

# **ANT<sup>TM</sup> + *Bluetooth*<sup>®</sup> Smart Module**

## **Bluetooth<sup>®</sup> 4.2 Low Energy**

### **EYAGJNZXX (32kB RAM)**

#### Data Report

The ***Bluetooth***<sup>®</sup> word mark and logos are owned by the ***Bluetooth*** SIG, Inc. and any use of such marks by TAIYO YUDEN CO., LTD. is under license.

ANT<sup>TM</sup> is a trademark of Dynastream Innovation Inc.

**EYAGJNZXX**

TAIYO YUDEN

**Document constituent list**

| <b>Control name</b>        | <b>Control No.</b> | <b>Document Page</b> |
|----------------------------|--------------------|----------------------|
| General Items              | HD-AG-A140402      | 1/4 - 4/4            |
| Absolute maximum ratings   | HD-AM-A140402      | 1/1                  |
| Electrical characteristics | HD-AE-A140402      | 1/7 - 7/7            |
| Circuit schematic          | HD-MC-A140402      | 1/3 - 3/3            |
| Outline / Appearance       | HD-AD-A140402      | 1/1                  |
| Pin Layout                 | HD-BA-A140402      | 1/2 - 2/2            |
| Handling Precaution        | HQ-BA-523          | 1/2 - 2/2            |
| Packaging Specification    | HD-BB-A140402      | 1/3 - 3/3            |
| Antenna application note   |                    | 1/3 - 3/3            |
| Design guide               |                    | 1/1                  |
| Notes                      |                    | 1/1                  |

## Revision History

14-Sep.-2015 &gt; Ver.1.00 Release

TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |                               |
|------------------------------|-------|-------------------------------|
| Control No.<br>HD-AG-A140402 | (1/4) | Control name<br>General Items |
|------------------------------|-------|-------------------------------|

**Scope**

This specification ("Specification") applies to the hybrid IC "EYAGJNZXX", a ANT<sup>TM</sup>+ **Bluetooth**<sup>®</sup> 4.2 Low Energy module ("Product") manufactured by TAIYO YUDEN Co., Ltd. ("TAIYO YUDEN")

**1. Type: EYAGJN**

User Code: EYAGJNZXX (32kB RAM)

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

**2. Function:**

Radio frequency module. ANT<sup>TM</sup>+**Bluetooth**<sup>®</sup> 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<sup>+6</sup>, PBB, PBDE)

**5. Outline: 11.3 x 5.1 x 1.3 mm**

28-pin Land Grid Array

**6. Marking: Part number, Lot number****7. Features:**

- Small outline by PCB substrate
- Low power consumption
- Integrated antenna
- Integrated system clock
- ANT<sup>TM</sup>+**Bluetooth**<sup>®</sup> 4.2 Low Energy conformity
- Slave Role

**8. Packaging:**

Packaging method: Tape & reel + aluminum moisture barrier bag

Packaging unit: 2000

\*It might be provided as tray at sample stage.

TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |                               |
|------------------------------|-------|-------------------------------|
| Control No.<br>HD-AG-A140402 | (2/4) | Control name<br>General Items |
|------------------------------|-------|-------------------------------|

## 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 ANT<sup>TM</sup> or Bluetooth<sup>®</sup> 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..)

**TAIYO YUDEN**

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |                               |
|------------------------------|-------|-------------------------------|
| Control No.<br>HD-AG-A140402 | (3/4) | Control name<br>General Items |
|------------------------------|-------|-------------------------------|

l. Alternative components may 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.

Please ensure that the sentence below is clearly stated on your product or product manual.

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 and the Telecommunication Business Law.

Name of the radio system: 001-A06159



**R** 001-A06159

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.

c) Please ensure that one of the following is clearly stated on your product.

-Contains Transmitter module IC : 4389B-EYAGJN

-Contains IC : 4389B-EYAGJN

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 ensure that one of the following is clearly stated on your product.

-Contains Transmitter Module FCC ID: RYYEYAGJN

-Contains FCC ID: RYYEYAGJN

c) CAUTION: changes or modifications not expressly approved by the party responsible for compliance could void the use's authority to operate the equipment

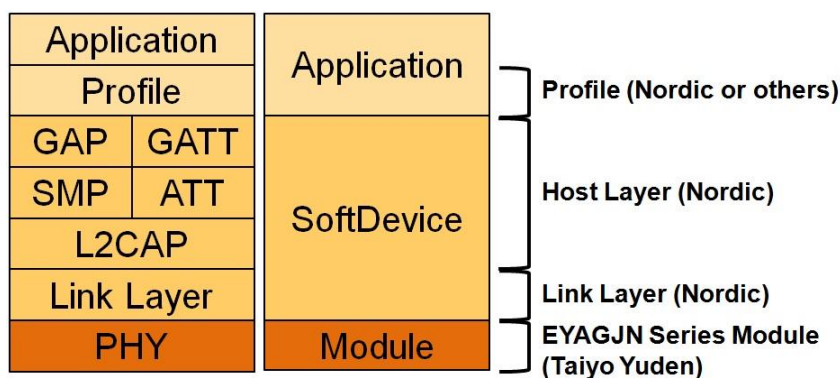
**TAIYO YUDEN**

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |                               |
|------------------------------|-------|-------------------------------|
| Control No.<br>HD-AG-A140402 | (4/4) | Control name<br>General Items |
|------------------------------|-------|-------------------------------|

- d) This product is certified as type of the portable device with FCC.
- q. This Product is designed for use in products which comply with *Bluetooth*<sup>®</sup> 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.
- r. Taiyo Yuden writes firmware for fixed SoftDevice (EYAGJNZXX : S310 V3.0.0) to this product. Customer writes firmware that is match the customer applications including SoftDevice at the customer's own responsibility.
- s. 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.
- t. EYAGJN series module is qualified as PHY only with Component category by Bluetooth SIG.. The QDID of this module is 69825. 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.



TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |  |
|------------------------------|-------|--|
| Control No.<br>HD-AM-A140402 | (1/1) | Control name<br>Absolute maximum ratings |
|------------------------------|-------|--|

**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 | 2        |              |                    |
| ESD HBM  | Human Body Model           |          | 1            | kV                 |
| ESD CDM  | Charged Device 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              |

TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |  |
|------------------------------|-------|--|
| Control No.<br>HD-AE-A140402 | (1/7) | Control name<br>Electrical characteristics |
|------------------------------|-------|--|

**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,<br>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)  |      |      | 100  | ms    |
| TA         | Operation temperature  | -25  | 25   | 75   | Deg-C |

The on-chip power-on reset circuitry may not function properly for rise times outside the specified interval.

**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    |
| IOFF,8k   | Current in SYSTEM-OFF mode 8 kB SRAM retention |             | 0.6  |             | uA    |
| ION       | SYSTEM-ON base current                         |             | 2.6  |             | uA    |

TAIYO YUDEN



**EYAGJNZXX**

TAIYO YUDEN

|                              |       |  |
|------------------------------|-------|--|
| Control No.<br>HD-AE-A140402 | (2/7) | Control name<br>Electrical characteristics |
|------------------------------|-------|--|

**UART specifications**

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

## EYAGJNZXX

TAIYO YUDEN

Control No.  
HD-AE-A140402

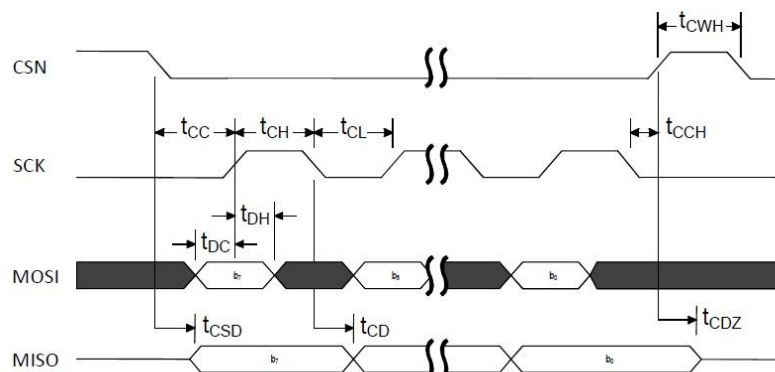
(3/7)

Control name  
Electrical characteristics

## SPI Slave specifications

| Symbol        | Description   | Min.  | Typ. | Max. | Units   |
|---------------|---|-------|------|------|---------|
| $I_{SPI125K}$ | Run current for SPI slave at 125 kbps. <sup>1</sup> |       | 180  |      | $\mu A$ |
| $I_{SPI2M}$   | Run current for SPI slave at 2 Mbps. <sup>1</sup>   |       | 183  |      | $\mu A$ |
| $f_{SPI}$     | Bit rates for SPIs.                                 | 0.125 |      | 2    | Mbps    |

1. CSN asserted.



SPI 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. <sup>1</sup><br>Constant latency mode. <sup>1</sup> |              |      | 7100<br>2100    | ns    |
| $t_{CD}$   | SCK to Data Valid.         | $C_{LOAD} = 10 \text{ pF}$  |              |      | 97 <sup>2</sup> | ns    |
| $t_{CL}$   | SCK Low time.              |   | 40           |      |                 | ns    |
| $t_{CH}$   | SCK High time.             |   | 40           |      |                 | ns    |
| $t_{CC}$   | CSN to SCK Setup.          | Low power mode. <sup>1</sup><br>Constant latency mode. <sup>1</sup> | 7000<br>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               | 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.

