

## Features

- 3GPP release 14 compliant with support for NTN Release 17
- LTE CAT M1/NB2 – 23 dBm
- 16 MByte of flash
- Dimension: 11.1x11.4x1.4 mm (typ), 1.5mm(max)
- Package: LGA
- Antenna configurations: external
- 3GPP Rel. 14 eDRX
- Power Consumption: enables up to 10 year battery life
  - eDRX current: <45 uA (avg) @ 8 Hyperframes
- Moisture control: MSL4
- Operating temperature range: -40°C to 85°C
- OTA firmware upgrade
- Cellular regulatory certificate: FCC/IC, ETSI, TELEC
- Global certification: PTCRB, GCF
- Control via AT commands according to 3GPP TS27.005, 27.007 and customized AT commands
- IPv4/IPv6 stack with TCP and UDP protocol
- SSL/TLS

## Benefits

- 4G LTE technology capability
- Dedicated LTE half-duplex operation (HD-FDD) for CatM1
- LTE universal modem supports (low-band and mid-band):
  - Low-band B5/B8/B12/B13/B17/B18/B19/B20/B26/B28
  - Mid-band B1/B2/B3/B4/B25
- NTN NTN band B23/255/256
- Optimized for Class 3 LTE output power (+23 dBm)

## Applications

- Wearables
- Smart Meter
- Medical/Healthcare
- Asset Tracking

**LBAD0XX1SC-005**

**LTE CAT M1&NB2  
Module**



## Revision History

| Revision | Date       | Author | Change Description                                                                                                                                  |
|----------|------------|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.0      | 11/01/2024 | RF PD  | New Certified Module Release                                                                                                                        |
| 1.1      | 01/04/2025 | RF PD  | Updated 13.Ordering Information<br>Updated 3.3 and 3.4 Power consumption<br>Updated Table 11.1 Regulatory Standards Conformance for 1SC single mode |
|          |            |        |                                                                                                                                                     |
|          |            |        |                                                                                                                                                     |
|          |            |        |                                                                                                                                                     |
|          |            |        |                                                                                                                                                     |
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# 1 Introduction

## 1.1 Scope

This product is designed to meet 3GPP Rel-14 specifications and support for NTN Release 17.

- Host Interface : UART
- Reference Clock : Reference clock embedded
- Size : 11.1 x 11.4 x 1.5 mm (max)
- Weight : 0.45g (typ)
- RoHS : This component can meet with RoHS compliance
- MSL :Level 4
- \*This product is moisture sensitive. Please check the detail in 14.1 Storage Condition section.

## 1.2 Block Diagram

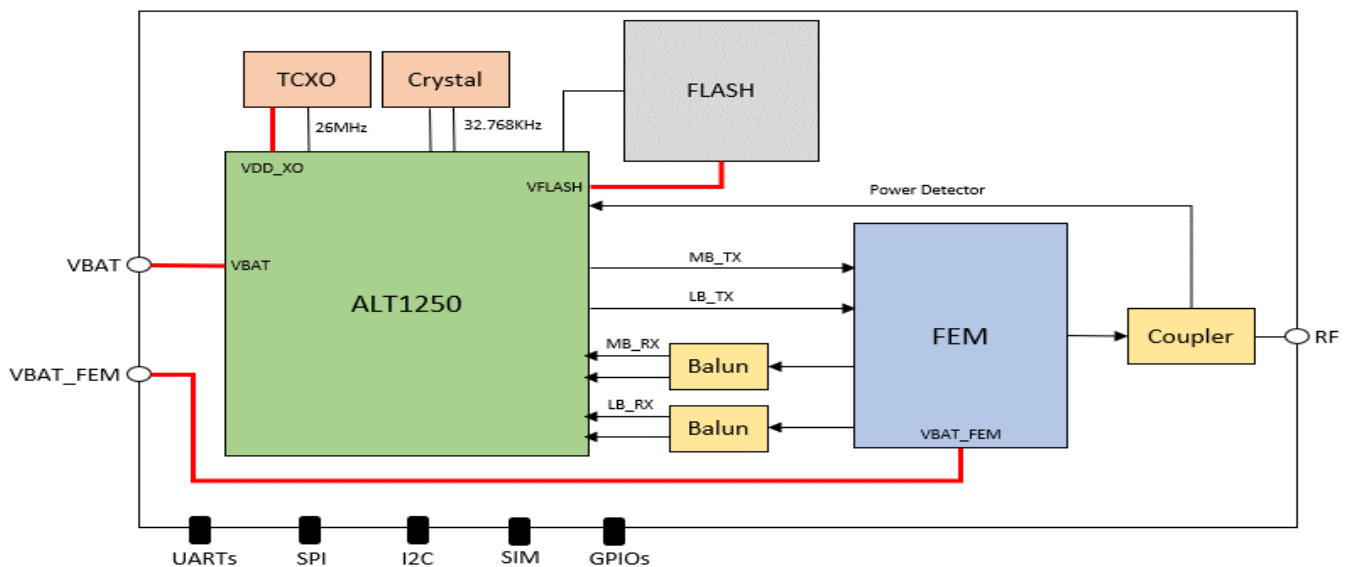


Figure 1.1 Block Diagram

## 1.3 Acronyms

- LTE Long Term Evolution
- UART Universal Asynchronous Receiver Transmitter
- eUICC Embedded Universal Integrated Circuit Card
- LGA Land Grid Array
- BB Baseband
- RFIC Radio Frequency Integrated Circuit
- GPS Global Positioning System
- LB Low Band (699 MHz to 960 MHz frequency range)
- MB Mid Band (1710 MHz to 2170 MHz frequency range)
- eDRX Extended Discontinuous Reception
- GLONASS Global Navigation Satellite System

