HMC273MS10G / 273MS10GE

v04.0907

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

RoHS✓ EARTH FRIENDLY

Designer's Kit Available

Typical Applications

The HMC273MS10G(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

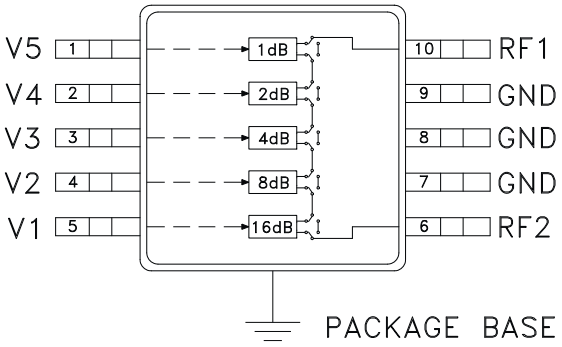
Single Positive Control Per BIT

±0.2 dB Typical Bit Error

Miniature MSOP 10 Package: 14.8mm²

Included in the HMC-DK004 Designer's Kit

Functional Diagram



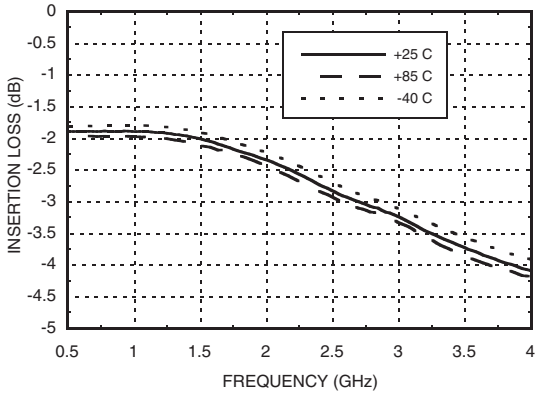
General Description

The HMC273MS10G(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 2.5 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 +48 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° C, Vdd = +3V to +5V & Vctl = 0/Vdd (Unless Otherwise Stated)

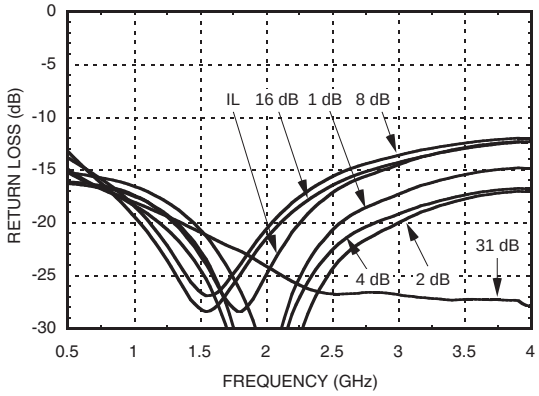
Parameter		Frequency	Min.	Typical	Max.	Units
Insertion Loss		0.7 - 1.4 GHz 1.4 - 2.3 GHz 2.3 - 2.7 GHz 2.7 - 3.7 GHz 3.7 - 3.8 GHz		1.8 2.3 2.8 3.5 3.9	2.4 2.9 3.4 4.2 4.4	dB dB dB dB dB
Attenuation Range		0.7 - 3.8 GHz		31		dB
Return Loss (RF1 & RF2, All Atten. States)		0.7 - 1.4 GHz 1.4 - 2.7 GHz 2.7 - 3.8 GHz	11 12 10	17 20 14		dB dB dB
Attenuation Accuracy: (Referenced to Insertion Loss) All Attenuation States All Attenuation States All Attenuation States All Attenuation States		0.7 - 1.4 GHz 1.4 - 2.2 GHz 2.2 - 2.7 GHz 2.7 - 3.8 GHz	± (0.30 + 3% of Atten. Setting) Max ± (0.30 + 4% of Atten. Setting) Max ± (0.40 + 5% of Atten. Setting) Max ± (0.50 + 5% of Atten. Setting) Max			dB dB dB dB
Input Power for 0.1 dB Compression	Vdd = 5V Vdd = 3V	0.7 - 3.8 GHz		27 22		dBm dBm
Input Third Order Intercept Point (Two-tone Input Power = 0 dBm Each Tone)	Vdd = 5V Vdd = 3V	0.7 - 3.8 GHz		48 46		dBm dBm
Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF)		0.7 - 3.8 GHz		560 600		ns ns

