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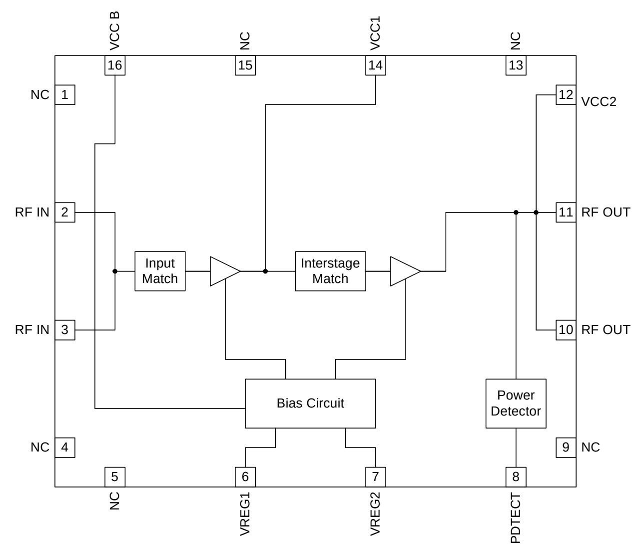
RF5102

3V TO 5V LINEAR POWER AMPLIFIER FOR 2.4GHz WIFI

Package Style: QFN, 16-Pin, 3mmx3mmx0.9mm



Functional Block Diagram

Features

- Single Power Supply 3.0V to 5V
- +21dBm, <4.0%EVM, 185mA at V_{CC}=3.3V
- +23dBm, <4% EVM, 250mA at V_{CC}=5.0V
- 28dB Typical Small Signal Gain
- 50Ω Input and Interstage Matching
- 2400MHz to 2500MHz Frequency Range

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

Product Description

The RF5102 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 3mmx3mmx0.9mm, 16-pin, QFN with a backside ground. The RF5102 is designed to maintain linearity over a wide range of supply voltage and power output.

Ordering Information

RF5102	Standard 25 piece bag
RF5102SR	Standard 100 piece reel
RF5102TR7	Standard 2500 piece reel
RF5102PCK-41X	Fully Assembled Evaluation Board Kit (3.3V tune)
RF5102WL50PCK-41X	Fully Assembled Evaluation Board Kit (5.0V Tune)

Optimum Technology Matching® Applied

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

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Absolute Maximum Ratings

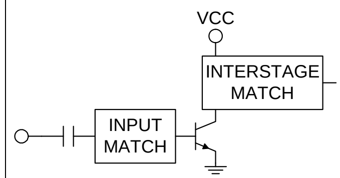
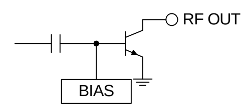
Parameter	Rating	Unit
Supply Voltage	5	V
Power Control Voltage (V_{REG})	3.3	V
DC Supply Current	500	mA
Input RF Power	+5	dBm
Operating Ambient Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C
Moisture Sensitivity	MSL2	

Caution! ESD sensitive device.

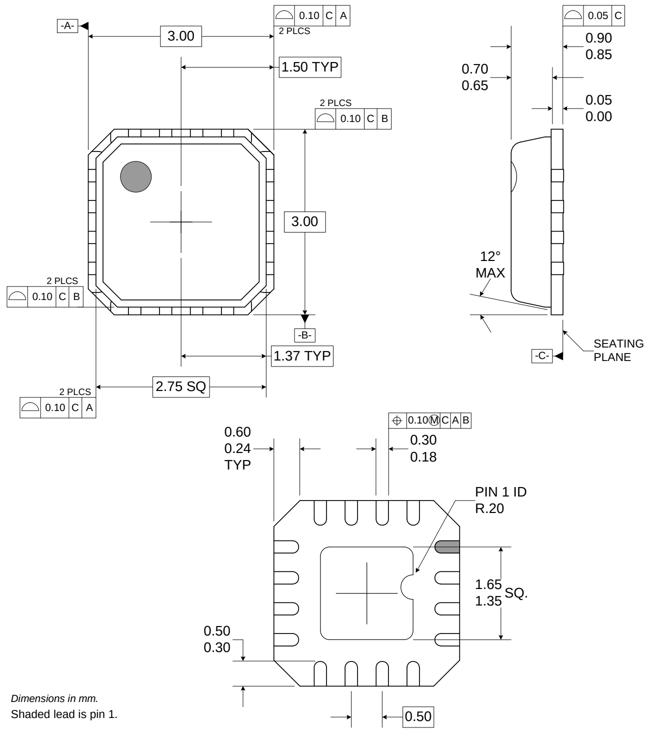
Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute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

