

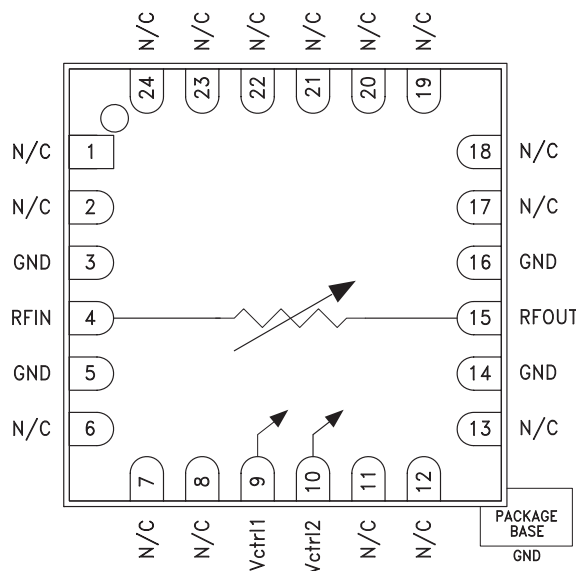
GaAs MMIC VOLTAGE-VARIABLE ATTENUATOR, 5 - 30 GHz

Typical Applications

The HMC812LC4 is ideal for:

- Point-to-Point Radio
- VSAT Radio
- Test Instrumentation
- Microwave Sensors
- Military, ECM & Radar

Functional Diagram



Features

- Wide Bandwidth: 5 - 30 GHz
- Excellent Linearity: +25 dBm Input P1dB
- Wide Attenuation Range: 30 dB
- 24 Lead Ceramic 4x4mm SMT Package: 16mm²

General Description

The HMC812LC4 is an absorptive Voltage Variable Attenuator (VVA) which operates from 5 - 30 GHz and is ideal in designs where an analog DC control signal must be used to control RF signal levels over a 30 dB amplitude range. It features two shunt-type attenuators which are controlled by two analog voltages, Vctrl1 and Vctrl2. Optimum linearity performance of the attenuator is achieved by first varying Vctrl1 of the 1st attenuation stage from -3V to 0V with Vctrl2 fixed at -3V. The control voltage of the 2nd attenuation stage, Vctrl2, should then be varied from -3V to 0V, with Vctrl1 fixed at 0V. The HMC812LC4 is housed in a RoHS compliant 4x4 mm QFN leadless ceramic package

However, if the Vctrl1 and Vctrl2 pins are connected together it is possible to achieve the full analog attenuation range with only a small degradation in input IP3 performance. Applications include AGC circuits and temperature compensation of multiple gain stages in microwave point-to-point and VSAT radios.

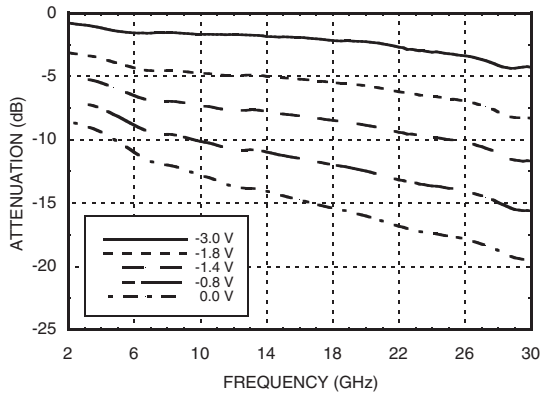
Electrical Specifications, $T_A = +25^\circ C$, 50 Ohm system

Parameter	Min.	Typ.	Max.	Units
Insertion Loss	5 - 16 GHz	2		dB
	16 - 24 GHz	3		dB
	24 - 30 GHz	4		dB
Attenuation Range		30		dB
Input Return Loss		12		dB
Output Return Loss		8		dB
Input Power for 1 dB Compression (any attenuation)		25		dBm
Input Third Order Intercept (Two-tone Input Power = 10 dBm Each Tone)		28		dBm

