

## LoRa Sensor, Beacon Applications

LR62E LoRa transceiver module uses a Semtech SX1262 sub-GHz radio transceiver. An u.FL connector is on-board for external antenna. It is paired with Fanstel BM833, a low cost Nordic nRF52833 BLE 5.1 module. The Cortex M4F MCU in BM833 manages LR62E through SPI interface. BM833 GPIOs can be used for sensor data input or control output. Android OS app is available for field set up through Bluetooth interface.

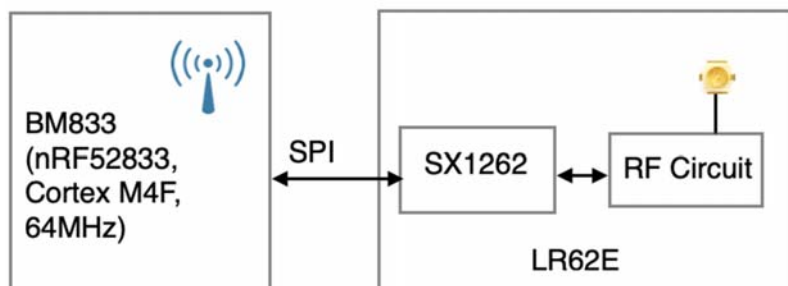


BM833 + LR62E pair can be used in LoRaWAN™ application. LoRaWAN stacks are not available from Fanstel.

## Cloud Connection, LoRa Gateway

The 2nd application example is in a gateway for connecting to cloud servers(AWS, Microsoft, Google, Fanstel development server, etc.) through Ethernet, WiFi, or LTE network.

Fanstel BM833 BLE 5.1 module (Nordic nRF52833) manages LR62E through SPI interface.

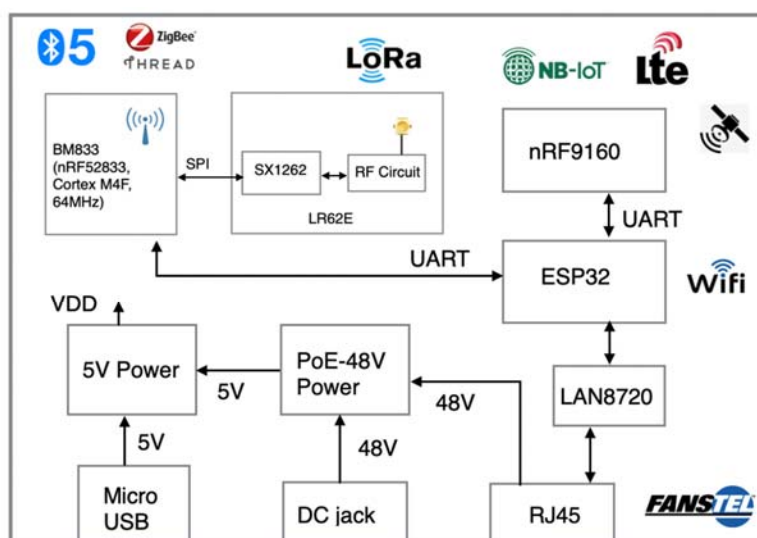


## LR62E Specifications:

- Semtech SX1262 transceiver
- Up to +22 dBm TX power (USA) at 902 to 928 MHz.
- Low power consumption: 4.2 mA at RX.

## BM833 Brief Specifications:

- Nordic nRF52 with ARM Cortex M4F.
- Serial Wire Debug (SWD)
- Over-the-Air (OTA) firmware update
- Flash/RAM: 512KB/128KB
- 42 General purpose I/O pins
- 12 bit/200KSPS ADC, 8 configurable channels with programmable gain.
- 3X SPI Master/Slave (8Mbps)
- 3X 4-channel pulse width modulator (PWM)
- 2X 2-wire Master/Slave (I<sup>2</sup>C compatible)
- UART (with CTS/RTS and DMA)
- 128-bit AES HW encryption
- 5 x 32 bits, 3 x 24 bits Real Time Counters (RTC)
- Available NFC-A tag interface for OOB pairing
- Certifications: FCC, ISED, CE, RCM, TELEC, QDID
- Operation temperature: -40 °C to +105 °C



Open Source IoT Gateway supporting multiple radios, multiple networks

## Model Summaries

module	BM833	LR62E
Flash/RAM	512KB/128KB	
Size	10.2x15x1.9mm	10.2x15x1.9mm
GPIO		32



## LR62E LoRa Module Product Specifications

Ver 0.90 Jan. 2020

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Antenna	PCB Trace	u.FL
Range between 2 modules	700 meters at 1 Mbps, est.	50 Km, est.
Availability	Production	Sample

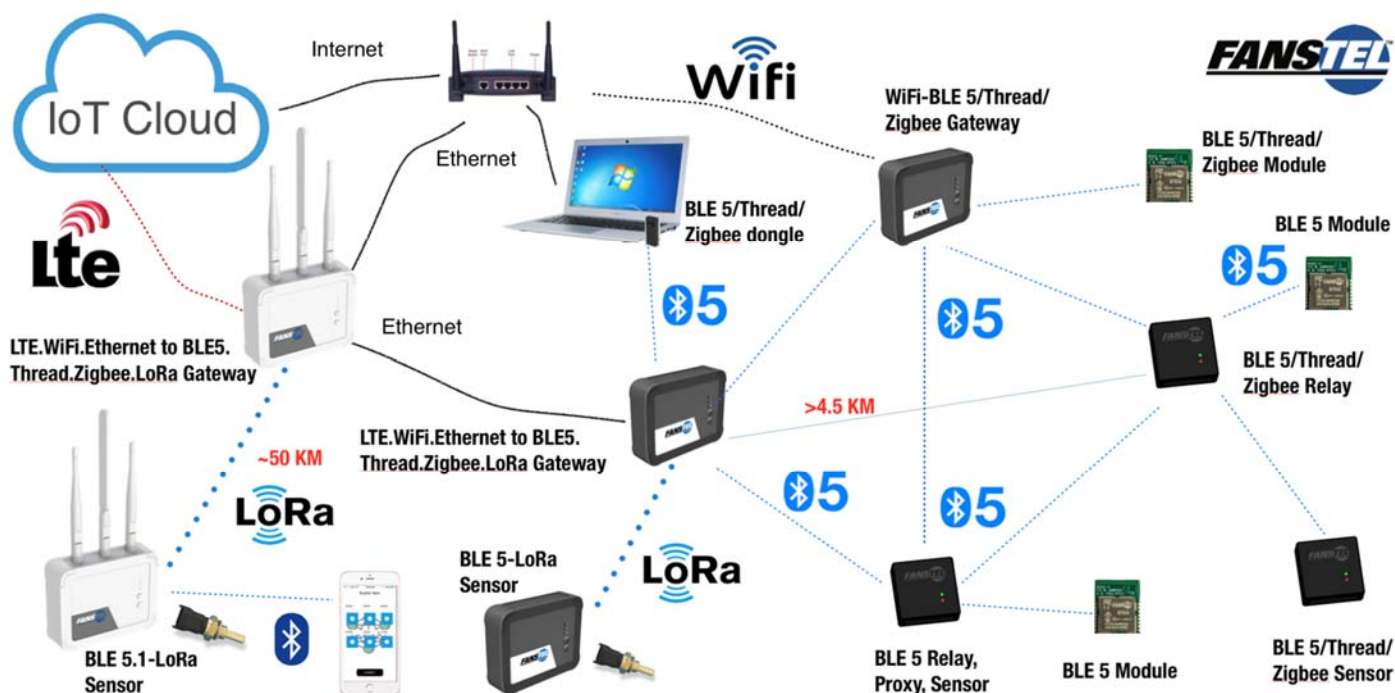
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## 1. Introduction

LR62E LoRa module with Semtech SX1262 transceiver are ideal for long range wireless applications. It can be paired with BM833 BLE module in LoRa sensor or beacon design. A smart phone can set up sensor or beacon easily through Bluetooth interface.

BM833 is powerful, highly flexible, ultra low power Bluetooth Low Energy (BLE) modules using Nordic nRF52833 SoCs. With an ARM Cortex™ M4F MCU, available 512KB flash, 128KB RAM, embedded 2.4GHz multi-protocol transceiver, and an integrated antenna, it allows faster time to market with reduced development



cost.

