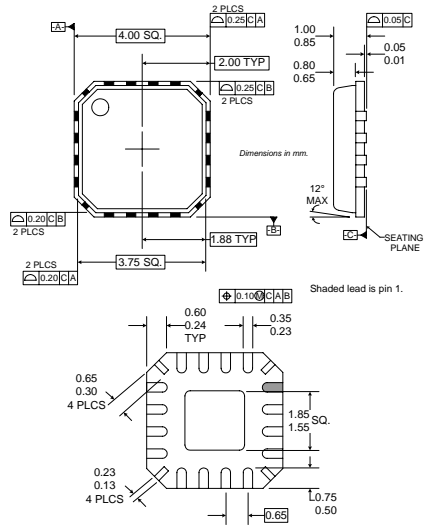


- ### Typical Applications
- 915MHz ISM Band Products
 - Quadrature Modulation
 - Digital Communications
 - Portable Battery-Powered Equipment

Product Description

The RF2942 is an integrated power amplifier and quadrature modulator IC. The quadrature modulator is driven with a single-ended local oscillator (LO) source. The quadrature phase generation of the LO is accomplished using an internal passive network tuned for twice the operating frequency. The LO frequency is at twice the RF frequency to avoid interfering with an external synthesizer.



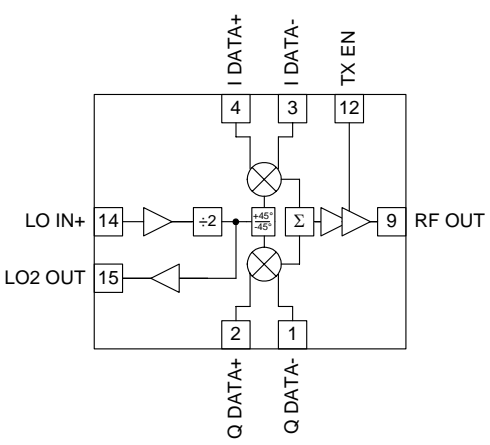
Optimum Technology Matching® Applied

- | | | |
|-------------------------------------|-----------------------------------|--|
| <input type="checkbox"/> Si BJT | <input 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 checked="" type="checkbox"/> SiGe Bi-CMOS |

Package Style: QFN, 16-Pin, 4x4

Features

- 2.0V to 3.6V Power Supply
- 902MHz to 928MHz Frequency Range
- 200mW Output Power
- Low LO Input Level
- Low Broadband Noise Floor
- Small Footprint



Functional Block Diagram

Ordering Information

- | | |
|-------------|--|
| RF2942 | UHF Quadrature Modulator and Transmitter |
| RF2942 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>

RF2942

Absolute Maximum Ratings

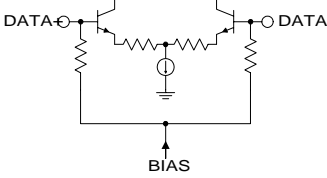
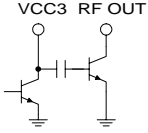
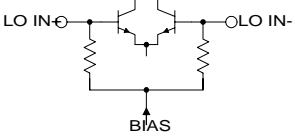
Parameter	Rating	Unit
Supply Voltage	-0.5 to +3.6	V _{DC}
Power Down Voltage (V _{PD})	V _{CC} +0.4	V _{DC}
Input LO and RF Levels	+6	dBm
Operating Ambient Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C



Caution! ESD sensitive device.

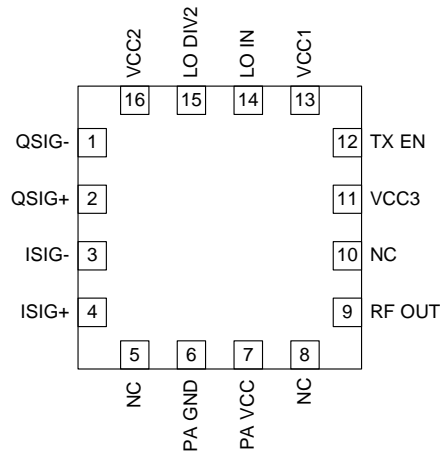
RF Micro Devices believes the furnished information is correct and accurate at the time of this printing. However, RF Micro Devices reserves the right to make changes to its products without notice. RF Micro Devices does not assume responsibility for the use of the described product(s).

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Power Supply					
Voltage	2.0	2.8	3.6	V	Specifications Operating limits TXEN=0.0V T=25 °C, V _{CC} =2.8V
Current	170	225	260	mA	
	10		24	mA	
Carrier Input (LO IN)					
Frequency Range		1800 to 1860		MHz	1830MHz
Power Level	-15	-6		dBm	
Input Impedance		50		Ω	
Modulation Input					
Frequency Range	DC	2	10	MHz	50Ω source, I,Q=400mV _{p-p} Differential
Modulation for P _{OUT} Power (I & Q)		400		mV _{p-p}	
Quadrature Phase Error		±2	±5	°	
I/Q Amplitude Imbalance		0.2		dB	
Input Impedance		≥10		kΩ	
RF Output					
Power Output		23		dBm	T=25°C, V _{CC} =2.8V, LO power=-6dBm, SSB, I/Q=400mV _{p-p} sine wave, 500kHz V _{CC} =3.0V V _{CC} =2.8V Modulation DC offset can be externally adjusted for optimum suppression. Carrier suppression is then typically better than 40dB.
Second Harmonic Output	21	22	27	dBm	
Third Harmonic Output	-20	-25		dBc	
Sideband Suppression	-35	-45		dBc	
Carrier Suppression	-25	-40		dBc	
Broadband Noise Floor		-90		dBm/Hz	

Pin	Function	Description	Interface Schematic
1	QSIG-	Reference voltage for the I and Q mixer. This voltage should be the same as the DC voltage supplied to the I and Q SIG pin. To obtain a carrier suppression of better than 40dB it may be tuned $\pm 0.15V$ (relative to the I and Q SIG DC voltage). Without tuning, the carrier suppression will typically be better than 25dB. The input impedance of this pin is typically $>10 k\Omega$.	
2	QSIG+	Same as pin 1, except complementary input.	See pin 1.
3	ISIG-	Same as pin 4, except complementary input.	See pin 1.
4	ISIG+	This pin is used to supply V_{CC} to the modulator circuits. A RF bypass capacitor should be connected directly to this and ground. Baseband input to the I mixer. A DC bias of approximately 1.2V is present at this pin. A DC blocking capacitor is needed if the signal has a different DC level. Maximum output power is obtained when the input signal has a peak to peak amplitude of 1V. The input impedance of this pin is about $3 k\Omega$. The SIG- and SIG+ inputs are interchangeable. If swapping the I SIG+ and I SIG- pins, the Q SIG+ and Q SIG- also need to be swapped to maintain the correct phase. The SIG+ and SIG- pins may be driven differentially for BPSK to increase conversion gain.	See pin 1.
5	N/C	No connection.	
6	GND		
7	PA VCC	Voltage supply for PA driver.	
8	N/C	No connection.	
9	RF OUT	Power Amp output, open collector output.	
10	N/C	No connection.	
11	VCC3	Voltage supply for PA buffer.	
12	TX EN	TX enabled when $>2.0V$. When TX EN is held low, only the LO buffer, LO divider and LO divider buffer are left on. To power all of the circuitry down, TX EN and VCC1 must be held low.	
13	VCC1	Voltage supply for LO buffer and divider.	
14	LO IN	The LO input level should be greater than $-15dBm$ for proper operation.	
15	LO/2 OUT	LO divide-by-2 output.	
16	VCC2	Voltage supply for mixers.	

RF2942

Pin Out



Theory of Operation

Modulator

The modulator is a direct conversion double balanced quadrature mixer architecture. The local oscillator signal is buffered then split with internal phase shifters that are optimized for twice the operating frequency. The LO buffer provides isolation from load changes that may occur as the power amplifier section is turned on and off. In addition, the LO buffer may be left on when the transmit section is turned off to prevent load pulling of the external oscillator, by holding TX EN low and leaving the bias on VCC1.

The baseband I and Q pins are connected to the internal mixer bias, therefore it is recommended that the modulation signal be DC-blocked if a similar external reference voltage cannot be provided. The baseband drive may be either single-ended with the complementary input AC-grounded with a capacitor or driven differentially.

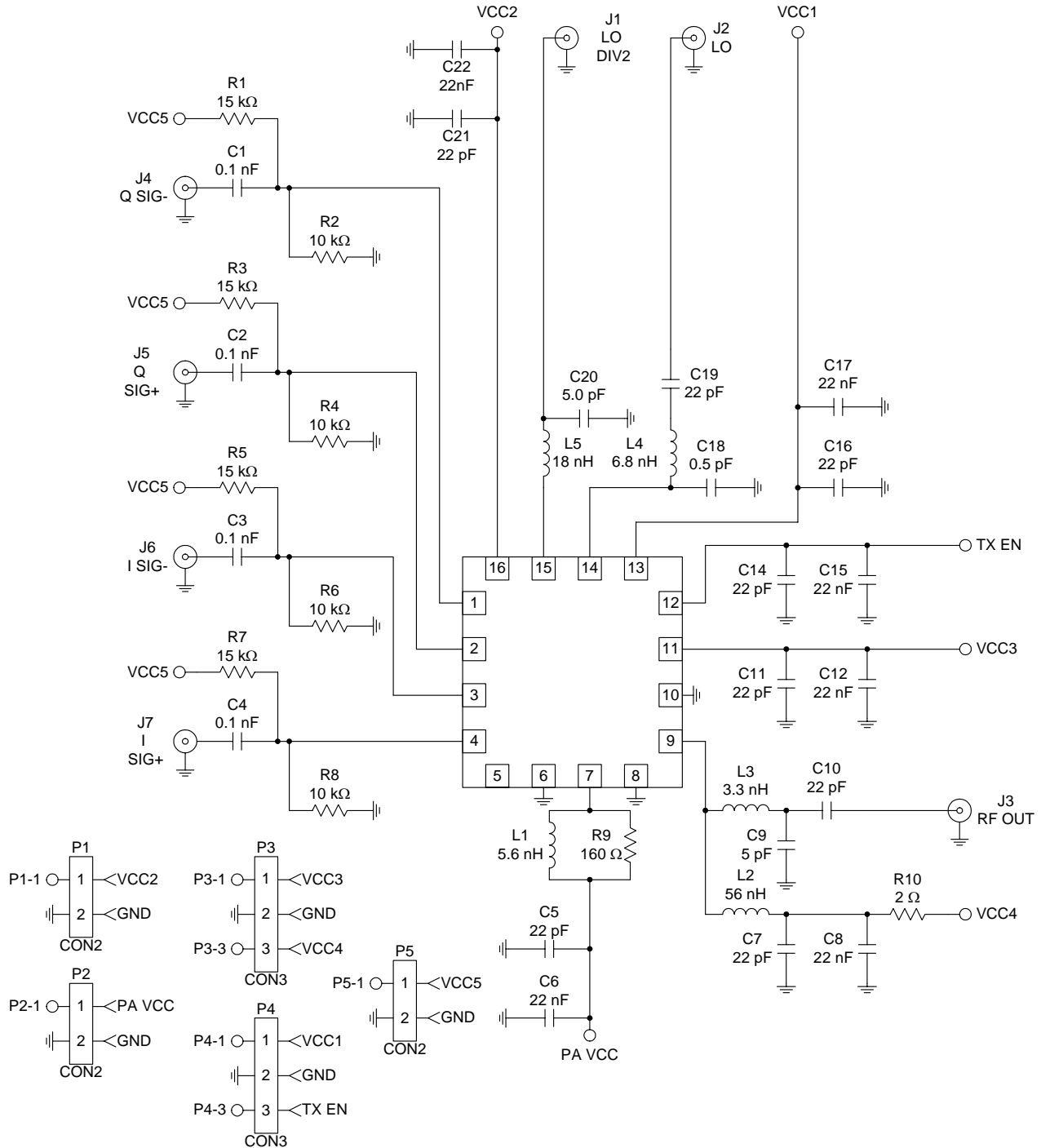
Power Amplifier

The power amplifier requires matching on the output (RF OUT) and the interstage transistor (PA VCC).

RF2942

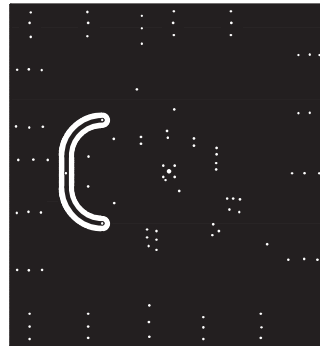
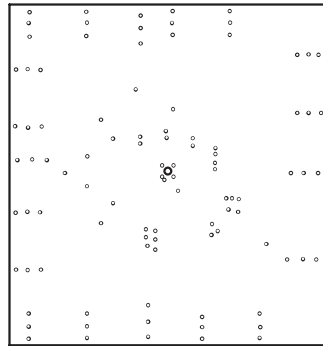
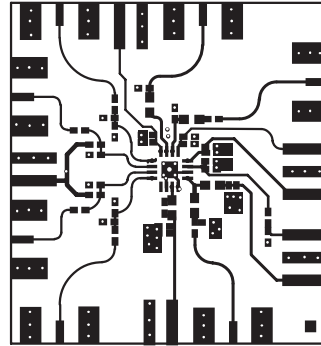
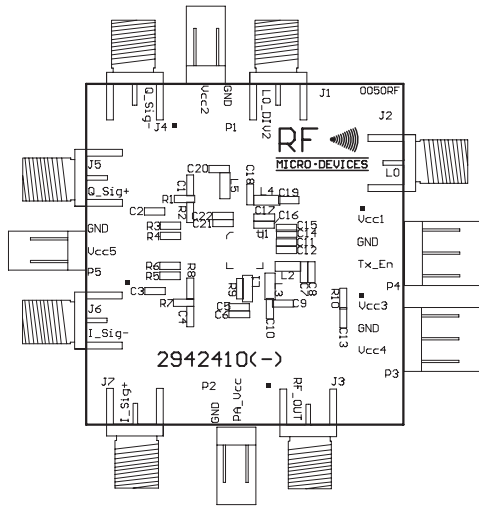
Evaluation Board Schematic - 915MHz

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



Evaluation Board Layout Board Size 1.4" x 1.5"

Board Thickness 0.032", Board Material FR-4, Multi-Layer



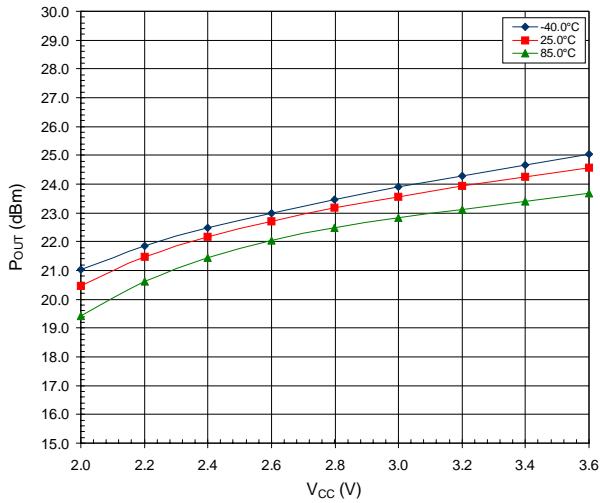
RF2942

Graphs

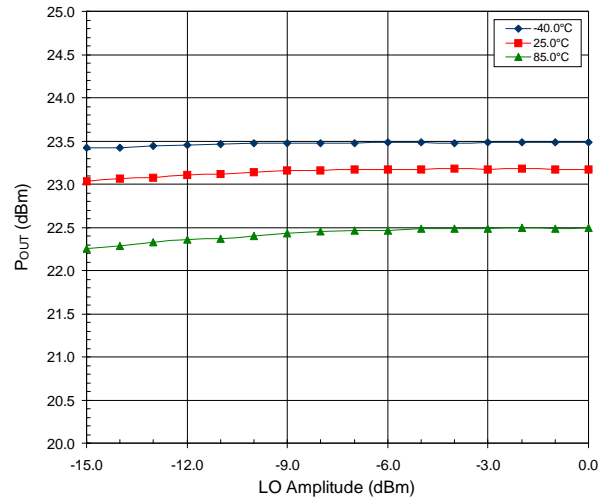
Unless swept, the conditions for the subsequent graphs are as follows. All cable losses accounted for in measurements.

VCC=2.8V I/Q Frequency=1MHz
 LO Frequency=1830MHz I/Q Amplitude=400mV_{P-P}
 LO Amplitude=-6dBm I/Q Phase=90°

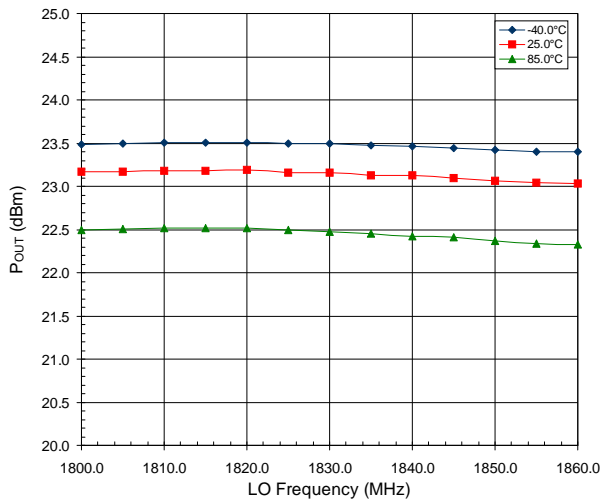
P_{OUT} versus V_{CC} Over Temperature



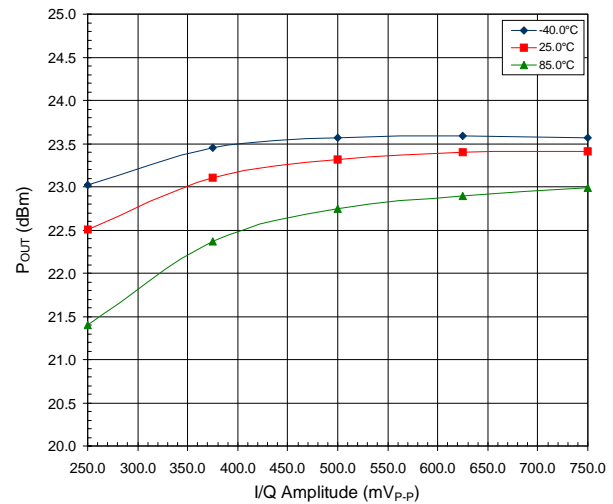
P_{OUT} versus LO Amplitude Over Temperature



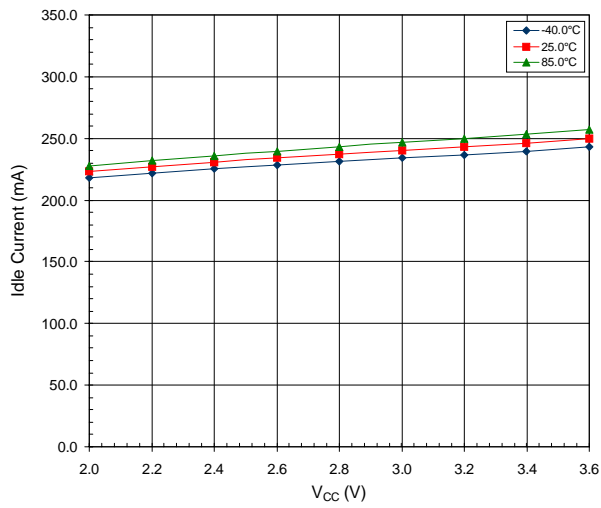
P_{OUT} versus LO Frequency Over Temperature



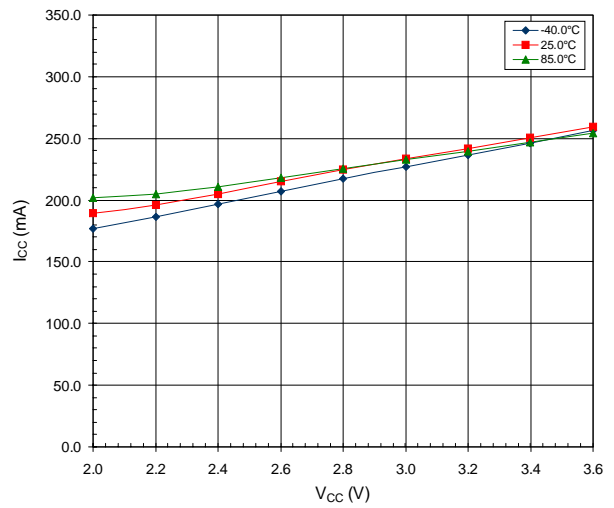
P_{OUT} versus I/Q Amplitude Over Temperature



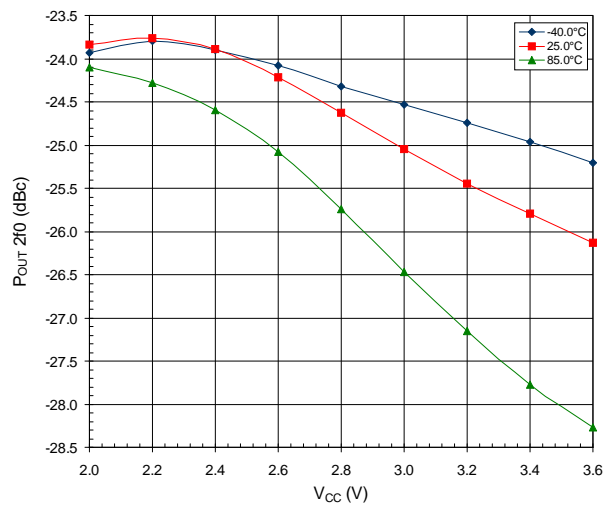
Idle Current versus V_{CC} Over Temperature



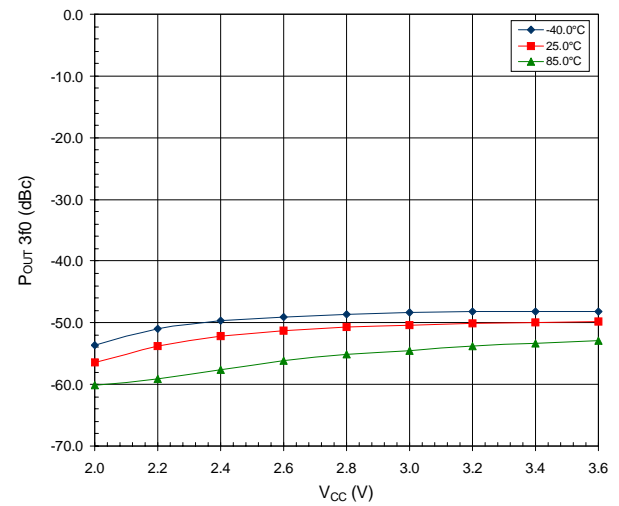
I_{CC} versus V_{CC} Over Temperature



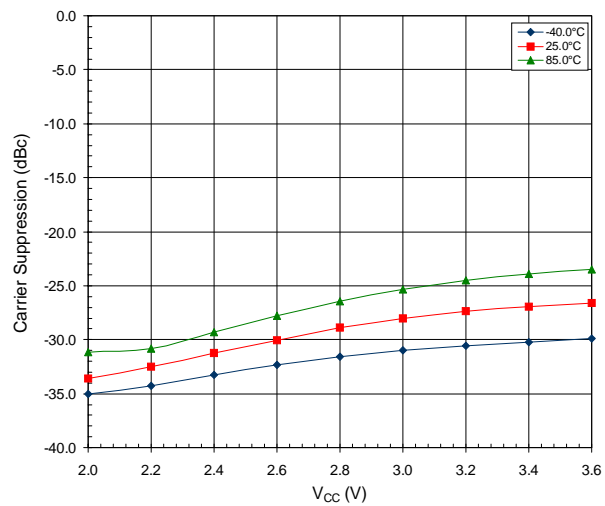
P_{OUT} 2f0 versus V_{CC} Over Temperature



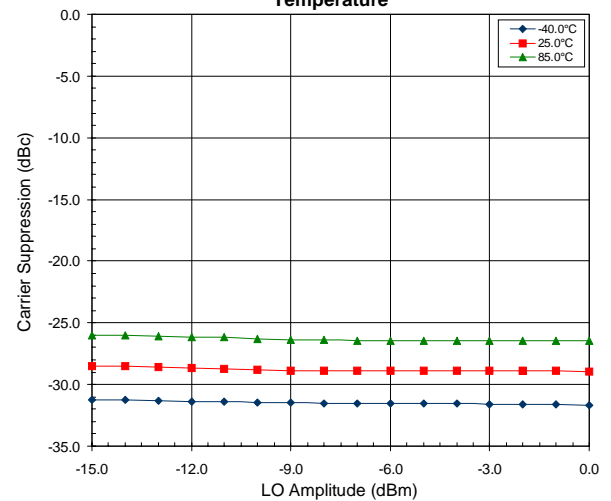
P_{OUT} 3f0 versus V_{CC} Over Temperature



Carrier Suppression versus V_{CC} Over Temperature

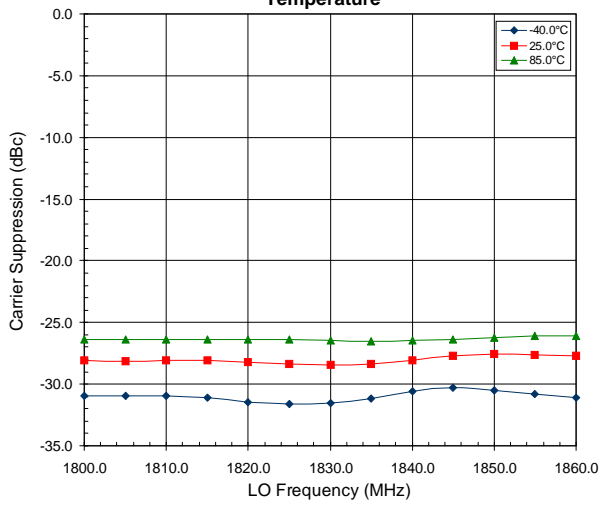


Carrier Suppression versus LO Amplitude Over Temperature

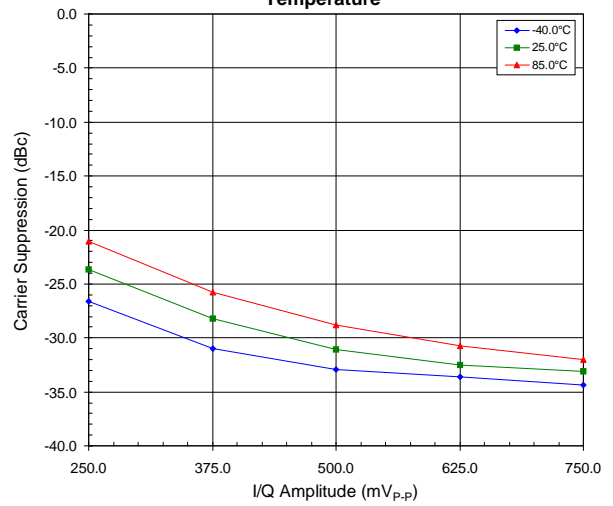


RF2942

Carrier Suppression versus LO Frequency Over Temperature



Carrier Suppression versus I/Q Amplitude Over Temperature



Carrier Suppression versus I/Q Phase Over Temperature

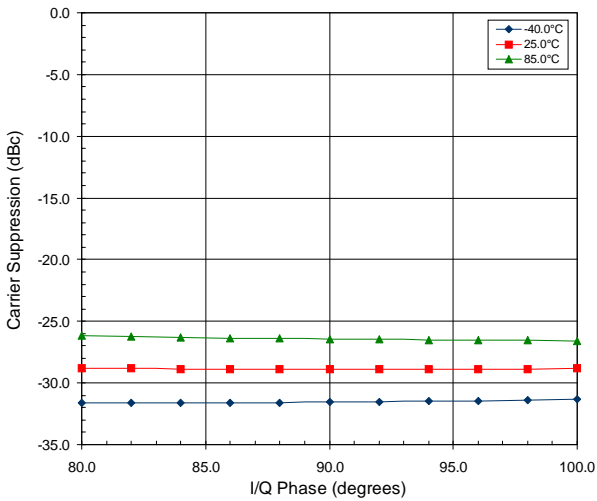


Image Suppression versus V_{CC} Over Temperature

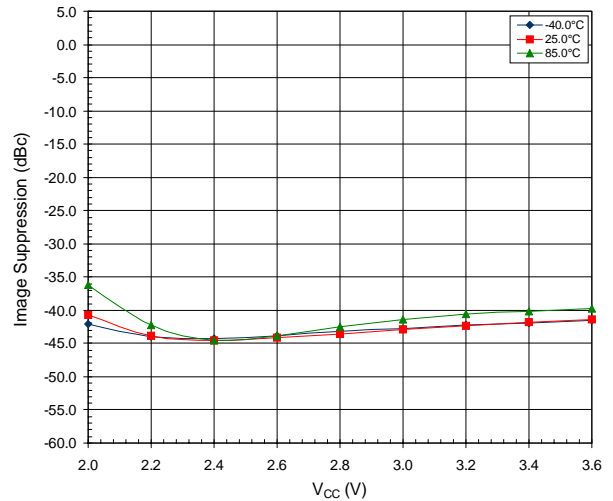


Image Suppression versus LO Amplitude Over Temperature

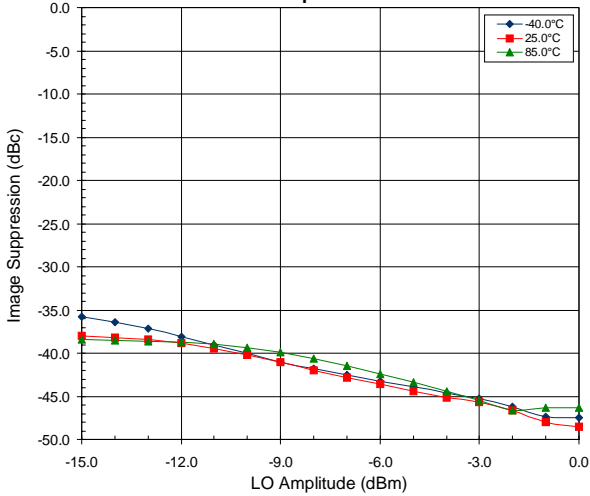


Image Suppression versus LO Frequency Over Temperature

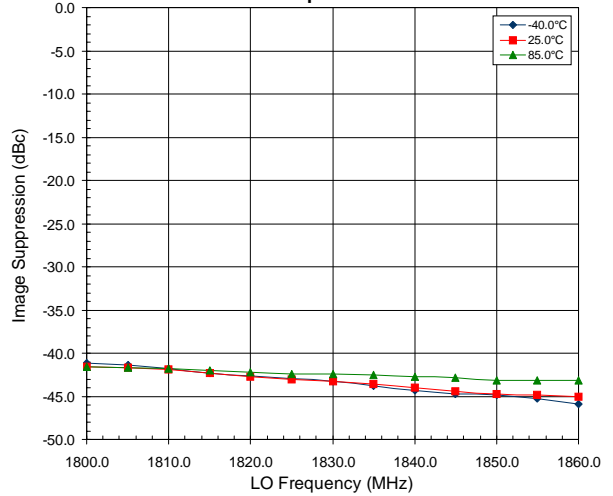


Image Suppression versus I/Q Amplitude Over Temperature

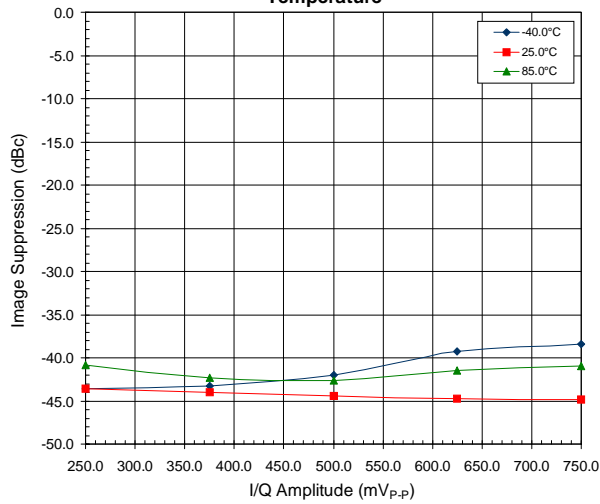
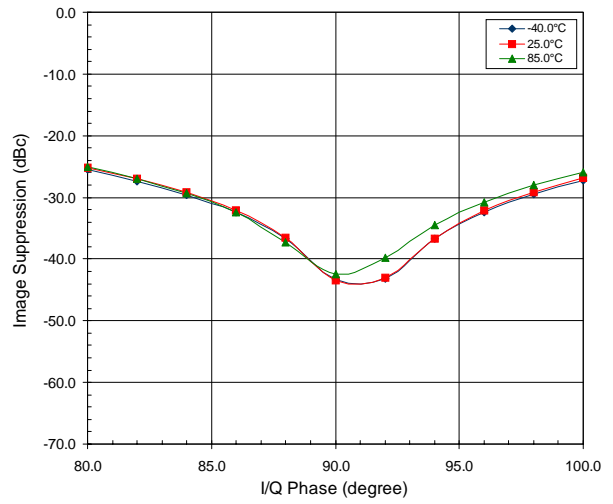
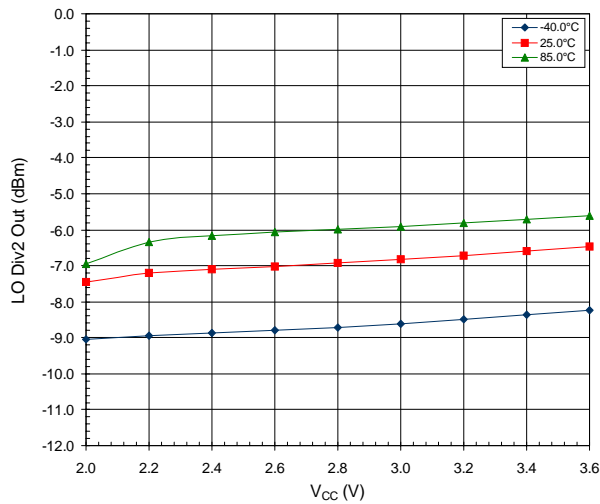


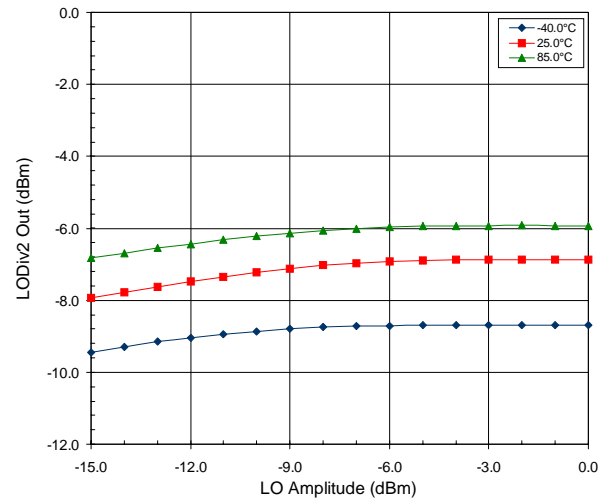
Image Suppression versus I/Q Phase Over Temperature



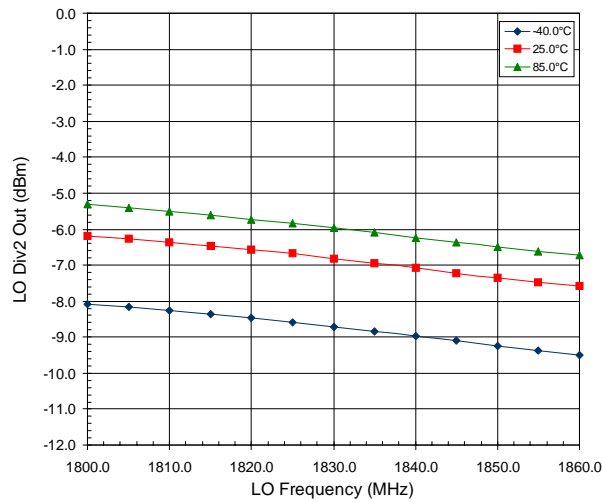
LO Div2 Out versus V_{CC} Over Temperature



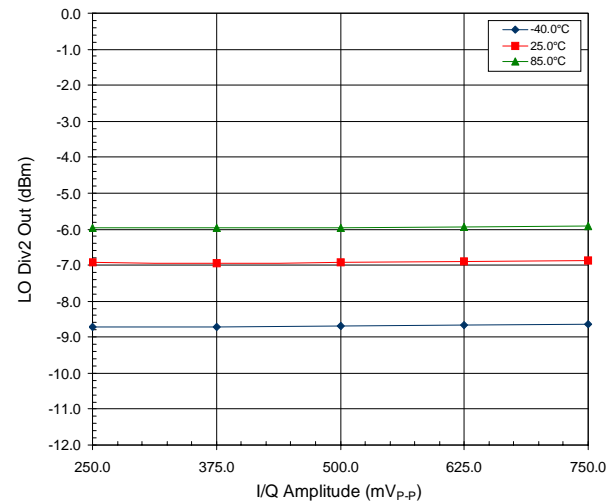
LO Div2 Out versus LO Amplitude Over Temperature



LO Div2 Out versus LO Frequency Over Temperature



LO Div2 Out versus I/Q Amplitude Over Temperature



RF2942