## 1.4 References

[1] Altair Semiconductor, AL1250 – Datasheet 1.24, August 2020

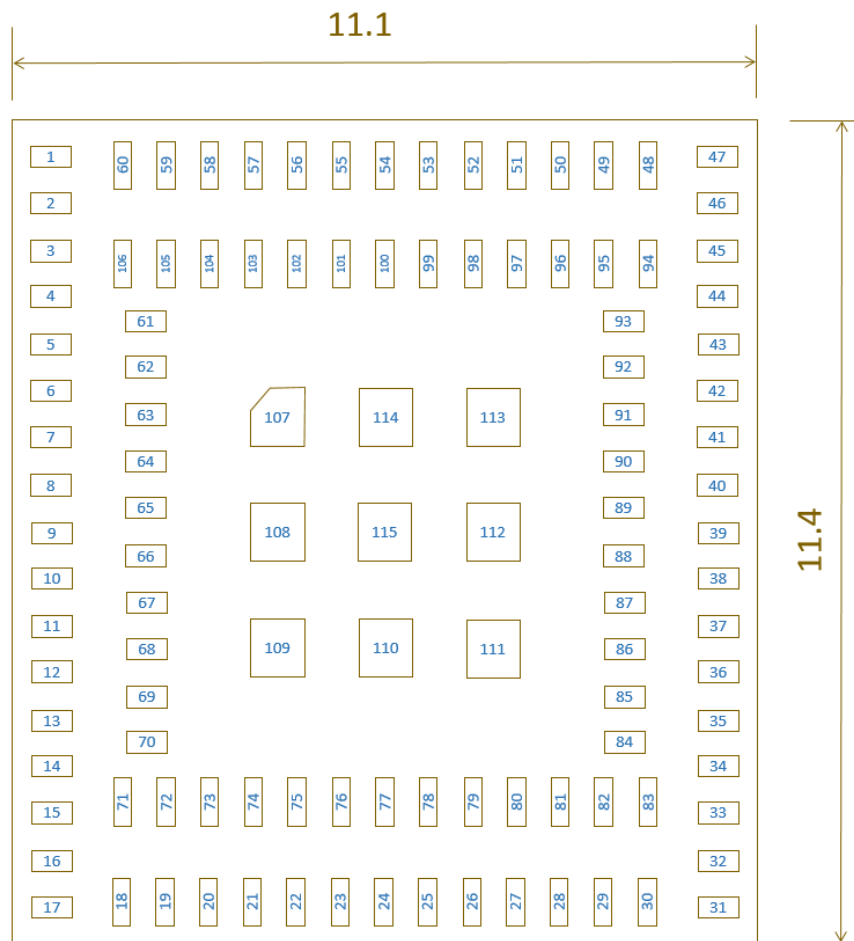


**Table 2.1 Dimension**

| Mark      | Dimension        | Mark      | Dimension       | Mark       | Dimension       |
|-----------|------------------|-----------|-----------------|------------|-----------------|
| <b>L</b>  | $11.10 \pm 0.20$ | <b>W</b>  | $11.4 \pm 0.20$ | <b>T</b>   | 1.50 max        |
| <b>a1</b> | $0.30 \pm 0.10$  | <b>a2</b> | $0.80 \pm 0.10$ | <b>b1</b>  | $0.30 \pm 0.20$ |
| <b>b2</b> | $1.50 \pm 0.20$  | <b>b3</b> | $3.55 \pm 0.20$ | <b>b4</b>  | $3.85 \pm 0.20$ |
| <b>b5</b> | $0.35 \pm 0.20$  | <b>b6</b> | $3.70 \pm 0.20$ | <b>b7</b>  | $0.30 \pm 0.20$ |
| <b>b8</b> | $0.60 \pm 0.10$  | <b>b9</b> | $1.70 \pm 0.20$ | <b>b10</b> | $1.70 \pm 0.20$ |
| <b>c1</b> | $0.60 \pm 0.10$  | <b>c2</b> | $0.80 \pm 0.10$ | <b>e1</b>  | $0.35 \pm 0.10$ |
| <b>e2</b> | $0.80 \pm 0.10$  | <b>e3</b> | $0.80 \pm 0.10$ |            |                 |

unit [mm]

