

***Bluetooth*[®] low energy module**

Bluetooth[®] 5.0 low energy

EYSHSNZWZ

Data Report

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Revision History

30-Jun.-2017 > Ver.1.0 Release

25-Sep.-2017 > Ver.1.1 Update

15-Dec.-2017 > Ver.1.2 Update

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Control No. HD-AG-A160195	(1/6)	Control name General Items
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1. Scope

This specification ("Specification") applies to the hybrid IC "EYSHSNZWZ", a **Bluetooth®** 5.0 low energy module ("Product") manufactured by TAIYO YUDEN Co., Ltd. ("TAIYO YUDEN")

2. Description

- a) User Code : EYSHSNZWZ
Type : EYSHSN

*User Code may be changed for mass production or other cases.

Note: Please use the User Code (EYSHSNZWZ) to order this product

- b) Chip : Nordic nRF52832 (512kB Flash, 64kB RAM)
- c) Function : Radio frequency transceiver Module. Bluetooth®5.0 conformity.
- d) Application : IoT devices, Health & Fitness Equipment, Sensor, Toys
- e) Structure : Hybrid IC loaded with silicon monolithic semiconductor
Containment of hazardous substance in this Product
Can meet with RoHS compliance (Pb, Cd, Hg, Cr+6, PBB, PBDE)
- f) Outline : 28-pin Land Grid Array
- g) Marking : Part Number, Lot Number, and manufacturer on Shielding Case
- h) Country of origin : Japan
- i) Packaging : Packaging method: Tape & reel + aluminum moisture barrier bag
Packaging unit: 2000
*It might be provided as tray at sample stage.

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Control No. HD-AG-A160195	(2/6)	Control name General Items
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j) Notes:

a. Limitation of Warranty

- 1) TAIYO YUDEN provides warranties only if the Product is operated under the condition set forth in this Specification. Please note that TAIYO YUDEN shall not be liable for any defect and/or malfunction arising from use of the Product under the terms and conditions other than the operating conditions hereof. In addition when this Product is used under environmental conditions such as over voltage which is not guaranteed, it may be destroyed in short mode. To ensure the security of customer's product, please add an extra fuse or/and a protection circuit for over voltage.
- 2) This Product is designed for use in products which comply with Bluetooth® Specifications. TAIYO YUDEN disclaims and is not responsible for any liability concerning infringement by this Product under any intellectual property right owned by third party in case the customer uses this Product in any product which does not comply with Bluetooth® Specifications (the "non-complying products"). Furthermore, TAIYO YUDEN warrants only that this Product complies with this Specification and does not grant any other warranty including warranty for application of the non-complying products.
- 3) In some cases, TAIYO YUDEN may use replacements as component parts of Products. Such replacement shall apply only to component part of Products, which TAIYO YUDEN deems it possible to replace or substitute according to (i) Scope of Warranty provided in this specification (e.g. Electric Characteristics, Outline, dimension, Conditions of Use, Reliability Tests, Official Standard (Type Approvals etc.)) and (ii) Quality of Products. TAIYO YUDEN also ensures traceability of such replacement on production lot basis.

b. Instruction for Use (CAUTION)

- 1) Because Product is not designed for radiation durability, please refrain from exposing Product to radiation in the use.
- 2) Communication between this Product and other might not be established nor maintained depending upon radio environment or operating condition of this Product and other products with wireless technology.
- 3) This Product operates in the unlicensed ISM band at 2.4GHz. In case this Product is used around the other wireless devices which operate in same frequency band of this Product, there is a possibility that interference occurs between this Product and such other devices. If such interference occurs, please stop the operation of other devices or relocate this Product before using this Product or do not use this Product around the other wireless devices.
- 4) This Product mentioned in this Specification is manufactured for use in Health & Fitness Equipment, Sensor, Toys. Before using this Product in any special equipment (such as medical equipment, space equipment, air craft, disaster prevention equipment), where higher safety and reliability are duly required, the applicability and suitability of this Product must be fully evaluated by the customer at its sole risk to ensure correct and safety operation of those special equipments. Also, evaluation of the safety function of this Product even for use in general electronics equipment shall be thoroughly made and when necessary, a protective circuit shall be added in design stage, all at the customer's sole risk.

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Control No. HD-AG-A160195	(3/6)	Control name General Items
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5) Japan Regulatory Information

- a) This Product is a radio system and obtained certification of construction type combined with the specific antenna.
- b) Please ensure that your product has a label with the following certification mark at easily viewable location. If your product is too small to have the label, please place it in the instruction manual and package of your product. The mark diameter shall be equal or greater than 3mm. In case your product does not have the label with the following certification mark, you or your customer who uses your product may be against the Radio Law and subjected to criminal punishment. TAIYO YUDEN shall not be liable for any loss or damage incurred by you or your customer arising from use of your product which does not have following certification mark.

This product has a radio system which was approved as a radio station in a low power data communication system based on the Radio Law.

EYSHSN : 001-A10996



R 001-A10996

6) Canada Regulatory Information

- a) This device complies with Industry Canada's applicable licence-exempt RSSs. 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.

- b) This product is certified as type of the portable device with Industry Canada Rules. To maintain compliance with RF Exposure requirement, please use within specification of this product.

Ce produit est certifié comme type de l'appareil portable avec Industrie Règles de Canada. Pour maintenir l'acquiescement avec exigence Exposition de RF, veuillez utiliser dans spécification de ce produit.

- IC: 4389B-EYSHSN

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Control No. HD-AG-A160195	(4/6)	Control name General Items
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- c) Please notify certified ID by either one of the following method on your product.
-Contains IC : 4389B-EYSHSN

Specifiez ID certifiée dans votre produit par une de méthode suivante.
-Contains IC : 4389B-EYSHSN

7) FCC Regulatory Information

- 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.
- b) Please notify certified ID by either one of the following method on your product.
-Contains Transmitter Module FCC ID: RYYEYSHSN
-Contains FCC ID: RYYEYSHSN
- c) CAUTION: Changes or modifications not expressly approved by the party responsible for compliance could void the use's authority to operate the equipment.
- d) This product is certified as type of the portable device with FCC Rules. To maintain compliance with RF Exposure requirement, please use within specification of this product.
- e) The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- f) This module can change the output power depending on the circumstances by the application software which is developed by module installer. Any end user cannot change the output power.

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Control No. HD-AG-A160195	(5/6)	Control name General Items
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8) CE Regulatory Information

- a) When your end product installs this module, it is required to proceed additional certification processes before placing on the market in EU member states to make your products fully comply with relative EU standards.
- b) TAIYO YUDEN can provide you the test reports of conducted measurement portion for the radio module. You can utilize the test reports for the certification processes of your end product as it requires radio testing.

c. Term of Support

- 1) In the case that customer requests TAIYO YUDEN to customize the hardware of this Product in order to meet such customer's specific needs, TAIYO YUDEN will make commercially reasonable effort to modify such hardware or software at customer's expense; provide however, the customer is kindly requested to agree it doesn't mean that TAIYO YUDEN has obligations to do so even in the case it is technically difficult for TAIYO YUDEN.
- 2) Any failure arising out of this Product will be examined by TAIYO YUDEN regardless of before or after mass production. Customer agrees that once such failure is turned out not to be responsible for TAIYO YUDEN after aforesaid examination, some of the technical support shall be conducted by TAIYO YUDEN at customer's expense; provided however, exact cost of this technical support can be agreed through the negotiation by the parties.
- 3) Do not alter hardware and/or software of this Product. Please note that TAIYO YUDEN shall not be liable for any problem if it is caused by customer's alteration of Hardware without Taiyo Yuden's prior approvals.
- 4) TAIYO YUDEN does not guarantee functions and performances which depend on the customer's firmware. TAIYO YUDEN does not assume liabilities for defects and failures (i) in functions, performances and quality of the Customer's product incorporating the Products and (ii) which may occur as the Product is incorporated in the Customer's product.

d. Caution for Export Control

This Product may be subject to governmental approvals, consents, licenses, authorizations, declarations, filings, and registrations for export or re-export of the Product, required by Japanese Foreign Exchange and Foreign Trade Law (including related laws and regulations) and/or any other country's applicable laws or regulations related to export control.

In case you will export or re-export this Product, you are strongly recommended to check and confirm, before exporting or re-exporting, necessary procedures for export or re-export of this Product which is required by applicable laws and regulations, and if necessary, you have to obtain necessary and appropriate approvals or licenses from governmental authority at your own risk and expense.

e. Term of Warranty

TAIYO YUDEN warrants only that this Product is in conformity with this Specification for one year after purchase and shall in no event give any other warranty.

