

DATA SHEET

# RFX8050: CMOS 5 GHz WLAN 802.11ac RFelC with PA, LNA, and SPDT

## Applications

- 802.11a/n/ac
- Smartphones
- Tablets/MIDs
- Gaming
- Notebook/netbook/ultrabooks
- Mobile/portable devices
- Consumer electronics
- Other 5 GHz ISM platforms

## Features

- 5 GHz WLAN single-chip, single-die RF front-end IC
- High transmit signal linearity meeting standards for 802.11ac OFDM /MCS9 Modulation
- Separate TX and RX transceiver port and single antenna port
- 5 GHz power amplifier with low-pass harmonic filter
- Low-noise amplifier with bypass mode
- Transmit/receive switch circuitry
- Integrated power detector for transmit power monitor and control
- Low voltage (1.2 V) CMOS control logic
- Low-current mode in TX for battery current savings
- ESD protection circuitry on all pins
- DC decoupled RF ports
- Internal RF Decoupling on All VDD Bias Pins
- Low noise figure for the receive chain
- High power capability for received signals in bypass mode
- Very low DC power consumption
- Full on-chip matching circuitry
- Minimal external components required
- 50 Ω input/output matching
- Market-proven CMOS technology
- Small QFN (16-lead, 2.5 x 2.5 x 0.45 mm) package with exposed ground pad

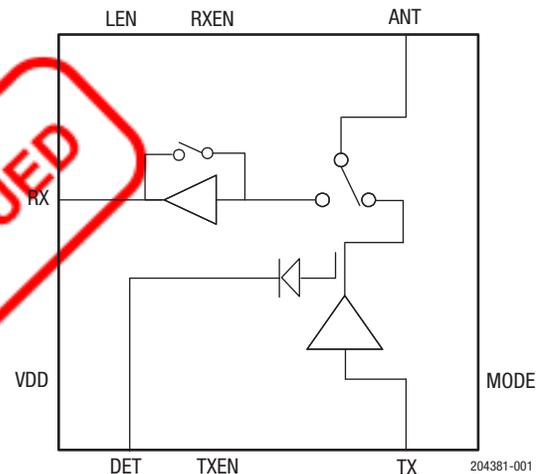
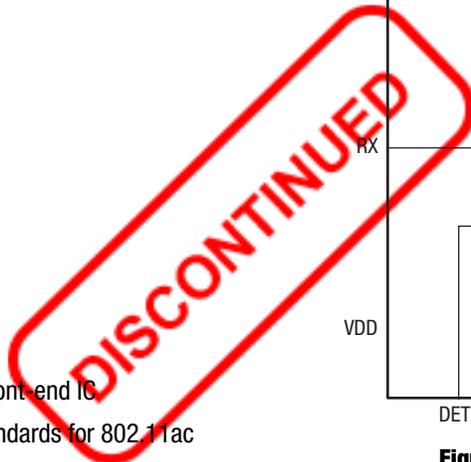


Figure 1. RFX8050 Block Diagram

## Description

The RFX8050 is a highly integrated, single-chip, single-die RFelC (RF Front-end Integrated Circuit) that incorporates key RF functionality for IEEE 802.11a/n/ac WLAN system operating in the 4.9 to 5.85 GHz range. The RFX8050 architecture integrates a high-efficiency high-linearity power amplifier (PA), a low noise amplifier (LNA) with bypass, the associated matching network, LO rejection, and harmonic filters in a CMOS single-chip device.

The RFX8050 has simple and low-voltage CMOS control logic that requires minimal external components. A directional coupler-based power detect circuit is integrated for accurate monitoring of output power from the PA.

The RFX8050 is an ultra-compact low-profile 2.5 x 2.5 x 0.45 mm 16-lead QFN package. With support to direct battery operation, the RFX8050 is an ideal RF front-end solution for implementing 5 GHz WLAN in smartphones and other mobile platforms.



