

EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

***Bluetooth*® low energy Module**

Bluetooth® 4.2 low energy

EYSGCNZXX (16kB RAM)

EYSGCNZWY (32kB RAM)

Data Report

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EYSGCNZXX, EYSGCNZWY

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Revision History

- 14-Sep.-2015 > Ver.1.00 Release
- 21-Dec.-2015 > Ver.1.01 Update
- 18-Mar.-2016 > Ver.1.1 Update
- 12-Jul.-2016 > Ver.1.2 Update
- 09-Aug.-2016 Ver.1.3 Update
- 06-Feb.-2017 Ver.1.4 Update
- 25-May-2017 Ver.1.5 Update
- 30-Jun.-2017 Ver.1.6 Update

EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. HD-AG-A150046	(1/5)	Control name General Items
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Scope

This specification ("Specification") applies to the hybrid IC "EYSGCNZXX" and "EYSGCNZWY", a **Bluetooth®** 4.2 low energy module ("Product") manufactured by TAIYO YUDEN Co., Ltd. ("TAIYO YUDEN")

1. Type: EYSGCN

User Code: EYSGCNZXX (16kB RAM), EYSGCNZWY (32kB RAM)

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

2. Function:

Radio frequency module. **Bluetooth®** standard Ver 4.2 low energy conformity

3. Application: Health & Fitness Equipment, Sensor, Toys

4. Structure:

Hybrid IC loaded with silicon monolithic semiconductor

Compatible with industrial standard reflow profile for Pb-free solders

Can meet with RoHS compliance (Pb, Cd, Hg, Cr⁺⁶, PBB, PBDE)

5. Outline: 12.9x 9.6 x 2.0 mm

49-pin Land Grid Array

6. Marking: Part number, Lot number, Japan ID, FCC ID, IC ID

7. Features:

- Small outline by PCB substrate
- Low power consumption
- Integrated antenna
- Integrated system and sleep clock
- **Bluetooth®** 4.2 low energy conformity
- Slave or Master Role

8. Packaging:

Packaging method: Tape & reel + aluminum moisture barrier bag

Packaging unit: 1000

*It might be provided as tray at sample stage.

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Control No. HD-AG-A150046	(2/5)	Control name General Items
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9. Note:

- a. Any question arising from this Specification shall be solved through mutual discussion by the parties hereof.
- b. This Product is not designed to be radiation durable and should not be used under the circumstance of radiation.
- c. The operating conditions of this Product are as shown in this Specification. Please note that TAIYO YUDEN shall not be liable for a failure and/or abnormality which is caused by use under the conditions other than the operating conditions hereof.
- d. The Product mentioned in this Specification is manufactured for use in Health & Fitness Equipment, Sensor and 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 safe operation of these 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 during the design stage, all at the customer's sole risk.
- e. a) You are requested to fully check and confirm by the start of mass production of this Product that (1) no bug, defect or other failure is included in firmware incorporated in this Product ("Incorporated Software"), (2) no bug defect or other failure arising from installation of this Product in which is contained Incorporated Software into your products is included in Incorporated Software, and that Incorporated Software fully meets your intended use, although TAIYO YUDEN sufficiently inspects or verifies quality of Incorporated Software.
b) Please note that TAIYO YUDEN is not responsible for any failure arising out of bugs or defects in Incorporated Software.
- f. 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.
- g. Communication between this Product and others might not be established nor maintained depending on radio environment or operating conditions of this Product and other *Bluetooth®* products.
- h. In order to test for Radio Law certification with a device incorporating this module, the Host Software must be able to put the module into test mode. Please contact TAIYO YUDEN for further details.
- i. 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 may occur 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.
- j. Please thoroughly evaluate our module with your products before going mass production.
- k. User Code Modification Notice.

User Code for sample modules or part numbers in this Specification are TAIYO YUDEN standard part numbers. When any modification is made to a module to meet requested specifications, the part number will be changed. Please contact TAIYO YUDEN to confirm whether your part number needs to be modified.

Please see the following examples for cases when part numbers are modified:

- for specific firmware version (our standard item firmware will be upgraded occasionally)
- for other relevant cases (specific or different setting, form, sizes, or display etc..)

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I. Alternative components may be used to this module. The intended components is used within the warranty written in this document (characteristics, size, operating condition, reliability, public regulation such as radio type approval) and Taiyo Yuden confirmed there are not any problems with the replacement. The traceability of the components is secured each production lot.

m. 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.

If you plan to export or re-export this Product, it is strongly recommended that you check and confirm, the necessary procedures to export or re-export of this Product as 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.

n. Japan Regulatory Information

This module is approved with the specific antenna on this module.

- a) Please ensure that your product can bear a label with the following information. If the product is so small that it is not practicable to place the label, please place it in the instruction manual and package.

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

EYSGCN : 001-A06158

o. Canada Regulatory Information

- a) This device complies with Industry Canada license-exempt RSS standards. 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.

L'utilisation de ce dispositif est autorisée seulement aux conditions suivantes: (1) il ne doit pas produire de brouillage et (2) l'utilisateur du dispositif doit être prêt à accepter tout brouillage radioélectrique reçu, même si ce brouillage est susceptible de compromettre le fonctionnement du dispositif.

- 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-EYSGCN

- c) Please notify certified ID by either one of the following method on your product.

Specifyz ID certifiée dans votre produit par une de méthode suivante.

- Contains Transmitter module IC : 4389B-EYSGCN

- Contains IC : 4389B-EYSGCN

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Control No. HD-AG-A150046	(4/5)	Control name General Items
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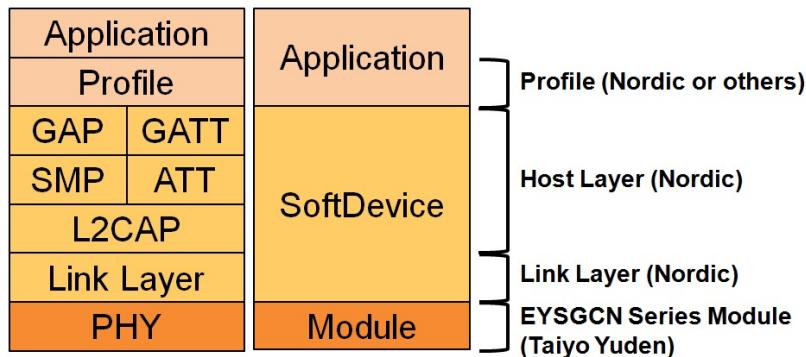
- p. FCC Regulatory Information
- a) This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
 - b) Please notify certified ID by either one of the following method on your product.
 - Contains Transmitter Module FCC ID: RYYEYSGCN
 - Contains FCC ID: RYYEYSGCN
 - 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.
- q. 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.
- r. This Product is designed for use in products which comply with *Bluetooth®* Specifications (Ver 4.2 LE) ("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.
- s. Taiyo Yuden writes firmware for fixed SoftDevice (EYSGCNZXX : S110 V8.0.0, EYSGCNZWY : S120 V2.1.0) to this product. Customer writes firmware that is match the customer applications including SoftDevice at the customer's own responsibility.
- t. The Electrical Characteristics defined in this Specification are of the module with above SoftDevice. If other firmware is installed, the characteristics may differ from the defined value in the Electrical Characteristics. Bluetooth qualification and radio type approval may become invalid.
- u. EYSGCN series module is qualified as PHY only with Component category by Bluetooth SIG. The QDID of this module is 72109. 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-AG-A150046	(5/5)	Control name General Items
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EYSGCNZXX, EYSGCNZWY

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Control No. HD-AM-A150046	(1/1)	Control name Absolute maximum ratings
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Absolute maximum ratings

Symbol	Parameter	Min.	Max.	Units
VCC_NRF		-0.3	+3.6	V
GND			0	V
VIO		-0.3	VCC_NRF+ 0.3	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	20000		write/erase cycles
Retention	Flash Memory Retention	10 years		At 40 deg-C
Number of times an address can be written between erase cycles			2	times

EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. HD-AE-A150046	(1/7)	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		1.8	3.0	3.6	V
VCC_NRF	Supply voltage, normal mode, DC/DC converter output voltage 1.9 V		2.1	3.0	3.6	V
tR_VCC_NRF	Supply rise time (0V to 1.8V)*1				100	ms
TA	Operation temperature	EYSGCNZXX	-40	25	85	Deg-C
		EYSGCNZWY	-25	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 (std. drive, 0.5 mA)	VCC_NRF-0.3		VCC_NRF	V
VOH	Output high voltage (high-drive, 5 mA)	VCC_NRF-0.3		VCC_NRF	V
VOL	Output low voltage (std. drive, 0.5 mA)	GND		0.3	V
VOL	Output low voltage (high-drive, 5 mA)	GND		0.3	V
RPU	Pull-up resistance	11	13	16	kohm
RPD	Pull-down resistance	11	13	16	kohm
ITX,+4dBm	TX only run current @ POUT =+4 dBm		16		mA
ITX,0dBm	TX only run current @ POUT = 0 dBm		10.5		mA
IRX	RX only run current		13		mA
IOFF	Current in SYSTEM-OFF, no RAM retention		0.6		uA
ION,16k	SYSTEM-ON base current with 16kB RAM enabled		2.6		uA
ION,32k	SYSTEM-ON base current with 32kB RAM enabled		3.8		uA

Note that when you use the RC oscillator, it will increase around 10uA of average power consumption compared to a 32.768kHz crystal.

