Telink 8258 EVK TLSR8258DK48 Specification

PS-18122800-E3

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Keyword:

Features; Pin layout; Mechanical dimensions;

Electrical specifications; Reference design;

Pin connection

Brief:

This document is a specification for Telink 8258 EVK TLSR8258DK48.

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Revision History

Version	Major Changes	Date	Author
1.0.0	Initial release	2019/1	HZF, LX, Cynthia
1.1.0	Updated the sections below: 3.3 RF performance, 3.4 Audio performance	2019/1	HZF, LX, Cynthia
1.2.0	Updated the sections below: 3.2 DC characteristics, 4 Reference Design	2019/2	HZF, LX, Cynthia

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1 Product Introduction

1.1 General description

The TLSR8258DK48, which is based on Telink TLSR8258F512ET48 chip, provides a Bluetooth LE wireless system.

The TLSR8258DK48 integrates a power-balanced 32-bit MCU, BLE Radio, 64kB SRAM, 512kB internal Flash, 14bit ADC with PGA, analog and digital microphone input, stereo audio output, 6-channel PWM, one quadrature decoder (QDEC), abundant and flexible GPIO interfaces, and nearly all the peripherals needed for IoT (Internet of Things) and HID (Human Interface Devices) application development (e.g. Bluetooth Low Energy).

The TLSR8258DK48 supports standards and industrial alliance specifications including Bluetooth Low Energy (up to Bluetooth 5), BLE Mesh, 6LoWPAN, Thread, RF4CE, HomeKit, ANT and 2.4GHz proprietary standard.

Tel ink TLSR8258DK48 board can be used for SDK development. Firmware can be directly downloaded to the TLSR8258DK48 board to be up and running.

1.2 Key features

- ✧ Bluetooth 5 Compliant, 1Mbps, 2Mbps, Long Range 125kbps and 500kbps
- ✧ 64kB on-chip SRAM with up to up to 32kB retention
- ✧ 512kB internal Flash
- ✧ A rich set of I/Os: SPI, I2C, USB, Single wire, up to 16 GPIOs, UART with hardware flow control and 7816 protocol support, DMIC (Digital Mic), AMIC (Analog Mic), I2S, Stereo Audio output
- ✧ 6-channel PWM (Pulse Width Modulation) output
- ✧ 10-channel (only GPIO input), 14-bit SAR ADC with 10.5-bit ENOB
- ✧ 4-channel PGA, differential input

- ✧ Rx sensitivity: -96dBm@BLE 1Mbps, -100dBm@ 250kbps, -93dBm @ BLE 2Mbps mode, -98dBm @ BLE 500kbps mode, -100dBm @ BLE 125kbps mode
- ✧ RSSI monitoring with +/-1dB resolution
- ✧ Power supply: 1.8V~3.6V (Battery) or 4.5V~5.5V (USB)
- ✧ Whole module RX mode: 5.7mA

1.3 Mechanical and PCB fabrication Specifications

- ✧ PCB dimension: 68.6mm*63.3mm*1.6mm
- ✧ PCB layer: 2 layers
- ✧ Dielectric constant: 4.2
- ✧ Impedance: 50 Ω