TAIYO YUDEN

**EYAGJNZXX**

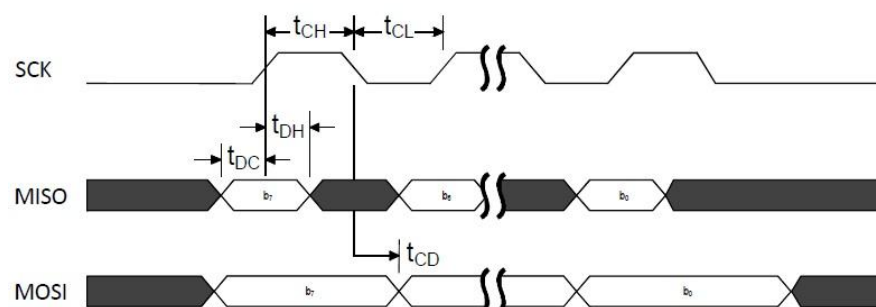
TAIYO YUDEN

Control No.  
HD-AE-A140402

(4/7)

Control name  
Electrical characteristics**SPI Master specifications**

| Symbol        | Description                             | Min.  | Typ. | Max. | Units   |
|---------------|---|-------|------|------|---------|
| $I_{SPI125K}$ | Run current for SPI master at 125 kbps. |       | 180  |      | $\mu A$ |
| $I_{SPI4M}$   | Run current for SPI master at 4 Mbps.   |       | 200  |      | $\mu A$ |
| $f_{SPI}$     | Bit rates for SPI.                      | 0.125 |      | 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 <sup>1</sup> | ns    |
| $t_{CL}$   | SCK Low time.           |                            | 40    |      |                 | ns    |
| $t_{CH}$   | SCK High time.          |                            | 40    |      |                 | ns    |
| $f_{SCK}$  | SCK Frequency.          |                            | 0.125 |      | 4               | MHz   |
| $t_R, t_F$ | SCK Rise and Fall time. |                            |       |      | 100             | ns    |

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

TAIYO YUDEN

## EYAGJNZXX

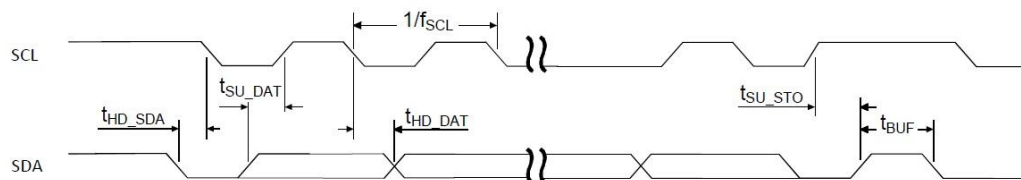
TAIYO YUDEN

|                              |       |  |
|------------------------------|-------|--|
| Control No.<br>HD-AE-A140402 | (5/7) | Control name<br>Electrical characteristics |
|------------------------------|-------|--|

## TWI specifications

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

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    |

TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |  |
|------------------------------|-------|--|
| Control No.<br>HD-AE-A140402 | (6/7) | Control name<br>Electrical characteristics |
|------------------------------|-------|--|

**GPIOTE specifications**

| Symbol                   | Description   | Min. | Typ. | Max. | Units         |
|--------------------------|---|------|------|------|---------------|
| $I_{\text{GPIOTE,IN}}$   | Run current with 1 or more GPIOTE active channels in Input mode.  |      | 22   |      | $\mu\text{A}$ |
| $I_{\text{GPIOTE,OUT}}$  | Run current with 1 or more GPIOTE active channels in Output mode.   |      | 0.1  |      | $\mu\text{A}$ |
| $I_{\text{GPIOTE,IDLE}}$ | Run current when all channels in Idle mode. PORT event can be generated with a delay of up to $t_{1V2}$ . |      | 0.1  |      | $\mu\text{A}$ |

**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**

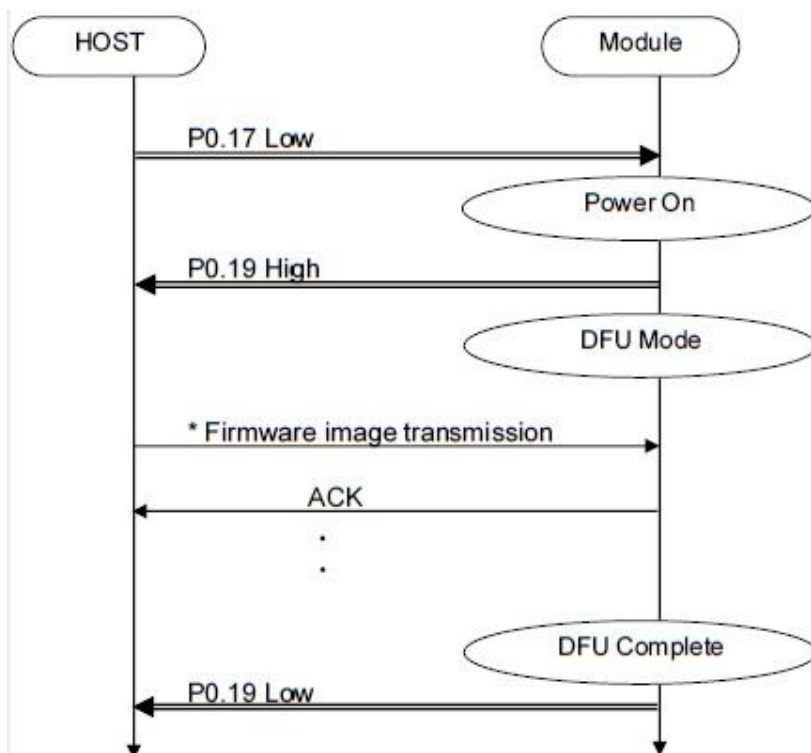
| Symbol   | Description                                       | Min.   | Typ.   | Max.   | Units |
|----------|---|--------|--------|--------|-------|
| Fop      | Operating frequencies                             | 2402   |        | 2480   | MHz   |
| PLLres   | PLL programming resolution                        |        | 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     | 1st Adjacent Channel Transmit Power 1 MHz         |        |        | -20    | dBc   |
| PRF2     | 2nd 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   |

TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |  |
|------------------------------|-------|--|
| Control No.<br>HD-AE-A140402 | (7/7) | Control name<br>Electrical characteristics |
|------------------------------|-------|--|

**DFU Specifications**

| UART                            |             |
|---------------------------------|-------------|
| Baud rate : 38400 bps           | UART PIN :  |
| Data : 8 bit                    | RX : P0.03  |
| Parity : none                   | TX : P0.01  |
| Stop : 1 bit                    | CTS : P0.02 |
| Hardware flow control : Enabled | RTS : P0.00 |

\* 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 (HCI) packet format

Software Development Kit > nRF51 SDK > nRF51 SDK v9.0.0 > Examples > BLE DFU Bootloader  
> Creating a DFU bootloader

