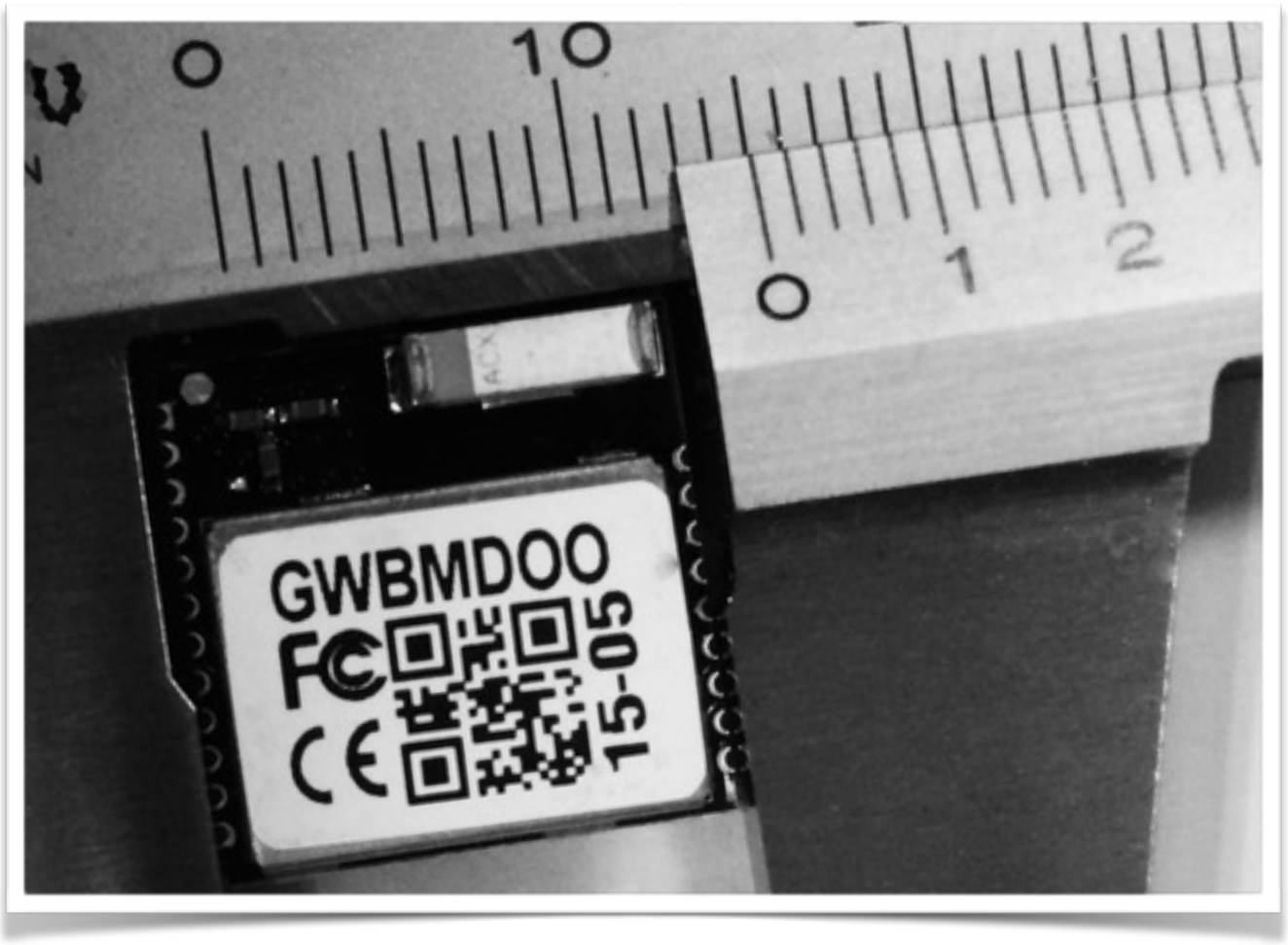
GWBMD0x Bluetooth Low Energy module

Data sheet version 2.0 draft



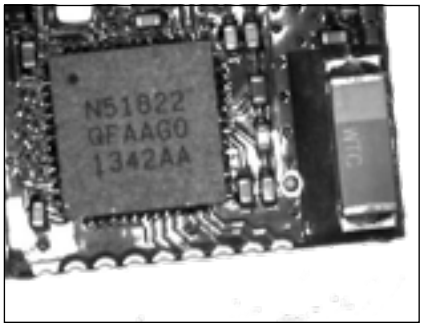
Introduction

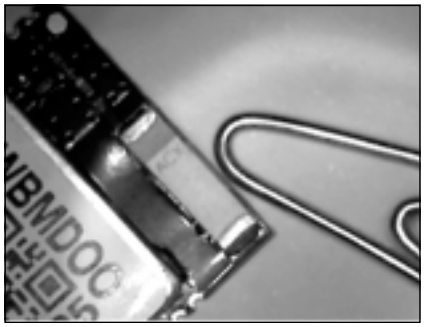
Base on Nordic Semiconductor's nRF51822 BLE protocol processor, Gigawit GWBMD0x BLE module provides a reliable and easy BLE solution, allowing user, even without any RF design experience, brings their their product or system, embedded with BLE feature, to market in time.

Integrated with almost all peripheral components, such as RF matching network, Antenna, 16MHz Crystal, 32768Hz Crystal, and DC/DC inductor, GWBMD0x BLE module save engineer resource from hardware design for BLE.

The tiny form factor of GWBMD0x allows it to be adapted into different application, such as portable, handheld device…etc.

GWBMD0x is FCC and CE certified module, which reduces customer's resource for qualification and allows product to be time to market.






