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MICROWAVE CORPORATION v00.0409



# HMC754S8GE

## GaAs HBT HIGH LINEARITY PUSH-PULL AMPLIFIER, 75 Ohm, DC - 1 GHz

### Typical Applications

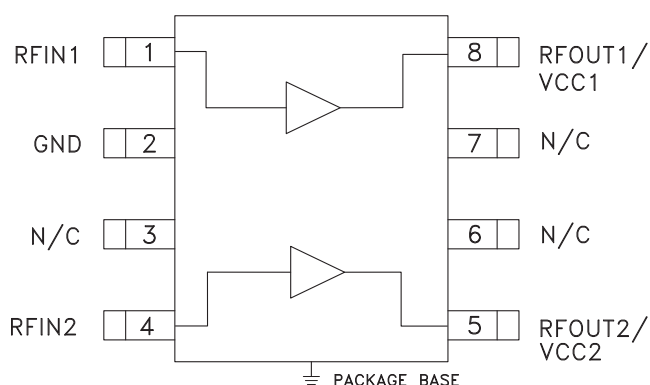
The HMC754S8GE is ideal for:

- CATV / Broadband Infrastructure
- Test & Measurement Equipment
- Line Amps and Fiber Nodes
- Customer Premise Equipment

### Features

Output IP2: +78 dBm  
High Gain: 14.5 dB  
High Output IP3: +38 dBm  
75 Ohm Impedance  
Single Positive Supply: +5V  
Robust 1000V ESD, Class 1C  
SOIC-8 SMT Package

### Functional Diagram



### General Description

The HMC754S8GE is a GaAs/InGaP HBT Dual Channel Gain Block MMIC SMT amplifier covering DC to 1 GHz. This versatile product contains two gain blocks, packaged in a single 8 lead plastic SOIC-8, for use with both amplifiers combined in push-pull configuration using external baluns to cancel out second order non-linearities and improve IP2 performance. In this configuration, the HMC754S8GE offers high gain, very low distortion & simple external matching. This high linearity amplifier consumes only 160mA from a single positive supply.

### Electrical Specifications, $T_A = +25^\circ\text{C}$ , $V_{cc1} = V_{cc2} = 5\text{V}$ , $Z_o = 75\text{ Ohm}$ [1]

| Parameter                                                                         |                 | Min. | Typ.  | Max. | Units  |
|-----------------------------------------------------------------------------------|-----------------|------|-------|------|--------|
| Gain                                                                              | 0.05 - 0.5 GHz  | 13.5 | 14.7  |      | dB     |
|                                                                                   | 0.5 - 0.87 GHz  | 12.7 | 14.2  |      | dB     |
|                                                                                   | 0.87 - 1.0 GHz  | 12.1 | 13.4  |      | dB     |
| Gain Variation Over Temperature                                                   | 0.05 - 0.87 GHz |      | 0.008 |      | dB/ °C |
| Input Return Loss                                                                 | 0.05 - 0.5 GHz  |      | 17    |      | dB     |
|                                                                                   | 0.5 - 0.87 GHz  |      | 10    |      | dB     |
| Output Return Loss                                                                | 0.05 - 0.5 GHz  |      | 10    |      | dB     |
|                                                                                   | 0.5 - 0.87 GHz  |      | 20    |      | dB     |
| Reverse Isolation                                                                 | 0.05 - 0.87 GHz |      | 23    |      | dB     |
| Output Power for 1 dB Compression (P1dB)                                          | 0.05 - 0.87 GHz | 19.5 | 21    |      | dBm    |
| Output Third Order Intercept Point (IP3)<br>(Pout= 0 dBm per tone, 1 MHz spacing) | 0.05 - 0.87 GHz |      | 38    |      | dBm    |
| Output Second Order Intercept Point (IP2)                                         | 0.05 - 0.5 GHz  |      | 78    |      | dBm    |
| Composite Second Order (CSO) <sup>[2]</sup>                                       | 0.05 - 0.87 GHz |      | -81   |      | dBc    |
| Composite Triple Beat (CTB) <sup>[2]</sup>                                        | 0.05 - 0.87 GHz |      | -75   |      | dBc    |
| Cross Modulation (XMOD) <sup>[2]</sup>                                            | 0.05 - 0.87 GHz |      | -67   |      | dBc    |
| Noise Figure                                                                      | 0.05 - 0.5 GHz  |      | 5.5   |      | dB     |
|                                                                                   | 0.05 - 0.87 GHz |      | 6.5   |      | dB     |
| Supply Current (Icc1 + Icc2)                                                      |                 | 145  | 160   | 175  | mA     |

[1] Data taken with dual amplifiers combined in push-pull (default) configuration

[2] Input level +15 dBmV, 133 channels - with analog modulation

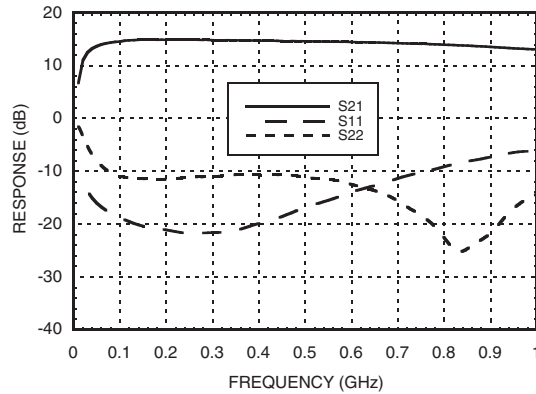
For price, delivery and to place orders: Hittite Microwave Corporation, 20 Alpha Road, Chelmsford, MA 01824

Phone: 978-250-3343 Fax: 978-250-3373 Order On-line at [www.hittite.com](http://www.hittite.com)

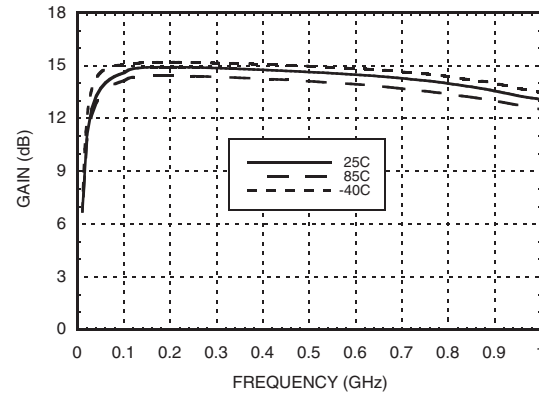
Application Support: Phone: 978-250-3343 or [apps@hittite.com](mailto:apps@hittite.com)

## GaAs HBT HIGH LINEARITY PUSH-PULL AMPLIFIER, 75 Ohm, DC - 1 GHz

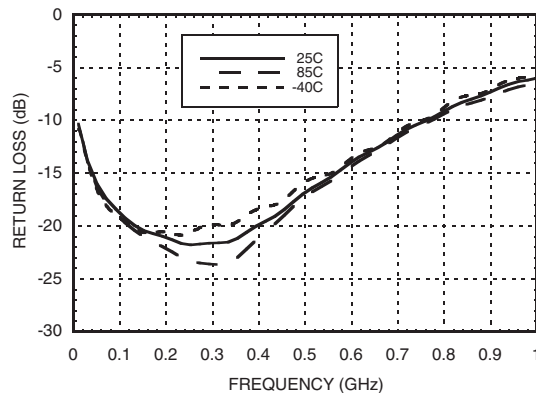
**Gain & Return Loss**



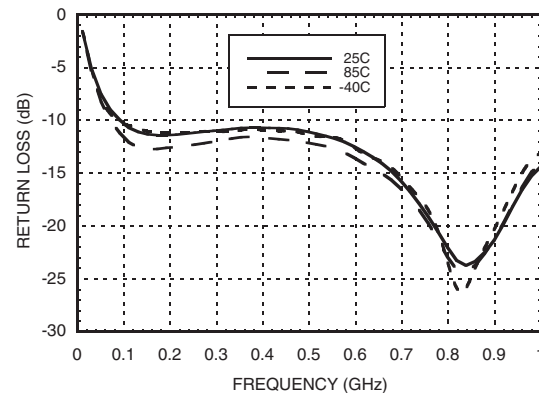
**Gain vs. Temperature**



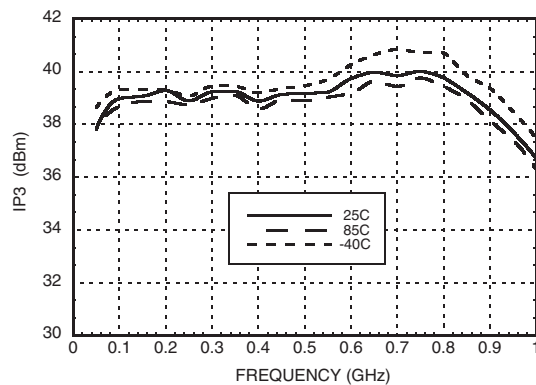
**Input Return Loss vs. Temperature**



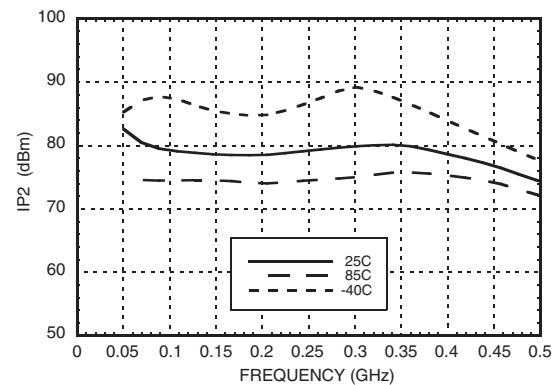
**Output Return Loss vs. Temperature**



**Output IP3 vs. Temperature**

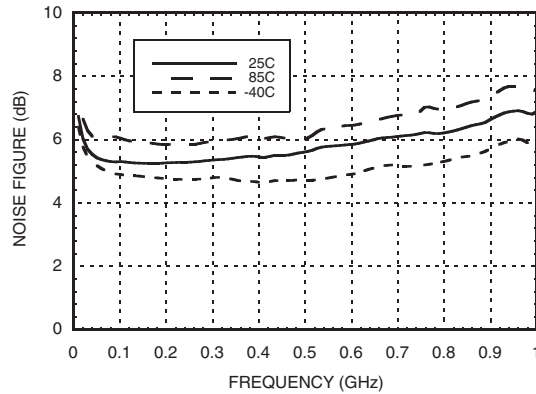


**Output IP2 vs. Temperature**

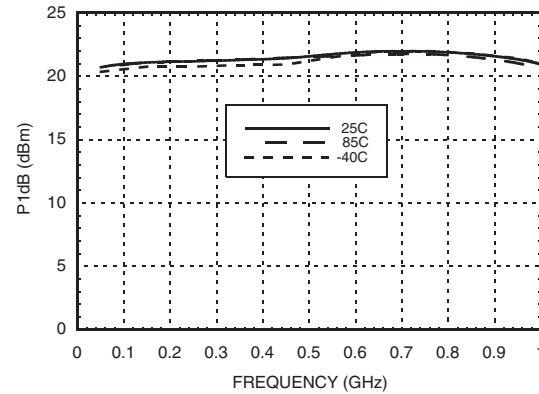


## GaAs HBT HIGH LINEARITY PUSH-PULL AMPLIFIER, 75 Ohm, DC - 1 GHz

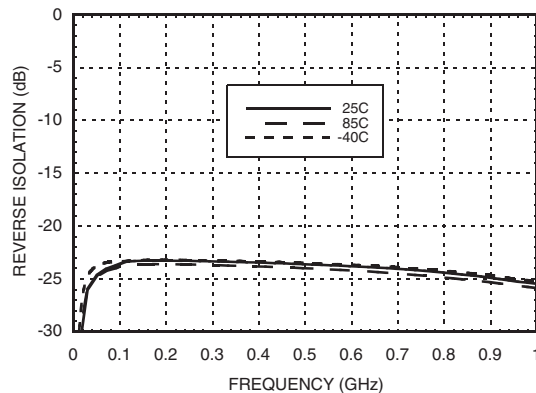
**Noise Figure vs. Temperature**



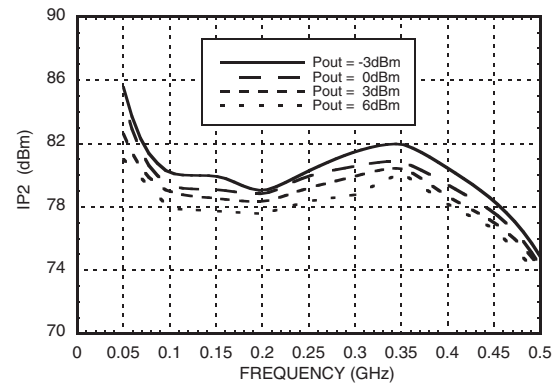
**P1dB vs. Temperature**



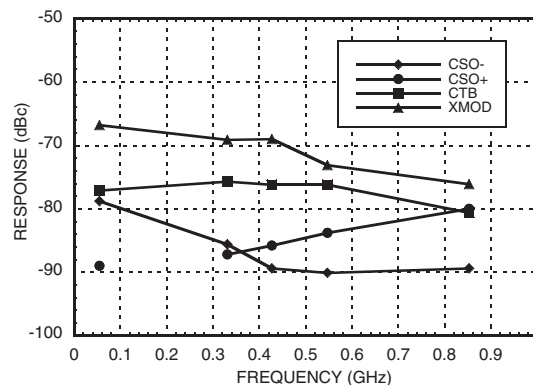
**Reverse Isolation vs. Temperature**



**Output IP2 vs. Output Power**



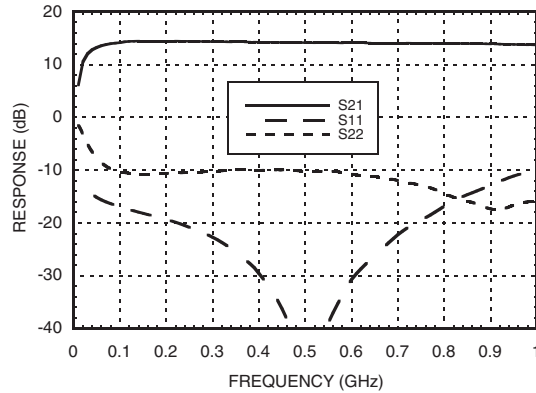
**CSO / CTB / XMOD  
@ +15 dBmV input, 133 channels (Analog)**



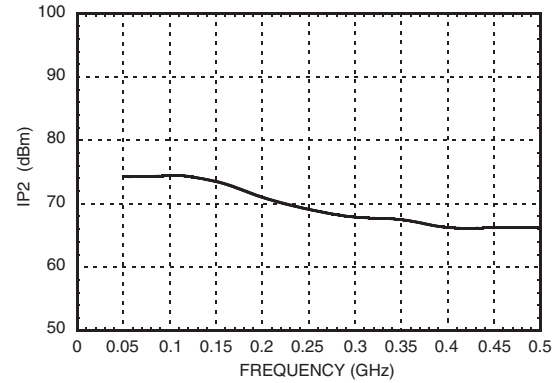
## GaAs HBT HIGH LINEARITY PUSH-PULL AMPLIFIER, 75 Ohm, DC - 1 GHz

### Option 1 - Improved Input Return Loss & Gain Flatness (with Lower IP2) Application

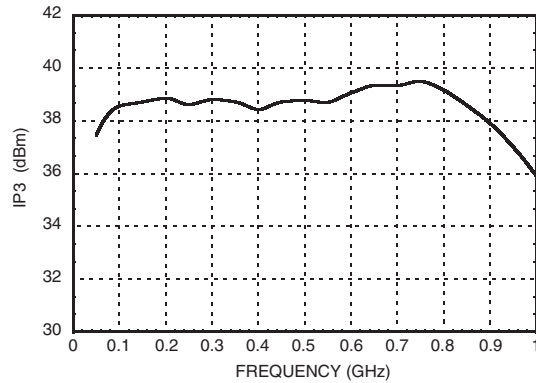
**Gain & Return Loss**



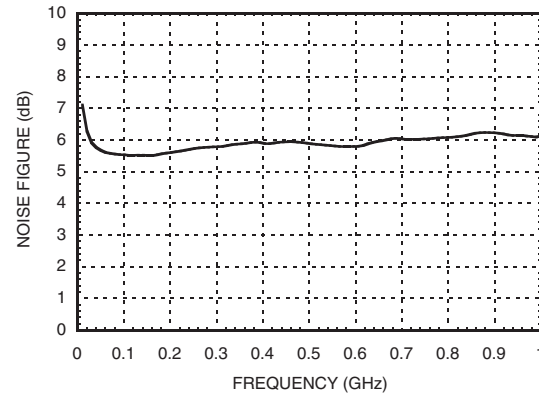
**Output IP2 vs. Frequency**



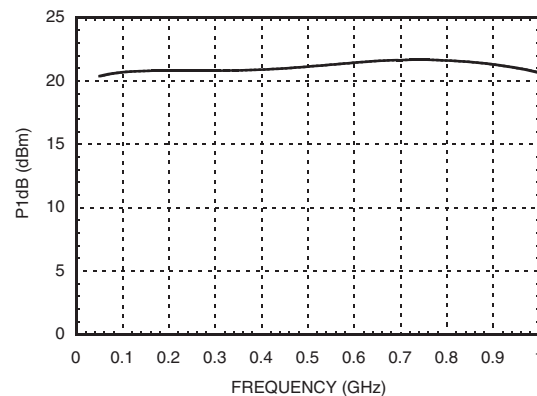
**Output IP3 vs. Frequency**



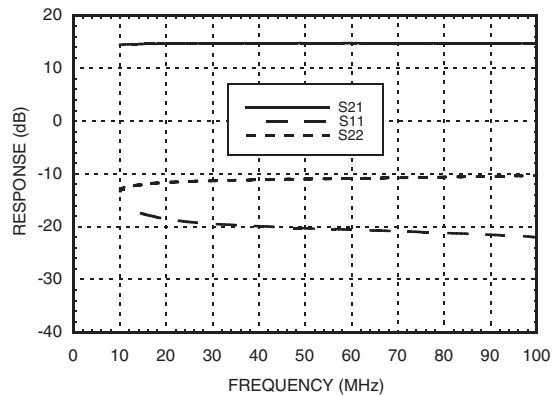
**Noise Figure vs. Frequency**



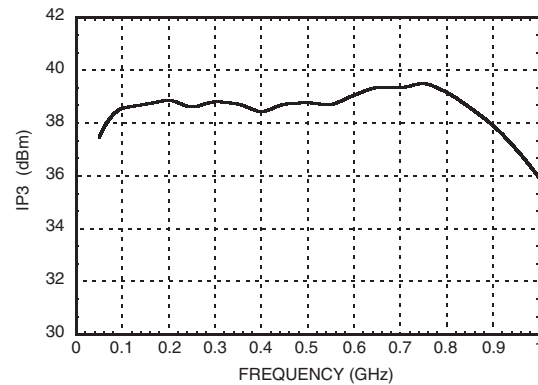
**P1dB vs. Frequency**



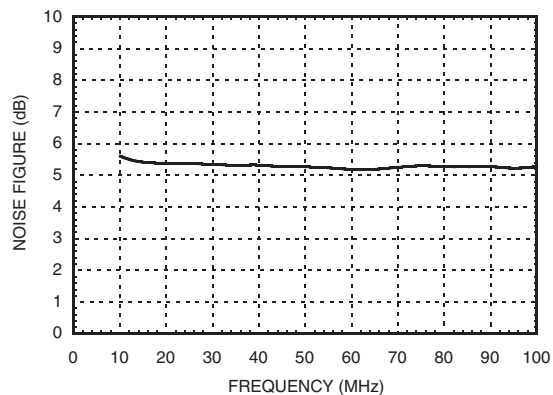
**Gain & Return Loss**



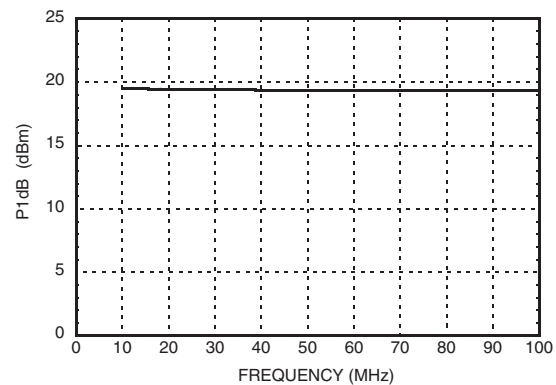
**Output IP3 vs. Frequency**



**Noise Figure vs. Frequency**



**P1dB vs. Frequency**



### Absolute Maximum Ratings

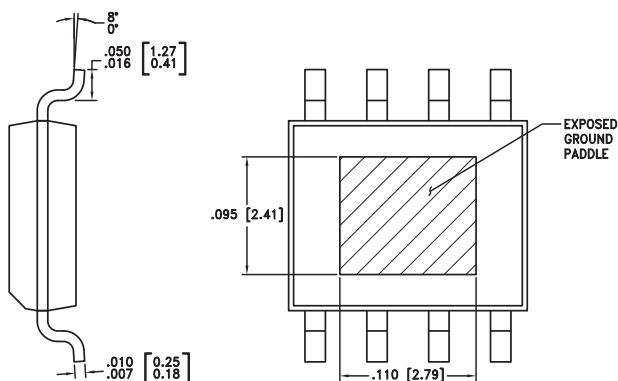
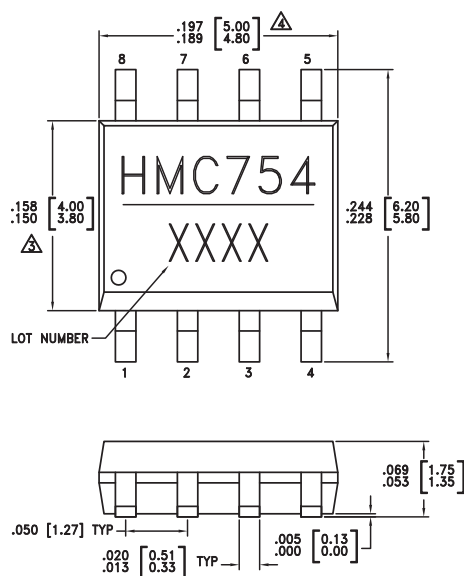
|                                                                              |                |
|------------------------------------------------------------------------------|----------------|
| Collector Bias Voltage (Vcc)                                                 | +5.5 Vdc       |
| RF Input Power (RFIN)                                                        | +10 dBm        |
| Junction Temperature                                                         | 150 °C         |
| Continuous P <sub>diss</sub> (T = 85 °C)<br>(derate 18.69 mW/°C above 85 °C) | 1.21 W         |
| Thermal Resistance<br>(junction to ground paddle)                            | 53.5 °C/W      |
| Storage Temperature                                                          | -65 to +150 °C |
| Operating Temperature                                                        | -40 to +85 °C  |
| ESD Sensitivity (HBM)                                                        | Class 1C       |



ELECTROSTATIC SENSITIVE DEVICE  
OBSERVE HANDLING PRECAUTIONS

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### 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> |
|-------------|----------------------------------------------------|---------------|---------------------|--------------------------------|
| HMC754S8GE  | RoHS-compliant Low Stress Injection Molded Plastic | 100% matte Sn | MSL1 <sup>[2]</sup> | HMC754<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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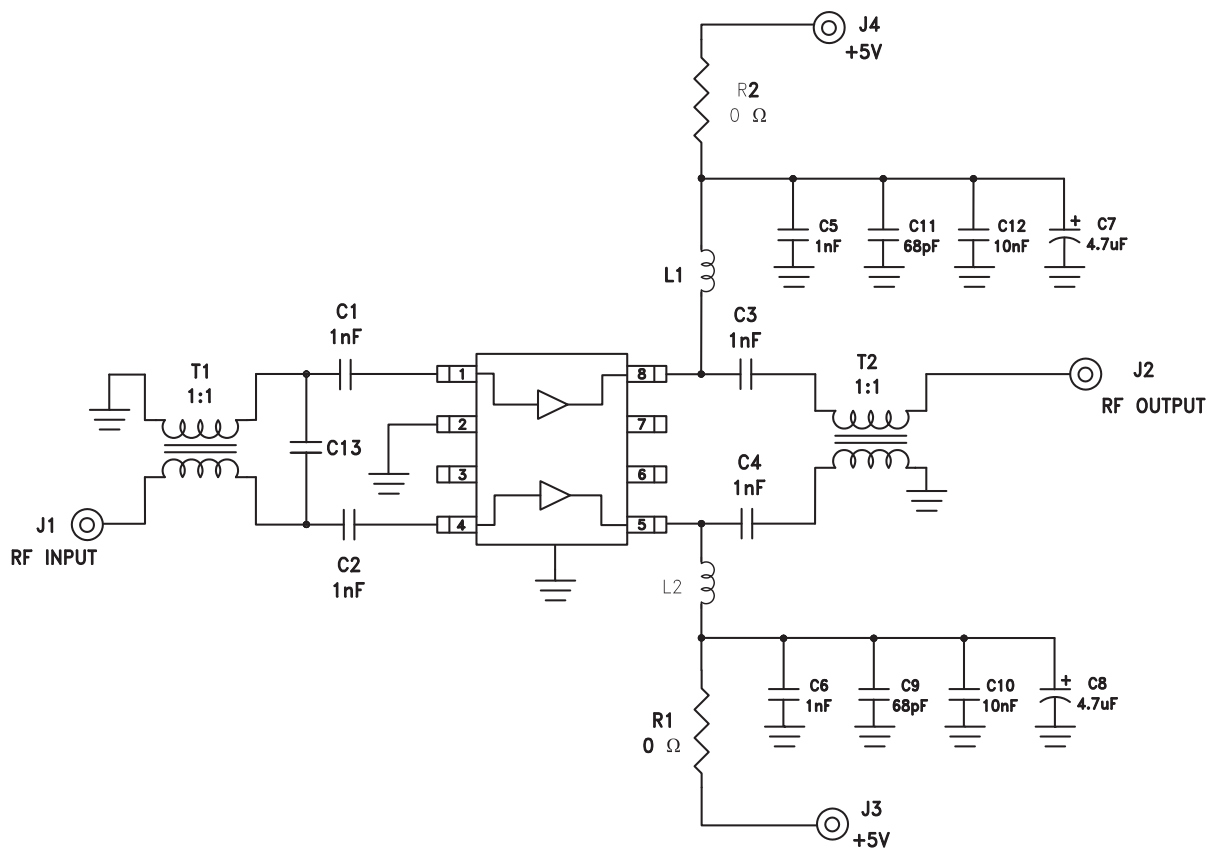
#### Pin Descriptions

