LoRa + Wi-Fi + Bluetooth + GNSS Module Data Sheet

Semtech LR1110 Chipset for 802.11 b/g/n (sniff),LoRa, GNSS
ST Micro STM32WB55VGY6 Chipset for MCU and BT

Design Name: **Type1WL**
Sample Part Number: **LBEU5ZZ1WL-857SMP**
MP Part Number: **LBEU5ZZ1WL-857**

This Datasheet is preliminary version, and subject to change without notice

The revision history of the product specification

Revised Date	Revision Code	Revised Page	Revised Item	Change Reason
2022/09/20	-	-	-	First release
2022-09-21	A	3,5	Added the weight information. Updated the laser mark information on top side Changed sample par number and EVK part number	Update

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Please be aware that an important notice concerning availability, standard warranty and use in critical applications of Murata products and disclaimers thereto appears at the end of this specification sheet.

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1. SCOPE

This specification is applied to Geolocation module for LoRa, Wi-Fi, BT, and GNSS.

- Interface   : USB/UART/SPI/I2C
- Chipset   : Semtech LR1110 for LoRa, Wi-Fi, and GNSS
                             STMicro STM32WB55 for MCU and BT

- Module Size   : 17.50 x 17.00 x 2.15(MAX) mm
- Weight   : 1130 mg
- Structure   : Metal case＋PCB (Lead Free Module)
- RoHS   : This component can meet with RoHS compliance.

2. Part Number

Ordering Part Number	Description
LBEU5ZZ1WL-857-TEMP	In case of sample order
LBEU5ZZ1WL-857-EVB	In case of EVB order
LBEU5ZZ1WL-857	Mass Produced Product

"Type1WL" is design name of this module.　Design name may be used in certification test report.

3. Block Diagram
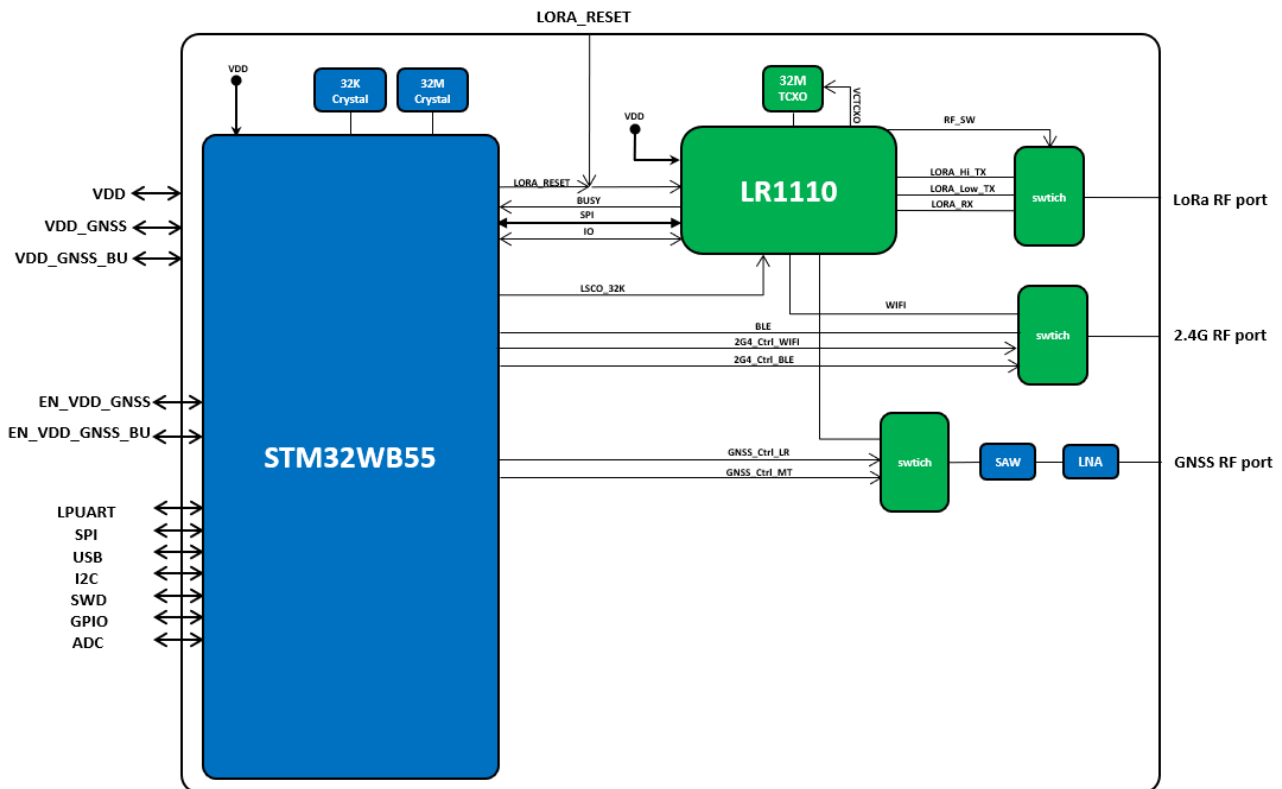
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4. Certification Information

4.1. Radio Certification

USA/Canada

FCC ID	
IC	

*Please follow installation manual in Appendix

Europe

 TBD

Japan

 TBD

4.2. Bluetooth® Qualification

QDID: T.B.D.

