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MICROWAVE CORPORATION v05.0514



# HMC606LC5

## GaAs InGaP HBT MMIC ULTRA LOW PHASE NOISE, DISTRIBUTED AMPLIFIER, 2 - 18 GHz

### Typical Applications

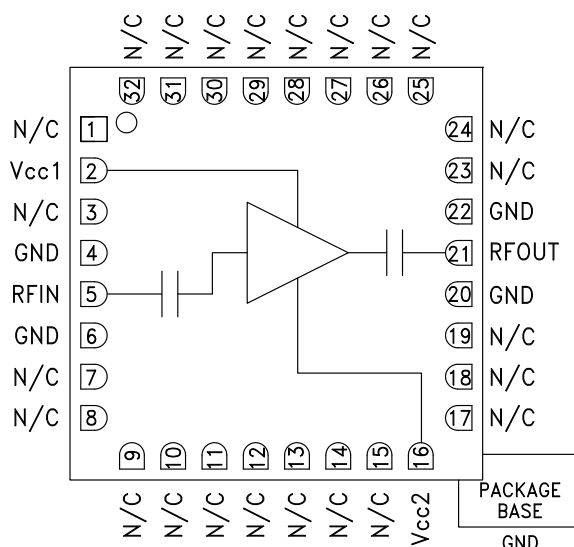
The HMC606LC5 is ideal for:

- Radar, EW & ECM
- Microwave Radio
- Test Instrumentation
- Military & Space
- Fiber Optic Systems

### Features

Ultra Low Phase Noise: -160 dBc/Hz @ 10 kHz  
 P1dB Output Power: +15 dBm  
 Gain: 13.5 dB  
 Output IP3: +27 dBm  
 Supply Voltage: +5V @ 64 mA  
 50 Ohm Matched Input/Output  
 32 Lead Ceramic 5x5mm SMT Package: 25mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC606LC5 is a GaAs InGaP HBT MMIC Distributed Amplifier housed in a leadless 5x5 mm surface mount package which operates between 2 and 18 GHz. With an input signal of 12 GHz, the amplifier provides ultra low phase noise performance of -160 dBc/Hz at 10 kHz offset, representing a significant improvement over FET-based distributed amplifiers. The HMC606LC5 provides 13.5 dB of small signal gain, +27 dBm output IP3 and +15 dBm of output power at 1 dB gain compression while requiring 64 mA from a +5V supply. The HMC606LC5 amplifier I/Os are internally matched to 50 Ohms and are internally DC blocked.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{cc1} = V_{cc2} = 5\text{V}$

| Parameter                                | Min.   | Typ.      | Max. | Min.   | Typ.      | Max. | Units                |
|------------------------------------------|--------|-----------|------|--------|-----------|------|----------------------|
| Frequency Range                          | 2 - 12 |           |      | 2 - 18 |           |      | GHz                  |
| Gain                                     | 10.5   | 13.5      |      | 9.5    | 12.5      |      | dB                   |
| Gain Flatness                            |        | $\pm 1.0$ |      |        | $\pm 1.0$ |      | dB                   |
| Gain Variation Over Temperature          |        | 0.021     |      |        | 0.024     |      | dB/ $^\circ\text{C}$ |
| Noise Figure                             |        | 5         |      |        | 7         |      | dB                   |
| Input Return Loss                        |        | 20        |      |        | 18        |      | dB                   |
| Output Return Loss                       |        | 15        |      |        | 15        |      | dB                   |
| Output Power for 1 dB Compression (P1dB) | 12     | 15        |      | 10     | 13        |      | dBm                  |
| Saturated Output Power (Psat)            |        | 17        |      |        | 15        |      | dBm                  |
| Output Third Order Intercept (IP3)       |        | 27        |      |        | 22        |      | dBm                  |
| Phase Noise @ 100 Hz                     |        | -140      |      |        | -140      |      | dBc/Hz               |
| Phase Noise @ 1 kHz                      |        | -150      |      |        | -150      |      | dBc/Hz               |
| Phase Noise @ 10 kHz                     |        | -160      |      |        | -160      |      | dBc/Hz               |
| Phase Noise @ 1 MHz                      |        | -170      |      |        | -170      |      | dBc/Hz               |
| Supply Current                           |        | 64        | 95   |        | 64        | 95   | mA                   |

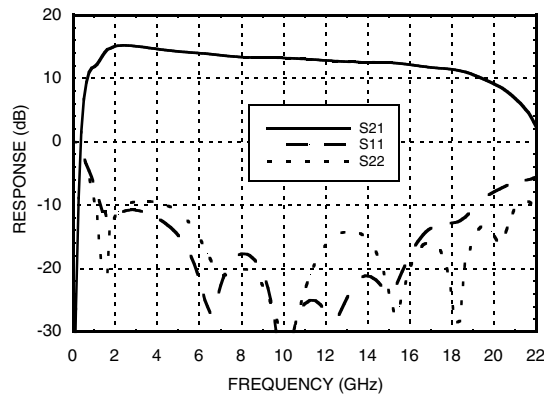
For price, delivery and to place orders: Hittite Microwave Corporation, 2 Elizabeth Drive, Chelmsford, MA 01824

Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at [www.hittite.com](http://www.hittite.com)

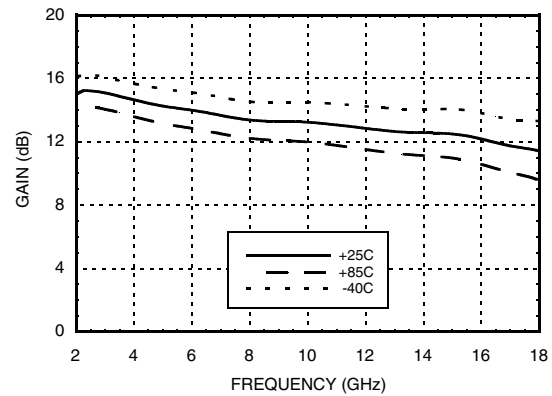
Application Support: Phone: 978-250-3343 or [apps@hittite.com](mailto:apps@hittite.com)

## GaAs InGaP HBT MMIC ULTRA LOW PHASE NOISE, DISTRIBUTED AMPLIFIER, 2 - 18 GHz

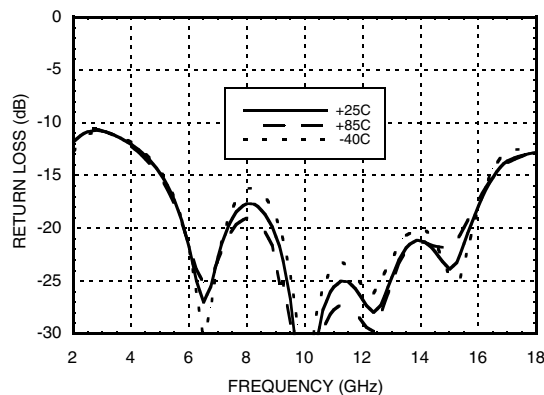
**Gain & Return Loss**



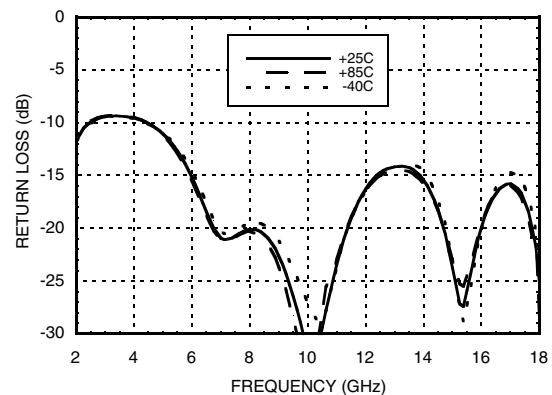
**Gain vs. Temperature**



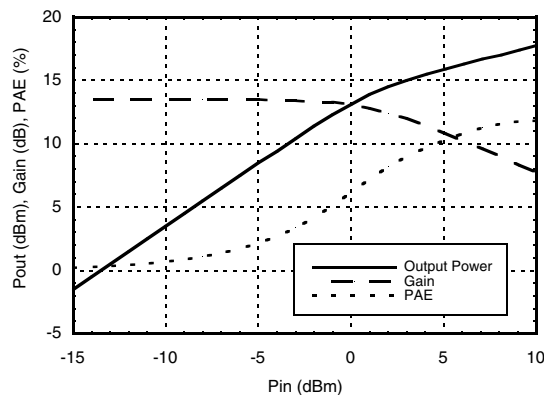
**Input Return Loss vs. Temperature**



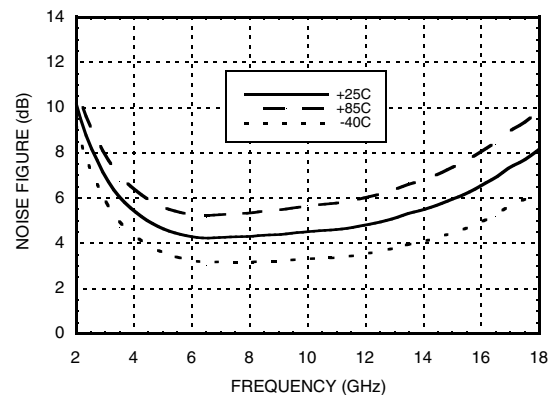
**Output Return Loss vs. Temperature**



**Power Compression**

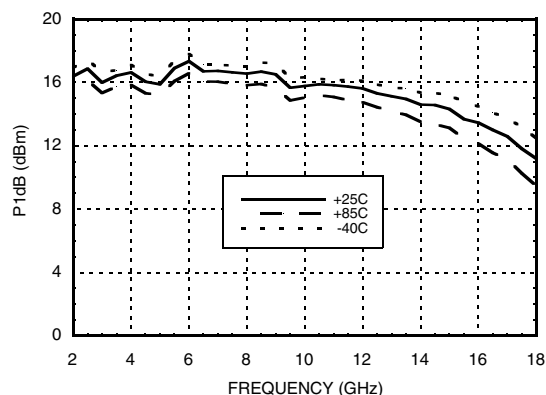


**Noise Figure vs. Temperature**

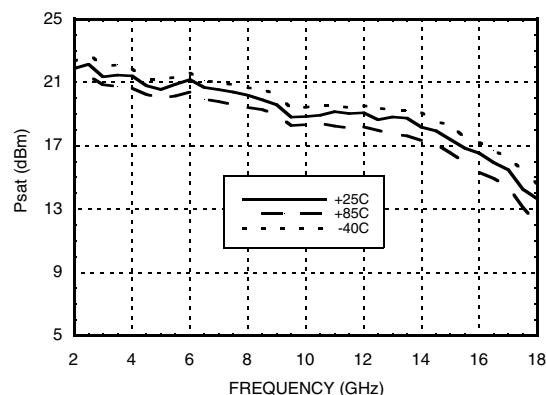


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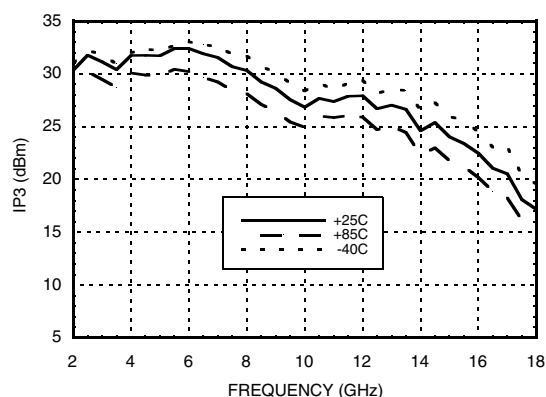
**P1dB vs. Temperature**



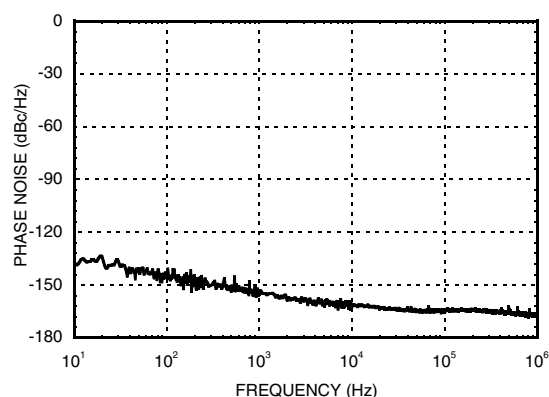
**Psat vs. Temperature**



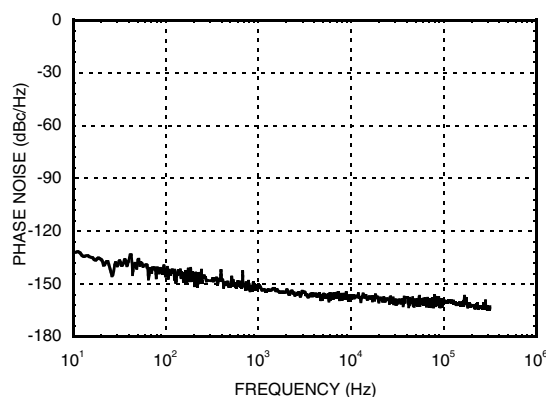
**Output IP3 vs. Temperature**



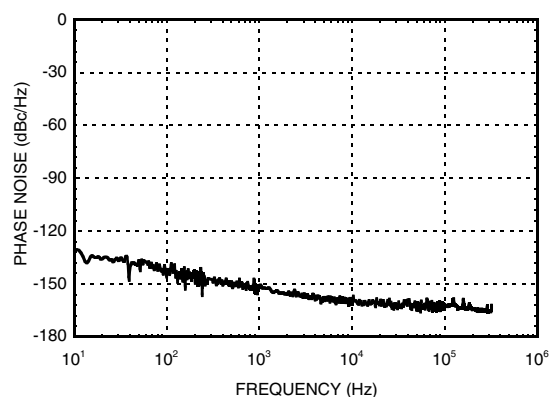
**Phase Noise @ 12 GHz**



**Phase Noise at P1dB @ 12 GHz**



**Phase Noise at Psat @ 12 GHz**



# GaAs InGaP HBT MMIC ULTRA LOW PHASE NOISE, DISTRIBUTED AMPLIFIER, 2 - 18 GHz

## Absolute Maximum Ratings

|                                                                          |                    |
|--------------------------------------------------------------------------|--------------------|
| Vcc1= Vcc2                                                               | 7V                 |
| RF Input Power (RFIN)                                                    | +15 dBm            |
| Channel Temperature                                                      | 175 °C             |
| Continuous P <sub>diss</sub> (T = 85 °C)<br>(derate 6 mW/°C above 85 °C) | 0.55 W             |
| Thermal Resistance<br>(channel to ground paddle)                         | 169.5 °C/W         |
| Storage Temperature                                                      | -65 to +150 °C     |
| Operating Temperature                                                    | -40 to +85 °C      |
| ESD Sensitivity (HBM)                                                    | Class 0, Pass 100V |

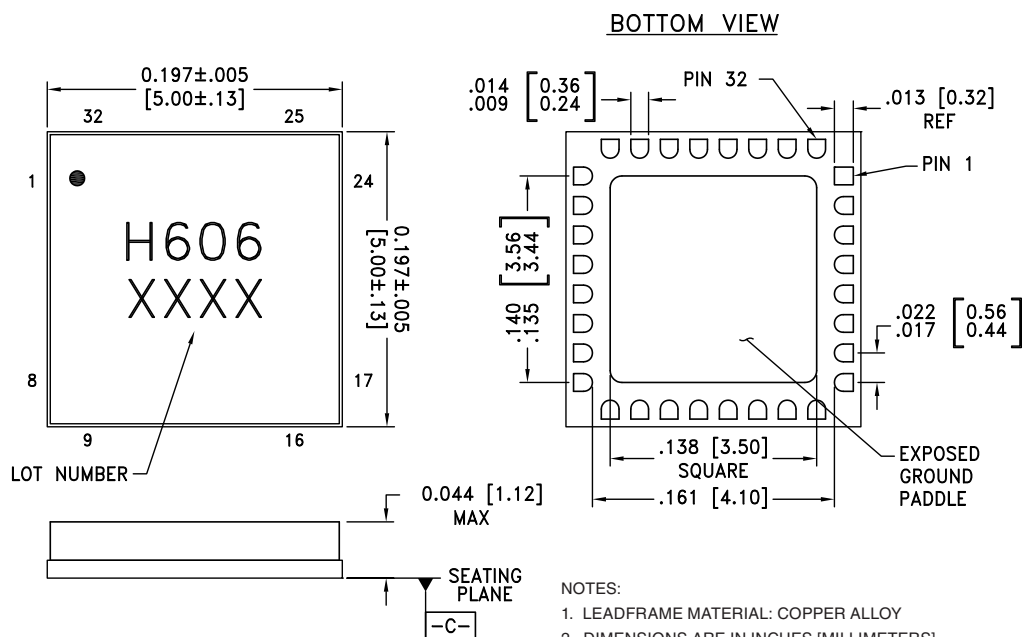
## Typical Supply Current vs. Vcc1, Vcc2

| Vcc1, Vcc2 (V) | Icc1 + Icc2 (mA) |
|----------------|------------------|
| +4.5           | 53               |
| +5.0           | 64               |
| +5.5           | 71               |



**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 <sup>[2]</sup> |
|-------------|-----------------------|------------------|---------------------|--------------------------------|
| HMC606LC5   | Alumina, White        | Gold over Nickel | MSL3 <sup>[1]</sup> | H606<br>XXXX                   |

[1] Max peak reflow temperature of 260 °C

[2] 4-Digit lot number XXXX



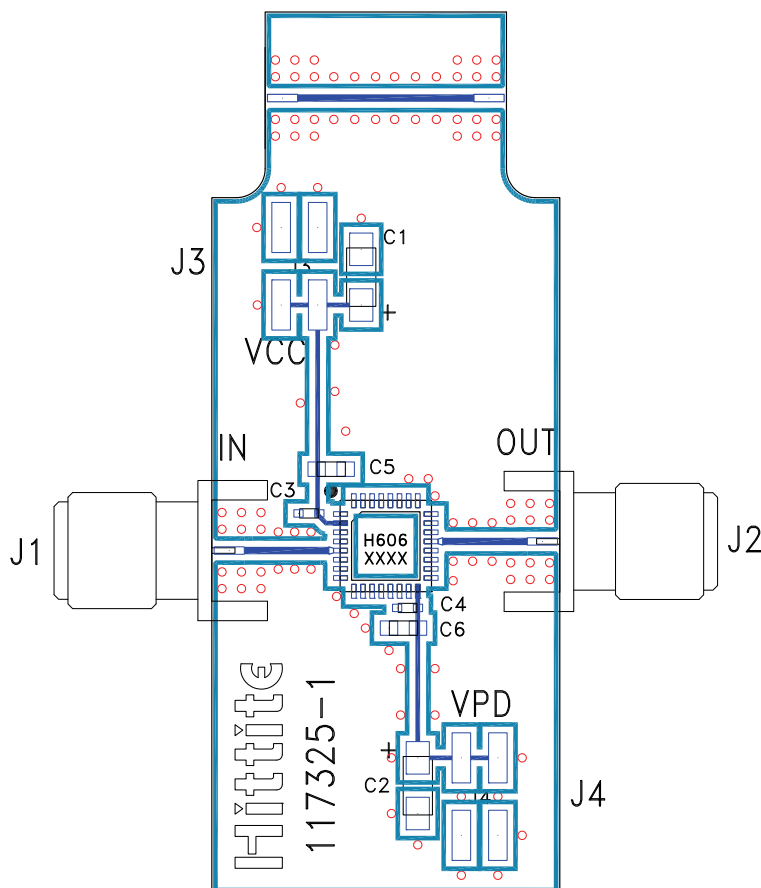
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**HMC606LC5**
**GaAs InGaP HBT MMIC ULTRA LOW  
PHASE NOISE, DISTRIBUTED AMPLIFIER, 2 - 18 GHz**
**Pin Descriptions**

| Pin Number                        | Function   | Description                                                                                | Interface Schematic |
|-----------------------------------|------------|--------------------------------------------------------------------------------------------|---------------------|
| 1, 3, 7 - 15,<br>17 - 19, 23 - 32 | N/C        | No connection. These pins may be connected to RF ground. Performance will not be affected. |                     |
| 2, 16                             | Vcc1, Vcc2 | Power supply voltage for the amplifier.                                                    |                     |
| 4, 6, 20, 22<br>Ground Paddle     | GND        | Ground paddle must be connected to RF/DC ground.                                           |                     |
| 5                                 | RFIN       | This pin is AC coupled and matched to 50 Ohms.                                             |                     |
| 21                                | RFOUT      | This pin is AC coupled and matched to 50 Ohms.                                             |                     |

## GaAs InGaP HBT MMIC ULTRA LOW PHASE NOISE, DISTRIBUTED AMPLIFIER, 2 - 18 GHz

### Evaluation PCB



### List of Materials for Evaluation PCB 117156 <sup>[1]</sup>

| Item               | Description                  |
|--------------------|------------------------------|
| J1 - J2            | SRI K Connector              |
| J3 - J4            | 2mm Molex Header             |
| C1, C2             | 4.7 µF Capacitor, Tantalum   |
| C3, C4             | 100 pF Capacitor, 0402 Pkg.  |
| C5, C6             | 1000 pF Capacitor, 0603 Pkg. |
| U1                 | HMC606LC5                    |
| PCB <sup>[2]</sup> | 117325 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 package bottom 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.