

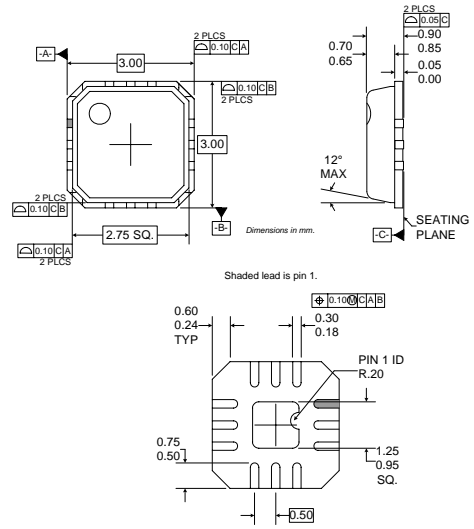
**RoHS Compliant & Pb-Free Product**

Typical Applications

- Basestation Applications
- Cellular and PCS Systems
- CDMA, W-CDMA Systems
- GSM/EDGE Systems
- Final PA for Low-Power Applications

Product Description

The RF3220 is a high-efficiency GaAs Heterojunction Bipolar Transistor (HBT) amplifier packaged in a low-cost surface-mount package. This amplifier is ideal for use in applications requiring high-linearity and low noise figure over the 500MHz to 3GHz frequency range. The RF3220 operates from a single 5V power supply, and is assembled in an economical 3mmx3mm QFN package.



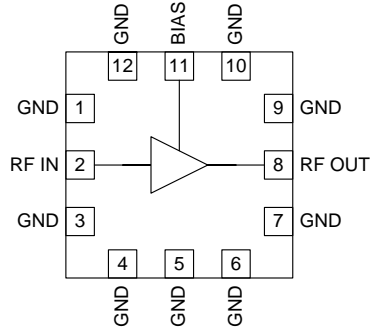
Optimum Technology Matching® Applied

- |                                     |  |                                       |
|-------------------------------------|--|---------------------------------------|
| <input type="checkbox"/> Si BJT     | <input checked="" type="checkbox"/> GaAs HBT | <input type="checkbox"/> GaAs MESFET  |
| <input type="checkbox"/> Si Bi-CMOS | <input type="checkbox"/> SiGe HBT            | <input type="checkbox"/> Si CMOS      |
| <input type="checkbox"/> InGaP/HBT  | <input type="checkbox"/> GaN HEMT            | <input type="checkbox"/> SiGe Bi-CMOS |

Package Style: QFN, 12-Pin, 3x3

Features

- 500MHz to 2GHz
- +40.8dBm Output IP3
- +14.2dB Gain at 1850MHz
- +12.4dBm Input P1dB at 1850MHz
- 2.8dB Noise Figure at 1850MHz
- Single 5V Power Supply



Functional Block Diagram

Ordering Information

RF3220 High Linearity/Driver Amplifier  
 RF3220PCBA-41X Fully Assembled Evaluation Board

RF Micro Devices, Inc. Tel (336) 664 1233  
 7628 Thorndike Road Fax (336) 664 0454  
 Greensboro, NC 27409, USA <http://www.rfmd.com>

# RF3220

## Absolute Maximum Ratings

Parameter	Rating	Unit
RF Input Power	+20	dBm
Device Voltage	-0.5 to +6.0	V
Device Current	250	mA
Operating Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C



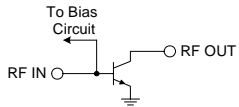
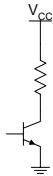
Caution! ESD sensitive device.

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
<b>Overall</b>					$V_{CC}=5V$ , $RF_{IN}=-10dBm$ , Freq=1850MHz, with Temp=25°C unless otherwise noted.
<b>AC Specifications</b>					
Frequency	500		2000	MHz	
Gain	12	14.2	15.5	dB	
Input VSWR		1.2	1.5	SWR	
Output VSWR		1.7	2.0	SWR	
Reverse Isolation	20	23			
Output IP3	36	40		dBm	$F_1=1850MHz$ , $F_2=1851MHz$
Output P1dB	23	+25.5		dBm	
Noise Figure		2.9	3.3	dB	
<b>Thermal</b>					$I_{CC}=160mA$ , $P_{DISS}=0.997W$ . (See Note.)
Theta <sub>JC</sub>		76		°C/W	
Maximum Measured Junction Temperature at DC Bias Conditions		153		°C	$T_{CASE}=+85°C$
Mean Time To Failures		5800		years	$T_{CASE}=+85°C$
<b>DC Specifications</b>					
Device Voltage	4.5	5.0	5.5	V	$I_{CC}=160mA$
Operating Current Range	110	145	170	mA	$V_{CC}=5V$

