

**LBAD0XX1SC**

**LTE CAT M1  
Module**



## Features

- **LTE CAT M1 – 23 dBm**
- **16 MB of flash**
- **Dimension: 11.1x11.4x1.4 mm (typ), 1.5mm(max)**
- **Package: LGA**
- **Antenna configurations: external**
- **SIM card: external**
- **3GPP Rel. 13 eDRX and PSM modes**
- **Power Consumption: enables up to 10 year battery life Hibernation current: 1.5  $\mu$ A(avg) eDRX current: <45  $\mu$ A (avg) @ 8 Hyperframes**
- **PSM current: dormant window configurable**
- **Operating temperature range: -40°C to 85°C**
- **OTA firmware upgrade**
- **Regulatory certificate:**
  - **FCC/IC: HSW-TY1SC**
  - **ETSI: EN 301 489-1 and EN 301 908-1**
  - **TELEC: 003-180242**
- **Carrier Certifications: PTCRB (5.38), GCF (3.73)**
- **3GPP release 13 compliant**
- **OMA Lightweight M2M (LWM2M)**
- **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**

## Applications

- **4G LTE technology capability**
- **Dedicated LTE half-duplex operation (HD-FDD) for CatM1**
- **Cellular transceiver designed to meet 3GPP Rel-13 specifications**
- **LTE universal modem supports (low-band and mid-band):**
- **Low-band B5/B8/B12/B13/B14/B17/B18/B19/B20/B26/B28**
- **Mid-band B1/B2/B3/B4/B25**
- **Optimized for Class 3 LTE output power (+23 dBm)**
- **Wearables**
- **Building automation/Security**
- **Medical/Healthcare**
- **Asset Tracking**

### RoHS Compliance

This component is compliant with RoHS directive.  
This component was always RoHS compliant from the first date of manufacture.

## Revision History

| Revision | Date       | Author | Change Description                                                                       |
|----------|------------|--------|------------------------------------------------------------------------------------------|
| 0.1      | 04/03/2019 | RF PD  | Preliminary version                                                                      |
| 0.2      | 05/20/2019 | RF PD  | Updated feature summary; updated VBAT_FEM min voltage supply                             |
| 0.3      | 07/23/2019 | RF PD  | Remove any reference to NB1, set several MCU pins to NC, Updated Block Diagram           |
| 1.0      | 11/14/2019 | RF PD  | Updated power specs                                                                      |
| 1.1      | 12/17/19   | RF PD  | Fixed Pin 46 description                                                                 |
| 1.2      | 04/22/20   | RF PD  | Fixed Dimensions of tape on page 18 and Storage period condition to 72 hours on page 21. |
|          |            |        |                                                                                          |
|          |            |        |                                                                                          |
|          |            |        |                                                                                          |
|          |            |        |                                                                                          |
|          |            |        |                                                                                          |
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# 1 Introduction

## 1.1 Block Diagram

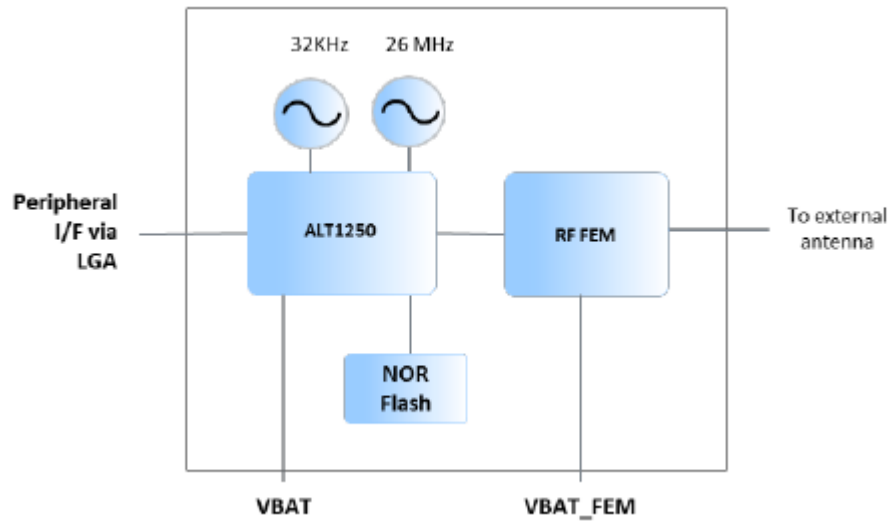


Figure 1.1 Block Diagram

## 1.2 Acronyms

- LTE Long Term Evolution
- UART Universal Asynchronous Receiver Transmitter
- eUICC Embedded SIM (Subscriber Identity Module)
- LGA Land Grid Array
- BB Baseband
- RFIC Radio Frequency Integrated Circuit
- GPS Global Positioning System
- LB Low Band (699 MHz to 915 MHz frequency range)
- MB Mid Band (1710 MHz to 2025 MHz frequency range)
- PSM Power Save Mode
- eDRX Extended Discontinuous Receive
- GPS Global Positioning System

## 1.3 References

- [1] Altair Semiconductor, AL1250 – Datasheet 1.18, Aug 2018

# 2 Mechanical Specification

## 2.1 Module Dimensions

Table 2.1: Module Dimensions

| Parameter             | Typical                                | Unit |
|-----------------------|----------------------------------------|------|
| Dimension (L x W x H) | 11.1 ±0.2mm x 11.4 ±0.2mm x 1.50 (max) | mm   |
| Weight                | 0.45 (typical)                         | g    |