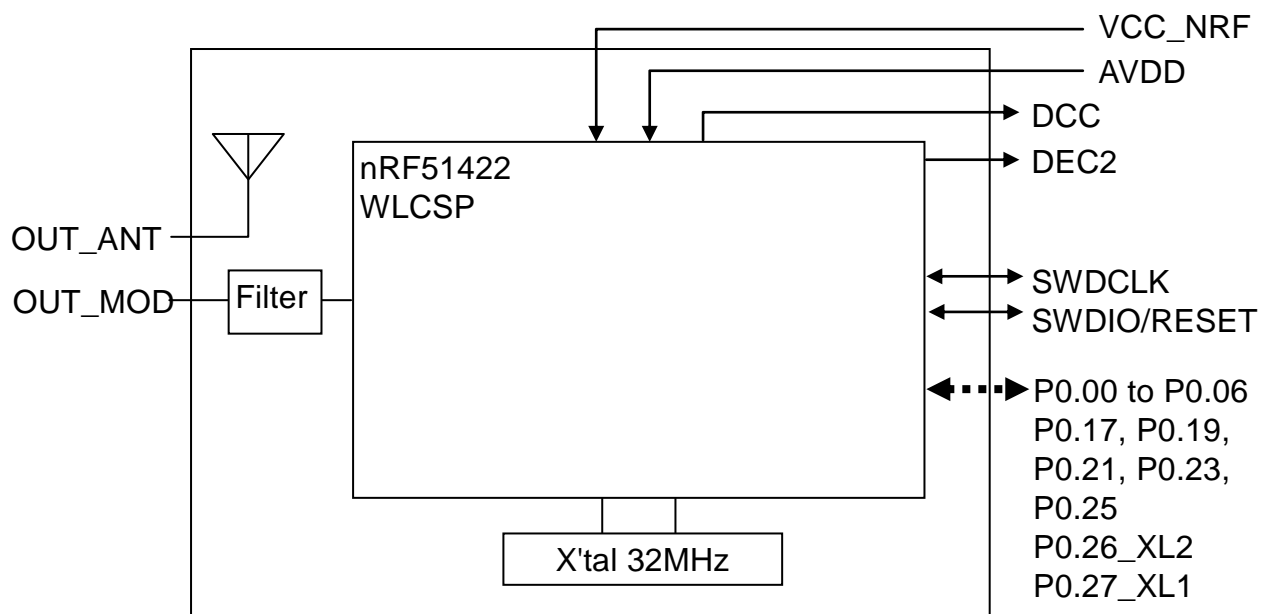
[nRFgo Studio] Download from Nordic web site <http://www.nordicsemi.com>  
nRFgo Studio help > Program nRF51 devices > Serial Bootloader

TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |                                   |
|------------------------------|-------|-----------------------------------|
| Control No.<br>HD-MC-A140402 | (1/3) | Control name<br>Circuit Schematic |
|------------------------------|-------|-----------------------------------|

**Block Diagram**

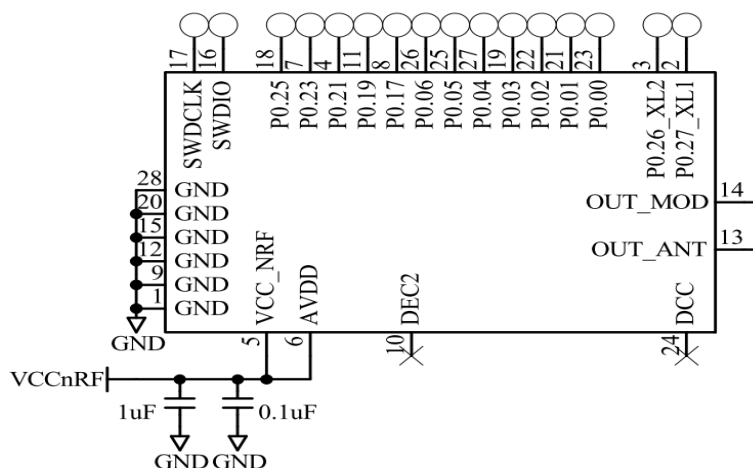
TAIYO YUDEN

**EYAGJNZXX**

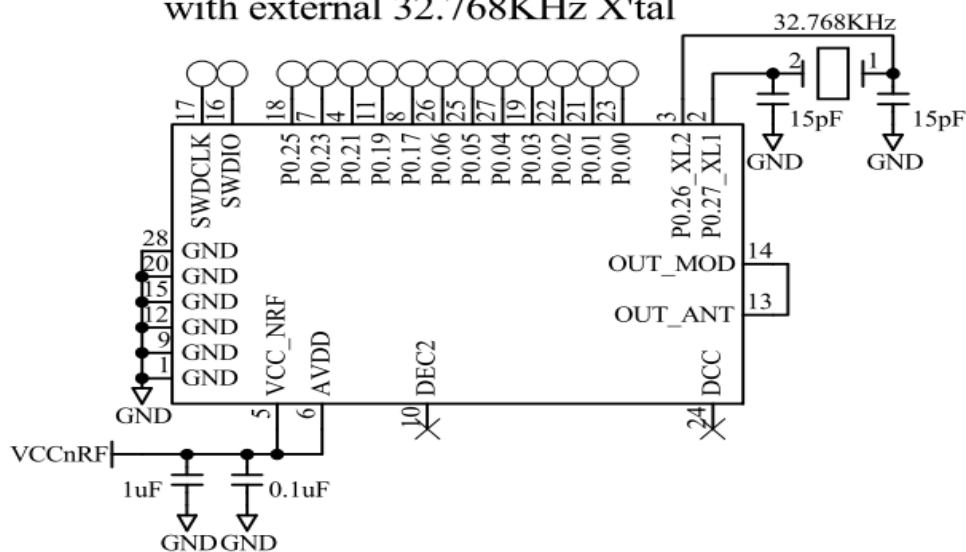
TAIYO YUDEN

Control No.  
HD-MC-A140402

(2/3)

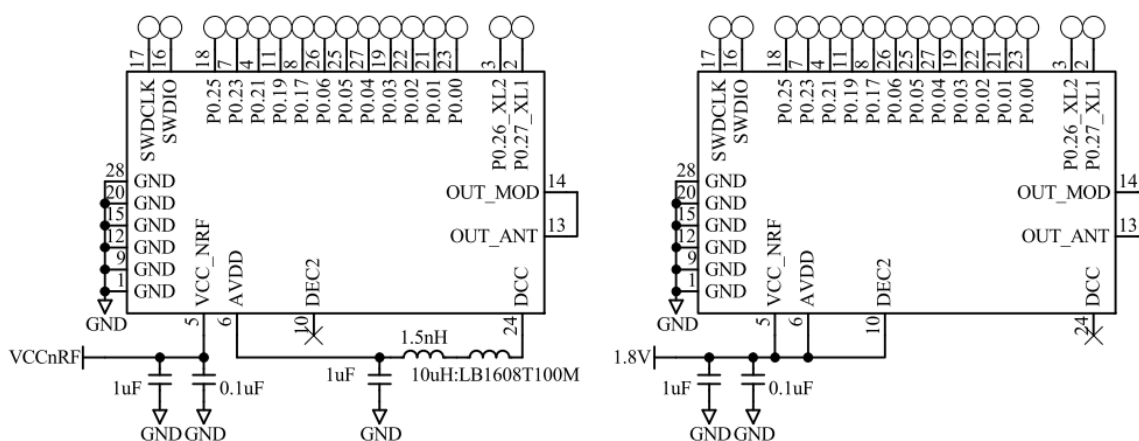
Control name  
Circuit Schematic**Sample circuits**

with external 32.768KHz X'tal



with internal DC/DC converter

with 1.8V low voltage mode



TAIYO YUDEN

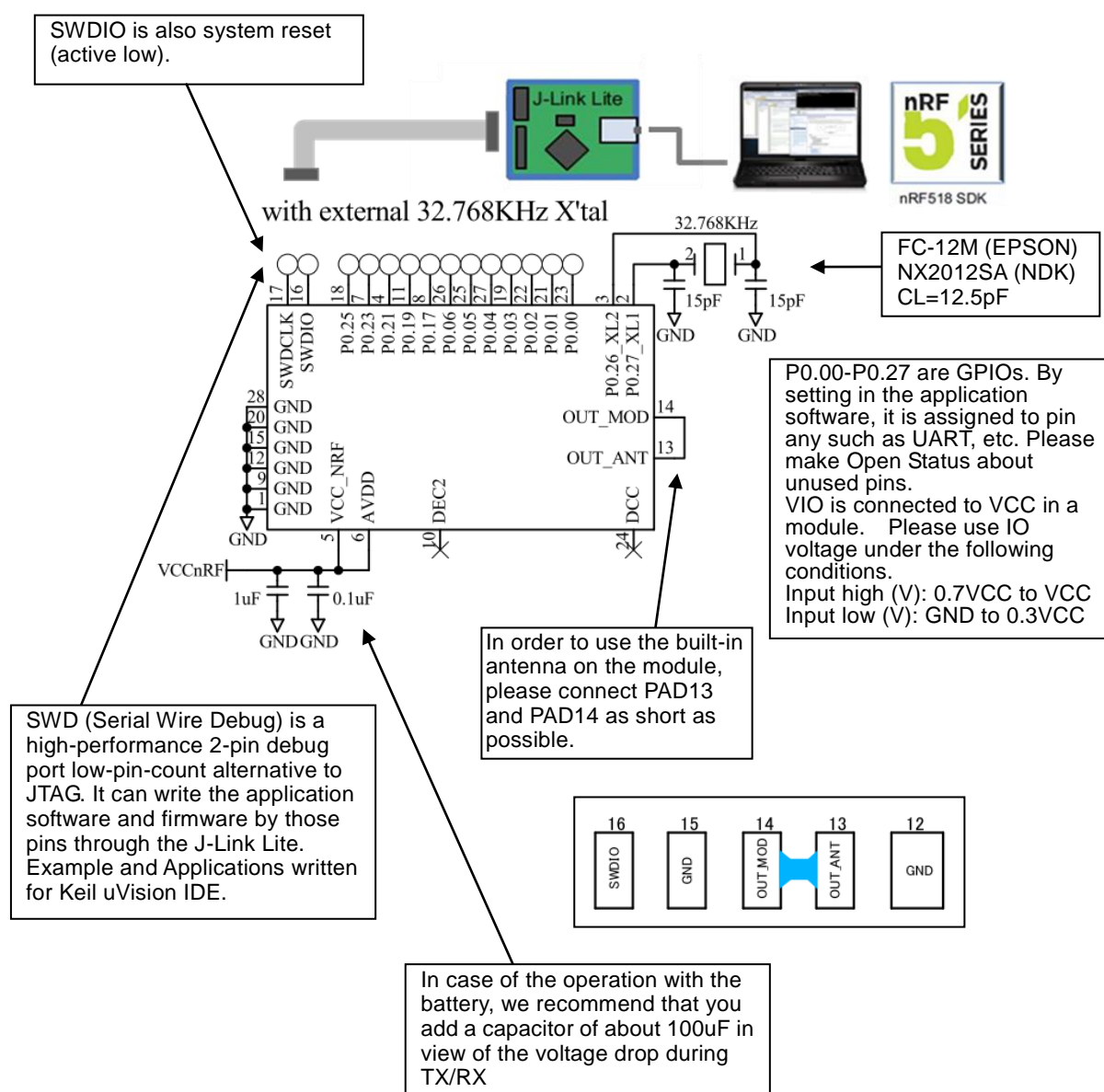


Control No.  
HD-MC-A140402

(3/3)

Control name  
Circuit Schematic

## Reference Circuits

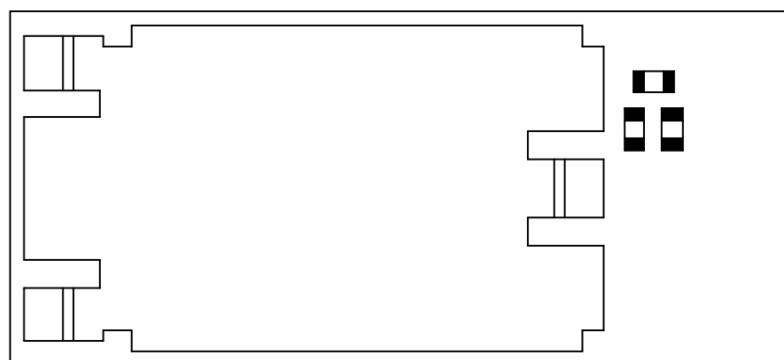


## EYAGJNZXX

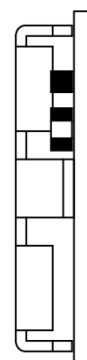
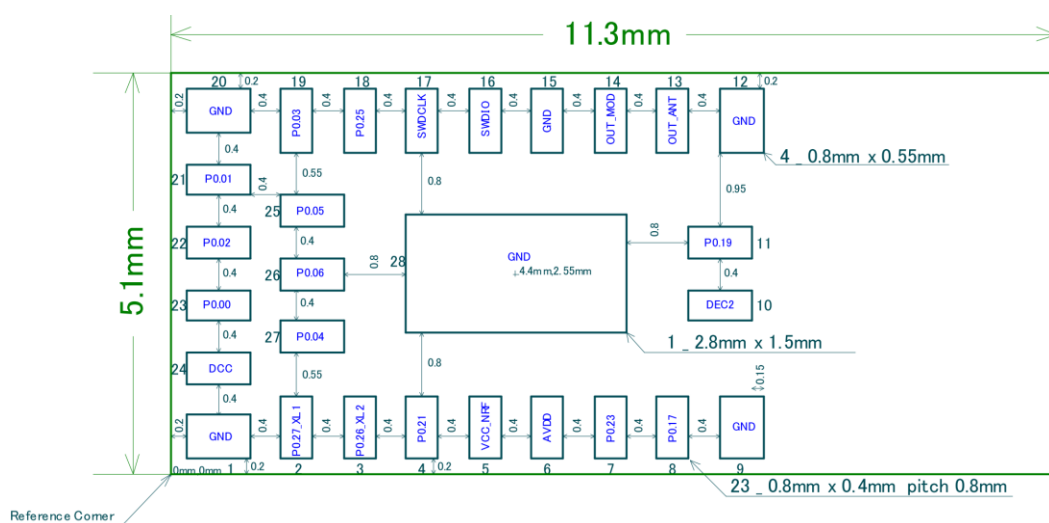
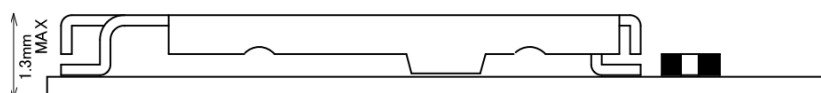
TAIYO YUDEN

Control No.  
HD-AD-A140402

(1/1)

Control name  
Outline/Appearance

Tolerance: +/- 0.2mm

Tolerance: +/- 0.2mm  
Unit : (mm)

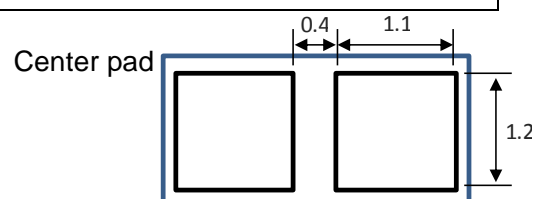
Top view

The dimension of the land pattern is the same as a foot pattern.

Recommended metal mask for solder printing

| Pad size                     | Metal mask opening |
|------------------------------|--------------------|
| Signal pad 23 - 0.4 x 0.8 mm | 0.35 x 0.7 mm      |
| Corner pad 4 - 0.55 x 0.8 mm | 0.45 x 0.75 mm     |
| Center pad 1 - 2.8 x 1.5 mm  | 1.1 x 1.2 mm x 2   |

The metal mask thickness: t=0.1mm



TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |                            |
|------------------------------|-------|----------------------------|
| Control No.<br>HD-BA-A140402 | (1/2) | Control name<br>Pin Layout |
|------------------------------|-------|----------------------------|

