



GaAs PHEMT MMIC DRIVER AMPLIFIER, 5.5 - 17 GHz

Typical Applications

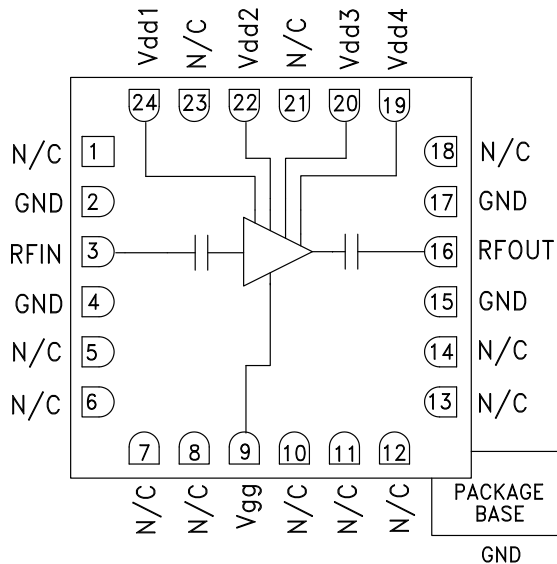
The HMC633LC4 is ideal for:

- Point-to-Point Radios
- Point-to-Multi-Point Radios & VSAT
- LO Driver for Mixers
- Military & Space

Features

- Gain: 30 dB
- P1dB: +23 dBm
- Saturated Power: +23.8 dBm @ 24% PAE
- Supply Voltage: +5V @180 mA
- 50 Ohm Matched Input/Output
- 24 Lead Ceramic 4x4mm SMT Package: 16mm²

Functional Diagram



General Description

The HMC633LC4 is a GaAs PHEMT MMIC Driver Amplifier in a leadless 4x4 mm ceramic surface mount package which operates between 5.5 and 17 GHz. The amplifier provides up to 30 dB of gain, +30 dBm Output IP3, and +23 dBm of output power at 1 dB gain compression, while requiring 180 mA from a +5V supply. The HMC633LC4 is an ideal driver amplifier for microwave radio applications from 5.5 to 17 GHz and may be biased at +5V, 130 mA to provide 2 dB lower gain with improved PAE. The amplifier's I/Os are DC blocked and matched to 50 Ohms with no external matching required.

Electrical Specifications, $T_A = +25^\circ\text{C}$, $V_{dd_{1-4}} = 5\text{V}$, $I_{dd} = 180\text{mA}$ [1]

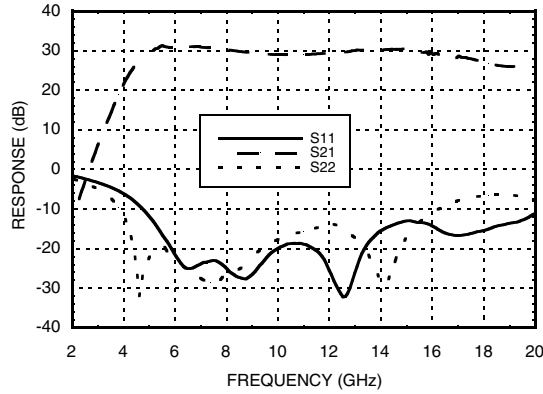
| Parameter | Min. | Typ. | Max. | Min. | Typ. | Max. | Units |
|--|---------|-------|--------|------|-------|-------|--------|
| Frequency Range | 5.5 - 9 | | 9 - 17 | | | | GHz |
| Gain | 26 | 30 | | 25 | 28 | | dB |
| Gain Variation Over Temperature | | 0.030 | 0.040 | | 0.030 | 0.040 | dB/ °C |
| Input Return Loss | | 22 | | | 17 | | dB |
| Output Return Loss | | 22 | | | 15 | | dB |
| Output Power for 1 dB Compression (P1dB) | 20 | 23 | | 18 | 21 | | dBm |
| Saturated Output Power (P _{sat}) | | 23.8 | | | 22 | | dBm |
| Output Third Order Intercept (IP3) | | 30 | | | 29 | | dBm |
| Noise Figure | | 10 | | | 7 | | dB |
| Supply Current (I _{dd}) (I _{dd} = I _{dd1} + I _{dd2} + I _{dd3} + I _{dd4}) | | 180 | | | 180 | | mA |

[1] Adjust V_{gg} between -2 to 0V to achieve I_{dd} = 180 mA typical.

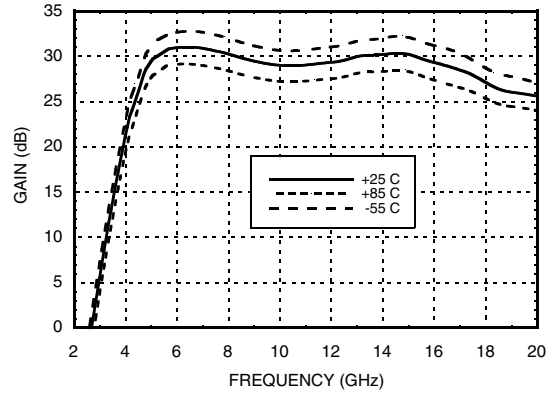


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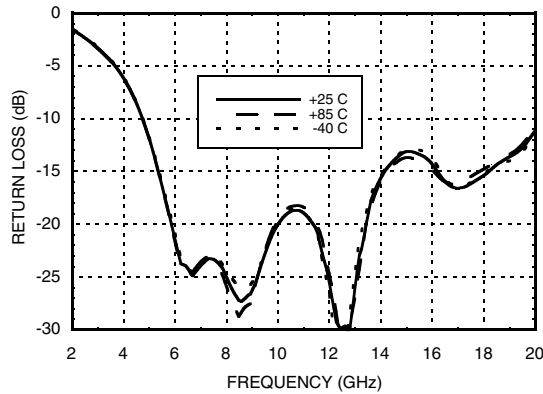
Broadband Gain & Return Loss



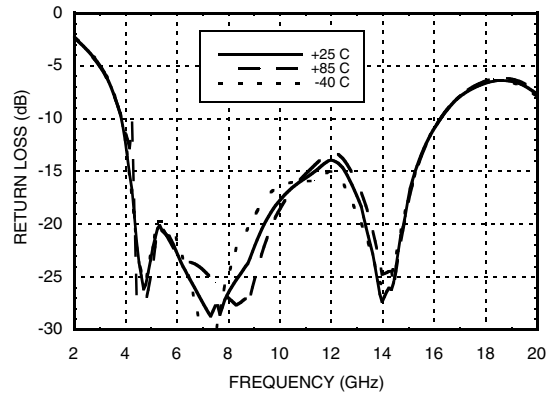
Gain vs. Temperature



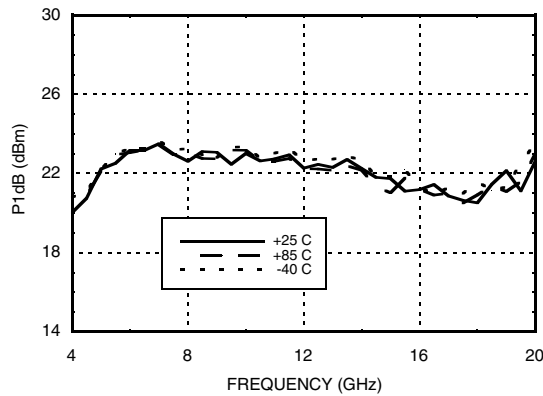
Input Return Loss vs. Temperature



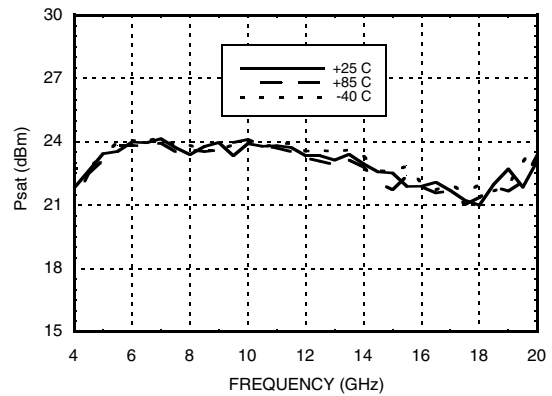
Output Return Loss vs. Temperature



P1dB vs. Temperature



Psat vs. Temperature



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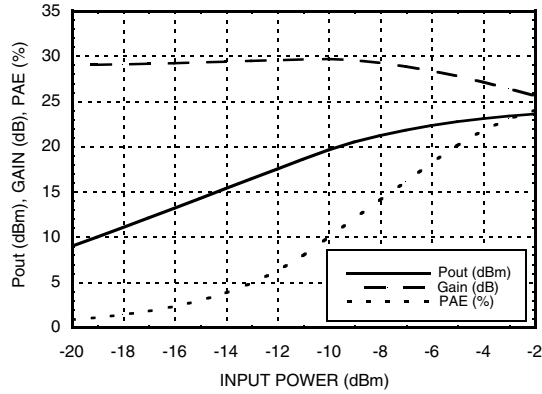
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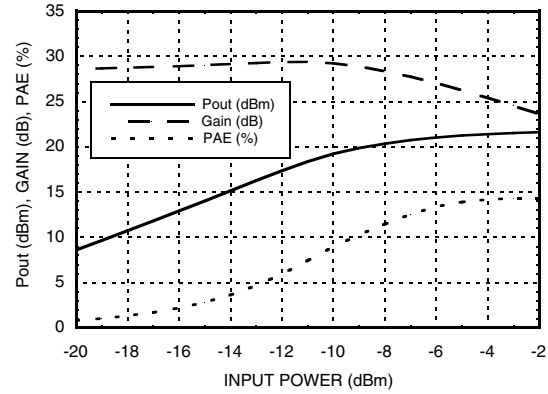
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DRIVER & GAIN BLOCK AMPLIFIERS - SMT

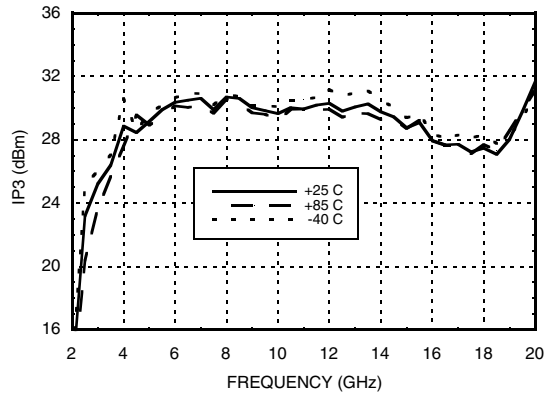
Power Compression @ 11 GHz



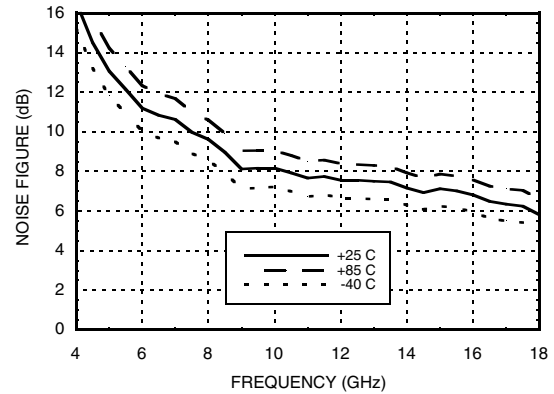
Power Compression @ 17 GHz



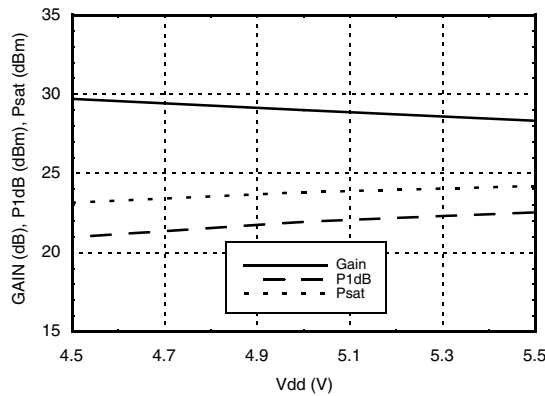
Output IP3 vs. Temperature



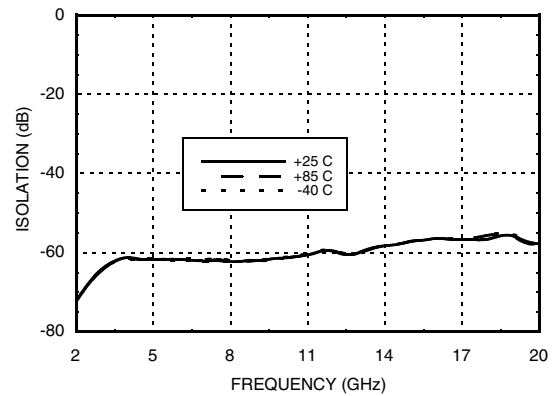
Noise Figure vs. Temperature



Gain & Power vs. Supply Voltage @ 11 GHz



Reverse Isolation vs. Temperature



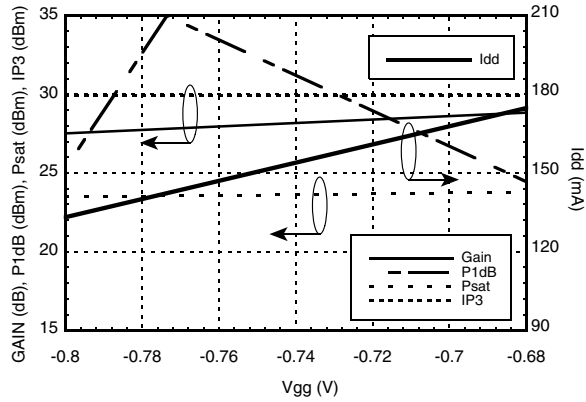
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**Gain, Power & Output IP3
vs. Gate Voltage @ 11 GHz**



Absolute Maximum Ratings

| | |
|---|----------------|
| Drain Bias Voltage (Vdd1, Vdd2, Vdd3, Vdd4) | +5.5V |
| Gate Bias Voltage (Vgg) | -3 to 0V |
| RF Input Power (RFIN)(Vdd = +5 Vdc) | +5 dBm |
| Channel Temperature | 175 °C |
| Continuous P _{diss} (T= 85 °C) (derate 11.08 mW/°C above 85 °C) | 0.99 W |
| Thermal Resistance (channel to package bottom) | 90.23 °C/W |
| Storage Temperature | -65 to +150 °C |
| Operating Temperature | -40 to +85 °C |



**ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS**

Typical Supply Current vs. Vdd

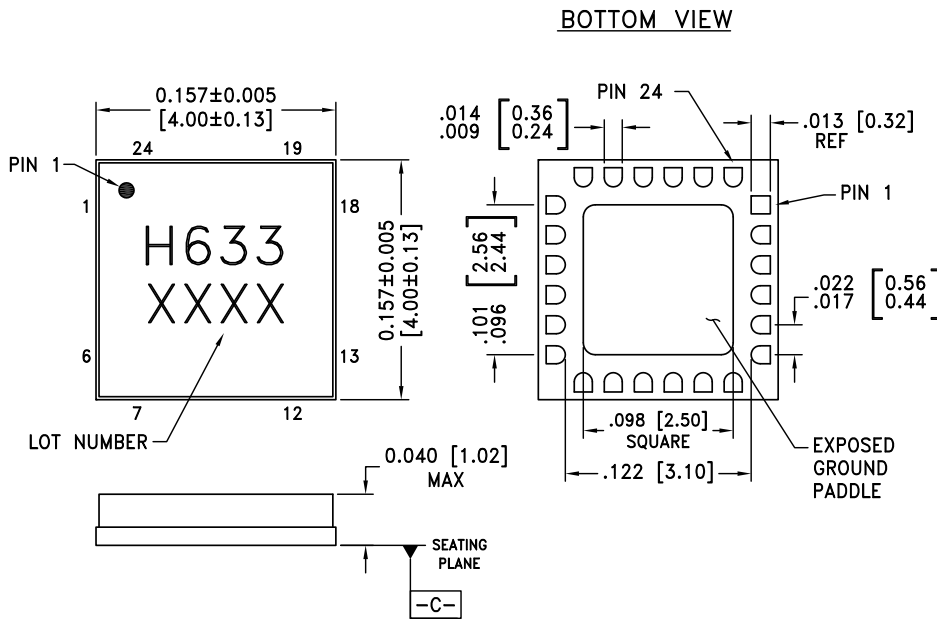
| Vdd (V) | I _{dd} (mA) |
|---------|----------------------|
| 4.5 | 177 |
| 5.0 | 180 |
| 5.5 | 182 |

Note: Amplifier will operate over full voltage ranges shown above



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Outline Drawing



NOTES:

1. PACKAGE BODY MATERIAL: ALUMINA
2. LEAD AND GROUND PADDLE PLATING: 30-80 MICROINCHES GOLD OVER 50 MICROINCHES MINIMUM NICKEL.
3. DIMENSIONS ARE IN INCHES [MILLIMETERS].
4. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
5. PACKAGE WARP SHALL NOT EXCEED 0.05mm DATUM -C-
6. 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 ^[2] |
|-------------|-----------------------|------------------|---------------------|--------------------------------|
| HMC633LC4 | Alumina, White | Gold over Nickel | MSL3 ^[1] | H633 XXXX |

[1] Max peak reflow temperature of 260 °C

[2] 4-Digit lot number XXXX

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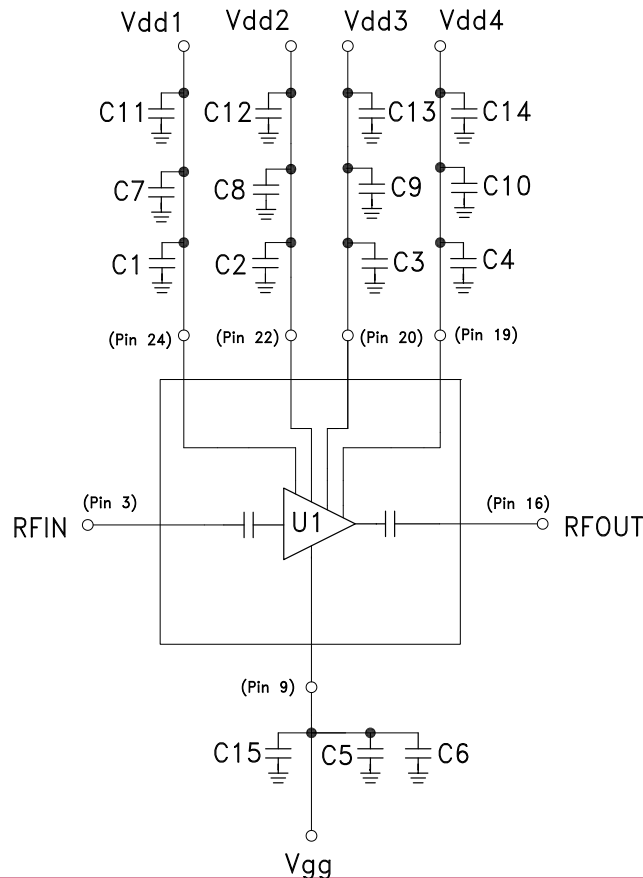


Pin Descriptions

| Pin Number | Function | Description | Interface Schematic |
|-------------------------------|------------------------|--|---------------------|
| 1, 5 - 8, 11 - 14, 18, 21, 23 | N/C | No connection. These pins may be connected to DC/RF ground. Performance will not be affected. | |
| 2, 4, 15, 17 | GND | Package Bottom must be connected to RF/DC ground. | |
| 3 | RFIN | This pin is AC coupled and matched to 50 Ohms. | |
| 9 | Vgg | Gate control for amplifier, please follow "MMIC Amplifier Biasing Procedure" Application Note: See application circuit for required external components. | |
| 16 | RFOUT | This pin is AC coupled and matched to 50 Ohms. | |
| 24, 22, 20, 19 | Vdd1, Vdd2, Vdd3, Vdd4 | Power Supply Voltage for the amplifier. See application circuit for required external components. | |

Application Circuit

| Component | Value |
|-----------|---------|
| C1 - C5 | 100 pF |
| C6 - C10 | 1000 pF |
| C11 - C15 | 2.2 μF |



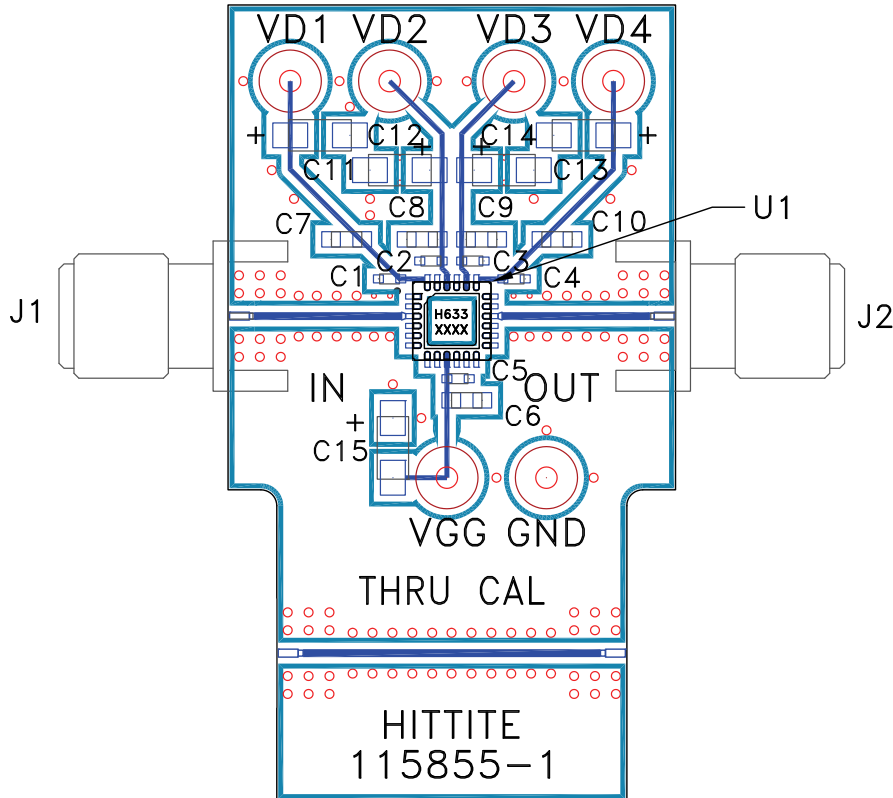
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Evaluation PCB



List of Materials for Evaluation PCB 115857 [1]

| Item | Description |
|-----------|------------------------------|
| J1 - J2 | 2.92 mm PC Mount K-Connector |
| VD1 - VD4 | DC Pin |
| C1 - C5 | 100 pF Capacitor, 0402 Pkg. |
| C6 - C10 | 1000 pF Capacitor, 0603 Pkg. |
| C11 - C15 | 2.2 μF Capacitor, Tantalum |
| U1 | HMC633LC4 Driver Amplifier |
| PCB [2] | 115855 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 board should be mounted to an appropriate heat sink. The evaluation circuit board shown is available from Hittite upon request.

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