

BLE 5.4, 802.15.4 Modules BM833/F/E/P

Ver 1.15 June 2025

BluNor BM833 are powerful, highly flexible, ultra low power Bluetooth Low Energy (BLE) modules using Nordic nRF52 SoC. With an ARM Cortex™ M4F MCU, 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.

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



Specifications:

- Nordic nRF52 with ARM Cortex M4F at 64 MHz.
- Supported data rate:
 - BLE 5.4: 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: 512KB/128KB
- 42 General purpose I/O pins
- 12 bit/200KSPS ADC, 8 configurable channels.
- 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: 8 dBm to -20dBm in 4 dB steps.
- 4.6 mA peak current at RX or +0dBm TX.
- Integrated DC-DC converter.
- Embedded inductors for DCDC converter
- 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)

APprotect

- APprotect:** New modules supporting appprotect, “-p” or “-T” is added to the part number, e.g., BM833-p. A “p” or “T” mark is on the RFI shield.
- Visit [Fanstel](https://www.fanstel.com) for additional appprotect information.

Model Summaries

module	BM833P	BM833	BM833F	BM833E
APprotect	BM833P-T	BM833-T	BM833F-T	BM833E-T
SoC	nRF52833 QIAA	nRF52833 QIAA	nRF52833 QIAA	nRF52833 QIAA
Flash/RAM	512KB/128KB	512KB/128KB	512KB/128KB	512KB/128KB
Size	15x20.6x1.9mm	10.2x15x1.9mm	15x20.6x1.9mm	10.2x15x1.9mm
GPIO		42	42	42
Operating temp.	-40°C to +125°C ^{note1}	-40°C to +125°C	-40°C to +125°C	-40°C to +125°C
Max. TX. conducted	+8.16 dBm	+8.16 dBm	+8.16 dBm	+8.16 dBm
Antenna	High perform. PCB	PCB trace	High perform. PCB	u.FL
Est. BLE Range	3000M at 125 Kbps	1400M at 125 Kbps	2300M at 125Kbps	3400M at 125 Kbps
FCC ID		X8WBM833 + SAR	X8WBM833	X8WBM833
ISED		4100A-BM833	4100A-BM833	4100A-BM833
TELEC		201-19838/00	201-19838/00	201-19838/00
Taiwan NCC		CCAL25Y10180T2	CCAL25Y10182T3	CCAL25Y10181T1
CE. RCM	Compliant	Compliant	Compliant	Compliant
QDID		138767	138767	138767
Availability	Production	Production	Production	Production

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1. Introduction

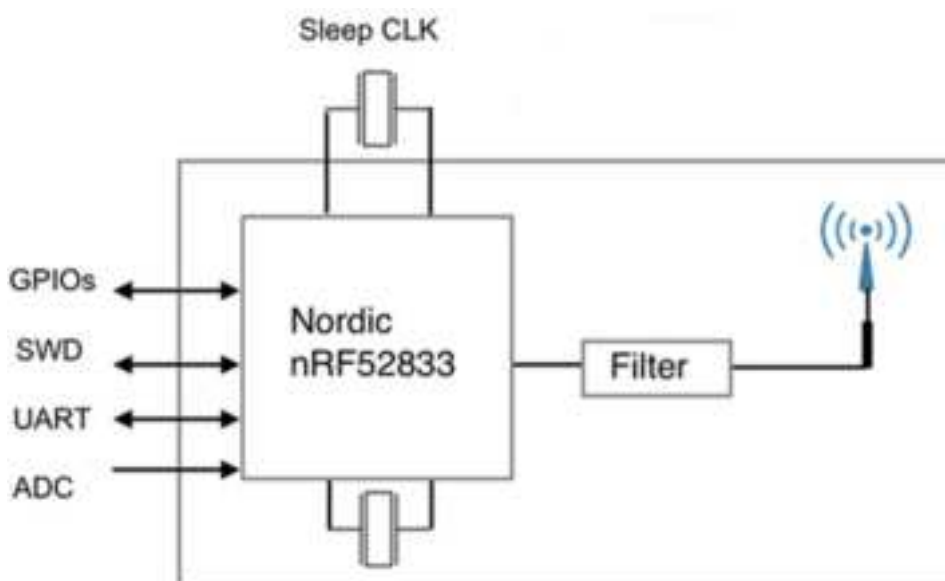
BluNor BM833 is powerful, highly flexible, ultra low power Bluetooth Low Energy (BLE) modules using Nordic nRF52 SoCs. With an ARM Cortex™ M4F MCU, available 512KB flash, 128KB RAM, embedded 2.4GHz multi-protocol transceiver, and an integrated antenna or an u.FL connector for external antenna, it allows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

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

BM833, BM833F, BM833E, BM833P Block Diagram

A block diagram of BM833 Series is shown below.



BM833

- BM833: uses an nRF52833 QIAA.
- BM833-p: uses an nRF52833 QIAA B or newer, supporting appprotect.
- Cortex M4F MCU with 512KB flash, 128 KB RAM
- Supports NFC
- Support Bluetooth 5.3, 802.15.4, proprietary radio protocols.
- Max. TX power: + 8.16dBm.
- 68 pins, 42 GPIOs.
- CODED PHY



- Size: 10.2x14.8x1.9 mm
- SAR evaluation report for BM833 only.

BM833F

- BM833F: uses an nRF52833 QIAA.
- BM833F-p: uses an nRF52833 QIAA B or newer, supporting appprotect.
- BM833F-T: uses an nRF52833 QIAA B or newer, 125°C RF components and crystal. Supporting appprotect.
- Cortex M4F MCU with 512KB flash, 128 KB RAM
- Supports NFC
- Support Bluetooth 5.4, 802.15.4, proprietary radio protocols.
- Max. TX power: + 8.16dBm.
- 68 pins, 42 GPIOs
- CODED PHY
- High performance PCB trace antenna
- Size: 10.2 (15mm antenna area) x20.6x1.9mm



BM833E

- BM833E: uses an nRF52833 QIAA.
- BM833E-p: uses an nRF52833 QIAA B or newer, supporting appprotect.
- BM833E-T: uses an nRF52833 QIAA B or newer, 125°C RF components and crystal. Supporting appprotect.
- Cortex M4F MCU with 512KB flash, 128 KB RAM
- Supports NFC
- Support Bluetooth 5.4, 802.15.4, proprietary radio protocols.
- Max. TX power: + 8.16dBm.
- 68 pins, 42 GPIOs
- CODED PHY
- 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.



crystal.



