



SGW101X BLE Modules Series Datasheet

1. Introduction

The SGW101X series is an advanced, highly flexible, ultra-low power multiprotocol SoM that enables Bluetooth (BLE) connectivity for portable and extremely low power embedded systems.

The SGW101X series delivers robust RF performance, low energy consumption, a wide selection of MCU peripherals and either an integrated PCB trace antenna or a u.FL connector for an external antenna. These modules are created to minimize the engineering efforts and development costs associated with adding Bluetooth 5.0 to any product, accelerating its time-to-market.

2. Features

- Complete RF solution with integrated antenna
- Bluetooth 5 ready multi-protocol module:
 - 2Mbps
 - Long Range
 - Advertising Extension support
- Wireless System-on-Chip: Nordic nRF52840:
 - 32Mbit ARM Cortex™ – M4F CPU @64MHz
 - 1MB Flash program memory
 - 256kB RAM data memory
- Wide selection of MCU Peripherals:
 - Full-speed USB (12Mbps)
 - Four SPI Master/Slave (8Mbps)
 - Two 2Wire Master/Slave (I2C compatible)
 - Two UARTs (with CTS/RTS)
 - NFC Tag-A interface
 - 20 channel CPU independent
 - Programmable Peripheral Interconnect (PPI)
 - 5x32 bit, 3x24bit Real Timer Counters (RTC)
 - 12Mbit/200K SPS ADC.
- Support 128Mbit AES HW encryption
- 48 General Purpose I/O pins
- Supply voltage: 1.7–5.5 V
- Low Energy Current consumption, 3 V DCDC enabled:

- Tx only, 0dBm: 4.8mA (typical)
 - Rx only @1Mbps: 4.6mA (typical)
 - System On mode, with full RAM retention: 2.35uA
 - System Off mode, with full RAM retention: 1.86uA
- Operating Temperature: -40°C to 85°
 - BQB: DID D046088, QDID: 135014
 - FCC ID: 2AS9401
 - IC (Industrial Canada) ID: 25021-01
 - CE: Certified
 - Mechanical Dimension: 10.2mm x 15.0mm x 2.1mm

2.1. Applications

- Connected home
- Smart city infrastructure
- Industrial mesh networks
- Industrial smart lighting
- Logistics and transportation



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3. Ordering Information

Part No	Description
SGW1010	Bluetooth 5 module, Built-in antenna
SGW1011	Bluetooth 5 module, u.FL connector for external antenna
SGW1010A	Bluetooth 5 module, Built-in antenna, Low voltage operation
SGW1011A	Bluetooth 5 module, u.FL connector for external antenna, Low voltage operation
SGW1010 –EVK	SGW1010 Bluetooth 5 module Evaluation Kit

Table 1. Ordering Part Number

4. Block Diagram

Below are the block diagrams of the SGW1010 and SGW1011. All 48 GPIOs of nRF52840 can be accessed from the module.

