## Voltage Variable Attenuator 824 - 960 MHz



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.

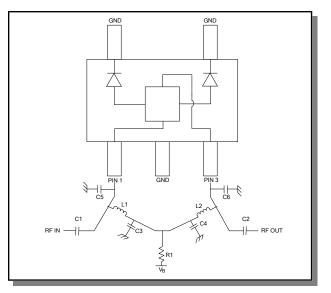
## **Ordering Information**

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

Note: Reference Application Note M513 for reel size information.

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

## **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.

ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed. PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

North America Tel: 800.366.2266 / Fax: 978.366.2266 Europe Tel: 44.1908.574.200 / Fax: 44.1908.574.300

٠

Asia/Pacific Tel: 81.44.844.8296 / Fax: 81.44.844.8298 Visit www.macomtech.com for additional data sheets and product information.

M/A-COM Technology Solutions Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

1



## Voltage Variable Attenuator 824 - 960 MHz

Rev. V3

### 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	$V_B = 0 V$	dB	_	1.7	2.1
VSWR		Ratio	—	1.7	2.2
Attenuation Flatness vs. Frequency	0 - 10 dB 0 - 20 dB 0 - 30 dB	dB dB dB		1.3 1.3 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	—

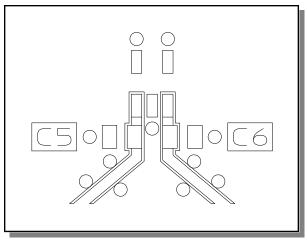
### Absolute Maximum Ratings <sup>3,4</sup>

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

Exceeding any one or combination of these limits may 3. cause permanent damage to this device.

4. M/A-COM does not recommend sustained operation near these survivability limits.

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



Circuit Material = FR-406, 0.031 inches thick. 5. Line Width = 0.025 inches, Line Spacing = 0.0056 inches.

#### Handling Procedures

Please observe the following precautions to avoid damage:

### **Static Sensitivity**

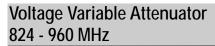
GMIC Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed. PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

- North America Tel: 800.366.2266 / Fax: 978.366.2266 •
- Europe Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- Asia/Pacific Tel: 81.44.844.8296 / Fax: 81.44.844.8298 Visit www.macomtech.com for additional data sheets and product information.

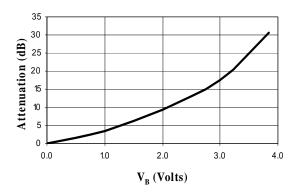
M/A-COM Technology Solutions Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

<sup>2</sup> 

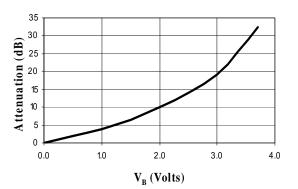


#### **Typical Performance Curves**

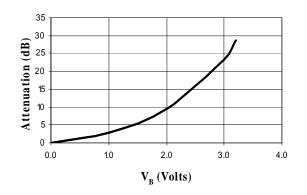
#### Attenuation vs. Voltage with 1.5 pF Tuning Cap @ +25°C



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



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



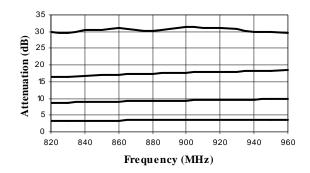
3

ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed. PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology

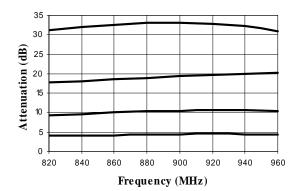
Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.



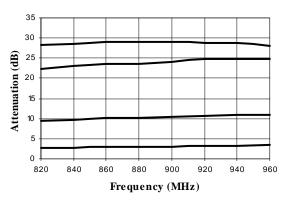
Attenuation vs. Freq. With 1.5 pF Tuning Cap @ +25°C



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



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



• North America Tel: 800.366.2266 / Fax: 978.366.2266

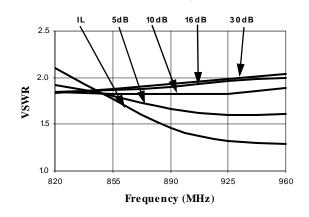
- Europe Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- Asia/Pacific Tel: 81.44.844.8296 / Fax: 81.44.844.8298
  Visit www.macomtech.com for additional data sheets and product information.

M/A-COM Technology Solutions Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

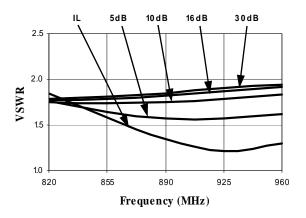
## Voltage Variable Attenuator 824 - 960 MHz

#### **Typical Performance Curves**

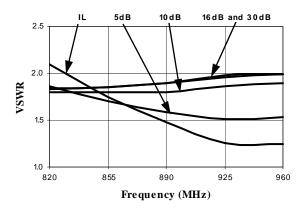
VSWR vs. Freq. With 1.5 pF Tuning Cap @ +25°C



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



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



4

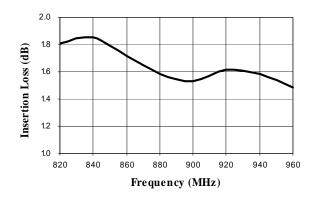
ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed. PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology

PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology Solutions has under development. Performance is based on engineering tests. Specifications are typical. Mechanical outline has been fixed. Engineering samples and/or test data may be available. Commitment to produce in volume is not guaranteed.

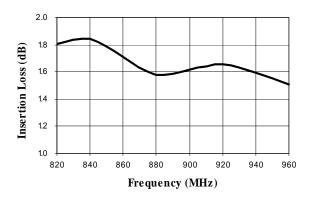


Rev. V3

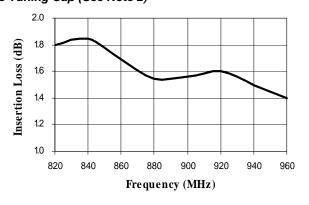
Loss vs. Frequency @ +25°C No Tuning Cap (See Note 2)



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



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



• North America Tel: 800.366.2266 / Fax: 978.366.2266

- Europe Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- Asia/Pacific Tel: 81.44.844.8296 / Fax: 81.44.844.8298
  Visit www.macomtech.com for additional data sheets and product information.

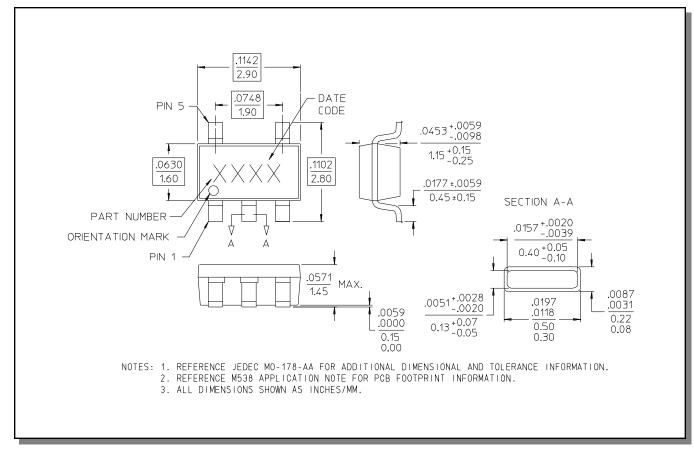
M/A-COM Technology Solutions Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.

Voltage Variable Attenuator 824 - 960 MHz



5

Lead-Free, SOT-25<sup>†</sup>



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

ADVANCED: Data Sheets contain information regarding a product M/A-COM Technology Solutions

is considering for development. Performance is based on target specifications, simulated results, and/or prototype measurements. Commitment to develop is not guaranteed.

PRELIMINARY: Data Sheets contain information regarding a product M/A-COM Technology

• North America Tel: 800.366.2266 / Fax: 978.366.2266

- Europe Tel: 44.1908.574.200 / Fax: 44.1908.574.300
- Asia/Pacific Tel: 81.44.844.8296 / Fax: 81.44.844.8298
  Visit www.macomtech.com for additional data sheets and product information.

M/A-COM Technology Solutions Inc. and its affiliates reserve the right to make changes to the product(s) or information contained herein without notice.



Rev. V3