

Features

- LTE-M1/NB2 3GPP rel14, upgradable to rel17
- LTE CAT M1 – 23 dBm
- LTE NB2 – 23 dBm
- 8 MByte of flash
- Dimension: 10.8 x 11.0 mm (typ), 1.35mm(max)
- Package: LGA
- Antenna configurations: external
- SIM configuration: external; integrated SIM capable for MNO/MVNO (optional)
- 3GPP Rel. 14 eDRX and PSM modes
- Power Consumption: TBD
- Moisture control: MSL4
- Operating temperature range: -40°C to 85°C
- OTA firmware upgrade
- 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/5G technology capability
- Dedicated LTE half-duplex operation (HD-FDD) for CatM1
- Cellular transceiver designed to meet 3GPP Rel-14 specifications
- 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/B66
- Optimized for Class 3 LTE output power (+23 dBm)

Applications

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

LBAD0ZZ2GD

**LTE CAT M1&NB2
Module**



Revision History

Revision	Date	Author	Change Description
1.0	12/20/2024	RF PD	New Release (Preliminary version)
1.1	03/04/2024	RF RD	Updated Figure 2.3 Pinout Diagram Bottom view Updated Table 2.2 Pinouts Updated 4.2 Recommended Operating Condition, 4.3 Interface Voltage specifications Updated Figure 7.1 Recommended PCB Landing Pattern
1.2	07/31/2024	PM	Updated 1.1 Scope Updated Table 2.2 Pinouts Updated Table 3.3 Power Consumption for CAT M1, Table 3.6 Power Consumption for NB1 Updated 4.1 Absolute Maximum Rating Updated 5 POWER SEQUENCE Updated 10.4 Module Marking Information
1.3	11/12/2024	RA	Updated FCC/IC Statements
1.4	11/22/2024	RA	TCB Feedback

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1 Introduction

1.1 Scope

This product is designed to meet 3GPP Rel-14 specifications

- Host Interface : UART
- Reference Clock : Reference clock embedded
- Size : 10.8 x 11.0 x 1.35 mm
- Weight : TBD
- RoHS : This component can meet with RoHS compliance
- MSL :Level 4
- Surface-mount type

*This product is moisture sensitive. Please check the detail in 15.1 Storage Condition section.

1.2 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)
- PSM Power Save Mode
- eDRX Extended Discontinuous Reception
- GLONASS Global Navigation Satellite System

1.3 References

TBD

2 Mechanical Specification

2.1 Dimension

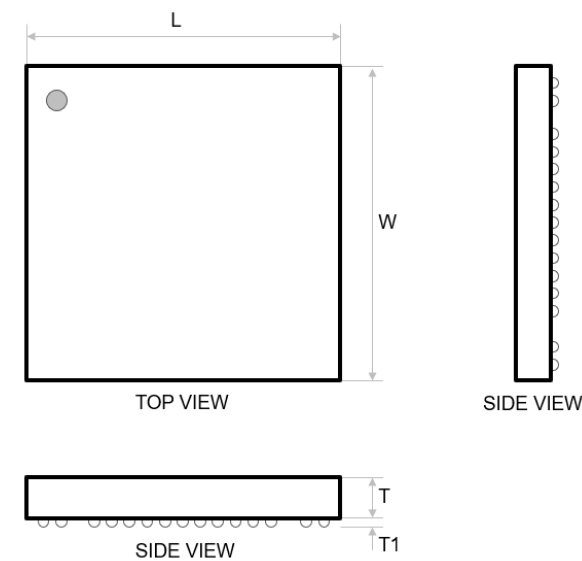


Figure 2.1 Module Top and Side View

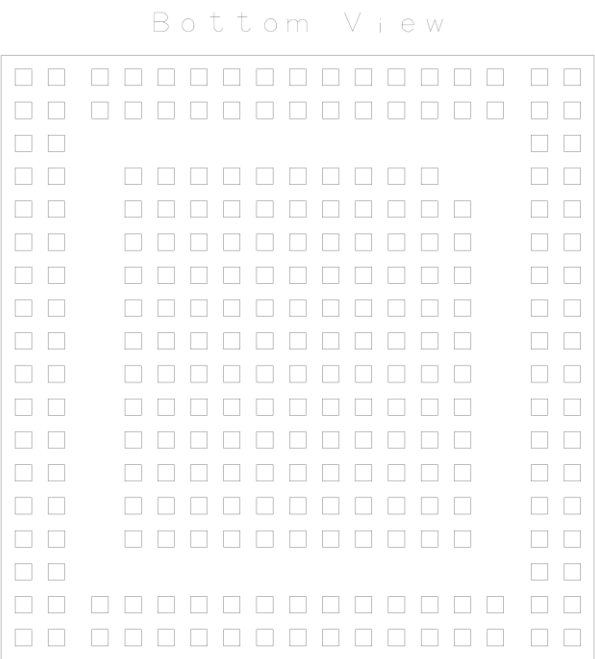


Figure 2.2 Module Footprint Bottom View

Table 2.1 Dimension

Mark	Dimension	Mark	Dimension	Mark	Dimension
L	10.80±0.20	W	11.0±0.20	T	1.35 max
T1	0.04 typical				

Unit [mm]

