

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

**AT90-1107  
V13**

**Features**

- Attenuation: 0.5 dB Steps to 31.5 dB
- Single Positive Supply
- Contains internal DC to DC converter
- Low DC Power Consumption
- Small Footprint, JEDEC Package
- Integral TTL Driver
- 50 ohm Impedance

**Description**

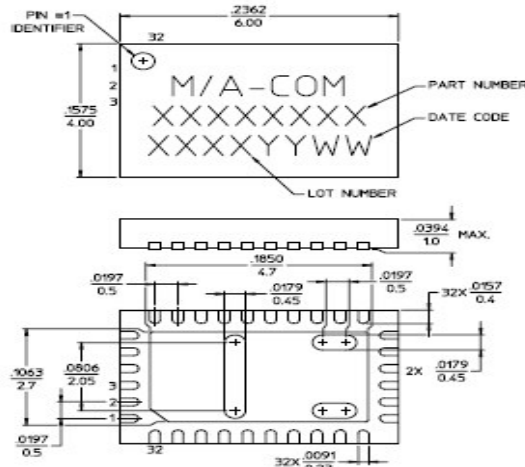
M/A-COM's AT90-1107 is a GaAs FET 6-bit digital attenuator with integral TTL driver. Step size is 0.5 dB providing a 31.5 dB total attenuation range. This device is in an FQFP-N plastic surface mount package. The AT90-1107 is ideally suited for use where accuracy, fast speed, very low power consumption and low costs are required. For dual supply designs without switching noise, use AT90-0107.

**Pin Configuration**

Pin No.	Function	Pin No.	Function
1	C8	17	NC
2	C4	18	NC
3	C2	19	+Vcc <sup>2</sup>
4	C1	20	NC
5	C0.5	21	CP <sup>4</sup>
6	C16	22	NC
7	GND	23	CP <sup>4</sup>
8	NC	24	NC
9	NC	25	-Vee <sup>3</sup>
10	NC <sup>1</sup>	26	GND
11	GND	27	RF2
12	RF1	28	GND
13	GND	29	NC <sup>1</sup>
14	NC	30	-Vee <sup>3,5</sup>
15	NC	31	NC
16	NC	32	+Vcc <sup>2,6</sup>

1. Pins 10 & 29 must be isolated
2. Pin 19 must be connected to Pin 32
3. Pin 25 must be connected to Pin 30
4. .01µF cap must be connected between Pins 21 and 23
5. -Vee is produced internally and requires a .1µF cap to GND. Generated noise is typical of switching DC-DC Converters.
6. +Vcc requires a .1µF cap to GND

**CSP-1**



NOTES: 1. REFERENCE JEDEC MO-220, FOR ADDITIONAL DIMENSIONAL AND TOLERANCE INFORMATION.  
2. REFERENCE S209 APPLICATION NOTE FOR PCB FOOTPRINT INFORMATION.  
3. ALL DIMENSIONS SHOWN AS INCHES/MM.

**Ordering Information**

Part Number	Package
AT90-1107	Bulk Packaging
AT90-1107TR	Tape and Reel (1K Reel)
AT90-1107-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:  $T_A = +25^\circ\text{C}$ ,  $V_{CC} = +5\text{ V} \pm 0.25\text{ V}$**

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	dB	—	—	$\pm(.3 + 7\%$ of atten setting)
		DC - 4.0 GHz	dB	—	—	$\pm(.5 + 8\%$ 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	—	75	—
		—	nS	—	20	—
1 dB Compression	— —	50 MHz	dBm	—	+21	—
		0.5 - 4.0 GHz	dBm	—	+24	—
Input IP3	Two-tone inputs up to +5 dBm	50 MHz	dB	—	+35	—
		0.5 - 4.0 GHz	dB	—	+48	—
$I_{CC}^{1,2}$	$V_{CC}$ min to max, Logic "0" or "1" <sup>3,4</sup>	—	mA	—	8	—
Switching Noise	Generated from DC-DC Converter with recommended capacitors	3.5 MHz	mA	—	-93	—
Thermal Resistance $\theta_{JA}$	—	—	$^\circ\text{C/W}$	—	15	—