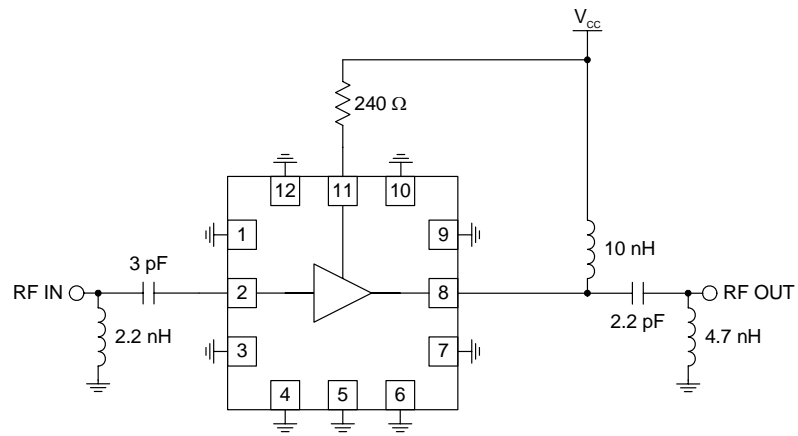
Note: The RF3220 must be operated at or below 175mA in order to achieve the thermal performance listed above. While the RF3220 may be operated at higher bias currents, 175mA is the recommended bias to ensure the highest possible reliability and electrical performance.

# RF3220

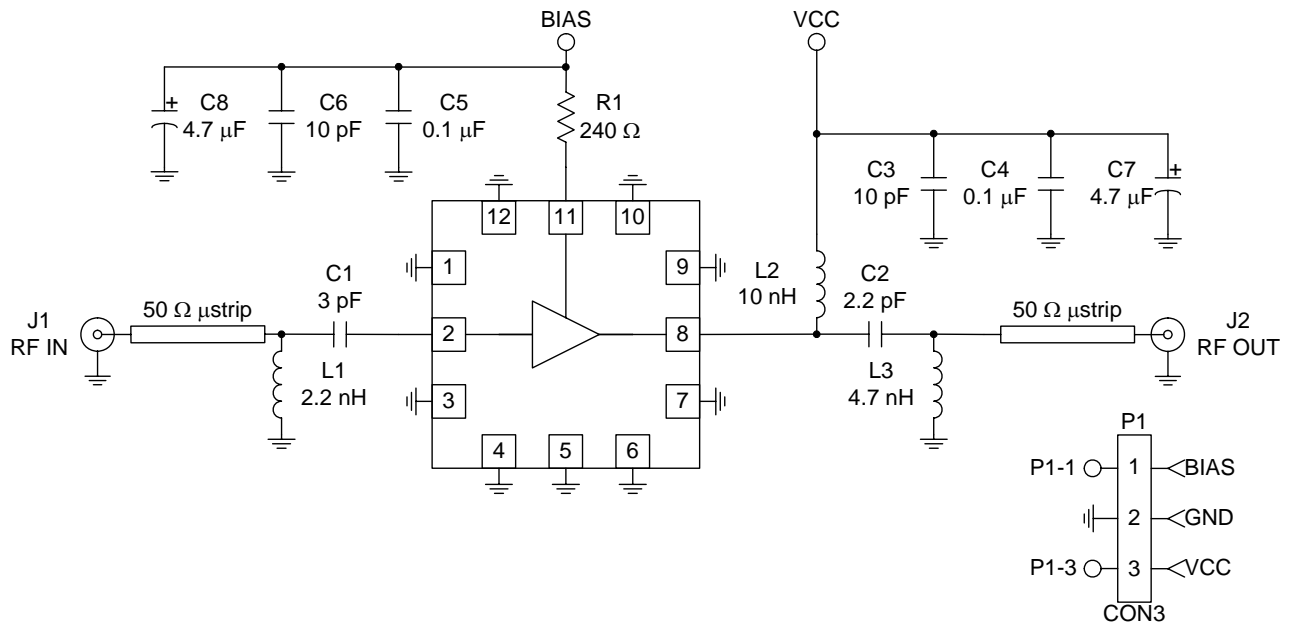
Pin	Function	Description	Interface Schematic
1	GND	Ground connection.	
2	RF IN	RF input pin. This pin is not internally DC-blocked. A DC blocking capacitor suitable for the frequency of operation should be used.	
3	GND	Ground connection.	
4	GND	Ground connection.	
5	GND	Ground connection.	
6	GND	Ground connection.	
7	GND	Ground connection.	
8	RF OUT	Amplifier output pin. This pin is an open-collector output. It must be biased to $V_{CC}$ through a choke or matching inductor. This pin is typically matched to $50\Omega$ with a shunt bias/matching inductor and series blocking/matching capacitor. Refer to application schematics.	See pin 2.
9	GND	Ground connection.	
10	GND	Ground connection.	
11	BIAS	This pin is used to control the bias current. An external resistor may be used to set the bias current for any $V_{PD}$ voltage. Allows for trade-offs between IP3 versus noise figure and $T_{MAX}$ .	
12	GND	Ground connection.	
Pkg Base	GND	Ground connection. Vias to ground required under the package base.	

