By purchase of any products described in this document, the customer is deemed to understand and accept contents of this document.

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Revision History

14-Oct. -2019 > Ver.0.9 Release
EYSDKDNZWB

1. Scope
This specification ("Specification") applies to the hybrid IC “EYSDKDNZWB”, a Bluetooth® 5.0 low energy module (“Product”) manufactured by TAIYO YUDEN Co., Ltd. (“TAIYO YUDEN”)

2. Description
   a) User Code : EYSDKDNZWB
      Type : EYSDKDN
         *User Code may be changed for mass production or other cases.
         Note: Please use the User Code (EYSDKDNZWB) to order this product
   b) Chip : Nordic nRF52840 (1MB Flash, 256kB RAM)
   c) Function : Radio frequency transceiver Module. Bluetooth®5.0 conformity.
   d) Application : IoT devices, Health & Fitness Equipment, Sensor, Toys
   e) Structure : Hybrid IC loaded with silicon monolithic semiconductor
      Regarding the containment of hazardous substance in this Product, it conforms to RoHS Directive.
   f) Outline : 38-pin Land Grid Array
   g) Marking : Part Number, Lot Number, FCC ID and ISED Number on Shielding Case
      Japan ID and manufacturer on Module board
   h) Country of origin : Japan, Thailand
   i) Packaging : Packaging method: Tape & reel + aluminum moisture barrier bag
      Packaging unit: 1000
      *It might be provided as tray at sample stage.
Notes:

a. Limitation of Warranty

1) TAIYO YUDEN provides warranties only if the Product is operated under the condition set forth in this Specification. Please note that TAIYO YUDEN shall not be liable for any defect and/or malfunction arising from use of the Product under the terms and conditions other than the operating conditions hereof. In addition when this Product is used under environmental conditions such as over voltage which is not guaranteed, it may be destroyed in short mode. To ensure the security of customer’s product, please add an extra fuse or/and a protection circuit for over voltage.

2) This Product is designed for use in products which comply with Bluetooth® Specifications. TAIYO YUDEN disclaims and is not responsible for any liability concerning infringement by this Product under any intellectual property right owned by third party in case the customer uses this Product in any product which does not comply with Bluetooth® Specifications (the “non-complying products”). Furthermore, TAIYO YUDEN warrants only that this Product complies with this Specification and does not grant any other warranty including warranty for application of the non-complying products.

3) In some cases, TAIYO YUDEN may use replacements as component parts of Products. Such replacement shall apply only to component part of Products, which TAIYO YUDEN deems it possible to replace or substitute according to (i) Scope of Warranty provided in this specification (e.g. Electric Characteristics, Outline, dimension, Conditions of Use, Reliability Tests, Official Standard (Type Approvals etc.)) and (ii) Quality of Products. TAIYO YUDEN also ensures traceability of such replacement on production lot basis.

b. Instruction for Use (CAUTION)

1) Because Product is not designed for radiation durability, please refrain from exposing Product to radiation in the use.

2) Communication between this Product and other might not be established nor maintained depending upon radio environment or operating condition of this Product and other products with wireless technology.

3) This Product operates in the unlicensed ISM band at 2.4GHz. In case this Product is used around the other wireless devices which operate in same frequency band of this Product, there is a possibility that interference occurs between this Product and such other devices. If such interference occurs, please stop the operation of other devices or relocate this Product before using this Product or do not use this Product around the other wireless devices.

