
BLUETOOTH MODULE DATASHEET

Product: 2.4GHz Bluetooth Low Energy Module

Solution: Nordic nRF52832, WLCSP package 3.0 x 3.2mm

Model: BT5XLCANI01

Version 0.3



FCC ID: S7Q-C03

IC: 31309-C03



R XXX-XXXXXX

Revision History

Revision	Date	Description
0.1	2023/4/13	1 st release
0.2	2023/6/28	Update radio characteristic, antenna layout recommendation
0.3	2023/8/4	1. update support BT 5 to BT 5.3 2. update GPIO including interfaces 3. update chip antenna characteristic

Index

1. PRODUCT INTRODUCTION.....	4
1.1 APPLICATION	4
1.2 FEATURE	4
2. CERTIFICATION	5
3. POWER MODE	6
3.1 SYSTEM ON MODE	6
3.2 SYSTEM OFF MODE	6
4. ELECTRICAL SPECIFICATION	7
4.1 ABSOLUTE MAXIMUM RATING.....	7
4.2 RECOMMENDED OPERATING CONDITIONS	8
4.3 GENERAL RADIO CHARACTERISTICS	8
4.4 TRANSMITTER SPECIFICATION.....	8
4.5 RECEIVER OPERATION	9
5. ANTENNA CHARACTERISTICS	9
5.1 ANTENNA PERFORMANCE	9
5.2 ANTENNA RADIATION PATTERN	9
6. PIN DESCRIPTION.....	10
7. REFERENCE DESIGN.....	12
7.1 POWER SUPPLY WITH INTERNAL DC/DC	12
7.2 POWER SUPPLY WITH INTERNAL LDO	13

8. ANTENNA LAYOUT RECOMMENDATION	14
9. PCB DIMENSIONS.....	15
10. LAND PATTERN DRAWING	16
11. STENCIL DESIGN RECOMMENDATIONS	17
12. REFLOW THERMAL PROFILE PARAMETERS.....	18
13. PACKAGING INFORMATION.....	19
14. MOISTURE SENSITIVE LEVEL INFORMATION	20
15. PART NUMBER DEFINITION	21
16. DECLARATION OF CONFORMITY.....	22

1. Product introduction

BT5XLCANI01 is a Bluetooth 5.3 module based on Nordic nRF52832 SOC solution. It meets the application challenges that require advanced low-power Bluetooth functionality, protocol concurrency performance, and a rich set of peripheral devices and features. In addition, It supports low power Bluetooth, including 2 Mbps high transmission speed. Bluetooth Mesh networks can run simultaneously with low power Bluetooth, enabling smart devices to join, configure, and control Mesh network nodes.

1.1 Application

- ◆ Smart Home
- ◆ Sensor Networks
- ◆ Building automation
- ◆ Medical
- ◆ Remote control
- ◆ Beacons
- ◆ PC peripherals
- ◆ Toys
- ◆ Wearables

1.2 Feature

- ◆ ARM processor
 - 64 MHz ARM Cortex-M4 with FPU
 - 512 KB Flash + 64 KB RAM
 - Cache
- ◆ Bluetooth 5.3
 - Bluetooth mesh
 - +4 dBm TX power

- -96 dBm sensitivity (1 Mbps)
- ◆ Programmable output power +4 dBm to -20 dBm
- ◆ Flexible and configurable 32 pin GPIO
32 GPIO pins include the following:
 - 1x UART (CTS/RTS) with EasyDMA
 - Up to 3x SPI masters or slaves
 - Up to 2x I2C compatible 2-wire masters/slaves
 - 1x I2S with EasyDMA
 - Type 2 NFC-A tag
- ◆ Automatic smart power management
- ◆ Full set of digital interfaces with DMA:
 - SPI
 - TWI
 - I2S
 - UART
 - PWM
 - SWD
- ◆ 128 bit AES/ECB/CCM/AAR accelerator
- ◆ 12-bit 200 ksps ADC
- ◆ 1.7-3.6 V supply voltage range

2. Certification

Country	ID	Country Code
USA (FCC)	S7Q-C03	US
Canada (IC)	31309-C03	CA
Europe (CE)		DE
Japan (TELEC)		JP

3. Power mode

3.1 System ON mode

System ON mode is the default state after power-on reset. In this mode, all functional blocks such as the CPU or peripherals can be in IDLE or RUN mode, depending on the configuration set by the software and the state of the application executing.

3.2 System OFF mode

System OFF mode is the deepest power saving mode which the system can enter. In this mode, the system's core functionality is powered down and all ongoing tasks are terminated.