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

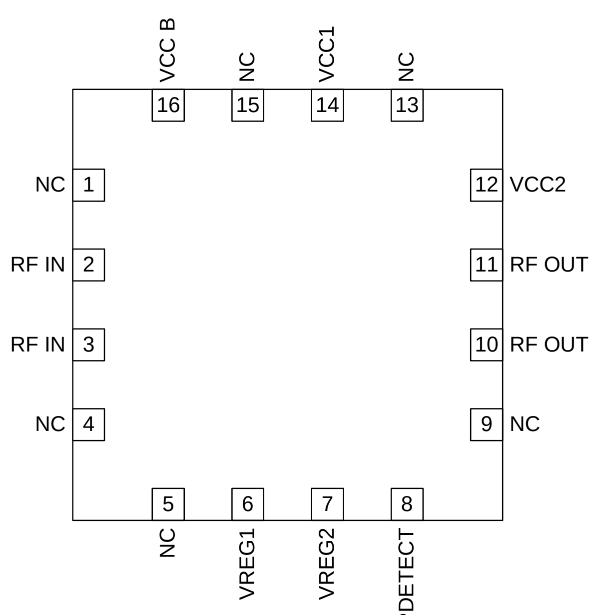
Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Compliance and Nominal Conditions					IEEE802.11g, IEEE802.11b, FCC CFG 15.247, .205, .209, EN and JDEC V_{CC}=3.3V, V_{REG}=2.85V pulsed at 1% to 99% duty cycle ,Temp=+25°C, Freq=2.4GHz to 2.5GHz, OFDM 54Mbps signal, unless noted otherwise.
Frequency Range	2400		2500	MHz	
Linear Output Power		21.0		dBm	V_{CC}=3.3V. Meets 802.11g spectral mask
		23.0		dBm	V_{CC}=5.0V. Meets 802.11g spectral mask
EVM		3.3	4.0	%	P_{OUT}=+21dBm, 54M OFDM, V_{CC}=3.3V_{DC}
		3.3	4.0	%	P_{OUT}=+23dBm, 54M OFDM, V_{CC}=5.0V_{DC}
Gain	26	28		dB	Both P_{OUT}=+21dBm and +23dBm. V_{CC}=3.3V and 5.0V.
Input Impedance		50		Ω	Internally Matched Input and Interstage
Output VSWR			10:1		No spurs above -43dBm
Power Detector (P_detect)					
P_{OUT}=21dBm	0.13		1.10	V	V_{CC}=3.3V
P_{OUT}=23dBm	0.13		2.2	V	V_{CC}=5.0V
Power Supply					
Operating Voltage	3.0	3.3	5.0	V_{DC}	5V operation requires output match revision
V_{REG} (Bias) Voltage (V_{REG1}, V_{REG2})	2.75	2.85	2.95	V_{DC}	
Current Consumption		185		mA	RF P_{OUT}=+21dBm, V_{CC}=3.3V, 54Mbps OFDM
		250			RF P_{OUT}=+23dBm, V_{CC}=5.0V, 54Mbps OFDM
Quiescent Current		95		mA	RF=OFF
Leakage Current			10	uA	V_{CC}=ON; RF In=OFF; V_{REG} OFF
V_{REG} (Bias) Current (Total)			3	mA	V_{CC}=3.3V
			3	mA	V_{CC}=5.0V

