Shenzhen Hi-Link Electronic Co.,Ltd

HLK-V20 Data Sheet
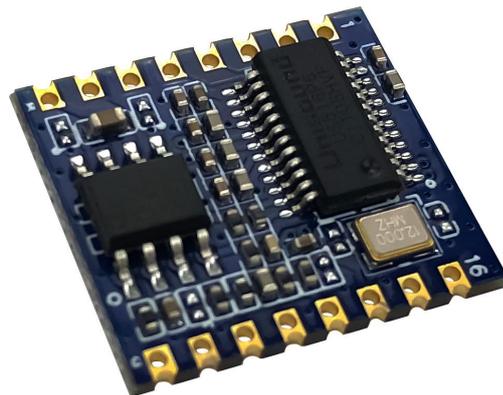
Contents

1. Product Description

1.1. Overview

HLK-V20 is a high-performance pure offline voice recognition module newly launched by Hi-link Electronics according to a large number of pure offline control scenarios and products. It can be widely and quickly applied to smart homes, various smart small appliances, 86 boxes, toys, lamps, Industrial, medical, Internet of Things, automotive, security and lighting products that require voice control.

The module uses a 32bit RSIC architecture core, and adds a DSP instruction set specifically for signal processing and speech recognition, an FPU operation unit that supports floating point operations, and an FFT accelerator. The audio signal is trained and learned through the neural network to improve the voice signal Recognition ability.

The solution supports offline recognition of 150 local commands, free configuration of wake-up words, command words, and broadcast reply words through the background, supports lightweight RTOS systems, rich peripheral interfaces, and simple and friendly customized tools.

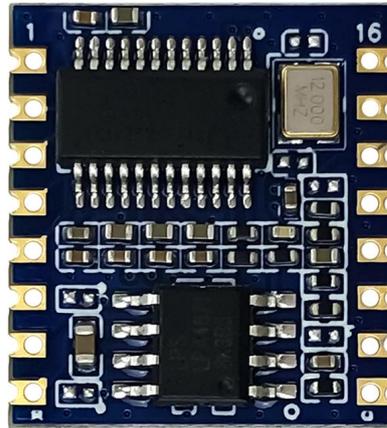The physical diagram of the module is shown below:

Figure 1. Module physical diagram

1.2. Product features

Processing kernel:

- 32bit RISC core, running frequency 240M
- Support DSP instruction set and FPU floating point operation unit
- FFT accelerator: supports up to 1024 points of complex FFT/IFFT operations or 2048 points of real FFT/IFFT operations
- Customized voice algorithm operator

Storage:

- Built-in high-speed SRAM
- Built-in 2MB FLASH

Audio input and output:

- Support 1 analog Mic input, SNR≥94db
- Support 4 digital Mic input
- Support dual channel DAC output
- Support I2S input/output

Power supply and clock:

- Built-in 5V to 3.3V, 3.3V to 1.2V LDO to power the chip
- RC 12MHz clock source and PLL phase-locked loop clock source
- Set POR (Power on Reset), low voltage detection and watchdog

Peripheral interface:

- Support up to 10 GPIO
- All GPIOs can be configured as external interrupt input and wake-up sources
- 1 standard SPI Master interface, the highest rate is 30MHz
- 1 SPI Slave interface with a maximum rate of 30MHz
- 1 full-duplex UART with a maximum rate of 3Mbps
- 1 I2C master/slave controller with a maximum rate of 400kHz
- 2 PWM outputs
- 1 12-bit SAR-ADC with a maximum sampling rate of 450Khz

Custom voice:

- Customize the startup announcement
- Custom voice wake-up words
- Customize voice command words
- Custom TTS voice broadcast
- Support no wake-up words (no need to wake up, direct recognition of command words)