# RF3220

## Application Schematic - 1850MHz

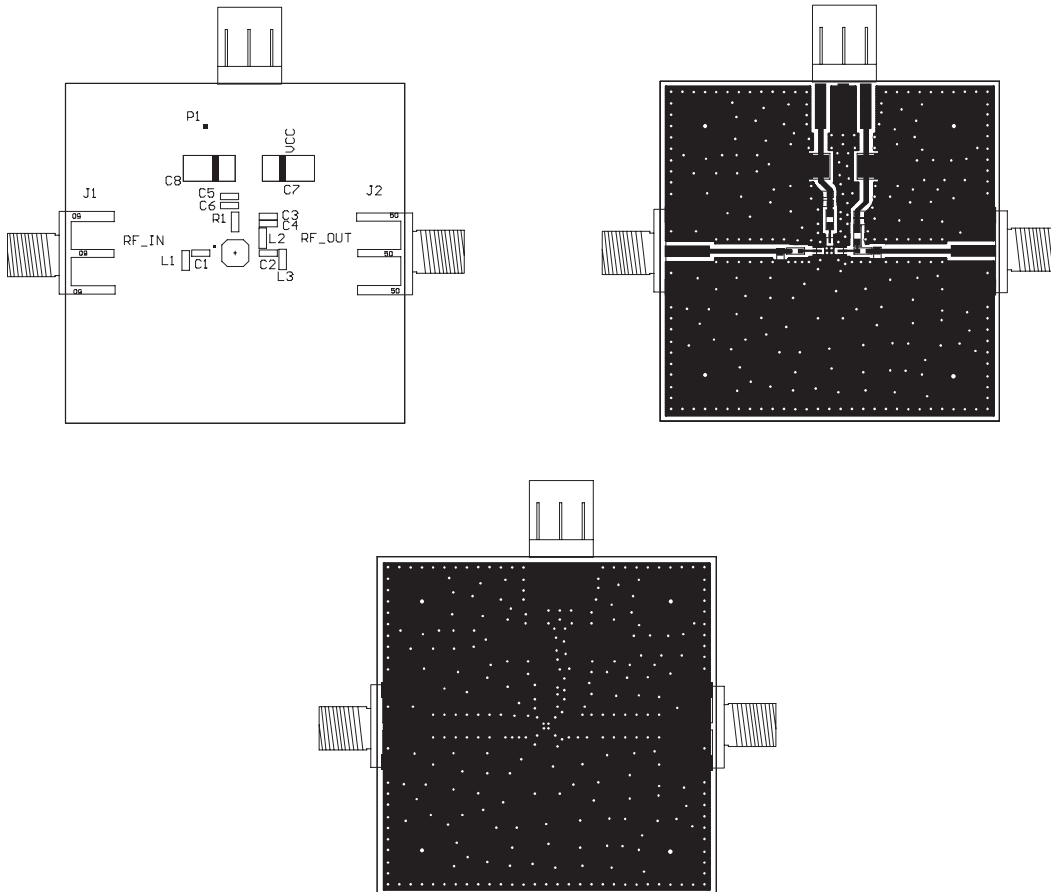


## Evaluation Board Schematic

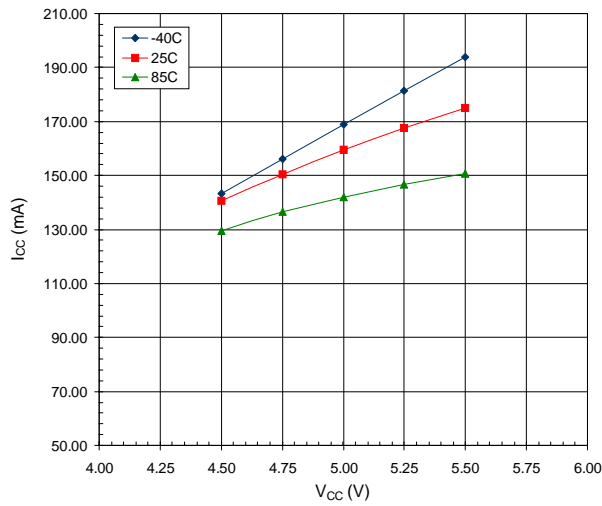


# RF3220

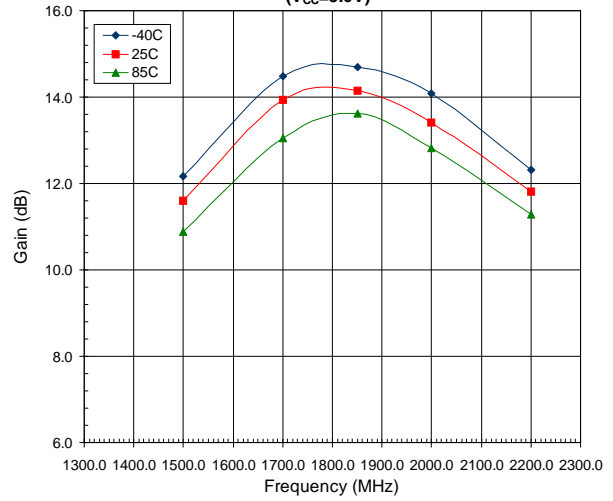
## Evaluation Board Layout Board Size 1.5" x 1.5" Board Thickness 0.032", Board Material FR-4



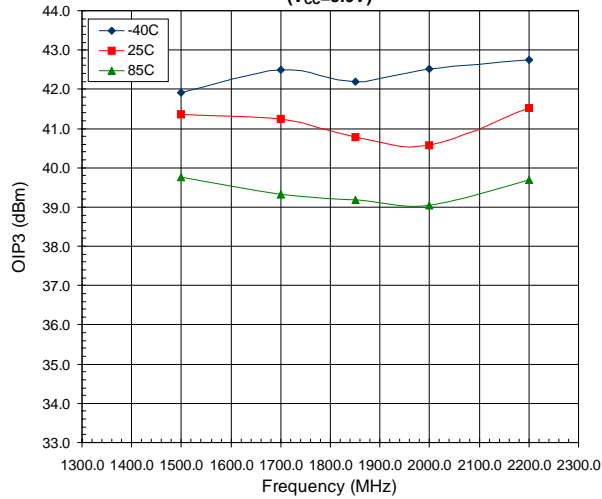
**I<sub>cc</sub> versus V<sub>cc</sub> Across Temperature**