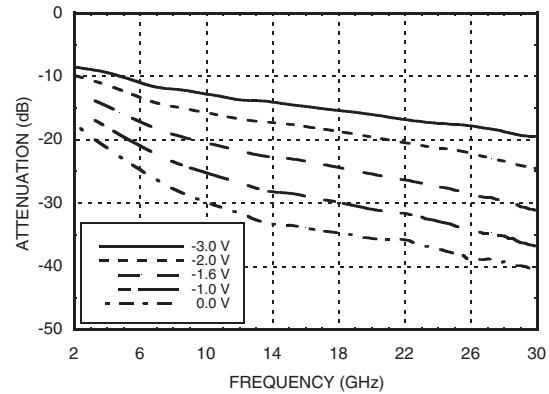


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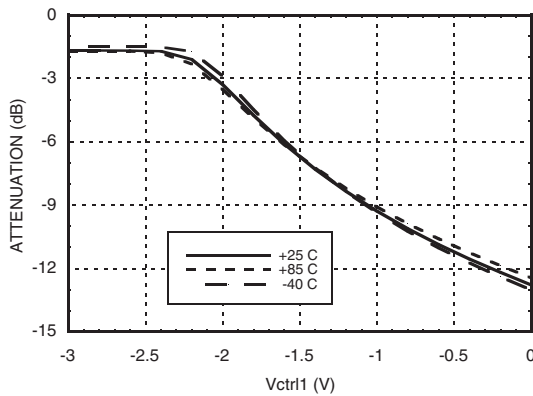
Attenuation vs. Frequency over Vctrl
Vctrl1 = Variable, Vctrl2 = -3V



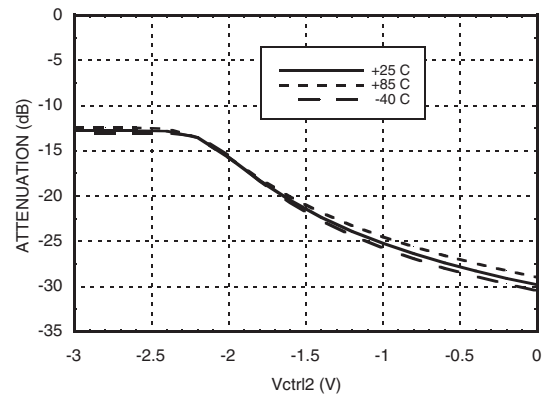
Attenuation vs. Frequency over Vctrl
Vctrl1 = 0V, Vctrl2 = Variable



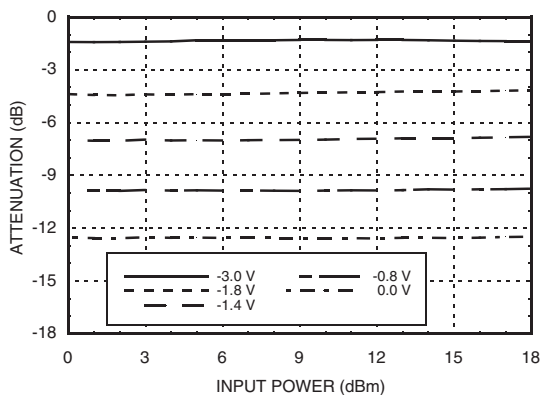
Attenuation vs. Vctrl1
Over Temperature @ 10 GHz, Vctrl2 = -3V



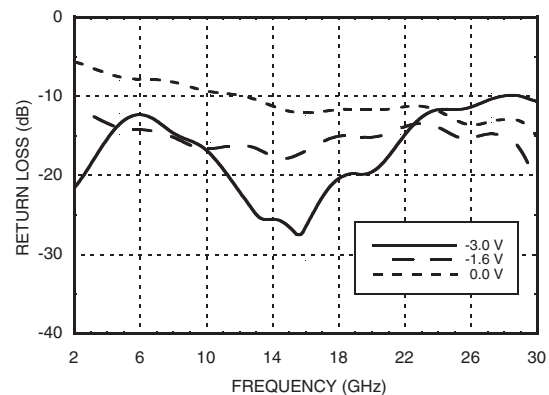
Attenuation vs. Vctrl2
Over Temperature @ 10 GHz, Vctrl1 = 0V