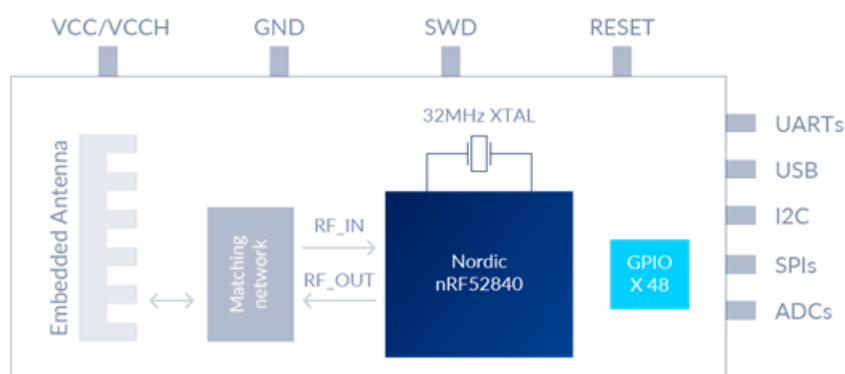


Figure 1. SGW1010 (Embedded Antenna) Block Diagram

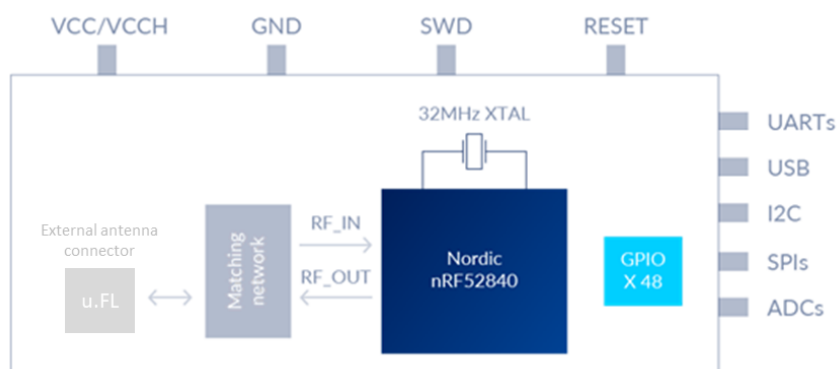


Figure 2. SGW1011 (External Antenna) Block Diagram

5. Pin Descriptions

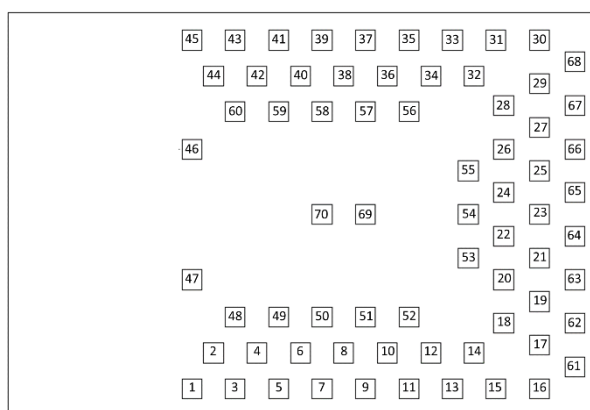


Figure 3. SGW1010/SGW1011 Pin Out (Top View)

Pin Number	Pin Name	Function	Description
6	P0.25	Digital I/O	General purpose I/O
7	P0.26	Digital I/O	General purpose I/O
8	P0.27	Digital I/O	General purpose I/O
9	P0.28	Digital I/O, Analog Input	General purpose I/O, AIN4 ⁽¹⁾
10	P0.29	Digital I/O, Analog Input	General purpose I/O, AIN5 ⁽¹⁾
11	P0.30	Digital I/O, Analog Input	General purpose I/O, AIN6 ⁽¹⁾
12	P0.31	Digital I/O, Analog Input	General purpose I/O, AIN7 ⁽¹⁾
13	P0.00	Digital I/O, Analog Input	General purpose I/O, XTAL1 (32.768kHz)
14	P0.01	Digital I/O, Analog Input	General purpose I/O, XTAL2 (32.768kHz)
15	P0.02	Digital I/O, Analog Input	General purpose I/O, AIN0 ⁽¹⁾
19	P0.03	Digital I/O, Analog Input	General purpose I/O, AIN1 ⁽¹⁾
20	P0.04	Digital I/O, Analog Input	General purpose I/O, AIN2
21	P0.05	Digital I/O, Analog Input	General purpose I/O, AIN3
22	P0.06	Digital I/O	General purpose I/O
23	P0.07	Digital I/O	General purpose I/O, TRACE_CLK
24	P0.08	Digital I/O	General purpose I/O

Pin Number	Pin Name	Function	Description
25	P0.09	Digital I/O	General purpose I/O, NFC1 ⁽¹⁾
26	P0.10	Digital I/O	General purpose I/O, NFC2 ⁽¹⁾
27	P0.11	Digital I/O	General purpose I/O, TRACE_D2
28	P0.12	Digital I/O	General purpose I/O, TRACE_D1
31	P0.13	Digital I/O	General purpose I/O
32	P0.14	Digital I/O	General purpose I/O
33	P0.15	Digital I/O	General purpose I/O
34	P0.16	Digital I/O	General purpose I/O
35	P0.17	Digital I/O	General purpose I/O
36	P0.21	Digital I/O	General purpose I/O
37	P0.19	Digital I/O	General purpose I/O
38	P0.20	Digital I/O	General purpose I/O
39	P0.18	Digital I/O	General purpose I/O, nRESET
40	P0.22	Digital I/O	General purpose I/O
41	P0.23	Digital I/O	General purpose I/O
42	P0.24	Digital I/O	General purpose I/O
43	SWCLK	In	Serial wire debug clock input
44	SWDIO	Out	Serial wire debug I/O
48	P1.05	Digital I/O	General purpose I/O ⁽¹⁾
49	P1.06	Digital I/O	General purpose I/O ⁽¹⁾
50	P1.07	Digital I/O	General purpose I/O ⁽¹⁾
51	P1.08	Digital I/O	General purpose I/O
52	P1.09	Digital I/O	General purpose I/O, TRACE_D3
53	P1.10	Digital I/O	General purpose I/O ⁽¹⁾
54	P1.11	Digital I/O	General purpose I/O ⁽¹⁾
56	P1.00	Digital I/O	General purpose I/O, TRACE_D0, SWO

Pin Number	Pin Name	Function	Description
57	P1.01	Digital I/O	General purpose I/O ⁽¹⁾
58	P1.02	Digital I/O	General purpose I/O ⁽¹⁾
59	P1.03	Digital I/O	General purpose I/O ⁽¹⁾
60	P1.04	Digital I/O	General purpose I/O ⁽¹⁾
61	P1.12	Digital I/O	General purpose I/O ⁽¹⁾
62	P1.13	Digital I/O	General purpose I/O ⁽¹⁾
63	P1.14	Digital I/O	General purpose I/O ⁽¹⁾
64	P1.15	Digital I/O	General purpose I/O ⁽¹⁾
67	USB-D-	Digital I/O	USB-Data-
68	USB-D+	Digital I/O	USB-Data+
69,70	TEST	TEST PADs	Connect to Electrical Ground in application
66	VBUS	Power	5 V input for USB 3.3 V regulator
17	VCC	Power	Normal Mode: 1.7 V to 3.6V in High Voltage Mode: 1.8 V to 3.3 V supply out
65	VCCH	Power	Normal Mode: Connect to VCC High Voltage Mode: 2.5 V to 5.5 V in
1, 2, 3, 4, 5, 16, 18, 29, 30, 45, 46, 47, 55	GND	Power	Electrical Ground