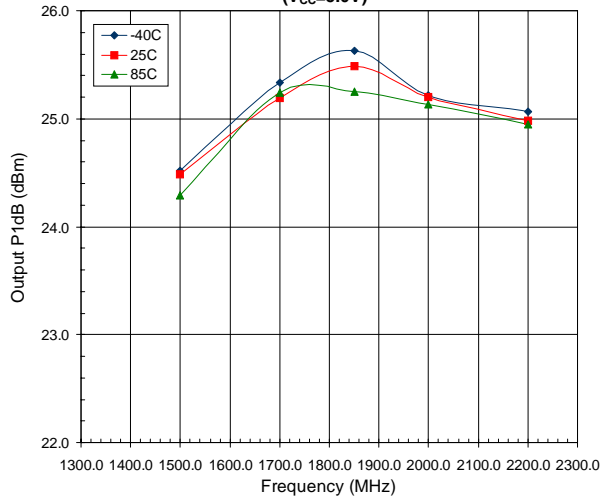
**Gain versus Frequency Across Temperature (V<sub>cc</sub>=5.0V)**



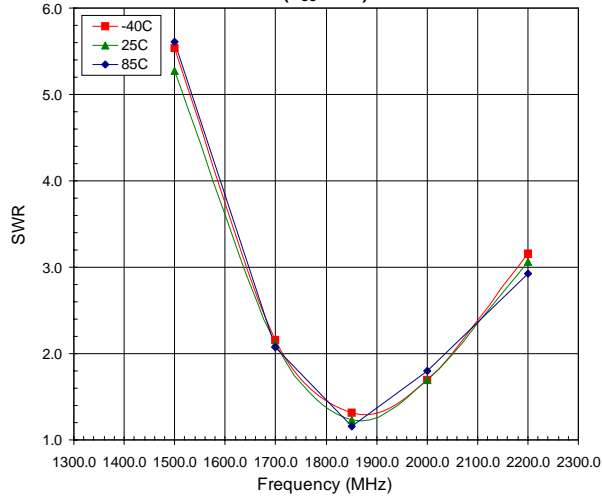
**OIP3 versus Frequency Across Temperature (V<sub>cc</sub>=5.0V)**



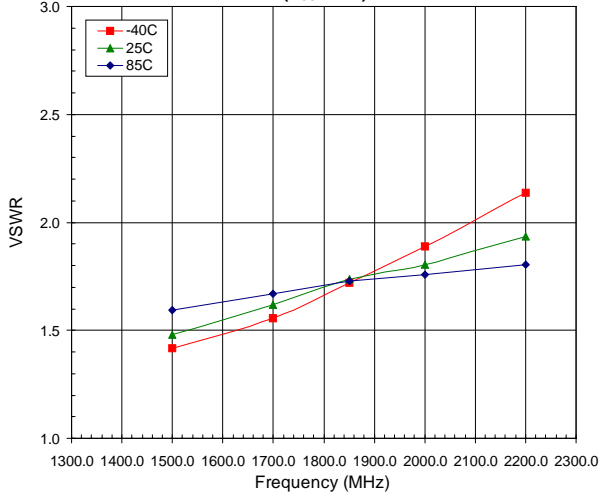
**Output P1dB versus Frequency Across Temperature (V<sub>cc</sub>=5.0V)**



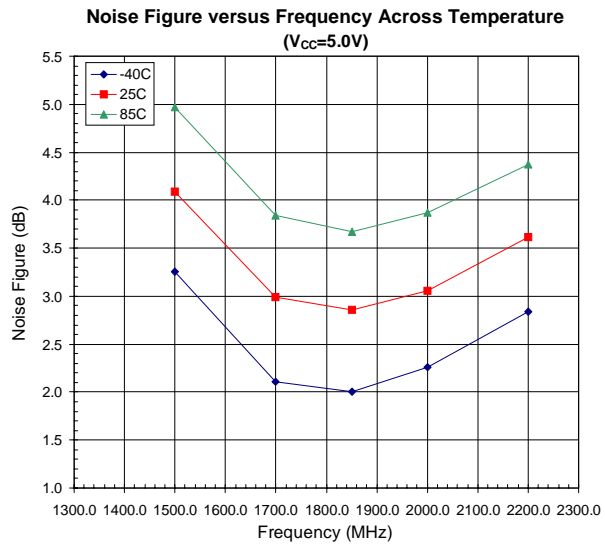
**Input SWR versus Frequency Across Temperature (V<sub>cc</sub>=5.0V)**



**Output VSWR versus Frequency Across Temperature (V<sub>cc</sub>=5.0V)**



# RF3220





## PCB Design Requirements

### PCB Surface Finish

The PCB surface finish used for RFMD's qualification process is electroless nickel, immersion gold. Typical thickness is 3μinch to 8μinch gold over 180μinch nickel.

