RF2302

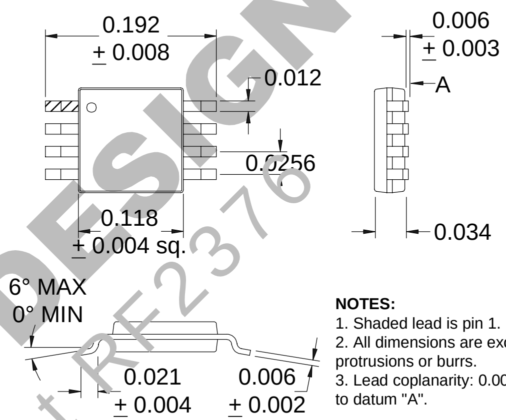
BROADBAND LINEAR VARIABLE GAIN AMPLIFIER

Typical Applications

- CDMA Cellular/PCS and JCDMA Systems
- TDMA Cellular/PCS Systems
- GSM Systems
- Wireless Local Loop Systems
- Wideband CDMA Systems
- PDC Systems (950MHz and 1450MHz)

Product Description

The RF2302 is a broadband linear variable gain amplifier that was designed specifically for digital communications systems that require linear amplification over a wide gain control range. It is suitable for use in CDMA or TDMA systems in the cellular or PCS band, in DAMPS systems, and in PDC systems. Operating supply voltage ranges from 3V to 6V. The device operates over a large frequency band, from 100MHz to 2000MHz, and is tuned to a specific frequency band with an output bias feed inductor and blocking capacitor. Bias optimization may be achieved by adjusting the voltage to pin 8 (PD). The IC is manufactured on an advanced Gallium Arsenide Heterojunction Bipolar Transistor (GaAs HBT) process and is featured in a new standard miniature 8-lead plastic MSOP package.



NOTES:
1. Shaded lead is pin 1.
2. All dimensions are exclusive of flash, protrusions or burrs.
3. Lead coplanarity: 0.002 with respect to datum "A".

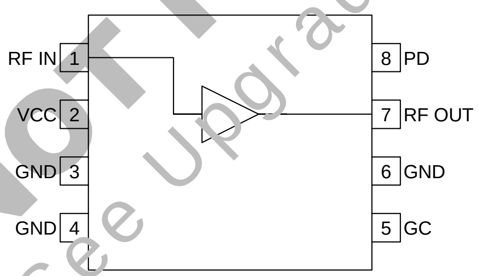
Package Style: MSOP-8

Optimum Technology Matching® Applied

- ☐ Si BJT
- ☑ GaAs HBT
- ☐ GaAs MESFET
- ☐ Si Bi-CMOS
- ☐ SiGe HBT
- ☐ Si CMOS

Features

- 25dB Linear Gain Control range
- +14dBm OP1dB at 3.5V (836MHz)
- Single 3V to 6V Supply
- 14dB Max Gain at 836MHz
- 10dB Max Gain at 1900MHz
- 4dB Noise Figure at 836MHz



Functional Block Diagram

Ordering Information

RF2302	Broadband Linear Variable Gain Amplifier
RF2302 PCBA-L	Fully Assembled Evaluation Board 836MHz
RF2302 PCBA-H	Fully Assembled Evaluation Board 1.88GHz

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	0 to +8.0	V_{DC}
Power Down Voltage	0 to +3.1	V_{DC}
Gain Control Voltage	0 to +3.1	V_{DC}
DC Current	100	mA
Output Load VSWR	12:1	
Operating Ambient Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C

