LoRaWAN Modem Module Data Sheet

MP Part Number: **CMWX1ZZABZ-093**

Revision History

Revision Code	Date	Description	Comments
A	Dec 20, 2016	Initial Draft	
B	Feb 23, 2017	Updated pin description according to MuRata LoRa modem command specification v0.5	
C	July 3, 2017	Added reference circuit	
D	Sep 29, 2017	Updated reference circuit	
E	Nov 23, 2017	Updated Electrical Characteristics and reference circuit	

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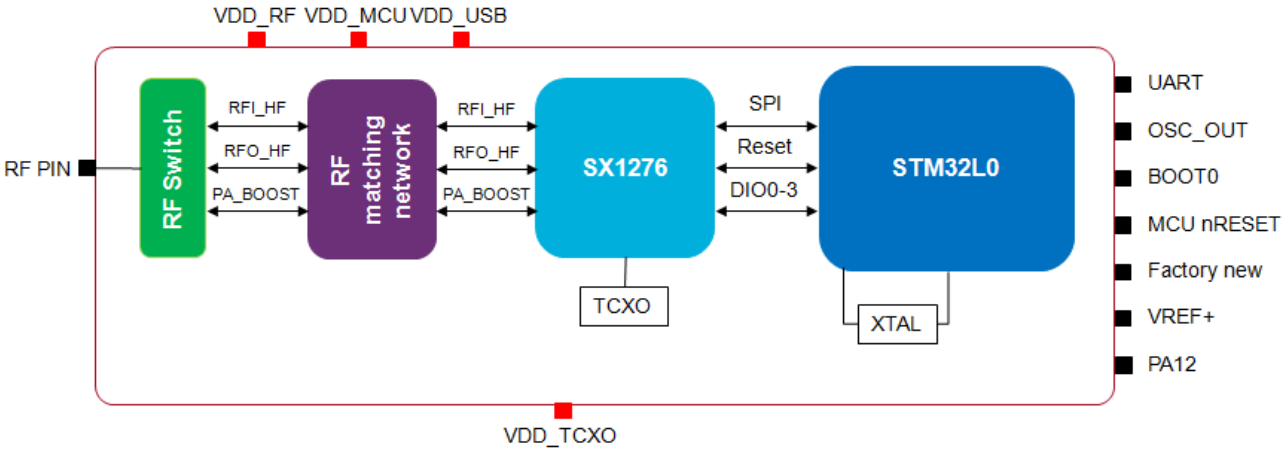
1. Features

Interfaces	: UART
Main ICs	: STM32L, SX1276
Reference Clocks	: Integrated 32MHz clock (TCXO with frequency error=±2 ppm) and 32.768KHz clock (frequency error=±20 ppm)
Supported Frequencies	: 868 MHz, 915 MHz
Module Size	: 12.5 mm x 11.6 mm x 1.76 mm (Max.)
Weight	: 0.48g (Typ.)
Package	: Metal Shield can
RoHS	: This module is compliant with the RoHS directive

2. Part Number

Ordering Part Number	Description
B-L072Z-LRWAN1	Evaluation board (owned by ST)
CMWX1ZZABZ-**093**	MP P/N

