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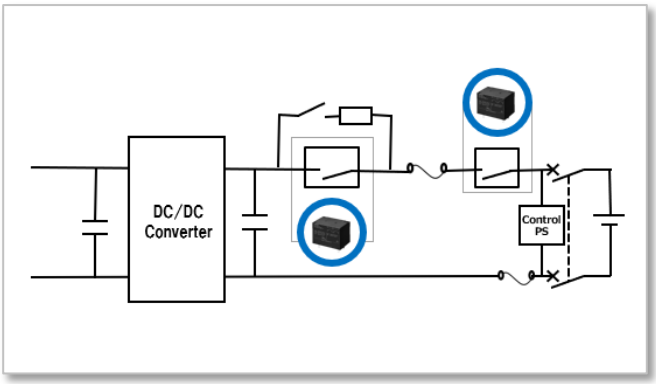
1000 VDC High-power 2 pole contacts (Total Contact Gap: 6.0mm) PCB relay G7L-X Instruction of product performance and reference circuit

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.

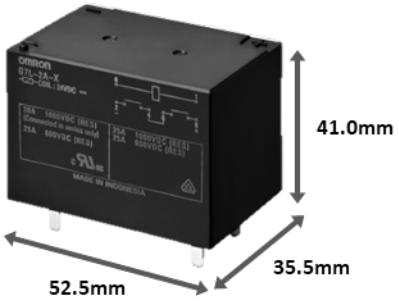


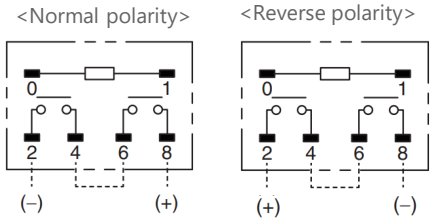
To meet evolving needs in the sector, we are constantly developing our range of components to support the next generation of energy systems. This includes an expanding range of high-power PCB relays with a focus on low contact resistance to increase the safety, reliability, durability, bidirectional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

Figure 1: Example of Solar inverter and Battery Unit relay application

Overview

G7L-X relay expands your design possibilities with high DC voltage switching (1000VDC or 600VDC). G7LX has 2 pole contacts and efficient low coil holding voltage and bidirectional contact capability contributes to your design. (Figure 2).





Specifications			G7L-2A-X
Coil	Coil Voltage		12VDC, 24VDC
	Power consumption		2.3W (0.6 W at Holding voltage 50%)
Contact	Contact form		DPST (2a)
	Rated Load (Resistive)		600VDC, 30A / 1000VDC, 25A
	Contact resistance (measurement condition : DC5, 1A voltage drop method)		≦100mΩ (Actual value see Page 4)
	Contact Gap		6.0mm (two-pole series wiring)
Endurance	Mechanical		1,000,000 ops
	Electrical (1 second ON – 9 seconds OFF at 85℃) (two-pole series wiring)	Normal polarity	600VDC, 30A, 6000 operations min. 1000VDC, 25A, 100 operations min.
		Reverse Polarity	600VDC, -30A, 5000 operations min.
Ambient temperature			–40℃ ~ +85℃
Safety standard			UL , VDE

Figure 2: G7L-X relay specifications

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Energy management trend for carbon neutral

The world is transforming towards a carbon-neutral society. The use of natural energy such as solar power generation is steadily expanding, and the use of storage batteries is indispensable for efficient use of the generated self-generated energy. Therefore, as the self-power generation system expands, the battery management system will continue to expand in the future (Figure 3). DC power is used to charge the battery, and since high voltage is used, a switching device that enables safe cut-off switching of DC high capacity is required.

