

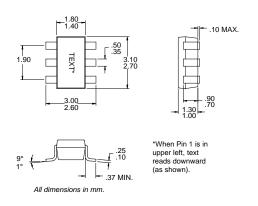
PCS/CELLULAR TDMA/CDMA/W-CDMA LINEAR VARIABLE GAIN AMPLIFIER

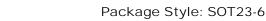
**RF2377** 

Typical Applications

- CDMA PCS/Cellular Handsets
- TDMA PCS/Cellular Handsets
- Product Description

The RF2377 is a linear variable gain amplifier suitable for use in TDMA and CDMA systems in the cellular or PCS band and for W-CDMA systems. The features of this device include linear gain control, high gain, and high linearity. The IC is manufactured on an advanced Gallium Arsenide Heterojunction Bipolar Transistor (GaAs HBT) process and is featured in an industry-standard miniature 6-lead plastic SOT package.





W-CDMA Handsets

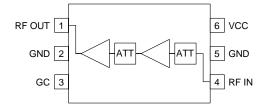
#### Features

- 50dB Linear Gain Control Range
- 24dB Maximum Gain
- Single 2.7V to 3.3V Supply
- 45mA Supply Current
- High Linearity

Ordering Information				
RF2377 PCS/Cellular TDMA/CDMA/W-CDMA Linear Vari- able Gain Amplifier				
RF2377-410 PCBAFully Assembled Evaluation Board, PCS RF2377-411 PCBAFully Assembled Evaluation Board, W-CDMA				
RF Micro Devices, Inc. 7625 Thorndike Road Greensboro, NC 27409, USA	Tel (336) 664 1233 Fax (336) 664 0454 http://www.rfmd.com			

Optimum Technology Matching® Applied

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

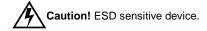


Functional Block Diagram

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### **Absolute Maximum Ratings**

Parameter	Rating	Unit
Supply Voltage	0 to +5.0	V <sub>DC</sub>
DC Current	100	mA
Operating Ambient Temperature	-20 to +85	°C
Storage Temperature	-40 to +150	°C



