

## **W-LAN + Bluetooth Module Data Sheet**

**Qualcomm Chipset**  
**for 802.11a/b/g/n/ac + Bluetooth 4.2**

**Tentative P/N : LBEE5U91CQ-TEMP**

## The revision history of the product specification

| Issued Date  | Revision Code | Revision Page | Changed Items                              | Change Reason          |
|--------------|---------------|---------------|--------------------------------------------|------------------------|
| 8, Apr, 2015 | -             | -             | -                                          | First Issue            |
| 27.Jul.2017  | A             | 12            | Reference Circuit                          | Corrected              |
| 30.Mar.2018  | B             | Top page      | Bluetooth version from BT4.1 to BT4.2      | Updated                |
|              |               | 7             | 6.2 External Sleep clock timing            | Added                  |
|              |               | 11            | 8.3.2.Tx characteristics                   | Corrected              |
|              |               | 12            | 8.4 DC/RF Characteristics for Bluetooth LE | Added                  |
| 14.May.2018  | C             | 3             | 2. Sample part Number Header               | Corrected<br>Corrected |
|              |               |               |                                            |                        |

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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

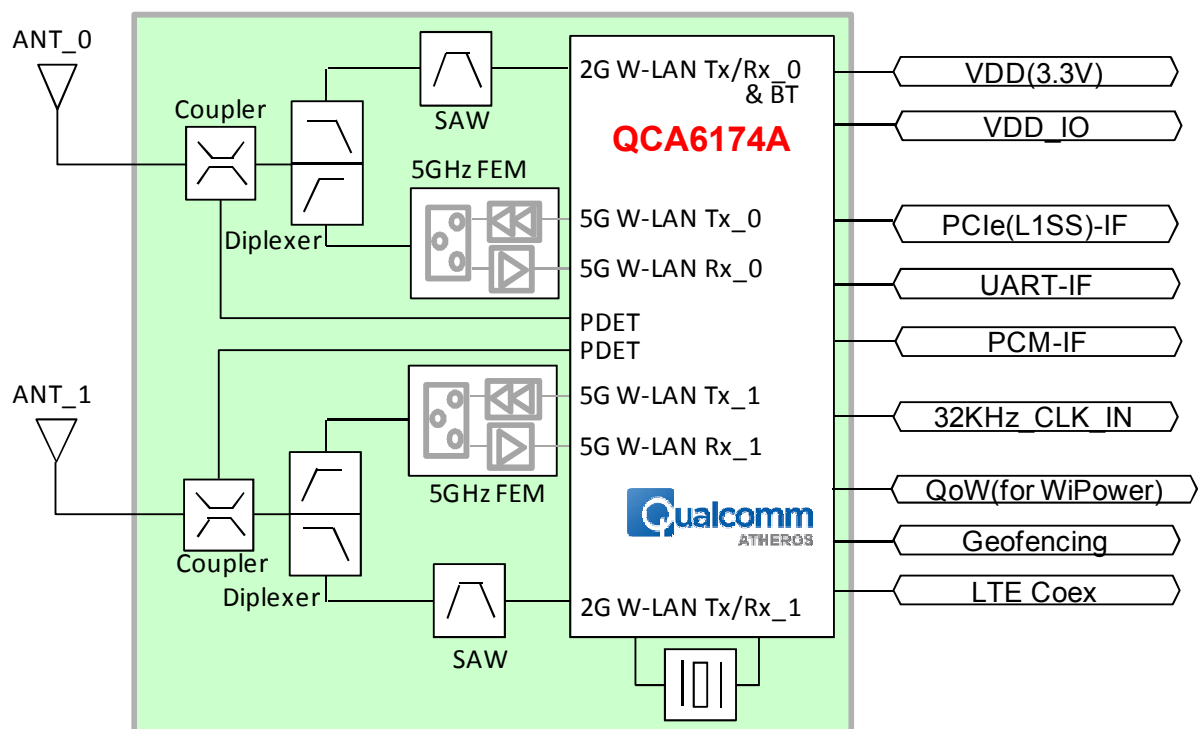
This specification is applied to the W-LAN [IEEE802.11a/b/g/n/ac] + Bluetooth [4.2] module.

- Qualcomm QCA6174A
- Compliant with IEEE802.11a/b/g/n/ac
- Compliant with Bluetooth specification v4.2
- Supports PCIe host interface for W-LAN
- Supports UART interface for Bluetooth
- Surface mount type 11.0 x 8.8mm , H=1.15mm Max
- Weight : TBD
- MSL : 3
- RoHS compliant

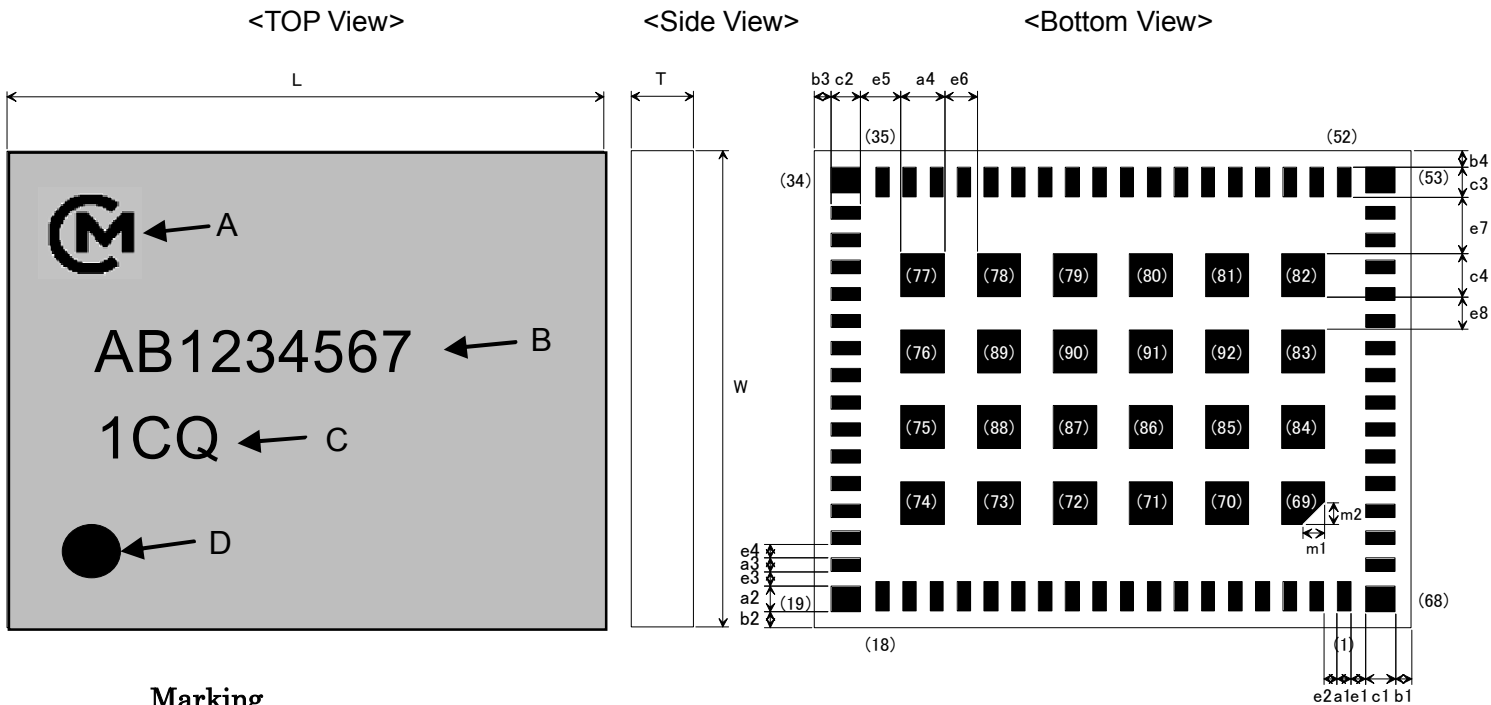
## 2. Part Number

|                    |
|--------------------|
| Sample Part Number |
| LBEE5U91CQ-TEMP    |

## 3. Block Diagram



#### 4. Dimensions, Marking and Terminal Configurations



##### Marking

| Marking | Meaning           |
|---------|-------------------|
| A       | Murata Logo       |
| B       | Inspection Number |
| C       | Module Type       |
| D       | #1 Pin Marking    |

