

## Typical Applications

- Bluetooth™ PA
- 2.4GHz to 2.5GHz ISM Band Systems
- 902MHz to 928MHz ISM Band Systems
- 3.6V Spread-Spectrum Cordless Phones
- Portable Battery-Powered Equipment
- Spread-Spectrum Systems

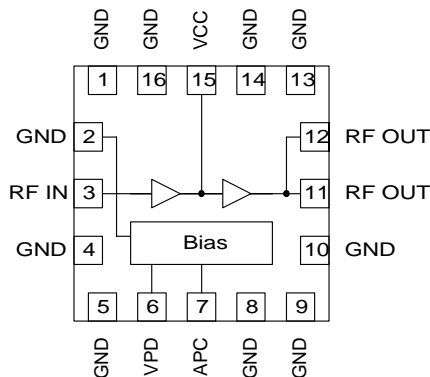
## Product Description

The RF2172 is a medium-power high efficiency amplifier IC targeting 3.6V handheld systems. The device is manufactured on an advanced Gallium Arsenide Heterojunction Bipolar Transistor (HBT) process, and has been designed for use as the final RF amplifier in 2.45GHz Bluetooth applications and frequency hopping/direct sequence spread-spectrum cordless telephones or other applications in the 902MHz to 928MHz ISM band. The device is packaged in a compact 4mmx4mm LCC. The device features analog gain control to optimize transmit power while maximizing battery life in portable equipment requiring up to 100mW transmit power at the antenna port.

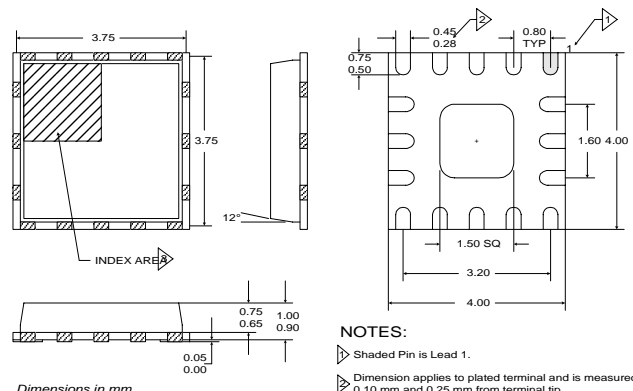
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### Optimum Technology Matching® Applied

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



Functional Block Diagram



#### NOTES:

- Shaded Pin is Lead 1.
- Dimension applies to plated terminal and is measured 0.10 mm and 0.25 mm from terminal tip.
- The terminal #1 identifier and terminal numbering convention shall conform to JESD 95-1 SPP-012. Details of terminal identifier are optional, but must be located within the 2 indicated. The identifier may be either a mold or mark feature.
- Pins 1 and 9 are fused.
- Package Warpage: 0.05 max.

Package Style: LCC, 16-Pin, 4 x 4

## Features

- 23.5dBm Typical Output Power
- 0dB to 28dB Variable Gain
- 45% Efficiency at Max Output
- On-Board Power Down Mode
- 2.4GHz to 2.5GHz Operation
- 902MHz to 928MHz Operation

## Ordering Information

- RF2172      ISM Band 3.6V, 250mW Amp with Analog Gain Control
- RF2172 PCBA-H      Fully Assembled Evaluation Board 2.4to2.5GHz
- RF2172 PCBA-L      Fully Assembled Evaluation Board 902to928MHz

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# RF2172

## Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage (RF off)	-0.5 to +6.0	V <sub>DC</sub>
APC Current (Maximum)	+10	mA
Control Voltage (V <sub>PD</sub> )	-0.5 to +6.0	V <sub>DC</sub>
Input RF Power	+10	dBm
Operating Case Temperature	-40 to +85	°C
Storage Temperature	-55 to +155	°C



