SKU620 超宽带测距模组规格书

SKU620 UWB Ranging Module Datasheet

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SKU620-P	0944302	PVT Production

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1. 产品介绍/Product information

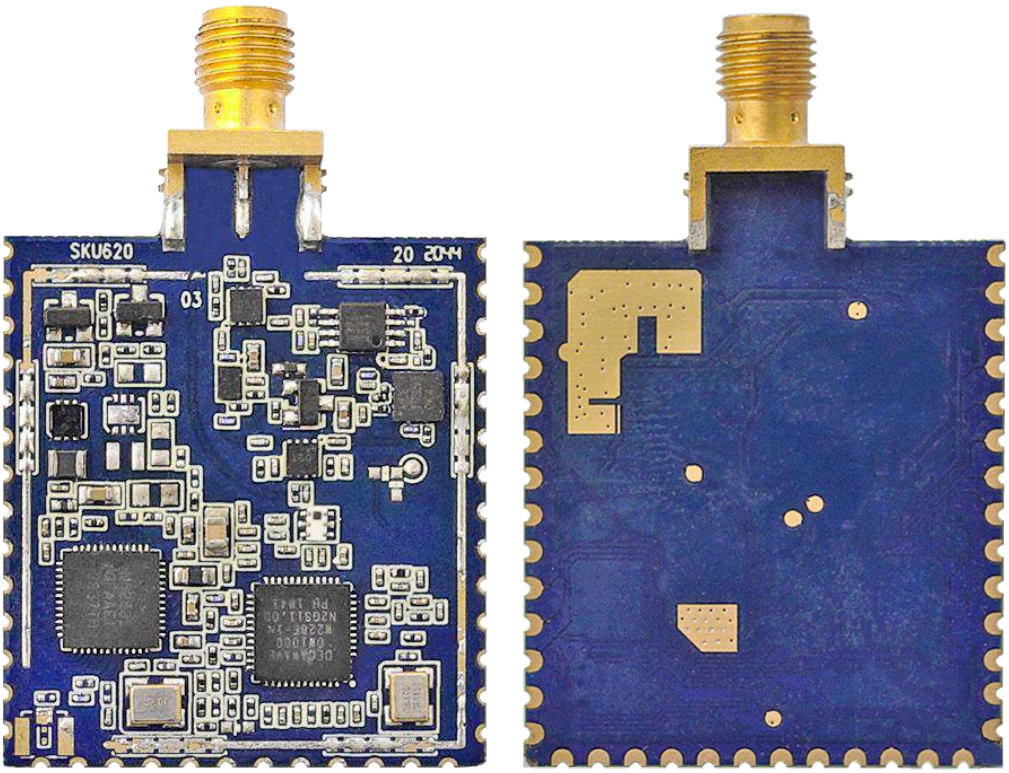


Figure 1.1 SKU620-E with SMA RF connector

SKU620 是一款基于 UWB 的高精度测距模组。模组基于 Decawave DW1000 超宽带芯片，支持 IEEE802.15.4-2011 UWB 协议 ，并对射频链路增加了 PA 和 LNA 提升其收发性能，让 SKU620 覆盖范围更广，测距精度更高。

SKU620 is an UWB high precison ranging module. It use Decawave's DW1000 transceiver IC, which support IEEE 802.15.4-2011 UWB protocol. The module support PA and LNA in its RF chain in order to enhance its TX and RX performance. And it will result in larger coverage and higher precision.

SKU620 模块主控 IC 采用 nordic 蓝牙 4.2 芯片 nRF52832。模块采用 3 边半孔设计，开放了较多 IO 口，可以被配置成 UART、SPI、I2C、PWM 等接口，方便客户二次开发。模块底部留有 PA 散热地铜皮开窗，方便散热。

SKU620 module use nordic BLE 4.2 nRF52832 as MCU.And the module's 3-side-half-hole footprint support many GPIO pin out which can be configured into UART,SPI,I2C,PWM interface, which is convenient for secondary development of customers. The module reserve uncovered copper on the bottom for heat dissipation.

