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# Datasheet

产品名称 (Product):    BT 5.4 module

产品型号 (Model No.):  HOLYIOT-24005 -nRF54L15

# 1. Description

NRF54L15 is the first system level chip (SoC) in the nRF54L series. It is an ultra-low power Bluetooth 5.4 SoC with the best in class new multi protocol radio and advanced security features. The nRF54L series takes the popular nRF52 series to a new level with a more compact packaging, featuring excellent processing power and efficiency, expanded memory, and new peripherals. Main advantages Taking the nRF52 series to the next level: achieving significant leaps in performance, efficiency, and security. Resisting security threats: Advanced security features, including secure boot, secure firmware updates, secure storage, and physical attack protection.Providing long-distance: the best in class multi protocol radio with low power consumption for 1 Mbps Bluetooth, with a transmission power of up to 8 dBm and a reception sensitivity of -98 dBm.Extending battery life or reducing battery size: efficient processing, ultra-low power radio, and minimum sleep current.

## Hardware :

SWD programmer (SWDIO,SWCLK,VDD,GND)

nRF54L15 -QFAA-QFN48

Size : 24mm*15.6mm

BLE stack & RF 2.4Ghz

## Features :
Excellent processing ability and efficiency

The nRF54L15 SoC integrates an Arm Cortex-M33 processor with a operating frequency of 128 MHz, which has twice the processing power of the nRF52840 and reduces power consumption. It has 1.5 MB of non-volatile memory and 256 KB of RAM, which is sufficient to run multiple wireless protocols simultaneously.

Advanced Security

NRF54L15 is designed specifically for PSA certification level 3, which is the highest level of PSA certified IoT security standard. It provides security services such as secure boot, secure firmware updates, and secure storage. The integrated tampering sensor can detect attacks and take appropriate measures, while the encryption accelerator can be reinforced to resist side channel attacks.

A first-class multi protocol radio

This best in class multi protocol RF product has higher robustness and longer transmission distance. For 1 Mbps Bluetooth with low power consumption, the transmission power can reach 8 dBm (with a step of 1 dB), and the receiving sensitivity is -98 dBm. This radio includes a new 4 Mbps data rate option for 2.4 GHz proprietary protocols, with improved throughput,

efficiency, and latency. It supports low-power Bluetooth and all Bluetooth 5.4 features, and is specifically designed to support the upcoming Bluetooth specifications. In addition, it also supports protocols such as Bluetooth grid, Thread, and Matter.

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New Global RTC peripherals that can extend battery life

The new global RTC peripherals can wake up SoC from the deepest sleep mode, eliminating the need for external RTC, greatly reducing energy consumption for long-term sleep applications and extending battery life.

Ultra compact packaging suitable for size limited designs

NRF54L15 samples are now available in QFN packaging. It will also adopt two ultra compact WLCSP packages. These packages will be 50% smaller than nRF52840 and are suitable for designs with strict size limitations.
6x6 mm QFN48 with 31 GPIOs
2.4x2.2 mm WLCSP with 32 GPIOs (300 um pitch)
2.4x2.2 mm WLCSP with 14 GPIOs (350 um pitch)

# Application:

Computer accessories, game controllers, and remote controllers

Virtual reality and augmented reality

Smart Home and Materials

Medical equipment

Industrial Internet of Things

# 2. **Introduction**

## 2.1 Programmer

HOLYIOT-24005- NRF54L15 module use the Serial Wire Debug(SWD port ), the module which layout the SWDIO, SWCLK, VDD, GND for debug and flash your own firmware, more info about the SWD, please visit https://www.silabs.com/community/mcu/32-bit/knowledge-base.entry.html/2014/10/21/serial_wire_debugs-qKCT

You can using the Jlink or Jtag for programmer.

## 2.2 Software development Tool

It supports the standard Nordic Software Development Tool-chain using Segger Embedded Studio, Keil, IAR and GCC. More info please visit https://www.nordicsemi.com/Software-and-Tools/Development-Tools

## 2.3 Protocols

This module support Bluetooth 5, Bluetooth Low Energy,Bluetooth mesh,Thread,802.15.4,ANT, 2.4GHz proprietary. So we can use different protocols for different situations.

**Software Development Kit**
Nordic Semiconductor's Software Development Kits (SDK) are your starting point for software development on the nRF51 and nRF52 Series. It contains source code libraries and example applications covering wireless functions, libraries for all peripherals, bootloaders, wired and OTA FW upgrades, RTOS examples, serialization libraries.
More info please visit https://www.nordicsemi.com/Software-and-Tools/Software/nRF5-SDK
You can also download the SDK for coding development .

