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RF5622

3.0V TO 3.6V, 2.4GHz TO 2.5GHz LINEAR POWER AMPLIFIER

Package Style: QFN, 8-Pin, 2.2x2.2x0.45mm

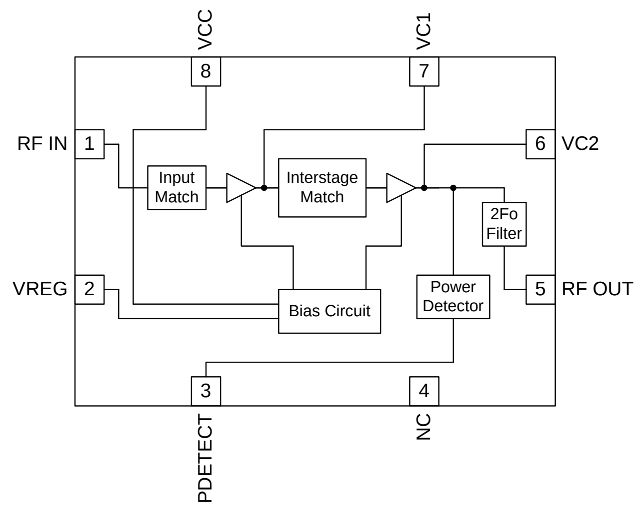
RoHS

Features

- Single Power Supply 3.0V to 3.6V
- 30dB Typical Gain, Input Matched to 50Ω
- 2.4GHz to 2.5GHz Frequency Range
- 11g P_{OUT}=+18dBm@3% Typ EVM, 95mA

Applications

- IEEE802.11b/g/n WiFi Applications
- 2.5GHz ISM Band Applications
- Commercial and Consumer Systems
- Portable Battery-Powered Equipment
- Spread-Spectrum and MMDS Systems



Functional Block Diagram

Product Description

The RF5622 is a linear, medium-power, high-efficiency, two-stage amplifier IC designed specifically for battery-powered WiFi applications such as PC cards, mini PCI, and compact flash applications. The device is manufactured on an advanced InGaP Gallium Arsenide Heterojunction Bipolar Transistor (HBT) process, and has been designed for use as the final RF amplifier in 2.5GHz OFDM and other spread-spectrum transmitters. The device is provided in a 2.2mmx2.2mmx0.45mm, 8-pin, QFN with a backside ground. The RF5622 is designed to maintain linearity over a wide range of supply voltage and power output. The RF5622 also has built-in power detector and incorporates the input and interstage matching components internally which reduces the component count used externally and makes it easier to incorporate on any design.

Ordering Information

RF5622	Standard 25 piece bag
RF5622SR	Standard 100 piece reel
RF5622TR7	Standard 2500 piece reel
RF5622PCK-410	Fully assembled evaluation board tuned for 2.4GHz to 2.5GHz and 5 piece loose samples

Optimum Technology Matching® Applied

☐ GaAs HBT	☐ SiGe BiCMOS	☐ GaAs pHEMT	☐ GaN HEMT
☐ GaAs MESFET	☐ Si BiCMOS	☐ Si CMOS	
☑ InGaP HBT	☐ SiGe HBT	☐ Si BJT	

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage	-0.5 to +5.0	V_{DC}
Power Control Voltage (V_{REG})	-0.5 to +3.3	V
DC Supply Current	240	mA
Input RF Power	+5	dBm
Extreme Operating Temperature	-30 to +85	°C
Full Specification Temperature Range	-15 to +85	°C
Storage Temperature	-40 to +150	°C
Moisture sensitivity	JEDEC Level 2	

Caution! ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.

RoHS status based on EUDirective2002/95/EC (at time of this document revision).