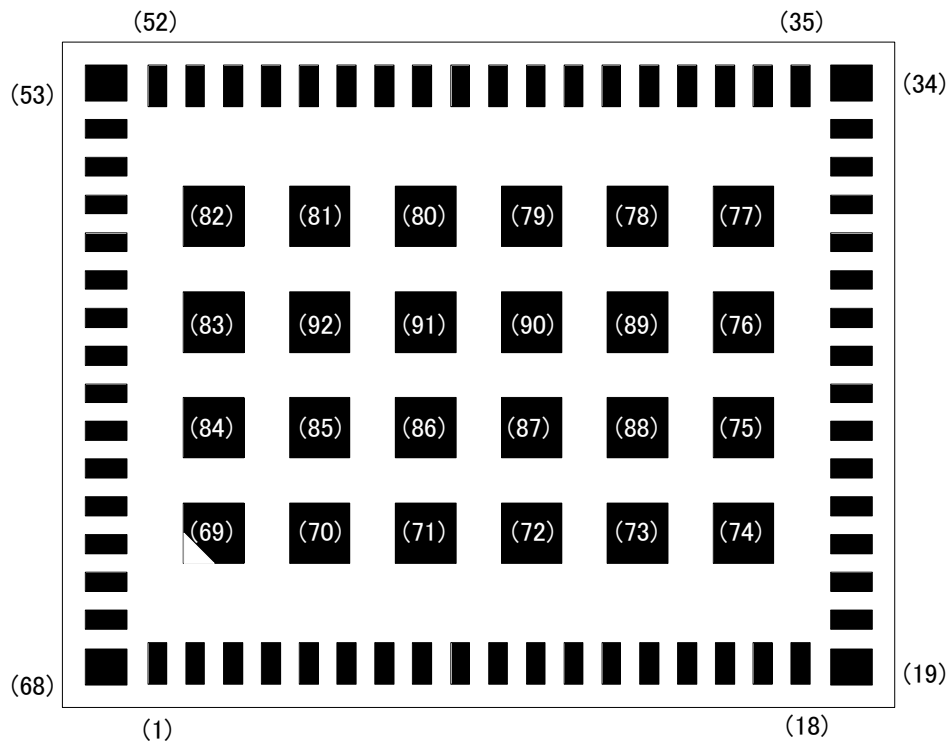
##### Dimensions

(unit : mm)

| Mark | Dimensions    | Mark | Dimensions    | Mark | Dimensions   |
|------|---------------|------|---------------|------|--------------|
| L    | 11.0 +/- 0.1  | W    | 8.8 +/- 0.1   | T    | 1.15 max.    |
| a1   | 0.25 +/- 0.1  | a2   | 0.475 +/- 0.1 | a3   | 0.25 +/- 0.1 |
| a4   | 0.8 +/- 0.1   | b1   | 0.3 +/- 0.1   | b2   | 0.3 +/- 0.1  |
| b3   | 0.3 +/- 0.1   | b4   | 0.3 +/- 0.1   | c1   | 0.55 +/- 0.1 |
| c2   | 0.55 +/- 0.1  | c3   | 0.55 +/- 0.1  | c4   | 0.8 +/- 0.1  |
| e1   | 0.275 +/- 0.1 | e2   | 0.25 +/- 0.1  | e3   | 0.25 +/- 0.1 |
| e4   | 0.25 +/- 0.1  | e5   | 0.75 +/- 0.1  | e6   | 0.6 +/- 0.1  |
| e7   | 1.05 +/- 0.1  | e8   | 0.6 +/- 0.1   |      |              |
| m1   | (0.4)         | m2   | (0.4)         |      |              |

# Terminal Configurations

< TOP View >



| No. | Pin Name       | Connection to IC Terminal | Description                                                                           |
|-----|----------------|---------------------------|---------------------------------------------------------------------------------------|
| 1   | SWREG_IN       | SWREG_IN, REG33_FB        | SWREG voltage input                                                                   |
| 2   | SWREG_IN       |                           |                                                                                       |
| 3   | GND            | -                         | Ground                                                                                |
| 4   | BT_RF_KILL     | BT_RF_KILL                | Turn-off BT RF analog and front-end. Active low.                                      |
| 5   | VDDIO_GPIO1    | VDDIO_GPIO1               | Voltage supply for IO                                                                 |
| 6   | VDDIO_GPIO0    | VDDIO_GPIO0               | Voltage supply for IO                                                                 |
| 7   | VDD_3P3        | VDD3.3V, VDDIO_GPIO0      | Voltage supply (3.3V)                                                                 |
| 8   | VDD_3P3        |                           |                                                                                       |
| 9   | PCIE_CLKREQ_L  | PCIE_CLKREQ_L             | Reference clock request for PCIe                                                      |
| 10  | PCIE_RST_L     | PCIE_RST_L                | PCI Express reset with weak pulldown                                                  |
| 11  | PCIE_WAKE_L    | PCIE_WAKE_L               | Request to service a functioninitiated wake event for PCIe                            |
| 12  | GPS_COEX_WOW   | GPS_COEX                  | This signal can be used to do GPS co- existence signal. Active high means WLAN is TX. |
| 13  | QoW            | QoW ( or GPIO[23] )       | for WiPower                                                                           |
| 14  | BT_WAKEUP_HOST | BT_WAKEUP_HOST            | Bluetooth wakeup the host. Active high.                                               |
| 15  | BT_LED         | BT_LED                    | BT_LED                                                                                |
| 16  | GND            | -                         | Ground                                                                                |
| 17  | LF_CLK_IN      | 32KHz_CLK_IN              | Slow-clock (32.768kHz) input                                                          |
| 18  | GND            | -                         | Ground                                                                                |
| 19  | GND            | -                         | Ground                                                                                |
| 20  | ANT_0          | -                         | RF output of Chain0                                                                   |
| 21  | GND            | -                         | Ground                                                                                |
| 22  | BT_EN          | BT_EN                     | Bluetooth Enable, Active high                                                         |
| 23  | WL_EN          | WL_EN                     | WLAN ENABLE. Active high                                                              |
| 24  | GND            | -                         | Ground                                                                                |
| 25  | VDD_FEM        | -                         | Voltage supply for 5GHz FEM                                                           |
| 26  | VDD_FEM        |                           |                                                                                       |
| 27  | GND            | -                         | Ground                                                                                |
| 28  | GND            | -                         | Ground                                                                                |
| 29  | ANT_1          | -                         | RF output of Chain1                                                                   |
| 30  | GND            | -                         | Ground                                                                                |

|       |               |                              |                                       |
|-------|---------------|------------------------------|---------------------------------------|
| 31    | LTE_PRI       | LTE_PRI                      | for LTE co-ex                         |
| 32    | LTE_SYNC      | LTE_SYNC                     | for LTE co-ex                         |
| 33    | LTE_ACTIVE    | LTE_ACTIVE                   | for LTE co-ex                         |
| 34    | GND           | -                            | Ground                                |
| 35    | BT_UART_TXD   | UART_TXD                     | UART TXD signal for Bluetooth         |
| 36    | BT_UART_RXD   | UART_RXD                     | UART RXD signal for Bluetooth         |
| 37    | BT_UART_CTS   | UART_CTS                     | UART CTS signal for Bluetooth         |
| 38    | BT_UART_RTS   | UART_RTS                     | UART RTS signal for Bluetooth         |
| 39    | PCM_SYNC      | PCM_SYNC                     | Bluetooth PCM_SYNC signal             |
| 40    | PCM_IN        | PCM_IN                       | Bluetooth PCM_IN signal               |
| 41    | PCM_CLK       | PCM_CLK                      | Bluetooth PCM_CLK signal              |
| 42    | PCM_OUT       | PCM_OUT                      | Bluetooth PCM_OUT signal              |
| 43    | VDDIO_XTAL    | VDDIO_XTAL                   | Voltage supply for XTAL               |
| 44    | CLK_REQ_OUT   | CLK_REQ_OUT                  | Clock request output.                 |
| 45    | GPIO2         | GPIO2                        | GPIO2                                 |
| 46    | GPIO10        | GPIO10                       | GPIO10                                |
| 47    | GND           | -                            | Ground                                |
| 48    | PCIE_TX_P     | PCIE_TXP                     | Differential transmit for PCIe        |
| 49    | PCIE_TX_N     | PCIE_TXN                     | Differential transmit for PCIe        |
| 50    | GND           | -                            | Ground                                |
| 51    | PCIE_REFCLK_P | PCIE_REFCLK_P                | Differential reference clock for PCIe |
| 52    | PCIE_REFCLK_N | PCIE_REFCLK_N                | Differential reference clock for PCIe |
| 53    | GND           | -                            | Ground                                |
| 54    | PCIE_RX_N     | PCIE_RXN                     | Differential receive for PCIe         |
| 55    | PCIE_RX_P     | PCIE_RXP                     | Differential receive for PCIe         |
| 56    | GND           | -                            | Ground                                |
| 57    | GPIO4         | GPIO4                        | GPIO4                                 |
| 58    | GPIO3         | GPIO3                        | GPIO3                                 |
| 59    | GPIO1         | GPIO1                        | GPIO1                                 |
| 60    | GPIO5         | GPIO5                        | GPIO5 (for Geofencing)                |
| 61    | GPIO6         | GPIO6                        | GPIO6 (for Geofencing)                |
| 62    | GND           | -                            | Ground                                |
| 63    | SWREG_FB      | SWREG_FB, VDD11D, VDD11_PCIE | 1.1V voltage feedback to SWREG PMU    |
| 64    | SWREG_FB      |                              |                                       |
| 65    | GND           | -                            | Ground                                |
| 66    | SWREG_OUT     | SWREG_OUT                    | SWREG PMU output                      |
| 67    | SWREG_OUT     |                              |                                       |
| 68    | GND           | -                            | Ground                                |
| 69    | GPIO8         | GPIO8                        | GPIO8                                 |
| 70-81 | GND           | -                            | Ground                                |
| 82    | GPIO0         | GPIO0                        | GPIO0                                 |
| 83    | GPIO9         | GPIO9                        | GPIO9                                 |
| 84    | GPIO7         | GPIO7                        | GPIO7                                 |
| 85-92 | GND           | -                            | Ground                                |

## 5. Rating

|                     |            | min. | max. | unit |
|---------------------|------------|------|------|------|
| Storage Temperature |            | -40  | +85  | °C   |
| Supply Voltage      | VDD_3P3    | -0.3 | 3.63 | V    |
|                     | SWREG_IN   | -0.3 | 3.63 | V    |
|                     | VDD_FEM    | -0.5 | 3.63 | V    |
|                     | VDDIO_GPIO | -0.3 | 3.63 | V    |
|                     | VDDIO_XTAL | -0.3 | 3.63 | V    |

\* 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 are set within operating condition.

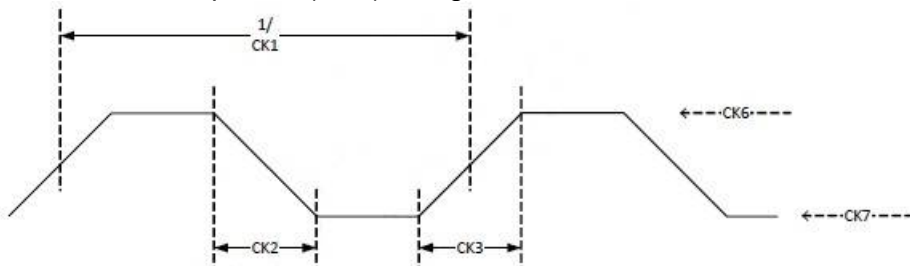
## 6. Operating Condition

### 6.1 Operating Conditions

|                       |             | min.  | typ.       | max. | unit |
|-----------------------|-------------|-------|------------|------|------|
| Operating Temperature | Ambient     | -20   | +25        | +70  | °C   |
|                       | Top surface |       |            | +85  | °C   |
| Supply Voltage        | VDD_3P3     | 3.135 | 3.3        | 3.46 | V    |
|                       | SWREG_IN    | 3.135 | 3.3        | 3.46 | V    |
|                       | VDD_FEM     | 3.1   | 3.3        | 3.5  | V    |
|                       | VDDIO_GPIO  | 1.71  | 1.8 or 3.3 | 3.46 | V    |
|                       | VDDIO_XTAL  | 1.71  | 1.8 or 3.3 | 3.46 | V    |

\* Functionality is guaranteed but specifications require derating at extreme temperatures.

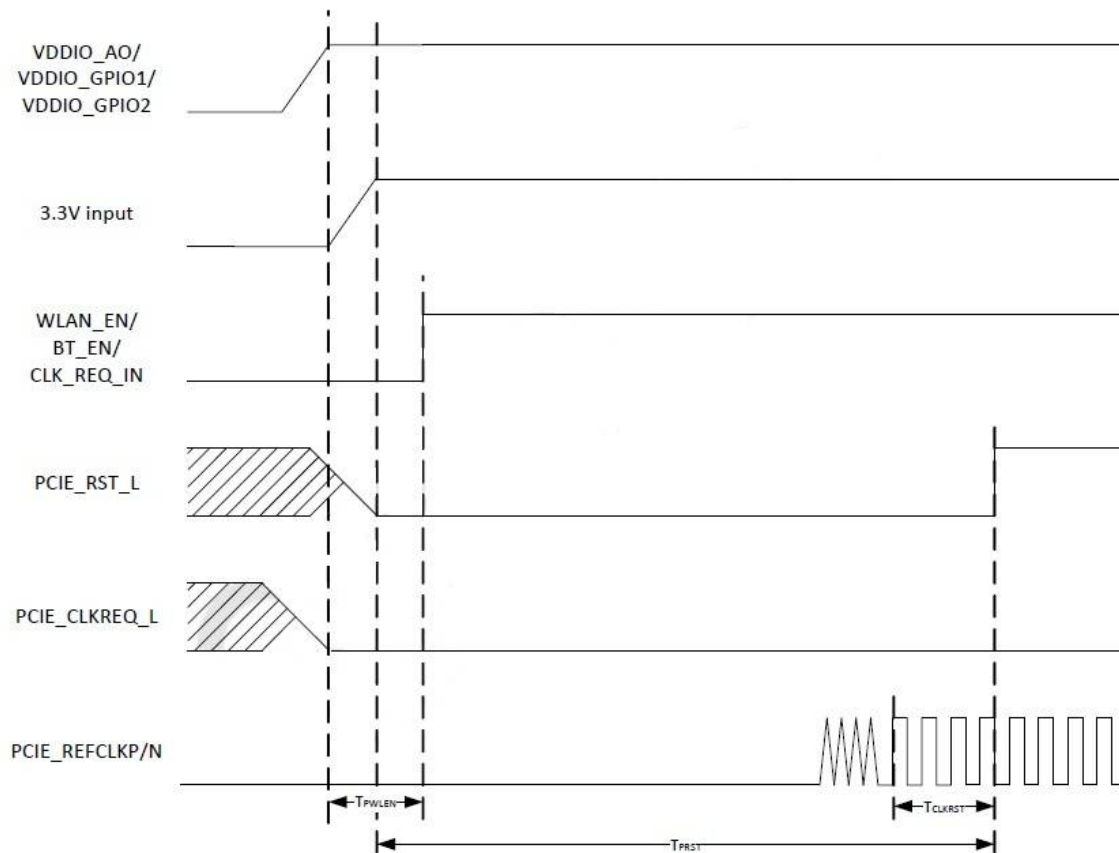
### 6.2 External Sleep clock (LPO) timing



| Parameter | Description                    | Min                       | Typ    | Max                       | Unit |
|-----------|--------------------------------|---------------------------|--------|---------------------------|------|
| CK1       | Clock rate                     | —                         | 32.768 | —                         | kHz  |
| CK2       | Fall time                      | 1                         | —      | 100                       | ns   |
| CK3       | Rise time                      | 1                         | —      | 100                       | ns   |
| CK4       | Duty cycle (high to low ratio) | 15                        | —      | 85                        | %    |
| CK5       | Frequency stability            | -200                      | —      | 200                       | PPM  |
| CK6       | Input high voltage             | $0.8 \times VDDIO\_GPIO2$ | —      | $VDDIO\_GPIO2 + 0.2$      | V    |
| CK7       | Input low voltage              | -0.3                      | —      | $0.2 \times VDDIO\_GPIO2$ | V    |

## 7. Digital logic characteristics

### 7.1 PCIe sequence timing



| Parameter | Description                                            | Min | Typ | Max | Unit |
|-----------|--------------------------------------------------------|-----|-----|-----|------|
| Tpwlen    | Time from power valid to WLAN_EN input active          | 10  | –   | –   | μs   |
| Tprst     | Time from power valid to PCIE_RESET_L assertion        | 10  | –   | –   | ms   |
| Tclkst    | Time from PCIE_REFCLK stable to PCIE_RESET_L assertion | 100 | –   | –   | μs   |

## 8. Electrical Characteristics

Normal Condition: 25deg.C, Voltage supplies are typical values.

