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# RFMD

# RF2337

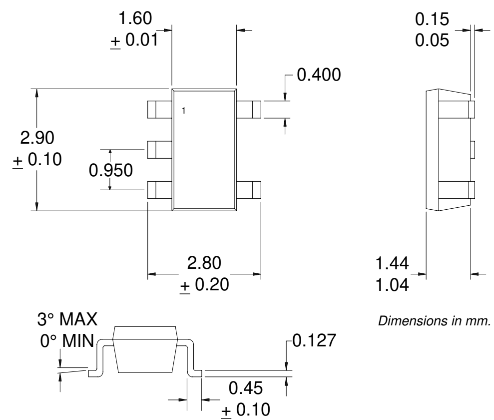
## GENERAL PURPOSE AMPLIFIER

### Typical Applications

- Broadband, Low Noise Gain Blocks
- IF or RF Buffer Amplifiers
- Driver Stage for Power Amplifiers
- Final PA for Low Power Applications
- Broadband Test Equipment

### Product Description

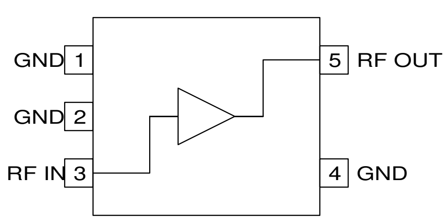
The RF2337 is a general purpose, low-cost RF amplifier IC. The device is manufactured on an advanced Gallium Arsenide Heterojunction Bipolar Transistor (HBT) process, and has been designed for use as an easily-cascadable 50Ω gain block. Applications include IF and RF amplification in wireless voice and data communication products operating in frequency bands up to 6000MHz. The device is self-contained with 50Ω input and output impedances and requires only two external DC biasing elements to operate as specified. The RF2337 is available in a very small industry-standard SOT23-5 surface mount package, enabling compact designs which conserve board space.




**Package Style: SOT23-5**

### Optimum Technology Matching® Applied

| | | |
|---|---|---|
| ☐ Si BJT | ☑ GaAs HBT | ☐ GaAs MESFET |
| ☐ Si Bi-CMOS | ☐ SiGe HBT | ☐ Si CMOS |
| ☐ InGaP/HBT | ☐ GaN HEMT | ☐ SiGe Bi-CMOS |




**Functional Block Diagram**

### Features

- DC to 6000MHz Operation
- Internally matched Input and Output
- 15dB Small Signal Gain
- +25dBm Output IP3
- +12dBm Output Power
- Single Positive Power Supply

### Ordering Information

| | |
|---|---|
| RF2337 | General Purpose Amplifier |
| RF2337 PCBA | Fully Assembled Evaluation Board |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Greensboro, NC 27409, USA

Tel (336) 664 1233
Fax (336) 664 0454
http://www.rfmd.com

## Absolute Maximum Ratings

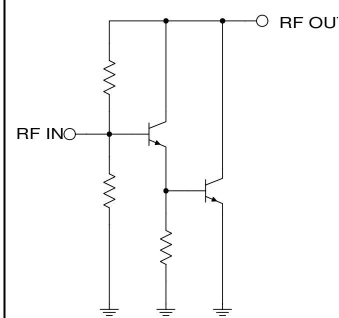
| Parameter | Rating | Unit |
|---|---|---|
| Input RF Power | +15 | dBm |
| Operating Ambient Temperature | -40 to +85 | °C |
| Storage Temperature | -60 to +150 | °C |