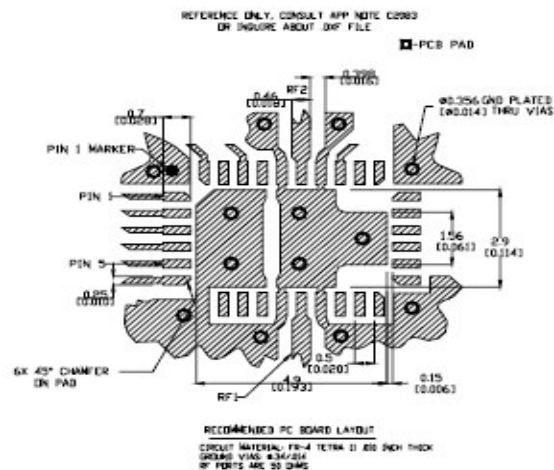
1. During turn-on, the device requires an initial "Turn-on Current". Once operational,  $I_{CC}$  will drop to the specified levels.
2. The DC-DC converter is guaranteed to start in 100  $\mu\text{s}$  as long as the power supplies can provide a minimum of 100 mA "Turnon Current".
3. Logic "0" = 0.0 to 0.8V, sink current is 20  $\mu\text{A}$  maximum.
4. Logic "1" = 2.0 to 5.0V, source current is 20  $\mu\text{A}$  maximum.

**Absolute Maximum Ratings<sup>3</sup>**

Parameter	Absolute Maximum
Max. Input Power 0.05 GHz 0.5 - 4.0 GHz	+27 dBm +34 dBm
Supply Voltages $V_{CC}$	+5.5V
Logic Voltage <sup>4</sup>	-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.

**Recommended PCB Configuration<sup>5</sup>**



5. Application Note C2083 is available on line at [www.macom.com](http://www.macom.com)

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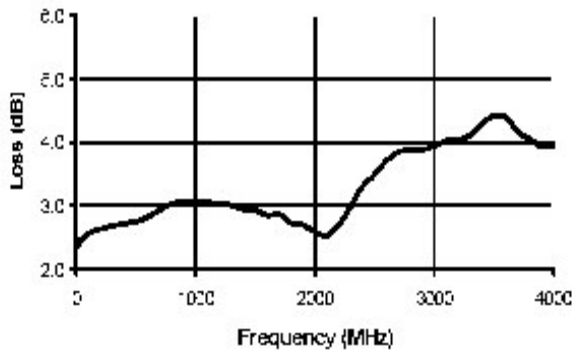
Visit [www.macom.com](http://www.macom.com) for additional data sheets and product information.

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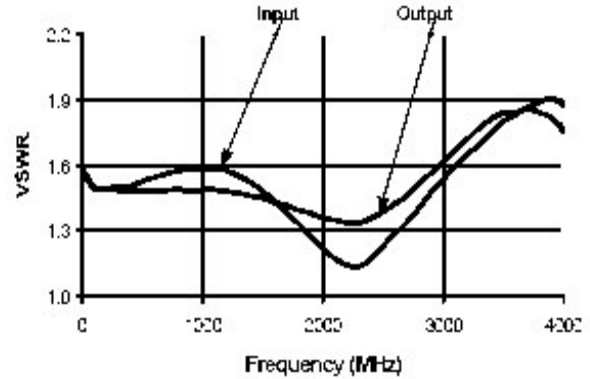
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**Typical Performance Curves @ 25°C**