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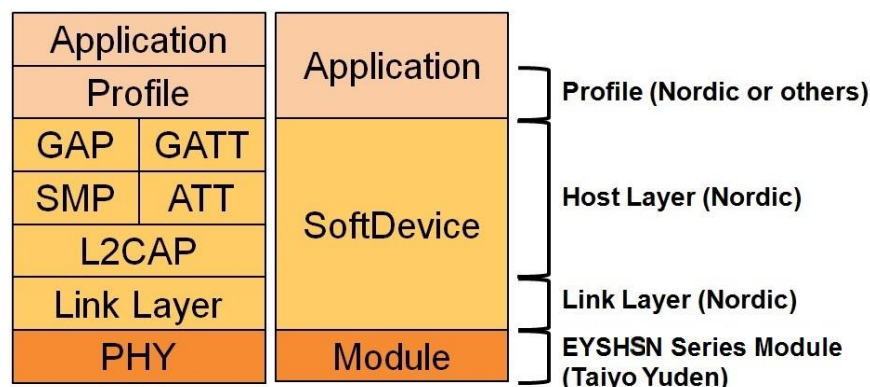
Control No. HD-AG-A160195	(6/6)	Control name General Items
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f. Items of the Specification

- 1) Any question arising from the Specification shall be solved in good faith through mutual discussion by the parties hereof.
- 2) The language of this “General items” is Japanese and this “General items” shall be interpreted by Japanese Any copies of translation is a reference purpose only and is not binding on both parties hereto.

g. Special note

- 1) Taiyo Yuden writes firmware for and fixed SoftDevice (s132_nrf52_5.0.0_softdevice.hex) to this product. Customer writes firmware that is match the customer applications including SoftDevice at the customer's own responsibility.
- 2) The Electrical Characteristics defined in this Specification are of the module with above Firmware (s132_nrf52_5.0.0_softdevice.hex). If other firmware developed by Customer is installed, the characteristics may differ from the defined value in the Electrical Characteristics. Bluetooth qualification and radio type approval may become invalid.
- 3) EYSHSN series module is qualified as PHY only with Component category by Bluetooth SIG. The QDID of this module is 98386. The final product needs to get qualification as End product combining with PHY (module), SoftDevice and Profile before selling the product. The combination of Link and Host layer is differ with SoftDevice. Please refer to following combination and consult with your qualification body and BQE.



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Control No. HD-AM-A160195	(1/1)	Control name Absolute maximum ratings
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Absolute maximum ratings

Symbol	Parameter	Min.	Max.	Units
VCC_NRF		-0.3	+3.9	V
GND			0	V
VIO, VCC_NRF \leq 3.6V		-0.3	VCC_NRF+ 0.3	V
VIO, VCC_NRF $>$ 3.6V		-0.3	+3.9	V
Storage temperature		-40	+85	Deg-C
MSL	Moisture Sensitivity Level	3		
ESD HBM	Human Body Model		1	kV
ESD MM	Machine Model		100	V
Endurance	Flash Memory Endurance	10000		write/erase cycles
Retention	Flash Memory Retention	10 years		At 40 deg-C
Number of times a 512 byte block can be written between erase cycles	32bit writes		181	times

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Control No. HD-AE-A160195	(1/3)	Control name Electrical characteristics
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Electrical characteristics**Recommendation operating range**

Symbol	Parameter	Min.	Typ.	Max.	Units
VCC_NRF	Supply voltage, normal mode	1.7	3.0	3.6	V
tR_VCC_NRF	Supply rise time (0V to 1.7V)*1			60	ms
TA	Operation temperature	-40	25	85	Deg-C

*1 The on-chip power-on reset circuitry may not function properly for rise times outside the specified interval. Also after power off, it must start up from below 0.3V. The on-chip power-on reset circuitry may not function properly.

DC Specifications

The Specification applies for Topr.= 25 degrees C, VCC_NRF = 3.0V

Symbol	Parameter (condition)	Min.	Typ.	Max.	Units
VIH	Input high voltage	0.7 VCC_NRF		VCC_NRF	V
VIL	Input low voltage	GND		0.3 VCC_NRF	V
VOH	Output high voltage (high drive 5 mA)	VCC_NRF-0.4		VCC_NRF	V
VOL	Output low voltage (high drive 5 mA)	GND		GND+0.4	V
RPU	Pull-up resistance	11	13	16	kohm
RPD	Pull-down resistance	11	13	16	kohm
ITX,+4dBm ,DCDC	TX only run current (DCDC, 3V) PRF=+4 dBm		7.5		mA
ITX,+4dBm	TX only run current PRF=+4 dBm		16.6		mA
IRX,1M, DCDC	RX only run current (DCDC, 3V) 1Mbps BLE		5.4		mA
IRX,1M	RX only run current 1Mbps BLE		11.7		mA
IRX,2M, DCDC	RX only run current (DCDC, 3V) 2Msps BLE		5.8		mA
IRX,2M	RX only run current 2Msps BLE		12.9		mA
IOFF	Current in SYSTEM-OFF, no RAM retention		0.3		uA
ION	SYSTEM-ON base current		1.2		uA
IRAM	Additional RAM retention current per 4KB RAM block		20		nA

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Control No. HD-AE-A160195	(2/3)	Control name Electrical characteristics
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RF Specifications

Symbol	Description	Min.	Typ.	Max.	Units
Fop	Operating frequencies	2402		2480	MHz
PLLchsp	PLL channel spacing		1		MHz
DfBLE2M	Frequency deviation @ BLE 1Mbps		+/-250		kHz
DfBLE2M	Frequency deviation @ BLE 2Msps		+/-500		kHz
PRF	Maximum output power		4	6	dBm
PRFC	RF power control range		24		dB
PRFCR	RF power accuracy			+/-4	dB
PRF1	1st Adjacent Channel Transmit Power 1 MHz		-25		dBc
PRF2	2nd Adjacent Channel Transmit Power 2 MHz		-50		dBc
PRXMAX	Maximum received signal strength at < 0.1% PER		0		dBm
PSENS,IT,1M,BLE	Receiver sensitivity 1Msps BLE Ideal transmitter ≤37bytes (0.1% BER)		-94		dBm
PSENS,IT,2M,BLE	Receiver sensitivity 2Msps BLE Ideal transmitter Packet length≤37bytes		-91		dBm

Reference documents for electrical characteristics

nRF52832_Product Specification

http://infocenter.nordicsemi.com/topic/com.nordic.infocenter.nrf52/dita/nrf52/chips/nrf52832_ps.htmlhttp://infocenter.nordicsemi.com/pdf/nRF52832_PS_v1.4.pdf

nRF52832_Rev1 Errata

<http://infocenter.nordicsemi.com/topic/com.nordic.infocenter.nrf52/dita/nrf52/errata.html>http://infocenter.nordicsemi.com/pdf/nRF52832_Rev_1_Errata_v1.7.pdf

S132_SoftDevice Specification

<http://infocenter.nordicsemi.com/topic/com.nordic.infocenter.softdevices52/dita/softdevices/s130/s130.html>http://infocenter.nordicsemi.com/pdf/S132_SDS_v5.0.pdf

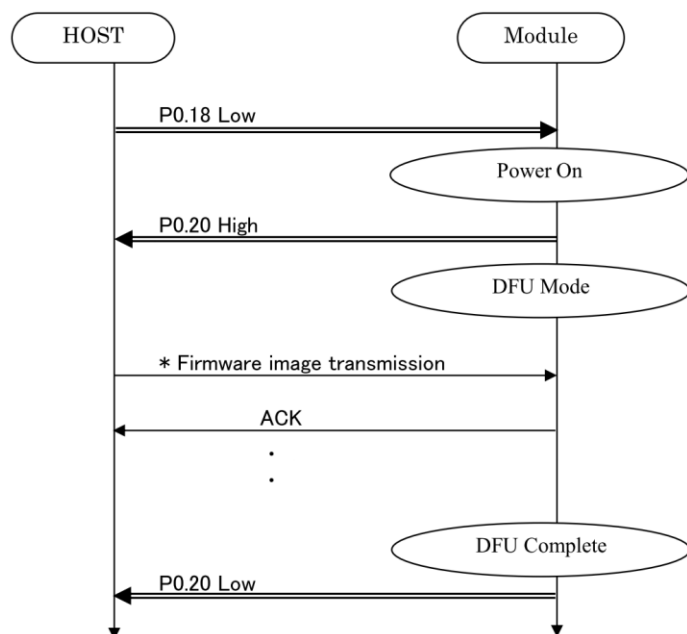
For more information

<https://infocenter.nordicsemi.com/index.jsp>**TAIYO YUDEN CO., LTD.**

Control No.
HD-AE-A160195

(3/3)

Control name
Electrical characteristics

DFU Specifications

UART	
Baud rate : 38400 bps	UART PIN :
Data : 8 bit	RX : P0.08
Parity : none	TX : P0.06
Stop : 1 bit	CTS : P0.07
Hardware flow control : Enable	RTS : P0.05

* see Nordic Infocenter

[Nordic Infocenter] <http://infocenter.nordicsemi.com/index.jsp>

Software Development Kit > nRF5 SDK > nRF5 SDK v14.0.0 > Examples > DFU bootloader examples
> Serial Secure DFU Bootloader

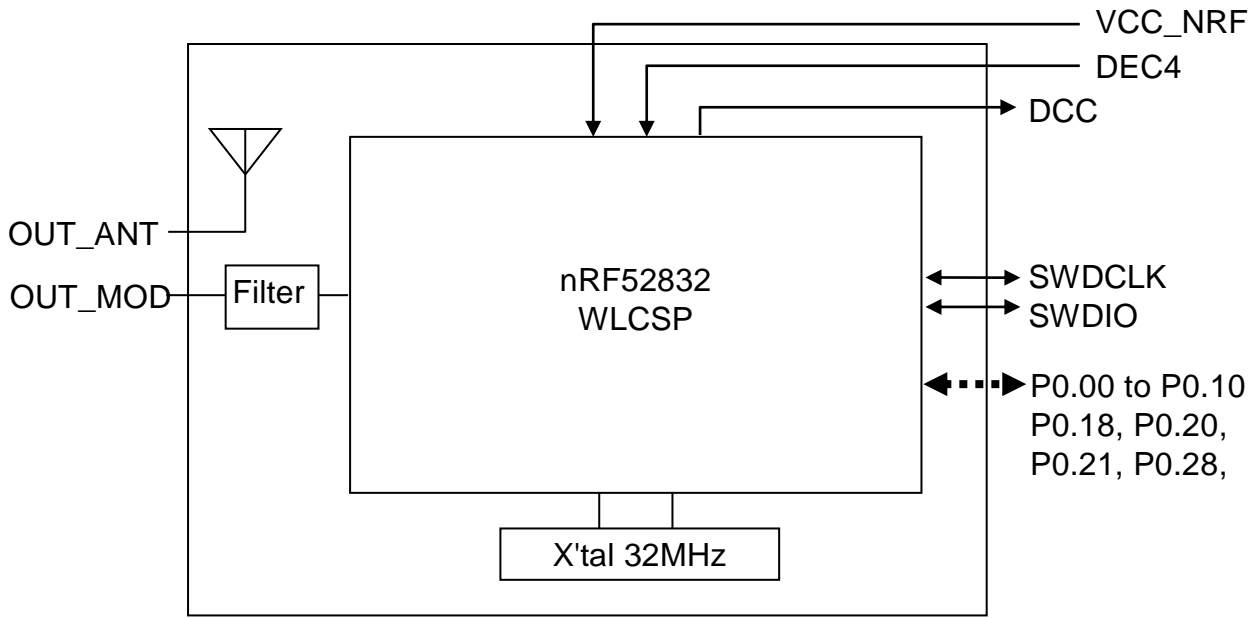
How to obtain Private (signing) key is attached to evaluation board (E**B**SHxNZWZ) or evaluation kit (E**K**SHxNZWZ).

EYSHSNZWZ

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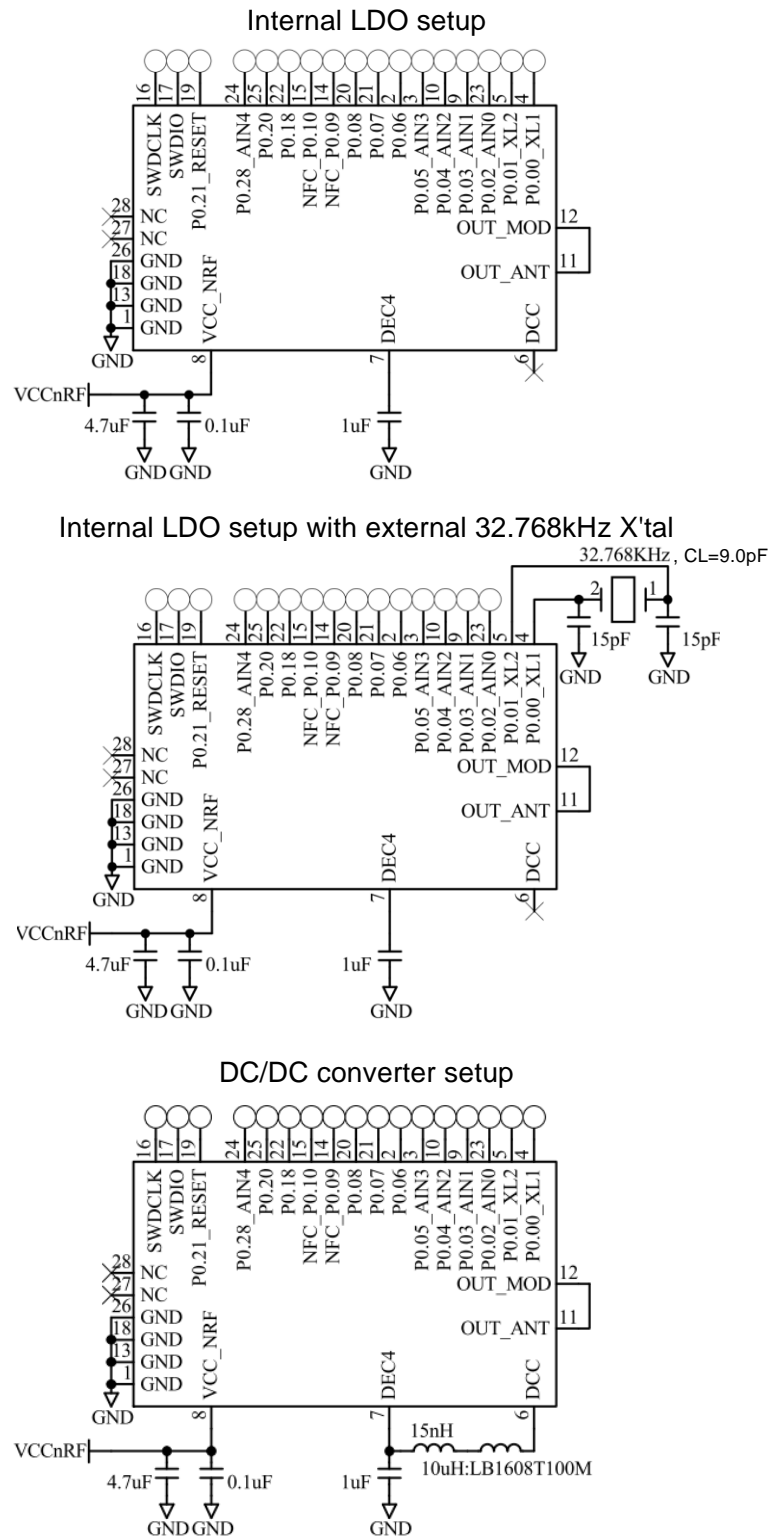
Control No. HD-MC-A160195	(1/3)	Control name Circuit Schematic
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Block Diagram



Control No. HD-MC-A160195	Control name Circuit Schematic
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Sample circuits



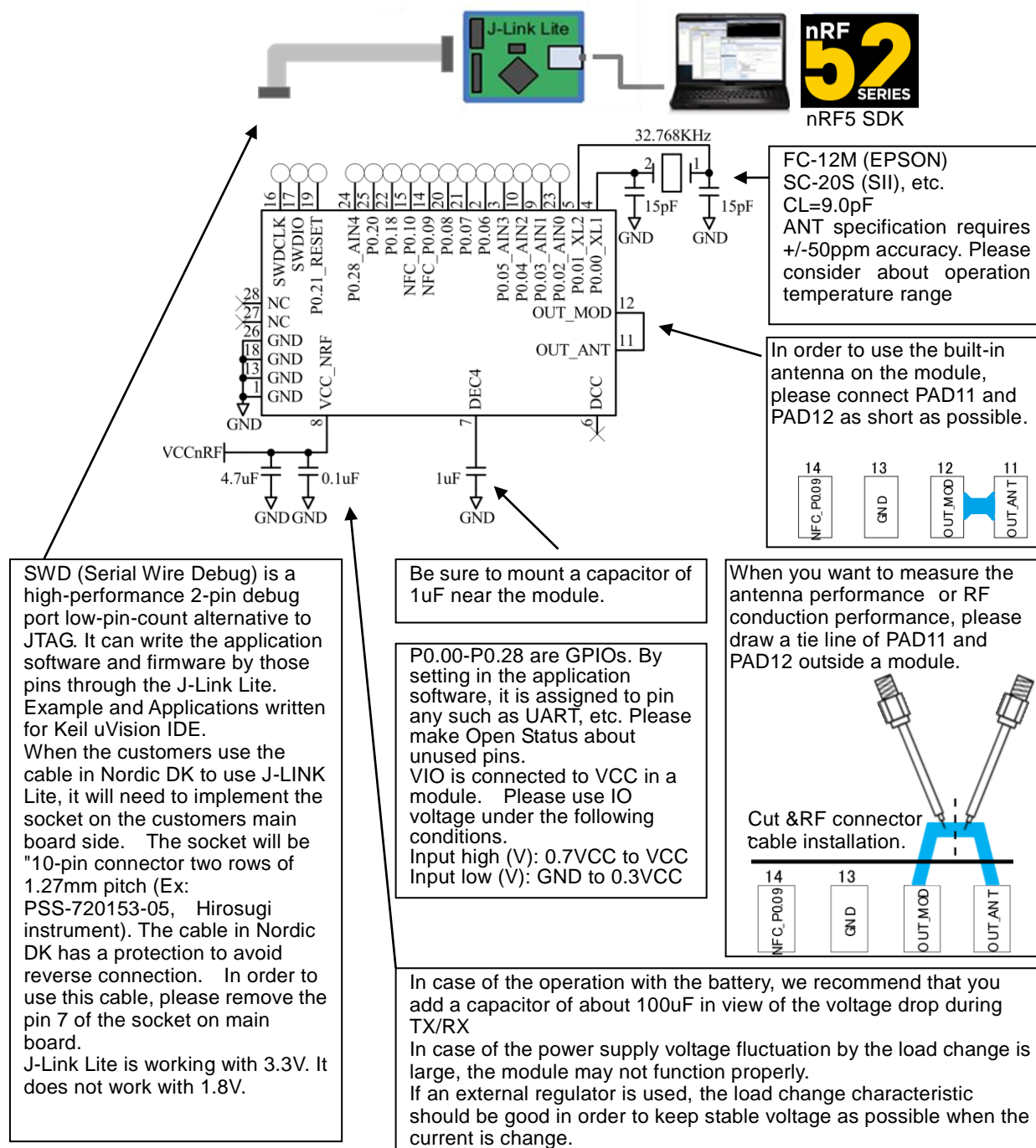
Control No.
HD-MC-A160195

(3/3)

