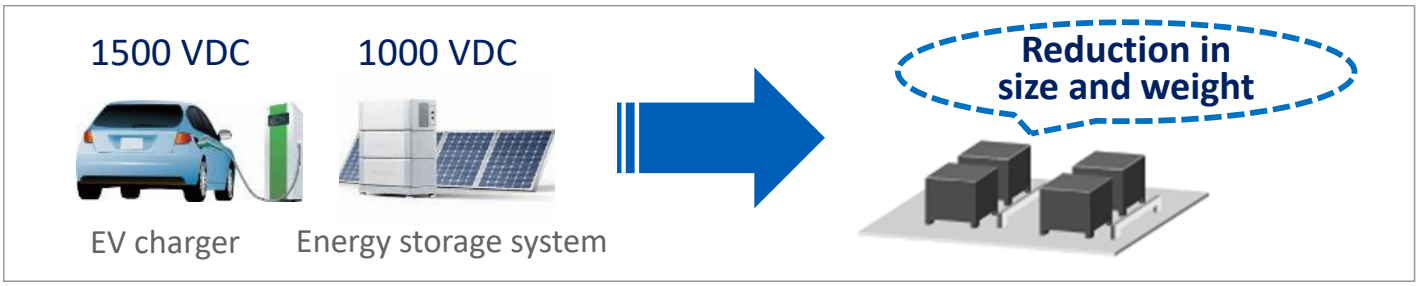
Issue Date: March 2026

Meeting the needs of high-voltage PCB designDC1500V/150A Relay-Type G9KD

Summary

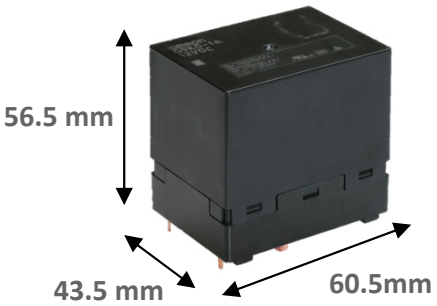
In recent years, energy-related equipment has become increasingly high voltage. For example, the maximum voltage standard for EV chargers has been expanded to 1500 VDC, and in energy storage systems as well, hybridization with solar power generation is driving the need for designs exceeding 1000 VDC on DC lines. Although voltages and currents are increasing, the demand for smaller and lighter equipment remains constant. However, current-interrupting devices capable of controlling high voltages and large currents are large in size, and it is common to use multiple units on the same PCB. As a result, there is an issue that the equipment and related wiring and mounting space also become enlarged in line with the increase in high voltage and high capacity.



[Figure 1: Market needs]

The G9KD model is a high-voltage relay rated for DC 1000V to 1500V that also offers PCB terminal options. While screw-type terminals are commonly used for disconnect devices in high-voltage systems, considering PCB terminal designs can help reduce conventional wiring space, wiring labor time, and costs.

Product Overview



Contact form	1a (NO)	1a/1b (NC)
Contact voltage (maximum value)	1500 VDC	30 VDC
Switching current (maximum value)	Input 100 A Break 150 A	1 A
Rated current	100 A (85°C) 150 A (70°C)	1 A

※UL/C-UL, TUV, and CQC certified For details, please refer to the datasheet.

Value Proposition

- **PCB terminal design for 1500 VDC contributes to improved work efficiency**
- **The mirror contact structure enables weld detection with a single unit**
- **Air insulated switchgear (AIS) technology contributes to improved equipment reliability and safety**

[Main application examples]