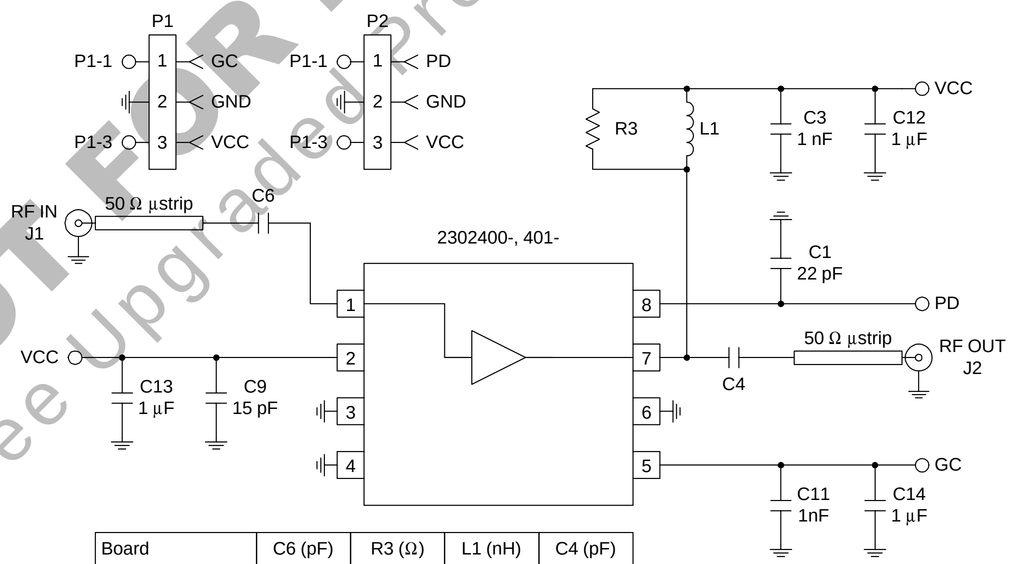
Caution! ESD sensitive device.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Overall					V_{CC}=3.0V, V_{PD}=2.8V, V_{GC}=2.2V, T=25°C
RF Frequency Range	100		2000	MHz	
Small Signal Maximum Gain	13	14	15	dB	Freq=836MHz, V_{GC}=2.2V
	9	11	12	dB	Freq=1880MHz, V_{GC}=2.2V
Small Signal Minimum Gain	-22	-20	-19	dB	Freq=836MHz, V_{GC}=1.4V
	-30	-29	-27	dB	Freq=1880MHz, V_{GC}=1.4V
Noise Figure		4		dB	Freq=836MHz, V_{GC}=2.2V
		7		dB	Freq=1880MHz, V_{GC}=2.2V
Linear Gain Control Range	32	34		dB	V_{GC}=1.4V to 2.2V
Gain Control Slope	1		3	V/V	Slope=ΔOutput peak voltage/ΔV_{GC}
Input IP3	+11	+12.5		dBm	Freq=836 MHz, V_{GC}=2.2V
	+10	+11		dBm	Freq=1880 MHz, V_{GC}=2.2V
	-1	+1		dBm	Freq=836MHz, V_{GC}=1.4V
	+1	+3		dBm	Freq=1880MHz, V_{GC}=1.4V
Input VSWR		1.8:1	3:1		In 50Ω system
Output VSWR		2.5:1			In 50Ω system
TDMA					
ACPR	-33	-34		dBc	836MHz, V_{GC}=2.2V
	-34	-35		dBc	1880MHz, V_{GC}=2.2V
ALT1	-63	-68		dBc	836MHz, V_{GC}=2.2V
	-73	-75		dBc	1880MHz, V_{GC}=2.2V
CDMA					
ACPR	-50	-52		dBc	836MHz, V_{GC}=2.2V
	-55	-59		dBc	1880MHz, V_{GC}=2.2V
ALT1	-55	-57		dBc	836MHz, V_{GC}=2.2V
Power Supply					T=25°C
Supply Voltage	3		6	V	
Power Down Voltage High	2.7		2.9	V	
Power Down Voltage Low			1.0		
DC Current Consumption	40	50	55	mA	V_{CC}=3.0V, V_{PD}=2.8V, V_{GC}=1.4V to 2.2V
V_{PD} Current		7	9	mA	V_{PD}=2.8V, V_{GC}=2.2V, V_{CC}=3.0V
V_{GC} Current		16	18	µA	V_{PD}=2.8V, V_{GC}=2.2V, V_{CC}=3.0V
Power Down Current			10	µA	V_{PD}<1V, V_{GC}<1V
Turn On/Off Time			100	nS	

