武汉芯源半导体有限公司
WUHAN XINYUAN SEMICONDUCTOR CO., LTD

CW32W031R8U6 StartKit User Manual

Rev 1.0

www.whxy.com

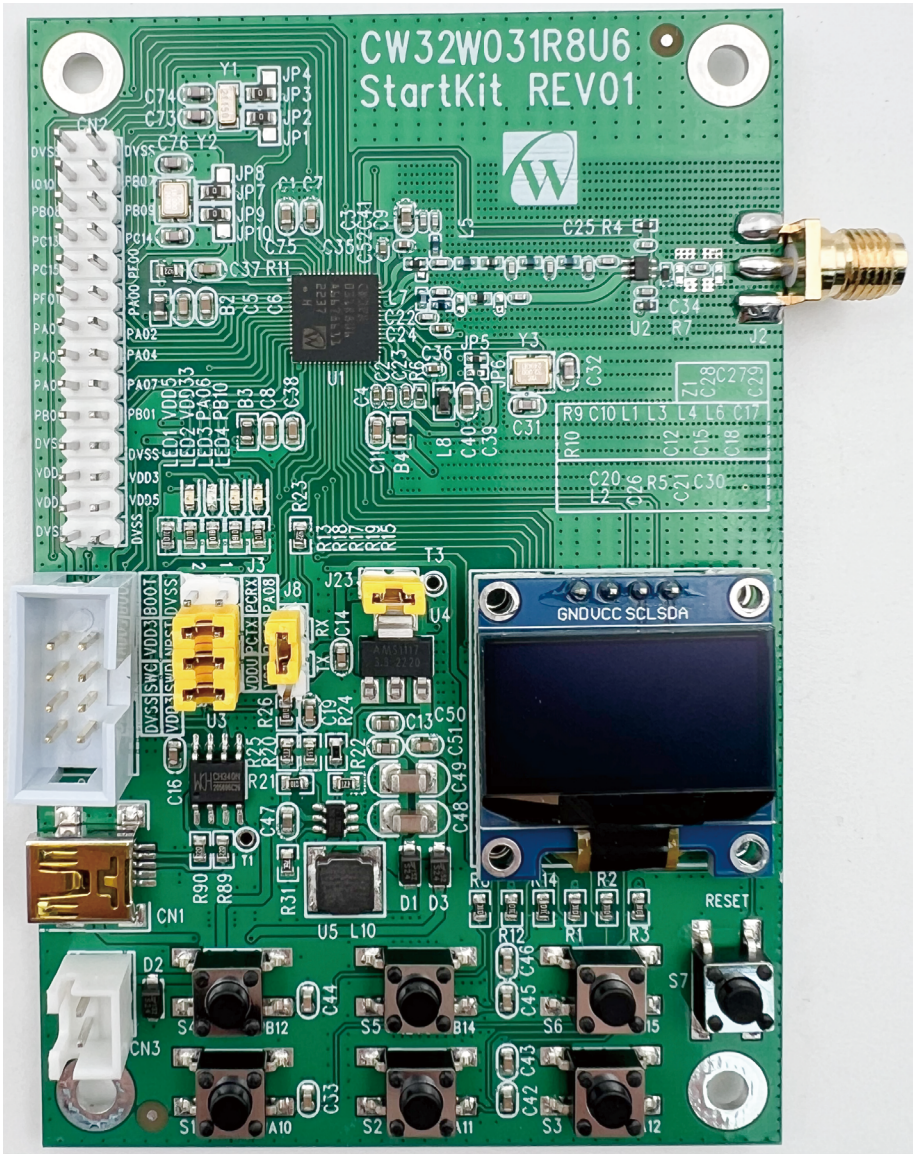
Introduction

The CW32W031R8U6 StartKit evaluation board provides users with an economical and flexible way to build system prototypes using the CW32W031R8U6 chip. All aspects of performance, power consumption, and functionality can be quickly verified.

The CW32W031R8U6 StartKit evaluation board needs to be used with the CW-DAPLINK debugger.

The CW32W031R8U6 StartKit evaluation board comes with the CW32W031 StartKit software package and the CW32W031-StdPeriph-Lib firmware library and routines.

