# SPINTLY

## SPNYH02-C High Efficiency 2.4GHz Wireless

## **Module** SPNYH02-C

**Datasheet**

MODEL NO: SPNYH02-C

VERSION: P01

CONTENTS

Table of Contents

**1. Product Description** ..... 4
**2. Key Features** ..... 4
**3. Applications** ..... 4
**4. Module Block Diagram** ..... 5
**5. Product Specifications** ..... 6
**6 Module Pinout and Pin Description** ..... 8
**6.1 Module Pinout** ..... 8
**6.2 Pin Assignment** ..... 9
**7. PCB Design Guide** ..... 11
**7.1 Layout notes** ..... 11
**8. Mechanical Dimensions** ..... 13
**9. PCB Footprint and Dimensions** ..... 14
**10. Qualification and approvals** ..... 15
10.1. United States (FCC) ..... 15
10.1.1. Labelling and user information requirements ..... 15
10.1.2. RF exposure ..... 15
10.2. European Union regulatory compliance ..... 15
10.2.1. Radio Equipment Directive (RED) 2014/53/EU ..... 16
10.2.2. Labelling and user information requirements ..... 16
**11. Cautions** ..... 16
11.1 Reflow soldering ..... 16
11.2 Usage Condition Notes ..... 17
11.3 Storage Notes ..... 18
**12. Package information** ..... 18
12.1. Ordering information ..... 18
**Revision History** ..... 18
- Antennas ..... 19
- List of applicable FCC rules ..... 19
- Specific operational use conditions ..... 19
- Limited module procedures ..... 19
- Trace antenna designs ..... 19
- RF exposure considerations ..... 19
- Antennas ..... 20
- Label and Compliance information ..... 20
- Information on test modes and additional testing requirements ..... 20
- FCC ID Location: ..... 20

- Additional testing:..... 20
- USERS MANUAL OF THE END PRODUCT: ..... 21

**Contact Information**..... 21

## 1. Product Description

SPNYH02-C series is a powerful, highly flexible, ultra-low power wireless module using Nordic nRF52833 SoCs made for IOT applications. It was designed for high data rate wireless communication in the 2.4GHz ISM band. With an 32bit ARM® Cortex M4 MCU, available 512KB flash, 128KB RAM, embedded 2.4GHz multi-protocol transceiver.
SPNYL01 series brings out all nRF52833 hardware features and capabilities including USB, up to +8dBm transmit power, 5.5v Supply considerations and NFC tag implementation. Complete regulatory certifications enable faster time to market and reduced development risk

supports an extensive range of wireless protocols. It supports BLE® (Bluetooth Low Energy), and is capable of Bluetooth® Direction Finding in addition Long Range and 2 Mbps. Bluetooth mesh, 802.15.4, Thread, Zigbee, proprietary 2.4 GHz protocols and NFC-A are also supported.

## 2. Key Features

Bluetooth® 5

- Direction Finding
- 2Mbps
- CSA#2
- Advertising Extensions
- Long Range

IEEE 802.15.4 radio support

- Thread
- Zigbee

Supported data rates

- Bluetooth®: 2 Mbps, 1 Mbps, 500 kbps, and 125 kbps
- IEEE 802.15.4-2006: 250 kbps
- Proprietary 2.4 GHz: 2 Mbps, 1 Mbps

Wide supply voltage range: 1.7 V to 5.5V
518kB Flash and 128kB RAM
Full set of digital interfaces including: SPI, TWI, UART, PDM, PWM, QDEC
12-bit, 200ksps ADC
128-bit AES ECB/CCM/AAR co-processor
Individual power management for all peripherals
On-chip DC/DC buck converter
Dimension: 21.0 x 13.8 x 2.3mm (with shield)
40 GPIOs

## 3. Applications

- Internet of things (IoT)
  - Smart home sensors and controllers
  - Industrial IoT sensors and controllers

- Advanced wearables
    - Health/fitness sensor and monitor devices
    - Wireless payment enabled devices
- Advanced computer peripherals and I/O devices
    - Mouse
    - Keyboard
    - Multi-touch trackpad
- Interactive entertainment devices
    - Remote controls
    - Gaming controllers