## 2.4 SoftDevices

Nordic Semiconductor protocol stacks are known as SoftDevices. SoftDevices are pre-compiled, pre-linked binary files. SoftDevices can be programmed in nRF5 series devices, and are freely downloadable from the Nordic website. Please download that here:
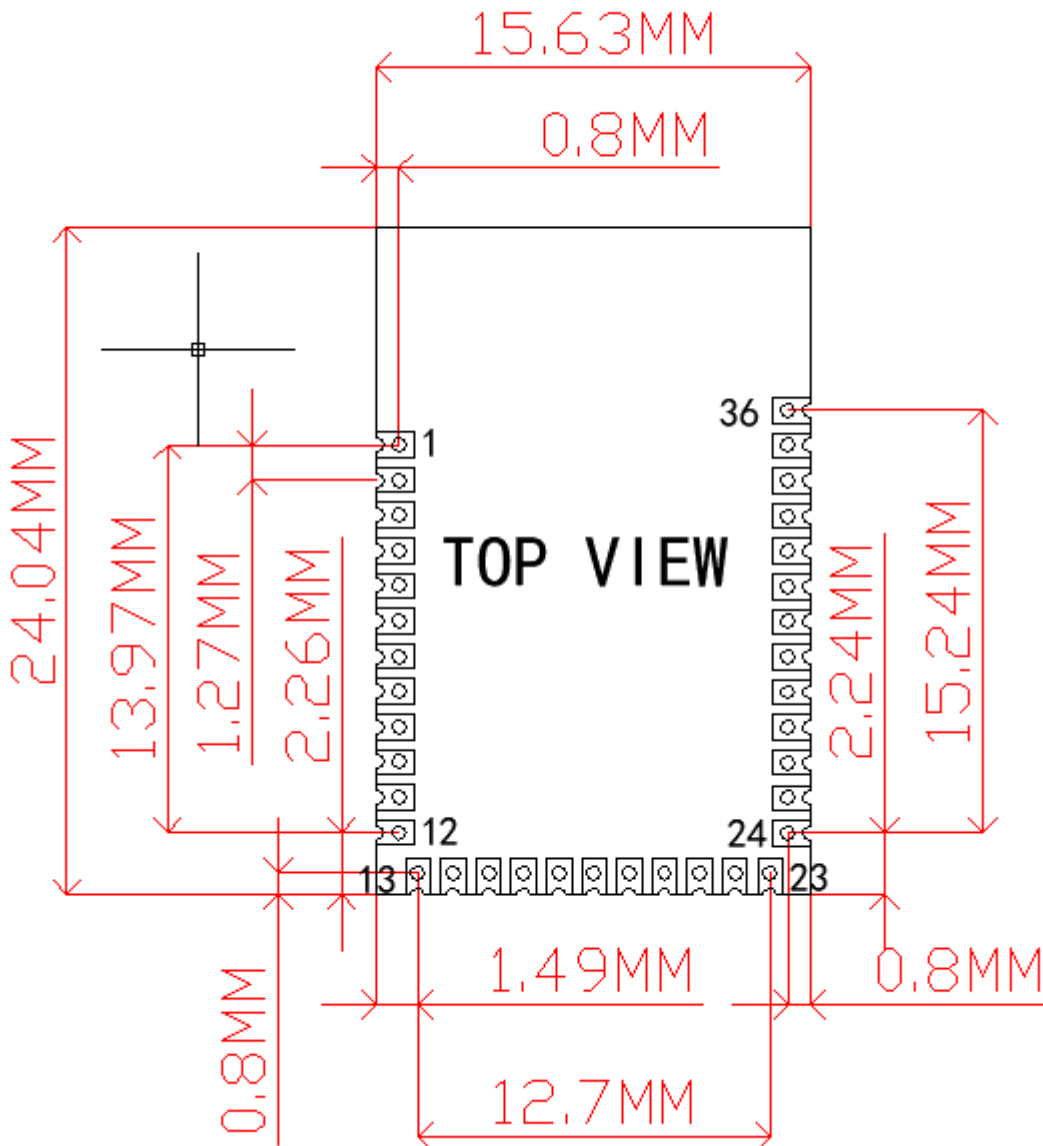https://www.nordicsemi.com/Software-and-Tools/Software/S132
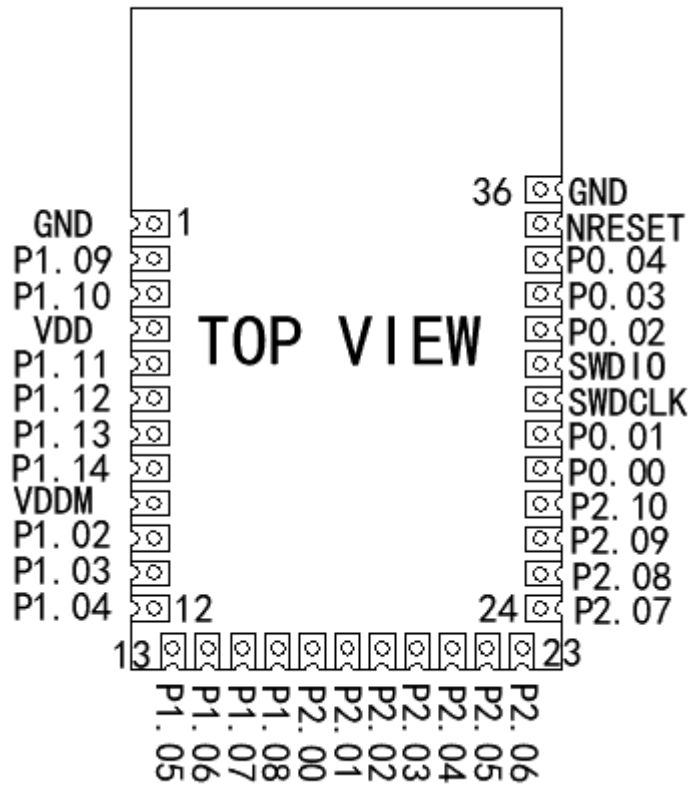
Over-The-Air DFU

