Sub-G Module Data Sheet

Sample Part Number: **CMWX1ZZABZ-TEMP**
CMWX1ZZABZ-TEMP-1
MP Part Number: **CMWX1ZZABZ-078**
CMWX1ZZABZ-091

Revision History

Revision Code	Date	Description	Comments
A	Dec 1, 2016	Initial Draft	
B	Jan 19, 2017	Revise template	
C	Oct 16, 2018	Updated the RF performance, Electrical Characteristics and power up sequence. Added weight info. Updated P/N Revised label info	

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1. Features

|	
Interfaces	: I2C, UART, USB, SPI
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	MCU	Secure element	Description
CMWX1ZZABZ-TEMP	STM32L082	NA	Engineering sample
CMWX1ZZABZ-EVK	STM32L082	NA	Evaluation board
CMWX1ZZABZ-078	STM32L082	NA	MP P/N
CMWX1ZZABZ-TEMP-1	STM32L072	NA	Engineering sample
CMWX1ZZABZ-EVK-1	STM32L072	NA	Evaluation board
CMWX1ZZABZ-091	STM32L072	NA	MP P/N

3. Block Diagram

4. Label Information

1 pin mark →	▬
Product name →	Model:CMWX1ZZABZ
FCC ID number →	FCC ID:VPYCMABZ
IC ID number →	IC:772C-CMABZ
Inspection number →	SS *******
TELEC logo →	⊖ Ⓡ001-P01026
KCC logo →	KC
Murata Logo →	Ⓜ
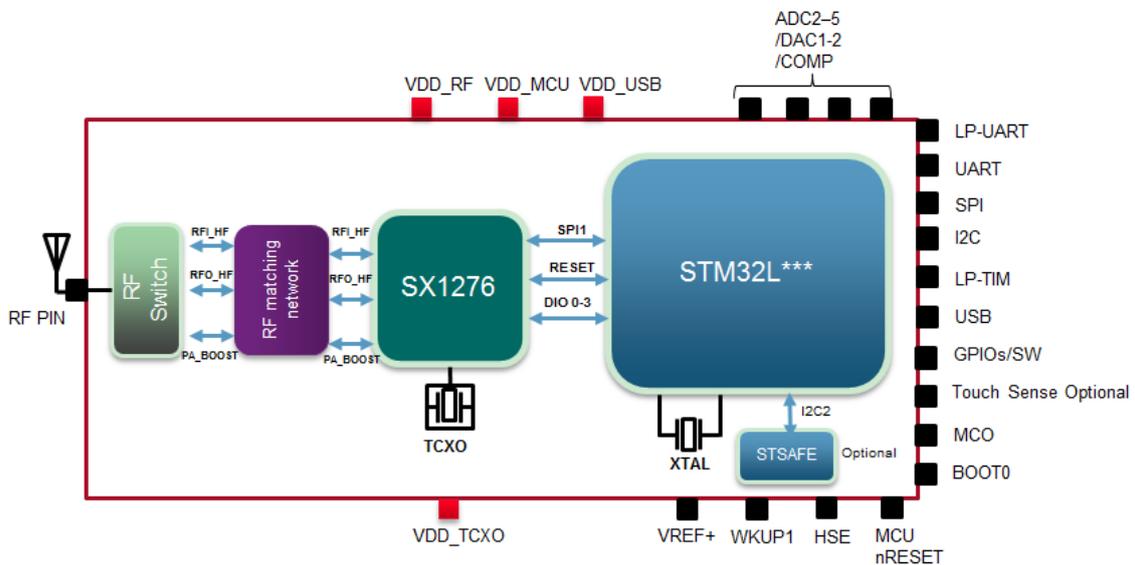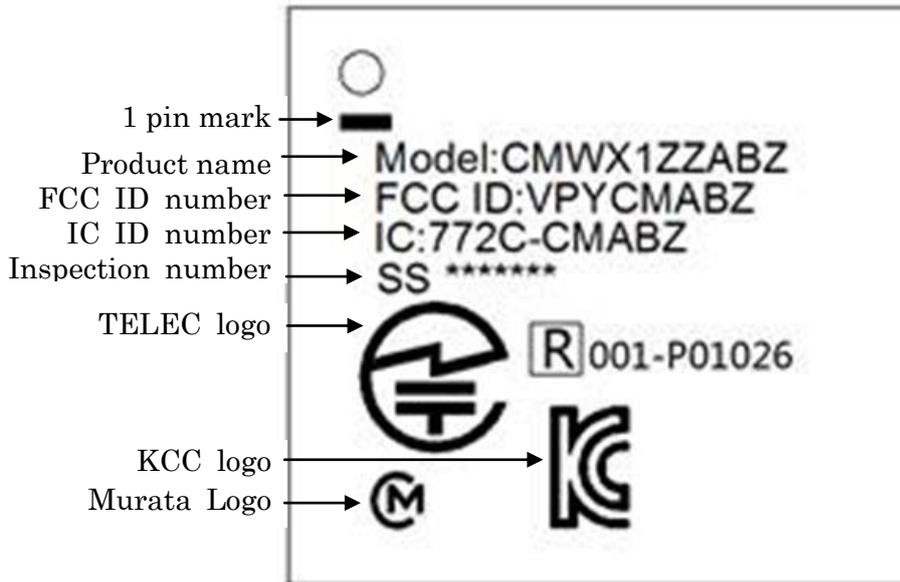
5. Absolute Maximum Ratings