## 4. Module Block Diagram

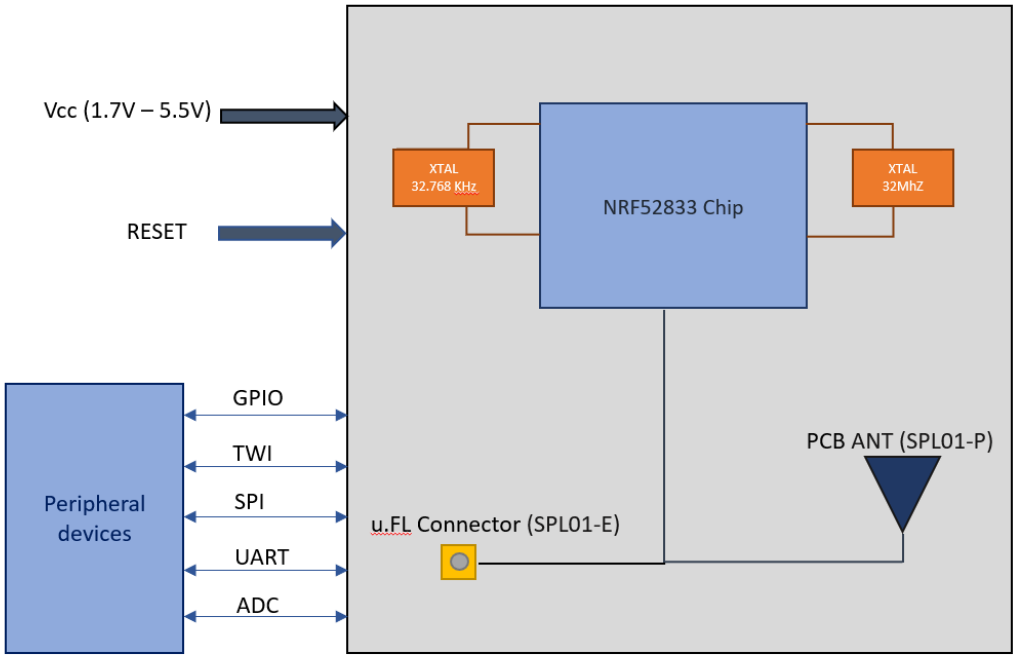



Figure 1: SPNYH02-C lock diagram

## 5. Product Specifications

| Details | Description |
|---|---|
| **Bluetooth** | |
| Feature | Bluetooth® Low Energy<br>Bluetooth® Mesh<br>Bluetooth® Direction Finding<br>1M LE PHY<br>2M LE PHY<br>Coded LE PHY (Long Range)<br>Advertising Extensions<br>CSA #2 |
| Security | AES-128 |
| LE connections | Concurrent central, observer, peripheral, and broadcaster roles with up to twenty concurrent connections along with one observer and one broadcaster. |
| **Radio** | |
| Frequency | 2360MHz - 2500MHz |
| Modulations | GFSK at 1 Mbps/2 Mbps<br>250kbps (IEEE 802.15.4-2006) and<br>Long range (125kbps and 500kbps) data rates |
| **Current Consumption** | |
| TX only (DCDC enabled, 3V) @ +8dBm / +4dBm / 0dBm / -4dBm/-20dBm/-40dBm | 14.2mA / 9.6mA / 4.9mA / 3.8mA / 2.7mA / 2.3mA |
| TX only @ +8dBm / +4dBm / 0dBm / -4dBm / -20dBm / -40dBm | 30.4mA / 20.7mA / 10.3mA / 8.0mA / 5.5mA / 4.5mA |
| RX only (DCDC enabled, 3V) @1Msps / 1Msps BLE | 4.6mA |
| RX only @ 1Msps / 1Mbps BLE | 9.6mA |
| RX only (DCDC enabled, 3V) @2Msps / 2Msps BLE | 5.2mA |
| RX only @ 2Msps / 2Mbps BLE | 10.7mA |
| System OFF mode（3V） | 0.6uA |
| System OFF mode with full 64kB RAM retention（3V） | 1.3uA |
| System ON mode, no RAM retention, wake on RTC（3V） | 1.5uA |
| **Mechanical** | |
| Dimensions | Length: 21mm±0.2mm<br>Width: 13.8mm±0.2mm<br>Height: 2.3mm+0.1mm/-0.15mm |
| Package | 34 diameters of Half-holes + 20 LGA pads |
| PCB material | FR-4 |
| Impedance | 50Ω |
| **Hardware** | |
| CPU | ARM® Cortex®-M4 32-bit processor with FPU, 64 MHz |
| Memory | 512kB flash, 128kB RAM |

| | |
|---|---|
| Interfaces | 4x SPI master/3x SPI slave with EasyDMA<br>2x I2C compatible two-wire master/slave<br>2x UART (CTS/RTS) with EasyDMA<br>3x real-time counter (RTC)<br>5x 32-bit timer with counter mode<br>4x 4-channel pulse width modulator (PWM) unit with EasyDMA<br>40 GPIOs<br>8x 12bit, 200ksps ADC<br>Audio peripherals – I<br>2<br>S, digital microphone interface (PDM) |
| Power supply | 1.7V to 5.5V |
| Operating temperature range | -40 to 85 °C<br>(-40 to +105 °C can be customized) |
| Clock control | 32.768 kHz +/-20 ppm crystal oscillator |
| Power regulator | DC/DC regulator setup |