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
IEEE802.11g					Temperature=+25°C, V_{CC}=3.3V, V_{REG}=2.8V pulsed at 1% to 100% duty cycle, Frequency=2450MHz, circuit per evaluation board schematic, unless otherwise specified
Frequency	2.4		2.5	GHz	IEEE802.11g IEEE802.11n
Output Power		13		dBm	At max data rate, OFDM modulation RMS, mean, V_{CC}=2.8V
		18		dBm	At max data rate, OFDM modulation RMS, mean, V_{CC}=3.3V
EVM*		3.0	4.0	%	RMS, mean
Gain	26	30		dB	At +18dBm RF P_{OUT} and 54Mbps
Gain Variance Over Temperature			1.5	±dB	-30°C to +85°C, 2.4GHz to 2.5GHz
Power Detector					
P_{OUT}=8dBm		0.320		V	
P_{OUT}=18dBm		1.2		V	
Power Supply	2.8	3.3	3.6	V_{DC}	
V_{REG} Input Voltage	2.75	2.8	3.0	V_{DC}	Operating
Output VSWR			10:1		No damage to the PA
Input Return Loss		-15	-10	dB	
Turn-on Time**		0.5	1.8	μS	Output stable to within 90% of final gain
Second Harmonic			-43	dBm	Fundamental frequency is between 2.4GHz and 2.5GHz; RFP_{OUT}=+18dBm, 1Mbps CCK IEEE802.11b modulation
Current Consumption					
Quiescent Current		55		mA	Data rate @≤3.5% EVM RMS, mean
Operating Current		70		mA	P_{OUT}=+13dBm, V_{CC}=2.8V
		95		mA	P_{OUT}=+18dBm, V_{CC}=3.3V, diff. output match required
I_{REG} Current		2	6	mA	V_{CC}=+3.3V_{DC}
Shutdown Current		0.5	10	μA	

Notes:
*The EVM specification is obtained with a signal generator that has an EVM floor of less than 0.7%.
**The PA must operate with gated bias voltage input at 1% to 99% duty cycles without any EVM or other parameter degradation.

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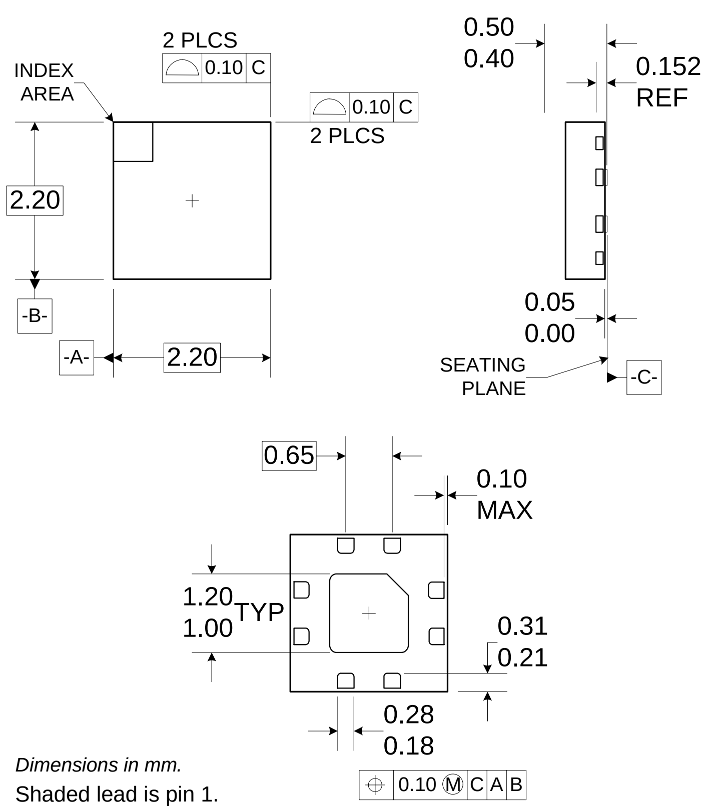
Pin	Function	Description
1	RF IN	RF input. Input is matched to 50Ω and DC block is provided internally.
2	VREG	Bias current control voltage for the first and second amplifier stage.
3	PDETECT or NC	Power detector which provides an output voltage proportional to the RF output power level. May need external decoupling capacitor for load sensitivity. May be left unconnected if function is not desired.
4	NC	This pin may be left unconnected or may be connected to ground.
5	RF OUT	RF output. A DC blocking capacitor may be needed as this pin of the PA is a DC short to ground.
6	VC2	Voltage supply for second stage amplifier. External low frequency bypass capacitors should be connected if no other low frequency decoupling is employed.
7	VC1	Voltage supply for the first amplifier stage. External low frequency bypass capacitors should be connected if no other low frequency decoupling is employed.
8	VCC	Supply voltage for the bias reference and control circuit. May be connected with V_{C1} and V_{C2} (with a single supply voltage). The 56pF bypass capacitor on the V_{CC} line should be placed as close as possible to the IC.
Pkg Base	GND	The center metal base of the QFN package provides DC and RF ground as well as heat sink for the amplifier.

