Digital Attenuator
31.0 dB, 5-Bit, TTL Driver, DC-3.0 GHz

Features

- Attenuation: 1.0 dB Steps to 31 dB
- Low DC Power Consumption
- Small Footprint, JEDEC Package
- Integral TTL Driver
- 50 ohm Impedance
- Test Boards are 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 AT90-0263

Description

M/A-COM's MAATCC0010 is a GaAs FET 5-bit digital attenuator with integral TTL driver. Step size is 1.0 dB providing 31 dB total attenuation range. This device is in a PQFN plastic surface mount package. The MAATCC0010 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required.
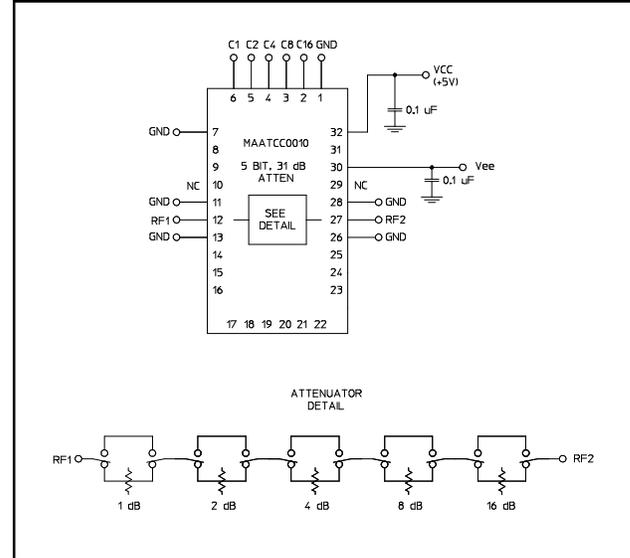
Ordering Information

Part Number	Package
MAATCC0010	Bulk Packaging
MAATCC0010TR	1000 piece reel
MAATCC0010-TB	Sample Test Board

Note: Reference Application Note M513 for reel size information.
Note: Die quantity varies.

Block Diagram

Pin Configuration[2]

Pin No.	Function	Pin No.	Function
1	GND	17	NC
2	C16	18	NC
3	C8	19	NC
4	C4	20	NC
5	C2	21	NC
6	C1	22	NC
7	GND	23	NC
8	NC	24	NC
9	NC	25	NC
10	NC[3]	26	GND
11	GND	27	RF2
12	RF1	28	GND
13	GND	29	NC[1]
14	NC	30	Vee
15	NC	31	NC
16	NC	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.

- **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

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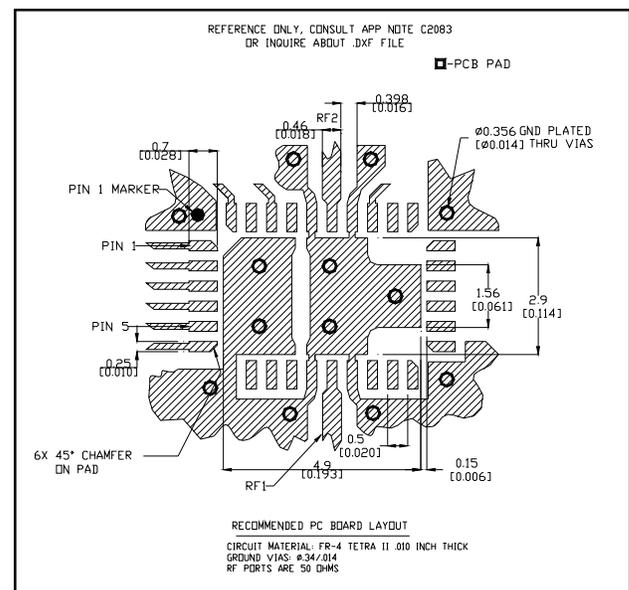**V3**

Electrical Specifications: T_A = +25°C

Parameter	Test Conditions	Frequency	Units	Min	Typ	Max
Insertion Loss	—	DC - 3.0 GHz	dB	—	3.6	4.0
Attenuation Accuracy	Individual Bits 1-2-4-8-16 dB Any Combination of Bits 1 to 31 dB	DC - 3.0 GHz DC - 3.0 GHz	dB dB	— —	— —	±(.3 +5% of atten setting) ±(.5 +7% of atten setting)
VSWR	Full Range	DC - 3.0 GHz	Ratio	—	2.0:1	2.2:1
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 - 3.0 GHz	dBm dBm	— —	+21 +24	— —
Input IP$_3$	Two-tone inputs up to +5 dBm	50 MHz 0.5 - 3.0 GHz	dB dB	— —	+35 +48	— —
Vcc Vee	— —	— —	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
Iin (Input Leakage Current)	Vin = V_{CC} or GND	—	uA	-1.0	—	1.0
Icc (Quiescent Supply Current)	Vcntrl = V_{CC} or GND	—	uA	—	250	400
ΔIcc (Additional Supply Current Per TTL Input Pin)	V_{CC} = Max, Vcntrl = V_{CC} - 2.1 V	—	mA	—	—	1.0
I_{EE}	V_{EE} min to max, Vin = V_{IL} or V_{IH}	—	mA	-1.0	-0.2	—
Thermal Resistance θjc	—	—	°C/W	—	35	—

Absolute Maximum Ratings[3,4]

Parameter	Absolute Maximum
Max. Input Power 0.05 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	-40ºC to +85ºC
Storage Temperature	-65ºC to +125ºC

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 is applied prior to power supply.

Recommended PCB Configuration[6]

REFERENCE ONLY, CONSULT APP NOTE C2083
OR INQUIRE ABOUT .DXF FILE

RECOMMENDED PC BOARD LAYOUT
CIRCUIT MATERIAL: FR-4 TETRA II .010 INCH THICK
GROUND VIAS: Ø.34/.014
RF PORTS ARE 50 OHMS

6. Application Note S2083 is available on line at www.macom.com

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RoHS Compliant

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.
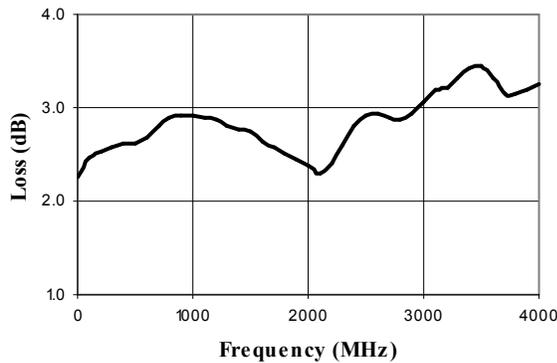
Truth Table (Digital Attenuator)

C16	C8	C4	C2	C1	Attenuation
0	0	0	0	0	Loss, Reference
0	0	0	0	1	1.0 dB
0	0	0	1	0	2.0 dB
0	0	1	0	0	4.0 dB
0	1	0	0	0	8.0 dB
1	0	0	0	0	16.0 dB
1	1	1	1	1	31.0 dB

0 = TTL Low; 1 = TTL High

Typical Performance Curves

Insertion Loss

VSWR @ Insertion Loss
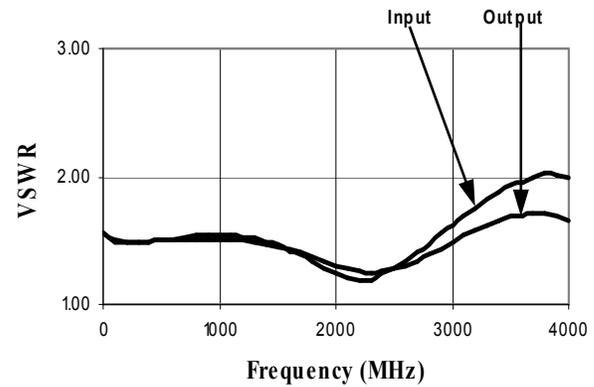
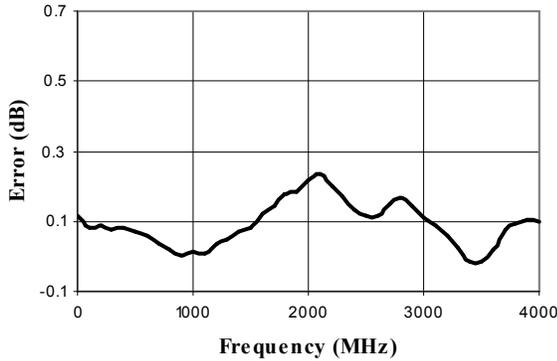### Attenuation Error, 1 dB Bit
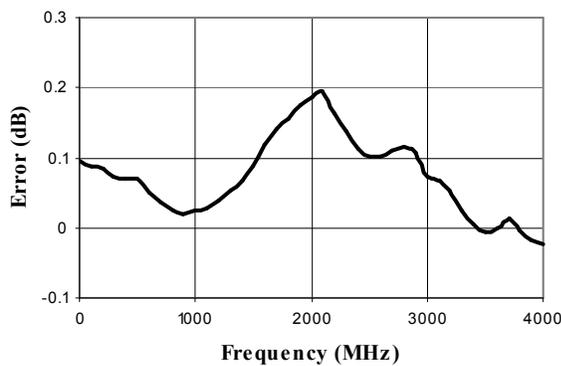
Attenuation Error, 2 dB Bit

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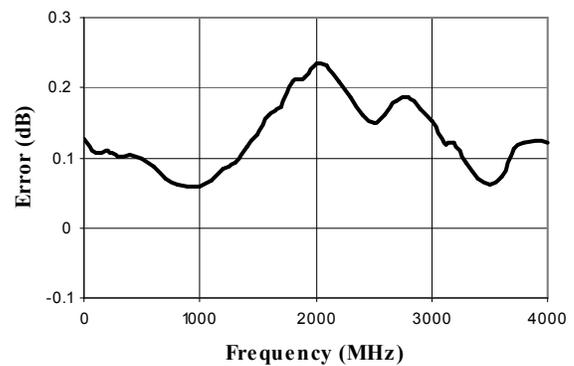
Digital Attenuator
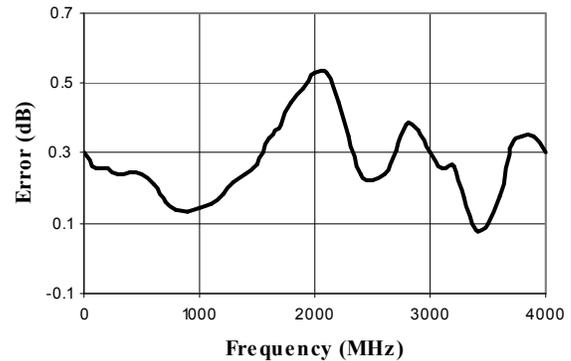## 31.0 dB, 5-Bit, TTL Driver, DC-3.0 GHz

MAATCC0010
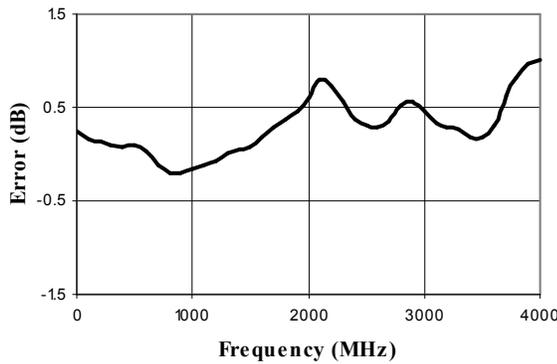## V3

Typical Performance Curves
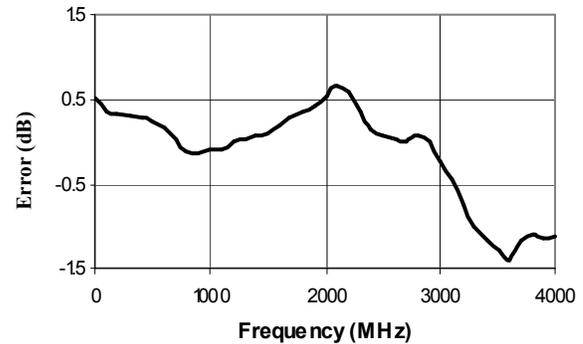
Attenuation Error, 4 dB Bit

Attenuation Error, 8 dB Bit

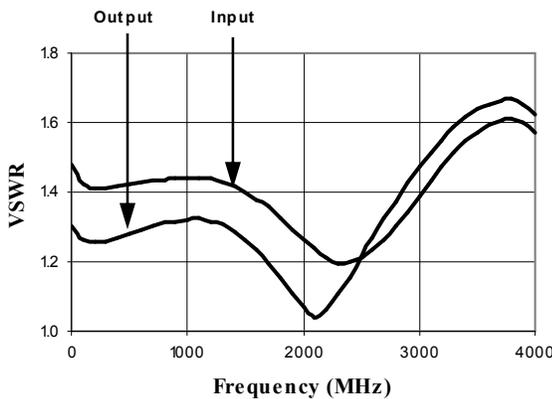### *Attenuation Error, 16 dB Bit*

Attenuation Error, Max. Attenuation

VSWR, 1 dB Bit

VSWR, 2 dB Bit

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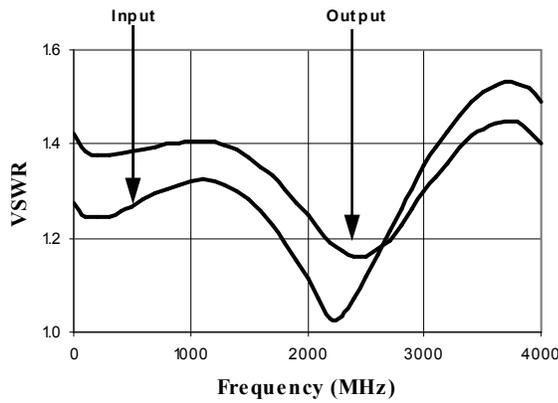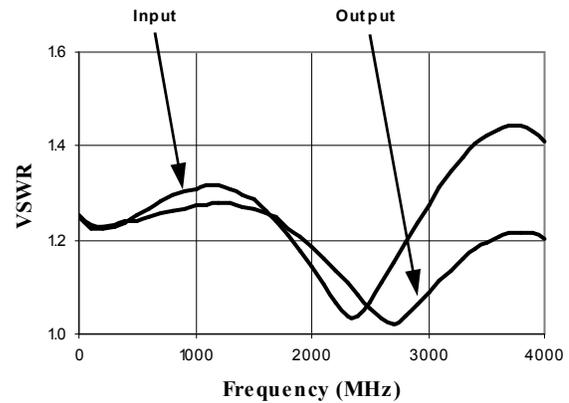**31.0 dB, 5-Bit, TTL Driver, DC-3.0 GHz**
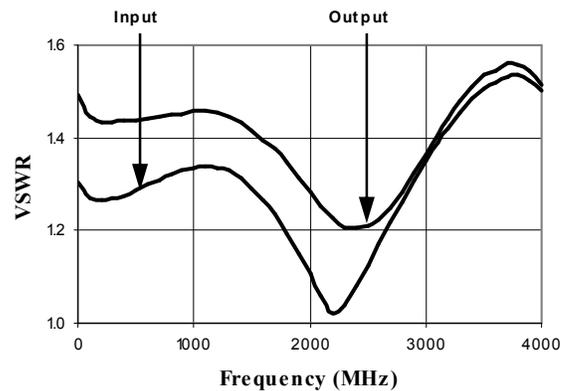
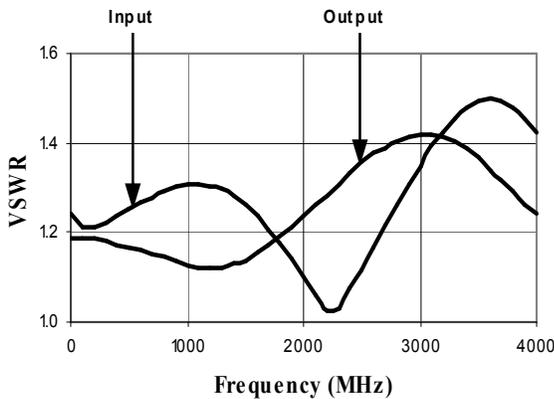## Typical Performance Curves

VSWR, 4 dB Bit

VSWR, 8 dB Bit

VSWR, 16 dB Bit

VSWR, Maximum Attenuation

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MAATCC0010
V3

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

NOTES: 1. REFERENCE JEDEC MO-220, FOR ADDITIONAL DIMENSIONAL AND AND TOLERANCE INFORMATION.
2. REFERENCE S2083 APPLICATION NOTE FOR PCB FOOTPRINT INFORMATION.
3. ALL DIMENSIONS SHOWN AS INCHES/MM.

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

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