

**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

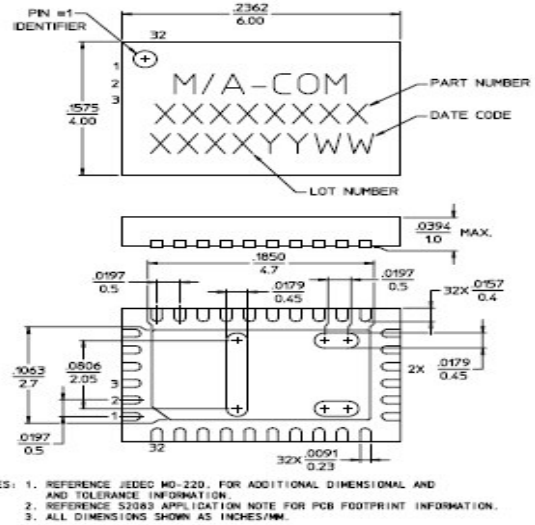
M/A-COM's AT90-0413 is a GaAs FET 4-Bit digital attenuator with integral driver. Step size is 1 dB providing a 15 dB attenuation range. This device is in an FQFP-N plastic surface mount package. The AT90-0413 is suited for applications where accuracy, fast speed, low power consumption and low costs are 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 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
AT90-0413	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_A = +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 _{cc}	V _{cc} min to max, Logic "0" or "1"	—	mA	—	0.2	6
-I _{ee}	-V _{ee} min to max, Logic "0" or "1"	—	mA	—	-0.2	-1
Thermal Resistance θ _{JA}	—	—	°C/W	—	15	—

Absolute Maximum Ratings³

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°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

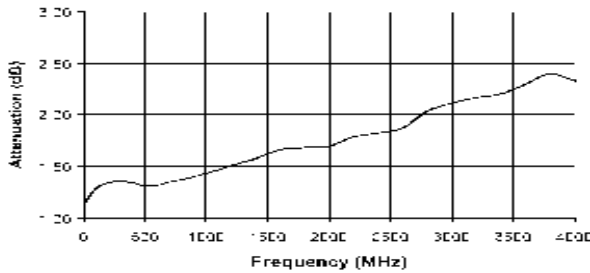
Please observe the following precautions to avoid damage:

Static Sensitivity

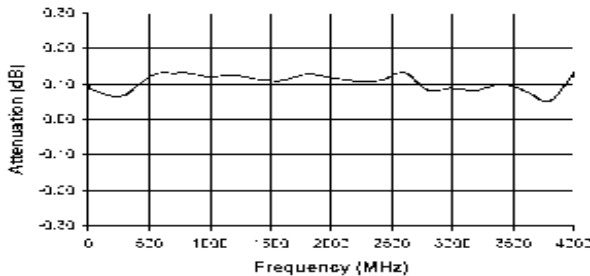
GMIC Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

