RFPA5201

5.0V 2.4GHz to 2.5GHz Matched Power Amplifier

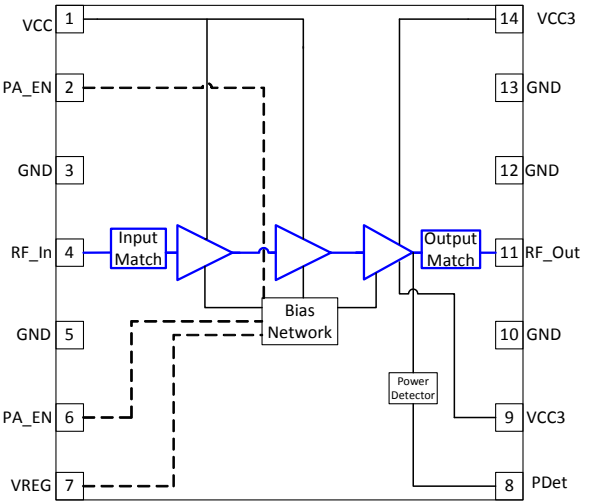
Package: Laminate, 14-pin,7mm x 7mm x 1mm

Features

- P_{OUT} = 29dBm; EVM = 3%; 11n MCS7 HT40
- Input and Output Matched to 50Ω
- High Gain: 33.5dB
- Integrated Power Detector
- High Impedance Enable Pin
- High PAE Design

Applications

- IEEE 802.11b/g/n WiFi Systems
- Customer Premise Equipment (CPE)
- Wireless Access Points, Gateways & Router Applications
- ISM Band Transmitter Applications



Functional Block Diagram

Product Description

The RFPA5201 is a highly integrated Power Amplifier Module (PAM) designed for high performance WiFi requiring up to +29dBm linear output power. This PAM is manufactured on an advanced RFMD InGaP Hetero-junction Bipolar Transistor (HBT) process.

The PAM is packaged in a 14-pin, 7mm x 7mm Multi-Chip Module (MCM) with an integrated power detector, biasing and input/output matching components. The RFPA5201 is designed to exceed system efficiency targets at +29dBm linear output power while meeting 802.11n dynamic Error Vector Magnitude (EVM) specifications. This solution provides a high performance, highly integrated solution with minimal external components.

Ordering Information

RFPA5201PCK-410	RFPA5201 Eval Board with 5-piece bag
RFPA5201SB	5-Piece Bag
RFPA5201SR	100-Piece Reel
RFPA5201TR13	2500-Piece Reel
RFPA5201SQ	25-Piece Bag

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Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage (RF Applied)	-0.5 to +5.5	V
Supply Voltage (No RF Applied)	-0.5 to +6.0	V
DC Supply Current	1800	mA
Input RF Power with 50Ω Output Load	10	dBm
Maximum VSWR with no damage	10:1	
Operating Ambient Temperature	-40 to +85	°C
Storage Temperature	-40 to +150	°C
MSL	3	

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.

Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Typical Conditions					V_{CC} = 5.0V, V_{REG} = 2.9V, 11n MCS7 HT20 and HT40 65MBps, temperature = 25°C, unless otherwise noted
Tx Performance - 11g/n					Compliance with standard 802.11g/n
Frequency	2412		2484	MHz	
802.11n Output Power		29		dBm	802.11n HT20 and HT40 MCS7
11n Dynamic EVM		2.5	3	%	
Second Harmonic		-20	-16	dBm/MHz	At rated P_{OUT}
Third Harmonic		-48	-45	dBm/MHz	
Gain	31.5	33.5		dB	
Gain Variation			+/-1	dB	over frequency
			+/-2.5	dB	Over temperature of -40°C to +85°C
Power Detect Range	0.1		2.2	V	P_{OUT} = 0dBm to 30dBm
Power Detect Voltage	1.8	1.9	2.0	V	At rated P_{OUT}
Input Return Loss		-15	-12	dB	In specified frequency band
Output Return Loss		-10	-8	dB	
Operating Current		850	975	mA	At rated P_{OUT}
Quiescent Current		350	425	mA	V_{CC} = 5.0, V_{REG} = PA_EN = 2.9V and RF = OFF
PAE (Power Added Efficiency)		18.5		%	At rated P_{OUT} (PA only)
Power Down Current		16		mA	PA_EN = 0V, V_{CC} = 5V, V_{REG} = 2.9V
I_{REG}		12	15	mA	V_{CC}=5V, PA_EN = 2.9V, V_{REG} = 2.9V
Leakage Current		0.5	0.7	mA	V_{CC}=5V, V_{REG} = 0V, PA_EN=0V
Power Supply - V_{CC}		5	5.25	V	
V_{REG} Voltage (at V_{REG} pin of Eval board)	2.85	2.9	3.0	V	
Turn-on time from setting of V_{REG}S			1	µsec	Output stable to within 90% of final gain
Turn-off time from setting of V_{REG}S			1	µsec	
Stability	-25		33	dBm	No spurs above -47dBm into 4:1 VSWR
Output P1dB		35		dBm	CW signal

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Parameter	Specification			Unit	Condition
	Min.	Typ.	Max.		
Generic Performance					Compliance with standard 802.11g/n
ESD					
Human Body Model	500			V	EIA/JESD22-114A all pins
Charge Device Model	1000			V	JESD22-C101C all pins
Thermal Resistance					
Theta_JC		13		°C/W	P_{OUT} - 29dBm; duty cycle - 90%; V_{CC} = 5V; V_{REG} = 2.90V; junction to bottom of laminate package; T_{REF} = 85°C
Theta_J-REF		18		°C/W	P_{OUT} - 29dBm; duty cycle - 90%; V_{CC} = 5V; V_{REG} = 2.90V; junction to bottom of PCB; T_{REF} = 85°C
Maximum Junction Temperature for Long Term Reliability					
T_Jmax		175		°C	P_{OUT} - 29dBm; V_{CC} = 5V; V_{REG} = 2.90V; T_{REF} = 85°C

Pin Names and Descriptions

Pin	Name	Description
1	VCC	This pin is connected internally to the collectors of RF device. To achieve specified performance, the layout of the pin should match the Recommended Land Pattern.
2	PA_EN	High Impedance enable pin, Apply < 0.6VDC to power down the PA. Apply 1.75VDC to 5VDC to enable the PA.
3	GND	Ground connection.
4	RF_IN	RF input, is internally matched to 50Ω. DC Blocked
5	GND	Ground connection.
6	PA_EN	High Impedance enable pin, Apply < 0.6VDC to power down the PA. Apply 1.75VDC to 5VDC to enable the PA.
7	VREG	PA bias voltage. This pin requires regulated supply for best performance.
8	PDET	Power detector provides an output voltage proportional to the RF output power level.
9	VCC3	This pin is connected internally to the collectors of RF device. To achieve specified performance, the layout of the pin should match the Recommended Land Pattern
10	GND	Ground connection.
11	RFOUT	RF output, is internally matched to 50Ω. DC Blocked
12	GND	Ground connection.
13	GND	Ground connection.
14	VCC3	This pin is connected internally to the collectors of RF device. To achieve specified performance, the layout of the pin should match the Recommended Land Pattern
Pkg Base	GND	Ground connection. The back side of the package should be connected to the ground plane through as short connection as possible, e.g., PCB vias under the device are recommended.

