



## Product Description

GRF3042 is a broadband low noise gain block designed for applications in the 0.05 to 13.0 GHz spectrum, exhibiting a typical low noise figure (NF) of 3.5 dB along with high gain.

This resistively biased device employs an external resistor in series with VDD to set a nominal IDDQ of 45 mA. GRF3042 is internally matched to 50Ω at the input and output ports.

The device can be operated down to low frequency via the selection of suitably large input/output caps and bias inductor.

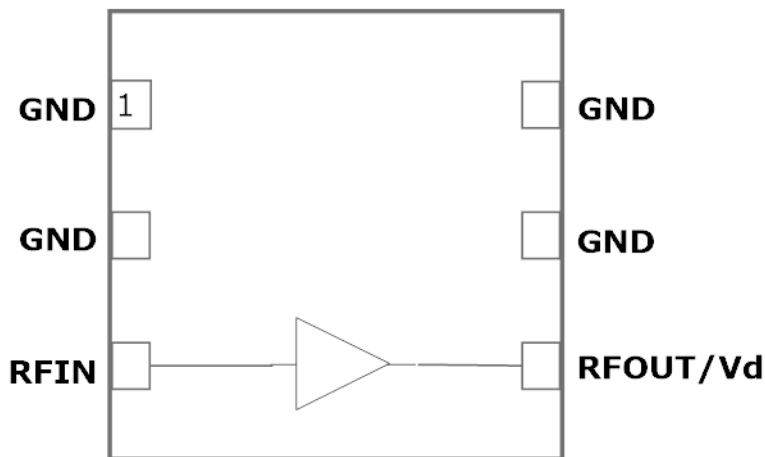
Consult with the GRF applications engineering team for custom tuning/evaluation board data and device s-parameters.

## Features

- Reference: 4.0 GHz; Iddq: 45 mA
- Gain: 14.3 dB
- OP1dB: 14.0 dBm
- OIP3: 26.0 dBm
- NF: 3.0 dB
- Internally Matched to 50 Ω
- Process: GaAs pHEMT

## Applications

- Microwave Backhaul
- C and X-Band Amplifiers
- General Purpose Amplifiers
- Instrumentation



1.5 x 1.5 mm DFN-6

## Absolute Ratings:

| Parameter   | Symbol                | Min. | Max. | Unit |
|---|-----------------------|------|------|------|
| Drain Voltage   | V <sub>D</sub>        | 0    | 6.0  | V    |
| RF Input Power: (Load VSWR < 2:1; V <sub>D</sub> : 5.0 volts) | P <sub>IN MAX</sub>   |      | 17   | dBm  |
| Operating Temperature (Package Heat Sink)                     | T <sub>AMB</sub>      | -40  | 105  | °C   |
| Maximum Channel Temperature (MTTF > 10 <sup>6</sup> Hours)    | T <sub>MAX</sub>      |      | 170  | °C   |
| Maximum Dissipated Power                                      | P <sub>DISS MAX</sub> |      | 350  | mW   |
| <b>Electrostatic Discharge:</b>                               |                       |      |      |      |
| Charged Device Model:   | CDM                   | 1500 |      | V    |
| Human Body Model:   | HBM                   | 250  |      | V    |
| <b>Storage:</b>   |                       |      |      |      |
| Storage Temperature   | T <sub>STG</sub>      | -65  | 150  | °C   |
| Moisture Sensitivity Level                                    | MSL                   |      | 1    | --   |



**Caution!** ESD Sensitive Device

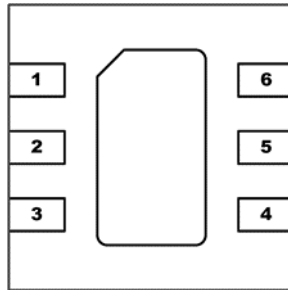


Exceeding Absolute Maximum Rating conditions may cause permanent damage to the device.

**Note:** For package dimensions and manufacturing information, see the [Guerrilla-RF.com](http://Guerrilla-RF.com) website for the following document located on the GRF3042 landing page: Manufacturing Note—MN-001 Product Tape and Reel, Solderability and Package Outline Specification.