Pin	Function	Description	Interface Schematic
1	NC	Not connected. May be connected to ground (GND).	
2	RF IN	RF input. See evaluation board schematic for details.	
3	RF IN	RF input. See evaluation board schematic for details.	See pin 2.
4	NC	Not connected. May be connected to ground (GND).	
5	NC	Do not connect. Note: VCC voltage may be applied to this pin without damage to, or affecting the performance of, the RF5102.	
6	VREG1	Bias current control voltage for the first stage.	
7	VREG2	Bias current control voltage for the second stage. The VREG2 pin may be connected to VREG1 through an external resistor bridge.	
8	PDETECT (or N/C*)	Provides an output voltage proportional to the output RF level. *In applications where the PDETECT function is not desired, this pin may be left unconnected.	
9	NC	No-connect.	
10	RF OUT	RF output.	
11	RF OUT	Same as pin 10.	See pin 10.
12	VCC2	Power supply for second stage amplifier. Connect as shown on evaluation board schematic.	
13	NC	Not connected. May be connected to ground (GND).	
14	VCC1	Power supply for first stage amplifier. Connect as shown on evaluation board schematic.	
15	NC	Not connected. May be connected to ground (GND).	
16	VCC B	Supply voltage for the bias reference and control circuits. May be connected with VC1 and VC2 (single-supply voltage).	
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