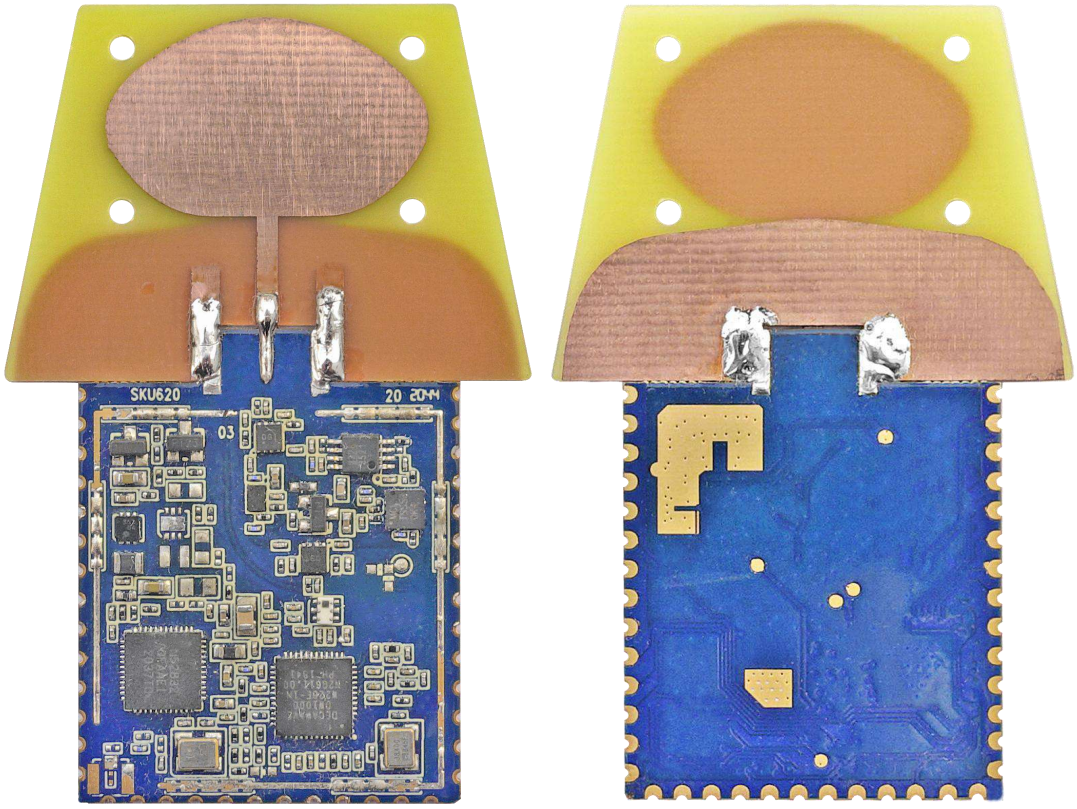


Figure 1.2 KU620-P with PCB soldering Antenna

模块使用 SMA 夹板式射频头，支持外接高增益天线的同时也减小了不必要的插损；另有可配套焊接的 PCB 板载天线，节省天线成本，并最大化板载天线性能。

SKU620 module use side SMA RF connector to support external high gain antenna with low insertion loss. Ant the SMA pads supports soldering our specially designed PCB antenna for SKU620, making the antenna low cost and high performance.

模块可以搭配 EVB 板（VDU2506），支持 USB 转串口功能；复杂版带 485 串口功能，方便接到工控机调试；满配版带网口和 WiFi 上网功能，可以直接使用 TCP/IP 、UDP 协议把 SKU620 模块的串口数据透传到 TCP/IP、UDP 的服务器上，方便组网调试 TWR 定位系统。

SKU620 module has its EVB board (VDU2506-EVB), which can transfer UART data to USB com port. The complex version support 485 UART to industrial machines. The fully-configured version support WiFi and Ethernet connection to TCP/IP or UDP server, making it easy to build a TWR positioning system.

