BluNor BT832 is a powerful, highly flexible, ultra low power Bluetooth Low Energy (BLE) using Nordic nRF52832 SoC. With an ARMCortex™ M4F MCU, available 512KB flash, 64KB RAM, embedded 2.4GHz multi-protocol transceiver, and an integrated PCB trace antenna. It allows faster time to market with reduced development cost.

For applications needing limited number of IO pins, prototyping and production are easier using 16 castellated pins. Additional 24 LGA (Land Grid Array) pins provide full access to 32 GPIOs of nRF52832.

BT832F is developed for ultra long Bluetooth range. It is measured at over 100 meters with a smartphone.

Specifications:

- Nordic nRF52832 with ARM Cortex M4F.
- Complete RF solution with integrated antenna
- Integrated DC-DC converter
- Serial Wire Debug (SWD)
- Nordic SoftDevice Ready
- Over-the-Air (OTA) firmware update
- Flash/RAM: 512KB/64KB or 256KB/32KB.
- 32 General purpose I/O pins
- 12 bit/200KSPS ADC
- 3 SPI Master/Slave (8Mbps)
- Low power comparator
- Two 2-wire Master/Slave (I^{2}C compatible)
- I2S audio interface
- UART (with CTS/RTS and DMA)

- 20 channel CPU independent Programmable Peripheral Interconnect (PPI).
- Quadrature Demodulator (QDEC)
- 128-bit AES HW encryption
- 5 x 32 bits, 3 x 24 bits Real Time Counters (RTC)
- NFC-A tag interface for OOB pairing
- Receiver Sensitivity: -96 dBm
- TX power: +/- 0 dBm; programmable +3dBm to -20dBm in 4 dB steps.
- Sizes: 14.0x16.0x2.5mm
- Hybrid pins: 16 castellated and 24 LGA.
- Integrated high performance PCB trace antenna:
- Operation voltage: 1.7V to 3.6V
- Operation temperature: -40°C to +85°C

Applications

- IoT (Internet of Things)
- Wearable
- Beacons/Proximity
- Fitness/Sports
- Smart toys
- Connected appliances
- Lighting products

- Sensors
- Home and building automation
- Key fobs
- Wrist watches
- Wireless charger
- Interactive entertainment devices

Model Summaries

| module	BT832	BT832-23	BT832F
SoC	nRF52832-QFAA	nRF52832-QFAB	nRF52832-QFAA
Flash/RAM	512KB/64KB	256KB/32KB	512KB/64KB
BT Antenna	PCB trace	PCB trace	PCB trace
FCC ID	Pending	Pending	Pending
Canada IC ID	Pending	Pending	Pending

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2. Introduction
BluNor BT832 is powerful, highly flexible, ultra low power Bluetooth Low Energy (BLE) modules using Nordic nRF52832 SoCs. With an ARMCortex™ M4F MCU, available 512KB flash, 64KB RAM, embedded 2.4GHz multi-protocol transceiver, and an integrated antenna, it allows faster time to market with reduced development cost.

The following is a block diagram of BT832. Antenna circuit and main clock are integrated. All 32 GPIOs of nRF52832 can be accessed from main board. For lower power consumption at idle state, a 32.768 kHz crystal is added on the main board. Connection to an external NFC (Near Field Communication) antenna is provided.

BlurNor BT832F is a sister module of BT832. The foot print for for the main body of module is identical. The only difference is a larger area for PCB trace antenna for ultra long Bluetooth operation range. Bluetooth line of sight range with a smartphone is measured at more than 100 meters.
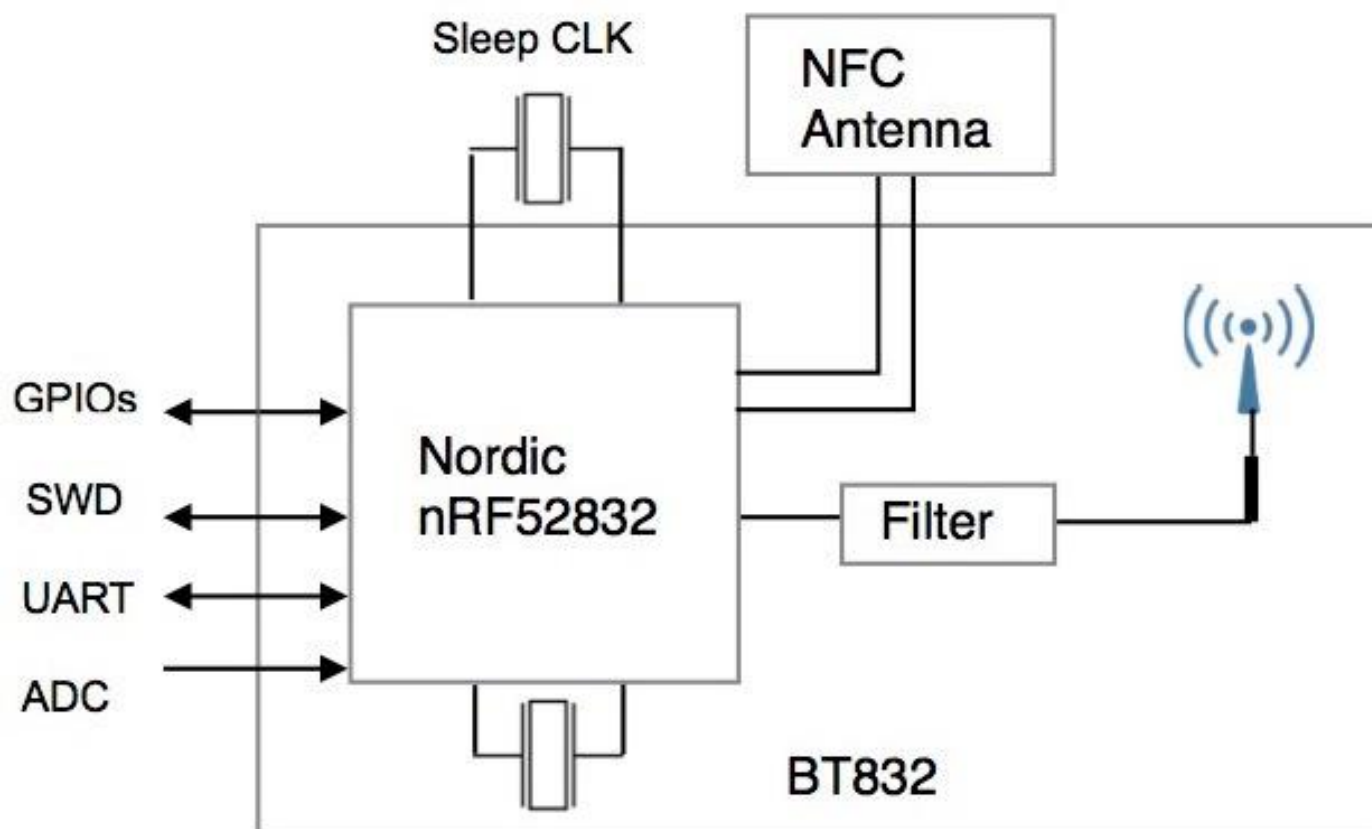
3. Codes Development Using Nordic Tools
Development tools by Nordic and other third party development tools recommended by Nordic should be used .

Easy, fast and safe code development
Nordic development environment for nRF52832 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 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 nRF52832 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:
S132: Bluetooth low energy concurrent central/peripheral/observer/broadcaster stack.

