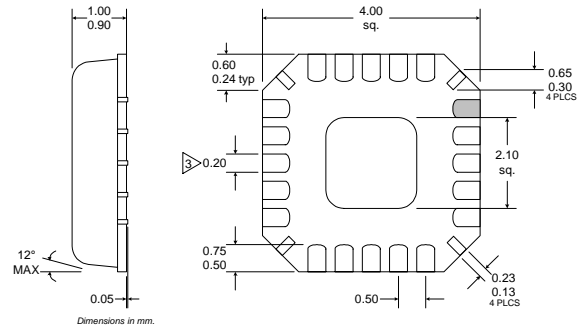


Typical Applications

- 3V 1850-1910MHz CDMA-2000 Handsets
- Commercial and Consumer Systems
- 3V 1920-1980MHz W-CDMA Handsets
- Portable Battery-Powered Equipment
- Spread-Spectrum Systems

Product Description

The RF5176 is a high-power, high-efficiency linear amplifier IC targeting 3V handheld systems. The device is manufactured on an advanced Gallium Arsenide Heterojunction Bipolar Transistor (HBT) process, and has been designed for use as the final RF amplifier in 3V CDMA-2000 and W-CDMA handsets as well as other applications in the 1850MHz to 2000MHz band. The device is self-contained, and the output can be easily matched to obtain optimum power, efficiency, and linearity characteristics over all recommended supply voltages. The device has a continuously variable bias circuit to allow idle current to be optimized for a given output power.



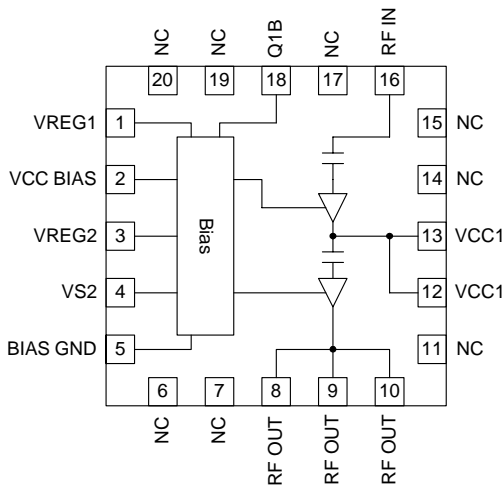
- NOTES:**
- 1 Shaded lead is Pin 1.
  - 2 Pin 1 identifier must exist on top surface of package by identification mark or feature on the package body. Exact shape and size is optional.
  - 3 Dimension applies to plated terminal: to be measured between 0.02 mm and 0.25 mm from terminal end.
  - 4 Package Warpage: 0.05 mm max.
  - 5 Die Thickness Allowable: 0.305 mm max.

Optimum Technology Matching® Applied

- Si BJT       GaAs HBT       GaAs MESFET  
 Si Bi-CMOS       SiGe HBT       Si CMOS

Package Style: LCC, 20-Pin, 4 x 4

- Features**
- Single 3V Supply
  - 27dBm Linear Output Power
  - 26dB Linear Gain
  - 40% Linear Efficiency
  - On-board Power Down Mode



Functional Block Diagram

**Ordering Information**

|             |  |
|-------------|--|
| RF5176      | 3V W-CDMA Power 1900MHZ/ 3V Linear Power Amplifier |
| RF5176 PCBA | 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

## Absolute Maximum Ratings

| Parameter                                 | Rating      | Unit            |
|---|-------------|-----------------|
| Supply Voltage (RF off)                   | +8.0        | V <sub>DC</sub> |
| Supply Voltage (P <sub>OUT</sub> ≤31 dBm) | +5.0        | V <sub>DC</sub> |
| Bias Voltage (V <sub>BIAS</sub> )         | +3.0        | V <sub>DC</sub> |
| Control Voltage (V <sub>REG</sub> )       | +3.0        | V <sub>DC</sub> |
| Input RF Power                            | +6          | dBm             |
| Operating Case Temperature                | -30 to +100 | °C              |
| Storage Temperature                       | -30 to +150 | °C              |



**Caution!** ESD sensitive device.

RF Micro Devices believes the furnished information is correct and accurate at the time of this printing. However, RF Micro Devices reserves the right to make changes to its products without notice. RF Micro Devices does not assume responsibility for the use of the described product(s).