IEEE802.11b 11Mbps (SISO) mode unless otherwise specified.

IEEE802.11a/g 54Mbps (SISO) mode unless otherwise specified.

IEEE802.11n MCS7 (SISO) mode unless otherwise specified.

IEEE802.11ac MCS9 (SISO) mode unless otherwise specified.

### 8.1. DC/RF Characteristics for WLAN 2.4GHz

| Items         | Contents                                                                            |
|---------------|-------------------------------------------------------------------------------------|
| Specification | IEEE802.11b/g/n                                                                     |
| Mode          | DSSS / CCK / OFDM                                                                   |
| Frequency     | 2412 to 2472 MHz                                                                    |
| Data rate     | 11b; 1, 2, 5.5, 11Mbps<br>11g; 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>11n; MCS0 ~ MCS7 |

#### 8.1.1. DC Characteristics

| Items   |     |              | min. | typ. | max. | unit |
|---------|-----|--------------|------|------|------|------|
| Tx mode | 11b | SISO         | -    | -    | 580  | mA   |
|         |     | Tx diversity | -    | -    | 1000 | mA   |
|         | 11g | SISO         | -    | -    | 380  | mA   |
|         |     | Tx diversity | -    | -    | 800  | mA   |
|         | 11n | SISO         | -    | -    | 370  | mA   |
|         |     | MIMO         | -    | -    | 800  | mA   |
| Rx mode | -   |              | -    | -    | 240  | mA   |

#### 8.1.2. Tx Characteristics

| Normal Condition            |                           |                            | min. | typ. | max. | unit |
|-----------------------------|---------------------------|----------------------------|------|------|------|------|
| Power Levels<br>(ANT0/ANT1) | 11b(Target:17dBm)         |                            | 15   | 17   | 19   | dBm  |
|                             | 11g(Target:14dBm)         |                            | 12   | 14   | 16   | dBm  |
|                             | 11n(Target:13dBm)         |                            | 11   | 13   | 15   | dBm  |
| Spectrum Mask               | 11b                       | 1 <sup>st</sup> Side lobes | -    | -    | -30  | dBr  |
|                             |                           | 2 <sup>nd</sup> Side lobes | -    | -    | -50  | dBr  |
|                             | 11g                       | fc +/- 11MHz               | -    | -    | -20  | dBr  |
|                             |                           | fc +/- 20MHz               | -    | -    | -28  | dBr  |
|                             |                           | fc +/- 30MHz               | -    | -    | -40  | dBr  |
|                             | 11n                       | fc +/- 11MHz               | -    | -    | -20  | dBr  |
|                             |                           | fc +/- 20MHz               | -    | -    | -28  | dBr  |
|                             |                           | fc +/- 30MHz               | -    | -    | -45  | dBr  |
|                             | Modulation Accuracy (EVM) |                            | 11b  | -    | -    | 35   |
| 11g                         |                           |                            | -    | -    | -25  | dB   |
| 11n                         |                           |                            | -    | -    | -27  | dB   |
| Frequency Tolerance         |                           |                            | -20  | -    | 20   | ppm  |
| Spurious Emissions *        |                           |                            |      |      |      |      |
| 1) 30-1000MHz               |                           |                            | -    | -    | -36  | dBm  |
| 2) 1000-12750MHz            |                           |                            | -    | -    | -30  | dBm  |
| 3) 1800-1900MHz             |                           |                            | -    | -    | -47  | dBm  |
| 4) 5150-5300MHz             |                           |                            | -    | -    | -47  | dBm  |

### 8.1.3. Rx Characteristics

| Normal Condition      |                                    | min. | typ. | max. | unit |
|-----------------------|------------------------------------|------|------|------|------|
| Minimum Input Level * | 11b (FER $\leq$ 8%) 1Mbps          | -    | -    | -88  | dBm  |
|                       | 11b (FER $\leq$ 8%) 11Mbps         | -    | -    | -78  | dBm  |
|                       | 11g (PER $\leq$ 10%) 54Mbps        | -    | -    | -67  | dBm  |
|                       | 11n (PER $\leq$ 10%) / HT20 / MCS7 | -    | -    | -66  | dBm  |
| Maximum Input Level   | 11b (FER $\leq$ 8%)                | -10  | -    | -    | dBm  |
|                       | 11g/n (PER $\leq$ 10%)             | -20  | -    | -    | dBm  |

## 8.2. DC/RF Characteristics for WLAN 5GHz

| Items         | Contents                                                                       |
|---------------|--------------------------------------------------------------------------------|
| Specification | IEEE802.11a/n/ac                                                               |
| Mode          | OFDM                                                                           |
| Frequency     | HT20; 5180 to 5825MHz<br>HT40; 5190 to 5795 MHz<br>HT80; 5210 to 5775 MHz      |
| Data rate     | 11a; 6, 9, 12, 18, 24, 36, 48, 54Mbps<br>11n; MCS0 ~ MCS7<br>11ac; MCS0 ~ MCS9 |

### 8.2.1. DC Characteristics

| Items   |      |              | min. | typ. | max. | unit |
|---------|------|--------------|------|------|------|------|
| Tx mode | 11a  | SISO         | -    | -    | 430  | mA   |
|         |      | Tx diversity | -    | -    | 800  | mA   |
|         | 11n  | SISO         | -    | -    | 350  | mA   |
|         |      | MIMO         | -    | -    | 650  | mA   |
|         | 11ac | SISO         | -    | -    | 300  | mA   |
|         |      | MIMO         | -    | -    | 500  | mA   |
| Rx mode | -    |              | -    | -    | 340  | mA   |

### 8.2.2. Tx Characteristics

| Normal Condition             |                    |               | min. | typ. | max. | unit |
|------------------------------|--------------------|---------------|------|------|------|------|
| Power Levels<br>(ANT0/ANT1)  | 11a(Target:14dBm)  |               | 12   | 14   | 16   | dBm  |
|                              | 11n(Target:13dBm)  |               | 11   | 13   | 15   | dBm  |
|                              | 11ac(Target:11dBm) |               | 9    | 11   | 13   | dBm  |
| Spectrum<br>Mask             | 11a                | fc +/- 11MHz  | -    | -    | -20  | dBr  |
|                              |                    | fc +/- 20MHz  | -    | -    | -28  | dBr  |
|                              |                    | fc +/- 30MHz  | -    | -    | -40  | dBr  |
|                              | 11n                | fc +/- 21MHz  | -    | -    | -20  | dBr  |
|                              |                    | fc +/- 40MHz  | -    | -    | -28  | dBr  |
|                              |                    | fc +/- 60MHz  | -    | -    | -40  | dBr  |
|                              | 11ac               | fc +/- 41MHz  | -    | -    | -20  | dBr  |
|                              |                    | fc +/- 80MHz  | -    | -    | -28  | dBr  |
|                              |                    | fc +/- 120MHz | -    | -    | -40  | dBr  |
| Modulation Accuracy<br>(EVM) |                    | 11a(54Mbps)   | -    | -    | -25  | dB   |
|                              |                    | 11n(MCS7)     | -    | -    | -27  | dB   |
|                              |                    | 11ac(MCS9)    | -    | -    | -32  | dB   |
| Frequency Tolerance          |                    |               | -20  | -    | 20   | ppm  |
| Spurious Emissions           |                    |               |      |      |      |      |
| 1) 30-1000MHz                |                    |               | -    | -    | -36  | dBm  |
| 2) 1000-12750MHz             |                    |               | -    | -    | -30  | dBm  |
| 3) 1800-1900MHz              |                    |               | -    | -    | -47  | dBm  |