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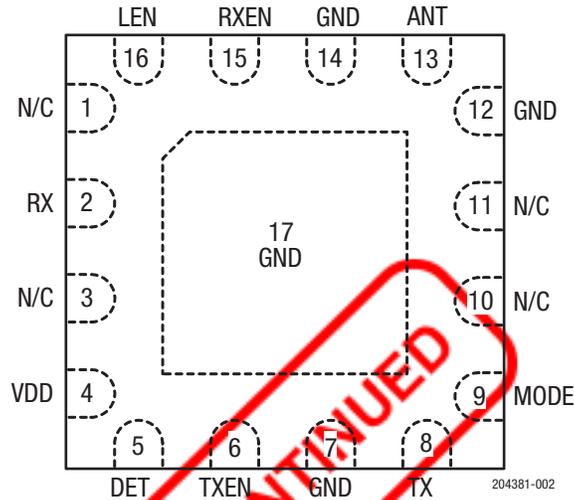


Figure 2. RFX8050 Pinout (Top View)

Table 1. RFX8050 Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1, 3, 10, 11	N/C	No internal connection	9	MODE	CMOS input to control high-linearity/low-current mode
2	RX	RF output port from LNA or bypass (DC shorted to ground)	13	ANT	Antenna port RF signal from the PA or RF signal applied to the LNA (DC shorted to ground)
4	VDD	DC supply voltage	15	RXEN	CMOS input to control RX enable
5	DET	Analog voltage proportional to the PA power output	16	LEN	CMOS input to control LNA enable or bypass mode
6	TXEN	CMOS input to control TX enable	7, 12, 14	GND	Ground (must be connected to ground in the application circuit)
8	TX	RF input port from the transceiver (DC shorted to ground)			

## Electrical and Mechanical Specifications

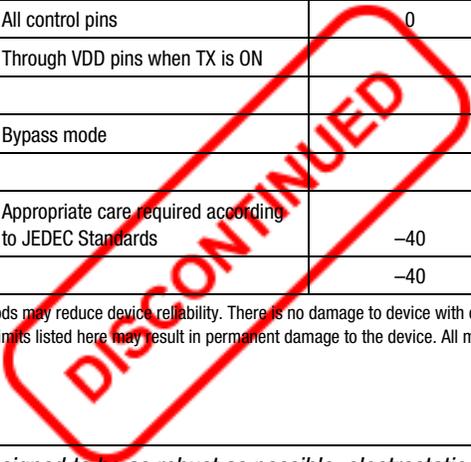
The absolute maximum ratings of the RFX8050 are provided in Table 2. The recommended operating conditions are specified in Table 3.

The electrical specifications are provided in Tables 4 and 5. The state of the RFX8050 is determined by the logic provided in Table 6.

**Table 2. RFX8050 Absolute Maximum Ratings<sup>1</sup>**

Parameter	Conditions	Minimum	Maximum	Units
DC VDD voltage supply	All VDD pins	0	5.0	V
DC control pin voltage	All control pins	0	3.6	V
DC VDD current consumption	Through VDD pins when TX is ON		400	mA
TX RF input power			+7	dBm
ANT RF input power	Bypass mode		+10	dBm
Junction temperature			+135	°C
Storage ambient temperature	Appropriate care required according to JEDEC Standards	-40	+125	°C
Operating ambient temperature		-40	+85	°C

<sup>1</sup> Exposure to maximum rating conditions for extended periods may reduce device reliability. There is no damage to device with only one parameter set at the limit and all other parameters set at or below their nominal value. Exceeding any of the limits listed here may result in permanent damage to the device. All maximum RF input power ratings assume 50 Ω terminal impedance.



**ESD HANDLING:** Although this device is designed to be as robust as possible, electrostatic discharge (ESD) can damage this device. This device must be protected at all times from ESD when handling or transporting. Static charges may easily produce potentials of several kilovolts on the human body or equipment, which can discharge without detection. Industry-standard ESD handling precautions should be used at all times.

**Table 3. RFX8050 Recommended Operating Conditions**

Parameter	Conditions	Minimum	Typical	Maximum	Units
DC VDD voltage supply <sup>1</sup>	All VDD pins	3.0	3.6	4.8	V
Control voltage high <sup>2</sup>	3.6 V or VDD, whichever is lower <sup>3</sup>	1.2		Note 3	V
Control voltage low		0		0.3	V
DC control pin current consumption			1		uA
DC shutdown current	All control lines low		3		uA
PA turn-on/turn-off time			0.5	1	µsec
LNA turn on/turn-off time			0.5	1	µsec
Shutdown and ON state switching time			0.5	1	µsec

<sup>1</sup> For normal operation of the RFX8050, VDD must be continuously applied to all VDD supply pins.

<sup>2</sup> If control voltage can exceed 1.8V, a 1 kΩ to 10 kΩ series resistor is recommended for the application circuit on each control line.

