

**Voltage Variable Attenuator  
824 - 960 MHz**

**MAATCC0013  
V2**

**Features**

- 25 dB Attenuation Range
- High IP3
- Excellent Linearity Performance
- Low Cost/High Performance
- 50 Ohm Nominal Impedance
- Lead-Free SOT-25 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- RoHS\* Compliant Version of AT65-0009

**Description**

M/A-COM’s MAATCC0013 is an integrated voltage variable attenuator containing two PIN diodes and a passive glass quadrature hybrid. This device is packaged in a 5 leaded SOT plastic surface mount package. Maximum attenuation is typically achieved at 3.5 V bias using the suggested bias circuit. The MAATCC0013 is ideally suited for GSM communication applications requiring variable attenuation in the 824 to 960 MHz bandwidth.

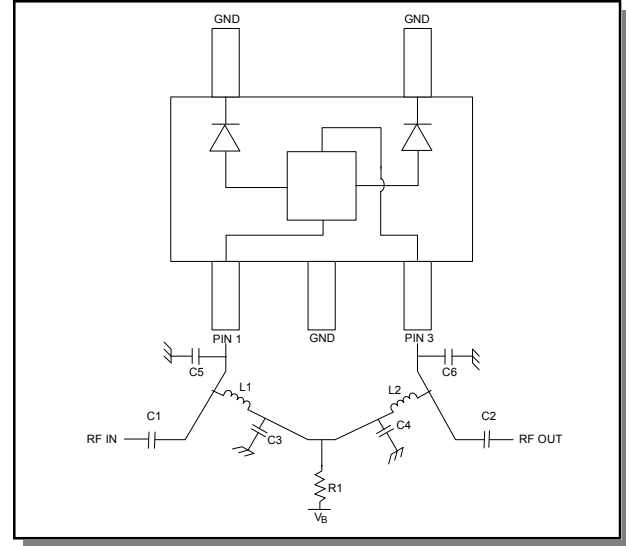
**Ordering Information**

Part Number	Package
MAATCC0013	Bulk Packaging
MAATCC0013TR	1000 piece reel
MAATCC0013-TB	Sample Test Board

Note: Reference Application Note M513 for reel size information.

Note: Die quantity varies.

**Functional Diagram and Bias Circuitry**



**Pin Configuration**

Pin No.	Function
1	RFIN, V <sub>B</sub>
2	GND
3	RFOUT, V <sub>B</sub>
4	GND
5	GND

**External Circuitry Parts <sup>1</sup>**

Part	Value	Purpose
C1	390 pF	DC Block
C2	390 pF	DC Block
C3	390 pF	By-pass
C4	390 pF	By-pass
L1	180 nH	RF Choke
L2	180 nH	RF Choke
R1	10 KOhm	Current Limiting
C5 <sup>2</sup>	1.5 pF	RF Tune
C6 <sup>2</sup>	1.5 pF	RF Tune

1. All external circuitry parts are readily available, low cost surface mount components (.060 in. x .030 in. or .080 in. x .050 in.).
2. See Application Note MA-C-05010008A for external tuning capacitor values to suit specific Communication Bandwidths. Insertion Loss will vary depending on tuning capacitor value chosen.

\* Restrictions on Hazardous Substances, European Union Directive 2002/95/EC.

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**Electrical Specifications:  $T_A = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$ ,  $F = 824$  to  $960$  MHz**

Parameter	Test Conditions	Units	Min	Typ	Max
Insertion Loss	$V_B = 0$ V	dB	—	1.7	2.1
VSWR		Ratio	—	1.7	2.2
Attenuation Flatness vs. Frequency	0 - 10 dB	dB	—	1.3	—
	0 - 20 dB	dB	—	1.3	—
	0 - 30 dB	dB	—	2.5	—
Switching Speed	50% control to 90%/10% RF	usec	—	7.0	—
Input IP3	Two Tones 900 MHz, 905 MHz, +5 dBm $V_B = 0$ V	dBm	—	40	—
Input IP2	Two Tones 900 MHz, 905 MHz, +5 dBm $V_B = 0$ V	dBm	—	34	—
Attenuation	$I_B = 0.30$ to $0.45$ mA	dB	25	28	—

**Absolute Maximum Ratings <sup>3,4</sup>**

Parameter	Absolute Maximum
Max Input Power	+27 dBm
Operating Voltage	+5 V
Operating Temperature	$-40^\circ\text{C}$ to $+85^\circ\text{C}$
Storage Temperature	$-65^\circ\text{C}$ to $+125^\circ\text{C}$

- Exceeding any one or combination of these limits may cause permanent damage to this device.
- M/A-COM does not recommend sustained operation near these survivability limits.

