v00.0813

HMC1094LP3E

50 dB, LOGARITHMIC DETECTOR, 1 - 23 GHz

Typical Applications

The HMC1094LP3E is ideal for:

- Point-to-Point Microwave Radio
- VSAT
- Wideband Power Monitoring
- Receiver Signal Strength Indication (RSSI)
- Test & Measurement

Features

Wide Input Bandwidth: 1 to 23 GHz

Wide Dynamic Range: 50 dB up to 23 GHz

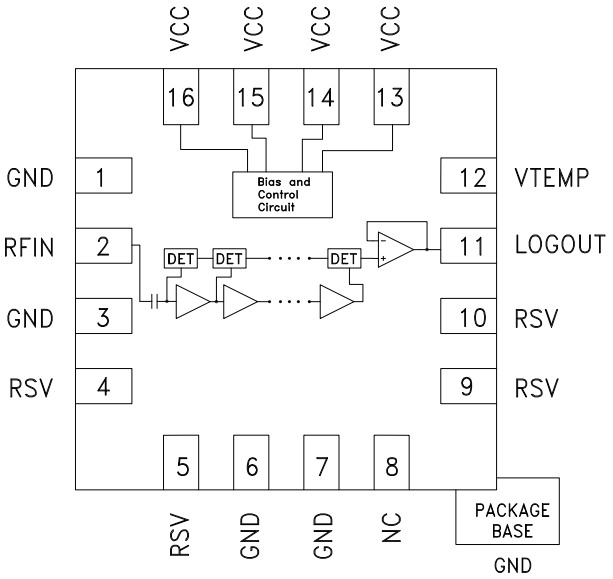
Single Positive Supply: +3.3V

Excellent Stability Over Temperature

Fast Rise / Fall Time: 12 / 65 ns

16 Lead 3x3 mm SMT Package: 9 mm²

Functional Diagram



General Description

The HMC1094LP3E Logarithmic Detector converts RF signals at its input, to a proportional DC voltage at its output. The HMC1094LP3E employs successive compression topology which delivers high dynamic range over a wide input frequency range. As the input power is increased, successive amplifiers move into saturation one by one creating an approximation of the logarithm function. The output of a series of detectors is summed, converted into the voltage domain and buffered to drive the LOGOUT output. The HMC1094LP3E provides a nominal logarithmic slope of +18 mV/dB and an intercept of -113 dBm at 23 GHz. Ideal as a log detector for high volume microwave radio and VSAT applications, the HMC1094LP3E is housed in a compact 3x3 mm RoHS compliant SMT plastic package.

Electrical Specifications, T_A = +25°C VCC = +3.3V

Parameter	Typ.	Typ.	Typ.	Typ.	Typ.	Typ.	Typ.	Typ.	Units
Input Frequency[1]	1	5	10	14	16	18	20	23	GHz
±3 dB Dynamic Range	48	48	48	50	54	54	55	57	dB
±3 dB Dynamic Range Center	-20	-22	-23	-24	-25	-26	-27	-24	dBm
Log Error Over Temperature (-40°C to +85°C)	±0.8	±0.7	±0.5	±1	±0.7	±0.7	±0.8	±1.1	dB
Output Intercept	-96	-97	-100	-105	-108	-111	-113	-113	dBm
Output Slope	20	21	20	19	19	18	18	18	mV/dB

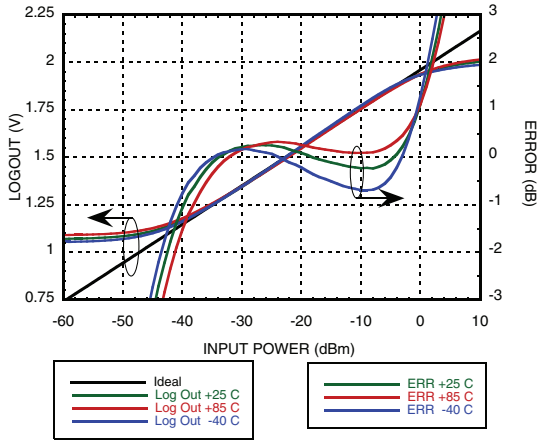
[1] Video output load should be 1K Ohm or higher.

