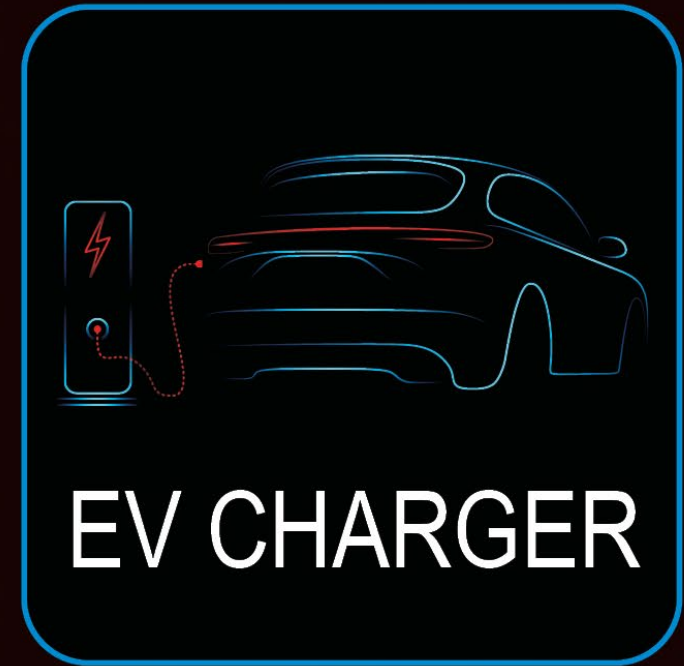
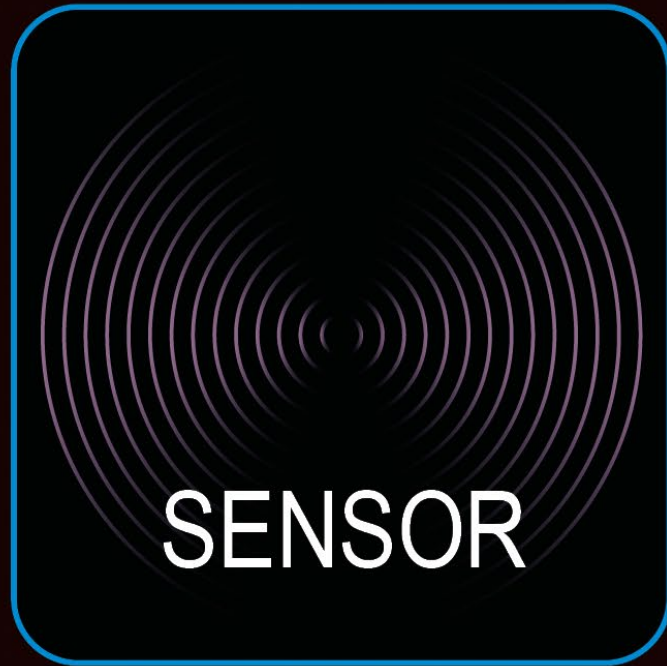


# RUTRONIK TECHTALK MEETS



08.06. - 10.06.2021 | **ONLINE**

Achieving well performing and dependable AC shutdown  
in smart EV Chargers

Steve Drumm  
Business Development Manager - Energy

**OMRON**



# ENERGY



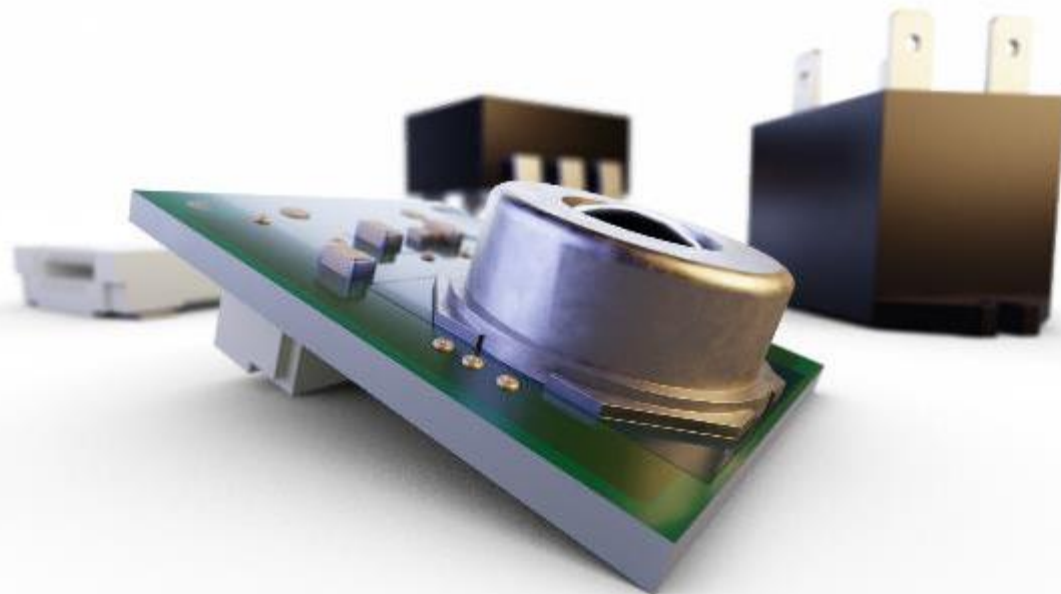


## EV CHARGER AC SHUTDOWN

A key function that defines EV Charger daily performance and usable lifetime

Good energy management design for enhanced performance.

Energy savings and improved heat dissipation



## RELIABILITY STARTS WITH GOOD DESIGN

DEPENDABLE EV CHARGER



## NEEDS

- ✓ Long-time carry current capability
- ✓ Low initial and E.O.L contact resistance
- ✓ Efficient heat dissipation
- ✓ Low power consumption
- ✓ Small footprint
- ✓ Performance to meet Regulatory compliance

## Contribute energy industry growth by our innovative solutions, based on sensing and control technologies

### Industry's GOAL

Self-generation of solar power, storage and usage (e.g. EV Charger)  
(= Ensures safe, secure and stable use at lower cost than other power sources)

### Industry challenges

Minimize the  
**installation &  
maintenance cost**

Improve reliability and safety

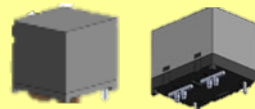
Maximize the  
power availability

### Omron's value proposition

#### Temperature-rise control

With high-capacity and smart inverter based , heat dissipation optimization become key design challenge

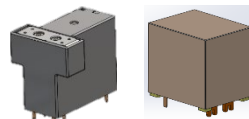
**Low-heat high  
power PCB relays**



#### DC safety

Compact and cost effective devices are required for fail safe design of battery and PV applications

**DC relays for high-  
voltage interruption**



#### Improve workability

Abnormal heat generation caused by variance in production and construction tasks

**Push-in terminal  
block**



#### Condition monitoring

Reduce power generation opportunity loss by preventing sudden abnormalities of equipment

