

## Features

- Linearizes PIN Diode Attenuators Over a Wide Attenuation Range
- Output Currents up to 12 mA
- Operates with a Single Supply Voltage of +3V to +12V
- Low Quiescent Currents
- Single Control Voltage
- Test Boards are Available
- Tape and Reel Packaging Available
- Lead-Free SOW-16 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free "Green" Mold Compound
- 260°C Reflow Compatible
- RoHS\* Compliant Version of DR65-0002

## Description

M/A-COM's MADR-007098-000100 is a break point free driver that produces a logarithmic output current suitable for linearizing PIN diode based shunt attenuators. This driver, in conjunction with customer defined external components, produces a linear transfer function (dB/V) between the input control voltage of the driver and the attenuation output of the PIN attenuator. The MADR-007098-000100 has been optimized for linearizing M/A-COM's MAAV-007089-000100 or MAAV-007090-000100 attenuators, but will function well with most types of cathode grounded, PIN attenuators. The driver is packaged in a SOW-16 package for commercial SMT applications. A typical schematic for a 30 dB, 7.5 dB/V linear attenuator is shown in Figure 1.

## Ordering Information

Part Number	Package
MADR-007098-000100	Bulk Packaging
MADR-007098-0001TR	1000 piece reel
MAAV-007089-DR01TB	Test Board with Circuit per Figure 1 (MAAV-007089-000100, GSM Attenuator)
MAAV-007090-DR01TB	Test Board with Circuit per Figure 1 (MAAV-007090-000100, PCS Attenuator)

Note: Reference Application Note M513 for reel size information.

## Circuit Description:

### (Reference Figures 1 and 2)

The input divider, R1 and the sum of R2 and R3, sets the overall transfer function of the circuit. To increase the transfer function, decrease the Control Voltage and the value of R1. Varying the value of R4 will optimize the linearity of the circuit. One can achieve a very linear transfer function (less than  $\pm 1$  dB/V) by driving the attenuator over a smaller portion of its dynamic range. In the case of the MAAV-007089-000100 and MAAV-007090-000100 attenuators, this would be limited to a dynamic range of 28 and 25 dB, respectively. Temperature compensation is a function temperature coefficient of the thermistor, R3, and the ratio of R2 to R3, and can only be optimized once the transfer function and linearity component values have been established.

## Pin Configuration

Pin No.	Function	Pin No.	Function
1	N/C	9	N/C
2	N/C	10	N/C
3	REF	11	N/C
4	INPUT +	12	OUTPUT
5	GND	13	N/C
6	N/C	14	+ V <sub>CC</sub>
7	N/C	15	N/C
8	N/C	16	N/C

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

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Figure 1. Linear Attenuator Schematic

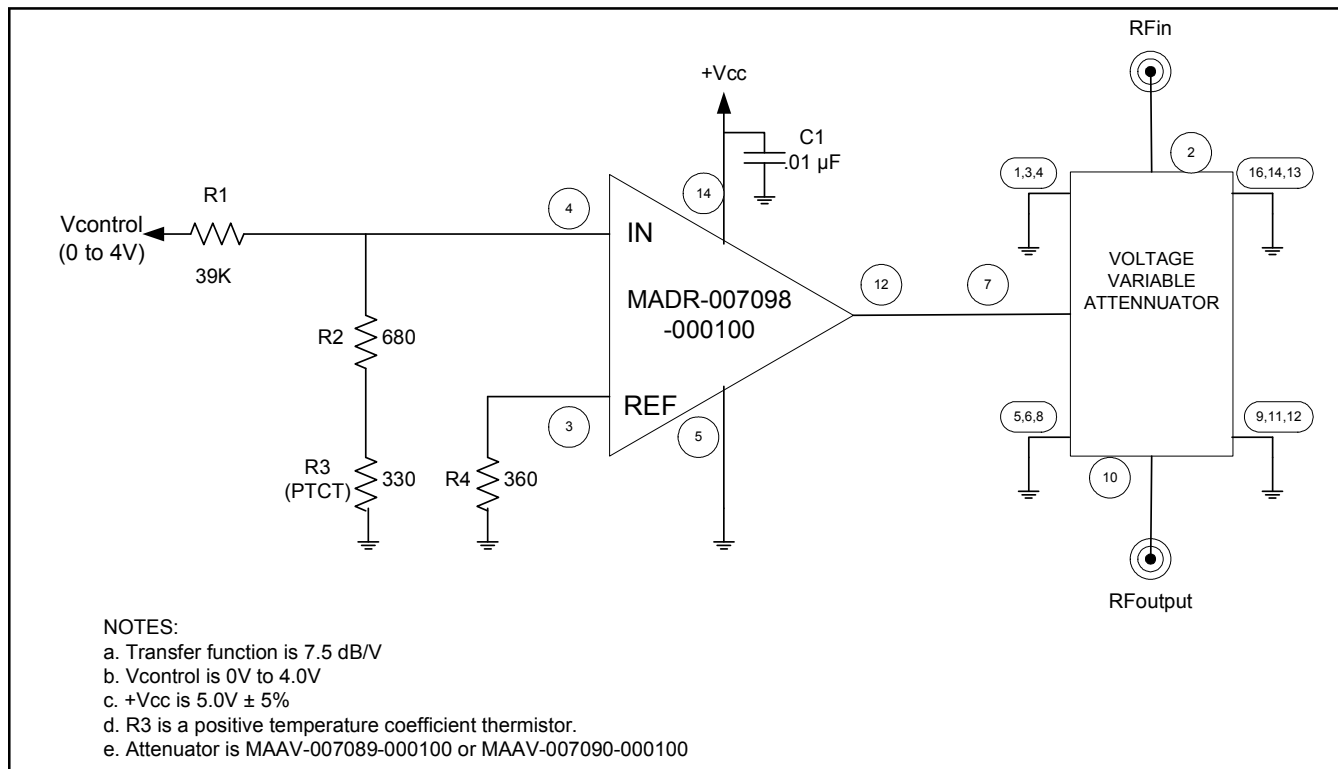
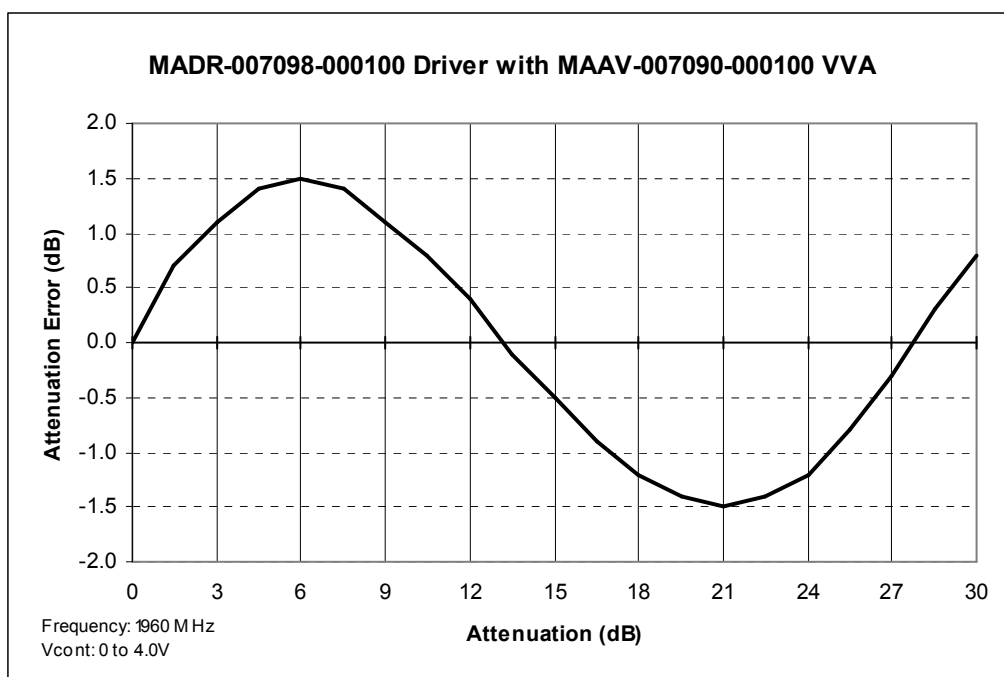


Figure 2. Typical Attenuation Error



**Electrical Specifications:  $T_A = 25^\circ\text{C}$ ,  $Z_0 = 50\Omega$**

Parameter	Test Conditions	Units	Min	Typ	Max
Output Drive Current	Load Dependent	mA	10	—	—
+V <sub>CC</sub> Supply Range	—	V	3.0	5.0	12
+V <sub>CC</sub> Supply Tolerance	—	%	—	5	—
+V <sub>CC</sub> Quiescent Current	No Load	mA	—	1.0	2.0
Linearity	Application Dependent	dB	± 1	± 2.5	—
Transfer Function	Application Dependent	dB/V	3	7.5	10
Settling Time	50% Ctl to 90%/10% RF	µs	—	50	—