### 8.2.3. Rx Characteristics

| Normal Condition    |                                     | min. | typ. | max. | unit |
|---------------------|-------------------------------------|------|------|------|------|
| Minimum Input Level | 11a (PER $\leq$ 10%) / 6Mbps        | -    | -    | -87  | dBm  |
|                     | 11a (PER $\leq$ 10%) / 54Mbps       | -    | -    | -67  | dBm  |
|                     | 11n (PER $\leq$ 10%) / HT40 / MCS7  | -    | -    | -63  | dBm  |
|                     | 11ac (PER $\leq$ 10%) / HT80 / MCS9 | -    | -    | -53  | dBm  |
| Maximum Input Level | 11a (PER $\leq$ 10%)                | -30  | -    | -    | dBm  |
|                     | 11n (PER $\leq$ 10%)                | -30  | -    | -    | dBm  |
|                     | 11ac (PER $\leq$ 10%)               | -30  | -    | -    | dBm  |

### 8.3. DC/RF Characteristics for Bluetooth

| Items                  | Contents                                                                                      |
|------------------------|-----------------------------------------------------------------------------------------------|
| Frequency              | 2402 to 2480 MHz                                                                              |
| Number of RF channel   | 79                                                                                            |
| Operation mode (Rx/Tx) | Time division multiplex either transmit or receive<br>Frequency hopping after one Rx/Tx cycle |

#### 8.3.1. Power Consumption

| Items             | min. | Typ | max. | unit |
|-------------------|------|-----|------|------|
| Power consumption | -    | -   | 100  | mA   |

#### 8.3.2. Tx Characteristics

| Items                                                   |                      | min.      | Typ | max. | unit     |     |
|---------------------------------------------------------|----------------------|-----------|-----|------|----------|-----|
| Output Power<br>(BT power setting = 9)                  | BR (nomal condition) | 4.5       | -   | 11.5 | dBm      |     |
|                                                         | EDR                  | 1.5       | -   | 8.5  | dBm      |     |
| -20dB bandwidth                                         |                      | -         | -   | 1    | MHz      |     |
| Modulation characteristics                              | δf1avg               | 140       | -   | 175  | kHz      |     |
|                                                         | δf2max               | 115       | -   | -    | kHz      |     |
|                                                         | δf2avg/δf1avg        | 0.8       | -   | -    | -        |     |
| Initial Carrier Frequency Tolerance                     |                      | -75       | -   | 75   | kHz      |     |
| Carrier Frequency Drift                                 | 1slot                | -25       | -   | +25  | kHz      |     |
|                                                         | 3slot                | -40       | -   | +40  | kHz      |     |
|                                                         | 5slot                | -40       | -   | +40  | kHz      |     |
|                                                         | Max drift rate       | -20       | -   | +20  | kHz/50μs |     |
| Spurious Emissions                                      |                      |           |     |      |          |     |
| 1) 30-1000MHz                                           |                      | -         | -   | -36  | dBm      |     |
| 2) 1000-12750MHz                                        |                      | -         | -   | -30  | dBm      |     |
| 3) 1800-1900MHz                                         |                      | -         | -   | -47  | dBm      |     |
| 4) 5150-5300MHz                                         |                      | -         | -   | -47  | dBm      |     |
| EDR Relative Power                                      |                      | -4        | -   | 1    | dB       |     |
| EDR Carrier Frequency Stability and Modulation Accuracy | Pi/4-DQPSK & 8DPSK   | ωi        | -75 | -    | 75       | kHz |
|                                                         |                      | ω0        | -10 | -    | 10       | kHz |
|                                                         |                      | ωi+ω0     | -75 | -    | 75       | kHz |
|                                                         | Pi/4-DQPSK           | RMS DEVM  | -   | -    | 20       | %   |
|                                                         |                      | 99% DEVM  | -   | -    | 30       | %   |
|                                                         |                      | Peak DEVM | -   | -    | 35       | %   |
|                                                         | 8DPSK                | RMS DEVM  | -   | -    | 13       | %   |
|                                                         |                      | 99% DEVM  | -   | -    | 20       | %   |
|                                                         |                      | Peak DEVM | -   | -    | 25       | %   |

#### 8.3.3. Rx Characteristics

| Items                              | min | Typ | max | unit |
|------------------------------------|-----|-----|-----|------|
| Sensitivity (BER $\leq$ 0.1%)      | -   | -   | -72 | dBm  |
| EDR Sensitivity (BER $\leq$ 0.01%) | -   | -   | -72 | dBm  |
| Maximum Input Level                | -20 | -   | -   | dBm  |

#### 8.4. DC/RF Characteristics for Bluetooth LE

| Items                | Contents                |
|----------------------|-------------------------|
| Frequency (spacing)  | 2402 to 2480 MHz (2MHz) |
| Number of RF channel | 40                      |

##### 8.4.1. Tx Characteristics

| Items                                                | min  | typ | max | unit |
|------------------------------------------------------|------|-----|-----|------|
| Output power *1                                      | -1   | -   | 6   | dBm  |
| Modulation characteristics                           |      |     |     |      |
| 1) $\Delta f_{1\text{avg}}$                          | 225  | -   | 275 | kHz  |
| 2) $\Delta f_{2\text{max}}$                          | 185  | -   | -   | kHz  |
| 3) $\Delta f_{2\text{avg}} / \Delta f_{1\text{avg}}$ | 0.8  | -   | -   | -    |
| Carrier frequency offset and drift                   |      |     |     |      |
| 1) $f_n - f_{TX}$ , $n=0,1,2,3,\dots,k$              | -150 | -   | 150 | kHz  |
| 2) $ f_0 - f_n $ , $n=2,3,4,\dots,k$                 | -    | -   | 50  | kHz  |
| 3) $ f_1 - f_0 $                                     | -    | -   | 20  | kHz  |
| 4) $ f_n - f_{n-5} $ , $n=6,7,8,\dots,k$             | -    | -   | 20  | kHz  |

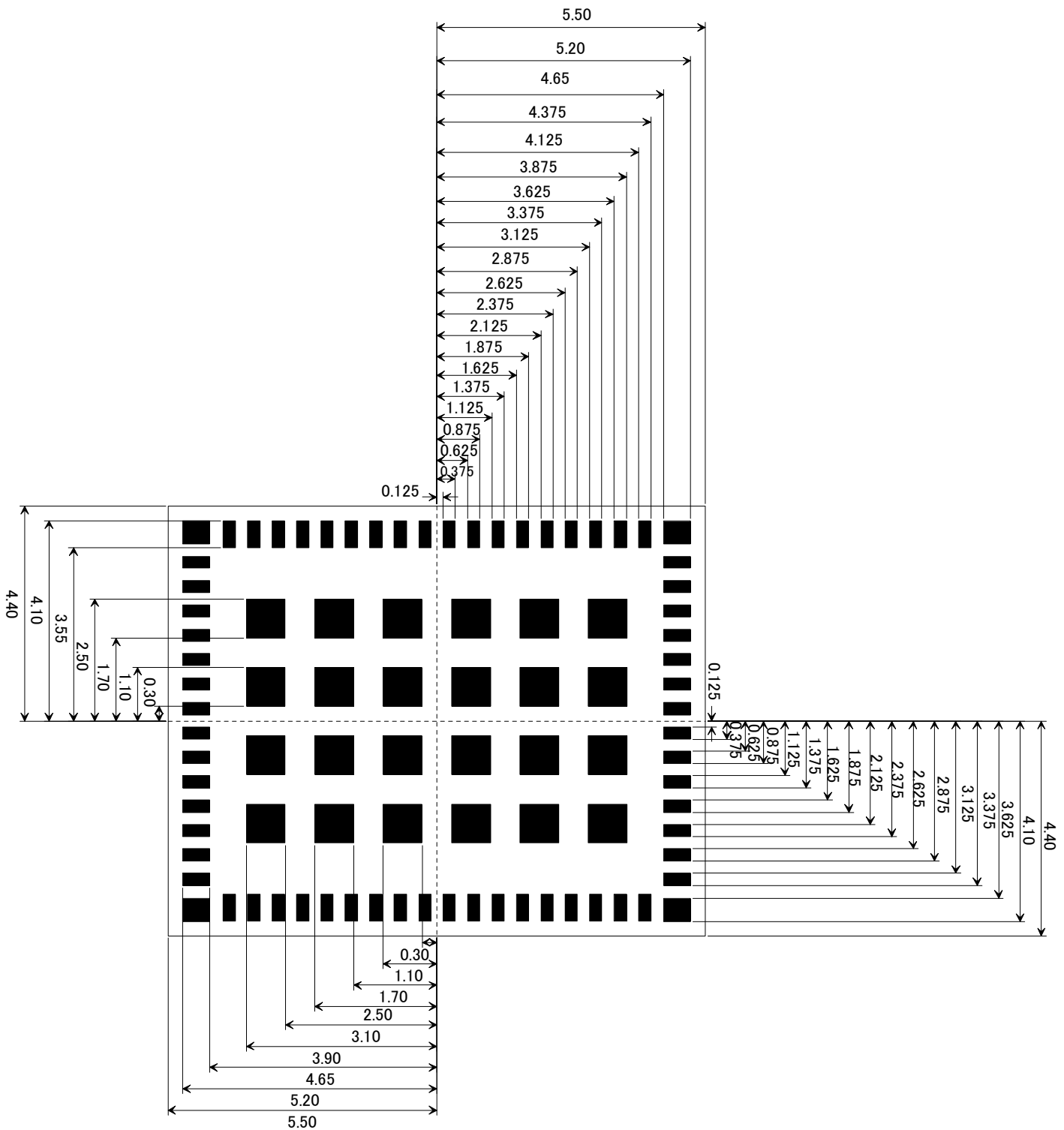
\*1: Qualcomm default setting

##### 8.4.2. Rx Characteristics

| Items                                    | min | typ | max | unit |
|------------------------------------------|-----|-----|-----|------|
| Receiver sensitivity (PER < 30.8%)       | -   | -   | -72 | dBm  |
| Maximum input signal level (PER < 30.8%) | -10 | -   | -   | dBm  |
| PER Report Integrity (-30dBm input)      | 50  | -   | -   | %    |