Electrical Specifications, (continued)

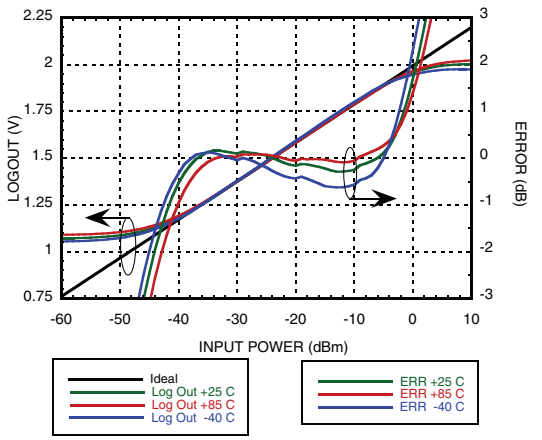
Parameter	Conditions	Min.	Typ.	Max.	Units
LOGOUT Interface					
Output Voltage Range		1		2.1	V
Output Rise Time [1] / Fall Time [2]	f = 10 GHz		12 / 65		ns
Power Supply (Vcc)					
Operating Voltage Range		3.15	3.3	3.45	V
Supply Current in Normal Mode		70	85	95	mA

[1] 0 dBm Input Pulsed; measured from 10% to 90%
[2] 0 dBm Input Pulsed; measured from 90% to 10%

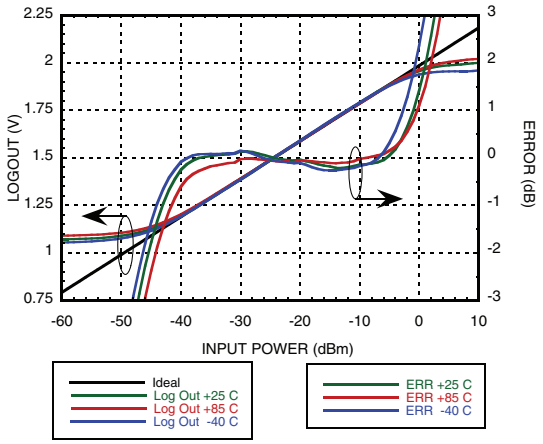
LOGOUT & Error vs. Input Power, Fin = 1 GHz



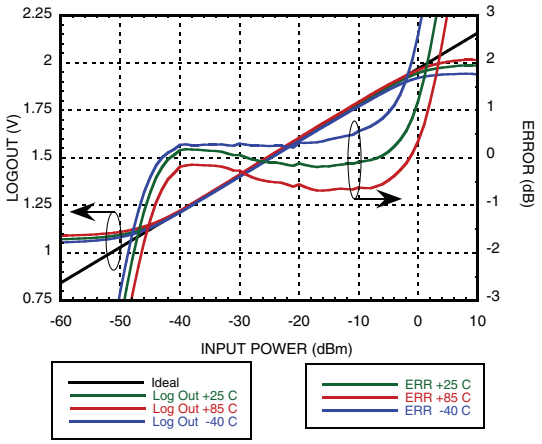
LOGOUT & Error vs. Input Power, Fin = 5 GHz



