

## **FUJITSU Component Wireless module**

### **Bluetooth® Smart Beacon (with Sensor)**

#### **FWM8BLZ02-19047 Datasheet**

Rev. 0.01  
DEC 21, 2015

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The above Product is designed, developed and manufactured as contemplated for general use, including without limitation, general office use, personal use, household use, and ordinary industrial use, but is not designed, developed and manufactured as contemplated (1)for use accompanying fatal risks or dangers that, unless extremely high safety is secured, could lead directly to death, personal injury, severe physical damage or other loss (i.e., nuclear reaction control in nuclear facility, aircraft flight control, air traffic control, mass transport control, medical life support system, missile launch control in weapon system), or (2)for use requiring extremely high reliability (i.e., submersible repeater and artificial satellite), hereinafter referred to as "High Safety Required Use". You shall not use this Product without securing the sufficient safety or reliability required for the High Safety Required Use. If you wish to use this Product for High Safety Required Use, please consult with our sales representatives in charge before such use.

Fujitsu Component Limited

**All specifications are preliminary which may be changed without any prior notice**

<b>1.</b>	<b>Summary</b> .....	<b>4</b>
<b>2.</b>	<b>Features</b> .....	<b>4</b>
<b>3.</b>	<b>Applicable Standard</b> .....	<b>5</b>
<b>4.</b>	<b>Block Diagram</b> .....	<b>5</b>
<b>5.</b>	<b>Electrical Characteristics</b> .....	<b>6</b>
5-1.	General Features.....	6
5-2.	Absolute Maximum Rating .....	7
5-3.	Recommendable Operating Condition .....	7
5-4.	General radio characteristics .....	7
5-5.	Transmitter Specifications .....	7
5-6.	Receiver sensitivity.....	7
5-7.	Receiver specifications.....	8
5-8.	Current Consumption .....	8
5-8-1.	Current consumption of wireless part .....	8
5-8-2.	Current consumption of Sensor .....	8
5-9.	Sensor specification .....	9
5-9-1.	3-axis acceleration sensor .....	9
5-9-1-1.	The axial direction .....	10
5-9-2.	Temperature sensor .....	10
<b>6.</b>	<b>Interface specifications</b> .....	<b>11</b>
6-1.	Software Interface .....	11
6-2.	Hardware Interface .....	11
<b>7.</b>	<b>Function Specification</b> .....	<b>12</b>
7-1.	Operation Mode.....	12
7-1-1.	Mode 1 (Normal Operation) .....	12
7-1-1-1.	Behavior of Mode 1 .....	13
7-1-2.	Mode 2 (Remote Controllable Mode).....	13
7-1-2-1.	Behavior of Mode 2 .....	14
7-1-3.	Mode 3 (Method of Starting on Recovery Mode).....	14
7-1-3-1.	Behavior of Mode 3 .....	15
7-1-4.	Function of pushbutton and LED indicator .....	15
<b>8.</b>	<b>Firmware default setting</b> .....	<b>16</b>

<b>9.</b>	<b>Mechanical Characteristics</b> .....	<b>18</b>
9-1.	Appearance and Dimensions .....	18
9-2.	Stamping label specification .....	18
<b>10.</b>	<b>Storage Conditions</b> .....	<b>19</b>
<b>11.</b>	<b>Mounting / Replacement method of battery</b> .....	<b>20</b>
11-1.	Removal of a battery case lid .....	20
11-2.	Mounting of a battery .....	20
11-3.	Installation of a battery cover lid .....	21
11-4.	Replace battery .....	21
<b>12.</b>	<b>Packing Specification in shipment</b> .....	<b>22</b>
12-1.	Reel label .....	22
12-2.	Outer Packaging Label .....	22
12-3.	Shipment Packing .....	23
12-3-1.	Tray packing .....	23
12-3-2.	Shipping package .....	25
<b>13.</b>	<b>Revision History</b> .....	<b>26</b>

## 1. Summary

This datasheet applies to the *Bluetooth*<sup>®</sup> Smart Beacon (with Sensor) FWM8BLZ02-109047.

## 2. Features

This product is an antenna integrated Beacon Unit compliant with *Bluetooth* Specification Version 4.1, and is possible to communicate in an ISM(Industrial Scientific Medical) band. This product is a unit product that puts Bluetooth Smart module and motion sensor MPU-6500(made of the InvenSense Inc.) in our original housing, and it provides with the slide switch, the pushbutton, and the LED indicator, and it drives with the coin type battery. This product conforms to single mode of *Bluetooth* low energy technology, and mainly operates as peripheral device and transmits acceleration data and temperature data from motion sensor.

The followings are the key features.

- *Bluetooth* Specification Version 4.1 (*Bluetooth* Smart Single mode) Compliant
- Dimension: 40.0mm x 31.0mm x 12.0mm
- Weight: 9.4g \*without CR2450 coin-cell battery
- Software Interface: Fujitsu Component proprietary commands/events
- Hardware Interface: Push Button, Slide Switch
- Operating Temperature: -30 ~ +60 °C \*without CR2450 coin-cell battery
- Operating Humidity : +20 ~ +80 %RH (No dew condensation)
- MPU-6500 motion sensor is installed (The function of 3-axis acceleration sensor and the temperature sensor is used).
- Power Supply: Coin-cell battery 3V (CR2450: 620mAh)

The followings are functions.

- Operation as peripheral device
- Transmission of acceleration and thermal data
- Operation mode change by handling a button
- Status display by LED indicator
- Changing of settings from central device (wireless)

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### 3. Applicable Standard

- *Bluetooth* Specification Version 4.1  
QDID: 59305
- FCC,IC certification  
FCC ID : SQK-7BLZXX  
IC ID : 337L-7BLZXX
- CE Marking
- ARIB STD-T66  
Radio Act(Japan)Certification No. 007-AB0237  
(Certificated by the combination of embedded module.)
- RoHS Compliant