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Min.     Typ.     Max.     Vcc=2.8V, Vgc=2.0V, T=25 °C       Usable Frequency Range Linear Gain Control Range Gain Control Slope     50     600 to 2200     MHz     Vcc=2.8V, Vgc=2.0V, T=25 °C       Operating Frequency Maximum Small Signal Gain     22     24     27     dB     Vcc=2.8V, Vgc=2.0V, T=25 °C       Operating Frequency Maximum Small Signal Gain     22     2.4     27     dB     Vcc=2.8V, Vgc=2.0V, T=25 °C       Maximum Small Signal Gain     22     2.4     27     dB     Vcc=2.8V, Vgc=2.0V, T=25 °C       Maximum Small Signal Gain     22     2.4     27     dB     Vcc=2.8V, Vgc=2.0V, T=25 °C       Maximum Small Signal Gain     22     2.4     27     dB     Maximum gain       Maximum Small Signal Gain     22     2.4     27     dB     Maximum gain       Rejection     -61     -57     dBc     TDMA modulation; Pour=+8dBm     Vcc=2.8V, Vgc=2.0V, T=25 °C       Operating Frequency     1880     MHz     dB     Maximum gain     Maximum gain       Noise Figure     7     dB     Maximum Gain     Vcc=2.0V, T=25 °C     Vcc=2.0V, T=25 °C	Demonster	Specification			11		
Usable Frequency Range Linear Gain Control Range Gain Control Slope800 to 2200MHz dBLinear Gain Control Range Gain Control Slope70dB/VTDMA Operating Frequency Maximum Small Signal Gain222427dBTDWA Maximum Small Signal Gain222427dBNoise Figure Rejection+23+26dBmMaximum gain TDMA modulation; Pourt=+8dBmNoise Figure Maximum Average Output Power Rejection-61-57dBcTDMA modulation; 	Parameter	Min. Typ. Max.		Max.	Unit	Condition	
Linear Gain Control Range Gain Control Stope 70 dB $V_{CC}$ =2.8V, V <sub>GC</sub> =2.0V, T=25°C $V_{CC}$ =2.8V, T=25°C	Overall					V <sub>CC</sub> =2.8V, V <sub>GC</sub> =2.0V, T=25°C	
Gain Control Slope70dBAVTDMA Operating Frequency1880MHzMaximum Small Signal Gain Ioput VSWR222427dBOutput IP3+23+26dBmMaximum gainNoise Figure7dBMaximum Average Output Power Rejection	Usable Frequency Range		800 to 2200		MHz		
Gain Control Slope70dBAVTDMA Operating Frequency1880MHzMaximum Small Signal Gain Ioput VSWR222427dBOutput IP3+23+26dBmMaximum gainNoise Figure7dBMaximum Average Output Power Rejection	Linear Gain Control Range	50			dB		
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Maximum Small Signal Gain Input VSWR222427dB 2.5:1Over entire gain control rangeMaximum Average Output Power Adjacent Channel Power Rejection+23+26dBmMaximum gainTDMA Output Power Rejection-33-32dBcTDMA modulation: $P_{OUT}=+8dBm$ CDMA Operating Frequency Maximum Average Output Power Rejection-61-57dBcTDMA modulation: $P_{OUT}=+8dBm$ CDMA Maximum Small Signal Gain Input VSWR222427dBOver entire gain control rangeOutput IP3 Rejection+23+26dBmVcc=2.8V, Vgc=2.0V, T=25°COver entire gain control range-53dBcMaximum gainMaximum Average Output Power Rejection-53dBcCDMA modulation: $V_{Cc}=3.0V$ , maximum gain setting. ACPR <-52dBc.						V <sub>CC</sub> =2.8V, V <sub>GC</sub> =2.0V, T=25°C	
Maximum Small Signal Gain Input VSWR222427dB 2.5:1Over entire gain control rangeMaximum Average Output Power Adjacent Channel Power Rejection+23+26dBmMaximum gainTDMA Output Power Rejection-33-32dBcTDMA modulation: $P_{OUT}=+8dBm$ CDMA Operating Frequency Maximum Average Output Power Rejection-61-57dBcTDMA modulation: $P_{OUT}=+8dBm$ CDMA Maximum Small Signal Gain Input VSWR222427dBOver entire gain control rangeOutput IP3 Rejection+23+26dBmVcc=2.8V, Vgc=2.0V, T=25°COver entire gain control range-53dBcMaximum gainMaximum Average Output Power Rejection-53dBcCDMA modulation: $V_{Cc}=3.0V$ , maximum gain setting. ACPR <-52dBc.	Operating Frequency		1880		MHz		
