

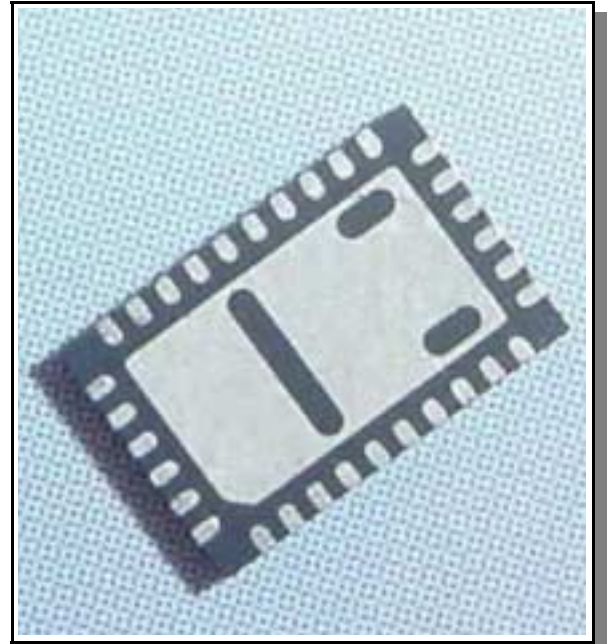
## Features

- Attenuation: 1 dB Steps to 50 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 AT90-1106 is a GaAs FET 6-bit digital attenuator with integral TTL driver. Step size is 1 dB providing a 50 dB total attenuation range. This device is in a FQFP-N plastic surface mount package. The AT90-1106 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 AT90-0106.

## CSP-1



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

Parameter	Test Conditions	Frequency	Units	Min	Typical	Max
Insertion Loss	—	DC - 2.4 GHz	dB	—	5.5	6.0
Attenuation Accuracy	Individual Bits 1-2-4-8-16-32 dB Any Combination of Bits 1 to 50 dB	DC - 2.4 GHz	dB	—	—	$\pm(.3 + 5\% \text{ of atten setting})$
		DC - 2.4 GHz	dB	—	—	$\pm(.5 + 8\% \text{ of atten setting})$
VSWR	Full Range	DC - 2.4 GHz	Ratio	—	1.8:1	2:1
Switching Speed	50% Cntl to 90%/10% RF 10% to 90% or 90% to 10%	—	nS	—	75	150
		—	nS	—	20	50
1 dB Compression	— —	50 MHz	dBm	—	+21	—
		0.5 - 2.40 GHz	dBm	—	+29	—
Input IP <sub>3</sub>	Two-tone inputs up to +5 dBm	50 MHz	dB	—	+35	—
		0.5-2.4 GHz	dB	—	+48	—
+Vcc	—	—	V	4.75	5.0	5.25
Logic "0"	Sink Current is 20 $\mu\text{A}$ max.	—	V	0.0	—	0.8
Logic "1"	Source Current is 20 $\mu\text{A}$ max.	—	V	2.0	—	5.0
I <sub>cc</sub> <sup>1</sup>	Vcc min to max, Logic "0" or "1"	—	mA	—	6	10
Turn-on Current <sup>2</sup>	For guaranteed start-up	—	mA	—	—	125
Switching Noise	Generated from DC-DC Converter with recommended capacitors	3.5 MHz	dBm	—	-93	—

1. During turn-on, the device requires an initial start up current (I<sub>cc</sub>) specified as "Turn-on Current". Once operational, I<sub>cc</sub> 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 have the maximum turn-on current available for start-up.

