Issue Date: 1st April 2022

100A High power PCB relay G7EB
Instruction of product performance and reference circuit

Introduction

Today's energy industry is working towards the goal of self-generated solar power which can be used as a primary source of electricity. While maximizing power availability, designers and manufacturers need to improve the reliability and safety of their systems in balance of the costs.

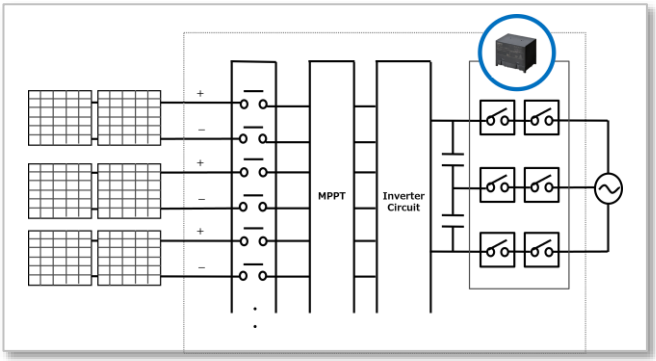
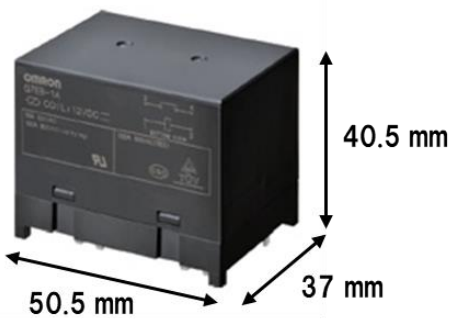


Figure 1: Example of PV inverter relay application

To meet evolving needs in the sector, we are constantly developing our range of components to support the next generation of energy systems. This includes an expanding range of high-power PCB relays with a focus on low contact resistance to increase the safety, reliability, durability, and cost-effectiveness of your products (Figure 1). Our relays are trusted worldwide and are making an important contribution for more energy-efficient future.

Overview

G7EB relay expands your design possibilities with low contact resistance (Typical ≤ 1 mΩ) maintained throughout the lifetime of the relay. Also, efficient low holding voltage capability contributes to your design enabling low power consumption during relay energization (Figure 2).



Terms		Specification
Coil	Coil voltage	12 VDC, 24 VDC
	Power consumption	2.8 W (575mW at Holding voltage 45%)
Contact	Rated load (Resistive)	480 VAC 100 A, 800 VAC 40 A 60 VDC 100 A, 60 VDC 50 A, 60 VDC 40A
	Contact resistance	Initial ≤ 5 mΩ @6 VDC 20 A
	Contact gap	3.6 mm
Endurance	Mechanical	1,000,000 ops.
	Electrical *1sON/9sOFF at85℃	480 VAC 100 A 300 ops.
		800 VAC Make 40 A Carry 100 A Break 40 A 30k ops.
		60 VDC 100 A 400 ops. 60 VDC 50 A 1k ops. 60 VDC 40 A 6k ops.
Ambient temperature range		-40℃ to 85℃
Terminal type		PCB
Safety standard		TUV, UL, CQC

Figure 2: G7EB relay specifications

100A High power PCB relay G7EB
Instruction of product performance and reference circuit

G7EB relay is widely used in commercial and industrial PV inverters, industrial online uninterruptible power supplies (UPS) and industrial inverters. Moreover, G7EB have DC contact rating and it can be used for low voltage (≤60VDC) battery application such as energy storage system (ESS).

