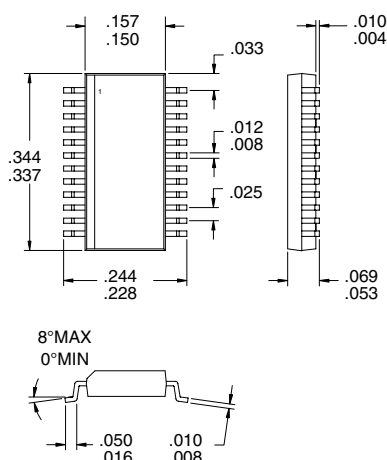


Typical Applications

- CDMA/FM Cellular Systems
- CDMA PCS Systems
- Wireless Local Loop Systems
- Spread Spectrum Cordless Phones
- High Speed Data Modems
- General Purpose Digital Receivers

Product Description

The RF9957 is an integrated complete IF AGC amplifier and Quadrature Demodulator designed for the receive section of dual-mode CDMA/FM cellular and PCS applications. It is designed to amplify received IF signals, while providing 100dB of gain control range, and demodulate to baseband I and Q signals. Noise Figure, IP_3 , and other specifications are designed to be compatible with the IS-98 and J-STD-018 Interim Standard for CDMA cellular communications. The IC is manufactured on an advanced 15GHz F_T Silicon Bipolar process, and is packaged in a standard miniature 24-lead plastic SSOP package.



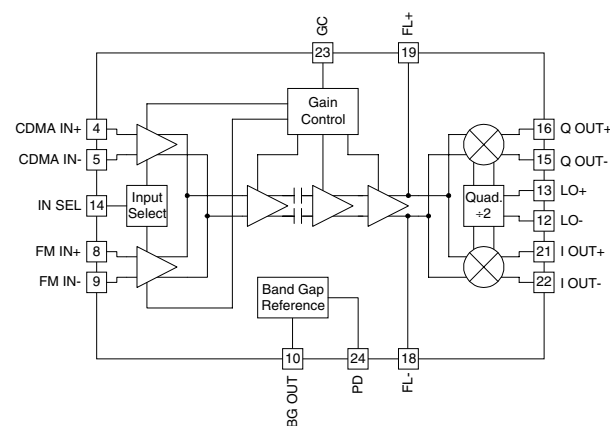
Optimum Technology Matching® Applied

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

Package Style: SSOP-24

Features

- Supports Dual Mode Operation (CDMA and FM)
- Digitally Controlled Power Down Mode
- 2.7V to 3.3V Operation
- Quadrature LO Divider
- IF AGC Amp with 100dB Gain Control



Functional Block Diagram

Ordering Information

- | | |
|-------------|-------------------------------------|
| RF9957 | CDMA/FM Receive AGC and Demodulator |
| RF9957 PCBA | Fully Assembled Evaluation Board |

RF Micro Devices, Inc.
7625 Thorndike Road
Greensboro, NC 27409, USA

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

Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	-0.5 to +5	V _{DC}
Power Down Voltage (V _{PD})	-0.5 to V _{CC} +0.7	V _{DC}
Input RF Power	+3	dBm
Ambient Operating Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C

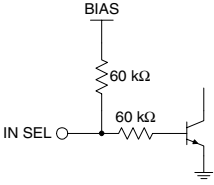
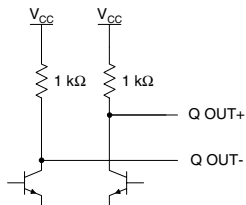
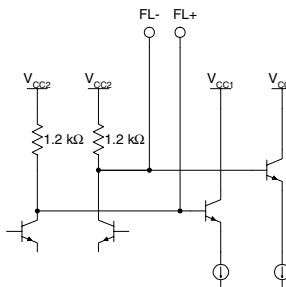
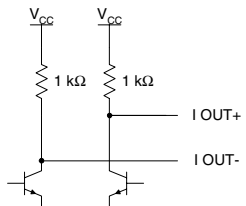
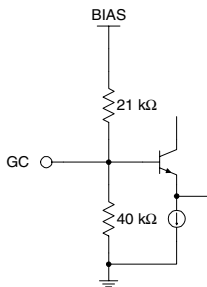
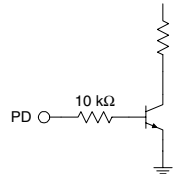


Caution! ESD sensitive device.

