GaAs pHEMT MMIC 0.25 WATT POWER AMPLIFIER, DC - 40 GHz

Typical Applications

The HMC5805LS6 is ideal for:

- Test Instrumentation
- Microwave Radio & VSAT
- Military & Space
- Telecom Infrastructure
- Fiber Optics

Features

High P1dB Output Power: 22 dBm

High Psat Output Power: 24 dBm

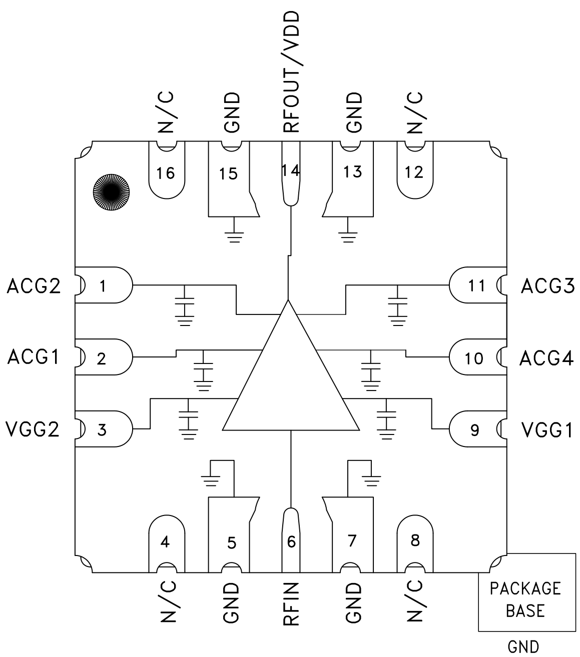
High Gain: 13.5 dB

High Output IP3: 33 dBm

Supply Voltage: +10 V @ 175 mA

16 Lead Ceramic 6x6 mm SMT Package: 36 mm^2

Functional Diagram



General Description

The HMC5805LS6 is a GaAs pHEMT MMIC Distributed Power Amplifier which operates between DC and 40 GHz. The amplifier provides 13 dB of gain, 33 dBm output IP3 and +22 dBm of output power at 1 dB gain compression while requiring 175 mA from a +10 V supply. The HMC5805LS6 exhibits a slightly positive gain slope from 8 to 32 GHz, making it ideal for EW, ECM, Radar and test equipment applications. The HMC5805LS6 amplifier I/Os are internally matched to 50 Ohms and the 6x6 mm SMT package is well suited for automated assembly techniques.

Electrical Specifications, T_A = +25° C, Vdd = +10 V, Vgg2 = +3.5 V, Idd = 175 mA*

Parameter	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Frequency Range		DC - 12			12 - 35			35 - 40		GHz
Gain	11	13		11.5	13.5		7	10		dB
Gain Flatness		±0.35			±0.5			±1.0		dB
Gain Variation Over Temperature		0.02			0.03			0.05		dB/ °C
Input Return Loss		18			15			12		dB
Output Return Loss		24			13			11		dB
Output Power for 1 dB Compression (P1dB)	20	22		19	21		16	19		dBm
Saturated Output Power (Psat)		24			23.5			21		dBm
Output Third Order Intercept (IP3)		33			31			27		dBm
Noise Figure		4.5			4			7		dB
Supply Current (Idd) (Vdd= 10V, Vgg1= -0.8V Typ.)		175			175			175		mA