## 2.2 Top and Side View

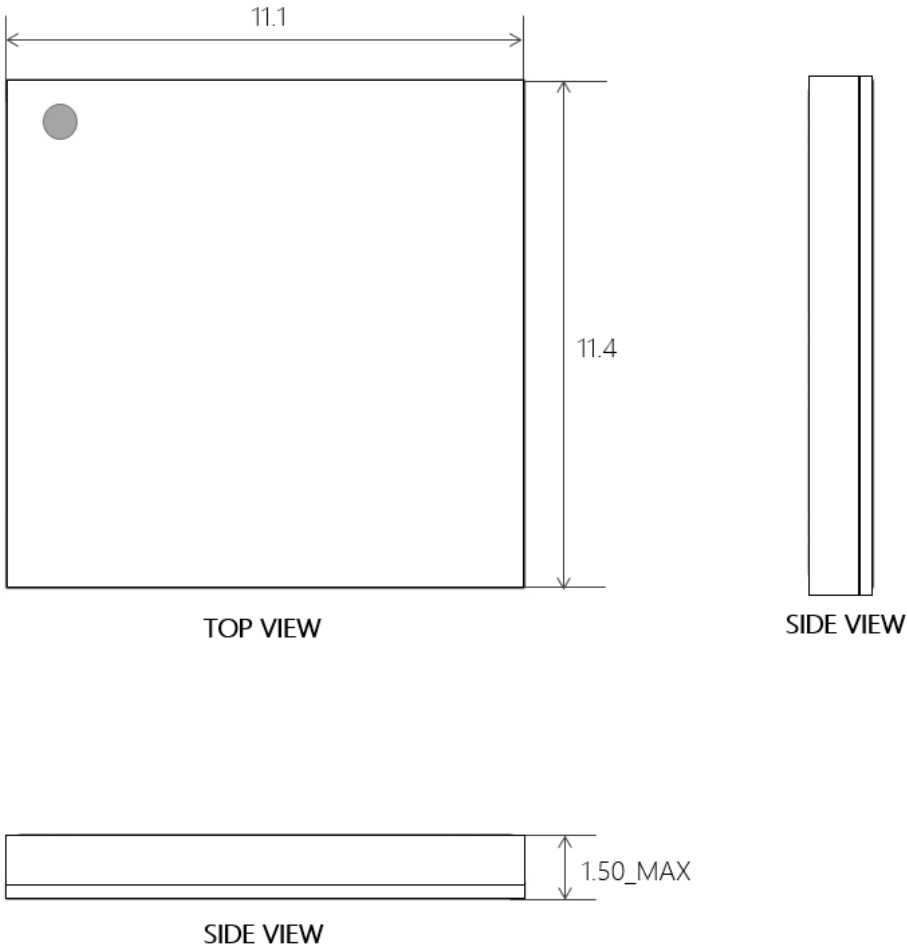


Figure 2.1 Module Top and Side View (Unit: mm)

2.3 PCB Footprint Top View

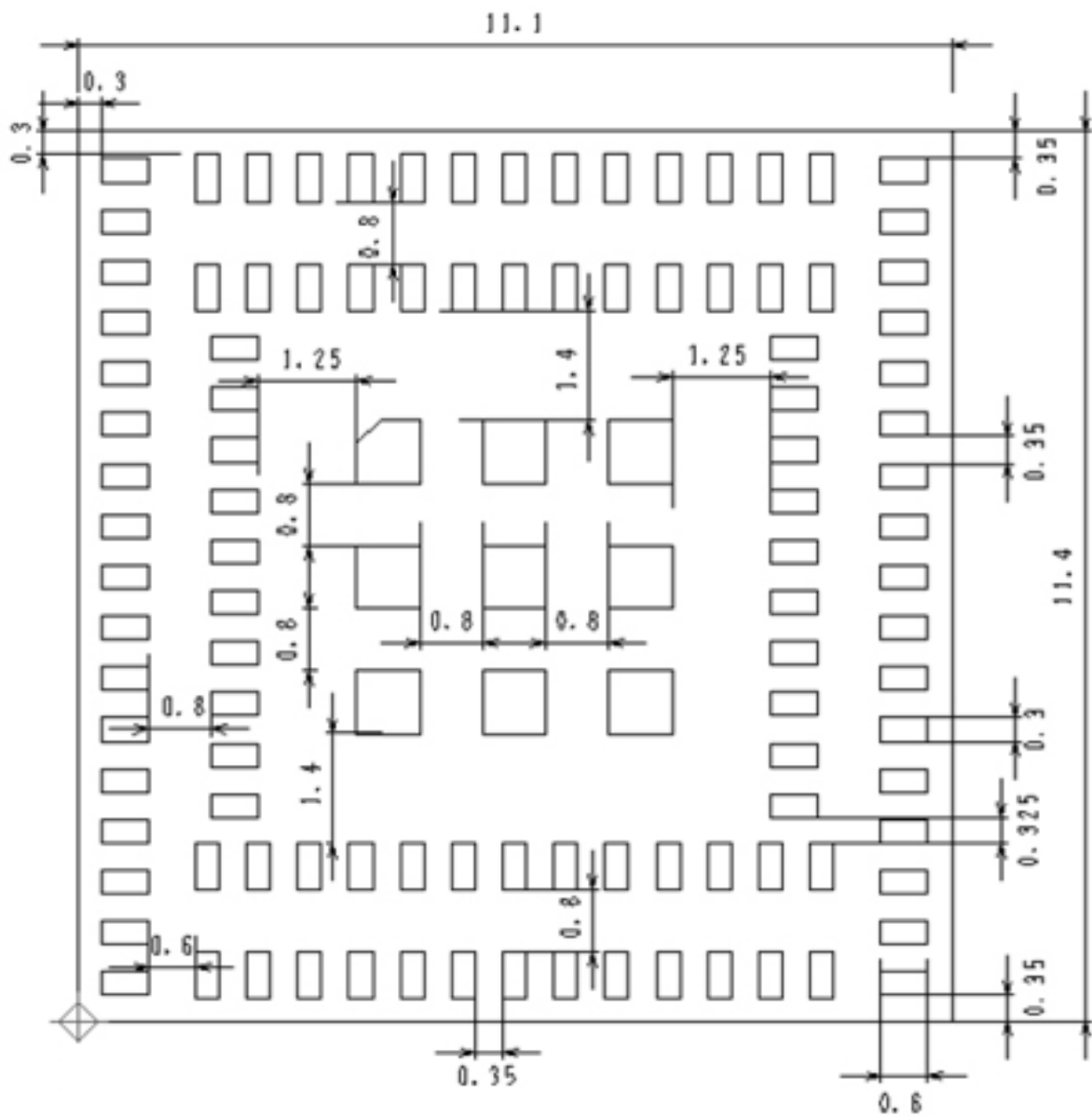


Figure 2.2 Module Footprint Top View (Unit: mm)

2.4 Pin Configuration

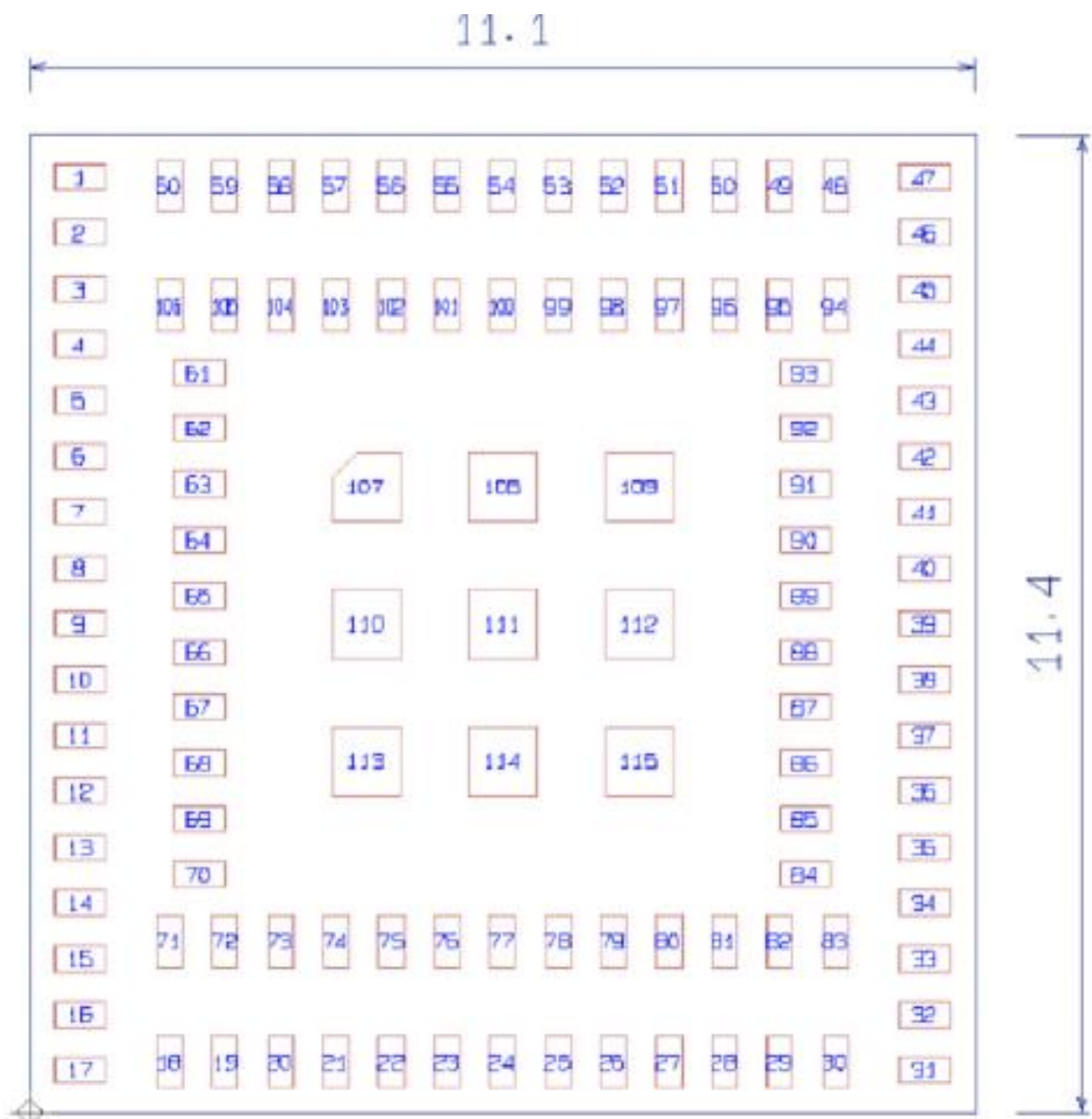


Figure 2.3 Pinout Diagram Top View



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        | DEBUG_RSTN      | P4             | DEBUG_RSTN                                                                                                                                          | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                                                                                           |
| 2        | DEBUG_SEL       | M4             | DEBUG_SEL/GPIO31                                                                                                                                    | Digital | I/O       | PD          | VDDIO              | Reserved (No Connection)                                                                                                           |
| 3        | EJ_TDO          | N5             | EJ_TDO/GPIO22                                                                                                                                       | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                                                                                           |
| 4        | EJ_TRST         | J5             | EJ_TRST/GPIO20                                                                                                                                      | Digital | I/O       | PD          | VDDIO              | JTAG Test Reset - require external pull down                                                                                       |
| 5        | PMU_AT_IN       | R3             | PMU_AT_IN                                                                                                                                           | Analog  | I         |             | VRTC               | Anti-tamper input; short to GND if not used                                                                                        |
| 6        | PMU_WAKEUP      | P2             | PMU_WAKEUP                                                                                                                                          | Analog  | I         |             | 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       | VDD_XO          | N1             | PMU_VO_XO                                                                                                                                           | Power   | O         |             |                    | Reserved (No Connection)                                                                                                           |
| 11       | SIMIO           | M10            | SC_IO/GPIO14                                                                                                                                        | Digital | I/O       | PD          | VDDIO              | SIM Data 1.8V                                                                                                                      |
| 12       | I2C1_SDA        | H2             | I2C1_SDA/SPIS_MRDY/<br>PWM3/MCU_I2C1_SDA/<br>MCU_FLASH1_SCK/<br>UART0_RI/MCU_S<br>PIM1_CLK_A/<br>MCU_PWM3/GPIO44                                    | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                                                                                           |
| 13       | I2C1_SCL        | H4             | I2C1_SCL/SPIS_CLK/<br>LED3/MCU_I2C1_SCL/<br>MCU_FLASH1_CS_N/<br>UART0_DTR/MCU_SPI<br>M1_EN0_A/MCU_LED3/<br>GPIO45                                   | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                                                                                           |
| 14       | I2C0_SCL        | L7             | I2C0_SCL/SPIS_MISO/<br>KEYPAD9/FEM19/<br>MCU_I2C0_SCL/<br>UART0_DSR/GPIO43                                                                          | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                                                                                           |
| 15       | I2C0_SDA        | J7             | I2C0_SDA/SPIS_MOSI/<br>CLKOUT/KEYPAD7/<br>MCU_I2C0_SDA/<br>UART0_DCD/<br>MCU_CLKOUT/GPIO42                                                          | Digital | I/O       | PU          | VDDIO              | 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/<br>SPIS_MOSI_A/PWM2/<br>EJ1_TDI_B/UART1_RX/<br>MCU_UART1_RX/<br>MCU_SPI_M1_MISO_A/<br>MCU_SPIM0_MISO_A/<br>UART3_RX_B/<br>MCU_PWM2/GPIO27 | Digital | I/O       | PU          | VDDIO              | <ul style="list-style-type: none"> <li>• Default is UART1 Receive Data</li> <li>• Dedicated for Altair debug interface</li> </ul>  |
| 21       | UART2_CTS       | G15            | UART2_CTS/<br>SPIS_MRDY_A/E<br>J1_TRST_B/<br>UART1_CTS/<br>MCU_UART1_CTS/<br>MCU_SPIM1_CLK_A/<br>MCU_SPIM0_CLK_A/U                                  | Digital | I/O       | PD          | VDDIO              | <ul style="list-style-type: none"> <li>• Default is UART1 Clear to Send</li> <li>• Dedicated for Altair debug interface</li> </ul> |

