



Application guide PV Inverter

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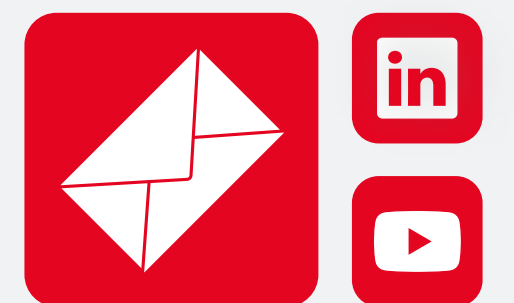
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Overview

A key market sector for future sustainability

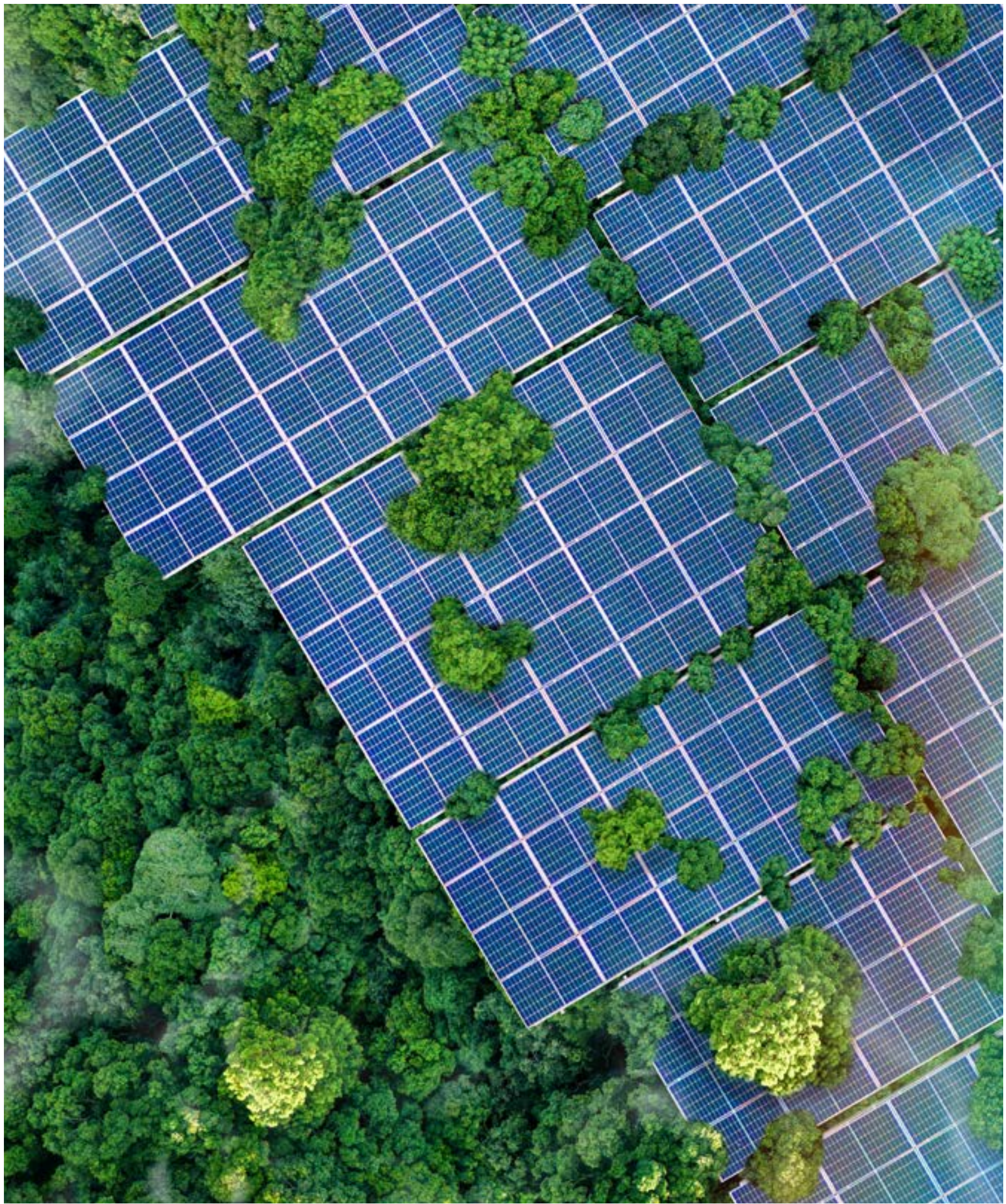
Introduction

Shifting global energy generation from fossil fuel powered systems to sustainable alternatives is vital for reducing global CO2 emissions and the move towards Net Zero. A crucial aspect of this initiative involves the utilization of solar photovoltaic (PV) technology.

The modularity of the panels contributes to widespread adoption in both large-scale commercial and small-scale residential settings, driving demand and ultimately decreasing component costs.

The success of renewables like PV panels depends on a number of factors ranging from regulatory and economic support through to the reliance and quality of underlying components manufacturing, such as PV inverters.

During the COP28 climate change conference in Dubai over 130 national governments, including the European Union, set the ambitious goal of tripling the global installed renewable energy capacity to [at least 11,000 GW by 2030](#), underscoring the importance of PV solutions in driving our future sustainability.



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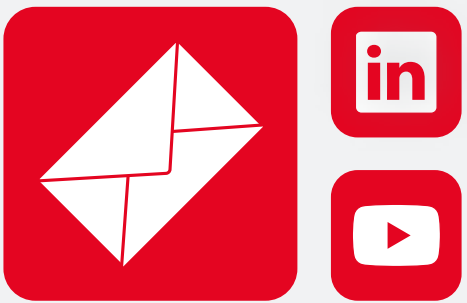
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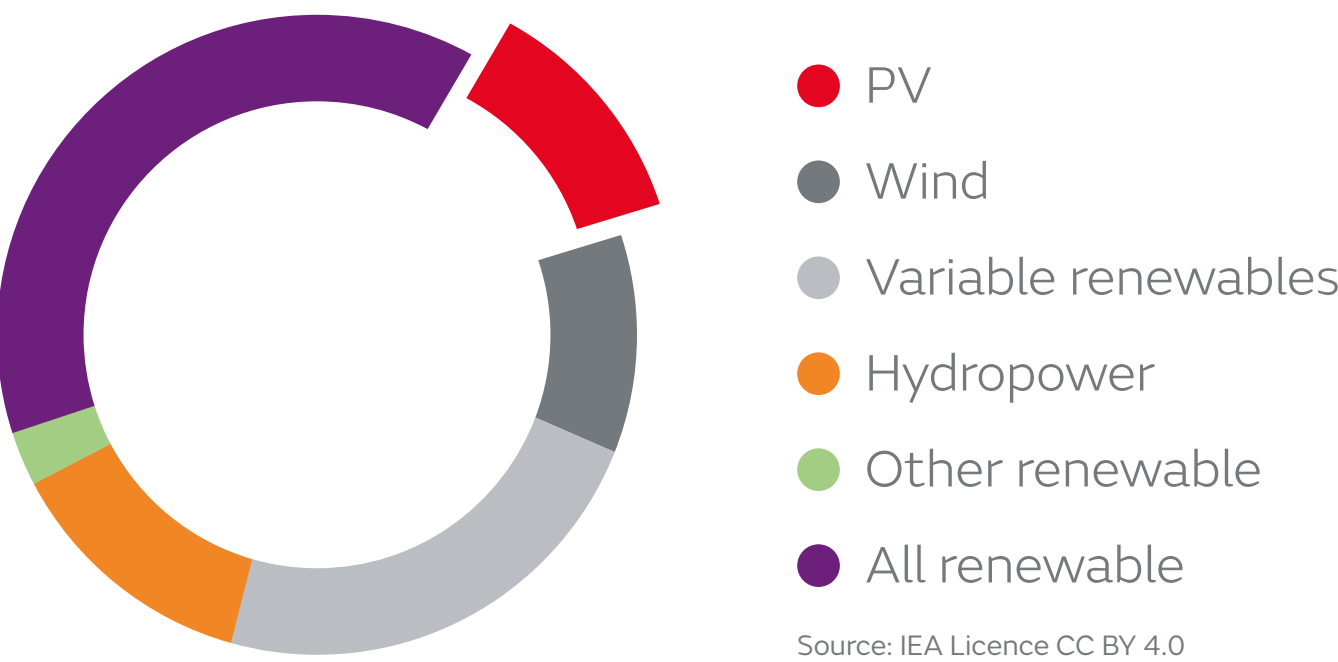


Market

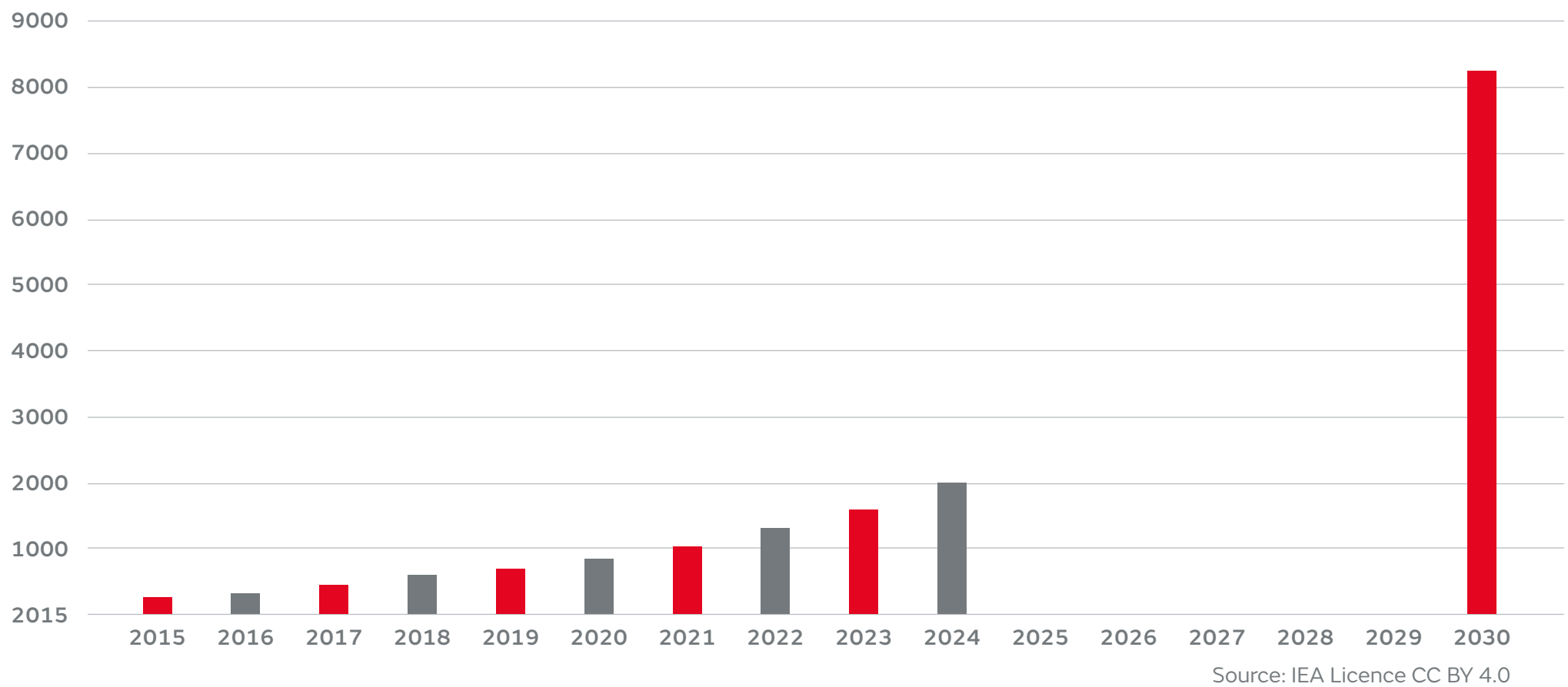
There has been considerable progress, but this represents just the start

The PV market is projected to see significant growth in the next four years, but even then, more needs to be done to help reach Net Zero. [The International Energy Agency \(IEA\)](#) predicts that approximately 3,700 GW of new renewable capacity will be installed during the period from 2023 to 2028.

Solar PV and wind power are projected to contribute 95% of the worldwide increase in renewable energy, and by 2028, renewable energy sources are expected to contribute to more than 42% of global electricity generation.



Solar PV Generation - Net Scenario 2015-2030



Policy Support

Support from nations worldwide will continue to be the main driving force behind PV expansion. Under the REPowerEU plan, the EU aims to install [320 GW of solar photovoltaic by 2025 and almost 600 GW by 2030.](#)

Under China's 14th Five-Year renewable energy plan, it set the objective of achieving 33% of energy generation from renewable sources by 2025. This target encompasses an 18% goal specifically for wind and solar technologies. Meanwhile in the US, over 22 million acres of land have been identified for the construction of large-scale solar farms.

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Technical Trends

Exploring the trends within the PV solar inverter and climate control markets

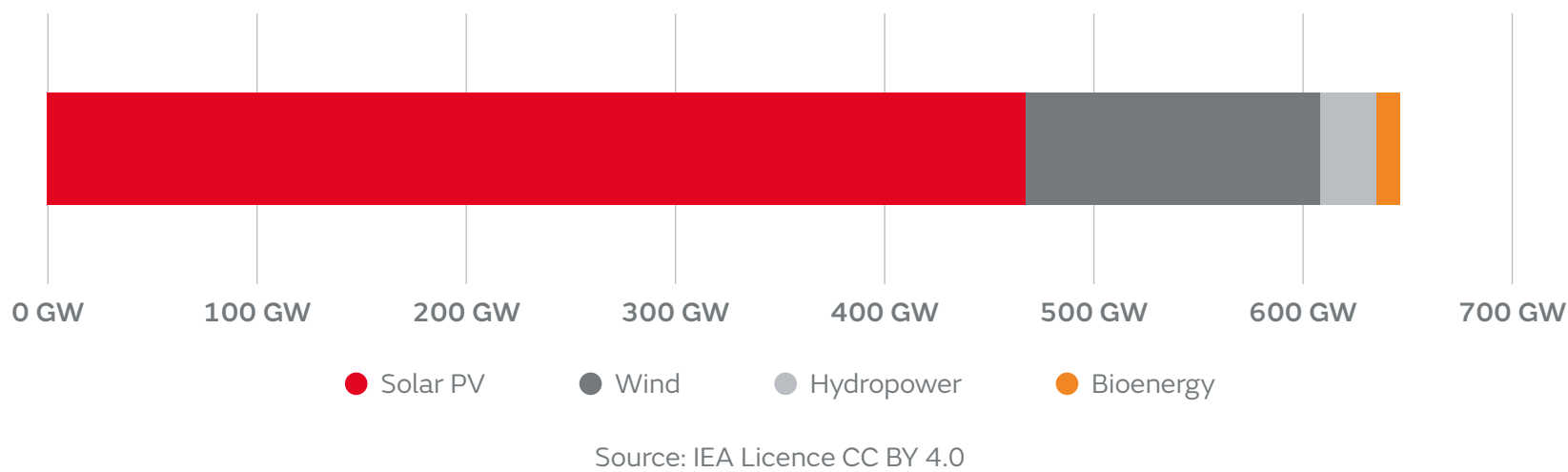
New Applications

Cutting-edge PV installations are changing technical requirements, and the rise of dual-purpose PV installations is a prime illustration of this. In the agricultural sector, solar panels can be strategically placed above crops to shield them from harsh weather conditions and minimize water consumption by mitigating ground water evaporation, while also generating power.

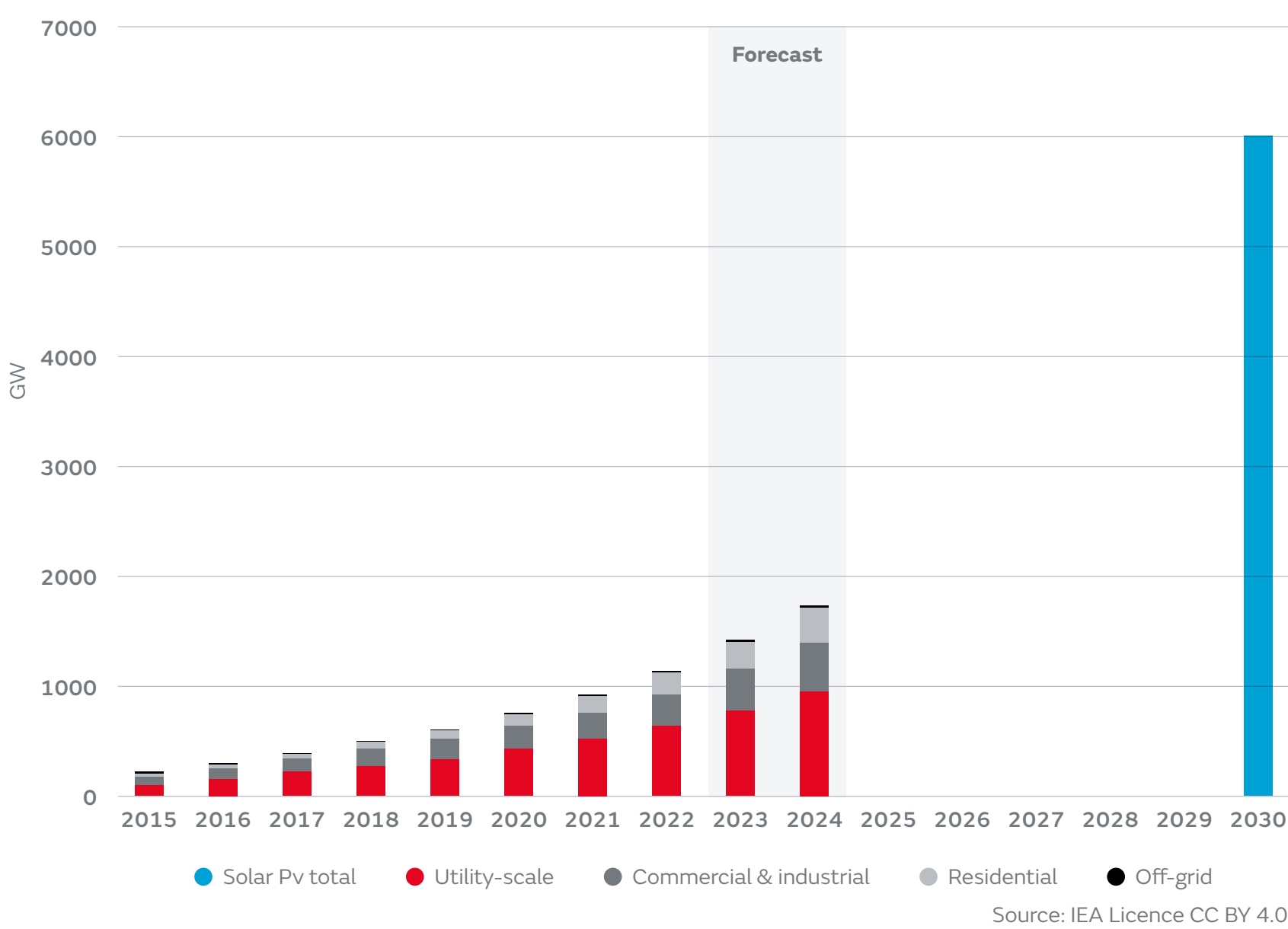
Escalating Technical Demands for PV Inverters

Intelligent PV inverters ensure system efficiency and safety, integrating seamlessly with the national grid, EV chargers, and battery storage. Communication is crucial to any intelligence, with residential PV inverters offering continuous monitoring through smart apps, and constant insight for safety and optimization in commercial and industrial applications.

Projected Renewable Electricity Additions 2024



Solar PV Capacity - Net Zero Scenario 2015-2030



Increase in Distributed Networks

Due to rising fuel and electricity costs in 2021-2022, distributed PV has gained popularity as a more appealing option for consumers, leading to increased investment. In 2024 commercial and industrial solar capacity should hit 447GW with residential peaking at 319GW. This exceeds the total solar capacity available worldwide in 2016.