** Adjust Vgg1 between -2 to 0 V to achieve Idd = 175 mA typical.*

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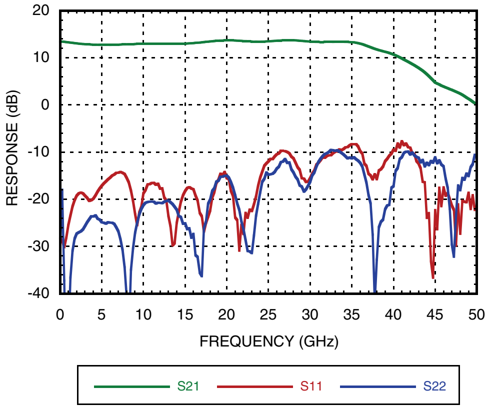
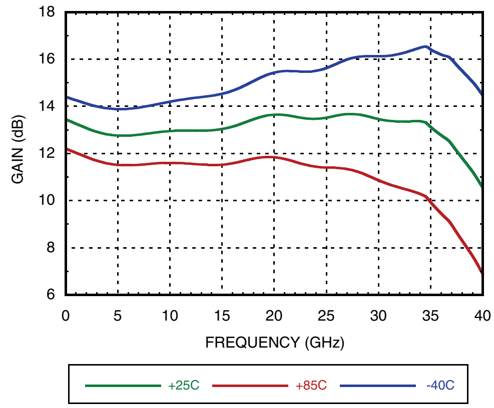
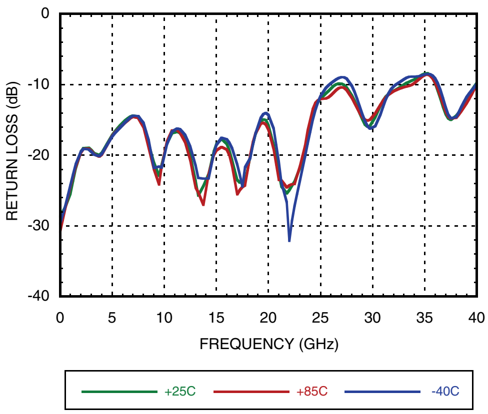
Gain & Return Loss