[Link to manufacturing note](#)

### Pin Out (Top View)



### Pin Assignments:

| Pin      | Name                   | Description          | Note  |
|----------|------------------------|----------------------|---|
| 1        | NC                     | No Connect or Ground | No internal connection to die   |
| 2        | NC                     | No Connect or Ground | No internal connection to die   |
| 3        | RF_In                  | LNA RF input         | Internally matched 50Ω. An external DC blocking cap must be used.   |
| 4        | RF_Out/V <sub>DD</sub> | LNA RF output        | Internally matched 50Ω. V <sub>DD</sub> must be applied through a choke to this pin   |
| 5        | NC                     | No Connect or Ground | No internal connection to die   |
| 6        | NC                     | No Connect or Ground | No internal connection to die   |
| PKG BASE | GND                    | Ground               | Provides DC and RF ground for LNA, as well as thermal heat sink. Recommend multiple 8 mil vias beneath the package for optimal RF and thermal performance. Refer to evaluation board top layer graphic on schematic page. |



Preliminary

# GRF3042

Broadband Gain Block  
10 MHz to 13.0 GHz

## Nominal Operating Parameters:

| Parameter   | Symbol               | Specification |      |      | Unit | Condition   |
|---|----------------------|---------------|------|------|------|---|
|   |                      | Min.          | Typ. | Max. |      |   |
| <b>Gain Mode (Venable high)</b>                           |                      |               |      |      |      | I <sub>DDQ</sub> = 45 mA, T <sub>A</sub> = 25 °C                                    |
| Test Frequency  | F <sub>TEST</sub>    |               | 4.0  |      | GHz  |   |
| Gain  | S <sub>21</sub>      | 13.3          | 14.3 |      | dB   |   |
| Noise Figure  | NF                   |               | 3.0  |      | dB   | Input trace losses de-embedded  |
| Output 3rd Order Intercept                                | OIP <sub>3</sub>     |               | 26.0 |      | dBm  | 0 dBm P <sub>OUT</sub> per tone at 2 MHz Spacing (3999 and 4001 MHz)                |
| Output 1dB Compression Power                              | OP1dB                | 13.0          | 14.0 |      | dBm  |   |
| Switching Rise Time                                       | T <sub>RISE</sub>    |               | 500  |      | ns   |   |
| Switching Fall Time                                       | T <sub>FALL</sub>    |               | 500  |      | ns   |   |
| Supply Current  | I <sub>DDQ</sub>     | 40            | 45   | 50   | mA   | Ref: V <sub>DD</sub> : 7.0 V; R <sub>BIAS</sub> : 22 Ohm                            |
| <b>Thermal Data</b>                                       |                      |               |      |      |      |   |
| Thermal Resistance (measured via IR scan)                 | Θ <sub>JC</sub>      |               | 218  |      | °C/W | On standard evaluation board  |
| Channel Temperature @ +85 C Reference (Package Heat Sink) | T <sub>CHANNEL</sub> |               | 149  |      | °C   | V <sub>D</sub> : 5.9 V; I <sub>DDQ</sub> : 50 mA; No RF; P <sub>DISS</sub> : 295 mW |

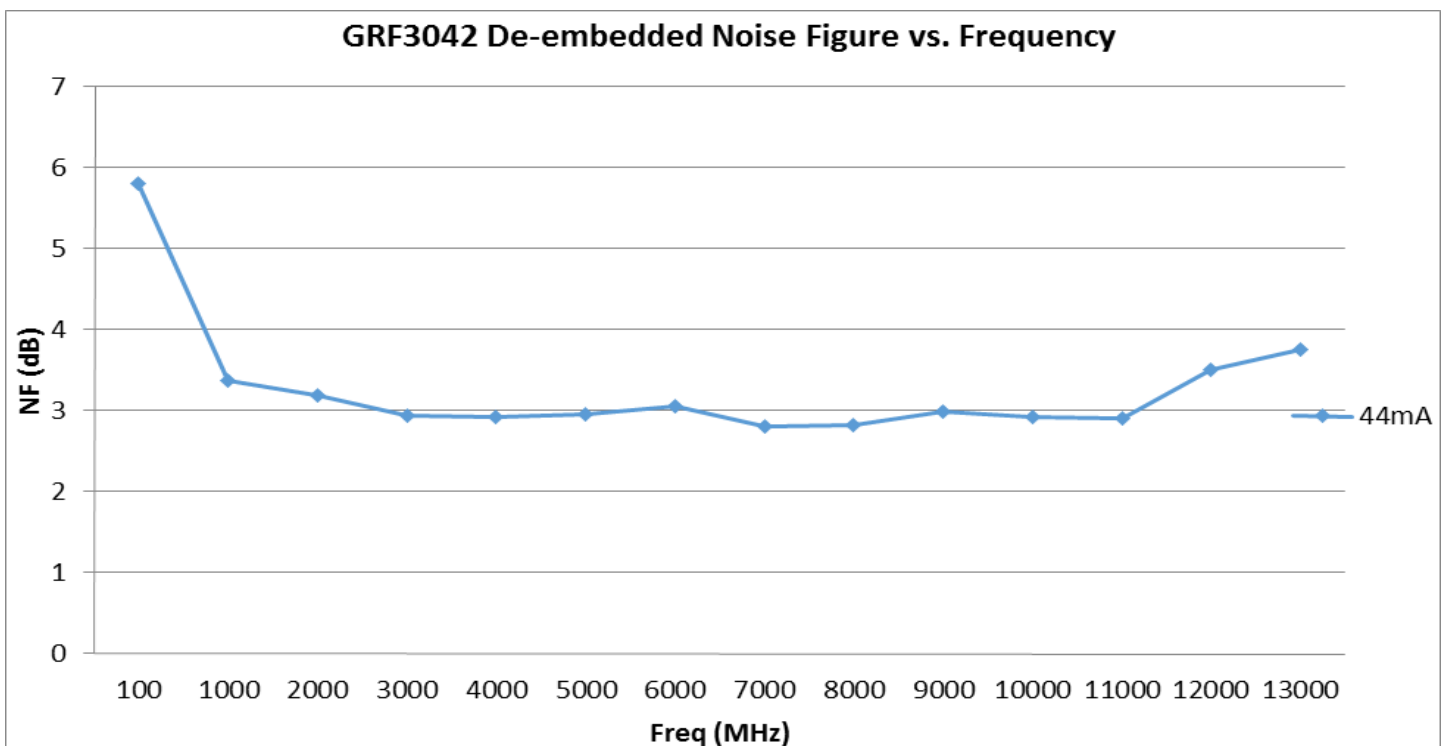
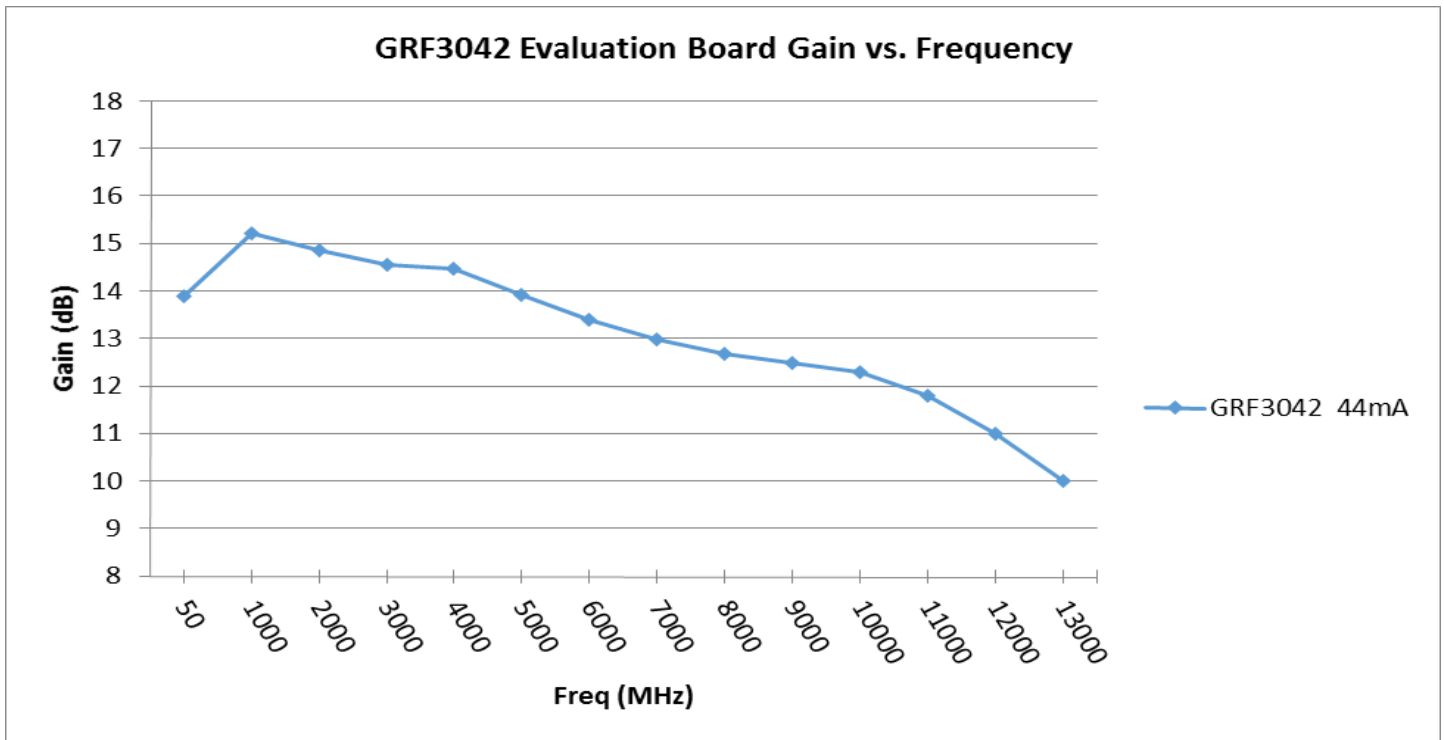


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## GRF3042 Evaluation Board Measured Data:



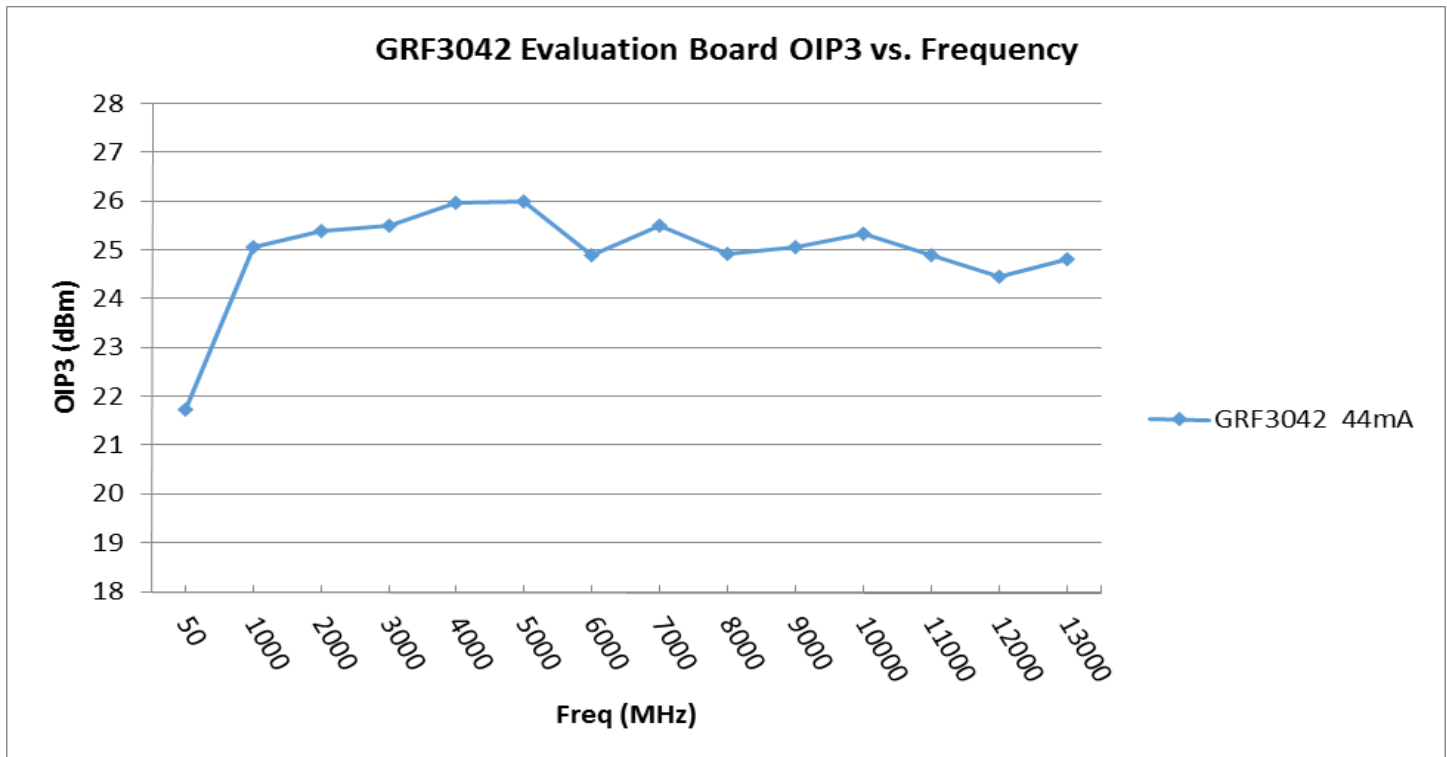
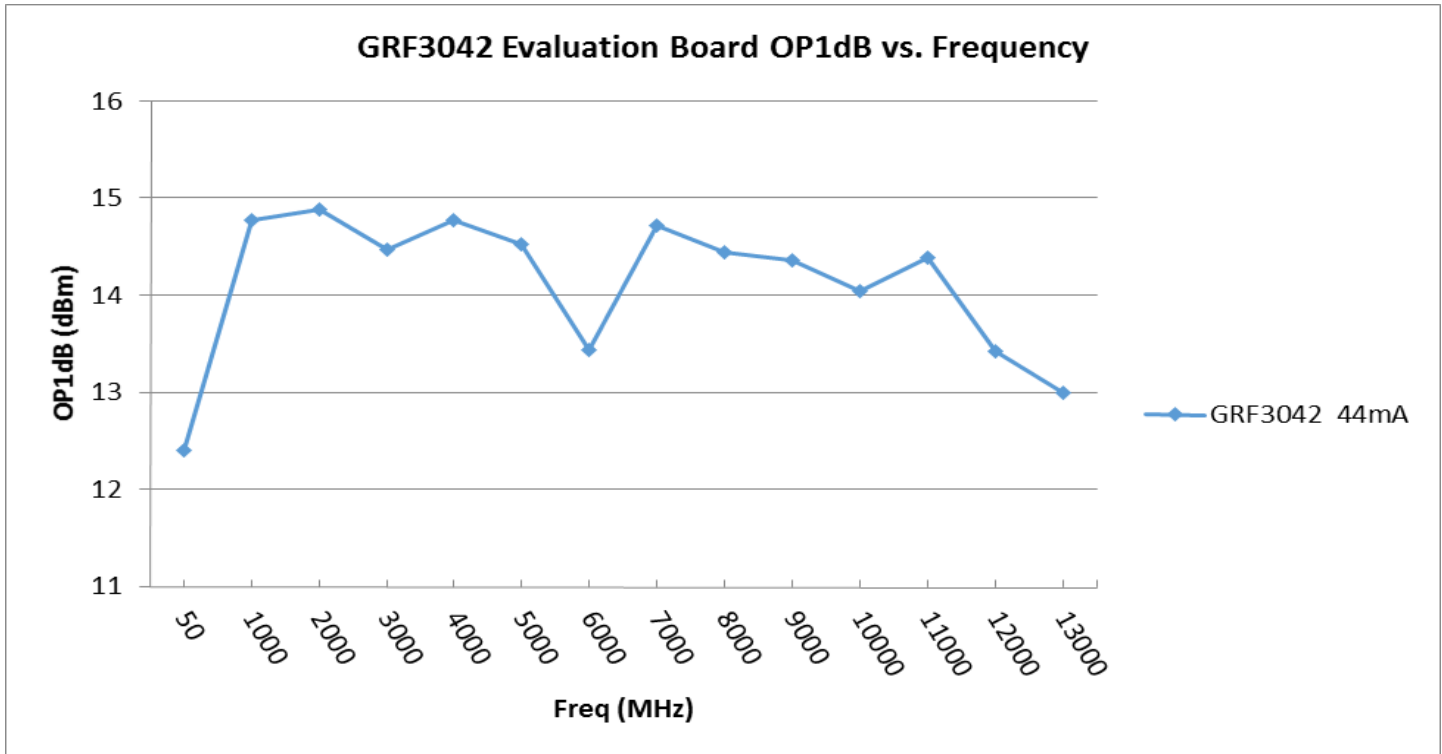


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Broadband Gain Block  
10 MHz to 13.0 GHz

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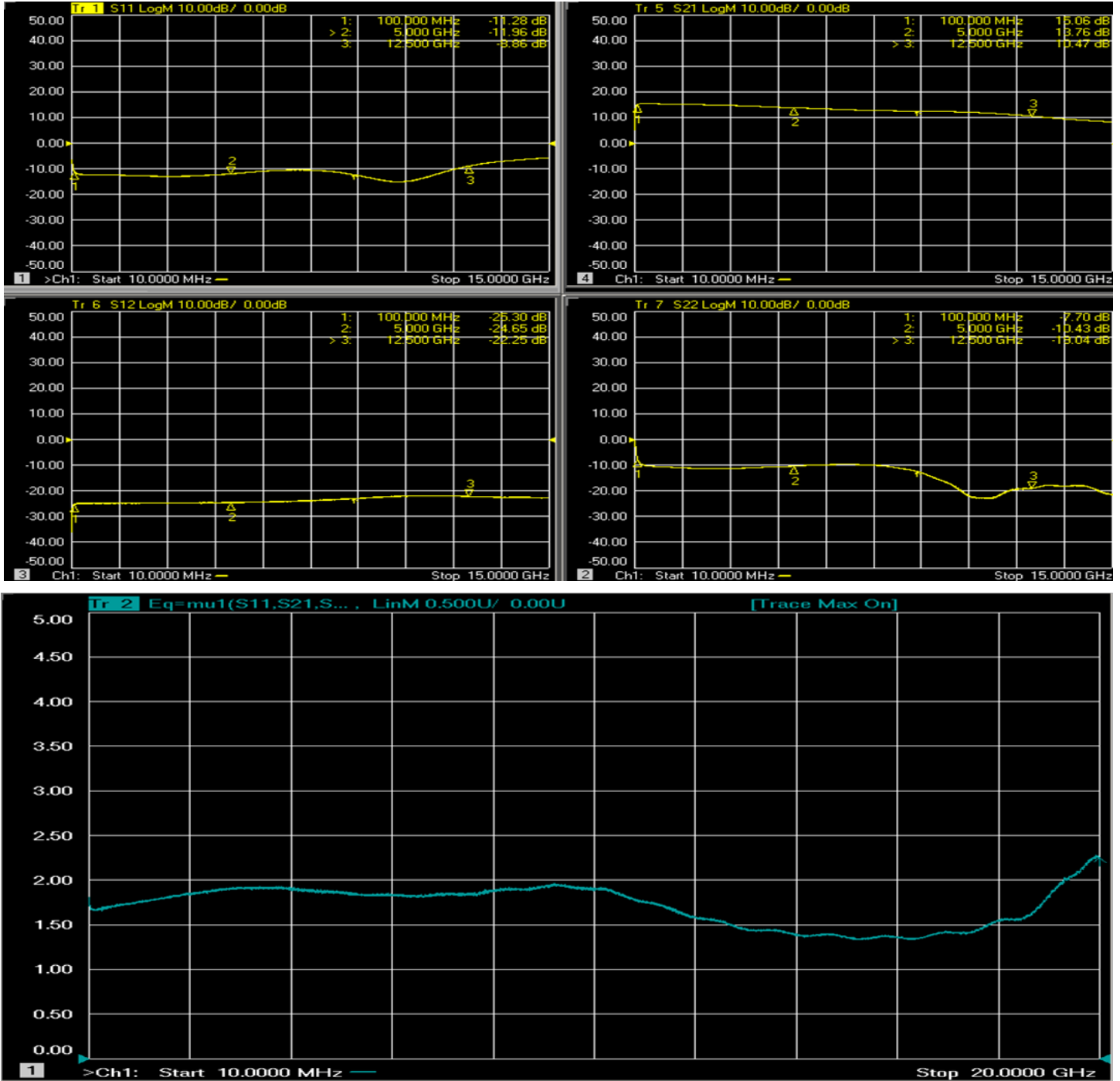


