RF2381

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

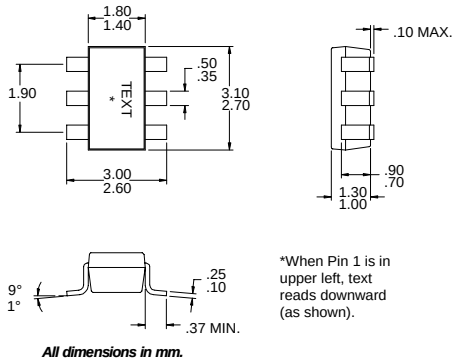
RoHS Compliant & Pb-Free Product

Typical Applications

- CDMA PCS/Cellular Handsets
- TDMA PCS/Cellular Handsets
- W-CDMA Handsets

Product Description

The RF2381 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.



*When Pin 1 is in upper left, text reads downward (as shown).

All dimensions in mm.

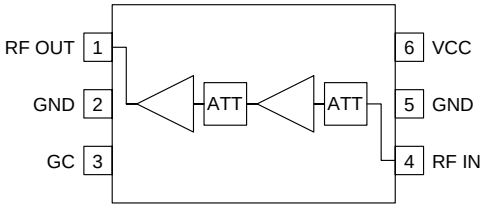
Optimum Technology Matching® Applied

- ☐ Si BJT
- ☑ GaAs HBT
- ☐ GaAs MESFET
- ☐ Si Bi-CMOS
- ☐ SiGe HBT
- ☐ Si CMOS
- ☐ InGaP/HBT
- ☐ GaN HEMT
- ☐ SiGe Bi-CMOS

Package Style: SOT23-6

Features

- 50dB Linear Gain Control Range
- 22dB Maximum Gain
- Single 2.7V to 3.3V Supply
- 35mA Supply Current
- High Linearity



Functional Block Diagram

Ordering Information

RF2381	PCS/Cellular TDMA/CDMA/W-CDMA Linear Variable Gain Amplifier
RF2381PCBA-41X	Fully Assembled Evaluation Board

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	0 to +5.0	V_{DC}
DC Current	100	mA
Operating Ambient Temperature	-30 to +85	°C
Storage Temperature	-40 to +150	°C

Caution! ESD sensitive device.

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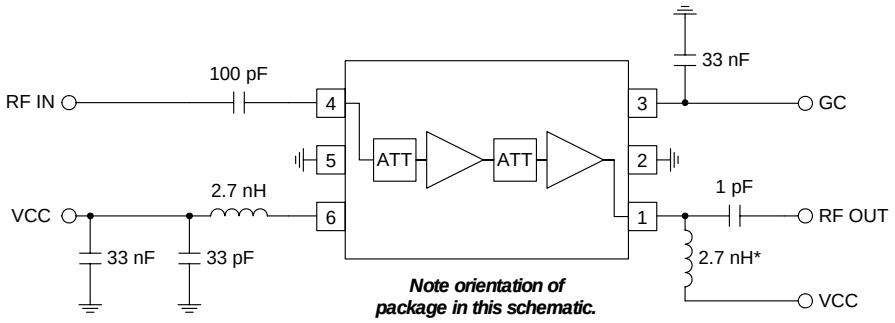
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Overall					V_{CC}=2.8V, V_{GC}=2.0V, T=25°C
Usable Frequency Range		800 to 2100		MHz	
Linear Gain Control Range	50			dB	
Gain Control Slope		70		dB/V	
Input VSWR		1.5:1	2.5:1		Over entire gain control range
Output VSWR		1.5:1	2.5:1		Over entire gain control range
Output IP3	+23	+26		dBm	
Noise Figure		9		dB	Maximum gain
TDMA					V_{CC}=2.8V, V_{GC}=2.0V, T=25°C
Operating Frequency		1880		MHz	
Maximum Small Signal Gain	18	20	22	dB	
Maximum Average Output Power		+8		dBm	TDMA modulation; ACP≤-32dBc
Maximum Average Input Power		-9	-8	dBm	TDMA modulation; for any V_{GC} that gives P_{OUT}≤+8dBm, ACP≤-32dBc, ALT≤-52dBc
Adjacent Channel Power		-33	-32	dBc	TDMA modulation; P_{OUT}≤+8dBm and P_{IN}≤-11dBm, at all V_{GC}.
		-61	-52	dBc	TDMA modulation; P_{OUT}≤+8dBm and P_{IN}≤-11dBm, at all V_{GC}.
CDMA					V_{CC}=2.8V, V_{GC}=2.0V, T=25°C
Operating Frequency		1880		MHz	
Maximum Small Signal Gain	18	20	22	dB	
Maximum Average Output Power		+6		dBm	CDMA modulation; V_{CC}=3.0V, maximum gain setting, ACP≤-52dBc.
Maximum Average Input Power		-13		dBm	CDMA modulation; for any V_{GC} that gives P_{OUT}≤+6dBm, ACP≤-52dBc
Adjacent Channel Power		-53		dBc	CDMA modulation; V_{CC}=3.0V. P_{OUT}≤+6dBm and P_{IN}≤-13dBm, at all V_{GC}.
W-CDMA					V_{CC}=2.8V, V_{GC}=2.0V, T=25°C
Operating Frequency		1920 to 1980		MHz	
Small Signal Gain	17.5	19.5	22	dB	
Maximum Linear Output Power		+5		dBm	W-CDMA ACP<-46dBc
Adjacent Channel Power			-46	dBc	W-CDMA modulation; P_{OUT}≤+5dBm and P_{IN}<-12dBm
			-43	dBc	W-CDMA modulation; Over entire gain control range, P_{IN}<-17dBm
			-43	dBc	W-CDMA modulation; V_{GC}=1.0V, P_{IN}<-14dBm

