

***Wireless LAN + Bluetooth<sup>®</sup> Module***  
**IEEE802.11ac (1x1) + Bluetooth<sup>®</sup> 4.2**

**WYSEGVDXG**

Data Report

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

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TAIYO YUDEN CO., LTD.

# WYSEGVDXG

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***ATTENTION: This module requires device drivers that are under Japan export control. Depending on the customer's country and application (e.g. weapons), Taiyo Yuden may not be able to provide these drivers to all customers. Please contact your local Taiyo Yuden sales office for additional information.***

***To contact your local sales office and for additional product information, please visit [www.ty-top.com](http://www.ty-top.com).***

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## Rev. records

Apr.-08-2019&gt;Ver1.0 Release

May.-24-2019&gt;Ver1.1 update

Sep. -27-2019&gt;Ver1.2 Update

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## 1. Scope

This specification ("Specification") applies to the hybrid IC "WYSEGVDXG" for use Wireless LAN and Bluetooth® module ("Product") manufactured by TAIYO YUDEN CO., LTD. ("TAIYO YUDEN")

## 2. Description

## ① Model : WYSEGVDXG

Note: Please let us know the model (WYSEGVDXG) to order this product.

## ② Chip: Marvell 88W8887

③ Function: Radio frequency transceiver Module.  
(IEEE802.11ac/a/b/g/n and Bluetooth®4.2 conformity)

## ④ Application: Portable audio/ video device, wireless home audio/video entertainment, handy terminal

## ⑤ Structure: Hybrid IC loaded with silicon and Gallium arsenide compound monolithic semiconductor

Containment of hazardous substance in this Product:

\* This product conforms to RoHS Directive.

## ⑥ Outline: 56pin leadless chip carrier

## ⑦ Marking: Part Number, Lot Number, Japan ID, FCC ID, ISED ID Number and manufacturer on Shielding Case

## ⑧ Features:

-**IEEE802.11ac/a/b/g/n** and **Bluetooth®4.2** standard

-Interface: SDIO3.0, PCM

-Embedded MPU for reducing loads on host processor

## ⑨ Security: TKIP, WEP, AES, CCMP, CMAC, WAPI, WPA/WPA2(64bit/128bit)

## ⑩ Country of origin : Japan or Thailand

## ⑪ Packing:

Packaging method: Tray

Packaging unit: 48 pieces/Tray, 480pieces/Box

Standard order quantity : 960 pcs multiples

## ⑫ Mount: SMD Type

## ⑬ Notes

a. Limitation of Warranty

i ) TAIYO YUDEN provide warranties only if the product is operated under the condition set

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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.

- ii) 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.
- iii) 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.
- iv) 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.
- b. Instruction for Use (CAUTION)
  - i) Because product is not designed for radiation durability, please refrain from exposing product to radiation in the use.
  - ii) Communication between this product and other might not be established nor maintained

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depending upon radio environment or operating condition of this product and other products with wireless technology.

- iii) This product operates in the unlicensed ISM band at 2.4GHz/5GHz. 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.

c. Term of Support

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

e. Items of the Specification

Any question arising from the Specification shall be solved in good faith through mutual discussion by the parties hereof.

f. Caution for Export Control

This Product may be subject to governmental approvals, consents, licenses, authorizations, declarations, filings, and registrations for export or re-export as required by Japanese Foreign Exchange and Foreign Trade Law (including related laws and regulations) and/or

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any other country's applicable laws or regulations related to export control.

If this Product will be exported or re-exported, it is strongly recommended that customers check and confirm the necessary procedures to export or re-export this Product as required by applicable laws and regulations, and if necessary, customers must obtain the necessary and appropriate approvals or licenses from governmental authority at their own risk and expense.

g. Japan Regulatory Information

This module is approved with the specific antenna on this module. Please ensure that your product shall 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. The mark diameter shall be equal or greater than 3 mm.

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.

WYSEGVDXG : 001-A14609



Ⓜ001-A14609

h. Canada Regulatory Information

i ) The following statements in rectangle must be described on the user manual of the host device of this module.

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

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

Ce appareil contient émetteur(s) / récepteur(s) d'exemption de licence, et il est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes :

- 1) l'appareil ne doit pas produire de brouillage;
- 2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment and meets RSS-102 of the IC radio frequency (RF)

Exposure rules. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

Cet équipement est conforme aux limites d'exposition aux rayonnements énoncées pour un environnement non contrôlé et respecte les règles d'exposition aux fréquences radioélectriques (RF) CNR-102 de l'IC. Cet équipement doit être installé et utilisé en gardant une distance de 20 cm ou plus entre le dispositif rayonnant et le corps.

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- ii ) Please notify certified ID by either one of the following method on your product.  
 Specifiez ID certifiée dans votre produit par une de méthode suivante.

- Contains Transmitter module IC : 4389B-WYSAGVDXG
- Contains IC : 4389B-WYSAGVDXG

The model name is WYSEGVDXG, but please use “4389B-WYSAGVDXG” for the certified ID.

Le nom du modèle est WYSEGVDXG, mais ID certifiée est “4389B-WYSAGVDXG”.

- iii ) This product is certified under the conditions of using channels 1(2412MHz) to 11(2462MHz). Please set the region as CANADA or other which uses channels from 1 to 11. If channels 12(2467MHz) or 13(2472MHz) are used, it may violate the radio regulations.

Ce produit est certifié pour une utilisation sur les canaux 1 (2412MHz) à 11 (2462MHz). Veuillez choisir la région CANADA ou toute autre région utilisant uniquement ces canaux. L'utilisation sur les canaux 12 (2467MHz) ou 13 (2472MHz) peut constituer une violation des règlements sur les radiocommunications.

- iv ) The device for operation in the bands 5150–5250 MHz and 5250-5350MHz are only for indoor use to reduce the potential for harmful interference to co-channel mobile satellite systems.

Ce produit dont la fréquence de fonctionnement se situe entre 5150-5250MHz et 5250-5350MHz est conçue uniquement pour une utilisation en intérieur afin de réduire les risques d'interférences nuisibles avec les systèmes mobiles par satellite à deux canaux.

- v ) This radio transmitter; 4389B-WYSAGVDXG is approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Ce émetteur radio; 4389B-WYSAGVDXG a été approuvé par Innovation, Sciences et Développement économique Canada pour fonctionner avec les types d'antenne énumérés ci-dessous, le gain maximal admissible étant indiqué. Les types d'antennes non inclus dans cette liste dont le gain est supérieur au gain maximal indiqué pour tout type répertorié sont strictement interdits pour ce appareil.



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Antenna Manufacturer	Antenna No.	Antenna Gain (Peak)	Radio Frequency	Feed Point Impedance
Ethertronics	1001932FT	2.5 dBi	2402 - 2480 MHz	50 $\Omega$
		2.5 dBi	2412 - 2462 MHz	
		4.4 dBi	5180 - 5825 MHz	
Ethertronics	1001932PT	2.5 dBi	2402 - 2480 MHz	
		2.5 dBi	2412 - 2462 MHz	
		4.5 dBi	5180 - 5825 MHz	

- vi) The device driver/firmware for this product is downloaded from a limited access web site provided by the device manufacturer and is implemented specifically for this product. The ID/password required to access the web site can be obtained after the conclusion of a contract with the device manufacturer.

Le pilote / micrologiciel du dispositif pour ce produit est téléchargé à partir d'un site internet à accès limité fourni par le fabricant de l'appareil et est mis en oeuvre spécifiquement pour ce produit. L'identifiant / mot de passe requis pour accéder au site internet peut être obtenu après la conclusion d'un contrat avec le fabricant du périphérique.

- vii) To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

Afin de réduire les interférences potentielles avec les autres utilisateurs, il est nécessaire de choisir le type d'antenne et le gain ne dépassant pas (e.i.r.p.) accepté pour une communication normale.

- viii) Please inform your users that high-power radars are allocated as primary users (i.e. priority users) of the bands 5250-5350 MHz and 5650-5850 MHz and that these radars could cause interference and/or damage to LE-LAN devices.

Veuillez informer vos utilisateurs que les radars à haute puissance sont désignés comme utilisateurs principaux (c-à-d des utilisateurs prioritaires) des fréquences 5250-5350 MHz et 5650-5850 MHz et que ces radars pourraient provoquer des interférences et / ou endommager les appareils.

- ix) This product shall not be capable of transmitting in the band 5600-5650MHz.

Ce produit ne doit pas être capable de transmettre entre les fréquences 5600-5650MHz.

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## i. FCC Regulatory Information

## FCC Regulatory Information

- i ) 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.

**FCC CAUTION**

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

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines. This equipment should be installed and operated keeping the radiator at least 20cm or more away from person's body.

- ii ) Please notify certified ID by either one of the following method.

-Contains Transmitter Module FCC ID: RYYWYSAGVDXG  
-Contains FCC ID: RYYWYSAGVDXG

The model name is WYSEGVDXG, but please use "RYYWYSAGVDXG" for the certified ID.

- iii ) The antenna used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

- iv ) This module can set the output power by the application software which is developed by module installer. Any end user cannot change the output power.

- v ) This product is certified under the condition of using 1(2412MHz) to 11(2462MHz)channels. Region is set to US as default and 1 to 11 channels are used. Please set the region as default (US) and do not change. If 12(2467MHz) or 13(2472MHz) channels are used, it may violate the radio regulations.

- vi ) Data transmission is inevitably initiated by software of host devices with the exception that several special packets are transmitted through the MAC. However, data transmission is terminated by end of packets in any cases. Therefore, it is RF transmitted only while packets are being transmitted. This modular transmitter automatically discontinues transmission in case of either absence of information to transmit or operational failure because RF parts will not be ON in neither cases.

