



# MN52H-C40

## Bluetooth® Low Energy Module

### Datasheet Version A

#### Ordering Code

MN52H-C40 module for Box packaging: MN-840A2-01A-CB

## BLE Solution: Nordic NRF52840

| RF IC              | Crystal                 | Chip antenna |
|--------------------|-------------------------|--------------|
| Nordic NRF52840/V2 | 32MHz/20ppm<br>Embedded | Embedded     |

# Overview and Benefits

## Overview

The MN52H-C40 from **Aradconn** is a highly flexible, ultra-low power, Bluetooth Low Energy module based on the nRF52840 SoC from Nordic Semiconductor. With an Arm® Cortex®-M4 with FPU 32-bit processor, embedded 2.4GHz transceiver, and integrated chip antenna. Providing full use of the nRF52840's capabilities and peripherals, which include I2C, SPI, UART, I2S, ADC, GPIO, PWM, NFC and USB interfaces.

## Benefits

- **Bluetooth qualification and Regulatory certification reduce the burden to enter the market.**
- **Complete RF solution with no additional RF design, allowing faster time to launch a new product, and providing long working distance.**

**MN52H-C: up to 550 meters in open space. @1 Mbps**

- **Compact size: (L) 15.5 x (W) 10.1 x (H) 2.1mm.**
- **Provides flexibility in the OEM's application development choice with full support for using Nordic SDK and firmware tools.**

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# 1. Features and Application

## 1.1 Features

### • 2.4 GHz transceiver

- -95 dBm sensitivity in 1Mbps Bluetooth® low energy mode
- -103 dBm sensitivity in 125kbps Bluetooth® low energy mode(long range)
- -20 to +8dBm TX power, configurable in 4 dB steps
- Supported data rates:
  - Bluetooth® 5 – 2 Mbps, 1 Mbps, 500 kbps, and 125 kbp
  - IEEE 802.15.4-2006 – 250 kbps
  - Proprietary 2.4 GHz – 2 Mbps, 1 Mbps
- 4.8 mA peak current in TX (0 dBm)
- 4.6 mA peak current in RX
- RSSI (1 dB resolution)

### • Arm® Cortex®-M4 32-bit processor with FPU, 64 MHz

- 212 EEMBC CoreMark® score running from flash memory
- 52 µA/MHz running from flash memory
- Serial wire debug (SWD)

### • Flexible power management

- 1.7 V–5.5 V supply voltage range
- On-chip DC/DC and LDO regulators with automated low current modes
- 1.8 V to 3.3 V regulated supply for external components
- 0.4 µA at 3 V in System OFF mode, no RAM retention
- 1.5 µA at 3 V in System ON mode, no RAM retention, wake on RTC

### • Memory

- 1MB flash/256 kB RAM

### • USB 2.0 full speed (12 Mbps) controller

### • QSPI 32 MHz interface

### • High-speed 32 MHz SPI

### • Nordic SoftDevice ready with support for concurrent multi-protocol

### • Type 2 near field communication (NFC-A) tag with wakeup-on-field and touch-to-pair capabilities

### • 12-bit, 200 ksps ADC - 8 configurable channels with programmable gain

### • 64 level comparator

### • 15 level low power comparator with wakeup from System OFF mode

### • Temperature sensor

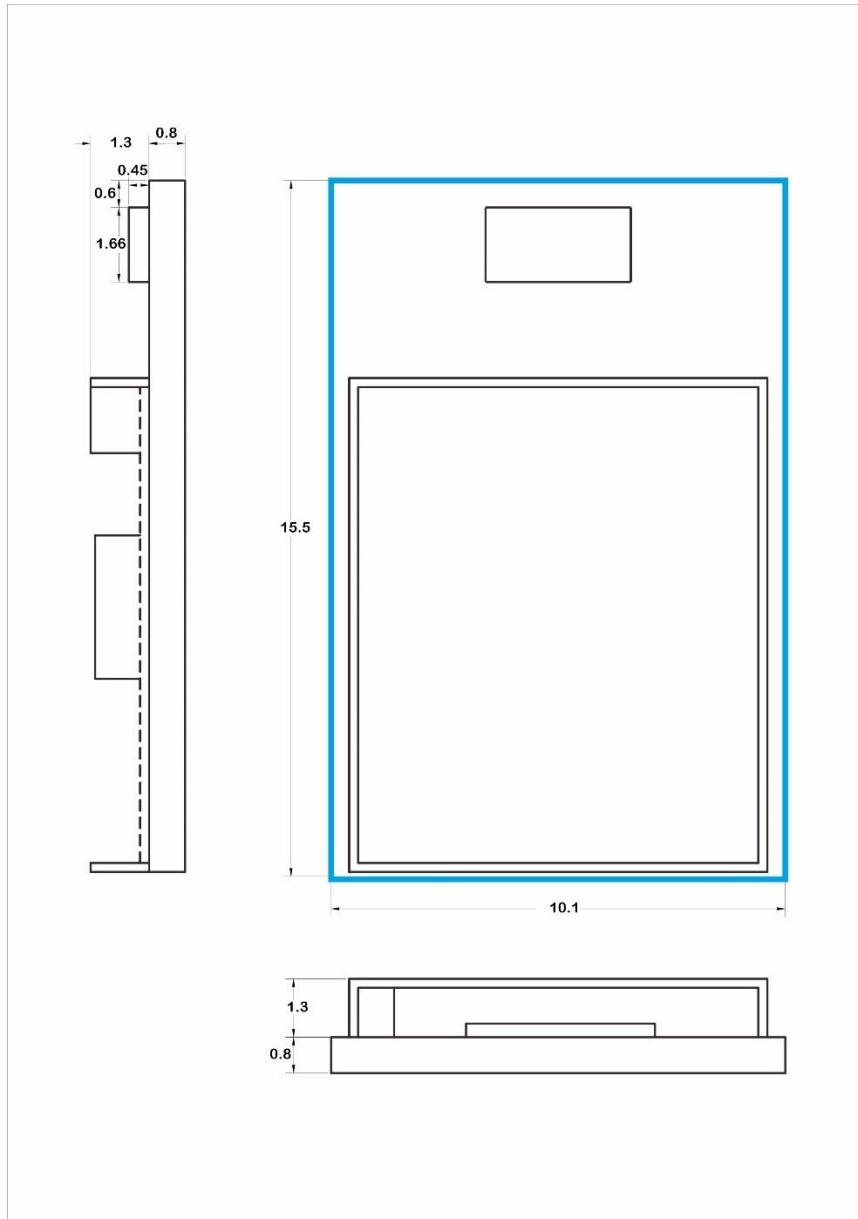
- 48 general purpose I/O pins
- 4x 4-channel pulse width modulator (PWM) unit with EasyDMA
- Digital microphone interface (PDM)
- 5x 32-bit timer with counter mode
- Up to 4x SPI master/3 x SPI slave with EasyDMA
- Up to 2x I2C compatible 2-wire master/slave
- I2S with EasyDMA
- 2 X UART (CTS/RTS) with EasyDMA
- Programmable peripheral interconnect (PPI)
- Quadrature decoder (QDEC)
- AES HW encryption with EasyDMA
- 3x real-time counter (RTC)
- Single crystal operation

## 1.2 Application

|                                                      |                                                                                                                                            |
|------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <b>IoT</b>                                           | <ul style="list-style-type: none"> <li>• Smart home sensors and controllers</li> <li>• Industrial IoT sensors and controllers</li> </ul>   |
| <b>Advanced wearables</b>                            | <ul style="list-style-type: none"> <li>• Health / fitness sensor and monitor device</li> <li>• Wireless payment enabled devices</li> </ul> |
| <b>Interactive entertainment devices</b>             | <ul style="list-style-type: none"> <li>• Remote control</li> <li>• Gaming controller</li> </ul>                                            |
| <b>Advanced computer peripherals and I/O devices</b> | <ul style="list-style-type: none"> <li>• Mouse</li> <li>• Keyboard</li> <li>• Multi-touch trackpad</li> </ul>                              |

## 2. Mechanical specifications

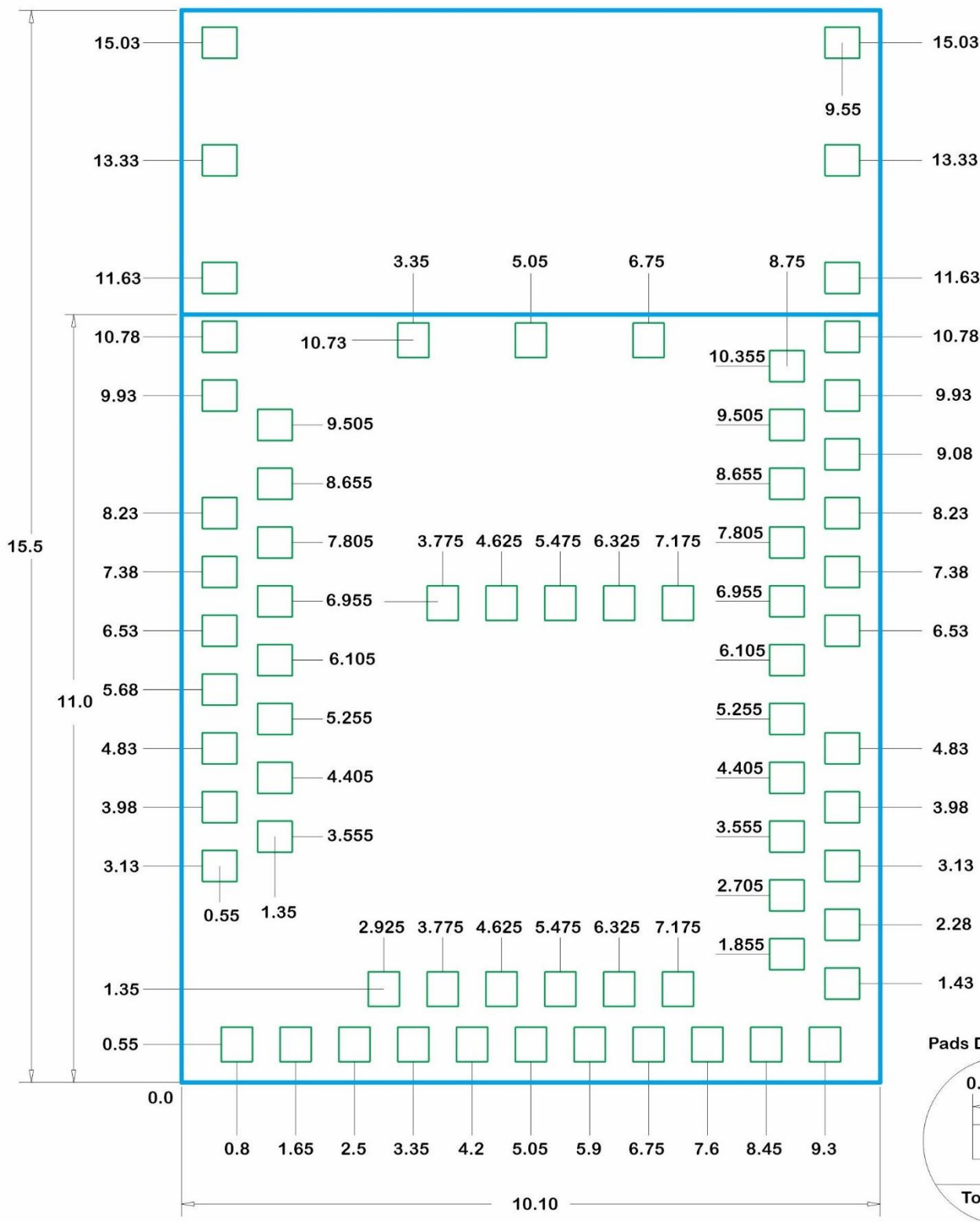
### 2.1 Dimensions



All dimensions are in millimeters.