Package Drawing



Dimensions in mm.

Shaded lead is pin 1.

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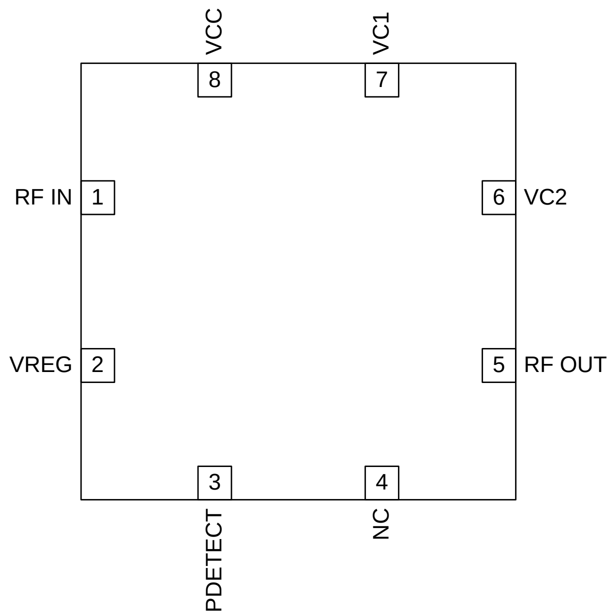
Pin Out



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Theory of Operation and Application Information

The RF5622 is a two-stage power amplifier (PA) with a typical gain of 30dB in the 2.4GHz to 2.5GHz ISM band. The RF5622 has integrated input and interstage matching components thus allowing a minimal bill of material (BOM) part count in end applications. The RF5622 is designed primarily for IEEE802.11b/g/n WiFi applications where the available supply voltage and current are limited. This amplifier will operate to (and below) the lowest expected voltage made available by a typical PCMCIA slot in a laptop PC, and will maintain required linearity at decreased supply voltages. The device is provided in a 2mmx2mmx0.45mm, 8-pin, QFN with backside ground.

The RF5622 requires only a single positive supply of 3.3V nominal to operate to full specifications. Power control is provided through one bias voltage pin (V_{REG}). The input DC blocking cap is provided internally, the output of the PA is not internally DC blocked. The evaluation board circuit (available from RF Micro Devices, Inc. (RFMD)) is optimized for 3.3V_{DC} applications. For best performance, it is important to duplicate (as closely as possible) the layout of the evaluation board. The RF5622 has primarily been characterized with a voltage on V_{REG} of 2.8V_{DC}. If you prefer to use a bias voltage that is significantly different than 2.8V_{DC}, or a different frequency than the recommended frequency range, contact RFMD Sales or Applications Engineering for additional data and guidance.

For best results, the PA circuit layout from the evaluation board should be copied as closely as possible, particularly the ground layout and ground vias. Other configurations may also work, but the design process is much easier and quicker if the layout is copied from the RF5622 evaluation board. Gerber files of RFMD PCBA designs can be provided on request. The RF5622 is a very easy part to implement, but care in circuit layout and component selection is always advisable when designing circuits to operate at 2.5GHz. The RF5622 evaluation board layout and schematic are available using 0201 (US) size components which will help shrink the overall size of the total area of the PA and components of the intended design. If you prefer to use a supply or bias voltage that is significantly different than what is specified, or a different frequency than the recommended frequency range, contact RFMD Sales or Applications Engineering for additional data and guidance.