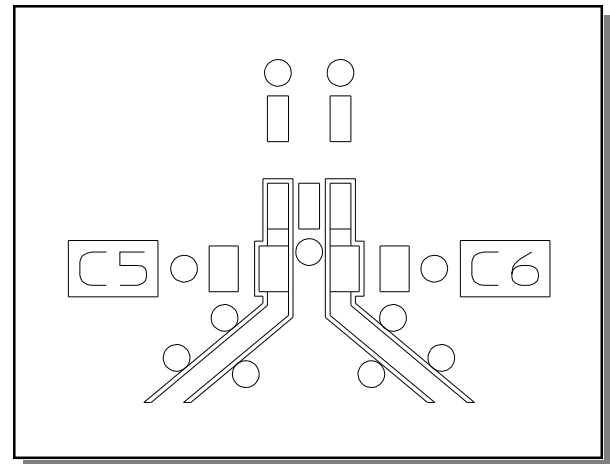
**Handling Procedures**

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.

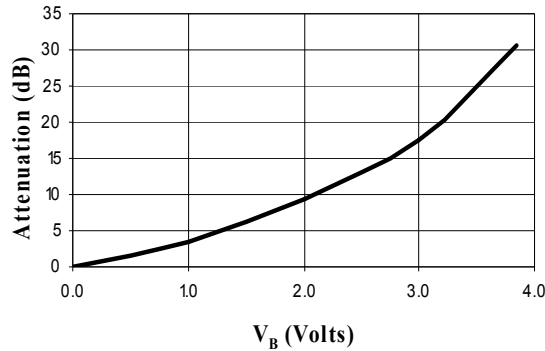
**Recommended PCB Configuration <sup>5</sup>**



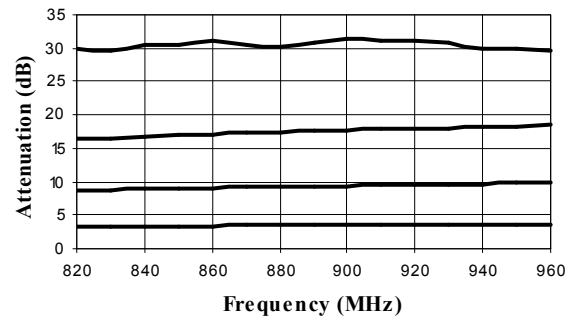
- Circuit Material = FR-406, 0.031 inches thick.  
Line Width = 0.025 inches, Line Spacing = 0.0056 inches.

**Typical Performance Curves**

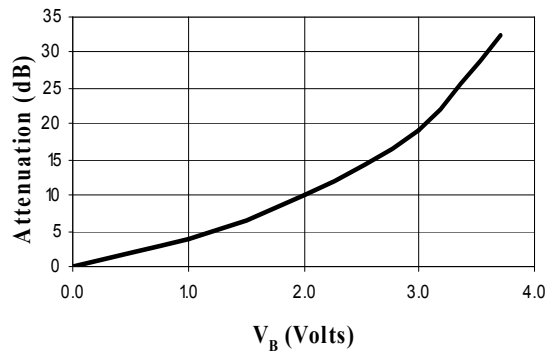
*Attenuation vs. Voltage with 1.5 pF Tuning Cap @ +25°C*



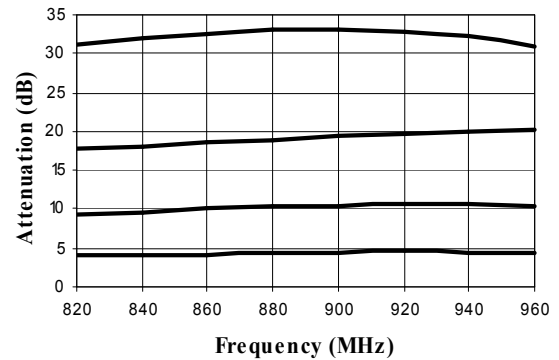
*Attenuation vs. Freq. With 1.5 pF Tuning Cap @ +25°C*