Pin	Function	Description	Interface Schematic
1	RF IN	RF input pin. This pin is DC coupled and requires a blocking capacitor.	
2	VCC	Power supply. This pin is connected to a battery or a regulated supply and requires a bypass capacitor as close to the pin as possible.	
3	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance.	
4	GND	Ground connection. Keep traces physically short and connect immediately to ground plane for best performance. Use a separate ground via for this pin.	
5	GC	Analog gain control pin. This pin controls the gain of the IC. Minimum gain occurs at V_{GC}<1V and maximum gain is achieved with V_{GC}=2.2V. 25dB of linear gain control with no variation of input P_{1dB} is available, and additional attenuation is possible with V_{GC}<1V with input P_{1dB} variation. Bypass this pin near the device.	
6	GND	Same as pin 3.	
7	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. This LC transformation sets the output load line for the amplifier. If this amplifier is driving a power amplifier or antenna, no additional matching is required. However, to improve the output match, a parallel resistor can be added across the inductor. For 836MHz applications use a 10nH bias inductor (optional resistor R3=100 ohms) and 2.7pF coupling capacitor. For 1900MHz applications use a 2.7nH bias inductor (optional resistor R3=150ohms) and 1.0pF coupling capacitor.	
8	PD	Power down pin. This pin provides bias for the amplifier. To turn the amplifier on, this pin should be at 2.8V. Reducing this voltage below 0.5V ensures that the amplifier will draw less than 10µA current from the supply. Additionally, bias current can be optimized for lower output power by adjusting this voltage over a 2.7V to 2.9V range from a regulated supply.	

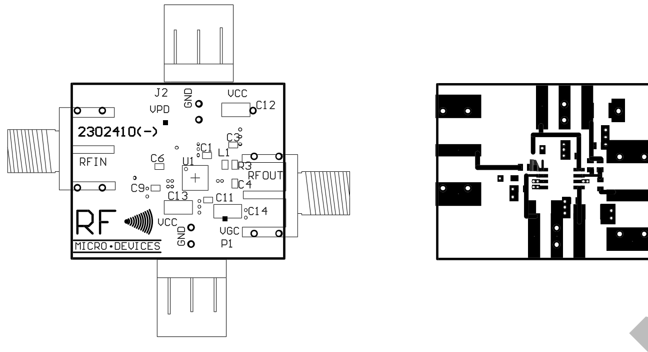
Evaluation Board Schematic - 836MHz or 1900MHz

(Download Bill of Materials from www.rfmd.com.)

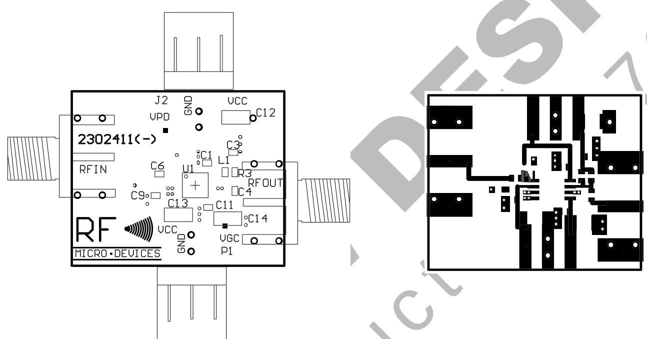


Board	C6 (pF)	R3 (Ω)	L1 (nH)	C4 (pF)
L (836 MHz)	12	100	10	2.7
H (1900 MHz)	3.3	150	2.7	1

