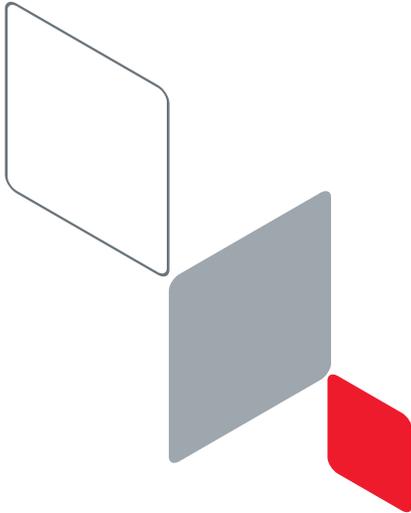


Components Selection Guide for Bluetooth[®] Low Energy

Optimize designs, reduce time to market



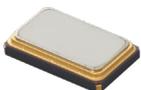
Ceramic
Capacitors



RF
Inductors



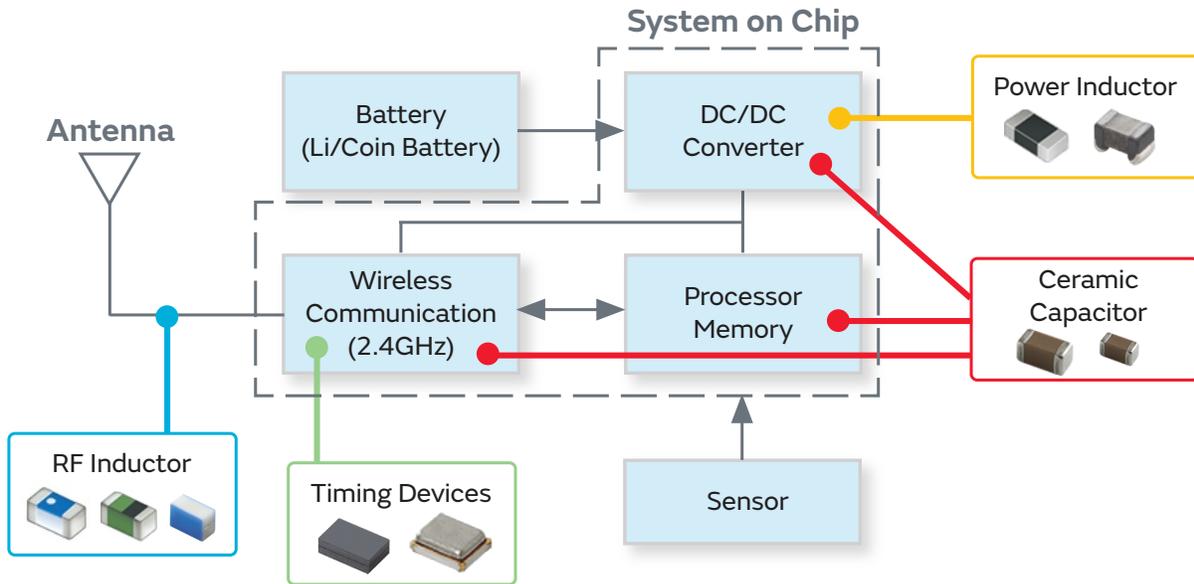
Power
Inductors



Timing
Devices



Bluetooth® Low Energy (BLE) is the next generation Bluetooth® release since version 4.0. Its low power consumption feature makes the BLE a popular choice across many applications. Knowledge of selecting the appropriate peripheral components greatly reduces design time and improves efficiency.



Block diagram / Peripheral components

Market / applications

- **IoT devices:** Beacon, sensing device with wireless communication
- **Healthcare:** Medical IoT devices, insulin pen, continuous glucose monitoring (CGM), medical tester, portable and personal devices
- **Industrial:** Factory automation (FA), item tracking, monitoring

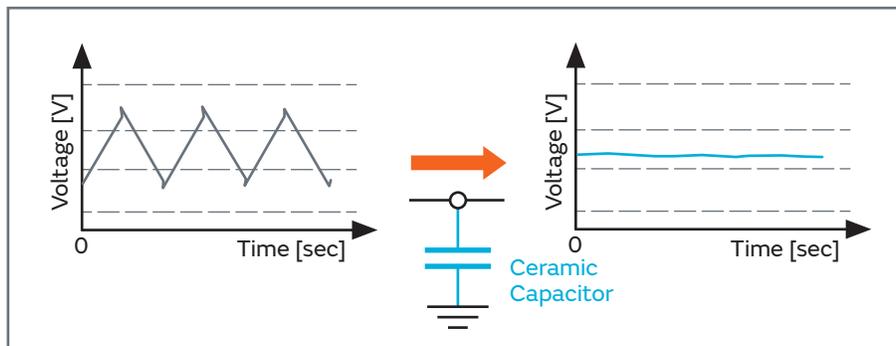
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Ceramic capacitors - high dielectric constant type

Power lines on circuits have capacitance and inductance components. If these components cause the voltage variation on power lines to increase, operation of the circuit becomes unstable. In extreme cases, fluctuations in the power source can become superimposed on the signal line, causing transmission of incorrect signals. Decoupling capacitors are used to pass noise coming in from the power source to the ground terminal, while at the same time continuously supplying stabilized current to combat sudden changes in load current on ICs and other circuits.

Decoupling and smoothing



Recommended ceramic capacitors for BLE

Maximum Operating Temperature	Size [inch/mm]	Rated Voltage [V]	Capacitance Range
GRM033R6 series X5R(EIA) 85°C guarantee	0201/0603	50	100pF - 1nF
		25	100pF - 10nF
		16	100nF - 10nF
		10	1.2nF - 100nF
		6.3	1.0μF - 1.0μF
		4	1.0μF
GRM155R6 series X5R(EIA) 85°C guarantee	0402/1005	50	2.2nF - 100μF
		25	22nF - 1μF
		16	22nF - 0.1μF
		10	22nF - 2.2μF
		6.3	22nF - 2.2μF
		4	1.0μF - 1μF

Maximum Operating Temperature	Size [inch/mm]	Rated Voltage [V]	Capacitance Range
GRM033R6 series X5R(EIA) 85°C guarantee	0201/0603	16	2.2nF - 2.2μF
		10	2.2nF - 2.2μF
		6.3	2.2nF - 4.7μF
		4	2.2nF - 4.7μF
GRM155R6 series X5R(EIA) 85°C guarantee	0402/1005	16	1.0nF - 10μF
		10	2.2nF - 2.2μF
		6.3	2.2nF - 2.2μF
		4	2.2nF - 2.2μF

For the full lineup, please click the link below.

GRM series

Ceramic capacitors - temperature compensating type

As the operating temperature of electrical devices becomes higher due to the enhanced functionality and multifunctionality of electronic equipment, there is a growing need for more stable characteristics of parts in response to temperature fluctuations and for larger capacitance.

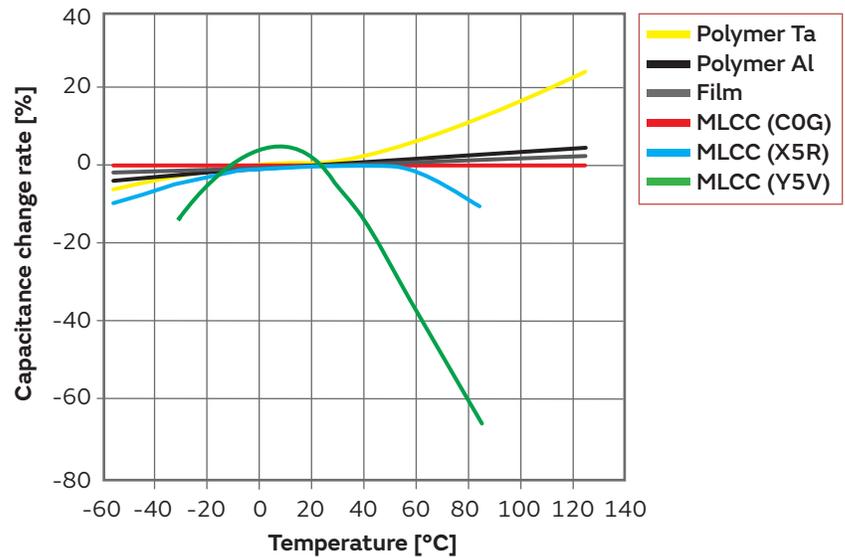
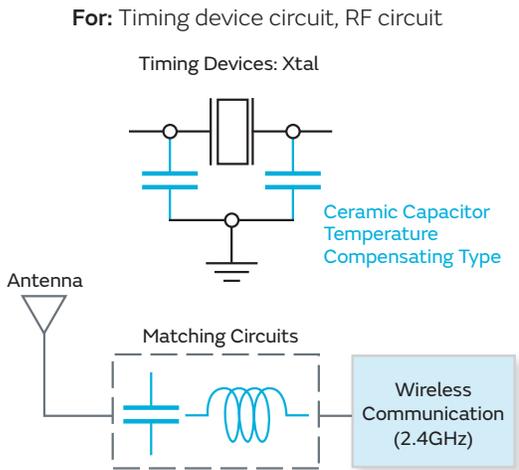


Figure 1 Capacitance change rate vs. temperature characteristics of various capacitor types

Recommended ceramic capacitors for BLE

Temperature Compensating Type	Size [inch/mm]	Rated Voltage [V]	Capacitance Range
GRM03355C series COG	0201 / 0603	50	0.1pF - 1000pF
0 ± 30ppm/°C guarantee		25	0.1pF - 1000pF
GRM1555C1 series COG	0402 / 1005	50	270pF - 8200pF
0 ± 30ppm/°C guarantee		25	10nF

For the full lineup, please click the link below.

[GRM series](#)

RF inductors

RF matching circuit maximizes RF signal power efficiency by matching line impedance. However, each matching circuit component has an AC loss; therefore it is important to choose low loss components for the matching circuit.