**Caution!** ESD sensitive device.



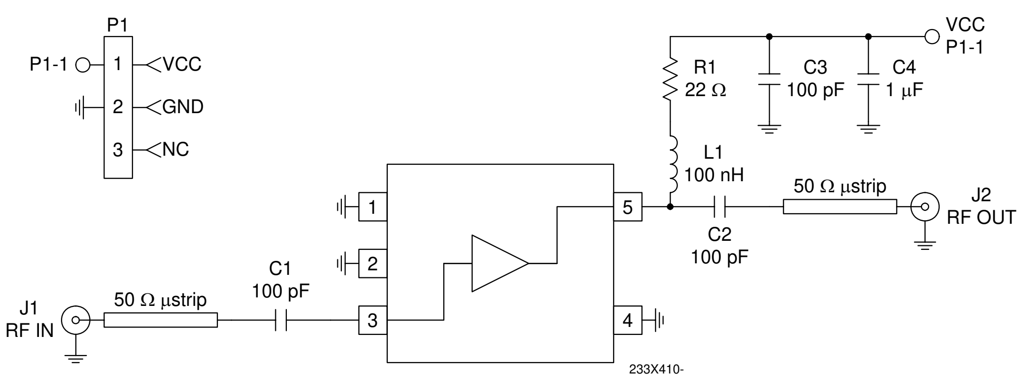
| Parameter | Specification | | | Unit | Condition |
|---|---|---|---|---|---|
| | Min. | Typ. | Max. | | |
| ***Overall*** | | | | | T=25°C, $I_{CC}$=40mA |
| Frequency Range | | DC to 6000 | | MHz | |
| 3dB Bandwidth | | 2 | | GHz | |
| Gain | | 16 | | dB | Freq=100MHz |
| | | 15.4 | | dB | Freq=1000MHz |
| | | 14.4 | | dB | Freq=2000MHz |
| | | 12.5 | | dB | Freq=3000MHz |
| | | 11.5 | | | Freq=4000MHz |
| | | 10.6 | | | Freq=5000MHz |
| | | 10 | | | Freq=6000MHz |
| Noise Figure | | 4.5 | | dB | Freq=2000MHz |
| Input VSWR | | 2.0:1 | | | In a 50Ω system, DC to 3000MHz |
| Output VSWR | | 2.0:1 | | | In a 50Ω system, DC to 3000MHz |
| Output $IP_3$ | | +25 | | dBm | Freq=1000MHz±50kHz, $P_{TONE}$=-10dBm |
| Output $P_{1dB}$ | | +11.8 | | dBm | Freq=2000MHz |
| Reverse Isolation | | 17.5 | | dB | Freq=2000MHz |
| ***Thermal*** | | | | | $I_{CC}$=40mA, $P_{DISS}$=134mW (See Note.) |
| $Theta_{JC}$ | | 338 | | °C/W | |
| Maximum Measured Junction Temperature | | 130 | | °C | $T_{AMB}$=+85°C, $V_{PIN}$=3.34V |
| Mean Time Between Failures | | 20,000 | | years | See Note. |
| ***Power Supply*** | | | | | With 22Ω bias resistor |
| Device Operating Voltage | | 3.5 | | V | At pin 5 with $I_{CC}$=40mA |
| Supply Voltage | | 4.4 | | V | At evaluation board connector, $I_{CC}$=40mA |
| Operating Current | | 40 | 51 | mA | See note. |

Note: Because of process variations from part to part, the current resulting from a fixed bias voltage will vary. As a result, caution should be used in designing fixed voltage bias circuits to ensure the worst case bias current does not exceed 51mA over all intended operating conditions.

| Pin | Function | Description | Interface Schematic |
|---|---|---|---|
| 1 | GND | Ground connection. For best performance, keep traces physically short and connect immediately to ground plane. | |
| 2 | GND | Same as pin 1. | |
| 3 | RF IN | RF input pin. This pin is NOT internally DC-blocked. A DC-blocking capacitor, suitable for the frequency of operation, should be used in most applications. DC coupling of the input is not allowed, because this will override the internal feedback loop and cause temperature instability. | |
| 4 | GND | Same as pin 1. | |
| 5 | RF OUT | RF output and bias pin. Biasing is accomplished with an external series resistor and choke inductor to $V_{CC}$. The resistor is selected to set the DC current into this pin to a desired level. The resistor value is determined by the following equation:<br>$R = \frac{(V_{SUPPLY} - V_{DEVICE})}{I_{CC}}$<br>Care should also be taken in the resistor selection to ***ensure that the current into the part never exceeds 51mA over the planned operating temperature***. This means that a resistor between the supply and this pin is always required, even if a supply near 3.6V is available, to provide DC feedback to prevent thermal runaway. Because DC is present on this pin, a DC blocking capacitor, suitable for the frequency of operation, should be used in most applications. The supply side of the bias network should also be well bypassed. |   |