BM833P

- BM833P-T: uses an nRF52833 QIAA B or newer, 125°C RF components and crystal. Supporting appprotect.
- Cortex M4F MCU with 512KB flash, 128 KB RAM
- Supports NFC
- Support Bluetooth 5.4, 802.15.4, proprietary radio protocols.
- Max. TX power: + 8.16dBm.
- 68 pins, 42 GPIOs
- CODED PHY
- High performance PCB trace antenna
- Size: 10.2 (15mm antenna area) x20.6x1.9mm

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

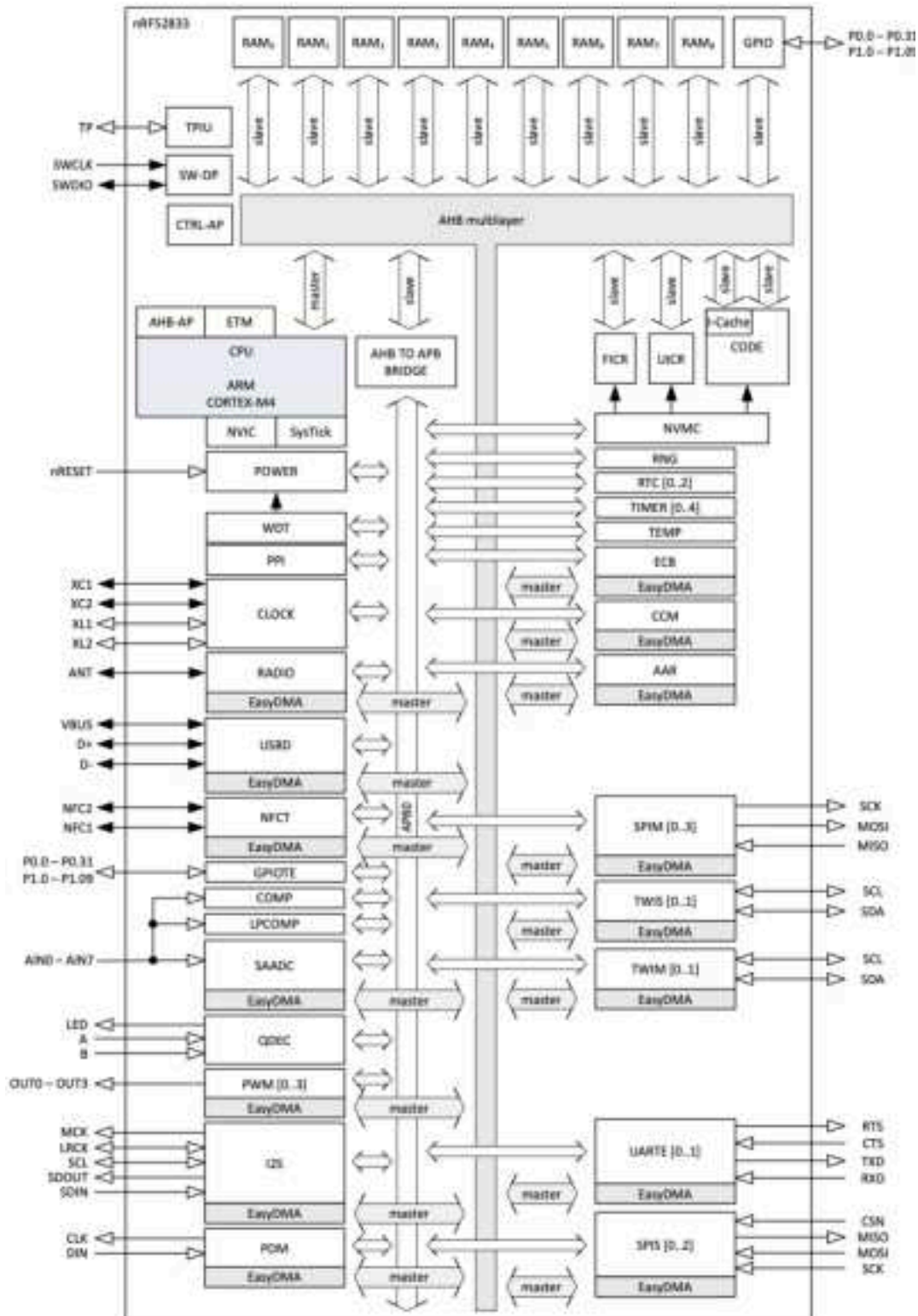
Nordic Semiconductor provides a complete range of hardware and software development tools for the nRF52 Series devices. nRF52840 DK board is recommended for firmware development.

3. Product Overview

Nordic nRF52833 SoC

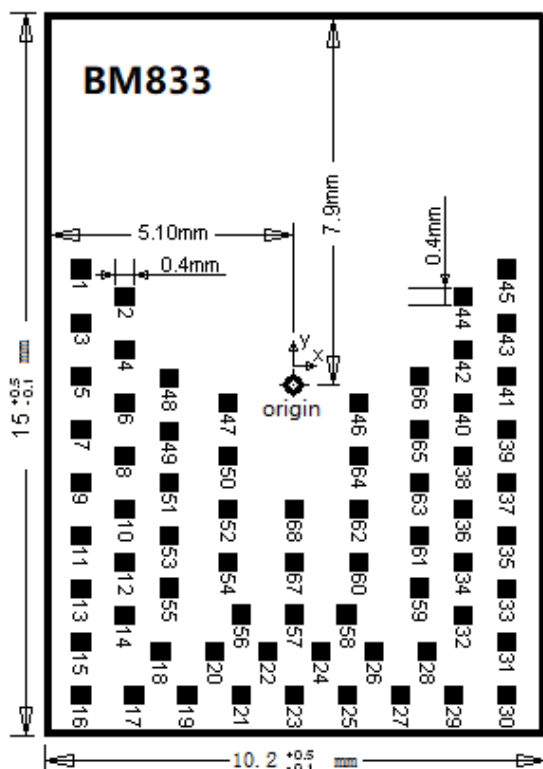
The block

following is a diagram of Nordic nRF52833 SoC.