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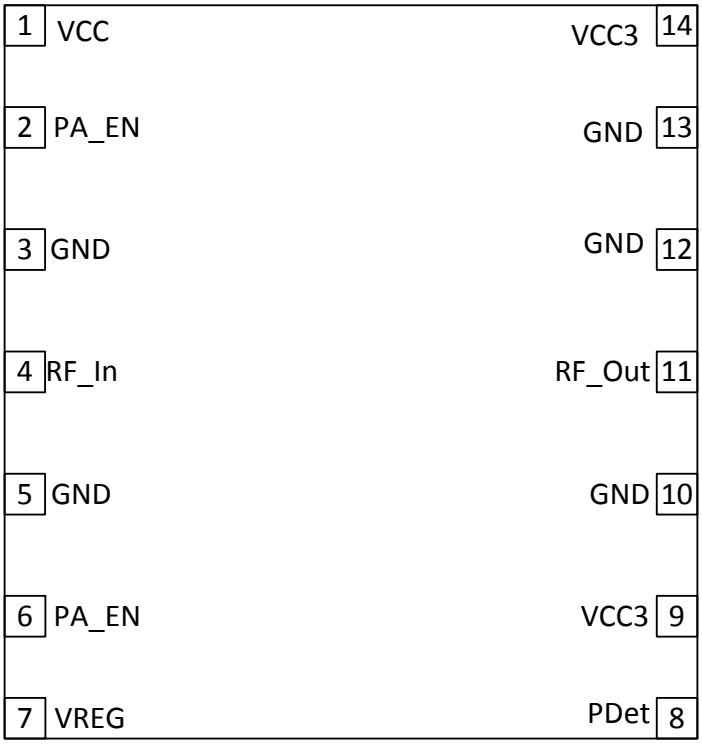
Pin Out


1 VCC
2 PA_EN
3 GND
4 RF_In
5 GND
6 PA_EN
7 VREG
VCC3 14
GND 13
GND 12
RF_Out 11
GND 10
VCC3 9
PDet 8

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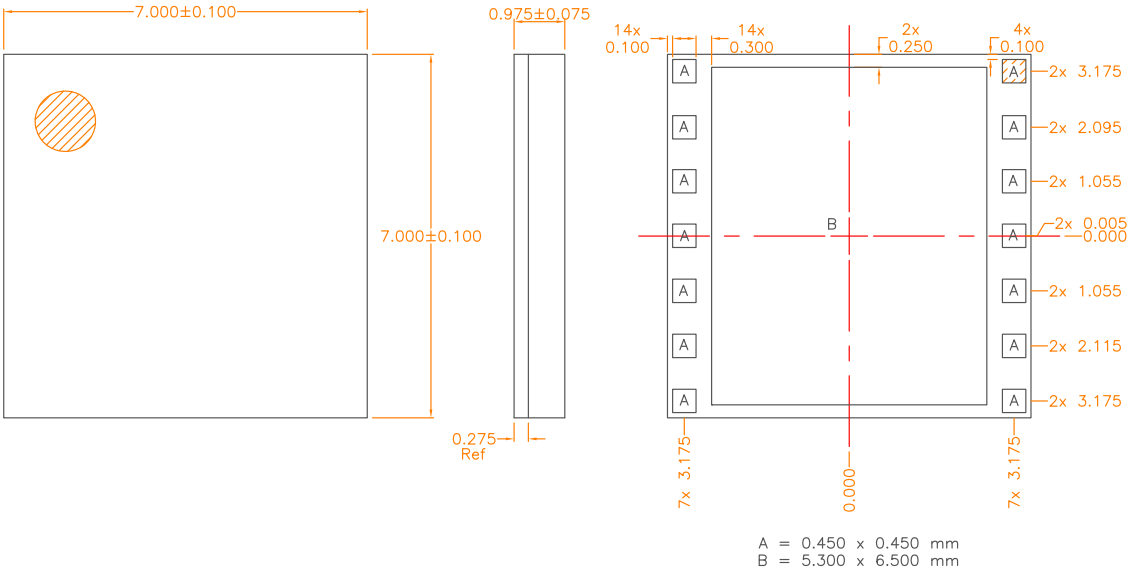
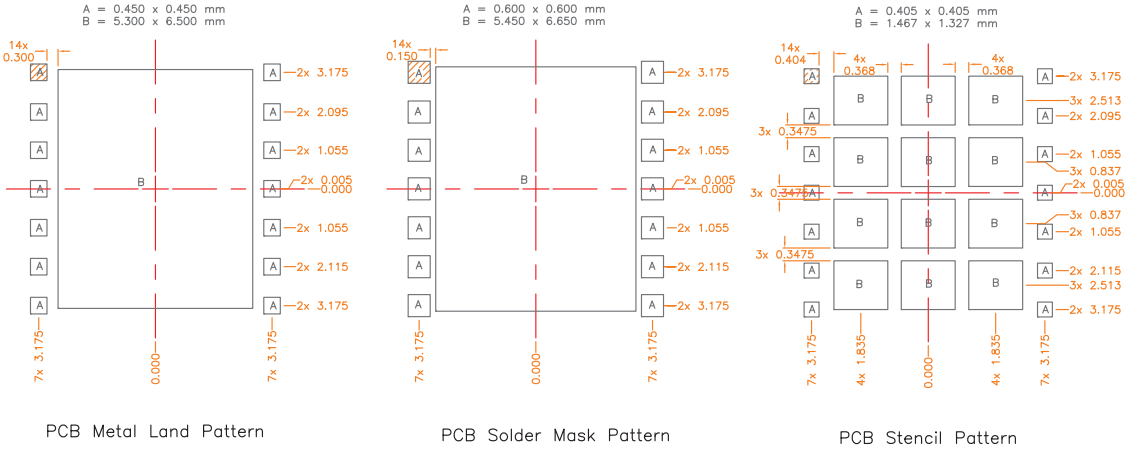
Package Drawing



