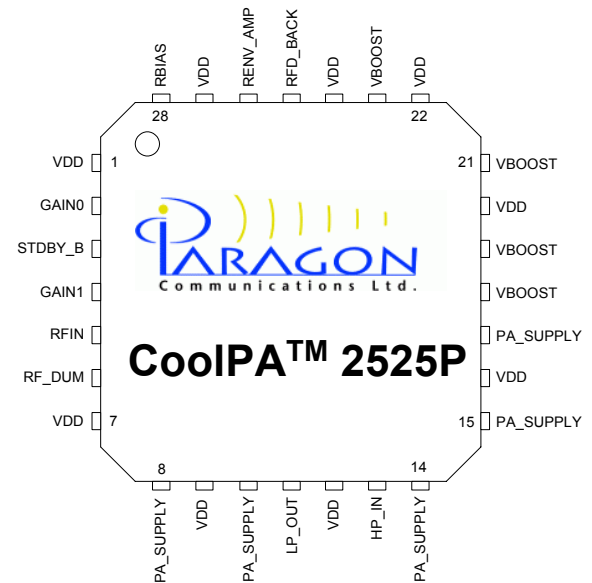


# RF Amplifier Power Enhancer

## Features

- Standard CMOS process
- System power supply (3.3 +/- 10%)
- DC Supply current up to 400mA
- Very compact die (fits in 2.2mm<sup>2</sup> cavity)
- QFN5x5 package
- Supports Wi-Fi, Wi-Max and Wibro RF inputs
- Low power stand-by mode
- Clamped output voltage.
- Output power and Efficiency increase under same EVM criteria



## Applications

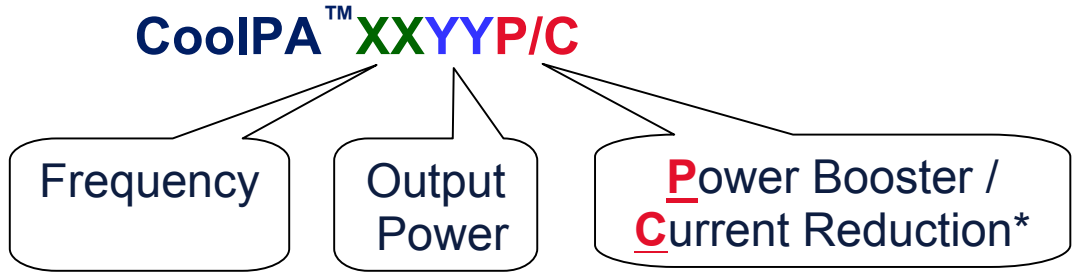
- Wi-Fi/Wibro/WiMAX

## Description

The CoolPA™ is an integrated circuit application for efficiency increase of RF power amplifiers based on Paragon's proprietary XNN (eXcess eNvelop eNhancement) technology. The CoolPA™ tracks the signal envelope and "boosts" the dynamic range of the PA on the fly by increasing the amplifier drain voltage through a bootstrapping capacitor, increasing output power and efficiency to prolong battery life.

The CoolPA™ driver improves EVM and reduces supply current in the TX channel of different OFDM signal configurations, including Wi-Fi, Wibro and WiMax.

**Marking Information**



Power Boosting Products	CoolPA™ <sub>2425P</sub>	CoolPA™ <sub>3525P</sub>	CoolPA™ <sub>5525P</sub>
Frequency	2.3-2.8GHz	3.3-3.8GHz	4.9-5.9GHz
Output Power	25dBm	25dBm	25dBm

\* Current Reduction Products will be available in Q407.