### 4. Block Diagram

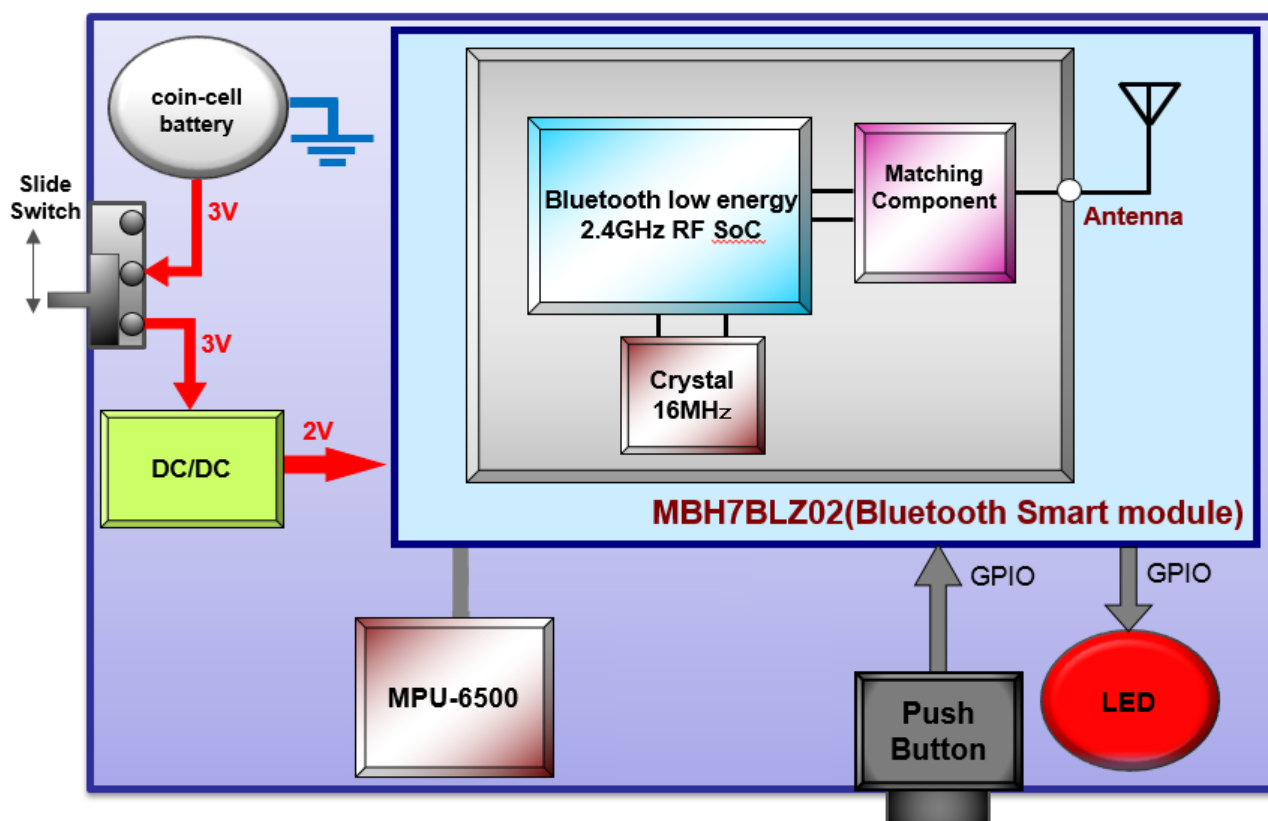


Figure 4-1: Block Diagram

## 5. Electrical Characteristics

### 5-1. General Features

*Bluetooth* Specification Version 4.1 Compliant

Carrier Frequency: 2400 MHz ~ 2483.5 MHz

Modulation: GFSK

Symbol Rate: 1 Mbps

Data Rate: 1 Mbps

Channel: 40 channels

Channel Spacing: 2 MHz

Output power: +4 dBm max

### 5-2. Absolute Maximum Rating

Items	Symbol	Min	Max	Unit
Supply voltage (VDD)	VDD	-0.3	6.0	V
Supply voltage (GND)	GND	-	0	V

### 5-3. Recommendable Operating Condition

Items	Symbol	Min	Typ	Max	Unit
Operating Voltage	VDD	2.4	3.0	3.6	V
Operating Temperature	Ta	-30	25	+60	°C
Operating Humidity	Hopr	20	-	+80	%RH

\*No dew condensation

### 5-4. General radio characteristics

Ta=25±2°C

Items	Condition	Min	Typ	Max	Unit
Operating frequencies	2MHz channel spacing	2400	-	2483.5	MHz
PLL programming resolution			1		MHz
Frequency deviation		±225	±250	±275	kHz

### 5-5. Transmitter Specifications

Ta=-30°C~60°C

Items	Condition	Min	Typ	Max	Unit
Output power		-20		+4	dBm
Step size of RF power control			4		dB
RF power control range		+20	+24		dB

### 5-6. Receiver sensitivity

Ta=-30°C~60°C

Items	Condition	Min	Typ	Max	Unit
Maximum received signal strength	< 30.8% PER			-10	dBm
Receiver sensitivity	Ideal transmitter < 30.8% PER		-90		dBm
	Dirty transmitter < 30.8% PER		-88		dBm

## 5-7. Receiver specifications

Ta=25±2°C

Items	Condition	Min	Typ	Max	Unit
RX selectivity	C/I co-channel	-	10	21	dB
	1st ACS, C/I 1 MHz	-	1	15	dB
	2nd ACS, C/I 2 MHz	-	-25	-17	dB
	ACS, C/I (3+n) MHz offset [n = 0, 1, 2, . . .]	-	-51	-27	dB
	Image blocking level	-	-30	-9	dB
	Adjacent channel to image blocking level (±1 MHz)	-	-31	-15	dB
RX intermodulation	IMD performance, 3rd, 4th and 5th offset channel	-50	-39	-	dBm

## 5-8. Current Consumption

### 5-8-1. Current consumption of wireless part

Ta=25±2°C

Description	Symbol	Typ.	Max.	Unit
TX only run current @ P <sub>OUT</sub> = +4 dBm	I <sub>TX,+4dBm</sub>	10.9	16.0	mA
TX only run current @ P <sub>OUT</sub> = 0 dBm	I <sub>TX,0dBm</sub>	8.0	12.0	mA
TX only run current @ P <sub>OUT</sub> = -4 dBm	I <sub>TX,-4dBm</sub>	7.3	11.0	mA
TX only run current @ P <sub>OUT</sub> = -8 dBm	I <sub>TX,-8dBm</sub>	6.6	10.0	mA
TX only run current @ P <sub>OUT</sub> = -12 dBm	I <sub>TX,-12dBm</sub>	6.3	9.5	mA
TX only run current @ P <sub>OUT</sub> = -16 dBm	I <sub>TX,-16dBm</sub>	6.1	9.0	mA
RX current	I <sub>RX</sub>	11.2	16.3	mA
Deep Sleep current	I <sub>SLEEP</sub>	5.5		uA

### 5-8-2. Current consumption of Sensor

Ta=25±2°C

Description	Symbol	Typ.	Max.	Unit
Accelerometer (active)		450		uA
Accelerometer (Full-Chip Sleep Mode)		6		uA



## 5-9. Sensor specification

This product builds the motion sensor (made of the InvenSense Inc.MPU-6500) into, and uses the following function of the motion sensor.

- 3-axis acceleration
- Temperature

### 5-9-1. 3-axis acceleration sensor

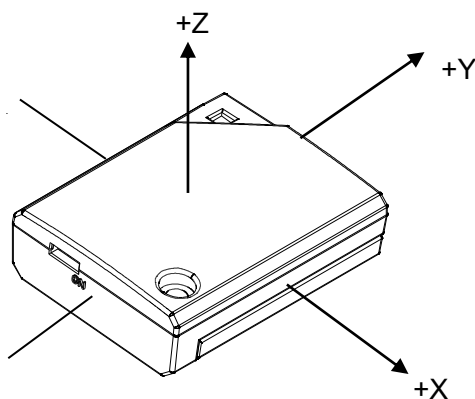
Items	Symbol	Min	Typ	Max	Unit
<b>ABSOLUTE MAXIMUM RATING</b>					
Impact-proof				10,000	G
<b>ACCELEROMETER SENSITIVITY</b>					
Full-Scale Range	AFS_SEL=3		±16		G
ADC Word Length	Output in two's complement format		16		bits
Sensitivity Scale Factor	AFS_SEL=3		2048		LSB/g
Initial Tolerance			±3		%
Nonlinearity	Best Fit Straight Line		±0.5		%
Cross-Axis Sensitivity			±2		%
<b>ZERO-G OUTPUT</b>					
Initial Tolerance			±60		mg
<b>NOISE PERFORMANCE</b>					
Power Spectral Density	Low noise mode		300		Ug/Hz
Low Pass Filter Response	Programable Range	5		260	Hz
Intelligence Function Increment			4		Mg/LSB
Accelerometer Startup Time	From Sleep mode		20		ms
	From Cold Start, 1ms Vdd ramp		30		ms
Output Data Rate	Low noise (active)	4		4000	Hz

\*The above-mentioned is a value of motion sensor device MPU-6500(3-axis acceleration sensor) with built-in this product.