REMARK:

(1): These pins are in close proximity to the nRF52840 radio power supply and antenna pins. Radio performance parameters may be affected by high frequency digital I/O with large sink/source current on these pins. Nordic recommends using only low frequency, low drive functions when possible.

Table 2. SGW1010/SGW1011 Pins Description

6. Electrical Specifications

6.1. Absolute Maximum Ratings

Symbol	Parameter	Min.	Max.	Unit
VCC _{max}	Voltage on VCC supply pin	-0.3	3.9	V
VCCH _{max}	Voltage on VCCH supply pin	-0.3	5.8	V
VBUS _{max}	Voltage on VBUS supply pin	-0.3	5.8	V
VIO _{max}	Voltage on GPIO pin (VCC > 3.6 V)	-0.3	3.9	V
VIO _{max}	Voltage on GPIO pin (VCC ≤ 3.6 V)	-0.3	VCC+0.3 V	V
T _{storage}	Storage Temperature Range	-40	125	°C

Table 3. Absolute Maximum Ratings

6.2. Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
VCC	VCC Operating supply voltage	1.7	3.0	3.6	V
VCC	VCC DCDC Startup voltage	1.75	3.0	3.6	V
VCCH	VCCH Operating supply voltage	2.5	3.7	5.5	V
VBUS	VBUS USB supply voltage	4.35	5.0	5.5	V
T _{R_VCC}	VCC Supply Rise time (0V to 1.7 V)			60	ms
T _{R_VCCH}	VCCH Supply Rise time (0V to 3.7 V) ⁽¹⁾			100	ms
T _{Ambient}	Operating Temperature Range	-40		85	°C

REMARK:

(1): Applicable to module configures as nRF52840 HV mode.

Table 4. Operating Conditions

7. Module Interface

7.1. Power Management

7.1.1. Module supply input (VCC & VCCH).

The SGW101X series modules use integrated two step-down regulators (REG0 & REG1) to transform the supply voltage presented at the VCC & VCCH pins into a stable system voltage. Each regulator can be programmed as Low-dropout regulator (LDO) or Buck regulator (DC/DC), depending on the operating mode of the module. There are two operating modes for the module which depends on the VCC and VCCH configuration:

- Normal/Low Voltage (LV) mode
- High Voltage (HV) mode

Mode	Pin No	Pin Name	Connection
Normal	17	VCC	1.7 V to 3.6 V supply source input
	65	VCCH	Same as VCC
High Voltage	17	VCC	1.8 V to 3.3 V output voltage for module internal operating supply
	65	VCCH	2.5 V to 5.5 V supply source input

REMARK:

In LV or HV mode, the GPIO logic level is determined by the VCC pin.

Table 5. Power Mode Pin connections

7.1.2. USB Power input (VBUS).

The USB interface of the SGW101X series can be used in either Normal (LV) or High Voltage mode. The inside USB peripheral has a dedicated internal voltage regulator for converting the VBUS supply to 3.3 V.

7.1.3. Low Voltage Power Mode Example.

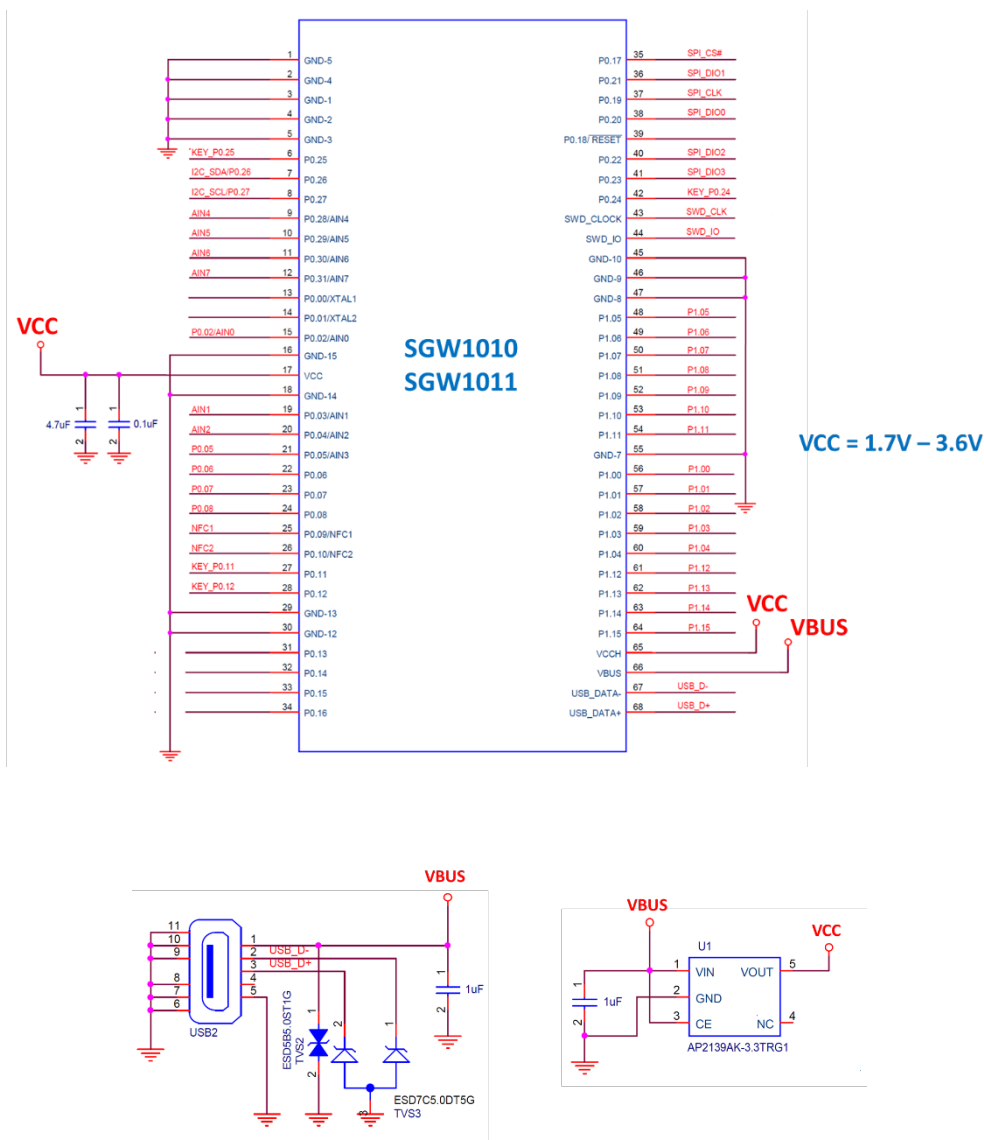


Figure 4. SGW1010/SGW1011 Low Voltage Mode Application Example

7.1.4. High Voltage Power Mode Example.

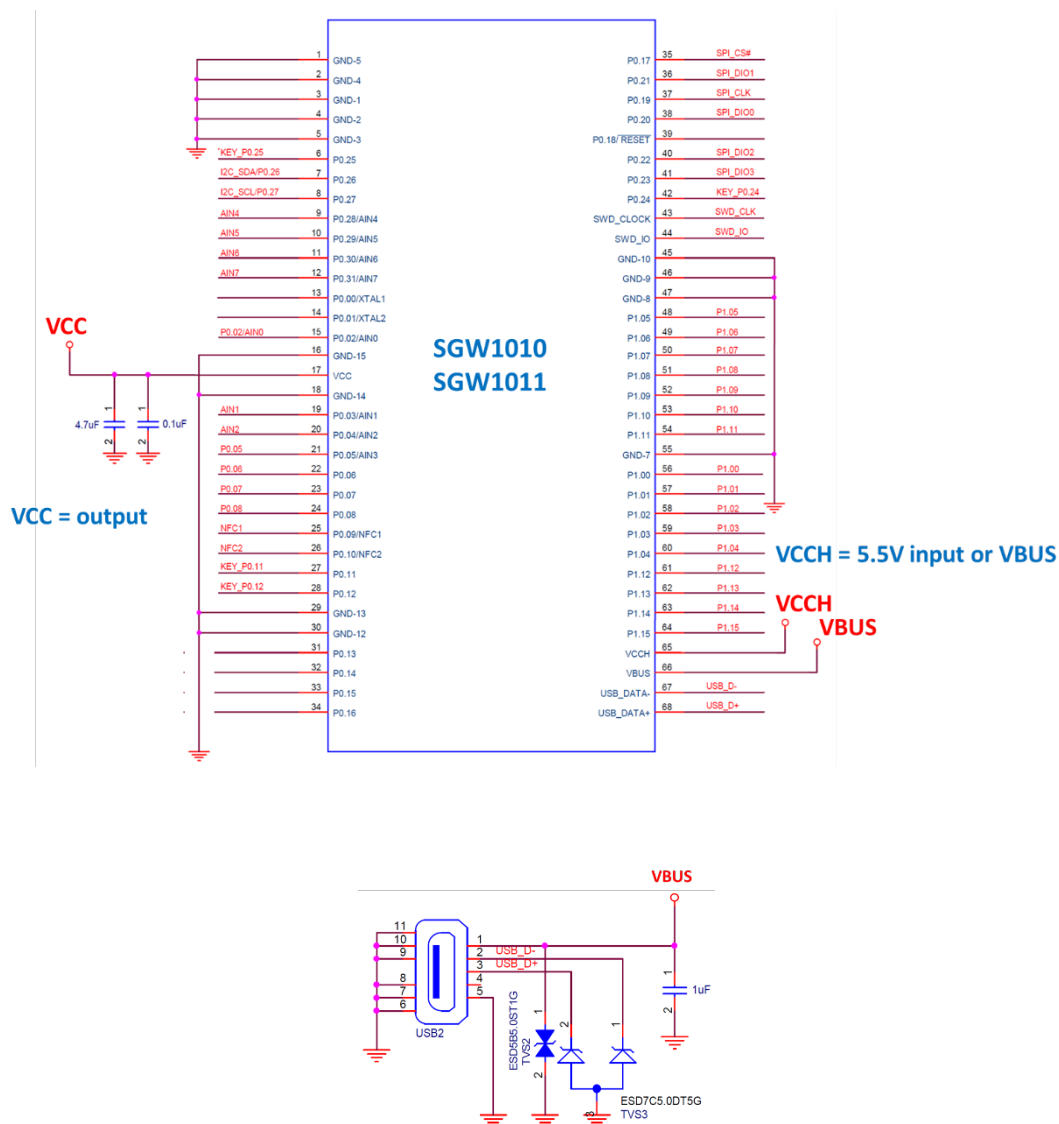


Figure 5. SGW1010/SGW1011 High Voltage Mode Application Example

7.2. RF Antenna Interface

7.2.1. 2.4 GHz radio.

The SGW101X series BLE modules have their own 2.4 GHz antenna solutions respectively:

- The SGW1010 modules use a PCB trace antenna integrated into the module's PCB. This low-profile antenna solution is useful in space constrained designs.
- The SGW1011 modules provide an onboard antenna connector with a nominal characteristic impedance of 50Ω.

7.2.2. Near Field Communication (NFC).

The SGW101X series modules include a Near Field Communication interface capable of operating as a 13.56 MHz NFC tag, at a bit rate of 106 kbps. As an NFC tag, the data can be read from or written to the SGW101X modules using an NFC reader.

Two pins are available for connecting to an external NFC antenna: NFC1 (P0.09) and NFC2 (P0.10).

7.3. General Purpose I/O

There are a total 48 available GPIO pins for user application. Each pin can be programmable individually with the following configurable features:

- Input/output direction
- Output drive strength
- Internal pull-up and pull-down resistors
- Wake-up from high or low-level triggers on all pins
- Trigger interrupt on all pins
- All pins can be individually configured as serial interface or quadrature demodulator signals

Symbol	Parameter	Min.	Typ.	Max.	Unit
V _{IH}	Input High Voltage	0.7 x V _{CC}		V _{CC}	V
V _{IL}	Input Low Voltage	V _{SS}		0.3 x V _{CC}	V
V _{OH}	Output High Voltage	V _{CC} - 0.4		V _{CC}	V
V _{OL}	Output High Voltage	V _{SS}		V _{SS} + 0.4	V
R _{PU}	Pull-up Resistance	11	13	16	kΩ
R _{PD}	Pull-down Resistance	11	13	16	kΩ

Table 6. GPIO Pin information

7.3.1. Serial interfaces.

The SGW101X series provides the following serial communication interfaces:

- 2x UART interfaces: 4-wire universal asynchronous receiver/transmitter interface used for AT command interface, data communication, and u-connect software upgrades using the Software update +UFWUPD AT command
- 3x SPI interfaces: Up to three serial peripheral interfaces can be used simultaneously
- 1x QSPI interface: High speed interface used to connect to the external flash memories
- 2x I2C interfaces: Inter-Integrated Circuit (I2C) interface for communication with digital sensors
- 1x I2S interface: Used to communicate with external audio devices
- 1x USB 2.0 interface: The USB device interface to connect to the upstream host

7.3.2. Analog interfaces.

8 out of the 48 digital GPIOs can be multiplexed to analog functions. The following analog functions are available:

- 1x 8-channel ADC
- 1x Analog comparator (*)
- 1x Low-power analog comparator (*)

REMARK:

(*): Only one comparator can be used at any given point of time.

7.3.3. Module Reset.

The modules can be reset using one of the following ways:

- Low level on the nRESET (P0.18) input pin, normally kept high using an internal pull-up. This causes an “external” or “hardware” reset of the module
- Using the AT+CPWROFF command. This causes an “internal” or “software” reset of the module

7.3.4. Debug and Programming interfaces.

The SGW101X series modules provide an SWD interface for flashing and debugging. The SWD interface consists of two pins - SWDCLK and SWDIO.

The SGW101X series modules also support parallel trace output. This allows output from the Embedded Trace Macrocell (ETM) and Instrumentation Trace Macrocell (ITM) embedded in

the Arm Cortex-M4 core of the nRF52840 chip. The ETM trace data allows a user to record exactly how the application goes through the CPU instructions in real time. The parallel trace interface uses 1 clock signal and 4 data signals respectively - TRACE_CLK, TRACE_D0, TRACE_D1, TRACE_D2 and TRACE_D3.