| 1SC Pin# | Module Pin Name    | ALT1250 Pin No | ALT1250 IC Symbol Pin Name                                                                                                                                     | Type    | Direction | Reset Value | IO Domain / Supply | Description                                                              |
|----------|--------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------|-------------|--------------------|--------------------------------------------------------------------------|
| 22       | UART2_TX           | G13            | ART3_CTS_B/GPIO29<br>"UART2_TX/<br>SPIS_MISO_A/FE M22/<br>EJ1_TMS_B/UART1_TX/<br>MCU_UART1_TX/<br>MCU_SPIM1_MOSI_A/<br>MCU_SPIM0_MOSI_A/<br>UART3_TX_B/GPIO 28 | Digital | I/O       | PU          | VDDIO              | •Default is UART1 Transmit Data<br>•Dedicated for Altair debug interface |
| 23       | GND                |                |                                                                                                                                                                |         |           |             |                    |                                                                          |
| 24       | RF_GNSS_COMMON_ANT |                |                                                                                                                                                                | RF      | O         |             |                    | GNSS receiver output                                                     |
| 25       | RF_GNSS_ANT        |                |                                                                                                                                                                | RF      | I         |             |                    | GNSS receiver input                                                      |
| 26       | GND                |                |                                                                                                                                                                |         |           |             |                    |                                                                          |
| 27       | RF_AUX_OUT1        |                |                                                                                                                                                                | RF      |           |             | I                  |                                                                          |
| 28       | GND                |                |                                                                                                                                                                |         |           |             |                    |                                                                          |
| 29       | RF_RXTX            |                |                                                                                                                                                                | RF      |           |             | I/O                | CAT-M1 RF in/out signal                                                  |
| 30       | GND                |                |                                                                                                                                                                |         |           |             |                    |                                                                          |
| 31       | PWM3               | N13            | PWM3/I2C1_SDA/<br>SC_SWP/F EM29/<br>MCU_CC_OUT3/<br>MCU_CC_IN3/<br>MCU_LED3/MCU_P<br>WM3/GPIO53                                                                | Digital | I/O       | PU          | VDDIO              | TX Indicator                                                             |
| 32       | PWM0               | P10            | PWM0/CLKOUT/<br>MCU_CC_O UT0/<br>MCU_CC_IN0/MCU_CLK<br>OUT/FEM28/<br>MCU_PWM0/G PIO50                                                                          | Digital | I/O       | PD          | VDDIO              | Device Reset Status (HI)                                                 |
| 33       | AUX_ADC4           | H12            | AUX_ADC4/FEM7/<br>PCM_OUT/MCU_LED0/<br>MCU_CC_OUT1/GPIO5                                                                                                       | Digital | I/O       | PD          | VDDIO              | External DCDC Control                                                    |
| 34       | AUX_ADC3           | J13            | AUX_ADC3/FEM6/<br>PCM_IN/K EYPAD4/<br>MCU_SPIM1_CLK_B/<br>MCU_I2C1_SCL/<br>SWDAT/MCU_CC_IN3/<br>GPIO4                                                          | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                                 |
| 35       | AUX_ADC2           | K14            | AUX_ADC2/FEM5/<br>PCM_FS/K EYPAD7/<br>MCU_SPIM1_EN0_B/<br>MCU_I2C1_SDA/<br>SWCLK/MCU_CC_IN2/<br>GPIO3                                                          | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                                 |
| 36       | AUX_ADC0           | L13            | AUX_ADC0/I2C1_SCL/<br>MCU_CC_IN0/<br>KEYPAD9/MCU_LED 4/<br>PWM2/MCU_PWM2/<br>GPIO 1                                                                            | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                                 |
| 37       | AUX_ADC1           | M14            | AUX_ADC1/FEM4/<br>PCM_CLK/ KEYPAD6/<br>CLKOUT/MCU_LED 1/<br>MCU_CLKOUT/<br>MCU_CC_I N1/GPIO2                                                                   | Digital | I/O       | PD          | VDDIO              | GNSS coexistence indicator                                               |
| 38       | GND                |                |                                                                                                                                                                |         |           |             |                    |                                                                          |
| 39       | SF_SO/IO1          | "Y14           | FLASH0_IO1/GPIO71                                                                                                                                              | Digital | I/O       | PD          | V_FLASH            | Reserved (No Connection)                                                 |
| 40       | SF_SI/IO0          | "AA15          | FLASH0_IO0/GPIO70                                                                                                                                              | Digital | I/O       | PU          | V_FLASH            | Reserved (No Connection)                                                 |
| 41       | SF_nHOLD/IO3       | "Y12           | FLASH0_IO3/GPIO73                                                                                                                                              | Digital | I/O       | PU          | V_FLASH            | Reserved (No Connection)                                                 |
| 42       | SF_nWP/IO2         | "AA13          | FLASH0_IO2/GPIO72                                                                                                                                              | Digital | I/O       | PD          | V_FLASH            | Reserved (No Connection)                                                 |
| 43       | SPIM0_EN0          | P12            | SPIM0_EN0/<br>UART1_RTS/MC<br>U_PCM_OUT_A/<br>UART0_DSR/                                                                                                       | Digital | I/O       | PU          | VDDIO              | Port C: UART RTS                                                         |

| 1SC Pin# | Module Pin Name | ALT1250 Pin No | ALT1250 IC Symbol Pin Name                                                                                                        | Type    | Direction | Reset Value | IO Domain / Supply | Description                                          |
|----------|-----------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------|---------|-----------|-------------|--------------------|------------------------------------------------------|
|          |                 |                | MCU_SPIS_CLK_B/<br>SWDAT/<br>MCU_SPIM0_EN0_A/<br>GPIO35                                                                           |         |           |             |                    |                                                      |
| 44       | SPIM0_EN1       | R13            | SPIM0_EN1/<br>SPIS_SRDY_ABC/<br>KEYPAD4/FEM18/<br>MCU_SPIS_SRDY_AB/<br>MCU_CC_IN2/MC<br>U_FLASH1_CS_N1/<br>MCU_CC_OUT2/<br>GPIO36 | Digital | I/O       | PU          | VDDIO              | External LNA GNSS                                    |
| 45       | SPIM0_MISO      | T12            | SPIM0_MISO/<br>UART1_RX/MC<br>U_PCM_FS_A/<br>UART0_DTR/<br>MCU_SPIS_MOSI_B/<br>MCU_UART1_RX/<br>MCU_SPIM0_MISO_AB/<br>GPIO34      | Digital | I/O       | PU          | VDDIO              | Port C: UART RX                                      |
| 46       | SPIM0_MOSI      | U13            | SPIM0_MOSI/<br>UART1_TX/MC<br>U_PCM_IN_A/<br>UART0_DCD/<br>MCU_SPIS_MISO_B/<br>SWCLK/<br>MCU_SPIM0_MOSI_AB/<br>GPIO33             | Digital | I/O       | PU          | VDDIO              | Port C: UART TX                                      |
| 47       | NC              |                |                                                                                                                                   |         |           |             |                    | Reserved (No Connection)                             |
| 48       | VFLASH          | R15<br>AA5     | PMU_VDDIO_FLASH0_<br>R15PMU_VO_FLASH                                                                                              | Power   | O         |             |                    | Reserved (No Connection)                             |
| 49       | VDDIO           | AA7<br>Y6      | PMU_VDDIO<br>PMU_VO_IO                                                                                                            | Power   | O         |             |                    | IO Reference                                         |
| 50       | VDD_RET         | "W9<br>V8      | PMU_VDD_RET<br>PMU_VO_RET                                                                                                         | Power   | O         |             |                    | Debug monitoring only                                |
| 51       | FLASH0_CS_N1    | V14            | FLASH0_CS_N1/FEM24/<br>GPIO 66                                                                                                    | Digital | I/O       | PU          | V_FLASH            | GNSS SFN indication                                  |
| 52       | FLASH1_CS_N     | M6             | MCU_FLASH1_CS_N/<br>PWM0/KEYPAD5/LED0/<br>MCU_LED0/<br>FLASH1_CS_N1/<br>MCU_PWM0/GPIO54                                           | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                             |
| 53       | FLASH1_IO1      | R7             | MCU_FLASH1_IO1/<br>I2C0_SCL/UART0_TX/<br>KEYPAD1/MCU_<br>I2C0_SCL/<br>MCU_CC_OUT1/M<br>CU_UART1_TX/GPIO57                         | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                             |
| 54       | FLASH0_CS_N2    | W11            | FLASH0_CS_N2/FEM27/<br>LED5/MCU_LED5/<br>GPIO78                                                                                   | Digital | I/O       | PU          | V_FLASH            | Reserved (No Connection)                             |
| 55       | FLASH1_SCK      | U7             | MCU_FLASH1_SCK/<br>PWM1/KEYPAD8/LED1/<br>MCU_LED1/M<br>CU_PWM1/GPIO55                                                             | Digital | I/O       | PD          | VDDIO              | Reserved (No Connection)                             |
| 56       | PMU_VBACKUP     | W7             | PMU_VBACKUP                                                                                                                       | Power   | I         |             |                    | Input from backup battery or NC if not used          |
| 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       |                 | V2             | PMU_VBAT_DCDC_V2                                                                                                                  | Power   | I         |             |                    |                                                      |
| 60       |                 | W1             | PMU_VBAT_DCDC_W1                                                                                                                  | Power   | I         |             |                    |                                                      |

| 1SC Pin# | Module Pin Name     | ALT1250 Pin No | ALT1250 IC Symbol Pin Name                                                                                          | Type    | Direction | Reset Value | IO Domain / Supply | Description                                                                                                                        |
|----------|---------------------|----------------|---------------------------------------------------------------------------------------------------------------------|---------|-----------|-------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------|
| 61       | EJ_TDI              | L5             | EJ_TDI/GPIO21                                                                                                       | Digital | I/O       | PD          | VDDIO              | Reserved (No Connection)                                                                                                           |
| 62       | EJ_TMS              | K4             | EJ_TMS/SWDAT/GPIO19                                                                                                 | Digital | I/O       | PD          | VDDIO              | Reserved (No Connection)                                                                                                           |
| 63       | PMU_AT_OUT          | N3             | PMU_AT_OUT                                                                                                          | Analog  | O         |             | VRTC               | Anti-tamper output; connect to PMU_AT_IN or NC if not used                                                                         |
| 64       | PMU_SHUTDOWN        | M2             | PMU_SHUTDOWN                                                                                                        | Analog  | I         | PU          | VRTC               | "Shutdown active low , Modem reset (HI)                                                                                            |
| 65       | PMU_EXT_ALARM       | L3             | PMU_EXT_ALARM/ALARM/3 2KHZ_CLK_OUT/GPO0                                                                             | Analog  | O         |             | VDDIO              | Debug monitoring only                                                                                                              |
| 66       | PMU_POWER_BUTTON ON | K2             | PMU_POWER_BUTTON                                                                                                    | Analog  | I         | PU          | VRTC               | Power button active low                                                                                                            |
| 67       | PMU_ATB             | J3             | PMU_ATB                                                                                                             | Test    | I/O       |             | VBAT               | Reserved (No Connection)                                                                                                           |
| 68       | SIMRST              | M8             | SC_RST/GPIO13                                                                                                       | Digital | I/O       | PD          | VDDIO              | SIM Reset 1.8V                                                                                                                     |
| 69       | SIMCLK              | L9             | SC_CLK/GPIO15                                                                                                       | Digital | I/O       | PD          | VDDIO              | SIM Clock 1.8V                                                                                                                     |
| 70       | SIM_DETECT          | J11            | SC_DET/PWM0/FEM12/MCU_PWM0/GPIO16                                                                                   | Digital | I/O       | PD          | VDDIO              | SIM Detection 1.8V                                                                                                                 |
| 71       | SC_SWP              | J9             | SC_SWP/CLKOUT/FEM13/P WM3/MCU_PM3/EJ1_TO_AB/CLK32KHZ_EXT/MCU_CLKOUT/MCU_CC_OUT3/GPI O17                             | Digital | I/O       | PD          | VDDIO              | Host Wake-Up (HI)                                                                                                                  |
| 72       | UART0_RTS           | K8             | UART0_RTS/SPIM0_EN0_A/I 2C0_SDA/UART2_RTS/MCU_UART0_RTS/EJ1_TCK_A/MC U_I2C0_SDA/MCU_SPIM0_E N0_B/UART3_RTS_A/GPIO26 | Digital | I/O       | PU          | VDDIO              | <ul style="list-style-type: none"> <li>•Default is UART0 Request to Send</li> <li>•Data host interface; UART RTS (HI)</li> </ul>   |
| 73       | UART0_TX            | K10            | UART0_TX/SPIM0_MOSI_A/F EM15/UART2_TX/MCU_UA RT0_TX/EJ1_TMS_A/UART3_T X_A/GPIO24                                    | Digital | I/O       | PU          | VDDIO              | <ul style="list-style-type: none"> <li>•Default is UART0 Transmit Data</li> <li>•Data host interface; UART TX (HI)</li> </ul>      |
| 74       | UART2_RTS           | K6             | UART2_RTS/SPIS_CLK_A/FE M23/EJ1_TCK_B/UART1_RTS/MCU_UART1_RTS/MCU_SPI M1_EN_A/MCU_SPIM0_EN0_A/UART3_RTS_B/GPIO30    | Digital | I/O       | PU          | VDDIO              | <ul style="list-style-type: none"> <li>•Default is UART1 Request to Send</li> <li>•Dedicated for Altair debug interface</li> </ul> |
| 75       | UART0_RX            | G11            | UART0_RX/SPIM0_MISO_A/ FEM14/UART2_RX/MCU_UA RT0_RX/EJ1_TDI_A/UART3_RX_A/GPIO23                                     | Digital | I/O       | PU          | VDDIO              | <ul style="list-style-type: none"> <li>•Default is UART0 Clear to Send</li> <li>•Data host interface; UART RX (HI)</li> </ul>      |
| 76       | UART0_CTS           | G9             | UART0_CTS/SPIM0_CLK_A/I2 C0_SCL/UART2_CTS/MCU_UA RT0_CTS/EJ1_TRST_A/MCU_I2C0_SCL/MCU_SPIM0_CLK_B/UART3_CTS_A/GPIO25 | Digital | I/O       | PU          | VDDIO              | <ul style="list-style-type: none"> <li>•Default is UART0 Clear to Send</li> <li>•Data host interface; UART CTS (HI)</li> </ul>     |
| 77       | RFFE_SCLK           | H6             | RFFE_SCLK/FEM10/GPIO11                                                                                              | Digital | I/O       | PD          | VDDIO              | MIPI RFFE Clock (antenna tuning)                                                                                                   |
| 78       | RFFE_SDATA          | H8             | RFFE_SDATA/FEM11/GPIO12                                                                                             | Digital | I/O       | PD          | VDDIO              | MIPI RFFE data (antenna tuning)                                                                                                    |
| 79       | GND                 |                |                                                                                                                     |         |           |             |                    | Ground                                                                                                                             |

