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MICROWAVE CORPORATION v07.1008



# HMC346MS8G / 346MS8GE

## GaAs MMIC SMT VOLTAGE-VARIABLE ATTENUATOR, DC - 8 GHz

### Typical Applications

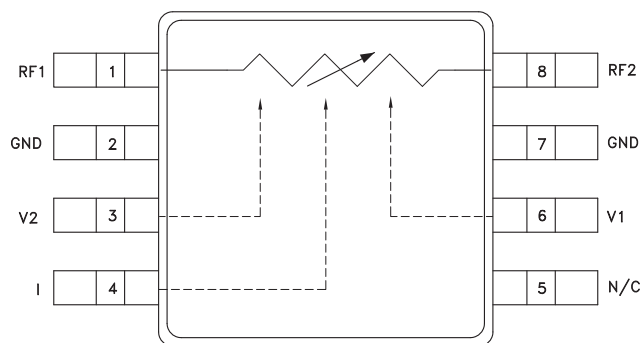
This attenuator is ideal for use as a VVA for DC - 8 GHz applications:

- Point-to-Point Radio
- VSAT Radio

### Features

- Wide Bandwidth: DC - 8 GHz
- Low Phase Shift vs. Attenuation
- 32 dB Attenuation Range

### Functional Diagram



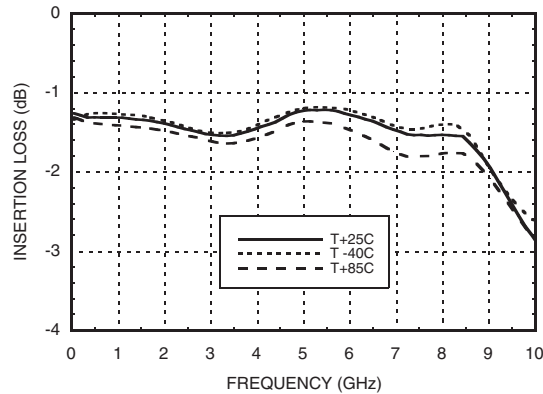
### General Description

The HMC346MS8G & HMC346MS8GE are absorptive Voltage Variable Attenuators (VVA) in 8 lead surface-mount packages operating from DC - 8 GHz. It features an on-chip reference attenuator for use with an external op-amp to provide simple single voltage attenuation control, 0 to -3V. The device is ideal in designs where an analog DC control signal must control RF signal levels over a 30 dB amplitude range. Applications include AGC circuits and temperature compensation of multiple gain stages in microwave point-to-point and VSAT radios.

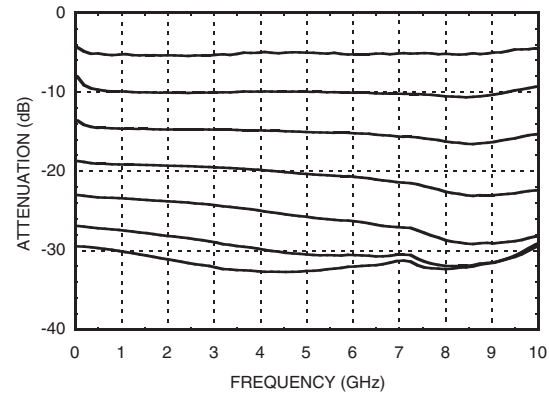
### Electrical Specifications, $T_A = +25^\circ\text{C}$ , 50 ohm system

| Parameter                                                                              |                                  | Min | Typical | Max | Units |
|----------------------------------------------------------------------------------------|----------------------------------|-----|---------|-----|-------|
| Insertion Loss                                                                         | DC - 8 GHz                       |     | 1.5     | 2.5 | dB    |
| Attenuation Range                                                                      | DC - 8 GHz                       | 27  | 32      |     | dB    |
| Return Loss                                                                            | DC - 8 GHz                       | 5   | 10      |     | dB    |
| Switching Characteristics                                                              | tRISE, tFALL (10/90% RF)         |     | 2       |     | ns    |
|                                                                                        | tON, tOFF (50% CTL to 10/90% RF) |     | 8       |     | ns    |
| Input Power for 0.25 dB Compression (0.5 - 8 GHz)                                      | Min. Atten.                      |     | +8      |     | dBm   |
|                                                                                        | Atten. >2 dB                     |     | -2      |     | dBm   |
| Input Third Order Intercept (0.5 - 8 GHz)<br>(Two-tone Input Power = -8 dBm Each Tone) | Min. Atten.                      |     | +25     |     | dBm   |
|                                                                                        | Atten. >2 dB                     |     | +10     |     | dBm   |

