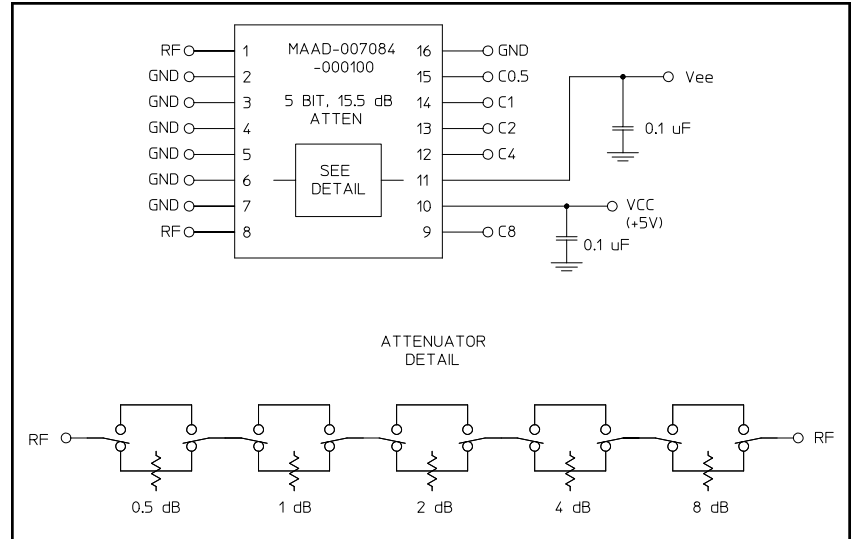
15.5 dB, 5-Bit, TTL Driver, DC-2.0 GHz

Rev. V2

Features

- Attenuation: 0.5 dB Steps to 15.5 dB
- Low DC Power Consumption
- Integral TTL Driver
- 50 ohm Impedance
- Test Boards are Available
- Tape and Reel Packaging Available
- Lead-Free SOW-16 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- 260°C Reflow Compatible
- RoHS* Compliant Version of AT65-0283

Schematic with Off-Chip Components



Description

M/A-COM's MAAD-007084-000100 is a GaAs FET 5-bit digital attenuator with integral TTL driver. Step size is 0.5 dB providing a 15.5 dB total attenuation range. This device is in a SOW-16 plastic surface mount package. The MAAD-007084-000100 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required.

Pin Configuration

Pin No.	Function	Pin No.	Function
1	RF	9	C8
2	GND	10	Vcc
3	GND	11	Vee
4	GND	12	C4
5	GND	13	C2
6	GND	14	C1
7	GND	15	C0.5
8	RF	16	GND

Ordering Information

Part Number	Package
MAAD-007084-000100	Bulk Packaging
MAAD-007084-0001TR	1000 piece reel
MAAD-007084-0001TB	Sample Test Board

Note: Reference Application Note M513 for reel size information.

Note: Die quantity varies.

Truth Table (Digital Attenuator)

C8	C4	C2	C1	C0.5	Attenuation
0	0	0	0	0	Loss, Reference
0	0	0	0	1	0.5 dB
0	0	0	1	0	1.0 dB
0	0	1	0	0	2.0 dB
0	1	0	0	0	4.0 dB
1	0	0	0	0	8.0 dB
1	1	1	1	1	15.5 dB

0 = TTL Low; 1 = TTL High

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

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

Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Insertion Loss	—	DC - 1.0 GHz DC - 2.0 GHz	dB dB	— —	2.5 2.7	2.7 3.0
Attenuation Accuracy	Any Bit Any Combination of Bits	DC - 2.0 GHz DC - 2.0 GHz	dB dB	— —	— —	$\pm(.3 + 4\% \text{ of atten})$ $\pm(.3 + 6\% \text{ of atten})$
VSWR	Full Range	DC - 2.0 GHz	Ratio	—	1.5:1	2:1
Switching Speed ¹	50% Cntl to 90%/10% RF 10% to 90% or 90% to 10%	— —	ns ns	— —	75 20	150 50
1 dB Compression	— —	50 MHz 0.5 - 2.0 GHz	dBm dBm	— —	+21 +29	— —
Input IP ₃	Two-tone inputs up to +5 dBm	50 MHz 0.5-2.0 GHz	dB dB	— —	+35 +48	— —
V _{CC} V _{EE}	— —	— —	V V	4.75 -8.0	5.0 -5.0	5.25 -4.75
V _{IL} V _{IH}	LOW-level input voltage HIGH-level input voltage	— —	V V	0.0 2.0	— —	0.8 5.0
I _{in} (Input Leakage Current)	V _{in} = V _{CC} or GND	—	uA	-1.0	—	1.0
I _{CC} (Quiescent Supply Current)	V _{cntrl} = V _{CC} or GND	—	uA	—	250	400
ΔI_{CC}^2 (Additional Supply Current Per TTL Input Pin)	V _{CC} = Max, V _{cntrl} = V _{CC} - 2.1 V	—	mA	—	—	1.0
I _{EE}	V _{EE} min to max, V _{in} = V _{IL} or V _{IH}	—	mA	-1.0	-0.2	—

