HMC413QS16G

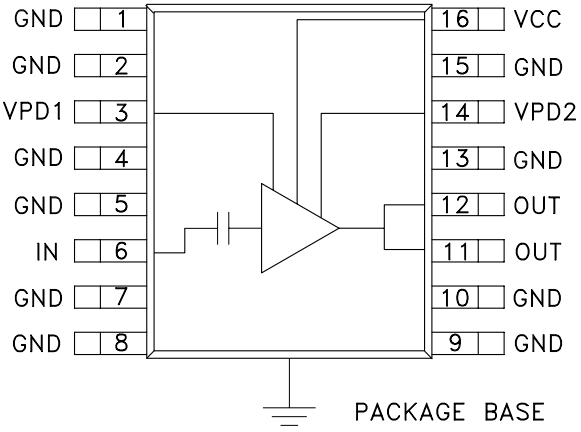
GaAs InGaP HBT MMIC POWER AMPLIFIER, 1.6 - 2.2 GHz

Typical Applications

This amplifier is ideal for use as a power/driver amplifier for 1.6 - 2.2 GHz applications:

- Cellular / PCS / 3G
- Portable & Infrastructure
- Wireless Local Loop

Functional Diagram



Features

Gain: 23 dB

Saturated Power: +29.5 dBm

42% PAE

Supply Voltage: +2.75V to +5.0 V

Power Down Capability

Low External Part Count

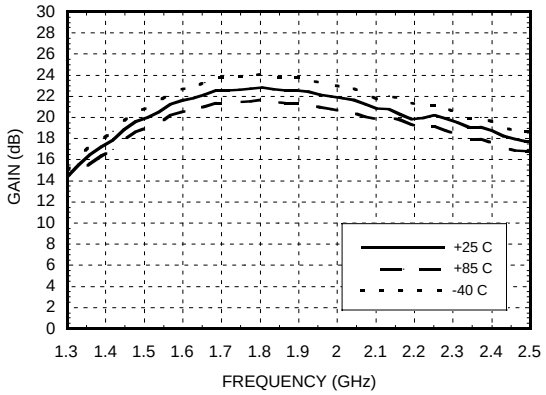
General Description

The HMC413QS16G is a high efficiency GaAs InGaP Heterojunction Bipolar Transistor (HBT) MMIC Power amplifier which operates between 1.6 and 2.2 GHz. The amplifier is packaged in a low cost, surface mount 16 leaded package with an exposed base for improved RF and thermal performance. With a minimum of external components, the amplifier provides 23 dB of gain, +29.5 dBm of saturated power at 42% PAE from a +5.0V supply voltage. The amplifier can also operate with a 3.6V supply. Vpd can be used for full power down or RF output power/current control.

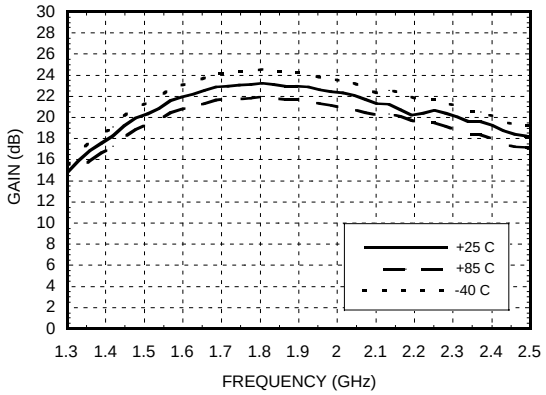
Electrical Specifications, T_A = +25° C, As a Function of Vs, Vpd = 3.6V