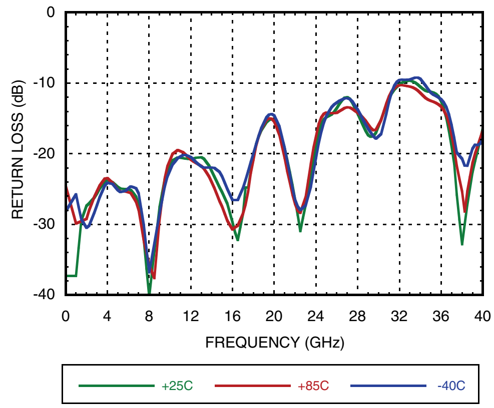
Gain vs. Temperature



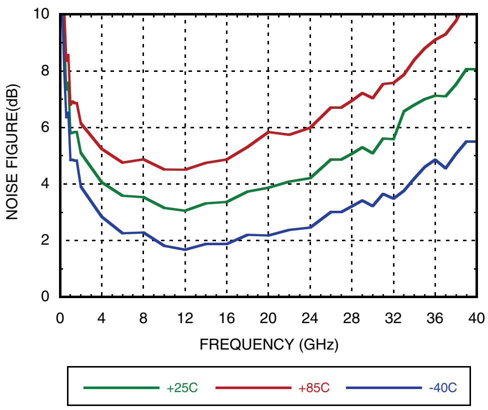
Input Return Loss vs. Temperature



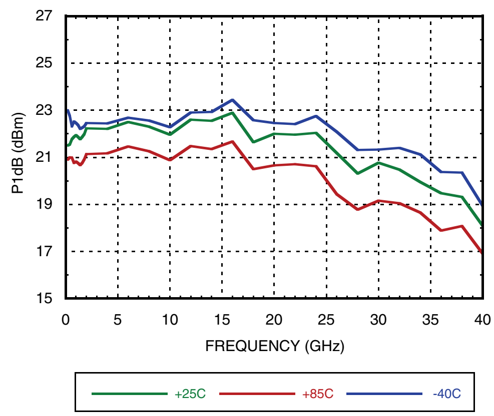
Output Return Loss vs. Temperature



Noise Figure vs. Temperature



P1dB vs. Temperature



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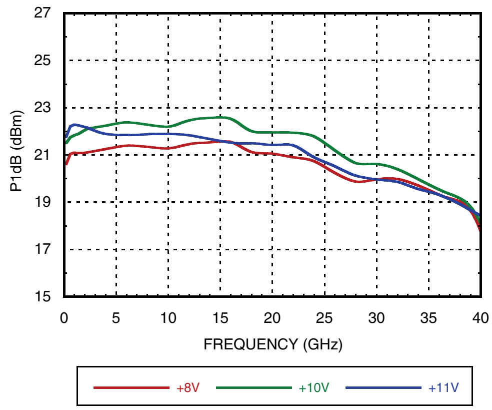
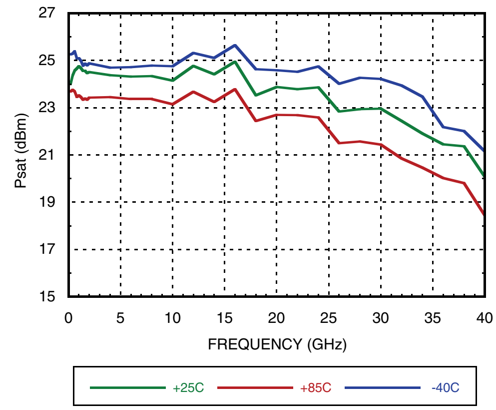
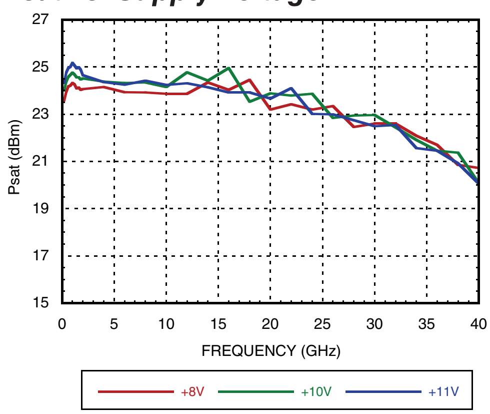
P1dB vs. Supply Voltage