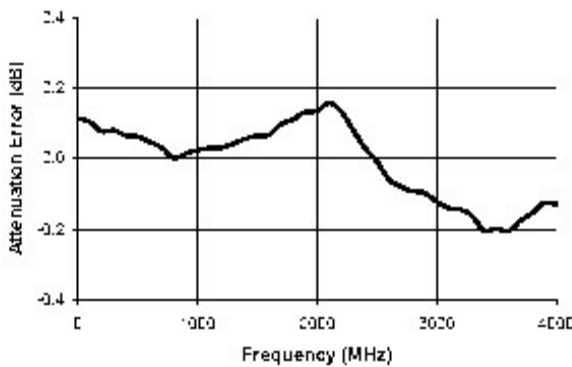
*Insertion Loss*



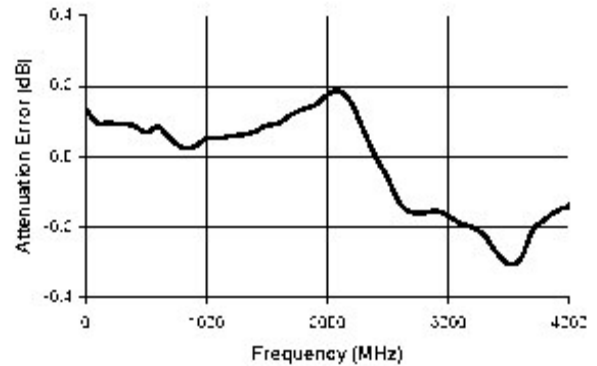
*VSWR @ Insertion Loss*



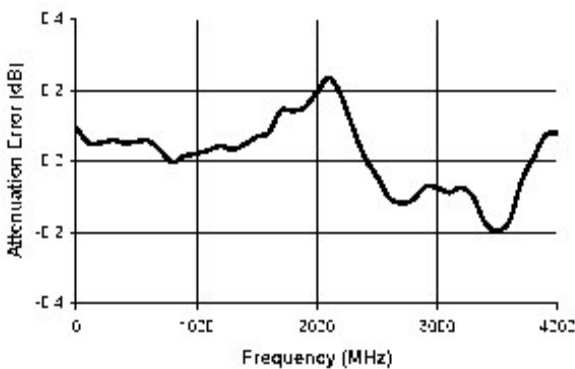
*Attenuation Error, 0.5 dB Bit*



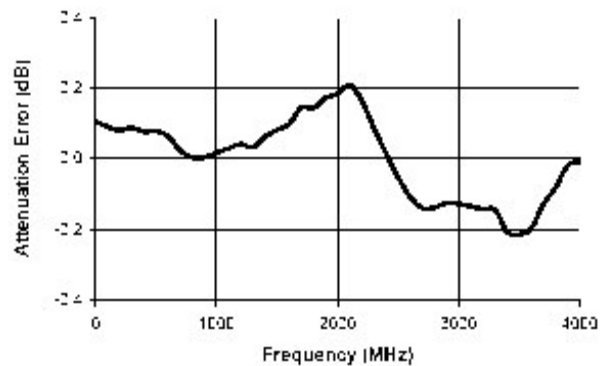
*Attenuation Error, 1 dB Bit*



*Attenuation Error, 2 dB Bit*



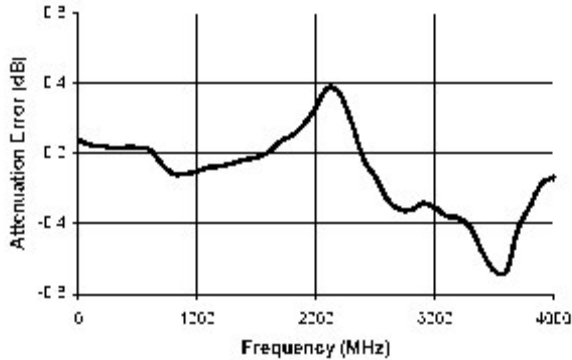
*Attenuation Error, 4 dB Bit*



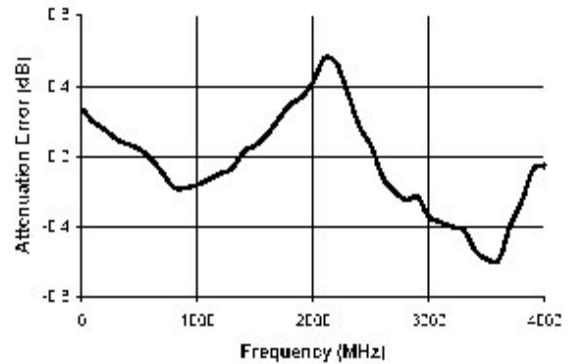
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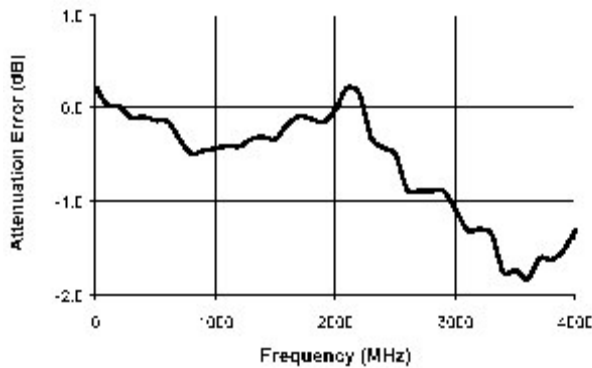
**Attenuation Error, 8 dB Bit**