Attenuation vs. Pin @ 10 GHz
Vctrl1 = Variable, Vctrl2 = -3V



Input Return Loss
Vctrl1 = Variable, Vctrl2 = -3V





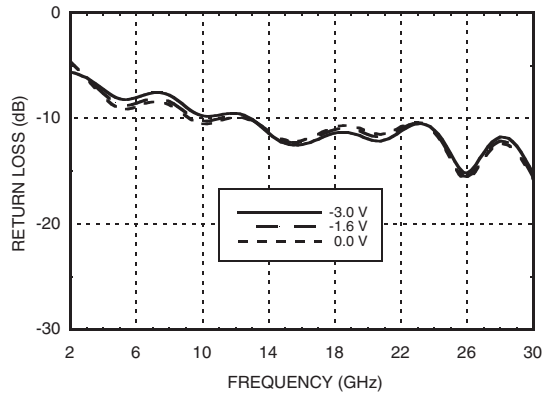
**GaAs MMIC VOLTAGE-VARIABLE
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ATTENUATORS - ANALOG - SMT

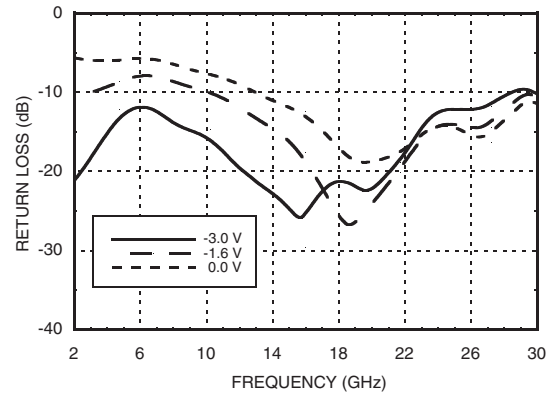
Input Return Loss

Vctrl1 = 0V, Vctrl2 = Variable



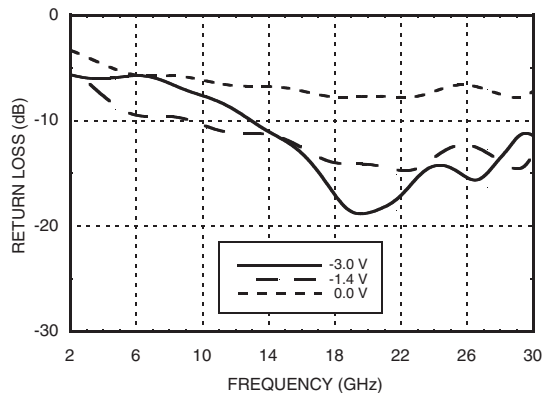
Output Return Loss

Vctrl1 = Variable, Vctrl2 = -3V



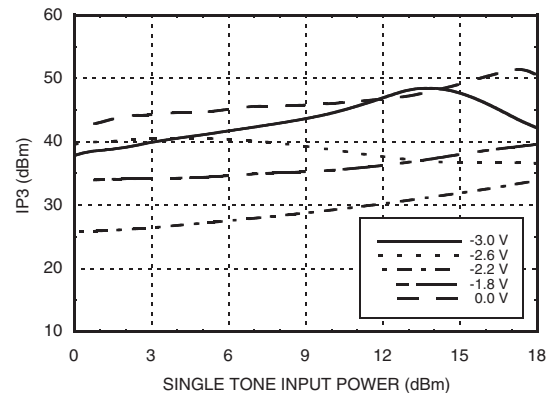
Output Return Loss

Vctrl1 = 0V, Vctrl2 = Variable