## 2.2 Pin Configuration



**Figure 2.3 Pinout Diagram Top View**

Table 2.2 Pinouts

| 1SC Pin# | Module Pin Name    | ALT1250 Pin No | ALT1250 IC Symbol Pin Name | Type    | Direction | Reset Value | IO Domain / Supply | Description                                          |
|----------|--------------------|----------------|----------------------------|---------|-----------|-------------|--------------------|------------------------------------------------------|
| 1        | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 2        | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 3        | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 4        | EJ_TRST            | J5             | EJ_TRST/GPIO20             | Digital | I         | PD          | VDDIO              | JTAG Test Reset - require external pull down(10kOhm) |
| 5        | PMU_AT_IN          | R3             | PMU_AT_IN                  | Analog  | I         |             | PMU_VRTC           | Anti-tamper input; short to GND if not used          |
| 6        | PMU_WAKEUP         | P2             | PMU_WAKEUP                 | Analog  | I         |             | PMU_VRTC           | Wakeup active high; Device Wake-Up (HI)              |
| 7        | VDD_RF             | L1             | PMU_VO_RF                  | Power   | O         |             |                    | MIPI RFFE IO (antenna tuning)                        |
| 8        | VSIM               | R1             | PMU_VO_SIM                 | Power   | O         |             |                    | SIM LDO output                                       |
| 9        | VDD_AUX            | T2             | PMU_VO_AUX_LDO             | Power   | O         |             |                    | SC2 LDO output                                       |
| 10       | NC                 |                |                            | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 11       | SIMIO              | M10            | SC_IO/GPIO14               | Digital | I/O       | PD          | VDDIO              | SIM Data 1.8V                                        |
| 12       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 13       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 14       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 15       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 16       | VBAT_FEM           |                |                            | Power   | I         |             |                    | Input from battery to FEM                            |
| 17       | VBAT_FEM           |                |                            | Power   | I         |             |                    | Input from battery to FEM                            |
| 18       | VBAT_FEM           |                |                            | Power   | I         |             |                    | Input from battery to FEM                            |
| 19       | GND                |                |                            |         |           |             |                    |                                                      |
| 20       | UART2_RX           | H14            | UART2_RX                   | Digital | I         | PU          | VDDIO              | Only use for internal test                           |
| 21       | UART2_CTS          | G15            | UART2_CTS                  | Digital | I         | PD          | VDDIO              | Only use for internal test                           |
| 22       | UART2_TX           | G13            | UART2_TX                   | Digital | O         | PU          | VDDIO              | Only use for internal test                           |
| 23       | GND                |                |                            |         |           |             |                    |                                                      |
| 24       | RF_GNSS_COMMON_ANT |                |                            | RF      | O         |             |                    | GNSS is not default support                          |
| 25       | RF_GNSS_ANT        |                |                            | RF      | I         |             |                    | GNSS is not default support                          |
| 26       | GND                |                |                            |         |           |             |                    |                                                      |
| 27       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 28       | GND                |                |                            |         |           |             |                    |                                                      |
| 29       | RF_RXTX            |                |                            | RF      |           |             |                    | CAT-M1 RF in/out signal                              |
| 30       | GND                |                |                            |         |           |             |                    |                                                      |
| 31       | GPIO53             | N13            | GPIO53                     | Digital | O         | PU          | VDDIO              | TX Indicator                                         |
| 32       | GPIO50             | P10            | GPIO50                     | Digital | O         | PD          | VDDIO              | Device Reset Status (HI)                             |
| 33       | GPIO5              | H12            | GPIO5                      | Digital | O         | PD          | VDDIO              | External DCDC Control                                |
| 34       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 35       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 36       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 37       | GPIO2              |                | GPIO2                      | Digital | O         | PD          | VDDIO              | Reserved (No Connection)                             |
| 38       | GND                |                |                            |         |           |             |                    |                                                      |
| 39       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 40       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 41       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 42       | NC                 |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                             |
| 43       | UART1_RTS          | P12            | UART1_RTS                  | Digital | O         | PU          | VDDIO              | Port 1: UART RTS                                     |

| 1SC Pin# | Module Pin Name     | ALT1250 Pin No | ALT1250 IC Symbol Pin Name | Type    | Direction | Reset Value | IO Domain / Supply | Description                                                                                                                   |
|----------|---------------------|----------------|----------------------------|---------|-----------|-------------|--------------------|-------------------------------------------------------------------------------------------------------------------------------|
| 44       | GPIO36              | R13            | GPIO36                     | Digital | O         | PU          | VDDIO              | Reserved (No Connection)                                                                                                      |
| 45       | UART1_RX            | T12            | UART1_RX                   | Digital | I         | PU          | VDDIO              | Port 1: UART RX                                                                                                               |
| 46       | UART1_TX            | U13            | UART1_TX                   | Digital | O         | PU          | VDDIO              | Port 1: UART TX                                                                                                               |
| 47       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 48       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 49       | VDDIO               | AA7 Y6         | PMU_VDDIO<br>PMU_VO_IO     | Power   | O         |             |                    | IO Reference                                                                                                                  |
| 50       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 51       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 52       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 53       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 54       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 55       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 56       | PMU_VBACKUP         | W7             | PMU_VBACKUP                | Power   | I         |             |                    | Connect to backup battery or VBAT                                                                                             |
| 57       | PMU_VRTC            | W5             | PMU_VRTC                   | Power   | O         |             |                    | Use for PMU_SHUTDOWN and PMU_POWERBUTTON pull source                                                                          |
| 58       | VBAT                | U3             | PMU_VBAT_LDO               | Power   | I         |             |                    | Voltage from Battery                                                                                                          |
| 59       | VBAT                | V2             | PMU_VBAT_DCDC_V2           | Power   | I         |             |                    | Voltage from Battery                                                                                                          |
| 60       | VBAT                | W1             | PMU_VBAT_DCDC_W1           | Power   | I         |             |                    | Voltage from Battery                                                                                                          |
| 61       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 62       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 63       | PMU_AT_OUT          | N3             | PMU_AT_OUT                 | Analog  | O         |             | PMU_VRTC           | Anti-tamper output; connect to PMU_AT_IN or NC if not used                                                                    |
| 64       | PMU_SHUTDOWN        | M2             | PMU_SHUTDOWN               | Analog  | I         | PU          | PMU_VRTC           | "Shutdown active low , Pull up with 620kΩ on to PMU_VRTC                                                                      |
| 65       | PMU_EXT_ALARM       | L3             | PMU_EXT_ALARM/             | Analog  | O         |             | VDDIO              | Debug monitoring only                                                                                                         |
| 66       | PMU_POWER_BUTTON ON | K2             | PMU_POWER_BUTTON ON        | Analog  | I         | PU          | PMU_VRTC           | Power button active low Pull up with 620kΩ onto PMU_VRTC                                                                      |
| 67       | NC                  |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                      |
| 68       | SIMRST              | M8             | SC_RST/GPIO13              | Digital | O         | PD          | VDDIO              | SIM Reset 1.8V                                                                                                                |
| 69       | SIMCLK              | L9             | SC_CLK/GPIO15              | Digital | O         | PD          | VDDIO              | SIM Clock 1.8V                                                                                                                |
| 70       | SIM_DETECT          | J11            | SC_DET                     | Digital | I         | PD          | VDDIO              | SIM Detection 1.8V                                                                                                            |
| 71       | SC_SWP              | J9             | SC_SWP                     | Digital | O         | PD          | VDDIO              | Host Wake-Up (HI)                                                                                                             |
| 72       | UART0_RTS           | K8             | UART0_RTS                  | Digital | O         | PU          | VDDIO              | <ul style="list-style-type: none"> <li>• Default is UART0 Request to Send</li> <li>• Data host interface; UART RTS</li> </ul> |
| 73       | UART0_TX            | K10            | UART0_TX                   | Digital | O         | PU          | VDDIO              | <ul style="list-style-type: none"> <li>• Default is UART0 Transmit Data</li> <li>• Data host interface; UART TX</li> </ul>    |
| 74       | UART2_RTS           | K6             | UART2_RTS                  | Digital | O         | PU          | VDDIO              | Only use for internal test                                                                                                    |
| 75       | UART0_RX            | G11            | UART0_RX                   | Digital | I         | PU          | VDDIO              | <ul style="list-style-type: none"> <li>• Default is UART0 Clear to Send</li> <li>• Data host interface; UART RX</li> </ul>    |