Pin Configuration

Pin #	Function	Pin #	Function
1	C16	17	NC
2	C8	18	NC
3	C4	19	+Vcc <sup>4</sup>
4	C2	20	NC
5	C1	21	Cp <sup>6</sup>
6	C32	22	NC
7	GND	23	Cp <sup>6</sup>
8	NC	24	NC
9	NC	25	-Vee <sup>5</sup>
10	NC <sup>3</sup>	26	GND
11	GND	27	RF2
12	RF1	28	GND
13	GND	29	NC <sup>3</sup>
14	NC	30	-Vee <sup>5,7</sup>
15	NC	31	NC
16	NC	32	+Vcc <sup>4,8</sup>

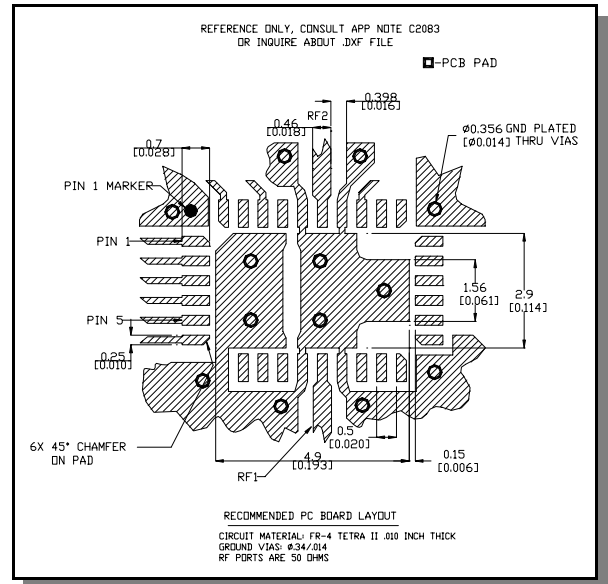
- Pins 10 & 29 must be isolated
- Pin 19 must be connected to Pin 32
- Pin 25 must be connected to Pin 30
- .01µF cap must be connected between Pins 21 and 23
- Vee is produced internally and requires a .1µF cap to GND. Generated noise is typical of switching DC-DC Converters.
- +Vcc requires a .1µF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

Truth Table

C32	C16	C8	C4	C2	C1	Attenuation
0	0	0	0	0	0	Loss, Reference
0	0	0	0	0	1	1.0 dB
0	0	0	0	1	0	2.0 dB
0	0	0	1	0	0	4.0 dB
0	0	1	0	0	0	8.0 dB
0	1	0	0	0	0	16.0 dB
1	0	0	0	0	0	32.0 dB
1	1	0	0	1	0	50.0 dB

0 = TTL Low; 1 = TTL High

Recommended PCB Layout <sup>9</sup>



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

Absolute Maximum Ratings <sup>10</sup>

Parameter	Absolute Maximum
Max. Input Power 0.05 GHz 0.5 - 2.4 GHz	+27 dBm +34 dBm
+Vcc	+5.5V
Logic Voltages <sup>11</sup>	-0.5 to +Vcc + 0.5V
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C

- Operation of this device above any one of these parameters may cause permanent damage.
- Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

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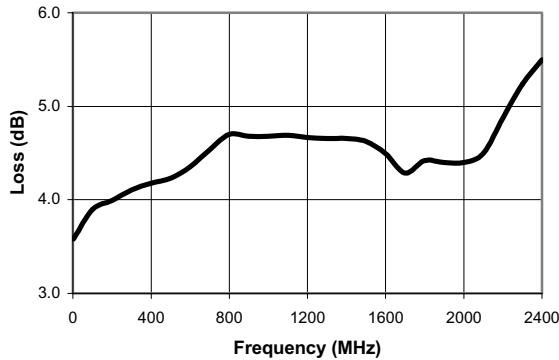
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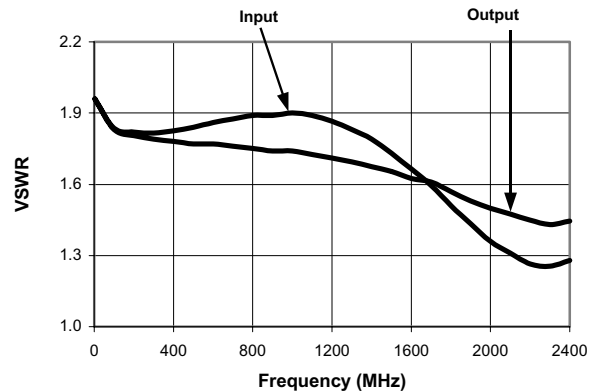
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Typical Performance Curves