**Pin Descriptions**

| Pin | Pin name             | Pin function                                 | Description   |
|-----|----------------------|--|---|
| 1   | GND                  | Ground                                       | Ground (0 V)  |
| 2   | P0.27<br>AIN1<br>XL1 | Digital I/O<br>Analog input<br>Analog input  | General purpose I/O pin<br>ADC input 1<br>Crystal connection for 32.768kHz crystal oscillator or external 32.768kHz crystal reference |
| 3   | P0.26<br>AIN0<br>XL2 | Digital I/O<br>Analog input<br>Analog output | General purpose I/O pin<br>ADC input 0<br>Crystal connection for 32.768kHz crystal oscillator   |
| 4   | P0.21                | Digital I/O                                  | General purpose I/O pin   |
| 5   | VCC_NRF              | Power  | Power supply  |
| 6   | AVDD                 | Power  | Analog Power supply   |
| 7   | P0.23                | Digital I/O                                  | General purpose I/O pin   |
| 8   | P0.17                | Digital I/O                                  | General purpose I/O pin   |
| 9   | GND                  | Ground                                       | Ground (0 V)  |
| 10  | DEC2                 | Power  | Power supply for low voltage mode   |
| 11  | P0.19                | Digital I/O                                  | General purpose I/O pin   |
| 12  | GND                  | Ground                                       | Ground (0 V)  |
| 13  | OUT_ANT              | Antenna In/Out                               | Internal antenna. It should be connected to Pin 14 OUT_MOD for normal operation.  |
| 14  | OUT_MOD              | RF In/Out                                    | RF I/O pin. It should be connected to Pin 13 OUT_ANT for normal operation.  |
| 15  | GND                  | Ground                                       | Ground (0 V)  |
| 16  | SWDIO                | Digital I/O                                  | System reset (active low). Also HW debug and flash programming I/O  |
| 17  | SWDCLK               | Digital input                                | HW debug and flash programming I/O  |
| 18  | P0.25                | Digital I/O                                  | General purpose I/O pin   |
| 19  | P0.03<br>AIN4        | Digital I/O<br>Analog input                  | General purpose I/O pin<br>ADC input 4  |
| 20  | GND                  | Ground                                       | Ground (0 V)  |
| 21  | P0.01<br>AIN2        | Digital I/O<br>Analog input                  | General purpose I/O pin<br>ADC input 2  |
| 22  | P0.02<br>AIN3        | Digital I/O<br>Analog input                  | General purpose I/O pin<br>ADC input 3  |

TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

|                              |       |                            |
|------------------------------|-------|----------------------------|
| Control No.<br>HD-BA-A140402 | (2/2) | Control name<br>Pin Layout |
|------------------------------|-------|----------------------------|

| Pin | Pin name               | Pin function                                | Description   |
|-----|------------------------|---|---|
| 23  | P0.00<br>AREF0         | Digital I/O<br>Analog input                 | General purpose I/O pin<br>ADC Reference voltage                |
| 24  | DCC                    | Power                                       | DC/DC output  |
| 25  | P0.05<br>AIN6          | Digital I/O<br>Analog input                 | General purpose I/O pin<br>ADC input 6                          |
| 26  | P0.06<br>AIN7<br>AREF1 | Digital I/O<br>Analog input<br>Analog input | General purpose I/O pin<br>ADC input 7<br>ADC Reference voltage |
| 27  | P0.04<br>AIN5          | Digital I/O<br>Analog input                 | General purpose I/O pin<br>ADC input 5                          |
| 28  | GND                    | Ground                                      | Ground (0 V)  |

TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

|                          |                                     |
|--------------------------|-------------------------------------|
| Control No.<br>HQ-BA-523 | Control name<br>Handling Precaution |
|--------------------------|-------------------------------------|

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. Please do not wash this 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.

TAIYO YUDEN

**EYAGJNZXX**

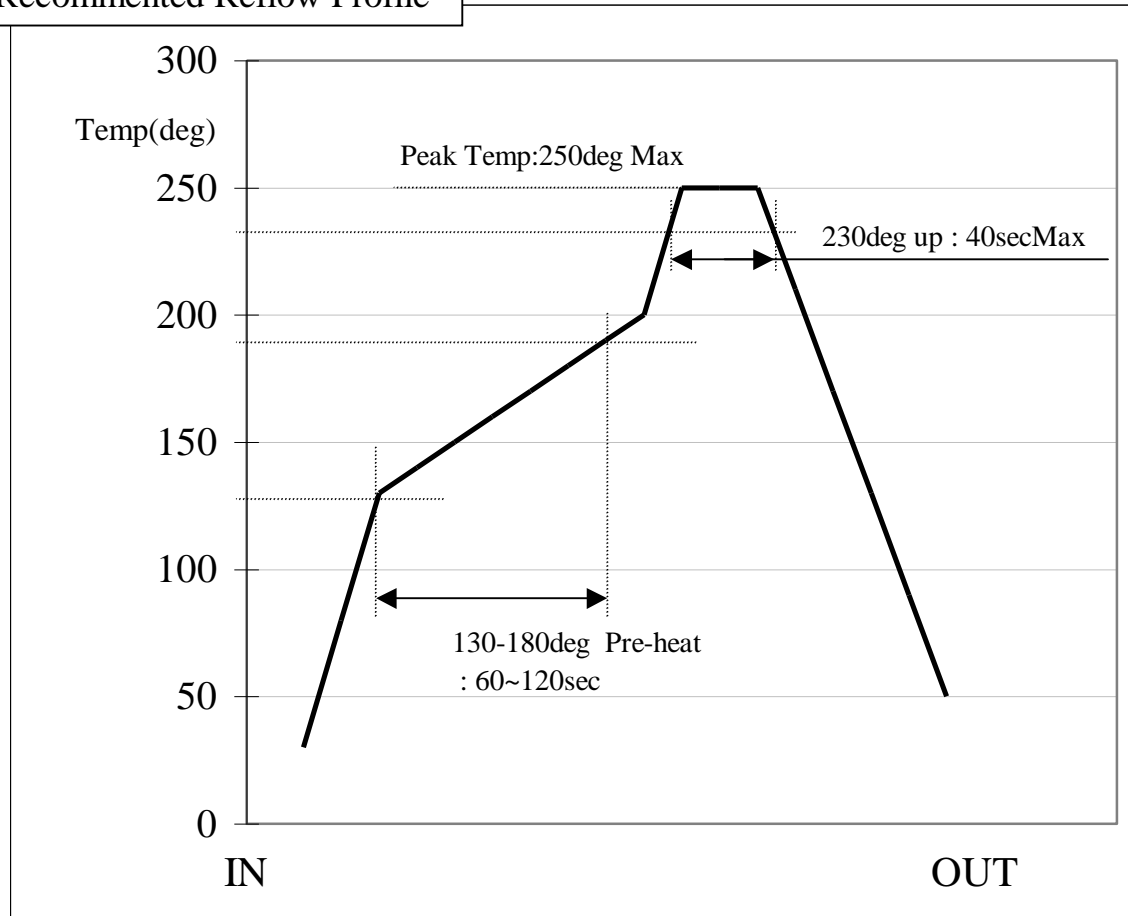
TAIYO YUDEN

Control No.  
HQ-BA-523

(2/2)

Control name  
Handling Precaution

## Recommended Reflow Profile



TAIYO YUDEN

EYAGJNZXX

TAIYO YUDEN

|                              |       |   |
|------------------------------|-------|---|
| Control No.<br>HD-BB-A140402 | (1/3) | Control name<br>Packaging Specification |
|------------------------------|-------|---|

## Packaging Specification

## 梱包仕様

## (1) Packaging Material 梱包材料

| Name<br>部材名                             | Outline<br>概要                            | Materials<br>材質         | Note<br>備考 |
|---|--|-------------------------|------------|
| Emboss<br>エンボス                          | 24mm wide - 12mmPitch<br>24mm幅 - 12mmピッチ | Conductive PS<br>導電性 PS |            |
| Cover Tape<br>カバーテープ                    |  |                         |            |
| Reel<br>リール                             | φ 330 mm                                 | Conductive PS<br>導電性 PS |            |
| Desiccant<br>乾燥剤                        | 30g×1                                    |                         |            |
| Humidity indicator card<br>湿度インジケータ     |  |                         |            |
| Aluminum moisture barrier bag<br>アルミ防湿袋 | 420×460(mm)                              | (AS)PET/AL/NY/PE(AS)    |            |
| Label<br>ラベル                            |  |                         |            |
| Corrugated cardboard box(Inner)<br>個装箱  | 339×351×74(mm)                           |                         |            |
| Corrugated cardboard box(Outer)<br>外装箱  | 369×369×277(mm)                          |                         |            |