**System auto  
switching module**



## EV Charger solution focus

# Stationary, Residential & Commercial Wallbox/ Pedestal

## LEVEL 2/ MODE 3

AC Mode 3: 1 Phase 3.3 – 7kW ; 11-22kW 16A (<32A) 230 - 400VAC





AC Mode 3: 3 Phase <11kW 230 – 400VAC; 22kW(32A)

AC Wireless: 1 Phase (inductive) <11kW

(DC Mode 4: <24kW, 600VDC)



## Solutions

	 Mode 2		 Mode 3		 Inductive	 Mode 4
	AC-charging Wall outlet	AC-charging Wall outlet IC-CPD	AC-charging Wallbox	AC- public charging-station	Inductive charging	DC-charging
Mode	1	2	3		-	4
Standard		IEC 62752/UL 2231	IEC 61851-1/-21/-22		IEC 61980-3	IEC 61851-23
Power class	max. 1ph 16A (3.7 kW) max. 3ph 16A (11 kW) max. 3ph 32A (22 kW)		max. 1ph 16A (3.7 kW) max. 3ph		2...5 kW 11 kW	25 kW-400 kW
Connection	Schuko	Schuko	CCE		Schuko / CCE	
Communication	none	Control Pilot	Control Pilot / Power Line		Wireless	Power Line

☐ No support for Mode 1 or 2 (IC-CPD) Cable Charger

Support for  
☐ fixed (tethered) Wallbox

☐ and Pedestal

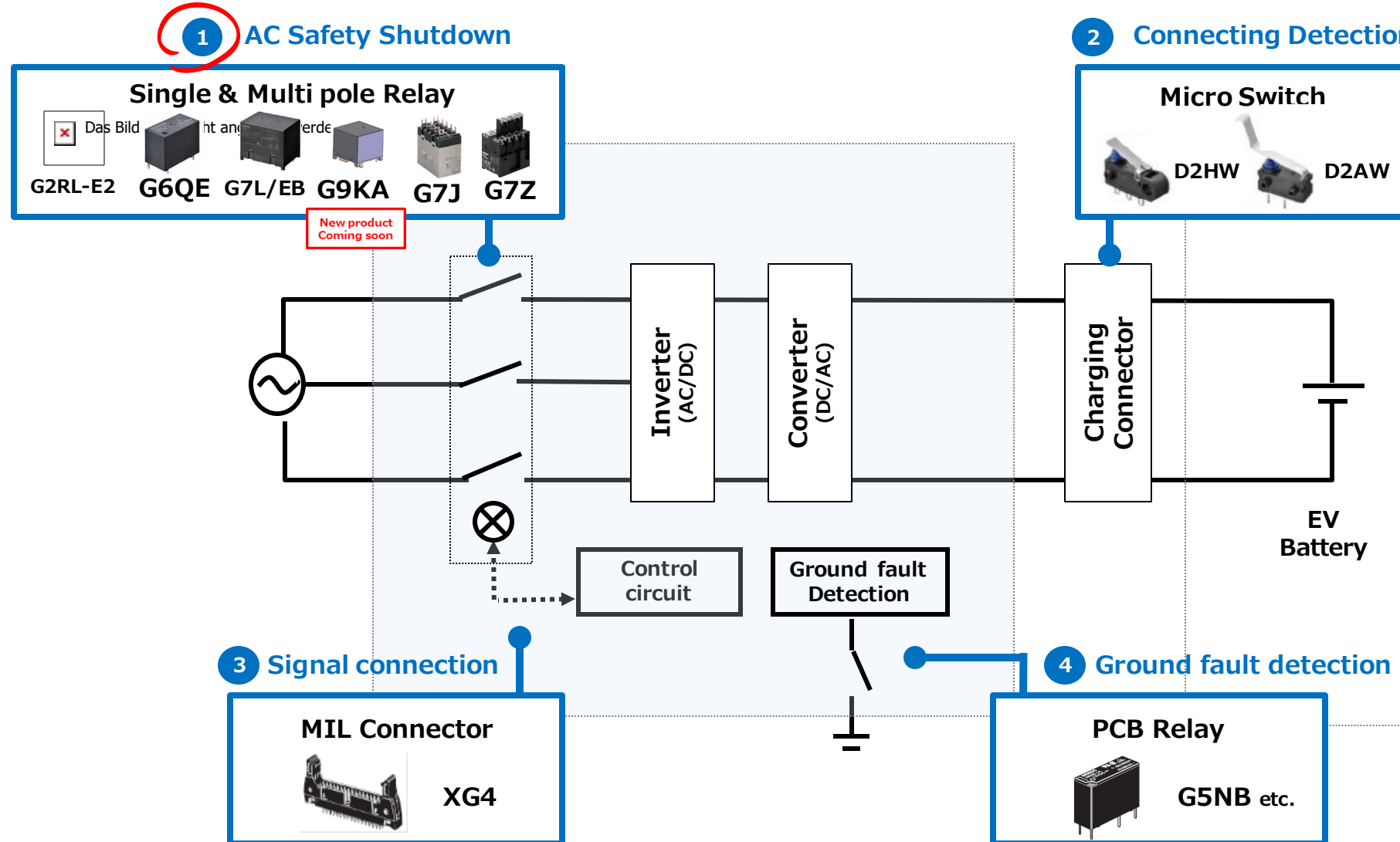
**Solution focus:**

- ☐ AC carry, connect/disconnect
- ☐ DC carry, connect/disconnect
- ☐ User interface
- ☐ Interconnect

\*Omron plans to expand its offer to meet changing regulations such as IEC61851 and IEC62955

# Solution for EV Charger application

- We can offer Multi pole and single pole solutions for 1& 3 Phase L+N line switching



# Miniature and low height single-pole power relay with high capacity 36A switching current

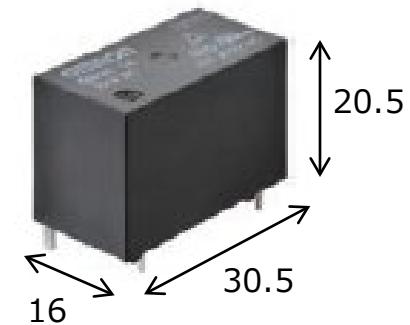
【Application】 EV charger, PV inverter (commercial/residential), UPS

Terms	Specification		
Model	G6QE-1A		
Contact type	1a		
Contact resistance	100mΩ max. (initial)		
Rated load	AC250V / 30A	AC250V / 32A	AC250V / 36A
Max. switching voltage	AC277V		
Electronical endurance	AC250V 30A 100,000 cycles min. AC250V 32A 50,000 cycles min. AC250V 36A 10,000 cycles min.		
Coil power consumption	Approx. 1.4W with holding voltage		
Ambient operating temperature	-40~ +85℃		
Dimensions	L30.5mm x W16.0mm x H20.5mm		
Terminal type	PCB		
Safety standard	UL / VDE / CQC		