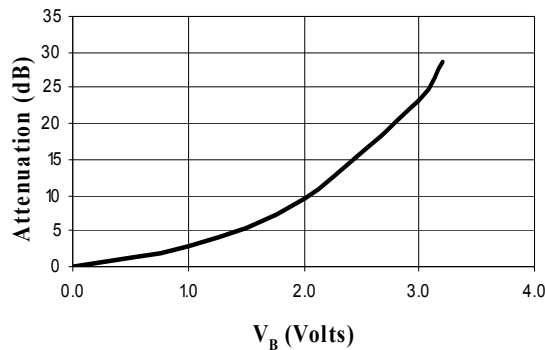
*Attenuation vs. Voltage with 1.5 pF Tuning Cap @ +85°C*



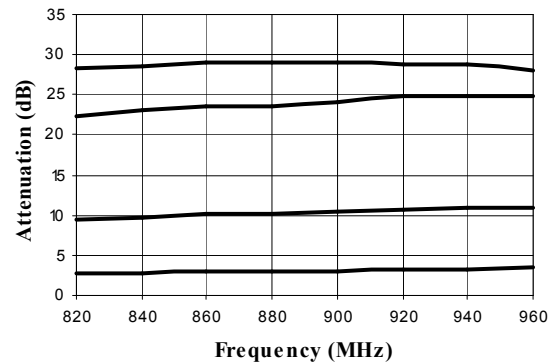
*Attenuation vs. Freq. With 1.5 pF Tuning Cap @ +85°C*



*Attenuation vs. Voltage with 1.5 pF Tuning Cap @ -40°C*



*Attenuation vs. Freq. With 1.5 pF Tuning Cap @ -40°C*

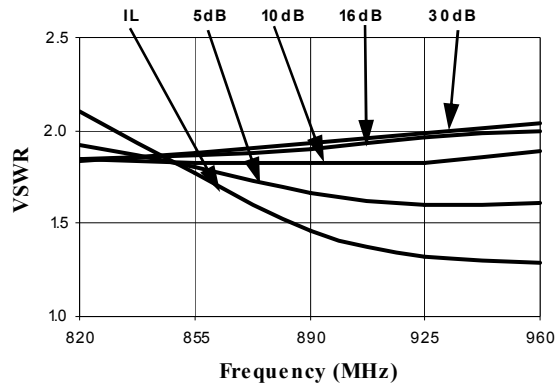


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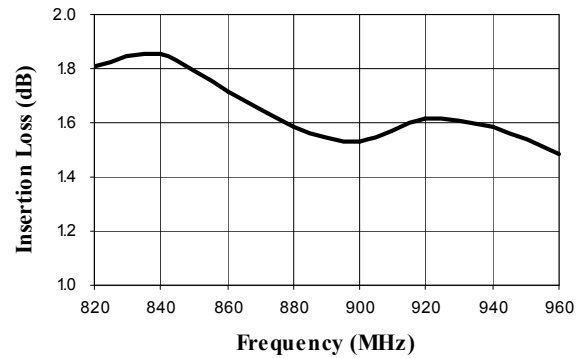
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**Typical Performance Curves**

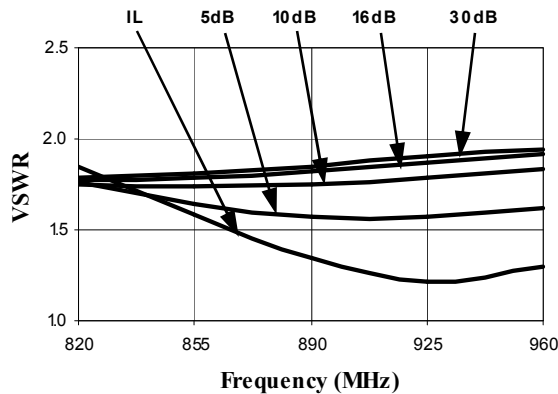
**VSWR vs. Freq. With 1.5 pF Tuning Cap @ +25°C**