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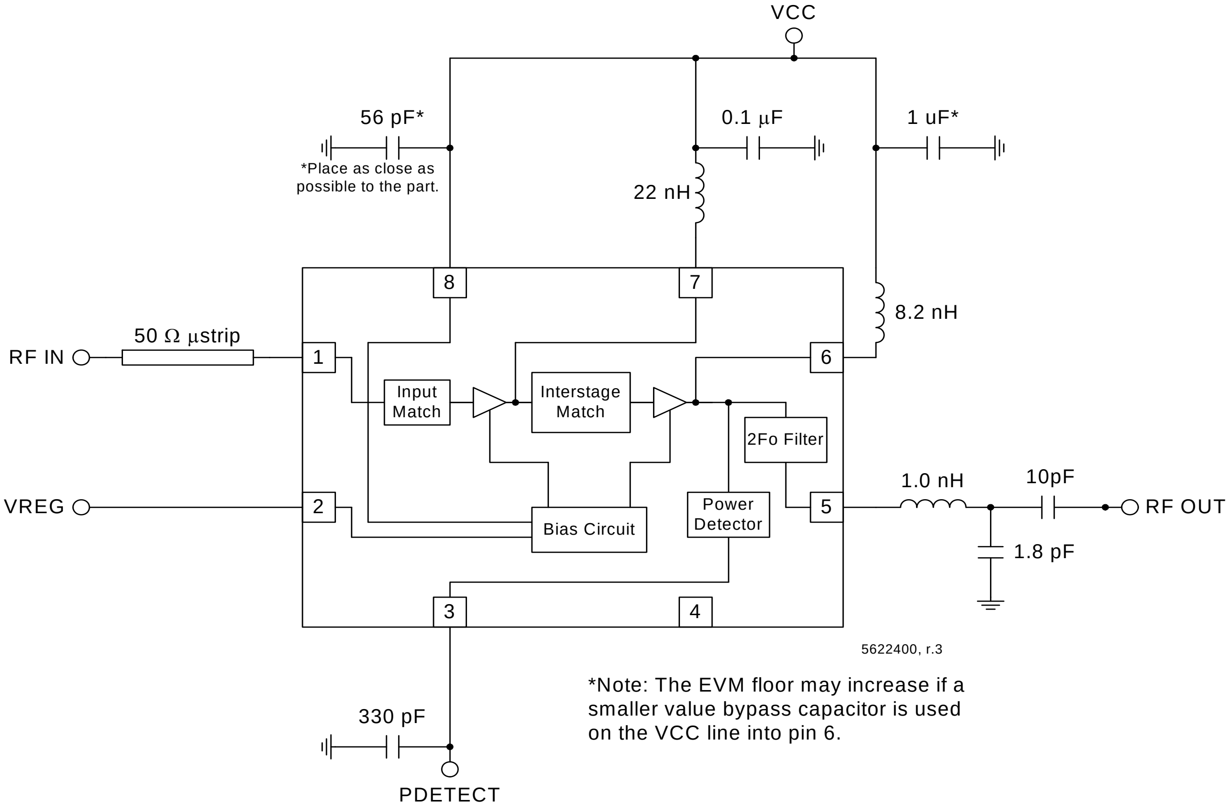
Application Schematic



*Note: The EVM floor may increase if a smaller value bypass capacitor is used on the VCC line into pin 6.