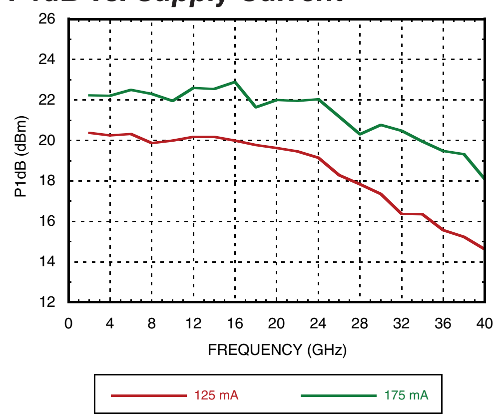
Psat vs. Temperature



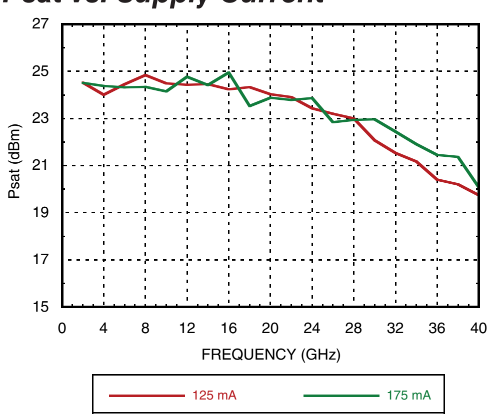
Psat vs. Supply Voltage



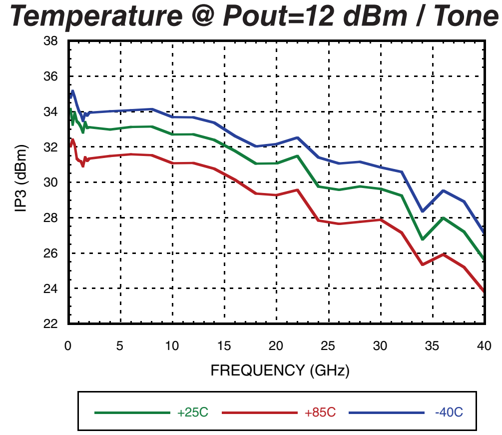
P1dB vs. Supply Current



Psat vs. Supply Current



Output IP3 vs. Temperature @ Pout=12 dBm / Tone



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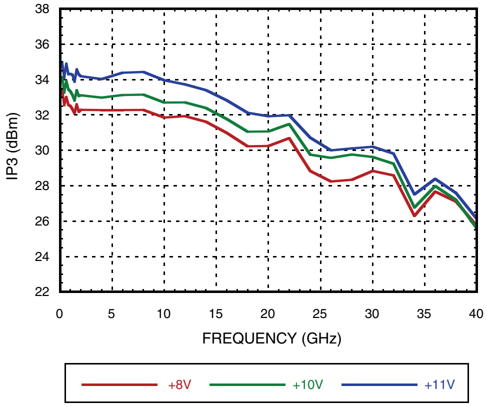
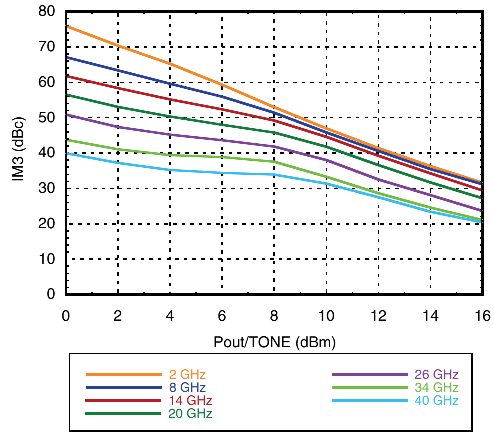
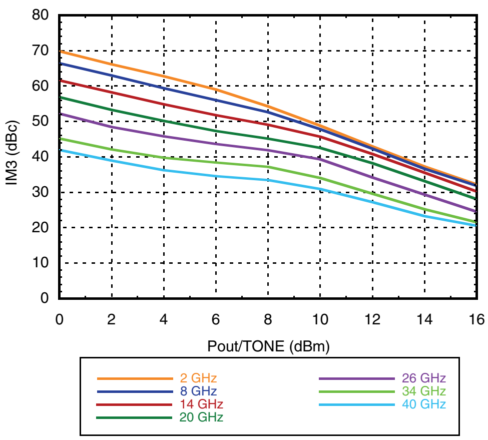
Output IP3 vs. Supply Voltage @ Pout=12 dBm / Tone



