

DATASHEET

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1. Introduction

SVN-840C is a powerful, highly flexible, ultra-low power multiprotocol 2.4GHz transceiver system on module (SoM). It integrates Bluetooth 5 (Bluetooth Low Energy) into a low power system using the Nordic nRF52840 SoC. With an ARM® Cortex™ M4F CPU, integrated chip antenna, 2.4GHz radio, and increased integration with USB and 5.5V compatible DC/DC supply, the SVN-840C allows for shorter development time and lower cost as well as reduced time to market.

2. Features

- Nordic nRF52840 with ARM Cortex M4F, 64 MHz
- ARM Trust Zone Cryptocell-310 co-processor
- Bluetooth 5, ANT, 2.4 GHz transceiver
 - o -95dBm sensitivity in 1Mbps Bluetooth low energy (BLE) mode
 - o -103dBm sensitivity in 125Kbps BLE mode (long range)
 - o +8 dBm TX power (down to -20 dBm in 4 dB steps)
 - o On-air compatible with nRF52, nRF51, nRF24L and nRF24AP Series
 - o Supported data rates:
 - Bluetooth 5: 2 Mbps, 1 Mbps, 500 kbps, 125 kbps
- Complete RF solution with integrated chip antenna
- Integrated DC-DC converter
- Memory: 1MB flash / 256KB RAM
- HW accelerated security
 - o ARM® Trust Zone® Crypto cell 310 Security
 - o 128 bit AES / ECB / CCM / AAR co-processor (on-the-fly packet encryption)
- Advanced on-chip interfaces
 - o USB 2.0 full speed (12Mbps) controller
 - o QSPI 32MHz interface
 - o High speed 32MHz SPI
 - o Type 2 near field communication (NFC-A) tag with wake-on field and Touch to Pair support
 - o Programmable Peripheral Interconnect (PPI), 20 Channels, CPU independent
 - o Type 2 near field communication (NFC-A) tag with wake-on field and Touch to Pair support
 - o 48 general purpose I/O pins
 - o EasyDMA automated data transfer without CPU processing on peripherals
 - o 12 bit, 200ksps ADC – 8 configurable channels with programmable gain
 - o 4 x 4 channel pulse width modulator (PWM) units with EasyDMA
 - o I2S, digital microphone interface (PDM)
 - o 5 X 32-bit, 3 x 24-bit real-time counters (RTC)
 - o Up to 4 x SPI masters / 3 x SPI slaves with EasyDMA
 - o Up to 2 x I2C compatible 2-wire masters / slaves
 - o 2 x UART(CTS/RTS) with EasyDMA
 - o Quadrature Demodulator (QDEC)
 - o Temperature sensor
- Dimensions: 16 x 10.8 x 1.9 mm
- Flexible power management
 - o Supply voltage range 1.7V to 5.5V
 - o On-chip DC/DC and LDO regulators with automated low current modes
 - o Regulated supply for external components from 1.8V to 3.3V
 - o Automated peripheral power management
 - o Fast wake-up using 64MHz internal oscillator
 - o 0.4uA at 3V in OFF mode, no RAM retention
 - o 1.5uA at 3V in ON mode, no RAM retention, wake on RTC

3. Applications

- Secure Internet of Things
- Industrial IoT Controllers
- Advanced Remote Controls
- Low Power Sensor Networks
- Access Control
- Environmental Monitoring
- Climate Control
- Smart Home Devices
- Smart City Networks
- Smart Energy Management
- Connected Appliances
- Health/Fitness monitoring
- Medical Devices
- Connected Watch
- Gaming Controllers

4. Block Diagram

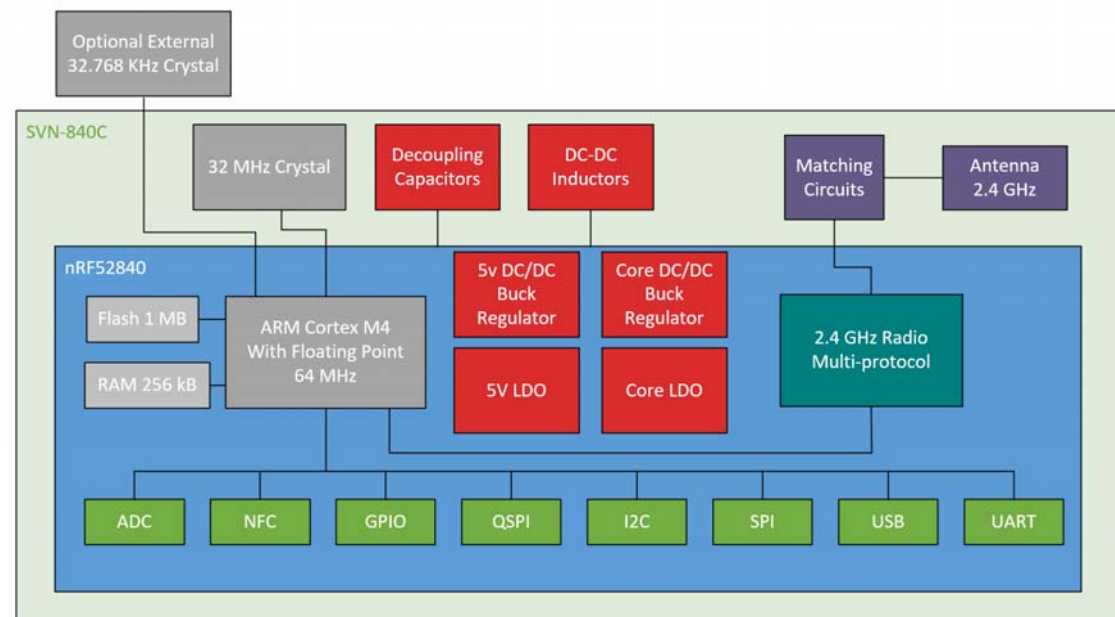


Figure 1: SVN-840C Block Diagram

5. Specification

5.1 Absolute Maximum Rating

Symbol	Parameter	Minimum	Maximum	Unit
VDD Max	Voltage on VDD supply in	-0.3	3.9	V
VDDH Max	Voltage on VDDH supply in	-0.3	5.8	V
VBUS Max	Voltage on VBUS supply in	-0.3	5.8	V
VIO Max	Voltage on GPIO pin (VCC>3.6V)	-0.3	3.9	V
VIO Max	Voltage on GPIO pin (VCC≤3.6V)	-0.3	VCC+0.3V	V
T _{Storage}	Storage temperature range	-40	125	°C

Table 1: Absolute Maximum Ratings

5.2 Operating Condition

Symbol	Parameter	Minimum	Typical	Maximum	Unit
VDD In	VDD operating supply voltage in	1.7	3.0	3.6	V
VDD DC/DC	VDD DC/DC starting voltage	1.75	-	-	V
VDDH In	VDDH operating supply voltage in	2.5	5.0	5.5	V
Rise Time VDD	VDD supply rise time (0V to 1.7V)	4.35	5.0	5.5	V
Rise Time VDDH	VDDH supply rise time (0V to 3.7V) ¹	-	-	60	ms
VBUS IN	VBUS operating supply voltage in	-	-	1	ms
T _{Ambient}	Operating ambient temperature range	-40	25	85	°C

Table 2: Operating Conditions

6. Electrical Specifications

6.1 Power and DC-DC Configuration

Important note for REG0 of the Nordic nRF52840.