5. DIMENSIONS, MARKING AND TERMINAL CONFIGURATIONS

5.1. Dimensions
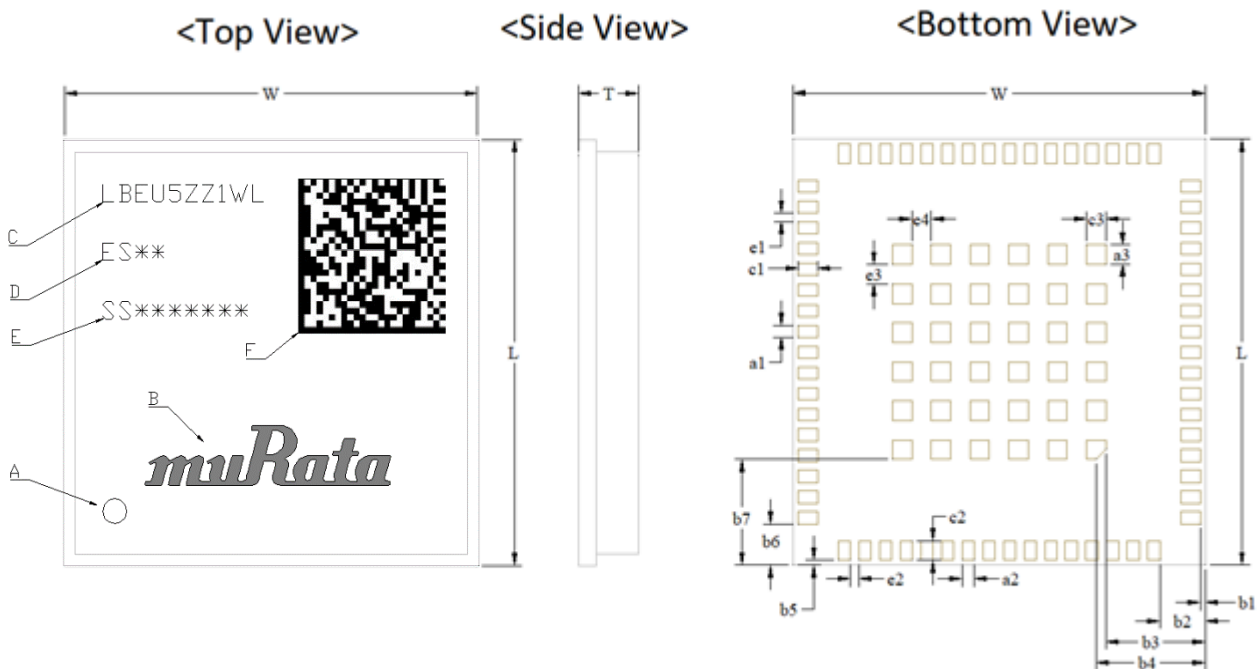
A	Pin 1 Hole
B	Murata Logo
C	Module model name
D	ES Version
E	Inspection Number
F	2D Code

Mark	Dimension	Mark	Dimension	Mark	Dimension
W	17.00±0.20	L	17.50±0.20	a1	0.50±0.10
a2	0.50±0.10	a3	0.80±0.10	b1	0.20±0.15
b2	1.875±0.150	b3	4.10±0.15	b4	4.50±0.15
b5	0.20±0.15	b6	1.70±0.15	b7	4.35±0.15
c1	0.80±0.10	c2	0.80±0.10	c3	0.80±0.10
e1	0.35±0.10	e2	0.35±0.10	e3	0.80±0.10
e4	0.80±0.10	T	2.15max		

Note: The laser mark is temporary.

5.2. Pin Layout and Descriptions

Top View
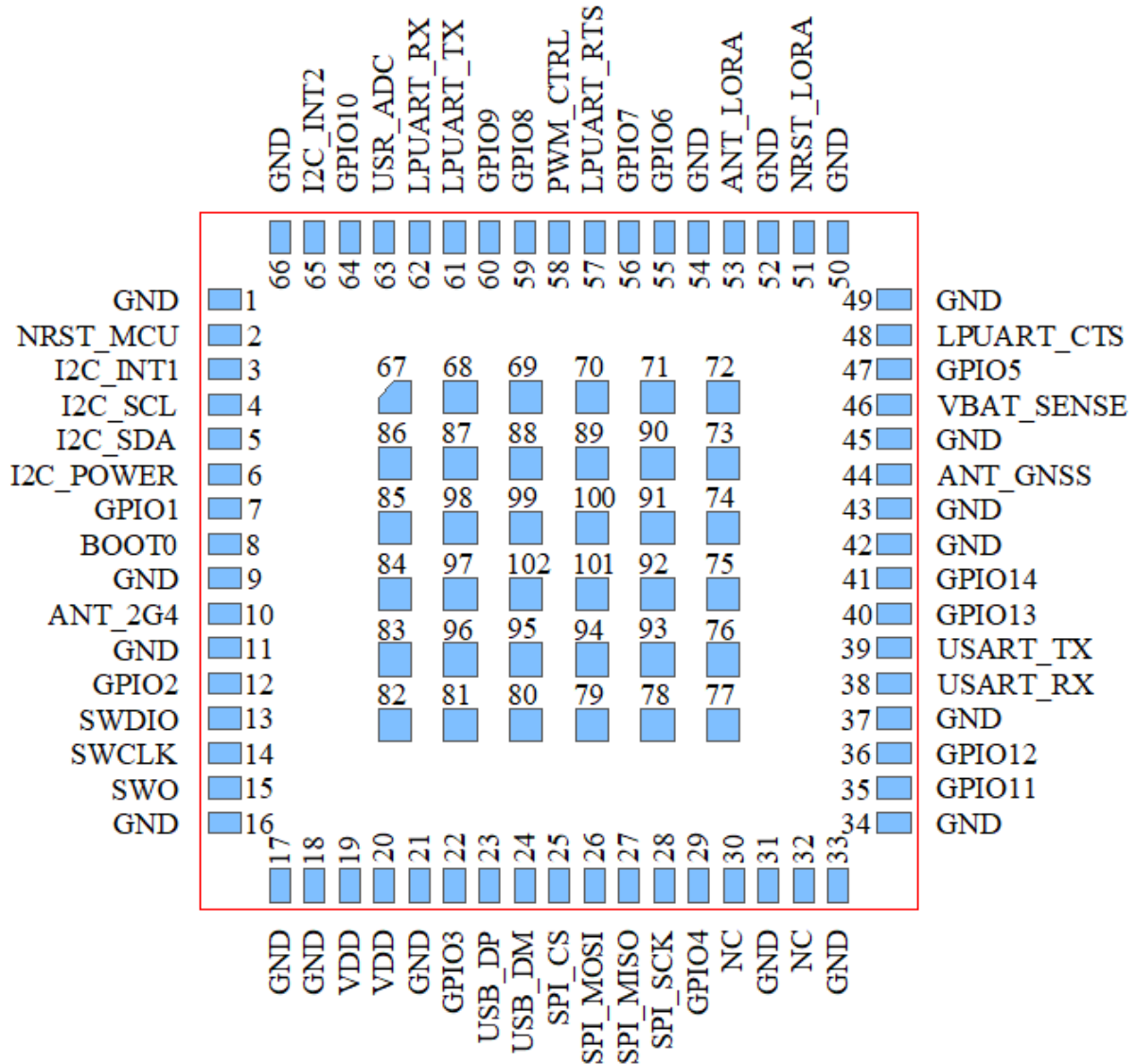
Pin NO.	Terminal Name	Type	Connection to IC terminal	Description
1	GND	GND	-	Ground
2	NRST_MCU	I	STM32: NRST	STM32 reset signal, active low
3	I2C_INT1	I/O	STM32: PC2	Interrupt for I2C sensor
4	I2C_SCL	I/O	STM32: PB8	I2C clock
5	I2C_SDA	I/O	STM32: PB7	I2C data
6	I2C_POWER	I/O	STM32: PB9	Power for I2C sensor
7	GPIO1	I/O	STM32: PD14	General purpose I/O
8	BOOT0	I	STM32: PH3-BOOT0	STM32 BOOT0 pin. At start up, BOOT0 pin and BOOT1 option bit are used to select three boot option: Boot from user flash:(BOOT1:x, BOOT0:0) Boot from system memory: (BOOT1:0,

