# W-LAN + Bluetooth Combo Module Data Sheet

## 802.11b/g/n and Bluetooth v4.0 module

## Product Part Number: LBEE5ZSTNC-523

# Revision History

| Revision Code | Date | Description | Comments |
|---|---|---|---|
| B | Oct.21Aug.18.2011 | Add: Module Features<br>Update: Notice for Murata Wireless Modules<br>Update: Taping and Reel information | |
| A | Jul.15.2011 | Update: Component Height<br>Update: Current Consumption | |
| - | Apr.28.2011 | First Issue | |
| | | | |

**Notice for Murata Wireless Modules.**

Please read the specification including the NOTICE (Page29) and the Disclaimer (Page33) in this datasheet before using the Murata Wireless Modules.

## Module Features

- Murata LBEE5ZSTNC module integrates WLAN and Bluetooth functions.
- WLAN: IEEE 802.11 b, g, n compliant.
- Bluetooth: Bluetooth version 4.0 with Bluetooth Low Energy (BLE). Power Class 1.5.
- Typical WLAN Transmit Power (typical):
  - +20.0dBm at 11Mbps, CCK (11b)
  - +15.0dBm at 54Mbps, OFDM (11g)
  - +14.5dBm at 65Mbps, OFDM (11n)
- Typical Bluetooth Transmit Power (typical):
  - +8.0dBm BDR
- Typical WLAN Sensitivity (typical):
  - -88.0dBm at 8% PER, 11Mbps
  - -73.0dBm at 10% PER, 54Mbps
  - -70.0dBm at 10% PER, 65Mbps
- Typical Bluetooth Sensitivity (typical):
  - -92.0dBm DH5
  - -85.0dBm EDR
- Module size: 17.0x10.0mm typical.
- Module height: 2.2mm max.

- FCC (USA) and IC (Canada) Certification with mono-pole type antenna.
  - FCC ID: VPYLBTN, IC ID: 772C-LBTN
- (Option) U.FL connector for external antenna.
- Integrated Band Pass Filter
- Seamless integration with several Texas Instruments OMAP™, SITARA™, DaVinci™ and Integra™ processors
- SDIO host interface for WLAN
- UART host interface for Bluetooth, PCM interface for Audio.
- RoHS Compliance

1. Scope

This specification is applied to the IEEE802.11 b/g + Bluetooth ver. 4.0 module.

Host Interface
- W-LAN : SDIO,
- Bluetooth : UART, PCM

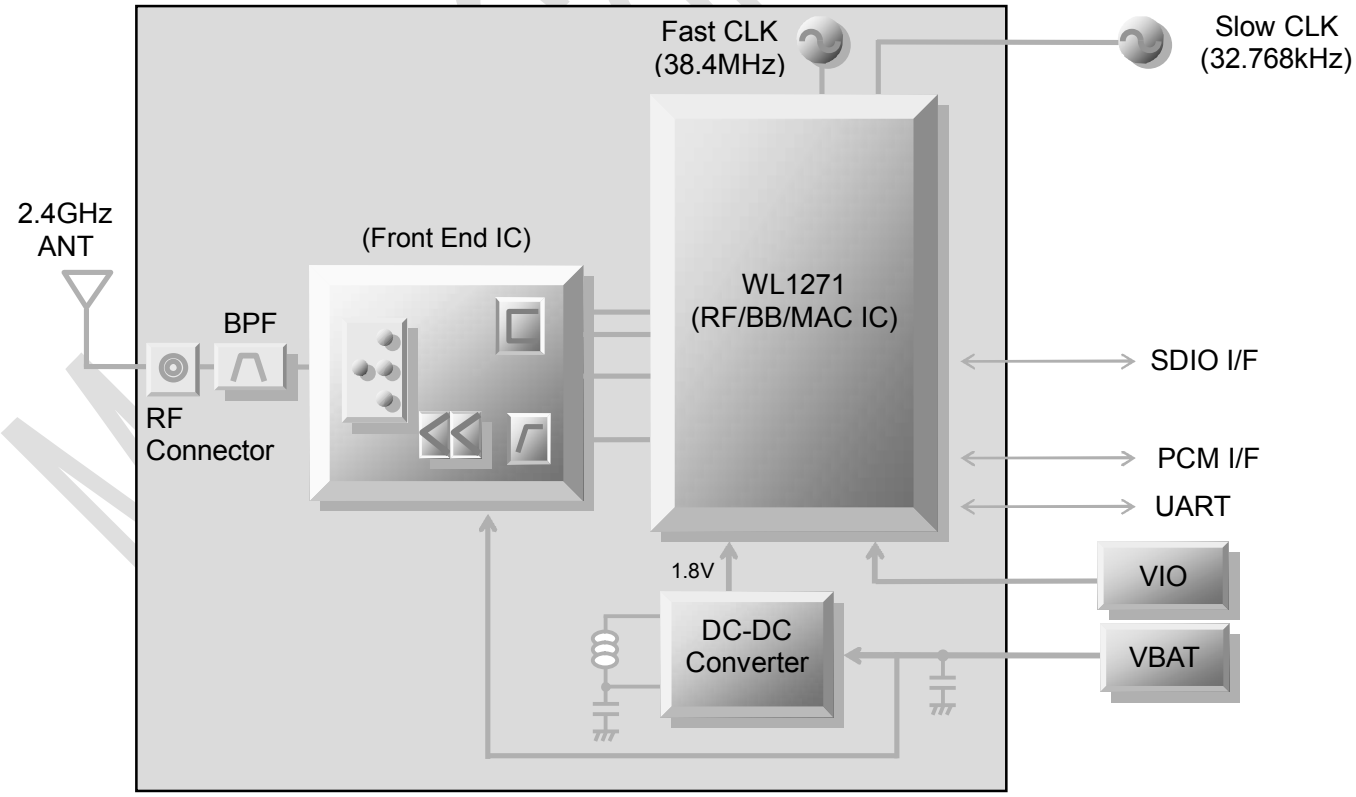
IC/ Firmware version.
- W-LAN/BT BB/MAC : Texas Instruments WL1271L (PG3.32)
- FEM for WL1271 : TriQuint TQM679002A (ES2.6)

Reference Clock : 38.4MHz Reference Clock is integrated.
Sleep Clock : External 32.768 kHz oscillator is required.
Weight : T.B.D (mg)
MSL : Level 3
RoHS Compliance

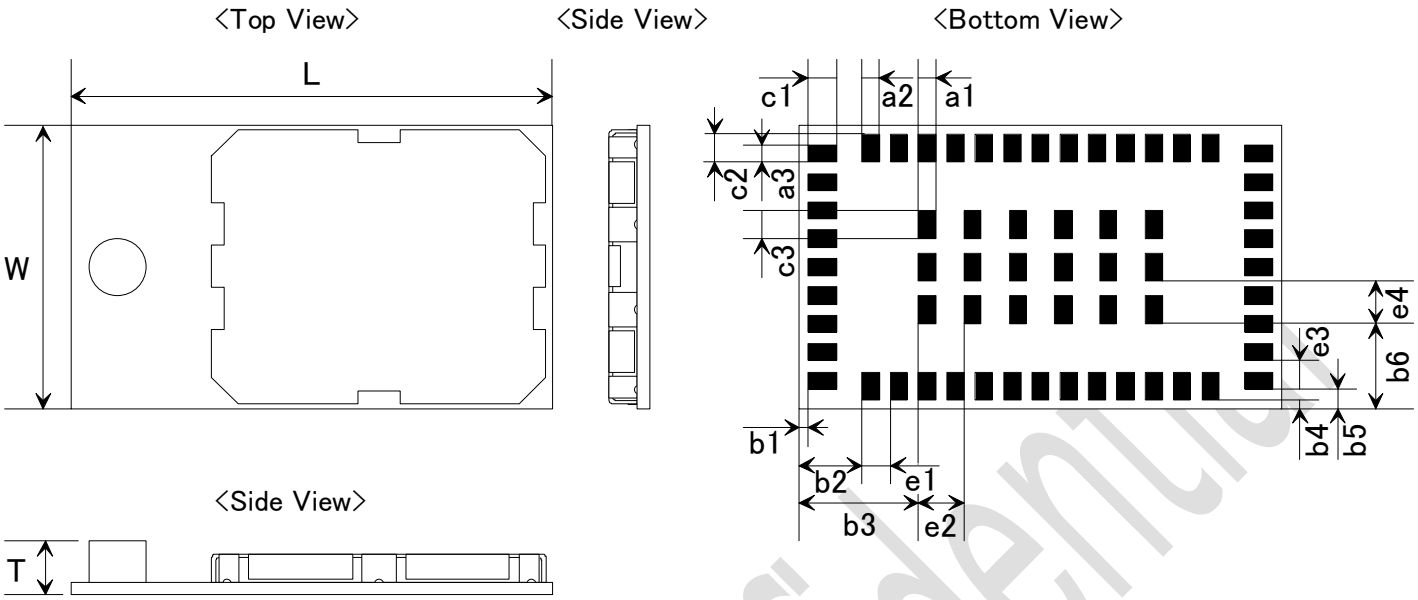
2. Part Number

| Part Number | LBEE5ZSTNC-523 |
|---|---|

3. Block Diagram



4. Dimensions and Terminal Configurations

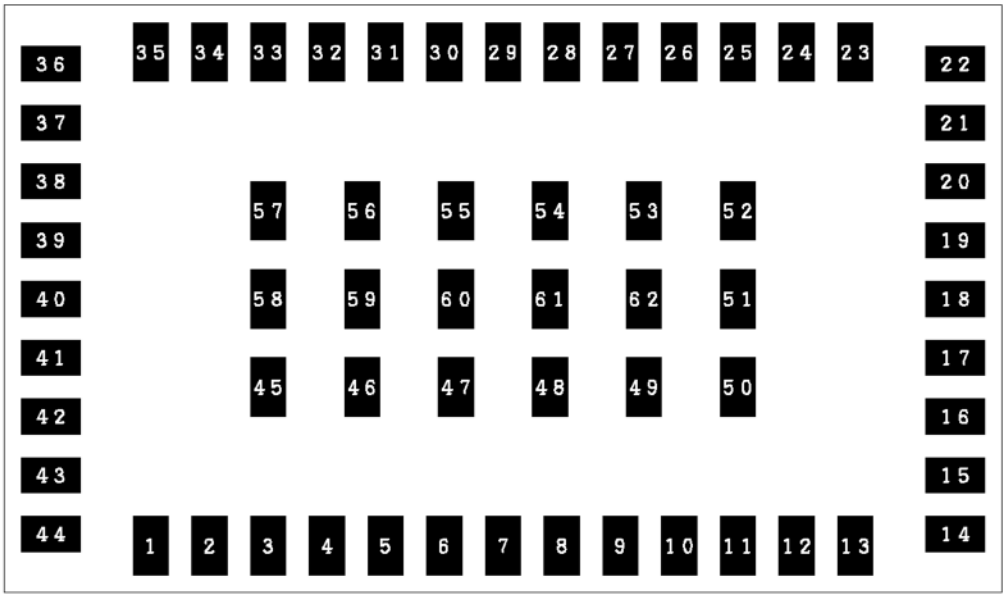



Dimensions

(unit: mm)