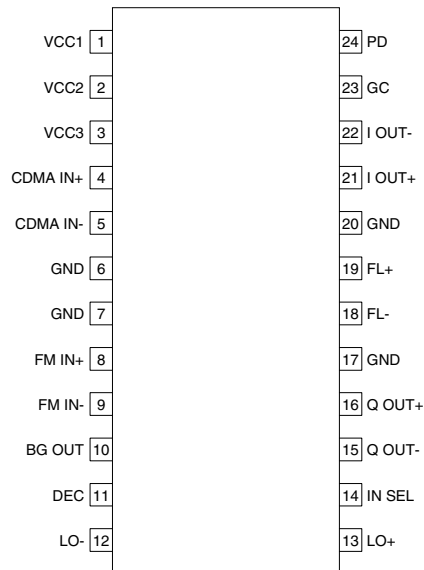
RF Micro Devices believes the furnished information is correct and accurate at the time of this printing. However, RF Micro Devices reserves the right to make changes to its products without notice. RF Micro Devices does not assume responsibility for the use of the described product(s).

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Overall (Cascaded)					T=25 °C, V _{CC} =3.0V, Z _{LOAD} =5kΩ, LO=170MHz @400mV _{PP} IF Freq=85MHz, Z _S =500Ω (CDMA), Z _S =850Ω (FM)
Maximum Gain	+45	+50		dB	V _{GC} =2.5V, FM or CDMA Input, Balanced
Minimum Gain		-55	-50	dB	V _{GC} =0.5V, FM or CDMA Input, Balanced
Gain Variation vs. V _{CC} and T	-3		+3	dB	V _{CC} =2.7V to 3.3V and T=-30°C to +85°C
Input IP3		-50		dBm	V _{GC} =2.5V, Maximum Gain
	-39	-36		dBm	Gain = 35 dB, P _{IN} =-61dBm
Noise Figure		-4		dBm	V _{GC} =0.5V, Minimum Gain
		5		dB	V _{GC} =2.5V, Maximum Gain
		70		dB	V _{GC} =0.5V, Minimum Gain
IF Input Frequency Range		50 to 250		MHz	
IF Input Impedance	2040	2400	2760	Ω	FM or CDMA, Balanced
	1020	1200	1380	Ω	FM or CDMA, Single Ended
I/Q Frequency Range		0 to 50		MHz	
I/Q Amplitude Balance		0.1	0.5	dB	
I/Q Phase Balance		1	5	deg	
Max I/Q Output Voltage	500			mV _{PP}	Balanced, maximum output level
I/Q DC Output		2.0		V _{DC}	Common Mode
I/Q DC Offset		5	20	mV _{DC}	I OUT+ to I OUT-; Q OUT+ to Q REF-
LO Input Frequency Range		100 to 500		MHz	
LO Input Level		60 to 600		mV _{PP}	Balanced
LO Input Impedance	680	800	920	Ω	Balanced
	340	400	460	Ω	Single Ended
Power Supply					
Supply Voltage	2.7	3.0	3.3	V _{DC}	
Current Consumption		14.5	18	mA	CDMA Mode
		12.5	16	mA	FM Mode
			10	μA	Sleep Mode (PD≤0.5V)