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		22		27			
	•				42	Over entire gain control range	
Noise Figure Maximum Average Output Power Rejection7 +8dB dB dBmMaximum gain TDMA modulation TDMA modulation TDMA modulation POUT=+8dBmAlternate Channel Power Rejection-61-57dBcTDMA modulation TDMA modulation POUT=+8dBmCDMA Maximum Small Signal Gain Input VSWR222427dBOutput IP3 Noise Figure Rejection+23+26dBmVcc=2.8V, Vgc=2.0V, T=25°COutput IP3 Maximum Average Output Power Rejection+23+26dBmMaximum gain CDMA dBCDMA modulation; Vcc=3.0V, maximum gain setting, ACPR to maintain ACPR performance over gain control range.Maximum gain setting, ACPR PIN>-16dBm, adjustment of PIN is required to maintain ACPR performance over gain control range.W-CDMA Output IP3 Maximum Average Output Power Rejection1920 to 1980MHz Maximum Average.Vcc=2.0V. For PIN>-16dBm, ACPR performance over gain control range.W-CDMA Noise Figure Mult IP3 Maximum Linear Output IP3 Noise Figure1920 to 1980MHz MHzW-CDMA Noise Figure Maximum Linear Output Power Rejection1920 to 1980MHz MHzW-CDMA Noise Figure Maximum Linear Output Power Rejection15:12.5:1 Maximum gain Maximum gain Maximum gain Maximum Linear Output Power Ha48-43-43dBcW-CDMA modulation; Vgc=2.0V, PIN<-12 dBm		+23	-		dBm		
Maximum Average Output Power Rejection+8 -33-32 -32dBm dBcTDMA modulation TDMA modulation; POUT=+8dBmAdjacent Channel Power Rejection-61-57dBcTDMA modulation; POUT=+8dBmAlternate Channel Power Rejection-61-57dBcTDMA modulation; POUT=+8dBmOperating Frequency Maximum Small Signal Gain Input VSWR1880MHz $V_{CC}=2.8V, V_{GC}=2.0V, T=25^{\circ}C$ Output IP3+23+26dBmMaximum gainNoise Figure Rejection7dBMaximum gainAdjacent Channel Power Rejection-53dBcCDMA modulation; $V_{CC}=3.0V,$ maximum gain setting, ACPR <-52.dBc.	-		-			Maximum gain	
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Alternate Channel Power Rejection-61-57dBcTDMA modulation; $P_{OUT}$ =+8dBmCDMA Operating Frequency Maximum Small Signal Gain222427dBInput VSWR Output IP31.5:12.5:1Over entire gain control rangeOutput IP3 Maximum Average Output Power Rejection+23+26dBmAdjacent Channel Power Rejection-53dBcCDMA modulation; $V_{CC}$ =3.0V, maximum gain setting, ACPR $\leq$ -52dBc. CDMA modulation; $V_{CC}$ =3.0V. For $P_{IN}>$ -16dBm, adjustment of $P_{IN}$ is required to maintain ACPR performance over gain control range. For $P_{IN} \leq$ -16dBm, AdCPR performance over gain control range.W-CDMA Output IP31920 to 1980MHzW-CDMA Noise Figure1.5:12.5:1Over entire gain control rangeW-CDMA Noise Figure1.5:12.5:1Over entire gain control rangeW-CDMA Noise Figure202224dBV_CC=2.8V, T=25°CMHzMHzSmall Signal Gain202224323-32-31dBVigc=0.3VOver entire gain control rangeOutput IP3 Noise Figure456Maximum Linear Output Power Rejection+48+4643dBcW-CDMA modulation; V <sub>GC</sub> =2.0V, P <sub>IN</sub> <-12 dBm	Adjacent Channel Power		-	-32			
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Alternate Channel Power		-61	-57	dBc	TDMA modulation; P <sub>OUT</sub> =+8dBm	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	,					Vcc=2.8V. Vcc=2.0V. T=25°C	