\*Refer to the document of "Bluetooth Smart Beacon (with Sensor) Functional, Firmware Specification" for the method of calculating the acceleration data.

### 5.9.1.1. The axial direction

The axial direction is shown in the following.



### 5-9-2. Temperature sensor

Items	Symbol	Min	Typ	Max	Unit
Operating temperature	Ta	-30	25	+60	°C
Temperature accuracy			±0.3		°C

\*Refer to the document of “Bluetooth Smart Beacon (with Sensor) Functional, Firmware Specification” for the method of calculating the temperature data.

## 6. Interface specifications

### 6-1. Software Interface

Refer to the document of “*Bluetooth Smart Beacon (with Sensor) Functional, Firmware Specification*”.

### 6-2. Hardware Interface

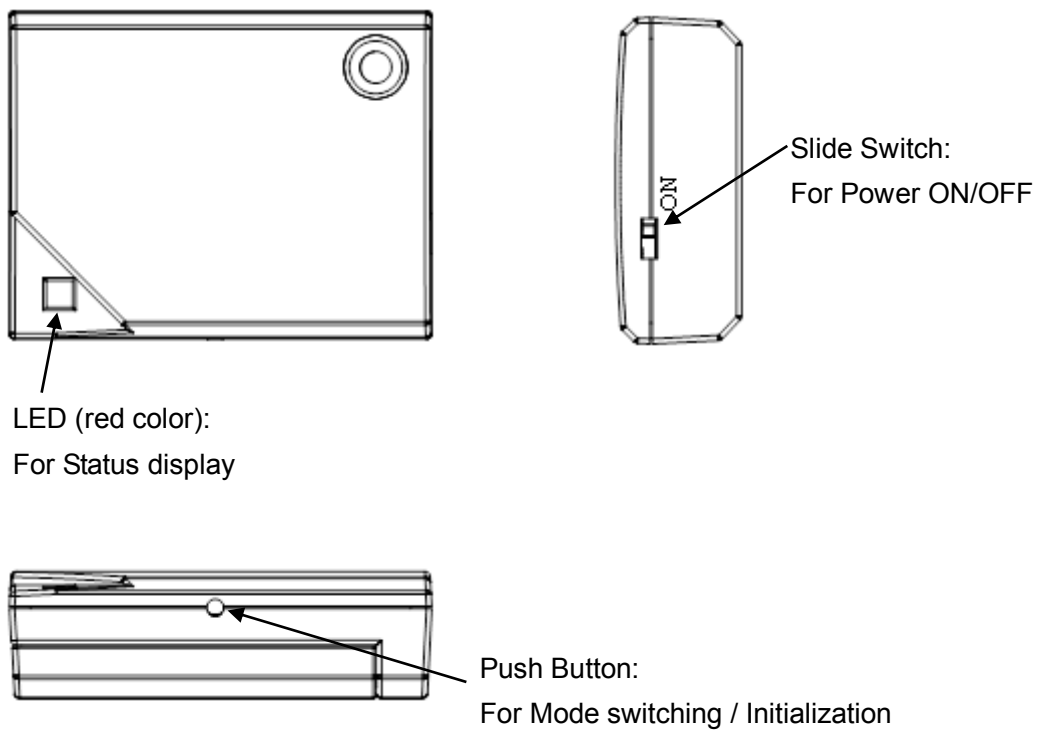


Figure 6-1: Hardware Interface

## 7. Function Specification

### 7-1. Operation Mode

This product has three operation modes and user can switch the mode by handling the slide switch and the push button on this product at the time of startup. The behavior of MODE\_1 and MODE\_2 is configurable.

Operation Mode	Description
MODE_1	The mode assumed to be used for normal operation.
MODE_2	The mode assumed to be used for changing settings.
MODE_3 (Recovery Mode)	All configurations are deleted and restored with "Firmware Default Setting".

Various operation settings of this product can be changed.

The setting change under operation is executed by way of the wireless. In particular, the setting change is possible by the connection to this product from the Central device that mounts our original command, and the issue of the command.

\*Refer to the document of "*Bluetooth Smart Beacon (with Sensor) Functional, Firmware Specification*".

#### 7-1-1. Mode 1 (Normal Operation)

By the following procedure, user can set this product into each mode.

Please manipulate this product according to the following instructions.

Operating Instructions	Slide Switch	Push Button	LED
Turn on this product with a slide switch while not pushing a button.	OFF	OFF	lighting-off
	ON		blinking (1 second)
			lighting-off

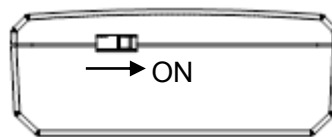


Figure 7-1: Mode 1

### 7-1-1-1. Behavior of Mode 1

The LED indicator blinks for one second after completing the start, and it turns it off afterwards. The blinking operation at the start-up can not be changed.

After completing the start-up, according to the setting by WRITE\_AS\_NV command, this product operates as advertising operation in AUTO\_SLAVE function. According to the setting by 1<sup>st</sup> ~ 3<sup>rd</sup> parameter of WRITE\_AS\_PARAM1\_NV command, it operates as connectable peripheral device.

It is not possible to connect it by a remote command mode.

Note: Operation parameters are configurable.

WRITE\_AB\_NV Command

WRITE\_AS\_NV Command

WRITE\_AS\_PARAM1\_NV Command

Note: Refer to the document of “Bluetooth Smart Beacon (with Sensor) Functional, Firmware Specification”.

### 7-1-2. Mode 2 (Remote Controllable Mode)

Operating Instructions	Slide Switch	Push Button	LED
Turn on this product with a slide switch while pushing a button. Then LED will light up in 1 second.	OFF	ON	lighting-off
	ON		lighting-off (1 second)
Stop pushing a button within 5 seconds, after LED lights up.			lighting-up
		OFF	lighting-up (within 5 seconds)
		OFF	lighting-off

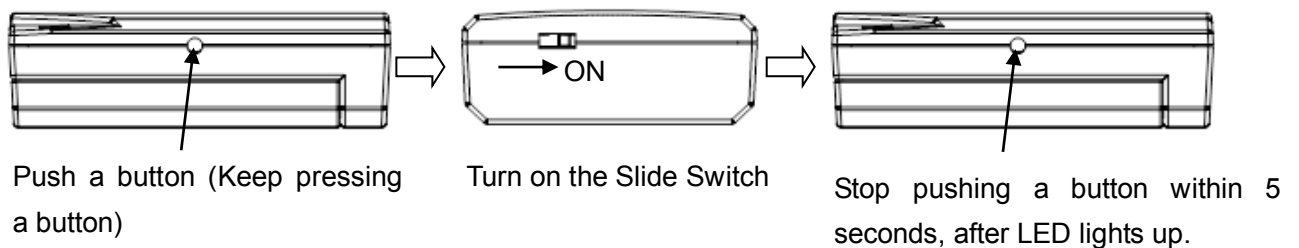


Figure 7-2: Mode 2

### 7-1-2-1. Behavior of Mode 2

In Basically, though it is the same operation as Mode 1, it is possible to connect it by a remote command mode.