Initial mass production silicon (Nordic Rev1) for the nRF52840 includes some errata that affect the REG0 regulator. The REG0 DC-DC converter mode cannot be used reliably. The LD0 mode of REG0 can be used in high voltage mode but when applying power, the input voltage must have a rise time of 1ms or less. Due to the rise time constraints and higher current consumption of LD0 mode compared to DCDC, high voltage mode should be considered non – functional for most application and should not be used on SVN-840C modules see Nordic nRF52840 errata 197 and 202 for more details. These errata are expected to be corrected in future production silicon release and subsequent revisions of the SVN-840 module.

The SVN-840 has two internal regulator stages REG0 and REG1 that each contains an LD0 and DC-DC regulator. The REG0, is fed by the VDDH pin and can accept a source voltage of 2.5V to 5.5V and its output is connected to the VDD pin and the input of the second regulator stage REG1.

The second Regulator (REG1) supplies power to the module core and can accept an input source voltage of 1.7V to 3.6V. Depending on how the VDD and VDDH pin are connected, the module will operate in one of two modes:

Normal/low voltage or high voltage. Regardless of power mode, the voltage present on the VDD pin is a the GPIO high logic level voltage. In both LV and HV mode, the GPIO logic level voltage is determined by the VDD in. In HV mode, all external devices that are connected to the SVN-840's GPIO must either be powered by the module (from VDD) or use level translation.

When the source voltage is applied to both VDD and VDDH using REG0 to automatically shut down leaving only the REG1 stage active, at this stage the module will enter the LV mode. Similarly, when the source voltage is only applied to VDDH causing the VDD pin to become an output source supplied by REG0, thus the module will enter HV mode.

Mode	Pin	Name	Connection
Normal (LV)	38	VDD	1.7 – 3.6V source in
	39	VDDH	Same source as VCC
High voltage (HV)	38	VDD	1.8V – 3.3V supply out
	39	VDDH	2.5V – 5.5V source in

Table 3: Power Mode Pin Selection and Connections

6.1.1 USB Power Configuration

The USB interface on the SVN-840C can be used when the module is in either normal (LV) or high voltage (HV) mode. The SVN-840C USB PHY is powered by a dedicated, internal LDO regulator that is fed by the VBUS pin (40). This means VBUS power cannot power the rest of the module. If you want to power from USB, you must connect to VDDH as well as VBUS or use an external low drop out regulator or DC/DC converter to power VDD. For the USB PHY to operate, VBUS must be externally powered. Examples in Figure 2 and Figure 3 below.