Typical Performance Curves @ 25°C

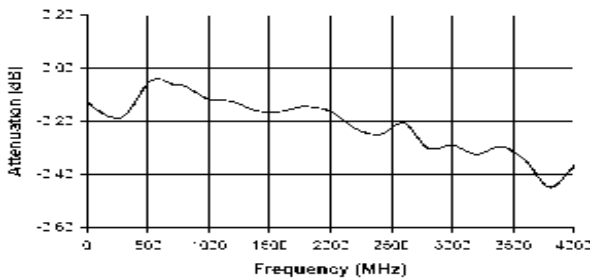
Insertion Loss



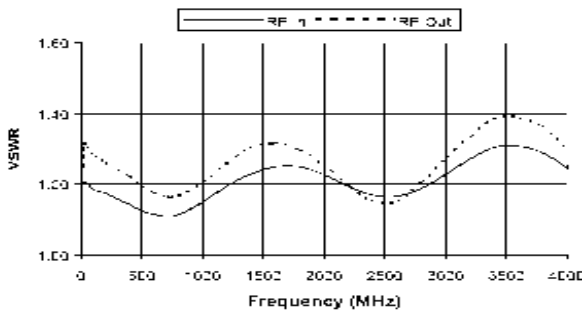
Attenuation Error, 2 dB Bit



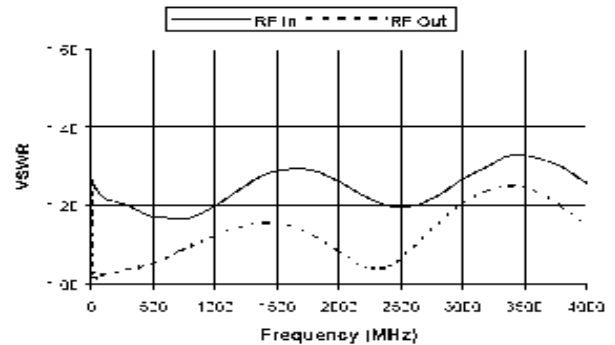
Attenuation Error, 8 dB Bit



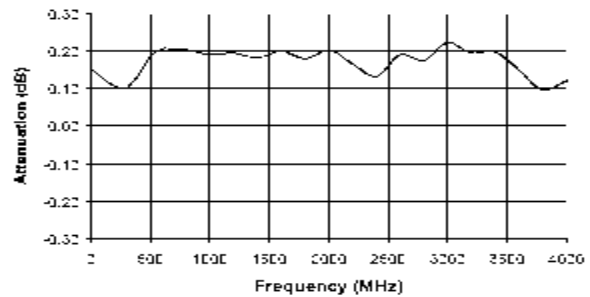
VSWR, 1 dB Bit



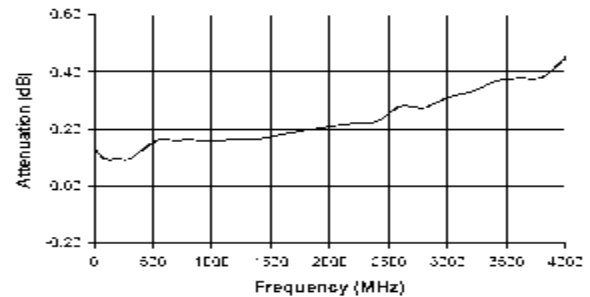
VSWR @ Insertion Loss



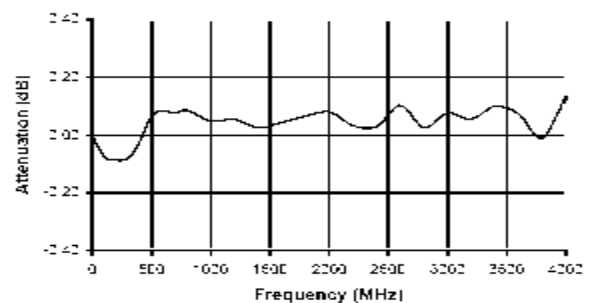
Attenuation Error, 1 dB Bit



Attenuation Error, 4 dB Bit



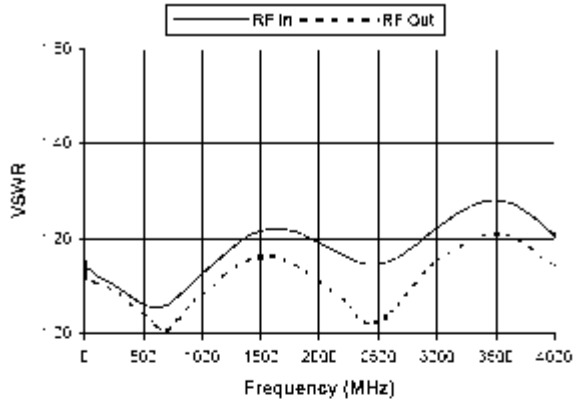
Attenuation Error, Max. Attenuation



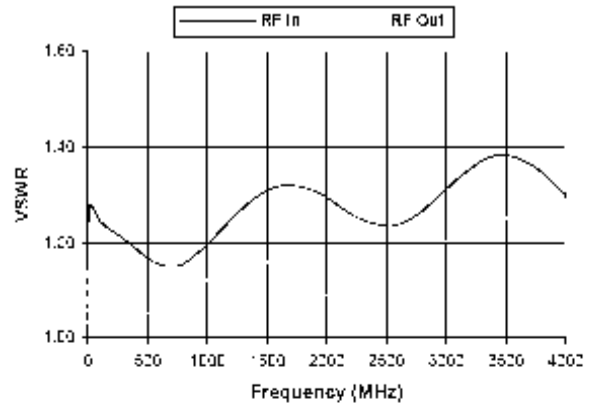
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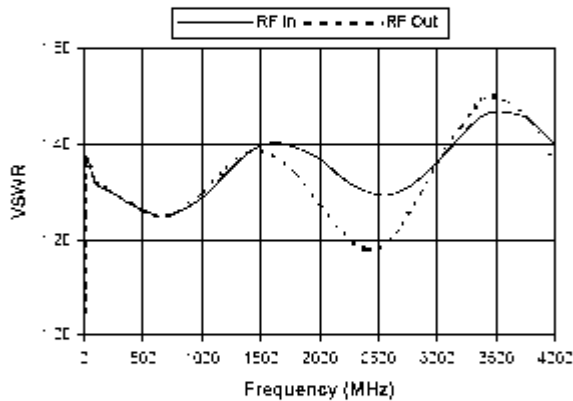
VSWR, 2 dB Bit