LOGOUT & Error vs. Input Power, Fin = 10 GHz

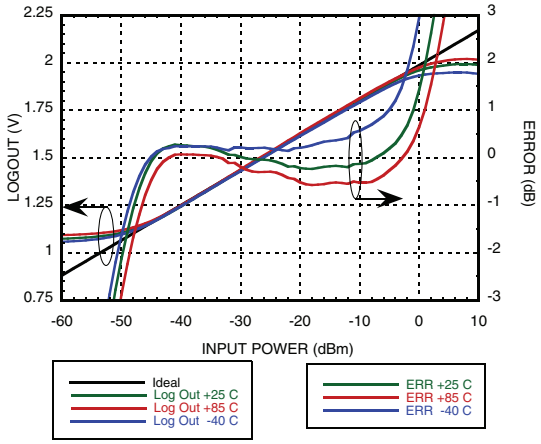


LOGOUT & Error vs. Input Power, Fin = 14 GHz

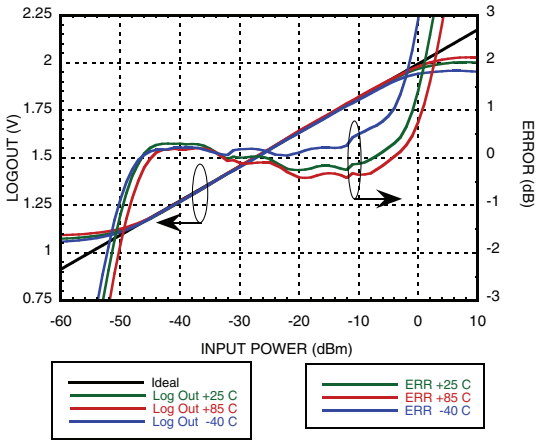


Unless otherwise noted: VCC= +3.3V, T_A = +25°C

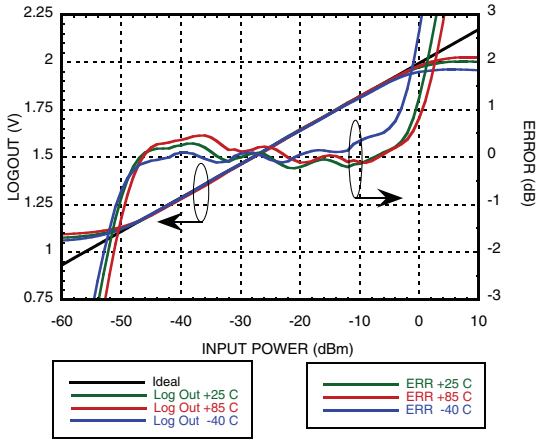
LOGOUT & Error vs. Input Power, Fin = 16 GHz



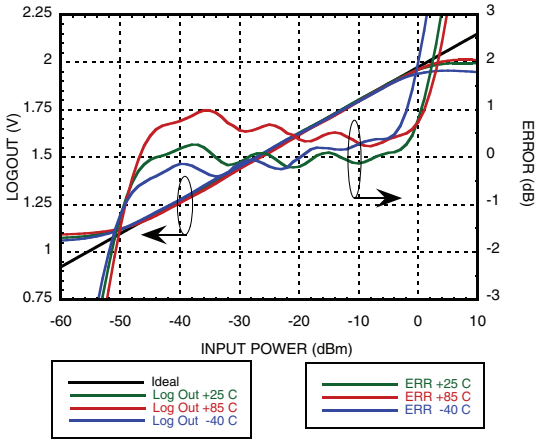
LOGOUT & Error vs. Input Power, Fin = 18 GHz



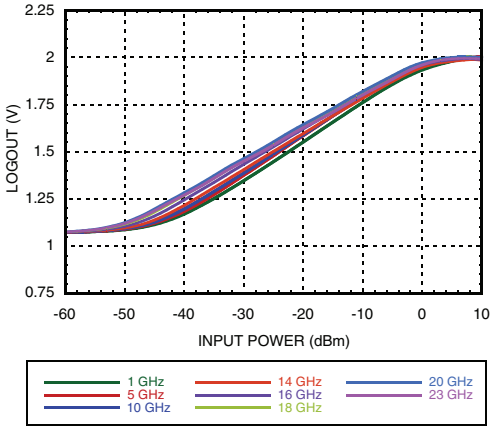
LOGOUT & Error vs. Input Power, Fin = 20 GHz



