

DATA SHEET

# RFX8425: 2.4 GHz CMOS WLAN/Bluetooth® Dual-Mode RFeIC with PA, LNA, and SP3T

## Applications

- Smartphones, feature phones, and MIDs with WLAN/Bluetooth
- WLAN/Bluetooth platforms requiring shared antenna
- Laptop/netbook/smartbook with embedded WiFi and Bluetooth
- Portable platforms with integrated 802.11b/g/n and Bluetooth
- RoHS and REACH compliant

## Features

- Combines 802.11b/g/n/ac and Bluetooth applications
- High-linearity PA for 802.11 b/g/n/ac WLAN
- Low noise figure WLAN receive LNA with bypass for near range operation
- Built-in directional coupler-based output power detector
- ESD protection circuitry on all ports
- DC decoupled RF ports and VDD/RF isolation
- Small QFN (16-lead, 2.3 x 2.3 x 0.45 mm) package (MSL1, 260 °C per JEDEC J-STD-020)



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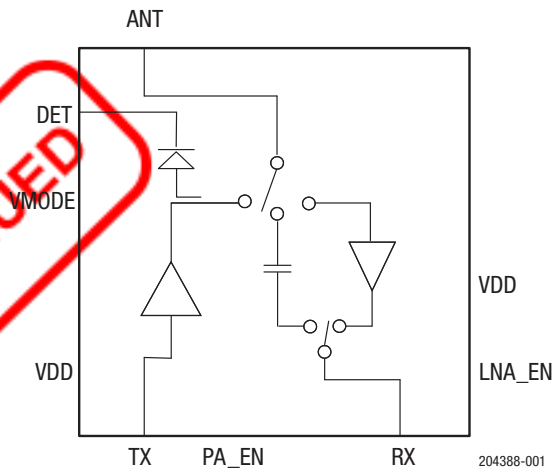
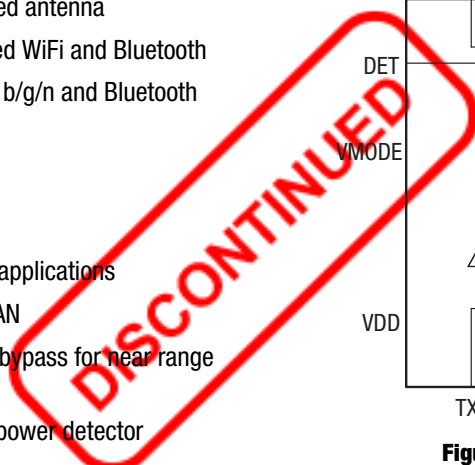
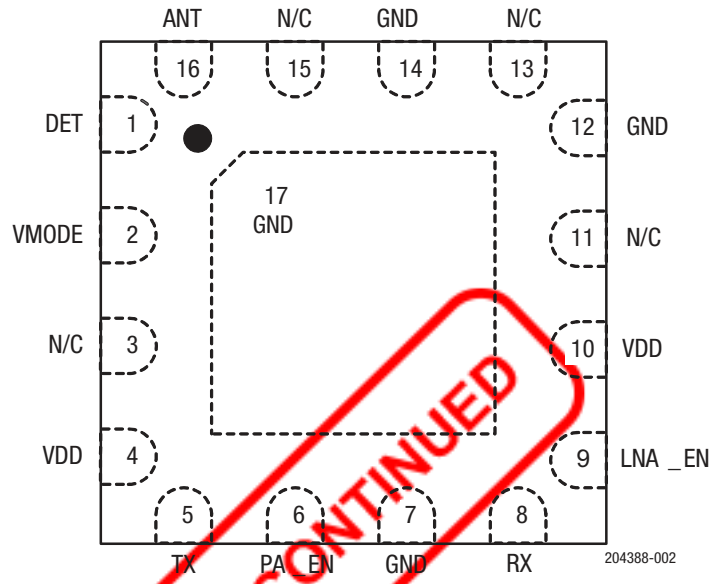