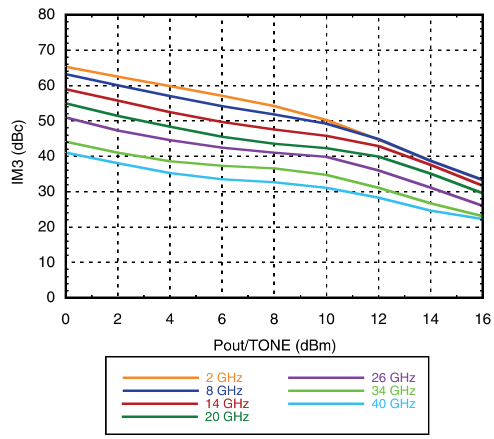
Output IM3 @ Vdd=+8V



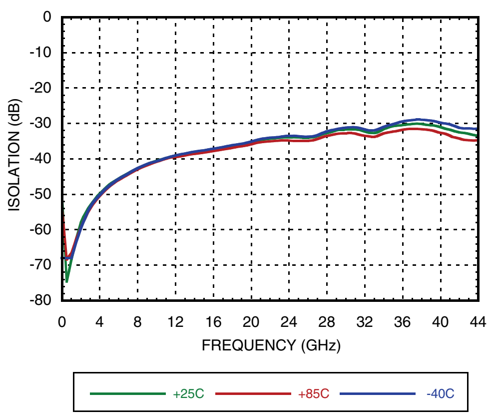
Output IM3 @ Vdd=+10V



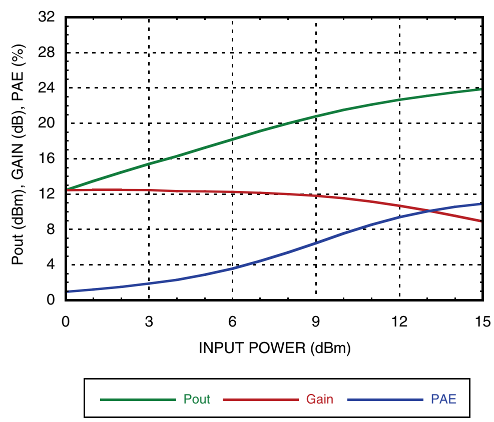
Output IM3 @ Vdd=+11V



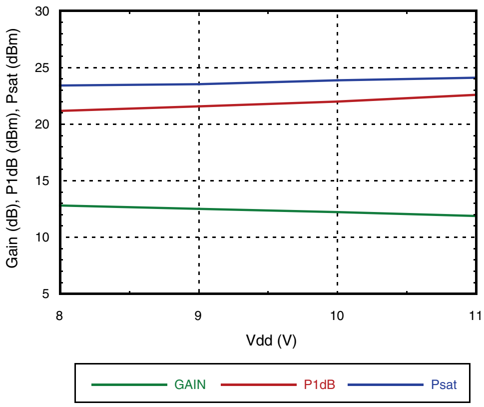
Reverse Isolation vs. Temperature



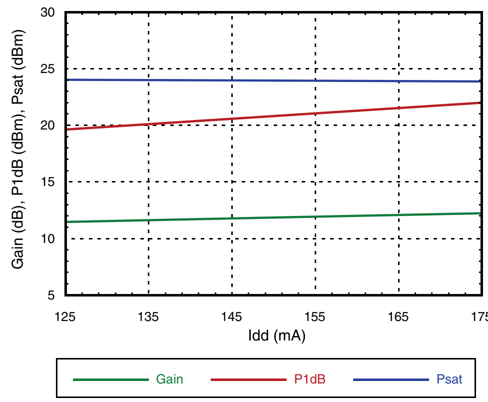
Power Compression @ 20GHz



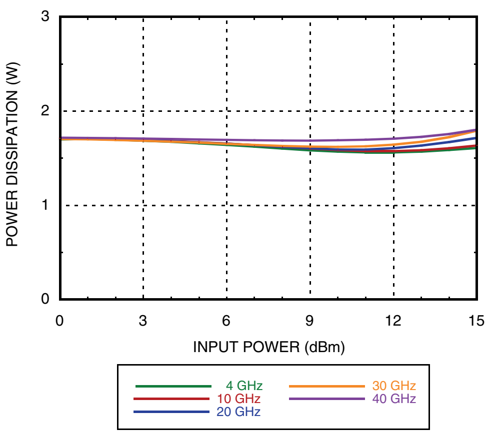
Gain and Power vs. Supply Voltage



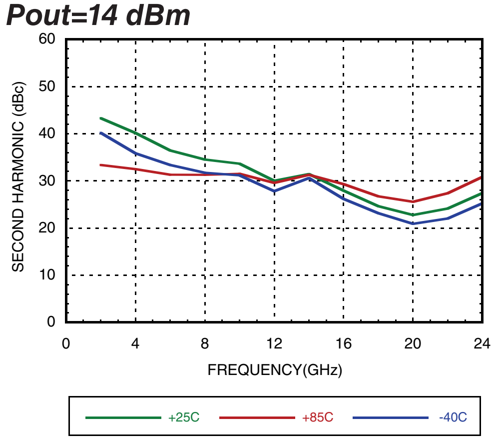
Gain and Power vs. Supply Current



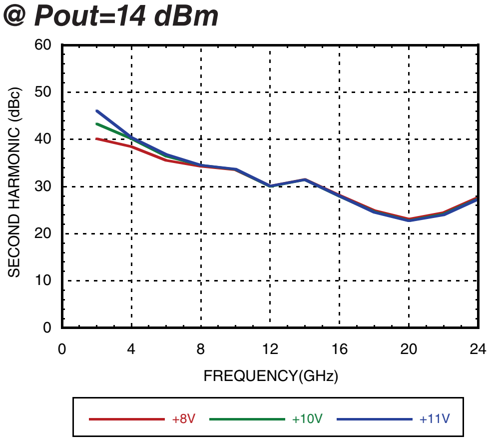
Power Dissipation



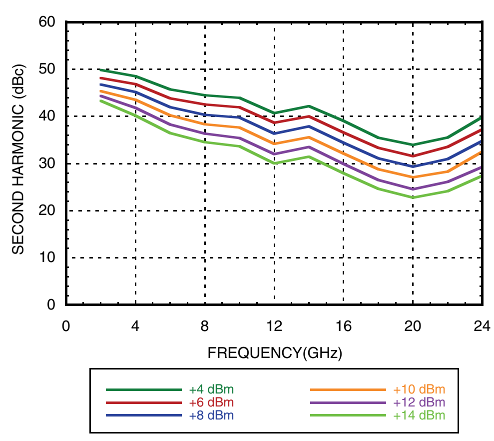
Second Harmonics vs. Temperature @ Pout=14 dBm



Second Harmonics vs. Vdd @ Pout=14 dBm



Second Harmonics vs. Pout



Absolute Maximum Ratings

Drain Bias Voltage (Vdd)	12V
Gate Bias Voltage (Vgg1)	-3 to 0 Vdc
Gate Bias Voltage (Vgg2)	For Vdd = 12V, Vgg2 = 5.5V Idd >145mA For Vdd between 8.5V to 11V, Vgg2 = (Vdd - 6.5V) up to 4.5V For Vdd < 8.5V, Vgg2 must remain > 2V
RF Input Power (RFIN)	17 dBm
Channel Temperature	150 °C
Continuous Pdiss (T= 85 °C) (derate 69 mW/°C above 85 °C)	2.1 W
Thermal Resistance (channel to ground paddle)	31.1 °C/W
Output Power into VSWR >7:1	24 dBm
Storage Temperature	-65 to 150 °C
Operating Temperature	-40 to 85 °C
ESD Sensitivity (HBM)	Class 0 Passed 150V

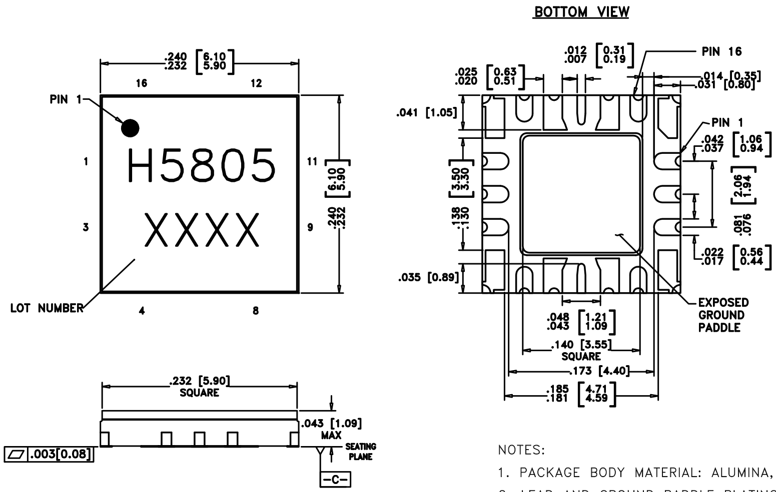
Typical Supply Current vs. Vdd

Vdd (V)	Idd (mA)
+9	175
+10	175
+11	175

Note: Amplifier will operate over full voltage ranges shown above. Vgg adjusted to achieve Idd = 175 mA.

ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



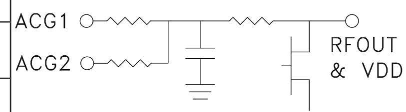
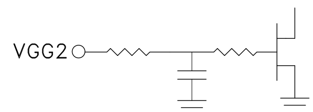
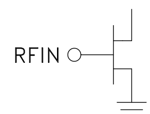
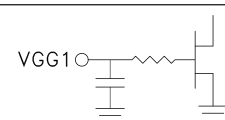
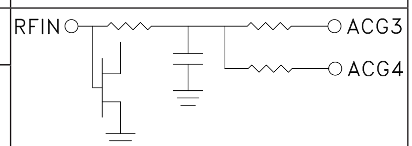
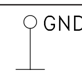
NOTES:
1. PACKAGE BODY MATERIAL: ALUMINA, WHITE
2. LEAD AND GROUND PADDLE PLATING: GOLD OVER NICKEL.
3. DIMENSIONS ARE IN INCHES [MILLIMETERS].
4. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
5. CHARACTERS TO BE WHITE INK MARKED WITH .018"MIN to .030"MAX HEIGHT REQUIREMENTS. UTILIZE MAXIMUM CHARACTER HEIGHT BASED ON LID DIMENSIONS AND BEST FIT. LOCATE APPROX. AS SHOWN.
6. PACKAGE WARP SHALL NOT EXCEED 0.05mm DATUM –C–
7. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.