Applications

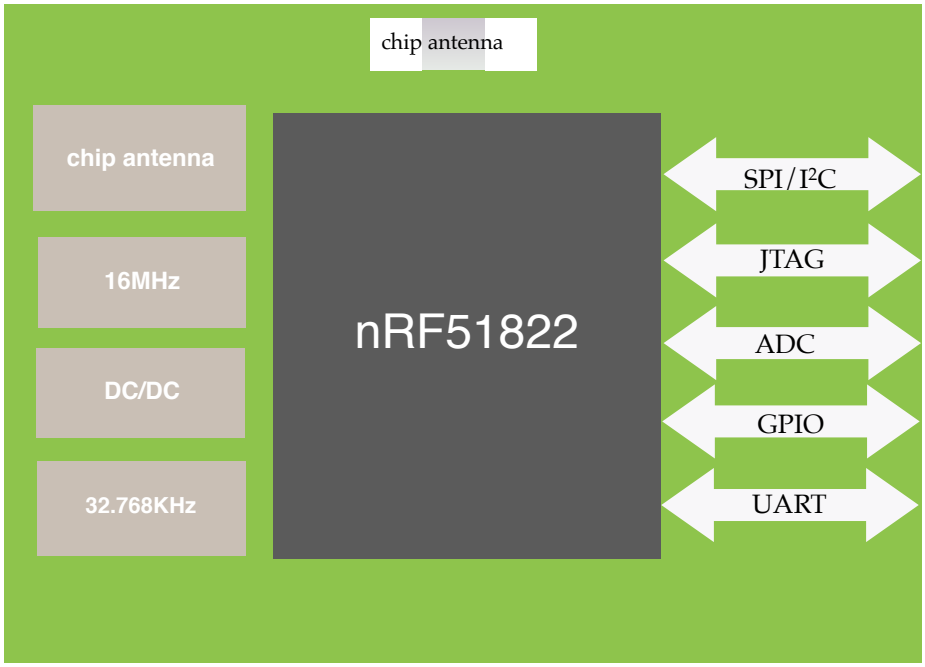
- Phone accessories
- Computer peripherals
- CE remote controls for TV, STB and media systems
- Beacons
- Proximity and security alert tags
- Sports and fitness sensors
- Healthcare and lifestyle sensors
- Game controllers
- Home Automation
- Smart RF tags for tracking and social interaction

Feature

- Based on nRF51822, 32bit Cortex-M0 Bluetooth Low Energy Processor
- Plug & play module with integrated Antenna
- On board 16MHz / 32768Hz Crystal
- On board DC/DC converter
- Small form factor: 15mm x 15mm
- Bluetooth v4.0 compliant Protocol Stack (BLE)
- Support Master and Slave mode
- Excellent link budget (up to 95 dB)
- Programmable output power up to +4dBm
- Rich and flexible I/Os including UART/I2C/SPI/PWM/JTAG
- FCC/CE certification

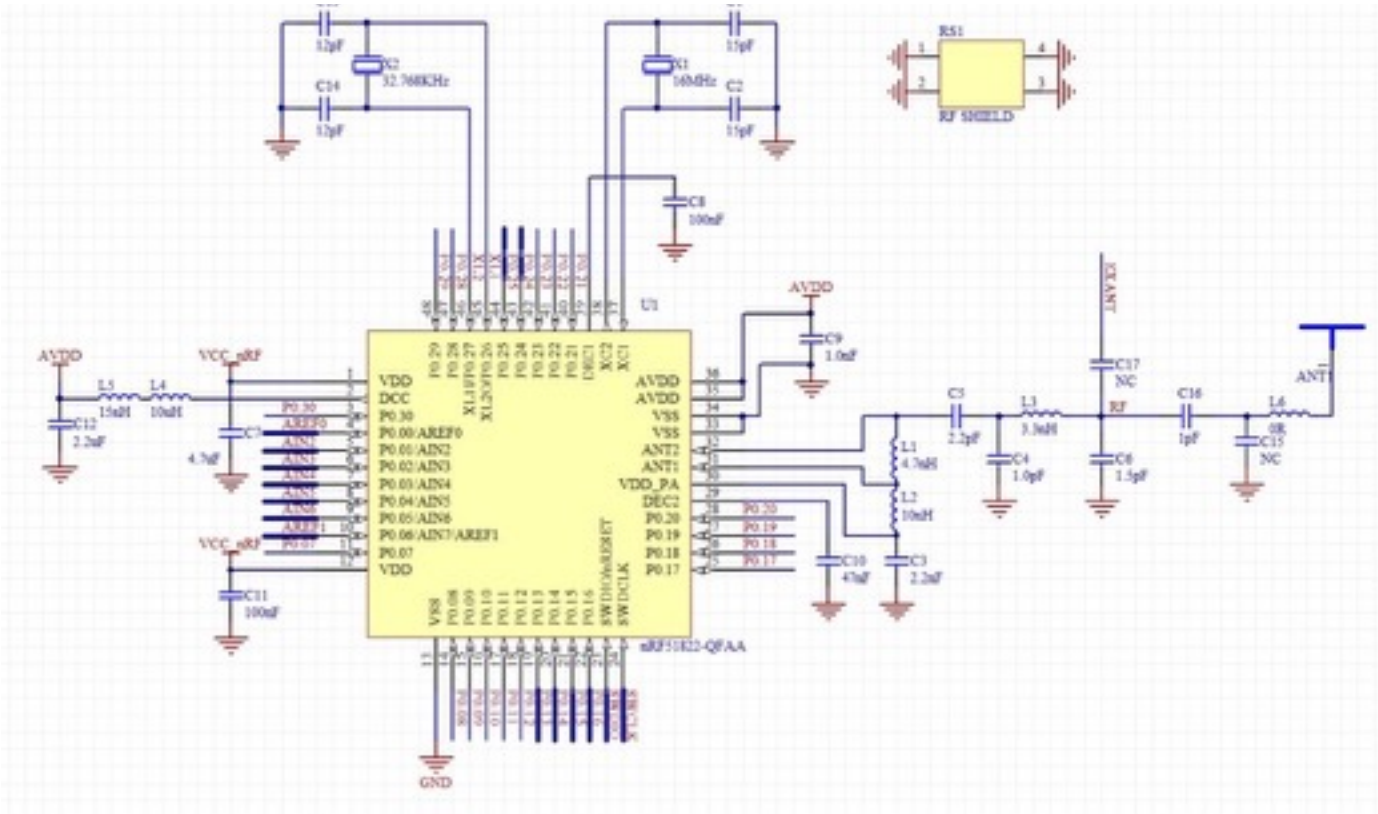
Hardware information

Block Diagram



GWBMD0x Block Diagram

Module Schematic



Electrical Specification

Table 1 Electrical Specification

	Description	Typical
General	Operation voltage	1.8V to 3.6V DC
	Supply current	13mA peak RX, 10.5mA peak TX (0dbm)
	Microcontroller	32-bit ARM Cortex M0
	Hardware Security	128-bit AES ECB/CCM/AAR co-processor
	GPIO	20 configurable
	Oscillators	16MHz crystal oscillator 16MHz RC oscillator 32kHz crystal oscillator 32kHz RC oscillator (±250 ppm)