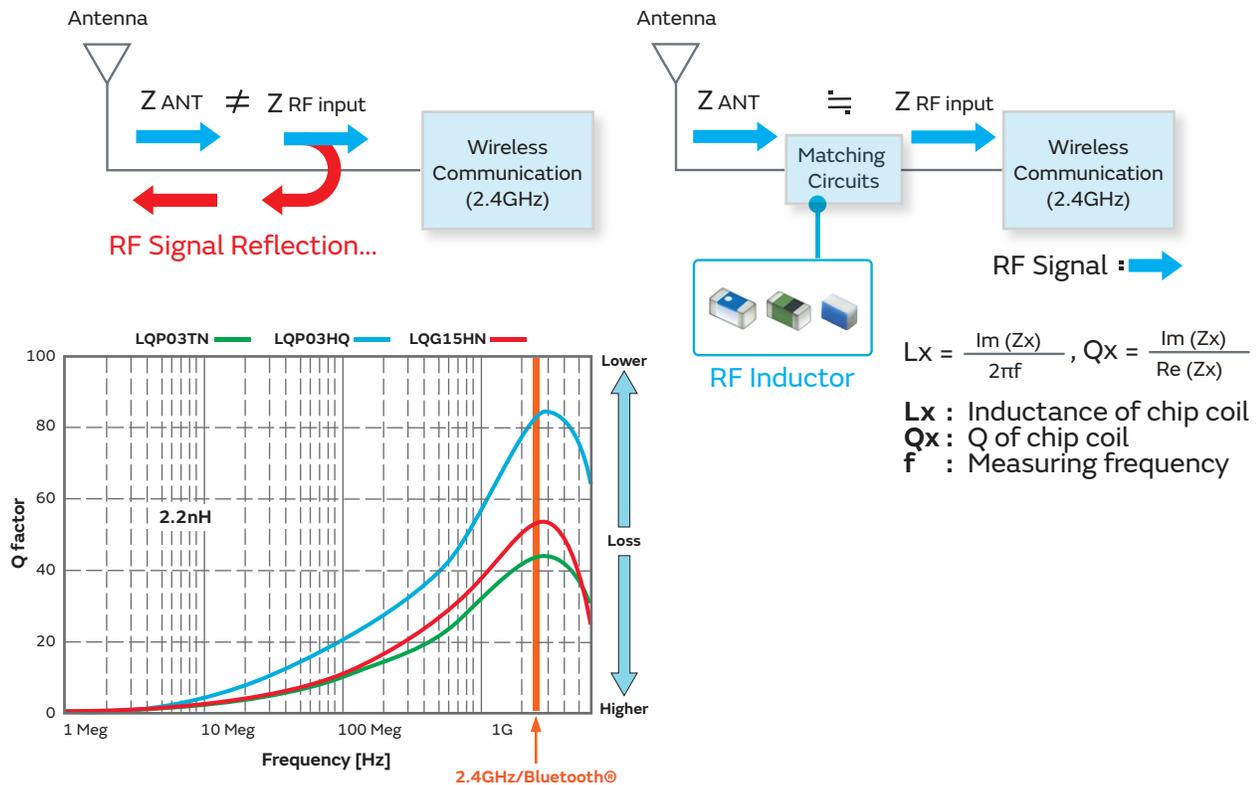


Figure 2 Q factor (RF Inductor Loss) vs frequency

Recommended RF inductors for BLE

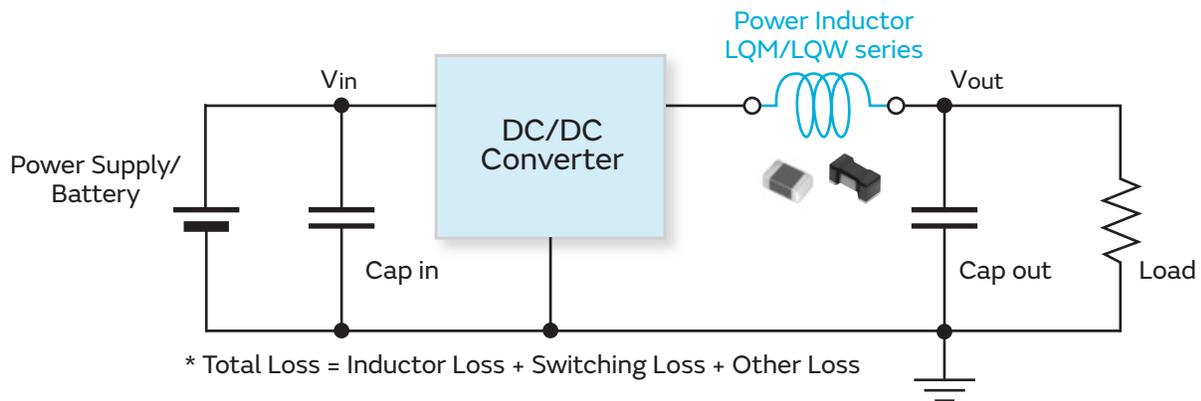
Series	LQP03TN series	LQP03HQ series	LQG15HN series
Case size [inch]	0201	0201	0402
Inductance/Tolerance	2.2nH ±0.1nH	2.2nH ±0.1nH	2.2nH ±0.1nH
Rdc*	0.15 ohm	0.12 ohm	0.10 ohm
Rated current*	600mA	600mA	900mA
Q (typ.) at 2.4GHz*	52	78	62
Datasheet	View PDF	View PDF	View PDF

Excellent Performance

* 2.2nH

Power inductors

The power supply is often regulated using LDO, which can result in reducing the supply voltage. An alternative solution is using a DC/DC function to regulate the power and increase the overall efficiency of the system to enhance battery life. The total circuit loss includes the power inductor and IC switching and other circuit losses. Therefore, it's important to select the power inductor considering size, price, and performance characteristics (ie., low loss).

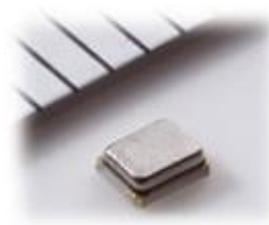


Recommended power inductors for BLE

	Part number	Size [inch]	Inductance [uH]	Rated Current [mA]	Datasheet 
Lower cost	LQM18PN_FR 	0603	1.0 - 4.7	620 - 1250	View PDF
	LQM18DN_70 	0603	6.8 - 10	300 - 330	View PDF
Better performance	LQM18PN_GH 	0603	1.0 - 3.3	1050	View PDF
Smallest size / Excellent performance	LQW15CN_10 	0402	0.02 - 3.3	130 - 2200	View PDF
	LQW15DN_00 	0402	10 - 15	100 - 120	View PDF

Timing devices (crystal unit)

Crystal units are used in RF reference clock Bluetooth® Low Energy. The power consumption of a Crystal unit is smaller than oscillator. Due to Murata's unique design and manufacturing process, we have successfully developed a low cost solution which has led to the Crystal unit XRCGB earning certification from several IC manufacturers.



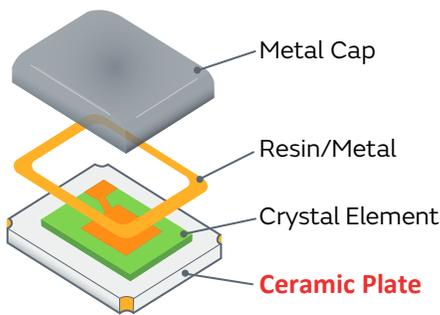
Part number: XRCGB series

Features

- Small size : 2.0 x 1.6mm
- Stable supply: With Murata unique design
- High Quality : Low defect rate

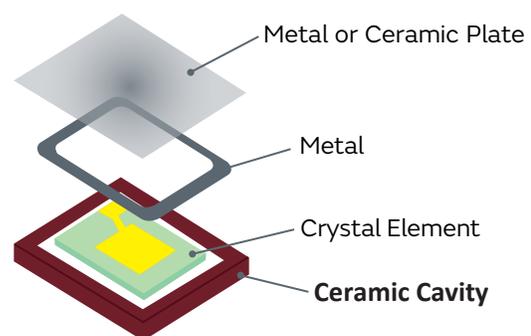
Murata Crystal Unit

Low cost, easy multi-sourcing



Conventional Crystal Unit

High cost and limited suppliers

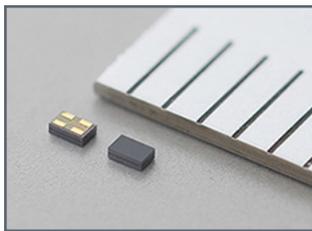


Recommended crystal units for BT/BLE

IC Manufacturer	IC P/N or series name	Murata Crystal Unit	
		Part Number	Frequency
Telink	TLSR8262 / 8266 / 8267 / 8269 / 86xx	XRCGB16M000FXN20R0	16MHz
Nordic	nRF51xxx / nRF52xxx	XRCGB32M000F2P10R0	32MHz
Dialog	DA14682/3	XRCGB32M000F2P29R0	32MHz
TI	CC26xx / 13xx	XRCGB24M000FBP12R0	24MHz
Qcomm (CSR)	QCC51xx / 31xx / 32xx	XRCGB32M000F1H19R0	32MHz
NXP (Quintic)	QN9080A	XRCGB32M000F2N13R0	32MHz
Renesas	RL78/G1D	XRCGB32M000F2P26R0	32MHz
Qorvo (Green Peak)	GP502 / 565 / 712	XRCGB32M000FBH50R0	32MHz
Semtech	SX1276	XRCGB32M000F1H83R0	32MHz
MediaTek	MTK2625	XRCGB26M000F1H23R0	26MHz

Timing devices (MEMS resonator)

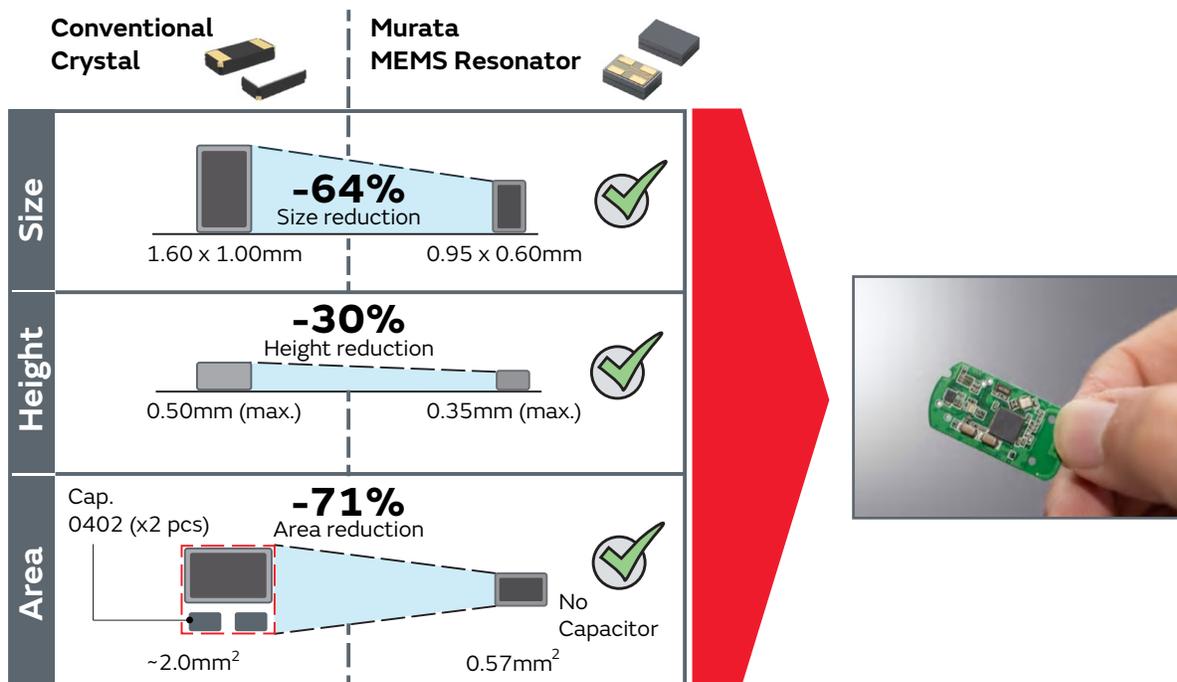
To save current consumption, an external kHz crystal is used for BLE function as an alarm clock. Murata released its super tiny and smaller kHz MEMS resonator, the WMRAG series. In addition, since Murata's MEMS resonators utilize built-in loading capacitance; customers do not need two external loading caps. Murata's MEMS resonators contribute to the overall size reduction and PCB space savings by eliminating the need for two external loading capacitors. A total of 71% space savings is made possible by our 1.6 x 1.0mm kHz crystal.