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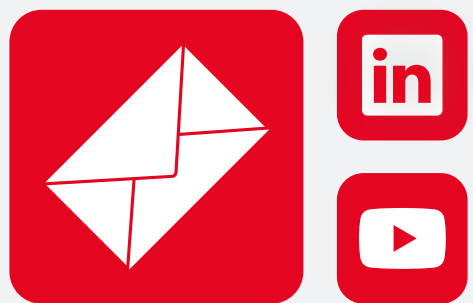
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Technical Challenges

Keeping pace with market diversification and growth requires the support of reliable manufacturing

One of the biggest challenges for the solar PV market is its success. It's seen as a central element in achieving global NZE by 2030 and so manufacturing numbers will continue to increase, but with this growth comes a number of challenges.

Supply Chain Resilience

With this demand comes a test of the global supply chains. The global manufacturing capacity for solar PV saw a significant increase in 2022 with a [growth of over 70%](#). The capacity for polysilicon reached 450 GW, while modules reached up to 640 GW.

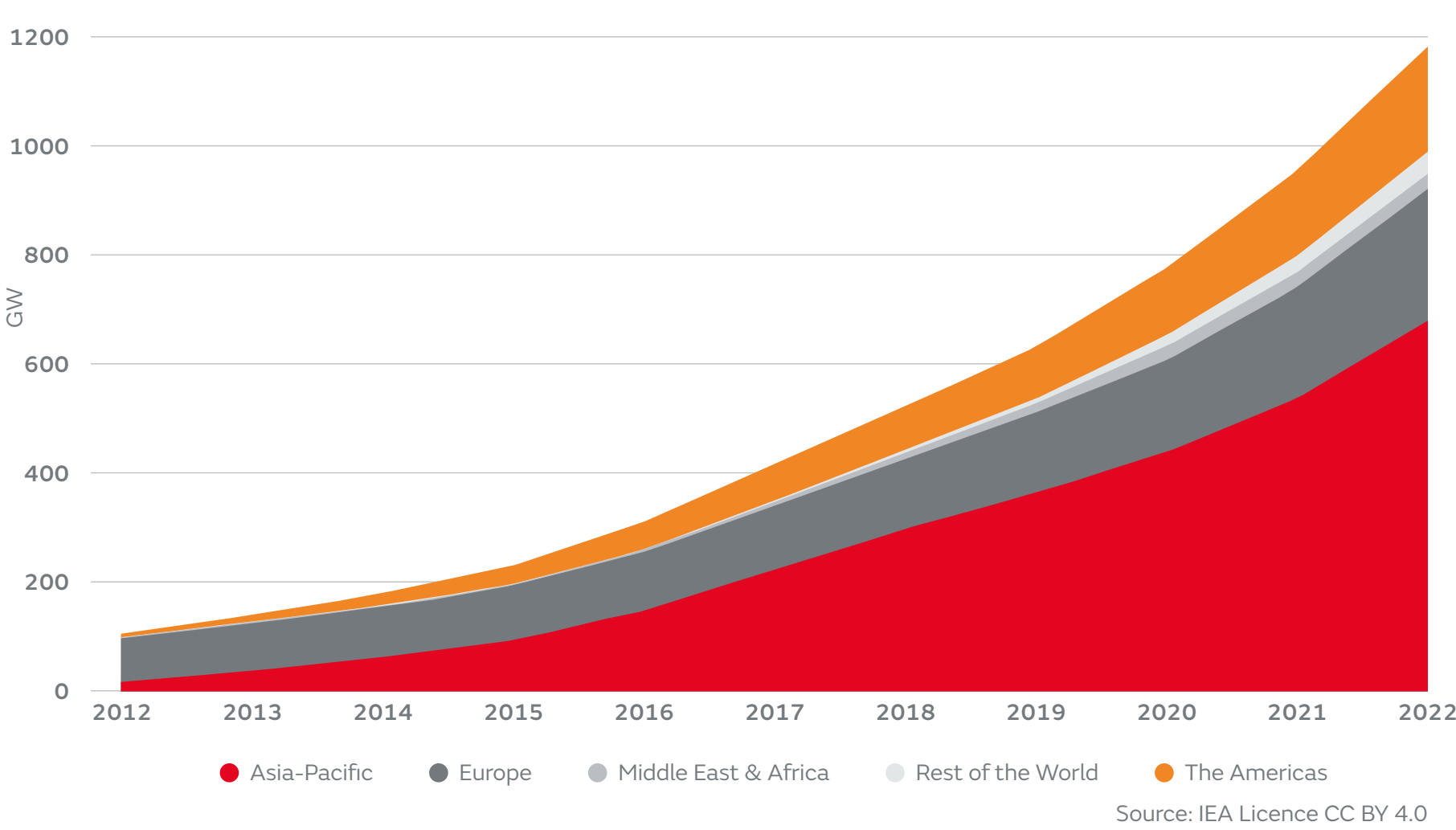
Integrating New Technology

The use of AI and ML algorithms in failure detection and electricity generation optimization for solar systems has the potential to decrease operation and maintenance expenses. However, these new initiatives come at an engineering cost that must be managed.

Rate of Growth

Filling manufacturing and installation roles is crucial for continued success as the market grows. At present, an estimated [5.8 million people](#) work in the PV industry.

Evolution of Regional PV Installations



Partnering with Trusted Component Manufacturers

The PV market has witnessed the installation of over [1,183 GW of PV plants globally](#), with the majority (around 65%) of these installations occurring within the last five years. This global growth of the PV market can create supply chain vulnerabilities. Solar PV manufacturers need reliable component suppliers with extensive manufacturing facilities to ensure the reliable supply of crucial components for both new manufacturing and existing maintenance.

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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**’. We apply these philosophies to all of our PV inverter products, constantly seeking to make our solutions and components smaller and more efficient.

At Murata, our dedication to sustainability extends beyond supporting renewable energy production with our wide range of highly optimized products. Our company is committed to aligning with the United Nations **Sustainability and Development Goals (SDGs)** by reducing material waste and preserving power through enhanced efficiency and miniaturization across all our solutions and business sectors.

Murata incorporates a wide range of climate change and sustainability initiatives, partnerships, and working groups. From our executive membership in the **Japan Climate Leaders’ Partnership (JCLP)** to our continuous responses to the **Carbon Disclosure Project (CDP)** climate change questionnaires.

With such scrutiny applied to our own working practices, our customers can be sure that our solar PV solutions lead the way in terms of efficiency and design optimization.



Murata Micropower

In an effort to promote sustainable practices, Murata became a member of RE100 in December 2020, aligning ourselves with the aim of attaining **100% renewable electricity usage in business activities by 2050**.

Our Kanazawa Murata Manufacturing facility has accomplished a significant milestone by being the first among Murata’s facilities to attain “**100% renewable energy**.” Notably, the facility incorporates a groundbreaking dual-purpose carport with a roof comprising 383kW of solar panels.

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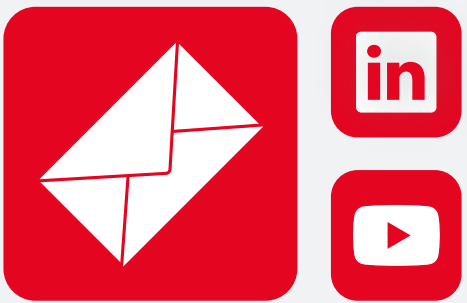
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Why choose Murata...

Marketing leading solutions for the latest solar PV demands

As a recognized leader in the world of electronics, **Murata has the technical expertise and support teams needed to help your project from inception to delivery.** We remain unwavering in our commitment to innovation, continuously working to ensure that our industry-leading solutions provide exceptional performance and reliability, while also being cost-effective.

Within this application guide we will explore a selection of Murata’s latest innovations including **thermistors, ESD protection devices, RF modules and sensor solutions.**

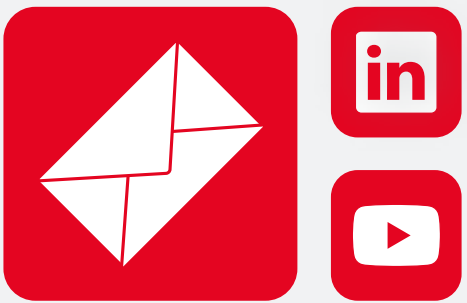
Each section is designed to provide a thorough overview of our products’ exceptional functionality, demonstrating how their exceptional performance, dependability, and cost-effective functionality can enhance your future solar PV design.

For further details regarding Murata’s extensive range of solutions or if you would like to reach out to your local representative, please visit our website [here](#).



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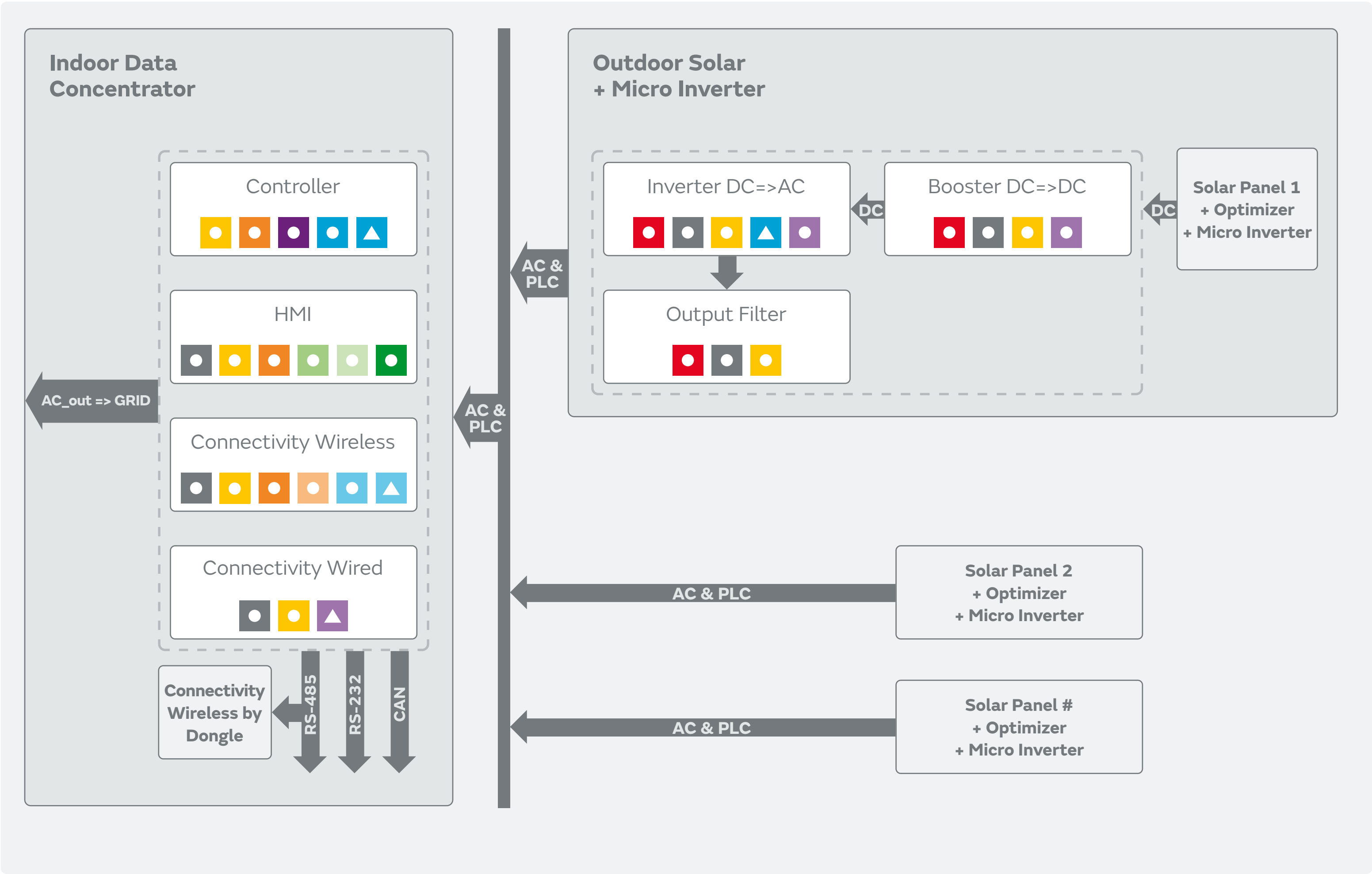


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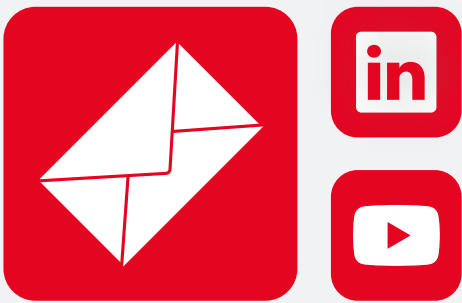
PV Micro Inverter

Block diagram



▲ PTC	● NTC
▲ Isolated DC-DC	● DC-DC for Gate Drive
▲ Coaxial Connector	● LTCC

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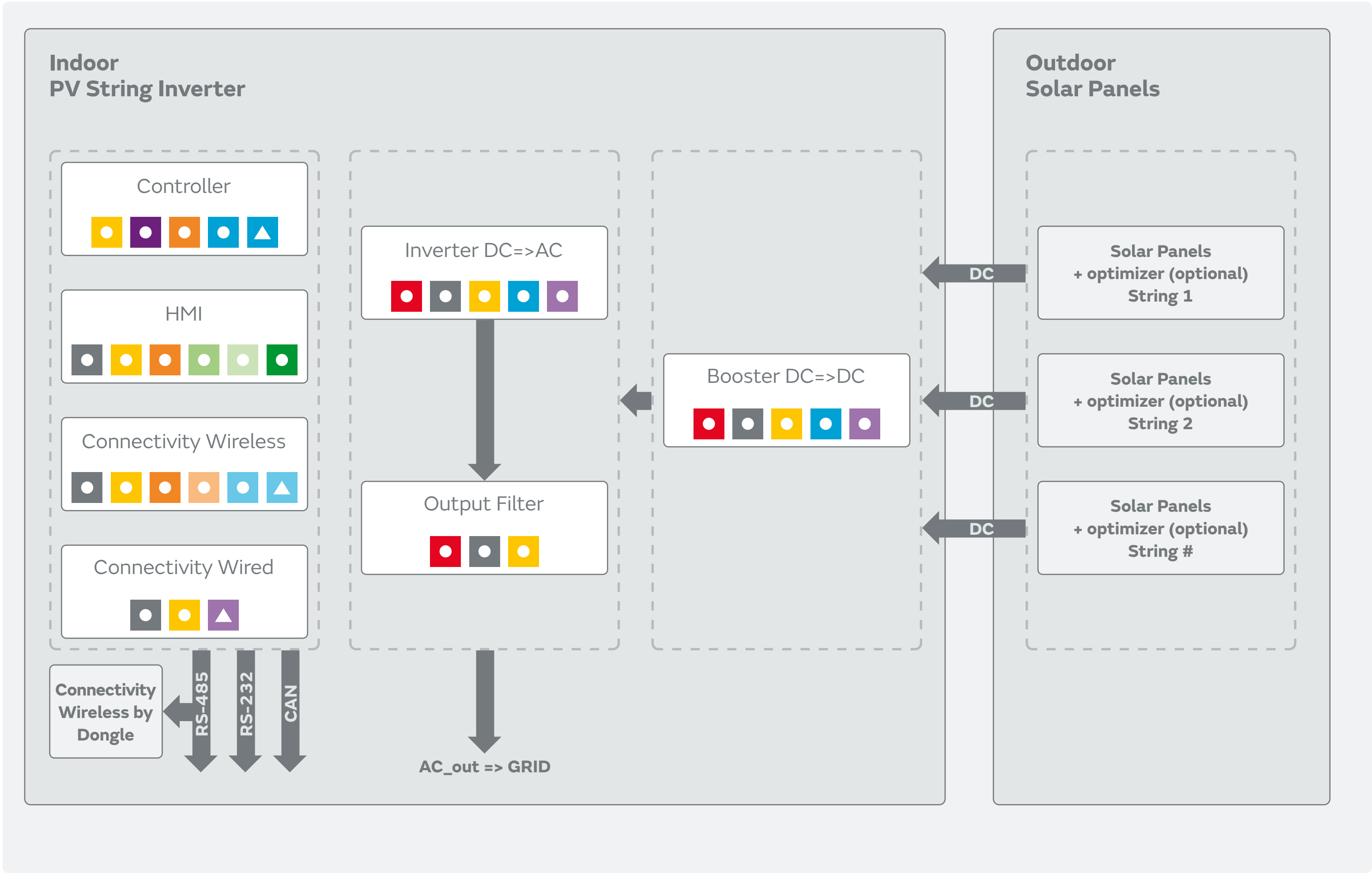


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PV String Inverter

Block diagram



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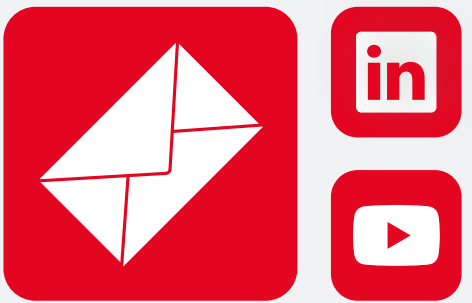
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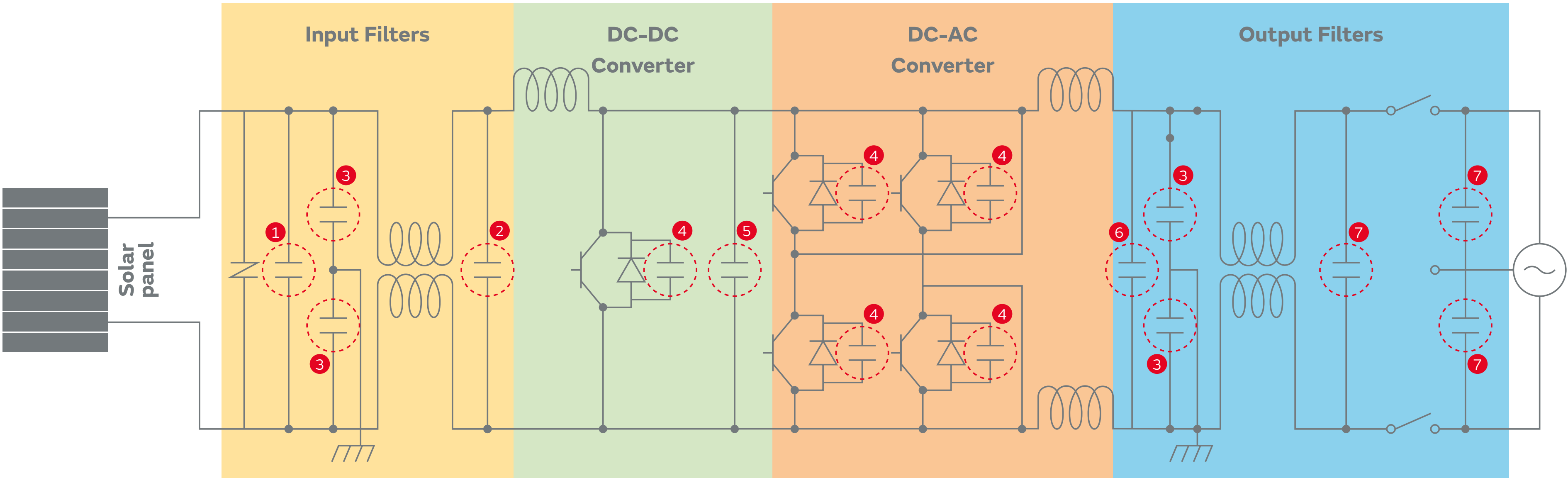


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General Circuit of PV String/Micro Inverter

Both Micro Inverter and String Inverter block diagrams are included in below circuit.