LOGOUT & Error vs. Input Power, Fin = 23 GHz

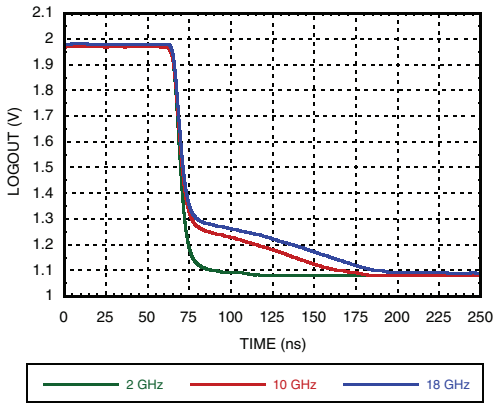


LOG OUT vs. Frequency

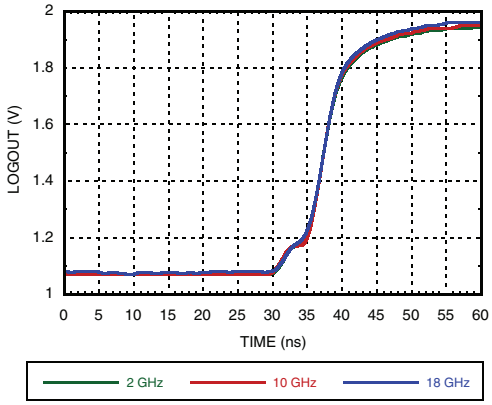


Unless otherwise noted: VCC = +3.3V, T_A = +25 °C

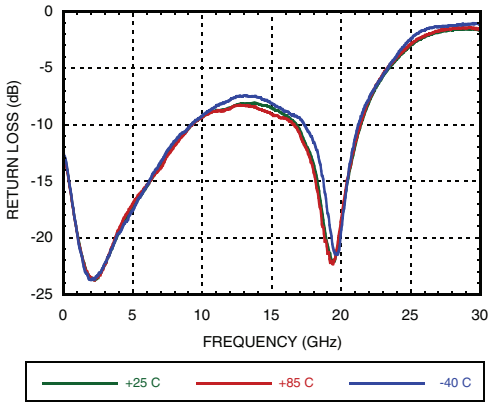
Fall Time for Various Frequencies @ 0 dBm



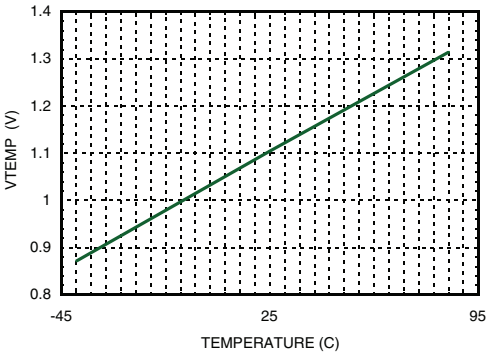
Rise Time for Various Frequencies @ 0 dBm