6.1.2 Normal (LV) power mode example

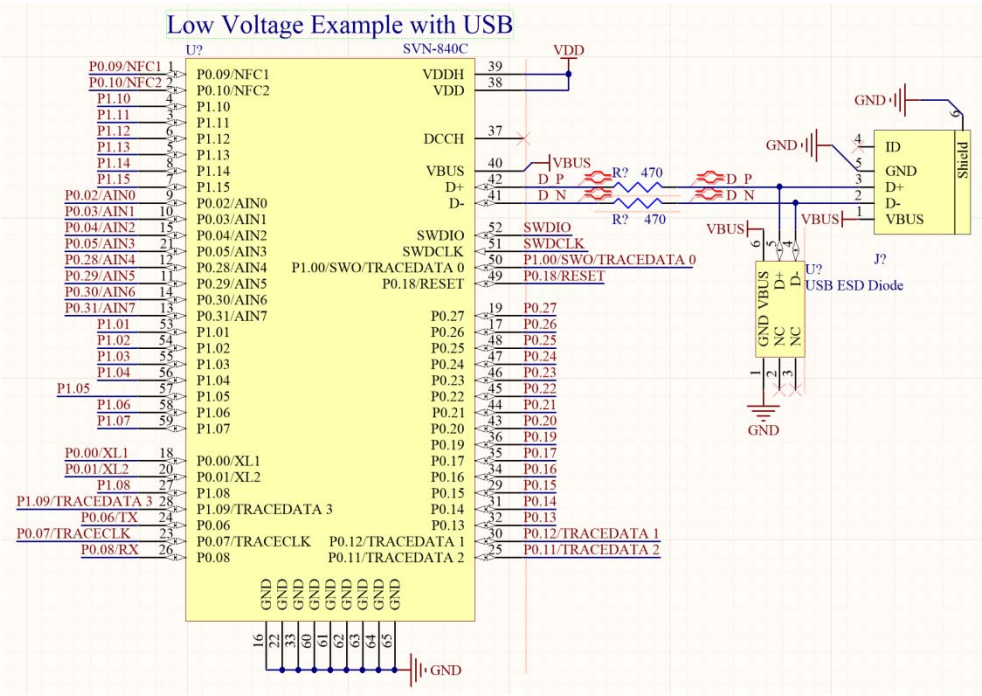


Figure 2: Normal (LV) Power Mode example

6.1.3 High voltage (HV) power mode example

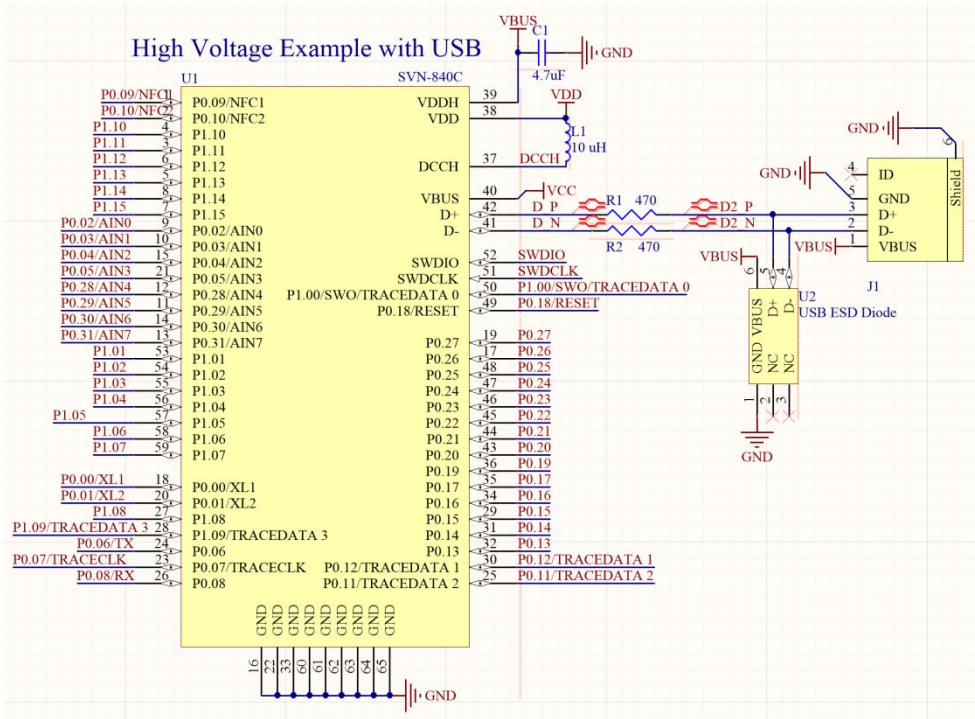


Figure 3: High Voltage (HV) Power Mode example

6.2 General Purpose I/O

The general purpose I/O pins are grouped in 2 ports of 48 GPIO pins in total. The first port allows access to pins P0.00 to P0.31 and the second allows access to pins P1.00 to P1.15.

The GPIO has the following user-configurable features:

- Input/output direction
- Output drive strength
- Internal pull-up and pull-down resistors
- Wake-up from high or low level trigger on all pins
- Trigger interrupt on state changes on all pins
- All pins can be used by the PPI task/events system; the maximum number of pins that can be interfaced through the PPI at the same time is limited by the number of GPIOTE channels

Symbol	Parameter	Minimum	Type	Maximum	Unit
V In High	Input high voltage	0.7*V _{cc}	-	V _{cc}	V
V In Low	Input low voltage	V _{ss}	-	0.3*V _{cc}	V
V Out High	Output high voltage	V-0.4	-	V _{cc}	V
V Out Low	Output low voltage	V _{ss}	-	V _{ss} +0.4	V
R Pull Up	Pull-up resistance	11	13	16	K
R Pull Down	Pull down resistance	11	13	16	K

Table 4:GPIO Electrical Characteristics

6.3 Module Reset

For hardware reset GPIO pin P0.18 may be used by setting the UICR register PSELRESET[0] and PSELRESET[1] to the value 0x7FFFFFFD2. When P0.18 is programmed as error!, the internal pull-up is automatically enabled. Nordic example applications and development kit programs use P0.18 as a reset.

6.4 Debug and Programming

The SVN-840C offers a flexible and power mechanism for non-intrusive debugging. It supports two pin Serial Wire Debug (SWD) interface. This allows for real time debugging with breakpoints, single stepping, and instruction trace capture of code execution flow.

The SVN-840 also supports ETM and ITM trace. Trace data from the ETM and the ITM are sent to an external debugger via a 4-bit wide parallel trace port interface unit (TPIU). In addition to parallel trace the TPIU supports serial trace via the serial wire output (SWO) trace protocol. Parallel and serial trace cannot be used at the same time. ETM trace is only supported in parallel trace mode, while ITM trace is supported in both parallel and serial trac modes.

6.5 Clocks

The SVN-840C has two clocks, a high frequency and low frequency clock. The high frequency clock is provided by an on module high accuracy 32 MHz crystal. The low frequency clock can be provided by an internal RC oscillator or synthesized from the high frequency clock or by an external 32.768 kHz crystal. The external low frequency crystal provides the lowest power consumption and the greatest accuracy. If using the internal RC oscillator for the low frequency clock it must be calibrated, see Nordic nRF52480 datasheet for details. It is recommended to use an external low frequency crystal when using BLE.

Symbol	Parameter	Typical	Maximum	Unit
F _{NOM_LFXO}	Crystal frequency	32.768	-	kHz
F _{TOL_LEFXO_BLE}	Frequency tolerance, BLE application	-	+250	Ppm
C _{CL_LFXO}	Load capacitance	-	12.5	pF
C _{CO_LFXO}	Shunt capacitance	-	2	pF
R _{S_LFXO}	Equivalent series resistance	-	100	K
C _{PIN}	Input capacitance on XL1 & XL2 pads	4	-	pF

Table 5: 32.768 kHz Crystal Requirements

7. Firmware

7.1 Easy, fast and safe code development

Nordic development environment for the nRF52840 has a clean separation between application code development and embedded protocol stack. The protocol stacks by Nordic are known as SoftDevices and are precompiled, pre-linked binary files. Because there is a separation of protocol and application code there is a removal of the challenges in debugging when using an embedded stack. The SoftDevices are available for download from the Nordic website. The SVN-840C Supports the S140 (BLE Central & Peripheral) SoftDevice and the features are listed on Nordics website.

7.2 Over-The-Air Device Firmware

The Over-The-Air Device Firmware Upgrade (OTA DFU) feature of nRF52840 allows for in the field updates of application software and softdevices.

7.3 Development Tools

For the nRF52 series of devices Nordic semiconductor provides a complete range of hardware and software development tools. For the firmware development nRF52480 DK board is recommended

Nordic software development tools can be downloaded from the following webpage:

<http://infocenter.nordicsemi.com/index.jsp?topic=%2Fcom.nordic.infocenter.gs%2Fdita%2Fgs%2Fgs.html&cp=1>

8. Product Descriptions

This is a brief description on the nRF52480 SoC that is on the module. For the full description of the SoC visit Nordic's website:

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

8.1 Block Diagram of nRF52480

The block diagram of Nordic nRF52480 Bluetooth Low energy (BLE) SOC is shown in Figure 4. The signals that share physical pins with other signals are indicated by arrows with white heads.