4) This Product mentioned in this Specification is manufactured for use in Health & Fitness Equipment, Sensor, Toys. Before using this Product in any special equipment (such as medical equipment, space equipment, air craft, disaster prevention equipment), where higher safety and reliability are duly required, the applicability and suitability of this Product must be fully evaluated by the customer at its sole risk to ensure correct and safety operation of those special equipments. Also, evaluation of the safety function of this Product even for use in general electronics equipment shall be thoroughly made and when necessary, a protective circuit shall be added in design stage, all at the customer’s sole risk.
5) Japan Regulatory Information
   a) This Product is a radio system and obtained certification of construction type combined
      with the specific antenna.
   b) Please ensure that your product has a label with the following certification mark at easily
      viewable location. If your product is too small to have the label, please place it in the
      instruction manual and package of your product. The mark diameter shall be equal or
      greater than 3mm. In case your product does not have the label with the following
      certification mark, you or your customer who uses your product may be against the Radio
      Law and subjected to criminal punishment. TAIYO YUDEN shall not be liable for any
      loss or damage incurred by you or your customer arising from use of your product which
      does not have following certification mark.
      
      This product has a radio system which was approved as a radio station in a low
      power data communication system based on the Radio Law.
      -EYSKDN : 005-102211

   6) Canada Regulatory Information
   a) This device complies with Industry Canada’s applicable licence-exempt RSSs.
      Operation is subject to the following two conditions:
      (1) This device may not cause interference; and
      (2) This device must accept any interference, including interference that may cause
          undesired operation of the device.
      
      Le présent appareil est conforme aux CNR d’Industrie Canada applicables aux
      appareils radio exempts de licence. L’exploitation est autorisée aux deux conditions
      suivantes :
      1) l’appareil ne doit pas produire de brouillage;
      2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le
         brouillage est susceptible d’en compromettre le fonctionnement.
   b) This product is certified as type of the portable device with Industry Canada Rules. To
      maintain compliance with RF Exposure requirement, please use within specification of
      this product and have a separation distance of minimum 20 mm between the user
      and/or bystander and the antenna and /or radiating element.
      This distance ensures that the output power (e.i.r.p.) of EYSKDN is below the SAR
      evaluation Exemption limits defined in RSS-102 issue 5.
      
      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 et respecter une distance de séparation d'au
      moins 20 mm entre l'utilisateur et / ou un tiers et l'antenne et / ou l’élément rayonnant.
      Cette distance garantit que la puissance de sortie (p.i.r.e.) d'EYSKBN est inférieure aux
      limites d’exemption de l’évaluation SAR définies dans le numéro 5 de la norme
      RSS-102.
      - IC: 4389B-EYSKDN
c) Please notify certified ID by either one of the following method on your product.
-Contains IC : 4389B-EYSKDN

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

7) FCC Regulatory Information
   a) This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
   b) Please notify certified ID by either one of the following method on your product.
-Contains Transmitter Module FCC ID: RYYEYSKDN
-Contains FCC ID: RYYEYSKDN
   c) CAUTION: Changes or modifications not expressly approved by the party responsible for compliance could void the use's authority to operate the equipment.
   d) This product is certified as type of the portable device with FCC Rules. To maintain compliance with RF Exposure requirement, please use within specification of this product.
   e) The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
   f) This module can change the output power depending on the circumstances by the application software which is developed by module installer. Any end user cannot change the output power.

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

TAIYO YUDEN CO., LTD.
c. Term of Support

1) In the case that customer requests TAIYO YUDEN to customize the hardware of this Product in order to meet such customer's specific needs, TAIYO YUDEN will make commercially reasonable effort to modify such hardware or software at customer's expense; provide however, the customer is kindly requested to agrees it doesn't mean that TAIYO YUDEN has obligations to do so even in the case it is technically difficult for TAIYO YUDEN.

2) Any failure arising out of this Product will be examined by TAIYO YUDEN regardless of before or after mass production. Customer agrees that once such failure is turned out not to be responsible for TAIYO YUDEN after aforesaid examination, some of the technical support shall be conducted by TAIYO YUDEN at customer's expense; provided however, exact cost of this technical support can be agreed through the negotiation by the parties.

3) Do not alter hardware and/or software of this Product. Please note that TAIYO YUDEN shall not be liable for any problem if it is caused by customer's alteration of Hardware without Taiyo Yuden's prior approvals.