Pin Out



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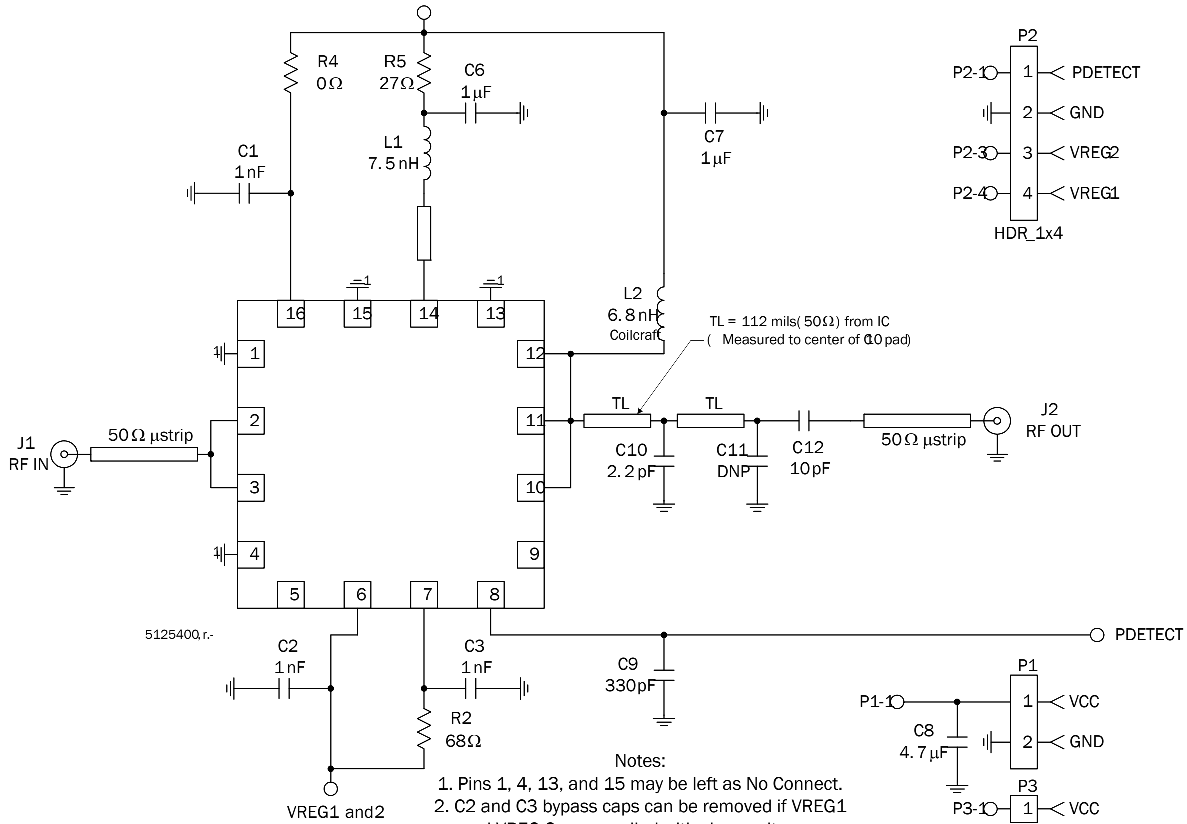
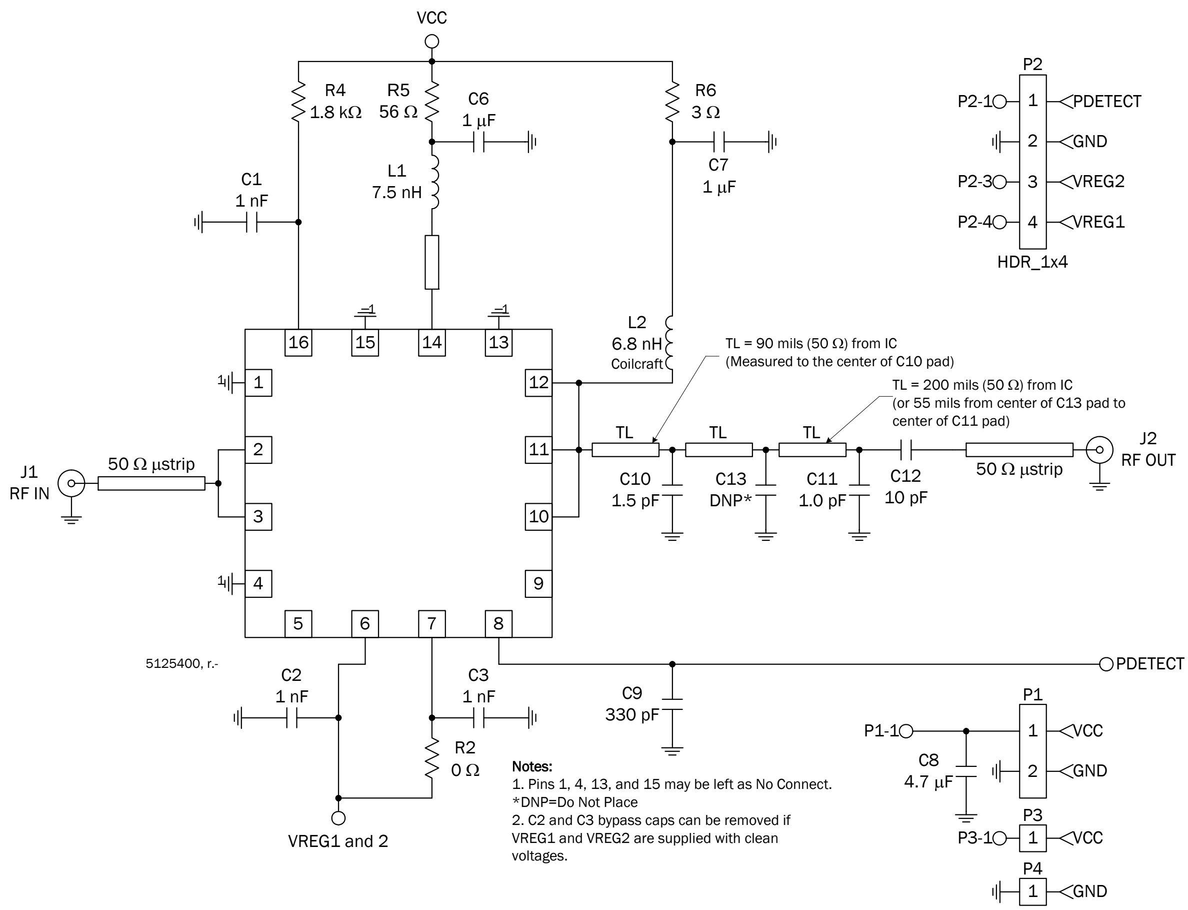
Evaluation Board Schematic - 3.3V