Mechanical Drawings BM833

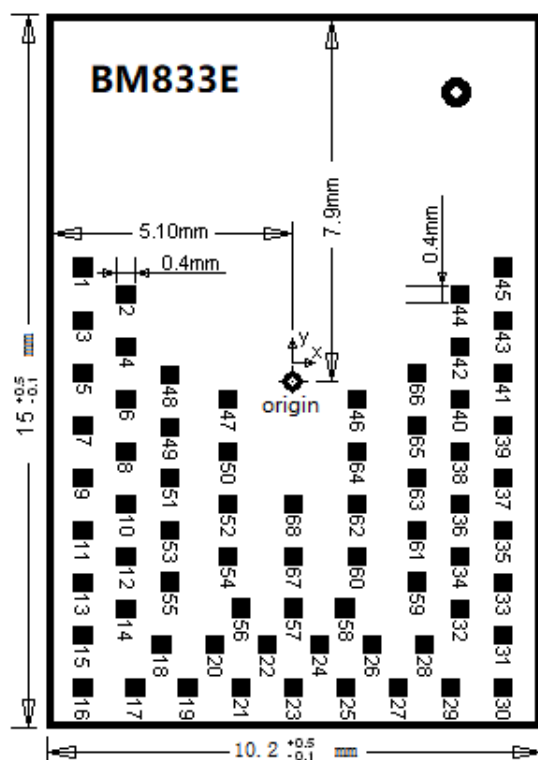
The followings are mechanical drawings of BM833, top view. X-axis and Y-axis coordinate of each pin is shown in table.



	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			

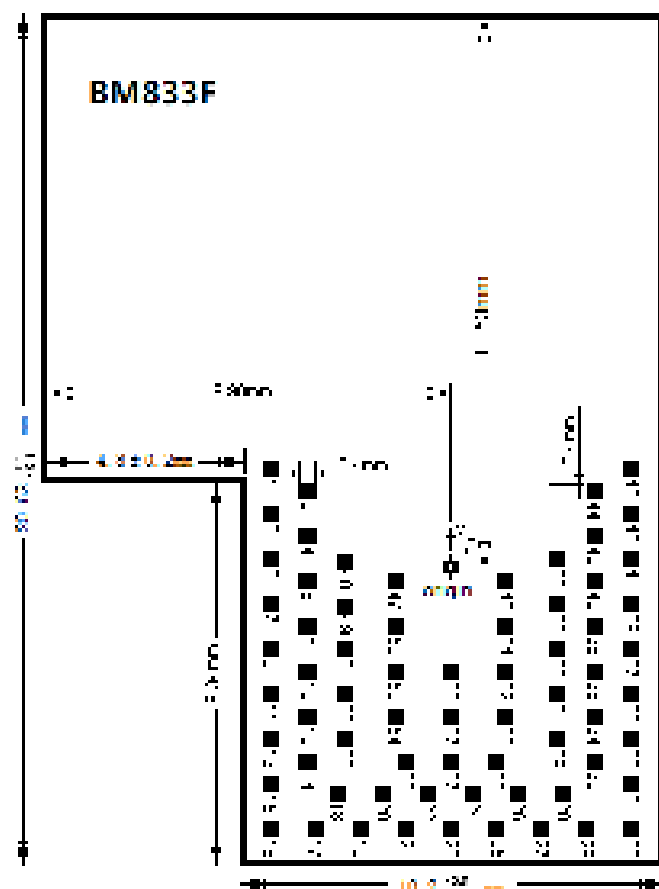
Mechanical Drawings BM833E

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 BM833F



Pin No.	X (mm)	Y (mm)	Pin No.	X (mm)	Y (mm)	Pin No.	X (mm)	Y (mm)
1	0.0	0.35	45	0.0	2.35	17	0.0	6.45
3	-0.4	1.35	43	0.4	1.35	19	-0.4	-0.45
5	0.0	0.15	41	0.0	0.15	21	1.1	6.45
7	-0.4	-0.35	39	0.4	-0.35	23	0	-0.45
9	0.0	0.05	37	0.0	2.05	25	1.1	6.45
11	-0.4	-0.15	35	0.4	-0.15	27	1.1	-0.45
13	0.0	-1.05	33	0.0	0.25	29	0.0	6.45
15	-0.4	-0.35	31	0.4	-0.35			
16	0.0	6.45	30	0.0	5.15			
2	-0.4	1.3	44	0.4	1.3	18	-0.4	-0.45
4	0.0	0.7	42	0.0	0.7	20	1.35	5.55
6	-0.4	-0.4	40	0.4	-0.4	22	-0.4	-0.45
8	0.0	1.5	38	0.0	1.5	24	0.55	5.55
10	-0.4	-0.0	36	0.4	-0.0	26	1.35	-0.45
12	0.0	0.7	34	0.0	0.7	28	2.75	5.55
14	-0.4	-0.3	32	0.4	-0.3			
48	-1.3	0.15	66	1.3	0.15	68	0	-0.0
49	2.3	0.95	65	2.3	0.95	67	0	0.7
51	-1.3	-0.05	63	1.3	-0.05	69	0	-0.3
53	2.3	0.15	61	2.3	0.15			
55	-1.3	-0.35	59	1.3	-0.35			
47	-1.3	-0.4	46	1.3	-0.4	56	-1.1	-0.3
50	1.35	1.5	64	1.35	1.5	50	1.1	-1.0
52	-1.3	-0.0	62	1.3	-0.0			
54	1.35	0.7	60	1.35	0.7			

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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.