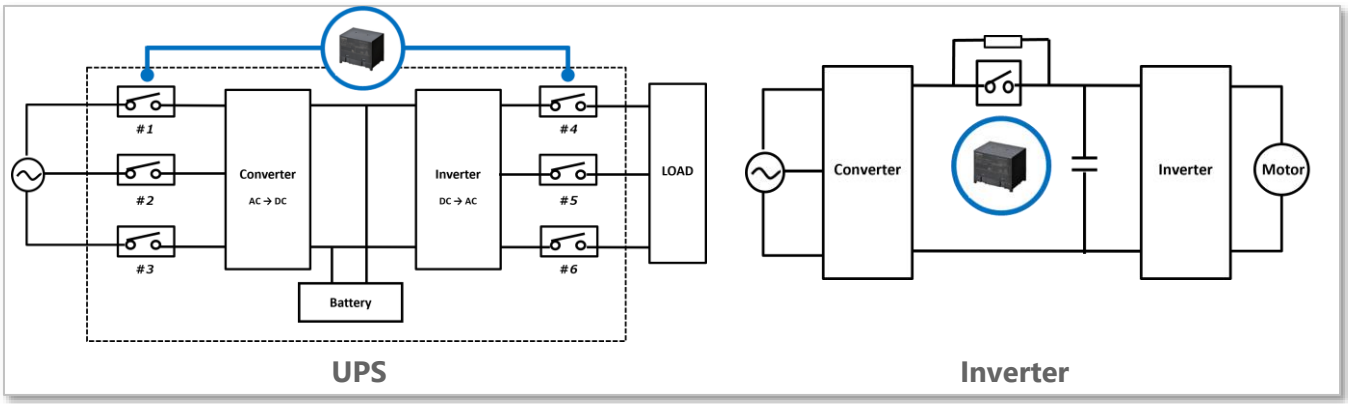


Figure 3: Example of commercial and industrial UPS and Inverter application

Low contact resistance

Contact resistance is one of the key characteristics for PCB high-power relay to reduce heat generation inside the component. Lower contact resistance improves PCB design reliability by reducing the heat stress of terminal solder joint and surrounding components.

● Typical initial contact resistance value

G7EB contact resistance is defined as 5 mΩ but this is no more than the value for warranty. Actual initial contact resistance is less than 1mΩ (at 6 VDC 20 A after 5 minutes N=32 pcs) as you can see in Figure 4.

● Contact resistance at end of life

Generally, contact resistance increases due to the contact aging caused by switching. But our proven competences in structures, materials and manufacturing maintains low contact resistance throughout the lifetime of G7EB relay (Figure 5 : 6 VDC at 100 A after 10 minutes N=3 pcs)

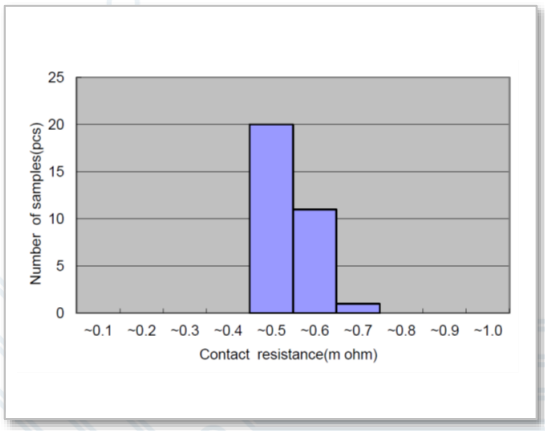


Figure 4: Initial contact resistance

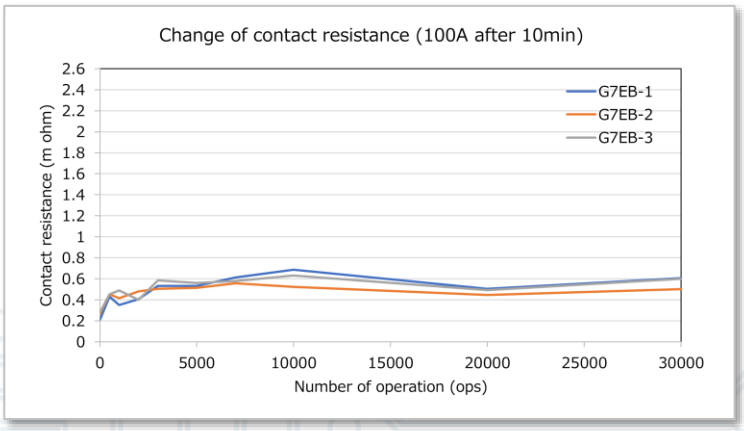


Figure 5: Reference data of contact resistance change

100A High power PCB relay G7EB
Instruction of product performance and reference circuit

Low power consumption

G7EB coil power consumption is 2.8W at rated coil voltage, however actual power consumption can be reduced to 525 mW by Holding voltage 45 %. PWM control is another method to reduce the coil power consumption. G7EB relay is applicable for both methods by following reference circuit diagrams.

