HMC290

2 dB LSB GaAs MMIC 2-BIT DIGITAL ATTENUATOR, 0.7 - 4.0 GHz

Typical Applications

The HMC290 is ideal for:

- Cellular
- PCS, ISM, MMDS
- WLL Handset & BaseStation

Features

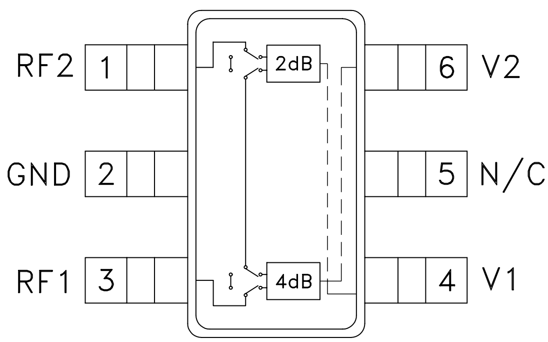
2 dB LSB Steps to 6 dB

Single Positive Control Per BIT

+/-0.2 dB Typical Bit Error

Miniature SOT 26 Package: 9 mm^2

Functional Diagram



General Description

The HMC290 is a broadband 2 - bit positive control GaAs IC digital attenuator in a 6 lead SOT26 surface mount plastic package. Covering 0.7 to 4 GHz, the insertion loss is typically less than 0.7 dB. The attenuator bit values are 2 (LSB) and 4 dB for a total attenuation of 6 dB. Accuracy is excellent at ± 0.2 dB typical with an IIP3 of up to +52 dBm. Two bit control voltage inputs, toggled between 0 and +3 to +5 volts, are used to select each attenuation state at less than 50 uA each. A single Vdd bias of +3 to +5 volts applied through an external 5K Ohm resistor is required. Occupying less than 9 mm^2, this is the smallest 2 - bit digital attenuator available.

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 - 4.0 GHz		0.5 0.5 0.6 0.8	0.7 0.8 0.9 1.2	dB dB dB dB
Attenuation Range		0.7 - 4.0 GHz		6		dB
Return Loss (RF1 & RF2, All Atten. States)		0.7 - 2.7 GHz 2.7 - 4.0 GHz	16 15	20 18		dB dB
Attenuation Accuracy: (Referenced to Insertion Loss) 2, 4 dB States 6 dB States		 0.7 - 4.0 GHz 0.7 - 4.0 GHz		 ± 0.2 + 2% of Atten. Setting Max ± 0.3 + 2% of Atten. Setting Max		 dB dB
Input Power for 0.1 dB Compression	5V 3V	0.7 - 4.0 GHz		27 24		dBm dBm
Input Third Order Intercept Point (Two-tone Input Power = 0 dBm Each Tone)	5V 3V	0.7 - 4.0 GHz		52 50		dBm dBm
Switching Characteristics tRISE, tFALL (10/90% RF) tON, tOFF (50% CTL to 10/90% RF)		0.7 - 4.0 GHz		 400 420		 ns ns

For price, delivery, and to place orders, please contact Hittite Microwave Corporation:
12 Elizabeth Drive, Chelmsford, MA 01824 Phone: 978-250-3343 Fax: 978-250-3373
Order Online at www.hittite.com

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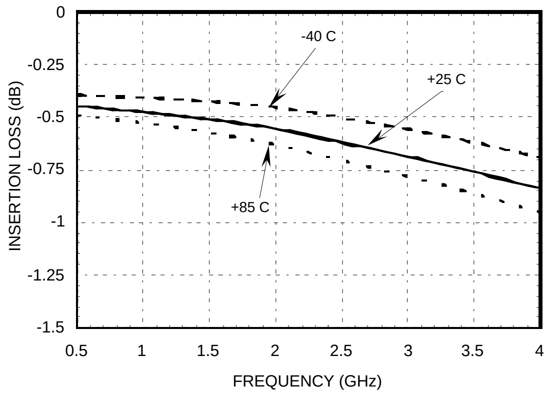
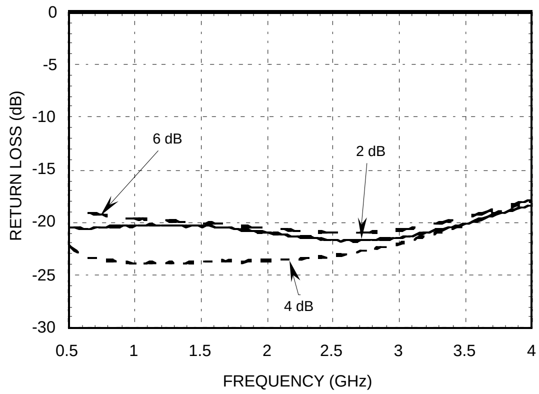
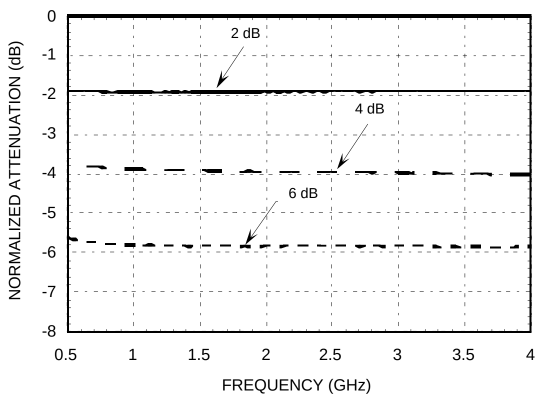
Insertion Loss