Maximum Small Signal Gain Input VSWR222427dBInput VSWR1.5:12.5:1Over entire gain control rangeOutput IP3+23+26dBmMaximum Average Output Power+11dBmAdjacent Channel Power Rejection-53dBcM-CDMA-53dBcW-CDMA-53dBcW-CDMA1920 to 1980MHzSmall Signal Gain20222427dBNoise Figure1.5:12.5:1Operating Frequency1920 to 1980MHzSmall Signal Gain2022244BNoise Figure4Maximum Linear Output Power Rejection1.5:125:234dBMaximum Linear Output Power Rejection-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-42dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard-43dBard	-		1880		MH7		
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		22		27			
Output IP3 Noise Figure+23+26 7dBmdBmMaximum gain CDMA modulation; V <sub>CC</sub> =3.0V, maximum gain setting, ACPR cC=3.0V. For P <sub>IN</sub> >-16dBm, adjustment of P <sub>IN</sub> is required to maintain ACPR performance over gain control range.Adjacent Channel Power Rejection-53dBcCDMA modulation; V <sub>CC</sub> =3.0V. For P <sub>IN</sub> >-16dBm, adjustment of P <sub>IN</sub> is required to maintain ACPR performance over gain control range. For P <sub>IN</sub> -16dBm, adjustment of P <sub>IN</sub> is required to maintain ACPR performance over gain control range.W-CDMA Operating Frequency Small Signal Gain1920 to 1980 20MHz 22V <sub>CC</sub> =2.0V 4V <sub>GC</sub> =2.0VInput VSWR Output IP3 Noise Figure1.5:1 422.5:1 44Over entire gain control rangeMaximum Linear Output Power Rejection4 485 448dBm 46Maximum gain Maximum gain Maximum Linear Output Power RejectionAdjacent Channel Power Rejection-43dBcW-CDMA modulation; V <sub>GC</sub> =2.0V, P <sub>IN</sub> <-17 dBm	0	22			uD	Over entire gain control range	
Noise Figure Maximum Average Output Power Rejection7dBMaximum gain CDMA modulation; V <sub>CC</sub> =3.0V, maximum gain setting, ACPR CDMA modulation; V <sub>CC</sub> =3.0V. For P <sub>IN</sub> >-16 dBm, adjustment of P <sub>IN</sub> is required to maintain ACPR performance over gain control range. For P <sub>INS</sub> -16 dBm, adjustment of P <sub>IN</sub> is required to maintain ACPR performance over gain control range. For P <sub>INS</sub> -16 dBm, ACPR performance over gain control range.W-CDMA Operating Frequency Small Signal Gain1920 to 1980 20MHz 22V <sub>CC</sub> =2.8V, T=25°COperating Frequency Small Signal Gain1920 to 1980 -33MHz -32V <sub>GC</sub> =2.0V -33Input VSWR Output IP3 Noise Figure1.5:1 -322.5:1 -34Over entire gain control rangeMaximum Linear Output Power Rejection456dB -43Maximum gain -43Maximum Linear Output Power Rejection-43-46dBc -43W-CDMA modulation; V <sub>GC</sub> =1.0V,		1.23	-	2.0.1	dBm	Over entire gain control lange	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	-	723	-			Maximum gain	
Adjacent Channel Power Rejection-53-53dBcgain setting, $ACPR \le 52 dBc.$ CDMA modulation; $V_{CC} = 3.0 V.$ For $P_{ N} > -16 dBm, adjustment of P_{ N} is requiredto maintain ACPR performance over gaincontrol range. For P_{ N} \le -16 dBm, ACPR performance over gaincontrol range. For P_{ N} \le -16 dBm, ACPR performance is maintained over entire gain con-trol range.W-CDMA1920 to 1980MHzOperating Frequency1920 to 1980MHzSmall Signal Gain202224dBV_{CC}=2.8V, T=25°C-33-32-31dBInput VSWR1.5:12.5:1Over entire gain control rangeOutput IP3+22+24dBmNoise Figure456dBMaximum Linear Output PowerRejection+8+9dBmAdjacent Channel PowerRejection-43dBcW-CDMA modulation; V_{GC} = 2.0V,P_{ N} < -12 dBm$	5					5	