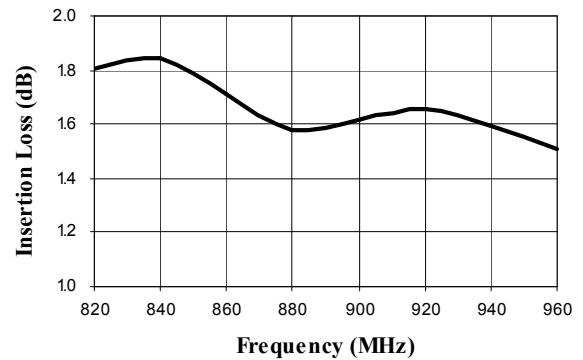
**Loss vs. Frequency @ +25°C  
No Tuning Cap (See Note 2)**



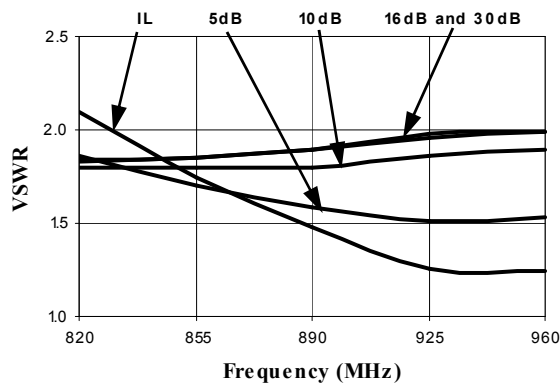
**VSWR vs. Freq. With 1.5 pF Tuning Cap @ +85°C**



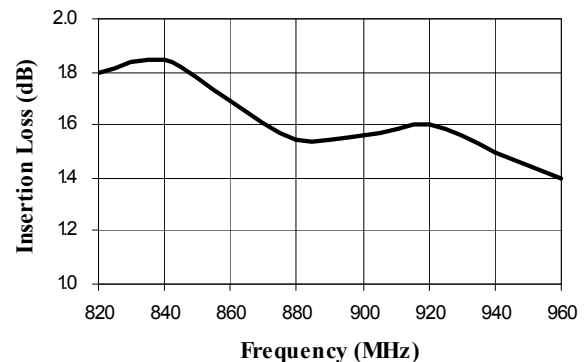
**Loss vs. Frequency @ +85°C  
No Tuning Cap (See Note 2)**



**VSWR vs. Freq. With 1.5 pF Tuning Cap @ -40°C**



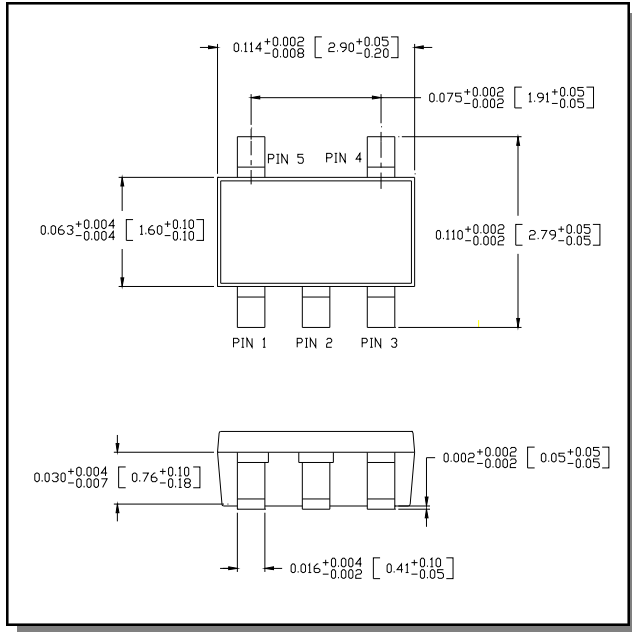
**Loss vs. Frequency @ -40°C  
No Tuning Cap (See Note 2)**



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**Lead-Free, SOT-25<sup>†</sup>**



<sup>†</sup> Reference Application Note M538 for lead-free solder reflow recommendations.