| 1SC Pin# | Module Pin Name | ALT1250 Pin No | ALT1250 IC Symbol Pin Name | Type    | Direction | Reset Value | IO Domain / Supply | Description                                                                                                                 |
|----------|-----------------|----------------|----------------------------|---------|-----------|-------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------|
| 76       | UART0_CTS       | G9             | UART0_CTS                  | Digital | I         | PU          | VDDIO              | <ul style="list-style-type: none"> <li>• Default is UART0 Clear to Send</li> <li>• Data host interface; UART CTS</li> </ul> |
| 77       | RFFE_SCLK       | H6             | RFFE_SCLK                  | Digital | O         | PD          | VDDIO              | MIPI RFFE Clock (antenna tuning)                                                                                            |
| 78       | RFFE_SDATA      | H8             | RFFE_SDATA                 | Digital | I/O       | PD          | VDDIO              | MIPI RFFE data (antenna tuning)                                                                                             |
| 79       | GND             |                |                            |         |           |             |                    |                                                                                                                             |
| 80       | GND             |                |                            |         |           |             |                    |                                                                                                                             |
| 81       | GND             |                |                            |         |           |             |                    |                                                                                                                             |
| 82       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 83       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 84       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 85       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 86       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 87       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 88       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 89       | GND             |                |                            |         |           |             |                    |                                                                                                                             |
| 90       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 91       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 92       | GND             |                |                            |         |           |             |                    |                                                                                                                             |
| 93       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 94       | UART1_CTS       | V12            | UART1_CTS                  | Digital | I         | PU          | VDDIO              | Port1 : UART CTS                                                                                                            |
| 95       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 96       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 97       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 98       | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 99       | GND             |                |                            |         |           |             |                    |                                                                                                                             |
| 100      | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 101      | GND             |                |                            |         |           |             |                    |                                                                                                                             |
| 102      | PMU_VCAP        | V6             | PMU_VCAP                   | Analog  | O         |             | VBAT               | Connecting external capacitor as backup for VBAT or NC if not used                                                          |
| 103      | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 104      | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 105      | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 106      | NC              |                | N/A                        | N/A     | N/A       | N/A         | N/A                | Reserved (No Connection)                                                                                                    |
| 107-115  | GND             |                |                            |         |           |             |                    |                                                                                                                             |

## 3 RF Specification

### 3.1 Tx Output Power

The module is compliant to the 3GPP spec for release 14 and NTN Release 17 and rated at a Class 3 device (23 dBm) for CATM1 and NB1.

### 3.2 Rx Sensitivity

**Table 3.1 Rx Sensitivity**

| Items           |                                  | Contents |      |      |      |
|-----------------|----------------------------------|----------|------|------|------|
|                 |                                  | Min      | Typ. | Max  | Unit |
| Frequency Range | LB                               | 699      | -    | 960  | MHz  |
|                 | MB                               | 1710     | -    | 2170 | MHz  |
| Rx Sensitivity  | MCS5, BER<5%<br>All OneSKU bands | -        | -103 | -    | dBm  |

### 3.3 Power Consumption for CAT M1

**Table 3.2 Power Consumption for CAT M1**

| Mode            | Current (TYP) | Condition                                       |
|-----------------|---------------|-------------------------------------------------|
| Tx Power @23dBm | 400mA         | CAT M1                                          |
| Rx              | 90mA          | RRC connected monitoring consecutive sub frames |
| Sleep mode      | 45uA          | eDRX, 8HF, 81.92s, PTW=1, excluding SIM         |

### 3.4 Power Consumption for NB1 ( for dual mode only)

**Table 3.3 Power Consumption for NB1**

| Mode            | Current (TYP) | Condition                                       |
|-----------------|---------------|-------------------------------------------------|
| Tx Power @23dBm | 800mA         | Single Tone (3.75kHz)                           |
| Rx              | 90mA          | RRC connected monitoring consecutive sub frames |
| Sleep mode      | 45uA          | eDRX, 8HF, 81.92s, PTW=1, excluding SIM         |