**Caution!** ESD sensitive device.

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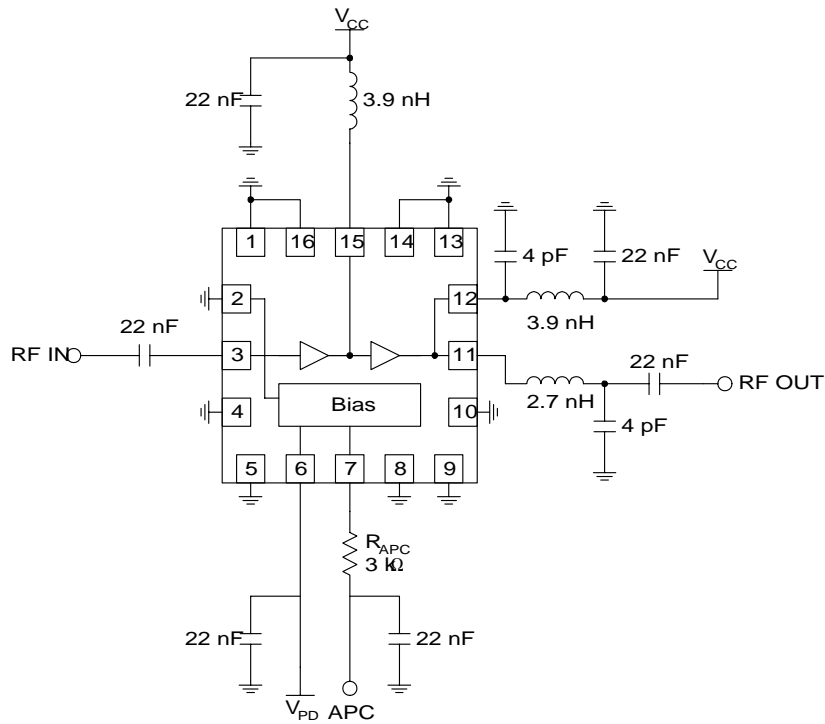
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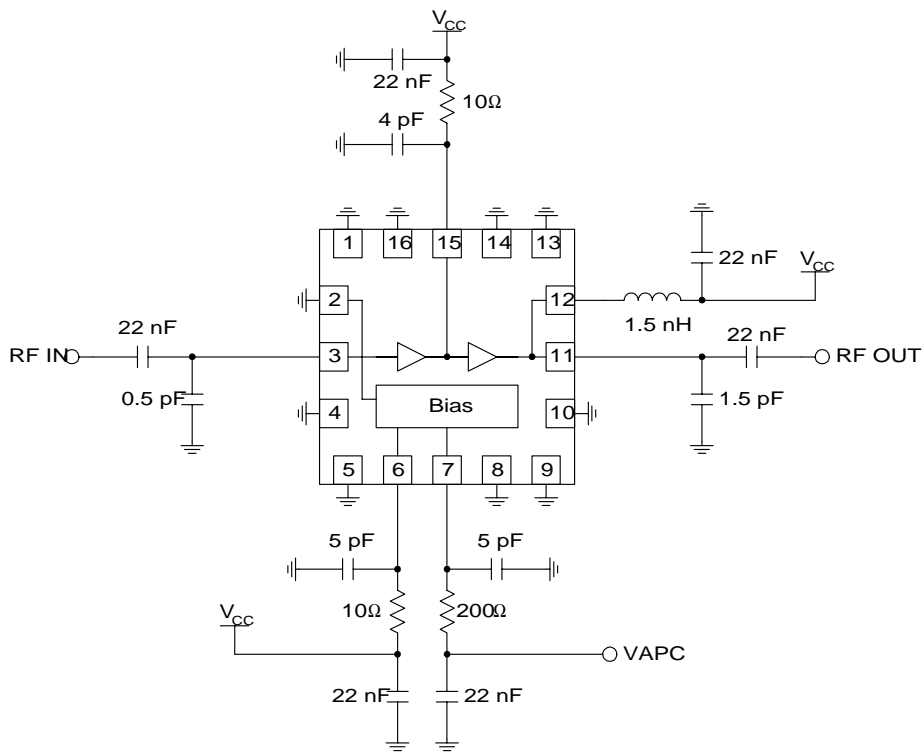
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
<b>Overall</b>					T=25°C, V <sub>CC</sub> =3.6V, V <sub>PD</sub> =3.6V, V <sub>APC</sub> =2.5V
Usable Frequency Range		500 to 2500		MHz	
Input Impedance		50		Ω	
Input VSWR		1.8:1			Without Input Match
Output Load VSWR	<10:1 <6:1				0 ≤ V <sub>APC</sub> ≤ 3.0V 0 ≤ V <sub>APC</sub> ≤ 3.6V
<b>2.45GHz Operation</b>					Freq=2.4GHz to 2.5GHz, P <sub>IN</sub> =0dBm
Operating Frequency		2.4 to 2.5		GHz	
Maximum Output Power	22	+23.5	24.5	dBm	
Total Efficiency		45		%	
Reverse Isolation		-25		dB	
Second Harmonic		-45		dBc	
Third Harmonic		-40		dBc	
All Other Spurious		-50		dBc	
Output Load Impedance		20-j4.5			Present to part
Gain Control Voltage		0 to V <sub>CC</sub>		V	
High Gain	+22			dB	V <sub>APC</sub> =3.6V, V <sub>CC</sub> =3.6V, P <sub>IN</sub> =0dBm
Low Gain			-10	dB	V <sub>APC</sub> =0V, V <sub>CC</sub> =3.6V, P <sub>IN</sub> =0dBm
<b>902MHz Operation</b>					Freq=902MHz to 928MHz, P <sub>IN</sub> =-3.0dBm
Operating Frequency		902 to 928		MHz	
Maximum Output Power		+24		dBm	
Total Efficiency		58		%	
Reverse Isolation		-35		dB	
Second Harmonic		-40		dBc	
Third Harmonic		-40		dBc	
All Other Spurious		-50		dBc	
Output Load Impedance		20-j1.6		Ω	Present to part
Gain Control Voltage		0 to V <sub>CC</sub>		V	
Gain Control Slope		20		dB/V	
Gain		0 to 28		dB	
<b>Power Supply</b>					
Power Supply Voltage		3.6		V	
Power Supply Current		145		mA	V <sub>CC</sub> =3.6V, V <sub>APC</sub> =3.6V, P <sub>IN</sub> =-3dBm, V <sub>PD</sub> =3.6V
Idle Current		35		mA	V <sub>PD</sub> =3.6V, V <sub>APC</sub> =3.6V, RF P <sub>IN</sub> ≤ -30dBm
<b>Power Down Current</b>					
I(PD)		2.8	10	μA	V <sub>CC</sub> =3.6V, V <sub>APC</sub> =0V, V <sub>PD</sub> =0V total I <sub>CC</sub>
I(PD)		4.5		mA	V <sub>CC</sub> =3.6V, V <sub>PD</sub> =3.6V into PD pin
I(PD)		2.25		mA	V <sub>CC</sub> =3.0V, V <sub>PD</sub> =3.0V into PD pin

