# WiFi / Bluetooth Module Data Sheet

## Cypress CYW43438 WLAN / BT + ST Micro STM32F412 MCU for 802.11b/g/n & Bluetooth® 4.1

### Electric Imp P/N : imp004m
### MURATA P/N : LBEE5ZZ1MD-011

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

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# Revision history

| Issued Date | Revision Code | Revision Page | Changed Items | Change Reason |
|---|---|---|---|---|
| Jul. 6. 2016 | | | First Issue | |
| Sep. 9. 2016 | A | P3<br>P4<br>P6<br>P15<br>P17 | 2. Part Number<br>4.1. Dimensions<br>4.2. Terminal Configurations<br>11. Land pattern (Top View)<br>13. Tape and Reel Packing | |
| Oct. 11. 2016 | B | P3<br>P4<br>P6<br>P10<br>P12 | 2. Part Number<br>4.1. Dimensions (LMK)<br>42 Terminal Configurations<br>8. Power up sequence<br>9. RF Characteristics | |
| Oct. 13. 2016 | C | P6<br>P8<br>P9<br>P10<br><br>P11<br><br>P16<br>P17 | 4.2. Pin configurations<br>4.3. Pin mux table<br>5. LED drive<br>6. Phototransistor<br>7. SPI flash requirements<br>9. Operating condition<br>10. External 32kHz crystal<br>14. Reference circuit<br>15. Recommended components | |
| Oct. 20. 2016 | D | P10 | 6. Phototransistor | Correct imp003 reference |
| Oct. 21. 2016 | E | P3 | 1. Scope | Update cloud information |
| Mar. 14. 2017 | F | P5 | 4.1. Dimensions | Correct Pin 1 Marking |
| Apr. 13. 2017 | G | P5<br><br>P12 | 4. Dimensions, Marking and Terminal Configurations<br>9. Operating Condition | Correct Top view design<br><br>Correct the range of VDD_WLAN, VDDA_MCU and VDD_IO_MCU |
| Apr. 20. 2017 | H | P5 | 4.1. Dimensions | Correct the marking. |
| Jun. 27. 2017 | I | P3 | 1.  Scope | Wording |
| Jul. 29. 2017 | J | P1<br><br>P15<br><br>P16<br><br>P23<br>P17<br><br>P24<br><br>P34 | Part number<br><br>7. SPI flash requirements<br><br>8. Required wiring for Bluetooth operation<br>15. Reference circuit<br>9. Absolute Maximum Rating<br><br>16.3 Flash memory<br><br>20. Regulatory Requirements | Updated from temp to production part number<br><br>Added SPI commands<br><br>Added Bluetooth connections<br><br><br>Correction<br><br>Updated part number recommendations<br><br>Added FCC and IC regulations for modular certification |

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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.

## 1. Scope

This specification is for the LBEE5ZZ1MD (imp004m) module that provides connectivity to the internet via WiFi. The fully maintained, secure OS that is part of the Electric Imp cloud service comes pre-loaded.

- 802.11 b/g/n 1x1 WiFi
  - 802.11b 17dBm (typ.)
  - 802.11g 13dBm (typ.)
  - 802.11n 12dBm (typ.) [20MHz channels]
  - RX Sensitivity -98dBm (typ.) [@1Mbps]
  - On-board antenna
  - Supports WEP, WPA, WPA2, WPS

- Bluetooth 4.1
  - BTLE support for WiFi configuration using GATT
  - Automatically shares antenna with WiFi
  - Optional: requires 4 MCU pins and stack license fee to enable functionality in commercial products

- 32-bit Cortex M4 processor
  - Robust embedded operating system with fail-safe firmware updates
  - Virtual machine for customer firmware
  - 256kB of application bytecode flash
  - Over 190kB of free application RAM

- Electric Imp OS & service
  - Robust embedded operating system with fail-safe, secure OS & Application updates
  - Pre-provisioned MAC address & per-device secrets
  - TLS1.2-RSA-ECDHE (forward secrecy) connection to cloud
  - Elliptic curve challenge-response to prevent device impersonation
  - Fully featured cloud VM for every device for easy integration with RESTful APIs
  - Open source integrations with AWS, Azure, etc services

- LED drive for red/green status LEDs

- Phototransistor input for Electric imp's patented BlinkUp™ technology for easy configuration from any smartphone, tablet, or web browser

- 18 user selectable I/Os
  - GPIO, PWM, Analog input, SPI, UART, I2C
  - Dedicated SPI bus for local storage

- Low power 14uA (typ.) sleep mode
  - Option for coin cell RTC battery backup

- Compliant with the RoHS directive

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## 2. Part Number

| Sample Part Number |
| --- |
| LBEE5ZZ1MD-TEMP |

| Production Part Number |
| --- |
| LBEE5ZZ1MD-011 |

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## 3. Block Diagram



Note: 32.768KHz outside of module
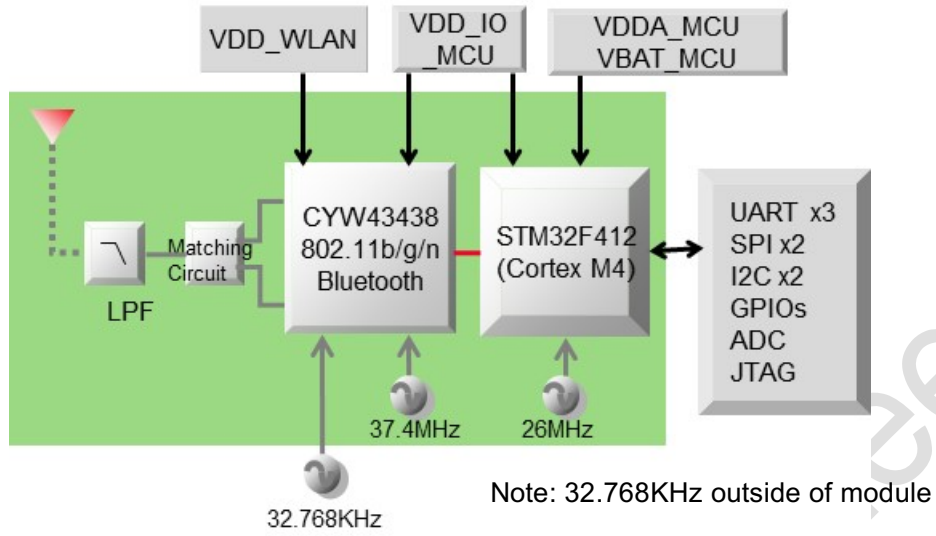
## 4. Dimensions, Marking and Terminal Configurations

### 4.1. Dimensions

< Top View >

R 001-P01018
FCC:VPYLB1MDIMP004
IC :772C-LB1MDIMP004

Model:Type1MD

imp004m    XXXXXXXXX

electricimp

(H)
(I)
(J)
(G)
(D)
(F)
(E)
(A)
(B)
(C)