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- vii) The device driver/firmware for this product is downloaded from a limited access web site provided by the device manufacturer and is implemented specifically for this product. The ID/password required to access the web site can be obtained after the conclusion of a contract with the device manufacturer.

j. CE Regulatory Information

- i ) 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. Additionally, if your end product is subject to the restrictions of RE Directive, Article 10.10, it is required to display the required information in addition to the certification processes.

Referenced regulations

- Directive 2014/53/EU
- COMMISSION IMPLEMENTING REGULATION (EU) 2017/1354 of 20 July 2017 specifying how to present the information provided for in Article 10(10) of Directive 2014/53/EU of the European Parliament and of the Council

Restrictions to this product (as of June, 2018):

- Radio LAN operating in 5.15 – 5.35 GHz: restricted to indoor use only

Above regulations are referenced as of the issue date of this document. Since the aforementioned regulations have possibilities to be modified and added in the future, please make sure that you should always confirm the latest regulations.

- ii ) 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.

k. France Regulatory Information

When using this radio module within 20cm from human body, it can be required to proceed additional testing or evaluation for Specific Absorption Rate (SAR). When performing the additional SAR test or evaluation, please indicate the SAR value on your user instructions in a legible, intelligible and visible manner if your final device is being put into service and intended to be used in France.

Referenced regulations (France)

- Order of amending the Order of 8 October 2003 on consumer information regarding radio terminal equipment issued pursuant to Article R20-10 of the Postal and Telecommunications Code, the Order of 8 October 2003 setting out the technical

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specifications applicable to radio terminal equipment and the Order of 12 October 2010 on displaying the specific absorption rate of radio terminal equipment

-Order of 8 October 2003 on consumer information regarding radio terminal equipment issued pursuant to Article R20-10 of the Postal and Telecommunications Code

-Order of 8 October 2003 setting out the technical specifications applicable to radio terminal equipment

-Order of 12 October 2010 on displaying the specific absorption rate of radio terminal equipment

Above regulations are referenced as of the issue date of this document. Since the aforementioned regulations have possibilities to be modified and added in the future, please make sure that you should always confirm the latest regulations.

I. Operating in 12ch(2467MHz) and 13ch(2472MHz) in Japan

i ) In case operating in 12ch and 13ch in JAPAN, region code for JAPAN need to be set.

ii ) In case host device of this product operates in 12ch and 13ch, do not describe items instructed to describe in FCC and IC regulatory information in this specification on the host device or user manual. The product operates in 12ch and 13ch can be used only in Japan.

iii ) This product is certified under the condition of operating in 1ch(2412MHz) to 11ch(2462MHz) for FCC and IC regulatory, so please control this product and its operation appropriately. If this product operates in 12ch or 13ch in target country of FCC and IC, it may violate the regulations. Please note that TAIYO YUDEN shall not be liable in such case.

iv ) RF specification for 12ch and 13ch is applied for Electrical specification(RF) in this specification.

m. This product is certified with the following functions in each region.

Region	Frequency Band			
	W52 (5180 – 5240 MHz)	W53 (5260 – 5320 MHz)	W56 (5500 – 5700 MHz)	W58 (5745 – 5825 MHz)
Japan	AP & STA mode	AP & STA mode	AP & STA mode	N/A
U.S.A./ Canada	AP & STA mode	STA mode	STA mode	AP & STA mode
EU (Conducted Test Report)	STA mode	STA mode	STA mode	N/A

[ AP: Access Point, STA: Station ]

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n. This product is certified in combination with the following antennas for each region.

Region	Antenna Manufacturer	Part Number	Peak Gain (dBi)	
			2.4GHz	5GHz
Japan	SANSEI ELECTRIC	STDANTEMD-009	-1.1	1.1
		STDANTEMD-001	1.4	2.8
		ANTDP-027A0	1.4	1.4
	GLEAD	WIFI_PAD2400NO_P408_P90MM	0.8	3.8
		WIFI_PL2400C1D_J	2.59	4.58
	Ethertronics	1001932PT	2.5	4.5
		1001932FT	2.5	4.4
	Molex	2042810100	2.0	3.3
		1461870100	3.2	4.5
		1461530100	3.0	4.5
U.S.A./ Canada	Ethertronics	1001932PT	2.5	4.5
		1001932FT	2.5	4.4

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Control No. HD-AM-A171012	(1/1)	Control name Absolute maximum ratings
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**Absolute maximum ratings**

Item	Symbol	Rating			Unit	Remark
		Min.	Typ.	Max.		
Supply voltage 1	VBAT	-	3.3	4.5	V	
Supply voltage 2	VDD33	-	3.3	4.0	V	
Supply voltage 3	VIO	-	1.8	2.2	V	
		-	2.5	3.0	V	
		-	3.3	4.0	V	
Supply voltage 4	VIO_SD	-	1.8	2.2	V	
		-	3.3	4.0	V	
Supply voltage 5	VIO_RF	-	3.3	4.0	V	

**Recommendation operating range**

Item	Symbol	Rating			Unit	Remark
		Min.	Typ.	Max.		
Supply voltage 1	VBAT	2.7	3.3	4.5	V	
Supply voltage 2	VDD33	3.0	3.3	3.6	V	
Supply voltage 3	VIO	1.62	1.8	1.98	V	
		2.25	2.5	2.75	V	
		3.0	3.3	3.6	V	
Supply voltage 4	VIO_SD	1.62	1.8	1.98	V	
		3.0	3.3	3.6	V	
Supply voltage 5	VIO_RF	3.0	3.3	3.6	V	
Operation temperature range	Taopr	-30	25	85	Degrees C	
Storage temperature range	Tstg	-40		85	Degrees C	

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**Power consumption**

The Specification applies for Topr.= 25 degrees C, Supply voltage=Typical voltage

No.	Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
1	Power consumption1	Tx: 12dBm 11b, 11Mbps	Pc1		488		mW	Duty=46.8%
2	Power consumption2	Rx 11b, 11Mbps	Pc2		201		mW	
3	Power consumption3	Tx: 12dBm 11g, 54Mbps	Pc3		297		mW	Duty=25.4%
4	Power consumption4	Rx 11g, 54Mbps	Pc4		211		mW	
5	Power consumption5	Tx: 10dBm, 40MHz BW 11n, MCS7, 2.4GHz	Pc5		211		mW	Duty=2.2%
6	Power consumption6	Rx, 40MHz BW 11n, MCS7, 2.4GHz	Pc6		251		mW	
7	Power consumption7	Tx: 12dBm 11a, 54Mbps	Pc9		363		mW	Duty=25.4%
8	Power consumption8	Rx 11a, 54Mbps	Pc10		244		mW	
9	Power consumption9	Tx: 10dBm, 40MHz BW 11n, MCS7, 5GHz	Pc11		244		mW	Duty=2.4%
10	Power consumption10	Rx, 40MHz BW 11n, MCS7, 5GHz	Pc12		286		mW	
11	Power consumption11	Tx: 8dBm, 80MHz BW 11ac, MCS9, 5GHz	Pc13		321		mW	Duty=1.4%
12	Power consumption12	Rx, 80MHz BW 11ac, MCS9, 5GHz	Pc14		358		mW	
13	Power consumption13	Power save mode (DTIM=1, Beacon_interval =100ms)	Pc15		5.0		mW	
14	Power consumption14	Deep Sleep	Pc16		1.8		mW	

\*The power consumption might fluctuate with the condition of radio communication, host performance and test circuit.

\*The Typ. is a reference value. The value may change depending on the evaluation.

**DC Specifications**

Digital Pad Ratings (SDIO, PCM, GPIO) (VIO=1.8/ 2.5/ 3.3V)

No.	Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit	Remark
1	Input High Voltage		VIH	0.7xVIO		VIO+0.4	V	
2	Input Low Voltage		VIL	-0.4		0.3xVIO	V	
3	Output High Voltage		VOH	VIO-0.4		-	V	
4	Output Low Voltage		VOL	-		0.4	V	

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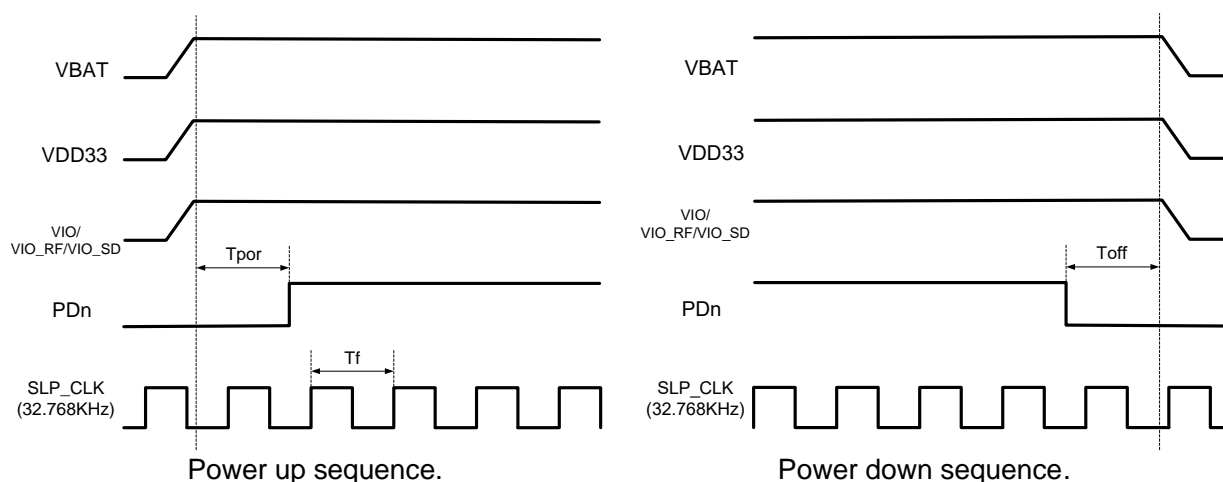
**AC Specifications**