4) TAIYO YUDEN does not guarantee functions and performances which depend on the customer's firmware. TAIYO YUDEN does not assume liabilities for defects and failures (i) in functions, performances and quality of the Customer's product incorporating the Products and (ii) which may occur as the Product is incorporated in the Customer's product.

d. Caution for Export Control

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

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

e. Term of Warranty

TAIYO YUDEN warrants only that this Product is in conformity with this Specification for one year after purchase and shall in no event give any other warranty.
f. Items of the Specification
   1) Any question arising from the Specification shall be solved in good faith through mutual discussion by the parties hereof.
   2) The language of this “General items” is Japanese and this “General items” shall be interpreted by Japanese. Any copies of translation is a reference purpose only and is not binding on both parties hereto.

   g. Special note
   1) The latest errata and document released by Nordic Semiconductor ASA must be referred the document is given priority over this document. Please note that TAIYO YUDEN shall not be liable for any problem and related issue for developed or manufactured application software or product without reference or consideration of the information released by Nordic Semiconductor ASA.
   2) Taiyo Yuden writes firmware for and fixed SoftDevice (s140_nrf52_6.1.0_softdevice.hex) to this product. Customer writes firmware that is match the customer applications including SoftDevice at the customer’s own responsibility.
   3) The Electrical Characteristics defined in this Specification are of the module with above Firmware (s140_nrf52_6.1.0_softdevice.hex). If other firmware developed by Customer is installed, the characteristics may differ from the defined value in the Electrical Characteristics. Bluetooth qualification and radio type approval may become invalid.
   4) 802.15.4 at 2.4GHz band is used 16ch from ch11 (2405MHz) to ch26 (2480MHz). Due to the wide occupied bandwidth of the 802.15.4 signal, the radiated emission level exceeds the FCC (Federal Communications Commission) regulation limit level if it transmits the ch26 near 2483.5MHz witch starting FCC restricted band. Therefore integrators of this module have to make the application software that should not be possible to transmit the 26ch, and cannot be unlocked by an end-user.
   5) EYSKDN series module is qualified as PHY only with Component category by Bluetooth SIG. The QDID of this module is 138245. 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.
Absolute maximum ratings

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Min.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDD</td>
<td></td>
<td>-0.3</td>
<td>+3.9</td>
<td>V</td>
</tr>
<tr>
<td>VDDH</td>
<td></td>
<td>-0.3</td>
<td>+5.8</td>
<td>V</td>
</tr>
<tr>
<td>VBUS</td>
<td></td>
<td>-0.3</td>
<td>+5.8</td>
<td>V</td>
</tr>
<tr>
<td>GND</td>
<td></td>
<td>0</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>VIO, VDD≤3.6V</td>
<td></td>
<td>-0.3</td>
<td>VDD+ 0.3</td>
<td>V</td>
</tr>
<tr>
<td>VIO, VDD&gt;3.6V</td>
<td></td>
<td>-0.3</td>
<td>+3.9</td>
<td>V</td>
</tr>
<tr>
<td>Storage temperature</td>
<td></td>
<td>-40</td>
<td>+85</td>
<td>Deg-C</td>
</tr>
<tr>
<td>MSL</td>
<td>Moisture Sensitivity Level</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ESD HBM</td>
<td>Human Body Model</td>
<td>1</td>
<td></td>
<td>kV</td>
</tr>
<tr>
<td>ESD MM</td>
<td>Machine Model</td>
<td>100</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Endurance</td>
<td>Flash Memory Endurance</td>
<td>10000</td>
<td></td>
<td>write/erase cycles</td>
</tr>
<tr>
<td>Retention</td>
<td>Flash Memory Retention</td>
<td>10 years</td>
<td></td>
<td>At 40 deg-C</td>
</tr>
</tbody>
</table>

TAIYO YUDEN CO., LTD.
EYSKDNZWB

TAIYO YUDEN CO., LTD.

Control No. HD-AE-A191023  (1/3)  Control name Electrical characteristics

Electrical characteristics

Recommendation operating range

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter (condition)</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>VDD, POR</td>
<td>VDD supply voltage needed during power-on reset.</td>
<td>1.75</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>tR_VDD</td>
<td>Supply rise time (0V to 1.7V)*1</td>
<td>60</td>
<td></td>
<td></td>
<td>ms</td>
</tr>
<tr>
<td>tR_VDDH</td>
<td>Supply rise time (0V to 1.7V)*1</td>
<td>100</td>
<td></td>
<td></td>
<td>ms</td>
</tr>
<tr>
<td>TA</td>
<td>Operation temperature</td>
<td>-40</td>
<td>25</td>
<td>85</td>
<td>Deg-C</td>
</tr>
</tbody>
</table>

*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, VDD and VDDH = 3.0V

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter (condition)</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>VIH</td>
<td>Input high voltage</td>
<td>0.7 x VDD</td>
<td></td>
<td>VDD</td>
<td>V</td>
</tr>
<tr>
<td>VIL</td>
<td>Input low voltage</td>
<td>GND</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>VOH</td>
<td>Output high voltage (high drive 5 mA)</td>
<td>VDD-0.4</td>
<td></td>
<td>VDD</td>
<td>V</td>
</tr>
<tr>
<td>VOL</td>
<td>Output low voltage (high drive 5 mA)</td>
<td>GND</td>
<td></td>
<td>GND+0.4</td>
<td>V</td>
</tr>
<tr>
<td>RPU</td>
<td>Pull-up resistance</td>
<td>11</td>
<td>13</td>
<td>16</td>
<td>Kohm</td>
</tr>
<tr>
<td>RPD</td>
<td>Pull-down resistance</td>
<td>11</td>
<td>13</td>
<td>16</td>
<td>Kohm</td>
</tr>
<tr>
<td>ITX, +8dBm</td>
<td>TX only run current</td>
<td>PRF=8 dBm</td>
<td>32.7</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>IRX, 1M</td>
<td>RX only run current</td>
<td>1Mps BLE</td>
<td>9.9</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>IRX, 2M</td>
<td>RX only run current</td>
<td>2Mps BLE</td>
<td>11.1</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>IOFF</td>
<td>System OFF, no RAM retention, wake on reset</td>
<td>0.40</td>
<td></td>
<td></td>
<td>uA</td>
</tr>
</tbody>
</table>
Control No.
HD-AE-A191023

Control name
Electrical characteristics

RF Specifications

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fop</td>
<td>Operating frequencies</td>
<td></td>
<td></td>
<td>2402</td>
<td>2480</td>
</tr>
<tr>
<td>PLLchsp</td>
<td>PLL channel spacing</td>
<td>1</td>
<td></td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td>D_{BLE1M}</td>
<td>Frequency deviation @ BLE 1Mps</td>
<td>+/-250</td>
<td></td>
<td></td>
<td>kHz</td>
</tr>
<tr>
<td>D_{BLE2M}</td>
<td>Frequency deviation @ BLE 2Mps</td>
<td>+/-500</td>
<td></td>
<td></td>
<td>kHz</td>
</tr>
<tr>
<td>P_{RF}</td>
<td>Maximum output power</td>
<td>8.0</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>P_{RFC}</td>
<td>RF power control range</td>
<td>28</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>P_{RFCR}</td>
<td>RF power accuracy</td>
<td>+/-4</td>
<td></td>
<td></td>
<td>dB</td>
</tr>
<tr>
<td>P_{RF1}</td>
<td>1st Adjacent Channel Transmit Power 1 MHz (1 Mbps)</td>
<td>-24.8</td>
<td></td>
<td></td>
<td>dBc</td>
</tr>
<tr>
<td>P_{RF2}</td>
<td>2nd Adjacent Channel Transmit Power 2 MHz (1 Mbps)</td>
<td>-54.0</td>
<td></td>
<td></td>
<td>dBc</td>
</tr>
<tr>
<td>PRXMAX</td>
<td>Maximum received signal strength at &lt; 0.1% PER</td>
<td>0</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>P_{SENS,IT,1M,BLE}</td>
<td>Receiver sensitivity 1Mps BLE Ideal transmitter &lt;=37bytes (0.1% BER)</td>
<td>-94</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>P_{SENS,IT,2M,BLE}</td>
<td>Receiver sensitivity 2Mps BLE Ideal transmitter Packet length&lt;=37bytes</td>
<td>-91</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>P_{SENS,IT,BLE LE125k}</td>
<td>Sensitivity, 125 kbps BLE mode</td>
<td>-102</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
<tr>
<td>P_{SENS,IT,BLE LE500k}</td>
<td>Sensitivity, 500 kbps BLE mode</td>
<td>-98</td>
<td></td>
<td></td>
<td>dBm</td>
</tr>
</tbody>
</table>