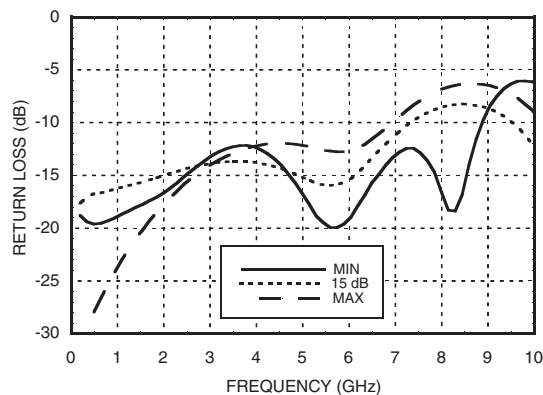
**Insertion Loss vs. Temperature**



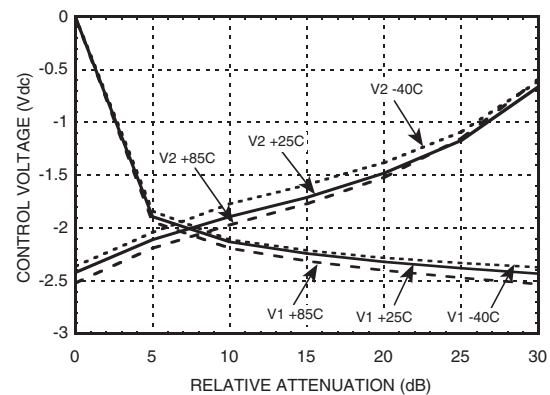
**Relative Attenuation**



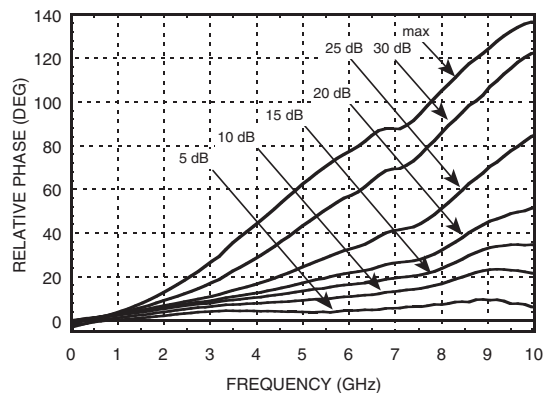
**Return Loss vs. Attenuation**



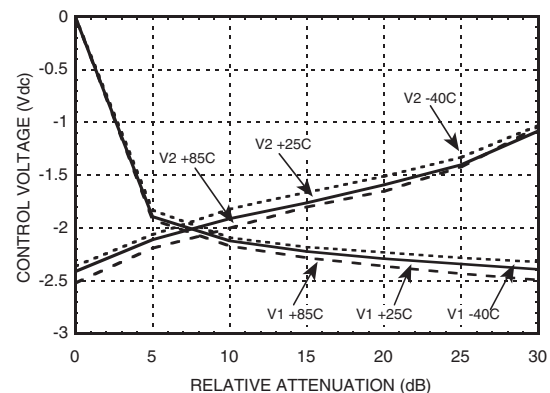
**Relative Attenuation vs.  
Control Voltage @ 4 GHz**