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				BOOT0:1) Boot from embedded SRAM: (BOOT1:1, BOOT0:1)
9	GND	GND	-	Ground
10	ANT_2G4	RF	-	2.4GHz antenna(BLE/ Wi-Fi)
11	GND	GND	-	Ground
12	GPIO2	I/O	STM32: PD13	General purpose I/O
13	SWDIO	I/O	STM32: PA13	SWD interface data pin
14	SWCLK	I/O	STM32: PA14	SWD interface clock pin
15	SWO	I/O	STM32: PB3	SWD interface debug pin
16	GND	GND	-	Ground
17	GND	GND	-	Ground
18	GND	GND	-	Ground
19	VDD	Power	-	Power supply for MCU and LoRa
20	VDD	Power	-	Power supply for MCU and LoRa
21	GND	GND	-	Ground
22	GPIO3	I/O	STM32: PD7	General purpose I/O
23	USB_DP	I/O	STM32: PA12	USB interface data positive
24	USB_DM	I/O	STM32: PA11	USB interface data minus
25	SPI_CS	I/O	STM32: PD2	SPI interface chip select
26	SPI_MOSI	I/O	STM32: PD4	SPI interface master output slave input
27	SPI_MISO	I/O	STM32: PD3	SPI interface master input slave output
28	SPI_SCK	I/O	STM32: PD1	SPI interface clock
29	GPIO4	I/O	STM32: PD0	General purpose I/O
30	NC	Power	-	NC
31	GND	GND	-	Ground
32	NC	Power	-	NC
33	GND	GND	-	Ground
34	GND	GND	-	Ground
35	GPIO11	I/O	STM32: PC10	General purpose I/O
36	GPIO12	I/O	STM32: PA15	General purpose I/O
37	GND	GND	-	Ground
38	USART_RX	I/O	STM32: PA10	USART of STM32
39	USART_TX	I/O	STM32: PA9	USART of STM32
40	GPIO13	I/O	STM32: PE4	General purpose I/O
41	GPIO14	I/O	STM32: PB15	General purpose I/O
42	GND	GND	-	Ground
43	GND	GND	-	Ground
44	ANT_GNSS	RF	-	GNSS antenna
45	GND	GND	-	Ground
46	VBAT_SENSE	AI/O	STM32: PA1	Measure battery voltage
47	GPIO5	I/O	STM32: PC9	General purpose I/O
48	LPUART_CTS	I/O	STM32: PB13	LPUART of STM32
49	GND	GND	-	Ground
50	GND	GND	-	Ground
51	NRST_LORA	I	LR1110: NRESET	LR1110 reset, active low
52	GND	GND	-	Ground
53	ANT_LORA	RF	-	LoRa antenna
54	GND	GND	-	Ground
55	GPIO6	I/O	STM32: PD6	General purpose I/O
56	GPIO7	I/O	STM32: PD10	General purpose I/O
57	LPUART_RTS	I/O	STM32: PB12	LPUART of STM32
58	PWM_CTRL	I/O	STM32: PB6	Load control
59	GPIO8	I/O	STM32: PC4	General purpose I/O
60	GPIO9	I/O	STM32: PC5	General purpose I/O
61	LPUART_TX	I/O	STM32: PB11	LPUART of STM32
62	LPUART_RX	I/O	STM32: PB10	LPUART of STM32
63	USR_ADC	AI/O	STM32: PA0	Analog IO
64	GPIO10	I/O	STM32: PC11	General purpose I/O
65	I2C_INT2	I/O	STM32: PC3	Interrupt for I2C sensor
66	GND	GND	GND	Ground

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67-102	GND	GND	-	Ground

6. ABSOLUTE MAXIMUM RATINGS

Parameter		min.	typ.	max.	unit
Storage Temperature		-40	-	85	deg.C
Supply Voltage	VDD_3V3	-0.3		3.6	V
	VDD_GNSS	-0.3		4.3	V
	VDD_GNSS_BU	-0.3		4.3	V

7. OPERATING CONDITION

Parameter		min.	typ.	max.	unit
Operating Temperature		-30	-	85	deg.C
Supply Voltage	VDD_3V3	3.0		3.3	V
	VDD_GNSS	2.8		4.3	V
	VDD_GNSS_BU	2.0		4.3	V

8. RF Characteristics

8.1. RF Characteristics for Sub-GHz

Sub-GHz Bands Receiver Specifications

Symbol	Description	Conditions	Min	Typ.	Max	Unit
FRRXLF	RX input frequency	Sub-GHz frequency range, LoRa and FSK	863	-	928	MHz
RXS2F3	Sensitivity 2-FSK	BRF = 4.8 kb/s, FDA = 5 kHz, BWF = 20 kHz	-	TBD	-	dBm
RXS2F3HP3	Sensitivity 2-FSK, RxBoosted = 1	BRF = 4.8 kb/s, FDA = 5 kHz, BWF = 20 kHz	-	TBD	-	dBm
RXSL3	Sensitivity LoRa® RxBoosted = 0	BWL = 125 kHz, SF = 7	-	TBD	-	dBm
RXSL4		BWL = 125 kHz, SF = 12	-	TBD	-	
RXSL5		BWL = 250 kHz, SF = 7	-	TBD	-	
RXSL6		BWL = 250 kHz, SF = 12	-	TBD	-	
RXSL7		BWL = 500 kHz, SF = 7	-	TBD	-	
RXSL8		BWL = 500 kHz, SF = 12	-	TBD	-	
RXSL3HP7	Sensitivity LoRa®, RxBoosted = 1	BWL = 125 kHz, SF = 7	-	TBD	-	dBm
RXSL4HP7		BWL = 125 kHz, SF = 12	-	-140	-	
RXSL5HP7		BWL = 250 kHz, SF = 7	-	TBD	-	
RXSL6HP7		BWL = 250 kHz, SF = 12	-	TBD	-	
RXSL7HP7		BWL = 500 kHz, SF = 7	-	TBD	-	
RXSL8HP7		BWL = 500 kHz, SF = 12	-	TBD	-	
IDDR_F	Supply current in receiver FSK mode	RxBoost OFF	-	TBD	-	mA
		RxBoost ON	-	TBD	-	
IDDR_L	Supply current in receiver LoRa mode, RxBoost off	BW = 125 kHz	-	TBD	-	mA
		BW = 250 kHz	-	TBD	-	
		BW = 500 kHz	-	TBD	-	

