

1 dB LSB GaAs MMIC 5-BIT DIGITAL ATTENUATOR, 0.7 - 3.8 GHz

Typical Applications

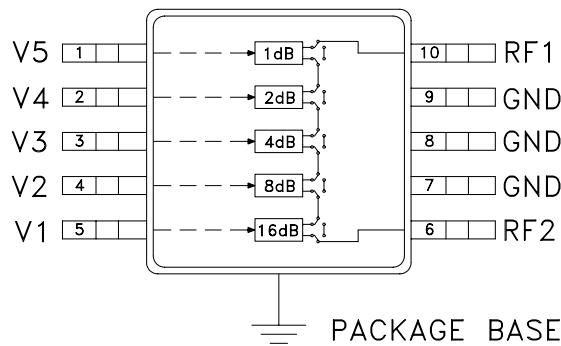
The HMC273AMS10G(E) is ideal for:

- Cellular; UMTS/3G Infrastructure
- ISM, MMDS, WLAN, WiMAX
- Microwave Radio & VSAT
- Test Equipment and Sensors

Features

- RoHs Compliant Product
- 1 dB LSB Steps to 31 dB
- Single Positive Control Per BIT
- ±0.2 dB Typical Bit Error
- Miniature MSOP 10 Package: 14.8mm²
- Included in the HMC-DK004 Designer's Kit

Functional Diagram



General Description

The HMC273AMS10G(E) is a general purpose broadband 5-Bit positive control GaAs IC digital attenuator in a 10 lead MSOP plastic package. Covering 0.7 to 3.8 GHz, the insertion loss is typically less than 3 dB. The attenuator bit values are 1 (LSB), 2, 4, 8, and 16 dB for a total attenuation of 31 dB. Accuracy is excellent at ±0.2 dB typical with an IIP3 of up to +46 dBm. Five bit control voltage inputs, toggled between 0 and +3 to +5 volts, are used to select each attenuation state. A single Vdd bias of +3 to +5 volts applied through an external 5K Ohm resistor is required.

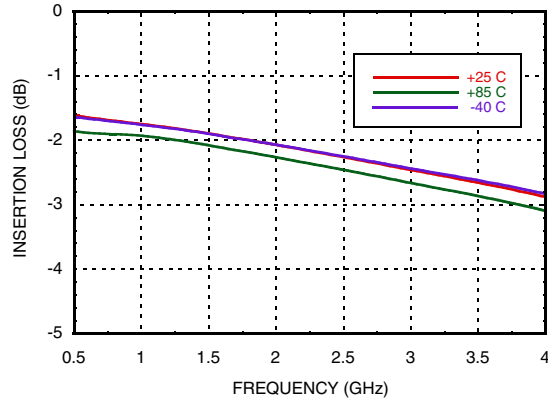
Electrical Specifications,

$T_A = +25^\circ\text{C}$, $V_{dd} = +3\text{V to } +5\text{V}$ & $V_{ctl} = 0/V_{dd}$ (Unless Otherwise Stated)