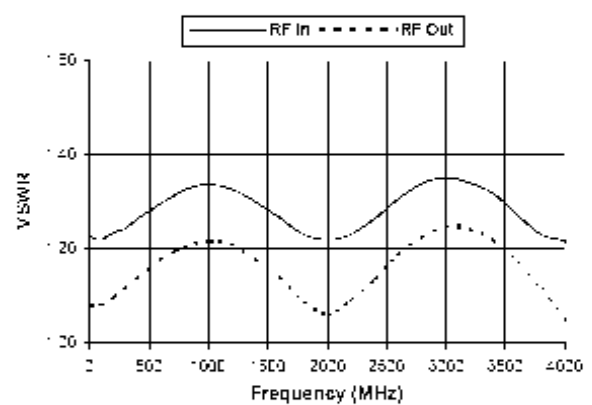
VSWR, 4 dB Bit



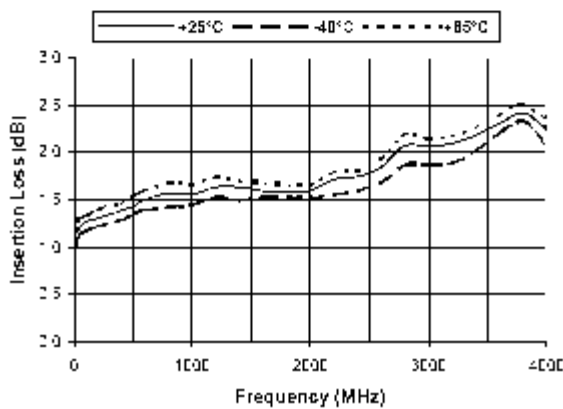
VSWR, 8 dB Bit



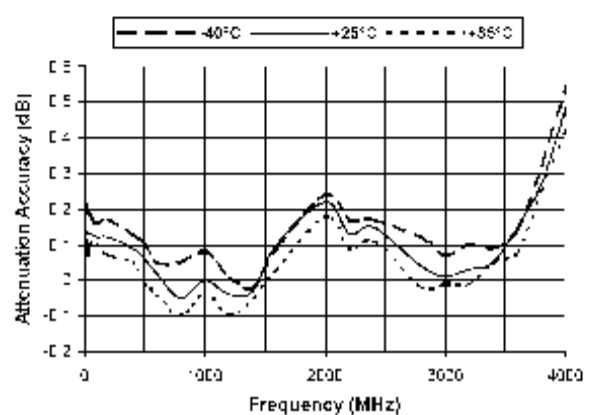
VSWR, Max. Attenuation



Insertion Loss vs. Temperature



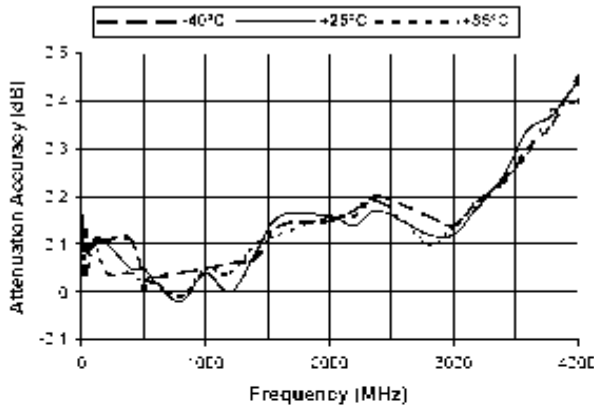
1 dB Bit vs. Temperature



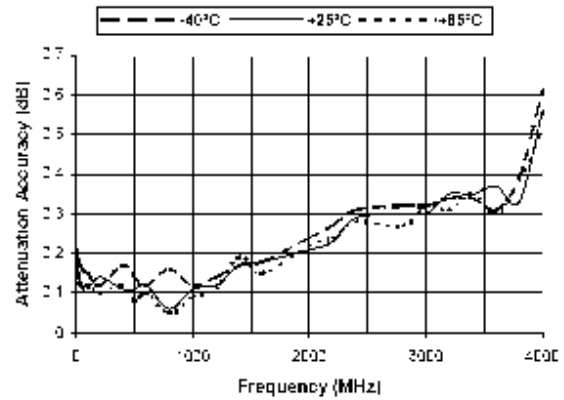