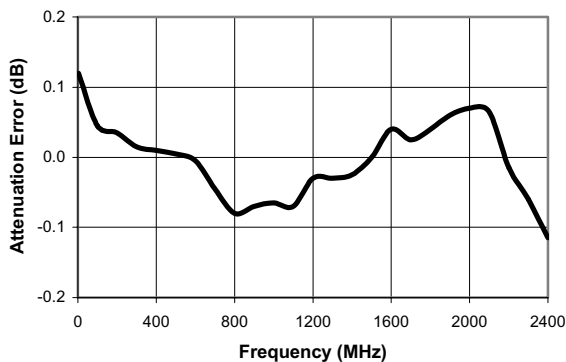
Insertion Loss



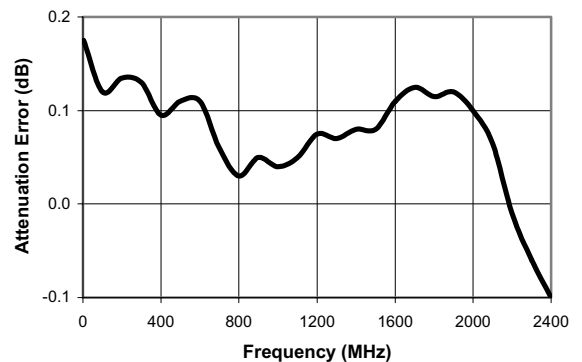
VSWR @ Insertion Loss



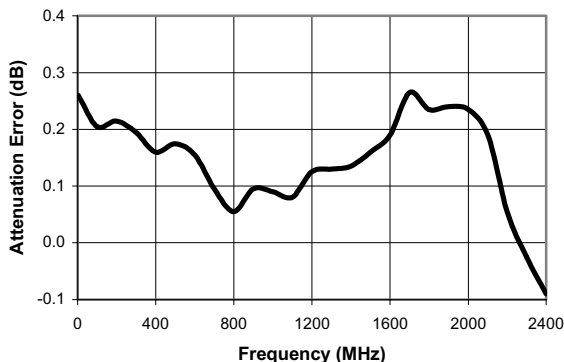
Attenuation Error, 1 dB Bit



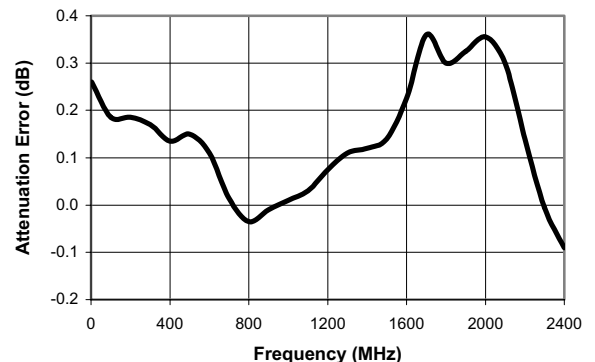
Attenuation Error, 2 dB Bit



Attenuation Error, 4 dB Bit



Attenuation Error, 8 dB Bit



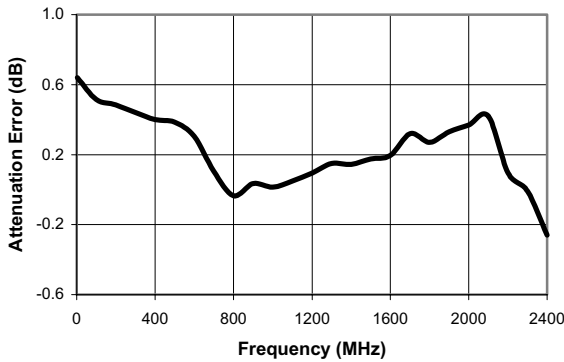
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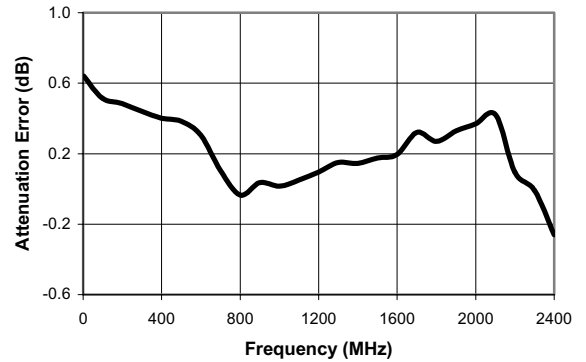
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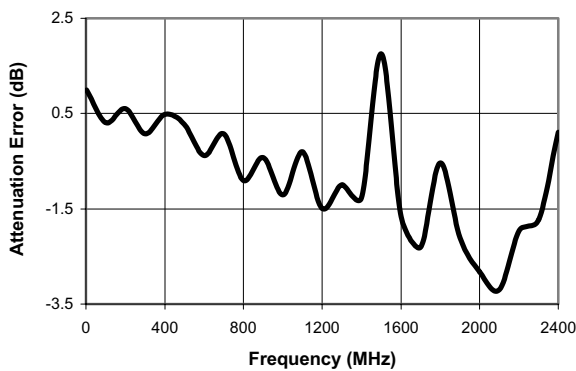
Attenuation Error, 16 dB Bit