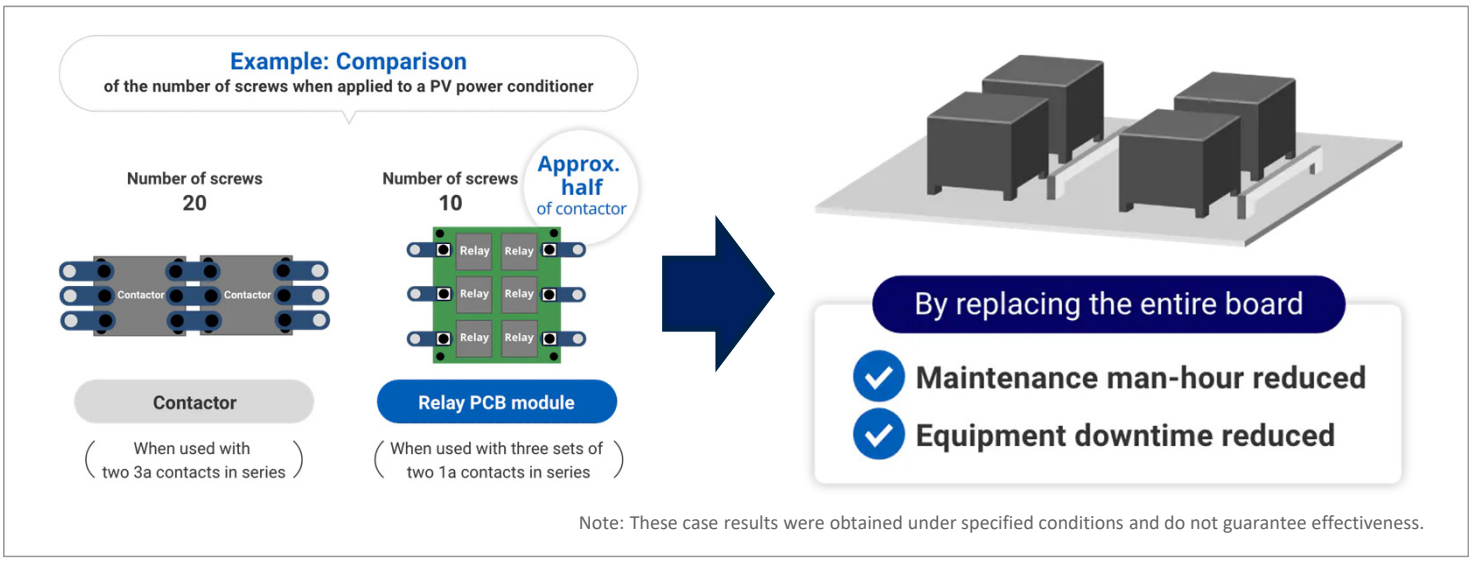
PV inverter | EV charger | Energy storage system | Industrial inverter (3-phase power)

[Figure 2: Specification overview, value proposition, and main applications]

Value Proposition (G9KD)

＜Improved work efficiency with PCB terminals＞

Screw-type devices are commonly used for switching applications in high-voltage systems exceeding DC 1000V (especially DC 1500V).Therefore, it is considered difficult to automate assembly or improve mass production efficiency. However, because the G9KD uses PCB terminals, it is possible to significantly reduce the number of screw fastening points. Furthermore, replacing the entire PCB during maintenance helps reduce equipment downtime and man-hours.



[Figure 3: Example of reduced man-hours using PCB relays]

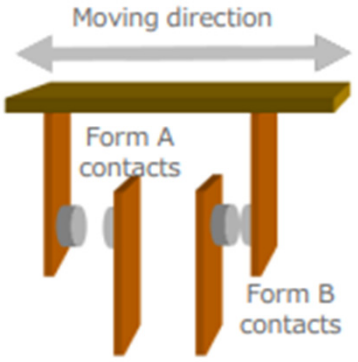
＜Fault detection using relays with an auxiliary contact＞

Matrix switch circuits in EV chargers carry a high risk of equipment failure due to unintended connections, making weld detection an essential requirement. By utilizing a relay with auxiliary contact, it becomes possible to simultaneously detect abnormalities such as welding while constantly monitoring the open/closed status of the main contact. There are several methods for detecting welding other than using auxiliary contacts, but using relays with auxiliary contact like G9KD enables simpler circuit design and allows fault detection with a single relay.

- Design structure conforming to IEC60947-4-1

The G9KD has a mirror contact 1b (normally closed) conforming to IEC60947-4-1. (Optional)

If the main contacts of the relay body weld together, even after de-energizing the coil, all auxiliary contact blocks' b contacts are designed to satisfy an impulse withstand voltage of 2.5kV or higher and maintain a contact gap of 0.5mm or greater.