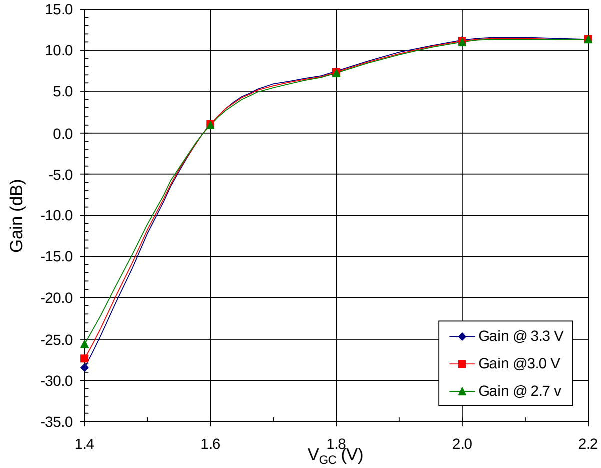
Evaluation Board Layout 836MHz
Board Size 2.0” x 2.0”



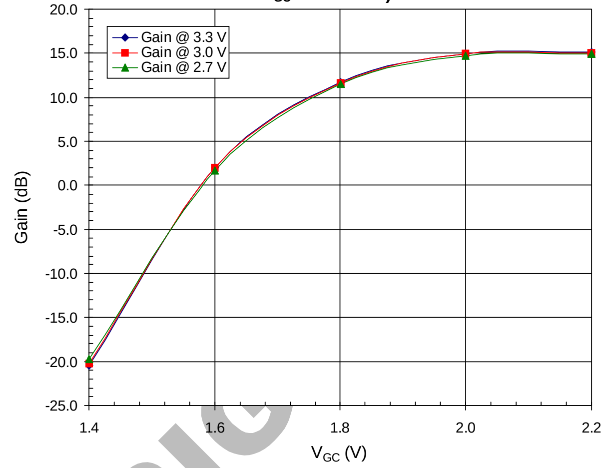
Evaluation Board Layout 1.88GHz



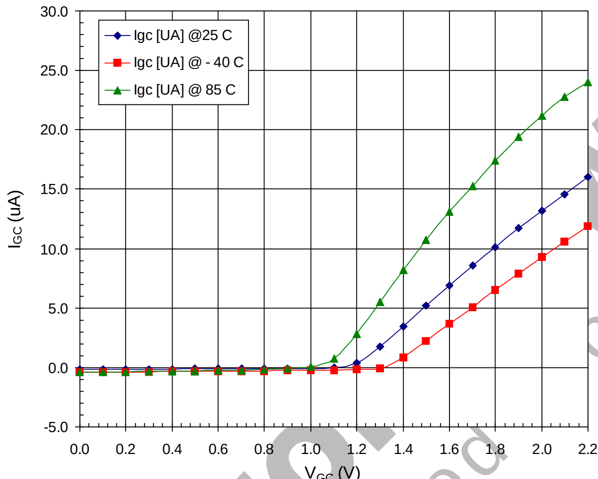
Gain @ 3.3, 3.0, 2.7V versus V_{GC}
(Frequency 1880MHz @ -8dBm, IS-95 Mod. V_{PD}=2.8V, V_{GC}=2.2 to 1.4V)



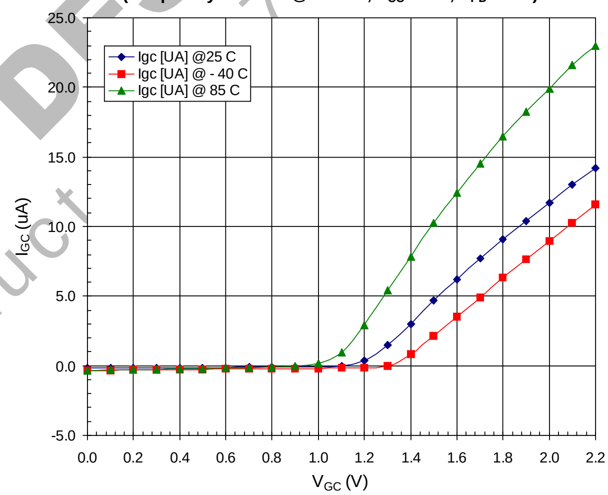
Gain @ 3.3, 3.0, 2.7V versus V_{GC}
(Frequency 836MHz @ -6dBm, IS-95 Mod., V_{CC}=3.0V, V_{PD}=2.8V, V_{GC}=2.2 to 1.4V)