### PCB Land Pattern Recommendation

PCB land patterns are based on IPC-SM-782 standards when possible. The pad pattern shown has been developed and tested for optimized assembly at RFMD; however, it may require some modifications to address company specific assembly processes. The PCB land pattern has been developed to accommodate lead and package tolerances.

### PCB Metal Land Pattern

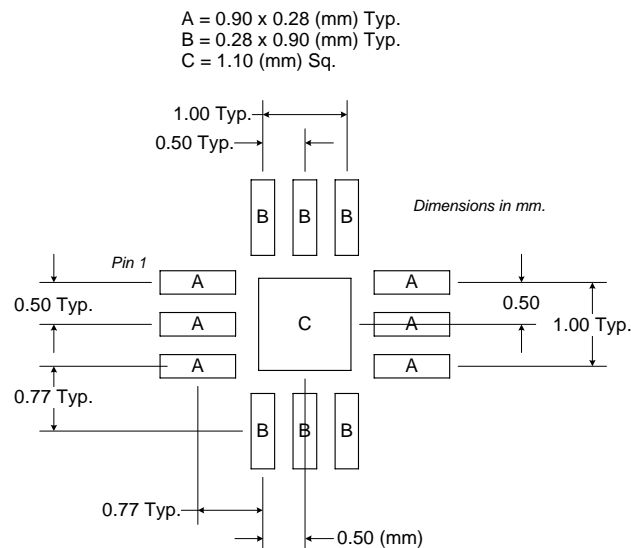


Figure 1. PCB Metal Land Pattern (Top View)

### PCB Solder Mask Pattern

Liquid Photo-Imageable (LPI) solder mask is recommended. The solder mask footprint will match what is shown for the PCB metal land pattern with a 3mil expansion to accommodate solder mask registration clearance around all pads. The center-grounding pad shall also have a solder mask clearance. Expansion of the pads to create solder mask clearance can be provided in the master data or requested from the PCB fabrication supplier.

### Thermal Pad and Via Design

The PCB metal land pattern has been designed with a thermal pad that matches the exposed die paddle size on the bottom of the device.

Thermal vias are required in the PCB layout to effectively conduct heat away from the package. The via pattern has been designed to address thermal, power dissipation and electrical requirements of the device as well as accommodating routing strategies.

The via pattern used for the RFMD qualification is based on thru-hole vias with 0.203mm to 0.330mm finished hole size on a 0.5mm to 1.2mm grid pattern with 0.025mm plating on via walls. If micro vias are used in a design, it is suggested that the quantity of vias be increased by a 4:1 ratio to achieve similar results.

# RF3220

A = 1.00 x 0.38 (mm) Typ.  
B = 0.38 x 1.00 (mm) Typ.  
C = 1.20 (mm) Sq.

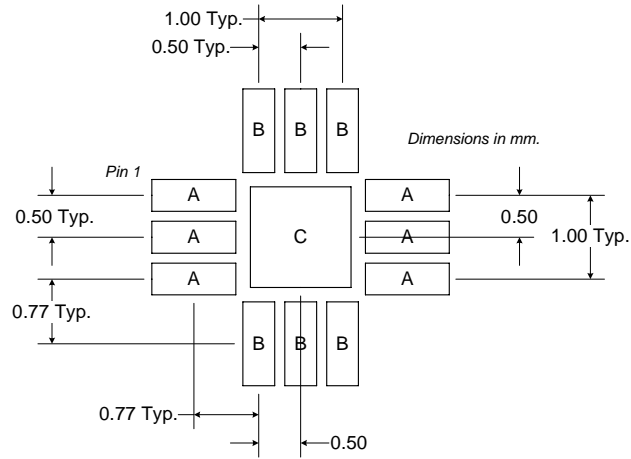


Figure 2. PCB Solder Mask Pattern (Top View)