Notes:
1. Pins 1, 4, 13, and 15 may be left as No Connect.
2. C2 and C3 bypass caps can be removed if VREG1 and VREG 2 are cupplied with clean voltages.
*DNP = Do Not Place

Evaluation Board Schematic - 5V



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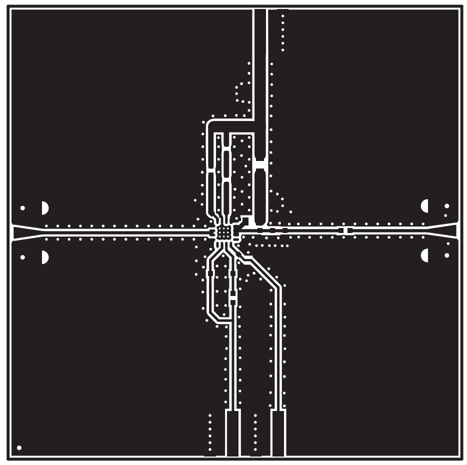
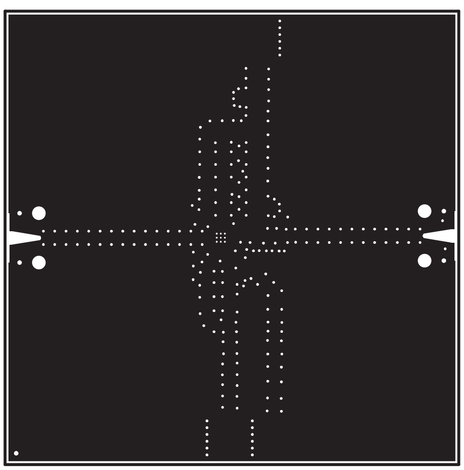
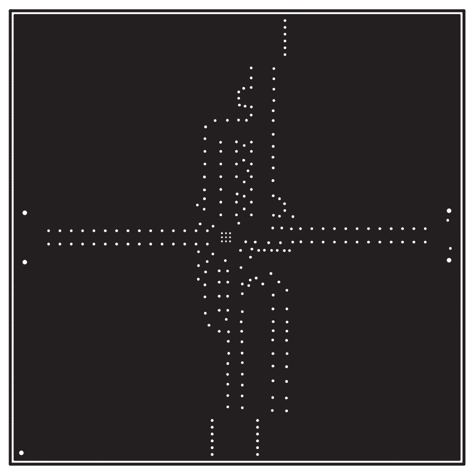
Evaluation Board Layout
Board Size 2.0" x 2.0"
Board Thickness 0.031", Board Material FR-4, Multi-Layer



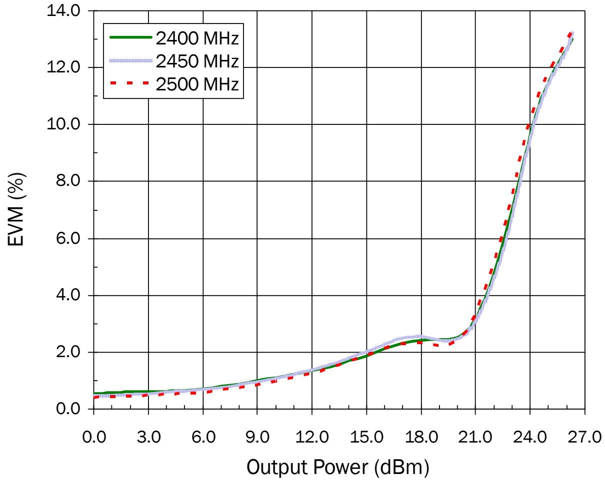




3.3V Operation Typical Performance

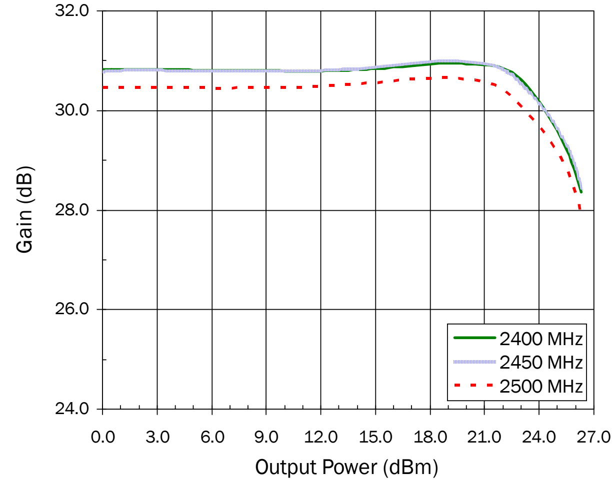
EVM versus Output Power versus Frequency

