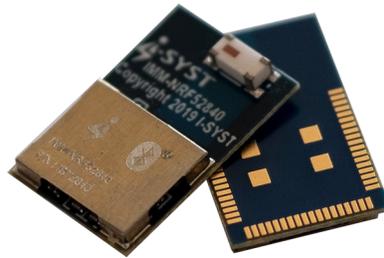# IMM-NRF52840 (BLYST840)

Module

Bluetooth® 5 / Bluetooth® Mesh
Thread / Zigbee

Part No : IBTZ840

C E

FCCID: 2ATLY- IBTZ840
IC: 25671-IBTZ840

Revision history

Version	Date	Note	Contributor(s)	Approver
1.0	12 Dec 2018	Initial version	Nguyen Hoang Hoan	Nguyen Hoang Hoan
1.1	2019		Nguyen Hoang Hoan	Nguyen Hoang Hoan
1.2	2020		Nguyen Hoang Hoan	Nguyen Hoang Hoan
1.3	2021		Nguyen Hoang Hoan	Nguyen Hoang Hoan

Limited Warranty

The IMM-NRF52840 module is warranted against defects in materials and workmanship for a period of 30 days from the date of purchase from I-SYST or from an authorized dealer.

Disclaimer

I-SYST reserves the right to change this product without prior notice. Information furnished by I-SYST is believed to be accurate and reliable. However, no responsibility is assumed by I-SYST for its use; nor for any infringement of patents nor other rights of third parties which may result from its use. No license is granted by implication or otherwise under the patent rights of I-SYST.

In no event shall I-SYST be liable for any direct, indirect, incidental, special, exemplary, or consequential damages (including, but not limited to, procurement of substitute goods or services; loss of use, data, or profits; or business interruption) however caused and on any theory of liability, whether in contract, strict liability, or tort (including negligence or otherwise) arising in any way out of the use of I-SYST hardware and software, even if advised of the possibility of such damage.
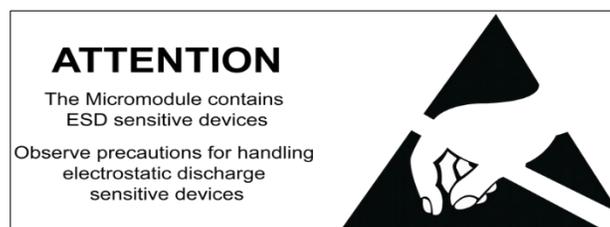
I-SYST products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury.

I-SYST customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify I-SYST for any damages resulting from such improper use or sale.

Trademark

ARM® Cortex™ are registered trade mark of ARM

Bluetooth® is a registered trade mark of Bluetooth SIG

ATTENTION
The Micromodule contains ESD sensitive devices
Observe precautions for handling electrostatic discharge sensitive devices

FCC Caution

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

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.

FCC RF Radiation Exposure Statement

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

I.2 This equipment complies with RF radiation exposure limits set forth for an uncontrolled environment.

I.3 This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

Host product manufacturers that they need to provide a physical or e-label stating "Contains FCC ID : 2ALTY-IBTZ840" with their finished product. **Only those antennas with same type and lesser gain filed under this FCC ID can be used with this device. The host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed. The final host integrator must ensure there is no instruction provided in the user manual or customer documentation indicating how to install or remove the transmitter module except such device has implemented two-ways authentication between module and the host system. The final host manual shall include the following regulatory statement: This equipment has been tested and found to comply with the limits for a 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.**

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

1 This device may not cause interference, and

2 This device must accept any interference, including interference that may cause undesired operation of the device.

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.