Figure 1. RFX8425 Block Diagram

## Description

The RFX8425 is a pure CMOS-based, single-chip/single-die RFeIC (RF front-end integrated circuit) that incorporates all key RF functionality needed for implementing high-performance RF front-end for WLAN IEEE 802.11b/g/n and OFDM/256QAM operation in the 2.4 GHz band. The RFX8425 architecture integrates a high-efficiency high-linearity power amplifier (PA) with harmonic filter, a directional coupler-based power detector, a low-noise amplifier (LNA), an SP3T switch for Bluetooth antenna sharing, and an additional SPDT switch for selection between LNA and Bypass in receive mode. All the impedance matching components and DC-block capacitors are also integrated to minimize the PCB footprint for system implementation.

The RFX8425 is assembled in an ultra-compact, low-profile 2.3 x 2.3 x 0.45 mm 16-lead QFN package. It has simple and low-voltage CMOS control logic, and requires minimal external components. Designed to work in the 3.0 to 3.6 V range, the RFX8425 is an ideal RF front-end solution for implementing 2.4 GHz WLAN/BT in PC clients, tablets, and many other mobile platforms including smartphones that have a PMIC available to provide the required supply voltage for the RF front-end.



**Figure 2. RFX8425 Pinout (Top View)**

**Table 1. RFX8425 Signal Descriptions**

Pin	Name	Description	Pin	Name	Description
1	DET	PA power detector output voltage	8	RX	WLAN RX signal port to the transceiver/BT port (DC shorted to GND)
2	VMODE	CMOS logic control used for PA Mode control in rome platform (unused for rhino platform)	9	LNA_EN	CMOS logic control to enable LNA
4, 10	VDD	DC voltage supply	3, 11, 13, 15	N/C	Not connected internally (can be grounded or left open)
5	TX	WLAN TX signal port from the transceiver (DC shorted to GND)	7, 12, 14, 17	GND	Ground (must be connected to ground in the application circuit)
6	PA_EN	CMOS logic control to enable WLAN transmit	16	ANT	RF signal port to/from the antenna (DC shorted to GND)

### Electrical and Mechanical Specifications

The absolute maximum ratings of the RFX8425 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 RFX8425 is determined by the logic provided in Table 6.

**Table 2. RFX8425 Absolute Maximum Ratings<sup>1</sup>**

Parameter	Conditions	Minimum	Maximum	Units
DC VDD voltage supply	All VDD pins	-0.3	4	V
DC control pin voltage	All control pins	-0.3	3.6	V
DC VDD current consumption	Through VDD pins when TX is ON		350	mA
TX RF input power			+10	dBm
ANT RF input power	Bypass mode		+20	dBm
Junction temperature			150	°C
Storage ambient temperature	Appropriate care required according to JEDEC Standards	-40	+150	°C
Operating ambient temperature		-20	+85	°C
Electrostatic discharge: Human Body Model (HBM)	All pins	±4250		V

<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. RFX8425 Recommended Operating Conditions**

Parameter	Conditions	Min	Typ	Max	Units
VDD voltage supply <sup>1</sup>	All VDD pins	3.0	3.3	3.6	V
RF port impedance			50		Ω
Control voltage high <sup>2</sup>		1.2		3.6	V
Control voltage low		0		0.4	V
Control pin current			1		µA
Shutdown current			6		µA
PA turn on/off time				0.4	µs
LNA turn on/off time				0.4	µs
θ <sub>jc</sub> <sup>3</sup>			29		°C/W
θ <sub>ja</sub>			45		°C/W

<sup>1</sup> For normal operation of the RFX8425, VDD must be continuously applied to all VDD supply pins.

<sup>2</sup> If control voltage can exceed 2.0 V, a 1 kΩ to 10 kΩ series resistor is recommended for the application circuit on each control line.

<sup>3</sup> Thermal measurements were performed on a test EVB under typical use conditions. Please contact Skyworks for details regarding the test conditions and the configuration of the thermal vias on the EVB. Refer to the PCB Land Pattern in Figure 3 for recommended thermal vias.

