

## WaveLAN™ WL54040 Dual-Band Wireless LAN Transceiver

### 1 Features

- Direct-conversion receiver for *IEEE*® 802.11b and low-IF receiver for *IEEE* 802.11a/g with integrated channel filter and programmable gain control.
- dc offset cancellation.
- Synthesizer with integrated VCO, PLL, 40 MHz crystal oscillator with digital frequency calibration.
- I-Q differential interface for RX and TX, multiplexed for *IEEE* 802.11a/b/g.
- Direct modulation transmitter with programmable output power  $-10$  dBm to 0 dBm.
- High sensitivity (under normal operating conditions):
  - *IEEE* 802.11b mode:  $-88$  dBm for 11 Mbits/s.
  - *IEEE* 802.11a and *IEEE* 802.11g modes:  $-74$  dBm for 54 Mbits/s.
- No external SAW filter required.
- Low BOM, low external component count.
- 0.25  $\mu$ m BiCMOS technology.
- Three-wire bus control.
- Supply voltage 3.0 V—3.6 V.
- Alternative direct supply of regulated supply voltage 2.5 V—2.7 V.
- Two integrated voltage regulators (LDO).
- Powerdown modes.
- Operational temperature  $-30$  °C to  $+85$  °C.

### 2 Wireless LAN Applications

- High data-rate multimode applications.
- Client cards for notebooks, desktop PCs, and PDAs.
- Modules with WLAN functionality.
- Enterprise and home infrastructure devices.
- High-speed bridges and point-to-multipoint systems.
- Home entertainment and multimedia systems.



### 3 Description

The WaveLAN WL54040 is a low-power, high-performance dual-band transceiver for the *IEEE* 802.11a, *IEEE* 802.11b, and *IEEE* 802.11g wireless LAN standards. The WL54040 is designed to form a complete Agere *IEEE* 802.11a/b/g chip set in combination with the WL64040 multimode baseband processor, the WL60040 WMAC, and the WL54240 dual-band power amplifier.

The WL54040 is designed in 0.25  $\mu$ m BiCMOS technology. It is capable of automatically switching between low intermediate-frequency conversion (low-IF) for OFDM and direct down conversion for DSSS/CCK modulation, enabling the device to achieve optimal throughput for all of the *IEEE* 802.11 standards. Specifically, low-IF conversion guards against dynamic range degradation, an inherent limitation of direct-down OFDM architectures, to provide improved system performance.

