

**Digital Attenuator, 31.5 dB, 6-Bit, TTL Driver
DC - 4.0 GHz**

**AT90-0107
V10**

Features

- Attenuation: 0.5 dB Steps to 31.5 dB
- Low DC Power Consumption
- Small Footprint, JEDEC Package
- Integral TTL Driver
- 50 ohm Impedance
- Test Boards are Available
- Tape and Reel Packaging Available

Description

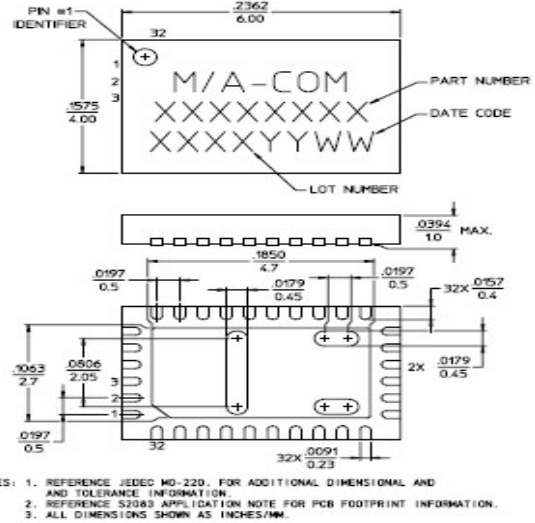
M/A-COM's AT90-0107 is a GaAs FET 6-bit digital attenuator with integral TTL driver. Step size is 0.5 dB providing a 31.5 dB total attenuation range. This device is in an FQFP-N plastic surface mount package. The AT90-0107 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required.

Pin Configuration

Pin No.	Function	Pin No.	Function
1	C8	17	NC
2	C4	18	NC
3	C2	19	NC
4	C1	20	NC
5	C0.5	21	NC
6	C16	22	NC
7	GND	23	NC
8	NC	24	NC
9	NC	25	NC
10	NC ¹	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

CSP-1



Ordering Information

Part Number	Package
AT90-0107	Bulk Packaging
AT90-0107TR	Tape and Reel (1K Reel)
AT90-0107-TB	Units Mounted on Test Board

Note: Reference Application Note M513 for reel size information.

Truth Table

C16	C8	C4	C2	C1	C0.5	Attenuation
0	0	0	0	0	0	Loss, Reference
0	0	0	0	0	1	0.5 dB
0	0	0	0	1	0	1.0 dB
0	0	0	1	0	0	2.0 dB
0	0	1	0	0	0	4.0 dB
0	1	0	0	0	0	8.0 dB
1	0	0	0	0	0	16.0 dB
1	1	1	1	1	1	31.5 dB

0 = TTL Low; 1 = TTL High

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Electrical Specifications: $T_A = +25^\circ\text{C}$, $V_{ee} = -5\text{ V} \pm 0.25\text{ V}$, $V_{cc} = +5\text{ V} \pm 0.25\text{ V}$

Parameter	Test Conditions	Frequency	Units	Min.	Typ.	Max.
Insertion Loss	—	DC - 4.0 GHz	dB	—	4.5	5.1
Attenuation Accuracy	Individual Bits 0.5-1-2-4-8-16 dB Any Combination of Bits 1 to 31.5 dB	DC - 4.0 GHz DC - 4.0 GHz	dB dB	— —	— —	$\pm(.3 + 7\%$ of atten setting) $\pm(.5 + 8\%$ of atten setting)
VSWR	Full Range	DC - 4.0 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	— —
1 dB Compression	— —	50 MHz 0.5 - 4.0 GHz	dBm dBm	— —	+21 +24	— —
Input IP3	Two-tone inputs up to +5 dBm	50 MHz 0.5 - 4.0 GHz	dB dB	— —	+35 +48	— —
I _{cc}	V _{cc} min to max, Logic "0" or "1" ^{1,2}	—	mA	—	6	—
-I _{ee}	-V _{ee} min to max, Logic "0" or "1" ^{1,2}	—	mA	—	-1	—
Thermal Resistance θ_{JA}	—	—	$^\circ\text{C/W}$	—	15	—

1. Logic "0" = 0.0 - 0.8 V, sink current is 20 μA maximum.
2. Logic "1" = 2.0 - 5.0 V, source current is 20 μA maximum.

Absolute Maximum Ratings ³

Parameter	Absolute Maximum
Max. Input Power 0.05 GHz 0.5 - 4.0 GHz	+27 dBm +34 dBm
Supply Voltages V _{cc} V _{ee}	+5.5V -8.5V
Logic Voltage ⁴	-0.5V to V _{cc} +0.5V
Operating Temperature	-40 $^\circ\text{C}$ to +85 $^\circ\text{C}$
Storage Temperature	-65 $^\circ\text{C}$ to +125 $^\circ\text{C}$

3. Exceeding any one or combination of these limits may cause permanent damage to this device.
4. Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

Handling Procedures

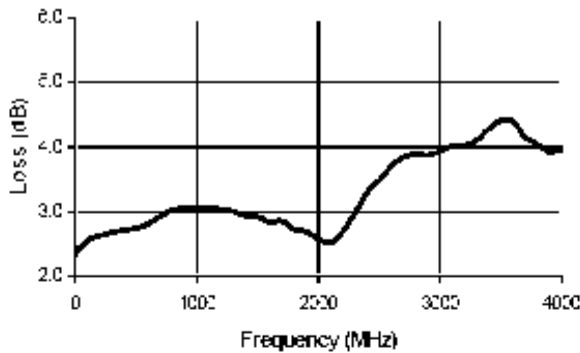
Please observe the following precautions to avoid damage:

Static Sensitivity

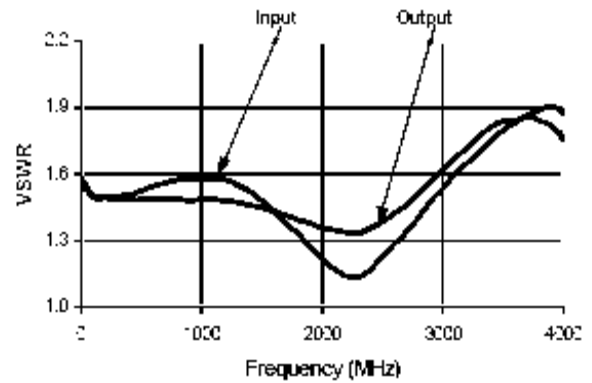
GMIC Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance Curves @ 25°C

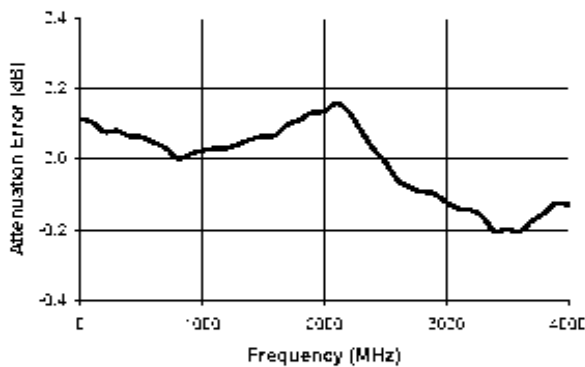
Insertion Loss



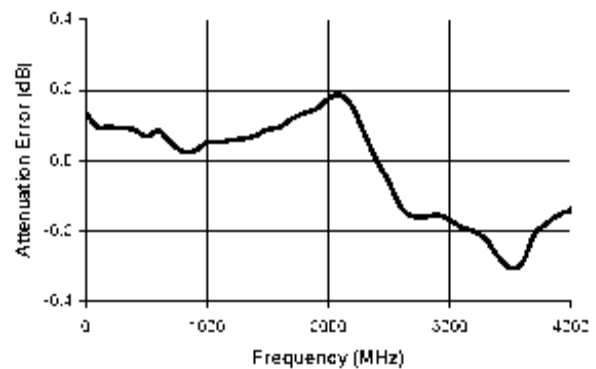
VSWR @ Insertion Loss



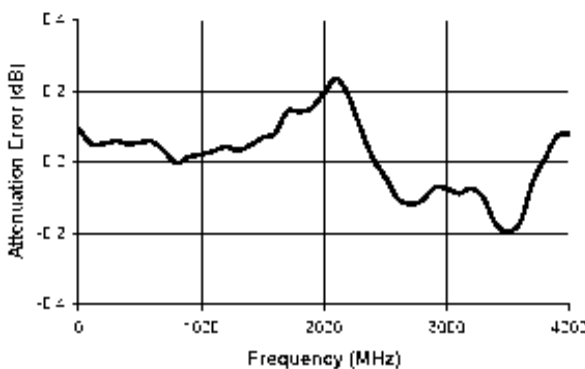
Attenuation Error, 0.5 dB Bit



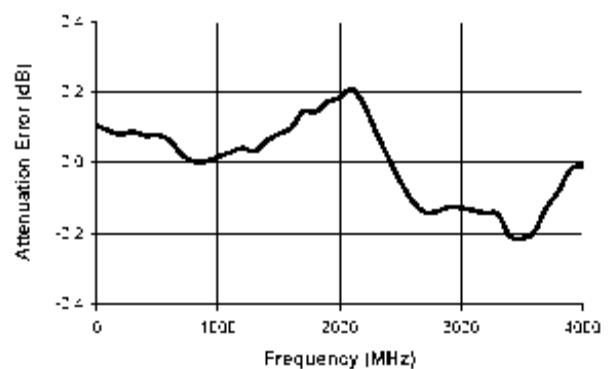
Attenuation Error, 1 dB Bit



Attenuation Error, 2 dB Bit



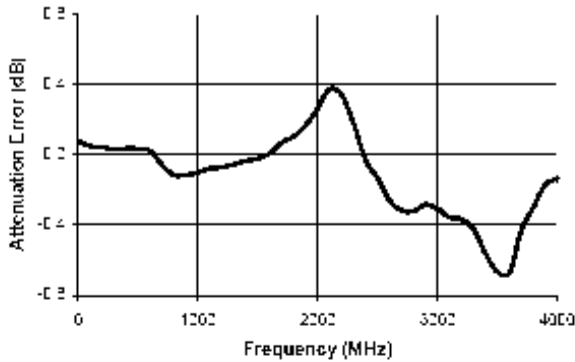
Attenuation Error, 4 dB Bit



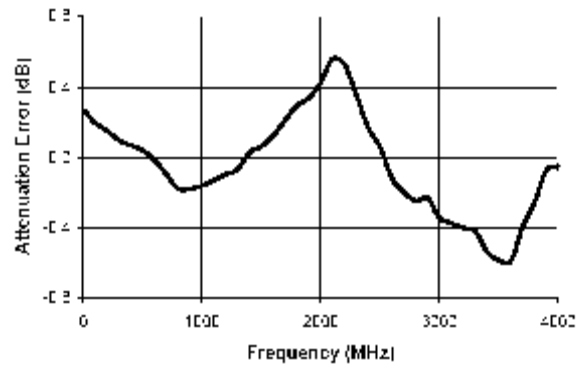
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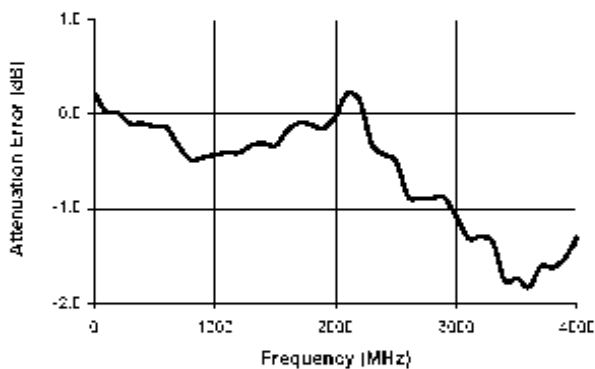
Attenuation Error, 8 dB Bit



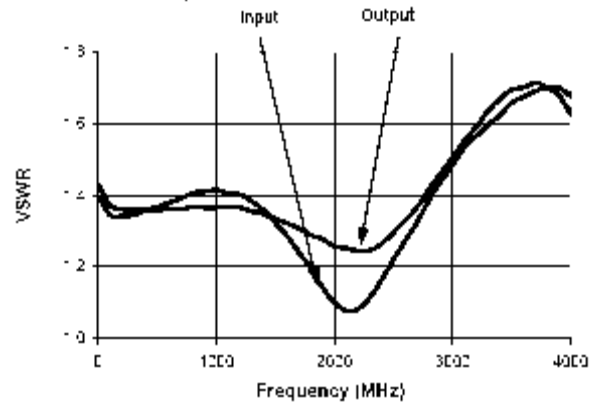
Attenuation Error, 16 dB Bit



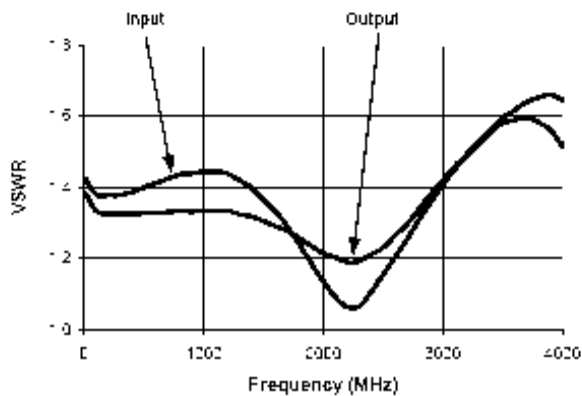
Attenuation Error, Max. Attenuation



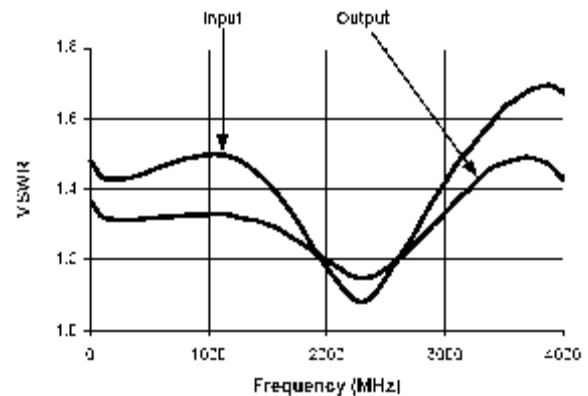
VSWR, 0.5 dB Bit



VSWR, 1 dB Bit



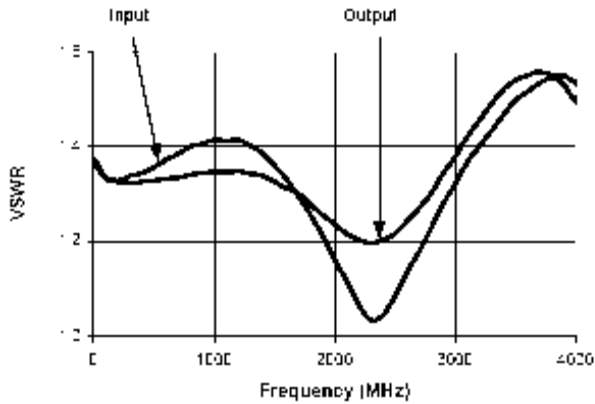
VSWR, 2 dB Bit



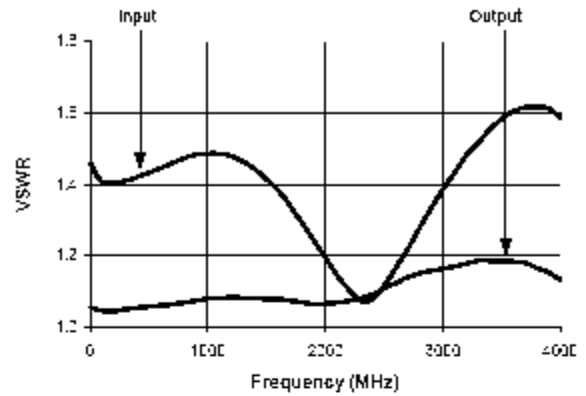
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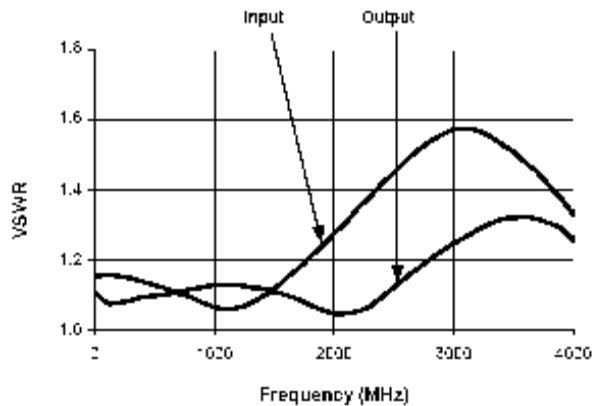
VSWR, 4 dB Bit



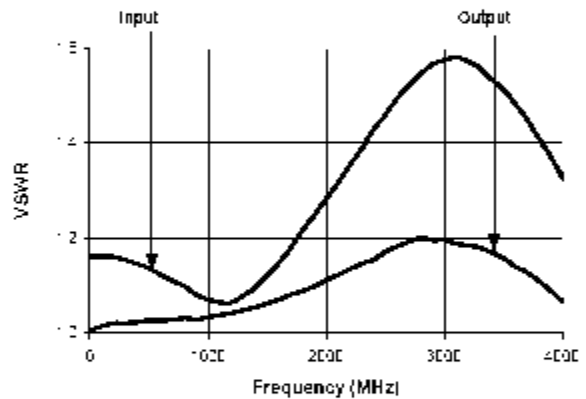
VSWR, 8 dB Bit



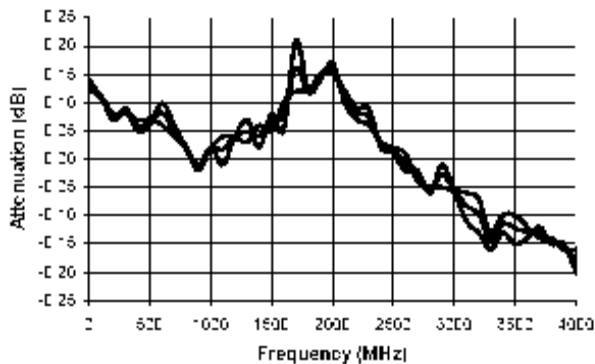
VSWR, 16 dB Bit



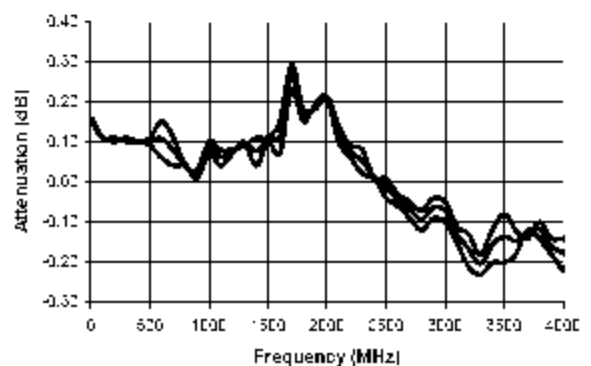
VSWR, Max. Attenuation



Typical Attenuation Deviation vs. Temperature for 0.5 dB Bit



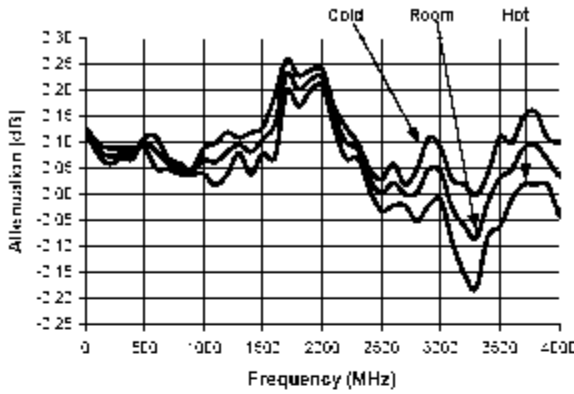
Typical Attenuation Deviation vs. Temperature for 1 dB Bit



