

BluNor BM833/A are powerful, highly flexible, ultra low power Bluetooth Low Energy (BLE) modules using Nordic nRF52 SoC. With an ARM Cortex™ M4(F) MCU, up to 512KB flash, 128KB RAM, embedded 2.4GHz multi-protocol transceiver, and an integrated PCB trace antenna or an u.FL for external antenna. It allows faster time to market with reduced development cost.

BM833A/AF are designed to minimize PCB cost and to maximize efficiency in production line dedicated for Bluetooth modules. The cost of using BM833A module can be lower than designing-in SoC at any quantity. At low cost, BM833A are full feature modules. Inductors for DCDC converter are integrated. All 32 GPIOs are accessible.



BM833/F/E, nRF52833 modules have compatible footprint for upgrading. They offer more GPIOs, more memories, +8 dBm TX.

“Max. TX, FCC” is the maximum TX power at antenna input measured in FCC certification testings. BM833E max. TX power is +14 dBm with FCC certified ANT060.

BM833A Specifications:

- Nordic nRF52 with ARM Cortex M4 at 64 MHz.
- Supported data rate:
 - ◆ BLE 5.1: 2Mbps, 1Mbps, 500kbps, 125kbps
 - ◆ IEEE 802.15.4-2006: 250 kbps
 - ◆ Proprietary 2.4 GHz: 2 Mbps, 1Mbps
- Angle-of-Arrival (AoA) and Angle-of-Departure (AoD) direction finding using Bluetooth.
- RSSI, 1 dB resolution
- Serial Wire Debug (SWD)
- Nordic SoftDevice Ready
- Over-the-Air (OTA) firmware update
- Flash/RAM: 192KB/24KB
- 32 General purpose I/O pins
- 12 bit/200KSPS ADC, 8 configurable channels with programmable gain.
- 2X SPI Master/Slave (8Mbps)
- 4-channel pulse width modulator (PWM)
- Low power comparator
- 2-wire Master/Slave (I²C compatible)
- Digital microphone interface (PDM)
- UART (with CTS/RTS and DMA)
- 20 channel CPU independent Programmable Peripheral Interconnect (PPI).
- Quadrature Demodulator (QDEC)
- AES HW encryption
- 3 x 32 bit timer with counter mode
- 2x realtime counter
- SoC receiver Sensitivity: -97 dBm at 1Mbps; -104 dBm at 125 kbps
- SoC TX power: +/- 0 dBm; programmable 4 dBm to -20dBm in 4 dB steps.
- Operation voltage: 1.7V to 3.6V
- 4.6 mA peak current at RX or +0dBm TX.
- Integrated DC-DC converter.
- Embedded inductors for DCDC converter

Major BM833 Enhancement

- Cortex M4F at 64 MHz
- Max SoC TX power: +8 dBm.
- NFC-A tag interface for OOB pairing
- Secure boot ready
- 1.7V to 5.5V supply voltage
- USB 2.0 full speed controller (12 Mbps)

Model Summaries

| module | BM833A | BM833AF | BM833 | BM833F | BM833E |
|-----------------|-----------------|-------------------|-------------------|-------------------|-------------------|
| SoC | nRF52811 QFAA | nRF52811 QFAA | nRF52833 QIAA | nRF52833 QIAA | nRF52833 QIAA |
| Flash/RAM | 192KB/24KB | 192KB/24KB | 512KB/128KB | 512KB/128KB | 512KB/128KB |
| Size | 10.2x15x1.9mm | 15x20.6x1.9mm | 10.2x15x1.9mm | 15x20.6x1.9mm | 10.2x15x1.9mm |
| GPIO | | 32 | 42 | 42 | 42 |
| Operating temp. | -40°C to +85°C | -40°C to +85°C | -40°C to +105°C | -40°C to +105°C | -40°C to +105°C |
| Max. TX, FCC | +4.81 dBm | +4.81 dBm | +8.16 dBm | +8.16 dBm | +8.16 dBm |
| Antenna | PCB trace | High perform. PCB | PCB trace | High perform. PCB | u.FL |
| Est. BLE Range | 680M at 125Kbps | 1500M at 125 Kbps | 1400M at 125 Kbps | 2300M at 125Kbps | 3400M at 125 Kbps |
| FCC ID | X8WBM833A | X8WBM833A | X8WBM833F | X8WBM833F | X8WBM833F |
| ISED | 4100A-BM833A | 4100A-BM833A | 4100A-BM833F | 4100A-BM833F | 4100A-BM833F |
| TELEC | 201-190840/00 | 201-190840/00 | 201-19838/00 | 201-19838/00 | 201-19838/00 |
| CE, RCM | Certified | Certified | Certified | Certified | Certified |
| QDID | | 138767 | 138767 | 138767 | 138767 |

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E**Table Of Contents**

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BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

1. Introduction

BluNor BM833 is powerful, highly flexible, ultra low power Bluetooth Low Energy (BLE) modules using Nordic nRF52 SoCs. With an ARM Cortex™ M4F MCU, available 512KB flash, 128KB RAM, embedded 2.4GHz multi-protocol transceiver, and an integrated antenna or an u.FL connector for external antenna, it allows faster time to market with reduced development cost.

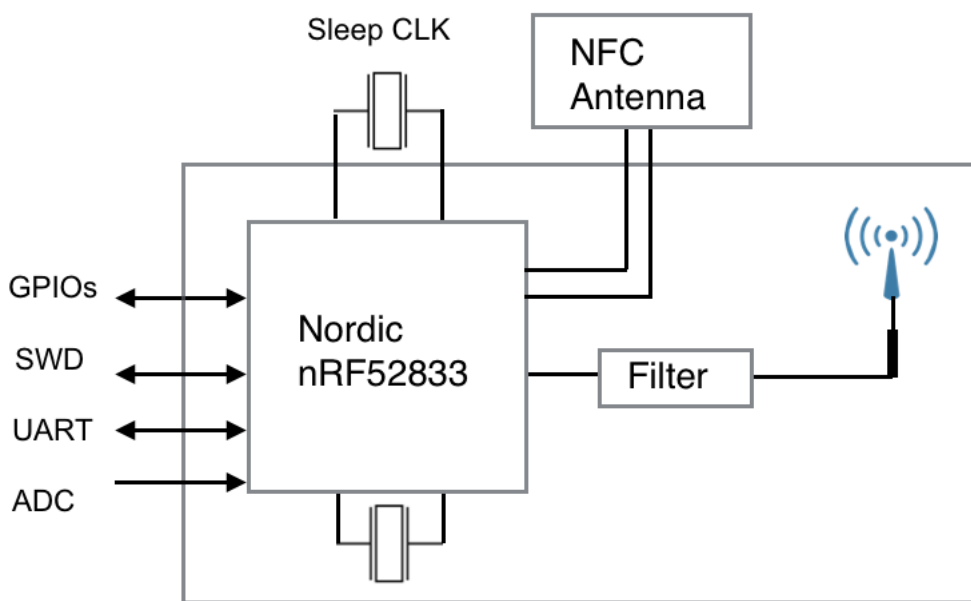
The following is a block diagram of BM833. Antenna circuit and main clock are integrated. All 32 GPIOs of nRF52833 can be accessed from main board. For lower power consumption at idle state, a 32.768 kHz crystal is added on the host board. Connection to an external NFC (Near Field Communication) antenna is provided.

BM833A is sister module of BM833 using nRF52811 instead. BM833 has 42 GPIOs comparing to 32 GPIOs for BM833A. Soldering pad footprints are compatible.

In these data sheets, BM833, BM833F, and BM833E are referred as BM833. BM833A and BM833AF are referred as B833A.

BM833, BM833F, BM833E Block Diagram

A block diagram of BM833 Series is shown below.



BM833 Series modules have the same features except the followings.

BM833

- Uses an nRF52833 QIAA with Cortex M4F MCU
- 512KB flash, 128 KB RAM
- 68 pins, 42 GPIOs
- Supports NFC
- Support Bluetooth 5.1, 802.15.4, proprietary radio protocols.
- Max. TX power: + 8.16dBm.
- CODED PHY
- Size: 10.2x14.8x1.9 mm



BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

BM833F

BM833F offers the same features as BM833 except:

- High performance PCB trace antenna
- Size: 10.2 (15mm antenna area) x20.6x1.9mm



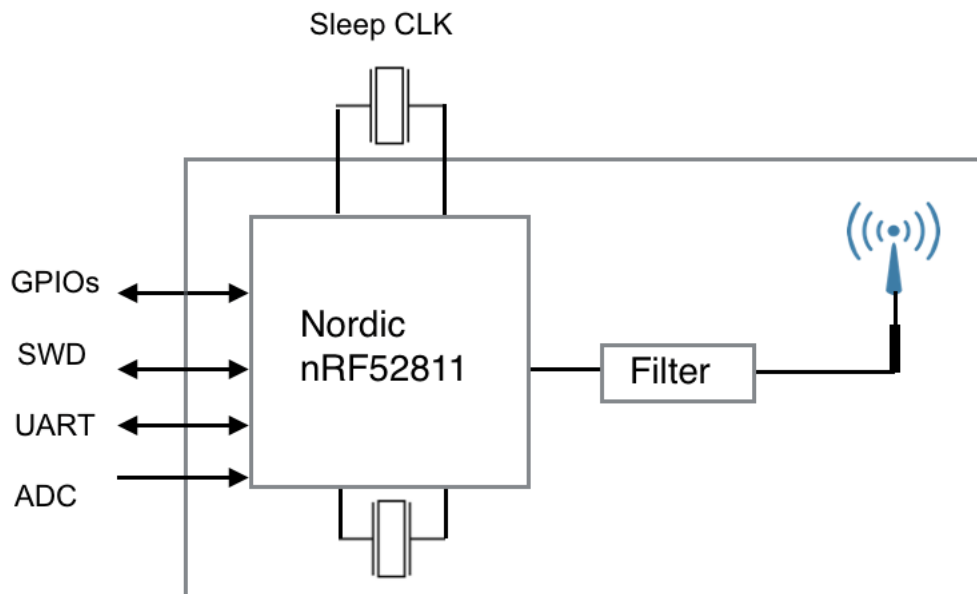
BM833E

BM833E offers the same features as BM833 excepts:

- An u.FL connector for external antenna
- Size: 10.2 x14.8mm
- FCC certified antenna, ANT060 with 6 dBi gain.
- CE certified antenna, ANT000 with 0 dB gain.



BM833A, BM833AF Block Diagram



BM833A

- Uses an nRF52811 QFAA with Cortex M4 MCU
- 192 KB flash, 24 KB RAM
- 47 pins, 32 GPIOs
- Size: 10.2x14.8x1.9mm
- Bluetooth 5.1, 802.15.4, proprietary radio protocols.
- Does not support NFC
- Max. TX power: + 4.81 dBm



BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

- Support CODED PHY at 125 Kbps for longer range

BM833AF

- Size: 10.2 (15 antenn area) x20.6x1.9mm
- Integrated high performance PCB trace antenna



BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

2. Codes Development Using Nordic Tools

Development tools by Nordic and other third party development tools recommended by Nordic should be used .

Easy, fast and safe code development

Nordic development environment for nRF52 offers a clean separation between application code development and embedded protocol stacks. This means compile, link and run time dependencies with the embedded stack and associated debugging challenges are removed. The Bluetooth low energy and ANT stack is a pre-compiled binary, leaving application code to be compiled stand-alone. The embedded stack interface uses an asynchronous and event driven model removing the need for RTOS frameworks.

Over-The-Air DFU

The nRF52 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.

SoftDevices

The Nordic protocol stacks are known as SoftDevices and complement the nRF52 Series SoCs. All nRF52 Series are programmable with software stacks from Nordic. This bring maximum flexibility to application development and allows the latest stack version to be programmed into the SoC.

SoftDevices available from Nordic:

- **S113 SoftDevice**

The S113 SoftDevice is a *Bluetooth*® Low Energy peripheral protocol stack solution. It supports up to four peripheral connections with an additional broadcaster role running concurrently. The S113 SoftDevice integrates a Bluetooth Low Energy Controller and Host, and provides a full and flexible API for building Bluetooth Low Energy nRF52 System on Chip solutions.

- **S140 SoftDevice**

The S140 SoftDevice is a *Bluetooth*® Low Energy Central and Peripheral protocol stack solution. The S140 SoftDevice supports running up to twenty connections concurrently, with an additional observer role and broadcaster role. The S140 SoftDevice integrates a Bluetooth Low Energy Controller and Host, and provides a full and flexible API for building Bluetooth Low Energy nRF52 System on Chip solutions.

Development Tools

Nordic Semiconductor provides a complete range of hardware and software development tools for the nRF52 Series devices. nRF52840 DK board is recommended for firmware development.

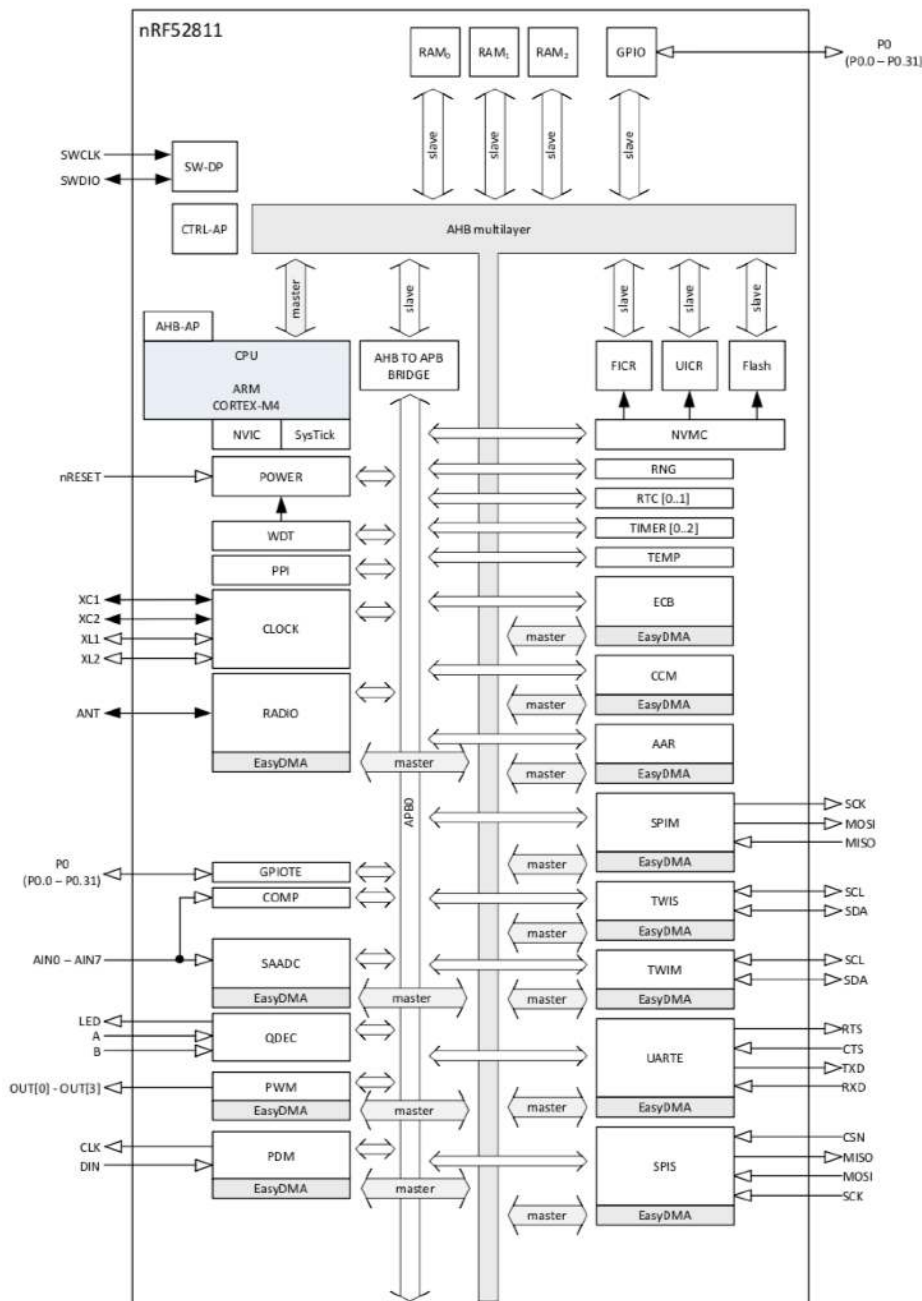
3. Product Overview

Nordic nRF52811 SoC

For full description of the SoC, please download data sheets from Nordic Semiconductor website.

<https://www.nordicsemi.com/eng/Products/Bluetooth-low-energy>

The following is a block diagram of Nordic nRF52811 Bluetooth Low Energy (BLE) SoC.



BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

The 32 bit ARM Cortex M4F MCU with hardware supports for DSP instructions and floating point operations, code density and execution speed are higher than other Cortex M MCU. The Programmable Peripheral Interconnect (PPI) system provides a 20-channel bus for direct and autonomous system peripheral communication without CPU intervention. This brings predictable latency times for peripheral to peripheral interaction and power saving benefits associated with leaving CPU idle. The device has 2 global power modes ON/OFF, but all system blocks and peripherals have individual power management control which allows for an automatic switching RUN/IDLE for system blocks based only on those required/not required to achieve particular tasks.

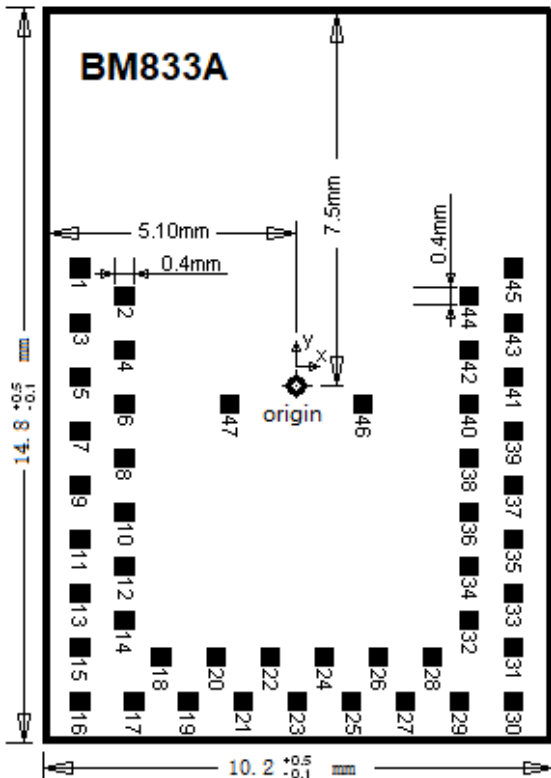
The radio supports Bluetooth low energy, 802.15.4, proprietary and ANT. Output power is scalable from a maximum of +4dBm down to -20 dBm in 4dB steps. BLE Sensitivity is increased to -97 dBm at 1Mbps and -104 dBm at 125 kbps with CODED PHY..

The NFC block supports NFC-A tags with proximity detection and Wake-on-field from low power mode. The NFC enables Out-Of-Band (OOB) Bluetooth pairing of devices and thus greatly simplifying deployment.

Mechanical Drawings BM833A

The followings are mechanical drawings of BM833A, top view. Size of module is 10.2x15.0x1.9mm. X-axis and Y-axis coordinate of each pin is shown in table.

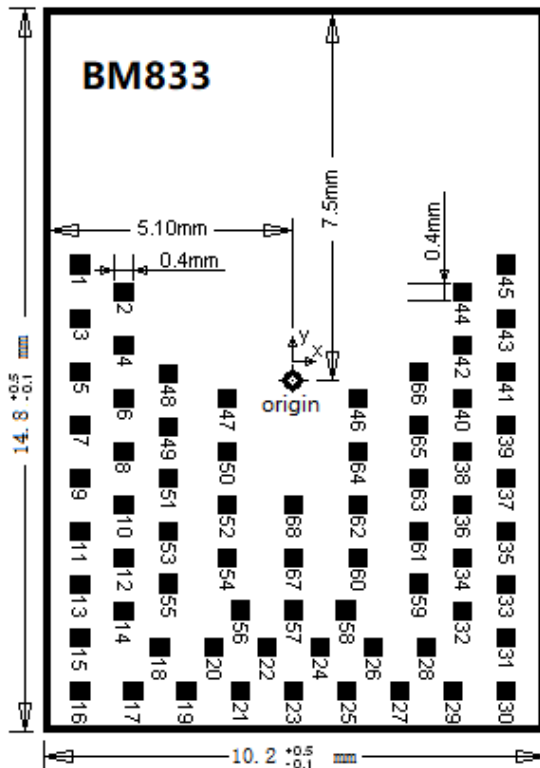
BM833 drawings are on the following page. If you can use BM833 footprint for BM833A, your host board is upgradeable to an nRF52833 module.



