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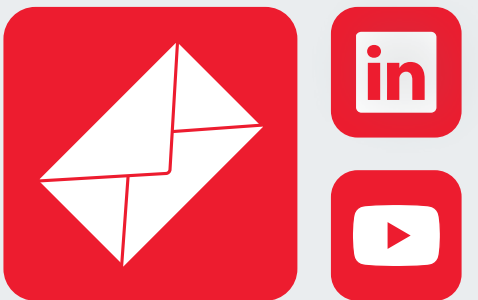
Application

Heat Pump Block Diagram

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Application guide

Heat Pump - Climate Control

Heat Pump Principle

A heat pump can use stored solar energy from rock, ground or water in order to heat a property.

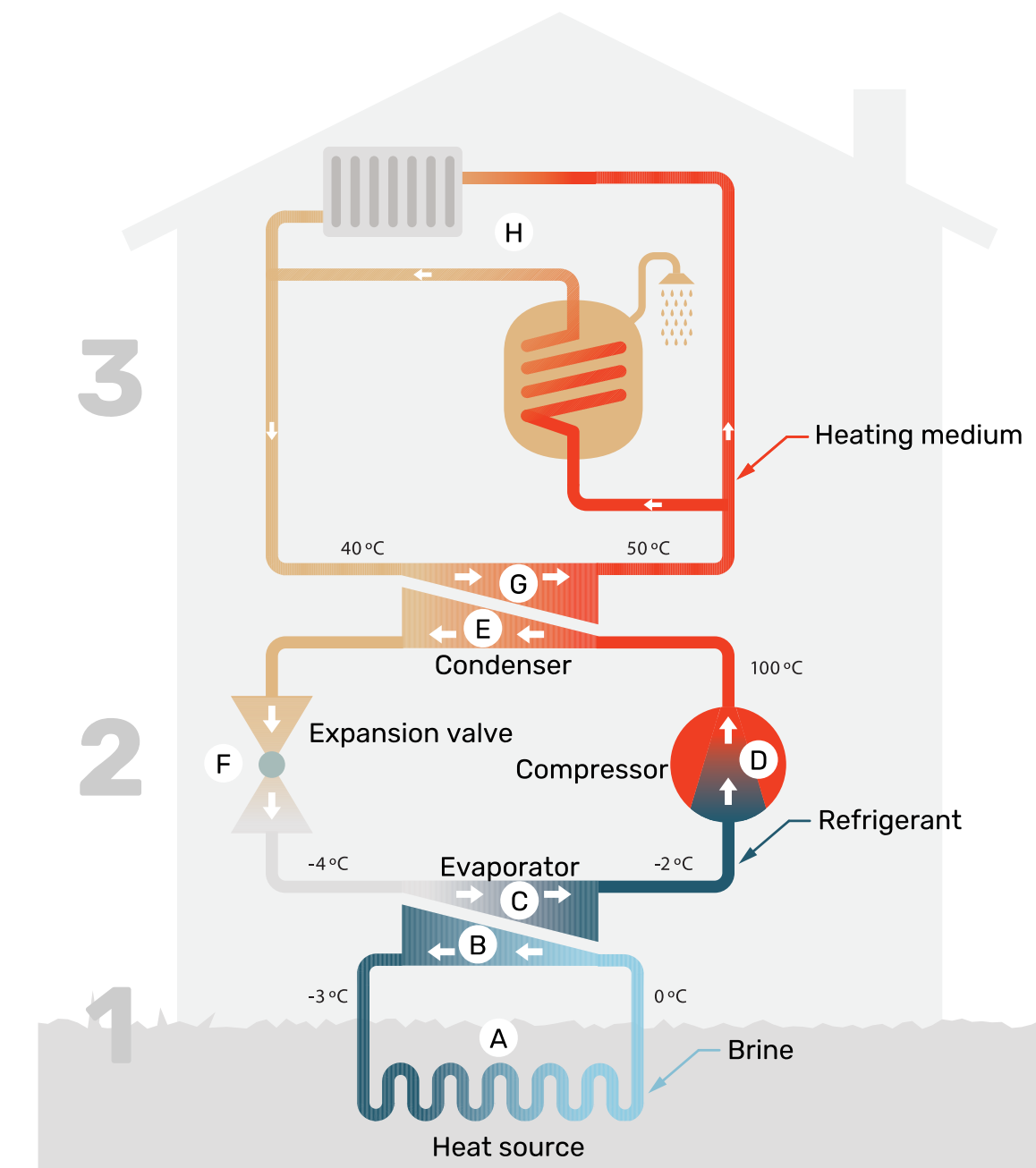
The conversion of energy stored in nature to property heating occurs in three different circuits. In the brine circuit, (1), free heat energy is retrieved from the surroundings and transported to the heat pump. The heat pump increases the retrieved heat's low temperature to a high temperature in the refrigerant circuit, (2). The heat is distributed around the house in the heating medium circuit, (3).

Brine circuit

- Ⓐ In a hose, collector, an anti-freeze liquid, brine, circulates from the heat pump out to the heat source (rock/ground/lake). The energy from the heat source is stored by it heating the brine a few degrees, from about -3°C to about 0°C .
- Ⓑ The collector then routes the brine to the heat pump's evaporator. Here, the brine releases heat energy and the temperature drops a few degrees. The liquid then returns to the heat source to retrieve energy again.

Refrigerant circuit

- Ⓒ Another liquid circulates in a closed system in the heat pump, a refrigerant, which also passes the evaporator. The refrigerant has a very low boiling point. In the evaporator the refrigerant receives the heat energy from the brine and starts to boil.
- Ⓓ The gas that is produced during boiling is routed into an electrically powered compressor. When the gas is compressed, the pressure increases and the gas's temperature increases considerably, from approx. 5°C to approx. 100°C .
- Ⓔ From the compressor, gas is forced into a heat exchanger, condenser, where it releases heat energy to the heating system in the house, whereupon the gas is cooled and condenses to a liquid form again.
- Ⓕ As the pressure is still high, the refrigerant can pass an expansion valve, where the pressure drops so that



the refrigerant returns to its original temperature. The refrigerant has now completed a full cycle. It is routed to the evaporator again and the process is repeated.

Heat medium circuit

- Ⓖ The heating energy that the refrigerant releases in the condenser is retrieved by the heat pump's boiler section.
- Ⓗ The heating medium circulates in a closed system and transports the heated water's heat energy to the house water heater and radiators/heating coils.

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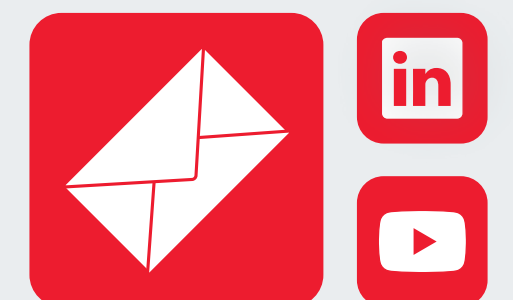
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Heat Pump Market Overview

A rapidly evolving market key to future sustainability

Heat pumps are perceived by many experts as a pivotal element in increasing the sustainability of a building's climate systems. In recent years, numerous governments globally have opted to directly incentivize consumer uptake, aiding uptake and market growth. In 2022, the market saw a sizeable growth of 11%, representing back-to-back years of double-digit growth.

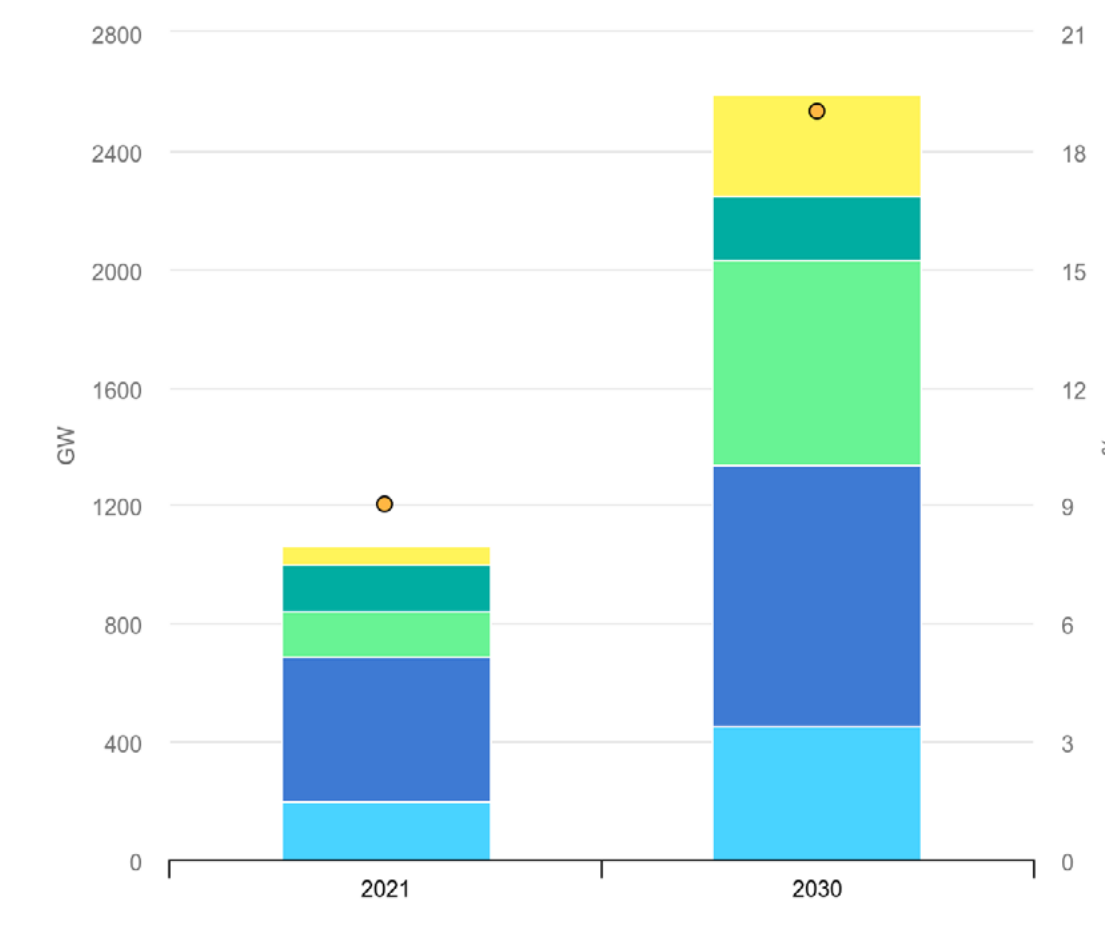
The market expansion is expected to continue despite the challenging global economy, with strong growth projected for the foreseeable future. The International Energy Agency (IEA) estimates that annual sales of heat pumps in the EU could potentially surge to 7 million by 2030, compared to 2 million in 2021.

Increasing Sustainability and Market Distribution

In terms of reducing global carbon dioxide (CO₂) emissions, the IEA estimates heat pumps have the potential to reduce CO₂ output by at least 500 million

tonnes in 2030 – this is equivalent to the annual CO₂ emissions of all cars in Europe today. According to the IEA, heat pumps fulfilled 9% of space heating demand in 2021, and this percentage is expected to reach 19% by 2030. This signifies a need for an additional thermal energy capacity of approximately 1,530 GW from heat pumps.

In terms of deployed heating capacity, North America is currently leading the market. Gas furnace sales were surpassed by heat pumps in the United States in 2022, following years of similar growth, with most residential units using air-to-air models in ducted air systems. In Europe and Asia, heat pumps are seeing rapid expansion. Over 60% of buildings in Norway have heat pumps, while Sweden and Finland exceed 40%, challenging the idea that heat pumps are not viable in cold climates and reinforcing consumer confidence in the technology.



Europe North America China Japan and Korea
Rest of world Share of heat pumps in global heating demand

 www.iea.org [Link](#)

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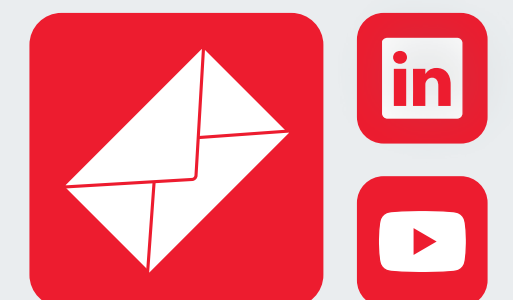
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Heating Up Trends

Exploring the trends within the heat pump and climate control markets

While heat pump technology has seen exceptional success in the past few years, the market needs continued widespread backing and technological innovation if rapid adoption is to continue.

Increasing Consumer Support – More than 30 countries, representing 70% of the world’s heating demand, currently offer financial incentives designed to reduce the entry barrier for heat pump for consumers. These help to level the total ownership costs between traditional gas and heat pump solutions. But further support can help the market’s continued expansion. Poland has introduced incentives aimed at low-income houses, while Canada offers reductions for higher efficiency systems, further helping uptake.

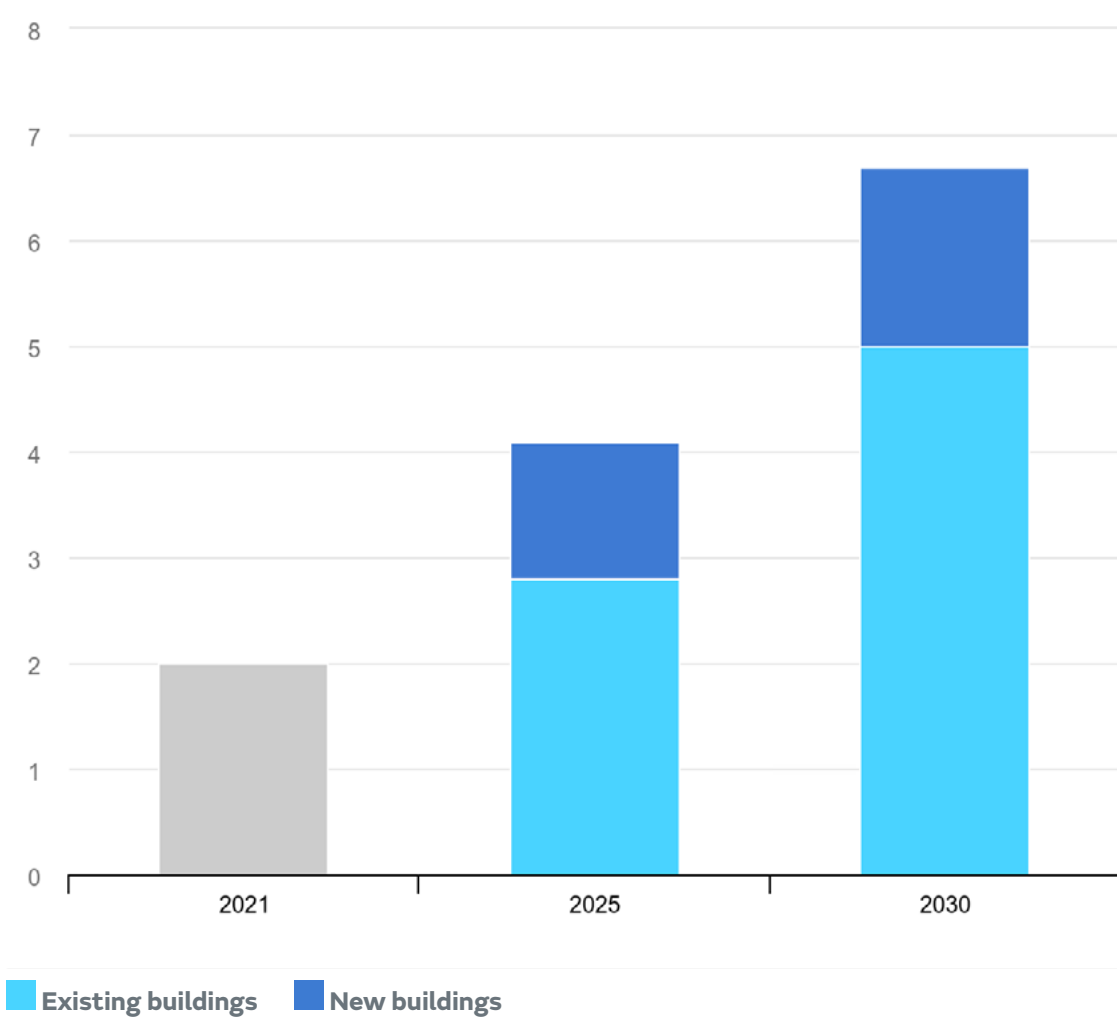
Creating Industrial Opportunities – With the continuous improvement of heat pump performance, an increasing number of opportunities for new industrial applications will arise. At present, heat pump units of larger sizes can produce heat with temperatures as high as 140-160°C, and through continuous innovation and enhanced designs, higher

temperatures can be attained. According to the IEA, the paper, food, and chemicals industries possess the most significant market prospects in the near term, as approximately 30% of their collective heating requirements can be met by industrial heat pumps. Within Europe alone, an estimated 15 GW of heat pumps could potentially be installed in approximately 3,000 facilities across these sectors, all of which have been significantly affected by recent spikes in natural gas prices.

Enhancement Functionality – One approach manufacturers can adopt to make heat pump systems more appealing to end users is by incorporating smart functionality enabled by wireless connectivity. By maintaining a continuous connection, users can conveniently control the heating of their home from devices like a smartphone. This feature enables consumers to preheat their houses before returning home or establish automated routines that lower the heating when everyone is away. Enhancing heat pump connectivity can also contribute to improving retrofitting and system performance. Intelligent wirelessly



connected thermostats can significantly reduce install time versus wired equivalents, while additional temperature sensors can help implement independent room climate control, increasing system efficiency.



 www.iea.org: [Link](#)

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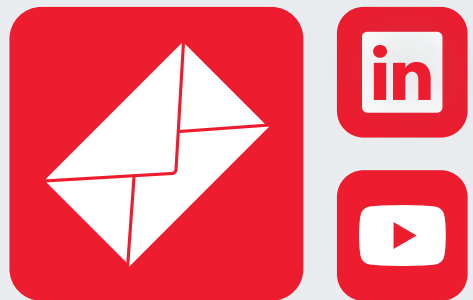
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Increasing Performance and Reducing Costs

Improving performance while lowering initial ownership costs requires high-performance and cost-effective solutions

Compared to traditional gas boilers, the initial capital expenditure is seen as the biggest barrier to heat pump adoption. Although existing heat pumps already provide comparable or lower total ownership costs, the initial investment cost of the equipment remains higher. While the incentives provided in numerous countries can aid in mitigating this issue, manufacturers can also achieve a competitive market advantage and boost sales in non-incentivized areas by reducing the cost of heat pumps through upgrading the underlying components.

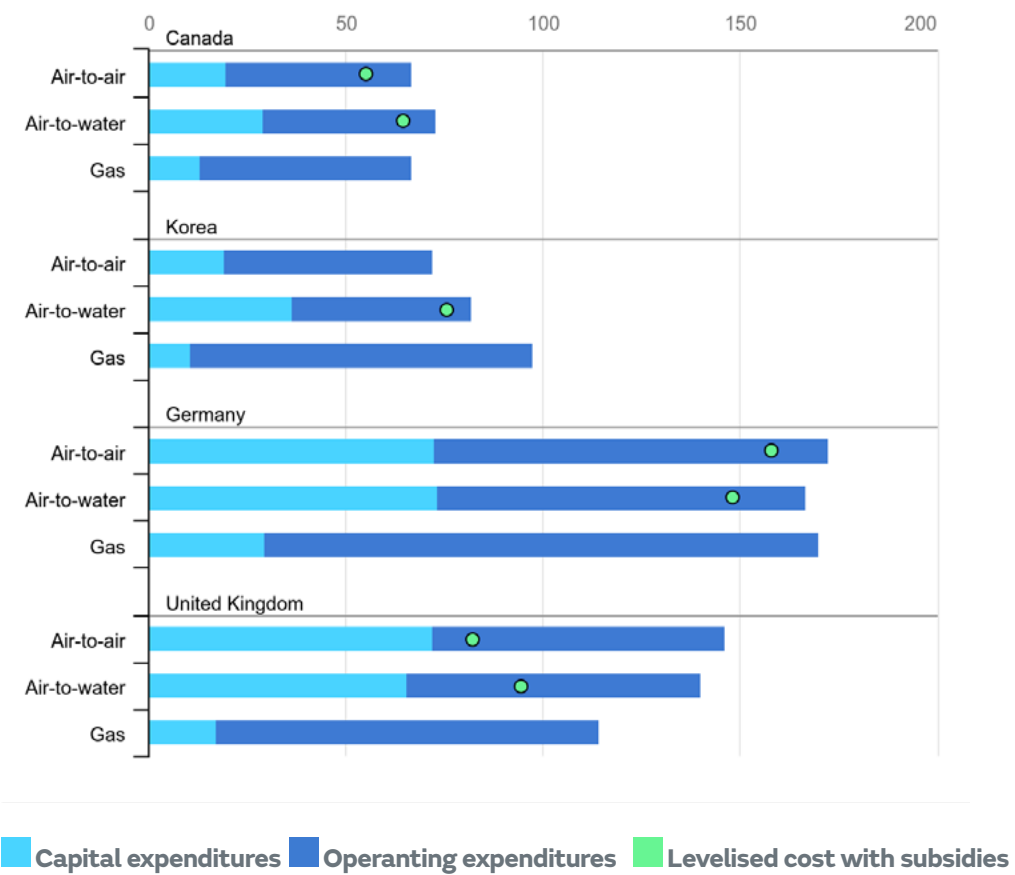
For manufacturers of heat pump equipment, the ever-increasing global demand can also create supply chain vulnerabilities. Due to the necessity of various crucial components for manufacturing units and meeting market demands for spare parts, it is imperative for heat pump OEMs to establish partnerships with high-quality component manufacturers who are backed by

extensive and dependable manufacturing facilities. Both industrial and consumer applications are also demanding an increase in functionality alongside a reduction in initial investment. Higher output temperatures, elevated efficiency and greater connectivity are all key elements heat pump OEMs need to explore and develop further in order to remain competitive in this rapidly evolving market.

Heat pump manufacturers can meet these challenges head on with correct component selection, able to alleviate or overcome many existing technical barriers. Murata offers an expansive selection of products that are specifically engineered to support manufacturers in the creation of cost-effective, high-performance solutions, thereby promoting the advancement of heat pump climate systems. Furthermore, Murata's solutions are thoroughly tested, trusted, and inherently robust. From thermistors and EMI Filters to connectivity



modules and supporting sensors, designers of heat pump systems can be sure Murata solutions will provide reliable performance for years to come.



www.iea.org: [Link](#)

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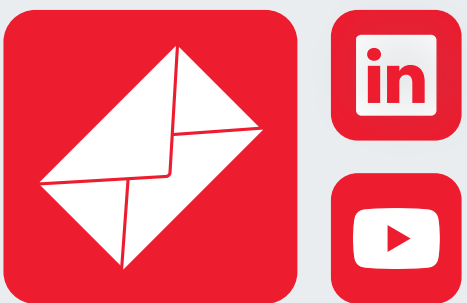
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Murata & Sustainability

The move towards carbon neutral starts at manufacturing

‘Keihakutansho’, which means ‘light, thin, short and small’ in Japanese, has been a core principle of Murata since our inception in 1944. It is the very embodiment of efficiency and sits alongside our company slogan ‘Innovator in Electronics’. These philosophies apply to all our products, from Isolated DC-DC Converters for Gate Drive, Extensive range of Passive components, IOT-Connectivity modules and more have been developed to fulfill heat pump design requirements.

At Murata, we are committed to sustainability. Our efforts go beyond supporting the automotive industry’s aim of achieving carbon neutrality with our wide range of highly optimized products. Aligning with the United Nations Sustainability and Development Goals (SDGs), we are committed across all of our solutions and business groups to reduce material waste and conserve power through miniaturization and heightened efficiency.

 www.corporate.murata.com: [Link](#) [Link2](#) [Link3](#)

Murata encompasses many climate change and sustainability initiatives, partnerships and working groups into its core business practices. From our executive membership in the Japan Climate Leaders’ Partnership (JCLP) to our continuous responses to the Carbon Disclosure Project (CDP) climate change questionnaires, we are always exploring how our business and products can help the world become more sustainable. With such scrutiny applied to our own working practices, our customers can be sure that our solutions lead the way in terms of efficiency and design optimization.

Standalone Fact: In December 2020, Murata joined RE100, which aims to change the power used in business activities to 100% renewable electricity by 2050. Kanazu Murata Manufacturing is the first of Murata’s facilities to achieve “100% renewable energy” and the facility includes an innovative carport with 383kW solar panels on the roof.

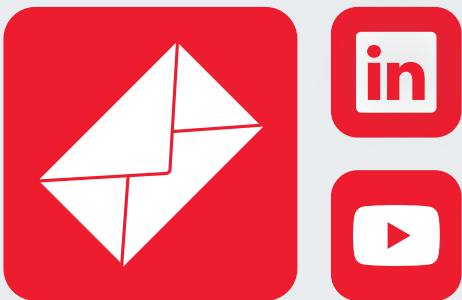


Kanazu Murata Manufacturing



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Content Guide

In this application guide, we will take a closer look at a range of Murata's latest advancements that are perfectly suited for the latest heat pump and climate control systems. Each section with this guide has been designed to provide a detailed look at our products' standout features, exploring how their high-performance, reliability, and cost-effective operation can help to elevate your next design.

We have included within this guide a wide range of cost-effective, reliable and high-performance solutions, ranging from compact passive components like capacitors, EMI filters and inductors, through to highly efficient Charge Pump and Isolated DC-DC converters. Also included are our state-of-the-art short and long range communication modules which support the latest protocols and enable designers to build smarter heat pump and climate control solutions.

To learn more about Murata's comprehensive range of solutions or to get in touch with your local representative, please visit our website [here](#).



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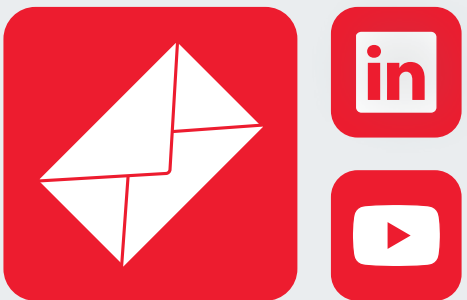
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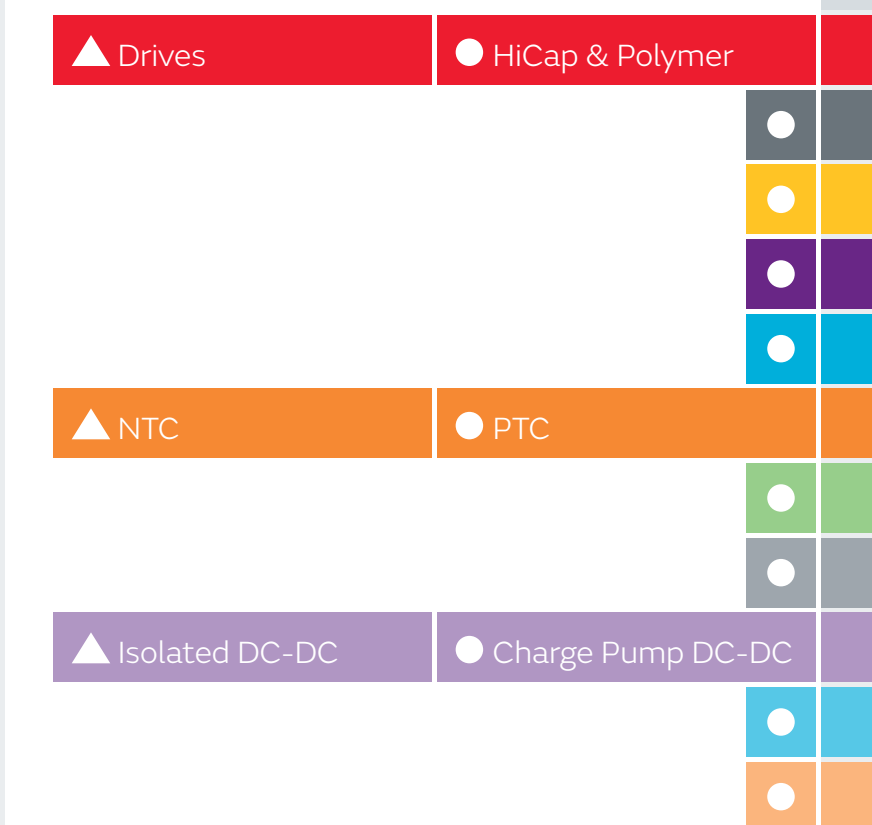
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Block diagram



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Capacitors

C1. Polymer Capacitors (ECAS)

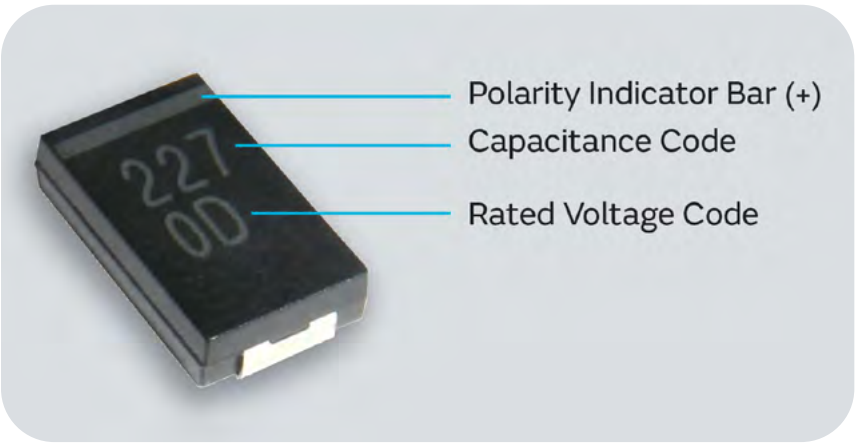
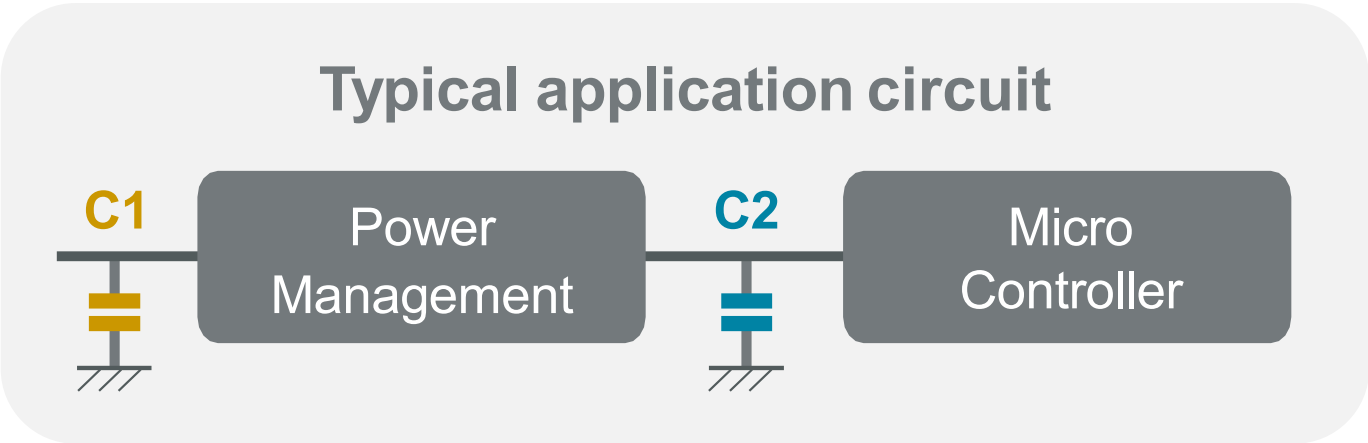
Bulk capacitor to compensate voltage drop, due to sudden high load. Polymer has no DC Bias and is stable over temperature range.

Murata’s polymer capacitor has the feature of low ESR, low impedance, and large scale. Furthermore, there is no DC bias characteristic of capacitance, and since temperature characteristics are also stable, it excels in the Ripple absorption, smoothness, and the transient response performance.

- Features**
- High capacitance
 - ESR: 4.5 to 40 mΩ
 - No acoustic noise issue
 - Stable capacitance for DC bias and temperature



- Capacitors
- HiCap & Polymer
- ▲ Drives



C2. MLCC (GRM HICAPS)

Remove ripple and spikes. Ceramic capacitor used due to low impedance.

Murata offers the No. 1 most abundant lineup in the industry, responding to all possible needs, and proposing ideal solutions.

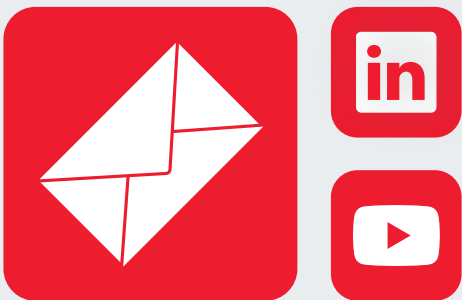
Continuing to evolve as the world’s No.1 manufacturer of ceramic capacitor.



- Polymer Aluminum Capacitors >
- Ceramic Capacitors >

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Capacitors

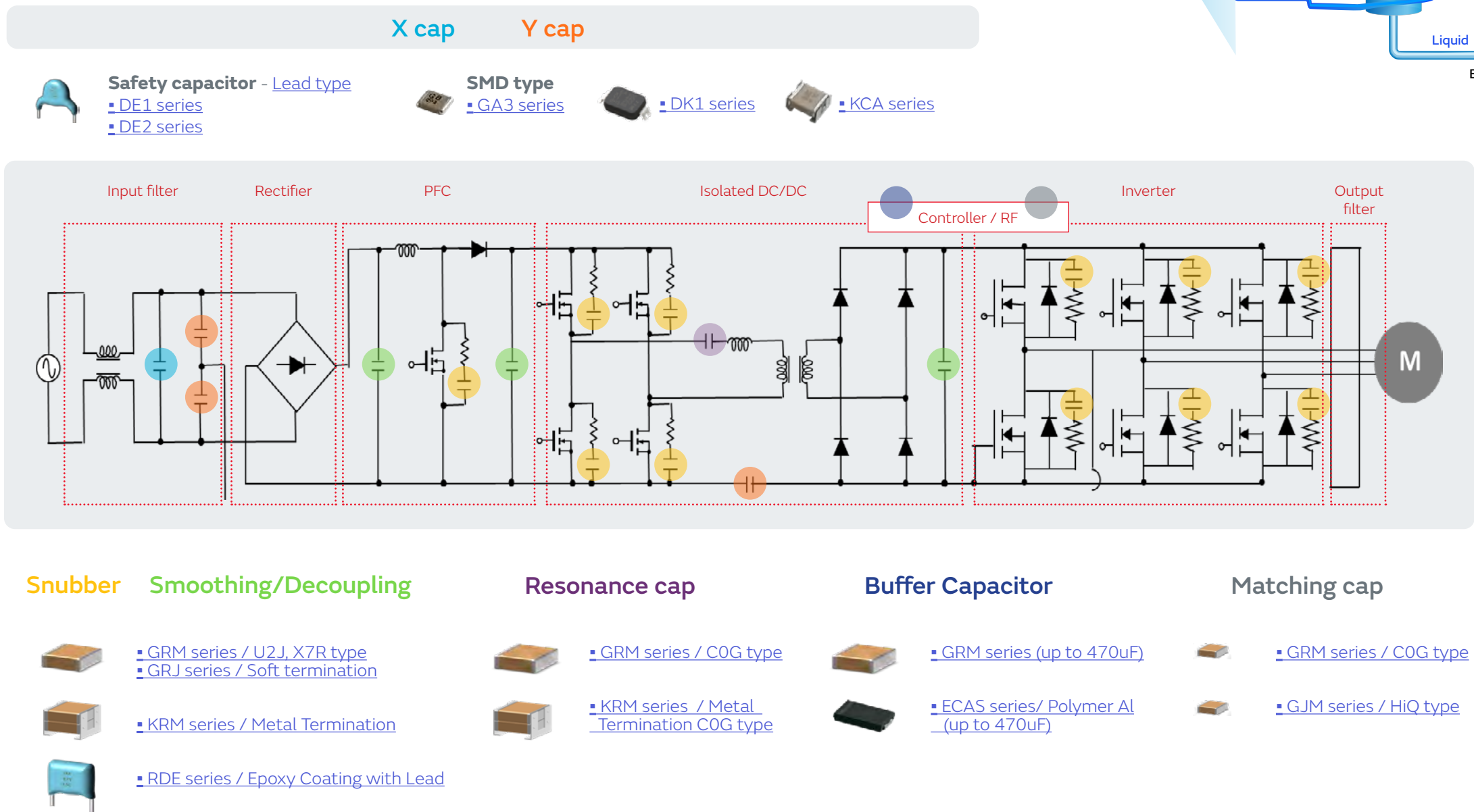
Variable Frequency Drives

Murata provides an abundant capacitor product line to meet the needs of various functional circuits.

Variable Frequency Drives are a key part to improve heat pump efficiency:

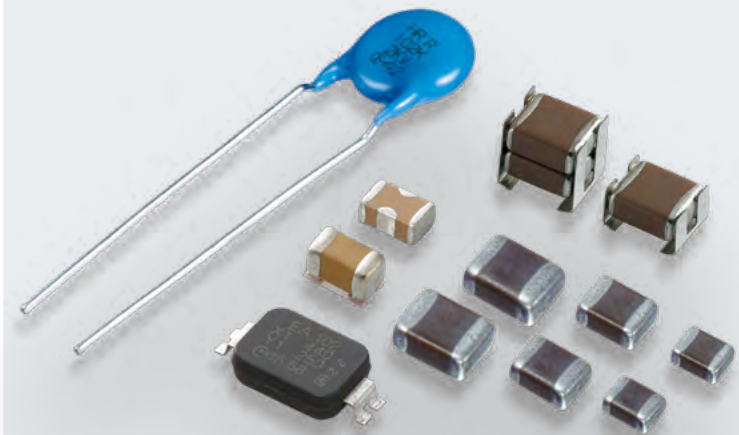
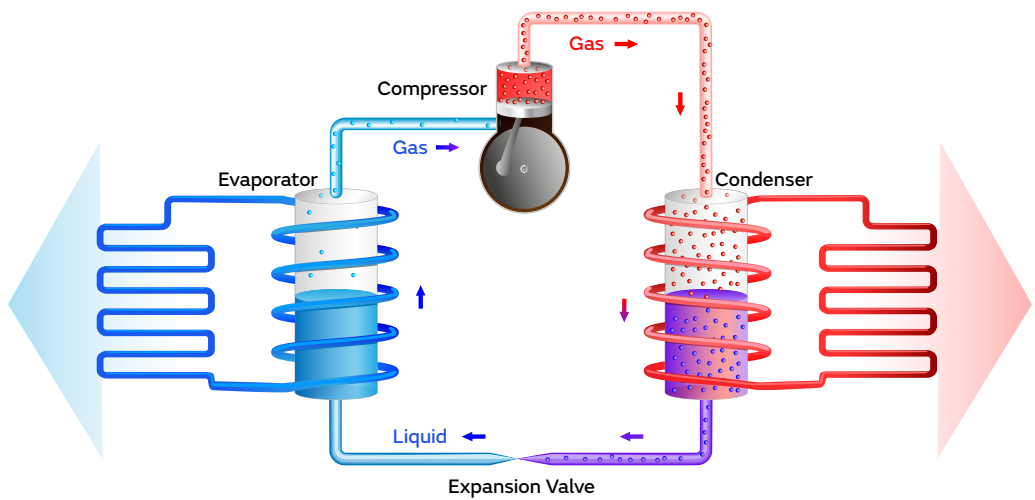
- Combined Compressor & Inverter
- Control motor rotation speed by changing frequency, depending on the temperature
- That improves electrical efficiency

Full bridge LLC



Features

- Ultra-small capacitors allow for ultra-compact design products
- High-quality capacitors make your products highly reliable
- Excellent electrical characteristics of capacitors can increase energy conversion efficiency and cope with changing environmental conditions



Capacitors

- HiCap & Polymer
- ▲ Drives

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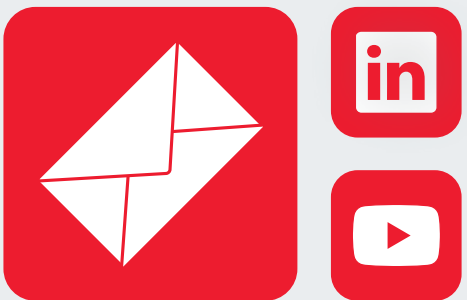
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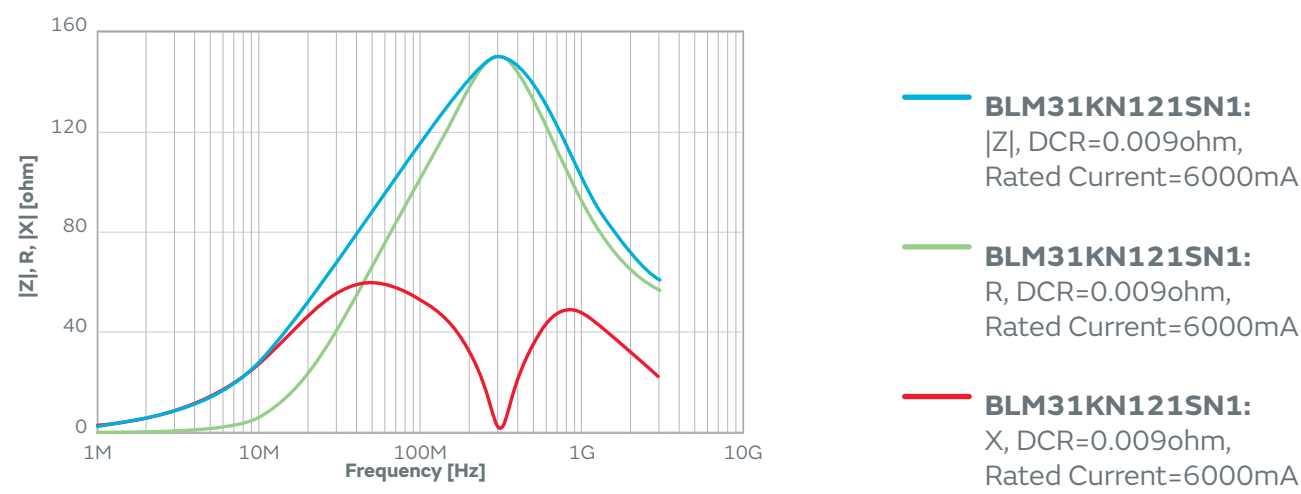
Ferrites Beads

Ferrite beads are passive electronic components that can suppress high frequency noise and transform noise to heat.

Features

- Miniaturized
- High rated current & low DCR
- Ideal for noise suppression

Technical details of [BLM31KN121SN1](#)



Block	Sub-Block	EMI Filters	Function	Product Feature
Inside Main Equipment	DC/DC	DLW, PLT	To supress power line common mode noise	High current capability
	HMI	DLW, DLM	To supress signal line common mode noise	Improve signal integrity in high speed interfaces
Outdoor machine	Sensor	BLM/BLE	Noise suppression of differential noise in signal and power lines	High current, high impedance capability & good saturation
	Heating Compressor Fan	PLT	To supress power line common mode noise	High current capability
Peripherals indoor	Sensor	BLM	High current, high impedance capability and good saturation	High current, high impedance capability & good saturation
	Gateway	DLW, DLM	To supress signal line common mode noise	Improve signal integrity in high speed interfaces
	Thermostat	BLM	High current, high impedance capability and good saturation	High current, high impedance capability & good saturation

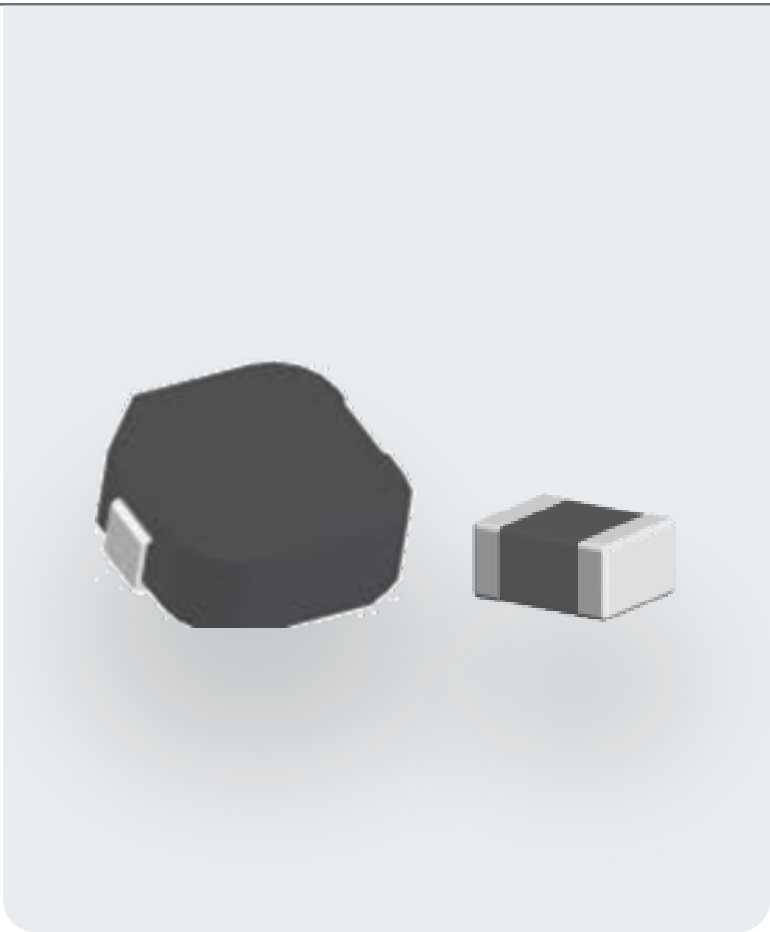
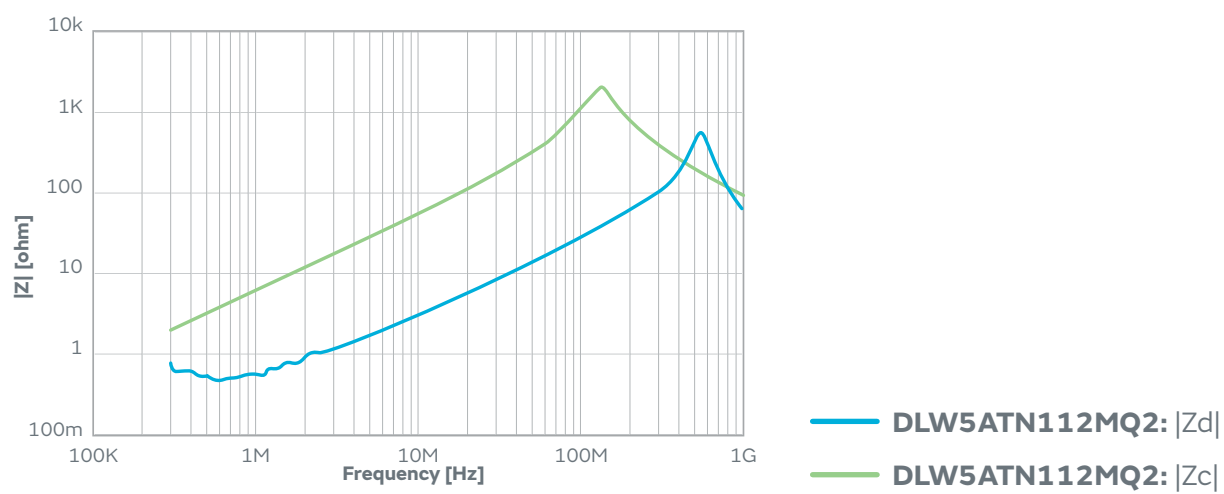
Common Mode Choke Coils

Common Mode Choke Coils are made up of two conduction wires wrapped around a single core in opposite direction. Its purpose is to reduce common mode noise which needs to be suppressed in differential transmission lines.

Features

- High rated current
- High impedance at low frequency
- Broad band impedance

Technical details of [DLW5ATN112MQ2](#)

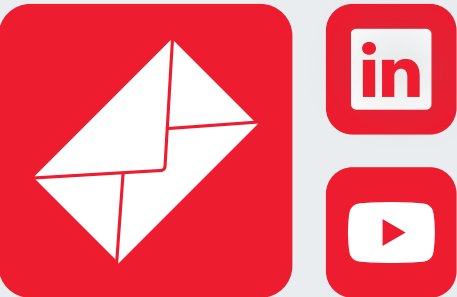


- Ferrite Beads >
- Common Mode Choke Coils >

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Inductors

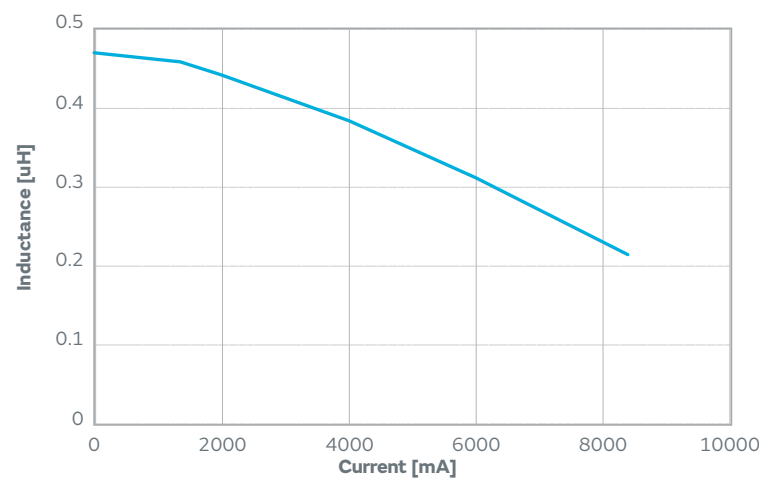
Power

A power inductor is a coil of wire wound around a magnetic core. It has the purpose to filter electrical noise, as a choke for low frequency or be used as energy storage in switch regulators to provide stable and voltage converted DC power.

Features

- High Isat
- Low DCR
- Good temperature characteristics

Technical details of [DFE252010P-R47M](#)



RF

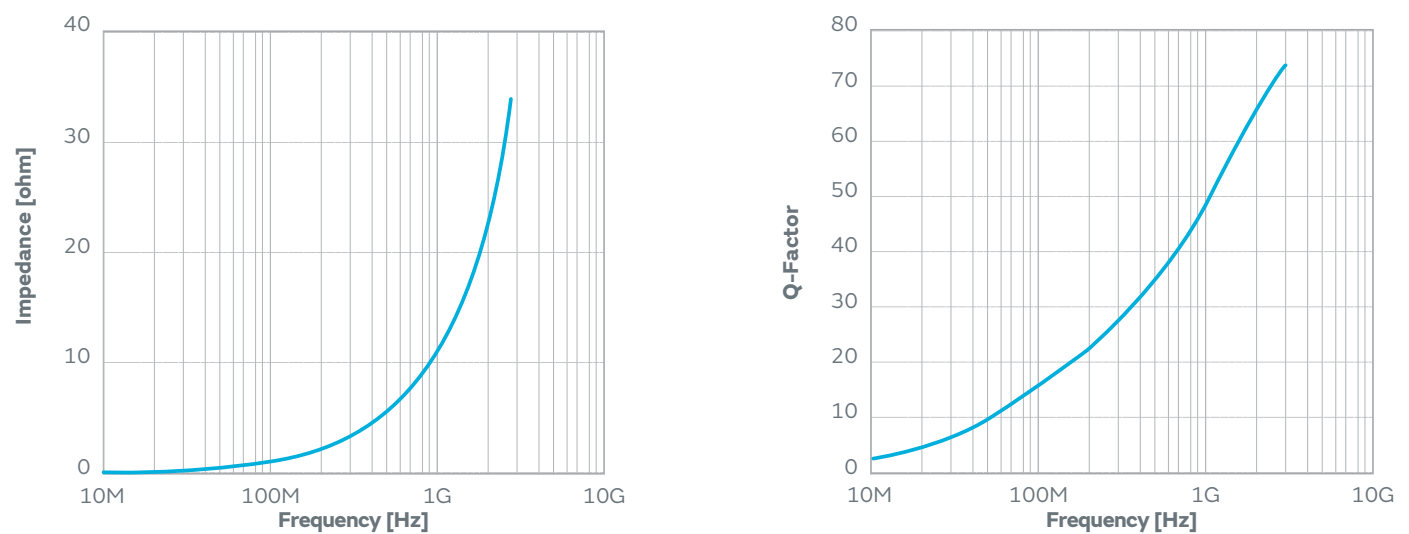
RF inductors are usually constructed with a coil of wire wound mostly around a non-magnetic core*. It has the purpose to filter out unwanted high frequency noise, maintain signal integrity in RF circuits and provide impedance matching in RF systems.

Features

- Miniaturized
- Low DCR
- High Q value

* Linup also features compact film type and multilayer RF inductors

Technical details of [LQW03AW1N8C00](#)



Block	Sub-Block	Power Inductors	RF Inductors	Function	Product Feature
Inside Main Equipment	DC/DC	DEM, DFE, MDH, LQH		Energy storage for switch regulator for Low loss and high efficiency	High current and wide inductance range
	Connectivity wireless		LQP, LQW	Impedance matching in RF circuits with low losses and high signal integrity	High impedance, high Q, low Rdc & tight tolerance
	Connectivity wired	LQM		Choke inductor	Smaller case size
Outdoor machine	Sensor	LQM		Choke inductor	Smaller case size
	Heating Compressor Fan	DEM		Energy storage for switch regulator for Low loss and high efficiency	High current and low Rdc
Peripherals indoor	Sensor	LQM		Choke inductor	Smaller case size
	Thermostat	LQH		Choke inductor	

Power Inductor >

RF Inductor >

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Micro Batteries

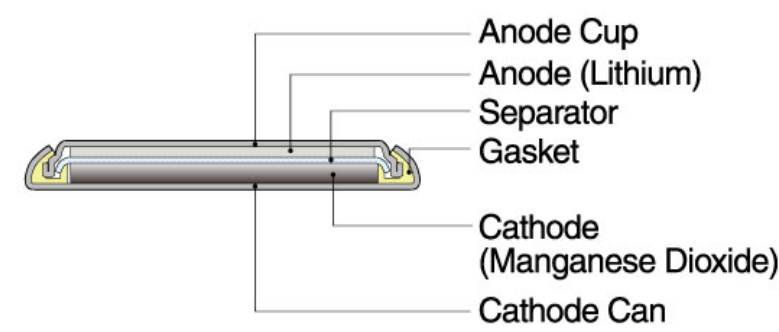
Coin Manganese Dioxide Lithium Batteries (CR)

Murata supplies a wide range of micro batteries with high performance and reliability, taking advantage of state-of-the-art design and production technologies.

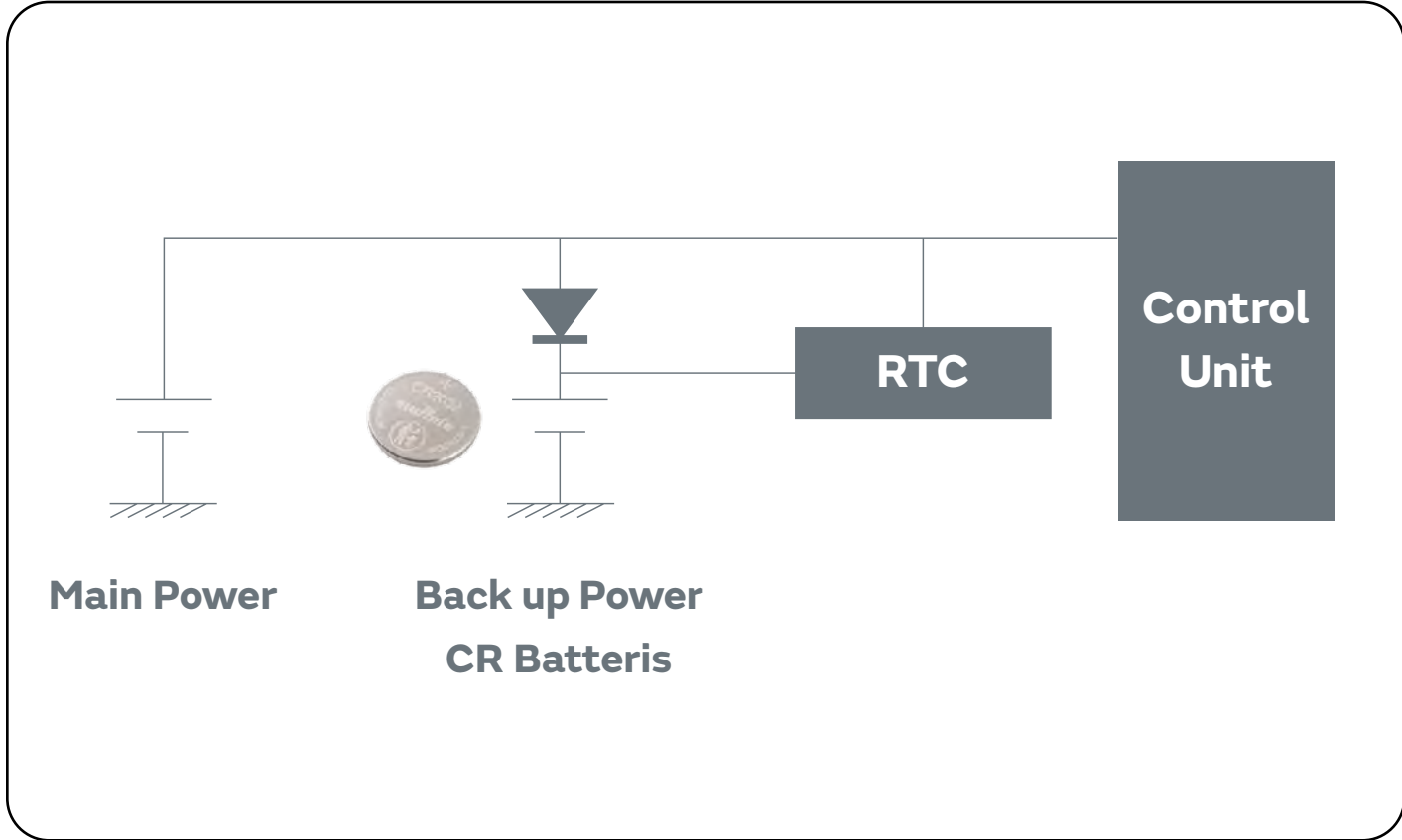
The Extended Temperature lithium coin batteries are designed mainly for automotive devices and outdoor IoT systems, including smart meters and FA control systems.

Model	CR2477X	CR2032W
Nominal Capacity	1000mAh	210mAh
Size Diameter (mm) Height (mm)	24.5mm 7.7mm	20.0mm 3.2mm
Operating temperature	-40°C to +85°C	-40°C to +125°C
Recommended discharge current*	1mA or less	1mA or less

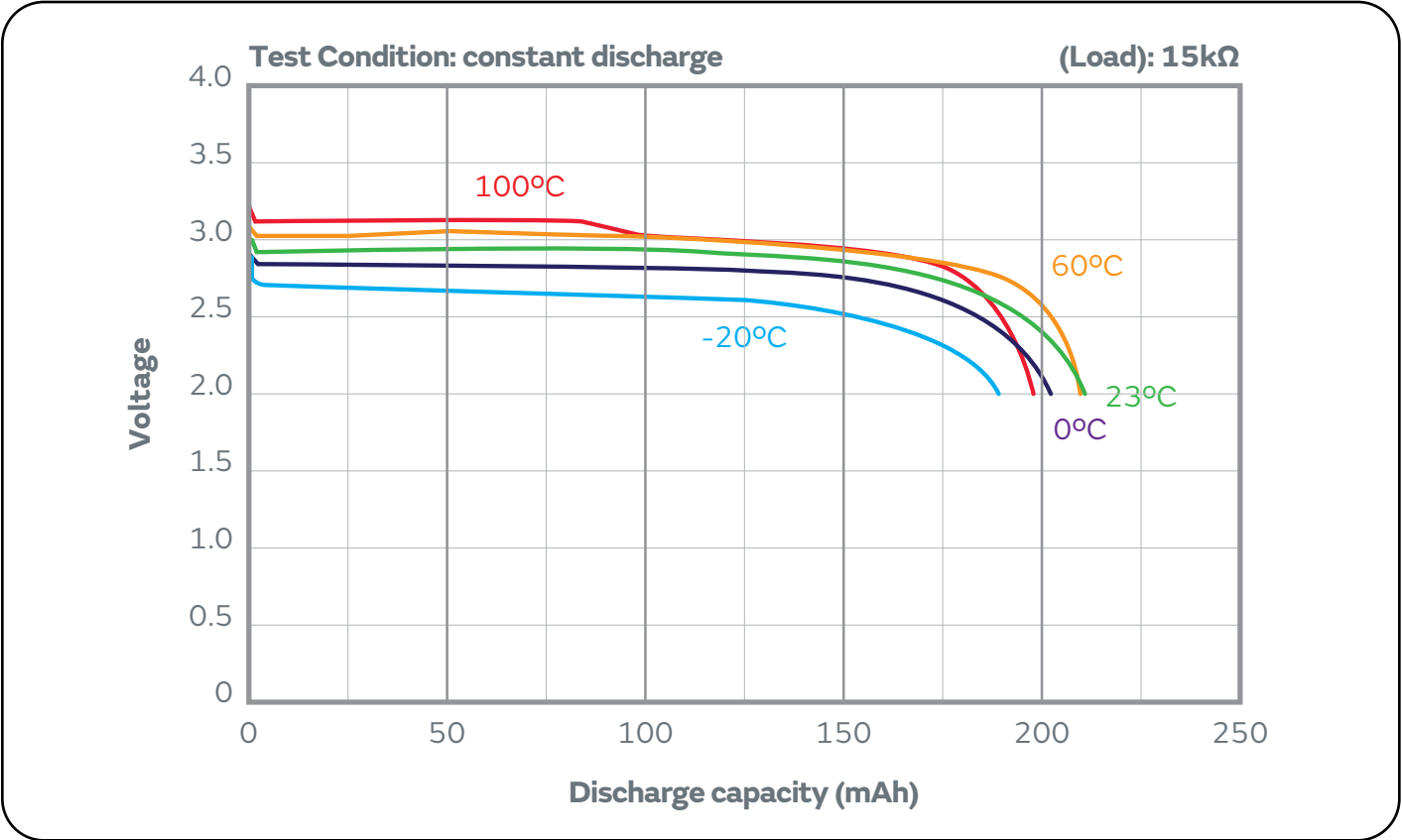
- Features
- Excellent Discharge Characteristics
 - Outstanding Temperature Characteristics
 - Low Leakage



Typical circuit



Discharge Characteristics: [CR2032W](#)



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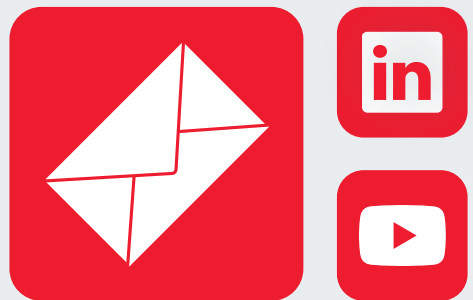
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Piezoelectric Quartz Crystal

Crystal is made of high-stability piezoelectric quartz crystal, functioning as a mechanical resonator.

Crystal can generate clock signals which are essential for ICs and LSIs to operate, achieving high stability, adjustment-free performance and miniaturization.

Murata's design contributes to:

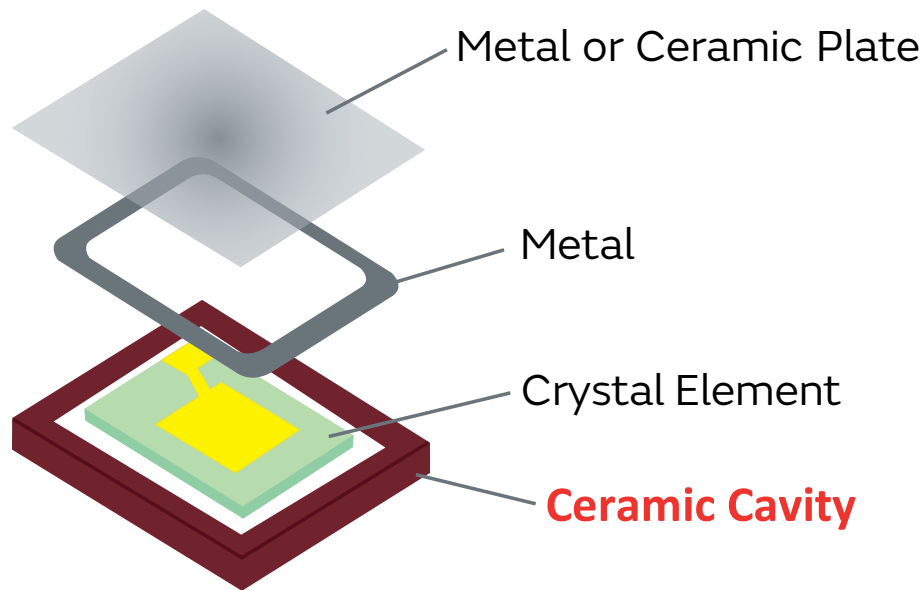
- Stable delivery
- Higher drive level resistance= Selectable for wider ICs
- No need for Pb-contained material

Features

- Frequency range: 16 to 50MHz
- Size: 2.0 x 1.6 mm
- IC matching service available [link](#)
- Industrial and Automotive grade
- Stable supply by using in-houseceramic plate production

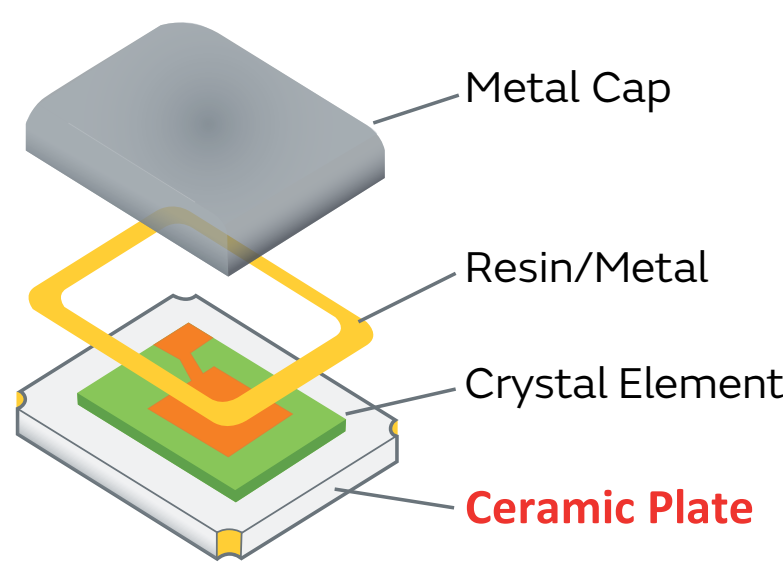


Conventional Crystal



Ceramic cavity plate designs used in conventional Crystal are both complex and expensive

Murata Crystal



The unique metal cap and planar ceramic plate construction has a proven track record, increases our production output and reduces costs

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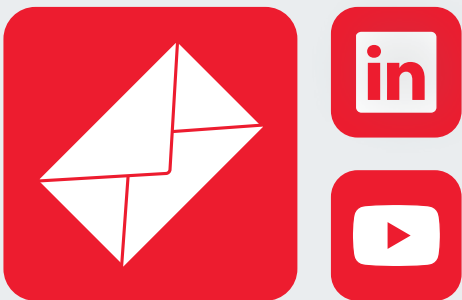
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- Heat Pump Block Diagram

