

Rev. V3

#### **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**

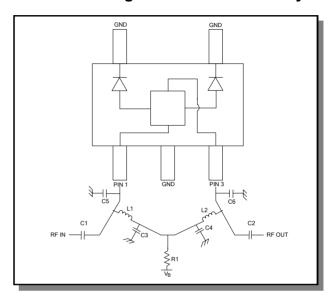
M/A-COM's MAATCC0013 is an integrated voltage variable attenuator containing two PIN diodes and a passive glass quadrature hybrid. This device is packaged in a 5 leaded SOT plastic surface mount package. Maximum attenuation is typically achieved at 3.5 V bias using the suggested bias circuit. The MAATCC0013 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.

#### **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          |  |

- All external circuitry parts are readily available, low cost surface mount components (.060 in. x .030 in. or .080 in. x .050 in.).
- 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.

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



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

| Parameter                             | Test Conditions                                      | Units          | Min | Тур               | Max |
|---------------------------------------|--|----------------|-----|-------------------|-----|
| Insertion Loss                        | V <sub>B</sub> = 0 V                                 | dB             | _   | 1.7               | 2.1 |
| VSWR                                  |  | Ratio          | _   | 1.7               | 2.2 |
| Attenuation Flatness vs.<br>Frequency | 0 - 10 dB<br>0 - 20 dB<br>0 - 30 dB                  | dB<br>dB<br>dB |     | 1.3<br>1.3<br>2.5 |     |
| Switching Speed                       | 50% control to 90%/10% RF                            | usec           | _   | 7.0               | _   |
| Input IP3                             | Two Tones 900 MHz, 905 MHz, +5 dBm $V_{\rm B}$ = 0 V | dBm            | _   | 40                | _   |
| Input IP2                             | Two Tones 900 MHz, 905 MHz, +5 dBm $V_{\rm B}$ = 0 V | dBm            | _   | 34                | _   |
| Attenuation                           | I <sub>B</sub> = 0.30 to 0.45 mA                     | dB             | 25  | 28                | _   |

## Absolute Maximum Ratings 3,4

| Parameter             | Absolute Maximum |
|-----------------------|------------------|
| Max Input Power       | +27 dBm          |
| Operating Voltage     | +5 V             |
| Operating Temperature | -40°C to +85°C   |
| Storage Temperature   | -65°C to +125°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.

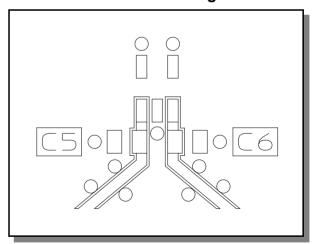
# **Handling Procedures**

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.

# MAATCC0013

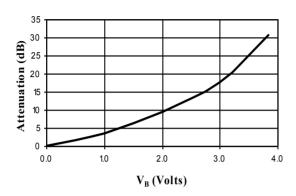


Voltage Variable Attenuator 824 - 960 MHz

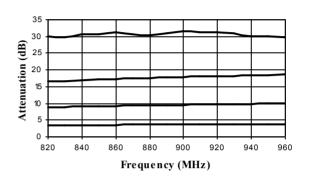
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#### **Typical Performance Curves**

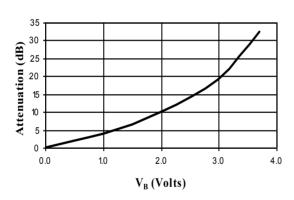
Attenuation vs. Voltage with 1.5 pF Tuning Cap @ +25°C



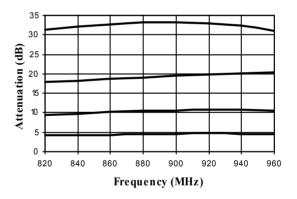
Attenuation vs. Freq. With 1.5 pF Tuning Cap @ +25°C



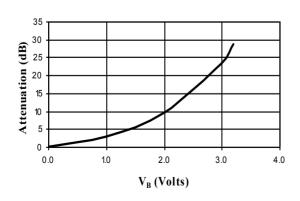
Attenuation vs. Voltage with 1.5 pF Tuning Cap @ +85°C



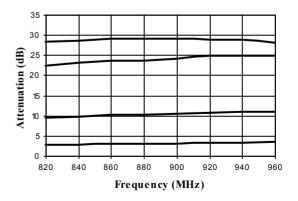
Attenuation vs. Freq. With 1.5 pF Tuning Cap @ +85°C



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



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

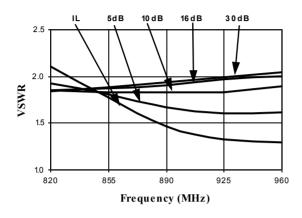




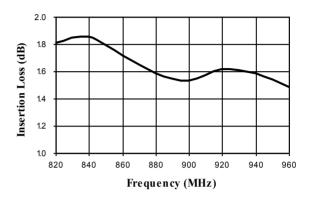
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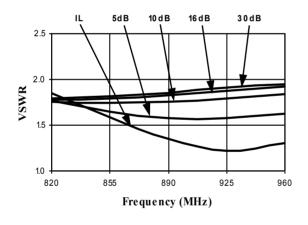
VSWR vs. Freq. With 1.5 pF Tuning Cap @ +25°C



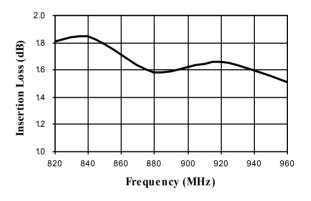
Loss vs. Frequency @ +25°C No Tuning Cap (See Note 2)



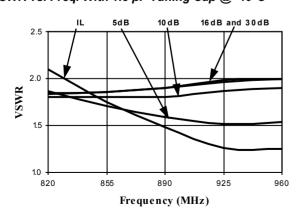
VSWR vs. Freq. With 1.5 pF Tuning Cap @ +85°C



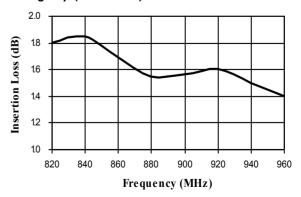
Loss vs. Frequency @ +85°C No Tuning Cap (See Note 2)



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



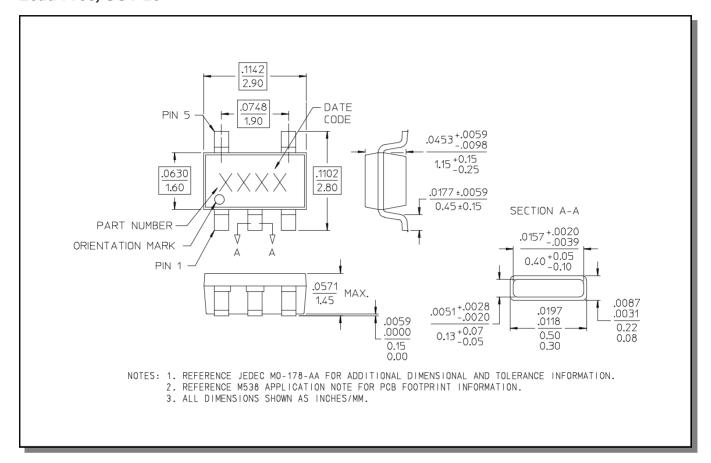
Loss vs. Frequency @ -40°C No Tuning Cap (See Note 2)





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### Lead-Free, SOT-25<sup>†</sup>



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

# MAATCC0013



**Voltage Variable Attenuator** 824 - 960 MHz

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