

## DATA SHEET

# RFX8422S: 2.4 GHz CMOS WLAN / Bluetooth RFIC with PA, LNA with Bypass, and SP3T Switch

## Applications

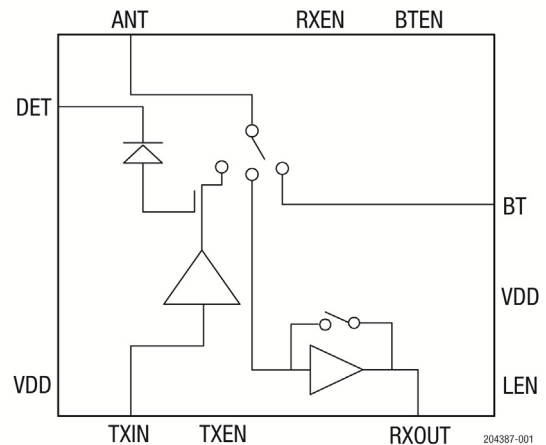
- Smartphones, feature phones and MIDs with WLAN / Bluetooth®
- WLAN / Bluetooth platforms requiring shared antenna
- Laptop / netbook / smartbook with embedded Wi-Fi and Bluetooth
- Portable platforms with integrated 802.11b/g/n and Bluetooth

## Features

- Combines 802.11b/g/n and Bluetooth applications
- High-linearity PA for 802.11 b/g/n WLAN
- Simultaneous WLAN and Bluetooth receive mode
- Low noise figure WLAN receive LNA with bypass for near range operation
- Supports direct battery operation
- Built in directional coupler based output power detector
- ESD protection circuitry on all ports
- DC decoupled RF ports and VDD / RF isolation
- Small outline 16L QFN package (16-lead, 2.5 x 2.5 x 0.45 mm) package with exposed ground pad



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**Figure 1. RFX8422S Block Diagram**

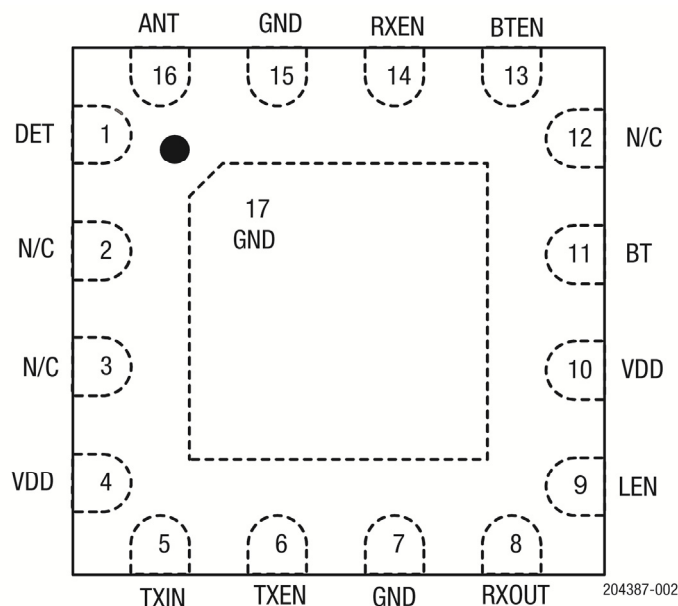
## Description

The RFX8422S is a fully integrated, single-chip, single-die RFIC (RF front-end integrated circuit) that incorporates all the RF functionality needed for dual-mode WLAN, Bluetooth operations including simultaneous WLAN and Bluetooth receive capability.

The RFX8422S architecture integrates a high-efficiency high-linearity PA, a directional coupler and output power detector, impedance matching networks, harmonic filters, a LNA with Bypass and an SP3T antenna switch all in a single CMOS device.

This RFIC is designed to be used in combined 802.11b/g/n and Bluetooth applications operating in the 2.4 GHz band, and can be powered directly from the battery.

Combining superior performance, ultra-low power consumption, small form factor, and low cost, RFX8422S is the perfect solution for mobile, handheld, and portable devices with integrated WLAN and Bluetooth. RFX8422S is assembled in the ultra-compact 2.5 x 2.5 x 0.45 mm 16L QFN package, and requires minimal external components and PCB footprint.