	Description	Typical
	Digital I/O	X2 Hardware SPI master UART
	Operation temperature	-10 ~ +60°C
RF	Frequency band	2.4GHz ISM (2.40000 – 2.4835GHz)
	Modulation	GFSK
	Data rate	250kbps, 1 Mbps, 2 Mbps
	TX Power	-20 to +4dBm in 4dB steps
	Sensitivity	-92.5dBm Bluetooth low energy -96dBm at 250kb -90dBm at 1Mbs -85dBm at 2Mbs
	RF Range (indoor)	15m (GWBMD0x)

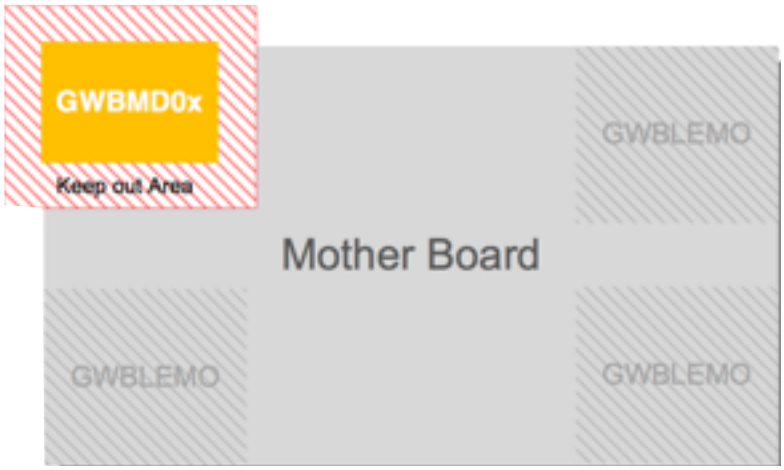
Pin	name	Type	Description
1	GND	GND	Ground
2	EXANT	ANT	External Antenna
3	GND	GND	Ground
4	SWDCLK	I/O	SWD Clock
5	SWDIO	I/O	System reset (active low). SWD Data
6	P0.05	I/O	General purpose IO
7	P0.04	I/O	General purpose IO
8	P0.03	I/O	General purpose IO
9	P0.02	I/O	General purpose IO
10	P0.01	I/O	General purpose IO

Pin	name	Type	Description
11	P0.00	I/O	General purpose IO
12	GND	GND	Ground
13	GND	GND	Ground
14	3.3VIN	POWER	+3.3V Power Input
15	P0.06	I/O	General purpose IO
16	P0.12	I/O	General purpose IO
17	P0.13	I/O	General purpose IO
18	P0.14	I/O	General purpose IO
19	P0.15	I/O	General purpose IO
20	P0.16	I/O	General purpose IO
21	GND	GND	Ground

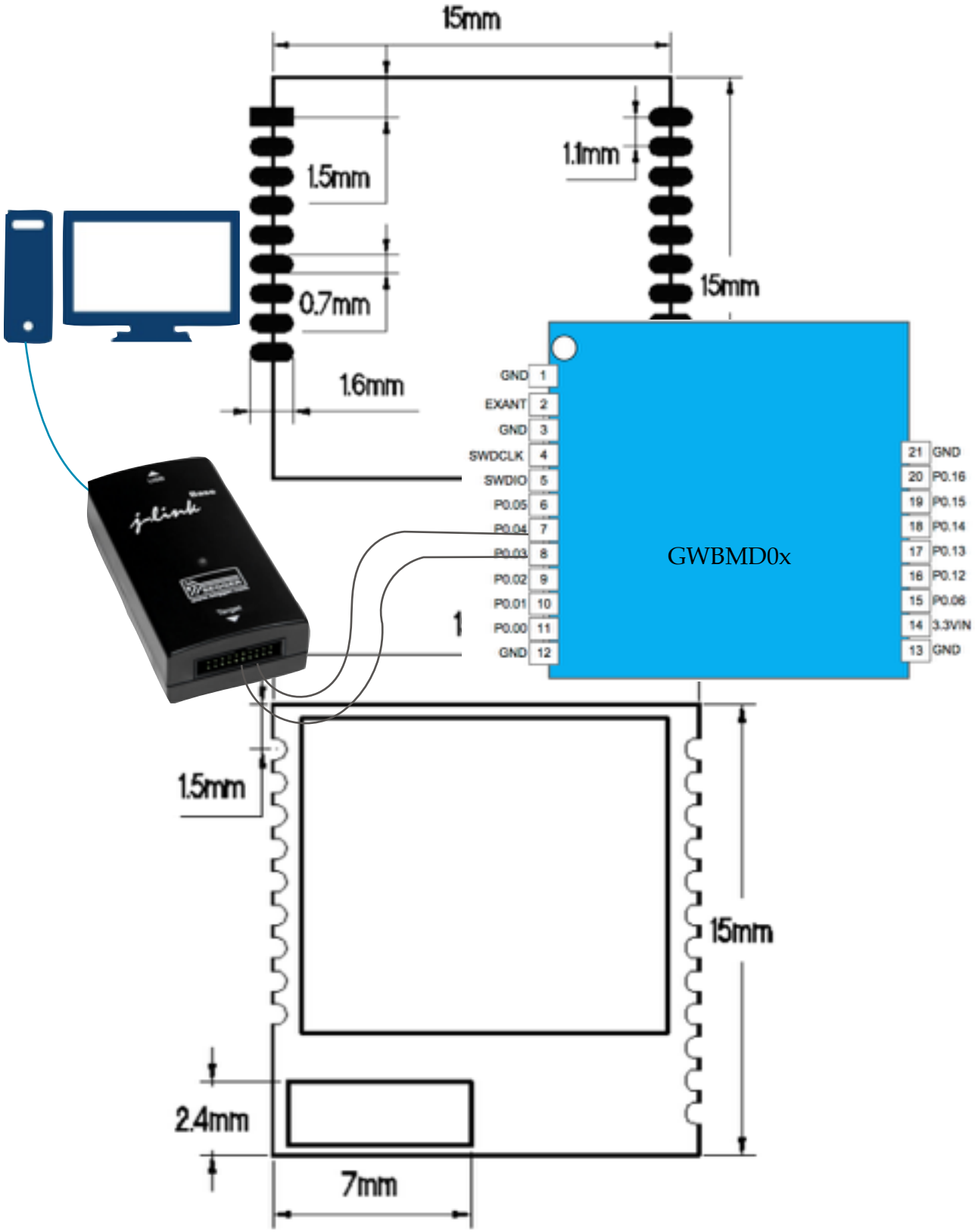
Pin Assignment

Mounting GWBMD0x

GWBMD0x is RF sensitive; in order to obtain the best performance, it is recommended to mount the module at corner of mother board, and with some marginal space.
Also, keep it away from metal components, such like speakers, transformers, batteries, big aluminum capacitors, heat sinks and Metal Panels.
The figure below illustrates how to mount the GWBMD0x module. Improper mounting will decrease the RF performance dramatically.



Physical Dimension



Dimension

JTAG connection

Pin 4 (SWDCLK) and 5 (SWDIO) of GWBMD0x are JTAG interface for the purpose of firmware programming and real time debugging.
Segger J-Link adaptor from SEGGER Microcontroller (www.segger.com) is recommended for connecting GWBMD0x and computer.
It is also recommended to have a pin header on the mother board connecting to Pin4 and 5 of GWBMD0x for firmware upgrading and recovering purpose.

UART/SPI/I²C and GPIO

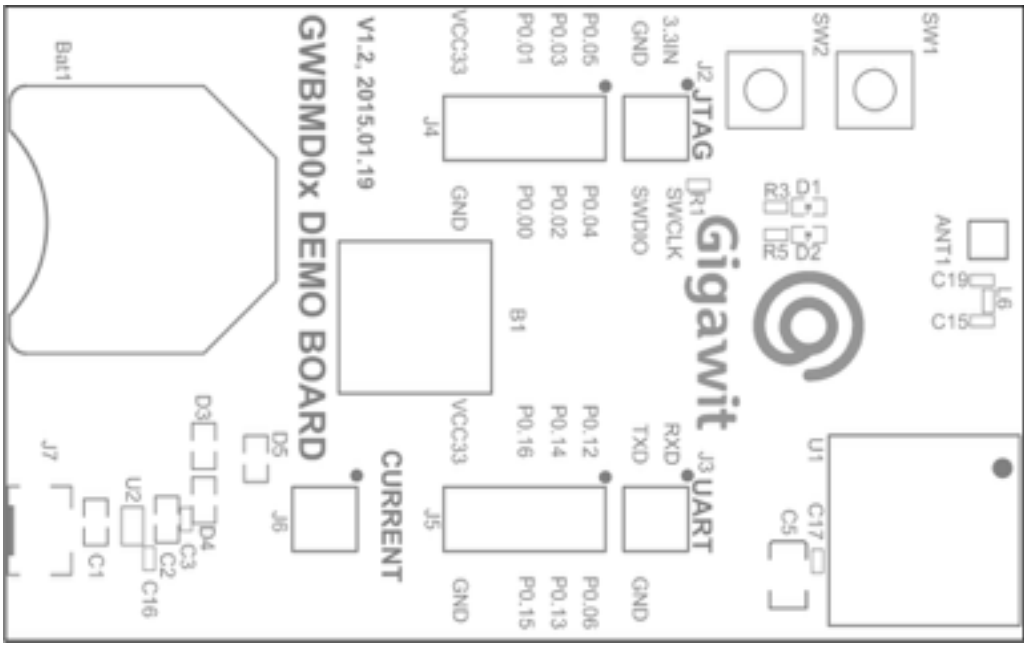
GWBMD0x module provides 12 General Purpose I/O (GPIO), which can be mapped to UART, SPI and I²C port by software. It provides high flexibility to engineer for different circuit layout requirement.