2 L'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

IC SAR Warning

The device has been tested and compliance with SAR limits, users can obtain Canadian information on RF exposure and compliance.
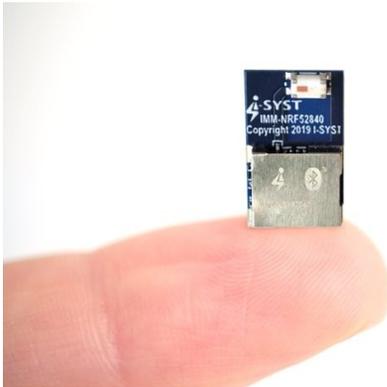
Le présent appareil est conforme Après examen de ce matériel aux conformité aux limites DAS et/ou aux limites d'intensité de champ RF, les utilisateurs peuvent sur l'exposition aux radiofréquences et la conformité and compliance d'acquérir les informations correspondantes

The ISED certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labelled to display the ISED certification number for the module, preceded by the word "contains" or similar wording expressing the same meaning, as follows: Contains IC: 25671-IBTZ840

Contents

1. Introduction

The **IMM-NRF52840** SoM is built around the Nordic Semiconductor ultra low power nRF52840

32-bit ARM® Cortex™ M4F CPU with floating point unit running at 64 MHz. It integrates the nRF52 series 2.4GHz transceiver with programmable output power -20dBm to +8 dBm, USB 2.0, Flash memory, analog and digital I/O. The nRF52840 supports Bluetooth® 5, Zigbee, Threads and proprietary wireless protocols.

The IMM-NRF52840 is a 14x9x1.5 mm module with embedded ceramic antenna. It allows developers to take full advantage of the nRF52840 by making all its I/O available via 54 SMD 0.4mm pitch pads.

1.1 Overview and Features

IMM-NRF52840 modules are designed so that no extra PCB space or any external components are required on user's application board for all the functionality of the nRF52840.

- A fingertip-size ARM® Cortex™ M4F module with Bluetooth® 5.2, Thread, Zigbee and 46 I/O
- It's designed as a feature-rich but tiny and ultra-low-power SoM to make it easy to integrate into your own projects and IoT hardware.
- It has 46 fully programmable I/O, 1 MB flash, 256 kB RAM, is ready for Bluetooth® 5.2, is Thread and ZigBee capable, is NFC-enabled, has built-in security measures, and supports MicroPython.

Features

- 64MHz ARM® Cortex™ M4F
- 2.4GHz transceiver, Bluetooth® 5
- IEEE 802.15.4 radio support Zigbee, Thread
- USB 2.0 Device full speed 12Mbps
- 1MB FLASH, 256KB SRAM.
- 32 MHz Crystal 20PPM
- 32.768 KHz Crystal 20PPM
- DC/DC power mode configurations builtin
- 46 configurable I/O pins
- NFC-A Tag with wakeup on field
- ARM® CryptoCell CC310
- 8 configurable 12 bits, 200 ksps ADC

- Digital microphone interface
- 3 x 4 channels PWM
- AES hardware encryption
- Temperature sensor
- Up to 4 PWM
- Digital interfaces SPI Master/Slave, Quad SPI, 2-wire Master/Slave (I2C compatible), UART (CTS/RTS)
- Quadrature decoder
- Low power comparator
- Operating voltage : 1.7V to 5.5V
- Dimension: 14x9x1.5 mm

1.2 Application

IoT

- Smart Home products
- Industrial mesh networks
- Smart city infrastructure

Interactive entertainment devices

- Advanced remote controls
- Gaming controller

Advanced wearables

- Connected watches
- Advanced personal fitness devices
- Wearables with wireless payment
- Connected Health
- Virtual/Augmented Reality applications

2. Specification

Frequency band	2.4GHz
On-air data rate	2Mbs/1Mbs/500kbs/125kbs - Bluetooth low energy 250kbs – 802.15.4 2Mbs/1Mbs – 2.4GHz proprietary
Output power	Programmable -20dBm to +8dBm
Sensitivity	Bluetooth 5: -103dBm at 125kbs, -99dBm at 500kbs, -96dBm at 1Mbs, -92dBm at 2Mbs 802.15.4: -100dBm at 250kbs ANT: -92.5dBm at 1Mbs 2.4GHz: -92.5dBm at 1Mbs, -89dBm at 2Mbs
Radio current consumption DC-DC at 3v	4.8mA TX at 0dBm, DC/DC at 3V 14.8mA TX at +8dBm, DC/DC at 3V 9.6mA TX at +4dBm, DC/DC at 3V 4.6mA RX at 1Mbps
Microcontroller	64MHz ARM® Cortex™-M4F
Program memory	1MB Flash with cache
RAM	256kB
Oscillators	32MHz crystal oscillator, 64MHz RC oscillator, 32kHz crystal oscillator, 32kHz RC oscillator
System current consumption	0.5µA at 3V System OFF mode, no RAM retention 1.5µA System ON mode, no RAM retention 0.7µA All peripherals in IDLE mode 0.03µA per 4kB RAM retention
Hardware security	128-bit AES ECB/CCM/AAR co-processor
Cryptography	ARM CryptoCell 310
GPIO	48 configurable
Digital I/O	QSPI x 1, SPI master x 3, SPI slave x 3, 2-wire master x 2, 2-wire slave, UARTE x 2, Quadrature decoder, PDM, I²S
Peripherals	12-bit/200ksps ADC, RNG, LP comparator, WDT, PWM x 4