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Power Supply					T=25°C
Supply Voltage		2.8		V	Specifications
		2.7 to 3.3		V	Operating range
Gain Control Voltage (V_{GC})		0 to 2.2		V	
Supply Current		35		mA	V_{CC}=2.8V, V_{GC}=2.2V
		50		mA	V_{CC}=3.3V, V_{GC}=2.2V
		21		mA	V_{CC}=2.8V, V_{GC}=0.4V
V_{GC} Current	-2.0		+2.4	mA	V_{GC}=0.4V to 2.2V

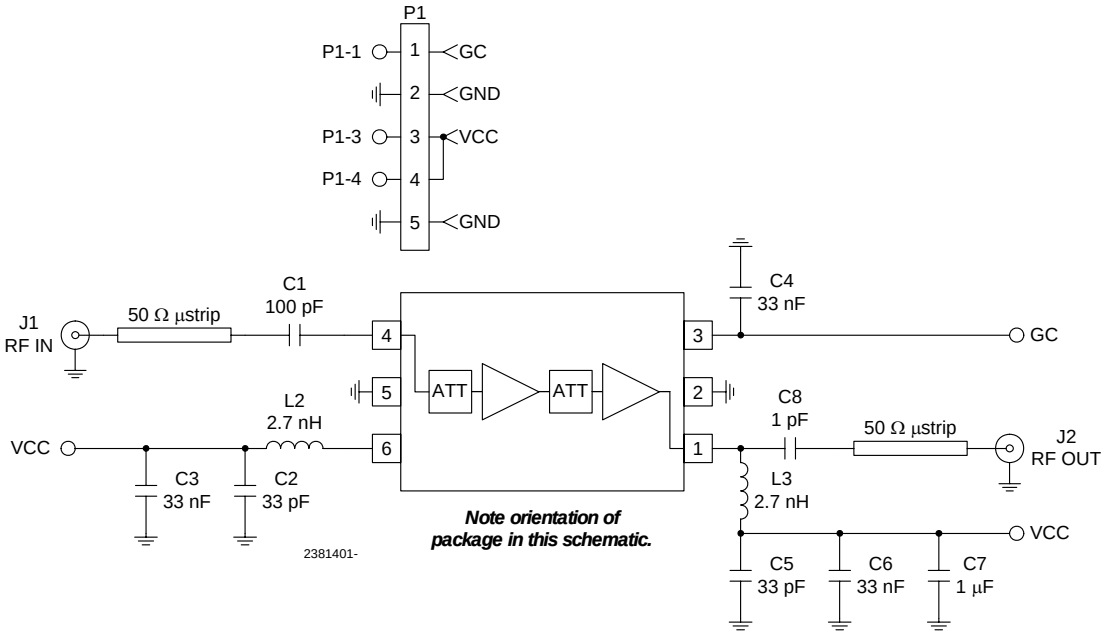
Pin	Function	Description	Interface Schematic
1	RF OUT	RF output pin. This pin is DC-coupled and requires V_{CC} through a bias inductor sized accordingly to provide a high pass transformation with a series capacitor.	
2	GND	Ground connection. For best performance, keep traces physically short and connect immediately to ground plane.	
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_{1dB} is available.	
4	RF IN	RF input pin. This pin is DC-coupled.	
5	GND	Ground connection. For best performance, keep traces physically short and connect immediately to ground plane.	
6	VCC	Power supply. This pin should be connected to a regulated supply and requires a series inductor and 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
1850MHz to 1910MHz



