4 dB LSB SILICON 2-BIT POSITIVE CONTROL DIGITAL ATTENUATOR, 0.7 - 4.0 GHz

Typical Applications

The HMC291SE is ideal for:

- Cellular
- PCS, ISM, MMDS
- WLL Handset & Base Station

Features

RoHS Compliant Product

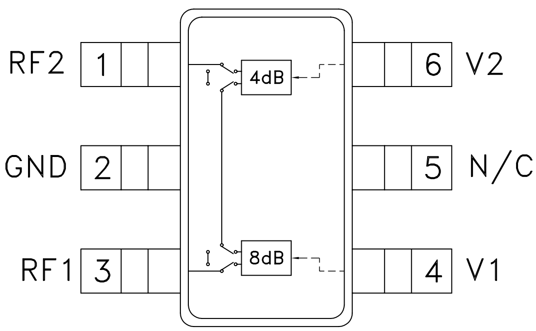
4 dB LSB Steps to 12 dB

Single Positive Control Per Bit, 0/+3V or +5V

Typical Step Error : ±0.3 dB

Miniature SOT 26 Package: 9 mm^2

Functional Diagram



General Description

The HMC291SE is a general purpose broadband 2-bit positive control silicon IC digital attenuator in 6 lead SOT26 surface mount plastic package. The insertion loss is typically in between 0.4 dB - 1 dB through operating frequency range. The attenuator bit values are 4 (LSB) and 8 dB for a total attenuation of 12 dB. State error is excellent at ± 0.4 dB typical with an IIP3 of up to 57 dBm. Two bit control voltage inputs, toggled between 0V and +3V or +5V, are used to select each attenuation state at less than 25 µA each. A single VDD supply voltage of +3V to +5V applied through an external 4.7K 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 - 4.0 GHz		0.5 0.5 0.6 0.8	0.65 0.65 0.7 1.32	dB dB dB dB
Attenuation Range		0.7 - 4.0 GHz		12		dB
Return Loss (RF1 & RF2, All Atten. States)		0.7 - 1.4 GHz 1.4 - 4.0 GHz	20 17	25 27		dB dB
State Error All Attenuation States All Attenuation States All Attenuation States All Attenuation States		 0.7 - 1.4 GHz 1.4 - 2.3 GHz 2.3 - 2.7 GHz 2.7 - 4.0 GHz	 ± (0.1 + 4% of Atten. Setting Max) ± (0.2 + 2% of Atten. Setting Max) ± (0.4 + 3% of Atten. Setting Max) ± (0.4 + 4% of Atten. Setting Max)			 dB dB dB dB
Input Power for 0.1 dB Compression (Input P0.1dB)	5V[1] 3V	0.7 - 4.0 GHz		28 27		dBm dBm
Input Third Order Intercept Point (IIP3) (Two-tone Input Power = 15 dBm Each Tone)	5V 3V	0.7 - 4.0 GHz	52 52	57 54	59 56	dBm dBm
Switching Characteristics t_{RISE}, t_{FALL} (10/90% RF) t_{ON}, t_{OFF} (50% CTL to 10/90% RF)		0.7 - 4.0 GHz		 250 300		 ns ns

[1] Compression point is above maximum input power

For price, delivery, and to place orders: Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106
Phone: 781-329-4700 • Order online at www.analog.com
Application Support: Phone: 1-800-ANALOG-D

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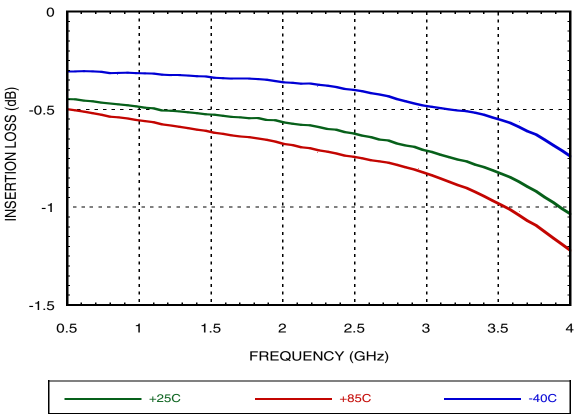
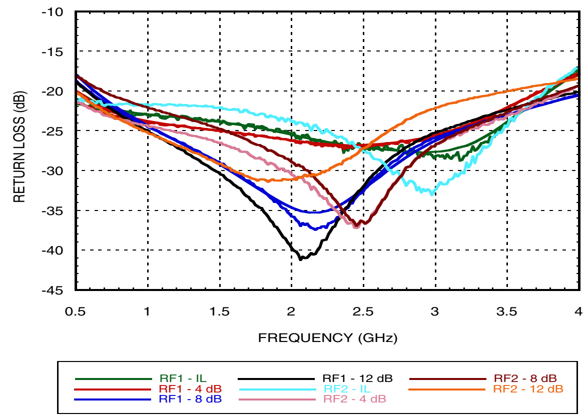
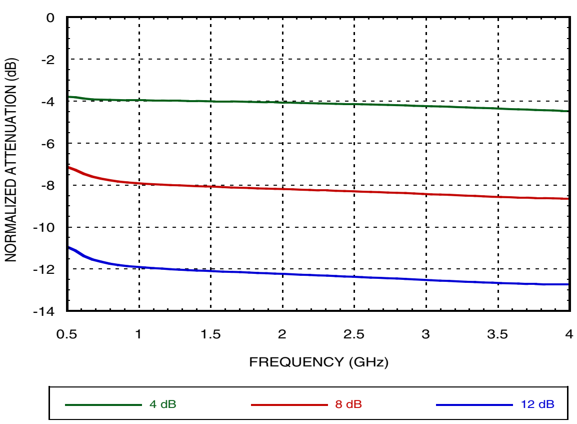
Insertion Loss