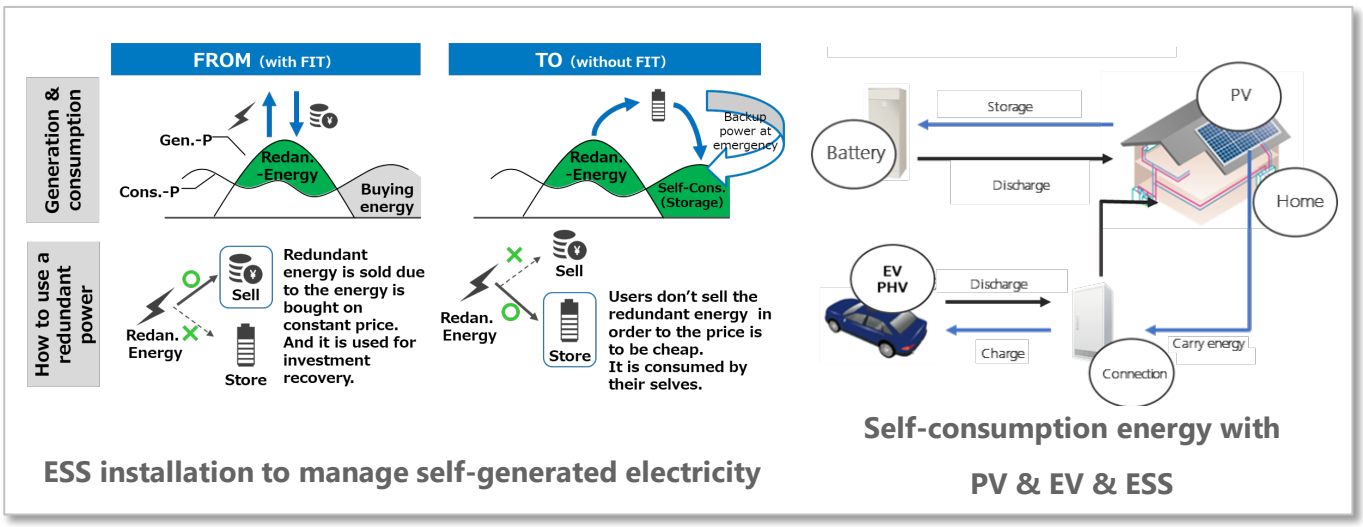

Figure 3: Background of market trend for G7L-X relay

G7L-X can be used for bidirectional switching. Therefore, G7L-X relay is widely expected to be used in commercial and industrial energy storage system (ESS), battery applications Solar inverter and Battery Unit (BMU) and V2H of industrial / Residential EV Charger (Mode 4) (Figure 4).

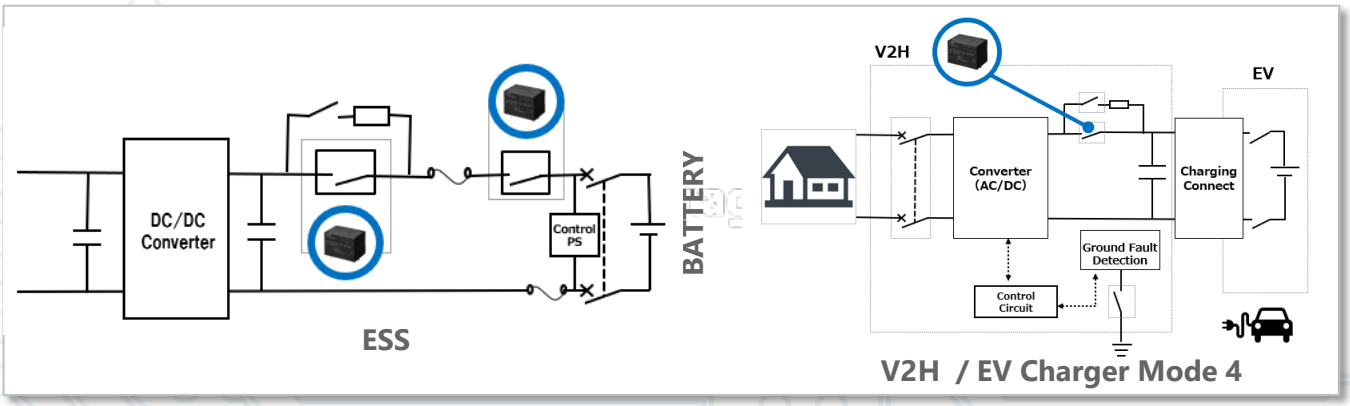

Figure 4: Example of V2H application and commercial and industrial ESS

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High-power bidirectional switching capability

Through Omron`s long-cultivated technical knowledge, we have achieved opening and closing performance in the bidirectional contact switching performance. Especially, V2H (V2X) applications use bidirectional current supply, which G7L-X can contribute to customer application. (Figure 5)