Parameter	Frequency	Vs= 3.6V			Vs= 5.0V			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Gain	1.6 - 1.7 GHz 1.7 - 2.0 GHz 2.0 - 2.1 GHz 2.1 - 2.2 GHz	18 19 18 17	21 22 21 20		19 20 19 18	22 23 22 21		dB dB dB dB
Gain Variation Over Temperature	1.6 - 2.2 GHz		0.025	0.035		0.025	0.035	dB/°C
Input Return Loss	1.6 - 2.2 GHz		10			10		dB
Output Return Loss	1.6 - 2.2 GHz		8			9		dB
Output Power for 1 dB Compression (P1dB)	1.6 - 1.7 GHz 1.7 - 2.2 GHz	20 21	23 24		23 24	26 27		dBm dBm
Saturated Output Power (Psat)	1.6 - 1.7 GHz 1.7 - 2.2 GHz		25.5 26.5			28.5 29.5		dBm dBm
Output Third Order Intercept (IP3)	1.6 - 1.7 GHz 1.7 - 2.0 GHz 2.0 - 2.2 GHz	32 33 32	35 36 35		36 37 36	39 40 39		dBm dBm dBm
Noise Figure	1.6 - 2.2 GHz		5.5			5.5		dB
Supply Current (Icq) Vpd= 0V/3.6V			0.002/220			0.002/270		mA
Control Current (Ipd) Vpd= 3.6V			7			7		mA
Switching Speed tON, tOFF			80			80		ns

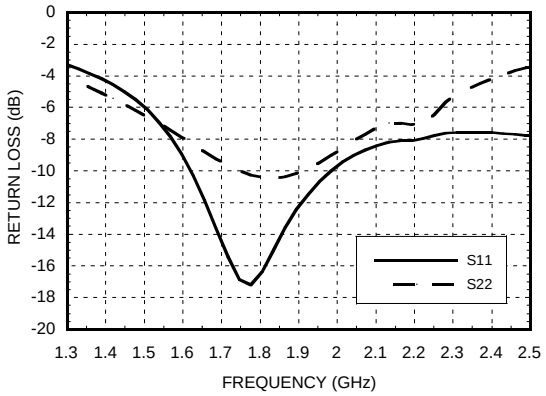
Gain vs. Temperature, Vs= 3.6V



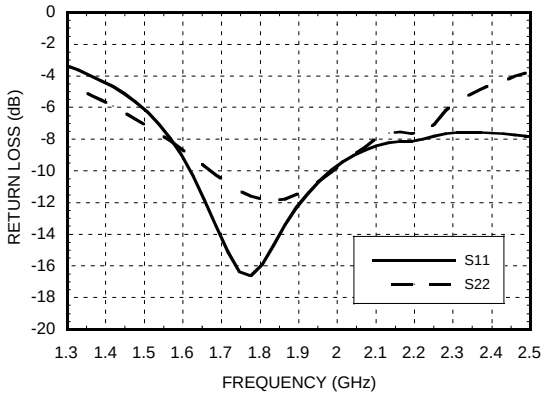
Gain vs. Temperature, Vs= 5.0V



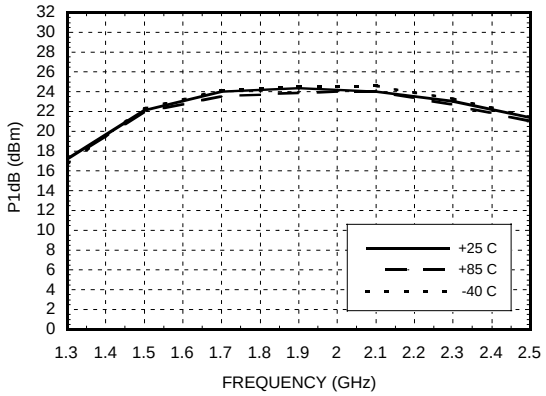
Return Loss, Vs= 3.6V



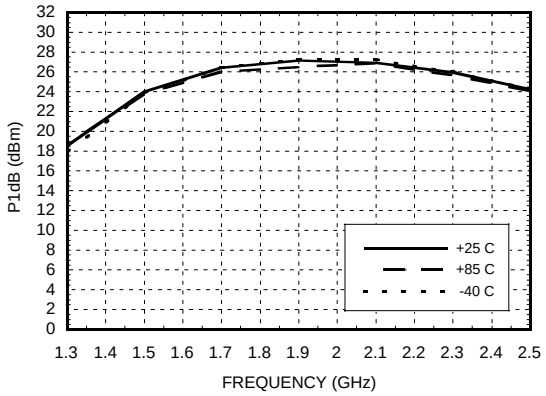
Return Loss, Vs= 5.0V



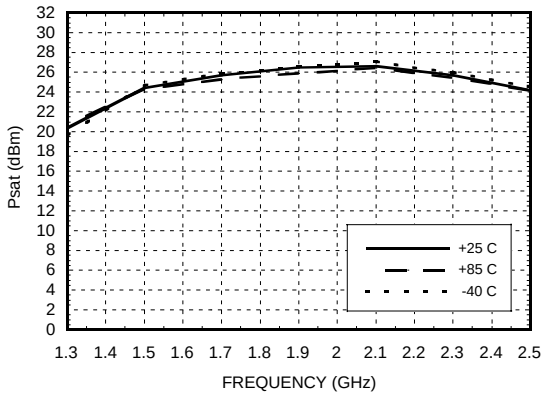
P1dB vs. Temperature, Vs= 3.6V



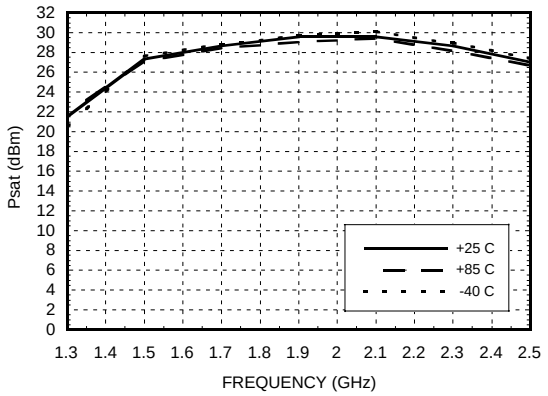
P1dB vs. Temperature, Vs= 5.0V



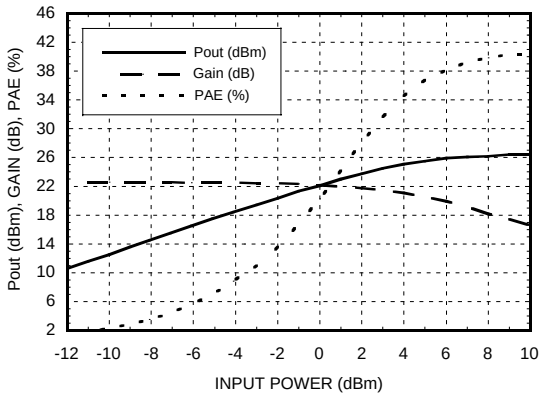
Psat vs. Temperature, Vs= 3.6V



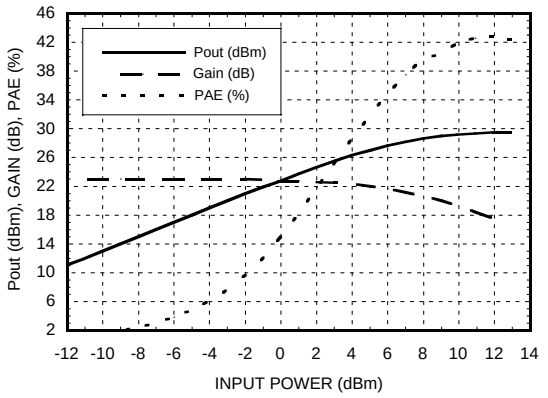
Psat vs. Temperature, Vs= 5.0V



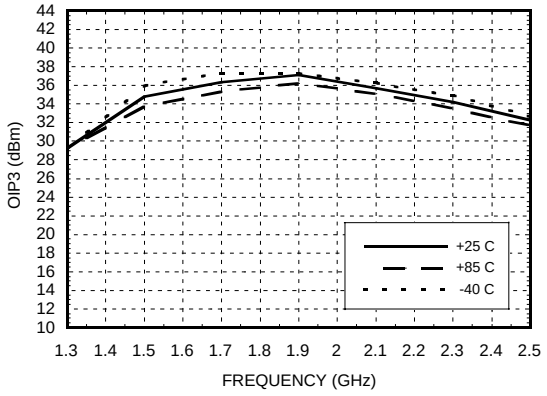
Power Compression@ 1.9 GHz, Vs= 3.6V



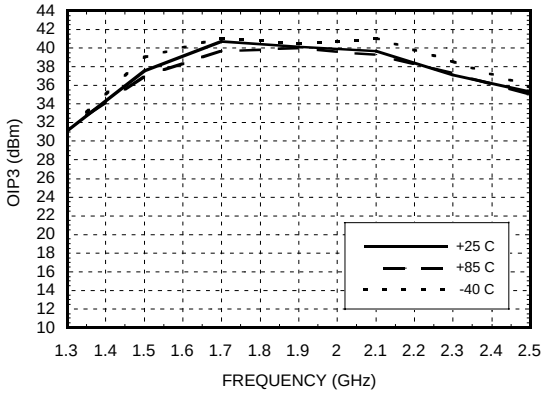
Power Compression@ 1.9 GHz, Vs= 5.0V



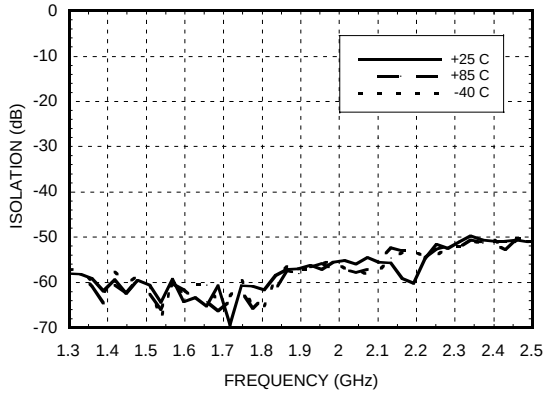
Output IP3 vs. Temperature, Vs= 3.6V



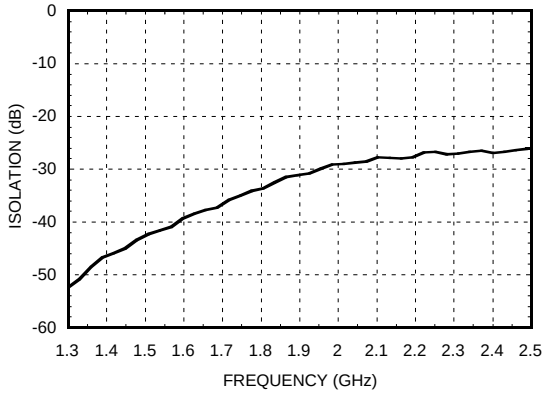
Output IP3 vs. Temperature, Vs= 5.0V



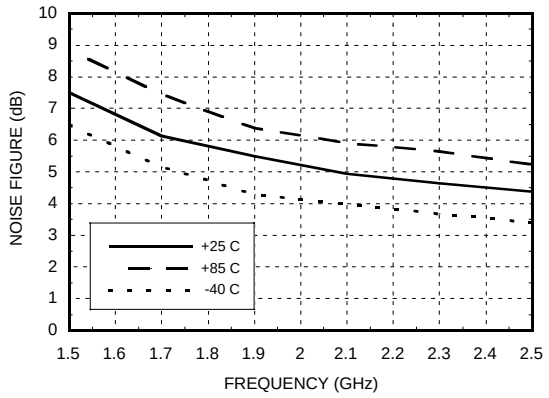
Reverse Isolation vs. Temperature, Vs= 3.6V



