



# RN52x DataSheet

v1.1.0-en

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## 1. Revision History

Date	Version	Description
2019/01	1.0.0	First Release
2020/03	1.1.0	Add Recommended metal mask for solder printing Add SMT Reflow Profile

## 2. Overview



The RN52x module based on the nRF52840 is an advanced, highly flexible single chip solution for today's increasingly demanding ULP wireless applications for connected devices on our person, connected living environments and the IoT at large. It is designed ready for the major feature advancements of Bluetooth® 5 and takes advantage of Bluetooth 5's increased performance capabilities which include long range and high throughput modes. Inherent industry-grade security is essential in today's applications. The RN52x module based on the nRF52840 adds best-in-class security for Cortex™-M Series with on-chip ARM® CryptoCell cryptographic accelerator.

### **Bluetooth 5 – Bluetooth Low Energy further and faster**

The RN52x module based on the nRF52840 is ready to take advantage of the considerable performance improvements for Bluetooth LE with the arrival of the Bluetooth 5 specification. Of greatest importance is the support for longer range (up to x4 compared to Bluetooth 4.x) and doubling of on-air data-rate, up to 2 Mbps from 1 Mbps in Bluetooth 4.x.

### **Thread certified and 802.15.4 support**

The RN52x module based on the nRF52840 is a Thread certified component and as such is ideal for home networking products using the Thread mesh stack. The radio supports 802.15.4 PHY and MAC layers and makes it suitable for additional stacks using 802.15.4 such as Zigbee.

## High link budget for in-home applications

The RN52x module is the ideal solution for smart connected home applications. It supports both Bluetooth 5's Long Range feature and also 802.15.4 which is already a popular technology for home networking protocols. With a maximum output power of 8 dBm a total link budget of >111 dBm is achievable for achieving robust communications through objects within the home.

## Arm CryptoCell 310

The RN52x module features an on-chip Arm CryptoCell 310 cryptographic hardware accelerator. CryptoCell offers a wide range of ciphers and security features for building solid security into applications from the ground up. Use of CryptoCell also makes associated security operations run faster and uses less processing time and power than equivalent operation carried out in software by the CPU.

## OTA DFU

The RN52x module is supported by Over-the-Air Device Firmware Upgrade (OTA-DFU). This allows for in the field updates of application and/or protocol stack.

## Nordic SoftDevices

Nordic protocol stacks are known as SoftDevices. SoftDevices are pre-compiled binaries without runtime dependencies. They reside in a separate memory location to your application and offer safer, easier, and more secure application development. The RN52x module is supported by the S140 SoftDevice which supports 20 links operating concurrently.

## S140 SoftDevice

The S140 SoftDevice supports 20 Bluetooth LE links in concurrent operation operation for all 4 roles (Central/Peripheral/Broadcaster/Observer). The S140 is a Bluetooth 5 qualified stack and as such supports the latest long range and high throughput features introduced in Bluetooth 5.

## 2.1. Features

- Bluetooth 5, IEEE 802.15.4-2006, 2.4 GHz transceiver
  - -95 dBm sensitivity in 1 Mbps Bluetooth low energy (BLE) mode
  - -103 dBm sensitivity in 125 kbps BLE mode (long range)
  - +8 dBm TX power (down to -20 dBm in 4 dB steps)
  - On-air compatible with nRF52, nRF51, nRF24L and nRF24AP Series
  - Supported data rates:
    - Bluetooth 5: 2 Mbps, 1 Mbps, 500 kbps and 125 kbps
    - IEEE 802.15.4-2006: 250 kbps
    - Proprietary 2.4 GHz: 2 Mbps, 1 Mbps
  - Single-ended antenna output (on-chip balun)
  - 128-bit AES/ECB/CCM/AAR co-processor (on-the-fly packet encryption)
  - RSSI (1 dB resolution)
- ARM Cortex-M4 32-bit processor with FPU, 64 MHz
  - 212 EEMBC CoreMark score running from flash memory
  - 52  $\mu$ A/MHz running from flash memory
  - Watchpoint and trace debug modules (DWT, ETM and ITM)
  - Serial wire debug (SWD)
- ARM TrustZone Cryptocell 310 security subsystem
  - NIST SP800-90A and SP800-90B compliant random number generator
  - AES-128: ECB, CBC, CMAC/CBC-MAC, CTR, CCM/CCM
  - Chacha20/Poly1305 AEAD supporting 128- and 256-bit key size
  - SHA-1, SHA-2 up to 256 bits
  - Keyed-hash message authentication code (HMAC)
  - RSA up to 2048-bit key size
  - SRP up to 3072-bit key size
  - ECC support for most used curves, among others P-256 (secp256r1) and Ed25519/Curve25519
  - Application key management using derived key model