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- EMI Filters
- Inductors
- Micro Batteries
- Timing Devices
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Thermistors

PTC

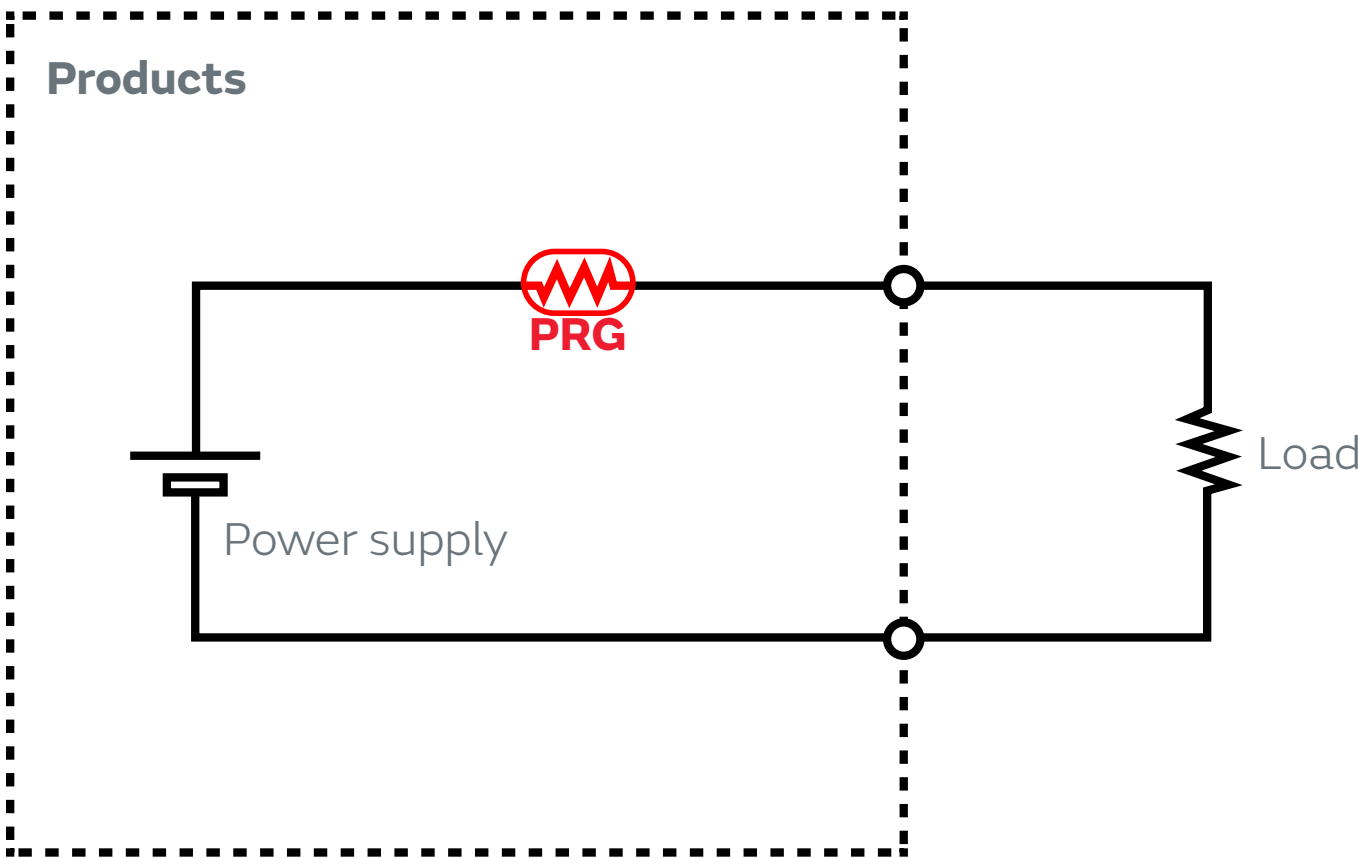
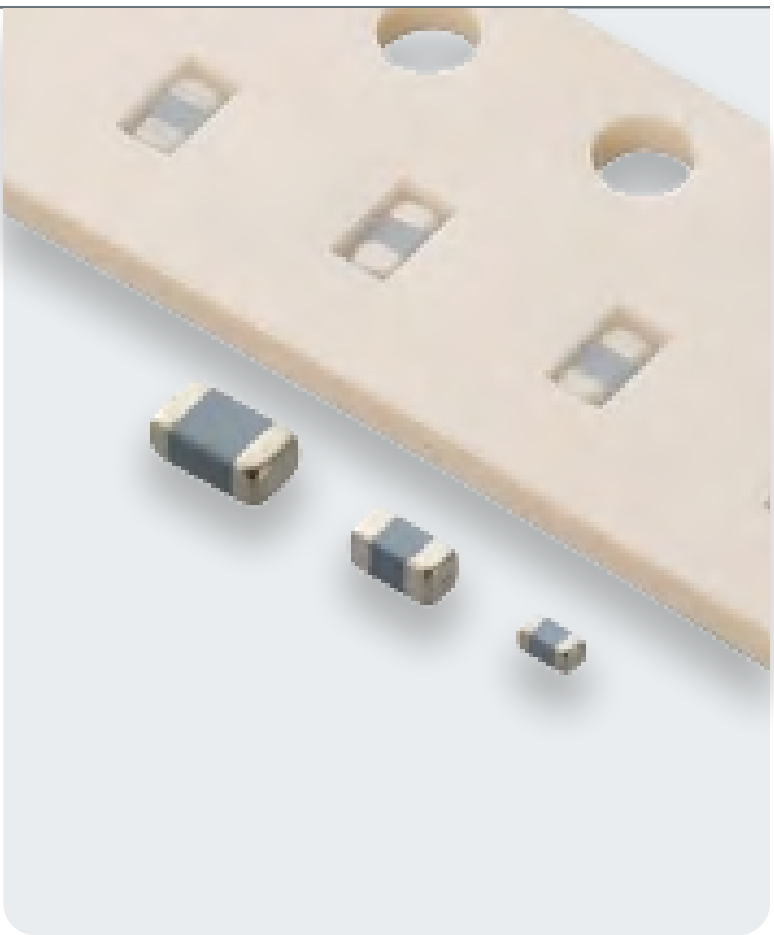
PTC thermistors for overcurrent protection (PRG series) features rapid operation to protect the circuit as an overcurrent is generated, for example due to a short circuit.

Use of ceramics material means high reliability and quick protection after short circuits, allowing the customer to make equipment safer and maintenance-free.

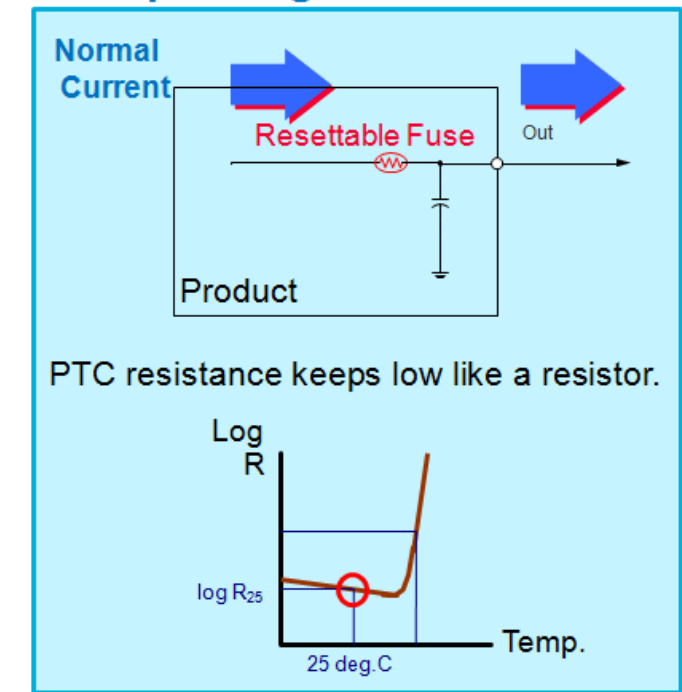
Compared with organic PTC elements and chip resistors having the same characteristics, the PRG series features higher withstand voltage and higher power capacity, making it possible to reduce the chip size. This helps the customer downsize equipment.

Features

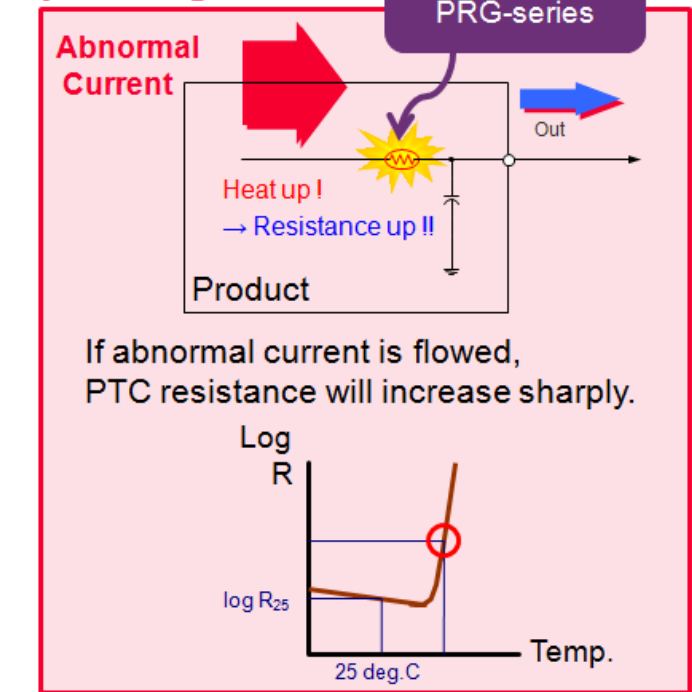
- High Reliability
- Low characteristics change after mounting and energization
- Fast time to trip
- Current 10 to 75mA
- Voltage up to 32V



Non-Operating Mode



Operating Mode



Thermistors

- PTC
- ▲ NTC

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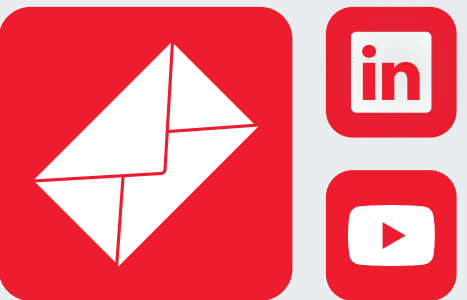
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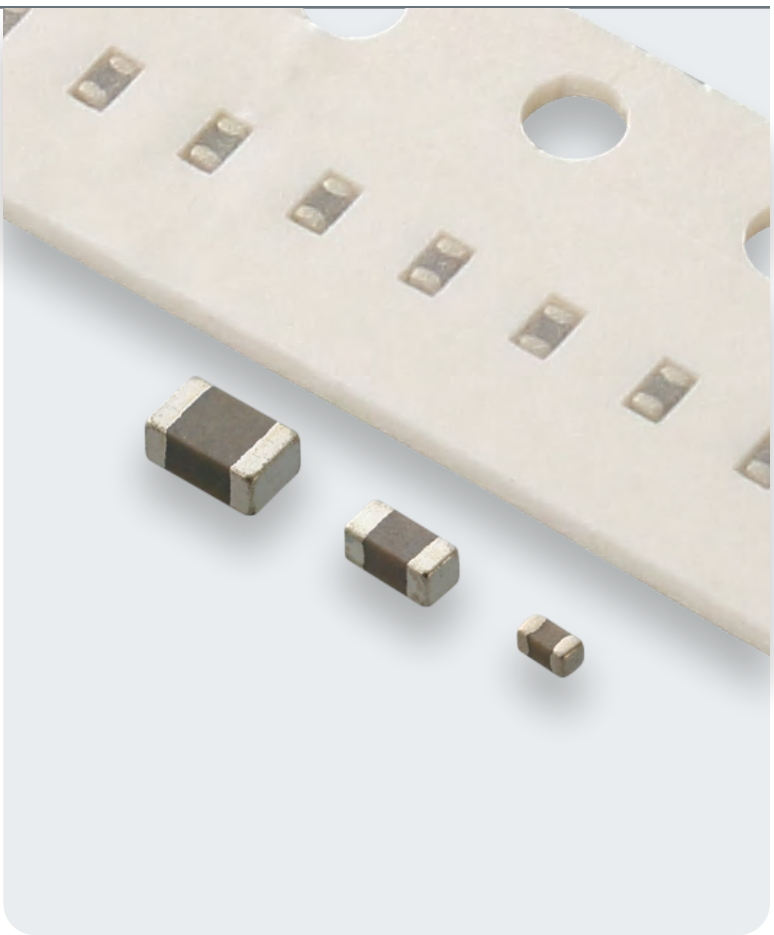
Thermistors

NTC

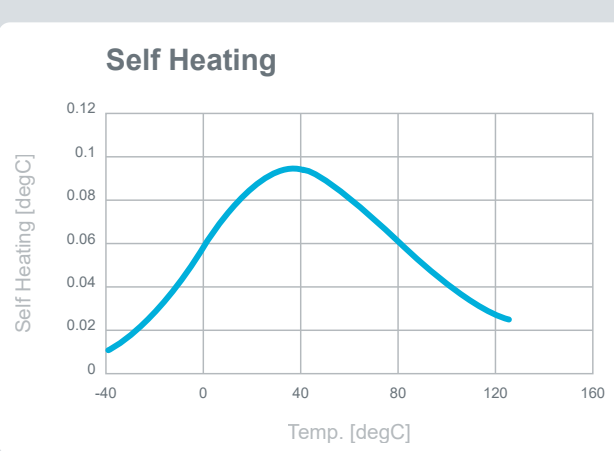
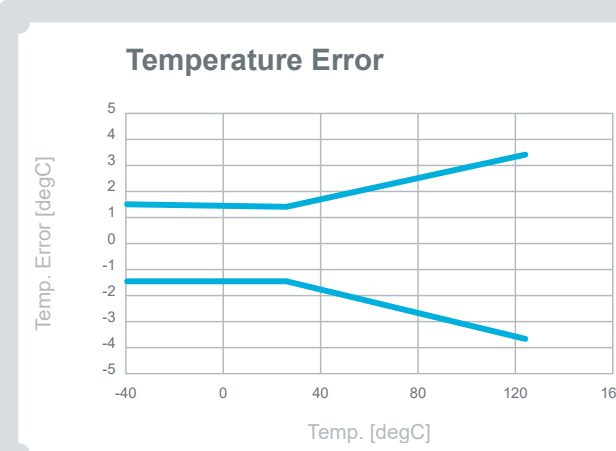
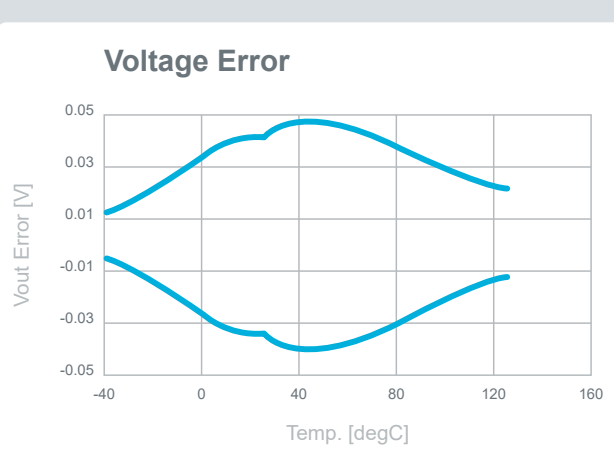
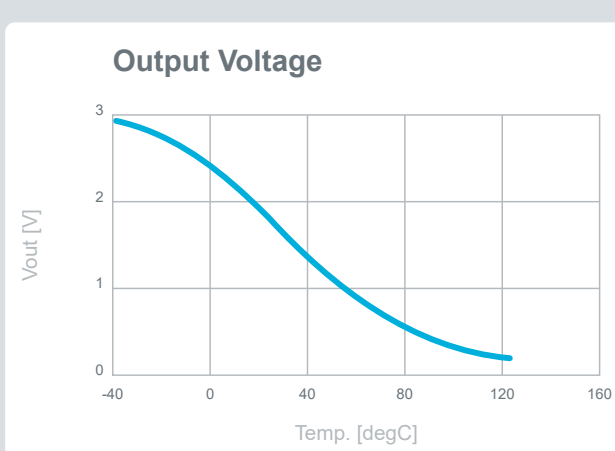
NTC thermistors are elements whose resistance falls with an increase in temperature and find use in applications such as temperature sensing, a critical element of heat pump and climate control design. Murata's NTC thermistors deliver excellent precision and thermal response and are available in a range of packaging designs. They ensure streamlined integration throughout climate control circuits and offer the required precision and durability to fulfill functions such as temperature feedback in refrigerant, evaporator, and condenser coils, as well as temperature compensation and measurement of both the external environment and internal components

Features

- Multiple sizes: 0603, 0402, 0201
- Available R25 tolerances: 5%, 2%, and 1%
- Murata's N°1 market share ensures a reliable supply
- Included in SimSurfing design tool



Example of Simulation data



Thermistors

- PTC
- NTC

Product search: [Link](#) Performance simulator: [Link](#)