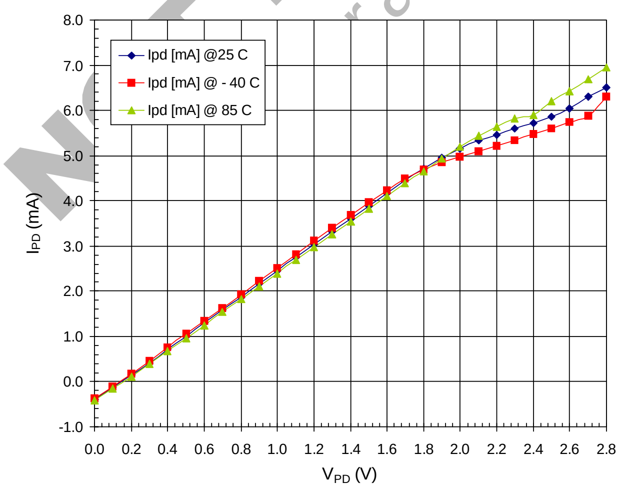
I_{GC} versus V_{GC}
(Frequency 1880MHz @ -8dBm, V_{CC}=3.0V, V_{PD}=2.8V)



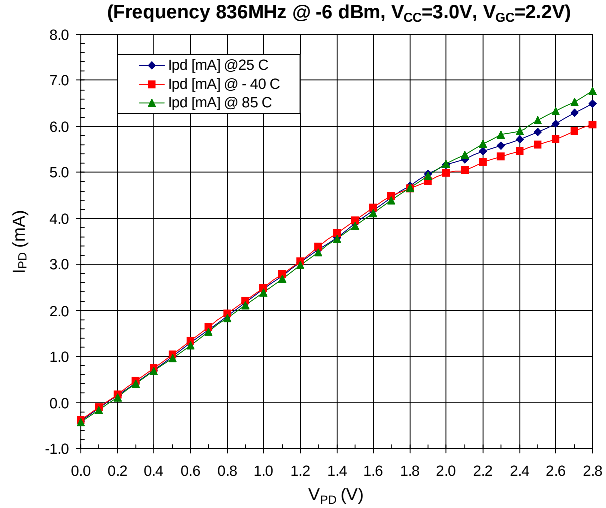
I_{GC} versus V_{GC}
(Frequency 836MHz @ -6dBm, V_{CC}=3.0V, V_{PD}=2.8V)



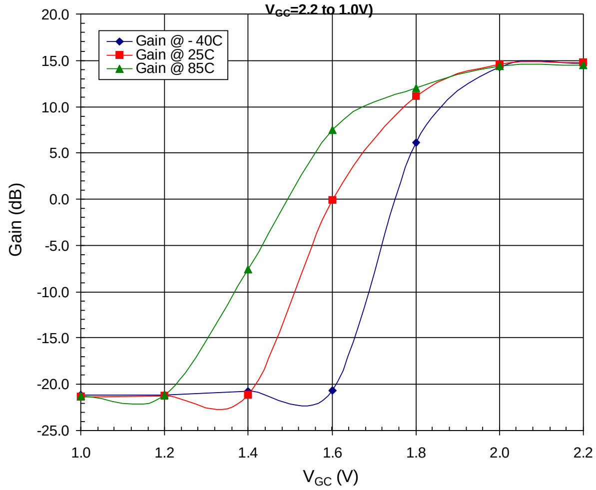
I_{PD} versus V_{PD}
(Frequency 1880MHz, V_{CC}=3.0V, V_{GC}=2.2V)