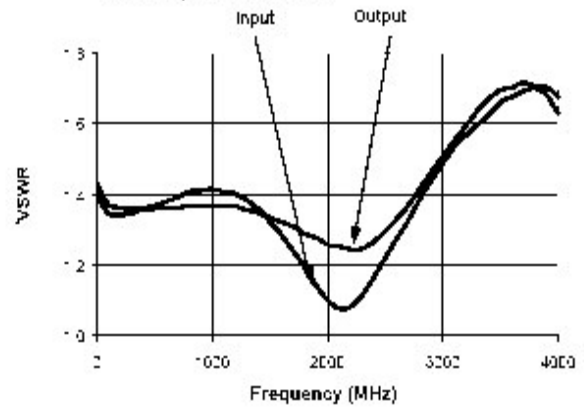
**Attenuation Error, 16 dB Bit**



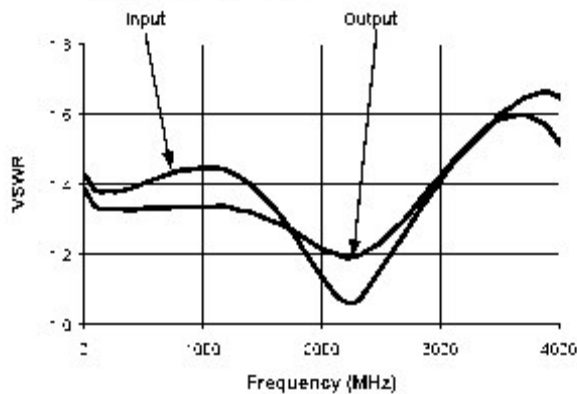
**Attenuation Error, Max. Attenuation**



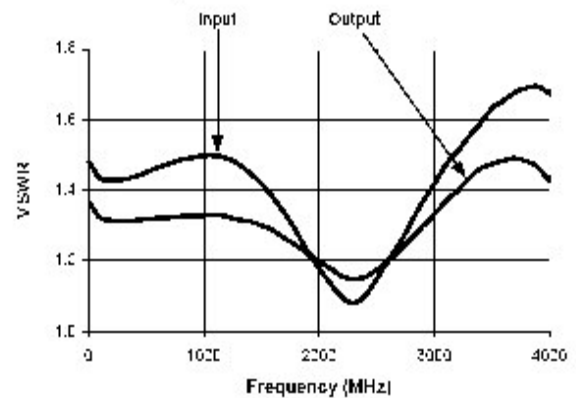
**VSWR, 0.5 dB Bit**



**VSWR, 1 dB Bit**



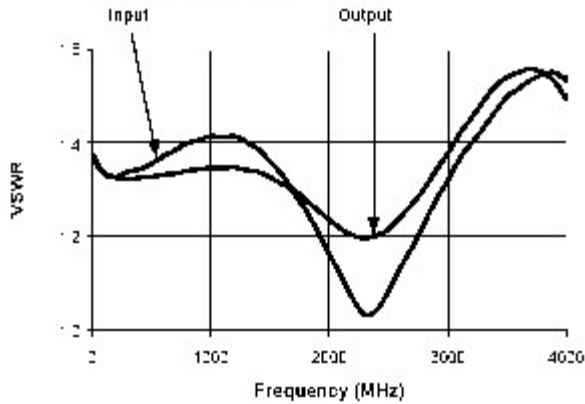
**VSWR, 2 dB Bit**



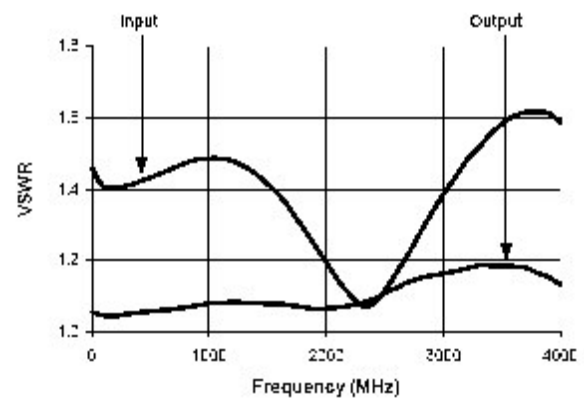
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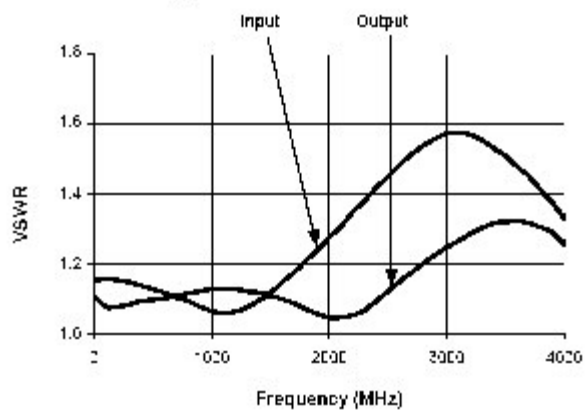