3. Block Diagram

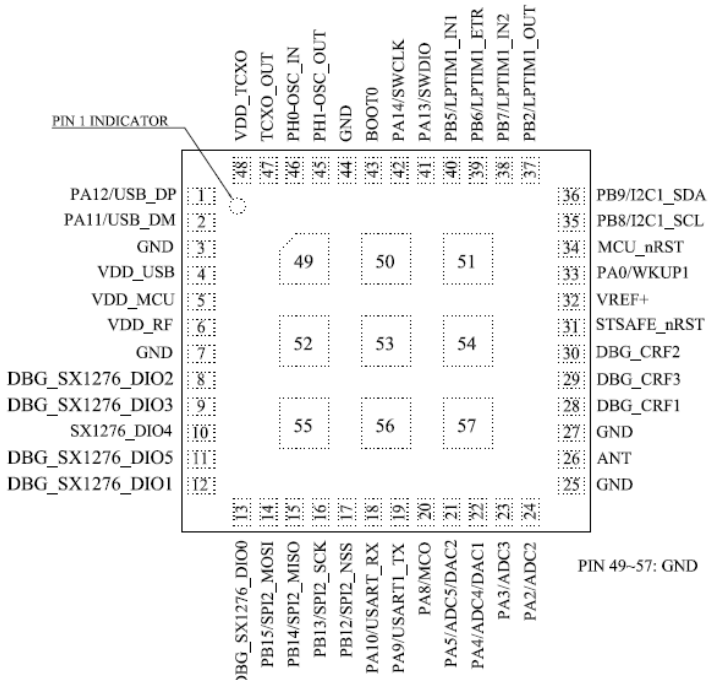


4. Dimensions, Marking and Terminal Configurations

Full datasheet with Terminal dimensions is available in my Murata. Check https://my.murata.com under the “LoRa/Sigfox Module, Type ABZ LoRa Support Site”.

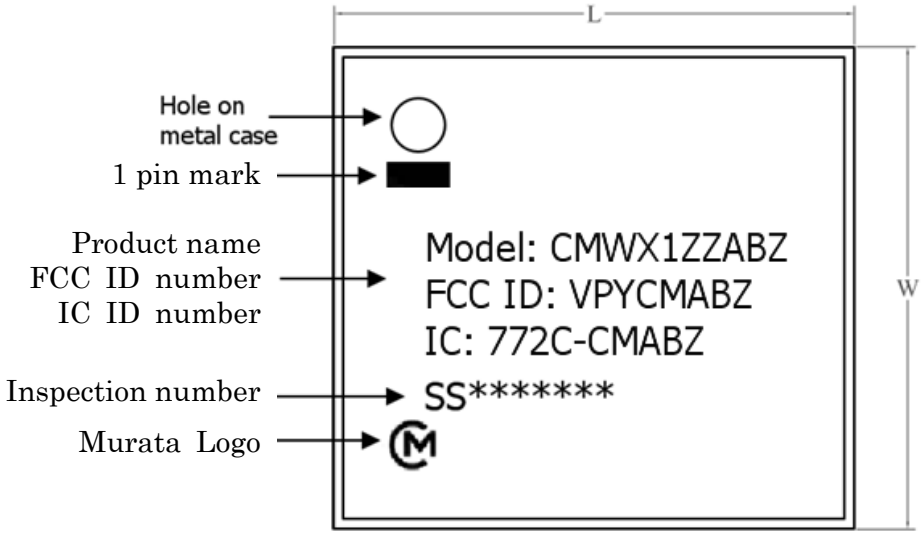
Terminal Configurations

< Top View >



22	PA4/ADC4/DAC1	I/O	STM32L072_PA4	Unused
23	PA3/ADC3	I/O	STM32L072_PA3	UART_RX for AT command interface
24	PA2/ADC2	I/O	STM32L072_PA2	UART_TX for AT command interface
25	GND	Ground	-	Ground
26	ANT	A,I/O	-	Transmit / Receive antenna
27	GND	Ground	-	Ground
28	DBG_CRF1	I/O	STM32L072_PA1	Unused
29	DBG_CRF3	I/O	STM32L072_PC1	Unused
30	DBG_CRF2	I/O	STM32L072_PC2	Unused
31	STSAFE_nRST	I	-	Unused
32	VREF+	Power	-	Reference Voltage for ADC and DAC
33	PA0/WKUP1	I/O	STM32L072_PA0	Input for bootloader mode. In normal work mode, this pin should be pulled up. If this pin is pulled down during power on, the module will enter bootloader mode.
34	MCU_nRST	I	STM32L072_ nRST	nRST
35	PB8/I2C1_SCL	I/O	STM32L072 PB8	Unused