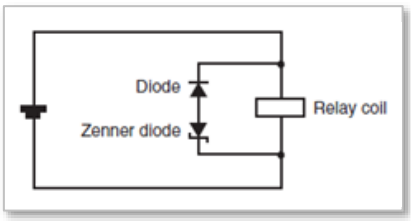
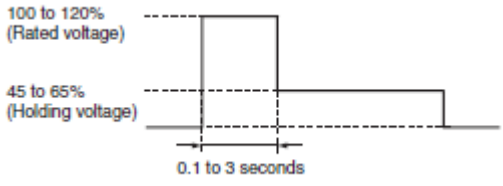


Figure 6: Diode connection

Please use a diode for coil surge absorption. A zener diode is also required in combination to maintain the G7EB switching performance. Diode connection is required in reverse polarity of the voltage applied to the coil (Figure 6).

- Recommended zener diode is 3 times of the rated coil voltage.
- Please use diodes with reverse dielectric strength 10 times or more of coil rated voltage.



	Applied coil voltage	Coil resistance *	Coil power consumption
Rated voltage	100 to 120%	51 Ω (12 VDC) 206 Ω (24 VDC)	Approx. 2.8 to 4.0 W
Holding voltage	45 to 65%		Approx. 0.57 to 1.2 W

Figure 7: Coil voltage reduction after operation

● Holding voltage

To reduce actual coil power consumption, please apply rated coil voltage for 0.1 to 3.0 seconds at first. The range of coil rated voltage must be set as 100 to 120 % and acceptable holding voltage is 45 to 65 % (Figure 7).

A CR circuit might be the simplest configuration to realize holding voltage. Operate the relay by current through capacitor and coil current will be reduced by the resistance (Figure 8). Please select the capacitor that can provide rated coil current for 40 ms or more. Choose the resistance value so that coil voltage will be over 45%.

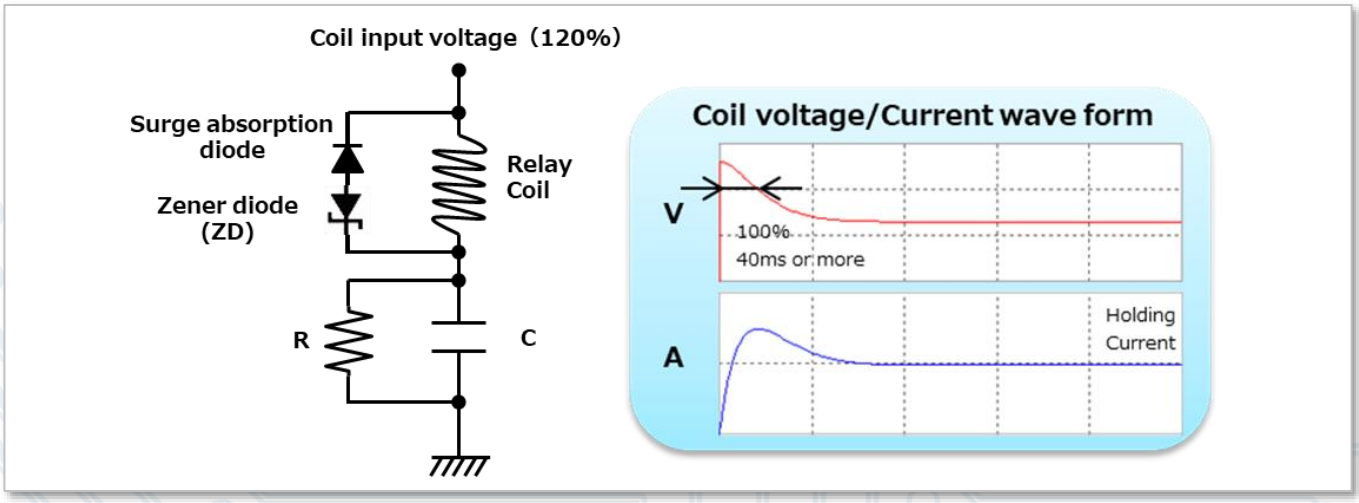


Figure 8: Reference of holding voltage CR circuit diagram

100A High power PCB relay G7EB
Instruction of product performance and reference circuit

A switching device can be use as an alternative to capacitor (Figure 9). Rated coil voltage will apply to the relay when switch is turned on and coil voltage will decrease when switching device turns off.