< Top View >

c2  e6                    e3  m1
                                    b2
                                    e7
                                    m4
                                    e4
                                    m2
e2                                  e5
a2
c1
b1  a1    e1                  m3
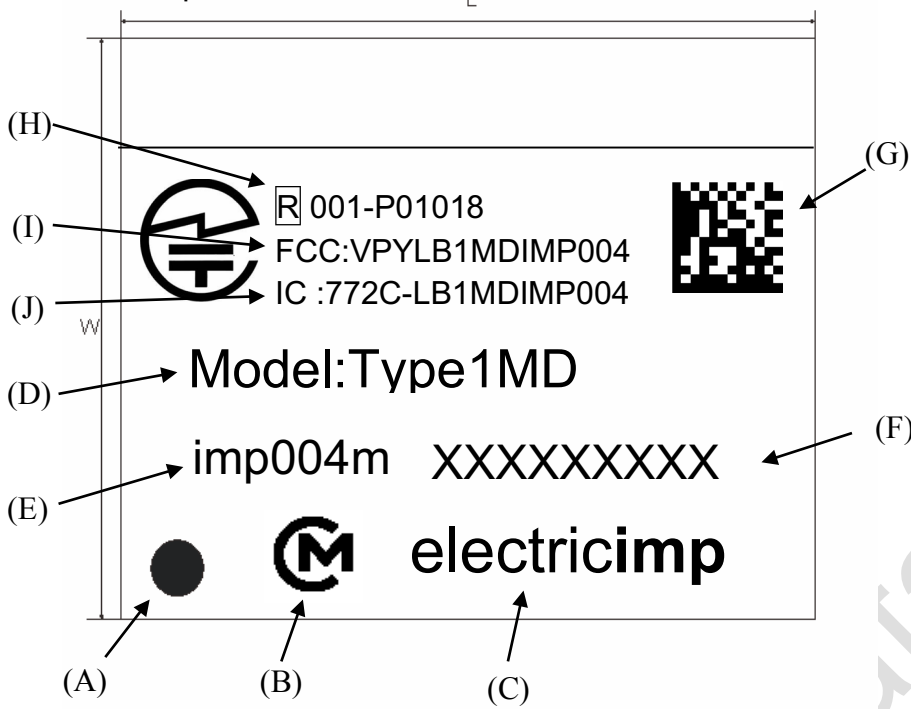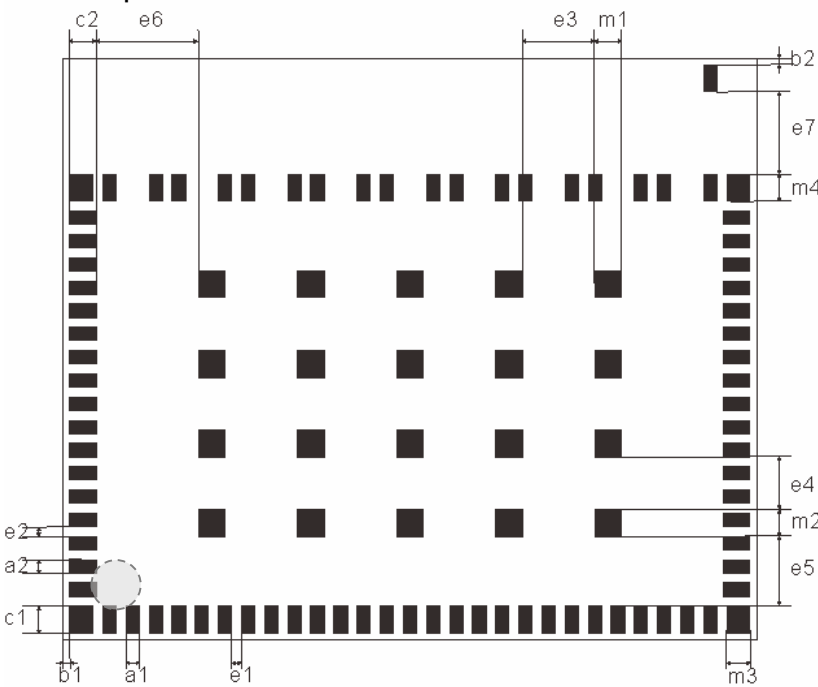
< Side View
>
T
T1

| Mark | Dimensions | Mark | Dimensions | Mark | Dimensions |
|------|------------|------|------------|------|------------|
| L | 21.0 +/- 0.2 | W | 17.5 +/- 0.2 | T | 2.3 max. |
| a1 | 0.4 +/- 0.1 | a2 | 0.4 +/- 0.1 | b1 | 0.2 +/- 0.2 |
| b2 | 0.2 +/- 0.2 | c1 | 0.8 +/- 0.1 | c2 | 0.8 +/- 0.1 |
| e1 | 0.3 +/- 0.1 | e2 | 0.3 +/- 0.1 | e3 | 2.2 +/- 0.1 |
| e4 | 1.6 +/- 0.1 | e5 | 2.1 +/- 0.1 | e6 | 3.1 +/- 0.1 |
| e7 | 2.5 +/- 0.1 | m1 | 0.8 +/- 0.1 | m2 | 0.8 +/- 0.1 |
| m3 | 0.7 +/- 0.1 | m4 | 0.8 +/- 0.1 | | |

(unit : mm)

## Marking

| Marking | Meaning |
|---------|---------|
| (A) | Pin 1 Marking |
| (B) | Murata Logo |
| (C) | Electric Imp Logo |
| (D) | Murata Module Type |
| (E) | Imp Module Type |
| (F) | Inspection Number |
| (G) | 2D code |
| (H) | Japanese Type certification No. |
| (I) | FCC certification ID |
| (J) | IC certification No. |

## Structure



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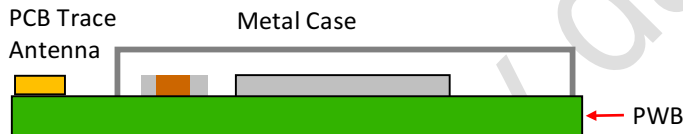
## Mounting

The module is designed to be mounted on the edge of the board, with the antenna section hanging off in free space. The antenna is tuned for free space operation. Please see the design guide on Electric Imp dev center website at http://www.electricimp.com/docs for more information.