Note: Refer to the document of “Bluetooth Smart Beacon (with Sensor) Functional, Firmware Specification”.

### 7-1-3. Mode 3 (Method of Starting on Recovery Mode)

Operating Instructions	Slide Switch	Push Button	LED
Turn on this product with a slide switch while pushing a button. Then LED will light up in 1 second.	OFF	ON	lighting-off
	ON		lighting-off (1 second)
Continues to push a button more than 15 seconds.  Stop pushing a button within 5 seconds, after LED starts blinking.  Then all configuration will be initialized and automatically re-boots.			lighting-up
			lighting-up (15 seconds)
			blinking (within 5seconds)
		OFF	-

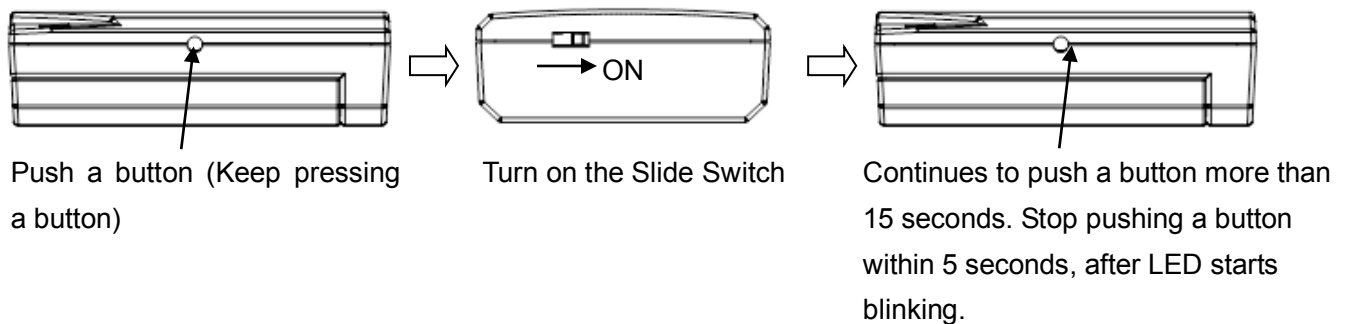


Figure 7-3: Mode 3

#### **7-1-3-1. Behavior of Mode 3**

Recovery mode is the function that intend to forcibly recover this product to the default configuration if this product has been uncontrollable by incorrect setting.

To clear all the settings, and then restored the initial configuration of the firmware. After restoration, it reactivates automatically.

Note: All data including advertising data are initialized. Please use this function carefully.  
Please refer to section 8.

#### **7-1-4. Function of pushbutton and LED indicator**

At start-up, the pushbutton is used to switch the operation mode (Mode 1, Mode 2, and Mode 3).

## 8. Firmware default setting

\* These settings differ from the“Factory Default Setting” to be written on mass-production in advance.

\* In case of Mode 3 (Section 7-1-3), all data is initialized as below.

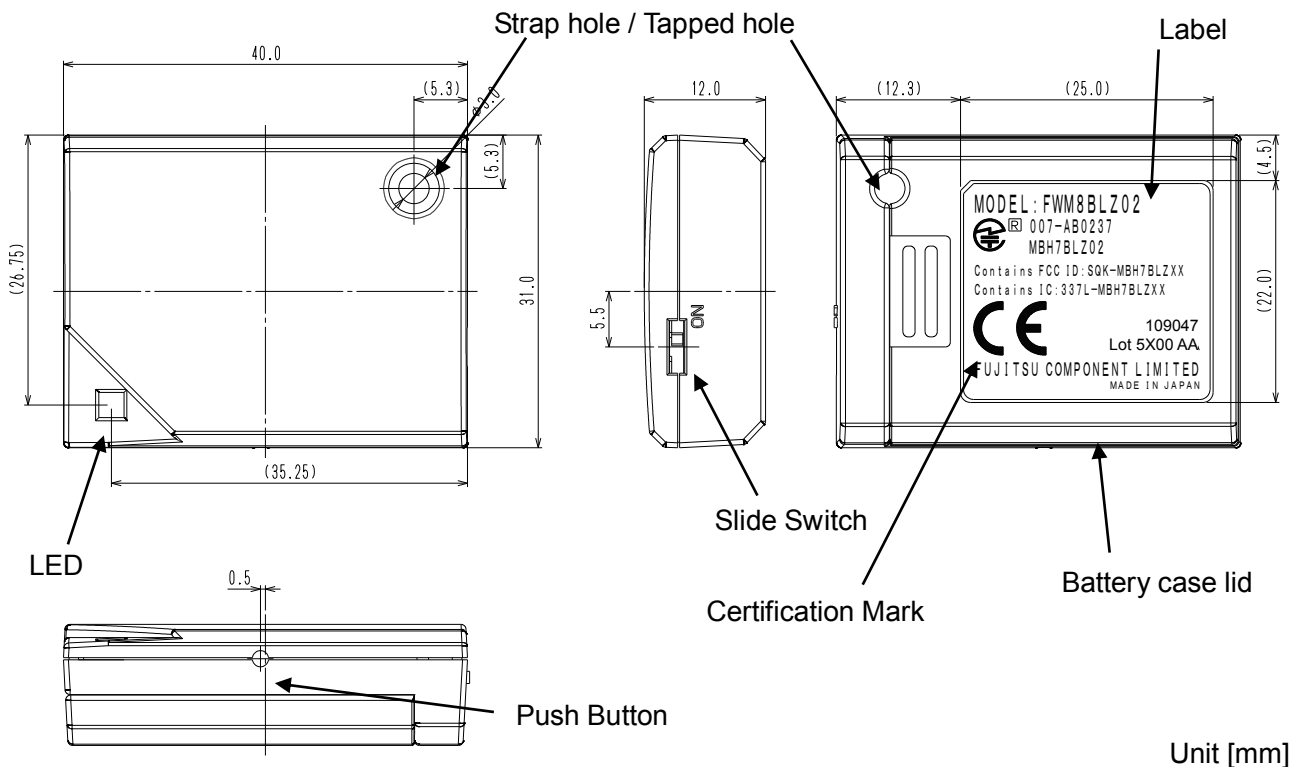
Command Name	Parameter Name	Value	Explanatory Remarks
WRITE_AS_NV	AS_MODE_1	1 (Disable)	Used the setting by WRITE_AS_PARAM1_NV command.
	AS_MODE_2	2 (Enable)	Used the setting by WRITE_AS_PARAM2_NV command.
WRITE_AS_PARAM1_NV	MODE (1st)	General	500 milliseconds
	INTERVAL (1st)	0x0320	
	TIMEOUT (1st)	15	15 seconds
	MODE (2nd)	General	1 seconds
	INTERVAL (2nd)	0x0640	
	TIMEOUT (2nd)	60	60 seconds
	MODE (3rd)	General	4 seconds
	INTERVAL (3rd)	0x0c80	
TIMEOUT (3rd)	0		
WRITE_AS_PARAM2_NV	MODE (1st)	General	200 milliseconds
	INTERVAL (1st)	0x0140	
	TIMEOUT (1st)	15	15 seconds
	MODE (2nd)	General	1 second
	INTERVAL (2nd)	0x0640	
	TIMEOUT (2nd)	0	
	MODE (3rd)	General	*Unused
	INTERVAL (3rd)	0x0c80	*Unused
TIMEOUT (3rd)	0x0000	*Unused	
WRITE_AB_NV	AUTO_BROADCAST	0	Disabled
	ADV_DATA	1	Used the user defined advertising data. Scan response data is not used.
	INTERVAL	0x0640	1 second
	TIMEOUT	0	
WRITE_ADV_DATA_NV	ADV_DATA	0c0946434c20 426561636f6e 31	Complete local name 「FCL Beacon1」
WRITE_SR_DATA_NV	SR_DATA	None	
WRITE_SEC_PARAM_NV	IO_CAPABILITY	3	No input No output
	MITM_PROTECTION	0	
	BOND	1	
	OOB	0	
	TIMEOUT	30	
WRITE_TX_POWER_NV	TX_POWER	0	
	OFFSET_FOR_ADV	0	