**Table 4. RFX8050 Transmit Electrical Characteristics (VDD = 3.6 V, TA = +25°C, Unless Otherwise Specified)**

Parameter	Test Condition	Min	Typical	Max	Units
Operating frequency band		4.9		5.85	GHz
Linear Output Power for 802.11ac	High-linearity mode, For EVM <1.8%, MCS9/256 QAM/80 MHz		+16		dBm
Linear output power for 802.11a	High-linearity mode, EVM <3%, 64 QAM/54 Mbps/20 MHz		+17		dBm
	Low-current mode, EVM <3%, 64 QAM/54 Mbps/20 MHz		+15.5		
Small-signal power gain	High-linearity mode, between TX and ANT pins		28		dB
	Low-current mode, between TX and ANT pins		27		
TX quiescent current	High-linearity mode		145		mA
	Low-current mode		100		
TX linear current	POUT = +17 dBm, high-linearity mode, 20 MHz		205		mA
	POUT = +17 dBm, low-current mode, 20 MHz		155		
Power detector voltage output	POUT = +5 to +20 dBm, 10 k $\Omega$ Load		200–1000		mV
Second harmonic	POUT=+20 dBm HT20/MCS0		-30		dBm/MHz
Third harmonic	POUT=+20 dBm HT20/MCS0		-35		dBm/MHz
Input return loss	At TX port		-12		dB
Output return loss	At ANT port		-12		dB
Load VSWR for stability (CW, fix pin for POUT = +20 dBm with 50 $\Omega$ load)	All non-harmonically related spurs less than -43 dBm/MHz	4:1	6:1		N/A
Load VSWR for ruggedness (CW, fix pin for POUT = +20 dBm with 50 $\Omega$ load)	No damage	8:1	10:1		N/A

**Table 5. RFX8050 Receive Electrical Characteristics (VDD = 3.6 V, TA = +25°C, Unless Otherwise Specified)**

Parameter	Test Condition	Min	Typical	Max	Units
Operating frequency band	All RF pins terminated by 50 $\Omega$	4.9		5.85	GHz
Gain	High-gain mode, between ANT and RX pins; RXEN = LEN = High		12		dB
Noise figure	High-gain mode, at ANT pin		3.6		dB
Insertion loss for LNA bypass mode	Between ANT and RX pins; RXEN = High, LEN = Low		6		dB
Input return loss	At ANT port, high-gain mode		-10		dB
	Bypass mode		-10		
Output return loss	At RX port, high-gain mode		-10		dB
	Bypass mode		-10		
RF port impedance			50		$\Omega$
DC quiescent current	No RF applied, through VDD, high-gain mode		13		mA
	No RF applied, through VDD, bypass mode		1.2		
Input $P_{1dB}$	At ANT pin, high-gain mode		-5		dBm
	At ANT pin, bypass mode		+10		

**Table 6. RFX8050 Control Logic<sup>1</sup>**

Mode of Operation	TXEN	LEN	RXEN	MODE
Shutdown	0	0	0	0
Transmit mode, high-linearity	1	X	X	0
Transmit mode, low-current	1	X	X	1
Receive mode, high-gain	0	1	1	X
Receive mode, bypass	0	0	1	X
Unsupported (no damage)	All others			

<sup>1</sup> "1" denotes high voltage state (> 1.2 V)  
 "0" denotes low voltage stage (< 0.3 V) at control pins  
 "X" denotes do not care: either 1 or 2 without change  
 1 k $\Omega$  – 10 k $\Omega$  series resistor may be required for each control line.



### Package Dimensions

The PCB layout footprint for the RFX8050 is shown in Figure 3. The typical part marking is shown in Figure 4. Package dimensions are shown in Figure 5. Tape and reel dimensions are provided in Figure 6.

### Package and Handling Information

Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The RFX8050 is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

Care must be taken when attaching this product, whether it is done manually or in a production solder reflow environment. Production quantities of this product are shipped in a standard tape and reel format.