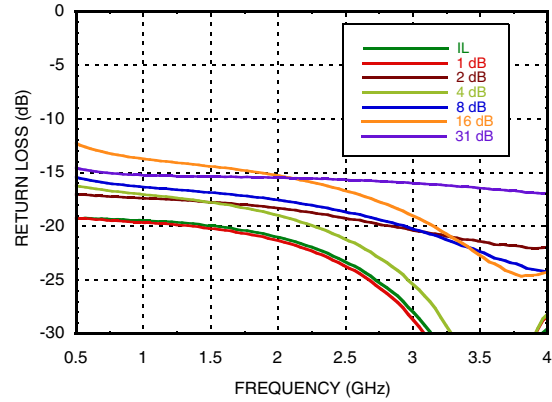
| Parameter | Frequency | Min. | Typical | Max. | Units |
|--|---------------|-------------------------------------|---------|------|-------|
| Insertion Loss | 0.7 - 1.4 GHz | | 1.8 | 2.4 | dB |
| | 1.4 - 2.3 GHz | | 2.3 | 2.9 | dB |
| | 2.3 - 2.7 GHz | | 2.5 | 3.1 | dB |
| | 2.7 - 3.8 GHz | | 2.9 | 3.5 | dB |
| Attenuation Range | 0.7 - 3.8 GHz | | 31 | | dB |
| Return Loss (RF1 & RF2, All Atten. States) | 0.7 - 1.4 GHz | 10 | 14 | | dB |
| | 1.4 - 2.7 GHz | 11 | 15 | | dB |
| | 2.7 - 3.8 GHz | 12 | 16 | | dB |
| Attenuation Accuracy: (Referenced to Insertion Loss) All Attenuation States All Attenuation States All Attenuation States All Attenuation States | 0.7 - 1.4 GHz | ± (0.30 + 3% of Atten. Setting) Max | | | dB |
| | 1.4 - 2.2 GHz | ± (0.30 + 4% of Atten. Setting) Max | | | dB |
| | 2.2 - 2.7 GHz | ± (0.40 + 5% of Atten. Setting) Max | | | dB |
| | 2.7 - 3.8 GHz | ± (0.50 + 5% of Atten. Setting) Max | | | dB |
| Input Power for 0.1 dB Compression | 0.7 - 3.8 GHz | Vdd = 5V | 28 | | dBm |
| | | Vdd = 3V | 26 | | dBm |
| Input Third Order Intercept Point (Two-tone Input Power = 0 dBm Each Tone) | 0.7 - 3.8 GHz | Vdd = 5V | 46 | | dBm |
| | | Vdd = 3V | 45 | | dBm |
| Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF) | 0.7 - 3.8 GHz | | 1250 | | ns |
| | | | 1300 | | ns |

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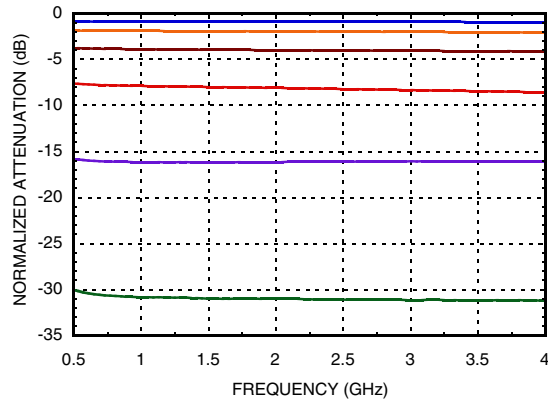
Insertion Loss vs. Temperature



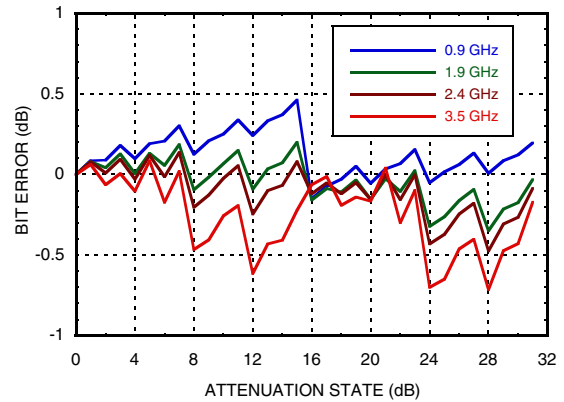
Return Loss RF1, RF2
(Only Major States are Shown)



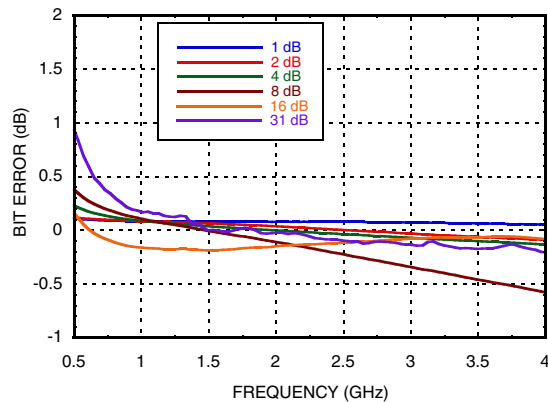
Normalized Attenuation
(Only Major States are Shown)



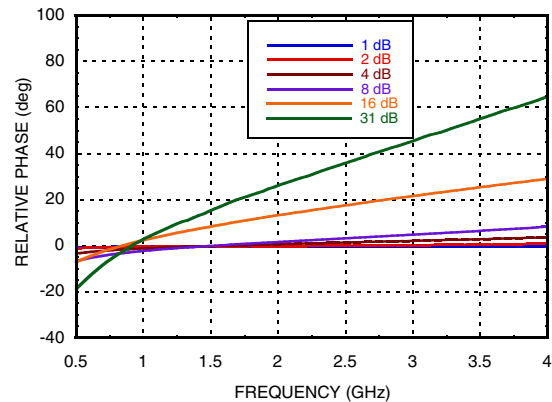
Bit Error vs. Attenuation State



Bit Error vs. Frequency
(Only Major States are Shown)



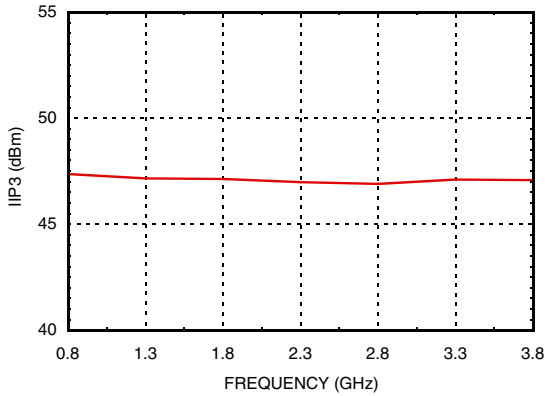
Relative Phase vs. Frequency
(Only Major States are Shown)



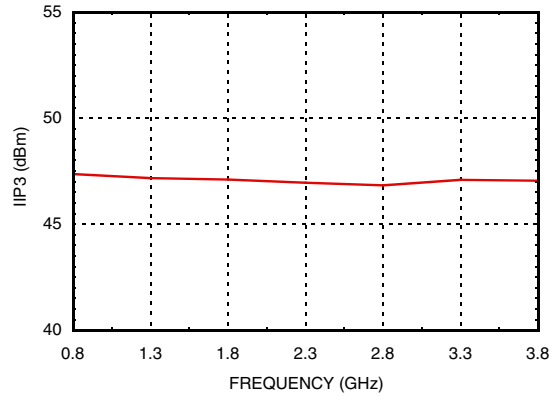
Note: All Data Typical Over Voltage (+3V to +5V)

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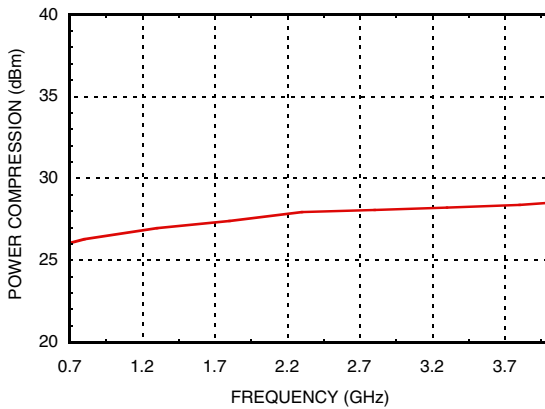
**Input IP3 Vs. Frequency @ VDD= 3V,
 $T_A = +25^\circ\text{C}$**



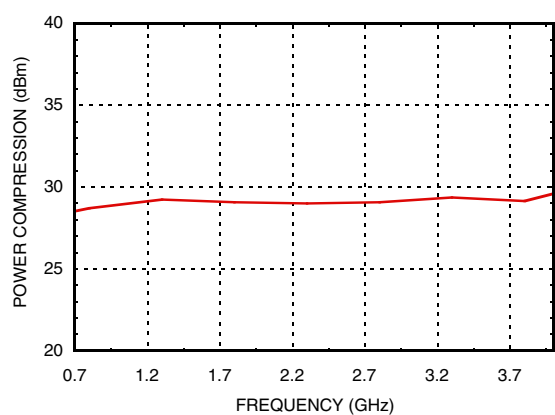
**Input IP3 vs. Frequency @ VDD= 5V,
 $T_A = +25^\circ\text{C}$**



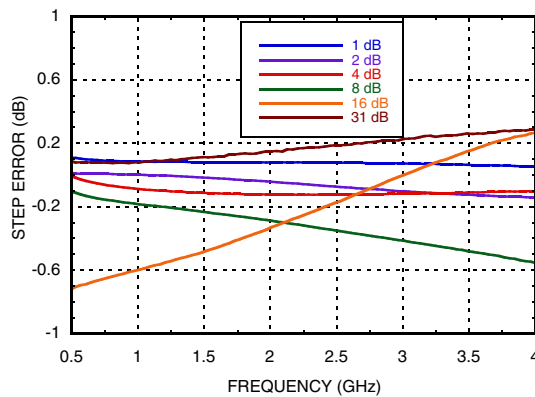
**P0.1dB Vs. Frequency @ VDD= 3V,
 $T_A = +25^\circ\text{C}$**



**P0.1dB Vs. Frequency @ VDD= 5V,
 $T_A = +25^\circ\text{C}$**

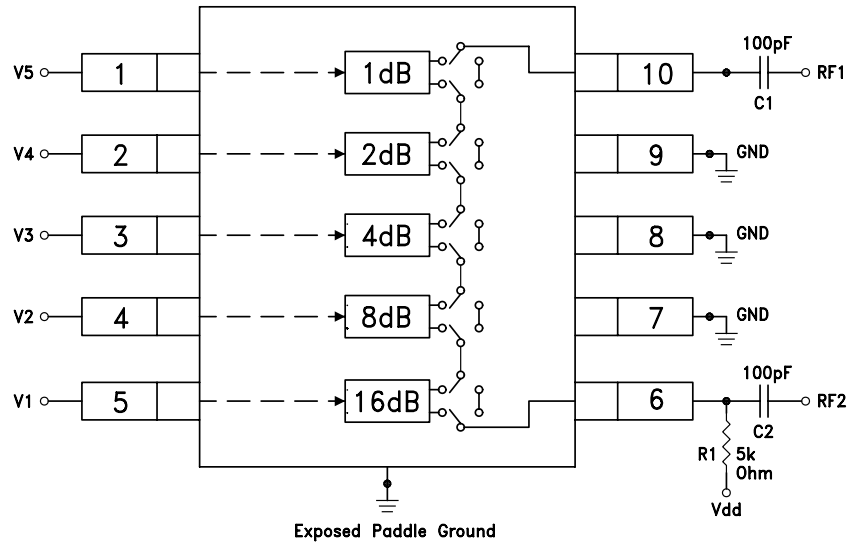


**Step Error Vs. Frequency
(Only Major States are Shown)**



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Application Circuit



DC blocking capacitors C1 & C2 are required on RF1 & RF2. Choose C1 = C2 = 100 ~ 300 pF to allow lowest customer specific frequency to pass with minimal loss. R1 = 5K Ohm is required to supply voltage to the circuit through either PIN 6 or PIN 10.