**Figure 2. RFX8422S Pinout  
(Top View)**

**Table 1. RFX8422S Signal Descriptions**

Pin	Name	Description	Pin	Name	Description
1	DET	PA power detector output	8	RXOUT	WLAN RX signal port to the transceiver: DC shorted to GND
2, 3, 12	NC	Not connected internally (can be grounded or left open)	9	LEN	CMOS logic control to enable LNA. Use to switch between the LNA and bypass modes
4, 10	VDD	DC voltage supply	11	BT	RF signal port from / to the Bluetooth transceiver: DC shorted to GND
5	TXIN	WLAN TX signal port from the transceiver: DC shorted to GND	13	BTEN	CMOS logic control to enable Bluetooth
6	TXEN	CMOS logic control to enable WLAN transmit	14	RXEN	CMOS logic control to enable WLAN receive
7, 15, Paddle	GND	Ground (must be connected to ground)	16	ANT	RF Signal Port to/from the antenna: DC Shorted to GND

## Electrical and Mechanical Specifications

The absolute maximum ratings of the RFX8422S 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 RFX8422S is determined by the logic provided in Table 6.

**Table 2. RFX8422S Absolute Maximum Ratings<sup>1</sup>**

Parameter	Conditions	Minimum	Maximum	Units
DC VDD voltage supply	All VDD pins	0	4.5	V
DC control pin voltage	All control pins	0	3.6	V
DC current consumption	TXEN = 1		300	mA
TX RF input power			+5	dBm
ANT RF input power			+10	dBm
BT TX RF input power			+20	dBm
Junction temperature			150	°C
Operating temperature		-40	+85	°C
Storage ambient temperature	Appropriate care required according to JEDEC standards	-40	+150	°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  $\Omega$  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. RFX8422S Recommended Operating Conditions<sup>1</sup>**

Parameter	Conditions	Min	Typ	Max	Units
VDD voltage supply <sup>1</sup>		2.9	3.6	4.5	V
RF port impedance	Single ended		50		$\Omega$
Control voltage HIGH <sup>2</sup>		1.2		3.6	V
Control voltage LOW		0		0.3	V
Control pin current			0.1		$\mu$ A
Shutdown current	All operation modes		6		$\mu$ A
PA turn-on / turn-off time			0.5	1	$\mu$ s
$\theta_{ja}$ <sup>3</sup>			35		°C/W
$\theta_{jc}$ top <sup>4</sup>				15	°C/W
Antenna switch speed			0.5	1	$\mu$ s

<sup>1</sup> For normal operation of the RFX8422S, VDD must be continuously applied to all VDD supply pins.

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

<sup>3</sup> For operation above +85 °C, use the  $\theta_{ja}$  as guidance for system design to assure the junction temperature will not exceed the maximum of +150 °C.

<sup>4</sup> For reference only. Contact Skyworks for details regarding thermal testing and PCB thermal configuration.

**Table 4. RFX8422S PA Transmit Mode Electrical Characteristics (VDD = 3.6 V, TA = +25°C, Unless Otherwise Specified)**

Parameter	Test Condition	Min	Typ	Max	Units
Operating frequency		2.4		2.5	GHz
Linear output power 1	EVM < 3%, 802.11g 64 QAM / 54 Mbps		+18		dBm
Linear output power 2	EVM < 2.8%, 802.11n MCS7 HT40		+17.5		dBm
Linear output power 3	802.11b 1 Mbps CCK mask compliance		+21		dBm
TX small signal gain			26		dB
Current consumption	POUT = +18 dBm		170		mA
Second harmonics	POUT = +21 dBm (CW)		-21		dBc
Third harmonics	POUT = +21 dBm (CW)		-42		dBc
Power detector voltage	POUT = +5 to +21 dBm, 10 k $\Omega$ load		0.15 - 1		V
Directional coupler directivity			20		dB
Input return loss			-15		dB
Output return			-15		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. RFX8422S Receive Mode Electrical Characteristics (VDD = 3.6 V, TA = +25°C, Unless Otherwise Specified)**

Parameter	Test Condition	Min	Typ	Max	Units
Operating frequency		2.4		2.5	GHz
Small-signal gain (high-gain mode)	Between ANT and RX pins; LEN = HIGH		10		dB
Small-signal current (high-gain mode)	LEN = HIGH, No RF applied		10		mA
Noise figure (high-gain mode)	At ANT pin		3.3		dB
LNA 2 <sup>nd</sup> harmonic	At input P1 dB		-30		dBc
LNA 3 <sup>rd</sup> harmonic	At input P1 dB		-30		dBc
Insertion loss (bypass mode)	Between ANT and RX pins; LEN = LOW		11		dB
Insertion loss (BT)	Between ANT and BT pins		1		dB