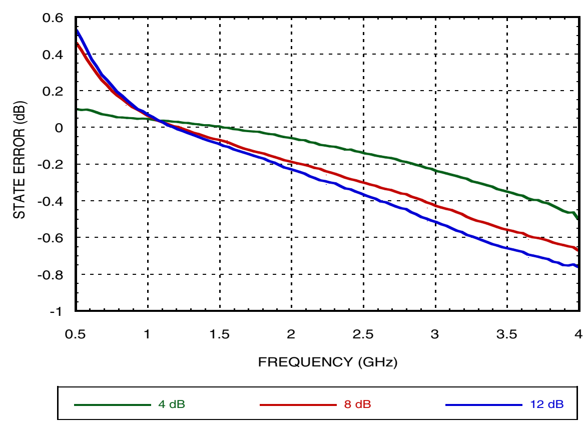
Return Loss RF1, RF2



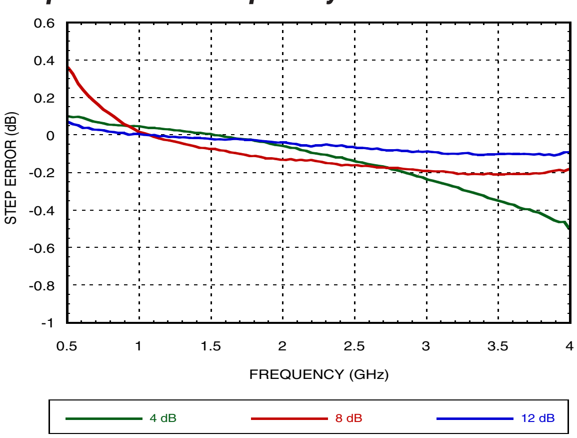
Normalized Attenuation vs. Attenuation State



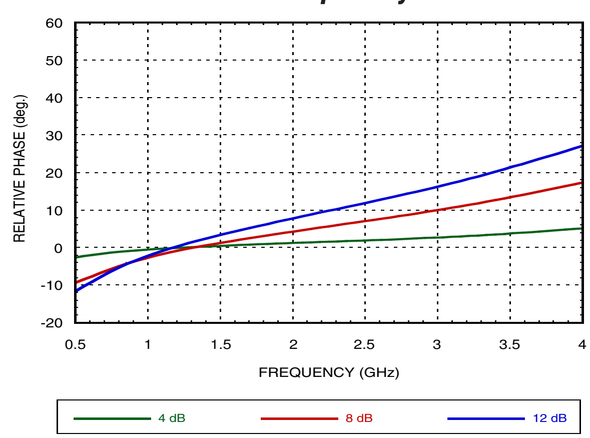
State Error vs. Attenuation State



Step Error vs. Frequency



Relative Phase vs. Frequency



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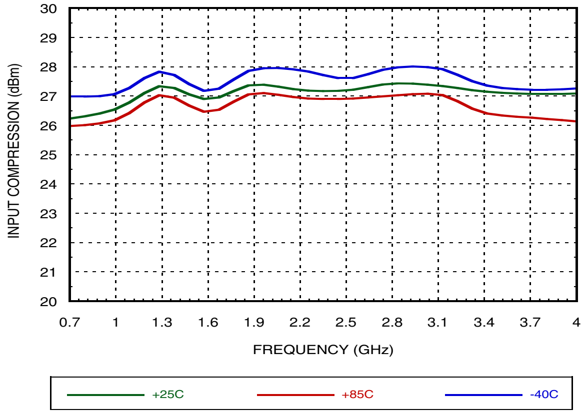
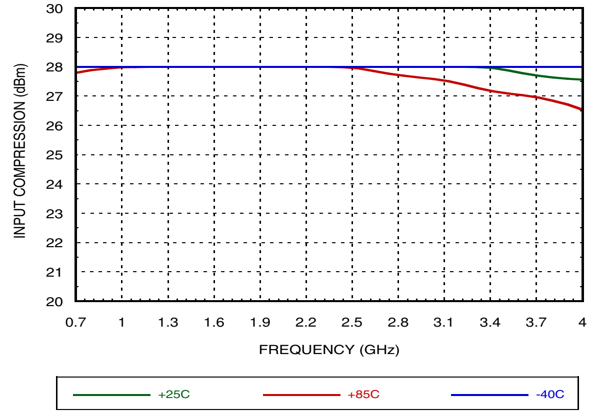
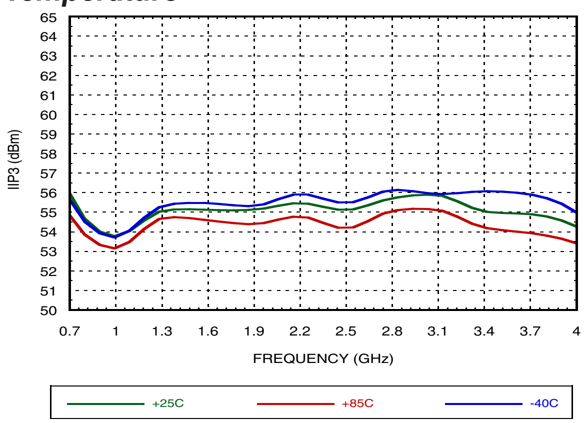
Input P0.1dB vs. Frequency at 3V over Temperature