Control name
Circuit Schematic

Reference Circuits

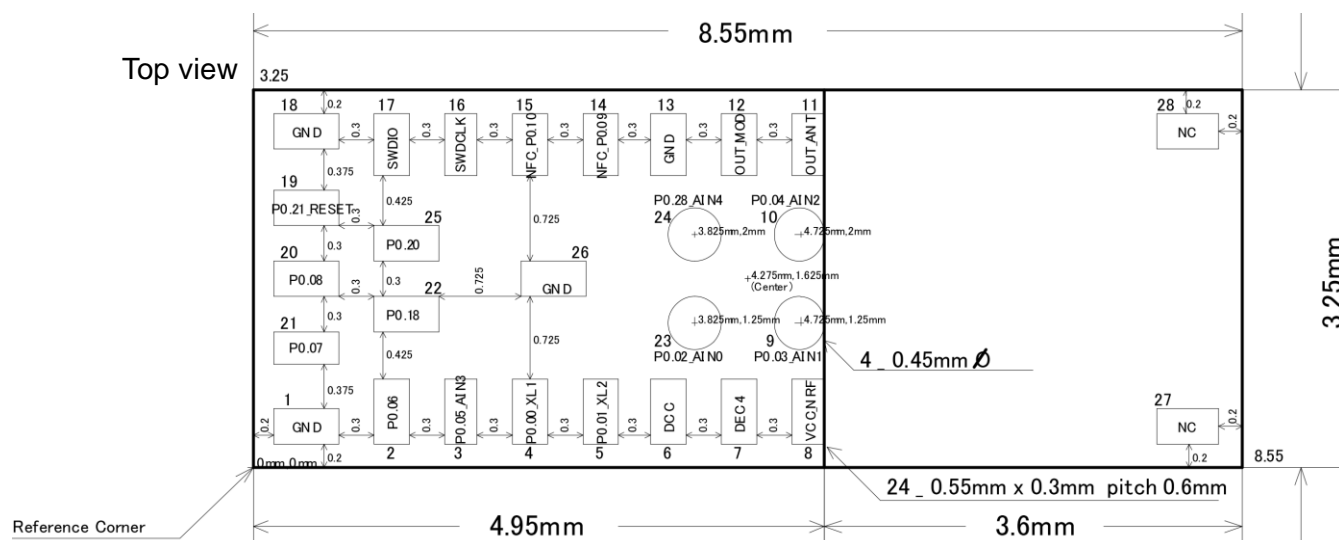
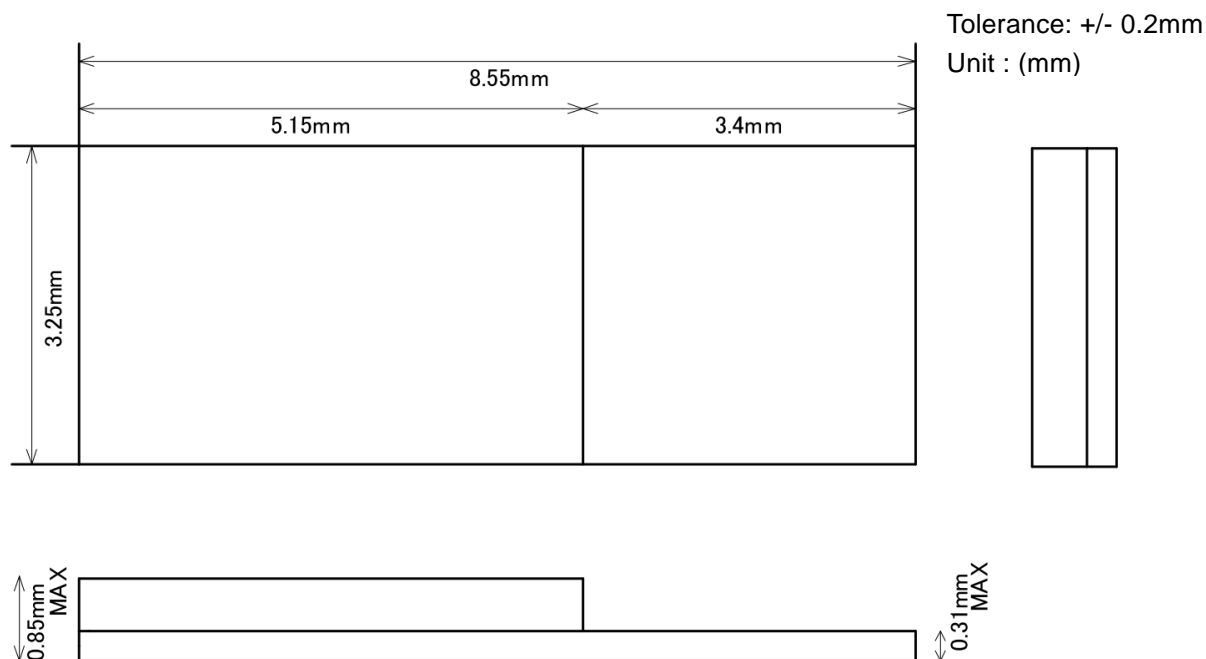
Internal LDO setup with external 32.768kHz X'tal



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Control No. HD-AD-A160195	Control name Outline/Appearance
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The dimension of the land pattern is the same as a foot pattern.

Recommended metal mask for solder printing

Pad size	Metal mask opening
Square pad 24 – 0.55 x 0.3 mm	0.44 x 0.3 mm
Circle pad 4 – 0.45 mm dia	0.4 mm

The metal mask thickness: t=0.1mm

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Control No. HD-BA-A160195	(1/2)	Control name Pin Layout
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Pin Descriptions

Pin	Pin name	Pin function	Description
1	GND	Ground	Ground pin. (0 V)
2	P0.06	Digital I/O	General purpose I/O pin.
3	P0.05 AIN3	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input.
4	P0.00 XL1	Digital I/O Analog input	General purpose I/O pin. Connection for 32.768kHz crystal (LFXO).
5	P0.01 XL2	Digital I/O Analog input	General purpose I/O pin. Connection for 32.768kHz crystal (LFXO).
6	DCC	Power	DC/DC converter output pin.
7	DEC4	Power	1V3 regulator supply decoupling. Input from DC/DC converter. Output from 1.3 V LDO.
8	VCC_NRF	Power	Power supply pin.
9	P0.03 AIN1	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input.
10	P0.04 AIN2	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input.
11	OUT_ANT	Antenna In/Out	Internal antenna. It should be connected to Pin 12 OUT_MOD for normal operation.
12	OUT_MOD	RF In/Out	RF I/O pin. It should be connected to Pin 11 OUT_ANT for normal operation.
13	GND	Ground	Ground pin. (0 V)
14	NFC P0.09	NFC input Digital I/O	NFC antenna connection. General purpose I/O pin.
15	NFC P0.10	NFC input Digital I/O	NFC antenna connection. General purpose I/O pin.
16	SWDCLK	Digital input	Serial Wire Debug clock input for debug and programming
17	SWDIO	Digital I/O	Serial Wire Debug I/O for debug and programming
18	GND	Ground	Ground pin. (0 V)
19	P0.21 RESET	Digital I/O	General purpose I/O pin Configurable as system RESET pin. (Factory default : RESET)
20	P0.08	Digital I/O	General purpose I/O pin.
21	P0.07	Digital I/O	General purpose I/O pin.
22	P0.18 TRACEDATA[0]	Digital I/O	General purpose I/O pin Trace port output.

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Control No. HD-BA-A160195	(2/2)	Control name Pin Layout
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Pin	Pin name	Pin function	Description
23	P0.02 AIN0	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input.
24	P0.28 AIN4	Digital I/O Analog input	General purpose I/O pin. SAADC/COMP/LPCOMP input.
25	P0.20 TRACECLK	Digital I/O	General purpose I/O pin. Trace port clock output.
26	GND	Ground	Ground pin. (0 V)
27	NC	Not Connected	Isolated pad on PCB for mechanical stability.
28	NC	Not Connected	Isolated pad on PCB for mechanical stability.

TAIYO YUDEN CO., LTD.

Control No. HQ-BA-537	(1/2)	Control name Handling Precaution
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This specification describes desire and conditions especially for mounting.

Desire/Conditions

(1) Environment conditions for use and storage

1. Store the components in an environment of < **40deg-C/90%RH** if they are in a moisture barrier bag packed by TAIYO YUDEN.
2. Keep the factory ambient conditions at < **30deg-C/60%RH**.
3. Store the components in an environment of < **25±5deg-C/10%RH** after the bag is opened.
(The condition is also applied to a stay in the manufacture process).

(2) Conditions for handling of products

Make sure all of the moisture barrier bags have no holes, cracks or damages at receiving. If an abnormality is found on the bag, its moisture level must be checked in accordance with 2 in (2).