**Table 6. RFX8422S Control Logic<sup>1</sup>**

Mode of Operation	TXEN	BTEN	RXEN	LEN
Shutdown mode	0	0	0	x
WLAN receive. bypass mode	0	0	1	0
WLAN receive. high-gain mode	x	0	1	1
Bluetooth transmit / receive mode	0	1	0	x
WLAN transmit mode	1	0	0	x
Unsupported	1	1	x	x
Unsupported	0	1	1	x
Unsupported	1	0	1	0

<sup>1</sup> "1" denotes high voltage state (> 1.2 V)

"0" denotes low voltage stage (&lt; 0.3 V) at control pins

"X" denotes do not care: either 1 or 0 without change

1 k $\Omega$  – 10 k $\Omega$  series resistor may be required for each control line

## Package Dimensions

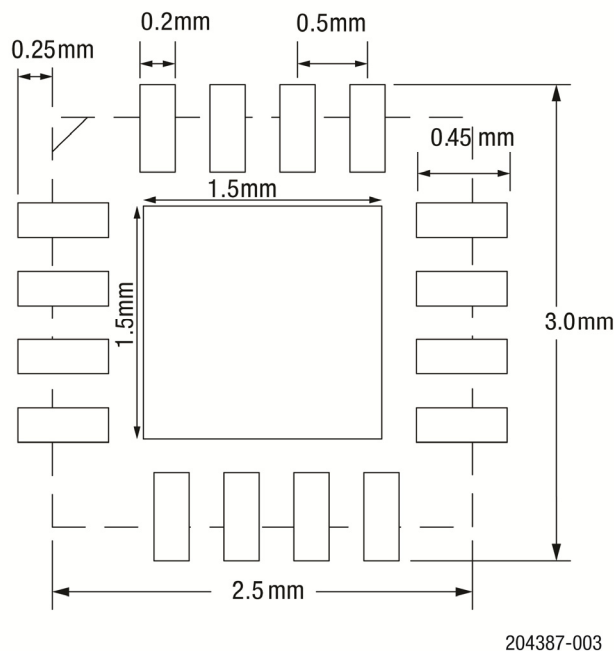
The PCB layout footprint for the RFX8422S is shown in Figure 3. The typical part marking is shown in Figure 4. Package dimensions are shown in Figure 5. Tape and reel dimensions are provided in Figure 6.

## Package and Handling Information

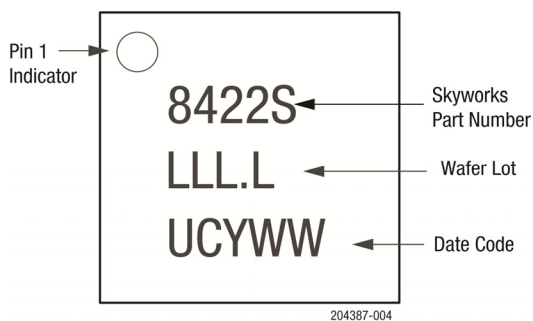
Instructions on the shipping container label regarding exposure to moisture after the container seal is broken must be followed. Otherwise, problems related to moisture absorption may occur when the part is subjected to high temperature during solder assembly.

The RFX8422S 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. RFX8422S PCB Layout Footprint**