Pin	Function	Description	Interface Schematic
1	<b>GND</b>	Ground connection. For best performance, keep traces physically short and connect immediately to the ground plane.	
2	<b>GND</b>	Ground connection for the driver stage. For best performance, keep traces physically short and connect immediately to the ground plane.	
3	<b>RF IN</b>	RF input. This is a 50Ω input. No external matching is needed. An external DC blocking capacitor is required if this port is connected to a DC path to ground or a DC voltage.	See pin 15.
4	<b>GND</b>	See pin 1.	
5	<b>GND</b>	See pin 1.	
6	<b>VPD</b>	Power down pin. When this pin is 0V, the device will be in power down mode, dissipating minimum DC power. This pin also serves as the V <sub>CC</sub> supply pin for the bias circuitry. V <sub>PD</sub> should be at the supply voltage when the part is not in power down mode.	
7	<b>APC</b>	Analog power control. Output power varies as a function of the voltage on this pin. See graph. This pin must be driven through a series resistor with a voltage between 0V and V <sub>CC</sub> . Series resistor determines dynamic range of power control. See plot "P <sub>OUT</sub> versus Gain Control versus Gain Control Resistor".	
8	<b>GND</b>	See pin 1.	
9	<b>GND</b>	See pin 1.	
10	<b>GND</b>	See pin 1.	
11	<b>RF OUT</b>	RF output. An external matching network is required to provide the optimum load impedance at this pin.	See pin 15.
12	<b>RF OUT</b>	RF output and power supply for the output stage. Bias voltage for the output stage is provided through this pin. A shunt cap resonating with the bond wire inductance at 2xf <sub>0</sub> can also be used at this pin to provide a second harmonic trap.	See pin 15.
13	<b>GND</b>	See pin 1.	
14	<b>GND</b>	See pin 1.	
15	<b>VCC</b>	Power supply for driver stage and interstage matching. This pin forms the shunt inductance needed for proper tuning of the interstage. Refer to the application schematic for the proper configuration. Note: Position and value of the components are important.	
16	<b>GND</b>	See pin 1.	
<b>Pkg Base</b>	<b>GND</b>	Ground connection for the output stage. This pad should be connected to the groundplane by vias directly under the device. A short path is required to obtain optimum performance, as well as provide a good thermal path to the PCB for maximum heat dissipation.	