The module has rich system peripherals, including UART/I2C/SPI/PWM/I2S/DAC/GPIO/

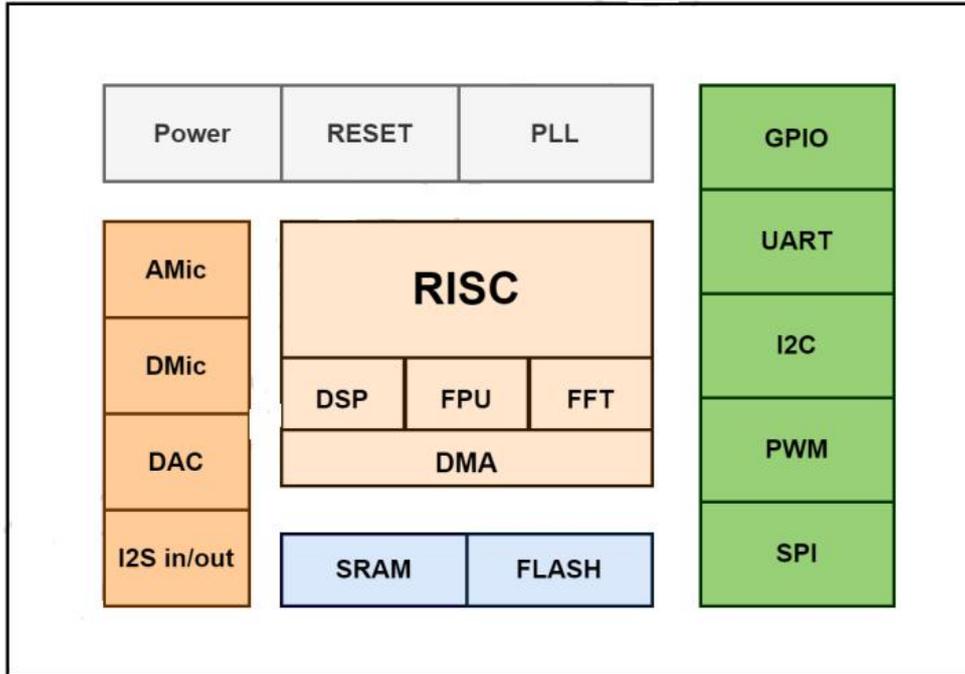DMic/AMic. The following figure shows the functional block diagram of the module system.

Figure 2   System Functional diagram
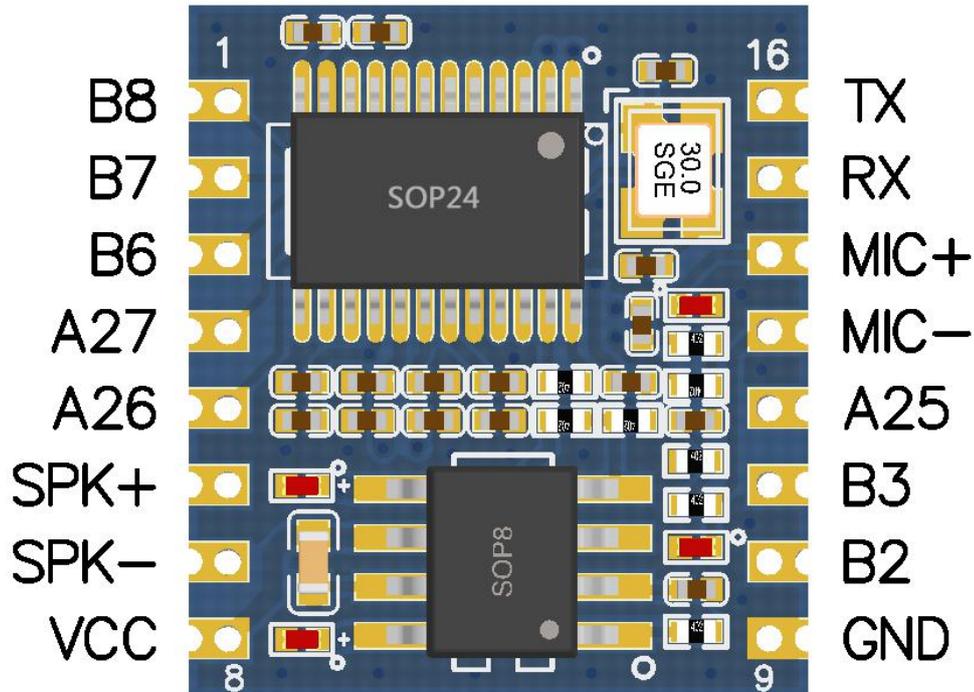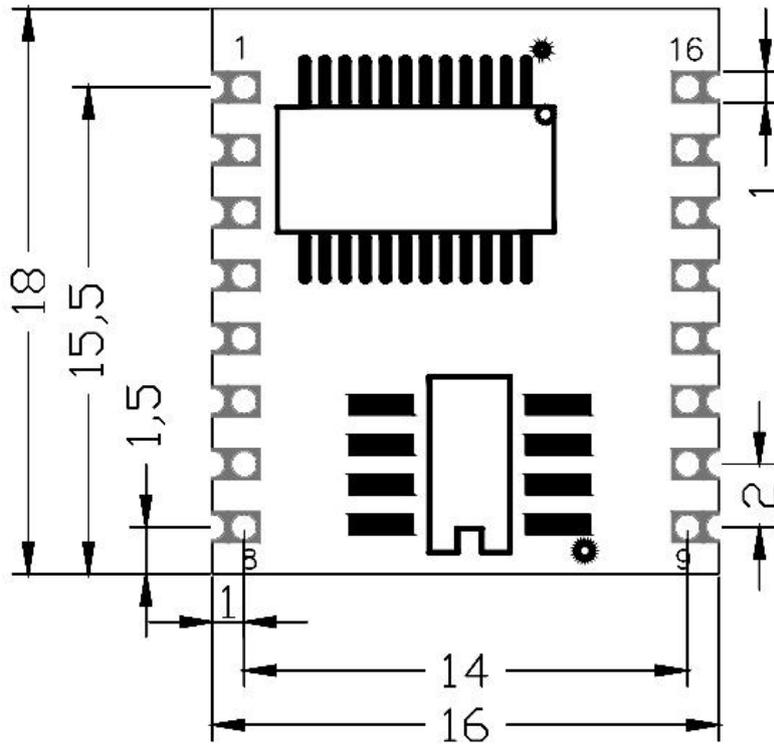
1.3. Pin description

Figure 3   Module pinout diagram

The module has 16 pins, including power amplifier output, differential input and serial port. Specific definitions as below table.

Pin	Items	Type	Description
1	**B8**	I	General purpose input/output
2	**B7**	I/O	General purpose input/output
3	**B6**	I/O	General purpose input/output
4	**A27**	I/O	General purpose input/output
5	**A26**	I/O	General purpose input/output
6	**SPK+**	O	Power amplifier differential output P terminal
7	**SPK-**	O	Power amplifier differential output N terminal
8	**VCC**	PWR	Power supply
9	**GND**	GND	GND
10	**B2**	I/O	General purpose input/output
11	**B3**	I/O	General purpose input/output
12	**A25**	I/O	General purpose input/output
13	**MIC-**	I	MIC1 differential input N terminal
14	**MIC+**	I	MIC1 differential input P terminal
15	**RX**	I/O	Uart rx
16	**TX**	I/O	Uart tx

Table 1   Pin definition description

1.4. Mechanical dimensions

Unit: mm

Figure 4   Module size diagram

2. Function description

The HLK-V20 test board is convenient for customers to intuitively experience voice control LED lights and serial port output protocol data after voice recognition.

The demo firmware supports voice wake-up words: Xiaoke Xiaoke, Xiaoling Xiaoling, Hello Lamp, Hello Rubik's Cube, Xiaohai Xiaohai.

