HMC593LP3 / 593LP3E

v00.0407

GaAs PHEMT MMIC LOW NOISE AMPLIFIER w/ BYPASS MODE, 3.3 - 3.8 GHz

Typical Applications

The HMC593LP3 / HMC593LP3E is ideal for:

- Wireless Infrastructure
- Fixed Wireless
- WiMAX WiBro / 4G
- Tower Mounted Amplifiers

Features

Noise Figure: 1.2 dB

Output IP3: +29 dBm

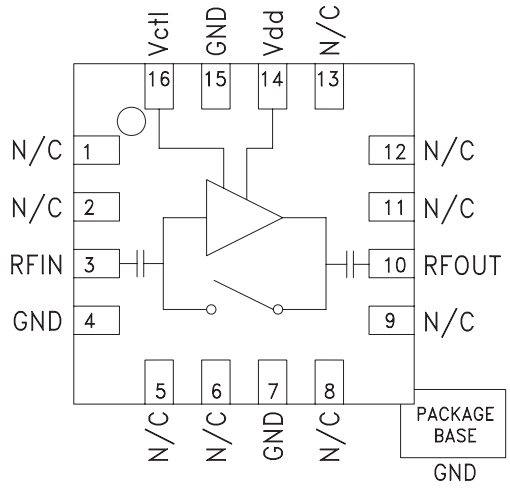
Gain: 19 dB

Low Loss LNA Bypass Path

Single Supply: +5.0V @ 40mA

50 Ohm Matched Output

Functional Diagram



TOP VIEW

General Description

The HMC593LP3 / HMC593LP3E are versatile, high dynamic range GaAs MMIC Low Noise Amplifiers that integrate a low loss LNA bypass mode on the IC. The amplifier is ideal for WiBro & WiMAX receivers operating between 3.3 and 3.8 GHz and provides 1.2 dB noise figure, 19 dB of gain and +29 dBm IP3 from a single supply of +5.0V @ 40mA. Input and output return losses are 23 and 13 dB respectively with no external matching components required. A single control line (0/+3V) is used to switch between LNA mode and a low 2.0 dB loss bypass mode reducing the current consumption to 10 µA.

Electrical Specifications, T_A = +25° C, Vdd = +5V

Parameter	LNA Mode			Bypass Mode			Units
	Min.	Typ.	Max.	Min.	Typ.	Max.	
Frequency Range		3.3 - 3.8			3.3 - 3.8		GHz
Gain	16	19		-3.0	-2.0		dB
Gain Variation Over Temperature		0.011			0.002		dB / °C
Noise Figure		1.2	1.6				dB
Input Return Loss		23			30		dB
Output Return Loss		13			25		dB
Reverse Isolation		19					dB
Power for 1dB Compression (P1dB)*	13	16			30		dBm
Saturated Output Power (Psat)		17					dBm
Third Order Intercept (IP3)* (-20 dBm Input Power per tone, 1 MHz tone spacing)		29					dBm
Supply Current (Idd)		40	50		0.01		mA
Swtiching Speed — LNA Mode to Bypass Mode		-			<4		ns
Swtiching Speed — Bypass Mode to LNA Mode		250			-		µs

* P1dB and IP3 for LNA Mode are referenced to RFOUT while P1dB for Bypass Mode is referenced to RFIN.