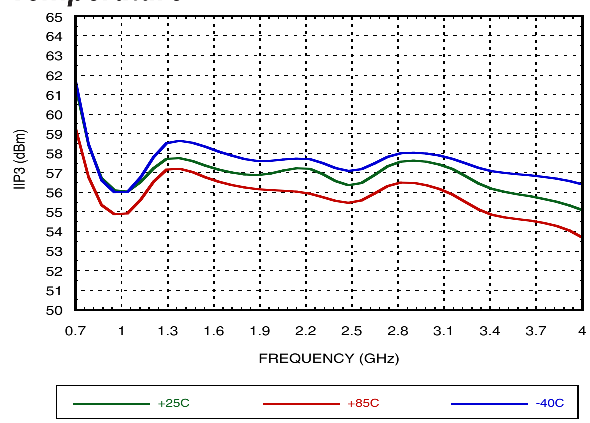
Input P0.1dB vs. Frequency at 5V over Temperature[1]



IIP3 vs. Frequency at 3V over Temperature



IIP3 vs. Frequency at 5V over Temperature



[1] Input P0.1dB is limited by maximum test power of 28 dBm.

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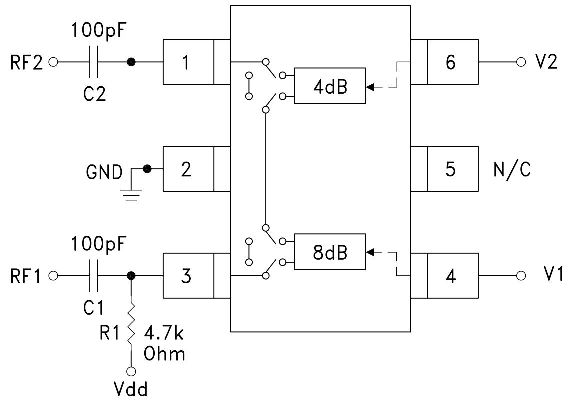
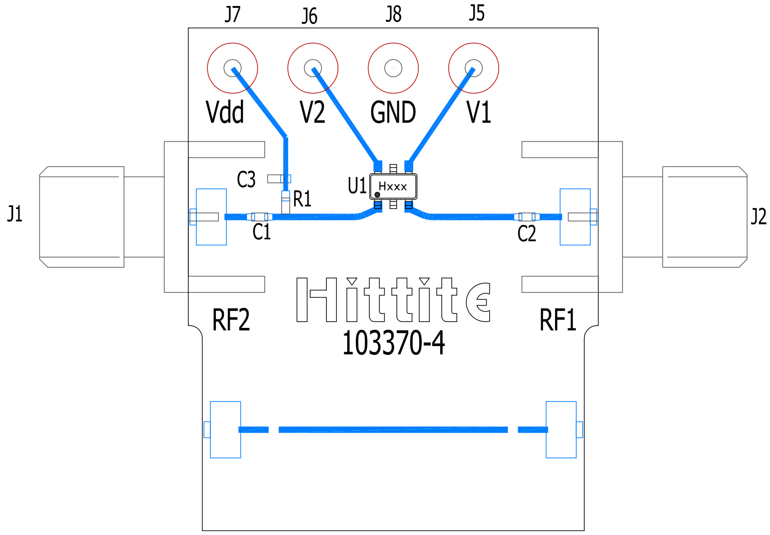
Application Circuit

DC blocking capacitors C1 and C2 are required on RF1 and RF2. Choose C1 = C2 = 100 ~ 300 pF to allow lowest frequency of operation to pass with minimal loss. R1 = 4.7K Ohm is required to supply voltage to the circuit through either PIN 3 or PIN 1.



Evaluation Circuit Board



List of Materials for Evaluation PCB EV1HMC291SE [1]

Item	Description
J1 - J2	PCB Mount SMA Connector
J5 - J8	DC Pin
R1	4.7 kOhm Resistor, 0402 Pkg.
C1, C2	0402 Pkg. Capacitor, Select for Lowest Frequency of Operation
C3	1 nF capacitor, 0402 Pkg.
U1	HMC291SE Digital Attenuator
PCB [2]	103370 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 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 Analog Devices upon request.