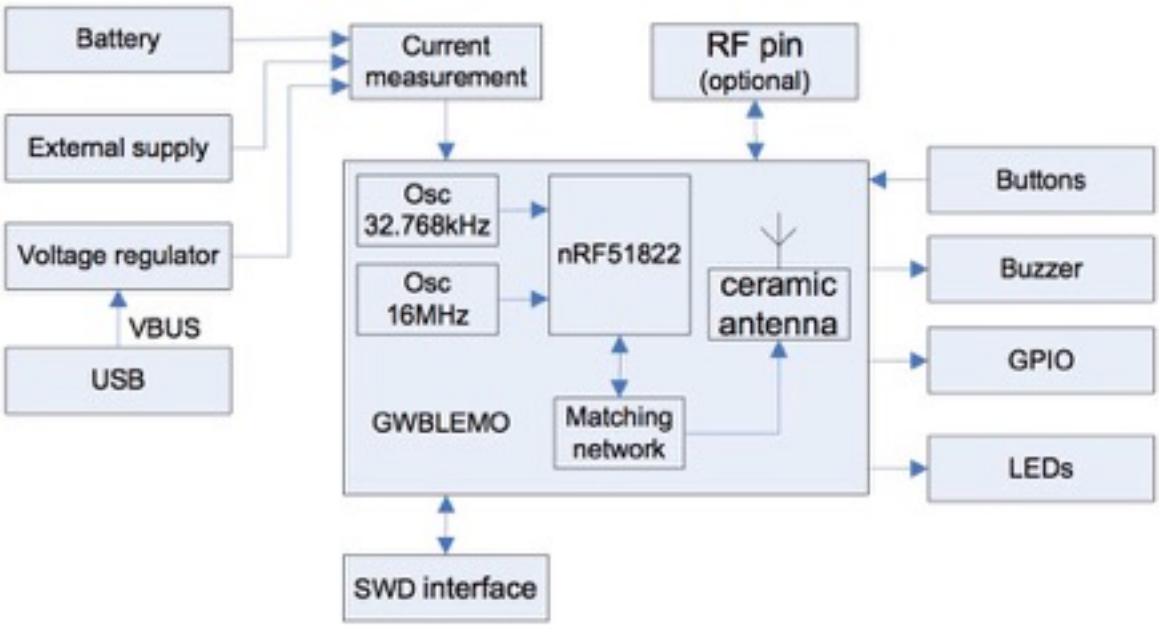
nRF51822

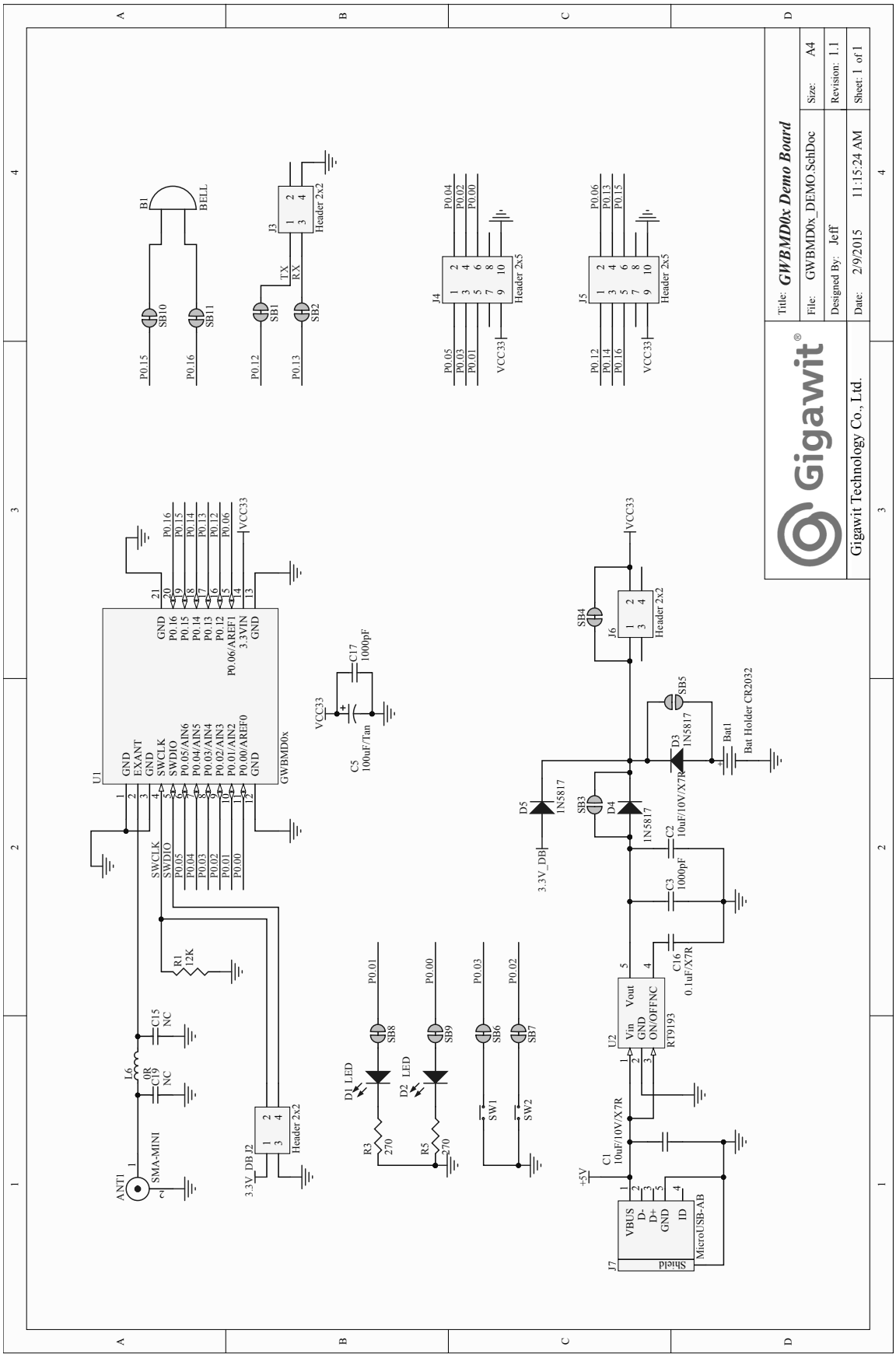
Nordic Semiductor's nRF51822 is the core of GWBMD0x BLE module. nRF51822 is ARM® CortexTM-M0 core CPU, embedded with 2.4GHz RF and other functional blocks.
Like other ARM Cortex M0 CPU, user can easily develop the source code by different tools. Through the software for the ARM core, user is able to control all the functional blocks.
BLE stack is not hard-coded in the nRF51822, instead, Nordic will provide the stack as SoftDevice for BLE, it provide high flexibility for the nRF51822 and also allow it compatible with the latest version of BLE, as long as the hardware is capable.

Evaluation Board

Evaluation board (EVB) for GWBMD0x is available, helping engineer for the firmware development. The LED contains 2 push buttons, 2 LEDs and headers that connected to GWBMD0x directly, and engineers can connect them to target PCB easily. The Evaluation board also consists of JTAG interface, which allows real time debugging and firmware download.