Many documents of nRF52840, such as product specification and the errata, can be found at the link below. Please be sure to check these latest documents when using our module.

nRF52840_Product Specification
https://infocenter.nordicsemi.com/topic/ps_nrf52840/keyfeatures_html5.html?cp=3_0_0

nRF52840 Errata
https://infocenter.nordicsemi.com/topic/struct_nrf52/struct/nrf52840_errata.html?cp=3_0_1

S140_SoftDevice Specification
https://infocenter.nordicsemi.com/topic/sds_s140/SDS/s1xx/s140.html?cp=3_4_2_0

For more information
https://infocenter.nordicsemi.com/topic/struct_welcome/struct/welcome.html
**DFU Specifications**

**Device Firmware Updates (DFU)**

<table>
<thead>
<tr>
<th>UART</th>
<th>UART PIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baud rate : 38400 bps</td>
<td>RX : P0.08</td>
</tr>
<tr>
<td>Data : 8 bit</td>
<td>TX : P0.06</td>
</tr>
<tr>
<td>Parity : none</td>
<td>CTS : P0.07</td>
</tr>
<tr>
<td>Stop : 1 bit</td>
<td>RTS : P0.05</td>
</tr>
<tr>
<td>Hardware flow control : Enabled</td>
<td></td>
</tr>
</tbody>
</table>

* see Nordic Infocenter help

Software Development Kit > nRF5 SDK v15.2.0 > Libraries > Bootloader and DFU modules
Software Development Kit > nRF5 SDK v15.2.0 > Examples > DFU bootloader examples
> Secure DFU Bootloader over Serial Link (UART/USB)

nRF Tools > nrfutil > Performing a DFU
Block Diagram

- OUT_ANT
- OUT_MOD
- Filter
- nRF52840
- WLCSP
- VDD
- VDDH
- USB VBUS
- USB D+
- USB D-
- SWDCLK
- SWDIO
- 19 GPIOs
  (System RESET,
  Analog input,
  32.768kHz X’tal,
  NFC)
- X’tal 32MHz
Reference Circuits

1. Normal voltage mode
Normal voltage mode is entered when the supply voltage is connected to both the VDD and VDDH pins (so that VDD equals VDDH).

In case of the operation with the battery, we recommend that you add a bypass capacitor about 100uF in view of the voltage drop during TX/RX. Please consider whether it is necessary according to the performance of the customer’s battery.

SWD (Serial Wire Debug) is a high performance 2-pin debug port that replaces JTAG. You can debug and program with J-link Lite. When using J-LINK Lite, it is convenient to mount a socket on the customer's main board. The socket will be 10-pin connector two rows of 1.27mm pitch (Ex: PSS-720153-05, Hirosgui instrument). J-Link Lite operates at 3.3 V, do not operate at 1.7 V, so please be careful.

The SWDIO line has a 13kΩ internal pull-up resistor.
The SWDCLK line has a 13kΩ internal pull-down resistor.

If you need to measure the antenna performance and RF conduction performance, please draw a tie line of PAD14 and PAD15 outside a module beforehand. When measuring, please cut off the signal line and attach the RF connector cable.