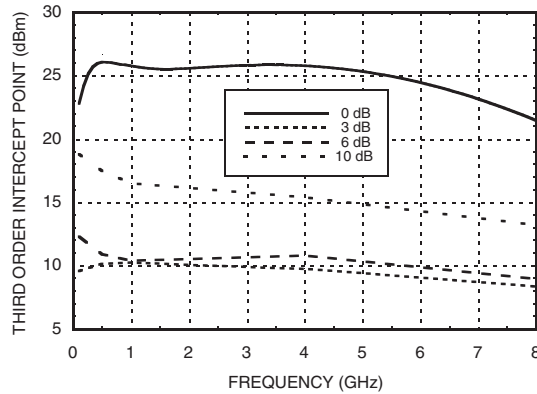
**Relative Phase**



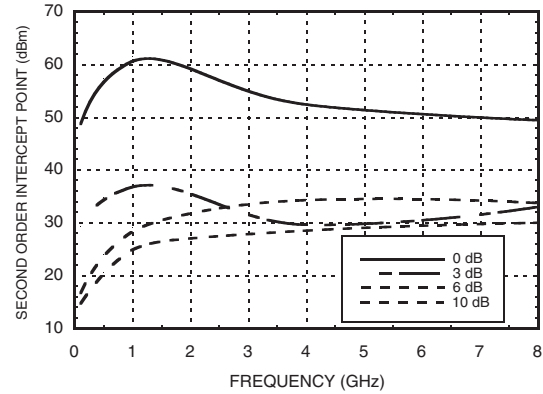
**Relative Attenuation vs.  
Control Voltage @ 8 GHz**



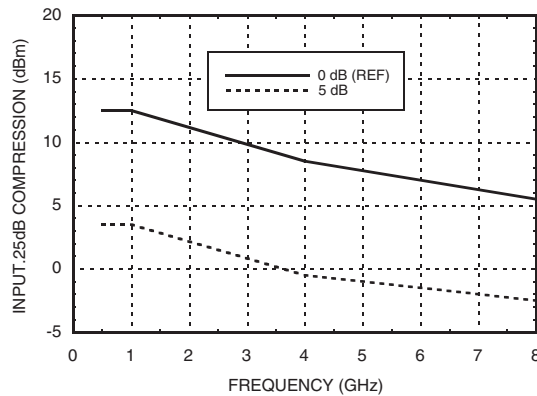
**Input Third Order Intercept vs Attenuation\***



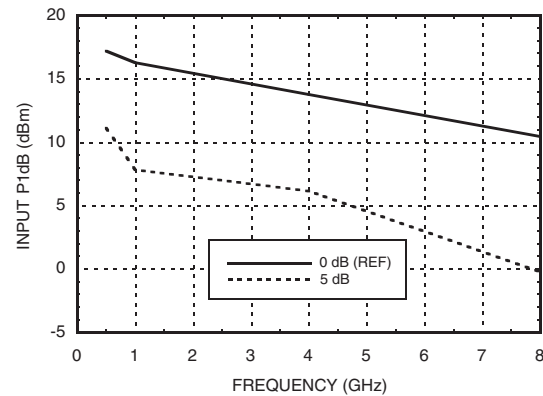
**Input Second Order Intercept vs. Attenuation\***



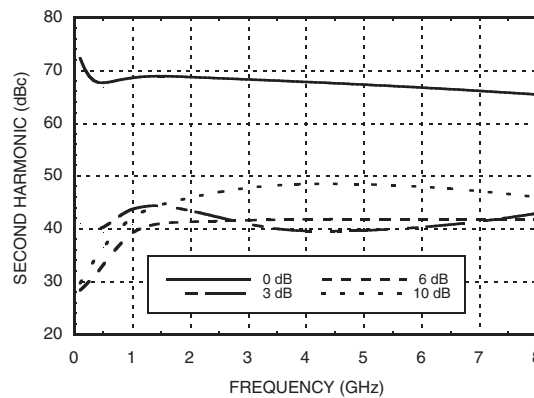
**0.25 dB Compression vs. Attenuation**



**1 dB Compression vs. Attenuation**



**Second Harmonic vs. Attenuation**



\*Two-tone input power = -8 dBm each tone, 1 MHz spacing.