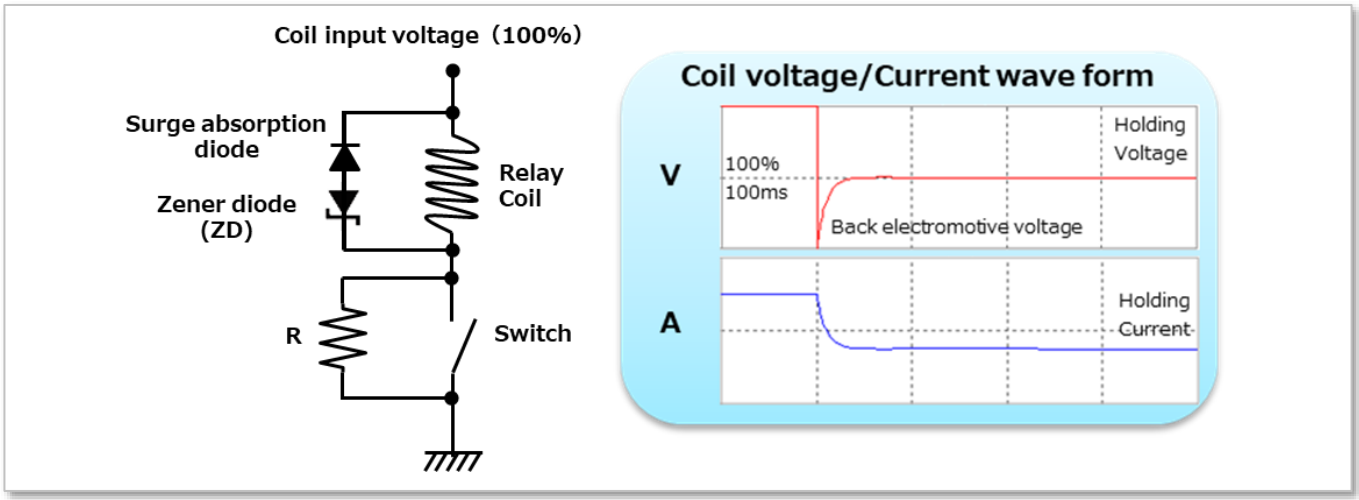


Figure 9: Reference of holding voltage by switch

● PWM control

To avoid the power loss caused by the zener diode, general PWM control circuit is not recommended. Please implement switching device in parallel with zener diode and bypass it during the PWM control (Figure 10). Turn off the switching device first and thereafter relay will turn off properly by zener diode and diode.