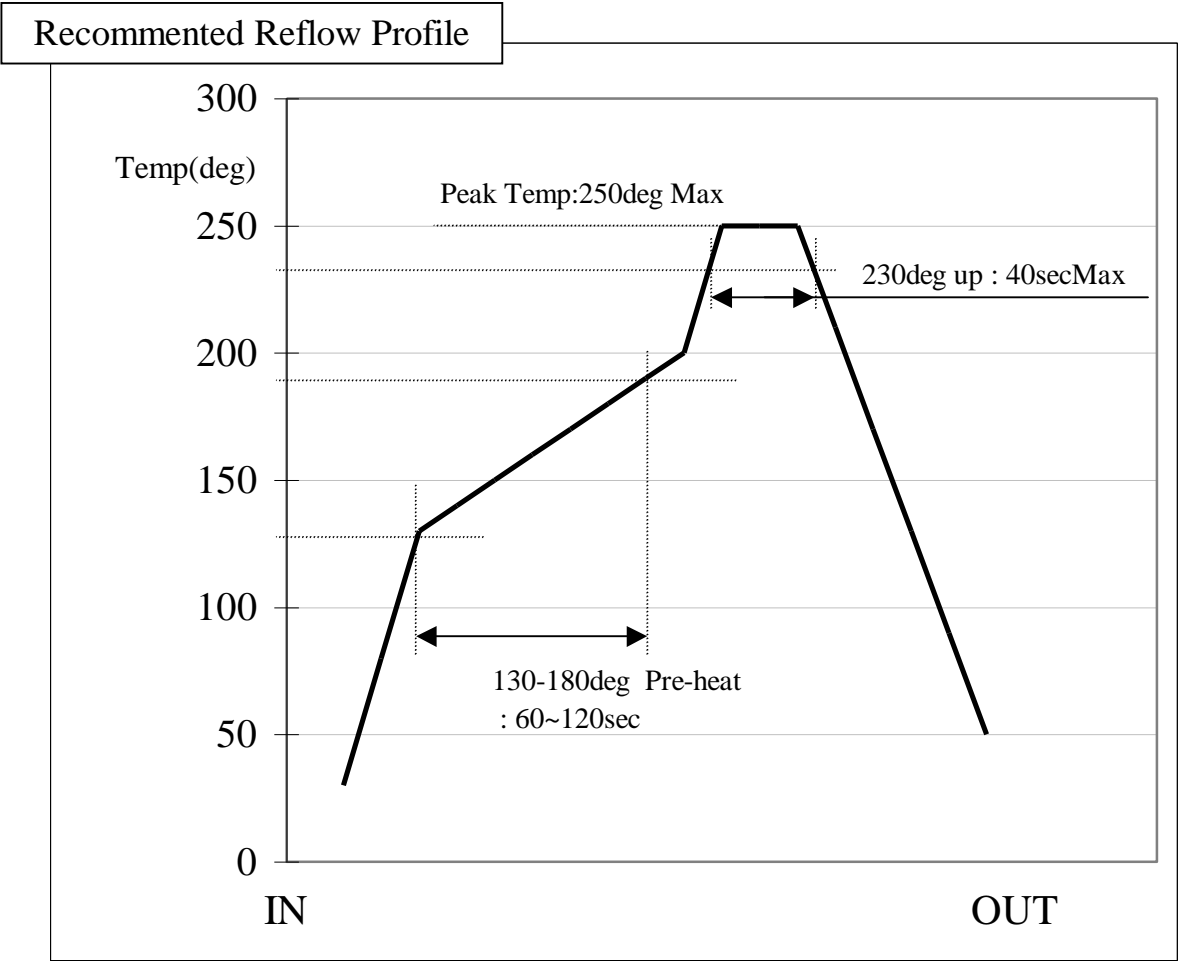
Refer to the label on the bag.

1. All of the surface mounting process (reflow process) must be completed **in 12 months** from the bag sea date.
2. Make sure humidity in the bag is less than **10%RH** immediately after open, using a humidity indicator card sealed with the components.
3. **All** of the surface mounting process (reflow process including rework process) must be completed in **168 hours** after the bag is opened (inclusive of any other processes).
4. If any conditions in (1) or condition 2 and 3 in (2) are not met, bake the components in accordance with the conditions at **125deg-C 24hours**
5. As a rule, baking the components in accordance with conditions 4 in (2) shall be once.
6. Since semi-conductors are inside of the components, they must be free from static electricity while handled.(<100V) Use ESD protective floor mats, wrist straps, ESD protective footwear, air ionizers etc. , if necessary.
7. Please make sure that there are lessen mechanical vibration and shock for this module, and do not drop it.
8. Please recognize pads of back side at surface mount.
9. Washing the module is not recommended. If washing cannot be avoided, please test module functionality and performance after thoroughly drying the module.
We cannot be held responsible for any failure due washing the module.
10. Please perform temperature conditions of module at reflow within the limits of the following.
Please give the number of times of reflow as a maximum of 2 times.

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Control No. HQ-BA-537	(2/2)	Control name Handling Precaution
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梱包仕様

(1) Packaging Material 梱包材料

1) Packaging Material 梱包材名	Outline 概要	Materials 材質	Note 備考
Emboss エンボス	16mm wide - 8mmPitch 16mm幅 - 8mmピッチ	Conductive PS 導電性 PS	
Cover Tape カバーテープ			
Reel リール	φ 330 mm	Conductive PS 導電性 PS	
Desiccant 乾燥剤	30g×1		
Humidity indicator card 湿度インジケータ			
Aluminum moisture barrier bag アルミ防湿袋	420×460(mm)	(AS)PET/AL/NY/PE(AS)	
Label ラベル			
Corrugated cardboard box (Inner) 個装箱	339×351×74(mm)		
Corrugated cardboard box (Outer) 外装箱	369×369×277(mm)		

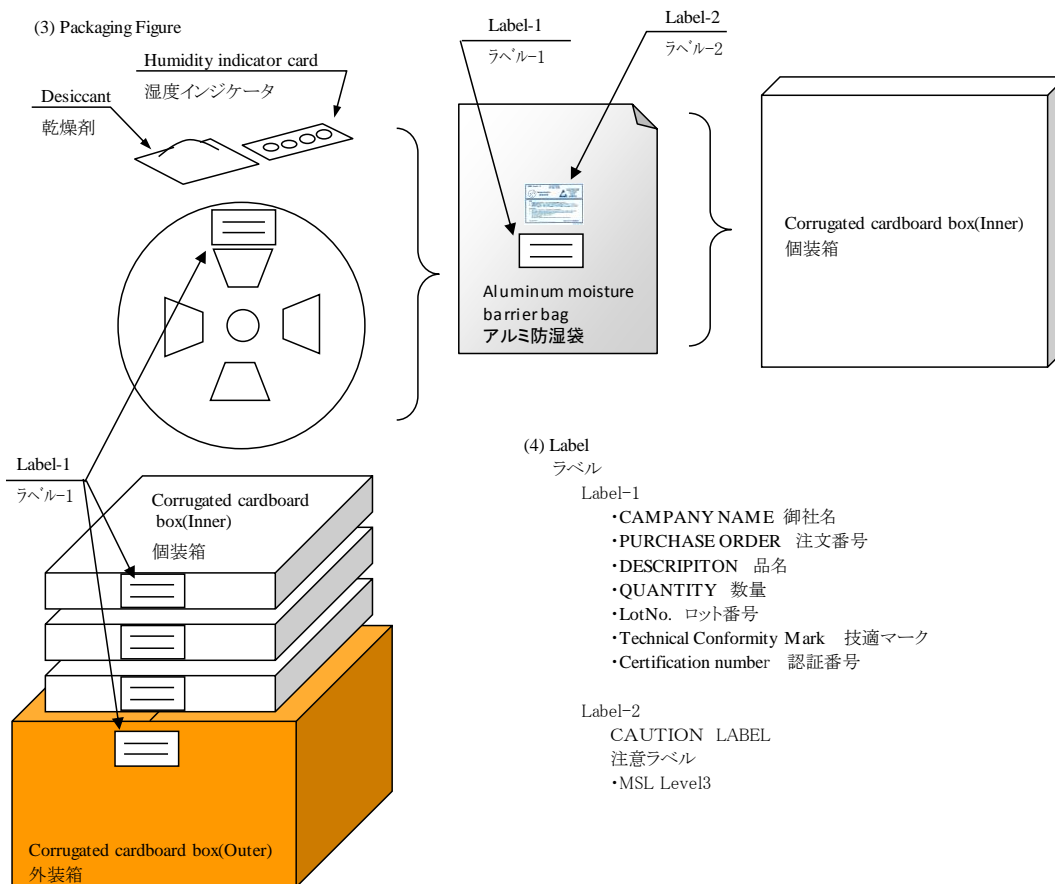
(2) Packaging Unit

捆包数量

Max 2000 pieces/Reel

Max 6000 pieces/Box(Outer)

(3) Packaging Figure



(4) Label

ラベル

Label-1

- ・COMPANY NAME 御社名
- ・PURCHASE ORDER 注文番号
- ・DESCRIPITON 品名
- ・QUANTITY 数量
- ・LotNo. ロット番号
- ・Technical Conformity Mark 技適マーク
- ・Certification number 認証番号

Label-2

CAUTION LABEL

注意ラベル

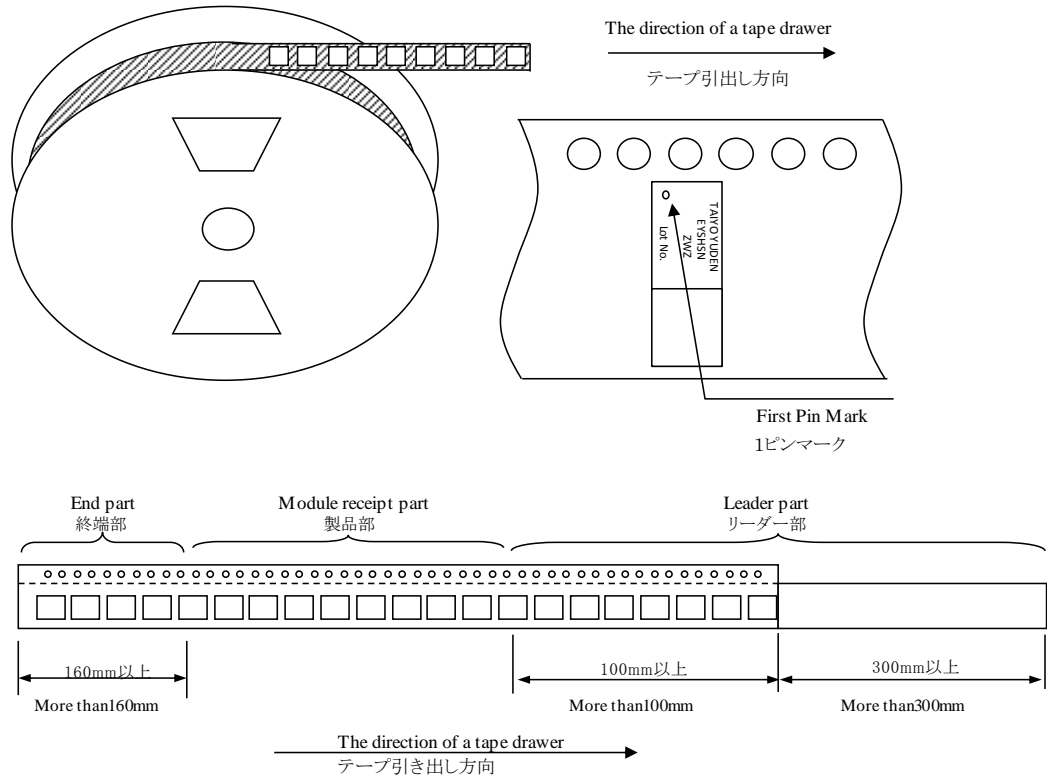
- MSL Level3

EYSHSNZWZ

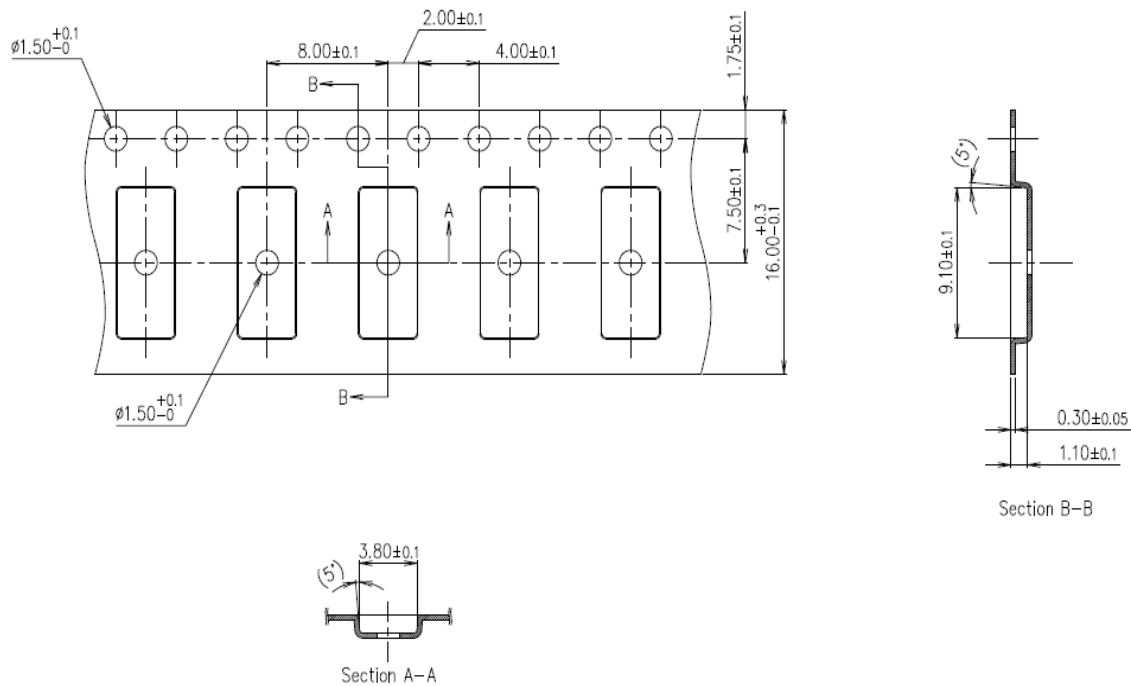
TAIYO YUDEN CO., LTD.

Control No. HD-BB-A160195	Control name Packaging Specification
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Tape specification
テーピング仕様



キャリアエンボス図面



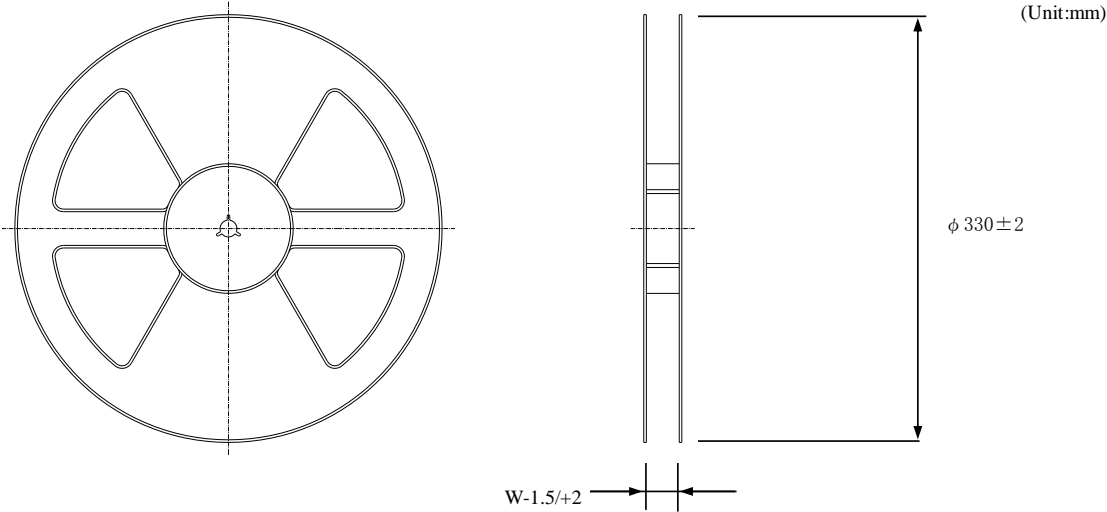
TAIYO YUDEN CO., LTD.

EYSHSNZWZ

TAIYO YUDEN CO., LTD.

Control No. HD-BB-A160195	(3/3)	Control name Packaging Specification
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Reel specification
リール仕様



Tape wide	8mm	12mm	16mm	24mm	32mm	44mm
W	9.4mm	13.4mm	17.4mm	25.4mm	33.4mm	45.4mm

Taping performance
テーピング性能

Both of an embossing tape top cover tape bear this, when the power of 10N is applied in the direction of a drawer.
•エンボステープ、トップカバーテープともに、引き出し方向に10Nの力を加えた場合に、これに耐えうること。

The exfoliation adhesion of a top cover tape is the intensity of 0.1～1.3N.
(The angle to pull is 165～180 degrees. The speed to pull is 300 mm/min.)
•トップカバーテープの剥離強度は、角度165～180度に保ち、300mm/minのスピードでトップカバーテープを引っ張ったとき、0.1～1.3Nとする。