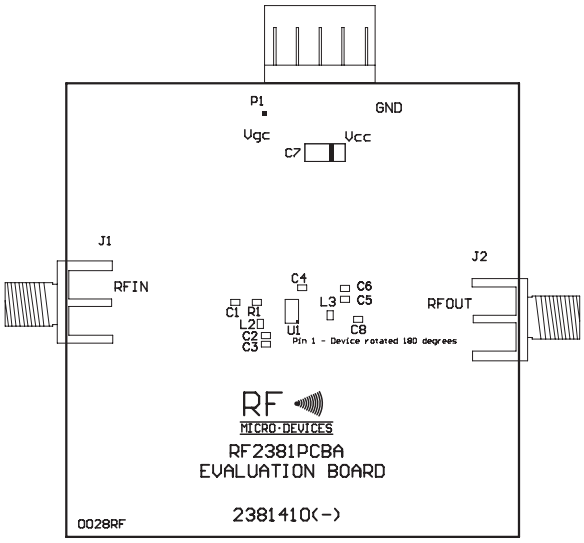
*For W-CDMA, use 2.2 nH

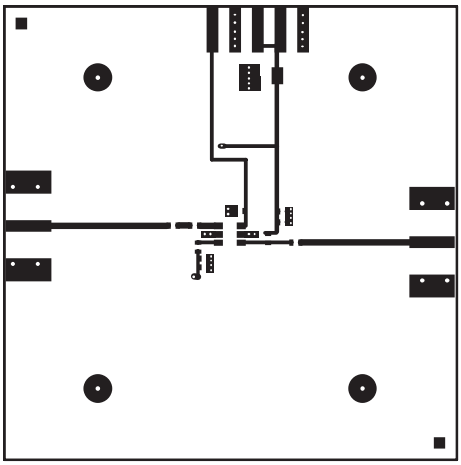
Evaluation Board Schematic

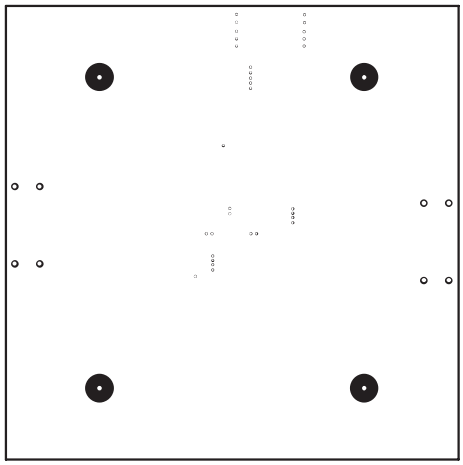


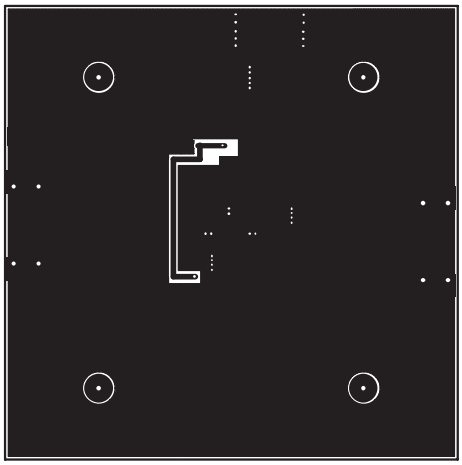
Evaluation Board Layout
Board Size 2.0” x 2.0”

