

# LoRaWAN Modem Module Data Sheet

Sample Part Number: **CMWX1ZZABZ-TEMP-8**  
MP Part Number: **CMWX1ZZABZ-104**

## **Revision History**

Revision Code	Date	Description	Comments
-	2019/5/7	Initial release	
A	2019/6/24	Updated 1. General description, 5. Terminal Description and 11. Reference circuit.	
B	2019/6/25	Updated 4. Block Diagram and 5. Terminal Description	

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## 1. General Description

The CMWX1ZZABZ is a highly integrated LoRaWAN compliance module designed to deliver a cost effective, small form factor, and simple to use LPWAN IoT solution.

This module consists of the SX1276 transceiver, STM32L series MCU, RF switch, TCXO, crystal, and all of the necessary matching components. And it's equipped with a modem firmware which greatly simplify the development and improve the quality of LoRaWAN devices. It's capable of supporting both supporting both US 915MHz and EU 868MHz ISM frequency bands while delivering output power as high as 18.5dBm and receive sensitivity as low as -135.5dBm.

The CMWX1ZZABZ LoRaWAN module comes in a size of 12.5 mm x 11.6 mm x 1.76 mm and operates over a temperature range of -40°C to +85°C.

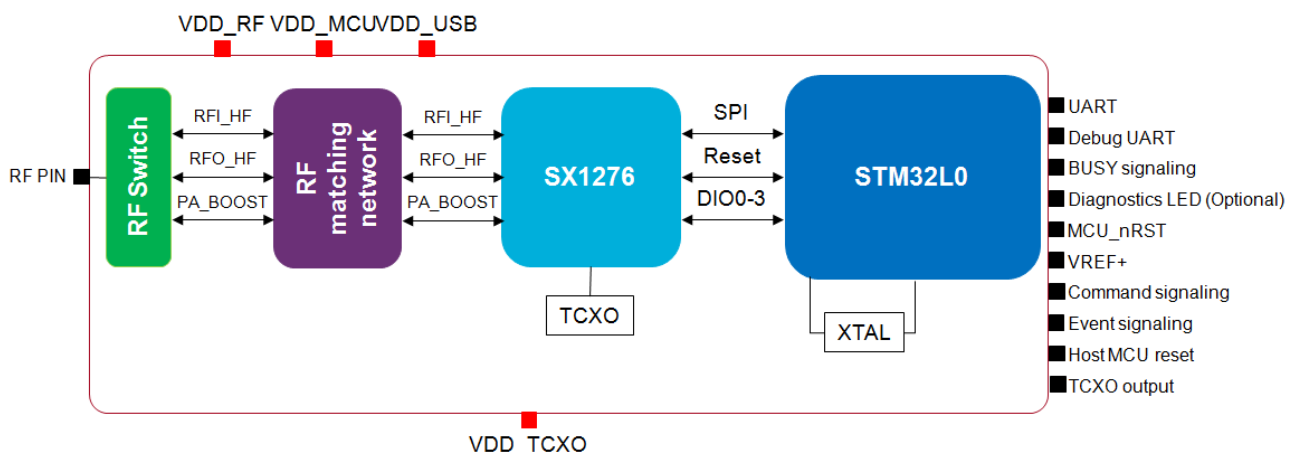
## 2. Features

Interface	: UART
Main ICs	: STM32L, SX1276
Reference Clocks	: Integrated 32MHz TCXO(frequency error = $\pm 2$ ppm) and 32.768kHz XTAL(frequency error = $\pm 20$ ppm)
Supported Frequencies	: US 915MHz, EU 868MHz
Module Size	: 12.5 mm x 11.6 mm x 1.76 mm (Max.)
Weight	: 0.48g (Typ.)
Package	: Multi-chip Module with Metal Shield can
RoHS	: This module is compliant with the RoHS directive

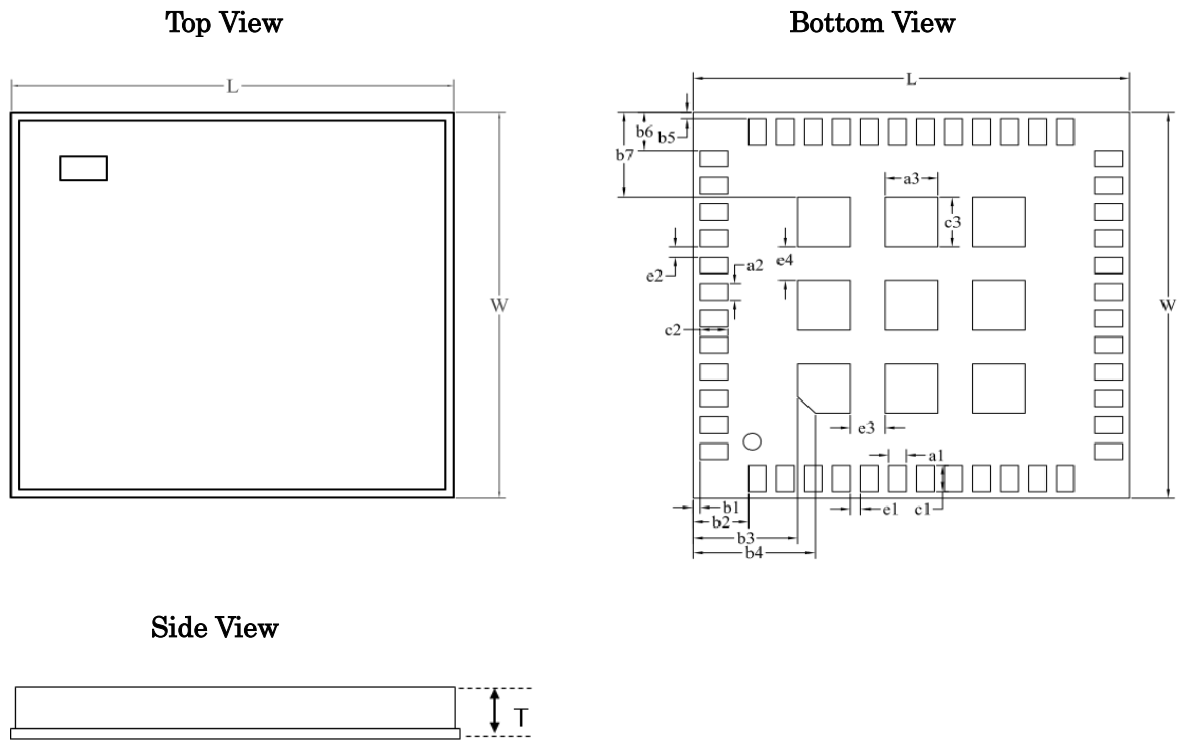
## 3. Ordering Information

Ordering Part Number	Description
CMWX1ZZABZ-TEMP-8	Engineering sample
CMWX1ZZABZ-104	MP P/N