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Control No. HD-AE-A150046	(2/7)	Control name Electrical characteristics
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UART specifications

Symbol	Description	Note	Min.	Typ.	Max.	Units
I_{UART1M}	Run current at max baud rate.		230			μA
$I_{UART115k}$	Run current at 115200 bps.		220			μA
$I_{UART1k2}$	Run current at 1200 bps.		210			μA
f_{UART}	Baud rate for UART.		1.2		1000	kbps

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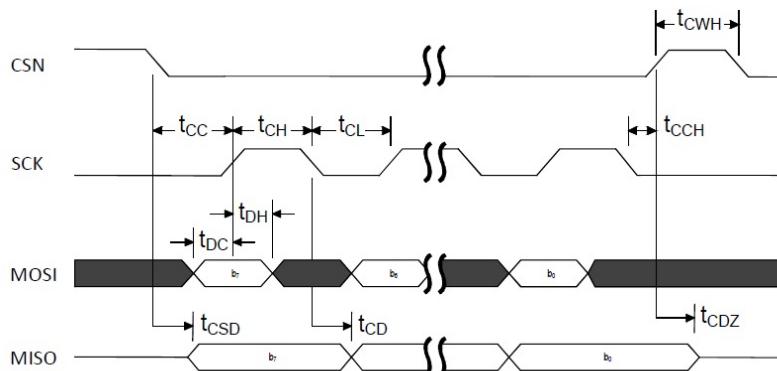
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Control No. HD-AE-A150046	(3/7)	Control name Electrical characteristics
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SPI Slave specifications

Symbol	Description	Min.	Typ.	Max.	Units
$I_{SPIS125K}$	Run current for SPI slave at 125 kbps. ¹		180		μA
I_{SPIS2M}	Run current for SPI slave at 2 Mbps. ¹		183		μA
f_{SPIS}	Bit rates for SPIS.	0.125	2	2	Mbps

1. CSN asserted.



SPIS timing diagram, one byte transmission, SPI Mode 0

Symbol	Description	Note	Min.	Typ.	Max.	Units
t_{DC}	Data to SCK setup.		10			ns
t_{DH}	SCK to Data hold.		10			ns
t_{CSD}	CSN to Data valid.	Low power mode. ¹ Constant latency mode. ¹	7100 2100			ns
t_{CD}	SCK to Data Valid.	$C_{LOAD} = 10 \text{ pF}$		97 ²		ns
t_{CL}	SCK Low time.		40			ns
t_{CH}	SCK High time.		40			ns
t_{CC}	CSN to SCK Setup.	Low power mode. ¹ Constant latency mode. ¹	7000 2000			ns
t_{CCH}	Last SCK edge to CSN Hold.		2000			ns
t_{CWH}	CSN Inactive time.		300			ns
t_{CDZ}	CSN to Output High Z.			40		ns
f_{SCK}	SCK frequency.		0.125	2	2	MHz
t_R, t_F	SCK Rise and Fall time.			100		ns

1. For more information on how to control the sub power modes, see the *nRF51 Series Reference Manual*.

2. Increases/decreases with 1.2 ns/pF load.

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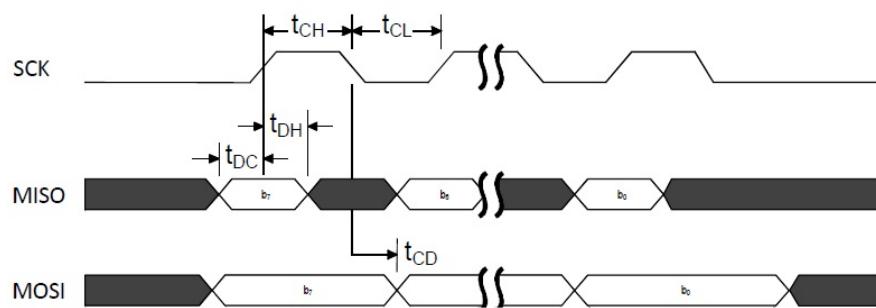
EYSGCNZXX, EYSGCNZWY

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Control No. HD-AE-A150046	(4/7)	Control name Electrical characteristics
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SPI Master specifications

Symbol	Description	Min.	Typ.	Max.	Units
$I_{SPI125K}$	Run current for SPI master at 125 kbps.		180		μA
I_{SPI4M}	Run current for SPI master at 4 Mbps.		200		μA
f_{SPI}	Bit rates for SPI.	0.125	4	4	Mbps



Symbol	Description	Note	Min.	Typ.	Max.	Units
t_{DC}	Data to SCK setup.		10			ns
t_{DH}	SCK to Data hold.		10			ns
t_{CD}	SCK to Data valid.	$C_{LOAD} = 10 \text{ pF}$		97 ¹		ns
t_{CL}	SCK Low time.		40			ns
t_{CH}	SCK High time.		40			ns
f_{SCK}	SCK Frequency.		0.125	4	4	MHz
t_R, t_F	SCK Rise and Fall time.			100		ns

- Increases/decreases with 1.2 ns/pF load.

EYSGCNZXX, EYSGCNZWY

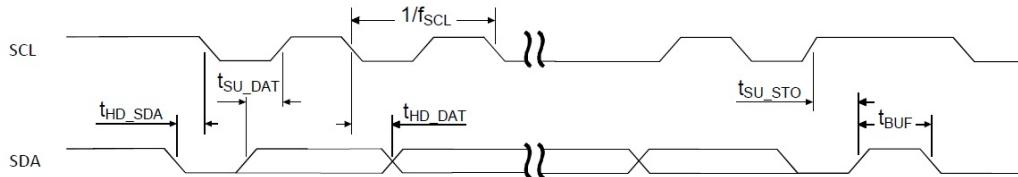
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Control No. HD-AE-A150046	(5/7)	Control name Electrical characteristics
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TWI specifications

Symbol	Description	Note	Min.	Typ.	Max.	Units
I_{2W100K}	Run current for TWI at 100 kbps.		380			μA
I_{2W400K}	Run current for TWI at 400 kbps.		400			μA
f_{2W}	Bit rates for TWI.		100	400	400	kbps
$t_{TWI,START}$	Time from STARTRX/STARTTX task is given until start condition.	Low power mode. ¹ Constant latency mode. ¹	3 1	4.4	4.4	μs

1. For more information on how to control the sub power modes, see the *nRF51 Series Reference Manual*.



Symbol	Description	Standard		Fast		Units
		Min.	Max.	Min.	Max.	
f_{SCL}	SCL clock frequency.			100	400	kHz
t_{HD_STA}	Hold time for START and repeated START condition.			5200	1300	ns
t_{SU_DAT}	Data setup time before positive edge on SCL.			300	300	ns
t_{HD_DAT}	Data hold time after negative edge on SCL.			300	300	ns
t_{SU_STO}	Setup time from SCL goes high to STOP condition.			5200	1300	ns
t_{BUF}	Bus free time between STOP and START conditions.			4700	1300	ns

EYSGCNZXX, EYSGCNZWY

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Control No. HD-AE-A150046	(6/7)	Control name Electrical characteristics
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GPIOTE specifications

Symbol	Description	Min.	Typ.	Max.	Units
I _{GPIOTE,IN}	Run current with 1 or more GPIOTE active channels in Input mode.	22			µA
I _{GPIOTE,OUT}	Run current with 1 or more GPIOTE active channels in Output mode.	0.1			µA
I _{GPIOTE,IDL}	Run current when all channels in Idle mode. PORT event can be generated with a delay of up to t _{1V2} .	0.1			µA

Note: Setting up one or more GPIO DETECT signals to generate PORT EVENT, which can be used either as a wakeup source or to give an interrupt, will not lead to an increase of the current consumption.

RF Specifications

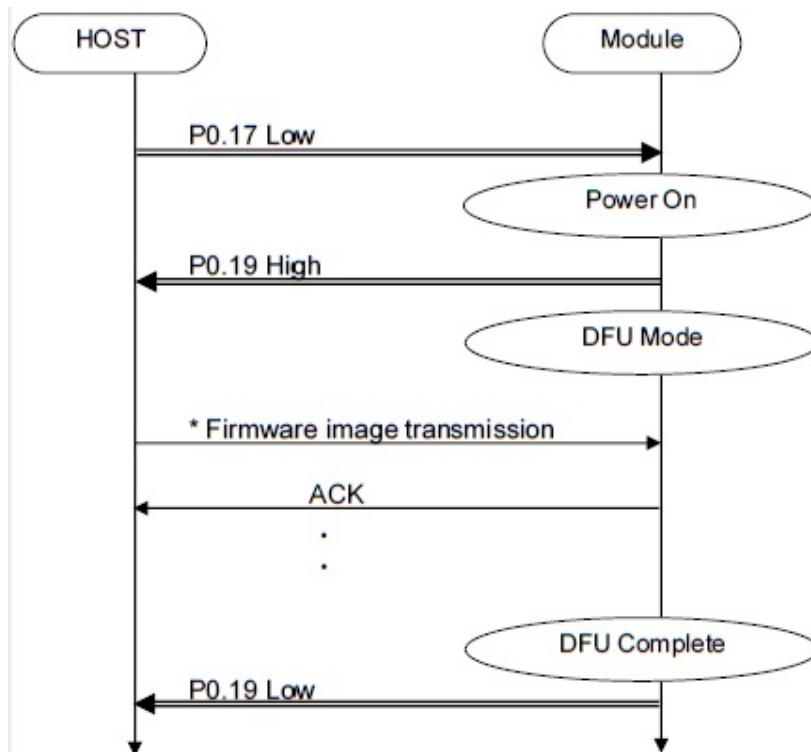
Symbol	Description	Min.	Typ.	Max.	Units
F _{op}	Operating frequencies	2402		2480	MHz
PLLres	PLL programming resolution		1		MHz
Df	Frequency deviation	+/-225	+/-250	+/-275	kHz
PRF	Maximum output power		4		dBm
PRFC	RF power control range	20	24		dB
PRFCR	RF power accuracy			+/-4	dB
PWHISP	RF power whisper mode		-30		dBm
PBW	20 dB bandwidth for modulated carrier		950	1100	kHz
PRF1	1 st Adjacent Channel Transmit Power 1 MHz			-20	dBc
PRF2	2 nd Adjacent Channel Transmit Power 2 MHz			-45	dBc
PRXMAX	Maximum received signal strength at < 0.1% PER		0		dBm
PSENS IT	Receiver sensitivity (0.1% BER) Ideal transmitter		-93		dBm
PSENS DT	Receiver sensitivity (0.1% BER) dirty transmitter		-91		dBm

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Control No. HD-AE-A150046	(7/7)	Control name Electrical characteristics
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DFU Specifications

UART	Baud rate : 38400 bps Data : 8 bit Parity : none Stop : 1 bit Hardware flow control : Enabled	UART PIN : RX : P0.03 TX : P0.01 CTS : P0.02 RTS : P0.00
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* see Nordic Infocenter and nRFgo Studio help

[Nordic Infocenter] <http://infocenter.nordicsemi.com/index.jsp>
 Software Development Kit > nRF51 SDK > nRF51 SDK v9.0.0 > Examples > BLE DFU Bootloader
 > Transport layers > Serial (HCl) packet format
 Software Development Kit > nRF51 SDK > nRF51 SDK v9.0.0 > Examples > BLE DFU Bootloader
 > Creating a DFU bootloader

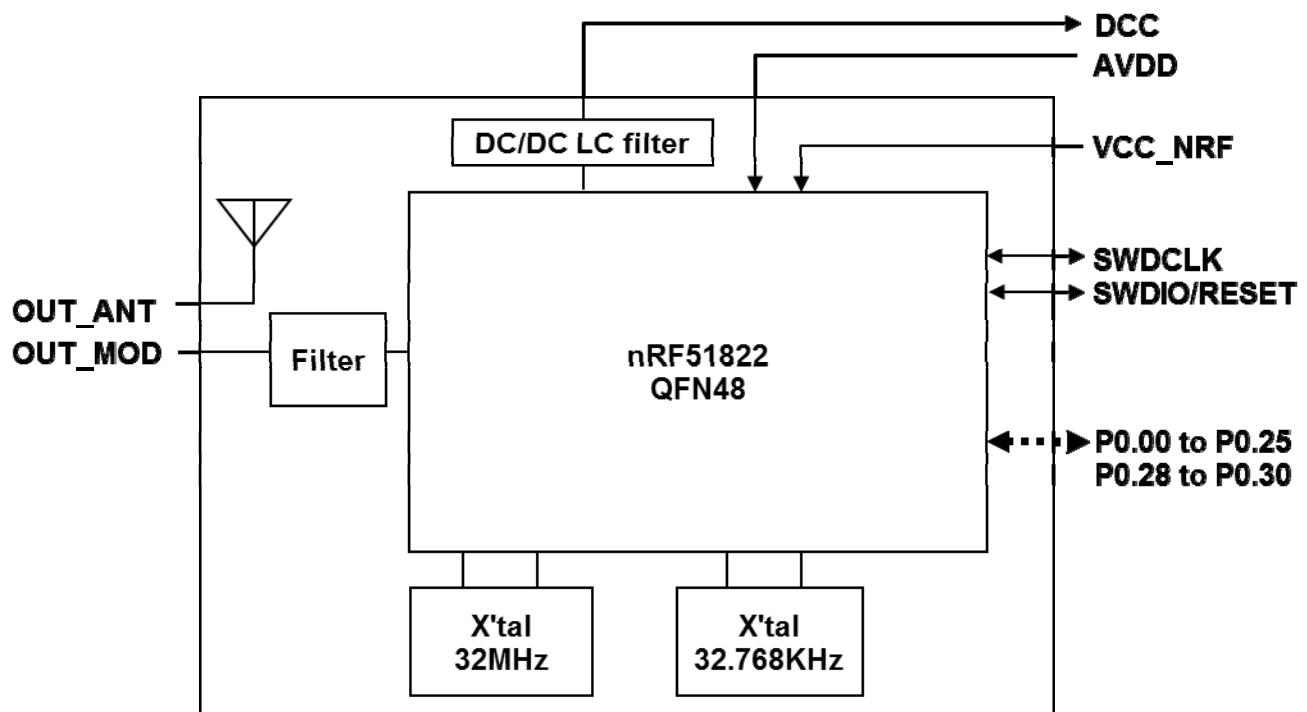
[nRFgo Studio] Download from Nordic web site <http://www.nordicsemi.com>
 nRFgo Studio help > Program nRF51 devices > Serial Bootloader

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Control No. HD-MC-A150046	Control name (1/3) Circuit Schematic
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Block Diagram

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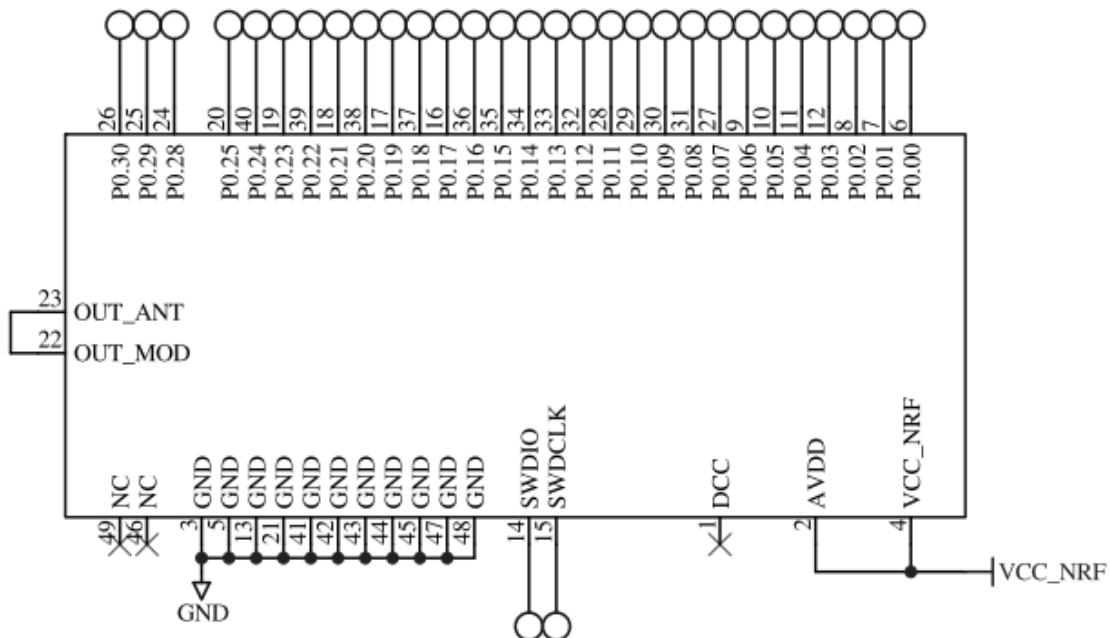
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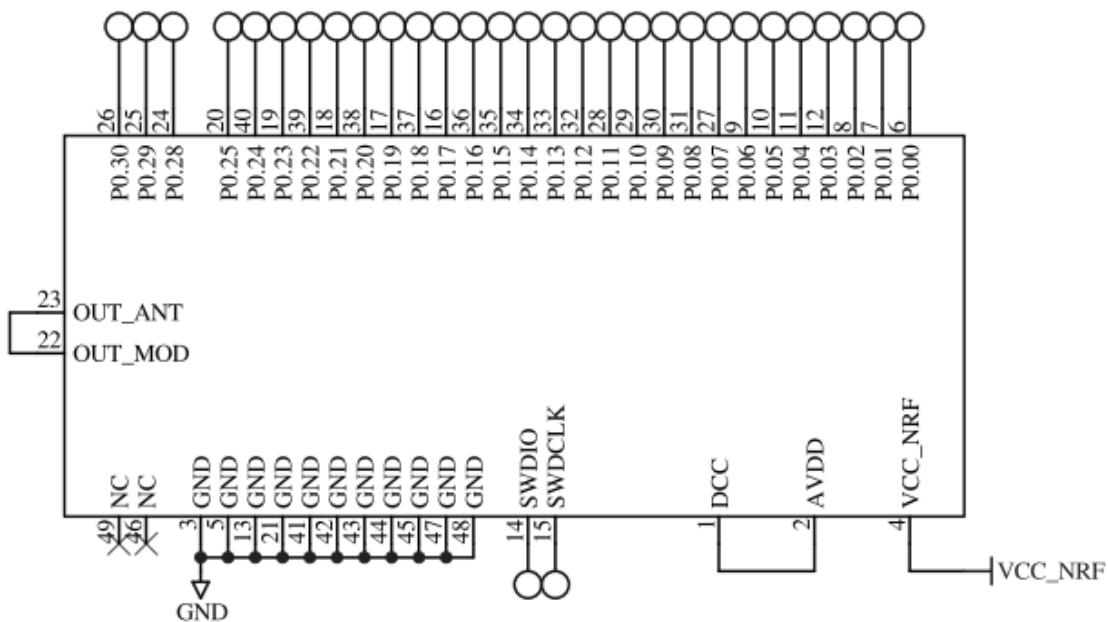
Control No. HD-MC-A150046	Control name (2/3) Circuit Schematic
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Sample circuits

Internal LDO setup



DC/DC converter setup

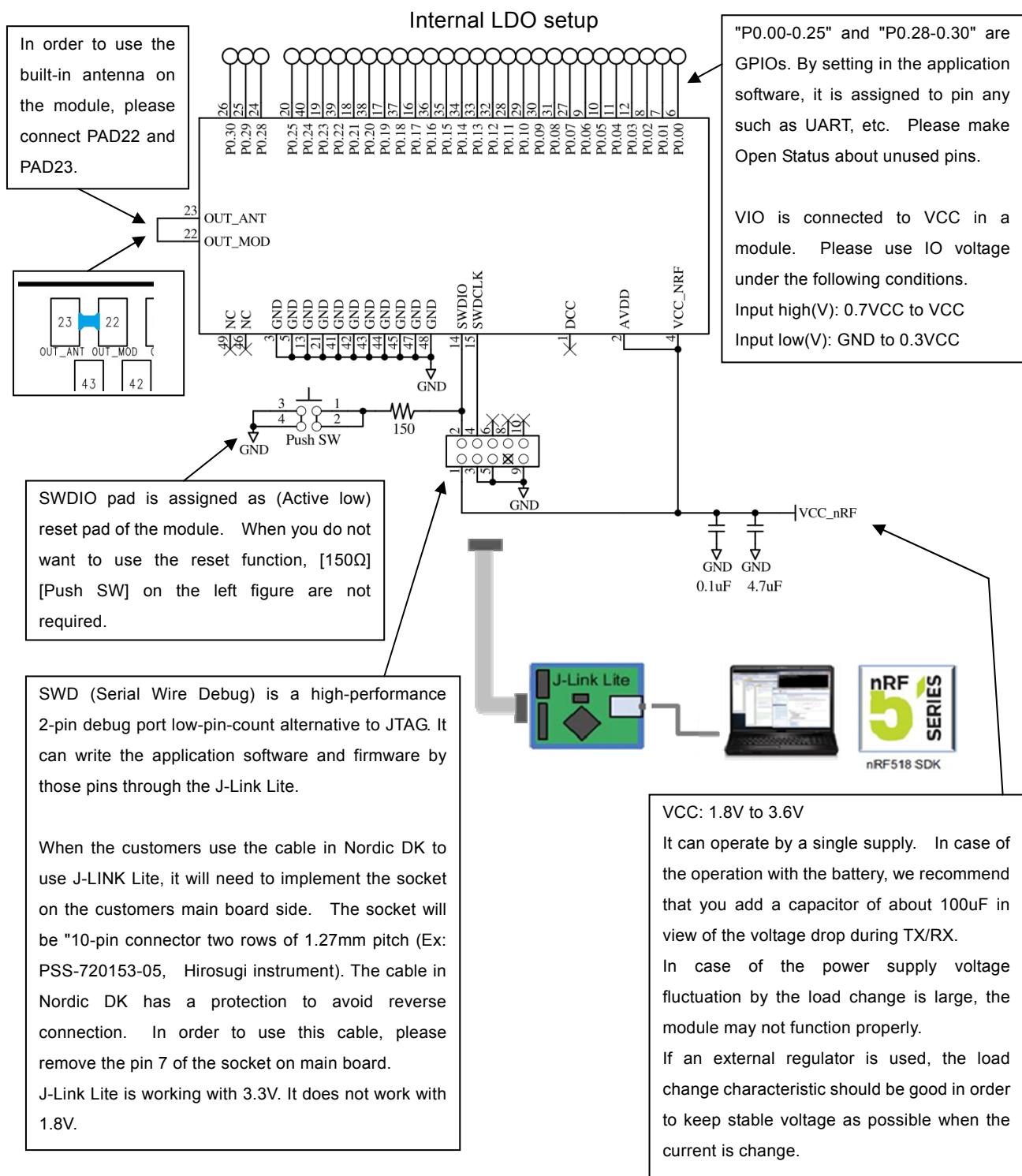


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Control No. HD-MC-A150046	Control name (3/3)
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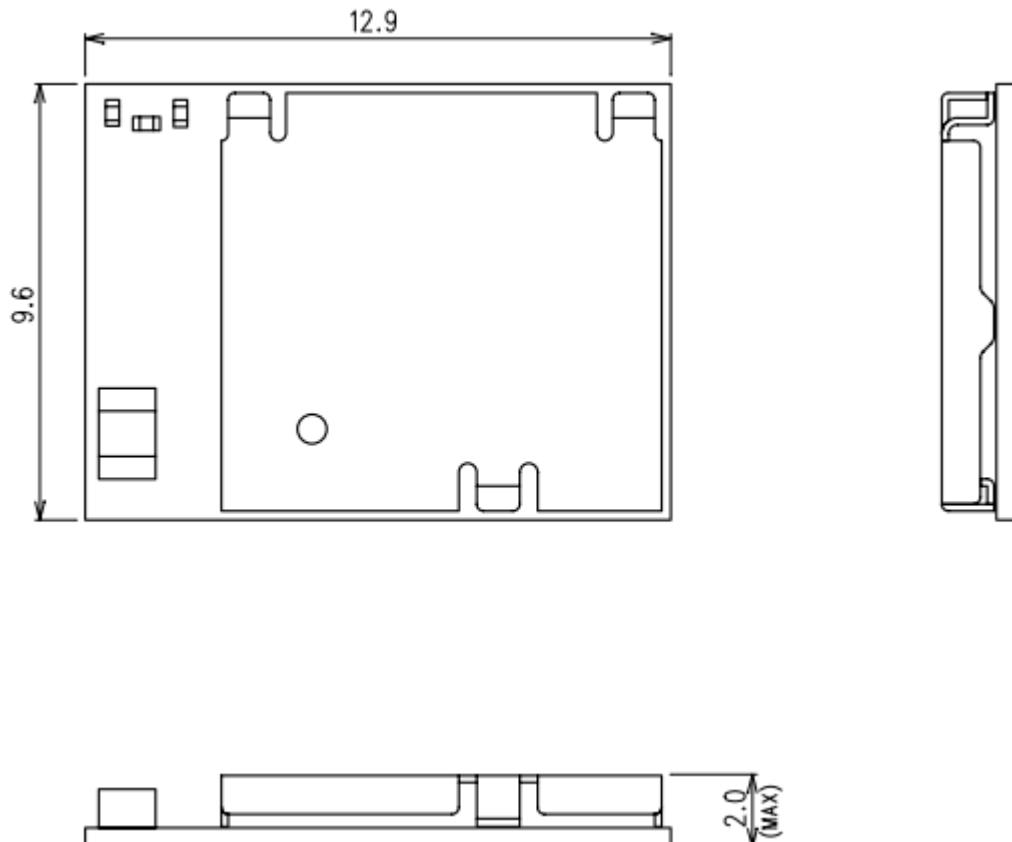
Reference Circuits

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EYSGCNZXX, EYSGCNZWY

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Control No. HD-AD-A150046	(1/3)	Control name Outline/Appearance
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Tolerance: +/- 0.2mm
Unit : (mm)

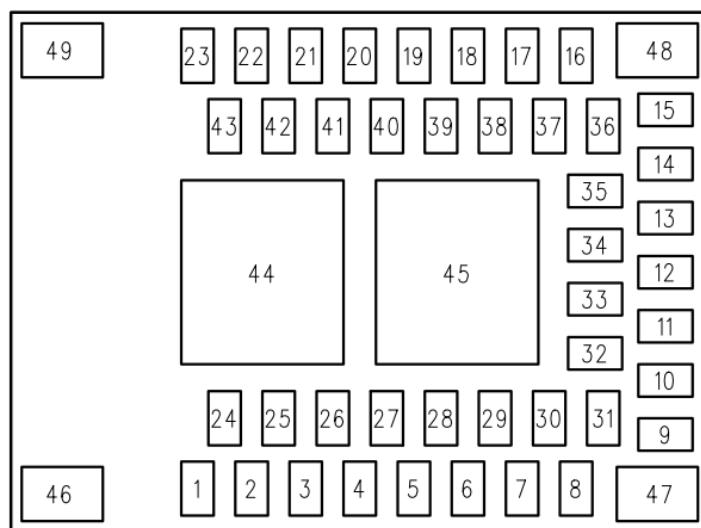
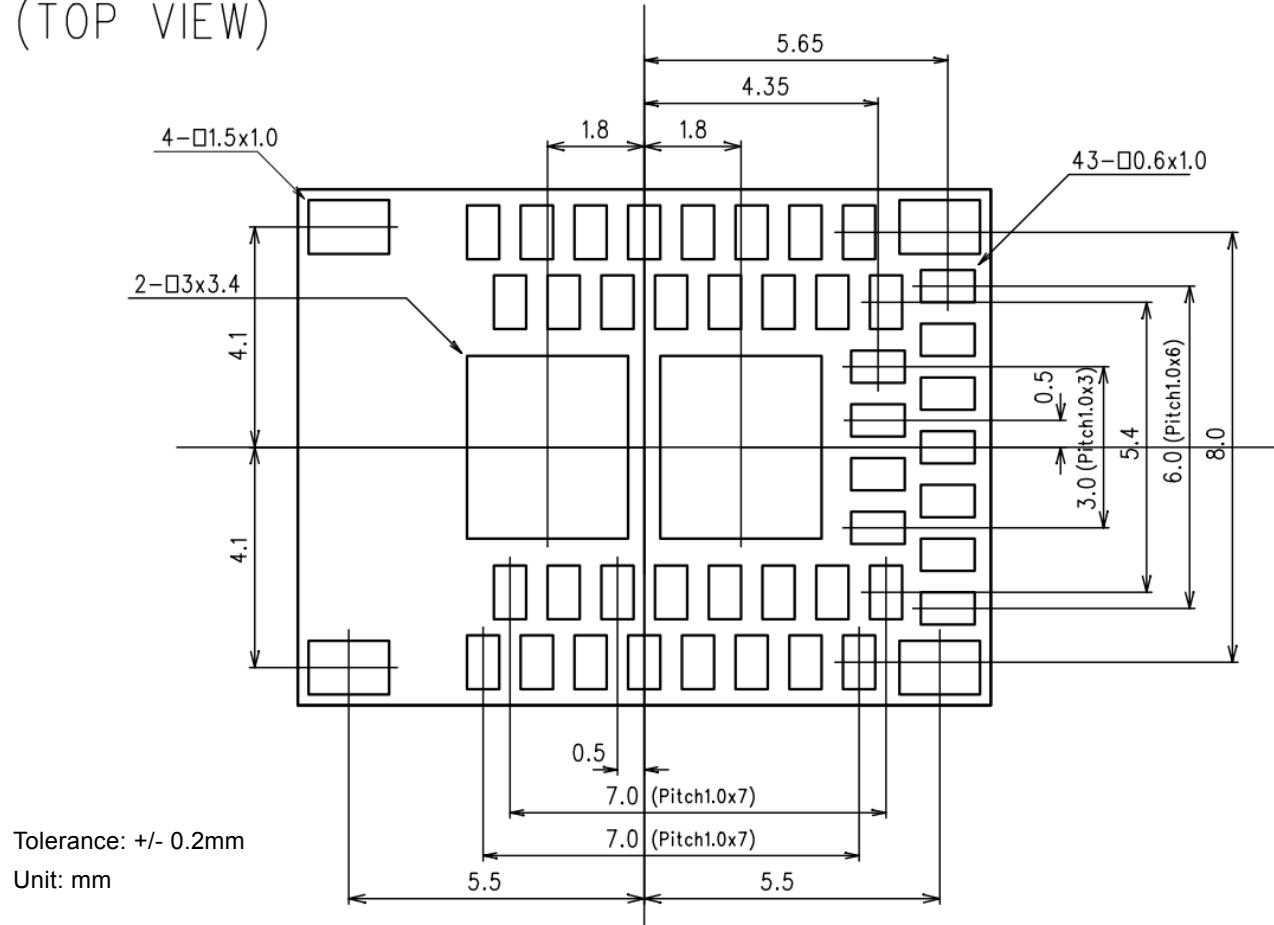
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EYSGCNZXX, EYSGCNZWY

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Control No. HD-AD-A150046	Control name (2/3) Outline/Appearance
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(TOP VIEW)



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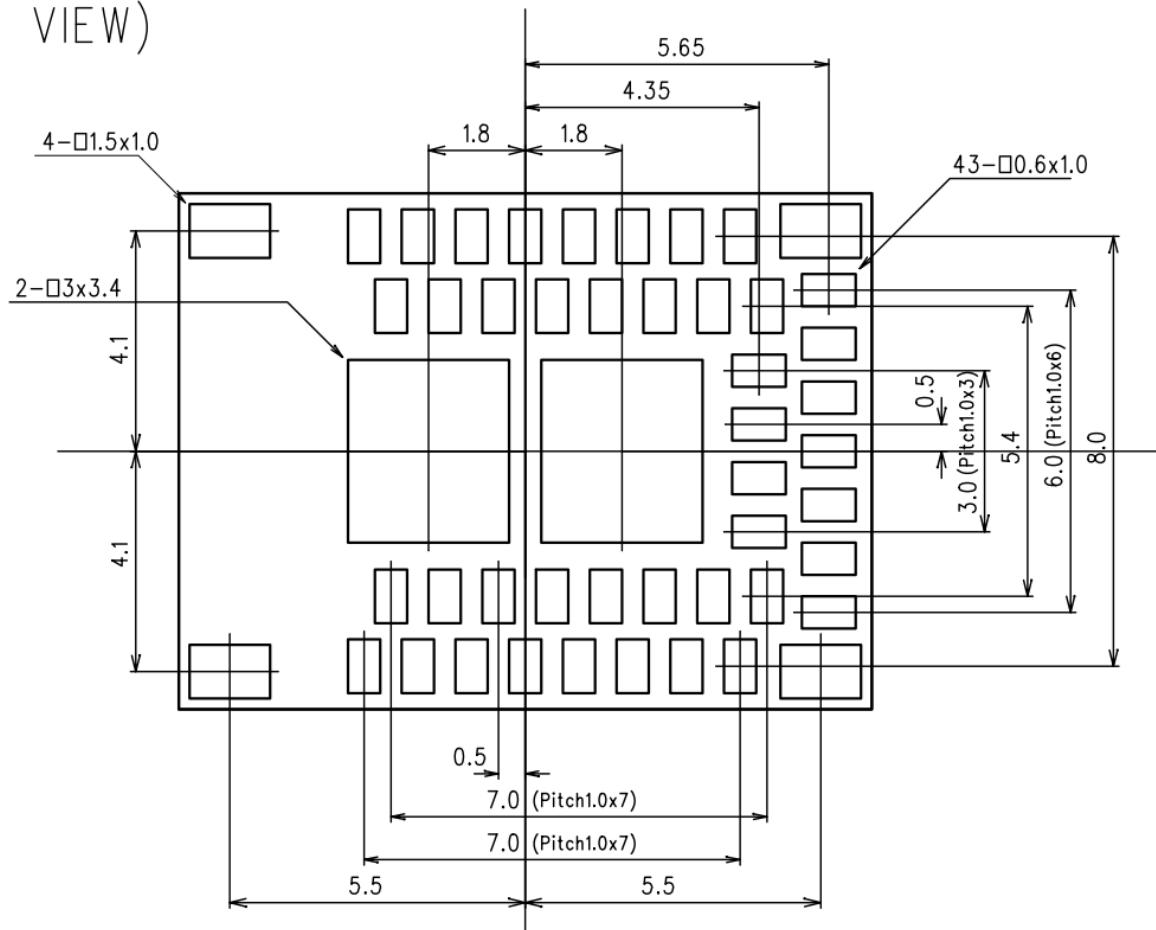
EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. HD-AD-A150046	(3/3)	Control name Outline/Appearance
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LAND PATTERN EXAMPLE

(TOP VIEW)

**Recommended metal mask for solder printing**

Pad size	Mask opening
Signal pad 43 – 0.6 x 1.0 mm	0.5 x 0.9 mm
Corner pad 4 – 1.5 x 1.0 mm	1.0 x 0.7 mm
Center pad 2 – 3.0 x 3.4 mm	2.6 x 3.0 mm

The center of each mask opening is same as the pad center.

The metal mask thickness: t=0.1mm

The solder volume should be same by changing the mask opening if different metal mask thickness is used.

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EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. HD-BA-A150046	(1/2)	Control name Pin Layout
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Pin Descriptions

Pin	Pin name	Pin function	Description
1	DCC	Power	DC/DC output (built-in LC for DC/DC)
2	AVDD	Power	Analog Power supply
3	GND	Ground	Ground (0 V)
4	VCC_NRF	Power	Power supply
5	GND	Ground	Ground (0 V)
6	P0.00 AREF0	Digital I/O Analog input	General purpose I/O pin ADC Reference voltage
7	P0.01 AIN2	Digital I/O Analog input	General purpose I/O pin ADC input 2
8	P0.02 AIN3	Digital I/O Analog input	General purpose I/O pin ADC input 3
9	P0.06 AIN7 AREF1	Digital I/O Analog input Analog input	General purpose I/O pin ADC input 7 ADC Reference voltage
10	P0.05 AIN6	Digital I/O Analog input	General purpose I/O pin ADC input 6
11	P0.04 AIN5	Digital I/O Analog input	General purpose I/O pin ADC input 5
12	P0.03 AIN4	Digital I/O Analog input	General purpose I/O pin ADC input 4
13	GND	Ground	Ground (0 V)
14	SWDIO	Digital I/O	System reset (active low). Also HW debug and flash programming I/O
15	SWDCLK	Digital input	HW debug and flash programming I/O
16	P0.17	Digital I/O	General purpose I/O pin
17	P0.19	Digital I/O	General purpose I/O pin
18	P0.21	Digital I/O	General purpose I/O pin
19	P0.23	Digital I/O	General purpose I/O pin
20	P0.25	Digital I/O	General purpose I/O pin
21	GND	Ground	Ground (0 V)
22	OUT_MOD	RF In/Out	RF I/O pin. It should be connected to Pin 23 OUT_ANT for normal operation.

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EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. HD-BA-A150046	(2/2)	Control name Pin Layout
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Pin	Pin name	Pin function	Description
23	OUT_ANT	Antenna In/Out	Internal antenna. It should be connected to Pin 22 OUT_MOD for normal operation.
24	P0.28	Digital I/O	General purpose I/O pin
25	P0.29	Digital I/O	General purpose I/O pin
26	P0.30	Digital I/O	General purpose I/O pin
27	P0.07	Digital I/O	General purpose I/O pin
28	P0.11	Digital I/O	General purpose I/O pin
29	P0.10	Digital I/O	General purpose I/O pin
30	P0.09	Digital I/O	General purpose I/O pin
31	P0.08	Digital I/O	General purpose I/O pin
32	P0.12	Digital I/O	General purpose I/O pin
33	P0.13	Digital I/O	General purpose I/O pin
34	P0.14	Digital I/O	General purpose I/O pin
35	P0.15	Digital I/O	General purpose I/O pin
36	P0.16	Digital I/O	General purpose I/O pin
37	P0.18	Digital I/O	General purpose I/O pin
38	P0.20	Digital I/O	General purpose I/O pin
39	P0.22	Digital I/O	General purpose I/O pin
40	P0.24	Digital I/O	General purpose I/O pin
41 to 45	GND	Ground	Ground (0 V)
46	NC	Not Connected	Isolated pad on PCB for mechanical stability
47 to 48	GND	Ground	Ground (0 V)
49	NC	Not Connected	Isolated pad on PCB for mechanical stability

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EYSGCNZXX, EYSGCNZWY

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.

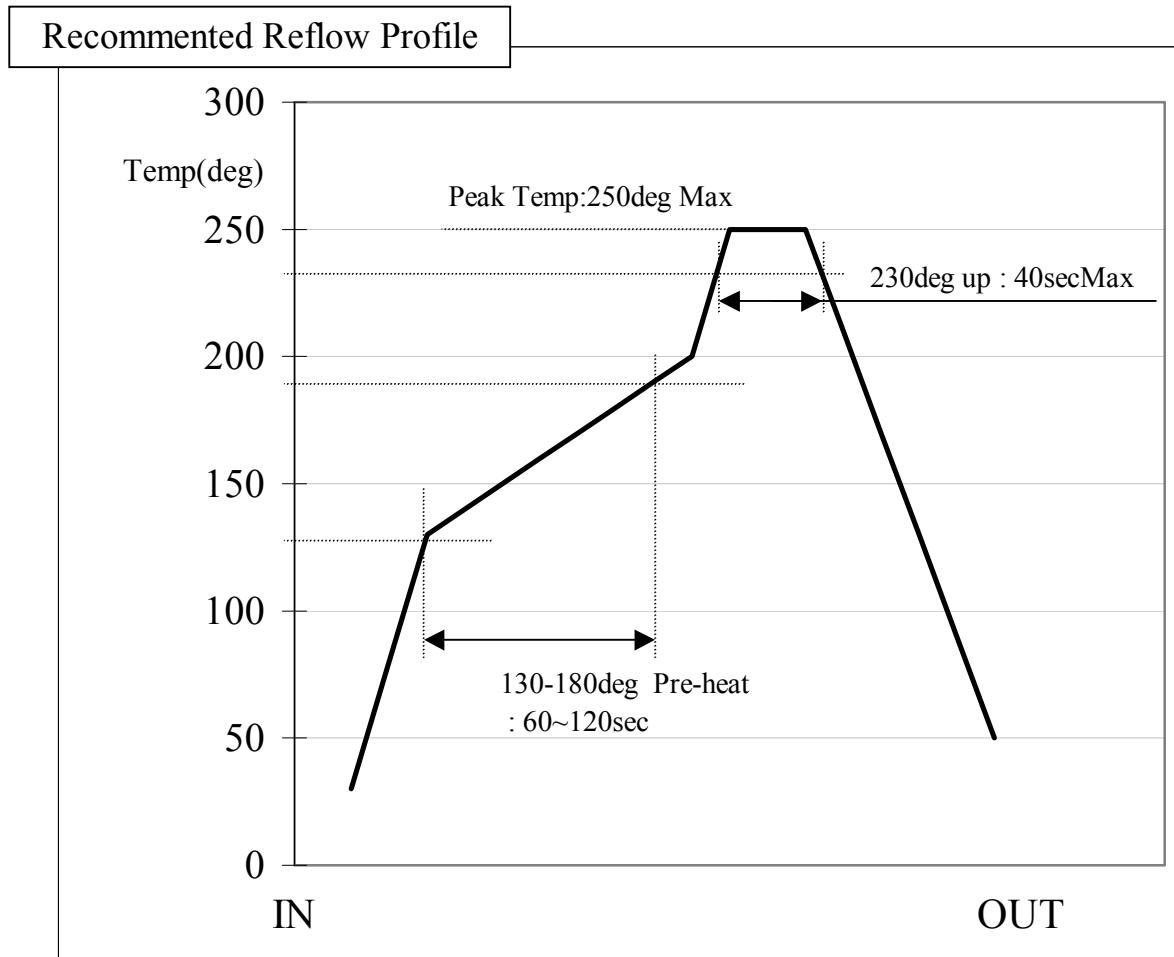
1. All of the surface mounting process (reflow process) must be completed **in 12 months** from the bag sea date.
 2. Make sure humidity in the bag is less than **10%RH** immediately after open, using a humidity indicator card sealed with the components.
 3. **All** of the surface mounting process (reflow 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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EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. HQ-BA-537	(2/2)	Control name Handling Precaution
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EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. HD-BB-A150046	(1/3)	Control name Packaging Specification
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Packaging Specification