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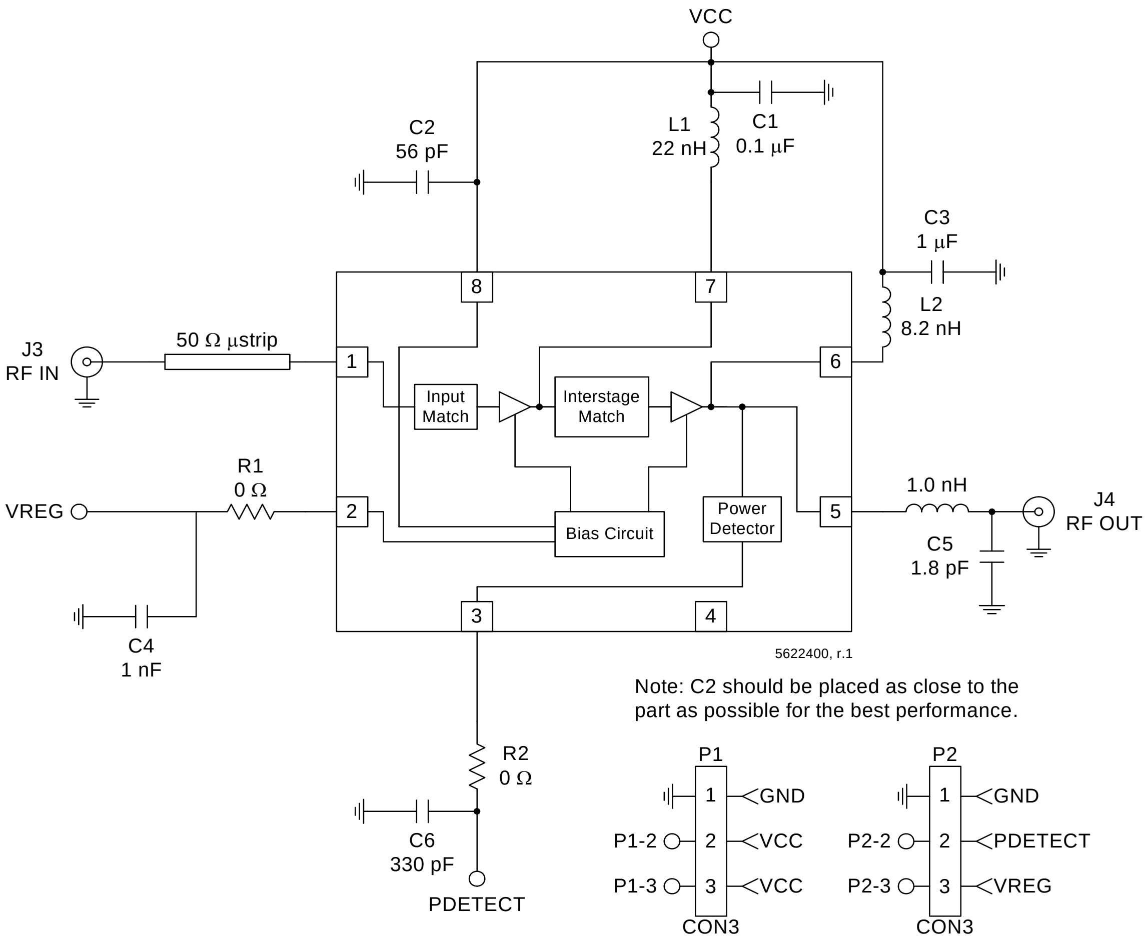
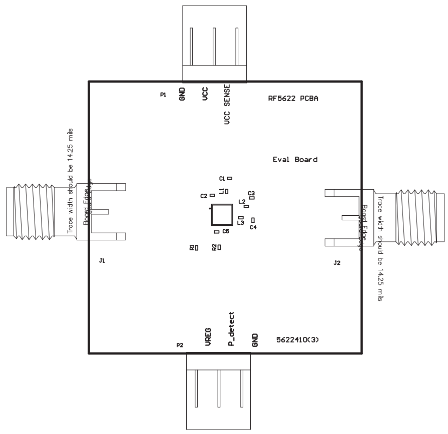
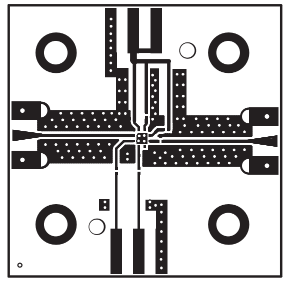
Evaluation Board Schematic (PROTOTYPE)
IEEE802.11b/g

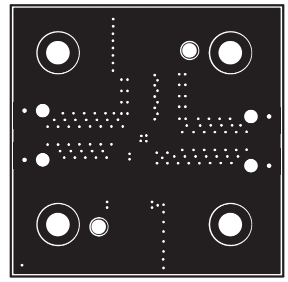


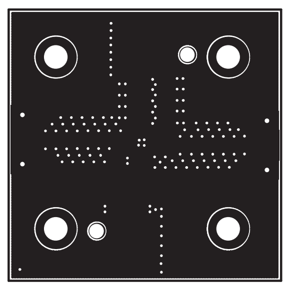
Note: C2 should be placed as close to the part as possible for the best performance.

Evaluation Board Layout
Board Size 1.2" x 1.2"
Board Thickness 0.032", Board Material FR-4