## Application Schematic - 915MHz

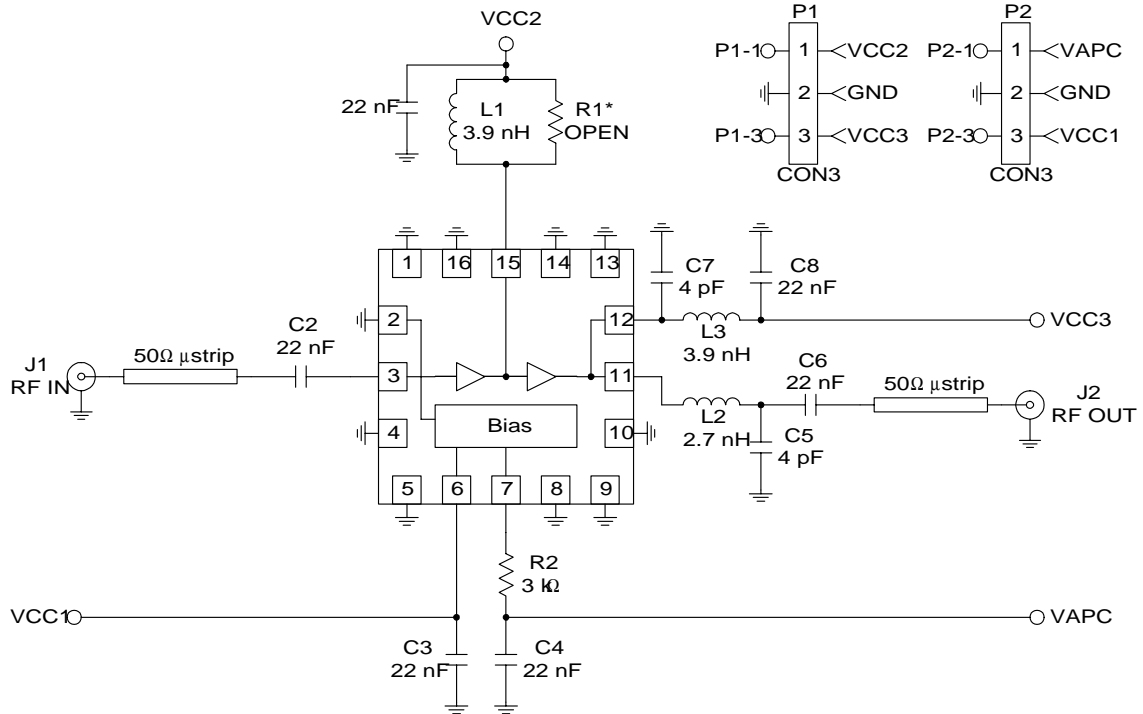


## Application Schematic - 2.45GHz



## Evaluation Board Schematic - 915MHz

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

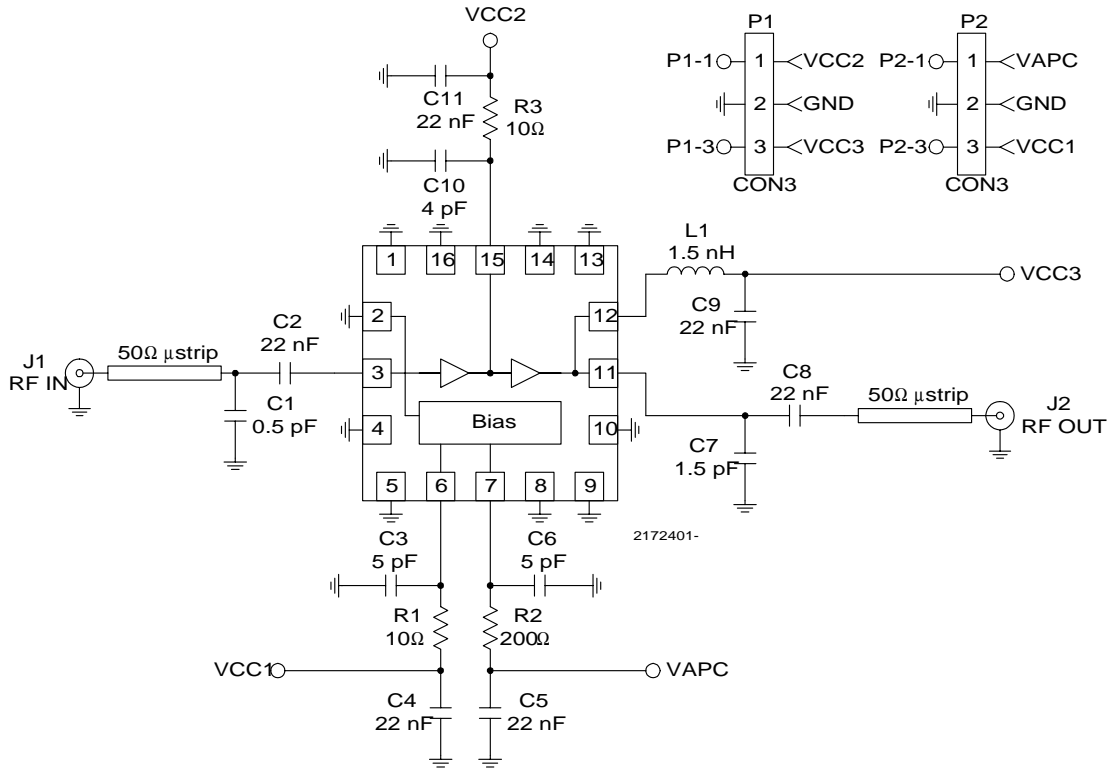


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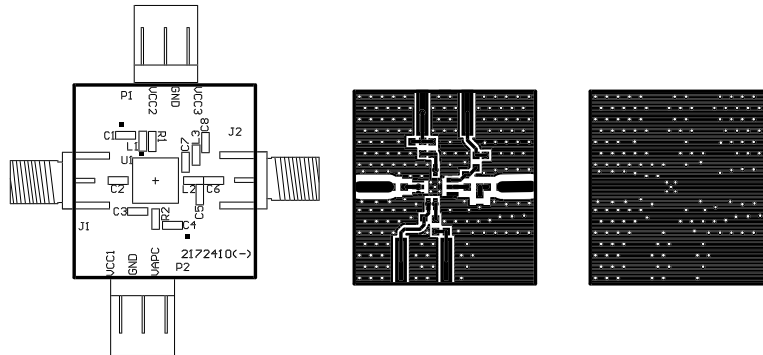