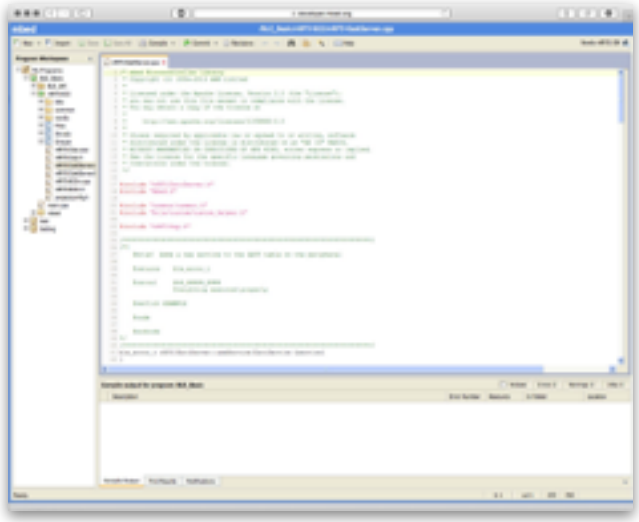
GWBMD0x EVK circuit diagram

Software information

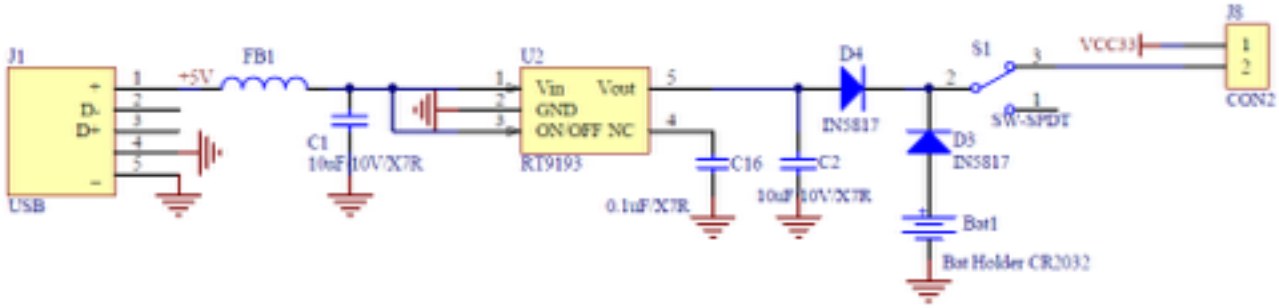
Power up the EVB

There are three ways to supply power to the EVB:

1. Connect a the USB port with any USB power,
2. 3.3V directly to jumper J3
3. Coin battery

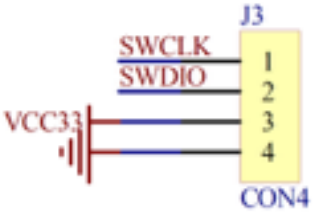


DC/DC convertor will regulate the 5V input from USB port to 3.3V for the module, and the circuit is as following:

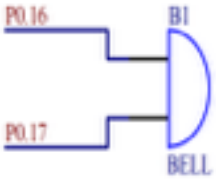


JTAG interface

GWBMD0x module can be programmed and debugged by connecting SEGGER J-Link's SWCLK, SWDIO, VCC and GND pint to J3 on the EVB. If VCC pin of J3 is connected, the power will then support the whole EVB and no external power or battery is required. If battery inserted or USB power is plugged, VCC pin of J3 should be left open. In both of the above scenarios, GND poin of J3 MUST be connected.

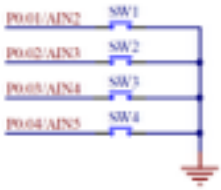


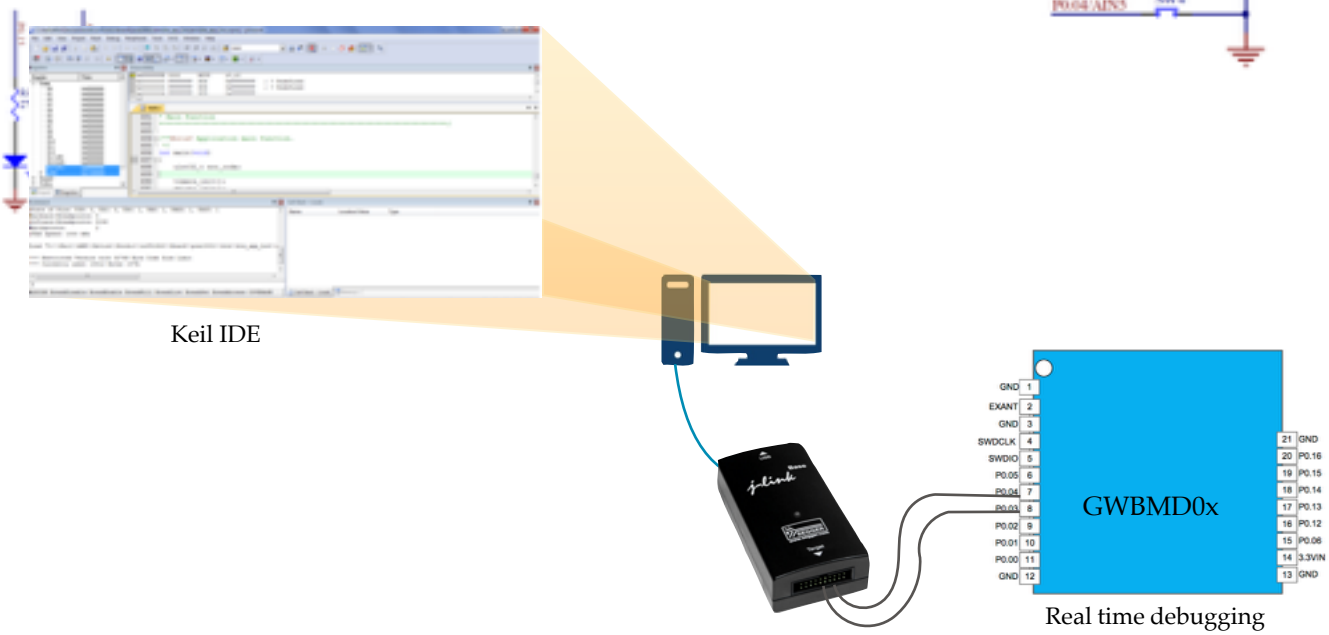
GPIO, Buzzer, Push button and LED



- Buzzer is connected to P0.16 and P0.17 of the module, to turn on the buzzer, one of the pins need to set as “1” and the other set as “0”

- Push buttons are tied to P0.01 to 0.04 respectively, and tied to ground on the other end, enhance, internal pull-up resistor must be enabled by software.





- LEDs are ties to P0.15 and P0.05, and will be illuminated when pins are set to high.

- All GPIOs are also connected to header P3 and J9, which allows engineer connecting the EVB to target PCB for evaluation and testing.

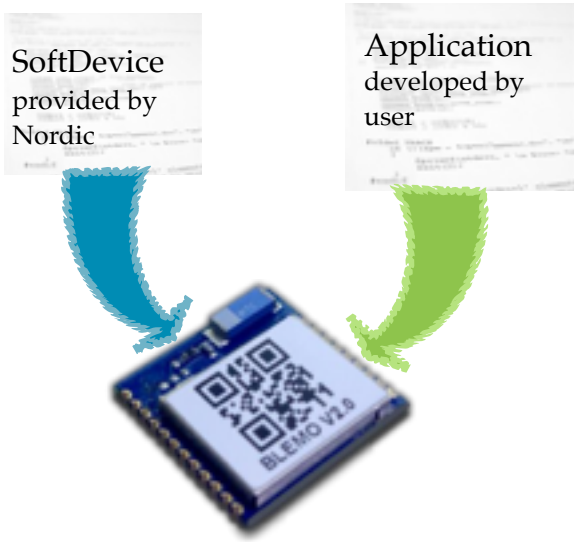
Firmware structure

As GWBMD0x is base on Nordic Semiconductor nRF51822, all firmware information for nRF51822 is also applicable to GWBMD0x.
Firmware for GWBMD0x (or nRF51822) consists of two main components: SoftDevice and Application.
SoftDevice is provided by Nordic as a precompiled HEX file, and consists of BLE peripheral protocol stack solution, which integrates a low energy controller and host, and also provides a full API for controlling nRF51822. **S110** SoftDevice should be used for BLE application.

Instead of hard code the protocol, the advantage of SoftDevice is the high flexibility, allowing the module can keep up with the latest BLE version. SoftDevice can be download at Nordic web site (https://www.nordicsemi.com/eng/Products/Bluetooth-Smart-Bluetooth-low-energy/nRF51822).

SoftDevice consumes a portion of nRF51822's RAM and flash memory, therefore, not 100% of RAM and flash memory can be allocated for application code purpose.

Application code is the application layer developed by user.



SDK

Nordic provides 3 types of SDK for nRF51822.

General purpose SDK

It consists of different libraries for nRF51822 firmware building. Developer can simply make use of these libraries in their application code and then needs not to concern all the low level handles. Example codes are also contained in SDK, so that developer can modify these examples for their own application.

IoT (Internet of Things) SDK

Its major feature is IPv6 over Bluetooth® , making BLE device to be connect to Ethernet directly.

HomeKit SDK

It helps developer to build the nRF51822 firmware which complies with Apple HomeKit requirement. MFI license is required.

Compile and debug

As the core GWBMD0x is ARM core, there are many different compilers available on the market, and here we just put some of them as an example.

On-line compiler
Free on-line compiler is provided by ARM© 's developer site. It is a comprehensive on-line tools that allows user to build the application code on line for nRF51822. Once the code is compiled, user can then download the hex code and program into GWBMD0x module.
For more information, please refers to: https://developer.mbed.org

Real-time debugger is not possible when developer using on-line compiler. Developer needs to download the compiled code, together with the S110 SoftDevice into the module and test if it is operated as expected.

Loading the compiler code and S110 SoftDevice into the module, SEGGER's JTAG adaptor and nRFGo Studio software tool (provided by Nordic) is needed.

Integrated Development Environment (IDE)
There are different IDE available on the market, and here we take Keil's IDE (www.keil.com) as an example.
The IDE provides not only coding ability, but also firmware downloading and real-time debugging feature to firmware developer. A SEGGER JTAG adaptor is required for real-time debugging and firmware download.

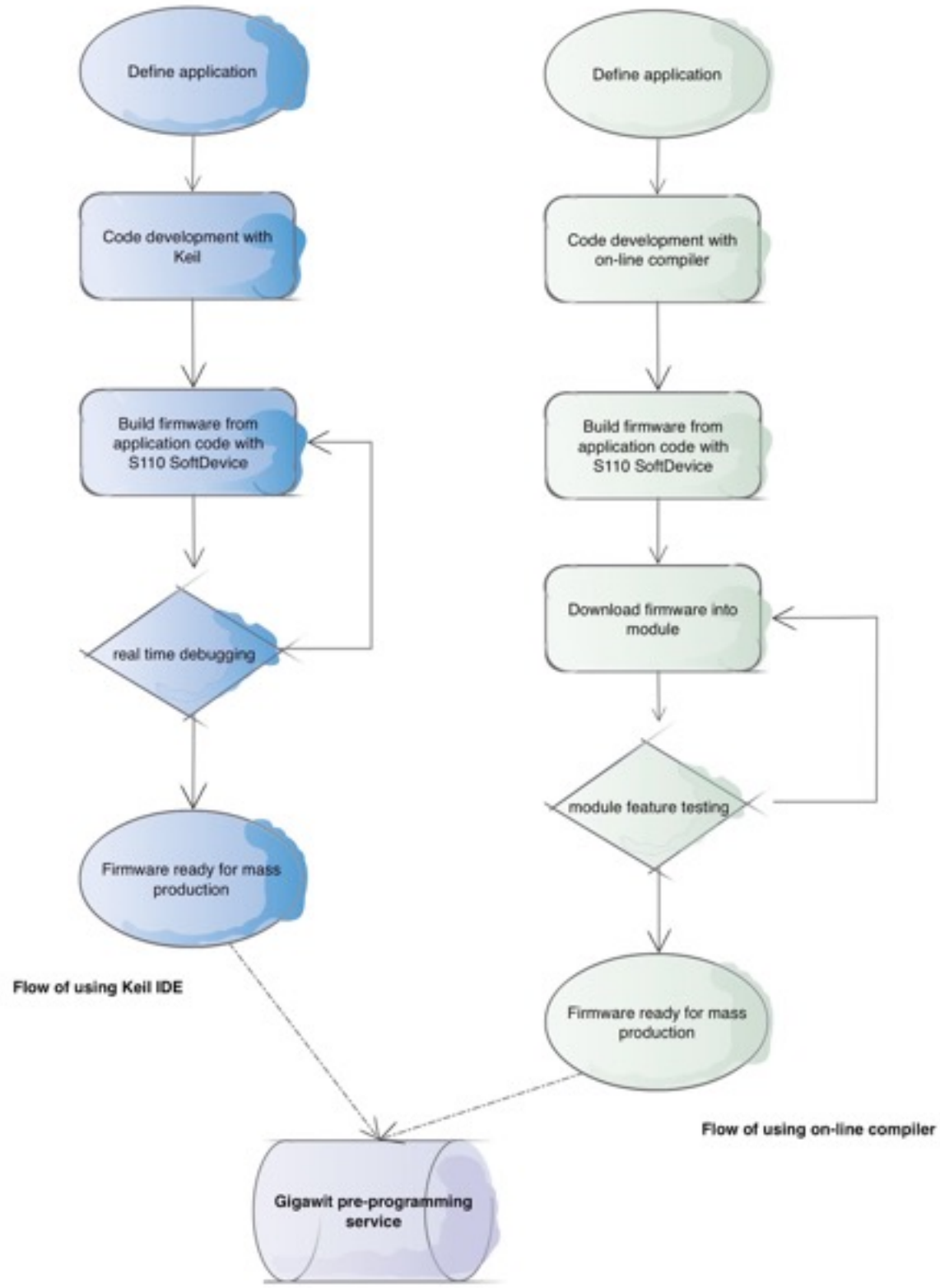
Firmware programming
As mentioned above, the firmware can be download to the module through JTAG adaptor and Nordic nRFGo Studio software tool.
With appropriate boot loader loaded into the module through the JTAG adaptor and nRFGo Studio, the module can also support Over-the-Air programming (OTA), which allows the firmware to be upgraded over BLE connection. OTA is only possible for 256K version only.