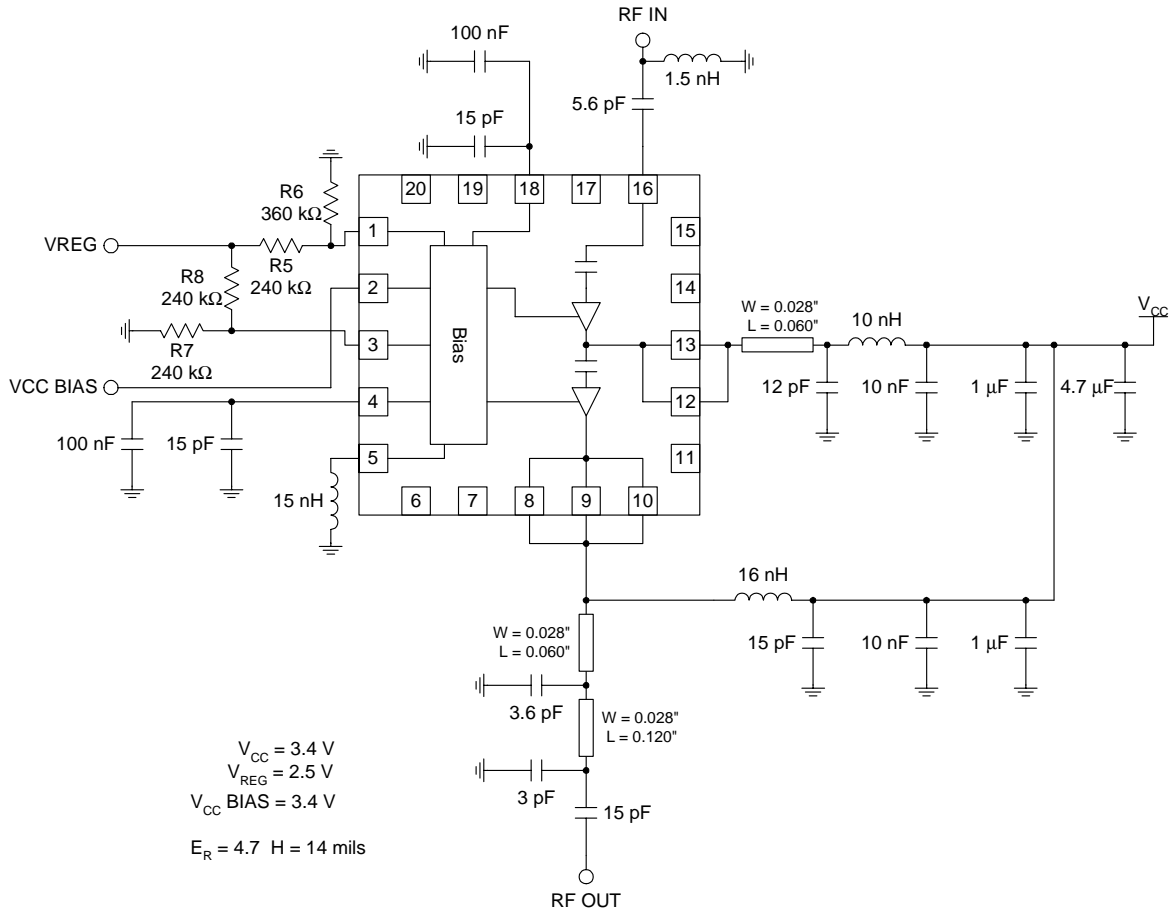
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POWER AMPLIFIERS