2.2 Pin Configuration

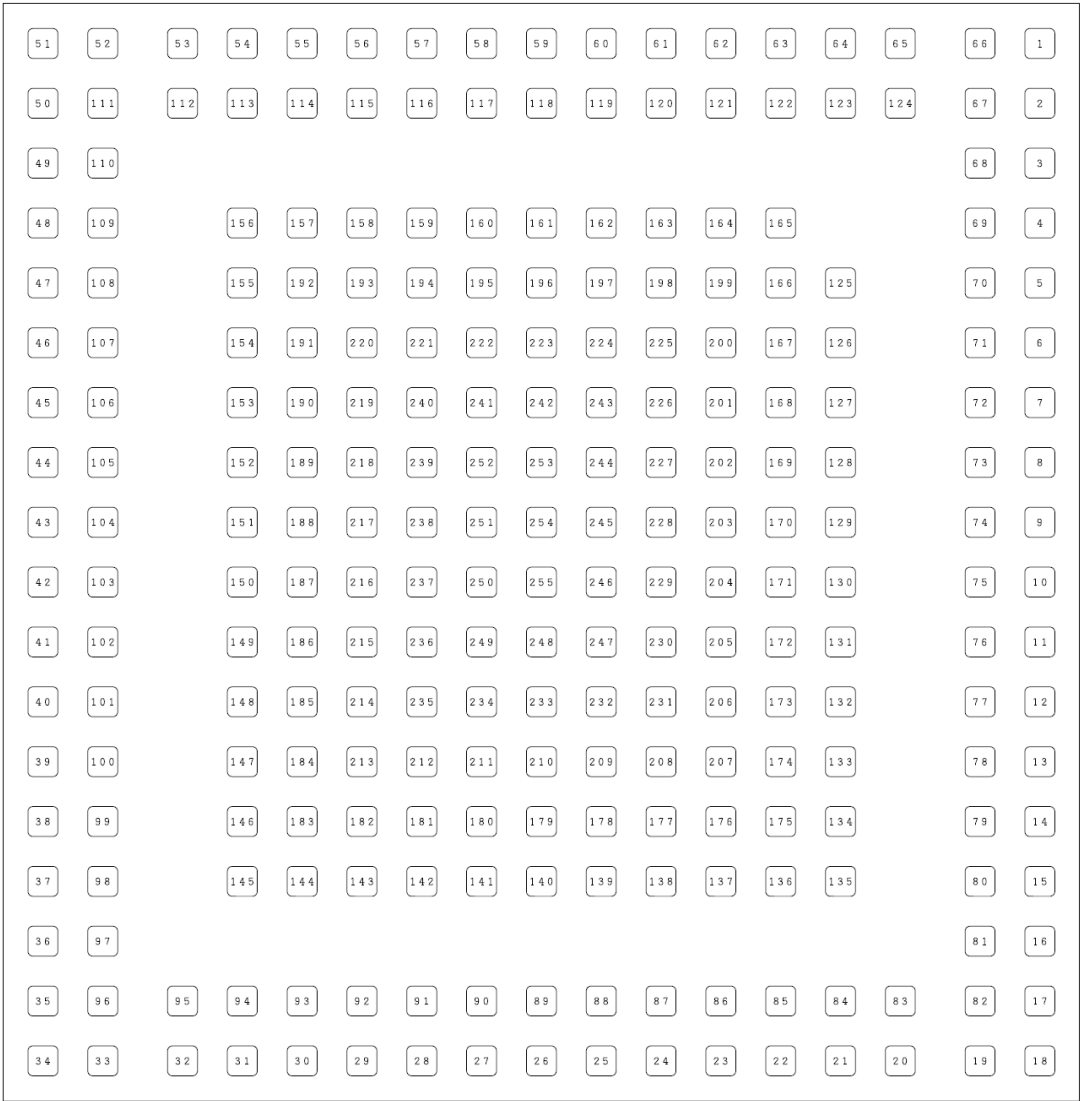


Figure 2.3 Pinout Diagram Bottom View

Table 2.2 Pinouts

2GD Pin#	Module Pin Name	ALT1350 IC Pin No	ALT1350 IC Symbol Pin Name	Type	Direction	Reset Value	IO Domain/ Supply	Description
1	GND							
2	POWER_BUTTON	W3	PMU_POWER_BUTTON	Analog	I	PU	VCASN/1.8 V tolerant	Shutdown active low, HW resetN
3	AUX_ADC5/THERM	Y8	AUX_ADC5	Analog	I		VO_GPIO	AUX_ADC input 5
4	EXT_ALARM	V6	PMU_EXT_ALARM	Analog	O		VDDIO	Alarm output
5	WAKEUP0	U3	PMU_WAKEUP_0	Analog	I		1.8V tolerant	Wakeup active high (H2M – HiFC)
6	WAKEUP1	R3	PMU_WAKEUP_1	Analog	I		1.8V tolerant	Wakeup active high (For SHUB wakeup)
7	VO_AUX	N1	PMU_VO_AUX	Power	O			1.8V VDD LDO output for AUX purpose
8	SHUTDOWN	M2	PMU_SHUTDOWN	Analog	I	PU	VCASN/1.8 V tolerant	Shutdown active low, HW resetN
9	GPIO4_MCU_I2CM_SCL	R7	GPIO_4/MCU_I2CM_SCL/SHUB_I2CM_SCL/APP_I2CM_SCL/MCU_I2CS_SCL/SHUB_I2CS_SCL/APP_I2CS_SCL/SHUB_CC_IN0/MCU_PWM0/CXD_PMI_C_REQUEST	Digital Fail Safe	I/O	PD	VO_GPIO	Currently not supported. For possible support, please contact local support team.
10	GND							
11	VBAT_FEM			Power	I			Input from battery to FEM
12	VBAT_FEM			Power	I			Input from battery to FEM
13	GND							
14	GPIO38/FEM_CTRL8	K8	GPIO_38/MCU_LED0/SHUB_LED0/MCU_PWM0/WiFi_FELNA_BYPASS/RFM_CTRL8	Digital	I/O	High-Z	VO_GPIO	
15	GPIO44_MCU_UART_TX	N9	GPIO_44/MCU_UART_TX/SHUB_UART_TX/APP_UART_TX/SRM_UART_TX/RFM_CTRL1	Digital	I/O	High-Z	VO_GPIO	Currently not supported. For possible support, please contact local support team
16	GND							
17	VBAT_FEM_SW			Power	O			Output from Power-SW
18	GND							
19	GPIO24_EJ_TMS	N11	GPIO_24/EJ_TMS/WDIO/RFM_CTRL7/SHUB_CC_IN1/MCU_PWM1	Digital	I/O	PU	VO_GPIO	JTAG Test Mode Select / Serial Wire Debug

20	GPIO30_RFFE_SCLK	K4	GPIO_30/RFFE_SCLK/RFM_CTRL17	Digital	I/O	PD	VO_GPIO	MIPI RFFE Clock signal
21	GPIO31_RFFE_SDATA	J3	GPIO_31/RFFE_SDATA/RFM_CTRL18	Digital	I/O	PD	VO_GPIO	MIPI RFFE directional/bidirectional data signal
22	GPIO49	K12	GPIO_49/SHUB_CC_IN1/MCU_PWM1/MCU_LED2/SHUB_LED2/RFM_CTRL_GPIO_49/SHUB_CC_IN1/MCU_PWM1/MCU_LED2/SHUB_LED2/RFM_CTRL15	Digital	I/O	High-Z	VO_GPIO	
23	RF_CLK_GNSS_FREF	E13	RF_CLK_GNSS_FREF	RF	O			For CXD5610 support
24	GPIO43_MCU_UART_RX	R9	GPIO_43/MCU_UART_RX/SHUB_UART_RX/APP_UART_RX/SRM_UART_RX/RFM_CTRL0	Digital	I/O	High-Z	VO_GPIO	Currently not supported. For possible support, please contact local support team
25	GND							
26	AUX_RF			RF	I			AUX_RF Input
27	GND							
28	RX_GNSS	A11		RF	I			GNSS receiver input
29	GND							
30	PSRAM_IO1_GPIO67	R15	GPIO_67/PSRAM_IO1/RFM_CTRL28/MCU_UART_CTS/APP_UART_CTS/S	Digital	I/O	High-Z	VDDIO_PSRAM	PSRAM I/O 1
31	GND							
32	ANT	A11		RF	I/O			CAT-M1 RF in/out signal
33	GND							
34	GND							
35	GPIO16_MCU_SPIM_EN1/FEM_CTRL12	H14	GPIO_16/MCU_SPIM_EN1/SHUB_SPIM_EN1/APP_SPIM_EN1/MCU_SPIS_SRDY/SHUB_SPIS_SRDY/APP_SPIS_SRDY/RFM_CTRL12/GNSS_PPS/WiFi_FE_LNA_BYPASS/WiFi_FE_SPARE/MCU_LED0/SHUB_LED0	Digital	I/O	PU	VO_GPIO	Currently not supported. For possible support, please contact local support team
36	GPIO37	K16	GPIO_37/SHUB_CC_OUT2/MCU_PWM2/RFM_CTRL24/WiFi_FE_LNA_BYPASS/MCU_UART_CTS/SHUB_UART_CTS/APP_UART_CTS/SRM_UART_CTS	Digital	I/O	PU	VO_GPIO	- Sensor Hub CC Timer Output 2 / MCU PWM2 - Currently not supported. For possible support, please contact local support team
37	VO_RF	L1	PMU_VO_RF	Power	O			1.8V VDD LDO output for RF purpose

38	GPIO13_MCU_SPIM_MISO	M16	GPIO_13/MCU_SPI M_MISO/MCU_SPI M_CD_OUT/SHUB_ SPIM_MISO/SHU B_SPIM_CD_OUT/A PP_SPIM_MISO/ APP_SPIM_CD_OU T/MCU_SPIS_MO SI/SHUB_SPIS_MO SI/APP_SPIS_MO	Digital	I/O	PU	VO_GPIO	Currently not supported. For possible support, please contact local support team
39	GPIO15_MCU_SPIM_EN0	N15	GPIO_15/MCU_SPI M_EN0/SHUB_SPI M_EN0/APP_SPIM_ EN0/MCU_SPIS_ MRDY/SHUB_SPIS_ MRDY/APP_SPIS_ MRDY/GNSS_PPS /MCU_UART_RTS /SHUB_UART_RTS/ APP_UART_CTS/ SRM_UART_RTS	Digital	I/O	PU	VO_GPIO	Currently not supported. For possible support, please contact local support team
40	PSRAM_IO0_GPIO66	P16	GPIO_66/PSRAM_I O0/RFM_CTRL27/ MCU_UART_RTS/A PP_UART_RTS/S RM_UART_RTS/GN SS_PPS	Digital	I/O	High-Z	VDDIO_PS RAM	PSRAM I/O 0 - Currently not supported. For possible support, please contact local support team
41	PSRAM_IO2_GPIO68	P14	GPIO_68/PSRAM_I O2/RFM_CTRL29/ MCU_I2CM_SCL/AP P_I2CM_SCL/MC U_I2CS_SCL/APP_I 2CS_SCL	Digital	I/O	High-Z	VDDIO_PS RAM	M2H (HiFC) - Currently not supported. For possible support, please contact local support team
42	GPIO6_PDM_CLK_O	T10	GPIO_6/MCU_I2CM _SCL/SHUB_I2CM _SCL/APP_I2CM_S CL/MCU_I2CS_SC L/SHUB_I2CS_SCL/ APP_I2CS_SCL	Digital	I/O	High-Z	VO_GPIO	PSRAM I/O2 - Currently not supported. For possible support, please contact local support team
43	GPIO17_SRM_UART_RX	T12	GPIO_17/SRM_UAR T_RX/MCU_UART _RX/SHUB_UART_ RX/APP_UART_R X/MCU_LED0/SHUB _LED0/UART_W AKEUP1_IN	Digital Fail Safe	I/O	High-Z	VO_GPIO	DEBUG UART Receive Data (SRM_UART_RX) - Currently not supported. For possible support, please contact local support team
44	GPIO5_MCU_I2CM_SDA	T8	GPIO_5/MCU_I2CM _SDA/SHUB_I2C M_SDA/APP_I2CM_ SDA/MCU_I2CS_ _SDA/SHUB_I2CS_ SDA/APP_I2CS_S DA/SHUB_CC_OUT 0/MCU_PWM1/C LK32K_OUT/REFCL K_OUT/GNSS_PP S/CXD_PMIC_REQ UEST	Digital Fail Safe	I/O	PD	VO_GPIO	Currently not supported. For possible support, please contact local support team
45	SF_nHOLD/IO3	AE15	GPIO_61/FLASH0_I O3	Digital	I/O	PU	VDDIO_FL AS H	Serial Flash Input/Output (IO3) for Quad commands
46	SF_CLK	AC15	GPIO_57/FLASH0_ CLK	Digital	I/O	PD	VDDIO_FL AS H	Serial Flash Serial Clock