Note
備考

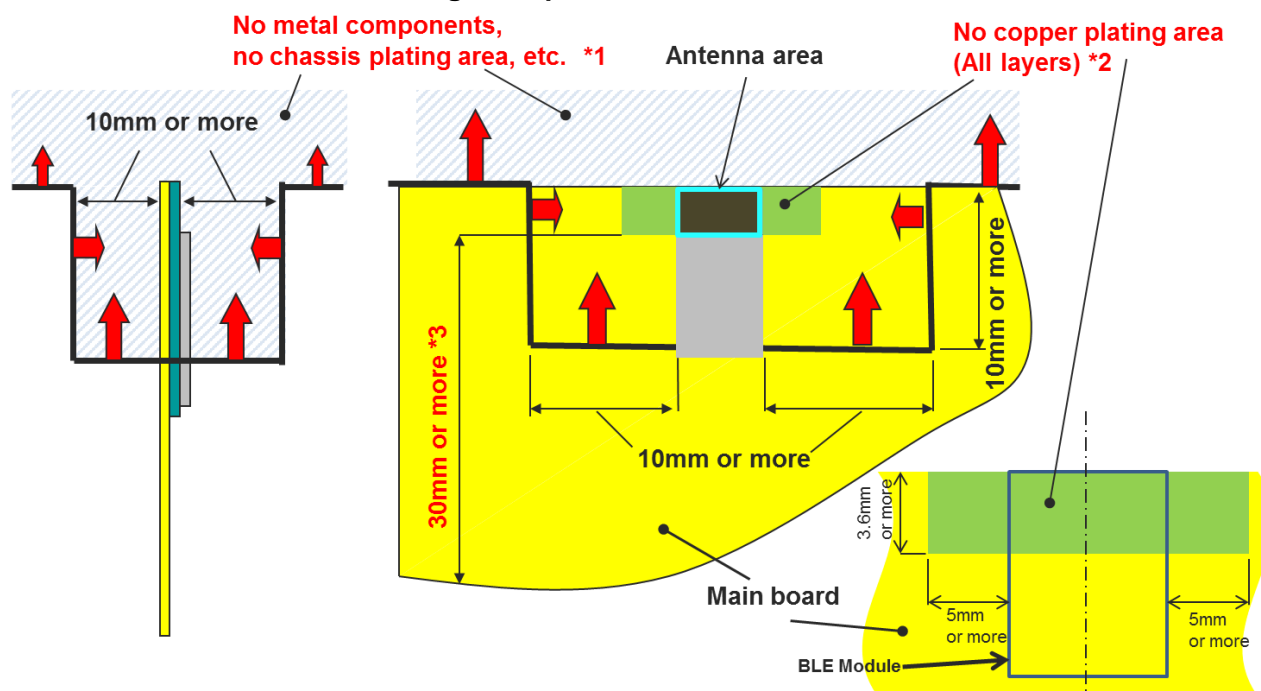
Lack of the parts in 1 reel is with two or less pieces.
1リール中の部品の欠落は2個までとします。(ラベル表示数量と梱包数は同じです。欠落とはテープ内でのモジュール抜けが2個まで許容させていただくという意味になります。)

MSL Level 3 Under control
MSL はレベル3 で管理しています。

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Control No.	Control name
(1/3)	Antenna application note

Recommended module mounting example



*1 Please do not place any metal components in **blue shaded space,(*1)** such as signal line and metal chassis as possible except for main board while mounting the components in *1 space on the main board is allowed except for no copper plating area. (*2).

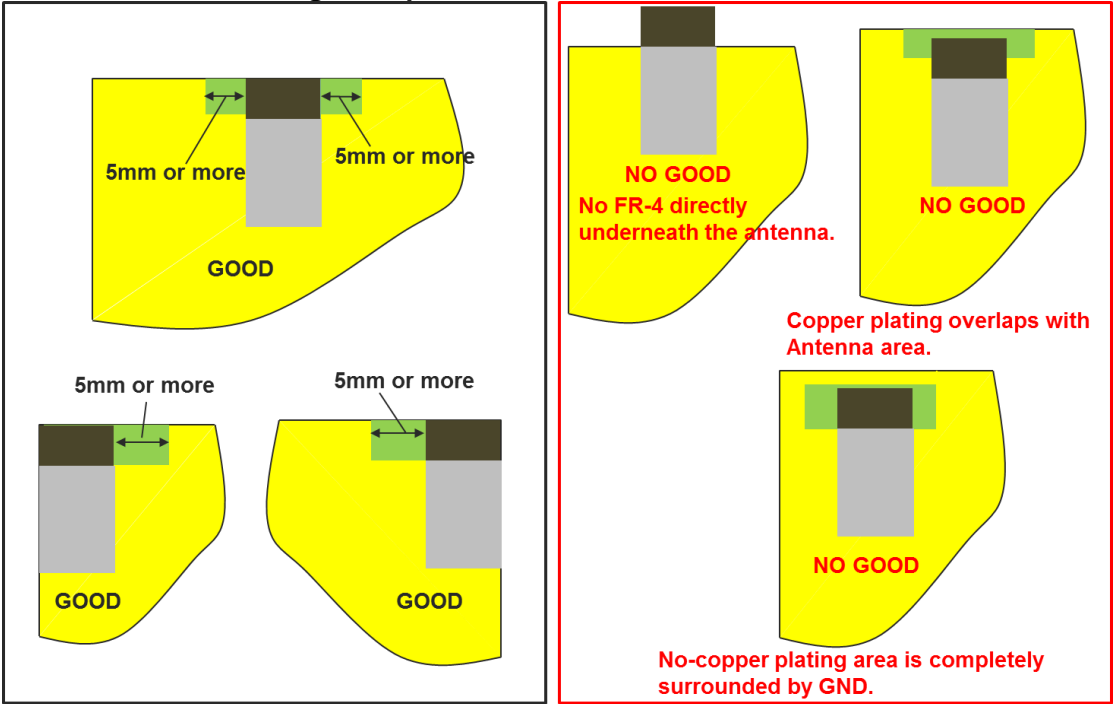
*2 This area is routing prohibited area on the main board. Please do not place copper on any layer. Please remain use of FR-4 dielectric material. The antenna is tuned with the FR-4.

*3 Characteristics may deteriorate when **GND pattern** length is less than 30mm. It should be 30 mm or more as possible.

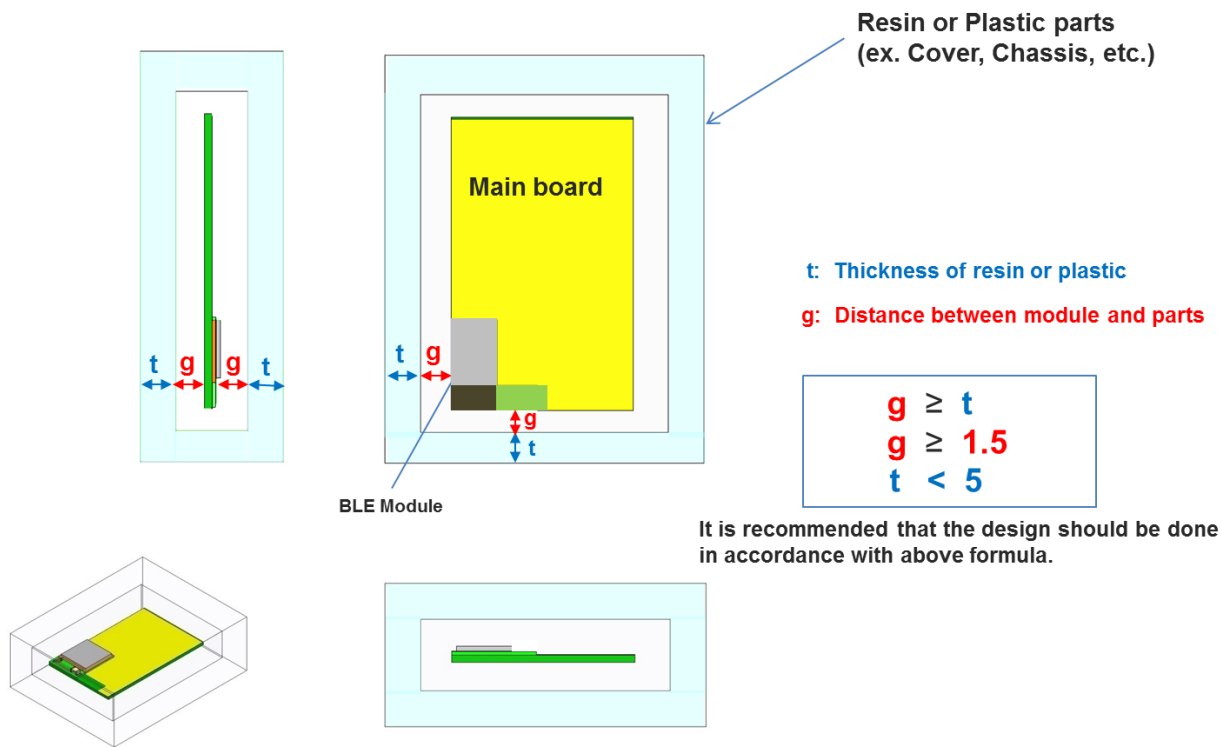
Even when above mentioned condition is satisfied, communication performance may be significantly deteriorated depending on the structure of the product.