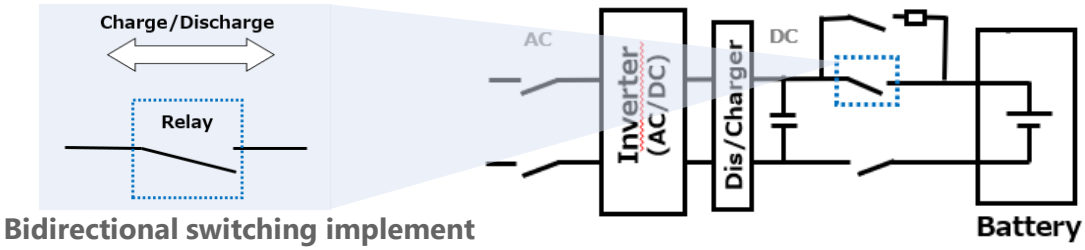

Figure 5: Bidirectional switching

Approved safety standards

DC switching performance is proven by UL/ VDE certification as you can see in Figure 6.

Approved Standards

- The approval rating values for overseas standards are different from the performance values determined individually confirm the values before use.

UL Recognized (File No. E41515)

Model	Coil ratings	Contact ratings	Number of test operations
G7L-2A-X	12 VDC, 24 VDC	15 A at 1000 VDC (Resistive) 85°C, Connected in series or Break all lines	6,000
		20 A at 1000 VDC (Resistive) 85°C, Connected in series	
		25 A at 600 VDC (Resistive) 85°C, Connected in series or Break all lines	
G7L-2A-X-L	12 VDC, 24 VDC	15 A at 1000 VDC (Resistive) 85°C, Connected in series or Break all lines	6,000
		20 A at 1000 VDC (Resistive) 85°C, Connected in series	
		20 A at 600 VDC (Resistive) 85°C, Connected in series or Break all lines	

● **EN/IEC and VDE Approval** (Approval No.40045061)

Model	Coil ratings	Contact ratings	Number of test operations
G7L-2A-X	12 VDC, 24 VDC	25 A at 1000 VDC (Resistive) 85°C, Connected in series or Break all lines	50
		15 A at 1000 VDC (Resistive) 85°C, Connected in series or Break all lines	8,000
		25 A at 600 VDC (Resistive) 85°C, Connected in series or Break all lines	10,000
G7L-2A-X-L	12 VDC, 24 VDC	20 A at 1000 VDC (Resistive) 85°C, Connected in series or Break all lines	50
		15 A at 1000 VDC (Resistive) 85°C, Connected in series or Break all lines	6,000
		20 A at 600 VDC (Resistive) 85°C, Connected in series or Break all lines	10,000

Figure 6: G7L-X approval safety standards

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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.

● Initial contact resistance value

G7L-X contact resistance is defined as <100 mΩ initial value for warranty but actual typical value is under 10 mΩ, AVE: 2 mΩ (at 5 VDC 1 A voltage drop method). (Figure 7).

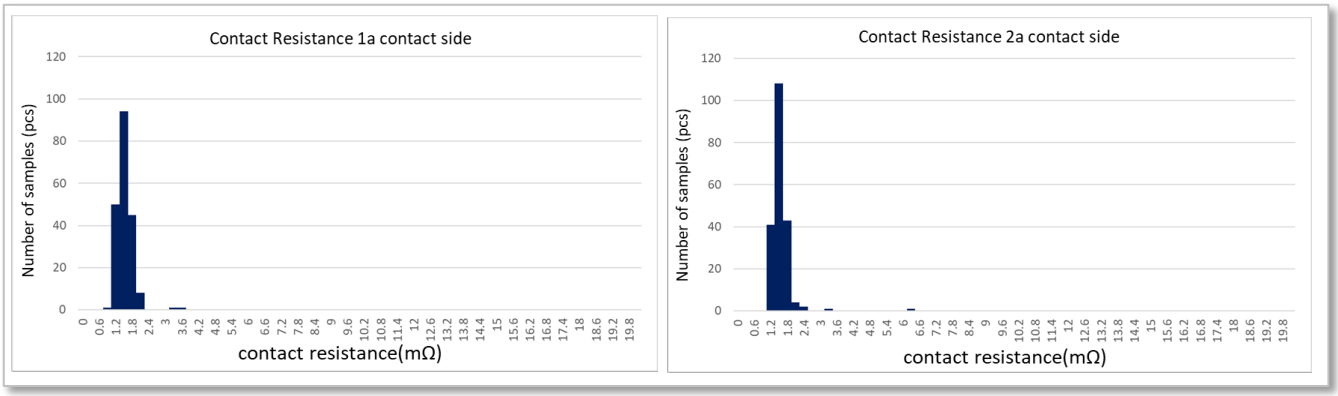
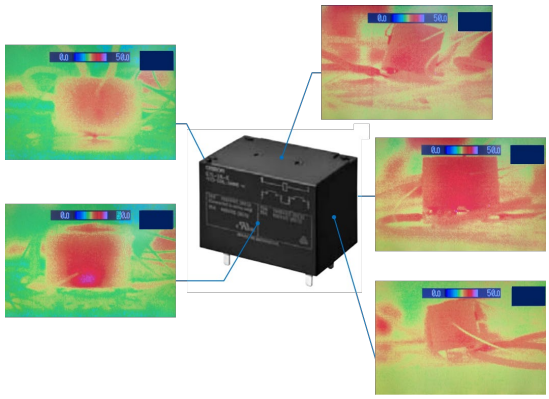


Figure 7: Initial contact resistance value (Total : 200 pcs)

● Product temperature rising performance [Reference data]

G7L-X product temperature rise when 30A carry current is applied through contacts (Figure 8).

[Reference data of product temperature rise]
Measurement product surface temperature to carry current 30A providing in two contacts, coil holding voltage 50% rated coil voltage. Ambient temperature is 25℃.



Result :
Highest product surface temperature is 37.8℃
(at 25℃ ambient temperature.)

Figure 8: Reference data of temperature rise with carry current 30A at 25℃ ambient temperature

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Low coil power consumption control

G7L-X coil power consumption is approx. 2.3W at rated coil voltage, however actual power consumption can be reduced to approx. 0.6 W by Holding voltage 50 %. PWM control is another method to reduce the coil power consumption. G7L-X relay is applicable for both methods by following reference circuit diagrams.

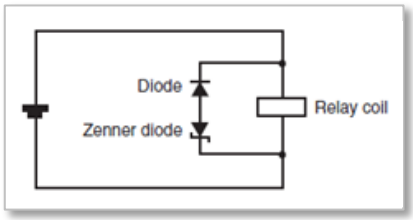


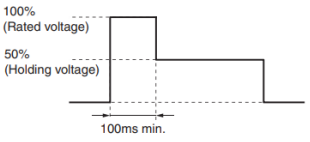
Figure 9: Diode connection

Please use a diode for coil surge absorption. A Zener diode is also required in combination to maintain the G7L-X switching performance. Diode connection is required in reverse polarity of the voltage applied to the coil (Figure 9).

- Recommended Zener diode is 1 to 2 times of the rated coil voltage.
- Please use diodes with reverse dielectric strength 10 times or more of coil rated voltage.

● Holding voltage

To reduce actual coil power consumption, please apply rated coil voltage for 0.1 seconds at first. The range of coil rated voltage must be set as 100% and acceptable holding voltage is 50% (Figure 10).



	Applied coil voltage	Coil resistance*	Power consumption
Rated voltage	100%	63Ω(DC12) 250Ω(DC24)	Approx. 2.3W
Holding voltage	50%		Approx. 0.6W

* The coil resistance were measured at a coil temperature of 23°C with tolerances of ± 15%.

Figure 10: Coil voltage reduction after operation

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 11). In this case usage, please select the capacitor that can provide rated coil voltage for 40 msec. or more. Choose the resistance value so that coil voltage will be over 50%.

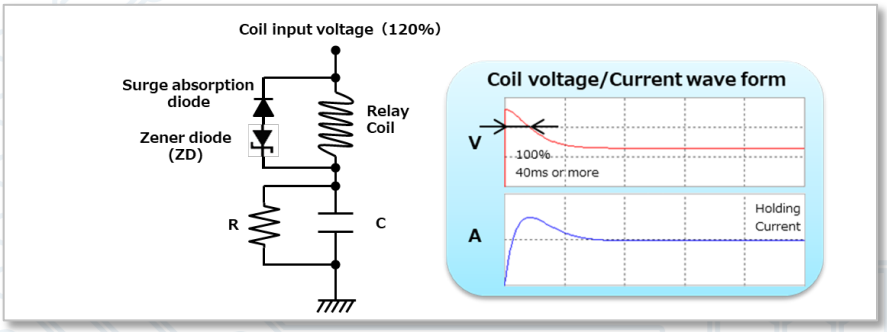


Figure 11: Reference of holding voltage CR circuit diagram

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A switching device can be use as an alternative to capacitor (Figure12). Rated coil voltage will apply to the relay when switch is turned on and coil voltage will decrease when switching device turns off.