5. Label Information



6. Absolute Maximum Ratings

Table 3 Maximum ratings

Parameters		Min	Typ	Max	Unit
Storage Temperature		-40	25	+90	degC
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	-	V_{DD_MCU}+0.4	V

7. Operating Condition

Table 4 Operating specification

Parameters		Min	Typ	Max	Unit
Operating Temperature		-40	25	+85	degC
Supply Voltage	VDD_USB (USB peripheral used) (1)	3.0	-	3.6	V
	VDD_USB(USB peripheral not used) (1)	$V_{DD\_MCU\_min}$	V_{DD_MCU}	$V_{DD\_MCU\_max}$	V
	VDD_MCU,VDD_RF,VDD_TCXO	2.2(3)	-	3.6	V
	VREF+(2)	1.8	-	V_{DD_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.

8. 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 LoRaTM 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

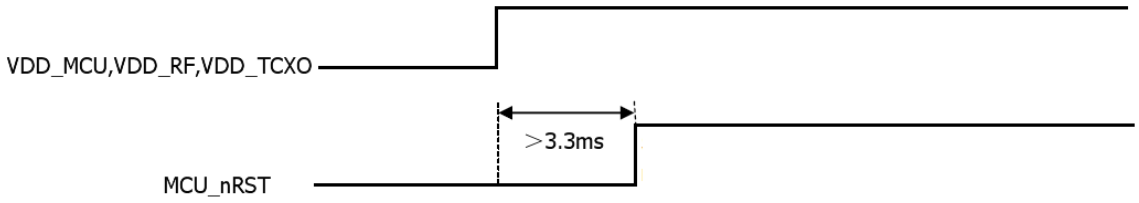
Conditions:

Power supply: 3.3V, Temp: Room,

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

9. Power Sequences

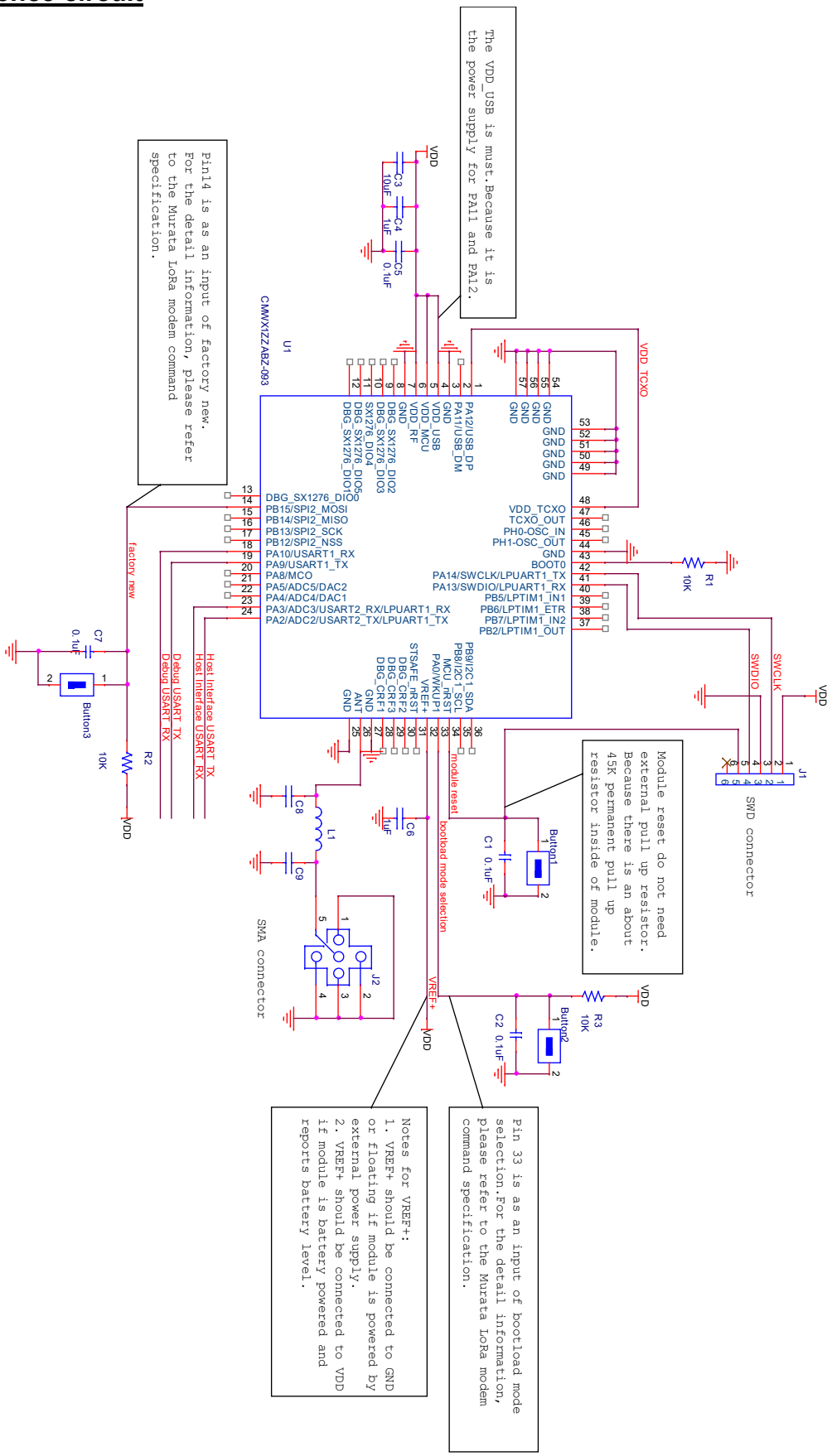
9.1 Power Up Sequence



10. Recommend Land Pattern

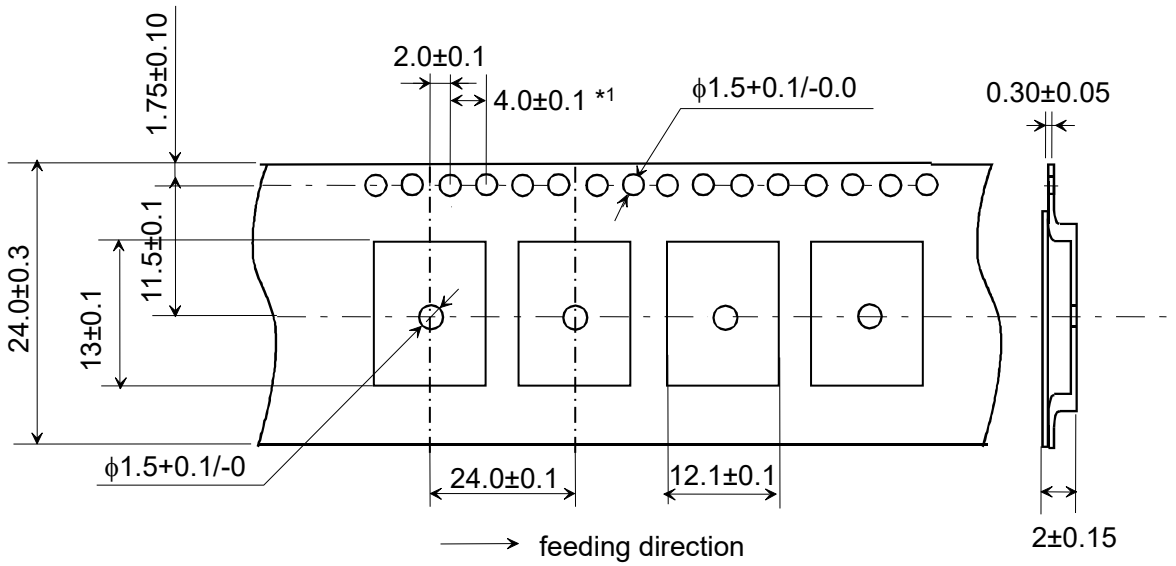
Full datasheet with recommended land pattern is available in my Murata. Check https://my.murata.com under the "LoRa/Sigfox Module, Type ABZ LoRa Support Site".