Normally, connect PAD 29 and PAD 30 as short as possible to improve the performance of the module’s built-in antenna. When using the internal antenna of the module, connect PAD29 and PAD30 as short as possible.
2. High voltage mode
This module supports supply voltage up to 5.5V, such as lithium-ion battery or USB bus power. High voltage mode is entered when the supply voltage is only connected to the VDDH pin and the VDD pin is not connected to any voltage supply.

Non USB operation

USB operation
3. Other

**P0.00 - P0.31 are GPIOs. By setting in the application software, it is assigned to pin as UART, etc. Although unused pins can be made OPEN, please do not recommend to draw signal line from them.**

<table>
<thead>
<tr>
<th>Control No.</th>
<th>Control name</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD-MC-A191023</td>
<td>(4/4) Circuit Schematic</td>
</tr>
</tbody>
</table>

The GPIO high reference voltage always equals the level on the VDD pin. In **normal voltage mode**, the GPIO high level equals the voltage supplied to the VDD pin, and in **high voltage mode** it equals the level specified in register REGOUT0.

- GPIO high (V): 0.7xVDD to VDD
- GPIO low (V): GND to 0.3xVDD

In **high voltage mode**, the output from internal regulator can be used to supply external circuitry from the VDD pin. The VDD output voltage is configured in register REGOUT0 and the supported output voltage range depends on the supply voltage provided to the VDDH pin. In addition, the external current draw is defined as the sum of all the GPIO currents and the currents being drawn from VDD, and the maximum value depends on the operating condition. Please refer to the product specification of nRF52840 chip.

nRF52840_Product Specification
https://infocenter.nordicsemi.com/topic/ps_nrf52840/keyfeatures_html5.html?cp=3_0_0
The dimension of the land pattern is the same as a foot pattern. Recommended metal mask for solder printing.

<table>
<thead>
<tr>
<th>Pad size</th>
<th>Metal mask opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal pad</td>
<td>31 – 0.4 x 0.8 mm</td>
</tr>
<tr>
<td>Corner pad</td>
<td>6 – 0.55 x 0.8 mm</td>
</tr>
<tr>
<td>Center pad</td>
<td>1 – 2.8 x 1.5 mm</td>
</tr>
</tbody>
</table>

