



## GaAs InGaP HBT MMIC POWER AMPLIFIER, 0.8 - 1.0 GHz

### Typical Applications

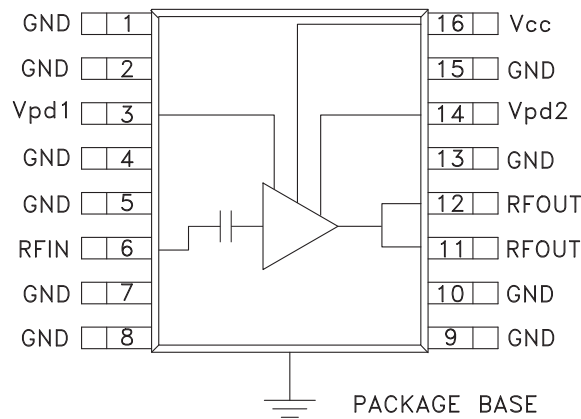
The HMC450QS16G / HMC450QS16GE is ideal for power and driver amplifier applications:

- GSM, GPRS, & Edge
- CDMA & WCDMA
- Base Stations & Repeaters

### Features

- Gain: 26 dB
- 32% PAE @ 28.5 dBm Output Power
- +40 dBm Output IP3
- Integrated Power Control (Vpd)
- Included in the HMC-DK002 Designer's Kit

### Functional Diagram



### General Description

The HMC450QS16G & HMC450QS16GE are high efficiency GaAs InGaP HBT Medium Power MMIC amplifiers operating between 800 and 1000 MHz. The amplifier is packaged in a low cost, surface mount 16 lead package and offers the same pinout and functionality as the higher band HMC413QS16G 1.6-2.3 GHz PA. With a minimum of external components, the amplifier provides 26 dB of gain, +40 dBm OIP3 and +28.5 dBm of saturated power from a +5V supply voltage. The integrated power control (Vpd) can be used for full power down or RF output power/current control. The combination of high gain and high output IP3 make the HMC450QS16G & HMC450QS16GE ideal linear drivers for Cellular, PCS & 3G applications.

### Electrical Specifications, $T_A = +25^\circ C$ , $V_s = +5V$ , $V_{pd} = +4V$ [1]

| Parameter                                | Min.      | Typ.  | Max.  | Units |
|--|-----------|-------|-------|-------|
| Frequency Range                          | 0.8 - 1.0 |       |       | GHz   |
| Gain                                     | 23        | 26    |       | dB    |
| Gain Variation Over Temperature          |           | 0.015 | 0.025 | dB/°C |
| Input Return Loss                        |           | 17    |       | dB    |
| Output Return Loss                       |           | 13    |       | dB    |
| Output Power for 1 dB Compression (P1dB) | 23        | 26    |       | dBm   |
| Saturated Output Power (Psat)            |           | 28.5  |       | dBm   |
| Output Third Order Intercept (IP3) [2]   | 37        | 40    |       | dBm   |
| Noise Figure                             |           | 8     |       | dB    |
| Supply Current (Icq)                     |           | 310   |       | mA    |
| Control Current (Ipd)                    |           | 12    |       | mA    |
| Switching Speed                          | tON, tOFF | 10    |       | ns    |

[1] Specifications and data reflect HMC450QS16G measured using the application circuit found herein. Contact the HMC Applications Group for assistance in optimizing performance for your application.

[2] Two-tone output power of +15 dBm per tone, 1 MHz spacing.

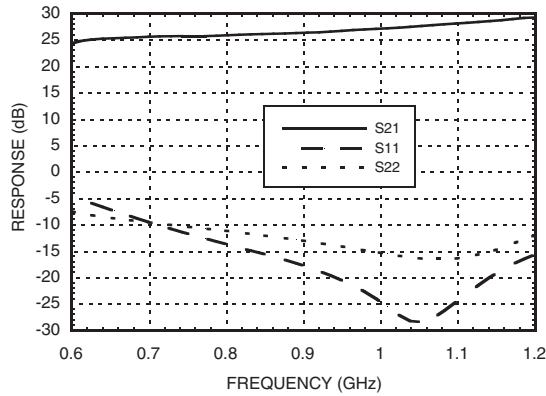
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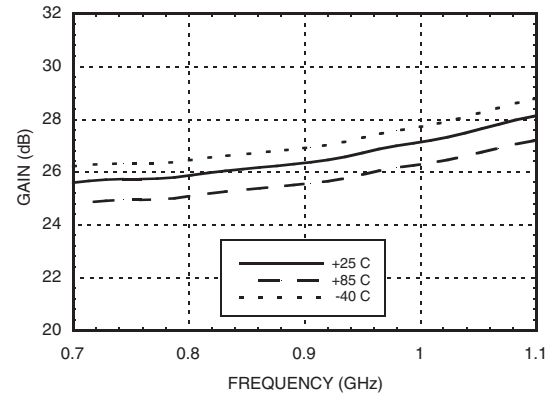


**GaAs InGaP HBT MMIC  
POWER AMPLIFIER, 0.8 - 1.0 GHz**

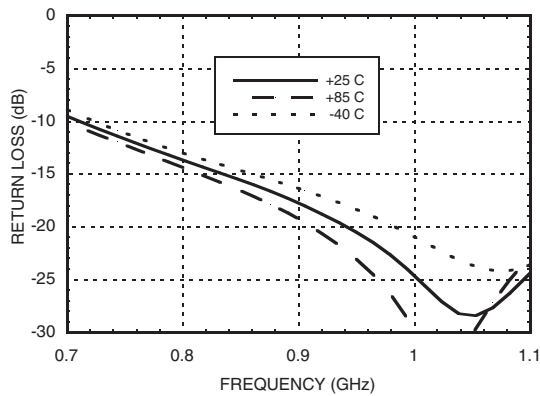
**Broadband Gain & Return Loss**



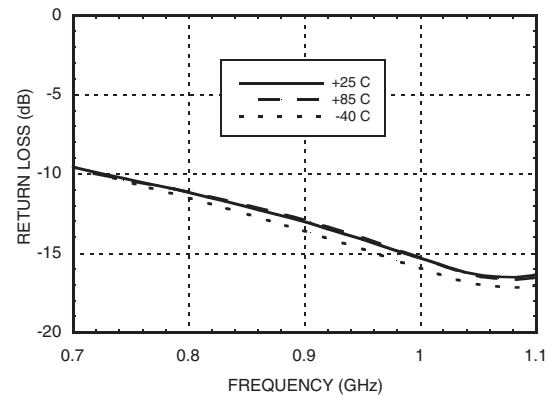
**Gain vs. Temperature**



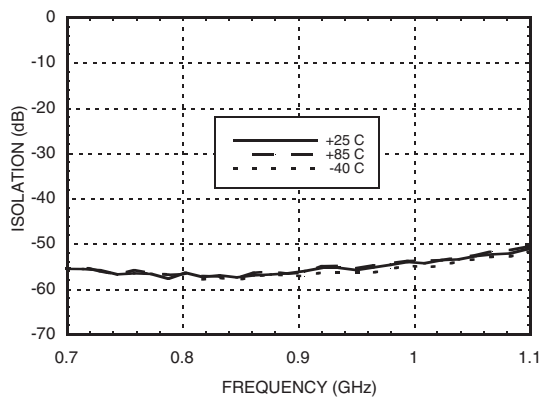
**Input Return Loss vs. Temperature**



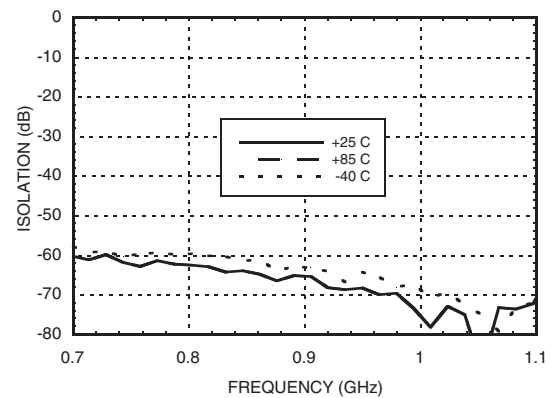
**Output Return Loss vs. Temperature**



**Reverse Isolation vs. Temperature**



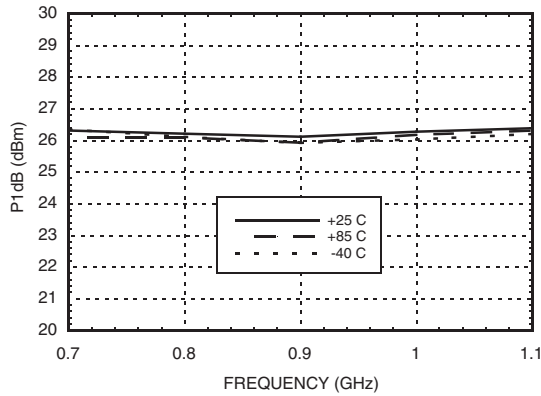
**Power Down Isolation vs. Temperature**



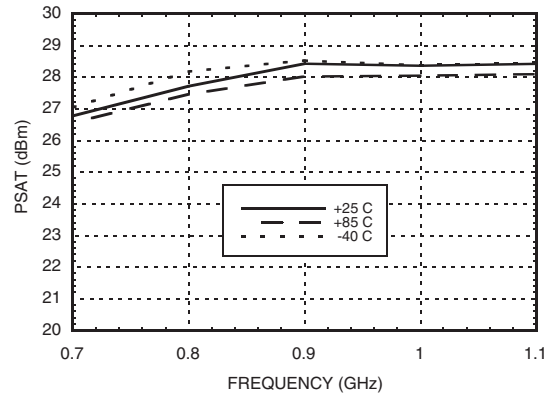
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LINEAR & POWER AMPLIFIERS - SMT

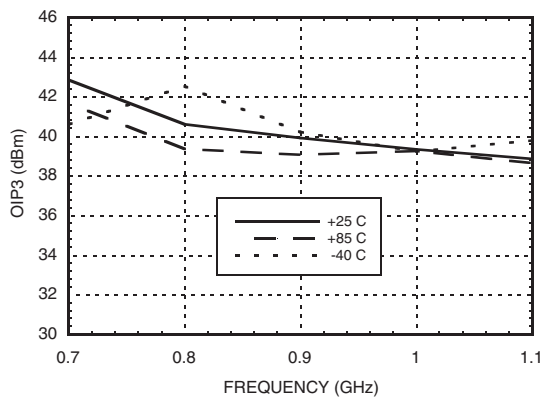
**P1dB vs. Temperature**



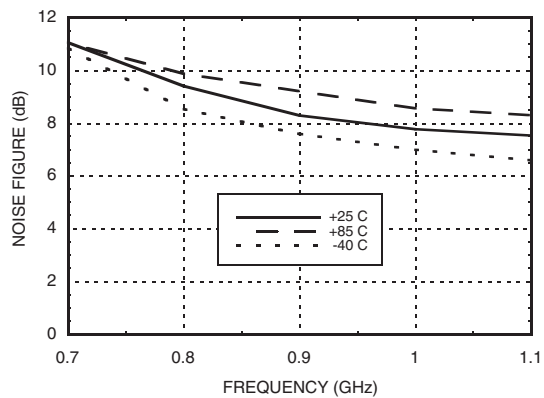
**Psat vs. Temperature**



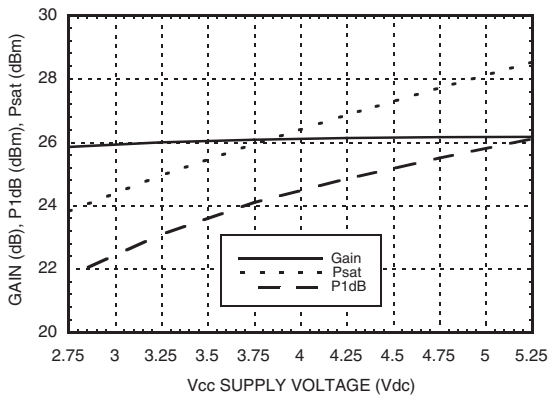
**Output IP3 vs. Temperature**



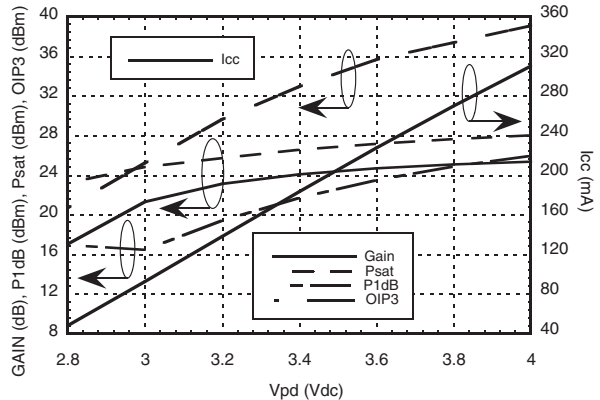
**Noise Figure vs. Temperature**



**Gain and Power vs. Supply Voltage @ 900 MHz, Vpd= 4V**



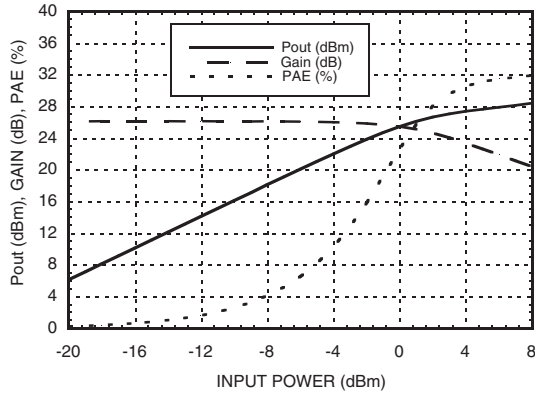
**Gain, Power, OIP3 and Supply Current vs. Power Down Voltage @ 900 MHz**



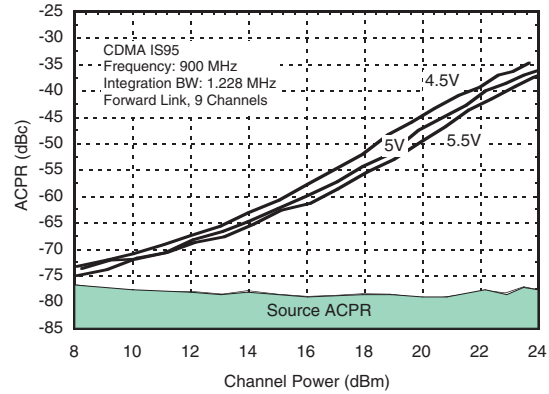


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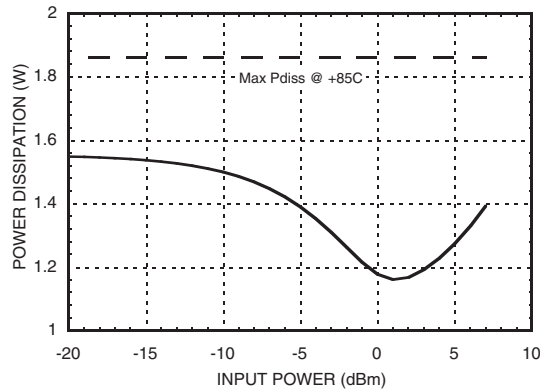
**Power Compression @ 900 MHz**



**ACPR vs. Supply Voltage @ 900 MHz  
CDMA IS95, 9 Channels Forward**



**Power Dissipation @ 900 MHz**



### Absolute Maximum Ratings

|   |                |
|---|----------------|
| Collector Bias Voltage (Vcc)                                  | +5.5 Vdc       |
| Control Voltage (Vpd1, Vpd2)                                  | +5Vdc          |
| RF Input Power (RFIN)(Vs = +5Vdc, VPD = +4.0 Vdc)             | +10 dBm        |
| Junction Temperature  | 150 °C         |
| Continuous Pdiss (T = 85 °C)<br>(derate 28 mW/°C above 85 °C) | 1.86 W         |
| Thermal Resistance<br>(junction to ground paddle)             | 35 °C/W        |
| Storage Temperature   | -65 to +150 °C |
| Operating Temperature   | -40 to +85 °C  |

### Typical Supply Current vs. Supply Voltage

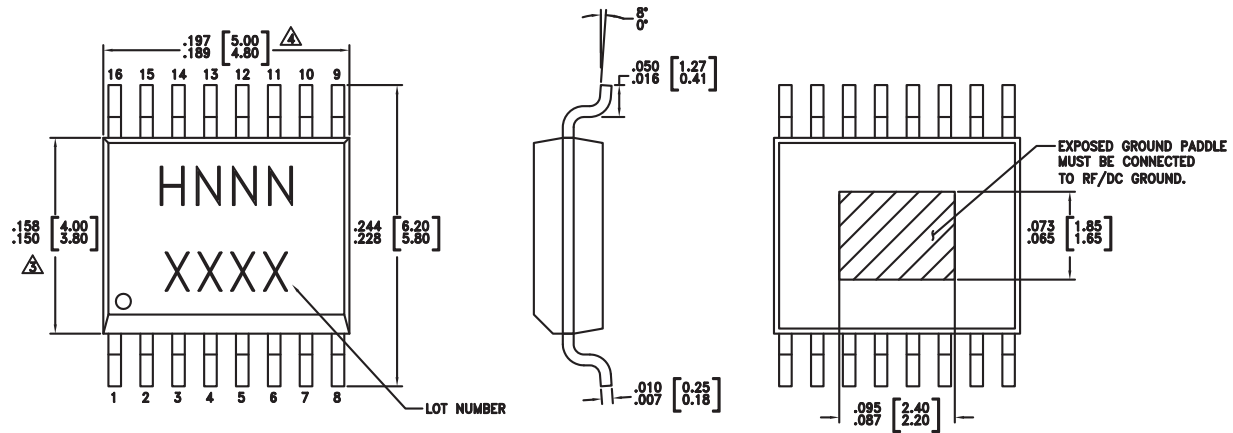
| Vs (V) | Icq (mA) |
|--------|----------|
| 4.75   | 300      |
| 5.0    | 310      |
| 5.25   | 325      |

Note: Amplifier will operate over full voltage range shown above



**ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS**

### Outline Drawing



NOTES:

1. LEADFRAME MATERIAL: COPPER ALLOY
2. DIMENSIONS ARE IN INCHES [MILLIMETERS]
3. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.15mm PER SIDE.
4. DIMENSION DOES NOT INCLUDE MOLDFLASH OF 0.25mm PER SIDE.
5. 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 <sup>[3]</sup> |
|--------------|--|---------------|---------------------|--------------------------------|
| HMC450QS16G  | Low Stress Injection Molded Plastic                | Sn/Pb Solder  | MSL1 <sup>[1]</sup> | H450<br>XXXX                   |
| HMC450QS16GE | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | H450<br>XXXX                   |

[1] Max peak reflow temperature of 235 °C

[2] Max peak reflow temperature of 260 °C


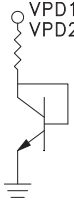

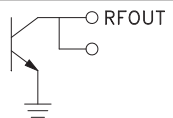
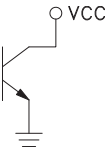
[3] 4-Digit lot number XXXX

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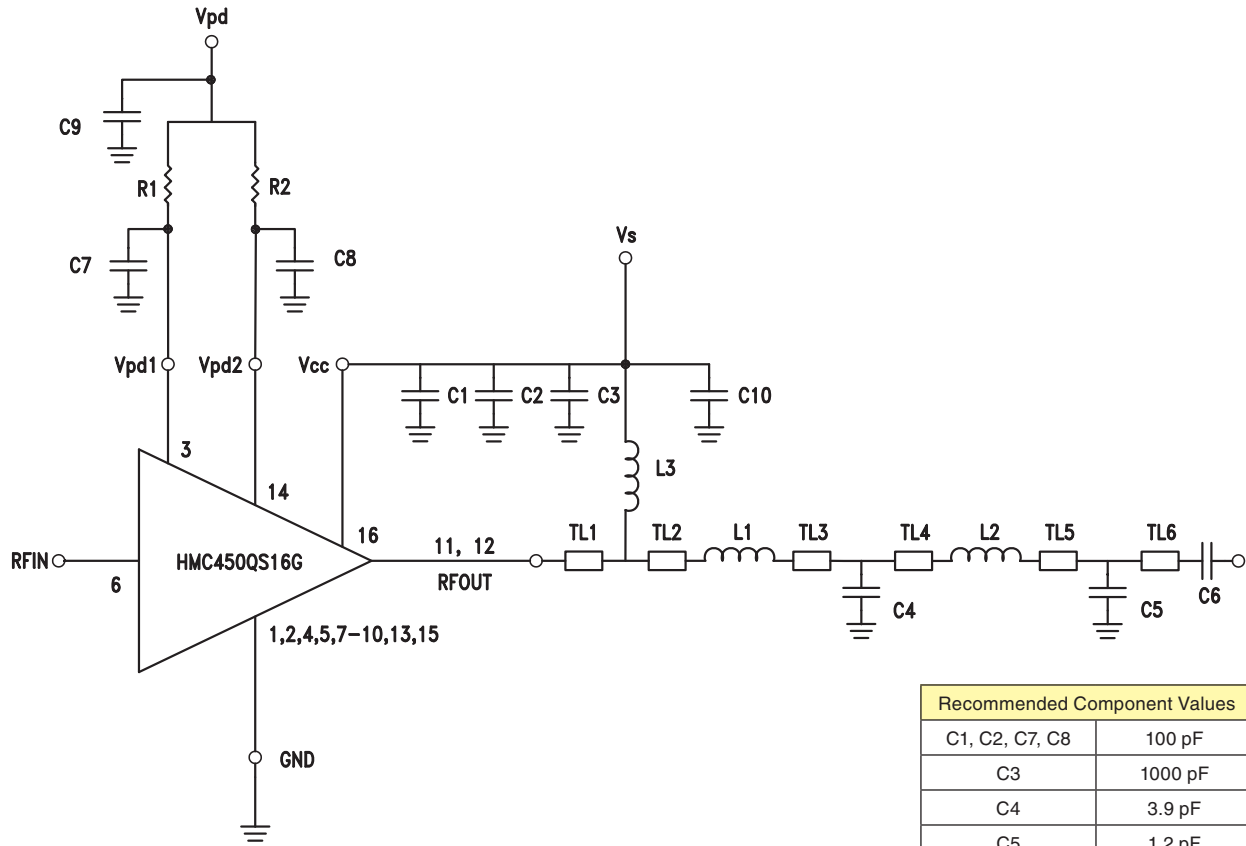
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### Pin Descriptions

| Pin Number                      | Function   | Description  | Interface Schematic  |
|---------------------------------|------------|--|--|
| 1, 2, 4, 5, 7, 8, 9, 10, 13, 15 | GND        | Ground: Backside of package has exposed metal ground slug that must be connected to ground thru a short path. Vias under the device are required.  |   |
| 3, 14                           | Vpd1, Vpd2 | Power Control Pin. For maximum power, this pin should be connected to 4.0V. For 5V operation, a dropping resistor is required. A higher voltage is not recommended. For lower idle current, this voltage can be reduced. |   |
| 6                               | RFIN       | This pin is AC coupled and matched to 50 Ohms from 0.8 to 1.0 GHz.   |   |
| 11, 12                          | RFOUT      | RF output and bias for the output stage.   |   |
| 16                              | Vcc        | Power supply voltage for the first amplifier stage. An external bypass capacitor of 330 pF is required as shown in the application schematic.  |  |

### Application Circuit



| Recommended Component Values |         |
|------------------------------|---------|
| C1, C2, C7, C8               | 100 pF  |
| C3                           | 1000 pF |
| C4                           | 3.9 pF  |
| C5                           | 1.2 pF  |
| C6                           | 27 pF   |
| C9, C10                      | 2.2 μF  |
| L1                           | 1.9 nH  |
| L2                           | 1.0 nH  |
| L3                           | 56 nH   |
| R1, R2                       | 50 Ohms |

|            |           | TL1    | TL2    | TL3    | TL4    | TL5    | TL6    |
|------------|-----------|--------|--------|--------|--------|--------|--------|
|            | Impedance | 50 Ohm | 50 Ohm | 50 Ohm | 50 Ohm | 50 Ohm | 50 Ohm |
| Physical   | Length    | 0.08"  | 0.05"  | 0.02"  | 0.02"  | 0.02"  | 0.02"  |
| Electrical | Length    | 4°     | 2.5°   | 1.02°  | 1.02°  | 1.02°  | 1.02°  |

