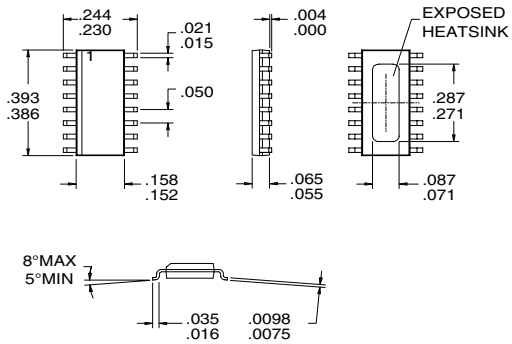
HIGH EFFICIENCY 400MHZ AMPLIFIER

Typical Applications

- 3.6V Analog Handsets
- Analog Communication Systems
- 400MHz Industrial Radios
- Portable Battery Powered Equipment

Product Description

The RF2117 is a high power amplifier IC. 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 analog cellular phone transmitters between 400MHz and 500MHz or ISM applications operating at 433MHz. The device is packaged in a low cost 16-lead plastic package with a metal backside. The device is self-contained with the exception of the output matching network and power supply feed line.

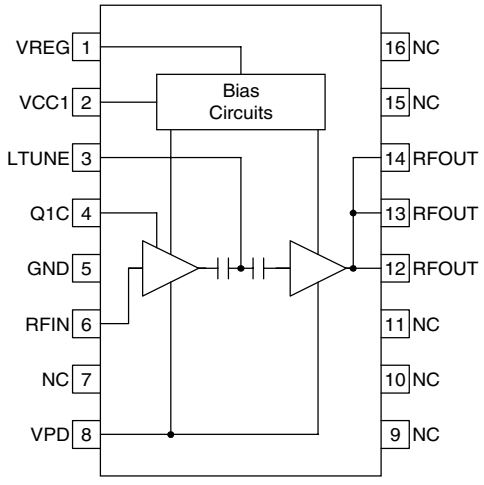


Package Weight
typically 0.22 grams

Optimum Technology Matching® Applied

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

Package Style: PSOP-16



Functional Block Diagram

Features

- Single 3V to 5.5V Supply
- Up to 2W CW Output Power
- 33dB Small Signal Gain
- >50% Efficiency
- 400MHz to 500MHz Operation

Ordering Information

RF2117	High Efficiency 400MHz Amplifier
RF2117 PCBA	Fully Assembled Evaluation Board

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage (V_{CC})	-0.5 to +6.0	V_{DC}
Power Down Voltage (V_{PD})	-0.5 to +3.0	V
DC Supply Current	1300	mA
Input RF Power	+10	dBm
Output Load	7:1	
Operating Case Temperature	-40 to +100	°C
Operating Ambient Temperature	-40 to +85	°C
Storage Temperature	-55 to +150	°C

Caution! ESD sensitive device.