Input Return Loss



VTEMP over Temperature



Unless otherwise noted: VCC = +3.3V, T_A = +25 °C

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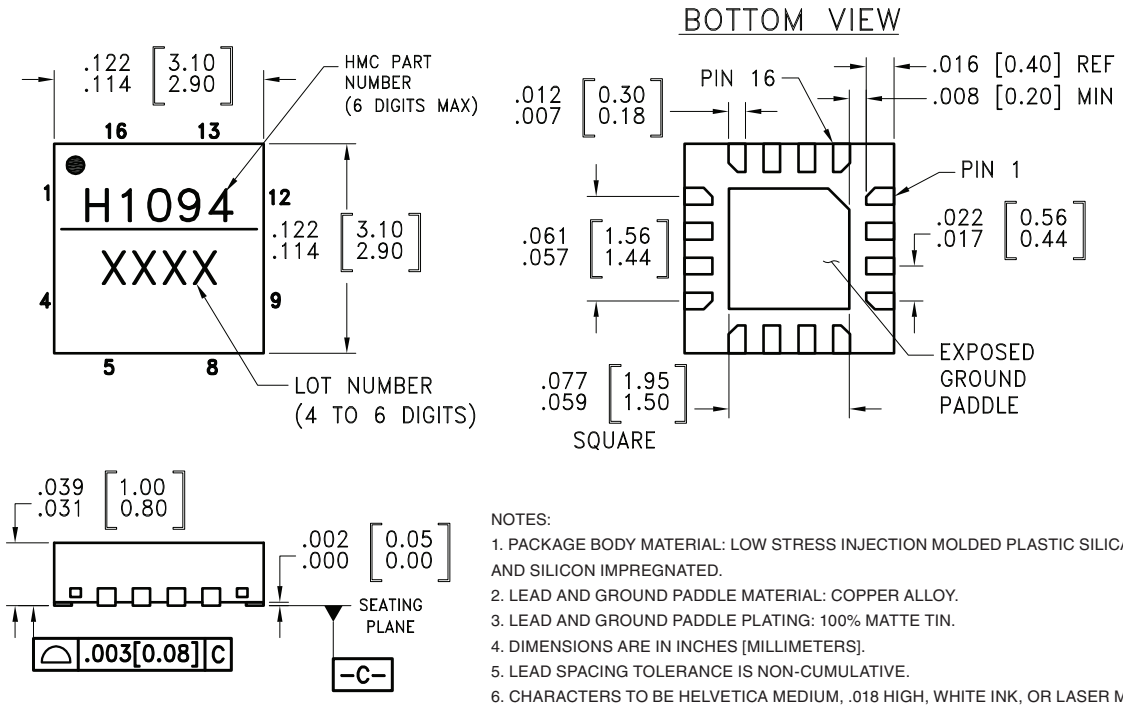
50dB, LOGARITHMIC DETECTOR, 1 - 23 GHz

Absolute Maximum Ratings

Vcc	+3.6V
RF Input Power	+13 dBm
RF DC Level	+1.1V
Maximum Junction Temperature	125 °C
Continuous Pdiss (T = 85°C) (Derate 65.4 mW/°C above 85°C)	2.62 W
Thermal Resistance (R_{th}) (junction to ground paddle)	15.29 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C
ESD Sensitivity (HBM)	Class 1B

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

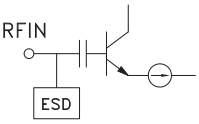
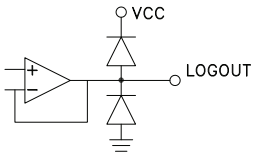
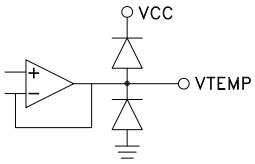
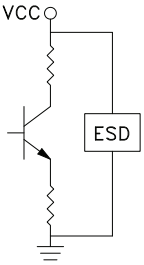
1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
2. LEAD AND GROUND PADDLE MATERIAL: COPPER ALLOY.
3. LEAD AND GROUND PADDLE PLATING: 100% MATTE TIN.
4. DIMENSIONS ARE IN INCHES [MILLIMETERS].
5. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
6. CHARACTERS TO BE HELVETICA MEDIUM, .018 HIGH, WHITE INK, OR LASER MARK LOCATED APPROX. AS SHOWN.
7. PAD BURR LENGTH SHALL BE 0.15mm MAX. PAD BURR HEIGHT SHALL BE 0.05mm MAX.
8. PACKAGE WARP SHALL NOT EXCEED 0.05mm
9. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
10. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED PCB LAND PATTERN.