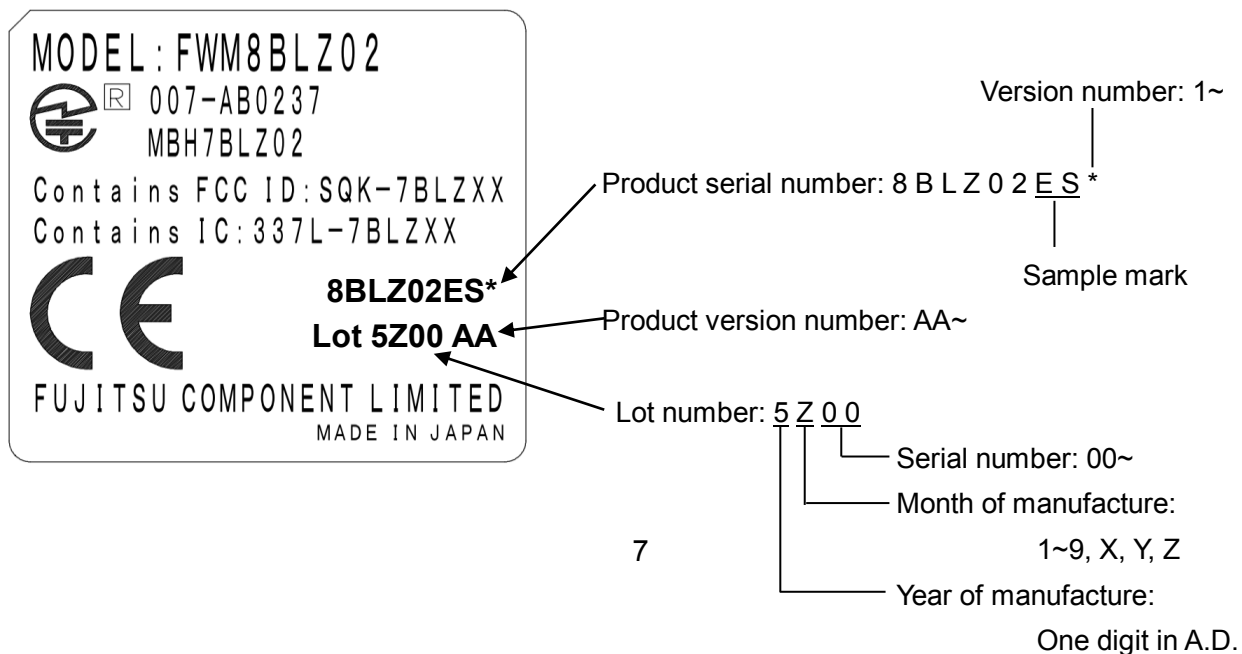
Command Name	Parameter Name	Value	Explanatory Remarks
WRITE_NAME_NV	NAME	FWM8BLZ02	
WRITE_APPEARANCE_NV	APPEARANCE	0x0000	
WRITE_PPCP_NV	MIN_INTERVAL	0x005a	56.250 milliseconds
	MAX_INTERVAL	0x00ff	159.375 milliseconds
	SLAVE_LATENCY	0x0000	
	SVTO	0x0190	
WRITE_BOOT_MODE_NV	MODE	0	Reserved parameter
	SKIP_CRC_CHECK	0	Reserved parameter
	CLK_CONFIG	3	
WRITE_REMOTE_CMD_ENABLE_NV	ENABLE_REMOTE_CMD	2	Enable (only in Mode 2)
WRITE_PW_NV	PASSWORD	None	None
	ENABLE_PROTECT	0	
	ENABLE_FAIL_COUNT	0	
	ENABLE_RESET	0	
WRITE_ADDR_NV	OVERWRITE_ADDR	0	Not overwrite
	BD_ADDR	000000000000	*Unused
	ADDR_TYPE	0	*Unused
	CYCLE_INTERVAL	0x0384	*Unused
	OVERWRITE_IRK	0	*Unused
	IRK	0x0000000000 000000000000 000000000000 000000000000 000000000000 000000	*Unused
WRITE_SEC_LEVEL_NV	SEC_LEVEL	2	
WRITE_PASSKEY_NV	ENABLE_STATIC_PASSKEY	0 (Disable)	
	STATIC_PASSKEY	000000	*Unused
WRITE_WL_NV	FILTER_POLICY	0	
WRITE_BTN_CONFIG_NV	BTN_CONFIG	1	LED blinking
WRITE_SEN_MSR_INT_NV	MEASUREMENT_INTERVAL	5000	5 seconds
WRITE_SEN_FDC_ENABLE_NV	ENABLE_FDC_OUT	1	Enable
WRITE_SEN_TXT_OUT_ENABLE_NV	ENABLE_TXT_OUT	1	Enable

## 9. Mechanical Characteristics

### 9-1. Appearance and Dimensions



### 9-2. Stamping label specification



## 10. Storage Conditions

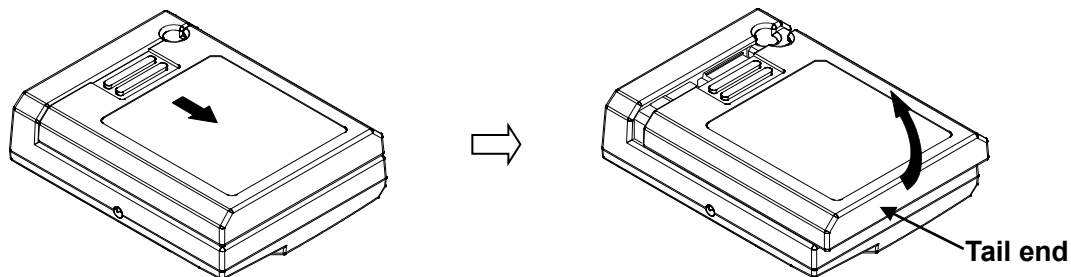
- Do not store this product in the environments exposed to shock or vibration. It may result in damage, malfunction, or deterioration of quality.
- Do not throw or drop cartons containing this product during transportation. It may result in damage, malfunction, or deterioration of quality.

## 11. Mounting / Replacement method of battery

### 11-1. Removal of a battery case lid

Slide a battery case lid in the direction of an arrowed line, and click is unlocked.