梱包仕様

(1) Packaging Material 梱包材料

Name 部材名	Outline 概要	Materials 材質	Note 備考
Emboss エンボス	24mm wide - 12mmPitch 24mm幅 - 12mm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)		

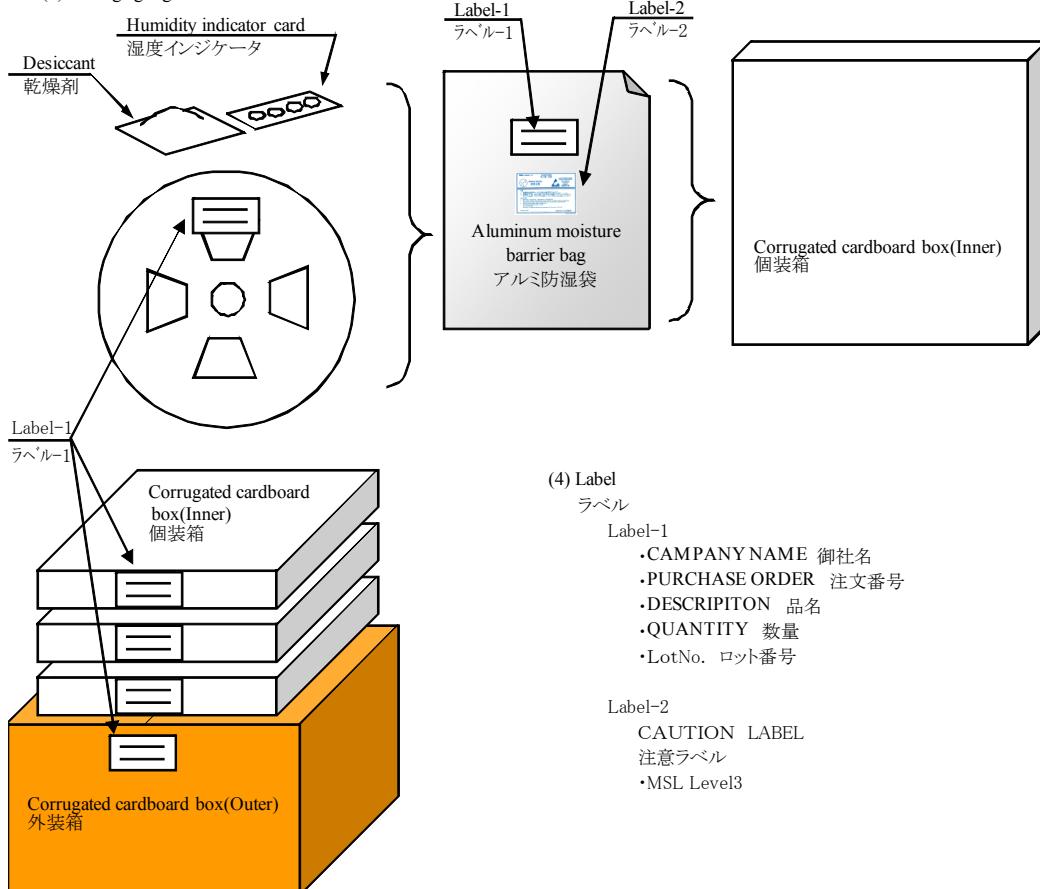
(2) Packaging Unit

梱包数量

Max 1000 pieces/Reel

Max 3000 pieces/Box(Outer)

(3) Packaging Figure



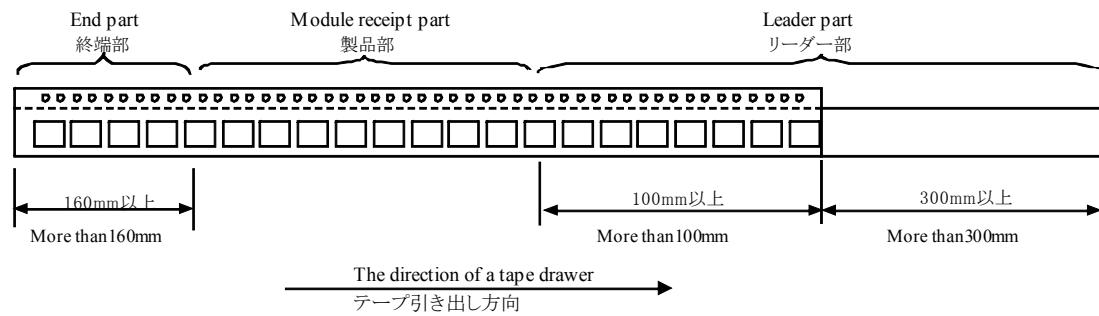
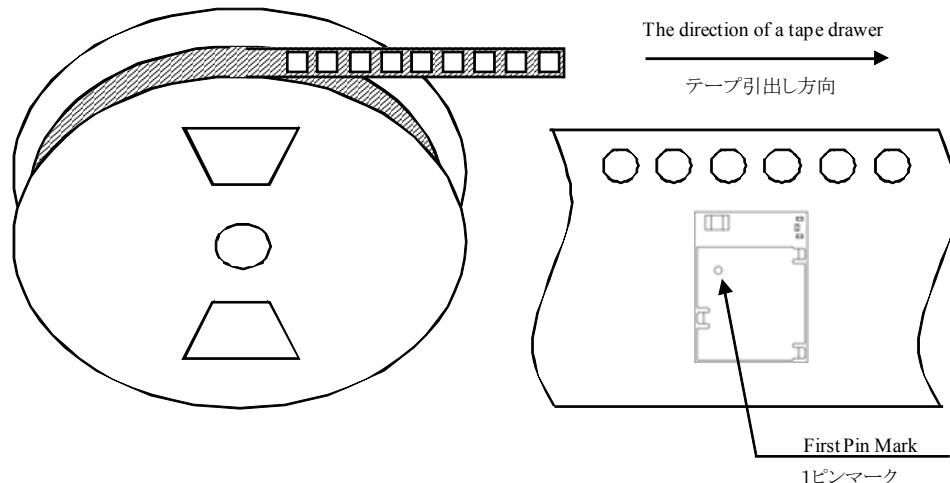
TAIYO YUDEN CO., LTD.

EYSGCNZXX, EYSGCNZWY

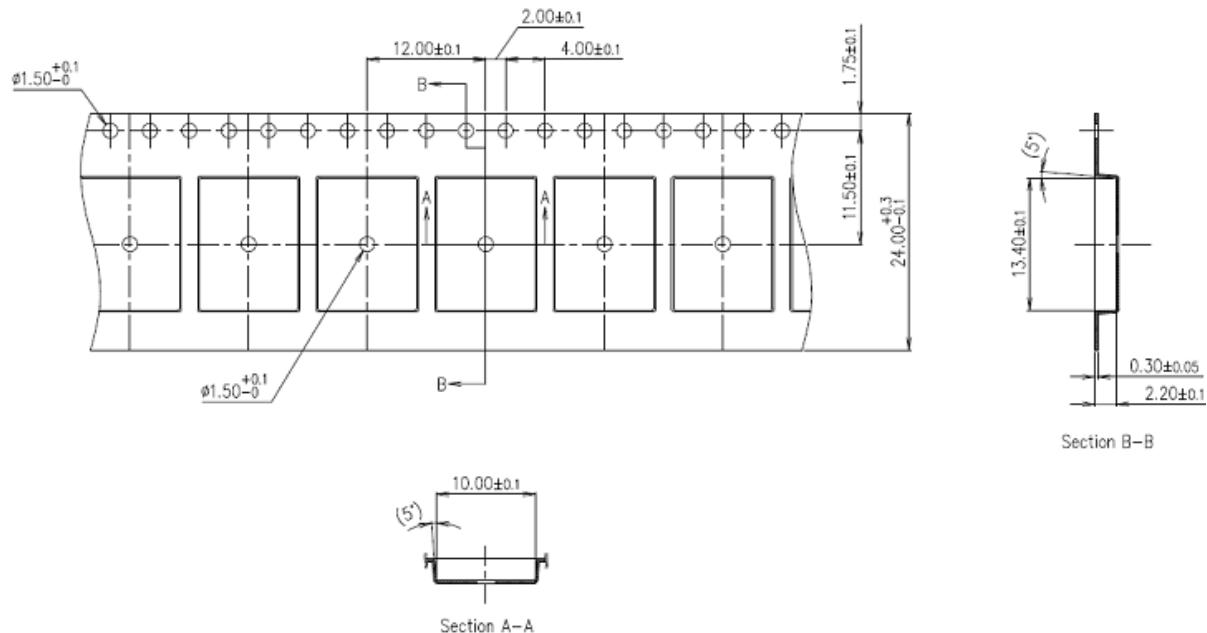
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Control No. HD-BB-A150046	(2/3)	Control name Packaging Specification
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Tape specification
テープ仕様



