

DATA SHEET

RFX8053: CMOS 5 GHz WLAN 802.11ac RFelC with PA, LNA, and SPDT

Applications

- 802.11a/n/ac WiFi devices
- Smartphones
- Tablets/MIDs
- Gaming
- Consumer electronics
- Notebooks/netbooks/ultrabooks
- Mobile/portable devices
- 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 ODFM/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
- Very low DC power consumption
- 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
- 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

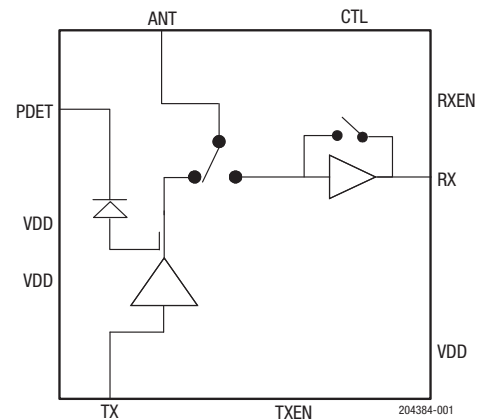


Figure 1. RFX8053 Block Diagram

Description

The RFX8053 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 systems operating in the 5.15 to 5.825 GHz range. The RFX8053 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 RFX8053 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 RFX8053 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 RFX8053 is an ideal RF front-end solution for implementing 5 GHz WLAN in smartphones and other platforms.



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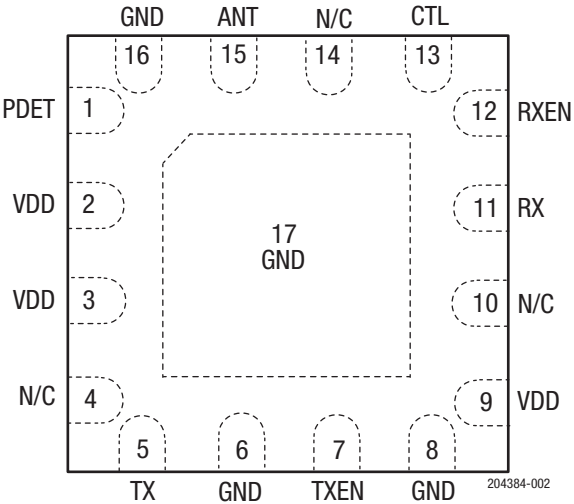


Figure 2. RFX8053 Pinout (Top View)

Table 1. RFX8053 Signal Descriptions

Pin	Name	Description	Pin	Name	Description
1	PDET	Analog voltage proportional to the PA power output	7	TXEN	CMOS input to control TX enable
2, 3, 9	VDD	DC supply voltage	11	RX	RF output port from LNA or bypass – DC shorted to GND
4, 10, 14	N/C	Not connected internally	12	RXEN	CMOS input to control RX enable
5	TX	RF input port from the transceiver – DC shorted to GND	13	CTL	CMOS input for additional TX control
6, 8, 16, 17	GND	Ground – must be connected to GND in the application circuit	15	ANT	Antenna port RF signal from the PA or RF signal applied to the LNA or bypass – DC shorted to GND

Electrical and Mechanical Specifications

The absolute maximum ratings of the RFX8053 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 RFX8053 is determined by the logic provided in Table 6.

Table 2. RFX8053 Absolute Maximum Ratings¹

Parameter	Conditions	Minimum	Maximum	Units
DC VDD voltage supply	All VDD pins	0	5.5	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			150	°C
Storage ambient temperature	Appropriate care required according to JEDEC Standards	-40	+150	°C
Operating temperature	Case temperature	-40	+85	°C
Electrostatic discharge: Human Body Model (HBM)		1000		V

¹ 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. RFX8053 Recommended Operating Conditions

Parameter	Conditions	Min	Typ	Max	Units
DC VDD voltage supply ¹	All VDD pins	3.0	3.6	4.8	V
Control voltage high ²	3.6 V or VDD (whichever is lower)	1.2			V
Control voltage low		0		0.3	V
DC control pin current consumption			1		μ A
DC shutdown current			3	10	μ A
PA turn-on/turn-off time				0.4	μ sec
θ_{ja} ³			28		°C/W
θ_{ja}			44		°C/W
LNA switch speed				0.4	μ sec

¹ For normal operation of the RFX8053, VDD must be continuously applied to all VDD supply pins.