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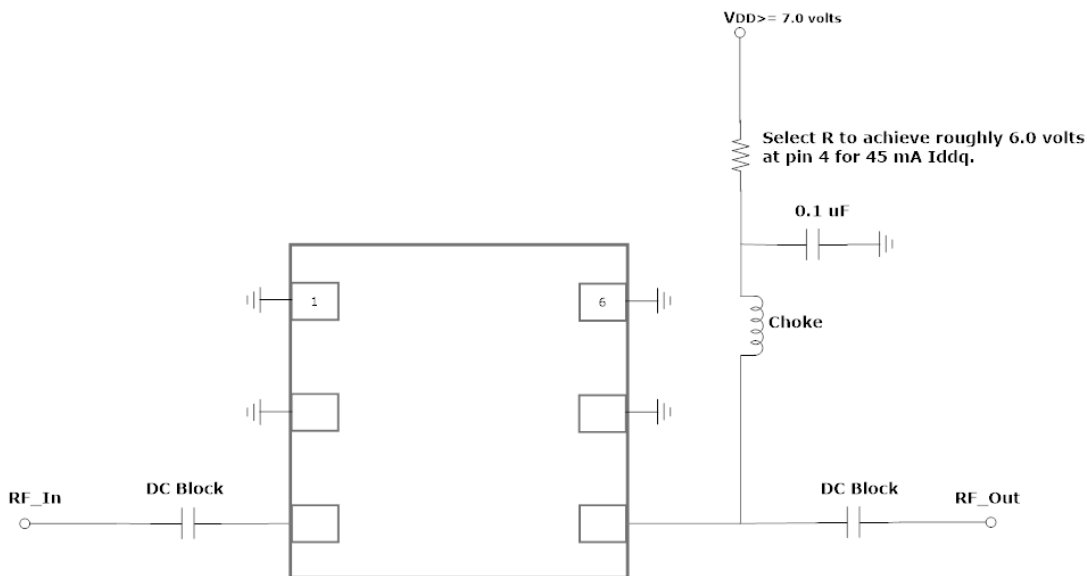
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Broadband Gain Block  
10 MHz to 13.0 GHz

