SE Relays Schneider Electric™ solid-state relays offer a number of advantages over electromechanical relays, including longer life cycles, less energy consumption and reduced maintenance costs, depending on the application.

Key Features
- 100% solid-state design
- Modern appearance and advanced technology
- Industry first design (861 and 861H series)
- Several styles to fit multiple applications

### Series Overview

<table>
<thead>
<tr>
<th>Series</th>
<th>Defining Feature</th>
<th>Style</th>
<th>Internal Heat Sink</th>
<th>Contact Configuration</th>
<th>Output Current Range (A)</th>
<th>Input Voltage Range</th>
<th>Output Voltage Range</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>861</td>
<td>Slim 17.5 mm profile</td>
<td>Slim DIN and panel mount</td>
<td>Yes</td>
<td>SPST-NO, SPST-NC</td>
<td>8–15</td>
<td>3–32 Vdc</td>
<td>90–280 Vac</td>
<td>3–150 Vdc</td>
</tr>
<tr>
<td>861H</td>
<td>Class I, Division 2 certified for use in hazardous locations</td>
<td>Slim DIN and panel mount</td>
<td>Yes</td>
<td>SPST-NO, SPST-NC</td>
<td>8–15</td>
<td>3–32 Vdc</td>
<td>90–280 Vac</td>
<td>3–150 Vdc</td>
</tr>
<tr>
<td>SSRDIN</td>
<td>Integrated heat sink and high current switching capacity</td>
<td>DIN and panel mount</td>
<td>Yes</td>
<td>SPST-NO</td>
<td>10–45</td>
<td>4–32 Vdc</td>
<td>90–280 Vac</td>
<td>0–60 Vdc</td>
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<tr>
<td>6000</td>
<td>High current switching capacity in a small package</td>
<td>Hockey puck—panel mount</td>
<td>No</td>
<td>SPST-NO, SPST-NO</td>
<td>10–75</td>
<td>3–32 Vdc</td>
<td>90–280 Vac</td>
<td>3–200 Vdc</td>
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<tr>
<td>70S2</td>
<td>Small package size</td>
<td>PCB and panel mount</td>
<td>No</td>
<td>SPST-NO</td>
<td>3–25</td>
<td>3–32 Vdc</td>
<td>8–280 Vac</td>
<td>3–40 Vdc</td>
</tr>
</tbody>
</table>
### SE Relays Solid-State Relays

#### 861
**SPST-NO, 8–15 A**
**SPST-NC, 10 A**

#### Description

**Description**

The 861 is the first complete solid-state relay without any moving parts, all in a slim 17.5 mm design.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid-state circuitry</td>
<td>Reduces no moving parts, which extends product life, increases reliability, and enables silent operation</td>
</tr>
<tr>
<td>Optically coupled circuit</td>
<td>Provides isolation between input and output circuits</td>
</tr>
<tr>
<td>DIN and panel mounting</td>
<td>Mounts directly onto a DIN rail or panel, and provides flexibility to accommodate last-minute design changes</td>
</tr>
<tr>
<td>Internal heat sink</td>
<td>Provides factory-tested thermal management</td>
</tr>
<tr>
<td>Finger protected terminals (per IEC)</td>
<td>Helps prevent operator from touching live circuits</td>
</tr>
</tbody>
</table>

#### Specifications

**Specifications (UL 508)**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>861SSR•••-DD</th>
<th>861SSR•••-DC-•</th>
<th>861SSR•••-AC-•</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>3–32 Vdc</td>
<td>24–280 Vac; 48–480 Vac; 48–600 Vac</td>
<td></td>
</tr>
<tr>
<td>Motor Release Voltage</td>
<td>1 Vac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal Input Impedance</td>
<td>Current regulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical Input Current at 5 Vdc</td>
<td>12 mA</td>
<td>12 mA</td>
<td>12 mA</td>
</tr>
<tr>
<td>Reverse Polarity Protection</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Output Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching Device</td>
<td>MOSFET</td>
<td>SCR</td>
<td>SCR</td>
</tr>
<tr>
<td>Switching Type</td>
<td>DC Switching</td>
<td>AC Zero Cross; AC Random</td>
<td>SCR</td>
</tr>
<tr>
<td>DIN Switching</td>
<td>SPST-NO</td>
<td>SPST-NO; SPST-NC</td>
<td>SPST-NO</td>
</tr>
<tr>
<td>SCR Switching</td>
<td>SPST-NO</td>
<td>SPST-NO; SPST-NC</td>
<td>SPST-NO</td>
</tr>
<tr>
<td><strong>Output Voltage Range</strong></td>
<td>3–50 Vdc; 3–150 Vdc</td>
<td>24–280 Vac; 48–480 Vac; 48–600 Vac</td>
<td></td>
</tr>
<tr>
<td>Maximum Load Voltage (aid)</td>
<td>N/A</td>
<td>125 Vdc</td>
<td></td>
</tr>
<tr>
<td>Maximum Load Current-Maintained</td>
<td>N/A</td>
<td>50 A</td>
<td></td>
</tr>
<tr>
<td>Maximum RMS Overload Current (1 h)</td>
<td>350 A</td>
<td>250 A</td>
<td>250 A</td>
</tr>
<tr>
<td>Maximum Off-State Leakage Current</td>
<td>0.25 mA</td>
<td>50 mA</td>
<td>50 mA</td>
</tr>
<tr>
<td>Typical On-State Voltage Drop</td>
<td>0.5 Vdc</td>
<td></td>
<td></td>
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<tr>
<td>Maximum On-State Resistance</td>
<td>60 mΩ</td>
<td>0.3 mΩ</td>
<td>0.3 mΩ</td>
</tr>
<tr>
<td>Maximum Turn-On Time</td>
<td>5 ms</td>
<td>5 ms</td>
<td>5 ms</td>
</tr>
<tr>
<td>Maximum Turn-Off Time</td>
<td>5 ms</td>
<td>5 ms</td>
<td>5 ms</td>
</tr>
<tr>
<td>Maximum T² for Flashing</td>
<td>N/A</td>
<td>125 A/sec (861SSR210); 600 A/sec (861SSR410); 600 A/sec (861SSR610)</td>
<td>250 A/sec</td>
</tr>
</tbody>
</table>

#### Part Number Explanation

**Series B61**

<table>
<thead>
<tr>
<th>Output Type:</th>
<th>SSR or SCR</th>
<th>SSR or MOSFET (DD only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage:</td>
<td>AC = 90–280 Vac</td>
<td>DC = 3–32 Vdc</td>
</tr>
<tr>
<td>Output Current:</td>
<td>10 A</td>
<td>10 A</td>
</tr>
<tr>
<td>Output Voltage:</td>
<td>08 = 8 A</td>
<td>08 = 8 A</td>
</tr>
</tbody>
</table>

**Contact Configuration & Switching Type**

1 = SPST-NO, AC Zero Cross
2 = SPST-NO, AC Random
4 = SPST-NC, AC Random
Null = SPST-NO, DC Switching

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**SE Relays Solid-State Relays**

**861**

**SPST-NO, 8–15 A**

**SPST-NC, 10 A**

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**Specifications**

**Specifications (UL 508)**

- **Input Characteristics**
- **Output Characteristics**
- **Safety Cover**
- **Agency Approvals**

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[UL Listed (File: E353877 CCM: N9N1, N9N17), cULus (File: E329387 CCM: N9N1, N9N17), Csa (File: E40787 Class: 3211 04); CE, RoHS]
SE Relays Solid-State Relays

**861**
SPST-NO, 8–15 A
SPST-NC, 10 A

**861H**
SPST-NO, 8–15 A

**Dimensions:**
- **Wiring Diagram**
- **Derating Curves**

**Wiring Diagram**

**Derating Curves**

Note: A minimum spacing of 17.5 mm (0.7 in.) is required between adjacent 861 relays in order to achieve the maximum ratings.

**Class I, Division 2 certification (1) UL certified for Class I Division 2 Hazardous Locations per ISA 12.12 Solid-state circuitry Involves no moving parts, which extends product life, increases reliability, and enables silent operation Optically coupled circuit Provides isolation between input and output circuits Internal snubber Helps protect the relay's internal circuit from high voltage transients Internal heat sink Provides factory-tested thermal management Finger protected terminals (per IP20) Help prevent an operator from touching live circuits DIN and panel mounting Mounts directly onto a DIN rail or panel, and provides flexibility to accommodate last-minute design changes

**Part Number Explanation**

<table>
<thead>
<tr>
<th>Series</th>
<th>861H</th>
<th>861HSSR</th>
<th>861HSSRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Type</td>
<td>SSR + MOSFET</td>
<td>SSR + SCR</td>
<td>SSR + TRIAC</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>AC = 90–280 Vac</td>
<td>DC = 3–32 Vdc</td>
<td>DC = 3–32 Vdc</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>1 = 3–50 Vdc</td>
<td>1 = 3–50 Vdc</td>
<td>1 = 3–50 Vdc</td>
</tr>
<tr>
<td>Output Current</td>
<td>08 = 8 A</td>
<td>08 = 8 A</td>
<td>08 = 8 A</td>
</tr>
<tr>
<td>Contact Configuration &amp; Switching Type</td>
<td>SPST-NO, AC Zero Cross</td>
<td>SPST-NO, AC Random</td>
<td>SPST-NO, AC Random</td>
</tr>
</tbody>
</table>

**Description**

The 861H is a patented solid-state relay, in a slim 17.5 mm design, approved for use in hazardous locations.

**Switching Type**
- DC Switching
- AC Random
- AC Zero Cross

**Switching Device (1) Input Voltage Range Output Voltage Range Contact Configuration Standard Part Number**

**Note:** A minimum spacing of 17.5 mm (0.7 in.) is required between adjacent 861 relays in order to achieve the maximum ratings.

Note: See page 29 for more information on Class I, Division 2.
### Specifications (UL 508)

#### Part Number
- 861HSSR•••-DD
- 861HSSRA•••-DC-•
- 861HSSR•••-DC-•
- 861HSSRA•••-AC-•
- 861SSR•••-AC-•

#### Specifications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>861HSSR•••-DD</th>
<th>861HSSRA•••-DC-•</th>
<th>861HSSR•••-DC-•</th>
<th>861HSSRA•••-AC-•</th>
<th>861SSR•••-AC-•</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Voltage Range</td>
<td>3.5–32 Vdc</td>
<td>3–32 Vdc</td>
<td>90–280 Vac</td>
<td>90–280 Vac</td>
<td>90–280 Vac</td>
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<tr>
<td>Nominal Input Impedance</td>
<td>Current regulator</td>
<td>Current regulator</td>
<td>Current regulator</td>
<td>Current regulator</td>
<td>Current regulator</td>
</tr>
<tr>
<td>Typical Input Current at 5 Vdc</td>
<td>12 mA</td>
<td>18 mA (12 mA for 861HSSR210–DC-4)</td>
<td>12 mA</td>
<td>18 mA (12 mA for 861HSSR210–DC-4)</td>
<td>12 mA</td>
</tr>
<tr>
<td>Reverse Polarity Protection</td>
<td>Yes</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Output Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching Device</td>
<td>MOSFET</td>
<td>Trac</td>
<td>SCR</td>
<td>Trac</td>
<td>SCR</td>
</tr>
<tr>
<td>Switching Type</td>
<td>DC Switching</td>
<td>AC Zero Cross</td>
<td>AC Random</td>
<td>AC Random</td>
<td>AC Random</td>
</tr>
<tr>
<td>Output Voltage Range</td>
<td>3–50 Vac; 3–190 Vdc</td>
<td>3–480 Vac; 48–480 Vac; 48–600 Vac</td>
<td>3–480 Vac; 48–480 Vac; 48–600 Vac</td>
<td>3–480 Vac; 48–480 Vac; 48–600 Vac</td>
<td>3–480 Vac; 48–480 Vac; 48–600 Vac</td>
</tr>
<tr>
<td><strong>Maximum Load Rating</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Current)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load rating</td>
<td>8 A (rms), 15 A (rms)</td>
<td>8 A (rms), 15 A (rms)</td>
<td>8 A (rms), 15 A (rms)</td>
<td>8 A (rms), 15 A (rms)</td>
<td>8 A (rms), 15 A (rms)</td>
</tr>
<tr>
<td><strong>Output Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching Device</td>
<td>MOSFET</td>
<td>Trac</td>
<td>SCR</td>
<td>Trac</td>
<td>SCR</td>
</tr>
<tr>
<td>Switching Type</td>
<td>DC Switching</td>
<td>AC Zero Cross</td>
<td>AC Random</td>
<td>AC Random</td>
<td>AC Random</td>
</tr>
<tr>
<td>Output Voltage Range</td>
<td>3–50 Vac; 3–190 Vdc</td>
<td>3–480 Vac; 48–480 Vac; 48–600 Vac</td>
<td>3–480 Vac; 48–480 Vac; 48–600 Vac</td>
<td>3–480 Vac; 48–480 Vac; 48–600 Vac</td>
<td>3–480 Vac; 48–480 Vac; 48–600 Vac</td>
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<tr>
<td><strong>Maximum Rate of Rise</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>(Off-State Voltage, dv/dt)</td>
<td>N/A</td>
<td>250 V/us</td>
<td>250 V/us</td>
<td>250 V/us</td>
<td>250 V/us</td>
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<tr>
<td><strong>Current Ratings</strong></td>
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<td></td>
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<tr>
<td>Load rating</td>
<td>8 A (rms), 15 A (rms)</td>
<td>8 A (rms), 15 A (rms)</td>
<td>8 A (rms), 15 A (rms)</td>
<td>8 A (rms), 15 A (rms)</td>
<td>8 A (rms), 15 A (rms)</td>
</tr>
<tr>
<td><strong>Maximum Load Rating</strong></td>
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<td></td>
</tr>
<tr>
<td>(Current)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load rating</td>
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<td>4.5 A (rms)</td>
<td>4.5 A (rms)</td>
<td>4.5 A (rms)</td>
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<tr>
<td><strong>Maximum Load Current</strong></td>
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<tr>
<td>Maintaining On</td>
<td>20 mA</td>
<td>150 mA</td>
<td>150 mA</td>
<td>150 mA</td>
<td>150 mA</td>
</tr>
<tr>
<td><strong>Maximum RMS Overload Current</strong></td>
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</tr>
<tr>
<td><strong>Maximum Off-State Leakage Current</strong></td>
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</tr>
<tr>
<td>N/A</td>
<td>10 mA (rms)</td>
<td>10 mA (rms)</td>
<td>10 mA (rms)</td>
<td>10 mA (rms)</td>
<td>10 mA (rms)</td>
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<tr>
<td><strong>Non-Repetitive Surge Current</strong></td>
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<tr>
<td>(1 cycle)</td>
<td>N/A</td>
<td>200 A</td>
<td>200 A</td>
<td>200 A</td>
<td>200 A</td>
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<tr>
<td><strong>Maximum On-State Voltage</strong></td>
<td></td>
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<td></td>
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<tr>
<td>(Drop)</td>
<td>0.25 Vdc</td>
<td>1.25 Vac (rms)</td>
<td>1.25 Vac (rms)</td>
<td>1.25 Vac (rms)</td>
<td>1.25 Vac (rms)</td>
</tr>
<tr>
<td><strong>Maximum On-State Voltage Drop</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(current)</td>
<td>0.5 Vdc</td>
<td>1.6 Vac (rms)</td>
<td>1.6 Vac (rms)</td>
<td>1.6 Vac (rms)</td>
<td>1.6 Vac (rms)</td>
</tr>
<tr>
<td><strong>Maximum On-State Resistance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>40 mΩ</td>
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<tr>
<td><strong>Maximum Turn-On Time</strong></td>
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<tr>
<td>5 ms</td>
<td>8.3 ms</td>
<td>8.3 ms</td>
<td>8.3 ms</td>
<td>8.3 ms</td>
<td>8.3 ms</td>
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<tr>
<td><strong>Maximum Turn-Off Time</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5 ms</td>
<td>8.3 ms</td>
<td>8.3 ms</td>
<td>8.3 ms</td>
<td>8.3 ms</td>
<td>8.3 ms</td>
</tr>
<tr>
<td><strong>Maximum I²t for Fusing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>250 A²sec</td>
<td>250 A²sec</td>
<td>250 A²sec</td>
<td>250 A²sec</td>
<td>250 A²sec</td>
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<tr>
<td><strong>General Characteristics</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Electrical Life</td>
<td>N/A for solid-state relays</td>
<td>N/A for solid-state relays</td>
<td>N/A for solid-state relays</td>
<td>N/A for solid-state relays</td>
<td>N/A for solid-state relays</td>
</tr>
<tr>
<td>Thermal Resistance (Junction–Case)</td>
<td>861HSSR115–DD: 2.5 °C/W</td>
<td>861HSSR208–DD: 2.5 °C/W</td>
<td>861HSSR208–DD: 2.5 °C/W</td>
<td>861HSSR208–DD: 2.5 °C/W</td>
<td>861HSSR208–DD: 2.5 °C/W</td>
</tr>
<tr>
<td>Internal Heat Sink</td>
<td>4 °C/W</td>
<td>4 °C/W</td>
<td>4 °C/W</td>
<td>4 °C/W</td>
<td>4 °C/W</td>
</tr>
<tr>
<td>Dielectric Strength (Input–Output)</td>
<td>2500 V (rms)</td>
<td>4000 V (rms)</td>
<td>4000 V (rms)</td>
<td>4000 V (rms)</td>
<td>4000 V (rms)</td>
</tr>
<tr>
<td>Strength (Terminals–Chassis)</td>
<td>2500 V (rms)</td>
<td>4000 V (rms)</td>
<td>4000 V (rms)</td>
<td>4000 V (rms)</td>
<td>4000 V (rms)</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-30 to +80 °C</td>
<td>-30 to +80 °C</td>
<td>-30 to +80 °C</td>
<td>-30 to +80 °C</td>
<td>-30 to +80 °C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>-40 to +100 °C</td>
<td>-40 to +100 °C</td>
<td>-40 to +100 °C</td>
<td>-40 to +100 °C</td>
<td>-40 to +100 °C</td>
</tr>
<tr>
<td>Weight</td>
<td>0.6 kg (2.6 lbs)</td>
<td>0.7 kg (2.6 lbs)</td>
<td>0.7 kg (2.6 lbs)</td>
<td>0.7 kg (2.6 lbs)</td>
<td>0.7 kg (2.6 lbs)</td>
</tr>
<tr>
<td>Terminal Wire Capacity</td>
<td>14 AWG (2.5 mm²)</td>
<td>14 AWG (2.5 mm²)</td>
<td>14 AWG (2.5 mm²)</td>
<td>14 AWG (2.5 mm²)</td>
<td>14 AWG (2.5 mm²)</td>
</tr>
<tr>
<td>Terminal Screw Torque</td>
<td>0.17 lbs-in (0.2 N•m)</td>
<td>0.17 lbs-in (0.2 N•m)</td>
<td>0.17 lbs-in (0.2 N•m)</td>
<td>0.17 lbs-in (0.2 N•m)</td>
<td>0.17 lbs-in (0.2 N•m)</td>
</tr>
<tr>
<td>Safety Cover</td>
<td>IP20</td>
<td>IP20</td>
<td>IP20</td>
<td>IP20</td>
<td>IP20</td>
</tr>
<tr>
<td>Agency Approvals</td>
<td>UL certified for Class I. Division 2 Hazardous Locations, per ISA 12.12.1, cURus (File: E317746 CCN: NQMJ2, NQMJ8), CSA (File: 4076 Class: C22.1-04), CE, RoHS</td>
<td>UL certified for Class I. Division 2 Hazardous Locations, per ISA 12.12.1, cURus (File: E317746 CCN: NQMJ2, NQMJ8), CSA (File: 4076 Class: C22.1-04), CE, RoHS</td>
<td>UL certified for Class I. Division 2 Hazardous Locations, per ISA 12.12.1, cURus (File: E317746 CCN: NQMJ2, NQMJ8), CSA (File: 4076 Class: C22.1-04), CE, RoHS</td>
<td>UL certified for Class I. Division 2 Hazardous Locations, per ISA 12.12.1, cURus (File: E317746 CCN: NQMJ2, NQMJ8), CSA (File: 4076 Class: C22.1-04), CE, RoHS</td>
<td>UL certified for Class I. Division 2 Hazardous Locations, per ISA 12.12.1, cURus (File: E317746 CCN: NQMJ2, NQMJ8), CSA (File: 4076 Class: C22.1-04), CE, RoHS</td>
</tr>
</tbody>
</table>
The SSRDIN relays offer a complete solid-state package that is an energy-efficient, current switching alternative to standard electromechanical relays. Advantages include longer life cycles, less energy consumption, and reduced maintenance costs.

### Feature | Benefit
--- | ---
Solid-state circuitry | Involves no moving parts
Optically coupled circuit | Provides isolation between input and output circuits
Internal snubber | Helps protect the relay’s internal circuit from high voltage transients
Internal heat sink | Provides factory tested thermal management
Integrated chassis ground | Simplifies system wiring
Finger protected terminals | Helps prevent an operator from touching live circuits
DIN and panel mounting | Increases functionality and ease of use, and fits a variety of applications

### Specifications (UL 508)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>SSR2-DIN-DC&lt;sup&gt;22&lt;/sup&gt;</th>
<th>SSR3-DIN-DC&lt;sup&gt;22&lt;/sup&gt;</th>
<th>SSR6-DIN-DC&lt;sup&gt;22&lt;/sup&gt;</th>
<th>SSR2-DIN-AC&lt;sup&gt;22&lt;/sup&gt;</th>
<th>SSR6-DIN-AC&lt;sup&gt;22&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Turn-On Voltage</td>
<td>4 Vdc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Turn-Off Voltage</td>
<td>1 Vdc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical Input Current</td>
<td>8–12 mA</td>
<td>9–11 mA</td>
<td>8–12 mA</td>
<td>2–4 mA</td>
<td></td>
</tr>
</tbody>
</table>

| **Output Characteristics** | | | | | |
| Output Type | SCR | MOSFET | SCR | AC Zero Cross | DC Switching |
| Switching Type | AC Zero Cross | DC Switching | AC Zero Cross | | |
| Output Voltage | 24–280 Vac | 0–60 Vdc | 48–660 Vac | 24–280 Vac | 48–660 Vac |
| Load Current Range | 10–45 A | 10–30 A | 10–45 A | | |
| Maximum Surge Current (at Rated Current) | 10 A: 120 A; 20 A: 250 A; 30/45 A: 625 A (at 16.6 ms) | | 625 A (at 16.6 ms) | 10 A: 120 A; 20 A: 250 A; 30/45 A: 625 A (at 16.6 ms) | 625 A (at 16.6 ms) |

### Part Number Explanation

- **Series**: SSR
- **Output Voltage**: 2 = SCR, 24–280 Vac; 3 = MOSFET, 0–60 Vdc; 6 = SCR, 48–660 Vac
- **Current Rating**: 10 = 10 A; 20 = 20 A; 30 = 30 A; 45 = 45 A; 65 = 65 A

---

(1) See page 28 for definitions of the different switching devices.
Wiring Diagram Derating Curves

**SE Relays Solid-State Relays**

**SSRDIN**

**SPST-NO, 10–45 A**

---

### Dimensions: in. (mm)

- **22 mm**
- **45 mm**

---

### Wiring Diagram

- **INPUT**
- **POWER SUPPLY**
- **MOSFET ONLY**
- **OUTPUT**
- **LOAD**

---

### Derating Curves

- **DC Switching**
  - **MOSFET**
  - Input Voltage Range: 3–32 Vdc
  - Output Voltage Range: 3–200 Vdc
  - Rated Output Current (A): 12, 25, 40
  - Standard Part Number: 6312AXXMDS-DC3, 6325AXXMDS-DC3, 6340AXXMDS-DC3

- **SCR**
  - Input Voltage Range: 24–280 Vac
  - Contact Configuration: SPST-NO
  - Rated Output Current (A): 10, 25, 40, 50, 75
  - Standard Part Number: 6210AXXSZS-DC3, 6225AXXSZS-DC3, 6240AXXSZS-DC3, 6250AXXSZS-DC3, 6275AXXSZS-DC3

- **TRIAC**
  - Input Voltage Range: 48–480 Vac
  - Contact Configuration: SPST-NO
  - Rated Output Current (A): 10, 25, 40, 50, 75
  - Standard Part Number: 6410AXXSZS-DC3, 6425AXXSZS-DC3, 6440AXXSZS-DC3, 6450AXXSZS-DC3, 6475AXXSZS-DC3

---

### Description

The 6000 Series solid-state relays offer an energy-efficient current switching alternative to standard electromechanical relays. Advantages include longer life cycles, less energy consumption, and reduced maintenance costs.

**Feature** | **Benefit**
---|---
Solid-state circuitry | Involve no moving parts
Optically coupled circuit | Provides isolation between input and output circuits
Internal snubber | Helps protect the relay’s internal circuit from high voltage transients
Finger protected terminals | Help prevent operator from touching live circuits

---

### Part Number Explanation

- **Series**: 6000
- **Output Voltage**: 2 = 24–280 Vac
  - 3 = 3–200 Vdc
  - 4 = 48–520 Vac
- **Current Rating**: 10 = 10 A
  - 25 = 25 A
  - 40 = 40 A
  - 50 = 50 A
  - 75 = 75 A
- **Contact Configuration**: M = MOSFET
  - AXX = SPST-NO
  - BXX = DPST-NO
- **Output Type**: S = SCR
  - T = TRIAC
- **Switching Type**: D = DC Switching
  - Z = AC Zero Cross
- **Connection Type**: B = Blade Terminals
  - S = Screw Terminals
- **Input Voltage**: AC90 = 90–280 Vac
  - DC3 = 3–32 Vdc
### Specifications (UL 508)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>62••AXXSZS-AC90</th>
<th>64••AXXSZS-AC90</th>
<th>62••AXXSZS-DC3</th>
<th>64••AXXSZS-DC3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Voltage Range</td>
<td>90–280 Vac (rms)</td>
<td>3–32 Vdc</td>
<td>4–32 Vdc</td>
<td></td>
</tr>
<tr>
<td>Maximum Turn-On Voltage</td>
<td>110 Vac</td>
<td>3 Vac</td>
<td>4 Vac</td>
<td></td>
</tr>
<tr>
<td>Minimum Turn-Off Voltage</td>
<td>10 Vac</td>
<td>1 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal Input Impedance</td>
<td>60 Ω</td>
<td>N/A (active current limiter)</td>
<td>10 mA at 12 Vdc</td>
<td>15 mA DC</td>
</tr>
<tr>
<td>Typical Input Current</td>
<td>2 mA at 120 V (rms); 4 mA at 240 V (rms)</td>
<td>10 mA at 12 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Output Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching Device</td>
<td>SCR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching Type</td>
<td>AC Zero Cross</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact Configuration</td>
<td>SPST-NO</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Current Range</td>
<td>10–50 A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage Range</td>
<td>24–280 Vac (rms)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Turn-On Voltage</td>
<td>90 Vac</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Turn-Off Voltage</td>
<td>2 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nominal Input Impedance</td>
<td>10 mA at 12 Vdc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical Input Current</td>
<td>2 mA at 120 V (rms); 4 mA at 240 V (rms)</td>
<td>10 mA at 12 Vdc</td>
<td></td>
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</tr>
</tbody>
</table>

### Specifications (continued)

<table>
<thead>
<tr>
<th>Part Number</th>
<th>6••XXTZB-DC3</th>
<th>63••AXXMS-DC3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input Characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control Voltage Range</td>
<td>3–32 Vdc</td>
<td>3–32 Vdc</td>
</tr>
<tr>
<td>Maximum Turn-On Voltage</td>
<td>3 Vdc</td>
<td>3.5 Vdc</td>
</tr>
<tr>
<td>Minimum Turn-Off Voltage</td>
<td>1 Vdc</td>
<td>3 Vdc</td>
</tr>
<tr>
<td>Nominal Input Impedance</td>
<td>3–32 Vdc</td>
<td>3 Vdc</td>
</tr>
<tr>
<td>Typical Input Current</td>
<td>25 A: 16 mA 10 A: 2 mA 50 A: 625 A</td>
<td>10 mA DC</td>
</tr>
<tr>
<td><strong>Output Characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching Device</td>
<td>TRIAC</td>
<td></td>
</tr>
<tr>
<td>Switching Type</td>
<td>AC Zero Cross</td>
<td></td>
</tr>
<tr>
<td>Contact Configuration</td>
<td>SPST-NO</td>
<td>SPST-NO</td>
</tr>
<tr>
<td>Output Current Range</td>
<td>10–25 A</td>
<td></td>
</tr>
<tr>
<td>Output Voltage Range</td>
<td>10–24–280 Vac</td>
<td>48–480 Vac</td>
</tr>
<tr>
<td>Maximum Turn-On Voltage</td>
<td>1 V</td>
<td></td>
</tr>
<tr>
<td>Minimum Turn-Off Voltage</td>
<td>1 V</td>
<td></td>
</tr>
<tr>
<td>Nominal Input Impedance</td>
<td>3–200 Vdc</td>
<td></td>
</tr>
<tr>
<td>Typical Input Current</td>
<td>25 A: 16 mA 10 A: 2 mA 50 A: 625 A</td>
<td>10 mA DC</td>
</tr>
</tbody>
</table>

### General Characteristics

<table>
<thead>
<tr>
<th>Electrical Life</th>
<th>N/A for solid-state relays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Turn-On Time</td>
<td>1/2 cycle</td>
</tr>
<tr>
<td>Maximum Turn-Off Time</td>
<td>1/2 cycle</td>
</tr>
<tr>
<td>Maximum Input Current</td>
<td>25 A: 120 A 40 A: 620 A</td>
</tr>
<tr>
<td>Maximum Output Current</td>
<td>25 A: 250 A 50 A: 625 A</td>
</tr>
<tr>
<td>Maximum Surge Current (16 ms)</td>
<td>10 A: 120 A 25 A: 250 A</td>
</tr>
<tr>
<td>Maximum On-State Voltage Drop</td>
<td>1.6 V (rms)</td>
</tr>
<tr>
<td>Minimum Power Factor (with Maximum Load)</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### Technical Details

- **Encapsulation**: Thermally conductive epoxy
- **Terminals**: Screw and saddle clamps furnished, unmarked
- **Safety Cover**: Yes
- **Wire Clamp Plates**: Yes
- **Agency Approvals**: UL Recognized (File: E258297, CCN: NRNT2, NRNT8), CSA (File: 188988, Class: 3211-07), CE, RoHS

---

### Technical Details (continued)

- **Agency Approvals**: UL Recognized (File: E258297, CCN: NRNT2, NRNT8), CSA (File: 188988, Class: 3211-07), CE, RoHS
Relay Mounting Example

**Description**

Thermal management is a fundamental consideration in the design and use of solid-state relays (SSRs) because of the contact dissipation (typically 1 W per ampere). It is vital to provide sufficient heat sinking, or the life and switching reliability of the SSR will be compromised.

The SSR-HS-1 heat sink maximizes heat dissipation and helps ensure reliable operation when properly selected for the specific application. For ease of installation, all mounting holes are pre-drilled and tapped.

The SSR-TP-1 simplifies installation with a simple peel-and-stick solution, which does not require messy thermal grease.

**Description Function Weight For Use With Relays Packaging Minimum Standard Part Number**

<table>
<thead>
<tr>
<th>Description</th>
<th>Function</th>
<th>Weight</th>
<th>For Use With Relays</th>
<th>Packaging Minimum</th>
<th>Standard Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat sink</td>
<td>Maximizes heat dissipation</td>
<td>558.5 g (19.7 oz)</td>
<td>6000 Series Relays (rated up to 50 A)</td>
<td>1</td>
<td>SSR-HS-1</td>
</tr>
<tr>
<td>Thermal pad</td>
<td>Simplifies installation with a peel-and-stick solution, which does not require messy thermal grease</td>
<td>N/A</td>
<td>6000 Series Relays (rated up to 50 A)</td>
<td>10</td>
<td>SSR-TP-1</td>
</tr>
</tbody>
</table>

**Dimensions**

Dimensions: in. (mm)

- Side View

**Wiring Diagram**

- Input Power Supply
- SSR
- Output Power Source
- Load

**Derating Curves**

- 10 A
- 25 A
- 50 A
- 75 A
- 25/40 A MOSFET

**Output Core Temp.**

- 120°C

**Ambient Temp.**

- 75°C max. ambient
The 70S2 Series are miniature solid-state relays ideal for small space applications. They are available in panel and PCB mount, which increases the level of flexibility for designers.

### Switching Type

<table>
<thead>
<tr>
<th>Switching Type</th>
<th>Switching Device (1)</th>
<th>Input Voltage Range</th>
<th>Output Voltage Range</th>
<th>Rated Output Current (A)</th>
<th>Terminal Style</th>
<th>Mounting Style</th>
<th>Standard Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>DC Switching</td>
<td>MOSFET</td>
<td>3–15 Vdc</td>
<td>3–60 Vdc</td>
<td>3</td>
<td>Solder</td>
<td>PCB Mount</td>
<td>70S2-01-A-03-V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24–140 Vac</td>
<td>24–140 Vac</td>
<td>6</td>
<td>Solder</td>
<td>Panel Mount</td>
<td>70S2-01-B-06-N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24–280 Vac</td>
<td>24–280 Vac</td>
<td>8</td>
<td>Screw</td>
<td>Panel Mount</td>
<td>70S2-01-B-08-S</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6–30 Vdc</td>
<td>24–280 Vac</td>
<td>10</td>
<td>Solder</td>
<td>PCB/Panel Mount</td>
<td>70S2-01-C-10-M</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24–280 Vac</td>
<td>24–280 Vac</td>
<td>12</td>
<td>Screw</td>
<td>Panel Mount</td>
<td>70S2-01-C-12-S</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3–32 Vdc</td>
<td>24–280 Vac</td>
<td>25</td>
<td>Solder</td>
<td>Panel Mount</td>
<td>70S2-01-C-25-S</td>
</tr>
</tbody>
</table>

### Derating Curves

- **Thermal Resistance vs Power Dissipation**
- **Load Current vs Ambient Temperature (100% Duty Cycle)**

#### Installation:
1. Release the liner on one side of the thermal pad and place underneath the Class 6 solid-state relay.
2. Release the liner on the other side of the thermal pad and place the relay and pad onto heat sink or panel.

#### Part Number Explanation

- **Series:** 70S2
- **Input Voltage:**
  - 01 = 3–15 Vdc
  - 02 = 9–30 Vdc
  - 03 = 3–30 Vdc
  - 04 = 3–30 Vdc
  - 05 = 6–30 Vdc
  - 06 = 6–30 Vdc
- **Output Voltage:**
  - A = 3–60 Vdc
  - B = 24–140 Vdc
  - C = 24–280 Vdc
  - D = 8–50 Vdc
- **Output Current:**
  - 03 = 3 A
  - 04 = 4 A
  - 05 = 5 A
  - 06 = 6 A
  - 08 = 8 A
  - 10 = 10 A
  - 12 = 12 A
  - 25 = 25 A
- **Package Type:**
  - F = PCB Mount with Solder Terminals
  - M = PCB/Panel Mount with Solder Terminals
  - N = Panel Mount with Blade Terminals
  - S = Panel Mount with Screw Terminals
  - V = PCB Mount with Solder Terminals

### Feature Benefit

- **Solid-state circuitry**
  - Involves no moving parts
- **Optically coupled circuit**
  - Provides isolation between input and output circuits
- **Internal snubber**
  - Helps protect the relay’s internal circuit from high voltage transients
- **Small package size**
  - Ideal for small spaces
- **Panel and PCB mounting**
  - Increases functionality and ease of use

### Accessory Information

- **Heat Sink, SSR-HS-1**
- **Thermal Pad, SSR-TP-1**

---

(1) See page 28 for definitions of the different switching devices.
## Specifications (UL 508)

### SE Relays Solid-State Relays

**70S2**

**Part Number**: 70S2-01-A, 70S2-02-A, 70S2-03-B, 70S2-03-C

### Specifications

#### Input Characteristics

- **Control Voltage Range**: 3–15 Vdc, 9–30 Vdc, 3–30 Vdc
- **Must Release Voltage**: 1 Vdc
- **Typical Input Current**: 3–40 mA, 5–17 mA, 7–16 mA, 6–10 mA
- **Maximum Reverse Control Voltage**: 3 Vdc

#### Output Characteristics

- **Switching Device**: MOSFET, TRIAC
- **Switching Type**: DC Switching, AC Zero Cross

#### Output Voltage Range

- **70S2**: 130 Vac, 300 Vac

#### Maximum Rate of Rise Off-State Voltage (dv/dt)

- **70S2**: 105 Vdc, 400 Vac, 600 Vac

#### Output Current Range (rms)

- **70S2**: 3–5 A, 5 A, 25 A
- **Typical On-State Voltage Drop (rms)**: 75 ms, 8.3 ms

### General Characteristics

- **Electrical Life**: N/A for solid-state relays
- **Thermal Resistance (Junction–Case)**: 3 A: 0.5 °C/W, 4/6/10/12 A: 4 °C/W
- **Dielectric Strength (Terminals–Case)**: 3 A: 4000 Vac, 5 A: 2500 Vac
- **Operating Temperature Range**: -40 to +100 °C
- **Storage Temperature Range**: -40 to +70 °C
- **Weight**: F/M: 35 g (1.2 oz), N/S: 47 g (1.7 oz), V: 35 g (0.9 oz)

### Agency Approvals

UL Recognized (E258297), CSA (040787), RoHS

---

**Specifications (UL 508) (continued)**

### SE Relays Solid-State Relays

**70S2**

**Part Number**: 70S2-04-B, 70S2-04-C, 70S2-04-D, 70S2-05-C, 70S2-06-C

### Specifications

#### Input Characteristics

- **Control Voltage Range**: 3 A: 3–32 Vdc; 4/6/10/12 A: 3–30 Vdc
- **Must Release Voltage**: 1 Vdc
- **Typical Input Current**: 3 A: 1–19 mA, 4/6/10/12 A: 7–16 mA
- **Maximum Reverse Control Voltage**: 3 Vdc

#### Output Characteristics

- **Switching Device**: TRIAC
- **Switching Type**: AC Zero Cross
- **Output Voltage Range**: 24–140 Vac, 24–280 Vac
- **Peak Blocking Voltage**: 400 Vac, 600 Vac
- **Maximum Rate of Rise Off-State Voltage (dv/dt)**: 300 V/us

#### Output Current Range (rms)

- **70S2**: 3 A: 12 A, 6 A: 12 A
- **Minimum Load Current–Maintain On**: 3/4/6 A: 75 mA
- **Non-Repetitive Surge Current (6.3 ms)**: 3/4/6 A: 60 A
- **Maximum Off-State Leakage Current (rms)**: 6 mA
- **Typical On-State Voltage Drop (rms)**: 1.8 Vac

### General Characteristics

- **Electrical Life**: N/A for solid-state relays
- **Thermal Resistance (Junction–Case)**: 3 A: 0.5 °C/W; 4/6/10/12 A: 2.4 °C/W
- **Dielectric Strength (Terminals–Chassis)**: 3 A: 4000 Vac
- **Operating Temperature Range**: -40 to +100 °C (derating applies)
- **Storage Temperature Range**: -40 to +125 °C
- **Weight**: F/M: 35 g (1.2 oz), N/S: 47 g (1.7 oz), V: 25 g (0.9 oz)

### Agency Approvals

UL Recognized (E258297), CSA (040787), RoHS
### Dimensions

**SE Relays Solid-State Relays**

**70S2**

**SPST-NO, 3–25 A**

#### Dimensions: in. (mm)

**70S2 (F)**

- Input: 0.2 (5.1)
- Output: 0.2 (5.1)
- Dimensions: 0.5 (12.7)

**70S2 (M)**

- Input: 0.2 (5.1)
- Output: 0.2 (5.1)
- Dimensions: 0.5 (12.7)

**70S2 (N)**

- Input: 0.2 (5.1)
- Output: 0.2 (5.1)
- Dimensions: 0.5 (12.7)

**70S2 (S)**

- Input: 0.2 (5.1)
- Output: 0.2 (5.1)
- Dimensions: 0.5 (12.7)

#### Derating Curves

- Load Current vs Ambient Temperature (100% Duty Cycle)

#### Wiring Diagram

- Power Source
- SSR
- MOSFET ONLY
- Load
Since its introduction, SSR technology has gained acceptance in many applications that had previously been the sole domain of the EMR or contactor. The major growth areas have come from industrial process control applications—particularly heat/cool temperature control, motors, lamps, solenoids, valves, and transformers. The list of applications for the SSR is almost limitless.

**Applications**

- **Electronic Appliances**
  - Domestic appliances, cooking appliances, heating elements, audio equipment
- **Industrial Heater Control**
  - Plastics industry: drying, extrusion/thermoforming, heat tracing, solder wave/reflow systems, car wash pumps and dryers
- **Food and Beverage**
  - Commercial/industrial cooking equipment, filtration systems, bottling, chillers, convection ovens
- **Lighting Control**
  - Traffic signal systems, highway information systems, theatrical lighting
- **HVAC and Refrigeration**
  - Anti-condensation equipment, compressor control, blower control, motorized duct/vent control
- **Mineral Extractors**
  - Blower control, motorized duct/vent control, drill control, explosive control, mineral extractors
- **Oil and Gas**
  - Burner assemblies, chemical injection systems, extraction machines, refining machines, solenoid control
- **Packaging**
  - Conveyor motors, heaters, product/shrink wrap, solenoid control
- **Industrial Automation**
  - Automotive assembly plants, conveyance, motor control

**Definition**

A solid-state relay (SSR) can perform many tasks that an electromechanical relay (EMR) can perform. The SSR differs in that it has no moving mechanical parts. It is essentially an electronic device that relies on the electrical and optical properties of semiconductors to achieve its isolation and switching function.

**Principle of Operation**

SSRs are similar to electromechanical relays, in that both use a control circuit and a separate circuit for switching the load. When voltage is applied to the input of the SSR, the relay is energized by a light emitting diode. The light from the diode is beamed into a light-sensitive semiconductor, which conditions the control circuit to turn on the output solid-state switch. In the case of zero-voltage crossover relays, the output solid-state switch is turned on at the zero crossing of AC voltage. Removal of input power disables the control circuit, and the solid-state switch also turns off when the load current passes through the zero point of its cycle. Zero cross only applies to AC switching circuits. DC switching circuits operate at an instant on/off rate.

**Advantages**

When used correctly in the intended application, the SSR provides many of the characteristics that are often difficult to find in the EMR. A high degree of reliability, long service life, significantly reduced electromagnetic interference, fast response, and high vibration resistance are significant benefits of the SSR. The SSR has no moving parts to wear out, or arcing contacts to deteriorate, which are often the primary cause of failure with an EMR.

- Long life (reliability) > 1E+9 operations
- Zero voltage turn-on, low EMI/RFI
- Resistance to shock and vibration
- Random turn-on, proportional control
- No moving parts
- Arc-less switching
- No acoustical noise
- TTL compatibility
- Fast response
- No moving parts
- No contact bounce
- Arc-less switching
- No acoustical noise
- TTL compatibility
- Fast response
- No moving parts
- Arc-less switching
- No acoustical noise
- TTL compatibility
- Fast response
- No moving parts

**Typical Examples of SSR Applications**

- **Electronic Appliances**
  - Domestic appliances, cooking appliances, heating elements, audio equipment
- **Industrial Heater Control**
  - Plastics industry: drying, extrusion/thermoforming, heat tracing, solder wave/reflow systems, car wash pumps and dryers
- **Food and Beverage**
  - Commercial/industrial cooking equipment, filtration systems, bottling, chillers, convection ovens
- **Lighting Control**
  - Traffic signal systems, highway information systems, theatrical lighting
- **HVAC and Refrigeration**
  - Anti-condensation equipment, compressor control, blower control, motorized duct/vent control
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  - Automotive assembly plants, conveyance, motor control
Using A Temperature Derating Curve

In the example below, a temperature derating curve for a 50 A, Class 6 solid-state relay is used to determine the maximum allowable load current at an ambient temperature of 70 °C. A heat sink with a 2 °C/W temperature coefficient is used in the application.

From the right half of the graphic, the point at which the heat sink coefficient curve crosses 70 °C is translated to the left half of the graphic until it intersects the power dissipation vs load current curve of the 50 A, Class 6 relay as shown in the illustration below.

The result is that a maximum load current of 20 Arms is recommended when using a 50 A, Class 6000 relay in an ambient temperature of 70 °C when using a heat sink with a 2 °C/W temperature coefficient.

Load Considerations

After improper heat sinking, the next most significant cause of application problems with SSRs stems from the operating conditions that specific loads impose on an SSR. Carefully consider the surge characteristics of the load when designing an SSR as a switching solution.

- **Resistive Loads**
  A load with a constant value of resistance is the simplest application of an SSR. Proper thermal consideration, along with attention to the steady-state current ratings, is important for reliable operation.

- **DC Loads**
  DC loads are inductive loads. Place a diode across the load to absorb surges during turn-off.

- **Lamp Loads**
  Incandescent lamp loads, though basically resistive, require special consideration. Because the resistance of the cold filament is about 5–10% of the heated value, a large inrush current can occur. It is essential to verify that this inrush current is within the surge specifications of the SSR. Also ensure that the lamp rating of the SSR is not exceeded. This UL rating is based on the inrush of a typical lamp. Due to the unusually low filament resistance at the time of turn-on, a zero voltage turn-on characteristic is particularly desirable with incandescent lamps.

- **Capacitive Loads**
  These types of loads can be difficult because of their initial appearance as short circuits. High surge currents can occur while charging, limited only by circuit resistance. Use caution with low impedance capacitive loads to verify that the di/dt capabilities are not exceeded. Zero voltage turn-on is a particularly valuable means of limiting di/dt with capacitive loads.

- **Motors and Solenoids**
  Motor and solenoid loads require special attention for reliable SSR functionality. Solenoids have high initial surge currents because their stationary impedance is very low. Motors can also have severe inrush currents during starting and can impose unusually high voltages during turn-off. As a motor’s rotor rotates, it creates a back-EMF (electromotive force) that reduces the flow of current. This back-EMF can add to the applied line voltage and create an overvoltage condition during turn-off. Likewise, consideration must be given to mechanical loads having high starting torque or inertia, such as fans and flywheels, to verify that the inrush currents are within the surge capabilities of the SSR. Use a current shunt and oscilloscope to examine the duration of the inrush current.
Transformers
When switching transformers, consider the characteristics of the secondary load. These characteristics reflect the effective load on the SSR. In addition, voltage transients from secondary load circuits can act as transformers and impose on the SSR.

Transformers present a special challenge: Depending on the transformer flux state at turn-off, the transformer may saturate during the first half-cycle when voltage is next applied. This saturation can impose a very large current (10–100 times the rated typical current) on the SSR, which far exceeds its half-cycle surge rating. SSRs with random turn-on may have a better chance of survival than a zero-cross turn-on device, since they commonly require the transformer to support only a portion of the first half-cycle of the voltage. On the other hand, a random turn-on device will frequently close at the zero-cross point, and then the SSR must sustain the worst-case saturation current. A zero-cross turn-on device has the advantage that it turns on in a known mode and will immediately demonstrate the worst case condition. The use of a current shunt and an oscilloscope is recommended to verify that the half-cycle surge capability is not exceeded.

As a general rule, when applying an SSR to a transformer load, select an SSR having a half-cycle current surge rating greater than the following:

\[
\text{(maximum applied line voltage)} + \text{(transformer primary resistance)}
\]

The primary resistance is usually easy to measure and can be relied on as a minimum impedance limiting the first half-cycle of inrush current. The presence of some residual flux, plus the saturated reactance of the primary, will then further limit, in the worst case, the half-cycle surge safely within the surge rating of the SSR.

Switching Devices
The power family of semiconductors consists of several switching devices. The most widely used of this family are metal-oxide semiconductor field-effect transistors (MOSFETs), silicon controlled rectifiers (SCRs), TRIAC, and Alternistor TRIAC. In many applications, these devices perform key functions, so you must understand their advantages as well as their shortcomings to properly design a reliable system. Applied correctly, SSRs are an asset in meeting environmental, speed, and reliability specifications which their electromechanical counterparts could not fulfill.

• MOSFET
A power MOSFET is a specific type of metal-oxide semiconductor field-effect transistor (MOSFET) designed to handle large amounts of power. It is a vertical-structured transistor capable of sustaining high blocking voltage and high current. Power MOSFETs are used in DC switching applications. Care must be taken to ensure proper polarity for all DC ports. Failure to do so can lead to permanent device damage.

• TRIAC
A TRIAC is an electronic component approximately equivalent to two silicon-controlled rectifiers joined in inverse parallel (paralleled but with the polarity reversed) and with their gates connected together. This results in a bidirectional electronic switch that can conduct AC current only. The TRIAC is ideal for switching non-reactive loads.

• Alternistor TRIAC
The Alternistor is specifically designed for applications that switch highly inductive AC loads. A special chip offers performance similar to two SCRs wired in inverse parallel (back-to-back), providing better turn-off behavior than a standard TRIAC. The Alternistor TRIAC is an economical solution, ideal for switching inductive AC loads.

• SCR
The SCR (silicon-controlled rectifier) acts as a switch, conducting when its gate receives a current pulse, and continuing to conduct as long as it is forward biased. The SCR is ideal for switching all types of AC loads.

Class I, Division 2 certification (y/n): ___
Input voltage: ___________________
Output voltage: ___________________
Load rating: ___________________
Contact configuration: ___________________
Ambient temperature: ___________________
In-rush currents: ___________________
Mounting style: ___________________

More About Class I, Division 2 Certified Products
Class I, Division 2 is a classification which was developed by the American National Standards Institute (ANSI) to provide requirements for the design and construction of electrical equipment and parts that will be used in hazardous locations. Certified components, when used properly, are not capable of igniting the surrounding atmosphere.

Class I, Division 2 components may be required in environments which may contain specific flammable gases, combustible dust, or fibers that can ignite. The 861H SSR carries a Class I, Division 2 (Categories A, B, C, D and Temperature code T5) approval from Underwriters Laboratories.
The Schneider Electric Relays website (www.aerelays.com) allows users to easily find the proper relay to fit design requirements and to help simplify and shorten workflow.

Easily find the proper relay to fit design requirements

■ Online Catalog
Find the right product by choosing specifications, compare products side-by-side, and view technical specifications, 2D and 3D drawings, and associated accessories.

■ Cross Reference Search
Search our comprehensive database to identify products by manufacturer and part number, and link directly to part specifications.

■ 3D CAD Library
View, email, download, or insert a file directly into your open CAD software pane, and select from 18 different file formats.

■ Order Free Samples
Schneider Electric offers free samples as a courtesy to individuals and companies evaluating our products in their designs and applications. Sample orders are subject to approval.

Simplify and shorten workflow

■ Interactive Tools
View interactive demonstrations such as our Time Delay Relay Interactive Demo (left) which visually demonstrates the different timing functions offered on Schneider Electric time delay relays.

■ Distributor Inventory Search
Search authorized distributors’ current Schneider Electric inventory and buy online. (Buying online is not available for all distributors.)