- Decoupling capacitors (.01 μF) are required on power supply lines.
- For calculating ΔI_{CC} , the number of TTL input pins is 6.

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}	$-0.5\text{V} \leq V_{CC} \leq +7.0\text{V}$
V _{EE}	$-8.5\text{V} \leq V_{EE} \leq +0.5\text{V}$
V _{CC} - V _{EE}	$-0.5\text{V} \leq V_{CC} - V_{EE} \leq 14.5\text{V}$
V _{in} ⁵	$-0.5\text{V} \leq V_{in} \leq V_{CC} + 0.5\text{V}$
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°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

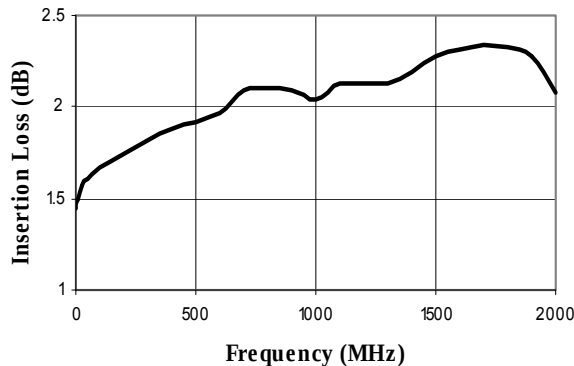
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

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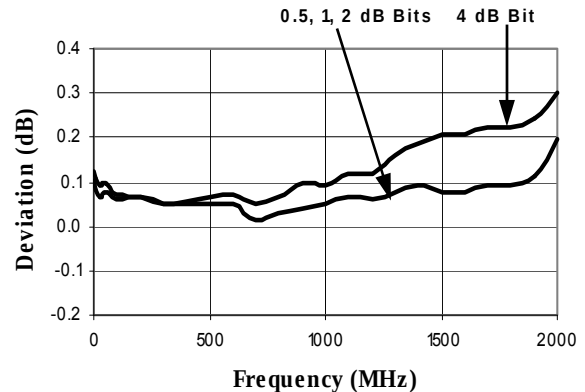
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Typical Performance Curves

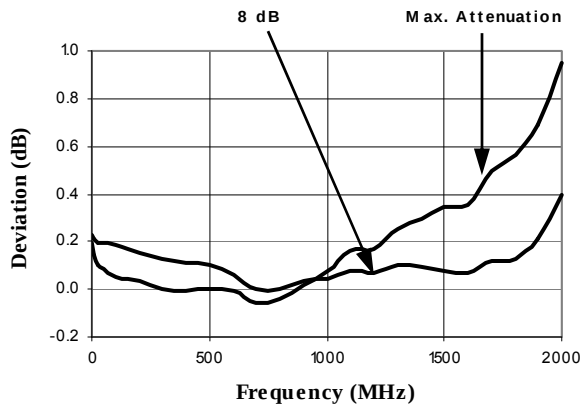
Insertion Loss



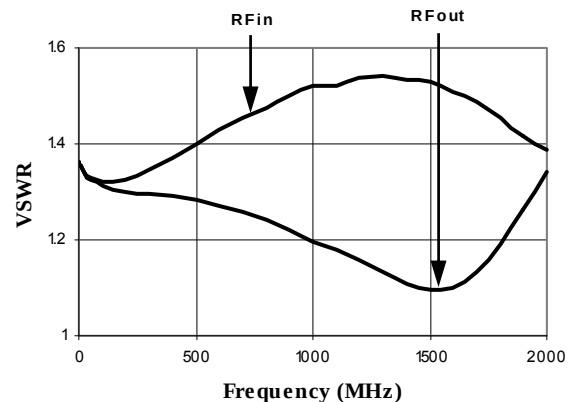
Attenuation Accuracy 0.5, 1, 2, and 4 dB Bits