7.3.5. Clocks.

The SGW101X series module requires two clocks: High frequency and low frequency clock.

The high frequency clock is provided by the on-board 32MHz crystal. For the low frequency clock, it supports several low frequency 32.768kHz clock sources: RC oscillator and external crystal.

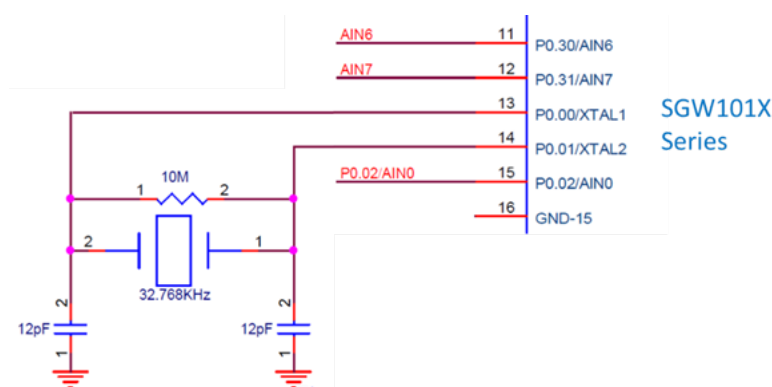


Figure 6. Low frequency clock reference circuit

8. Mechanical Dimension

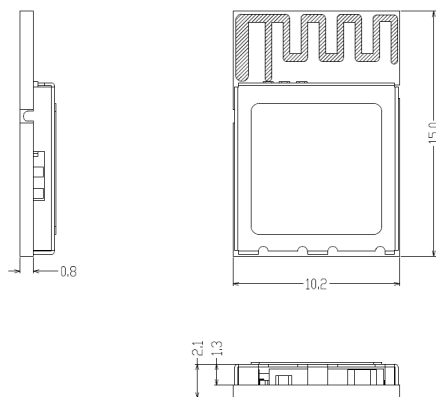


Figure 7. SGW1010 (Embedded Antenna) Mechanical Information

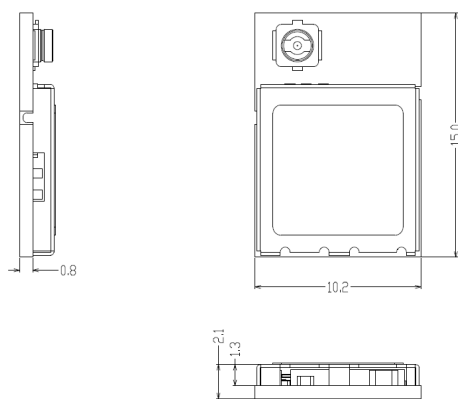


Figure 8. SGW1011 (External Antenna) Mechanical Information

9. Recommended PCB Landing Pattern & Pad Locations

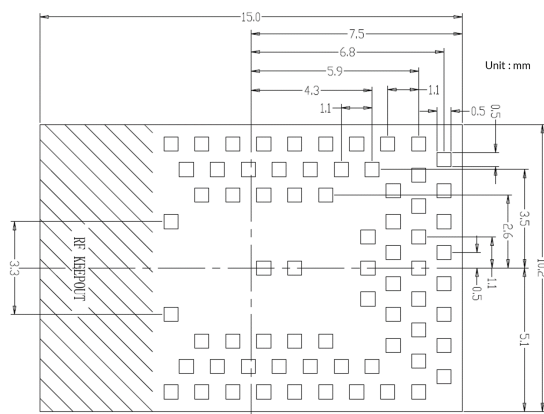


Figure 9. SGW1010/SGW1011 Dimension (Top View)