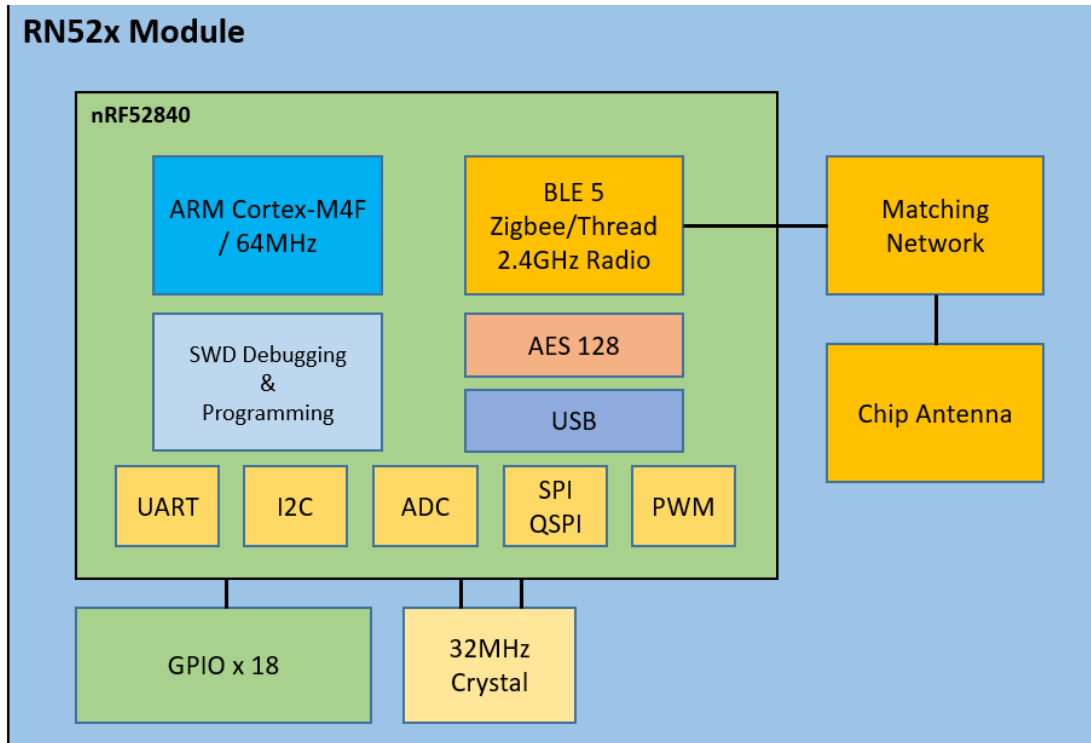
- Secure boot ready
  - Flash access control list (ACL)
  - Root-of-trust (RoT)
  - Debug control and configuration
  - Access port protection (CTRL-AP)
- Secure erase
- Flexible power management
  - 1.7 V-5.5 V supply voltage range
  - Automated peripheral power management
  - Fast wake-up using 64 MHz internal oscillator
- 1 MB flash and 256 kB RAM
- Advanced on-chip interfaces
  - USB 2.0 full speed (12 Mbps) controller
  - Programmable peripheral interconnect (PPI)
  - EasyDMA automated data transfer between memory and peripherals
- Nordic SoftDevice ready with support for concurrent multi-protocol
- 12-bit, 200 ksps ADC - 8 configurable channels with programmable gain
- 64 level comparator
- 15 level low-power comparator with wake-up from System OFF mode
- Temperature sensor
- 4x 4-channel pulse width modulator (PWM) unit with EasyDMA
- Audio peripherals: I2S, digital microphone interface (PDM)
- 5x 32-bit timer with counter mode
- Up to 4x SPI master/3x SPI slave with EasyDMA
- Up to 2x I2C compatible 2-wire master/slave
- 2x UART (CTS/RTS) with EasyDMA
- Quadrature decoder (QDEC)
- 3x real-time counter (RTC)

## 2.2. Application

- Internet of Things (IoT)
  - Home automation
  - Sensor networks
  - Building automation
  - Industrial
  - Retail
- Computer peripherals and I/O devices
  - Mouse
  - Keyboard
  - Multi-touch trackpad
- Interactive entertainment devices
  - Remote control
  - Gaming controller
- Beacons
- Personal Area Networks
  - Health/fitness sensor and monitor devices
  - Medical devices
  - Key-fobs + wrist watches
- Remote control toys
- Wireless Mesh Network