Power-on timing / External sleep clock

	Parameter	Condition	Symbol	Min	Typ	Max	Unit	Remark
1	Valid Power/ Clock to PDn de-asserted		Tpor	300			ms	
2	Input SLP_CLK frequency		Tf	-	32.768	-	KHz	
3	Input SLP_CLK high voltage	V=1.8V	V <sub>IH</sub>	0.7*V	-	V+0.4	V	
4	Input SLP_CLK low voltage		V <sub>IL</sub>	-0.4		0.3*V	V	
5	Input SLP_CLK phase noise requirement		PN	-	-125	-	dBc/Hz	@100KHz
6	Input SLP_CLK slew rate limit (10-90%)		SR	-	-	100	ns	
7	Input SLP_CLK duty cycle tolerance		DC	20	-	80	%	
8	PDN down to Power off		Toff	0			ms	

## &lt;Power-on sequence&gt;

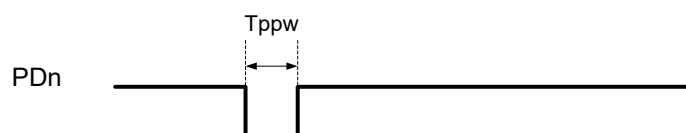
PDn must remain asserted for minimum of Tpor after VBAT/VDD33/VIO/VIO\_RF/VIO\_SD and SLP\_CLK are stable.



## External power down(PDn)

	Parameter	Condition	Symbol	Min	Typ	Max	Unit	Remark
1	PDn pulse width		Tppw	300			ms	

1. PDn should be asserted while VBAT/VDD33/VIO/VIO\_RF/VIO\_SD are stable.





**WYSEGVDXG**

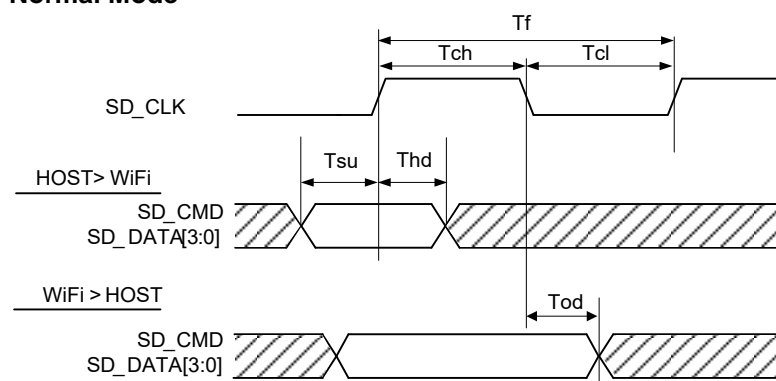
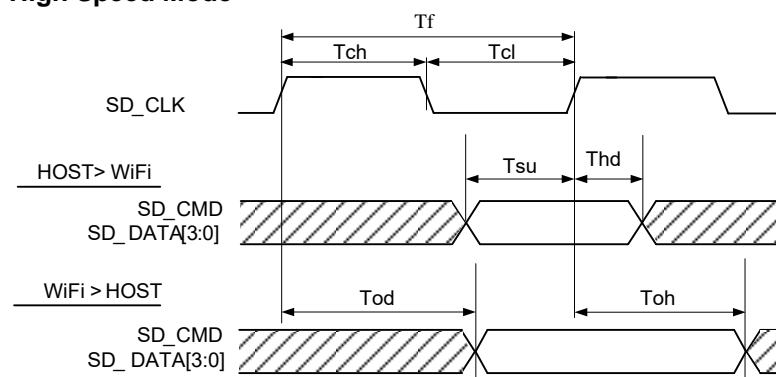
TAIYO YUDEN CO., LTD.

Control No. HD-AE-A171012	(3/6)	Control name Electrical characteristics
------------------------------	-------	--

**SDIO Interface Specifications**

The Specification applies for Topr.= 25 degrees C , Supply voltage=Typical voltage.

	Parameter	Symbol	Condition	Min	Typ	Max	Unit	Remark
1	Input SDIO_CLK Frequency	Tf	Normal	0	-	25	MHz	
			High Speed	0	-	50		
2	Input SDIO_CLK High Time	Tch	Normal	10	-	-	ns	
			High Speed	7	-	-		
3	Input SDIO_CLK Low Time	Tcl	Normal	10	-	-	ns	
			High Speed	7	-	-		
4	Input SDIO_CMD, DATA[3:0] Setup time	Tsu	Normal	5	-	-	ns	
			High Speed	6	-	-		
5	Input SDIO_CMD, DATA[3:0] Hold time	Thd	Normal	5	-	-	ns	
			High Speed	2	-	-		
6	Output SDIO_CMD, DATA[3:0] Delay time	Tod	Normal	-	-	14	ns	CL<40pF (1card)
			High-Speed	-	-	14	ns	
7	Output SDIO_CMD, DATA[3:0] Hold time	Toh	High Speed	2.5	-	-	ns	

**Normal Mode****High Speed Mode**

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**WYSEGVDXG**

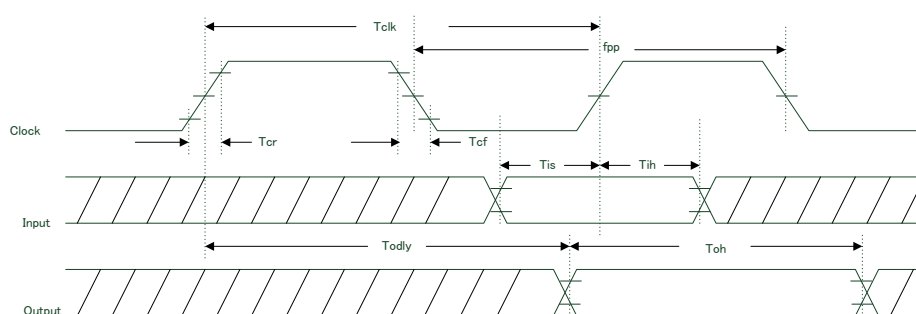
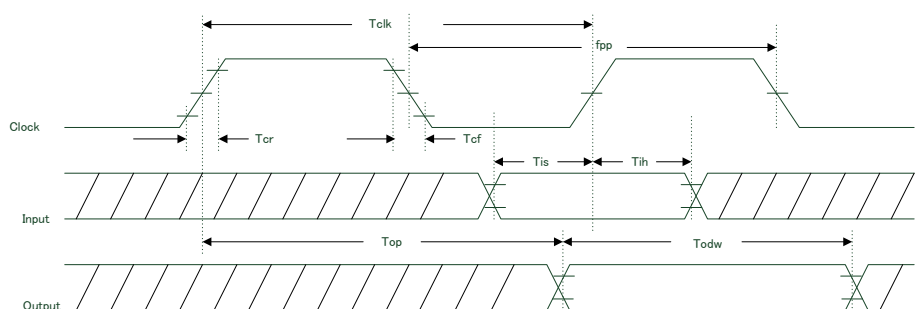
TAIYO YUDEN CO., LTD.

Control No. HD-AE-A171012	(4/6)	Control name Electrical characteristics
------------------------------	-------	--

**SDIO Interface Specifications**

The Specification applies for Topr.= 25 degrees C , Supply voltage=Typical voltage.

	Parameter	Symbol	Condition	Min	Typ	Max	Unit	Remark
1	Clock Frequency	fpp	SDR12/25/50	25	-	100	MHz	
			SDR104	0	-	150		
2	Input setup time	Tis	SDR12/25/50	3	-	-	ns	
			SDR104	1.4	-	-		
3	Input hold time	Tih	SDR12/25/50	0.8	-	-	ns	
			SDR104	0.8	-	-		
4	Clock time	Tclk	SDR12/25/50	10	-	40	ns	
			SDR104	4.8	-	-		
5	Rise time,fall time Tcr,Tcfs < 2ns(max)at100MHz Ccard=10pF	Tcr,Tcf	SDR12/25/50	-	-	0.2*Tclk	ns	
			SDR104	-	-	0.2*Tclk		
6	Output delay time Cl≤30pF	Todly	SDR12/25/50	-	-	7.5	ns	
7	Output hold time Cl=15pF	Toh	SDR12/25/50	1.5	-	-	ns	
8	Card output phase	Top	SDR104	0	-	10	ns	
9	Output timing of variable data window	Todw	SDR104	2.88	-	-	ns	