10. Module Marking

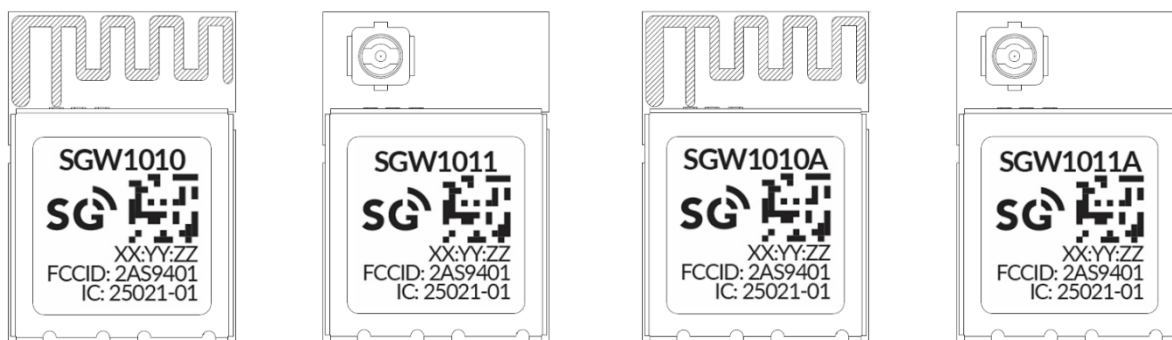


Figure 10. SGW1010/SGW1011 Module label

11. Soldering Temperature-Time Profile for Re-Flow Soldering

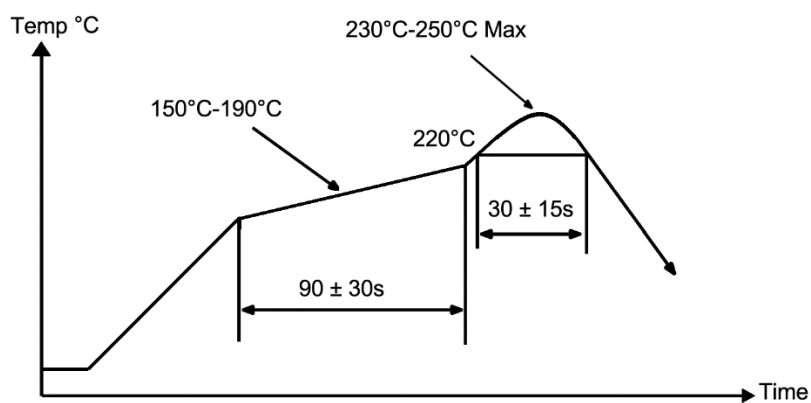


Figure 11. Soldering Temperature-Time Profile for Re-Flow Soldering

REMARK:

SGW1010 and SGW1011 is rated as MSL 3, 168-hour floor life after opening.

12. Certifications

12.1. Qualified Antenna Type

The SGW1011 and SGW1011A module, supporting an external antenna, have been designed to operate with a standard 3 dBi dipole antenna. Any antenna of a different type or with a gain higher than 3 dBi is strictly prohibited for use with this device. Using an antenna of a different type or gain more than 3 dBi will require additional testing for FCC, CE and IC. The required antenna impedance is 50 Ω .

Manufacturer	Part Number	Max. Gain	Antenna Type	Size
Master Wireless	JZC-RPF-N-ZBG19	1/4 wave Dipole	1/4 wave Dipole	Length: 196mm

12.2. Bluetooth

The SGW101X series are pre-qualified as a Low Energy RF-PHY tested component, having Declaration ID of D046088 and QDID of TBD. This allows customers to use different SoftDevices that have been qualified by Nordic without the need to complete additional RF-PHY testing.

To achieve Bluetooth End Product qualification, the SG Wireless RF-PHY QDID can be combined with Nordic QDIDs for the SoftDevice used when filing on the Bluetooth SIG website. The only testing required is for the Bluetooth profiles supported by the customer's product. Products with only custom profiles do not require any additional testing.

12.3. FCC Statement

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

12.3.1. FCC RF Exposure Information and 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 of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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 undesirable operation.

Any changes or modifications not expressly approved by SG Wireless could void the user's authority to operate the equipment.

12.3.2. OEM Responsibilities to comply with FCC Regulations:

OEM integrator is responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures.

12.3.3. Important Note:

In the event that the above conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

12.3.4. End Product Labeling.

The variants of SGW101X series are labeled with their own FCC ID. If the FCC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

"Contains FCC ID: 2AS9401"

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

12.4. IC Statement

EN: This device complies with RSS-247 of Industry Canada. 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.

RF exposure warning: This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

FR: 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.

Avertissement d'exposition RF: Cet équipement est conforme aux limites d'exposition aux rayonnements de la IC établies pour un environnement non contrôlé. Cet équipement doit être installé et fonctionner à au moins 20cm de distance d'un radiateur ou de votre corps.

12.4.1. OEM Responsibilities to comply with IC Regulations.

The SGW101X series have been certified for integration into products only by OEM integrators under the following conditions:

- The antenna(s) must be installed such that a minimum separation distance as stated above is maintained between the radiator (antenna) and all persons at all times

- The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter

As long as the two conditions above are met, further transmitter testing will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

12.4.2. Important Note:

In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the ISED authorization is no longer considered valid and the IC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate ISED authorization.

12.4.3. End Product Labeling.

The SGW101X series are labeled with its own IC ID. If the IC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. In that case, the final end product must be labeled in a visible area with the following:

“Contains IC: 25021-01”

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module or change RF related parameters in the user manual of the end product.

12.5. CE Statement

12.5.1. Declaration of Conformity.

The SGW101X series are in conformity with the essential requirements and other relevant requirements of the Radio Equipment Directive (RED) (2014/53/EU). Please note that every application using the BGM13S22 will need to perform the radio EMC tests on the end product, according to EN 301 489-17. It is ultimately the responsibility of the manufacturer to ensure the compliance of the end-product.

The SGW101X series are in conformity with the essential requirements and other relevant requirements of the radio Equipment Directive (RED) at rated 7 dBm transmit power. The operating frequency range is 2402-2480MHz.

The full text of the EU declaration of conformity is available at the following internet address:
www.sgwireless.com.

This device may be used in each EU member state.

13. Product Packaging

Carrier Tape dimension for SGW1010/SGW1011.