## 4.2. Terminal Configurations

Top view (through package)
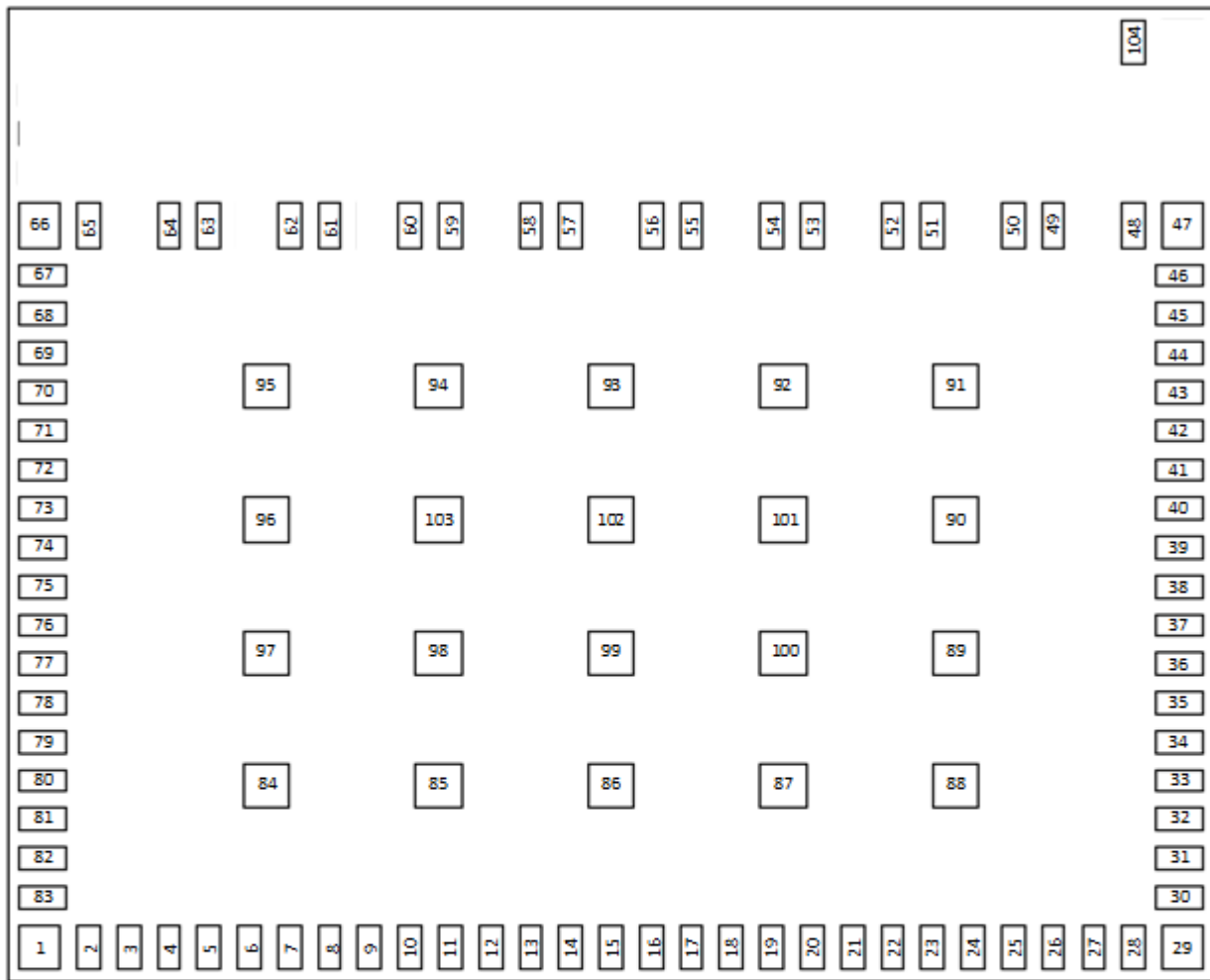
| No. | Name | Type | Description |
|-----|------|------|-------------|
| 1 | GND | GND | |
| 2 | CLK_REQ | O | Reference clock request. As the clock is internal, this pin does not need to be connected |
| 3 | BT_REG_ON | I | Enable Bluetooth power. Leave NC if Bluetooth is not used (active high) |
| 4 | NC | - | No Connect |
| 5 | pinM | I/O | GPIO, i2cNM SDA, PWM |
| 6 | pinN | I/O | GPIO, i2cNM SCL, PWM |
| 7 | pinP | I/O | GPIO, i2cQP SDA, PWM, IRQ |
| 8 | pinW | I/O | GPIO, uartBCAW CTS, ADC, IRQ & wake from deep sleep (active high) |
| 9 | GND | GND | |
| 10 | pinA | I/O | GPIO, uartBCAW RTS, spiAHSR MOSI, ADC, PWM |
| 11 | pinB | I/O | GPIO, uartBCAW TX, ADC, PWM, IRQ |
| 12 | pinC | I/O | GPIO, uartBCAW RX, ADC, IRQ |
| 13 | LPO_IN | I | Sleep Clock (for both WiFi & Bluetooth). If low power WiFi operation – or Bluetooth operation – is required, this pin should be connected to pinE. Otherwise, ground this pin. |
| 14 | pinD | I/O | GPIO, ADC, PWM, IRQ |
| 15 | pinE | I/O | GPIO, IRQ |
| 16 | pinK | I/O | GPIO, spiGJKL SCLK, ADC, PWM |
| 17 | pinL | I/O | GPIO, spiGJKL NSS, ADC, IRQ |
| 18 | GND | GND | |
| 19 | VDD_IO_MCU | PWR | MCU/WLAN VIO |
| 20 | GND | GND | |
| 21 | pinQ | I/O | GPIO, uartQ TX, i2cQP SCL, IRQ |
| 22 | pinR | I/O | GPIO, spiAHSR NSS, IRQ |
| 23 | pinS | I/O | GPIO, spiAHSR SCLK, IRQ |
| 24 | PSU_ENABLE | O | Active high when WiFi needs 2.7v+ |
| 25 | pinF | I/O | GPIO, uartFGJH TX |
| 26 | pinG | I/O | GPIO, uartFGJH RX, spiGJKL MOSI |
| 27 | pinH | I/O | GPIO, uartFGJH CTS, uartHJ TX, spiAHSR MISO, IRQ |
| 28 | pinJ | I/O | GPIO, uartFGJH RTS, uartHJ RX, spiGJKL MISO, pulse counter |
| 29 | GND | GND | |
| 30 | LED_RED | O | Red LED drive |
| 31 | LED_GREEN | O | Green LED drive |
| 32 | OPTO_IN | I | Phototransistor input |
| 33 | OPTO_BIAS | O | Phototransistor supply |
| 34 | FLASH_MOSI | O | SPI flash connection |
| 35 | FLASH_SCLK | O | SPI flash connection |
| 36 | FLASH_CS_L | O | SPI flash connection |

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| 37 | FLASH_MISO | I | SPI flash connection |
|---|---|---|---|
| 38 | NC | - | |
| 39 | RESET_L | I | MCU reset, internally pulled up |
| 40 | VSSA/VREF- | GND | Must be connected to GND |
| 41 | OSC32_OUT | O | 32kHz xtal connection |
| 42 | OSC32_IN | I | 32kHz xtal connection (ground if no xtal fitted) |
| 43 | GND | GND | |
| 44 | VBAT_MCU | PWR | MCU VBAT input |
| 45 | VDDA_MCU | PWR | MCU VDDA input |
| 46 | VDD_WLAN | PWR | WLAN VBAT input |
| 47-70 | GND | GND | |
| 71 | BT_UART_TXD | O | Bluetooth UART transmit. Leave NC if not used |
| 72 | BT_UART_RTS | O | Bluetooth UART ready to send. Leave NC if not used |
| 73 | BT_UART_RXD | I | Bluetooth UART receive. Leave NC if not used |
| 74 | BT_UART_CTS | I | Bluetooth UART clear to send. Leave NC if not used |
| 75-76 | GND | GND | |
| 77 | BT_HOST_WAKE | O | Signal to wake host (from Bluetooth core). Leave NC if not used |
| 78-81 | NC | - | |
| 82 | BT_DEV_WAKE | I | Signal to wake Bluetooth core (from host). Leave NC if not used |
| 83 | NC | - | No Connect |
| 84-103 | GND | GND | |
| 104 | NC | - | Note this pad should not be touching any PCB |

### 4.3. Pin Mux table

| Pin | Uart BCAW | uart FGJH | uart HJ | uart Q | i2c NM | i2c QP | spi AHSR | spi GJKL | ADC | PWM | Pulse count | State change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| pinA | RTS | | | | | | MOSI | | Yes | Yes | | |
| pinB | TX | | | | | | | | Yes | Yes | | Yes |
| pinC | RX | | | | | | | | Yes | | | Yes |
| pinD | | | | | | | | | Yes | Yes | | Yes |
| pinE | | | | | | | | | | | | Yes |
| pinF | | TX | | | | | | | | | | |
| pinG | | RX | | | | | | MOSI | | | | |
| pinH | | CTS | TX | | | | MISO | | | | | Yes |
| pinJ | | RTS | RX | | | | | MISO | | | Yes | |
| pinK | | | | | | | | SCLK | Yes | Yes | | |
| pinL | | | | | | | | NSS | Yes | | | Yes |
| pinM | | | | | SDA | | | | | Yes | | |
| pinN | | | | | SCL | | | | | Yes | | |
| pinP | | | | | | SDA | | | | Yes | | Yes |
| pinQ | | | | TX | | SCL | | | | | | Yes |
| pinR | | | | | | | NSS | | | | | Yes |
| pinS | | | | | | | SCLK | | | | | Yes |
| pinW | CTS | | | | | | | | Yes | | | Yes |

## 5. <u>LED drive</u>

The indicator LED should be bicolor, because red, green and amber (red+green) are used to indicate status.
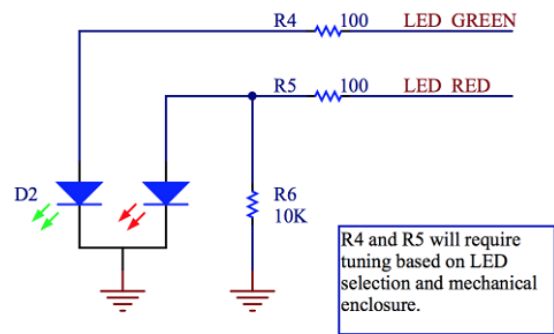
The LED drive pins will auto-detect common anode or common cathode parts. The detection is done by looking to see which way up the LED_RED pin is idling at boot; to ensure this works correctly, please place a 10k resistor in parallel with the red LED.

The current drive on these pins is 20mA maximum.
Please refer to section 15 for the recommended LEDs.

<Common anode diagram>                                          <Common cathode diagram>
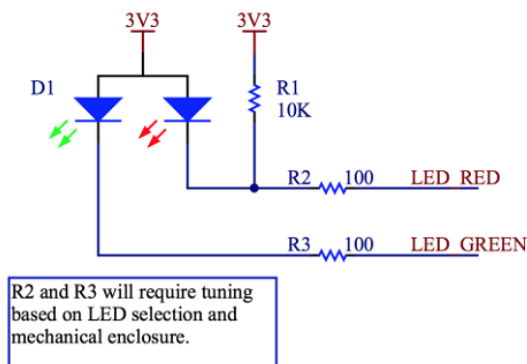


Two specific LED codes indicate errors when talking to the SPI flash:

| SPI flash not found | amber | red | off |
|---|---|---|---|
| SPI flash error | red | amber | off |

If you encounter either of these codes, then this indicates an electrical connection issue or an incompatible flash part.