**Absolute Maximum Ratings <sup>1,2</sup>**

Parameter	Absolute Maximum
+V <sub>CC</sub>	+20 V
Input +	± 5 V
REF	± 5 V
Output Current	20 mA
Operating Temperature	-40°C to +85°C
Storage Temperature	-65°C to +125°C
Package Power Dissipation	150 mW
Lead Temperature	300°C for 10 seconds

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

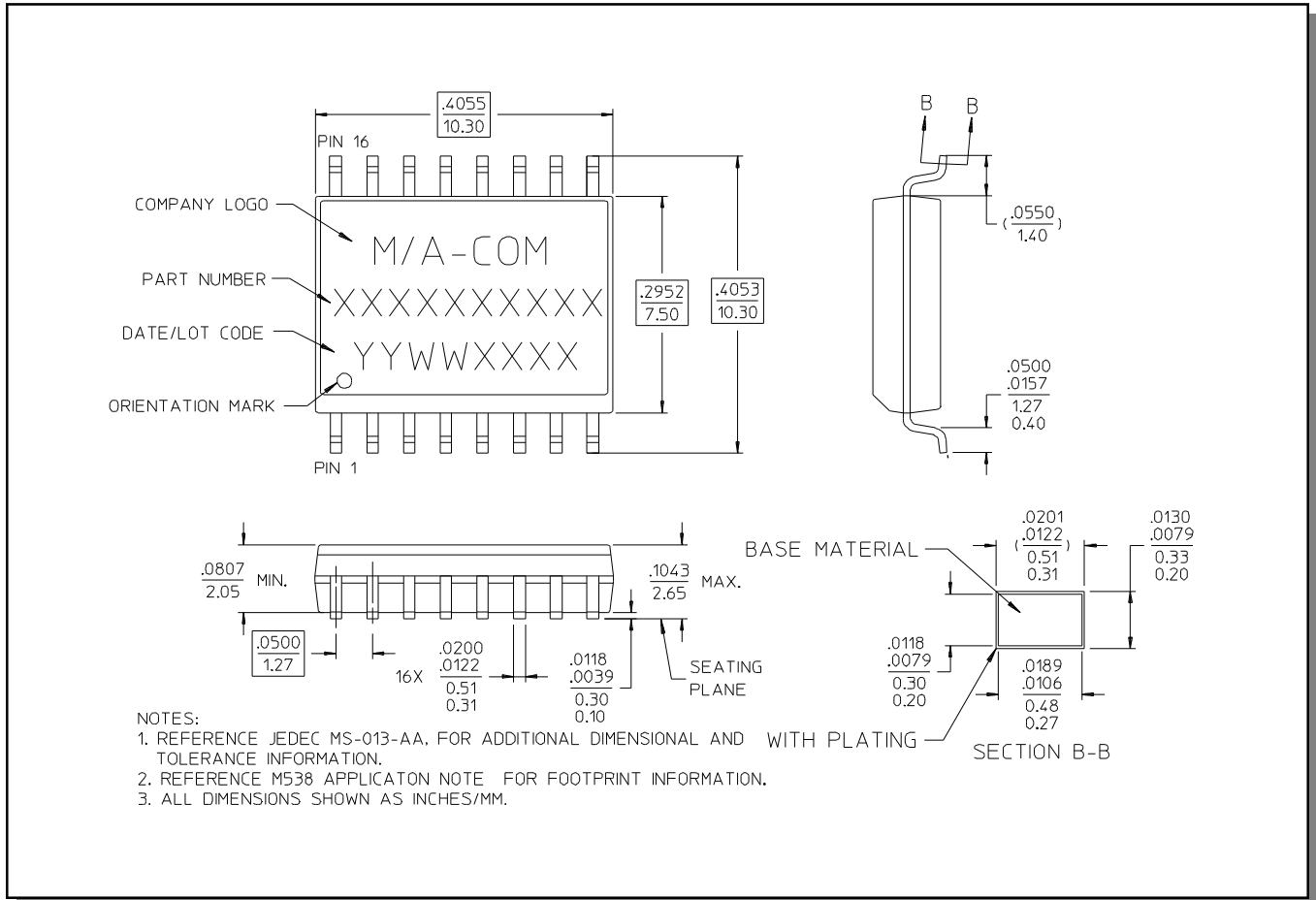
**Handling Procedures**

Please observe the following precautions to avoid damage:

**Static Sensitivity**

Gallium Arsenide Integrated 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.

**Lead-Free, SOW-16<sup>†</sup>**



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