HMC273MS10G

1 dB LSB GaAs IC 5 - BIT DIGITAL ATTENUATOR 0.7 - 3.7 GHz

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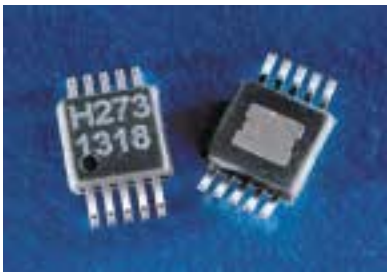
Features

1 dB LSB STEPS to 31 dB

SINGLE POSITIVE CONTROL PER BIT

+/- 0.5 dB TYPICAL BIT ERROR

MINIATURE MSOP 10 PACKAGE: 14.8 mm²



General Description

The HMC273MS10G is a broadband 5 - bit positive control GaAs IC digital attenuator in a 10 lead MSOP plastic package. Covering 0.7 to 3.7 GHz the insertion loss is typically less than 2 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 ± 0.5 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 5KΩ resistor is required. The HMC273MS10G is ideal for cellular, PCS, ISM, MMDS, and WLL applications and is an excellent alternative to the HMC235QS16G. At 14.8 mm², this is the smallest 5 - bit digital attenuator available in the market.

Guaranteed Performance

With Vdd =+3V to +5V & Vctl = 0/Vdd (Unless Otherwise Stated), -40 to +85 deg C

Parameter		Frequency	Min.	Typ.	Max.	Units
Insertion Loss		0.7 - 1.4 GHz 1.4 - 2.3 GHz 2.3 - 2.7 GHz 2.7 - 3.7 GHz		1.8 2.1 2.4 2.8	2.4 2.7 3.0 3.5	dB dB dB dB
Attenuation Range		0.7 - 3.7 GHz		31		dB
Return Loss (RF1 & RF2, All Atten. States)		0.7 - 1.4 GHz 1.4 - 2.7 GHz 2.7 - 3.7 GHz	11 14 10	17 20 14		dB dB dB
Attenuation Accuracy: (Referenced to Insertion Loss)						
All Attenuation States All Attenuation States All Attenuation States 1 - 15 dB States 16 - 31 dB States		0.7 - 1.4 GHz 1.4 - 2.3 GHz 2.3 - 2.7GHz 2.7 - 3.7 GHz 2.7 - 3.7 GHz	± 0.35 + 3% of Atten. Setting Max ± 0.25 + 3% of Atten. Setting Max ± 0.30 + 5% of Atten. Setting Max ± 0.30 + 5% of Atten. Setting Max ± 0.50 + 8% of Atten. Setting Max			dB dB dB dB dB
Input Power for 0.1 dB Compression	Vdd= 5V Vdd= 3V	0.7- 3.7 GHz		24 22		dBm dBm
Input Third Order Intercept Point (Two-Tone Onput Power = 0dBm Each).	Vdd= 5V Vdd= 3V	0.7- 3.7 GHz		48 46		dBm dBm
Switching Characteristics		0.7- 3.7 GHz				
tRISE, tFALL (10/90%RF) tON/tOFF (50% CTL to 10/90% RF)				560 600		ns ns