## 6. <u>Phototransistor</u>

The phototransistor is used to receive BlinkUp configuration data. The bias resistor connected between OPTO_IN and GND may need to be adjusted to ensure adequate sensitivity and response time - in general you need at least 500mV swing on the OPTO_IN pin between black and white states, with the worst (dimmest) BlinkUp sender you can find. More information and sample code to tune blinkup is available on the Electric Imp dev center website.

End-user BlinkUp send data at between 30 and 60 bits per second, depending on the user's device. For factory configuration, data is typically sent at 142 bits per second using red LED(s) in a test fixture. If your application does not require optical configuration, config can be sent electrically at 142 bits per second from another micro using the OPTO_IN pin. Please contact us for more details.

It is also recommended to place 0402, 13pF capacitor footprints (Murata GRM1555C1H130JA01) close to the imp004m between OPTO_BIAS and GND, and OPTO_IN and GND. If issues are seen with RF coupling onto the blinkup circuit, then these components will address the issue by presenting a low impedance in the 2.4GHz band.

Please refer to paragraph 15 for the recommended phototransistors.
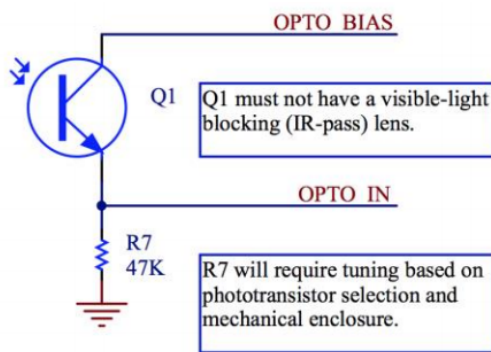
## 7. <u>SPI flash requirements</u>

An external SPI Flash part is required for operation, which must be pre-loaded with the correct WiFi firmware image before assembly. The required image is available from the Electric Imp dev center website at http://www.electricimp.com/docs

The minimum size of the SPI Flash is 8Mbit (1MB), and the maximum size is 128Mbit (16MB). The area below address 0xC2000 (776kB) is the pre-programmed area. The remainder of the flash device is made available to user code programmatically, and may optionally be pre-programmed for user applications before assembly.

The imp004m's SPI flash chip **must** support both 4KB erases (Command 0x20) and 64KB erases (command 0xD8) and Page Program (command 0x02). You must also ensure that the SPI flash you use is able to run down to the **minimum operational voltage** of your product to ensure that the SPI flash is operational at all times that the imp is operational. This is critical during upgrades in low battery states. If you are running from a single LiMnO$_2$ cell (eg. CR123), you should use a wide voltage range SPI flash that is operational from 1.7-3.6V such as the Macronix MX25R8035FM2IH0.

| Minimum Size | 8 Mbit (1024 kByte) |
|---|---|
| Reserved for OS (do not pre-program) | 0x000000 to 0xC2000 (776 kByte) |

Summary of required SPI flash commands

| Required Command | Command in Hex |
|---|---|
| 4KB Sector Erase | 0x20 |
| 64KB Block Erase | 0xD8 |
| Page Program | 0x02 |

## 8. Required wiring for Bluetooth operation

If Bluetooth is not used in the application, leave all Bluetooth pins (3, 71-74, 77, 82) unconnected.

To use Bluetooth in an application, you must connect the MCU pins to the Bluetooth device:

- BT_UART_TXD should be connected to an MCU UART RX pin (pinC, pinG or pinJ)
- BT_UART_RXD should be connected to the same UART's TX pin (pinB, pinF or pinH)
- pinE MUST be connected to the LPO in pin, to supply a 32kHz clock to the Bluetooth radio
- BT_REG_ON should be connected to any free MCU pin, to control Bluetooth power
- BT_UART_CTS should be grounded (The imp Bluetooth stack uses 2 wire UART)

Aside from pinE, which cannot be reassigned, choice of UART and control pin for BT_REG_ON is determined by the application – this allows flexibility in complex IO configurations.

Please refer to the Electric Imp dev center for more information on how to configure the Bluetooth stack, which is present from impOS release 40.

Note that though use of Bluetooth is free for developers, commercial use incurs an additional licensing fee for the stack. Please contact sales@electricimp.com for more details.

## 9. Absolute Maximum Rating

| | | min. | max. | unit |
|---|---|---|---|---|
| Storage Temperature | | -40 | 85 | deg.C |
| Supply Voltage | VBAT_MCU | -0.3 | 4 | V |
| | VDDA_MCU | -0.3 | 4 | |
| | VDD_WLAN | -0.5 | 6 | |
| | VDD_IO_MCU | -0.3 | 3.63 | |

Stresses in excess of the absolute ratings may cause permanent damage. Functional operation is not implied under these conditions. Exposure to absolute ratings for extended periods of time may adversely affect reliability. No damage assuming only one parameter is set at limit at a time with all other parameters is set within operating condition.

## 10. Operating Condition

| | | min. | typ. | max. | unit |
|---|---|---|---|---|---|
| Operating Temperature Range | | -30 | 25 | 70 | deg.C |
| Specification Temperature Range | | -20 | 25 | 55 | deg.C |
| Supply Voltage | VBAT_MCU | 1.65 | 3.3 | 3.6 | V |
| | VDDA_MCU | 1.8 | 3.3 | 3.6 | |
| | VDD_WLAN | 3.0 | 3.3 | 3.6 | |
| | VDD_IO_MCU | 1.8 | 3.3 | 3.6 | |

Notes :
- All RF characteristics in this datasheet are defined by Specification Temperature Range. Specifications require derating at extreme temperatures.
- VDDA_MCU and VDD_IO_MCU must be the same potential.