Truth Table

| Control Voltage Input | | | | | Attenuation Setting RF1 - RF2 |
|-----------------------|------------|------------|------------|------------|----------------------------------|
| V1 16 dB | V2 8 dB | V3 4 dB | V4 2 dB | V5 1 dB | |
| High | High | High | High | High | Reference I.L. |
| High | High | High | High | Low | 1 dB |
| High | High | High | Low | High | 2 dB |
| High | High | Low | High | High | 4 dB |
| High | Low | High | High | High | 8 dB |
| Low | High | High | High | High | 16 dB |
| Low | Low | Low | Low | Low | 31 dB Max. Atten. |

Any combination of the above states will provide an attenuation approximately equal to the sum of the bits selected.

Control Voltages

| State | Bias Condition |
|-------|-------------------------|
| Low | 0 to +0.2 V @ < 1uA Max |
| High | Vdd ± 0.2V @ 1uA Max |

Note: Vdd = +3V to 5V ± 0.2V

Absolute Maximum Ratings

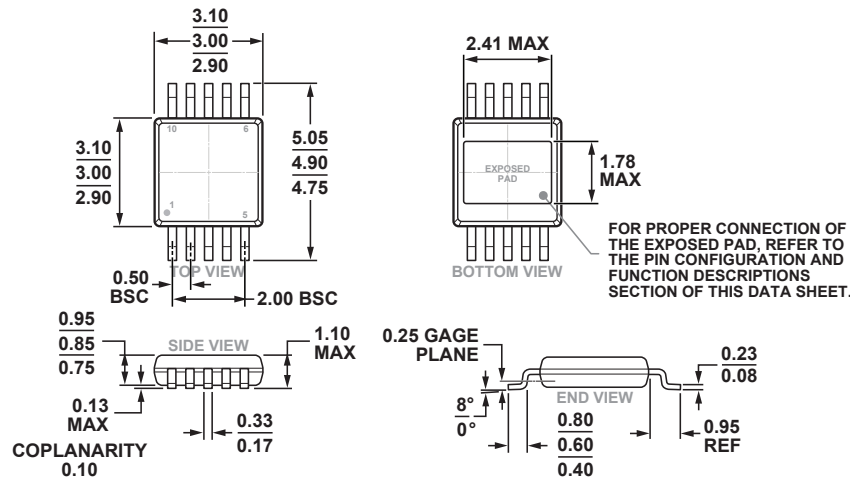
| | |
|---------------------------|----------------|
| Control Voltage (V1 - V5) | Vdd + 0.5 V |
| Bias Voltage (Vdd) | +8.0 Vdc |
| Channel Temperature | 150 °C |
| Continuous Pdiss | 0.68 W |
| Thermal Resistance | 95°C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |
| RF Input Power | +26 dBm |
| ESD Sensitivity (HBM) | Class 1A |



ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

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Outline Drawing



FOR PROPER CONNECTION OF THE EXPOSED PAD, REFER TO THE PIN CONFIGURATION AND FUNCTION DESCRIPTIONS SECTION OF THIS DATA SHEET.

COMPLIANT TO JEDEC STANDARDS MO-187-BA-T

10-Lead Mini Small Outline Package with Exposed Pad [MINI_SO_EP] (RH-10-3)
Dimensions shown in millimeters