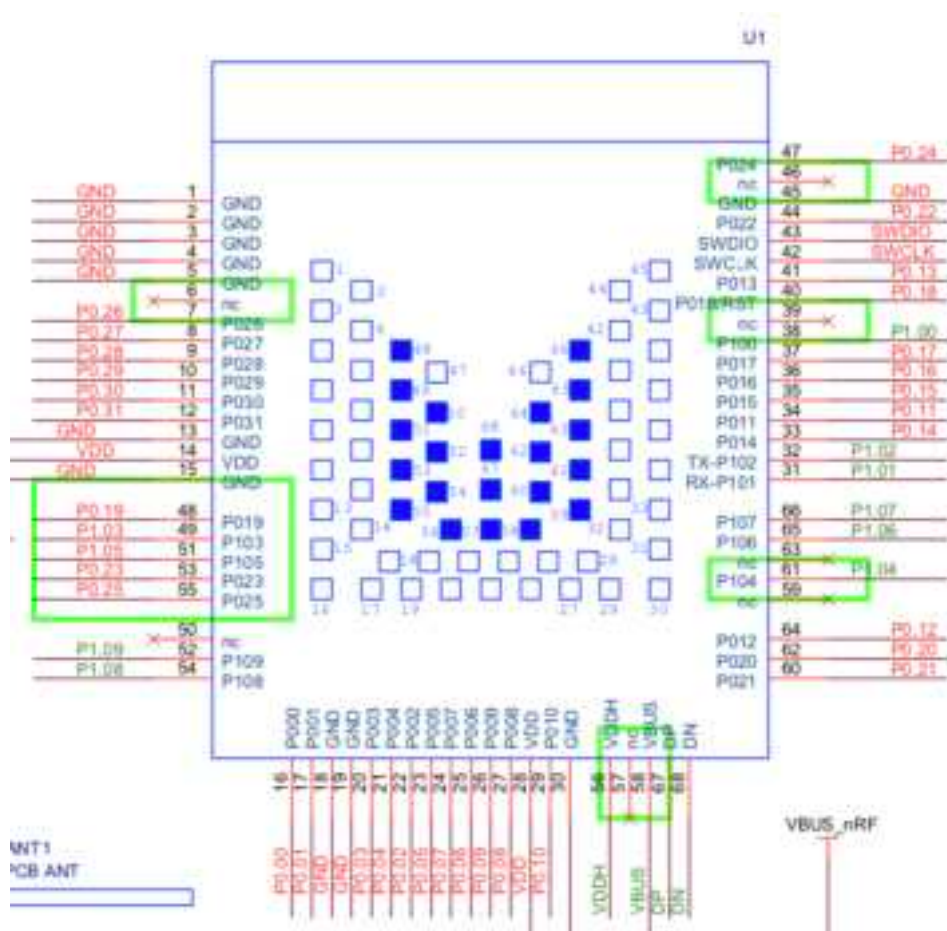
BM833 Pin Functions

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 5.4, 802.15.4 Modules BM833/F/E/P

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

BM833A	5281		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 (nRF52833 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 (nRF52833 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

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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-

Operating Temperature Range to 125°C

Nordic SoC nRF52833 QIAA has an operating temperature range of -40°C to +105°C. All RF components and crystal are upgraded to 125°C. We use a **Keysight N9021B Signal Analyzer** to measure the transmission powers and Bluetooth carrier frequencies of two BM833P-T samples.

Bluetooth TX Power and Carrier Frequency Measurements

BM833P-T sample is in an environmental controlled chamber.

- The temperature is set to -45°C initially. TX power and carrier frequency are measured.
- Chamber temperature is increased by 5°C. TX power and carrier frequency are measured again.
- These steps are repeated till the chamber temperature reaching 140°C.

A few notes on the measurement results.

- There is no cable loss compensation for the TX power measurements. TX power measurements are lower than those from the FCC test labs with cable loss compensation.
- The TX power measurements are relatively stable from -45°C to +140°C.
- The numbers in the **Diff. dB** columns are the TX power comparison to the measurements at the room temperature.
- The tolerance of the Epson crystal is +/- 10 PPM at the room temperature.
- Comparing to the Bluetooth carrier frequencies at the room temperature, the Bluetooth carrier frequencies are within +/- 30. PPM from -45°C to +125°C. The total frequency deviation is +/- 40PPM, within the Bluetooth specifications for the temperature range.
- At over 130°C, the deviation of the carrier frequency exceeds Bluetooth specifications.

Bluetooth Data Transmission Verification

During CE compliant testings, Bluetooth data transmission are verified at -40°C, room temperature, and +125°C. We verify Bluetooth data transmission using 5 pairs of BM833P-T.

- One BM833P-T sample is in an environmental controlled chamber, connected to antenna ANT000 outside of the chamber. A second BM833P-T is at room temperature, about 20 meters away.
- The temperature is set to -45°C initially. Bluetooth data packet are sent from the second BM833P-T to the first one in the chamber.
- The first BM833P-T in the chamber receives a data packet and replies. The second one outside of the chamber confirms receipt of a data packet.
- Chamber temperature is increased by 5°C.
- These steps are repeated till the chamber temperature reaching 140°C.
- Bluetooth data transmission verifications are repeated for all 5 pairs of BM833P-T.

There is no last data packet during these verifications.

BLE 5.4, 802.15.4 Modules BM833/F/E/P

Ver 1.15 June 2025

TX power and Bluetooth carrier frequency measurements for two BM833P-T samples.

	Sample 1				Sample 2			
Temp.	Carrier Frequency		TX power		Carrier Frequency		TX power	
C	GHz	Diff. ppm	dBm	Diff. dB	GHz	Diff. ppm	dBm	Diff. dB
room temp.	2.401992	0.00	4.32	0	2.401995	0.00	4.52	0
-45	2.402014	9.16	4.44	0.12	2.402016	8.74	4.71	0.19
-40	2.402023	12.91	4.46	0.14	2.402025	12.49	4.72	0.2
-35	2.40203	15.82	4.44	0.12	2.402032	15.40	4.71	0.19
-30	2.402034	17.49	4.39	0.07	2.402038	17.90	4.68	0.16
-25	2.402036	18.32	4.41	0.09	2.402041	19.15	4.62	0.1
-20	2.402038	19.15	4.52	0.2	2.402041	19.15	4.66	0.14
-15	2.402037	18.73	4.4	0.08	2.402041	19.15	4.63	0.11
-10	2.402035	17.90	4.44	0.12	2.402039	18.32	4.65	0.13
-5	2.402032	16.65	4.43	0.11	2.402033	15.82	4.66	0.14
0	2.402026	14.15	4.3	-0.02	2.402029	14.15	4.64	0.12
5	2.40202	11.66	4.38	0.06	2.402023	11.66	4.59	0.07
10	2.402013	8.74	4.39	0.07	2.402018	9.58	4.58	0.06
15	2.402006	5.83	4.35	0.03	2.402009	5.83	4.56	0.04
20	2.401999	2.91	4.42	0.1	2.402004	3.75	4.59	0.07
25	2.401989	-1.25	4.33	0.01	2.401992	-1.25	4.49	-0.03
30	2.401993	0.42	4.44	0.12	2.401984	-4.58	4.61	0.09
35	2.401973	-7.91	4.29	-0.03	2.40198	-6.24	4.66	0.14
40	2.401968	-9.99	4.4	0.08	2.401967	-11.66	4.55	0.03
45	2.401955	-15.40	4.39	0.07	2.401961	-14.15	4.59	0.07
50	2.401951	-17.07	4.34	0.02	2.401952	-17.90	4.43	-0.09
55	2.401945	-19.57	4.36	0.04	2.401944	-21.23	4.52	0
60	2.401935	-23.73	4.3	-0.02	2.401941	-22.48	4.47	-0.05
65	2.401932	-24.98	4.26	-0.06	2.401932	-26.23	4.53	0.01
70	2.40193	-25.81	4.4	0.08	2.401931	-26.64	4.6	0.08
75	2.401929	-26.23	4.42	0.1	2.40193	-27.06	4.59	0.07
80	2.40193	-25.81	4.41	0.09	2.40193	-27.06	4.58	0.06
85	2.401933	-24.56	4.35	0.03	2.401933	-25.81	4.5	-0.02
90	2.401939	-22.07	4.28	-0.04	2.401938	-23.73	4.43	-0.09
95	2.401946	-19.15	4.32	0	2.401945	-20.82	4.47	-0.05
100	2.401956	-14.99	4.15	-0.17	2.401953	-17.49	4.33	-0.19
105	2.401968	-9.99	4.14	-0.18	2.401965	-12.49	4.27	-0.25
110	2.401983	-3.75	3.68	-0.64	2.401979	-6.66	4.26	-0.26
115	2.402	3.33	4.23	-0.09	2.402	2.08	4.37	-0.15
120	2.402025	13.74	4.16	-0.16	2.402021	10.82	4.32	-0.2
125	2.402048	23.31	3.8	-0.52	2.402046	21.23	4.23	-0.29
130	2.402077	35.39	4.09	-0.23	2.402075	33.31	4.18	-0.34
135	2.402117	52.04	4.01	-0.31	2.402116	50.37	4.04	-0.48

BLE 5.4, 802.15.4 Modules BM833/F/E/P

Ver 1.15 June 2025

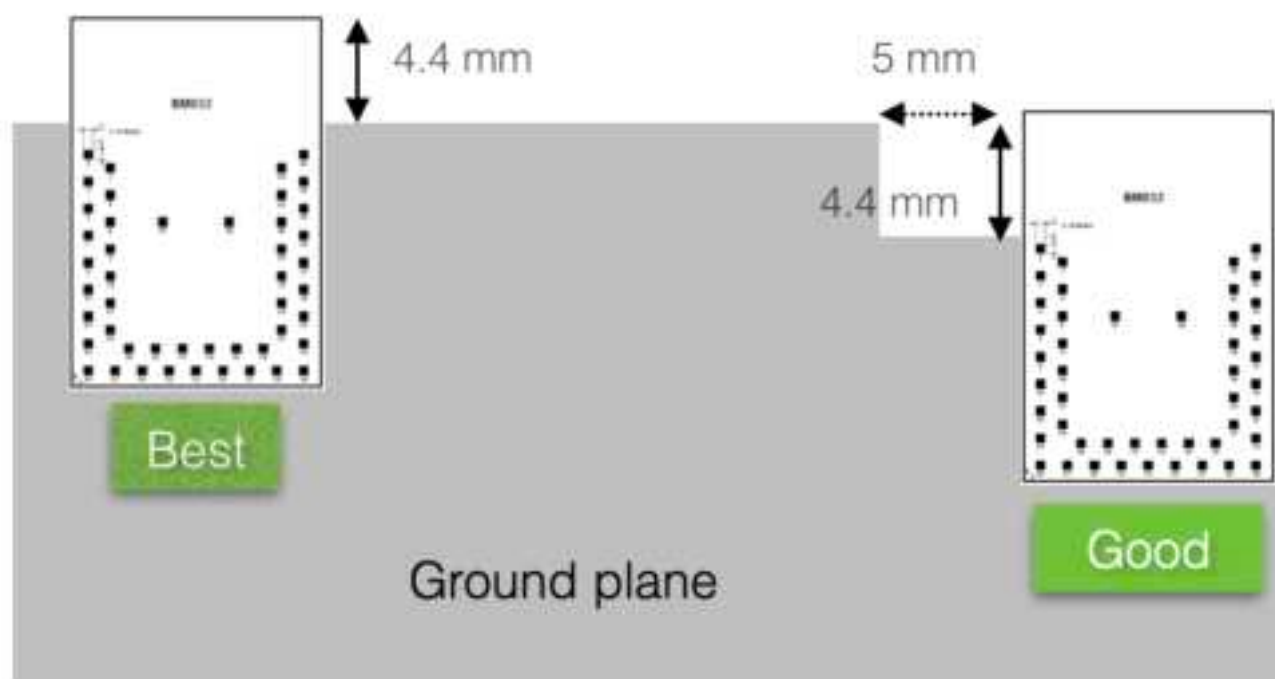
140	2.40215	65.78	3.86	-0.46	2.402149	64.11	3.96	-0.56
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Mounting BM833 on the Host PCB

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 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.