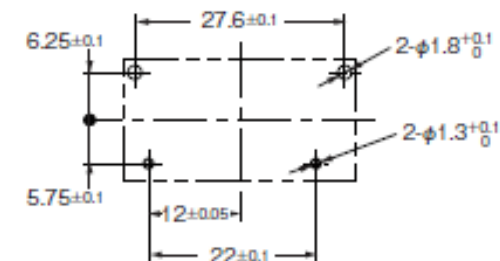
## AC Safety Shutdown: G6QE

### 【Dimensions】

NEW Product



### 【Terminal layout】



\* G6QE applicable to territories where 3mm contactgap non-EU is sufficient



# G7J : Multi pole Relay

- **Compact Multi pole 25A Relay alternative for Contactor applications**

## ***Features***

### **1. High capacity**

- **AC250V 25A Rating with compact package**

### **2. Multiple contacts**

- **4PST-NO**
- **3PST-NO/SPST-NC**
- **DPST-NO/DPST-NC**

### **3. High reliability**

- **No contact chattering at voltage drops up to 50% of rated voltage**



*Screw terminal*



*PCB terminal*



*Quick-connect terminal*

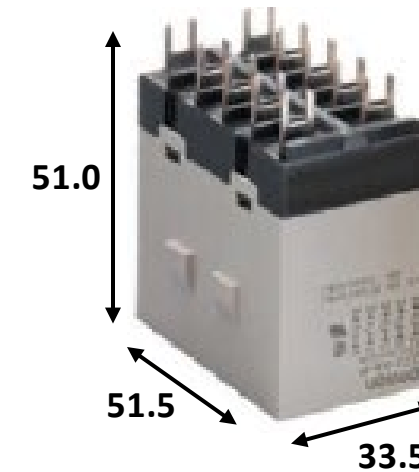
# New 4 Pole AC400V/32A Relay

- **4 pole AC400V/32A PCB Relay applicable for 11-22kw Wall box applications**

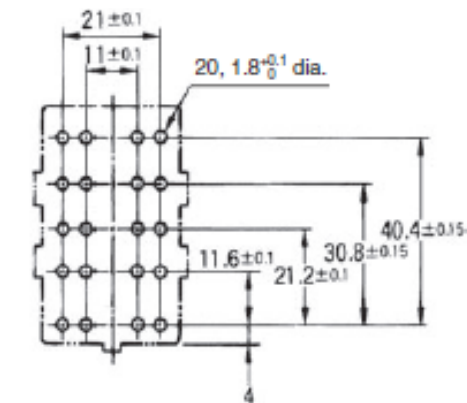
Content	Specification	Remark
Contact structure	<u>4PST-NO</u>	IEC62955: Multiple pole shall be mechanically coupled
Contact resistance	$\leq 100\text{m}\Omega$	---
Contact rating	<u>AC400V 32A</u>	IEC62955: Preferred value of rated voltage is max 400V
Electric durability (Resistive load)	<u>AC400V 32A 50,000 cycles</u>	IEC61851: CC 2 50k ops
Short circuit current	<u>1.85KA (<math>I_p</math>), 4.5KA<sup>2</sup>s (<math>I^2t</math>)</u>	IEC62955 : 9.11.2
Mechanical durability	1,000,000 cycles	---
Coil voltage	DC12V/24V	---
Power consumption	Approx. 2.0W	Same with Normal G7J
Ambient temperature	<u>-25~85 °C</u>	----
Dimensions (mm)	L 51.5 x W33.5 x H 51.0	Same with Normal G7J
Terminal type	PCB terminal	Screw, Quick-connect terminals Can be considered
Safety standard	UL / VDE / KEMA	UL840 IEC61810-1, IEC60947-1

## 【Dimensions】

Under Development



## 【Terminal layout】



(\*) The products cannot be used for Mode 1 and Mode 2 IC-CPD charging cable applications.

# (Reference) Insulation distance

- ***G7J will comply AC400V insulation distance which required by IEC and UL***

Unit : mm

		151-300V		301V-600V	
		Creepage	Clearance	Creepage	Clearance
<b><i>G7J-4A-P specification</i></b>		<b>7.21</b>	<b>13.74</b>	---	---
<b><i>Safety standard Requirements</i></b>	<b><i>IEC61810-1</i></b>	6.0	8.0	<b>6.0</b>	<b>12.5</b>
	<b><i>UL508</i></b>	6.4	9.5	9.5	12.7
	<b><i>UL840</i></b>	---	---	<b>5.5</b>	<b>8.0</b>

- ***UL840 is specific standard for insulation distance.***
- ***UL508 list UL840 as alternative standard in case can't achieve the UL508 requirement.***

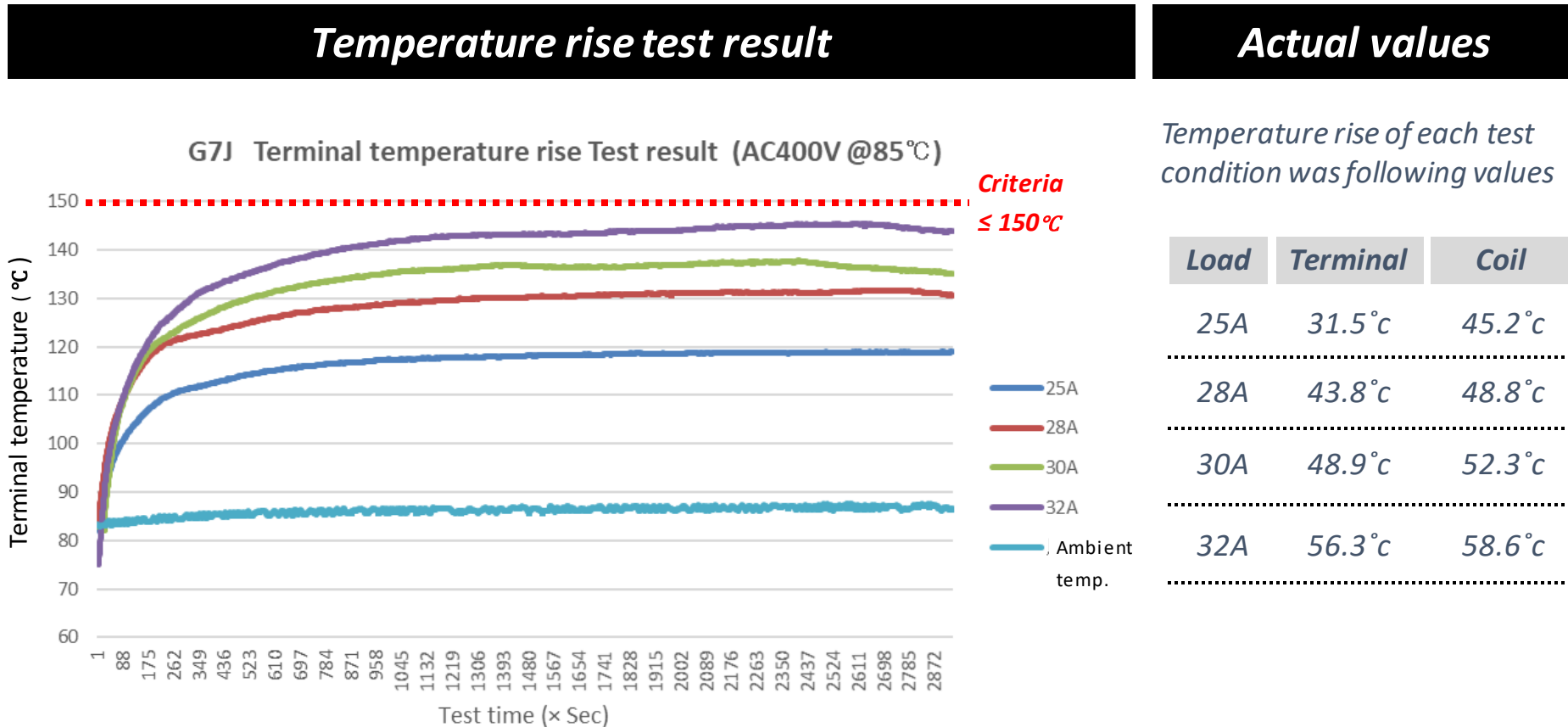
\*IEC61810-1 : Electromechanical elementary relays - Part 1: General requirements