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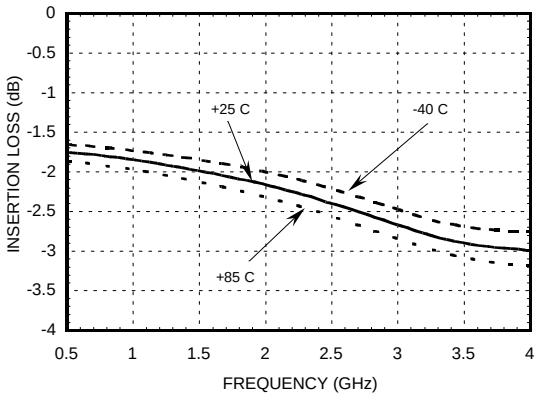
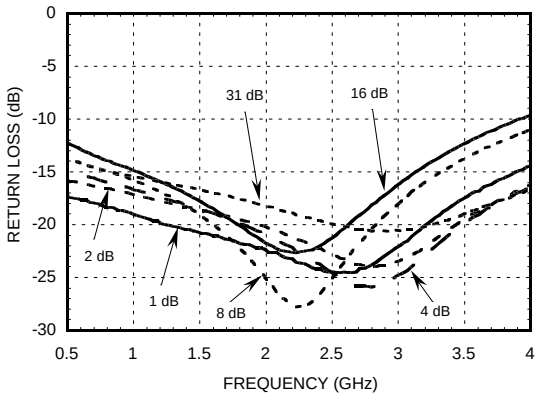
Insertion Loss



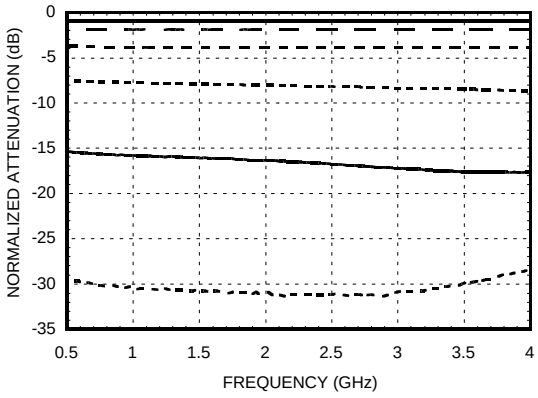
Return Loss RF1, RF2 for Major

(Only Major States are Shown)

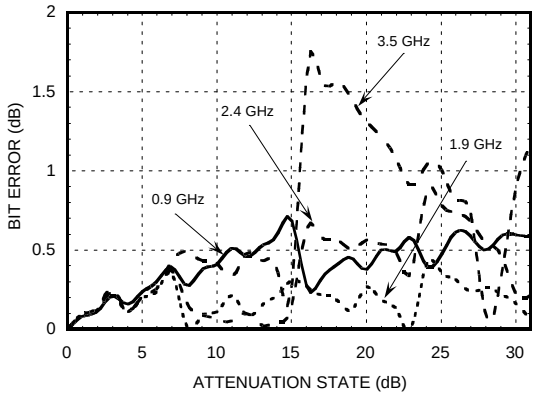


Normalized Attenuation

(Only Major States are Shown)



Absolute Bit Error vs. Attenuation State



Note: All Data Typical Over Voltage (+3V to +5V) & Temperature (-40 to +85 deg.C).