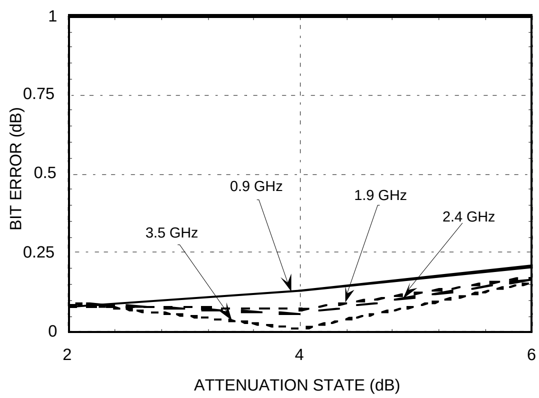
Return Loss RF1, RF2



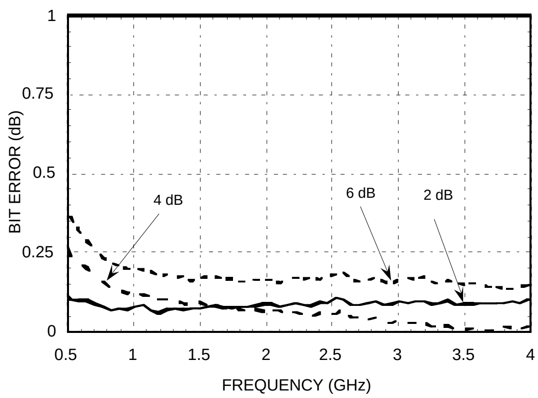
Normalized Attenuation



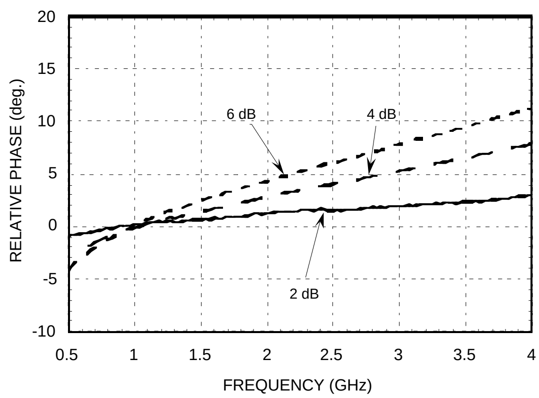
Absolute Bit Error vs. Attenuation State



Absolute Bit Error vs. Frequency



Relative Phase vs. Frequency



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

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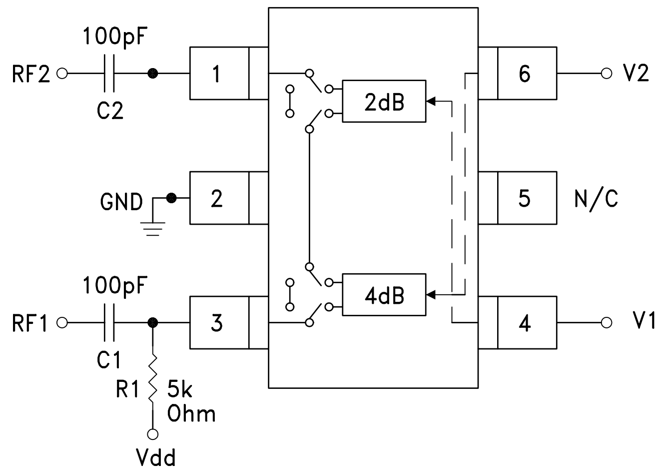
Truth Table

Control Voltage Input		Attenuation Setting RF1 - RF2
V2 4 dB	V1 2 dB	
High	High	Reference I.L.
High	Low	2 dB
Low	High	4 dB
Low	Low	6 dB Max. Atten.
Any combination of the above states will provide an attenuation approximately equal to the sum of the bits selected.		

Control & Bias Voltages

State	Bias Condition
Low	0 to + 0.2V @ 20 uA Max
High	Vdd ± 0.2V @ 50 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 throught either PIN 3 or PIN 1.

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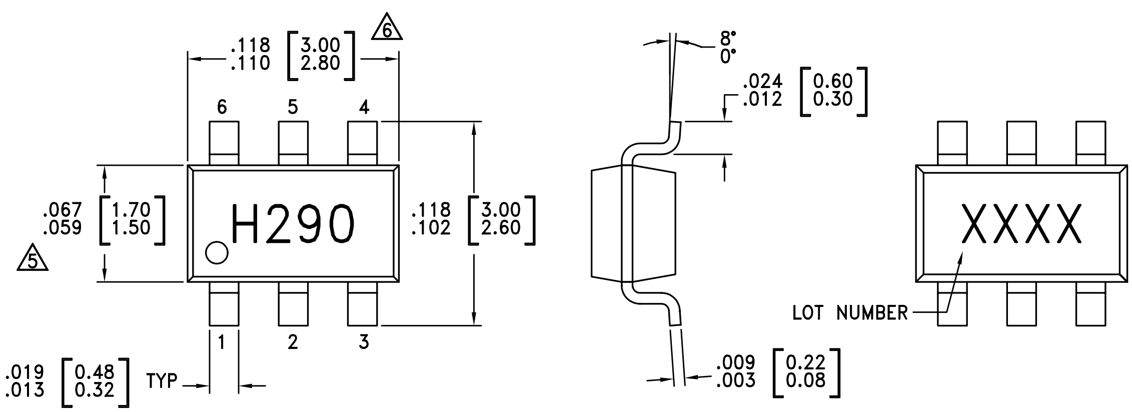
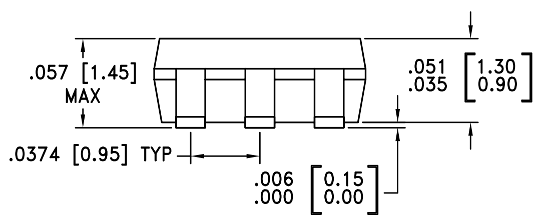
Absolute Maximum Ratings

Control Voltage (V1, V2)	Vdd + 0.5 Vdc
Bias Voltage (Vdd)	+ 8.0 Vdc
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
RF Input Power (0.7 - 4 GHz)	+28 dBm

Outline Drawing





NOTES:

1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
2. LEADFRAME MATERIAL: COPPER ALLOY
3. LEADFRAME PLATING: Sn/Pb SOLDER
4. DIMENSIONS ARE IN INCHES [MILLIMETERS].
5. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
6. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
7. ALL GROUND LEADS MUST BE SOLDERED TO PCB RF GROUND.

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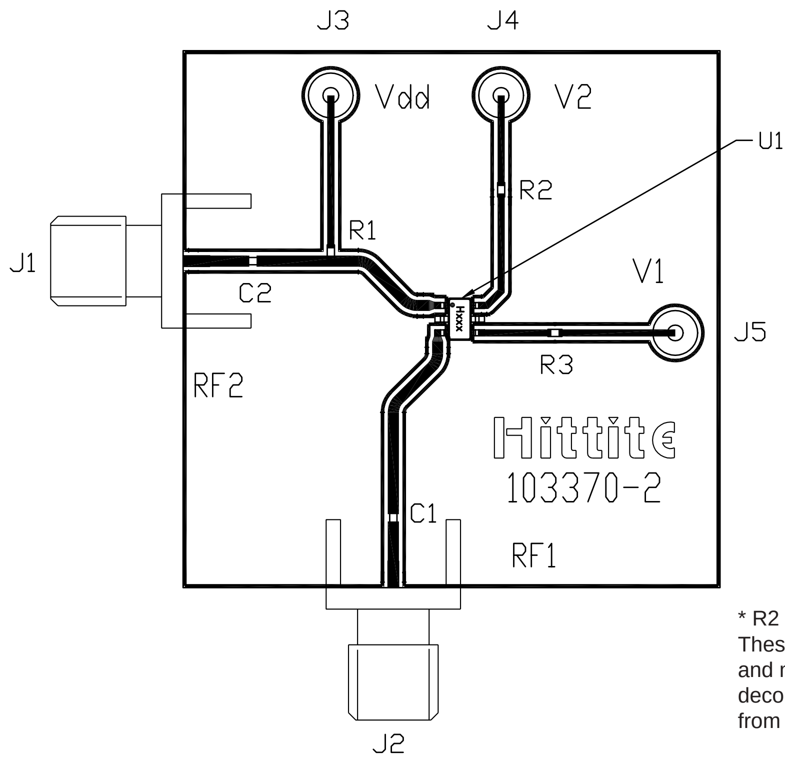
Evaluation Circuit Board



* R2 = R3 = 100 Ohm.
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 should be connected directly to the ground plane similar to that shown. 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.

List of Material

Item	Description
J1 - J2	PC Mount SMA Connector
J3 - J6	DC Pin
R1	5k Ohm Resistor, 0402 Chip
R2, R3	100 Ohm Resistor, 0402 Chip
C1, C2	0402 Chip Capacitor, Select for Lowest Frequency of Operation
U1	HMC290 Digital Attenuator
PCB*	103370 Evaluation PCB 1.5” x 1.5”
*Circuit Board Material: Rogers 4350	

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Notes: