Hittite MICROWAVE CORPORATION

HMC457QS16G / 457QS16GE

v03.0907

InGaP HBT 1 WATT POWER AMPLIFIER, 1.7 - 2.2 GHz

RoHS✓ EARTH FRIENDLY

Designer's Kit Available

Typical Applications

The HMC457QS16G / HMC457QS16GE is ideal for applications requiring a high dynamic range amplifier:

- CDMA & W-CDMA
- GSM, GPRS & Edge
- Base Stations & Repeaters

Features

Output IP3: +46 dBm

Gain: 27 dB @ 1900 MHz

48% PAE @ +32 dBm Pout

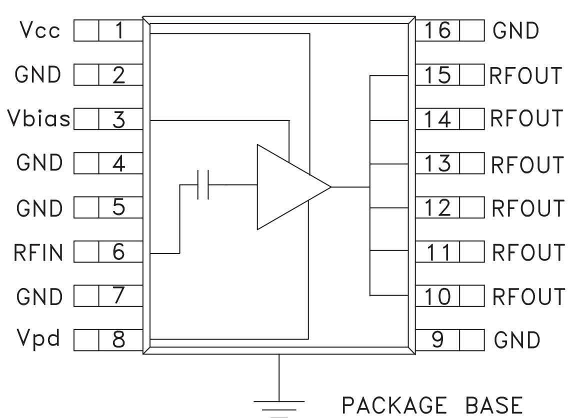
+25 dBm W-CDMA Channel Power @ -50 dBc ACPR

Integrated Power Control (Vpd)

QSOP16G SMT Package: 29.4 mm^2

Included in the HMC-DK002 Designer's Kit

Functional Diagram



General Description

The HMC457QS16G & HMC457QS16GE are high dynamic range GaAs InGaP Heterojunction Bipolar Transistor (HBT) 1 watt MMIC power amplifiers operating between 1.7 and 2.2 GHz. Packaged in a miniature 16 lead QSOP plastic package, the amplifier gain is typically 27 dB from 1.7 to 2.0 GHz and 25 dB from 2.0 to 2.2 GHz. Utilizing a minimum number of external components, the amplifier output IP3 can be optimized to +45 dBm. The power control (Vpd) can be used for full power down or RF output power/current control. The high output IP3 and PAE make the HMC457QS16G & HMC457QS16GE ideal power amplifiers for Cellular/3G base station & repeater applications.

Electrical Specifications, T_A = +25°C, Vs= +5V, Vpd = +5V, Vbias = +5V [1]

Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range		1710 - 1990			2010 - 2170		MHz
Gain	24	27		22	25		dB
Gain Variation Over Temperature		0.025	0.035		0.025	0.035	dB / °C
Input Return Loss		11			11		dB
Output Return Loss		8			5		dB
Output Power for 1dB Compression (P1dB)	26	29		27.5	30.5		dBm
Saturated Output Power (Psat)		32.5			32		dBm
Output Third Order Intercept (IP3) [2]	42	45		42	45		dBm
Noise Figure		6			5		dB
Supply Current (Icq)		500			500		mA
Control Current (Ipd)		4			4		mA
Bias Current (Vbias)		10			10		mA

[1] Specifications and data reflect HMC457QS16G measured using the respective application circuits for each designated frequency band found herein. Contact the HMC Applications Group for assistance in optimizing performance for your application.
[2] Two-tone output power of +15 dBm per tone, 1 MHz spacing.

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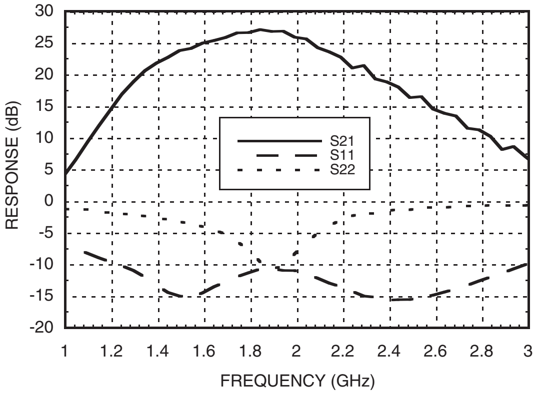
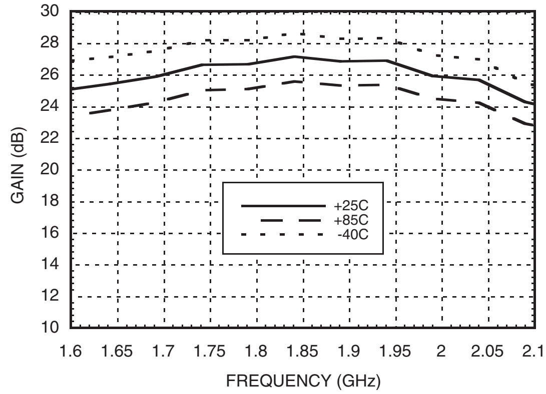
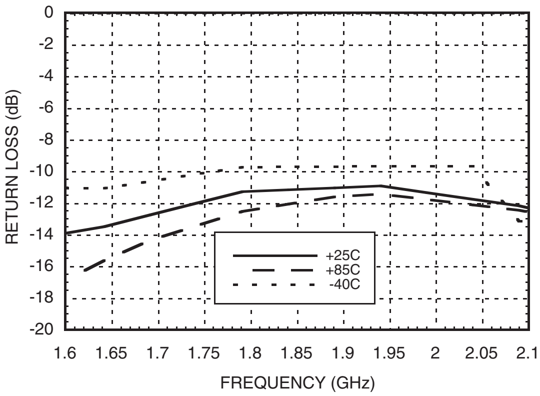
Broadband Gain & Return Loss @ 1900 MHz



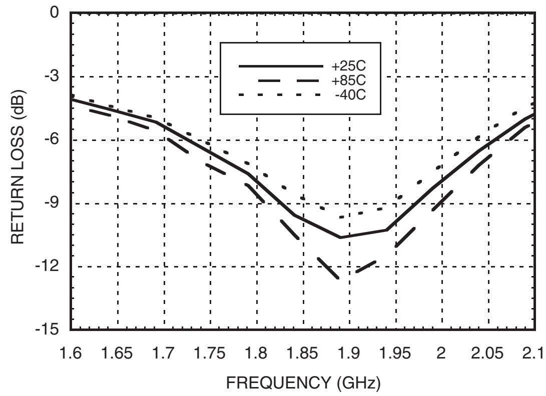
Gain vs. Temperature @ 1900 MHz



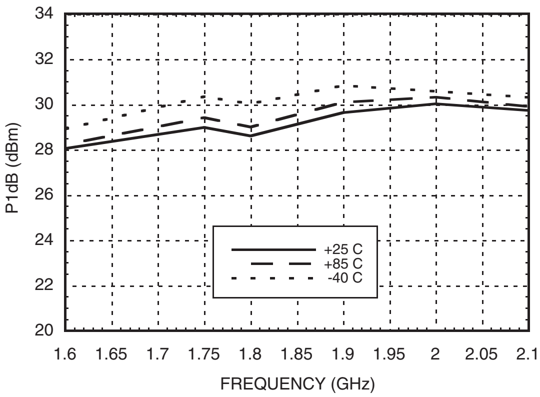
Input Return Loss vs. Temperature @ 1900 MHz



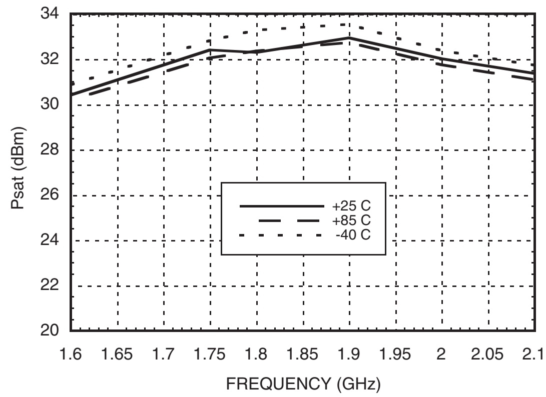
Output Return Loss vs. Temperature @ 1900 MHz



PldB vs. Temperature @ 1900 MHz



Psat vs. Temperature @ 1900 MHz



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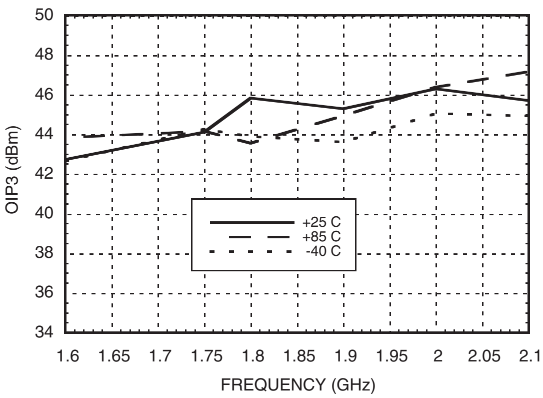
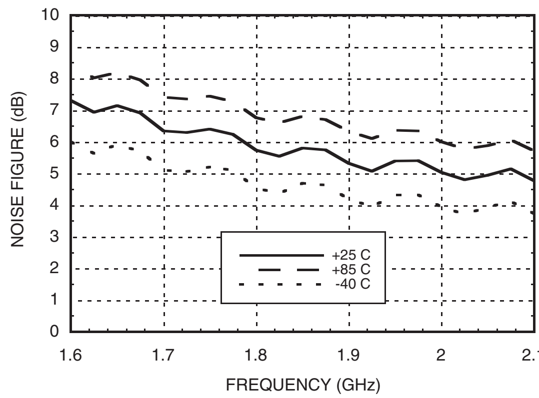
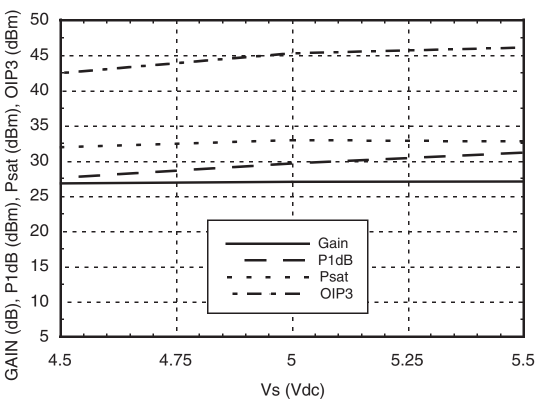
Output IP3 vs. Temperature @ 1900 MHz



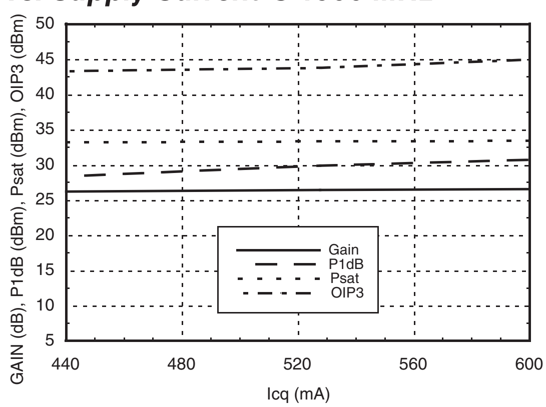
Noise Figure vs. Temperature @ 1900 MHz



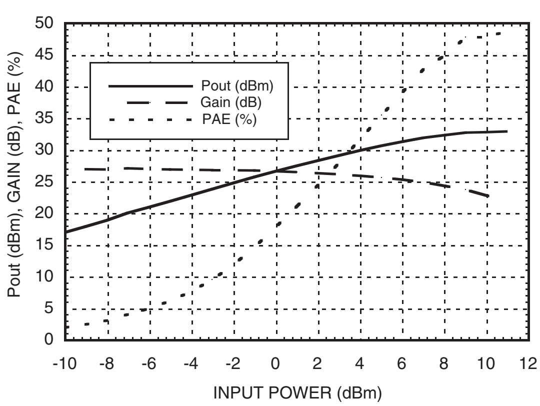
Gain, Power & IP3 vs. Supply Voltage @ 1900 MHz



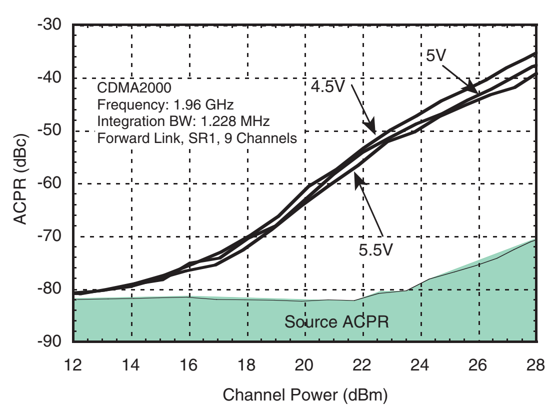
Gain, Power & IP3 vs. Supply Current @ 1900 MHz*



Power Compression @ 1900 MHz

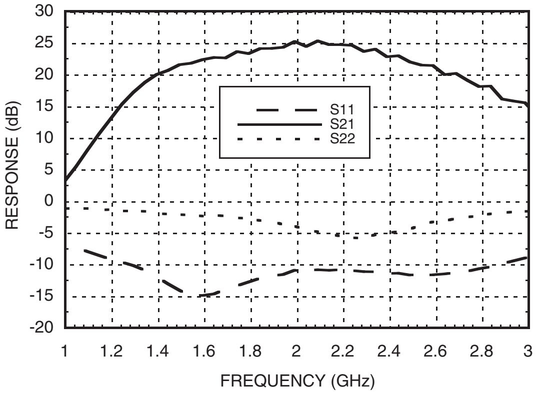


ACPR vs. Supply Voltage @ 1960 MHz CDMA 2000, 9 Channels Forward

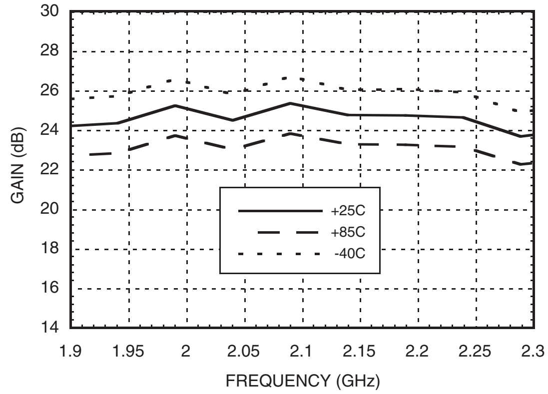


* Icq is controlled by varying Vpd.

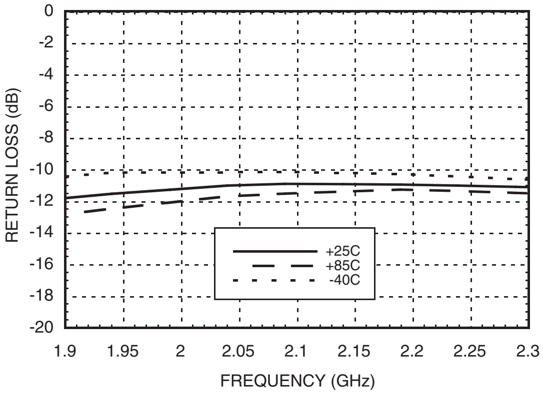
Broadband Gain and Return Loss @ 2100 MHz



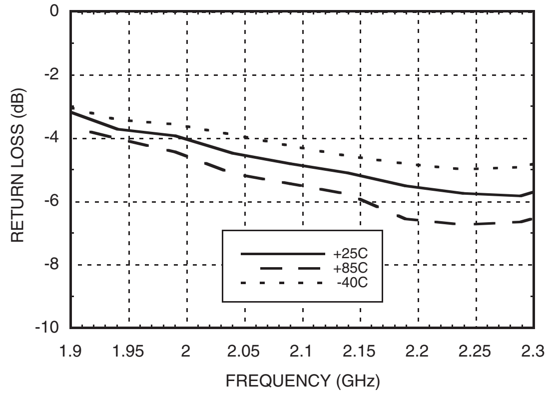
Gain vs. Temperature @ 2100 MHz



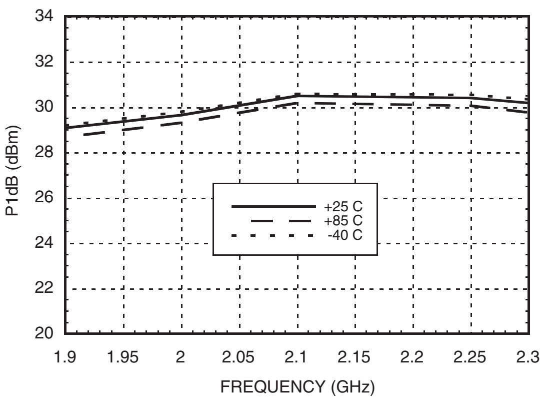
Input Return Loss vs. Temperature @ 2100 MHz



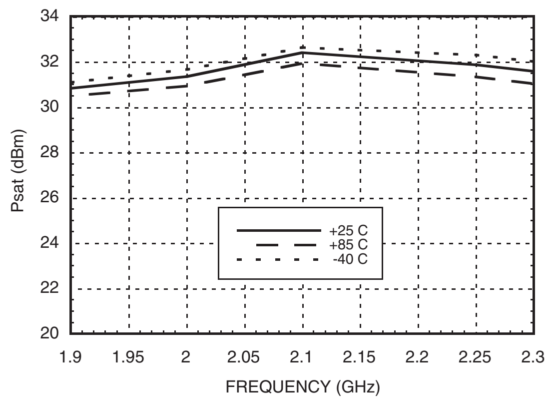
Output Return Loss vs. Temperature @ 2100 MHz



PldB vs. Temperature @ 2100 MHz



Psat vs. Temperature @ 2100 MHz



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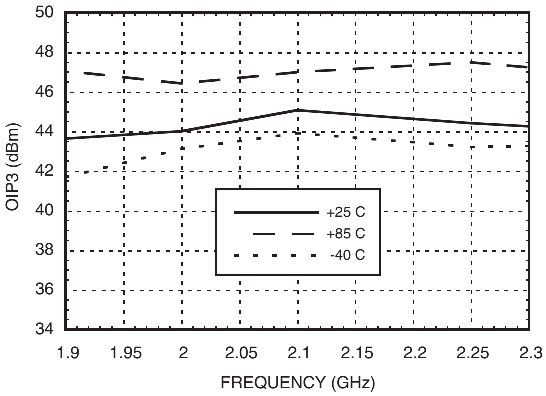
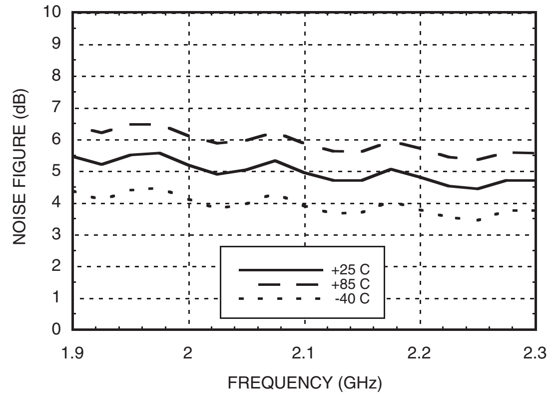
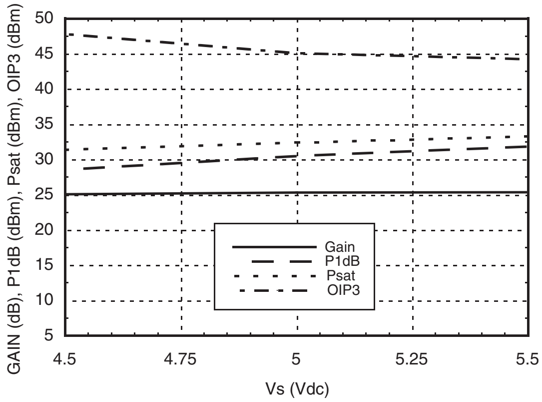
Output IP3 vs. Temperature @ 2100 MHz



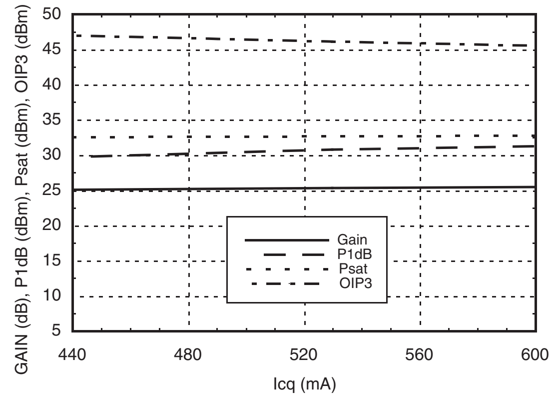
Noise Figure vs. Temperature @ 2100 MHz



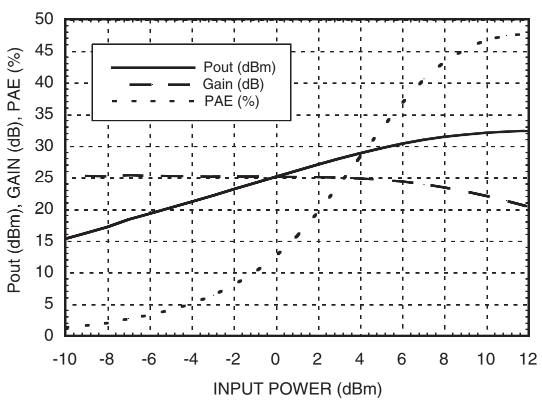
Gain, Power & IP3 vs. Supply Voltage @ 2100 MHz



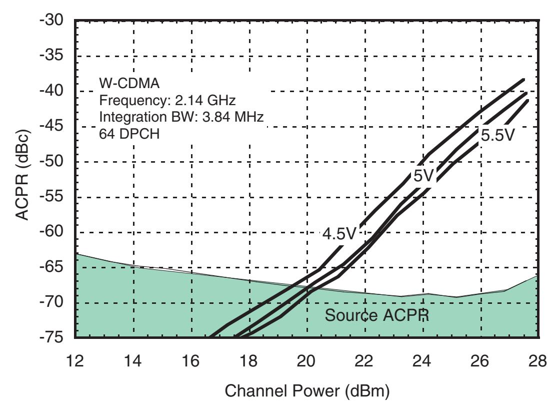
Gain, Power & IP3 vs. Supply Current @ 2100 MHz*



Power Compression @ 2100 MHz



ACPR vs. Supply Voltage @ 2140 MHz W-CDMA, 64 DPCH (Uplink)



*Icq is controlled by varying Vpd

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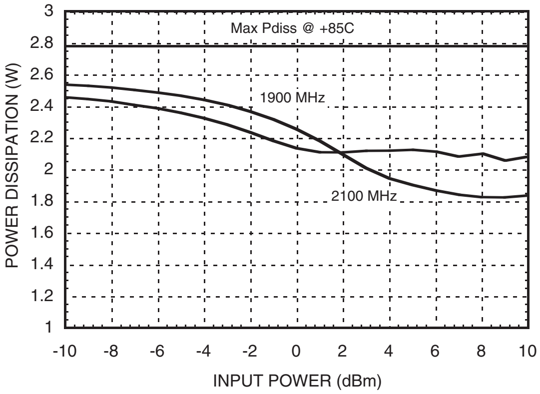
Power Dissipation



Typical Supply Current vs. Supply Voltage

Vs (V)	Icq (mA)
4.5	400
5.0	510
5.5	620

Absolute Maximum Ratings

Collector Bias Voltage (Vcc)	+6 Vdc
Control Voltage (Vpd)	+5.4 Vdc
RF Input Power (RFIN)(Vs = Vpd = +5 Vdc)	+15 dBm
Junction Temperature	150 °C
Continuous Pdiss (T = 85 °C) (derate 42.9 mW/°C above 85 °C)	2.78 W
Thermal Resistance (junction to ground paddle)	23.3 °C/W
Storage Temperature	-65 to +150 °C
Operating Temperature	-40 to +85 °C

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

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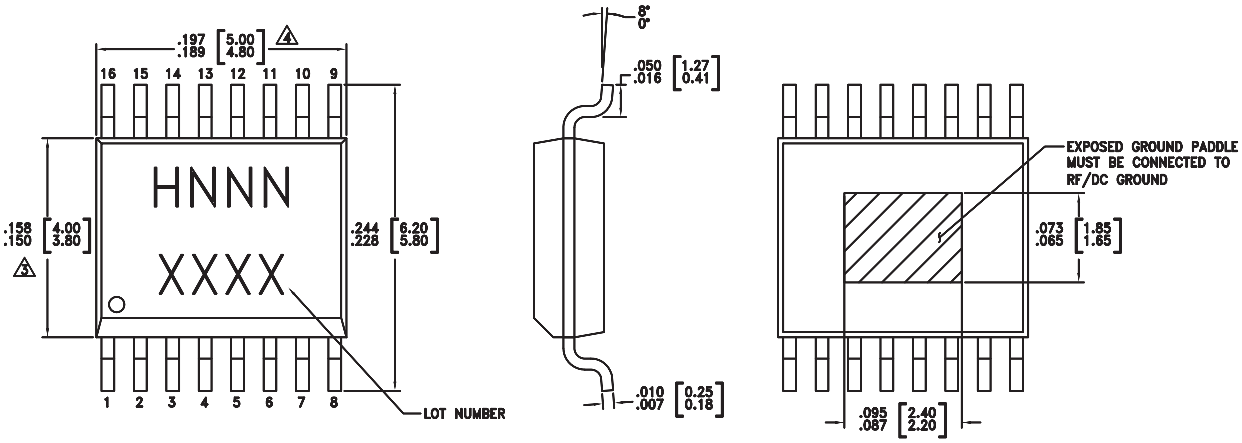
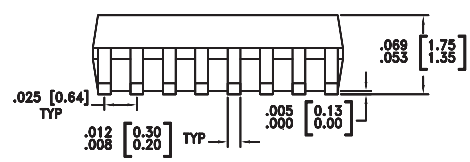
Outline Drawing





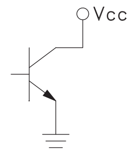
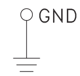
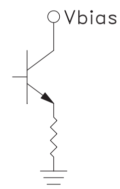
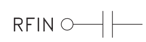
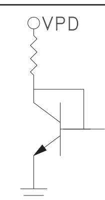
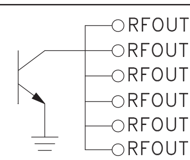
NOTES:
1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
5. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

Package Information

Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [3]
HMC457QS16G	Low Stress Injection Molded Plastic	Sn/Pb Solder	MSL1 [1]	H457 XXXX
HMC457QS16GE	RoHS-compliant Low Stress Injection Molded Plastic	100% matte Sn	MSL1 [2]	H457 XXXX

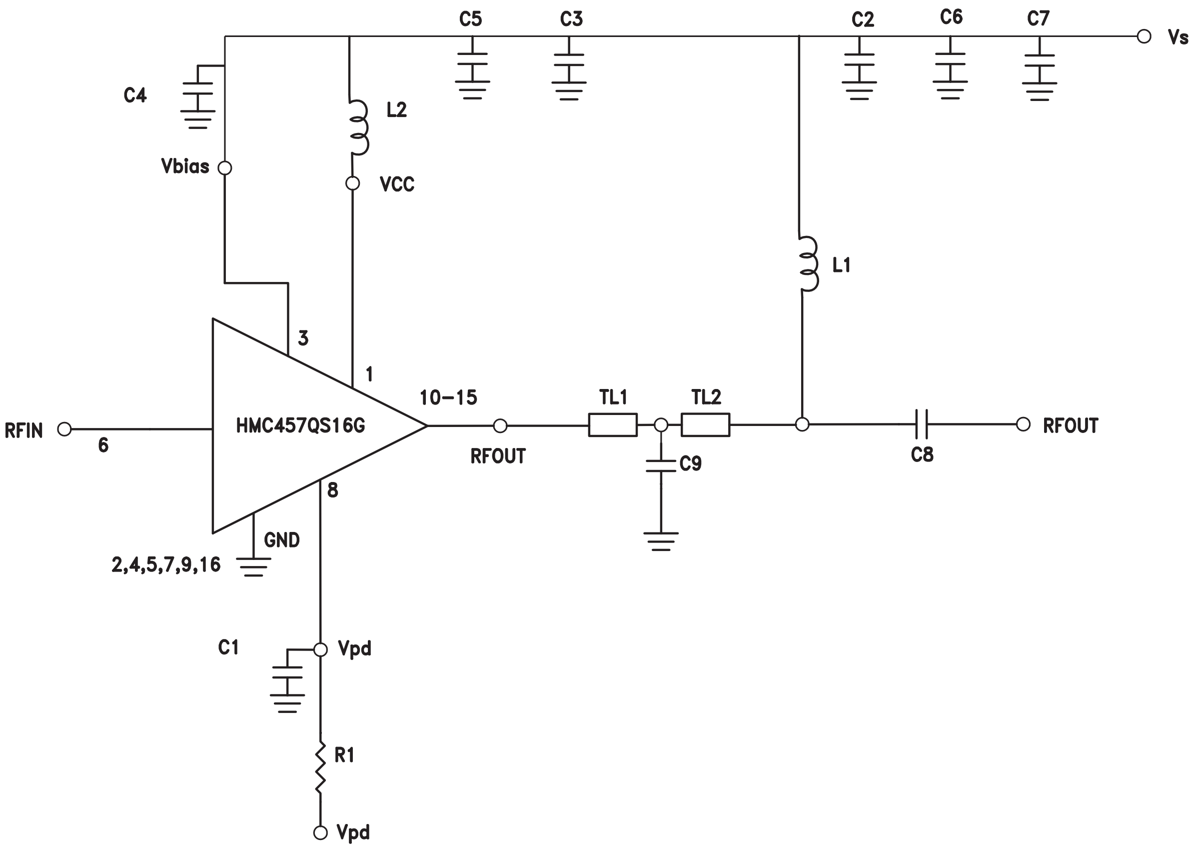
[1] Max peak reflow temperature of 235 °C
[2] Max peak reflow temperature of 260 °C
[3] 4-Digit lot number XXXX

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1	Vcc	Power supply voltage for the first amplifier stage. External bypass capacitors are required as shown in the application schematic.	
2, 4, 5, 7, 9, 16	GND	Ground: Backside of package has exposed metal ground slug that must also be connected to RF/DC ground. Vias under the device are required.	
3	Vbias	Power Supply for Bias Circuit	
6	RFIN	This pin is AC coupled and matched to 50 Ohms	
8	Vpd	Power control pin. For maximum power, this pin should be connected to +5V. A higher voltage is not recommended. For lower idle current, this voltage can be reduced.	
10 - 15	RFOUT	RF output and DC bias for the output stage.	

1900 & 2100 MHz Application Circuit

This circuit was used to specify the performance for 1900 & 2100 MHz operation. Contact the HMC Applications Group for assistance in optimizing performance for your application.