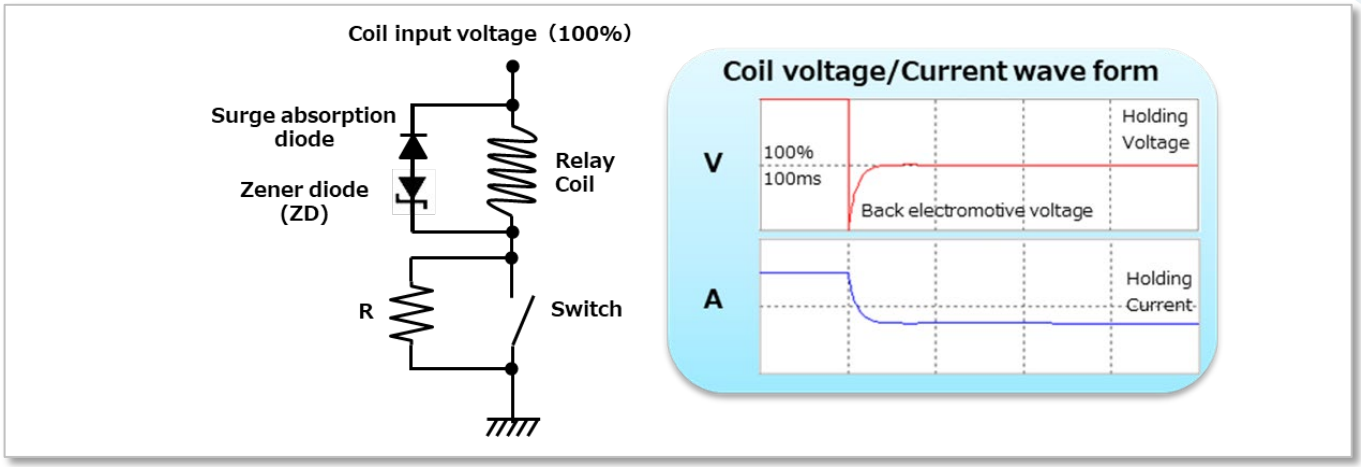

Figure 12: Reference of holding voltage by switch

● 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 13). Turn off the switching device first and thereafter relay will turn off properly by Zener diode and diode.

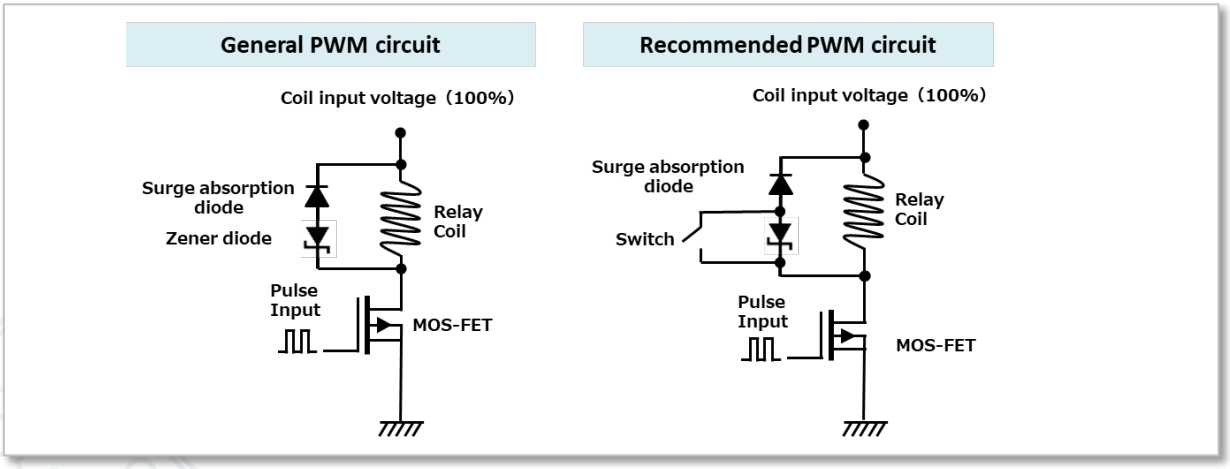

Figure 13: Reference of PWM control circuit diagram

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.

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