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

6. 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 STM32L082*** 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.

7. Electrical Characteristics
7.1. 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
IDDR (*)	Supply current in Receive mode	LnaBoost Off, band 1		22		mA
		LnaBoost On, band 1		23		mA

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 = +20 dBm, on PA_BOOST			128		mA
		RFOP = +17 dBm, on PA_BOOST			106		mA
		RFOP = +14 dBm, on RFO_HF pin			47		mA
		RFOP = + 7 dBm, on RFO_HF pin			34		mA

(*) IDDR and IDDT are total current consumption including MCU in active.

7.2. 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 (*)	Supply current in receiver LoRa mode, LnaBoost off	Band 1, BW = 125 kHz		21.5		mA
		Band 1, BW = 250 kHz		22.2		mA
		Band 1, BW = 500 kHz		23.6		mA
RFS_L125_HF	RF sensitivity, Long-Range Mode, highest LNA gain, LnaBoost for Band1, using split Rx/Tx path 125 kHz bandwidth	SF = 6		-117.5		dBm
		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, highest LNA gain, LnaBoost for Band1, using split Rx/Tx path	SF = 6		-114.0		dBm
		SF = 7		-119.0		dBm
		SF = 8		-122.0		dBm
		SF = 9		-125.0		dBm

		SF = 10		-127.5		dBm
250 kHz bandwidth		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		47		mA
		RFOP setting = 10 dBm		36		mA
IDDT_H_L (*)	Supply current in transmitter mode	Using PA_BOOST pin RFOP setting = 20 dBm		128		mA

(*) IDDR_L, IDDT_L and IDDT_H_L are total current consumption including MCU in active.

7.3. SIGFOX Transceiver Specification

Conditions:
The table below gives the electrical specifications for the transceiver operating with SIGFOX modulation. Following conditions apply unless otherwise specified: Supply voltage = 3.3 V, Temperature = 25° C. With matched impedances.

Notes: To operate as SIGFOX mode, the following configuration is required.
- TCXO_OUT (Pin 47) must be connected to PH0-OSC_IN (Pin46).
- PA12 (Pin 1) must be connected to TXCO_VCC (Pin48).
- SX1276_DIO4 (Pin10) must be connected to PA5 (Pin21).