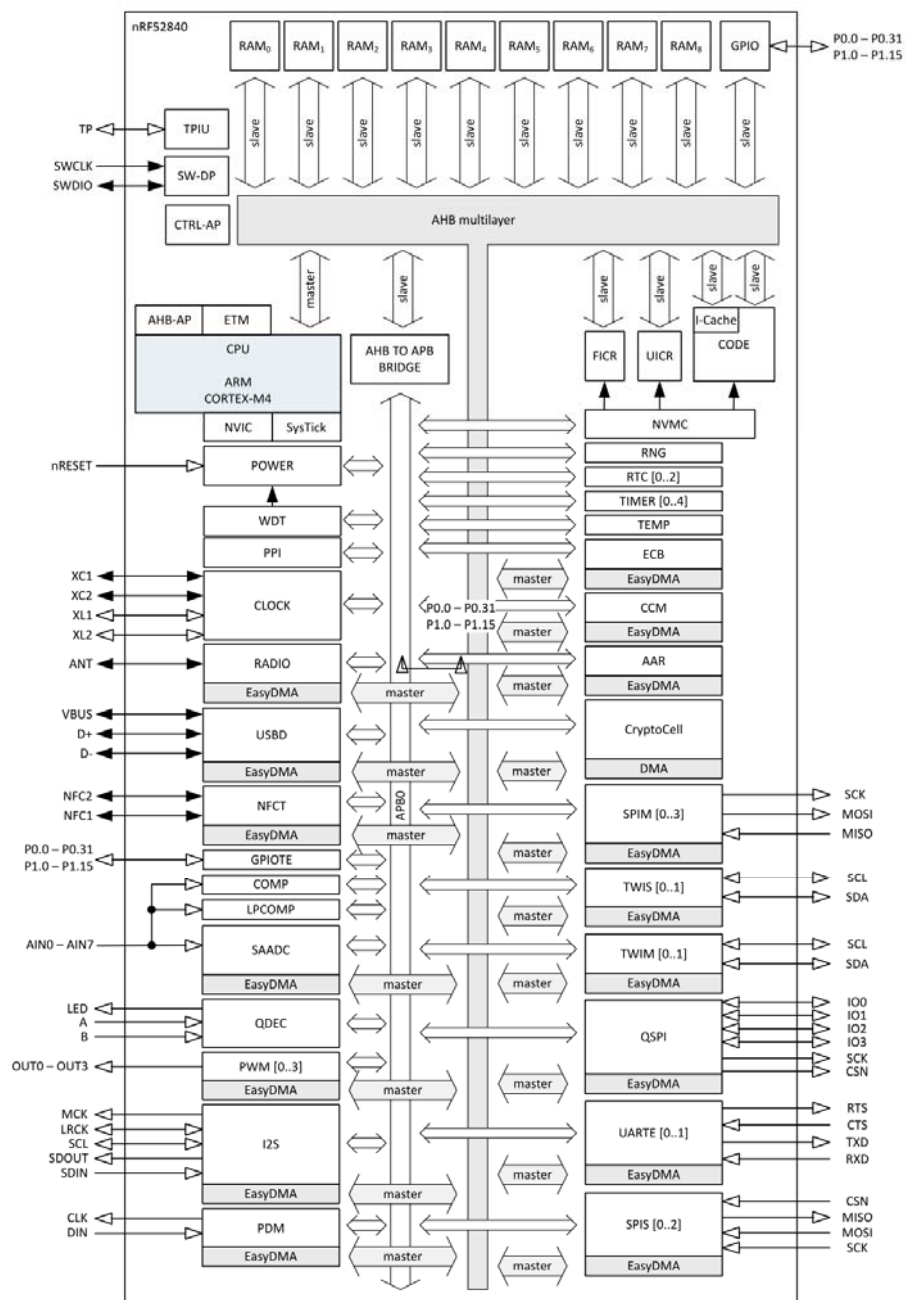


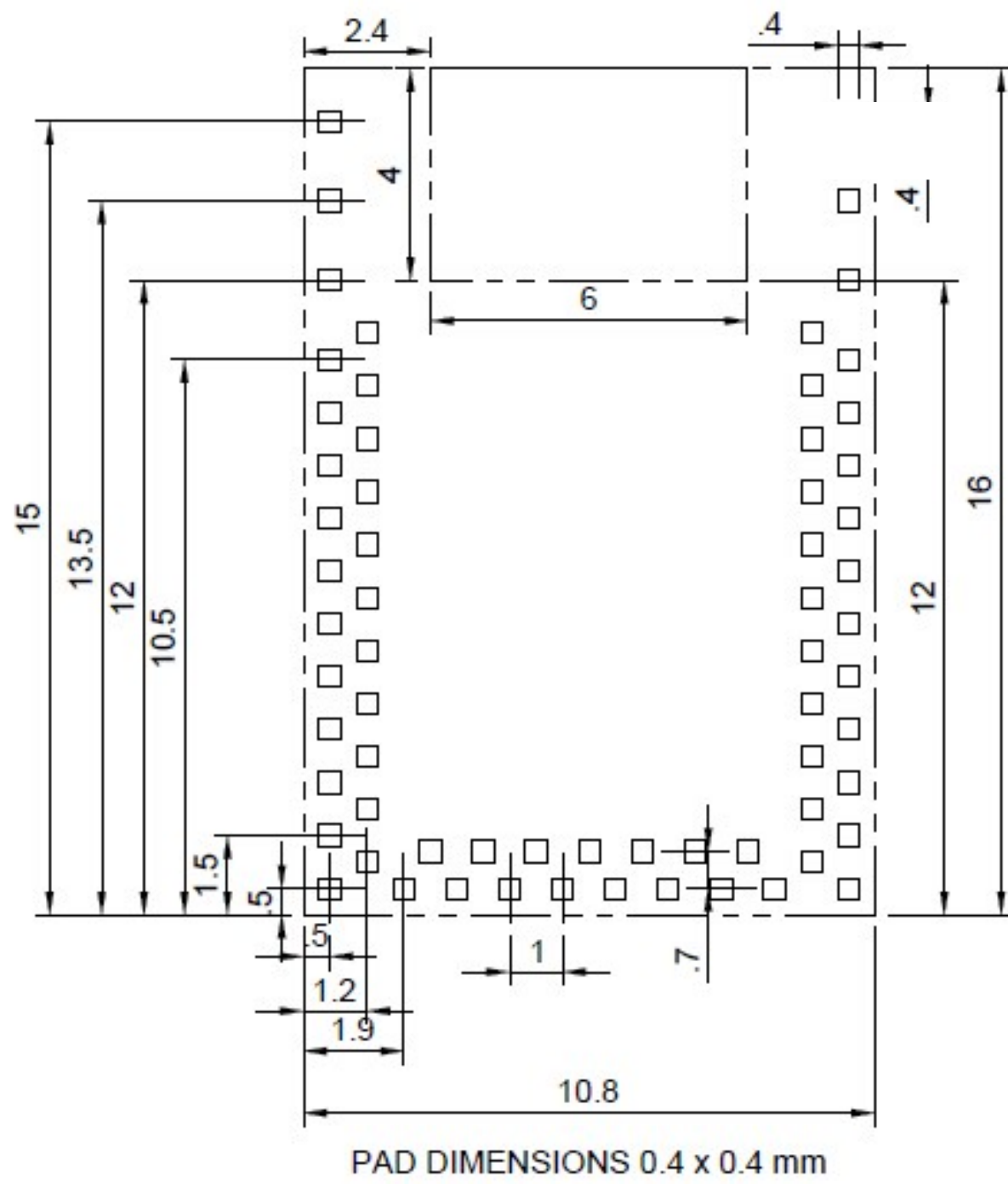
Figure 4: nRF52480 Block Diagram

The ARM® Cortex®-M4 processor with floating point unit (FPU) has an instruction set that maximized code density and performance over other ARM® Cortex® M-Series Microcontroller Units (MCU). A 20-channel bus provided by Programmable Peripheral Interconnects (PPI) system allows for a direct and autonomous system peripheral communication without CPU intervention. The CPU has 2 main power modes, ON and OFF, but all the internal system blocks and peripherals have their own power control systems. These systems allow each block to switch from RUN to IDLE state based on whether it is required or not by the current or particular tasks. Both the PPI system and the individual power management of system blocks allows for greater power saving than a standard MCU.