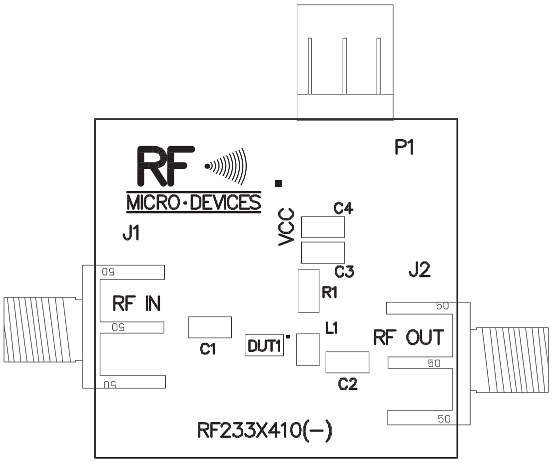
## Evaluation Board Schematic

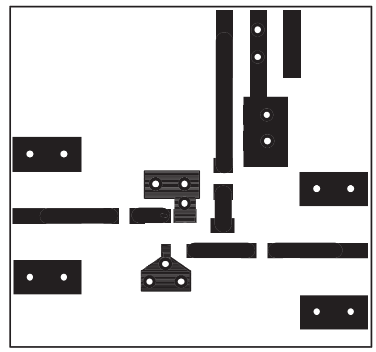
(Download Bill of Materials from www.rfmd.com.)



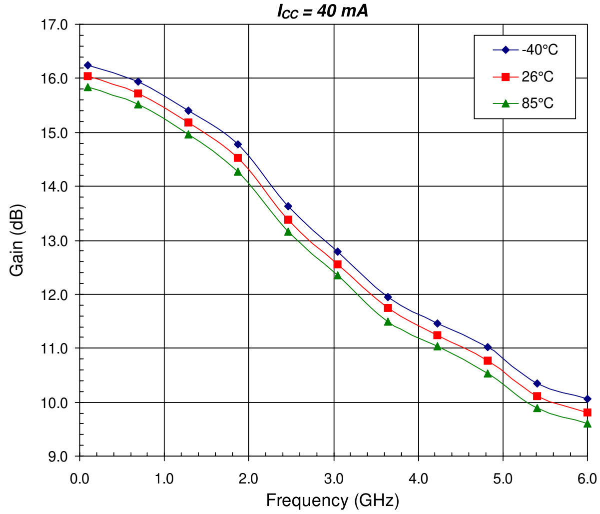
# Evaluation Board Layout
## Board Size 1.0” x 1.0”

Board Thickness 0.020”, Board Material R0-4003 Rogers

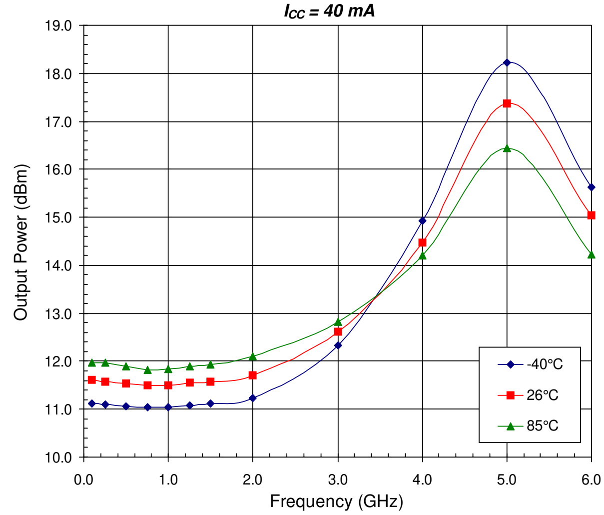


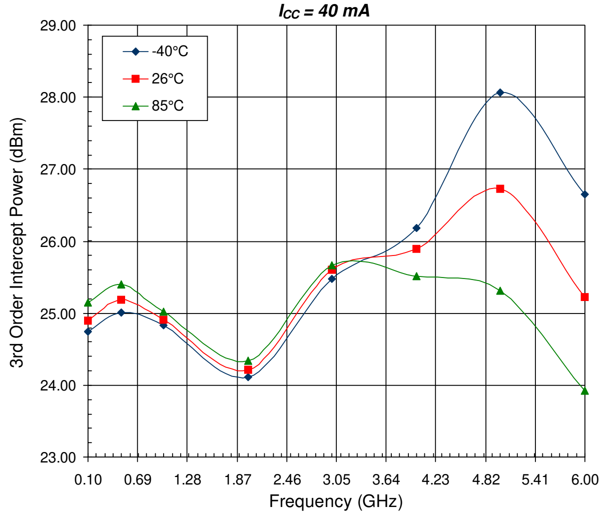
**Gain versus Frequency Across Temperature**
$I_{CC}$ = 40 mA



