



RN52e DataSheet

v1.2.0-en

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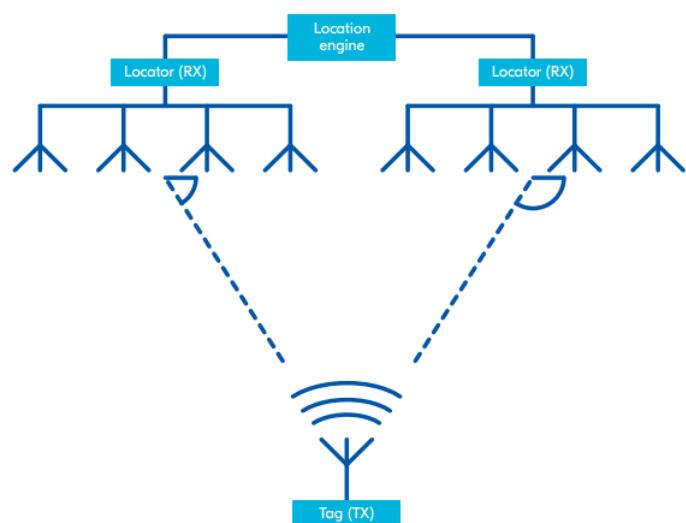
1. Revision History

Date	Version	Description
2020/01	1.0.0	First Release
2021/08	1.1.0	Change dimension data to high resolution
2021/11	1.2.0	Change dimension data (Chip Antenna)

2. Overview



The RN52e module based on the nRF52811 SoC is the 4th addition to the nRF52 Series, and adds capabilities for Bluetooth® 5.1 Direction Finding. Direction Finding enables positioning solutions to not only rely on received signal strength indicator (RSSI), but also the actual direction of a signal. This improves accuracy significantly and opens new possibilities for applications in this segment. There are two types of methods for determining direction, angle of arrival (AoA), where the direction of the received signal is calculated, and angle of departure (AoD), where the direction of the transmitted signal is calculated.



Real time locating system

Above you see an example of a real time location system (RTLS) where the principle of AoA is used to determine the location of an tag. The tag is just a simple beacon, broadcasting.

Each locator determines which direction the signal is coming from and together with the location engine they are able to calculate the location of the tag.

Enhancing beacon applications

The RN52e SoC gives the opportunity to enhance beacon applications to leverage the Long Range feature introduced in Bluetooth 5, in addition to Direction Finding introduced in Bluetooth 5.1. It achieves longer range without adding more costly components, providing an ideal option for cost-sensitive beacon applications.

The ultimate network processor

The RN52e offers comprehensive connectivity with a long list of capabilities and features. It is capable of all the latest features of Bluetooth, including Long Range and Direction Finding, but also 802.15.4, Thread and Zigbee. This comprehensive connectivity offer makes it the ultimate network processor, and paired with a companion MCU, it offers great value in for example gateway and router applications for smart home.

Get started today

The RN52e is supported by the nRF5 SDK, providing all the necessary examples, libraries and drivers to get started with development. SoftDevice S112, a Bluetooth 5 protocol stack, is already qualified for it, providing high throughput with 2 Mbps and improved coexistence with channel selection algorithm #2.

In addition, a Thread connectivity solution is available in the nRF5 SDK for Thread and Zigbee.