Control No.	Control name
(2/3)	Antenna application note

Other module mounting examples



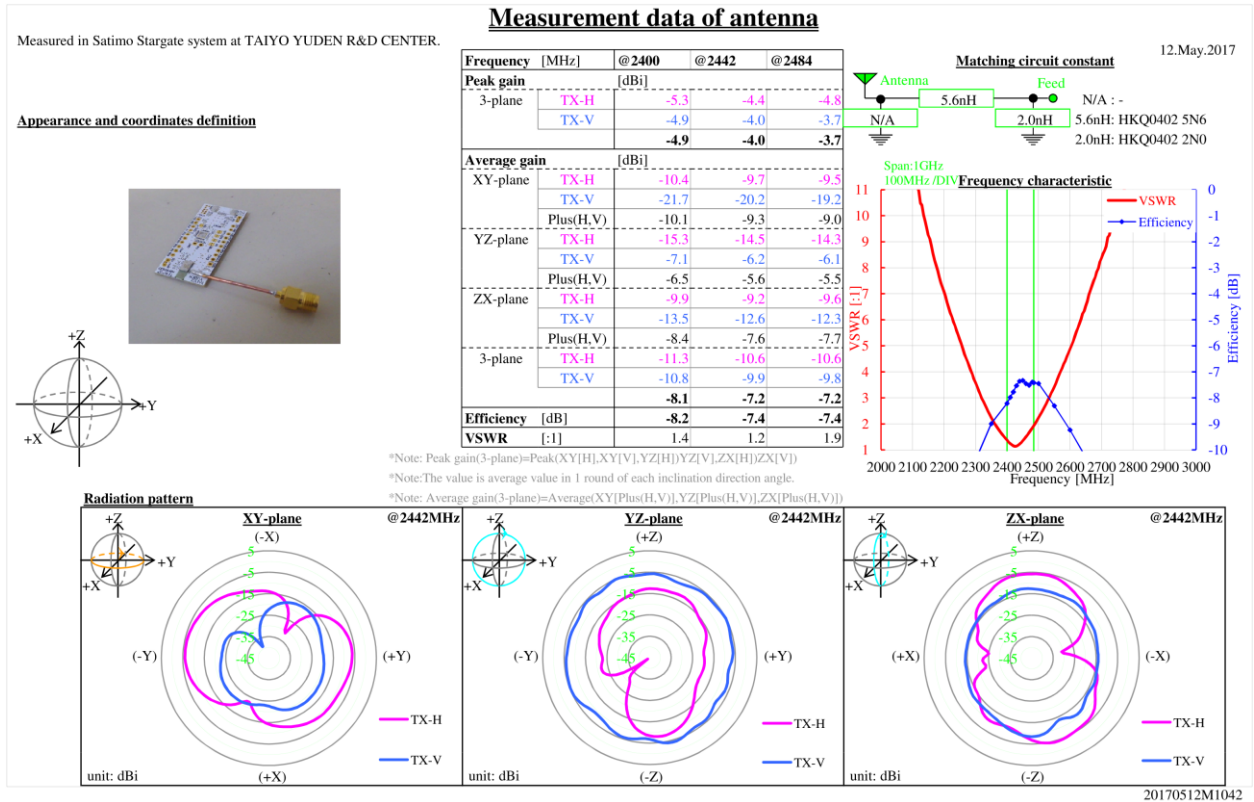
Placement of resin or plastic parts



Please do not apply molding over the antenna area of BLE module.

Control No.	Control name
(3/3)	Antenna application note

Directional characteristics example (when mounted on evaluation board)



About this Application Note

- This Application Note has been prepared as a reference material to help obtaining the antenna performance mounted on BLE module better while it is not guaranteed or assured to obtain better communication performance and distance.
- This product “BLE module” has been certified and matching circuit constant for antenna within module cannot be changed when ambient environment condition changes. The product must be re-certified when matching circuit constant is changed.

Control No.	Control name
(1/2)	Design guide

1. Power Up Sequence

VCC_NRF power supply rise time (0V to 1.7V) must not exceed 60ms.

2. Recommended Power Circuit

VCC_NRF is the main power supply (1.7 – 3.6V) for this module. The supply voltage range of VCC_NRF is 1.7V to 3.6V in both of LDO and DCDC mode. In case of the power supply voltage fluctuation by the load change is large, the module may not function properly. If an external regulator is used, the load change characteristic should be good in order to keep stable voltage as possible when the current is change.

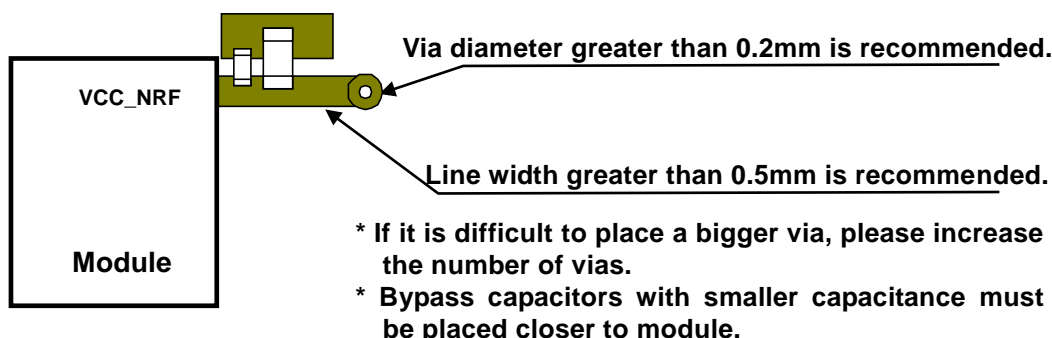
3. Battery operation

When using a small battery (e.g. CR2032), a large capacitor (e.g.100uF low leakage capacitor) should be placed near the battery. This will reduce the voltage drop especially when the module is operated at low temperatures

4. Pattern Design Guide

4-1. Power Supply System

Power supply bypass capacitors should be placed close to the VCC_NRF pin of the module. The VCC_NRF trace should be greater than 0.5mm and a bigger a via diameter is recommended.

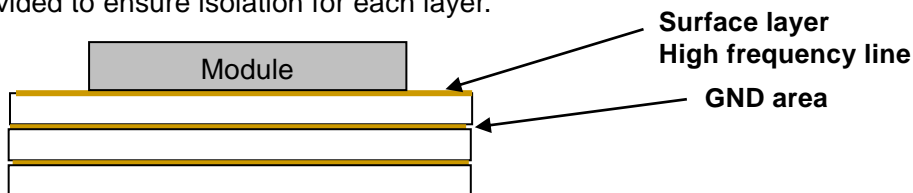


5.0. Bypass Capacitor Layout

A parallel combination of a small capacitance (about 10pF) and a large capacitance (1uF to 10uF) is recommended for bypass capacitors. The GND of the bypass capacitor should be placed close to an adjacent module GND to ensure the shortest closed loop.

4-3. GND Pattern

Power supply bypass capacitor GND should be placed in proximity of module GND. Wide GND area must be provided to ensure isolation for each layer.



GND pattern of each layer should be connected to GND area with large number of via.

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Control No.	Control name
(2/2)	Design guide

Reference information

EYSHSN Series may be able to develop the extremely slim product such as pen, chopsticks, glasses frames, ring, slim wrist band and so on.



Example of our demonstration board. (Not for sale)

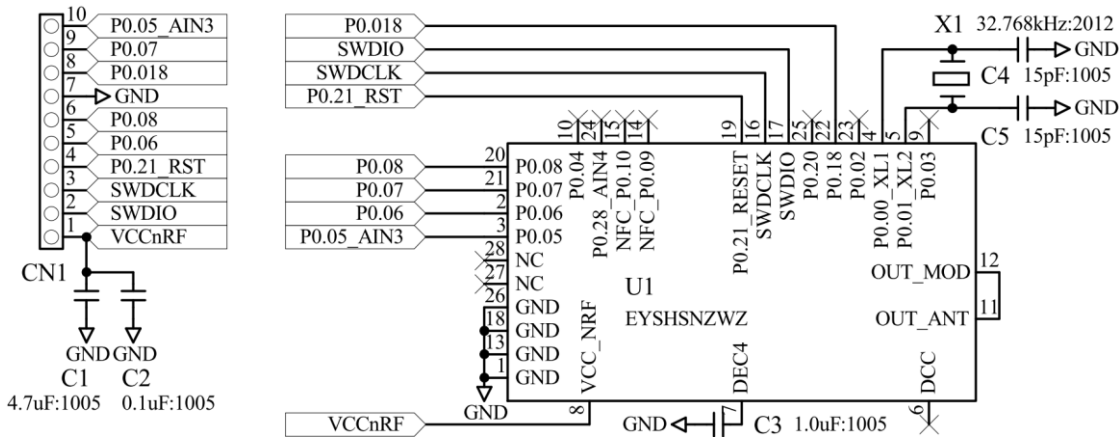
3. 65mm x 35. 6mm

U1 BLE	CN1 S10 2.54mm pitch
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2-Layers board

L/S : 100/100(um)
TH/Land : 250/500(um)
Solder resist opening : +50(um)
Board outline to Circuit pattern : 300(um)
Board outline to TH : 625(um)

Even in the case of a small product, please take the GND pattern that kept strong in any layer for antenna performance.



EYSHSNZWZ

TAIYO YUDEN CO., LTD.

Control No.	Control name
(1/1)	Notes

32kHz Clock

This module does not installed 32.768kHz crystal. In case of operating without external crystal, please use following example code in order to enable internal 32.768kHz RC oscillator (32k RCOSC).

```
nrf_clock_lf_cfg_t clock_lf_cfg;
clock_lf_cfg.rc_ctiv = 16;
clock_lf_cfg.rc_temp_ctiv = 2;
clock_lf_cfg.source = NRF_CLOCK_LF_SRC_RC;
clock_lf_cfg.xtal_accuracy = NRF_CLOCK_LF_XTAL_ACCURACY_250_PPM;
SOFTDEVICE_HANDLER_APPSH_INIT(&clock_lf_cfg, true);
```

Note that when you choose to use the RC oscillator, it will add around 2uA average current consumption compared to a 20ppm external crystal.
ANT specification requires +/-50ppm accuracy for 32.768kHz clock. There is a possibility that the internal RC oscillator does not meet to the specification.

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その他、注意事項について (Precautions)

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When our products are used even for high safety and/or reliability-required devices or circuits of general electronic equipment, it is strongly recommended to perform a thorough safety evaluation prior to use of our products and to install a protection circuit as necessary.
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