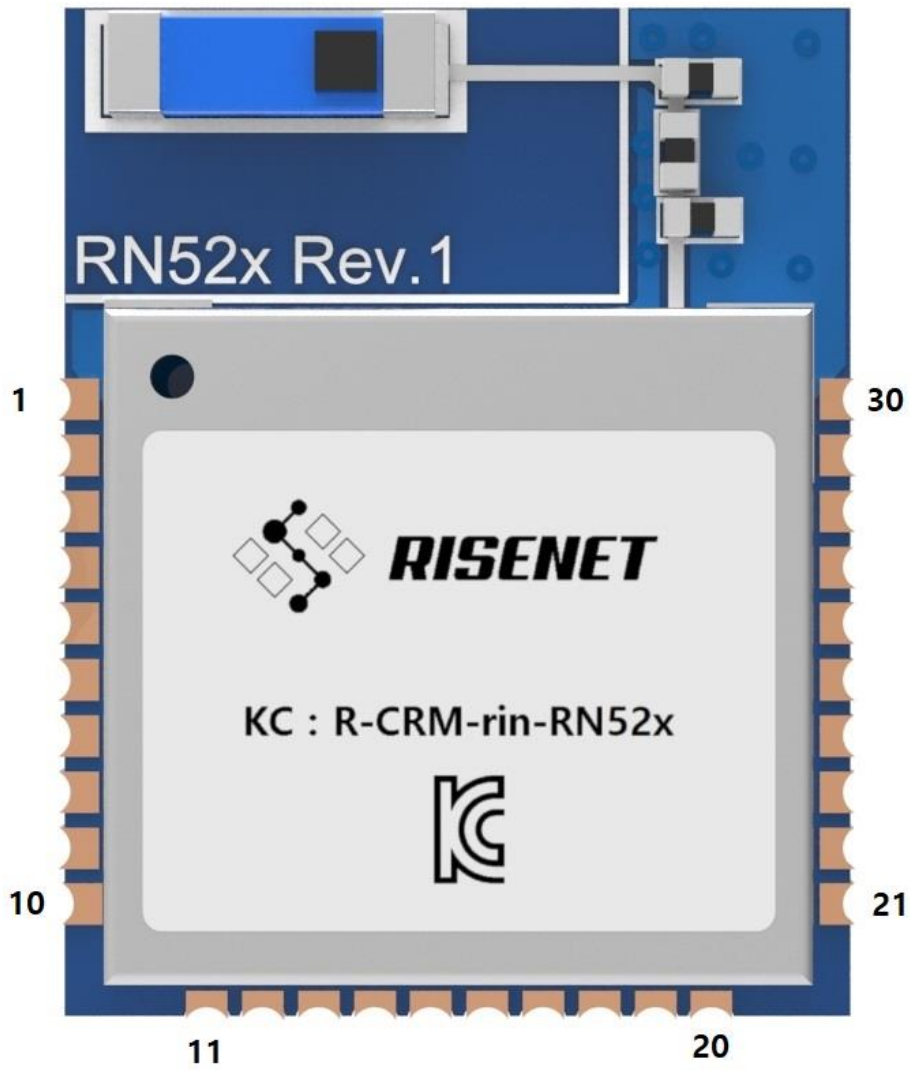


## 2.3. Block Diagram



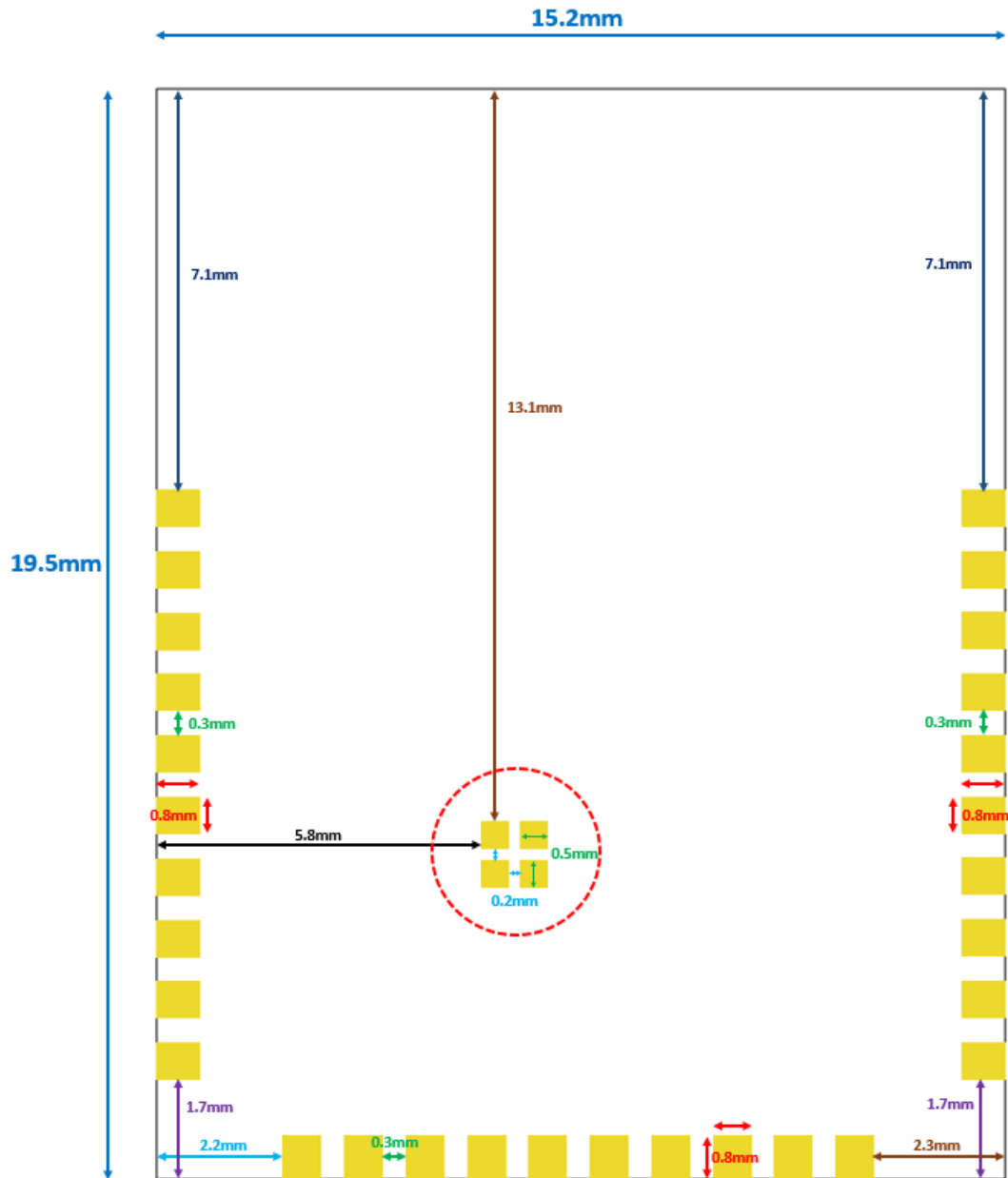
The RN52x module includes a matching network for chip antenna.

### 3. Pin Assignments and Functions



Pin	Pin Name	Pin Function	Description
1	GND	Power	Ground (0 V).
2	P0.03 AIN1	Digital I/O Analog Input	General purpose I/O. Analog input. Standard drive, low frequency I/O only
3	P0.29 AIN5	Digital I/O Analog Input	General purpose I/O. Analog input. Standard drive, low frequency I/O only
4	P0.00 XL1	Digital I/O Analog Input	General purpose I/O. Connection for 32.768 kHz crystal.
5	P0.01 XL2	Digital I/O Analog Input	General purpose I/O. Connection for 32.768 kHz crystal.
6	P0.26	Digital I/O	General purpose I/O
7	P0.04 AIN2	Digital I/O Analog Input	General purpose I/O. Analog input.
8	P0.05 AIN3	Digital I/O Analog Input	General purpose I/O. Analog input.
9	P0.07 TRACECLK	Digital I/O Trace clock	General purpose I/O. Trace buffer clock.
10	P1.09 TRACEDATA3	Digital I/O Trace data	General purpose I/O. Trace buffer TRACEDATA[3].
11	GND	Power	Ground (0 V).
12	VDD_OUT	Power	Power supply.
13	P0.11 TRACEDATA2	Digital I/O Trace data	General purpose I/O. Trace buffer TRACEDATA[2].
14	P0.12 TRACEDATA1	Digital I/O Trace data	General purpose I/O. Trace buffer TRACEDATA[1].
15	VDDH	Power	High voltage power supply
16	DECUSB	Power	USB 3.3 V regulator supply decoupling
17	VBUS	Power	5 V input for USB 3.3 V regulator
18	D-	Digital I/O	USB D-
19	D+	Digital I/O	USB D+
20	GND	Power	Ground (0 V).
21	P0.14	Digital I/O	General purpose I/O.
22	P0.18 nRESET	Digital I/O	General purpose I/O. Configurable as system RESET.
23	P0.19	Digital I/O	General purpose I/O.
24	SWDIO	Digital I/O	Serial wire debug I/O for debug and programming
25	SWDCLK	Digital Input	Serial wire debug clock input for debug and programming
26	P0.21	Digital I/O	General purpose I/O.
27	P0.22	Digital I/O	General purpose I/O.
28	P0.23	Digital I/O	General purpose I/O.
29	P1.00 TRACEDATA0	Digital I/O Trace data	General purpose I/O. Trace buffer TRACEDATA[0]. Serial wire output (SWO).
30	GND	Power	Ground (0 V).

## 4. Module Layout



RN52x Dimension and Bottom Pad (Top View)



The recommended metal mask sizes for the bottom pad type of the RN52x module are shown below.

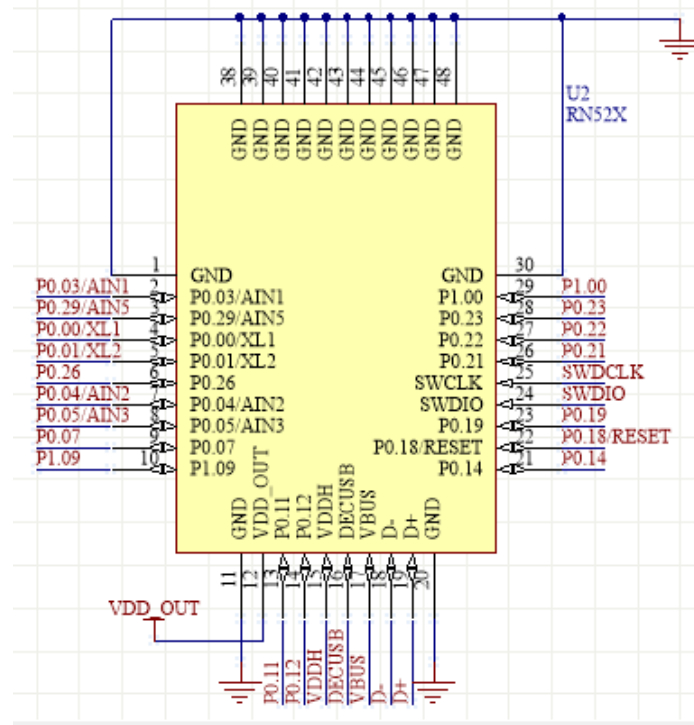
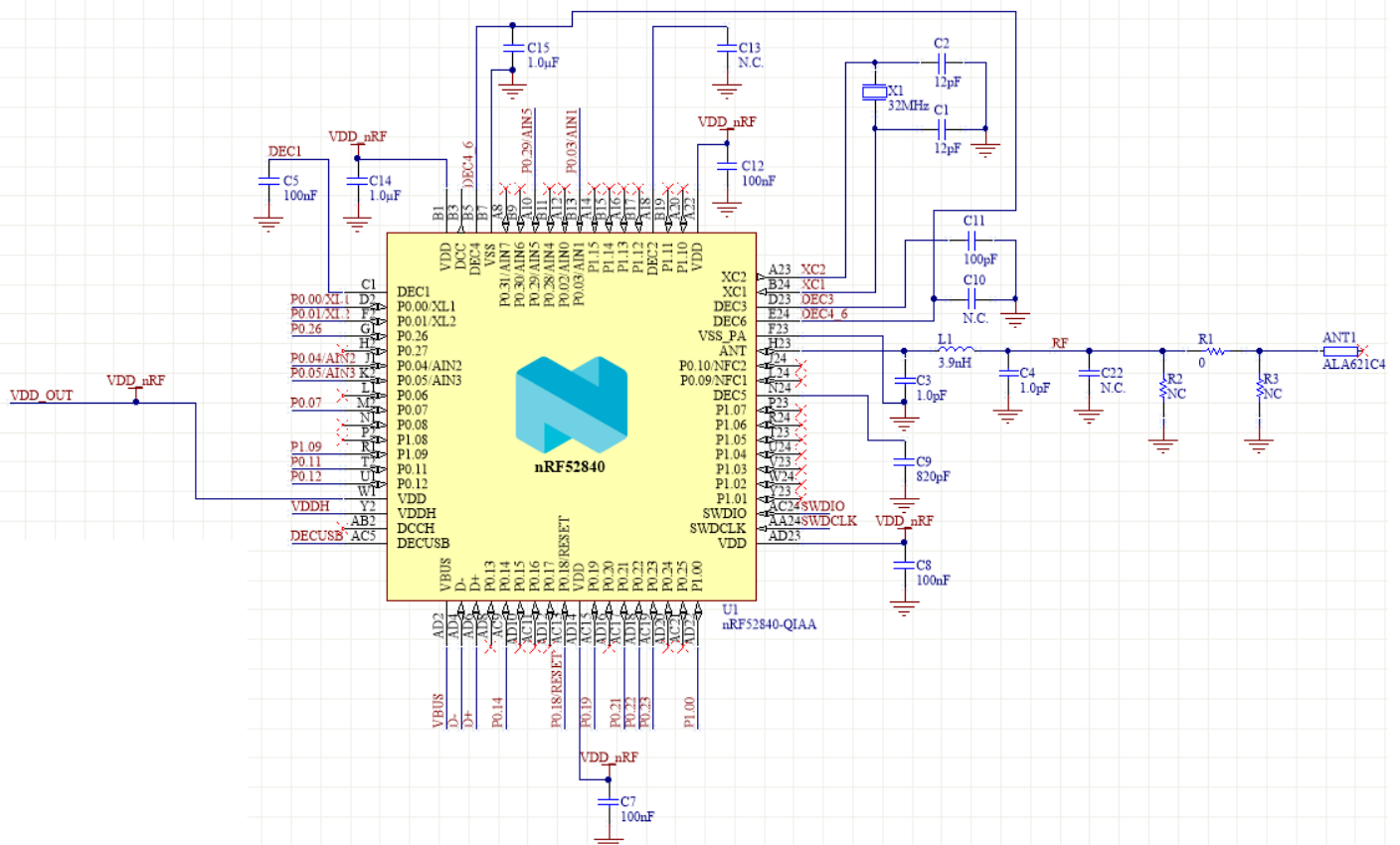
**<Recommended metal mask for solder printing>**

