

RFPA1802

Integrated Power Amplifier 1600MHz to 2000MHz

The RFPA1802 has over 28dB of small signal gain over 1600MHz to 2000MHz. When used with DPD at 3.3V, the RFPA1802 can deliver 24dBm LTE Downlink (CFR 7.5dB) with ACPR <-50dBc. Two digital control pins select high, medium or low power modes if desired to optimize performance and current drain at different power levels. The RFPA1802 has an integrated directional coupler, integrated biasing circuitry, and integrated matching to 50Ω . No external DC blocking is required as the RF pins are at DC ground.



Functional Block Diagram

Ordering Information

RFPA1802SQ	Sample bag with 25 pieces
RFPA1802SR	7" Reel with 100 pieces
RFPA1802TR7	7" Reel with 2500 pieces
RFPA1802PCK-410	1600MHz to 2000MHz PCBA with 5-piece sample bag

RF Micro Devices Inc. 7628 Thorndike Road, Greensboro, NC 27409-9421

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Package: MCM, 10-pin, 2.0mm x 2.5mm x 0.9mm

Features

- P_{OUT} = 24dBm, 25% PAE, with 3.3V, 20MHz LTE DL, CFR 7.5dB
- ACP <-50dBc with DPD
- 28dB Gain over 1600MHz to 2000MHz
- Instantaneous P3dB = 32dBm at 3.3V
- Designed to Support Flexible V_{CC} 0.5V to 4.5V for PAE Optimization
- Envelope Tracking Compatible
- Integrated Power Coupler
- Integrated 50Ω Matching
- Integrated Biasing
- No External DC Block Needed
- 3 Power Mode Operation
- GPIO Interface
- Ultra Small and Low Profile

Applications

- Power Amplifier, Power Amplifier Driver
- Small Cell Base Stations
- Wideband Instrumentation
- Customer Premise Equipment

DS150602

Data Cards



Absolute Maximum Ratings

Parameter	Rating	Unit
Supply Voltage in Standby Mode	6.0	V
Supply Voltage in Idle Mode	6.0	V
Supply Voltage in Operating Mode	6.0	V
Supply Voltage, VBATT	6.0	V
Control Voltage, V _{EN} , V _{MODE0} , V _{MODE1}	3.5	V
RF – Input Power (CW, V_{CC} = 3.3V, 50 Ω Load)	+10	dBm
RF – Output Power (CW, 50Ω Load)	+30	dBm
Output Load VSWR (LTE DL 7.5dB CFR, V _{CC} = 4.5V, P _{FORWARD} <24dBm)	8:1	
ESD Rating, All Pins, HBM, JESD22-A114	2000	V
ESD Rating, All Pins, CDM, JESD22-C101	1000	V
Moisture Sensitivity Level	MSL3	



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RFMD Green: RoHS status based on EU Directive 2011/65/EU (at time of this document revision), halogen free per IEC 61249-2-21, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

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.

Recommended Operating Condition

Parameter	S	Unit		
	Min	Тур	Max	
Operating Temperature Range	-30	+25	+85	°C
Operating Junction Temperature			125	°C
VBATT	+3	+3.3	+4.5	V
V _{cc} ¹	+0.5	+3.3	+4.5	V

Note: V_{CC} down to 0.5V may be used for backed-off power when using DC-DC converter to conserve battery current.

Nominal Operating Parameters

Parameter	Spe	ecificat	tion	Unit	Condition
	Min	Тур	Max		
General Performance					
Operating Frequency	1600		2000	MHz	
V _{EN} , Low Level	0		0.5	V	PA Disabled
V _{EN} , High Level	1.5	1.8	3	V	PA Enabled
V _{MODE0} , V _{MODE1} , Low Level	0		0.5	V	For logic "low"
V _{MODE0} , V _{MODE1} , High Level	1.5	1.8	3	V	For logic "high"
Maximum Linear Output P _{OUT} ^{1, 2}		24		dBm	High power mode (HPM); V _{CC} = 3.3V
Thermal Resistance		37		°C/W	To backside of evaluation board

Notes:

