

Class 1 Bluetooth® Module



Features

- Fully qualified Bluetooth 2.1/2.0/1.2/1.1 module
- Bluetooth v2.1+EDR support
- Postage stamp sized form factor, 13.4mm x 25.8 mm x 2mm
- Low power (30mA connected,, <10mA sniff mode)
- UART (SPP or HCI) and USB (HCI only) data connection interfaces.
- Sustained SPP data rates - 240Kbps (slave), 300Kbps (master)
- HCI data rates - 1.5Mbps sustained, 3.0Mbps burst in HCI mode
- Embedded Bluetooth stack profiles included (requires no host stack): GAP, SDP, RFCOMM and L2CAP protocols, with SPP and DUN profile support.
- Bluetooth SIG Qualified, End Product Listing
- Castellated SMT pads for easy and reliable PCB mounting
- Class 1 high power amplifier with on board ceramic RF chip antenna.
 - Certifications: FCC, ICS, CE
 - Environmentally friendly, RoHS compliant

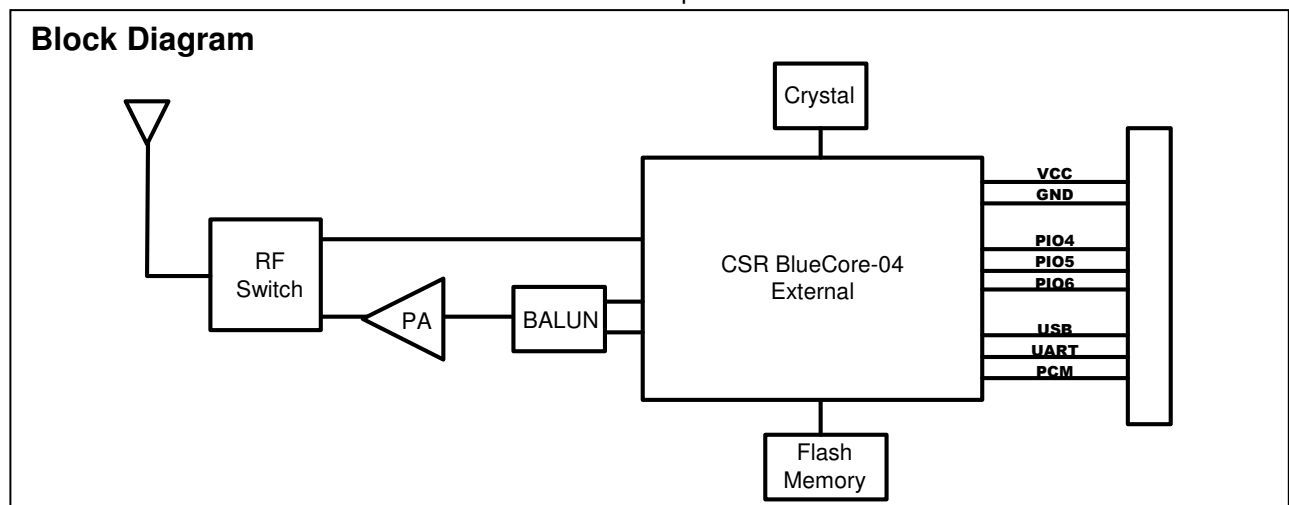
Applications

- Cable replacement
- Barcode scanners
- Measurement and monitoring systems
- Industrial sensors and controls
- Medical devices
- Asset tacking

Description

The RN41 is a small form factor, low power, highly economic Bluetooth radio for OEM's adding wireless capability to their products. The RN41 supports multiple interface protocols, is simple to design in and fully certified, making it a complete embedded Bluetooth solution. With its high performance on chip antenna and support for Bluetooth® Enhanced Data Rate (EDR), the RN41 delivers up to 3 Mbps data rate for distances to 100M.. The RN41 is the perfect product for engineers wanting to add wireless capability to their product but don't want to spend significant time and money developing Bluetooth specific hardware and software.

Block Diagram



Overview

- Baud rate speeds: 1200bps up to 921Kbps, non-standard baud rates can be programmed.
- Class 1 radio, 330' (100m) distance, 15dBm output transmitter, -80dBm typical receive sensitivity
- Frequency 2402 ~ 2480MHz,
- FHSS/GFSK modulation, 79 channels at 1MHz intervals
- Secure communications, 128 bit encryption
- Error correction for guaranteed packet delivery
- UART local and over-the-air RF configuration
- Auto-discovery/pairing requires no software configuration (instant cable replacement).
- Auto-connect master, IO pin (DTR) and character based trigger modes

Environmental Conditions

| Parameter | Value |
|-------------------------------|----------------|
| Temperature Range (Operating) | -40 °C ~ 85 °C |
| Temperature Range (Storage) | -40 °C ~ 85 °C |
| Relative Humidity (Operating) | ≤90% |
| Relative Humidity (Storage) | ≤90% |

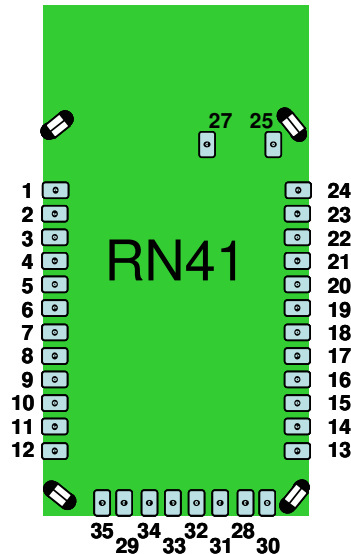
Electrical Characteristics

| Parameter | Min | Typ. | Max. | Unit |
|-----------------------------------|-------|------|------|------|
| Supply Voltage (DC) | 3.0 | 3.3 | 3.6 | V |
| RX Supply Current | | 35 | 60 | mA |
| TX Supply Current | | 65 | 100 | mA |
| Average power consumption | | | | |
| Standby/Idle (default settings) | | 25 | | mA |
| Connected (normal mode) | | 30 | | mA |
| Connected (low power Sniff) | | 8 | | mA |
| Standby/Idle (Deep sleep enabled) | 250uA | 2.5 | | mA |

Radio Characteristics

| Parameter | Freq. (GHz) | Min | Typ | Max | Bluetooth Specification | Units |
|--------------------------------------|-------------|------|------|------|-------------------------|-------|
| Sensitivity @ 0.1%BER | 2.402 | - | -80 | -86 | ≤ -70 | dBm |
| | 2.441 | - | -80 | -86 | | dBm |
| | 2.480 | - | -80 | -86 | | dBm |
| RF Transmit Power | 2.402 | 15.0 | 16.0 | | ≤ 20 | dBm |
| | 2.441 | 15.0 | 16.0 | | | dBm |
| | 2.480 | 15.0 | 16.0 | | | dBm |
| Initial Carrier Frequency Tolerance | 2.402 | - | 5 | 75 | 75 | kHz |
| | 2.441 | - | 5 | 75 | | kHz |
| | 2.480 | - | 5 | 75 | | kHz |
| 20dB bandwidth for modulated carrier | | - | 900 | 1000 | ≤ 1000 | kHz |
| Drift (Five slots packet) | | - | 15 | - | 40 | kHz |
| Drift Rate | | - | 13 | - | 20 | kHz |
| Δf _{1avg} Max Modulation | 2.402 | 140 | 165 | 175 | >140 | kHz |
| | 2.441 | 140 | 165 | 175 | | kHz |
| | 2.480 | 140 | 165 | 175 | | kHz |
| Δf _{2avg} Min Modulation | 2.402 | 140 | 190 | - | 115 | kHz |
| | 2.441 | 140 | 190 | - | | kHz |
| | 2.480 | 140 | 190 | - | | kHz |