## 4. Block Diagram



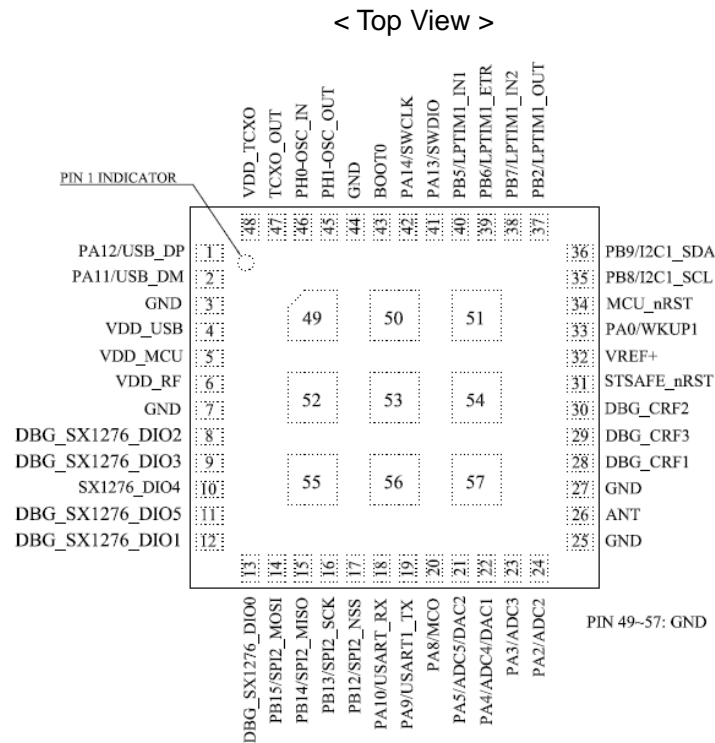
## 5. Dimensions, Marking and Terminal Configurations



**Table 1** Dimension (Unit: mm)

Mark	Dimension	Mark	Dimension	Mark	Dimension
<b>L</b>	$12.5 \pm 0.20$	<b>W</b>	$11.6 \pm 0.20$	<b>T</b>	1.76 max
<b>a1</b>	$0.50 \pm 0.10$	<b>a2</b>	$0.50 \pm 0.10$	<b>a3</b>	$1.50 \pm 0.10$
<b>b1</b>	$0.20 \pm 0.15$	<b>b2</b>	$1.60 \pm 0.15$	<b>b3</b>	$3.00 \pm 0.15$
<b>b4</b>	$3.50 \pm 0.15$	<b>b5</b>	$0.20 \pm 0.15$	<b>b6</b>	$1.15 \pm 0.15$
<b>b7</b>	$2.55 \pm 0.15$	<b>c1</b>	$0.80 \pm 0.10$	<b>c2</b>	$0.80 \pm 0.10$
<b>c3</b>	$1.50 \pm 0.10$	<b>e1</b>	$0.30 \pm 0.10$	<b>e2</b>	$0.30 \pm 0.10$
<b>e3</b>	$1.00 \pm 0.10$	<b>e4</b>	$1.00 \pm 0.10$		

## Pin Configurations



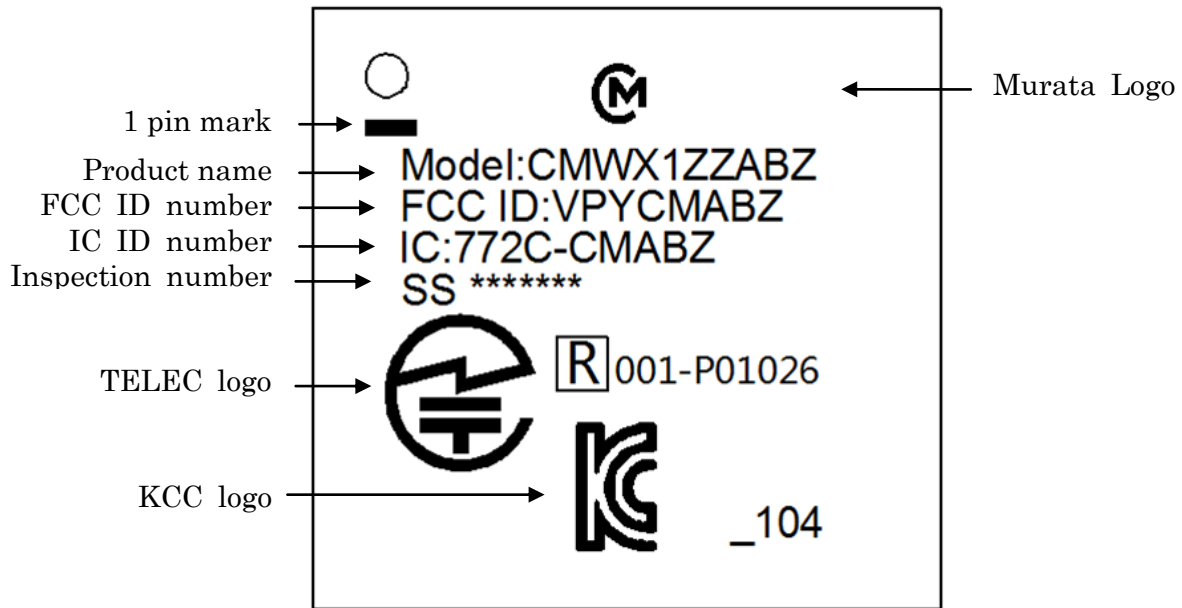
**Table 2** Terminal Description

Pin NO.	Terminal Name	Type	Description
1	PA12/USB_DP	O	TCXO power supply output. Must be externally connected to pin 48.
2	PA11/USB_DM	I/O	
3	GND	Ground	Ground
4	VDD_USB	Power	Power supply for TCXO (pin 1)
5	VDD_MCU	Power	Power supply for MCU
6	VDD_RF	Power	Power supply for RF section
7	GND	Ground	Ground
8	DBG_SX1276_DIO2	-	No Connect. Internal use
9	DBG_SX1276_DIO3	-	No Connect. Internal use
10	DBG_SX1276_DIO4	-	No Connect. Internal use
11	DBG_SX1276_DIO5	-	No Connect. Internal use
12	DBG_SX1276_DIO1	-	No Connect. Internal use
13	DBG_SX1276_DIO0	-	No Connect. Internal use
14	PB15/SPI2_MOSI	I/O	No Connect
15	PB14/SPI2_MISO	I/O	No Connect
16	PB13/SPI2_SCK	I/O	No Connect
17	PB12/SPI2_NSS	I/O	No Connect
18	PA10/USART1_RX	I	UART RX (Serial Interface: host-to-modem)
19	PA9/USART1_TX	O	UART TX (Serial Interface: modem-to-host)
20	PA8/MCO	O	BUSY signaling line.
21	PA5/ADC5/DAC2	O	Diagnostics LED (optional). Active high, connect to LED with appropriate in-
22	PA4/ADC4/DAC1	I/O	No Connect
23	PA3/ADC3	I	Internal Use. Debug UART_RX
24	PA2/ADC2	O	Internal Use. Debug UART_TX

25	GND	Ground	Ground
26	ANT	I/O	Transmit / Receive antenna port
27	GND	Ground	Ground
28	DBG_CRF1	-	No Connect. Internal use
29	DBG_CRF3	-	No Connect. Internal use
30	DBG_CRF2	-	No Connect. Internal use
31	STSAFE_nRST	I	No Connect. Internal use
32	VREF+	Power	Reference voltage for MCU ADC section. Must be externally connected to VD
33	PA0/WKUP1	I/O	No Connect
34	MCU_nRST	I	MCU reset pin. Has internal pull-up and may be left floating.
35	PB8/I2C1_SCL	I	COMMAND signaling line.
36	PB9/I2C1_SDA	O	EVENT signaling line.
37	PB2/LPTIM1_OUT	O	Host MCU reset line. Active low, Z (high impedance) when inactive.
38	PB7/LPTIM1_IN2	I/O	No Connect
39	PB6/LPTIM1_ETR	I/O	No Connect
40	PB5/LPTIM1_IN1	I/O	No Connect
41	PA13/SWDIO	I/O	Internal Use. Programming SWDIO.
42	PA14/SWCLK	I/O	Internal Use. Programming SWCLK.
43	BOOT0	I	No Connect. Internal use
44	GND	Ground	Ground
45	PH1-OSC_OUT	I/O	No Connect
46	PH0-OSC_IN	I/O	No Connect
47	TCXO_OUT	O	TCXO output
48	VDD_TCXO	Power	TCXO power supply input. Externally connect to pin 1.
49~57	GND	Ground	Ground

Notes: GPIO pins are to be left OPEN if not used.

## 6. Label Information





## 7. Absolute Maximum Ratings

**Table 3** Maximum ratings

Parameters		Min	Typ	Max	Unit
Storage Temperature		-40	25	+90	°C
Input RF Level		-	-	10	dBm
Supply Voltage	VDD_USB	-0.3	-	3.9	V
	VDD_MCU, VDD_RF, VDD_TCXO	-0.3	-	3.9	V
	VREF+	-0.3	-	VDD_MCU+0.4	V

## 8. Operating Condition

**Table 4** Operating specification

Parameters		Min	Typ	Max	Unit
Operating Temperature		-40	25	+85	°C
Supply Voltage	VDD_USB (USB peripheral used) <sup>(1)</sup>	3.0	-	3.6	V
	VDD_USB(USB peripheral not used) <sup>(1)</sup>	VDD_MCU_min	VDD_MCU	VDD_MCU_max	V
	VDD_MCU, VDD_RF, VDD_TCXO	2.2 <sup>(3)</sup>	-	3.6	V
	VREF+ <sup>(2)</sup>	1.8	-	VDD_MCU	V

(1) VDD\_USB must respect the following conditions:

- When VDD\_MCU is powered on (VDD\_MCU < VDD\_MCU\_min), VDD\_USB should be always lower than VDD\_MCU.
- When VDD\_MCU is powered down (VDD\_MCU < VDD\_MCU\_min), VDD\_USB should be always lower than VDD\_MCU.
- In operating mode, VDD\_USB could be lower or higher than VDD\_MCU.
- If the USB is not used, VDD\_USB must be tied to VDD\_MCU to be able to use PA11 and PA12 as standard I/Os.

(2) VREF+ is used to ensure a better accuracy on low-voltage inputs and outputs of ADC and DAC. Detailed information is on the STM32L072\*\*\* datasheet and user guider.

(3) When module is on +20dBm operation, the supply of the voltage should be set from 2.4V to 3.6V.

## 9. Electrical Characteristics

### 8.1 FSK/OOK Transceiver Specification

Conditions:

Supply voltage VDD=3.3 V, temperature = 25 °C, FXOSC = 32 MHz, FRF =868/915 MHz , 2-level FSK modulation without pre-filtering, FDA = 5 kHz, Bit Rate = 4.8 kb/s and terminated in a matched 50 Ohm impedance, shared Rx and TX path matching, unless otherwise specified.

### FSK/OOK Receiver Specification

Symbol	Description	Conditions	Min	Typ	Max	Unit
RFS_F_HF	LnaBoost is turned on	FDA = 5 kHz, BR = 4.8 kb/s		-117.5		dBm

### FSK/OOK Transmitter Specification

Symbol	Description	Conditions	Min	Typ	Max	Unit
RF_OP	RF output power in 50 ohms on RFO pin ( High efficiency PA)	Programmable with steps	Max	14		dBm
			Min	-5		dBm
RF_OPH	RF output power in 50 ohms on PA_BOOST pin( Regulated PA)	Programmable with 1dB steps	Max	18.5		dBm
			Min	2		dBm
ΔRF_OPH_V	RF output power stability on PA_BOOST pin versus voltage supply.	VDD = 2.2 V to 3.6 V		+/-1		dB
ΔRF_T	RF output power stability versus temperature on PA_BOOST pin.	From T = -40 °C to +85 °C		+/-1.5		dB
IDDT	Supply current in Transmit mode with impedance matching	RFOP setting = 20 dBm, on PA_BOOST		125		mA
		RFOP setting = 17 dBm, on PA_BOOST		101		mA

		RFOP setting = 14 dBm, on RFO_HF pin		46		mA
		RFOP setting = 7 dBm, on RFO_HF pin		34		mA

## 8.2 LoRa Transceiver Specification

Conditions:

The table below gives the electrical specifications for the transceiver operating with LoRa™ modulation. Following conditions apply unless otherwise specified: Supply voltage = 3.3 V, Temperature = 25° C, FXOSC = 32 MHz, Error Correction Code (EC) = 4/5, Packet Error Rate (PER)= 1%, CRC on payload enabled, Payload length = 10 bytes. With matched impedances

### LoRa Receiver Specification

Symbol	Description	Conditions	Min	Typ	Max	Unit
IDDR_L	Current in receiver	868 band		12.5		mA
		915 band		14.5		mA
RFS_L125_HF	RF sensitivity, Long-Range Mode, LnaBoost for Band1, using split Rx/Tx path 125 kHz bandwidth	SF = 7		-122.5		dBm
		SF = 8		-125.5		dBm
		SF = 9		-128.5		dBm
		SF = 10		-131.0		dBm
		SF = 11		-133.5		dBm
		SF = 12		-135.5		dBm
RFS_L250_HF	RF sensitivity, Long-Range Mode, LnaBoost for Band1, using split Rx/Tx path 250 kHz bandwidth	SF = 7		-119.0		dBm
		SF = 8		-122.0		dBm
		SF = 9		-125.0		dBm
		SF = 10		-127.5		dBm
		SF = 11		-130.0		dBm
		SF = 12		-133.0		dBm

### LoRa Transmitter Specification

Symbol	Description	Conditions	Min	Typ	Max	Unit
IDDT_L	Supply current in transmitter mode	RFOP setting = 14 dBm		36		mA
		RFOP setting = 10 dBm		27.5		mA
IDDT_H_L	Supply current in transmitter mode	Using PA_BOOST pin RFOP setting = 20 dBm		118		mA

## 8.3 Low power mode current

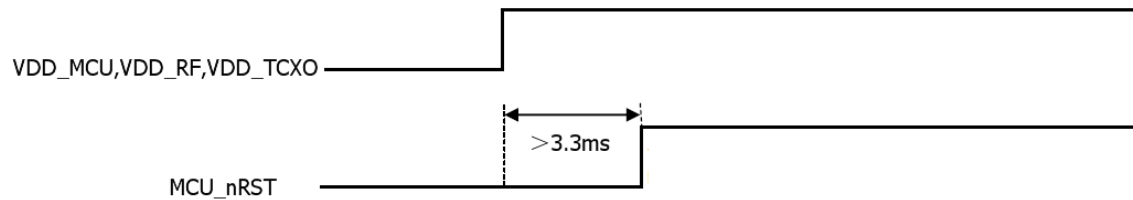
Conditions:

Power supply: 3.3V, Temp: Room,

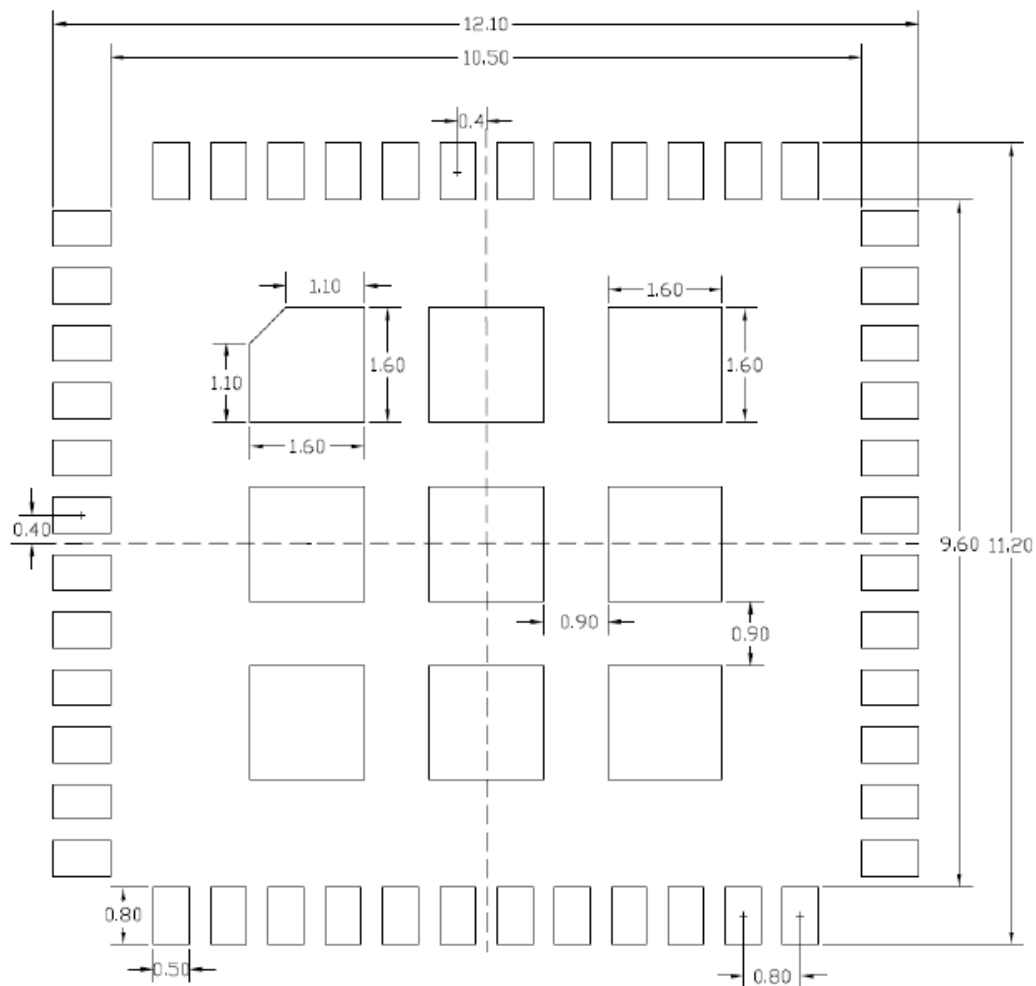
Description	Min	Typ	Max	Unit
STM32L0 in stop mode with RTC (Real Time Clock)		1.65		uA
SX1276 in sleep mode				

## **10. Power Sequences**

### **9.1 Power Up Sequence**



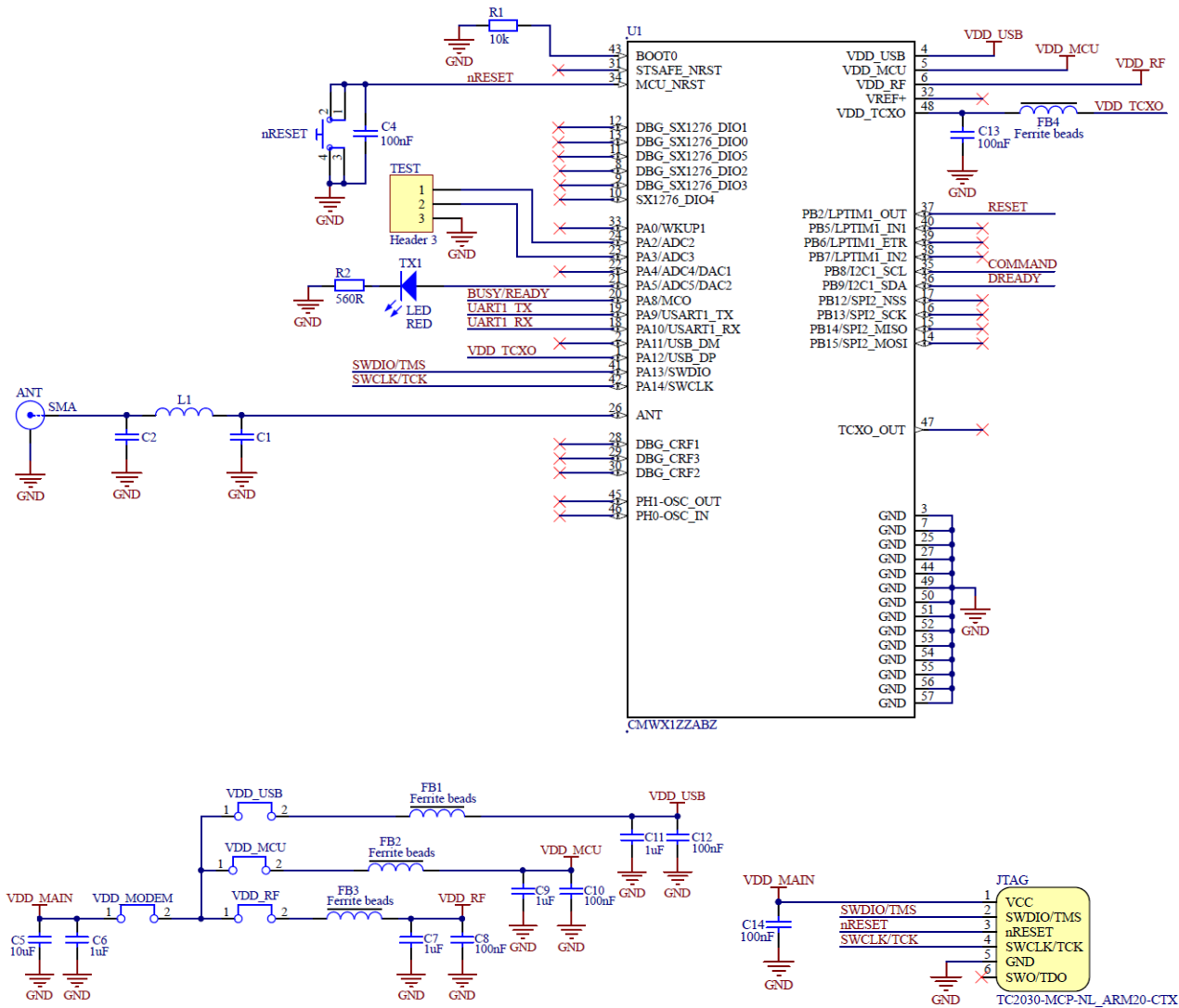
## **11. Recommend Land Pattern**



NOTES:

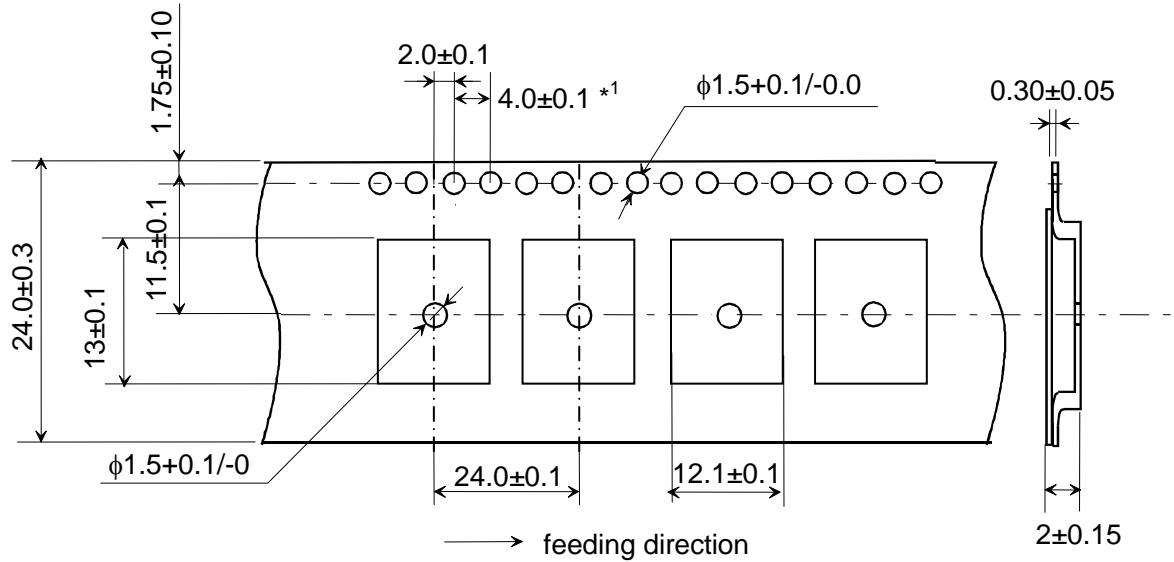
1. CONTROLLING DIMENSIONS ARE IN MILLIMETERS (ANGLES IN DEGREES).
2. THIS LAND PATTERN IS FOR REFERENCE PURPOSE ONLY.  
CONSULT YOUR MANUFACTURING GROUP TO ENSURE YOUR COMPANY'S  
MANUFACTURING GUIDELINES ARE MET.
3. THERMAL VIAS IN THE LAND PATTERN OF THE EXPOSED PAD SHALL BE CONNECTED  
TO A SYSTEM GROUND PLANE. FAILURE TO DO SO MAY COMPROMISE THE THERMAL  
AND/OR FUNCTIONAL PERFORMANCE OF THE DEVICE.
4. SQUARE PACKAGE-DIMENSIOND APPLY IN BOTH "X" AND "Y" DIRECTIONS.