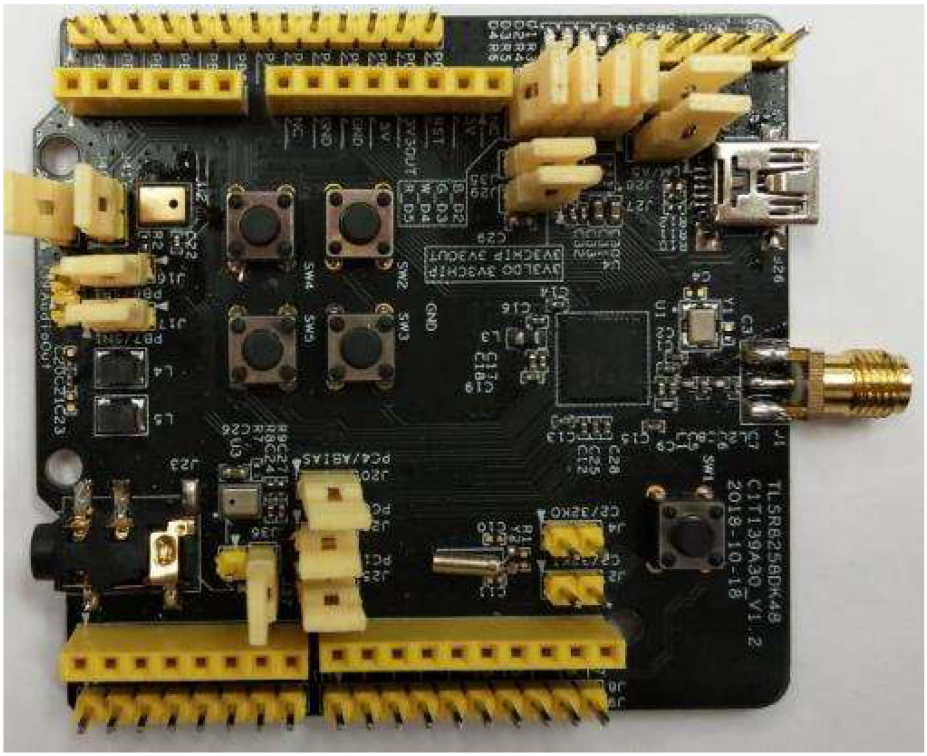


Figure 2 TLSR8258DK48 photo

1.4 Pin layout

1.4.1 GPIO interface

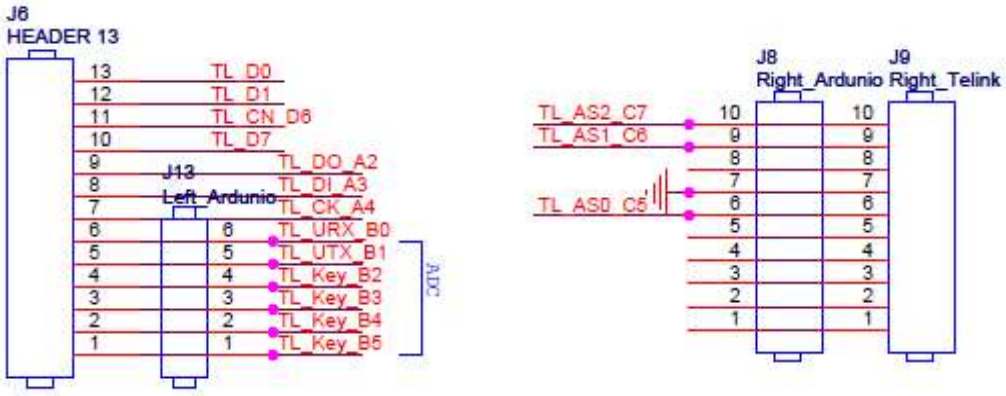


Figure 4 Pin layout

Pin definition is shown as the Table 1:

Table 1 Pin definition

Pin No	Module Pin Name	Chip Pin Name	Description
J6			
1	TL_Key_B5	SDM_N0/PWM5/lc_comp_ain<5>/ sar_aio<5>/PB<5>	SDM negative output 0 / PWM5 output / Low power comparator input / SAR ADC input / GPIO PB[5]
2	TL_Key_B4	SDM_P0/PWM4/lc_comp_ain<4>/ sar_aio<4>/PB<4>	SDM positive output 0 / PWM4 output / Low power comparator input / SAR ADC input / GPIO PB[4]
3	TL_Key_B3	PWM0_N/UART_RTS/TX_CYC2PA/ lc_comp_ain<3>/sar_aio<3>/ PB<3>	PWM0 inverting output / UART_RTS / Control external PA / Low power comparator input / SAR ADC input / GPIO PB[3]
4	TL_Key_B2	PWM5/UART_CTS/RX_CYC2LNA/ lc_comp_ain<2>/sar_aio<2>/ PB<2>	PWM5 output / UART_CTS / Control external LNA / Low power comparator input / SAR ADC input / GPIO PB[2]
5	TL_UTX_B1	PWM4/UART_TX/ATSEL2/ lc_comp_ain<1>/sar_aio<1>/PB<1>	PWM4 output / UART_TX / Antenna select pin 2 / Low power comparator input / SAR ADC input / GPIO PB[1]
6	TL_URX_B0	PWM3/UART_RX/ATSEL1/ sar_aio<0>/PB<0>	PWM3 output / UART_RX / Antenna select pin 1 / SAR ADC

Pin No	Module Pin Name	Chip Pin Name	Description
			input / GPIO PB[0]
7	TL_CK_A4	CK/UART_RTS/PWM2/PA<4>	SPI clock (I2C_SCK) / UART_RTS / PWM2 output / GPIO PA[4]
8	TL_DI_A3	DI/UART_CTS/PWM1/PA<3>	SPI data input (I2C_SDA) / UART_CTS / PWM1 output / GPIO PA[3]
9	TL_DO_A2	DO/UART_TX/PWM0/PA<2>	SPI data output / UART_TX / PWM0 output / GPIO PA[2]
10	TL_D7	SPI_CK/I2S_BCK/7816_TRX /PD<7>	SPI clock (I2C_SCK) / I2S bit clock / UART 7816 TRX / GPIO PD[7]
11	TL_CN_D6	CN/UART_RX/ATSEL0/PD<6>	SPI chip select (Active low) / UART_RX / Antenna select pin 0 / GPIO PD[6]
12	TL_D1	TX_CYC2PA/UART_CTS/PD<1>	Control external PA / UART_CTS / GPIO PD[1]
13	TL_D0	RX_CYC2LNA/7816_TRX/ PD<0>	Control external LNA / UART 7816 TRX / GPIO PD[0]
J9			
1	NC		Not connect
2	NC		Not connect
3	NC		Not connect
4	NC		Not connect
5	NC		Not connect
6	TL_AS0_C5	PWM3_N/UART_RX/ATSEL0/ sar_aio<9>/PC<5>	PWM3 inverting output / UART_RX / Antenna select pin 0 / SAR ADC input / GPIO PC[5]
7	GND		Ground
8	NC		Not connect
9	TL_AS1_C6	RX_CYC2LNA/ATSEL1/PWM4_N/ PC<6>	Control external LNA / Antenna select pin 1 / PWM4 inverting output / GPIO PC[6]
10	TL_AS2_C7	TX_CYC2PA/ATSEL2/PWM5_N/ PC<7>	Control external PA / Antenna select pin 2 / PWM5 inverting output / GPIO PC[7]

1.4.2 Arduino interface

Telink TLSR8258DK48 is compatible with Arduino standard interface, which adopts single-column direct-in female headers (J7, J8, J11, J13) with pin distance of 2.54mm. The TLSR8258DK48 can be used as “Host control board” or “Arduino shield daughter board”.

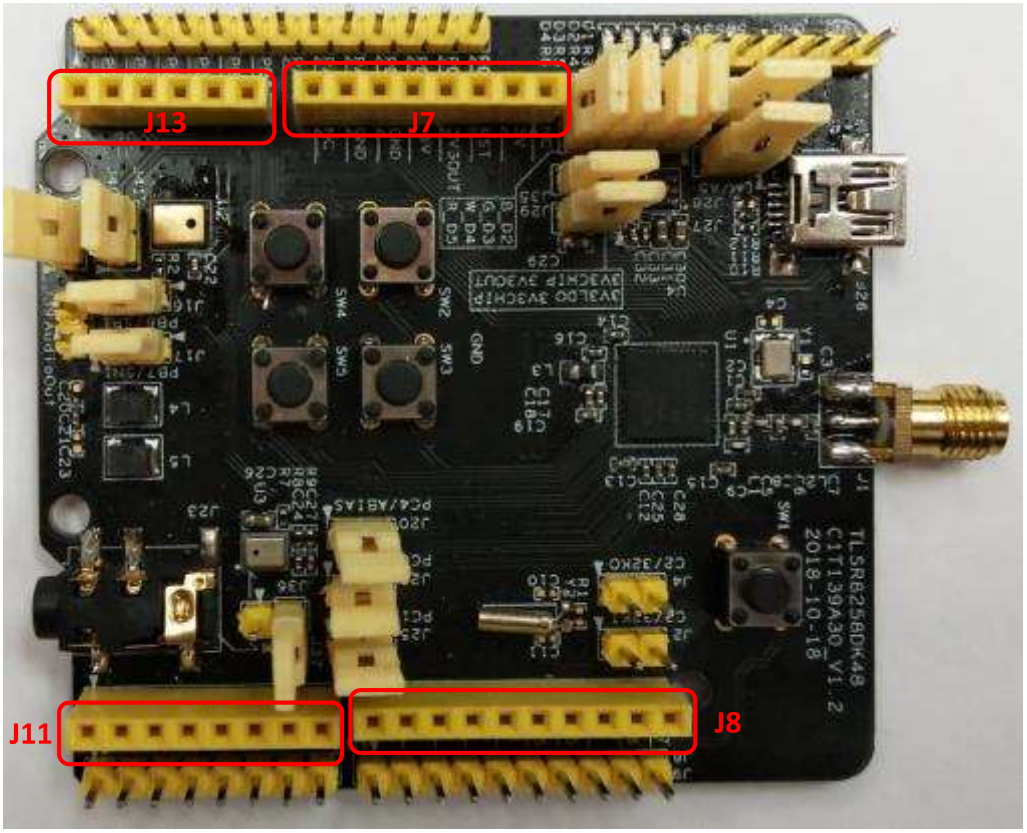


Figure 5 Connection chart to use Arduino interface

2 Pin Connection Guide

2.1 Supply power

There are two methods supported to supply power for the TLSR8258DK48.

1) Supply power via battery:

   Connect PIN3 and PIN6 of J18 with GND and 3.3V of power, respectively.

   Note: There is no need to connect any header with jumper cap.

2) Supply power via USB interface:

   Make sure one jumper cap is connected on J29 of TLSR8258DK48.

   Connect the miniUSB interface of the TLSR8258DK48 with PC USB.

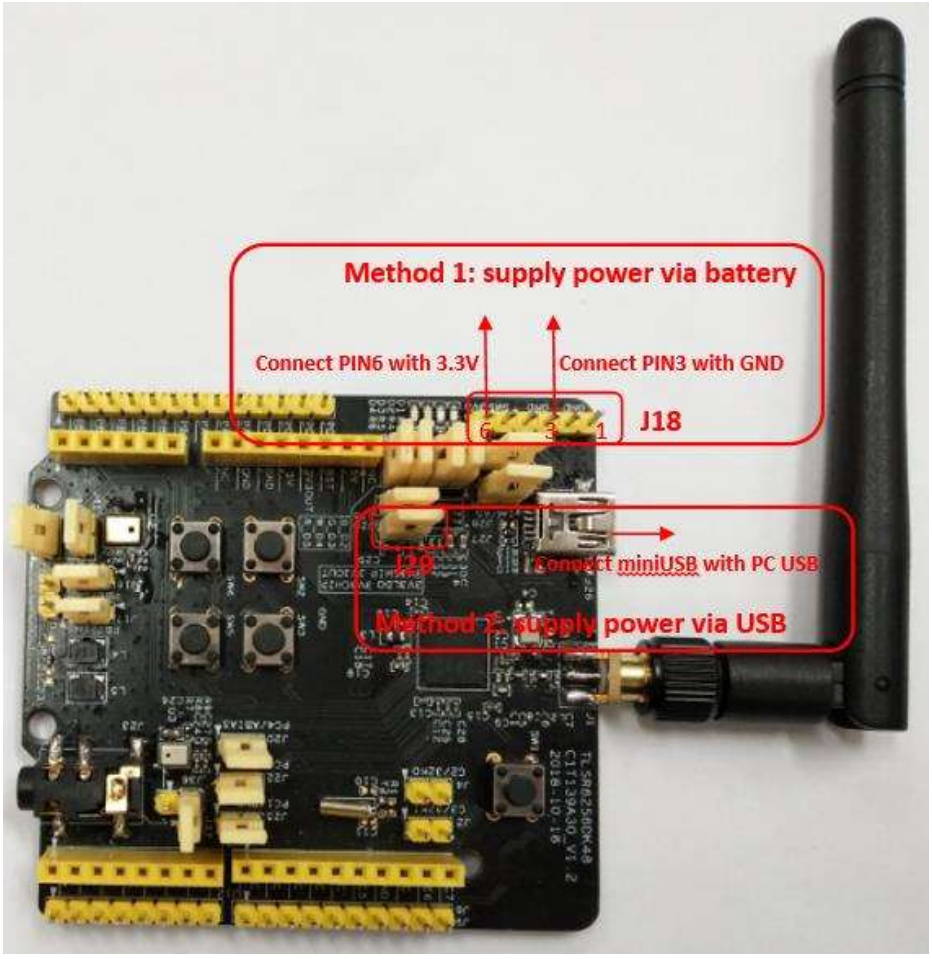


Figure 6 Connection chart to supply power

2.2 Download firmware

To download firmware into TLSR8258DK48, first make sure the TLSR8258DK48 is supplied with power normally (please refer to section **2.1**).

Then connect J18 PIN5 (SWS) of the TLSR8258DK48 with SWM of a burning EVK (TLSR8266BR56). Meanwhile, connect the miniUSB interface of the burning EVK with PC USB.

Figure 7 Connection chart to download firmware

2.3 Test RF signal

To test RF signal of TLSR8258DK48, first make sure the TLSR8258DK48 is supplied with power normally (please refer to section **2.1**).

Then remove the antenna from J1 of the TLSR8258DK48, and directly connect the J1 with a spectrum analyzer.