| 1SC Pin# | Module Pin Name | ALT1250 Pin No | ALT1250 IC Symbol Pin Name                                                                                                 | Type    | Direction | Reset Value | IO Domain / Supply | Description              |
|----------|-----------------|----------------|----------------------------------------------------------------------------------------------------------------------------|---------|-----------|-------------|--------------------|--------------------------|
| 80       | GND             |                |                                                                                                                            |         |           |             |                    | Ground                   |
| 81       | GND             |                |                                                                                                                            |         |           |             |                    | Ground                   |
| 82       | PWM1            | L11            | PWM1/I2C0_SDA/<br>MCU_SPI M1_MISO_AB/<br>KEYPAD5/MC<br>U_CC_OUT1/<br>MCU_CC_IN1/<br>MCU_PWM1/GPIO51                        | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection) |
| 83       | PWM2            | M12            | PWM2/I2C0_SCL/<br>MCU_SPIM1_MOSI_AB/<br>FEM16/MCU_C<br>C_OUT2/MCU_CC_IN2/<br>MCU_PWM2/GPIO52                               | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection) |
| 84       | SPIM1_MISO      | N9             | MCU_SPIM1_MISO/<br>SPIS_MOSI_A/<br>KEYPAD6/PWM1/MC<br>U_SPIS_MOSI_A/SC_IO/<br>MCU_PCM_FS_B/<br>MCU_PWM1/GPIO39             | Digital | I/O       | PD          | VDDIO              | Reserved (No Connection) |
| 85       | SPIM1_EN        | P8             | MCU_SPIM1_EN/<br>SPIS_CLK_A/KEYPAD8/<br>PWM3/<br>MCU_SPIS_CLK_A/<br>SC_DET/MCU_PCM_<br>IN_B/MCU_PWM3/<br>GPIO40            | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection) |
| 86       | SPIM1_MOSI      | T8             | MCU_SPIM1_MOSI/<br>SPIS_MISO_A/PWM2/<br>MCU_PWM2/<br>MCU_SPIS_MISO_A/<br>SC_CLK/<br>MCU_PCM_OUT_B/<br>GPIO38               | Digital | I/O       | PD          | VDDIO              | Reserved (No Connection) |
| 87       | SPIM1_CLK       | R9             | MCU_SPIM1_CLK/<br>SPIS_MRDY_A/PWM0/<br>MCU_CC_OUT0/<br>MCU_SPIS_MRDY_A/<br>SC_RST/<br>MCU_PCM_CLK_B/<br>GPIO41             | Digital | I/O       | PD          | VDDIO              | Reserved (No Connection) |
| 88       | SF_CLK          | W15            | FLASH0_SCK/GPIO67                                                                                                          | Digital | I/O       | PD          | V_FLASH            | Reserved (No Connection) |
| 89       | GND             |                |                                                                                                                            |         |           |             |                    |                          |
| 90       | USB_DN          | J15            | USB_DN/GPI64_3V3                                                                                                           | Digital | I         |             | VDDIO              | Reserved (No Connection) |
| 91       | USB_DP          | L15            | USB_DP/GPI63_3V3                                                                                                           | Digital | I/O       |             | VDDIO              | Reserved (No Connection) |
| 92       | GND             |                |                                                                                                                            |         |           |             |                    |                          |
| 93       | USB3V3          | N15            | USB_V3P3                                                                                                                   | Digital | I/O       |             | VDDIO              | Reserved (No Connection) |
| 94       | SPIM0_CLK       | V12            | SPIM0_CLK/<br>UART1_CTS/MC<br>U_PCM_CLK_A/<br>UART0_RI/M<br>CU_SPIS_MRDY_B/<br>MCU_UART1_TX/<br>MCU_SPIM0_CLK_A/<br>GPIO37 | Digital | I/O       | PU          | VDDIO              | Port C: UART CTS         |
| 95       | PCM_FS          | R11            | PCM_FS/UART1_RTS/<br>KEYPAD1/FEM21/<br>MCU_FLASH1_IO1/<br>MCU_LED5/<br>MCU_UART1_RTS/<br>MCU_PCM_FS/GPIO47                 | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection) |
| 96       | PCM_IN          | N11            | PCM_IN/UART1_RX/<br>KEYPAD2/LED4/                                                                                          | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection) |

| 1SC Pin# | Module Pin Name | ALT1250 Pin No | ALT1250 IC Symbol Pin Name                                                                                      | Type    | Direction | Reset Value | IO Domain / Supply | Description                                                        |
|----------|-----------------|----------------|-----------------------------------------------------------------------------------------------------------------|---------|-----------|-------------|--------------------|--------------------------------------------------------------------|
|          |                 |                | MCU_FLASH1_IO2/<br>MCU_LED4/<br>MCU_UART1_RX/<br>MCU_PCM_IN/GPIO48                                              |         |           |             |                    |                                                                    |
| 97       | PCM_OUT         | T10            | PCM_OUT/UART1_TX/<br>KEYPA D3/PWM2/<br>MCU_FLASH1_IO 3/<br>MCU_PWM2/<br>MCU_UART1_TX/<br>MCU_PCM_OUT/GPIO4 9    | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                           |
| 98       | PCM_CLK         | V10            | PCM_CLK/UART1_CTS/<br>KEYP AD0/FEM20/<br>MCU_FLASH1_I O0/<br>MCU_LED2/<br>MCU_UART1_CTS/<br>MCU_PCM_CLK/GPIO4 6 | Digital | I/O       | PD          | VDDIO              | Reserved (No Connection)                                           |
| 99       | GND             |                |                                                                                                                 |         |           |             |                    |                                                                    |
| 100      | CLKOUT          | U9             | CLKOUT/<br>32KHZ_CLK_OUT/<br>PWM0/FLASH1_CS_N1/<br>LED2/MCU_CLKOUT/<br>MCU_CC_OUT1/<br>MCU_PWM0/GPIO60          | Digital | O         | PD          | VDDIO              | 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      | FLASH1_IO3      | N7             | MCU_FLASH1_IO3/<br>I2C1_SCL/UART0_RTS/<br>KEYPAD3/<br>MCU_I2C1_SCL/<br>MCU_CC_OUT3/<br>MCU_UART1_RTS/<br>GPIO59 | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                           |
| 104      | FLASH1_IO2      | P6             | MCU_FLASH1_IO2/<br>I2C1_SDA/UART0_CTS/<br>KEYPAD2/<br>MCU_I2C1_SDA/<br>MCU_CC_OUT2/<br>MCU_UART1_CTS/<br>GPIO58 | Digital | I/O       | PD          | VDDIO              | Reserved (No Connection)                                           |
| 105      | FLASH1_IO0      | T6             | MCU_FLASH1_IO0/<br>I2C0_SDA/UART0_RX/<br>KEYPAD0/MCU_I2C0_SDA/<br>MCU_CC_OUT0/<br>MCU_UART1_RX/<br>GPIO56       | Digital | I/O       | PU          | VDDIO              | Reserved (No Connection)                                           |
| 106      | EJ_TCK          | R5             | EJ_TCK/SWCLK/GPIO18                                                                                             | Digital | I/O       | PD          | VDDIO              | Reserved (No Connection)                                           |
| 107-115  | GND_PAD         |                |                                                                                                                 |         |           |             |                    |                                                                    |

### 3 RF Specification

The module is compliant to the 3GPP spec for release 13 and rated at a Class 3 device (23 dBm)

## 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    |
| Interface Voltage     | V_IO        | 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.