Adjacent Channel Power Rejection-53-53dBcCDMA modulation; $V_{CC}=3.0V$ . For $P_{IN}>-16dBm, adjustment of P_{IN} is requiredto maintain ACPR performance over gaincontrol range. For P_{IN}>-16dBm, ACPR per-formance is maintained over entire gain control range.W-CDMA1920 to 1980MHzOperating Frequency1920 to 1980MHzSmall Signal Gain202224dBV_{GC}=2.0V-33-32-31dBV_{GC}=0.3VInput VSWR1.5:12.5:1Over entire gain control rangeOutput IP3+22+24dBmNoise Figure456dBMaximum Linear Output PowerRejection+8+9dBmAdjacent Channel PowerRejection-48-46dBcW-CDMA ACPR-43dBcW-CDMA modulation; V_{GC}=1.0V,$	Maximum Average Output Fower		<b>T</b> 11		ubiii		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Adiagant Channel Dower		50		dDa	S S.	
W-CDMA1920 to 1980MHzOperating Frequency1920 to 1980MHzSmall Signal Gain202224dBV-CDWA-33-32-31dBVgcc=2.0V-33-32-31dBUput VSWR1.5:12.5:1Over entire gain control rangeOutput IP3+22+24dBmNoise Figure4563232.534dBMaximum Linear Output Power+8+9Adjacent Channel Power-48-46Adjacent Channel Power-43dBcW-CDMA modulation; Vgc=1.0V,Uput VSWR-43dBcW-CDMA AcPR-43dBcW-CDMA AcPR-17 dBm			-03		ивс		
W-CDMAImage: Note that the problem of th	Rejection					to maintain ACPR performance over gain	
W-CDMAtrol range.Operating Frequency1920 to 1980MHzSmall Signal Gain202224dB $-33$ $-32$ $-31$ dB $V_{GC}=2.0V$ Input VSWR1.5:12.5:1Over entire gain control rangeOutput IP3 $+22$ $+24$ dBmNoise Figure456dBMaximum Linear Output Power $+8$ $+9$ dBmAdjacent Channel Power $-48$ $-46$ dBcW-CDMA modulation; V <sub>GC</sub> =2.0V,PIN<						control range. For P <sub>IN</sub> ≤-16dBm, ACPR per-	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $						formance is maintained over entire gain con-	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	W CDMA						
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$						V <sub>CC</sub> =2.8 V, 1=25 C	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$							
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Small Signal Gain	-					
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		-33	-32	-31	dB	V <sub>GC</sub> =0.3V	
Noise Figure   4   5   6   dB   Maximum gain     Maximum Linear Output Power   +8   +9   dB   Minimum gain     Adjacent Channel Power   +8   +9   dB   W-CDMA ACPR   -46dBc, V <sub>GC</sub> =2.0V     Rejection   -48   -46   dBc   W-CDMA modulation; V <sub>GC</sub> =2.0V, P <sub>IN</sub> <-12 dBm	Input VSWR		1.5:1	2.5:1		Over entire gain control range	
32 32.5 34 dB Minimum gain   Maximum Linear Output Power +8 +9 dBm W-CDMA ACPR<-46 dBc, V <sub>GC</sub> =2.0V   Adjacent Channel Power -48 -46 dBc W-CDMA modulation; V <sub>GC</sub> =2.0V, P <sub>IN</sub> <-12 dBm	Output IP3	+22	+24		dBm		
Maximum Linear Output Power   +8   +9   dBm   W-CDMA ACPR<-46dBc, V <sub>GC</sub> =2.0V     Adjacent Channel Power   -48   -46   dBc   W-CDMA modulation; V <sub>GC</sub> =2.0V, P <sub>IN</sub> <-12 dBm	Noise Figure	4	5	6	dB	Maximum gain	
Adjacent Channel Power   -48   -46   dBc   W-CDMA modulation; V <sub>GC</sub> =2.0 V, P <sub>IN</sub> <-12 dBm		32	32.5	34	dB	Minimum gain	
Rejection   -43   dBc   P <sub>IN</sub> <-12 dBm	Maximum Linear Output Power	+8	+9		dBm	W-CDMA ACPR<-46dBc, V <sub>GC</sub> =2.0V	
Rejection   -43   dBc   P <sub>IN</sub> <-12 dBm	Adjacent Channel Power		-48	-46	dBc	W-CDMA modulation; V <sub>GC</sub> =2.0V,	
-43 dBc W-CDMA modulation; Over entire gain con- trol range, P <sub>IN</sub> <-17 dBm -43 dBc W-CDMA modulation; V <sub>GC</sub> =1.0 V,	Rejection					P <sub>IN</sub> <-12dBm	
-43 dBc W-CDMA modulation; $V_{GC}$ =1.0V,				-43	dBc		
				-43	dBc		
						P <sub>IN</sub> <-14dBm	