Part number: WMRAG series

Features

- Area saving
- High reliability
- PCB space saving



Recommended MEMS resonators for BT/BLE

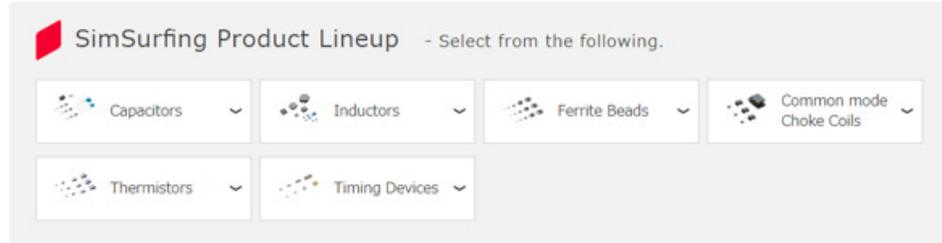
IC Manufacturer	IC P/N or series name	Murata Crystal Unit	
		Part Number	Frequency
Cypress	CYW20819	WMRAG32K76CS1C00R0	32.768kHz
Onsemi	RSL10	WMRAG32K76CS1C00R0	32.768kHz

Software design tools

SimSurfing is Murata's newest design tool. This gives the user the option of pre-selecting a known part number from a list or by inputting the part based on characteristics.



This "SimSurfing" supports viewing/downloading the characteristics data of Murata components and makes it easier to select them.



[View SimSurfing page >>](#)

Developer starter kit - passive components for BT/BLE

This kit conveniently contains all the necessary passive components to support your BT/BLE design activities. Looking for a development kit? Please request through the sample requests below.



Engineering sample - Nordic passive starter kit

nRF51x22 series: EKSM-PND51X22B-KIT

[Request sample](#)

nRF52x32 series: EKSM-PND52X32B-KIT

[Request sample](#)

Engineering sample - Dialog passive starter kit

DA14682, DA14683: EKSM-PDADA1A-KIT

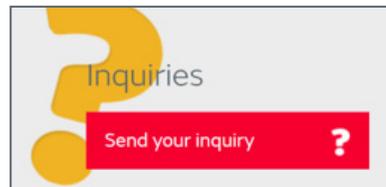
[Request sample](#)

DA14531: FXQS-200004-KIT

[Request sample](#)

Technical support and quotation

If you require engineering samples, product quote, or technical support for your design, please connect with us through the contact form at murata.com.



[Technical support](#)



Note

1 Export Control

Restriction of weapons of mass destruction and conventional weapons

Murata has established and implemented a fundamental policy regarding Security Export Control to comply with all applicable export control laws and regulations of each country where Murata operates. We are committed to follow this policy. We respectfully request our valued customers' understanding and cooperation for the following.

For customers outside Japan:

Murata requests customers to ensure that no Murata products are used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or otherwise contribution to Weapons of Mass Destruction (nuclear, chemical or biological weapons or missiles), conventional weapons, or items specially designed for them.

For customers in Japan:

For products which are controlled items subject to the "Foreign Exchange and Foreign Trade Law" of Japan, the export license specified by the law is required for export.

2 Please contact our sales representatives or product engineers before using the products in this brochure for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.

- ① Aircraft equipment
- ② Undersea equipment
- ③ Medical equipment
- ④ Traffic signal equipment
- ⑤ Data-processing equipment
- ⑥ Aerospace equipment
- ⑦ Power plant equipment
- ⑧ Transportation equipment (vehicles, trains, ships, etc.)
- ⑨ Disaster prevention / crime prevention equipment
- ⑩ Application of similar complexity and/or reliability requirements to the applications listed above

3 Product specifications in this catalog are as of October 2020. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.

4 Please read rating and & CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.

5 This catalog has only typical specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.

6 Please note that unless otherwise specified, we shall assume no responsibility whatsoever for any conflict or dispute that may occur in connection with the effect of our and/or a third party's intellectual property rights and other related rights in consideration of your use of our products and/or information described or contained in our catalogs. In this connection, no representation shall be made to the effect that any third parties are authorized to use the rights mentioned above under licenses without our consent.

7 No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.