## 5 Application Information

### 5.1 Recommended PCB Landing Pattern

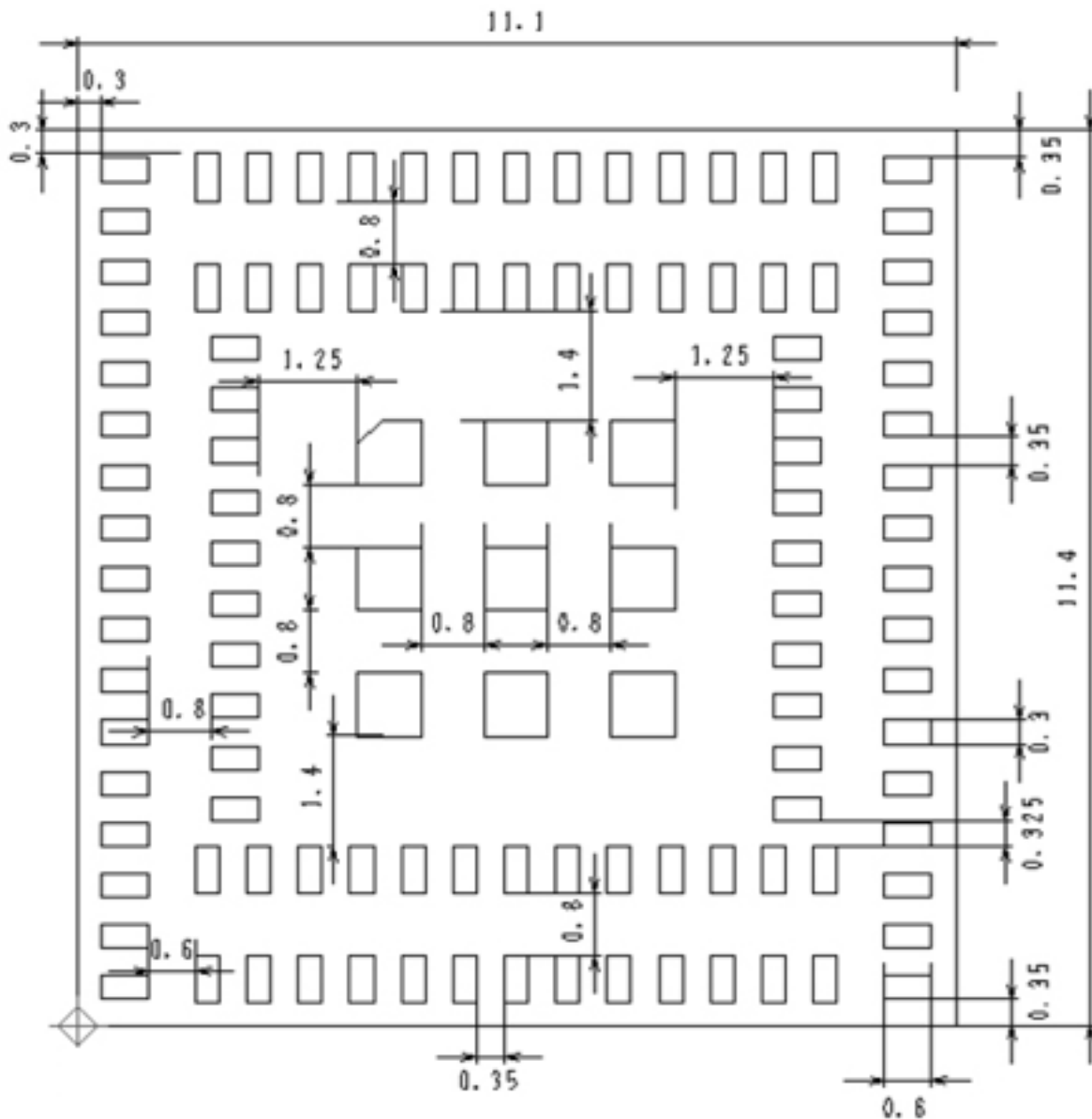


Figure 5.1 Recommended PCB Landing Pattern

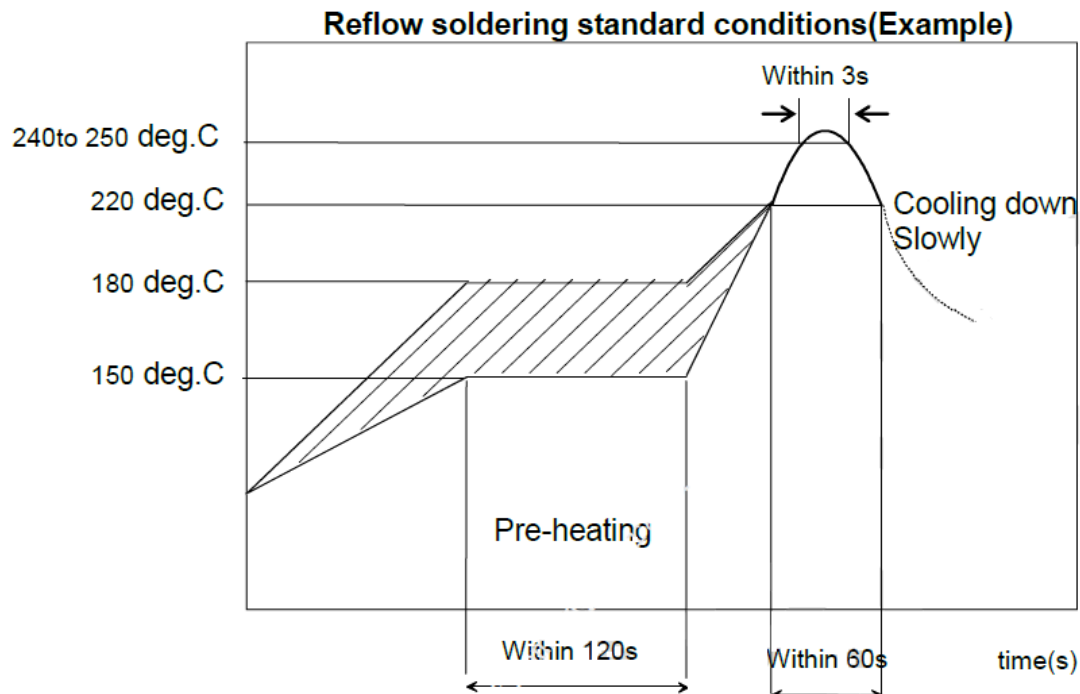


## 6 Assembly Information

Refer to Figure6.1 for recommended soldering conditions.