- 1. For input filter
- 2. For input filter
- 3. Line filter for noise suppression
- 4. For snubber
- 5. For smoothing
- 6. For output filter
- 7. Across-the-Line for noise suppression

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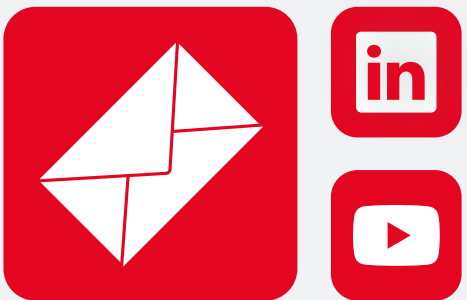
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Capacitors

MLCC capacitors

Murata provides a large capacitor product line to meet the needs of various functional circuits, including safety capacitors, standard MLCC, soft/metal termination capacitors, epoxy coating with lead and polymer aluminum capacitors.

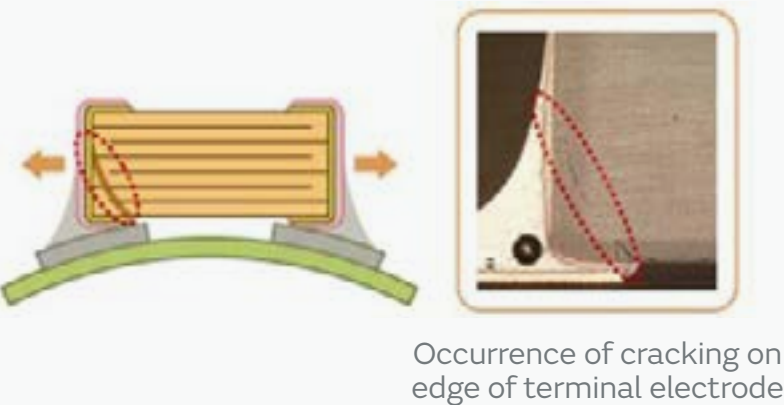
Features

- 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

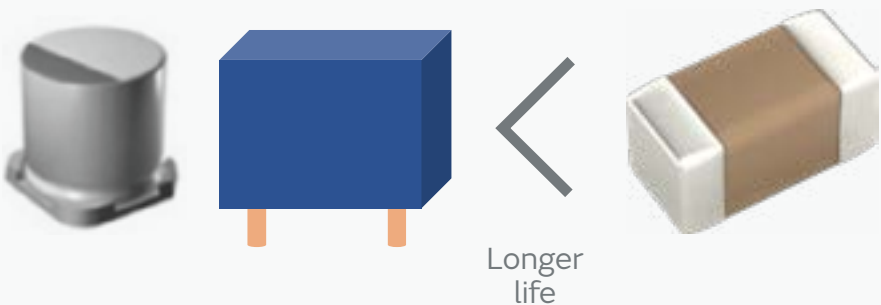
Murata’s capacitors design is able to:

- Support compact design: PV Inverters have a fixed shell, since the PCB space is limited. MLCCs are recommended.
- Support higher reliability spec: Photovoltaic inverters, with 10-25 year warranties, need highly reliable components. Murata supports high reliability and automotive-grade products in this market.
- Avoid bending crack: The installation of a photovoltaic inverter outside can cause PCB bending and component cracking due to temperature differences. Murata offers a soft/metal termination solution to solve this pain point.

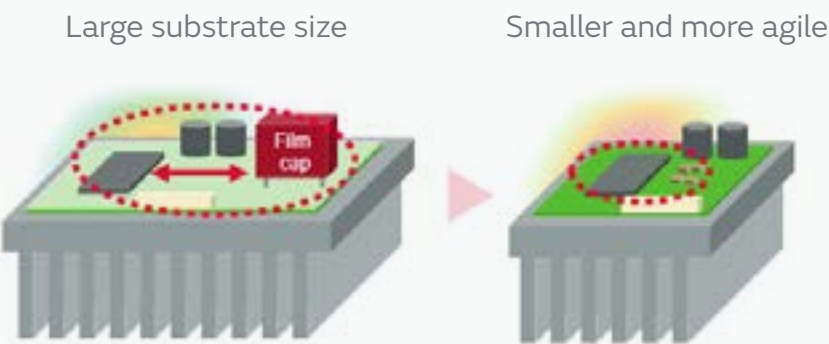
Avoid bending crack GRJ / GCJ (Soft termination)



MLCC has a longer product life than other capacitors



Compact design



More Information



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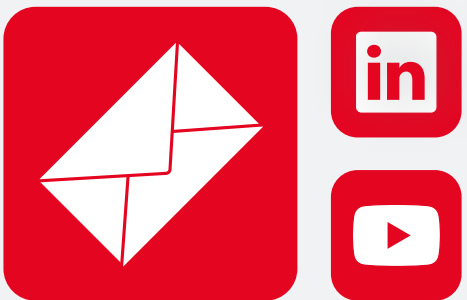
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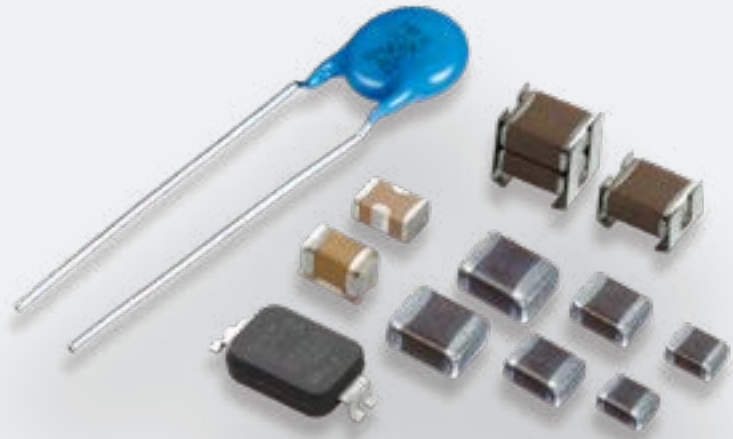
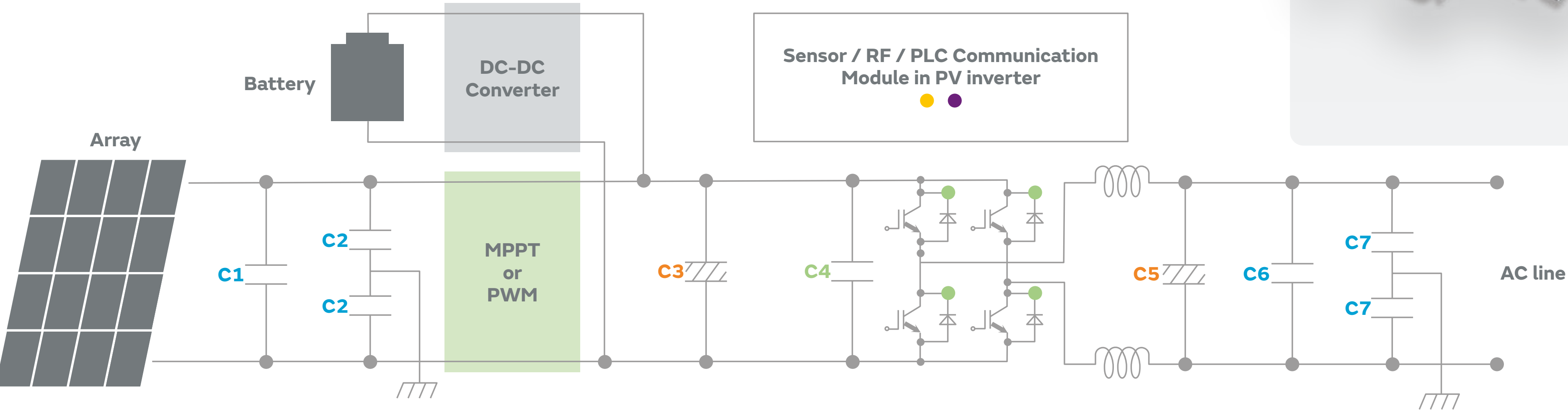


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Capacitors

Proposal for PV inverter



C1,C2,C6,C7: Noise Filter, Safety Capacitor



Safety capacitor
Lead type
DE1 series
DE2 series



Standard capacitor
GRM series
GRJ series



SMD type
GA3 series
DK1 series
EVA series
KCA series



GRM series /
U2J, X7R type

GRJ series /
Soft termination



KRM series /
Metal Termination



RDE series / Epoxy
Coating with Lead

In DC-DC: Resonance Capacitor



GRM series / COG type



KRM series / Metal
Termination COG type



Buffer Capacitor

GRM series (up to 470uF)



ECAS series/ Polymer Al
(up to 470uF)



RF Matching Capacitor

GRM series / COG type

GJM series / HiQ type

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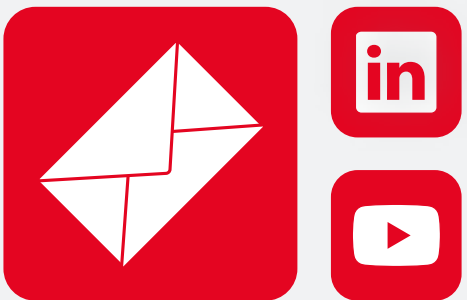
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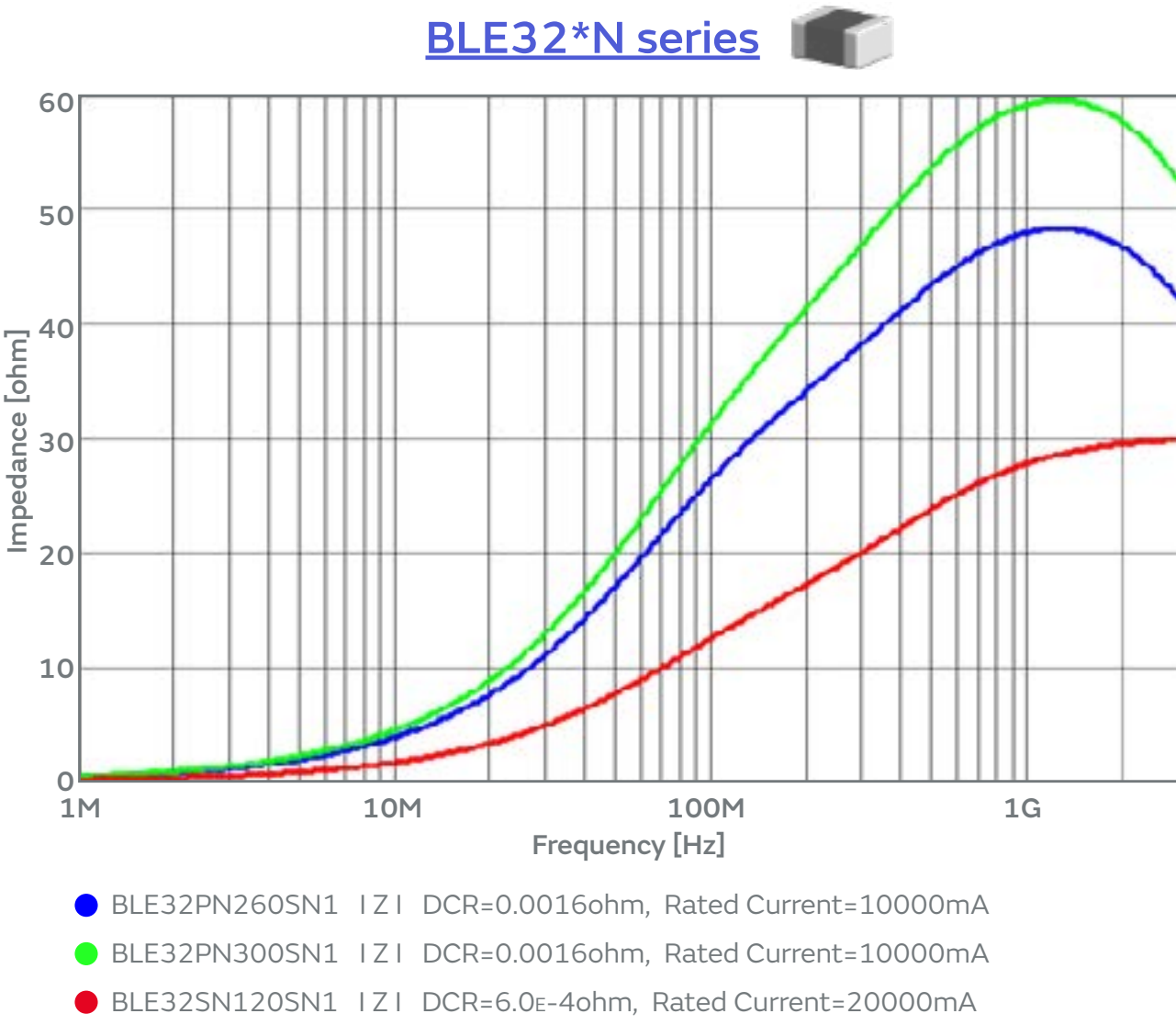
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EMI Filters

Ferrite Beads

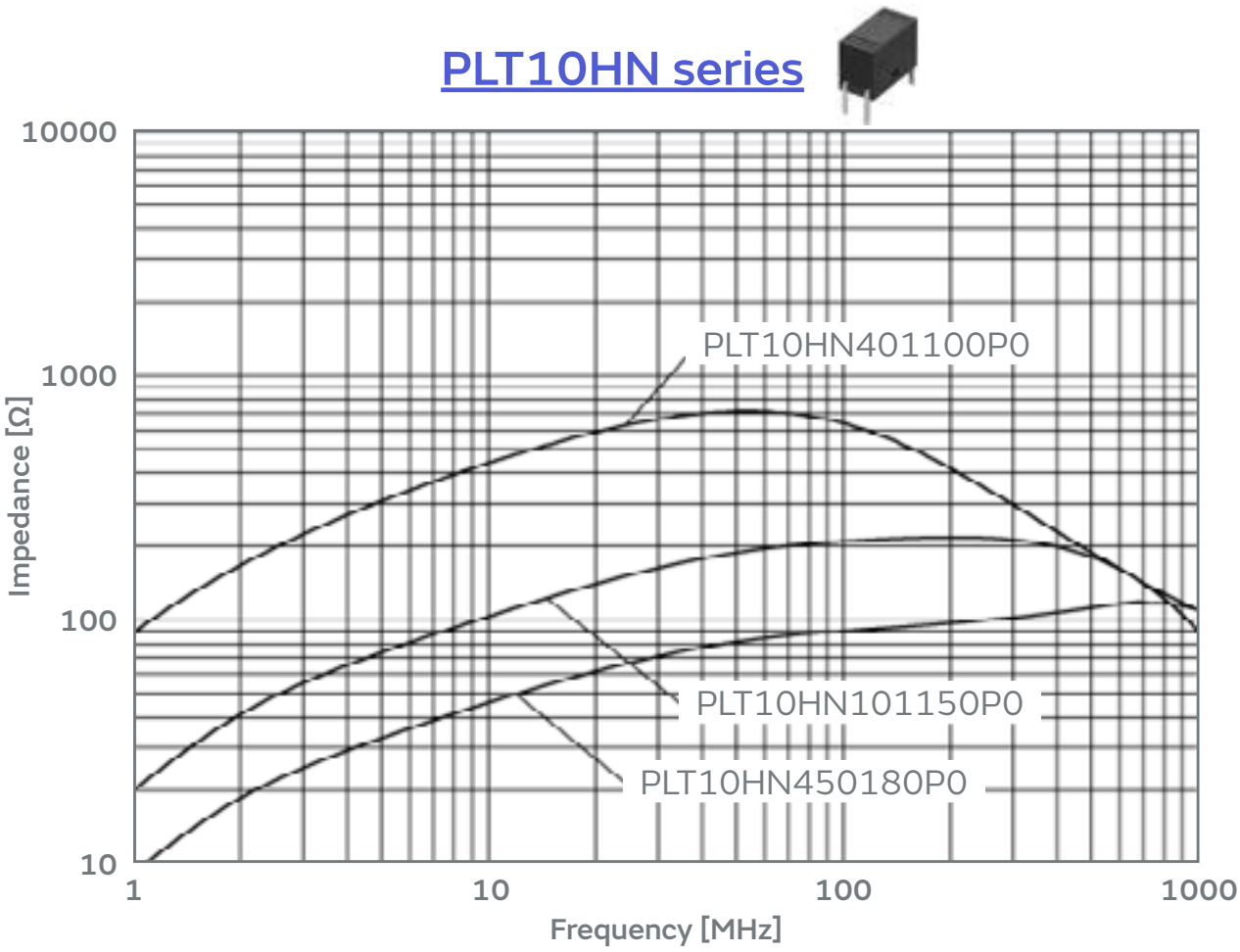
Ferrite Beads are passive electronic components that can suppress high-frequency noise and transform noise to heat.



Block	EMI Filters	Function	Product feature
Controller and HMI	DLW, DLM	To suppress signal line common mode noise	Improve signal integrity
Connectivity wireless	DLW, DLM	To suppress signal line common mode noise	Improve signal integrity in high-speed interfaces
Connectivity wired	DLW, PLT, BLM	To suppress signal and power line noise	High current and broad impedance band
DC/DC	DLW, PLT, BLM	To suppress power line noise	High current and broad impedance band
Output filter	BLM / BLE	To suppress differential noise in signal and power lines	High rated current, high impedance, good saturation

Common Mode Choke Coils

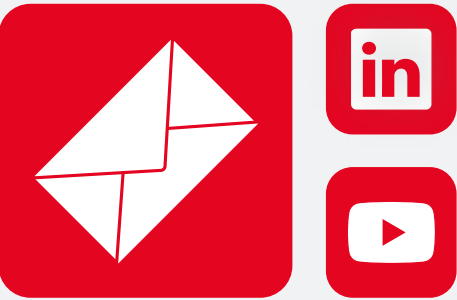
Common Mode Choke Coils are made up of two conduction wires wrapped around a single core in opposite directions. Its purpose is to reduce common mode noise which needs to be suppressed in differential transmission lines.



- Ferrite Beads
- Common Mode Choke Coils

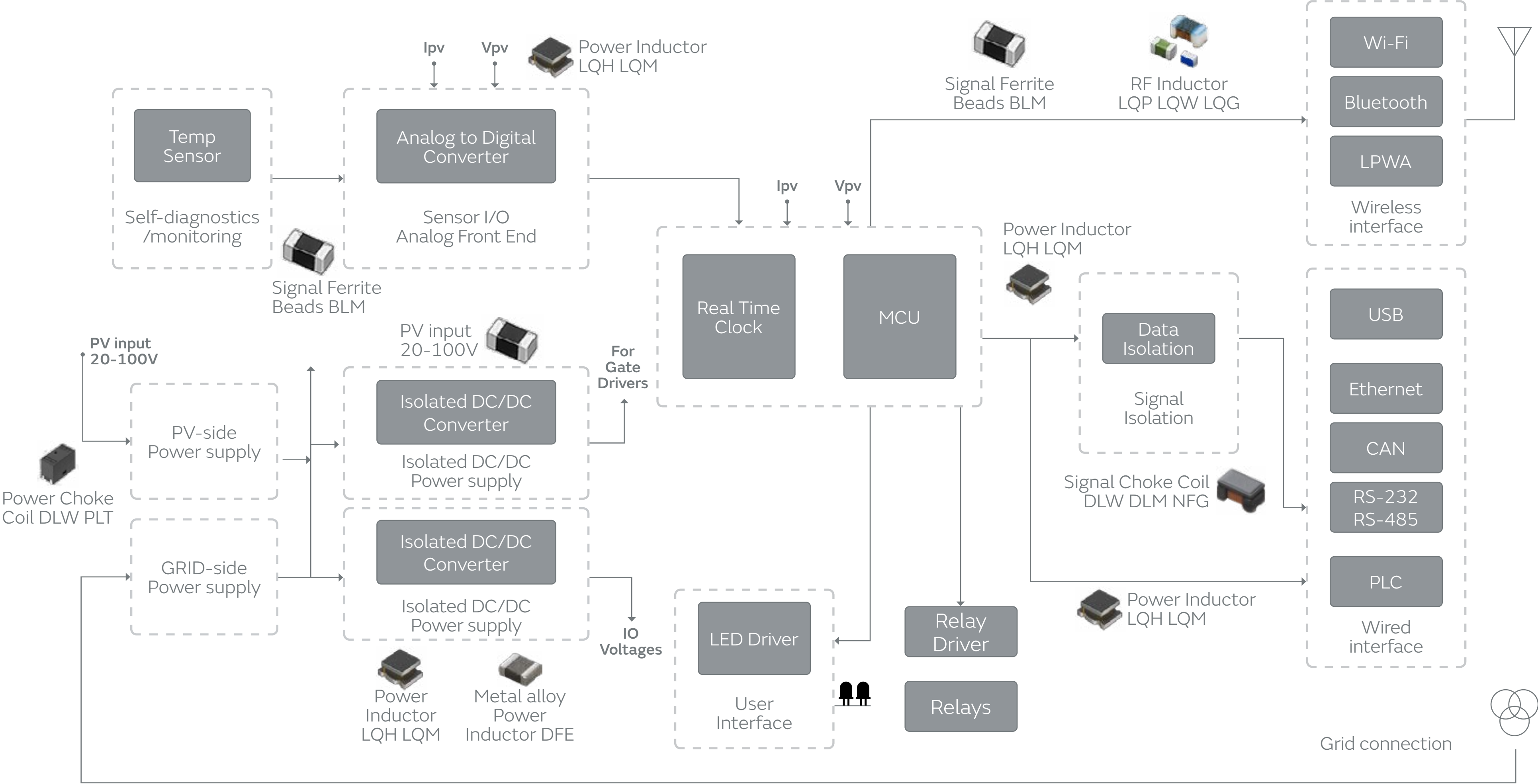
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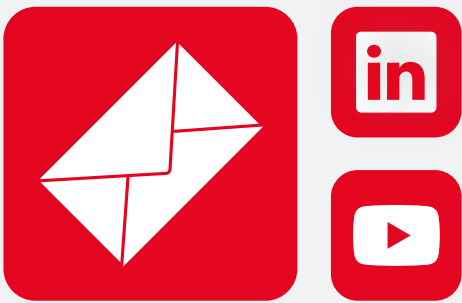


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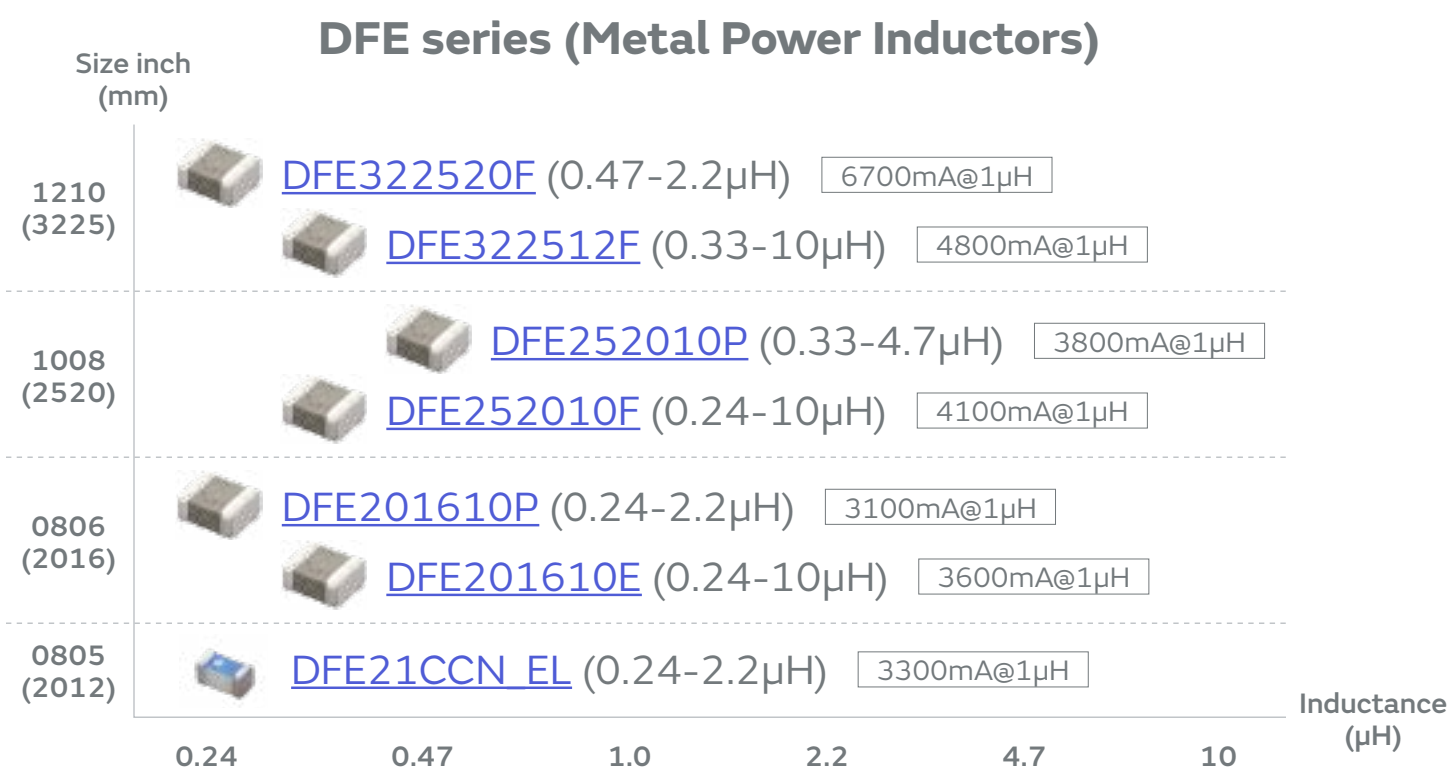


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Inductors

Power

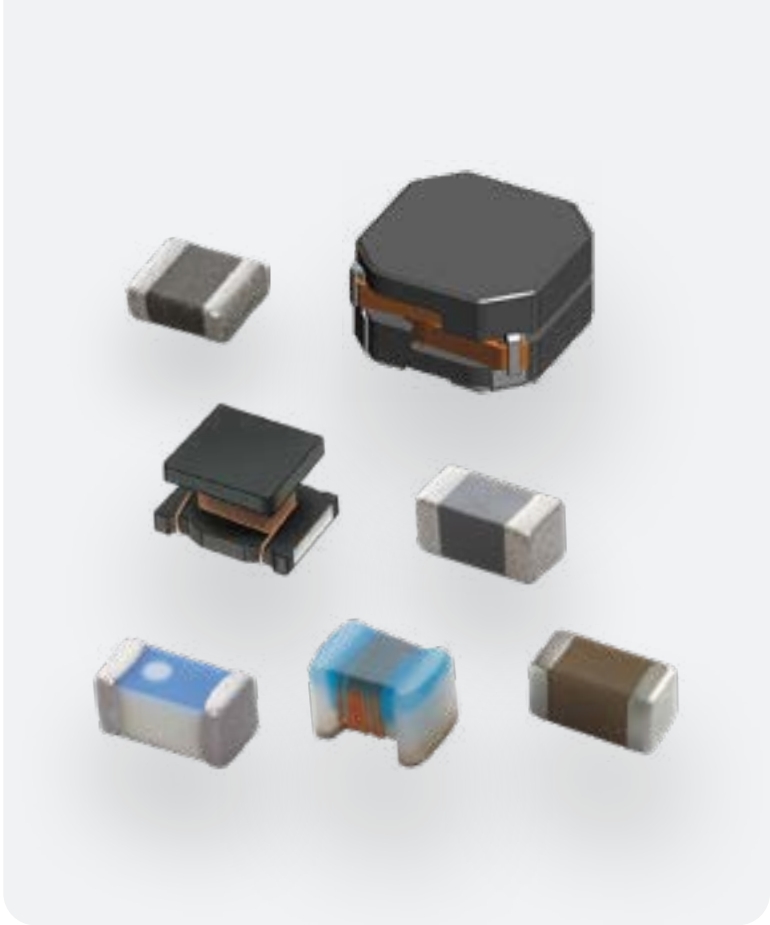
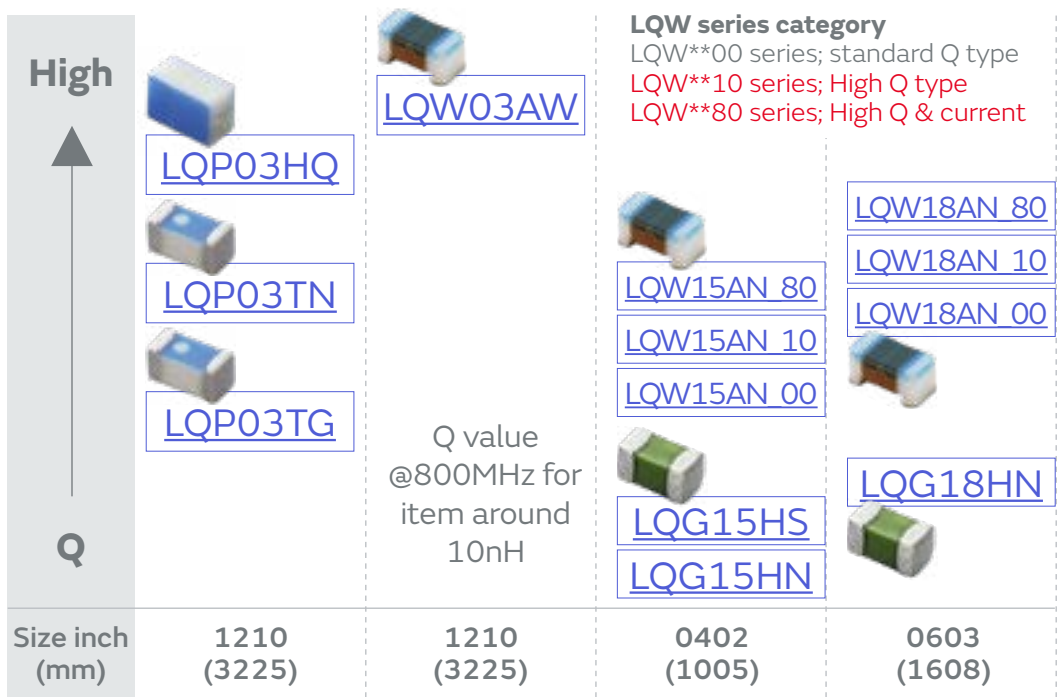
A power inductor is a coil of wire wound around a magnetic core. Its purpose is to filter electric noise as a choke for low frequency or be used as energy storage in switch regulators to provide stable and voltage converted DC power.



RF

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

*Line up also features compact film type and multilayer RF inductors

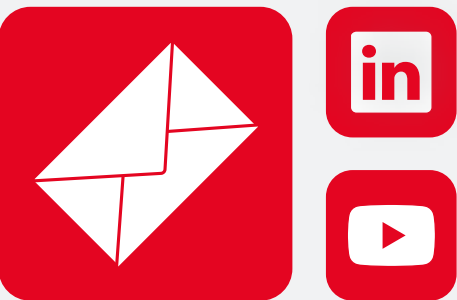


Block	Power Inductors	RF Inductors	Function	Product feature
Controller and HMI	LQH, DEM, DFE		Energy storage for switch regulator with low loss and high efficiency	High current and wide inductance range
Connectivity wireless		LQP,LQW	Impedance matching RF circuits with low losses and high signal integrity	High Q, low DCR, miniaturized
Connectivity wired	LQM		Choke inductor	Small case size
DC/DC	DFE, DEM, LQH, MDH		Energy storage for switch regulator with low loss and high efficiency	High current and wide inductance range
Output filter	LQM, LQH		Suppression of differential noise in signal and power line	Small case size & wide inductance range

- Power Inductors
- RF Inductors

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Micro Batteries

Lithium Coin Batteries

Murata offers 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).

Benefits

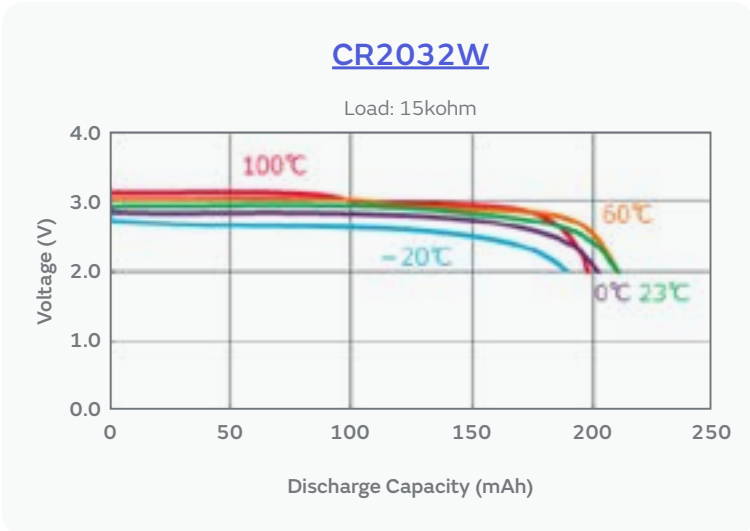
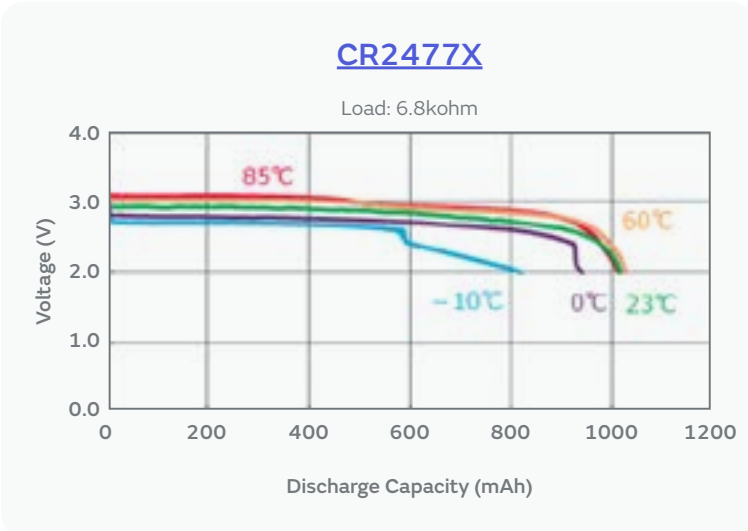
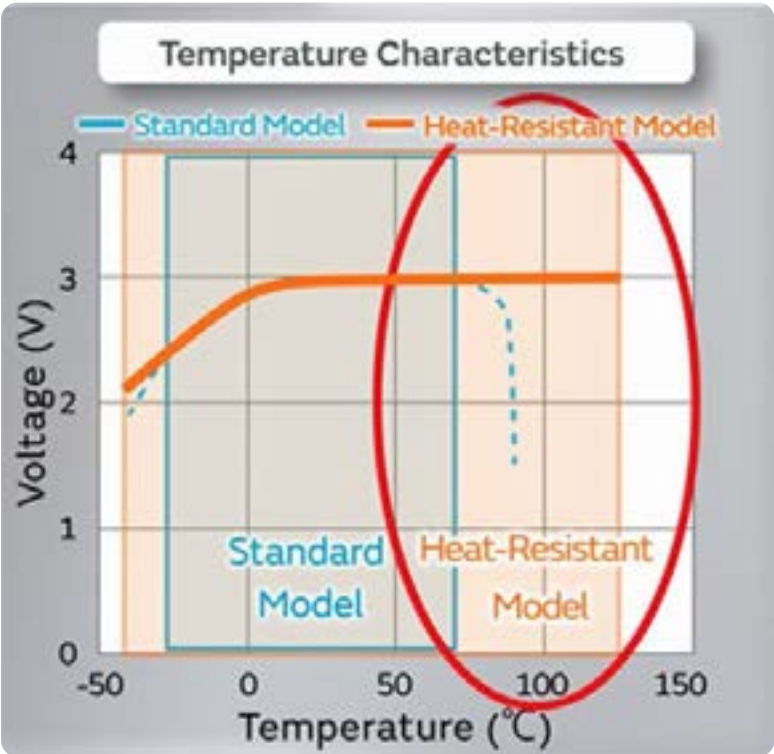
- Excellent Long-Term Reliability**
Carefully selected active materials are used for the electrolyte. These materials are sealed by Murata's innovative technology to minimize battery self-discharge. The annual self-discharge rate at room temperature and normal humidity is less than 1% of the nominal capacity.
- Lightweight, High Voltage and High Energy Density**
The battery voltage is 3V, almost double that of normal alkaline or manganese batteries. This means that the number of batteries required for equipment can be halved for maximum space saving and weight reduction.
- Multi-Variation Lineup**
Murata has several size and tab welder models.