For details of voice command words and corresponding broadcast words, please refer to **HLK-V20 Demo firmware command words and broadcast words V1.1.xlsx.**

For English voice command words and wake-up words, please refer to **HLK-V20 Demo firmware command words and broadcast words (English version) V1.0.xlsx.**
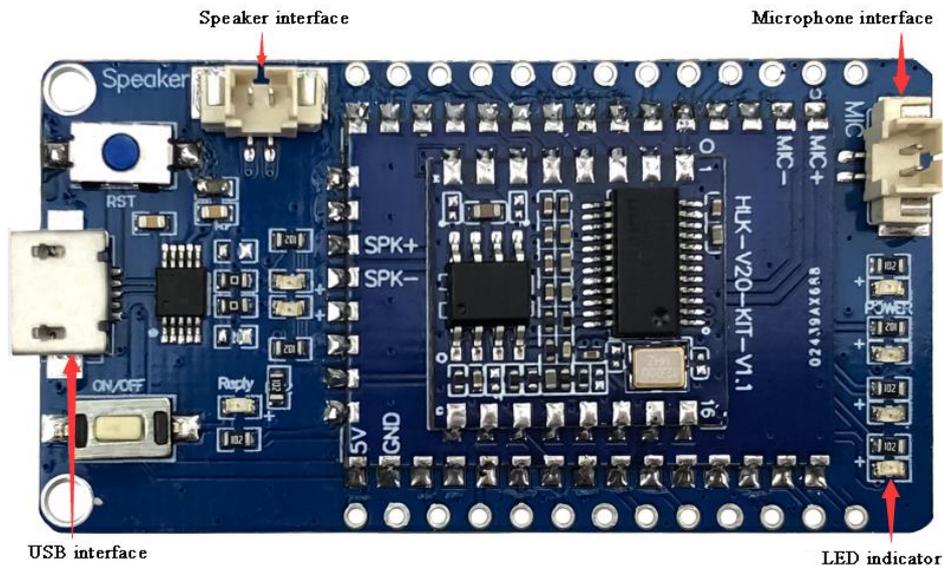
2.1. Test board description

Figure 5   Test Board description diagram

2.2. Local voice commands to control LED lights

1. Use the USB data cable to power on the test board, and connect external speakers and microphones.

2. After the module wakes up, use the command word "turn on the air conditioner", the LED on the bottom panel will light up; use the command word "turn off the air conditioner", and the LED light will go out.

3. Use the command word "turn on the light" to turn on the LED on the bottom panel, and use the command word "turn off the light" to turn off the LED.

4. Use the command word "Turn on the switch", the bottom panel LED will light up, use the command word "Turn off the switch", the LED light will go out.

2.3. Serial port output protocol data after local voice recognition

1. Use the USB data cable to power on the test board, and connect external speakers and microphones.

2. Open the serial port tool on the PC side, and the serial port configuration is 115200-8-N-1.

3. Use the wake-up word to wake up. After the module recognizes the wake-up word and command word, the serial port outputs protocol data. For details of the serial port protocol data, please refer to **HLK-V20 UART communication protocol description V1.0.pdf.**

3. Application examples

The module can be used with the serial port of the MCU. After the voice module recognizes the voice command, it outputs protocol data through the serial port, and the MCU serial port receives the voice module serial port data for processing.

Figure 6   Module application example diagram

The module can be used as the main control, used in voice control LED lights, voice control relays and other scenarios.

The module can be used in the following scenarios: voice-activated chandeliers, voice-activated wall lamps, voice-activated bath heaters, voice-activated switches, voice-activated spotlights, voice-activated ceiling lamps, voice-activated desk lamps, wall switches, hotel control panels, LED desk lamps, panels, clothes dryers, electric curtains, fans , Smart door locks, sweepers, smart desk lamps, smart air conditioners, smart teapots, story machines, smart curtains, smart fans, sound-controlled speakers, and car sound-controlled.