Package Information

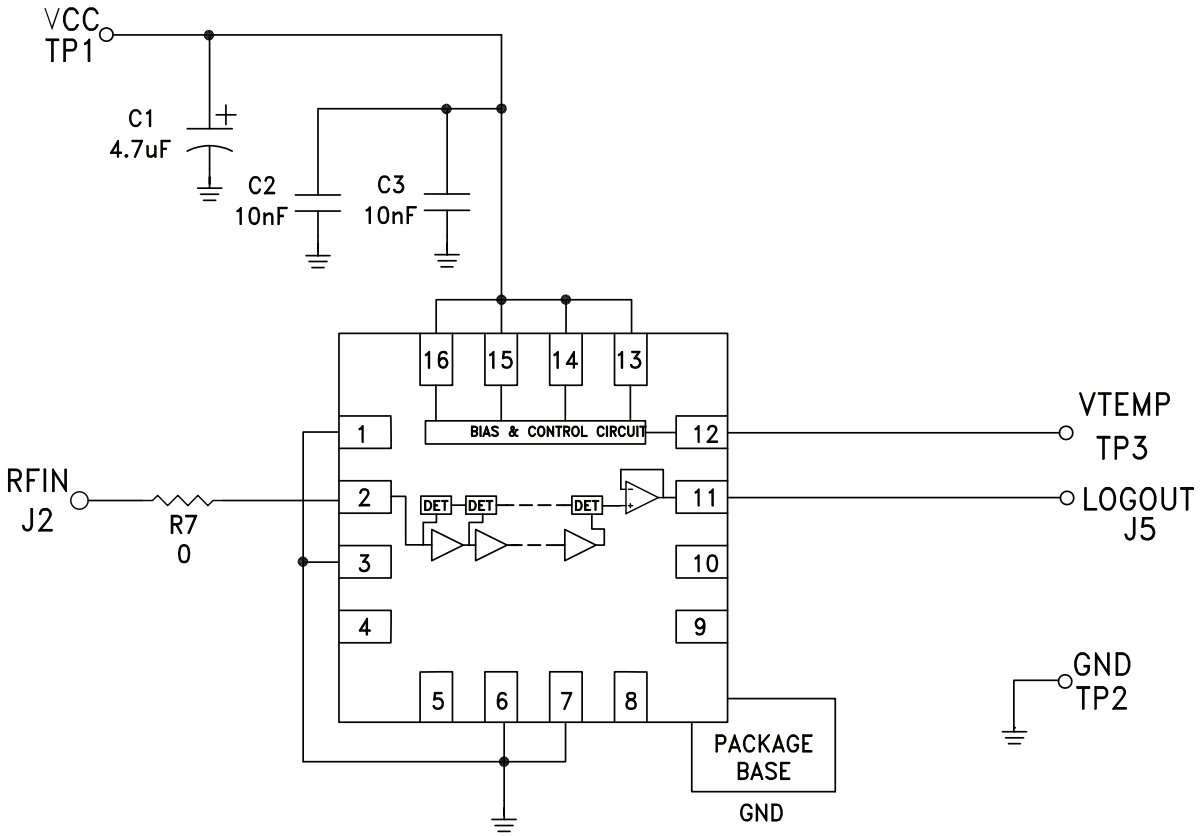
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [1]
HMC1094LP3E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H1094 XXX

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

Pin Descriptions

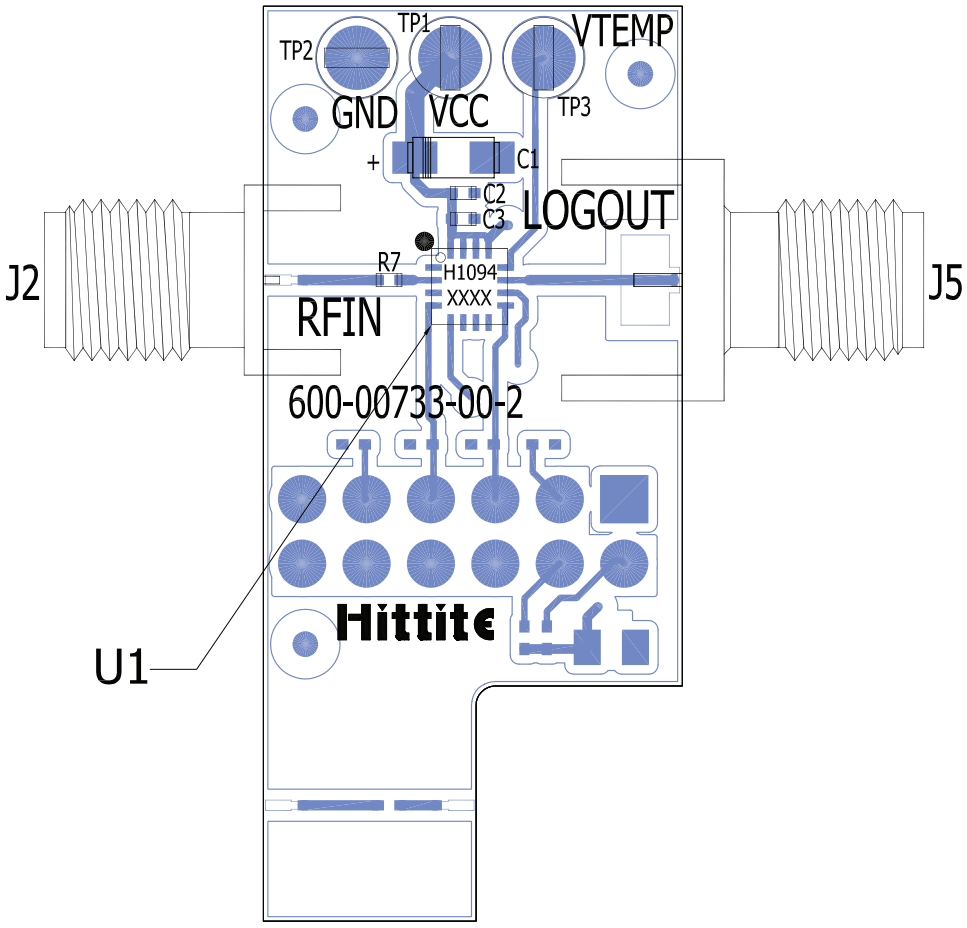
Pin Number	Function	Description	Interface Schematic
1, 3, 6 - 7	GND	These pins and the exposed package bottom must be connected to a high quality RF/DC ground.	
2	RFIN	RF input pin. DC voltage level of RF input should be 0V. If RF input has a DC level different than 0V, a DC block capacitor should be used.	
4 - 5, 9 - 10	RSV	Reserved for internal use. Should be left floating.	
8	NC	No connection necessary. These pins may be connected to RF/DC ground without affecting performance.	
11	LOGOUT	Log out load should be at least 1K Ohm or higher.	
12	VTEMP	Minimum 10K Ohm resistance or higher.	
13 - 16	VCC	Bias Supply. Connect supply voltage to these pins with appropriate filtering.	

Application & Evaluation PCB Schematic



Note:
1. Log output load should be 1K Ohm or higher.

Evaluation PCB



List of Materials for Evaluation PCB EV1HMC1094LP3 [1]

Item	Description
J2	K-Type Connector
J5	SMA Connector
TP1-TP3	DC Pin
C2-C3	10 nF Capacitor, 0402 Pkg.
C1	4.7 µF Tantalum Capacitor
R7	0 Ohm Resistor, 0402 Pkg.
U1	HMC1094LP3E Log Detector
PCB [2]	600-00733-00 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350B or Arlon 25 FR

The circuit board used in the application should use RF circuit design techniques. Signal lines should have 50 ohm impedance while the pckage 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.