The radio supports Bluetooth Low Energy (BLE) and ANT. Power output is scalable up from -20 dBm to +8 dBm in steps of 4 dBm. For BLE the noise sensitivity is -96 dBm and for ANT it is -92.5 dBm. The noise sensitivity is changed depending on the data rate in a range of -103dBm to -93 dBm.

9. Product Descriptions and Drawings

9.1 Mechanical Drawings



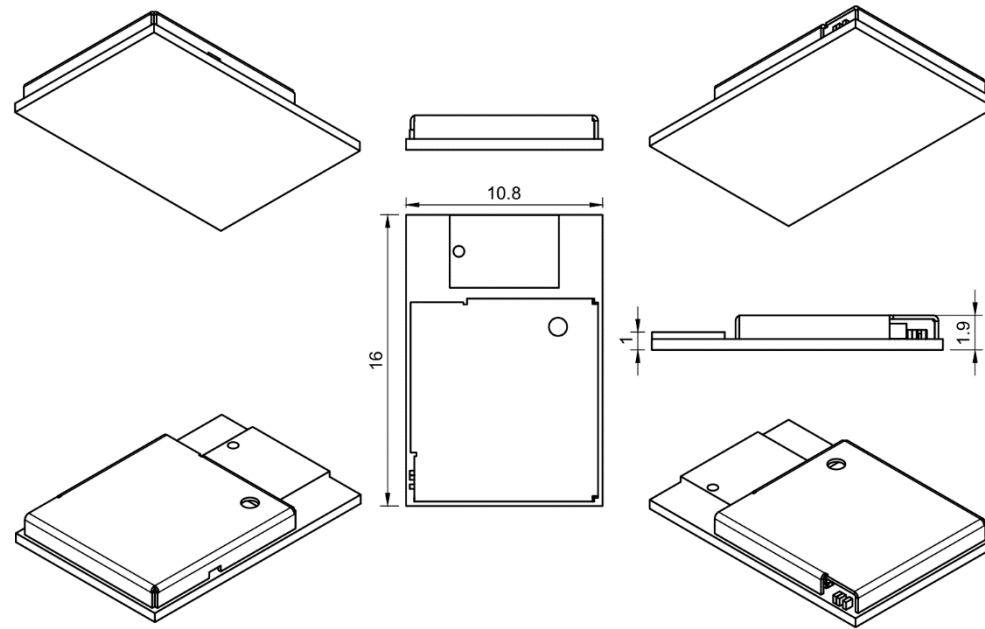


Figure 6: 3D View and Dimensions

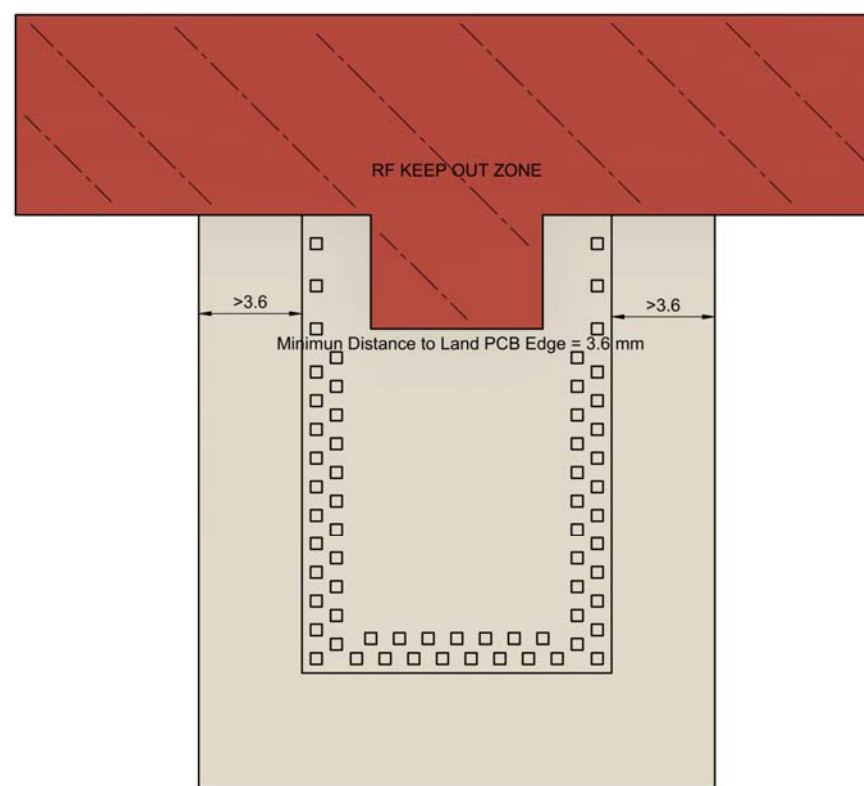


Figure 7: RF KEEP OUT ZONE (No Ground/Signals/Components)