1. For operation at V_{BATT} = 3.0V, de-rate P_{OUT} by 2.0dB

2. POUT is specified for 20MHz LTE downlink with CFR 7.5dB, -50dBc ACPR using digital or analog predistortion

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Parameter	Sp	ecificat	tion	Unit	Condition
	Min	Тур	Max		
Band 3 Downlink Electrical Specifications					Unless Otherwise Specified: Temp = 25°C, V _{BATT} = +3.3V, V _{EN} = +1.8V, Freq = 1830MHz, 50Ω, 20MHz LTE DL with 7.5dB CFR
Gain	25.5	28.5	31.5	dB	High Power Mode (HPM), $P_{OUT} = 24$ dBm, $V_{CC} = 3.3$ V
	20.5	23.5	26.5	dB	Medium Power Mode (MPM), P_{OUT} = 14dBm, V_{CC} = 1.5V
	11.5	14.5	17.5	dB	Low Power Mode (LPM), $P_{OUT} = 3dBm$, $V_{CC} = 0.7V$
ACLR 1		-32		dBc	HPM, $P_{OUT} = 24$ dBm, $V_{CC} = 3.3$ V, without DPD
		-50		dBc	HPM, P_{OUT} = 24dBm, V_{CC} = 3.3V, with DPD
ACLR 2		-48		dBc	HPM, $P_{OUT} = 24$ dBm, $V_{CC} = 3.3$ V, without DPD
		-60		dBc	HPM, $P_{OUT} = 24$ dBm, $V_{CC} = 3.3$ V, with DPD
PA Efficiency (PAE)		25		%	HPM, $P_{OUT} = 24$ dBm, $V_{CC} = 3.3$ V
PA Current Drain		294		mA	HPM, $P_{OUT} = 24$ dBm, $V_{CC} = 3.3$ V
PA Quiescent Current		119		mA	HPM, $V_{CC} = 3.3V$
		80		mA	MPM, $V_{CC} = 1.5V$
		38		mA	LPM, V _{CC} = 0.8V
Noise Figure		3.3		dB	
Input Impedance		1.8:1	2:1	VSWR	No external matching, $P_{OUT} \le 24$ dBm, all modes
IM3		-15		dBm	Two tones passed 600kHz, HPM, Total P _{OUT} \leq 24dBm, V _{CC} = 3.3V
IM5		-20		dBm	Two tones passed 600kHz, HPM, Total P _{OUT} \leq 24dBm, V _{CC} = 3.3V
Harmonics 2f0		-14		dBm	CW $P_{OUT} \le 24$ dBm, all power modes
Harmonics 3f0		-27		dBm	CW $P_{OUT} \le 24$ dBm, all power modes
Enable Current		0.1		mA	Sources or sink current, $V_{EN} = 1.8V$
Mode Current		0.1		mA	Source or sink current, V _{MODE0} , V _{MODE1} = 1.8V
Leakage Current			5	μA	DC only; $V_{CC} = V_{BATT} = 4.5V$, $V_{EN} = V_{MODE0} = V_{MODE1} = 0V$
DC Enable Time			10	μs	DC only; Time from V_{EN} = high to stable idle current (90% of steady state value)
RF Rise/Fall Time			10	μs	P _{OUT} ≤ 24dBm, all modes, 90% of target, DC settled prior to RF
Coupling Factor	18.5	20.5	22.5	dB	P _{OUT} ≤ 24dBm, all modes
Coupling Accuracy – Temp / Voltage	-0.5		0.5	dB	$P_{OUT} \le 24dBm,$ all modes 30°C $\le T \le 85^\circ C$, V_{CC} as required, referenced to 25°C, 3.3V conditions
Coupling Accuracy – VSWR	-0.8		0.8	dB	P _{OUT} ≤ 24dBm, all modes, load VSWR = 2.5:1
Output Load VSWR Stability (Spurious Emissions)			-60	dBc	$P_{OUT} \le 24$ dBm, all conditions, load VSWR = 8:1, all phase angles

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Mode Control Table

Mode of Operation	V _{EN}	V _{MODE0}	V _{MODE1}	V _{cc}
Power Down	Low	Low	Low	Х
Standby Mode	Low	Х	Х	On
High Power Mode (HPM)	High	Low	Low	On
Medium Power Mode (MPM)	High	High	Low	On
Low Power Mode (LPM)	High	High	High	On

Typical Application Schematic 1600MHz to 2000MHz Application Circuit



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Typical Performance: V_{CC} = 3.3V unless otherwise noted