When products are immersed in solvent after mounting, ensure the temperature difference is within 100°C. 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



**Figure6.1 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.



### 7.3 Taping Diagrams

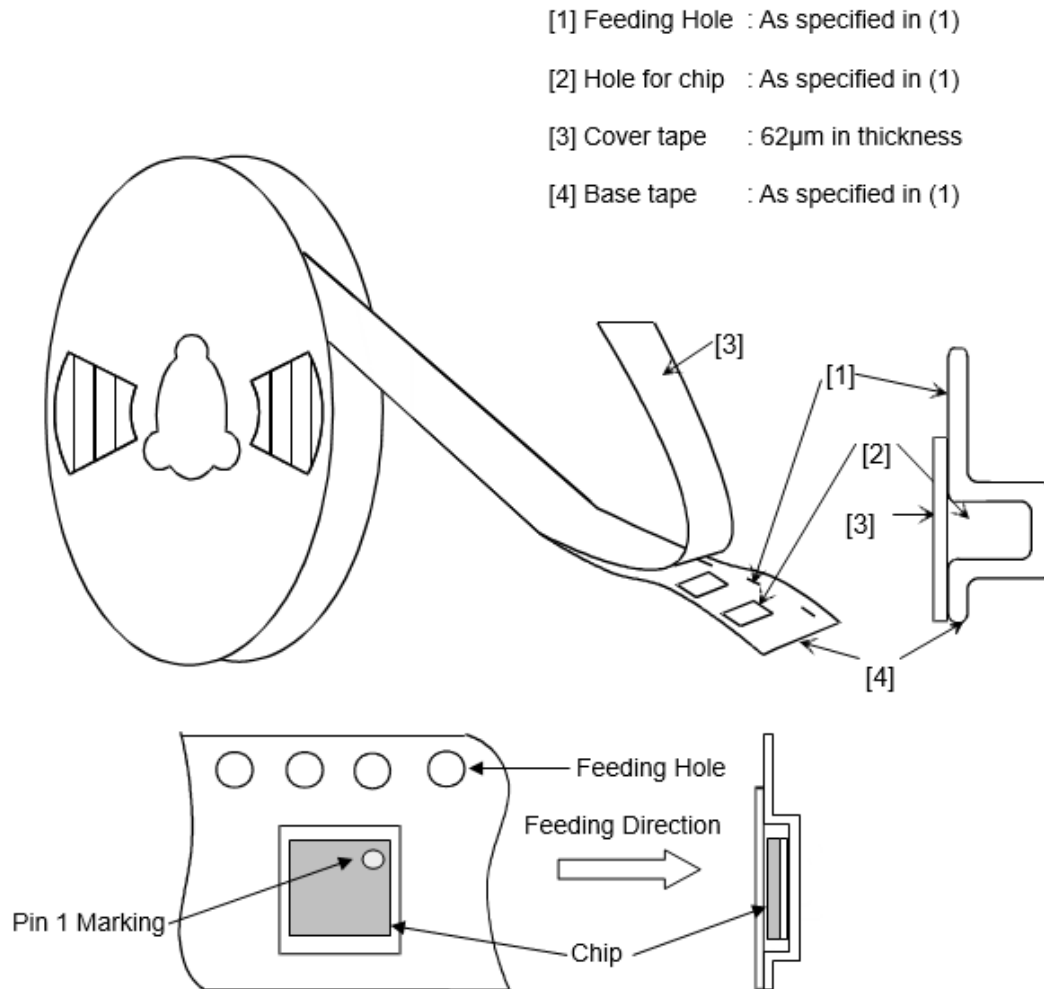


Figure 7.3 Tape Diagram

### 7.4 Module Marking Information

Figure 7.4 shows the module marking. Dimensions are nominal, not absolute.

TBD

Figure 7.4 Module Marking Diagram

### 7.5 Moisture Sensitivity Level

The module is rated to MSL 4 (72 hours). Please observe this rating with the utmost importance.

## 8 Regulatory Information

The module is FCC/IC certified (HSW-TY1SC and 4492A-TY1SC) and RED ETSI EN 301908-13, EN301908-1, EN301489-1, EN301489-19, EN301489-52 compliant. Please contact support if you need the DoC for the module. The module is also certified for use in Japan (TELEC 003-180242).

The module is certified to GCF 3.70.2 and PTCRB 5.36. The module is fully compliant to CAT M1 3GPP release 13.

## 9 RoHS Information

The Type 1SC module conforms to RoHS requirements.

## 10 Ordering Information

| Product         | Model Name  | Murata Ordering Part Number | Standard Order Increment |
|-----------------|-------------|-----------------------------|--------------------------|
| Module Sample   | Type 1SC    | LBAD0XX1SC-TEMP             | *** pcs                  |
| Development Kit | Type 1SC DK | LBAD0XX1SC-EVK-TEMP         | 1 pcs                    |

# 11 Notice

## 11.1 Storage Conditions

Please use this product within 6 months after receipt.

- The product shall be stored in original 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 6months 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>, Nox, 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

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

## 11.2 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.

## 11.3 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.

## 11.4 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.

## 11.5 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.

## 11.6 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.

# 12 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.

WE HEREBY DISCLAIMS ALL OTHER WARRANTIES REGARDING THE PRODUCTS, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, THAT THEY ARE DEFECT-FREE, OR AGAINST INFRINGEMENT OF INTELLECTUAL PROPERTY RIGHTS.

The product shall not be used in any application listed below which requires especially high reliability for the prevention of such defect as may directly cause damage to the third party's life, body or property. You acknowledge and agree that, if you use our products in such applications, we will not be responsible for any failure to meet such requirements. Furthermore, YOU AGREE TO INDEMNIFY AND DEFEND US AND OUR AFFILIATES AGAINST ALL CLAIMS, DAMAGES, COSTS, AND EXPENSES THAT MAY BE INCURRED, INCLUDING WITHOUT LIMITATION, ATTORNEY FEES AND COSTS, DUE TO THE USE OF OUR PRODUCTS IN SUCH APPLICATIONS.

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

We expressly prohibit you from analyzing, breaking, reverse-engineering, remodeling altering, and reproducing our product. Our product cannot be used for the product which is prohibited from being manufactured, used, and sold by the regulations and laws in the world.

We do not warrant or represent that any license, either express or implied, is granted under any our patent right, copyright, mask work right, or our other intellectual property right relating to any combination, machine, or process in which our products or services are used. Information provided by us regarding third-party products or services does not constitute a license from us to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from us under our patents or other intellectual property.

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

Moreover, you must comply with "foreign exchange and foreign trade law", the "U.S. export administration regulations", etc. Please note that we may discontinue the manufacture of our products, due to reasons such as end of supply of materials and/or components from our suppliers.

By signing on specification sheet or approval sheet, you acknowledge that you are the legal representative for your company and that you understand and accept the validity of the contents herein. When you are not able to return the signed version of specification sheet or approval sheet within 30 days from receiving date of specification sheet or approval sheet, it shall be deemed to be your consent on the content of specification sheet or approval sheet. Customer acknowledges that engineering samples may deviate from specifications and may contain defects due to their development status. We reject any liability or product warranty for engineering samples. In particular we disclaim liability for damages caused by

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- deviation or lapse in function of engineering sample,
- improper use of engineering samples.

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