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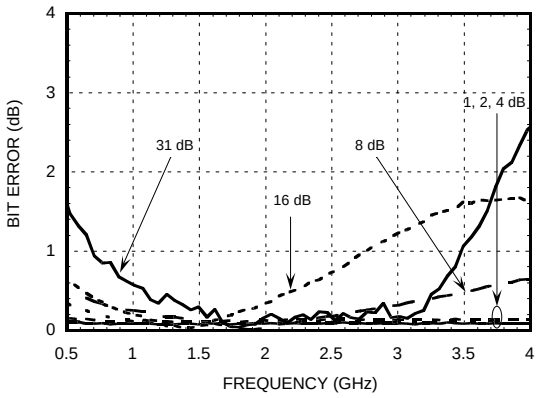
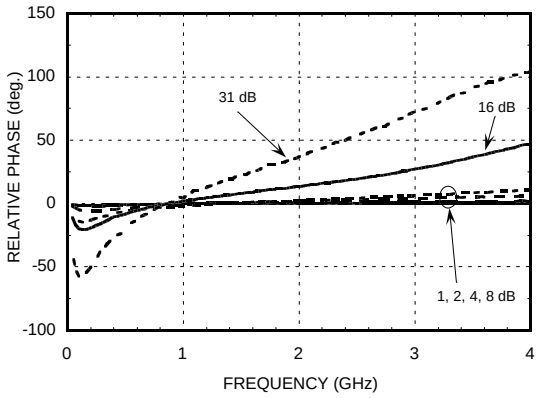
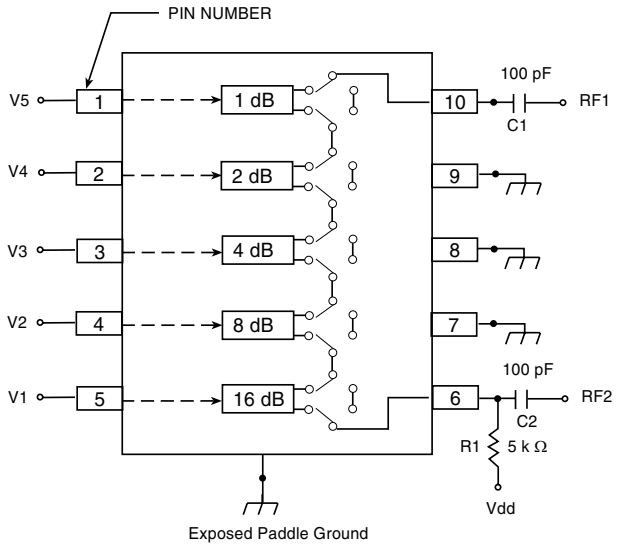
Absolute Bit Error vs Frequency
(Only Major States are Shown)



Relative Phase vs Frequency
(Only Major States are Shown)



Functional Diagram/ 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 = 5KΩ 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 above states will provide an attenuation approximately equal to the sum of the bits selected.					

Control Voltages

State	Bias Condition
Low	0 to +0.2V@ 20uA Max
High	Vdd ± 0.2V @ 100 uA Max
Note: Vdd = +3V to 5V ± 0.2 V	

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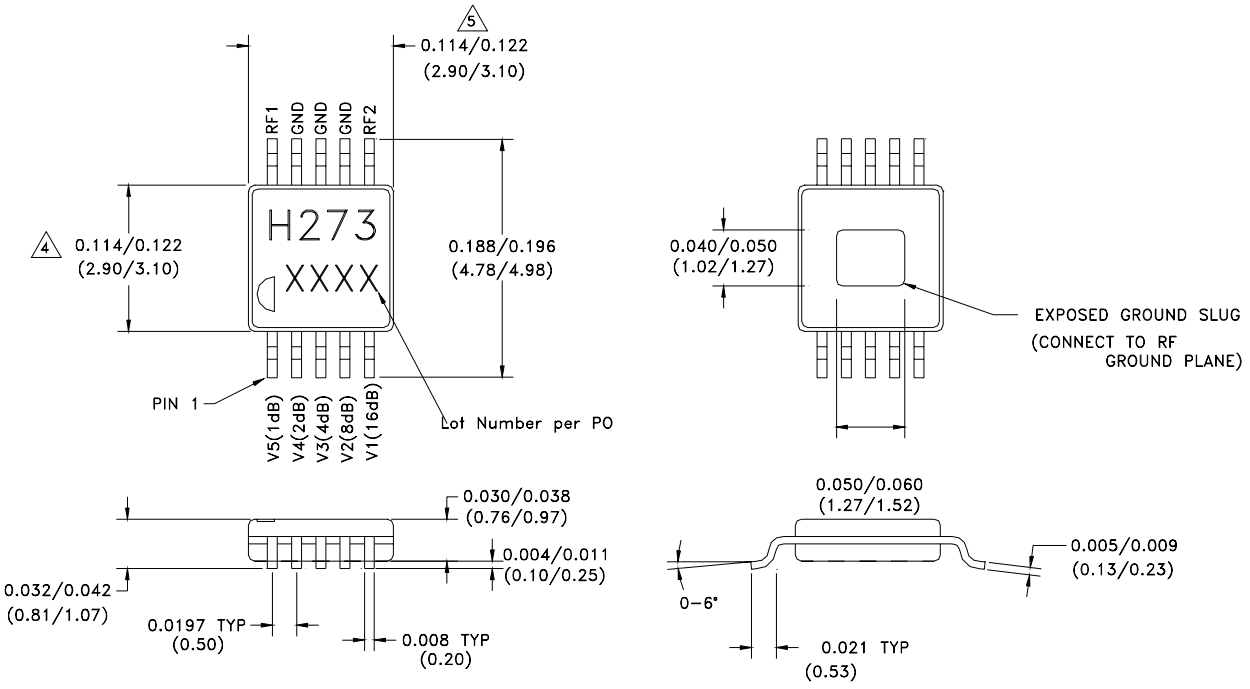
Absolute Maximum Ratings

Control Voltage (V1 - V5)	Vdd + 0.5 Vdc
Bias Voltage (Vdd)	+8.0 Vdc
Storage Temperature	-65 to +150 deg C
Operating Temperature	-40 to +85 deg C
RF Input Power (0.7 - 3.7 GHz)	+26 dBm

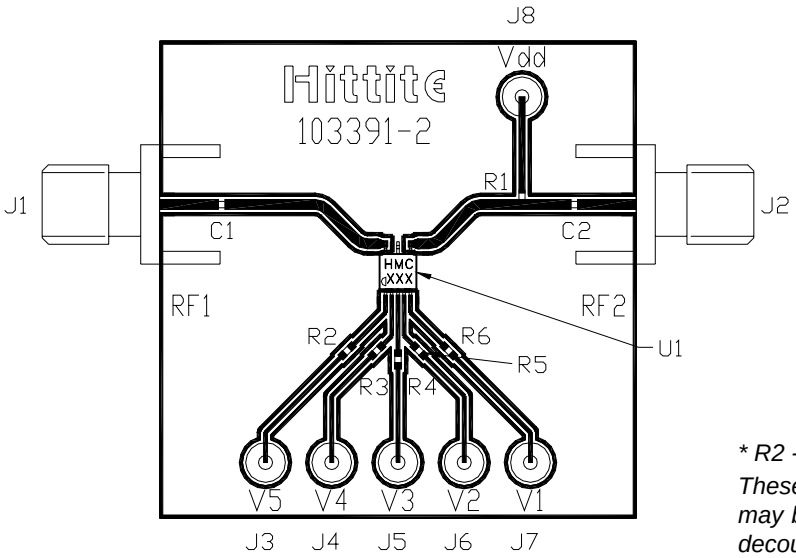
Outline



1. MATERIAL:
   A) PACKAGE BODY - LOW STRESS INJECTION-MOLDED PLASTIC.
   B) LEADFRAME MATERIAL: COPPER ALLOY
2. PLATING : LEAD - TIN SOLDER PLATE
3. DIMENSIONS ARE IN INCHES (MILLIMETERS).
   UNLESS OTHERWISE SPECIFIED ALL TOL. ARE ±0.005(±0.13).

4 DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15 MM PER SIDE
5 DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25 MM PER SIDE

Evaluation Circuit Board



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

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 paddle should be connected directly to the ground plane similar to that shown above. 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 upon request.

Evaluation Circuit Board Layout Design Details

Item	Description
J1 - J2	PC Mount SMA Connector
J3 - J6	DC Pin
R1	5k Ω Resistor, 0402 Chip
R2, R3, R4	100 Ω Resistor, 0402 Chip
C1, C2	0402 Chip Capacitor, Select Value for Lowest Frequency of Operation
U1	HMC273MS10G Digital Attenuator
PCB*	103391 Evaluation PCB 1.5" x 1.5"
*Circuit Board Material: Rogers 4350	

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NOTES: