

Solid State Relays Common Precautions

●For precautions on individual products, refer to "■Precautions" in individual product information.

⚠ CAUTION

Touching the charged section is likely to cause electric shock. Do not touch the SSR terminal section (the charged section) when the power supply is ON. For SSRs with terminal covers, be sure to attach the cover before use.



The SSR and heat sink will be hot and are likely to cause burns. Do not touch the SSR or the heat sink either while the power supply is ON, or immediately after the power is turned OFF.



The internal snubber circuit is charged and will cause electric shock. Do not touch the SSR load terminal immediately after the power is turned OFF.



Electric shock is likely to result. Be sure to conduct wiring with the power supply turned OFF.



SSRs may occasionally explode. Do not apply a short-circuit current to the load side of an SSR. To protect against short-circuit accidents, be sure to install a protective device, such as a quick-break fuse etc. on the power supply line.



Safety Cautions

OMRON constantly strives to improve quality and reliability. SSRs, however, use semiconductors, and semiconductors may commonly malfunction or fail. Short-circuit failures represent the main failure mode and can result in an inability to shut OFF the load. Therefore, for fail-safe operation of control circuits that use SSRs, do not use circuits that shut OFF the load power supply only with an SSR, but rather also use circuits with a contactor or breaker that shuts off the load when the SSR fails. In particular, it may not be possible to ensure safety if the SSRs are used outside the rated ranges. Therefore, always use the SSRs within the ratings.

When using an SSR, always design the system to ensure safety and prevent human accidents, fires, and social harm in the event of SSR failure. System design must include measures such as system redundancy, measures to prevent fires from spreading, and designs to prevent malfunction.

1. Do not apply voltage or current in excess of the ratings to the terminals of the SSR. Doing so may result in failure or burn damage.
2. Heat Radiation
 - Be careful with the increase in ambient temperature caused by self-heating. Mount a fan etc. to provide a sufficient air ventilation especially in case of internal mounting.
 - Mount the SSR following the specified mounting orientation. The abnormal heat generation from the body may cause output elements to short or may cause burning.
3. Perform correct wiring following the precautions below. Improper wiring may lead to abnormal heating resulting in burn damage to the SSR once the power is supplied.
 - Use a suitable wire according to the load current. Otherwise the abnormal heating of the wire may cause burning.
4. Operating Conditions
 - Designate the load within the rated range. Otherwise it may result in faulty operation, malfunction, or burning.
 - Use a power supply within the rated frequency range. Otherwise it may result in faulty operation, malfunction, or burning.
5. Do not transport the SSR under the following conditions. Failure, malfunction, or deterioration of performance characteristics may occur.
 - Conditions under which the SSR will be exposed to water
 - High temperatures or high humidity
 - Without proper packing
6. Operating and Storage Environment
Do not use or store the SSR in the following environments. Doing so may result in damage, malfunction, or deterioration of performance characteristics.

- Do not use or store in environments subject to exposure to sunlight.
- Do not use in environments subject to temperatures outside the range specified individually.
- Do not use in environments subject to relative humidity outside the range of 45% to 85% RH, or in locations subject to condensation as the result of severe changes in temperature.
- Do not store in environments subject to temperatures outside the range specified individually.
- Do not use or store in environments subject to corrosive or flammable gases.
- Do not use or store in environments subject to dust, salt, or iron dust, or in locations subject to salt damage.
- Do not use or store in environments subject to shock or vibration.
- Do not use or store in environments subject to exposure to water, oil, or chemicals, or in environments subject to exposure to rain and water splashes.
- Do not use or store in environments subject to high temperature or high humidity.

Solid State Relays Common Precautions

Precautions for Correct use

● Before Using SSR

- The SSR in operation may cause an unexpected accident. Therefore it is necessary to test the SSR under the variety of conditions that are possible.
For example, as for the characteristics of the SSR, it is necessary to consider differences in characteristics between individual SSRs.
- The ratings in this catalog are tested values in a temperature range between 15°C and 30°C, a relative humidity range between 25% and 85%, and an atmospheric pressure range between 88 and 106 kPa. It will be necessary to provide the above conditions as well as the load conditions if the user wants to confirm the ratings of specific SSRs.

■ Input Circuit

● Connecting to the Input Side

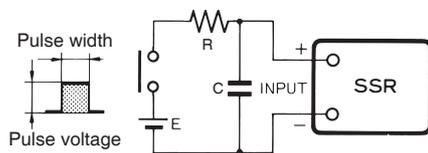
There is variation in the input impedance of SSRs. Therefore, do not connect multiple inputs in series. Otherwise malfunction may occur.

● Input Noise

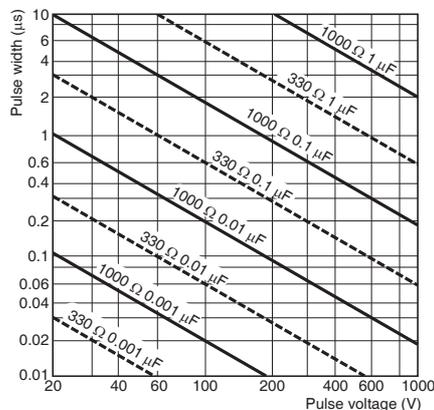
SSRs need only a small amount of power to operate. This is why the input terminals must shut out electrical noise as much as possible. Noise applied to the input terminals may result in malfunction. The following describes measures to be taken against pulse noise and inductive noise.

1. Pulse Noise

A combination of capacitor and resistor can absorb pulse noise effectively. The following is an example of a noise absorption circuit with capacitor C and resistor R connected to an SSR incorporating a photocoupler.



The value of R and C must be decided carefully. The value of R must not be too large or the supply voltage (E) will not be able to satisfy the required input voltage value. The larger the value of C is, the longer the release time will be, due to the time required for C to discharge electricity.



Note. For low-voltage models, sufficient voltage may not be applied to the SSR because of the relationship between C, R, and the internal impedance. When deciding on a value for R, check the input impedance for the SSR.

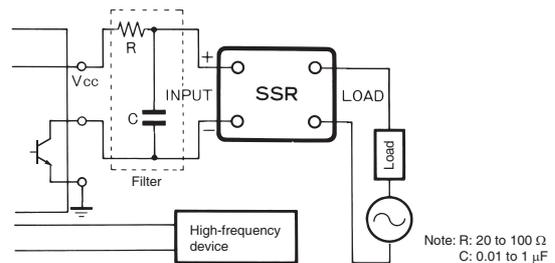
2. Inductive Noise

Do not wire power lines alongside the input lines. Inductive noise may cause the SSR to malfunction. If inductive noise is imposed on the input terminals of the SSR, use the following cables according to the type of inductive noise, and reduce the noise level to less than the must release voltage of the SSR.

Twisted-pair wire: For electromagnetic noise

Shielded cable: For static noise

A filter consisting of a combination of capacitor and resistor will effectively reduce noise generated from high-frequency equipment.



● Input Conditions

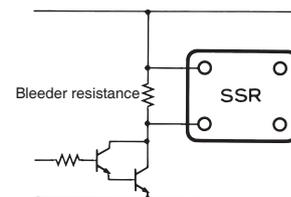
1. Input Voltage Ripples

When there is a ripple in the input voltage, set the input voltage so that the peak voltage is lower than the maximum operating voltage and the root voltage is above the minimum operating voltage.



2. Countermeasures for Leakage Current

When the SSR is powered by transistor output, the must release voltage may be insufficient due to leakage current while power is OFF. To counteract this, connect bleeder resistance as shown in the diagram below and set the bleeder resistance so that VR is half of the release voltage or less.



The bleeder resistance R can be obtained in the way shown below.

$$R \leq \frac{E}{I_L - I}$$

E : Voltage applied at both ends of the bleeder resistance = half of the release voltage of the SSR

I_L : Leakage current of the transistor

I : Release voltage of SSR

The actual value of the release current is not given in the datasheet and so when calculating the value of the bleeder resistance, use the following formula.

$$\text{Release current for SSR} = \frac{\text{Minimum value of release voltage}}{\text{Input impedance}}$$

For SSRs with constant-current input circuits, calculation is performed at 0.1 mA.

The calculation for the G3M-202P DC24 is shown below as an example.

$$\text{Release current } I = \frac{1 \text{ V}}{1.6 \text{ k}\Omega} = 0.625 \text{ mA}$$

$$\text{Bleeder resistance } R = \frac{1\text{V} \times 1/2}{I_L - 0.625 \text{ mA}}$$

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3. ON/OFF Frequency

An SSR has delay times called the operating time and release time. Loads, such as inductive loads, also have delay times called the operating time and release time. These delays must all be considered when determining the switching frequency.

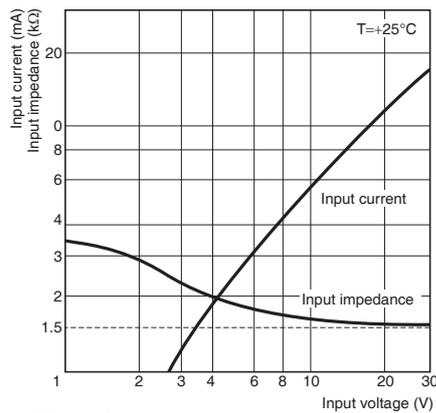
4. Input impedance

In SSRs which have wide input voltages (such as G3CN and G3TB), the input impedance varies according to the input voltage and changes in the input current.

For semiconductor-driven SSRs, changes in voltage can cause malfunction of the semiconductor, so be sure to check by the actual device before usage.

See the following examples.

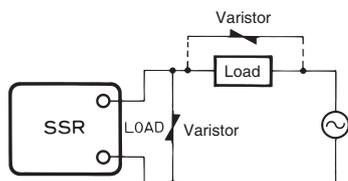
Input impedance (Example) G3CN



Output Circuit

AC Switching SSR Output Noise and Surges

- In case there is a large voltage surge in the AC current being used by the SSR, the RC snubber circuit built into the SSR between the SSR load terminals will not be sufficient to suppress the surge, and the SSR transient peak element voltage will be exceeded, causing overvoltage damage to the SSR.
- Only the following models have a built-in surge absorbing varistor: G3NA, G3S, G3PA, G3NE, G3PH, G3DZ (some models), G3RZ, and G3FM. When switching an inductive load with any other models, be sure to take countermeasures against surge, such as adding a surge absorbing element.
- In the following example, a surge voltage absorbing element has been added.



Select an element which meets the conditions in the following table as the surge absorbing element.

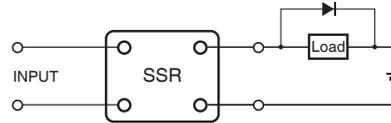
Voltage	Varistor voltage	Surge resistance
100 to 120 VAC	240 to 270 V	1,000 A min.
200 to 240 VAC	440 to 470 V	
380 to 480 VAC	820 to 1,000 V	

Output Connections

Do not connect SSR outputs in parallel. With SSRs, both sides of the output will not turn ON at the same time, so the load current cannot be increased by using parallel connections.

DC Switching SSR Output Noise Surges

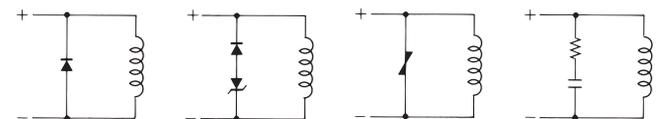
When an L load, such as a solenoid or electromagnetic valve, is connected, a diode that prevents counter-electromotive force. If the counter-electromotive force exceeds the withstand voltage of the SSR output element, it could result in damage to the SSR output element. To prevent this, insert the element parallel to the load, as shown in the following diagram and table.



As an absorption element, the diode is the most effective at suppressing the counter-electromotive force. The release time for the solenoid or electromagnetic valve will, however, increase. Be sure to check the circuit before use. To shorten the time, connect a Zener diode and a regular diode in series. The release time will be shortened at the same rate that the Zener voltage (V_z) of the Zener diode is increased.

Table 1. Absorption Element Example

Absorption element				
Diode	○	○	r	×
Diode + Zener diode				
Varistor				
CR				



(Reference)

1. Selecting a Diode

$$\text{Withstand voltage} = V_{RM} \geq \text{Power supply voltage} \times 2$$

$$\text{Forward current} = I_F \geq \text{load current}$$

2. Selecting a Zener Diode

$$\text{Zener voltage} = V_z < \text{SSR withstand voltage}$$

$$- (\text{Power supply voltage} + 2 \text{ V})$$

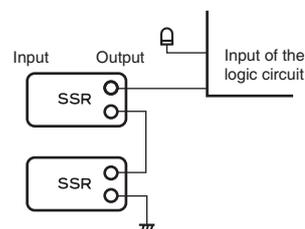
$$\text{Zener surge power} =$$

$$P_{RSM} > V_z \times \text{Load current} \times \text{Safety factor (2 to 3)}$$

Note. When the Zener voltage is increased (V_z), the Zener diode capacity (P_{RSM}) is also increased.

AND Circuits with DC Output SSRs

Use the G3DZ relay for the following type of circuit.



Self-holding Circuits

Self-holding circuits must use mechanical relays. (SSRs cannot be used to design self-holding circuits.)

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●Selecting an SSR for Different Loads

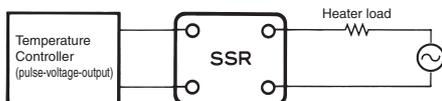
The following provides examples of the inrush currents for different loads.

AC Load and Inrush Current

Load	Solenoid	Incandescent lamp	Motor	Relay	Capacitor	Resistive load
Inrush current/Normal current	Approx. 10 times	Approx. 10 to 15 times	Approx. 5 to 10 times	Approx. 2 to 3 times	Approx. 20 to 50 times	1
Waveform						

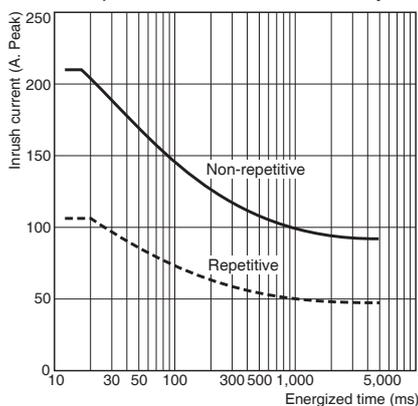
1. Heater Load (Resistive Load)

A resistive load has no inrush current. The SSR is generally used together with a pulse-voltage-output in temperature controller for heater ON/OFF switching. When using an SSR with the zero cross function, most generated noise is suppressed. This type of load does not, however, include all-metal and ceramic heaters. Since the resistance values at normal temperatures of all-metal and ceramic heaters are low, an overcurrent will occur in the SSR, causing damage. For switching of all-metal and ceramic heaters, select a Power Controller (G3PW, consult your OMRON representative) with a long soft-start time, or a constant-current switch.



2. Lamp Load

A large inrush current flows through incandescent lamps, halogen lamps, and similar devices (approx. 10 to 15 times higher than the rated current). Select an SSR so that the peak value of inrush current does not exceed half the inrush current resistance of the SSR. Refer to "Repetitive" (indicated by the dashed line) shown in the following figure. When a repetitive inrush current of greater than half the inrush current resistance is applied, the output element of the SSR may be damaged.



3. Motor Load

When a motor is started, an inrush current of 5 to 10 times the rated current flows and the inrush current flows for a longer time than for a lamp or transformer. In addition to measuring the startup time of the motor or the inrush current during use, ensure that the peak value of the inrush current is less than half the inrush current resistance when selecting an SSR. The SSR may be damaged by counterelectromotive force from the motor. Be sure to install overcurrent protection for when the SSR is turned OFF.

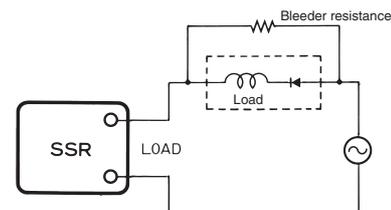
4. Transformer Load

When the SSR is switched ON, an energizing current of 10 to 20 times the rated current flows through the SSR for 10 to 500 ms. If there is no load in load side circuit, the energizing current will reach the maximum value. Select an SSR so that the energizing current does not exceed half the inrush current resistance of the SSR.

5. Half-wave Rectifying Circuit

AC electromagnetic counters or solenoids have built-in diodes, which act as half-wave rectifiers. For these types of loads, a halfwave AC voltage does not reach the SSR output. For SSRs with the zero cross function, this can cause them not to turn ON. Two methods for counteracting this problem are described below.

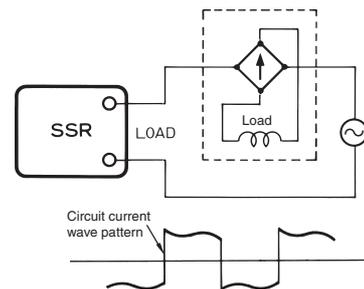
1. Connect a bleeder resistance with approximately 20% of the SSR load current.



2. Use SSRs without the zero cross function.

6. Full-wave Rectified Loads

AC electromagnetic counters and solenoids have built-in diodes, which act as full-wave rectifiers. The load current for these types of loads has a rectangular wave pattern, as shown in the following diagram.



Accordingly, AC SSRs use a triac (which turns OFF the element only when the circuit current is 0 A) in the output element. If the load current waveform is rectangular, it will result in an SSR release error.

When switching ON and OFF a load whose waves are all rectified, use Power MOS FET Relay.

-V-model SSRs: G3F-203SL-V, G3H-203SL-V

Power MOS FET Relay: G3DZ, G3RZ, G3FM

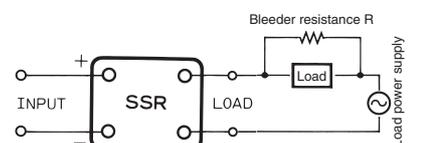
Note. Refer to "Control Component Catalogue" (Catalogue number: SAOO-206) for detailed specification of G3FM models.

7. Small-capacity Loads

Even when there is no input signal to the SSR, there is a small leakage current (IL) from the SSR output (LOAD). If this leakage current is larger than the load release current, the SSR may fail to release. Connect a bleeder resistance R in parallel to increase the SSR switching current.

$$R < \frac{E}{I_L - I}$$

E: Load (e.g., relays) release voltage
I: Load (e.g., relays) release current



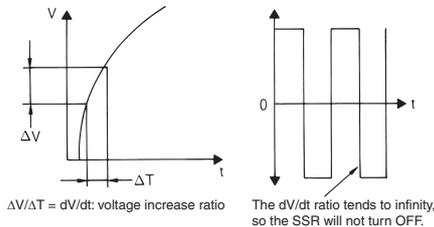
Bleeder resistance standards: 100-VAC power supply, 5 to 10 kΩ, 3 W
200-VAC power supply, 5 to 10 kΩ, 15 W

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8. Inverter Load

Do not use an inverter-controlled power supply as the load power supply for the SSR. Inverter-controlled waveforms become rectangular, so the dV/dt ratio is extremely large and the SSR may fail to release.

An inverter-controlled power supply may be used on the input side provided the effective voltage is within the normal operating voltage range of the SSR.



9. Capacitive Load

The supply voltage plus the charge voltage of the capacitor is applied to both ends of the SSR when it is OFF. Therefore, use an SSR model with an input voltage rating twice the size of the supply voltage. Limit the charge current of the capacitor to less than half the peak inrush current value allowed for the SSR.

10. SSR for DC Switching

Connection

With the SSR for DC switching, the load can be connected to either negative (-) or positive (+) output terminal of the SSR.

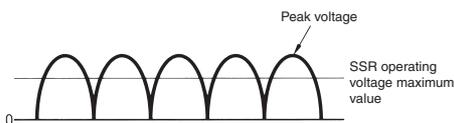
Protective Component

Since the SSR does not incorporate an overvoltage absorption component, be sure to connect an overvoltage absorption component when using the SSR under an inductive load.

Load Power Supply

1. Rectified Currents

If a DC load power supply is used for full-wave or half-wave rectified AC currents, make sure that the peak load current does not exceed the maximum usage load power supply of the SSR. Otherwise, overvoltage will cause damage to the output element of the SSR.



2. Operating Frequency for AC Load Power Supply

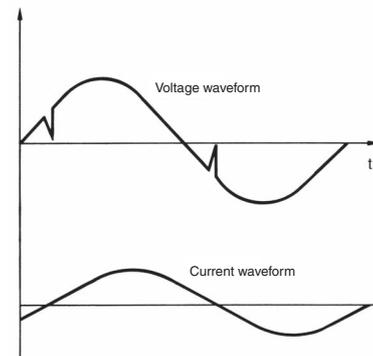
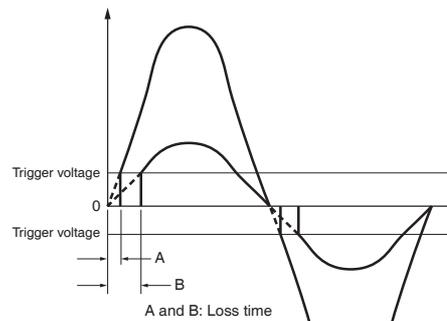
The operating frequency range for an AC load power supply is 47 to 63 Hz.

3. Low AC Voltage Loads

If the load power supply is used under a voltage below the minimum operating load voltage of the SSR, the loss time of the voltage applied to the load will become longer than that of the SSR operating voltage range. See the following load example. (The loss time is $A < B$.)

Before operating the SSR, make sure that this loss time will not cause problems.

If the load voltage falls below the trigger voltage, the SSR will not turn ON, so be sure to set the load voltage to 75 VAC min.



An inductance (L) load causes a current phase delay as shown on the left. Therefore, the loss is not as great as that caused by a resistive (R) load. This is because a high voltage is already imposed on the SSR when the input current to the SSR drops to zero and the SSR is turned OFF.

4. Phase-controlled AC Power Supplies

Phase-controlled power supply cannot be used.

Operating and Storage Environments

1. Operating Ambient Temperature

The rated value for the ambient operating temperature of the SSR is for when there is no heat build-up. For this reason, under conditions where heat dissipation is not good due to poor ventilation, and where heat may build up easily, the actual temperature of the SSR may exceed the rated value resulting in malfunction or burning.

When using the SSR, design the system to allow heat dissipation sufficient to stay below the "●Load Current vs. Ambient Temperature" characteristic curve. Note also that the ambient temperature of the SSR may increase as a result of environmental conditions (e.g., climate or air-conditioning) and operating conditions (e.g., mounting in an airtight panel).

2. Transportation

When transporting the SSR, observe the following points. Not doing so may result in damage, malfunction, or deterioration of performance characteristics.

3. Vibration and Shock

Do not subject the SSR to excessive vibration or shock.

Otherwise the SSR may malfunction and internal components may be damaged.

To prevent the SSR from abnormal vibration, do not install the SSR in locations or by means that will subject it to vibration from other devices, such as motors.

4. Solvents

Do not allow the SSR to come in contact with solvents, such as thinners or gasoline. Doing so will dissolve the markings on the SSR.

5. Oil

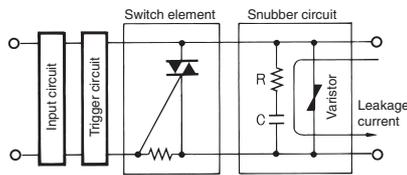
Do not allow the SSR terminal cover to come in contact with oil. Doing so will cause the cover to crack and become cloudy.

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Actual Operation

1. Leakage Current

A leakage current flows through a snubber circuit in the SSR even when there is no input. Therefore, always turn OFF the input or load and check that it is safe before replacing or wiring the SSR.



2. Cutting Terminals

Do not cut the terminals using an automated-cutter. Cutting the terminals with devices such as an automated-cutter may damage the internal components.

3. Deformed Terminals

Do not attempt to repair or use a terminal that has been deformed. Otherwise excessive force will be applied to the SSR, and it will lose its original performance capabilities.

4. Hold-down Clips

Exercise care when pulling or inserting the hold-down clips so that their form is not distorted. Do not use a clip that has already been deformed. Otherwise excessive force will be applied to the SSR, causing it not to perform to its specification, and also it will not have enough holding power, causing the SSR to be loose, and resulting in damage to the contacts.

5. PCB SSR Soldering

- SSRs must be soldered at 260°C within five seconds. For models, however, that conform to separate conditions, perform soldering according to the specified requirements.
- Use a rosin-based non-corrosive flux that is compatible with the material of the SSR.

6. Ultrasonic Cleaning

Do not perform ultrasonic cleaning. Performing ultrasonic cleaning after the SSR base has been installed will cause ultrasonic waves to resonate throughout the SSR internal structure, thereby damaging the internal components.

Safety Concept

1. Error Mode

The SSR is an optimum relay for high-frequency switching and highspeed switching, but misuse or mishandling of the SSR may damage the elements and cause other problems. The SSR consists of semiconductor elements, and will break down if these elements are damaged by surge voltage or overcurrent. Most faults associated with the elements are short-circuit malfunctions, whereby the load cannot be turned OFF.

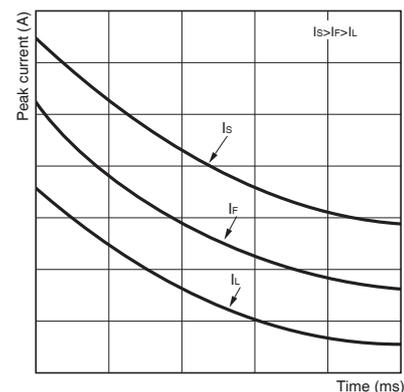
Therefore, to provide a safety feature for a control circuit using an SSR, design a circuit in which a contactor or circuit breaker on the load power supply side will turn OFF the load when the SSR causes an error. Do not design a circuit that turns OFF the load power supply only with the SSR. For example, if the SSR causes a half-wave error in a circuit in which an AC motor is connected as a load, DC energizing may cause overcurrent to flow through the motor, thus burning the motor. To prevent this from occurring, design a circuit in which a circuit breaker stops overcurrent to the motor.

Location	Cause	Result
Input area	Overvoltage	Input element damage
Output area	Overvoltage	Output element damage
	Overcurrent	
Whole Unit	Ambient temperature exceeding maximum	Output element damage
	Poor heat radiation	

2. Short-circuit Protection

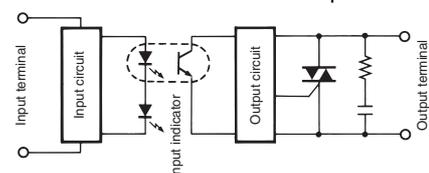
A short-circuit current or an overcurrent flowing through the load of the SSR will damage the output element of the SSR. Connect a quick-break fuse in series with the load as a short-circuit protection measure.

Design a circuit so that the protection coordination conditions for the quick-break fuse satisfy the relationship between the SSR surge resistance (I_s), quick-break fuse current-limiting feature (I_f), and the load inrush current (I_L), shown in the following chart.



3. Operation Indicator

The operation indicator turns ON when current flows through the input circuit. It does not indicate that the output element is ON.



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■ HANDLING THE SSR

● Do Not Drop

The SSR is a high-precision component. Do not drop the SSR or subject it to excessive vibration or shock regardless of whether the SSR is mounted or not.

The maximum vibration and shock that an SSR can withstand varies with the model. Refer to the relevant datasheet.

The SSR cannot maintain its full performance capability if the SSR is dropped or subjected to excessive vibration or shock. In addition, it may result in malfunction due to its damaged internal components if the SSR is dropped or subjected to excessive vibration or shock.