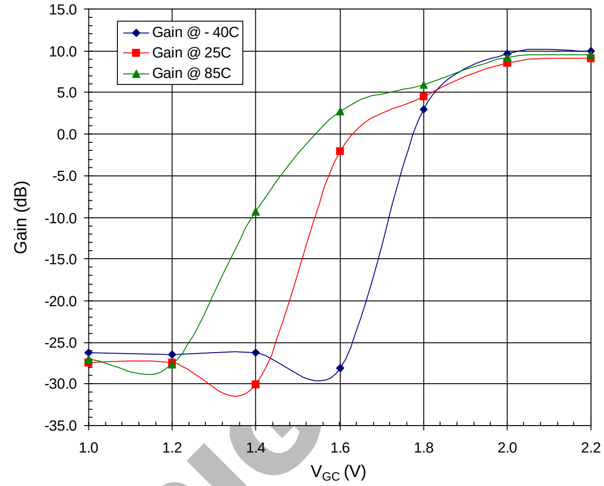
I_{PD} versus V_{PD}
(Frequency 836MHz @ -6 dBm, V_{CC}=3.0V, V_{GC}=2.2V)



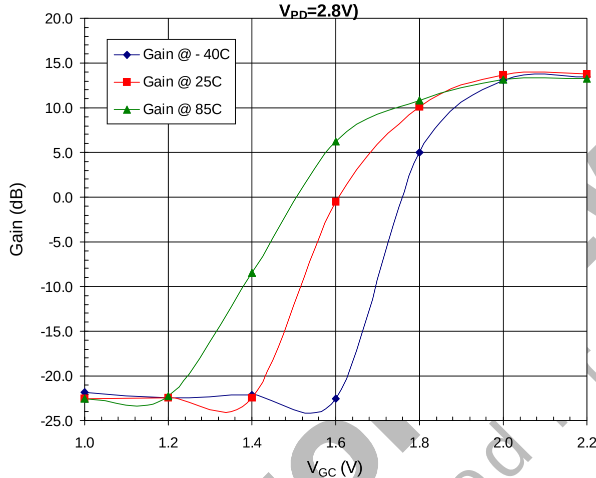
Gain versus V_{GC}
(Frequency 836MHz @ -6dBm, IS-95 Mod., V_{CC}=3.0V, V_{PD}=2.8V, V_{GC}=2.2 to 1.0V)



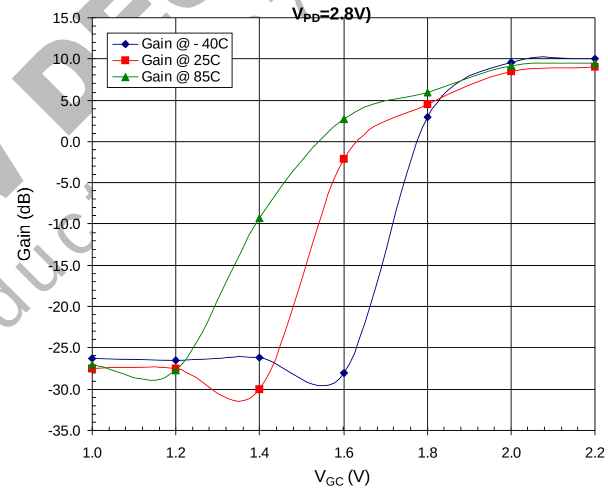
Gain versus V_{GC}
(Frequency 1880MHz @ -8dBm, IS-95 Mod., V_{CC}=3.0V, V_{PD}=2.8V



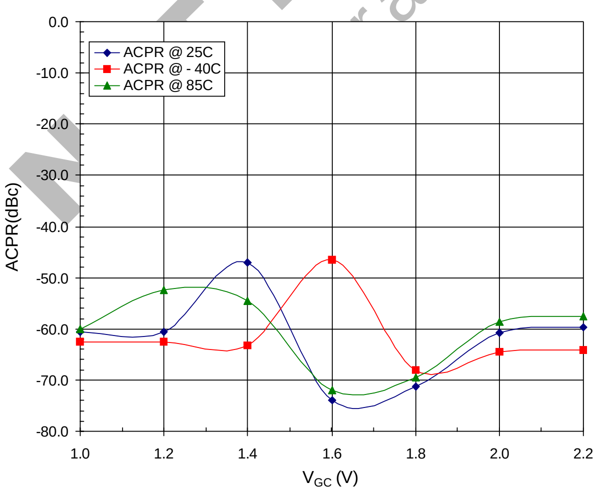
Gain versus V_{GC}
(Frequency 836MHz @ -6dBm, NADC. Mod., V_{CC}=3.0V, V_{PD}=2.8V)