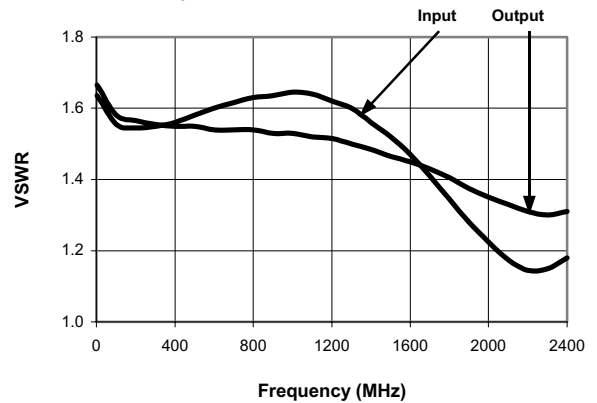
Attenuation Error, 32 dB Bit



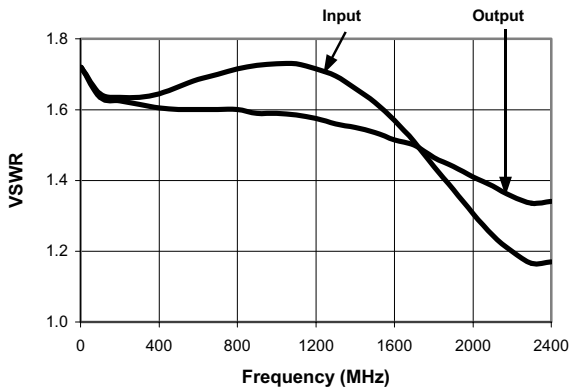
Attenuation Error, Max. Attenuation



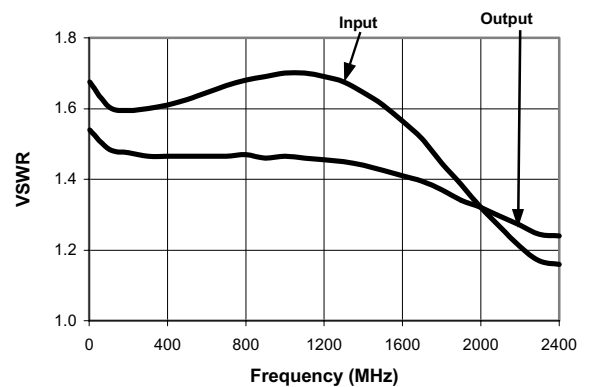
VSWR, 1 dB Bit



VSWR, 2 dB Bit



VSWR, 4 dB Bit



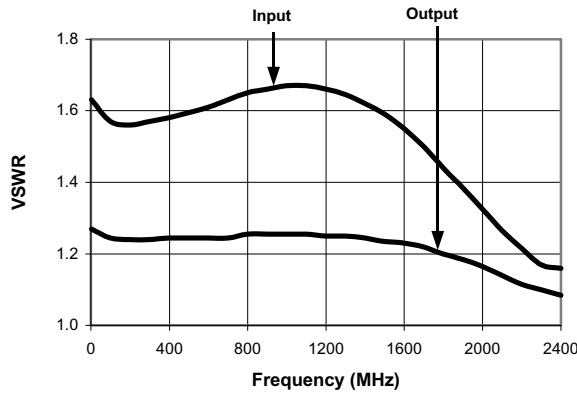
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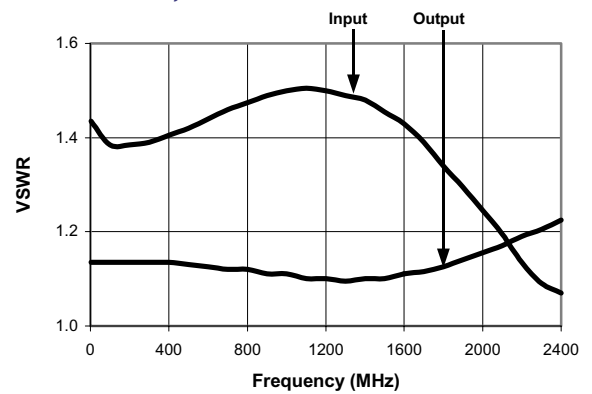
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Typical Performance Curves