## 11. External 32.768 kHz Crystal

If the application requires the imp004m to enter deep sleep mode, a 32kHz crystal should be attached to the OSC32_IN and OSC32_OUT pins. Please refer to the STM32F412 datasheet and application note AN2867 by STMicroelectronics NV for detailed crystal requirements.
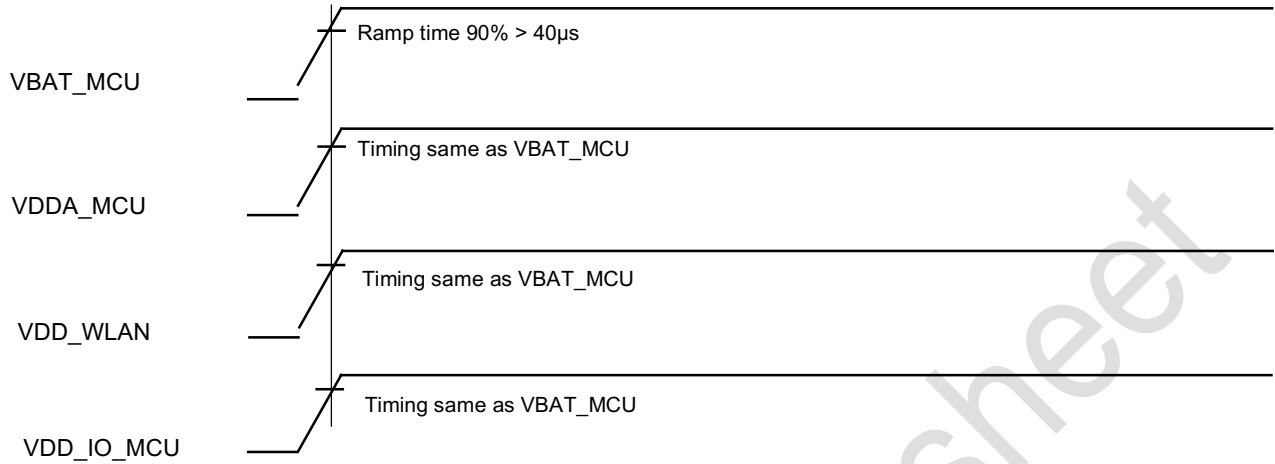
If deep sleep mode is not required, OSC32_IN should be connected to GND and OSC32_OUT left floating. The imp004m will detect this state and disable the sleep APIs.
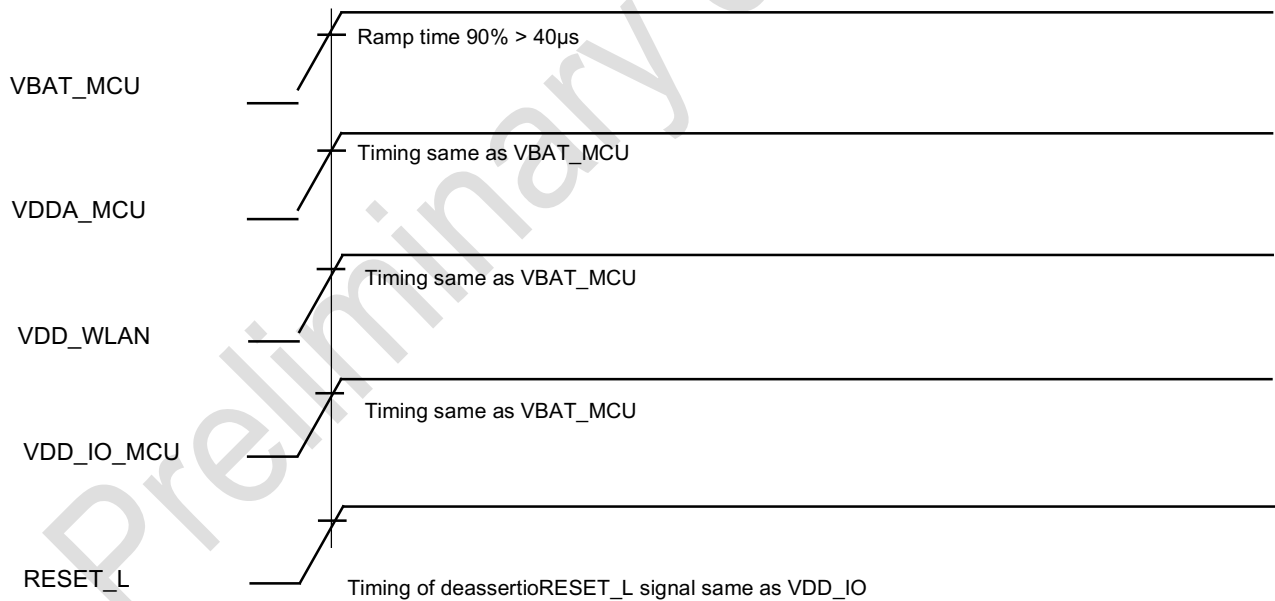
## 12. Power Up Sequence

### 12.1. Without RESET_L control

Following timing diagram explain module power up sequence.

VBAT_MCU — Ramp time 90% > 40µs

VDDA_MCU — Timing same as VBAT_MCU

VDD_WLAN — Timing same as VBAT_MCU

VDD_IO_MCU — Timing same as VBAT_MCU

*Power down sequence is opposite sequence of power up.

### 12.2. With RESET_L control

VBAT_MCU — Ramp time 90% > 40µs

VDDA_MCU — Timing same as VBAT_MCU

VDD_WLAN — Timing same as VBAT_MCU

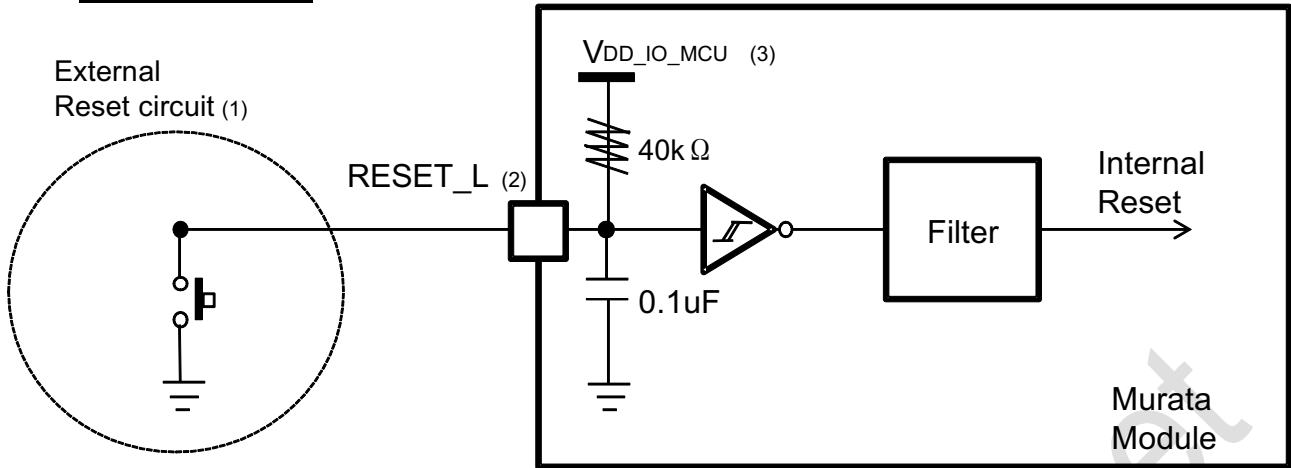VDD_IO_MCU — Timing same as VBAT_MCU

RESET_L — Timing of deassertioRESET_L signal same as VDD_IO

*Power down sequence is opposite sequence of power up.
*RESET_L pin must be controlled by Open Drain.

## 12.3. RESET_L Circuit



(1) The reset network protects the device against parasitic resets.

(2) The use must ensure that the level on the RESET_L pin can go below the $V_{IL}(NRST)$ max level specified in below table. Otherwise the reset is not taken into account by the device.

(3) RESET_L pin must be controlled by Open Drain. High signal must not input to this pin.

| Symbol | Parameter | Min | Typ | Max | Unit |
|--------|-----------|-----|-----|-----|------|
| $V_{IL}$ | RESET_L I/O input low level voltage | - | - | 0.1xVDD_IO_MCU+0.1 | V |

## 13. Electrical Characteristics

| - DC Characteristics - | min. | typ. | max. | unit |
|---|---|---|---|---|
| 1. DC current | | | | |
| 1) Tx mode[1] | | 300 | 370 | mA |
| 2) Rx mode | | 45 | 100 | mA |

1)  Conditions: 25deg.C, VDD_WLAN=3.3V, VDD_IO_MCU=3.3V
    (1Mbps mode unless otherwise specified.)

Note: The above mentioned values have been obtained according to our own measuring methods and may very depend on the circuit, in which the component is actually incorporated. Therefore, you are kindly requested to test the performance of the component actually in your set.
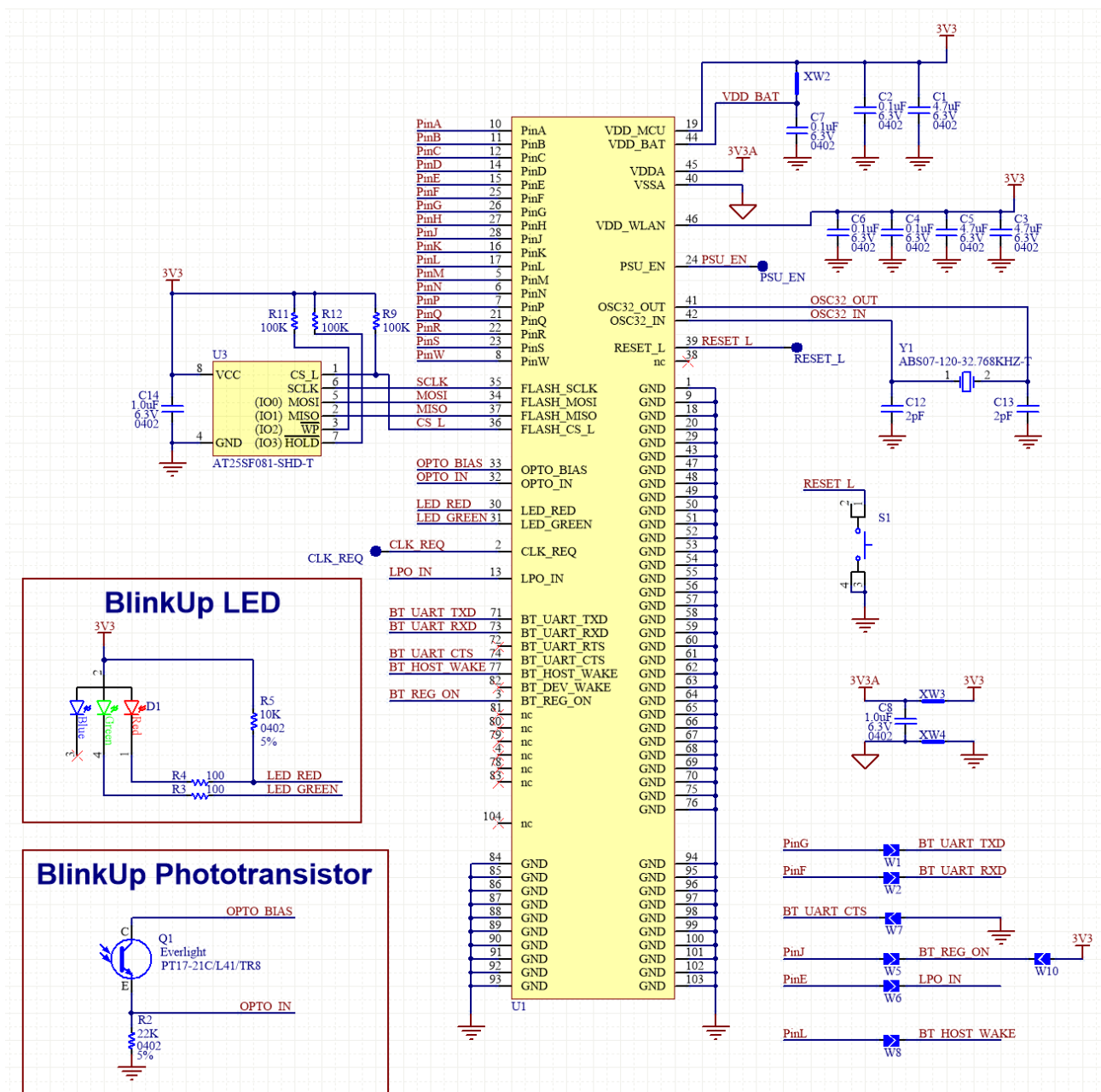
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## 14. Land pattern (Top View)

Unit : mm

## 15. Reference Circuit

**BlinkUp LED**

**BlinkUp Phototransistor**

## 16. Recommended Components

### 16.1. Bi-color LED

| | | Manufacturer | Manufacturer's part number |
|---|---|---|---|
| **Surface mount** | | | |
| top-view | | SunLED | XZMDKVG59W-1 |
| | | Liteon | LTST-C195KGJRKT |
| side-view | | SunLED | XZMDKVG88W |
| | | Bivar | SM1204BC |
| **Through-hole** | | | |
| 3mm | | SunLED | XLMDKVG34M |
| | | Liteon | LTL1BEKVJNN |

## 16.2. Phototransistor

| | Manufacturer | Manufacturer's part number |
|---|---|---|
| **Surface mount** | | |
| top-view | Everlight | PT17-21C/L41/TR8 |
| | Fairchild | KDT00030TR |
| side-view | SunLED | XZRNI56W-1 |
| | Everlight | PT12-21C/TR8 |
| **Through-hole** | | |
| 3mm | SunLED | XRNI30W-1 |
| | LiteOn | LTR-4206 |

## 16.3. SPI Flash

| Size | Manufacturer | Manufacturer's part number |
|---|---|---|
| 8 Mbit | Adesto Technologies<br>Macronix International | AT25SF081<br>MX25R8035F[1] |
| 16 Mbit | Adesto Technologies<br>Cypress Semiconductor Corp | AT25SF161<br>S25FL116K[2] |
| 32 Mbit | Adesto Technologies<br>Cypress Semiconductor Corp | AT25SF321<br>S25FL132K[2] |
| 64 Mbit | Cypress Semiconductor Corp<br>Cypress Semiconductor Corp | S25FL064L<br>S25FL164K[2] |

(1) This device offers a wide operating voltage range
(2) This part is EOL, though inventory may still be available through distributors

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## 17. Tape and Reel Packing

(1) Dimensions of Tape (Plastic tape)

1.75±0.1

44.0±0.3

40.4±0.1

20.2±0.1

2.0±0.15

4.0±0.1 *1

1.5+0.1/-0.0

0.3±0.05

22.00±0.10 *2

2.0+0.1/-0.0

24.0±0.1

18.00± 0.10

2.55±0.1
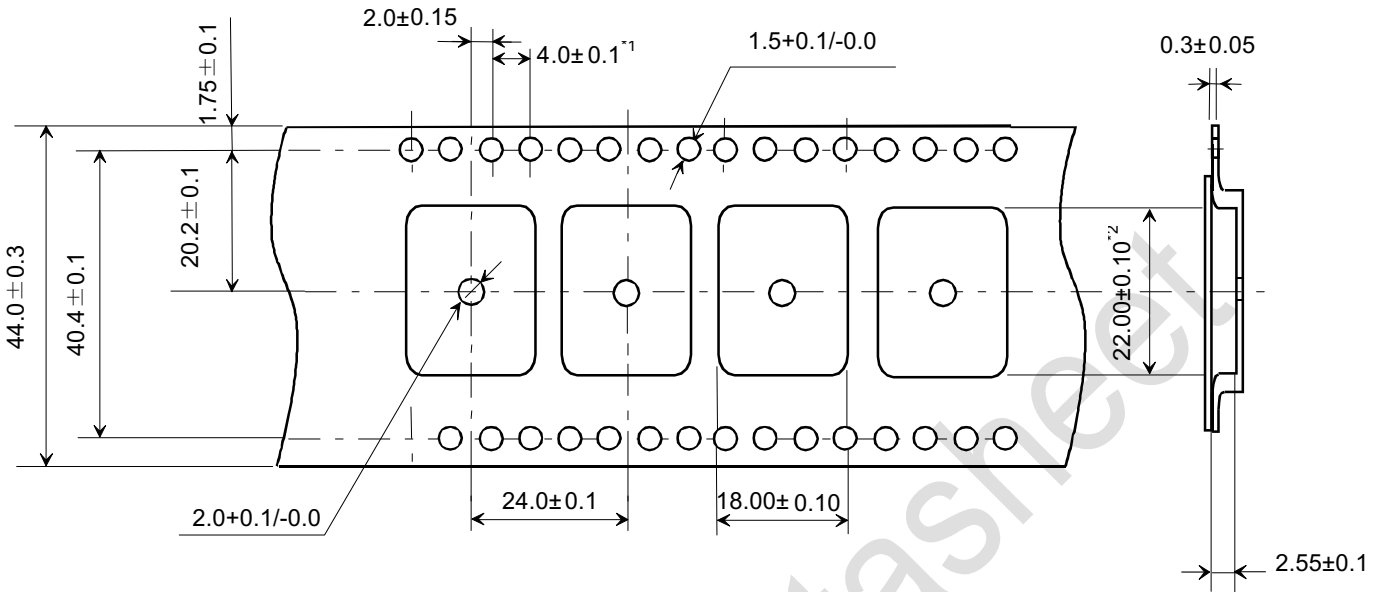
*1 Cumulative tolerance of max. ± 0.3 every 10 pitches
*2 Reference value

(Unit : mm)

(2) Dimensions of Reel

45.5

2.0±0.5

φ 21±0.8

(φ 100)

(φ 330)

50.5max

(Unit: mm)

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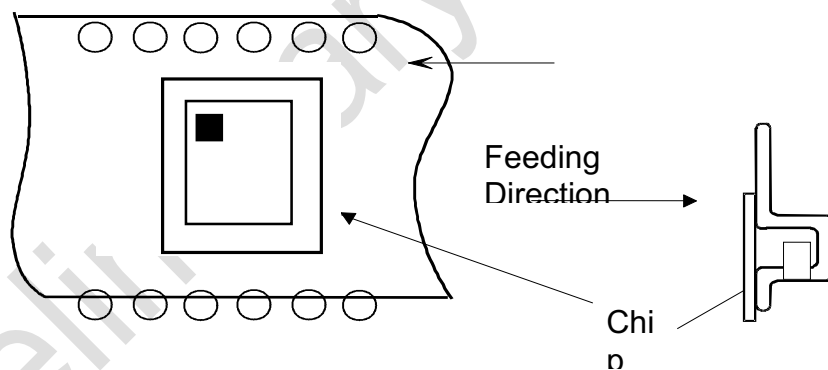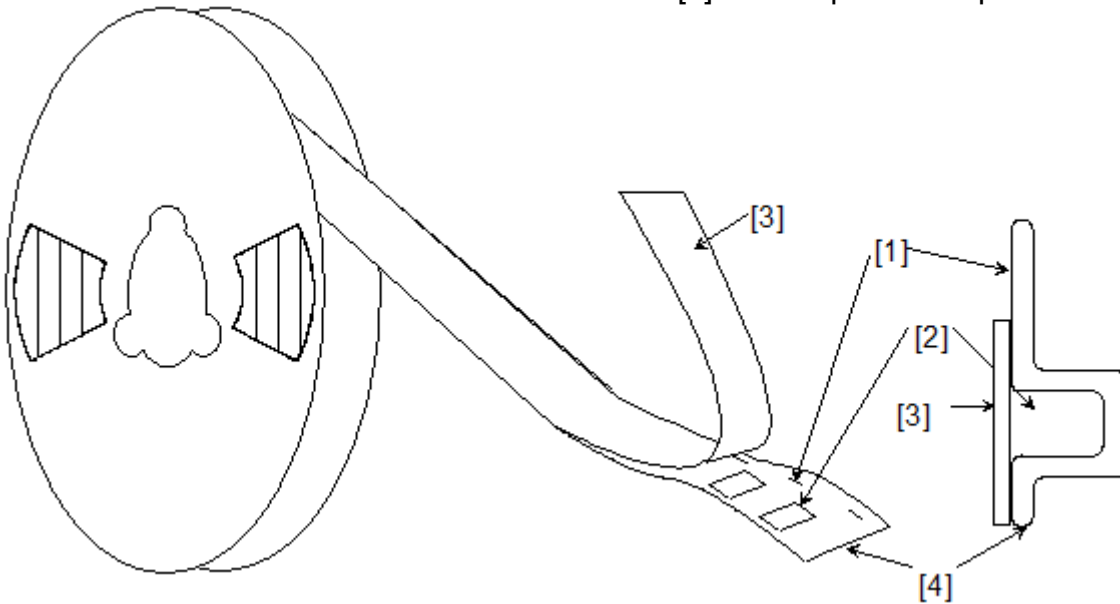Murata Manufacturing Co.,Ltd.
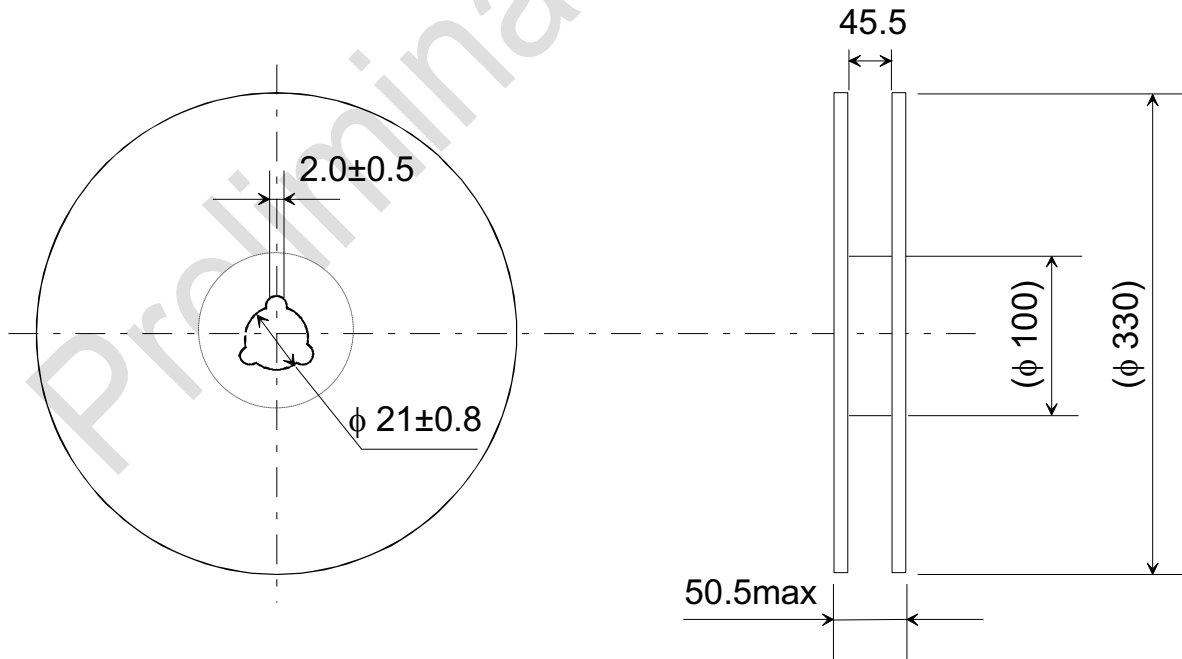
## (3) Taping Diagrams

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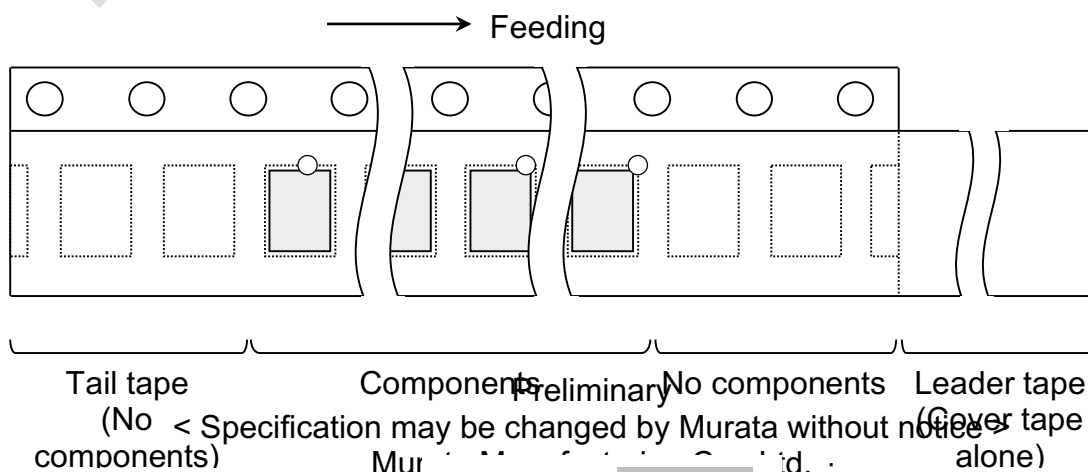
[2] Hole for chip     : As specified in (1)

[3] Cover tape  : 62μm in thickness

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



Feeding Direction

Chip

## (4) Leader and Tail tape

Feeding



| Tail tape (No components) | Components | No components | Leader tape (Cover tape alone) |

(5) The tape for chips are wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.
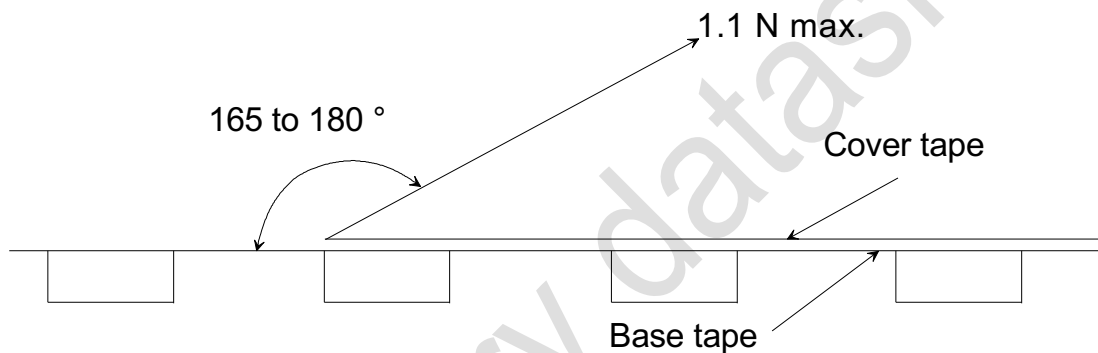
(6) The cover tape and the base tape are not adhered at no components area for 250mm min.