## Evaluation Board Schematic - 2.45GHz

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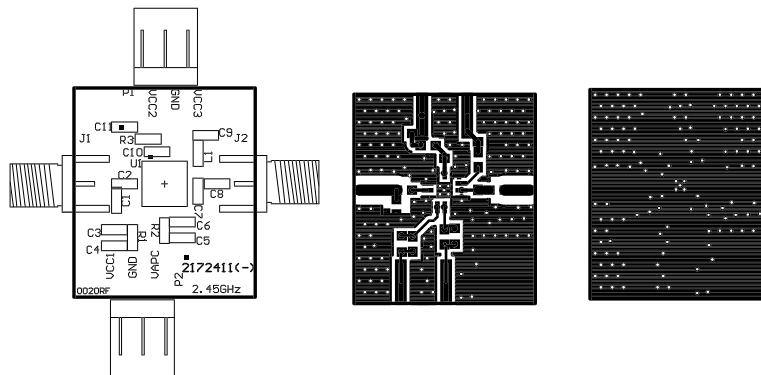
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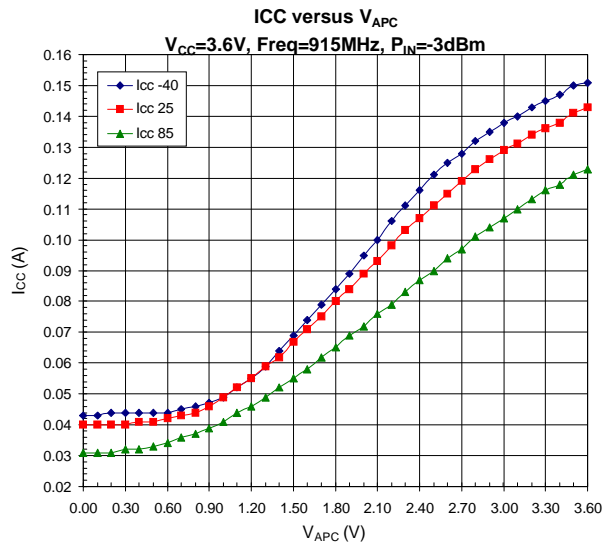
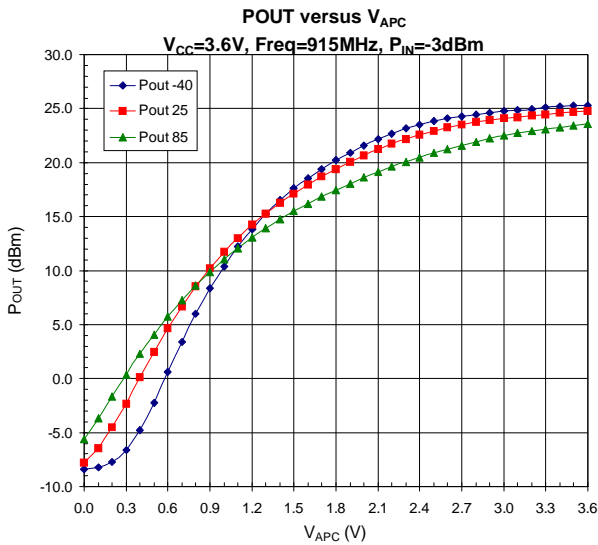
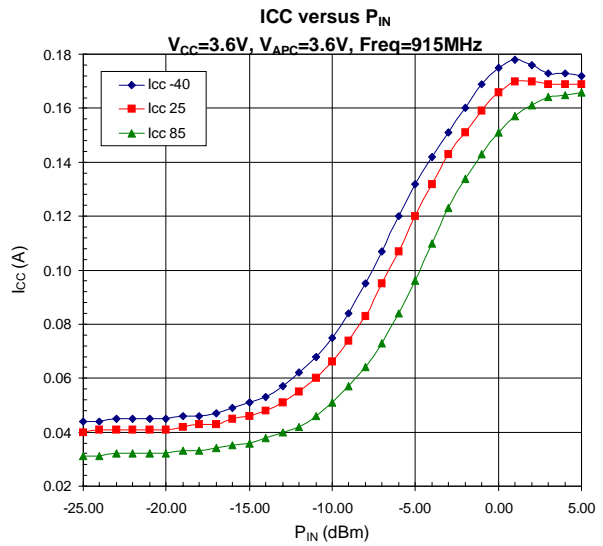
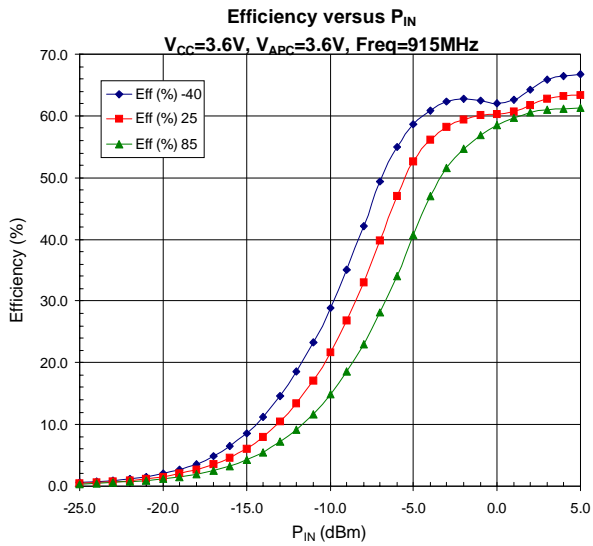
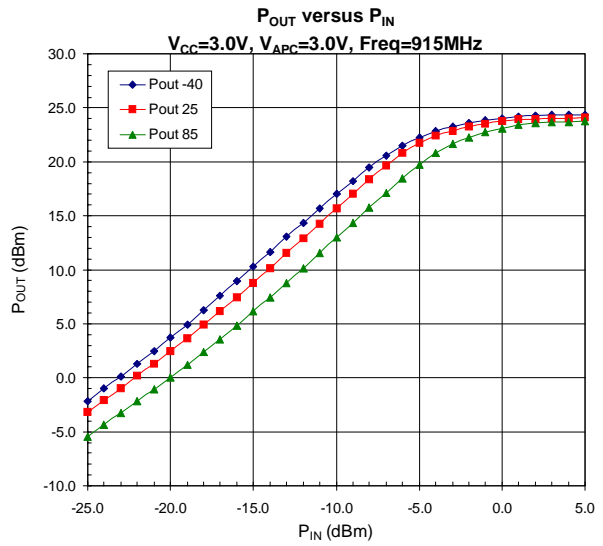
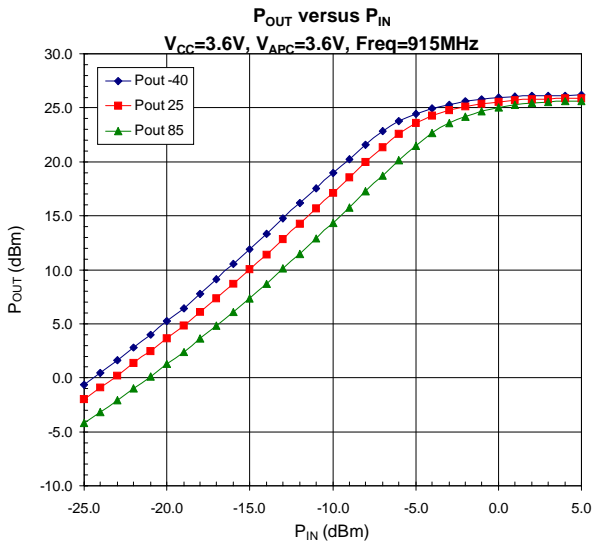


