

## GaAs pHEMT MMIC LOW NOISE AGC AMPLIFIER, 2 - 20 GHz

### Typical Applications

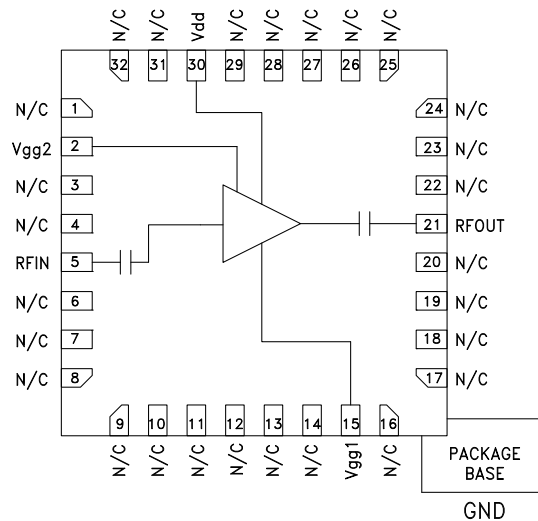
The HMC463LP5(E) is ideal for:

- Telecom Infrastructure
- Microwave Radio & VSAT
- Military EW, ECM & C<sup>3</sup>I
- Test Instrumentation
- Fiber Optics

### Features

- Gain: 13 dB
- Noise Figure: 2.8 dB @ 10 GHz
- P1dB Output Power: +18 dBm @ 10 GHz
- Supply Voltage: +5V @ 60mA
- 50 Ohm Matched Input/Output
- 32 Lead 5x5mm SMT Package: 25mm<sup>2</sup>

### Functional Diagram



### General Description

The HMC463LP5(E) is a GaAs MMIC pHEMT Low Noise AGC Distributed Amplifier packaged in a leadless 5x5 mm surface mount package which operates between 2 and 20 GHz. The amplifier provides 13 dB of gain, 2.8 dB noise figure and 18 dBm of output power at 1 dB gain compression while requiring only 60mA from a +5V supply. An optional gate bias (Vgg2) is provided to allow Adjustable Gain Control (AGC) of 8 dB typical. Gain flatness is excellent at ±0.5 dB from 6 - 18 GHz making the HMC463LP5(E) ideal for EW, ECM RADAR and test equipment applications. The HMC463LP5(E) LNA I/Os are internally matched to 50 Ohms and are internally DC blocked.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{dd} = 5\text{V}$ , $I_{dd} = 60\text{ mA}^*$

| Parameter  | Min.  | Typ.  | Max.  | Min.   | Typ.  | Max.  | Min.    | Typ.  | Max.  | Units |
|--|-------|-------|-------|--------|-------|-------|---------|-------|-------|-------|
| Frequency Range                                    | 2 - 6 |       |       | 6 - 18 |       |       | 18 - 20 |       |       | GHz   |
| Gain   | 10    | 13    |       | 9      | 12    |       | 8       | 11    |       | dB    |
| Gain Flatness                                      |       | ±0.5  |       |        | ±0.5  |       |         | ±0.5  |       | dB    |
| Gain Variation Over Temperature                    |       | 0.010 | 0.015 |        | 0.010 | 0.015 |         | 0.010 | 0.015 | dB/°C |
| Noise Figure                                       |       | 3     | 4     |        | 3     | 5     |         | 5.5   | 6.5   | dB    |
| Input Return Loss                                  |       | 15    |       |        | 13    |       |         | 12    |       | dB    |
| Output Return Loss                                 |       | 13    |       |        | 10    |       |         | 10    |       | dB    |
| Output Power for 1 dB Compression (P1dB)           | 16    | 19    |       | 11     | 16    |       | 10      | 12    |       | dBm   |
| Saturated Output Power (Psat)                      |       | 21    |       |        | 19    |       |         | 19    |       | dBm   |
| Output Third Order Intercept (IP3)                 |       | 30    |       |        | 24    |       |         | 22    |       | dBm   |
| Supply Current (Idd) (Vdd = 5V, Vgg1 = -0.9V Typ.) |       | 60    | 80    |        | 60    | 80    |         | 60    | 80    | mA    |

\* Adjust Vgg1 between -2 to -0V to achieve Idd = 60 mA typical.

# HMC463LP5\* PRODUCT PAGE QUICK LINKS

Last Content Update: 07/30/2017

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## COMPARABLE PARTS

View a parametric search of comparable parts.

## EVALUATION KITS

- HMC463LP5 Evaluation Board

## DOCUMENTATION

### Application Notes

- AN-1363: Meeting Biasing Requirements of Externally Biased RF/Microwave Amplifiers with Active Bias Controllers
- Broadband Biasing of Amplifiers General Application Note
- MMIC Amplifier Biasing Procedure Application Note
- Thermal Management for Surface Mount Components General Application Note

### Data Sheet

- HMC463LP5: GaAs pHEMT MMIC Low Noise AGC Amplifier, 2 - 20 GHz Data Sheet

## TOOLS AND SIMULATIONS

- HMC463LP5 S-Parameters

## REFERENCE MATERIALS

### Quality Documentation

- Package/Assembly Qualification Test Report: LP5 & LP5G (QTR: 2014-00150 REV: 02)
- Package/Assembly Qualification Test Report: Plastic Encapsulated QFN (QTR: 05006 REV: 02)
- Semiconductor Qualification Test Report: PHEMT-F (QTR: 2013-00269)

## DESIGN RESOURCES

- HMC463LP5 Material Declaration
- PCN-PDN Information
- Quality And Reliability
- Symbols and Footprints

## DISCUSSIONS

View all HMC463LP5 EngineerZone Discussions.

## SAMPLE AND BUY

Visit the product page to see pricing options.

## TECHNICAL SUPPORT

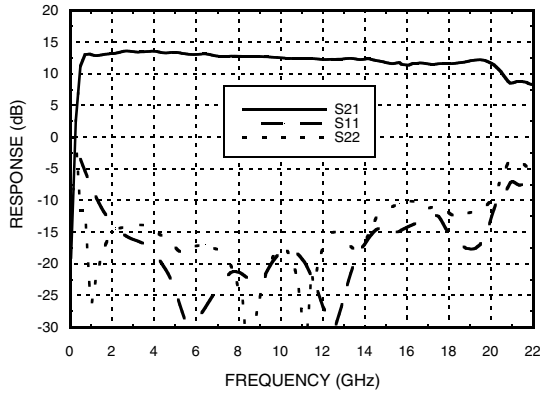
Submit a technical question or find your regional support number.

## DOCUMENT FEEDBACK

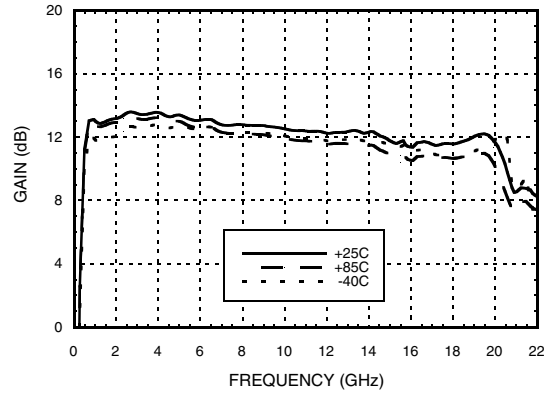
Submit feedback for this data sheet.

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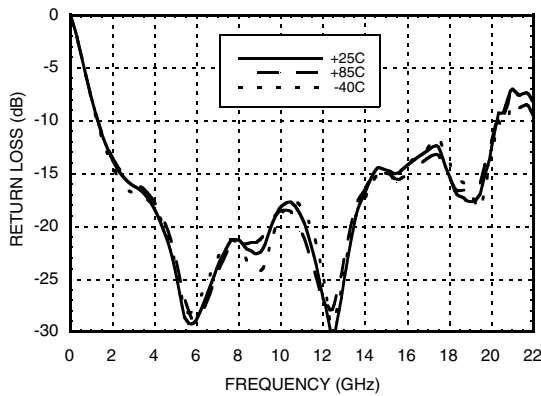
**Gain & Return Loss**



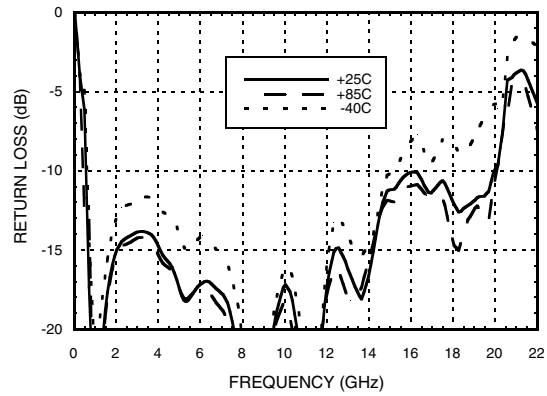
**Gain vs. Temperature**



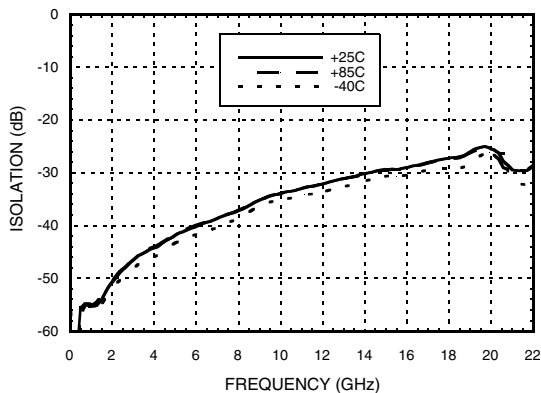
**Input Return Loss vs. Temperature**



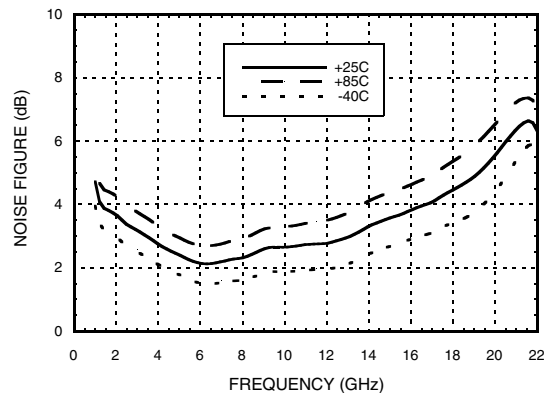
**Output Return Loss vs. Temperature**



**Reverse Isolation vs. Temperature**

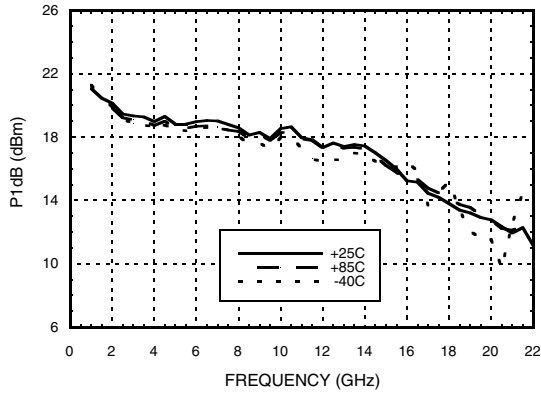


**Noise Figure vs. Temperature**

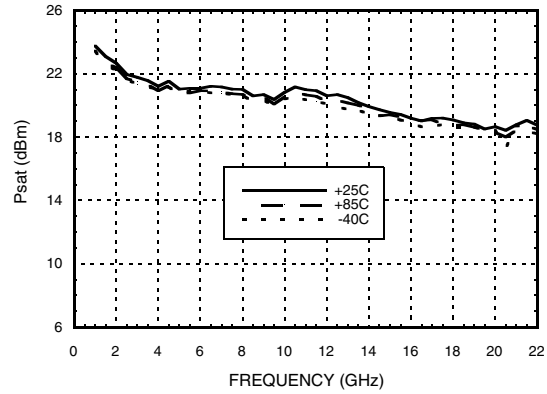


**GaAs pHEMT MMIC LOW NOISE AGC AMPLIFIER, 2 - 20 GHz**

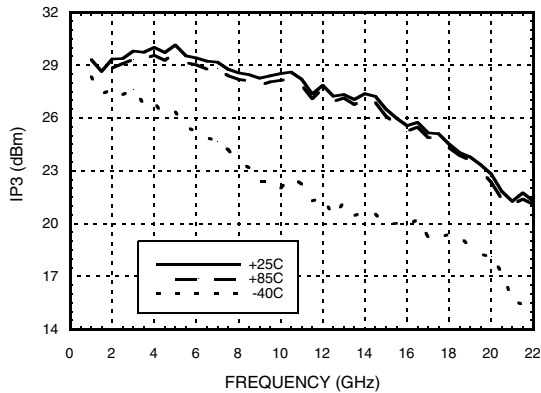
**P1dB vs. Temperature**



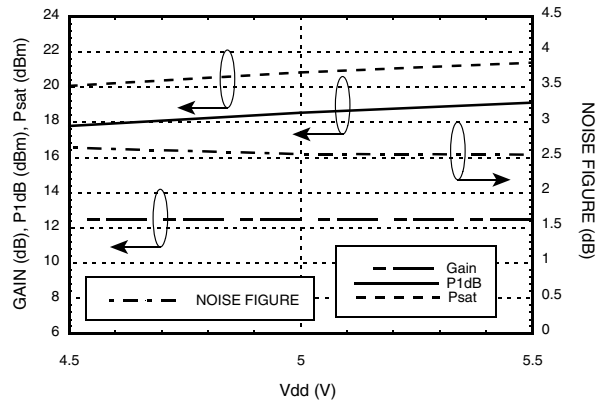
**Psat vs. Temperature**



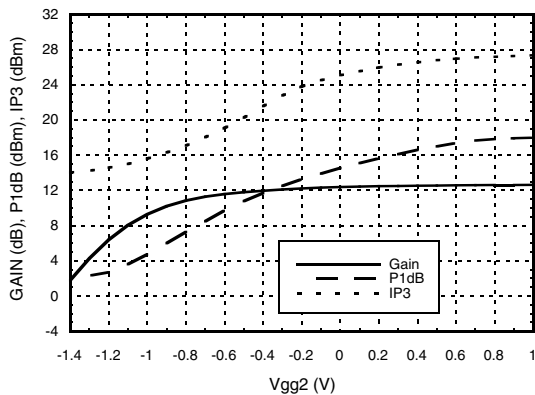
**Output IP3 vs. Temperature**



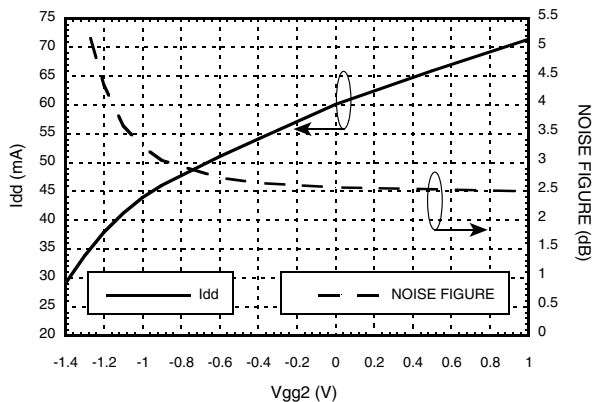
**Gain, Power & Noise Figure vs. Supply Voltage @ 10 GHz, Fixed Vgg1**

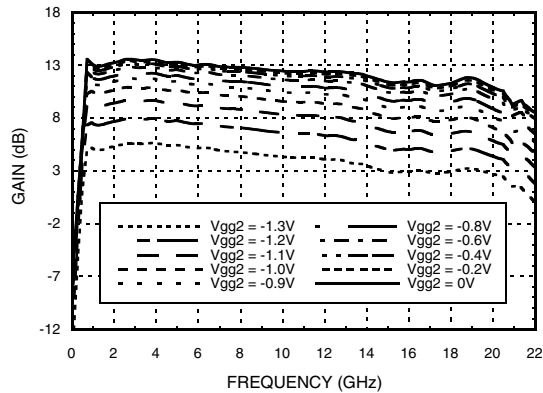


**Gain, P1dB & Output IP3 vs. Control Voltage @ 10 GHz**



**Noise Figure & Supply Current vs. Control Voltage @ 10 GHz**



**Gain @ Several Control Voltages (V<sub>gg2</sub>)**


**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

**Absolute Maximum Ratings**

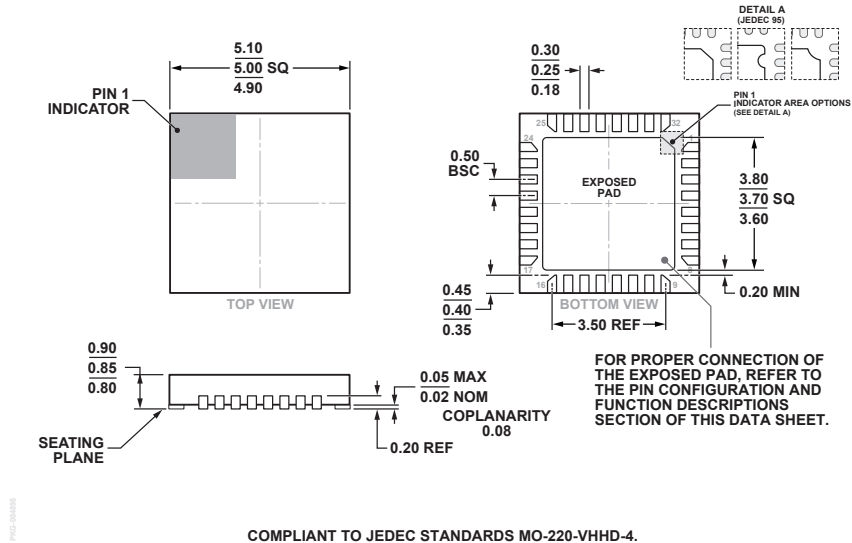
|  |                                 |
|--|---------------------------------|
| Drain Bias Voltage (V <sub>dd</sub> )                                      | +9V                             |
| Gate Bias Voltage (V <sub>gg1</sub> )                                      | -2 to 0V                        |
| Gate Bias Current (I <sub>gg1</sub> )                                      | 2.5 mA                          |
| Gate Bias Voltage (V <sub>gg2</sub> )(AGC)                                 | (V <sub>dd</sub> -9) Vdc to +2V |
| RF Input Power (RFIN)(V <sub>dd</sub> = +5V)                               | +18 dBm                         |
| Channel Temperature  | 150 °C                          |
| Continuous P <sub>diss</sub> (T= 85 °C)<br>(derate 19.1 mW/°C above 85 °C) | 1.24 W                          |
| Thermal Resistance<br>(channel to ground paddle)                           | 52.3 °C/W                       |
| Storage Temperature  | -65 to +150 °C                  |
| Operating Temperature  | -40 to +85 °C                   |
| ESD Sensitivity (HBM)  | Class 0B - Passed<br>150V       |

**Typical Supply Current vs. V<sub>dd</sub>**

| V <sub>dd</sub> (V) | I <sub>dd</sub> (mA) |
|---------------------|----------------------|
| +4.5                | 58                   |
| +5.0                | 60                   |
| +5.5                | 62                   |

## GaAs pHEMT MMIC LOW NOISE AGC AMPLIFIER, 2 - 20 GHz

### Outline Drawing



COMPLIANT TO JEDEC STANDARDS MO-220-VHHD-4.

32-Lead Lead Frame Chip Scale Package [LFCSP]  
5 mm x 5 mm Body and 0.90 mm Package Height  
(HCP-32-1)

Dimensions shown in millimeters

### Package Information

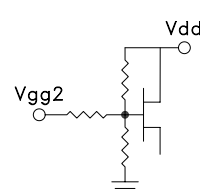
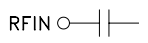
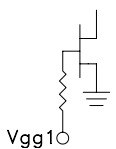
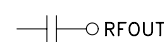
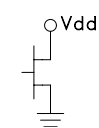

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|--|---------------|---------------------|--------------------------------|
| HMC463LP5   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | H463<br>XXXX                   |
| HMC463LP5E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | H463<br>XXXX                   |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C

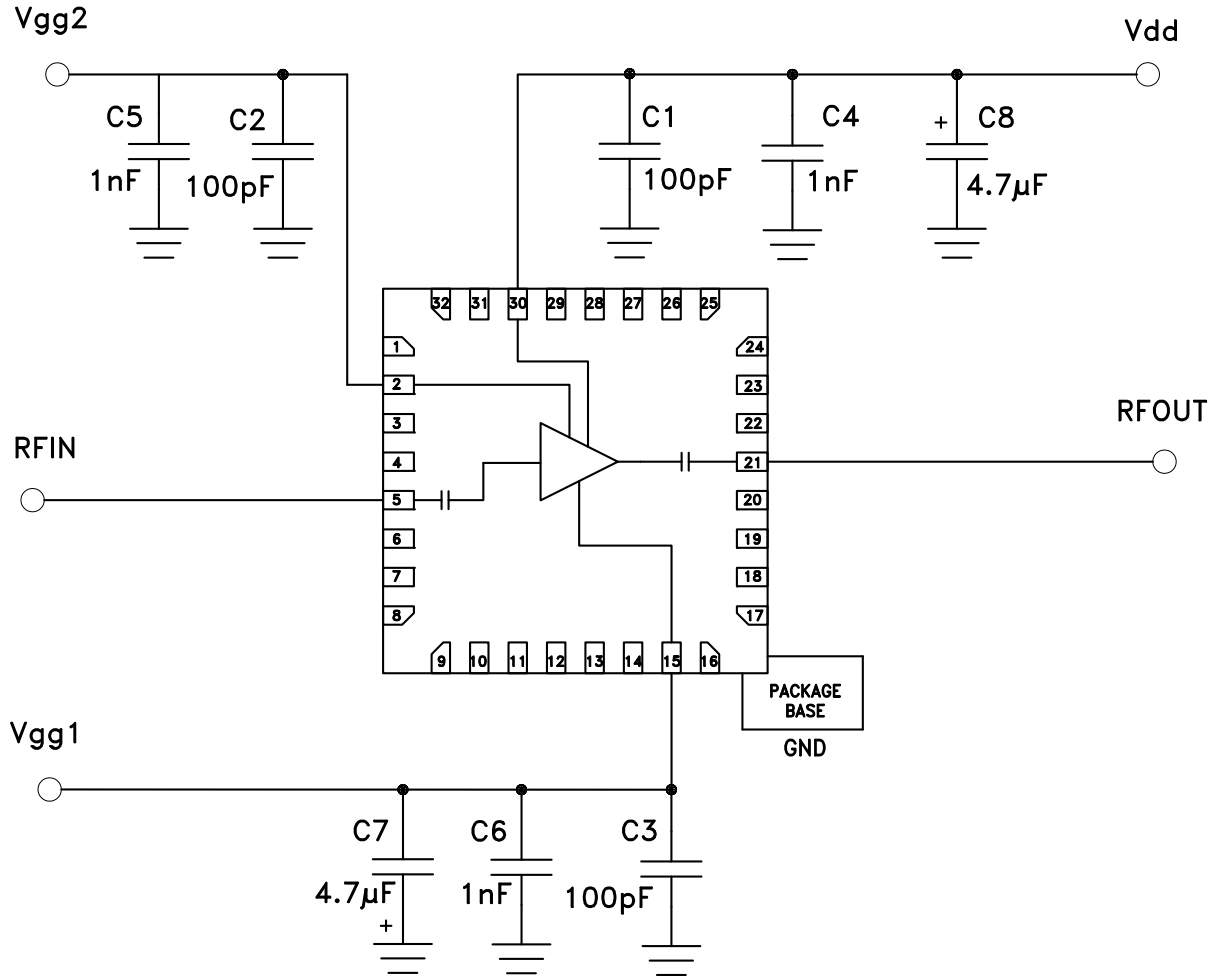
[3] 4-Digit lot number XXXX

### Pin Descriptions

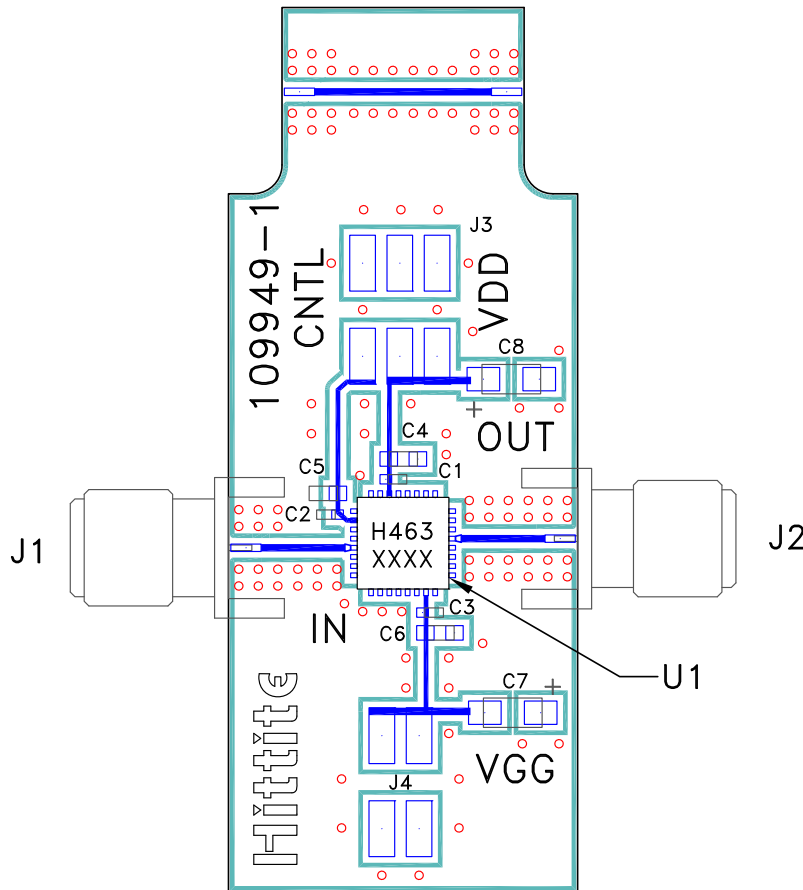
| Pin Number                                | Function | Description  | Interface Schematic   |
|---|----------|--|---|
| 1, 3, 4, 6-14,<br>16-20, 22-29,<br>31, 32 | N/C      | The pins are not connected internally; however, all data shown herein was measured with these pins connected to RF/DC ground externally. |   |
| 2   | Vgg2     | Optional gate control if AGC is required. Leave Vgg2 open circuited if AGC is not required. Typical Vgg2 = -1.5V to 0V                   |    |
| 5   | RFIN     | This pad is AC coupled and matched to 50 Ohms  |    |
| 15  | Vgg1     | Gate control for amplifier. Adjust to achieve I <sub>dd</sub> = 60mA.  |    |
| 21  | RFOUT    | This pad is AC coupled and matched to 50 Ohms  |  |
| 30  | Vdd      | Power supply voltage for the amplifier. External bypass capacitors are required  |  |
| Ground Paddle                             | GND      | Ground paddle must be connected to RF/DC ground.   |  |

**GaAs pHEMT MMIC LOW NOISE  
AGC AMPLIFIER, 2 - 20 GHz**

**Application Circuit**





**Evaluation PCB**

**List of Materials for Evaluation PCB 108341 [1]**

| Item    | Description                     |
|---------|---------------------------------|
| J1 - J2 | SRI K Connector                 |
| J3 - J4 | 2 mm Molex Header               |
| C1 - C3 | 100 pF Capacitor, 0402 Pkg.     |
| C4 - C6 | 1000 pF Capacitor, 0603 Pkg.    |
| C7 - C8 | 4.7 $\mu$ F Capacitor, Tantalum |
| U1      | HMC463LP5(E) Amplifier          |
| PCB [2] | 109949 Evaluation PCB           |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350 or Arlon 25FR

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 Analog Devices upon request.