² If control voltage can exceed 1.8 V, a 1 k Ω to 10 k Ω series resistor is recommended for the application circuit on each control line.

³ 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. RFX8053 Transmit Electrical Characteristics (VDD = 3.3 V, TA = +25°C, Unless Otherwise Specified)

Parameter	Test Condition	Min	Typ	Max	Units
Operating frequency band		5.15		5.825	GHz
Linear output power for 802.11ac	DEVM –35 dB, 802.11ac, MCS9, VHT80	+14.5	+15.5		dBm
Linear output power for 802.11n	EVM –32 dB, 802.11n, MCS7, HT40		+18		dBm
Linear output power for 802.11a	EVM 3.5%, 802.11a, QAM 64, 54 Mbps		+19		dBm
Linear output power for 802.11a, 6 Mbps	For 802.11a 6 Mbps mask compliance		+21		dBm
Small-signal power gain	Between TX and ANT pins		28		dB
Gain flatness	Between 5.15 and 5.85 GHz		±1		dB
TX quiescent current			210		mA
TX linear current	POUT = +18 dBm		270		mA
Out-of-band rejection	At 3.9 to 7.2 GHz, relative to in-band gain	-10	-15		
Power detector voltage output	POUT = +5 to +20 dBm, 10 k Ω load	300		1600	V
Second harmonic	POUT=+19 dBm, C/W		-35		dBc
Third harmonic	POUT=+19 dBm, C/W		-50		dBc
Input return loss	At TX port		-10		dB
Output return loss	At ANT port		-10		dB
Load VSWR for stability (CW, fix pin for POUT = +21 dBm with 50 Ω 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 = +21 dBm with 50 Ω load)	No damage	8:1	10:1		N/A

Table 5. RFX8053 Receive Electrical Characteristics (VDD = 3.3 V, TA = +25°C, Unless Otherwise Specified)

Parameter	Test Condition	Min	Typ	Max	Units
Operating frequency band	All RF pins loaded by 50 Ω	5.15		5.85	GHz
Gain	High-gain mode, between ANT and RX pins, RXEN = high, CTL = low	10	12		dB
Noise figure	High-gain mode, at ANT pin		3.1		dB
Insertion loss for LNA bypass mode	Between ANT and RX pins; RXEN = low, CTL = low		5		dB
Input return loss	At ANT port, high-gain mode		-6		dB
	Bypass mode		-10		
Output return loss	At RX port, high-gain mode		-6		dB
	Bypass mode		-8		
RF port impedance			50		Ω
DC quiescent current	No RF applied, through VDD, high-gain mode		16		mA
	No RF applied, through VDD, bypass mode		0.003		
IIP3	At ANT pin, high-gain mode		+6		dBm
	At ANT pin, bypass mode		+20		

Table 6. RFX8053 Control Logic¹

Mode of Operation	TXEN	LEN	RXEN
Receive Bypass Mode	0	0	0
Receive Mode, High-Gain	0	0	1
Transmit Mode	1	X	0
Not specified	All others		

¹ "1" denotes high voltage state (> 1.2 V)

"0" denotes low voltage stage (< 0.3 V) at control pins

"X" denotes do not care: high or low state

1 k Ω – 10 k Ω series resistor may be required for each control line.