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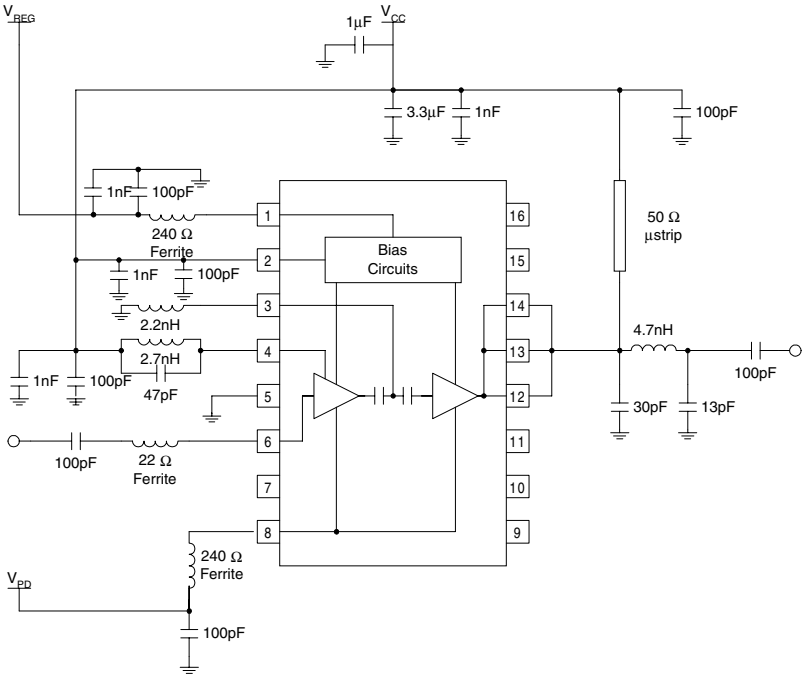
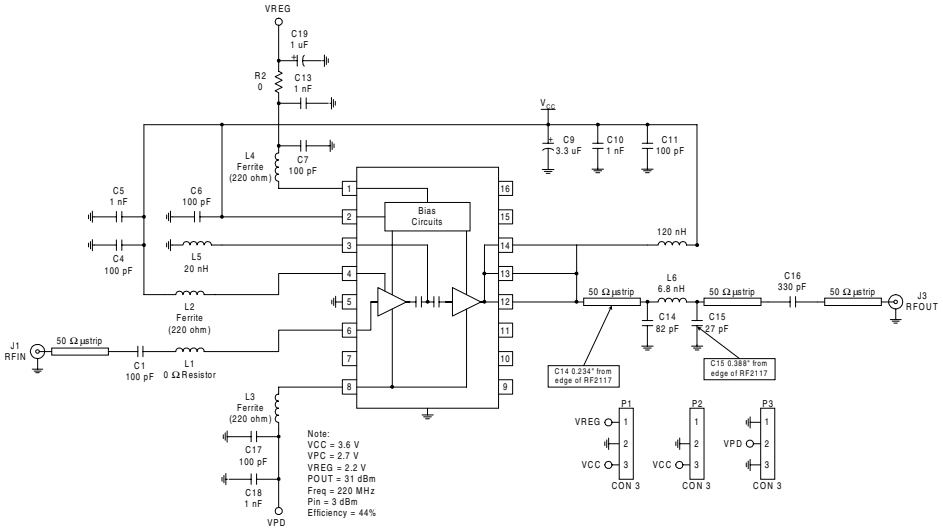
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Overall					T=25 °C, V_{CC}=3.6V, V_{PD}=2.2V, Z_{LOAD}=2.7Ω, P_{IN}=4dBm, Freq=450MHz
Frequency Range		400 to 500		MHz	
Maximum CW Output Power		+33		dBm	
	+32.5			dBm	V_{CC}=3.2 to 4.5V Tamb=-25 to +85 °C
	+31.5			dBm	V_{CC}=3.0 to 3.2V and 4.5 to 5.5V
Total CW Efficiency	52	55		%	Vcc=3.0V Pout=+32.5 dBm
		45		%	Vcc=3.6V Pout=+32.5 dBm
Small-signal Gain		33		dB	
Harmonics	-30	-40		dBc	Vcc=3.0 to 5.5V Tamb= -25 to +85 °C
All Other Spurious			-70	dBc	Load VSWR≤6:1 all phase angles, Zs=50 Ω, Vcc=3.0V to 5.5V, Tamb= -30 to +85° C
Input VSWR		<2:1			
Input Power	+2	+4	+6	dBm	
Input Impedance		50		Ω	
Noise Power in Rx Band			-80dBm	dBm	Pout=+32.5 dBm, Freq.= 410 to 485 MHz, Tamb= -30 to +85°C VSWR ≤ 6:1 all phase angles.
Intermodulation Conversion at TX Freq. - 10MHz	12			dB	Pout=+15dBm to +32.5 dBm
Power Down Isolation	45			dB	VPD grounded through 1kΩ resistor Pin=+6dBm
Power Control					
Control Voltage VPD	0		2.4	V	
Control Current			6	mA	
Gain Control	35			dB	
Power Supply					
Power Supply Voltage	3.0	3.6	5.3	V	
Power Supply Current		1100		mA	DC Current at POUT,MAX
Regulated Voltage VREG	2.7	2.8	2.9	V	
Current from VREG			12	mA	