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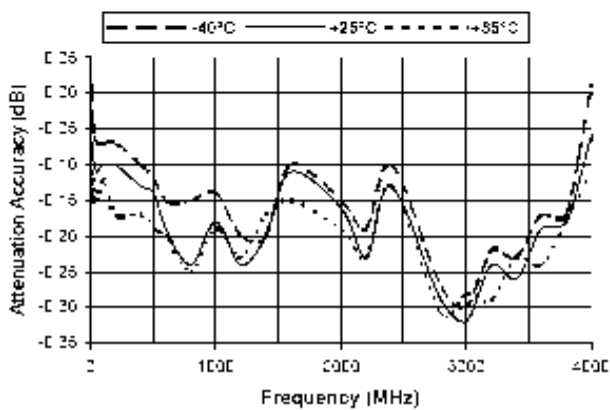
2 dB Bit vs. Temperature



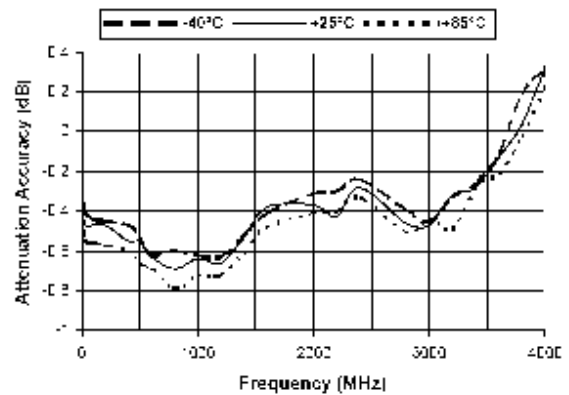
4 dB Bit vs. Temperature



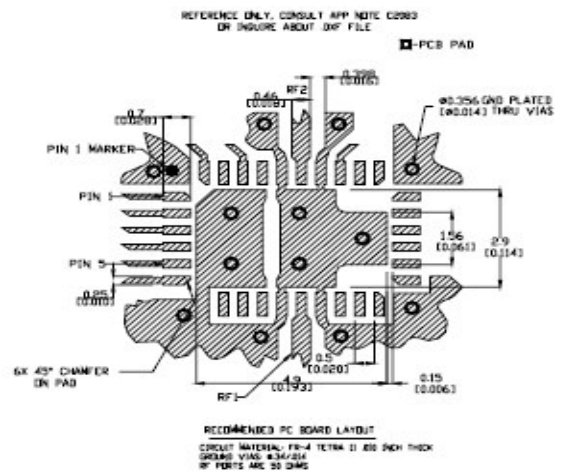
8 dB Bit vs. Temperature



Max. Attenuation vs. Temperature



Recommended PCB Configuration⁵



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