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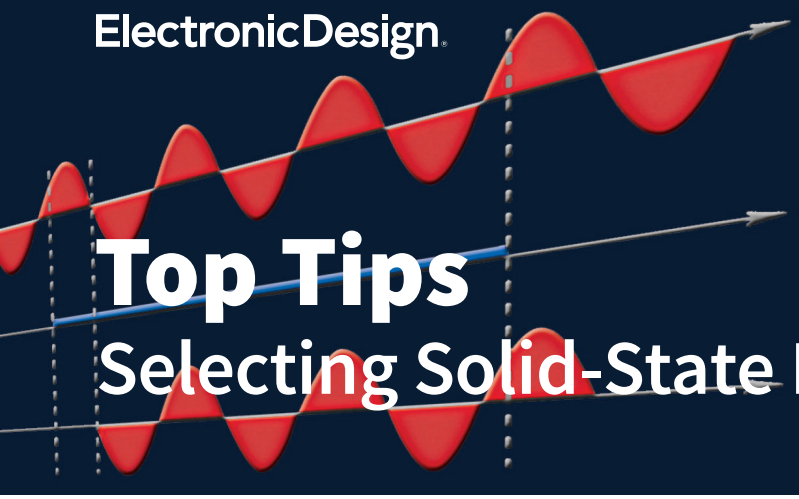

Top Tips
Selecting Solid-State Relays

A solid-state relay (SSR) is an electronic device that switches loads on or off when an external voltage is applied to its control terminals. SSRs' lack of moving parts lets them switch much faster than electromechanical relays while avoiding the creation of electrical arcs. Because they have no moving parts or contacts that can wear out, SSRs last much longer and require less maintenance than electromechanical relays.

SSRs are used in a wide variety of industries, including plastics, packaging, food and beverage, HVAC, semiconductor, renewable/conventional energy, oil/gas, transportation, printing, laboratory, kiln/oven, lighting, medical, and motion control.

Read on for some tips on selecting the best SSR for your application.

1

Determine Your Load Type

Each common load type (resistive, inductive, or capacitive) functions better with certain SSRs. Resistive loads convert electrical energy to heat or light, as in heating elements, incandescent light bulbs, and power resistors. This kind of load is best switched with a **zero-crossing SSR** in which the output is activated at the first zero crossing of the line voltage sine wave, often in less than 8.33 msec. Proportional control can also be achieved with an **analog-switching SSR** that comes with a built-in circuit that controls phase angle and can provide an output that is proportional to the input signal with a range between 4 to 20mA or 0 to 10 VDC.

Inductive loads are those that resist changes in current like solenoids, pump and fan motors, and coils. Choose an **instant on SSR** to switch this type of load. Instant-on SSRs are activated immediately after applying control voltage, often less than 0.35 msec. The heaviest inductive loads, such as transformers, should be switched with **peak-switching SSRs**. In these SSRs, the output is activated at the first peak of the line voltage (and close to the zero crossing point of the current) of the SSR.

Less common capacitive loads resist changes in voltage and are partially found in rapid charge/discharge situations like flashbulbs and cardiac defibrillators. These loads also work well with a **zero-crossing SSR**.

2

Determine the Number of Poles

When specifying your SSR, you'll also want to know how many poles or lines of voltage are connected to the load. If your application uses a DC load, you'll need a one-pole VDC SSR. For a single-phase AC load, you'll need a one-pole VAC SSR. For three-phase AC loads, consider if you want to switch two or three poles of your AC voltage via a two-pole or three-pole SSR.

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3 Find Your Load Voltage and Current

Next, determine the maximum AC or DC voltage and current for your load, usually found on the specs of your motor, heater, or other device. For AC loads, SSRs usually switch one phase at 120 or 240 VAC—or 208, 240, 480, or 600 VAC for three-phase applications.

For motors, you'll also need to know the maximum horsepower or kilowatt rating at the voltage of your application. Check for these specs on your motor nameplate or documentation.

4 Determine Your Control Voltage or Input Signal

Next you need to determine another kind of voltage—the pick-up voltage that is required to energize your load and drop out voltage, below which your load will de-energize. These are the critical control voltages for your SSR. You can typically find them on your controller's specification sheet. Unlike electromechanical relays which typically are controlled by a fixed voltage, SSRs have input ranges, either VAC, VDC or dual VAC/VDC.

If you need to proportionally control your load, you'll need some additional specs to choose the right SSR. Proportional control is typically done with a 0-10 VDC or 4-20 mA control signal. Also be sure to consult with an SSR manufacturer *like Carlo Gavazzi* to determine the optimum output-switching type for your load and application. Proportional output types include phase angle, distributed full cycle, burst full cycle, soft start, and burst full cycle with soft start.

5 Know Your Ambient Temperature

The maximum current rating of an SSR depends on the ambient temperature where it is mounted. Elevated temperatures can reduce the SSR's current rating.

Many SSRs are mounted on a chassis and require a heat sink to ensure optimum performance. You'll have to know the ambient temperature as well as mounting orientation upfront in order to specify the right kind of heat sink. Many manufacturers have online tools to help match single or multiple SSRs with the appropriate heat sink. With DIN rail-mounted SSRs, the heat sink is already preselected, rated, and attached to the SSR; however, elevated ambient temperatures will de-rate the current rating of the SSR.

6 Pick a Mounting Type

SSRs are available in a few mounting configurations. Printed circuit board (PCB) mount SSRs are limited in load size due to space and heat-dissipation constraints.

Chassis mount SSRs are often purchased without a heat sink, but require one to achieve the SSR's current rating. They are often installed on the back panel of an electrical cabinet, but may also mount directly on a metal surface within a machine or appliance. Typically, the SSR can be mounted without a heat sink if the load is under 5A, or under 8A if the mounting surface is a metal plate. Well established SSR manufacturers like Carlo Gavazzi offer an online Heat Sink Selector tool.

Engineers who don't want to worry about sizing and mounting a heat sink can choose a DIN rail mount model that snaps directly onto the DIN rail and is ready to wire up and use. Many of the more advanced SSRs, such as those enabling proportional control, are available in this design. It is also easier to obtain agency approvals with DIN rail mounting products, which are typically cUL listed.