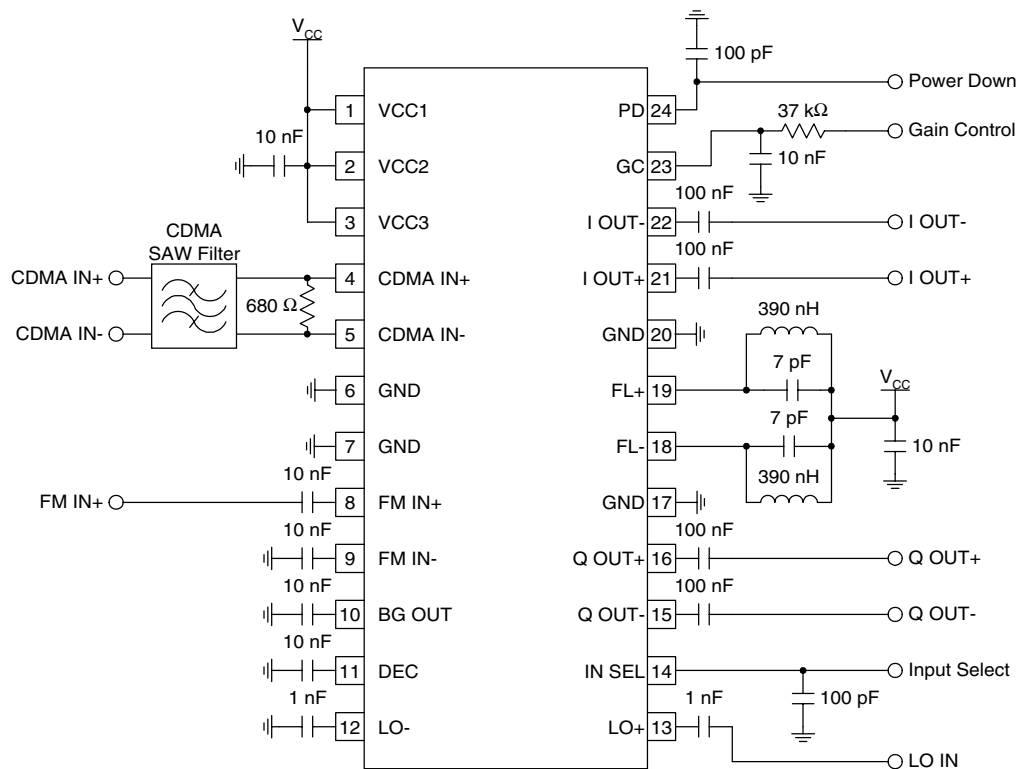
Pin	Function	Description	Interface Schematic
1	VCC1	Supply voltage for the LO flip-flop divider and limiting amp. This pin may be connected in parallel with pins 2 and 3. It should be bypassed by a 10nF capacitor. The trace length between the pin and the bypass capacitor should be minimized. The ground side of the bypass capacitor should connect immediately to ground plane. The part is designed to work from a 2.7V to 3.3V supply.	
2	VCC2	Supply voltage for the bandgap, gain control bias circuitry, and AGC stages 2, 3, and 4. This pin may be connected in parallel with pins 1 and 3. It should be bypassed by a 10nF capacitor. The trace length between the pin and the bypass capacitor should be minimized. The ground side of the bypass capacitor should connect immediately to ground plane. The part is designed to work from a 2.7V to 3.3V supply.	
3	VCC3	Supply voltage for the FM and CDMA AGC input stages. This pin may be connected in parallel with pins 1 and 2. It should be bypassed by a 10nF capacitor. The trace length between the pin and the bypass capacitor should be minimized. The ground side of the bypass capacitor should connect immediately to ground plane. The part is designed to work from a 2.7V to 3.3V supply.	
4	CDMA IN+	CDMA Balanced Input pin. This pin is internally DC biased and should be DC blocked if connected to a device with a DC level present. For single-ended input operation, one pin is used as an input and the other CDMA input is AC coupled to ground. The balanced input impedance is 2.4k Ω , while the single-ended input impedance is 1.2k Ω .	
5	CDMA IN-	Same as pin 4, except complementary input.	See pin 4.
6	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
7	GND	Same as pin 6.	
8	FM IN+	FM Balanced Input pin. This pin is internally DC biased and should be DC blocked if connected to a device with DC present. For single-ended input operation, one pin is used as an input and the other FM input is AC coupled to ground. The balanced input impedance is 2.4k Ω , while the single-ended input impedance is 1.2k Ω .	
9	FM IN-	Same as pin 8, except complementary input.	See pin 8.
10	BG OUT	Bandgap Voltage Reference. This voltage, constant over temperature and supply variation, is used to bias internal circuits. A 10nF external bypass capacitor is required. The trace length between the pin and the bypass capacitor should be minimized. The ground side of the bypass capacitor should connect immediately to ground plane.	
11	DEC	AGC decoupling pin. An external bypass capacitor of 10nF capacitor is required. The trace length between the pin and the bypass capacitor should be minimized. The ground side of the bypass capacitor should connect immediately to ground plane.	
12	LO-	LO Balanced Input pin. This pin is internally DC biased and should be DC blocked if connected to a device with DC present. For single-ended input operation, one pin is used as an input and the other LO input is AC coupled to ground. The frequency of the signal applied to these pins is internally divided by a factor of 2, hence the carrier frequency for the modulator becomes one half of the applied frequency. The single-ended input impedance is 400 Ω (balanced is 800 Ω). The LO input may be driven single-ended but balanced provides optimum gain and phase balance.	
13	LO+	Same as pin 12, except complementary input.	See pin 12.

