Solid State DC Contactor

Applications:

- Main DC Bus Switch
- DC Motor Bus Switch
- Battery Disconnect
- Bus Discharge



Description:

Sensitron has developed a small footprint High Voltage/High Current DC solid state Relay/Contactor. This device incorporates the latest state of the art technology to reduce the "on" state power losses and voltage drop to a minimum. The device is a true four terminal relay, and doesn't need an additional power source for bias. This device uses robust magnetic coupling to achieve high isolation, reliability, and long life. The input control lead will accept any voltage from 4.6V to 36VDC.

Features:

- 2000V Input to Output / Output to Baseplate Isolation
- Up to 1200V Blocking¹
- Up to 100A Continuous Current²
- Up to 400A Surge Capability
- Single wide range DC input signal 4.6V to 36V
- Low Power Control, 0.5W Typ.
- Low "on" state resistance
- Fast turn on/turn off
- High Current Terminals
- Three Point Mounting Plate
- R_{θJC ≤} 1.15°C/W
- 1.4" x 2.6" x .5"

Input Control Specifications:

| Parameter | Description | MIN | TYP | MAX | Unit |
|-----------|---|-----|-----|-----|-------|
| V control | DC Control Voltage Between pins 1 and 2 | 4.6 | | 36 | Volts |
| I control | Input Current at control pins 1 and 2, | 4 | | 100 | mA |
| | Vin = 4.6V to 36V | | | | |
| P control | Control Input Power Consumption | | 0.2 | 0.4 | Watt |

Note 1: Available in multiple voltage types ranging from 100V to 1200V. See part ordering information. Note 2: Available from 15A to 100A. See part ordering information.



Fig. 1 – Typical Input Current vs. Input Volt



| Parameter | Description | MIN | TYP | MAX | Unit |
|-----------------|--|-----|-------|-------|-----------------|
| Vout | Max Blocking Voltage Across Pins 3 and 4 | | | 400 | V _{DC} |
| | Output leakage | | | | |
| ILEAK | T _J = 25 °C, V _{DS} = 400V, V _{GS} = 0V | | | 300 | μΑ |
| | $T_J = 125 \text{ °C}, V_{DS} = 400 \text{ V}, V_{GS} = 0 \text{ V}^{(1)}$ | | | 3000 | |
| | Max Continuous Contact Current | | | | |
| Іоит | SSR025D060* | 0 | | 25 | А |
| | SSR050D060 | 0 | | 50 | |
| | | | | | |
| | Over Current latch, at 25°C, 300V DC bus, 20 | | | | |
| l | uH load inductance | | 175 | | A(pk) |
| ILATCH | SSR025D060* | | 125 | | А(рк) |
| | SSR050D060 | | 250 | | |
| Ron | Contact Resistance, TJ = 25 °C | | 9.5 | 12.3 | mOhm |
| Ron | Contact Resistance, T _J = 150 °C ⁽¹⁾ | | 19.1 | | mOhm |
| | Voltage drop at lout, TJ = 25 °C | | | | |
| Vdrop | SSR025D060* | | 0.238 | 0.308 | VDC |
| | SSR050D060 | | 0.475 | 0.615 | |
| | | | | | |
| COUT | Capacitance, V _{DS} =100V, f=100kHz | | 669 | | pF |
| E _{AS} | Avalanche energy, single pulse | | 2000 | | mal |
| | T _J = 25 °C, I _D = 15A, V _{DS} = 50V | | 2000 | | IIIJ |
| | | | | | |
| | | | | | |

SSR025D060*, SSR050D060 (600V Models) Output Specifications:

*Contact Factory for current ratings under 50A for the 600V models. Some models are still in prototype stage and not released for production yet.

| Parameter | Description | MIN | TYP | MAX | Unit |
|--------------------|--|-----|------|-------------|-----------------|
| Vout | Max Blocking Voltage Across Pins 3 and 4 | | | 70 | V _{DC} |
| Ileak | Output leakage $T_J = 25 ^{\circ}C, V_{DS} = 70V, V_{GS} = 0V$ $T_J = 125 ^{\circ}C, V_{DS} = 70V, V_{GS} = 0V ^{(1)}$ | | | 300 3000 | μΑ |
| Ιουτ | Max Continuous Contact Current SSR100D010* | 0 | | 100 | A |
| I _{LATCH} | Over Current latch, at 25°C, 30V DC bus, 5 uH load inductance SSR100D010* | | 750 | | A(pk) |
| Ron | Contact Resistance, TJ = 25 °C | | 1.3 | 1.8 | mOhm |
| Ron | Contact Resistance, T _J = 150 °C ⁽¹⁾ | | 2.8 | | mOhm |
| Vdrop | Voltage drop at lout, T _J = 25 °C SSR100D010* | | 0.13 | 0.18 | V _{DC} |
| Соит | Capacitance, V _{DS} =50V, f=100kHz | | 1470 | | pF |
| Eas | Avalanche energy, single pulse TJ = 25 °C, ID = 75A, VDs = 50V, L = 47μH | | 130 | | mJ |
| | | | | | |

SSR100D010* (100V Models) Output Specifications:

*Contact factory for current ratings under 100A.

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| Parameter | Description | MIN | TYP | MAX | Unit |
|-------------------|--|-----|------|-----------|-----------------|
| Vout | Max Blocking Voltage Across Pins 3 and 4 | | | 200 | V _{DC} |
| I _{LEAK} | Output leakage $T_J = 25 ^{\circ}C, V_{DS} = 200V, V_{GS} = 0V$ $T_J = 125 ^{\circ}C, V_{DS} = 200V, V_{GS} = 0V$ ⁽¹⁾ | | | 60 750 | μΑ |
| Іоит | Max Continuous Contact Current SSR066D020* | 0 | | 66 | A |
| | Quer Current lateh et 25% 100% DC hue 15 | | | | |
| Ilatch | uH load inductance SSR066D020* | | 350 | | A(pk) |
| Ron | Contact Resistance, T _J = 25 °C | | 2.7 | 4.0 | mOhm |
| Ron | Contact Resistance, T _J = 150 °C ⁽¹⁾ | | 6.8 | | mOhm |
| Vdrop | Voltage drop at lout, T _J = 25 °C SSR066D020* | | 0.18 | 0.26 | V _{DC} |
| | | | | | |
| COUT | Capacitance, V _{DS} =25V, f=100kHz | | 2430 | | pF |
| Eas | Avalanche energy, single pulse T _J = 25 °C, I _D = 60A, V _{DS} = 50V | | 760 | | mJ |
| | | | | | |
| | | | | | |

SSR066D020* (200V Models) Output Specifications:

*Contact factory for the 200V model availability. Some models are still in prototype stage and not released for production yet.

| Description | MIN | TYP | MAX | Unit |
|--|--|---|---|--|
| Max Blocking Voltage Across Pins 3 and 4 | | | 1200 | V _{DC} |
| Output leakage $T_J = 25 ^{\circ}$ C, $V_{DS} = 1200$ V, $V_{GS} = 0$ V $T_J = 125 ^{\circ}$ C, $V_{DS} = 1200$ V, $V_{GS} = 0$ V ⁽¹⁾ | | | 3 300 | μΑ |
| Max Continuous Contact Current SSR033D120* | 0 | | 33 | A |
| Over Current latch, at 25°C, 600V DC bus, 25 uH load inductance SSR033D120* | | 200 | | A(pk) |
| Contact Resistance, T _J = 25 °C | | 17.0 | 21.0 | mOhm |
| Contact Resistance, T _J = 150 °C ⁽¹⁾ | | 29.5 | 41.7 | mOhm |
| Voltage drop at lout, T _J = 25 °C SSR033D120* | | 0.56 | 0.69 | Vdc |
| Capacitance, V _{DS} =1000V, f=100kHz | | 450 | | pF |
| Avalanche energy, single pulse TJ = 25 °C, ID = 40A, VDS = 50V | | | 2000 | mJ |
| | | | | |
| | DescriptionMax Blocking Voltage Across Pins 3 and 4Output leakage $T_J = 25 °C$, $V_{DS} = 1200V$, $V_{GS} = 0V$ $T_J = 125 °C$, $V_{DS} = 1200V$, $V_{GS} = 0V (1)$ Max Continuous Contact CurrentSSR033D120*Over Current latch, at 25°C, 600V DC bus, 25uH load inductanceSSR033D120*Contact Resistance, $T_J = 25 °C$ Contact Resistance, $T_J = 150 °C (1)$ Voltage drop at lout, $T_J = 25 °C$ SSR033D120*Capacitance, $V_{DS}=1000V$, f=100kHzAvalanche energy, single pulse $T_J = 25 °C$, $I_D = 40A$, $V_{DS} = 50V$ | DescriptionMINMax Blocking Voltage Across Pins 3 and 4Output leakage $T_J = 25 ^{\circ}C, V_{DS} = 1200V, V_{GS} = 0V$ T $T_J = 125 ^{\circ}C, V_{DS} = 1200V, V_{GS} = 0V^{(1)}$ Max Continuous Contact CurrentMax Continuous Contact CurrentSSR033D120*Over Current latch, at 25°C, 600V DC bus, 25UH load inductanceSSR033D120*Contact Resistance, $T_J = 25 ^{\circ}C$ Contact Resistance, $T_J = 150 ^{\circ}C ^{(1)}$ Voltage drop at lout, $T_J = 25 ^{\circ}C$ SSR033D120*Capacitance, $V_{DS}=1000V, f=100$ kHzAvalanche energy, single pulseT_J = 25 ^{\circ}C, I_D = 40A, V_{DS} = 50V | DescriptionMINTYPMax Blocking Voltage Across Pins 3 and 4Output leakageTJ = 25 °C, VDS = 1200V, VGS = 0VTJ = 125 °C, VDS = 1200V, VGS = 0V (1)Max Continuous Contact CurrentSSR033D120*0Over Current latch, at 25°C, 600V DC bus, 25UH load inductance200SSR033D120*200Contact Resistance, TJ = 25 °C17.0Contact Resistance, TJ = 150 °C (1)29.5Voltage drop at lout, TJ = 25 °CSSR033D120*0.56Capacitance, VDS=1000V, f=100kHz450Avalanche energy, single pulseTJ = 25 °C, ID = 40A, VDS = 50V | Description MIN TYP MAX Max Blocking Voltage Across Pins 3 and 4 1200 Output leakage 1200 $T_J = 25 ^{\circ}$ C, $V_{DS} = 1200V$, $V_{GS} = 0V$ 3 $T_J = 125 ^{\circ}$ C, $V_{DS} = 1200V$, $V_{GS} = 0V^{(1)}$ 300 Max Continuous Contact Current 3 SR033D120* 0 33 Over Current latch, at 25°C, 600V DC bus, 25 200 uH load inductance 200 200 SSR033D120* 200 21.0 Contact Resistance, $T_J = 25 ^{\circ}$ C 17.0 21.0 Contact Resistance, $T_J = 150 ^{\circ}C^{(1)}$ 29.5 41.7 Voltage drop at lout, $T_J = 25 ^{\circ}$ C 0 |

SSR033D120* (1200V Models) Output Specifications:

*Contact factory for the 1200V model availability. Some models are still in prototype stage and not released for production yet.

Notes:

1. These parameters are controlled via design or process and are not directly tested. Parameters are characterized on initial design release and upon design changes which would affect these characteristics.

SENSITRON SEMICONDUCTOR TECHNICAL DATA

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Fig. 4 – Input vs. Output Timing





| Switching Ch | naracteristics: | | | | |
|-------------------|---|-----|-----|-----|------|
| Parameter | Description | MIN | TYP | MAX | Unit |
| ton | "Contact" turn on time | - | 0.5 | - | us |
| t _{off} | "Contact" turn off time | - | 1.0 | - | us |
| t _{don} | Delay from input command to contact on | - | 1.7 | - | ms |
| t _{doff} | Delay from input command to contact off | - | 0.2 | - | ms |
| tdlatch | Delay to latch after detection of Over | | 8 | - | us |
| | Current, lout = I _{latch} +10%, Tj = 25 °C | - | | | |
| Fswitch | Repetitive on to off switching frequency | - | - | 200 | Hz |

Environmental

| Parameter | Description | MIN | TYP | MAX | Unit |
|-------------------|---|------|-----|------|------|
| Isolation | Input to Output, <1mA | 2000 | - | - | VDC |
| Isolation | Input or Output to Case, <1mA | 2000 | - | - | VDC |
| T _{STG} | Storage Temperature | -55 | - | 150 | °C |
| T _{CASE} | Operating Temperature (Baseplate) | -55 | - | 100 | °C |
| TJ | Operating Temperature (Junction) | -55 | - | 150 | °C |
| R _{θJC} | Thermal Resistance (Baseplate – Junction) | - | 0.9 | 1.15 | °C/W |
| | Weight | - | 85 | - | g |

Mechanical Outline



Over Current Disable Pin Diameter = 0.025"

Pin Assigments:

Input – Apply a positive voltage to this pin with respect to pin Gnd to "close" the contacts.
GND – This is the return pin for the Input control voltage.
+OUTPUT – This is the positive terminal of the "contact".
-OUTPUT – this is the return terminal for the +OUTPUT pin.

Note:

- 1. Input pins and output pins are isolated up to 2000VDC
- 2. The device may be damaged if the input polarity is reversed.
- 3. The "contact" is uni-polar; a voltage reversal will result in current flow in the internal diode.

Application Notes:

A. Input Bias

The SSR will be energized and the "Contact" will be closed when a positive potential of 4.6VDC to 36VDC is applied between Input and Gnd. The input power consumption will be constant throughout the control voltage range therefore the contactor will draw more current at lower control voltages.







TTL with Buffer



Input Driven from TTL with Open Drain Driver

B. Output Load Connection

The output circuit is completely floating therefore the Load can be connected to either output terminal.







Load Connected to –Output Terminal

C. Over Current Disable

The SSR contains an Over Current latch which disables (opens) the contact whenever a large current in excess of the latching current is detected. The Over Current latch can only be reset be removing and reapplying the input control power. In noisy environments and in applications where high surge currents are encountered, the Over Current latch may be triggered prematurely. In these applications the latch circuit can be disabled by placing a short circuit between the over current disable terminals.



Disabling Over Current Latch Circuit

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D. Contact Protection
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The user must ensure that the peak voltage rating of the SSR is not exceeded. The SSRXXDXXX family of devices switch at extremely fast speeds, therefore extra care must be taken to suppress voltage transients that are generated when interrupting high currents. Sensitron strongly advises the user to us a snubber network similar in design to the one shown below. This is an energy absorbing snubber that transfers the energy from any parasitic line inductance into the capacitor and then is dissipated through the resistor. The capacitor should be sized so that the captured energy does not charge the capacitor beyond the contacts rated voltage.



E. AC Operation

The contactor can be used for AC loads if two devices are connected "back to back".



Part Number Ordering Information



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