

SKU610 规格书 超宽带模块 SKU610 Datasheet Ultra Wideband Module

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This document applicable to the following products:

Product name	Type number	Product status
SKU610	SKU610-GMP (09364)	OUT of stock
SKU610	SKU610-G (0936401)	Mass Production

注：G代表6轴加速度计传感器，M代表磁强计，P代表气压计压力传感器

Note: G stands for 6-axis accelerometer sensor, M for Magnetometer, and P for barometer Pressure sensor

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1 概述/ General Description

SKU610模块是基于十波的DW1000超宽带（UWB）收发器IC，这是一个IEEE 802.15.4-2011 UWB实现。它选择了一个外部天线连接器，可以帮助用户匹配不同的UWB天线。我们的模块集成了NRF52832的所有射频电路和一个2.4G陶瓷天线，用户可以轻松地使用BLE功能。

The SKU610 module is based on Decawave's DW1000 Ultra Wideband (UWB) transceiver IC, which is an IEEE 802.15.4-2011 UWB implementation. It chose a external antenna connector, which can help user to match the different UWB antennas. Our module integrates all RF circuitry of NRF52832 and a 2.4G Ceramic antenna, User can use the BLE function easily.

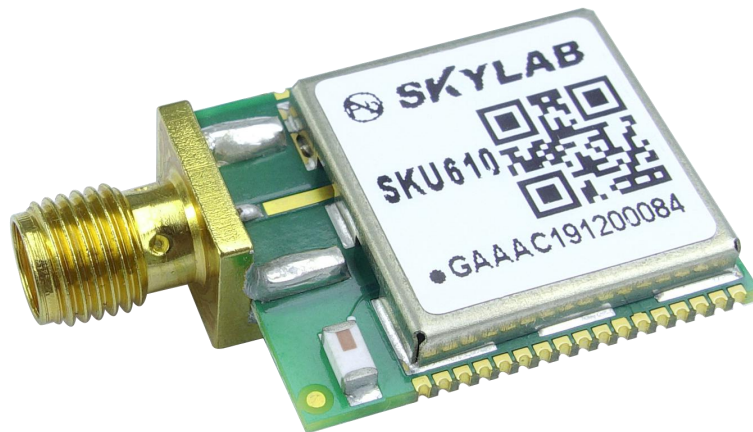


Figure 1-1: SKU610 Top View

2 应用/ Applications

- ◆ 医疗保健（定位资产、患者和工作人员）/ Healthcare (locate assets, patients & staff)
- ◆ 工业（资产跟踪、工厂自动化）/ Industrial (asset-tracking, factory automation).
- ◆ 零售（安全、导航、客户分析）/ Retail (security, navigation, customer analytics).
- ◆ 消费者（联网家庭、体育分析）/ Consumer (connected home, sports analytics).

3 特性/ Features

- ◆ 精度范围在10cm以内/ Ranging accuracy to within 10cm.
- ◆ 6.8Mbps数据速率/ 6.8 Mbps data rate.
- ◆ IEEE 802.15.4-2011 UWB兼容/ IEEE 802.15.4-2011 UWB compliant.
- ◆ Nordic Semiconductor nRF52832.

- ◆ 蓝牙®连接/ Bluetooth® connectivity.
- ◆ 蓝牙®芯片天线/ Bluetooth® chip antenna.
- ◆ 运动传感器：3轴加速度计/ Motion sensor: 3-axis accelerometer.
- ◆ 为低功耗睡眠模式优化的电流消耗：<15 μ A / Current consumption optimised for low power sleep mode: <15 μ A.
- ◆ 电源电压：2.8 V至3.6 V / Supply voltage: 2.8 V to 3.6 V.
- ◆ 尺寸/ Size: 19.0 mm x 23.0 mm x 3.2 mm.

3 主要优势/ Key Benefits

- ◆ 使锚点、标签和网关能够快速启动整个RTLS系统并正常运行/ Enables anchors, tags & gateways to quickly get an entire RTLS system up-and-running
- ◆ 加快产品设计，加快上市时间，降低开发成本/ Accelerates product designs for faster Time-to-Market & reduced development costs
- ◆ 无线更新/ Over-the-air updates
- ◆ 用户对SKU610固件的API（可作为一个库），用于用户代码定制/ User API to SKU610 firmware (available as a library) for user code customisation
- ◆ 车载蓝牙®智能设备，用于连接手机/平板电脑/个人电脑/ On-board Bluetooth® SMART for connectivity to phones/tablets/PCs
- ◆ 使用SPI、UART和蓝牙®API，可从外部设备访问SKU610固件/ SPI, UART and Bluetooth® APIs to access SKU610 firmware from an external device
- ◆ 低功耗硬件设计和软件架构，以延长电池寿命/ Low-power hardware design and software architecture for longer battery life