47	VO_FLASH	AE9	PMU_VO_FLASH	Power	O			1.8V VDD LDO output for FLASH purpose
48	GPIO18_SRM_UART_TX	U11	GPIO_18/SRM_UART_TX/MCU_UART_TX/SHUB_UART_TX/APP_UART_TX/MCU_LED1/SHUB_LED1	Digital Fail Safe	I/O	High-Z	VO_GPIO	DEBUG UART Transmit Data (SRM_UART_TX) Currently not supported. For possible support, please contact local support team
49	GPIO19_SRM_UART_RTS	V12	GPIO_19/SRM_UART_RTS/MCU_UART_RTS/SHUB_UART_RTS/APP_UART_RTS/MCU_LED2/SHUB_LED2/UART_WAKEUP1_OUT	Digital Fail Safe	I/O	High-Z	VO_GPIO	DEBUG UART Request to Send (SRM_UART_RTS) Currently not supported. For possible support, please contact local support team
50	GPIO28_SC_IO	AC11	GPIO_28/SC_IO/MCU_I2CM_SDA/SHUB_I2CM_SDA/APP_I2CM_SDA/MCU_I2CS_SDA/SHUB_I2CS_SDA/APP_I2CS_SDA/SHUB_C_C_OUT0/CLK32K_OUT/REFCLK_OUT/MCU_PWM1/MCU_LED1/SHUB_LED1	Digital	I/O	High-Z	VO_GPIO	SIM Data 1.8V Currently not supported. For possible support, please contact local support team
51	GND							
52	VO_SIM	AD10	PMU_VO_SIM	Power	O			1.8V VDD LDO output for SIM purpose
53	GPIO3_MCU_UART_CTS	W13	GPIO_3/MCU_UART_CTS/SHUB_UART_CTS/APP_UART_CTS/SRM_UART_CTS/MCU_SPIM_MOSI/SHUB_SPIM_MOSI/APP_SPIM_MOSI/MCU_SPIS_MISO/SHUB_SPIS_MISO/APP_SPIS_MISO	Digital Fail Safe	I/O	High-Z	VO_GPIO	MAIN UART Clear to Send Data host interface (MCU_UART_CTS) Currently not supported. For possible support, please contact local support team
54	VO_GPIO	AE11	PMU_VO_GPIO	Power	O			1.8V VDD LDO output for GPIO purpose
55	GPIO1_MCU_UART_TX	AA13	GPIO_1/MCU_UART_TX/SHUB_UART_TX/APP_UART_TX/SRM_UART_TX/MCU_SPIM_MISO/MCU_SPIM_CD_OUT/SHUB_SPIM_MISO/SHUB_SPIM_CD_OUT/APP_SPIM_MISO/APP_SPIM_CD_OUT/MCU_SPIS_MOSI/SHUB_SPIS_MOSI/APP_SPIS_MOSI	Digital Fail Safe	I/O	High-Z	VO_GPIO	MAIN UART Transmit Data host interface (MCU_UART_TX) Currently not supported. For possible support, please contact local support team

56	GPIO27_SC_RST	AC13	GPIO_27/SC_RST/ MCU_I2CM_SCL/S HUB_I2CM_SCL/AP P_I2CM_SCL/MC U_I2CS_SCL/SHUB _I2CS_SCL/APP_I2 CS_SCL/SHUB_CC _IN0/MCU_PWM0 /MCU_LED0/SHUB_ LED0	Digital	I/O	PD	VO_GPIO	SIM Reset 1.8V Currently not supported. For possible support, please contact local support team
57	GPIO29_SC_CLK	AB12	GPIO_29/SC_CLK/ MCU_PWM2/MCU_ _LED2/SHUB_LED2	Digital	I/O	PD	VO_GPIO	SIM Clock 1.8V
58	GPIO2_MCU_UART_RTS	Y12	GPIO_2/MCU_UAR T_RTS/SHUB_UAR T_RTS/APP_UART_ RTS/SRM_UART_ RTS/MCU_SPIM_E N0/SHUB_SPIM_E N0/APP_SPIM_EN0/ MCU_SPIS_MR DY/SHUB_SPIS_MR DY/APP_SPIS_M RDY/UART_WAKEU P0_OUT	Digital Fail Safe	I/O	PD	VO_GPIO	MAIN UART Request to Send Data host interface (MCU_UART_RT S) Currently not supported. For possible support, please contact local support team
59	GPIO0_MCU_UART_RX	AA11	GPIO_0/MCU_UAR T_RX/SHUB_UAR T_RX/APP_UART_R X/SRM_UART_R X/MCU_SPIM_CLK/ SHUB_SPIM_CLK/ APP_SPIM_CLK/MC U_SPIS_CLK/SH UB_SPIS_CLK/APP _SPIS_CLK/UART _WAKEUP0_IN	Digital Fail Safe	I/O	High-Z	VO_GPIO	MAIN UART Receive Data host interface (MCU_UART_RX) Currently not supported. For possible support, please contact local support team
60	GPIO20_SRM_UART_CTS	W11	GPIO_20/SRM_UAR T_CTS/MCU_UA RT_CTS/SHUB_UA RT_CTS/APP_UAR T_CTS/MCU_LED3/ SHUB_LED3	Digital Fail Safe	I/O	High-Z	VO_GPIO	DEBUG UART Clear to Send (SRM_UART_CT S) Currently not supported. For possible support, please contact local support team
61	GPIO7_PDM_IN	U9	GPIO_7/MCU_I2CM _SDA/SHUB_I2C M_SDA/APP_I2CM_ SDA/MCU_I2CS_ _SDA/SHUB_I2CS_ SDA/APP_I2CS_S	Digital	I/O	High-Z	VO_GPIO	M2H_RESET_IN D (HiFC) Currently not supported. For possible support, please contact local support team
62	GND							
63	VBAT_LDO	AD6/AB6	PMU_VBAT_LDO	Power	I			Input from battery to LDOs
64	GND							
65	VBAT_DCDC	U1/AB2/AC1 /AC3/AD2	PMU_VBAT_CP	Power	I			Input from battery to Charge Pump
66			PMU_VBAT_CP	Power	I			Input from battery to Charge Pump
67	GND							
68	GND							