| Mark | Dimensions | Mark | Dimensions | Mark | Dimensions |
|---|---|---|---|---|---|
| L | 17.0 +/- 0.2 | W | 10.0 +/- 0.2 | T | 2.2 max. |
| a1 | 0.6 +/- 0.1 | a2 | 0.6 +/- 0.1 | a3 | 0.6 +/- 0.1 |
| b1 | 0.3 +/- 0.2 | b2 | 2.2 +/- 0.2 | b3 | 4.2 +/- 0.2 |
| b4 | 0.3 +/- 0.2 | b5 | 0.7 +/- 0.2 | b6 | 3.0 +/- 0.2 |
| c1 | 1.0 +/- 0.1 | c2 | 1.0 +/- 0.1 | c3 | 1.0 +/- 0.1 |
| e1 | 1.0 +/- 0.1 | e2 | 1.6 +/- 0.1 | e3 | 1.0 +/- 0.1 |
| e4 | 1.5 +/- 0.1 | - | - | - | - |

Terminal configuration




<Top View>

| No. | Terminal Name | Type | Power | System | Connection to IC Terminal | | Description |
|---|---|---|---|---|---|---|---|
| 1 | GND | - | - | - | - | - | Ground |
| 2,3 | VBAT | P | - | - | 1271/ LDO | PMS VBAT, DCDC Converter | Power supply input |
| 4 | GND | - | - | - | - | - | Ground |
| 5 | UART_DBG | I/O | - | WLAN | 1271 | WL_UART_DBG | WL_UART_DBG Should be connected to TP on board for software debug. |
| 6 | WLAN_EN | I | - | WLAN | 1271 | WL_EN | WL_RST |
| 7 | RS232_RX | I/O | - | WLAN | 1271 | WL_RS232_Rx | RS232_Rx or I2C_M_SCL |
| 8 | RS232_TX | I/O | - | WLAN | 1271 | WL_RS232_Tx | RS232_Tx or I2C_M_SDA |
| 9 | WLAN_IRQ | O | - | WLAN | 1271 | WLAN_IRQ | WLAN interrupt request |
| 10 | BT_EN | I | - | BT | 1271 | BT_EN | BT_RST |
| 11 | BT_FUNC1 | IO | - | BT | 1271 | BT_FUNC1 | BT GPIO |
| 12 | VIO | P | - | - | 1271 | VDDS1 VDDS2 VDDS3 VDDS4 | Power supply input |
| 13 | GND | - | - | - | - | - | Ground |
| 14 | SDIO_D2 | I/O | - | WLAN | 1271 | SDIO_D2 | SDIO mode: DATA 2 |
| 15 | SDIO_CMD/SPI_DIN | I/O | - | WLAN | 1271 | SPI_DIN | SDIO mode: CMD |
| 16 | SDIO_CLK/SPI_CLK | I | - | WLAN | 1271 | SPI_CLK | SDIO mode: CLK |
| 17 | SDIO_D0/SPI_DOUT | I/O | - | WLAN | 1271 | SPI_DOUT | SDIO mode: DATA 0 |
| 18 | SDIO_D1 | I/O | - | WLAN | 1271 | SDIO_D1 | SDIO mode: DATA 1 |
| 19 | SDIO_D3/SPI_CSX | I/O | - | WLAN | 1271 | SPI_CSX | SDIO mode :DATA 3 |
| 20 | GND | - | - | - | - | - | Ground |
| 21 | SLEEP_CLK | I | - | - | 1271 | SLOWCLK | SLEEP_CLK input |
| 22 | GND | - | - | - | - | - | Ground |
| 23 | AUD_IN | I | | BT | 1271 | AUD_IN | PCM I/F |
| 24 | AUD_OUT | O | | BT | 1271 | AUD_OUT | PCM I/F |
| 25 | AUD_FSYNC | I/O | - | BT | 1271 | AUD_FSYNC | PCM I/F |
| 26 | AUD_CLK | I/O | - | BT | 1271 | AUD_CLK | PCM I/F |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 27 | UART_RTS | I/O | - | BT | 1271 | HCI_RTS | BT UART I/F or BT SPI_IRQ |
| 28 | UART_CTS | I/O | - | BT | 1271 | HCI_CTS | BT UART I/F or BT SPI_CS |
| 29 | UART_TX | I/O | - | BT | 1271 | HCI_TX | BT UART I/F or BT SPI_DOUT |
| 30 | UART_RX | I/O | - | BT | 1271 | HCI_RX | BT UART I/F or BT SPI_DIN |
| 31 | GND | - | - | - | - | - | Ground |
| 32 | BT_TX_DBG | I/O | - | BT | 1271 | BT_FUNC4 | BT_TX_DBG<br>Should be connected to TP for software debug. |
| 33 | BT_FUNC6 | IO | - | BT | 1271 | BT_FUNC6 | BT GPIO |
| 34 | BT_FUNC5 | I/O | - | BT | 1271 | BT_FUNC5 | BT GPIO |
| 35 | GND | - | - | - | - | - | Ground |
| 36 | GND | - | - | - | - | - | Ground |
| 37 | GND | - | - | - | - | - | Ground |
| 38 | GND | - | - | - | - | - | Ground |
| 39 | GND | - | - | - | - | - | Ground |
| 40 | 2.4G_ANT | I/O | - | BT/WLAN | - | - | RF transmitter output and RF receiver input |
| 41 | GND | - | - | - | - | - | Ground |
| 42 | GND | - | - | - | - | - | Ground |
| 43 | GND | - | - | - | - | - | Ground |
| 44 | GND | - | - | - | - | - | Ground |
| 45 | GND | - | - | - | - | - | Ground |
| 46 | GND | - | - | - | - | - | Ground |
| 47 | GND | - | - | - | - | - | Ground |
| 48 | GND | - | - | - | - | - | Ground |
| 49 | GND | - | - | - | - | - | Ground |
| 50 | GND | - | - | - | - | - | Ground |
| 51 | GND | - | - | - | - | - | Ground |
| 52 | GND | - | - | - | - | - | Ground |
| 53 | GND | - | - | - | - | - | Ground |
| 54 | GND | - | - | - | - | - | Ground |
| 55 | GND | - | - | - | - | - | Ground |
| 56 | GND | - | - | - | - | - | Ground |
| 57 | GND | - | - | - | - | - | Ground |
| 58 | GND | - | - | - | - | - | Ground |
| 59 | GND | - | - | - | - | - | Ground |
| 60 | GND | - | - | - | - | - | Ground |
| 61 | GND | - | - | - | - | - | Ground |
| 62 | GND | - | - | - | - | - | Ground |

5. Absolute Maximum Rating

| Parameter | | min. | max | unit |
|---|---|---|---|---|
| Storage Temperature | | -40 | 85 | deg.C |
| Supply Voltage | VBAT | -0.5 | 4.8 | V |
| | VIO | -0.5 | 2.1 | V |

6. Operating Condition

| Parameter | | min. | typ. | max | unit |
|---|---|---|---|---|---|
| Operating Temperature | | -30 | 25 | 70 | deg.C |
| Supply Voltage | VBAT | 2.7 | 3.6 | 4.8 | V |
| | VIO | 1.65 | 1.8 | 1.92 | V |

7. Input/Output Terminal Characteristic

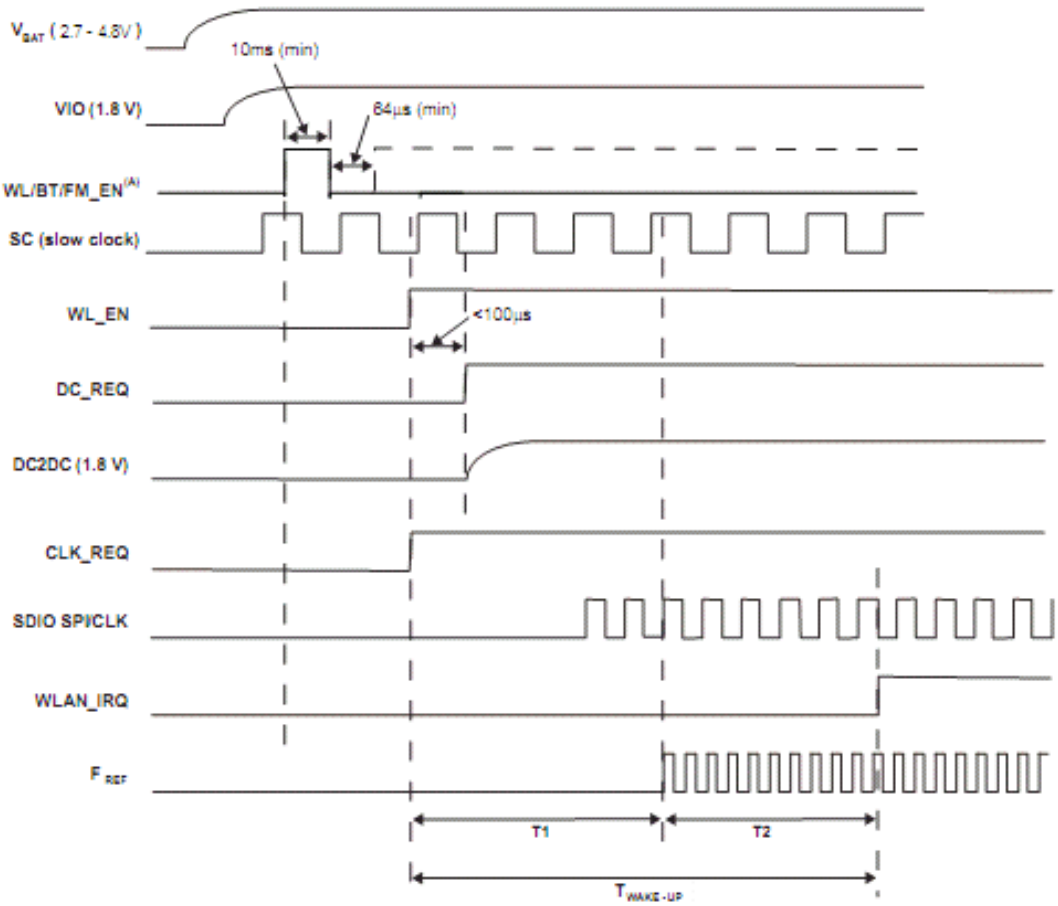
| | Condition | min. | max | unit |
|---|---|---|---|---|
| $V_{IH}$ : High-level input voltage(VDD_IO = IO supply for ring) | Default | 0.7 x VIO | VIO | V |
| $V_{IL}$ : Low-level input voltage | Default | 0 | 0.35 x VIO | V |
| $V_{OH}$ : High-level output voltage | 4mA | VIO - 0.45 | VIO | V |
| | 1mA | VIO - 0.112 | VIO | V |
| | 0.3mA | VIO-0.033 | VIO | V |
| $V_{OL}$ : Low-level output voltage | 4mA | 0 | 0.45 | V |
| | 1mA | 0 | 0.112 | V |
| | 0.09mA | 0 | 0.01 | V |

8. External Slow Clock specification

| Characteristics(*) | Condition | min. | Typ. | max | unit |
|---|---|---|---|---|---|
| Input slow clock frequency | | | 32.768 | | kHz |
| Input slow clock accuracy | WLAN, BT, | | | ±150 | ppm |
| Input transition time Tr/Tf -10% to 90% | Tr/Tf | | | 100 | ns |
| Frequency input duty cycle | | 30 | 50 | 70 | % |
| Input voltage limits | Square wave, DC-coupled | 0.65×VIO | | VIO | V |
| | | 0 | | 0.35×VIO | V |
| Input impedance | | 1 | | | MΩ |
| Input capacitance | | | | 5 | pF |
| Rise and fall time | | | | 100 | ns |
| Phase noise | | | | -125 | dBc/Hz |

9. WLAN Power Up/Down Sequence

9.1 Power Up Sequence




A. After this sequence is completed, the device is in the low VIO-leakage state while in shutdown.

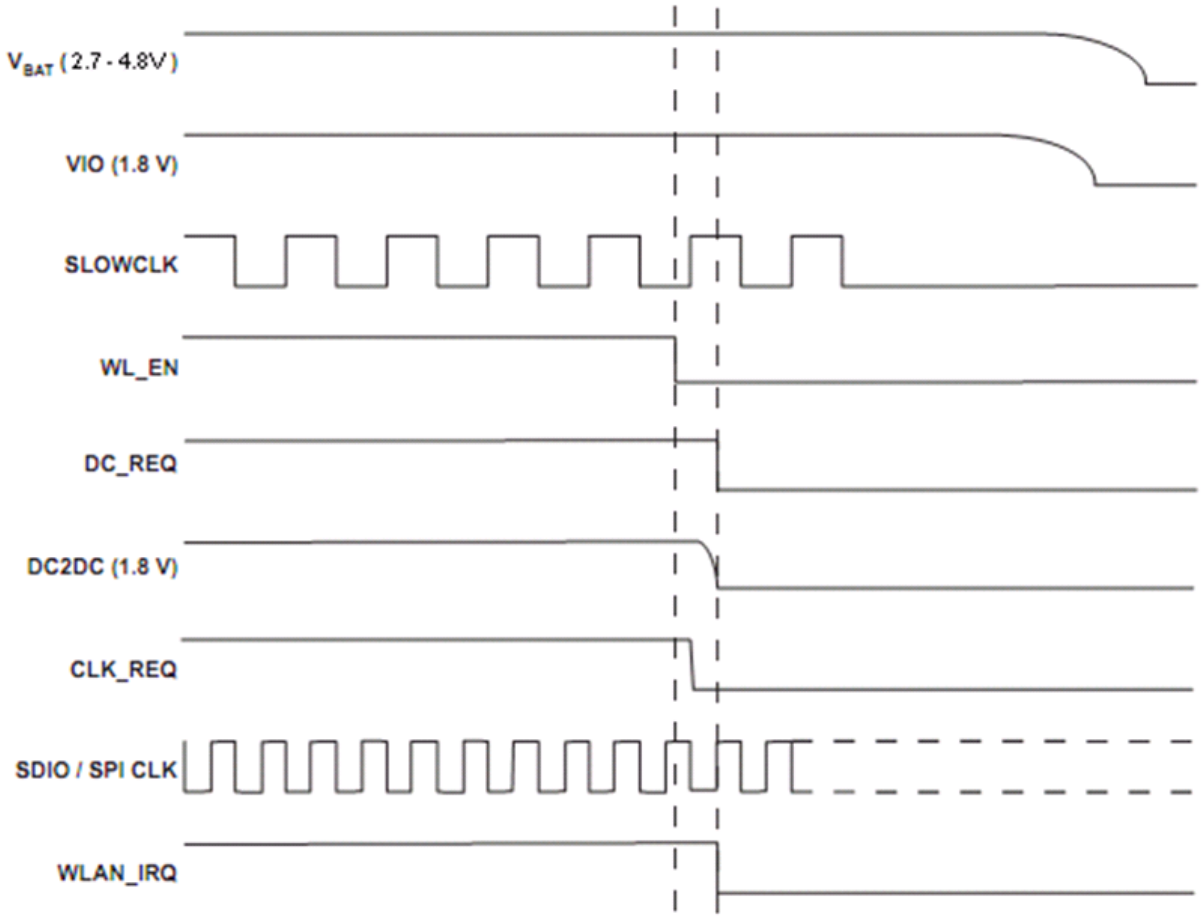
The following sequence describes device power up from shutdown. Only the WLAN Core is enabled; the BT and FM cores are disabled.

1. No signals are allowed on the IO pins if no IO power supplied, because the IOs are not 'fail safe'. Exceptions are SLEEP_CLK and AUD_xxx, which are failsafe and can tolerate external voltages with no VIO and DC2DC.

2. VBAT, VIO and SLEEP_CLK must be available before WLAN_EN.

3. Twakeup = T1 + T2
The duration of T1 is defined as the time from WLAN_EN=high until Fref is valid for the WL1271 SoC
T1 ~55ms
The duration of T2 depends on:
– Operating system
– Host enumeration for the SDIO
– PLL configuration
– Firmware download
– Releasing the core from reset
– Firmware initialization

9.2 Power Down Sequence




1. DC_REQ of WL1271 will go low only if WLAN is the only core working. otherwise if another core is working (e.g BT) it will stay high.

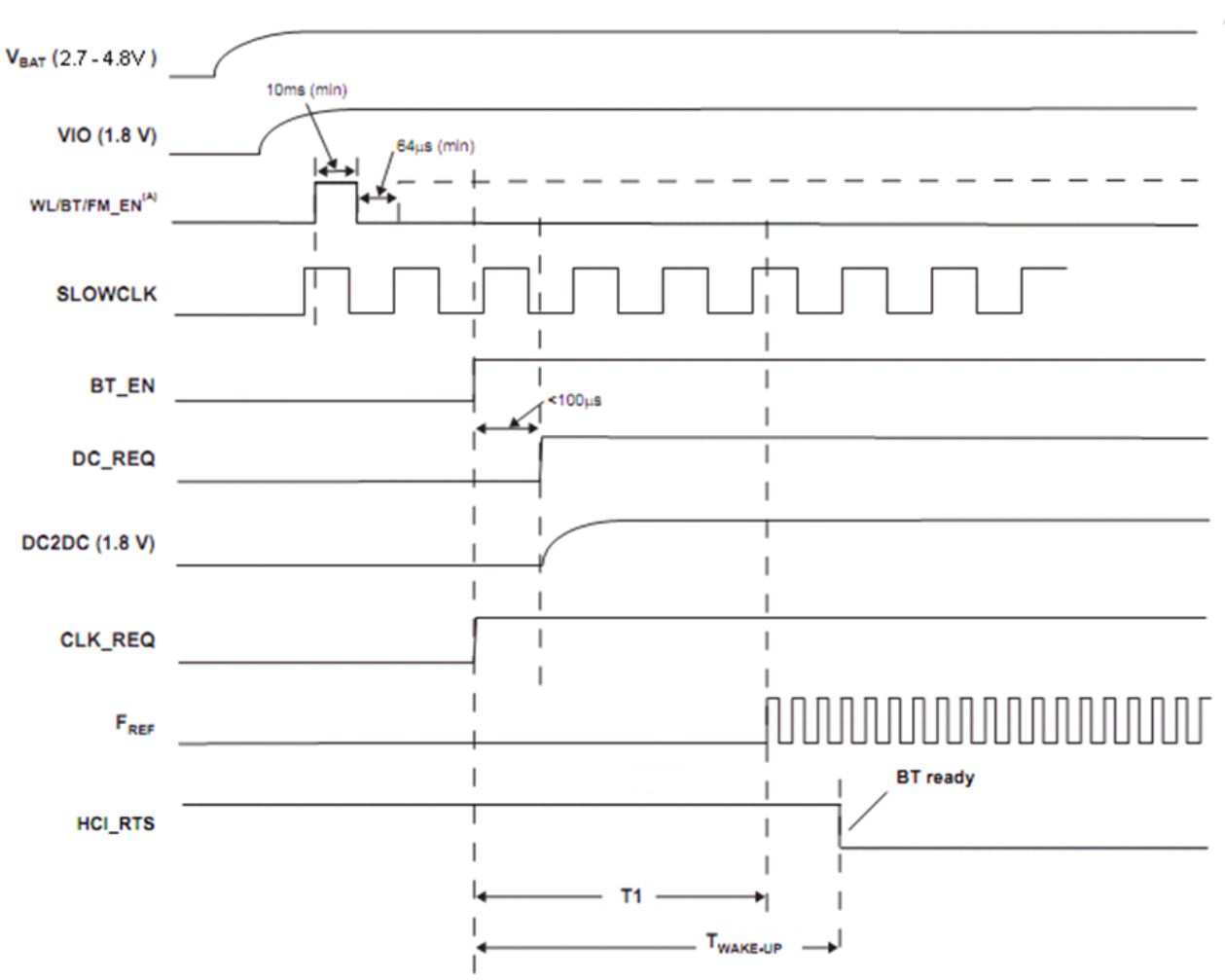
2. If WLAN is the only core that is operating, WLAN_EN must remain de-asserted for at least 64msec before it is re-asserted.

10. BT Power Up/Down Sequence

10.1 Power Up Sequence

The following sequence describes device powerup from shutdown. Only the BT core is enabled; the WLAN and FM cores are disabled.