9.2 Pin Assignments

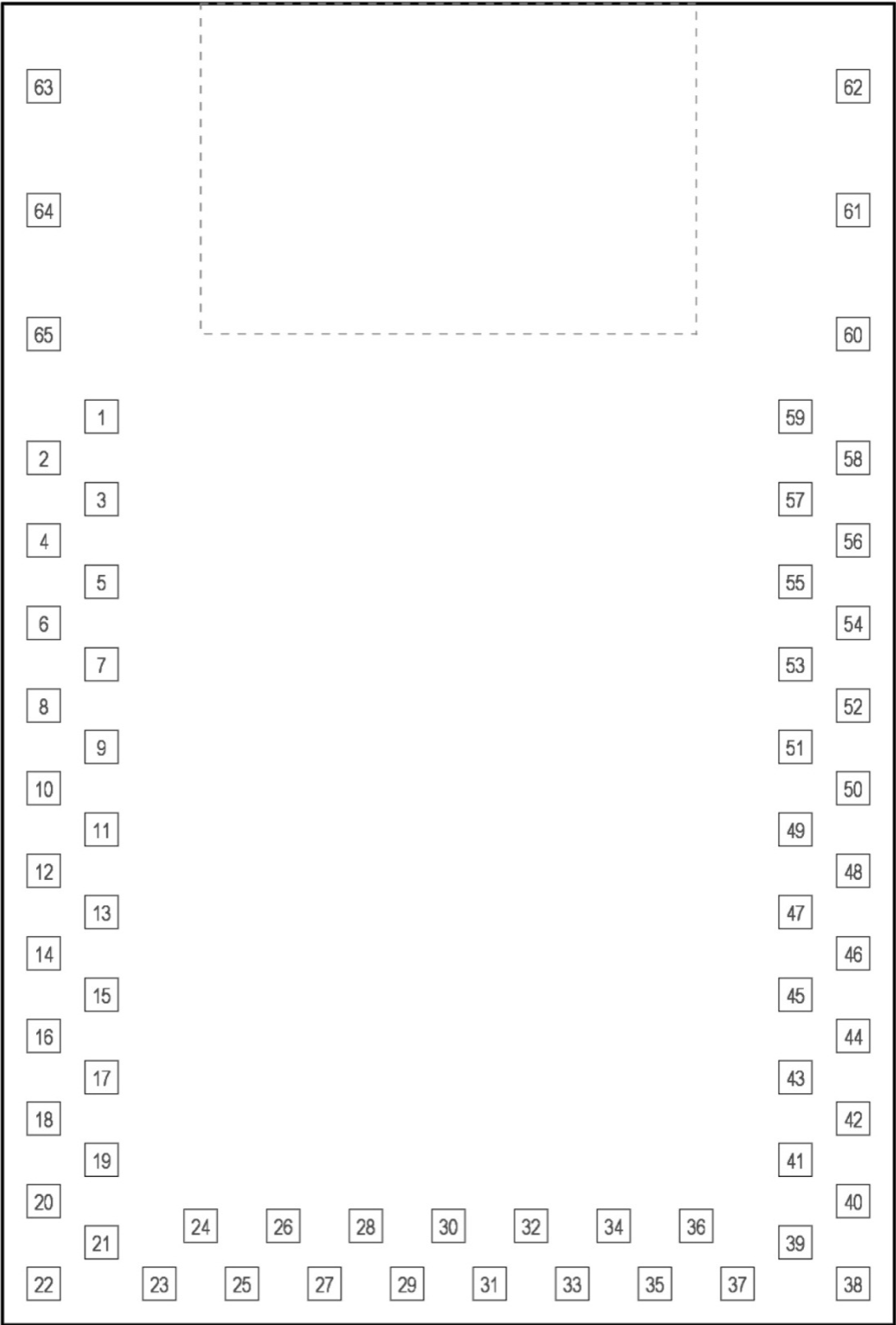


Figure 8: Pin Assignments

9.3 Pin Functions Table

PIN	Name	Type	Description
1	P0.09	Input/Output	GPIO/NFC1 ¹
2	P0.10	Input/Output	GPIO/NFC1 ¹
3	P1.11	Input/Output	GPIO ¹
4	P1.10	Input/Output	GPIO ¹
5	P1.13	Input/Output	GPIO ¹
6	P1.12	Input/Output	GPIO ¹
7	P1.15	Input/Output	GPIO ¹
8	P1.14	Input/Output	GPIO ¹
9	P0.02	Input/Output	GPIO/AIN0 ¹
10	P0.03	Input/Output	GPIO/AIN1 ¹
11	P0.29	Input/Output	GPIO/AIN5 ¹
12	P0.28	Input/Output	GPIO/AIN4 ¹
13	P0.31	Input/Output	GPIO/AIN7 ¹
14	P0.30	Input/Output	GPIO/AIN6 ¹
15	P0.04	Input/Output	GPIO/AIN2
17	P0.26	Input/Output	GPIO
18	P0.00	Input/Output	GPIO/XTAL1
19	P0.27	Input/Output	GPIO
20	P0.01	Input/Output	GPIO/XTAL2
21	P0.05	Input/Output	GPIO/AIN3
23	P0.07	Input/Output	GPIO/Trace Clock
24	P0.06	Input/Output	GPIO
25	P0.11	Input/Output	GPIO/Trace Data [2]
26	P0.08	Input/Output	GPIO
27	P1.08	Input/Output	GPIO
28	P1.09	Input/Output	GPIO/Trace Data [3]
29	P0.15	Input/Output	GPIO
30	P0.12	Input/Output	GPIO/Trace Data [1]
31	P0.14	Input/Output	GPIO
32	P0.13	Input/Output	GPIO
34	P0.16	Input/Output	GPIO
35	P0.17	Input/Output	GPIO
36	P0.19	Input/Output	GPIO
37	DCCH	Power	DC/DC Converter Output
38	VDD	Power Input/Output	Low Voltage Input: 1.7V-3.6V High Voltage Output: 1.8V-3.3V
39	VDDH	Power	Low Voltage: Connect to VDD High Voltage Input: 2.5V to 5.5V
40	VBUS	Power	USB Power
41	D-	Input/Output	USB Data -
42	D+	Input/Output	USB Data +
43	P0.20	Input/Output	GPIO
44	P0.21	Input/Output	GPIO
45	P0.22	Input/Output	GPIO

46	P0.23	Input/Output	GPIO
47	P0.24	Input/Output	GPIO
48	P0.25	Input/Output	GPIO
49	P0.18	Input/Output	GPIO/RESET
50	P1.00	Input/Output	GPIO/Trace Data [0]/SWO
51	SWDCLK	Input	SWD Clock
52	SWDIO	Input/Output	SWD IO
53	P1.01	Input/Output	GPIO ¹
54	P1.02	Input/Output	GPIO ¹
55	P1.03	Input/Output	GPIO ¹
56	P1.04	Input/Output	GPIO ¹
57	P1.05	Input/Output	GPIO ¹
58	P1.06	Input/Output	GPIO ¹
59	P1.07	Input/Output	GPIO ¹
16, 22, 33, 60, 61, 62, 63, 64, 65	GND	Power	Ground
Note 1: These pins are in close proximity to the nRF52480 antenna and power supply. Device radio performance could be affected by high frequency digital I/O and large currents in and out of these pins. Nordic recommends keeping only low frequency (less than 10 kHz) and low drive (Max 4 mA, see GPIO Electrical Specifications of Nordic DataSheet) signals on these pins.			

Table 6: Pin Function Table

10. RF Design

10.1 RF layout and Ground Plane

The integrated chip antenna requires a ground plane to radiate effectively. The area under the chip and along the top side of the module must be clear of any copper or other metals. Having these near the antenna will detune and significantly effect performance. The module should be placed on the longest edge facing out preferably in the middle of the PCB or at least 3.6 cm from the edge. Having a small ground place will reduce the effective radiated power so it is recommended to have a continuous uninterrupted ground plane of at least 40 mm by 40 mm or more under the module. An example is shown below in Figure 9.