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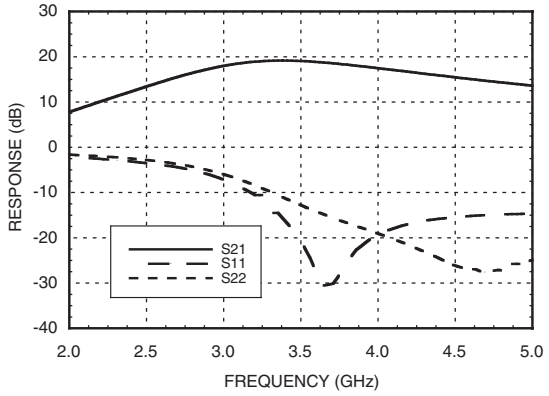
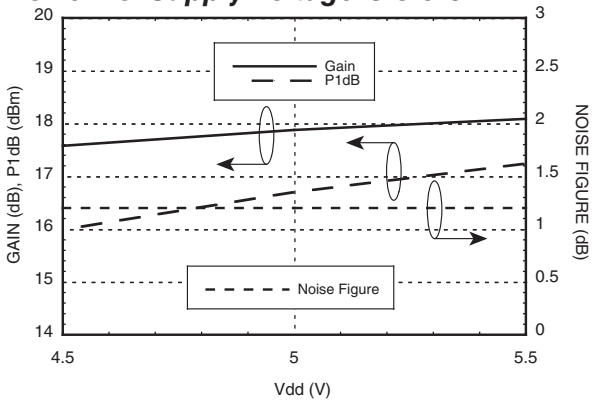
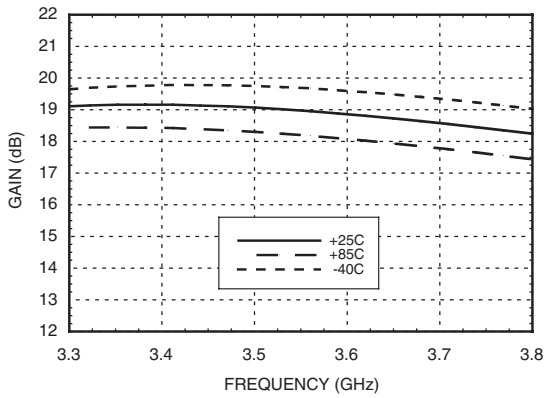
LNA Broadband Gain & Return Loss



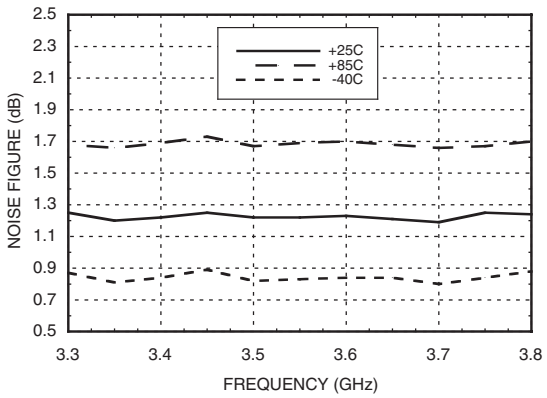
LNA - Gain, Noise Figure & Power vs. Supply Voltage @ 3.5 GHz



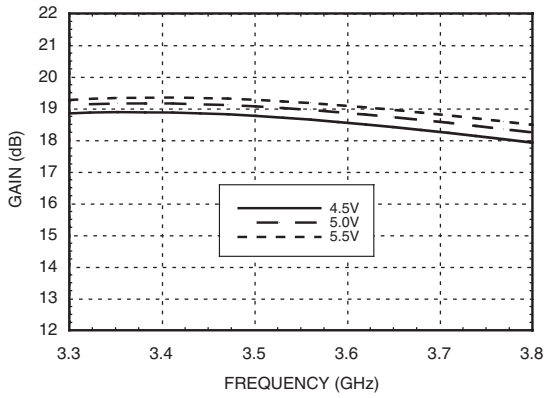
LNA Gain vs. Temperature



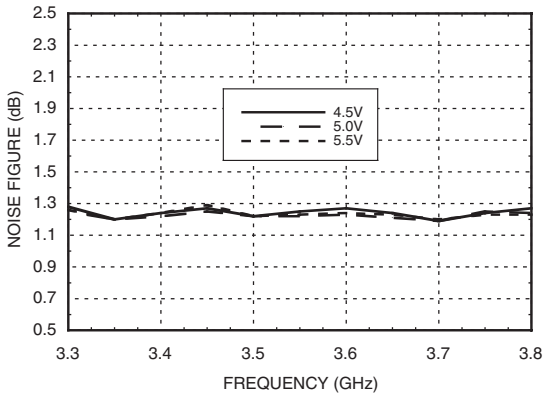
LNA Noise Figure vs. Temperature



LNA Gain vs. Vdd



LNA Noise Figure vs. Vdd



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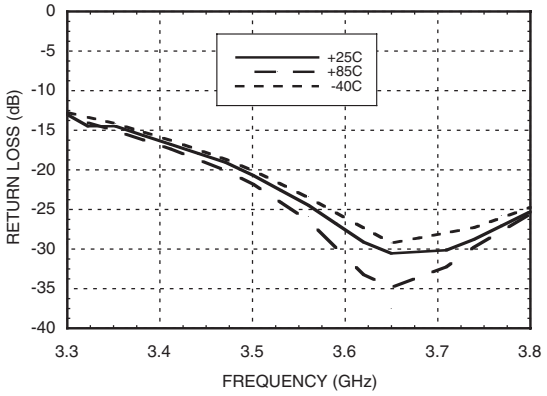
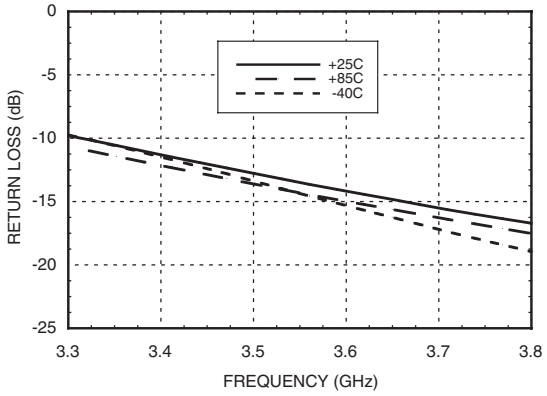
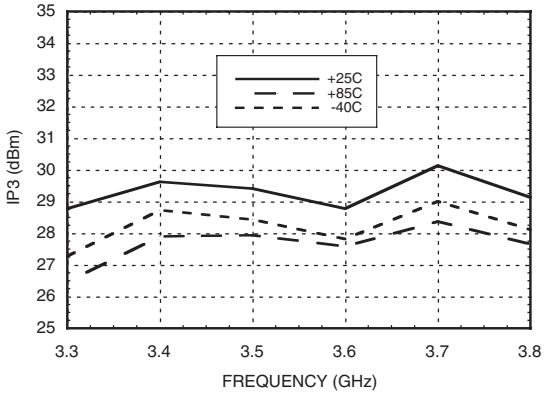
LNA Input Return Loss vs. Temperature



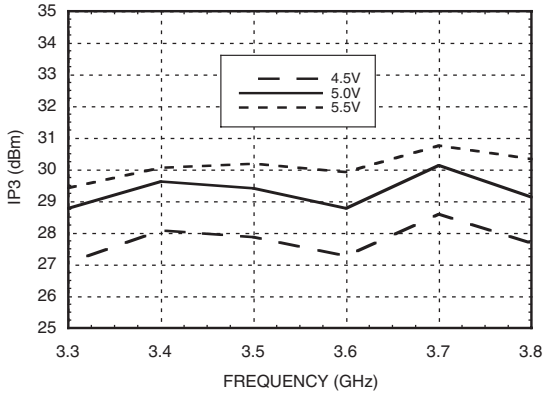
LNA Output Return Loss vs. Temperature



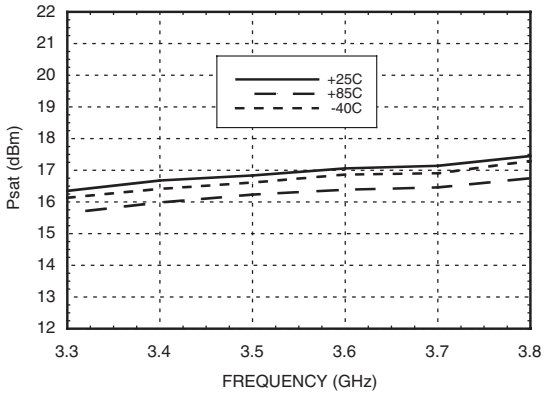
LNA Output IP3 vs. Temperature



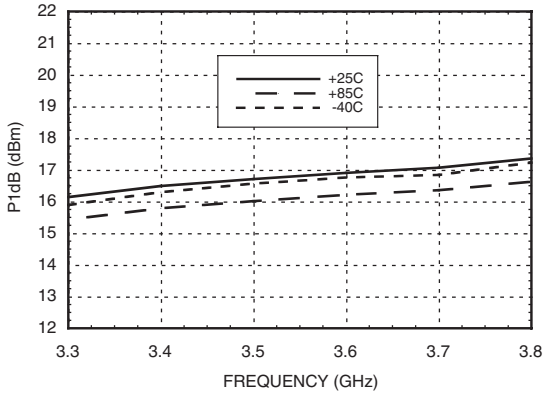
LNA Output IP3 vs. Vdd



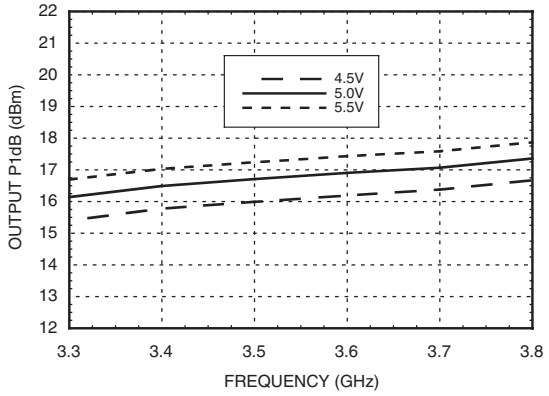
LNA Psat vs. Temperature



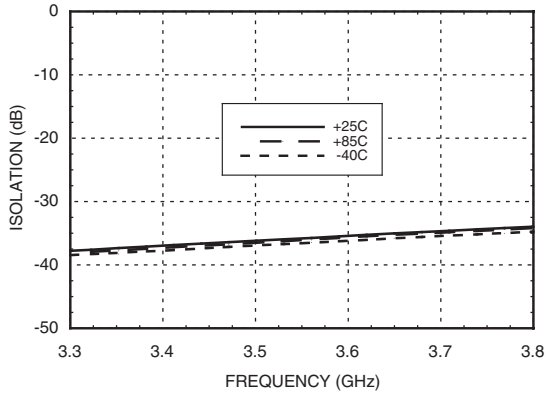
LNA Output P1dB vs. Temperature



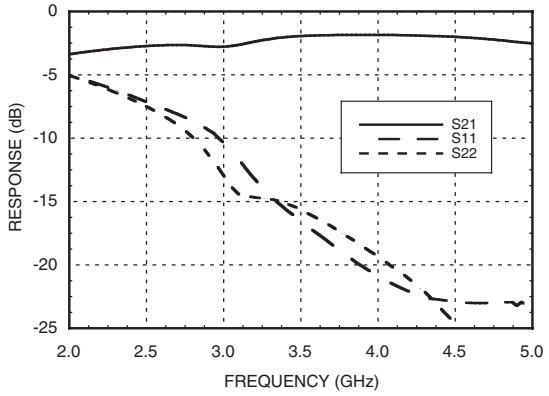
LNA Output P1dB vs. Vdd



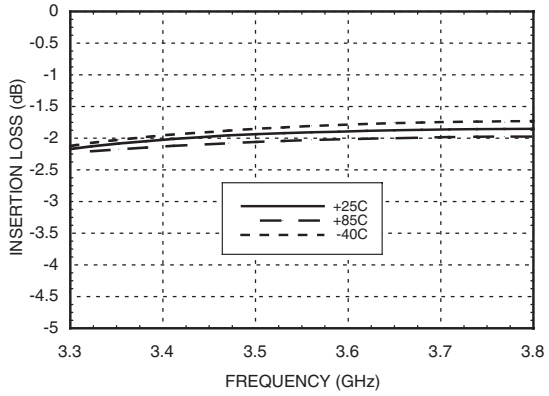
LNA Reverse Isolation vs. Temperature



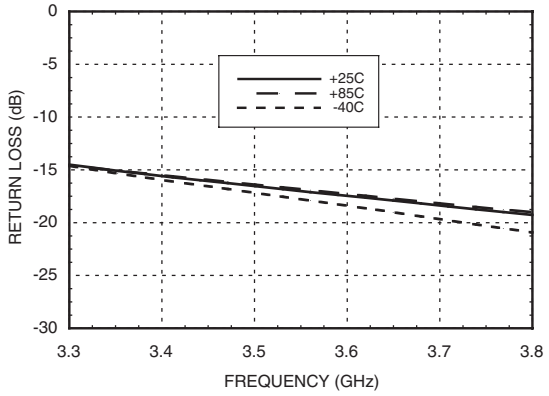
Bypass Mode
Broadband Insertion Loss & Return Loss



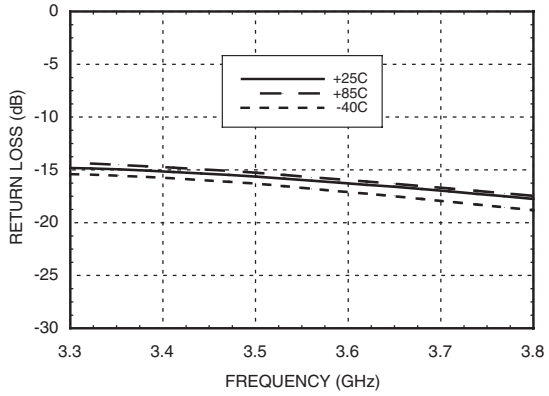
Bypass Mode
Insertion Loss vs. Temperature



Bypass Mode
Input Return Loss vs. Temperature



Bypass Mode
Output Return Loss vs. Temperature



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Absolute Maximum Ratings

Drain Bias Voltage (Vdd)		+8.0 Vdc
RF Input Power (RFin)(Vdd = +5.0 Vdc)	LNA Mode	+15 dBm
	Bypass Mode	+30 dBm
Channel Temperature		150 °C
Continuous Pdiss (T = 85 °C) (derate 13 mW/°C above 85 °C)		850 mW
Thermal Resistance (channel to ground paddle)		76.9 °C/W
Storage Temperature		-65 to +150° C
Operating Temperature		-40 to +85° C

Typical Supply Current vs. Vdd

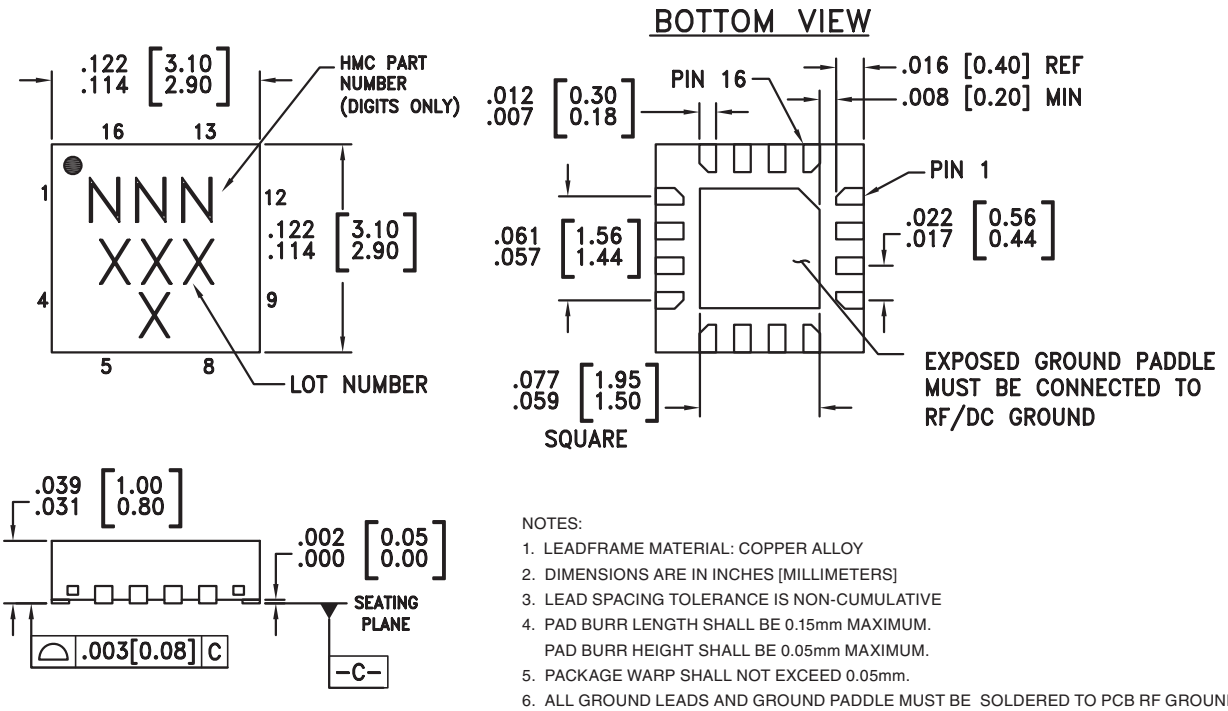
Vdd (Vdc)	Idd (mA)
+4.5	33
+5.0	39
+5.5	44

Truth Table

LNA Mode	Vctl= Vdd
Bypass Mode	Vctl= 0V

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

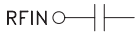
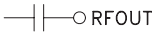
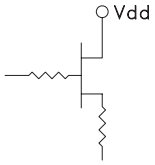
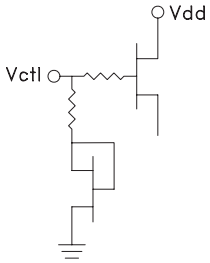
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. LEAD SPACING TOLERANCE IS NON-CUMULATIVE
4. PAD BURR LENGTH SHALL BE 0.15mm MAXIMUM. PAD BURR HEIGHT SHALL BE 0.05mm MAXIMUM.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm.
6. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
7. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED LAND PATTERN.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [3]
HMC593LP3	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 [1]	593 XXXX
HMC593LP3E	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	593 XXXX

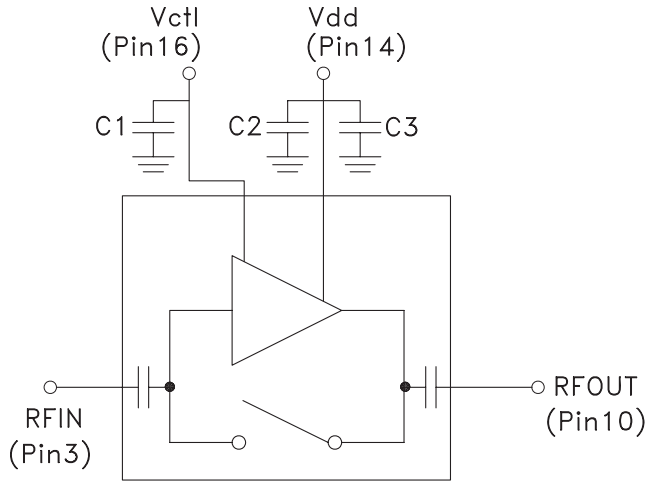
[1] Max peak reflow temperature of 235 °C
[2] Max peak reflow temperature of 260 °C
[3] 4-Digit lot number XXXX

Pin Descriptions

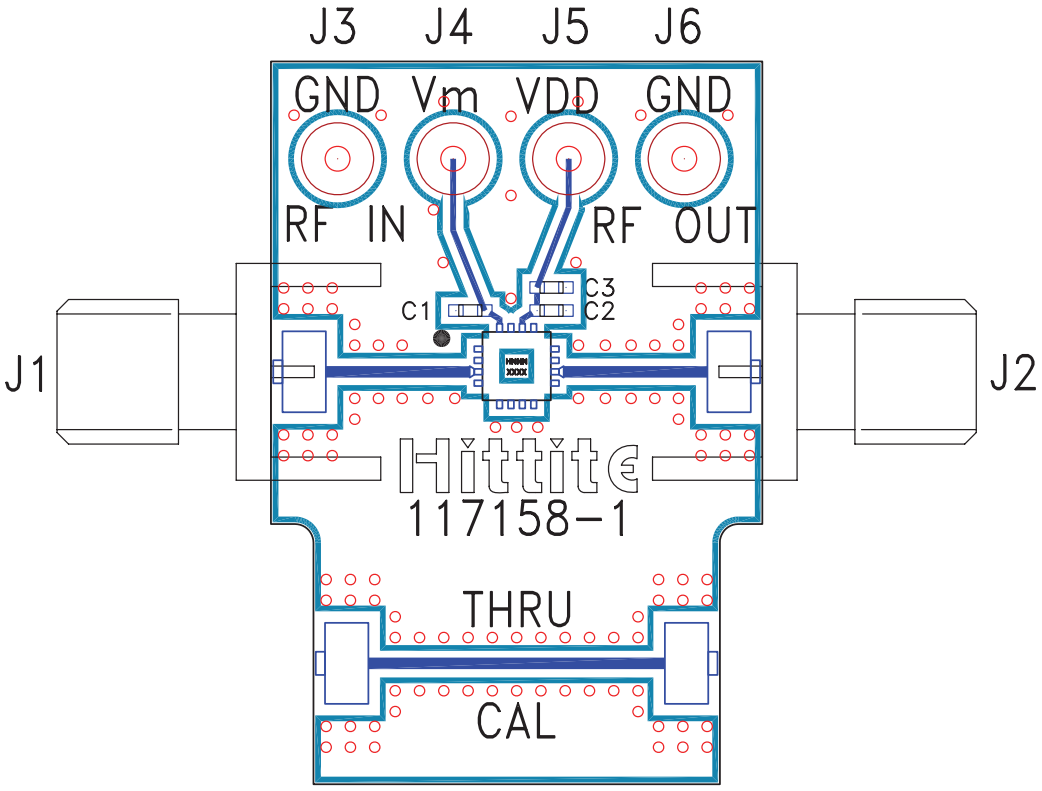
Pin Number	Function	Description	Interface Schematic
1, 2, 5, 6, 8, 9, 11 - 13	N/C	No connection necessary. These pins may be connected to RF/DC ground.	
3	RFIN	This pin is AC coupled and matched to 50 Ohms.	
4, 7, 15	GND	These pins must be connected to RF/DC ground.	
10	RFOUT	This pin is AC coupled and matched to 50 Ohms.	
14	Vdd	Power supply voltage. Bypass capacitors are required. See application circuit.	
16	Vctl	LNA/Bypass Mode Control Voltage. See truth table.	

Application Circuit

Component	Value
C1, C2	100pF
C3	10KpF



Evaluation PCB



List of Materials for Evaluation PCB 117160 [1]

Item	Description
J1 - J2	PCB Mount SMA RF Connector
J3 - J6	DC Pin
C1, C2	100 pF Capacitor, 0402 Pkg.
C3	10 KpF Capacitor, 0402 Pkg.
U1	HMC593LP3 / HMC593LP3E Amplifier
PCB [2]	117158 Evaluation Board

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: 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.

Notes: