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HMC3653* Product Page Quick Links

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Application Notes

- AN-1363: Meeting Biasing Requirements of Externally Biased RF/Microwave Amplifiers with Active Bias Controllers

Data Sheet

- HMC3653 Data Sheet

[Tools and Simulations](#)

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Quality Documentation

- Package/Assembly Qualification Test Report: LP2, LP2C, LP3, LP3B, LP3C, LP3D, LP3F, LP3G (QTR: 2014-0364)
- Semiconductor Qualification Test Report: GaAs HBT-A (QTR: 2013-00228)

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- HMC3653 Material Declaration
- PCN-PDN Information
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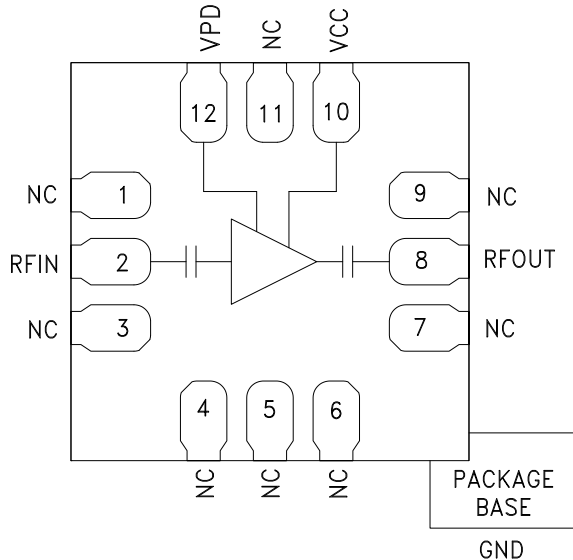
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Typical Applications

The HMC3653LP3BE is ideal for:

- Point-to-Point Radios
- Point-to-Multipoint Radios
- VSAT
- LO Driver for HMC Mixers
- Military EW & ECM

Functional Diagram



Features

- High Output IP3: +28 dBm
- Single Positive Supply: +5V
- Low Noise Figure: 4.0 dB ^[1]
- 12 Lead 3x3 mm SMT Package: 9mm²

General Description

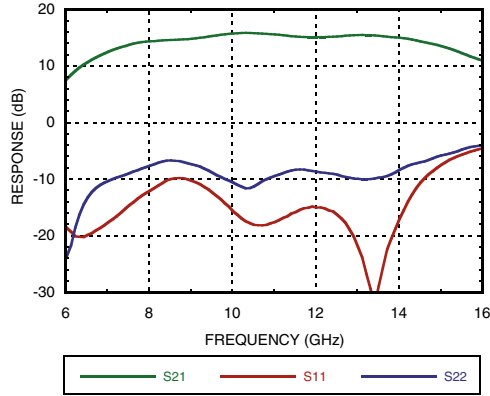
The HMC3653LP3BE is a HBT Gain Block MMIC amplifier covering 7 GHz to 15 GHz and packaged in a 3x3 mm plastic QFN SMT package. This versatile amplifier can be used as a cascadable IF or RF gain stage in 50 Ohm applications. The HMC3653LP3BE delivers 15 dB gain, and +15 dBm output P1dB with only 4 dB noise figure.

Electrical Specifications, $T_A = +25^\circ C$, $V_{cc} = 5V$, $V_{pd} = 5V$

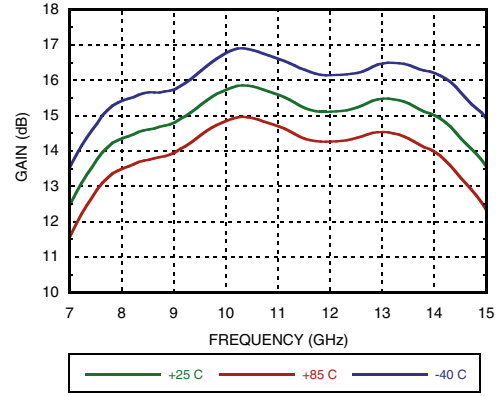
| Parameter | Min. | Typ. | Max. | Min. | Typ. | Max. | Min. | Typ. | Max. | Units |
|--|-------|-------|------|--------|-------|------|---------|-------|------|---------|
| Frequency Range | 7 - 9 | | | 9 - 14 | | | 14 - 15 | | | GHz |
| Gain ^[1] | 10.5 | 14 | | 12 | 15 | | 12 | 15 | | dB |
| Gain Variation Over Temperature | | 0.016 | | | 0.016 | | | 0.022 | | dB / °C |
| Input Return Loss | | 14 | | | 15 | | | 11 | | dB |
| Output Return Loss | | 8 | | | 8 | | | 7 | | dB |
| Output Power for 1 dB Compression (P1dB) ^[1] | 13 | 16 | | 12 | 15 | | 10.5 | 13.5 | | dBm |
| Output Third Order Intercept (IP3) (Pout = 0 dBm per tone, 1 MHz spacing) | | 26 | | | 28 | | | 26 | | dBm |
| Noise Figure ^[1] | | 6 | | | 4 | | | 4 | | dB |
| Supply Current 1 (Idd1) | | 40 | 55 | | 40 | 55 | | 40 | 55 | mA |
| Supply Current 2 (Idd2) | | 4 | 6 | | 4 | 6 | | 4 | 6 | mA |

[1] Board loss subtracted out

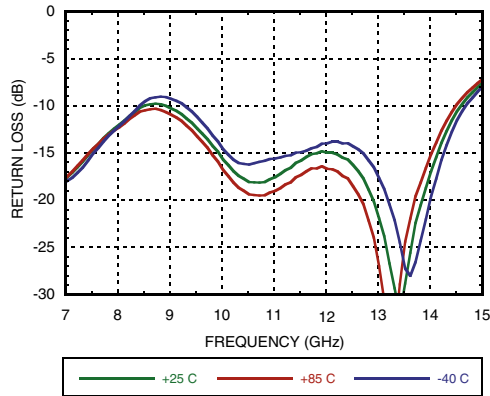
Gain & Return Loss



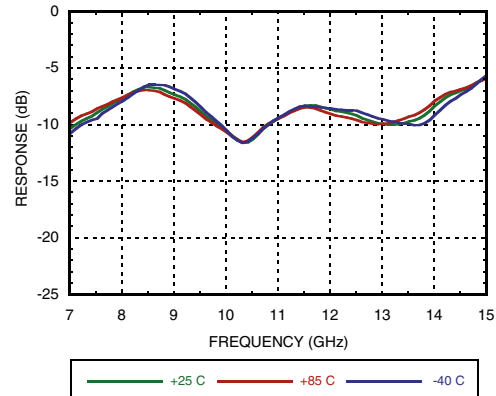
Gain vs. Temperature



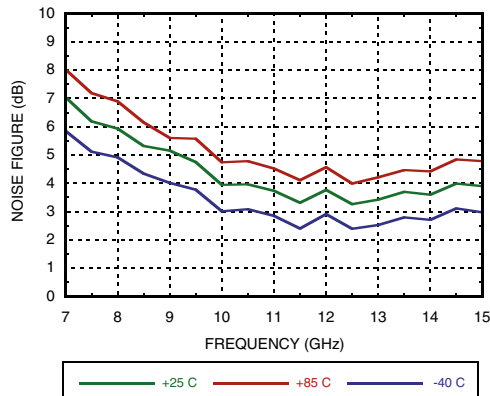
Input Return Loss vs. Temperature



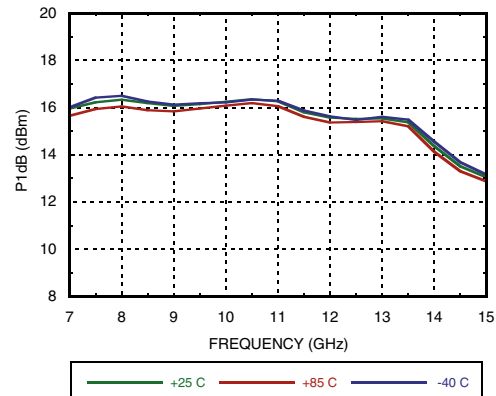
Output Return Loss vs. Temperature



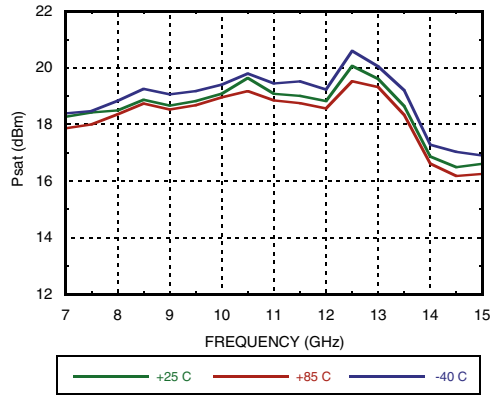
Noise Figure vs. Temperature



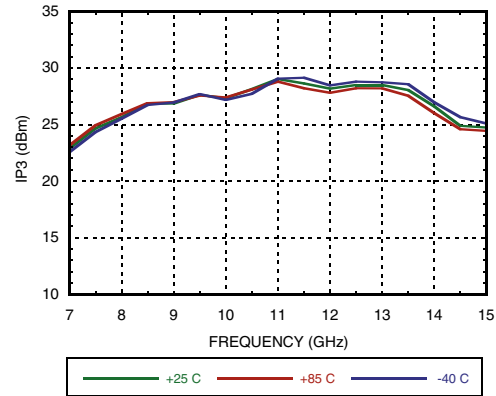
P1dB vs. Temperature



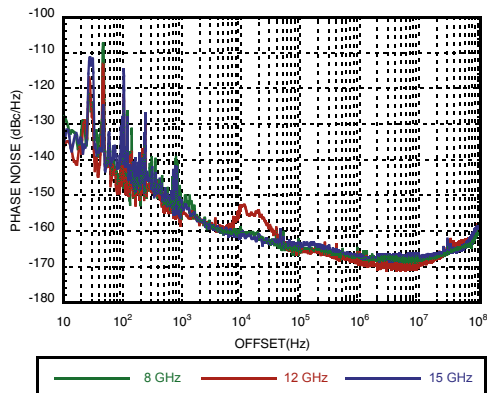
Psat vs. Temperature



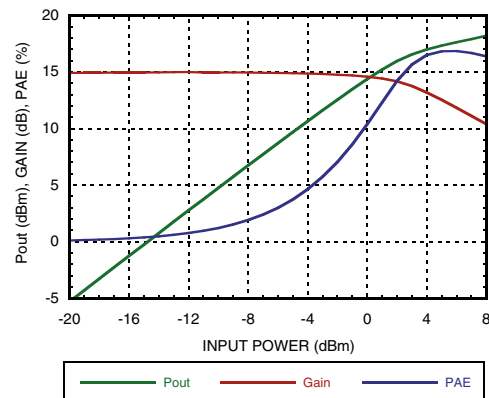
Output IP3 vs Temperature



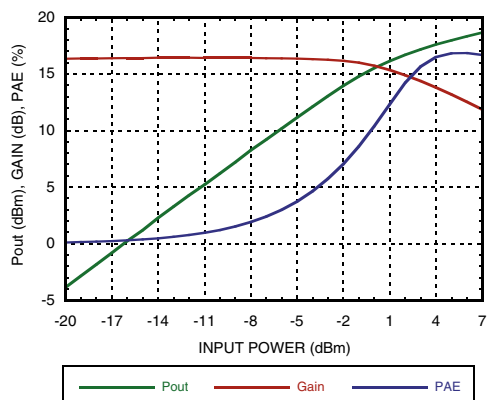
Phase Noise @ Pin=0 dBm



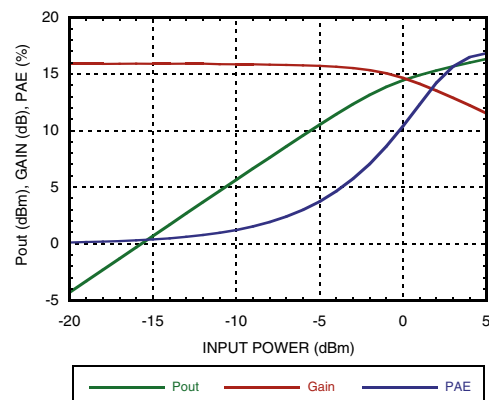
Power Compression @ 8 GHz



Power Compression @ 11 GHz



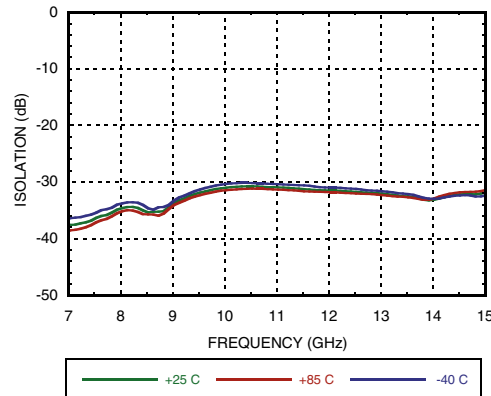
Power Compression @ 14 GHz





HBT GAIN BLOCK MMIC AMPLIFIER, 7 - 15 GHz

Reverse Isolation



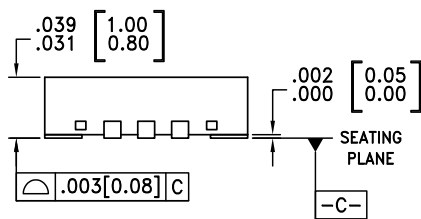
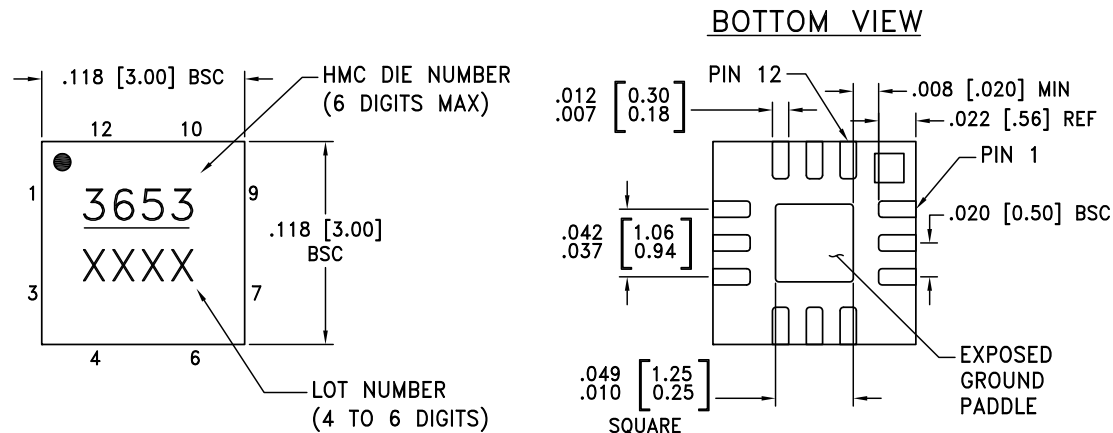
Absolute Maximum Ratings

| | |
|---|---------------|
| Drain Bias Voltage | 6 Vdc |
| RF Input Power (RFIN) | +12 dBm |
| Channel Temperature | 150 °C |
| Continuous Pdiss (T=85 °C) (derate 7.87 mW/ °C Above +85 °C) | 512 mW |
| Thermal Resistance (channel to ground paddle) | 127 °C/W |
| Storage Temperature | -65 to 150 °C |
| Operating Temperature | -40 to +85 °C |
| ESD Sensitivity (HBM) | Class 1A |



ELECTROSTATIC SENSITIVE DEVICE
OBSERVE HANDLING PRECAUTIONS

Outline Drawing



NOTES:

1. PACKAGE BODY MATERIAL: LOW STRESS INJECTION MOLDED PLASTIC SILICA AND SILICON IMPREGNATED.
2. LEAD AND GROUND PADDLE MATERIAL: COPPER ALLOY.
3. LEAD AND GROUND PADDLE PLATING: 100% MATTE TIN.
4. DIMENSIONS ARE IN INCHES [MILLIMETERS].
5. LEAD SPACING TOLERANCE IS NON-CUMULATIVE.
6. CHARACTERS TO BE HELVETICA MEDIUM, .018 HIGH, WHITE INK, OR LASER MARK LOCATED APPROX. AS SHOWN.
7. PAD BURR LENGTH SHALL BE 0.15mm MAX. PAD BURR HEIGHT SHALL BE 0.05mm MAX.
8. PACKAGE WARP SHALL NOT EXCEED 0.05mm
9. ALL GROUND LEADS AND GROUND PADDLE MUST BE SOLDERED TO PCB RF GROUND.
10. REFER TO HITTITE APPLICATION NOTE FOR SUGGESTED PCB LAND PATTERN.