Evaluation Board Layout - 915MHz  
 Board Size 0.80" x 0.85"  
 Board Thickness 0.031", Board Material FR-4

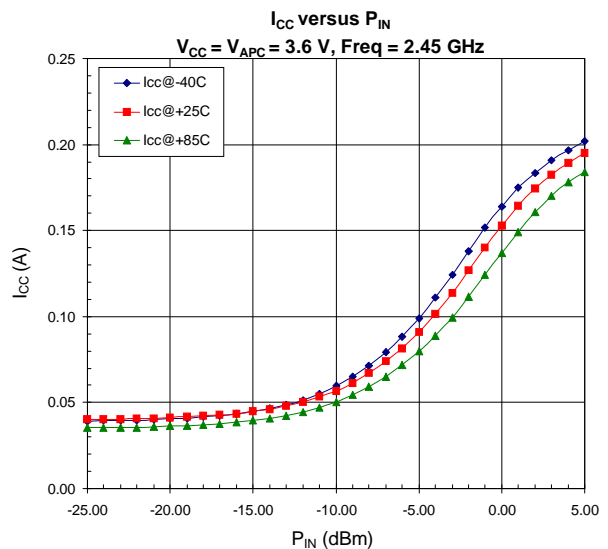
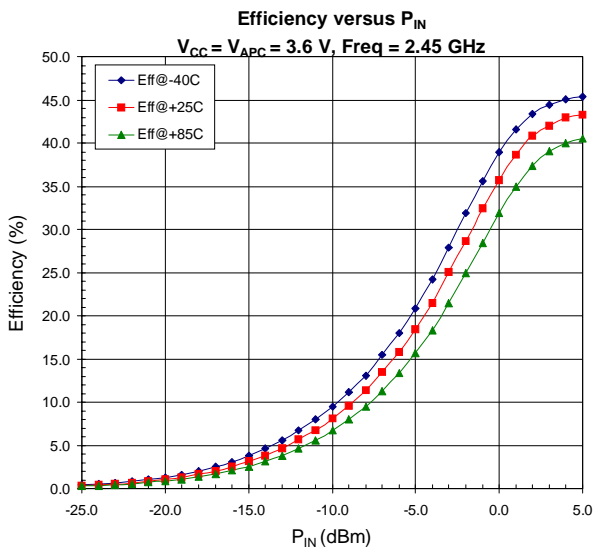
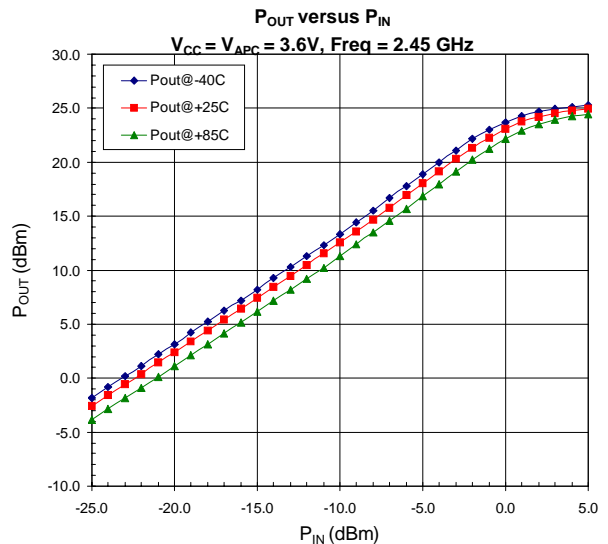
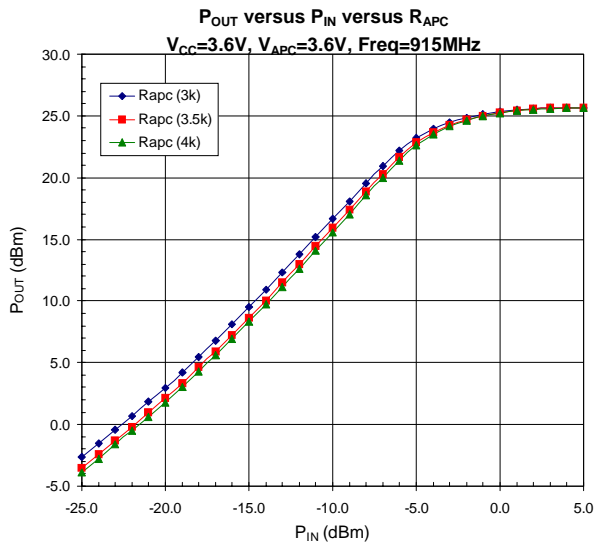
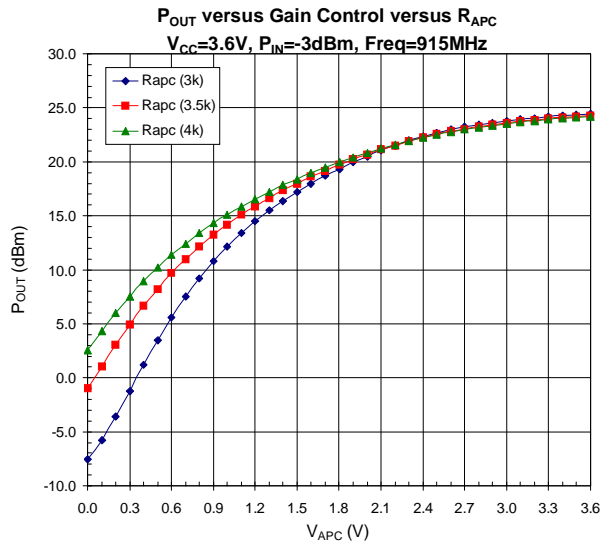
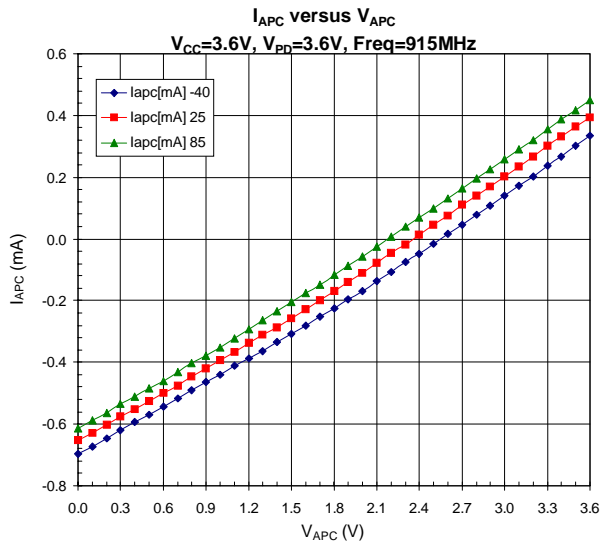