## 4 Environmental Specification

### 4.1 Absolute Maximum Rating

Table 4.1 Absolute Maximum Rating

| Parameters          |             | Min  | Typ | Max  | Unit |
|---------------------|-------------|------|-----|------|------|
| Storage Temperature |             | -40  | -   | +85  | degC |
| Supply Voltage      | VBAT        | -0.3 | -   | 4.35 | V    |
|                     | PMU_VBACKUP | -0.3 | -   | 4.35 | V    |
|                     | PMU_VCAP    | -0.3 | -   | 4.35 | V    |
|                     | VBAT_FEM    | -0.5 | -   | 5.2  | V    |

### 4.2 Recommended Operating Condition

Table 4.2 Recommended Operating Condition

| Parameters            |             | Min  | Typ | Max  | Unit |
|-----------------------|-------------|------|-----|------|------|
| Operating Temperature |             | -40  | 25  | +85  | degC |
| Supply Voltage        | VBAT        | 2.2  | -   | 4.35 | V    |
|                       | PMU_VBACKUP | 2.2  | -   | 4.35 | V    |
|                       | PMU_VCAP    | 2.2  | -   | 4.35 | V    |
|                       | VBAT_FEM    | 2.85 | -   | 4.5  | V    |

### 4.3 Interface Voltage specifications

Table 4.3 Interface Voltage Condition

| Parameters | Min | Typ | Max | Unit |
|------------|-----|-----|-----|------|
| VDDIO      | 1.7 | 1.8 | 1.9 | V    |

For VDDIO, the total current from all IOs combined, and supplied by PMU\_VDDIO, should not exceed 50mA.

### 4.4 Digital I/O Pin's specifications

Table 4.4 Digital IO Pin's Specifications

| Parameters        |            | Min       | typ | Max       | Unit |
|-------------------|------------|-----------|-----|-----------|------|
| Input Voltage     | High-level | 0.7*VDDIO | -   | VDDIO     | V    |
|                   | Low-level  | VSS       | -   | 0.3*VDDIO | V    |
| Output Voltage    | High-level | 0.8*VDDIO | -   | -         | V    |
|                   | Low-level  | -         | -   | 0.2*VDDIO | V    |
| IO Drive Strength |            | 2         | -   | 12        | mA   |

(\*)The total current from all IOs combined should not exceed 50mA

Table 4.5 Digital IO Absolute Maximum Rating

|                      | Min  | typ | Max         | Unit |
|----------------------|------|-----|-------------|------|
| All digital 1.8V IOs | -0.2 | -   | VDDIO + 0.2 | V    |

## 4.5 Analog I/O Pin's specifications

**Table 4.6 Analog IO Pin's specifications**

| Parameters       |            | Min | typ | Max | Unit |
|------------------|------------|-----|-----|-----|------|
| PMU_WAKEUP       | Low-level  | -   | -   | 0.3 | V    |
|                  | High-level | 1.2 | -   | -   | V    |
| PMU_POWER_BUTTON | Low-level  | -   | -   | 0.3 | V    |
|                  | High-level | 1   | -   | -   | V    |
| PMU_SHUTDOWN     | Low-level  | -   | -   | 0.3 | V    |
|                  | High-level | 1.3 | -   | -   | V    |

**Table 4.7 Analog IO Absolute Maximum Rating**

|                     | Min  | typ | Max         | Unit |
|---------------------|------|-----|-------------|------|
| All Analog 1.8V IOs | -0.2 | -   | VDDIO + 0.2 | V    |

# 5 POWER SEQUENCE

## 5.1 Power Sequence for power up

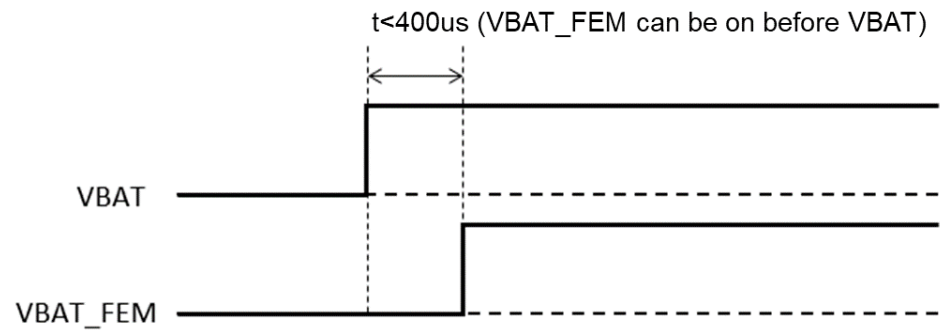


Figure 5.1 Power Sequence Diagram – Power Up

## 5.2 Power Sequence for power down

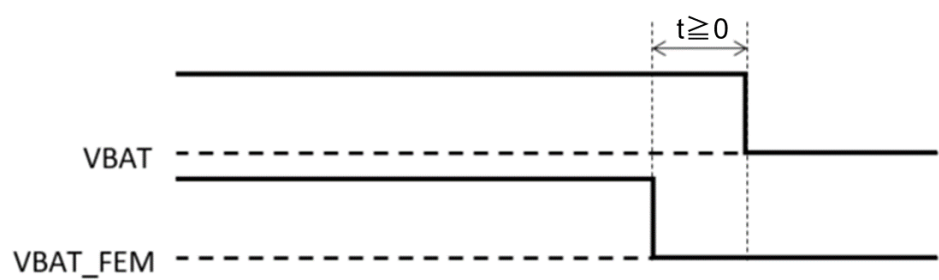


Figure 5.2 Power Sequence Diagram – Power Up

## 5.3 Power Sequence for reset

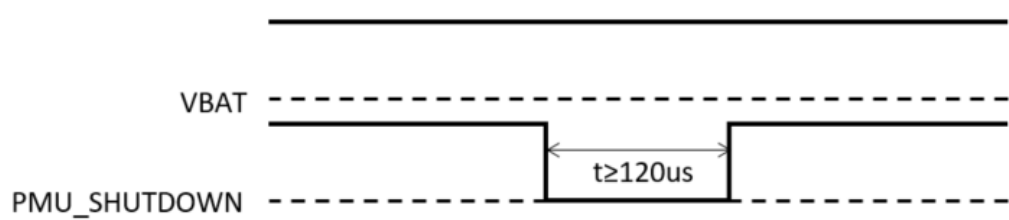


Figure 5.3 Power Sequence Diagram – Power Up



## 8 Reference Circuit

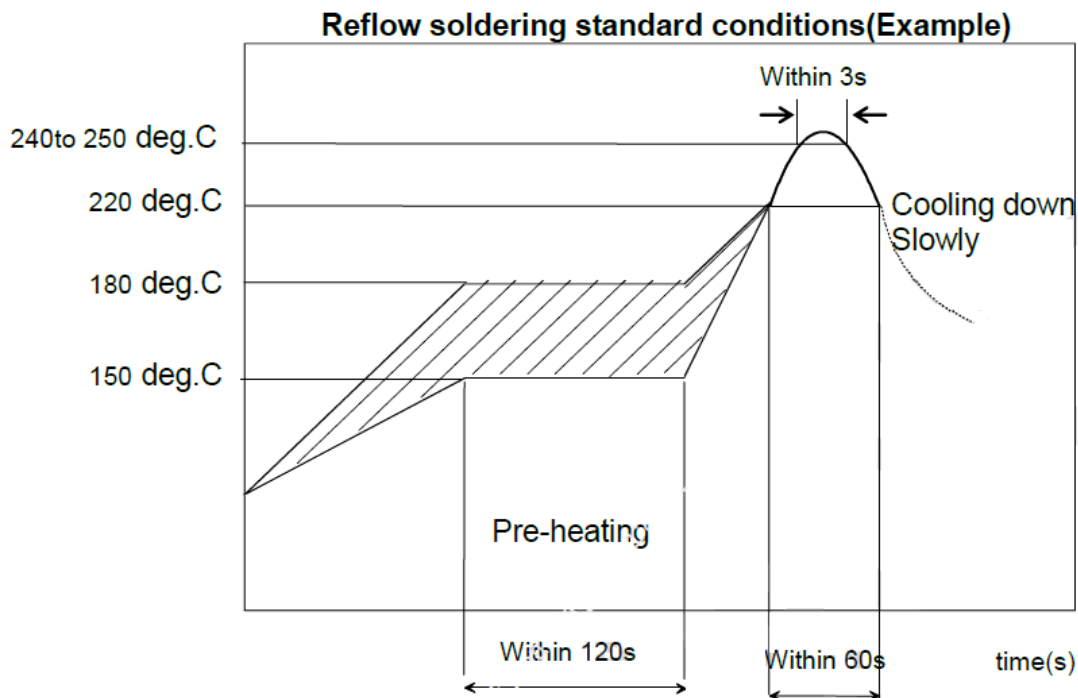
Please refer to "Reference Circuit\_Type1SC"

## 9 Assembly Information

Refer to Figure 9.1 for recommended soldering conditions.

Soldering must be done by this method to prevent products from damage. Set up the highest temperature of reflow within 260 °C. If considering other soldering conditions, you must contact Murata before proceeding.

Reflow soldering standard conditions



**Figure 9.1 Reflow Profile**

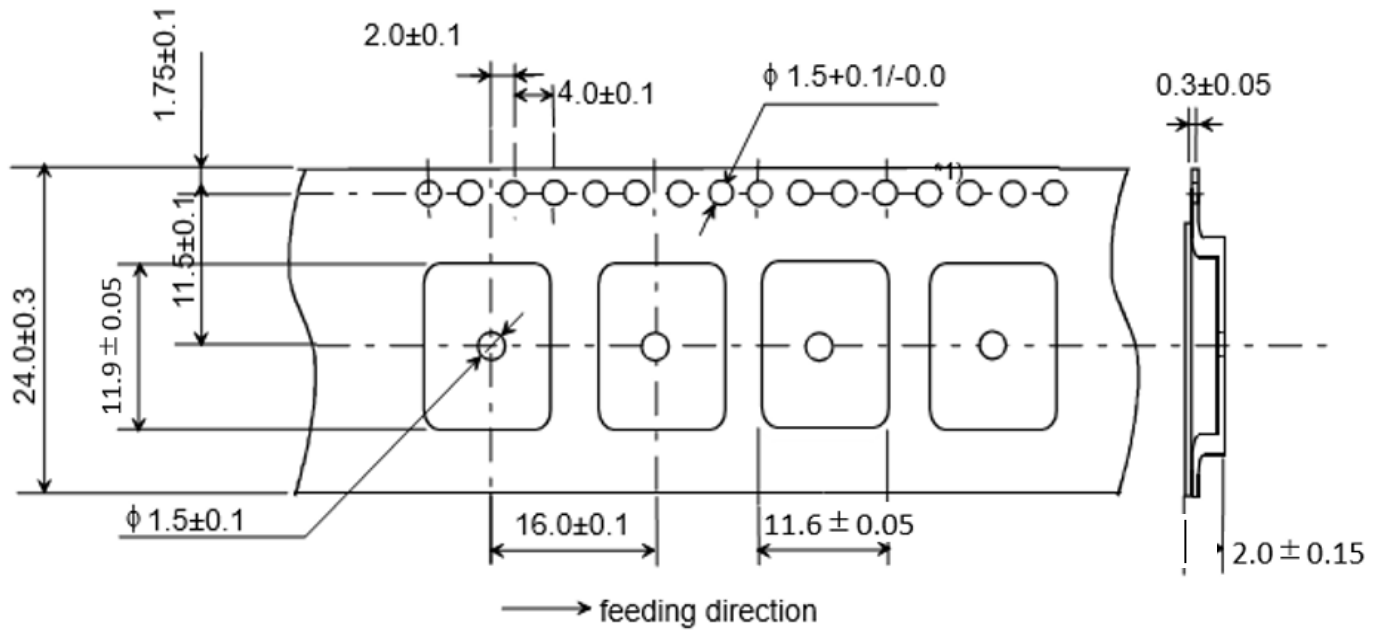
Please don't use the reflow method more than twice.