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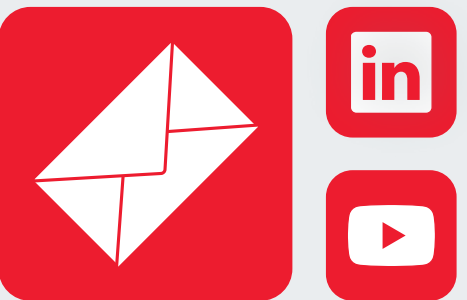
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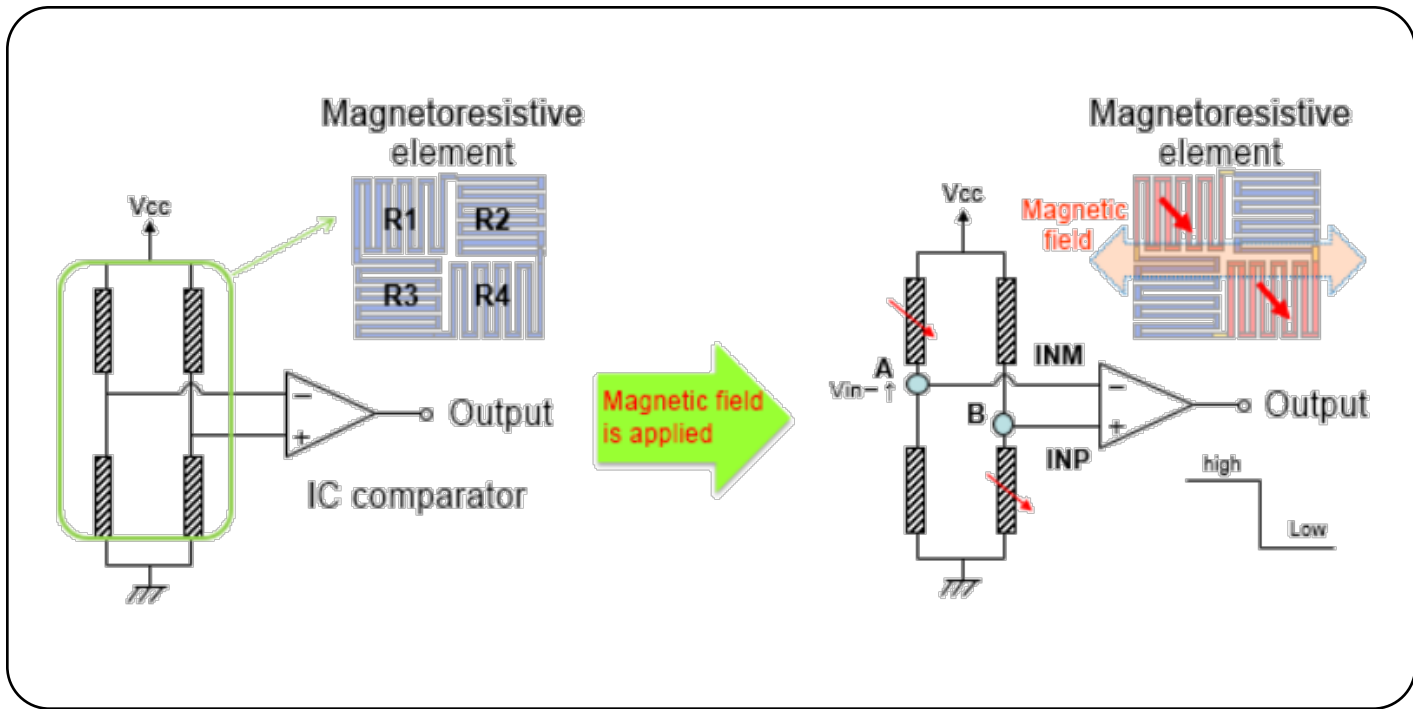
AMR Sensors (Magnetic Sensors)

Murata magnetic sensors use AMR elements whose resistance varies according to the strength or direction of the magnetic field. Combination with a magnet permits non-contact rotation detection or position detection. Magnetic switches have a built-in IC, based on the magnetic field strength, to provide High or Low digital output. Magnetic switches are widely used for cylinder position, rotation, and opening/closing.

Principle

When a magnetic field is applied, the resistance values drop for the magnetoresistive elements R1 and R4, and a potential difference occurs between midpoint A and midpoint B.

When the potential difference exceeds the specified setting value (threshold value), the sensor ON/OFF output is switched.



Features

- High sensitivity
- Low current consumption (3μA)
- Abundant variation (Package, Sensitivity, Supply voltage)
- Cost effective

Application

- Opening and closing switch
- Rotational sensor

Appearance

- MRMS2** (2.8 x 2.9 x 1.1 mm)
- MRMS5** (1.45 x 1.45 x 0.55 mm)

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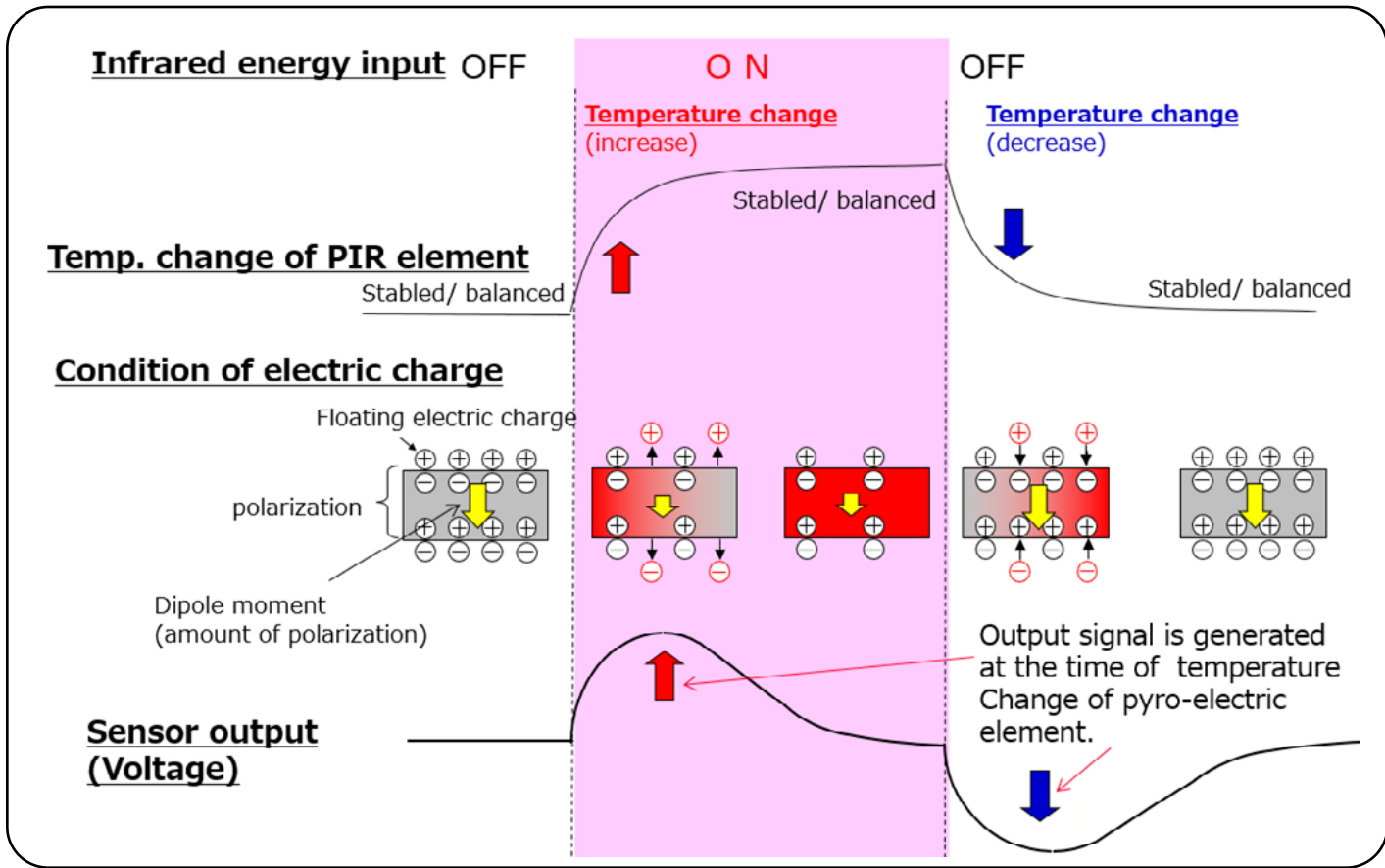
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PIR Sensor

Pyroelectric infrared sensors use the pyroelectric effect of pyroelectric ceramics, a type of piezo-electric ceramics, as a principle of infrared detection. Murata pyroelectric infrared sensors feature minimal variation thanks to the application of unique pyroelectric ceramic technologies cultivated by Murata over many years, and a high signal-to-noise ratio results in highly sensitive human detection capabilities, with low malfunctions and false positives.

Principle

- Pyroelectric effect
- The output signal is generated when the temperature of the pyroelectric element changes.



Features

- Excellent S/N ratio
- High stability against ambient temperature change
- Excellent immunity characteristics to electromagnetic waves

Appearance

- Dual Type IRA-S200 Series
- Quad Type IRA-S500 Series Principle
- Pyroelectric effect
- The output signal is generated when the temperature of the pyroelectric element changes



Applications

Human Detection
(Security, Lighting System, IP camera etc)

Security

Lighting

Home & Office Security

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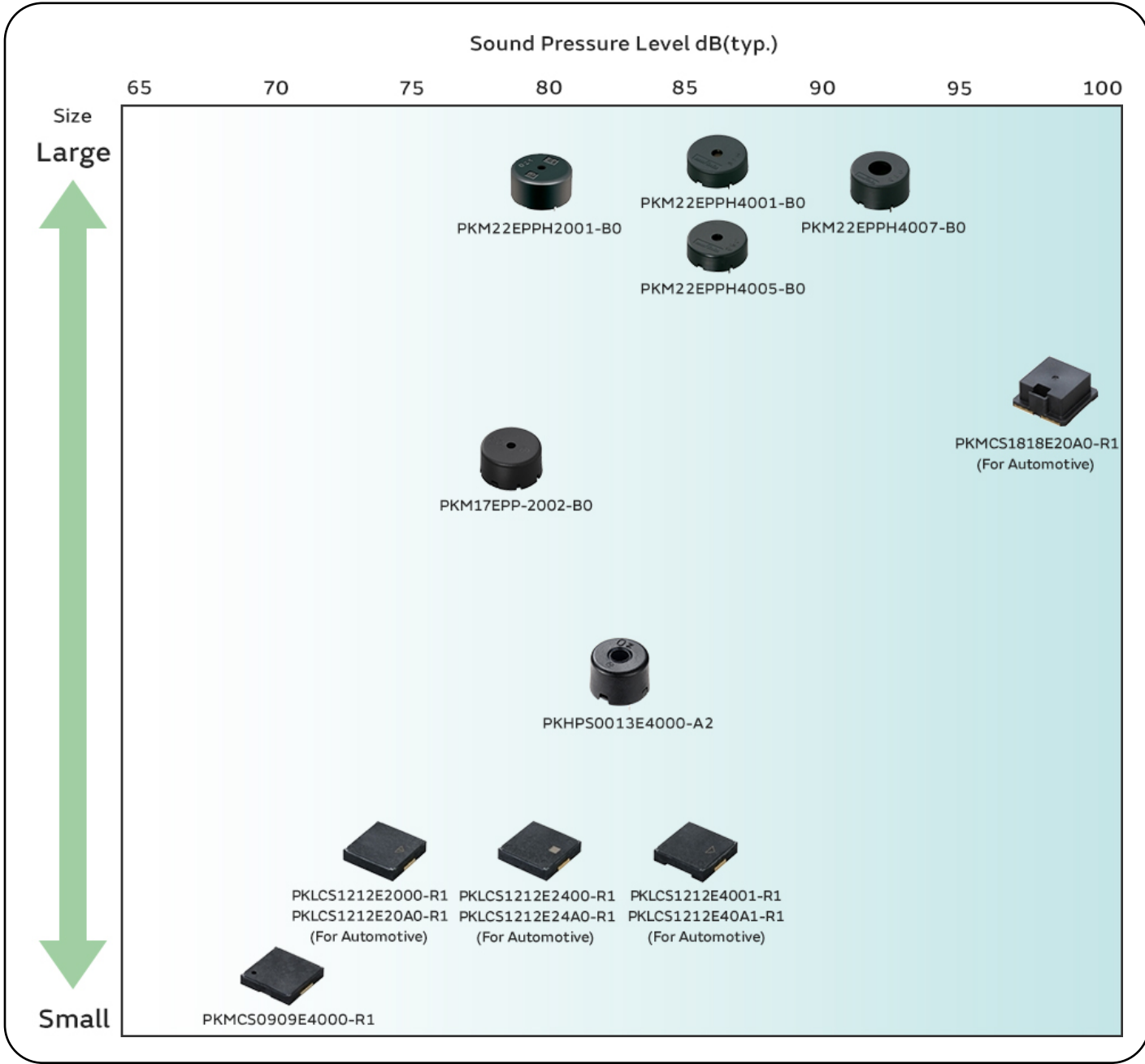
Sound Components

Piezoelectric Sounders

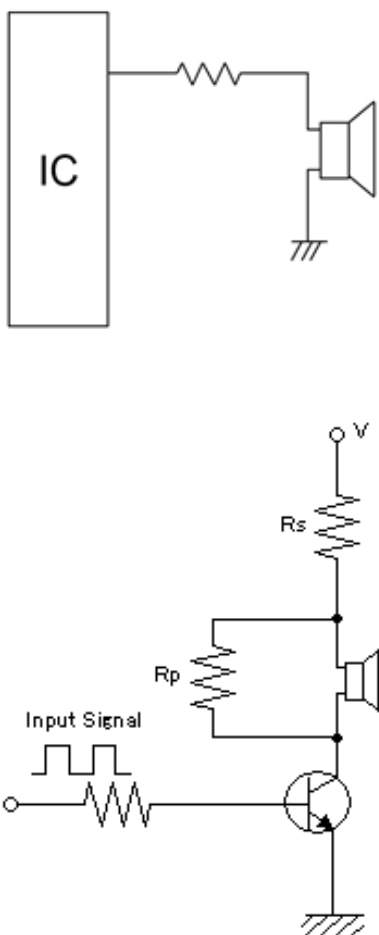
Murata's high-quality piezoelectric sounders are components that generate monotone sound suitable for providing systems with audible indication without the need for built-in oscillation circuits. Within heat pumps and climate control solutions, they are ideal for providing feedback in user interfaces and remote controls, as well as for indicating error conditions. These components come in SMD packaging, which is optimal for small, high-density mounting, and pin-type packaging, which can be used for general purposes.

Features

- Lightweight with no internal magnet
- Low current consumption
- Available for sounding with multiple frequencies
- Various sizes and sound pressure levels available



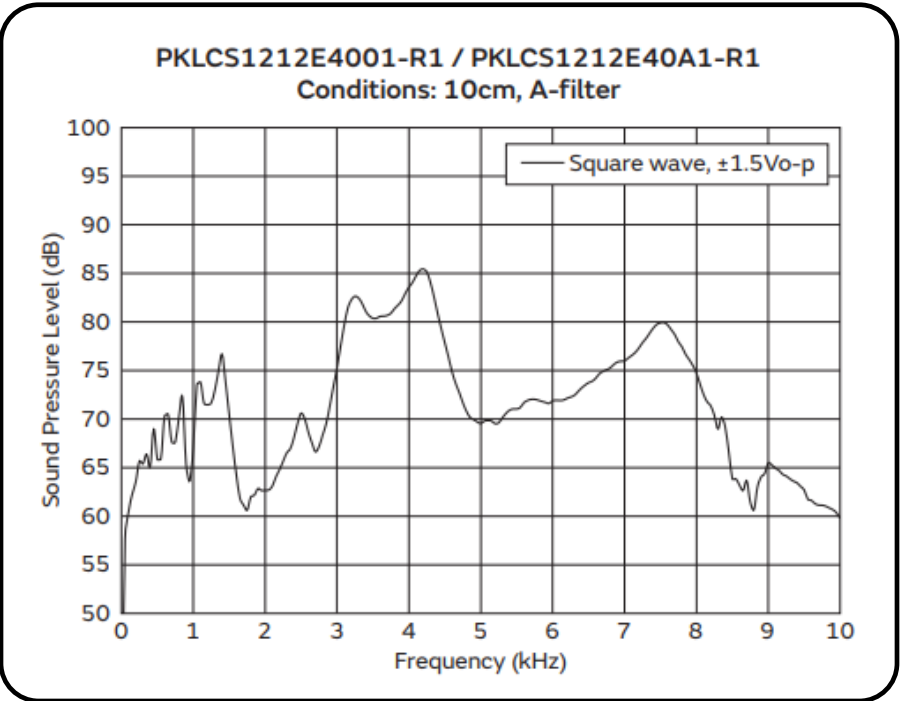
EASY TO DESIGN:



Magnet Free

Simple drive circuit

No cavity housing required



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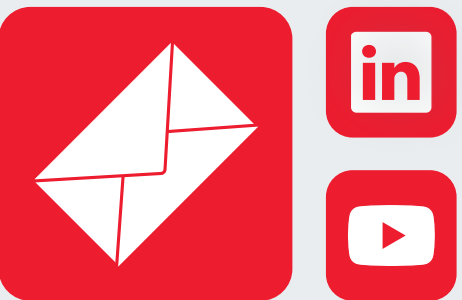
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Charge Pump DC-DC

Virtually Lossless Modules shrink Downstream Power

Murata Charge Pump divides down an input voltage by a certain divider ratio. Then Murata’s proprietary architecture enables higher overall system-level efficiency by providing a high-efficiency intermediate bus supply that reduces the size of downstream buck converters in space-critical applications.