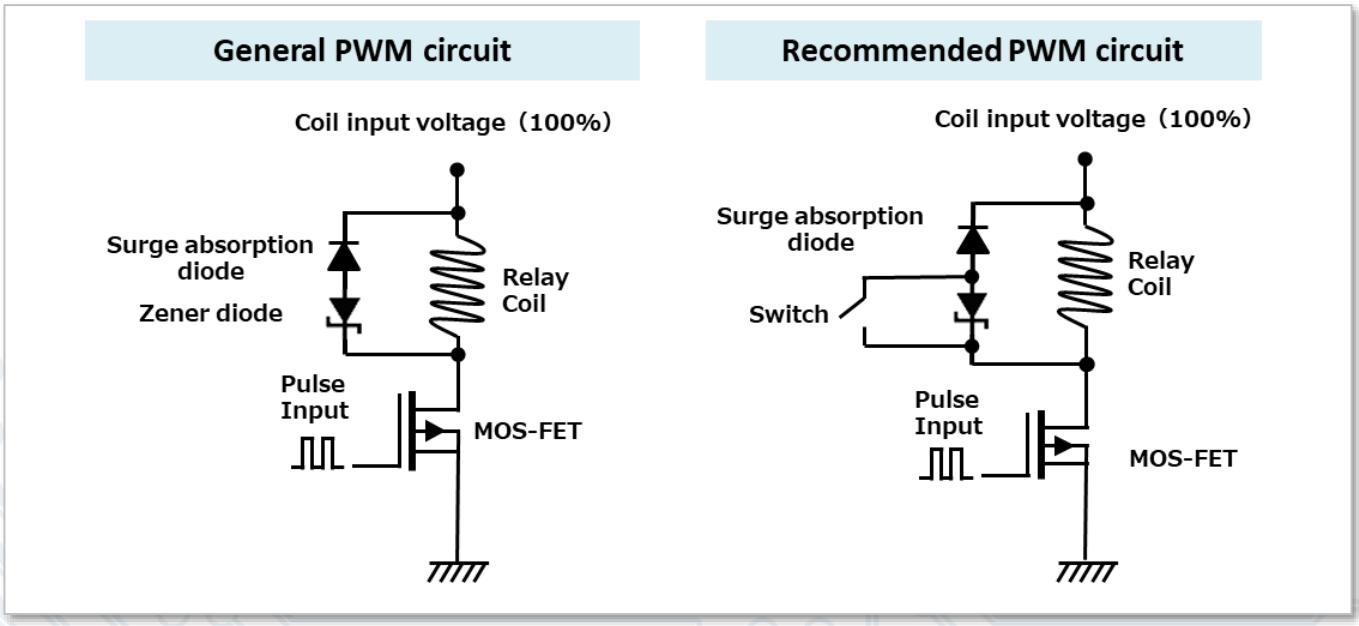


Figure 10: Reference of PWM control circuit diagram

100A High power PCB relay G7EB
Instruction of product performance and reference circuit

Figure 11 shows the comparison of coil current at each duty cycles. General PWM circuit require over 90 % duty cycle to keep the relay turn on. On the other hand, over 45 % duty cycle is acceptable for recommended PWM circuit to achieve the holding coil current criteria.

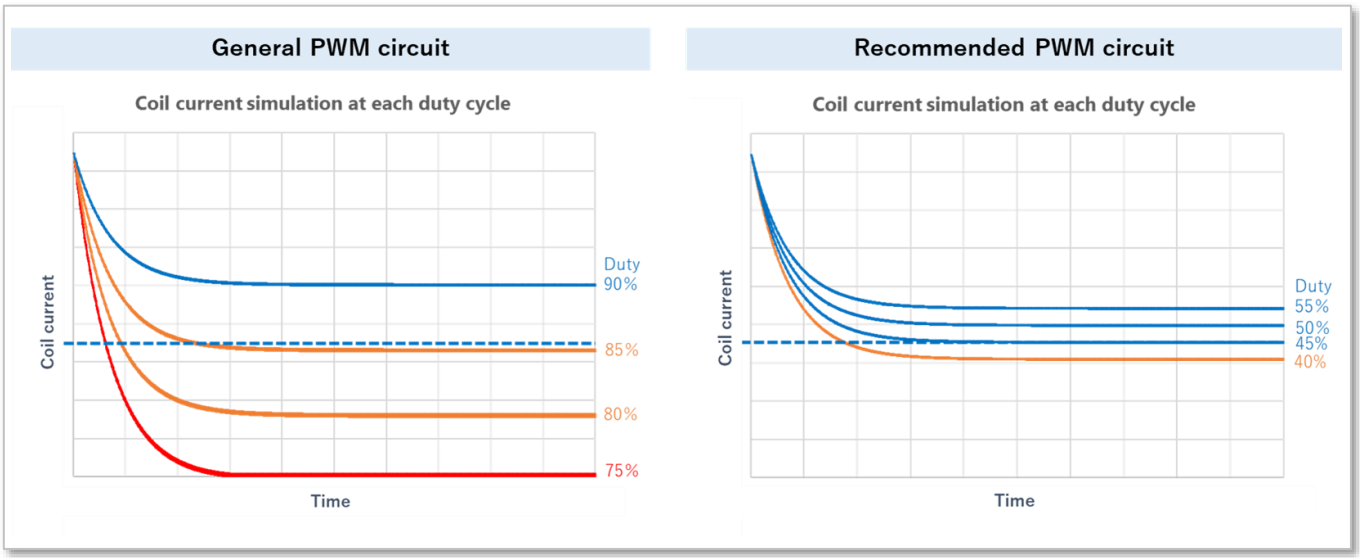


Figure 11: Reference of PWM control circuit diagram

DC contact rating

Battery management equipment is one of the market sectors which is significantly growing. Energy storage system (ESS) for residential applications is commonly designed with low voltage batteries (≤ 60 VDC) and relays are used for charge and discharge main line disconnection in safety purpose (Figure 12).
Relays are expected to have DC bidirectional switching capability and G7EB has the potential to contribute to this expectation. Thanks to over 3.6 mm double break wide contact gap structure which ensures stable bidirectional DC arc switching (Figure 13).