The second application example is in a gateway for connecting to cloud server. A LoRa sensor or beacon can be connected to a cloud server through Ethernet, WiFi, or LTE network.

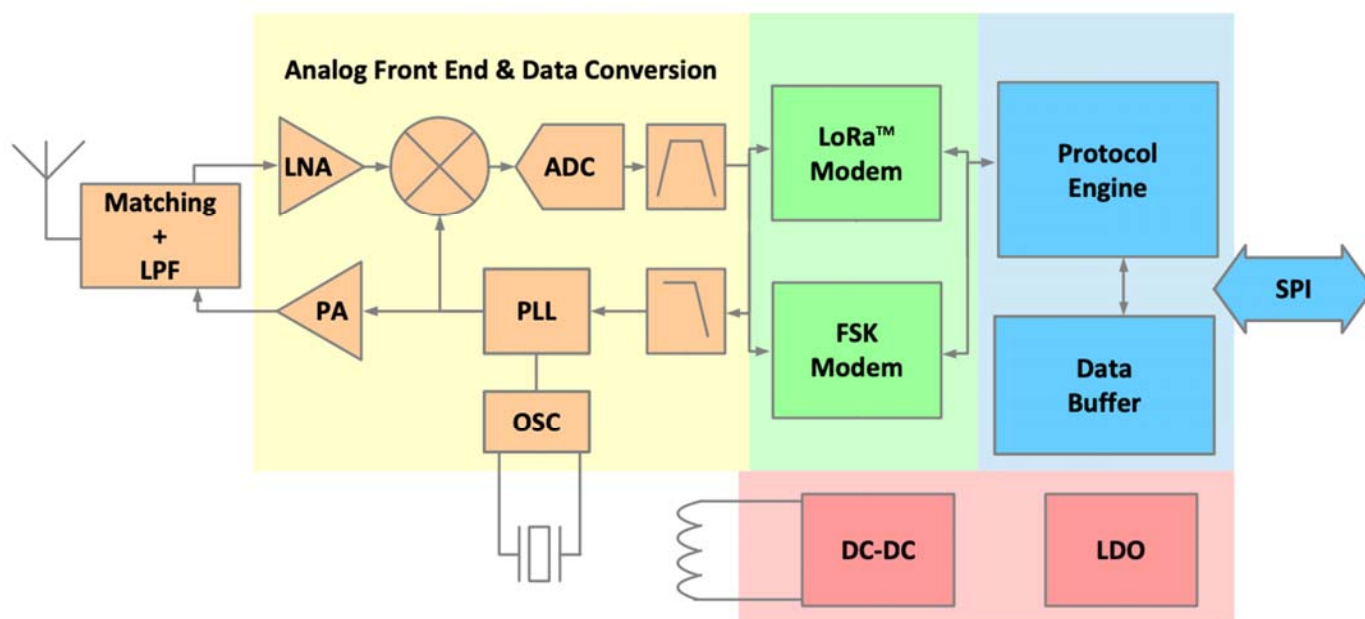
It is possible to port LoRaWAN™ stacks to Nordic nRF52 BLE SoCs. LoRaWAN™ stacks are not available from Fanstel.

## 2. Product Overview

### Semtech SX1262

Semtech SX1262 data sheets can be downloaded from this webpage.

<https://www.fanstel.com/wirelessdocument>



A block diagram is below.

LR62E module has an u.FL connector for external antenna. A BM832 or BT840F BLE module with Cortex M4F MCU manage LR62E through SPI interface.

### **Mechanical Drawings**

The followings are mechanical drawings of LR62E, top view. Size of module is 10.2x15.0x1.9mm.

Library components for PADS and EAGLE can be downloaded from

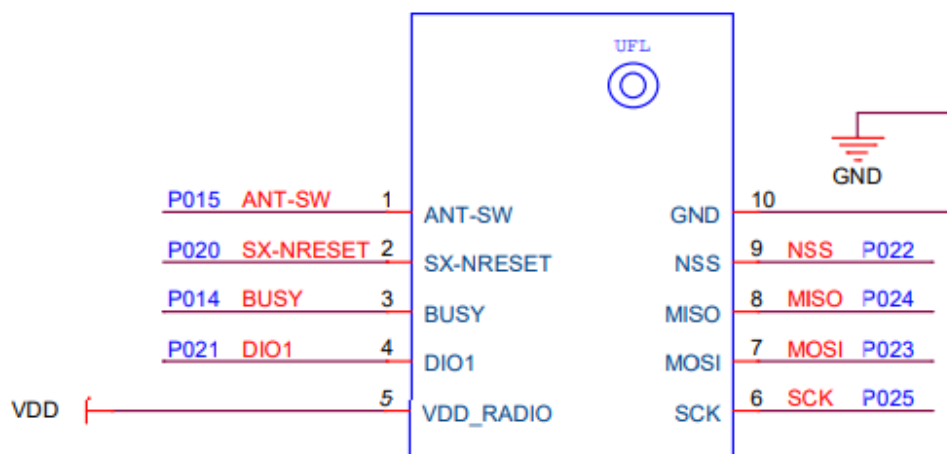
<http://www.fanstel.com/download-document/>

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

## LR62E Pin Functions

The followings are LR62E pin assignment. Pin functions are in a table below. Please refer to Semtech SX1262 Product Specifications for detailed descriptions and features supported. It can be downloaded from:

<https://www.fanstel.com/wirelessdocument>



LR62E Pin Functions

LR62E		SX1262	
pin#	pin name	pin#	Descriptions
1	ANT-SW		Antenna switch
2	SX-NRESET	15	Reset signal, active low
3	BUSY	14	Busy indicator
4	DIO1	13	Multiple purpose Digital IO
5	VDD	1	DC input voltage, 1.8V to 3.7V
6	SCK	18	SPI clock
7	MOSI	17	SPI Slave input
8	MISO	16	SPI Slave Output
9	NSS	19	SPI Slave Select
10	GND	20	Ground

## 3. 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. LR62E is paired with BM833 in the evaluation board.

### Nordic Development Environment

Nordic Semiconductor provides a complete range of hardware and software development tools for the nRF52 Series devices. nRF52DK or nRF52840DK 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](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/](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 nRFgo Studio**

<https://www.nordicsemi.com/eng/Products/2.4GHz-RF/nRFgo-Studio/>

#### *nRF52DK*

The nRF52 DK is a versatile single board development kit for *Bluetooth*® low energy, ANT and 2.4GHz proprietary applications using the nRF52832 SoC. This kit supports development for the nRF52832 and nRF52810 SoC.