14	IN SEL	Selects between CDMA and FM mode. This is a digitally controlled input. A logic "high" ($\geq V_{CC}-0.7V_{DC}$) selects CDMA mode. A logic "low" ($<0.5V_{DC}$) selects FM mode. In FM mode, ONLY the I mixer is active. There is no Q output in FM mode. The impedance on this pin is 30k Ω .	
15	Q OUT-	Balanced Baseband Output of Q Mixer. This pin is internally DC biased and should be DC blocked externally. This output is active in CDMA mode, but is NOT active in FM mode. The output can be used in a single-ended configuration by leaving one of the two pins unconnected, however half the output voltage will be lost. Each pin should be loaded with 2.5k Ω . The balanced load should be 5k Ω . The single-ended output impedance is 1k Ω , while the balanced output impedance is 2k Ω .	
16	Q OUT+	Same as pin 15, except complementary output.	See pin 15.
17	GND	Same as pin 6.	
18	FL-	Balanced AGC Output/Demod Input. This balanced node is pinned out to allow shunt filtering of the AGC output signal as it enters the demodulator. The basic configuration of the filter should consist of a shunt inductor and shunt capacitor, both connected to the power supply, as the internal circuitry requires this power supply connection through the inductor to operate.	
19	FL+	Same as pin 18, except complementary.	See pin 18.
20	GND	Same as pin 6.	
21	I OUT+	Balanced Baseband Output of I Mixer. This pin is internally DC biased and should be DC blocked externally. This output is active in both CDMA and FM modes. The output can be used in a single-ended configuration by leaving one of the two pins unconnected, however half the output voltage will be lost. Each pin should be loaded with 2.5k Ω . The balanced load should be 5k Ω . The single-ended output impedance is 1k Ω , while the balanced output impedance is 2k Ω .	
22	I OUT-	Same as pin 21, except complementary output.	See pin 22.
23	GC	Analog Gain Control for AGC Amplifiers. The valid control range is from 0.5 to 2.5V $_{DC}$. These voltages are valid for ONLY a 37k Ω source impedance. The gain range for the AGC is 95dB.	
24	PD	Power Down Control. When logic "high" ($\geq V_{CC}-0.3V$), all circuits are operating; when logic "low" ($\leq 0.5V$), all circuits are turned off. The input impedance of this pin is 10k Ω .	