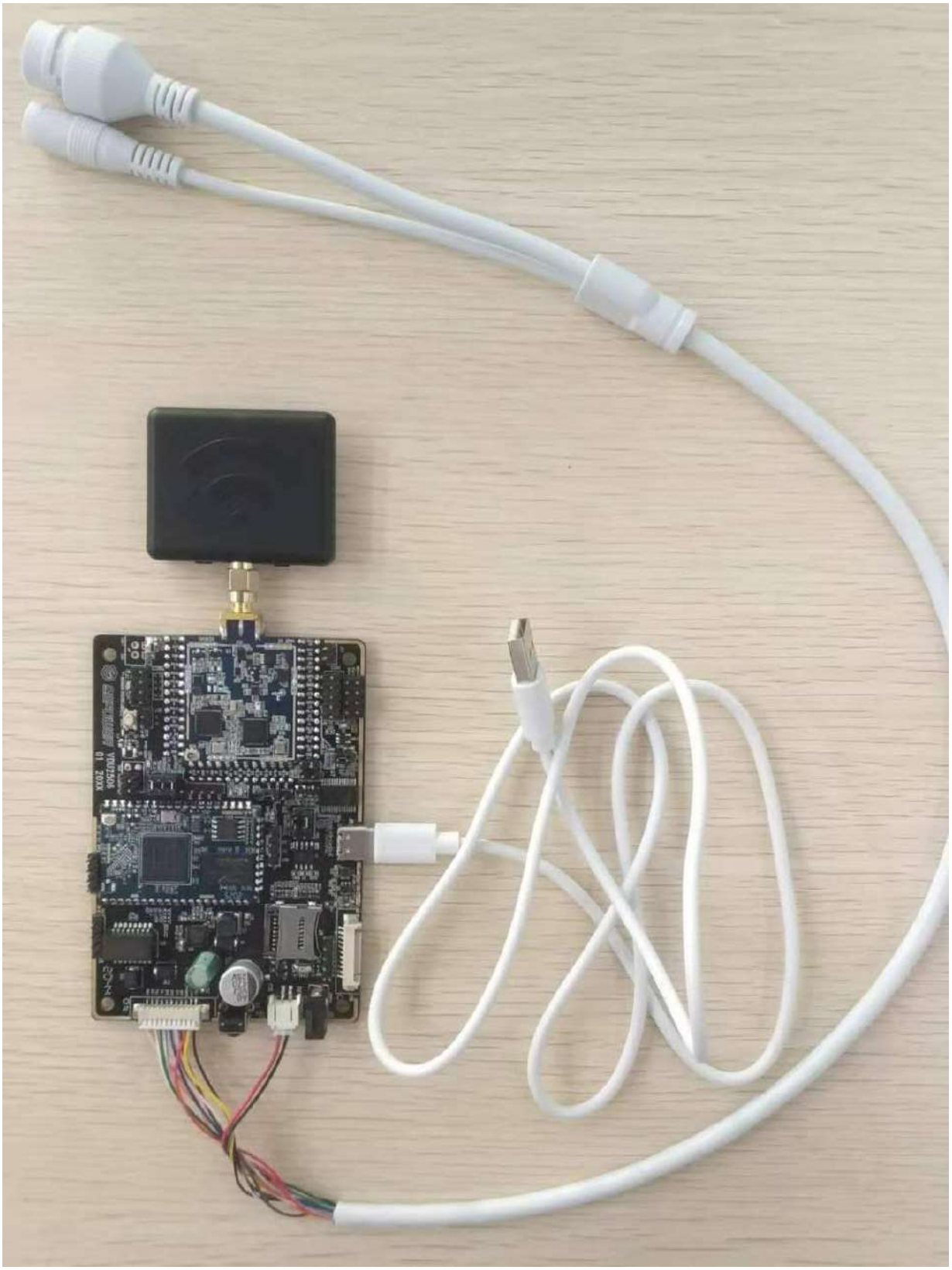


Figure 1.3 SKU620 EVB（Fully-configured version）

2 模块应用 Applications

◆ UWB 一维测距基站/UWB 1-dimension ranging anchor.

◆ UWB TWR 定位基站/UWB TWR positioning anchor

◆ UWB ranging or TWR positioning Tags

◆ 无线数据传输/Wireless data transfering

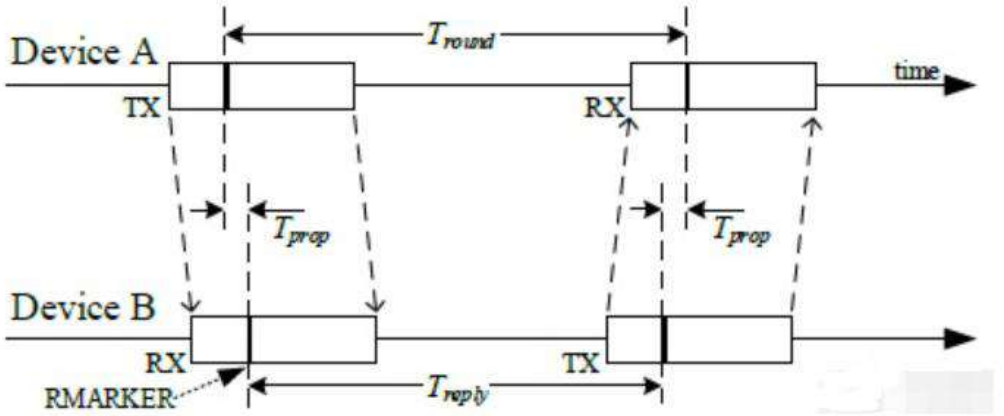


Figure 2.1 TWR ranging Process

3 特点 Features

◆ 静态测距精度 10~30cm / Static ranging accuracy up to 10cm.

◆ 最大 6.8Mbps 数据传输速率 / 6.8 Mbps Max data rate.

◆ 两级 PA 大功率方案 / 2 series PA high power solution.

◆ 可视范围 500m 以上测距距离 / 500 m+ line-of-sight range typical.

◆ IEEE 802.15.4-2011 UWB compliant.

◆ 蓝牙 4.2 芯片 nRF52832 / BLE 4.2 chip nRF52832.

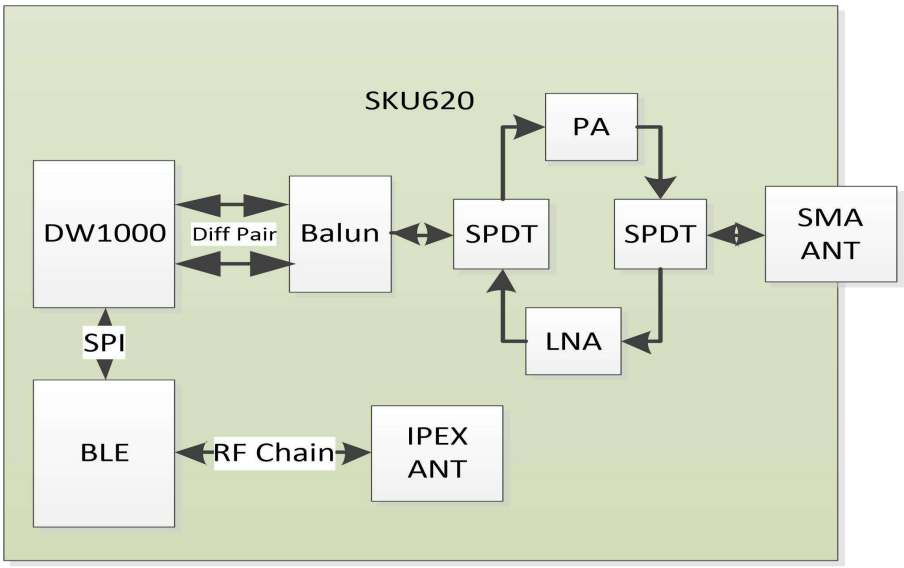
◆ 输入电压范围 3.4~5V，支持可充电锂电池（充电电路外置） / Supply voltage: 3.4V~5V，rechargable Li-Battery supportted（need external charging circuit）.