| A | B | C | D | E | F | G | H | I |
|-------------|-------|-------|-----------|-------|-------|-----------|-------|-------|
| | X(mm) | Y(mm) | | X(mm) | Y(mm) | | X(mm) | Y(mm) |
| Zero | | | | | | | | |
| 1 | -4.4 | 2.35 | 45 | 4.4 | 2.35 | 17 | -3.3 | -6.45 |
| 3 | -4.4 | 1.25 | 43 | 4.4 | 1.25 | 19 | -2.2 | -6.45 |
| 5 | -4.4 | 0.15 | 41 | 4.4 | 0.15 | 21 | -1.1 | -6.45 |
| 7 | -4.4 | -0.95 | 39 | 4.4 | -0.95 | 23 | 0 | -6.45 |
| 9 | -4.4 | -2.05 | 37 | 4.4 | -2.05 | 25 | 1.1 | -6.45 |
| 11 | -4.4 | -3.15 | 35 | 4.4 | -3.15 | 27 | 2.2 | -6.45 |
| 13 | -4.4 | -4.25 | 33 | 4.4 | -4.25 | 29 | 3.3 | -6.45 |
| 15 | -4.4 | -5.35 | 31 | 4.4 | -5.35 | | | |
| 16 | -4.4 | -6.45 | 30 | 4.4 | -6.45 | 18 | -2.75 | -5.55 |
| | | | | | | 20 | -1.65 | -5.55 |
| 2 | -3.5 | 1.8 | 44 | 3.5 | 1.8 | 22 | -0.55 | -5.55 |
| 4 | -3.5 | 0.7 | 42 | 3.5 | 0.7 | 24 | 0.55 | -5.55 |
| 6 | -3.5 | -0.4 | 40 | 3.5 | -0.4 | 26 | 1.65 | -5.55 |
| 8 | -3.5 | -1.5 | 38 | 3.5 | -1.5 | 28 | 2.75 | -5.55 |
| 10 | -3.5 | -2.6 | 36 | 3.5 | -2.6 | | | |
| 12 | -3.5 | -3.7 | 34 | 3.5 | -3.7 | 46 | 1.35 | -0.4 |
| 14 | -3.5 | -4.8 | 32 | 3.5 | -4.8 | 47 | -1.35 | -0.4 |

Mechanical Drawings BM833

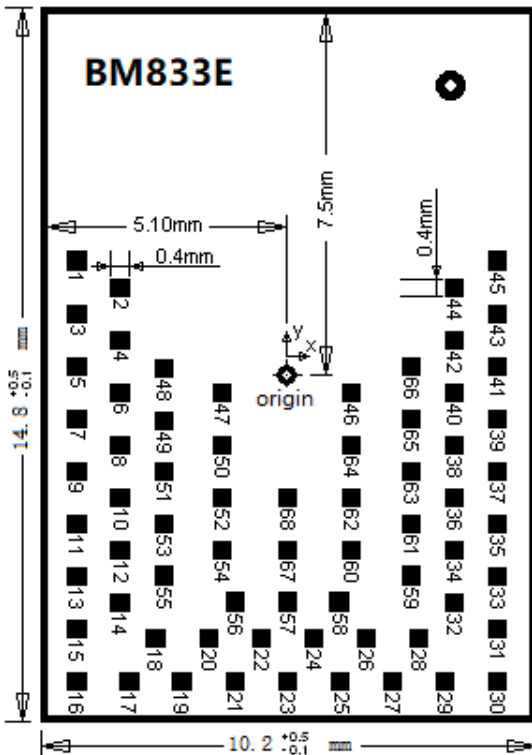
The followings are mechanical drawings of BM833, top view. X-axis and Y-axis coordinate of each pin is shown in table.



| | X(mm) | Y(mm) | | X(mm) | Y(mm) | | X(mm) | Y(mm) |
|-------------|-------|-------|-----------|-------|-------|-----------|-------|-------|
| Zero | 0 | 0 | | | | | | |
| 1 | -4.4 | 2.35 | 45 | 4.4 | 2.35 | 17 | -3.3 | -6.45 |
| 3 | -4.4 | 1.25 | 43 | 4.4 | 1.25 | 19 | -2.2 | -6.45 |
| 5 | -4.4 | 0.15 | 41 | 4.4 | 0.15 | 21 | -1.1 | -6.45 |
| 7 | -4.4 | -0.95 | 39 | 4.4 | -0.95 | 23 | 0 | -6.45 |
| 9 | -4.4 | -2.05 | 37 | 4.4 | -2.05 | 25 | 1.1 | -6.45 |
| 11 | -4.4 | -3.15 | 35 | 4.4 | -3.15 | 27 | 2.2 | -6.45 |
| 13 | -4.4 | -4.25 | 33 | 4.4 | -4.25 | 29 | 3.3 | -6.45 |
| 15 | -4.4 | -5.35 | 31 | 4.4 | -5.35 | | | |
| 16 | -4.4 | -6.45 | 30 | 4.4 | -6.45 | | | |
| 2 | -3.5 | 1.8 | 44 | 3.5 | 1.8 | 18 | -2.75 | -5.55 |
| 4 | -3.5 | 0.7 | 42 | 3.5 | 0.7 | 20 | -1.65 | -5.55 |
| 6 | -3.5 | -0.4 | 40 | 3.5 | -0.4 | 22 | -0.55 | -5.55 |
| 8 | -3.5 | -1.5 | 38 | 3.5 | -1.5 | 24 | 0.55 | -5.55 |
| 10 | -3.5 | -2.6 | 36 | 3.5 | -2.6 | 26 | 1.65 | -5.55 |
| 12 | -3.5 | -3.7 | 34 | 3.5 | -3.7 | 28 | 2.75 | -5.55 |
| 14 | -3.5 | -4.8 | 32 | 3.5 | -4.8 | | | |
| 48 | -2.6 | 0.15 | 66 | 2.6 | 0.15 | 68 | 0 | -2.6 |
| 49 | -2.6 | -0.95 | 65 | 2.6 | -0.95 | 67 | 0 | -3.7 |
| 51 | -2.6 | -2.05 | 63 | 2.6 | -2.05 | 57 | 0 | -4.8 |
| 53 | -2.6 | -3.15 | 61 | 2.6 | -3.15 | | | |
| 55 | -2.6 | -4.25 | 59 | 2.6 | -4.25 | | | |
| 47 | -1.35 | -0.4 | 46 | 1.35 | -0.4 | 56 | -1.1 | -4.8 |
| 50 | -1.35 | -1.5 | 64 | 1.35 | -1.5 | 58 | 1.1 | -4.8 |
| 52 | -1.35 | -2.6 | 62 | 1.35 | -2.6 | | | |
| 54 | -1.35 | -3.7 | 60 | 1.35 | -3.7 | | | |

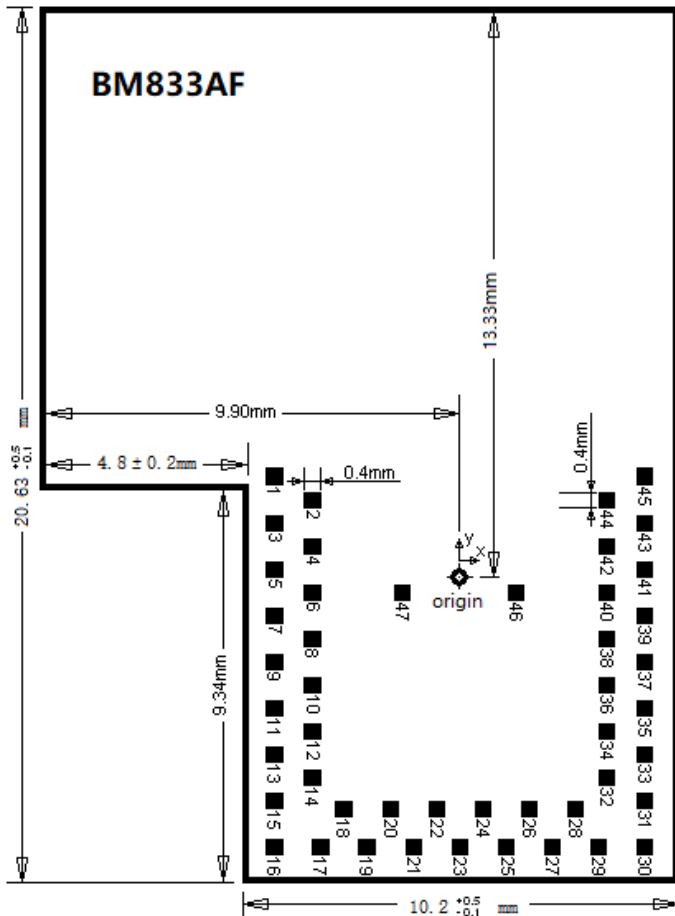
Mechanical Drawings BM833E

The following is mechanical drawings of B833E. Its footprint is the same as that of BM833.



| | X(mm) | Y(mm) | | X(mm) | Y(mm) | | X(mm) | Y(mm) |
|-------------|-------|-------|-----------|-------|-------|-----------|-------|-------|
| Zero | 0 | 0 | | | | | | |
| 1 | -4.4 | 2.35 | 45 | 4.4 | 2.35 | 17 | -3.3 | -6.45 |
| 3 | -4.4 | 1.25 | 43 | 4.4 | 1.25 | 19 | -2.2 | -6.45 |
| 5 | -4.4 | 0.15 | 41 | 4.4 | 0.15 | 21 | -1.1 | -6.45 |
| 7 | -4.4 | -0.95 | 39 | 4.4 | -0.95 | 23 | 0 | -6.45 |
| 9 | -4.4 | -2.05 | 37 | 4.4 | -2.05 | 25 | 1.1 | -6.45 |
| 11 | -4.4 | -3.15 | 35 | 4.4 | -3.15 | 27 | 2.2 | -6.45 |
| 13 | -4.4 | -4.25 | 33 | 4.4 | -4.25 | 29 | 3.3 | -6.45 |
| 15 | -4.4 | -5.35 | 31 | 4.4 | -5.35 | | | |
| 16 | -4.4 | -6.45 | 30 | 4.4 | -6.45 | | | |
| 2 | -3.5 | 1.8 | 44 | 3.5 | 1.8 | 18 | -2.75 | -5.55 |
| 4 | -3.5 | 0.7 | 42 | 3.5 | 0.7 | 20 | -1.65 | -5.55 |
| 6 | -3.5 | -0.4 | 40 | 3.5 | -0.4 | 22 | -0.55 | -5.55 |
| 8 | -3.5 | -1.5 | 38 | 3.5 | -1.5 | 24 | 0.55 | -5.55 |
| 10 | -3.5 | -2.6 | 36 | 3.5 | -2.6 | 26 | 1.65 | -5.55 |
| 12 | -3.5 | -3.7 | 34 | 3.5 | -3.7 | 28 | 2.75 | -5.55 |
| 14 | -3.5 | -4.8 | 32 | 3.5 | -4.8 | | | |
| 48 | -2.6 | 0.15 | 66 | 2.6 | 0.15 | 68 | 0 | -2.6 |
| 49 | -2.6 | -0.95 | 65 | 2.6 | -0.95 | 67 | 0 | -3.7 |
| 51 | -2.6 | -2.05 | 63 | 2.6 | -2.05 | 57 | 0 | -4.8 |
| 53 | -2.6 | -3.15 | 61 | 2.6 | -3.15 | | | |
| 55 | -2.6 | -4.25 | 59 | 2.6 | -4.25 | | | |
| 47 | -1.35 | -0.4 | 46 | 1.35 | -0.4 | 56 | -1.1 | -4.8 |
| 50 | -1.35 | -1.5 | 64 | 1.35 | -1.5 | 58 | 1.1 | -4.8 |
| 52 | -1.35 | -2.6 | 62 | 1.35 | -2.6 | | | |
| 54 | -1.35 | -3.7 | 60 | 1.35 | -3.7 | | | |

Mechanical Drawings BM833AF



| A | B | C | D | E | F | G | H | I |
|-------------|-------|-------|-----------|-------|-------|-----------|-------|-------|
| | X(mm) | Y(mm) | | X(mm) | Y(mm) | | X(mm) | Y(mm) |
| Zero | | | | | | | | |
| 1 | -4.4 | 2.35 | 45 | 4.4 | 2.35 | 17 | -3.3 | -6.45 |
| 3 | -4.4 | 1.25 | 43 | 4.4 | 1.25 | 19 | -2.2 | -6.45 |
| 5 | -4.4 | 0.15 | 41 | 4.4 | 0.15 | 21 | -1.1 | -6.45 |
| 7 | -4.4 | -0.95 | 39 | 4.4 | -0.95 | 23 | 0 | -6.45 |
| 9 | -4.4 | -2.05 | 37 | 4.4 | -2.05 | 25 | 1.1 | -6.45 |
| 11 | -4.4 | -3.15 | 35 | 4.4 | -3.15 | 27 | 2.2 | -6.45 |
| 13 | -4.4 | -4.25 | 33 | 4.4 | -4.25 | 29 | 3.3 | -6.45 |
| 15 | -4.4 | -5.35 | 31 | 4.4 | -5.35 | | | |
| 16 | -4.4 | -6.45 | 30 | 4.4 | -6.45 | 18 | -2.75 | -5.55 |
| | | | | | | 20 | -1.65 | -5.55 |
| 2 | -3.5 | 1.8 | 44 | 3.5 | 1.8 | 22 | -0.55 | -5.55 |
| 4 | -3.5 | 0.7 | 42 | 3.5 | 0.7 | 24 | 0.55 | -5.55 |
| 6 | -3.5 | -0.4 | 40 | 3.5 | -0.4 | 26 | 1.65 | -5.55 |
| 8 | -3.5 | -1.5 | 38 | 3.5 | -1.5 | 28 | 2.75 | -5.55 |
| 10 | -3.5 | -2.6 | 36 | 3.5 | -2.6 | | | |
| 12 | -3.5 | -3.7 | 34 | 3.5 | -3.7 | 46 | 1.35 | -0.4 |
| 14 | -3.5 | -4.8 | 32 | 3.5 | -4.8 | 47 | -1.35 | -0.4 |

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

Library components for PADS and EAGLE can be downloaded from

<http://www.fanstel.com/download-document/>

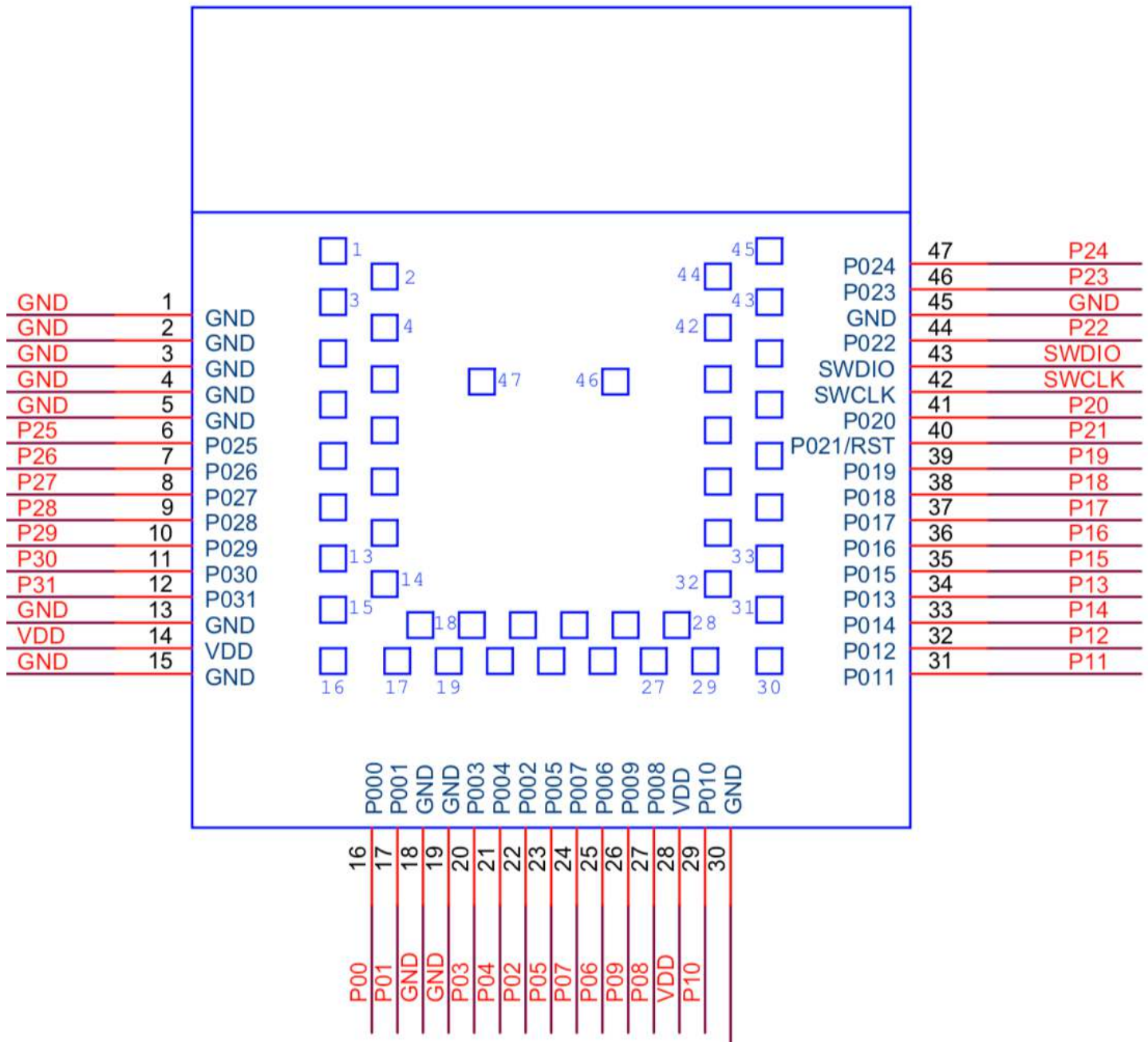
For other PCB layout tools, please download evaluation Gerber files and extract library component.

BM833A Pin Functions

The followings are BM833A pin assignment. Pin functions are in a table below. Please refer to Nordic nRF52811 Product Specifications for detailed descriptions and features supported.

https://infocenter.nordicsemi.com/pdf/nRF52811_PS_v1.0.pdf

You may develop your host board using BM833 footprint described in next section. Your host board will then upgradable to BM833 module for more memories and higher TX power.



BM833A Pin Functions

| BM833A | | nRF52811 | | |
|--------|----------|----------|------------|--|
| pin# | pin name | pin# | pin name | Descriptions |
| 1 | GND | 45 | VSS | Ground |
| 2 | GND | | | Ground |
| 3 | GND | | | Ground |
| 4 | GND | | | Ground |
| 5 | GND | | | Ground |
| 6 | P025 | 37 | P0.25 | GPIO |
| 7 | P026 | 38 | P0.26 | GPIO |
| 8 | P027 | 39 | P0.27 | GPIO |
| 9 | P028 | 40 | P0.28/AIN4 | GPIO, Analog input |
| 10 | P029 | 41 | P0.29/AIN5 | GPIO, Analog input |
| 11 | P030 | 42 | P0.30/AIN6 | GPIO, Analog input |
| 12 | P031 | 43 | P0.31/AIN7 | GPIO, Analog input |
| 13 | GND | | | Ground |
| 14 | VDD | 36 | VDD | DC supply 1.7V to 3.6V |
| 15 | GND | | | Ground |
| 16 | P000 | 2 | P0.00/XL1 | GPIO, connection for 32.768kHz crystal |
| 17 | P001 | 3 | P0.01/XL2 | GPIO, connection for 32.768kHz crystal |
| 18 | GND | | | Ground |
| 19 | GND | | | Ground |
| 20 | P003 | 5 | P0.03/AIN1 | GPIO, Analog input |
| 21 | P004 | 6 | P0.04/AIN2 | GPIO, Analog input |
| 22 | P002 | 4 | P0.02/AIN0 | GPIO, Analog input |
| 23 | P005 | 7 | P0.05/AIN3 | GPIO, Analog input |
| 24 | P007 | 9 | P0.07 | GPIO |
| 24 | P006 | 8 | P0.06 | GPIO |
| 24 | P009 | 11 | P0.09/NFC1 | GPIO, NFC antenna connection (nRF52832 only) |
| 27 | P008 | 10 | P0.08 | GPIO |
| 28 | VDD | | VDD | DC supply 1.7V to 3.6V |
| 29 | P010 | 12 | P0.10/NFC2 | GPIO, NFC antenna connection (nRF52832 only) |
| 30 | GND | | | Ground |
| 31 | P011 | 14 | P0.11 | GPIO, used as UART RX on evaluation board |
| 32 | P012 | 15 | P0.12 | GPIO, used as UART TX on evaluation board |
| 33 | P014 | 17 | P0.14 | GPIO |
| 34 | P013 | 16 | P0.13 | GPIO |
| 35 | P015 | 18 | P0.15 | GPIO |
| 36 | P016 | 19 | P0.16 | GPIO |
| 37 | P017 | 20 | P0.17 | GPIO |
| 38 | P018 | 21 | P0.18 | GPIO |
| 39 | P019 | 22 | P0.19 | GPIO |
| 40 | P021/RST | 24 | P0.21/RST | GPIO, configurable as RESET pin |
| 41 | P020 | 23 | P0.20 | GPIO |
| 42 | SWDCLK | 25 | SWDCLK | Serial Wire Debug clock input |

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

| | | | | |
|----|-------|----|-------|-----------------------|
| 43 | SWDIO | 26 | SWDIO | Serial Wire Debug I/O |
| 44 | P022 | 27 | P0.22 | GPIO |
| 45 | GND | | | Ground |
| 46 | P023 | 28 | P0.23 | GPIO |
| 47 | P024 | 29 | P0.24 | GPIO |

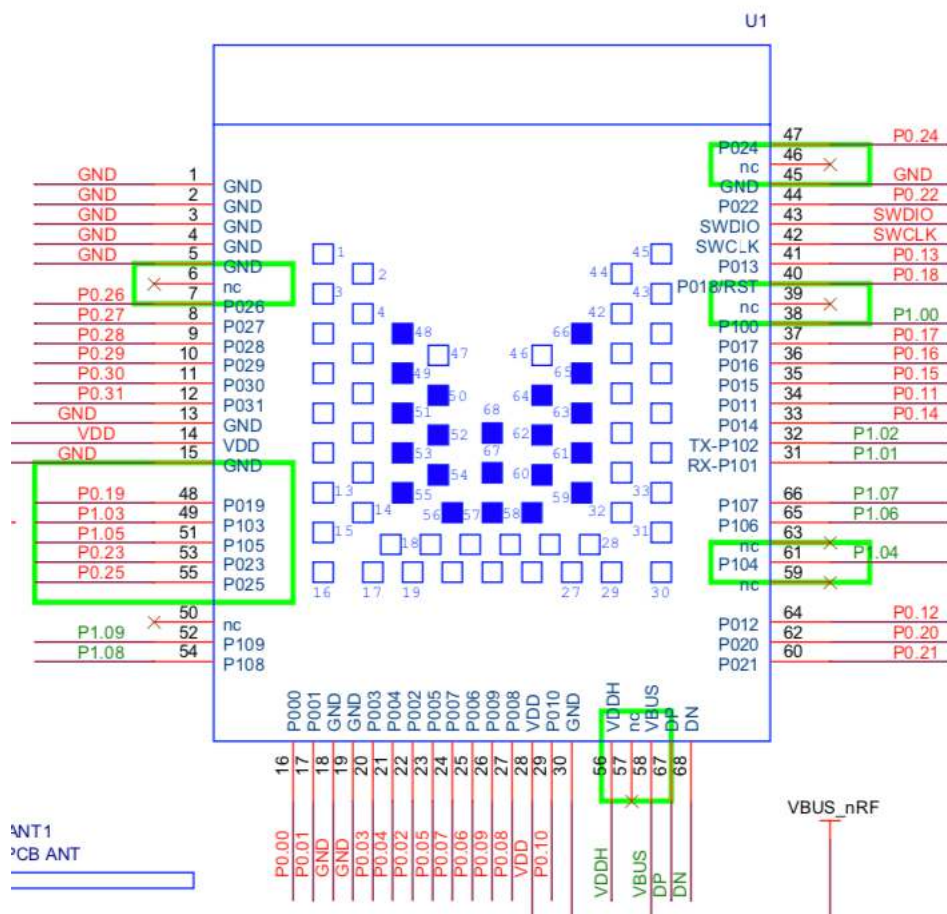
BM833 Pin Functions

BM833 uses an nRF52833 QIAA SoC. Pin functions are in a table below. Please refer to Nordic nRF52833 Product Specifications for detailed descriptions and features supported.

https://infocenter.nordicsemi.com/pdf/nRF52833_PS_v1.0.pdf

Pin assignments are below. Pins 1 to 47 are exactly at the same locations as BM833A. Pins 48 to 68 as shown in solid square are for BM833 only.

- For BM833 exclusive pins, names are in green color.
- For shares pins, pin names are in red color.



BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

BM833A (BM833AF), BM833 (BM833F, BM833E) Pin Functions:

| BM833A | 52811 | | BM833 | 52833 | | |
|--------|-------|------|-------|-------|------------|--|
| pin# | pin # | name | pin# | pin# | pin | Descriptions |
| 1 | 45 | GND | 1 | B7 | VSS | Ground |
| 2 | | GND | 2 | | | Ground |
| 3 | | GND | 3 | | | Ground |
| 4 | | GND | 4 | | | Ground |
| 5 | | GND | 5 | | | Ground |
| 6 | 37 | P025 | 6 | | | NC |
| 7 | 38 | P026 | 7 | G1 | P0.26 | GPIO |
| 8 | 39 | P027 | 8 | H2 | P0.27 | GPIO |
| 9 | 40 | P028 | 9 | B11 | P0.28/AIN4 | GPIO, Analog input |
| 10 | 41 | P029 | 10 | A10 | P0.29/AIN5 | GPIO, Analog input |
| 11 | 42 | P030 | 11 | B9 | P0.30/AIN6 | GPIO, Analog input |
| 12 | 43 | P031 | 12 | A8 | P0.31/AIN7 | GPIO, Analog input |
| 13 | | GND | 13 | | | Ground |
| 14 | 36 | VDD | 14 | B1 | VDD | DC supply 1.7V to 3.6V |
| 15 | | GND | 15 | | | Ground |
| 16 | 2 | P000 | 16 | D2 | P0.00/XL1 | GPIO, connection for 32.768kHz crystal |
| 17 | 3 | P001 | 17 | F2 | P0.01/XL2 | GPIO, connection for 32.768kHz crystal |
| 18 | | GND | 18 | | | Ground |
| 19 | | GND | 19 | | | Ground |
| 20 | 5 | P003 | 20 | B13 | P0.03/AIN1 | GPIO, Analog input |
| 21 | 6 | P004 | 21 | J1 | P0.04/AIN2 | GPIO, Analog input |
| 22 | 4 | P002 | 22 | A12 | P0.02/AIN0 | GPIO, Analog input |
| 23 | 7 | P005 | 23 | K2 | P0.05/AIN3 | GPIO, Analog input |
| 24 | 9 | P007 | 24 | M2 | P0.07 | GPIO |
| 25 | 8 | P006 | 25 | L1 | P0.06 | GPIO |
| 26 | 11 | P009 | 26 | L24 | P0.09/NFC1 | GPIO, NFC antenna connection (nRF52832 only) |
| 27 | 10 | P008 | 27 | N1 | P0.08 | GPIO |
| 28 | | VDD | 28 | | VDD | DC supply 1.7V to 3.6V |
| 29 | 12 | P010 | 29 | J24 | P0.10/NFC2 | GPIO, NFC antenna connection (nRF52832 only) |
| 30 | | GND | 30 | | | Ground |
| 31 | 14 | P011 | 31 | Y23 | P1.01 | GPIO, used as UART RX on evaluation board |
| 32 | 15 | P012 | 32 | W24 | P1.02 | GPIO, used as UART TX on evaluation board |
| 33 | 17 | P014 | 33 | AC9 | P0.14 | GPIO |
| 34 | 16 | P013 | 34 | T2 | P0.11 | GPIO |
| 35 | 18 | P015 | 35 | AD10 | P0.15 | GPIO |
| 36 | 19 | P016 | 36 | AC11 | P0.16 | GPIO |
| 37 | 20 | P017 | 37 | AD12 | P0.17 | GPIO |
| 38 | 21 | P018 | 38 | AD22 | P1.00 | GPIO |
| 39 | 22 | P019 | 39 | | | NC |

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

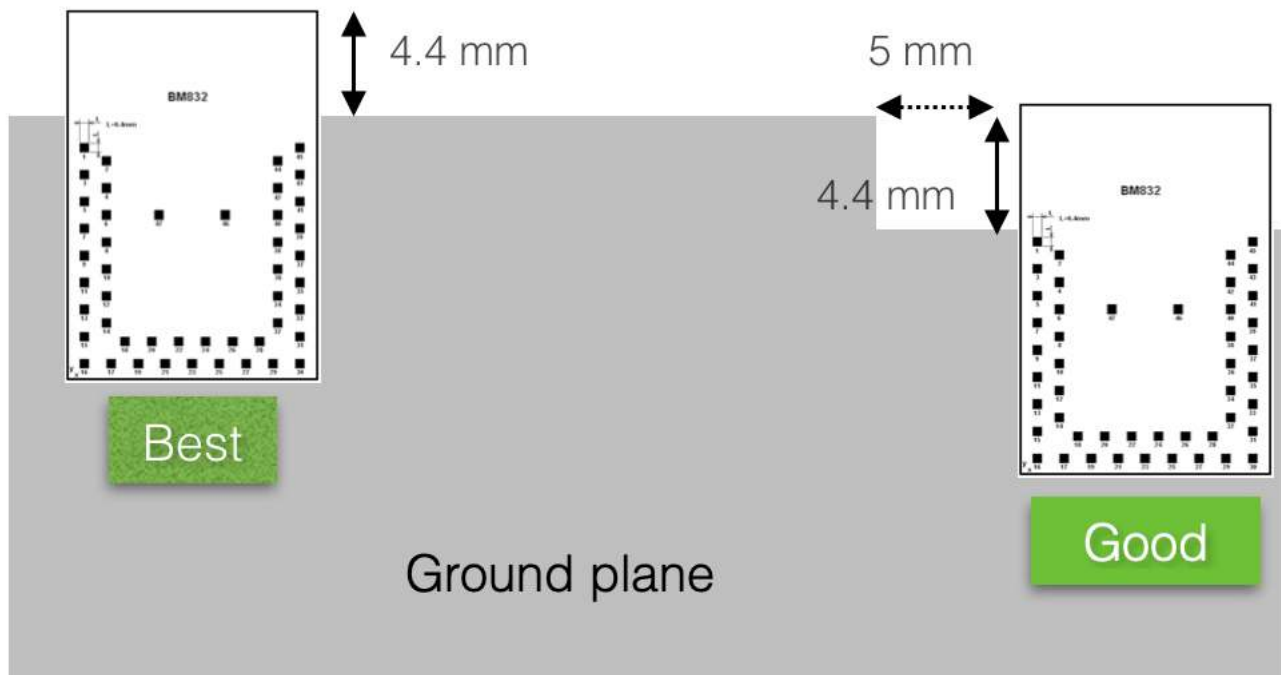
Ver 1.07 Feb. 2021

| | | | | | | |
|----|----|--------------|----|------|-----------|---------------------------------|
| 40 | 24 | P021/ RST | 40 | AC13 | P0.18/RST | GPIO, configurable as RESET pin |
| 41 | 23 | P013 | 41 | AD8 | P0.13 | GPIO |
| 42 | 25 | SWDCLK | 42 | AA24 | SWDCLK | Serial Wire Debug clock input |
| 43 | 26 | SWDIO | 43 | AC24 | SWDIO | Serial Wire Debug I/O |
| 44 | 27 | P022 | 44 | AD18 | P0.22 | GPIO |
| 45 | | GND | 45 | | | Ground |
| 46 | 28 | P023 | 46 | | | NC |
| 47 | 29 | P024 | 47 | AD20 | P0.24 | GPIO |
| | | | 48 | A14 | P0.19 | GPIO |
| | | | 49 | B15 | P1.03 | GPIO |
| | | | 50 | | | NC |
| | | | 51 | A16 | P1.05 | GPIO |
| | | | 52 | R1 | P1.09 | GPIO |
| | | | 53 | B17 | P0.23 | GPIO |
| | | | 54 | P2 | P1.08 | GPIO |
| | | | 55 | A20 | P0.25 | GPIO |
| | | | 56 | Y2 | VDDH | High voltage power supply |
| | | | 57 | | | NC |
| | | | 58 | AD2 | VBUS | 5V input for USB3.3V regulator |
| | | | 59 | V2 | | NC |
| | | | 60 | AC17 | P0.21 | GPIO |
| | | | 61 | U24 | P1.04 | GPIO |
| | | | 62 | AD16 | P0.20 | GPIO |
| | | | 63 | | | NC |
| | | | 64 | U1 | P0.12 | GPIO |
| | | | 65 | R24 | P1.06 | GPIO |
| | | | 66 | P23 | P1.07 | GPIO |
| | | | 67 | AD6 | D+ | USB D+ |
| | | | 68 | AD4 | D- | USB D- |

Mounting BM833, BM833A on the Host PCB

The following figure shows recommended mounting of BM833/BM833A module on the host PCB.

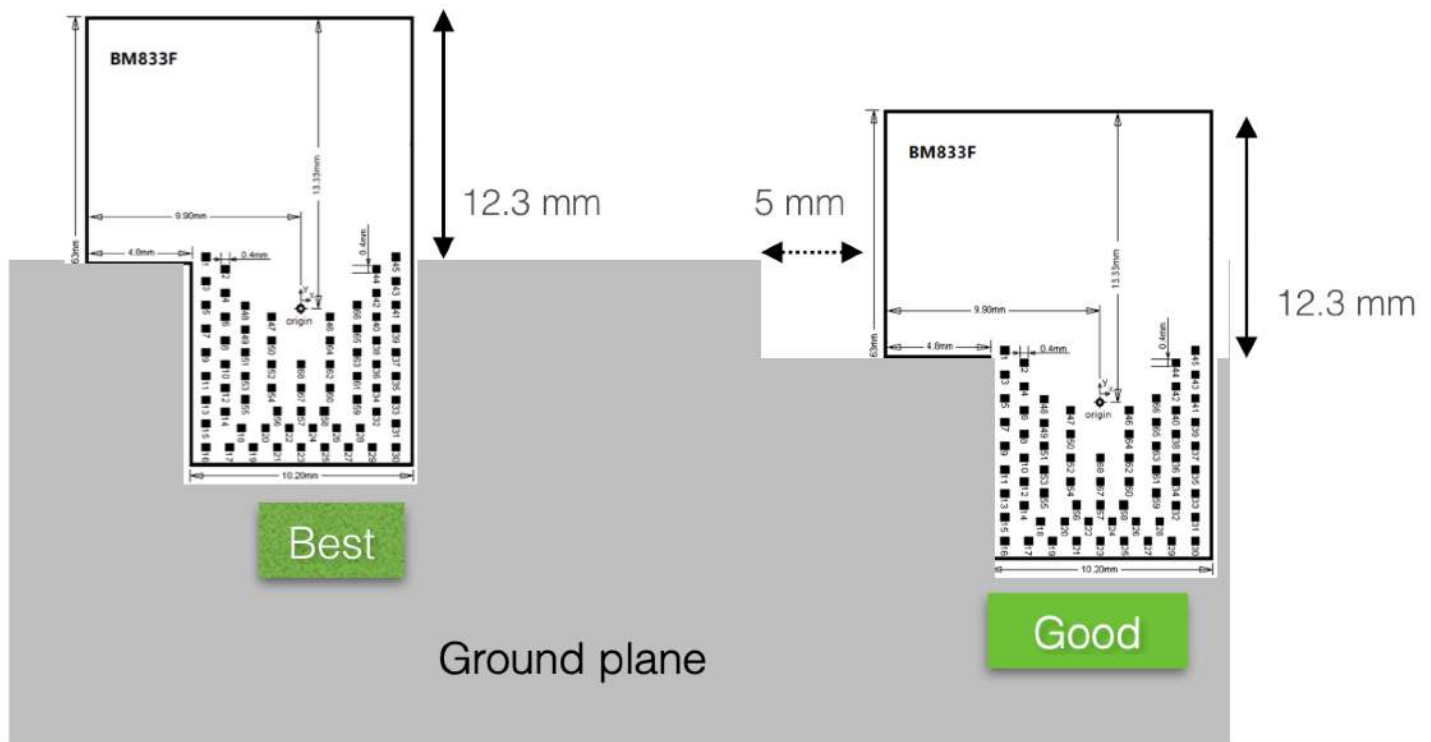
- For the best Bluetooth range performance, the antenna area of module shall extend 4.4 mm outside the edge of host PCB board, or 4.4 mm outside the edge of a ground plane.
- The next choice is to place a module on a corner of host PCB, the antenna area shall extend 4.4 mm from the edge of ground plane. Ground plane shall be at least 5 mm from the edge of the antenna area of module.
- We don't recommend mounting BM833 module in the middle of a host PCB.



Mounting BM833F and BM833AF on the host PCB

The following figure shows recommended mounting of BM833F/BM833AF modules on the host PCB.

- For the best Bluetooth range performance, the antenna area of module shall extend 12.3 mm outside the edge of host PCB board, or 12.3 mm outside the edge of a ground plane.
- The next choice is to place a module on a corner of host PCB, the antenna area shall extend 12.3 mm from the edge of ground plane. Ground plane shall be at least 5 mm from the edge of the antenna area of module.
- We don't recommend mounting BM833F/BM833AF module in the middle of a host PCB.



For the best Bluetooth range performance, keep all external metal at least 30mm from the antenna area.

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

4. Evaluation Board

An evaluation board can be used to evaluate performance of module and to develop and test your firmware before an application-specific host board is developed.

Nordic Development Environment

Nordic Semiconductor provides a complete range of hardware and software development tools for the nRF52 Series devices. nRF52 DK board is recommended for firmware development. Document and Software development tools can be downloaded by the following links.

Get started with Nordic chip and all online documents.

http://infocenter.nordicsemi.com/index.jsp?topic=/com.nordic.infocenter.nrf52/dita/nrf52/development/nrf52_dev_kit.html&cp=1_1

Nordic SDK with many example projects.

https://developer.nordicsemi.com/nRF5_SDK/

Nordic development zone.

<https://devzone.nordicsemi.com/tutorials/b/getting-started/posts/development-with-gcc-and-eclipse>

Programming the Nordic chip

Download and install Nrf5x-Command-Line Tools

<https://www.nordicsemi.com/eng/nordic/Products/nRF52840/nRF5x-Command-Line-Tools-Win32/58850>

Download and install nRF Connect PC software

<https://www.nordicsemi.com/Software-and-Tools/Development-Tools/nRF-Connect-for-desktop>

Download and install Segger Embedded Studio.

<https://www.nordicsemi.com/Software-and-Tools/Development-Tools/Segger-Embedded-Studio>

nRF52DK

The nRF52 DK is a versatile single board development kit for *Bluetooth*® low energy, ANT and 2.4GHz proprietary applications using the nRF52833 SoC.

It supports the standard Nordic Software Development Tool-chain using SES, Keil, IAR and GCC. Program/Debug options on the kit is Segger J-Link OB.

nRF52840DK

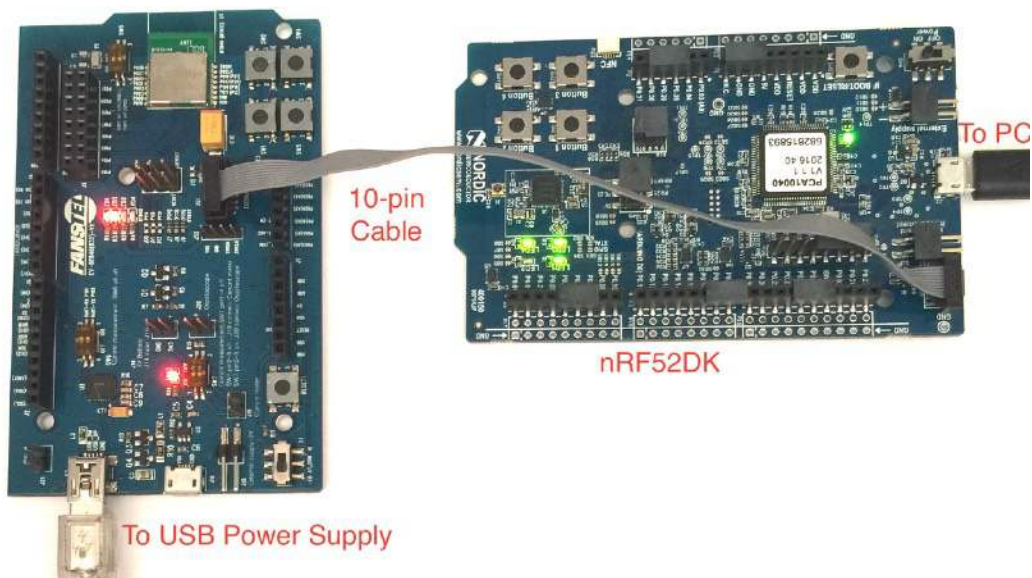
Nordic Semiconductor nRF52840 Development Kit (nRF52840-DK) is a versatile, single-board development tool for Bluetooth® 5 / Bluetooth Low Energy (BLE), 802.15.4 / Thread, ANT/ANT+, and proprietary 2.4GHz applications using the nRF52840 Multi-Protocol SoC (System on Chip).

The nRF52840-DK supports the standard Nordic tool-chain software using SES, Keil, IAR, and GCC. Program/debug options are available for Segger J-Link OB and external target boards.

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

Loading Firmware into Evaluation Board Through a Nordic DK Procedures to connect a Nordic DK to a EV-BM833A or EV-BM833AF.

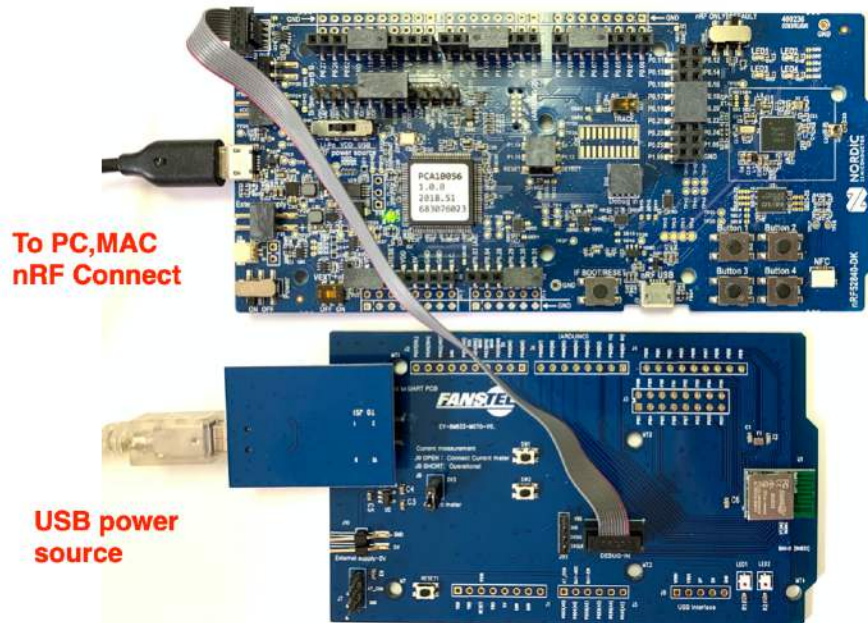
- Connect Nordic nRF52DK debug out to Fanstel evaluation board debug in using the 10-pin flat cable as shown below.
- Connect Nordic nRF52DK to PC.
- Connect a DC power source to micro or mini USB port of evaluation board.



BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

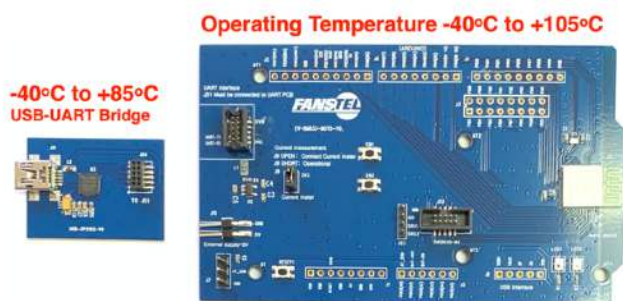
Procedures to connect a Nordic DK to a EV-BM833, EV-BM833F, EV-BM833E

- Connect Nordic nRF52DK debug out to Fanstel evaluation board debug in using the 10-pin flat cable as shown below.
- Connect Nordic nRF52DK to PC.
- Plug-in the USB to UART bridge board onto the main board.
- Connect a DC power source to micro or mini USB port of evaluation board.



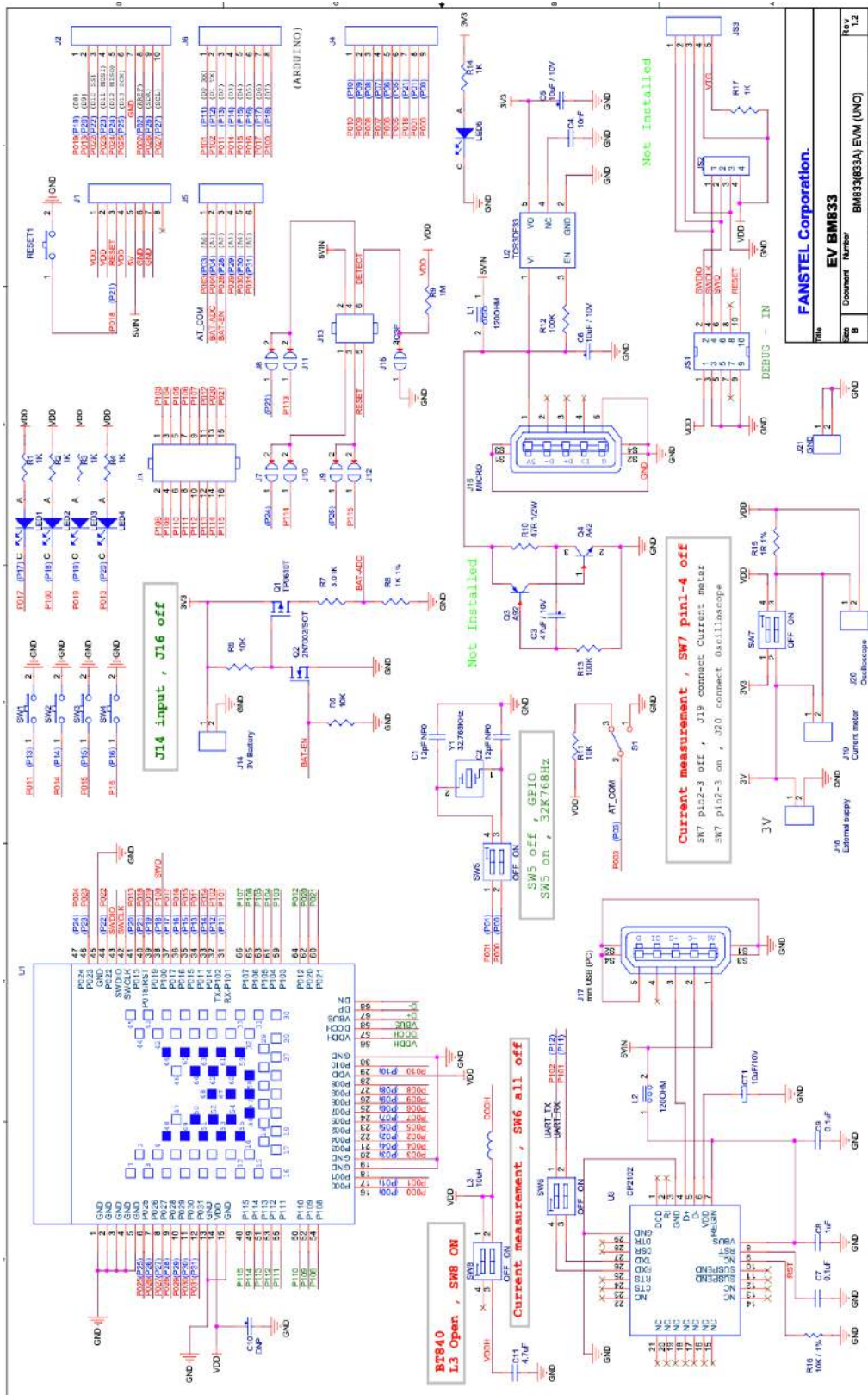
EV Board with Operating Temperature -40°C to $+105^{\circ}\text{C}$

After programming, the USB to UART bridge board can be removed. The main board can be used for operating temperature testing for up to 105°C .



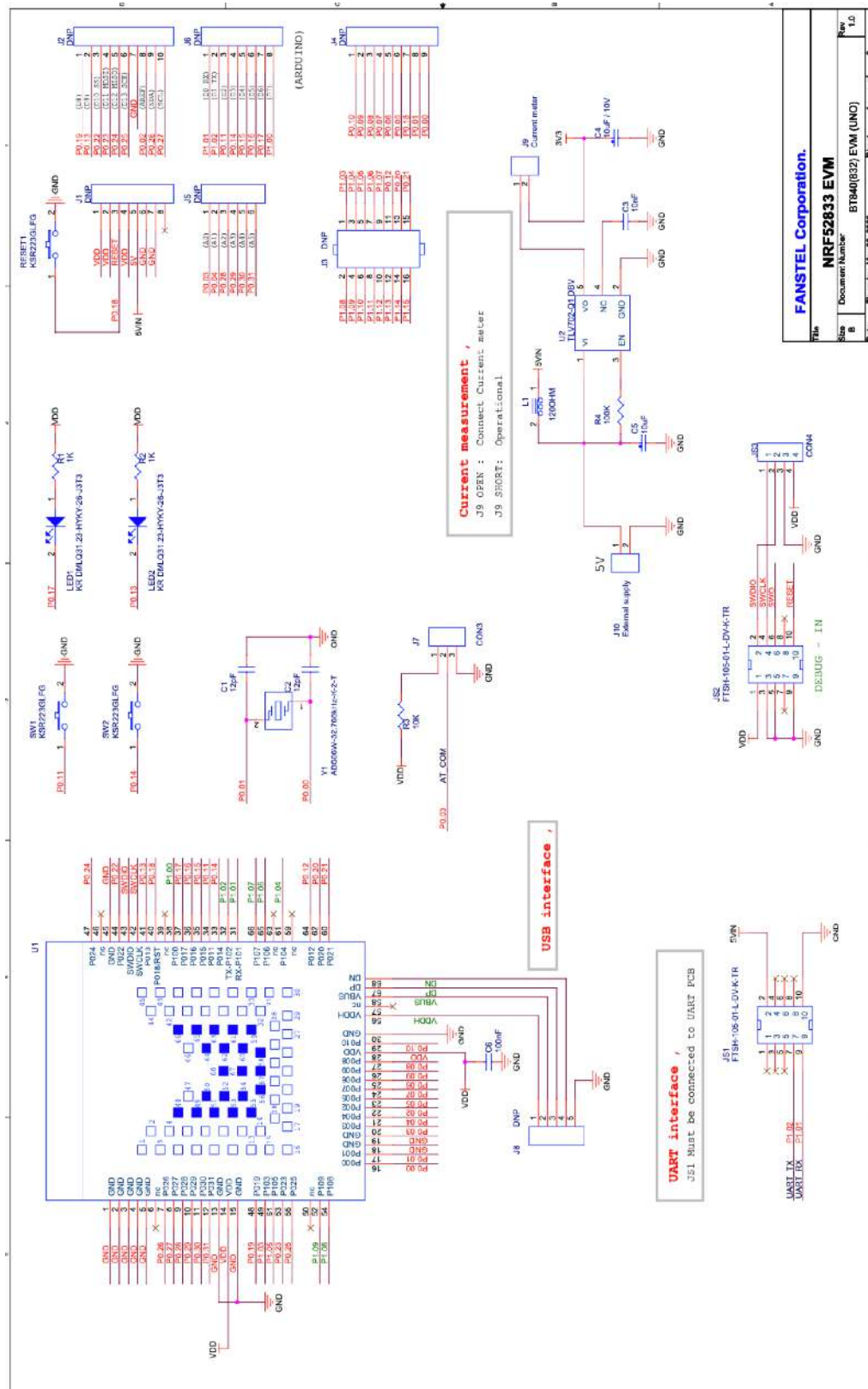
EV-BM833A/AF Schematics

Schematics for EV-BM833A and EV-BM833AF.



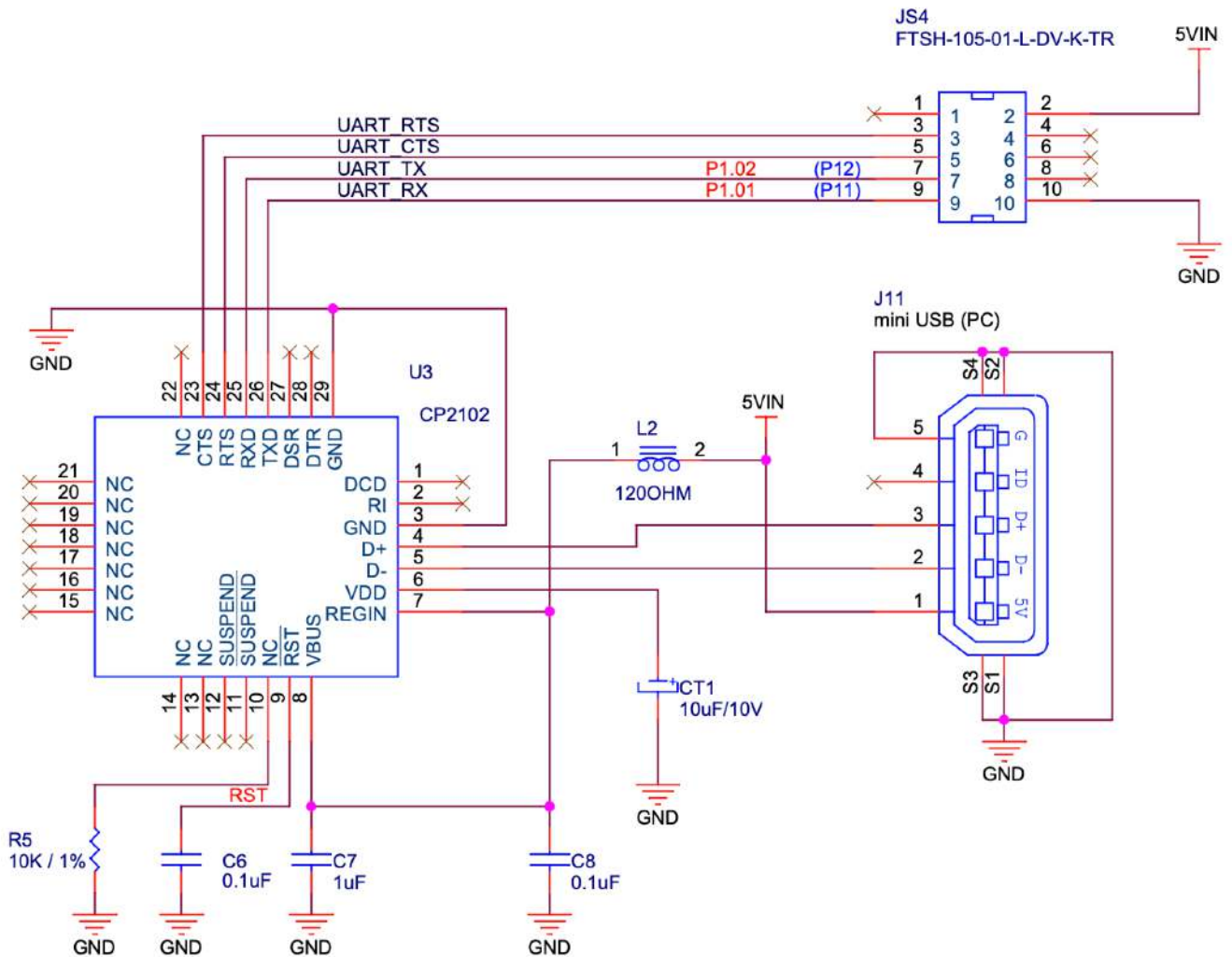
EV-BM833/E/F Schematics, Two Boards

The following main board operates from -40°C to +105°C.



BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

The following UART board operates from -40°C to +85°C.



Suggestion for Battery Power Application

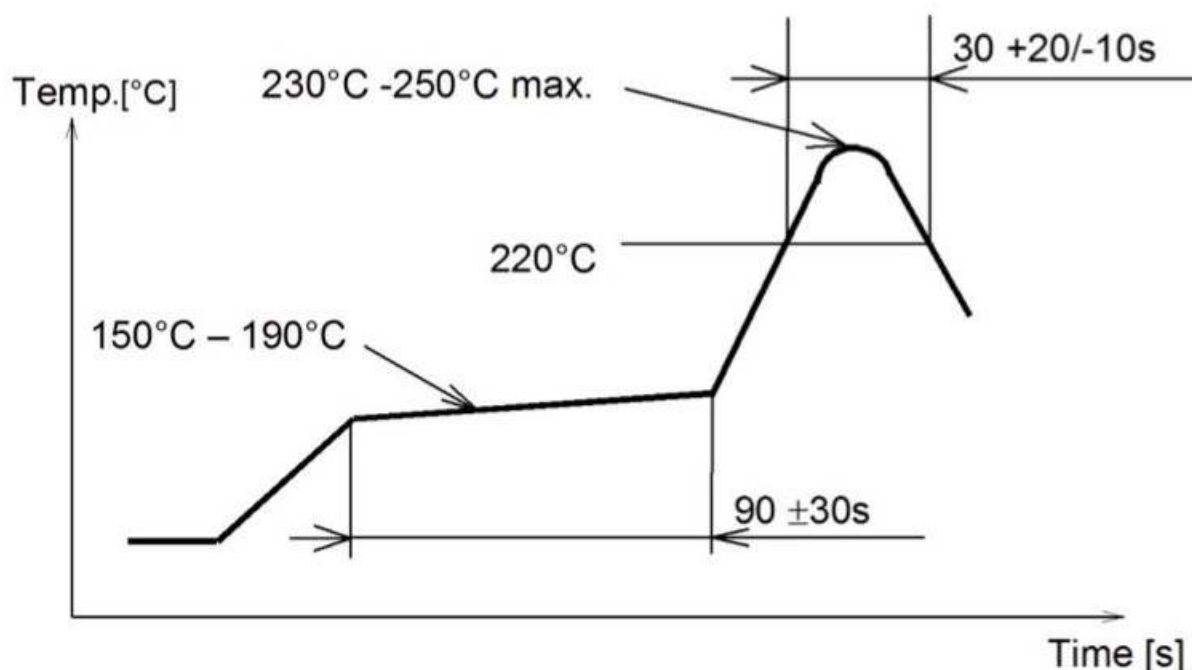
Standby current consumption is important for battery-powered product. We suggest adding a 32.768 kHz crystal and 2 capacitors as shown in the upper left corner of the evaluation board schematics. The 32MHz main clock won't be active at idle state to save power.

Two inductors required for DCDC converter are inside BM833 module. You can enable DCDC to lower power consumption.

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.



Cautions, Design Notes, and Installation Notes

Failure to follow the guidelines set forth in this document may result in degrading of the product's functions and damage to the product.

Design Notes

- (1) Follow the conditions written in this specification, especially the control signals of this module.
- (2) 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).
- (3) This product should not be mechanically stressed when installed.
- (4) Keep this product away from heat. Heat is the major cause of decreasing the life of these products.
- (5) Avoid assembly and use of the target equipment in conditions where the products' temperature may exceed the maximum tolerance.

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

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

(7) this product away from other high frequency circuits.

Notes on Antenna and PCB Layout

(1) Don't use a module with internal antenna inside a metal case.

(2) For PCB layout:

- Avoid running any signal line below module whenever possible,
- No ground plane below antenna,
- If possible, cut-off the portion of main board PCB below antenna.

Installation Notes

(1) Reflow soldering is possible twice based on the time-temperature profile in this data sheets. Set up the temperature at the soldering portion of this product according to this reflow profile.

(2) Carefully position the products so that their heat will not burn into printed circuit boards or affect the other components that are susceptible to heat.

(3) Carefully locate these products so that their temperatures will not increase due to the effects of heat generated by neighboring components.

(4) If a vinyl-covered wire comes into contact with the products, then the cover will melt and generate toxic gas, damaging the insulation. Never allow contact between the cover and these products to occur.

(5) This product should not be mechanically stressed or vibrated when reflowed.

(6) If you want to repair your board by hand soldering, please keep the conditions of this chapter.

(7) Do not wash this product.

(8) Refer to the recommended pattern when designing a board.

(9) Pressing on parts of the metal cover or fastening objects to the metal will cause damage to the unit.

Usage Condition Notes

(1) 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.

(2) Do not use dropped products.

(3) Do not touch, damage or soil the pins.

(4) Follow the recommended condition ratings about the power supply applied to this product.

(5) Electrode peeling strength: Do not add pressure of more than 4.9N when soldered on PCB

(6) Pressing on parts of the metal cover or fastening objects to the metal cover will cause damage.

(7) These products are intended for general purpose and standard use in general electronic equipment, such as home appliances, office equipment, information and communication equipment.

Storage Notes

(1) The module should not be stressed mechanically during storage.

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

(2) 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.

(3) Keep this product away from water, poisonous gas and corrosive gas.

(4) This product should not be stressed or shocked when transported.

(5) Follow the specification when stacking packed crates (max. 10).

Safety Conditions

These specifications are intended to preserve the quality assurance of products and individual components. Before use, check and evaluate the operation when mounted on your products. Abide by these specifications, without deviation when using the products. These products may short-circuit. If electrical shocks, smoke, fire, and/or accidents involving human life are anticipated when a short circuit occurs, then provide the following failsafe functions, as a minimum.

(1) Ensure the safety of the whole system by installing a protection circuit and a protection device.

(2) Ensure the safety of the whole system by installing a redundant circuit or another system to prevent a dual fault causing an unsafe status.

Other Cautions

(1) This specification sheet is copyrighted. Reproduction of this data sheet is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices.

(2) Do not use the products for other purposes than those listed.

(3) Be sure to provide an appropriate failsafe function on your product to prevent an additional damage that may be caused by the abnormal function or the failure of the product.

(4) This product has been manufactured without any ozone chemical controlled under the Montreal Protocol.

(5) These products are not intended for other uses, other than under the special conditions shown below. Before using these products under such special conditions, check their performance and reliability under the said special conditions carefully to determine whether or not they can be used in such a manner.

- In liquid, such as water, salt water, oil, alkali, or organic solvent, or in places where liquid may splash.
- In direct sunlight, outdoors, or in a dusty environment
- In an environment where condensation occurs.
- In an environment with a high concentration of harmful gas.

(6) If an abnormal voltage is applied due to a problem occurring in other components or circuits, replace these products with new products because they may not be able to provide normal performance even if their electronic characteristics and appearances appear satisfactory.

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

(7) When you have any question or uncertainty, contact Fanstel.

Packaging

Production modules are delivered in reel, 1000 modules in each reel.

FCC LABEL

The Original Equipment Manufacturer (OEM) must ensure that the OEM modular transmitter must be labeled with its own FCC ID number. This includes a clearly visible label on the outside of the final product enclosure that displays the contents shown below. If the FCC ID is not visible when the equipment is installed inside another device, then the outside of the device into which the equipment is installed must also display a label referring to the enclosed equipment

The end product with this module may subject to perform FCC part 15 unintentional emission test requirement and be properly authorized.

This device is intended for OEM integrator only.

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

Revision History

- Oct. 2019, Ver. 0.60: The first draft release
- Nov. 2019, Ver.0.90: The second draft release.
- Dec. 2019, Ver. 1.00: Initial release. Update module mechanical drawings and pictures.
- Jan. 2020, Ver. 1.01: Add QDID number and correct links to Nordic SoC Product Specifications.
- Jan. 2020, Ver. 1.02: Correct module mounting drawings.
- May 2020, Ver. 1.03: Update certified antenna and max TX power information.
- July 2020, Ver. 1.04: Add EV-BM833 board information
- Sep. 2020, Ver. 1.05: Add 105°C EV board schematics.
- Feb. 2021, Ver. 1.07: Add PCB size tolerance to mechanical drawings.

BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

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