11. Reference circuit



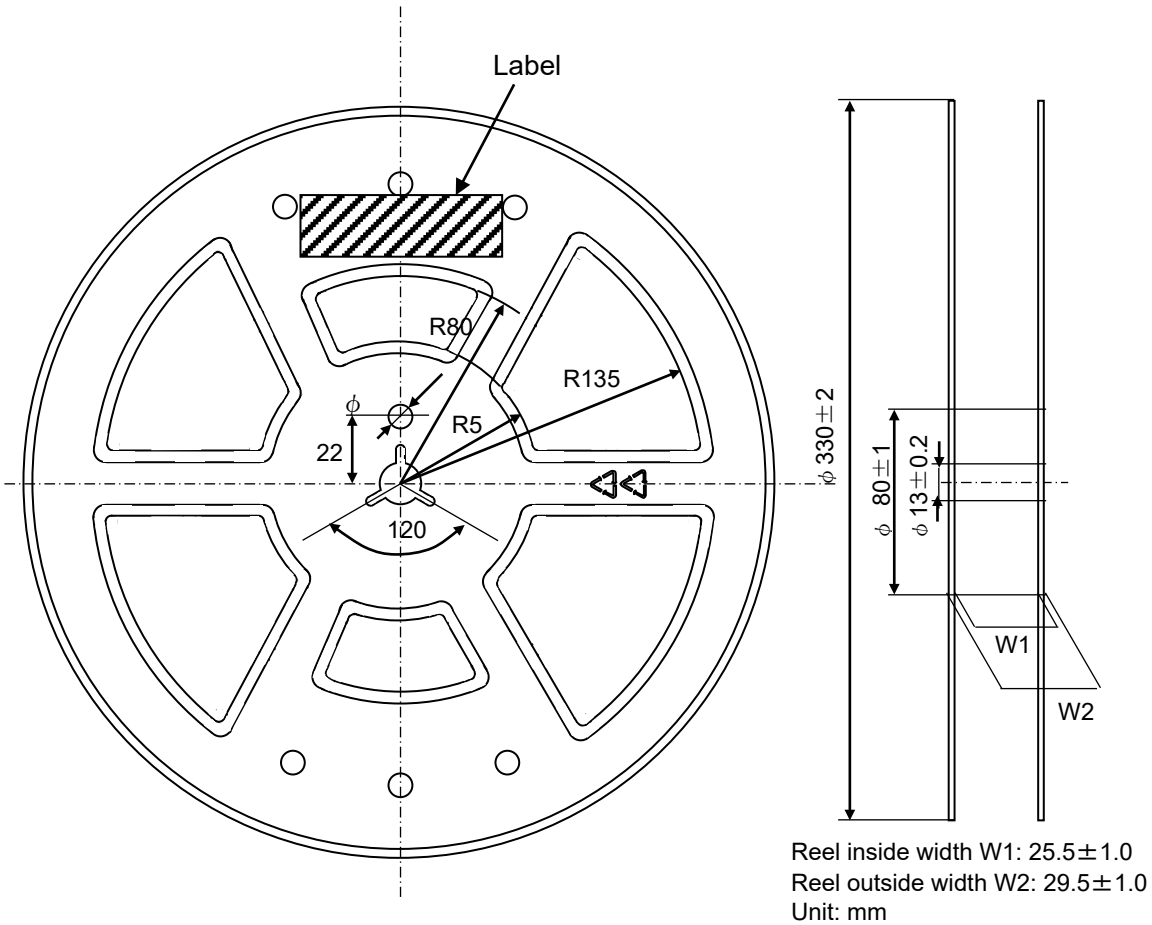
12. Tape and Reel packing

12.1 Dimension of Tape (Plastic tape)



(unit : mm)

12.2 Dimensions of Reel



Reel inside width W1: 25.5±1.0
Reel outside width W2: 29.5±1.0
Unit: mm

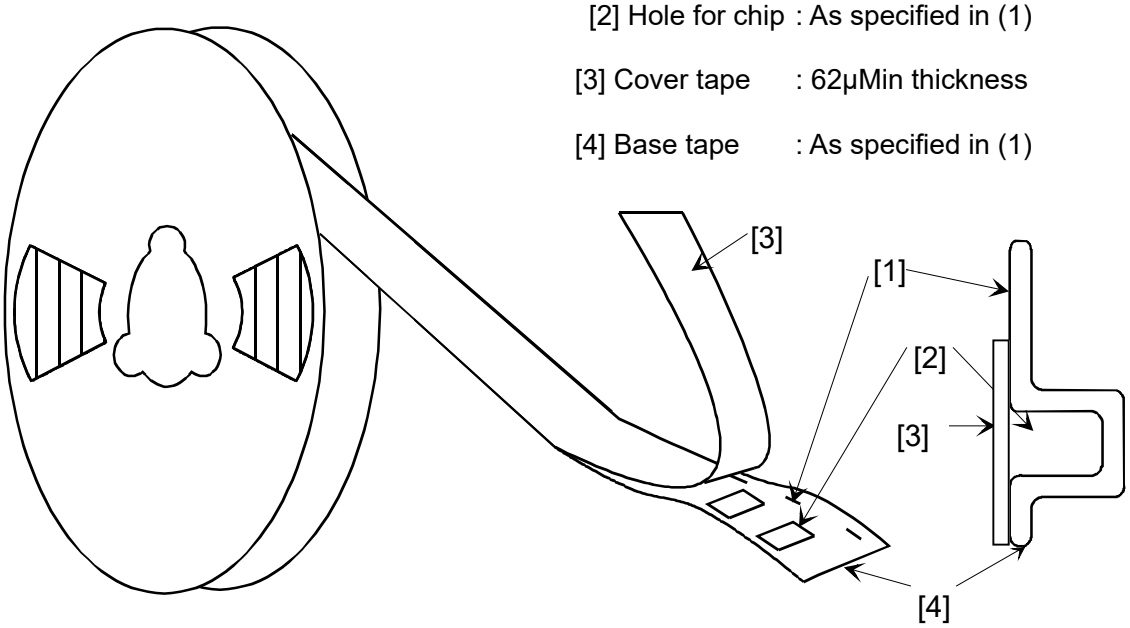
12.3 Taping Diagrams

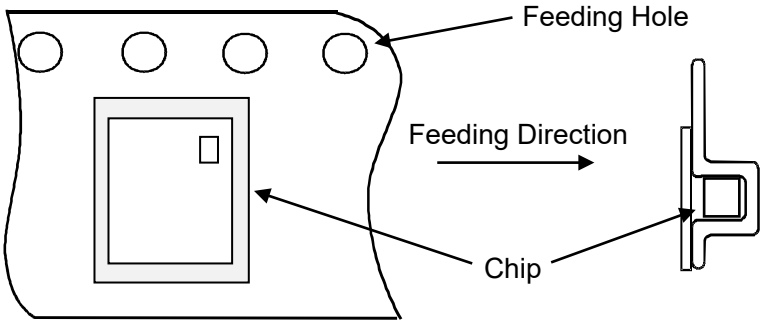
[1] Feeding Hole : As specified in (1)

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

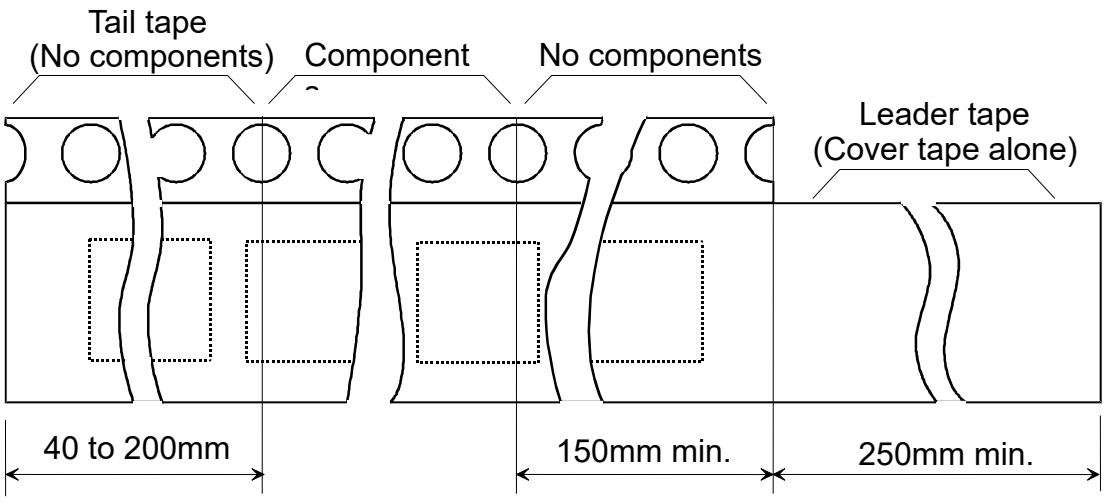
[3] Cover tape : 62μMin thickness

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



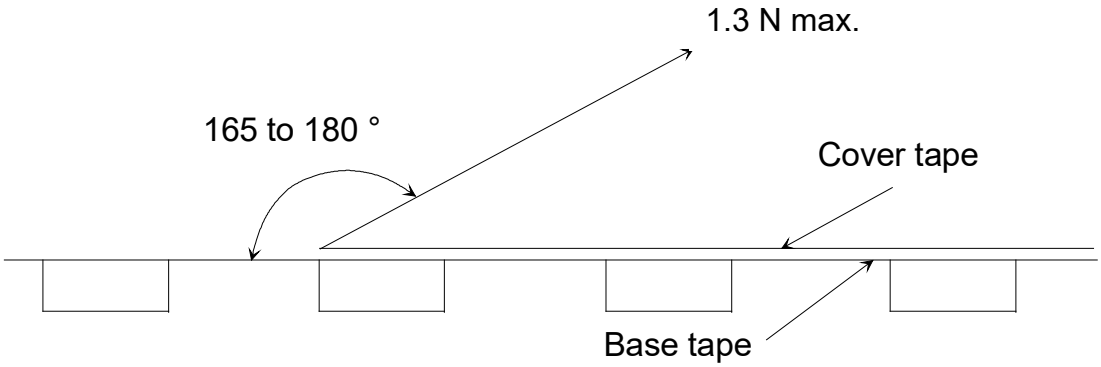


12.4 Leader and Tail tape

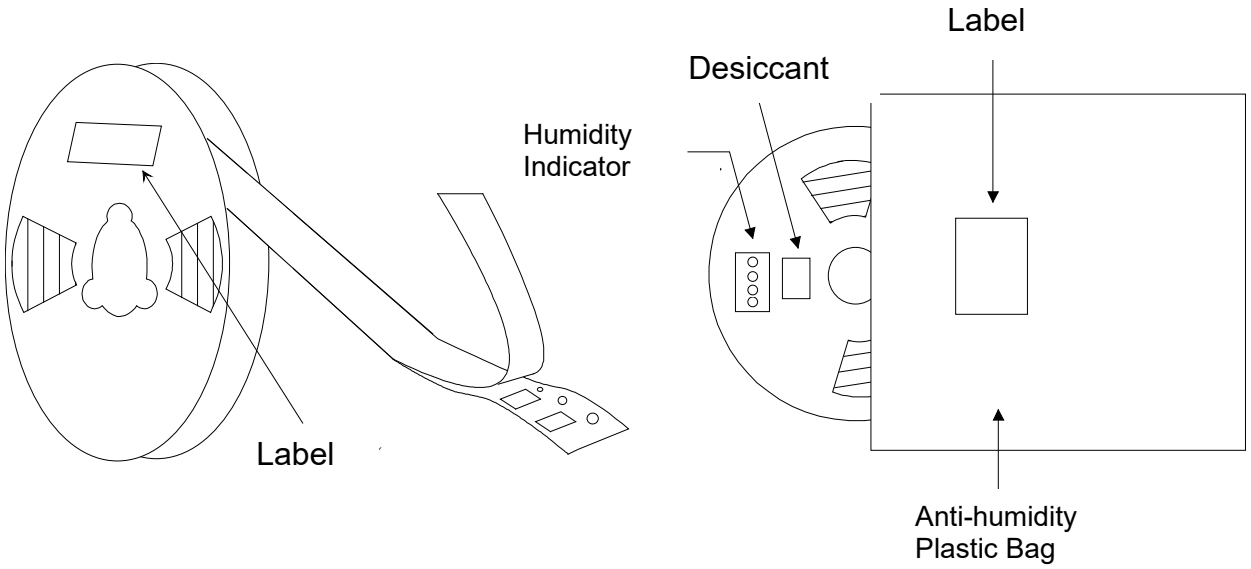


Feeding direction

- 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-humidiTyplastic bag. The bag contains the desiccant and the humidity indicator.

13. 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 (Cl2, NH3, SO2, 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 :

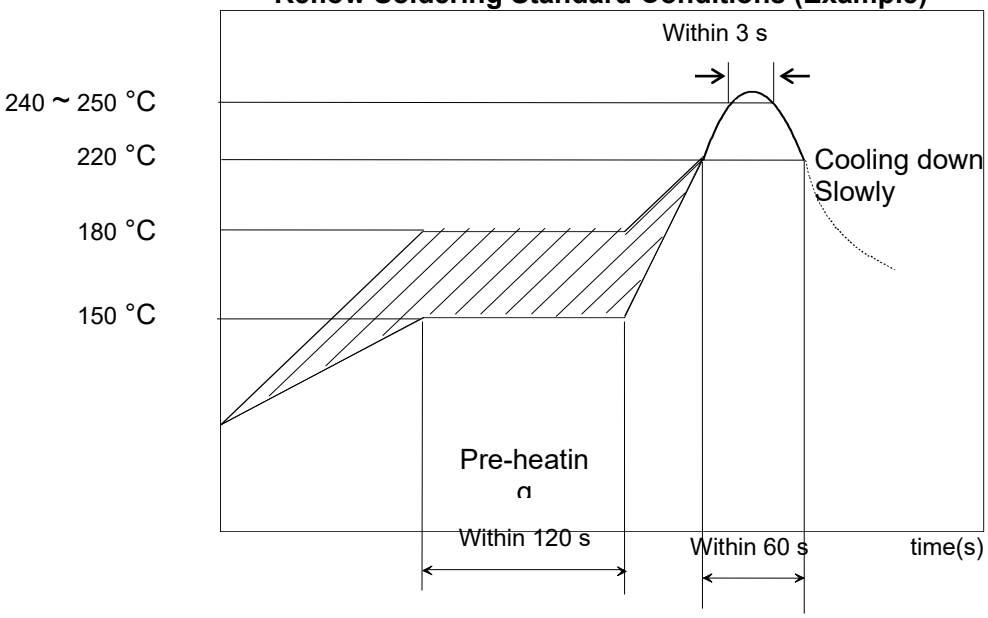
When placing products on the PCB, products may be stressed and broken by uneven forces from a worn-out chucking locating claw or a suction nozzle. To prevent products from damages, be sure to follow the specifications for the maintenance of the chip placer being used. For the positioning of products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

Reflow Soldering Standard Conditions (Example)



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 (Cl2, NH3, SOx, NOx etc.).
- In an atmosphere containing combustible and volatile gases.
- DusTyplace.
- 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.

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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.

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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.

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・deviation or lapse in function of engineering sample,
・improper use of engineering samples.
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