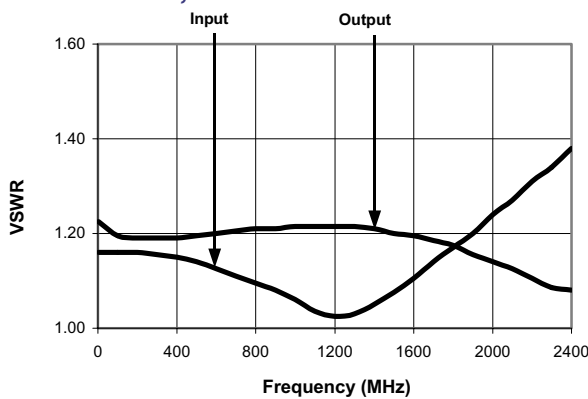
VSWR, 8 dB Bit



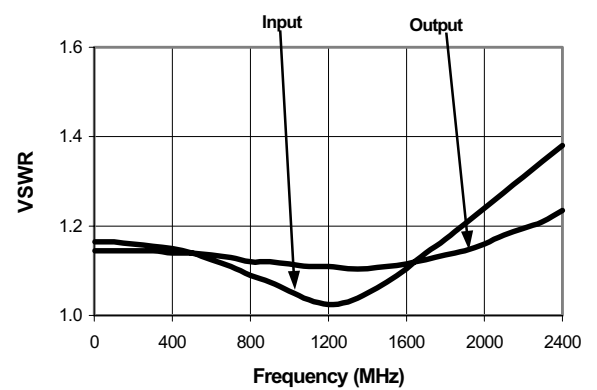
VSWR, 16 dB Bit



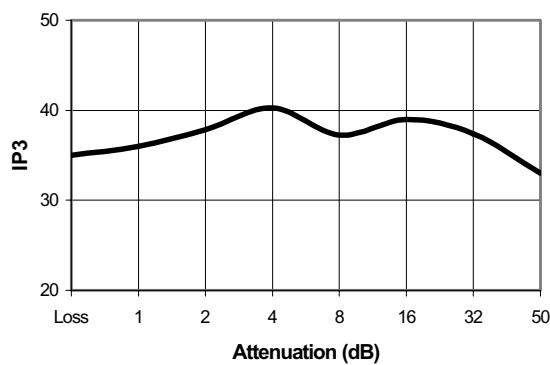
VSWR, 32 dB Bit



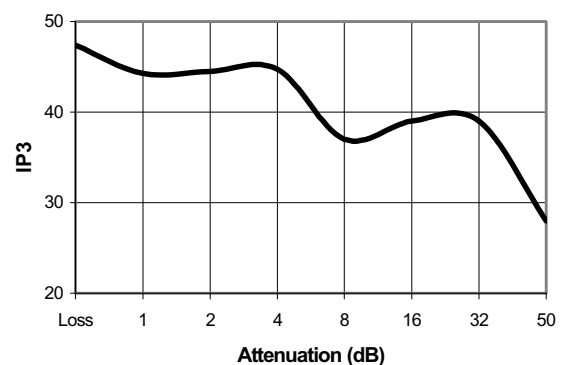
VSWR, Maximum Attenuation



Maximum IP3 over Temperature Range and Attenuation @ 50 MHz



Maximum IP3 over Temperature Range and Attenuation @ 950 MHz



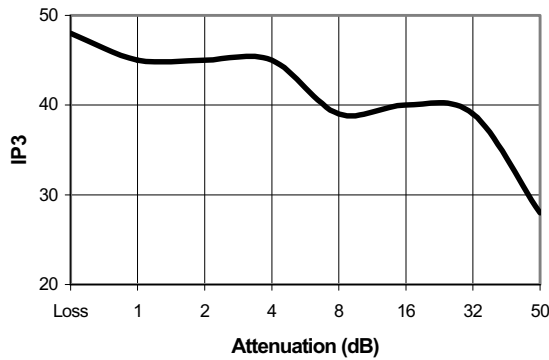