**Table 4. RFX8425 Transmit Electrical Characteristics (VDD = 3.3 V, TA = +25°C, Unless Otherwise Specified)**

Parameter	Test Condition	Min	Typ	Max	Units
Operating frequency band		2.4		2.5	GHz
Linear output power for 802.11ac	Dynamic EVM < -35 dB for MCS9/VHT40		+18		dBm
Linear output power for 802.11n	Dynamic EVM < -32 dB for MCS7/HT20		+18.5		dBm
Linear output power for 802.11a	Dynamic EVM < -32 dB for 64 QAM/54 Mbps		+19		dBm
Linear output power for 802.11a, 6 Mbps	For 802.11b 1 Mbps CCK mask compliance with 1.5 dB margin		+22		dBm
Total supply current for 802.11ac	For P <sub>OUT</sub> = +18 dBm, MCS9/VHT40		140		dB
TX small signal gain			26		mA
Second harmonic	P <sub>OUT</sub> = +22 dBm, 11b 1 Mbps CCK		-8		dB
Third harmonic	P <sub>OUT</sub> = +22 dBm, 11b 1 Mbps CCK		-27		dBm/MHz
Power detector voltage	Measured with 10 kΩ load, P <sub>OUT</sub> = +5 to +20 dBm		250 to 1000		mV
Input return loss			-12		dB
Output return loss			-6		dB

**Table 5. RFX8425 Receive Electrical Characteristics (VDD = 3.3 V, TA = +25°C, Unless Otherwise Specified)**

Parameter	Test Condition	Min	Typical	Max	Units
Operating frequency		2.4		2.5	GHz
Small-signal gain (high-gain mode)			16		dB
Noise figure			2.6		dB
LNA quiescent current			12		mA
IIP3			+3.0		dBm
Insertion loss (bypass mode)			1.5		dB

**Table 6. RFX8425 Control Logic<sup>1</sup>**

Mode of Operation	TXEN	LEN	RXEN
Bypass/sleep mode	0	0	0
High linearity transmit mode	1	X	X
Receive mode with LNA ON	0	1	1
Power save transmit mode	0	0	1
Power save transmit mode	All others		

<sup>1</sup> "1" denotes high voltage state (> 1.2 V)  
 "0" denotes low voltage stage (< 0.4 V) at control pins  
 "X" denotes do not care  
 1 kΩ – 10 kΩ series resistor may be required for each control line.

### Package Dimensions

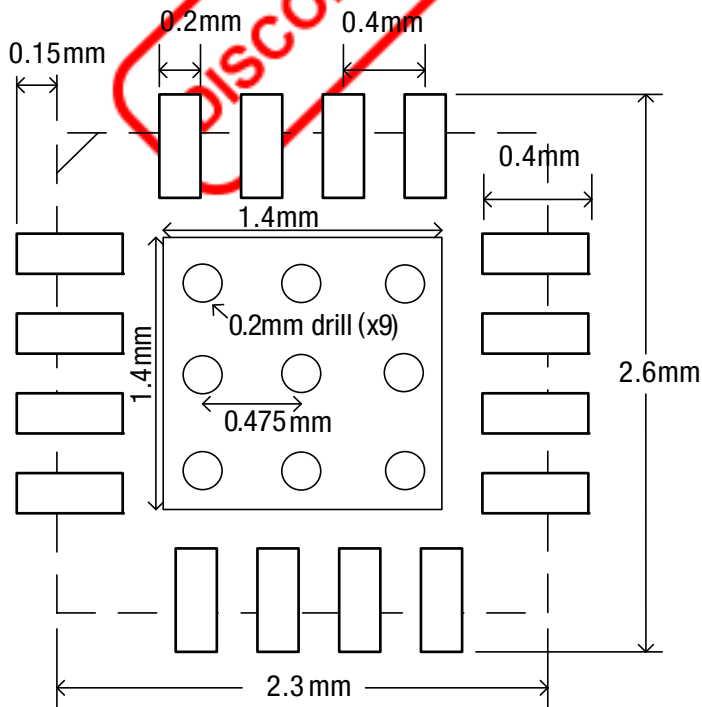
The PCB layout footprint for the RFX8425 is shown in Figure 3. The typical part marking is shown in Figure 4. Package dimensions are shown in Figure 5.