RF9957 Pin-Out



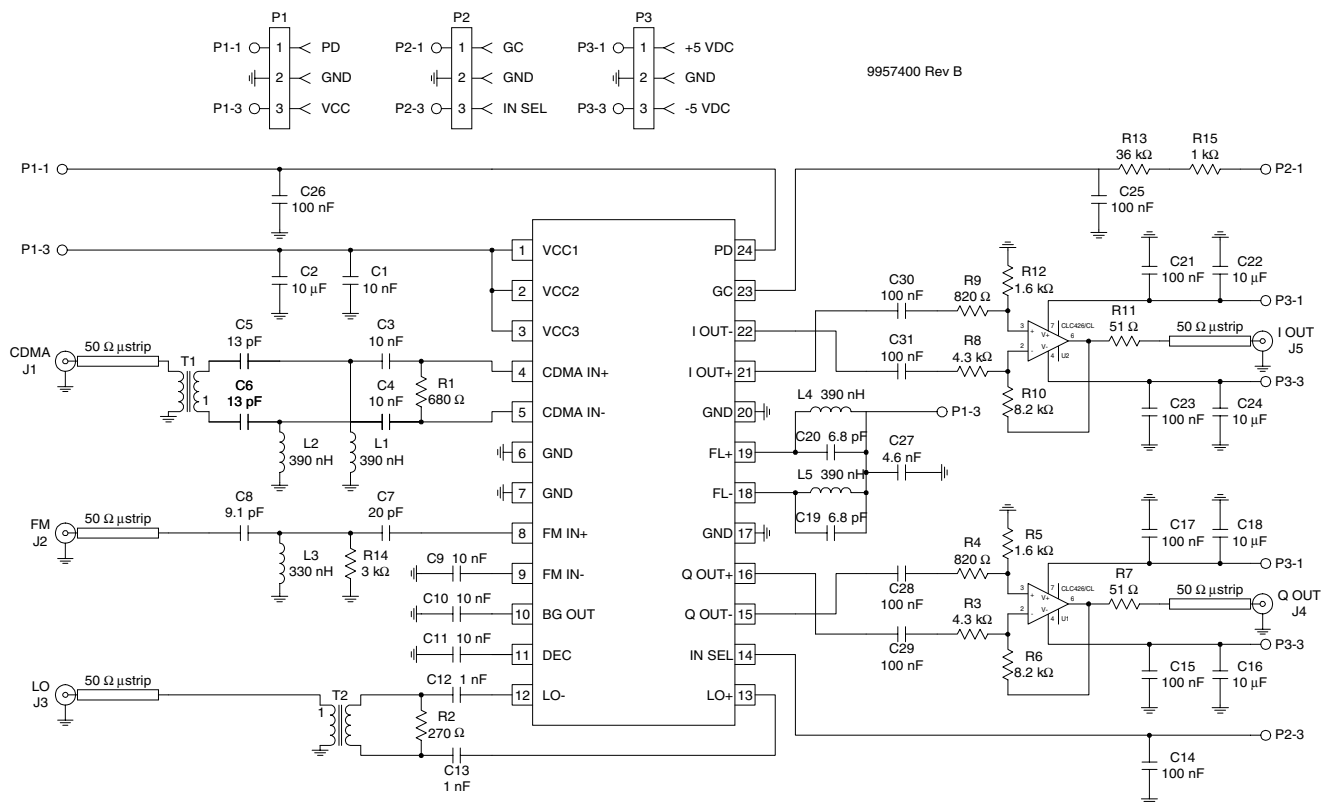
Application Schematic



Evaluation Board Schematic

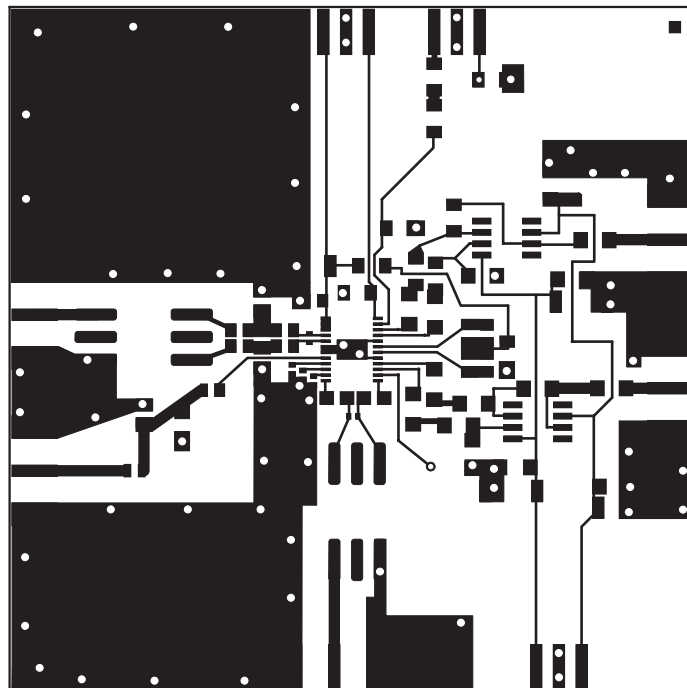
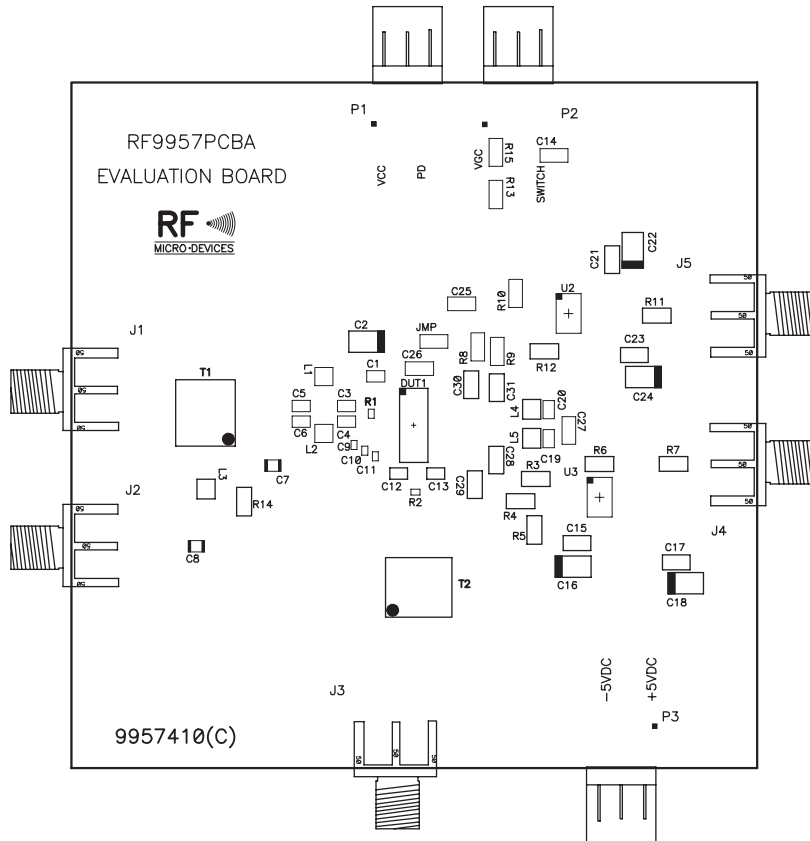
(Download [Bill of Materials](http://www.rfmd.com) from www.rfmd.com.)