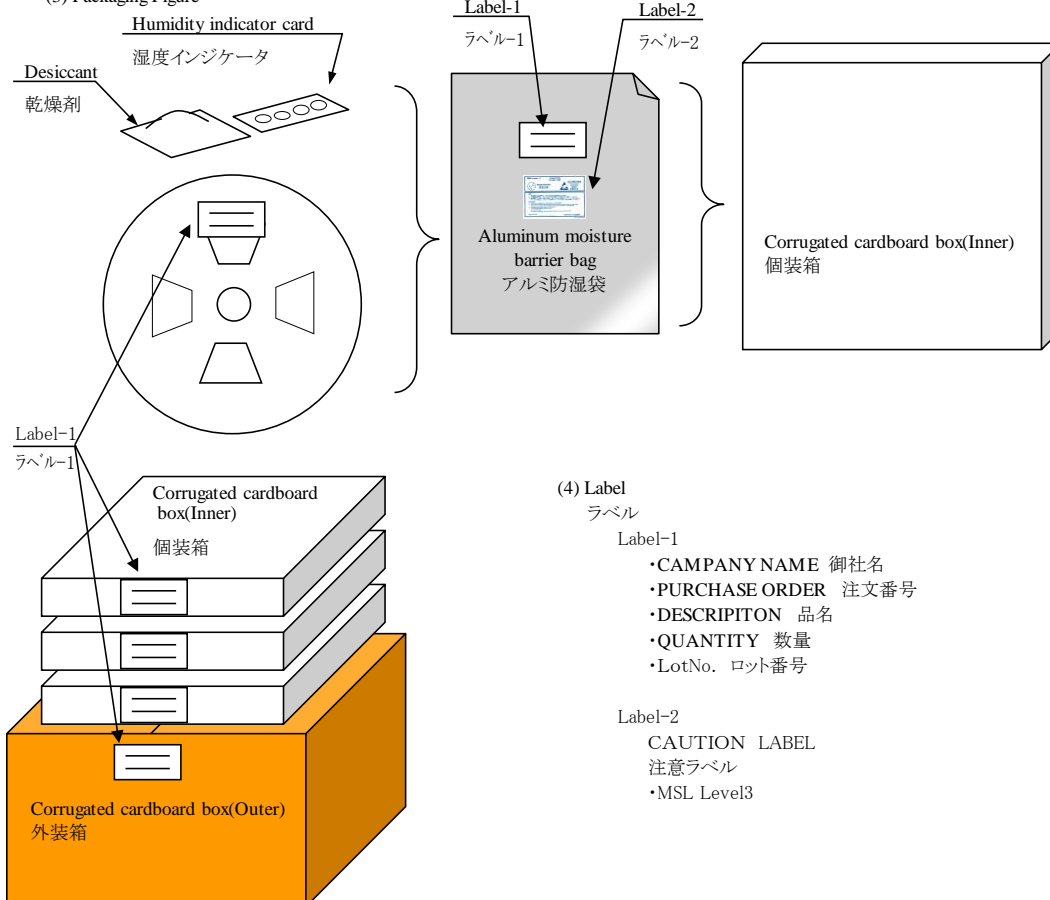
## (2) Packaging Unit

## 梱包数量

Max 2000 pieces/Reel

Max 6000 pieces/Box(Outer)

## (3) Packaging Figure



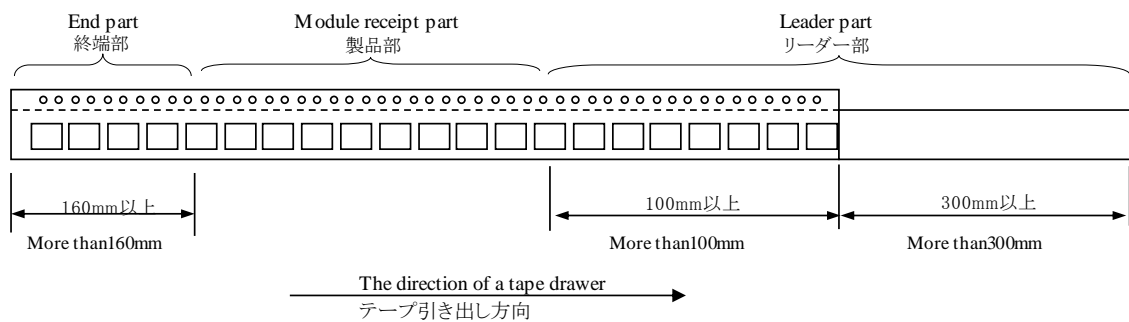
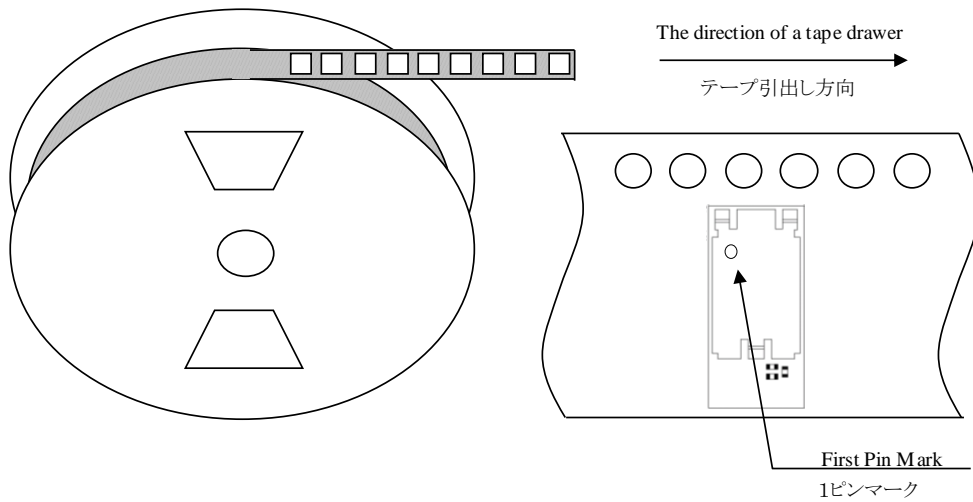
TAIYO YUDEN

**EYAGJNZXX**

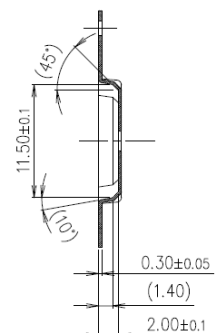
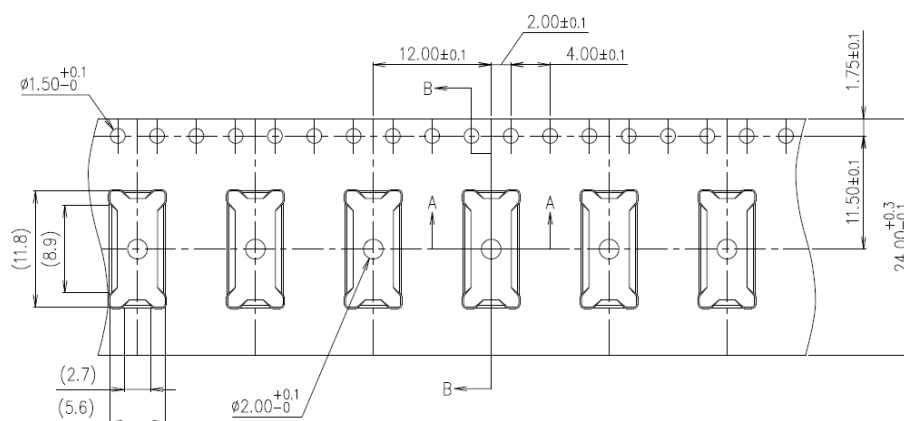
TAIYO YUDEN

Control No.  
HD-BB-A140402

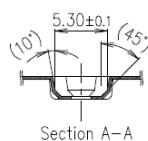
(2/3)