Notes

1. Shaded area represents Pin 1 location.
2. Thermal vias for center slug “B” should be incorporated into the PCB design. The number and size of thermal vias will depend on the application. Example of the number and size of vias can be found on the RFMD evaluation board layout.

PCB Pattern



Notes:
1. Shaded area represents Pin 1 location.

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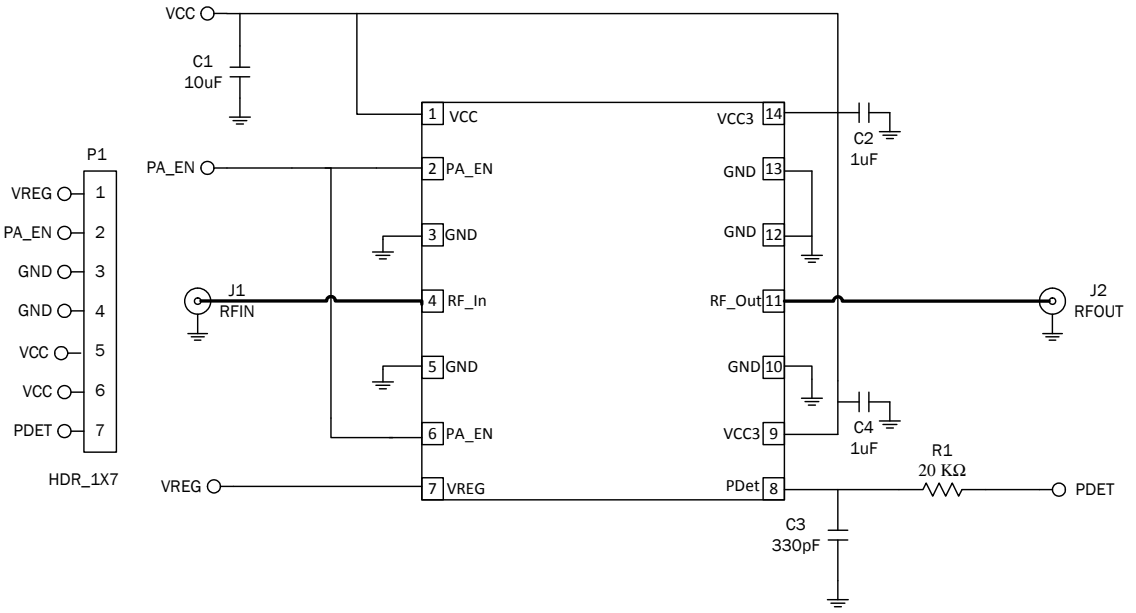
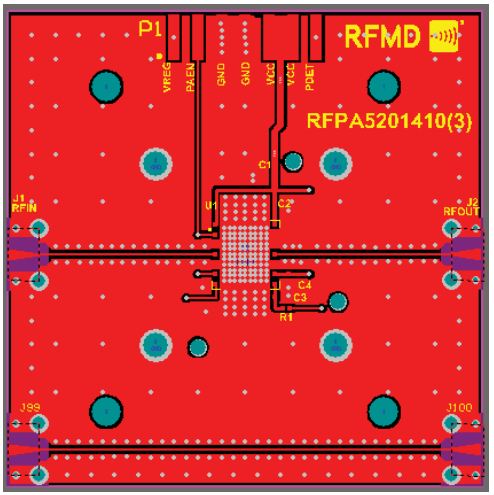
Evaluation Board Schematic