69	GND							
70	GPIO9_SDOOUT	P6	GPIO_9/LPP_PCM_OUT/MCU_PCM_OUT/MCU_UART_TX/SHUB_UART_TX/APP_UART_TX/SRM_UART_TX/SC_IO/MCU_LED1/SHUB_LED1	Digital	I/O	High-Z	VO_GPIO	I2S/PCM Data Out Currently not supported. For possible support, please contact local support team
71	GPIO10_SCLK	N5	GPIO_10/LPP_PCM_CLK/MCU_PCM_CLK/MCU_UART_RTS/SHUB_UART_RTS/APP_UART_RTS/SRM_UART_RTS/SC_CLK/WiFi_FE_SPARE/MCU_LED2/SHUB_LED2/UART_WAKEUP1_OUT	Digital	I/O	Pd	VO_GPIO	I2S/PCM Clock Currently not supported. For possible support, please contact local support team
72	GPIO11_LRCK	N7	GPIO_11/LPP_PCM_FS/MCU_PCM_FS/MCU_UART_CTS/SHUB_UART_CTS/APP_UART_CTS/SRM_UART_CTS/WiFi_FE_LNA_BYPASS/MCU_LED3/SHUB_LED3/CXD_PMIC_REQUEST	Digital	I/O	High-Z	VO_GPIO	I2S/PCM Frame Sync Currently not supported. For possible support, please contact local support team
73	GPIO8_SDIN	P8	GPIO_8/LPP_PCM_IN/MCU_PCM_IN/MCU_UART_RX/SHUB_UART_RX/APP_UART_RX/SRM_UART_RX/SC_RST/MCU_LED0/SHUB_LED0/UART_WAKEUP1_IN	Digital	I/O	PD	VO_GPIO	I2S/PCM Data In Currently not supported. For possible support, please contact local support team
74	GPIO48/FEM_CTRL11	J5	GPIO_48/SHUB_CC_OUT0/MCU_PWM0/MCU_LED1/SHUB_LED1/WiFi_FE_LNA_BYPASS/RFM_CTRL11	Digital	I/O	High-Z	VO_GPIO	
75	GPIO22_EJ_TRST	K10	GPIO_22/EJ_TRST/RFM_CTRL5/SHUB_CC_OUT0/CLK32K_OUT/REFCLK_OUT/GNSS_PPS/MCU_PWM0	Digital	I/O	PD	VO_GPIO	
76	GND							
77	GND							
78	GPIO47/FEM_CTRL10	L5	GPIO_47/SHUB_CC_IN0/MCU_PWM0/MCU_LED0/SHUB_LED0/WiFi_FE_SPARE/RFM_CTRL10	Digital	I/O	High-Z	VO_GPIO	
79	GPIO45_MCU_UART_RTS/FEM_CTRL2	M8	GPIO_45/MCU_UART_RTS/SHUB_UART_RTS/APP_UART_RTS/SRM_UART_RTS/RFM_CTRL2	Digital	I/O	High-Z	VO_GPIO	Currently not supported. For possible support, please contact local support team
80	GPIO46_MCU_UART_CTS/FEM_CTRL3	L9	GPIO_46/MCU_UART_CTS/SHUB_UART_CTS/APP_UART_CTS/SRM_UART_CTS/RFM_CTRL3	Digital	I/O	High-Z	VO_GPIO	Currently not supported. For possible support, please contact

								local support team
81	GPIO25_EJ_TDO	M10	GPIO_25/EJ_TDO/S WO/SHUB_CC_O UT2/MCU_PWM2	Digital	I/O	High-Z	VO_GPIO	JTAG Test Data Output / Serial Wire Debug
82	GND							
83	GPIO21_EJ_TDI	L11	GPIO_21/EJ_TDI/RF M_CTRL4/SHUB_ CC_IN0/MCU_PWM 0	Digital	I/O	High-Z	VO_GPIO	JTAG Test Data Input
84	GPIO23_EJ_TCK	J11	GPIO_23/EJ_TCK/S WDCLK/RFM_CTR L6/SHUB_CC_OUT1 /MCU_PWM1	Digital	I/O	PU	VO_GPIO	JTAG Test Clock
85	GPIO50	M12	GPIO_50/SHUB_CC _OUT1/MCU_PW M1/MCU_LED3/SHU B_LED3/GNSS_P PS	Digital	I/O	High-Z	VO_GPIO	
86	GPIO26_DEBUG_RSTN	P10	GPIO_26/DEBUG_R STN/RFM_CTRL1 3/SHUB_CC_IN2/G NSS_PPS/WiFi_FE _LNA_BYPASS/WiFi _FE_SPARE/MCU _LED1/SHUB_LED1 /MCU_PWM2	Digital	I/O	High-Z	VO_GPIO	Reset pin for the JTAG probe PWM0
87	GPIO42	L13	GPIO_42/GNSS_PP S/WiFi_FE_LNA_B YPASS/WiFi_FE_SP ARE/MCU_LED3/ SHUB_LED3	Digital	I/O	High-Z	VO_GPIO	
88	GPIO51_PMIC_REQUEST	J13	GPIO_51/SHUB_CC _IN2/MCU_PWM2 /CXD_PMIC_REQU EST/RFM_CTRL16	Digital	I/O	High-Z	VO_GPIO	
89	GND							
90	GPIO32	P12	GPIO_32/SHUB_CC _IN0/MCU_PWM 0/RFM_CTRL19/MC U_I2CM_SCL/SH UB_I2CM_SCL/MCU _I2CS_SCL/SHUB _I2CS_SCL	Digital	I/O	High-Z	VO_GPIO	Sensor Hub CC Timer input 0 / MCU PWM0
91	GND							
92	GPIO40	R11	GPIO_40/MCU_LED 2/SHUB_LED2/M CU_I2CM_SCL/SHU B_I2CM_SCL/APP _I2CM_SCL/MCU_I2 CS_SCL/SHUB_I2 CS_SCL/APP_I2CS _SCL	Digital	I/O	High-Z	VO_GPIO	Currently not supported. For possible support, please contact local support team
93	GPIO39	R13	GPIO_39/MCU_LED 1/SHUB_LED1/M CU_PWM1/GNSS_P PS/WiFi_FE_SPAR E/RFM_CTRL14	Digital	I/O	High-Z	VO_GPIO	

94	GPIO34/FEM_CTRL21	G15	GPIO_34/SHUB_CC_IN1/MCU_PWM1/RFM_CTRL21/MCU_UART_RX/SHUB_UART_RX/APP_UART_RX/SRM_UART_RX	Digital	I/O	High-Z	VO_GPIO	Sensor Hub CC Timer input 1 / MCU PWM1 - Currently not supported. For possible support, please contact local support team
95	GND							
96	GPIO35/FEM_CTRL22	H16	GPIO_35/SHUB_CC_OUT1/MCU_PWM1/RFM_CTRL22/MCU_UART_TX/SHUB_UART_TX/APP_UART_TX/SRM_UART_TX	Digital	I/O	High-Z	VO_GPIO	Sensor Hub CC Timer Output 1 / MCU PWM1 - Currently not supported. For possible support, please contact local support team
97	GPIO36	J15	GPIO_36/SHUB_CC_IN2/MCU_PWM2/RFM_CTRL23/WiFi_FE_SPARE/MCU_UART_RTS/SHUB_UART_RTS/APP_UART_RTS/SRM_UART_RTS	Digital	I/O	High-Z	VO_GPIO	Sensor Hub CC Timer input 2 / MCU PWM2 - Currently not supported. For possible support, please contact local support team
98	GPIO41	K14	GPIO_41/MCU_LED3/SHUB_LED3/MCU_I2CM_SDA/SHUB_I2CM_SDA/APB_I2CM_SDA/MCU_I2CS_SDA/SHUB_I2CS_SDA/APP_I2CS_SDA/RFM_CTL9	Digital	I/O	High-Z	VO_GPIO	Currently not supported. For possible support, please contact local support team
99	GPIO14_MCU_SPIM_MOSI	L15	GPIO_14/MCU_SPI_M_MOSI/SHUB_GPIO_14/MCU_SPI_M_MOSI/SHUB_SPI_M_MOSI/APP_SPI_M_MOSI/MCU_SPIS_MISO/SHUB_SPIS_MISO/APP_SPIS_MISO/WiFi_FE_LNA_BYPASS/MCU_UART_RX/SHUB_UART_RX/APP_UART_RX/SRM_UART_RX	Digital	I/O	High-Z	VO_GPIO	Currently not supported. For possible support, please contact local support team
100	GPIO12_MCU_SPIM_CLK	M14	GPIO_12/MCU_SPI_M_CLK/SHUB_SPI_M_CLK/APP_SPIM_CLK/MCU_SPIS_CLK/SHUB_SPIS_CLK/APP_SPIS_CLK/MCU_UART_TX/SHUB_UART_TX/APP_UART_TX/SRM_UART_TX	Digital	I/O	High-Z	VO_GPIO	Currently not supported. For possible support, please contact local support team

101	GPIO33	N13	GPIO_33/SHUB_CC_OUT0/MCU_PWM0/RFM_CTRL20/CLK_OUT/MCU_I2C_M_SDA/SHUB_I2CM_SDA/MCU_I2CS_SDA/SHUB_I2CS_SDA	Digital	I/O	High-Z	VO_GPIO	Sensor Hub CC Timer Output 0 / MCU PWM0
102	PSRAM_IO3_GPIO69	T14	GPIO_69/PSRAM_I03/RFM_CTRL30/MCU_I2CM_SDA/APP_I2CM_SDA/MCU_I2CS_SDA/APP_I2CS_SDA	Digital	I/O	High-Z	VDDIO_PSRAM	PSRAM I/O 3 - Currently not supported. For possible support, please contact local support team
103	RESERVED	-						Reserved (No Connection)
104	PSRAM_CLK_GPIO65	T16	GPIO_65/PSRAM_CLK/RFM_CTRL26/MCU_UART_TX/APP_UART_TX/SRM_UART_TX/REFCLK_OUT	Digital	I/O	High-Z	VDDIO_PSRAM	PSRAM Clock - Currently not supported. For possible support, please contact local support team
105	PSRAM_CSn_GPIO64	U13	GPIO_64/PSRAM_CS_N0/RFM_CTRL25/MCU_UART_RX/APP_UART_RX/SRM_UART_RX	Digital	I/O	PU	VDDIO_PSRAM	PSRAM Chip Select - Currently not supported. For possible support, please contact local support team
106	SF_SO/IO1	AD16	GPIO_59/FLASH0_IO1	Digital	I/O	High-Z	VDDIO_FLASH	Serial Flash Input/Output (IO1) for Dual or Quad commands
107	SF_nWP/IO2	AB16	GPIO_60/FLASH0_IO2	Digital	I/O	PD	VDDIO_FLASH	Serial Flash Input/Output (IO2) for Quad commands
108	SF_SI/IO0	AA15	GPIO_58/FLASH0_IO0	Digital	I/O	High-Z	VDDIO_FLASH	Serial Flash Input/Output (IO0) for Dual or Quad commands
109	GND							
110	PSRAM_DQS_GPIO70	V14	GPIO_70/PSRAM_I04_DQS/RFM_CTRL31/FLASH0_CS_N1/MCU_PWM0/MCU_LED0/WIFI_FE_SPARE	Digital	I/O	PU	VDDIO_PSRAM	PSRAM I/O 4
111	VDD_PSRAM	W15	VDDIO_PSRAMM	Power	I			PSRAM domain power supply input
112	GND							
113	GPIO52	V10	GPIO_52/SHUB_CC_OUT2/MCU_PWM2	Digital	I/O	PU	VO_GPIO	Used for silicon production testing purposes. - Cannot be driven low or pulled low during cold and warm boot.
114	GND							

115	AUX_ADC1	Y10	AUX_ADC1	Analog	I		VO_GPIO	AUX_ADC input1
116	AUX_ADC0	AB10	AUX_ADC0	Analog	I		VO_GPIO	AUX_ADC input0
117	AUX_ADC4	AC9	AUX_ADC4	Analog	I		VO_GPIO	AUX_ADC input4
118	AUX_ADC3	AA9	AUX_ADC3	Analog	I		VO_GPIO	AUX_ADC input3
119	AUX_ADC2	W9	AUX_ADC2	Analog	I		VO_GPIO	AUX_ADC input2
120	AT_OUT	AA7	PMU_AT_OUT	Analog	O		VCASN	Anti-tamper output
121	AT_IN	Y6	PMU_AT_IN	Analog	I		VCASN	Anti-tamper input
122	GND							
123	GND							
124	GND							
125-255	GND (Center Pad)							

3 RF Specification

3.1 LTE-CAT M1

3.1.1 Frequency Ranges

Table 3.1 Frequency bands

Items		Contents			
		Min	Typ.	Max	Unit
Frequency Range	LB	699	-	960	MHz
	MB	1710	-	2170	MHz

3.1.2 Frequency Bands

LTE Bands	Regions
LB: B5/B8/B12/B13/B17/B18/B19/B20/B26/B28 MB: B1/B2/B3/B4/B25/B66	Americas, EU and ASEAN

3.1.3 Tx Output Power

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

3.1.4 Rx sensitivity

Table 3.2 Rx Sensitivity

Items		Contents			
		Min	Typ.	Max	Unit
Rx Sensitivity	MCS5, BER<5% All OneSKU bands	-	-103	-	dBm

3.1.5 Power consumption

Table 3.3 Power Consumption for CAT M1

Mode	Current (TYP)	Condition
Tx Power @23dBm	450 mA	CAT M1
Rx	40 mA	RRC connected monitoring consecutive sub frames
PSM	1.3 uA	Hibernation period when module is asleep
eDRX	10.6 uA	eDRX, 8HF, 81.92s

3.2 LTE-NB2

3.2.1 Frequency bands

Table 3.4 Frequency bands

Items		Contents			
		Min	Typ.	Max	Unit
Frequency Range	LB	699	-	960	MHz
	MB	1710	-	2170	MHz

3.2.2 Tx output power

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

3.2.3 Rx sensitivity

Table 3.5 Rx Sensitivity

Items		Contents			
		Min	Typ.	Max	Unit
Rx Sensitivity	MCS5, BER<5% All OneSKU bands	-	-103	-	dBm

3.2.4 Power consumption

Table 3.6 Power Consumption for NB1

Mode	Current (TYP)	Condition
Tx Power @23dBm	TBD	Single Tone (3.75kHz)
Rx	TBD	RRC connected monitoring consecutive sub frames
PSM	1.3 uA	Hibernation period when module is asleep
eDRX	10.6 uA	eDRX, 8HF, 81.92s,

4 Environmental Specification

4.1 Absolute Maximum Rating

Table 4.1 Absolute Maximum Condition

Parameters		Min	Typ	Max	Unit
Operating Temperature		-30	25	+85	degC
Supply Voltage	VBAT	-0.2	-	4.6	V
	VBAT_FEM	TBD	-	5.5	V

4.2 Recommended Operating Condition

Table 4.2 Recommended Operating Condition

Parameters		Min	Typ	Max	Unit
Operating Temperature		-30	25	+85	degC
Supply Voltage	VBAT	2.2	-	4.6	V
	VBAT_FEM	2.5	-	5.5	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

4.4 Digital I/O Pin's specifications

TBD

4.5 Analog I/O Pin's specifications

TBD

5 POWER SEQUENCE

5.1 Power Sequence for power up

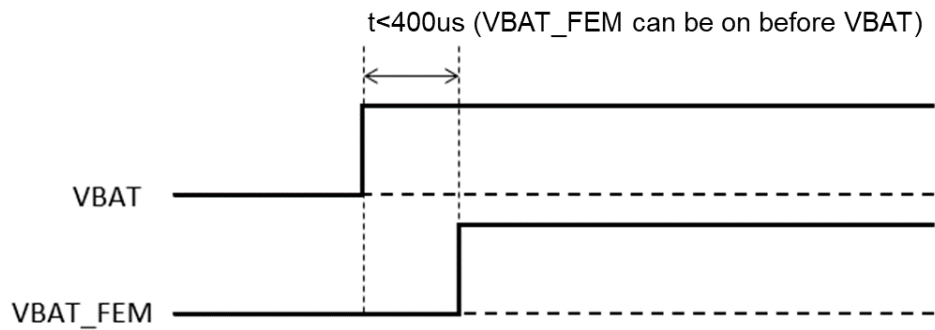


Figure 5.1 Power Sequence Diagram – Power Up

5.2 Power Sequence for power down

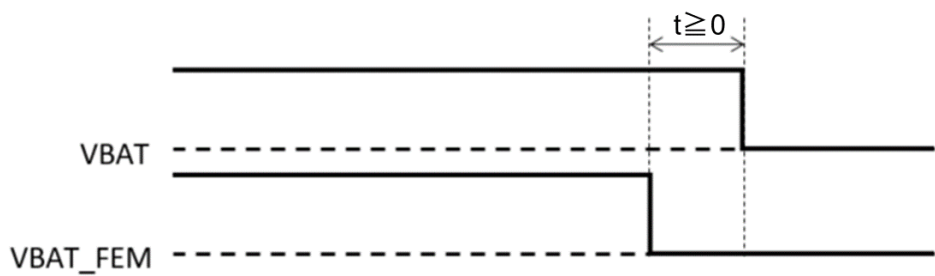


Figure 5.2 Power Sequence Diagram – Power Down

5.3 Power Sequence for reset

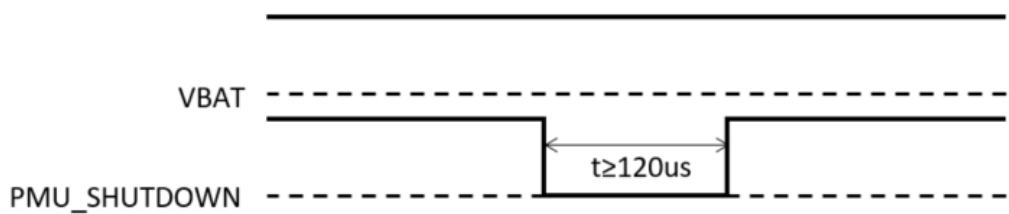


Figure 5.3 Power Sequence Diagram – Reset

8 EVK Schematic

Please refer to "EVK_Schematic_Type2GD" (TBD)