PPI	20
USB	USB 2.0 (12Mbs)
Timers/counters	32-bit timers x 5, RTC x 3
NFC	NFC-A

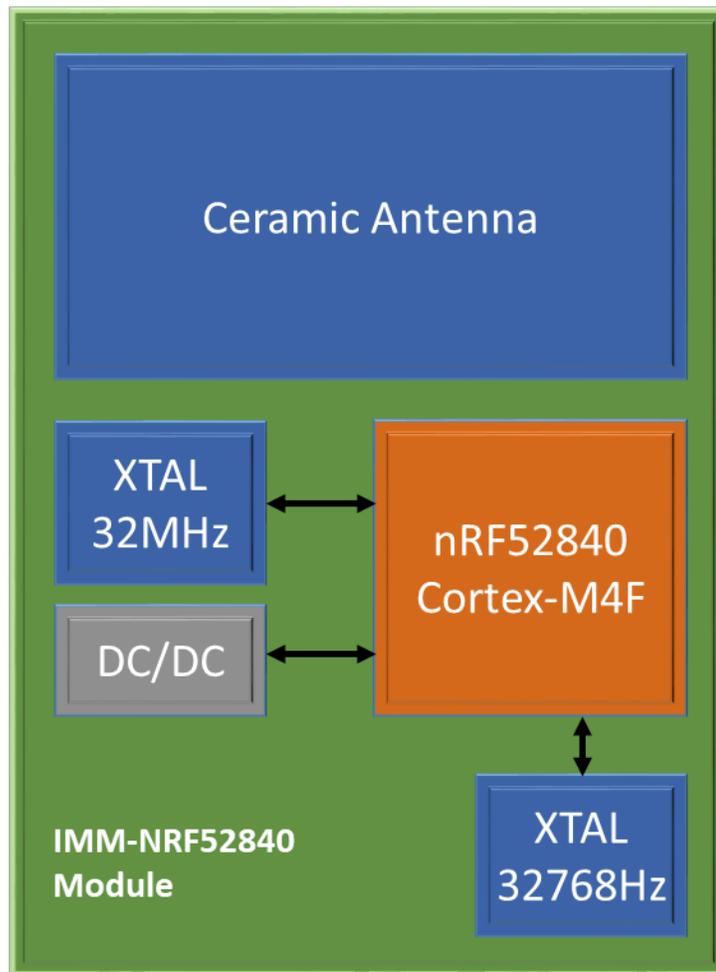## 3. Hardware Specification

3.1 Module Diagram

Figure 1: Module internal diagram

3.1.1 Dimensions and I/O pins layout

Bellow is the direct relationship of the module pads and the nRF52840 I/O pins.
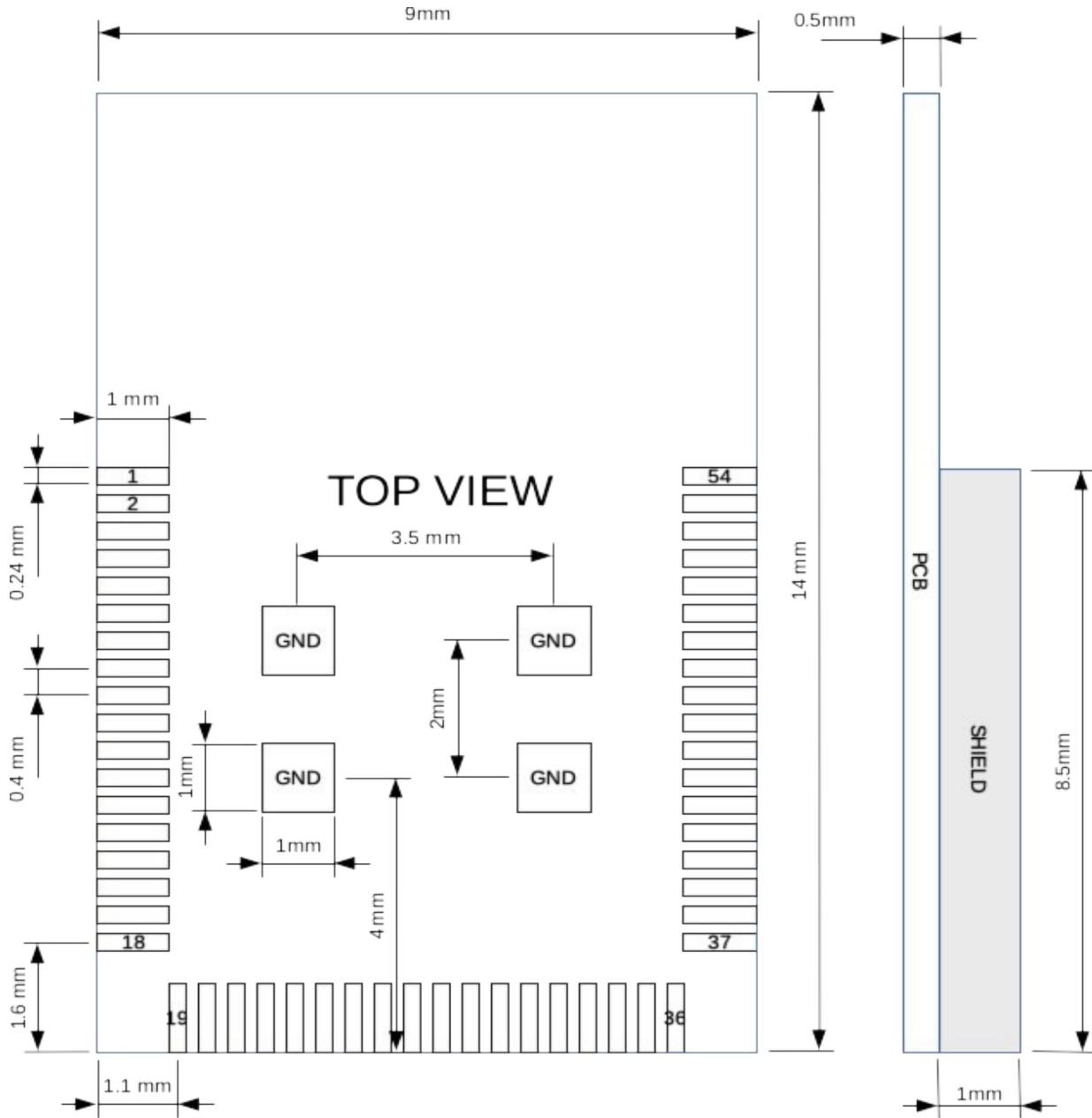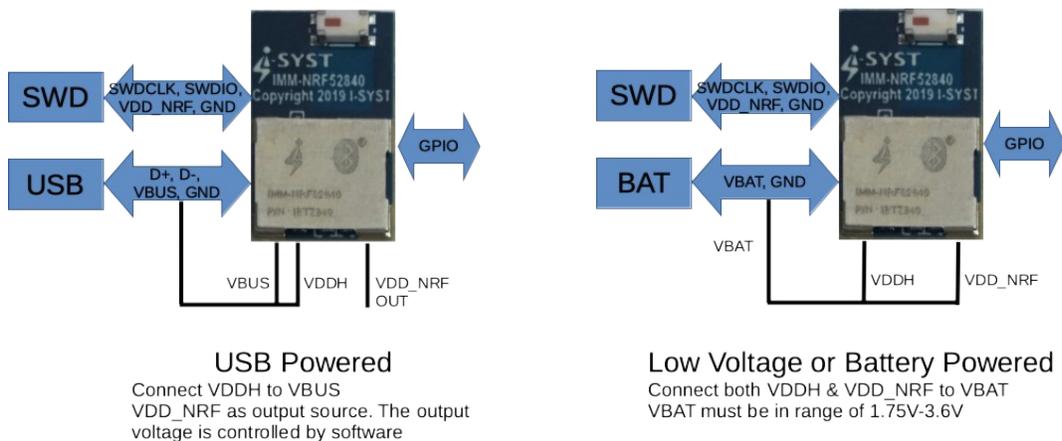

Figure 2: Dimensions top view

3.1.2 Pin Description

Pin Number	Pin Name	Description
1	P1.07	GPIO port 1, pin 7
2	P1.03	GPIO port 1, pin 3
3	P1.02	GPIO port 1, pin 2
4	P1.05	GPIO port 1, pin 5
5	SWDCLK	JTAG Clock
6	P1.04	GPIO port 1, pin 4
7	P1.01	GPIO port 1, pin 1
8	SWDIO	JTAG Data
9	P0.25	GPIO port 0, pin 25
10	P0.22	GPIO port 0, pin 22
11	P0.19	GPIO port 0, pin 19
12	P1.00	GPIO port 1, pin 0
13	P0.18/nRESET	GPIO port 0, pin 18 or nRESET
14	P0.21	GPIO port 0, pin 21
15	P0.24	GPIO port 0, pin 24
16	P0.23	GPIO port 0, pin 23
17	D-	USB D-
18	D+	USB D+
19	P0.20	GPIO port 0, pin 20
20	P0.17	GPIO port 0, pin 17
21	GND	Ground
22	VDD_nRF	Core voltage 1.75V-3.6V configurable as in or out
23	VDDH	Main input voltage 1.75V-5V
24	VUSB	USB input voltage 5V
25	P0.16	GPIO port 0, pin 16
26	P0.15	GPIO port 0, pin 15
27	P0.14	GPIO port 0, pin 14
28	P0.13	GPIO port 0, pin 13
29	P0.12	GPIO port 0, pin 12
30	P0.11	GPIO port 0, pin 11
31	P1.09	GPIO port 1, pin 9
32	P1.08	GPIO port 1, pin 8
33	P0.08	GPIO port 0, pin 8
34	P0.07	GPIO port 0, pin 7

35	P0.06	GPIO port 0, pin 6
36	P0.05/AIN3	GPIO port 0, port 5 or Analog Input 3
37	P0.04/AIN2	GPIO port 0, pin 4 or Analog Input 2
38	P0.27	GPIO port 0, pin 27
39	P0.26	GPIO port 0, pin 26
40	P0.31/AIN7	GPIO port 0, pin 31 or Analog Input 7
41	P0.30/AIN6	GPIO port 0, pin 30 or Analog Input 6
42	P0.29/AIN5	GPIO port 0, pin 29 or Analog Input 5
43	P0.28/AIN4	GPIO port 0, pin 28 or Analog Input 4
44	P0.03/AIN1	GPIO port 0, pin 3 or Analog Input 1
45	P0.02/AIN0	GPIO port 0, pin 2 or Analog Input 0
46	P1.15	GPIO port 1, 15
47	P1.14	GPIO port 1, pin 14
48	P1.13	GPIO port 1, pin 13
49	P1.12	GPIO port 1, pin 12
50	P1.11	GPIO port 1, pin 11
51	P1.10	GPIO port 1, pin 10
52	P1.06	GPIO port 1, pin 6
53	P0.10/NFC2	GPIO port 0, pin 10 or NFC2
54	P0.9/NFC1	GPIO port 0, pin 9 or NFC1

3.1.3 Power configuration

The modules supports 2 power modes as shown bellow.

USB Powered
Connect VDDH to VBUS
VDD_NRF as output source. The output
voltage is controlled by software

Low Voltage or Battery Powered
Connect both VDDH & VDD_NRF to VBAT
VBAT must be in range of 1.75V-3.6V

32.768KHz and all DC coils are builtin, no extra components require to work.
Just wire the power configuration of 3 power pins VUSB, VDDH and VDD_NRF
and the SWD debug Jtag.

Figure 3: Power Configuration

3.1.4 SMD Footprint

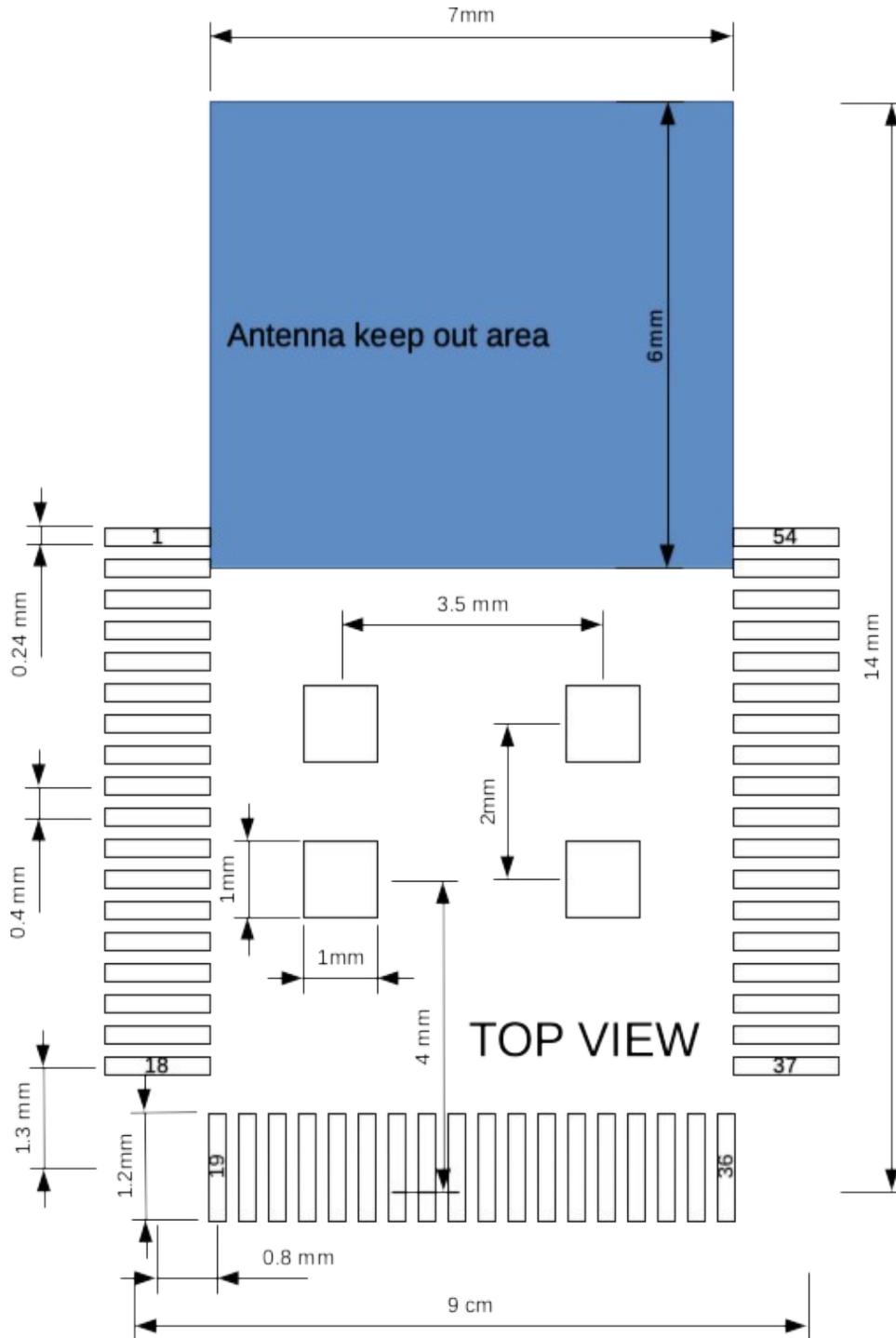**Note**: Do not route any traces or planes under the indicated antenna area.

Figure 4: SMD footprint top view

4. Quick Start

4.1 Requirements

The follows are required for software development
- Debug J-Tag : IDAP-Link, Segger J-Link, or any ARM compatible J-Tag.
- Nordic SDK & Softdevice BLE stack (https://developer.nordicsemi.com/)
- C/C++ embedded software development environment : Eclipse, Keil, CrossWorks, …

4.2 Flashing firmware

The Nordic Softdevice is required to use ANT, BLE, Zigbee, Thread application. There are many methods to flash it in the module. The official method from Nordic is to use nrfjprog with J-Link.