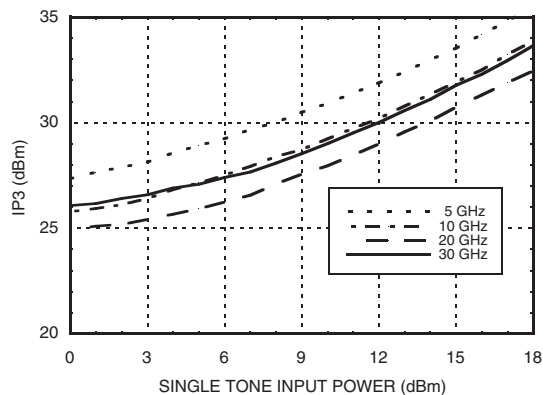


Input IP3 vs Input Power @ 10 GHz

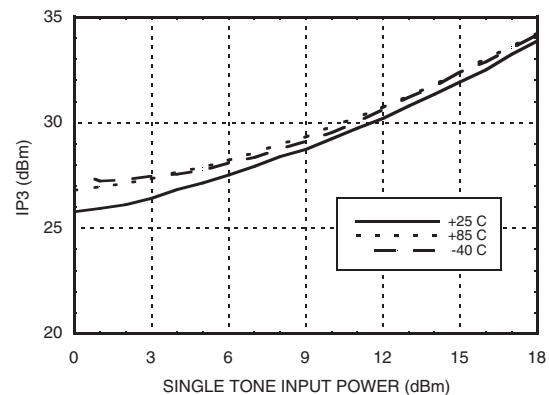
Vctrl1 = Variable, Vctrl2 = -3V



Input IP3 vs. Input Power Over Frequency
Vctrl1 = -2.2V, Vctrl2 = -3V (Worst Case IP3)



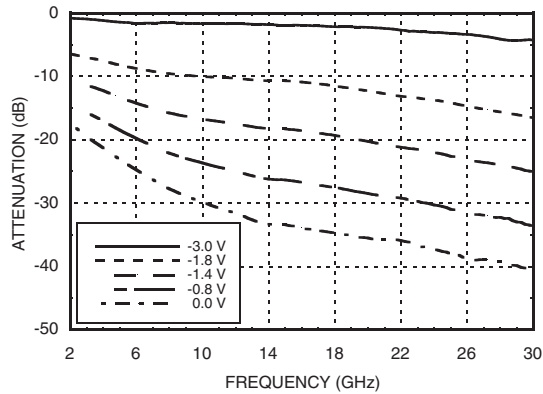
Input IP3 vs. Input Power Over Temperature
@ 10 GHz, Vctrl1 = -2.2V, Vctrl2 = -3V



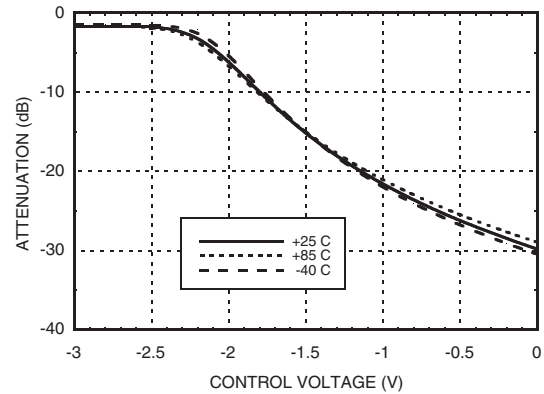


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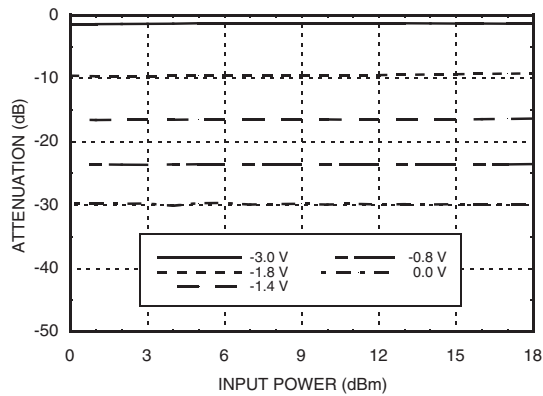
Attenuation vs. Frequency over Vctrl
Vctrl1 = Vctrl2