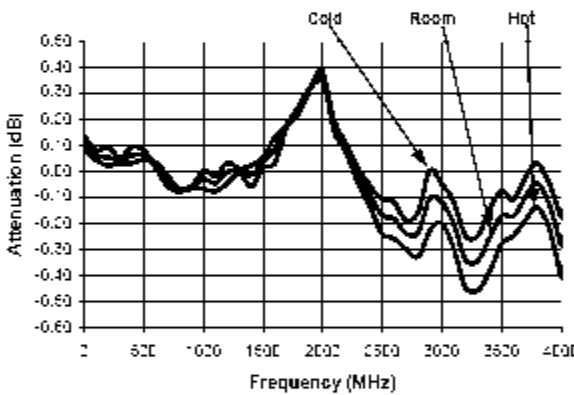
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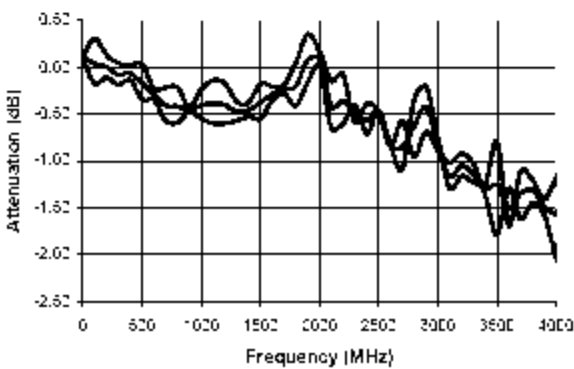
Typical Attenuation Deviation vs. Temperature for 2 dB Bit



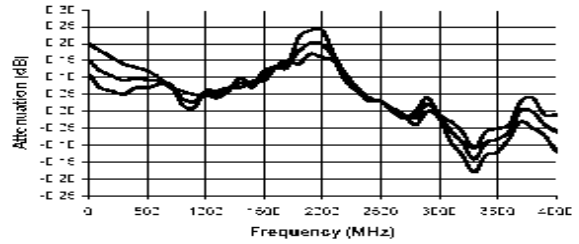
Typical Attenuation Deviation vs. Temperature for 8 dB Bit



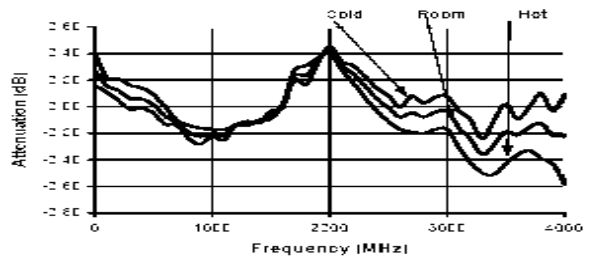
Typical Attenuation Deviation vs. Temperature at Maximum Atten.



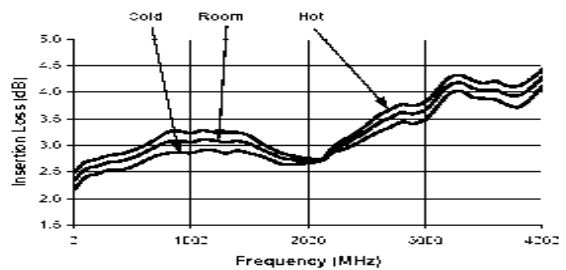
Typical Attenuation Deviation vs. Temperature for 4 dB Bit



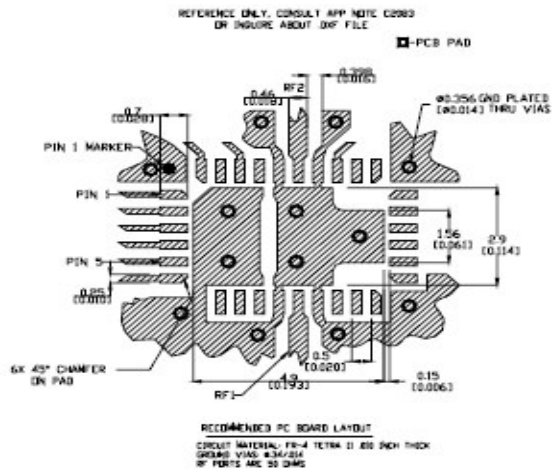
Typical Attenuation Deviation vs. Temperature for 16 dB Bit



Insertion Loss vs. Temperature



Recommended PCB Configuration⁵



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