**SDIO Protocol Timing Diagram-SDR12,SDR25,SDR50****SDIO Protocol Timing Diagram-SDR104**

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**WYSEGVDXG**

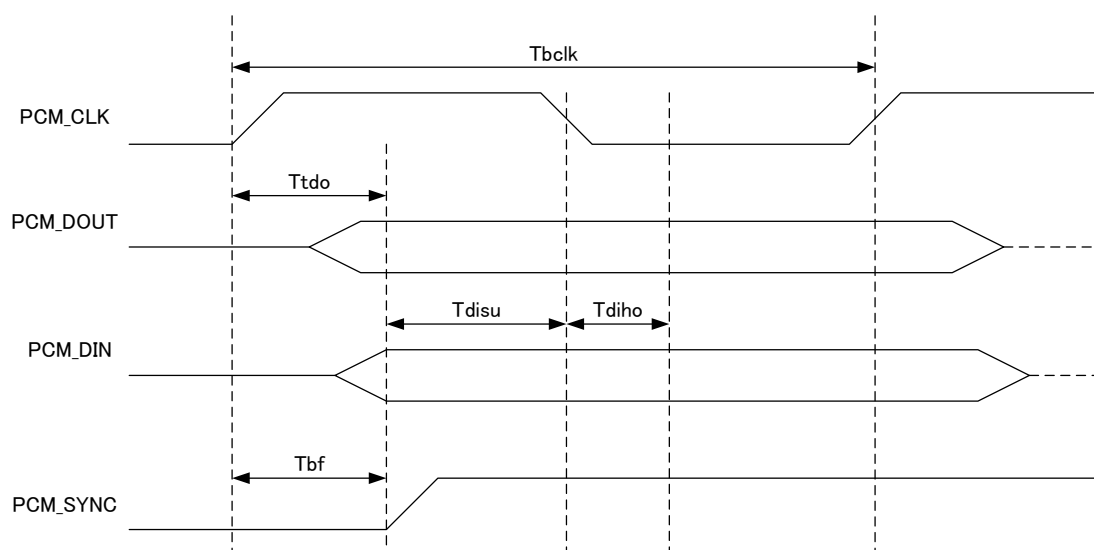
TAIYO YUDEN CO., LTD.

Control No. HD-AE-A171012	(5/6)	Control name Electrical characteristics
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**AC Specifications****PCM Interface**

The Specification applies for Topr.= 25 degrees C, Supply voltage=Typical voltage.

No.	Parameter	Condition	Symbol	Min	Typ	Max	Unit	Remark
1	PCM_CLK Frequency		Tbclk	-	2 / 2.048	-	MHz	
2	Delay time from PCM_CLK High to valid PCM_OUT		Tdo	-	-	15	ns	
4	Setup time for PCM_IN valid to PCM_CLK Low		Tdisu	20	-	-	ns	
5	Hold time for PCM_CLK Low to PCM_IN valid		Tdiho	15	-	-	ns	
6	Delay time from PCM_CLK High to PCM_SYNC High		Tbf	-	-	15	ns	

**Master Mode**

**WYSEGVDXG**

TAIYO YUDEN CO., LTD.

Control No. HD-AE-A171012	(6/6)	Control name Electrical characteristics
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**2.4GHz Band RF Specifications**

The Specification applies for Topr.= 25 degrees C, Supply voltage=Typical voltage

No.	Parameter	Condition	Symbol	Min	Typ	Max	Unit	Remark
1	TX Power	11Mbps, 11b	Po2-1	10	12	14	dBm	
		54Mbps, 11g	Po2-2	10	12	14		
		MCS7, 20MHz BW, 11n	Po2-3	10	12	14		
		MCS7, 40MHz BW, 11n	Po2-4	8	10	12		
2	Rx sensitivity	11Mbps, 11b	SEN2-1		-87	-76	dBm	
		54Mbps, 11g	SEN2-2		-73	-65		
		MCS7, 20MHz BW, 11n	SEN2-3		-69	-64		
		MCS7, 40MHz BW, 11n	SEN2-4		-66	-61		

**5GHz Band RF Specifications**

The Specification applies for Topr.= 25 degrees C, Supply voltage=Typical voltage

No.	Parameter	Condition	Symbol	Min	Typ	Max	Unit	Remark
1	TX Power	54Mbps, 11a	Po5-1	10	12	14	dBm	
		MCS7, 20MHz BW, 11n	Po5-2	10	12	14		
		MCS7, 40MHz BW, 11n	Po5-3	8	10	12		
		MCS9, 80MHz BW, 11ac	Po5-4	6	8	10		
2	Rx sensitivity	54Mbps, OFDM	SEN5-1		-71	-65	dBm	
		MCS7, 20MHz BW, OFDM	SEN5-2		-68	-64		
		MCS7, 40MHz BW, OFDM	SEN5-3		-65	-61		
		MCS9, 80MHz BW, OFDM	SEN5-4		-57	-51		

**RF Specifications (Bluetooth®)**

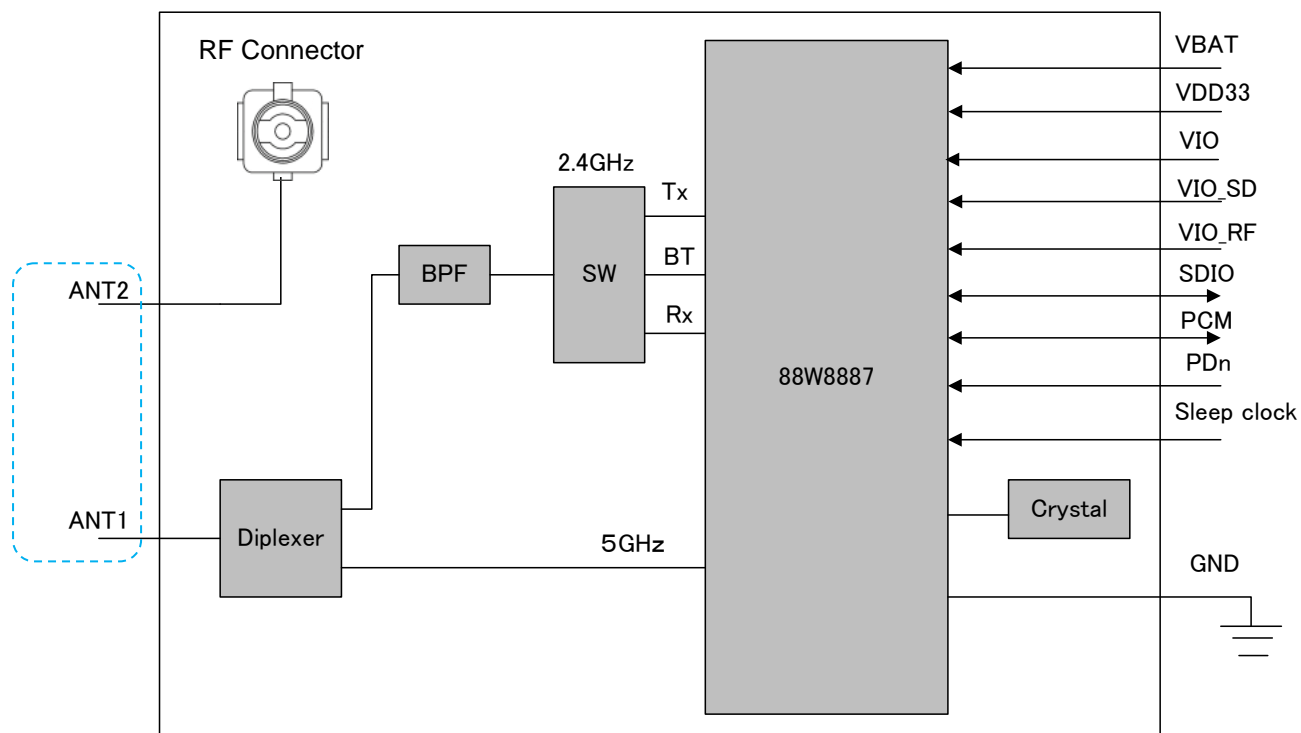
The Specification applies for Topr.= 25 degrees C, Supply voltage =Typical voltage.

No.	Parameter	Condition	Sym	Min	Typ	Max	Unit	Remark
1	Tx Power	Basic	Pob-2	-6	0	2	dBm	Class2
2	Sensitivity	Basic	SENB		-86	-70	dBm	

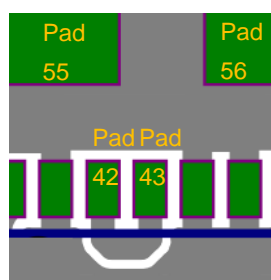
**WYSEGVDXG**

TAIYO YUDEN CO., LTD.

Control No. HD-MC-A171012	Control name Circuit Schematic
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**Block Diagram**