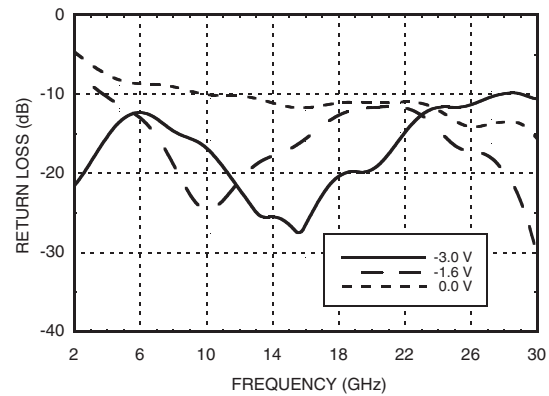
Attenuation vs. Vctrl over Temperature
@ 10 GHz, Vctrl1 = Vctrl2



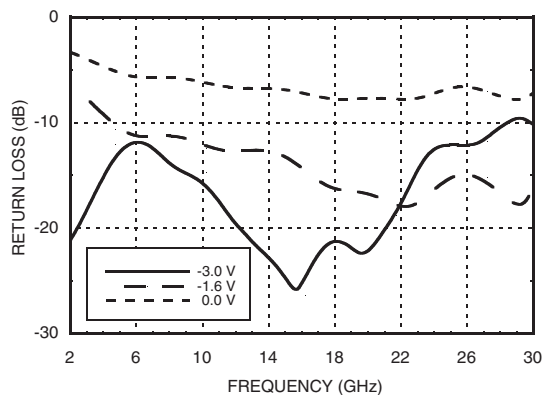
Attenuation vs. Input Power over Vctrl
Vctrl1 = Vctrl2



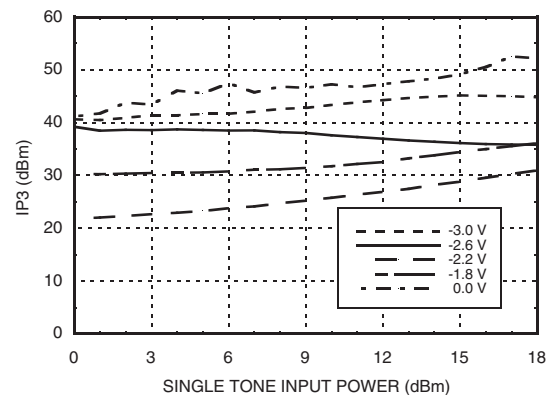
Input Return Loss, Vctrl1 = Vctrl2



Output Return Loss, Vctrl1 = Vctrl2



Input IP3 vs. Input Power Over Vctrl @ 10 GHz, Vctrl1 = Vctrl2



GaAs MMIC VOLTAGE-VARIABLE ATTENUATOR, 5 - 30 GHz

Absolute Maximum Ratings

RF Input Power	+30 dBm
Control Voltage Range	+1 to -5V
Channel Temperature	150 °C
Continuous P _{diss} (T = 85 °C) (derate 16.4 mW/ °C above 85 °C)	1W
Thermal Resistance (Channel to ground paddle)	61 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C