2.1. Features

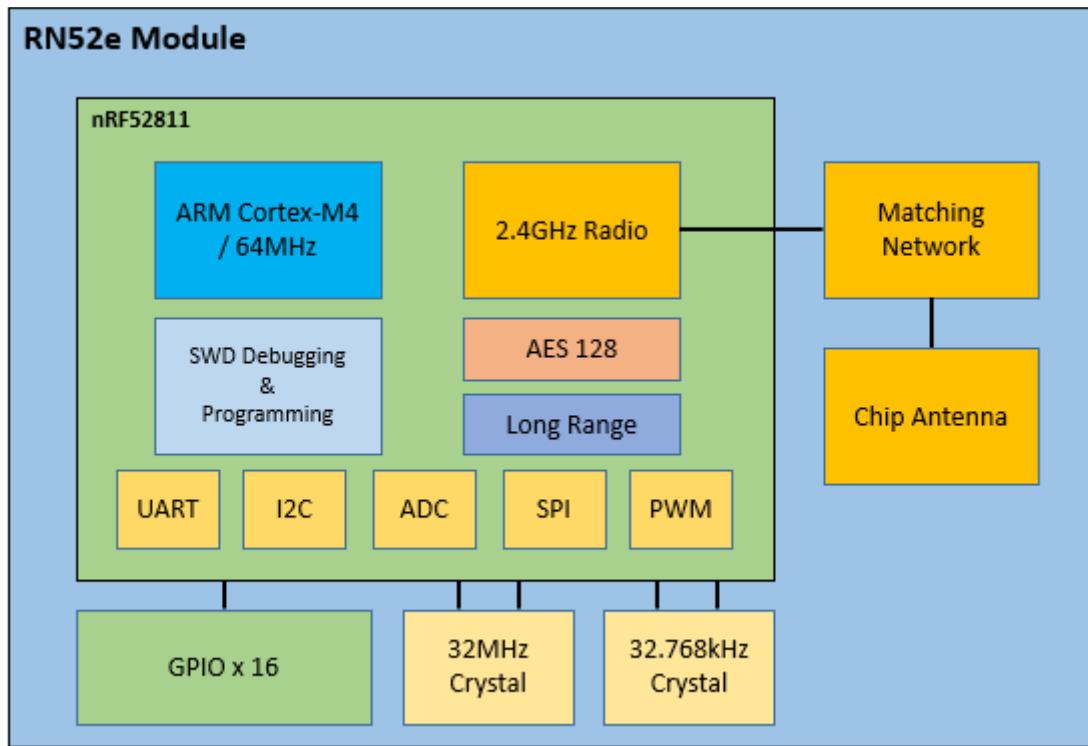
- Bluetooth 5.1, IEEE 802.15.4-2006, 2.4 GHz transceiver
 - -97 dBm sensitivity in 1 Mbps Bluetooth low energy mode
 - -104 dBm sensitivity in 125 kbps Bluetooth low energy mode (long range)
 - -20 to +4 dBm TX power, configurable in 4 dB steps
 - On-air compatible with nRF52, nRF51, nRF24L, and nRF24AP Series
 - Supported data rates:
 - Bluetooth 5.1: 2 Mbps, 1 Mbps, 500 kbps, and 125 kbps
 - IEEE 802.15.4-2006: 250 kbps
 - Proprietary 2.4 GHz: 2 Mbps, 1 Mbps
 - Angle-of-arrival (AoA) and angle-of-departure (AoD) direction finding using Bluetooth.
 - Single-ended antenna output (on-chip balun)
 - 4.6 mA peak current in TX (0 dBm)
 - 4.6 mA peak current in RX
 - RSSI (1 dB resolution)
- ARM Cortex-M4 32-bit processor, 64 MHz
 - 144 EEMBC CoreMark score running from flash memory
 - 34.4 μ A/MHz running CoreMark from flash memory
 - 32.8 μ A/MHz running CoreMark from RAM memory
 - Serial wire debug (SWD)
- Flexible power management
 - 1.7 V to 3.6 V supply voltage range
 - Fully automatic LDO and DC/DC regulator system
 - Fast wake-up using 64 MHz internal oscillator
- 192 kB flash and 24 kB RAM
- Nordic SoftDevice ready
- Support for concurrent multi-protocol
- 12-bit, 200 ksps ADC - 8 configurable channels with programmable gain

