

**Digital Attenuator, 15 dB, 4-Bit, TTL Driver  
DC - 4.0 GHz**

**AT90-0413  
V5**

**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

**Description**

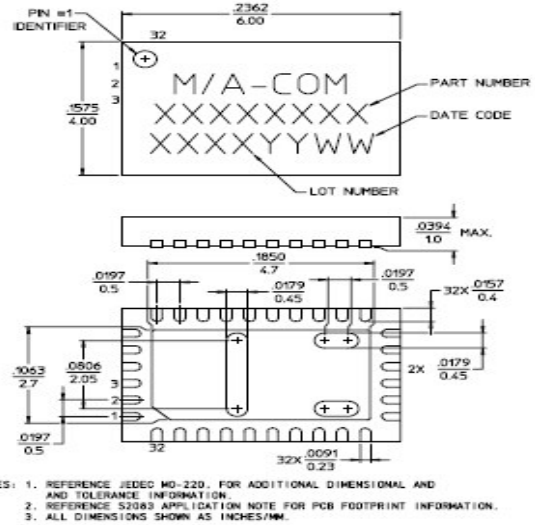
M/A-COM's AT90-0413 is a GaAs FET 4-Bit digital attenuator with integral driver. Step size is 1 dB providing a 15 dB attenuation range. This device is in an FQFP-N plastic surface mount package. The AT90-0413 is suited for applications where accuracy, fast speed, low power consumption and low costs are required.

**Pin Configuration**

Pin No.	Function	Pin No.	Function
1	GND	17	NC
2	C8	18	NC
3	C4	19	NC
4	C2	20	NC
5	C1	21	NC
6	GND	22	NC
7	GND	23	NC
8	NC	24	NC
9	NC	25	NC
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
15	NC	31	NC
16	NC	32	+Vcc

1. Pins 10 & 29 must be isolated

**CSP-1**



**Ordering Information**

Part Number	Package
AT90-0413	Bulk Packaging
AT90-0413TR	Tape and Reel (1K Reel)
AT90-0413-TB	Units Mounted on Test Board

Note: Reference Application Note M513 for reel size information.

**Truth Table**

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

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**Electrical Specifications: T<sub>A</sub> = +25°C**

Parameter	Test Conditions	Frequency	Units	Min.	Typ.	Max.
Insertion Loss	—	DC - 2.5 GHz	dB	—	2.0	2.5
		DC - 4.0 GHz	dB	—	2.5	3.0
Attenuation Accuracy	Individual Bits or Combination of Bits	DC - 2.5 GHz DC - 4.0 GHz	dB dB	— —	— —	±(.3 +4% of atten setting) ±(.3+6% of atten setting)
VSWR	Full 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	—	75	150
		—	nS	—	20	50
1 dB Compression	— —	50 MHz	dBm	—	+21	—
		0.5 - 4.0 GHz	dBm	—	+29	—
Input IP3	Two-tone inputs up to +5 dBm	50 MHz	dB	—	+35	—
		0.5 - 4.0 GHz	dB	—	+48	—
+Vcc -Vee	— —	—	V	4.75	5.0	5.25
		—	V	-8.0	-5.0	-4.75
Logic "0"	Sink Current is 20 µA max.	—	V	0.0	—	0.8
Logic "1"	Source Current is 20 µA max.	—	V	2.0	—	5.0
I <sub>cc</sub>	V <sub>cc</sub> min to max, Logic "0" or "1"	—	mA	—	0.2	6
-I <sub>ee</sub>	-V <sub>ee</sub> min to max, Logic "0" or "1"	—	mA	—	-0.2	-1
Thermal Resistance θ <sub>JA</sub>	—	—	°C/W	—	15	—

**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 <sub>cc</sub> V <sub>ee</sub>	+5.5V -8.5V
Logic Voltage <sup>4</sup>	-0.5V to V <sub>cc</sub> +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. Standard CMOS TTL interface, latch-up will occur if logic signal is applied prior to power supply.

**Handling Procedures**

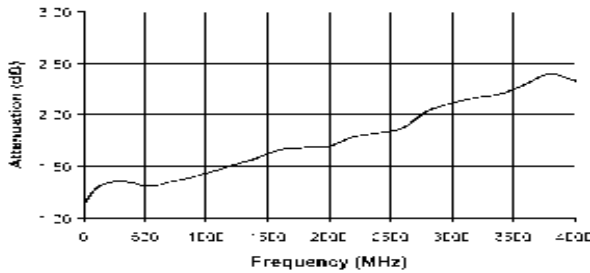
Please observe the following precautions to avoid damage:

**Static Sensitivity**

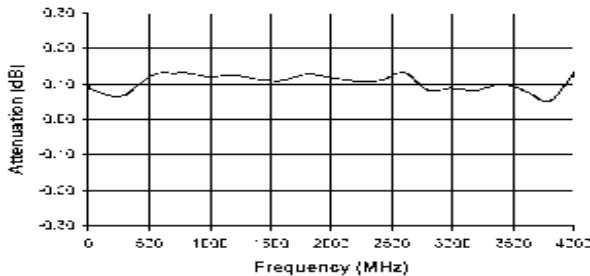
GMIC Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

**Typical Performance Curves @ 25°C**

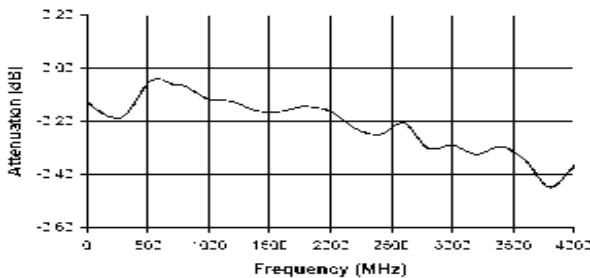
**Insertion Loss**



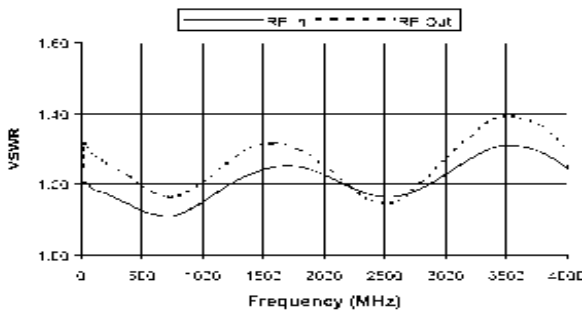
**Attenuation Error, 2 dB Bit**



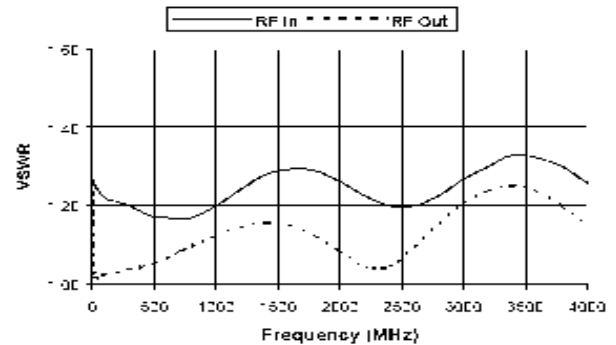
**Attenuation Error, 8 dB Bit**



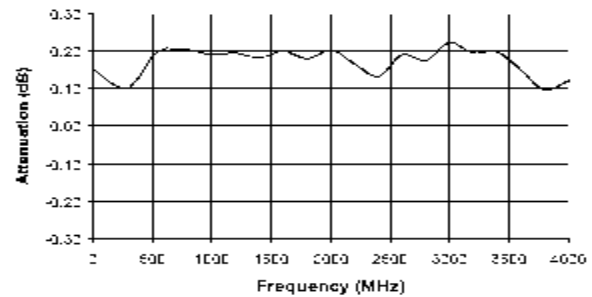