Sub-GHz Path Transmitter Specifications

Symbol	Description	Conditions	Min	Typ.	Max	Unit
TXOPLP TXOPHP	Maximum TX power	LP PA HP PA		+13.5 +21	- -	dBm dBm
ΔRF_OPH_V	RF output power stability versus voltage supply VDD = 3.0 V to 3.3 V	LP PA operating HP PA, operating	- -	TBD TBD	- -	dB
ΔRF_T	RF output power stability versus temperature From T = -40 °C to +85 °C	LP PA operating HP PA, operating	- -	TBD TBD	- -	dB
TXPRNGLF	TX power range	Programmable in steps of -1dB from maximum TX power	-	31	-	steps
IDDT_L	Supply current in LoRa transmitter mode with impedance matching	LP PA setting = 14 dBm HP PA, setting = 22 dBm	- -	TBD TBD	- -	mA

8.2. RF Characteristics for Wi-Fi Passive Scanner

Conditions : 25deg.C,

Items	Description	Conditions	Min	Typ.	Max	Unit
FRRXWF	RX input frequency	Wi-Fi channels	2412	-	2484	MHz
IDDRXWI-FI	Supply Current in Wi-Fi scan mode	Preambles detect phase Capture phase Processing phase		TBD TBD TBD		mA
RXSWFB1	Wi-Fi sensitivity for Wi-Fi 802.11 b, DSSS	DBPSK, DR = 1Mb/s		-92		dBm
RXSWFG1	Wi-Fi sensitivity for Wi-Fi 802.11 g, OFDM, 20MHz channel spacing	BPSK, CR = 1/2, DR = 6 Mb/s		TBD		dBm
RXSWFN1	Wi-Fi sensitivity for Wi-Fi 802.11 n, OFDM, 20MHz channel spacing, short guard interval	BPSK, CR = 1/2, DR = 7.2 Mb/s		TBD		dBm

8.3. RF Characteristics for BLE

RF characteristics are given at 1 Mbps, unless otherwise specified.

Normal conditions : 25 deg.C, VDD= 3.3V

Items	Contents			
Bluetooth specification (power class)	Version 5.0 (LE)			
Channel frequency (spacing)	2402 to 2480 MHz (2MHz)			
Number of RF Channel	40			
Item / Condition	**Min.**	**Typ.**	**Max.**	**Unit**
Center Frequency	2402	-	2480	MHz
Channel Spacing	-	2	-	MHz
Number of RF channel	-	40	-	-
Maximum output power	-	5.0	-	dBm
0 dBm output power	-	-	-	dBm
Minimum output power	-	-	-	dBm
Modulation Characteristics				
1) $\Delta f1_{avg}$	225	-	275	kHz
2) $\Delta f2_{max}$ (at 99.9%)	185	-	-	kHz
3) $\Delta f2_{avg}$ / $\Delta f1_{avg}$	0.8	-	-	-
Carrier frequency offset and drift				
1) Frequency offset	-150	-	150	kHz
2) Frequency drift	-	-	50	kHz
3) Drift rate	-	-	20	kHz
Receiver sensitivity (PER < 30.8%)	-	-92	-	dBm
Maximum input signal level (PER < 30.8%)	-	TBD	-	dBm
PER Report Integrity (-30dBm input)	50	-	65.4	%

RF BLE current consumption

Symbol	Parameter	Typ.	Unit
Itxmax	TX maximum output power consumption	TBD	
Itx0dbm	TX 0 dBm output power consumption	TBD	mA
Irxlo	Rx consumption	TBD	

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8.4. RF Characteristics for GNSS
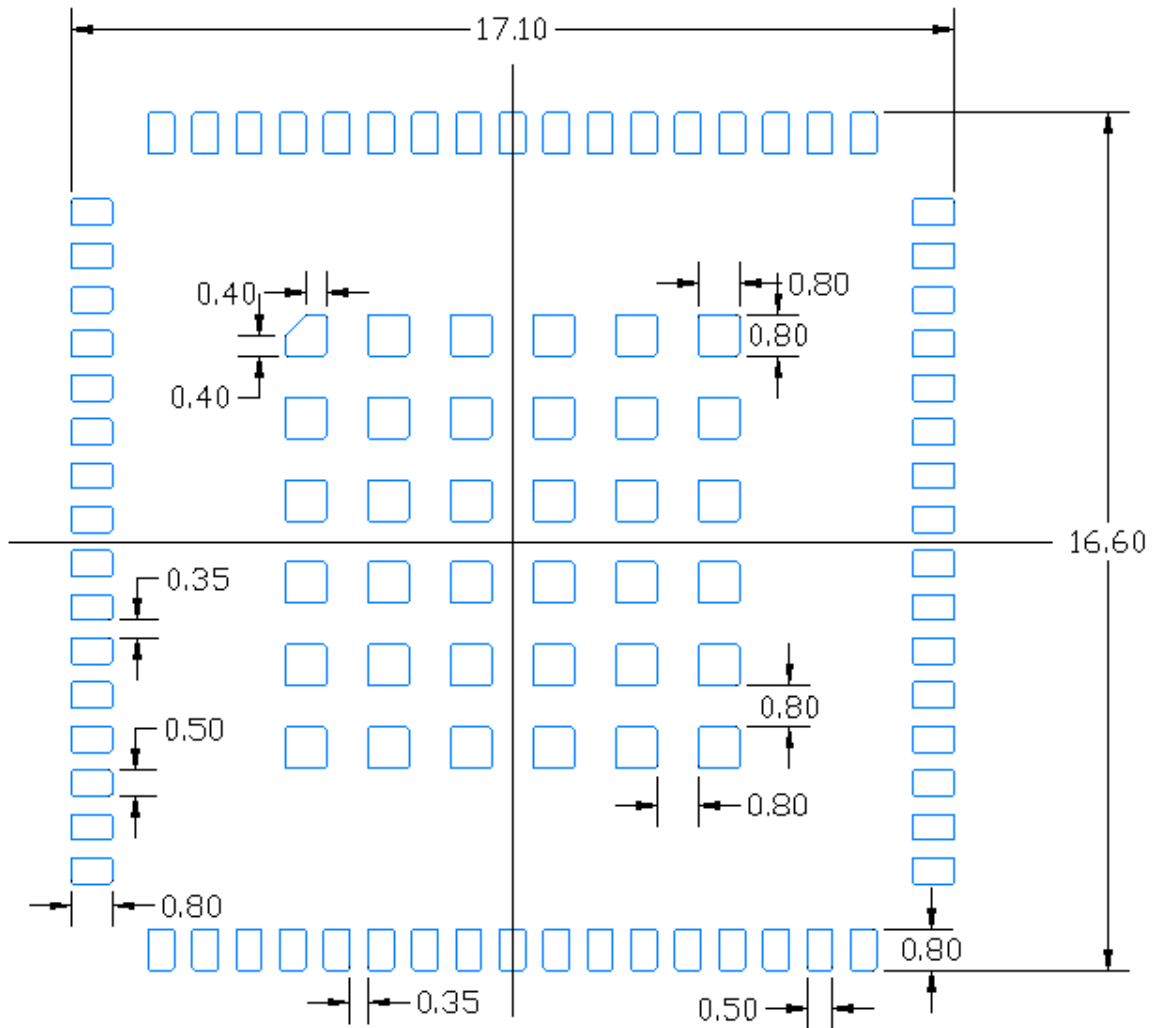
LR1110 GNSS Scanner Receiver Specifications