## 12. Reference Circuit



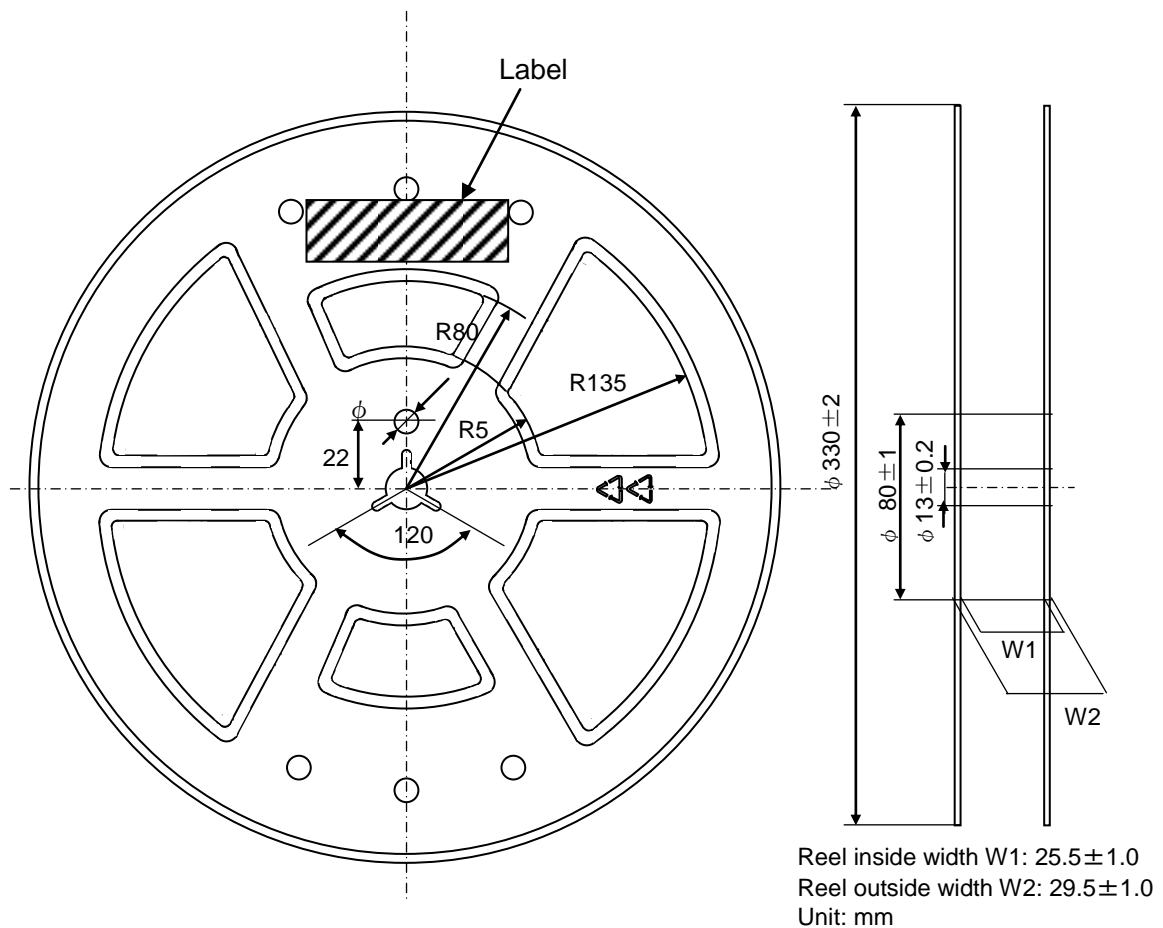
### 13. Tape and Reel packing

#### 12.1 Dimension of Tape (Plastic tape)



(unit : mm)