\*UL508 : Standard for Industrial Control Equipment

\*UL840 : Standard for Insulation Coordination Including Clearances and Creepage Distances for Electrical Equipment

# (Reference) Temperature rise test

- **AC400V 32A terminal temperature rise passed IEC requirement by no modifications**



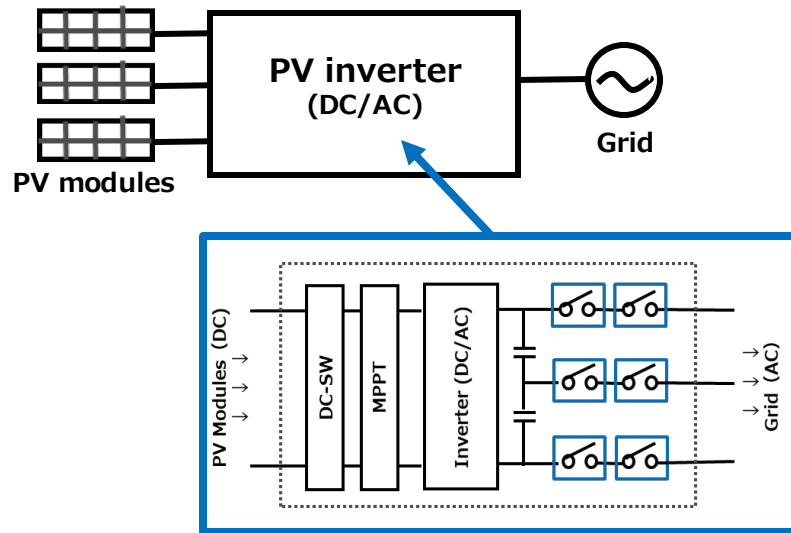
- IEC61810 Requirement : Ambient temp. + Terminal temperature rise  $\leq 150.0^{\circ}\text{C}$
- IEC60947 Requirement : Terminal temperature rise  $\leq 65.0^{\circ}\text{C}$



Our low-heat, high power relay will help optimize the heat dissipation design and contribute downsizing, cost reduction of customer's product

## Target application

[C&I PV inverter: Grid disconnection / ESS/ EVC]



Advancement of larger-capacity PV inverters

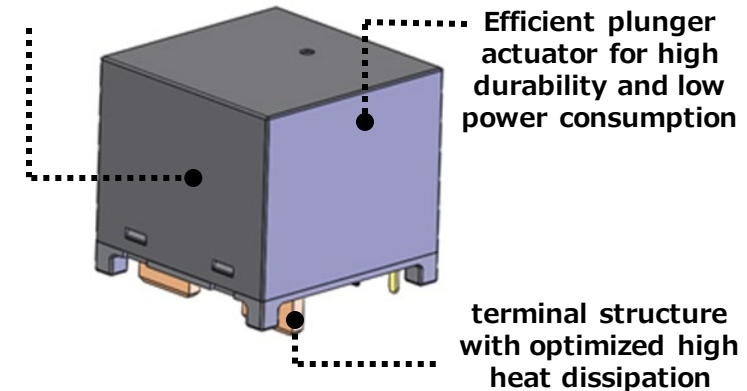
How to control temperature rise due to large current is essential in design

## Our solution : G9KA Relay

[200A Relay for efficient energy management]

"Purpose designed" contact structure provides lowest parasitic initial and end of life Contact Resistance