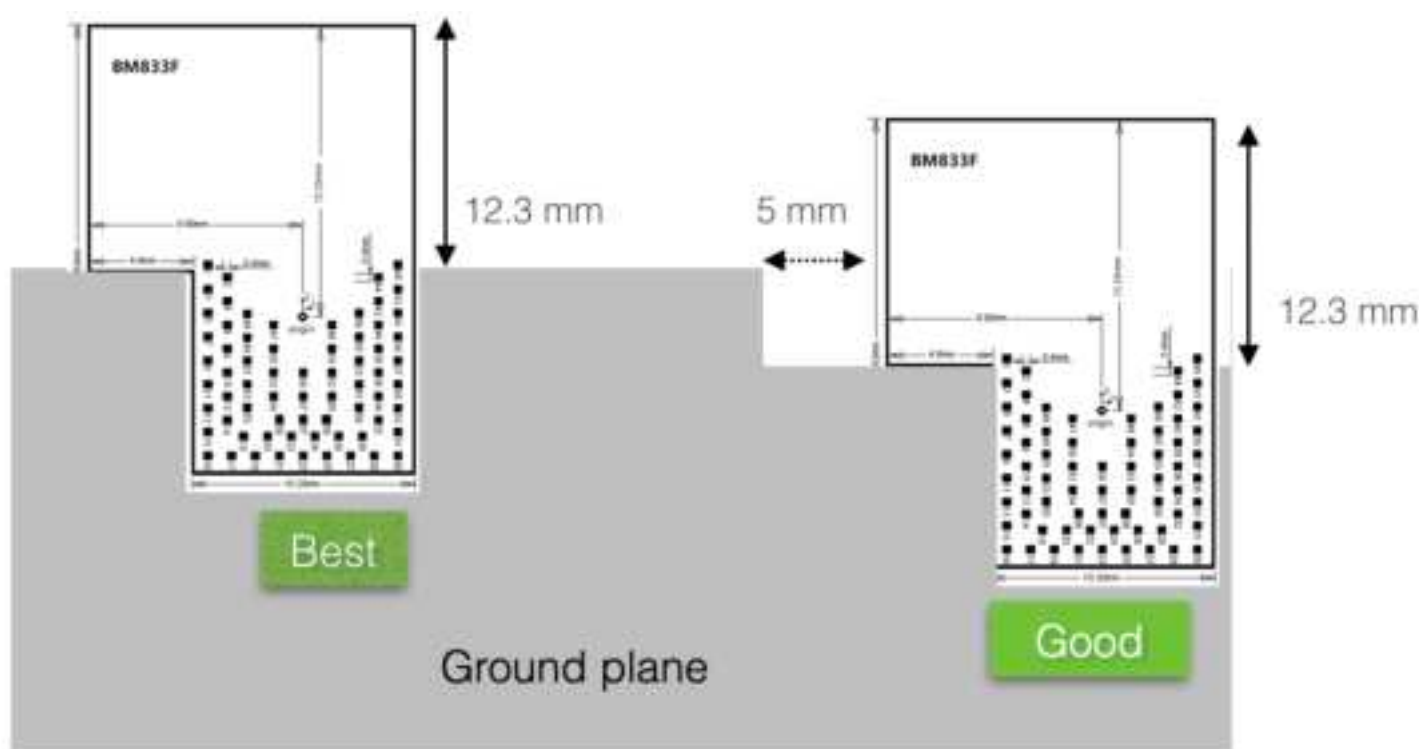


- We don't recommend mounting BM833 module in the middle of a host PCB.

Mounting BM833F on the host PCB

The following figure shows recommended mounting of BM833F 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.

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

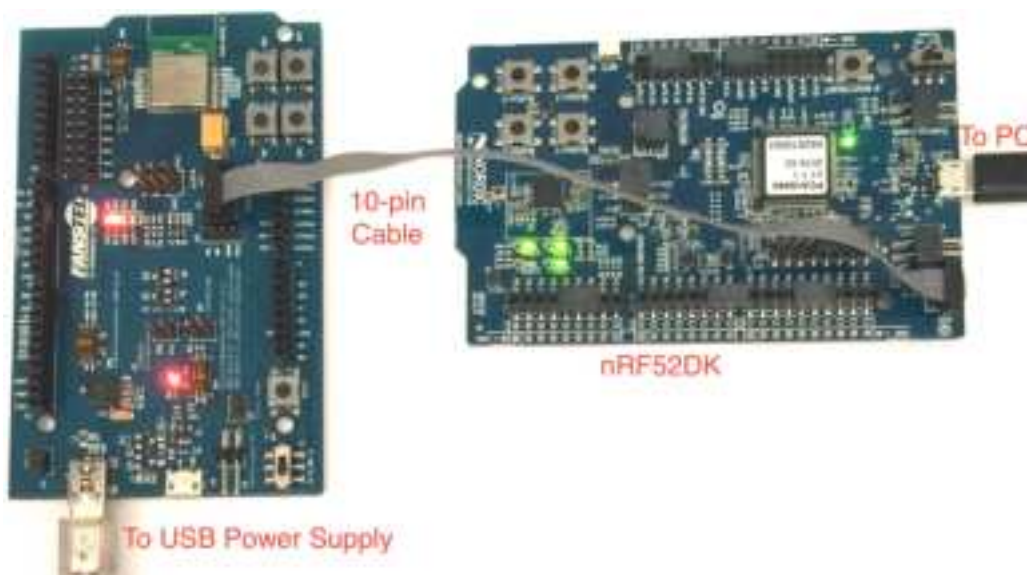
Nordic Semiconductor nRF52840 Development Kit (nRF52840-DK) is a versatile, single-board development tool for Bluetooth® 5 / Bluetooth Low Energy (BLE), 802.15.4 / Thread, ANT/ANT+, and proprietary 2.4GHz applications using the nRF52840 Multi-Protocol SoC (System on Chip).

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 these EV boards.