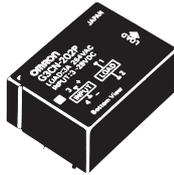
The impact of shock given to the SSR that is dropped varies upon the case. For example, if a single SSR is dropped on a plastic tile from a height of 10 cm, the SSR may receive a shock of 1,000 m/s² or more. (It depends on the floor material, the angle of collision with the floor, and the dropping height.)

Handle the SSR models in stick packages with the same care and keep them free from excessive vibration or shock.

● Terminal arrangement/Internal connections

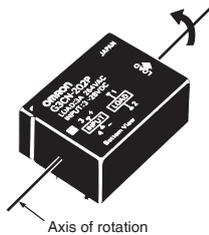
1. BOTTOM VIEW

If the relay's terminals cannot be seen from above, as in this example, a BOTTOM VIEW is shown.



2. Rotating direction to BOTTOM VIEW

The following shows the terminal rotated in the direction indicated by the arrow, with the coil always on the left (orientation mark on the left).



■ PCB-mounting SSRs

1. Suitable PCBs

1 PCB Material

PCBs are classified into epoxy PCBs and phenol PCBs. The following table lists the characteristics of these PCBs. Select one, taking into account the application and cost. Epoxy PCBs are recommended for SSR mounting in order to prevent the solder from cracking.

Item	Epoxy		Phenol
	Glass epoxy (GE)	Paper epoxy (PE)	Paper phenol (PP)
Electrical characteristics	<ul style="list-style-type: none"> High insulation resistance. Highly resistive to moisture absorption. 	<ul style="list-style-type: none"> Inferior to glass epoxy but superior to paper phenol PCBs. 	<ul style="list-style-type: none"> New PCBs are highly insulation-resistant but easily affected by moisture absorption and cannot maintain good insulation performance over a long time.
Mechanical characteristics	<ul style="list-style-type: none"> The dimensions are not easily affected by temperature or humidity. Ideal for through-hole or multi-layer PCBs. 	<ul style="list-style-type: none"> Inferior to glass epoxy but superior to paper phenol PCBs. 	<ul style="list-style-type: none"> The dimensions are easily affected by temperature or humidity. Not suitable for through-hole PCBs.
Economical efficiency	<ul style="list-style-type: none"> Expensive 	<ul style="list-style-type: none"> Rather expensive 	<ul style="list-style-type: none"> Inexpensive
Application	<ul style="list-style-type: none"> Applications that require high reliability. 	<ul style="list-style-type: none"> Applications that may require less reliability than those for glass epoxy PCBs but require more reliability than those of paper phenol PCBs. 	<ul style="list-style-type: none"> Applications in comparatively good environments with low-density wiring.

2 PCB Thickness

The PCB may warp due to the size, mounting method, or ambient operating temperature of the PCB or the weight of components mounted to the PCB. Should warping occur, the internal mechanism of the SSR on the PCB will be deformed and the SSR may not provide its full capability. Determine the thickness of the PCB by taking the material of the PCB into consideration.

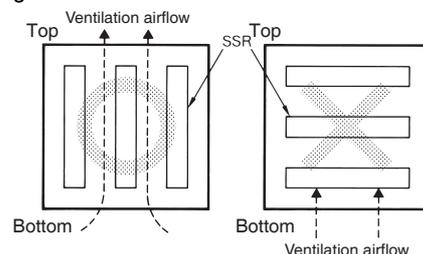
3 Terminal Hole and Land Diameters

Refer to the following table to select the terminal hole and land diameters based on the SSR mounting dimensions. The land diameter may be smaller if the land is processed with through-hole plating.

Hole dia. (mm)		Minimum land dia. (mm)
Nominal value	Tolerance	
0.6	±0.1	1.5
0.8		1.8
1.0		2.0
1.2		2.5
1.3		2.5
1.5		3.0
1.6		3.0
2.0		3.0

2. Mounting Space

The ambient temperature around the sections where the SSR is mounted must be within the permissible ambient operating temperature. If two or more SSRs are mounted closely together, the SSRs may radiate excessive heat. Therefore, make sure that the SSRs are separated from one another at the specified distance provided in the datasheet. If there is no such specification, maintain a space that is as wide as a single SSR. Provide adequate ventilation to the SSRs as shown in the following diagram.



Solid State Relays Common Precautions

3. Mounting SSR to PCB

Read the precautions for each model and fully familiarize yourself with the following information when mounting the SSR to the PCB.



Step 1
SSR mounting

- Do not bend the terminals to make the SSR self-standing, otherwise the full performance of the SSR may not be possible.
- Process the PCB properly according to the mounting dimensions.

Step 2
Flux coating

- The flux must be a non-corrosive rosin flux, which is suitable to the material of the SSR. Apply alcohol solvent to dissolve the flux.
- Make sure that all parts of the SSR other than the terminals are free of the flux. The insulation resistance of the SSR may be degraded if there is flux on the bottom of the SSR.