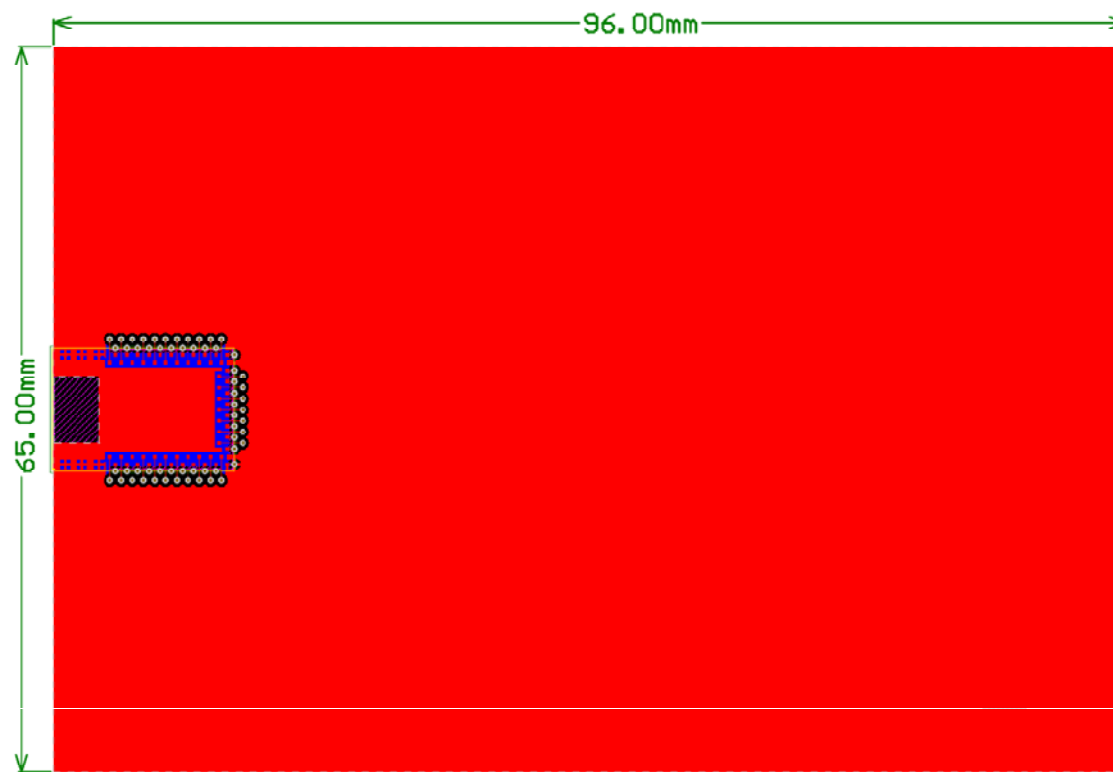


Figure 9: RF Ground Example based on Dev Board Ground Plane

10.2 Case Design

When designing and placing the module in a case or enclosure metal should be kept clear from the antenna area both above and below. All metal near the antenna impact RF performance and need to be considered in your designs. The module is tuned for free air and is somewhat resistance to the detuning caused by plastics. It is not immune and as such RF performance should be evaluated in your designs when placing plastic on or over then module.

11. Certification

11.1 Bluetooth Qualification

The SVN-840C Bluetooth Qualifications can be found under RF-PHY Component (Tested) Declaration ID XXXXXXXX and QDID XXXXX.

11.2 FCC statement

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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Radiation Exposure Statement

This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

If the FCC identification number 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. This exterior label can use wording such as the following: "Contains Transmitter Module FCC ID: 2AMOF-840C Or Contains FCC ID: 2AMOF-840C"

When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. 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.

(2) This device must accept any interference received, including interference that may cause undesired operation.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product

11.3 FCC Important Notes

11.3.1 FCC Radiation Exposure Statement

This equipment complies with FCC RF Radiation exposure limits set forth for an uncontrolled environment.

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

This equipment complies with part 15 of the FCC Rules. Operation is subject to the two conditions:

- This device may not cause harmful interference, and
- This device must accept any inference received, including interference that may cause undesired operation.

The device must be installed and used in strict accordance with the manufacturer's instructions as described in this document.

11.3.2 OEM integration instructions

This device is intended only for OEM integrators under the following conditions:

- The antenna and transmitter must not be co-located with any other transmitter or antenna.
- The module shall be only used with the integral antenna(s) that has been originally tested and certified with this module.

As long as the two (2) 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 with this module installed (for example, digital device emission, pc peripherals requirements etc.)

In the event that these conditions cannot be met (for example certain laptop configuration or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used the final product. In these and circumstance, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

11.3.3 End product labeling:

The following quotes must be labeled in the visible area of the final product

- SVN-840C: **"Contains FCC ID: 2AMOF-840C"**
- Any similar wordings that express the same meaning may be used.

The FCC Statement below should also be included on the label. When not possible, the FCC Statement should be included in the user manual of the host device.

"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. (2) This device must accept any interference received, including interference that may cause undesired operation."

11.3.4 Information regarding the end user manual

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as shown in this manual.

11.4 CE REGULATORY

The SVN-840C module is being tested and is expected to be compliant against the following standards. OEM integrators should consult with qualified test house to verify all regulatory requirements have been met of their complete device.

EU – Radio Equipment Directive 2014/53/EU:

- EN 60950-1: 2006 + A11: 2009 + A1: 2010 + A12: 2011
- ETSI EN 300 328 V 2.1.1
- ETSI EN 301 489-1 V2.1.1
- ETSI EN 301 489-17 V3.1.1

11.5 Japan (MIC)

The SVN-840C module has received type certification and is labeled with its own technical conformity mark and certification number as required to conform to the technical standards regulated by the Ministry of Internal Affairs and Communications (MIC) of Japan pursuant to the Radio Act of Japan. Integration of this module into a final end product does not require additional radio certification provided installation instructions are followed and no modifications of the module are allowed. Additional testing may be required:

- If the host product is subject to electrical appliance safety (for example, powered from an AC mains), the host product may require Product Safety Electrical Appliance and Material (PSE) testing. The integrator should contact their conformance laboratory to determine if this testing is required.
- There is a voluntary Electromagnetic Compatibility (EMC) test for the host product administered by VCCI:
http://www.vcci.jp/vcci_e/index.html

The label on the end product which contains a BMD-300 Series module must follow the MIC marking requirements. Labeling requirements for Japan available at the Ministry of Internal Affairs and Communications (MIC) website:
<http://www.tele.soumu.go.jp/e/index.htm>.

The SVN-840C module is labeled with its assigned technical conformity mark and certification number. The end product in which this module is being used must have an external label referring to the type certified module inside:

Contains transmitter module with certificate number:



12. 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.