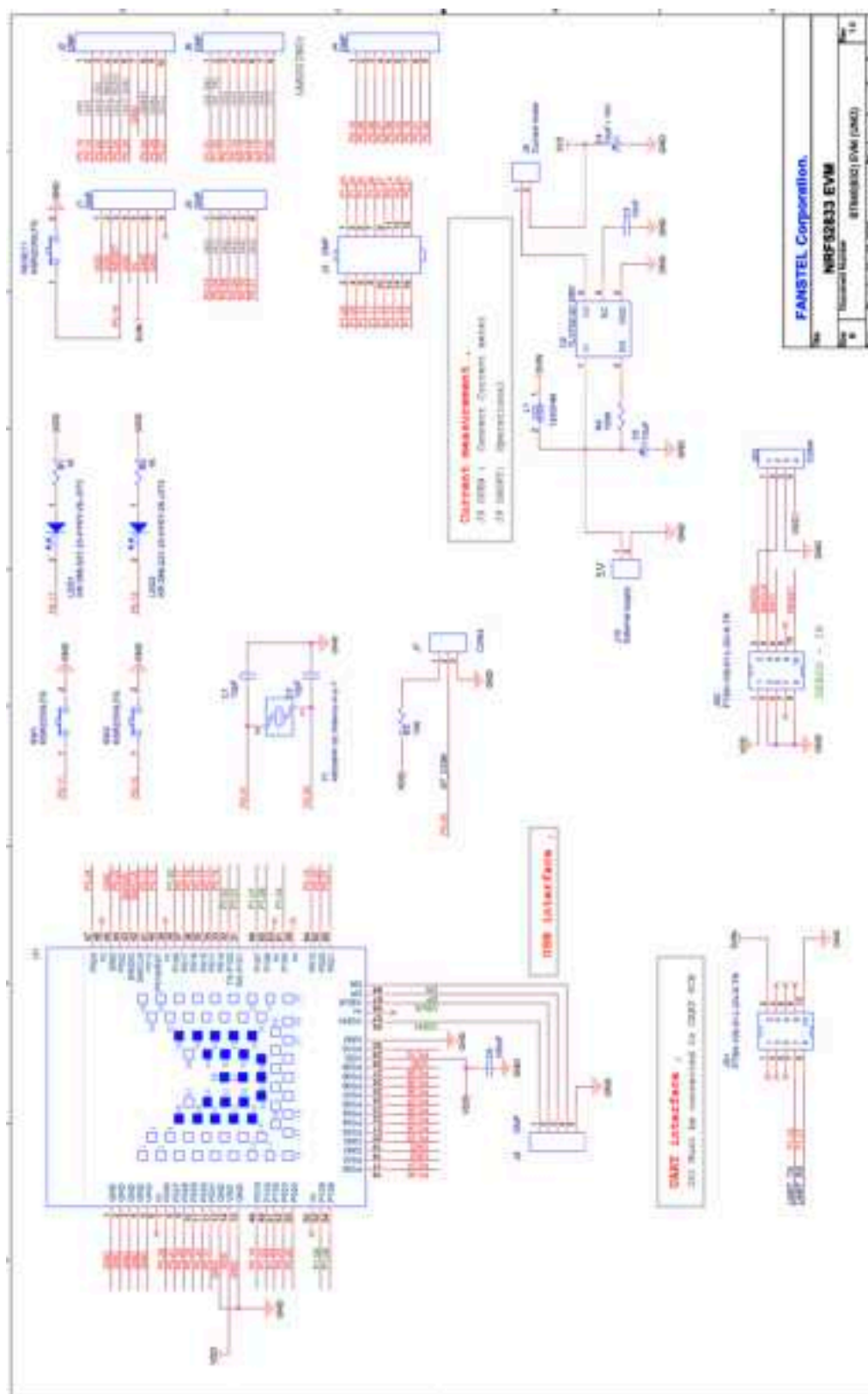
- Connect Nordic nRF52DK debug out to Fanstel evaluation board debug in using the 10-pin flat cable as shown below.
- Connect Nordic nRF52DK to PC.
- Connect a DC power source to micro or mini USB port of evaluation board.