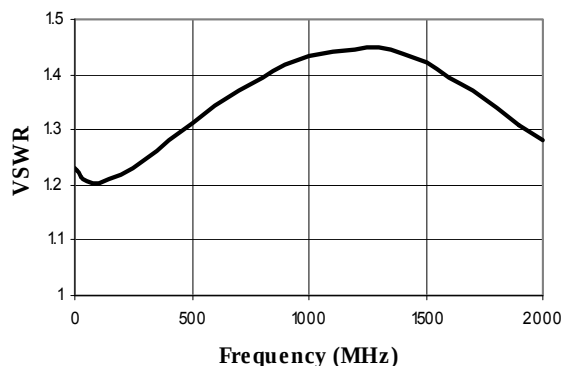
Attenuation Accuracy 8 dB Bit and Max. Attenuation



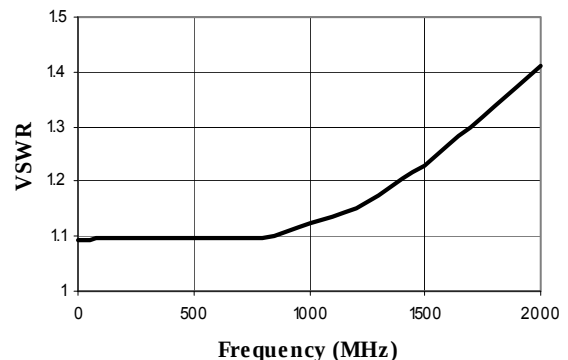
VSWR @ Insertion Loss



VSWR RF OUT 0.5, 1, 2, and 4 dB Bits



VSWR RF IN 0.5, 1, 2, 4, 8 dB Bits and Max. Attenuation

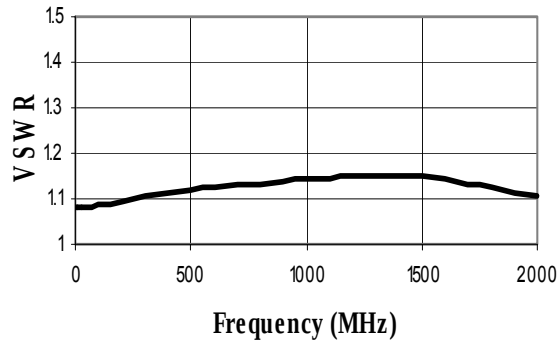


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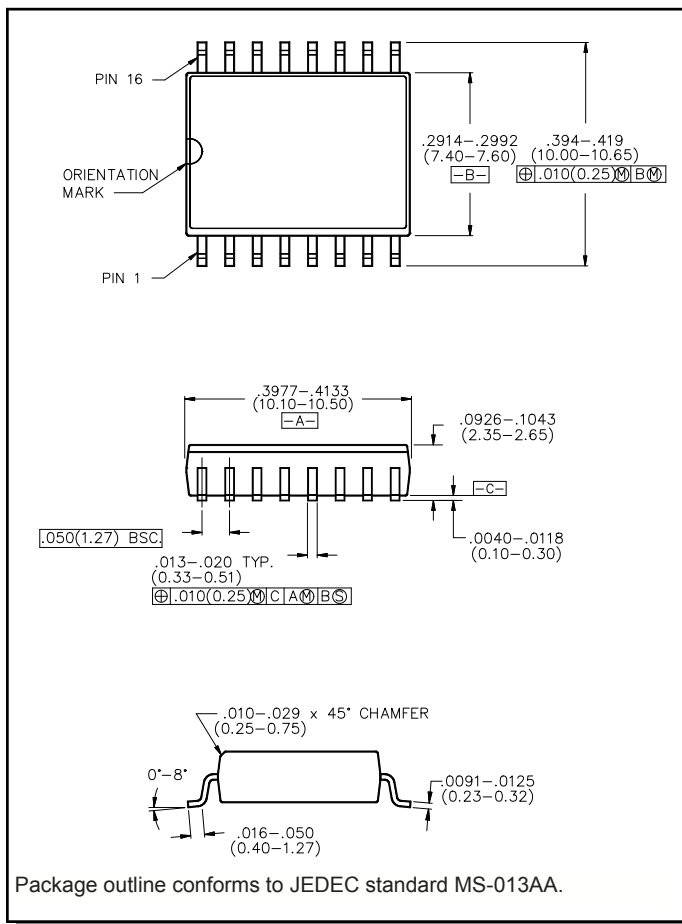
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VSWR RF OUT 8 dB Bit and Max. Attenuation



Lead-Free, SOW-16[†]



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