### 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.

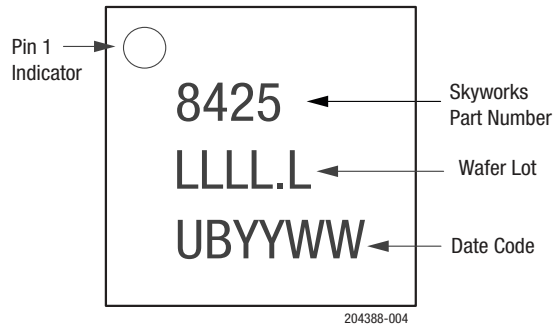
The RFX8425 is rated to Moisture Sensitivity Level 1 (MSL1) at 260 °C. It can be used for lead or lead-free soldering. For additional information, refer to the Skyworks Application Note, *Solder Reflow Information*, document number 200164.

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.

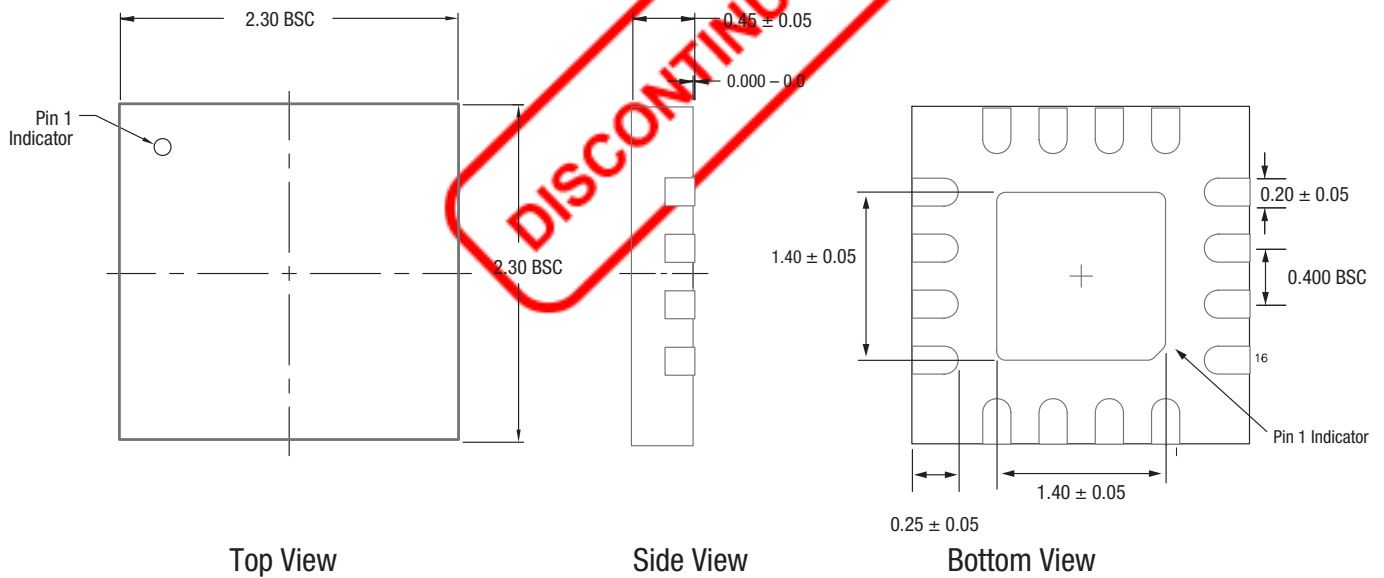


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Figure 3. RFX8425 PCB Layout Footprint



**Figure 4. Typical Part Markings (Top View)**



**DISCONTINUED**

All dimensions are in millimeters.

204388-005

**Figure 5. RFX8425 Package Dimensions**

### Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
RFX8425: 2.4 GHz CMOS WLAN/Bluetooth® Dual-Mode RFelC with PA, LNA, and SP3T	RFX8425	RFX8425-EK1



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