#### 12.2 Dimensions of Reel



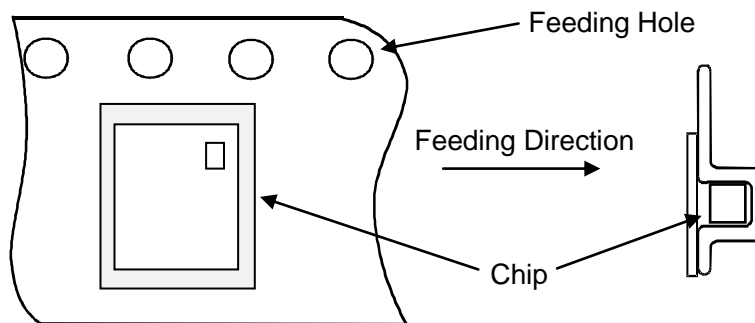
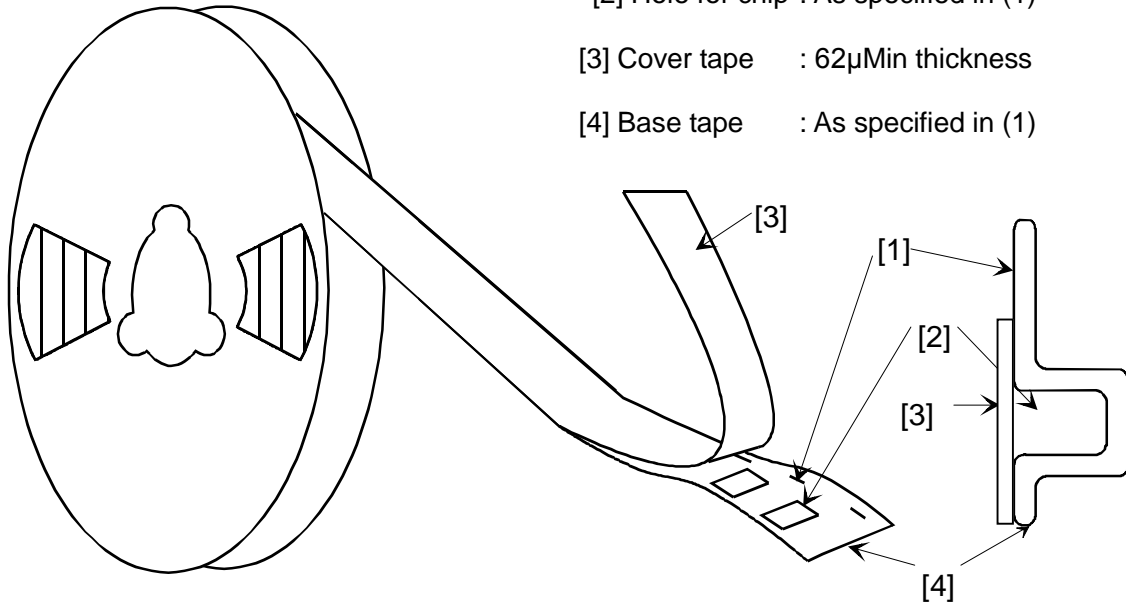
### 12.3 Taping Diagrams

[1] Feeding Hole : As specified in (1)

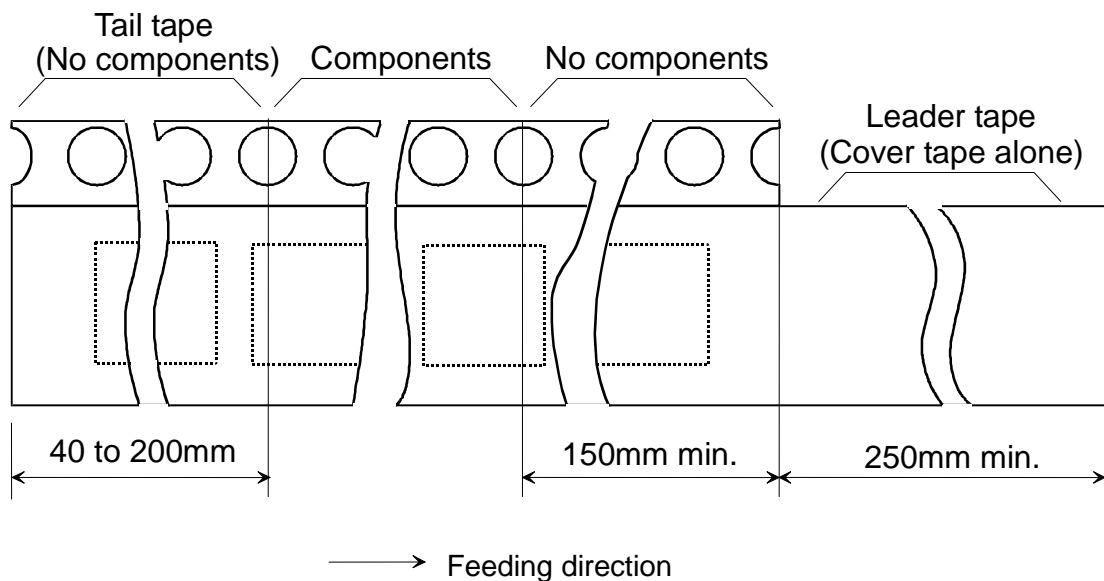
[2] Hole for chip : As specified in (1)

[3] Cover tape : 62μm thickness

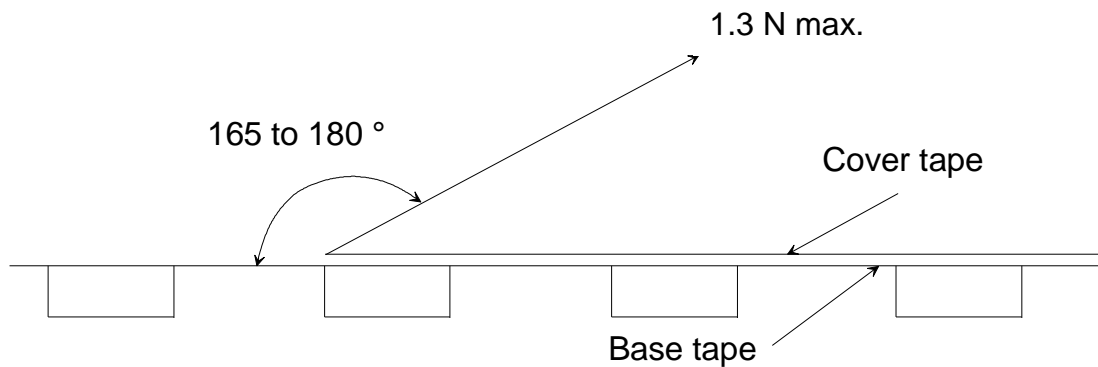
[4] Base tape : As specified in (1)