Symbol	Description	Conditions	Min	Typ.	Max	Unit
IDDRXGPS1 IDDRXGPS2	Supply current in GNSS scan mode	Capture phase Processing phase		TBD TBD		mA mA
FRRXGPS	RX input frequency	GPS BeiDou	- -	1.57542 1.5611	- -	GHz
RXSGPS1E RXSGPS2E RXSBEI1E RXSBEI2E	GNSS sensitivity	GPS, indoor classification, and strong signal SV capture GPS, weak signal SV capture BeiDou, strong signal SV capture BeiDou, weak signal SV capture	- - - -	TBD TBD TBD TBD	- - - -	dBm dBm dBm dBm

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9. LAND PATTERN (TOP VIEW)

10. REFERENCE CIRCUIT

11. TAPE AND REEL PACKING

11.1. Dimension of Tape
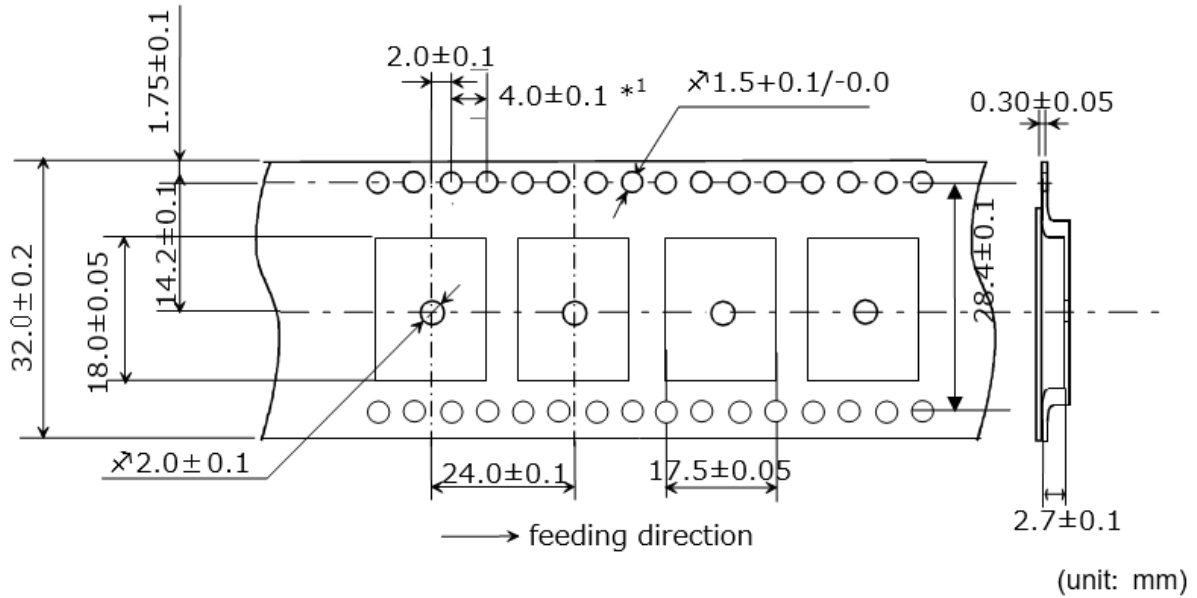
2.0±0.1

4.0±0.1 *1

↗1.5+0.1/-0.0

0.30±0.05

1.75±0.1

14.2±0.1

18.0±0.05

32.0±0.2

28.4±0.1

↗2.0±0.1

24.0±0.1

17.5±0.05

→ feeding direction

2.7±0.1

(unit: mm)