9957400 Rev B

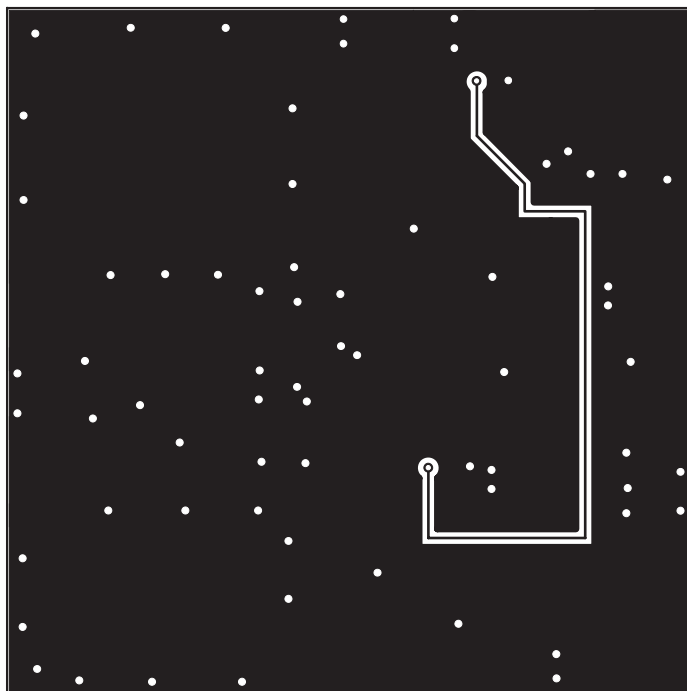


Evaluation Board Layout 3.025" x 3.025"

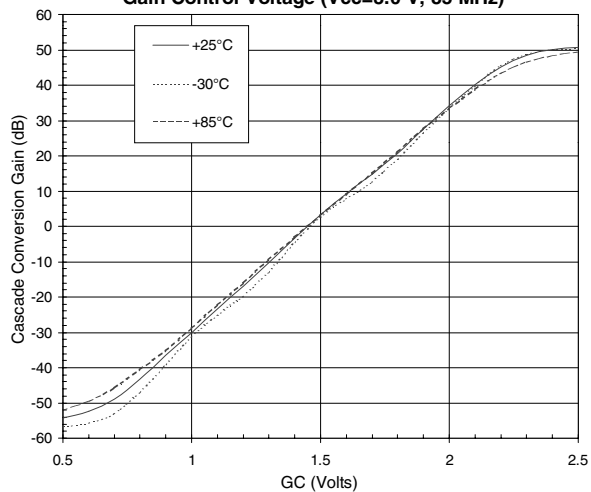
(Assembly, Top layer, Bottom layer)