Features

- Low ripple/noise
- Less external components
 - Space saving
- Highest Efficiency with Low profile 2.1mm
 - Can be put on the backside of the PCB
- Patented technology

Why use a Charge Pump?

1. Charge Pump + Buck converter

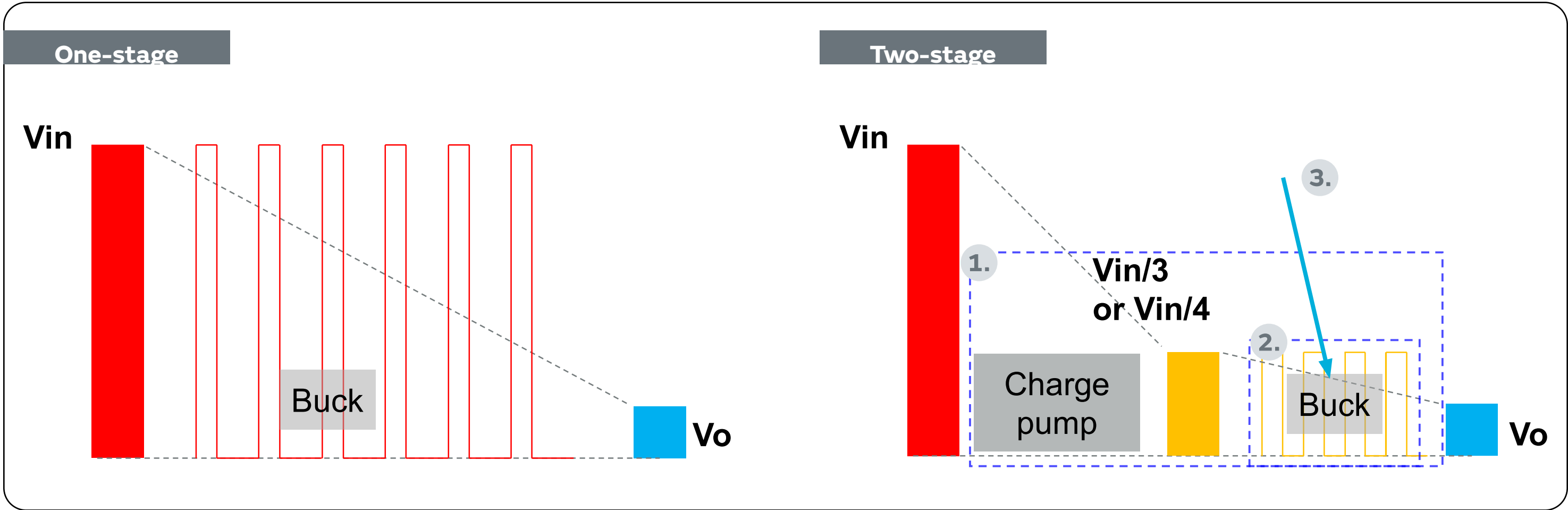
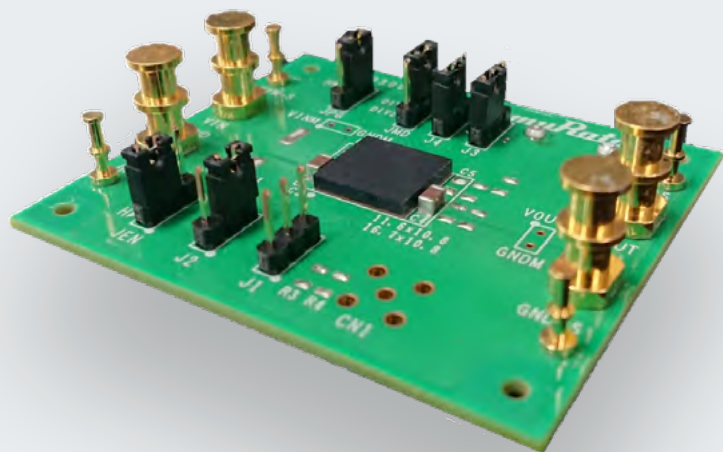
- > Higher efficiency
- > Reduced EMI emissions
- > Smaller sized input and output filters can be used

2. Chip Inductor

Lower input voltage at second stage allowing to use higher switching frequency hence chip inductor can be used for buck converter

3. FET

Due to lower input voltage losses and EMI are reduced, resulting in overall high efficiency buck converter.



Power Products

- Charge Pump DC-DC
- ▲ Isolated DC-DC

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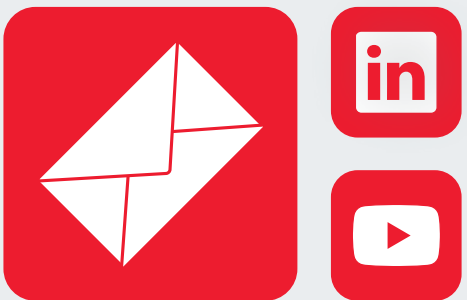
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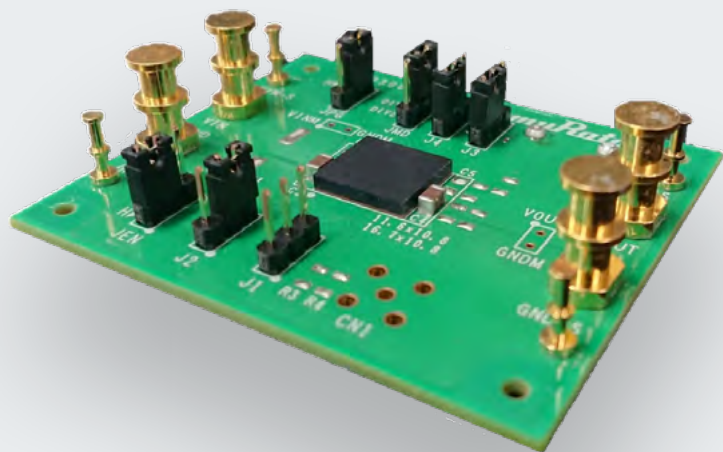
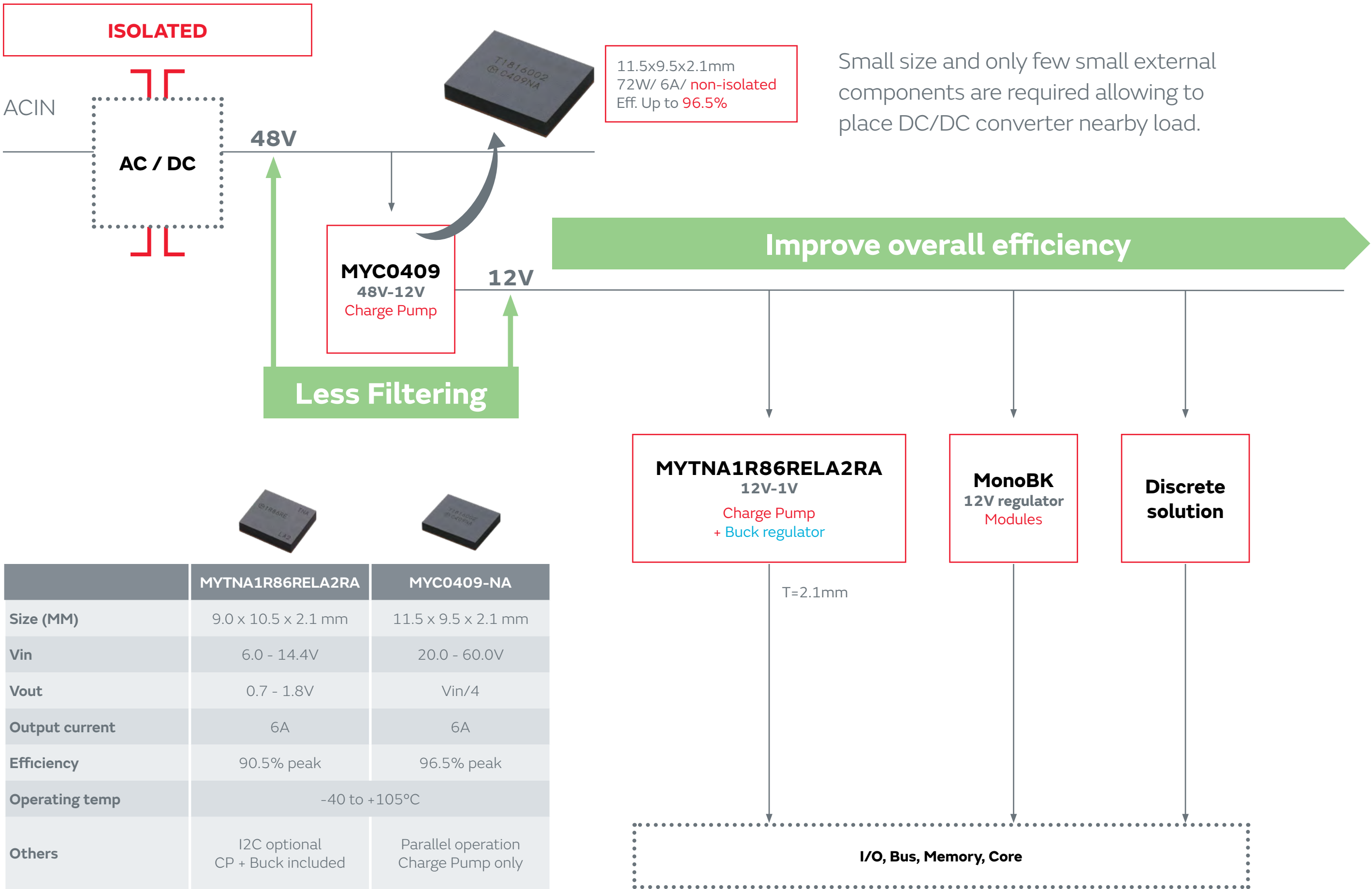
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Why Use a Charge Pump?



Power Products

- Charge Pump DC-DC
- ▲ Isolated DC-DC

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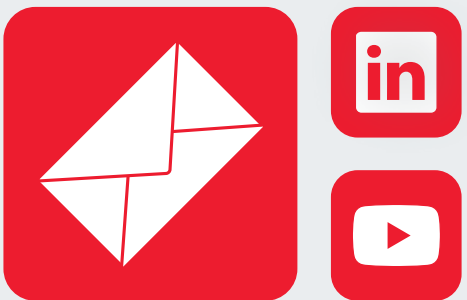
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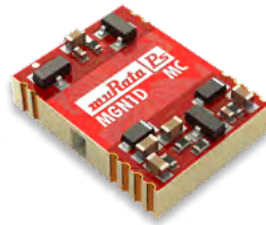
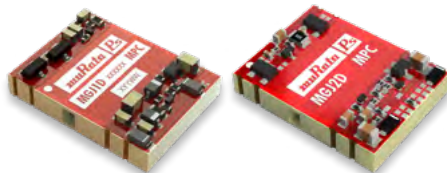
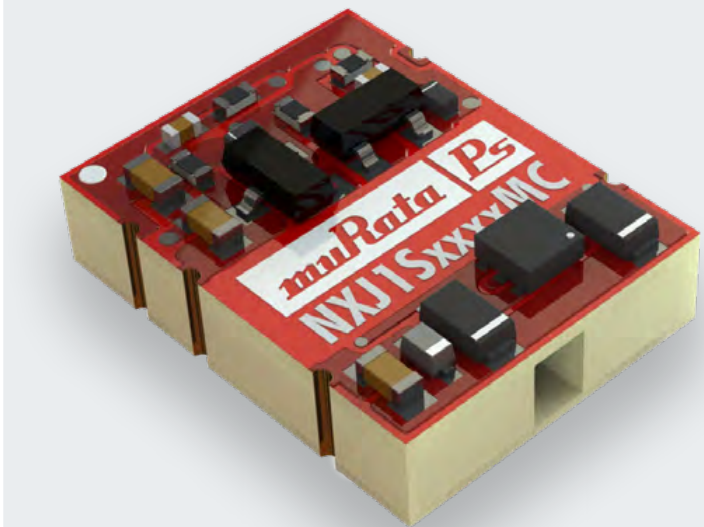
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NXE & NXJ series Isolated DC-DC

The NX and MGJ series’ advanced automated manufacturing processes enable increased product reliability and repeatability of performance. Featuring optimized (bipolar) output voltages for MOS, IGBT, SiC & GaN gate drives. Models include those with safety approvals up to 2 MOPP and 250V reinforced insulation.

Features

- 1W-2W
- Peak reflow temperature of 260°C as per J-STD-020
- Operating temperature -40 up to +110°C
- Ultra-low isolation capacitance
- UL62368 recognised
- Inspectable solder joints
- Lowest profile reinforced insulation DC-DC converters
- High continuous barrier withstand voltage
- Characterized partial discharge performance
- High dv/dt immunity



Key parameters	MGJ1 SIP - MGJ2B	MGJ1 - MGJ2	NXE1 - NXE2	NXJ1 - NXJ2	MGN1
Continuous barrier withstand voltage	2.4kVDC	2.5 - 3kVDC	1kVDC	1kVDC	1.1kV
Isolation capacitance	3pF (Typ)	3pF (Typ)	2.1 - 3pF (Typ)	2 – 2.5pF (Typ)	2.5pF (Typ)
Safety approvals	Reinforced - 300Vrms Basic - 600Vrms	Reinforced - 250VAC	Reinforced -125Vrms Basic - 250Vrms	Reinforced - 200 to 250Vrms Basic - 250Vrms	PENDING RECOGNITION Reinforced - 250Vrms Basic - 250Vrms
CMTI	>200kV/μs	>200kV/μs	Pending	Pending	>200kV/μs
Operating temperature	-40 to 105°C	-40 to 105°C	-40 to 105°C	-40 to 110°C	-40 to 105°C
Power	1W	1W – 2W	1W – 2W	1W – 2W	1W

Power Products

- Charge Pump DC-DC
- ▲ Isolated DC-DC

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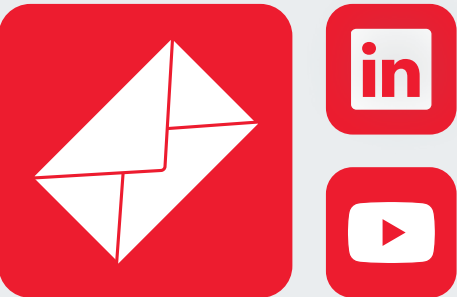
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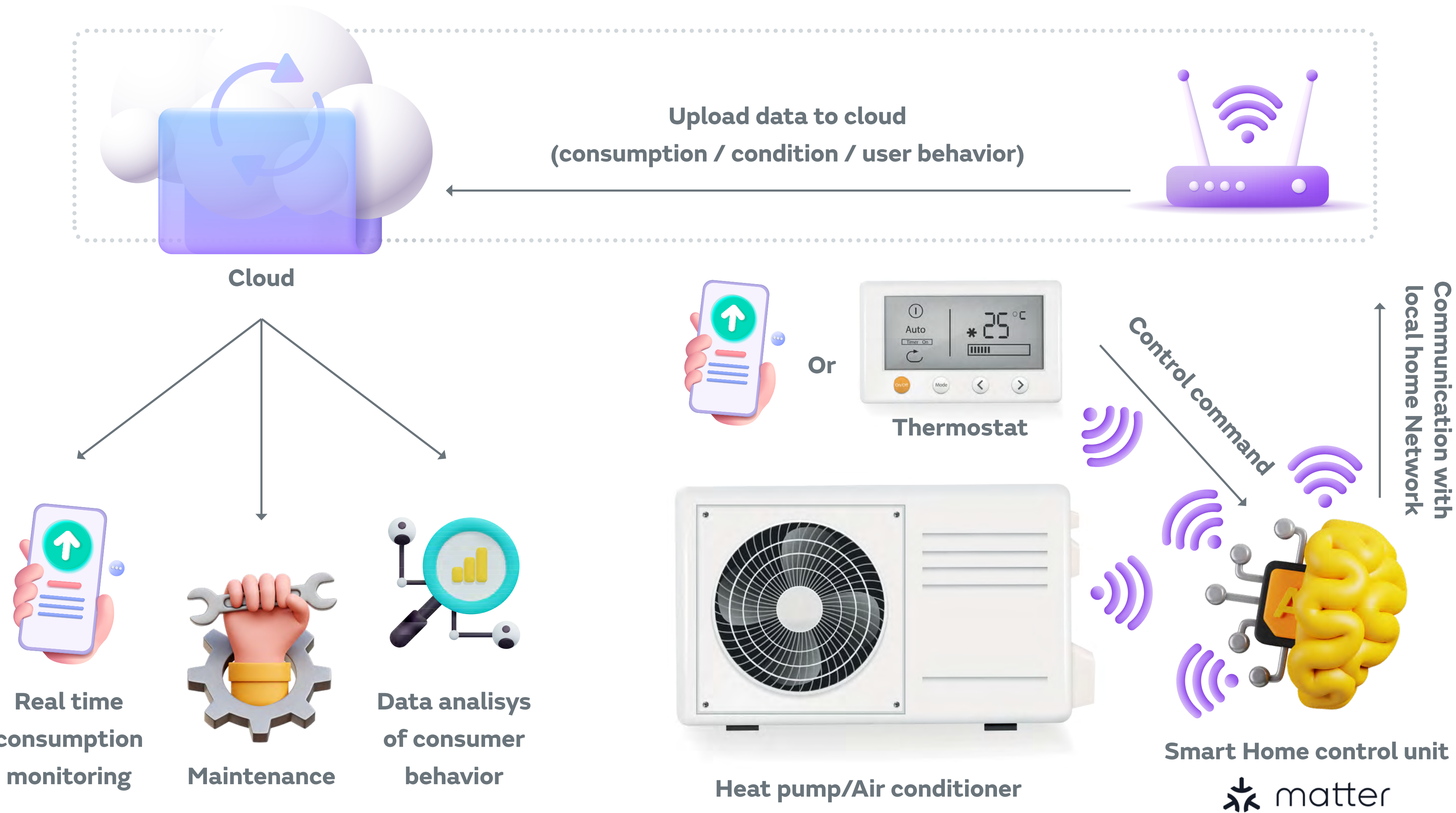
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Connectivity Modules

Long Range and Short Range

From the world’s smallest Cat. M1/NB-IoT module to Combo modules supporting Matter and integrating Wi-Fi, Bluetooth and 802.15.4.