Insertion Loss vs. Temperature



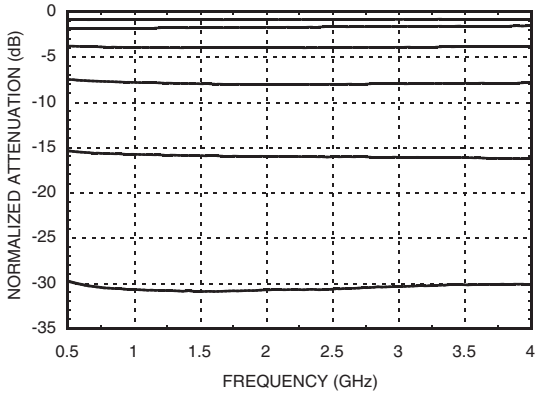
Return Loss RF1, RF2

(Only Major States are Shown)

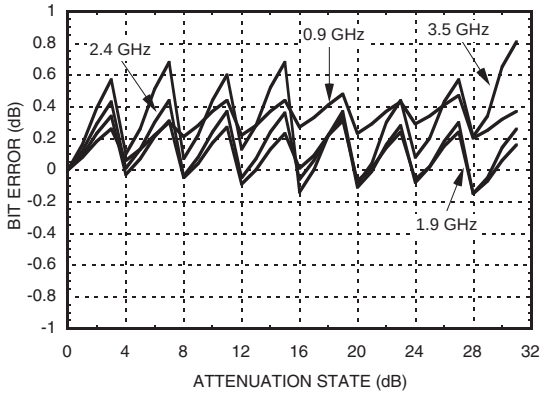


Normalized Attenuation

(Only Major States are Shown)

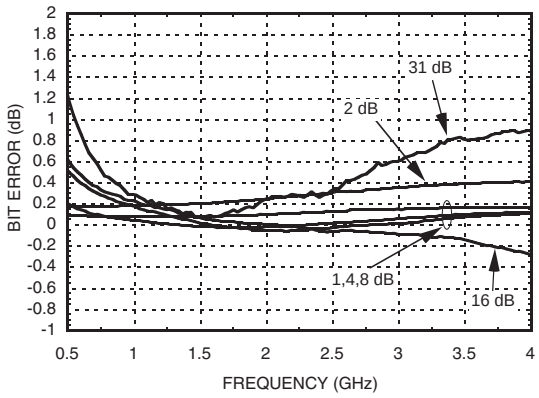


Bit Error vs. Attenuation State



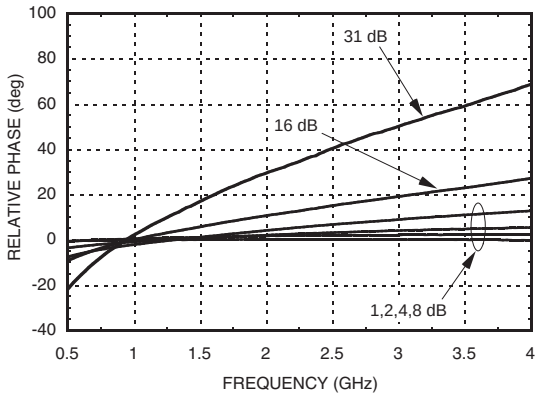
Bit Error vs. Frequency

(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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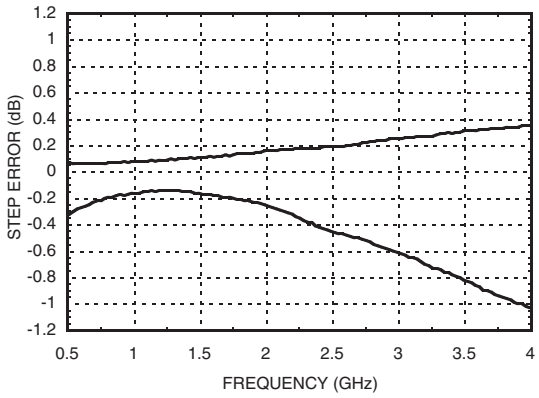
Worst Case Step Error Between Successive Attenuation States