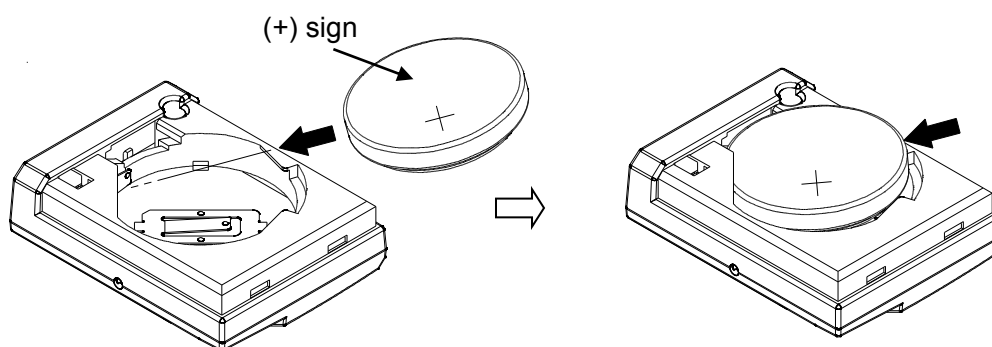
Lift a tail end of a battery case lid slantingly and remove it.



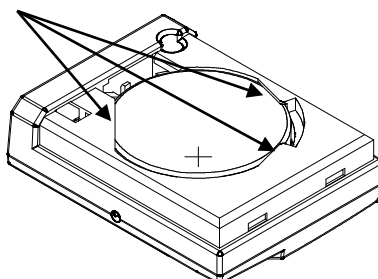
### 11-2. Mounting of a battery

Insert in a store part of a battery slantingly with the (+) sign facing up.

When insert a battery, push it gently.



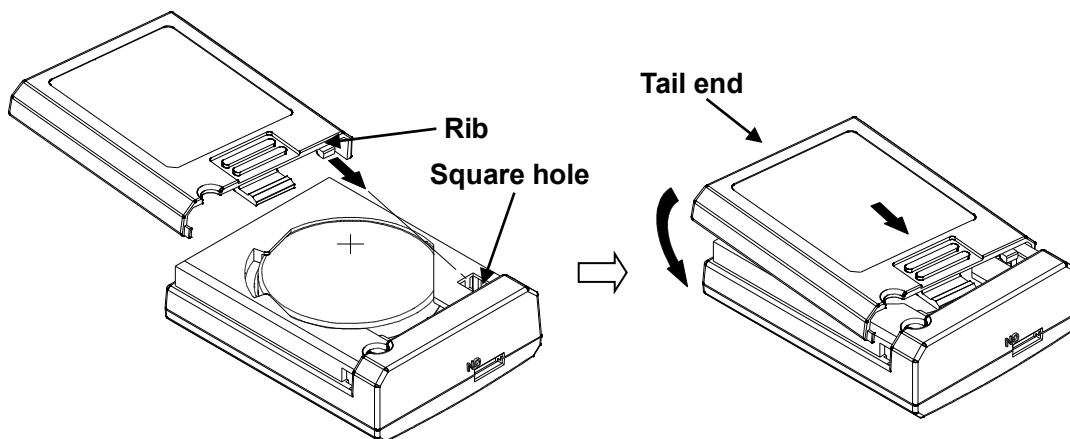
Battery is held by a rib of a store part of a battery



The state that a battery was mounted

### 11-3. Installation of a battery cover lid

Insert a rib of a battery case lid in square hole of a store part of a battery slantingly.  
Parallel the tail end to a store part of a battery and insert a battery case lid.



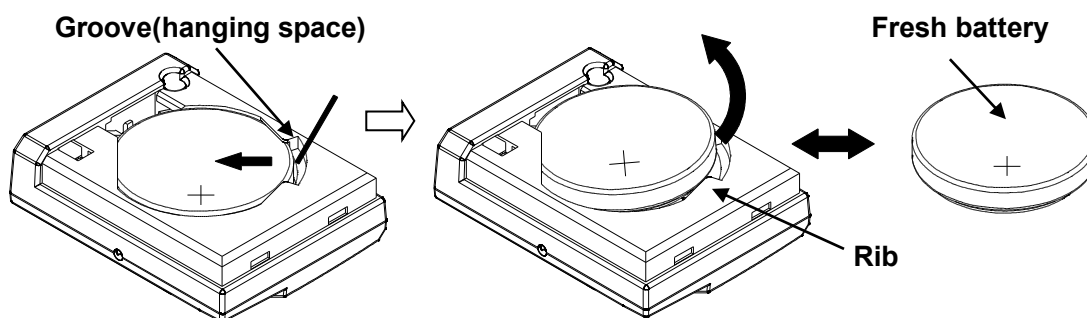
### 11-4. Replace battery

Remove a battery case lid. (Refer to a procedure of 11-1)

Hang a nail (or toothpick and so on) on a groove (hanging space) of a store part of a battery and push a battery gently in the direction of an arrowed line.

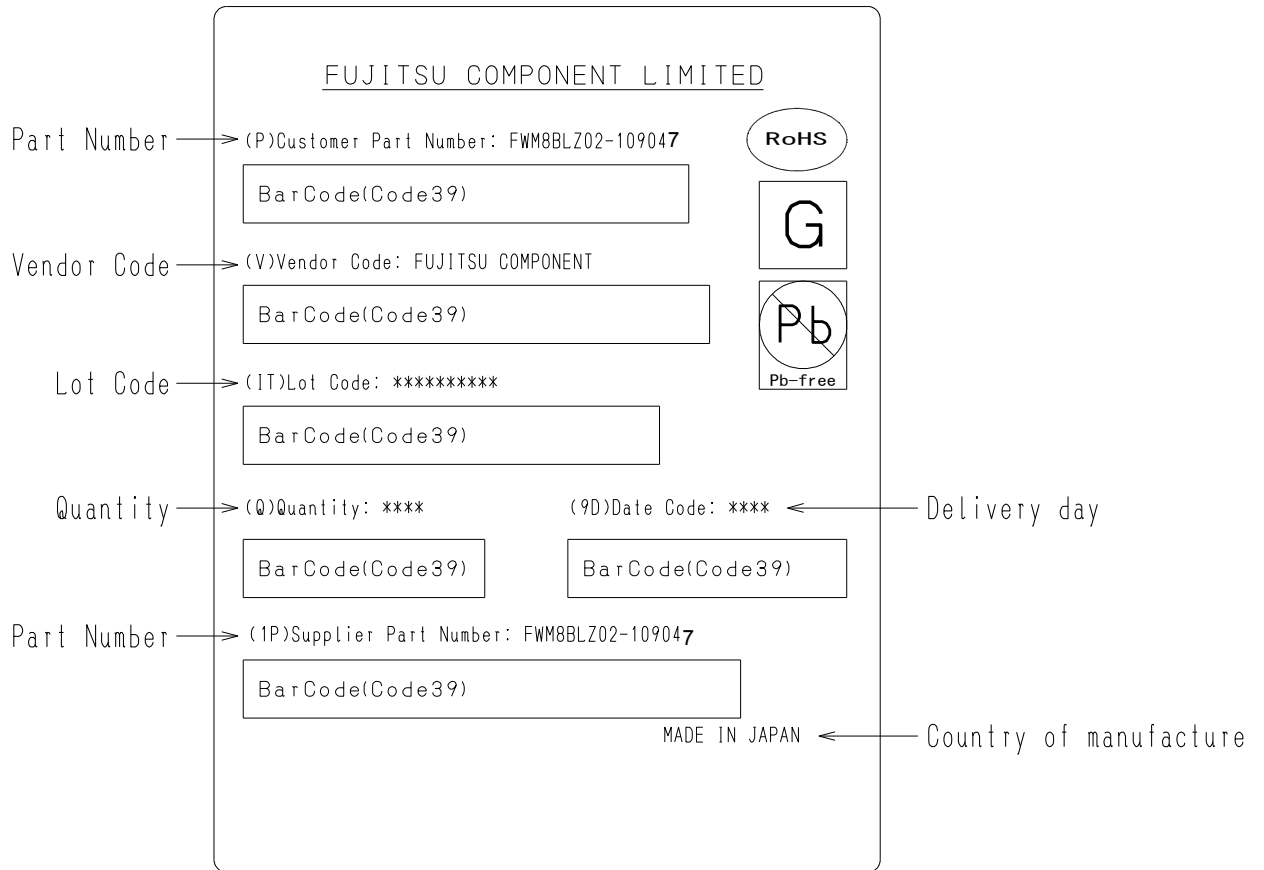
Lift a battery up in the direction of an arrowed line, and remove it from a rib.

Replace a fresh battery.

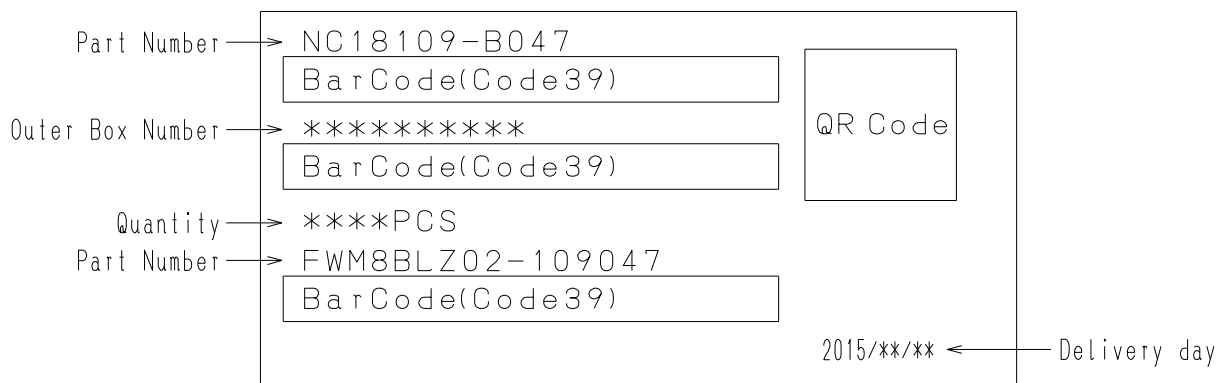


## 12. Packing Specification in shipment

### 12-1. Reel label

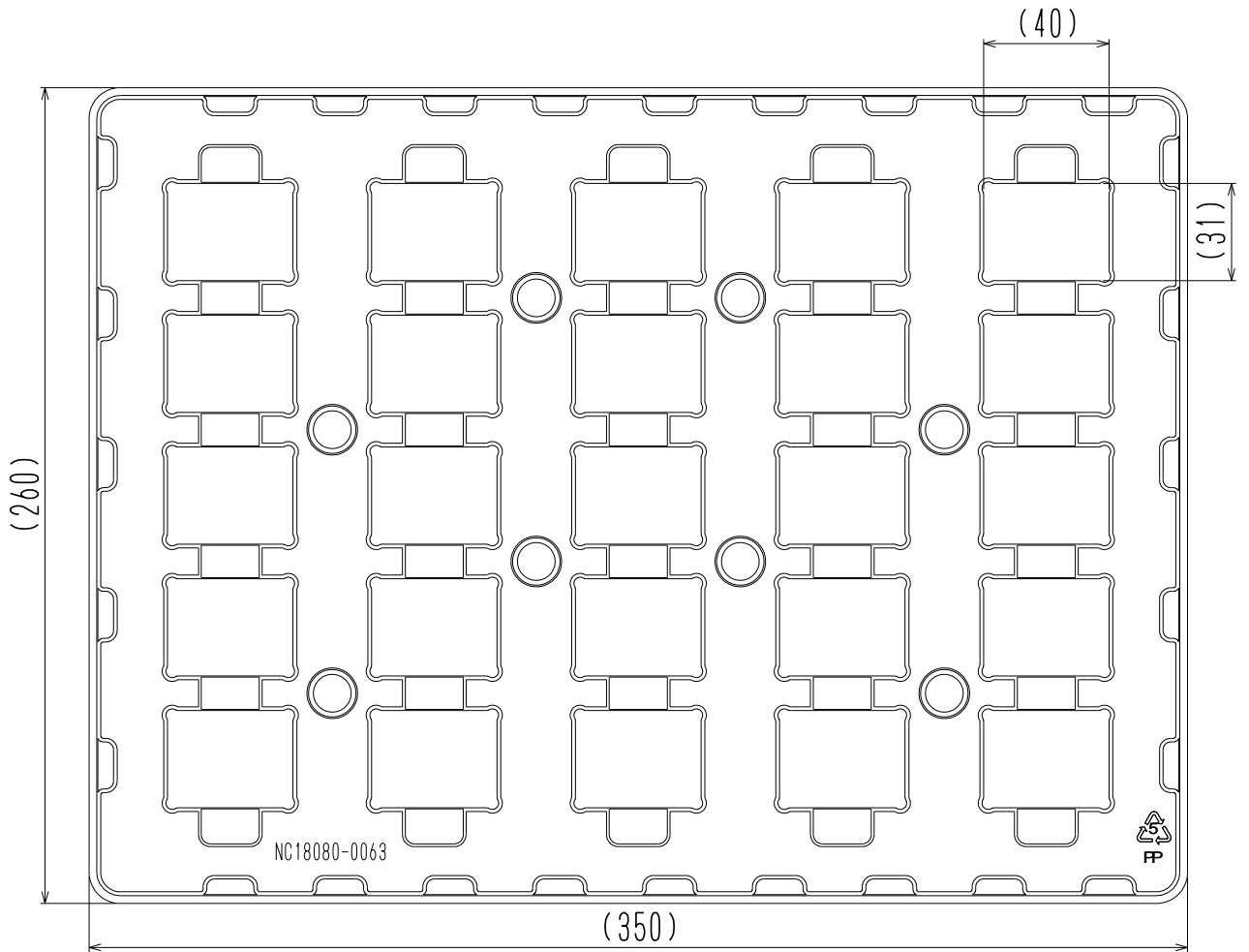


### 12-2. Outer Packaging Label

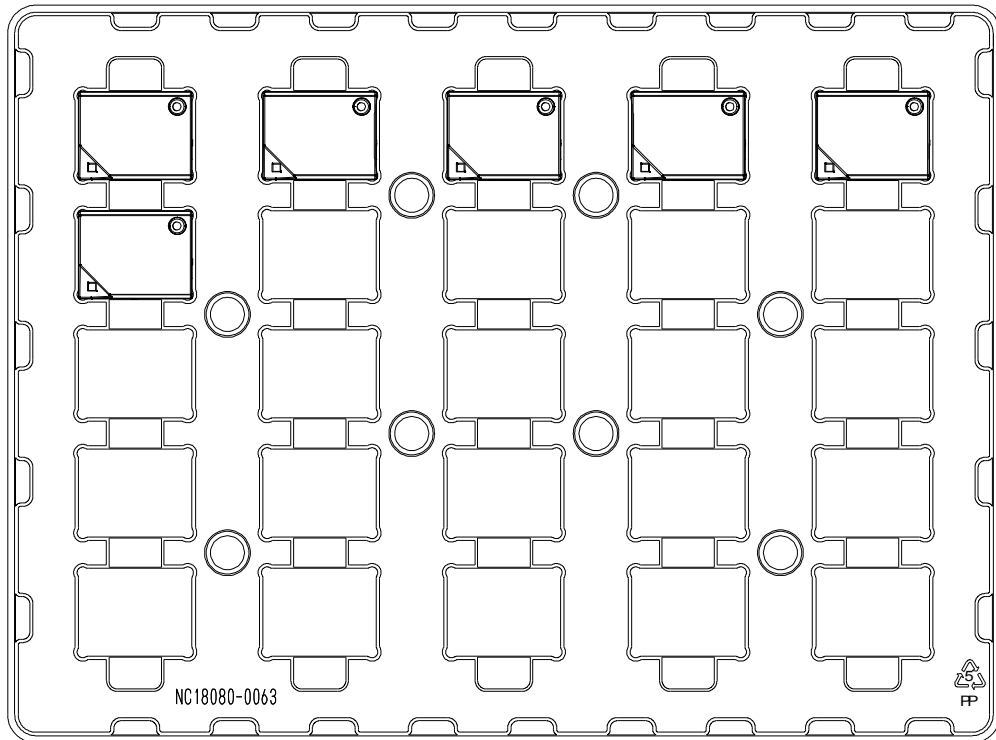


12-3. Shipment Packing

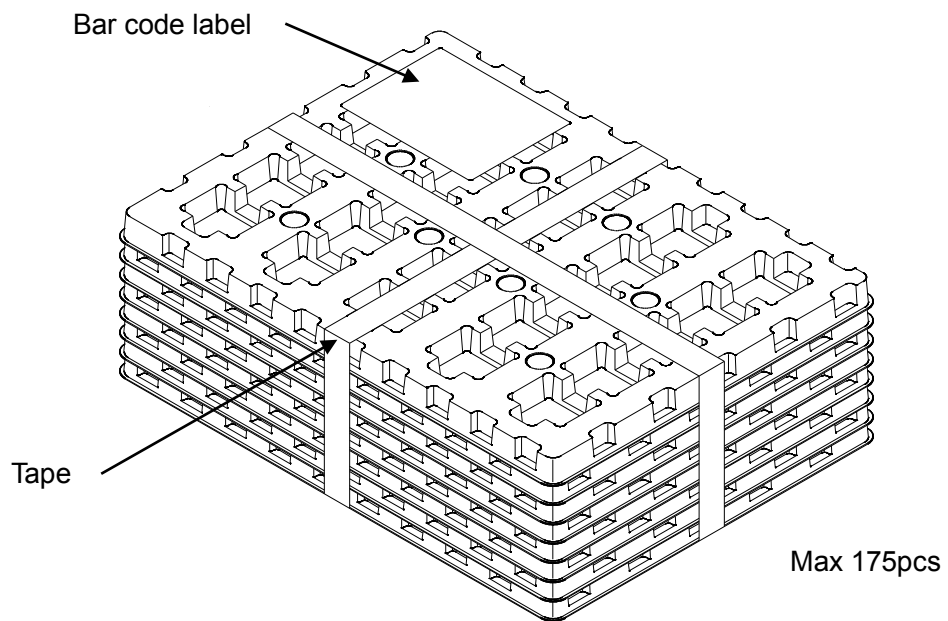