The device can be put into System OFF mode using the POWER register interface. When in System OFF mode, the device can be woken up through one of the following signals:

- The DETECT signal, optionally generated by the GPIO peripheral.
- The ANADETECT signal, optionally generated by the LPCOMP module.
- The SENSE signal, optionally generated by the NFC module to wake-on-field.
- Detecting a valid USB voltage on the VBUS pin (VBUS,DETECT).
- A reset.

When the system wakes up from System OFF mode, it gets reset

4. Electrical Specification

4.1 Absolute Maximum Rating

	Min.	Max.	Unit
Supply Voltages			
VDD	-0.3	3.9	V
VSS		0	V
I/O Pin Voltage			
$VDD \leq 3.6V$	-0.3	$VDD + 0.3$	V
$VDD \geq 3.6V$	-0.3	3.9	V
NFC antenna pin current			
$I_{NFC1/2}$		80	mA
Radio			
RF input level		10	dBm

4.2 Recommended Operating Conditions

Symbol	Parameter	Min.	Nom.	Max.	Units
VDD	VDD supply voltage, independent of DCDC enable	1.7	3.0	3.6	V
t_{R_VDD}	Supply rise time (0V to 1.7V)			60	ms
TA	Operating temperature	-40	25	85	°C

4.3 General Radio Characteristics

Symbol	Description	Min.	Nom.	Max.	Units
fOP	Operating frequencies	2360		2500	MHz
fPLL,CH,SP	PLL channel spacing		1		MHz
fDELTA,1M	Frequency deviation@ 1Msps		±170		kHz
fDELTA,BLE,1M	Frequency deviation@ BLE 1Msps		±250		kHz
fDELTA,2M	Frequency deviation@ 2Msps		±320		KHz
fDELTA,BLE,2M	Frequency deviation@ BLE2Msps		±500		kHz
fsksps	On-the-air data rate	1		2	Msps

4.4 Transmitter specification

Symbol	Parameter	Min.	Nom.	Max.	Units
PRF	Maximum output power		4		dBm
PRFC	RF power control range		24		dB
PRFCR	RF power accuracy			±4	dB

4.5 Receiver operation

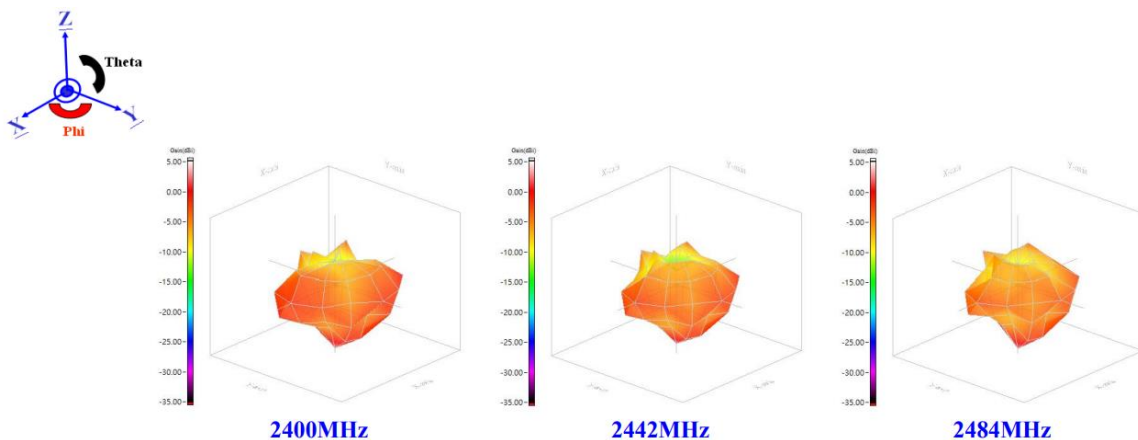
Symbol	Description	Min.	Nom.	Max.	Units
PRX,MAX	Maximum received signal strength at < 0.1% PER		0		dBm
PSENS,IT,1M	Sensitivity, 1 Msps BLE		-94		dBm
PSENS,IT,2M	Sensitivity, 2 Msps BLE		-90		dBm

5. Antenna Characteristics

5.1 Antenna Performance

Frequency (MHz)	2400	2442	2484
R.L. (dB)	-16.1	-12.8	-8.4
Max. Gain (dBi)	2.5	2.3	2.1
Avg. Gain (dB)	-3.9	-4.3	-4.7
Efficiency (%)	40.7	37.2	33.5

5.2 Antenna Radiation Pattern



6. Pin Description

Pin No.	Name	Function	Description
1	SWDCLK	Debug	Serial wire debug clock input for debug and programming
2	P0.24	Digital I/O	General purpose I/O
3	P0.23	Digital I/O	General purpose I/O
4	P0.19	Digital I/O	General purpose I/O
5	P0.20	Digital I/O	General purpose I/O
	TRACECLK		Trace port clock output
6	P0.10	Digital I/O	General purpose I/O
	NFC2	NFC input	NFC antenna connection
7	P0.09	Digital I/O	General purpose I/O
	NFC1	NFC input	NFC antenna connection
8	SWDIO	Debug	Serial wire debug I/O for debug and programming
9	P0.21	Digital I/O	General purpose I/O
	RESET		Configurable as pin reset
10	P0.18	Digital I/O	General purpose I/O
	TRACEDATA[0]		Trace port output
11	P0.22	Digital I/O	General purpose I/O
12	P0.17	Digital I/O	General purpose I/O
13	P0.16	Digital I/O	General purpose I/O
	TRACEDATA[1]		Trace port output
14	VDD1	Power	Power
15	P0.02	Digital I/O	General purpose I/O
	AIN0	Analog input	SAADC/COMP/LPCOMP input
16	P0.14	Digital I/O	General purpose I/O
	TRACEDATA[3]		Trace port output
17	GND1	POWER	Ground
18	P0.00	Digital I/O	General purpose I/O
	XL1	Analog input	Connection for 32.768 kHz crystal (LFXO)
19	P0.01	Digital I/O	General purpose I/O
	XL2	Analog input	Connection for 32.768 kHz crystal (LFXO)
20	P0.06	Digital I/O	General purpose I/O

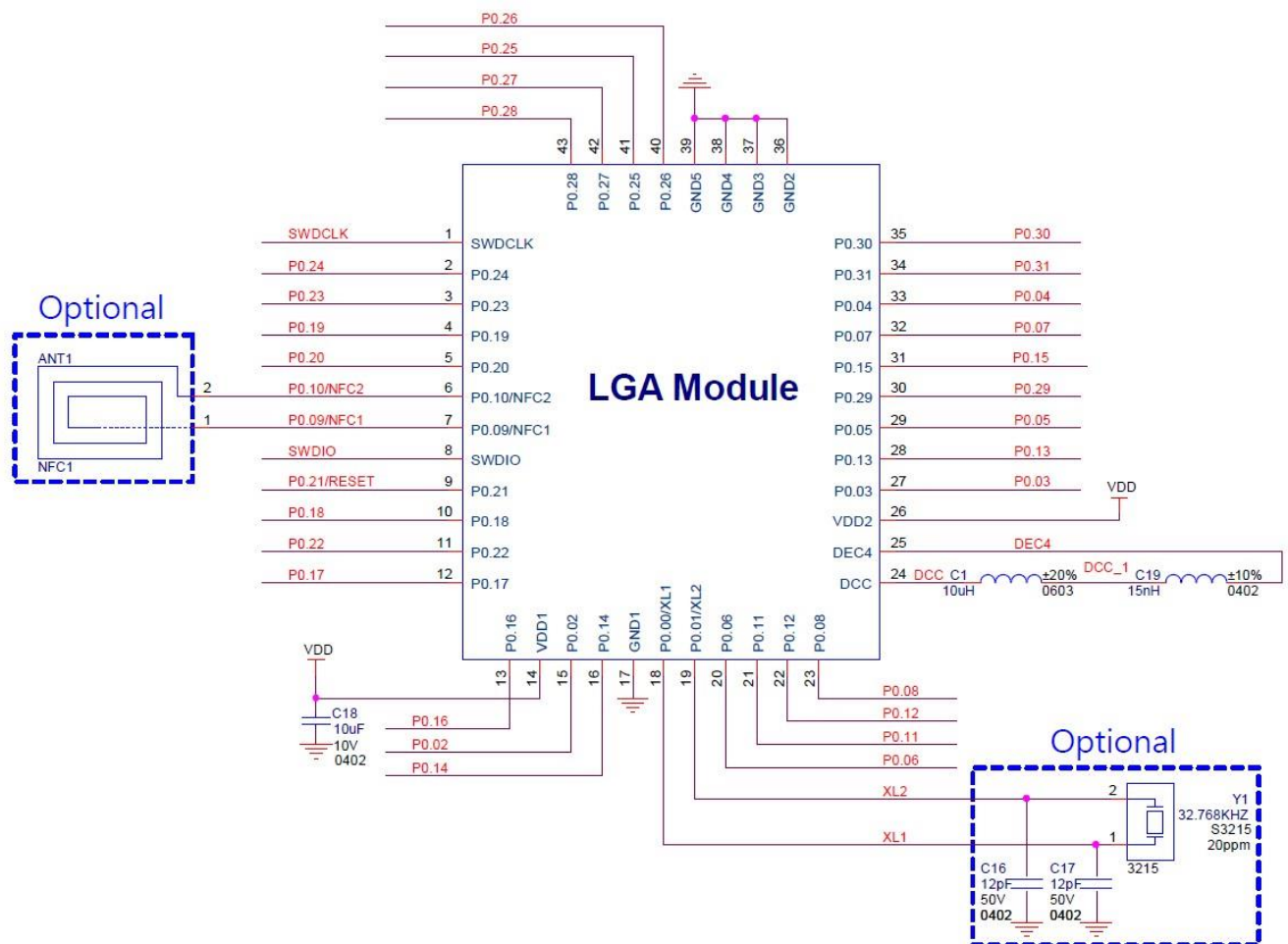
21	P0.11	Digital I/O	General purpose I/O
22	P0.12	Digital I/O	General purpose I/O
23	P0.08	Digital I/O	General purpose I/O
24	DCC	POWER	DC/DC converter output
25	DEC4	POWER	1.3 V regulator supply decoupling Input from DC/DC converter Output from 1.3 V LDO
26	VDD2	Power	Power
27	P0.03	Digital I/O	General purpose I/O
	AIN1	Analog input	SAADC/COMP/LPCOMP input
28	P0.13	Digital I/O	General purpose I/O
29	P0.05	Digital I/O	General purpose I/O
	AIN3	Analog input	SAADC/COMP/LPCOMP input
30	P0.29	Digital I/O	General purpose I/O
	AIN5	Analog input	SAADC/COMP/LPCOMP input
31	P0.15	Digital I/O	General purpose I/O
	TRACEDATA[2]		Trace port output
32	P0.07	Digital I/O	General purpose I/O
33	P0.04	Digital I/O	General purpose I/O
	AIN2		SAADC/COMP/LPCOMP input
34	P0.31	Digital I/O	General purpose I/O
	AIN7		SAADC/COMP/LPCOMP input
35	P0.30	Digital I/O	General purpose I/O
	AIN6	Analog input	SAADC/COMP/LPCOMP input
36	GND2	POWER	Ground
37	GND3	POWER	Ground
38	GND4	POWER	Ground
39	GND5	POWER	Ground
40	P0.26	Digital I/O	General purpose I/O
41	P0.25	Digital I/O	General purpose I/O
42	P0.27	Digital I/O	General purpose I/O
43	P0.28	Digital I/O	General purpose I/O
	AIN4	Analog input	SAADC/COMP/LPCOMP input

7. Reference Design

Please refer to the following reference circuits for power efficiency and system architecture consideration.

- Power supply with internal DC/DC
- Power supply with internal LDO

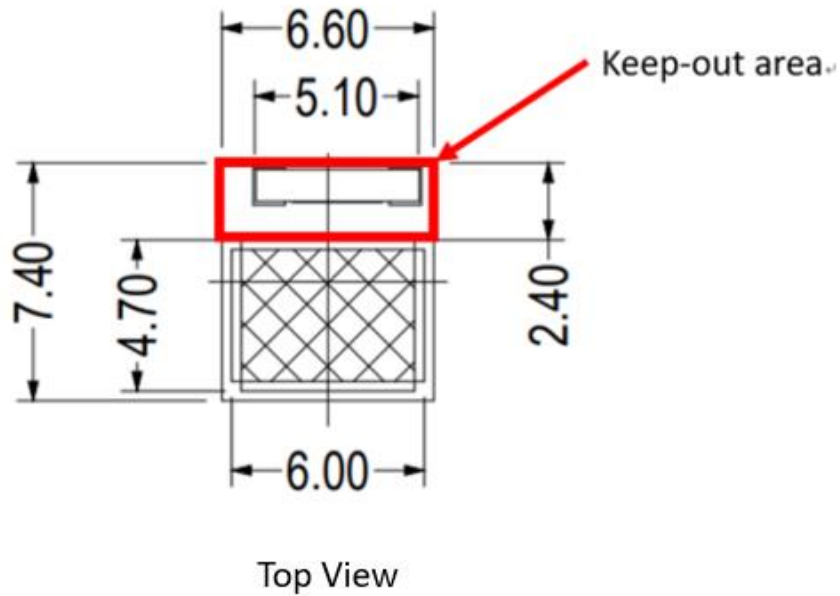
7.1 Power supply with internal DC/DC



[illegible]

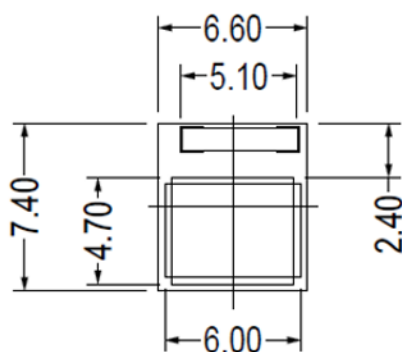
8. Antenna Layout Recommendation

For better antenna performance, please keep no copper in the corresponding position of the keep-out area in each layer. Please refer to the keep-out area shown below.

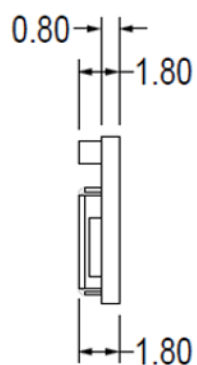


Unit : mm

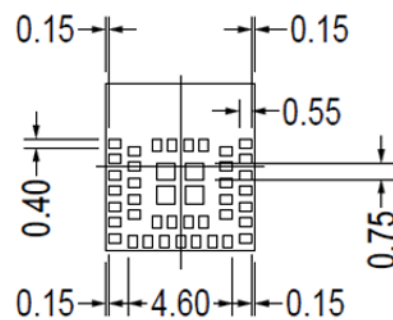
9. PCB Dimensions



Top View



Side View

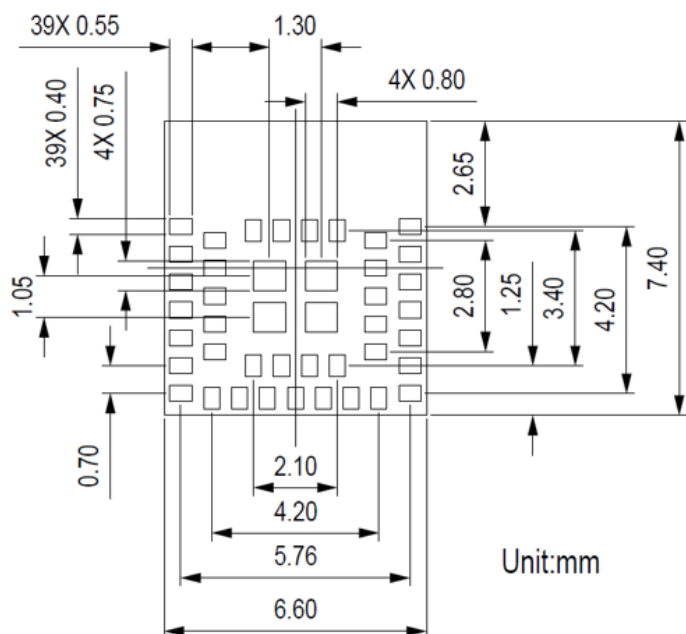


Bottom View

Unit : mm

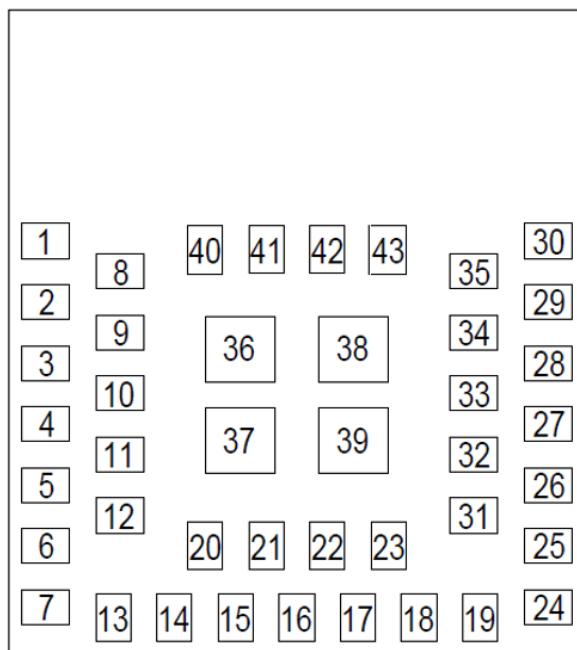
PCB SIZE (mm)	
L	6.6±0.1
W	7.4±0.1
H	1.8±0.1