◆ 尺寸 Size:37x30x2.5mm（不含屏蔽盖 No sheild cover，不含 SMA 射频头 No SMA connector）.

4.应用框图 Application Diagram

SKU620 由主芯片 nRF52832+UWB 射频芯片 DW1000 组成，UWB 射频链路增加两级 PA，单级 LNA 和两个收发切换的开关。

SKU620 use nRF52832 as main control chip, and DW1000 as UWB transiver chip. And we add 2 series PA, one LNA and 2 RF switches on the RF front end.



SKU620

5.电气参数 Electrical Specification

下述表格给出来 SKU620 的电气参数默认条件是室温 25℃，除非特别标出温度范围。

The following tables give detailed specifications for the SKU620module. Tamb = 25 ˚C for all specifications given.

5.1 正常工作条件 Nominal Operating Conditions

Parameter	Min.	Typ.	MAX.	Units	Condition/Note
工作温度 Operating temperature	-40		+85	˚C	
电源电压 Supply voltage VCC	3.4	4.2	5	V	
IO 口电压 Voltage on VDDIO	3.0	3.3	3.6	V	

Table 5-1: SKU620 Operating Conditions

5.2 直流参数 DC Characteristics

Parameter	Min.	Typ.	Max.	Units	Condition/Note
休眠电流 Sleep current		TBD		μA	
发射封装电流 TX peak current		TBD		mA	
接收电流 RX peak current		TBD		mA	
蓝牙扫描模式电流 Current in Bluetooth® discovery mode		6		mA	
IO 输入电压高电平 IO input voltage high	2.31		3.3	V	
IO 输入电压低电平 IO input voltage low	0		1	V	
IO 输出电压高电平 IO output voltage high	2.31		3.3	V	
IO 输出电压低电平 IO output voltage low	0		1	V	

Table5-2: SKU620 Receiver DC Characteristics

注：TBD 项可能因固件配置不同而不同，如发射电流受到增益的影响比较大。
Note：TBD item may differ from firmware configuration, for example, TX peak current depand mostly on TX gain.

5.3 信道频率参数 Channel Characteristic

UWB Channel Number	Centre Frequency (MHz)	Band (MHz)	Bandwidth (MHz)
1	3494.4	3244.8 – 3744	499.2
2	3993.6	3774 – 4243.2	499.2
3	4492.8	4243.2 – 4742.4	499.2
4	3993.6	3328 – 4659.2	1331.2*
5	6489.6	6240 – 6739.2	499.2
7	6489.6	5980.3 – 6998.9	1081.6*

Table 5-3: SKU620 Channel Frequence Characteristic

5.4 接收灵敏度 Receiver Sensitivity Characteristics

测试条件 25℃，20 字节 payload 长度。天线增益 0dBi，方向应根据天线方向性调整到 SKU620 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 SKU620.

丢包率 Packet Error Rate	数据速率 Data Rate	接收灵敏度 Receiver Sensitivity	单位 Units	测试条件备注 Condition/Note		
1%	6.8 Mbps	-98*(-92)	dBm/500 MHz	Preamble 128	Carrier frequency offset ±10 ppm	所以测试基于通道 5，PRF64MHz All measurements performed on Channel 5, PRF 64 MHz
10%	6.8 Mbps	-99*(-93)	dBm/500 MHz	Preamble 128		

Table 5-4: SKU620 Typical Receiver Sensitivity Characteristics

*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发射交流参数 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*	-7	dBm/MHz	最大功率只用于煤安产品 Max power is just applied in coal safty certification
Output Channel Power		-15	20	dBm/500MHz	

Table 5-5: SKU620Transmitter AC Characteristics

*如果使用预先集成到模块中的软件 If using the pre-loaded embedded firmware of the SKU620module

5.6 极限条件 Absolute Maximum Ratings

参数 Parameter	Min.	Max.	Units
供电电压 Supply voltage	3.0	5.5	V
接收电平 Receiver power		0	dBm
存储温度 Temperature - Storage temperature	-40	+125	˚C
使用温度 Temperature – Operating temperature	-40	+85	˚C
人体静电模型 ESD (Human Body Model)	-2000	2000	V
除 VBAT，3V3_OUT，GND 外其他脚的电平 Voltage on SKU620 pins other than VBAT, 3V3_OUT and GND	0	3.6	V

Table 5-6: SKU620Absolute Maximum Ratings

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: SKU620Module Pinout (TOP View)