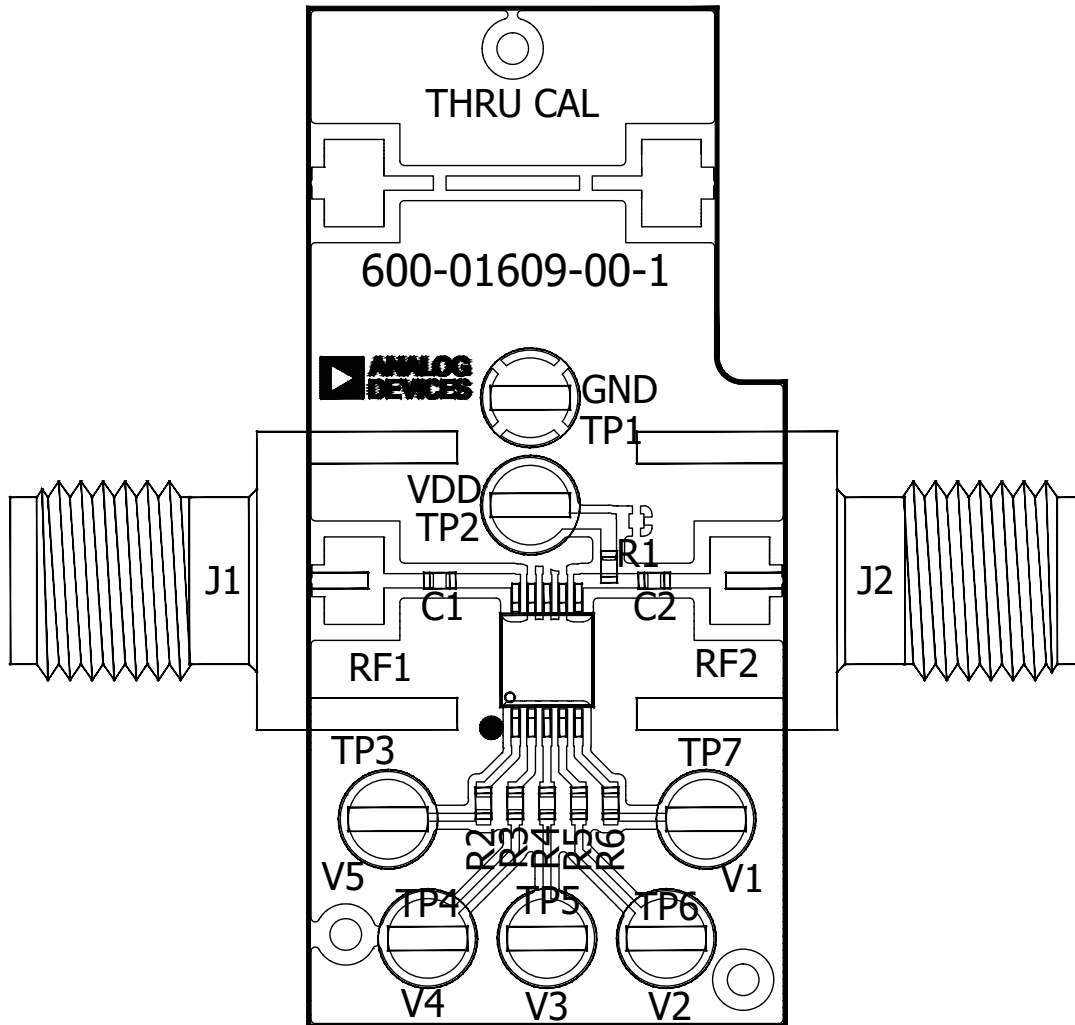
Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating | Package Marking ^[2] |
|---------------|--|---------------|---------------------|--------------------------------|
| HMC273AMS10GE | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL3 ^[1] | 273A XXXX |

[1] Max peak reflow temperature of 260 °C
[2] 4 - Digit lot number XXXX

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Evaluation Circuit Board



List of Materials for Evaluation PCB EV1HMC273AMS10G^[1]

| Item | Description |
|------------|---|
| J1 - J2 | PCB Mount SMA Connector |
| J3 - J6 | DC Pin |
| R1 | 5 kOhm Resistor, 0402 Chip |
| R2, R3, R4 | 100 Ohm Resistor, 0402 Chip |
| C1, C2 | 0402 Chip Capacitor, Select for Lowest Frequency of Operation |
| U1 | HMC273AMS10GE Digital Attenuator |
| PCB [2] | EV1HMC273AMS10G Evaluation PCB 1.5" x 1.5" |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 Ohm impedance while the package ground leads and exposed ground paddle should be connected directly to the ground plane similar to that shown below. A sufficient number of via holes should be used to connect the top and bottom ground planes. The evaluation circuit board as shown is available from Analog Devices, upon request.

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- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
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