Step 3
Preheating

- Be sure to preheat the SSR to allow better soldering.
- Preheat the SSR under the following conditions.

Temperature	100°C max.
Time	1 min max.

- Do not use the SSR if it is left at high temperature over a long time. This may change the characteristics of the SSR.

Step 4
Soldering

●Automatic Soldering

- Flow soldering is recommended for maintaining a uniform soldering quality.
 - Solder: JIS Z3282 or H63A
 - Soldering temperature: Approx. 250°C (Approx. 260°C for DWS)
 - Soldering time: Approx. 5 s (Approx. 2 s for first time and approx. 3 s for second time for DWS)
 - Perform solder level adjustments so that the solder will not overflow on the PCB.

●Manual Soldering

- After smoothing the tip of the soldering iron, solder the SSR under the following conditions.
 - Solder: JIS Z3282, 1160A, or H63A with rosin-flux-cored solder
 - Soldering iron: 30 to 80 W
 - Soldering temperature: 280°C to 350°C
 - Soldering time: Approx. 3 s
- As shown in the above illustration, solder with a groove for preventing flux dispersion.



Step 5
Cooling

- After soldering the SSR, be sure to cool down the SSR so that the soldering heat will not deteriorate the SSR or any other components.
- Do not dip the SSR into cold liquid, such as a detergent, immediately after soldering the SSR.

Step 6
Cleaning

- Refer to the following table for the selection of the cleaning method and detergent.

Detergent

Boiling or dip cleaning is possible for the SSR. Do not perform ultrasonic cleaning or cut the terminals, otherwise the internal parts of the SSR may be damaged. Make sure that the temperature of the detergent is within the permissible ambient operating temperature of the SSR.

2. Applicability of Detergents

Detergent	Applicability
Chlorine detergent <ul style="list-style-type: none"> Perochline Chlorosolder Trichloroethylene 	OK
Aqueous detergent <ul style="list-style-type: none"> Indusco Pure water (pure hot water) Holys 	OK
Alcohol <ul style="list-style-type: none"> IPA Ethanol 	OK
Others <ul style="list-style-type: none"> Paint thinner Gasoline 	NG

Note 1. Contact your OMRON representatives before using any other detergent. Do not apply Freon TMC, paint thinner, or gasoline to any SSR.

Note 2. The space between the SSR and PCB may not be adequately cleaned with a hydrocarbon or alcohol detergent.

Actions are being taken worldwide to stop the use of CFC-113 (chlorofluorocarbon) and 1.1.1 trichloroethane. Your understanding and cooperation are highly appreciated.

Step 7
Coating

- Do not fix the whole SSR with resin, otherwise the characteristics of the SSR may change.
- The temperature of the coating material must be within the permissible ambient operating temperature range.

Coating

Type	Applicability
Epoxy	OK
Urethane	OK
Silicone	OK

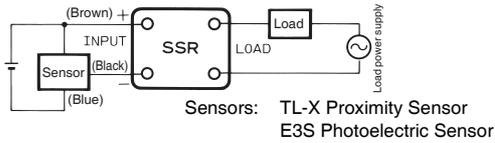
Note. When soldering PCB SSR with high-heat capacity such as the G3M, make sure that the soldering of SSR terminals is properly performed.

Solid State Relays Common Precautions

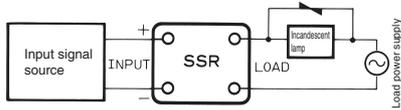
■ Application Circuit Examples

1. Connection to Sensors

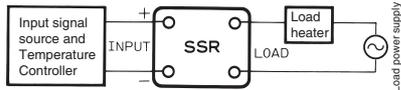
The SSR connects directly to a Proximity Sensor or Photoelectric Sensor.



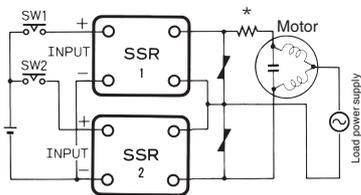
2. Switching Control of Incandescent Lamps



3. Temperature Control of Electric Furnaces



4. Forward and Reverse Operation of Singlephase Inductive Motors



Note 1. The voltage between the load terminals of either SSR 1 or SSR 2 when turned OFF is approximately twice as high as the supply voltage due to LC coupling. Be sure to use an SSR model with a rated output voltage of at least twice the supply voltage. For example, if the motor operates at a supply voltage of 100 VAC, the SSR must have an output voltage of 200 VAC or higher.

Note 2. Make sure that there is a time lag of 30 ms or more to switch over SW1 and SW2.

* Resistor to limit advanced phase capacitor discharge current. To select a suitable resistor, consult with the manufacturer of the motor.