11.2. Dimensions of Reel
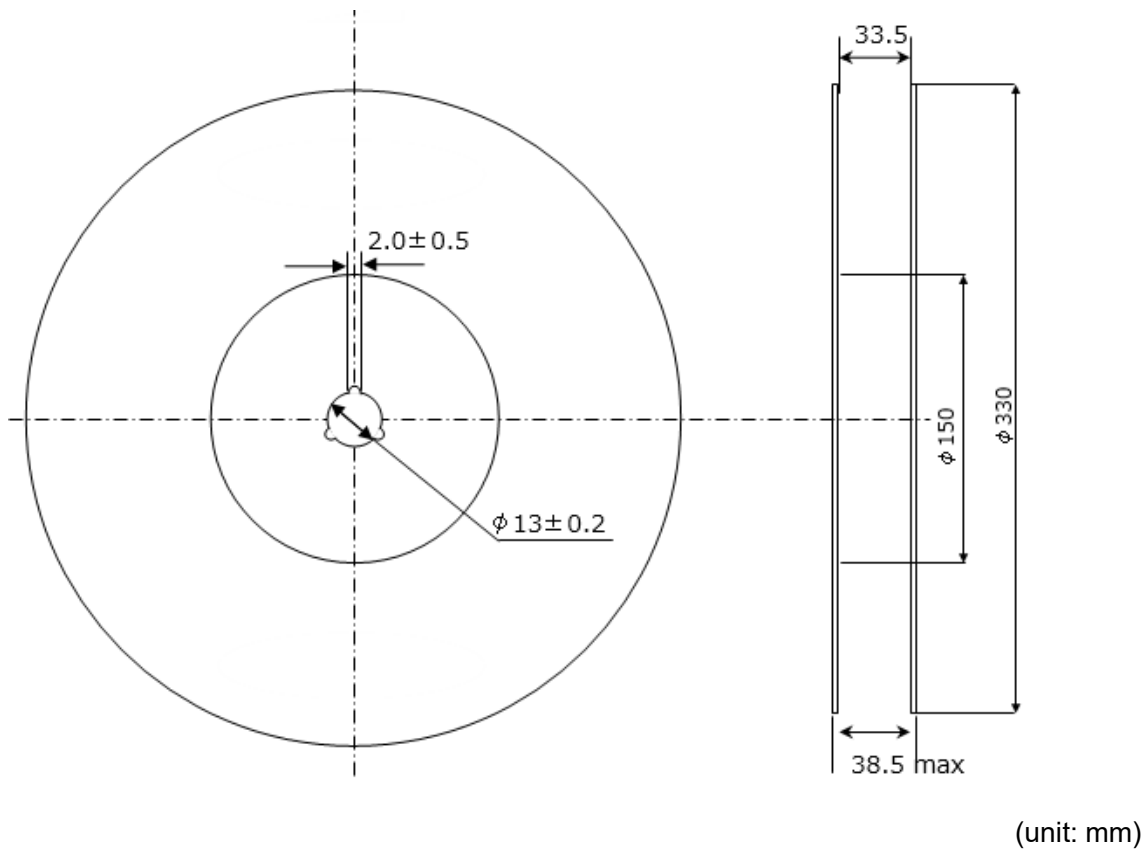
2.0±0.5

φ13±0.2

33.5

φ150

φ330

38.5 max

(unit: mm)

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11.3. Taping Diagrams
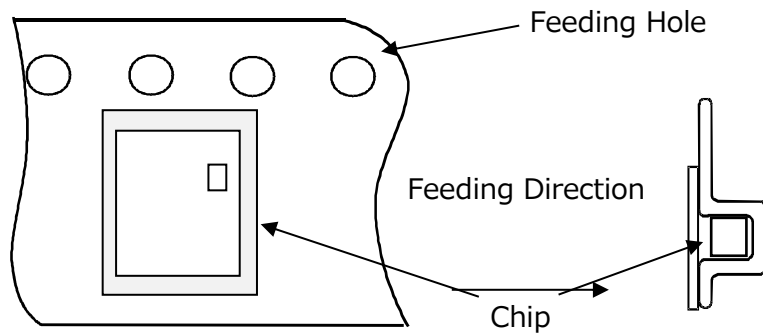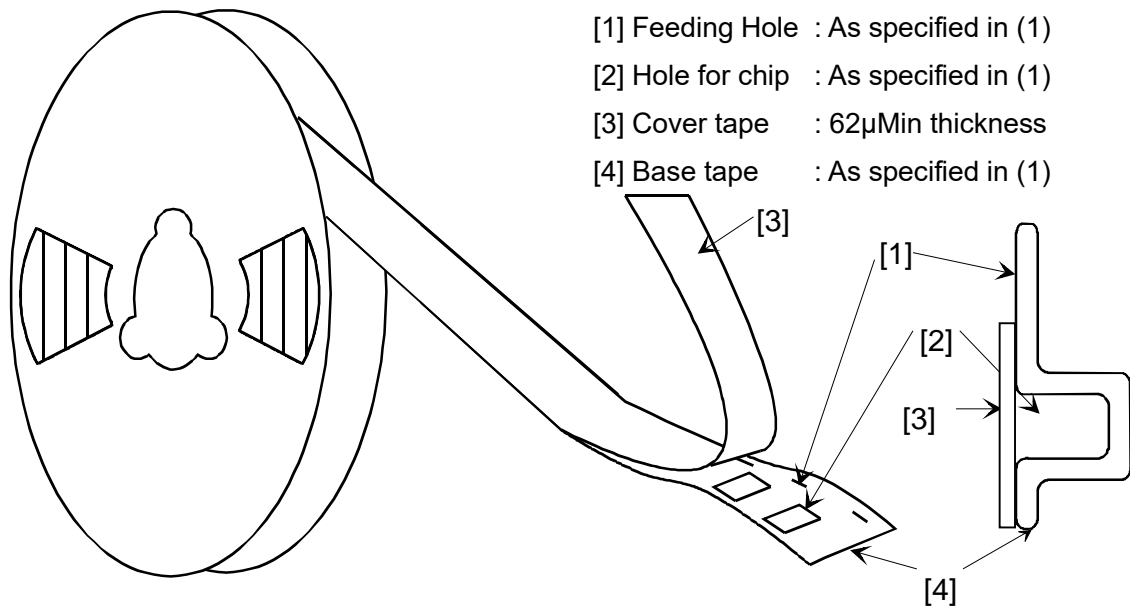
[1] Feeding Hole : As specified in (1)

[2] Hole for chip : As specified in (1)

[3] Cover tape : 62μMin thickness

[4] Base tape : As specified in (1)

[3]

[1]

[2]

[3]

[4]

Feeding Hole

Feeding Direction

Chip

11.4. Leader and Tail Tape
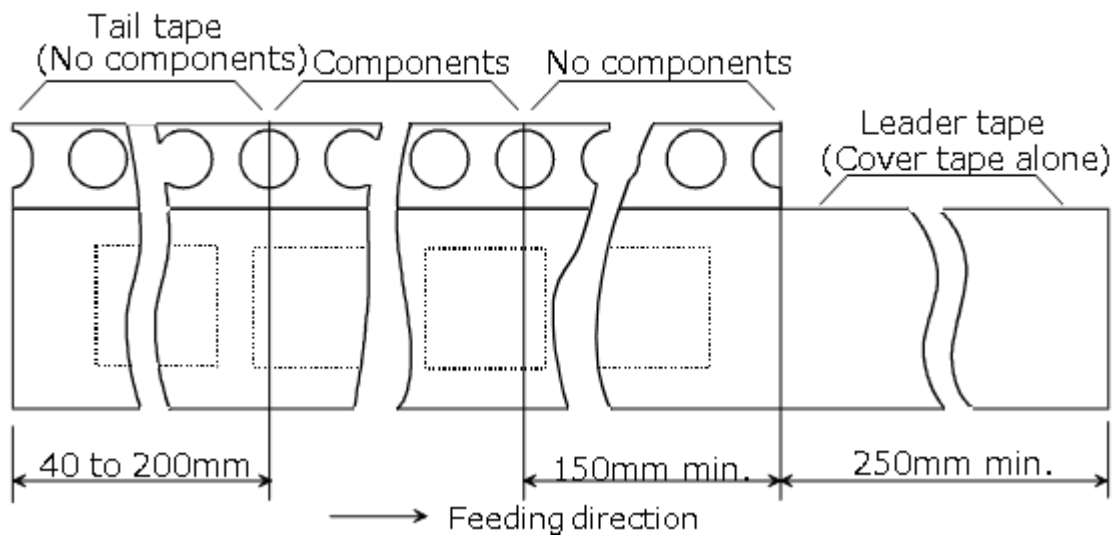
Tail tape
(No components) Components   No components

Leader tape
(Cover tape alone)

40 to 200mm   150mm min.   250mm min.

Feeding direction

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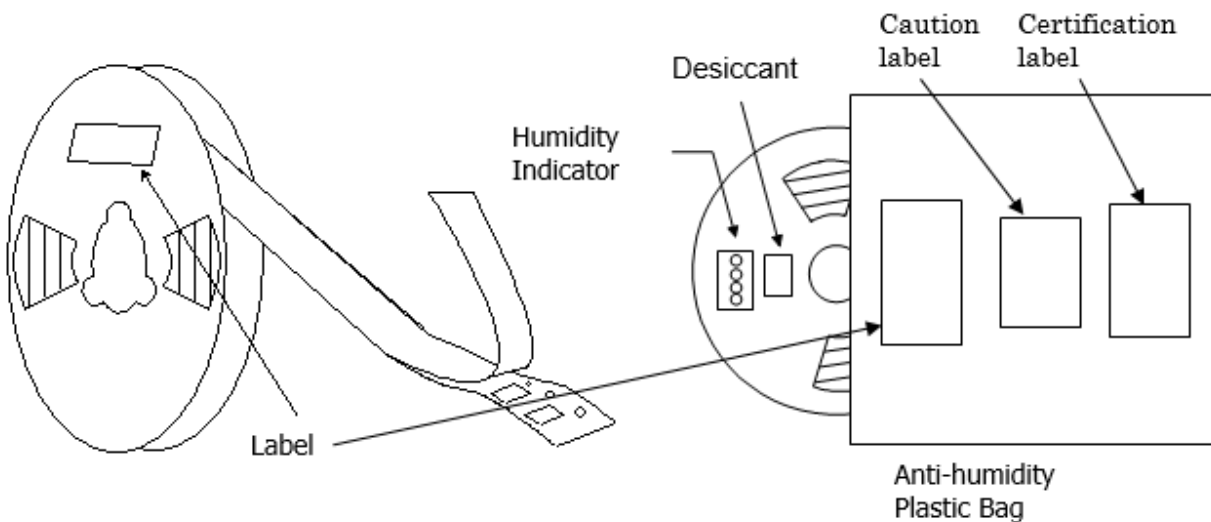< Specification may be changed by Murata without notice >

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- The tape for chips are wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.

- The cover tape and base tape are not adhered at no components area for 250mm Min.

- Tear off strength against pulling of cover tape: 5N Min.

- Packaging unit : 800 pcs/ reel

- Material

  ・ Base tape : Plastic

  ・ Reel   : Plastic

  ・ Cover tape, cavity tape and reel are made the anti-static processing.

- Peeling of force: 1.3N max. in the direction of peeling as shown below.
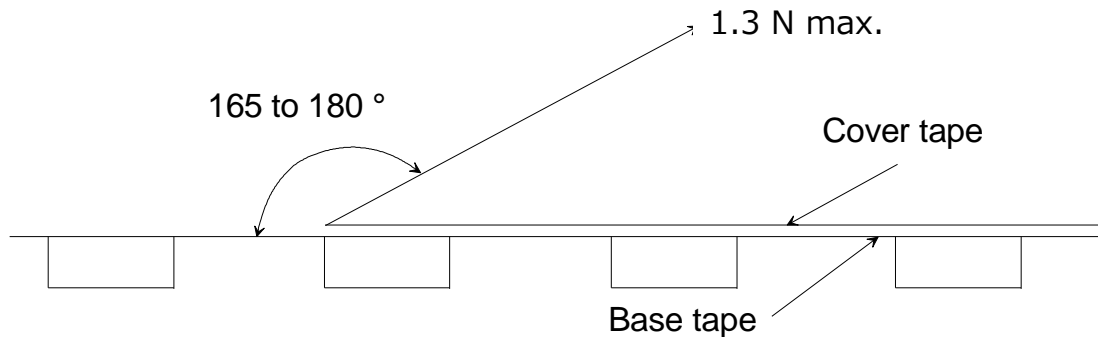
- Packaging (Humidity proof Packing)

Tape and reel must be sealed with the anti-humidity plastic bag. The bag contains the desiccant and the humidity indicator.

12. NOTICE
12.1. Storage Conditions:

Please use this product within 6month after receipt.

- The product shall be stored without opening the packing under the ambient temperature from 5 to 35deg.C and humidity from 20 to 70%RH.

(Packing materials, in particular, may be deformed at the temperature over 40deg.C.)

- The product left more than 6months after reception, it needs to be confirmed the solderbility before used.

- The product shall be stored in non corrosive gas (Cl_2, NH_3, SO_2, No_x, etc.).

- Any excess mechanical shock including, but not limited to, sticking the packing materials by sharp object and dropping the product, shall not be applied in order not to damage the packing materials.

This product is applicable to MSL3 (Based on JEDEC Standard J-STD-020)

- After the packing opened, the product shall be stored at $\leq$30deg.C / $\leq$60%RH and the product shall be used within 168hours.

- When the color of the indicator in the packing changed, the product shall be baked before soldering.

     Baking condition: 125+5/-0deg.C, 24hours, 1time

The products shall be baked on the heat-resistant tray because the material (Base Tape, Reel Tape and Cover Tape) are not heat-resistant.

12.2. Handling Conditions:

Be careful in handling or transporting products because excessive stress or mechanical shock may break products.

Handle with care if products may have cracks or damages on their terminals, the characteristics of products may change. Do not touch products with bear hands that may result in poor solder ability and destroy by static electrical charge.

12.3. Standard PCB Design (Land Pattern and Dimensions):

All the ground terminals should be connected to the ground patterns. Furthermore, the ground pattern should be provided between IN and OUT terminals. Please refer to the specifications for the standard land dimensions.

The recommended land pattern and dimensions is as Murata's standard. The characteristics of products may vary depending on the pattern drawing method, grounding method, land dimensions, land forming method of the NC terminals and the PCB material and thickness. Therefore, be sure to verify the characteristics in the actual set. When using non-standard lands, contact Murata beforehand.
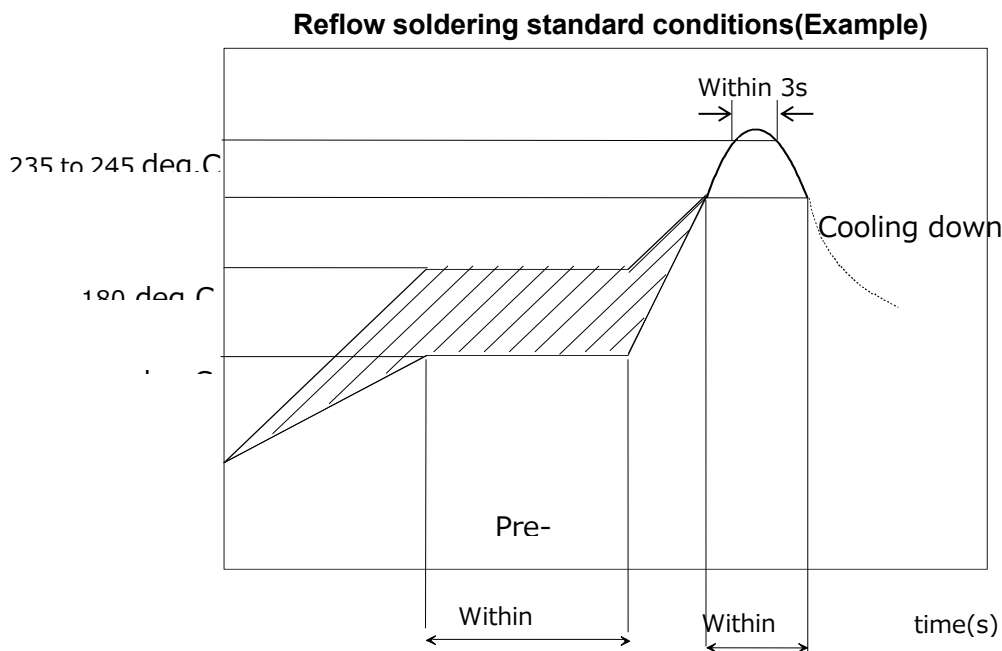
12.4. Notice for Chip Placer:

When placing products on the PCB, products may be stressed and broken by uneven forces from a worn-out chucking locating claw or a suction nozzle. To prevent products from damages, be sure to follow the specifications for the maintenance of the chip placer being used. For the positioning of products on the PCB, be aware that mechanical chucking may damage products.

12.5. Soldering Conditions:

The recommendation conditions of soldering are as in the following figure.
When products are immersed in solvent after mounting, pay special attention to maintain the temperature difference within 100 °C. Soldering must be carried out by the above mentioned conditions to prevent products from damage. Set up the highest temperature of reflow within 260 °C. Contact Murata before use if concerning other soldering conditions.

Reflow soldering standard conditions(Example)

Within 3s

235 to 245 deg.C

Cooling down

180 deg.C

Pre-

Within

Within

time(s)

Please use the reflow within 2 times.

Use rosin type flux or weakly active flux with a chlorine content of 0.2 wt % or less.

12.6. Cleaning:

Since this Product is Moisture Sensitive, any cleaning is not permitted.

12.7. Operational Environment Conditions:

Products are designed to work for electronic products under normal environmental conditions (ambient temperature, humidity and pressure). Therefore, products have no problems to be used under the similar conditions to the above-mentioned. However, if products are used under the following circumstances, it may damage products and leakage of electricity and abnormal temperature may occur.

- In an atmosphere containing corrosive gas (Cl_2, NH_3, SO_x, NO_x etc.).
- In an atmosphere containing combustible and volatile gases.
- Dusty place.
- Direct sunlight place.
- Water splashing place.
- Humid place where water condenses.
- Freezing place.

If there are possibilities for products to be used under the preceding clause, consult with Murata before actual use.

As it might be a cause of degradation or destruction to apply static electricity to products, do not apply static electricity or excessive voltage while assembling and measuring.

12.8. Input Power Capacity:

Products shall be used in the input power capacity as specified in this specifications.
Inform Murata beforehand, in case that the components are used beyond such input power capacity range.

13. <u>PRECONDITION TO USE OUR PRODUCTS</u>

PLEASE READ THIS NOTICE BEFORE USING OUR PRODUCTS.

Please make sure that your product has been evaluated and confirmed from the aspect of the fitness for the specifications of our product when our product is mounted to your product.

All the items and parameters in this product specification/datasheet/catalog have been prescribed on the premise that our product is used for the purpose, under the condition and in the environment specified in this specification. You are requested not to use our product deviating from the condition and the environment specified in this specification.

Please note that the only warranty that we provide regarding the products is its conformance to the specifications provided herein. Accordingly, we shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this specification.

WE HEREBY DISCLAIMS ALL OTHER WARRANTIES REGARDING THE PRODUCTS, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, THAT THEY ARE DEFECT-FREE, OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS.

The product shall not be used in any application listed below which requires especially high reliability for the prevention of such defect as may directly cause damage to the third party's life, body or property. You acknowledge and agree that, if you use our products in such applications, we will not be responsible for any failure to meet such requirements. Furthermore, YOU AGREE TO INDEMNIFY AND DEFEND US AND OUR AFFILIATES AGAINST ALL CLAIMS, DAMAGES, COSTS, AND EXPENSES THAT MAY BE INCURRED, INCLUDING WITHOUT LIMITATION, ATTORNEY FEES AND COSTS, DUE TO THE USE OF OUR PRODUCTS IN SUCH APPLICATIONS.

- Aircraft equipment.   - Aerospace equipment   - Undersea equipment.

- Power plant control equipment   - Medical equipment.

- Transportation equipment (vehicles, trains, ships, elevator, etc.).

- Traffic signal equipment.   - Disaster prevention / crime prevention equipment.

-Burning / explosion control equipment

- Application of similar complexity and/ or reliability requirements to the applications listed in the above.

We expressly prohibit you from analyzing, breaking, reverse-engineering, remodeling altering, and reproducing our product.   Our product cannot be used for the product which is prohibited from being manufactured, used, and sold by the regulations and laws in the world.

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Please do not use our products, our technical information and other data provided by us for the purpose of developing of

mass-destruction weapons and the purpose of military use.

Moreover, you must comply with "foreign exchange and foreign trade law", the "U.S. export administration regulations", etc.

Please note that we may discontinue the manufacture of our products, due to reasons such as end of supply of materials and/or components from our suppliers.

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Appendix