This program is available on Nordic website

https://www.nordicsemi.com/Software-and-Tools/Development-Tools/Test-and-Evaluation-Software.

The other method is to use IDAP-Link with IDAPnRFProg for OSX, Linux & Windows. More details available on blog page http://embeddedsoftdev.blogspot.ca/p/ehal-nrf51.html.

The IDAPnRFProg can program Softdevice, DFU and Firmware app without requiring mergehex. It can parallel program multiple nRF5x series boards at once when multiple IDAP-Link are connected to same PC

4.3 Breakout board

For quick development and prototyping, a breakout board, IBK-NRF52840, is available with all I/O pins routed out to standard DIP48, 2.54mm pitch header pin, onboard LED indicator, buttons and USB. Ready to be mounted on a breadboard. The SWD connector pins are also routed out for debug probe.   Connect it to the IDAP-Link for OpenOCD debugging.
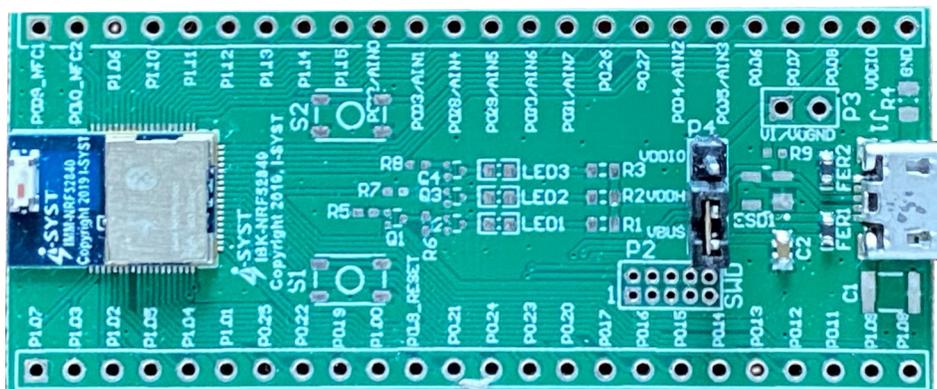

Figure 5: IBK-NRF52840 Breakout Board.

4.4 J-Tag wiring

The IMM-NRF52840 module has exposed the SWD (Serial Wire Debug) pins SWDIO & SWCLK, see I/O layout section. The module can be directly connected to a J-Tag tool for development by wiring the 2 SWD and the optional Reset pins to the appropriate pins on the J-Tag connector.   The

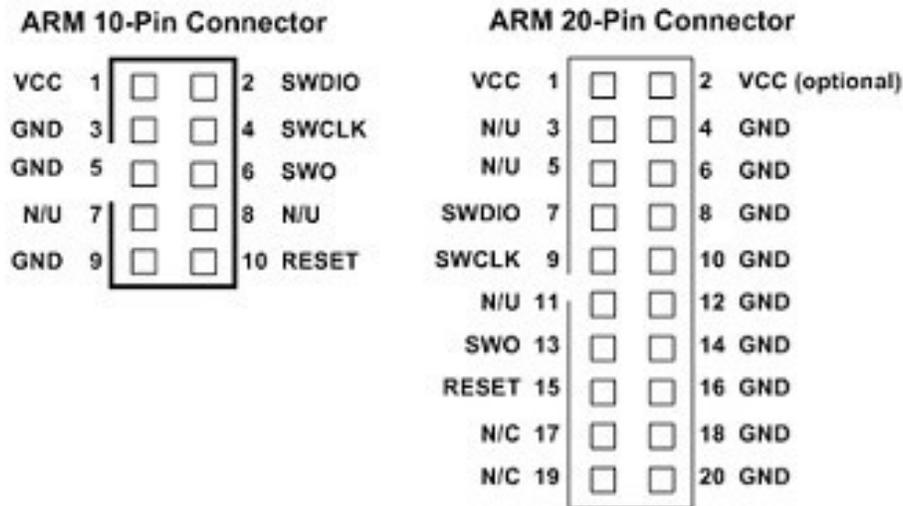VIN must be wire to the VCC pin on the J-Tag. GND pad is also require to be connected to GND on J-Tag.