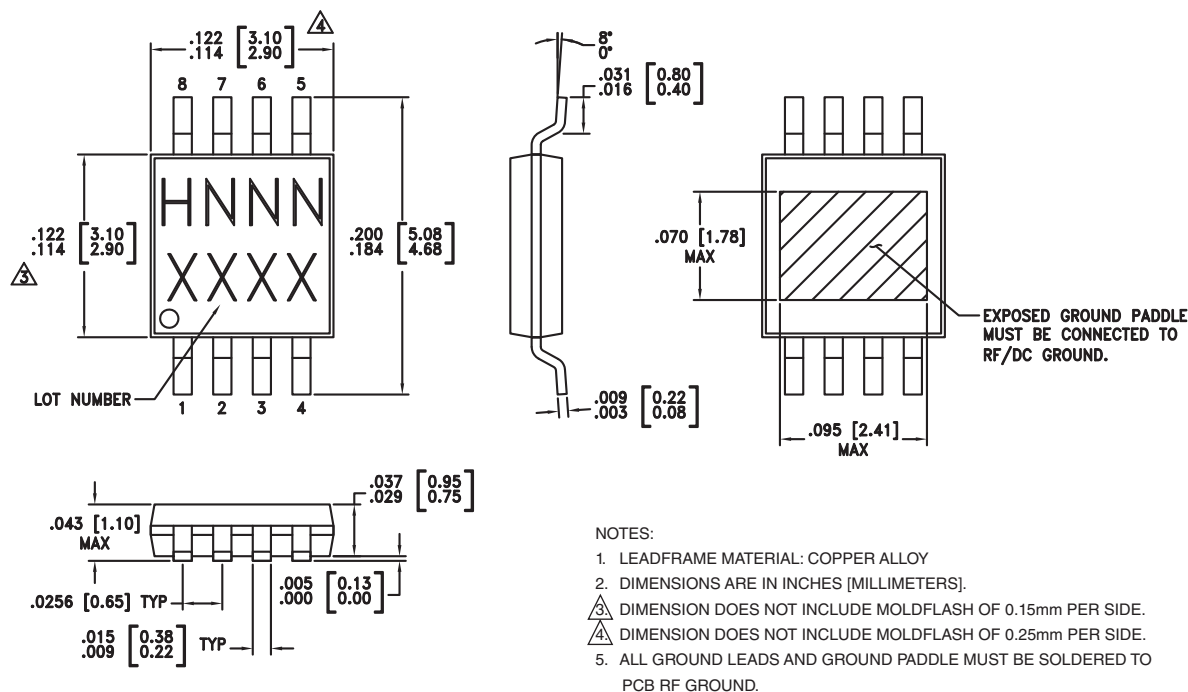
### Absolute Maximum Ratings

|                       |                |
|-----------------------|----------------|
| RF Input Power        | +18 dBm        |
| Control Voltage Range | +1 to -5 V     |
| Storage Temperature   | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C  |
| ESD Sensitivity (HBM) | Class 1A       |



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

### Outline Drawing



### Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC346MS8G  | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | H346<br>XXXX                   |
| HMC346MS8GE | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | H346<br>XXXX                   |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX



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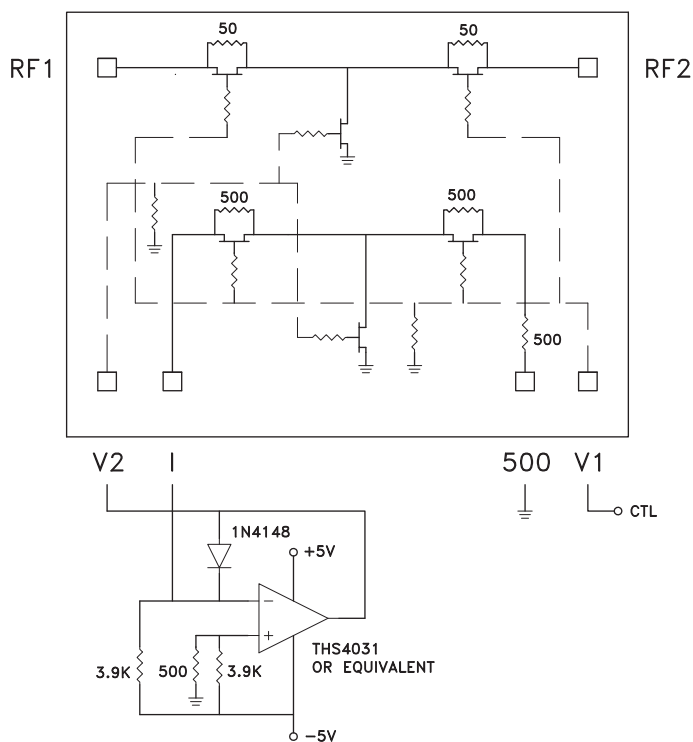
# HMC346MS8G / 346MS8GE