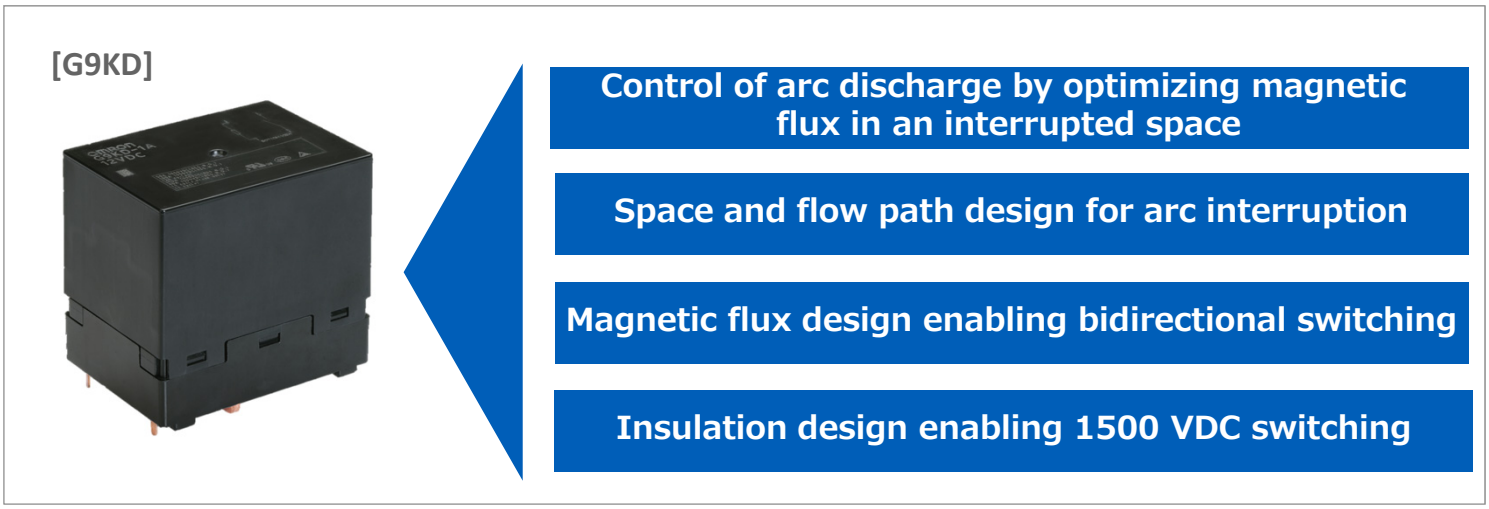


[Figure 4: Mirror contact structure operation image]

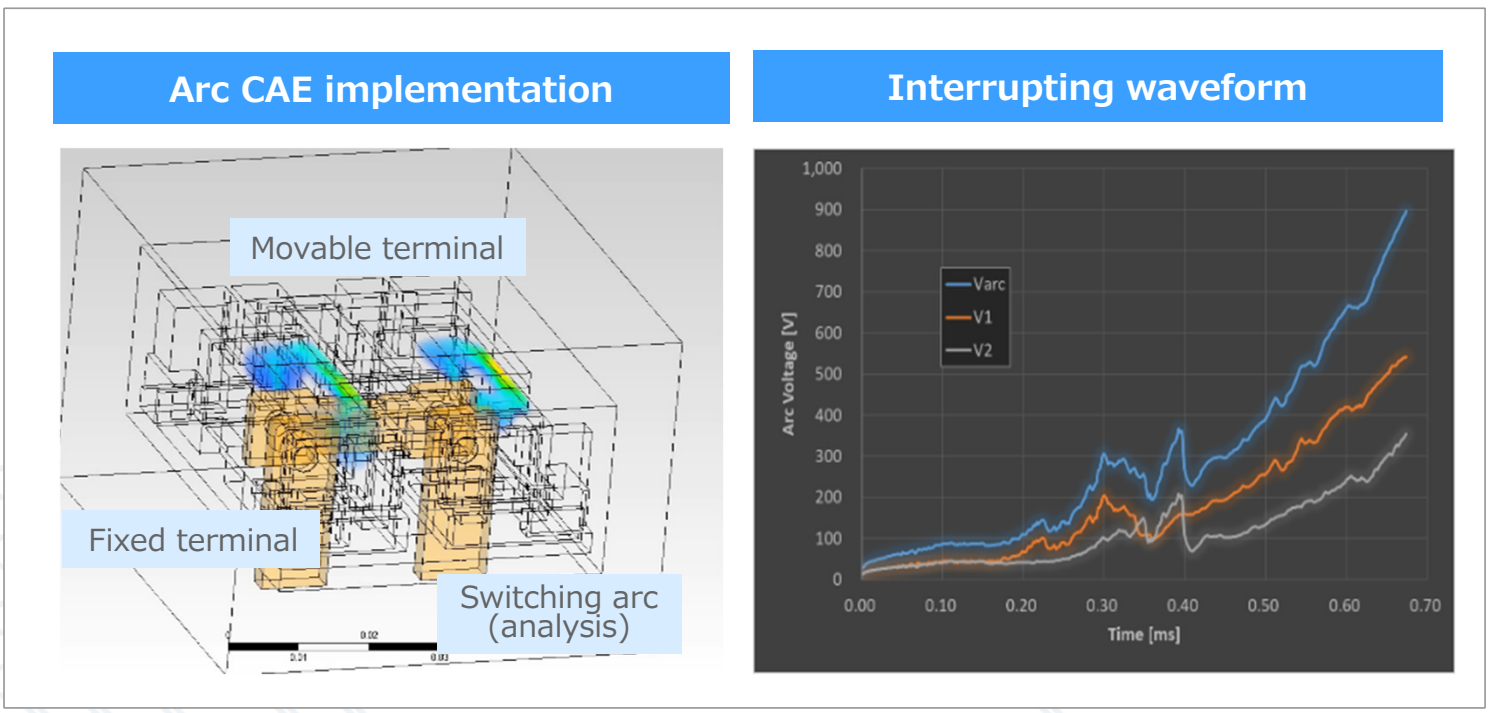
Value Proposition (G9KD)

＜Gasless design＞

Because the arc discharge energy during interruption increases under DC high-capacity load conditions, arc interruption design in a gas-filled space is common. OMRON's advanced switching technology enables gasless design, achieving high-capacity DC interruption without gas filling.
The arc behavior is measured by using OMRON's proprietary*1 arc simulation technology (CAE, etc.). Even without gas, the design enables switching of DC 1,500V/40A and DC 1,000V/150A. Furthermore, by eliminating main terminal polarity through arc control magnetic stone design, it also supports bidirectional switching applications. (*1 January 2026, according to our research)



[Figure 5: G9KD's high-capacity DC bidirectional switching technology]

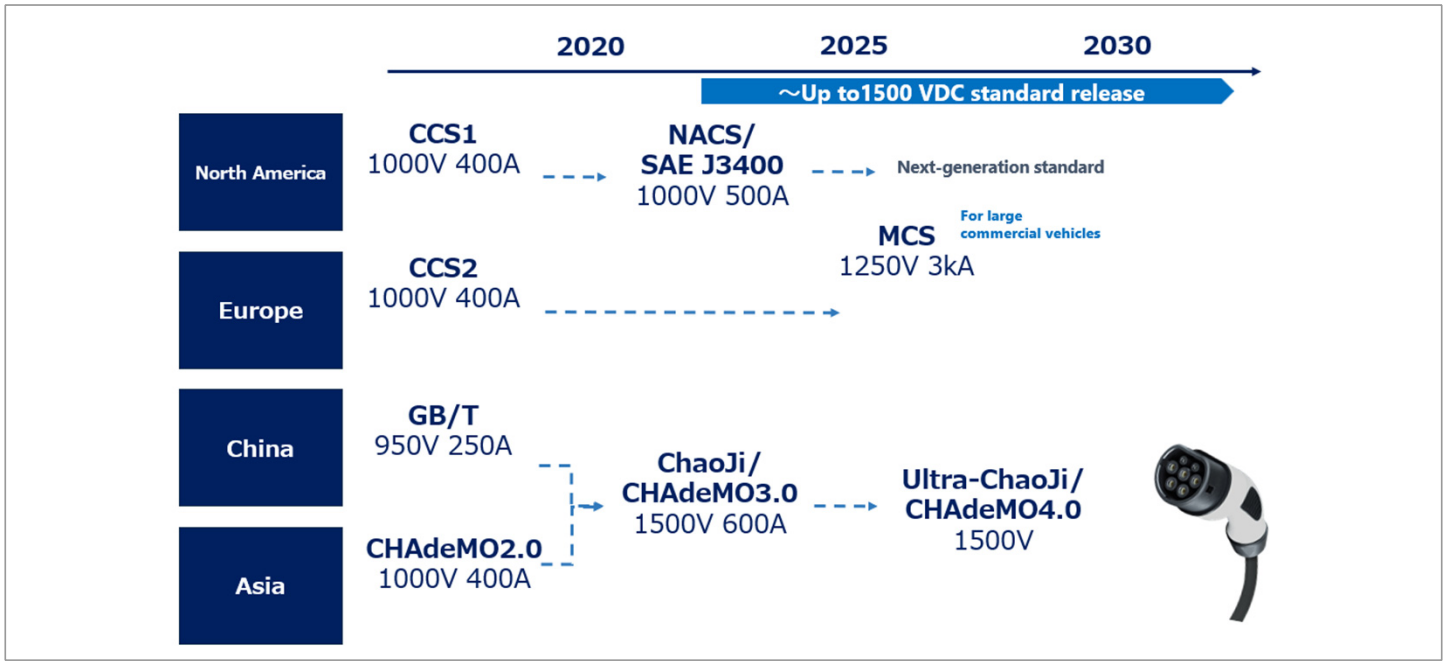


[Figure 6: Arc behavior data inside the relay (reference data)]

Market Trends (EV Chargers)

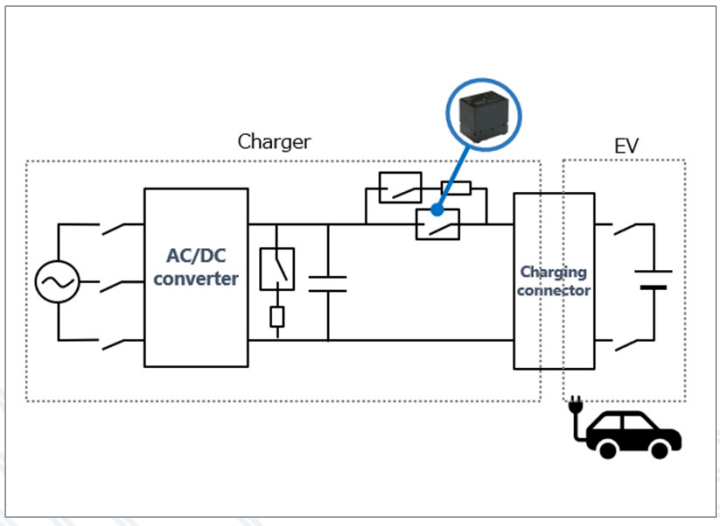
(1) EV Chargers

Since 2020, EV charger voltage standards have begun transitioning to the DC 800V range. Charging standards continue to expand, and it is anticipated that they will extend to the DC 1,500V range in the future; market trends indicate that discussions are progressing in some areas. Particularly for public use, DC 1,000V systems are already widespread due to their compatibility with all vehicle types and suitability for long-term use.