4 应用框图/ Applications Block Diagram

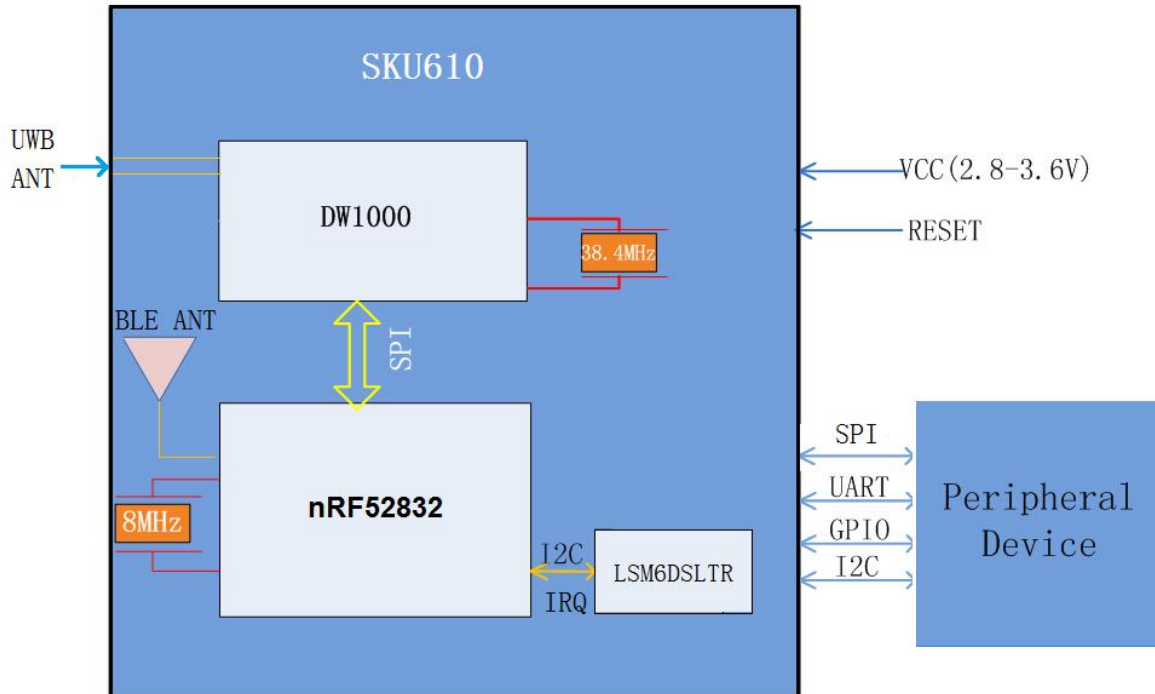


Figure 4-1: SKU610 Block Diagram

5. 电器特性/ Electrical Specification

下表给出了SKU610模块的详细规格说明。Tamb = 25℃，适用于所有规格。

The following tables give detailed specifications for the SKU610 module. Tamb = 25 °C for all specifications given.

5.1 工作条件/ Nominal Operating Conditions

Table 5-1: SKU610 Operating Conditions

参数/Parameter	Min.	Type	MAX.	Units	条件和注意事项/Condition/Note
Operating temperature	-40		+85	°C	
Supply voltage VCC	2.8	3.3	3.6	V	正常工作/Normal operation
Voltage on VDDIO for programming OTP	3.7	3.8	3.9	V	电源连接到SKU610中的OTP，该电源连接到位于PCB下面的VDDIO测试点/ Supply is connected to the OTP in the SKU610 this supply is connected to the VDDIO test point which is underneath the PCB