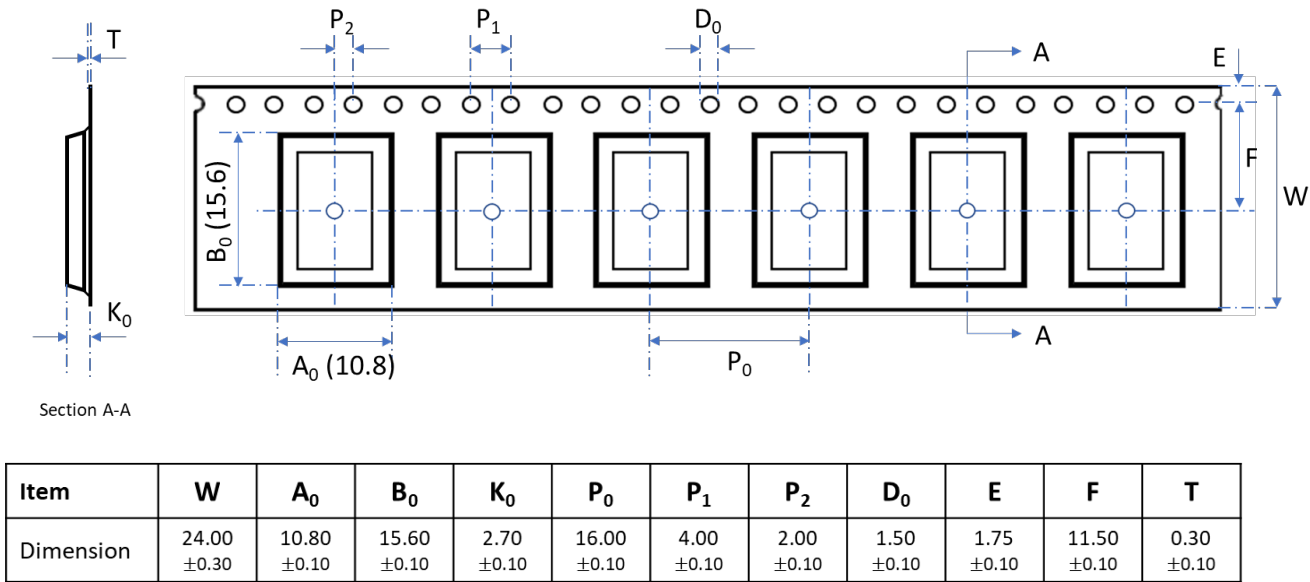


Figure 12. SGW1010/SGW1011 Tape Dimensions

Reel Packaging: 1000 modules will be loaded into the reel. Each reel will be placed in an antistatic bag and put into a 340 x350x45mm box as shown in below diagram.

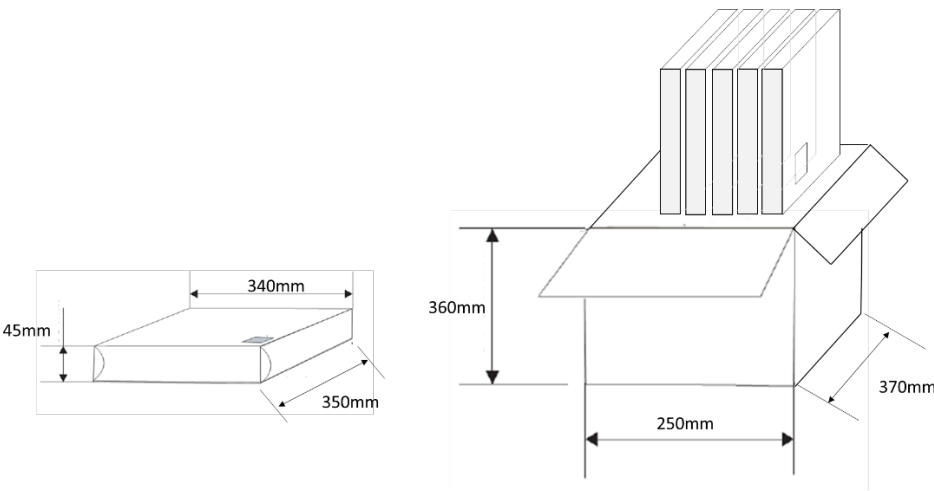


Figure 13. SGW1010/SGW1011 Reel Packaging

Packaging Label.



Figure 14. SGW1010/SGW1011 Packaging Label

14. Revision History

Revision	Date	Description
1.0	Jul 25, 2019	Initial Release

15. Useful Links

1. Nordic Info center: <https://infocenter.nordicsemi.com/index.jsp>. All the necessary technical files and software development kits of Nordic's chip are on this website.
2. Nordic Developer Zone: <https://devzone.nordicsemi.com/questions/>. A highly recommended website for firmware developer. Interact with other developers and Nordic's employees will help with your questions. The site also includes tutorials in detail to help you get started.
3. Official Page of nRF52840: <https://www.nordicsemi.com/eng/Products/nRF52840>. A brief introduction to nRF52840 and download links for Nordic's developing software and Soft Devices.