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

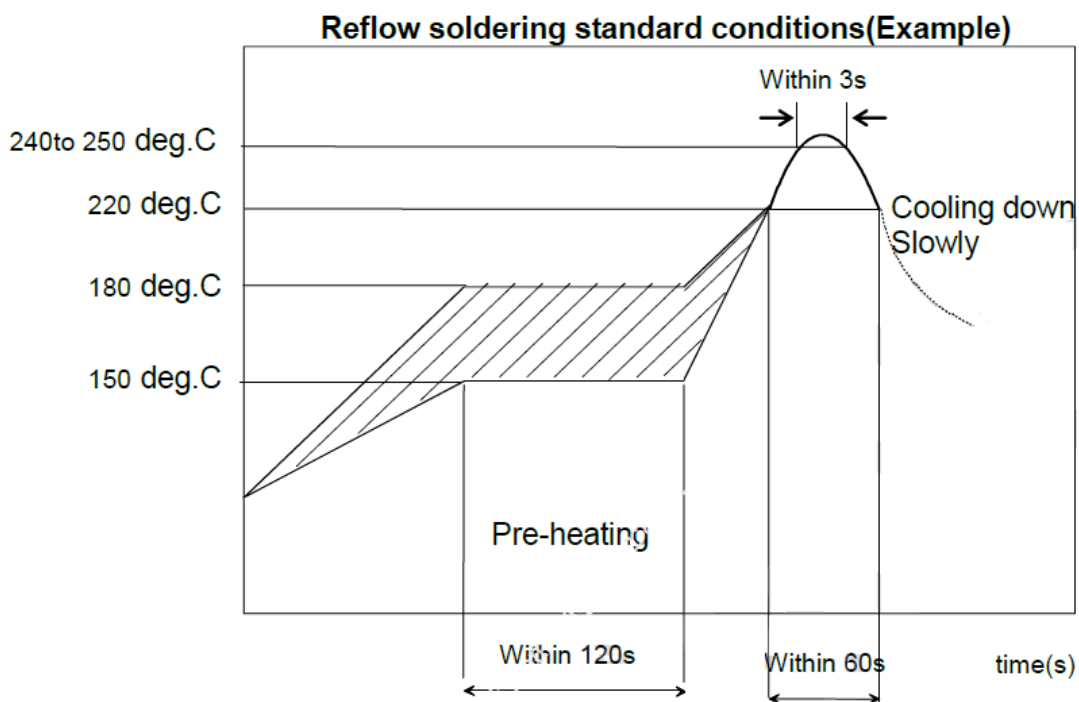


Figure 9.1 Reflow Profile

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)

(TBD)

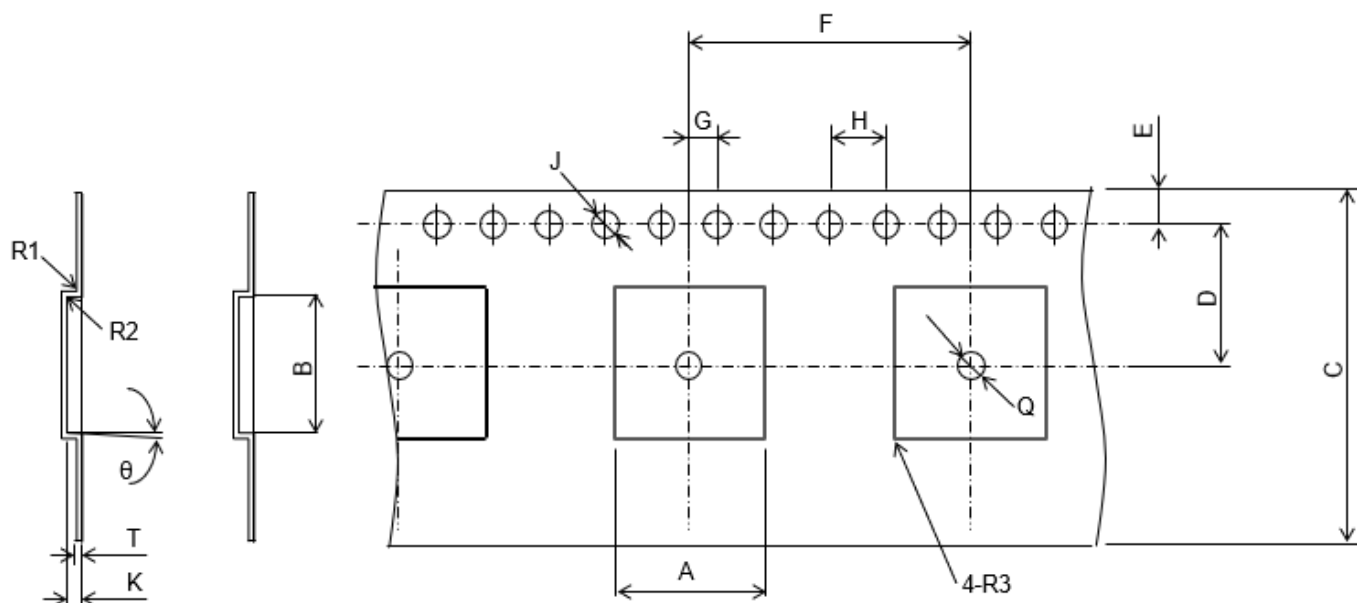


Figure 10.1 Tape Dimensions

Table 10.1 Dimension

Mark	Dimension	Mark	Dimension	Mark	Dimension	Mark	Dimension
A	11.3 ± 0.05	B	11.5 ± 0.05	C	24.0 ± 0.3	D	11.5 ± 0.1
E	1.75 ± 0.1	F	20.0 ± 0.1	G	2.0 ± 0.1	H	4.0 ± 0.1
J	24.1 max	K	1.65 ± 0.1	T	0.3 ± 0.05	Q	1.6 max
R1	0.3 max	R2	0.3 max	R3	0.3 max	θ	3° max

Unit [mm]

10.2 Dimensions of Reel

TBD

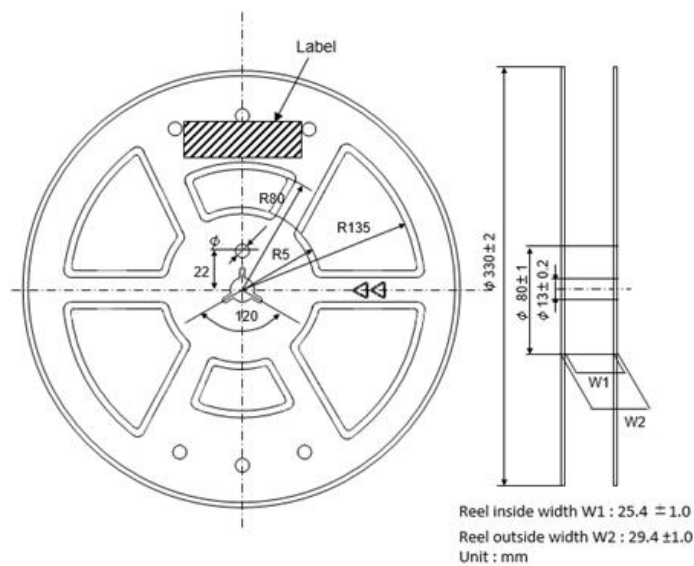


Figure 10.2 Reel Dimensions (Unit: mm)

10.3 Taping Diagrams

TBD

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

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

[3] Cover tape : 62μm in thickness

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

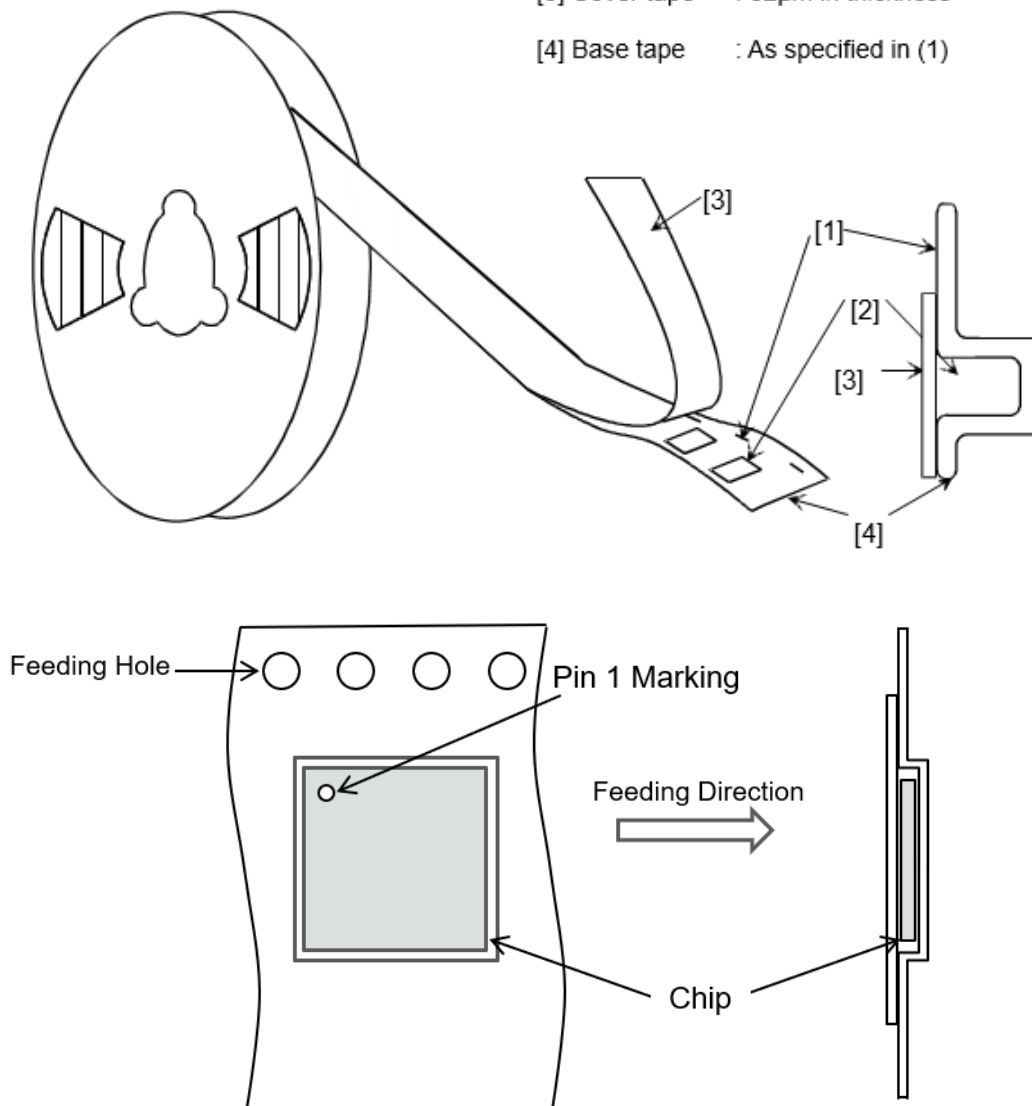


Figure 10.3 Tape Diagram

10.4 Module Marking Information

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

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Type 2GD Data Sheet Preliminary version, 11/26/2024, v1.0

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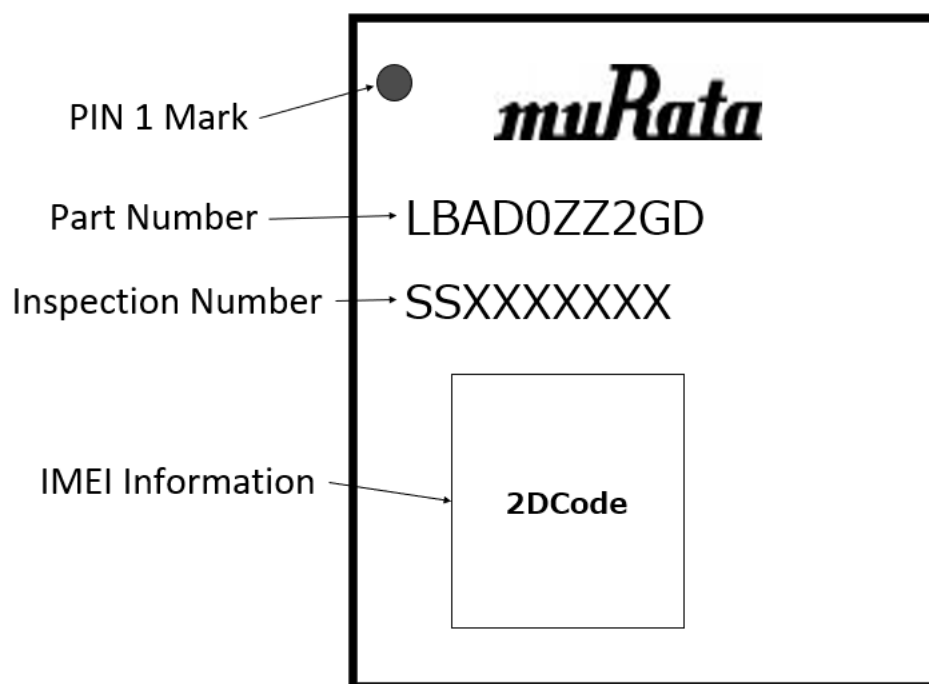


Figure 10.4 Type 2GD Module Marking Diagram

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 15.1 Storage Conditions.

11 Regulatory Information

11.1 FCC Notice

This device has Limited Modular Approval. This device is approved for mobile and fixed use with respect to RF exposure compliance, and may only be marketed to OEM installers. The antenna(s) used for this transmitter, as described in this filing, must be installed to provide a separation distance of at least 20 cm from all persons. Installers and end-users must be provided with operating conditions for satisfying RF exposure compliance. Maximum permitted antenna gain including cable loss should be determined from tables 8.1 and 8.2. Failure to follow these guidelines will result in radiated RF levels that exceed FCC MPE limits

This module does not contain voltage regulation and therefore is limited. The host integrator will be required to supply regulated voltage to the module through the host based upon the following operating range.

Minimum Operating Voltage: 2.5VDC
Maximum Operating Voltage: 4.6 VDC

11.2 FCC Test Data

FCC

CAT-M1	Freq. (MHz)	Operation Distance (cm)	Max. output Power include tolerance (dBm)	Max. Allowable Antenna Gain (dBi)	EIRP (ERP) Limit (dBm)	Max. output Power (mW)	Power Density (PD) (mW/cm ²)	PD Limit (mW/cm ²)	Allowable Gain according to EIRP (dBi)	Allowable Gain according to PD (dBi)	Power Density / Limit
LTE-Band 2	1850.7	20	24.00	9.00	33.00	1995.26	0.397	1.000	9.00	13.01	0.397
LTE-Band 4	1710.7	20	24.00	6.00	30.00	1000.00	0.199	1.000	6.00	13.01	0.199
LTE-Band 5	824.7	20	24.00	10.41	38.45	2760.58	0.549	0.550	14.45	10.41	0.998
LTE-Band 12	699.7	20	24.00	9.69	34.77	2338.84	0.466	0.466	10.77	9.69	1.000
LTE-Band 13	779.5	20	24.00	10.17	34.77	2612.16	0.520	0.520	10.77	10.17	1.000
LTE-Band 25	1850.7	20	24.00	9.00	33.00	1995.26	0.397	1.000	9.00	13.01	0.397
LTE-Band 26	824.7	20	24.00	10.41	38.45	2760.58	0.549	0.550	14.45	10.41	0.998
LTE-Band 26 Part 90	814.7	20	24.00	10.36	50.00	2728.98	0.543	0.543	26.00	10.36	1.000
LTE-Band 66	1710.70	20	24.00	6.00	30.00	1000.00	0.199	1.000	6.00	13.01	0.199