### 3 Description (continued)

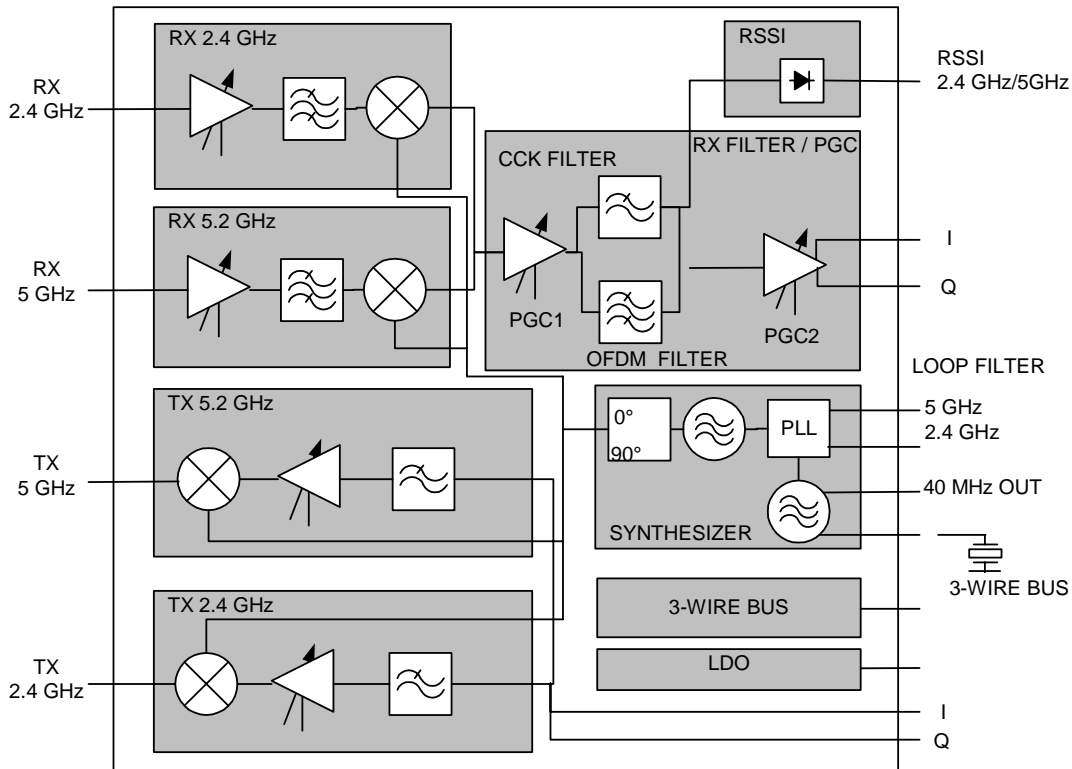


Figure 1. Block Diagram

### 4 Pin Descriptions

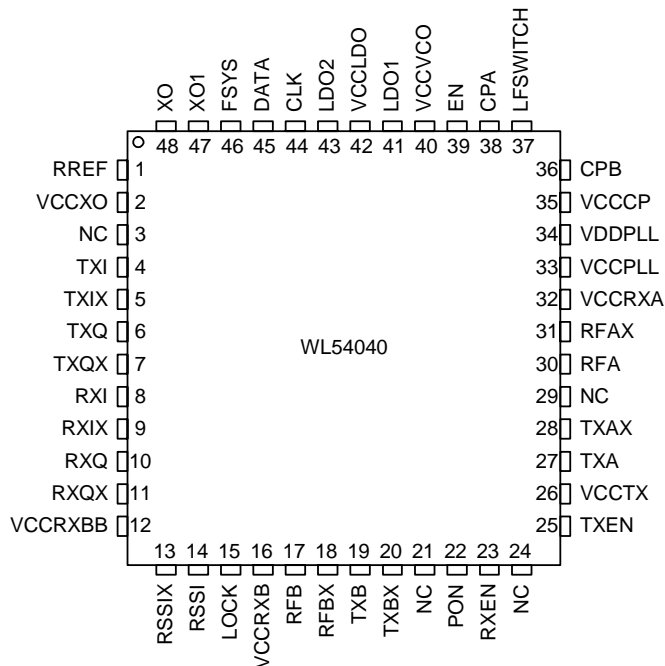


Figure 2. Pin Configuration

## 4 Pin Descriptions (continued)

Table 1. Pin Definitions and Functions

Pin #	Symbol	Pin Type	Function	Pin #	Symbol	Pin Type	Function
1	RREF	TBD	External reference resistor	25	TXEN	TBD	Transmit enable
2	VCCXO	TBD	Supply quartz oscillator	26	VCCTX	TBD	Supply voltage transmitter
3	NC	TBD	Not connected	27	TXA	TBD	Transmitter output 5 GHz 0°
4	TXI	TBD	Transmitter inputs 90°	28	TXAX	TBD	Transmitter output 5 GHz 180°
5	TXIX	TBD	Transmitter inputs 270°	29	NC	TBD	Not connected
6	TXQ	TBD	Transmitter inputs 0°	30	RFA	TBD	LNA inputs 5 GHz 0°
7	TXQX	TBD	Transmitter inputs 180°	31	RFAX	TBD	LNA inputs 5 GHz 180°
8	RXI	TBD	Baseband signal output 90°	32	VCCRXA	TBD	Supply voltage LNA 5 GHz
9	RXIX	TBD	Baseband signal output 270°	33	VCCPLL	TBD	Supply voltage PLL
10	RXQ	TBD	Baseband signal output 0°	34	VDDPLL	TBD	Supply voltage PLL
11	RXQX	TBD	Baseband signal output 180°	35	VCCCP	TBD	Supply voltage charge pump
12	VCCRXB	TBD	Supply voltage filters	36	CPB	TBD	Charge pump 2.4 GHz
13	RSSIX	TBD	RSSI output	37	LFSwitch	TBD	Loop filter switch
14	RSSI	TBD	RSSI output	38	CPA	TBD	Charge pump 5 GHz
15	LOCK	TBD	Lock detect output	39	EN	TBD	Enable (three-wire bus)
16	VCCRXB	TBD	Supply voltage LNA 2.4 GHz	40	VCCVCO	TBD	Supply voltage VCO
17	RFB	TBD	LNA inputs 2.4 GHz 0°	41	LDO1	TBD	Voltage regulator 1 output
18	RFBX	TBD	LNA inputs 2.4 GHz 180°	42	VCCLDO	TBD	Supply voltage regulator
19	TXB	TBD	Transmitter output 2.4 GHz 0°	43	LDO2	TBD	Voltage regulator 2 output
20	TXBX	TBD	Transmitter output 2.4 GHz 180°	44	CLK	TBD	Clock (three-wire bus)
21	NC	TBD	Not connected	45	DATA	TBD	Data (three-wire bus)
22	PON	TBD	Power on	46	FSYS	TBD	40 MHz reference frequency output
23	RXEN	TBD	Receive enable	47	XO1	TBD	External crystal conn 1
24	NC	TBD	Not connected	48	XO	TBD	External crystal conn 2

