RF2424

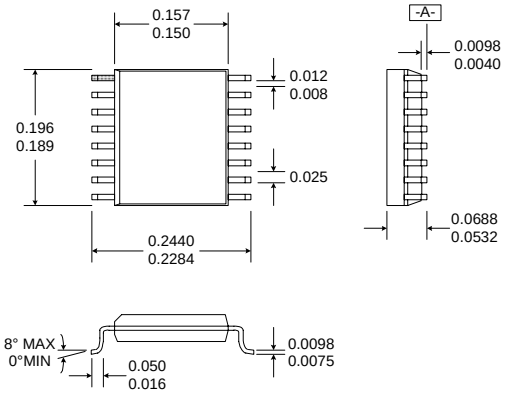
UHF QUADRATURE MODULATOR

Typical Applications

- Digital Communications Systems
- Spread Spectrum Communication Systems
- GMSK, 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.

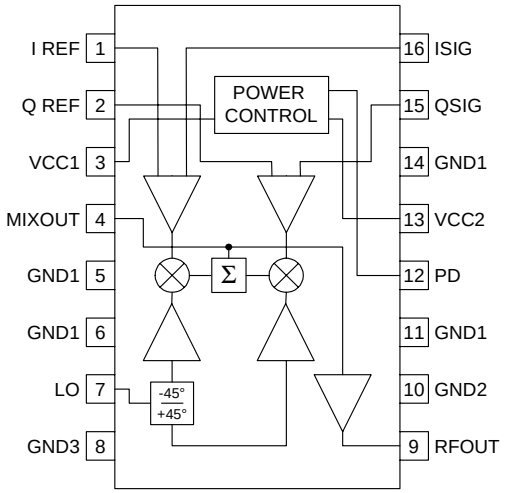


NOTES:
1. Shaded lead is Pin 1.
2. All dimensions are excluding mold flash.
3. Lead coplanarity - 0.005 with respect to datum "A".

Package Style: SSOP-16

Optimum Technology Matching® Applied

- [x] Si BJT
- [ ] Si Bi-CMOS
- [ ] GaAs HBT
- [ ] SiGe HBT
- [ ] GaAs MESFET
- [ ] Si CMOS



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

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	5.5	V_{DC}
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.

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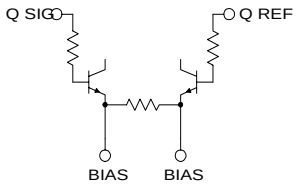
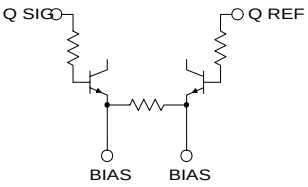
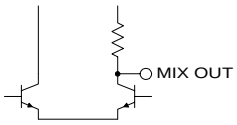
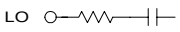
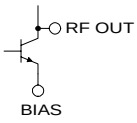
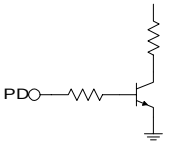
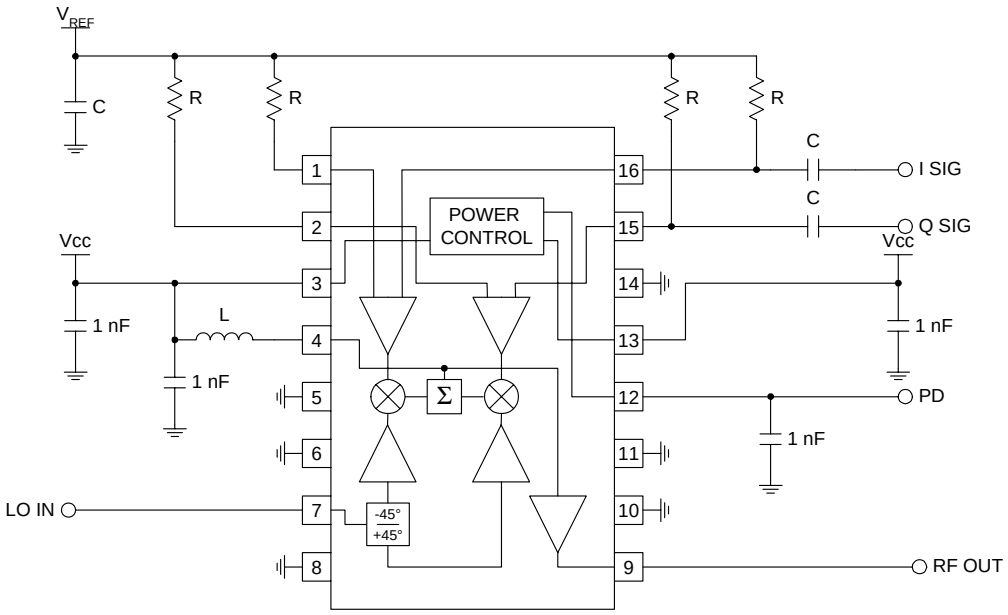
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Carrier Input					T=25 °C, V_{CC}=3V
Frequency Range	700		1000	MHz	
Power Level	-6		+6	dBm	
Input impedance		43 + j1.8		Ω	At 900MHz
Modulation Input					
Frequency Range	DC		100	MHz	
Reference Voltage (V_{REF})		1.6		V	
Maximum Modulation (I&Q)		V_{REF} ± 0.3		V	
Gain Asymmetry		0.2		dB	
Quadrature Phase Error		1		°	
Input DC Resistance		40		kΩ	
Input Bias Current		40		µA	
RF Output					V_{CC}=3V, LO power=-3dBm, LO freq=900MHz, I/Q drive level=0.2V_P, 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_3 Suppression	25	30		dB	DSB output (+9dBm total power)
Power Down					
Turn On/Off Time			100	ns	
PD Input Resistance	10			kΩ	
Power Down “ON”		V_{CC}		V	
Power Down “OFF”	1.0	1.2		V	
Power Supply					
Voltage	2.7		5.5	V	
Current		45	55	mA	V_{CC}=3V
		53		mA	V_{CC}=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 ±20mV 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 ±20mV 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.

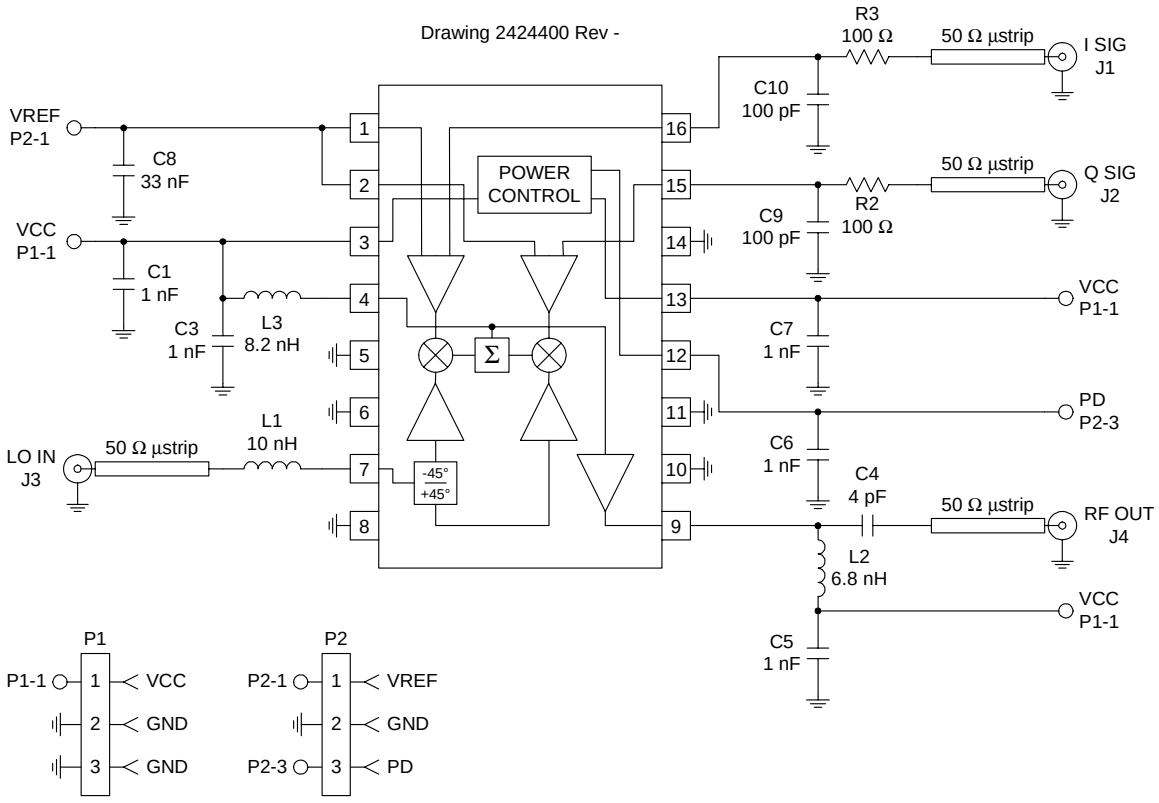
Application Schematic



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 from www.rfmd.com.)



Evaluation Board Layout
2” x 2”