| Pin Number | Function                    | Description                                                                                   | Interface Schematic |
|------------|-----------------------------|-----------------------------------------------------------------------------------------------|---------------------|
| 1, 4       | RFIN1, RFIN2                | These pins are DC coupled.<br>An off chip DC block capacitor is required.                     |                     |
| 5, 8       | RFOUT1/VCC1,<br>RFOUT2/VCC2 | RF Output and DC bias for the output stage.                                                   |                     |
| 2          | GND                         | These pins and package bottom must be connected to RF/<br>DC ground.                          |                     |
| 3, 6, 7    | N/C                         | No connection. These pins may be connected to RF ground.<br>Performance will not be affected. |                     |

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AMPLIFIERS - DRIVER & GAIN BLOCK - SMT

### Application Circuit for Push-Pull Operation



### Components for Selected Options

| Tune Options          | Standard   | Option 1   | Option 2    |
|-----------------------|------------|------------|-------------|
| Evaluation PCB Number | 124063     | 126311     | 124825      |
| T1 [1]                | ETC 1-1-13 | MABACT0039 | ETC1-1T-5TR |
| T2 [1]                | ETC 1-1-13 | ETC 1-1-13 | ETC1-1T-5TR |
| L1, L2                | 180 nH     | 180 nH     | 10 uH       |
| C13                   | Open       | 1.1 pF     | Open        |

[1] 1:1 Transformer



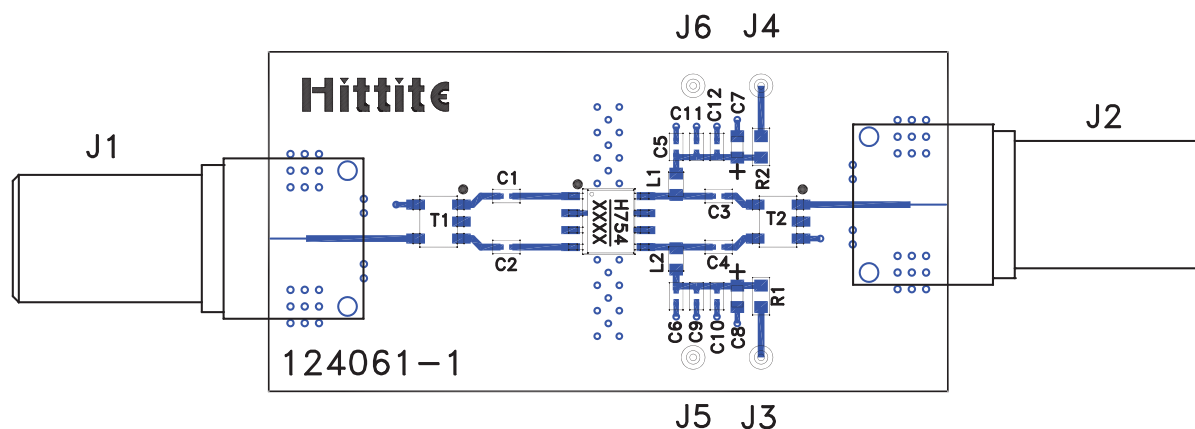
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# HMC754S8GE