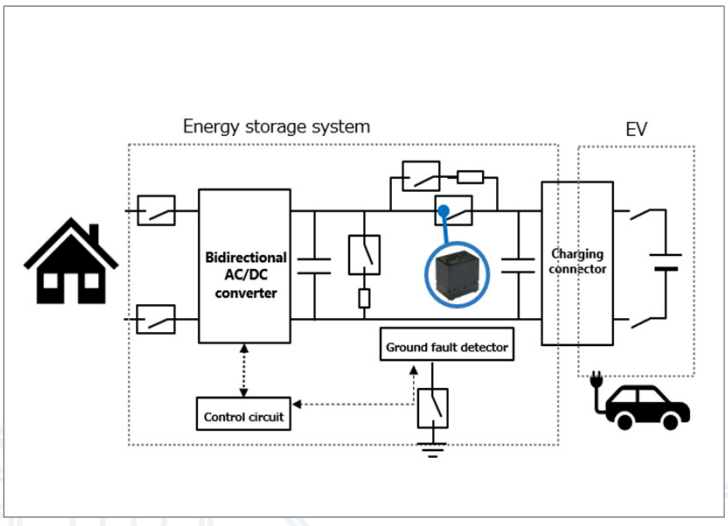


[Figure 7: Changes in EV charger capacity range]

The G9KD model can be considered for safety shutdown applications such as EV fast chargers (Mode 4) and V2H, as well as output switching applications.



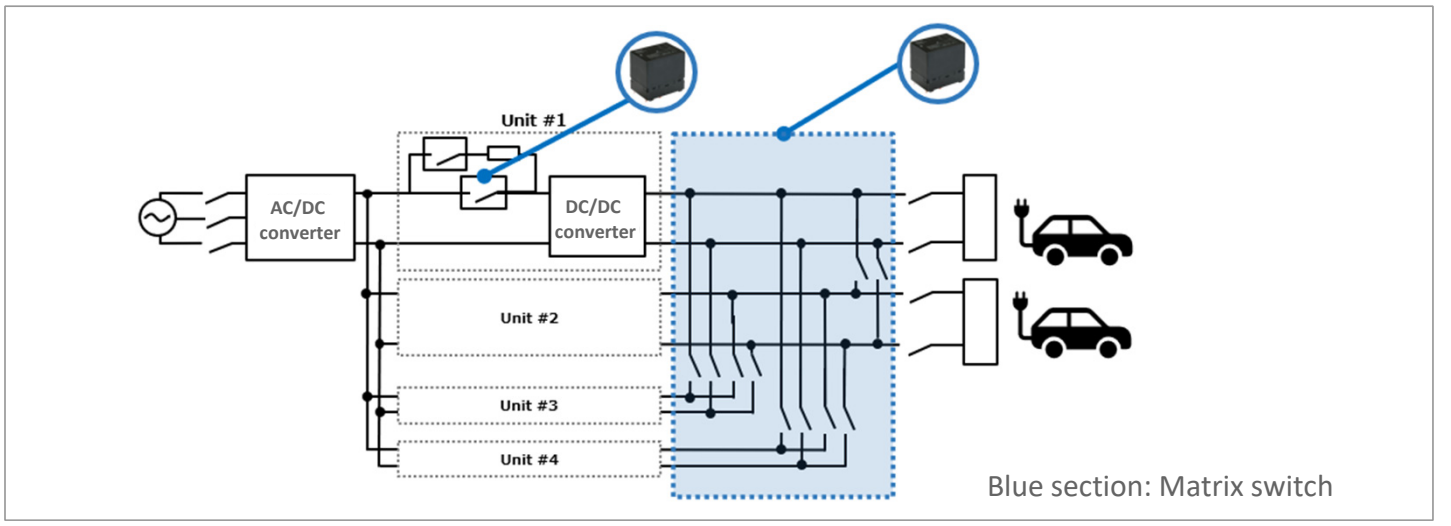
[Figure 8: Application example (EV charger: Mode 4) and G9KD installation locations]



[Figure 9: Application example (V2H) and G9KD installation locations]

Market Trends (EV Chargers)

EV charger manufacturers have achieved simultaneous charging for multiple EVs and power sharing by switching the number of parallel modules. These switching circuits (matrix switches) require numerous contactors, and with the widespread adoption of EV chargers, the need for cost reduction by replacing contactors with PCB relays has become apparent.