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Typical Performance Curves

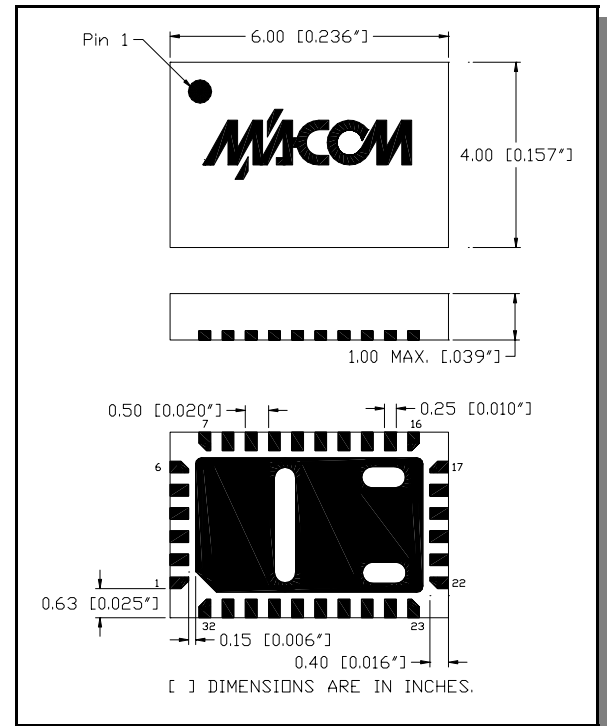
Maximum IP3 over Temperature Range and Attenuation @ 1900 MHz



Ordering Information

Part Number	Package
AT90-1106	Bulk Packaging
AT90-1106TR	Tape and Reel (1K Reel)
AT90-1106-TB	Units Mounted on Test Board

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