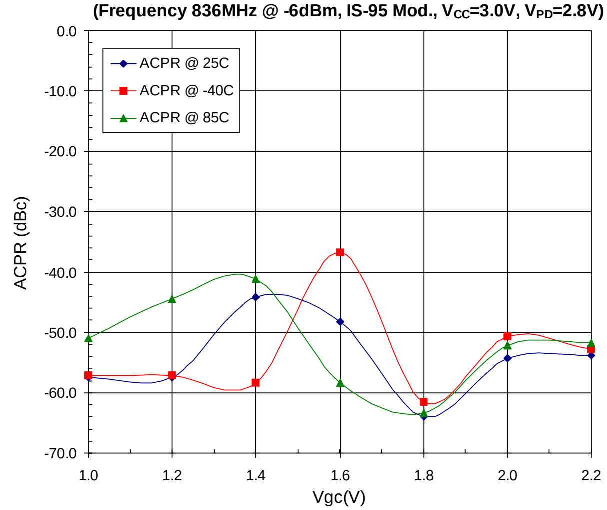
Gain versus V_{GC}
(Frequency 1880MHz @ -8dBm, NADC Mod. V_{CC}=3.0V, V_{PD}=2.8V)



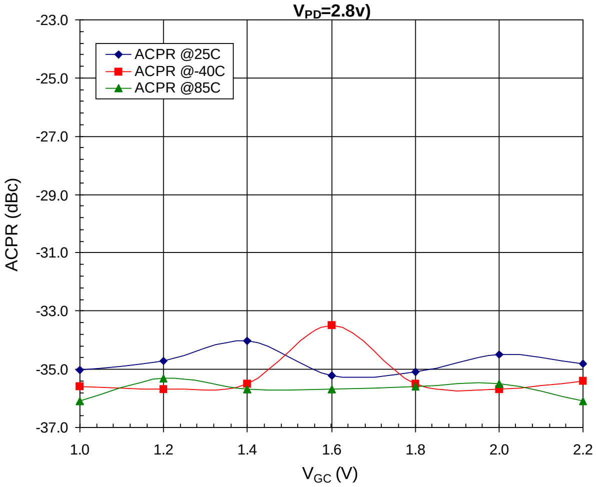
ACPR versus V_{GC}
(Frequency 1880MHz @ -8dBm, IS-95 Mod., V_{CC}=3.0V, V_{PD}=2.8V



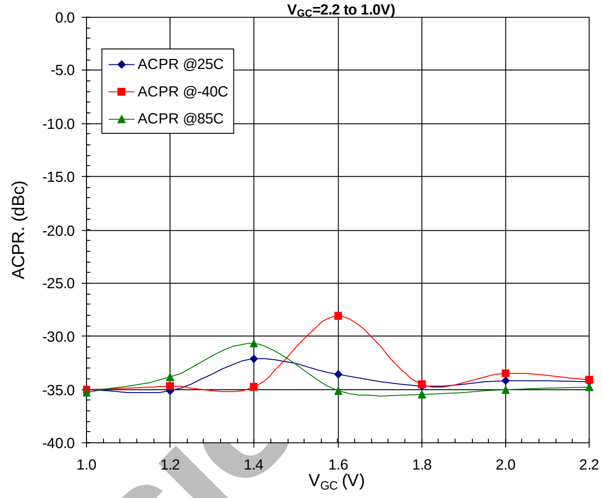
ACPR versus V_{GC}
(Frequency 836MHz @ -6dBm, IS-95 Mod., V_{CC}=3.0V, V_{PD}=2.8V)