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Gain



ACP with DPD, LTE DL 7.5dB CFR V_{CC} = 3.3V, I_{CC} = 299mA, 1830MHz

Center Freq 1.830000000 GHz		T I D				04:56:36 PM May 23, 201 Std: None Device: BTS
Ref Offset 6.3 dB 0 dB/div Ref 19.80 dBm						
- og 9.80		• •				
	.53.7 dBc	24.0 dE	sm	-53.8 dBc		
-34.3 UDC						-55.3 dBc
10.2						
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30.2						
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50.2						
70.2						
Center 1.83 GHz Res BW 220 kHz		VBW	22 kHz		5	Span 98 MH: Sweep 50.33 ms
T I I O I D 04040 - 101	18.00 MHz	ACP-IB	N			
Total Carrier Power 24.012 dBm/			in a second second	Upper		
			Lower			
Carrier Power Filter		Integ BW	dBc dBm	dBc dBm	Filter	
	20.00 MHz	18.00 MHz -	dBc dBm 53.64 -29.62	dBc dBm -53.76 -29.75	OFF	
Carrier Power Filter			dBc dBm 53.64 -29.62	dBc dBm	1000313737532020	
Carrier Power Filter	20.00 MHz	18.00 MHz -	dBc dBm 53.64 -29.62	dBc dBm -53.76 -29.75	OFF	

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ACP with DPD, LTE DL 7.5dB CFR V_{CC} = 3.3V, I_{CC} = 267mA, 1650MHz

ef Value 19.90 dBm	IFGain:Low	SENSE:EXT Center Fre Trig: Free F #Atten: 38 d	q: 1.650000 Run		Hold:>1	0/10		lio Std: N	
	IFGalm:LUW	WALLEH. OU					Trav	IIO DEVIC	e. 010
Ref Offset 6.4 dB dB/div Ref 19.90 dBm		-							
90	1								
	55.7 dBc	24.0	dBm	~~	-55.1	1 dBc	-	1.15	
-57.4 dBc								-56	.3 dBc
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enter 1.65 GHz			a strategy ou						an 98 MH:
Res BW 220 kHz		VBV	22 kH	z				Sweep	50.33 ms
otal Carrier Power 23.952 dBm/	18.00 MHz	ACP-I	BW						
			Lo	wer	Up	oper			
arrier Power Filter	Offset Freq	Integ BW	dBc	dBm	dBc	dBm	Filter		
1 23.952 dBm / 18.00 MHz OFF	20.00 MHz	18.00 MHz	-55.66	-31.71		-31.13	OFF		
	40.00 MHz	18.00 MHz	-57.42	-33.46	-56.32	-32.37	OFF		
							3		

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Evaluation Board Schematic 1600MHz to 2000MHz Application Circuit



Evaluation Board Bill of Materials (BOM) 1600MHz to 2000MHz Application Circuit

Description	Reference Designator	Manufacturer	Manufacturer's P/N
DUT	U1	RFMD, Inc.	RFPA1802
CAP, 22µF, 10%, 10V, TANT-A	C4	AVX Corporation	TAJA226K010RNJ
CAP, 4.7µF, 10%, 6.3V, X5R, 0805	C5-C6	Taiyo Yuden (USA), Inc.	CE MJK212 BJ475KD-T
CAP, 1000pF, 10%, 50V, X7R, 0402	C7, C9	Taiyo Yuden (USA), Inc.	RM UMK105BJ102KV-F
CAP, 10000pF, 10%, 25V, X7R, 0402	C8	Taiyo Yuden (USA), Inc.	RM TMK105BJ103KV-F
CONN, SMA, EL MINI FLT 0.048" SPE-000311	J1-J4	Amphenol RF Asia Corp.	901-10362
CONN, HDR, ST, PLRZD, 9-PIN	P1	ITW Pancon	MPSS100-9-C
Do Not Place	C1-C3, C10-C12, R1-R2		

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Evaluation Board Assembly Drawing 1600MHz to 2000MHz Application Circuit



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Pin Names and Descriptions

Pin	Name	Description
1	VBATT	Supply Voltage for bias circuitry
2	RFIN	RF Input; Connect to 50Ω nominally, presents as DC ground.
3	VMODE1/GND	Digital control input for power mode selection. Connect to GND if HPM and MPM only operations.
4	VMODE0	Digital control input for power mode selection
5	VEN	Digital control input for enable/disable of PA
6	CPL_OUT	Coupler Output
7	GND	Ground
8	CPL_IN	Coupler Input
9	RFOUT	RF Output; Connect to 50Ω nominally, present as DC ground
10	VCC	Supply voltage for PA stages which can be connected to battery supply or output of DC-DC converter
PCK BASE	GND	Ground Connection; This package backside should be soldered toa topside ground pad connecting to the PCB ground plane with multiple ground via. The pad should have a low thermal resistance and low electrical impedance to the ground plane.

Package Outline (Dimensions in millimeters)



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