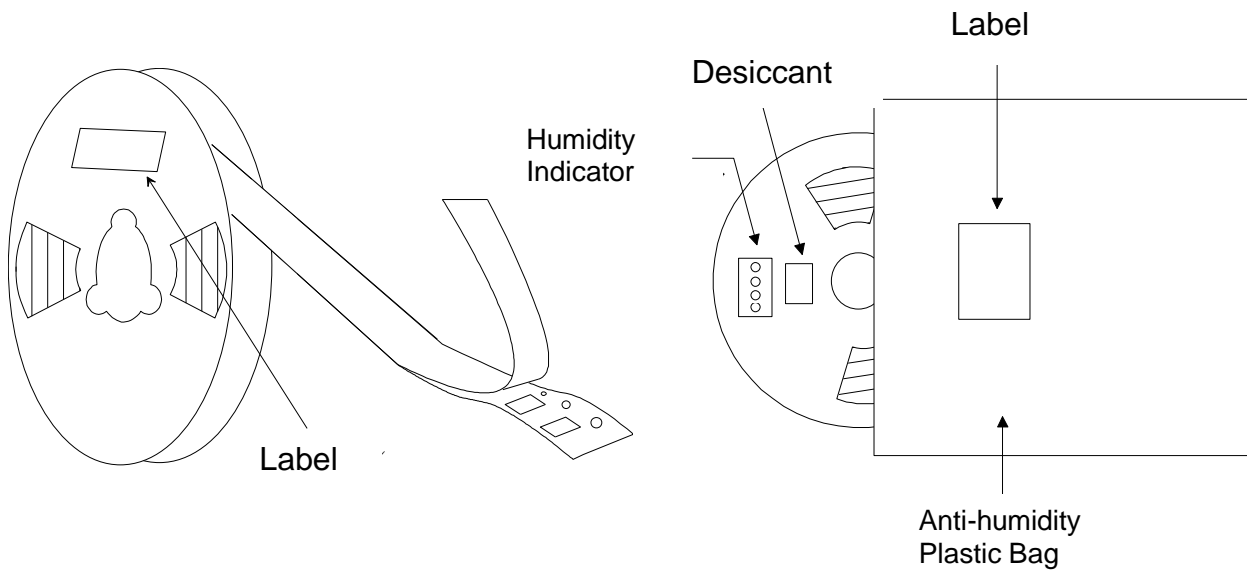
### 12.4 Leader and Tail tape



- 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 : 1000 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 (Humidityproof Packing)



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



## **14. Notice**

### **13.1 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 35 °C and humidity from 20 ~ 70 %RH.

(Packing materials, in particular, may be deformed at the temperature over 40 °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<sub>2</sub>, NH<sub>3</sub>, SO<sub>2</sub>, Nox, 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 IPC/JEDEC J-STD-020)

- After the packing opened, the product shall be stored at <30 °C / <60 %RH and the product shall be used within 168 hours.

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

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

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

### **13.2 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 solderability.

### **13.3 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.

### **13.4 Notice for Chip Placer :**

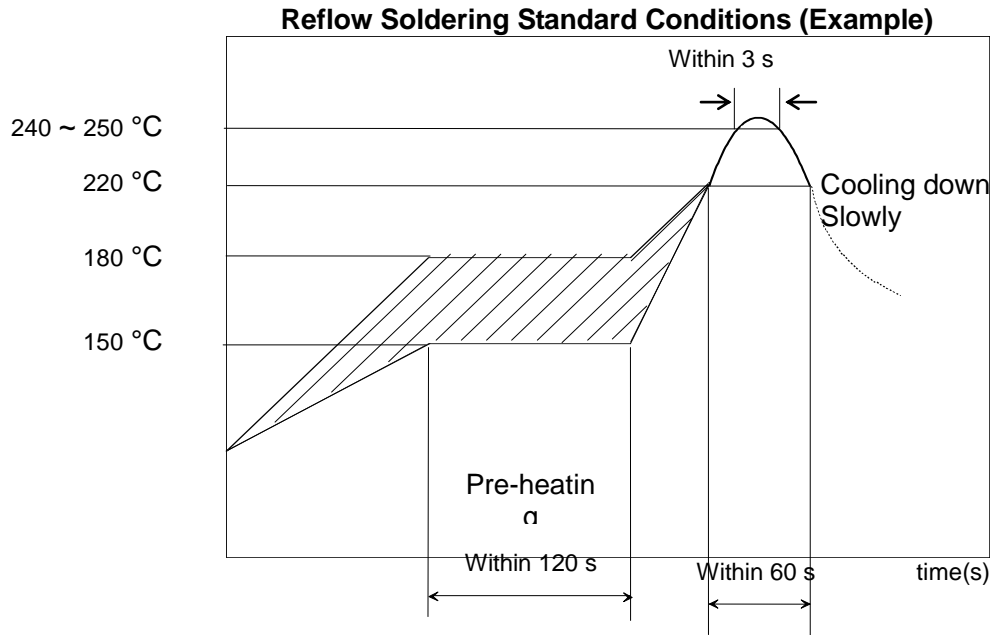
When placing products on the PCB, products may be stressed and broken by uneven forces from a worn-out chucking locating claw or a suction nozzle. To prevent products from damages, be sure to follow the specifications for the maintenance of the chip placer being used. For the positioning of products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

### **13.5 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.



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.

### 13.6 Cleaning :

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

### 13.7 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 (  $\text{Cl}_2$ ,  $\text{NH}_3$ ,  $\text{SO}_x$ ,  $\text{NO}_x$  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.

### 13.8 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.



## CAUTION

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.

Customer acknowledges that Murata will, if requested by you, conduct a failure analysis for defect or alleged defect of Products only at the level required for consumer grade Products, and thus such analysis may not always be available or be in accordance with your request (for example, in cases where the defect was caused by components in Products supplied to Murata from a third party).

By signing on specification sheet or approval sheet, you acknowledge that you are the legal representative for your company and that you understand and accept the validity of the contents herein. When you are not able to return the signed version of specification sheet or approval sheet within 90 days from receiving date of specification sheet or approval sheet, it shall be deemed to be your consent

on the content of specification sheet or approval sheet.

Customer acknowledges that engineering samples may deviate from specifications and may contain defects due to their development status.

We reject any liability or product warranty for engineering samples.

In particular we disclaim liability for damages caused by

- the use of the engineering sample other than for evaluation purposes, particularly the installation or integration in the product to be sold by you,
- deviation or lapse in function of engineering sample,
- improper use of engineering samples.

We disclaims any liability for consequential and incidental damages.

If you can't agree the above contents, you should inquire our sales.