**VSWR, 1 dB Bit**



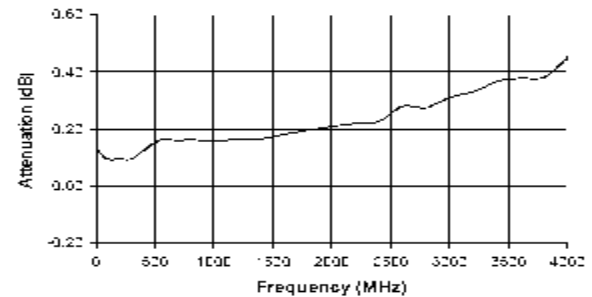
**VSWR @ Insertion Loss**



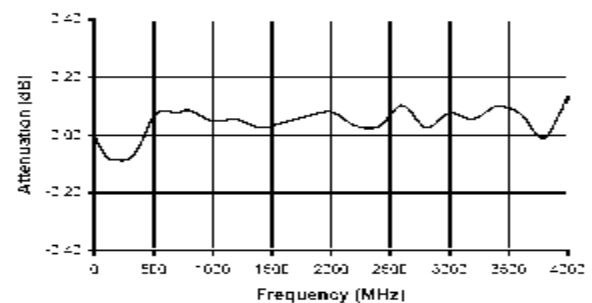
**Attenuation Error, 1 dB Bit**



**Attenuation Error, 4 dB Bit**



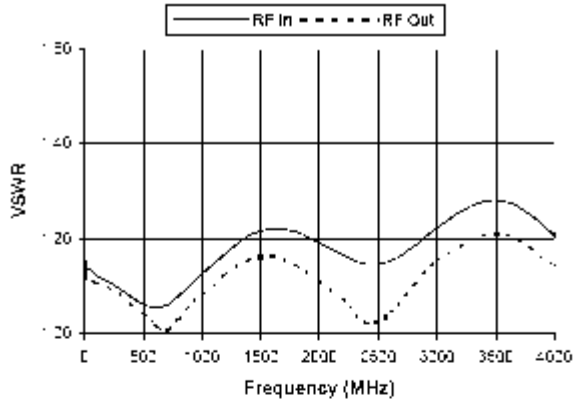
**Attenuation Error, Max. Attenuation**



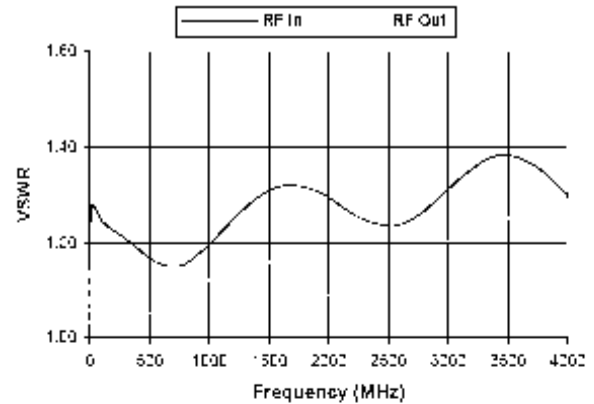
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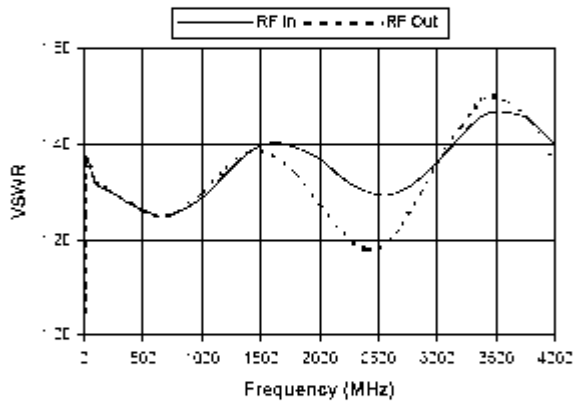
**VSWR, 2 dB Bit**