The module is highly integrated, simplifies the peripheral circuit, and provides a reference for the schematic diagram of the test board. The figure below is the schematic diagram of the test board.
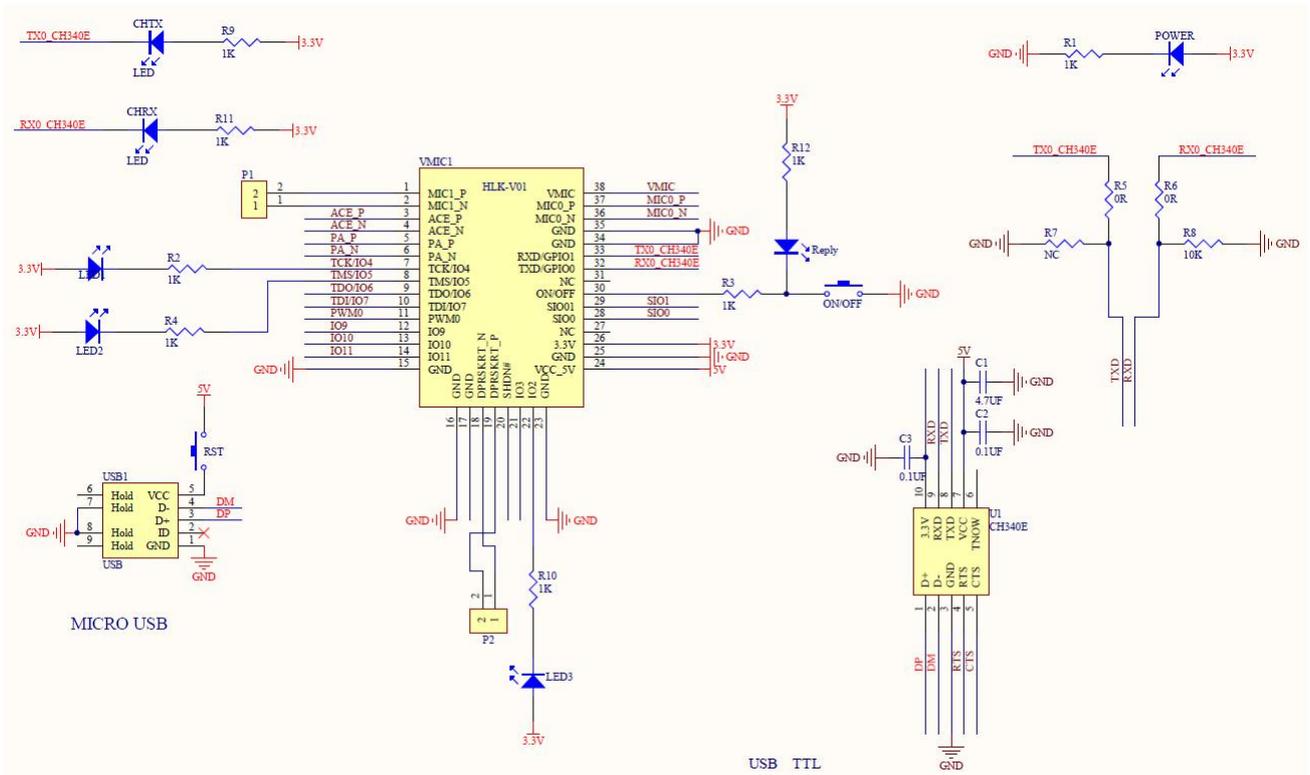
Figure 7   Test board schematic diagram

4. Electrical characteristics

4.1. Electrical parameters

Electrical parameters	
Power input voltage	DC:3.3V~5V
Working temperature	-20℃to 85℃