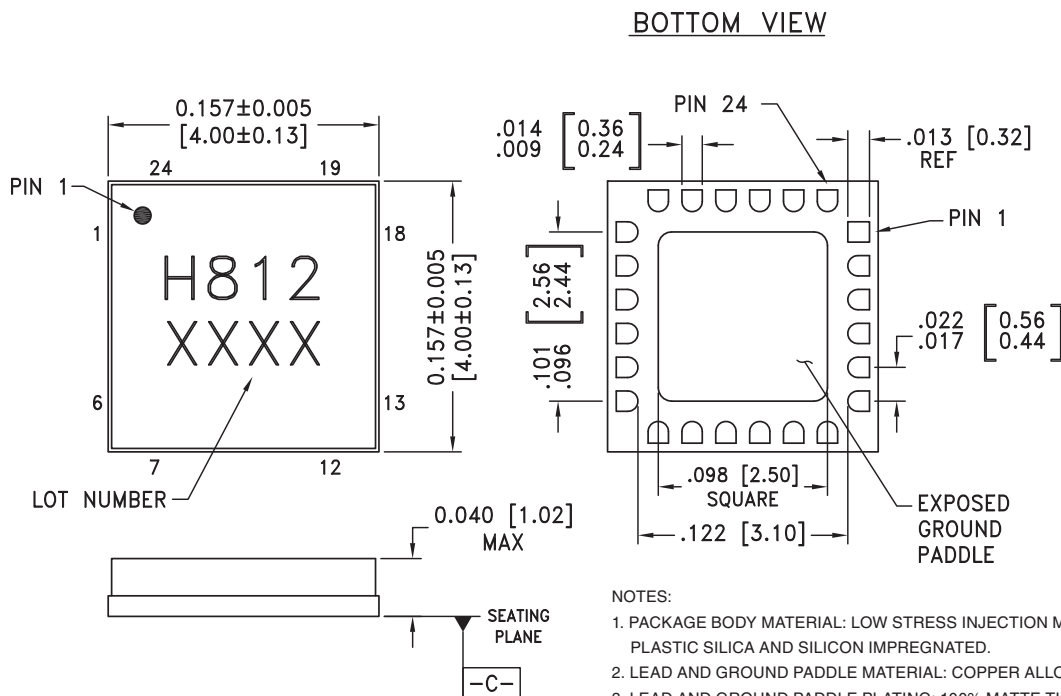
Control Voltages

Vctrl1	-3 to 0V @ 10 μA
Vctrl2	-3 to 0V @ 10 μA



ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS


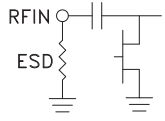
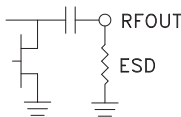
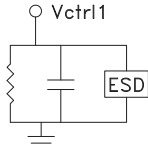
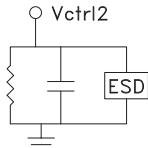
Outline Drawing

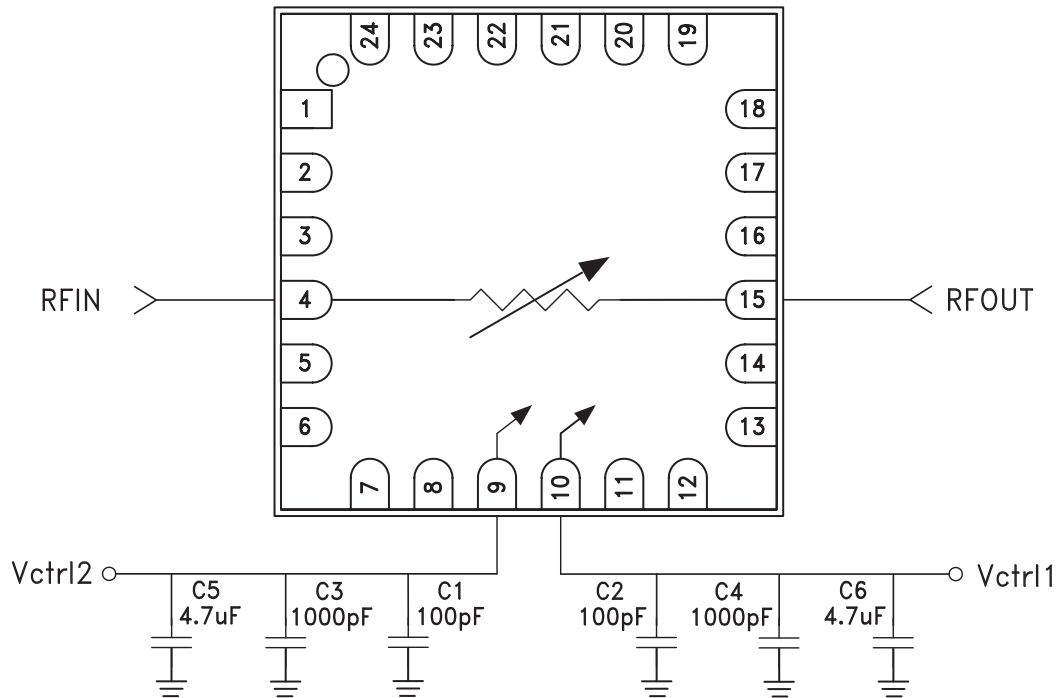


NOTES:

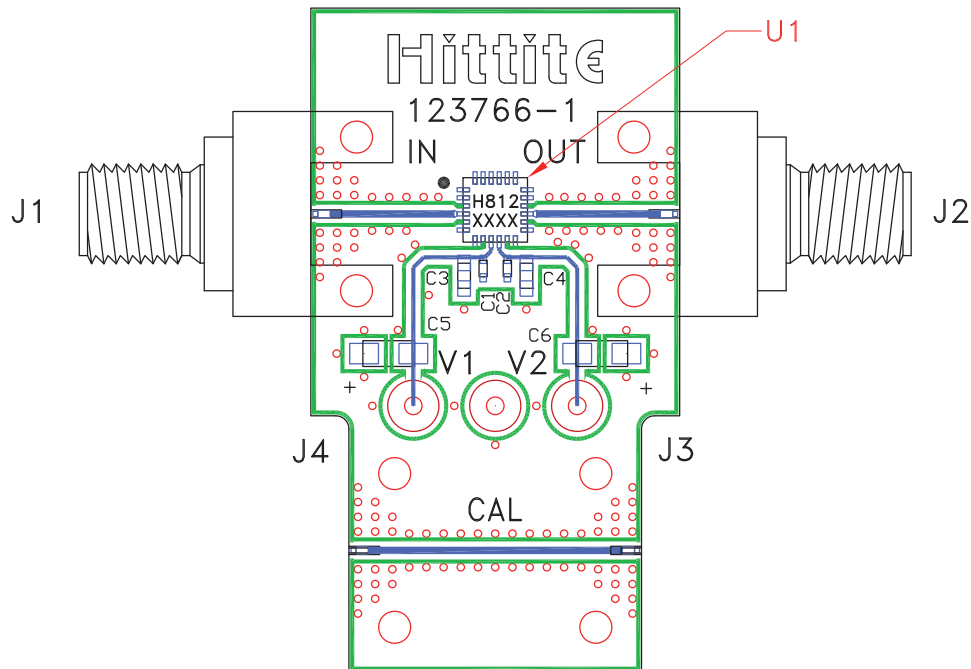
1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
2. LEAD AND GROUND PADDLE MATERIAL: COPPER ALLOY.
3. LEAD AND GROUND PADDLE PLATING: 100% MATTE TIN.
4. DIMENSIONS ARE IN INCHES [MILLIMETERS].
5. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
6. PAD BURR LENGTH SHALL BE 0.15mm MAX.
PAD BURR HEIGHT SHALL BE 0.05mm MAX.
7. PACKAGE WARP SHALL NOT EXCEED 0.05mm
8. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
9. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED PCB LAND PATTERN.

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 2, 6 - 8, 11 - 13, 17 - 24	N/C	No connection	
3, 5, 14, 16	GND	Die bottom must be connected to RF/DC ground.	
4	RFIN	This pad is DC coupled and matched to 50 Ohms. A blocking capacitor is required if RF line potential is not equal to 0V.	
15	RFOUT		
9	Vctrl1	Control Voltage 1	
10	Vctrl2	Control Voltage 2	

Application Circuit


Evaluation PCB



List of Materials for Evaluation PCB 123768 [1]

Item	Description
J1, J2	2.9 mm PC Mount RF Connector
J3, J4	DC Pin
C1, C2	100 pF Capacitor, 0402 Pkg.
C3, C4	1000 pF Capacitor, 0402 Pkg.
C5, C6	4.7 μF Capacitor, CASE A
U1	HMC812LC4 Analog VVA
PCB [2]	123766 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Arlon 25FR or 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 paddle 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 shown is available from Hittite upon request.