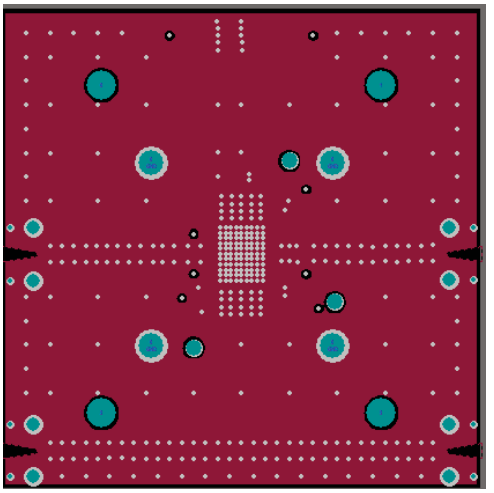
RFPA5201 Evaluation Board Layers

(2 x 2 x 0.034in ±10%; FR4, 6mils thick top dielectric)

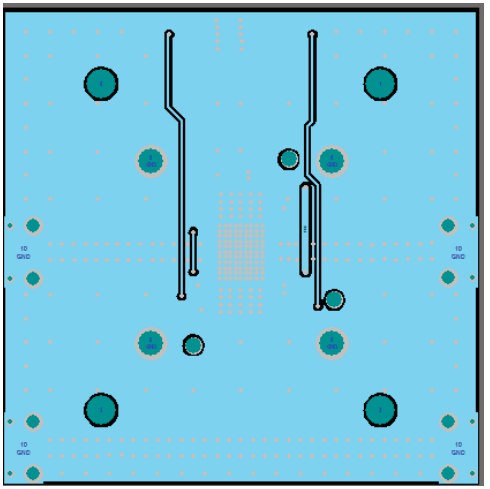
TOP



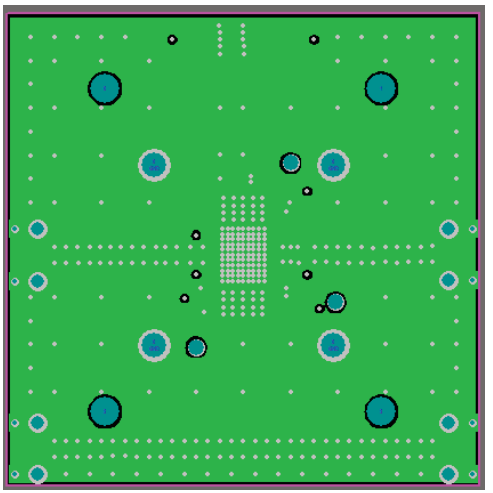
MID-1



MID-2



BOTTOM



Note: Gerber files available upon request.