10. Land Pattern Drawing



Top View

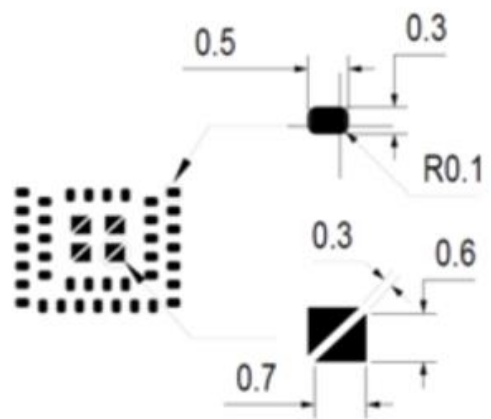
Unit : mm



Top View

11. Stencil design Recommendations

The recommended aperture dimensions bellow is based on the stencil thickness 0.1mm. Please modify the aperture and thickness for real SMT situation.



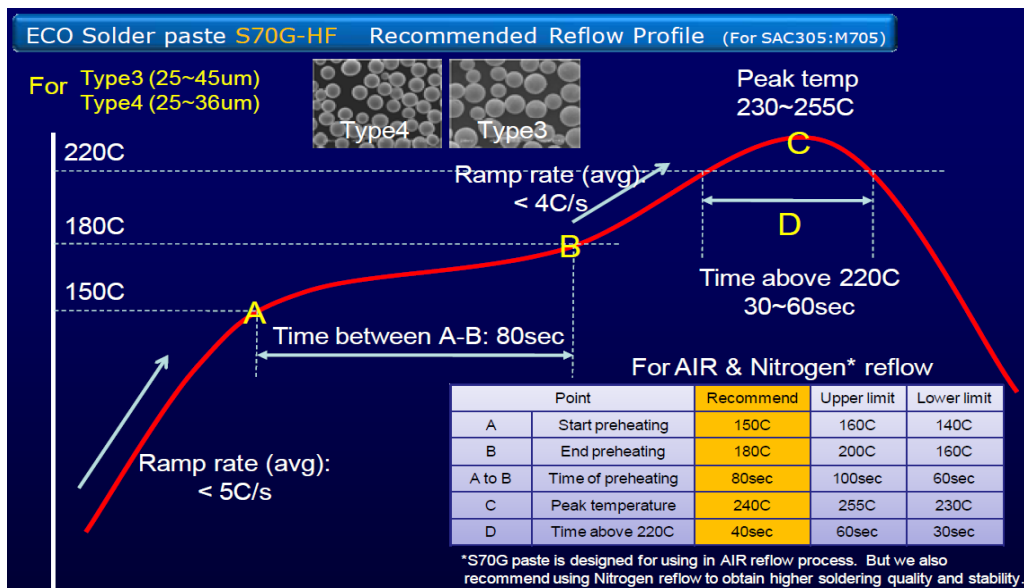
Scale 3:1

Top View

Unit : mm

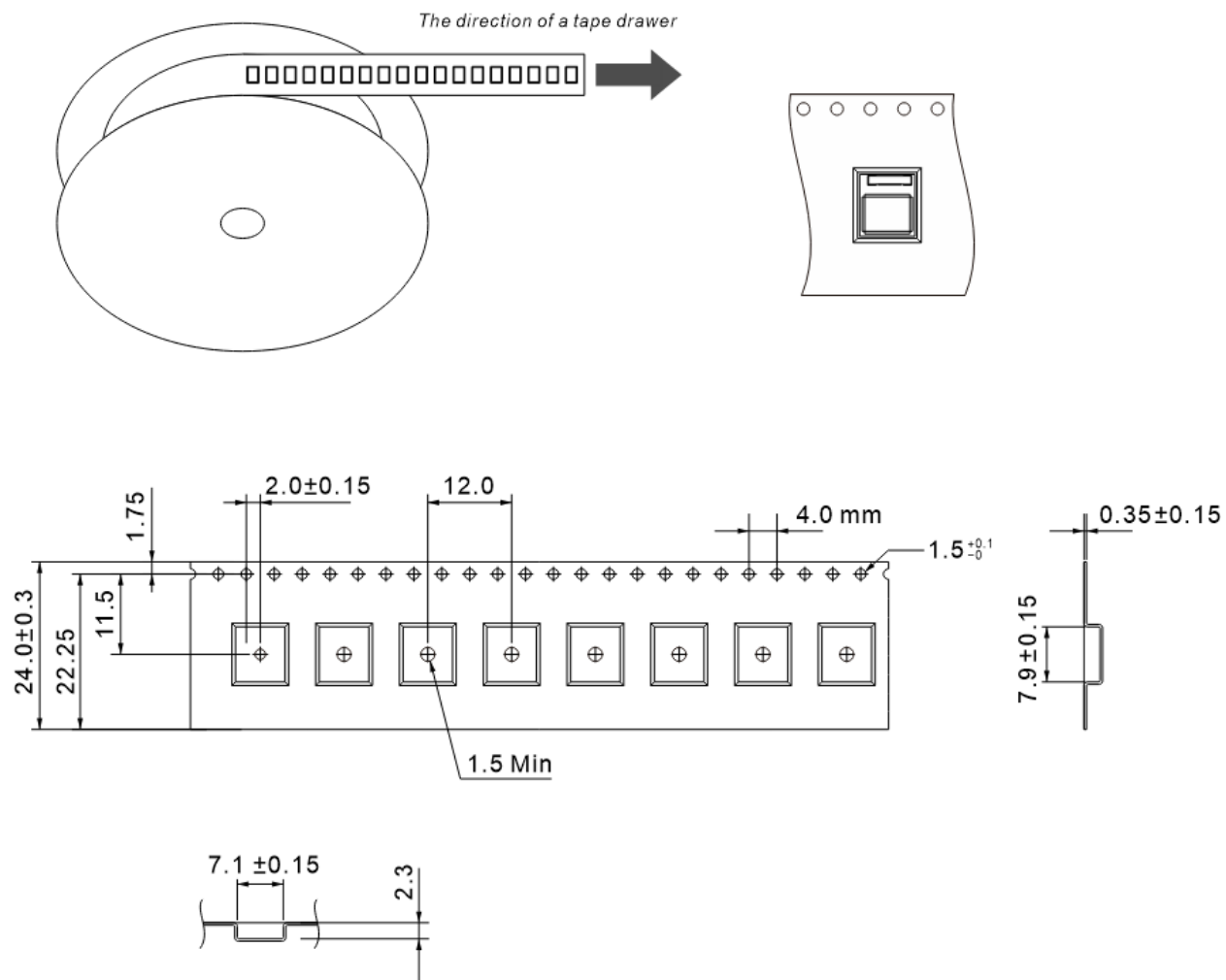
12. Reflow Thermal Profile Parameters

The following reflow profile is based on solder paste (Senju S70G-HF TYPE4) for reference only.