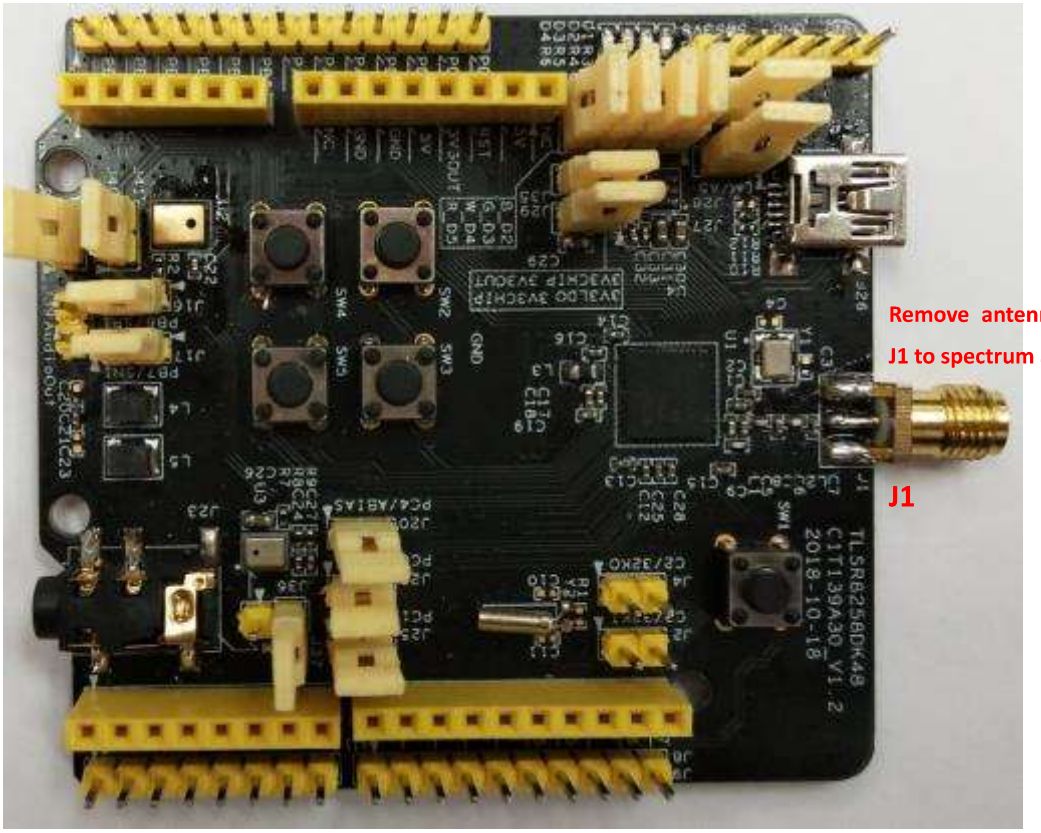


Figure 8 Connection chart to test RF signal

2.4 PWM output function

To control LEDs D1~D4 of TLSR8258DK48 via PWM output, first make sure the TLSR8258DK48 is supplied with power normally (please refer to section **2.1**).

Then make sure four jumper caps are connected on J38 of the TLSR8258DK48.

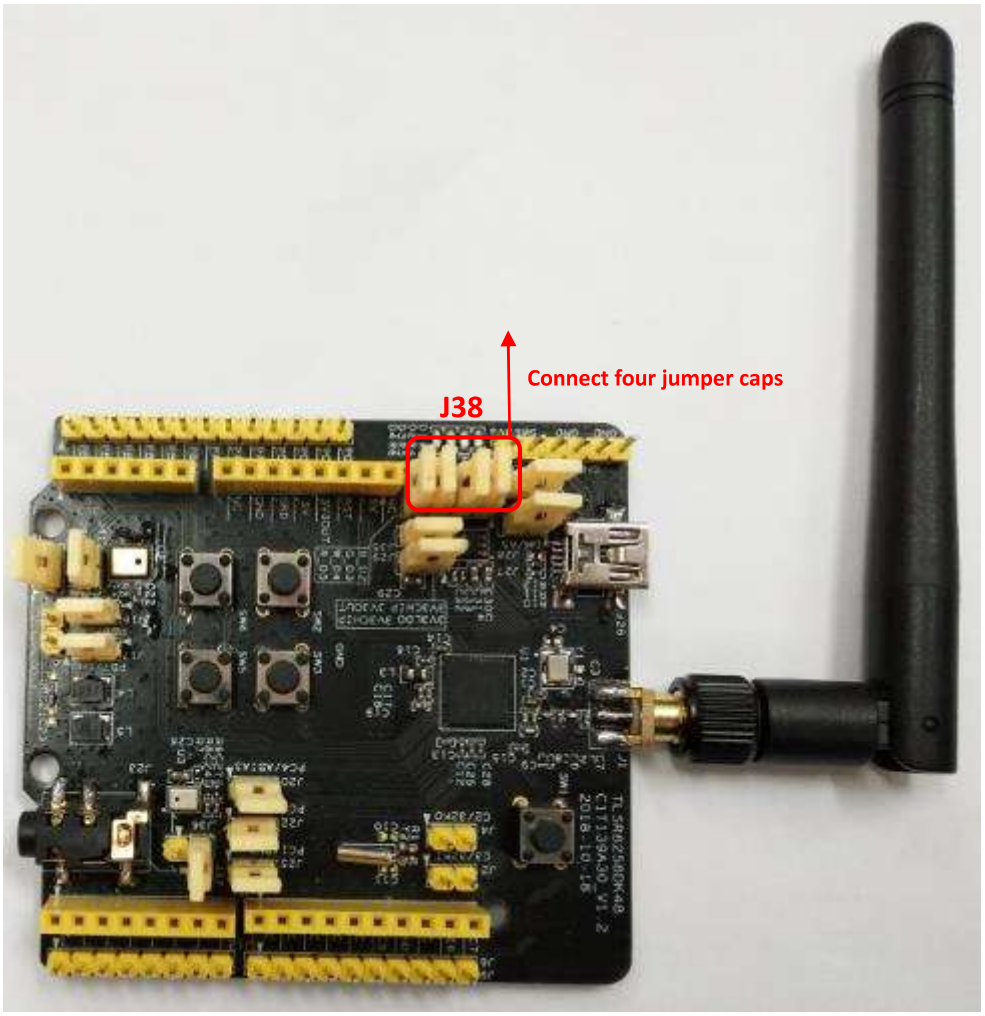


Figure 9 Connection chart to use PWM function

2.5 Audio function

To use audio function of TLSR8258DK48, first make sure the TLSR8258DK48 is supplied with power normally (please refer to section **2.1**).