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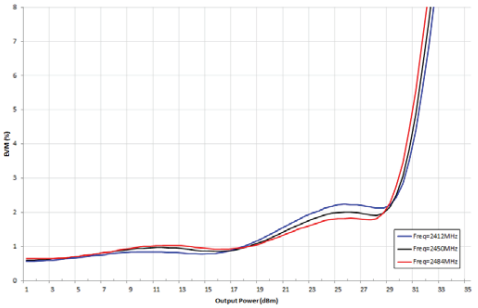
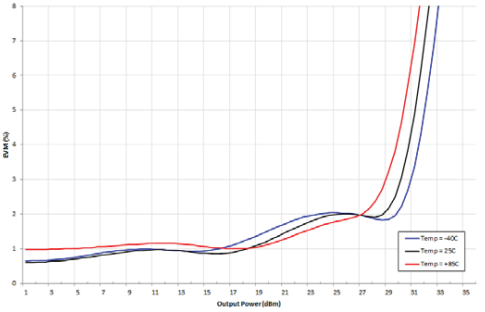
RFPA5201 Performance Plots

(11n MCS& HT40; V_{CC} = 5V; V_{REG} = 2.9V; Temp = 25°C; Duty Cycle = 50%)

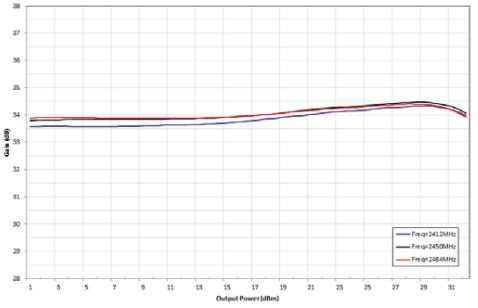
RFPA5201 EVM vs. Output Power
(11n MCS7 HT40; Vcc=5v; Vreg=2.9v; Temp=25˚C; Duty Cycle=50%)



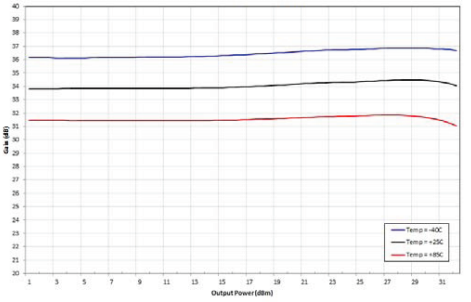
RFPA5201 EVM vs. Output Power vs. Temperature
(11n MCS7 HT40; Vcc=5v; Vreg=2.9v; Duty Cycle=50%)



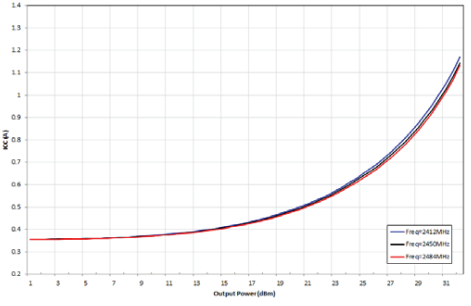
RFPA5201 GAIN vs. Output Power
(11n MCS7 HT40; Vcc=5v; Vreg=2.9v; Temp=25˚C; Duty Cycle=50%)



RFPA5201 GAIN vs. Output Power vs. Temperature
(11n MCS7 HT40; Vcc=5v; Vreg=2.9v; Duty Cycle=50%)



RFPA5201 Operating Current vs. Output Power
(11n MCS7 HT40; Vcc=5v; Vreg=2.9v; Temp=25˚C; Duty Cycle=50%)



RFPA5201 Operating Current vs. Output Power vs. Temperature
(11n MCS7 HT40; Vcc=5v; Vreg=2.9v; Duty Cycle=50%)