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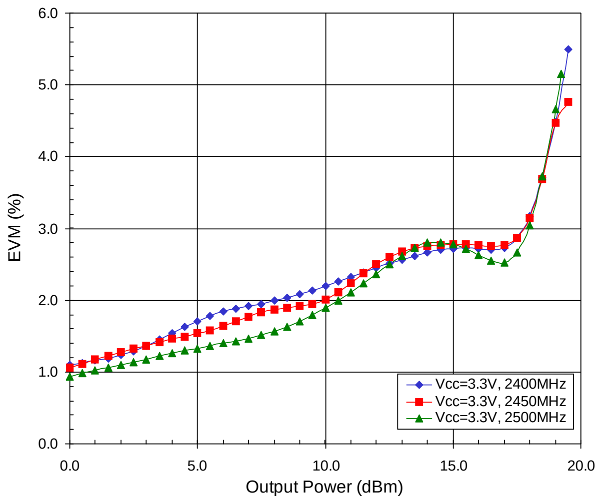
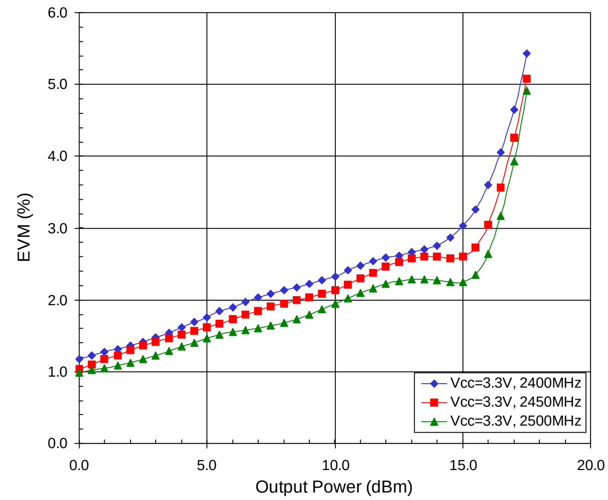
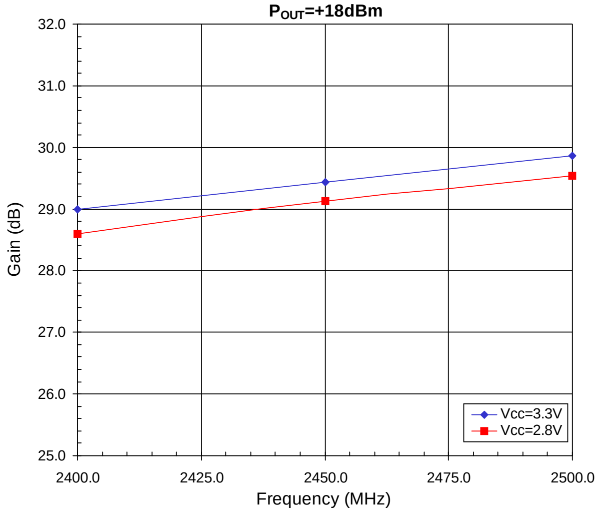
V_{CC}=3.3V: EVM versus P_{OUT}



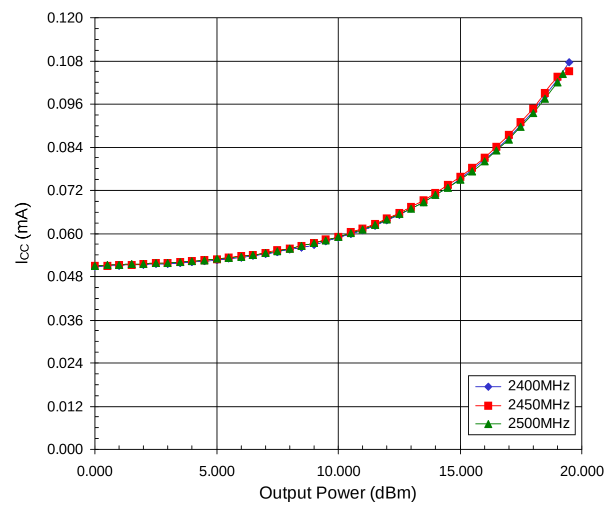
V_{CC}=2.8V: EVM versus P_{OUT}



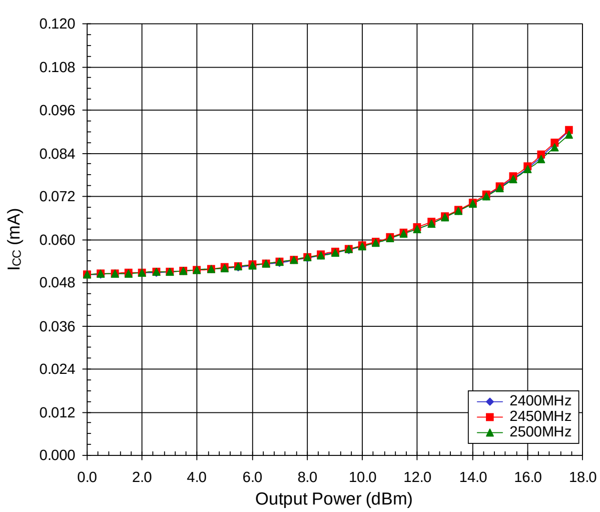
Gain versus Frequency
P_{OUT}=+18dBm



V_{CC}=3.3V: I_{CC} versus P_{OUT}



V_{CC}=2.8V: I_{CC} versus P_{OUT}



P_{DETECT} versus P_{OUT}