The metal mask thickness: $t=0.1\,\text{mm}$
## Pin Descriptions

<table>
<thead>
<tr>
<th>Pin</th>
<th>Pin name</th>
<th>Pin function</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GND (Corner pad)</td>
<td>Ground</td>
<td>Ground 0.55mm x 0.8mm</td>
</tr>
<tr>
<td>2</td>
<td>VBUS</td>
<td>Power</td>
<td>5 V input for USB 3.3 V regulator</td>
</tr>
<tr>
<td>3</td>
<td>D-</td>
<td>Digital I/O</td>
<td>USB D-</td>
</tr>
<tr>
<td>4</td>
<td>D+</td>
<td>Digital I/O</td>
<td>USB D+</td>
</tr>
<tr>
<td>5</td>
<td>P0.07</td>
<td>Digital I/O</td>
<td>General purpose I/O, Trace buffer clock</td>
</tr>
<tr>
<td>6</td>
<td>P0.08</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td>7</td>
<td>GND</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>8</td>
<td>P0.01/XL2</td>
<td>Ground</td>
<td>General purpose I/O Connection for 32.768 kHz crystal</td>
</tr>
<tr>
<td>9</td>
<td>P0.00/XL1</td>
<td>Ground</td>
<td>General purpose I/O Connection for 32.768 kHz crystal</td>
</tr>
<tr>
<td>10</td>
<td>P0.04_AIN2</td>
<td>Digital I/O</td>
<td>General purpose I/O Analog input</td>
</tr>
<tr>
<td>11</td>
<td>GND (Corner pad)</td>
<td>Ground</td>
<td>Ground 0.55mm x 0.8mm</td>
</tr>
<tr>
<td>12</td>
<td>P0.26</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td>13</td>
<td>GND</td>
<td>Ground</td>
<td>Ground</td>
</tr>
<tr>
<td>14</td>
<td>OUT_MOD</td>
<td>RF In/Out</td>
<td>RF I/O pin. It should be connected to <strong>Pin15 OUT_ANT</strong> for normal operation.</td>
</tr>
<tr>
<td>15</td>
<td>OUT_ANT</td>
<td>Antenna In/Out</td>
<td>Internal antenna. It should be connected to <strong>Pin14 OUT_MOD</strong> for normal operation</td>
</tr>
<tr>
<td>16</td>
<td>GND (Corner pad)</td>
<td>Ground</td>
<td>Ground 0.55mm x 0.8mm</td>
</tr>
<tr>
<td>17</td>
<td>GND (Corner pad)</td>
<td>Ground</td>
<td>Ground 0.55mm x 0.8mm</td>
</tr>
<tr>
<td>18</td>
<td>P0.10_NFC2</td>
<td>Digital I/O</td>
<td>General purpose I/O NFC antenna connection</td>
</tr>
<tr>
<td>19</td>
<td>SWDIO</td>
<td>Debug</td>
<td>Serial wire debug I/O for debug and programming</td>
</tr>
<tr>
<td>20</td>
<td>VDD</td>
<td>Power</td>
<td>Power supply</td>
</tr>
<tr>
<td>21</td>
<td>VDDH</td>
<td>Power</td>
<td>High voltage power supply</td>
</tr>
<tr>
<td>22</td>
<td>DECUUSB</td>
<td>Power</td>
<td>USB 3.3V regulator supply decoupling</td>
</tr>
<tr>
<td>Pin</td>
<td>Pin name</td>
<td>Pin function</td>
<td>Description</td>
</tr>
<tr>
<td>------</td>
<td>----------------</td>
<td>--------------</td>
<td>--------------------------------------</td>
</tr>
<tr>
<td>23</td>
<td>P0.15</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td>24</td>
<td>P0.05_AIN3</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog input</td>
<td>Analog input</td>
</tr>
<tr>
<td>25</td>
<td>P0.06</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td>26</td>
<td>P0.30_AIN6</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog input</td>
<td>Analog input</td>
</tr>
<tr>
<td>27</td>
<td>P0.27</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td>28</td>
<td>P0.28_AIN4</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog input</td>
<td>Analog input</td>
</tr>
<tr>
<td>29</td>
<td>P0.31_AIN7</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog input</td>
<td>Analog input</td>
</tr>
<tr>
<td>30</td>
<td>P0.02_AIN0</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog input</td>
<td>Analog input</td>
</tr>
<tr>
<td>31</td>
<td>P0.03_AIN1</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog input</td>
<td>Analog input</td>
</tr>
<tr>
<td>32</td>
<td>P0.29_AIN5</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Analog input</td>
<td>Analog input</td>
</tr>
<tr>
<td>33</td>
<td>P0.09_NFC1</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NFC input</td>
<td>NFC antenna connection</td>
</tr>
<tr>
<td>34</td>
<td>P0.18_RESET</td>
<td>Digital I/O</td>
<td>General purpose I/O</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Configurable as system RESET</td>
</tr>
<tr>
<td>35</td>
<td>SWDCLK</td>
<td>Debug</td>
<td>Serial wire debug clock input for debug and programming</td>
</tr>
<tr>
<td>36</td>
<td>GND (Center pad)</td>
<td>Ground</td>
<td>Ground 2.8mm x 1.5 mm</td>
</tr>
<tr>
<td>37</td>
<td>NC (Corner pad)</td>
<td>NC</td>
<td>NC 0.55mm x 0.8mm</td>
</tr>
<tr>
<td>38</td>
<td>NC (Corner pad)</td>
<td>NC</td>
<td>NC 0.55mm x 0.8mm</td>
</tr>
</tbody>
</table>
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.
EYSKDNZWB

Control No.  
HQ-BA-537

Control name  
Handling Precaution

Recommended Reflow Profile

IN

OUT

Temp(deg)