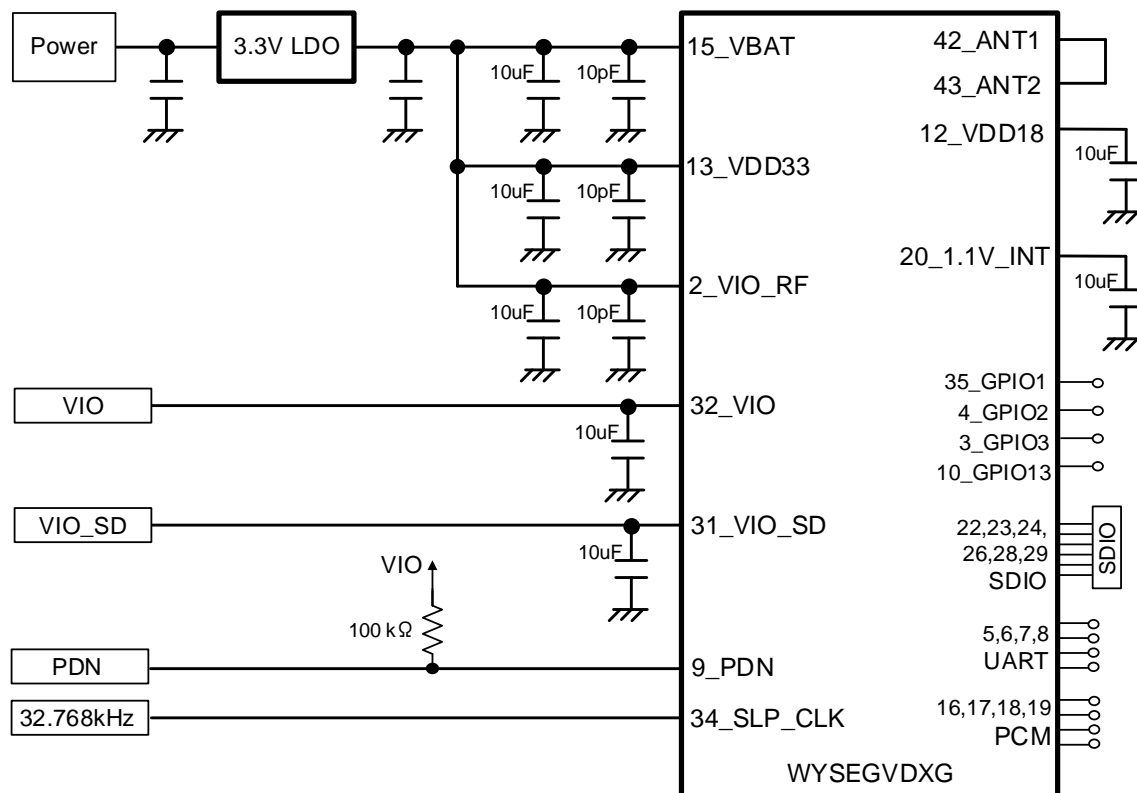
In order to use the module mounted RF connector, ANT1 and ANT2 need to be connected. When designing PCB board for the end product, please connect Pad42-Pad43 at the shortest length.



**WYSEGVDXG**

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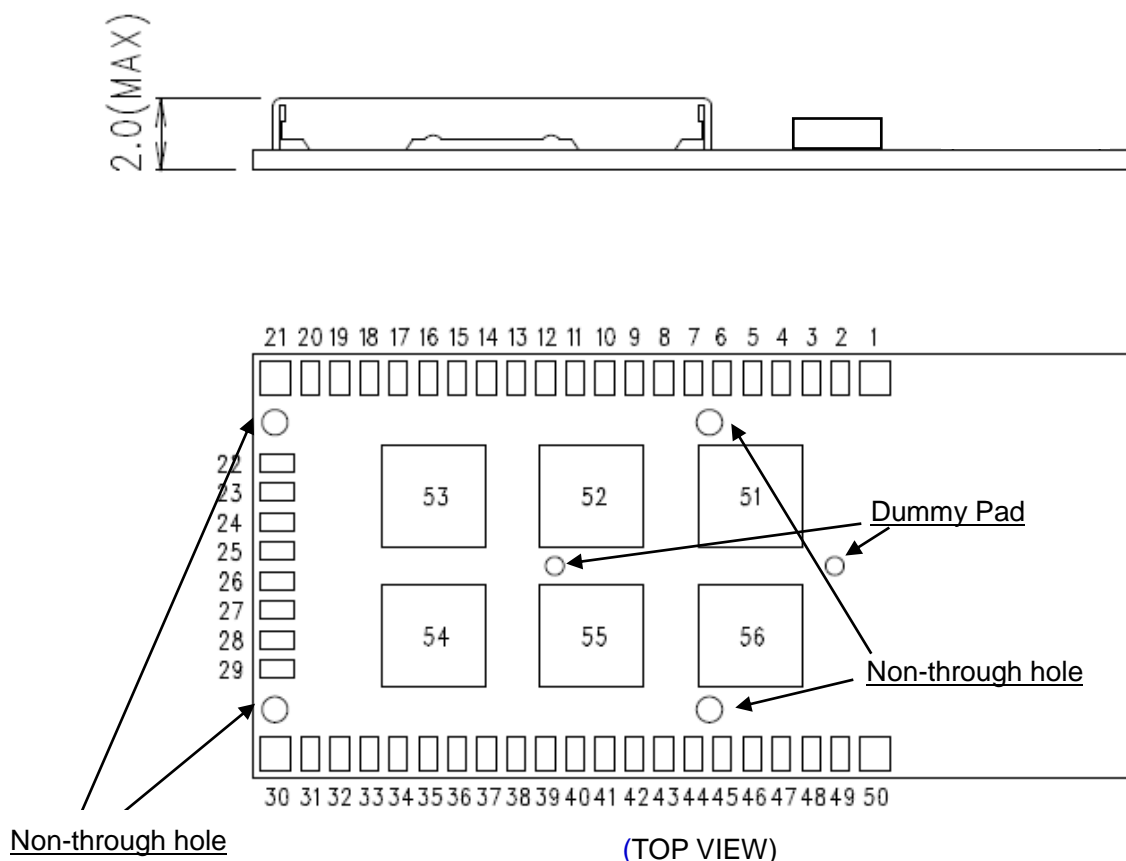
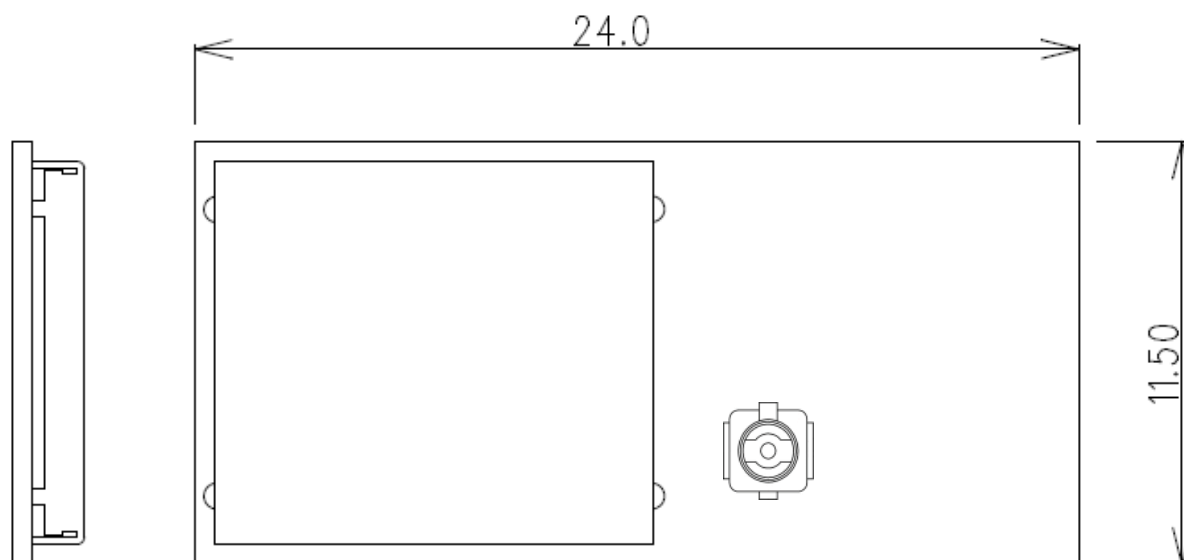
Control No. HD-MC-A171012	Control name Circuit Schematic
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**Example of peripheral circuit schematics**

**WYSEGVDXG**

TAIYO YUDEN CO., LTD.

Control No. HD-AD-A171012	(1/4)	Control name Outline/Appearance
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**OUTLINE**Unit: mm, Tolerances unless otherwise specified:  $\pm 0.2$ mm

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**WYSEGVDXG**

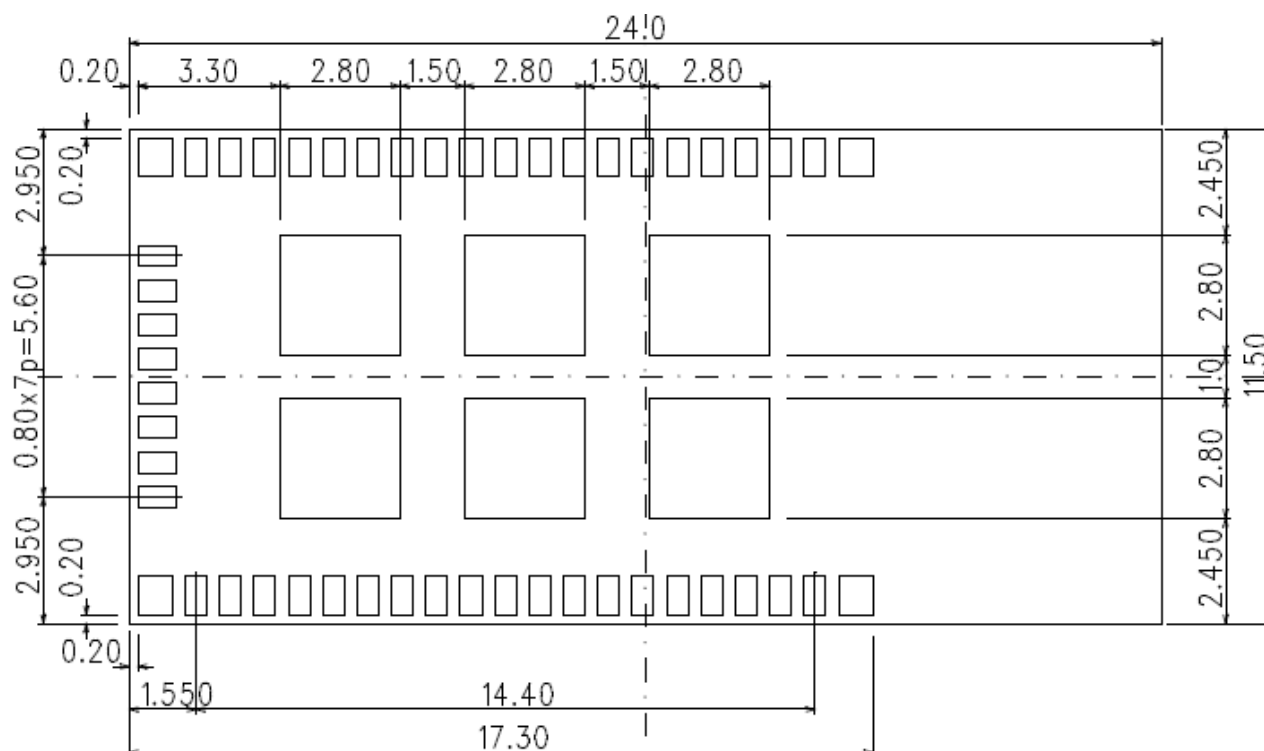
TAIYO YUDEN CO., LTD.