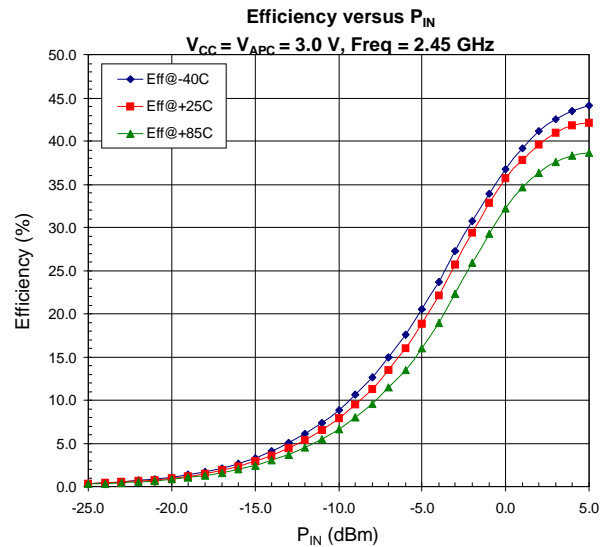
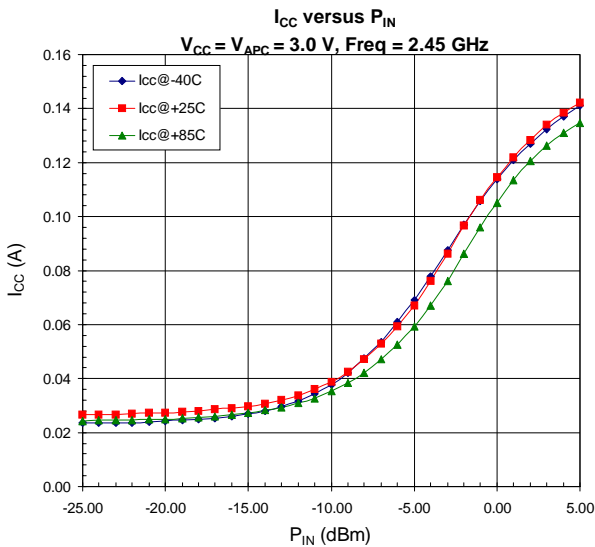
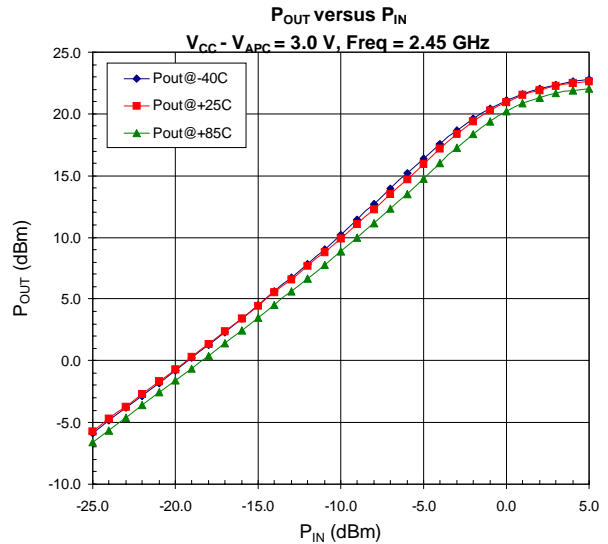
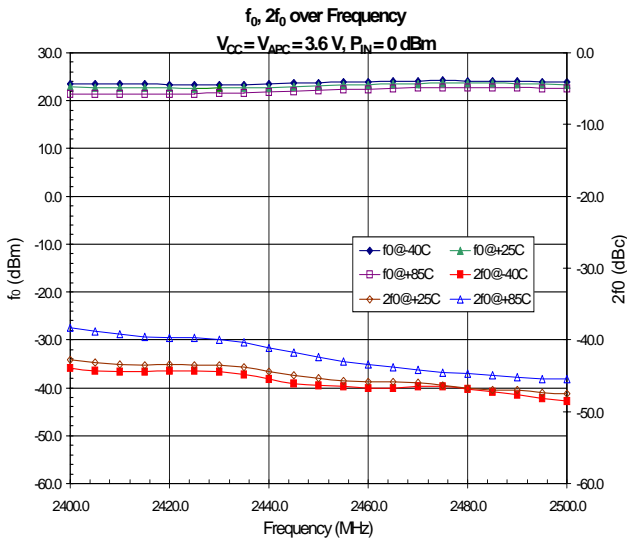
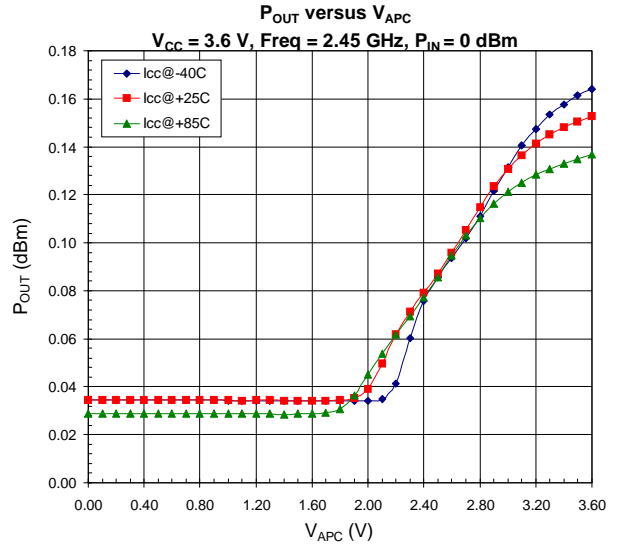
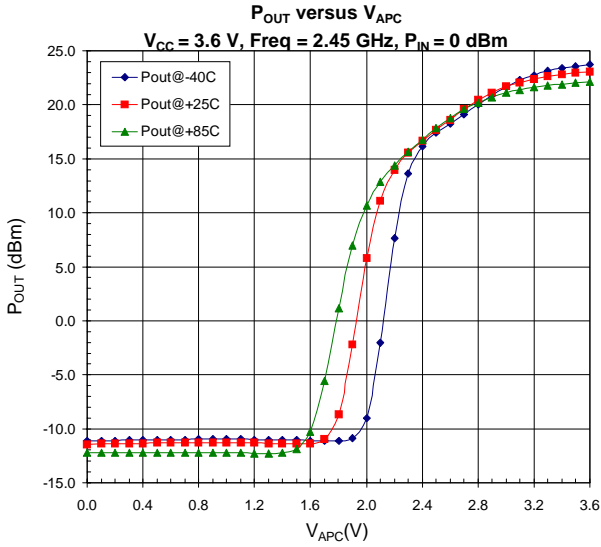
Evaluation Board Layout - 2.45GHz  