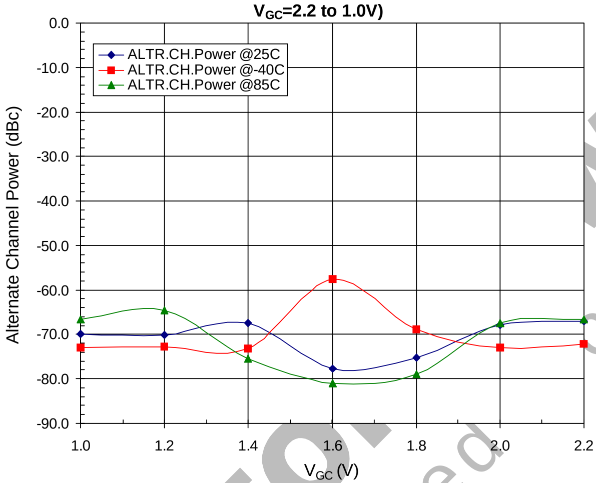
ACPR versus V_{GC}
(Frequency 1880MHz @ -8dBm.NADC Mod., V_{CC}=3.0v, V_{PD}=2.8v)



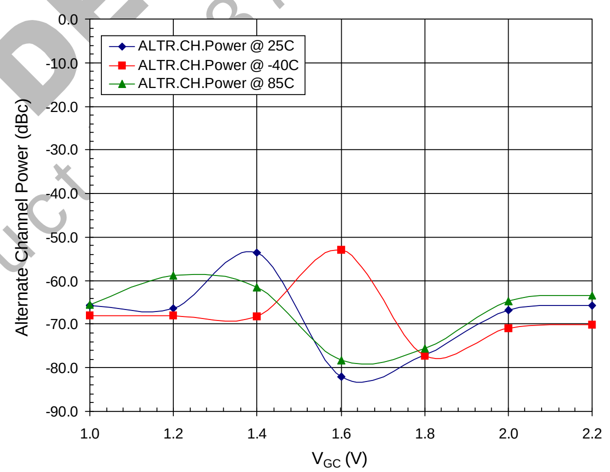
ACPR. versus V_{GC}
(Frequency 836MHz @ -6dBm, NADC.Mod., V_{CC}=3.0v, V_{PD}=2.8V, V_{GC}=2.2 to 1.0V)



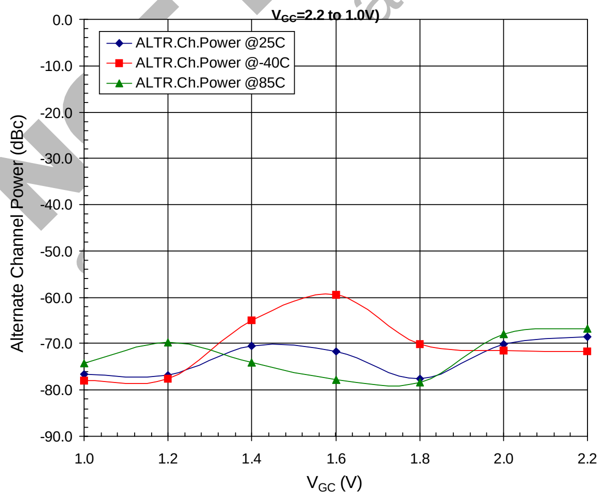
Alternate Channel Power versus V_{GC}
(Frequency 836MHz @ -6dBm, IS-95 Mod., V_{CC}=3.0V, V_{PD}=2.8V, V_{GC}=2.2 to 1.0V)



Alternate Channel Power versus V_{GC}.
(Frequency 1880MHz @ -8dBm, IS-95 Mod., V_{CC}=3.0V, V_{PD}=2.8)



Alternate Channel Power versus V_{GC}
(Frequency 836MHz @ -6dBm, NADC. Mod., V_{CC}=3.0V, V_{PD}=2.8V, V_{GC}=2.2 to 1.0V)



Alternate Channel Power versus V_{GC}
(Frequency 1880MHz @-8dBm, NADC Mod., V_{CC}=3.0V, V_{PD}=2.8V)