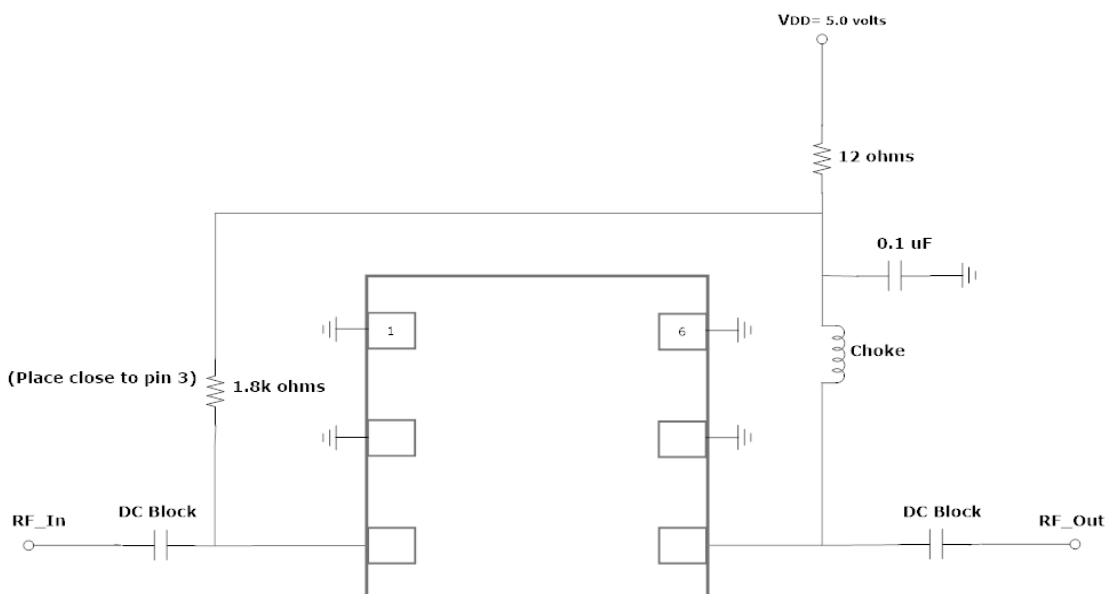
## GRF3042 Evaluation Board S-Pars and Stability Mu Factor:



Note: Mu factor  $\geq 1.0$  implies unconditional stability.



GRF3042 Standard Application Schematic



GRF3042 5-Volt Application Schematic





*Preliminary*

# GRF3042

## Broadband Gain Block 10 MHz to 13.0 GHz

### **GRF3042 Theory of Operation:**

The GRF3042 is a broadband gain block amplifier that is suitable for a wide range of applications. The device is internally matched to 50 ohms and covers 0.05 to 13.0 GHz requiring only a broadband choke to supply the device drain voltage ( $V_D$ ) and current ( $I_{DD}$ ) at pin 4.

This amplifier uses a resistive bias scheme requiring an external resistor in series with the supply voltage ( $V_{DD}$ ). The device quiescent bias current ( $I_{DDQ}$ ) is proportional to the  $V_D$ . The target  $I_{DDQ}$  is 45 mA and this requires a  $V_D$  of 6.0 volts. In order to have sufficient resistive feedback in the bias circuit, the minimum recommended  $V_{DD}$  is 7.0 volts. A 22 Ohm net resistance (Resistor plus bias choke DC resistance) in series with 7.0 volts  $V_{DD}$  will deliver the required 6.0 Volt drain voltage to the output pin of the device. Larger values of  $V_{DD}$  would simply require a larger bias resistor to achieve the desired 45 mA and 6.0 volts on pin 4.

Operating the device with a 6.0 Volt supply and no series resistor is not recommended as this condition would provide no bias current stability over normal process and temperature variations.

**5-Volt Operation:** The device can be operated with  $V_{DD}$  as low as 5 volts and the required 5-Volt application schematic is shown immediately below the standard schematic.

**BOM:** DC blocking caps must be used on both RF\_In and RF\_Out. These caps also need to be essentially an RF short over the band of interest. The bias inductor should be an RF choke over the target frequency range. For general purpose, extreme broadband performance, a large value conical inductor such as the Piconics: 220 nH (CC19T40K240G5-C) makes a good choice for the bias inductor.

**Note:** The performance plots shown in this document were taken on the VNA using the instrument bias T to provide the bias voltage/current to pin 6.



Preliminary

# GRF3042

**Broadband Gain Block**  
**10 MHz to 13.0 GHz**

| Data Sheet Release Status: | Notes   |
|----------------------------|---|
| Advance                    | S-parameter and NF data based on EM simulations for the fully packaged device using foundry supplied transistor s-parameters. Linearity estimates based on device size, bias condition and experience with related devices. |
| Preliminary                | All data based on evaluation board measurements in the Guerrilla RF Applications Lab.   |
| Released                   | All data based on device qualification data. Typically, this data is nearly identical to the data found in the preliminary version. Max and min values for key RF parameters are included.                                  |

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