Control name  
Packaging SpecificationTape specification  
テーピング仕様

キャリアエンボス図面



Section B-B



Section A-A

TAIYO YUDEN

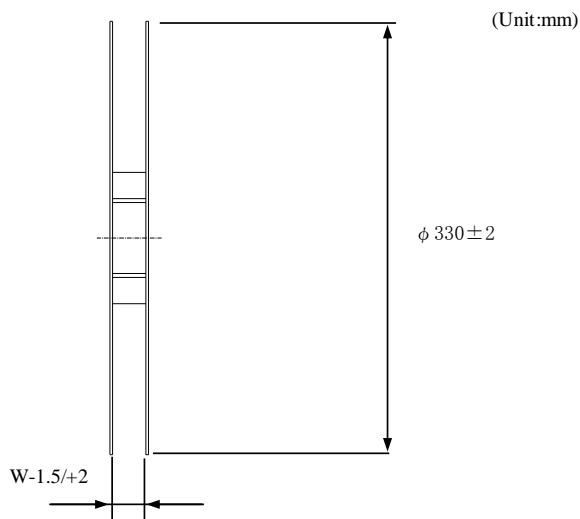
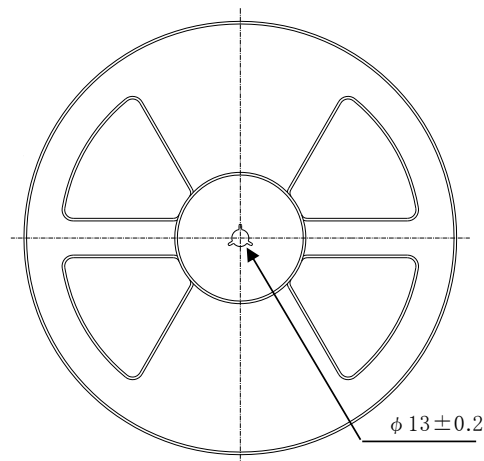


**EYAGJNZXX**

TAIYO YUDEN

Control No.  
HD-BB-A140402

(3/3)

Control name  
Packaging SpecificationReel 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

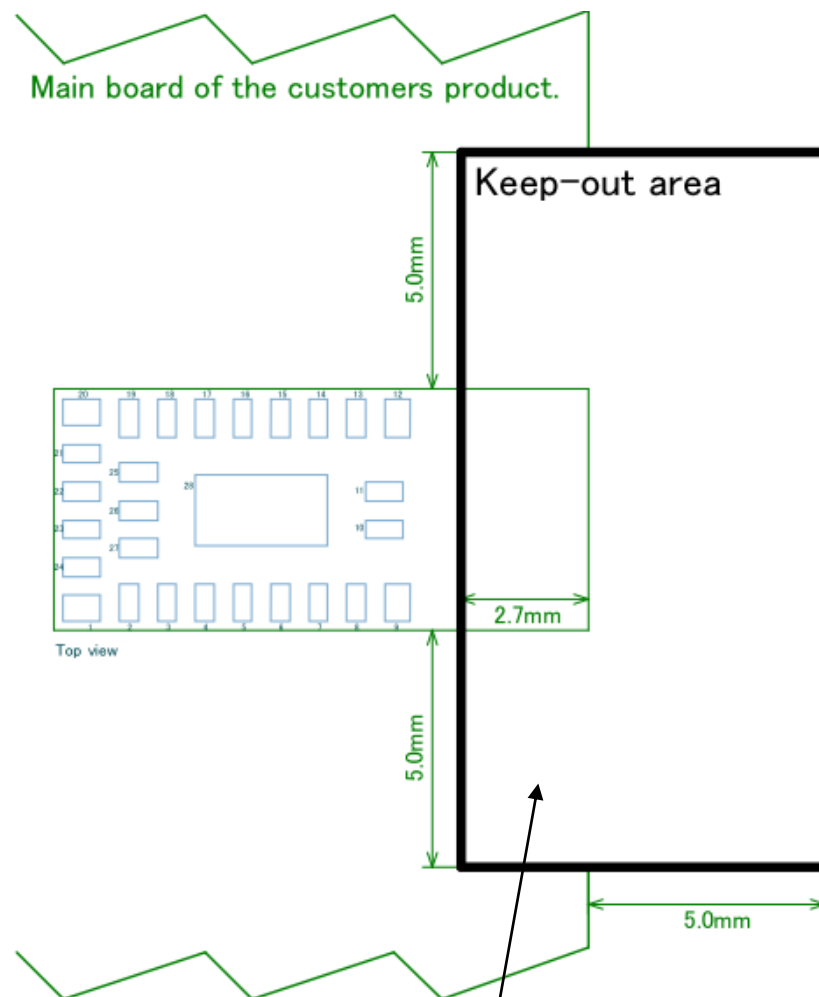
MSL はレベル3 で管理しています。

TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

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

**Keep-out area**

In order to keep the antenna performance on the module, please do not place any components, ground of main board, signal line, conductive plating in Keep-out area.

Keep-out area will be applicable in all layers of the customer's substrate.

Please consider on the occasion of pattern design.

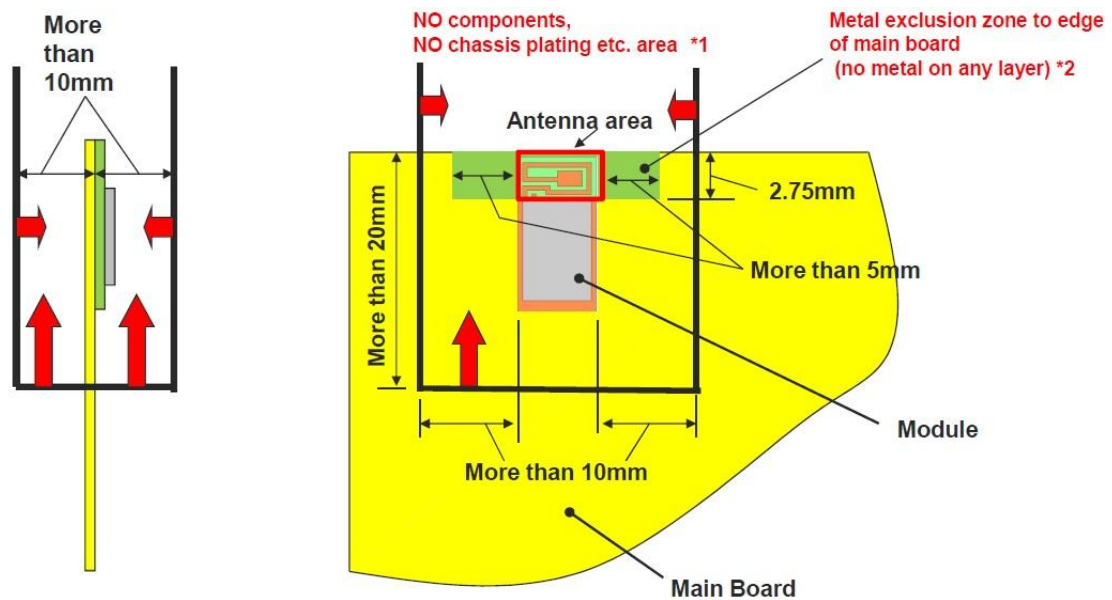
TAIYO YUDEN

## EYAGJNZXX

TAIYO YUDEN

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

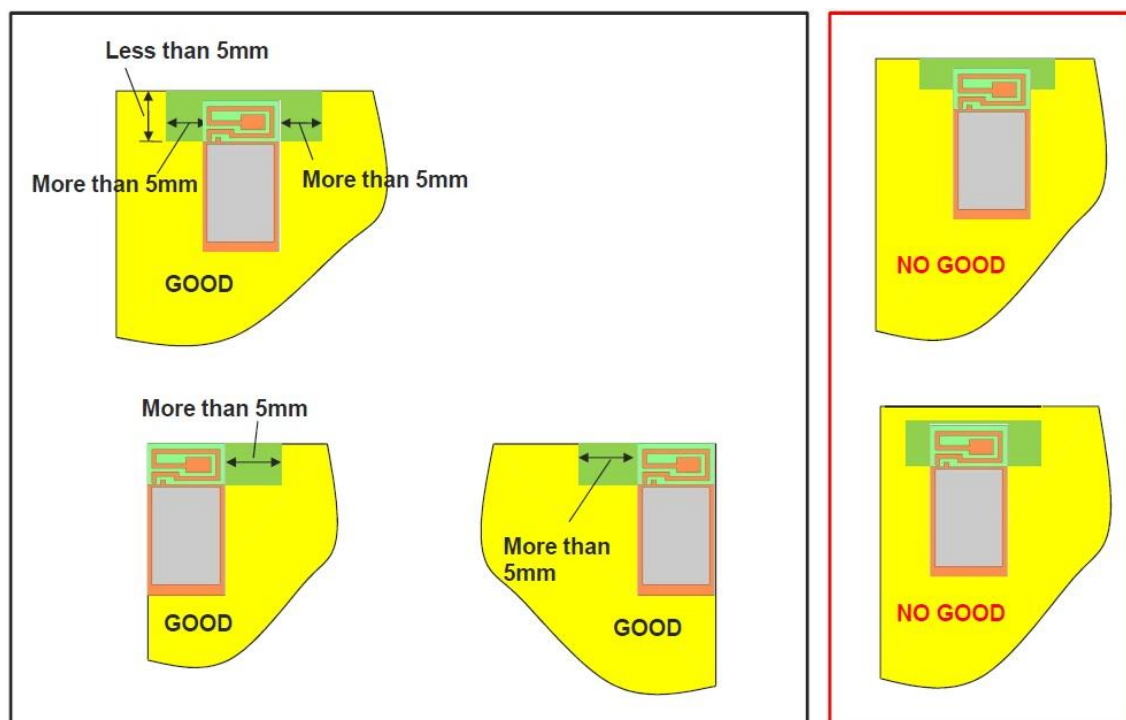
## Recommended arrangement of the module



\*1 It should not exist a component, conductive plating for chassis and so on in this area.  
In addition, main board, chassis etc. may exist outside of the "NO components, NO chassis plating etc.area".