1) To use DMIC input, make sure two jumper caps are connected on J40 and J41 of the TLSR8258DK48.
2) To use AMIC input, make sure four jumper caps are connected on J20, J22, J25 and J36 of the TLSR8258DK48.
3) To use I2S input, make sure four jumper caps are connected on J20, J22, J25 and J37 of the TLSR8258DK48.
4) To use USB Host input, make sure two jumper caps are connected on J27 and J28 of the TLSR8258DK48.
5) To use SDM output, make sure two jumper caps are connected on J16 and J17 of the TLSR8258DK48.

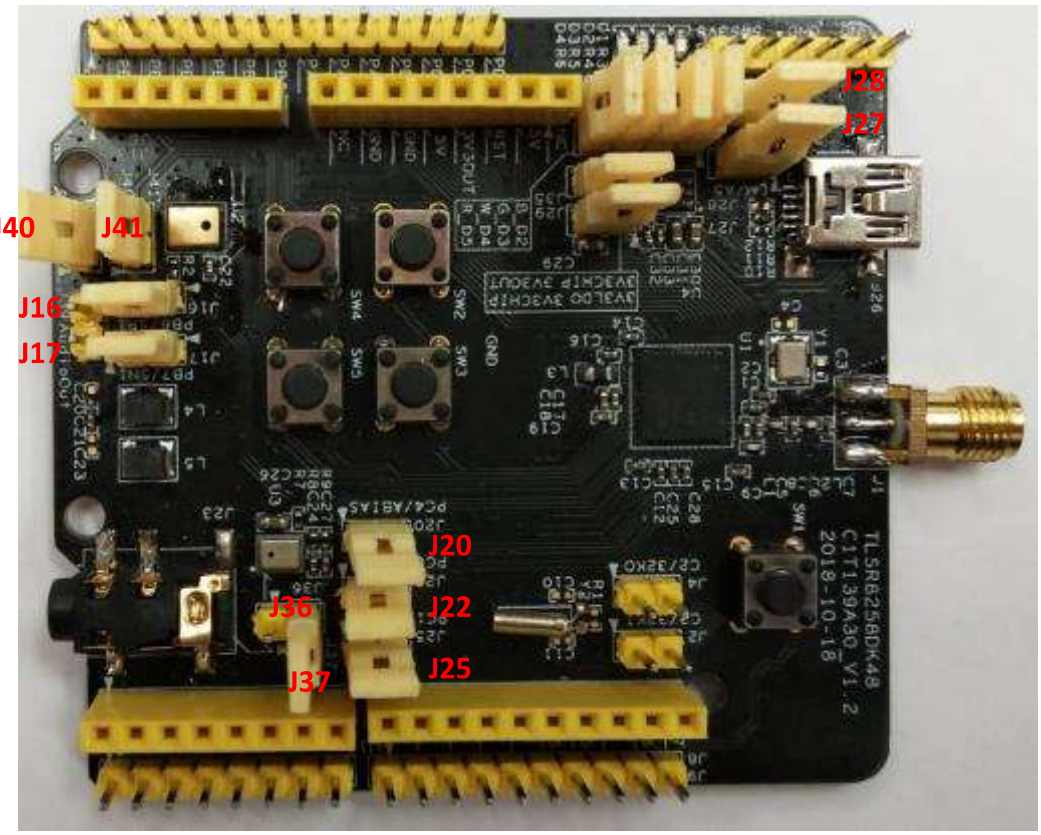


Figure 10 Connection chart to use audio function

3 Electrical Specifications

3.1 Recommended operating condition

Table 2 Recommended operation condition

Item	Sym.	Min	Typ.	Max	Unit	Condition
Power-supply voltage	VDD	1.8	3.3	3.6	V	battery as power supply
	VBUS	4.5	5.0	5.5	V	USB as power supply
Operating Temperature Range	T_{Opr}	-40		85	°C	

3.2 DC characteristics

3.2.1 Power consumption

Test equipment: Multimeter - FLUKE17B, Spectrum analyzer - N9020B

DUT FW: EMI binary file

Temperature: room temperature (T=25℃)

Power supply: 3.3V battery (For pin connection to supply power, see section 2.1).

Table 3 Current in various modes

Item	Sym.	Min	Typ.	Max	Unit	Condition
Tx current	I_{Tx}	-	4.9	-	mA	Continuous Tx transmission, 0dBm output power
			19.5		mA	Continuous Tx transmission, +11.8dBm Tx power
Rx current	I_{Rx}	-	5.7	-	mA	Continuous Rx reception
Suspend current			31.9		uA	All jumper caps are removed.
Deep sleep current without SRAM retention			0.8		uA	All jumper caps are removed.
Deep sleep with 8kB SRAM retention			1.5		uA	All jumper caps are removed.