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

Since this Product is Moisture Sensitive, any cleaning with liquid is NOT permitted.

## 10 Packaging and Marking Information

### 10.1 Dimensions of Tape (Plastic tape)



- 1) The corner and ridge radii (R) of inside cavity are 0.3mm max.
- 2) Cumulative tolerance of 10 pitches of the sprocket hole is  $\pm 0.2$ mm
- 3) Measuring of cavity positioning is based on cavity center in accordance with JIS/IES standard.

Figure 10.1 Tape Dimensions (Unit: mm)

## 10.2 Dimensions of Reel

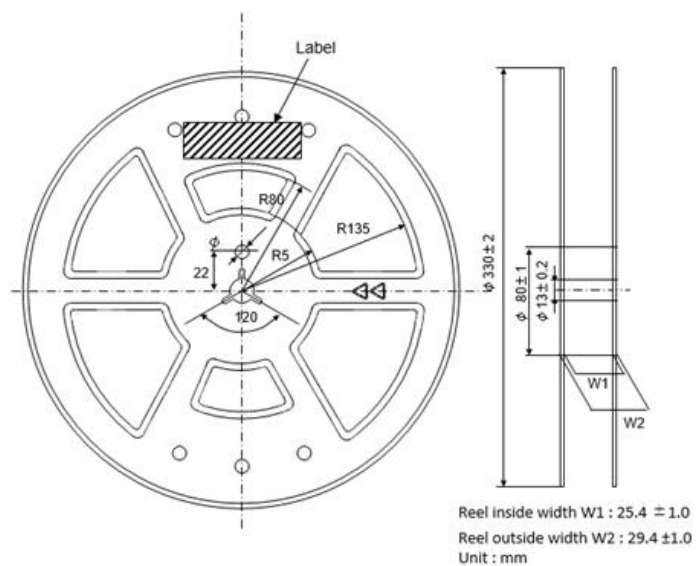


Figure 10.2 Reel Dimensions (Unit: mm)

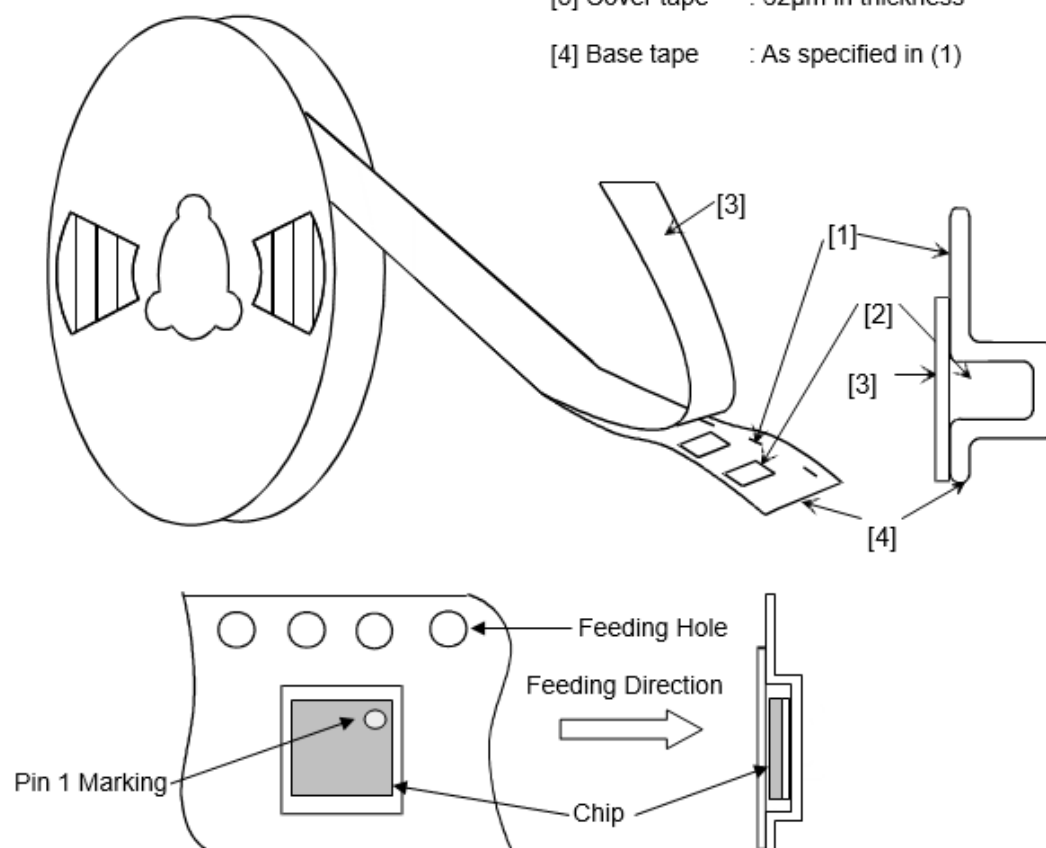
## 10.3 Taping Diagrams

[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)



**Figure 10.3 Tape Diagram**

## 10.4 Module Marking Information

Figures below show the module marking. Dimensions are nominal, not absolute.