**VSWR, 4 dB Bit**



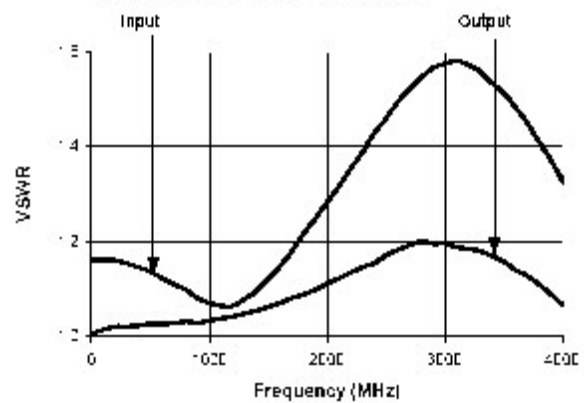
**VSWR, 8 dB Bit**



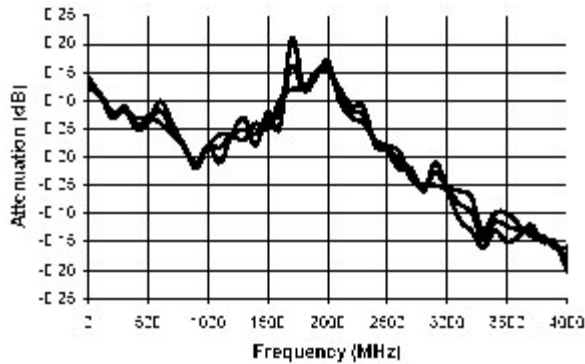
**VSWR, 16 dB Bit**



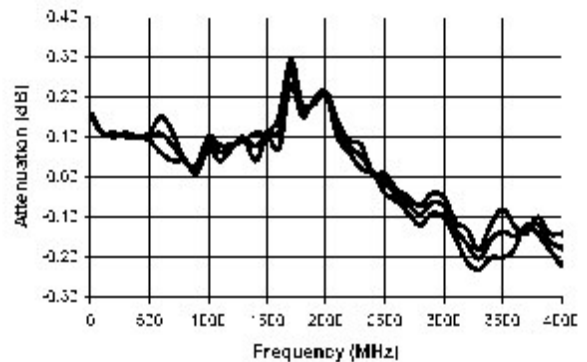
**VSWR, Max. Attenuation**



**Typical Attenuation Deviation vs. Temperature for 0.5 dB Bit**



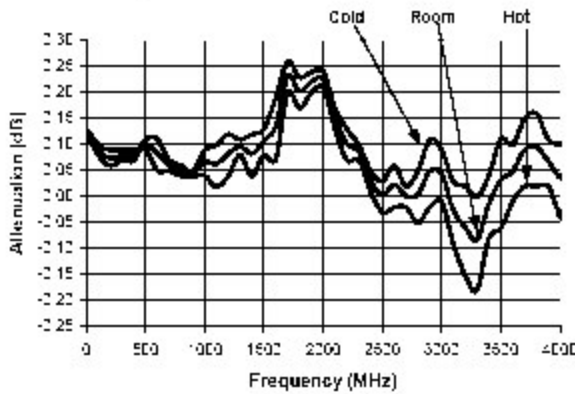
**Typical Attenuation Deviation vs. Temperature for 1 dB Bit**