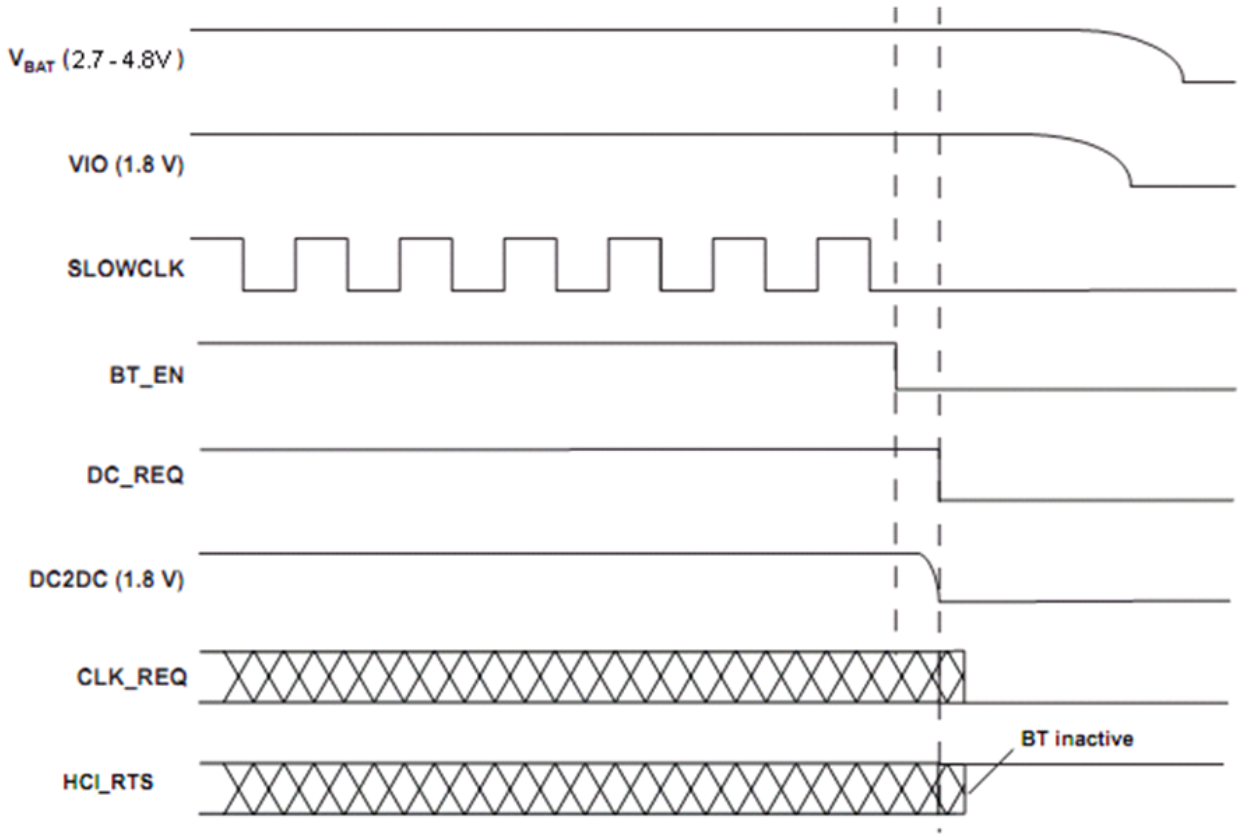
Power up requirements:
1. No signals are allowed on the IO pins if no IO power supplied, because the IOs are not 'failsafe'. Exceptions are SLEEP_CLK and AUD_xxx, which are failsafe and can tolerate external voltages with no VIO and DC2DC.
2. VIO and SLEEP_CLK must be stable before releasing BT_EN.
3. Fast clock must be stable maximum 55ms after BT_EN goes HIGH.




A. After this sequence is completed, the device is in the low VIO-leakage state while in shutdown.

1. The duration of T1 is defined as the time from BT_EN=high until Fref is valid for the WL1271.
2. T1□55ms
3. The duration of $T_{WAKE-UP}$ is defined as the time from BT_EN rising edge to HCI_RTS falling edge, <70ms.

10.2 Power Down Sequence




The WL1271 indicates completion of BT power up sequence by asserting RTS low. This occurs up to 100ms after BT_EN goes high.

# 11. HOST Interface

## 11.1 Host interface Combination

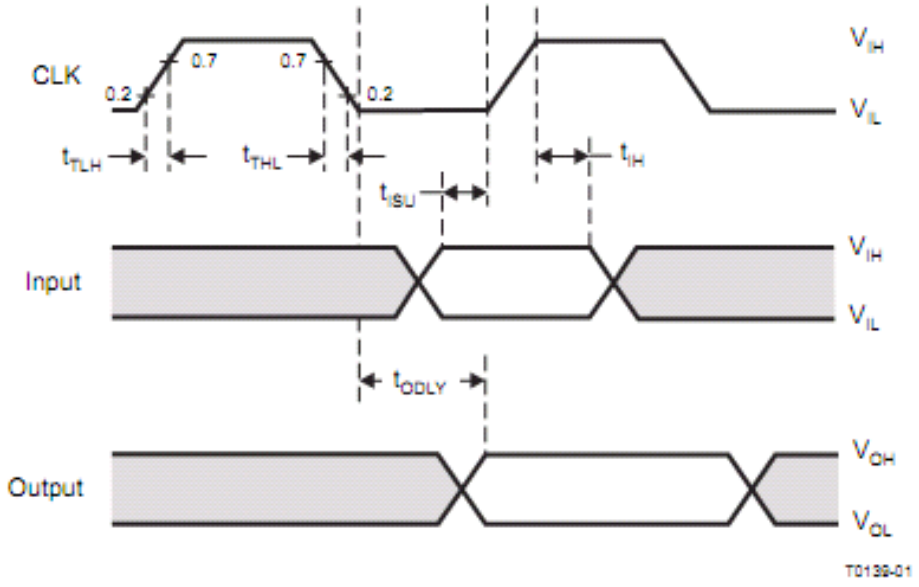
| WLAN | BT | Remarks |
|---|---|---|
| SDIO | UART | |

## 11.2 SDIO Interface

### 11.2.1 SDIO Clock Switching Characteristics

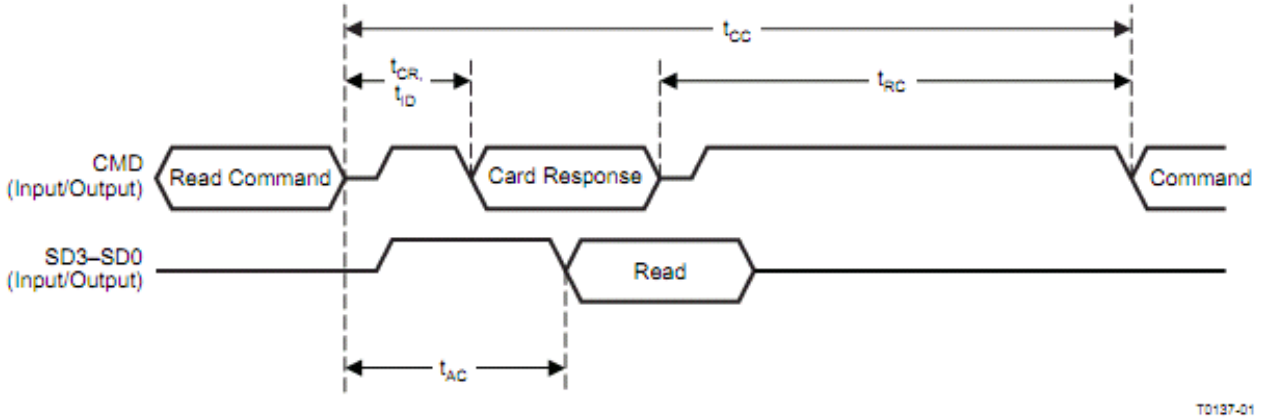
**Note**: all timing parameter are indicated for the maximum Host interface clock frequency.

| PARAMETER | | | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| Fclock | Clock frequency,CLK | CL □ 30pF | 0 | 25 | MHz |
| DC | Low/High duty cycle | CL □ 30pF | 40 | 60 | % |
| tTLH | Rise time, CLK | CL □ 30pF | | 4.3 | ns |
| tTHL | Fall time, CLK | CL □ 30pF | | 3.5 | ns |
| tISU | Setup time, input calid before CLK↑ | CL □ 30pF | 4 | | ns |
| tIH | Hold time, input valid after CLK↑ | CL □ 30pF | 5 | | ns |
| tODLY | Delay time, CLK↓ to output valid | CL □ 30pF | 2 | 12 | ns |



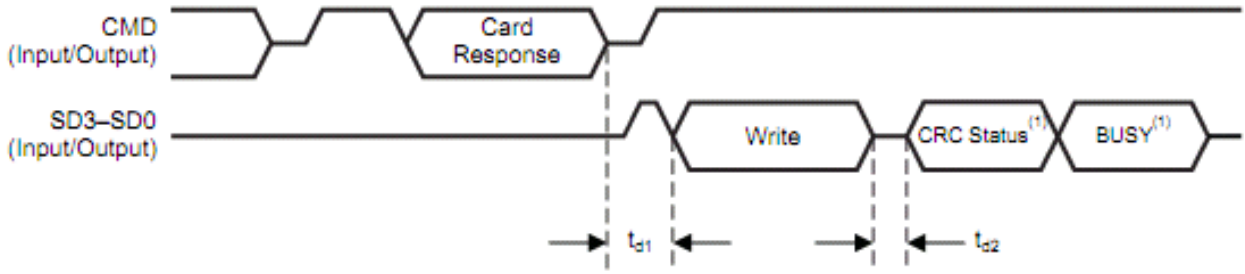
11.2.2 SDIO Data Switching Characteristics

SDIO Interface Read




| Parameter | | | MIN | MAX | Unit |
|---|---|---|---|---|---|
| tCR | Delay time,assign relative address or data transfer mode | Read-command CMD invalid to card-response CMD valid | 2 | 64 | Clock Cycle |
| tCC | Delay time,CMD command invalid to CMD command valid | | 58 | | Clock Cycle |
| tRC | Delay time,CMD response invalid to CMD command valid | | 8 | | Clock Cycle |
| tAC | Access time,CMD command invalid to SD3-SD0 read data valid | | 2 | | Clock Cycle |

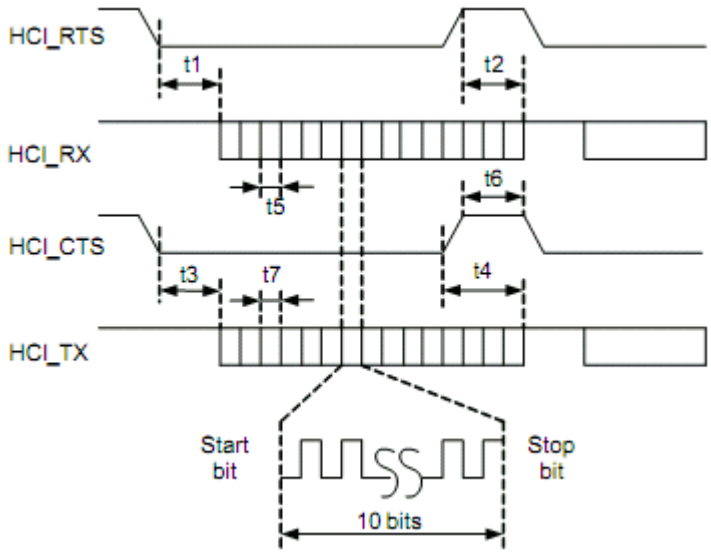
SDIO Interface Write




NOTE: CRC status and busy waveforms are only for data line 0. Data lines 1–3 are N/A. The busy waveform is optional, and may not be present.

| Parameter | | MIN | MAX | Unit |
|---|---|---|---|---|
| $T_{d1}$ | Delay time,CMD card response invalid to SD3-SD0 write data valid | 2 | | Clock Cycle |
| $T_{d2}$ | Delay time,SD3-SD0 wirte data invalid end to CRC status valid | 2 | 2 | Clock Cycle |

11.3 UART Interface timing




| Symbol | Characteristics | Condition | MIN | Typ | MAX | Unit |
|---|---|---|---|---|---|---|
| | Baud rate | Most rates | 37.5 | | 4000 | kbps |
| t5,t7 | Baud rate accuract | Receive/Transmit | -2.5 | | 1.5 | % |
| t3 | CTS low to TX_DATA | | 0 | 2 | | us |
| t4 | CTS high to TX_DATA | Hardware flow control | | | 1 | byte |
| t6 | CTS-high pulse width | | 1 | | | bit |
| t1 | RTS low to RX_DATA on | | 0 | 2 | | us |
| t2 | RTS high to RX_DATA off | Interrupt set to 1/4 FIFO | | | 16 | byte |

12. Electrical Characteristics

12.1 DC/RF Characteristics for IEEE802.11b

11Mbps mode unless otherwise specified. 25deg.C, VBAT=3.6V, VDDIO=1.8V

| Items | Contents | | | |
|---|---|---|---|---|
| Specification | IEEE802.11b | | | |
| Mode | DSSS / CCK | | | |
| Frequency | 2400 – 2483.5MHz | | | |
| Data rate | 1, 2, 5.5, 11Mbps | | | |
| - DC Characteristics - | min. | typ. | max. | unit |
| 1. DC current | | | | |
| 1) Tx mode at VBAT | - | 270 | | mA |
| 2) Rx mode at VBAT | - | 100 | | mA |
| 3) Sleep mode at VBAT | - | 100 | | uA |
| - Tx Characteristics - | min. | typ. | max. | unit |
| 2. Power Levels | | 20.0 | | dBm |
| 3. Spectrum Mask | | | | |
| 1) 1st side lobes | - | - | -30 | dBr |
| 2) 2nd side lobes | - | - | -50 | dBr |
| 4. Power-on and Power-down ramp | - | - | 2 | µsec |
| 5. RF Carrier Suppression | 15 | - | - | dB |
| 6. Modulation Accuracy (EVM) | - | - | 35 | % |
| - Rx Characteristics - | min. | typ. | max. | unit |
| 8. Minimum Input Level Sensitivity | | | | |
| 1) 11Mbps (FER ≤ 8%) | - | - | -76 | dBm |
| 9. Maximum Input Level (FER ≤ 8%) | -10 | - | - | dBm |

12.2 DC/RF Characteristics for IEEE802.11g

54Mbps mode unless otherwise specified. 25deg.C, VBAT=3.6V, VDDIO=1.8V

| Items | Contents | | | |
|---|---|---|---|---|
| Specification | IEEE802.11g | | | |
| Mode | OFDM | | | |
| Frequency | 2400 - 2483.5MHz | | | |
| Data rate | 6, 9, 12, 18, 24, 36, 48, 54Mbps | | | |
| - DC Characteristics - | min. | typ. | max. | unit |
| 1. DC current | | | | |
| 1) Tx mode at VBAT | - | 180 | - | mA |
| 2) Rx mode at VBAT | - | 100 | - | mA |
| 3) Sleep mode at VBAT | - | 100 | - | uA |
| - Tx Characteristics - | min. | typ. | max. | unit |
| 2. Power Levels | | 15.0 | | dBm |
| 3. Spectrum Mask | | | | |
| 1) at fc +/- 11MHz | - | | -20 | dBr |
| 1) at fc +/- 20MHz | - | | -28 | dBr |
| 1) at fc +/- 30MHz | - | | -40 | dBr |
| 4. Spurious Emissions | | | | |
| - Rx Characteristics - | min. | typ. | max. | unit |
| 6. Minimum Input Level Sensitivity | | | | |
| 1) 54Mbps (PER $\leq$ 10%) | - | | -65 | dBm |
| 7. Maximum Input Level (PER $\leq$ 10%) | -20 | | - | dBm |

12.3 DC/RF Characteristics for IEEE802.11n-2.4G

65Mbps (MCS7) mode unless otherwise specified. 25deg.C, VBAT=3.6V, VDDIO=1.8V

| Items | Contents | | | |
|---|---|---|---|---|
| Specification | IEEE802.11n-2.4G | | | |
| Mode | OFDM | | | |
| Frequency | 2400 - 2483.5MHz | | | |
| Data rate | 6.5, 13,19.5, 26, 39, 52, 58.5, 65Mbps | | | |
| - DC Characteristics - | min. | typ. | max. | unit |
| 1. DC current | | | | |
| 1) Tx mode at VBAT | - | 180 | - | mA |
| 2) Rx mode at VBAT | - | 100 | - | mA |
| 3) Sleep mode at VBAT | - | 100 | - | uA |
| - Tx Characteristics - | min. | typ. | max. | unit |
| 2. Power Levels | | 14.5 | | dBm |
| 3. Spectrum Mask | | | | |
| 1) at fc +/- 11MHz | - | | -20 | dBr |
| 1) at fc +/- 20MHz | - | | -28 | dBr |
| 1) at fc +/- 30MHz | - | | -45 | dBr |
| - Rx Characteristics - | min. | typ. | max. | unit |
| 6. Minimum Input Level Sensitivity | | | | |
| 1) 65Mbps (PER ≦ 10%) | - | | -64 | dBm |
| 7. Maximum Input Level (PER ≦ 10%) | -20 | | - | dBm |

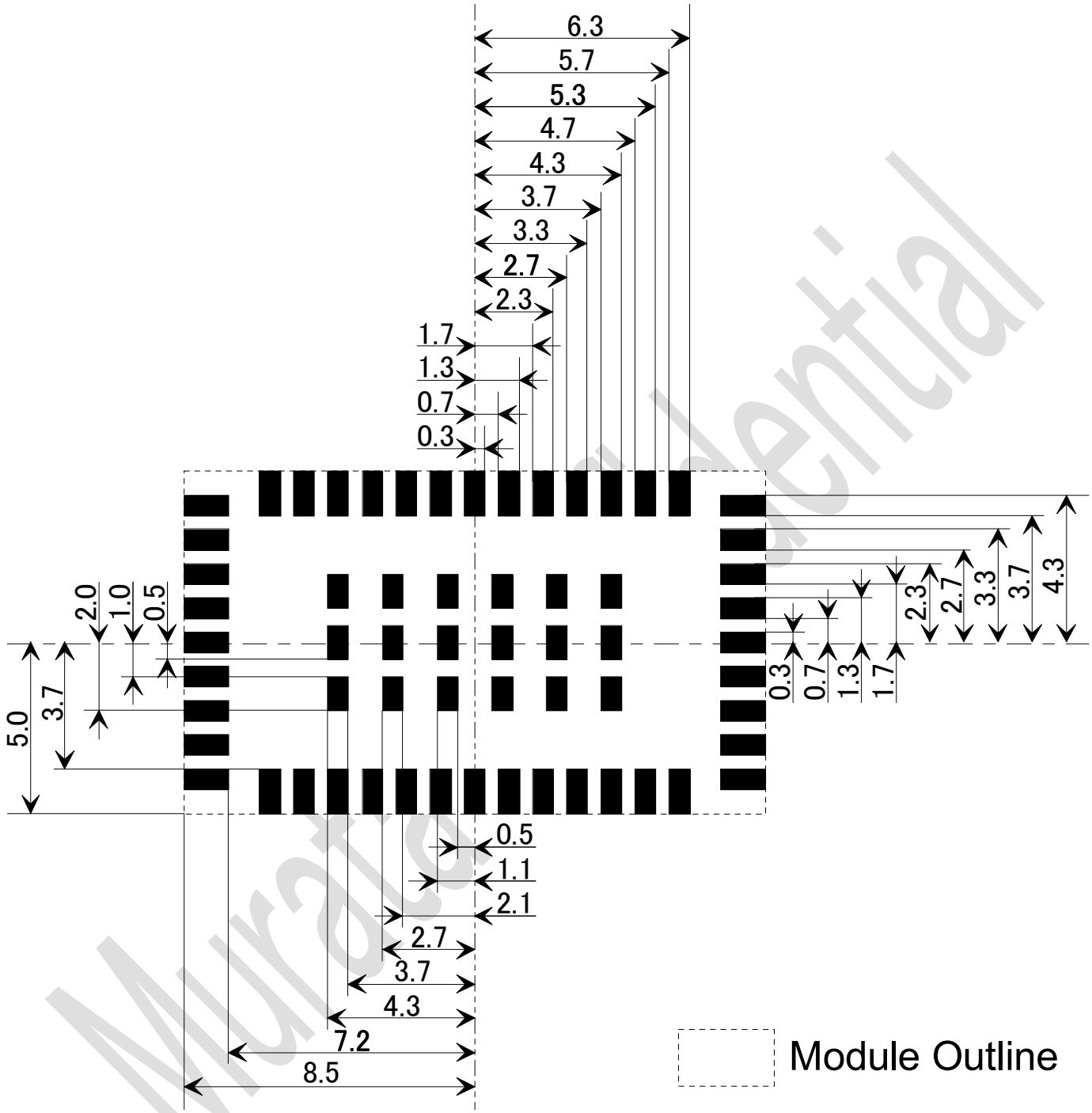
12.4 DC/RF Characteristics for Bluetooth
25deg.C, VBAT=3.6V, VDDIO=VDDHOST=1.8V

| Items | Contents | | | |
|---|---|---|---|---|
| Bluetooth specification | Ver. 4.0 | | | |
| Channel spacing | 1MHz | | | |
| Number of RF channel | 79 | | | |
| Power class | 1 | | | |
| Operation mode (Rx/Tx) | Time division multiplex either transmit or receive Frequency hopping after one Rx/Tx cycle | | | |
| Items | min. | typ. | max. | unit |
| 1. DC Current | | | | |
| 1) DH1 Packet 50% Rx/Tx slot duty cycle | - | 40 | - | mA |
| 2) DH3 Packet 50% Rx/Tx slot duty cycle | - | 50 | - | mA |
| 3) DH5 Packet 50% Rx/Tx slot duty cycle | - | 50 | - | mA |
| - TX characteristics - | min. | typ. | max. | unit |
| 2. Output Power | | 8.0 | | dBm |
| 3. Frequency range (Rx/Tx) | 2400 - 2483.5 | | | MHz |
| 4. -20dB bandwidth | - | | 1 | MHz |
| 5. Adjacent Channel Power *1 | | | | |
| 5.1 [M-N] = 2 | - | | -20 | dBm |
| 5.2 [M-N] ≧ 3 | - | | -40 | dBm |
| 6. ICFT (Initial Carrier Frequency Tolerance) | -75 | | +75 | kHz |
| 7. Modulation characteristics | | | | |
| 7.1 Modulation δf1avg | 140 | | 175 | kHz |
| 7.2 Modulation δf2max | 115 | | - | kHz |
| 7.3 Modulation δf2avg/δf1avg | 0.8 | | - | - |
| 8. Carrier Frequency Drift | | | | |
| 8.1 1slot | -25 | - | +25 | kHz |
| 8.2 3slot | -40 | - | +40 | kHz |
| 8.3 5slot | -40 | - | +40 | kHz |
| 8.4 Maximum drift rate | -20 | - | +20 | kHz/50μs |
| 9. EDR Relative Power (Pi/4-DQPSK and 8DPSK) | -4 | | 1 | |
| 10. EDR Carrier Frequency Stability and Modulation Accuracy | | | | |
| 10.1 ωi (Pi/4-DQPSK and 8DPSK) | -75 | | 75 | kHz |
| 10.2 ω0 (Pi/4-DQPSK and 8DPSK) | -10 | | 10 | kHz |
| 10.3 ωi+ω0 (Pi/4-DQPSK and 8DPSK) | -75 | | 75 | kHz |
| 10.4 RMS DEVM (Pi/4-DQPSK) | - | | 20 | % |
| 10.5 99% DEVM (Pi/4-DQPSK) | - | | 30 | % |
| 10.6 Peak DEVM (Pi/4-DQPSK) | - | | 35 | % |
| 10.7 RMS DEVM (8DPSK) | - | | 13 | % |
| 10.8 99% DEVM (8DPSK) | - | | 20 | % |
| 10.9 Peak DEVM (8DPSK) | - | | 25 | % |
| - RX characteristics - | min | Typ | max | unit |
| 11. Sensitivity (BER ≦ 0.1%) | | | | |
| 11.1 2402MHz | - | | -70 | dBm |
| 11.2 2441MHz | - | | -70 | dBm |
| 11.3 2480MHz | - | | -70 | dBm |
| 12. C/I Performance (BER ≦ 0.1%) *2 | | | | |
| 12.1 co-channel ratio (-60dBm input) | - | | 11 | dB |
| 12.2 1MHz ratio (-60dBm input) | - | | 0 | dB |
| 12.3 2MHz ratio (-60dBm input) | - | | -30 | dB |
| 12.4 3MHz ratio (-67dBm input) | - | | -40 | dB |

| | | | | |
|---|---|---|---|---|
| 12.5 image +/- 1MHz ratio (-67dBm input) | - | | -20 | dB |
| 13. Blocking performance (BER ≤ 0.1%) [*3] | | | | |
| 13.1 30MHz-2000MHz | -10 | | | dBm |
| 13.2 2000MHz-2400MHz | -27 | | - | dBm |
| 13.3 2500MHz-3000MHz | -27 | | - | dBm |
| 13.4 3000MHz-12750MHz | -10 | | - | dBm |
| 14. Intermodulation performance (BER ≤ 0.1%, -64dBm input) | -39 | | - | dBm |
| 15. Maximum Input Level | -20 | | - | dBm |
| 16. EDR Sensitivity (at 0.01% BER) | | | | |
| 16.1 Pi/4-DQPSK | - | | -70 | dBm |
| 16.2 8DPSK | - | | -70 | dBm |

[*1] Up to three spurious responses within Bluetooth limits are allowed.
[*2] Up to five spurious responses within Bluetooth limits are allowed.
[*3] Up to twenty-four spurious responses within Bluetooth limits are allowed.

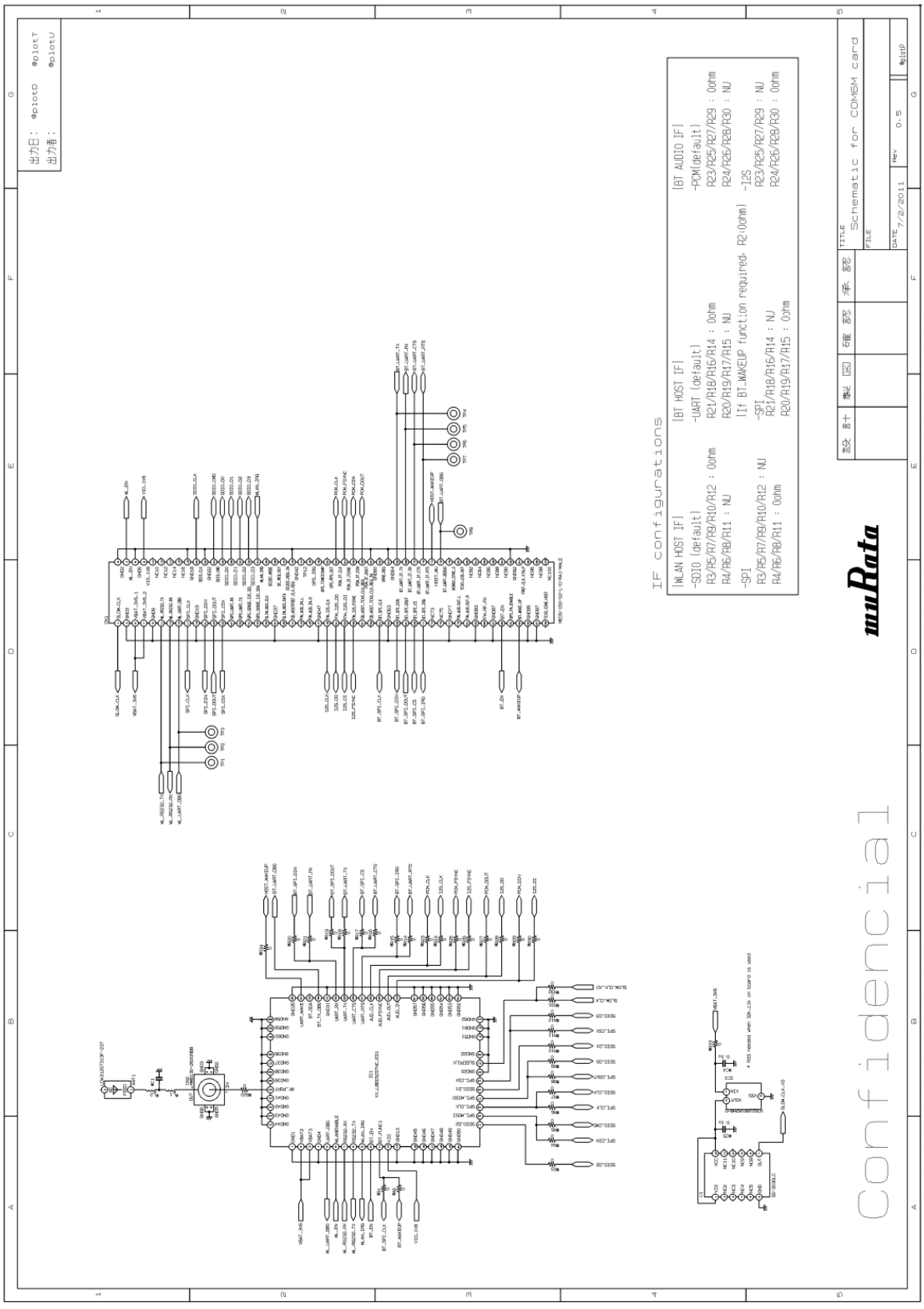
13. Land pattern






(unit : mm)

14. Reference Circuit



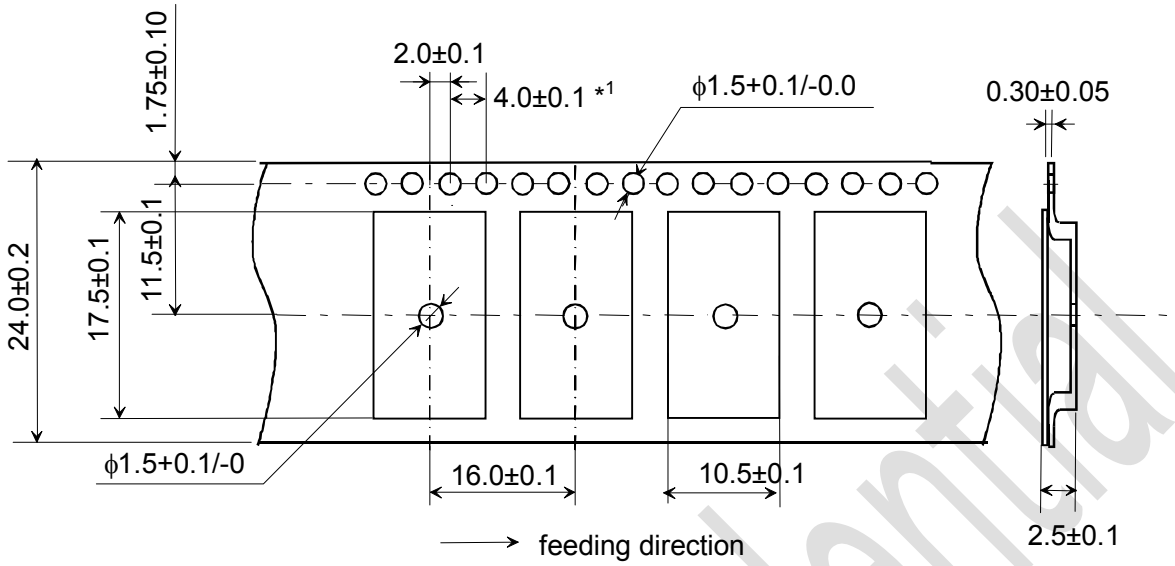
15. Evaluation board of LBEE5ZSTNC-TEMP

Murata LBEE5ZSTNC-TEMP is compatible to the following evaluation board.
Please refer to each operation manual if you would like to get more detail on it.

| | |
|---|---|
| COM6M Evaluation board<br>(Compatible to TI Platform) | Part Number: LBEE5ZSTNC-TEMP-D |

16.Tape and Reel Packing

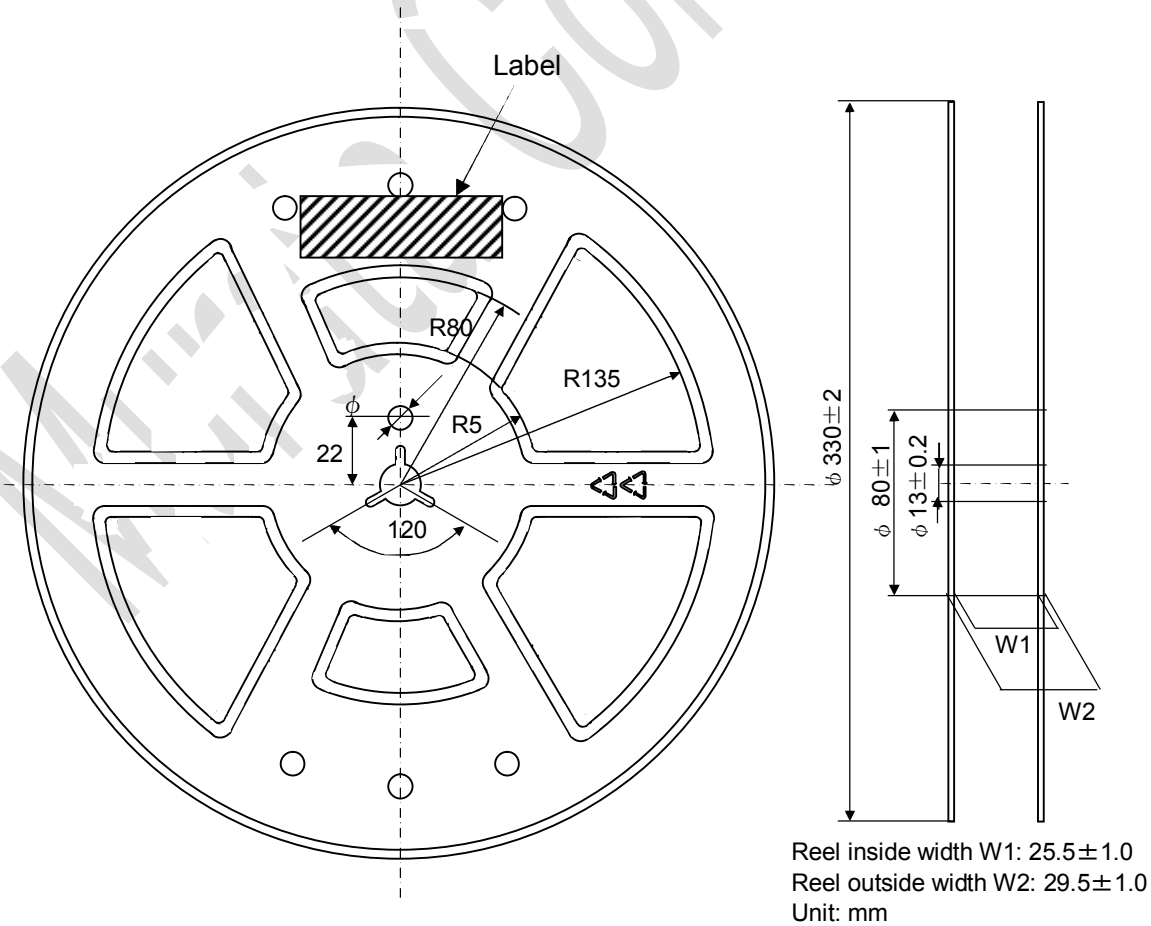
(1) Dimensions of Tape (Plastic tape)




*1 Cumulative tolerance of max. ± 0.3 every 10 pitches

(unit : mm)

(2) Dimensions of Reel




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

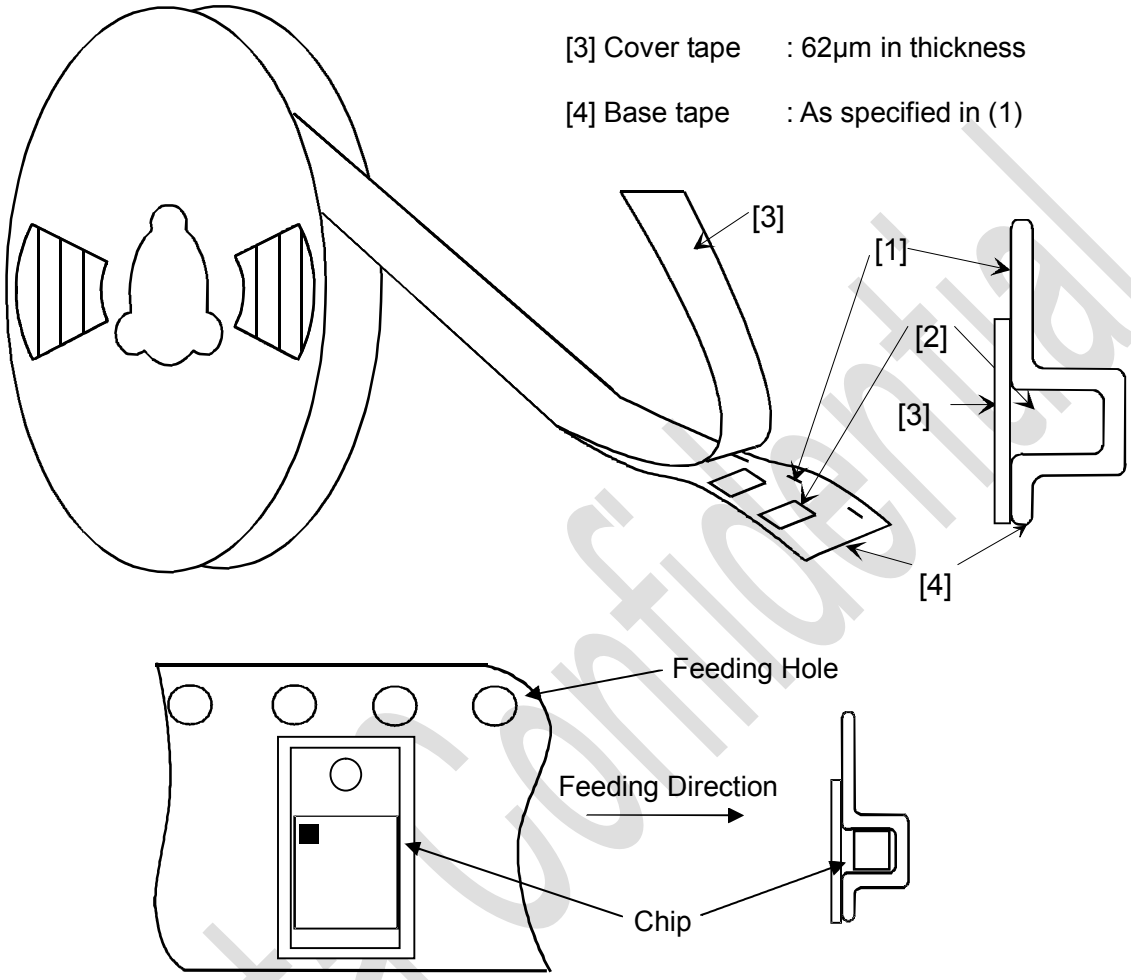
(3) Taping Diagrams

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

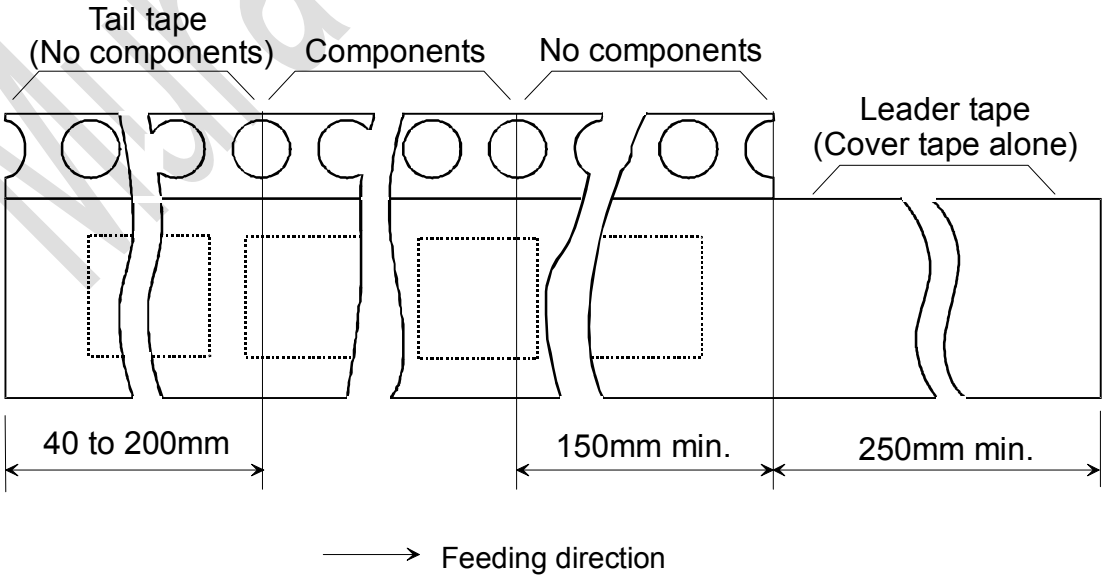
[2] Hole for chip : As specified in (1)

[3] Cover tape : 62μm in thickness

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




(4) Leader and Tail tape




Feeding direction

(5) The tape for chips are wound clockwise, the feeding holes to the right side as the tape is pulled toward the user.