SIGFOX Receiver Specification

Symbol	Description	Conditions	Min.	Typ	Max	Unit
RFS_F_HF		AT$SB=x,1, AT$SF=x,1, AT$SR PER<0.1		-122		dBm
IDDR_S	Supply current in Receive mode	AT$TM=3,10		23		mA

SIGFOX Transmitter Specification

Symbol	Description	Conditions		Min.	Typ	Max	Unit
RF_OP_S	RF output power in 50 ohms on RF pin	Programmable with steps AT$SF	Max		18.5		dBm
			Min		4.5		dBm
IDDT_S	Supply current in Transmit mode with impedance matching	Output power setting 20 dBm AT$SF			128		mA
		Output power setting 14 dBm AT$SF			44		mA

7.4. Low power mode current

Conditions:
Power supply: 3.3V, Temp: Room, TCXO_VDD (pin 48 of the module) is connected to PA12 (Pin1 of the module)

Mode	Description	Min.	Typ	Max	Unit
Mode0	STM32L0 in Stop mode with RTC (Real Time Clock) [1] [3] SX1276 in Sleep mode		1.65		uA
Mode1	STM32L0 in Standby mode with RTC (Real Time Clock) [2] SX1276 in Sleep mode		1.40		uA

(*1) The Stop mode achieves the lowest power consumption while retaining the RAM and register contents and real time clock. All clocks in the V_{CORE} domain are stopped, the PLL, MSI RC, HSE crystal and HSI RC oscillators are disabled. The LSE or LSI is still running. The voltage regulator is in the low-power mode.
Some peripherals featuring wakeup capability can enable the HSI RC during Stop mode to detect their wakeup condition. The device can be woken up from Stop mode by any of the EXTI line, in 3.5us, the processor can serve the interrupt or resume the code. The EXTI line source can be any GPIO. It can be the PVD output, the comparator 1 event or comparator 2 event (if internal reference voltage is on), it can be the RTC alarm/tamper/timestamp/wakeup events, the USB/USART/I2C/LPUART/LPTIMER wakeup events.

(*2) The Standby mode is used to achieve the lowest power consumption and real time clock. The internal voltage regulator is switched off so that the entire VCORE domain is powered off. The PLL, MSI RC, HSE crystal and HSI RC oscillators are also switched off. The LSE or LSI is still running. After entering Standby mode, the RAM and register contents are lost except for registers in the Standby circuitry (wakeup logic, IWDG, RTC, LSI, LSE Crystal 32 KHz oscillator, RCC_CSR register). The device exits Standby mode in 60 μs when an external reset (NRST pin), an

IWDG reset, a rising edge on one of the three WKUP pins, RTC alarm (Alarm A or Alarm B), RTC tamper event, RTC timestamp event or RTC Wakeup event occurs.

(*3) STM SigFox Firmware is always in stop mode by default, it wakes up automatically when receiving one character. Else it wakes up automatically when an interrupt is to be processed and returns in stop mode when finished.

# 8. Power Sequences

8.1 Power Up Sequence

9. Reference circuit

In case of using the module as LoRa

For VDD_TCXO connection
Option1:Connect VDD_TCXO to VDD
Option2:Connect VDD_TCXO to PA12 so
that MCU can control TCXO on/off

The VDD_USB is the power supply for
PA11 and PA12.

Optional

R1
10K

SWD connector

J1

VDD
SWCLK
SWDIO

Module reset do not need
external pull up resistor.
Because there is an about
45K permanent pull up
resistor inside of module.