3.2.2 Tx current vs. Power

Test equipment: Multimeter - FLUKE17B, Spectrum analyzer - N9020B

DUT FW: EMI binary file

Temperature: room temperature (T=25℃)

Power supply (For pin connection to supply power, see section 2.1)**:**

1) Case1: 3.3V battery

2) Case2: 1.8V battery

3.2.3 Tx Current/Power vs. VDD

Test equipment: Multimeter - FLUKE17B, Spectrum analyzer - N9020B

DUT FW: EMI binary file

Temperature: room temperature (T=25℃)

Power supply: DC power — 2230-30-1 (For pin connection to supply power, see section 2.1)

3.3 RF performance

3.3.1 Receiver sensitivity

Test equipment: BLE- CMW500

DUT FW: BQB binary file

Table 7 BLE Receiver Sensitivity*[1]

BLE PHY	Frequency (MHz)	Packet Type	Packet Length	RX Sensitivity (dBm)
1Mbps	2402	PRBS9	37	-96.1
	2440			-96.1
	2480			-96.1
2Mbps	2402			-92.9
	2440			-93.0
	2480			-93.0
LE Coded S=2 (500kbps)	2402			-98.1
	2440			-98.0
	2480			-98.0
LE Coded S=8 (125kbps)	2402			-100.3
	2440			-100.2
	2480			-100.2

[1] For actual sensitivity level of various BLE modes, please refer to Bluetooth 5 specification: Packet number=10000, PER≤30.8%.

Table 10 Frequency Deviation (Drift)

Item	Frequency (MHz)	Δ f1avg (kHz)	Δ f2avg (kHz)	Δ f2/ Δ f1
Frequency Deviation @ BLE 1Mbps	2402	250.5	230.8	0.921
	2440	249.5	232.3	0.931
	2480	249.8	227.5	0.911
Frequency Deviation @ BLE 2Mbps	2402	498	450	0.904
	2440	500	446	0.892
	2480	497	442	0.889

3.3.3 Radiation performance

DUT: C1T139A30_V1.2_20181019
DUT FW: EMI binary file
Test condition: 3.3V, 25℃
Test equipment: FSQ26
Match network: See Table 14 BOM table

Table 11 Test result

No.	Test Items				Test Result
FCC (DUT FW: EMI binary file)					
1	Tx Power Spectral Density				Pass
	RF Channel	2.402GHz	2.440GHz	2.480GHz	
	dBm@3kHz	-4.46	-4.73	-4.63	
2	Tx Minimum 6dB Bandwidth				Pass
	RF Channel	2.402GHz	2.440GHz	2.480GHz	
	KHz	>500	>500	>500	
3	Tx Band Limit				Pass
	Frequency	30MHz ~ 2400MHz	2483.5MHz ~ 25GHz	-	
	dB@100kHz	-50	-50	-	
4	TX Mode Harmonic (Radiated), Peak				Pass
	Frequency	4900MHz	7350MHz	9800MHz	
	dBm@1MHz	-53	-42	-46.5	

No.	Test Items				Test Result
5	TX Mode Harmonic (Radiated) 1-25GHz, Average				Pass
	Frequency	4900MHz	7350MHz	9800MHz	
	dBm@1MHz	-61	-43.7	-58	
6	Tx Radiated emission 30-1000MHz, Peak				Pass
	Frequency	475MHz	-	-	
	dBm@100kHz	-51.5	-	-	
7	Tx Radiated emission >1GHz, Average				Pass
	Frequency	2.1GHz	7.35GHz	-	
	dBm@100kHz	-47.6	-42	-	
8	RX Mode Spurious Emission (25MHz ~ 25GHz)				Pass
	Frequency	432MHz	-	-	
	dBm@100kHz	-55.2	-	-	
SRRC Test Items (DUT FW: EMI binary file)					
	Transmitter power				
1	Transmitter Frequency Range				Pass
	RF Channel	ChL	ChM	ChH	
	GHz	2.402	2.44	2.48	
2	Carrier frequency offset (BLE 1M)				Pass
	RF Channel	2.402GHz	2.440GHz	2.480GHz	
	kHz	16	16	16	
3	Occupied Bandwidth (BLE 1M)				Pass
	RF Channel	2.402GHz	2.440GHz	2.480GHz	
	MHz	770	770	770	
4	Emission Spectrum				Pass
	Frequency	30MHz ~ 1GHz	48.5MHz ~ 72.5Mhz	76MHz ~ 108Mhz	
	dBm@100kHz	-55	-70	-71	
	Frequency	167MHz ~ 223MHz	470MHz ~ 566MHz	606MHz ~ 798MHz	
	dBm@100kHz	-80	-80	-80	
	Frequency	1GHz ~ 12.75GHz	10MHz ~ 30MHz	-	
	dBm@100kHz	-42	-70	-	