Model	CR2032W	CR2477X
Nominal Capacity	210mAh	1000mAh
Size Diameter (mm) Height (mm)	20.0mm 3.2mm	24.5mm 7.7mm
Operating Temperature	-40°C to +125°C	-40°C to +85°C
Maximum Pulse Current*	30 mA	30 mA

* Current for maintaining minimum 2V voltage with pulsed discharge of 3 seconds and 50% nominal capacity discharged (ambient temperature 23°C)

Features

- Excellent Discharge Characteristics
- Outstanding Temperature Characteristics
- Low Leakage



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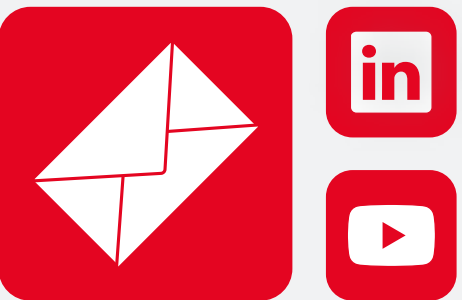
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Piezoelectric Quartz Crystal

Murata 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:

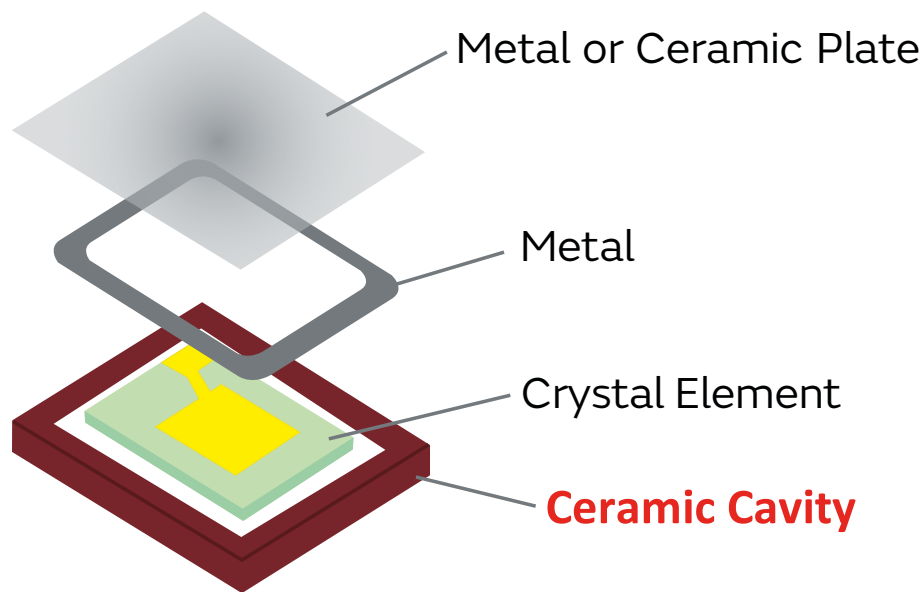
- Stable delivery
- Higher drive level resistance means Murata's timing devices are appropriate for a wider range of ICs
- No need for Pb-contained material

Features

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

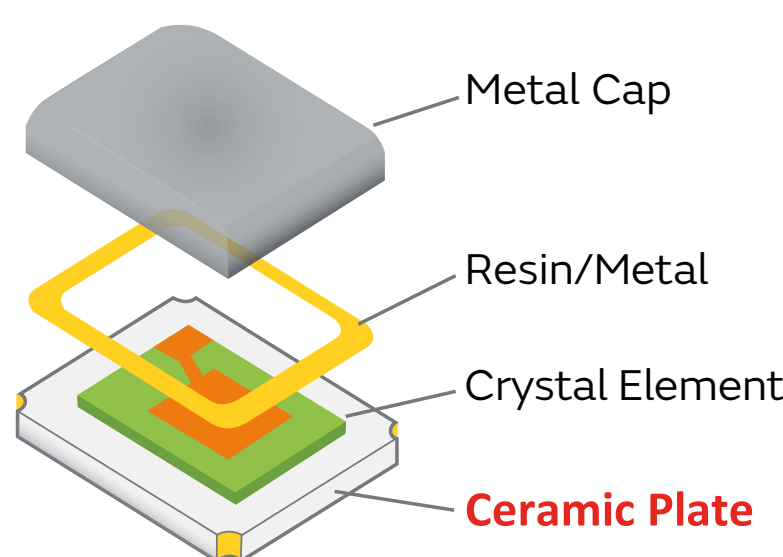


Conventional Crystal



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

Murata Crystal

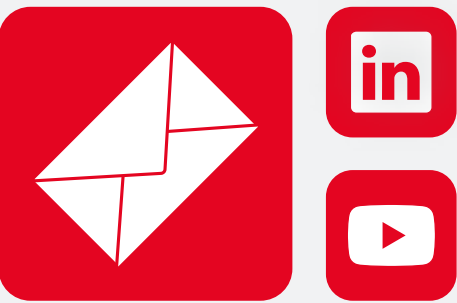


The unique metal cap and planar ceramic plate construction has a proven track record, increases our production output and reduces costs

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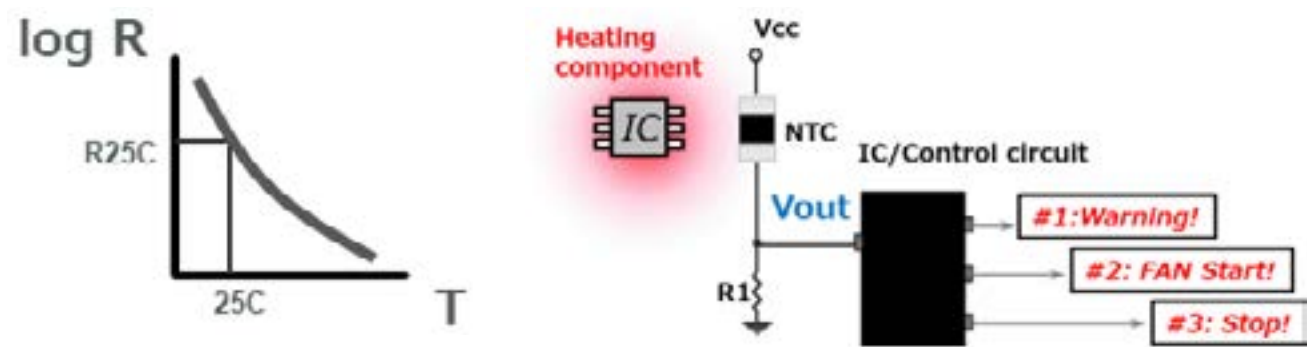
Thermistor products

NTC

Negative Temperature Coefficient (NTC) thermistors are electrical parts made to measure temperature. Murata has a lineup of products with characteristics and shapes for smartphones, wearable devices, various electronic devices, and automotive/ in-vehicle equipment.

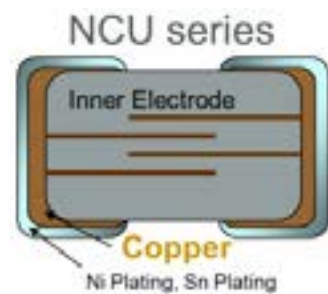
Benefits

- Temperature sensing
- Temperature compensation



Product Lineup

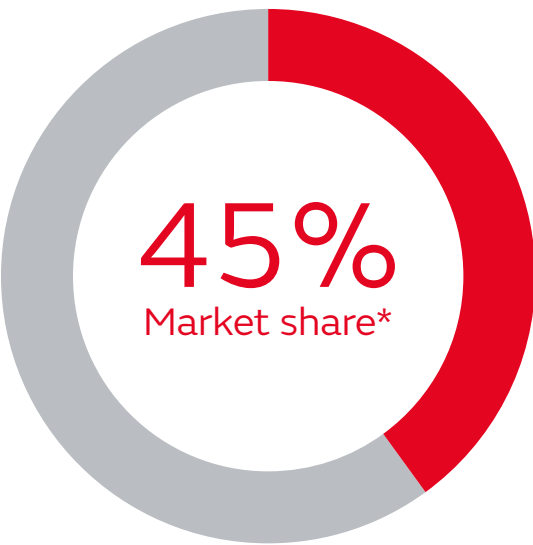
- NCU series: with Cu electrode



Series	Notes	Size	
		1.0x0.5[mm]	1.6x0.8[mm]
NCU	High reliability application	NCU15	NCU18

Features

- Stable supply
- Operating temperature range: -40 to +125°C
- Improved environmental resistance
- High safety standards (UL/cUL)



*FTI series : Direct wire bonding to the electrodes on NTC Thermistor package.

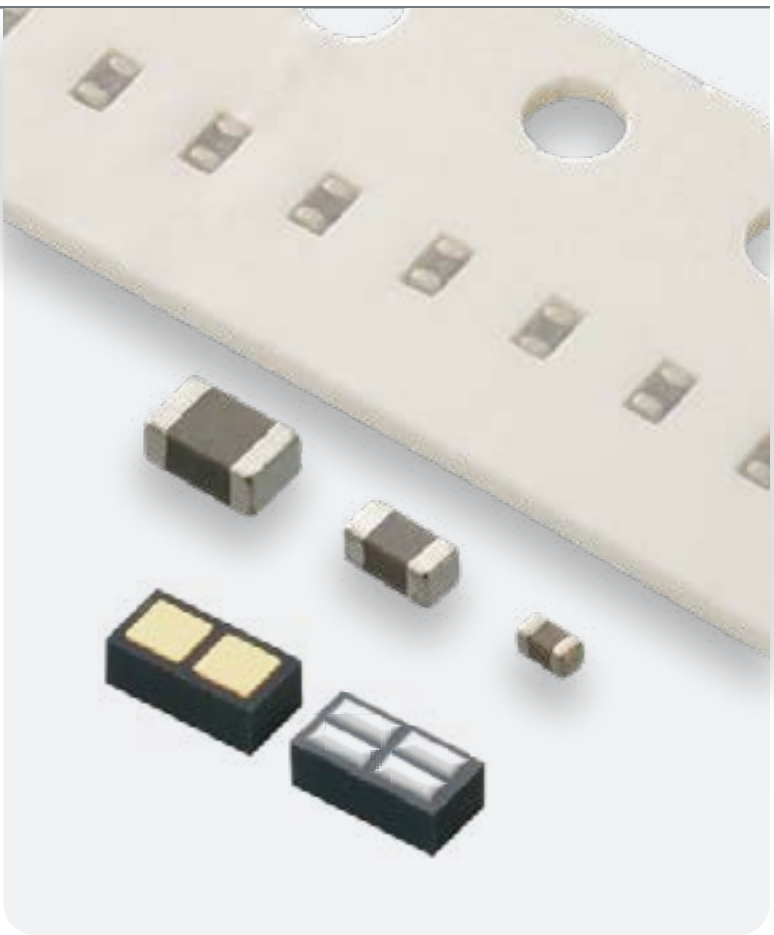
Features of FTI series

- Use of the same wire bonding process with SiC/IGBT dies.
- Locate NTC Thermistor as close as possible to SiC/IGBT dies.
- Up to 300 um diameter of Aluminum (Al) wire might be used.

Series	Notes	Size
		2.0x0.125[mm]
FTI*	Direct wire bonding	FTN21

*Under development

Mounting condition(example)



*ES sample: available SoP: 25CQ3

Thermistors

- NTC
- PTC

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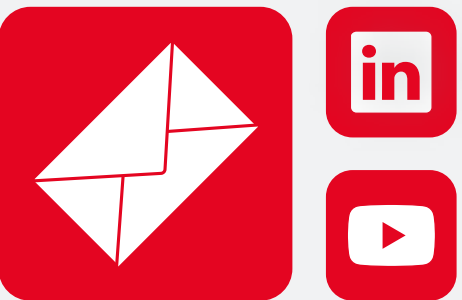
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Thermistor products

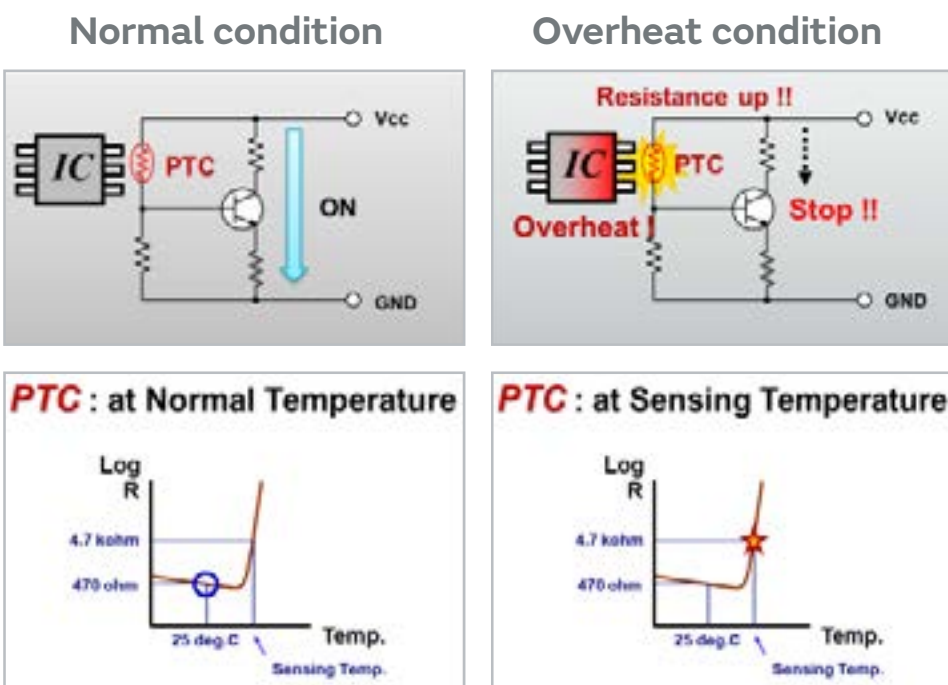
PTC

Positive Temperature Coefficient (PTC) thermistors are elements whose resistance rises with an increase in temperature. Murata PTC thermistors employ elements based on ceramics (featuring) high levels of reliability and performance.

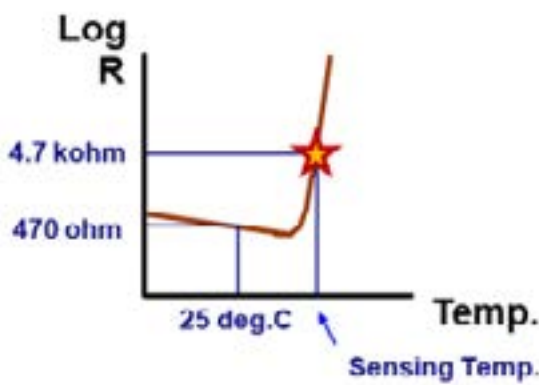
PRF series (for overheat sensing)

Features

- Simple circuit design (No need to use an IC with PTC)
- Wide sensing temperature lineup (+65 to +150 °C)
- High safety standards (UL : E137188, TUV etc.)



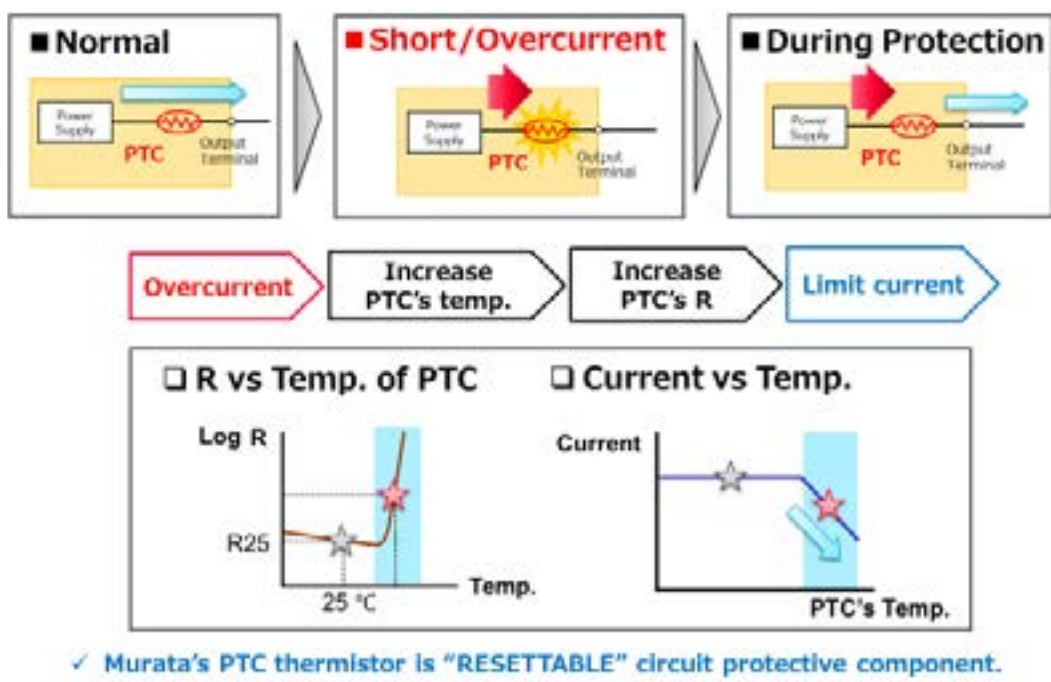
Size & Product series	Size	
	1.6x0.8x1.0[mm]	2.0x1.2x1.1[mm]
Product series	PRF18	PRF21



PRG series (for overcurrent protection)

Features

- Works as resettable fuse, if standard conditions are restored
- Compact design to save mounting space on a PCB
- Less characteristic change after mounting on PCB and activation
- Valid as a small current limiting resistor due to high-power capacity
- High safety standards (UL : E137188, TUV etc.)



Size & Product series	Size	
	1.6x0.8x1.0[mm]	2.0x1.2x1.1[mm]
Product series	PRG18	PRG21



Thermistors	
●	NTC
▲	PTC

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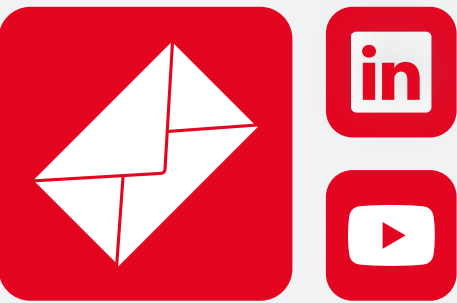
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Sound Components

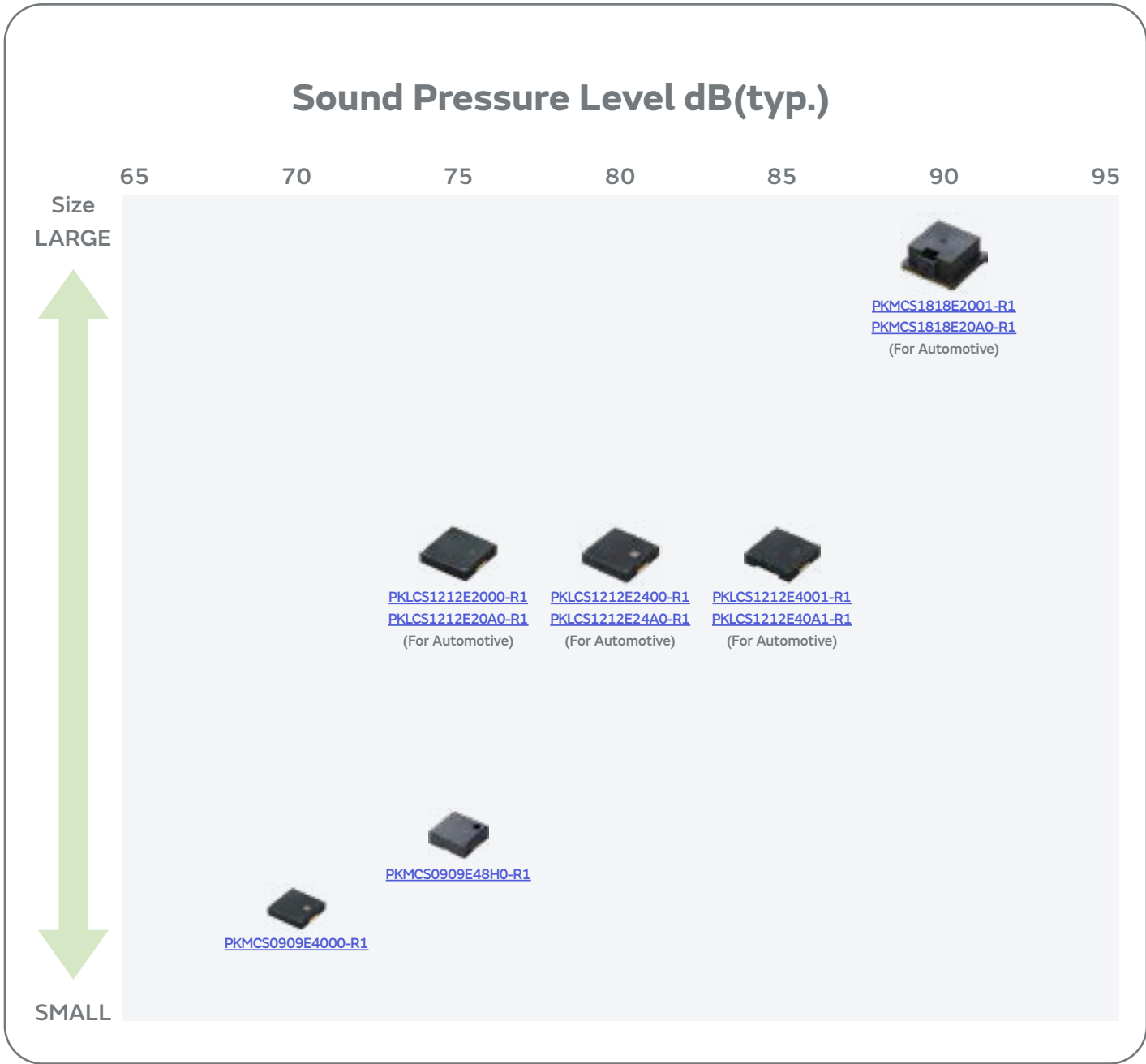
Piezoelectric Sounders

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.

These components come in Surface Mount Design (SMD) packaging, which is optimal for small, low-profile, high-density mounting, high-quality and reliability based on Murata's unique design and technologies.