| Parameter  | Specification |                              |      | Unit   | Condition  |
|--|---------------|------------------------------|------|--------|--|
|  | Min.          | Typ.                         | Max. |        |  |
| <b>Overall</b>                                   |               |                              |      |        | T=25°C, V <sub>CC</sub> =3.4V,<br>Freq=1920MHz to 1980MHz, V <sub>REG</sub> =2.5V,<br>unless otherwise specified |
| Usable Frequency Range                           | 1850          |                              | 2000 | MHz    |  |
| Typical Frequency Range                          |               | 1850 to 1910<br>1920 to 1980 |      | MHz    |  |
| Linear Gain                                      |               | 26                           |      | dB     |  |
| Second Harmonic (including second harmonic trap) |               | -55                          |      | dBc    |  |
| Third Harmonic                                   |               | -50                          |      | dBc    |  |
| Maximum Linear Output Power (W-CDMA Modulation)  |               | 27                           |      | dBm    |  |
| Total Linear Efficiency                          |               | 40                           |      | %      | P <sub>OUT</sub> =27 dBm   |
| Adjacent Channel Power Rejection @ 5MHz          |               | -40                          | -38  | dBc    | P <sub>OUT</sub> =27 dBm, W-CDMA Modulation, 3GPP 3.2 03-00 DPCCH + 1 DPDCH                                      |
| Adjacent Channel Power Rejection @ 10MHz         |               | -50                          | -48  | dBc    | P <sub>OUT</sub> =27 dBm, W-CDMA Modulation, 3GPP 3.2 03-00 DPCCH + 1 DPDCH                                      |
| Noise Power                                      |               | -144                         |      | dBm/Hz | P <sub>OUT</sub> =+27 dBm,<br>Rx Band 2110MHz to 2170MHz   |
| Input VSWR                                       |               | < 2:1                        |      |        |  |
| Output Load VSWR                                 |               |                              | 5:1  |        | No oscillations  |
| <b>Power Supply</b>                              |               |                              |      |        |  |
| Power Supply Voltage                             | 3.0           | 3.4                          | 5.0  | V      |  |
| Idle Current                                     |               | 80                           |      | mA     | V <sub>REG</sub> =2.5V   |
| VREG Current                                     |               | 10                           |      | μA     | Total pins 1 and 3, V <sub>REG</sub> =2.5V   |
| Turn On/Off time                                 |               |                              |      | ns     |  |
| Total Current (Power down)                       |               |                              | 10   | μA     | V <sub>REG</sub> =Low  |
| V <sub>REG</sub> "Low" Voltage                   |               | 0                            | 0.2  | V      |  |
| V <sub>REG</sub> "High" Voltage                  |               | 2.5                          |      | V      | See Alternative Biasing Network table following the application schematic.                                       |

| Pin      | Function | Description   | Interface Schematic |
|----------|----------|---|---------------------|
| 1        | VREG1    | Bias control for the first stage. Needs to be divided down from its nominal value of 2.5V using a resistive divider network of 240k $\Omega$ and 360k $\Omega$ . $V_{REG1}$ and $V_{REG2}$ may be adjusted to minimize idle current for a given output power. Alternative $V_{REG}$ voltages can be used as defined on the application schematic. |                     |
| 2        | VCC BIAS | Supply for bias circuits.   |                     |
| 3        | VREG2    | Bias control for the second stage. Needs to be divided down from its nominal value of 2.5V using a resistive divider network of 240k $\Omega$ and 240k $\Omega$ . Alternative $V_{REG}$ voltages can be used as defined on the application schematic.   |                     |
| 4        | VS2      | Second stage bias circuit source. For best linearity, decouple with bypassing capacitors of 15pF and 100nF.   |                     |
| 5        | BIAS GND | Connect to ground plane via a 15nH inductor. DC return for the second stage bias circuit.   |                     |
| 6        | NC       | Not currently used.   |                     |
| 7        | NC       | Not currently used.   |                     |
| 8        | RF OUT   | RF output and power supply for the final stage. This is the unmatched collector of the final stage. It requires an output matching network, including a DC blocking capacitor.  |                     |
| 9        | RF OUT   | Same as pin 8.  |                     |
| 10       | RF OUT   | Same as pin 8.  |                     |
| 11       | NC       | Not currently used.   |                     |
| 12       | VCC1     | Power supply for the first stage and interstage match. Requires a shunt capacitor of 12pF close to the pin for optimum match.   |                     |
| 13       | VCC1     | Same as pin 12.   |                     |
| 14       | NC       | Not currently used.   |                     |
| 15       | NC       | Not currently used.   |                     |
| 16       | RF IN    | RF input. Requires a blocking capacitor and shunt inductor to provide 2:1 VSWR.   |                     |
| 17       | NC       | Not currently used.   |                     |
| 18       | Q1B      | Base bias for first stage. For best linearity, decouple with 15pF and 100nF capacitors.   |                     |
| 19       | NC       | Not currently used.   |                     |
| 20       | NC       | Not currently used.   |                     |
| Pkg Base | GND      | Ground connection. The backside of the package should be soldered to a top side ground pad which is connected to the ground plane with multiple vias. The pad should have a short thermal path to the ground plane.   |                     |