(7) Tear off strength against pulling of cover tape : 5N min.
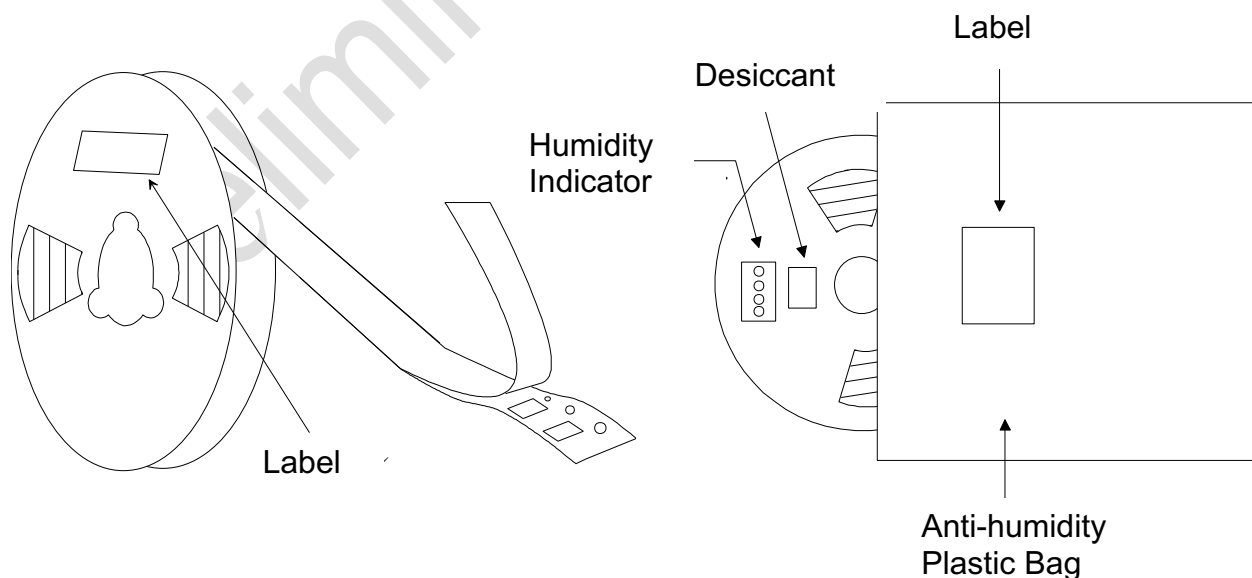
(8) Packaging unit:                500pcs./ reel

(9) Material:   Base tape :        Plastic
                Reel :              Plastic
                Cover tape, cavity tape and reel are made the anti-static processing.

(10) Peeling of force: 1.1N max. in the direction of peeling as shown below.



(11) 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.

## 18. NOTICE
### 18.1. 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 solderability 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.


### 18.2. 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.


### 18.3. 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.

**18.4. 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.

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**18.5. 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)**
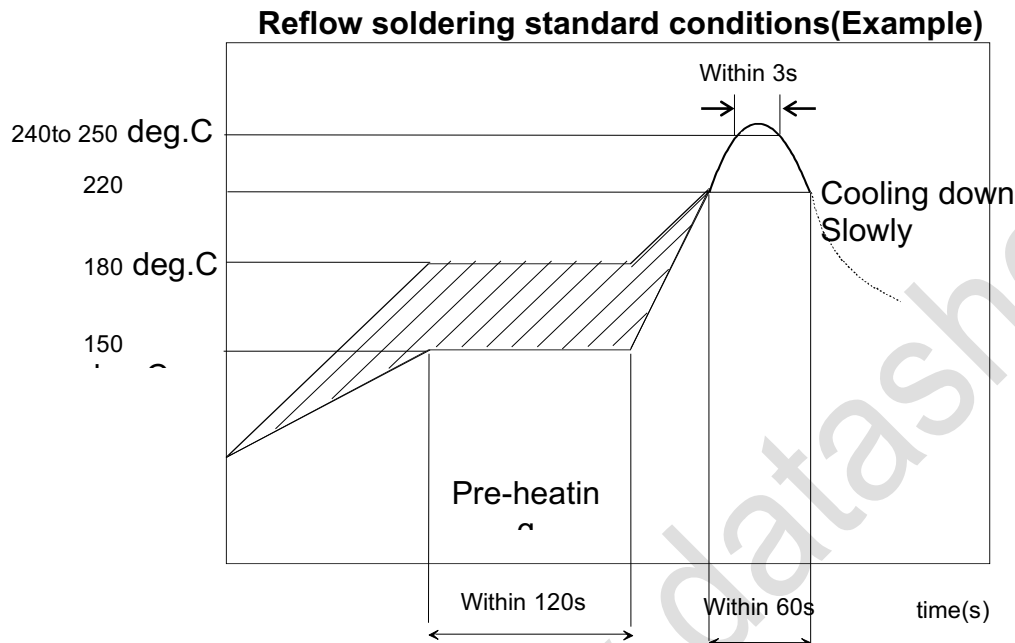


Please use the reflow within 2 times.
Use rosin type flux or weakly active flux with a chlorine content of 0.2 wt % or less.

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

**18.7. 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.

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## 18.8. 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.

## 19. <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.
We do not warrant or represent that any license, either express or implied, is granted under any our patent right, copyright, mask work right, or our other intellectual property right relating to any combination, machine, or process in which our products or services are used. Information provided by us regarding third-party products or services does not constitute a license from us to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from us under our patents or other intellectual property.
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.
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 30 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 disclaim any liability for consequential and incidental damages.
If you can't agree the above contents, you should inquire our sales.

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## 20. <u>Regulatory requirements</u>

If the OEM or system integrator incorporates the 1MD module into their final product and wishes to reuse the 1MD module's FCC certification, it is the OEM/system integrator's responsibility to ensure compliance is met on production units.

### 20.1. <u>FCC Warning Notice</u>

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

Information to Be Supplied to the End User by the OEM or Integrator
The following regulatory and safety notices must be published in documentation supplied to the end user of the product or system incorporating an adapter in compliance with local regulations. Host system must be labeled with "Contains FCC ID: VPYLB1MDIMP004. This imp004m module is to be used only for mobile and fixed application. In order to re-use the imp004m module FCC approvals, the antenna must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located with any other antenna or transmitter.   If the module is installed with a separation distance of less than 20cm from all person or is co-located or operating in conjunction with any other antenna or transmitter then additional FCC testing and certification may be required. End-Users must be provided with transmitter operation conditions for satisfying RF exposure compliance.

OEM integrators must ensure that the end user has no manual instructions to remove or install the imp004m module.

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## 20.2. IC Warning Notice

This device complies with Industry Canada license-exempt RSS standard(s).
a. Common information Operation is subject to the following two conditions:
1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme à la norme(normes) RSS exempte de licence d'Industrie Canada

a. Informations communes Son fonctionnement est soumis aux deux conditions suivantes:
1. Ce dispositive ne peut causer des interferences, et
2. Ce dispositive doit accepter toute interference, y compris les interferences qui peuvent causer un mauvais fonctionnement du dispositive.

Information to Be Supplied to the End User by the OEM or Integrator Modular information form OEM
Information to be Supplied to the End User by the OEM or Integrator

The following regulatory and safety notices must be published in documentation supplied to the end user of the product or system incorporating an adapter in compliance with local regulations. Host system must be labeled with "Contains IC: 772C-LB1MDIMP004" This imp004m module is to be used only for mobile and fixed application. In order to re-use the imp004m module IC approvals, the antenna(s) used in this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.   If antenna is installed with a separation distance of less than 20cm from all person or is co-located or operating in conjunction with any other antenna or transmitter then additional IC testing and certification may be required. End-Users must be provided with transmitter operation conditions for satisfying RF exposure compliance.

OEM integrators must ensure that the end user has no manual instructions to remove or install the imp004m module.

单击下面可查看定价，库存，交付和生命周期等信息

>>Murata(村田)