Board Thickness 0.028”, Board Material FR-4, Multi-Layer

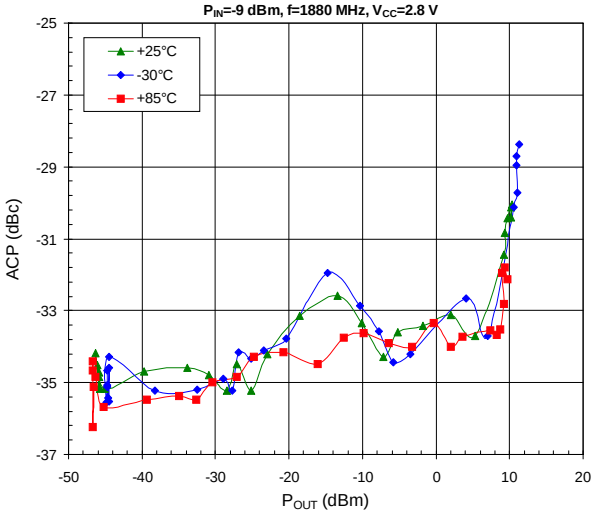




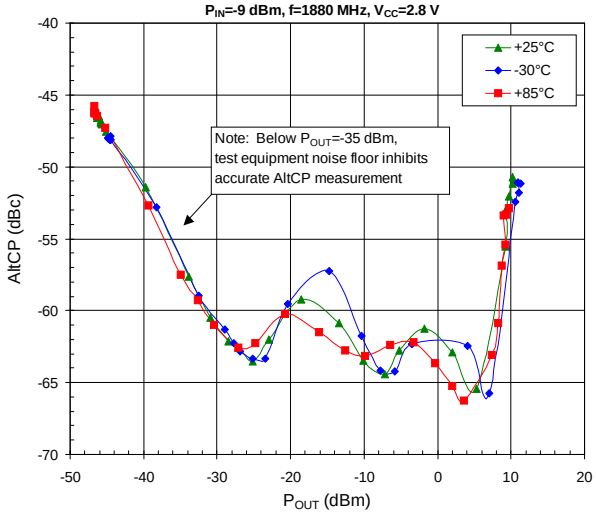




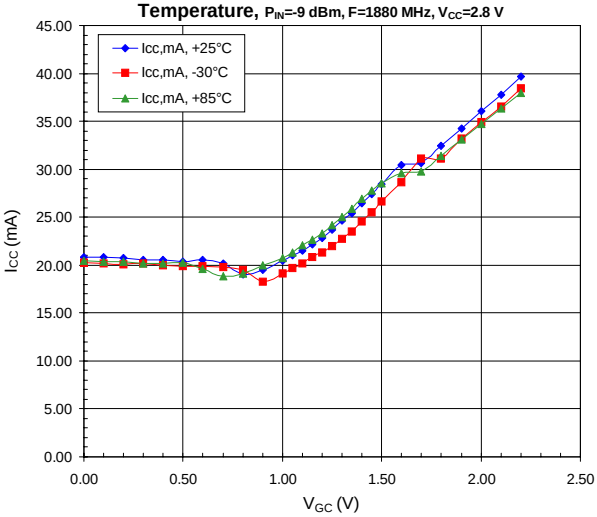
TDMA ACP versus P_{OUT} over Temperature,
P_{IN}=-9 dBm, f=1880 MHz, V_{CC}=2.8 V



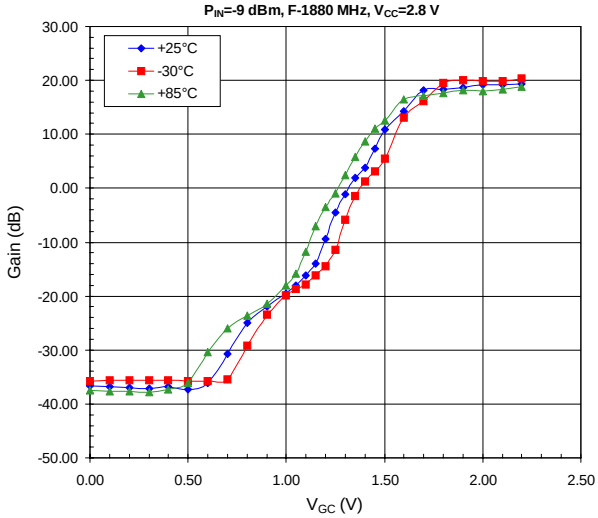
TDMA AltCP versus P_{OUT} over Temperature,
P_{IN}=-9 dBm, f=1880 MHz, V_{CC}=2.8 V