Table 1. Package Information

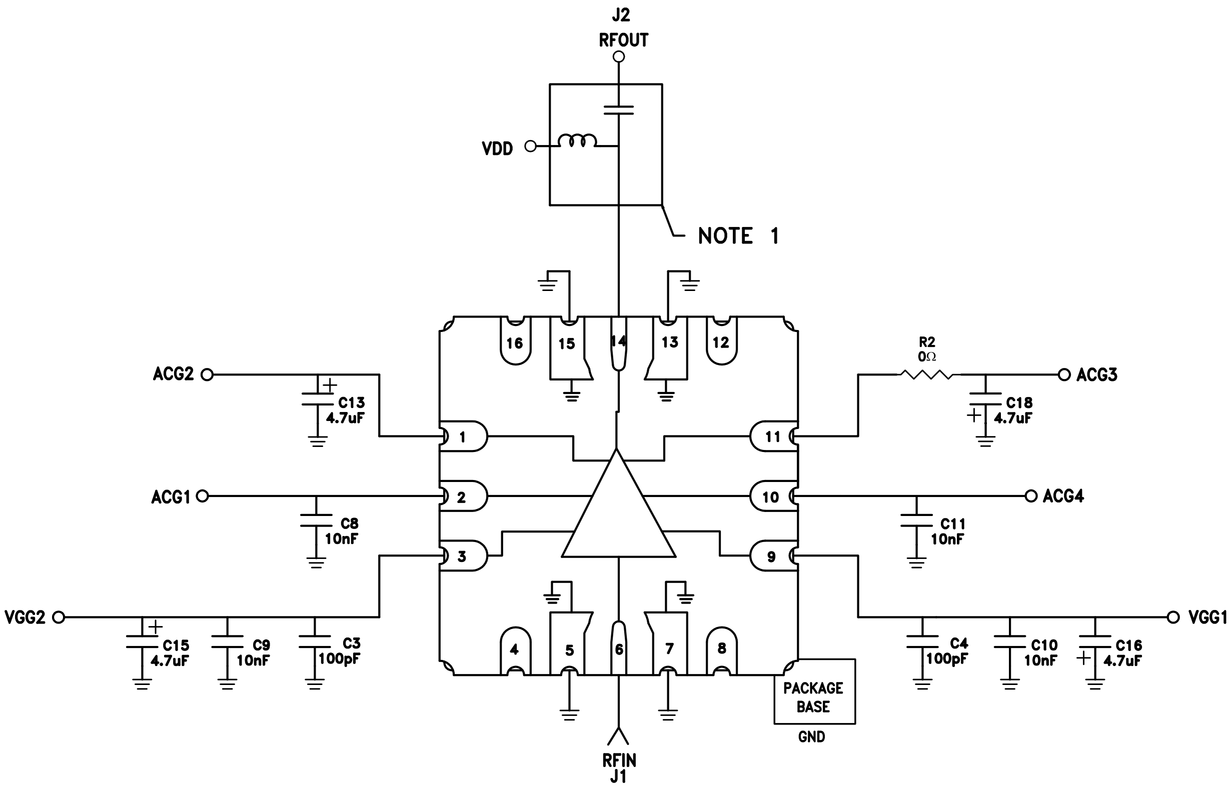
Part Number	Package Body Material	Lead Finish	MSL Rating	Package Marking [1]
HMC5805LS6	ALUMINA, WHITE	Gold over Nickel	N/A	H5805 XXXX

[1] 4-Digit lot number XXXX

Pin Descriptions

Pin Number	Function	Description	Interface Schematic
1, 2, 14	ACG2	Low frequency termination. Attach bypass capacitor per application circuit herein.	
	ACG1	Low frequency termination. Attach bypass capacitor per application circuit herein.	
	RFOUT & VDD	RF output for amplifier. Connect DC bias (VDD) network to provide drain current (Idd). See application circuit herein.	
3	VGG2	Gate control 2 for amplifier. Attach bypass capacitors per application circuit herein. For normal operation +3.5V should be applied to Vgg2.	
6	RFIN	This pin is DC coupled and matched to 50 Ohms. Blocking capacitor is required.	
9	VGG1	Gate control 1 for amplifier. Attach bypass capacitors per application circuit herein. Please follow “MMIC Amplifier Biasing Procedure” application note.	
10	ACG4	Low frequency termination. Attach bypass capacitor per application circuit herein.	
11	ACG3	Low frequency termination. Attach bypass capacitor per application circuit herein.	
5, 7, 13, 15	GND	These pins and exposed ground paddle must be connected to RF/DC ground.	
4, 8, 12, 16	N/C	These pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally.	