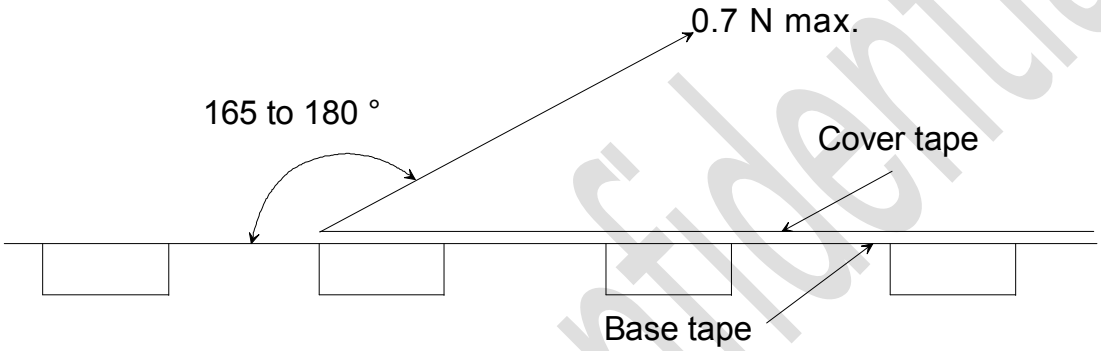
(6) The cover tape and base tape are not adhered at no components area for 250mm min.

(7) Tear off strength against pulling of cover tape : 5N min.

(8) Packaging unit : 500pcs./ reel

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

(10) Peeling of force: 0.7N max. in the direction of peeling as shown below.



## NOTICE

## 1. Storage Conditions:

Please use this product within 6 months 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 solderbility 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 ≦30deg.C / ≦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.

## 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.

## 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.

## 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.

## 5. Soldering Conditions:

Carefully perform preheating so that the temperature difference (△T) between the solder and products surface should be in the following range. After mounting, pay special attention to maintain the temperature difference within 100deg.C. Soldering must be carried out by the above mentioned conditions to prevent products from damage. Contact Murata before use if concerning other soldering conditions.

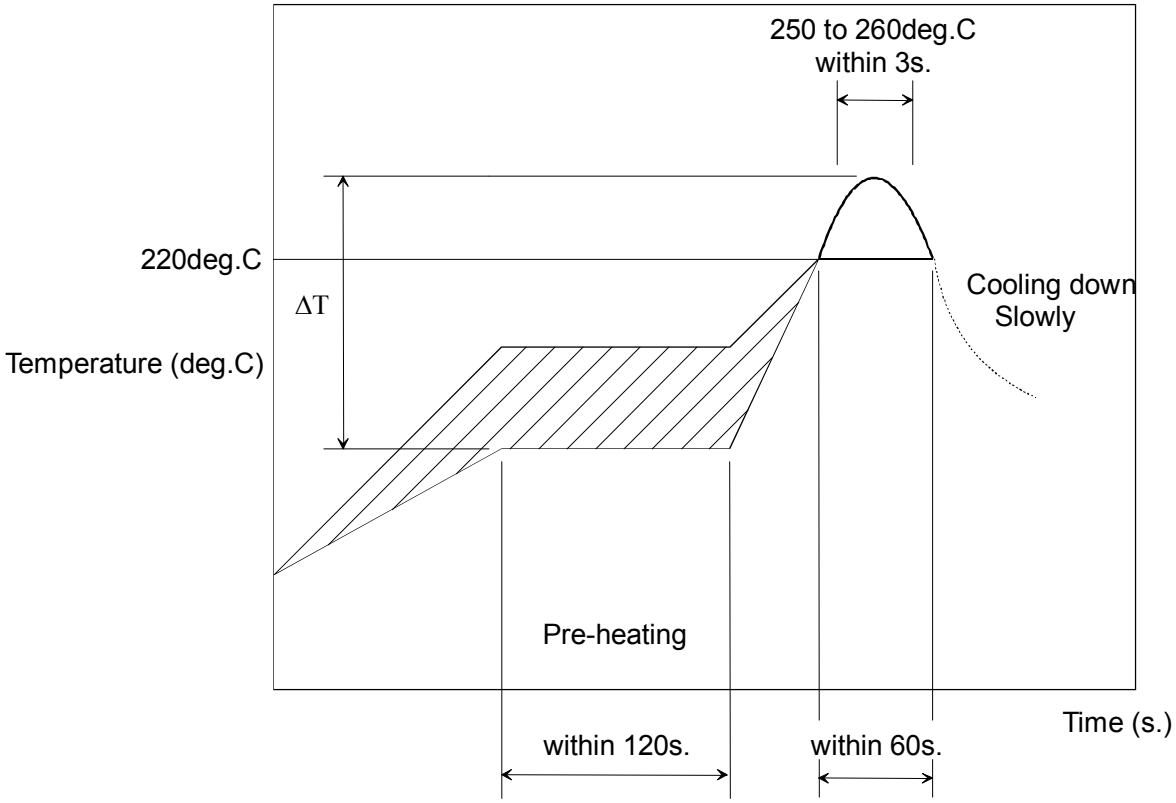
| Soldering method | Temperature |
|---|---|
| Soldering iron method | △T≦130deg.C |
| Reflow method | |

- Soldering iron method conditions are indicated below.

| Kind of iron / Item | Ceramics heater |
|---|---|
| Soldering iron wattage | ≦18W |
| Temperature of iron-tip | ≦350deg.C |
| Iron contact time | within 3s. |

- Diameter of iron-tip : Φ3.0mm max.

**Reflow soldering standard conditions (Example)**




Use rosin type flux or weakly active flux with a chlorine content of 0.2wt% or less.

## 6. Cleaning:

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

## 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.

## 8. Input Power Capacity:

Products shall be used in the input power capacity as specified in this specification.
Inform Murata beforehand, in case that the components are used beyond such input power capacity range.

## 9. Limitation of Applications:

The product is designed and manufactured for consumer application only and is not available for 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.

- Aircraft equipment.
- Aerospace equipment
- Undersea equipment.
- Power plant control equipment
- Medical equipment.
- Transportation equipment (vehicles, trains, ships, etc.).
- Traffic signal equipment.
- Disaster prevention / crime prevention equipment.
- Data-processing equipment
- Application of similar complexity and/ or reliability requirements to the applications listed in the above.

## 10. Underfill Condition:

Halfway underfill on components in the module can make unexpected stress on the components and the module has a possibility not to meet the specification.
In order to avoid this, any underfill shall not be into module inside in case of applying underfill on your PCB.

## ⚠ Note:

Please make sure that your product has been evaluated and confirmed against your specifications when our product is mounted to your product.

All the items and parameters in this product specification have been prescribed on the premise that our product is used for the purpose, under the condition and in the environment agreed upon between you and us. You are requested not to use our product deviating from such agreement.

We consider it not appropriate to include other terms and conditions for transaction warranty in product specifications, drawings or other technical documents. Therefore, even if your original part of this product specification includes such terms and conditions as warranty clause, product liability clause, or intellectual property infringement liability clause, we are not able to accept such terms and conditions in this product specification unless they are based on the governmental regulation or what we have agreed otherwise in a separate contact. We would like to suggest that you propose to discuss them under negotiation of contract.

## ● Disclaimer

Please read this notice before using the Murata Wireless Modules.

1. Please note that the only warranty that Murata Manufacturing Co., Ltd. (“Murata”) provides regarding the products is its conformance to the specifications provided herein. Accordingly, Murata 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.

   MURATA 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.
   YOU AGREE TO INDEMNIFY AND DEFEND MURATA AND ITS AFFILIATES AGAINST ALL CLAIMS, DAMAGES, COSTS, AND EXPENSES THAT MAY BE INCURRED, INCLUDING WITHOUT LIMITATION, ATTORNEY FEES AND COSTS, DUE TO THE USE OF PRODUCTS.

2. The product is designed and manufactured for general consumer applications, and not for any particular application, so testing and use of the product shall be conducted at your own risk and responsibility. Specifically, please observe the following:
   i) Please conduct validation and verification of the products in actual condition of mounting and operating environment before commercial shipment of the equipment.
   ii) Please pay attention to minimize any mechanical vibration or shock, not to drop the product or a substrate that contains the product during transportation.
   iii) Since the application of static electricity or overvoltage may cause defect in the product or deterioration of its reliability, caution must be taken against exposure to any static electricity generated by electrified items such as work benches, soldering irons, tools, carrying containers, etc.
   iv) Caution shall be taken to avoid overstress to the product during and after the soldering process.
   v) Since the applied soldering method may deteriorate the reliability, thorough evaluation is recommended.
   vi) In case the product is to be used in equipment or electric circuit that requires high safety or reliability function or performances, sufficient reliability evaluation check for safety shall be performed before commercial shipment and moreover, due consideration to install a protective circuit is strongly recommended at customer's design stage. Please provide and appropriate fail-safe function on your product to prevent any damages that may be caused by the abnormal function or the failure of our product.

   Notwithstanding the foregoing, 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.

   - Aircraft equipment.
   - Aerospace equipment
   - Undersea equipment.
   - Power plant control equipment
   - Medical equipment.
   - Transportation equipment (vehicles, trains, ships, etc.).
   - Traffic signal equipment.
   - Disaster prevention / crime prevention equipment.
   - Data-processing equipment
   - Application of similar complexity and/ or reliability requirements to the applications listed in the above.

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3. Murata's warranty as provided in Clause 1 above that the products comply with descriptions expressly specified in the specifications shall be effective for a period of six (6) months from the date of delivery.

Murata shall not be liable for any defects that occur in dry packed products that are installed more than six (6) months after shipment.

If the products do not comply with the warranty, Murata's sole and exclusive liability shall be, at Murata's option, to repair or replace the products, or to credit or refund the price of the products.

Murata's liability under this warranty shall be limited to products that are returned during the warranty period to the address designated by Murata and that are determined by Murata not to conform to such warranty. If Murata elects to repair or replace such products, Murata shall have reasonable time to repair such products or provide replacements. Repaired products shall be warranted for the remainder of the original warranty period. Replaced products shall be warranted for a new full warranty period.

For avoidance of doubt, Murata shall not be liable for any defects that are caused by neglect, misuse or mistreatment by an entity other than Murata including improper installation or testing, or for any products that have been altered or modified in any way by an entity other than Murata. Moreover, Murata shall not be liable for any defects that result from your or third party's design, specifications or instructions for such products.

4. Testing and other quality control techniques are used to the extent Murata deems necessary. Unless mandated by government requirements, Murata does not necessarily test all parameters of each product.

5. EOL

Please note that we may discontinue the manufacture of products, due to reasons such as end of supply of materials and/or components from our suppliers.