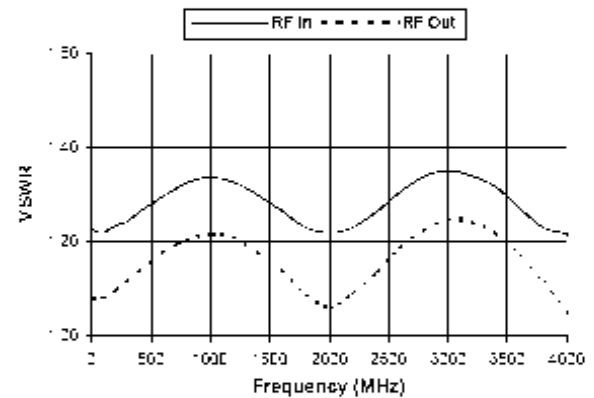
**VSWR, 4 dB Bit**



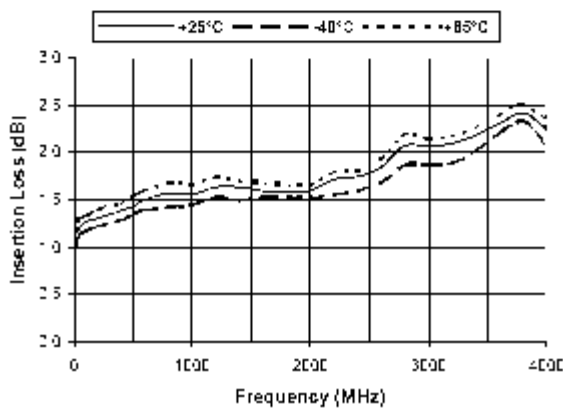
**VSWR, 8 dB Bit**



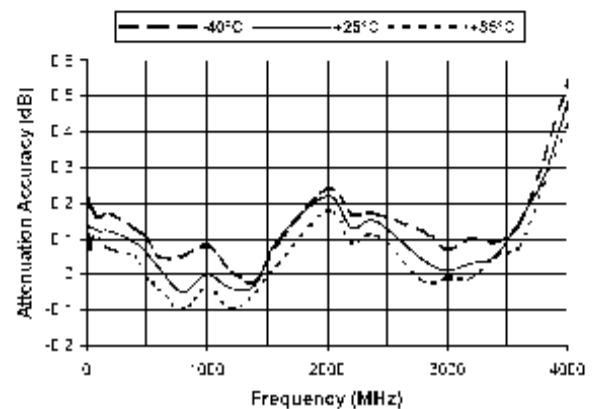
**VSWR, Max. Attenuation**



**Insertion Loss vs. Temperature**



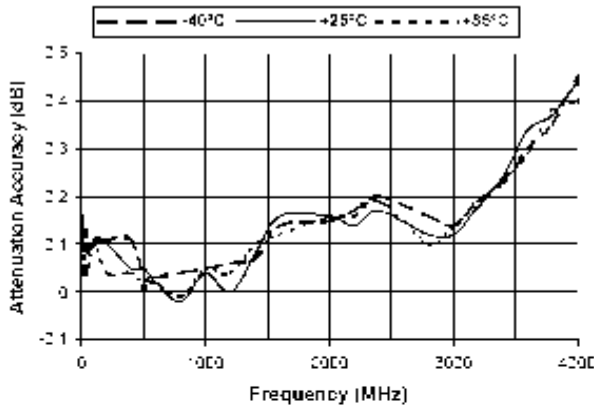
**1 dB Bit vs. Temperature**



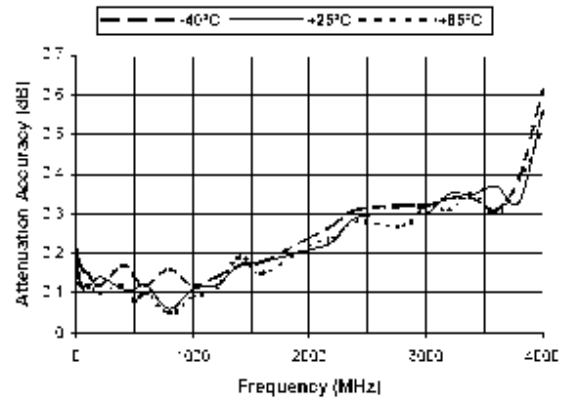
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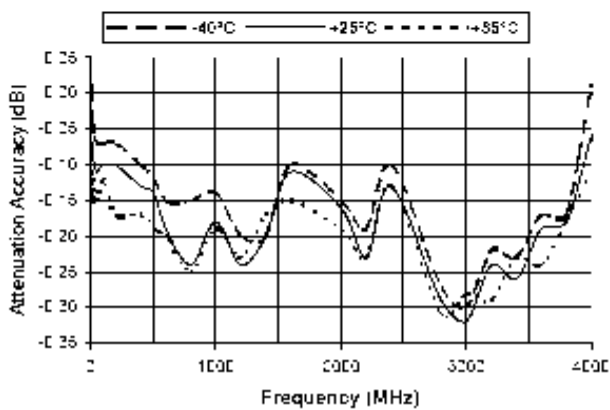
**2 dB Bit vs. Temperature**



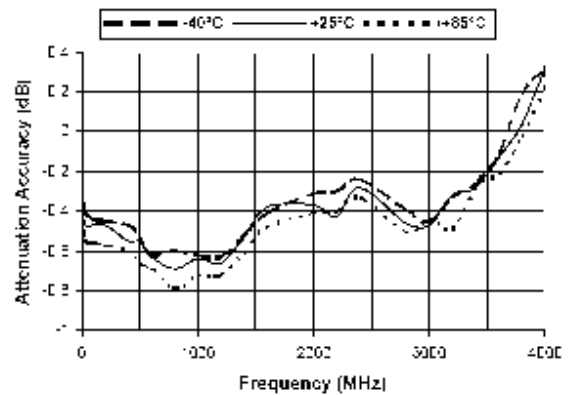
**4 dB Bit vs. Temperature**



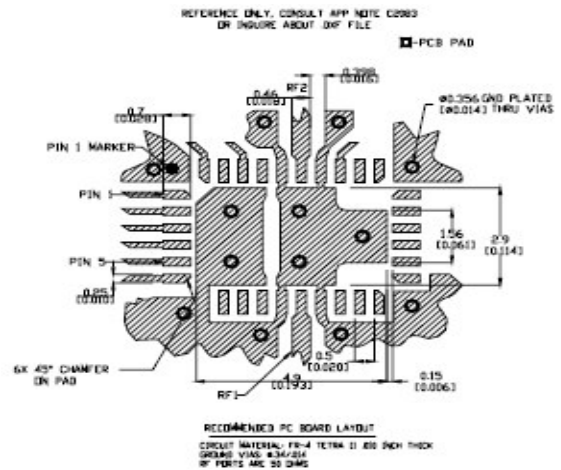
**8 dB Bit vs. Temperature**



**Max. Attenuation vs. Temperature**



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



5. Application Note S2083 is available on line at [www.macom.com](http://www.macom.com)