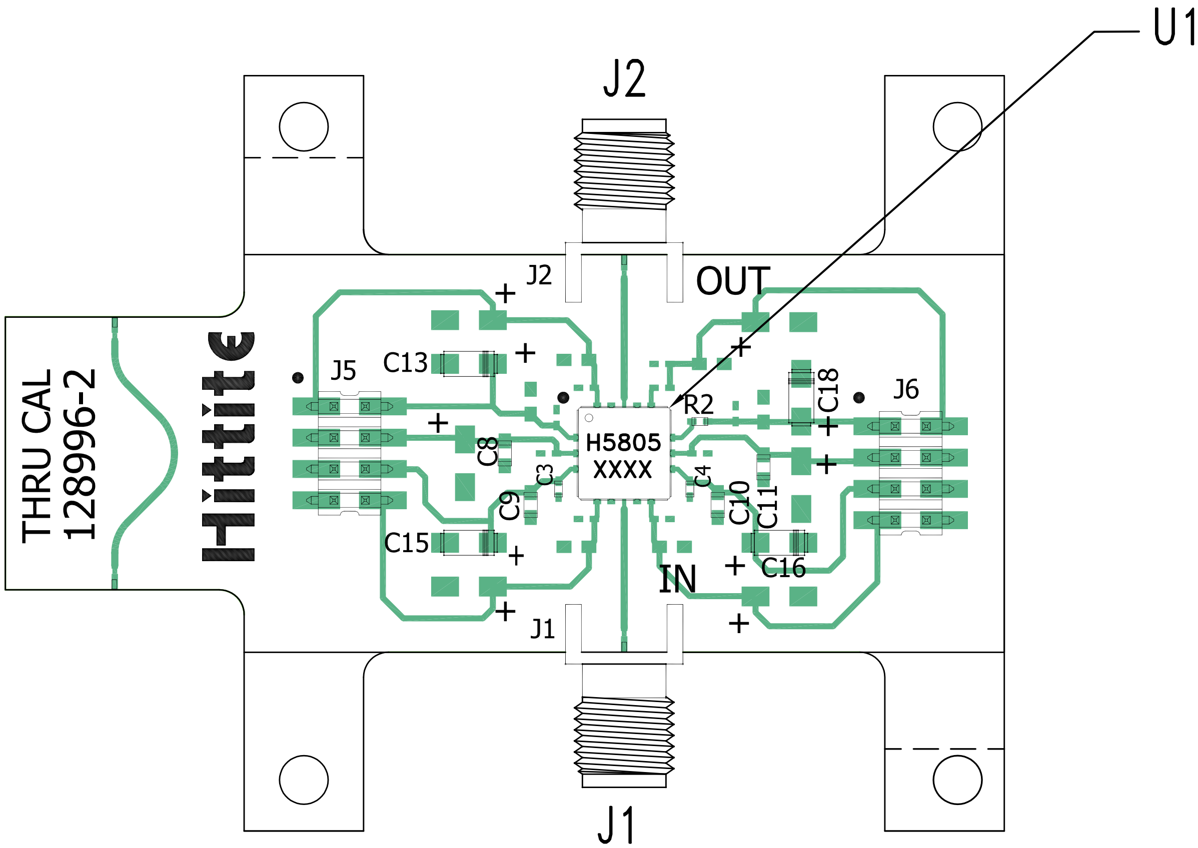
Application Circuit



NOTE 1: Drain Bias (Vdd) must be applied through a broadband bias tee with low series resistance and capable of providing 250 mA

For price, delivery and to place orders: Hittite Microwave Corporation, 20 Alpha Road, Chelmsford, MA 01824
Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at www.hittite.com
Application Support: Phone: 978-250-3343 or apps@hittite.com

Evaluation PCB



List of Materials for Evaluation EVAL01 HMC5805L56 [1]

Item	Description
J1, J2	PCB Mount K Connectors, SRI
J5, J6	DC Pins
C3, C4	100 pF Capacitors, 0402 Pkg.
C8 - C11	0.01 µF Capacitors, 0603 Pkg.
C13, C15, C16, C18	4.7 µF Capacitors, Case A Pkg.
R2	Zero Ohm Resistor, 0402 Pkg.
U1	HMC5805LS6 Amplifier
PCB [2]	128996 Evaluation PCB

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the 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