New product  
Coming soon

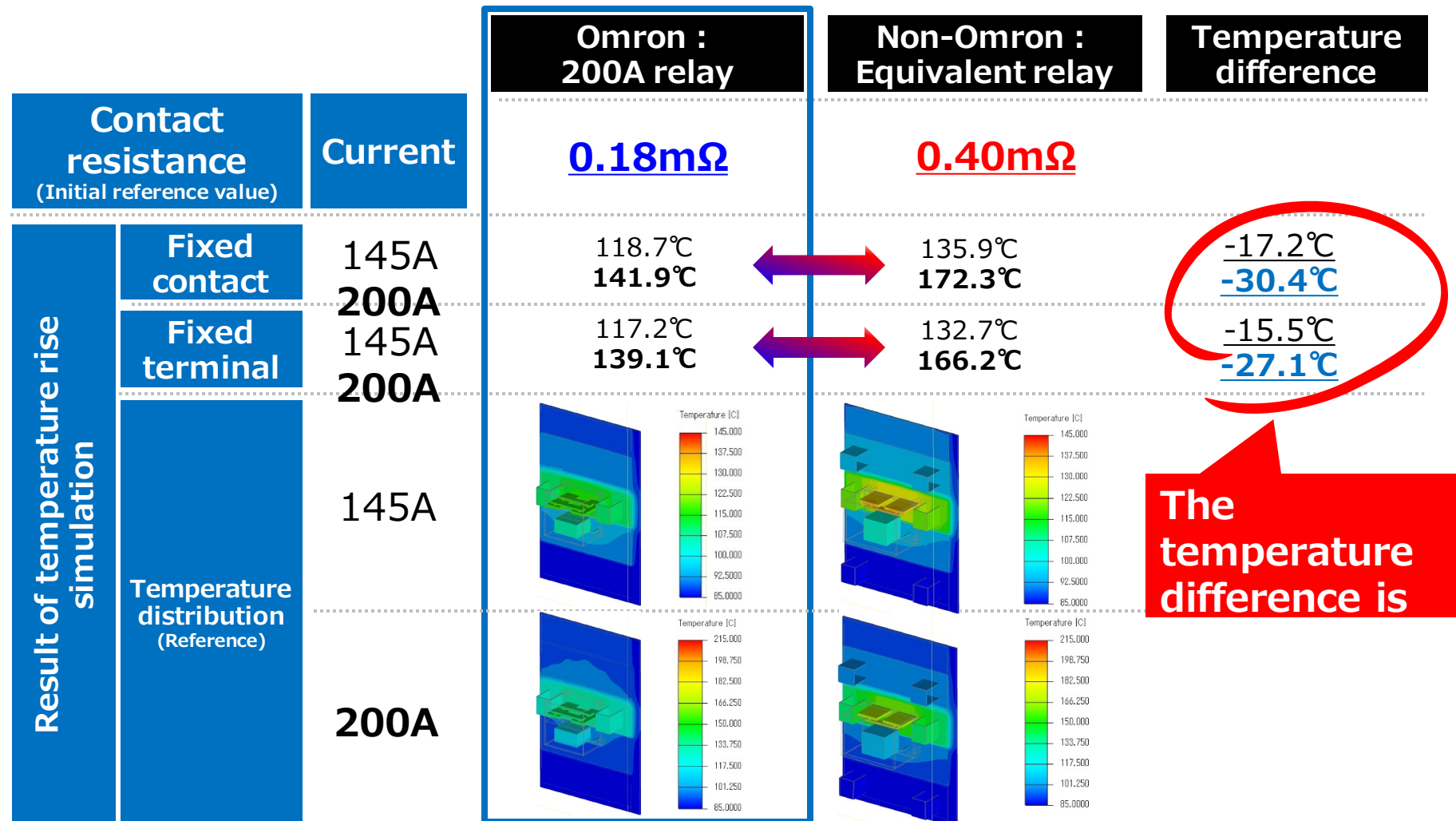


- Class leading low-heat performance

Contact resistance is dramatically reduced (<0.2mΩ at initial)

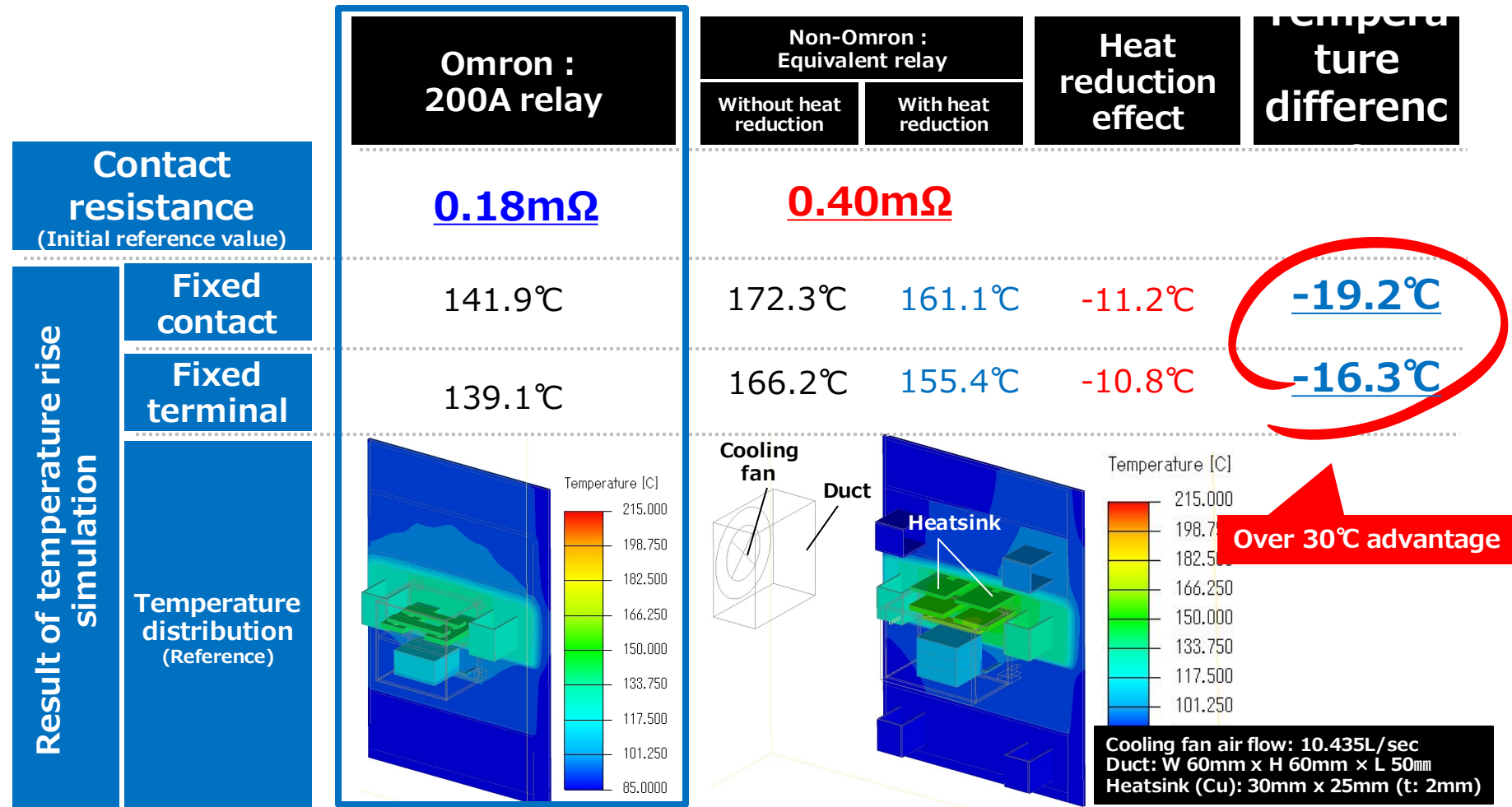
- PCB mounting, super-compact, and low profile package

Simplify and enable increased confidence your thermal designing process by low contact resistance feature



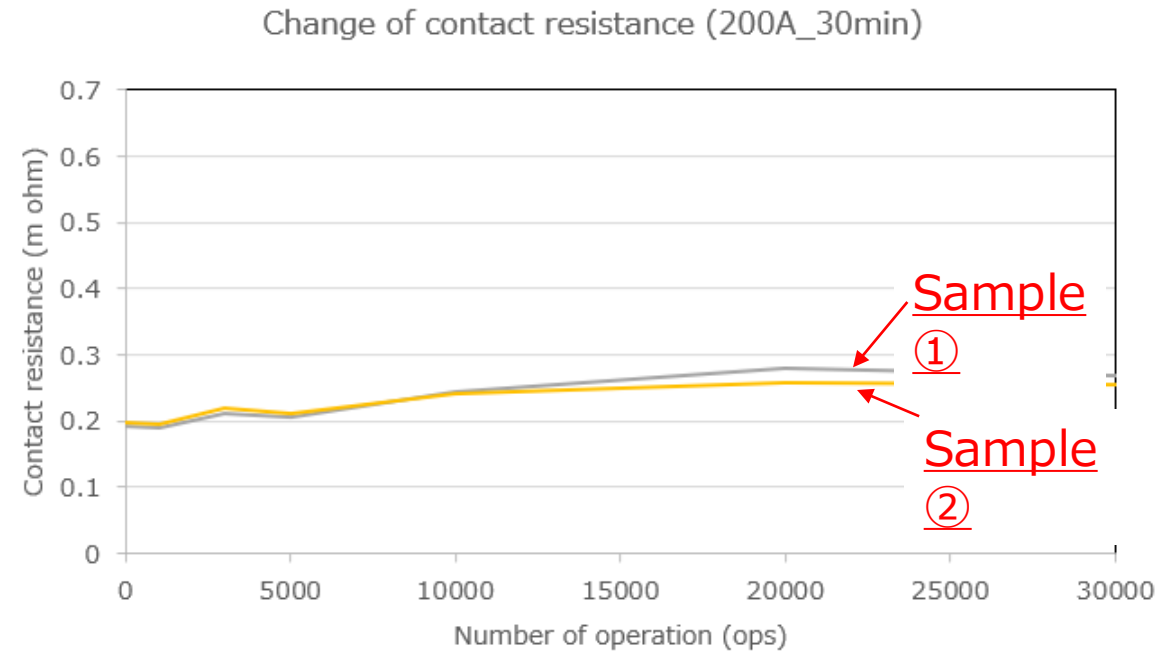
※ Thermal simulation results (480VAC / 145A & 200A natural air cooling)