Package Dimensions

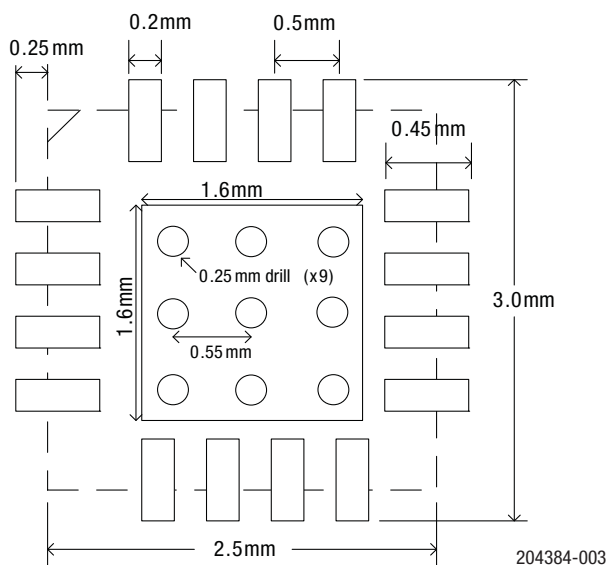
The PCB layout footprint for the RFX8053 is shown in Figure 3. The typical part marking is shown in Figure 4. Package dimensions are shown in Figure 5. Tape and reel dimensions are provided in Figure 6.

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 RFX8053 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. RFX8053 PCB Layout Footprint**

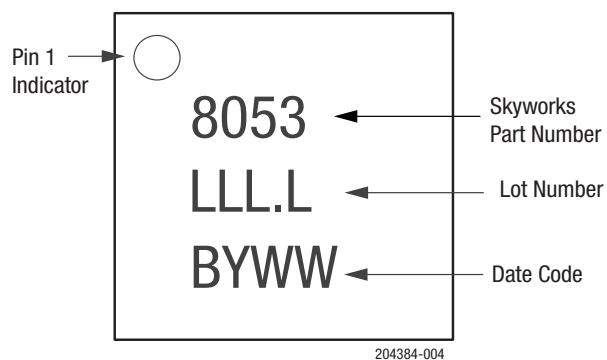
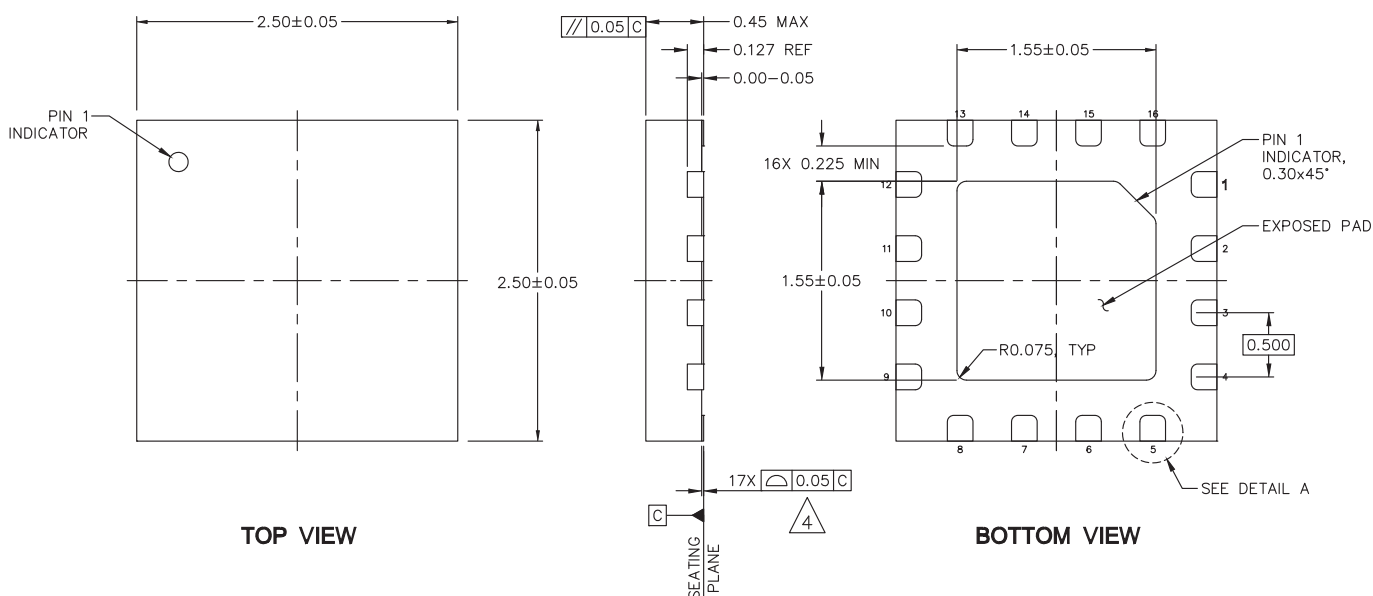