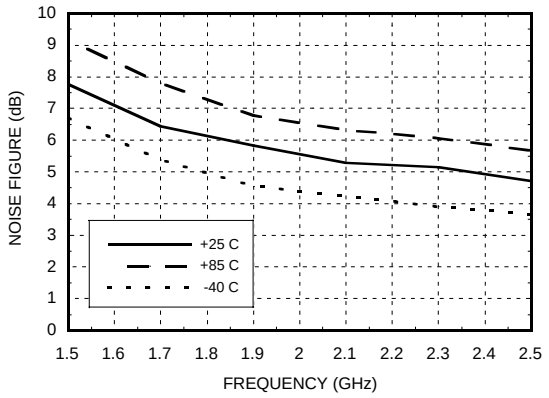
Power Down Isolation, Vs= 3.6V



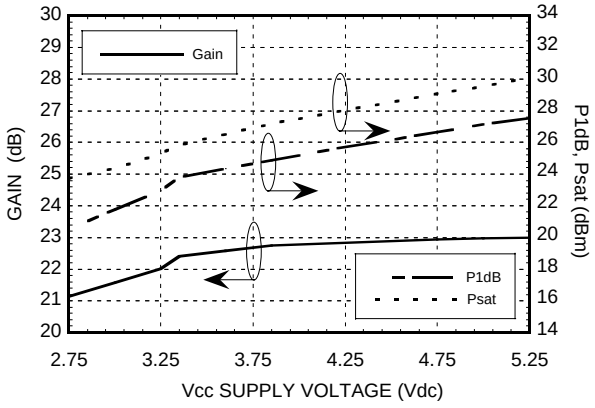
Noise Figure vs. Temperature, Vs= 3.6V



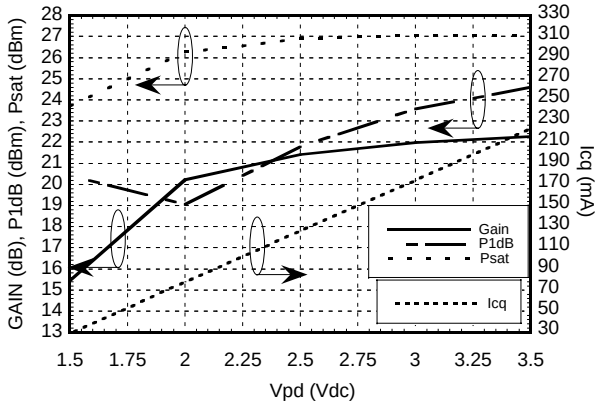
Noise Figure vs. Temperature, Vs= 5.0V



Gain & Power vs. Supply Voltage @ 1.9 GHz



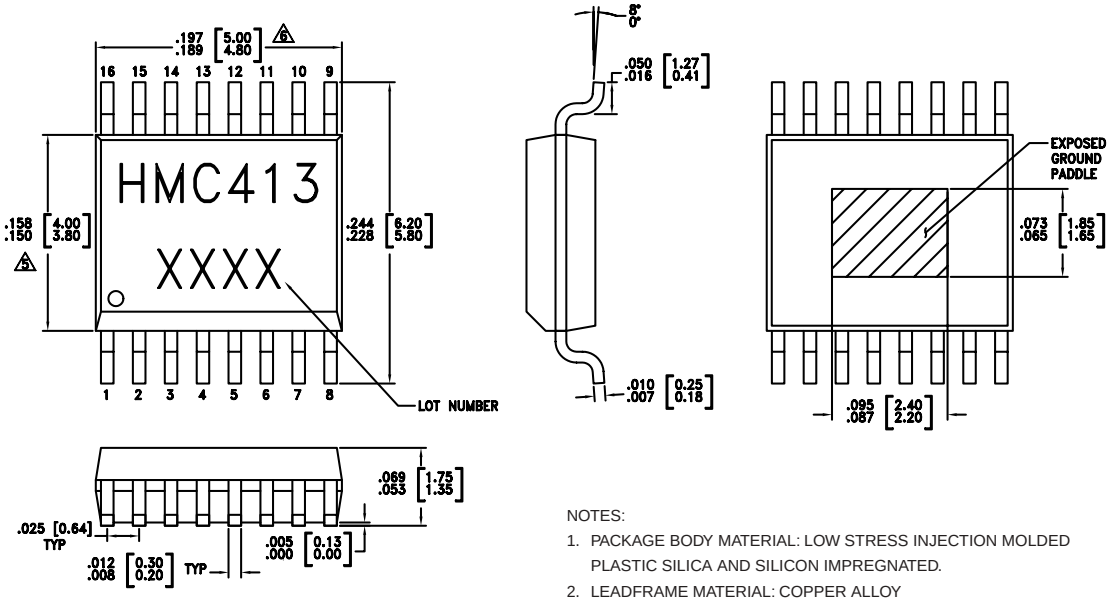
Gain, Power & Quiescent Supply Current vs. Vpd @ 1.9 GHz, Vcc = +3.6V



Absolute Maximum Ratings

Collector Bias Voltage (Vcc)	+5.5 Vdc
Control Voltage (Vpd1, Vpd2)	+4.0 Vdc
RF Input Power (RFin)(Vs = +5.0 Vdc, Vpd = +3.6 Vdc)	+20 dBm
Junction Temperature	150 °C
Continuous Pdiss (T = 85 °C) (derate 24 mW/°C above 85 °C)	1.56 W
Thermal Resistance (junction to ground paddle)	42 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C

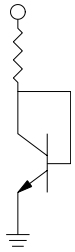
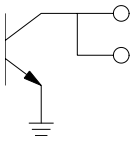
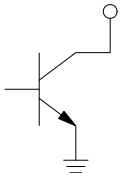
Outline Drawing



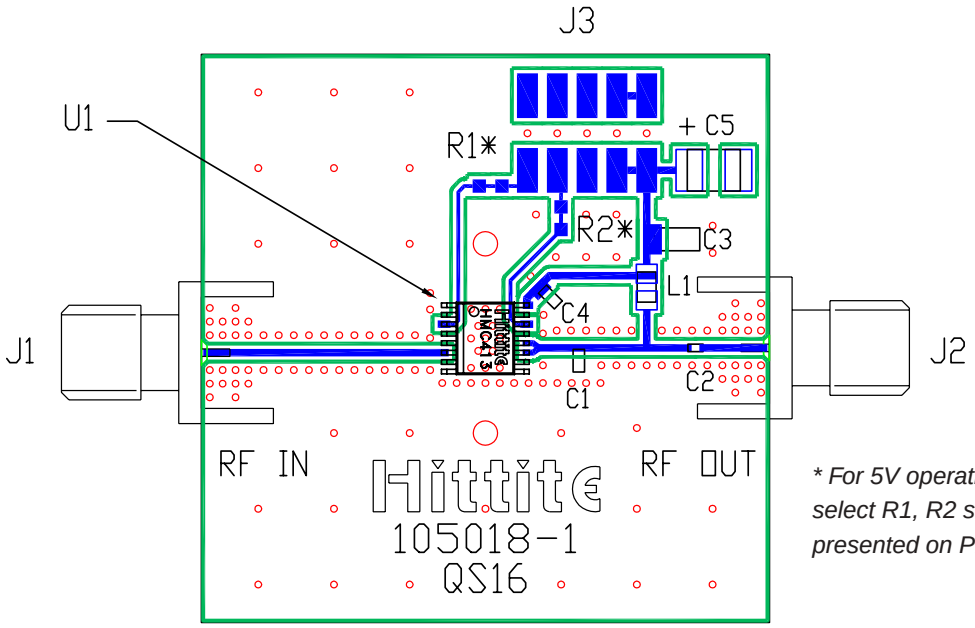
NOTES:

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 AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 2, 4, 5, 7, 8, 9, 10, 13, 15	GND	Ground: Backside of package has exposed metal ground slug that must be connected to ground thru a short path. Vias under the device are required.	
3, 14	Vpd1, Vpd2	Power Control Pin. For maximum power, this pin should be connected to 3.6V. For 5V operation, a dropping resistor is required. A higher voltage is not recommended. For lower idle current, this voltage can be reduced.	
6	RF IN	This pin is AC coupled and matched to 50 Ohms from 1.6 to 2.2 GHz.	
11, 12	RF OUT	RF output and bias for the output stage.	
16	Vcc	Power supply voltage for the first amplifier stage. An external bypass capacitor of 330 pF is required as shown in the application schematic.	

Evaluation PCB



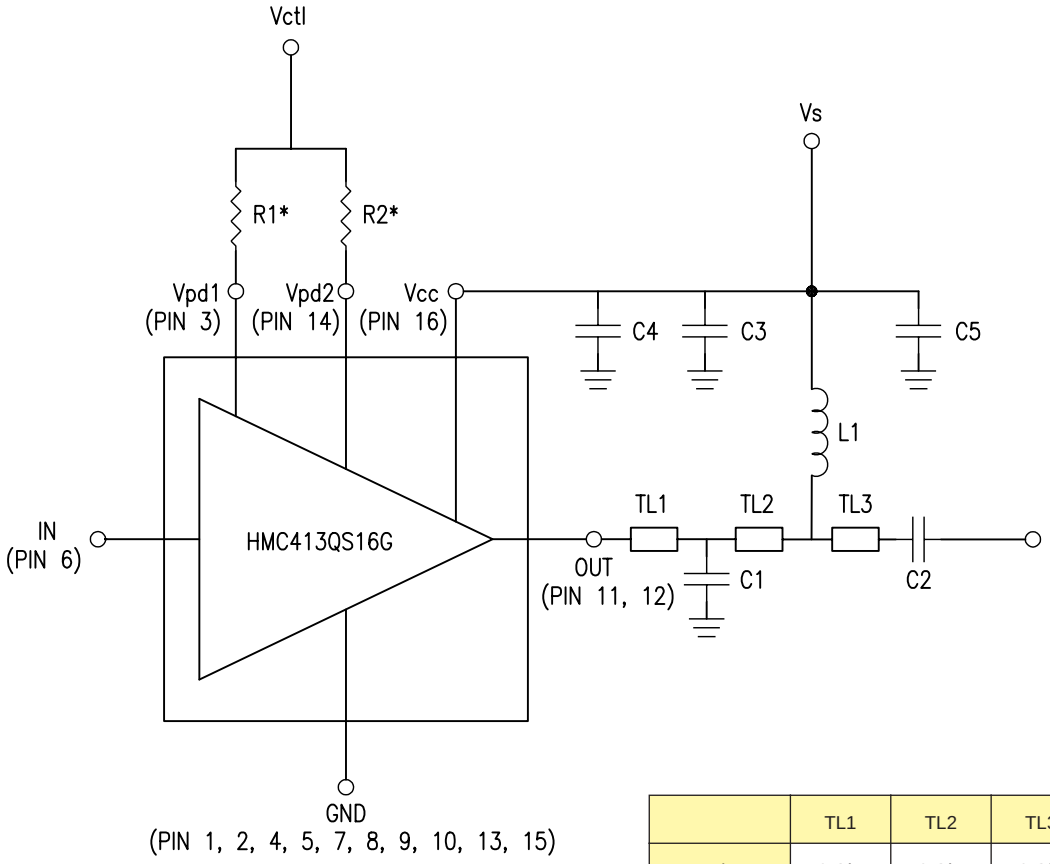
** For 5V operation on Vctl line, select R1, R2 such that 3.6V is presented on Pins 3 and 14.*

List of Material

Item	Description
J1 - J2	PC Mount SMA RF Connector
J3	2 mm DC Header
C1	2.2 pF Capacitor, 0603 Pkg.
C2	10 pF Capacitor, 0402 Pkg.
C3 - C4	330 pF Capacitor, 0603 Pkg.
C5	2.2 µF Capacitor, Tantalum
L1	16 nH Inductor 0603 Pkg.
U1	HMC413QS16G Amplifier
PCB*	105018 Eval Board
* 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 board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.

Application Circuit



	TL1	TL2	TL3
Impedance	50 Ohm	50 Ohm	50 Ohm
Length	0.1”	0.15”	0.1”

** For 5V operation on Vctl line, select R1, R2 such that 3.6V is presented on Pins 3 and 14.*