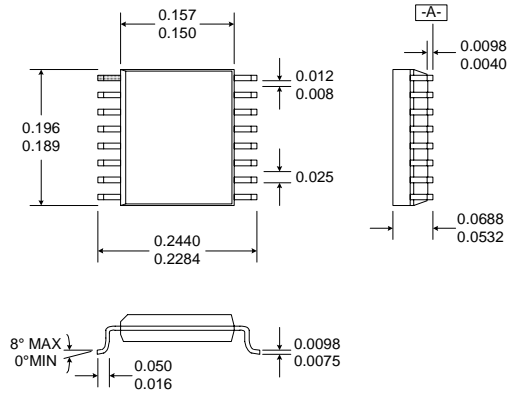


Typical Applications

- Digital Communications Systems
- Spread Spectrum Communication Systems
- GSM, QPSK, DQPSK, QAM Modulation
- GSM and D-AMPS Systems
- AM, SSB, DSB Modulation
- Image-Reject Upconverters

Product Description

The RF2424 is a monolithic integrated quadrature modulator IC capable of universal direct modulation for high-frequency AM, PM, or compound carriers. Maximum output power is +7.5dBm, which is achieved with low input I and Q signal levels. This low-cost IC implements differential amplifiers for the modulation inputs, 90° carrier phase shift network, carrier limiting amplifiers, two matched double-balanced mixers, summing amplifier, and an output RF amplifier which will drive 50Ω from 700MHz to 1000MHz.



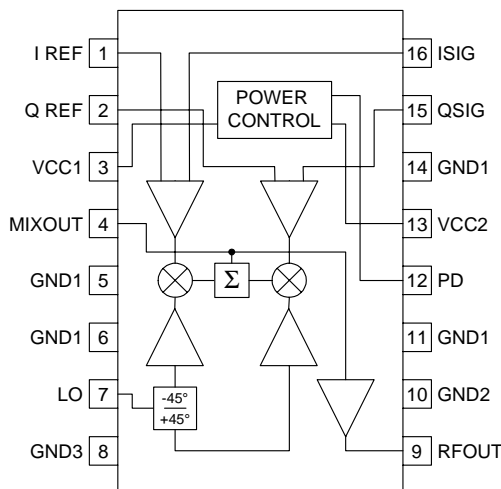
- NOTES:**
1. Shaded lead is Pin 1.
  2. All dimensions are excluding mold flash.
  3. Lead coplanarity - 0.005 with respect to datum "A".

**5**  
MODULATORS AND UPCONVERTERS

Optimum Technology Matching® Applied

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

Package Style: SSOP-16



Functional Block Diagram

Features

- Single 2.7V to 5.5V Power Supply
- +7.5dBm Output Power
- No Tuning Required
- Low LO Input Level
- Digitally Controlled Power Down Mode
- 700MHz to 1000MHz Operation

Ordering Information

- RF2424      UHF Quadrature Modulator  
 RF2424 PCBA      Fully Assembled Evaluation Board

RF Micro Devices, Inc.  
 7628 Thorndike Road  
 Greensboro, NC 27409, USA

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

# RF2424

## Absolute Maximum Ratings

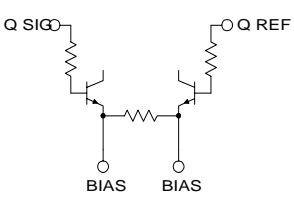
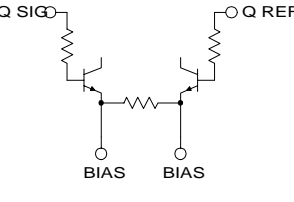
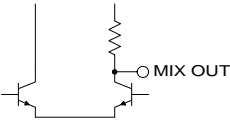
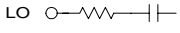
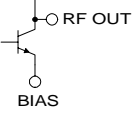
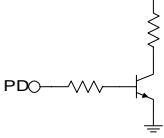
Parameter	Rating	Unit
Supply Voltage	5.5	V <sub>DC</sub>
Input LO and RF Levels	+6.0	dBm
Operating Ambient Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C



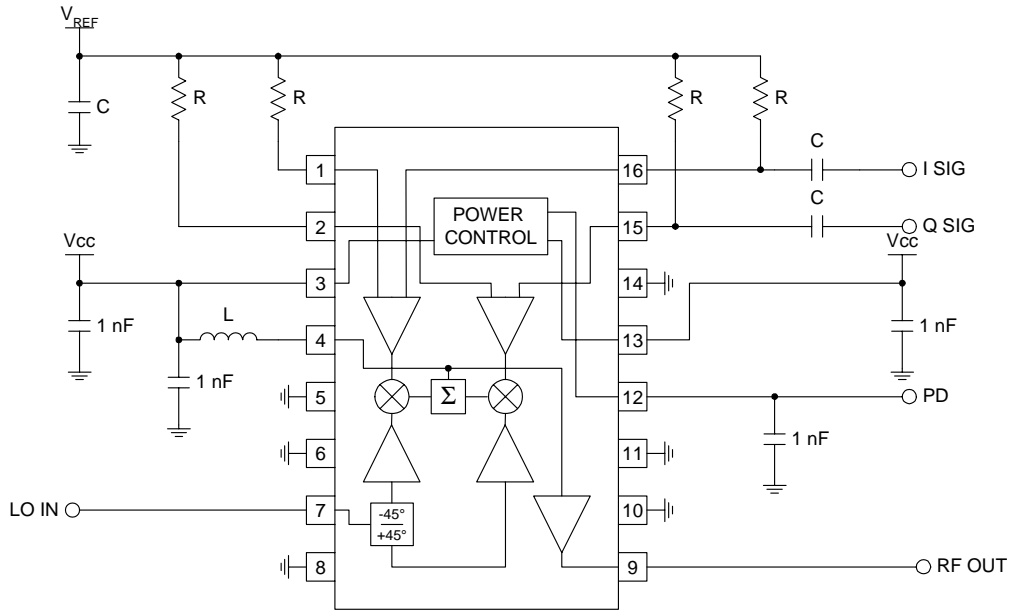
**Caution!** ESD sensitive device.

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).

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
<b>Carrier Input</b>					T=25 °C, V <sub>CC</sub> =3V
Frequency Range	700		1000	MHz	
Power Level	-6		+6	dBm	
Input impedance		43 + j1.8		Ω	At 900MHz
<b>Modulation Input</b>					
Frequency Range	DC		100	MHz	
Reference Voltage (V <sub>REF</sub> )		1.6		V	
Maximum Modulation (I&Q)		V <sub>REF</sub> ± 0.3		V	
Gain Asymmetry		0.2		dB	
Quadrature Phase Error		1		°	
Input DC Resistance		40		kΩ	
Input Bias Current		40		μA	
<b>RF Output</b>					V <sub>CC</sub> =3V, LO power=-3dBm, LO freq=900MHz, I/Q drive level=0.2V <sub>p</sub> , SSB
Output Power	+5.0	+7.5		dBm	
Output Impedance		50		Ω	
Broadband Noise Floor		-140		dBm/Hz	
Sideband Suppression	25	35		dB	
Carrier Suppression	25	30		dB	
IM <sub>3</sub> Suppression	25	30		dB	DSB output (+9dBm total power)
<b>Power Down</b>					
Turn On/Off Time			100	ns	
PD Input Resistance	10			kΩ	
Power Down "ON"		V <sub>CC</sub>		V	
Power Down "OFF"	1.0	1.2		V	
<b>Power Supply</b>					
Voltage	2.7		5.5	V	
Current		45	55	mA	V <sub>CC</sub> =3V
		53		mA	V <sub>CC</sub> =5V
Power Down			10	μA	

Pin	Function	Description	Interface Schematic
1	I REF	Reference voltage for the I mixer. This voltage should be the same as the DC voltage supplied to the I SIG pin. A voltage of 1.6V is recommended. The SIG and REF inputs are inputs of a differential amplifier. Therefore the REF and SIG inputs are interchangeable. If swapping the I SIG and I REF pins, the Q SIG and Q REF also need to be swapped to maintain the correct phase. It is also possible to drive the SIG and REF inputs in a balanced mode. If single ended operation is desired then the input is applied to I SIG, pin 16. In that case, I REF and Q REF are tied together and AC coupled to ground. To obtain a carrier suppression of better than 40dB, I REF may be tuned $\pm 20\text{mV}$ relative to the I SIG. Without tuning, it will typically be better than 25dB.	
2	Q REF	Reference voltage for the Q mixer. This voltage should be the same as the DC voltage supplied to the Q SIG pin. A voltage of 1.6V is recommended. The SIG and REF inputs are inputs of a differential amplifier. Therefore the REF and SIG inputs are interchangeable. If swapping the Q SIG and Q REF pins, the I SIG and I REF also need to be swapped to maintain the correct phase. It is also possible to drive the SIG and REF inputs in a balanced mode. If single ended operation is desired then the input is applied to Q SIG, pin 15. In that case, Q REF and Q REF are tied together and AC coupled to ground. To obtain a carrier suppression of better than 40dB, Q REF may be tuned $\pm 20\text{mV}$ relative to the Q SIG. Without tuning, it will typically be better than 25dB.	
3	VCC1	Power supply for the I mixer, Q mixer and the RF Output amplifier.	
4	MIX OUT	MIXOUT: Combined output of the I mixer and Q mixer. By changing the inductor value, maximum RF output is tuned to different frequency. If the inductor value is changed, the RF output match needs to be adjusted for 50Ω output impedance.	
5	GND1	Ground connection for the LO and baseband amplifiers and mixers.	
6	GND1	Same as pin 5.	
7	LO IN	The input of the phase shifting network.	
8	GND3	Ground connection for the LO phase shift network.	
9	RF OUT	RF Output. An external LC matching network is needed for a 50Ω match.	
10	GND2	Ground connection for the RF output stage.	
11	GND1	Same as pin 5.	
12	PD	Power Down control. When this pin is "low", all circuits are shut off.	
13	VCC2	Power supply for all circuits except mixers and output amplifier.	
14	GND1	Same as pin 5.	
15	Q SIG	Baseband input to the Q mixer. Maximum output power is obtained when the input signal has a peak to peak amplitude of 400mV. The DC level for this pin is 1.6V, same as QREF.	See pin 2.
16	I SIG	Baseband input to the Q mixer. Maximum output power is obtained when the input signal has a peak to peak amplitude of 400mV. The DC level for this pin is 1.6V, same as QREF.	See pin 1.

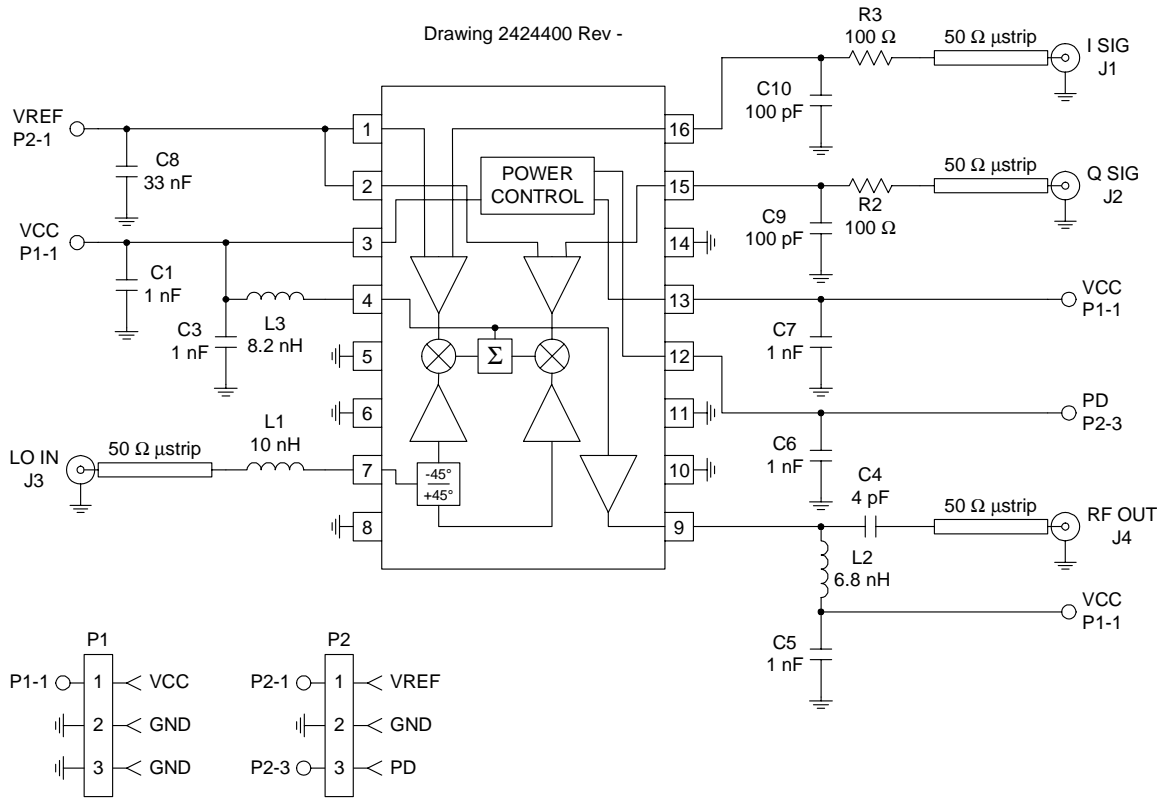
## Application Schematic



**NOTE:**  
 The values of R and C depend on the minimum baseband frequency (i.e., the cutoff frequency of this high pass filter should be lower than the lowest frequency component in the I/Q spectrum).

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

Drawing 2424400 Rev -



## Evaluation Board Layout 2" x 2"