The CW32W031R8U6 StartKit evaluation board is shown in the following figure:



Contents

1 Features

- CW32W031R8U6 SIP chip is based on an ARM® Cortex®-M0+ up to 48MHz and a Sub 1G RF transceiver, with QFN64 package, 64Kbytes FLASH, 8Kbytes RAM
- Four LEDs :
  - Power indicator (LED1, LED2), User indicator (LED3, LED4)
- Seven switches:
  - Reset switch (S7), User switch (S1, S2, S3, S4, S5, S6)
- USB to serial port chip (CH340N)
- A 0.96 inch OLED screen
- On-board interfaces:
  - Mini USB interface (serial communication, USB powered)
  - Downloader debug interface CN7
  - Battery interface CN3
- Multiple power supply methods: USB interface provides 3.3V power supply (LD1117AS33TR or AMS1117-3.3), CN3 is connected to 2.5V-6.0V external power supply
- The CW32W031-StdPeriph-Lib package provides a comprehensive set of free firmware libraries and routines
- Support for multiple IDEs, IAR ™，Keil®

2 Ordering Information

To order the CW32W031R8U6 StartKit evaluation board, please refer to the table below. For more information, refer to the CW32 series MCU datasheet and User Manuals.

Table 2-1 Ordering Information

Evaluation Board Code	Microcontroller Model
CW32W031R8U6 StartKit	CW32W031R8U6

3 Development Environment

3.1 System Requirements

Windows® OS (7,8,10), CW-DAPLINK debugger

Note: Windows® OS 7 and Windows® OS 8 require the CW-DAPLINK driver to be installed.

3.2 Integrated Development Environment

- EWARM v7.70 or higher
  - 30-day evaluation version
  - 32-Kb upper limit Quick Start version (ARM® Cortex®-M0 limited to 16-Kb)
- MDK-ARM v5.17 or higher
  - MDK-Lite (32-Kb code size limit)

Note: Only Windows® is supported

3.3 Demo Software

The demo software is included in the CW32W031 StartKit package that corresponds to the on-board microcontroller and is pre-installed in the CW32 flash memory for demonstrating device peripherals in standalone mode. The demo software source code and related documentation can be downloaded from the website (*www.whxy.com*).

4 Special Conventions

The conventions for ON and OFF settings in this document are shown in the following table:

Table 4-1 ON/OFF conventions

Conventions	Definitions
Jumper Jx ON	Jumper cap connected
Jumper Jx OFF	Jumper cap not connected
Jumper Jx [1-2]	Jumper caps connect Pin1 and Pin2
Resistor JPx ON	Solder 0Ω resistor
Resistor JPx OFF	Unsoldered 0Ω resistor

5 Quick Start

The CW32W031R8U6 StartKit evaluation board is a low-cost development kit for quickly evaluating the performance and functionality of the CW32W031 RF chip with QFN64 package. Before installing and using the product, please accept the license agreement for the evaluation product from the website.

5.1 Getting Started Guide

Follow the steps below to configure the CW32W031R8U6 StartKit evaluation board:

1. Confirm the location of the jumper caps on the evaluation board (See *Table 5-1 Jumper Configuration*);
2. Connect the CW-DAPLINK debugger, confirm that the host-side driver has been properly installed, and connect the debug interface cable to the evaluation board properly;
3. Powering the evaluation board by connecting to the evaluation board USB connector CN1 using a USB cable (Type-A to Mini USB);
4. Green LED1, red LED2 (power indicator) and OLED screen is lit;
5. For details about routine operation, see *7 Operation guide*
6. Develop your own programs based on the routines provided.

Table 5-1 Jumper Configuration

Jumper	Definition	ON/OFF	Function
J23	system power supply	ON	Shorting without system current measurement and supplying 3.3V to the MCU
J3[1-2]	VDD-VDDU	ON	Powering the CH340 chip
J3[3-4]	PCTX-PA09	ON	Connect PCTX to the chip's serial input
J3[5-6]	PCRX-PA08	ON	Connect PCRX to the chip's serial output
J8	TX/RX mode	-	CW32W031 evaluation board TX/RX mode selection

6 Hardware layout

The CW32W031R8U6 StartKit evaluation board is based on the CW32 RF chip design in the QFN64 package. *Figure 6-1 Top-level device layout* shows the placement of the CW32 microcontroller chip with its peripherals (buttons, LEDs, USB to serial port, debugger interface). *Figure 6-2 CW32W031R8U6 StartKit Mechanical Dimensions* shows the mechanical dimensions of the evaluation board.