- 64 level comparator
- Temperature sensor
- 4-channel pulse width modulator (PWM) unit with EasyDMA
- Digital microphone interface (PDM)
- 3x 32-bit timer with counter mode
- 2x SPI master/slave with EasyDMA
- I2C compatible 2-wire master/slave
- UART (CTS/RTS) with EasyDMA
- Programmable peripheral interconnect (PPI)
- Quadrature decoder (QDEC)
- AES HW encryption with EasyDMA
- 2x real-time counter (RTC)

2.2. Application

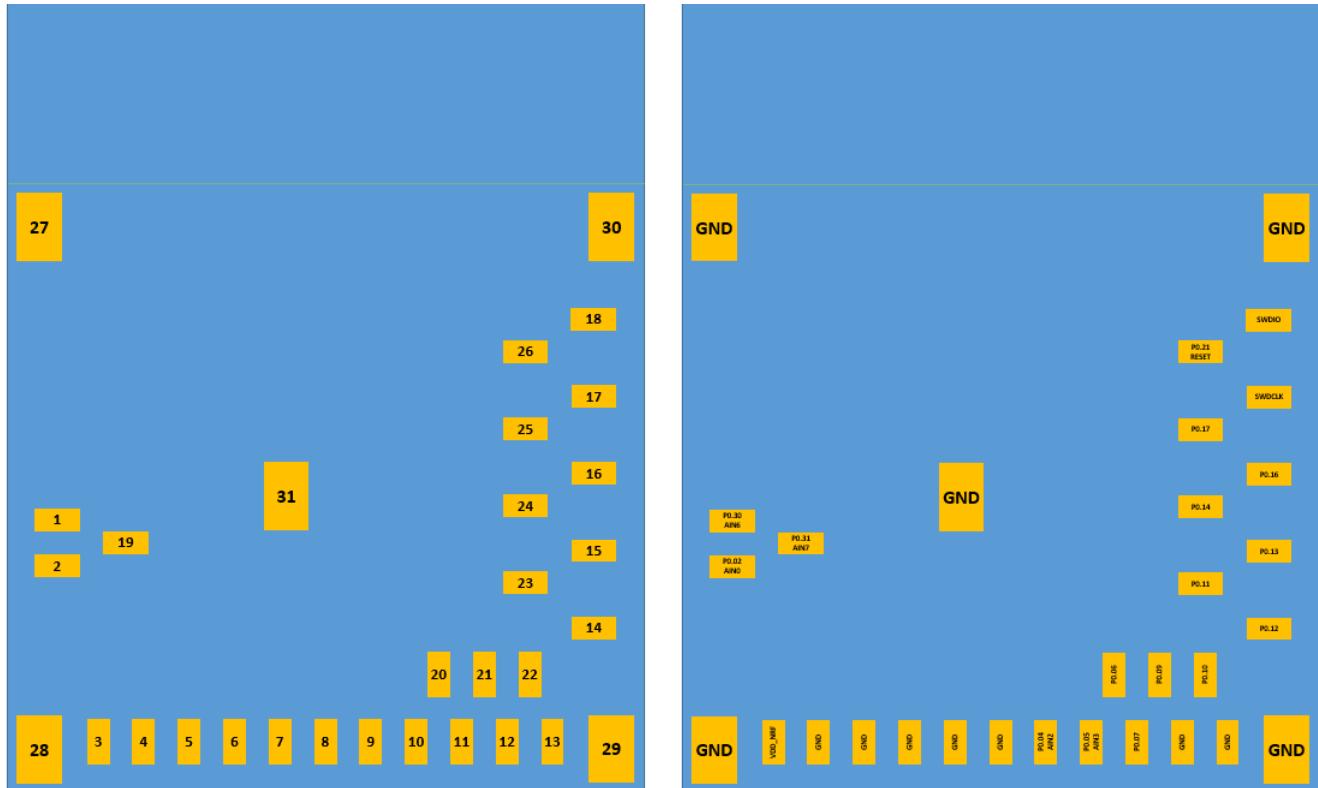
- Internet of Things (IoT)
 - Home automation
 - Sensor networks
 - Building automation
 - Industrial
 - Retail
- Computer peripherals and I/O devices
 - Mouse
 - Keyboard
 - Multi-touch trackpad
- Interactive entertainment devices
 - Remote control
 - Gaming controller
- Beacons
- Personal Area Networks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

2.3. Block Diagram



The RN52e module includes a matching network for chip antenna and external 32.768k crystal.