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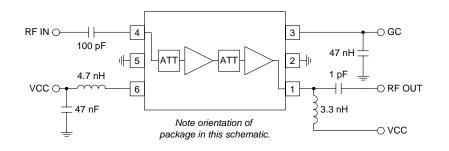
# RF2377

Parameter		Specification		Unit	Condition	
Farameter	Min.	Тур.	Max.	Unit	Condition	
Power Supply					T=25°C	
Supply Voltage		2.8		V	Specifications	
		2.7 to 3.3		V	Operating range	
Gain Control Voltage		0 to 2.0		V		
Supply Current	40	45	60	mA	V <sub>CC</sub> =2.8V, V <sub>GC</sub> =2.0V	
		56		mA	V <sub>CC</sub> =2.8V, V <sub>GC</sub> =2.0V V <sub>CC</sub> =3.0V, V <sub>GC</sub> =2.0V	
			20	mA	V <sub>CC</sub> =2.8V, V <sub>GC</sub> =0.4V	
V <sub>GC</sub> Current			1.5	mA		

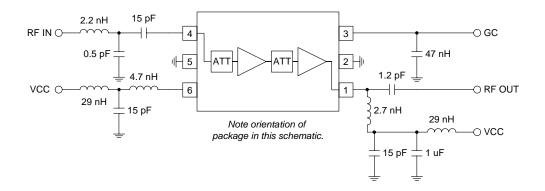
## **RF2377**

Pin	Function	Description	Interface Schematic
1	RF OUT	RF output pin. This pin is DC coupled and requires $V_{CC}$ through a bias inductor sized accordingly to provide a high pass transformation with a series capacitor.	
2	GND	Ground connection. Keep traces physically short and connect immedi- ately to ground plane for best performance.	
3	GC	Analog gain control pin. This pin controls the gain of the IC. Minimum gain occurs at $V_{GC}$ <0.4V and maximum gain is achieved with $V_{GC}$ =2.0V. 50dB of linear gain control with little variation of input P <sub>1dB</sub> is available.	
4	RF IN	RF input pin. This pin is DC coupled.	
5	GND	Ground connection. Keep traces physically short and connect immedi- ately to ground plane for best performance.	
6	VCC	Power supply. This pin should be connected to a regulated supply and requires a bypass capacitor. Voltage is supplied through this pin to the first stage collector; this voltage also controls the bias. Gain may be tuned by adjusting the value of the feed inductor.	

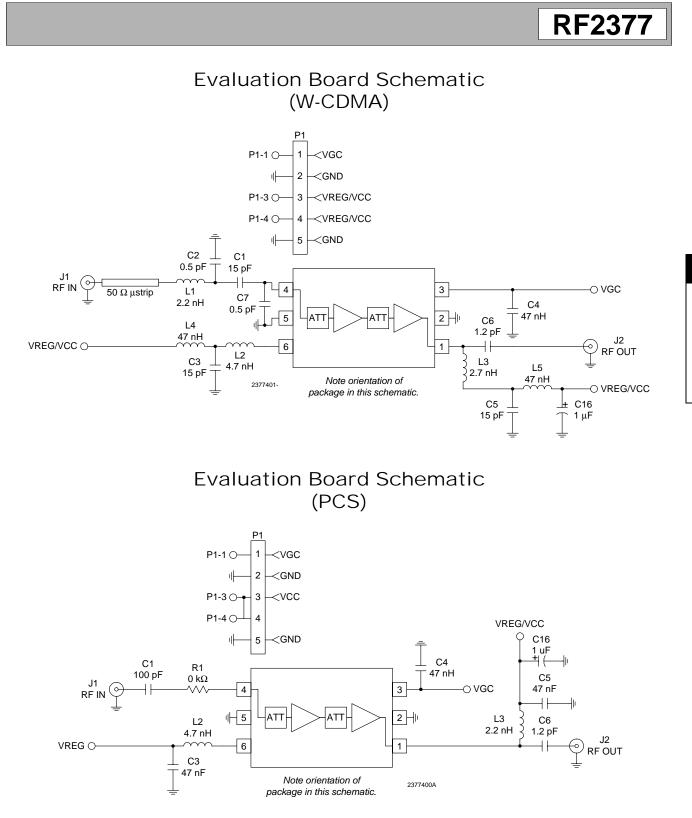
## Application Schematic



### W-CDMA Application Schematic



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RF2377

Evaluation Board Layout (PCS) Board Size 2.0" x 2.0" Board Thickness 0.028", Board Material FR-4

