

Digital Attenuator

15.0 dB, 4-Bit, TTL Driver, DC-4.0 GHz

MAADCC0006

V2

Features

- Attenuation: 1 dB Steps to 15 dB
- Low DC Power Consumption
- Small Footprint, JEDEC Package
- Integral TTL Driver
- 50 Ohm Impedance
- Test Boards Available
- Tape and Reel Packaging Available
- Lead-Free CSP-1 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- 260°C Reflow Compatible
- RoHS* Compliant Version of AT90-0413

Description

M/A-COM's MAADCC0006 is a GaAs FET 4-Bit digital attenuator with integral driver. Step size is 1 dB providing a 15 dB attenuation range. This device is in an PQFN plastic surface mount package. The MAADCC0006 is suited for applications where accuracy, fast speed, low power consumption and low costs are required.

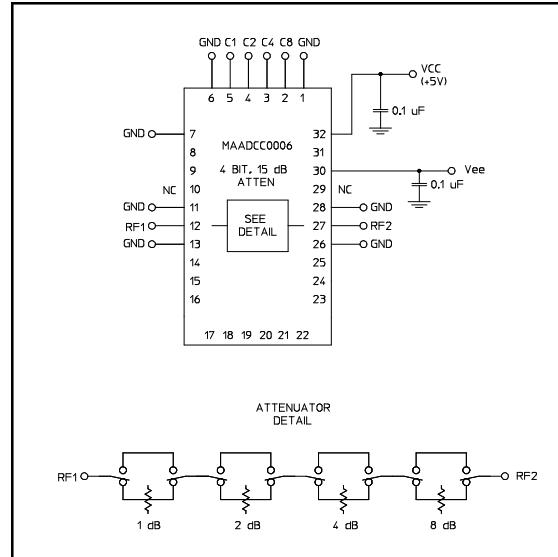
Ordering Information

Part Number	Package
MAADCC0006	Bulk Packaging
MAADCC0006TR	1000 piece reel
MAADCC0006-TB	Sample Test Board

Note: Reference Application Note M513 for reel size information.

Note: Die quantity varies.

Schematic with Off-Chip Components



Pin Configuration²

Pin No.	Function	Pin No.	Function
1	GND	17	N/C
2	C8	18	N/C
3	C4	19	N/C
4	C2	20	N/C
5	C1	21	N/C
6	GND	22	N/C
7	GND	23	N/C
8	N/C	24	N/C
9	N/C	25	N/C
10	N/C ¹	26	GND
11	GND	27	RF2
12	RF1	28	GND
13	GND	29	N/C ¹
14	N/C	30	-Vee
15	N/C	31	N/C
16	N/C	32	+Vcc

1. Pins 10 & 29 must be isolated.
2. The exposed pad centered on the package bottom must be connected to RF and DC ground. (For PQFN Packages)

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

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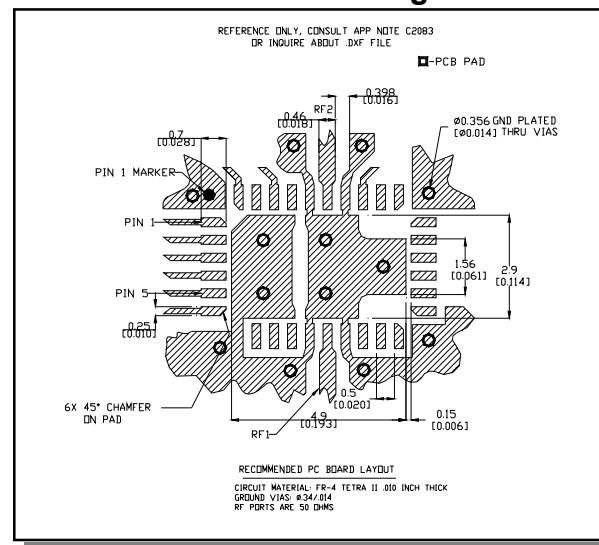
Electrical Specifications: $T_A = 25^\circ\text{C}$

Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Insertion Loss	—	DC-2.5 GHz DC-4.0 GHz	dB dB	— —	2.0 2.5	2.5 3.0
Attenuation Accuracy	Individual Bits or Combination of Bits	DC-2.5 GHz DC-4.0 GHz	dB dB	— —	— —	$\pm(0.3+4\% \text{ of atten setting})$ $\pm(0.3+6\% \text{ of atten setting})$
VSWR	Full Attenuation Range	DC-2.5 GHz DC-4.0 GHz	Ratio Ratio	— —	1.5:1 1.8:1	1.8:1 2.0:1
Switching Speed	50% Cntl to 90%/10% RF 10% to 90% or 90% to 10%	— —	nS nS	— —	75 20	150 50
1 dB Compression	—	50 MHz 0.5-4.0 GHz	dB dB	— —	+21 +29	— —
Input IP ₃	Two-tone Inputs up to +5 dBm	50 MHz 0.5-4.0 GHz	dB dB	— —	+35 +48	— —
+Vcc	—	—	V	4.75	5.0	5.25
-Vee	—	—	V	-8.0	-5.0	-4.75
Logic "0"	Sink Current is 20 μA max.	—	V	0.0	—	0.8
Logic "1"	Sink Current is 20 μA max.	—	V	2.0	—	5.0
I _{cc}	Vcc min to max, Logic "0" or "1"	—	mA	—	0.2	6
-I _{ee}	-Vee min to max, Logic "0" or "1"	—	mA	—	-0.2	-1
Thermal Resistance θ_{jc}	—	—	$^\circ\text{C}/\text{W}$	—	15	—

Absolute Maximum Ratings^{3,4}

Parameter	Absolute Maximum
Max. Input Power 0.05 GHz 0.5 - 4.0 GHz	+27 dBm +34 dBm
+Vcc	+5.5V
-Vee	-8.5V
Logic Voltages ⁵	-0.5 to +Vcc + 0.5V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. M/A-COM does not recommend sustained operation near these survivability limits.
5. Standard CMOS TTL interface, latch-up will occur if logic signal applied prior to power supply.

Recommended PCB Configuration⁵

5. Application Note C2083 is available on line at www.macom.com

- North America Tel: 800.366.2266 / Fax: 978.366.2266
- Europe Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- Asia/Pacific Tel: 81.44.844.8296 / Fax: 81.44.844.8298

Visit www.macom.com for additional data sheets and product information.

Digital Attenuator**15.0 dB, 4-Bit, TTL Driver, DC-4.0 GHz****MAADCC0006****V2****Handling Procedures**

Please observe the following precautions to avoid damage:

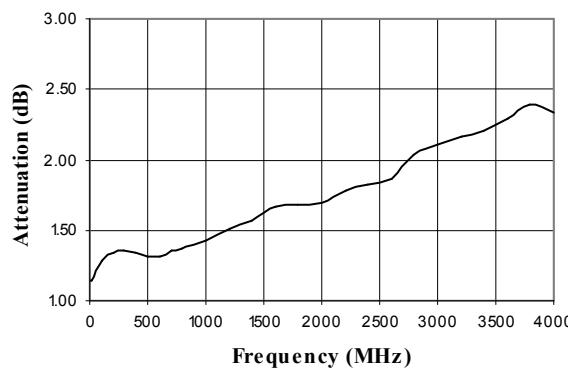
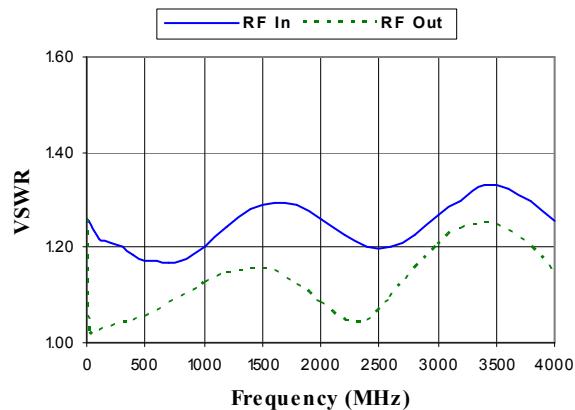
Static Sensitivity

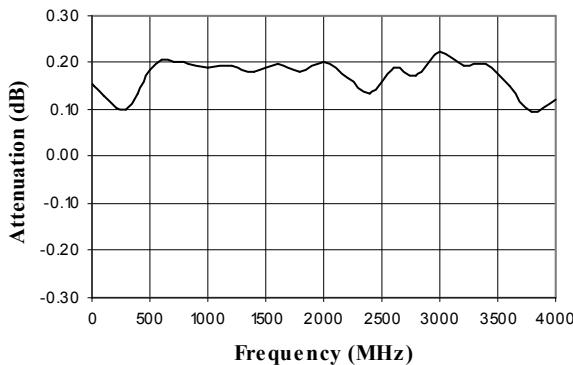
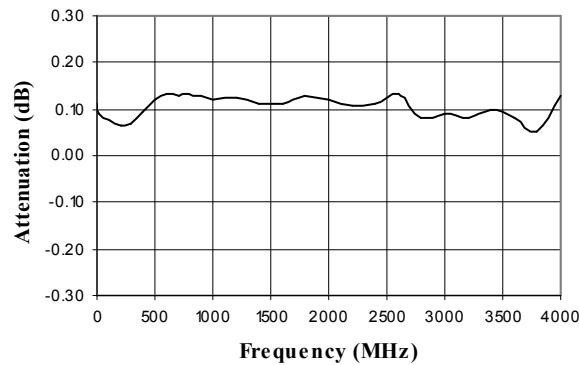
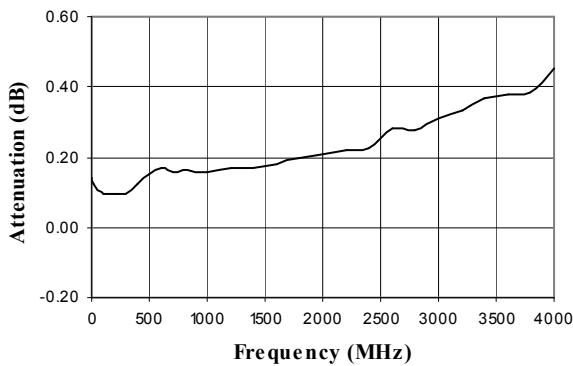
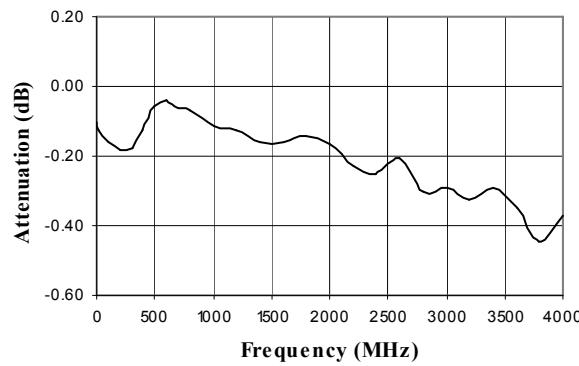
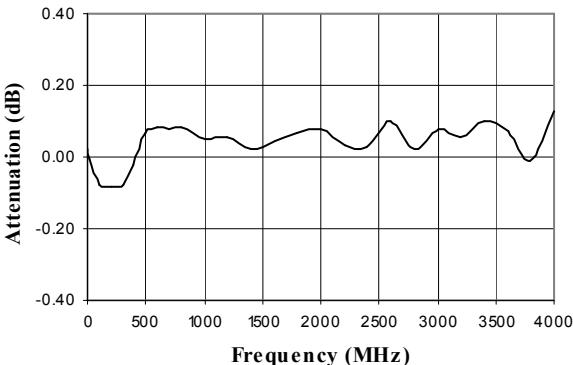
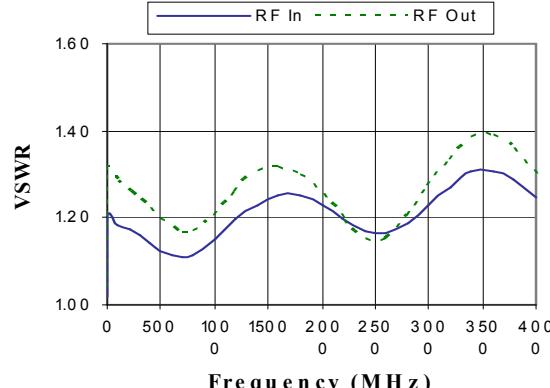
Gallium Arsenide Integrated Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Truth Table (Digital Attenuator)

C8	C4	C2	C1	Attenuation
0	0	0	0	Loss, Reference
0	0	0	1	1.0 dB
0	0	1	0	2.0 dB
0	1	0	0	4.0 dB
1	0	0	0	8.0 dB
1	1	1	1	15.0 dB

0 = TTL Low. 1 = TTL High

Typical Performance Curves**Insertion Loss****VSWR @ Insertion Loss**

Digital Attenuator**15.0 dB, 4-Bit, TTL Driver, DC-4.0 GHz****MAADCC0006****V2****Typical Performance Curves****Attenuation Error, 1 dB Bit****Attenuation Error, 2 dB Bit****Attenuation Error, 4 dB Bit****Attenuation Error, 8 dB Bit****Attenuation Error, Max. Attenuation****VSWR, 1 dB Bit**

Digital Attenuator

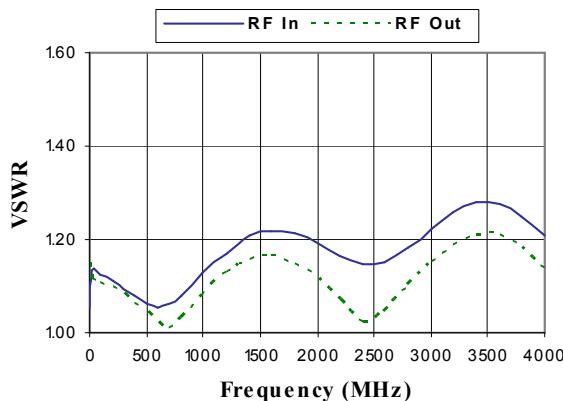
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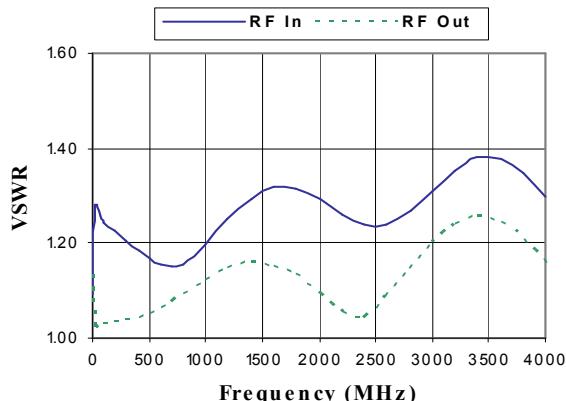
V2

Typical Performance Curves

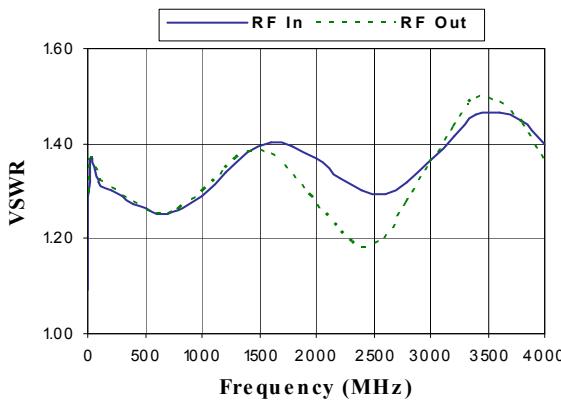
VSWR, 2 dB Bit



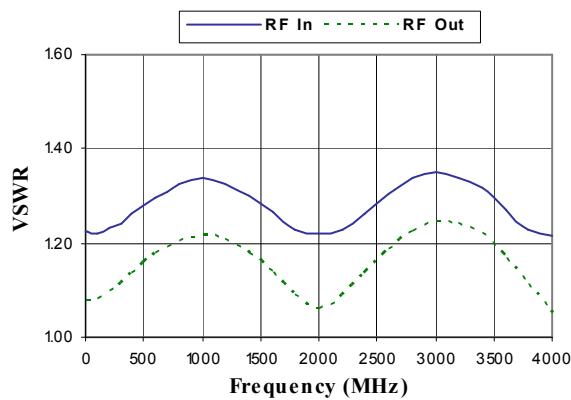
VSWR, 4 dB Bit



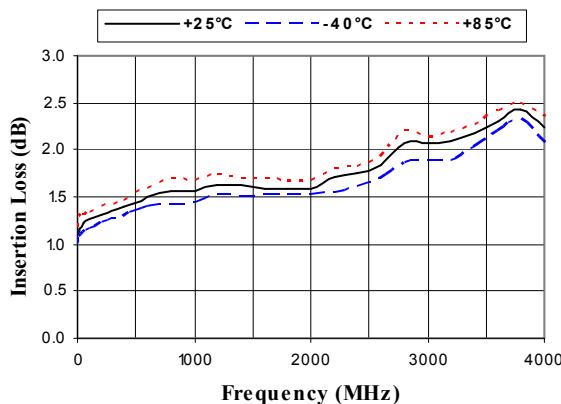
VSWR, 8 dB Bit



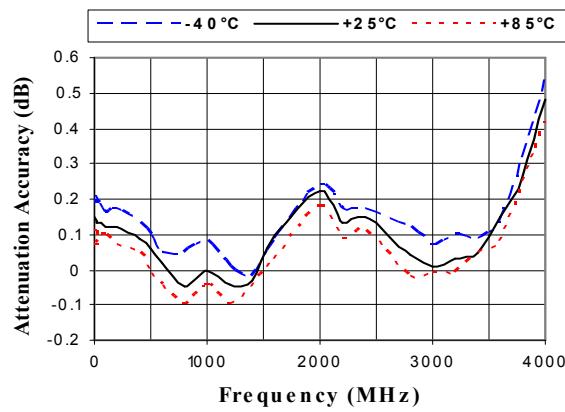
VSWR, Max. Attenuation

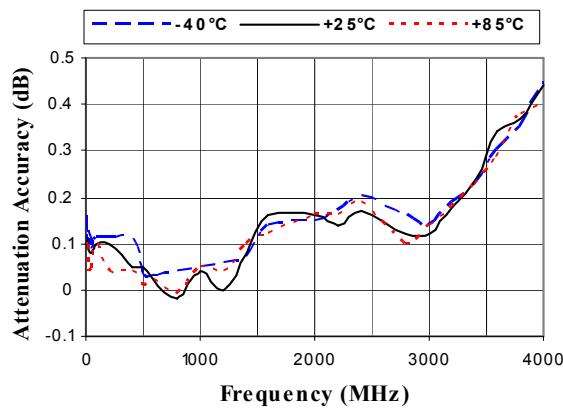
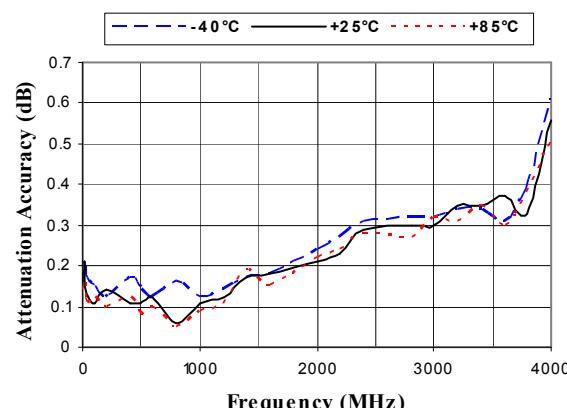
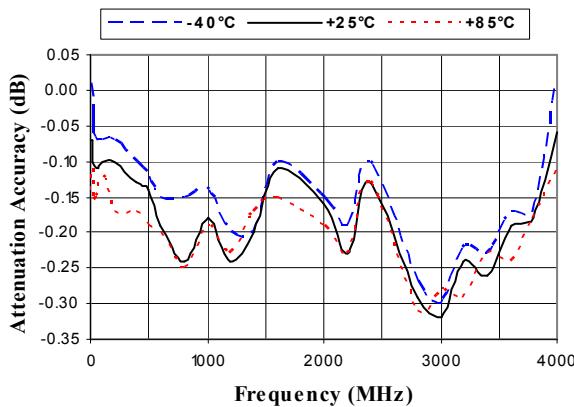
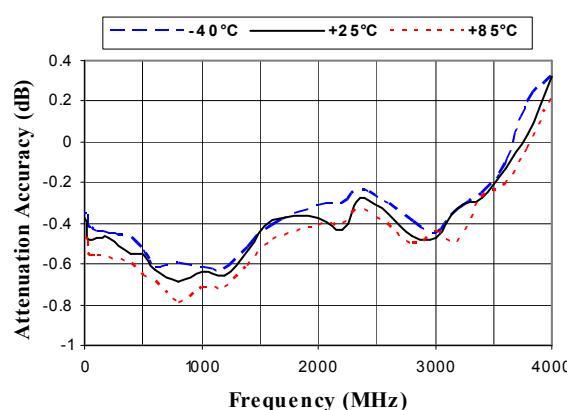


Insertion Loss vs. Temperature



1 dB Bit vs. Temperature



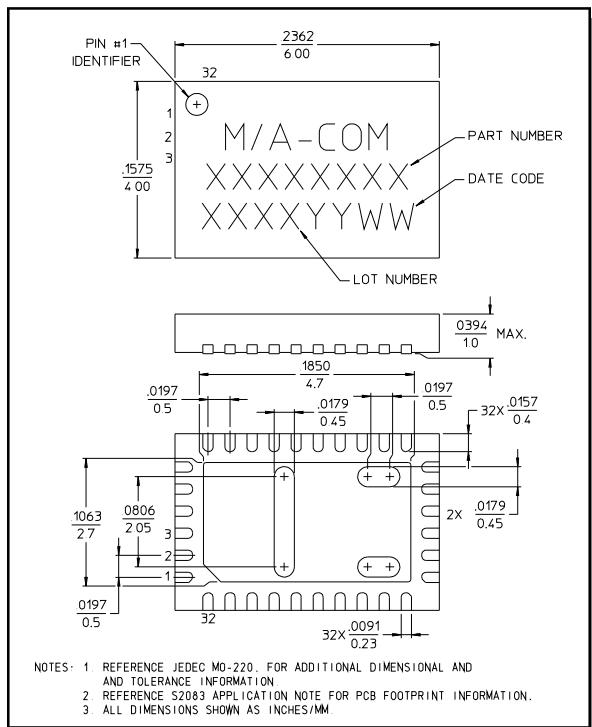
Digital Attenuator**15.0 dB, 4-Bit, TTL Driver, DC-4.0 GHz****MAADCC0006****V2****Typical Performance Curves****2 dB Bit vs. Temperature****4 dB Bit vs. Temperature****8 dB Bit vs. Temperature****Max. Attenuation vs. Temperature**

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**CSP-1, Lead-Free 4 x 6 mm, 32-lead
PQFN[†]**

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