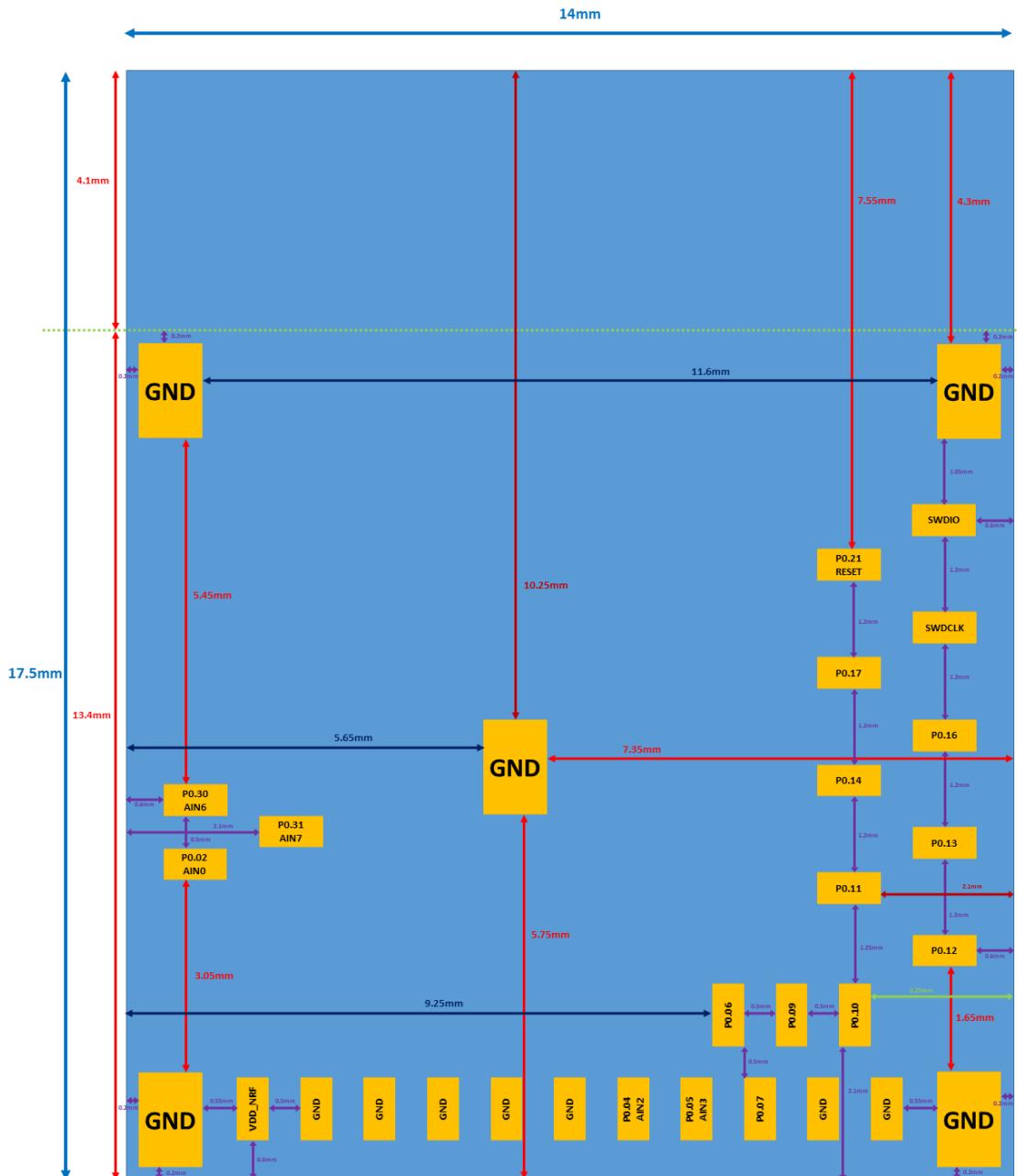
3. Pin Assignments and Functions (Top View)