	TL1	TL2
Impedance	50 Ohm	50 Ohm
Physical Length	0.170”	0.080”
Electrical Length	20°	9°
PCB Material: 10 mil Rogers 4350, Er = 3.48		

Recommended Component Values	1900 MHz	2100 MHz
C1 - C4	100 pF	100 pF
C5, C6	1000 pF	1000 pF
C7	2.2 µF	2.2 µF
C8	33 pF	33 pF
C9	3.9 pF	2.7 pF
L1, L2	3.9 nH	3.9 nH
R1	160 Ohm	160 Ohm

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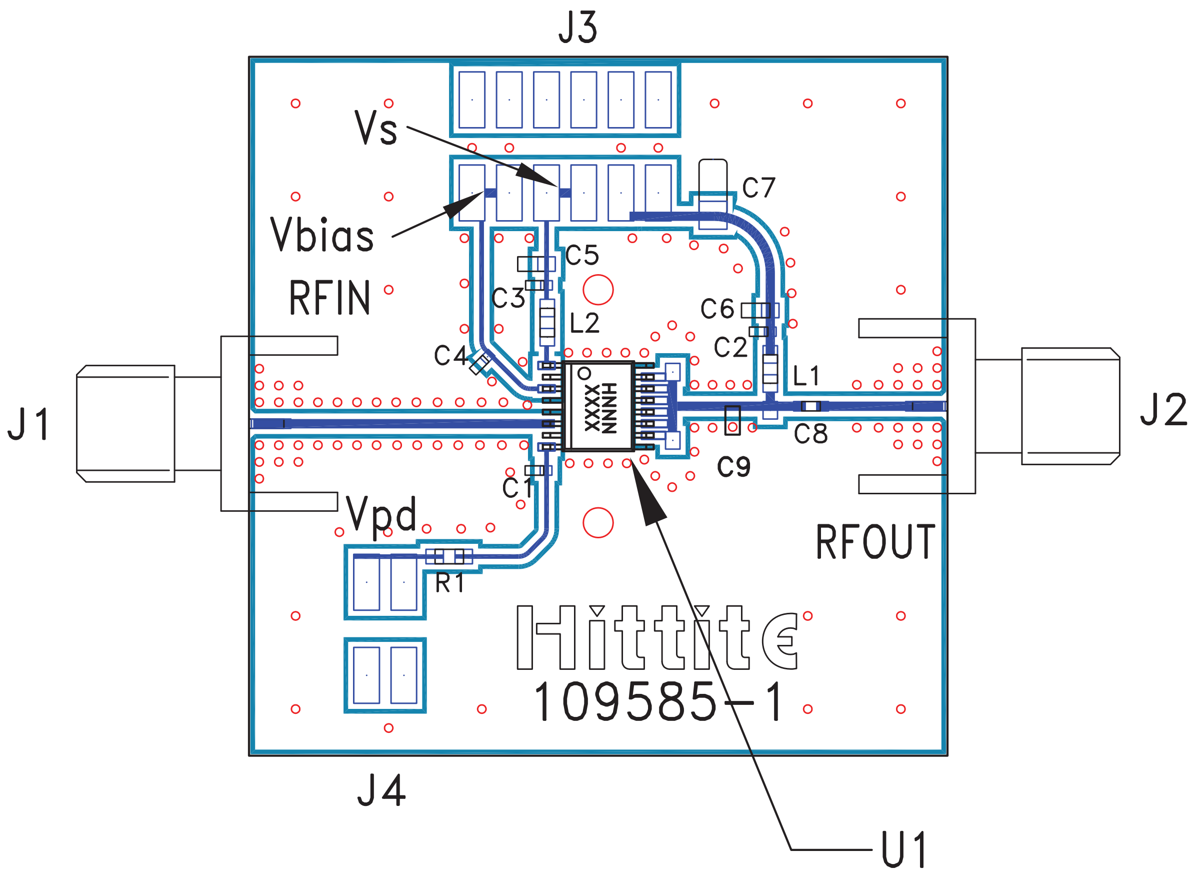
Evaluation PCB



List of Materials for Evaluation PCB 106043-1900, 110171-2100 [1]

Item	Description
J1, J2	PCB Mount SMA Connector
J3, J4	2 mm DC Header
C1 - C4	100 pF Capacitor, 0402 Pkg.
C5, C6	1000 pF Capacitor, 0603 Pkg.
C7	2.2 µF Capacitor, Tantalum
C8	33 pF Capacitor, 0402 Pkg.
C9	3.9 pF Capacitor, 0603 Pkg. - 1900 MHz
C9	2.7 pF Capacitor, 0603 Pkg. - 2100 MHz
L1, L2	3.9 nH Inductor, 0603 Pkg.
R1	160 Ohm Resistor, 0603 Pkg.
U1	HMC457QS16G / HMC457QS16GE
PCB [2]	109585 Evaluation PCB, 10 mils

[1] Reference one of these numbers when ordering complete evaluation PCB depending on frequency of operation.

[2] Circuit Board Material: Rogers 4350, Er = 3.48

The circuit board used in this 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.