Notes for VREF+:
1. VREF+ can be grounded or floating
when DAC and ADC function are not active.
2. VREF+ should be connected to VDD
if module is battery powered and need to
monitor the battery voltage

VDD_TCXO

Button1

C6 0.1uF

VDD_USB

C1   C2
10uF   0.1uF

VDD

C3   C4   C5
10uF   1uF   0.1uF

U1

CMWX1ZZABZ-078/091

GND
GND
GND
GND

VDD_TCXO
TCXO_OUT
PH0-OSC_IN
PH1-OSC_OUT
GND
BOOT0
PA14/SWCLK/LPUART1_TX
PA13/SWDIO/LPUART1_RX
PB5/LPTIM1_IN1
PB6/LPTIM1_ETR
PB7/LPTIM1_IN2
PB2/LPTIM1_OUT

PA12/USB_DP
PA11/USB_DM
GND
VDD_USB
VDD_MCU
VDD_RF
GND
DBG_SX1276_DIO2
DBG_SX1276_DIO3
SX1276_DIO4
DBG_SX1276_DIO5
DBG_SX1276_DIO0

DBG_SX1276_DIO1
PB15/SPI2_MOSI
PB14/SPI2_MISO
PB13/SPI2_SCK
PB12/SPI2_NSS
PA10/USART1_RX
PA9/USART1_TX
PA8/MCO
PA5/ADC5/DAC2
PA4/ADC4/DAC1
PA3/ADC3/USART2_RX/LPUART1_RX
PA2/ADC2/USART2_TX/LPUART1_TX

PB9/I2C1_SDA
PB8/I2C1_SCL
MCU_nRST
PA0/WKUP1
VREF+
STSAFE_nRST
DBG_CRF2
DBG_CRF3
DBG_CRF1
GND
ANT
GND

module reset

VREF+   VDD

C7
1uF

L1

C8   C9

J2

SMA connector

USART2_TX
USART2_RX

USART1_TX
USART1_RX

In case of using the module as SigFox modem with STM SigFox firmware

The VDD_USB is must.
Because it is the power
supply for PA11 and PA12.

Module reset do not need
external pull up resistor.
Because there is an about
45K permanent pull up
resistor inside of module.

SWD connector

SMA connector

U1
CMWX1ZZABZ-099

Host Interface USART_TX
Host Interface USART_RX

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10. Tape and Reel packing

10.1 Dimension of Tape (Plastic tape)

feeding direction
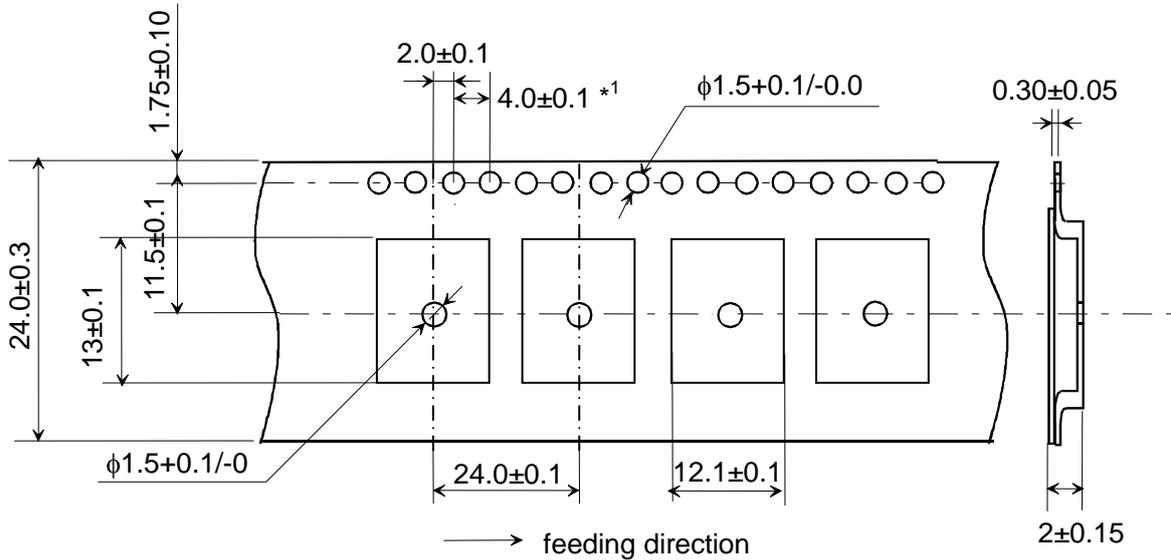
(unit : mm)

10.2 Dimensions of Reel

Label

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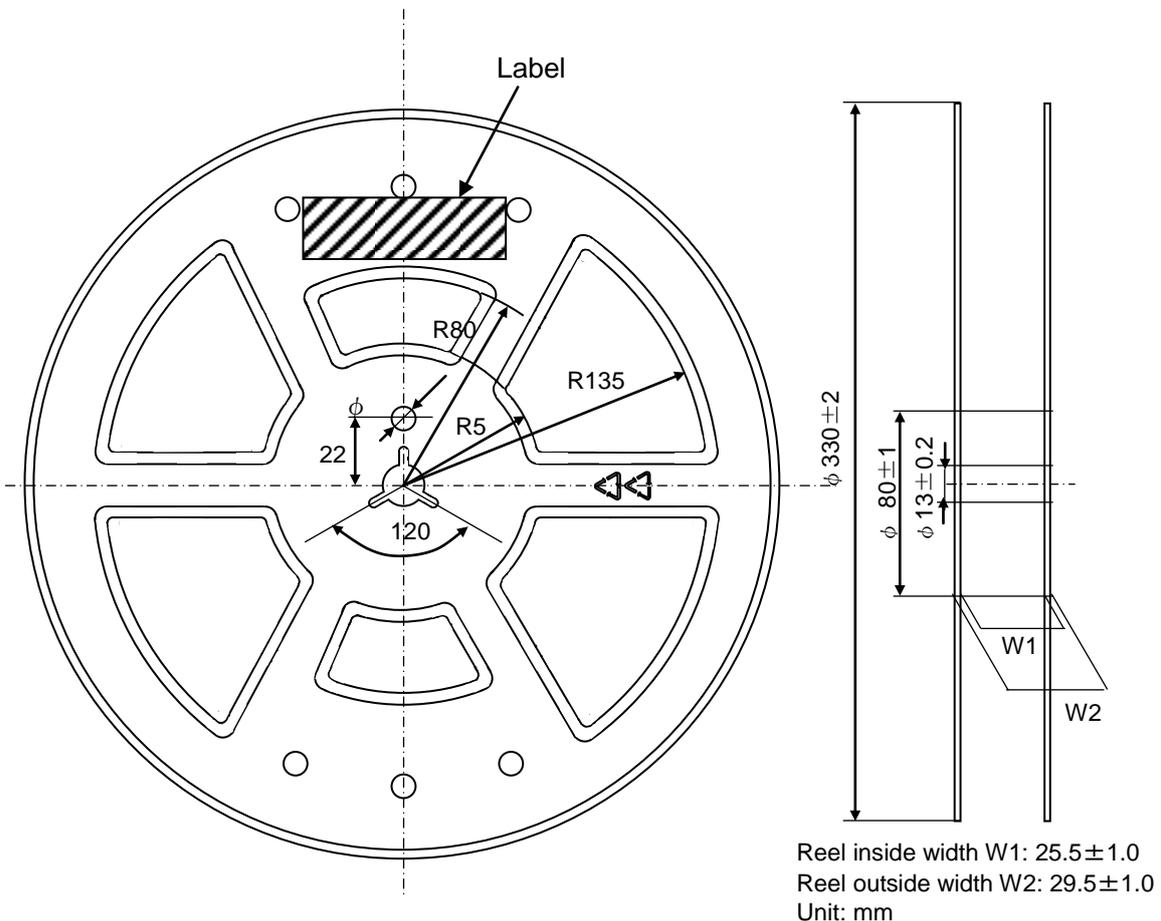
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10.3 Taping Diagrams

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

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

[3] Cover tape : 62μm in thickness

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

[3]

[1]

[2]

[3]

[4]

Feeding Hole

Feeding Direction
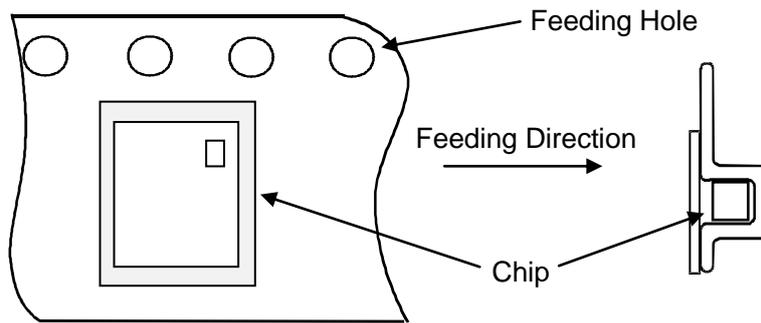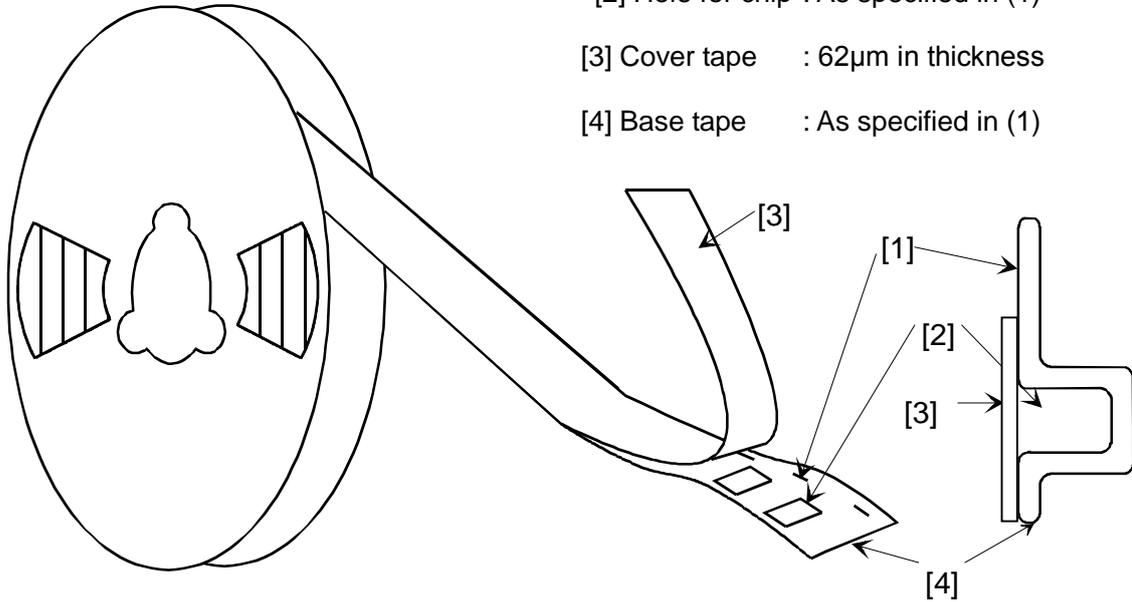
Chip

10.4 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
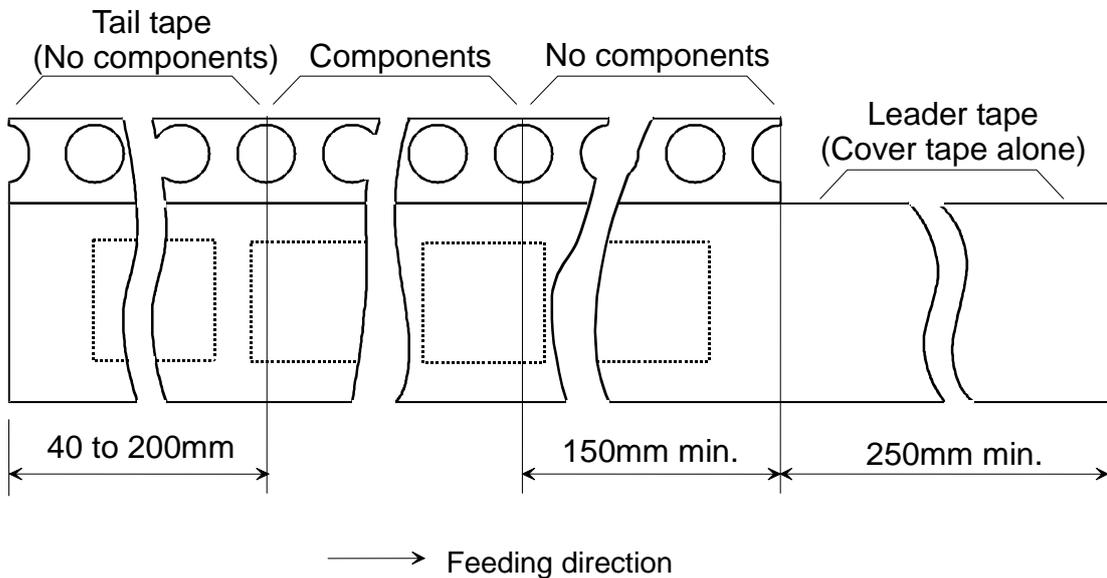
- The tape for chips are wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.
- The cover tape and base tape are not adhered at no components area for 250mm min.
- Tear off strength against pulling of cover tape : 5N min.
- Packaging unit : 1000 pcs/ reel
- Material
  - ➢ 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.
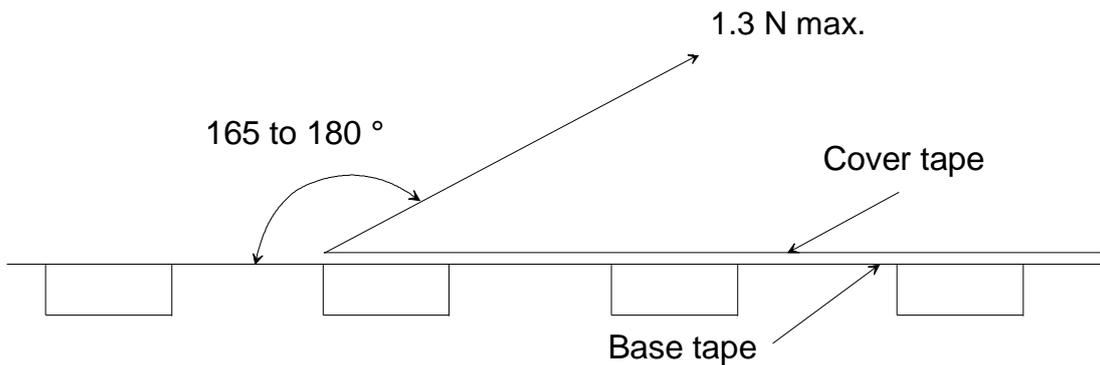
- Packaging (Humidity proof Packing)
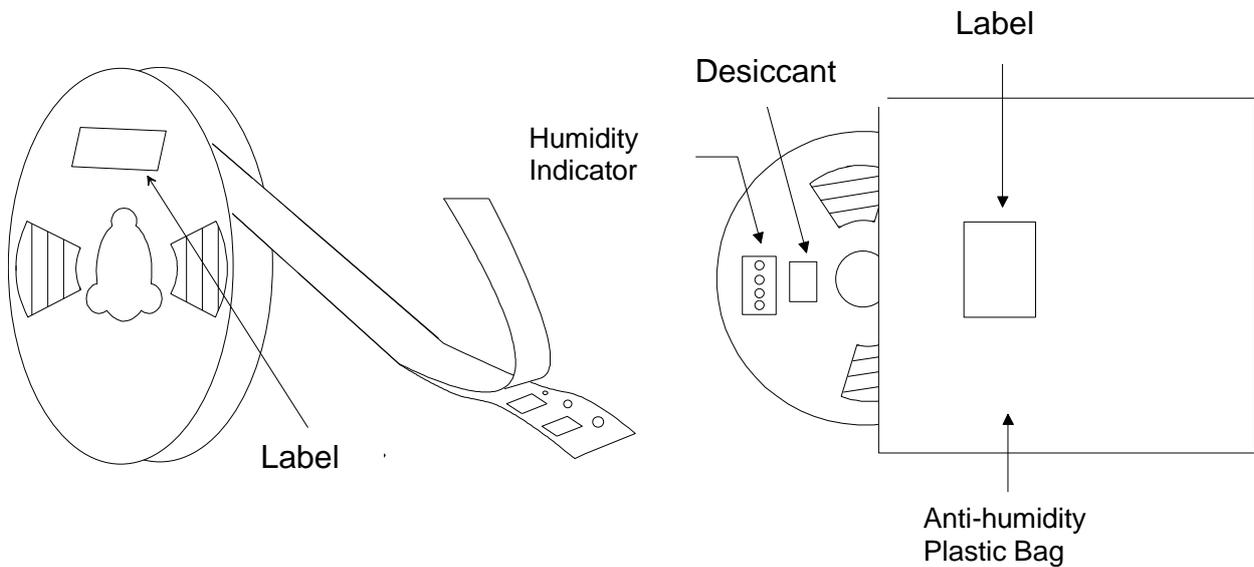
Tape and reel must be sealed with the anti-humidity plastic bag. The bag contains the desiccant and the humidity indicator.

11. Notice

11.1 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.

11.2 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.

11.3 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.

11.4 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.

11.5 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)
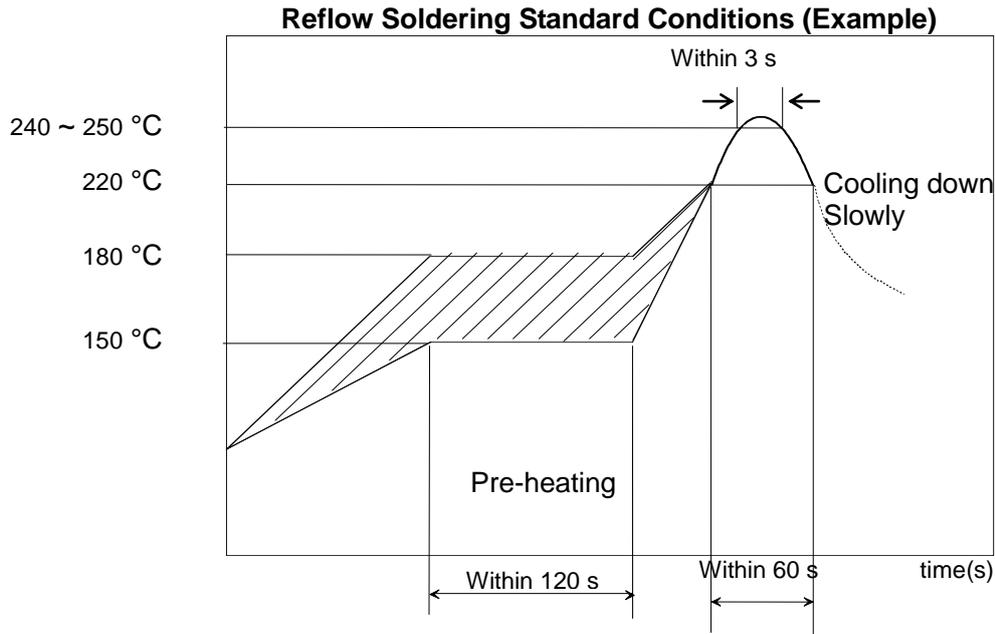
Please use the reflow within 2 times.
Use rosin type flux or weakly active flux with a chlorine content of 0.2 wt % or less.

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

11.7 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.
- 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.

11.8 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.

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⚠ 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.
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- 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.

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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.
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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.

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