3.4 Audio performance

Equipment to test audio precision: Audio analyzer, Model AP525

DUT FW: Audio binary file

Table 12 Analog line-in performance

Input Signal	400mV rms
Level	-1.271dBFS
SNR (Signal-Noise Ratio)	64.356dB
THD (Total Harmonic Distortion)	0.0577%

Table 13 SDM performance

Input Signal	0dBFSB
Level	+7.198dbV
SNR (Signal-Noise Ratio)	59.234dB
THD (Total Harmonic Distortion)	1.337%

4.4 32kHz XTAL

The TLSR8258DK48 supports 32kHz external crystal oscillator. To use 32kHz XTAL (corresponding to PC2*[3], PC3), please make sure two jumper caps are connected on J2 and J4 of the TLSR8258DK48.

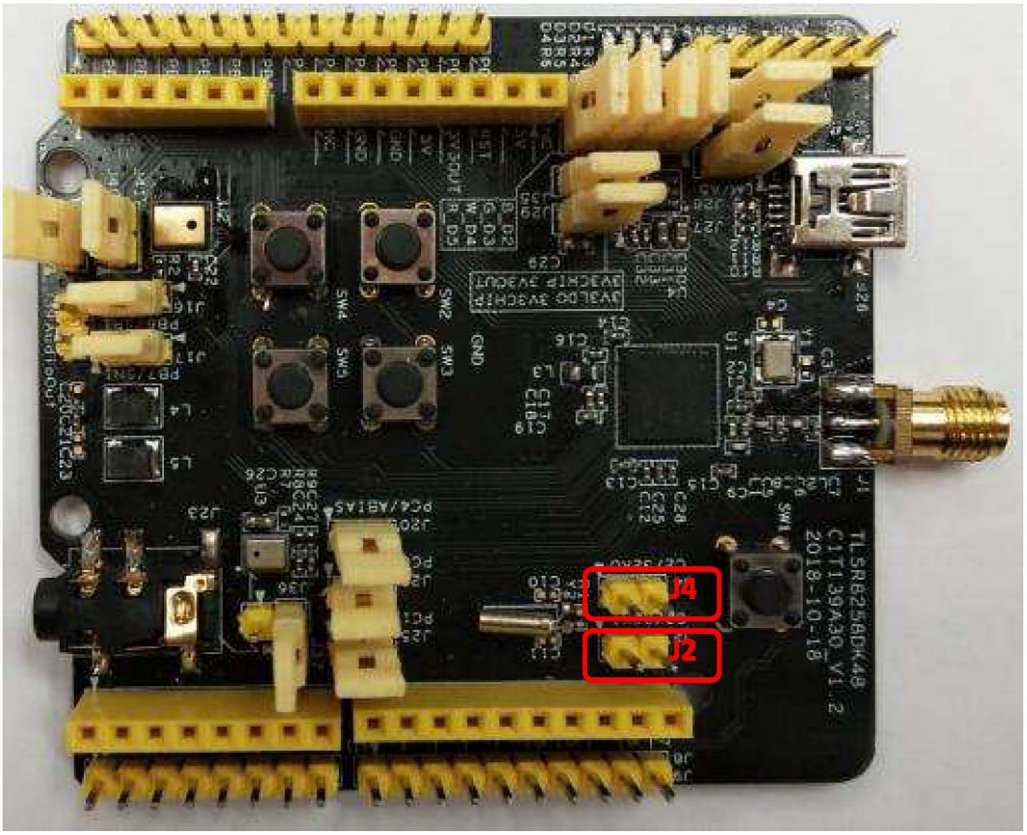
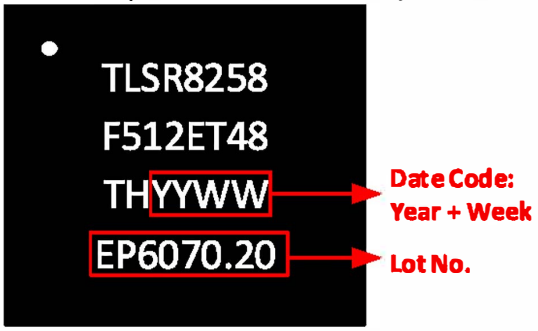


Figure 13 Connection chart to use 32kHz XTAL

[3] For 8258 chips with lot No. of EP5682.20 (VID=0x01, 1827 ≤ Data code < 1844), since PC2 is pulled down by an internal diode, all of its functions cannot act normally.
For 8258 chips with lot No. of EP6070.20 (VID=0x03, Date code≥1844), PC2 function bug has already been fixed.



This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

1) this device may not cause harmful interference, and

2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.