12-3-1. Tray packing



Tray dimensions



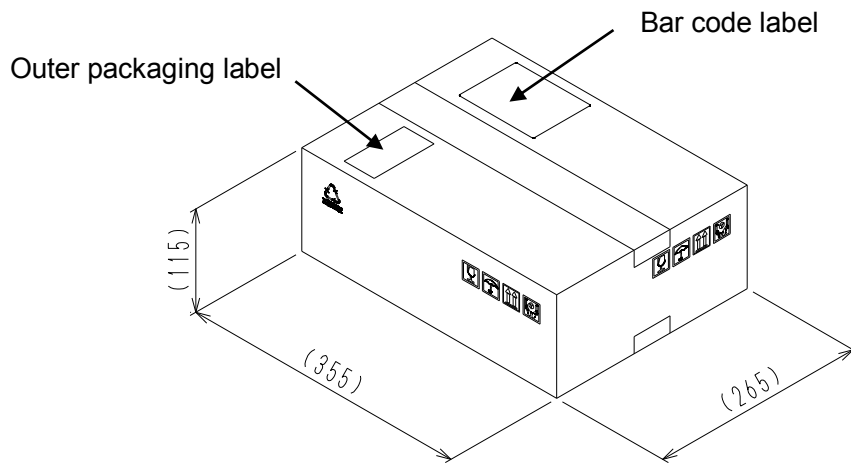
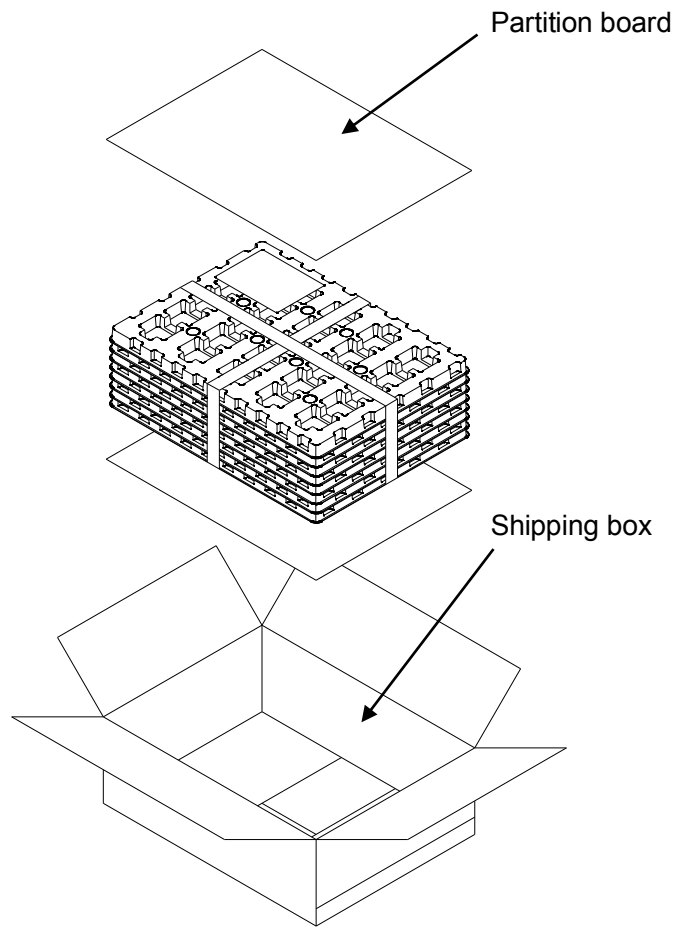
Tray packing



Tray convergence



12-3-2. Shipping package



Shipping box dimensions

### 13. Revision History

Revision	Contents change	Date
Rev. 0.01	Created first edition.	DEC 21, 2015