**Block Diagram**

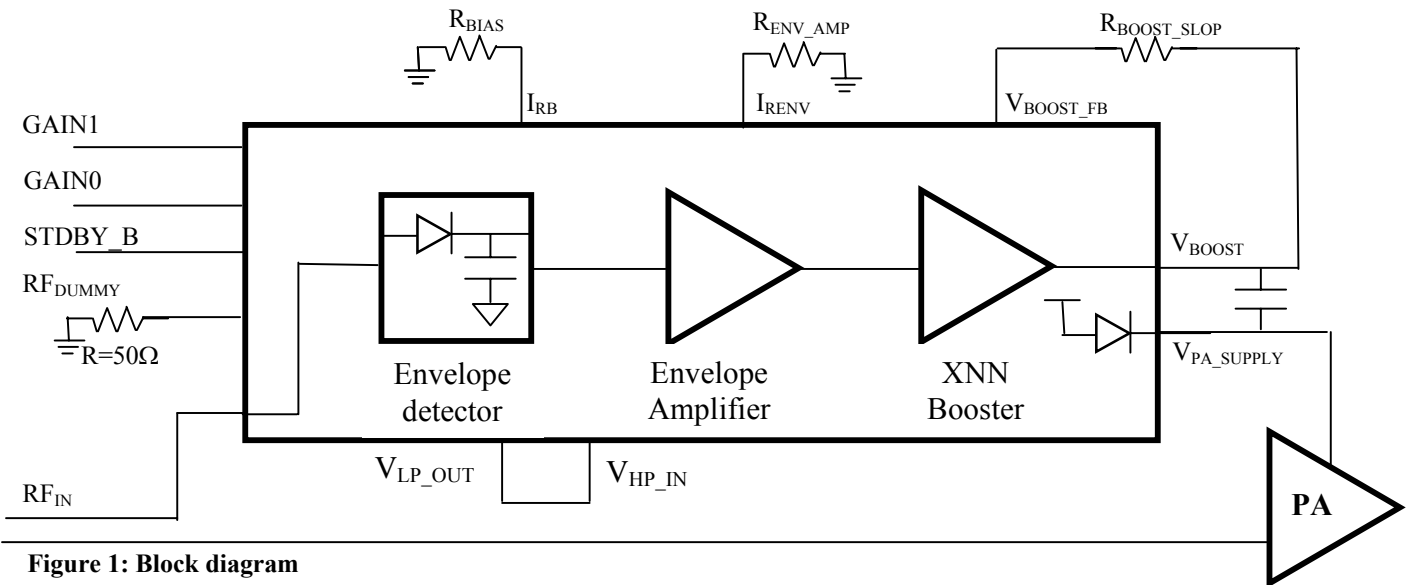


Figure 1: Block diagram

### Maximum Absolute Ratings

Name	Description	Min.	Typ.	Max.	Unit
VCC	Supply voltage	3.0	3.4	4.2	V
RF <sub>IN</sub>	RF average input level. Rf input is AC coupled.	-16	-13	-10	dBm
RF <sub>IN</sub>	RF Envelope dynamic range (PAPR 8-9.5[dB])	75		300	mV
V <sub>PA_SUPPLY</sub> MAX	Maximum V <sub>PA_SUPPLY</sub> voltage		2 x VCC - 0.3V	8.2	V
T	Junction Temperature	-20	25	70	°C
ESD	HBM	250			V

### Pin Description

Pin	Name	Description	Min.	Typ.	Max.	Unit
1,7,9,12,16,20,22,24,27	VDD	Supply voltage	2.7	3.3	3.6	V
2	GAIN0	Envelope detector Gain Control GND – Low Gain VCC – High Gain				
3	STDBY_B	When high turns on the device. When low device goes into standby.				
4	GAIN1	Envelope first stage gain control. GND – Low Gain (X1) High – High Gain (X2)				
5	RF <sub>IN</sub>	CoolPA™ <sub>2425P</sub> Input Frequency.	2.3		2.8	GHz
		CoolPA™ <sub>3525P</sub> Input Frequency.	3.3		3.8	GHz
		CoolPA™ <sub>5525P</sub> Input Frequency.	4.9		5.9	GHz
		RF input RMS average voltage level	35	50	71	mV rms
		RF input Envelope average level	50	70	100	mV
		Input impedance	25	50	75	Ohm
6	RF <sub>DUMMY</sub>	Dummy input. Should be connected to 50Ohm resistor.				
8,10, 14, 15, 17	V <sub>PA_SUPPLY</sub>	Power Amplifier Supply voltage during none enhancement mode.	300	400	500	mA
			VCC-0.2	VCC-0.1	VCC	V
11	V <sub>LP_OUT</sub>	Should be connected to HP_IN				
13	V <sub>HP_IN</sub>	Should be connected to LP_OUT				
18, 19, 21, 23	V <sub>BOOST</sub>	The main output driving the PA's supply during voltage enhancement.	-200	500	1400	mA
			-0.2	0	VCC	V
25	V <sub>BOOST_FB</sub>	V <sub>BOOST</sub> voltage feedback input. Should be connected to V <sub>BOOST</sub> via R <sub>BOOST_SLOP</sub> resistor.				
26	I <sub>RENV</sub>	Envelope Current. Should be connected to R <sub>ENV_AMP</sub> resistor.				

28	I <sub>RB</sub>	Bias current. Should be connected to 1% accurate R <sub>BIAS</sub> resistor to set the internal bias currents.				
Bottom Pad	VSS	Ground		0		V

### AC Characteristics

Name	Description	Min.	Typ.	Max.	Unit
T <sub>on</sub> → <sub>stby</sub>			100	200	nS
T <sub>stby</sub> → <sub>on</sub>			0.5	1	uS
T <sub>powerup</sub> *	VCC > 2.5[V] to device operational		1	2	mS

\* Device can be operated before this time, however performance may be affected

### Electrical Characteristics

Name	Description	Min.	Typ.	Max.	Unit
I <sub>STBY</sub> *	All circuits are closed except biases to support V <sub>PA_SUPPLY</sub> .		400	500	uA
I <sub>ON(ENHANCEMENT)</sub> *	During voltage enhancement. All circuits are on (dependant on PA current demand).			1500	mA
I <sub>ON(quiescent)</sub> *	No envelope enhancement. All circuits are on.		50	60	mA
P <sub>Diss</sub>	Power dissipation		250	300	mWatt

\* V<sub>PA\_SUPPLY</sub> not included

### Calibration Table

Resistor	Description	Min.	Typ.	Max	Unit
R <sub>BIAS</sub>	Sets internal bias currents. Should use 1% accuracy resistor.		3000		Ohm
R <sub>ENV_AMP</sub>	Sets the initial envelope voltage where enhancement begins. This resistor value depends on the RF <sub>IN</sub> level the CoolPA™ receives and the signal characteristics.	30	60	500	Ohm
R <sub>BOOST_SLOP</sub>	Sets the envelope voltage enhancement ratio. This resistor value depends on the RF <sub>IN</sub> level the CoolPA™ receives and the signal characteristics.	400	600	2000	Ohm