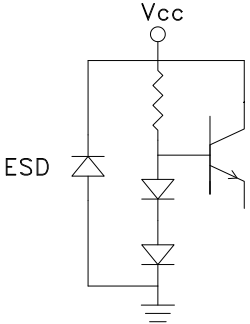
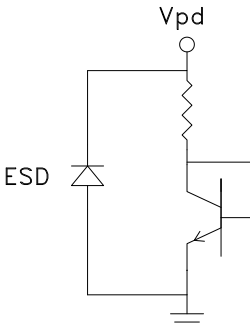
Package Information

| Part Number | Package Body Material | Lead Finish | MSL Rating ^[2] | Package Marking ^[1] |
|-------------|--|---------------|---------------------------|--------------------------------|
| HMC3653 | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 | H3653 XXXX |

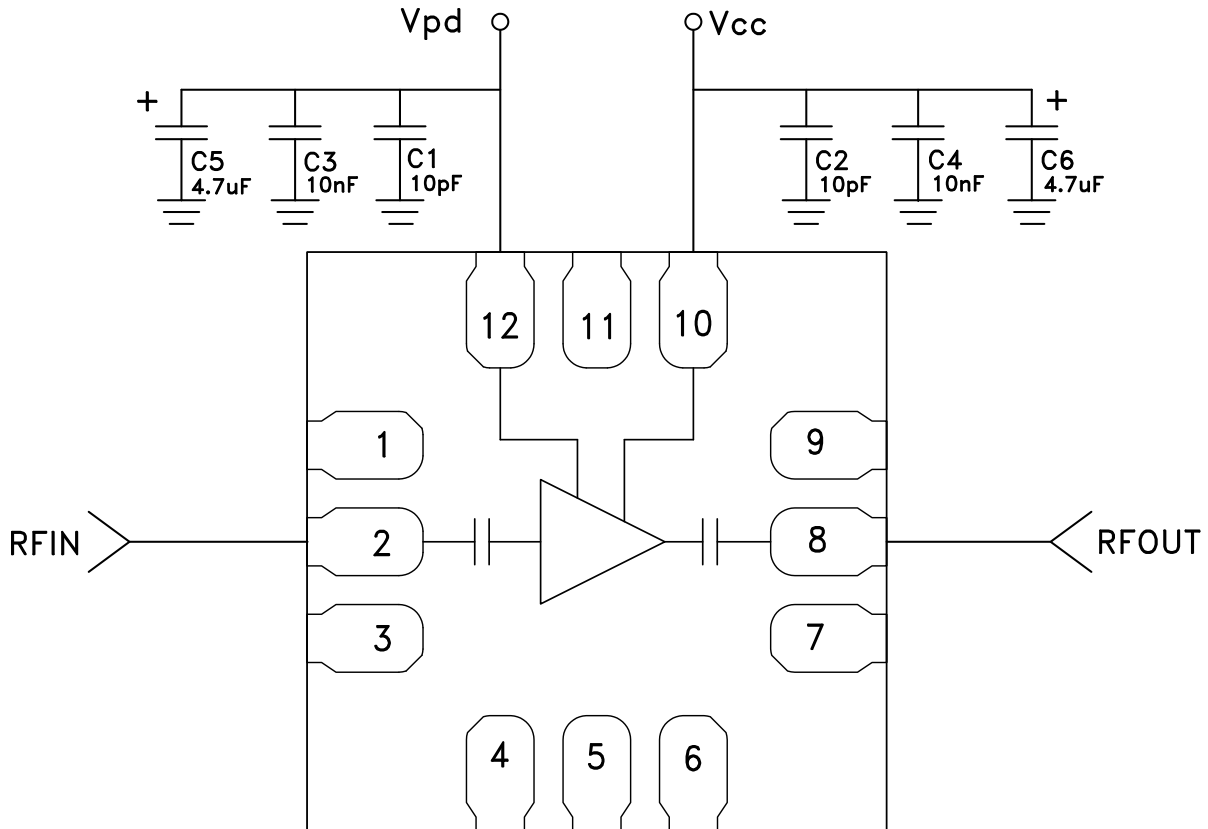
[1] 4-Digit lot number XXXX

[2] Max peak reflow temperature of 260 °C

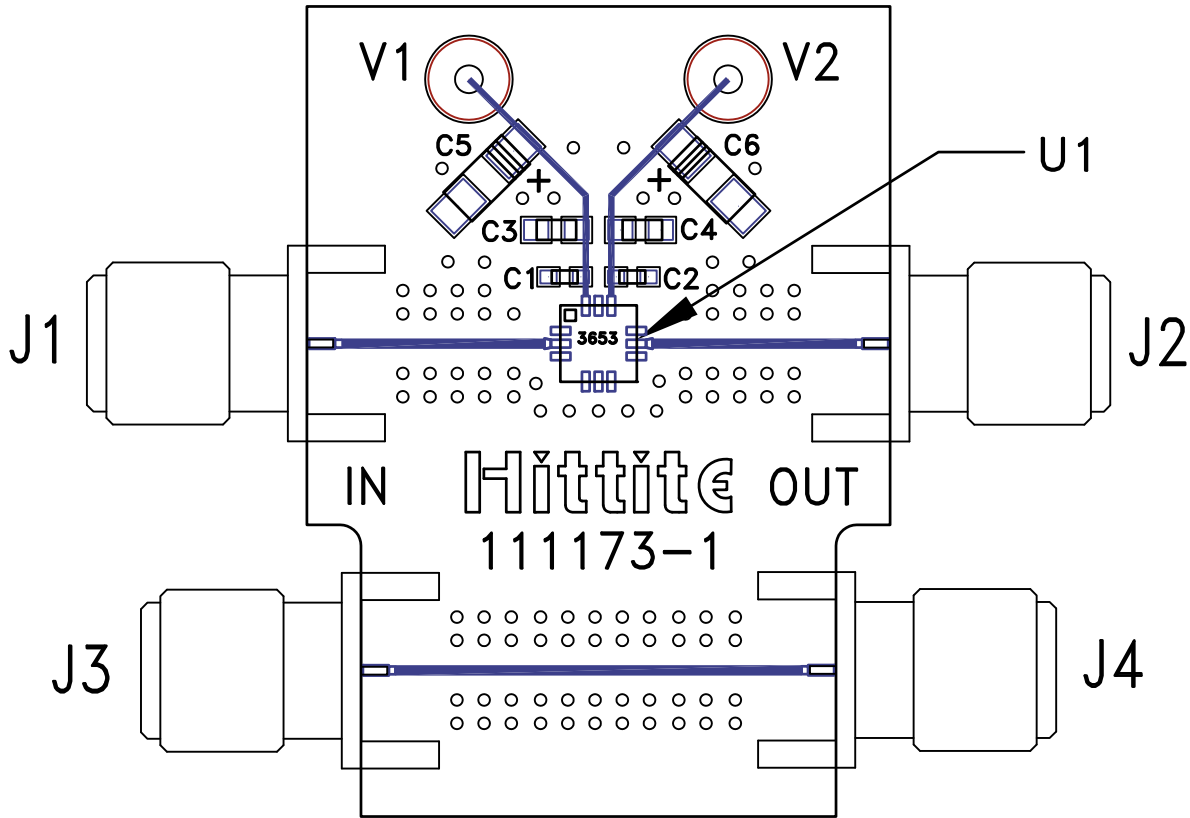
Pin Descriptions

| Pid Number | Function | Description | Interface Schematic |
|-------------------------|----------|---|---|
| 1, 3, 4, 5, 6, 7, 9, 11 | NC | No connection necessary. These pins may be connected to RF/DC ground. Performance will not be affected. | |
| 2 | RFIN | This pin is AC coupled and matched to 50 Ohms. | RFIN ○ — — |
| 8 | RFOUT | This pin is AC coupled and matched to 50 Ohms. | — — ○ RFOUT |
| 10 | Vcc | Power supply voltage for the amplifier |  |
| 12 | Vpd | Power Control Pin for proper control bias |  |
| GND Paddle | GND | Ground Paddle must be connected to RF/DC ground. | ○ GND |

Application Circuit



Evaluation PCB



List of Material for Evaluation PCB 113589-HMC3653LP3B-rev D ^[1]

| Item | Description |
|--------------------|-------------------------------|
| J1, J4 | PCB Mount SMA RF Connector |
| C1 - C2 | 10 pF Capacitor, 0402 Pkg. |
| C3 - C4 | 10000 pF Capacitor, 0603 Pkg. |
| C5 - C6 | 4.7 uF Capacitor, Tantalum. |
| U1 | HMC3653LP3BE |
| PCB ^[2] | 111173-1 Evaluation Board |

^[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 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.