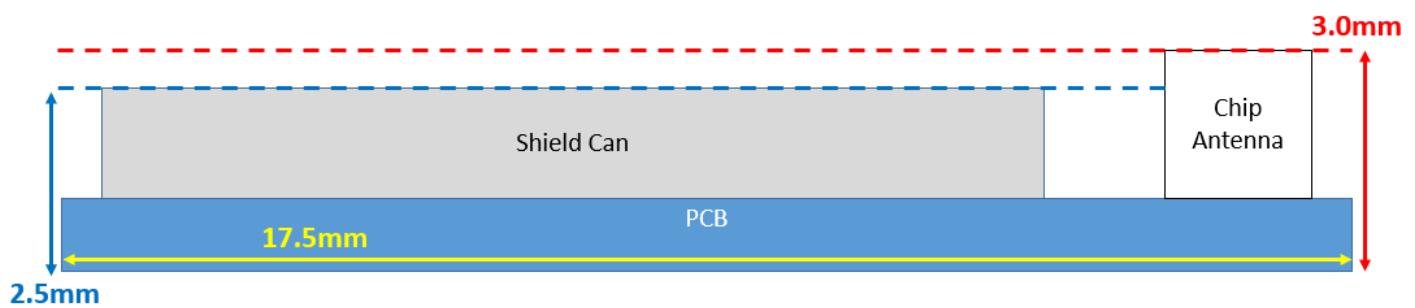
Pin	Pin Name	Pin Function	Description
1	P0.30 AIN6	Digital I/O Analog input	General purpose I/O COMP input SAADC input
2	P0.02 AIN0	Digital I/O Analog input	General purpose I/O COMP input SAADC input
3	VDD_NRF	Power	Power supply.
4	GND	Power	Ground (0 V).
5	GND	Power	Ground (0 V).
6	GND	Power	Ground (0 V).
7	GND	Power	Ground (0 V).
8	GND	Power	Ground (0 V).
9	P0.04 AIN2	Digital I/O Analog input	General purpose I/O COMP input SAADC input
10	P0.05 AIN3	Digital I/O Analog input	General purpose I/O COMP input SAADC input
11	P0.07	Digital I/O	General purpose I/O
12	GND	Power	Ground (0 V).

13	GND	Power	Ground (0 V).
14	P0.12	Digital I/O	General purpose I/O
15	P0.13	Digital I/O	General purpose I/O
16	P0.16	Digital I/O	General purpose I/O
17	SWDCLK	Digital Input	Serial wire debug clock input for debug and programming
18	SWDIO	Digital I/O	Serial wire debug I/O for debug and programming
19	P0.31 AIN7	Digital I/O Analog input	General purpose I/O COMP input SAADC input
20	P0.06	Digital I/O	General purpose I/O
21	P0.09	Digital I/O	General purpose I/O
22	P0.10	Digital I/O	General purpose I/O
23	P0.11	Digital I/O	General purpose I/O
24	P0.14	Digital I/O	General purpose I/O
25	P0.17	Digital I/O	General purpose I/O
26	P0.21 nRESET	Digital I/O	General purpose I/O. Configurable as system RESET.
27	GND	Power	Ground (0 V).
28	GND	Power	Ground (0 V).
29	GND	Power	Ground (0 V).
30	GND	Power	Ground (0 V).
31	GND	Power	Ground (0 V).

4. Module Layout



RN52e Dimension and Bottom Pad (Top View)



The recommended metal mask sizes for the bottom pad type of the RN52e module are shown below.

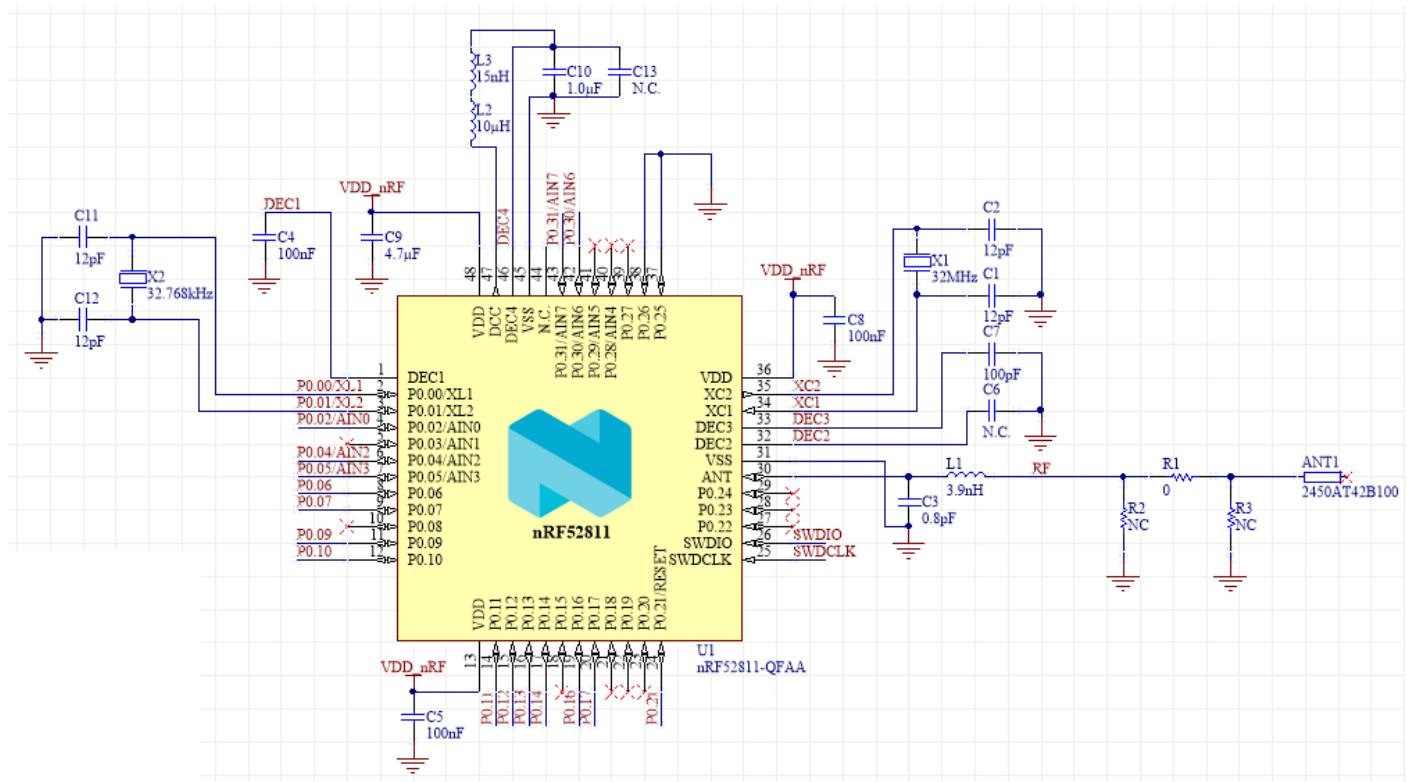
<Recommended metal mask for solder printing>

Pad	Pad size	Mask opening
Signal pad	0.5 x 1.0 mm & 1.0 x 0.5 mm	0.4 x 0.9 mm & 0.9 x 0.4 mm
Corner & Center pad	1.0 x 1.5 mm	0.7 x 1.0 mm

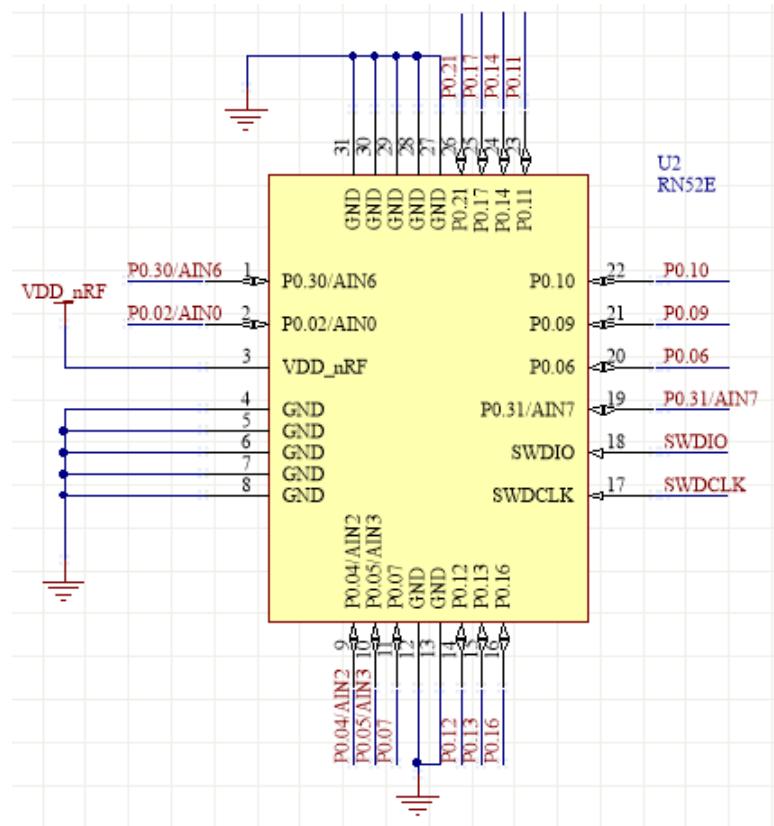
The metal mask thickness : $t = 0.1\text{mm}$

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

5. Module Schematics



6. Module Reference



The RN52e module can operate only by connecting VDD and GND.

FCC STATEMENT

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: This device may not cause harmful interference, and

This device must accept any interference received, including interference that may cause undesired operation.

Warning: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed

and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 5mm between the radiator & your body.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.249 & 15.207 & 15.209

2.3 Specific operational use conditions

Operation Frequency:2402~2480MHz

Number of Channel:40 Channels

Modulation Type:GFSK

Antenna Type:Ceramic antenna

Antenna Gain(Peak):0 dBi (Provided by customer)

The module can be used for mobile or portable applications with a maximum 1dBi antenna. The host manufacturer installing this module into their product must ensure that the final composit product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

2.4 Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs

Not applicable. The module has its own antenna, and doesn't need a host's printed board microstrip trace antenna etc.



2.6 RF exposure considerations

The module must be installed in the host equipment such that at least 5mm is maintained between the antenna and users' body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.7 Antennas

Antenna Specification are as follows:

Antenna Type:Ceramic antenna

Antenna Gain(Peak):0 dBi (Provided by customer)

This device is intended only for host manufacturers under the following conditions:

The transmitter module may not be co-located with any other transmitter or antenna;

The module shall be only used with the External antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employ a 'unique' antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating "Contains FCC ID 2A7LK-RN52E With their finished product.

2.9 Information on test modes and additional testing requirements

Operation Frequency:2402~2480MHz

Number of Channel:40 Channels

Modulation Type:GFSK

Antenna Type:Ceramic antenna

Antenna Gain(Peak):0 dBi (Provided by customer)

Host manufacturer must perform test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is **only** FCC authorized for FCC Part 15 Subpart C 15.249 & 15.207 & 15.209 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.