6.1 PCB layout and mechanical dimensions

Figure 6-1 Top-level device layout

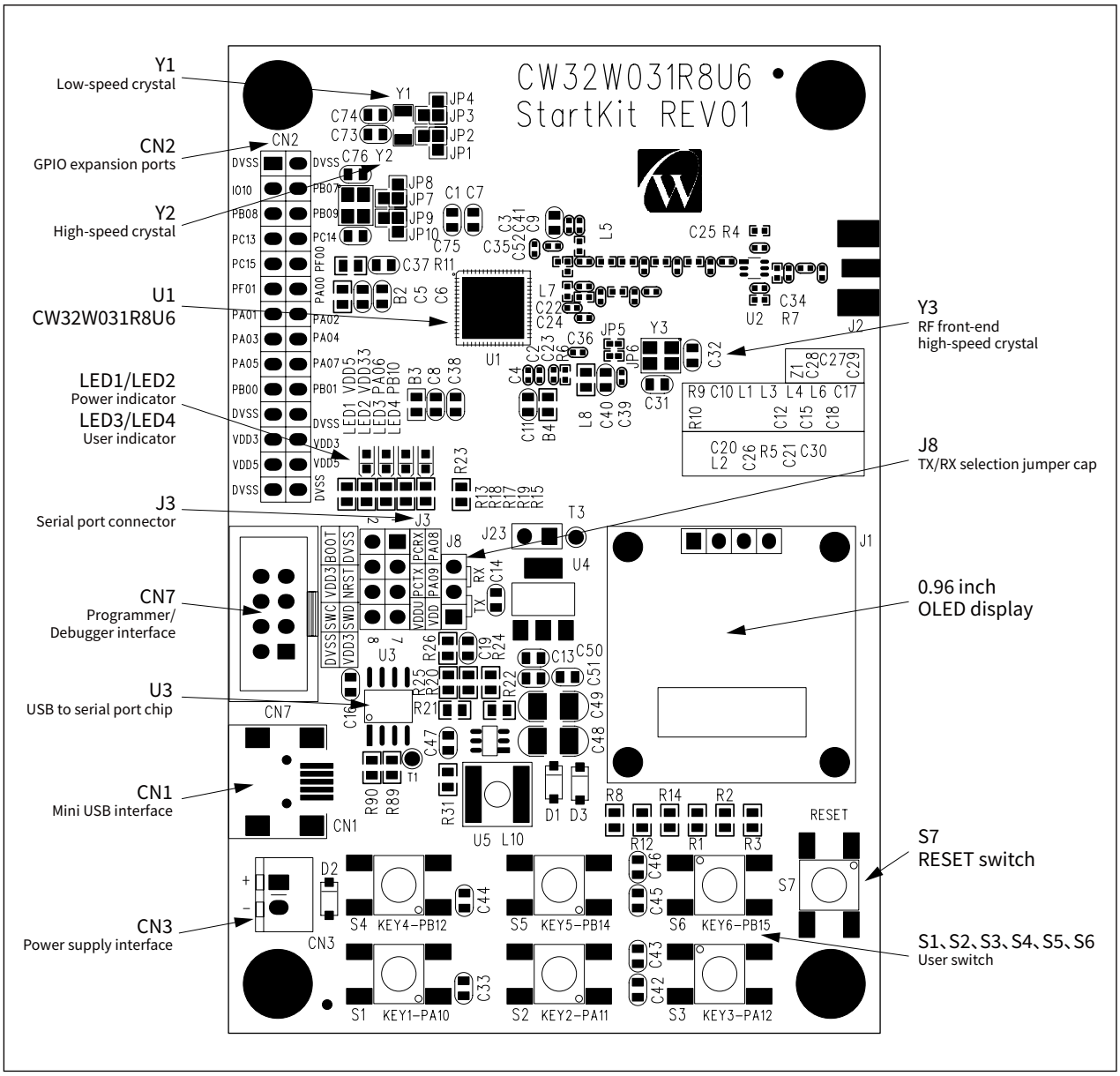
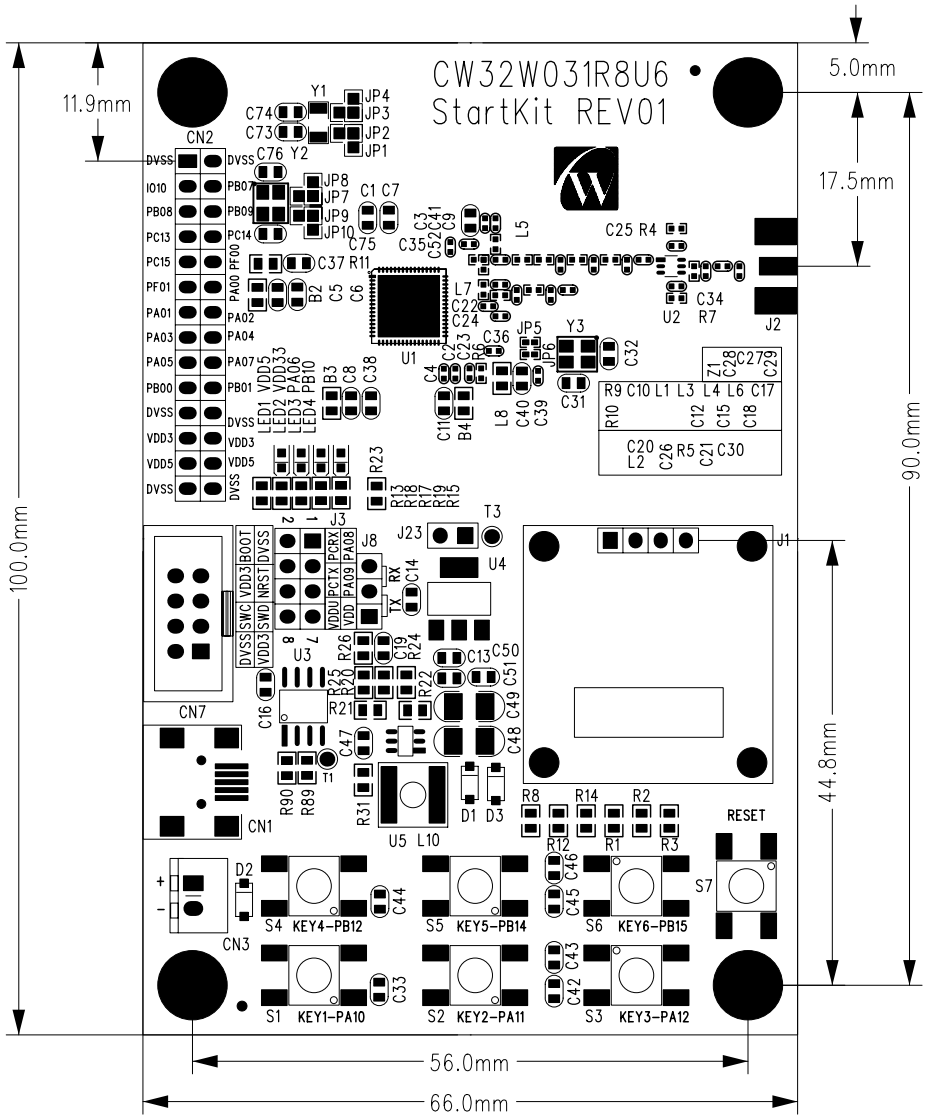


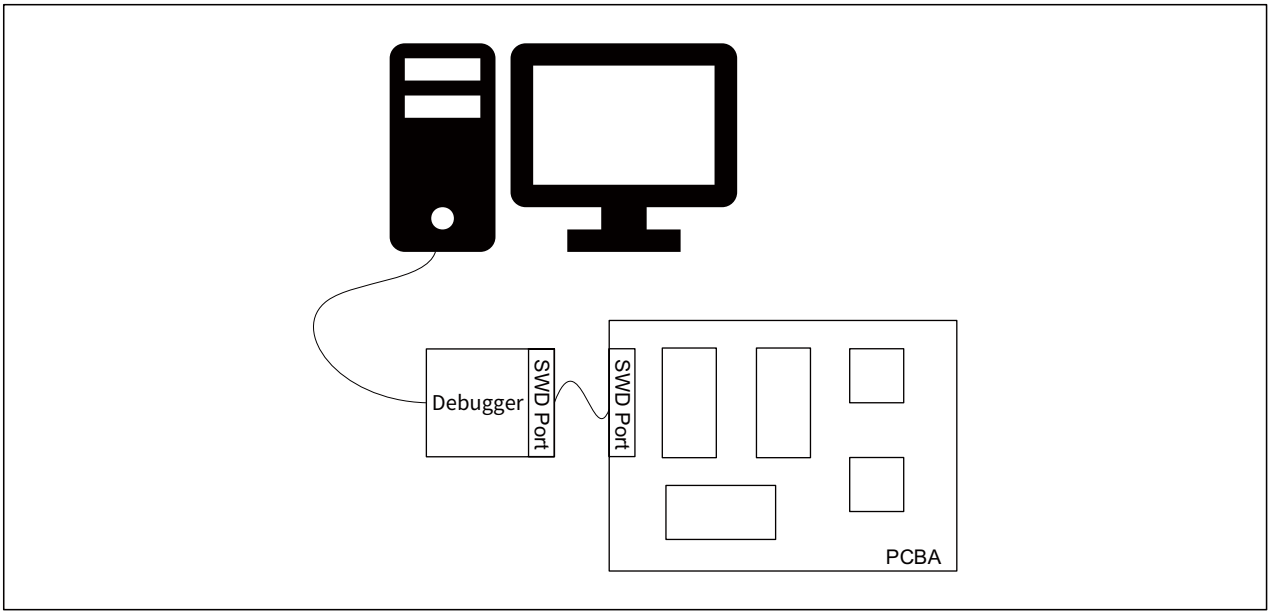
Figure 6-2 CW32W031R8U6 StartKit Mechanical Dimensions



6.2 Use of debugger

Xinyuan Semiconductor provides the CW-DAPLINK debugger for users to use to connect the host computer to the debugger (Type-A to Type-C) using a USB cable. The evaluation board also supports the use of ST-LINK and J-LINK debuggers. The connection is shown in the following figure:

Figure 6-3 Typical connection



CW-DAPLINK Driver

For Windows® 10 systems, CW-DAPLINK is driver free. For some Windows® 7 or Windows® 8 systems, the CW-DAPLINK virtual serial port is not available, so you need to add the driver manually.

The driver can be downloaded from the official website. Refer to the CW-DAPLINK User Manual for details of the driver installation procedure.

6.3 Power supply and power selection

Power can be provided via USB or from an external power supply: CN3 interface pin(2.5V~6V). CW32W031R8U6 operating voltage is 3.3V by default.

6.4 Evaluation board functions

LEDs

- Power indicator (LED1, LED2)

  LED1 and LED2 is on to indicate that the evaluation board is powered on, if J23 isconnected, the microcontroller is powered on at this time.

- User indicators (LED3, LED4)

  Green LED3 and LED4 connected to CW32W031R8U6 I/O:

  - PA06 connected to LED3 anode
  - PB10 connected to LED4 anode

Switches

- Reset switch (S7)

  This switch is connected to the NRST pin and is used to reset the CW32W031 microcontroller.

- User switch (S1, S2, S3, S4, S5, S6)

  PA10 connected to S1, external pull-up resistor

  PA11 connected to S2, external pull-up resistor

  PA12 connected to S3, external pull-up resistor

  PB12 connected to S4, external pull-up resistor

  PB14 connected to S5, external pull-up resistor

  PB15 connected to S6, external pull-up resistor

USB to serial port

The CW32W031R8U6 StartKit evaluation board has the CH340N USB to serial chip soldered on it. Users can use the J3 pin header to configure the serial transmit pins to I/O (PCTX) , and the serial receive pins to I/O (PCRX) . The CH340N port and CW32W031 port can be interfaced by shorting the jumper cap, the following table describes the configuration of J3:

Table 6-2 J3 Connection Description

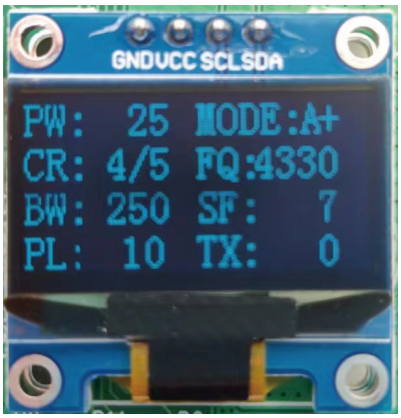
Jumper connections	Connection Description
J3[3-4]	Port PA08 connects to serial port PCRX
J3[5-6]	Port PA09 connects to serial port PCTX
J3[7-8]	VDDIN connects to VDDU

7 Operation guide

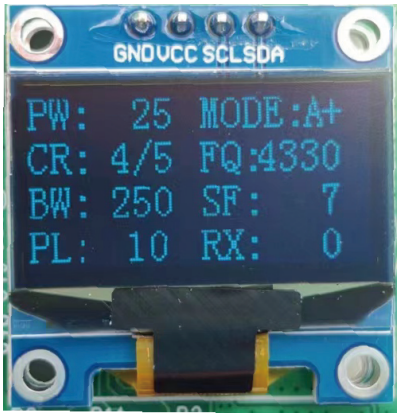
7.1 TX/RX mode selection

Transmit mode or receive mode can be selected at power-up via the J8 connection (transmit and receive modes are only judged at power-up, if you need to change the mode, you need to reset after changing the jumper cap wiring position)

When the jumper cap is connected to the TX, it is in transmit mode and "TX:" will be displayed on the bottom right of the OLED screen



When the jumper cap is connected to the RX, it is in receive mode and "RX:" will be displayed on the bottom right of the OLED screen:



7.2 User swtich

The CW32W031R8U6 StartKit evaluation board has 6 user switches with different functions in different modes

7.2.1 Switch descriptions in TX Mode

- KEY6 (S6)

  KEY6 is the function shift key, when this key is not pressed and other keys are pressed, the first function of the other keys is selected; when KEY6 is pressed and then other keys are pressed, the second function of the other keys is selected.

- KEY1 (S1)

  First function: setting the SF value, the values that can be set are 7, 8, 9, 10, 11, 12;

  Second function: set the payload length (10-240, in steps of 10).

- KEY2 (S2)

  First function: setting the BW value, the values that can be set are 500K, 250K, 125K, 62.5K;

  Second function: set the transmitting power, "PW" on the screen shows the power value, which is a decimal value.

- KEY3 (S3)

  First function: select the continuous transmit mode, "MODE" is displayed on the top right of the screen, three modes are available: A/B/C:

  - A: Single packet transmission
  - B: Continuous transmission of 100 packets of data
  - C: Continuous transmission of 9999 packets of data

  Second function: set the CodeRate, the values that can be set are 4/5, 4/6, 4/7 and 4/8.

- KEY4 (S4)

  First function: start transmitting, each press of the transmitting situation to be used with KEY3;

  Second function: display of the frequency value, "FQ" is displayed on the screen in 0.1 MHz.

- KEY5 (S5)

  The first function: clearing the count of packet transmit and receive statistics;

  Second function: LNA high and low switch, displayed in the top right of the screen ("+" for high gain, "-" for low gain).

7.2.2 Switch descriptions in RX Mode

- KEY6 (S6)

  The function is the same as in TX mode as a function shift key.

- KEY1 (S1)

  First function: setting the SF value, the values that can be set are 7, 8, 9, 10, 11, 12;

  Second function: set the payload length (10-240, in steps of 10).

- KEY2 (S2)

  First function: setting the BW value, the values that can be set are 500K, 250K, 125K, 62.5K;

  Second function: set the transmitting power, "PW" on the screen shows the power value, which is a decimal value.

- KEY3 (S3)

  Second function: set the CodeRate, the values that can be set are 4/5, 4/6, 4/7 and 4/8.

- KEY4 (S4)

  Second function: display of the frequency value, "FQ" is displayed on the screen in 0.1 MHz.

- KEY5 (S5)

  The first function: clearing the count of packet transmit and receive statistics;

  Second function: LNA high and low switch, displayed in the top right of the screen ("+" for high gain, "-" for low gain).

7.3 LDO mode and DCDC mode

The RF subsystem of the MCU can choose either external LDO or internal DCDC power supply mode. The power consumption of choosing DCDC mode at the receiver side will be lower than choosing LDO mode. The default DCDC register is disabled, if you want to enable it, you need to call the rf_set_dcdc_mode(uint32_t dcdc_val) function to enable it, and the JP5 short on the evaluation board should be replaced by JP6 short.

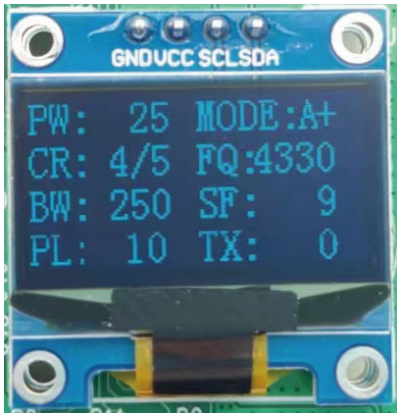
Additional Notes:

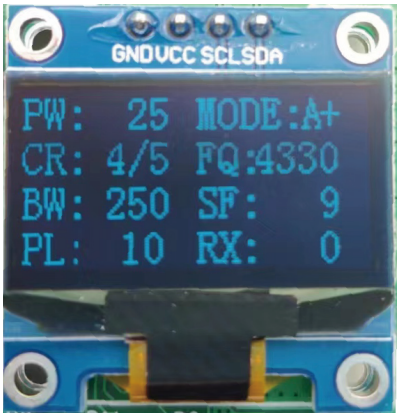
1. JP5, JP6 resistor bits description:

   If the LDO power supply mode is selected in receive mode, the JP5 resistor bit should be shorted to 0Ω resistor and the JP6 disconnected from 0Ω resistor; if the DCDC power supply mode is selected in receive mode, the JP6 resistor bit should be shorted to 0Ω resistor and the JP5 disconnected from 0Ω resistor.

7.4 CW32W031 evaluation board communication demo

This demonstration requires two CW32W031 evaluation boards and both development boards need to be connected to the antenna. Set one board to TX mode (use jumper caps to short J8[2-3]) and the other to RX mode (use jumper caps to short J8[1-2]), see *7.2.1 Switch descriptions in TX Mode*, *7.2.2 Switch descriptions in RX Mode* to set the parameters of both boards. Set the SF spreading factor to 9 and the BW bandwidth to 250K for both development boards, keeping all other parameters the same, the OLED screen displays as shown below:





Connect the serial port of the receiver board to the PC, press the KEY4 key (send key) of the sender board, then the value next to "TX:" on the bottom right of the screen of the transmitter board will increase, the value represents the number of times to transmit, and LED4 will flash at the same time.

If the receiver board receives data from the transmitter, the receiver value on the bottom right of the receiver screen will increase according to the amount of data received and LED4 will flash (in the case of no data received, the value next to "RX:" will not increase and LED4 will not flash) and the serial port will print the message , "RF RX: XXX" represents the number of data received, "Rx: SNR" is the signal to noise ratio, "RSSI" represents the signal strength and the bottom line represents the number of data transmitted, as shown in the following figure:

```
RF RX:995
Rx : SNR: -6.121884 ,RSSI: -104.509697
0x00 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08 0x09
```

Additional Notes:

1. The following table shows the transmitting power and its transmitting current for the different power levels in the CW32W031 transmit mode (433MHz).

Power level	Transmit power (dbm)	Transmit current (mA)
0	-23.5	11
1	-18	13
2	-11	15
3	-8	16
4	-7	17
5	-6	18
6	-4	20
7	-2	23
8	0	25
9	0.6	29
10	1.1	30
11	4.6	34
12	7.1	38
13	9	42
14	10	46
15	11.7	50
16	12.7	53
17	13.7	57
18	14.4	60
19	15.1	64
20	16.1	69
21	17	74
22	17.6	79
23	18.6	87
24	19.7	100
25	21	113
26	22	135
27	22	136
28	22	137
29	22	138

8 Revision history

Table 8-1 Document revision history

Date	Revision	Changes
May 28, 2023	Rev 1.0	Initial release.