\*2 Metal pattern on the main board should not exist under the antenna area.

## Example layout on main board

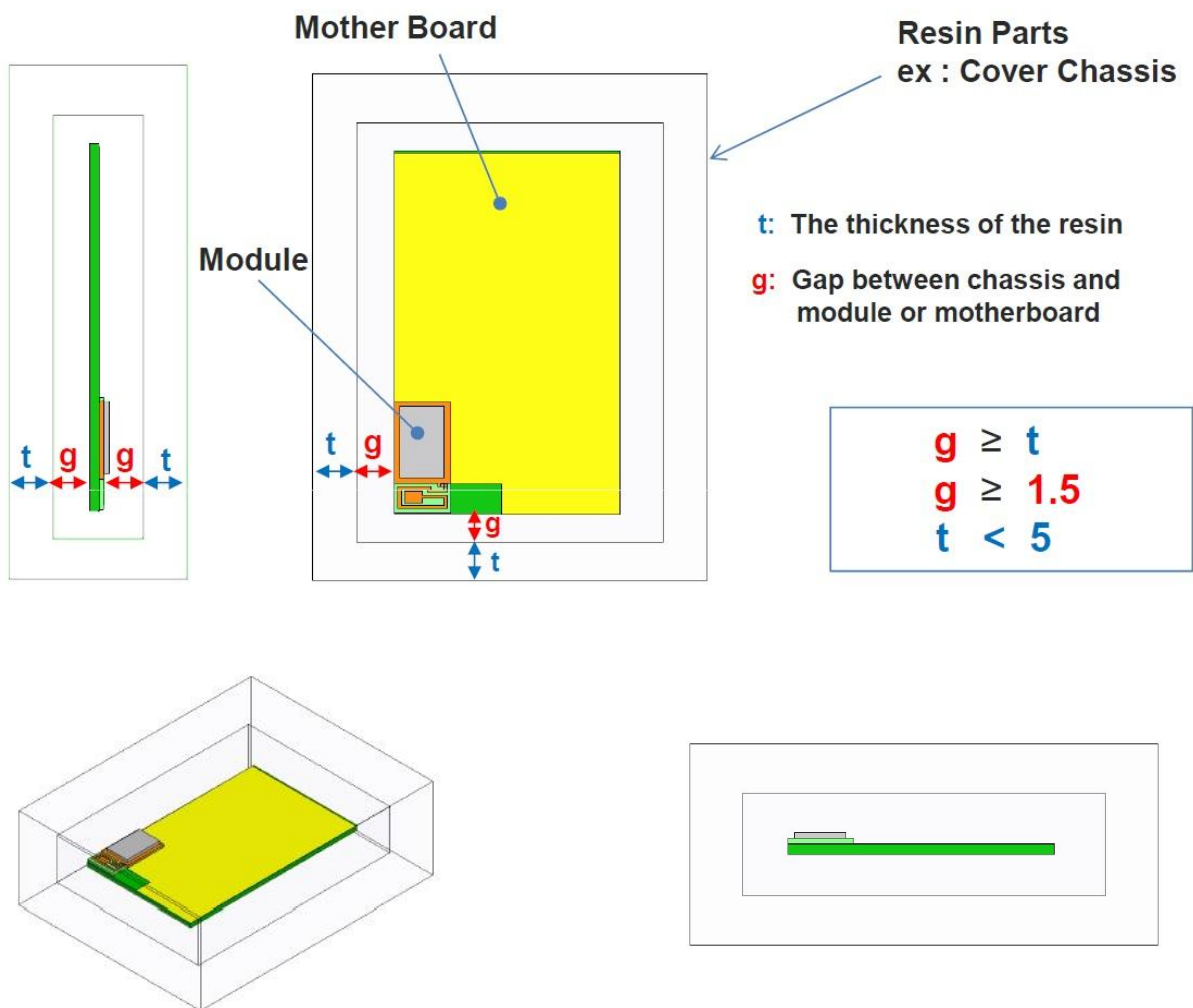


TAIYO YUDEN

**EYAGJNZXX**

TAIYO YUDEN

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

**Antenna arrangement near resin**

TAIYO YUDEN

|             |              |
|-------------|--------------|
| Control No. | Control name |
| (1/1)       | Design guide |

### 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.

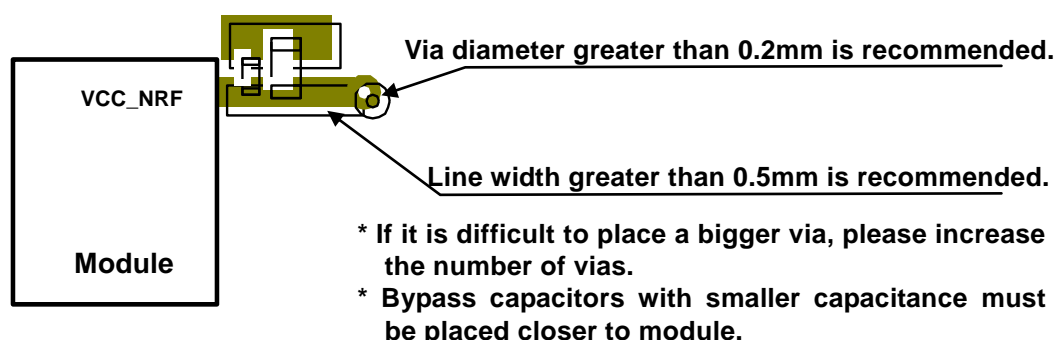
### 3. Battery operation

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 must be placed close to the VCC\_NRF pin of the module. The VCC\_NRF trace should be greater than 0.5mm and a bigger via diameter is recommended.

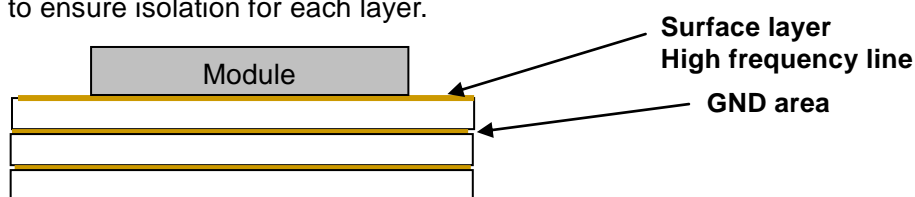


#### 4-2. Bypass Capacitor Layout

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 must be placed close to an adjacent module GND to ensure the shortest closed loop.

#### 4-3. GND Pattern

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



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

**EYAGJNZXX**

TAIYO YUDEN

| Control No. | Control name |
|-------------|--------------|
| (1/1)       | Notes        |

**Clock frequency**

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 EYAGJN 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 0xFFFFFFFF00 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 0xFFFFFFFF00
```

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 = 0xFFFFFFFF00;
    NRF_NVMC->CONFIG = NVMC_CONFIG_WEN_Ren << NVMC_CONFIG_WEN_Pos;
    while (NRF_NVMC->READY == NVMC_READY_READY_Busy){}
    NVIC_SystemReset();
    while (true){}
}
```

**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).

```
SOFTDEVICE_HANDLER_INIT(NRF_CLOCK_LFCLKSRC_RC_250_PPM_250MS_CALIBRATION, false);
```

Note that when you choose to use the RC oscillator, it will add around 10uA average current consumption compared to a 20ppm external crystal.

TAIYO YUDEN



**Стандарт  
Электрон  
Связь**

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

**Наши контакты:**

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331