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.
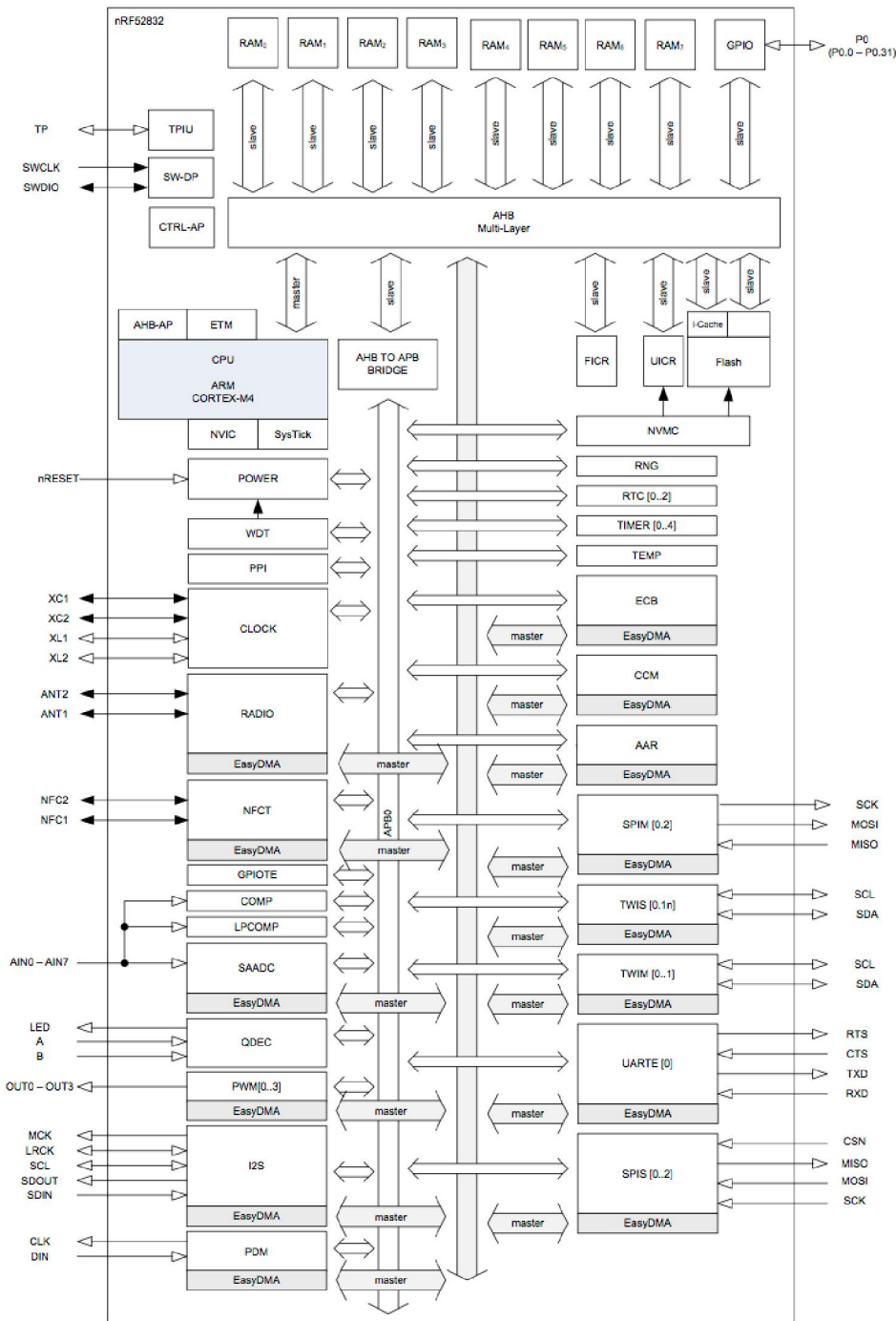
4. Product Overview

Brief description of nRF52832 SoC is provided. For full description of the SoC, please download from Nordic Semiconductor website.

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

Block Diagram

The following is a block diagram of Nordic nRF52832 Bluetooth Low Energy (BLE) SoC.

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 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.

Photo

The following is a photo of BT832 module.

Mechanical Drawings

The followings are mechanical drawings of BT832 and BT832F. The bottom portion of module is the main body (size: 14.0 x 9.57mm) with electronic components and pins for connection to the host board. The top portion of module is for integrated PCB trace antenna. BT832 and BT832F have identical main body. BT832F has a larger antenna area to accommodate a higher performance antenna.

We recommend layout the host PCB with clearance for the larger antenna area of BT832F. If the ultra long Bluetooth line of sight range of BT832F is not required, the lower cost BT832 can be installed.

Two types of pins are available to meet different application requirements.