## 5 Electrical Characteristics

Table 2. Absolute Maximum Ratings, TAMB = -30 °C to +85 °C\*

Parameter	Symbol	Min	Max	Unit	Parameter	Symbol	Min	Max	Unit
Supply Voltage† (Except VCCLDO)	VS	-0.3	2.8	V	Output Voltage	VO	0	VS	V
Supply Voltage for VCCLDO	VSLDO	-0.3	3.6	V	Open Collector Output Voltage	VOC	-0.3	4.0	V
Input Voltage	VI	-0.3	3.1	V	Total Power Dissipation (RthJA = 25 K/W)	Ptot	—	600	mW
Differential Input Voltage	VID	—	2.0	Vp-p	ESD-integrity*	VESD	—	1000	V

\* Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. These are absolute stress ratings only. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operations sections of the data sheet. Exposure to absolute maximum ratings for extended periods can adversely affect device reliability.

† Supply voltage for all supply pins except VCCLDO (VCCXO, VCCRXB, VCCRXB, VCCTX, VCCRXA, VCCPLL, VDDPLL, VCCCP, and VCCVCO).

Table 3. Operating Range

Parameter	Symbol	Min	Max	Unit
Ambient Temperature	TAMB	-30	85	°C
Supply Voltage	VS	2.5	2.7	V
Supply Voltage for Pin 42 VCCLDO	VVCCLDO	3.0	3.6	V

## 5 Electrical Characteristics (continued)

In the following tables, all voltages are rms values, where all exceptions are clearly stated. All values are preliminary target values and may be changed up until the final specification is released. Unless otherwise specified, the following conditions apply:  $T_{AMB} = 25\text{ }^{\circ}\text{C}$ ,  $V_S = 2.5\text{ V} - 2.7\text{ V}$ .

Table 4. IEEE 802.11a/IEEE 802.11g Receiver ac/dc Characteristics (low IF,  $f_{IF} = 10\text{ MHz}$ )

Parameter	Symbol	IEEE 802.11a			IEEE 802.11g OFDM			IEEE 802.11b DSSS/CCK (Direct Conversion)			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
Input Frequency	—	5150	—	5875	2400	—	2483.5	2400	—	2483.5	MHz	—
Overall Gain (high)	GVOH	63	69	75	62	—	74	76	82	88	dB	$T_{AMB} = 30\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$
Overall Gain (low)	GVOL	13	20	25	12	—	24	-3	3	9	dB	$T_{AMB} = 30\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$
LNA Gain Step	GS	17	20	23	24	—	30	24	27	30	dB	LNA gain = high $\rightarrow$ low, $T_{AMB} = -30\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$

Table 5. IEEE 802.11a/IEEE 802.11g Transmitter ac/dc Characteristics

Parameter	Symbol	IEEE 802.11a (incl. Filter, Modulator)			IEEE 802.11g (incl. Filter, Modulator, Driver)			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max		
Frequency Range	—	5170	—	5815	2400	—	2483.5	MHz	—
Max Output Level	PoutA	-6	-3	-1	-6	-3	-1	dBm	$T_{AMB} = -30\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$
PGC Gain Range	—	9	—	10	9	—	10	dB	—
EVM	—	-29	—	—	—	—	—	dB	$V_{in} = 1\text{ V}_{p-p}$ max; modulated with 64 QAM OFDM signal; $T_{AMB} = -30\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$

## 6 Ordering Information

Part Number	Temperature Range ( $^{\circ}\text{C}$ )	Package	Packing	MOQ	Comcode
WL54040-D	-30 to +85	P-VQFN-48-4	TBD	TBD	700054910

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