V_{CC}=3.3V, OFDM 54Mbps, 50% Duty Cycle, Temp=25°C



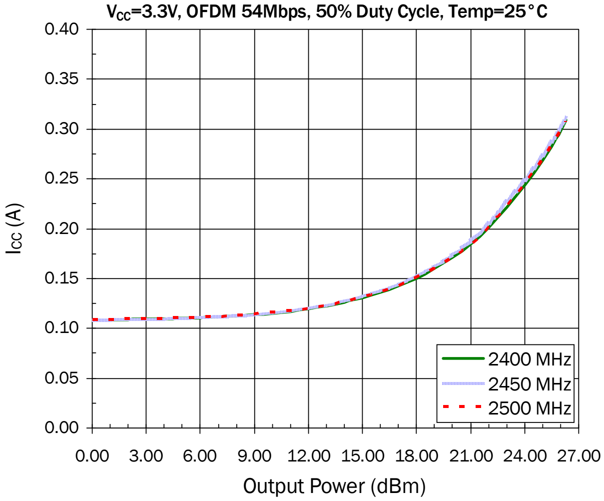
Gain versus Output Power versus Frequency

V_{CC}=3.3V, OFDM 54Mbps, 50% Duty Cycle, Temp=25°C



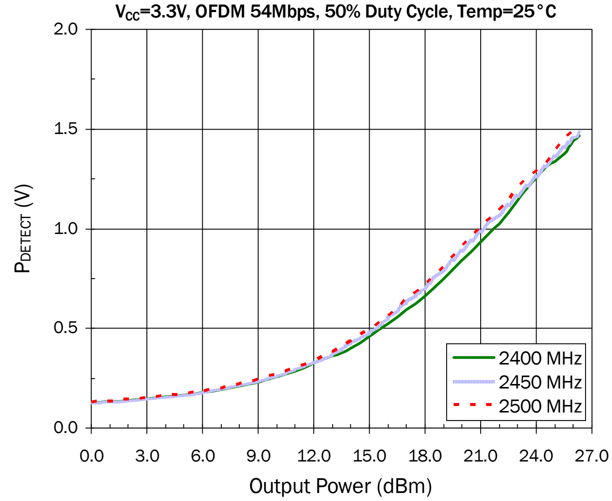
I_{CC} versus Output Power versus Frequency

V_{CC}=3.3V, OFDM 54Mbps, 50% Duty Cycle, Temp=25°C



P_{DETECT} versus Output Power versus Frequency

V_{CC}=3.3V, OFDM 54Mbps, 50% Duty Cycle, Temp=25°C



PCB Design Requirements

PCB Surface Finish

The PCB surface finish used for RFMD's qualification process is electroless nickel, immersion gold. Typical thickness is 3 μinch to 8 μinch gold over 180 μinch nickel.

PCB Land Pattern Recommendation

PCB land patterns for RFMD components are based on IPC-7351 standards and RFMD empirical data. The pad pattern shown has been developed and tested for optimized assembly at RFMD. The PCB land pattern has been developed to accommodate lead and package tolerances. Since surface mount processes vary from company to company, careful process development is recommended.