Pin Description



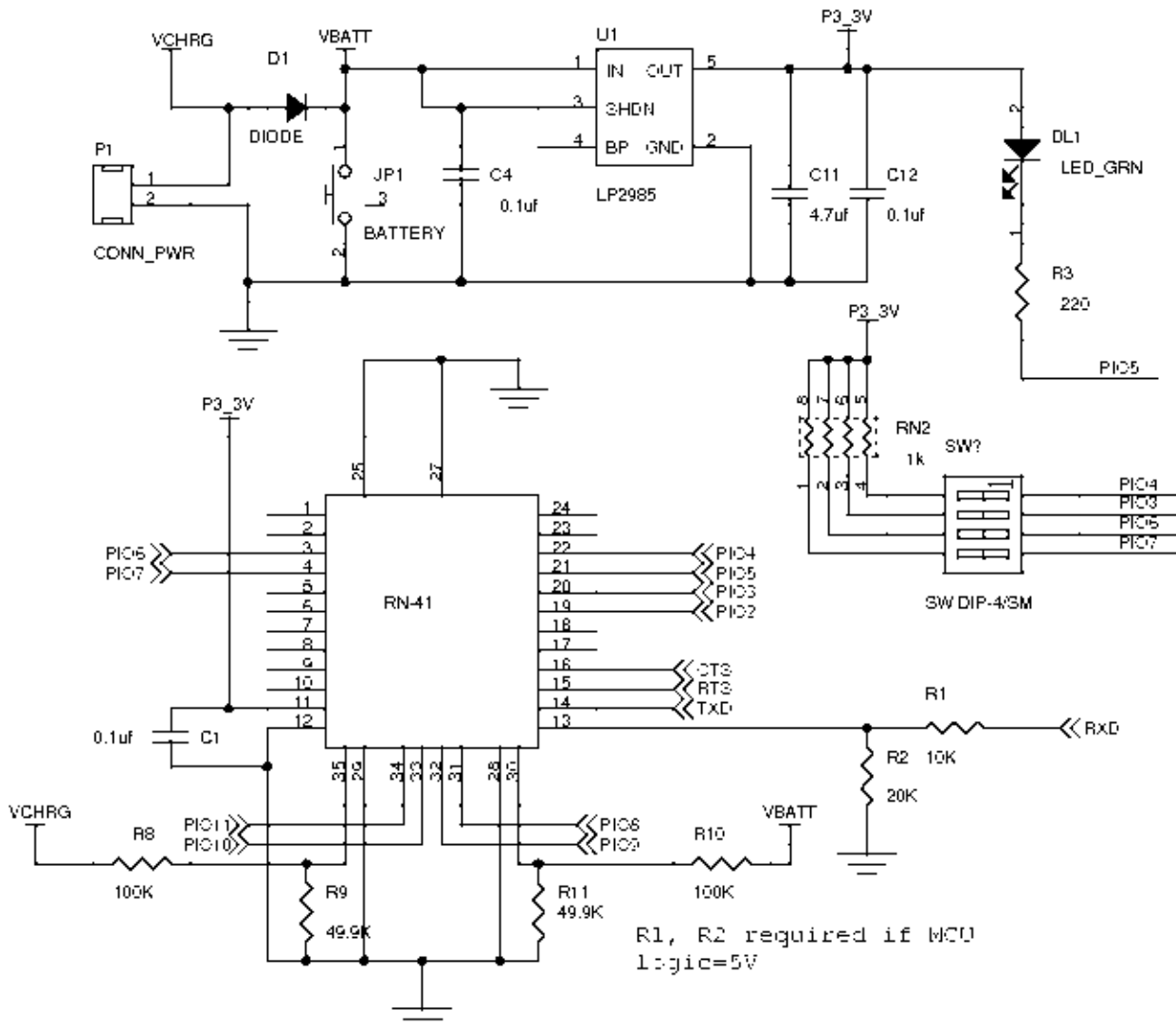
Top view

| Pin | Name | Description | Default |
|-------|----------|---|----------------------------------|
| 1 | GND | | |
| 2 | SPI MOSI | Programming only | No Connect |
| 3 | PIO6 | Set BT master (HIGH=auto-master mode) | Input to RN41 with weak pulldown |
| 4 | PIO7 | Set Baud rate (HIGH = force 9600, LOW = 115K or firmware setting) | Input to RN41 with weak pulldown |
| 5 | RESET | Active LOW reset | Input to RN41 with 1K pullup |
| 6 | SPI_CLK | Programming only | No Connect |
| 7 | PCM_CLK | PCM interface | No Connect |
| 8 | PCM_SYNC | PCM interface | No Connect |
| 9 | PCM_IN | PCM interface | No Connect |
| 10 | PCM_OUT | PCM interface | No Connect |
| 11 | VDD | 3.3V regulated power input | |
| 12 | GND | | |
| 13 | UART_RX | UART receive Input | Input to RN41 |
| 14 | UART_TX | UART transmit output | High level output from RN41 |
| 15 | UART_RTS | UART RTS, goes HIGH to disable host transmitter | Low level output from RN41 |
| 16 | UART_CTS | UART CTS, if set HIGH, disables transmitter | Low level input to RN41 |
| 17 | USB_D+ | USB port | Pull up 1.5K when active |
| 18 | USB_D- | USB port | |
| 19 | PIO2 | Status, HIGH when connected, LOW otherwise | Output from RN41 |
| 20 | PIO3 | Auto discovery = HIGH | Input to RN41 with weak pulldown |
| 21 | PIO5 | Status, toggles based on state, LOW on connect | Output from RN41 |
| 22 | PIO4 | Set factory defaults | Input to RN41 with weak pulldown |
| 23 | SPI_CSB | Programming only | No Connect |
| 24 | SPI_MISO | Programming only | No Connect |
| 25 | GND | | |
| 26 | NC | RF pad keep all traces and planes clear. | |
| 27-29 | GND | | |
| 30 | AIO0 | Optional analog input | Not Used |
| 31 | PIO8 | Status (RF data rx/tx) | Output from RN41 |
| 32 | PIO9 | IO | Input to RN41 with weak pulldown |
| 33 | PIO10 | IO (remote DTR signal) | Input to RN41 with weak pulldown |
| 34 | PIO11 | IO (remote RTS signal) | Input to RN41 with weak pulldown |
| 35 | AIO1 | Optional analog input | Not Used |

Digital I/O Characteristics

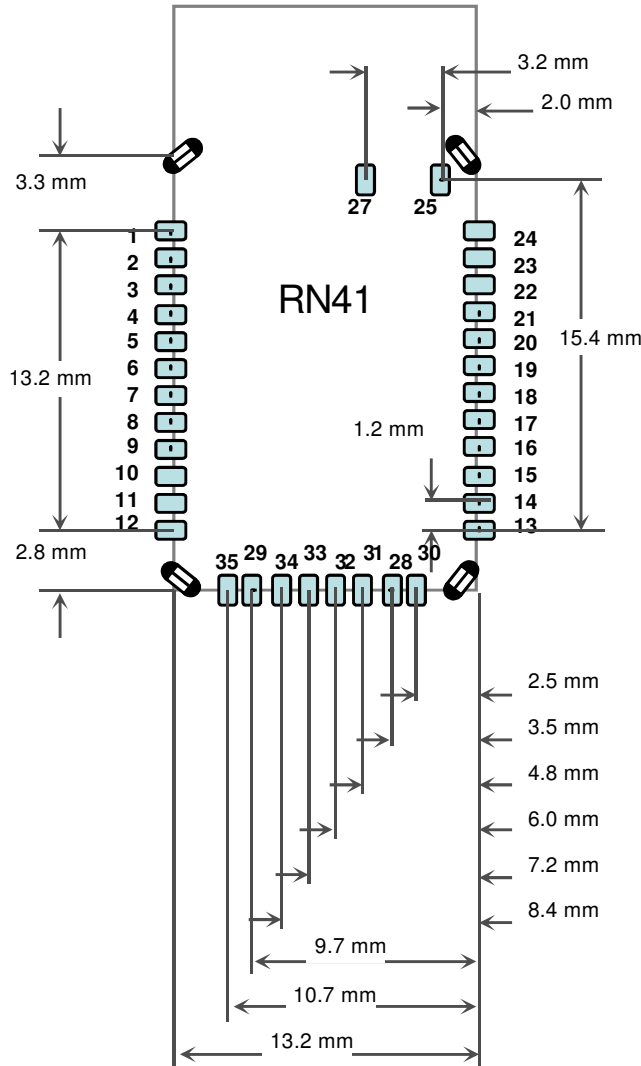
| $2.7V \leq VDD \leq 3.0V$ | Min | Typ. | Max. | Unit |
|---|---------|------|---------|---------|
| Input logic level LOW | -0.4 | - | +0.8 | V |
| Input logic level HIGH | 0.7VDD | - | VDD+0.4 | V |
| Output logic level LOW | - | - | 0.2 | V |
| Output logic level HIGH | VDD-0.2 | - | - | V |
| All I/O's (except reset) default to weakpull down | +0.2 | +1.0 | +5.0 | μA |

Typical Application Circuit

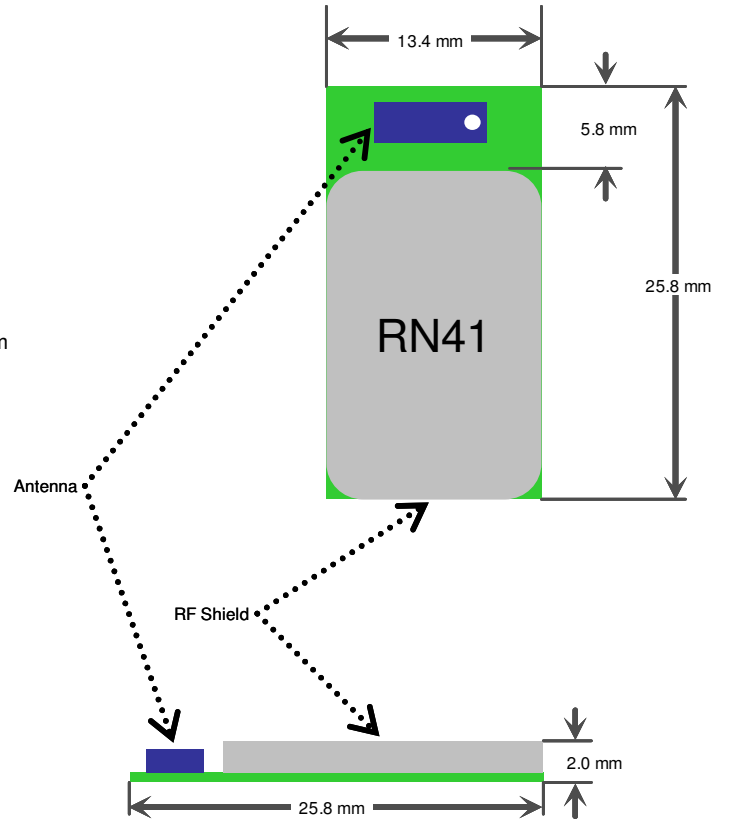


Module Dimensions

PCB LAYOUT
 PAD SIZE = 0.8 X 1.30 mm



MODULE DIMENSIONS



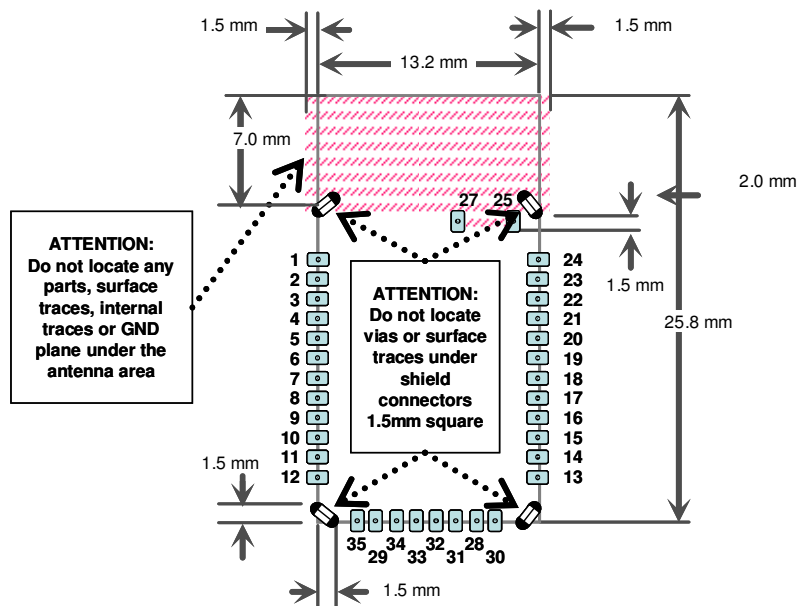
Design Concerns

- Reset circuit.** RN-41 contains a 1k pullup to VCC, the polarity of reset on the RN41 is ACTIVE LOW. A power on reset circuit with delay is OPTIONAL on the reset pin of the module. It should only be required if the input power supply has a very slow ramp, or tends to bounce or have instability on power up. Often a microcontroller or embedded CPU IO is available to generate reset once power is stable. If not, there are many low cost power supervisor chips available, such as MCP809, MCP102/121, and Torex XC61F.
- Factory reset PIO4.** It is a good idea to connect this pin to a switch, or jumper, or resistor, so it can be accessed. This pin can be used to reset the module to FACTORY DEFAULTS and is often critical in situations where the module has been mis-configured. To set Factory defaults start HIGH, then toggle times.
- Connection status.** PIO5 is available to drive an LED, and blinks at various speeds to indicate status. PIO2 is an output which directly reflects the connection state, it goes HIGH when connected, and LOW otherwise.
- HCI mode.** The RN41 module must be loaded with special firmware to run in HCI mode. When in HCI mode the standard SPP/DUN applications are disabled.
- Using SPI bus for flash upgrade.** While not required, this bus is very useful for configuring advanced parameters of the Bluetooth modules, and is required for upgrading the firmware on modules. The suggested ref-design shows a 6pin header which can be implemented to gain access to this bus. A minimum-mode version could just use the SPI signals (4pins) and pickup ground and VCC from elsewhere on the design.

- Minimizing Radio interference.**
 When laying out the carrier board for the RN41 module the areas under the antenna and shielding connections should not have surface traces, GND planes, or exposed vias. (See diagram to right) For optimal radio performance the antenna end of RN41 module should protrude 5mm past any metal enclosure.

7. Soldering Reflow Profile.

- Lead-Free Solder Reflow
- Temp: 230 degree C , 30-40 seconds, Peak 250 degree C maximum.
- Preheat temp: 165 +- 15 degree C, 90 to 120 seconds.
- Time: Single Pass, One Time



Compliance Information

| Category | Country | Standard |
|----------------------|----------------------|-------------------------------------|
| Radio | USA | FCC CFR47 Part 15 C, para 15.247 |
| | FCC ID: | T9J-R41-1 |
| | EUROPE | EN 300 328-1 |
| | | EN 300 328-2 2.4GHz |
| | CANADA | IC RSS-210 low power comm. device |
| | IC Canada ID: | 6514A-RN411 |
| | EMC | USA |
| EUROPE | | EN 55022 Class B radiated |
| | | EN61000-4-2 ESD immunity |
| | | EN61000-4-3 radiated field |
| | | EN61000-4-6 RF immunity |
| | | EN61000-4-8 power magnetic immunity |
| Bluetooth | | LISTED |
| Environmental | RoHS | RoHS compliant |

Ordering Information

| Part Number | Description |
|---|---|
| RN-41 | Standard Application firmware (SPP/DUN Master and Slave) |
| RN-41-H | HCI firmware (HCI over H4 UART) |
| RN-41-U | USB firmware (HCI over USB port, slave device at 12Mbps rate) |
| For other configurations, contact Roving Networks directly. | |

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