The SoC is supported by an Over-The-Air Device Firmware Upgrade (OTA DFU) feature. This allows for in the field updates of application software and SoftDevice.

# 3. Product Descriptions

## 3.1 Mechanical drawings

# 3.2 Pin assignments



| PIN No. | PIN define | Functions |
|:---:|:---:|:---:|
| 1 | GND | Ground |
| 2 | P1.09 | Digital I/O |
| | TAMPC.ASO[2] | Digital I/O |
| 3 | P1.10 | Digital I/O |
| | TAMP.ASI[2] | Digital I/O |
| 4 | VDD | power |
| 5 | P1.11 | Digital I/O |
| | TAMPC.ASO[3] | Digital I/O |
| | AIN4 | Analog input |
| 6 | P1.12 | Digital I/O |
| | TAMPC.ASI[3] | Digital I/O |
| | AIN5 | Analog input |
| 7 | P1.13 | Digital I/O |
| | AIN6 | Analog input |
| 8 | P1.14 | Digital I/O |

| | | AIN7 | Analog input |
|---|---|---|---|
| 9 | | VDDM | power |
| 10 | | P1.02 | Digital I/O |
| | | NFC1 | NFC input |
| 11 | | P1.03 | Digital I/O |
| | | NFC2 | NFC input |
| 12 | | P1.04 | Digital I/O |
| | | AIN0 | Analog input |
| | | ASO[0] | Digital I/O |
| 13 | | P1.05 | Digital I/O |
| | | AIN1 | Analog input |
| | | ASI[0] | Digital I/O |
| 14 | | P1.06 | Digital I/O |
| | | AIN2 | Analog input |
| | | ASO[1] | Digital I/O |
| 15 | | P1.07 | Digital I/O |
| | | AIN3 | Analog input |
| | | ASI[1] | Digital I/O |
| 16 | | P1.08 | Digital I/O |
| | | GRTCHFOUT | Digital I/O |
| | | TAMPC.EXT | Digital I/O |
| | | EXTREF | Analog input |
| 17 | | P2.00 | Digital I/O |
| 18 | | P2.01 | Digital I/O |
| 19 | | P2.02 | Digital I/O |
| | | SWO | Digital I/O |
| 20 | | P2.03 | Digital I/O |
| 21 | | P2.04 | Digital I/O |
| 22 | | P2.05 | Digital I/O |
| 23 | | P2.06 | Digital I/O |
| | | TRACECLK | Digital I/O |
| 24 | | P2.07 | Digital I/O |
| | | TRACEDATA[0] | Digital I/O |
| | | SWO | Digital I/O |
| 25 | | P2.08 | Digital I/O |
| | | TRACEDATA[1] | Digital I/O |

| 26 | P2.09 | Digital I/O |
| | TRACEDATA[2] | Digital I/O |
| 27 | P2.10 | Digital I/O |
| | TRACEDATA[3] | Digital I/O |
| 28 | P0.00 | Digital I/O |
| 29 | P0.01 | Digital I/O |
| 30 | SWDCLK | Debug |
| 31 | SWDIO | Debug |
| 32 | P0.02 | Digital I/O(general purpose I/O) |
| 33 | P0.03 | Digital I/O(general purpose I/O |
| | GRTCPWM | Trace port clock output ) |
| 34 | P0.04 | Digital I/O |
| | GRTCLFCLKOUT | Digital I/O |
| 35 | nRESET | Reset |
| 36 | GND | Ground |

# 4. Mounting our board on the host PCBA

We suggest that you mount our RF board(HOLYIOT-24005 -nRF54L15) on the board like that:

For the best Bluetooth performance, the antenna of the area need to extend about several mm without ground under the antenna of the edge of the host PCB.

 The second choice is that place our board at the corner of host PCB, the antenna of board need to extend several mm outside of the Ground plane of the host PCB.
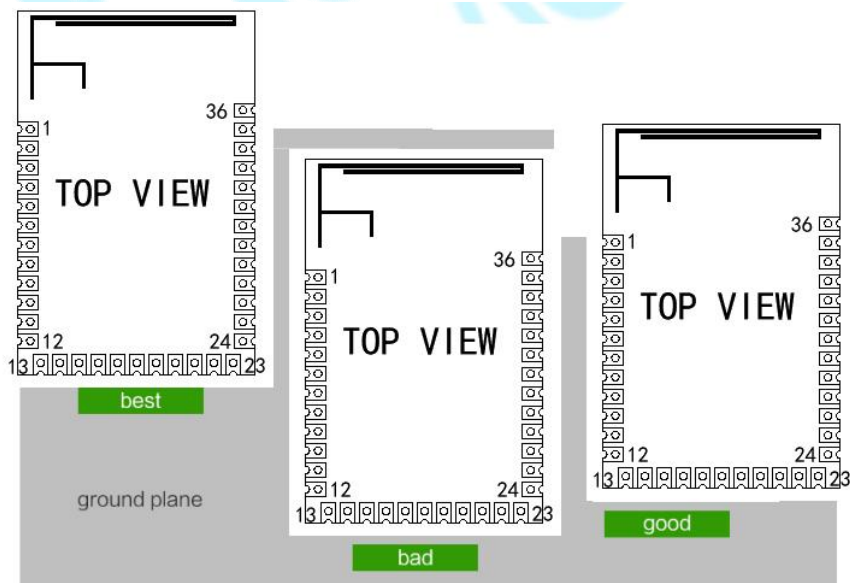
# 5. Miscellaneous

Soldering Temperature-Time Profile for Re-Flow Soldering. Maximum number of cycles for re-flow is 2. No opposite side re-flow is allowed due to module weight.
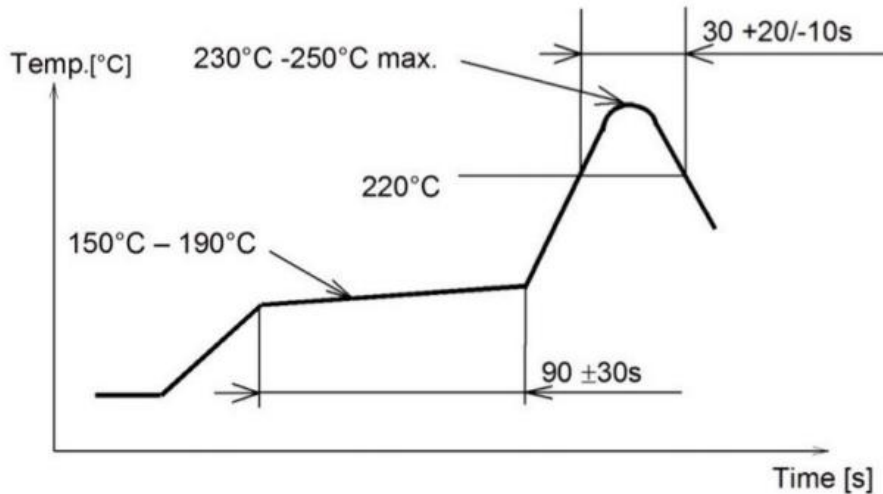


# 6. Recommended operating conditions

The operating conditions are the physical parameters that nRF54L15 can operate with.

| Symbol | Parameter | Min. | Nom. | Max. | Units |
|--------|-----------|------|------|------|-------|
| VDD | VDD supply voltage | 1.7 | | 2.7 | V |
| VDDM | VDDM supply voltage | 1.8 | 3.0 | 3.6 | V |
| TA | Operating temperature | -40 | 25 | 105 | °C |

*Table 88: Recommended operating conditions*



**ATTENTION**
**OBSERVE PRECAUTION FOR HANDLING**
**ELECTROSTATIC SENSITIVE DEVICE**
HBM (Human Body Model): Class 3A