**GaAs HBT HIGH LINEARITY  
PUSH-PULL AMPLIFIER, 75 Ohm, DC - 1 GHz**

## Evaluation PCB - Standard and Option 2 Application



## List of Materials for Evaluation PCB <sup>[1]</sup>

| Item                  | Description                                |
|-----------------------|--------------------------------------------|
| J1, J2                | F-Connector                                |
| J3 - J6               | DC PIN                                     |
| C1 - C6               | 1 nF Capacitor, 0402 Pkg.                  |
| C7, C8                | 4.7 $\mu$ F Capacitor, Tantalum, 0603 Pkg. |
| C9, C11               | 68 pF Capacitor, 0402 Pkg.                 |
| C10, C12              | 10 nF Capacitor, 0402 Pkg.                 |
| L1, L2 <sup>[2]</sup> | Inductor, 0603 Pkg.                        |
| R1, R2                | 0 Ohm Resistor, 0603 Pkg.                  |
| T1, T2 <sup>[2]</sup> | 1:1 Transformer                            |
| U1                    | HMC754S8GE Amplifier                       |
| PCB <sup>[3]</sup>    | 124061 Evaluation PCB                      |

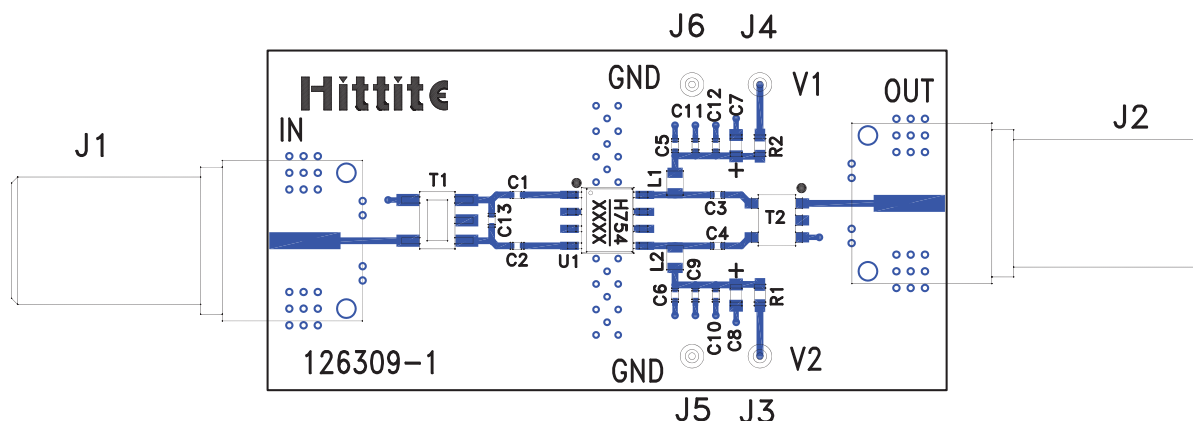
[1] When requesting an evaluation board, please reference the appropriate evaluation PCB number listed in the table "Components for Selected Options."

[2] Please refer to "Components for Selected Options" table for values

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

The circuit board used in the final application should use RF circuit design techniques. Signal lines should have 75 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 Hittite upon request.

### Evaluation PCB - Option 1 Application



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

| Item       | Description                                |
|------------|--------------------------------------------|
| J1, J2     | F-Connector                                |
| J3 - J6    | DC PIN                                     |
| C1 - C6    | 1 nF Capacitor, 0402 Pkg.                  |
| C7, C8     | 4.7 $\mu$ F Capacitor, Tantalum, 0603 Pkg. |
| C9, C11    | 68 pF Capacitor, 0402 Pkg.                 |
| C10, C12   | 10 nF Capacitor, 0402 Pkg.                 |
| C13        | 1.1 pF Capacitor, 0402 Pkg.                |
| L1, L2     | 180 nH Inductor, 0603 Pkg.                 |
| R1, R2     | 0 Ohm Resistor, 0603 Pkg.                  |
| T1, T2 [2] | 1:1 Transformer                            |
| U1         | HMC754S8GE Amplifier                       |
| PCB [3]    | 126309 Evaluation PCB                      |

[1] When requesting an evaluation board, please reference the appropriate evaluation PCB number listed in the table "Components for Selected Options."

[2] Please refer to "Components for Selected Options" table for values

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

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