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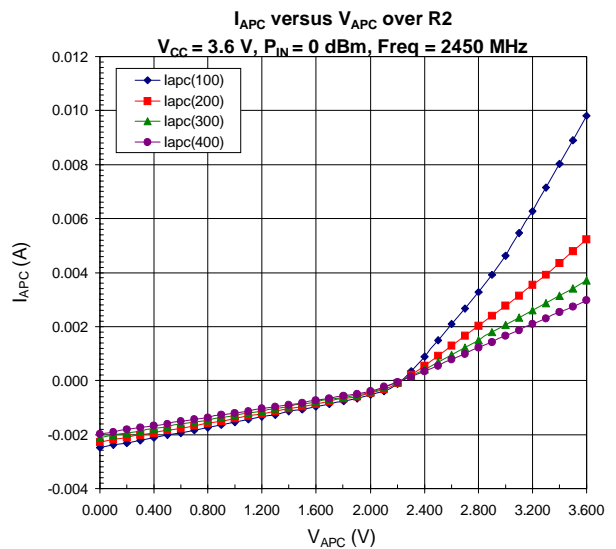
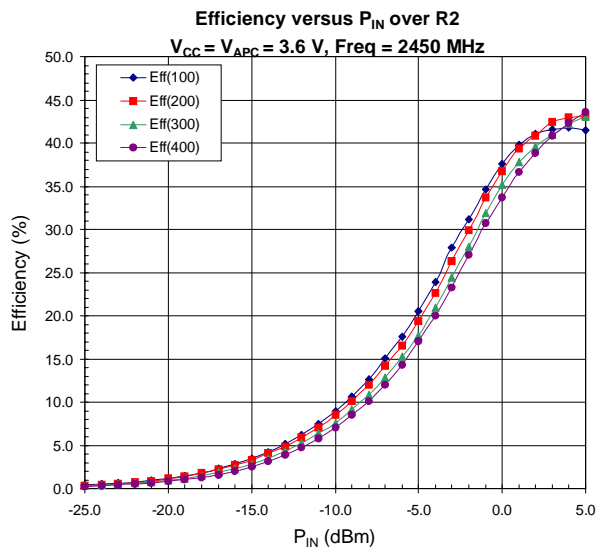
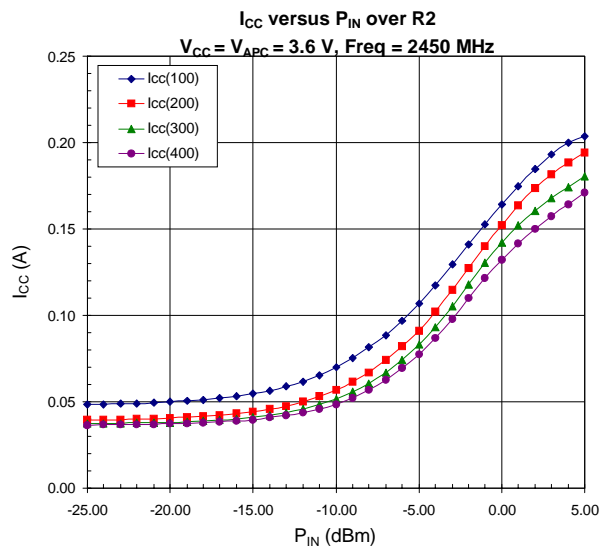
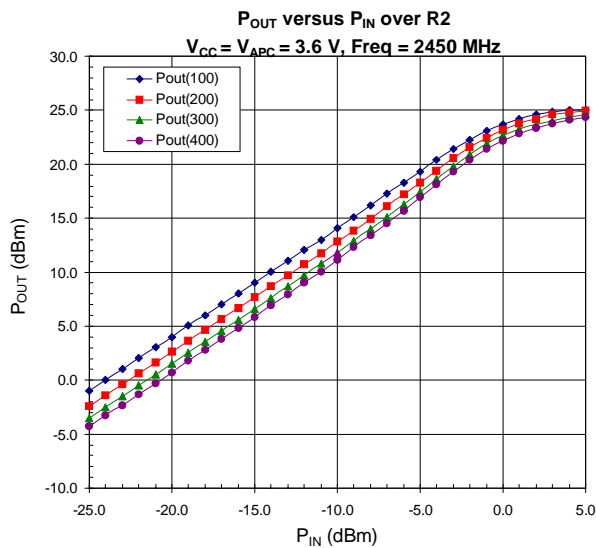
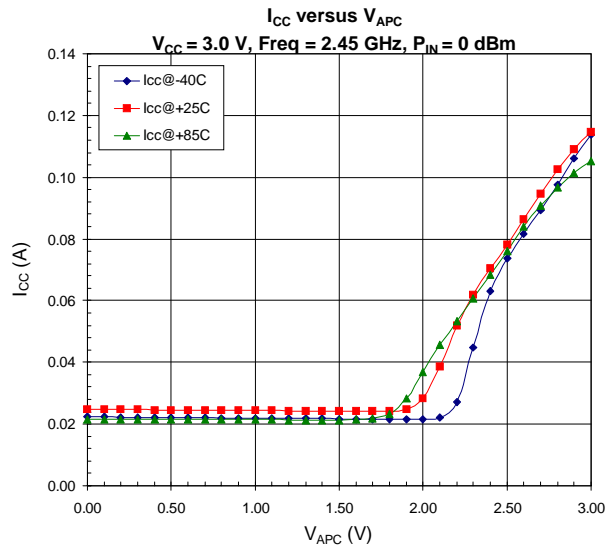
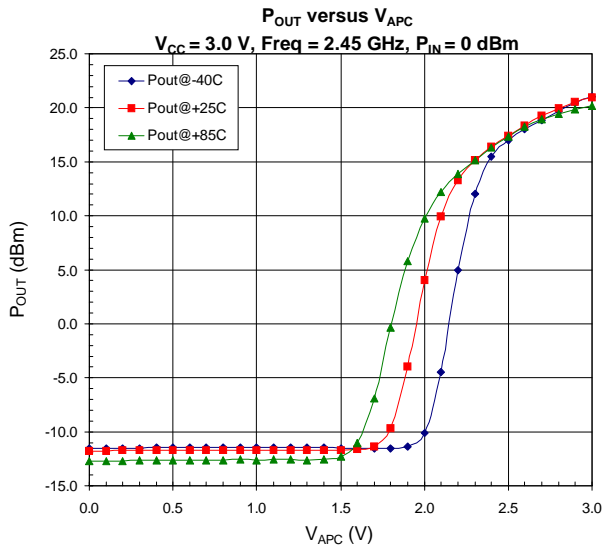












**RF2172**

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