Control No. HD-AD-A171012	Control name Outline/Appearance
------------------------------	------------------------------------

**Module Pad Dimension**

Unit: mm.

(TOP VIEW)



46\_Signal Pad : 0.50 x 0.90

4\_Corner Pad : 0.80 x 0.90

6\_Center Pad : □2.80

TAIYO YUDEN CO., LTD.



**WYSEGVDXG**

TAIYO YUDEN CO., LTD.

Control No. HD-AD-A171012	Control name Outline/Appearance
------------------------------	------------------------------------

**Recommended Land Pattern Dimension**

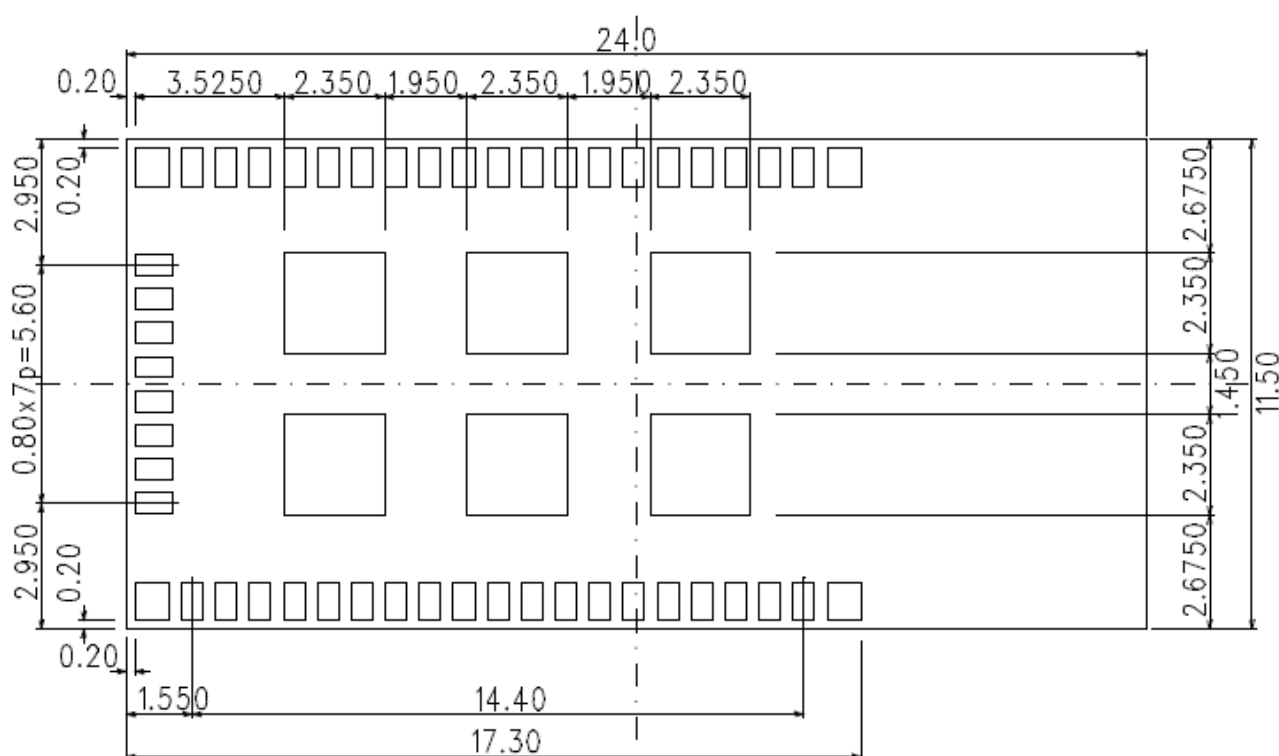
Pad sizes on the motherboard should be the same size as the module pad sizes.

**Recommended Metal Mask (Solder Mask) Conditions**

Mask size see below. Thickness of the Metal Mask should be in the range of 0.1 mm

Unit: mm

(TOP VIEW)



46\_Signal Pad Metal Mask Opening : 0.50 x 0.90

4\_Corner Pad Metal Mask Opening : 0.80 x 0.90

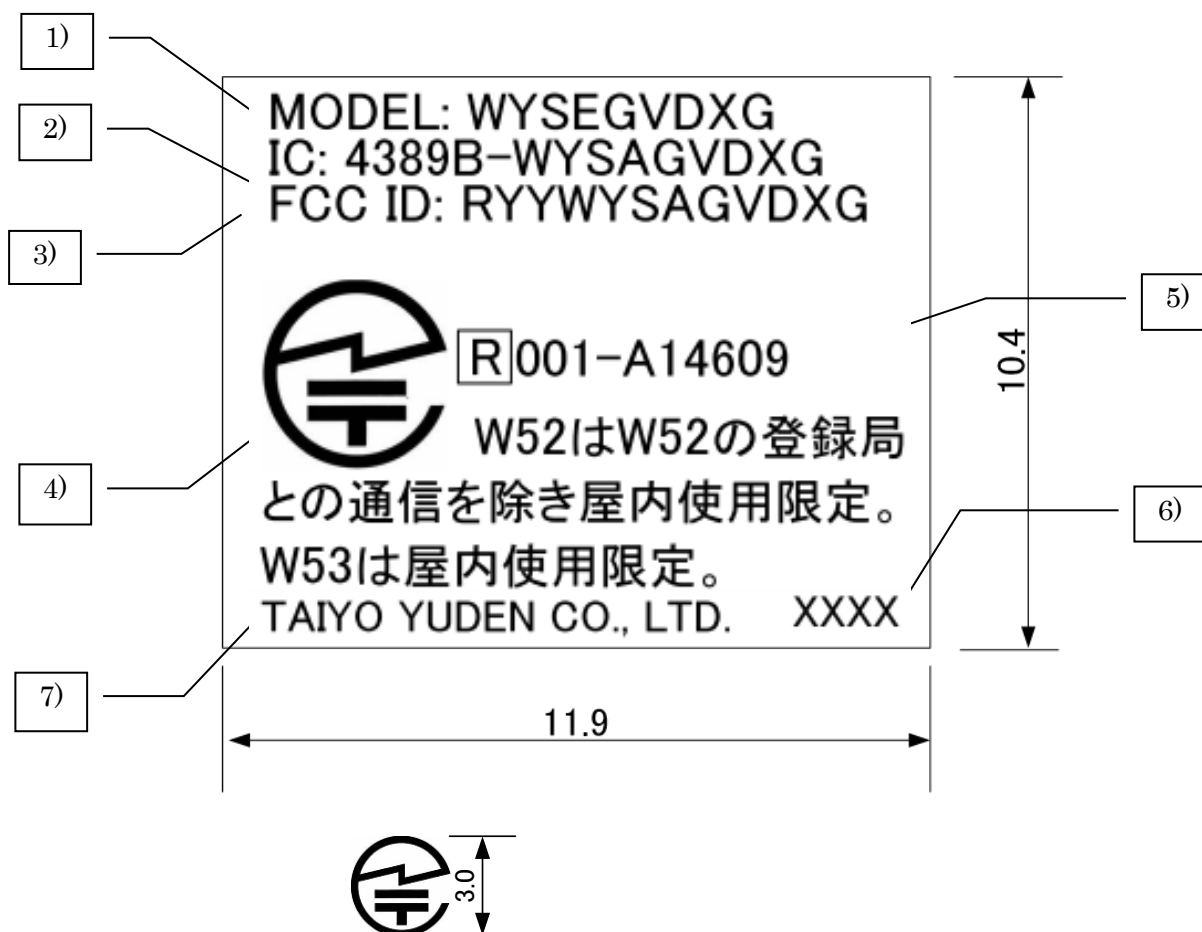
6\_Center Pad Metal Mask Opening : □2.35

**WYSEGVDXG**

TAIYO YUDEN CO., LTD.

Control No. HD-AD-A171012	Control name Outline/Appearance
------------------------------	------------------------------------

## Marking Information



- |                       |   |
|-----------------------|---|
| 1) MODEL              | : WYSEGVDXG   |
| 2) Industry Canada ID | : 4389B-WYSAGVDXG                                     |
| 3) FCC ID             | : RYYWYSAGVDXG  |
| 4) Japan logo mark    | : Specified logo mark                                 |
| 5) Japan ID           | : 001-A14609  |
| 6) Product Lot number | : Four digits (Refer to 「Instruction for lot number」) |
| 7) Manufacture        | : TAIYO YUDEN CO., LTD.                               |

TAIYO YUDEN CO., LTD.

**WYSEGVDXG**

TAIYO YUDEN CO., LTD.