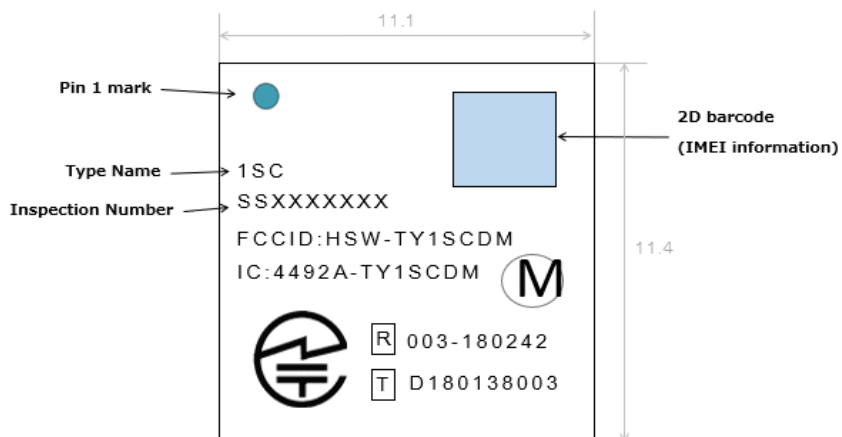


Figure 10.4 Type 1SC DM Module Marking Diagram

## 10.5 Moisture Sensitivity Level

The module is rated to MSL 4 (72 hours). Please observe this rating with the utmost importance. For storage condition detail, please refer to 14.1 Storage Conditions.

# 11 Regulatory Information

The table below shows the regulatory compliance status of the Type 1SC module.

**Table 11.1 Regulatory Standards Conformance for 1SC single mode**

| <b>Regulatory Body</b> | <b>Country</b>         | <b>Certificate ID for Cat M1/NB1</b> | <b>NTN Certification</b> |
|------------------------|------------------------|--------------------------------------|--------------------------|
| FCC                    | US                     | HSW-TY1SCDM                          | HSW-TY1SCDM              |
| IC                     | Canada                 | 4492A-TY1SCDM                        | 4492A-TY1SCDM            |
| ETSI                   | EU                     | Compliant                            | Compliant                |
| TELEC                  | Japan                  | 003-180242                           | -                        |
| RCM/ACMA               | Australia, New Zealand | 1102MUR_LBAD0_S 042-1                | -                        |
| GCF                    | Global                 | Compliant                            | -                        |
| PTCRB                  | Global                 | Compliant                            | -                        |

For the details; Please refer to Type1SC Hardware Design Guidelines.

## 12 RoHS Information

The Type 1SC module conforms to RoHS requirements.

## 13 Ordering Information

| Product         | Model Name  | Murata Ordering Part Number | Standard Order Increment |
|-----------------|-------------|-----------------------------|--------------------------|
| Module          | Type 1SC    | LBAD0XX1SC-005              | 1000 pcs                 |
| Development Kit | Type 1SC DK | LBAD0XX1SC-DMSB-EVK-B       | 1 pcs                    |

## 14 Notice

### 14.1 Storage Conditions

Please use this product within 6 months after receipt.

- The product shall be stored in original package under with an ambient temperature from 5 to 35°C, and humidity from 20% to 70%RH. (Packing materials, in particular, may become deformed if the temperature exceeds 40°C.)
- If the product is not used for more than 6 months after receipt, confirm the solderability before use.
- Store the product in non-corrosive gas (Cl<sub>2</sub>, NH<sub>3</sub>, SO<sub>2</sub>, NO<sub>x</sub>, etc.).
- Avoid mechanical shock, such as dropping or puncturing the product, to preserve integrity of the packing materials.
- After the package is opened, store it at <30°C / <60%RH and use the product within **72** hours.
- If the color of the indicator in the packing changes, bake the product before soldering.

**Baking condition:** 125 +5/-0 °C, 24hours, 1 time

Bake the product on a heat-resistant tray because other materials (Base Tape, Reel Tape and Cover Tape) are not heat-resistant.

### 14.2 Handling Conditions

Be careful in handling or transporting products because excessive stress or mechanical shock may break products.

Handle products with care to avoid cracks or damages on the terminals, causing unwarranted changes in the product characteristics. Do not touch products with bare hands to avoid degrading solder ability or damage caused by static electrical charge.

### 14.3 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 in accordance with 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. If using non-standard lands, contact Murata beforehand.

## 14.4 Notice for Chip Placer

When positioning products on the PCB, be aware that mechanical chucking may damage products. When placing products on the PCB, a worn-out chucking locating claw or a suction nozzle can cause undue stress and uneven force, resulting in damaged products. To prevent products from damage, be sure to follow the specifications for the maintenance of the chip placer in use.

## 14.5 Operational Environment Conditions

Products are designed to work under normal environmental conditions (ambient temperature, humidity and pressure) as stated above. However, if products are used under the following circumstances, they may be damaged, resulting in leakage of electricity and abnormal temperatures.

- 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 environment.
- Direct sunlight.
- Excessive moisture.
- Excessive humidity where water condenses.
- Extreme cold, such as in freezing temperatures.

If products could be exposed to those conditions described above, consult with Murata before actual use.

Static electricity may degrade or destroy products. Avoid static electricity or excessive voltage while assembling and measuring.

## 14.6 Input Power Capacity

Avoid exceeding the input power capacity as specified in this document.

If operating conditions may exceed parameters as stated in this document, inform Murata before use.

# 15 PRECONDITIONS TO USE MURATA 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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- 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.

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