Figure 6: ARM JTAGE Connector

4.5 Nordic Software

The Nordic SDK and software tools can be download from http://developer.nordicsemi.com and http://www.nordicsemi.com. Community support forum at https://devzone.nordicsemi.com.

4.6 Firmware development with Eclipse IDE

Eclipse with GCC is the most cost effective software development environment. It is 100% free. The drawback is that it requires a bit of gymnastics to setup. Fortunately many Blog posts are available on the Internet showing step by step. Follow this blog to setup the Eclipse IDE & GCC compiler:
http://embeddedsoftdev.blogspot.ca/p/eclipse.html.
There are samples code in the Nordic SDK itself. Other Eclipse based example code are available from this Blog page http://embeddedsoftdev.blogspot.ca/p/ehal-nrf51.html

5. CE conformity

SHENZHEN HUATONGWEI INTERNATIONAL INSPECTION Co., Ltd.

Test Verification of Conformity

Issued date:Dec.09, 2019   Certificate verification:

In accordance with the following applicable Directives:

Radio Equipment Directive (RED) 2014/53/EU

Certificate number:	SHT1907094305EW
Certificate Holder:	I-SYST Inc.
Address:	6245 rue Berthier, Brossard, QC., Canada J4Z 2K4
EUT Name:	Bluetooth Module
Trade Mark:	-
Model number:	IMM-NRF52840
Listed Model(s):	-
Test Laboratory:	Shenzhen Huatongwei International Inspection Co., Ltd.
	Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China
	Tel: 86-755-26748078 Fax: 86-755-26748089
	Http: //www.szhtw.com.cn E-mail: cs@szhtw.com.cn

The radio equipment meets the following essential requirements

Essential Requirement		Applied Standards	Test Report No.	Result
Art. 3.1a	Health	EN 62311:2008	CHTEW19120011	Conform
	Safety	EN 62368-1:2014+A11:2017	CHTSE19110119	Conform
Art. 3.1b	EMC	ETSI EN 301 489-1 V2.2.3 (2019-11) Draft ETSI EN 301 489-17 V3.2.0 (2017-03)	CHTEW19120010	Conform
Art. 3.2	Radio	ETSI EN 300 328 V2.1.1: 2016-11	CHTEW19120009	Conform

CE

The verification is only valid for the equipment and configuration described ,in conjunction with the test data detailed above

The CE mark as shown beside can be used ,under the responsibility of the manufacturer, after completion of an EU

Directive of Conformity and compliance with all relevant EU Directive.

Authorized by: **Jeffrey Lu**
Position: General Manager

CCIC (SHENZHEN) ENVIRONMENTAL SERVICE CO.,LTD.

Test Verification of Conformity

Certificate No.:CTC19110210

Issued Date: Nov 29, 2019

The sample, as described herewith, was tested pursuant to the testing standard :

IEC 62321-3-1-2013, IEC 62321-6-2015, IEC 62321-8-2017

and all the test results comply with the requirements of :

RoHS Directive 2011/65/EU, (EU) 2015/863

**Restriction of the use of certain Hazardous Substance
in electrical and electronic equipment**

Applicant: I-SYST Inc.

6245 rue Berthier, Brossard, QC., Canada J4Z 2K4

Manufacturer: I-SYST Inc.

6245 rue Berthier, Brossard, QC., Canada J4Z 2K4

Sample Name: **Bluetooth Module**

Sample Model(s):IMM-NRF52840

Laboratory: **CCIC (Shenzhen) Environmental Service Co., Ltd.**
Floor 2, Minlida Industrial Park, Honghualing Industrial Zone, Nanshan District, Shenzhen, Guangdong, China
Tel: 86-755-86632632   Fax: 86-755-86632632
Http: // www.ccicshenzhen.com.cn   E-mail: zjjc@sz.ccic.com

RoHS

Note:
The certification is only valid for the submitted sample(s), in conjunction with the test data detailed in our test report

No. :   QHJ19110210/EN

**For and on behalf of
CCIC (Shenzhen) Environmental Service Co., Ltd.**

Authorized by: *Renjou. Yang*