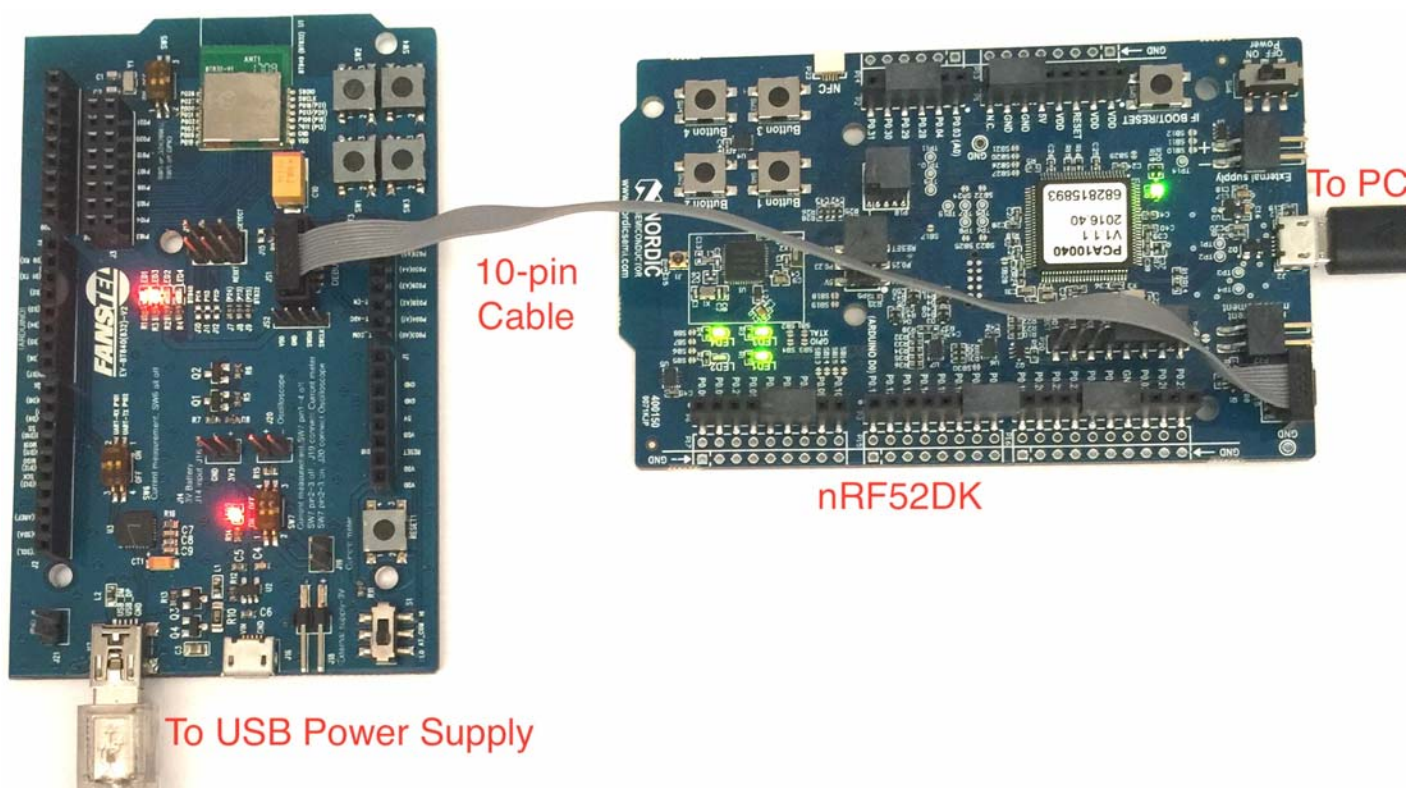
It supports the standard Nordic Software Development Tool-chain using SES, Keil, IAR and GCC. Program/Debug options on the kit is Segger J-Link OB.

### Loading Firmware into Evaluation Board Through a Nordic DK

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

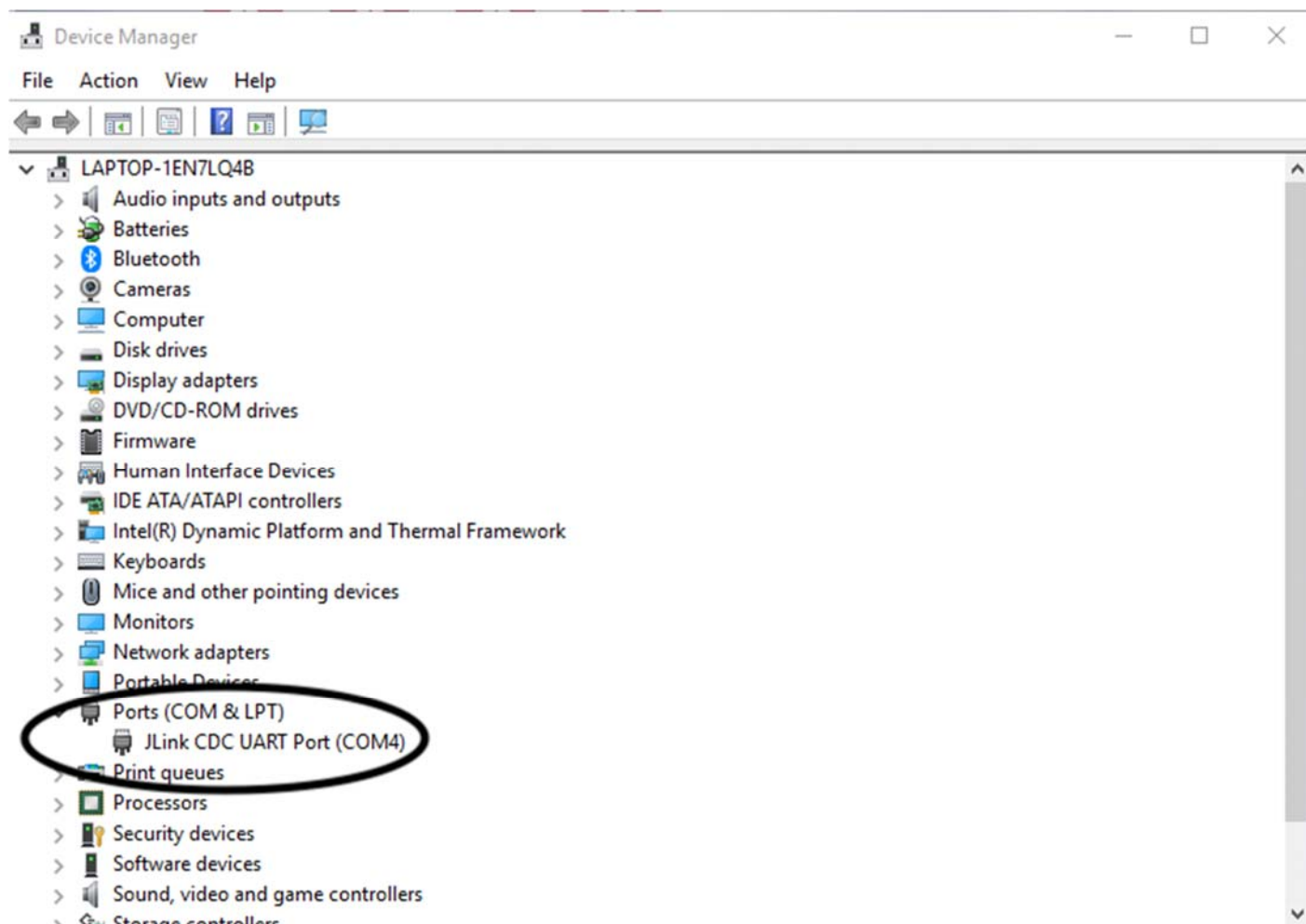
- Connect Nordic nRF52DK debug out to Fanstel evaluation board debug in using the 10-pin flat cable as shown below.
- Connect Nordic nRF52DK to PC.
- Connect a DC power source to micro or mini USB port of evaluation board.





## 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

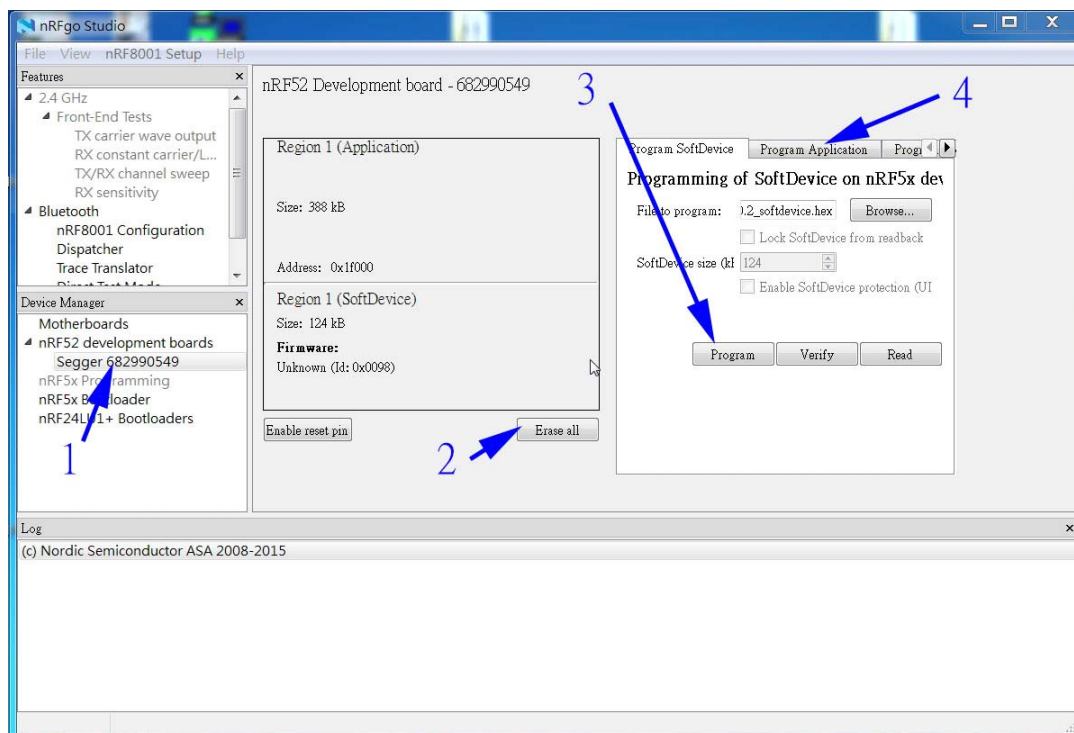


the PC control panel Device Manager.