13. Packaging Information

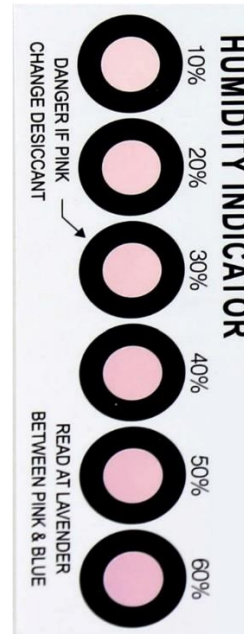
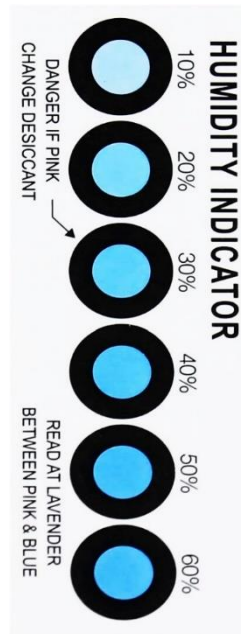
Tape & Reel Packing



Reel packaging is 1000 pcs

14. Moisture Sensitive Level Information

The moisture sensitive level (MSL) of this module is rated as “3”. Before reflow soldering, please confirm the status of humidity indicator card and baking is required if humidity indicator card is not blue (>30%).



15. Part Number Definition

BT5X L CA N I 01 - R

Packing

R: Reel

T: Tray

Series Number

Temp.