Control No. HD-BA-A171012	Control name Pin Layout
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(1/3)

**Pin Descriptions**

Terminal No.	Terminal Name	I/O	Pwr Domain	Description	Function	Internal PU
1	GND	-	GND	Ground	PWR	-
2	VIO_RF	I	VIO_RF	3.3V Analog I/O RF Power Supply	PWR	
3	GPIO3, CON[1]	I	VIO_RF	Configuration Mode: CON[1], See Table-1	CTRL	Enable
4	GPIO2, CON[0]	I	VIO_RF	Configuration Mode: CON[0], See Table-1	CTRL	Enable
5	UART_RTS	O	VIO	UART_RTSN Please put out the test terminal.	UART	Enable
6	UART_CTS	I	VIO	UART_CTSN Please put out the test terminal.	UART	Enable
7	UART_SIN	I	VIO	UART_SIN Please put out the test terminal.	UART	Enable
8	UART_SOUT	O	VIO	UART_SOUT Please put out the test terminal.	UART	Enable
9	PDN	I	VIO	Power Down (no internal pull-up on this pin) (0: Full Power Down, 1: Normal Operation)	CTRL	None
10	GPIO13/BT_WAKEUP_BT_HOST	O	VIO	Bluetooth wakeup host (Output).	CTRL	
11	GND	-	GND	Ground	PWR	-
12	VDD18	O	VDD18	1.8V buck voltage output	PWR	
13	VDD33	I	VDD33	3.3V Analog Power Supply	PWR	-
14	GND	-	GND	Ground	PWR	-
15	VBAT	I	VBAT	1.1v buck/1.8v buck/3.3v LDO VBAT input	PWR	-
16	PCM_DIN/PCM_A	I	VIO	PCM Data Input Signal	PCM	Enable
17	PCM_CLK	I/O	VIO	PCM Clock Signal. (Output if PCM master. Input if PCM slave.)	PCM	Enable
18	PCM_SYNC	I/O	VIO	PCM Sync Pulse Signal. (Output if PCM master. Input if PCM slave.)	SDIO	Enable
19	PCM_DOUT/PCM_B	O	VIO	PCM Data Output Signal	PCM	Enable
20	1.1V_INT	O	VDD11	1.1V buck voltage output	PWR	-
21	GND	-	GND	Ground	PWR	-
22	SD_D2	I/O	VIO_SD	SDIO Data line Bit[2]	SDIO	Enable
23	SD_D3	I/O	VIO_SD	SDIO Data line Bit[3]	SDIO	Enable
24	SD_CMD	I/O	VIO_SD	SDIO Command/Response	SDIO	Enable
25	GND	-	GND	Ground	PWR	-
26	SD_CLK	I	VIO_SD	SDIO Clock Input	SDIO	Enable
27	GND	-	GND	Ground	PWR	-
28	SD_D0	I/O	VIO_SD	SDIO Data line Bit[0]	SDIO	Enable
29	SD_D1	I/O	VIO_SD	SDIO Data line Bit[1]	SDIO	Enable
30	GND	-	GND	Ground	PWR	-
31	VIO_SD	I	VIO_SD	1.8/3.3V Digital SDIO Power Supply.	PWR	-

**WYSEGVDXG**

TAIYO YUDEN CO., LTD.

Control No. HD-BA-A171012	Control name Pin Layout
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Terminal No.	Terminal Name	I/O	Pwr Domain	Description	Function	Internal PU
32	VIO	I	VIO	1.8/2.5/3.3V Digital Power Supply	PWR	-
33	GND	-	GND	Ground	PWR	-
34	SLP_CLK	I	VDD18	Sleep Clock Input	CLOCK	-
35	GPIO1/WL_HOST_WAKE	O	VIO	WLAN wakeup HOST (Output)	CTRL	
36	RES	-	-	Reserved. Do not connect this pin. Leave this pin floating.	-	
37	TMS	I	VIO	JTAG Controller Select	JTAG	Enable
38	TDI	I	VIO	JTAG Test Data Input	JTAG	Enable
39	TDO	O	VIO	JTAG Test Data Output	JTAG	Enable
40	TCK	I	VIO	JTAG Test Clock Input	JTAG	Enable
41	GND	-	GND	Ground	PWR	-
42	ANT1	I/O	-	RF I/O, should be connected to Pin 43	RF I/O	
43	ANT2	I/O	-	Internal antenna, should be connected to Pin 42	Antenna	
44	GND	-	GND	Ground	PWR	-
45	GND	-	GND	Ground	PWR	-
46	RES	-	-	Reserved. Do not connect this pin. Leave this pin floating.		
47	RES	-	-	Reserved. Do not connect this pin. Leave this pin floating.		
48	RES	-	-	Reserved. Do not connect this pin. Leave this pin floating.		
49	RES	-	-	Reserved. Do not connect this pin. Leave this pin floating.		
50	GND	-	GND	Ground	PWR	-
51	GND	-	GND	Ground	PWR	-
52	GND	-	GND	Ground	PWR	-
53	GND	-	GND	Ground	PWR	-
54	GND	-	GND	Ground	PWR	-
55	GND	-	GND	Ground	PWR	-
56	GND	-	GND	Ground	PWR	-

**WYSEGVDXG**

TAIYO YUDEN CO., LTD.

Control No. HD-BA-A171012	(3/3)	Control name Pin Layout
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Table-1 HOST Interface / FW down load select

CON[1]	CON[0]	WLAN	BT/BLE
0	0	00,01 reserved	
0	1		
1	0	SDIO	UART
1	1	SDIO	SDIO

Note) The 88W8887 firmware and driver does not support UART as a Bluetooth host interface. However, please add UART test points to your design because the UART terminal may be needed during Bluetooth qualification testing.

**WYSEGVDXG**

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.

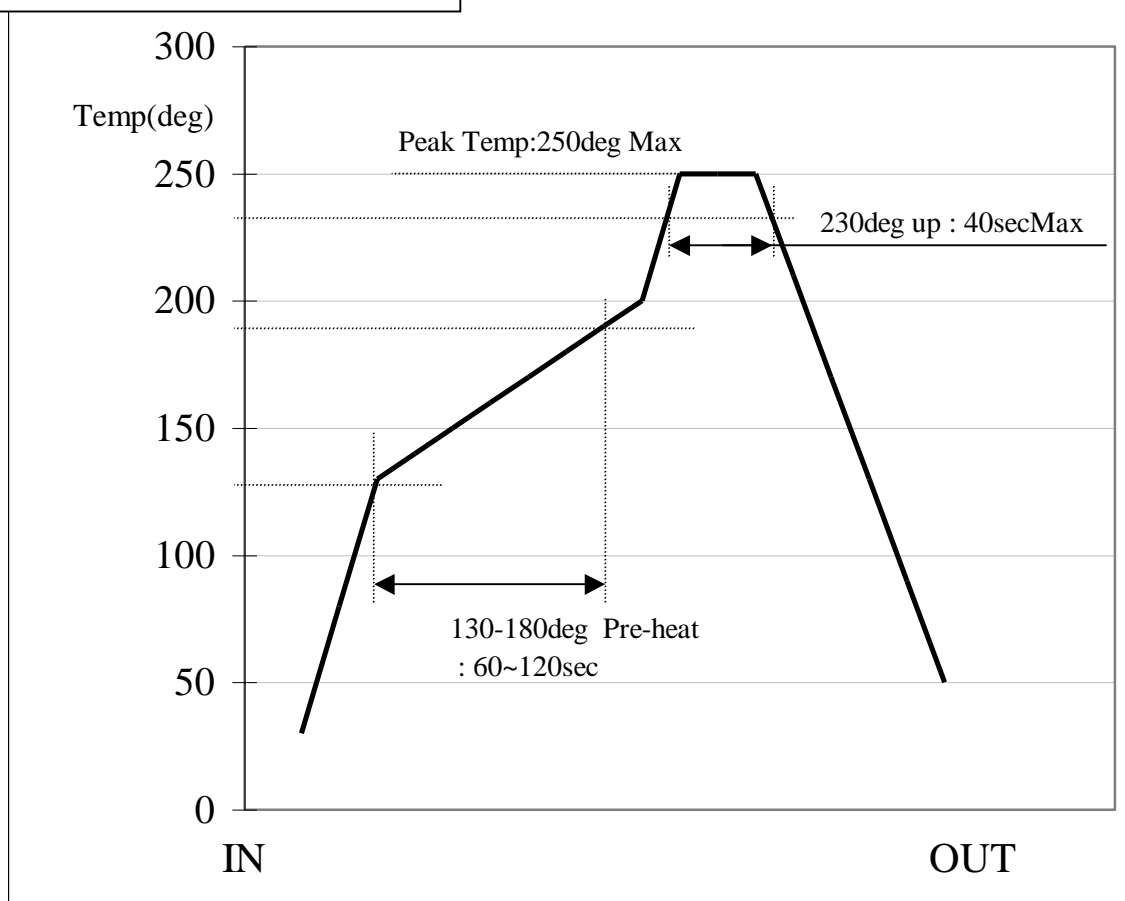
**TAIYO YUDEN CO., LTD.**

**WYSEGVDXG**

TAIYO YUDEN CO., LTD.

Control No. HQ-BA-537	(2/2)	Control name Handling Precaution
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Recommended Reflow Profile



## WYSEGVDXG

TAIYO YUDEN CO., LTD.

Control No. HD-BB-A171012	(1/2)	Control name Packaging Specification
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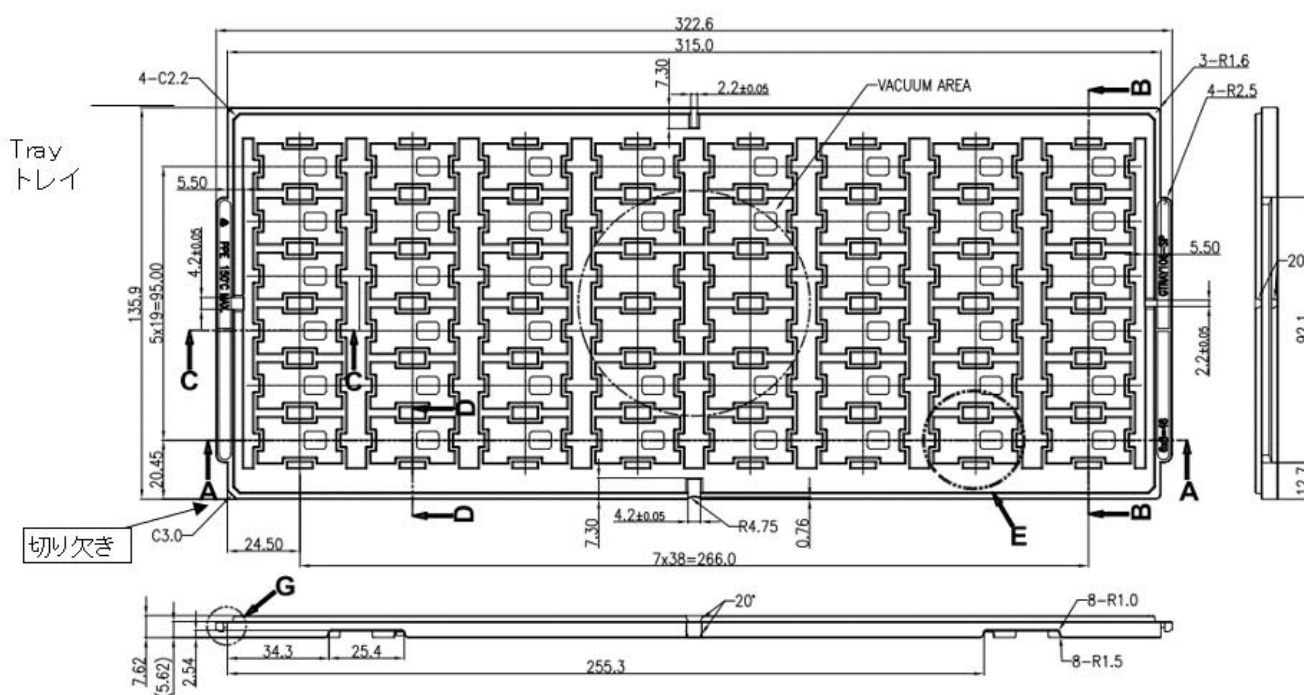
(1) Packaging Material  
梱包材料

Name 部材名	Outline 概要	Materials 材質	Note 備考
Tray トレイ	315×135.9×7.62(mm)	Conductive PPE 導電性PPE	48 pieces/tray 48 個/トレイ
Antistatic band 帯電防止結束バンド	8mm wide 8mm幅	Antistatic PP 帯電防止 PP	—
Desiccant 乾燥剤	—	Desi-Pak デシパック	—
Humidity indicator card 湿度インジケータ	—		—
Aluminum moisture barrier bag アルミ防湿袋	260×460(mm)	(AS)PET/AL/NY/PE(AS)	—
Buffer corrugated paper 緩衝ダンボール	—	Corrugated fiberboard. ダンボール	—
Label ラベル	—	—	—
Corrugated cardboard box 個装箱	345×205×95(mm)	Corrugated fiberboard. ダンボール	—

(2) Packaging Unit  
梱包数量

48 pieces/tray × 10 tray = 480 pieces  
48 個/トレイ × 10 トレイ = 480 個

(3) Packaging Figure  
梱包形態



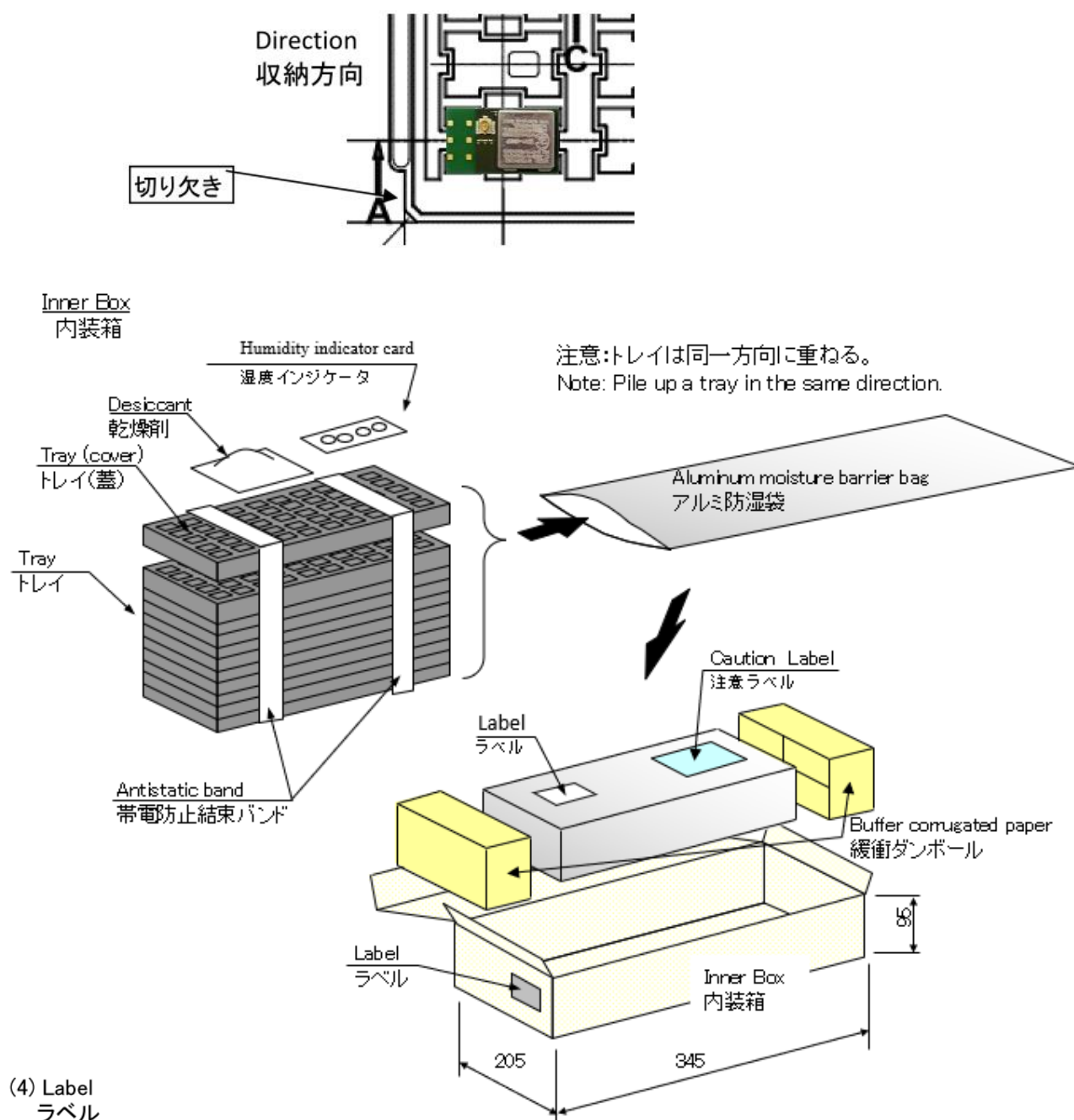
TAIYO YUDEN CO., LTD.



## WYSEGVDXG

TAIYO YUDEN CO., LTD.

Control No. HD-BB-A171012	Control name Packaging Specification
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The entry item to a label  
ラベルへの記載内容

COMPANY NAME	御社名
DESCRIPTION	品名
QUANTITY	納入数量
LotNo.	ロット
NOTE	備考
COUNTRY OF ORIGIN	原産国

TAIYO YUDEN CO., LTD.

## その他、注意事項について (Precautions)

- 弊社製品のご使用に際しては、使用する機器に実装された状態および実際の使用環境での評価および確認を必ず行ってください。
- 当仕様書に記載の製品は、一般的な電子機器【AV 機器、OA 機器、家電製品、事務機器、情報・通信機器（携帯電話、パソコンなど）】で使用されることを意図されています。したがって、生命または身体に直接危害を及ぼす可能性のある機器【輸送用機器（自動車駆動制御装置、列車制御装置、船舶制御装置など）、交通用信号機器、防災機器、医療機器（国際分類クラスⅠ、Ⅱ、Ⅲ）、公共性の高い情報通信機器（電話交換機、電話・無線・放送などの基地局）】などへのご使用をご検討の場合は、必ず事前に弊社までお問い合わせをお願いします。
- また、高度の安全性や信頼性が求められる機器【宇宙用機器、航空用機器、医療機器（国際分類クラスⅣ）、原子力用制御機器、海底用機器、軍事用機器など】につきましては、弊社製品をご使用されないようお願いします。
- なお、一般的な電子機器においても安全性や信頼性の要求が高い機器、回路などに弊社製品をご使用になる場合には、十分な安全性評価を実施され、必要に応じて設計時に保護回路などを追加していただくことをお勧めします。
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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.

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- 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.