- 16 castellated pins for application needing limited number of IOs. SMT equipment is not required for soldering castellated pins.
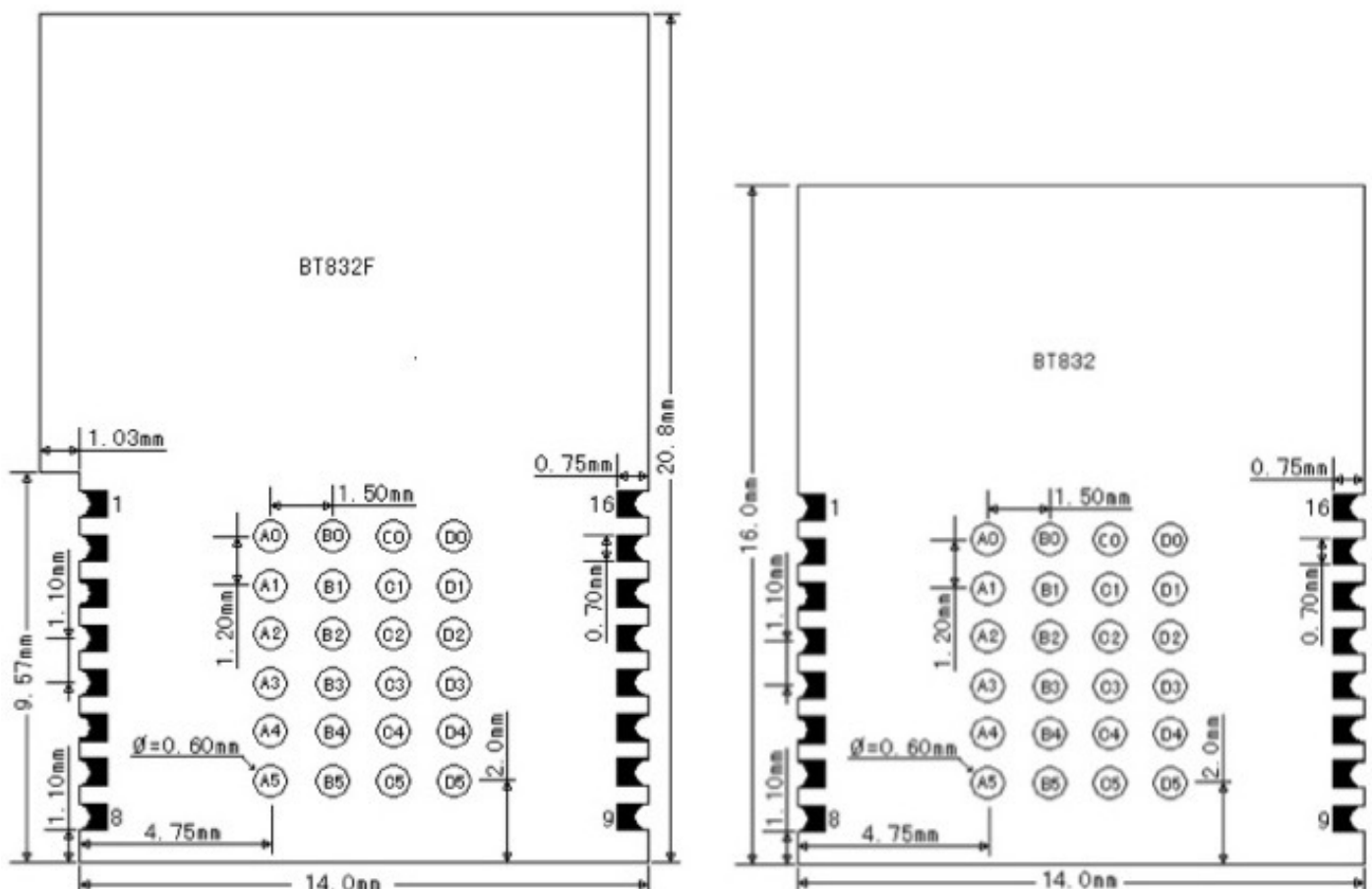
- 24 LGA (Land Grid Array) pins to access all 32 GPIOs of nRF52832 when needed.