## 6 Module Pinout and Pin Description

### 6.1 Module Pinout

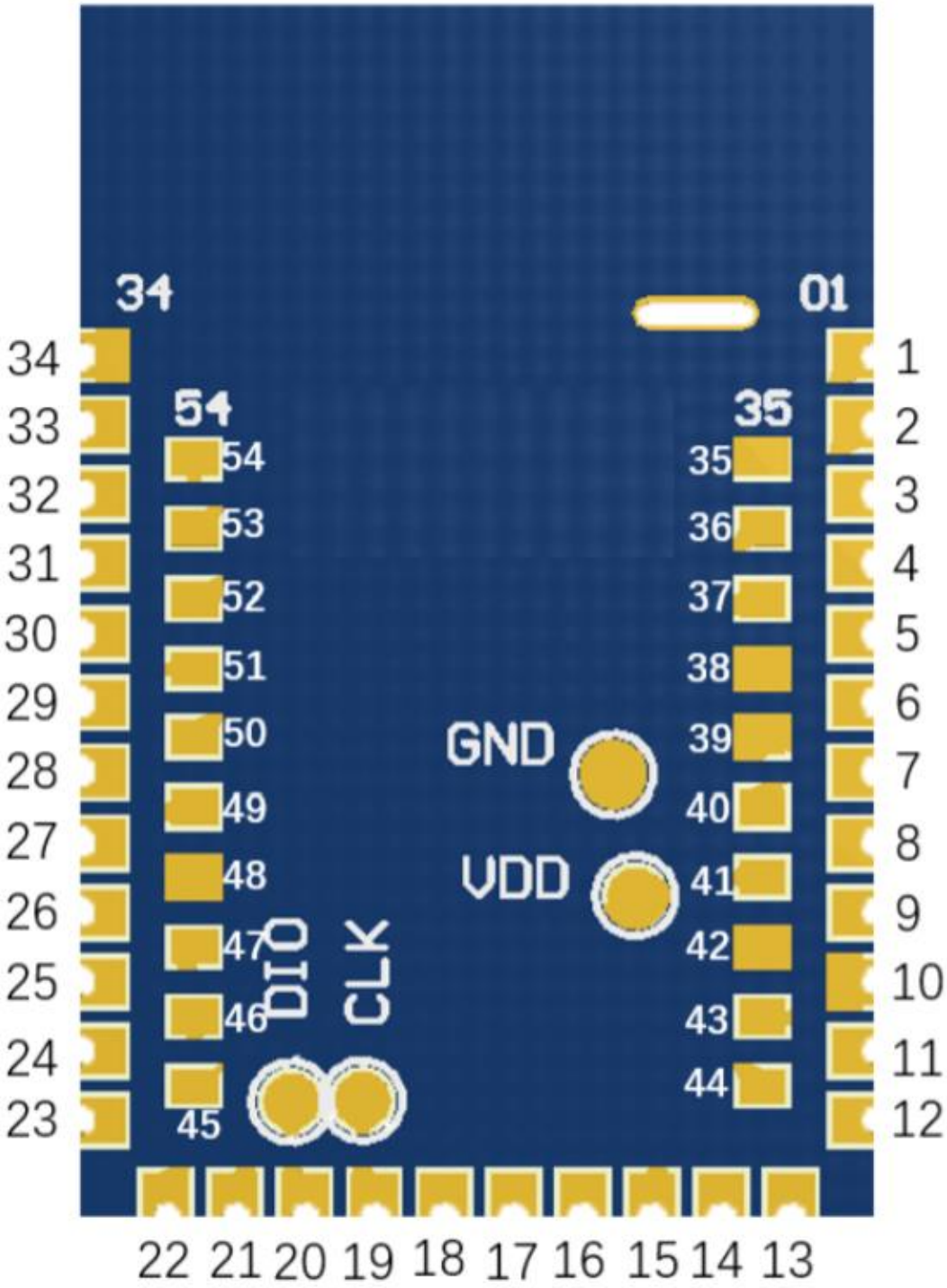



Figure 2: SPNYH02-C Module Pinout

## 6.2 Pin Assignment

| Module Pin Number | Module Pin Name | Description |
|---|---|---|
| | | |
| 1 | PO.25 | General Purpose I/O |
| 2 | P0.23 | General Purpose I/O |
| 3 | P0.03<br>AIN1 | General Purpose I/O,<br>SAADC/COMP/LPCOMP input |
| 4 | P0.02<br>AIN0 | General Purpose I/O,<br>SAADC/COMP/LPCOMP input |
| 5 | P0.28<br>AIN4 | General Purpose I/O,<br>SAADC/COMP/LPCOMP input |
| 6 | PO.29<br>AIN5 | General Purpose I/O,<br>SAADC/COMP/LPCOMP input |
| 7 | PO.30<br>AIN6 | General Purpose I/O,<br>SAADC/COMP/LPCOMP input |
| 8 | PO.31<br>AIN7 | General Purpose I/O,<br>SAADC/COMP/LPCOMP input |
| 9 | VDD | Power Supply |
| 10 | GND | Ground |
| 11 | P0.27 | General Purpose I/O |
| 12 | P0.26 | General Purpose I/O |
| 13 | P0.04<br>AIN2 | General Purpose I/O,<br>SAADC/COMP/LPCOMP input |
| 14 | P0.06 | General Purpose I/O |
| 15 | P0.05<br>AIN3 | General Purpose I/O,<br>SAADC/COMP/LPCOMP input |
| 16 | P0.08 | General Purpose I/O |
| 17 | P0.09<br>NFC1 | General purpose I/O, NFC antenna connection |
| 18 | P0.10<br>NFC2 | General purpose I/O, NFC antenna connection |
| 19 | SWDCLK | Serial wire debug clock input for debug and programming |
| 20 | SWDIO | Serial wire debug I/O for debug and programming |
| 21 | P0.07<br>TRACECLK | General Purpose I/O, Trace buffer clock |
| 22 | PO.11<br>TRACEDATA[2] | General Purpose I/O, Trace buffer TRACEDATA |
| 23 | PO.12<br>TRACEDATA[1] | General Purpose I/O, Trace buffer TRACEDATA |
| 24 | PO.13 | General Purpose I/O |
| 25 | PO.14 | General Purpose I/O |
| 26 | PO.15 | General Purpose I/O |

| | | |
|---|---|---|
| 27 | PO.16 | General Purpose I/O |
| 28 | PO.17 | General Purpose I/O |
| 29 | PO.18<br>nRESET | General purpose I/O, Configurable as pin reset |
| 30 | P0.20 | General Purpose I/O |
| 31 | P0.21 | General Purpose I/O |
| 32 | P0.22 | General Purpose I/O |
| 33 | P0.24 | General Purpose I/O |
| 34,35 | GND | Ground |
| 36 | P1.05 | General Purpose I/O |
| 37 | P1.03 | General Purpose I/O |
| 38 | GND | Ground |
| 39 | GND | Ground |
| 40 | P0.19 | General Purpose I/O |
| 41 | VDDH | High Voltage Power supply |
| 42 | GND | Ground |
| 43 | P1.08 | General purpose I/O |
| 44 | P1.09<br>TRACEDATA[3] | General Purpose I/O, Trace buffer TRACEDATA |
| 45 | VBUS | 5V input for USB 3.3v Regulator |
| 46 | D- | USB D- |
| 47 | D+ | USB D+ |
| 48 | GND | Ground |
| 49 | P1.00<br>TRACEDATA[0]/ SWO | General Purpose I/O, Trace buffer TRACEDATA/ Serial Wire Output |
| 50 | P1.01 | General Purpose I/O |
| 51 | P1.02 | General Purpose I/O |
| 52 | P1.04 | General Purpose I/O |
| 53 | P1.06 | General Purpose I/O |
| 54 | P1.07 | General Purpose I/O |

## 7. PCB Design Guide

### 7.1 Layout notes

Please do not place any metal components in blue shaded space (*1), such as signal line and metal chassis as possible except for main board while mounting the components in *1 space on the main board is allowed except for no copper plating area (*2).

• (*2) This area is routing prohibited area on the main board. Please do not place copper on any layer.

• (*3) Characteristics may deteriorate when GND pattern length is less than 30mm. It should be 30 mm or more as possible.

• For the best Bluetooth range performance, the antenna area of module shall extend 3 mm outside the edge of main board, or 3 mm outside the edge of a ground plane. Ground plane shall be at least 5 mm from the edge of the antenna area of module.

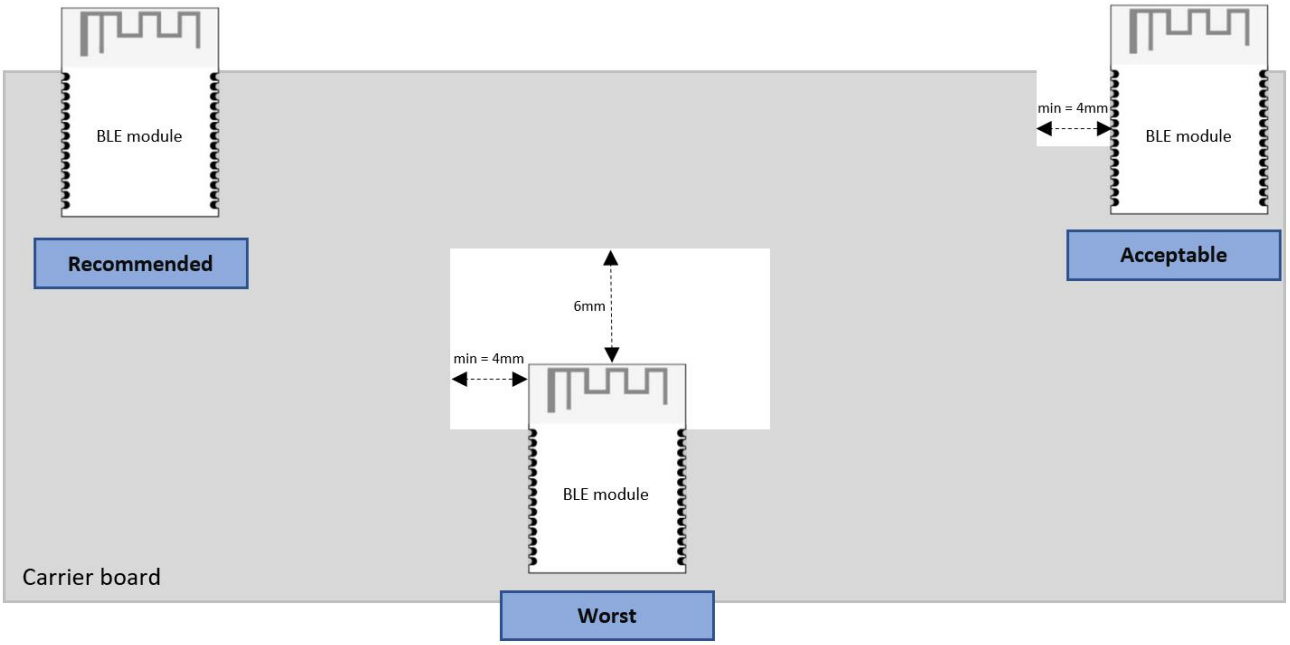
• All module GND pins MUST be connected to main board GND. Place GND vias close to module GND pads as possible. Unused PCB area on surface layer can flooded with copper but place GND vias regularly to connect copper flood to inner GND plane. If GND flood copper underside the module then connects with GND vias to inner GND plane.

• Even when above mentioned condition is satisfied, communication performance may be significantly deteriorated depending on the structure of the product. Bluetooth range performance is degraded if a module is placed in the middle of the main board.

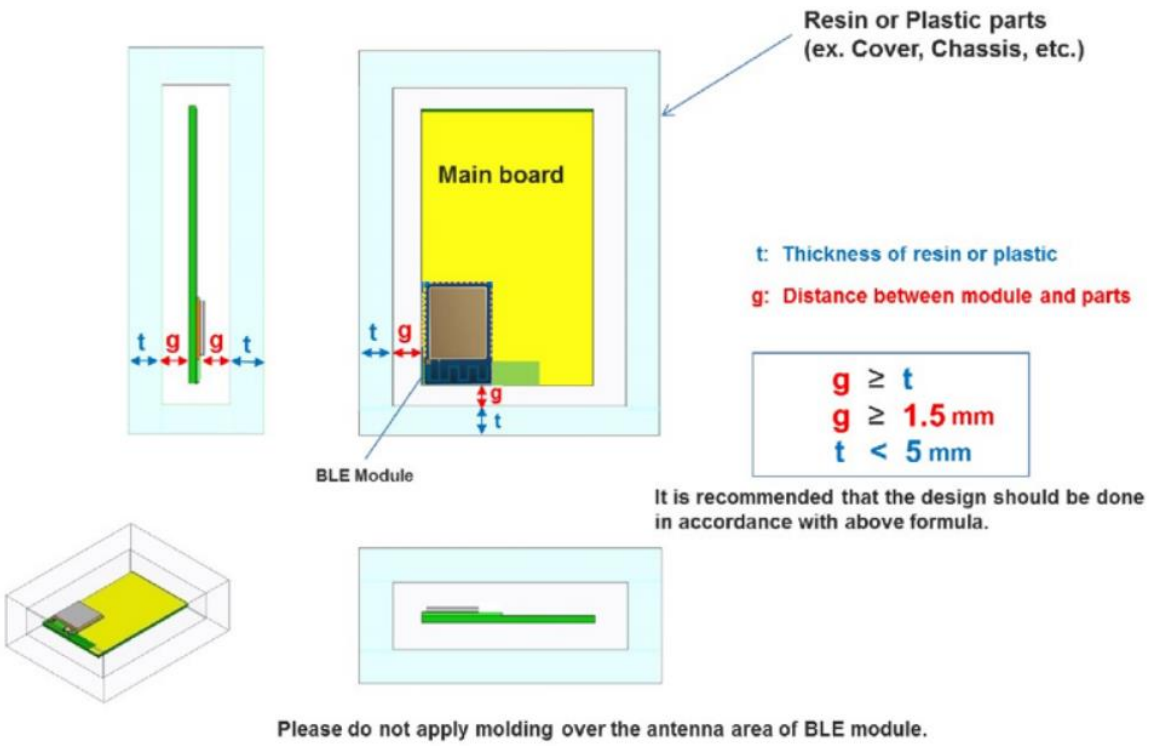
• For main board layout:

- Avoid running any signal line below module whenever possible.

- No ground plane below antenna.
- If possible, cut-off the portion of main board below antenna.




**Placement of resin or plastic parts:**



Placement of metal parts:

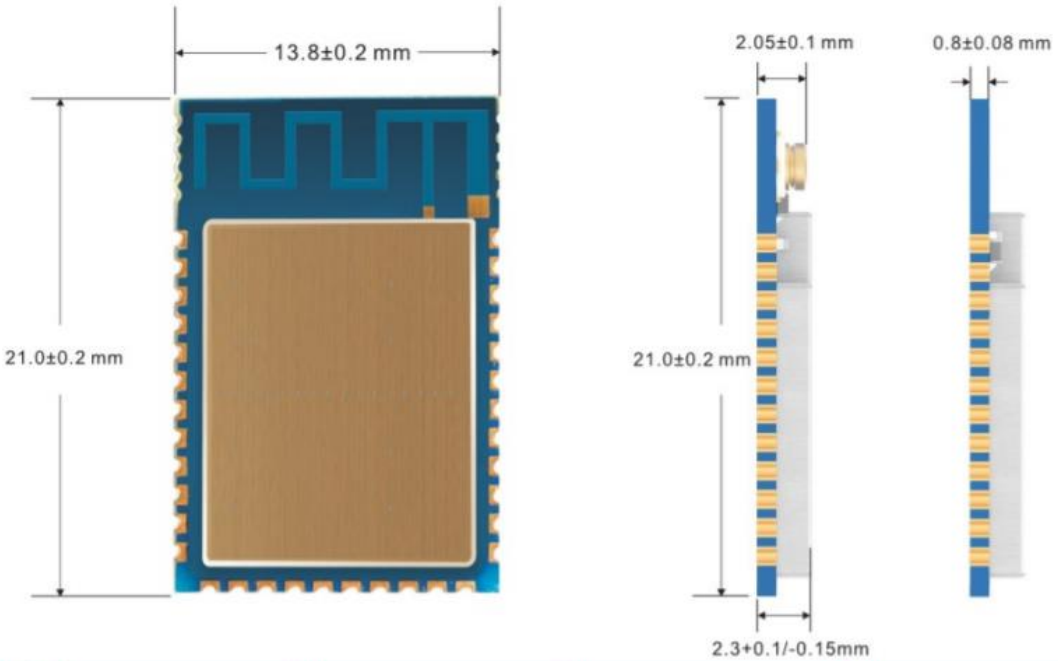
• Minimum safe distance for metal parts without seriously compromising the antenna (tuning) is 40 mm top/bottom and 30 mm left or right.

• Metal close to the module antenna (bottom, top, left, right, any direction) will have degradation on the antenna performance. The amount of that degradation is entirely system dependent, meaning you will need to perform some testing with your host application.

• Any metal closer than 20 mm will begin to significantly degrade performance (S11, gain, radiation efficiency).

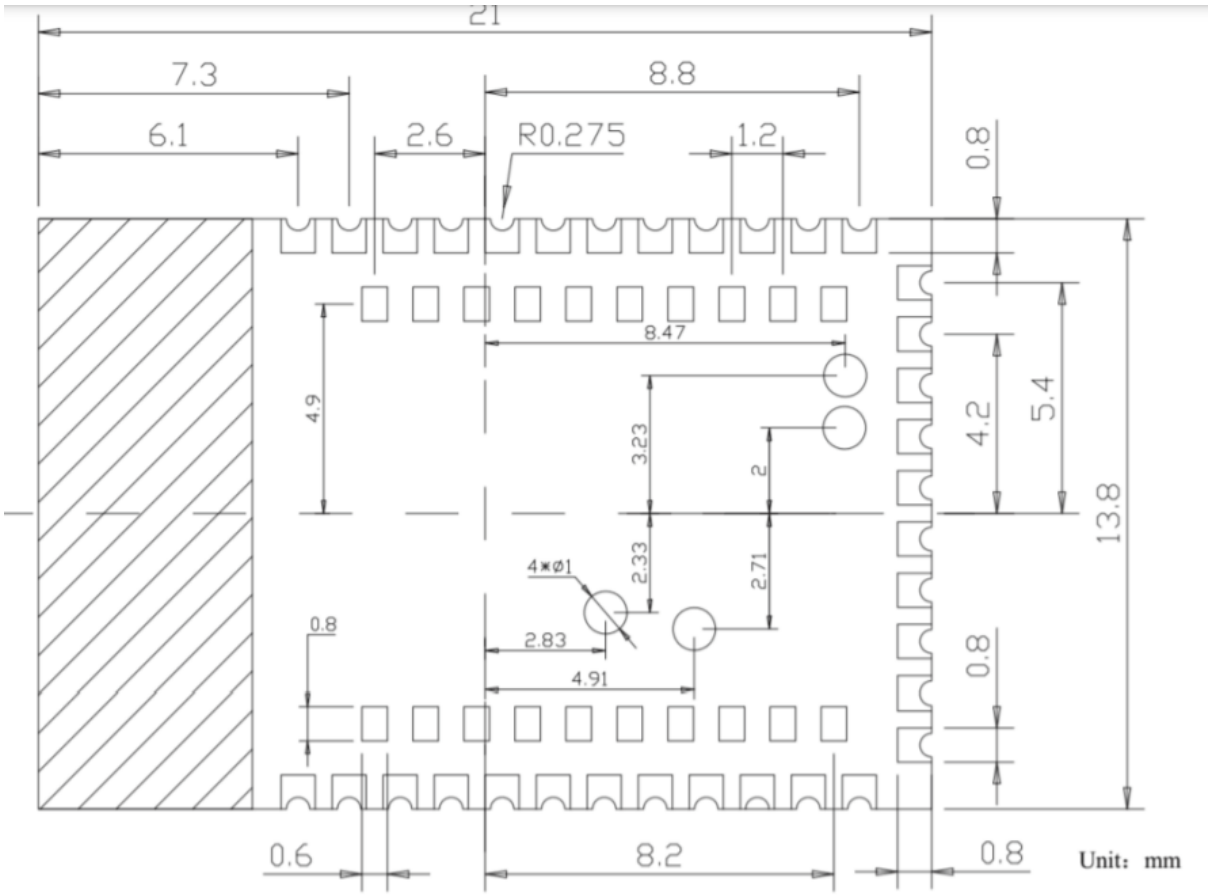
• It is best that you test the range with a mock-up (or actual prototype) of the product to assess effects of enclosure height (and materials, whether metal or plastic).

## 8. Mechanical Dimensions




| Symbol | Min. | Typ. | Max. |
|---|---|---|---|
| Length | -0.2mm | 21mm | +0.2mm |
| Width | -0.2mm | 13.8mm | +0.2mm |
| Height (PCB only) | -0.08mm | 0.8mm | +0.08mm |
| Height (with shield) | -0.15mm | 2.3mm | +0.1mm |

## 9. PCB Footprint and Dimensions



## 10. Qualification and approvals

### 10.1. United States (FCC)

The SPNYH02-C has received Federal Communications Commission (FCC) CFR47 Telecommunications, Part 15 Subpart C "Intentional Radiators" modular approval in accordance with Part 15.247 Modular Transmitter approval. The modular approval allows the end user to integrate the module into a finished product without obtaining subsequent and separate FCC approvals for intentional radiation, provided no changes or modifications are made to the module circuitry. Changes or modifications could void the user's authority to operate the equipment. The end user must comply with all of the instructions provided by the Grantee, which indicate installation and/or operating conditions necessary for compliance.
The finished product is required to comply with all applicable FCC equipment authorizations regulations, requirements and equipment functions not associated with the transmitter module portion. For example, compliance must be demonstrated to regulations for other transmitter components within the host product; to requirements for unintentional radiators (Part 15 Subpart B "Unintentional Radiators"), such as digital devices, computer peripherals, radio receivers, etc.; and to additional authorization requirements for the non-transmitter functions on the transmitter module (i.e., Verification, or Declaration of Conformity) (e.g., transmitter modules may also contain digital logic functions) as appropriate.

**Note:**

Modification to this product will void the users' authority to operate this equipment.
The OEM is still responsible for verifying end product compliance with FCC Part 15, subpart B limits for unintentional radiators through an accredited test facility.

#### 10.1.1. Labelling and user information requirements

**The SPNYL01-X is assigned the FCC ID number: 2A3ZU-SPNYH02**

If the FCC ID is not visible when the module is installed inside another device, then the outside of the finished product into which the module is installed must also display a label referring to the enclosed module. This exterior label can use the following or similar wording:
Contains FCC ID: 2A3ZU-SPNYH02
In addition to marking the product with the appropriate FCC ID, the end product user manual may also require specific information based on the digital device classification. Refer to the FCC Rules, Title 47, Subchapter A, Part 15, Subpart B, Chapter §15.105 for specific wording of the notices.

#### 10.1.2. RF exposure

All transmitters regulated by FCC must comply with RF exposure requirements. KDB 447498 General RF Exposure Guidance provides guidance in determining whether proposed or existing transmitting facilities, operations or devices comply with limits for human exposure to Radio Frequency (RF) fields adopted by the Federal Communications Commission (FCC).
This module is approved for installation into mobile and/or portable host platforms and must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter guidelines. End users must be provided with transmitter operating conditions for satisfying RF Exposure compliance.

### 10.2. European Union regulatory compliance

Information about regulatory compliance of the European Union for the SPNYH02-C module is available in the SPNYH02-C Declaration of Conformity.

### 10.2.1. Radio Equipment Directive (RED) 2014/53/EU

The SPNYH02-C module complies with the essential requirements and other relevant provisions of Radio Equipment Directive (RED) 2014/53/EU.

### 10.2.2. Labelling and user information requirements

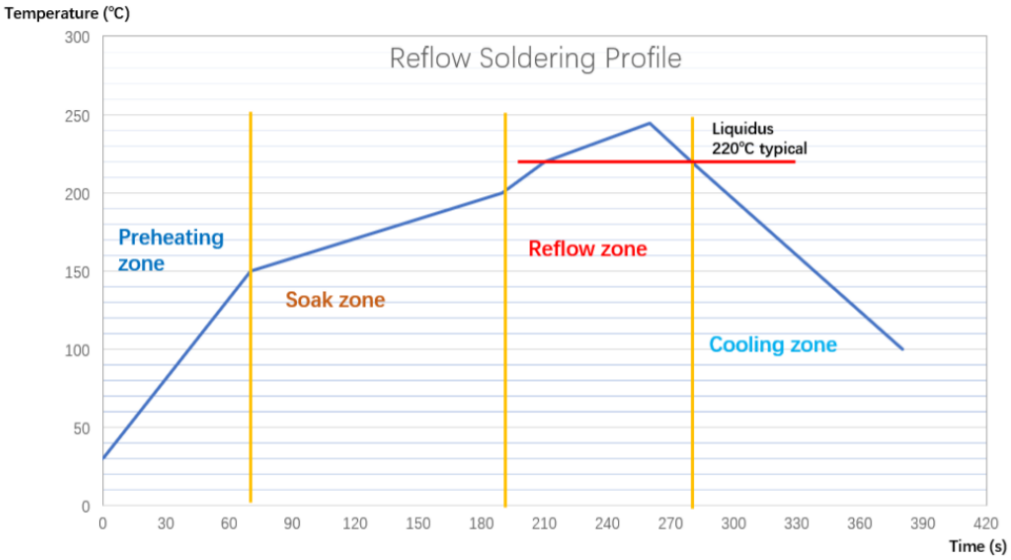
The label on the final products which contain the module must follow CE marking requirements. The "R&TTE Compliance

## 11. Cautions

### 11.1 Reflow soldering

Reflow soldering is a vitally important step in the SMT process. The temperature curve associated with the reflow is an essential parameter to control to ensure the correct connection of parts. The parameters of certain components will also directly impact the temperature curve selected for this step in the process.

## Temperature-Time Profile for Reflow Soldering:




• The standard reflow profile has four zones: ①preheat, ②soak, ③reflow, ④cooling. The profile describes the ideal temperature curve of the top layer of the PCB.

• During reflow, modules should not be above 260°C and not for more than 30 seconds.

| Specification | Value |
|---|---|
| Temperature Increase Rate | <2.5°C/s |
| Temperature Decrease Rate | Free air cooling |
| Preheat Temperature | 0-150°C |
| Preheat Period (Typical) | 40-90s |
| Soak Temp Increase Rate | 0.4-1°C/s |
| Soak Temperature | 150-200°C |
| Soak Period | 60-120s |
| Liquidus Temperature (SAC305) | 220°C |
| Time Above Liquidous | 45-90s |
| Reflow Temperature | 230-250°C |
| Absolute Peak Temperature | 260°C |

Note: The module is LGA package. Please be careful of the amount of solder paste. The module may be lifted due to excess solder.

## 11.2 Usage Condition Notes

• Follow the conditions written in this specification, especially the recommended condition ratings about the power supply applied to this product.

• The supply voltage has to be free of AC ripple voltage (for example from a battery or a low noise regulator output). For noisy supply voltages, provide a decoupling circuit (for example a ferrite in series connection and a bypass capacitor to ground of at least 47uF directly at the module).

• Take measures to protect the unit against static electricity. If pulses or other transient loads (a large load applied in a short time) are applied to the products, check and evaluate their operation before assembly on the final products.

• The supply voltage should not be exceedingly high or reversed. It should not carry noise and/or spikes.

• This product away from other high frequency circuits.

• Keep this product away from heat. Heat is the major cause of decreasing the life of these products.

• Avoid assembly and use of the target equipment in conditions where the product's temperature may exceed the maximum tolerance.

• This product should not be mechanically stressed when installed.

• Do not use dropped products.

• Do not touch, damage or soil the pins.

• Pressing on parts of the metal shield or fastening objects to the metal shield will cause damage.

### 11.3 Storage Notes

• The module should not be stressed mechanically during storage.

• Do not store these products in the following conditions or the performance characteristics of the product, such as RF performance will be adversely affected:

- Storage in salty air or in an environment with a high concentration of corrosive gas.
- Storage in direct sunlight
- Storage in an environment where the temperature may be outside the range specified.
- Storage of the products for more than one year after the date of delivery storage period.

• Keep this product away from water, poisonous gas and corrosive gas.

• This product should not be stressed or shocked when transported.

## 12. Package information

| Details | Tape and Reel |
|---|---|
| Quantity(module) | 400 pcs |
| Single module Weight | 45.0g |
| Dimension | 23 x 16.5 x 3.2 mm (L x W x H) |

## Revision History

| Revision | Description | Author | Date |
|---|---|---|---|
| V1.0 | Initial Release | Brosnan | 2021.10.04 |

- List of applicable FCC rules

The Bluetooth Low Energy Module is an BLE Module with digitally modulated systems using an GFSK modulation.It operates on the 2402- 2480MHz band. Complies with FCC CFR Title 47 Part 15 Subpart C Section 15.247.

- Specific operational use conditions

The 2A3ZU-SPNYH02is a BLE Module

Operation Frequency: 2402 - 2480MHzModulation Type: GFSK

Number Of Channel: 40CH

Antenna Designation: PCB Antenna and External 2.4Ghz FPC antenna

SPNYL01-X series is a powerful, highly flexible, ultra-low power Bluetooth® 5.1 module based on world-leading Nordic® Semiconductor nRF52833 SoC solution, which has a 32bit Arm® Cortex™-M4 CPU with floating point unit running at 64MHz. MK07 series is capable of the latest and greatest features of Bluetooth® 5.1, the most prominent being Direction Finding1, taking Bluetooth positioning to new heights.

Its application can be automatic meter reading, home building automation, security system, remote irrigation system.

- Limited module procedures

not applicable; Single Modular Approval Request

- Trace antenna designs

Not applicable;

- RF exposure considerations

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

- Antennas

The 2A3ZU-SPNYH02is an BLE Module beams signals and communicates with its antenna, which is PCB Antenna and External 2.4Ghz FPC antenna. Antenna could not be in no load state when module is working. During debugging, it is suggested to add 50 Ohms load to the antenna port to avoid damage or performance degradation of the module under long-time no-load conditions

- Label and Compliance information

The final end product must display the following content in the visible area
Host must Contains FCC ID: 2A3ZU-SPNYH02. If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: The device complies with part 15 of FCC rules. Operation is subject to the following 2 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

- Information on test modes and additional testing requirements

Data transfer module demo board can control the EUT work in RF test mode at specified test channel.

- FCC ID Location:

OEM Warning statement (Module)
The modular transmitter must be equipped with either a permanently affixed label or must be capable of electronically displaying its FCC identification number ：
If using a permanently affixed label, the modular transmitter must be labelled with its own FCC identification number, and, if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “Contains Transmitter Module FCC ID: 2A3ZU-SPNYH02.” Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement. In the latter case, a copy of these instructions must be included in the application for equipment authorization.

- Additional testing:

The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module. Appropriate measurements (e.g. 15 B compliance, 15C intentional emissions (Fundamental + Out-of-Band Emission)) and if applicable additional equipment authorizations (e.g. Verification, DoC) of the host device to be addressed by the integrator/manufacturer.

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

1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and

2) This device and its antenna(s) must not be co-located with any other transmitters except in accordance with FCC multi-transmitter product procedures. Referring to the multi-transmitter policy, multiple-transmitter(s) and module(s) can be operated simultaneously without C2P.

3) For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change.

- USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-
frequency exposure guidelines for an uncontrolled environment can be satisfied.

The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is
required to be available in the user's manual:

This device complies with Part 15 of 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.

LABEL OF THE END PRODUCT:

The final end product must be labelled in a visible area with the following " **Contains FCC ID: 2A3ZU-SPNYH02**". If the size of the end product is larger than 8x10cm, then the following
FCC part 15.19 statement has to also be available on the label:

This device complies with Part 15 of 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.

*DECLARATION: The contents of this datasheet are subject to change without prior notice for further improvement. Spintly team reserves all the rights for the final explanation.*
*Please contact Spintly sales team or visit WWW.SPINTLY.COM to get more related information if needed.*

## Contact Information

SPINTLY

Website: www.spintly.com

sales@spintly.com

Address: G1, Vaz Appts, Fatorda, Salcette, Goa 403602

Contact: +91 8766812888