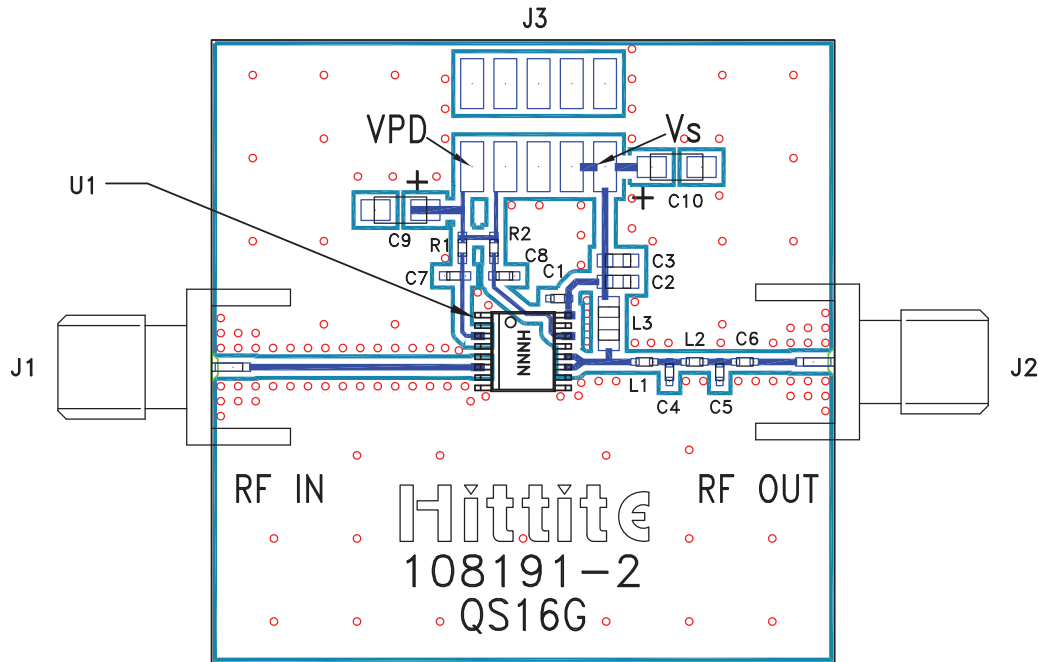
PCB Material: 10 mil Rogers 4350 Er = 3.48

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## Evaluation PCB



### List of Materials for Evaluation PCB 108349 [1]

| Item       | Description                           |
|------------|---------------------------------------|
| J1 - J2    | PCB Mount SMA Connector               |
| J3         | 2 mm DC Header                        |
| C1, C7, C8 | 100 pF Capacitor, 0402 Pkg.           |
| C2         | 100 pF Capacitor, 0603 Pkg.           |
| C3         | 1000 pF Capacitor, 0603 Pkg.          |
| C4         | 3.9 pF Capacitor, 0402 Pkg.           |
| C5         | 1.2 pF Capacitor, 0402 Pkg.           |
| C6         | 27 pF Capacitor, 0402 Pkg.            |
| C9, C10    | 2.2 uF Capacitor, Tantalum            |
| L1         | 1.9 nH Inductor 0402 Pkg.             |
| L2         | 1.0 nH Inductor, 0402 Pkg.            |
| L3         | 56nH Inductor, 0805 Pkg.              |
| R1, R2     | 50 Ohms Resistor, 0402 Pkg.           |
| U1         | HMC450QS16G / HMC450QS16GE Power Amp. |
| PCB [2]    | 108191 Evaluation PCB, 10 mils        |

[1] Reference this number when ordering complete evaluation PCB

[2] Circuit Board Material: Rogers 4350

The circuit board used in the final 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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