Pin Assignments of BT832

The followings are BT832 pin assignment. Pin functions are in a table in next section. Please refer to Nordic nRF52832 Product Specifications for detailed descriptions and features supported.
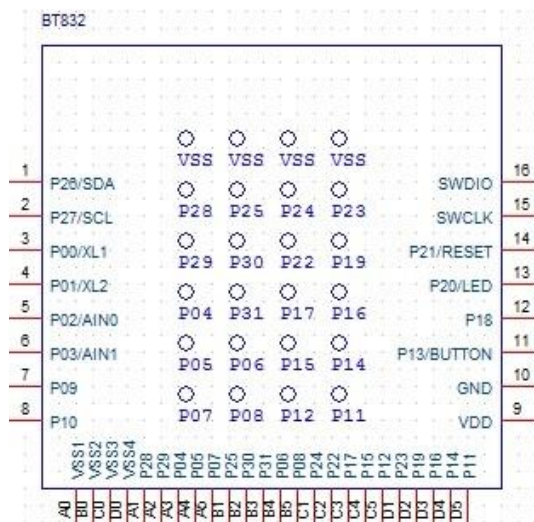
http://infocenter.nordicsemi.com/pdf/nRF52832_PS_v1.1.pdf

BT832		nRF52832		
pin#	pin name	pin#	pin name	Descriptions
1	P26/SDA	38	P0.26	GPIO, configured as I2C SDA on EV-BT832
2	P27/SCL	39	P0.27	GPIO, configured as I2C SCL on EV-BT832
3	P00/XL1	2	P0.00/XL1	GPIO, connection for 32.768kHz crystal
4	P01/XL2	3	P0.01/XL2	GPIO, connection for 32.768kHz crystal
5	P02/AIN0	4	P0.02/AIN0	GPIO, Analog input
6	P03/AIN1	5	P0.03/AIN1	GPIO, Analog input
7	P09	11	P0.09	GPIO
8	P10	12	P0.10	GPIO
9	VDD	13	VDD	DC supply 1.7V to 3.6V
10	GND	45	VSS	Ground
11	P13	16	P0.13	GPIO
12	P18	17	P0.14	GPIO
13	P20	23	P0.20	GPIO
14	P021/RESET	24	P0.21/RESET	GPIO, configurable as RESET pin
15	SWDCLK	25	SWDCLK	Serial Wire Debug clock input
16	SWDIO	26	SWDIO	Serial Wire Debug I/O

A0	GND	45	VSS	Ground
A1	P28	40	P0.28/AIN4	GPIO, Analog input
A2	P29	41	P0.29/AIN5	GPIO, Analog input
A3	P04	6	P0.04/AIN2	GPIO, Analog input
A4	P05	7	P0.05/AIN3	GPIO, Analog input
A5	P07	9	P0.07	GPIO
B0	GND	45	VSS	Ground
B1	P25	37	P0.25	GPIO
B2	P30	42	P0.30	GPIO
B3	P31	43	P0.31	GPIO
B4	P06	8	P0.06	GPIO
B5	P08	10	P0.08	GPIO
C0	GND	45	VSS	Ground
C1	P24	29	P0.24	GPIO
C2	P22	27	P0.22	GPIO
C3	P17	20	P0.17	GPIO
C4	P15	18	P0.15	GPIO
C5	P12	15	P0.12	GPIO
D0	GND	45	VSS	Ground
D1	P23	28	P0.23	GPIO
D2	P19	22	P0.19	GPIO
D3	P16	19	P0.16	GPIO
D4	P14	17	P0.14	GPIO
D5	P11	14	P0.11	GPIO

Pin Functions

Mounting BT832 on the Host PCB

The following figure shows recommended mounting of BT832 module on the host PCB.

- For the best Bluetooth range performance, the antenna area of module shall extend 6 mm outside the edge of host PCB board, or 6 mm outside the edge of a ground plane.