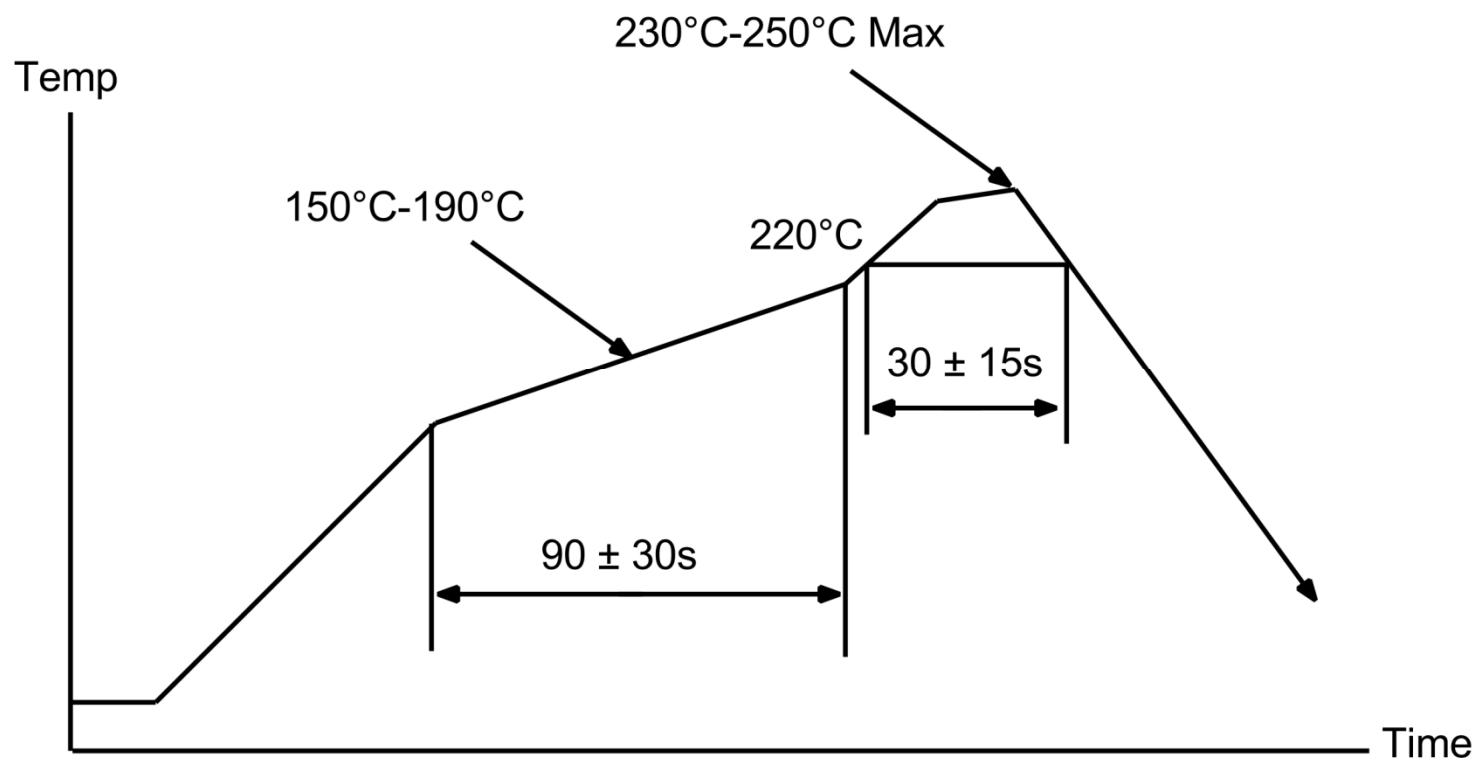


Figure 10: Reflow Profile for lead Free Solder

13. Design, Installation, and Caution notes

Failing to follow the guidelines set by this document may result in products failure of functions and damage the products.

13.1 Design notes

1. Follow the conditions defined in this datasheet in order to assure proper performance of the product.
2. Supply voltage must be free of AC ripple voltage.
3. Supply voltage should not be higher than the specified inputs or reversed. Also, it should not contain noise or spikes.
4. This product should not be mechanically stressed when installed.
5. Keep this product away from heat during storage and installation.
6. Avoid assembly and use of equipment where the products temperature may exceed the maximum allowance.
7. Keep this product away from other high frequency circuits.

13.2 Antenna and PCB Notes

Do not place the product with the antenna inside of a metal case. Doing this will significantly affect performance of the antenna.

For PCB layout avoid running signal lines below the product whenever possible, especially high frequency signals, unless the ground plane between the product and the signals lines. Do not put a ground plane under the antenna, see section 9 Product Descriptions and Drawings and section 10 RF Design.

13.3 Installation Notes

1. Refer to the recommend layout and design guidelines in this document when designing a board.
2. Do not press parts onto the metal shielding cover or secure object to the metal shielding, this will possibly damage the product.
3. Any contact with wires, casing, or object should be avoided, especially metal objects.
4. If hand soldering, refer to the precautions detailed in this document and keep the conditions defined in this section.
5. Reflow is possible with this product up to 2 times. The reflow temperature profile should be followed.
6. When reflowing do not mechanically stress or vibrate the product.
7. Carefully position the product such that its heat or other components that are susceptible to heat will not be burned or affected.
8. Carefully position the product such that its temperatures will not increase due to the effects of heat generated by nearby components or objects.
9. Do not wash this product.
10. Take precautions against static electricity. If pules or other electrical loads are applied to the product, please check the operations before assembling into a final product.
11. Do not use dropped products.
12. Do not touch or contaminate the pins.
13. Follow the recommended minimum and maximum power ratings for power supply applied to this product.
14. Do not apply pressure to the product when soldered onto the PCB it may peel off.
15. This product is intended for general purpose and standard use in general electronic equipment, such as home appliances, office equipment, information and communication equipment.

13.4 Storage Notes

1. The product should not be mechanically stressed during storage.
2. Do not store the product in the following conditions as the performance of the product could be adversely affected:
 - I. Storage in salty or humid air or in corrosive gas environments
 - II. Storage in direct sunlight
 - III. Storage in an environment outside the specified ranges defined in this document
 - IV. Storage of the products for more than one year after date of delivery storage period.
3. Keep away from water and poisonous or corrosive gas.
4. Do not stress or shock the product when transported.

13.5 Other Cautions

1. This specification sheet is copyrighted. Reproduction of this data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices.
2. Do not use the product for other purposes than what is defined in this document.
3. Provide failsafe functions on your product to prevent an additions damage that may be caused by abnormal function or the failure of a product.
4. If an abnormal or out of range voltage is applied due to a problem in the product, components or circuits, replace these products with new products. Even if they appear satisfactory they may not have the same performance as before the voltage was applied.
5. If you have any questions, contact EMC

14. 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.

- Install protection circuit and a protection device in order to ensure safety of the whole system.
- Install a redundant circuit or another system to prevent a dual fault causing an unsafe status to ensure safety of the whole system.

15. Revision History

Revision Number	Changes and Notes	Date
0.9	Initial Release	yyyy/mm/dd