Software service from Gigawit
Gigawit also provides firmware develop service for GWBMD0x module, hence customer do not need to spend their resource on the BLE feature development. As our engineers are experts for Nordic nRF51822 chip, usually we can delivery customised firmware within a month.

We also provide firmware pre-programming service, where customer can submitted us the compiled code file, then we delivery the module with the file pre-programmed, so that customer can put the modules into their production line directly.

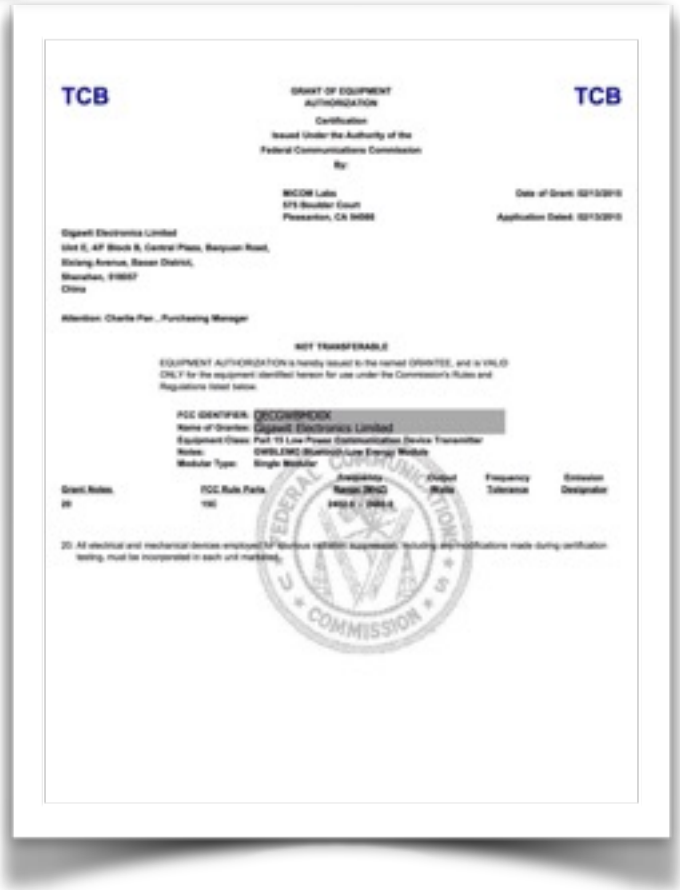
These services may require NRE charge. For the details, please contact our local sales representative or distributor.

Software development flow



FCC and CE Certification

EC-R&TTE Certification of Conformance



TCB

GRANT OF EQUIPMENT AUTHORIZATION

Certification

Issued Under the Authority of the Federal Communications Commission

By:

TCB

Reference

BLE information:
Bluetooth® Developer Portal
http://developer.bluetooth.org/

Nordic nRF51822 information:

nRF51 Series Reference Manual
http://infocenter.nordicsemi.com/topic/com.nordic.infocenter.pdf.rm/nRF51_RM_v3.0.pdf

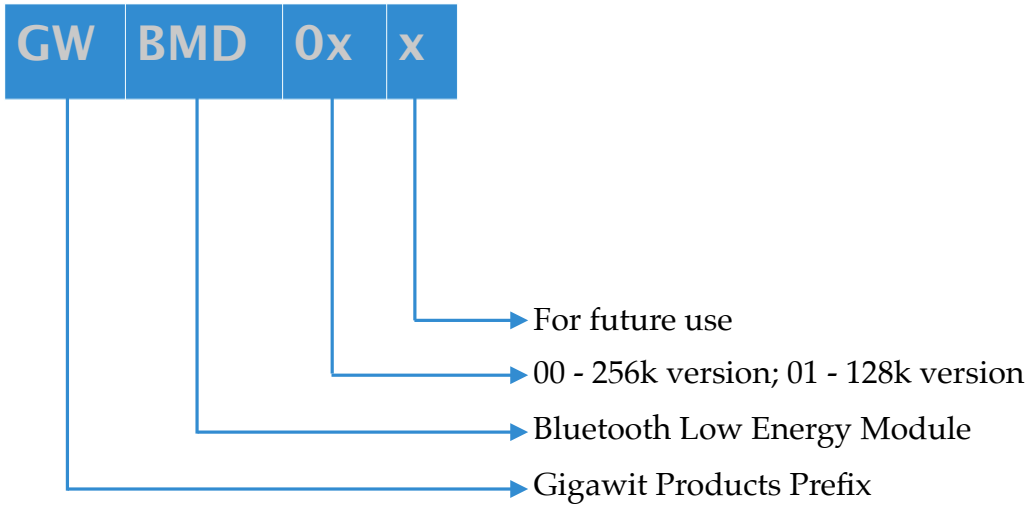
S11 nRF51 SoftDevice Specification v2.0
http://infocenter.nordicsemi.com/topic/com.nordic.infocenter.pdf.sds/S110_SDS_v2.0.pdf

nRF51 SDK (generic)
http://developer.nordicsemi.com

nRF51 IoT SDK (IPv6 over Bluetooth®)
https://developer.nordicsemi.com/nRF51_IoT_SDK/doc/

nRF51 HomeKit SDK (MFI license required)
http://www.nordicsemi.com/eng/News/News-releases/Product-Related-News/Nordic-Semiconductor-launches-HomeKit-solution-for-nRF51-Series-Bluetooth-Smart-SoCs

Ordering part number



Revision History

2013-12-12	version 1.0
2014-12-29	version 1.21
2015-08-20	version 2.0

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