<b>Pad</b>	<b>Pad size</b>	<b>Mask opening</b>
Signal pad	0.8 x 0.8 mm	0.7 x 0.7 mm
Center pad	0.5 x 0.5 mm	0.4 x 0.4 mm

The metal mask thickness :  $t = 0.1\text{mm}$

The solder volume should be same by changing the mask opening if different metal mask thickness is used.

## 5. Module Schematics

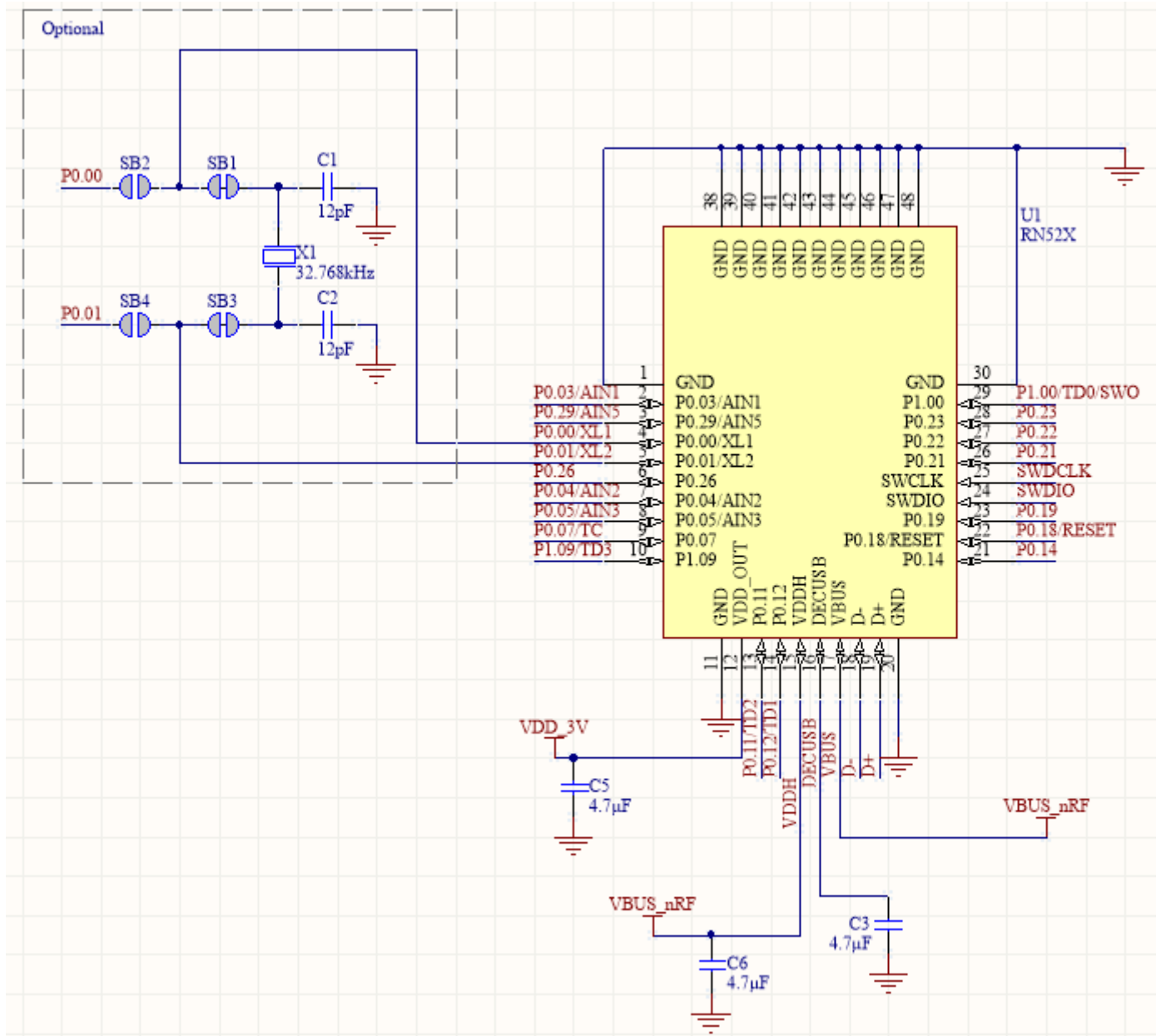


## 6. Module Reference

Config no.	Supply configuration		Features that can be enabled for each configuration example				
	VDDH	VDD	EXTSUPPLY	DCDCEN0	DCDCEN1	USB	NFC
Config. 1	USB (VDDH = VBUS)	N/A	Yes	No	No	Yes	No
Config. 2	Battery/Ext. regulator	N/A	Yes	No	No	Yes	No
Config. 3	N/A	Battery/Ext. regulator	No	No	No	Yes	No
Config. 4	Battery/Ext. regulator	N/A	Yes	Yes	Yes	Yes	No
Config. 5	N/A	Battery/Ext. regulator	No	No	Yes	Yes	Yes
Config. 6	N/A	Battery/Ext. regulator	No	No	No	No	No

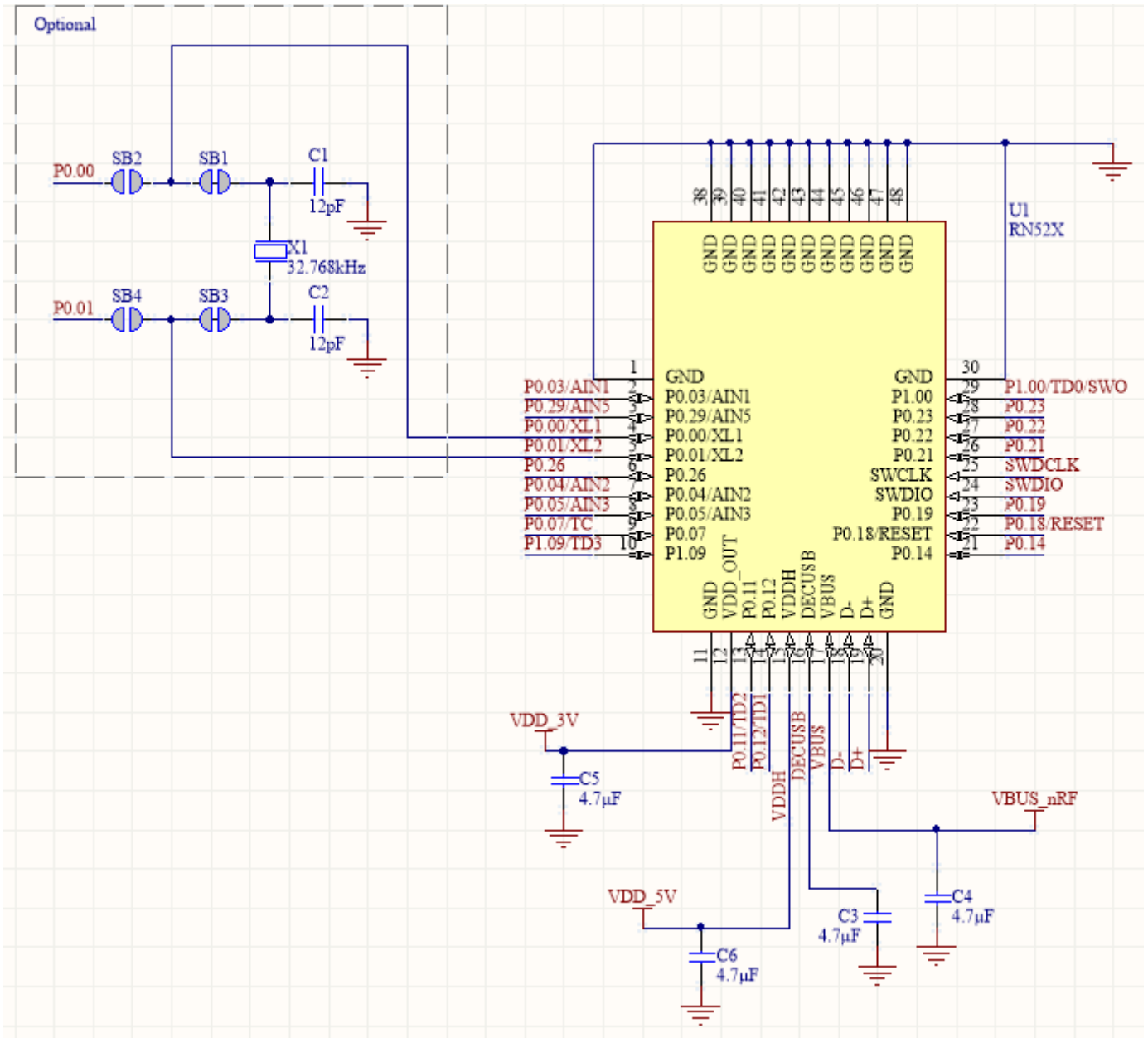
RN52x module supports Config-1,2,3,6 during supply configuration provided by nRF52840.

## 6.1. Config-1

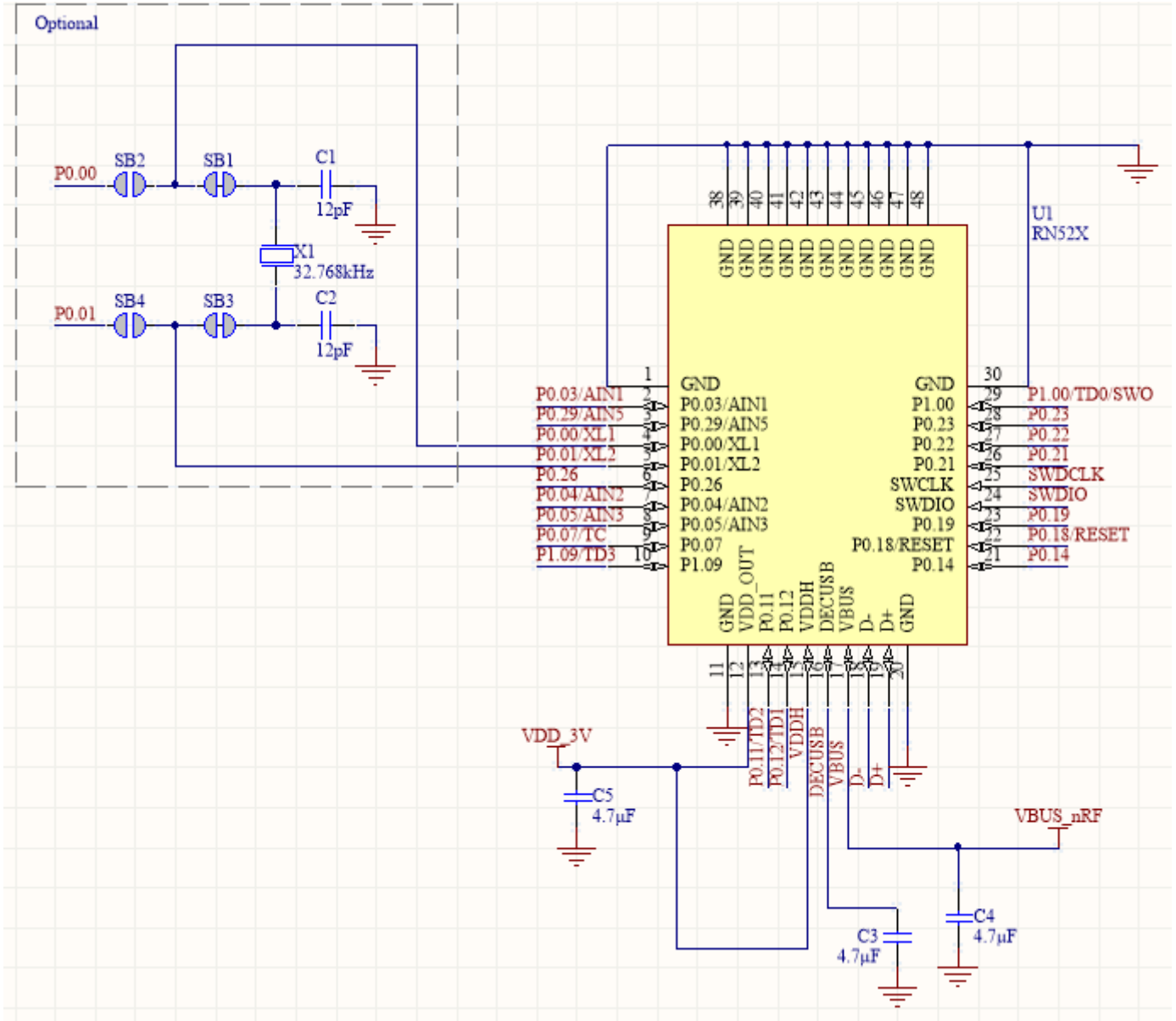




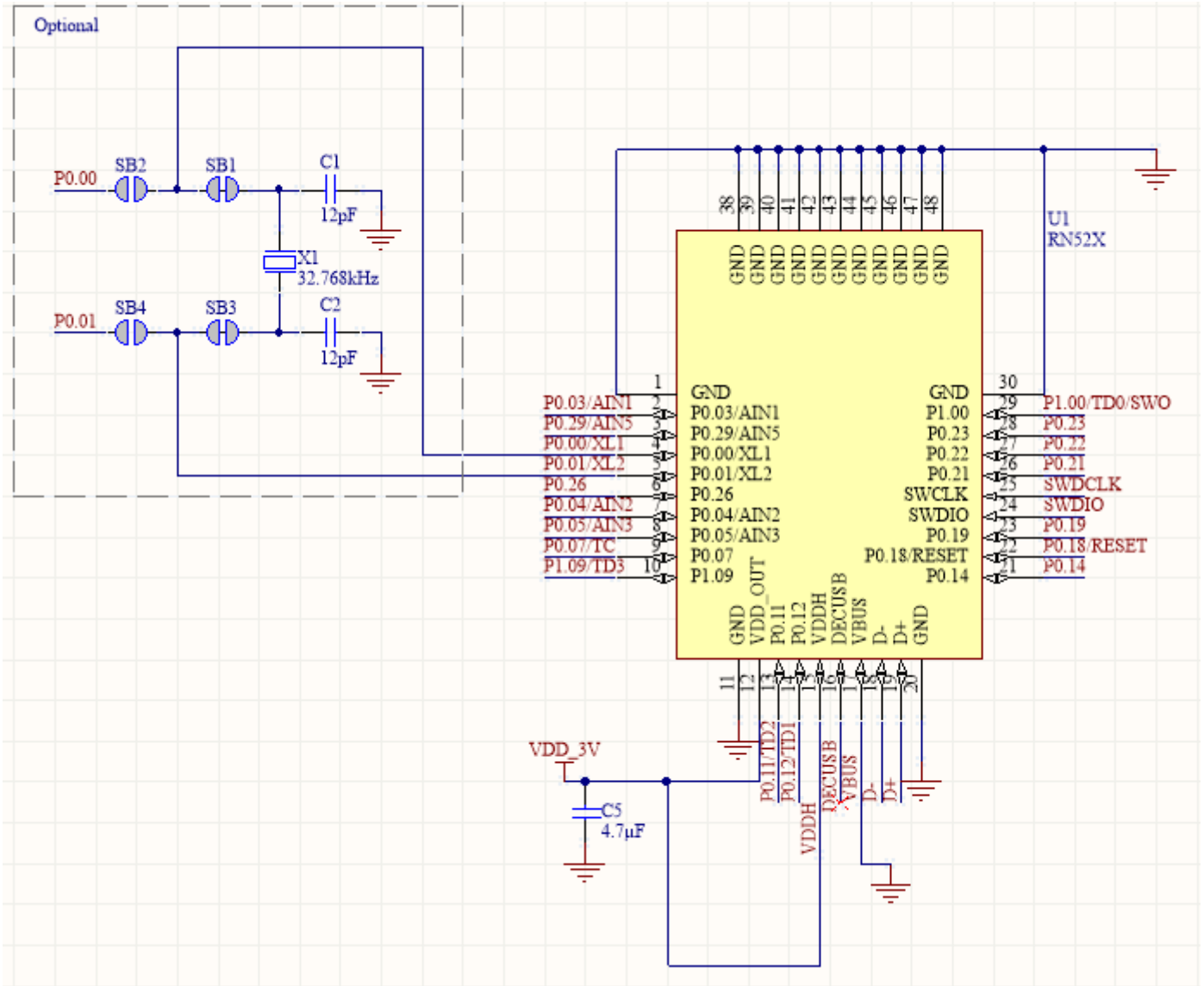
## 6.2. Config-2



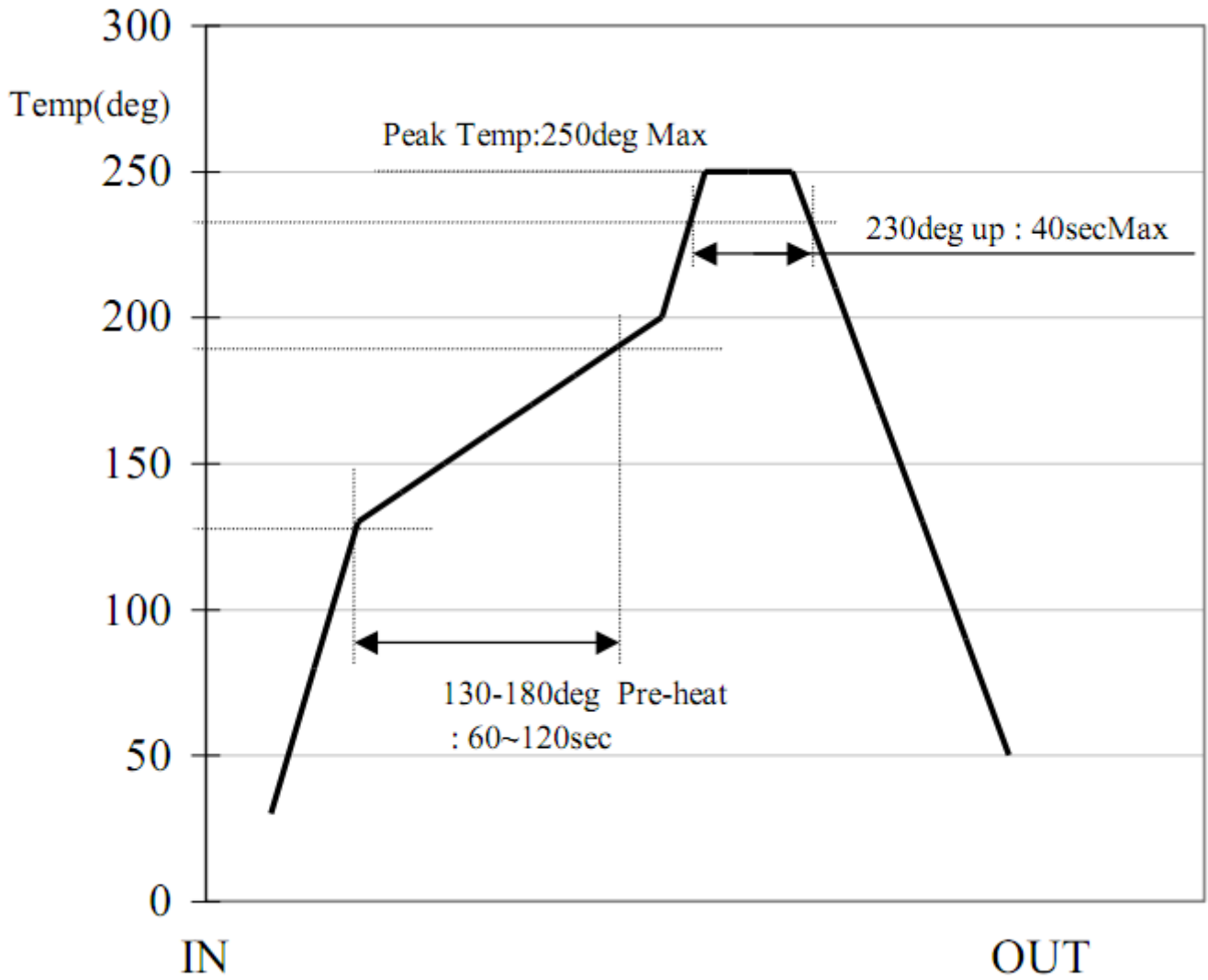
### 6.3. Config-3



## 6.4. Config-6



## 7. SMT Reflow Profile



## 8. Certification

### 8.1. KC (Republic of Korea)

<b>방송통신기자재등의 적합인증서</b> <i>Certificate of Broadcasting and Communication Equipments</i>	
상호 또는 성명 <i>Trade Name or Applicant</i>	(주)라이즈넷
기자재명칭(명칭) <i>Equipment Name</i>	특정소출력 무선기기(무선데이터통신시스템용 무선기기)
기본모델명 <i>Basic Model Number</i>	RN52x
파생모델명 <i>Series Model Number</i>	
인증번호 <i>Certification No.</i>	R-C-rin-RN52x
제조사/제조국가 <i>Manufacturer/ Country of Origin</i>	(주)라이즈넷 / 한국
인증연월일 <i>Date of Certification</i>	2019-05-31
기타 <i>Others</i>	
<p>위 기자재는 「전파법」 제58조의2 제2항에 따라 인증되었음을 증명합니다.</p> <p>It is verified that foregoing equipment has been certificated under the Clause 2, Article 58-2 of Radio Waves Act.</p> <p style="text-align: right;">2019년(Year) 05월(Month) 31일(Day)</p> <p style="text-align: center;">국립전파연구원장</p> <p style="text-align: center;"></p> <p style="text-align: center;"><i>Director General of National Radio Research Agency</i></p> <p style="text-align: center; color: red; font-size: small;">※ 인증 받은 방송통신기자재는 반드시 "적합성평가표시" 를 부착하여 유통하여야 합니다. 위반시 과태료 처분 및 인증이 취소될 수 있습니다.</p>	