Maintain an advantage of 16°C or higher even if heat sinks and fans are used on other companies' equivalents



※ Result of temperature rise simulation under 480VAC / 145A with cooling fan, duct and heat sink

Our proven development and manufacturing competences in structures, materials and manufacturing, realize low CR until end of life



## 【Test Condition】

- Resistive load : 800VA Making 50A, Carrying 200A, Breaking 50A
- Applied coil voltage : 12V (100%) -> 6V (Holding 50%)
- Ambient temperature : 23°C
- Contact resistance measured by 200A 30min

※Due to the product development stage, above data will updated at mass production samples



## High power PCB relay with 800V AC 200A contact rating class leading Low contact resistance & compact size features

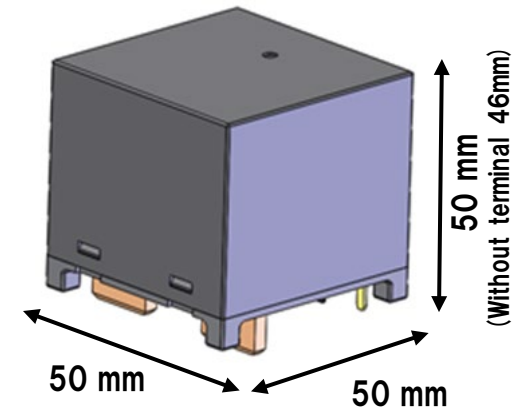
Terms		Specification
Coil	Coil voltage	12V DC
	Coil power consumption	<b>5.0W</b> (1.25W at Holding voltage 50%)
Contact	Rated load	<b>800V AC / 200A</b> (Resistive load)
	Contact resistance	Initial $\leq$ <b>0.2m<math>\Omega</math> @200A</b> *measured after 5minutes End of life $\leq$ <b>0.3m<math>\Omega</math> @200A</b> *measured after 30minutes *End of life value is only reference data
	Contact gap	4.0mm
Endurance	Mechanical	100,000 operations
	Electrical	800V AC / 200A 10 operations <b>800V AC</b> <b>Make 50A Carry 200A Break 50A</b> <b>30,000 operations</b> *1sON/9sOFF at85°C
Dimensions (mm)		<b>L 50.0 x W 50.0 x H 50.0</b>
Ambient temperature range		-40°C to 85°C
Terminal type		PCB
Safety standard		TUV, UL

※Due to the development stage, specification will change without notice

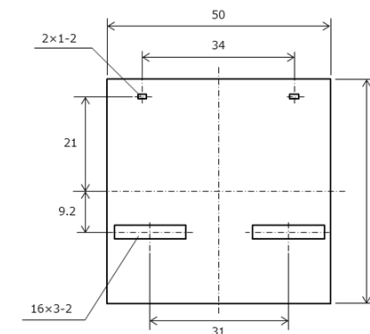
“To improve lives and contribute to a better society”

### 【Dimensions】

New product  
Coming soon



### 【Terminal layout】

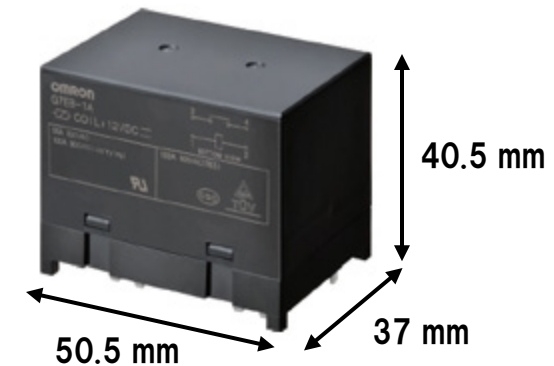


## 480VAC 100A high power and high temperature PCB Relay 2 types of terminals available according to your PCB design

Terms		Specification
Coil	Coil voltage	12V / 24V DC
	Coil power consumption	2.8 W (575mW at Holding voltage 45%)
Contact	Rated load (Resistive)	<b>480V AC / 100A</b> 800V AC / 40A DC60V/50A DC60V/40A
	Contact resistance	Initial $\leq 5.0\text{m}\Omega$ @20A End of life $\leq 10.0\text{m}\Omega$ @20A *measured after 5 sec *End of life value is only reference data
	Contact gap	3.6mm
Endurance	Mechanical	1,000,000 operations
	Electrical	480V AC / 100A 300 operations <b>800V AC</b> <b>Make 40A Carry 100A Break 40A</b> <b>30,000 operations</b> *1sON/9sOFF at85°C
Dimensions (mm)		L 50.5 x W 37.0 x H 40.5
Ambient temperature range		-40°C to 85°C
Terminal type		PCB
Safety standard		TUV, UL

### 【Dimensions】

NEW  
product



### 【Applications】

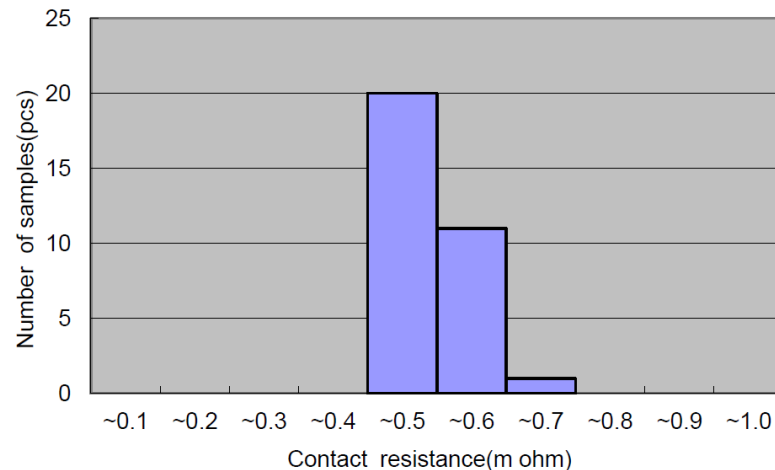
- Commercial and industrial PV inverters/ EVC
- Industrial online UPS
- Industrial inverters/ EVC
- Mounting Direction  
This relay has limitation for mounting direction due to the specification of Operate voltage and Electrical durability. Please check the precautions in datasheet.

Our proven development and manufacturing competences in structures, materials and manufacturing, realize low CR until End of Life

## Low contact resistance

[Technical reference data]

Distribution of G7EB contact resistance

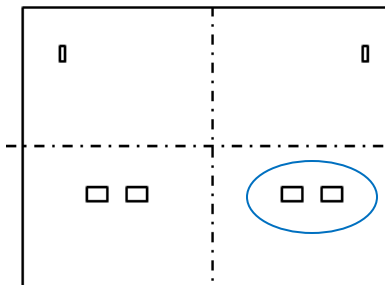


\* Measured by voltage drop method with 6VDC/20A @23°C

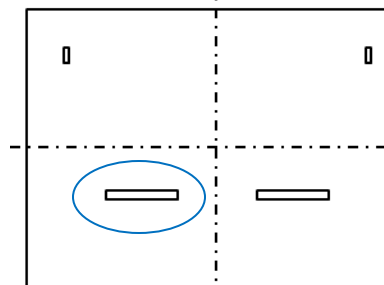
**Actual initial CR value is 0.5~0.7mΩ**  
which much lower than datasheet  
specification (5mΩ)

## Types of PCB terminal

Omron original  
pin type  
G7EB-1A



511HP1 (Songchuan)  
Terminal compatible pin type  
G7EB-1AP1

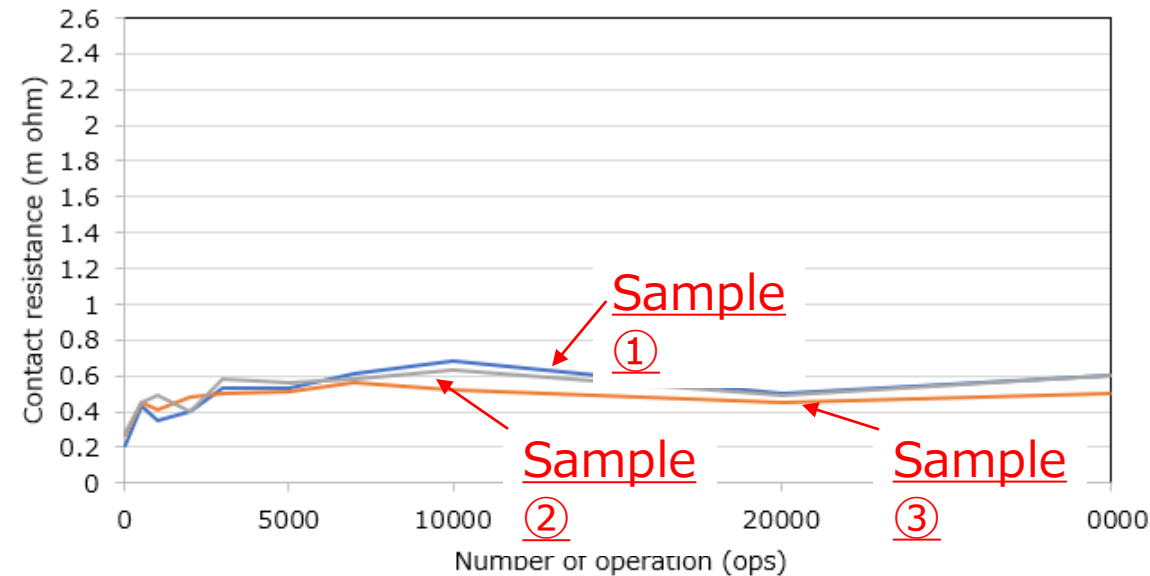


\*Only the main terminal side is compatible with 511HP1

Our proven development and manufacturing competences in structures, materials and manufacturing, realize low CR until end of life

## G7EB-1A

Change of contact resistance (100A\_10min)



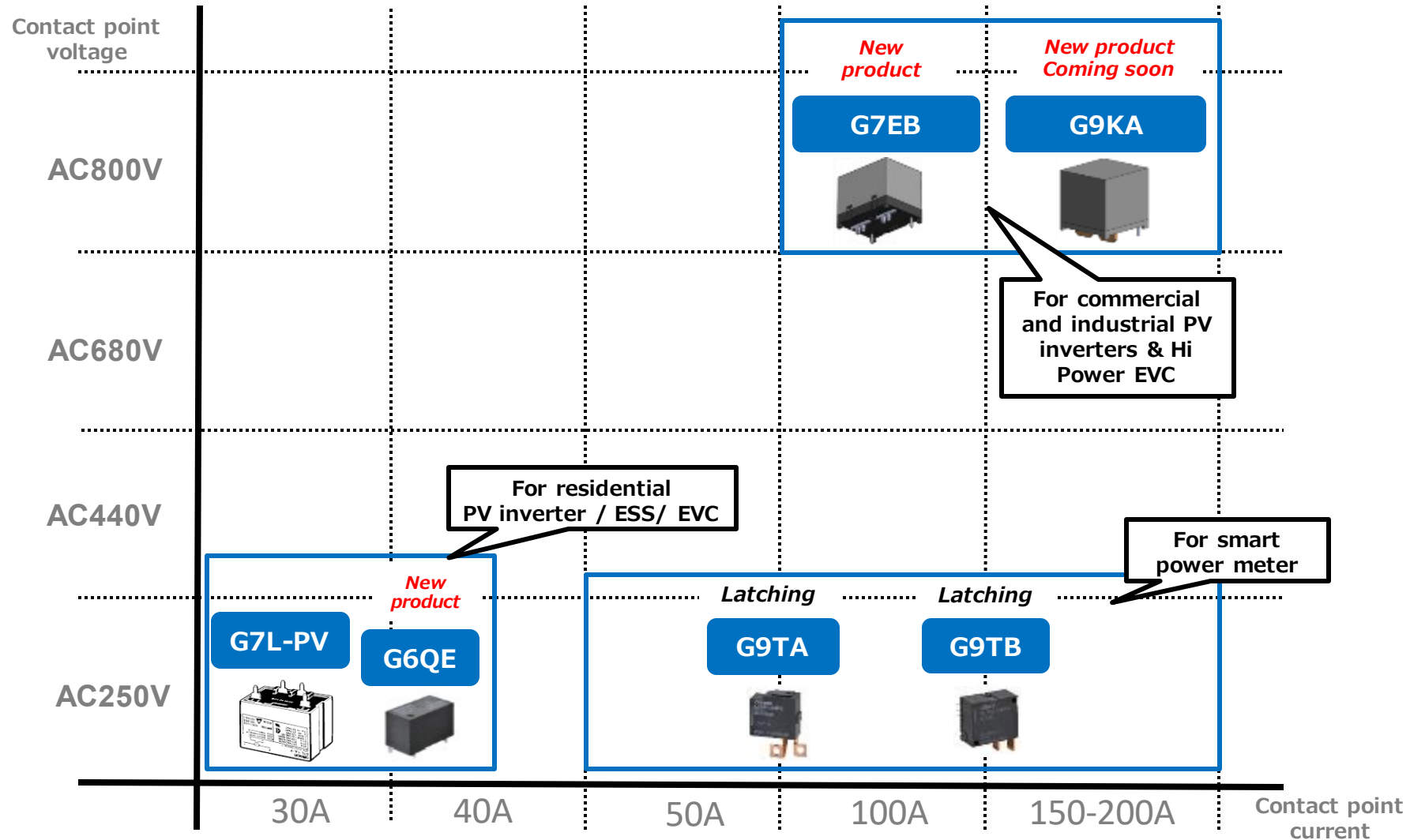
### **【Test Condition】**

- Resistive load : 800VA Making 50A, Carrying 100A, Breaking 50
- Applied coil voltage : 12V (100%) -> 6V (Holding 50%)
- Ambient temperature : 23℃
- Contact resistance measured by 200A 30min

