



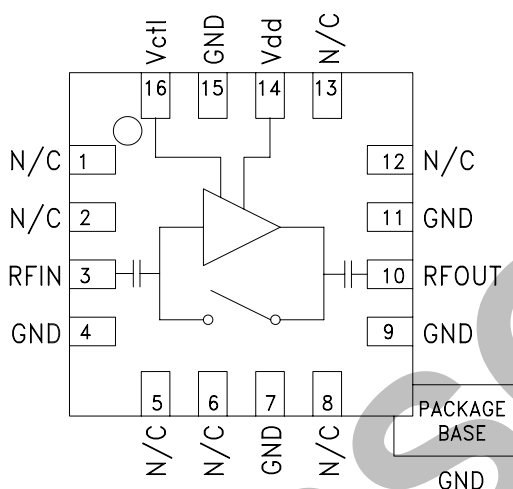
## GAAS PHEMT MMIC LOW NOISE AMPLIFIER w/ BYPASS MODE, 2.3 - 2.7 GHz

### Typical Applications

The HMC605LP3 / HMC605LP3E is ideal for:

- Wireless Infrastructure
- Customer Premise Equipment
- Fixed Wireless
- WiMAX & WiBro
- Tower Mounted Amplifiers

### Functional Diagram



### Features

- Noise Figure: 1.1 dB
- Output IP3: +31 dBm
- Gain: 20 dB
- Low Loss & Failsafe Bypass Path
- Single Supply: +3V or +5V
- 50 Ohm Matched Output/Input

### General Description

The HMC605LP3 / HMC605LP3E are versatile, high dynamic range GaAs MMIC Low Noise Amplifiers that integrate a low loss LNA bypass path on the IC. The amplifier is ideal for WiBro & WiMAX receivers operating between 2.3 and 2.7 GHz and provides 1.1 dB noise figure, 20 dB of gain and +31 dBm output IP3 from a single supply of +5V @ 74 mA. Input and output return losses are 14 and 15 dB respectively with no external matching components required. A single control line (Vctl) is used to switch between LNA mode and a low 2 dB loss bypass mode and reduces the current consumption to 10  $\mu$ A. The HMC605LP3 is failsafe and will default to the bypass mode with no DC power applied.

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

| Parameter                                       | LNA Mode                |       |      | Bypass Mode |       |      | Units                 |
|-------------------------------------------------|-------------------------|-------|------|-------------|-------|------|-----------------------|
|                                                 | Min.                    | Typ.  | Max. | Min.        | Typ.  | Max. |                       |
| Frequency Range                                 | 2.3 - 2.7               |       |      | 2.3 - 2.7   |       |      | GHz                   |
| Gain                                            | 17.5                    | 20.5  |      | -3.0        | -2.0  |      | dB                    |
| Gain Variation Over Temperature                 |                         | 0.012 |      |             | 0.002 |      | dB / $^\circ\text{C}$ |
| Noise Figure                                    |                         | 1.1   | 1.3  |             |       |      | dB                    |
| Input Return Loss                               |                         | 14    |      |             | 13    |      | dB                    |
| Output Return Loss                              |                         | 15    |      |             | 13    |      | dB                    |
| Reverse Isolation                               |                         | 33    |      |             |       |      | dB                    |
| Power for 1dB Compression (P1dB) <sup>[1]</sup> |                         | 17    |      |             | 14    |      | dBm                   |
| Third Order Intercept (IP3) <sup>[2]</sup>      |                         | 31    |      |             | 23    |      | dBm                   |
| Supply Current (I <sub>dd</sub> )               |                         | 74    | 90   |             | 0.01  |      | mA                    |
| Switching Speed                                 | LNA Mode to Bypass Mode |       | -    |             | 6.0   |      | ns                    |
|                                                 | Bypass Mode to LNA Mode |       | 60   |             | -     |      | ns                    |

<sup>[1]</sup> P1dB and IIP3 is referenced to RFOUT for LNA mode and to RFIN for Bypass Mode.

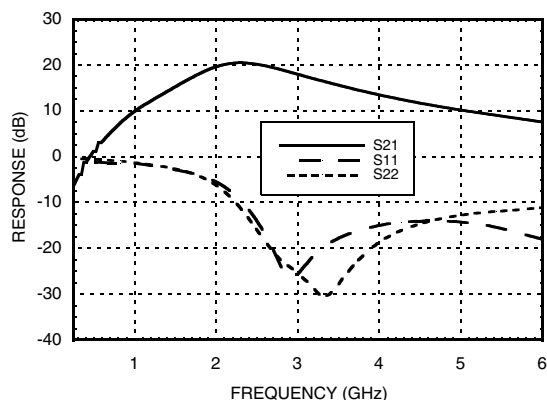
<sup>[2]</sup> For LNA Mode: Input tone power is -20 dBm/tone at 1 MHz tone spacing.

For Bypass Mode: Input tone power is 0dBm/tone at 1MHz tone spacing

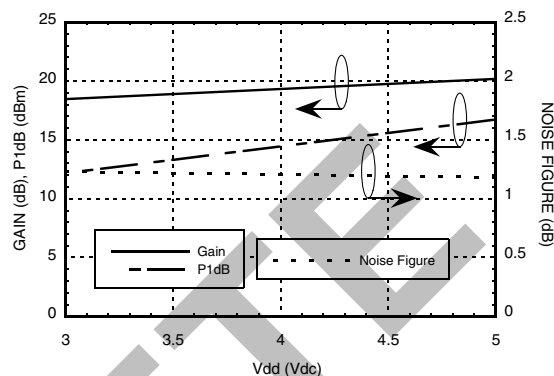


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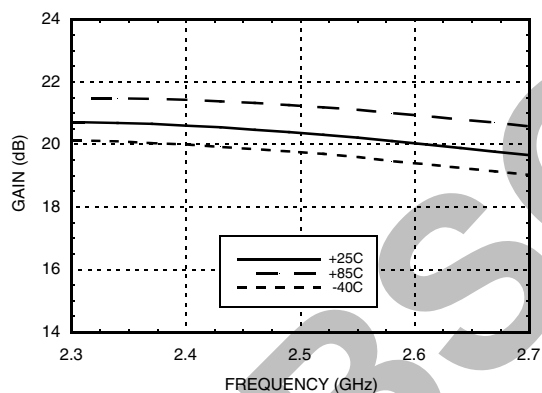
**LNA Broadband Gain & Return Loss**



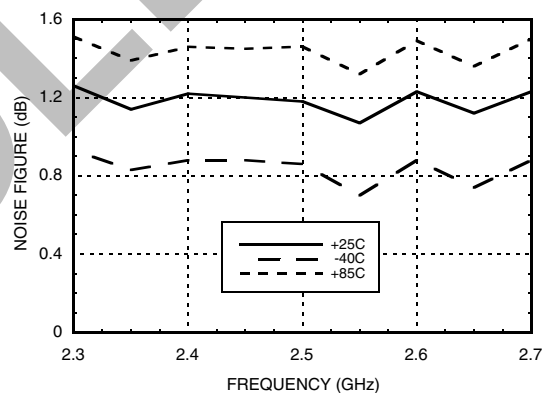
**LNA Gain, Noise Figure &  
Power vs. Supply Voltage @ 2.5 GHz**



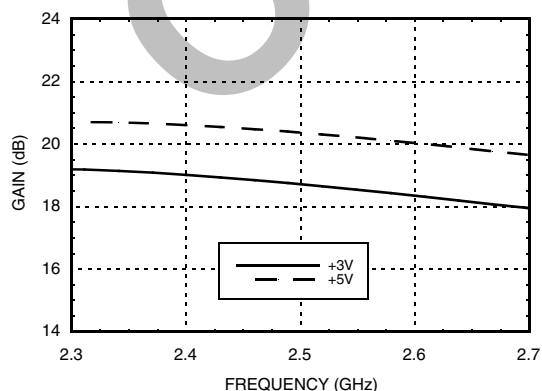
**LNA Gain vs. Temperature**



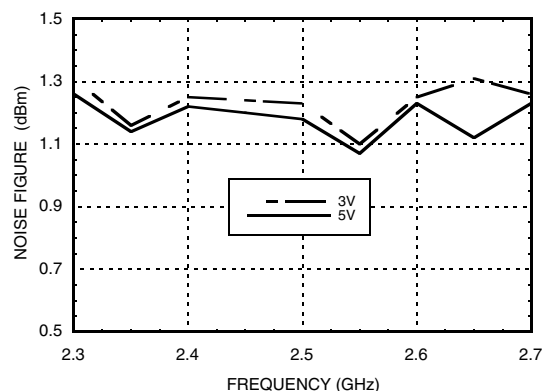
**LNA Noise Figure vs. Temperature**



**LNA Gain vs. Vdd**



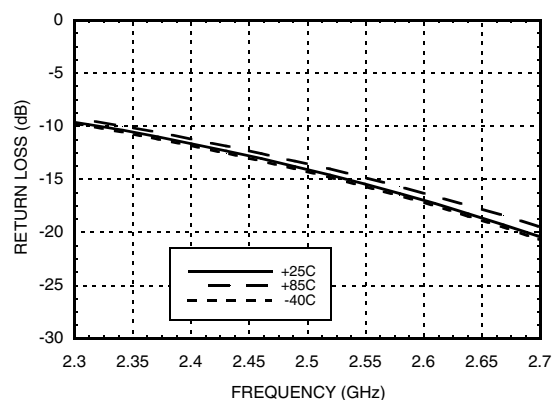
**LNA Noise Figure vs. Vdd**



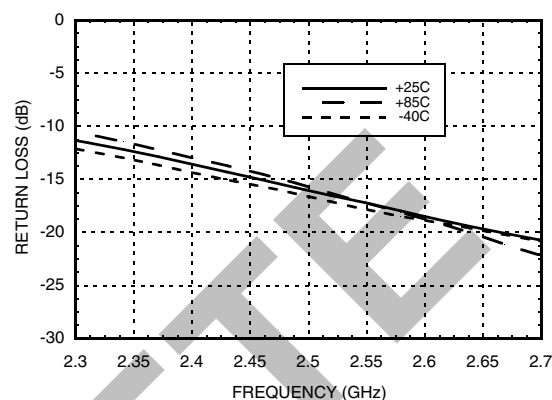


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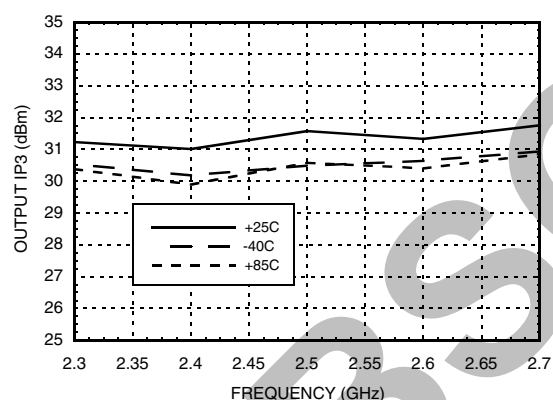
**LNA Input Return Loss vs. Temperature**



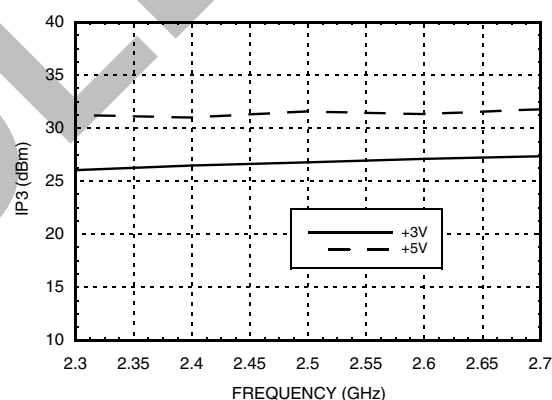
**LNA Output Return Loss vs. Temperature**



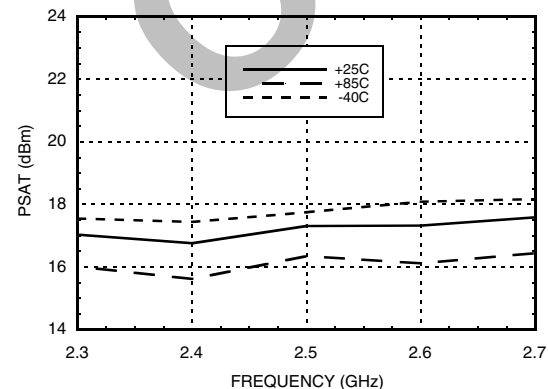
**LNA Output IP3 vs. Temperature**



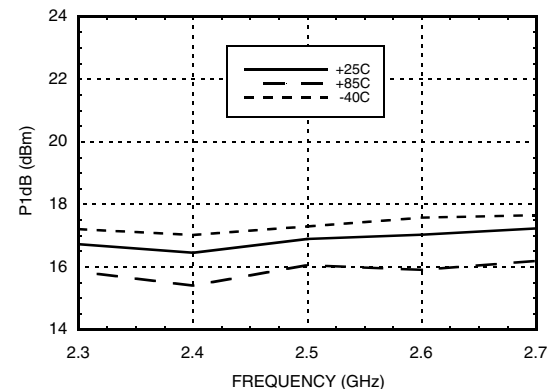
**LNA Output IP3 vs. Vdd**



**LNA Psat vs. Temperature**



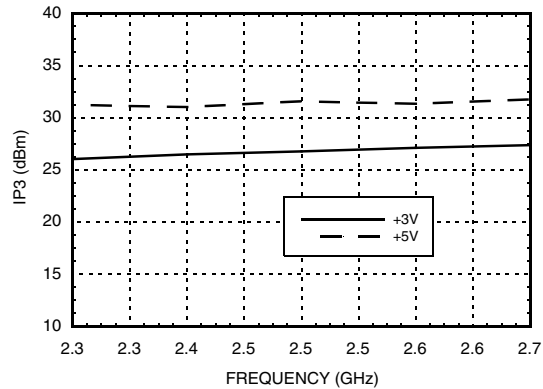
**LNA Output P1dB vs. Temperature**



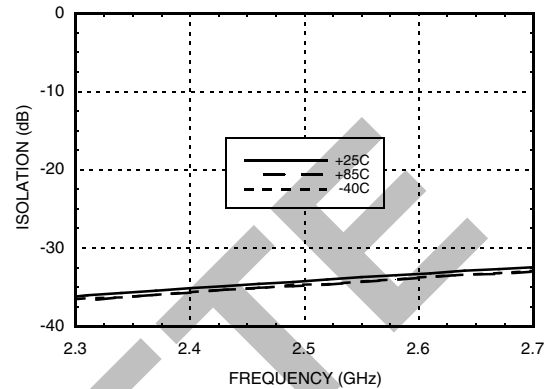


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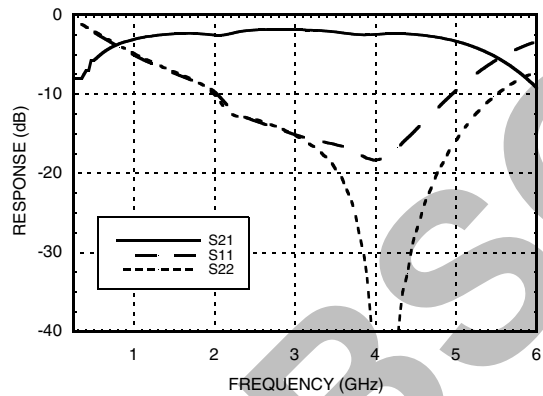
**LNA Output P1dB vs. Vdd**



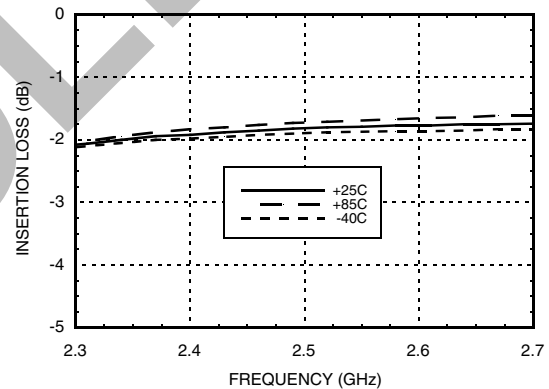
**LNA Reverse Isolation vs. Temperature**



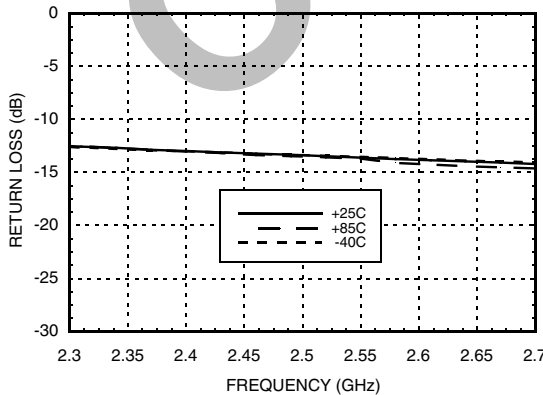
**Bypass Mode  
Broadband Gain & Return Loss**



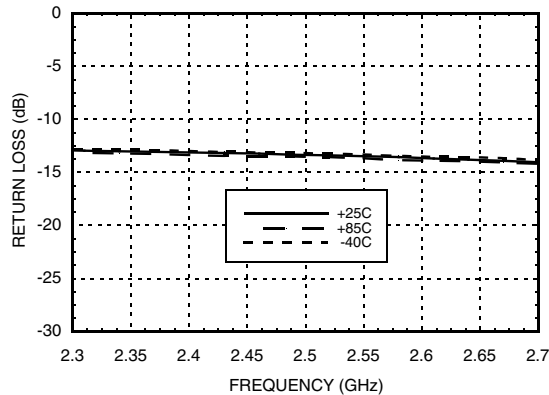
**Bypass Mode  
Insertion Loss vs. Temperature**



**Bypass Mode  
Input Return Loss vs. Temperature [1]**



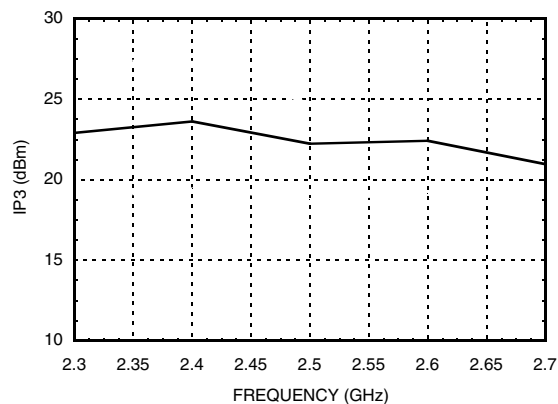
**Bypass Mode  
Output Return Loss vs. Temperature [1]**



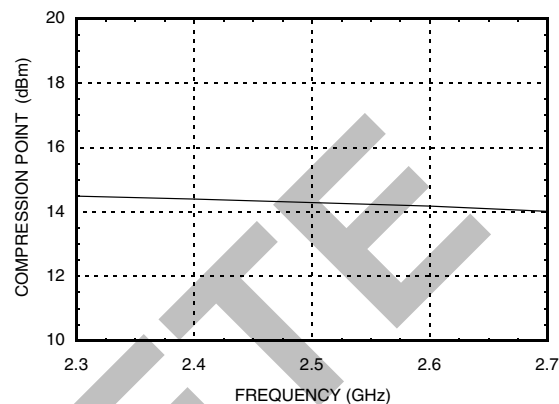


**GAAS PHEMT MMIC LOW NOISE  
AMPLIFIER w/ BYPASS MODE, 2.3 - 2.7 GHz**

**Bypass Mode  
Input IP3 vs. Frequency**



**Bypass Mode  
Input P1dB vs. Frequency**



OBSOLETE



# HMC605LP3 / 605LP3E

## GAAS PHEMT MMIC LOW NOISE AMPLIFIER w/ BYPASS MODE, 2.3 - 2.7 GHz

### Absolute Maximum Ratings

|                                                                              |                                         |
|------------------------------------------------------------------------------|-----------------------------------------|
| Drain Bias Voltage (Vdd)                                                     | +8 Vdc                                  |
| RF Input Power (RFIN)                                                        | LNA Mode +22 dBm<br>Bypass Mode +30 dBm |
| Channel Temperature                                                          | 150 °C                                  |
| Continuous P <sub>diss</sub> (T = 85 °C)<br>(derate 15.85 mW/°C above 85 °C) | 1.03 mW                                 |
| Thermal Resistance<br>(channel to ground paddle)                             | 63.08 °C/W                              |
| Storage Temperature                                                          | -65 to +150° C                          |
| Operating Temperature                                                        | -40 to +100° C                          |

### Typical Supply Current vs. Vdd

| Vdd (Vdc) | I <sub>dd</sub> (mA) |
|-----------|----------------------|
| +3.0      | 28                   |
| +5.0      | 74                   |

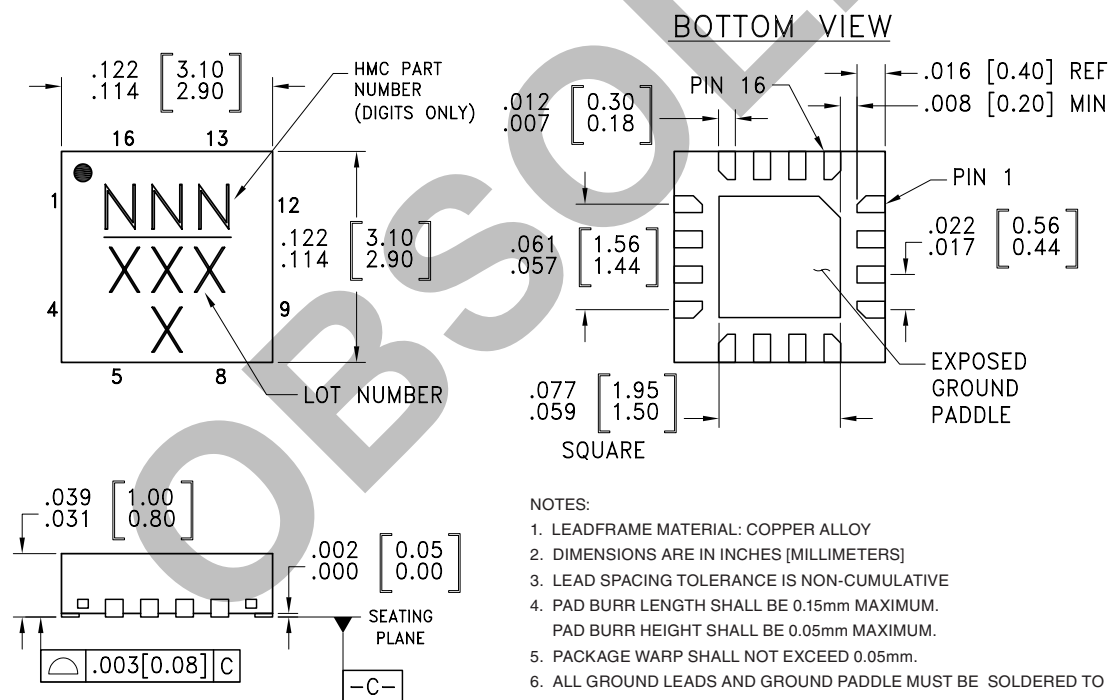
### Truth Table

|             |                               |
|-------------|-------------------------------|
| LNA Mode    | V <sub>ctl</sub> = Vdd ± 0.3V |
| Bypass Mode | V <sub>ctl</sub> = 0 ± 0.3V   |



**ELECTROSTATIC SENSITIVE DEVICE**  
**OBSERVE HANDLING PRECAUTIONS**

### Outline Drawing



### Package Information

| Part Number | Package Body Material                              | Lead Finish   | MSL Rating          | Package Marking <sup>[3]</sup> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC605LP3   | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | 605<br>XXXX                    |
| HMC605LP3E  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | 605<br>XXXX                    |

[1] Max peak reflow temperature of 235 °C

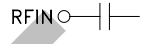
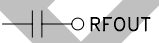
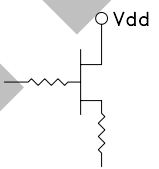
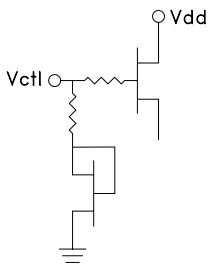
[2] Max peak reflow temperature of 260 °C

[3] 4-Digit lot number XXXX

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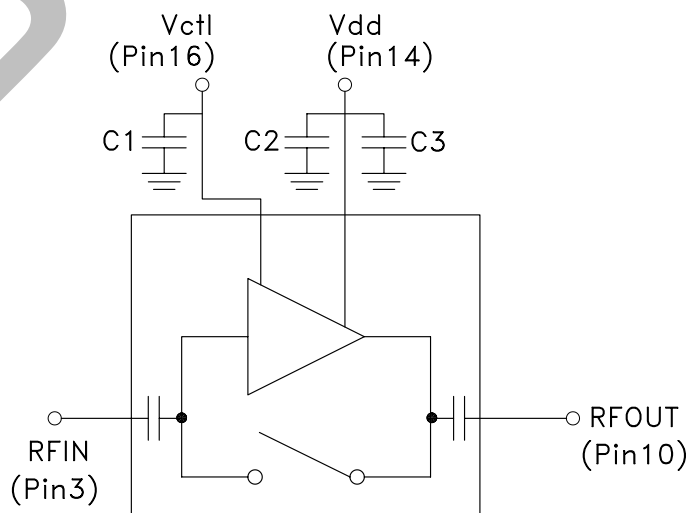
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**GAAS PHEMT MMIC LOW NOISE  
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**Pin Descriptions**

| Pin Number           | Function | Description                                                                       | Interface Schematic                                                                  |
|----------------------|----------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1, 2, 5,<br>6, 8, 12 | N/C      | No connection necessary.<br>These pins may be connected to RF/DC ground.          |                                                                                      |
| 3                    | RFIN     | This pin is AC coupled<br>and matched to 50 Ohms.                                 |   |
| 4, 7, 9,<br>11, 15   | GND      | These pins must be connected to RF/DC ground.                                     |   |
| 10                   | RFOUT    | This pin is AC coupled<br>and matched to 50 Ohms.                                 |   |
| 14                   | Vdd      | Power supply voltage. Bypass capacitors<br>are required. See application circuit. |   |
| 16                   | Vctl     | LNA/Bypass Mode Control Voltage. See truth table.                                 |  |

**Application Circuit**

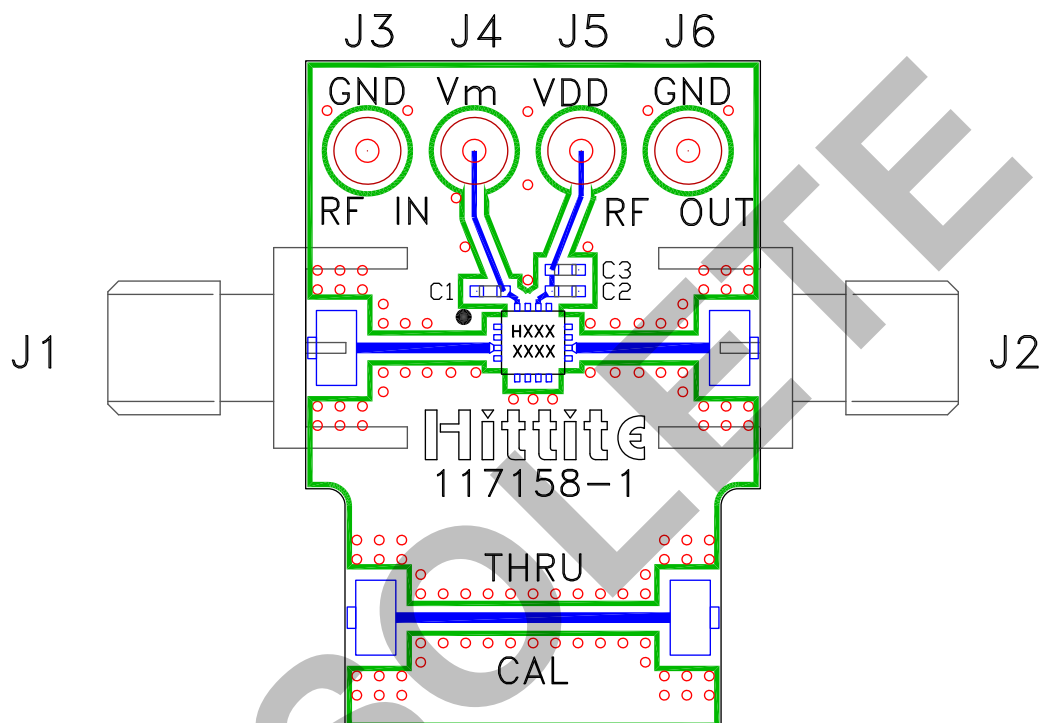
| Components | Value |
|------------|-------|
| C1, C2     | 100pF |
| C3         | 10KpF |





**GAAS PHEMT MMIC LOW NOISE  
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**Evaluation PCB**



**List of Materials for Evaluation PCB 117160 [1]**

| Item    | Description                   |
|---------|-------------------------------|
| J1 - J2 | PCB Mount SMA RF Connector    |
| J3 - J6 | DC Pin                        |
| C1, C2  | 100 pF Capacitor, 0402 Pkg.   |
| C3      | 10 KpF Capacitor, 0402 Pkg.   |
| U1      | HMC605LP3 / 605LP3E Amplifier |
| PCB [2] | 117158 Evaluation Board       |

[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.