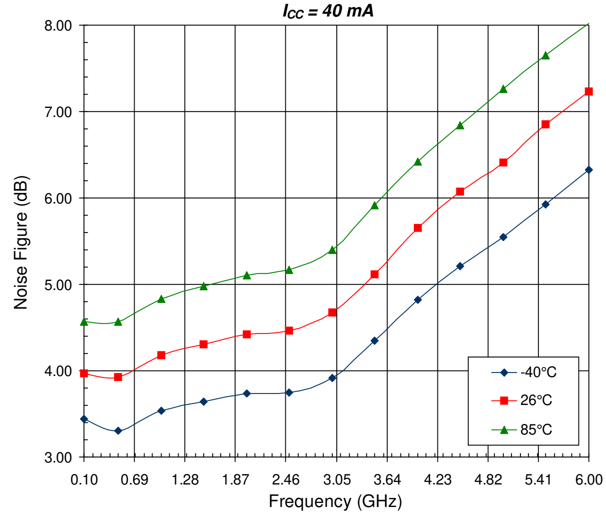

**Output P1dB versus Frequency Across Temperature**
$I_{CC}$ = 40 mA



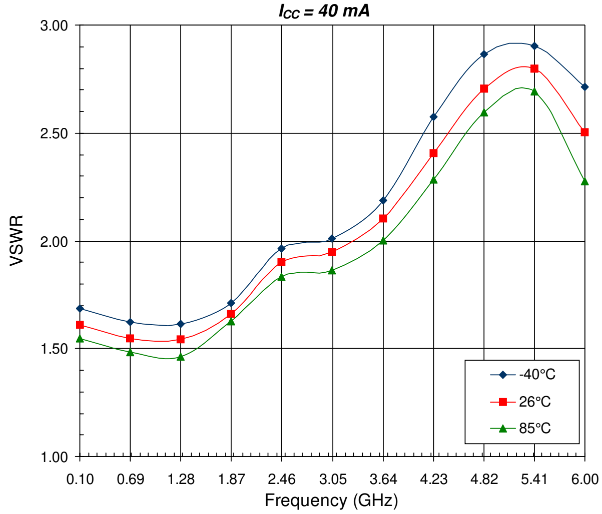

**Output IP3 versus Frequency Across Temperature**
$I_{CC}$ = 40 mA



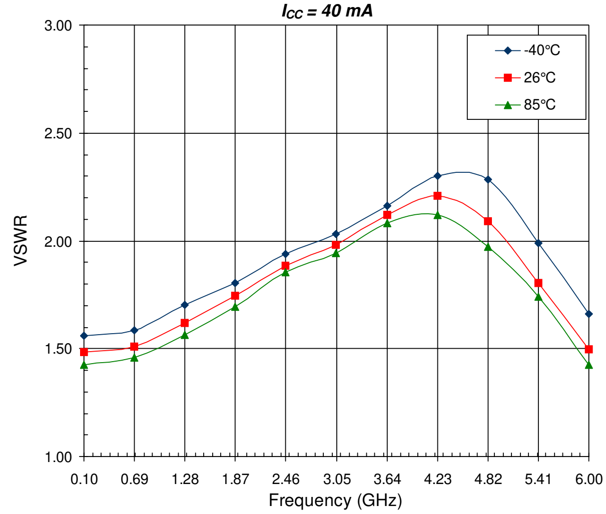

**Noise Figure versus Frequency Across Temperature**
$I_{CC}$ = 40 mA