Table 2   Electrical parameters

4.2. Current waveform

Module test environment: test module with backplane

4.2.1. Standby power consumption

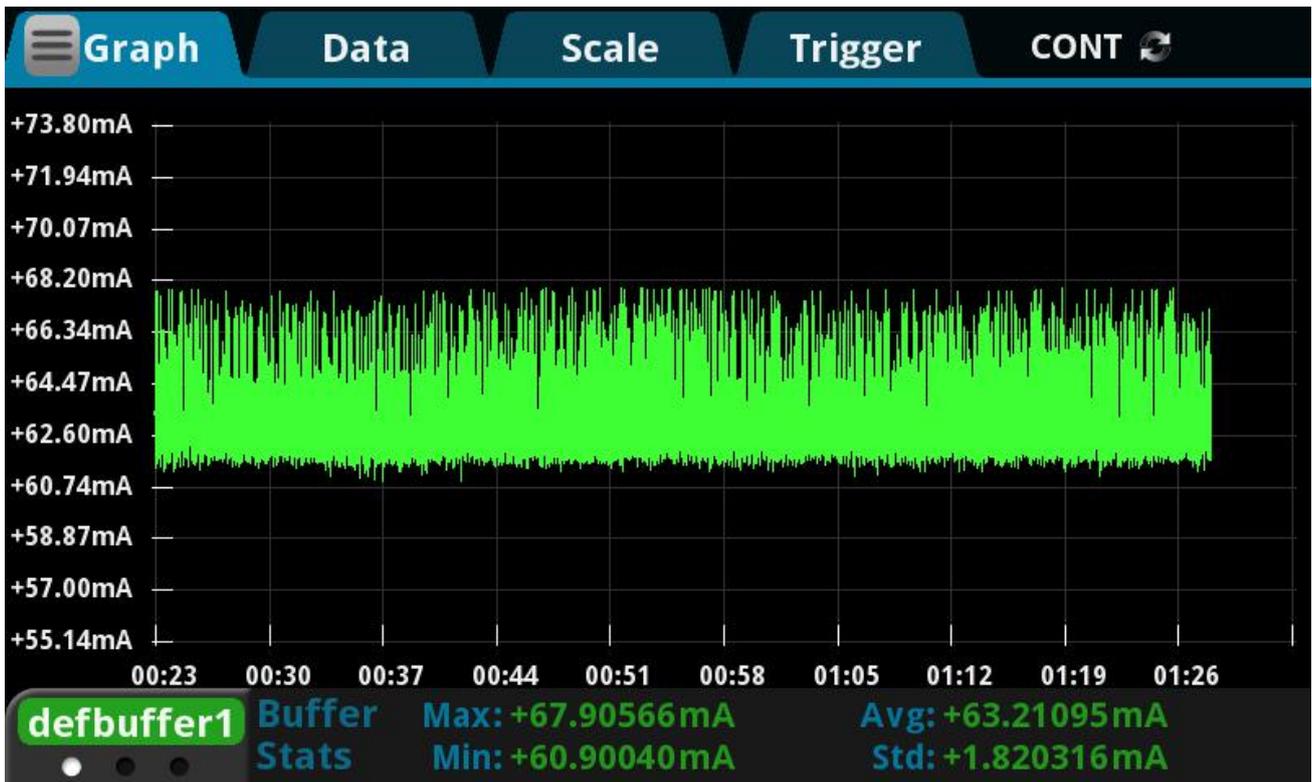5V power supply, average standby power consumption of 63mA. The detailed current waveform is shown below.

Figure 8   Standby power consumption diagram

4.2.2. Wake-up recognition power consumption

5V power supply, with speaker (8Ω1W) wake-up recognition, average power consumption 77mA. The detailed current waveform is shown below.
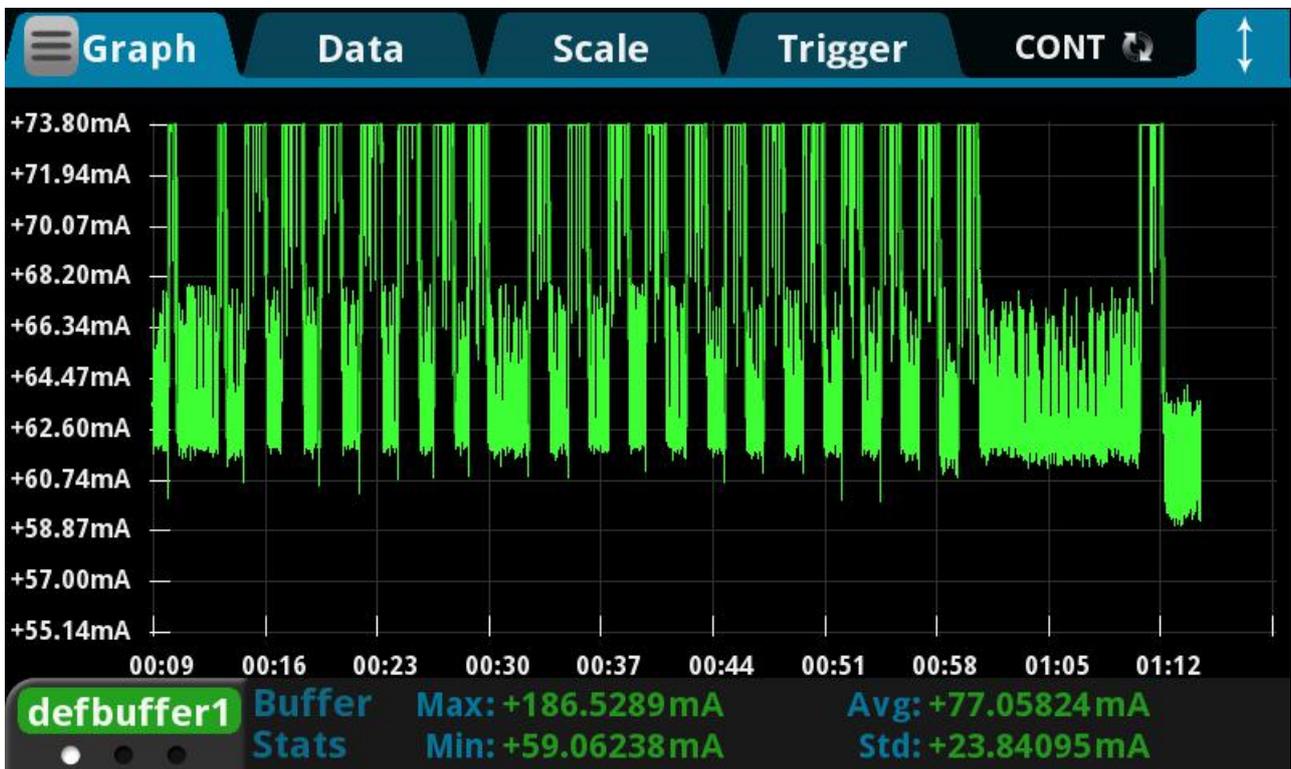

Figure 9   Wake-up recognition power consumption diagram

5. Recommended reflow soldering temperature

Please strictly follow this temperature curve when the module is heated for the second time.

Too much deviation of the reflow soldering temperature will damage the module!

Temperature setting (Celsius)									
Temperature zone	1	2	3	4	5	6	7	8	
Upper zone	125	135	155	185	195	225	240	230	
Lower zone	125	135	155	185	195	225	240	230	
Conveyor speed: 70.0 cm/min									
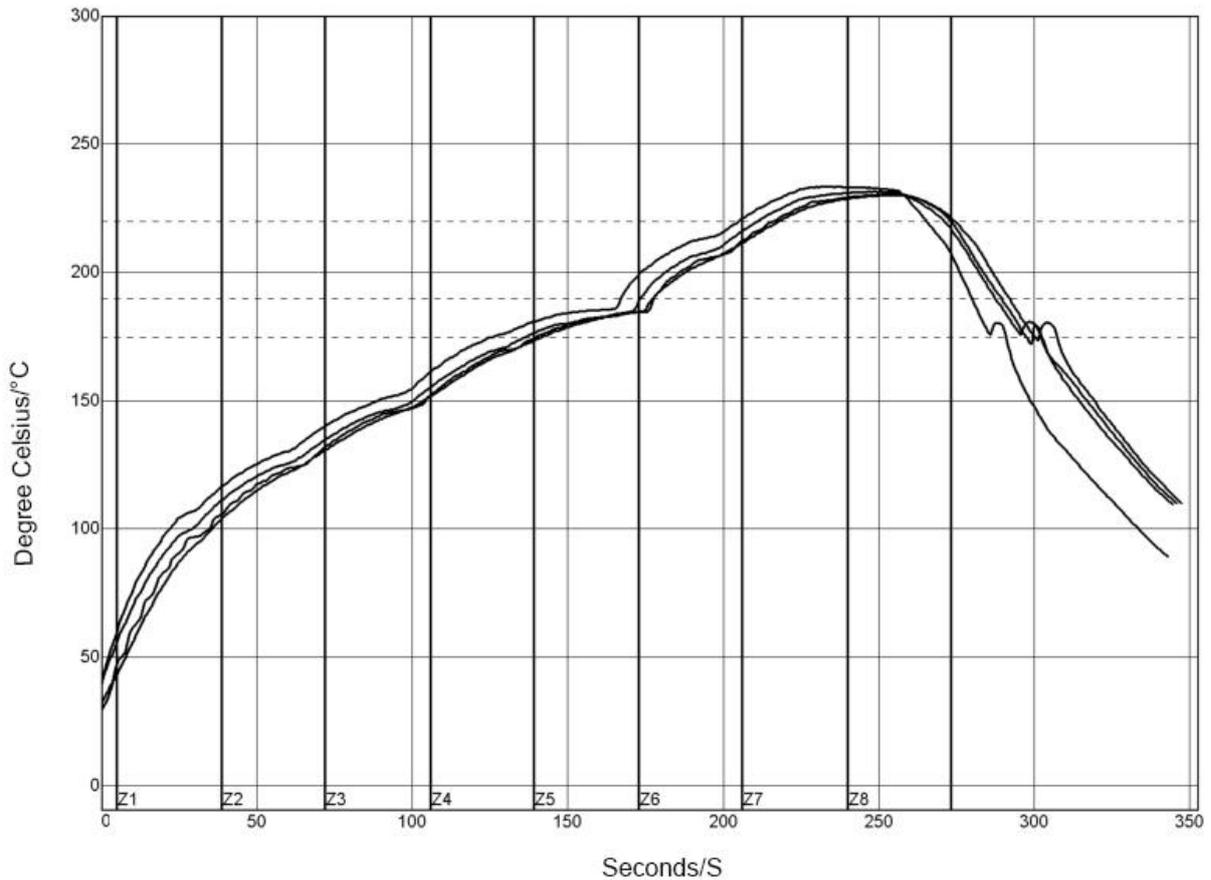
PWI= 94%	Constant temperature time 175~190°C		Reflux time/220° C		Max temp.	
<TC2>	35.53	-82%	55.58	-72%	230.28	-94%
<TC3>	37.66	-74%	58.66	-57%	230.56	-89%
<TC4>	41.52	-62%	60.63	-47%	233.62	-28%
<TC5>	37.07	-76%	60.44	-48%	231.67	-67%
Temp. difference	5.99		5.05		3.34	

Process boundary

Solder paste:	System Default for Reflow			
Statistic name	Minimum limit	Maximum limit	Unit	
Constant temperature time 175~190 °C	30	90	S	
Reflow time -220°C	50	90	S	
Maximum temp.	230	240	°C	

6. Appendix A Document Revision History

Version number	Version number Range of revision	Date	Revised by
V1.0	Initial version	2020/7/17	Mr. Jiang
V1.1	Add voice custom description	2020/7/24	Mr. Jiang