Pin	Function	Description	Interface Schematic
1	VREG	Regulated Supply for bias circuit. This pin should be connected to the regulated supply with a ferrite of 240 ohms and should have a UHF decoupling capacitor (100pF) to ground at the supply end of the ferrite. An additional capacitor of 1nF can be added with the 100 pF but it's placement is not as critical.	
2	VCC1	Positive supply for the active bias circuits. Bypassing should be accomplished with a single UHF decoupling capacitor, placed close to the Pin. Additional bypassing of 1nF is also recommended, but proximity to the package is not as critical.	
3	LTUNE	The Inter-stage matching point of the amplifiers. Matching should be performed with a small value inductor connected from the pin to ground.	
4	Q1C	Positive Supply to the first stage collector. The supply should be fed through a parallel LC network, resonant at the centre of the band of interest. A UHF decoupling capacitor should be placed from the supply end of the LC to ground. A 1nF capacitor can also be used but it's placement it not as critical.	
5	GND	Ground Contact for the driver stage. Keep traces physically short and connect immediately to the ground plane for best performance. It is important for stability that this pin has it's own via to the groundplane, to minimize any common inductance.	
6	RF IN	Amplifier RF input. This is a 50Ω RF input port to the amplifier. It does not contain internal DC blocking and therefore should be externally DC blocked before connecting to any device which has DC present or which contains a DC path to ground. A series UHF capacitor is recommended for the DC blocking.	
7	NC	Not internally connected.	
8	VPD	Power Down control. When this pin is "low" all circuits are off. A low is typically less than 0.5V at room temperature. This pin affords a measure of power control, however this response is not linear across much of the range. It is recommended that the pin be used in closed loop power control systems if it is to be used across a range of voltages and temperatures for power control.	
9	NC	Not internally connected.	
10	NC	Not internally connected.	
11	NC	Not internally connected.	
12	RF OUT	Amplifier RF output. This is an unmatched collector output of the final amplifier transistor. It is internally connected to pins 12, 13, and 14 to provide low series inductance and flexibility in output matching. Bias for the final power amplifier output transistor must also be provided through two of these three pins. Typically, these pins are externally connected very close to the package and used as the RF output with a matching network that presents the optimum load impedance to the PA for maximum power and efficiency, as well as providing DC blocking at the output. An additional network of a bias inductor (or λ/4 line) provides DC bias and helps to protect the output from high voltage swings due to severe load mismatches.	
13	RF OUT	Amplifier RF output, same as pin 12	
14	RF OUT	Amplifier RF output, same as pin 12. Do not feed the supply to this pin alone. If this pin is used as the supply pin it must be connected in parallel with pin 12 and/or 13.	
15	NC	Not internally connected.	
16	NC	Not internally connected.	
Pkg Base	GND	This contact is the main ground contact for the entire device. Care should be taken to ensure that this contact is well soldered in order to prevent performance from being degraded from that indicated in the specifications.	

Application Schematic
450MHz

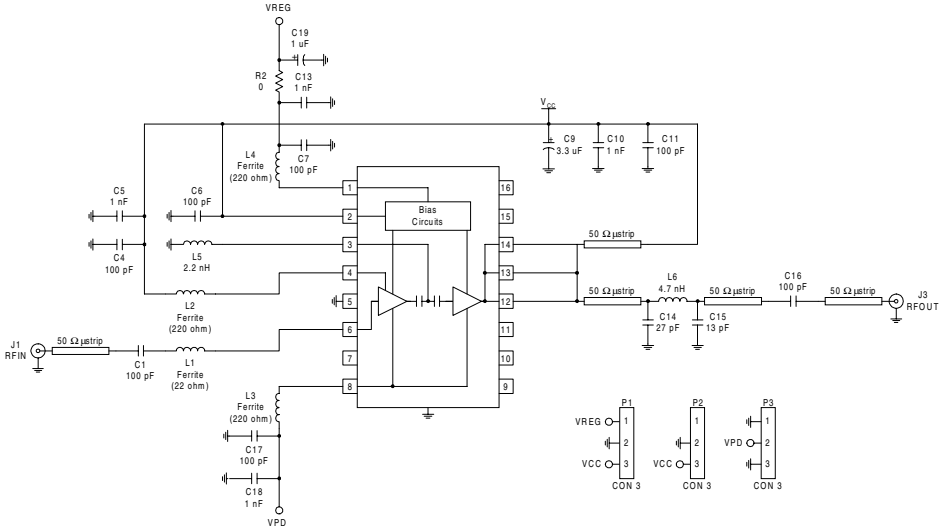


Application Schematic
220MHz



Evaluation Board Schematic

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



Evaluation Board Layout
2” x 3”