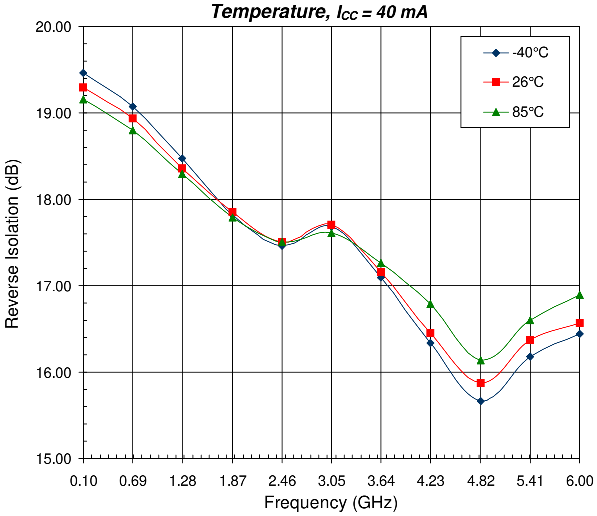

**Input VSWR versus Frequency Across Temperature**
$I_{CC}$ = 40 mA



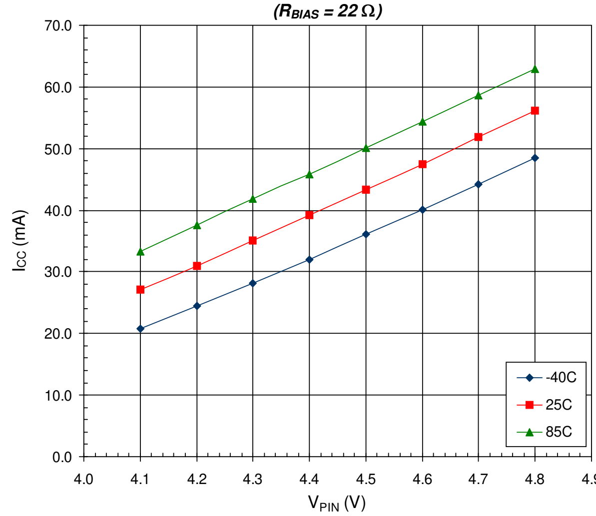

**Output VSWR versus Frequency Across Temperature**
$I_{CC}$ = 40 mA



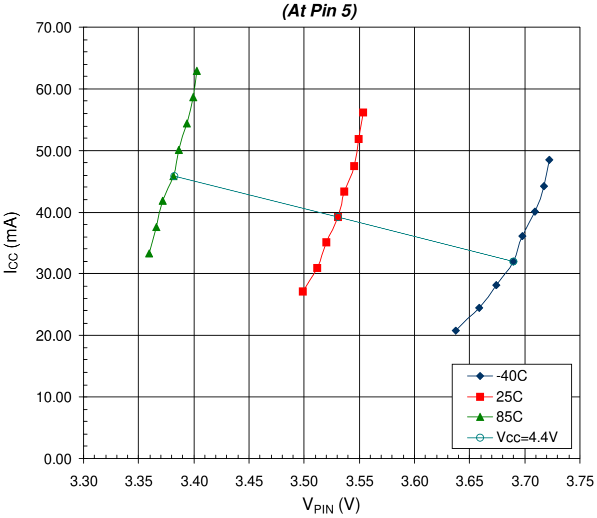
**Reverse Isolation versus Frequency Across Temperature, $I_{CC}$ = 40 mA**