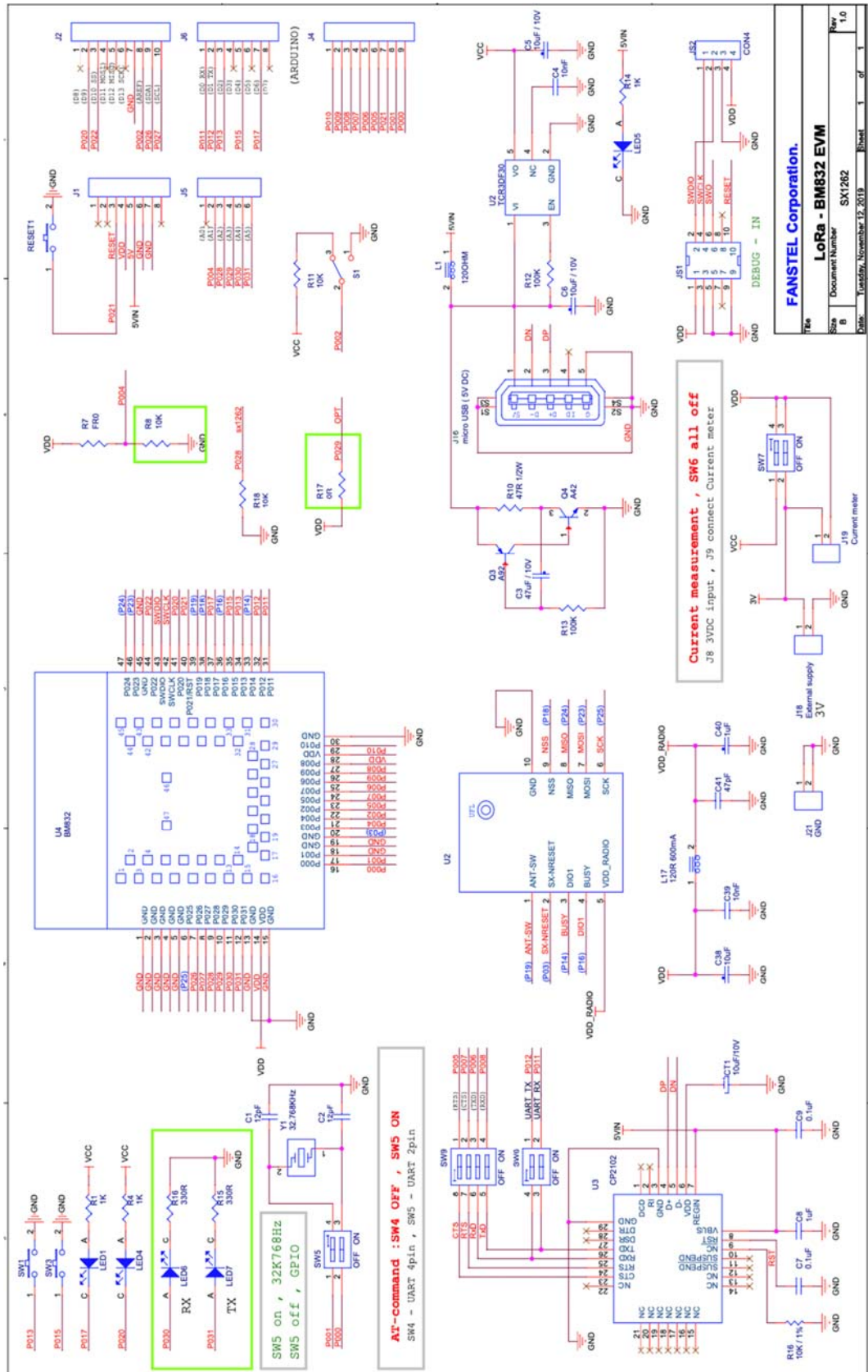
## Starting Nordic nRFgo

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



### **for Battery Power Application**

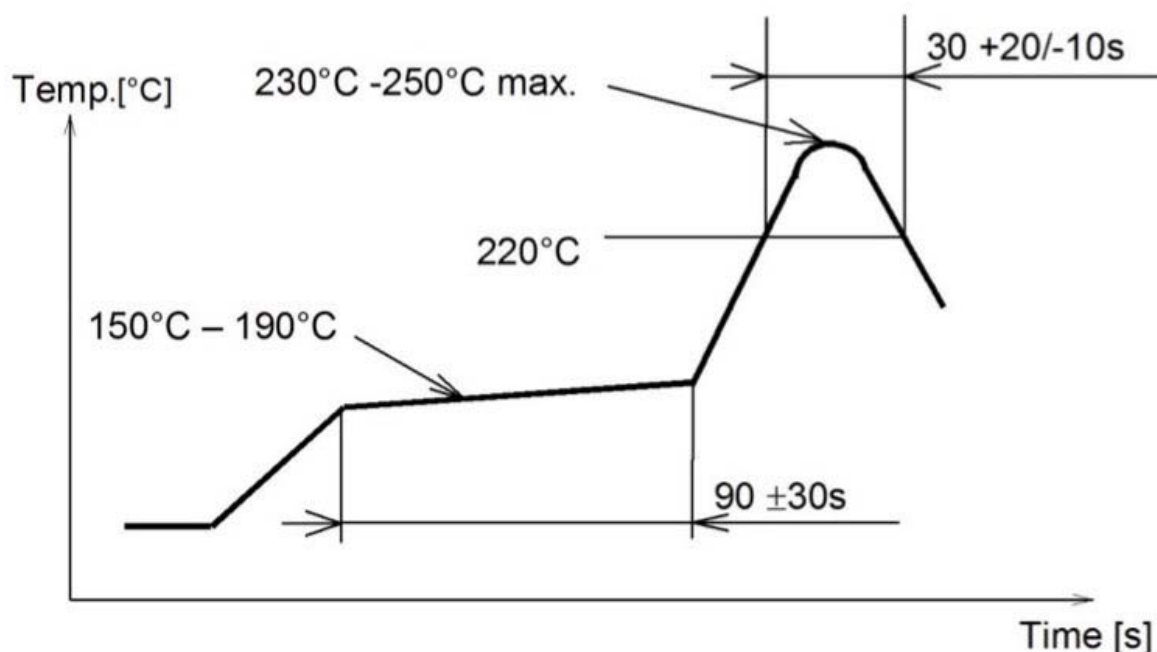
Standby current consumption is important for battery-powered product. We suggest adding a 32.768 kHz crystal and 2 capacitors as shown in the upper left corner of the evaluation board schematics. The 32MHz main clock won't be active at idle state to save power.

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

## 4. 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.
- (10) For more details on LGA (Land Grid Array) soldering processes refer to the application note.

## *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.

## 5. Revision History

- July 2020, Ver. 0.90: The first draft copy

## 6. Contact Us

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## 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

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

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

Note: The end product shall has the words "Contains Transmitter Module FCC ID: X8WLR62E"

## Canada, Industry Canada (IC)

This Class B digital apparatus complies with Canadian ICES-003

Cet appareil numérique de classe B est conforme à la norme NMB-003.

**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.

## Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition au rayonnement ISED établies pour un environnement non contrôlé.

Cet équipement doit être installé et utilisé à une distance minimale de 20 cm entre le radiateur et votre corps.

Cet émetteur ne doit pas être co-localisé ou fonctionner en conjonction avec une autre antenne ou un autre émetteur.

## (Modular approval) End Product Labeling:

The final end product must be labeled in a visible area with the following: "Contains IC: 4100A-LR62E".

## 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

This radio transmitter (192170139/AA/00) has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed Below, with the maximum permissible gain indicated. Antenna types not included in this list that Have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

LR62E: Dipole Antenna, 2.3dBi