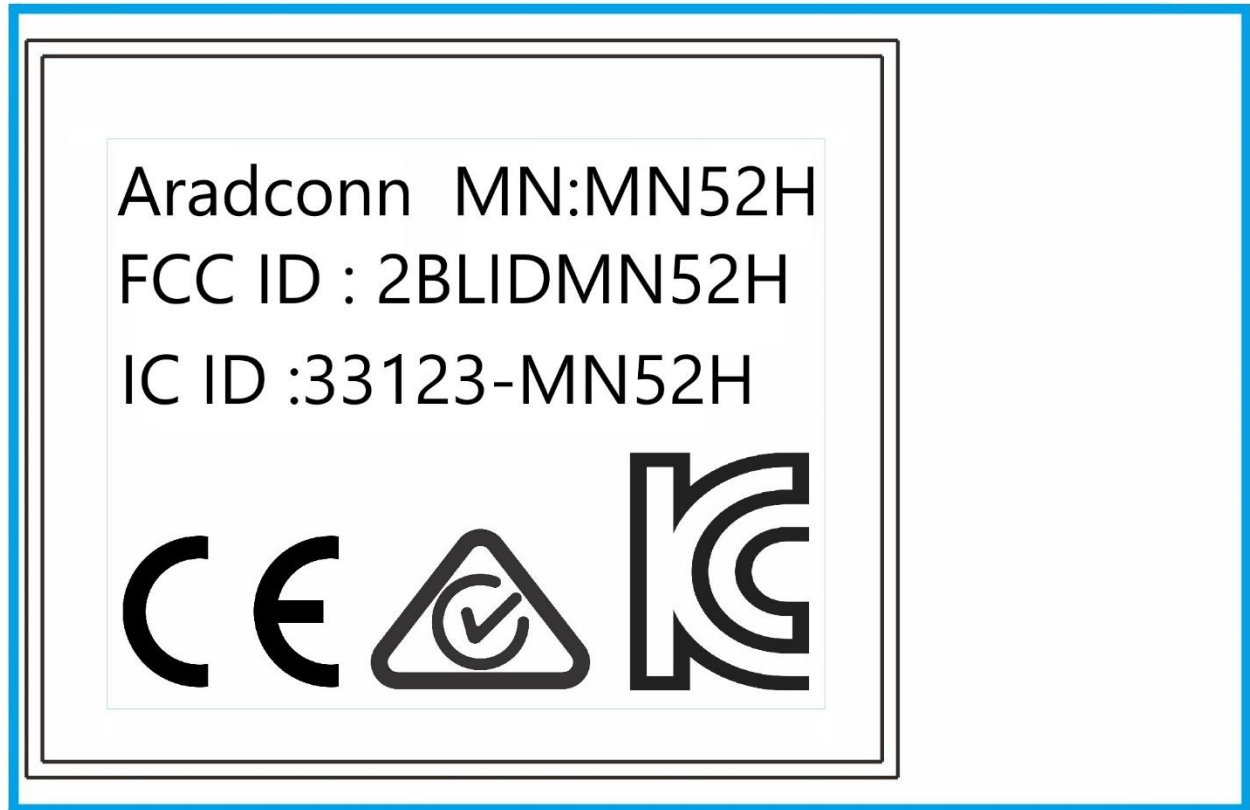
| Item   | Dimension | Tolerance |
|--------|-----------|-----------|
| Length | 15.5mm    | ±0.30 mm  |
| Width  | 10.1mm    | ±0.30mm   |
| Height | 2.1mm     | ±0.30mm   |

# 2.2 Footprint

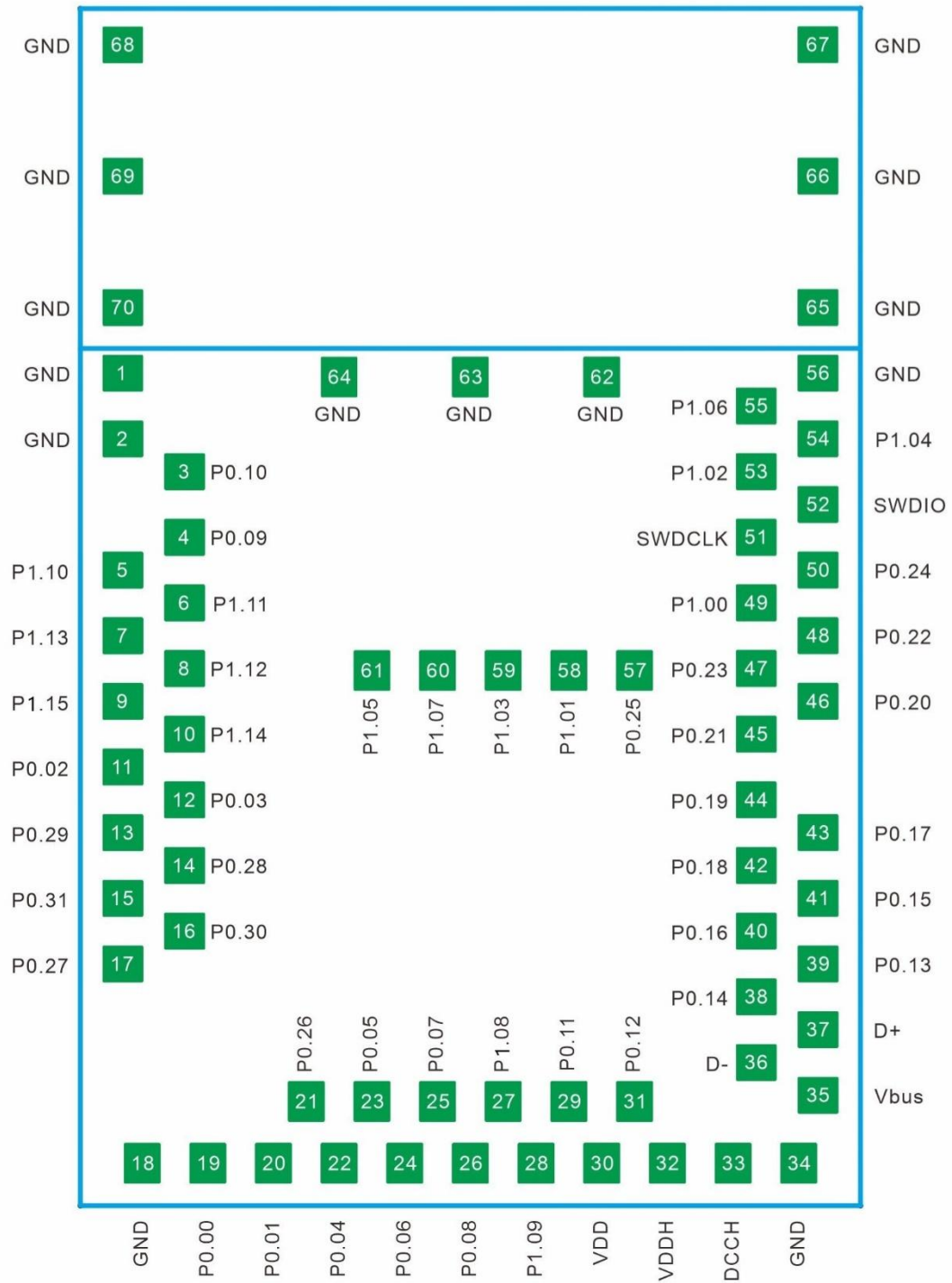


All dimensions are in millimeters.

## 2.3 Module Marking



### 3. Pin Assignment



| Pin No. | Name  | Pin function | Description                                       |
|---------|-------|--------------|---------------------------------------------------|
| (1)     | GND   | Ground       | The pad must be connected to a solid ground plane |
| (2)     | GND   | Ground       | The pad must be connected to a solid ground plane |
| (3)     | P0.10 | Digital I/O  | General-purpose I/O                               |
|         | NFC2  | NFC input    | NFC antenna connection                            |
| (4)     | P0.09 | Digital I/O  | General-purpose I/O                               |
|         | NFC1  | NFC input    | NFC antenna connection                            |
| (5)     | P1.10 | Digital I/O  | General-purpose I/O                               |
| (6)     | P1.11 | Digital I/O  | General-purpose I/O                               |
| (7)     | P1.13 | Digital I/O  | General-purpose I/O                               |
| (8)     | P1.12 | Digital I/O  | General-purpose I/O                               |
| (9)     | P1.15 | Digital I/O  | General-purpose I/O                               |
| (10)    | P1.14 | Digital I/O  | General-purpose I/O                               |
| (11)    | P0.02 | Digital I/O  | General-purpose I/O                               |
|         | AIN0  | Analog input | Analog input                                      |
| (12)    | P0.03 | Digital I/O  | General-purpose I/O                               |
|         | AIN1  | Analog input | Analog input                                      |
| (13)    | P0.29 | Digital I/O  | General-purpose I/O                               |
|         | AIN5  | Analog input | Analog input                                      |
| (14)    | P0.28 | Digital I/O  | General-purpose I/O                               |
|         | AIN4  | Analog input | Analog input                                      |
| (15)    | P0.31 | Digital I/O  | General-purpose I/O                               |
|         | AIN7  | Analog input | Analog input                                      |
| (16)    | P0.30 | Digital I/O  | General-purpose I/O                               |
|         | AIN6  | Analog input | Analog input                                      |
| (17)    | P0.27 | Digital I/O  | General-purpose I/O                               |
| (18)    | GND   | Ground       | The pad must be connected to a solid ground plane |
| (19)    | P0.00 | Digital I/O  | General-purpose I/O                               |
|         | XL1   | Analog input | Connection to 32.768kHz crystal (LFXO)            |
| (20)    | P0.01 | Digital I/O  | General-purpose I/O                               |
|         | XL2   | Analog input | Connection to 32.768kHz crystal (LFXO)            |
| (21)    | P0.26 | Digital I/O  | General-purpose I/O                               |
| (22)    | P0.04 | Digital I/O  | General-purpose I/O                               |
|         | AIN2  | Analog input | Analog input                                      |
| (23)    | P0.05 | Digital I/O  | General-purpose I/O                               |
|         | AIN3  | Analog input | Analog input                                      |
| (24)    | P0.06 | Digital I/O  | General-purpose I/O                               |
| (25)    | P0.07 | Digital I/O  | General-purpose I/O                               |
| (26)    | P0.08 | Digital I/O  | General-purpose I/O                               |
| (27)    | P1.08 | Digital I/O  | General-purpose I/O                               |
| (28)    | P1.09 | Digital I/O  | General-purpose I/O                               |
| (29)    | P0.11 | Digital I/O  | General-purpose I/O                               |
| (30)    | VDD   | Power        | Power-supply                                      |
| (31)    | P0.12 | Digital I/O  | General-purpose I/O                               |
| Pin No. | Name  | Pin function | Description                                       |