キャリアエンボス図面



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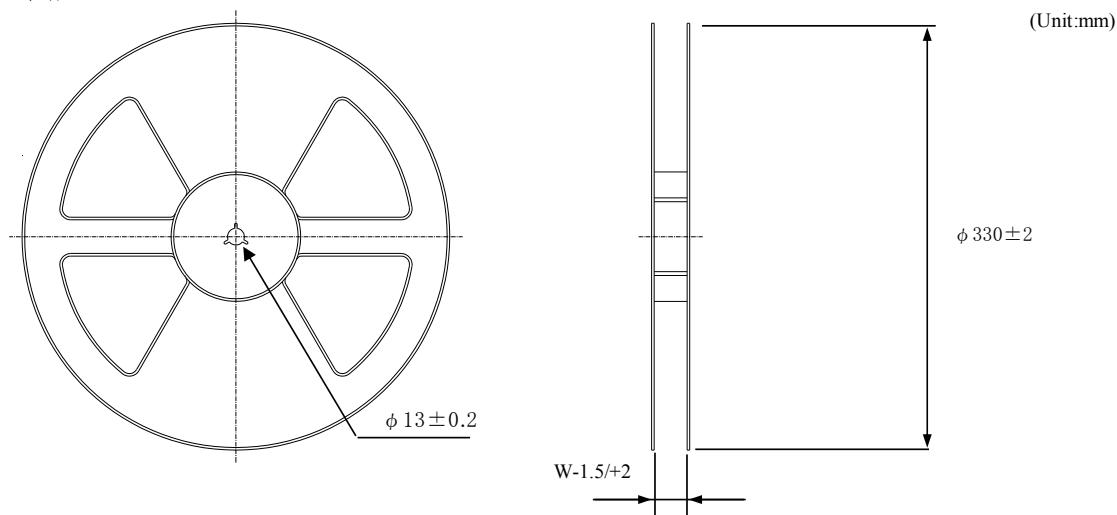
EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. HD-BB-A150046	(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。)

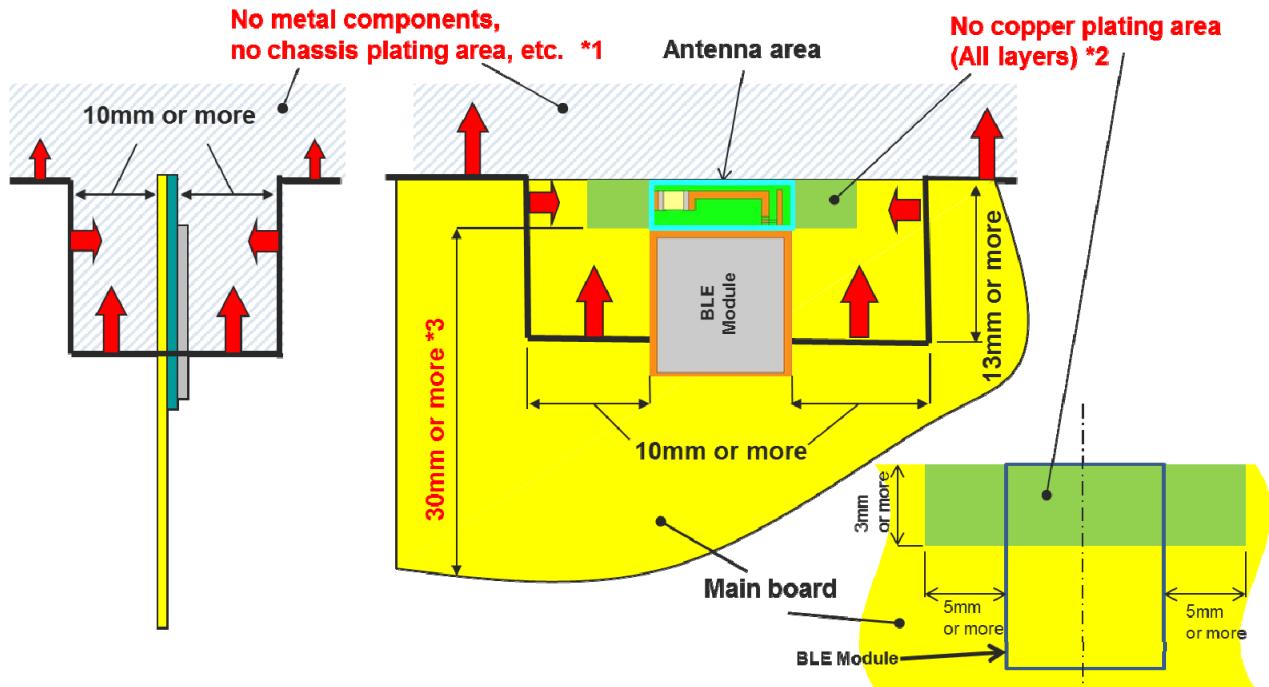
MSL Level 3 Under control
MSL はレベル3で管理しています。

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EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

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

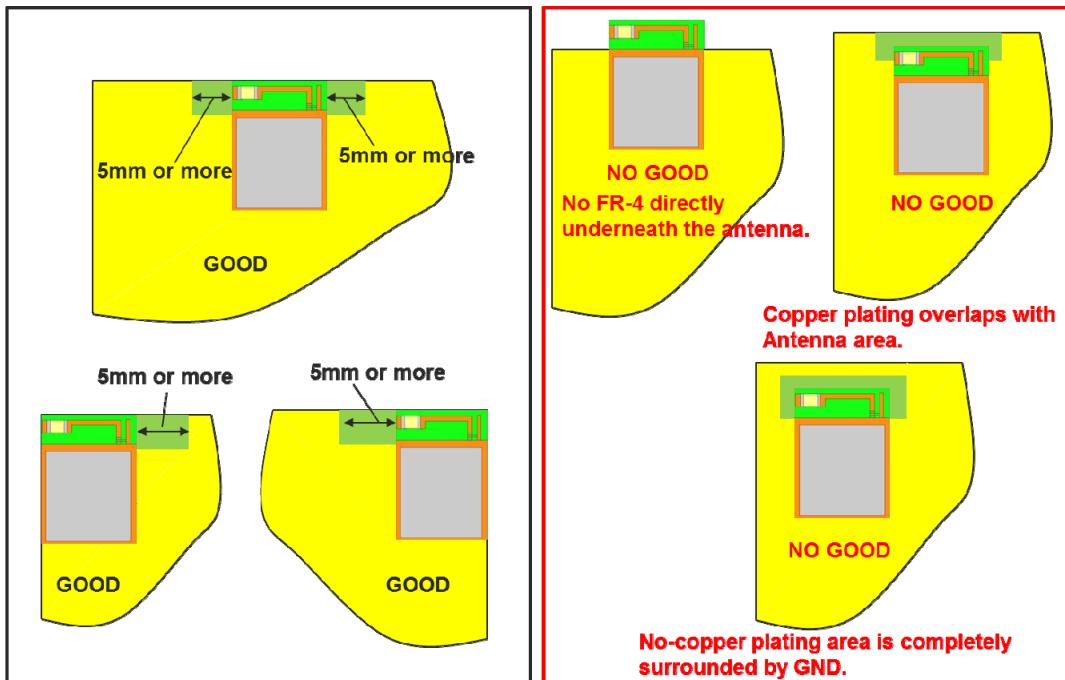
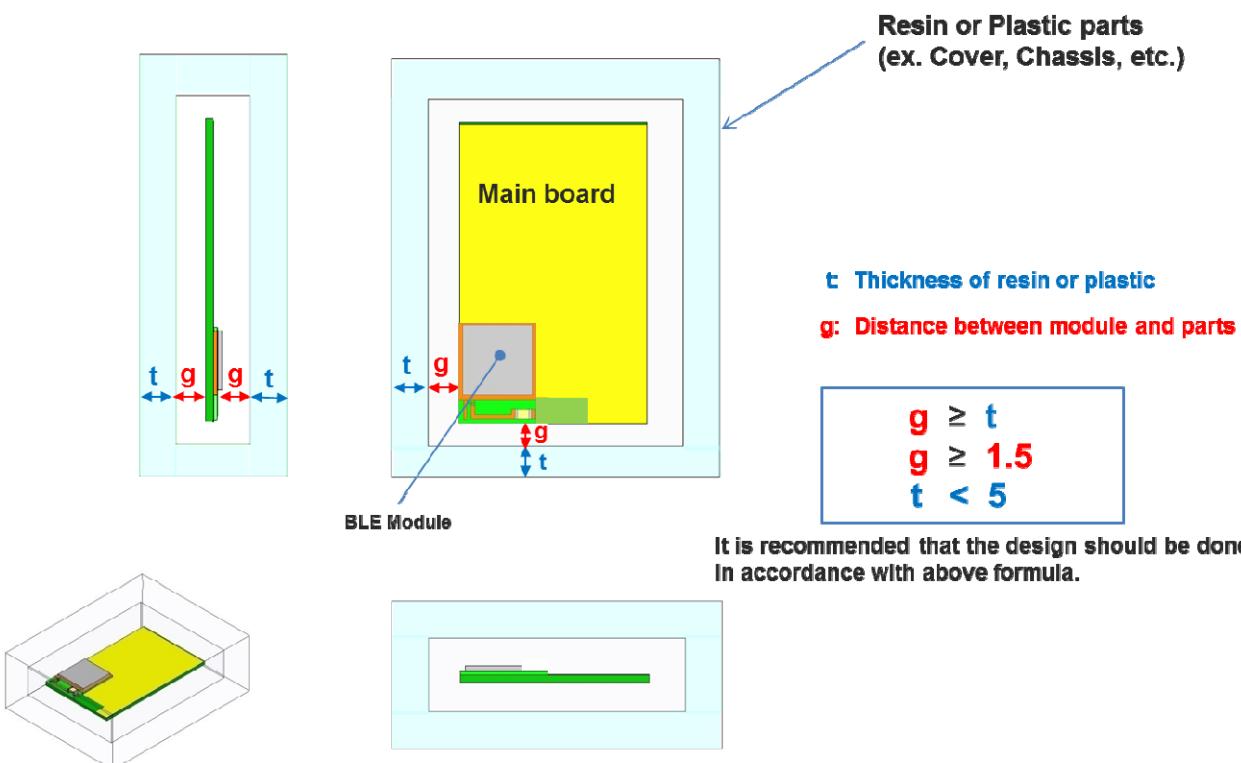
*3 Characteristics may deteriorate when **GND pattern** length is less than 30mm. It should be 30 mm or more as possible.