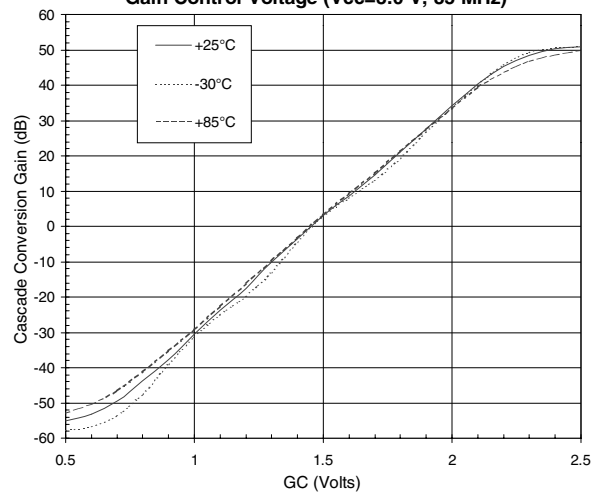
Evaluation Board Layout cont'd



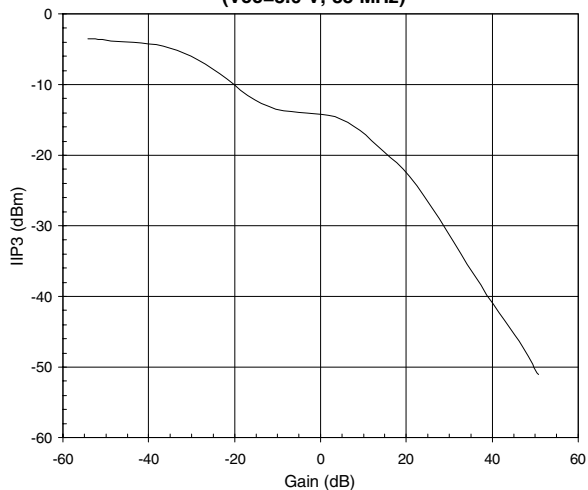
RF9957 CDMA Cascade Conversion Gain vs. Gain Control Voltage ($V_{CC}=3.0$ V, 85 MHz)



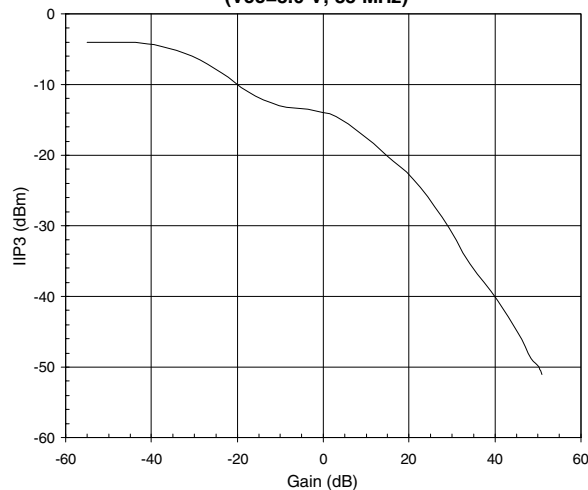
RF9957 FM Cascade Conversion Gain vs. Gain Control Voltage ($V_{CC}=3.0$ V, 85 MHz)



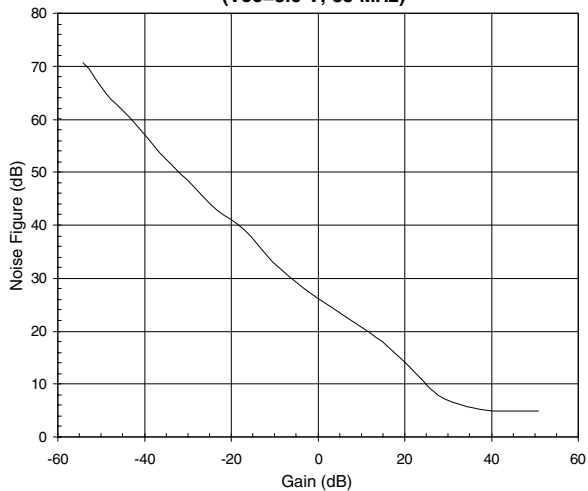
RF9957 CDMA IIP3 vs. Gain ($V_{CC}=3.0$ V, 85 MHz)



RF9957 FM IIP3 vs. Gain ($V_{CC}=3.0$ V, 85 MHz)



RF9957 CDMA Noise Figure vs. Gain ($V_{CC}=3.0$ V, 85 MHz)



RF9957 FM Noise Figure vs. Gain ($V_{CC}=3.0$ V, 85 MHz)