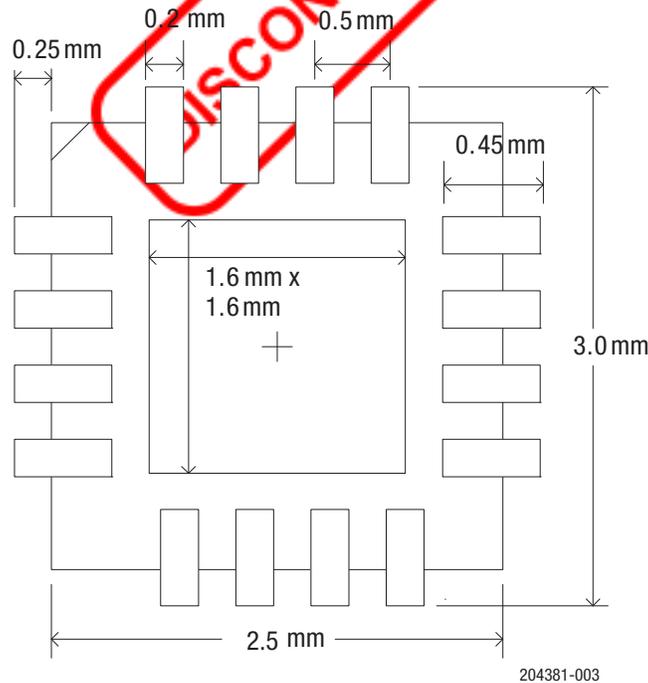


Figure 3. RFX8050 Typical Part Marking

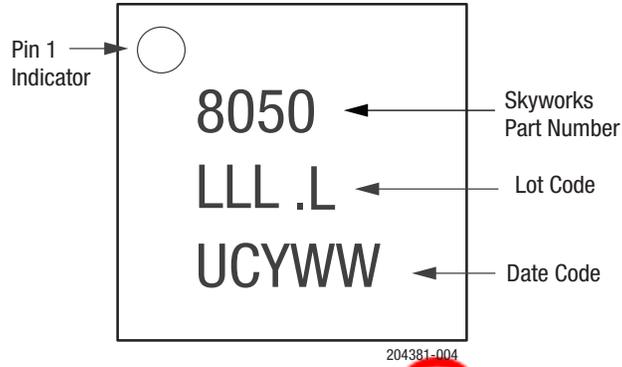


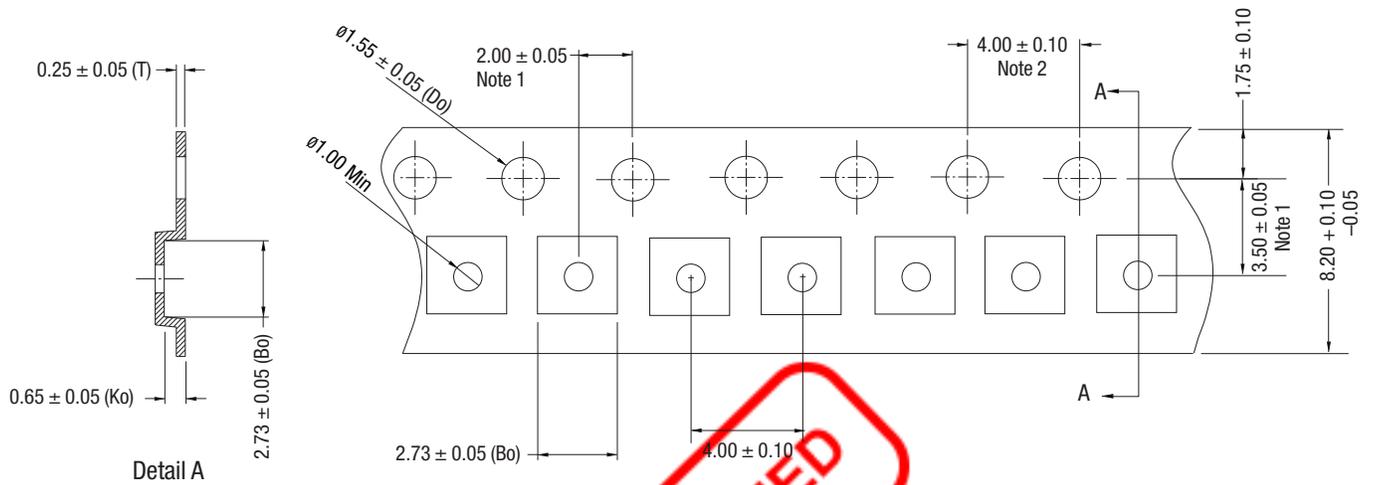
Figure 4. Typical Part Markings (Top View)



All dimensions are in millimeters.

204381-008

Figure 5. RFX8050 Package Dimensions



Notes:

1. Measured from center line of sprocket hole to center line of pocket.
2. 10-sprocket hole pitch cumulative tolerance:  $\pm 0.20$  mm.
3. All measurements are in millimeters.

204381-006

Figure 6. RFX8050 Tape and Reel Dimensions

## Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
RFX8050: CMOS 5 GHz WLAN 802.11ac RFEIC with PA, LNA, and SPDT	RFX8050	RFX8050-EK1



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