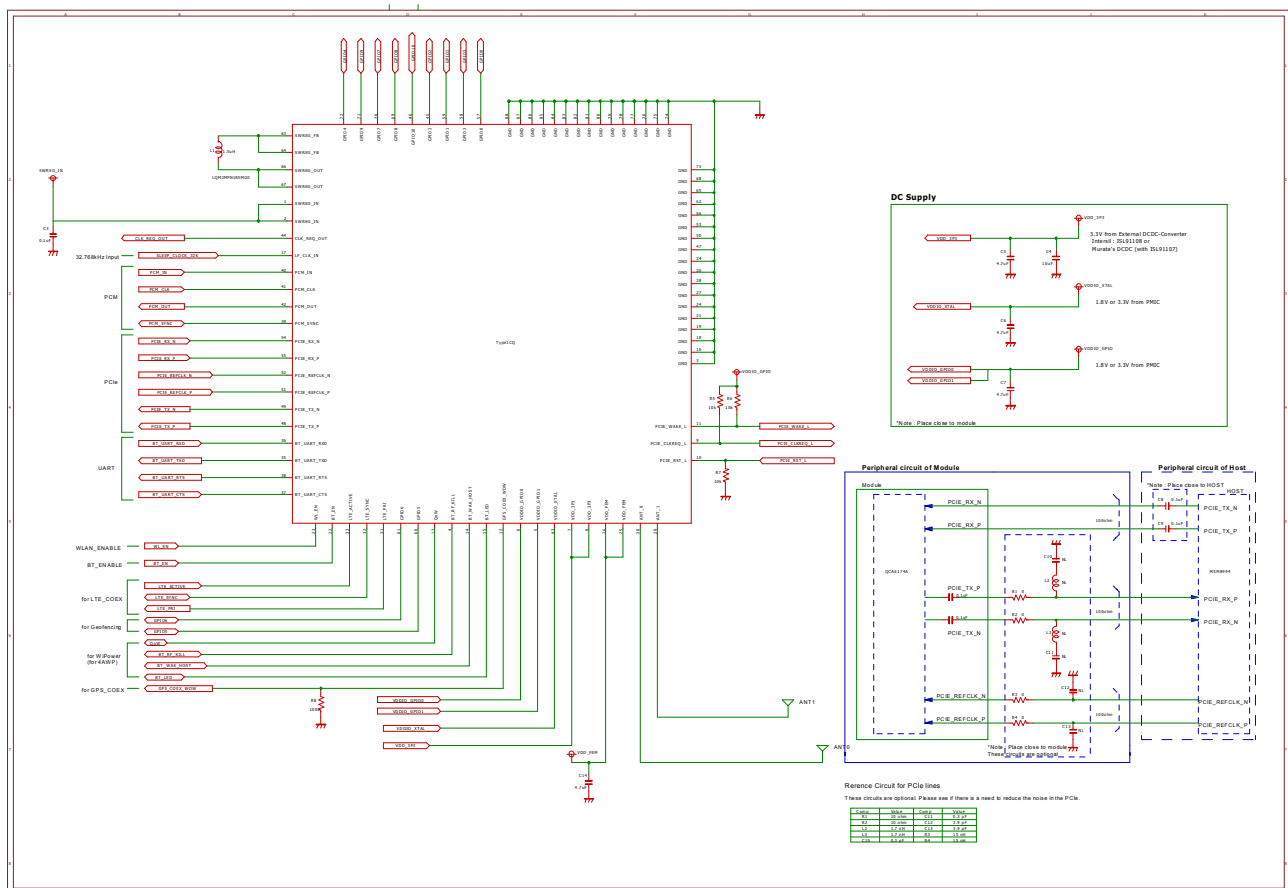
## 9. Reference Land pattern

<Top View>



Unit: mm

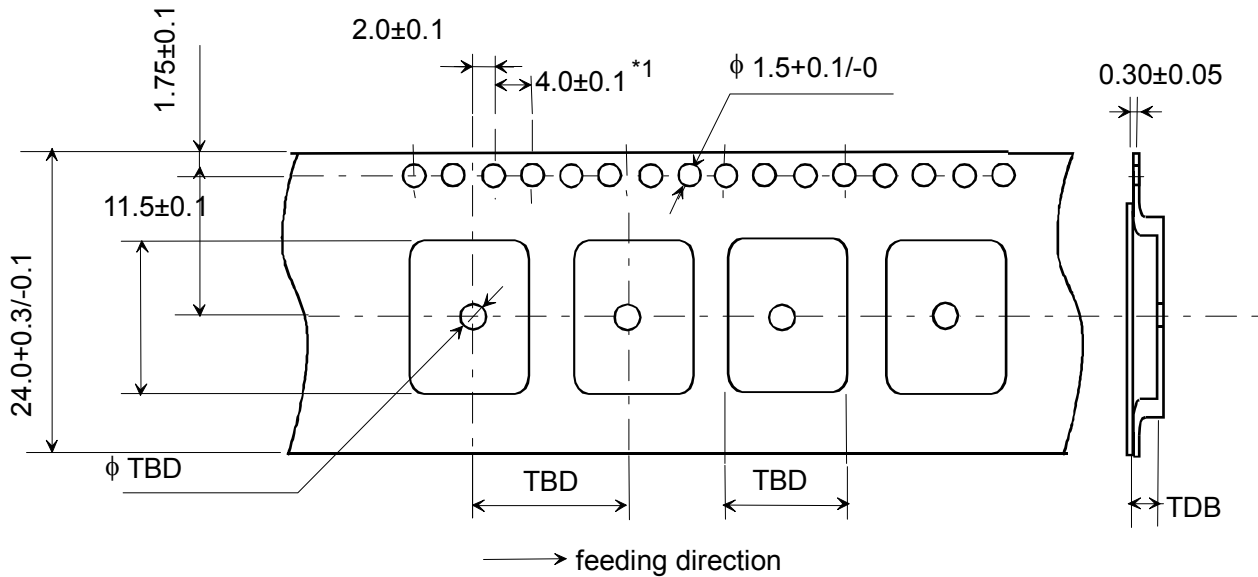
## 10. Reference Circuit



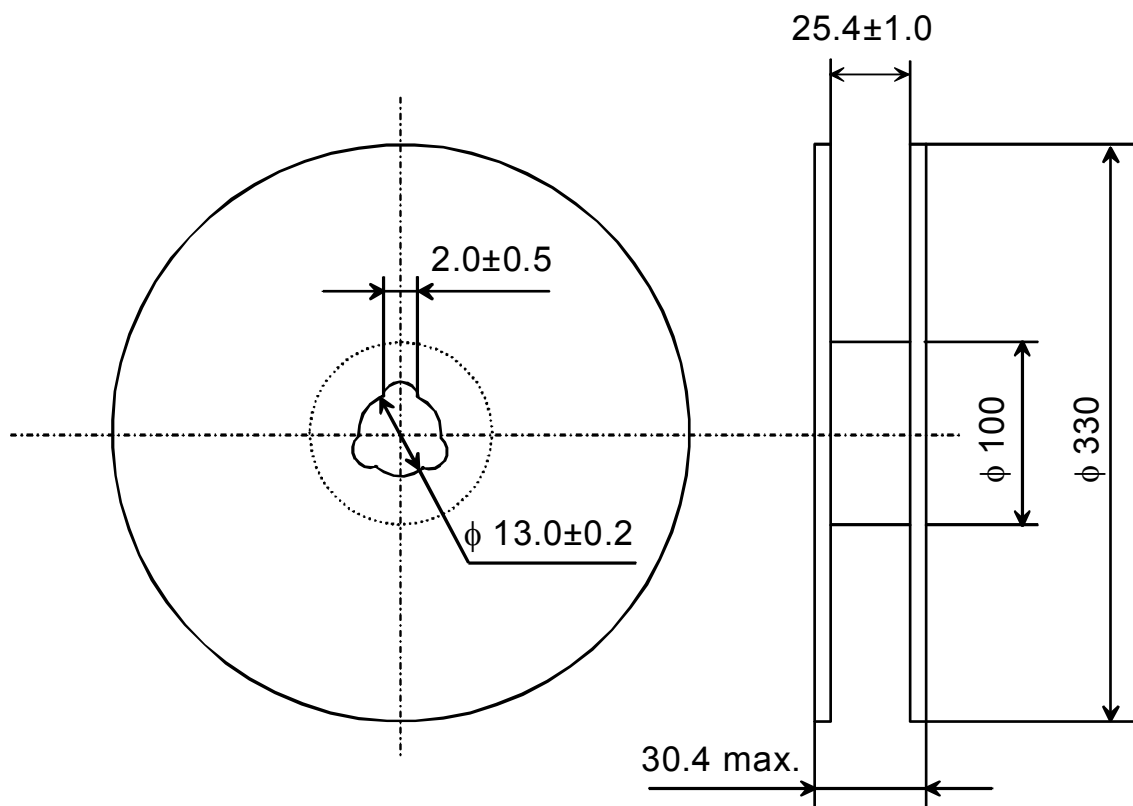
## 11. Tape and Reel Packing

### (1) Dimensions of Tape (Plastic tape)

\*1. Cumulative tolerance of max.  $40.0 \pm 0.15$  every 10 pitches



### (2) Dimensions of Reel



(unit: mm)

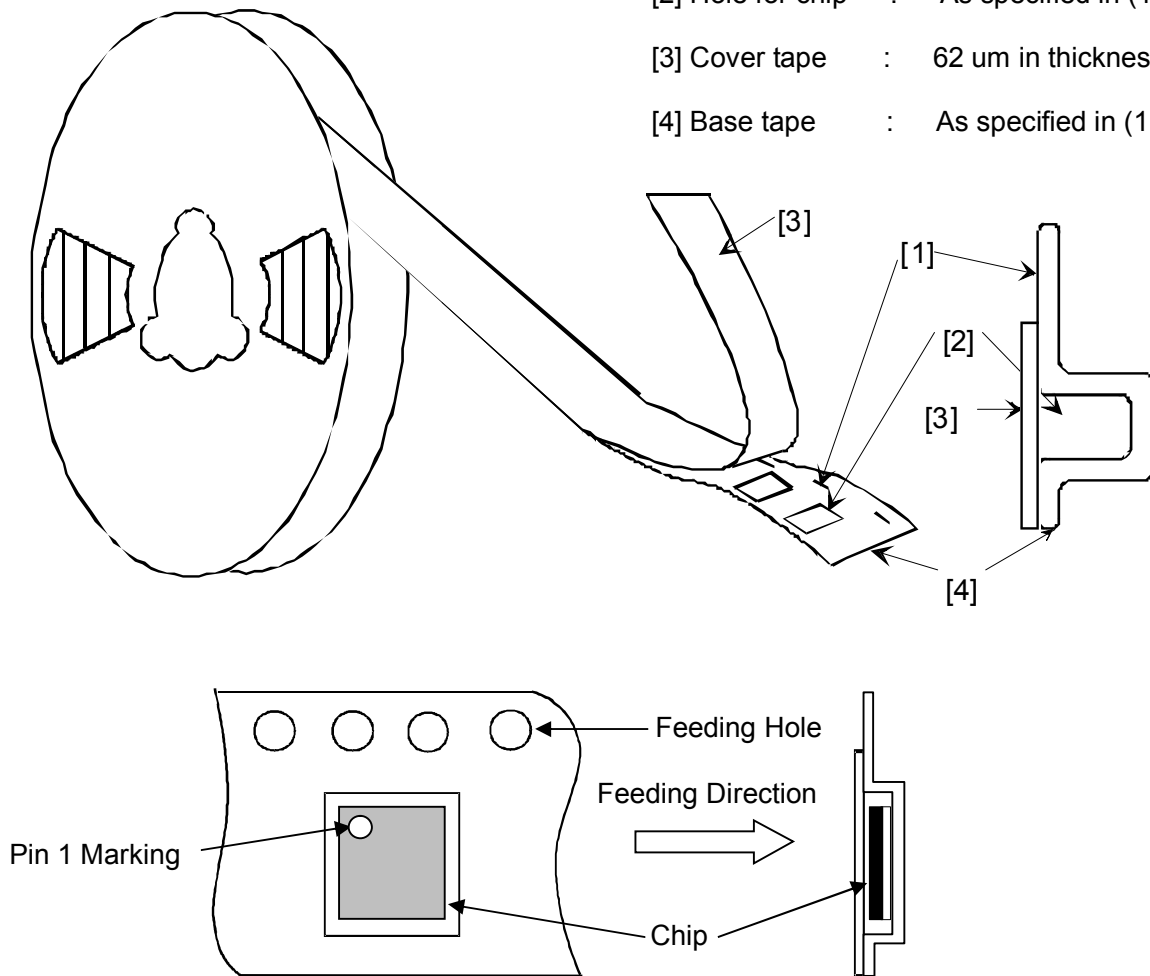
### (3) Taping Diagrams

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

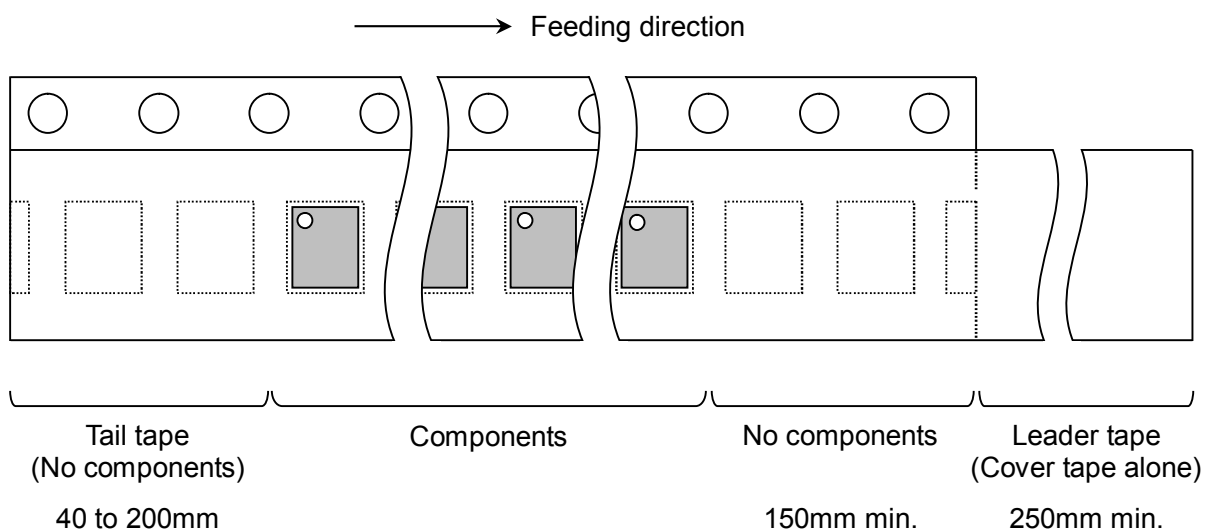
[2] Hole for chip : As specified in (1)