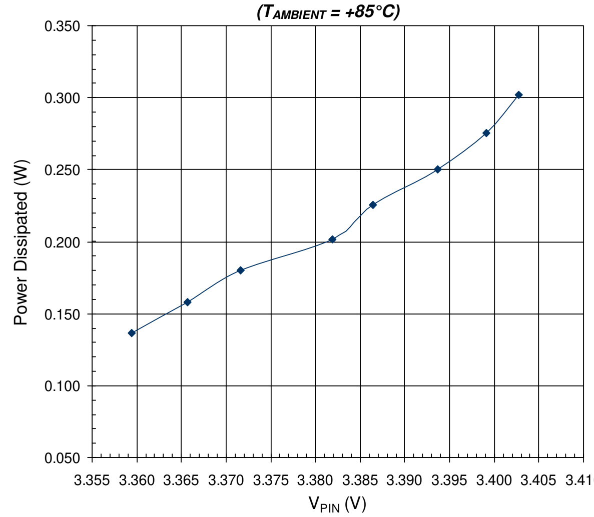

**Current versus Voltage at Evaluation Board Connector, ($R_{BIAS}$ = 22 Ω)**



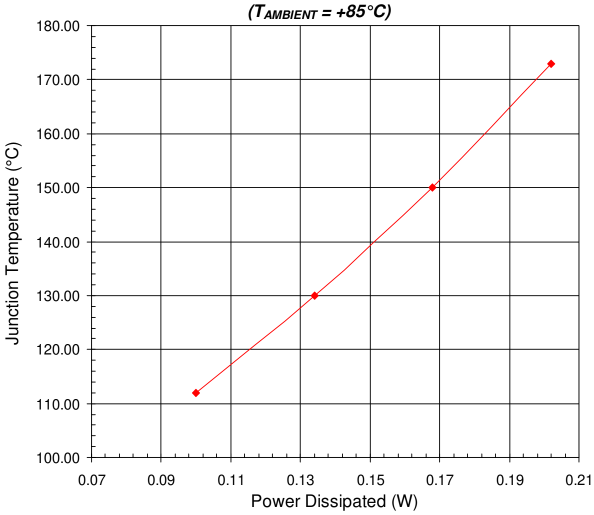

**Current versus Voltage (At Pin 5)**



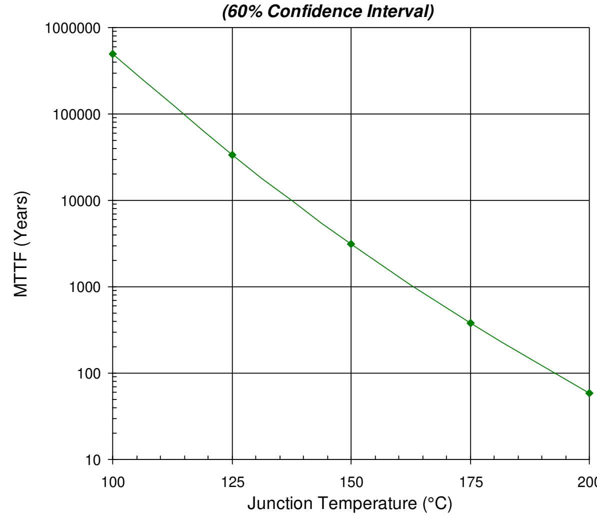

**Power Dissipated versus Voltage at Pin 5 ($T_{AMBIENT}$ = +85°C)**



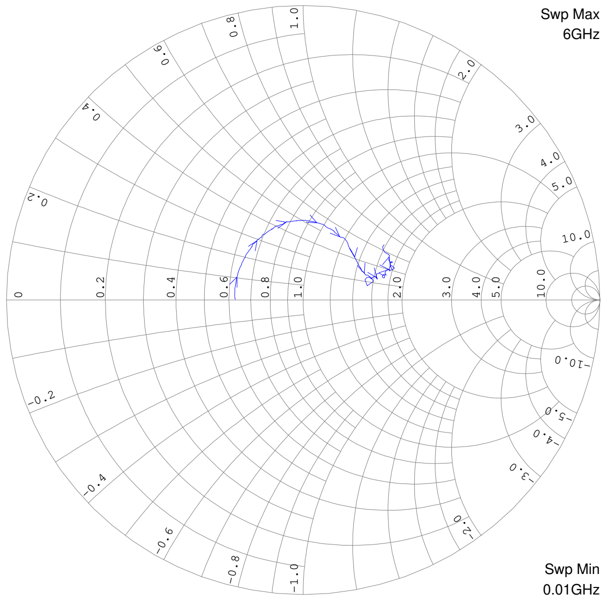

**Junction Temperature versus Power Dissipation ($T_{AMBIENT}$ = +85°C)**




**MTTF versus Junction Temperature (60% Confidence Interval)**



**De-Embedded S11, $V_{CC}$ = 3.65V, $I_{CC}$ = 40mA, T = 25°C**




**De-Embedded S22, $V_{CC}$ = 3.65V, $I_{CC}$ = 40mA, T = 25°C**