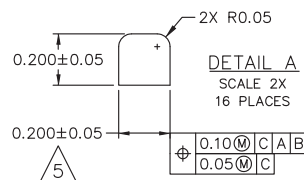
Figure 4. Typical Part Markings (Top View)



NOTES:

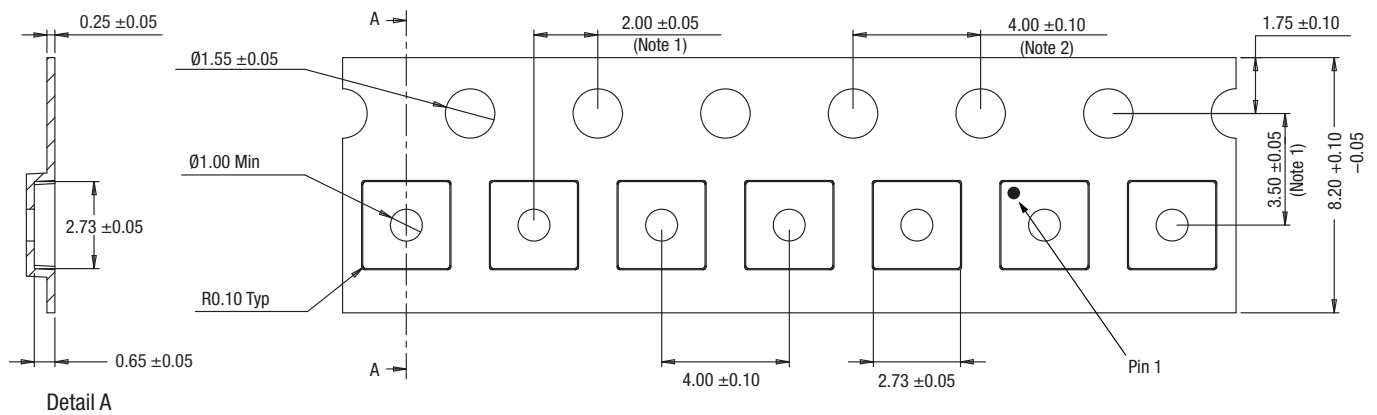
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-2009.
2. DIMENSIONS ARE IN MILLIMETERS.
3. TOLERANCING (UNLESS OTHERWISE SPECIFIED):

DECIMAL TOLERANCE:	ANGULAR TOLERANCE:
X.X (1 PLC) ± 0.1mm	± 1/2°
X.XX (2 PLC) ± 0.05mm	
X.XXX (3 PLC) ± 0.025mm	
4. COPLANARITY APPLIES TO THE TERMINALS AS WELL AS ALL OTHER BOTTOM SURFACE METALLIZATION.
5. DIMENSION APPLIES TO METALIZED TERMINAL. IF TERMINAL TIP HAS A RADIUS, DIMENSION SHOULD NOT BE MEASURED IN THAT RADIUS AREA.
6. PLATING REQUIREMENTS PER SOURCE CONTROL DRAWING (SCD) 2504.
7. UNLESS SPECIFIED DIMENSIONS ARE SYMMETRICAL ABOUT CENTER LINES.



204384-005

Figure 5. RFX8053 Package Dimensions



Notes:

1. Measured from center line of sprocket hole to center line of pocket.
2. Cumulative tolerance of 10 sprocket holes = ± 0.10 mm.
3. Other material available.
4. All dimensions are in millimeters.

204384-006

Figure 6. RFX8053 Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Evaluation Board Part Number
RFX8053: CMOS 5 GHz WLAN 802.11ac RFEIC with PA, LNA, and SPDT	RFX8053	RFX8053-EK1

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