PCB Metal Land Pattern

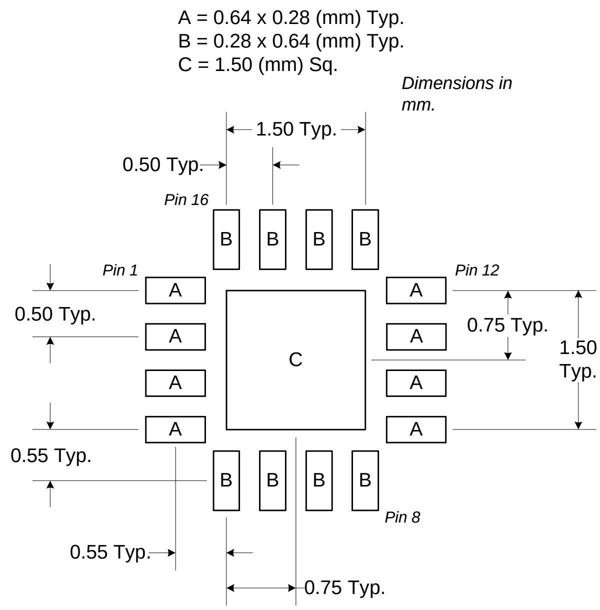


Figure 1. PCB Metal Land Pattern (Top View)

PCB Solder Mask Pattern

Liquid Photo-Imageable (LPI) solder mask is recommended. The solder mask footprint will match what is shown for the PCB metal land pattern with a 2mil to 3mil expansion to accommodate solder mask registration clearance around all pads. The center-grounding pad shall also have a solder mask clearance. Expansion of the pads to create solder mask clearance can be provided in the master data or requested from the PCB fabrication supplier.

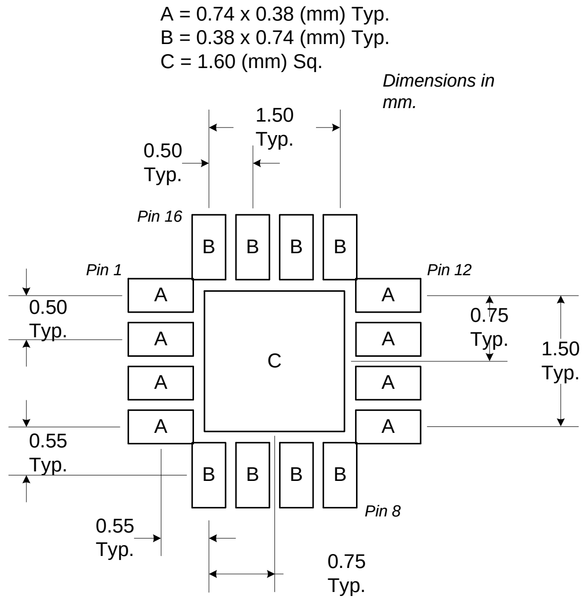


Figure 2. PCB Solder Mask Pattern (Top View)

Thermal Pad and Via Design

The PCB land pattern has been designed with a thermal pad that matches the die paddle size on the bottom of the device.

Thermal vias are required in the PCB layout to effectively conduct heat away from the package. The via pattern has been designed to address thermal, power dissipation and electrical requirements of the device as well as accommodating routing strategies.

The via pattern used for the RFMD qualification is based on thru-hole vias with 0.203mm to 0.330mm finished hole size on a 0.5mm to 1.2mm grid pattern with 0.025mm plating on via walls. If micro vias are used in a design, it is suggested that the quantity of vias be increased by a 4:1 ratio to achieve similar results.

RoHS* Banned Material Content

RoHS Compliant:	Yes
Package total weight in grams (g):	0.015
Compliance Date Code:	N/A
Bill of Materials Revision:	-
Pb Free Category:	e3

Bill of Materials	Parts Per Million (PPM)					
	Pb	Cd	Hg	Cr VI	PBB	PBDE
Die	0	0	0	0	0	0
Molding Compound	0	0	0	0	0	0
Lead Frame	0	0	0	0	0	0
Die Attach Epoxy	0	0	0	0	0	0
Wire	0	0	0	0	0	0
Solder Plating	0	0	0	0	0	0

This RoHS banned material content declaration was prepared solely on information, including analytical data, provided to RFMD by its suppliers, and applies to the Bill of Materials (BOM) revision noted above.

* DIRECTIVE 2002/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment

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