※Due to the product development stage, above data will updated at mass production samples



We plan to expand product lineup for high capacity area more than 50A

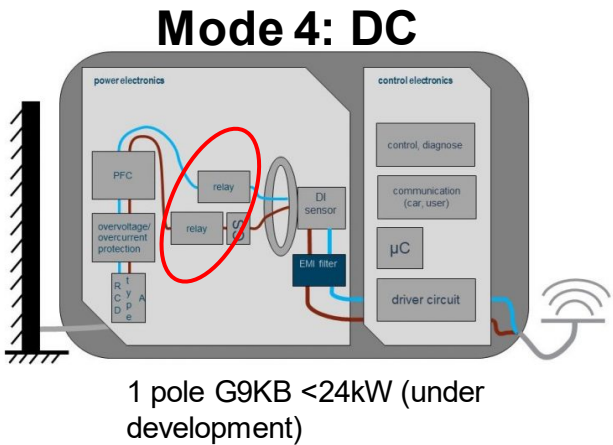


(\*) The products cannot be used for Mode 1 and Mode 2 IC-CPD charging cable applications.

DC component solutions

DC Mode 4: <24kW, 400 & 600VDC

Expanding range of reliable AC & DC relay solutions for high power Wallbox and Pedestal



DC disconnect  
G9E-J (max. rating  
400V/ 15A)

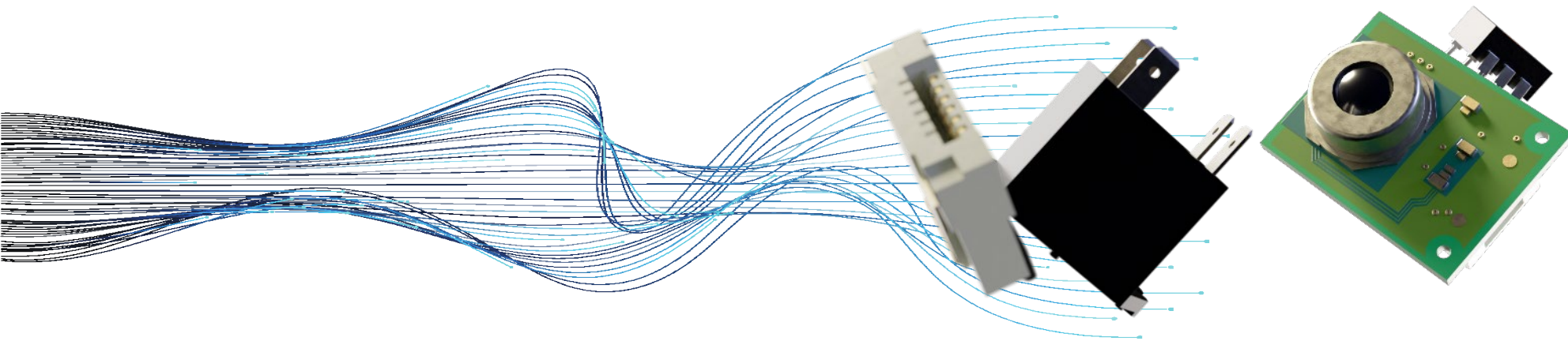
New Dev.  
\*\*G9KB /E\* -  
Under planning  
1a 50A+ Bi-Di/  
600V DC

(OBC control pre-charge - G6QE)

No solution currently  
for >24kW ..

1 Pole relays:		Rapid Charger	
G9E-J	G6QE	G7EB	G9KA
15A/400VDC DC disconnect	20AAC Pre-charge	200AAC *AC disconnect	200AAC

# THANK YOU!



# QUESTIONS?

Feel free to contact us!

## STEVE DRUMM

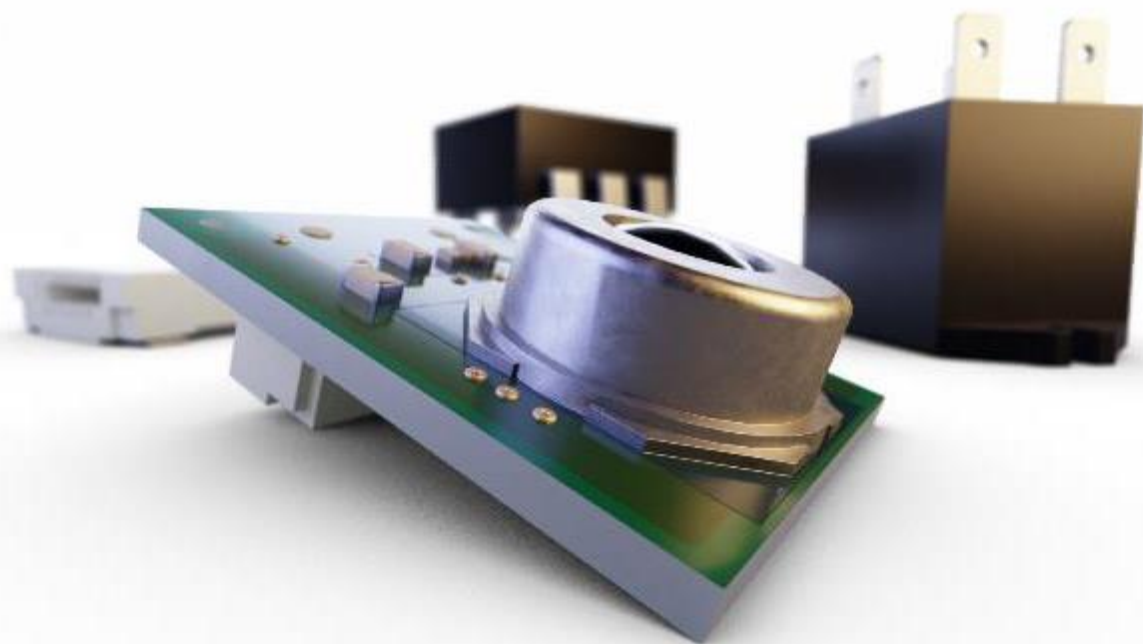
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**To improve lives and contribute to a  
better society**