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

EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. (2/3)	Control name Antenna application note
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Other module mounting examples**Placement of resin or plastic parts**

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

TAIYO YUDEN CO., LTD.

EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. (3/3)	Control name Antenna application note
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Directional characteristics example (when mounted on evaluation board)**Measurement data of antenna**

Measured in Satimo Stargate system at TAIYO YUDEN R&D CENTER.

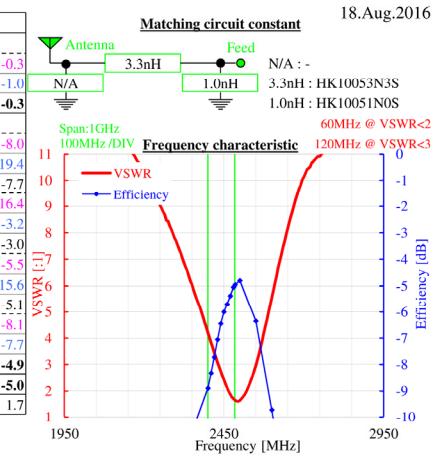
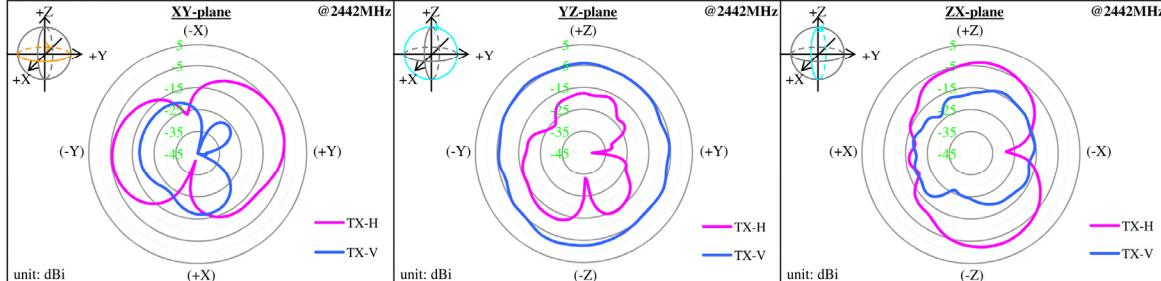
Appearance and coordinates definition

Frequency [MHz]	@2400	@2442	@2484
Peak gain [dBi]			
3-plane	TX-H: -4.1	TX-V: -5.2	-1.6
			-1.0
	-4.1	-4.1	-1.6
			-0.3
Average gain [dBi]			
XY-plane	TX-H: -11.2	TX-V: -23.7	-9.1
			-21.1
	-11.2	-23.7	-9.1
			-19.4
YZ-plane	TX-H: -11.0	TX-V: -19.7	-8.8
			-17.5
	-11.0	-19.7	-8.8
			-7.7
ZX-plane	TX-H: -6.9	TX-V: -7.1	-4.4
			-4.7
	-6.9	-7.1	-4.4
			-3.2
Plus(H,V)	TX-H: -9.1	TX-V: -20.7	-6.7
			-17.8
	-9.1	-20.7	-6.7
			-15.6
3-plane	TX-H: -11.6	TX-V: -11.6	-9.3
			-9.1
	-11.6	-11.6	-9.3
			-7.7
	-8.6	-8.6	-6.2
			-4.9
Efficiency [dB]	-8.9	-8.9	-6.4
VSWR [:1]	4.2	2.7	1.7

*Note: Peak gain(3-plane)=Peak(XY[H],XY[V],YZ[H],YZ[V],ZX[H],ZX[V])

*Note: The value is average value in 1 round of each inclination direction angle.

*Note: Average gain(3-plane)=Average(XY[Plus(H,V)],YZ[Plus(H,V)],ZX[Plus(H,V)])

Radiation pattern**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.

EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. (1/1)	Control name Design guide
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1. Power Up Sequence

VCC_NRF power supply rise time (0V to 1.8V) must not exceed 100ms.

2. Recommended Power Circuit

VCC_NRF is the main power supply (1.8 – 3.6V) for this module. The supply voltage range of VCC_NRF is 1.8V to 3.6V in LDO mode and 2.1V to 3.6V in DCDC mode. For more information of internal DC/DC converter operation, please refer to chapter 12.1.3 of "nRF51_Series_Reference_Manual v3.0" by Nordic Semiconductor. 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.

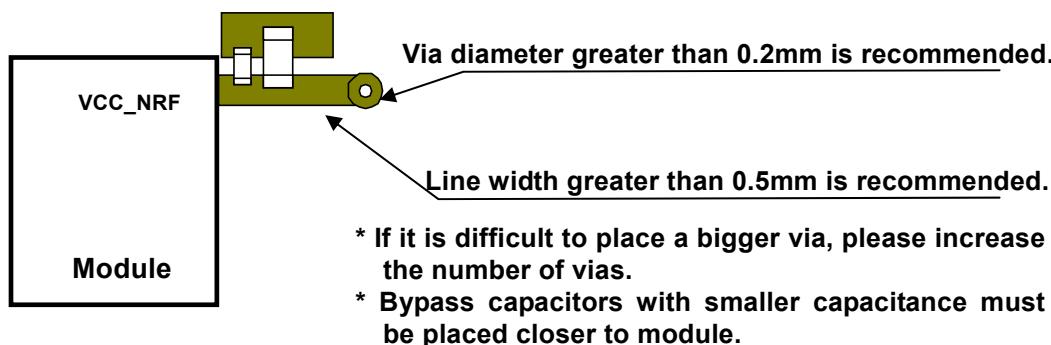
3. Battery operation

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.

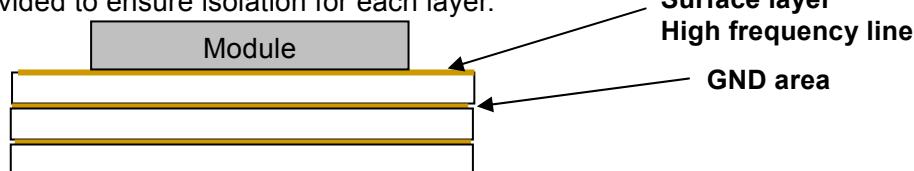


4-2. Bypass Capacitor Layout

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.

EYSGCNZXX, EYSGCNZWY

TAIYO YUDEN CO., LTD.

Control No. (1/1)	Control name Notes
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The evaluation board included with the Nordic Development Kit uses a 16MHz clock. Therefore the sample code from Nordic is designed to be used with a 16MHz clock. On the other hand, the EYSGCN series module uses a 32MHz system clock, making it incompatible with the Nordic sample code (i.e. sample code does not configure HFCLK: XTALFREQ register for 32MHz). To fix this issue, we need to write the value 0xFFFFFFF00 to the UICR (User Information Configuration Register) at address 0x10001008. Please note that the UICR is erased whenever you download a SoftDevice.

The UICR can be written by using the debug tools:

```
nrfjprog.exe --snr <your_jlink_debugger_serial_number> --memwr 0x10001008 --val 0xFFFFFFF00
```

Or the following code can be added to the SystemInit function in the system_nRF51.c file, right before launching the TASK_HFCLKSTART task:

```
if (*(uint32_t *)0x10001008 == 0xFFFFFFFF)
{
    NRF_NVMC->CONFIG = NVMC_CONFIG_WEN_Wen << NVMC_CONFIG_WEN_Pos;
    while (NRF_NVMC->READY == NVMC_READY_READY_Busy){}
    *(uint32_t *)0x10001008 = 0xFFFFFFF00;
    NRF_NVMC->CONFIG = NVMC_CONFIG_WEN_Ren << NVMC_CONFIG_WEN_Pos;
    while (NRF_NVMC->READY == NVMC_READY_READY_Busy){}
    NVIC_SystemReset();
    while (true){}
}
```

その他、注意事項について (Precautions)

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- Please conduct validation and verification of our products in actual condition of mounting and operating environment before using our products.
- The products listed in this specification are intended for use in general electronic equipment (e.g., AV equipment, OA equipment, home electric appliances, office equipment, information and communication equipment including, without limitation, mobile phone, and PC). Please be sure to contact TAIYO YUDEN for further information before using the products for any equipment which may directly cause loss of human life or bodily injury (e.g., transportation equipment including, without limitation, automotive powertrain control system, train control system, and ship control system, traffic signal equipment, disaster prevention equipment, medical equipment, highly public information network equipment including, without limitation, telephone exchange, and base station).
Please do not incorporate our products into any equipment requiring high levels of safety and/or reliability (e.g., aerospace equipment, aviation equipment, nuclear control equipment, undersea equipment, military equipment).
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.
Please note that unless you obtain prior written consent of TAIYO YUDEN, TAIYO YUDEN shall not be in any way responsible for any damages incurred by you or third parties arising from use of the products listed in this specification for any equipment requiring inquiry to TAIYO YUDEN or prohibited for use by TAIYO YUDEN as described above.
- Please note that TAIYO YUDEN shall have no responsibility for any controversies or disputes that may occur in connection with a third party's intellectual property rights and other related rights arising from use of our products. TAIYO YUDEN grants no license for such rights.
- Please note that unless otherwise agreed in writing, the scope of warranty for our products is limited to the delivered our products themselves and TAIYO YUDEN shall not be in any way responsible for any damages resulting from a fault or defect in our products.
- The contents of this specification are applicable to our products which are purchased from our sales offices or authorized distributors (hereinafter "TAIYO YUDEN's official sales channel"). Please note that the contents of this specification are not applicable to our products purchased from any seller other than TAIYO YUDEN's official sales channel.
- **Caution for Export**
Some of our products listed in this specification may require specific procedures for export according to "U.S. Export Administration Regulations", "Foreign Exchange and Foreign Trade Control Law" of Japan, and other applicable regulations. Should you have any questions on this matter, please contact our sales staff.