0

50

100

150

200

250

300

Peak Temp: 250 deg Max

230 deg up: 40 sec Max

130-180 deg Pre-heat

: 60-120 sec
### Packaging Specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Outline</th>
<th>Materials</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emboss</td>
<td>24mm wide - 16mm Pitch</td>
<td>Conductive PS</td>
<td></td>
</tr>
<tr>
<td>Cover Tape</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reel</td>
<td>330 mm</td>
<td>Conductive PS</td>
<td></td>
</tr>
<tr>
<td>Desiccant</td>
<td>30g x 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humidity indicator card</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminum moisture barrier bag</td>
<td>420 x 460(mm) (AS/PET/AL/NY/PE/AS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Label</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrugated cardboard box (Inner)</td>
<td>339 x 351 x 74(mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrugated cardboard box (Outer)</td>
<td>369 x 369 x 277(mm)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Packaging Unit

Max 1,000 pieces/Reel Max 3,000 pieces/Box (Outer)

### Packaging Figure

- **Label-1**: Corrugated cardboard box (Inner)
- **Label-2**: Corrugated cardboard box (Inner)
- **Label-3**: Corrugated cardboard box (Outer)
- **Humidity Indicator Card**: 

### Label

- **Label-1**: COMPANY NAME 御社名
- **Label-2**: PURCHASE ORDER 注文番号
- **Label-3**: CAUTION LABEL 注意ラベル
- **Label-4**: MSL Level 3

---

**Control No.**

HD-BB-A191023

14-Oct. 2019 Ver.0.9

TAIYO YUDEN CO., LTD.
Tape specification
テーピング仕様

The direction of a tape drawer
テープ引き出し方向

End part
終端部

Module receipt part
製品部

Leader part
リーダー部

The direction of a tape drawer
テープ引き出し方向

First Pin Mark
1ピンマーク

More than 160mm
製品部

More than 100mm
終端部

More than 300mm

Control No.
HD-BB-A191023

Control name
Packaging Specification
### Taping performance

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

**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。（ラベル表示数値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。
**Recommended module mounting example**

*1 Please do not place any metal components in blue shaded space. (*1). We do not recommend to place any metal objects upper space of the module in the above figure. If it needs to place metal objects, please consider to keep the metal off from the antenna as far as you can. 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.
Other module mounting examples

Placement of resin or plastic parts

Resin or Plastic parts (ex. Cover, Chassis, etc.)

\[ g \geq 1.5 \quad t < 5 \]

Please do not apply molding over the antenna area of BLE module.
Directional characteristics example (when mounted on evaluation board)

About this Application Note

- This Application Note has been prepared as a reference material to help obtaining the antenna performance mounted on BLE module better while it is not guaranteed or assured to obtain better communication performance and distance.
- This product “BLE module” has been certified and matching circuit constant for antenna within module cannot be changed when ambient environment condition changes. The product must be re-certified when matching circuit constant is changed.
1. 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.

2. Pattern Design Guide
2-1. Power Supply System
Power supply bypass capacitors should be placed close to the VDD pin of the module. The VDD/VDDH/VBUS trace should be greater than 0.5mm and a bigger via diameter is recommended.

* If it is difficult to place a bigger via, please increase the number of vias.

* Place bypass capacitor close to the module.

2-2. 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. Also, please surround the signal lines of GPIO, DCC etc. with GND layer as much as possible.

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

TBD
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 classified as Class I, II or III by IMDRF, 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, medical equipment classified as Class IV by IMDRF, 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.

Information contained in this specification is intended to convey examples of typical performances and/or applications of our products and is not intended to make any warranty with respect to the intellectual property rights or any other related rights of TAIYO YUDEN or any third parties nor grant any license under such rights.

Please note that 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. Notwithstanding the foregoing, if there is a written agreement (e.g., supply and purchase agreement, quality assurance agreement) signed by TAIYO YUDEN and your company, TAIYO YUDEN will warrant our products in accordance with such agreement.
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.