- The next choice is to place module on a corner of host PCB, the antenna area shall extend 6mm from the edge of ground plane. Ground plane shall be at least 5 mm from the edge of the antenna area of module.
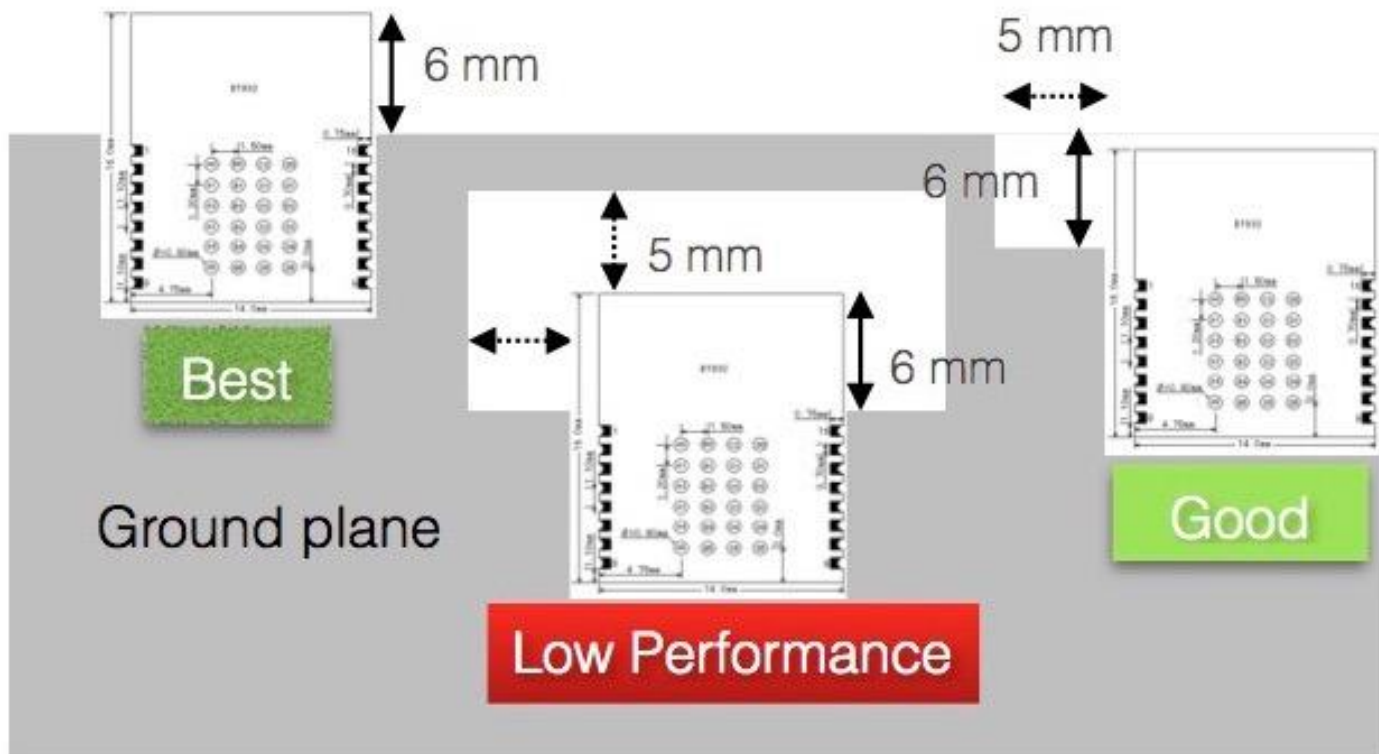
1.BT832 module extends 6 mm from edge or ground plane of the host PCB board.

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

• Bluetooth range performance is degraded if a module is placed in the middle of the host PCB.

Mounting BT832F on the Host PCB

The following figure shows recommended mounting of BT832F 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.

1.BT832F module extends 11.2 mm from edge or ground plane of the host PCB board.
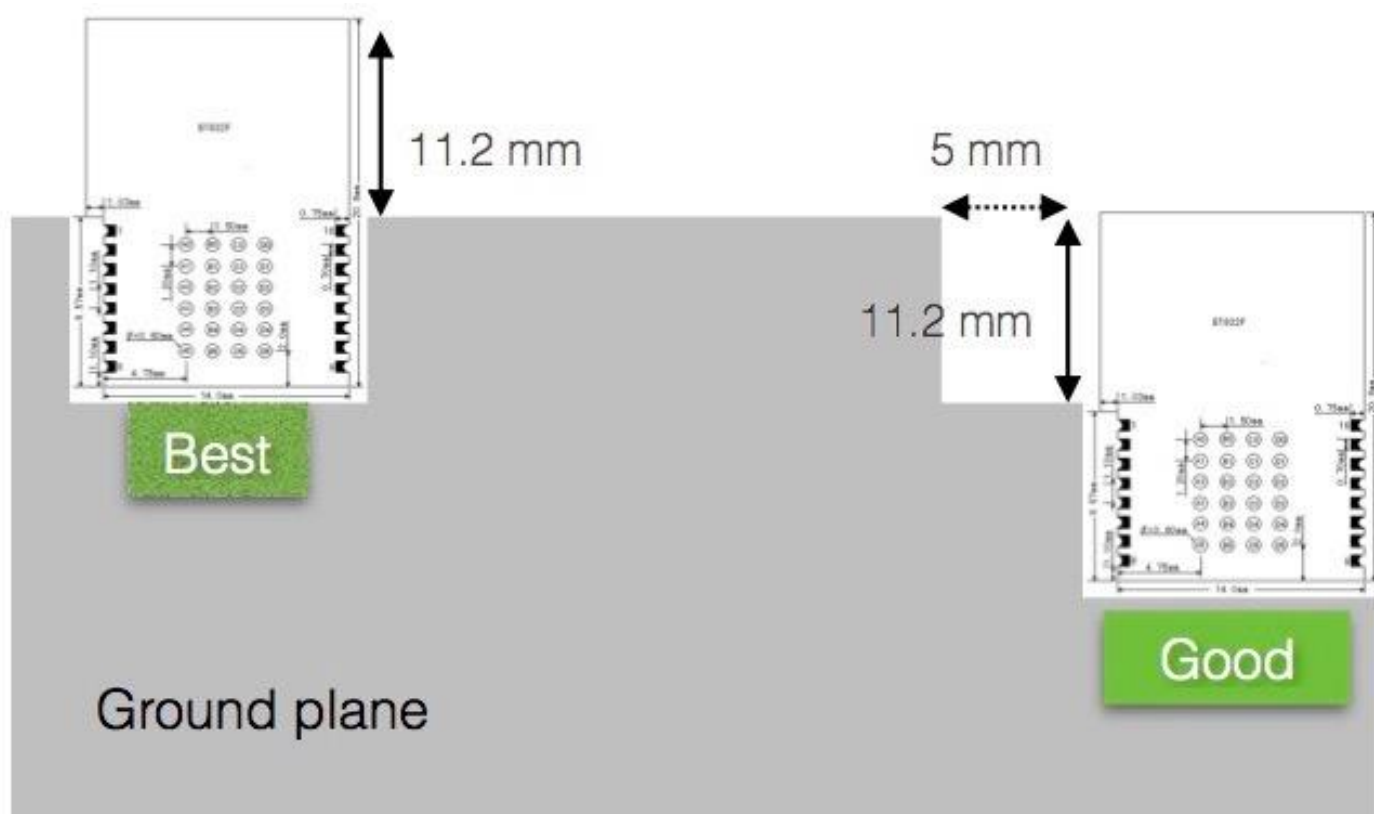2.No ground plane on all layers for at least 5mm from edge of module. Longer distance for longer Bluetooth range.

- We don't recommend mounting BT832F 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.

5. AT Commands

BT832 module is available with firmware supporting AT commands. Part number is BT832-AT.

Brief description of AT commands

☐ Each command line consists of a prefix, a body and a terminator.

☐ All command lines begin with the prefix AT (ASCII 065, 084) or at (ASCII 097, 116).

☐ The body is a string of characters in the ASCII range 032-255. Control characters other than <CR> (carriage return; ASCII 013) and <BS> (back space; ASCII 008) in a command line are ignored.

☐ The terminator is <CR>.

☐ There is no distinction between upper-case and lower-case characters. A command line can have a maximum length of 80 characters. It is automatically discarded if the input is longer. Corrections are made

☐ AT command is case-insensitive, following /r/n for end code.

☐ The default baud rate is 9600 one stop bit and no parity

Command mode

When P0.02of nRF52832 (pin 13 of BT832) is pulled high, it is set to AT command mode. In AT command mode, the host processor communicates with the processor on BT832.

Command	Response	Parameter	example
AT	OK or FAIL	none	AT/r/n OK/r/n
AT+RESET	OK or FAIL	none	AT+RESET/r/n OK/r/n
AT+VERSION?	+VERSION:<param> OK	Software version number	AT+VERSION?/r/n +VERSION140804 OK/r/n
AT+NAME?	+NAME:<param> OK	Device name	AT+NAME?/r/n +NAME:EZPro OK/r/n
AT+NAME=<param>	OK or FAIL	Device name	AT+NAME=Fanstel/r/n Or AT_Name="Fanstel"/r/n OK/r/n
AT+UART?	+UART:<param>,<param2>,<param3>	Baud rate,	AT+UART?/r/n

	OK	Stop bit, Parity	+UART:115200,1,0 OK/r/n
AT+UART=<parm>	+UART:<parm>	Baud rate	AT+UART=115200/r/n +UART:115200,1,0 OK/r/n 1200 2400 4800 9600 default 19200 38400 57600 115200 230400 460800 921600 1000000
AT+ADDR?	+ADDR:<param> OK	Device MAC address	AT+ADDR?/r/n +ADDR:abb5:cd:604ace OK/r/n
AT+REGISTER	OK or FAIL	none	AT+REGISTER/r/n OK/r/n
AT+QUITREGISTER	OK or FAIL	none	AT+QUITREGISTER/r/n OK/r/n
AT+RX?	+Name:<parm> +UART:<parm> +ADDR:<parm>	none	AT+RX?/r/n +NAME:EZPro/r/n +UART:115200,1,1/r/n +ADDR:abb5:cd:604ace/r/n
AT+DEFAULT	OK or FAIL	none	AT+DEFAULT/r/n OK/r/n
AT_RFPW?	+RFPW:parm	+4~-8	AT+RFPW?/r/n +RFPW:-4 OK/r/n

			0:+4
			1:+0 default
			2:-4
			3:-8
AT_RFPW=\<parm>	OK or FAIL	+4~-8	AT+RFPW= 1/r/n
			OK/r/n
			0:+4
			1:+0
			2:-4
			3:-8
AT+PIO=\<param>\<param1>	OK or FAIL	P00-P05	AT+PIO=05, 0\r\n
		1=High ,0=low	OK/r/n
AT+PIS=\<param>\<param1>	OK or FAIL	P00-P05	AT+PIS=05, 1\r\n
		1=output, 0=input	OK/r/n

Data Mode

When P0.02 of nRF52832 (pin 13) of BT832 is pulled low, it is set to data mode. In data model, BT832 provides transparent data transfer between the host processor and a remote device, for example, a smartphone.

6. BT832 Evaluation Board

Communicating with a PC

A quick and easy way to evaluate BT832 is to use a PC as the host processor. Connect the development board EV-BT832 to a PC with an USB cable. Then,

- ☐ SetS1, BT832 is set to command mode. PC will communicate with BT832.
- ☐ Set switch S1 to the other position, BT832 is set to data mode. PC will communicate with a remote device through BT832 Bluetooth wireless connection.

Docklight is a testing, analysis and simulation tool for serial communication protocols (RS232, RS485/422 and others). It allows you to monitor the communication between two serial devices or to test the serial communication of a single device. Docklight significantly increases productivity in a broad range of industries, including automation and control, communications, automotive, equipment manufacturers, and embedded /

consumer products. Docklight is easy to use and runs on almost any standard PC using Windows 10, Windows 8, Windows 7, Windows Vista or Windows XP operating system.

Docklight software can be downloaded from the following:

http://www.docklight.de/download_en.htm

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.

7. Miscellaneous

- DON'T USE A MODULE WITH INTERNAL ANTENNA INSIDE A METAL CASE.
- USE A MODULE WITH EXTERNAL ANTENNA INSIDE A METAL CASE. ANTENNA MUST BE OUTSIDE OF A METAL CASE.
- 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.
- CONNECT MODULE GROUND TO BATTERY GROUND.

8. Contact Us

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QQ. 3076221086
Email: sz@fanstel.com
Website: www.fanstel.com

Federal Communications Commission (FCC) Statement

15.21
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.

15.105(b)
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

1) This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

2) This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed.
Note: The end product shall has the words "Contains Transmitter Module FCC ID: X8WBT832

Canada, Industry Canada (IC)
Cet appareil numérique de classe B est conforme à la norme NMB-003.

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

Le present appareil est conforme aux CNR d'Industrie Canada applicables auxappareils 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 adioélectrique subi, même si le brouillage est susceptible d'en compromettre

le fonctionnement.

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."

(Modular approval) End Product Labeling:
The final end product must be labeled in a visible area with the following: "Contains IC: 4100A-BT832".

Caution: Exposure to Radio Frequency Radiation.
To comply with RSS 102 RF exposure compliance requirements

OEM statement

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.