Features

- Low current consumption
- Small, thin, and lightweight
- High sound pressure level and clear sound
- Easy assembly
- Available for automotive grade (PKLCS1212 series and PKMCS1818 series)

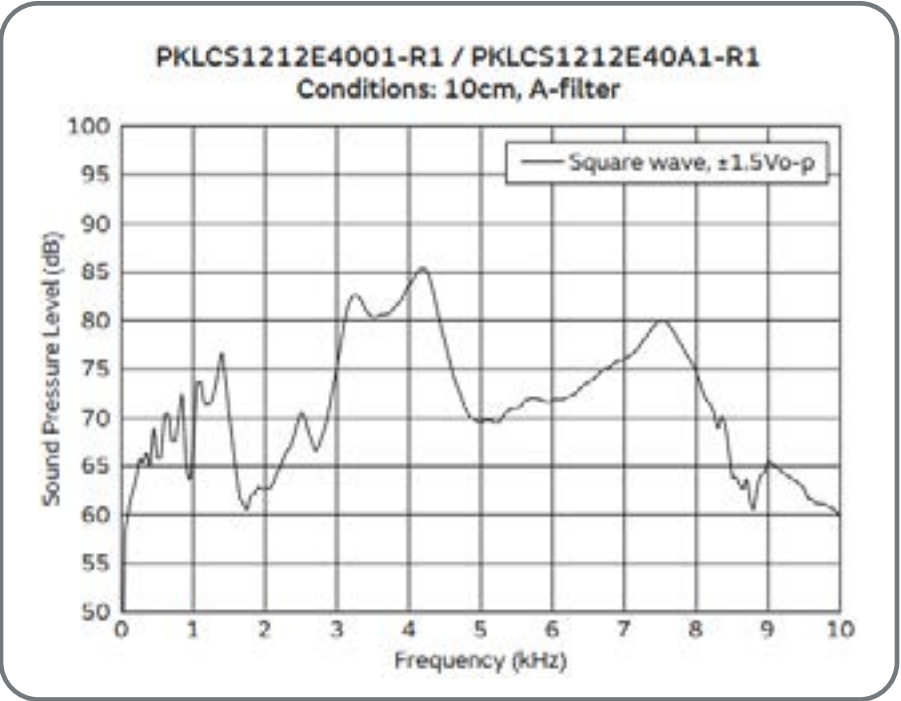
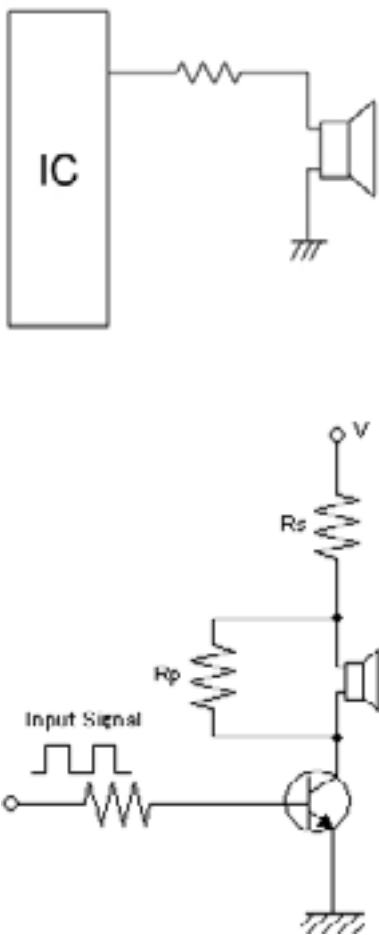


EASY TO DESIGN:

Magnet free

Simple drive circuit

No cavity housing required



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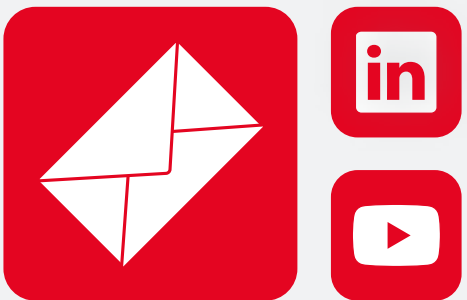
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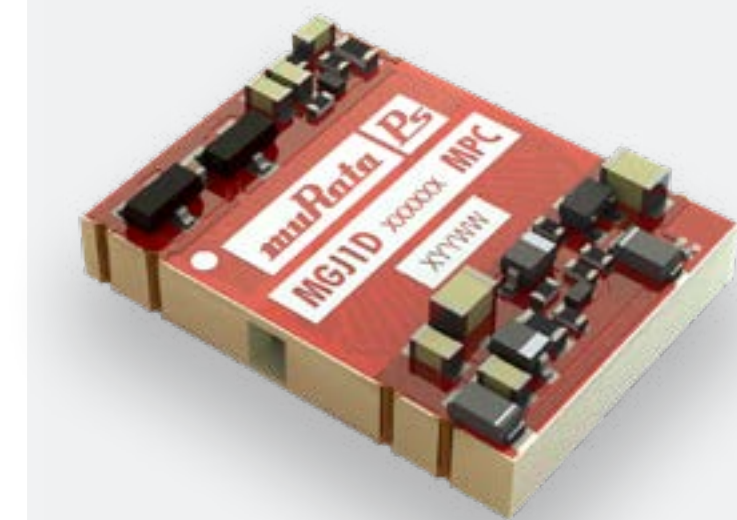
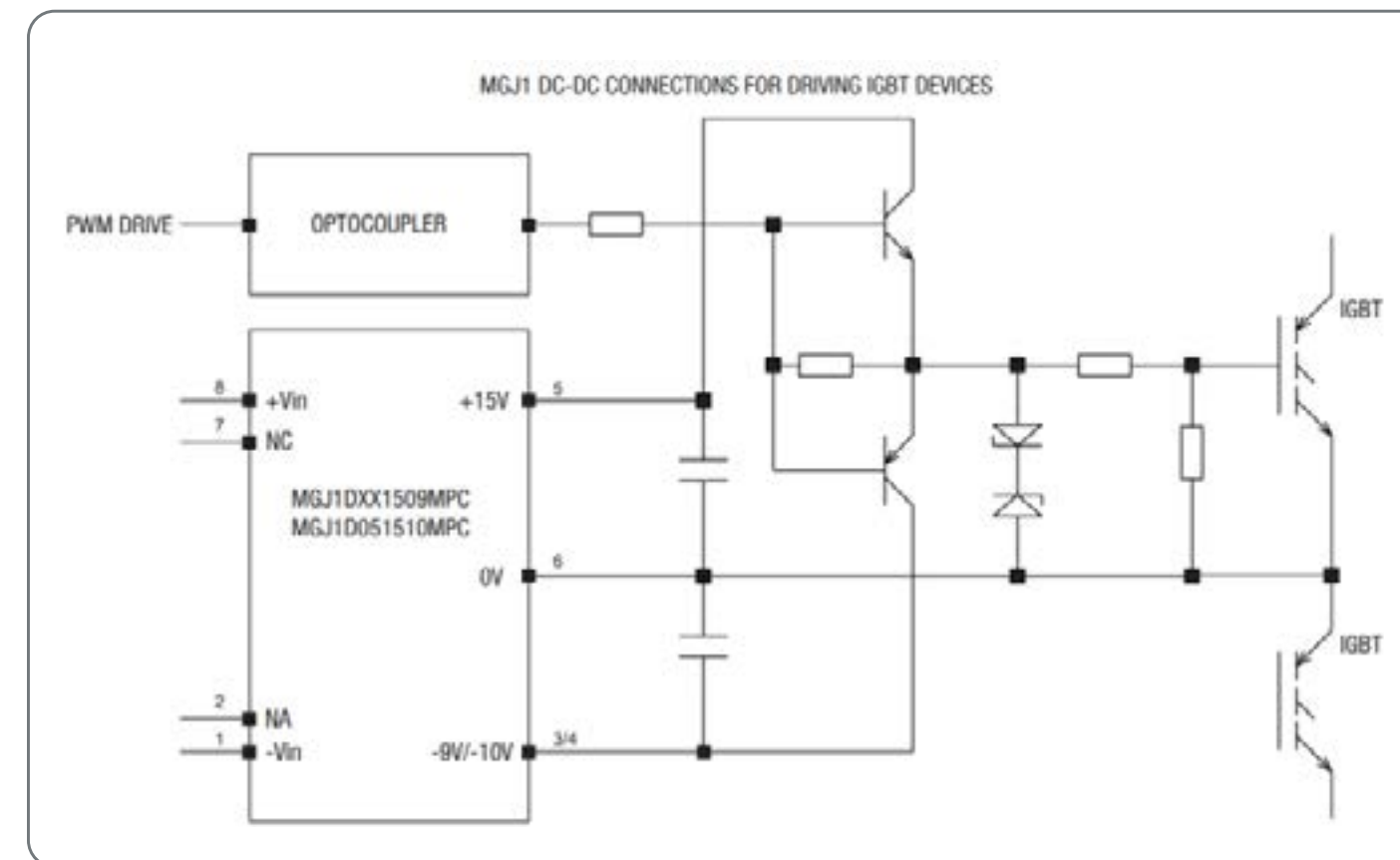
Power Products

Isolated DC-DC for Gate Drive

Gate drive applications create challenging conditions which are not factored into the design of standard DC-DC converters. For this reason Murata has created a range of converters specifically engineered and tested to ensure the reliability and safety required in gate drive.

Features

- Ultra low isolation capacitance – type 3pF
- CMTI > 200 kV/μs
- Partial discharge qualified
- Optimized positive & negative voltages for leading SiC & GaN devices
- Continuous rated working voltage up to 3kV DC
- UL26368 reinforced insulation rating for grid connect applications



FOCUS PRODUCTS					
Key parameters	MGN1	MGJ1 / MGJ2 SM	MGJ1 SIP	MGJ2B	MGJ3/MGJ6
Continuous barrier with stand voltage	1.1kVDC	2.5 - 3kVDC	2.4kVDC	2.4kVDC	3kVDC
Isolation capacitance	2.5pF (Typ)	3pF (Typ)	3pF (Typ)	3pF (Typ)	13 - 15pF (Typ)
Safety approvals	Reinforced - 250Vrms Basic - 650Vrms	Reinforced - 250VAC	Reinforced - 300Vrms Basic - 600Vrms	Reinforced - 300Vrms Basic - 600Vrms	Reinforced - 250VAC to 690Vrms
CMTI	>200kV/μs	>200kV/μs	>200kV/μs	>200kV/μs	>200kV/μs
Operating temperature	-40 up to 105°C	-40 up to 105°C	-40 to 105°C	-40 to 105°C	-40 up to 105°C
Power	1W	1W – 2W	1W	2W	3W – 6W
Semiconductor gate driver compatibility	GaN	SiC, IGBT, MOSFET and GaN			

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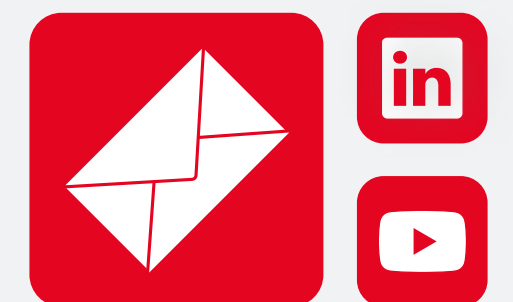
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Power Products

- DC-DC for Gate Drive
- ▲ Isolated DC-DC

More Information

Isolated DC-DC Converters

Murata's portfolio includes industry standard pinout DC-DC converters, with galvanic isolation, for noise isolation, negative voltage generation or high-reliability communication interface isolation.

Benefits

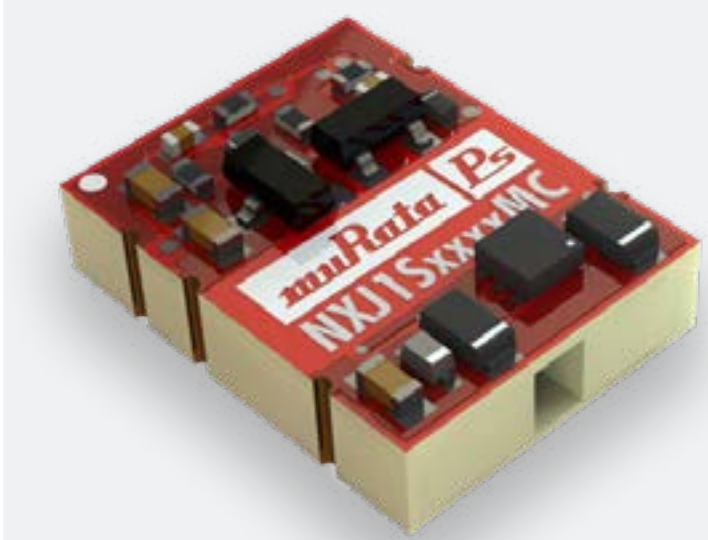
- Options for UL 62368 recognition for functional insulation
- Up to 250Vrms reinforced insulation
- Industry standard SIP4, SIP7 & SMD packages
- JEDEC JESD22-A104 temperature cycle tested

Features

- Operating up to 115°C with derating
- Standard SMD and through packages
- UL62368 recognized
- 3.3, 5, 12V & 24V input voltages
- 3.3, 5, 12 & 15V output voltages



FOCUS PRODUCTS					
Key parameters	NMV1	NME1	NMR1	NXE	NXJ
Isolation test voltage	3kVDC	1kVDC	1kVDC	3kVDC	4.2kVDC
Isolation capacitance	15pF (Typ)	15pF (Typ)	15pF (Typ)	2.1 - 3pF (Typ)	2 - 2.5pF (Typ)
Safety approvals	Functional	Functional	Functional	Reinforced - 125Vrms Basic - 250Vrms	Reinforced - 200 to 250Vrms Basic - 250Vrms
Package	SIP	SIP	SIP	Open frame SMD	Open frame SMD
Operating temperature	-40 up to 115°C	-40 up to 115°C	-40 up to 115°C	-40 up to 105°C	-40 up to 110°C
Power	1W	1W	1W	1W-2W	1W - 2W

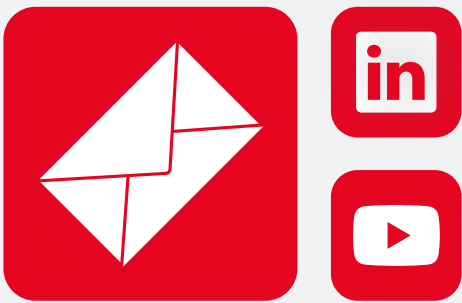


- Power Products
 - DC-DC for Gate Drive
 - Isolated DC-DC

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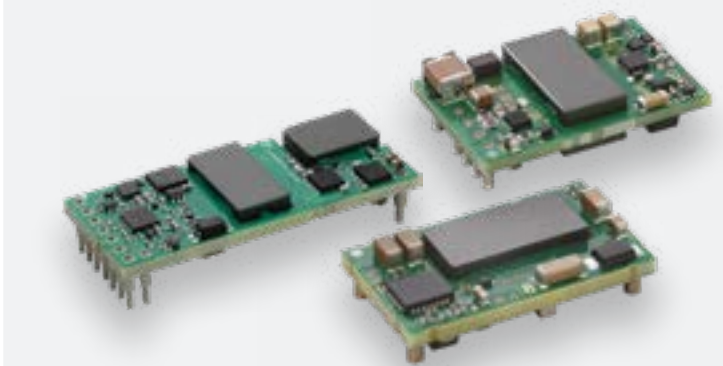
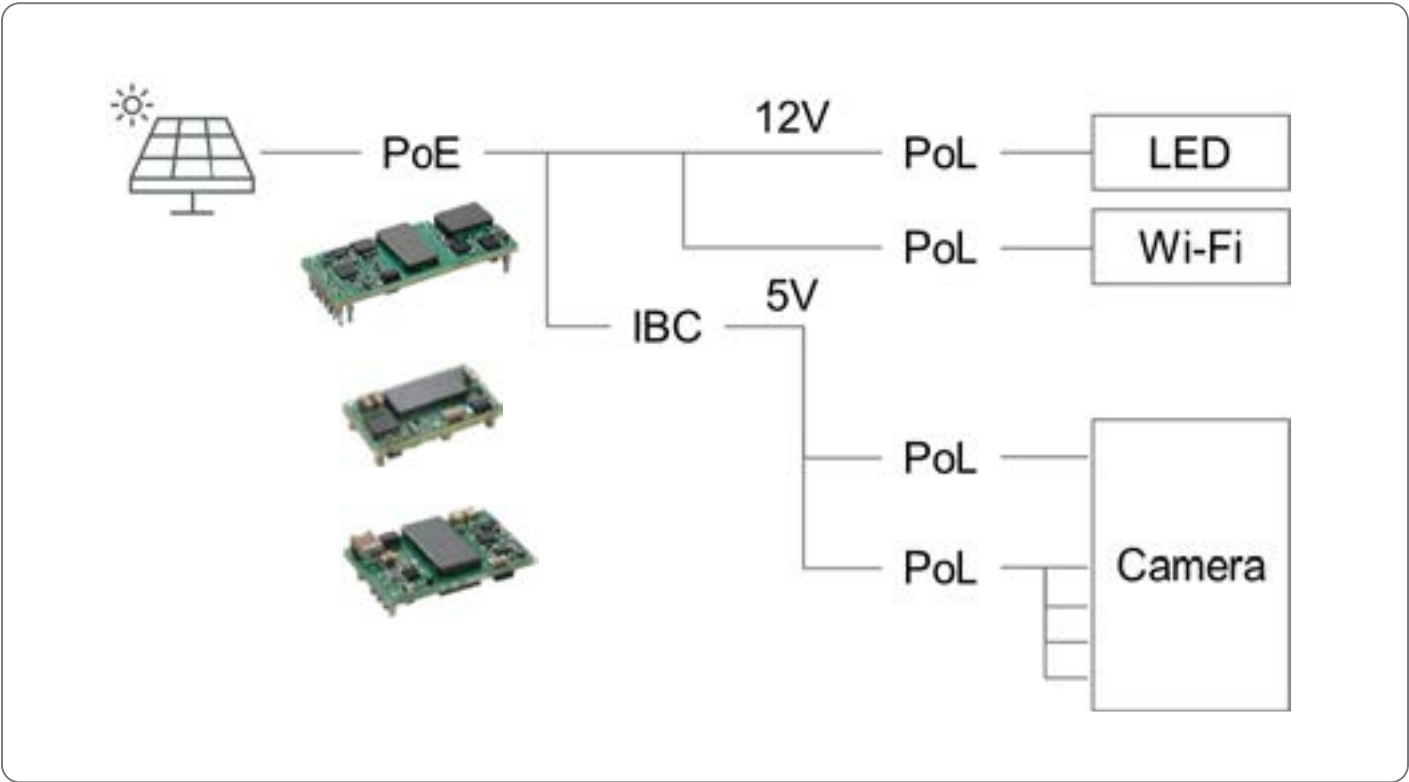
Isolated DC-DC for PoE system

Murata’s smallest size, highest efficiency and high-power density PoE isolated DC-DC converter modules are providing the easiest way to configure PoE systems efficiently for powering LED, Wi-Fi, camera devices and more with no additional external components.

These products come in an SMD type module.

Features

- Easy to use
- High-Power Density
- Saves space
- Lower EMI
- Saves design and test costs



	For PD						For PSE
	PoE / af		PoE+ / at		PoE++ / bt		Boost-up
P/N	MYBSP00502ABF	MYBSP01201ABF	MYBSP0055AABFT	MYBSP0122BABFT	MYBSP0124CAZFT	MYBSP01206AZFT	MYBSS054R6EBF
Power	10W	12W	25.5W		51W	72W	30W
Size[mm]	26.0 x 14.8 x 6.8		35.5 x 22.4 x 10.55		56.4 x 22.2 x 8.6		35.5 x 22.4 x 8.9
Input	37 – 57V		37 – 57V		41.1 – 57V		10.8 - 27V
Output	5V/2A	12V/1A	5V/5.1A	12V/2.125A	12V/4.25A	12V/6A	54V/0.6A
Adapter Oring	N/A	N/A	Available	Available	Available	Available	N/A

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DC-DC for Gate Drive

Isolated DC-DC

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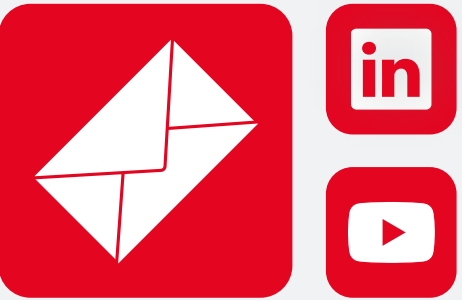
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RF Modules

Wi-Fi® and Bluetooth® allows you to connect to the internet directly, so it is the most flexible wireless technology for your IoT products.