|      |        |             |                                                         |
|------|--------|-------------|---------------------------------------------------------|
| (32) | VDDH   | Power       | High voltage power supply                               |
| (33) | DCCH   | Power       | DC/DC converter output                                  |
| (34) | GND    | Ground      | The pad must be connected to a solid ground plane       |
| (35) | VBUS   | Power       | 5V input for USB 3.3V regulator                         |
| (36) | D-     | USB         | USB D-                                                  |
| (37) | D+     | USB         | USB D+                                                  |
| (38) | P0.14  | Digital I/O | General-purpose I/O                                     |
| (39) | P0.13  | Digital I/O | General-purpose I/O                                     |
| (40) | P0.16  | Digital I/O | General-purpose I/O                                     |
| (41) | P0.15  | Digital I/O | General-purpose I/O                                     |
| (42) | P0.18  | Digital I/O | General-purpose I/O                                     |
|      | nRESET |             | Configurable as pin RESET                               |
| (43) | P0.17  | Digital I/O | General-purpose I/O                                     |
| (44) | P0.19  | Digital I/O | General-purpose I/O                                     |
| (45) | P0.21  | Digital I/O | General-purpose I/O                                     |
| (46) | P0.20  | Digital I/O | General-purpose I/O                                     |
| (47) | P0.23  | Digital I/O | General-purpose I/O                                     |
| (48) | P0.22  | Digital I/O | General-purpose I/O                                     |
| (49) | P1.00  | Digital I/O | General-purpose I/O                                     |
| (50) | P0.24  | Digital I/O | General-purpose I/O                                     |
| (51) | SWDCLK | Debug       | Serial wire debug clock input for debug and programming |
| (52) | SWDIO  | Debug       | Serial wire debug I/O for debug and programming         |
| (53) | P1.02  | Digital I/O | General-purpose I/O                                     |
| (54) | P1.04  | Digital I/O | General-purpose I/O                                     |
| (55) | P1.06  | Digital I/O | General-purpose I/O                                     |
| (56) | GND    | Ground      | The pad must be connected to a solid ground plane       |
| (57) | P0.25  | Digital I/O | General-purpose I/O                                     |
| (58) | P1.01  | Digital I/O | General-purpose I/O                                     |
| (59) | P1.03  | Digital I/O | General-purpose I/O                                     |
| (60) | P1.07  | Digital I/O | General-purpose I/O                                     |
| (61) | P1.05  | Digital I/O | General-purpose I/O                                     |
| (62) | GND    | Ground      | The pad must be connected to a solid ground plane       |
| (63) | GND    | Ground      | The pad must be connected to a solid ground plane       |
| (64) | GND    | Ground      | The pad must be connected to a solid ground plane       |
| (65) | GND    | Ground      | The pad must be connected to a solid ground plane       |
| (66) | GND    | Ground      | The pad must be connected to a solid ground plane       |
| (67) | GND    | Ground      | The pad must be connected to a solid ground plane       |
| (68) | GND    | Ground      | The pad must be connected to a solid ground plane       |
| (69) | GND    | Ground      | The pad must be connected to a solid ground plane       |
| (70) | GND    | Ground      | The pad must be connected to a solid ground plane       |

### 3.1 GPIO Recommended usage

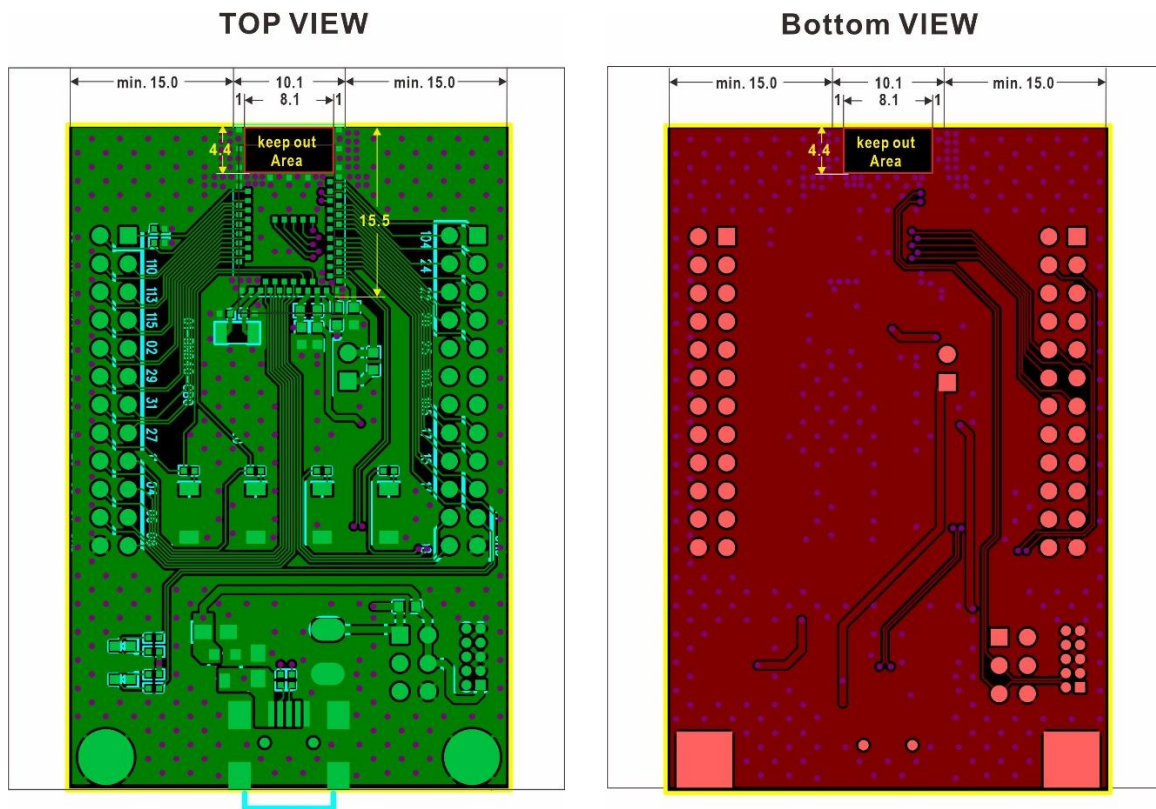
| Module<br>PIN NO. | NRF52840<br>GPIO | Recommended usage                                                                                                    |  |      |      |      |      |          |  |  |  |  |  |
|-------------------|------------------|----------------------------------------------------------------------------------------------------------------------|--|------|------|------|------|----------|--|--|--|--|--|
| 03                | P0.10            | These GPIO are Standard driver only                                                                                  |  |      |      |      |      |          |  |  |  |  |  |
| 04                | P0.09            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 05                | P1.10            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 06                | P1.11            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 07                | P1.13            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 08                | P1.12            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 09                | P1.15            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 10                | P1.14            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 11                | P0.02            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 12                | P0.03            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 13                | P0.29            | Description(Standard driver)                                                                                         |  | Min. | Typ. | Max. | Unit |          |  |  |  |  |  |
| 14                | P0.28            | VDD ≥1.7, output set low                                                                                             |  | 1    | 2    | 4    | mA   |          |  |  |  |  |  |
| 15                | P0.31            | VDD≥ 1.7, output set high                                                                                            |  | 1    | 2    | 4    | mA   |          |  |  |  |  |  |
| 16                | P0.30            | These GPIO are low frequency I/O only :<br>A frequency over 10kHz (UART, SPI, I2C,I2S PWM,QSPI) are not recommended. |  |      |      |      |      |          |  |  |  |  |  |
| 53                | P1.02            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 54                | P1.04            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 55                | P1.06            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 58                | P1.01            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 59                | P1.03            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 60                | P1.07            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 61                | P1.05            |                                                                                                                      |  |      |      |      |      |          |  |  |  |  |  |
| 42                | P0.18            |                                                                                                                      |  |      |      |      |      | QSPI/CSN |  |  |  |  |  |
| 44                | P0.19            |                                                                                                                      |  |      |      |      |      | QSPI/SCK |  |  |  |  |  |
| 45                | P0.21            | QSPI                                                                                                                 |  |      |      |      |      |          |  |  |  |  |  |
| 47                | P0.23            | QSPI                                                                                                                 |  |      |      |      |      |          |  |  |  |  |  |
| 48                | P0.22            | QSPI                                                                                                                 |  |      |      |      |      |          |  |  |  |  |  |
| 49                | P1.00            | QSPI                                                                                                                 |  |      |      |      |      |          |  |  |  |  |  |