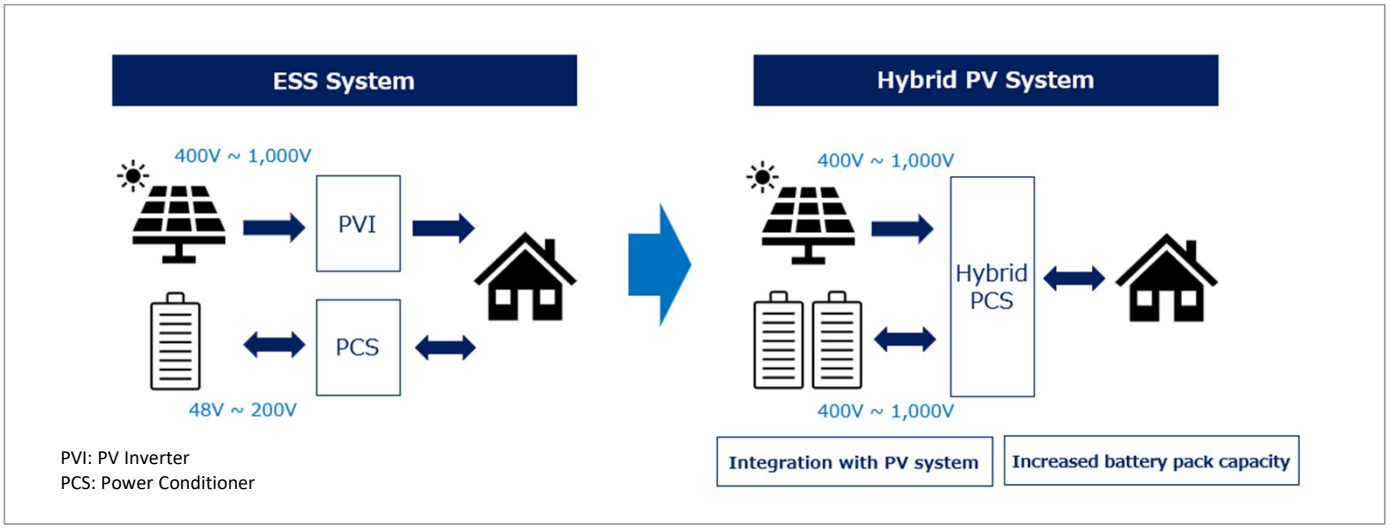


[Figure 10: Application example (EV charger: matrix switch) and G9KD installation locations]

Market Trends (Energy Storage Systems)

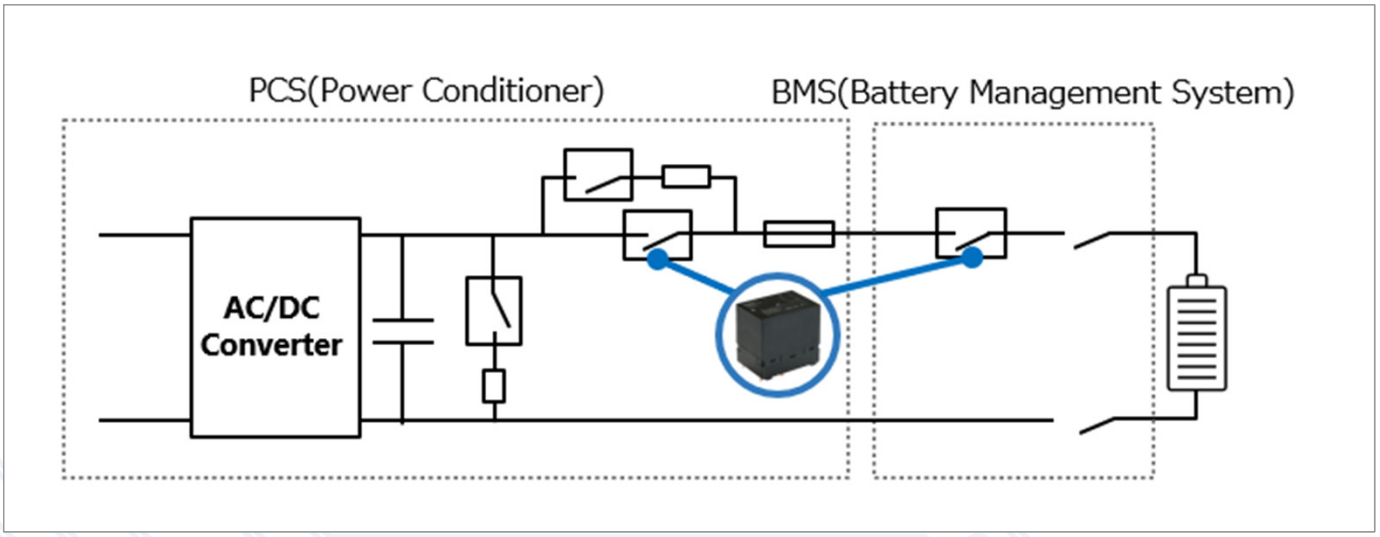
(2) Energy Storage Systems

Just like EV chargers, energy storage systems are also moving toward higher voltages. Due to hybridization with PV systems and safety standard requirements, the demand for 1000 VDC in home energy storage systems is becoming apparent.(See Figure 8) Similarly, the demand for 1500 VDC is becoming commonplace in large-scale energy storage systems as well. Increasing voltage levels not only improves energy conversion efficiency but also brings benefits in many areas including integration with EVs and renewable energy sources, and compliance with international standards.