Murata offers a wide range of modules which can include an integrated MCU for simplified solutions.

LoRa allows devices to connect at long distances and for users to create their own network. This is incredibly effective for remote, rural or large areas.

Benefits

- Fast time to market
- High performance and reliability
- Local and global FAE support
- Longevity guarantee
- RF & certification support



Features

- Wi-Fi®4, Wi-Fi®5 and Wi-Fi®6 /BT
- LoRa
- Certified for FCC/IC, CE and Japan
- Integrated on Linux or RTOS platforms
- Wi-Fi and Thread mesh support
- Matter support

Find out more about Murata’s lineup of Matter compatible modules using NXP and Infineon Wi-Fi®/Bluetooth®/Thread IC

[Wi-Fi® Modules / Wi-Fi® + Bluetooth® Modules](#)

[Infineon Based Modules](#)

[Wi-Fi® Modules / Wi-Fi® + Bluetooth® Modules](#)

[NXP Based Modules](#)



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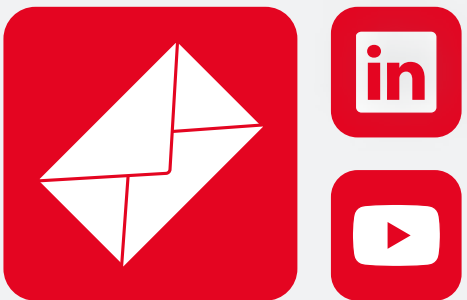
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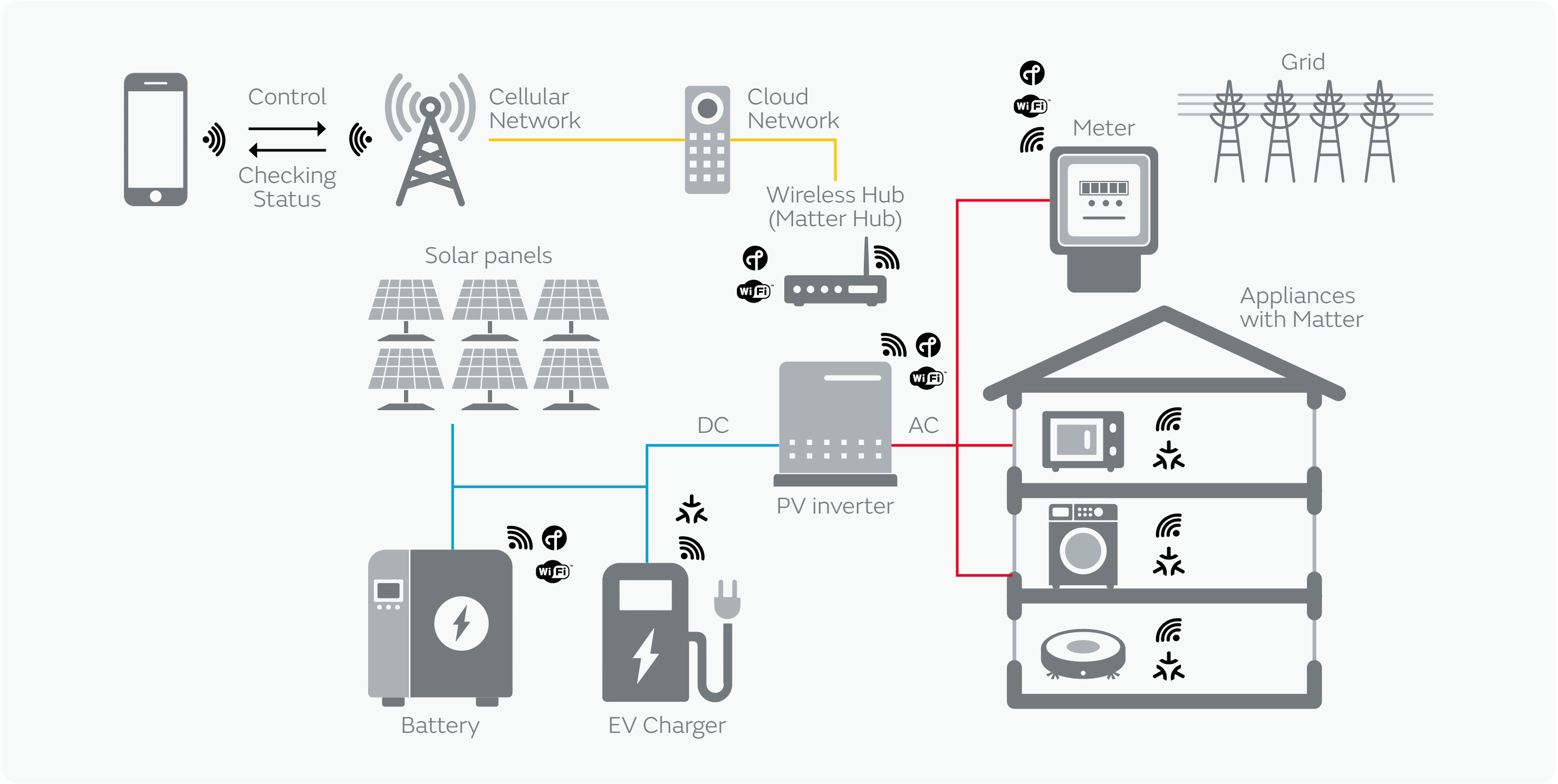
IoT Connectivity

Matter™ Under IoT connectivity

Matter™ aims to provide seamless and secure connectivity between different smart home platforms. This will allow consumers to manage smart devices from different manufacturers in a unified ecosystem.

Matter™ requires IPv6 connectivity such as Wi-Fi, and Thread.

Version 1.3 - Matter™ 1.3 introduces energy reporting capabilities for energy management. This enables any device to report power, voltage, current, and others, in real-time, as well as its energy consumption or generation over time. More energy-related devices, for example, Solar Power and Battery Storage will be incorporated into Matter in future versions.



[Learn more about Matter™](#)
[*Official Website Link](#)

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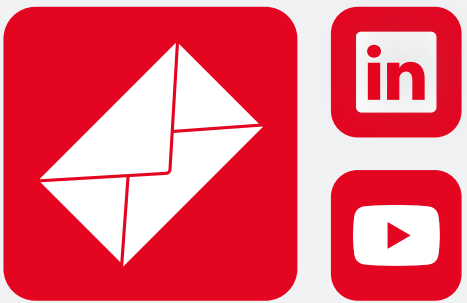
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Microwave Coaxial Switch Connectors

Features

- Microwave coaxial switch connectors are very useful for electrical characteristics measurement of microwave circuits in products.

Benefits

- The built-in mechanical switch separates the RF circuit and antenna circuit, so that the circuit can be measured without disruption using a dedicated probe made by Murata.
- When measuring with a probe, the internal mechanical switch disconnects - this means that the RF and antenna circuit remain connected even during the measurement process"

Manual probe with cable



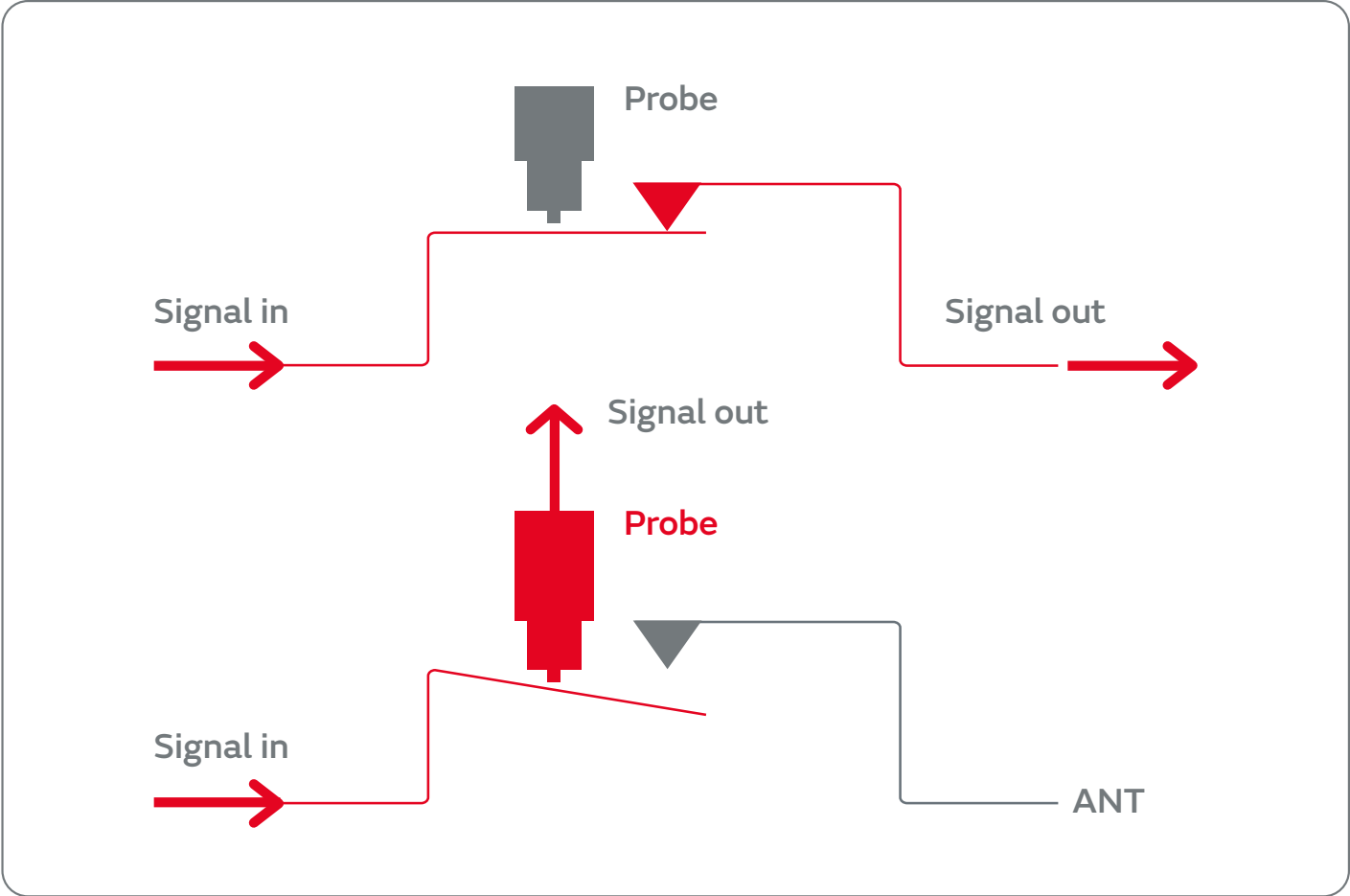
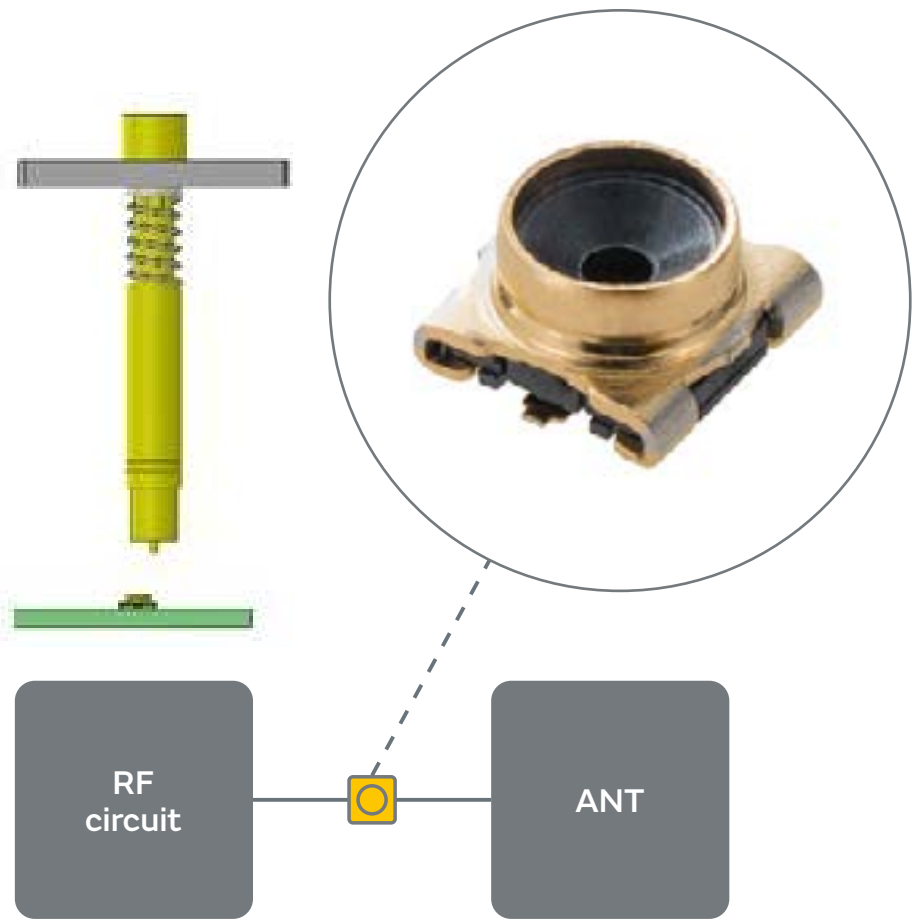
Used for evaluation in the lab, this probe stands by itself after mating is completed, because it has claw at the contact point with connectors.

Automatic test probe



Used for inspection in mass production process, these probes are built into the measurement fixture, and pressed at connectors.

Murata can advise optimal test fixture design and provide guidance on how to set probes on the measurement fixture.



RF Products	
▲	Coaxial Connector
●	LTCC

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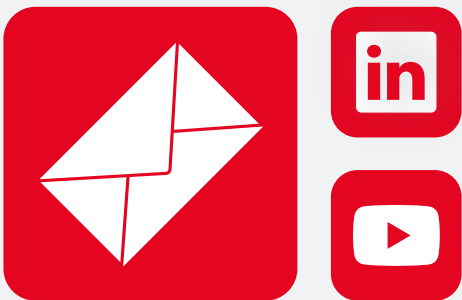
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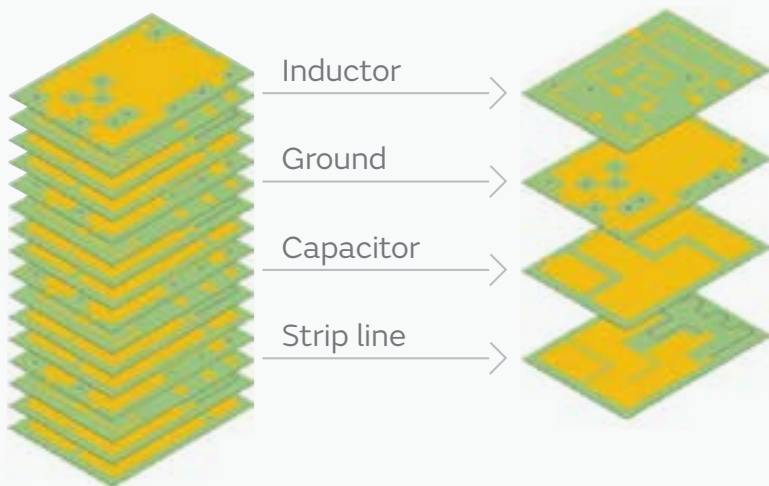
LTCC RF Components

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.

Applications

- Cellular communication
- Base-station
- WiFi / BT / UWB / GNSS connectivity
- IoT



LC filters are passive components which pass or reject a specific frequency band. These components are used for extracting the specific frequency band, or rejecting for noise reduction.

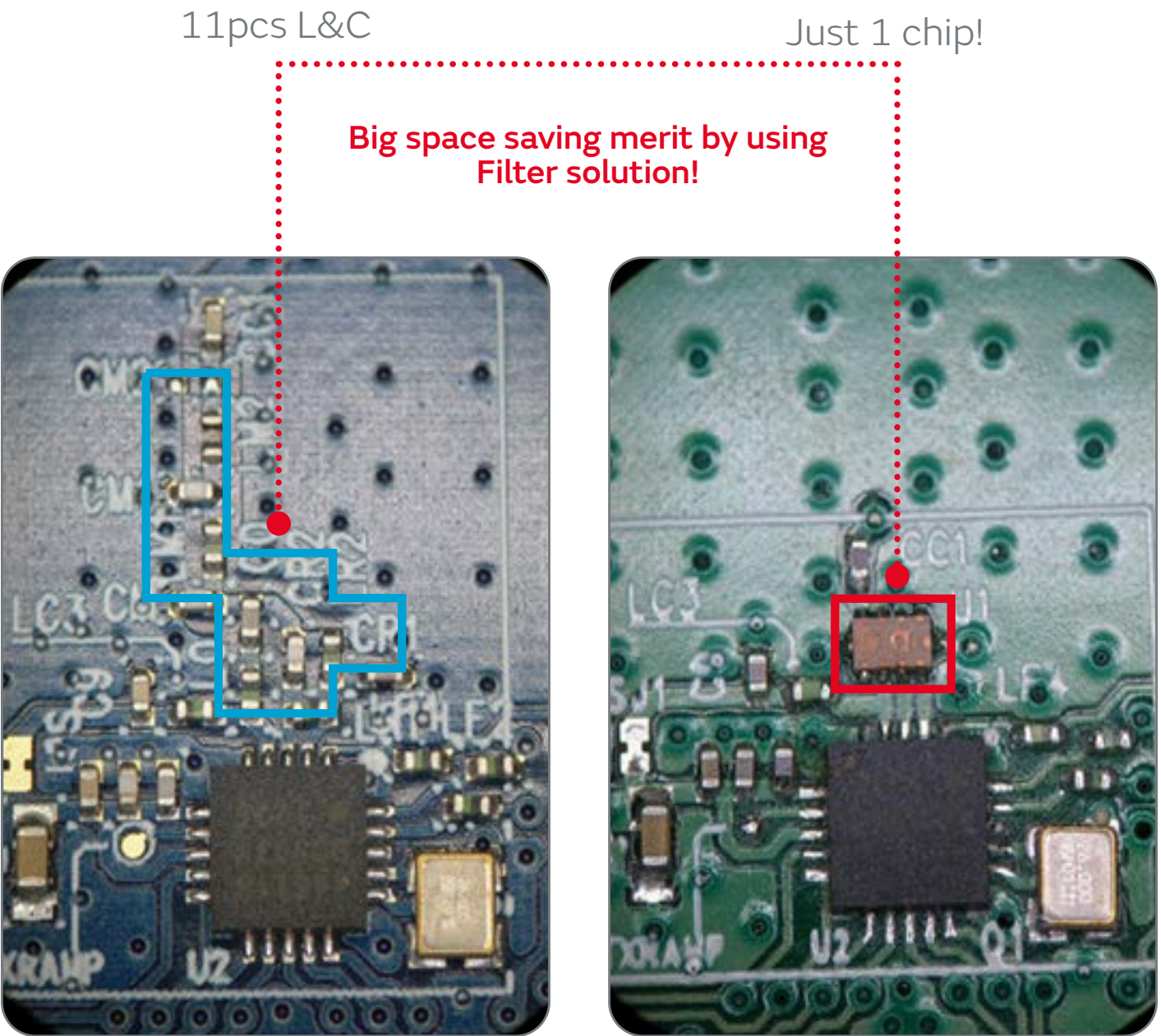
Couplers are RF passive devices used for coupling a specific frequency from an inputted RF signal. These products are used for power level control of transmitters.

Baluns are used for converting between a balanced transmission line and an unbalanced transmission line.

Dividers are the components made to divide one high-frequency signal into two signals.

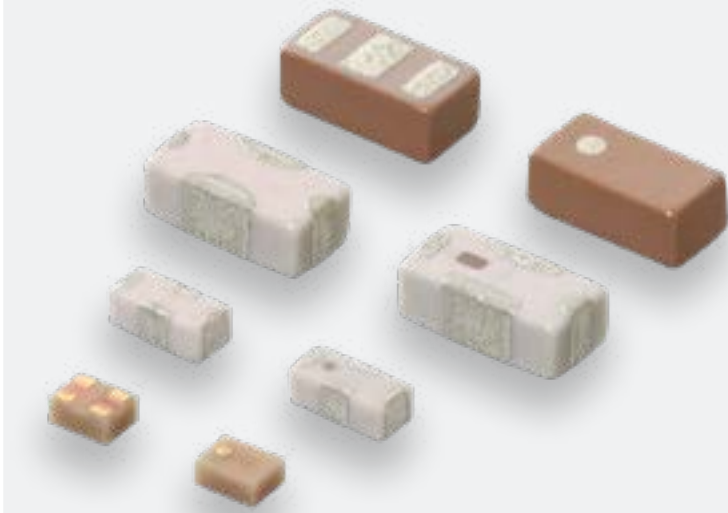
Features

- Easier for design and saving engineering effort
- Less component variation
- Space saving
- Less component count in BOM



RF board with discrete circuit

RF board with LTCC filter



RF Products

- Coaxial Connector
- LTCC

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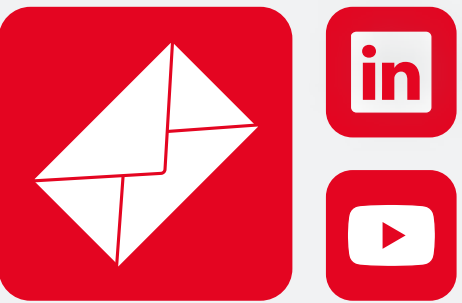
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AMR Sensors (Magnetic Sensors)

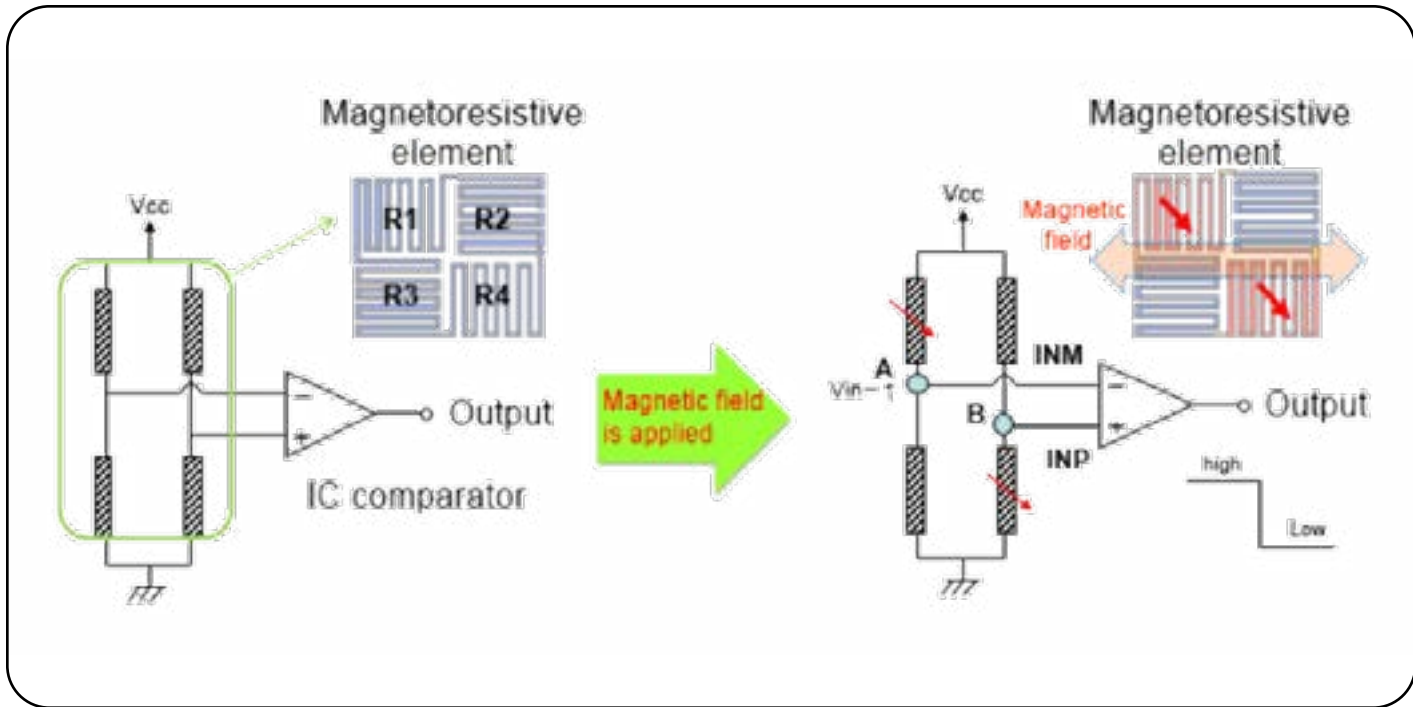
Murata magnetic sensors use AMR elements whose resistance varies according to the strength or direction of the magnetic field.

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.

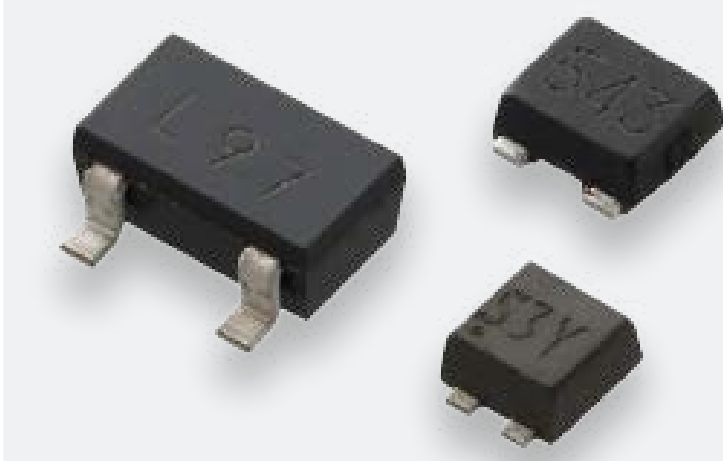


Features

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

Application

- Opening and closing switch
- Rotational sensor

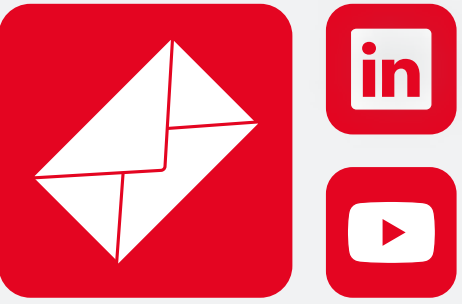


Appearance

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

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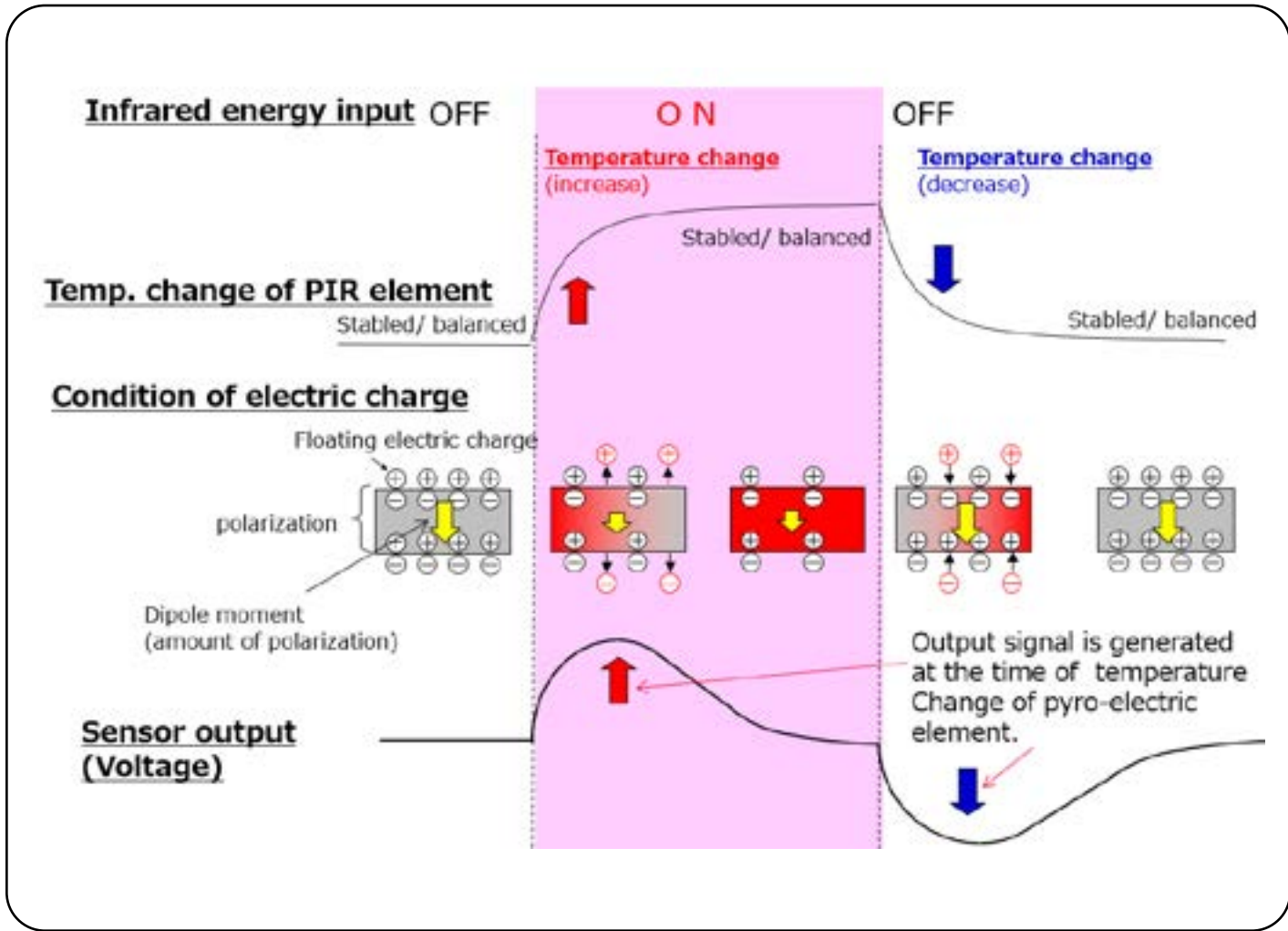
PIR Sensor

Pyroelectric infrared sensors use the pyroelectric effect of pyroelectric ceramics, a type of piezoelectric 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



Applications



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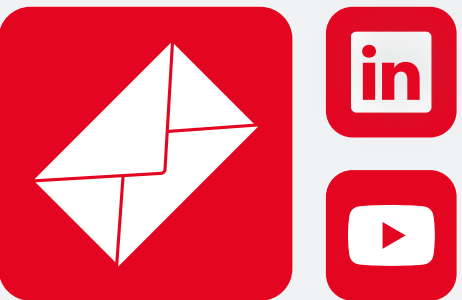
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- ESD Protection Devices



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ESD Protection Devices

TVS Diode

TVS diodes (ESD protection devices) are used to prevent electronic equipment from breakdown or malfunctioning due to electro-static discharge (ESD).

Features

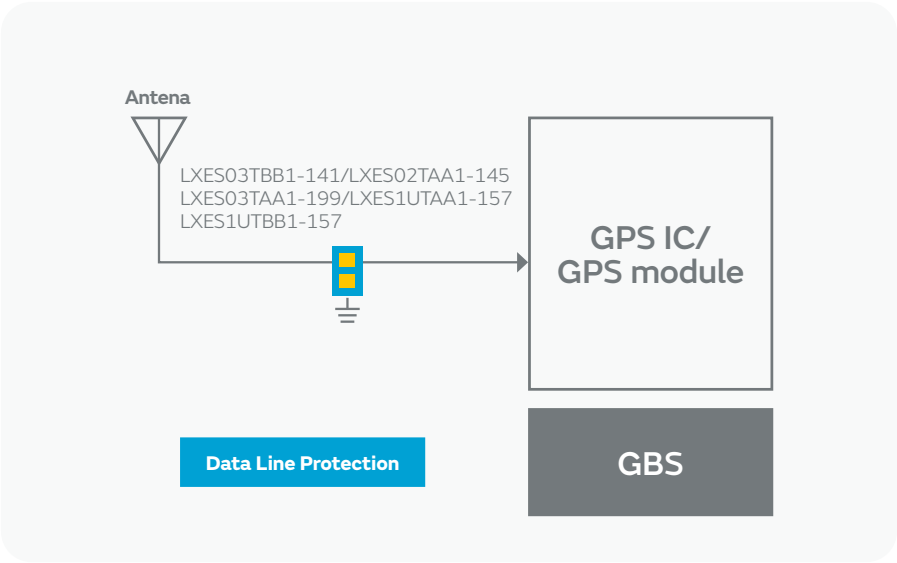
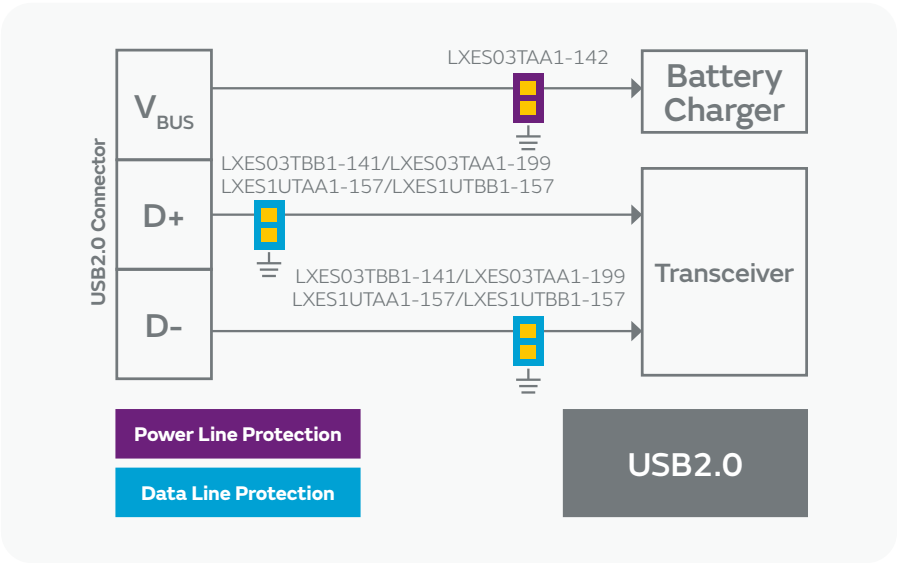
- **Small products**
Murata offers 0.4 mm x 0.2 mm (size 0402), 0.6 mm x 0.3 mm (size 0603), and 1.0 mm x 0.6 mm (size 1006) sizes, and there are two types of packages. (DFN and CSP)
- **Wide variety of applications**
Murata offers a product lineup that protects a wide range of applications, from power lines to high-speed transmission lines.

Application

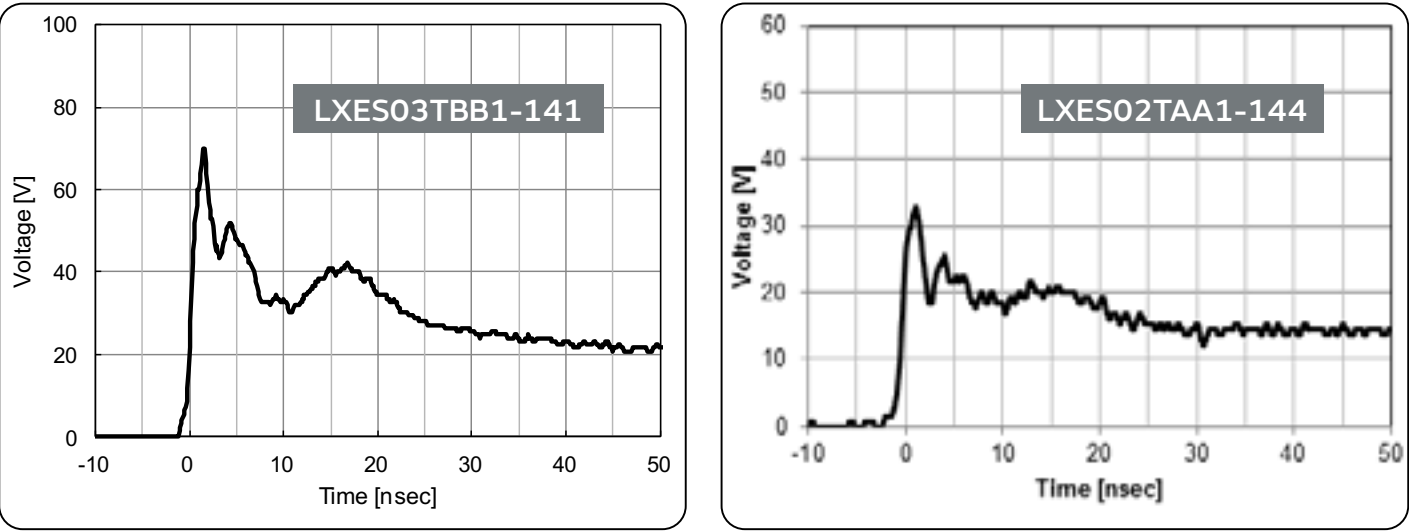
- I/O Interfaces Ex) USB HDMI
- RF ports for receive-only Ex) GPS

Model	LXES03TBB1-141	LXES02TAA1-144
Capacitance	0.45[pF]	5.0[pF]
Size (L×W,T)	L×W: 0.60×0.30[mm] T: 0.20[mm]	L×W: 0.40×0.20[mm] T: 0.15[mm]
ESD per IEC 61000-4-2 (air, contact)	air: +/- 25[kV] contact: +/- 8[kV]	air: +/- 15[kV] contact: +/- 8[kV]
Break down Voltage	7[A] (min)	7[A] (min)

Usage example

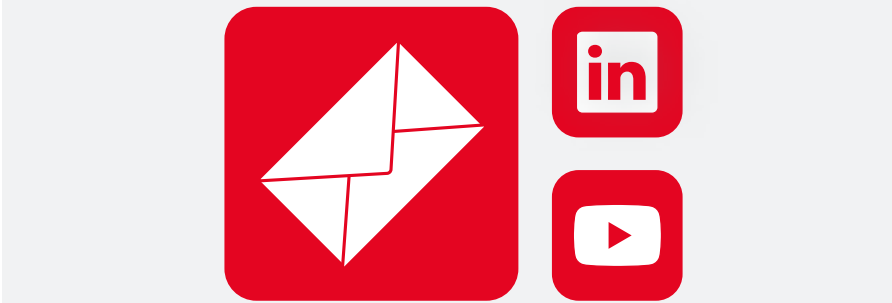


ESD Waveform (IEC61000-4-2:8kV Contact)



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Global Locations

For details please visit www.murata.com

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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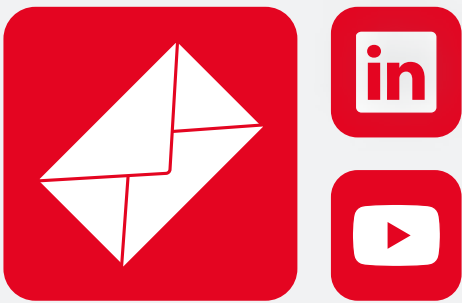
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