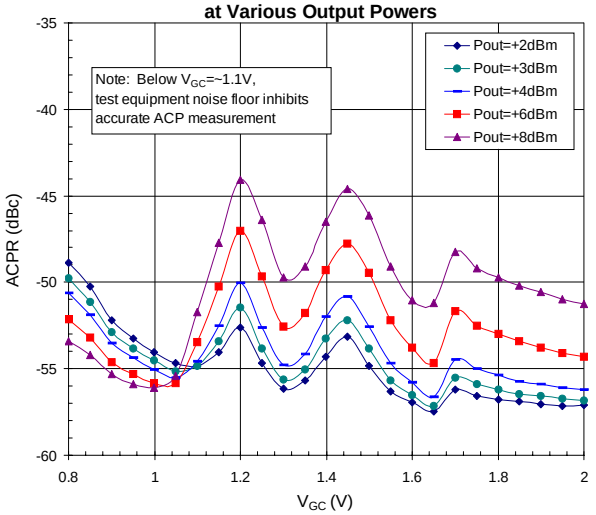
Supply Current versus Gain-Control Voltage over Temperature, P_{IN}=-9 dBm, F=1880 MHz, V_{CC}=2.8 V



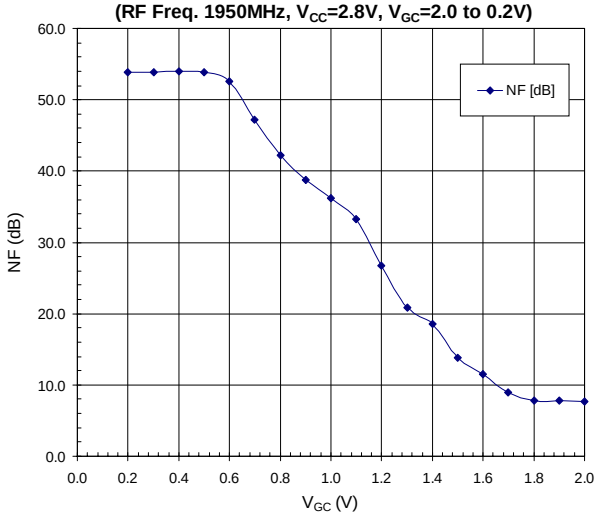
Gain versus Gain-Control Voltage over Temperature,
P_{IN}=-9 dBm, F-1880 MHz, V_{CC}=2.8 V

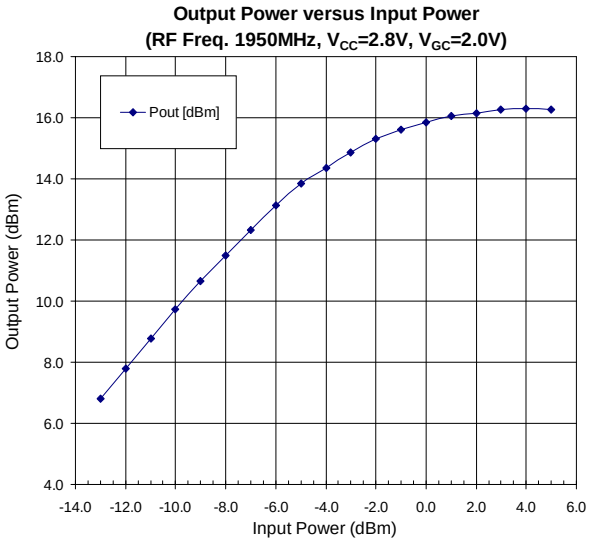


W-CDMA ACPR versus V_{GC} at Various Output Powers



NF versus VGC
(RF Freq. 1950MHz, V_{CC}=2.8V, V_{GC}=2.0 to 0.2V)




Output Power versus Input Power
(RF Freq. 1950MHz, V_{CC}=2.8V, V_{GC}=2.0V)
Pout [dBm]
Output Power (dBm)
Input Power (dBm)
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
-14.0
-12.0
-10.0
-8.0
-6.0
-4.0
-2.0
0.0
2.0
4.0
6.0