[Figure 11: Changes in the capacity range of home energy storage system]

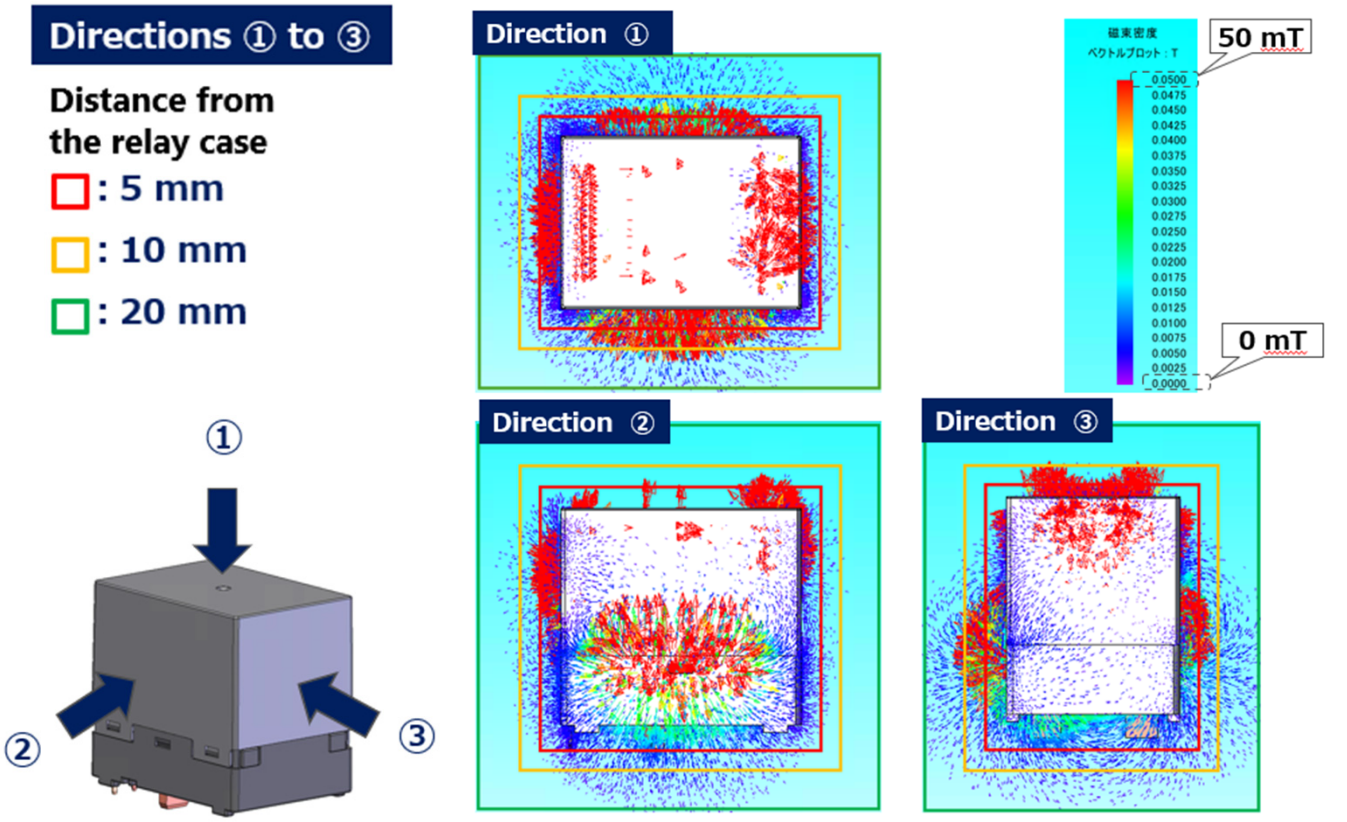
The G9KD model is capable of meeting the DC 1,500V safety disconnect requirements that are becoming apparent in energy storage systems (ESS).