6.2 引脚描述 Pin Description

Pin No.	Pin Name	I/O	Description
1	VBAT	PI	电源输入 3.4V~5V Power Input.
2	3V3_OUT	PO	模块内部开关电源的 3.3V 输出，最大外接电流小于 200mA 3.3V output from moudule internal DC-DC(Max current <200mA)
3	GND	G	地 Ground
4	P0.04	I/O	通用 IO，ADC 功能，双模块时 SPI_MISO 功能 General purpose I/O pin; ADC function of nRF52;
5	P0.05	I/O	通用 IO，ADC 功能，双模块时 SPI_MOSI 功能 General purpose I/O pin; ADC function of nRF52;
6	P0.06	DIO	通用 IO，ADC 功能，双模块时 SPI_CLK 功能 General purpose I/O pin;
7	P0.07	DIO	通用 IO，ADC 功能，双模块时 SPI_MISO 功能 General purpose I/O pin;
8	P0.08	DIO	通用 IO 口,状态灯 General purpose I/O pin;Default LED state indicater.
9	P0.11	DIO	通用 IO 口 General purpose I/O pin
10	P0.12	DIO	通用 IO 口 General purpose I/O pin.
11	DW_WAKEUP	DI	预留，开路即可；Reserved DW1000_Wakeup pin .**Leave it open**
12	DW_IRQ	DI	预留，开路即可；Reserved DW1000_IRQ interrupt pin. **Leave it open**
13	P0.21/RESET	DIO	通用 IO，复位功能； General purpose I/O pin. Reset input for nRF52832
14	GND	G	地 Ground
15	BLE_ANT	AIO	蓝牙天线（无 IPEX 时启用）Bluetooth antenna pin out(If no IPEX)
16	GND	G	地 Ground
17	SWDIO	DIO	Jlink 烧录脚 SWDIO；Serial wire debug I/O for J-link debug and programming of Nordic Processor

18	SWCLK	DI	Jlink 烧录脚 SWCLK；Serial wire debug clock input for J-link debug and programming of Nordic Processor.
19	TX_P0.20	DIO;DO	通用 IO,默认串口 TX；General purpose I/O pin; **Uart TX by default**
20	RX_P0.19	DIO;DI	通用 IO,默认串口 RX；General purpose I/O pin; **Uart RX by default**
21	P0.18	DIO	通用 IO；General purpose I/O pin.
22	P0.17	DIO	通用 IO，485 模式下做 CTS 功能；General purpose I/O pin; **CTS** pin in 485 half-duplexer mode
23	P0.16	DIO	通用 IO，General purpose I/O pin.
24	P0.15	DIO;DI	通用 IO，双模块时做主从检测；General purpose I/O pin; Master/Slave anchor selection pin in 2 SKU620 mode
25	P0.14	DIO	通用 IO，General purpose I/O pin
26	P0.13	DIO	通用 IO，General purpose I/O pin.
27	GND	G	地 Ground
28	P0.31	DIO;AI	通用 IO，模数转换脚；General purpose I/O pin; ADC function
29	P0.22	DIO	通用 IO；General purpose I/O pin
30	P0.23	DIO	通用 IO；General purpose I/O pin.
31	P0.24	DIO	通用 IO，内部预留做第一级 PA 直通选择功能，仅当两级 PA 模式下，第一级需要直通时使用；General purpose I/O pin. Reserverd PA_Bypass_N(used if first
32	P0.37	DIO	通用 IO；General purpose I/O pin
33	DW_RST	DI	预留，不接 Reserved for DW1000 reset pin; Leave it open
34	DW_CS	DI	预留，不接 Reserved for DW1000 SPI_CS pin; Leave it open
35	DW_MOSI	DI	预留，不接 Reserved for DW1000 SPI_MOSI pin; Leave it open
36	DW_MISO	DO	预留，不接 Reserved for DW1000 SPI_MISO pin; Leave it open
37	DW_CLK	DI	预留，不接 Reserved for DW1000 Slave SPI_CLK pin; Leave it open
38	GND	G	地 Ground
39	DW_IO4	DIO	DW1000 通用 IO；DW1000 General purpose I/O pin.
40	DW_IO3	DIO	DW1000 通用 IO；DW1000 General purpose I/O pin.

Table 6-1: SKU620Pin Description

缩略词简介 Short Expression：

(1) PI:Power supply input 电源输入;

(2) PO:Power supply output 电源输出

(3) DI:Digital Input 数字输入;

(4) DO:Digital Output 数字输出;

(5) AI: Analog Input 模拟输入;

(6) AO：Analog Output 模拟输出

(7) DIO:Digital Input/Output 数字输入/输出;

(8) AIO：Analog Input / Output 模拟输入/输出

(9) G:Ground 接地

DW1000 的 SPI 模式默认设置成模式 0，并与 nRF52832 相连如下：

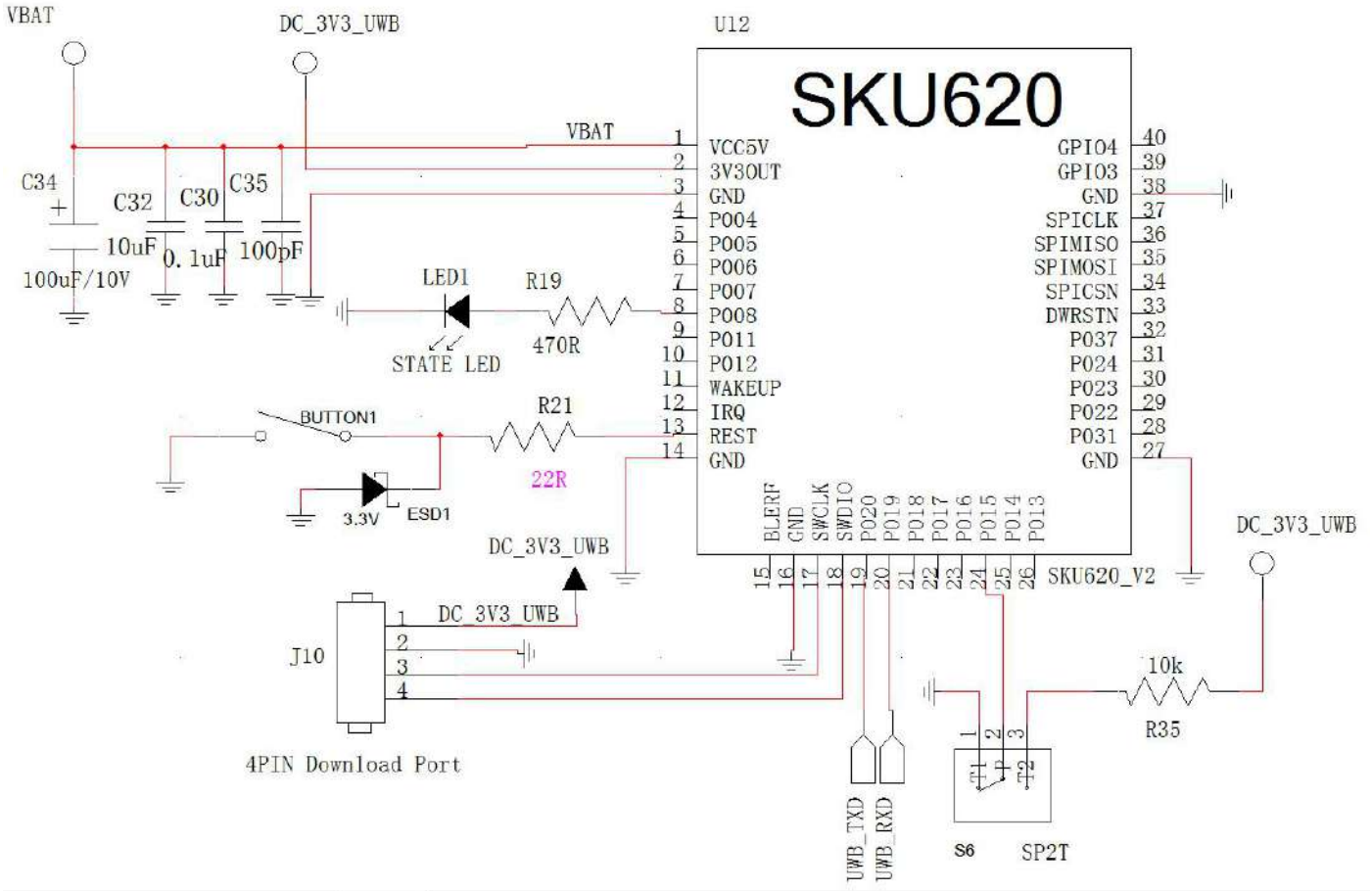
DW1000's SPI is set to mode 0 by default, and connected to nRF52832 GPIO like below:

nRF52832 Pin	Function
P0.03	DW_IRQ
P0.30	DW_SCK
P0.28	DW_MOSI
P0.29	DW_MISO
P0.27	DW_SPI_CS
P0.26	DW_RST
P0.24	Reserverd PA_Bypass_N

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

7 参考设计原理图 Reference schematic design

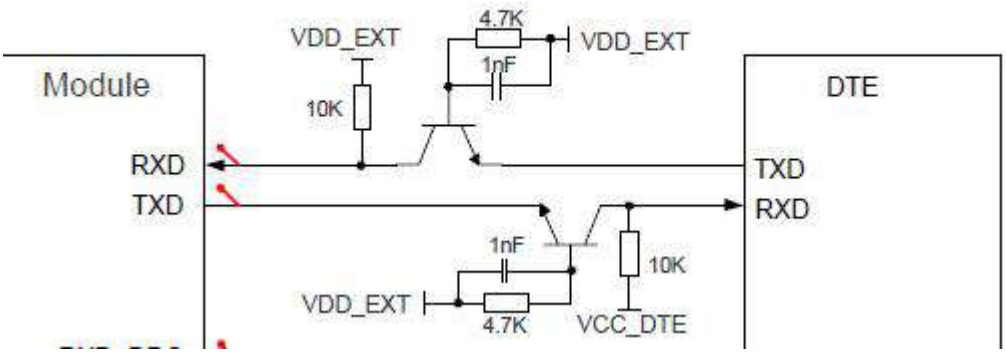
我司针对如下参考设计原理图（我司 DEMO 板的最小系统）可以提供 demo 软件，含数据协议。如果自行更改 IO 口功能需要走定制软件流程，不推荐。



备注：

1. UWB_TXD, UWB_RXD 为 3.3V TTL 电平,如需电平转换可以参考如下电平转换电路：

UWB_TXD,UWB_RXD is 3.3V TTL voltage level. If you need voltage shift please refer to the circuit below:



2. 为防止静电对模块造成损害，请把使用到的有可能外露的 IO 口增加 ESD 保护器件，参考原理图中按键处预留；

Please reserve ESD protect circuit to all pins you might used or exposed, such as the button protect circuit in the reference.

3. P015 模式选择脚为双模块主从切换的预留，单模块时需要拉低；

P015 GPIO is reserved for SPI Master/Slave switch in 2 module mode, if you use just 1 module please ground it.

4. 为方便调试，请把 Jlink 下载口接出 4pin 2.54 排针，方便烧录软件。

Please reserve a 2.54mm pitch 4 pin needle holes for downloading firmware using Jlink.

8 PCB 封装和 Layout 指导 PCB Footprint and Layout notice

我司提供 PADS VX2.4, CAD 格式的封装，如有需要，请联系技术支持。建议 Layout 时，发给技术支持 Review 下。

We can supply footprint in PADS VX2.4,Auto CAD2010 formart. And we can help review your design when you finish SKU620 layout. Please contact tech-support team for further information.

PCB 封装参考如下：

PCB footprint is as follows:

注 Notice：

1. 上方等腰梯形区域为焊接式 PCB 片状天线，当使用片状天线时，其对应区域及左右两侧不得有地平面或者其他起屏蔽效应的结构件。

The isosceles trapezoid PCB antenna area is copper fobidden, when using the soldering PCB antenna(SKU620-P). And the nearing left and right and up area of the antenna cannot have ground component like shield cover.

2. 使用 SMA 外接天线时，SMA 对应下方 PCB 板应镂空，或者把模块 SMA 头伸出 PCB 板外。

When using SMA to connect external antenna(SKU620-E), the PCB below SMA should be cut or put the SMA side out of your PCB.

3. Pin 间距默认 2.3mm，除非下图特殊标出；焊盘为标准跑道型结构（两个直径 1.4mm 半圆被长 1.4，宽 9mm 矩形隔开）。

The pin pitch is default 2.3mm unless remarked on the next figure; The pin is standard racetrack shape (two half circle whose diameter is 1.4mm, isolated by a 1.4mm*0.9mm rectangle).

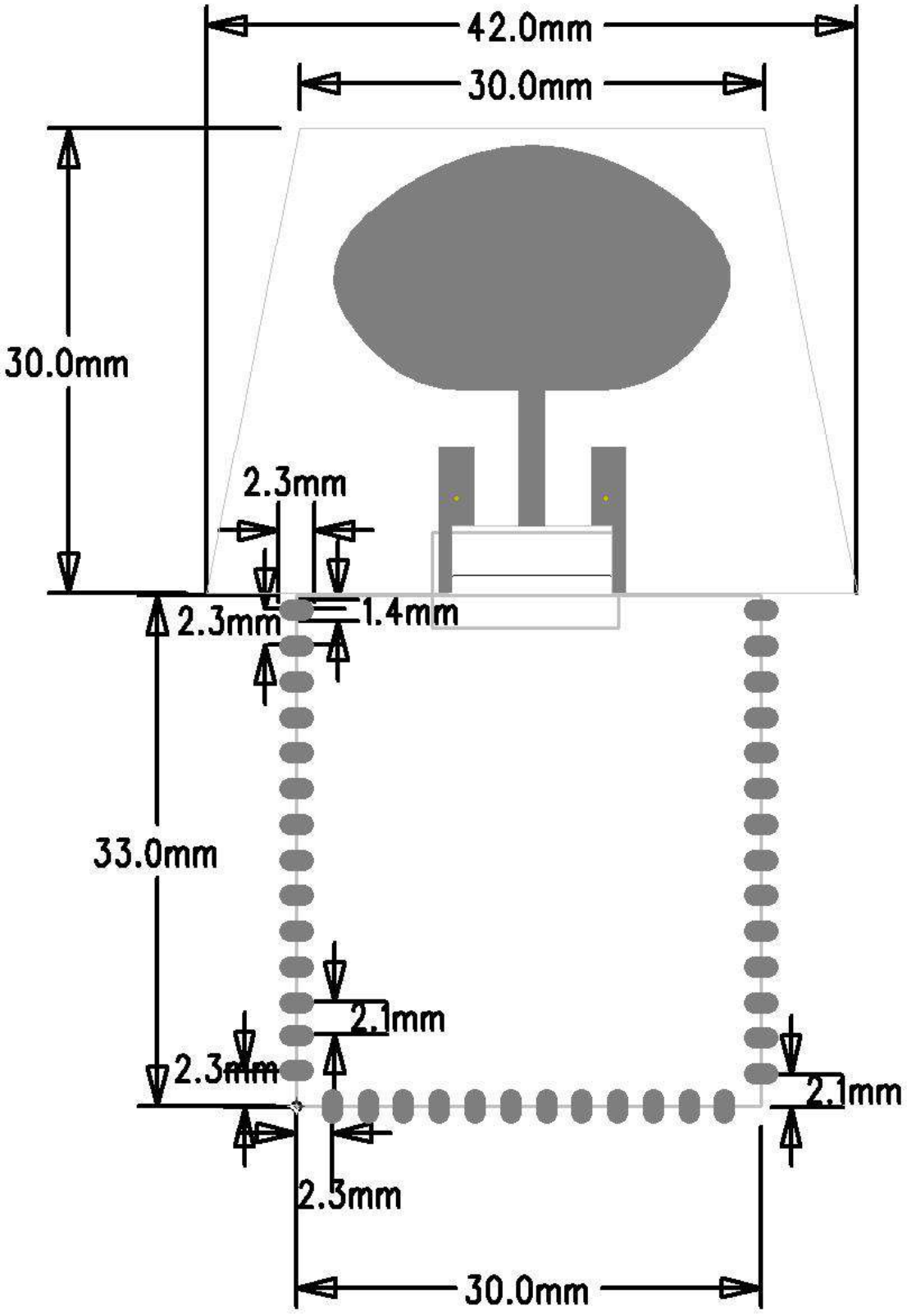


Figure 8-1: SKU620 PCB Footprint and Dimensions(units: mm)

9 生产流程建议 Manufacturing Process Recommendations

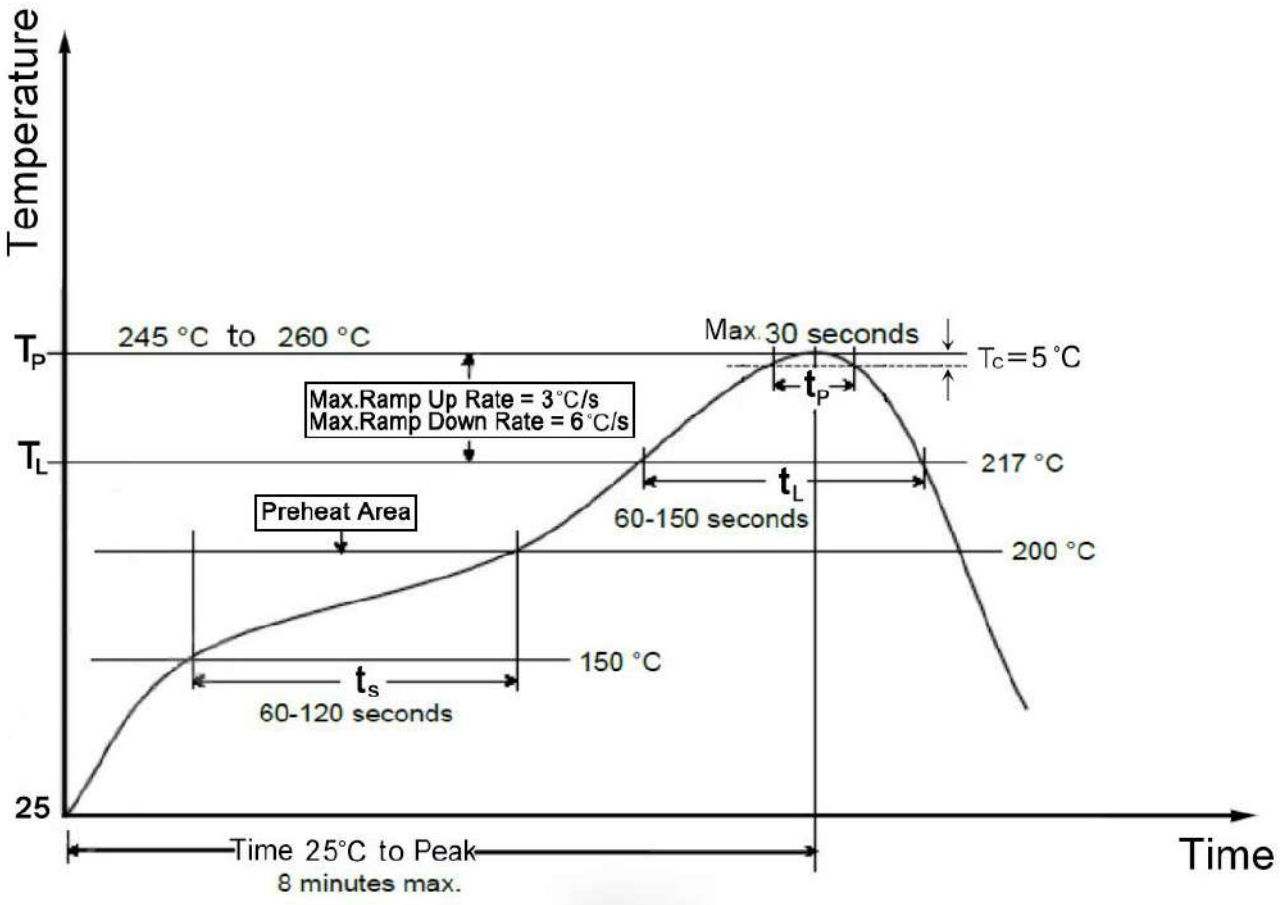


Figure 9-1: SKU620Typical Lead-free Soldering Profile 无铅回流焊接炉温曲线

注：在工厂选择的最终回流焊接温度图取决于其他外部因素，例如焊接膏的选择、模块基板的尺寸、厚度和性能等。超过推荐焊接曲线中的最高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.

静电防护 ESD precautions

SKU620 模块包含高度敏感的电子电路，属于静电敏感器件(ESD)。在没有适当的静电放电保护的情况下使用 SKU620 模块可能会永久的破坏或损坏它们。

SKU620 模块是静电敏感器件，需要适用于静电敏感元件特殊的静电防护措施，正确的 ESD 处理和包装流程必须应用在使用 SKU620 模块的过程中，包括处理、运输和操作包含 SKU620 模块的任何应用程序。不可裸手触摸模块或用不防静电烙铁焊接，以免损坏模块。

SKU620 series modules are Electrostatic Sensitive Devices and require special precautions while handling. The SKU620 modules contain highly sensitive electronic circuitry and are Electrostatic Sensitive Devices (ESD). Handling the SKU620 modules without proper ESD protection may destroy or damage them permanently.

The SKU620 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 SKU620 module. Don't touch the module by hand or solder with non-anti-static soldering iron to avoid damage to the module.

10 历史版本 History

版本号/Version	更新内容/Content	制作人/Maker	日期/Date
V1.01	初始文档/Initial release	Sherman	20201130

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