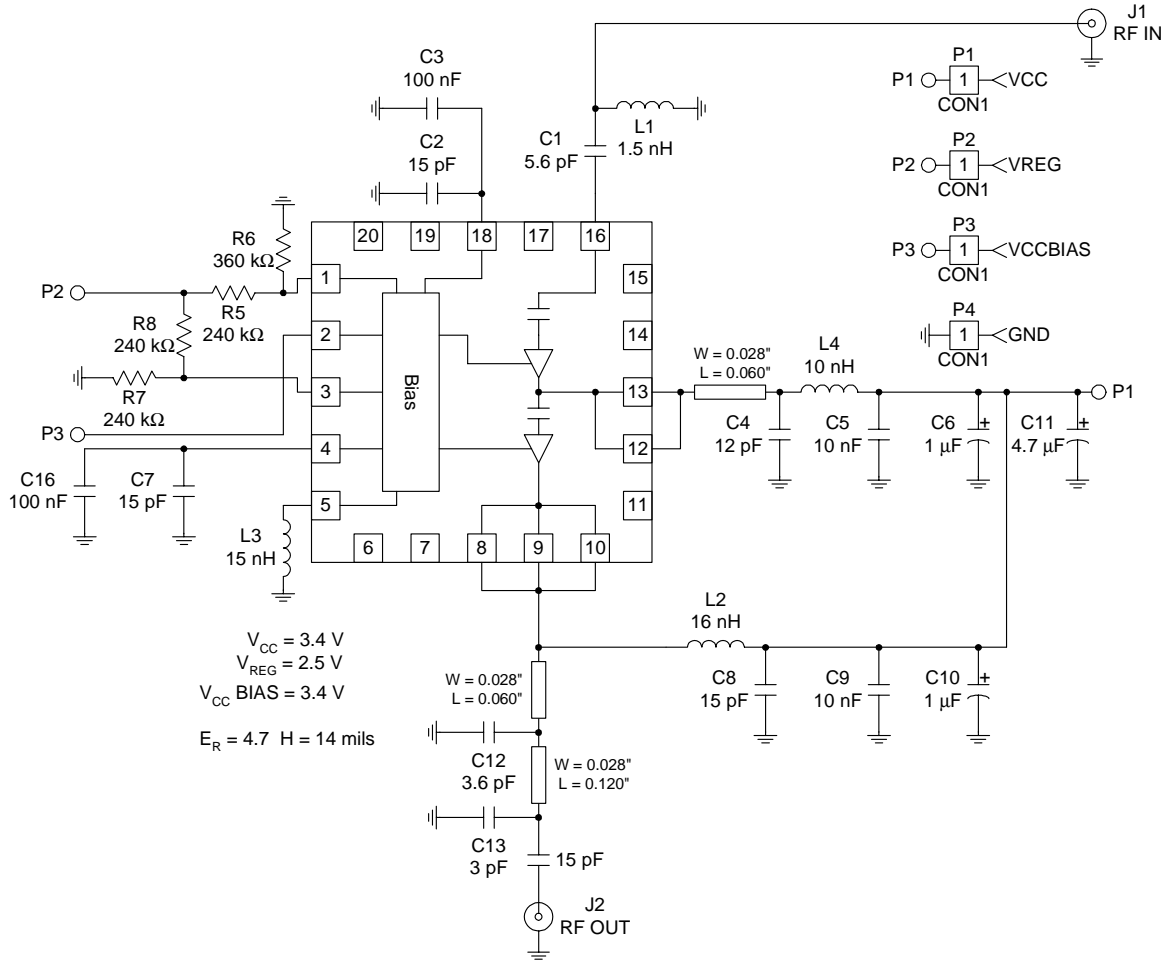
## Application Schematic



Alternative Biasing Networks for Various  $V_{REG}$  Voltages

| $V_{REG}$ (V) | R5 (1ST) kΩ | R6 (1ST-GND) kΩ | R7 (2ND-GND) kΩ | R8 (2ND) kΩ |
|---------------|-------------|-----------------|-----------------|-------------|
| 2.50          | 240         | 360             | 240             | 240         |
| 2.60          | 240         | 330             | 360             | 380         |
| 2.70          | 240         | 300             | 200             | 230         |
| 2.80          | 240         | 270             | 220             | 270         |
| 2.90          | 220         | 240             | 180             | 240         |

Evaluation Board Schematic  
(Download [Bill of Materials](http://www.rfmd.com) from www.rfmd.com.)



## Evaluation Board Layout Board Size 2.0" x 2.0"

Board Thickness 0.028", Board Material FR-4, Multi-Layer  
Ground Plane at 0.014"

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POWER AMPLIFIERS