NB-IoT	Freq. (MHz)	Operation Distance (cm)	Max. output Power include tolerance (dBm)	Max. Allowable Antenna Gain (dBi)	EIRP (ERP) Limit (dBm)	Max. output Power (mW)	Power Density (PD) (mW/cm ²)	PD Limit (mW/cm ²)	Allowable Gain according to EIRP (dBi)	Allowable Gain according to PD (dBi)	Power Density / Limit
LTE-Band 2	1850.7	20	24.00	9.00	33.00	1995.26	0.397	1.000	9.00	13.01	0.397
LTE-Band 4	1710.7	20	24.00	6.00	30.00	1000.00	0.199	1.000	6.00	13.01	0.199
LTE-Band 5	824.7	20	24.00	10.41	38.45	2760.58	0.549	0.550	14.45	10.41	0.998
LTE-Band 12	699.7	20	24.00	9.69	34.77	2338.84	0.466	0.466	10.77	9.69	1.000
LTE-Band 13	779.5	20	24.00	10.17	34.77	2612.16	0.520	0.520	10.77	10.17	1.000
LTE-Band 25	1850.7	20	24.00	9.00	33.00	1995.26	0.397	1.000	9.00	13.01	0.397
LTE-Band 26	824.7	20	24.00	10.41	38.45	2760.58	0.549	0.550	14.45	10.41	0.998
LTE-Band 26 Part 90	814.7	20	24.00	10.36	50.00	2728.98	0.543	0.543	26.00	10.36	1.000
LTE-Band 66	1710.70	20	24.00	6.00	30.00	1000.00	0.199	1.000	6.00	13.01	0.199

11.3 ISED Test Data

ISED

CAT-M1	Freq. (MHz)	Operation Distance (cm)	Max. output Power include tolerance (dBm)	Max. Allowable Antenna Gain (dBi)	EIRP (ERP) Limit (dBm)	Max. output Power (mW)	Limit (W)	Allowable Gain according to RF EIRP (dBi)	Allowable Gain according to MPE EIRP (dBi)
LTE-Band 2	1850.7	20	24.00	9.00	33.00	1995.26	2.240	9.00	9.50
LTE-Band 4	1710.7	20	24.00	6.00	30.00	1000.00	2.122	6.00	9.27
LTE-Band 5	824.7	20	24.00	7.10	40.60	1288.25	1.289	16.60	7.10
LTE-Band 12	699.7	20	24.00	6.61	34.77	1150.80	1.152	10.77	6.61
LTE-Band 13	779.5	20	24.00	6.93	34.77	1238.80	1.240	10.77	6.93
LTE-Band 25	1850.7	20	24.00	9.00	33.00	1995.26	2.240	9.00	9.50
LTE-Band 26	824.7	20	24.00	7.10	40.61	1288.25	1.289	16.61	7.10
LTE-Band 66	1710.70	20	24.00	6.00	30.00	1000.00	2.122	6.00	9.27

NB-IoT	Freq. (MHz)	Operation Distance (cm)	Max. output Power include tolerance (dBm)	Max. Allowable Antenna Gain (dBi)	EIRP (ERP) Limit (dBm)	Max. output Power (mW)	Limit (W)	Allowable Gain according to RF EIRP (dBi)	Allowable Gain according to MPE EIRP (dBi)
LTE-Band 2	1850.7	20	24.00	9.00	33.00	1995.26	2.240	9.00	9.50
LTE-Band 4	1710.7	20	24.00	6.00	30.00	1000.00	2.122	6.00	9.27
LTE-Band 5	824.7	20	24.00	7.10	40.60	1288.25	1.289	16.60	7.10
LTE-Band 12	699.7	20	24.00	6.61	34.77	1150.80	1.152	10.77	6.61
LTE-Band 13	779.5	20	24.00	6.93	34.77	1238.80	1.240	10.77	6.93
LTE-Band 25	1850.7	20	24.00	9.00	33.00	1995.26	2.240	9.00	9.50
LTE-Band 26	824.7	20	24.00	7.10	40.61	1288.25	1.289	16.61	7.10
LTE-Band 66	1710.70	20	24.00	6.00	30.00	1000.00	2.122	6.00	9.27

11.4 List of Applicable FCC Rules

This module complies with below part 22, 24, 27 and 90 of the FCC Rules.

Part 22 Subpart H

Part 24 Subpart 24E

Part 27 Subpart B, C & L

Part 90 R & S

11.5 Labeling Requirements

Any device incorporating this module must include an external, visible, permanent marking or label which states: "Contains FCC ID: HSW-TY2GD" and "Contains IC :4492A-TY2GD"

Obligation d'étiquetage du produit final:

Tout dispositif intégrant ce module doit comporter un externe, visible, marquage permanent ou une étiquette qui dit: "Contient IC : 4492A-TY2GD"

11.6 Additional Testing Requirements

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification.

The final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

11.7 Test Modes

Murata Manufacturing Co., Ltd. uses various test mode programs for test set up which operate separate from production firmware. Host integrators should contact Murata Manufacturing Co., Ltd. for assistance with test modes needed for module/host compliance test requirements.

Federal Communications Commission (FCC) Statement

15.21

You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference and

2) this device must accept any interference received, including interference that may cause undesired operation of the device.

ISED

Canadian Notice

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- 1. This device may not cause interference.*
- 2. This device must accept any interference, including interference that may cause undesired operation of the device.*

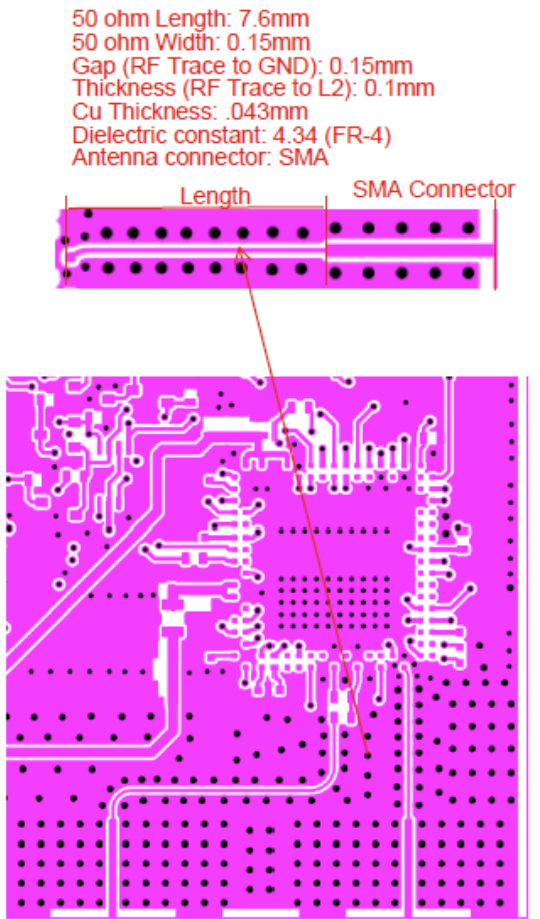
Avis Canadien

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

- 1. L'appareil ne doit pas produire de brouillage;*
- 2. L'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

12 Antenna Requirements

The Type 2GD is configured for monostatic operation, which requires only a single RF I/O pin for full duplex communication. The output must be routed to the antenna via 50 ohm microstrip or stripline on the OEM PCB. No coupling capacitor is required given that the RF pin is AC-coupled internal to the module.



PCB Stackup information

	記号	Item	Spec
			Center [um]
Thickness	①	S/R (on pattern)	35
	②	Layer1 Cu	43
	③	Prepreg L1-L2	100
	④	Layer2 Cu	35
	⑤	Core L2-L3	1000
	⑥	Layer3 Cu	35
	⑦	Prepreg L3-L4	100
	⑧	Layer4 Cu	43
	⑨	S/R (on pattern)	35
		Silk screen	15

The trace from Pin No. 32 to antenna connector on the OEM PCB must be maintained identical as the above specification with SMA connector. Only trace designs approved with an original grant or through permissive change can be used by an OEM, any changes are deemed as antenna type change and should be reviewed to ensure compliance with the FCC and ISSED requirements.

Verification must be conducted and the results shall not exceed below ranges to ensure identical antenna design is applied to subsequent integration and end product production.

Impedance 50 ohm

Input power > 23dBm Average power

VSWR absolute max $\leq 10:1$ (limit to avoid permanent damage)

VSWR recommended $\leq 2:1$ (limit to fulfill all regulatory requirements)

13 RoHS Information

The Type 2GD module conforms to RoHS requirements.

14 Ordering Information

Product	Model Name	Murata Ordering Part Number	Standard Order Increment
Module Sample	Type 2GD	LBAD0ZZ2GD-xxxSMP	10 pcs
Development Kit	Type 2GD	LBAD0ZZ2GD-EVK	1 pcs

*"xxx" shows a temporary No. which will be changed depend on customer's requirement , please contact Murata PIC to get a suitable PN here.

15 Notice

15.1 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 (Cl₂, NH₃, SO₂, NO_x, 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.

15.2 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.

15.3 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.

15.4 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.

15.5 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 (Cl₂, NH₃, SO_x, NO_x, 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.

15.6 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.

16 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.

We disclaim any liability for consequential and incidental damages.

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