5.2 直流特性/ DC Characteristics

Table5-2: SKU610 Receiver DC Characteristics

参数/Parameter	Min.	Type	Max.	Units	条件和注意事项/Condition/Note
Supply current in DEEPSLEEP mode		4		μA	所有外设 in 最低功耗模式可实现，RTC 和加速度计被禁用与自定义固件。 / All peripherals in lowest power consumption mode Achievable where RTC and accelerometer are disabled with custom firmware.
Supply current in DEEP SLEEP mode		12		μA	RTC 和加速度计运行，所有其他外设 in 最低功耗模式 / RTC and accelerometer operational, all other peripherals in lowest power consumption mode
Supply current in IDLE mode		13		mA	MCU 和 DW1000 唤醒 / MCU and DW1000 awake
TX peak current		111		mA	
TX mean current		82		mA	
RX peak current		154		mA	
RX mean current		134		mA	
Current in Bluetooth® discovery mode		6		mA	
Digital input voltage high	0.7 x VCC		VCC	V	
Digital input voltage low	GND		0.3 x VCC	V	
Digital output voltage high	0.7 x VCC		VCC	V	
Digital output voltage low	GND		0.3 x VCC	V	

5.3 接收机交流特性/ Receiver AC Characteristic

Table 5-3: SKU610 Receiver AC Characteristic

参数/Parameter	Min.	Type	Max.	Units	条件和注意事项/Condition/Note
Frequency range	6240		6739.2	MHz	Centre Frequency 6489.6 MHz

5.4 接收机灵敏度特性/ Receiver Sensitivity Characteristics

测试条件25°C，20字节payload长度。天线增益0dBi，方向应根据天线方向性调整到SKU610合适的位置。

Tamb = 25 °C, 20 byte payload. These sensitivity figures assume an antenna gain of 0 dBi and should be modified by the antenna characteristics, depending on the orientation of the SKU610.

Table 5-4: SKU610 Typical Receiver Sensitivity Characteristics

Packet Error Rate	Data Rate	Receiver Sensitivity	Units	Condition/Note		
1%	6.8Mbps	-98*(-92)	dBm/500MHz	Preamble 128	Carrier frequency offset ±10 ppm	所有测试基于通道5, PRF64MHz / All measurements performed on Channel 5, PRF 64MHz
10%	6.8Mbps	-99*(-93)	dBm/500MHz	Preamble 128		

*智能发射增益使能后的等效灵敏度。标准固件默认打开。

*equivalent sensitivity with Smart TX Power enabled. This is enabled in the onboard firmware.

5.5 发射机交流特性/ Transmitter AC Characteristics

Table 5-5: SKU610 Transmitter AC Characteristics

参数/ Parameter	最小值/ Min.	典型值/Typ.	最大值/ Max.	单位/ Units	备注/ Note
Output power spectral density			-41.3*	dBm/MHz	
Output Channel Power		-17		dBm/500MHz	

*如果使用预先集成到模块中的软件。

* If using the pre-loaded embedded firmware of the SKU610 module

5.6 绝对最大额定参数/Absolute Maximum Ratings

Table 5-6: SKU610 Absolute Maximum Ratings

Parameter	Min.	Max.	Units
供电电压/ Supply voltage	2.8	3.9	V
接收电平/ Receiver power		0	dBm
存储温度/ Storage temperature	-40	+85	°C
工作温度/ Operating temperature	-40	+85	°C
ESD (Human Body Model)		2000	V
除 VBAT, 3V3_OUT, GND 外其他脚的电平/ SKU610 pins other than VCC, VDDIO and GND		3.6	Note that 3.6 V is the max voltage that may be applied to these pins

超出上述电压、功率、温度范围时，可能会导致模块永久失效。上述仅仅是极限参数，正常工作范围外极限范围内的操作条件本规格书不提供保证。长时间暴露在这些条件下可能影响到设备的可靠性。

Stresses beyond those listed in this table may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions beyond those indicated in the operating conditions of the specification is not implied. Exposure to the absolute maximum rating conditions for extended periods may affect device reliability.

6 模块引脚介绍/Module Pinout and Pin Description

6.1 引脚分布/Module Pinout

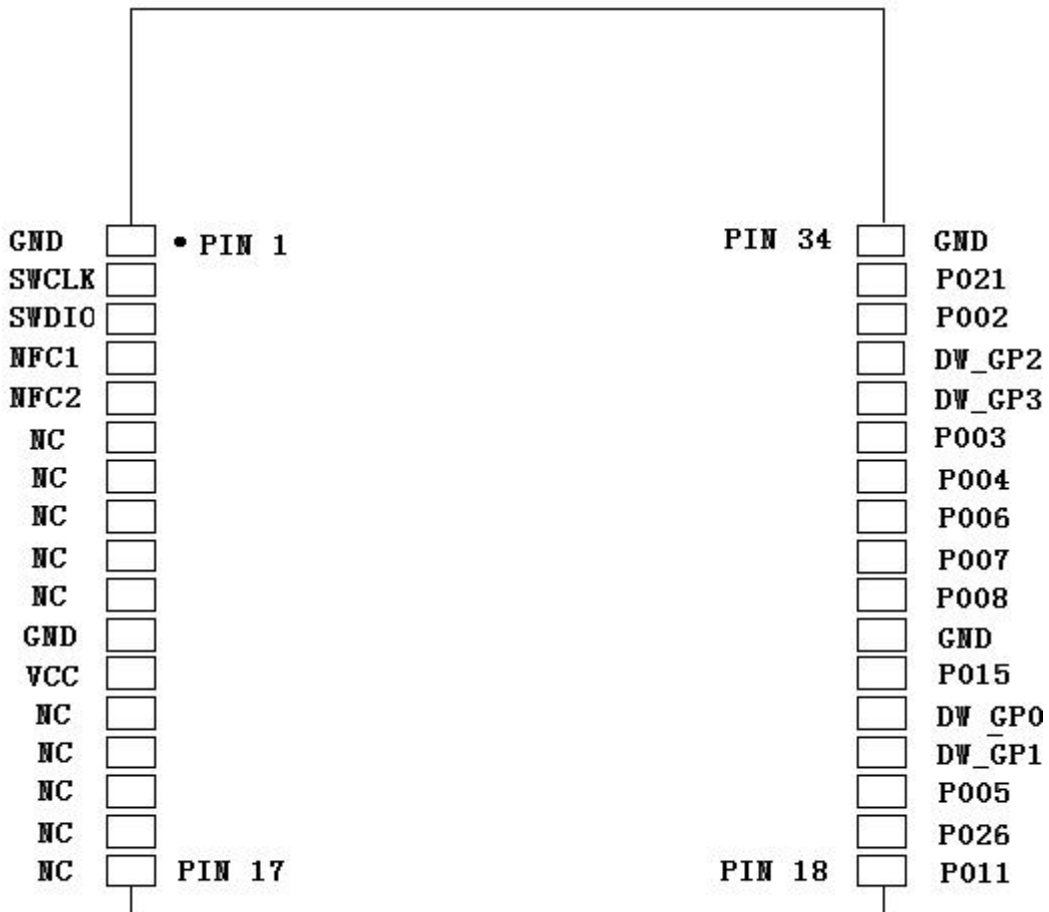


Figure 6-1: SKU610 Module Pinout (TOP View)

6.2 引脚描述/Pin Description

Table 6-1: SKU610 Pin Description

Pin No.	Pin Name	I/O	Description
1	GND	G	接地/ Common ground.
2	SWD_CLK	P	处理器调试和编程的串行线调试时钟输入。/ Serial wire debug clock input for debug and programming of Nordic Processor.
3	SWD_DIO	DIO	处理器调试和编程的串行线调试I/O / Serial wire debug I/O for debug and programming of Nordic Processor
4	NFC1	DIO	NFC天线连接/ NFC antenna connection

5	NFC2	DIO	NFC天线连接/ NFC antenna connection
6	NC	DIO	悬空/ Don't connect anything
7	NC	DIO	悬空/ Don't connect anything
8	NC	DIO	悬空/ Don't connect anything
9	NC	DIO	悬空/ Don't connect anything
10	NC	DIO	悬空/ Don't connect anything
11	GND	G	接地/ Common ground
12	VCC	P	外部电源: 2.8V - 3.6V/ External supply for the module. 2.8V - 3.6V
13	NC	G	悬空/ Don't connect anything
14	NC	DIO	悬空/ Don't connect anything
15	NC	DO	悬空/ Don't connect anything
16	NC	DIO	悬空/ Don't connect anything
17	NC	DIO	悬空/ Don't connect anything
18	P011	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin of NRF52832
19	P026	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin o NRF52832
20	P005	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin of NRF52832
21	DW_GP1	DIO	DW1000的通用I/O引脚/ General purpose I/O pin of DW1000
22	DW_GP0	DIO	DW1000的通用I/O引脚/ General purpose I/O pin of DW1000
23	GPIO_15	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin of NRF52832
24	GND	G	接地/ Common GND
25	GPIO_8	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin of NRF52832
26	GPIO_7	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin of NRF52832
27	GPIO_6	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin of NRF52832
28	GPIO_4	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin of NRF52832
29	GPIO_3	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin of NRF52832
30	DW_GP3	DIO	NRF52832的通用I/O引脚/ General purpose I/O pin of DW1000
31	DW_GP2	DIO	NRF52832的通用I/O引脚/ General purpose I/O pin of DW1000
32	P002	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin of NRF52832

33	P021	DIO	NRF52832的通用I/O引脚/ General purpose I/O Pin of NRF52832
34	GND	G	接地/ Common ground.

- (1) P: 电源/ Power supply
- (2) DI: 默认输入/ Default Input
- (3) DO: 默认输出/ Default Output
- (4) DIO: 默认输入/输出/ Default Input/Output
- (5) G: 接地/ Ground

Table 6-2: Internal nRF52832 pins used and their function

nRF52832 Pin	DW1000
PO.19	DW_IRQ
PO.16	DW_SCK
PO.20	DW_MOSI
PO.18	DW_MISO
PO.17	DW_SPI_CS
PO.24	DW_RST
nRF52832 Pin	LSM6DSLTR
PO.23	ACC_IRQ
PO.29	I2C_SDA
PO.28	I2C_SCL

DW1000的GPIOs 5, 6控制DW1000 SPI模式的配置。在DWM1001模块中，这些GPIO未连接并将在内部下拉。因此，SPI将被设置为模式0。

DW1000's GPIOs 5,6 control the DW1000 SPI mode configuration. Within the DWM1001 module, those GPIOs are unconnected and will be internally pulled down. Consequently, SPI will be set to mode 0.

Table6-3: I2C slave devices address I2C

I2C slave device	Address
LIS2DH12	0X6B

7 参考电路/ Reference Circuit

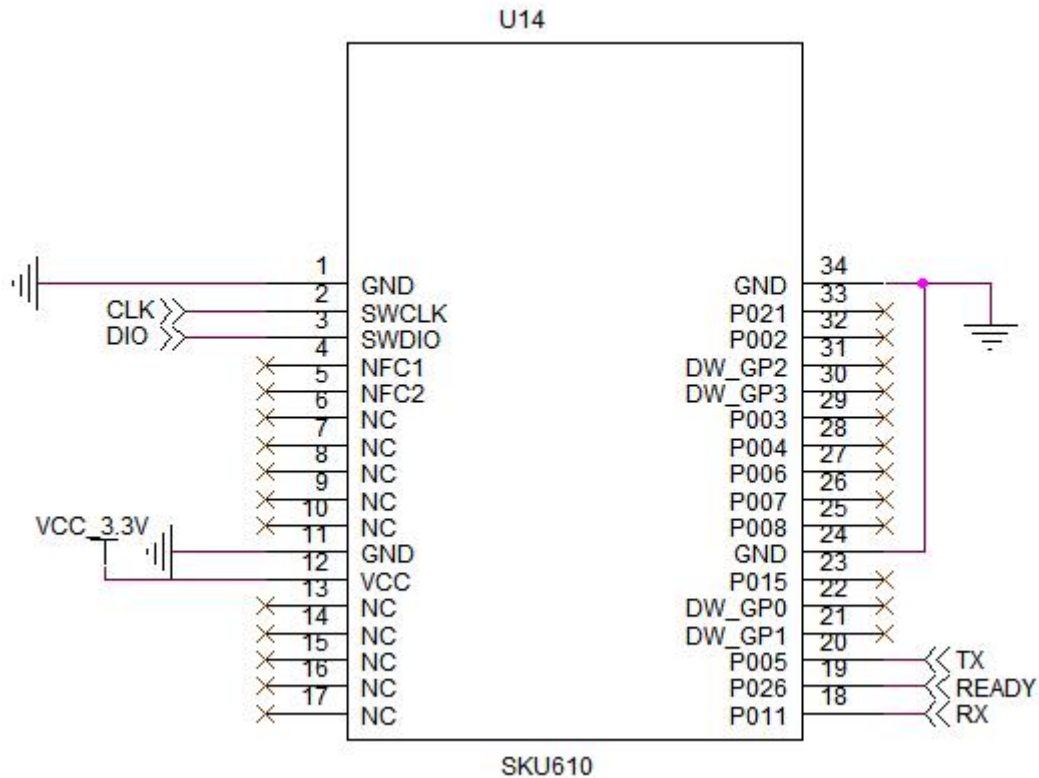


Figure7-1: SKU610 reference circuit

一般来说，用户只需要在TDOA系统中使用VCC和GND pin打开模块，对于TWR应用程序，用户需要将UART连接到他们的CPU来获取数据。但是，我们建议用户应该为SWD端口添加测试点来更新固件。

In general, user just need to power on the module wit the VCC and GND pin in a TDOA system, For TWR application, user need to connect the UART to their CPU to get data. However, we recommend that user should add test points for SWD port to update the firmware.

8 PCB封装和尺寸/ PCB Footprint and Dimensions

8.1 模块尺寸图/ Module Drawings

所有的测量值都以毫米为单位。 / All measurements are given in millimetres.

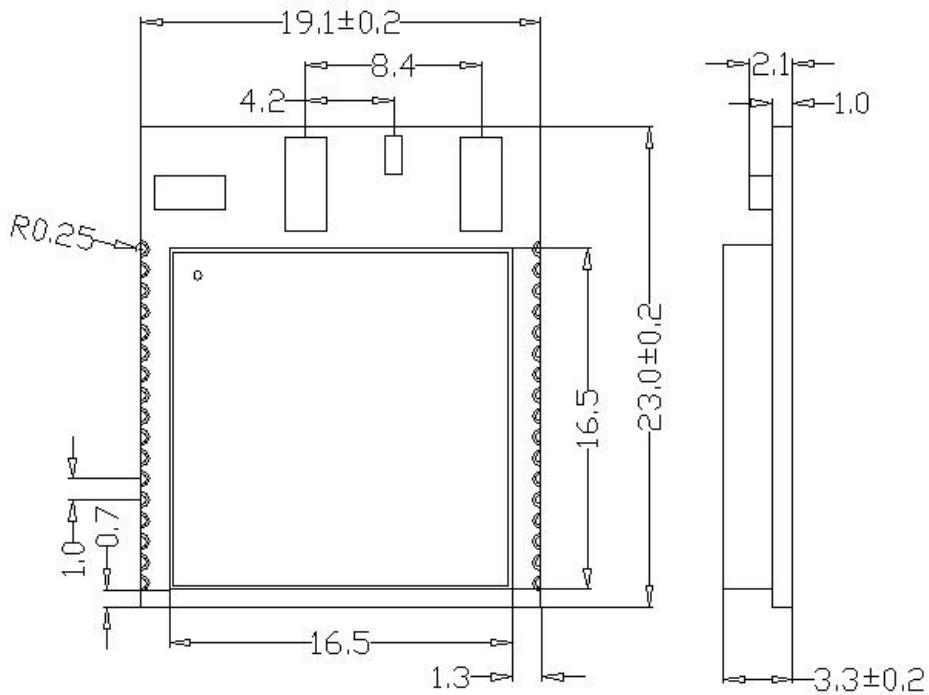


Figure 8-1: SKU610 PCB Footprint and Dimensions(units: mm)

8.2 模块封装图/ Module Footprint

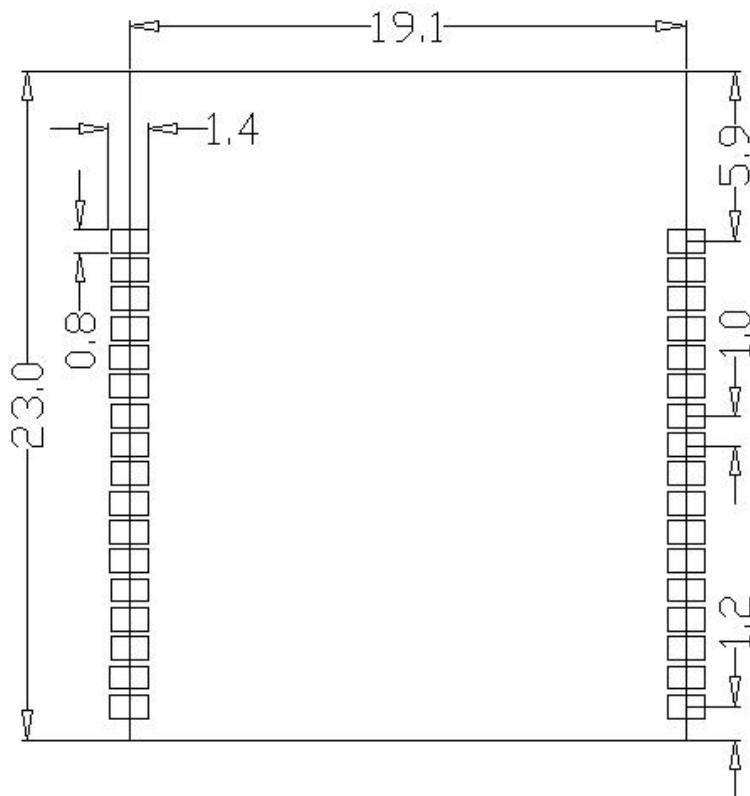


Figure 8-2: SKU610 Module Land Pattern (units: mm)

9 制造工艺的建议/ Manufacturing Process Recommendations

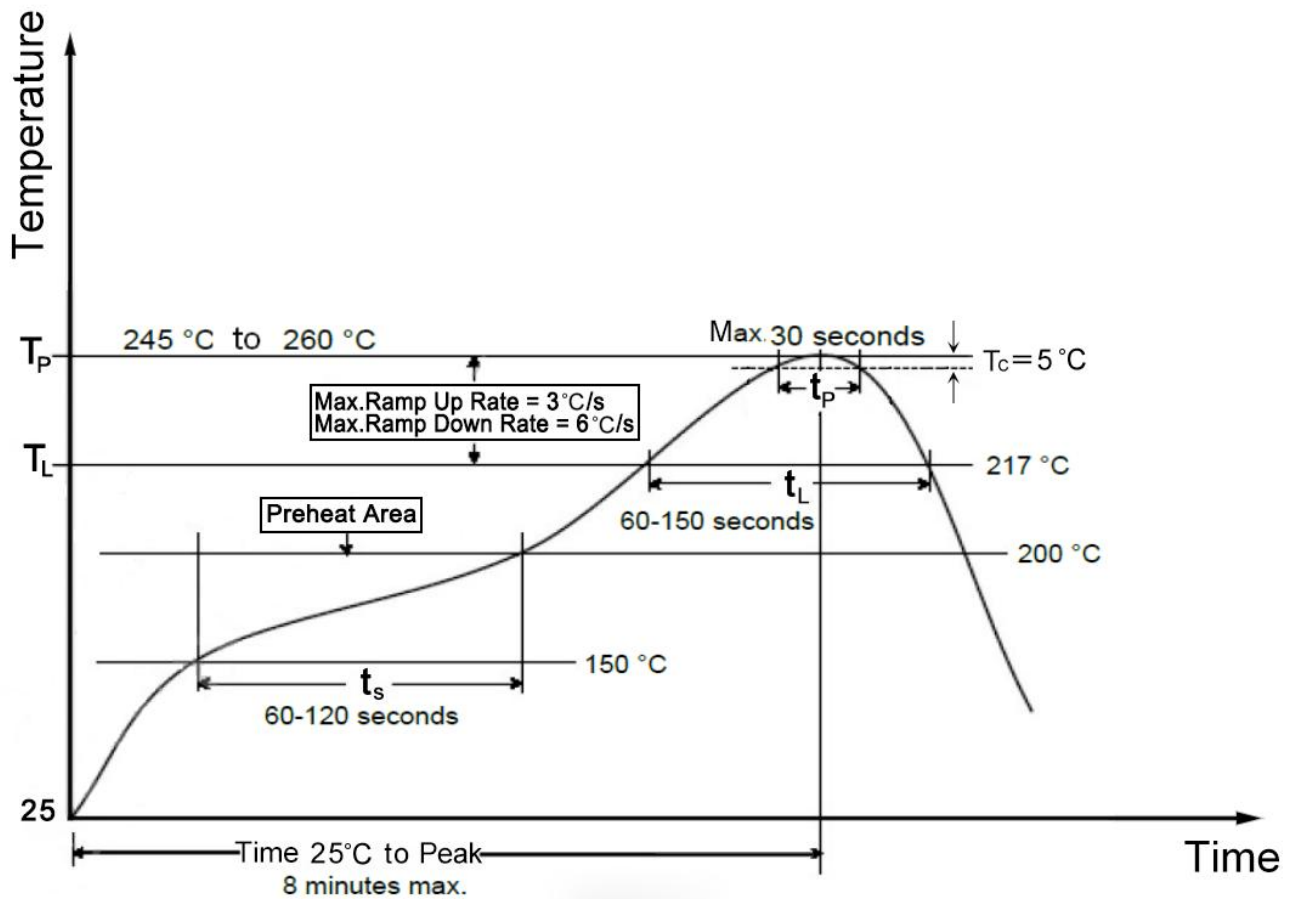


Figure 9-1: SKU610 Typical Lead-free Soldering Profile

注：在工厂选择的最终再流焊接温度图取决于其他外部因素，例如，焊膏的选择、尺寸、厚度和模块底板的性能等。超过推荐焊接轮廓线中的最大焊接温度可能会永久损坏模块。

Note: The final re-flow soldering temperature map chosen at the factory depends on additional external factors, for example, choice of soldering paste, size, thickness and properties of the module's baseboard etc. Exceeding the maximum soldering temperature in the recommended soldering profile may permanently damage the module.

10 包装规范/ Packaging Specification

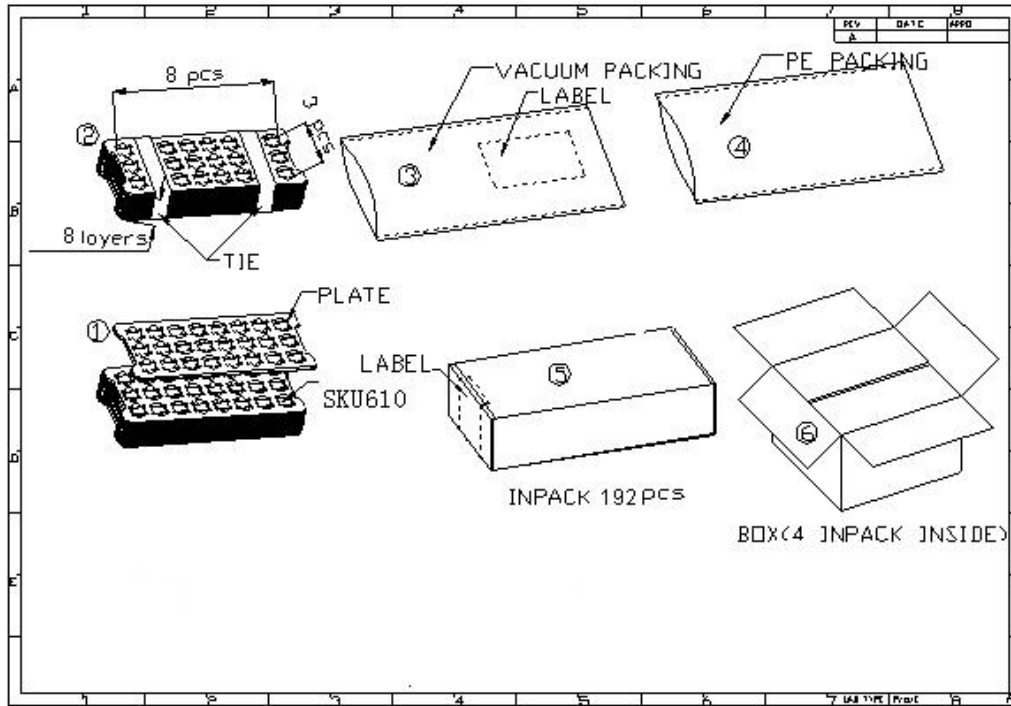


Figure10-1: SKU610 Packaging

SKU610模块被放入托盘中，每个托盘有528个单元。每个托盘都是“干燥的”和真空包装的。SKU610系列模块是静电敏感设备，在处理时需要特殊的注意事项。

SKU610 modules are put into tray and 528 units per tray. Each tray is 'dry' and vacuum packaging. SKU610 series modules are Electrostatic Sensitive Devices and require special precautions while handling.

ESD预防措施/ ESD precautions



SKU610模块包含高灵敏度的电子电路，是静电敏感器件（ESD）。在没有适当的ESD保护的情况下处理SKU610模块可能会永久破坏或损坏它们。

The SKU610 modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling the SKU610 modules without proper ESD protection may destroy or damage them permanently.

SKU610模块是静电敏感器件（ESD），需要特殊的ESD预防措施，通常适用于ESD敏感组件。在任何包含SKU610模块的应用程序的处理、处理、运输和操作过程中，都必须采用适当的ESD处理和包装程序。不要用手或非防静电焊铁接触模块，以免损坏模块。

The SKU610 modules are electrostatic sensitive devices (ESD) and require special ESD precautions typically applied to ESD sensitive components. Proper ESD handling and packaging procedures must be applied throughout the processing, handling, transportation and operation of any application that incorporates the SKU610 module. Don't touch the module by hand or solder with non-anti-static soldering iron to avoid damage to the module.

11 联系信息/Contact Information

Skylab M&C Technology Co., Ltd.

深圳市天工测控技术有限公司

Address: 6 Floor, No.9 Building, Lijincheng Scientific & Technical park, Gongye East Road,

Longhua District, Shenzhen, Guangdong, China

Phone: 86-755 8340 8210 (Sales Support)

Phone: 86-755 8340 8510 (Technical Support)

Fax: 86-755-8340 8560

E-Mail: technicalsupport@skylab.com.cn

Website: www.skylab.com.cn www.skylabmodule.com