## GaAs MMIC SMT VOLTAGE-VARIABLE ATTENUATOR, DC - 8 GHz

### Pin Descriptions

| Pin Number | Function   | Description                                                                                                             | Interface Schematic |
|------------|------------|-------------------------------------------------------------------------------------------------------------------------|---------------------|
| 1, 8       | RF1<br>RF2 | This pin is DC coupled and matched to 50 Ohm. Blocking capacitors are required if RF line potential is not equal to 0V. |                     |
| 2, 7       | GND        | This pin must be DC grounded.                                                                                           |                     |
| 3, 6       | V2, V1     | Control Input (Master).                                                                                                 |                     |
| 4          | I          | Control Input (Slave).                                                                                                  |                     |
| 5          | N/C        | Not Connected.                                                                                                          |                     |

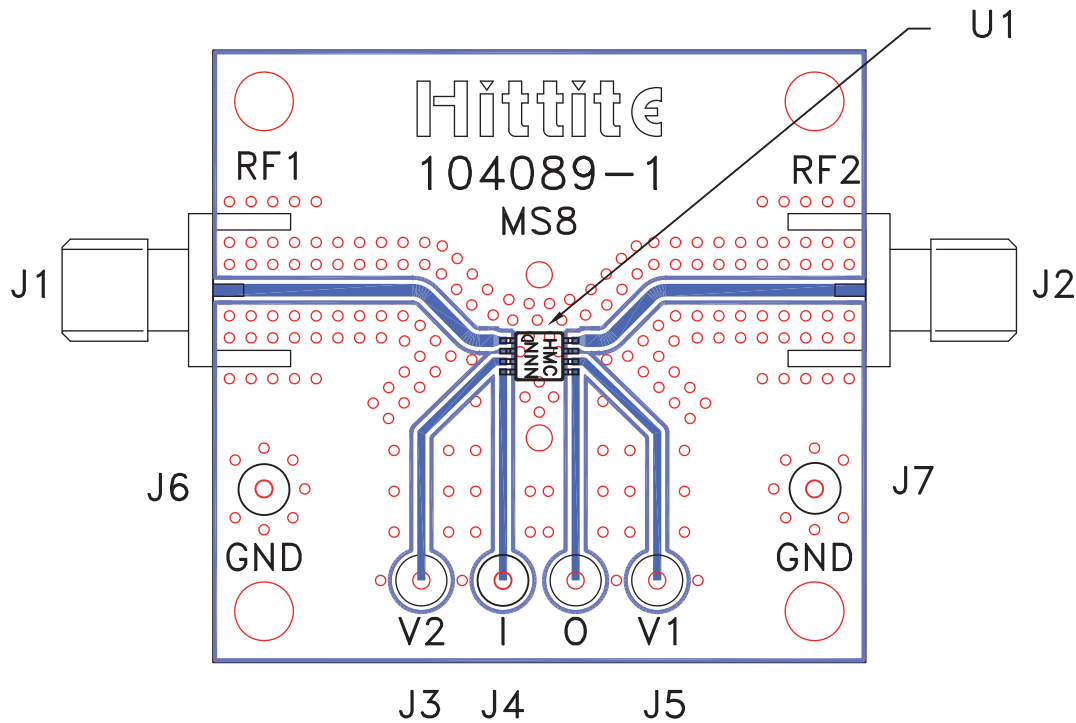
### Single-Line Control Driver



External op-amp control circuit maintains impedance match while attenuation is varied. Input control ranges from 0 Volts (min. attenuation) to -2.5 Volts (max. attenuation.)

For price, delivery, and to place orders, please contact Hittite Microwave Corporation:  
 20 Alpha Road, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373  
 Order On-line at [www.hittite.com](http://www.hittite.com)

**Evaluation PCB**



**List of Materials for Evaluation PCB 104091 [1]**

| Item    | Description                |
|---------|----------------------------|
| J1 - J2 | PCB Mount SMA RF Connector |
| J3 - J7 | DC PIN                     |
| U1      | HMC346MS8G / HMC346MS8GE   |
| PCB [2] | 104089 Eval Board          |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the final application should be generated with proper RF circuit design techniques. Signal lines at the RF ports should be 50 ohm impedance and the package ground leads and package bottom should be connected directly to the PCB RF ground plane, similar to that shown above. The evaluation circuit board shown above is available from Hittite Microwave Corporation upon request.