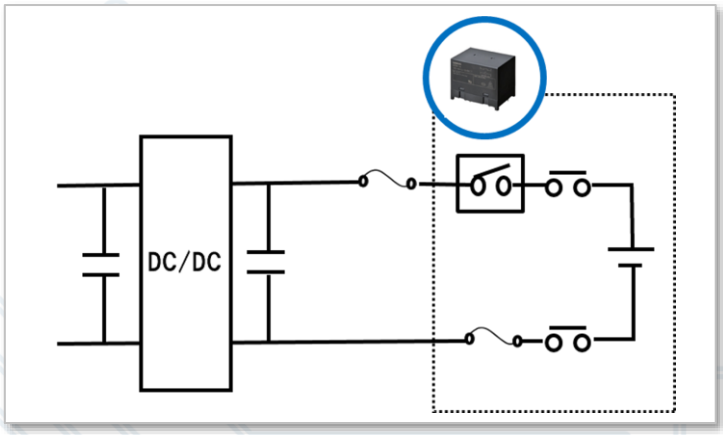


Figure 12: Example of energy storage application

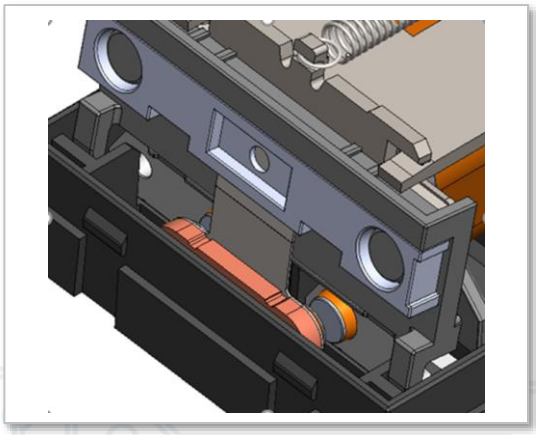


Figure 13: Contact structure of G7EB

100A High power PCB relay G7EB
Instruction of product performance and reference circuit

DC switching performance is proven by UL/ TUV/ CQC certification as you can see in Figure 14. G7EB is capable to provide to 60 VDC 100 A, 400 operations at resistive load. Longer life can be expected in case contact current is lower than 100 A. (e.g. 60 VDC 40 A, 6,000 operations)

Approval Standard

UL Recognized: (File No. E41515)

Model	Contact form	Coil ratings	Contact ratings	Number of test operations
G7EB-1A G7EB-1AP1	SPST-NO(1a)	12, 24 VDC	800 VAC 55 A (Resistive)	6,000
			800 VAC Making and Breaking 40 A, Carrying 100 A (Resistive)	30,000
			60 VDC 40 A (Resistive)	6,000
			60 VDC 100 A (Resistive)	400

EN/IEC, TÜV Certificated: (Certificate No. R50416743)

Model	Contact form	Coil ratings	Contact ratings	Number of test operations
G7EB-1A G7EB-1AP1	SPST-NO(1a)	12, 24 VDC	800 VAC, 100 A (Resistive)	200
			60 VDC 40 A (Resistive)	6,000
			60 VDC 50 A (Resistive)	1,000
			60 VDC 100 A (Resistive)	400

CQC Certificated: (Certificate No. CQC18002207225)

Model	Contact form	Coil ratings	Contact ratings	Number of test operations
G7EB-1A G7EB-1AP1	SPST-NO(1a)	12, 24 VDC	800 VAC, 100 A (Resistive)	200
			60 VDC 100 A (Resistive)	400

Figure 14: G7EB approval safety standards

Afterword

We hope you found this material useful. By adopting some or all of these suggestions contained in this material you'll be able to get maximum usage benefit as we intended. Please contact us in case you need further detail.

Please check each region's Terms & Conditions by region website.

OMRON Corporation
Device & Module Solutions Company

Regional Contact

Americas
https://components.omron.com/us-en/

Europe
http://components.omron.com/eu-en/

Asia-Pacific
https://components.omron.com/sg-en/

China
https://components.omron.com.cn

Korea
https://components.omron.com/kr-en/

Japan
https://components.omron.com/jp-ja/

Cat. No. K341-E1-02
0422