[3] Cover tape : 62  $\mu$ m in thickness

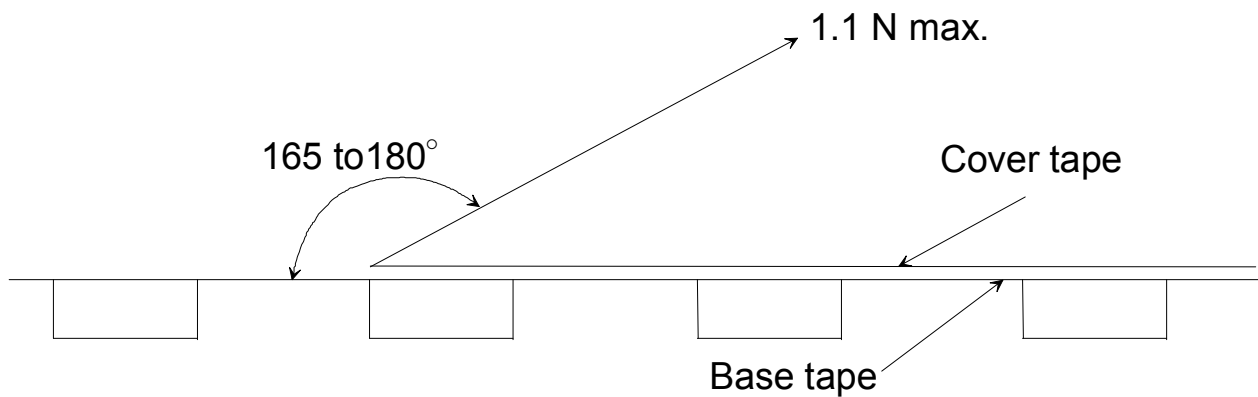
[4] Base tape : As specified in (1)



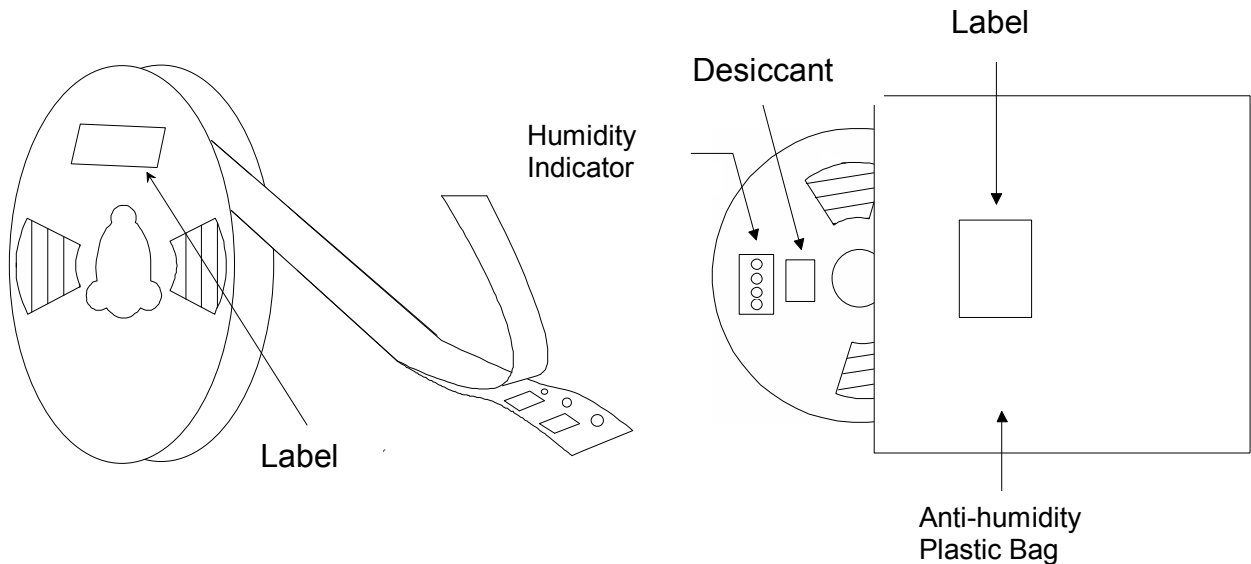
### (4) Leader and Tail tape



- (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 250 mm min.
- (7) Tear off strength against pulling of cover tape : 5 N min.
- (8) Packaging unit : 1000 pcs./ 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) PACKAGE (Humidity proof Packing)



Tape and reel must be sealed with the anti-humidity plastic bag. The bag contains the desiccant and the humidity indicator.

## **12. NOTICE**

### **12.1. 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 solderbility before used.

- The product shall be stored in non corrosive gas (Cl<sub>2</sub>, NH<sub>3</sub>, SO<sub>2</sub>, No<sub>x</sub>, 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  $\leq 30\text{deg.C}$  /  $\leq 60\%\text{RH}$  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.

### **12.2. 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.

### **12.3. 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.

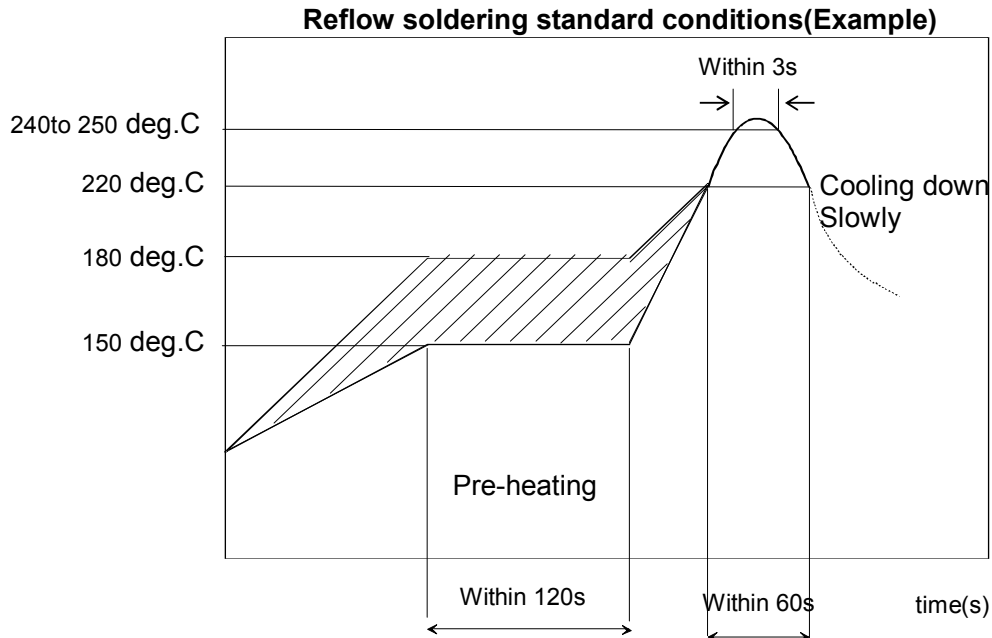
### **12.4. Notice for Chip Placer:**

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.

### 12.5. 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.



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.

### 12.6. Cleaning:

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

### 12.7. 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<sub>2</sub>, NH<sub>3</sub>, SO<sub>x</sub>, NO<sub>x</sub> 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.

### 12.8. 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.

### **13. PRECONDITION TO USE OUR PRODUCTS**

PLEASE READ THIS NOTICE BEFORE USING OUR PRODUCTS.

Please make sure that your product has been evaluated and confirmed from the aspect of the fitness for the specifications of our product when our product is mounted to your product.

All the items and parameters in this product specification/datasheet/catalog have been prescribed on the premise that our product is used for the purpose, under the condition and in the environment specified in this specification. You are requested not to use our product deviating from the condition and the environment specified in this specification.

Please note that the only warranty that we provide regarding the products is its conformance to the specifications provided herein. Accordingly, we shall not be responsible for any defects in products or equipment incorporating such products, which are caused under the conditions other than those specified in this specification.

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

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Please do not use our products, our technical information and other data provided by us for the purpose of developing of mass-destruction weapons and the purpose of military use.

Moreover, you must comply with "foreign exchange and foreign trade law", the "U.S. export administration regulations", etc.

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

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