[Figure 12: Application example (energy storage system) and G9KD installation locations]

G9KD Magnetic Field Analysis

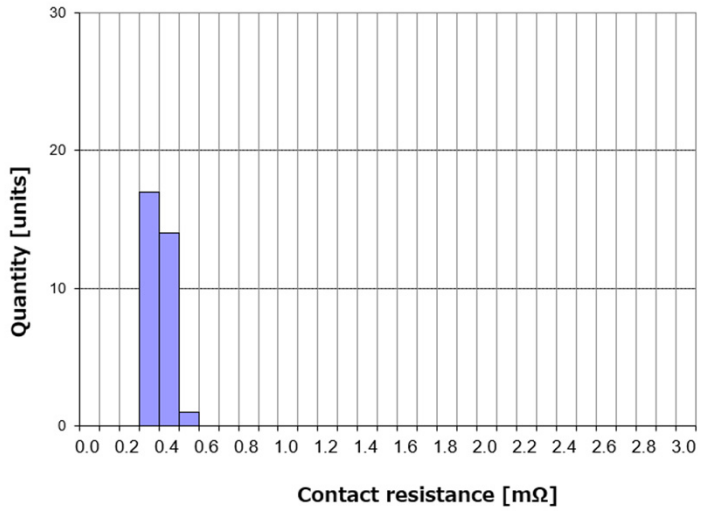
Generally, DC power relays incorporate permanent magnets to extend the arc during interruption. The magnetic field generated by this magnet may affect the operation of surrounding electronic components. Current sensors carry the risk of hindering accurate current value measurements and placing additional strain on equipment, so please utilize the magnetic field distribution data below to aid your PCB layout design.



[Figure 13: Magnetic field analysis data (reference data)]

Distribution of Initial Contact Resistance for G9KD

Contact resistance is one of the most important characteristics of high-capacity relays, as it helps to suppress heat generation inside the component. Reducing contact resistance minimizes thermal stress on terminal solder joints and surrounding components, resulting in improved PCB design reliability. The guaranteed initial contact resistance value for the G9KD series is 4 mΩ or less, but the actual value is lower. For reference, please refer to Figure 14 for actual initial contact resistance measurement data.



＜Evaluation conditions＞
Ambient temperature: 23°C
Load: 5 VDC 40 A (main contact)
Using the voltage drop method
Measurement time: 3 minutes
Number of samples: 32

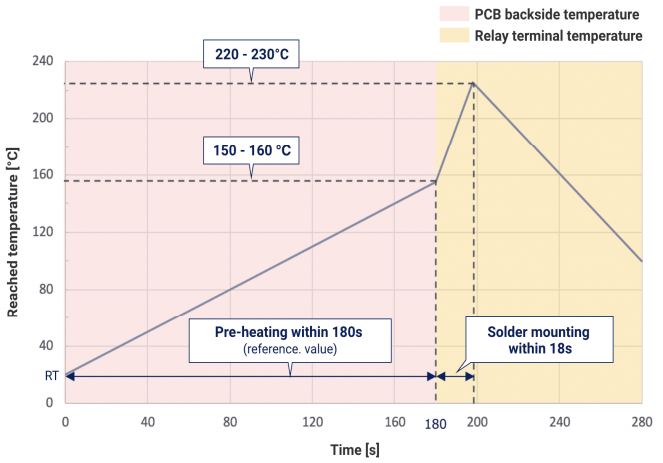
Note: The graph on the left is reference data based solely on evaluations conducted by our company and does not guarantee actual measured values.

[Figure 14: Initial contact resistance for G9KD (reference data)]

Recommended Soldering Conditions

High-capacity relays feature larger terminal surface areas to handle high current flow. Typically, solder mounting is performed by raising the temperature of the terminals and substrate to enhance solder wettability. However, the larger terminals also increase heat dissipation, making it difficult to sufficiently raise the temperature of the solder around the terminals as it cools. Below are the results of measuring the temperature profile during solder mounting for Omron's main high-current relays.

※This profile is based solely on evaluations conducted by our company and does not guarantee solder mounting conditions or similar factors. Customers should evaluate the conditions themselves and determine the appropriate mounting profile.



Pre-heating section	Backside of PCB
Solder mounting section	Relay terminal (unsoldered section)
Temperature in pre-heating bath	Approx. 340°C
Temperature in solder bath	Approx. 260°C

	Flux	**Solder (lead free)**
Manufacturer	Tamura Corporation	Senju Metal Industry Co., Ltd.
Model	CF-111V-3	M705

[Figure 15: Solder mounting conditions (reference data)]

Other Reference Materials

Additionally, the special page introducing the characteristics of each circuit and the lineup of compatible relays for EV chargers is available for your reference. Please make use of this as well.

https://components.omron.com/us-en/solutions/relays/mode4
https://components.omron.com/eu-en/solutions/relays/mode4
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Refer to our support page for more details regarding frequently asked questions about high-capacity power relays. Please refer to the URL below when designing or if you need assistance.

https://components.omron.com/us-en/solutions/relays/power-relays-support
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For the latest product specification information, please refer to the datasheet.

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