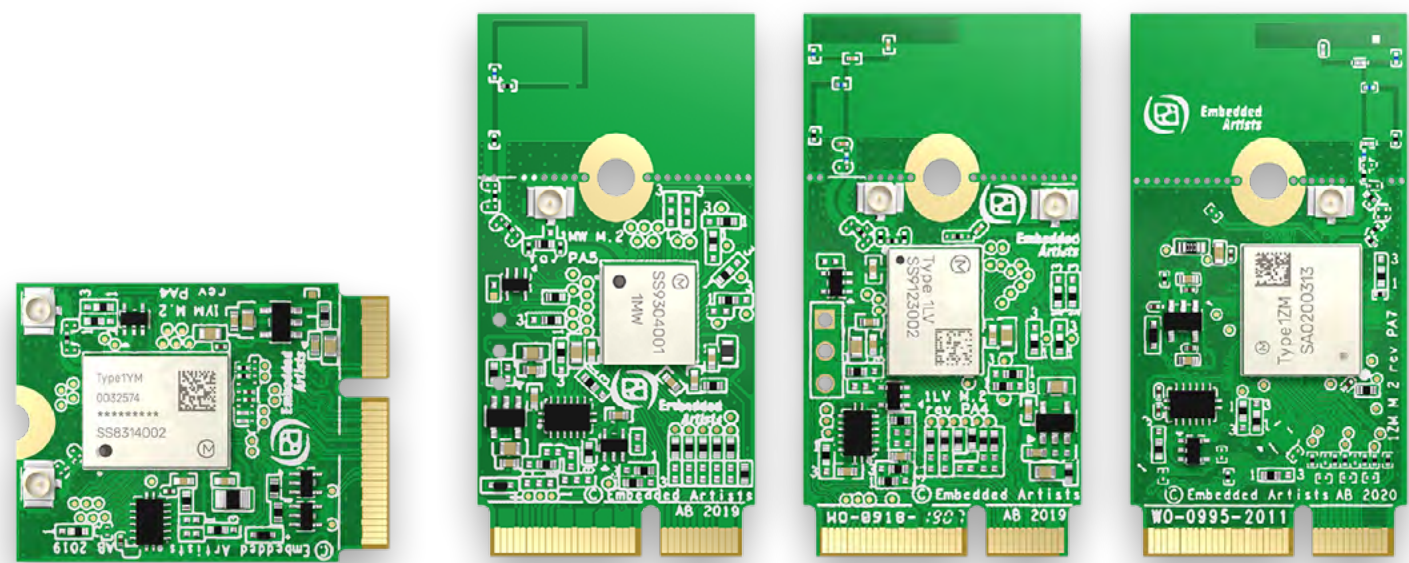
Murata provides a comprehensive range of connectivity solutions designed to speed up development and deliver high performance and reliable operation.

The modules follow Murata’s ethos of miniaturization and efficiency, and feature incredibly low energy requirements in compact packaging. All the latest wireless protocols are supported from short range Wi-Fi 6 and UWB to long range NB+GNSS communication.

Features

- Broad product line-up
- Strong partnerships with IC vendors
- Multiple production locations
- 100% Pre-tested
- Certified Modules
- FAE Support (Global and Local)
- Online support & Forum
- RF simulation & design support

Wi-Fi easy evaluation using [Embedded Artist M.2 boards](#)



Long Range [Cat. M1/NB-IoT](#)

Features:

- Cat. M1/NB-IoT
- Small size
- GPS/GNSS
- Supporting global regulation and major worldwide carriers
- AT-Commands



Short Range [Wi-Fi / Bluetooth](#)

Features:

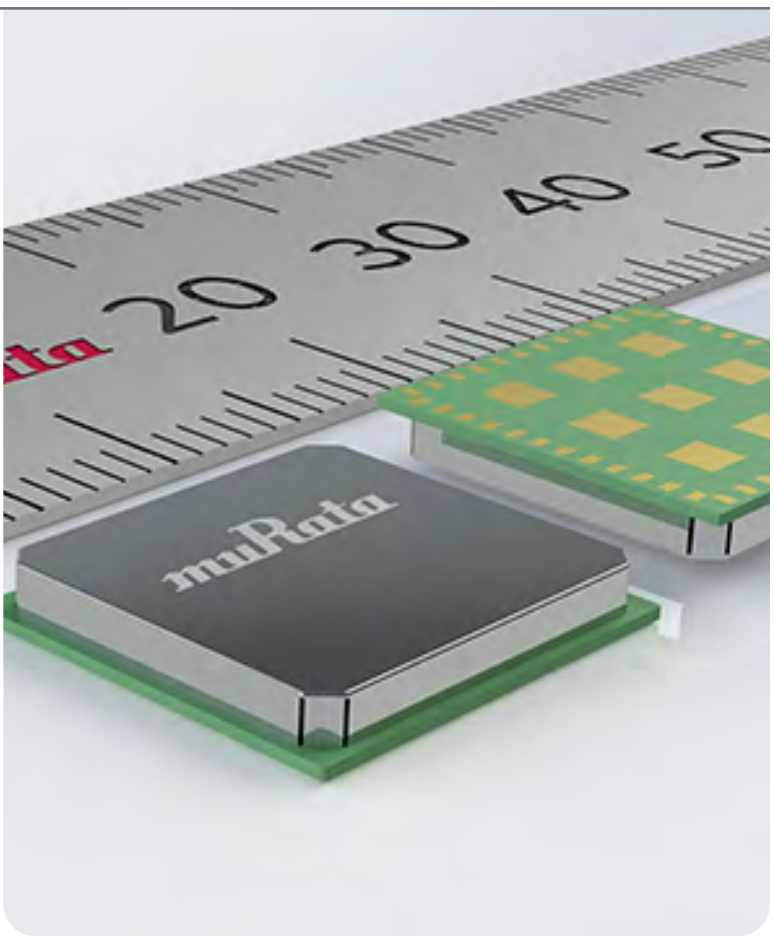
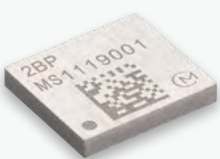
- WiFi 4,5,6,6E+BT/BLE and 802.15.4
- Matter support
- Linux, Android or RTOS integration



Short Range [UWB](#)

Features:

- Contactless presence detection
- High Security
- Precise Distance & AoA measuring



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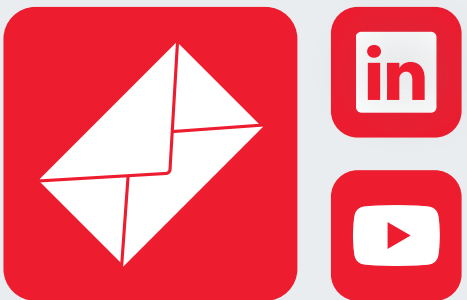
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RF-Filters

LTCC

LC filters are passive components that pass or block specific frequency bands. These components are used to extract a specific frequency band or attenuate noise frequencies.

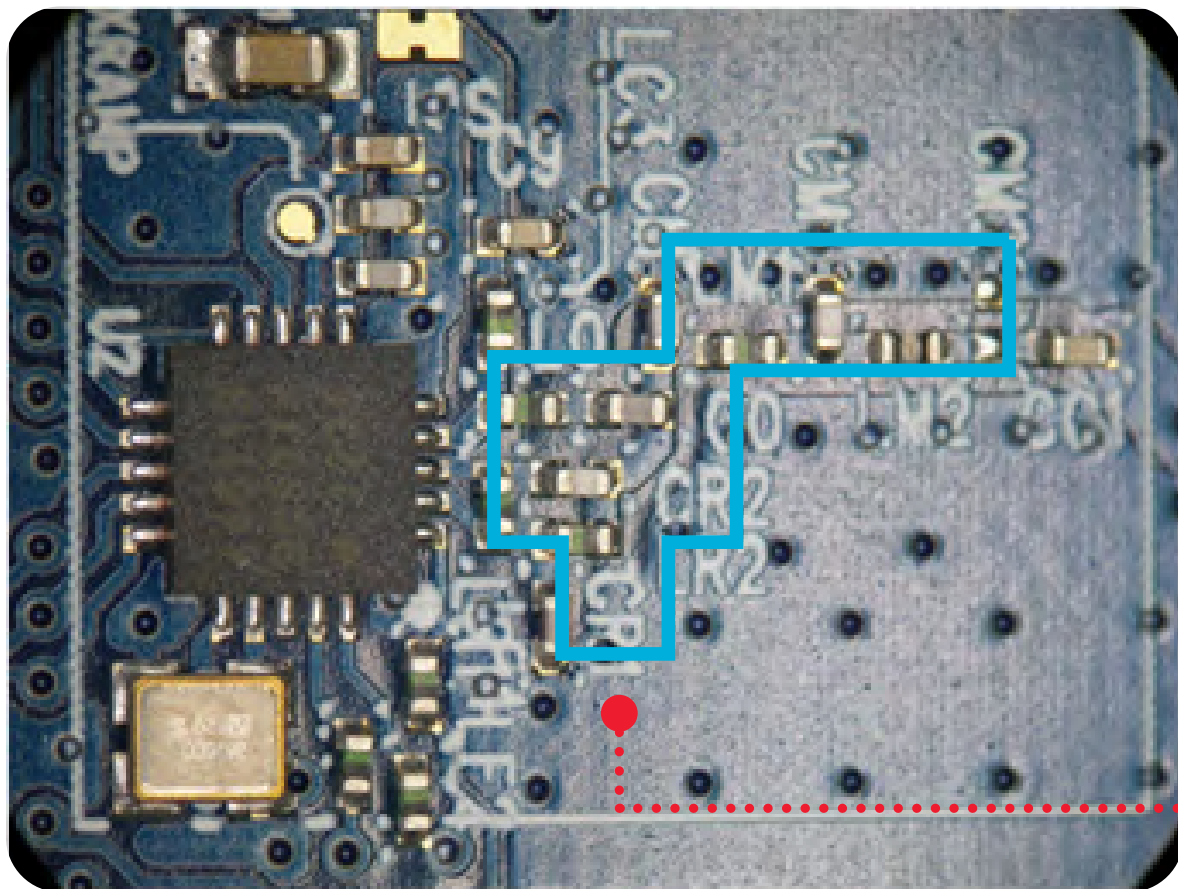
Murata delivers high performance LTCC packaged products with multilayer ceramics integration technology.

Features

- Easier for design and saving engineering effort
- Less Component Variation
- Space Saving
- Less Component Count in BOM

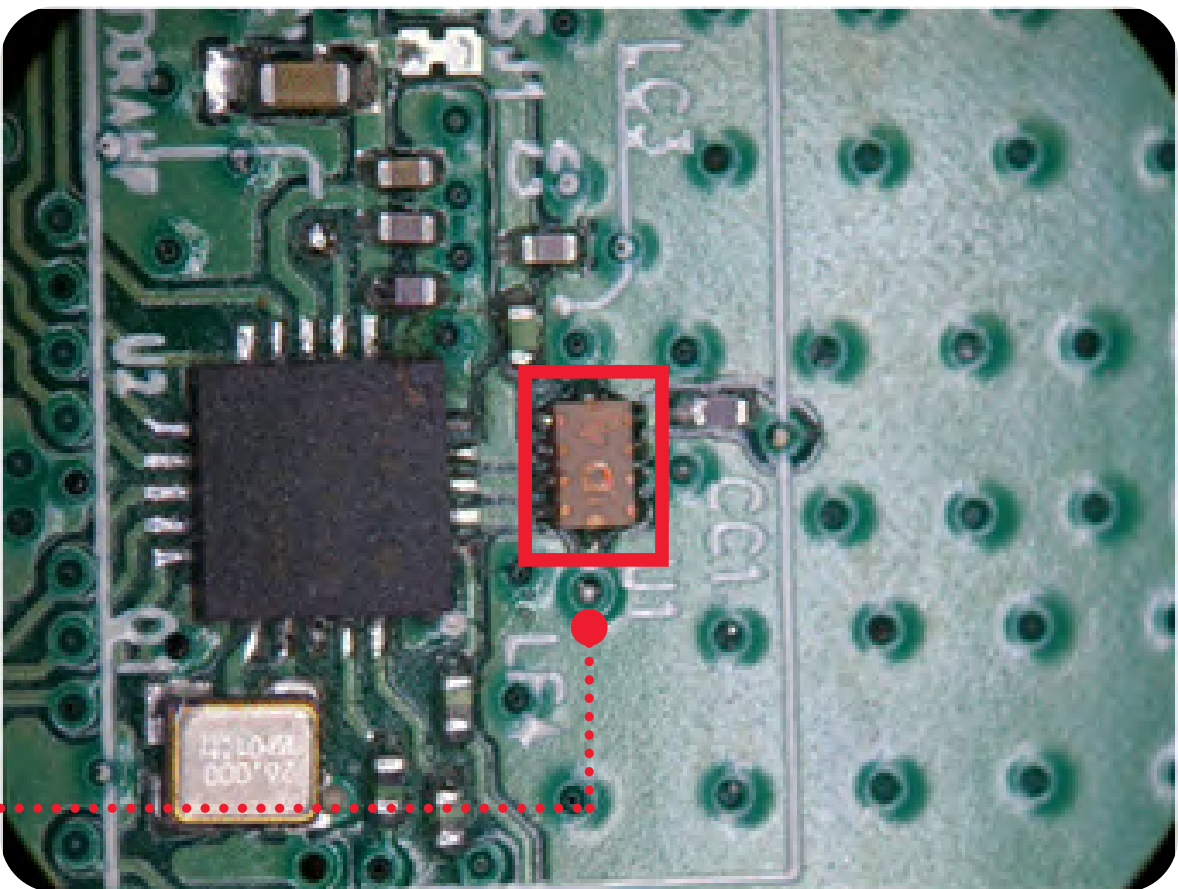


RF board with discrete circuit



11pcs L&C

RF board with LTCC filter



Just 1 chip!

Big Space saving
merit by using
Filter solution!

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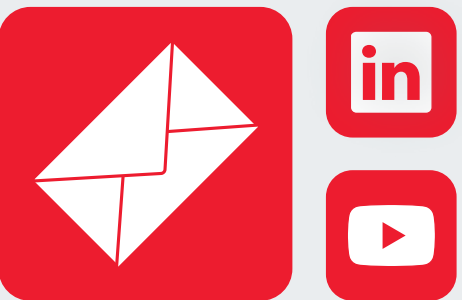
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Note

1 Export Control

For customers outside Japan:

No Murata products should be used or sold, through any channels, for use in the design, development, production, utilization, maintenance or operation of, or otherwise contribution to (1) any weapons (Weapons of Mass Destruction [nuclear, chemical or biological weapons or missiles] or conventional weapons) or (2) goods or systems specially designed or intended for military end-use or utilization by military end-users.

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

3 Product specifications in this catalog are as of March 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.



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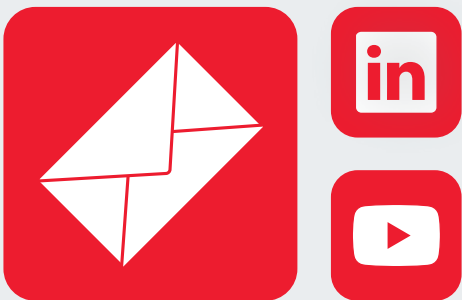
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