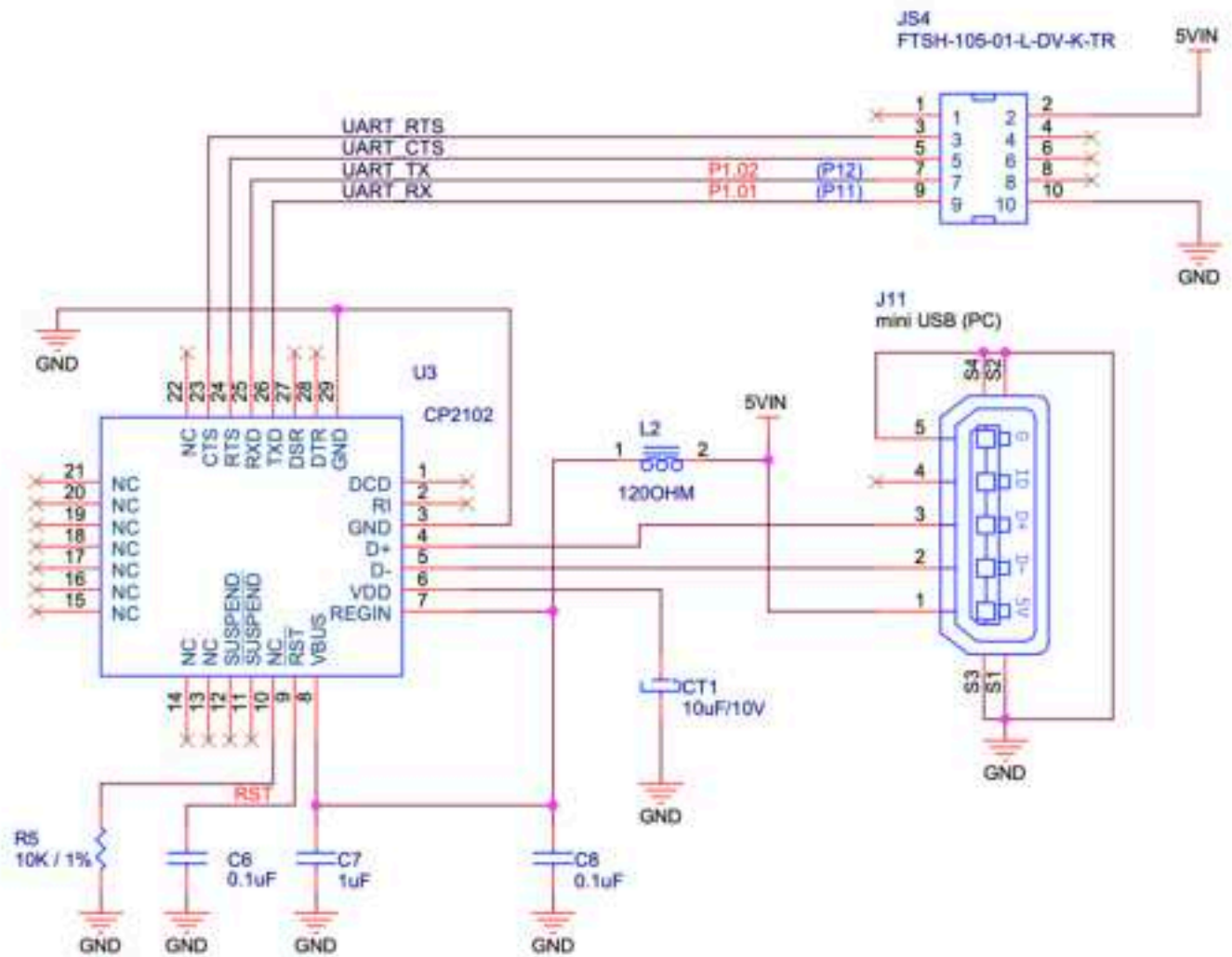


EV-BM833/E/F Schematics, Two Boards

The following board operates 40°C to +105°C.

main
from -





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

Suggestion for Battery Power Application

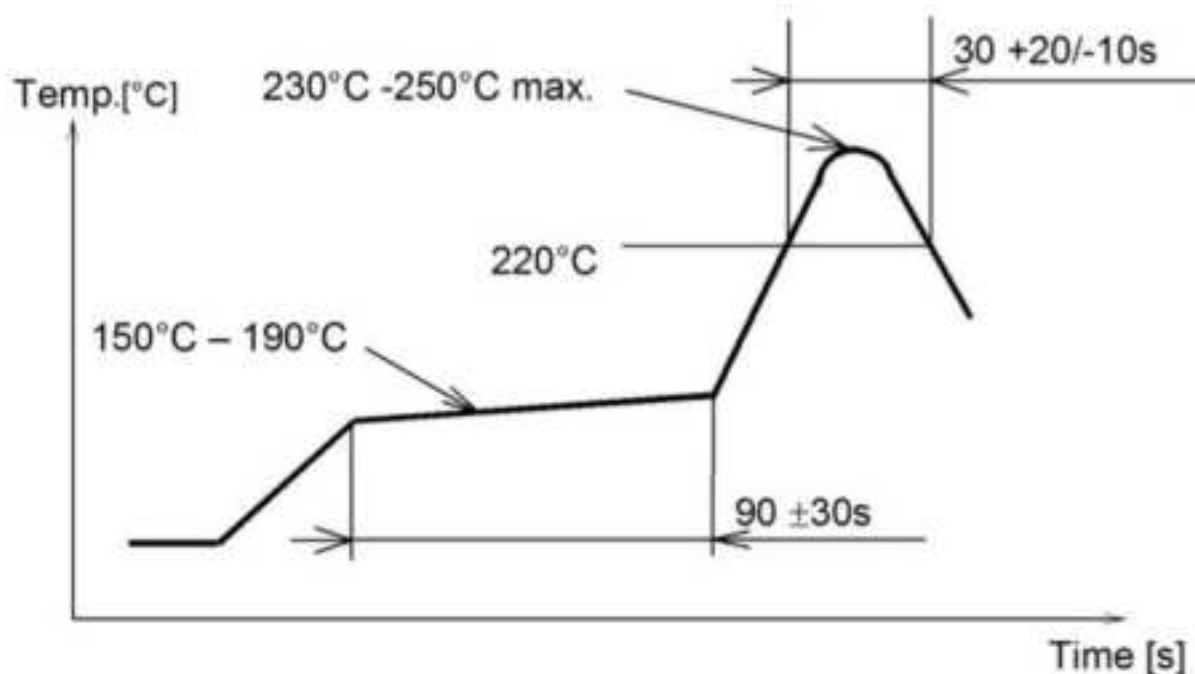
Standby current consumption is important for battery-powered product. We suggest adding a 32.768 kHz crystal and 2 capacitors as shown in the upper left corner of the evaluation board schematics. The 32MHz main clock won't be active at idle state to save power.

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.
- (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.
- (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.
- (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.

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.
- June 2022, Ver. 1.08: Update mechanical drawings.
- July 2022, Ver. 1.09: Correct NFC pin descriptions and FCC ID number.
- Aug. 2022, Ver. 1.10: Add SAR reports for BM833.
- Nov. 2022, Ver. 1.11: Add appprotect module information
- Oct. 2023, Version 1.12: Change appprotect version status to production.
- Oct. 2024, Version 1.13: BM833A and BM833AF to support appprotect only.
- Mar. 2025, Version 1.14: Add Taiwan NCC IDs for BM833, BM833E, and BM833F.

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Federal Communications Commission (FCC) Statement

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 1) this device may not cause harmful interference, and
- 2) this device must accept any interference received, including interference that may cause undesired operation of the device.

FCC RF Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

RF exposure warning

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

Industry Canada (IC) Statement

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Canada, avis d'Industry Canada (IC)

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Informations concernant l'exposition aux fréquences radio (RF)

Cet équipement est conforme avec l'exposition aux radiations IC définies pour un environnement noncontrôlé. Cet équipement doit être installé et utilisé à une distance minimum de 20 cm entre le radiateur et votre corps. Cet émetteur ne doit pas être co-localisées ou opérant en conjonction avec une autre antenne ou transmetteur. Les utilisateurs finaux et les installateurs doivent être informés des instructions d'installation de l'antenne et des conditions de fonctionnement de l'émetteur afin de satisfaire à la conformité d'exposition RF.

Note: The end product shall has the words “Contains Transmitter Module FCC ID:X8WBM833, IC: 4100A-BM833”

Information for the OEM and Integrators

The following statement must be included with all versions of this document supplied to an OEM or integrator, but should not be distributed to the end user.

- (1) This device is intended for OEM integrators only.
- (2) Please see the full Grant of Equipment document for other restrictions.

The PCB antenna used with this transmitter can be installed to the platform w/o the restriction in mobile, and portable environment, however, it must not be co-located or operating in conjunction with any other antenna or transmitter.

NCC 警語:

取得審驗證明之低功率射頻器材，非經核准，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

低功率射頻器材之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前述合法通信，指依電信管理法規定作業之無線電通信。低功率射頻器材須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。