## 4 Layout design notes

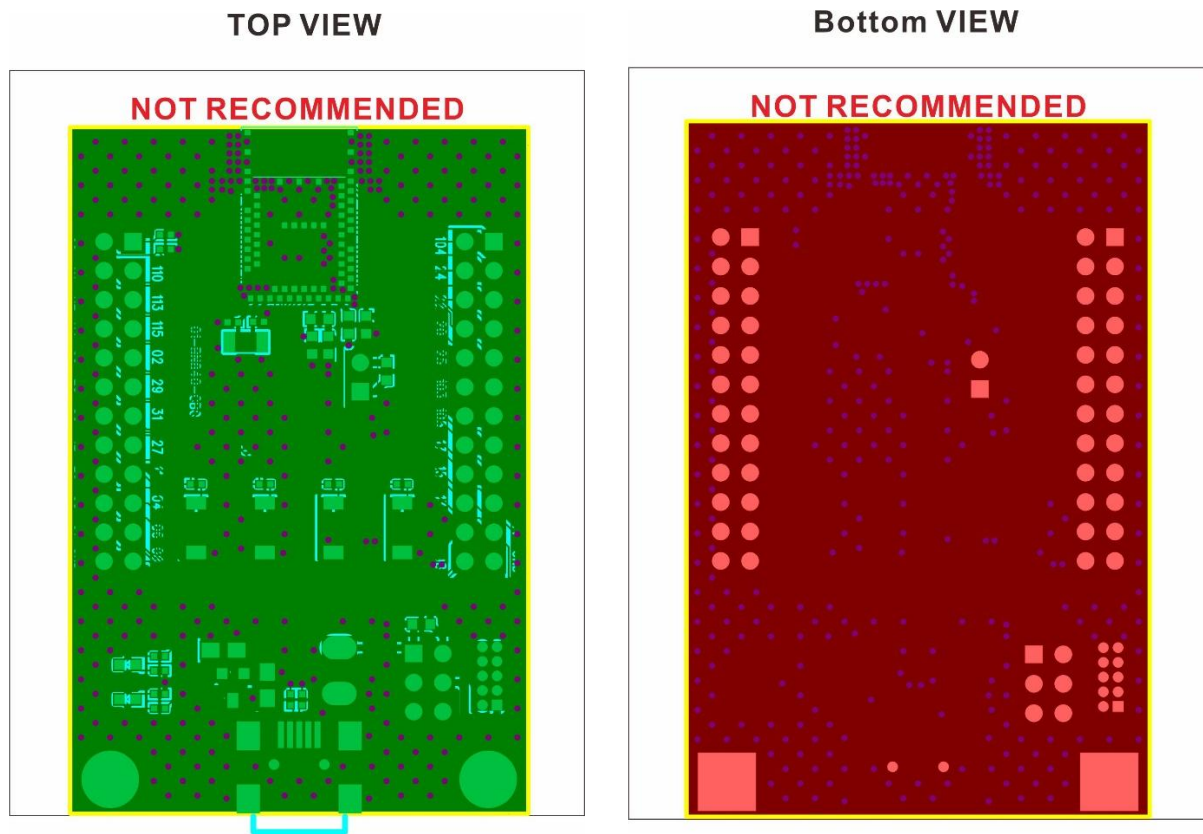
### 4.1 Recommended RF layout and ground plane

It is recommended to place the module:

- In the center (horizontal) of any mother PCB edge, with GND planes to the left and right
- Keep out Area should be included in the corresponding position of the antenna in each layer.
- Add via hole around GND pads on the mother PCB as many as you can, especially on the four corners and antenna area.



## 4.2 Not Recommended RF layout and ground plane



## 4.3 Antenna keep out when proximity to Metal

- The minimum safe distance for metals without seriously compromising the antenna tuning is 4cm (bottom, top, left, right).
- Metal close to the antenna (bottom, top, left, right) will degrade RF performance. Any metal closer than 2 cm will significantly degrade RF performance.

## 5. Electrical Specification

### 5.1 Absolute Maximum Ratings

Maximum ratings are the extreme limits to which the chip can be exposed for a limited amount of time without causing permanent damage. Prolonged exposure to absolute maximum ratings may affect the device's reliability.

| Parameter                        | Min. | Max.             | Unit               |
|----------------------------------|------|------------------|--------------------|
| <b>Supply voltage</b>            |      |                  |                    |
| VDD                              | -0.3 | +3.9             | V                  |
| VDDH                             | -0.3 | +5.8             |                    |
| VBUS                             | -0.3 | +5.8             |                    |
| VSS                              |      | 0                | V                  |
| <b>I/O pin voltage</b>           |      |                  |                    |
| VI/o, VDD ≤3.6 V                 | -0.3 | VDD+0.3          | V                  |
| VI/o, VDD >3.6 V                 | -0.3 | 3.9              | V                  |
| <b>NFC antenna pin current</b>   |      |                  |                    |
| NFC 1/2                          |      | 80               | mA                 |
| <b>Radio</b>                     |      |                  |                    |
| RF input level                   |      | 10               | dBm                |
| <b>Environmental</b>             |      |                  |                    |
| Storage temperature              | -40  | +125             | °C                 |
| MSL (moisture sensitivity level) |      | 2                |                    |
| ESD HBM (human body model)       |      | 2                | KV                 |
| ESD CDM (charged device model)   |      | 450              | V                  |
| <b>Flash memory</b>              |      |                  |                    |
| Endurance                        |      | 10000            | Write/erase cycles |
| Retention                        |      | 10 years at 85°C |                    |

## 5.2 Operation Conditions

| Parameter                   | Min. | Nom. | Max. | Units |
|-----------------------------|------|------|------|-------|
| VDD (independent of DCDC)   | 1.7  | 3.0  | 3.6  | V     |
| VDDH (independent of DCDC)  | 2.5  | 3.7  | 5.5  | V     |
| VBUS (USB supply voltage)   | 4.35 | 5.0  | 5.5  | V     |
| VDD rise time (0V to 1.7V)  |      |      | 60   | ms    |
| VDDH rise time (0V to 3.7V) |      |      | 100  | ms    |
| Operating temperature       | -40  | 25   | 85   | °C    |

**Important:** The on-chip power-on reset circuitry may not function properly if the rise times exceed the specified maximum.

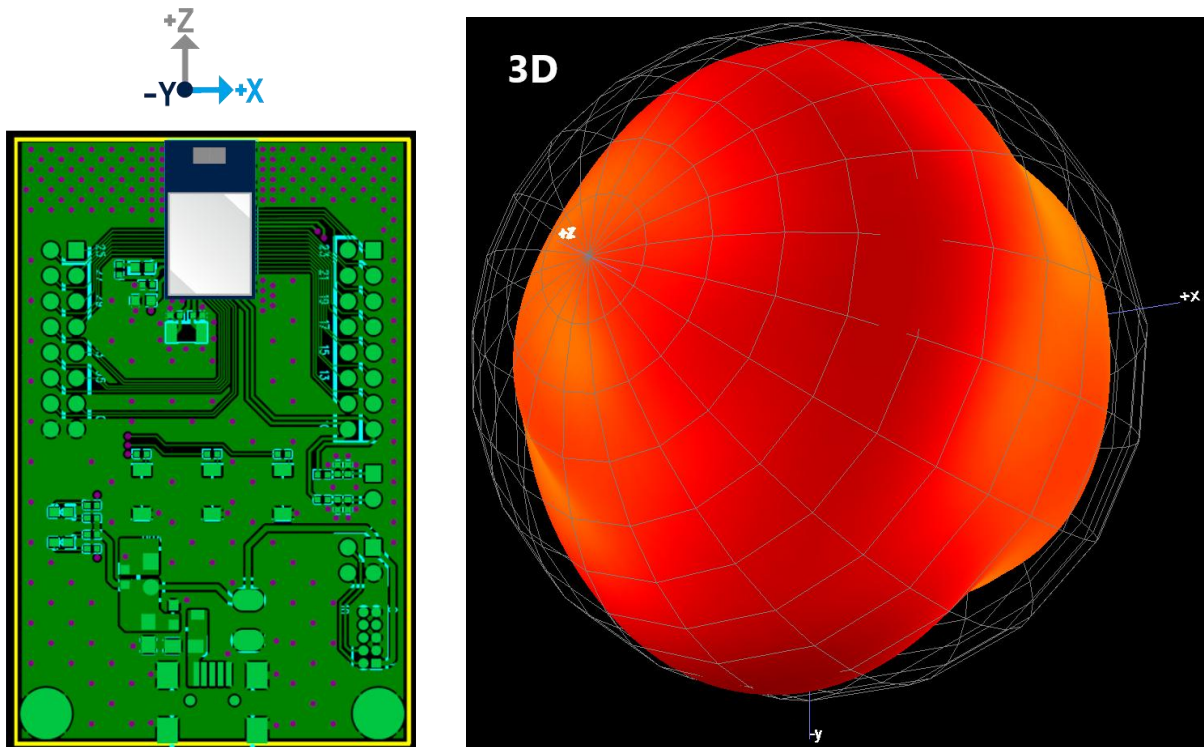
## 5.3 Radio Specifications

| Parameter              | Description                                                | Min. | Typ. | Max. | Unit |
|------------------------|------------------------------------------------------------|------|------|------|------|
| Operating frequencies  | BLE                                                        | 2402 |      | 2480 | MHz  |
| Channel spacing        | BLE                                                        |      | 2    |      | MHz  |
| Frequency deviation    | BLE 1Mbps                                                  |      | ±250 |      | kHz  |
|                        | BLE 2Mbps                                                  |      | ±500 |      | kHz  |
| On-the-air data rate   |                                                            | 125  |      | 2000 | kHz  |
| Transmitter            |                                                            |      |      |      |      |
| TX power               | Setting at +8dBm                                           |      | +8   |      | dBm  |
| RF power control range | -20 ~+8dBm, in 4db step                                    | -20  |      | +8   | dBm  |
| TX current (TX only)   | DCDC@3V/+8 dBm                                             |      | 14.8 |      | mA   |
|                        | Setting at +8dBm                                           |      | 32.7 |      | mA   |
| Receiver               |                                                            |      |      |      |      |
| Receive Sensitivity    | 1Msps BLE ideal transmitter<br>Packet <=37bytes BRE=0.1%   |      | -95  |      | dBm  |
|                        | 2Msps BLE ideal transmitter<br>Packet <=37bytes BRE=0.1%   |      | -92  |      | dBm  |
|                        | 125ksps BLE ideal transmitter<br>Packet <=37bytes BRE=0.1% |      | -103 |      | dBm  |
| RX current (RX only)   | DCDC@3V/1Msps BLE                                          |      | 4.6  |      | mA   |
|                        | Setting at 1Msps BLE                                       |      | 9.9  |      | mA   |
|                        | DCDC@3V/2Msps BLE                                          |      | 5.2  |      | mA   |
|                        | Setting at 2Msps BLE                                       |      | 11.1 |      | mA   |
| RSSI                   | RSSI Accuracy Valid range                                  | -90  |      | -20  | dBm  |
|                        | RSSI resolution                                            |      | 1    |      | dB   |
|                        | Sample period                                              |      | 0.25 |      | us   |
| Antenna gain           |                                                            |      | 1.05 |      | dBi  |

## 5.4 Antenna information

The antenna test report is based on the BN52H-C40 with a ground plane size of 60 mm x 40 mm.

### 5.4.1 The orientation of Antenna

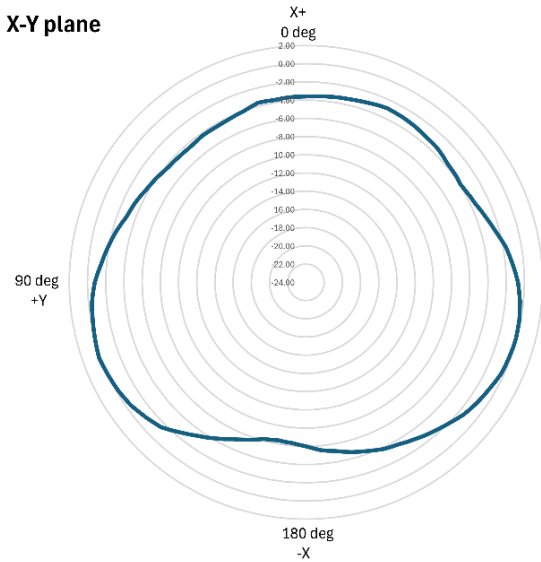


### 5.4.2 Antenna Gain and Efficiency

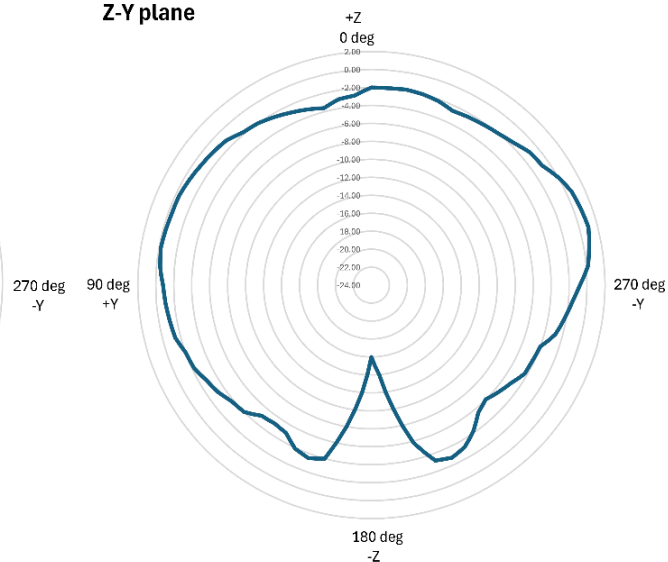
| Frequency | Gain(dBi) | Efficiency |
|-----------|-----------|------------|
| 2400MHZ   | -0.21     | 42         |
| 2410MHZ   | 0.22      | 45         |
| 2420MHZ   | 0.52      | 47         |
| 2430MHZ   | 0.92      | 50         |
| 2440MHZ   | 1.05      | 51         |
| 2450MHZ   | 0.87      | 50         |
| 2460MHZ   | 0.62      | 48         |
| 2470MHZ   | 0.43      | 44         |
| 2480MHZ   | 0.19      | 40         |
| 2490MHZ   | -0.27     | 35         |

# 5.4.3 Antenna Pattern 2D

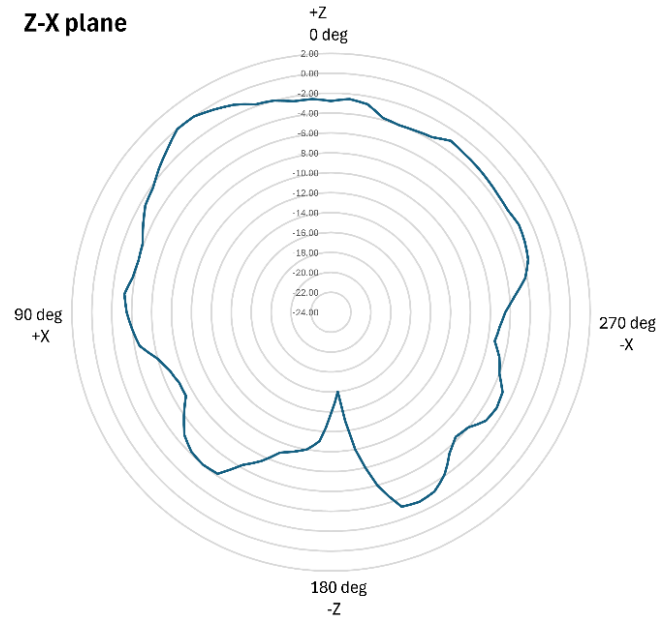
X-Y plane



Z-Y plane



Z-X plane



## 5.5 CPU Specifications

The ARM® Cortex®-M4 processor with floating-point unit (FPU) has a 32-bit instruction set.

| Memory        | Flash                                         | RAM   |      |      |                  |
|---------------|-----------------------------------------------|-------|------|------|------------------|
|               | 1024KB                                        | 256KB |      |      |                  |
| Parameter     | Description                                   | Min.  | Typ. | Max. | Unit             |
| CoreMark      | running from flash, cache enabled             |       | 212  |      | CoreMark         |
| CoreMark /MHz | running from flash, cache enabled             |       | 3.3  |      | CoreMark/<br>MHz |
| CoreMark/mA   | running from flash, cache enabled,<br>DCDC 3V |       | 64   |      | CoreMark/<br>mA  |
| CPU current   | running from flash, cache enabled,<br>LDO     |       | 6.3  |      | mA               |
|               | running from flash, cache enabled,<br>DCDC 3V |       | 3.3  |      | mA               |
|               | running from RAM, LDO                         |       | 5.2  |      | mA               |
|               | running from RAM, DCDC 3V                     |       | 2.8  |      | mA               |

## 5.6 Power Management

| Parameter   | Description                                                                                        | Min. | Typ. | Max. | Unit |
|-------------|----------------------------------------------------------------------------------------------------|------|------|------|------|
| System OFF  | No RAM retention, Wake on reset                                                                    |      | 0.4  |      | uA   |
|             | No RAM retention, Wake on LPCOMP                                                                   |      | 0.86 |      | uA   |
|             | Full 256 kB RAM retention, Wake on reset                                                           |      | 1.86 |      | uA   |
| System ON   | No RAM retention, Wake on any event                                                                |      | 0.97 |      | uA   |
|             | Full RAM retention, Wake on any event                                                              |      | 2.35 |      | uA   |
|             | No RAM retention, Wake on RTC                                                                      |      | 1.5  |      | uA   |
| MCU + Radio | running CoreMark from Flash,<br>Clock = HFXO, Cache enabled,<br>0 dBm TX @ 1 Mb/s BLE , DC/DC mode |      | 8.1  |      | mA   |
|             | running CoreMark from Flash,<br>Clock = HFXO, Cache enabled,<br>RX @ 1 Mb/s BLE , DC/DC mode       |      | 8.6  |      | mA   |
|             | running CoreMark from Flash,<br>Clock = HFXO, Cache enabled,<br>0 dBm TX @ 1 Mb/s BLE , LDO mode   |      | 15.4 |      | mA   |
|             | running CoreMark from Flash,<br>Clock = HFXO, Cache enabled,<br>RX @ 1 Mb/s BLE , LDO mode         |      | 16.2 |      | mA   |

## 5.7 System Clock

The MN52H-40 requires two clocks, a high frequency clock and a low frequency clock.

- The high frequency clock (HFCLK)

HFCLK is provided on-module by a high-accuracy 32 MHz/±20 ppm crystal for radio and CPU operation.

- The low frequency clock (LFCLK)

LFCLK can be provided internally by an RC oscillator (±250 ppm) with calibration, or externally by a 32.768 kHz crystal.

### Internal 32.768 kHz RC oscillator (LFRC)

| Description                                                                                        | Min. | Typ.   | Max. | Unit |
|----------------------------------------------------------------------------------------------------|------|--------|------|------|
| Nominal frequency                                                                                  |      | 32.768 |      | kHz  |
| Frequency tolerance for LFRC after calibration<br>(calibration performed at least every 8 seconds) |      |        | ±500 | ppm  |
| Run current for 32.768 kHz RC oscillator                                                           |      | 0.7    |      | uA   |
| Startup time for 32.768 kHz RC oscillator                                                          |      | 1000   |      | us   |

### External 32.768 kHz crystal oscillator (LFXO)

| Parameter | Description                                   | Min. | Typ.   | Max. | Unit |
|-----------|-----------------------------------------------|------|--------|------|------|
|           | Crystal frequency                             |      | 32.768 |      | kHz  |
|           | Frequency tolerance requirement for BLE stack |      |        | ±500 | ppm  |
|           | Frequency tolerance requirement for ANT stack |      |        | ±50  | ppm  |
|           | Run current for 32.768 kHz crystal oscillator |      | 0.23   |      | uA   |
| CL        | Load capacitance                              |      |        | 12.5 | pF   |
| CO        | Shunt capacitance                             |      |        | 2    | pF   |
| RS        | Equivalent series resistance                  |      |        | 100  | Kohm |
| PD        | Drive level                                   |      |        | 0.5  | uW   |
| Cpin      | Input capacitance on XL1 and XL2 pads         |      | 4      |      | pF   |

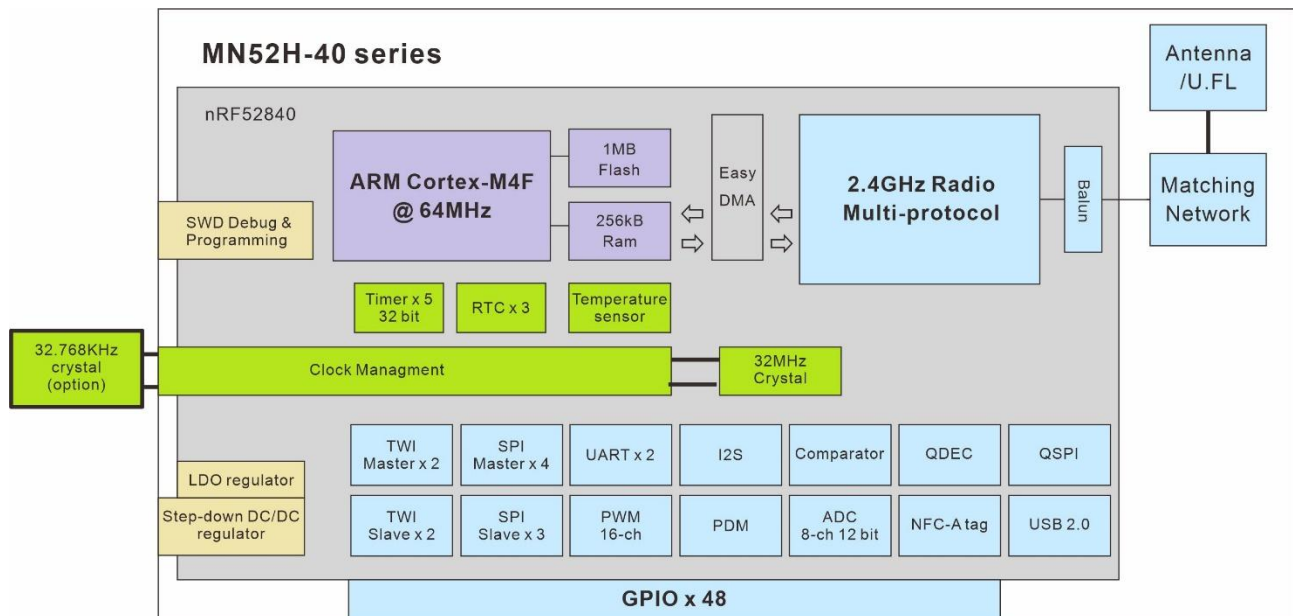
An external crystal provides the lowest power consumption and greatest accuracy.

Using the internal RC oscillator with calibration provides acceptable performance for BLE stack at a reduced cost and slight increase in power consumption.

### Important:

- The ANT protocol requires the use of an external crystal for high accuracy.
- Nordic SDK example program P0.00/P0.01 as external LFXO, you need an external crystal to work.
- Nordic SDK example program P0.00/P0.01 as external LFXO, if you would like to reduce material cost, save layout space or requires 2 more GPIO for application. you need program p0.00/p0.01 as internal LFRC.

## 5.8 Block Diagram



## 6. BN52H-C40 evaluation board

### 6.1 BN52H-C40 component placement

**BN52H-C40** is a full-featured evaluation board for MN52H-C40 that supports:

M1:MN52H-C40 module

J6: A power over mini-USB

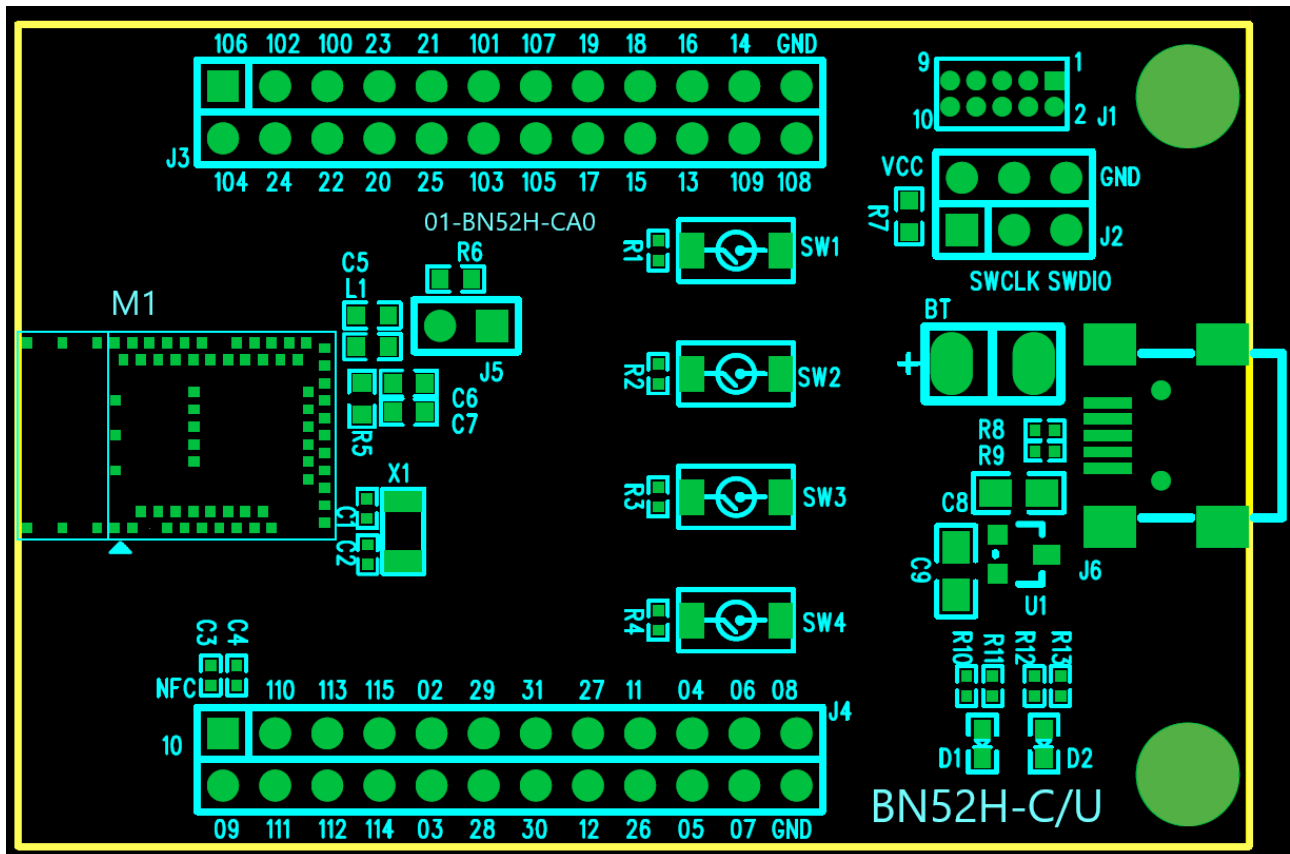
J3/J4: Complete I/O pinout to headers

J1: On-board programming and debugging interface

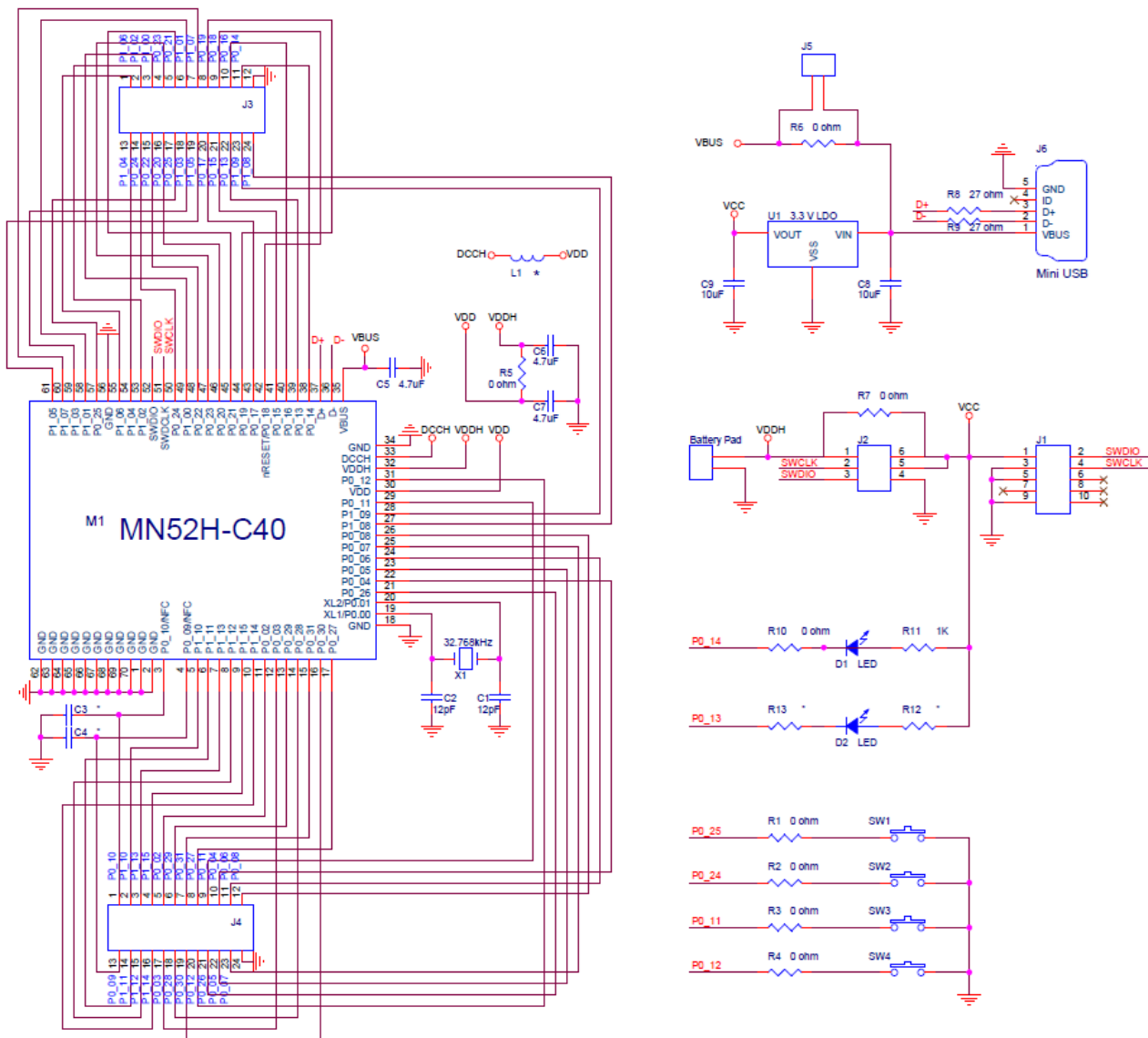
X1:32.768 kHz crystal

D1: One user LED

SW1/SW2/SW3/SW4: Four user buttons



## 6.2 BN52H-C40 schematic



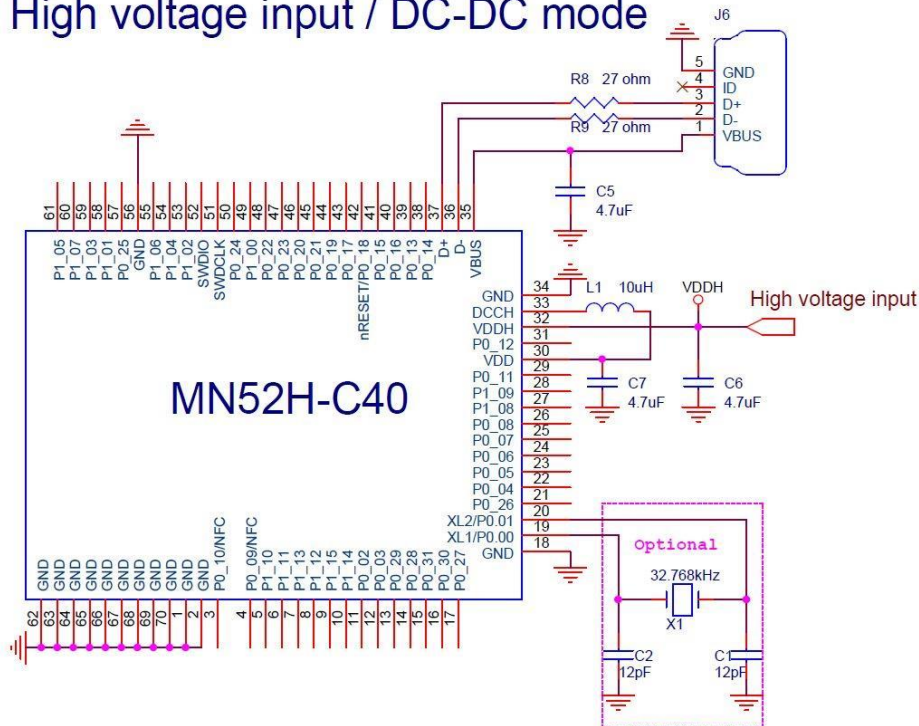
### REMARK:

- When using internal 32.768kHz RC oscillator, please remove X1 / C1 / C2 and calibration performed at least every 8 seconds.

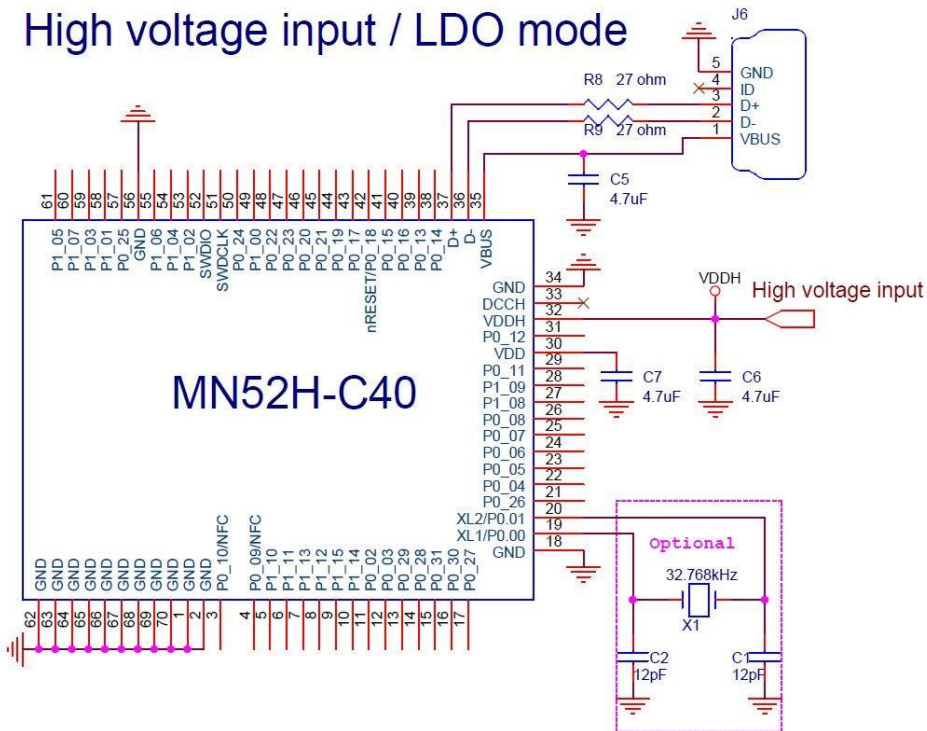
## 7. Reference Circuit for power mode

### 7.1 High voltage mode : Input from VDDH (2.5V~5.5V)

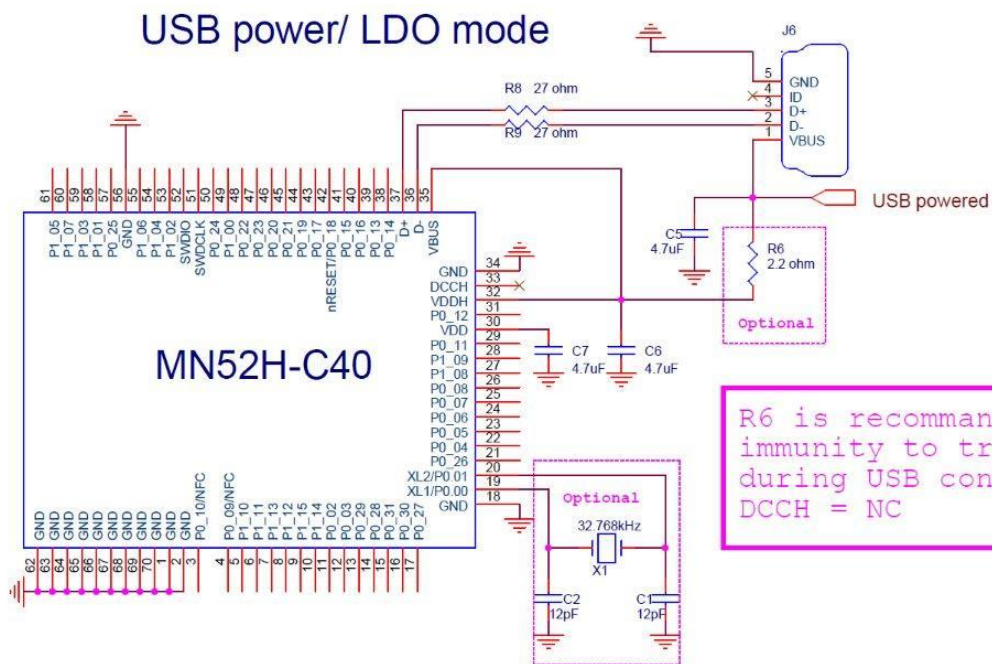
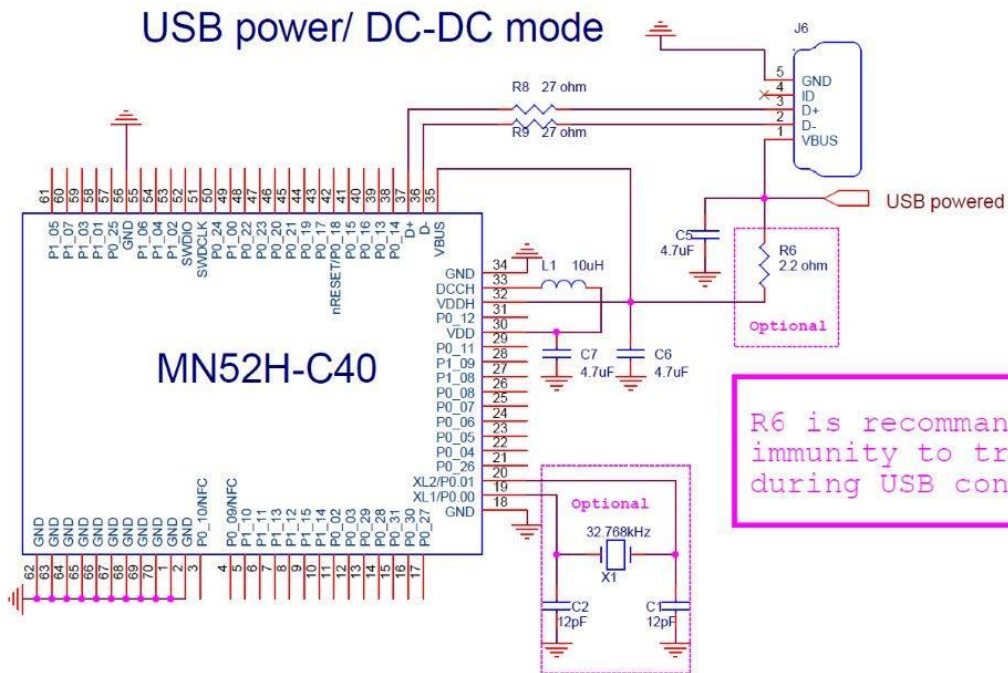
High voltage input / DC-DC mode



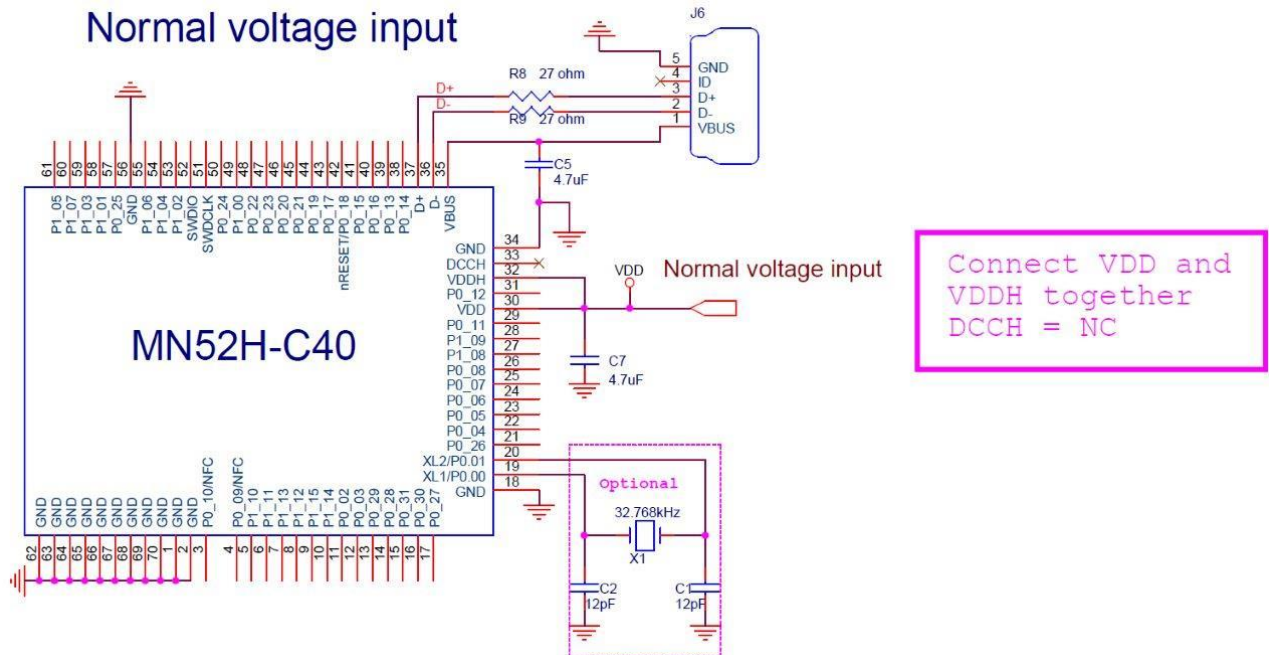
High voltage input / LDO mode



## 7.2 USB powered mode : Input from VBUS

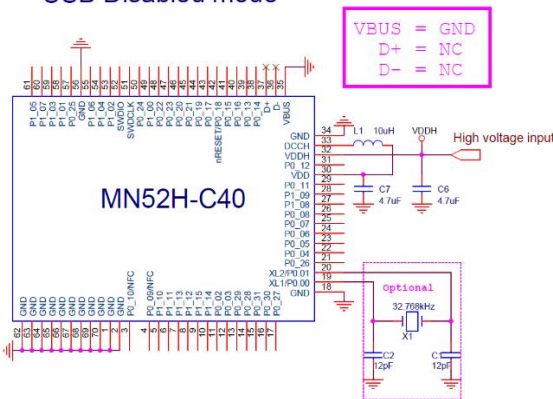


## 7.3 Normal voltage mode : Input from VDD (1.7V~3.6V)

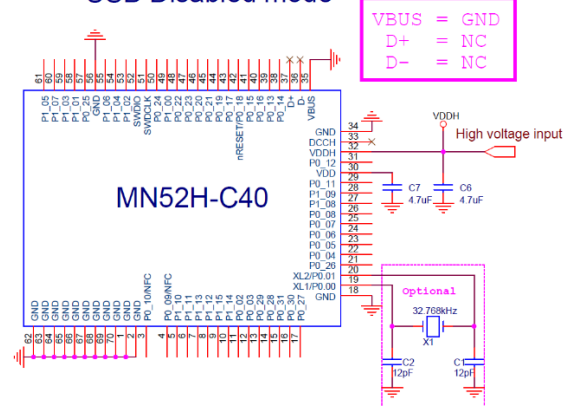


## 7.4 USB Disabled mode

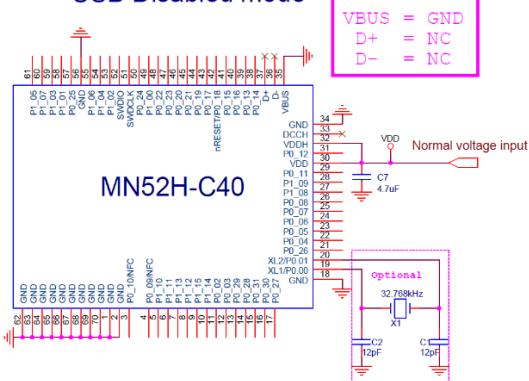
USB Disabled mode



USB Disabled mode



USB Disabled mode



## 7. Product Information

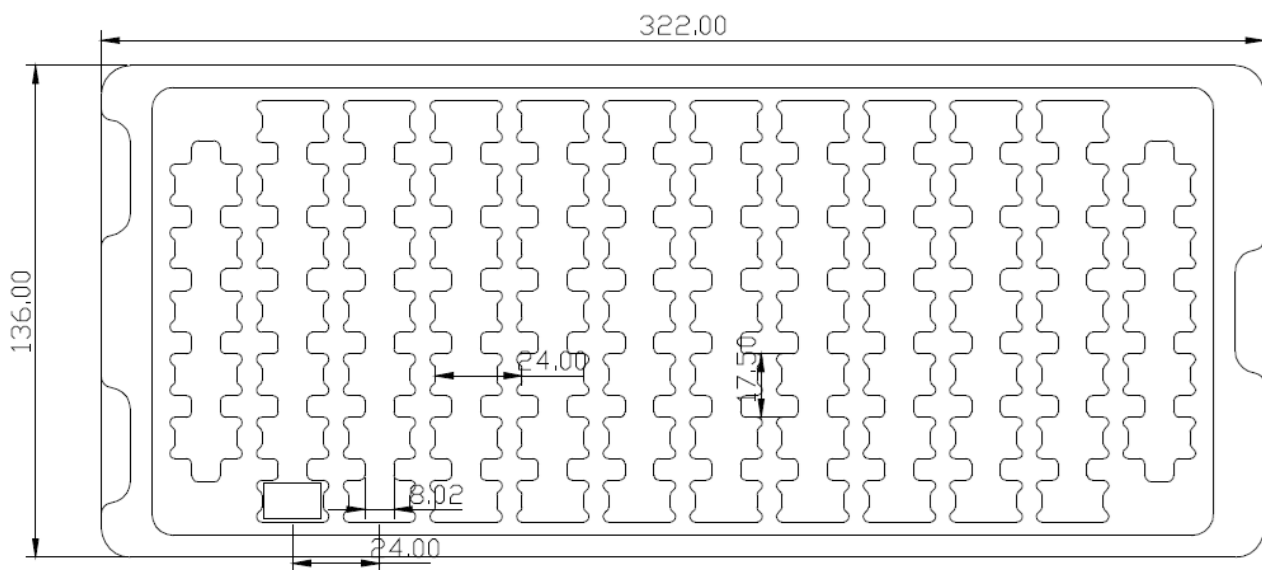
### 7.1 Mass production information

#### 7.1.1 Tray Packaging:

**Material:** anti-static PET

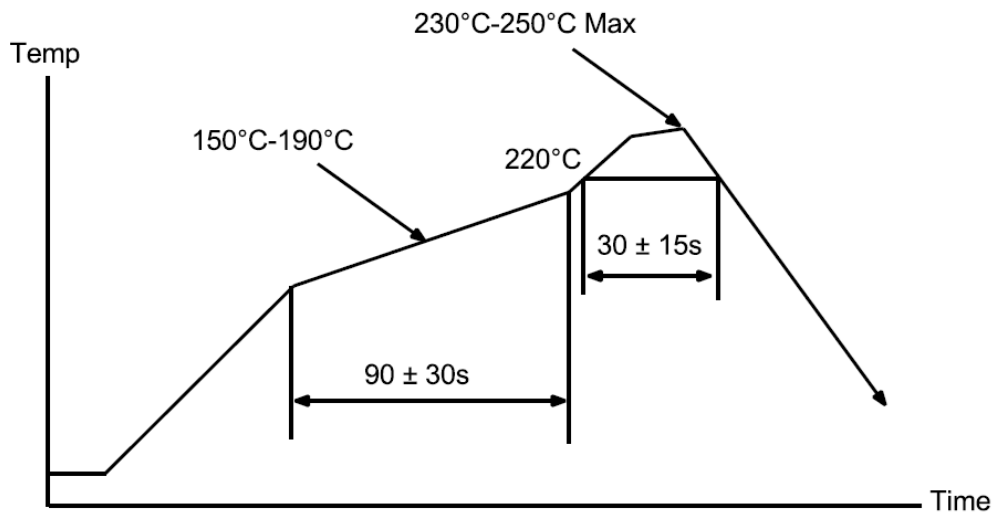
**PET thickness:** 0.8mm

**Dimension:** 322mm x 136mm x 8.5mm



The tray is designed for direct use on a SMT automatic machine.

### 7.1.2 Reflow Parameters



## 7.2 Packing information

| Type | Quantity           | Dimension (L)x(W)x(H) | Gross Weight |
|------|--------------------|-----------------------|--------------|
| Unit | 1 pcs              | 15.5x10.1x2.1mm       |              |
| Tray | 80 pcs per tray    | 322x136x8.5mm         |              |
| Box  | 1040 pcs(13 trays) | 36x20x12cm            | 3.0Kg        |

## 7.3 Ordering Code

| Model | Ordering code | Photo |
|-------|---------------|-------|
|-------|---------------|-------|

MN52H-C40

MN-840A2-01A-CB

**Ordering code: MN-840Q2-01A-CB**

**MN: Module/Nordic**

**840A2: NRF52840/AQFN/V2**

**01A: Aradconn standard module without customer code**

**CB: Chip antenna/Box packing**

### MN52H Series

| Model     | IC/Version  | Antenna        | Ordering code   | Quantity |
|-----------|-------------|----------------|-----------------|----------|
| MN52H-C40 | NRF52840/V2 | Chip           | MN-840A2-01A-CB | 1040     |
| MN52H-C33 | NRF52833/V1 |                | MN-833A1-01A-CB | 1040     |
| MN52H-P40 | NRF52840/V2 | PCB            | MN-840A2-01A-PB | 1040     |
| MN52H-P33 | NRF52833/V1 |                | MN-833A1-01A-PB | 1040     |
| MN52H-U40 | NRF52840/V2 | U.FL Connector | MN-840A2-01A-UB | 1040     |

## 8. Bluetooth qualification& Regulatory certification

### 8.1 Bluetooth qualification

The MN52H-C40 Bluetooth Low Energy module is based on Nordic Semiconductor's NRF52 series SOC and listed on the Bluetooth SIG website as a qualified End Product.

| Model     | Bluetooth Version | DID     | QDID                                     | Company           |
|-----------|-------------------|---------|------------------------------------------|-------------------|
| MN52H-C40 | 5.4               | Q331704 | 183532<br>(Nordic)<br>228005<br>(Nordic) | Arad Connectivity |

### 8.2 USA (FCC Certificate)

#### 8.2.1 FCC ID and Labeling requirements

The MN52H series hold full modular certification, are assigned the

**FCC ID number: 2BLIDMN52H**

If the FCC ID is not visible when the module is installed inside OEM device, then the outside of the finished product must also display a label referring to the enclosed module. The end product must in any case be labelled on the exterior with:

**Contains FCC ID: 2BLIDMN52H**

#### 8.2.2 FCC Notice:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### **8.2.3 CAUTION:**

The OEM should have their device which incorporates the MN52H series tested by a qualified test Lab to verify compliance with FCC Part 15 Subpart B limits for unintentional radiators.

### **8.2.4 RF Exposure Statement:**

This module is approved for installation into mobile and/or portable host platforms.

This device is intended only for OEM integrators under the following conditions:

(1) The transmitter module may not be co-located with any other transmitter or antenna.

(If the condition above is met, further transmitter test will not be required.)

(2) The OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for satisfying RF Exposure compliance when this module installed.

## **8.3 Canada (IC Certificate)**

### **8.3.1 IC ID and Labeling requirements**

The MN52H series hold full modular certification, are assigned the

**IC ID number: 33123-MN52H**

If the IC ID is not visible when the module is installed inside OEM device, then the outside of the finished product must also display a label referring to the enclosed module. The end product must in any case be labelled on the exterior with:

**Contains IC ID: 33123-MN52H**

### **8.3.2 IC Notice:**

**This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:**

**(1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.**

**Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:**

**(1) l'appareil ne doit pas produire de brouillage;**  
**(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.**

### **8.3.3 RF Exposure Statement:**

**This module is approved for installation into mobile and/or portable host platforms.**

**This device is intended only for OEM integrators under the following conditions:**

**(1) The transmitter module may not be co-located with any other transmitter or antenna.**

**(If the condition above is met, further transmitter test will not be required.)**

**(2) The OEM integrator is still responsible for testing their end-product for any additional compliance requirements required for satisfying RF Exposure compliance when this module installed.**

## 8.4 European Union (CE)

### 8.4.1 Labeling requirements

The label on the final products which contain the MN52H series module must follow CE marking requirements, should be labelled as follows:



The OEM should consult with a qualified test Lab before entering their device into an EU member country to make sure all regulatory requirements have been met for their complete device.

### 8.4.2 Radio Equipment Directive (RED)

The MN52H series module complies with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2019/07

## 8.5 Australia / New Zealand (RCM)

The MN52H series has been tested to comply with the AS/NZS 62368.1:2022



## 8.6 NCC Certificate (Taiwan)

### 8.6.1 NCC ID and Labeling requirements

MN52H 系列依天線不同,可分為 3 種型式, 認證為 3 個不同的 NCC ID

MN52H-C NCC ID number:

MN52H-P NCC ID number:

MN52H-U NCC ID number:

請依下列標籤式樣自製標籤，標貼或印鑄於器材(產品)本體明顯處，始得販賣或公開陳列。

**NCC logo and NCC ID**

**MN52H-C:**

**MN52H-P:**

**MN52H-U:**

**NCC 平台政策下的完全模組: 須符合平台政策才能適用完全模組**

「平台」定義如下：若器材無安裝型式認證之模組仍具備其它複合性功能，該器材得視為平台，若無其它複合性功能，則不能視為平台。

## 9. RoHS & REACH Report

MN52H series modules comply with EU RoHS Directive 2011/65/EU, 2015/863/EU and do not contain or over the threshold value of SVHC (Substance of Very High Concern), as defined by Directive EC/1907/2006 Article according to REACH Annex XVII.

## 10. Life support warning

This module is not designed for use in life support appliances, devices, or systems where malfunction can reasonably be expected to result in a significant personal injury to the user, or as a critical component in any life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety.

## Revision history

| Version | Date       | Notes           | Name |
|---------|------------|-----------------|------|
| 1.0     | 2024/12/01 | Initial Release |      |
|         |            |                 |      |
|         |            |                 |      |