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

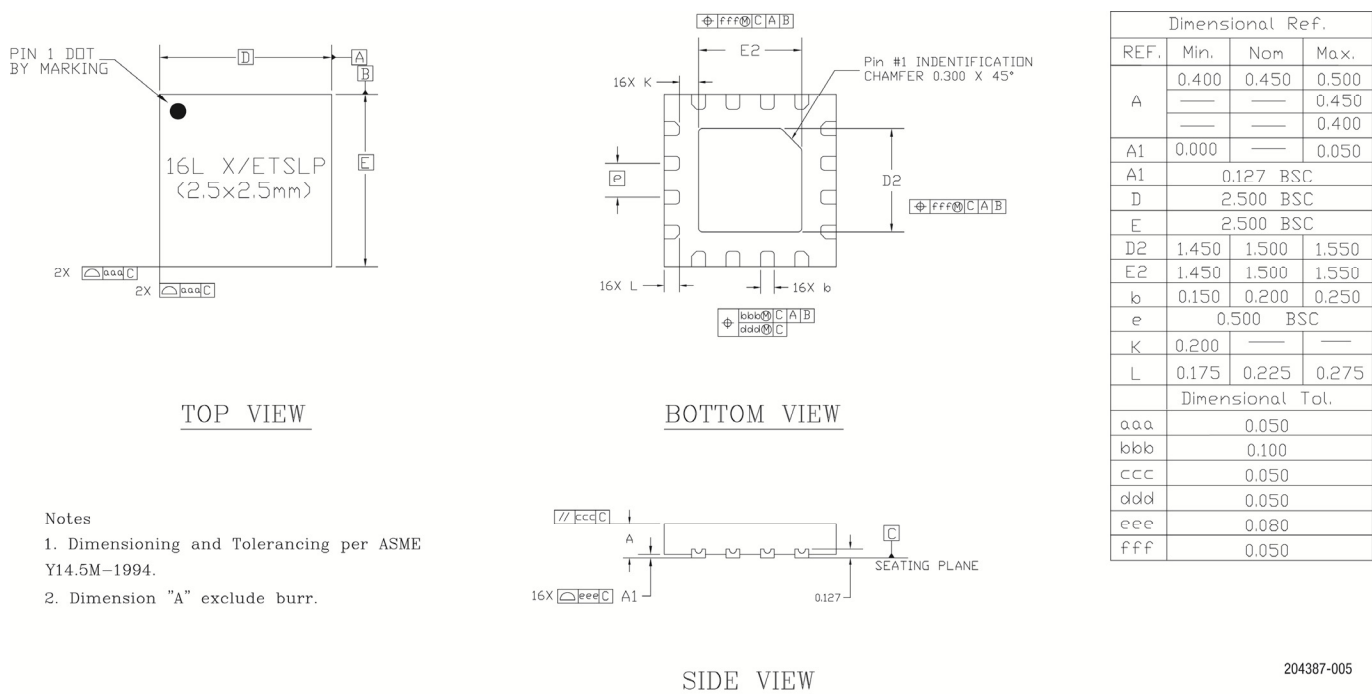


Figure 5. RFX8422S Package Dimensions

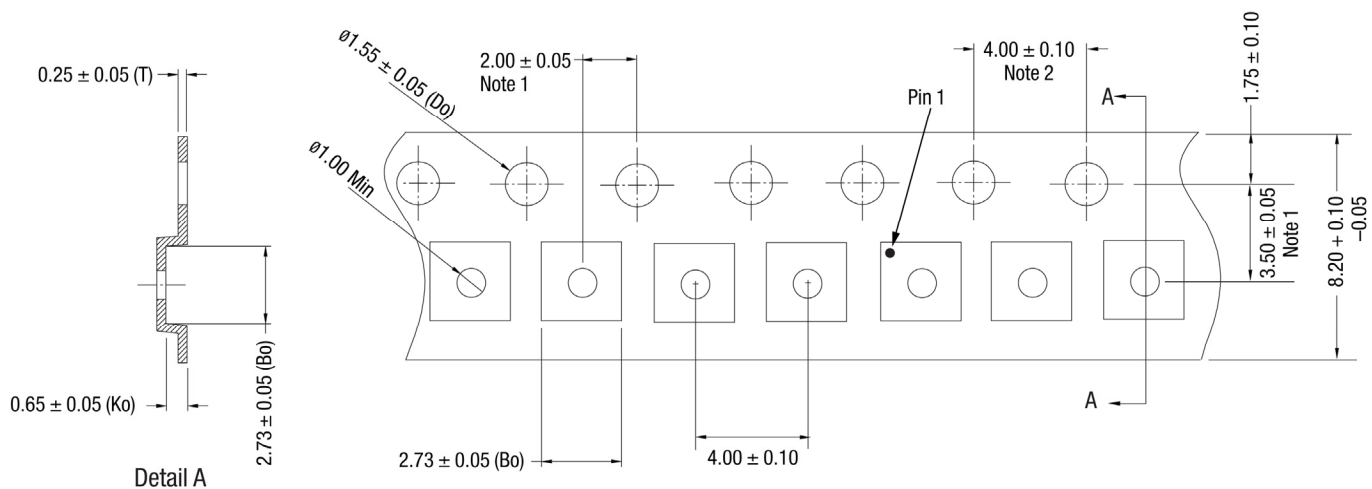


Figure 6. RFX8422S Tape and Reel Dimensions

## Ordering Information

Part Number	Product Description	Evaluation Board Part Number
RFX8422S	2.4 GHz CMOS WLAN / Bluetooth RFEIC with PA, LNA with Bypass, and SP3T Switch	RFX8422S-EK1

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