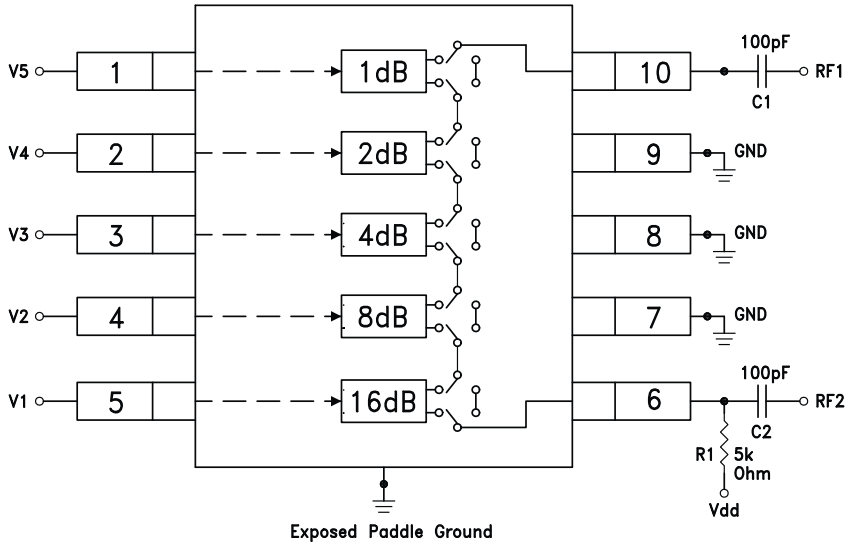
Truth Table

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 @ 20 uA Max
High	Vdd ± 0.2V @ 100 uA Max
Note: Vdd = +3V to 5V ± 0.2V	

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.

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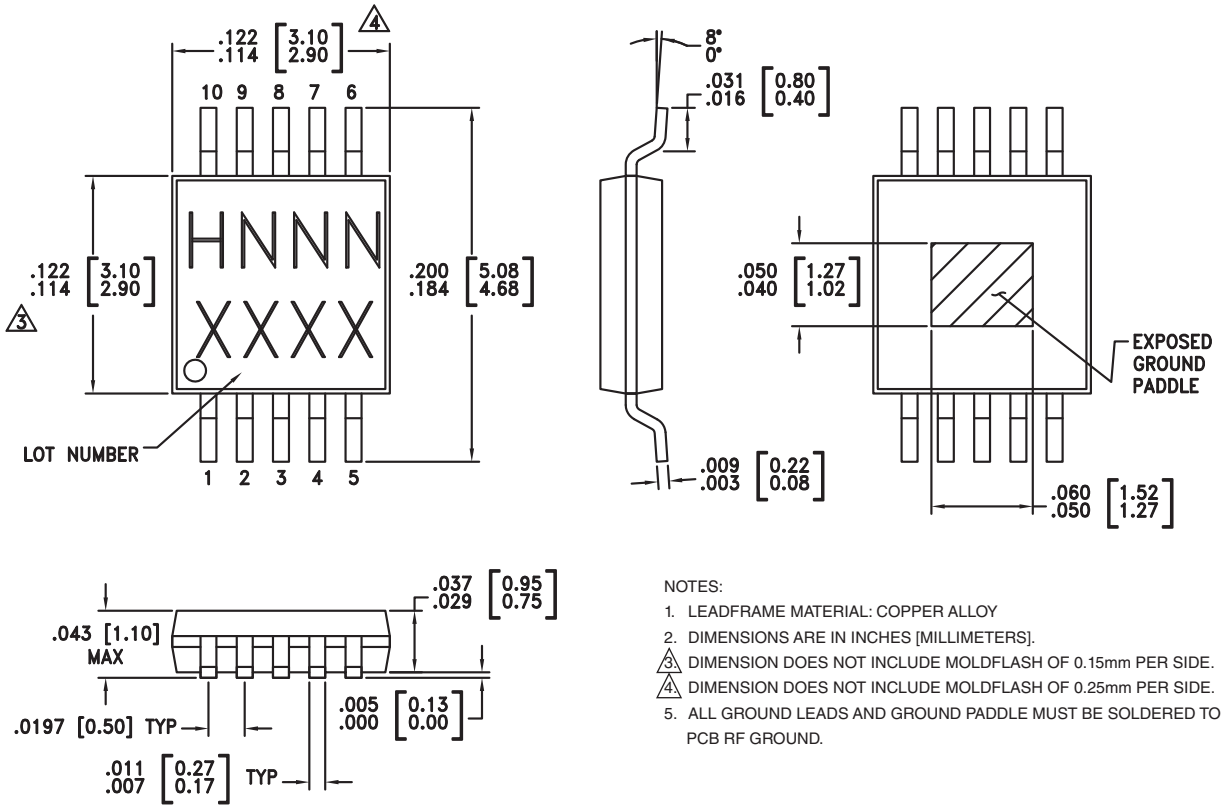
ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Absolute Maximum Ratings

Control Voltage (V1 - V5)	Vdd + 0.5 Vdc
Bias Voltage (Vdd)	+8.0 Vdc
Channel Temperature	150 °C
Continuous Pdiss (T=85°C) (derate 6mW/°C above 85°C)	0.4 W
Thermal Resistance	163 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
RF Input Power (0.7 - 3.7 GHz)	+30 dBm
ESD Sensitivity (HBM)	Class 1A

Outline Drawing



NOTES:

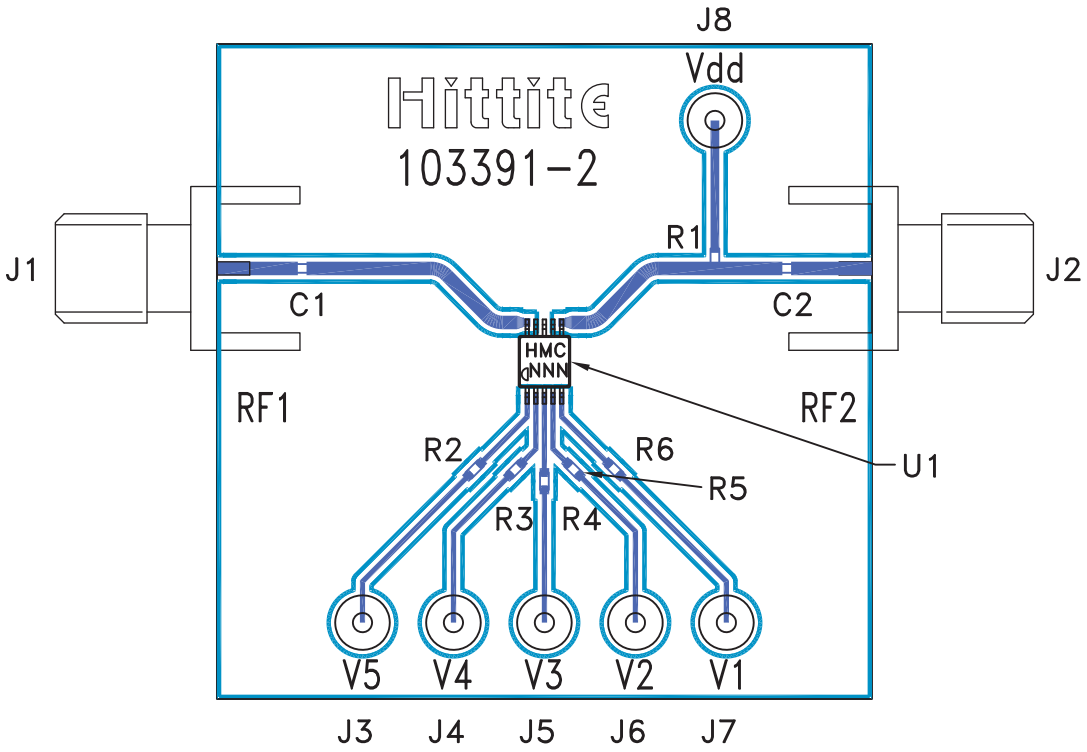
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS].
3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
5. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [3]
HMC273MS10G	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 [1]	H273 XXXX
HMC273MS10GE	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H273 XXXX

[1] Max peak reflow temperature of 235 °C
[2] Max peak reflow temperature of 260 °C
[3] 4-Digit lot number XXXX

Evaluation Circuit Board



* R2 - R6 = 100 Ohm. These resistors are optional and may be used to enhance decoupling of the RF path from the control inputs.

List of Materials for Evaluation PCB 103393 [1]

Item	Description
J1 - J2	PCB Mount SMA Connector
J3 - J6	DC Pin
R1	5k Ohm Resistor, 0402 Chip
R2, R3, R4	100 Ohm Resistor, 0402 Chip
C1, C2	0402 Chip Capacitor, Select for Lowest Frequency of Operation
U1	HMC273MS10G / HMC273MS10GE Digital Attenuator
PCB [2]	103391 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 final 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 Hittite Microwave Corporation upon request.

Notes: