

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

Ver 0.90 Nov. 2019

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.

Array antenna will be supported in BT833 Series modules.



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	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
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					

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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.

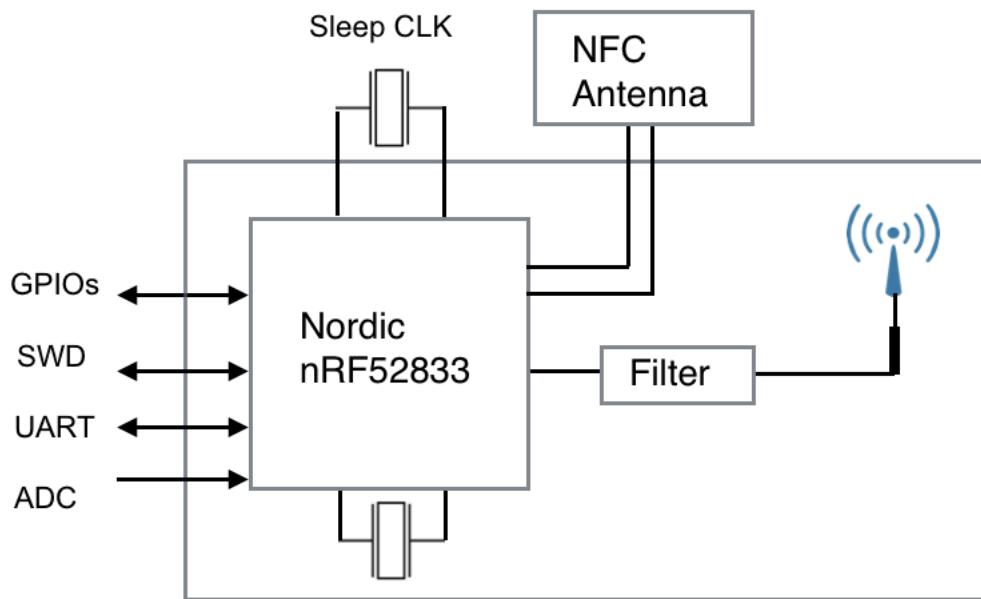
The following is a block diagram of BM833. Antenna circuit and main clock are integrated. All 32 GPIOs of nRF52833 can be accessed from main board. For lower power consumption at idle state, a 32.768 kHz crystal is added on the host board. Connection to an external NFC (Near Field Communication) antenna 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.
- Up to + 8dBm TX.
- CODED PHY
- Size: 10.2x15x1.9 mm

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

BM833F

BM833 offers the same features as BM833 except:

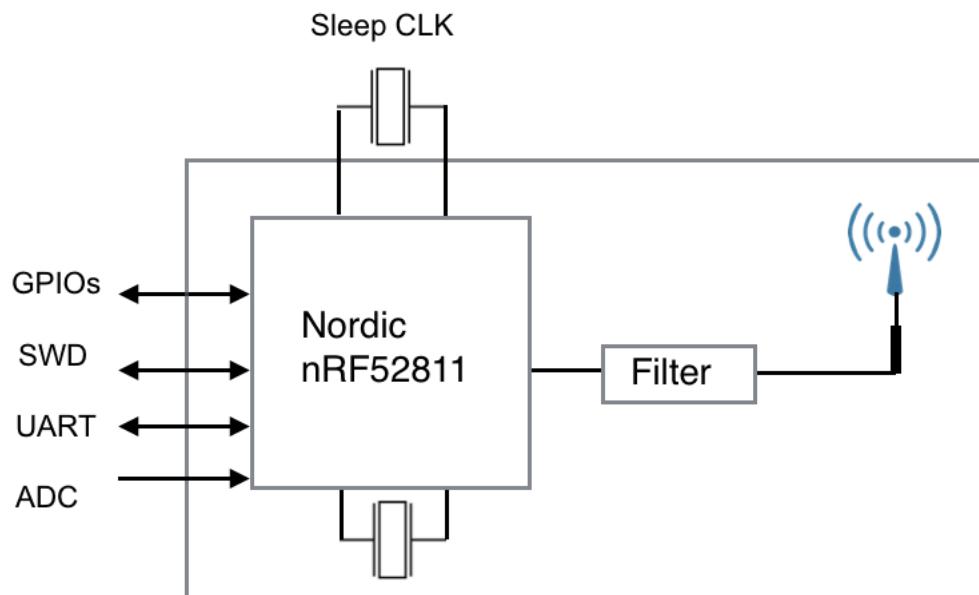
- High performance PCB trace antenna
- Size: 10.2 (15mm antenna area) x20.6x1.9mm

BM833E

BM833E offers the same features as BM833 excepts:

- An u.FL connector for external antenna
- Size: 10.2 x20.6mm

BM833A, BM833AF Block Diagram



BM833A

- Uses an nRF52811 QFAA with Cortex M4 MCU
- 192 KB flash, 24 KB RAM
- 47 pins, 32 GPIOs
- Size: 10.2x15x1.9mm
- Bluetooth 5.1, 802.15.4, proprietary radio protocols.
- Does not support NFC
- Up to + 4 dBm TX
- Support CODED PHY at 125 Kbps for longer range

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

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:

- **S112 SoftDevice**

The S112 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 S112 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 (SoC) solutions. S112 can be used for for BM832A.

- **S132 SoftDevice**

The S132 SoftDevice is a *Bluetooth* low energy Central and Peripheral protocol stack solution. It supports up to twenty connections with an additional observer and a broadcaster role all running concurrently. The S132 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 (SoC) solutions.

Development Tools

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.

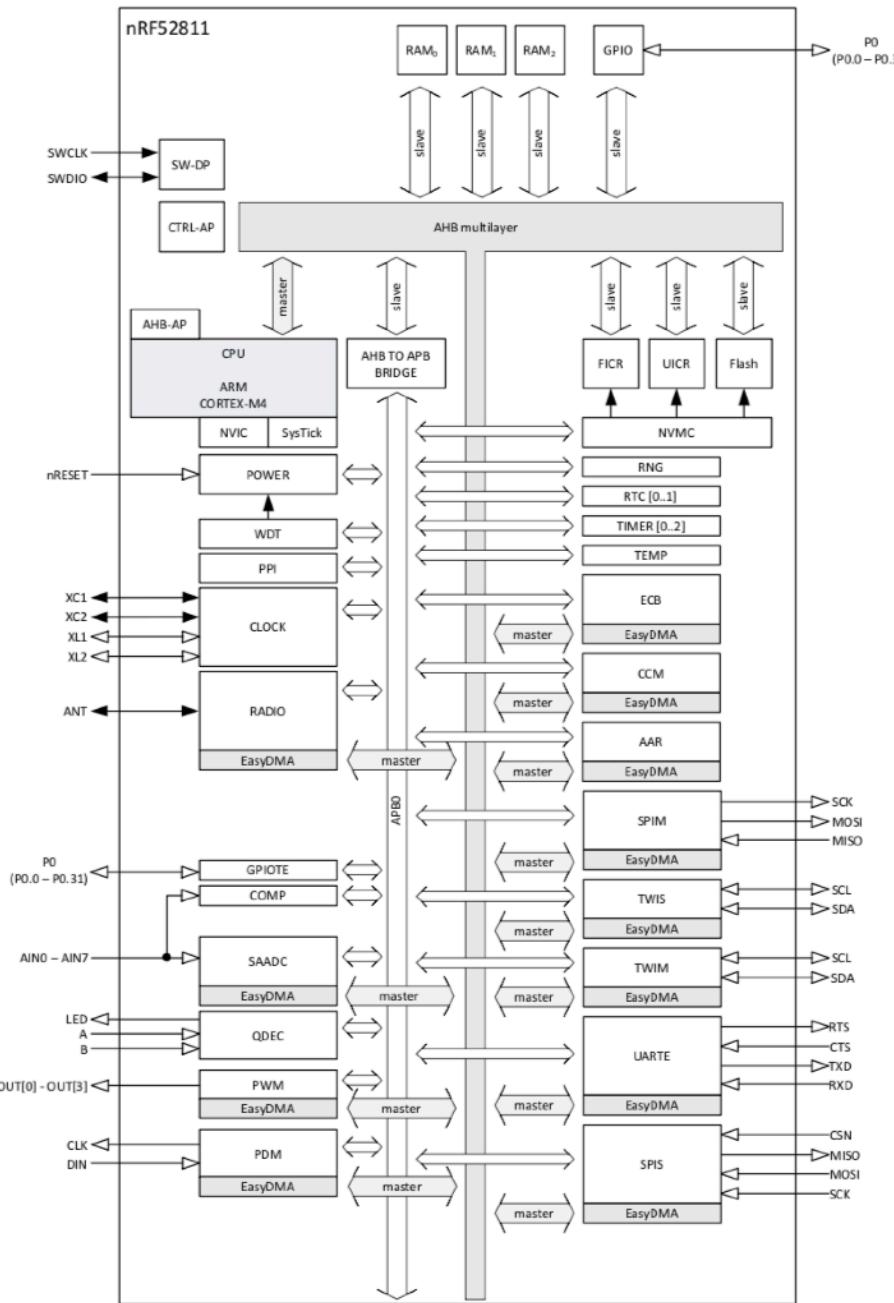
3. Product Overview

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.



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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.

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

Nordic nRF52833 SoC

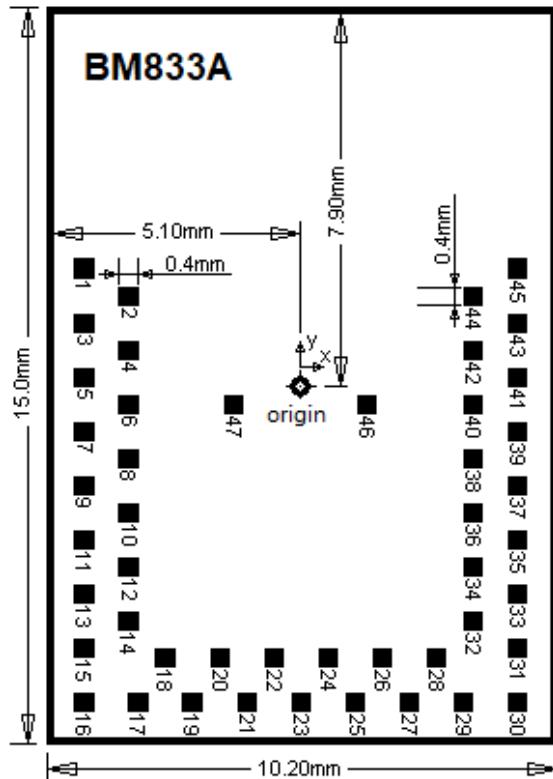
The following is a block diagram of Nordic nRF52833 SoC.

To be provided.

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.

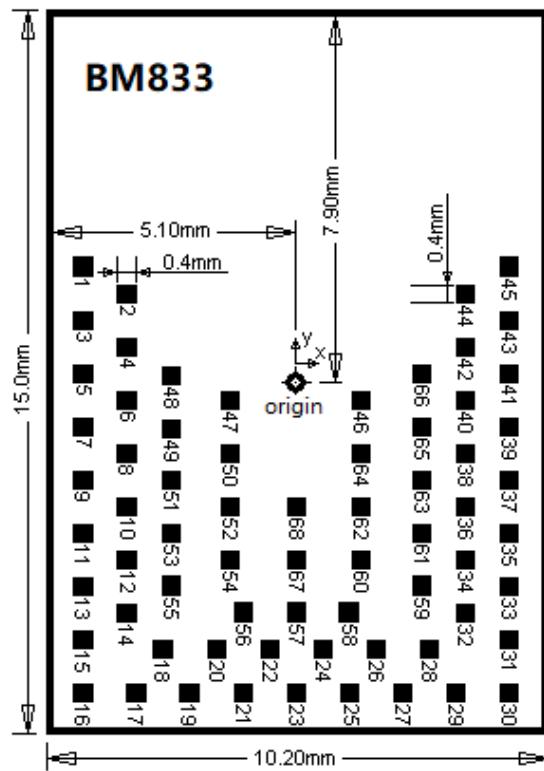
BM833 drawings are on the following page. If you can use BM833 footprint for BM833A, your host board is upgradeable to an nRF52833 module.



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

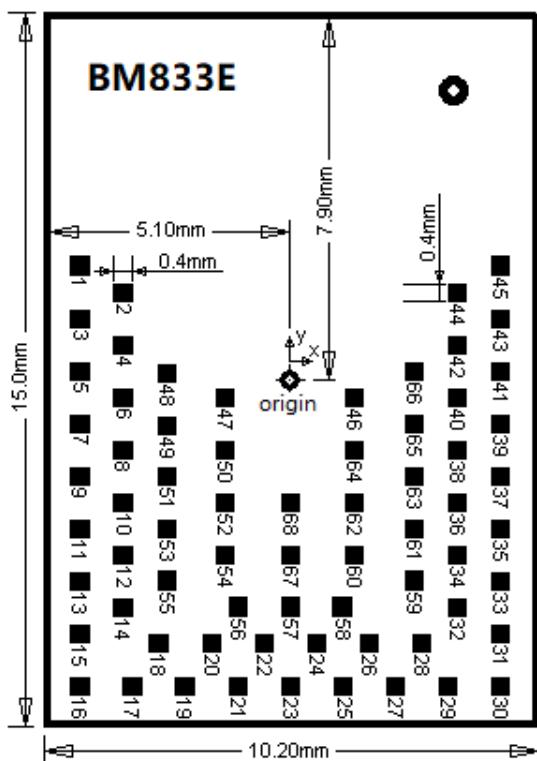
The followings are mechanical drawings of BM833, top view. X-axis and Y-axis coordinate of each pin is shown in table.



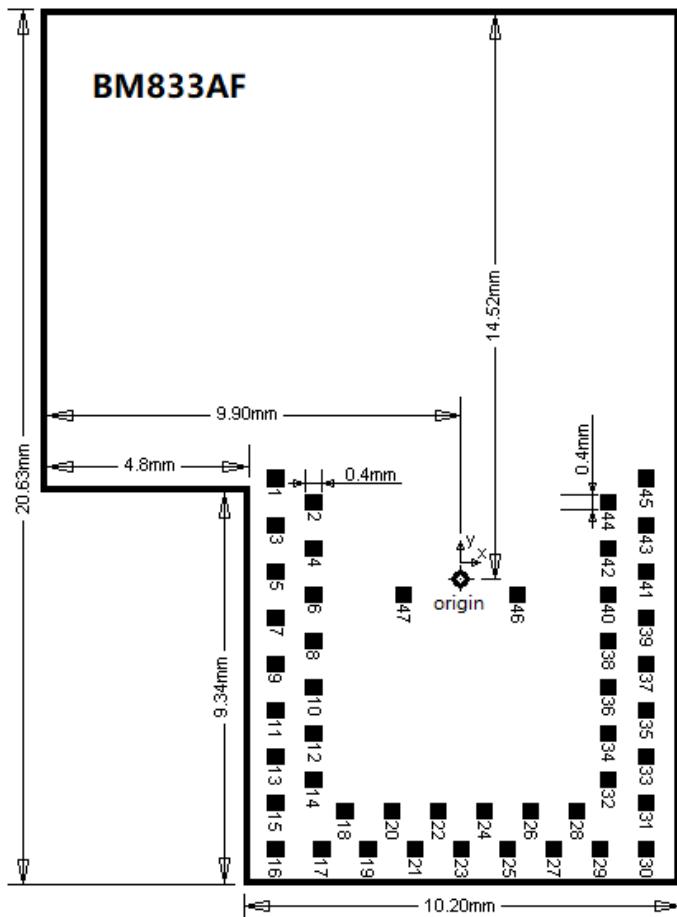
	X (mm)	Y (mm)		X (mm)	Y (mm)		X (mm)	Y (mm)
Zero	0	0						
1	-4.4	2.35	45	4.4	2.35	17	-3.3	-6.45
3	-4.4	1.25	43	4.4	1.25	19	-2.2	-6.45
5	-4.4	0.15	41	4.4	0.15	21	-1.1	-6.45
7	-4.4	-0.95	39	4.4	-0.95	23	0	-6.45
9	-4.4	-2.05	37	4.4	-2.05	25	1.1	-6.45
11	-4.4	-3.15	35	4.4	-3.15	27	2.2	-6.45
13	-4.4	-4.25	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

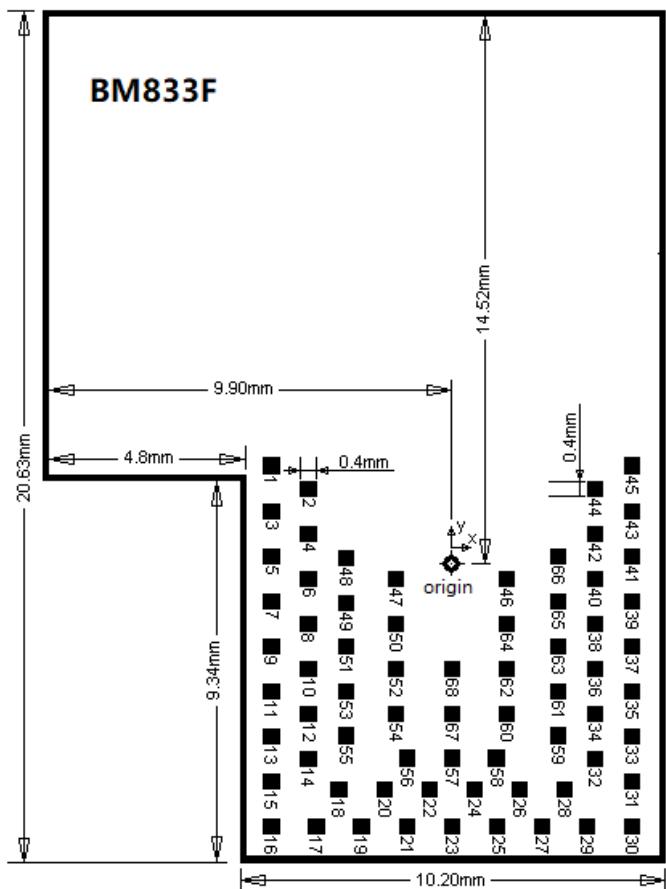
The following is mechanical drawings of B833E. Its footprint is the same as that of BM833.



	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

Mechanical Drawings BM833F


Zero	X (mm)	Y (mm)		X (mm)	Y (mm)		X (mm)	Y (mm)
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			

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.

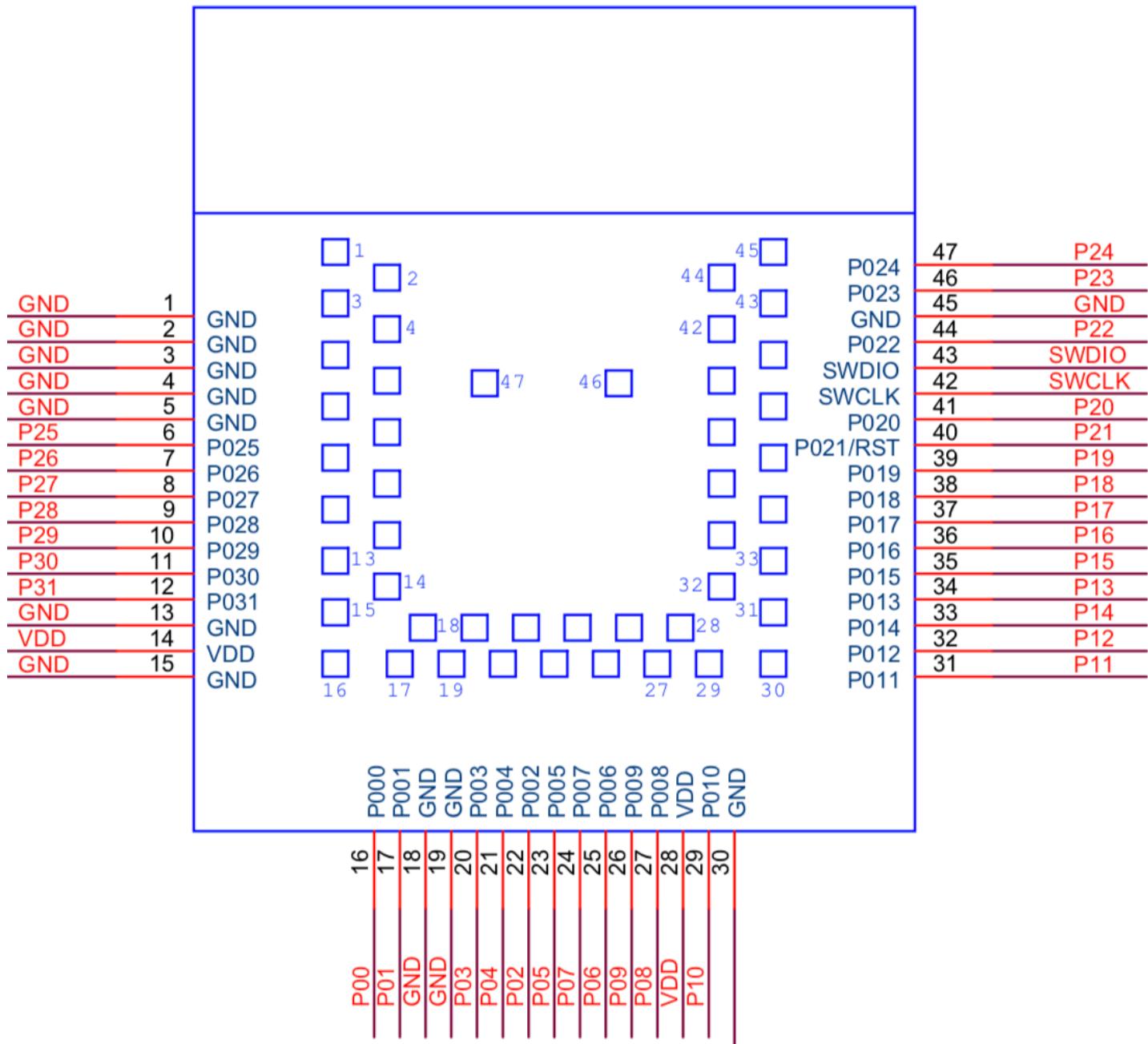
BLE 5.1, 802.15.4 Modules BM833A/AF, BM833/F/E

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://www.nordicsemi.com/?sc_itemid=%7B7CBDF55C-9745-4A7D-A491-5B66AE9454B6%7D

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.



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

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

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

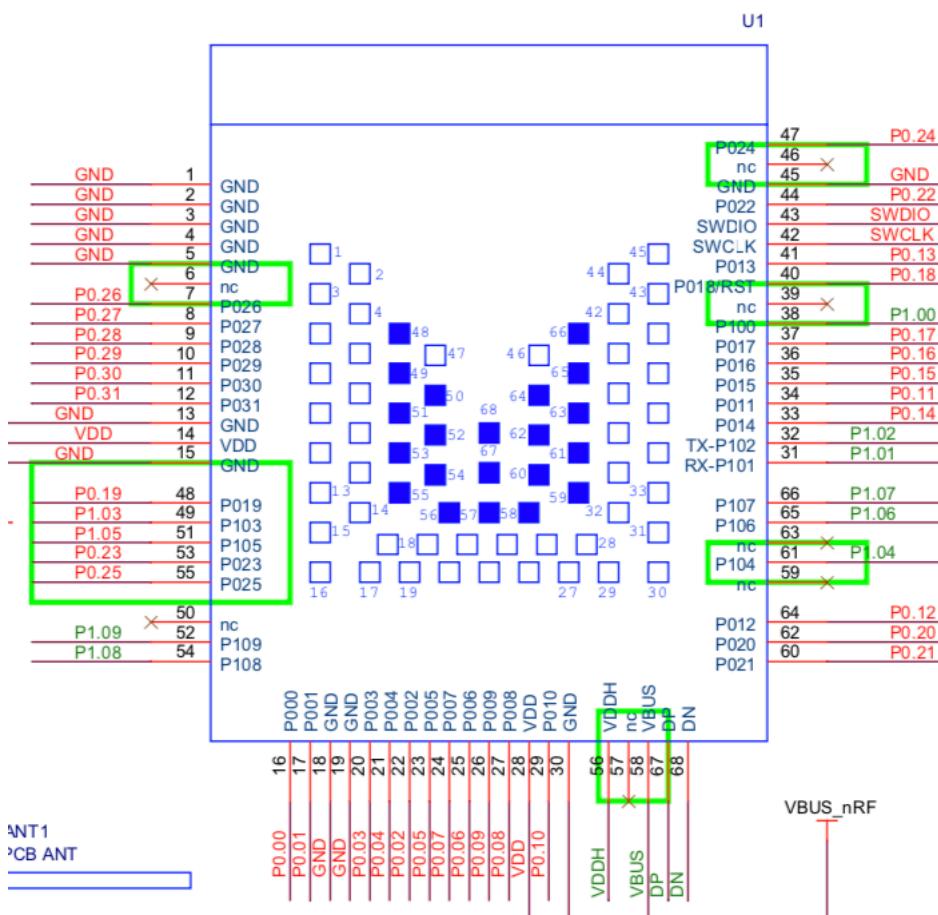
BM833 Pin Functions

BM833 uses an nRF52833 QIAA, Nordic Product Specifications:

http://infocenter.nordicsemi.com/pdf/nRF52840_PS_v1.0.pdf

Pin assignments are below. Pins 1 to 47 are exactly at the same locations as those of 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, BM833 pin names are in red color.
- BM833A pin names are in blue 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

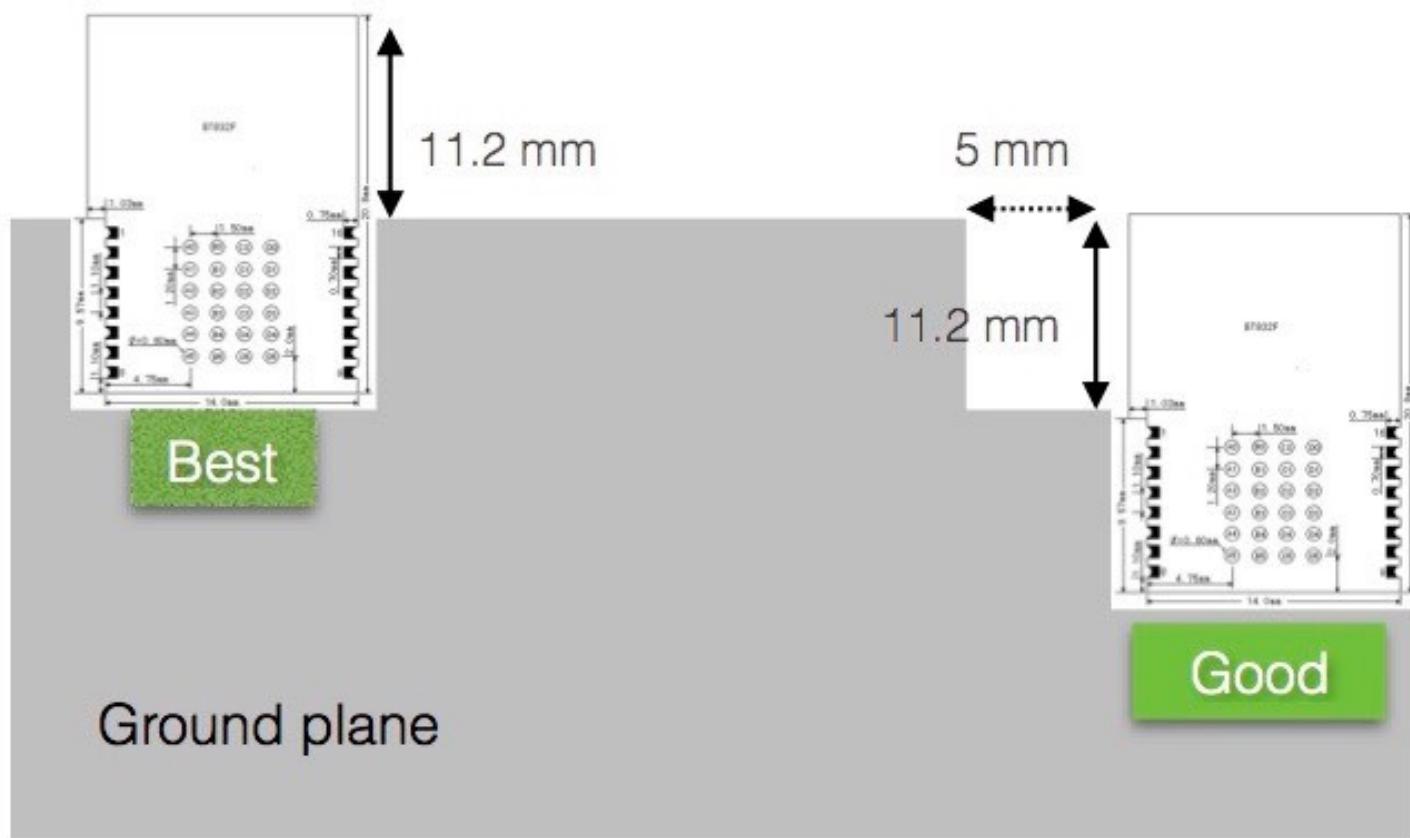
40	24	P021/ RST	40	AC13	P0.18/RST	GPIO, configurable as RESET pin
41	23	P013	41	AD8	P0.13	GPIO
42	25	SWDCLK	42	AA24	SWDCLK	Serial Wire Debug clock input
43	26	SWDIO	43	AC24	SWDIO	Serial Wire Debug I/O
44	27	P022	44	AD18	P0.22	GPIO
45		GND	45			Ground
46	28	P023	46			NC
47	29	P024	47	AD20	P0.24	GPIO
			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-

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

Mounting BM833 on the Host PCB

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

- For the best Bluetooth range performance, the antenna area of module shall extend 11.2 mm outside the edge of host PCB board, or 11.2 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 11.2 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.



1. BT832F module extends 11.2 mm from edge or ground plane of the host PCB board.

2. No ground plane on all layers for at least 5mm from edge of module. Longer distance for longer Bluetooth range.

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

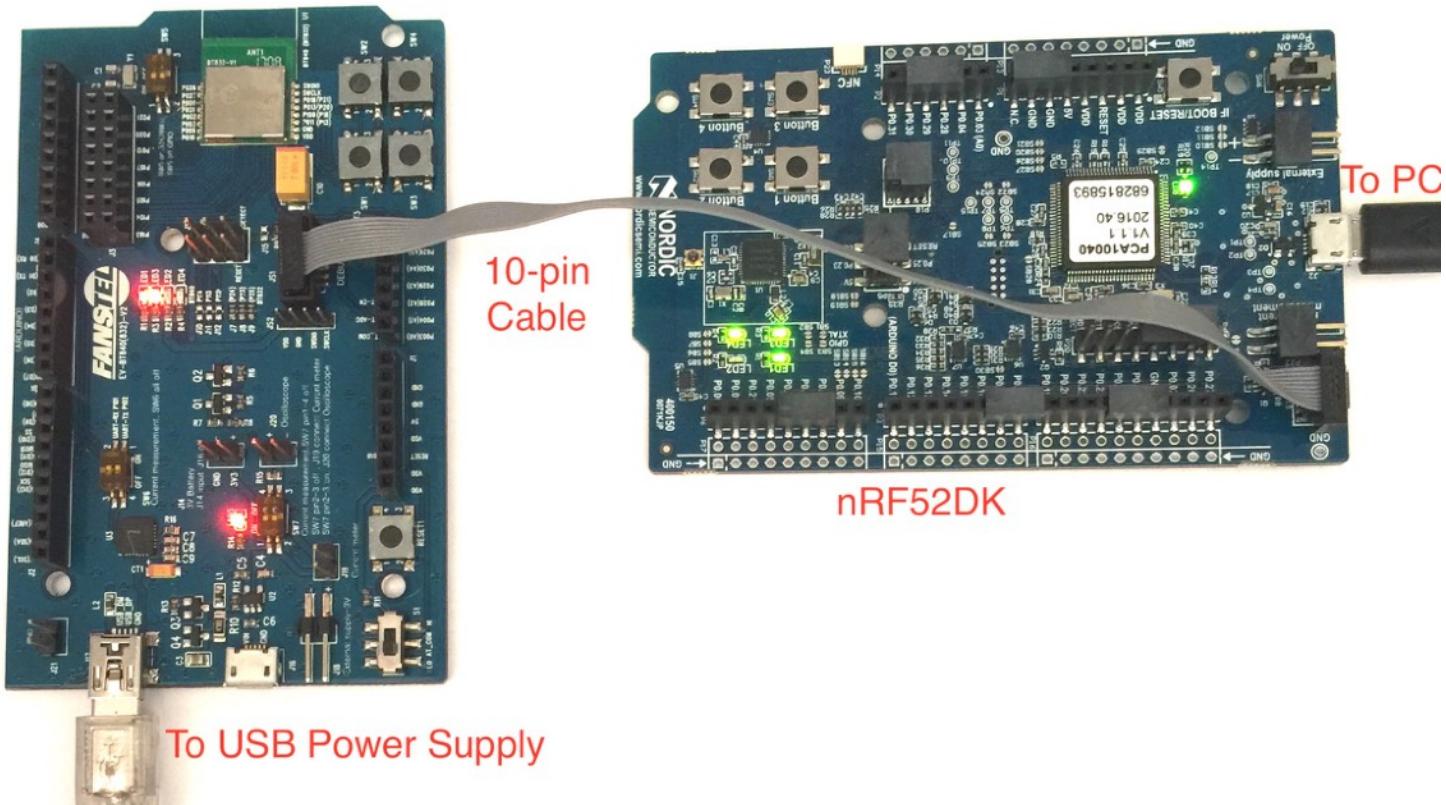
Nordic Semiconductor nRF52840 Development Kit (nRF52840-DK) is a versatile, single-board development tool for *Bluetooth®* 5 / *Bluetooth Low Energy (BLE)*, 802.15.4 / Thread, ANT/ANT+, and proprietary 2.4GHz applications using the nRF52840 Multi-Protocol SoC (System on Chip).

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.

Loading Firmware into Evaluation Board Through a Nordic DK

Procedures to connect a Nordic DK to a Fanstel nRF52 module evaluation board.

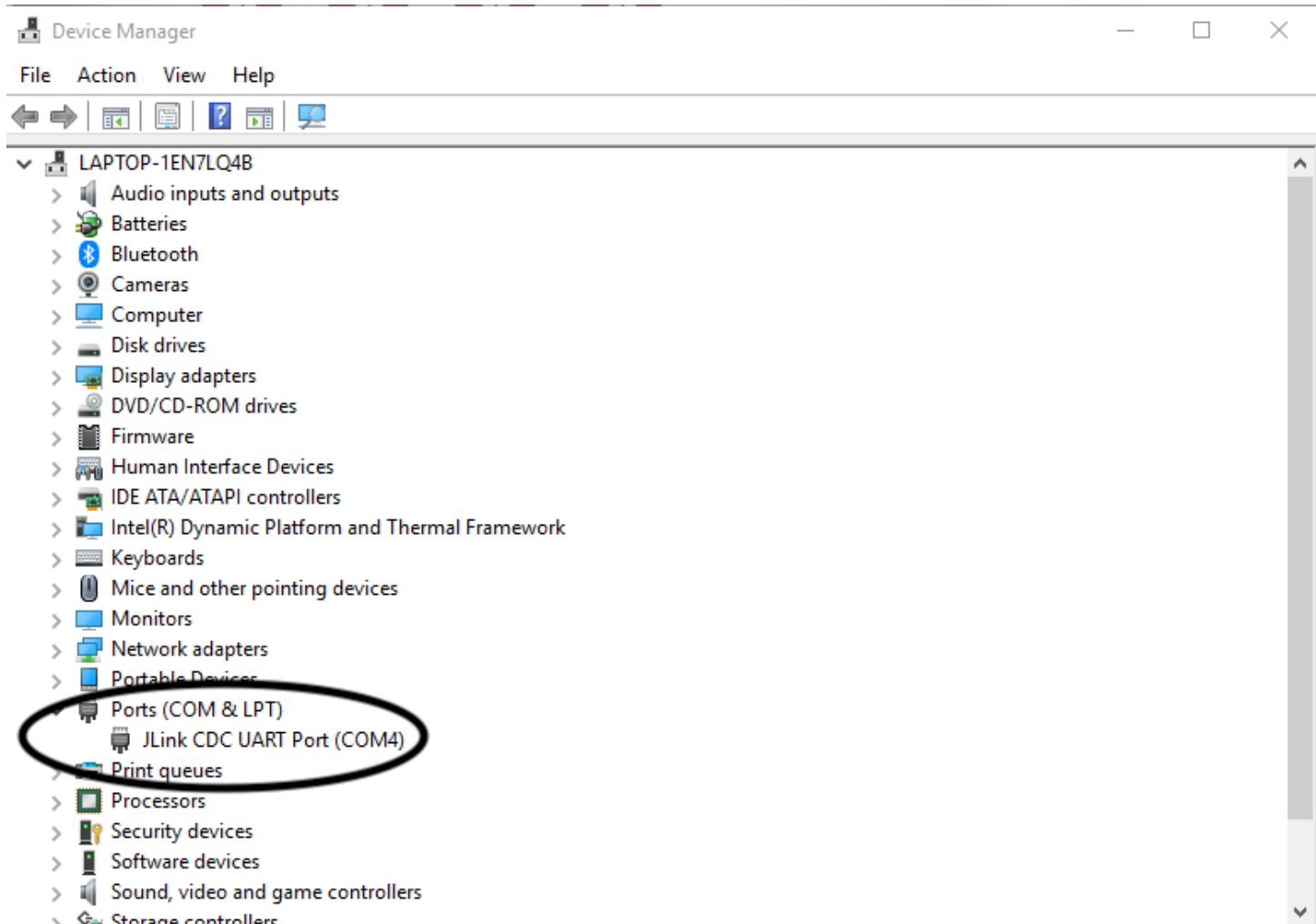
- Connect Nordic nRF52DK debug out to Fanstel evaluation board debug in using the 10-pin flat cable as shown below.
- Connect Nordic nRF52DK to PC.
- Connect a DC power source to micro or mini USB port of evaluation board.



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

Check COM Port Connection

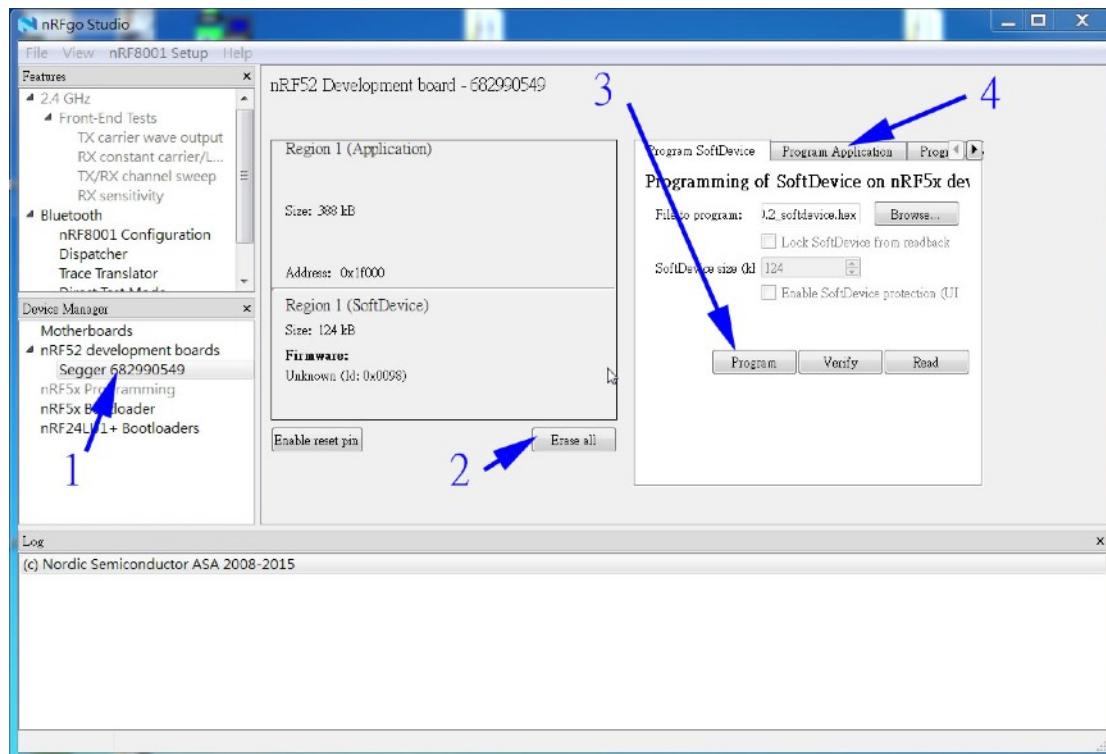
After connecting nRF52DK and an nRF52 sensor/evaluation board, you can see You can J-Link device and COM port on the PC control panel Device Manager.



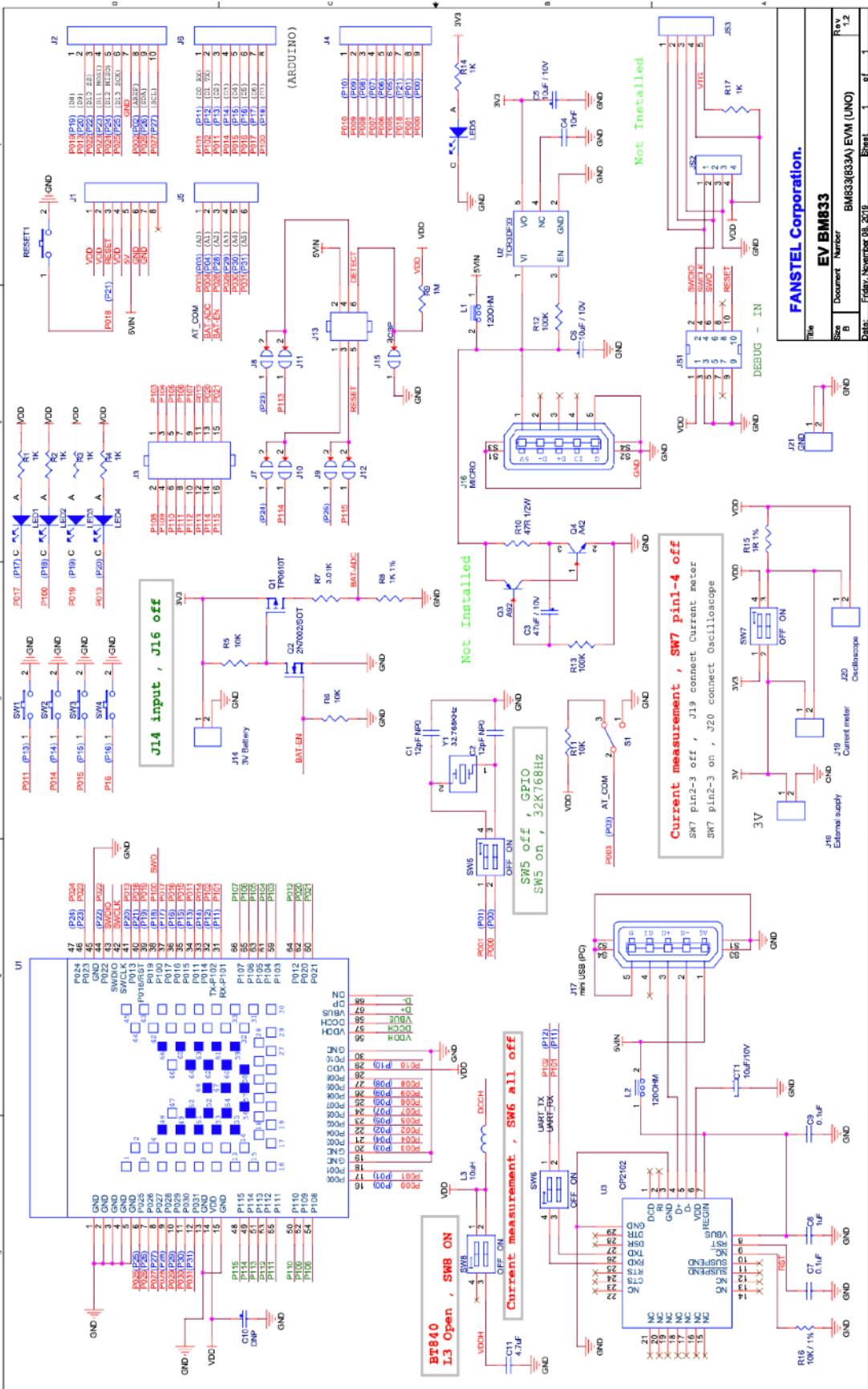
Starting Nordic nRFgo

Open nRFgo Studio.

1. Click **Segger 682990549** as in the example below.
2. Erase all if needed
3. Browse for Bootloader and program. After programming bootloader, you can use OTA for firmware update.
4. Browse for the SoftDevice and program.
5. Browse for the application hex file and program



Evaluation Board Schematic



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

Suggestion for Battery Power Application

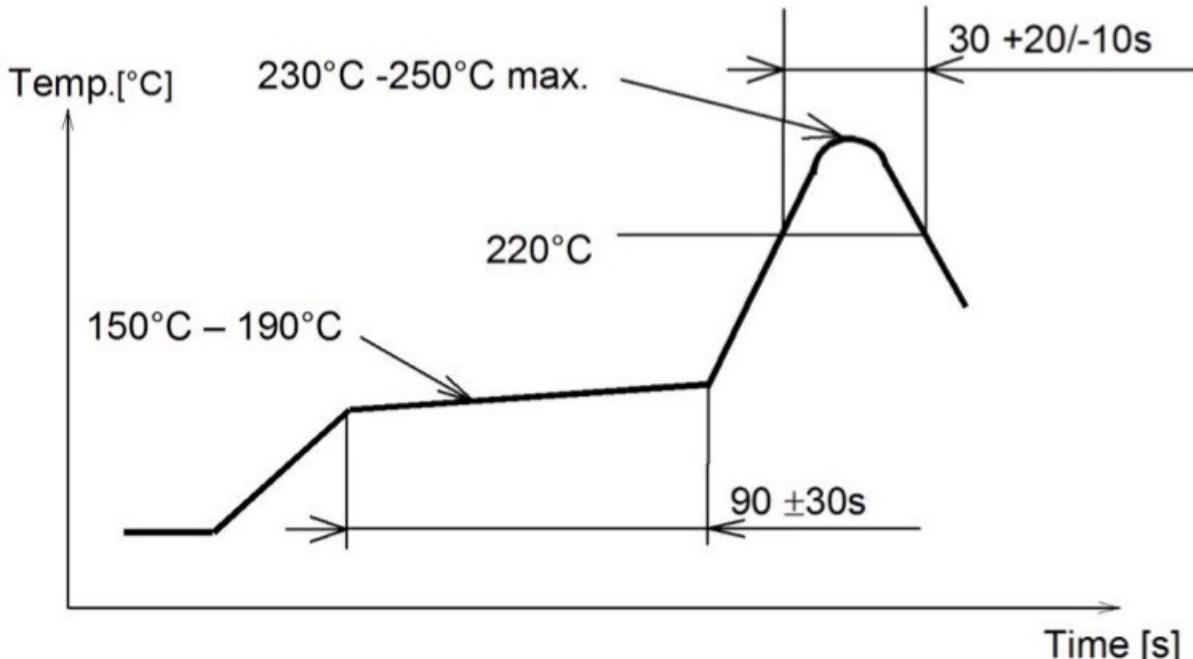
Standby current consumption is important for battery-powered product. We suggest adding a 32.768 kHz crystal and 2 capacitors as shown in the upper left corner of the evaluation board schematics. The 32MHz main clock won't be active at idle state to save power.

Two inductors required for DCDC converter are inside BM832 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 sheets 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.

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

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