C : 0~70℃

I : -40~85℃

W: -40~105℃

Application

H: Host only

N: Device or Host

Antenna type

CA: Chip antenna

EX: External antenna

PC: PCB printed antenna

Form Factor

M: M.2

P: Mini-PCle

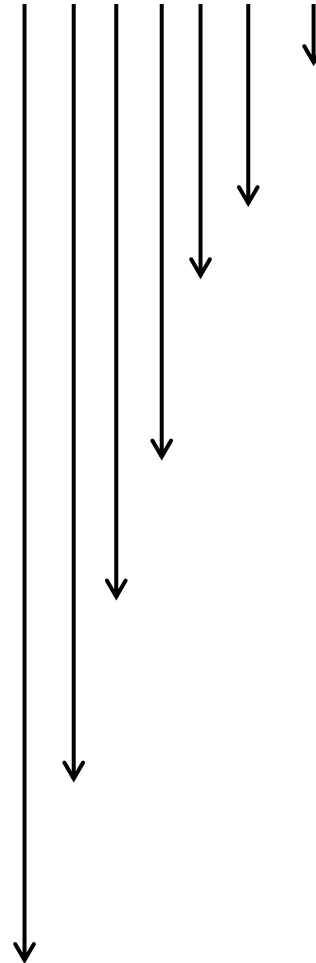
L: LGA/LCC

Function

BT5X: Bluetooth 5 series

WF60: Wi-Fi 6 ; WF6E: Wi-Fi 6E ; WFAH: 802.11ah

LORA: LoRa



Order Code

Model	Reel
BT5XLCANI01	BT5XLCANI01-R

16. Declaration of Conformity

FCC Supplier's Declaration of Conformity §2.1077(a)(3)

Name: Quanta Storage Inc.

Address: 392 Andover Street, Wilmington, MASSACHUSETTS, 1887, USA

Telephone number or Internet contact: 1 (617) 997-4010

The OEM or integrator is obligated to adhere to these requirements and restrictions as a condition for using the module's certification. The OEM or integrator is responsible to perform the required additional host regulatory testing and/or obtaining the required host approvals for compliance.

Per KDB 996369 D03 v01r01 OEM Manual, this module is intended for OEM integrators under the following conditions:

1. Ensure that the end-user has no manual instructions to remove or install module.
2. This module is certified pursuant to Part 15 rule section 15.247 and RSS-247.
3. This module has been approved to operate with the antenna types listed below, with the maximum permissible gain indicated.

Frequency Band	Model Number	Antenna Type	Gain(dBi)
2400-2483.5MHz, Bluetooth	ANT5010LL04R2400A	Chip	2.5

4. Label and compliance information

Label of the end product:

FCC:

The host product must be labeled in a visible area with the following " Contains FCC ID: S7Q-C03".

The end product shall bear the following 15.19 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.

ISED:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: "Contains transmitter module IC: 31309-C03" or "Contains IC: 31309-C03"

Contient le module d'émission IC: 31309-C03

The Host Model Number (HMN) must be indicated at any location on the exterior of the end product or product packaging or product literature which shall be available with the end product or online.

5. Information on test modes and additional testing requirements

This module has been approved under stand-alone configuration.

The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093/RSS-102 and different antenna configurations.

The information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host can be found at KDB Publication 996369 D04.

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.).

IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC/ISED authorization is no longer considered valid and the FCC/IC No. 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/ISED authorization.

6. Additional testing, Part 15 Subpart B and ICES-003 disclaimer

Appropriate measurements (e.g. Part 15 Subpart B compliance) and if applicable additional equipment authorizations (e.g. SDoC) of the host product to be addressed by the integrator/manufacturer.

This module is only FCC/ISED authorized for the specific rule parts 15.247, RSS-247 listed on the grant, and the host product manufacturer is responsible for compliance to any other FCC/ISED rules that apply to the host product as being Part 15 Subpart B/ICES-003 compliant.

7. Note EMI Considerations

Note that a host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties

For standalone mode, reference the guidance in D04 Module Integration Guide and for simultaneous mode; see D02 Module Q&A Question 12, which permits the host manufacturer to confirm compliance.

8. How to make changes

If any changes or modifications need to be made to the integrated product, such as adding or adjusting the antenna or cable, follow the guidelines provided by Grantee.

For further assistance, please contact: Sales Eric Tsuei <Eric.Tsuei@qsitw.com>

9. The user manual of the end product should include (information for OEMs):

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

Information To Be Supplied to the End User by the OEM or Integrator

FCC:

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

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons.

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.

The antenna(s) used for this transmitter must not transmit simultaneously with any other antenna or transmitter.

ISED:

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique 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'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

ISED Radiation Exposure Statement:

This equipment complies with IC RSS-102 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.

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20cm de distance entre la source de rayonnement et votre corps.

The transmitter module may not be co-located with any other transmitter or antenna.

Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.