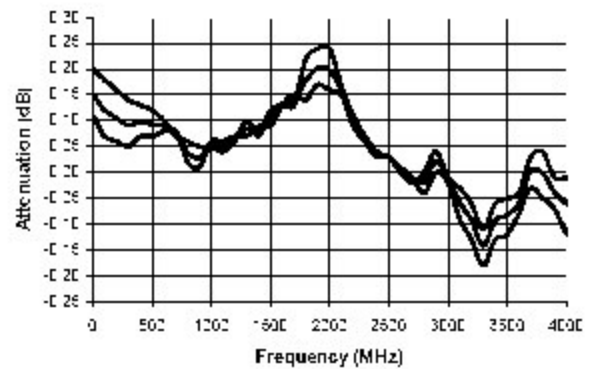
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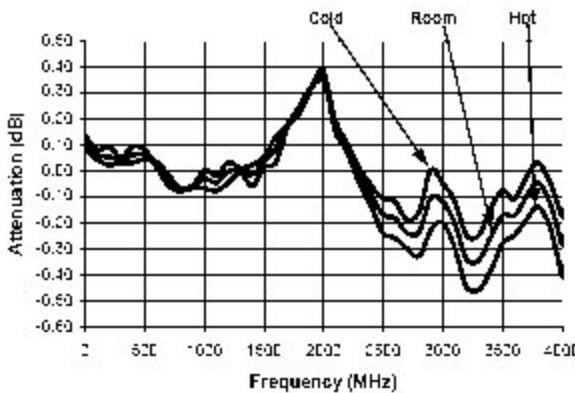
*Typical Attenuation Deviation vs. Temperature for 2 dB Bit*



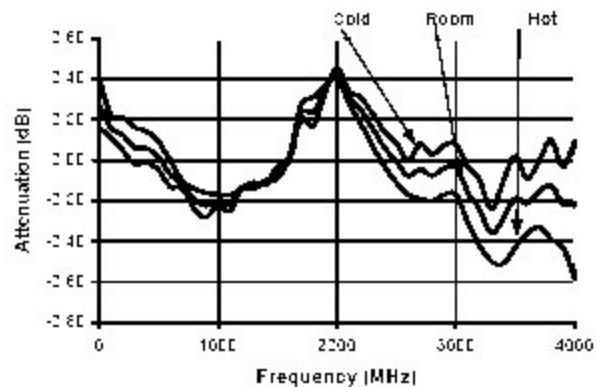
*Typical Attenuation Deviation vs. Temperature for 4 dB Bit*



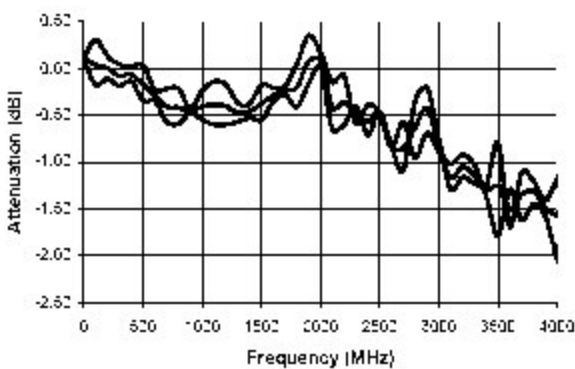
*Typical Attenuation Deviation vs. Temperature for 8 dB Bit*



*Typical Attenuation Deviation vs. Temperature for 16 dB Bit*



*Typical Attenuation Deviation vs. Temperature at Maximum Atten.*



*Insertion Loss vs. Temperature*

