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:

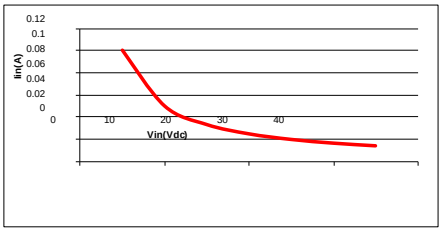
- 2000V Input to Output / Output to Baseplate Isolation
- Up to 1200V Blocking[1]
- Up to 100A Continuous Current[2]
- Up to 400A Surge Capability
- Single wide range DC input signal 4.6V to 36V
- Low Power Control, 0.5W Typ.
- Low "on" state resistance
- Fast turn on/turn off
- High Current Terminals
- Three Point Mounting Plate
- $R_{\theta JC} \leq 1.15^{o}C/W$
- 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, Vin = 4.6V to 36V	4		100	mA
$P_{control}$	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



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

Parameter	Description	MIN	TYP	MAX	Unit
V_{OUT}	Max Blocking Voltage Across Pins 3 and 4			400	V_{DC}
I_{LEAK}	Output leakage T_J = 25 °C, V_{DS} = 400V, V_{GS} = 0V T_J = 125 °C, V_{DS} = 400V, V_{GS} = 0V (1)			 300 3000	µA
I_{OUT}	Max Continuous Contact Current SSR025D060* **SSR050D060**	 0 0		 25 50	A
I_{LATCH}	Over Current latch, at 25°C, 300V DC bus, 20 uH load inductance SSR025D060* **SSR050D060**		 125 250		A(pk)
R_{ON}	Contact Resistance, T_J = 25 °C		9.5	12.3	mOhm
R_{ON}	Contact Resistance, T_J = 150 °C (1)		19.1		mOhm
V_{DROP}	Voltage drop at Iout, T_J = 25 °C SSR025D060* **SSR050D060**		 0.238 0.475	 0.308 0.615	V_{DC}
C_{OUT}	Capacitance, V_{DS}=100V, f=100kHz		669		pF
E_{AS}	Avalanche energy, single pulse T_J = 25 °C, I_D = 15A, V_{DS} = 50V		2000		mJ

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

SSR100D010* (100V Models) Output Specifications:

Parameter	Description	MIN	TYP	MAX	Unit
V_{OUT}	Max Blocking Voltage Across Pins 3 and 4			70	V_{DC}
I_{LEAK}	Output leakage T_J = 25 °C, V_{DS} = 70V, V_{GS} = 0V T_J = 125 °C, V_{DS} = 70V, V_{GS} = 0V (1)			300 3000	µA
I_{OUT}	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)
R_{ON}	Contact Resistance, T_J = 25 °C		1.3	1.8	mOhm
R_{ON}	Contact Resistance, T_J = 150 °C (1)		2.8		mOhm
V_{DROP}	Voltage drop at Iout, T_J = 25 °C SSR100D010*		0.13	0.18	V_{DC}
C_{OUT}	Capacitance, V_{DS}=50V, f=100kHz		1470		pF
E_{AS}	Avalanche energy, single pulse T_J = 25 °C, I_D = 75A, V_{DS} = 50V, L = 47µH		130		mJ

***Contact factory for current ratings under 100A.**

SSR066D020* (200V Models) Output Specifications:

Parameter	Description	MIN	TYP	MAX	Unit
V_{OUT}	Max Blocking Voltage Across Pins 3 and 4			200	V_{DC}
I_{LEAK}	Output leakage T_J = 25 °C, V_{DS} = 200V, V_{GS} = 0V T_J = 125 °C, V_{DS} = 200V, V_{GS} = 0V (1)			60 750	µA
I_{OUT}	Max Continuous Contact Current SSR066D020*	0		66	A
I_{LATCH}	Over Current latch, at 25°C, 100V DC bus, 15 uH load inductance SSR066D020*		350		A(pk)
R_{ON}	Contact Resistance, T_J = 25 °C		2.7	4.0	mOhm
R_{ON}	Contact Resistance, T_J = 150 °C (1)		6.8		mOhm
V_{DROP}	Voltage drop at Iout, T_J = 25 °C SSR066D020*		0.18	0.26	V_{DC}
C_{OUT}	Capacitance, V_{DS}=25V, f=100kHz		2430		pF
E_{AS}	Avalanche energy, single pulse T_J = 25 °C, I_D = 60A, V_{DS} = 50V		760		mJ

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

SSR033D120* (1200V Models) Output Specifications:

Parameter	Description	MIN	TYP	MAX	Unit
V_{OUT}	Max Blocking Voltage Across Pins 3 and 4			1200	V_{DC}
I_{LEAK}	Output leakage T_J = 25 °C, V_{DS} = 1200V, V_{GS} = 0V T_J = 125 °C, V_{DS} = 1200V, V_{GS} = 0V (1)			3 300	µA
I_{OUT}	Max Continuous Contact Current SSR033D120*	0		33	A
I_{LATCH}	Over Current latch, at 25°C, 600V DC bus, 25 uH load inductance SSR033D120*		200		A(pk)
R_{ON}	Contact Resistance, T_J = 25 °C		17.0	21.0	mOhm
R_{ON}	Contact Resistance, T_J = 150 °C (1)		29.5	41.7	mOhm
V_{DROP}	Voltage drop at Iout, T_J = 25 °C SSR033D120*		0.56	0.69	V_{DC}
C_{OUT}	Capacitance, V_{DS}=1000V, f=100kHz		450		pF
E_{AS}	Avalanche energy, single pulse T_J = 25 °C, I_D = 40A, V_{DS} = 50V			2000	mJ

***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.

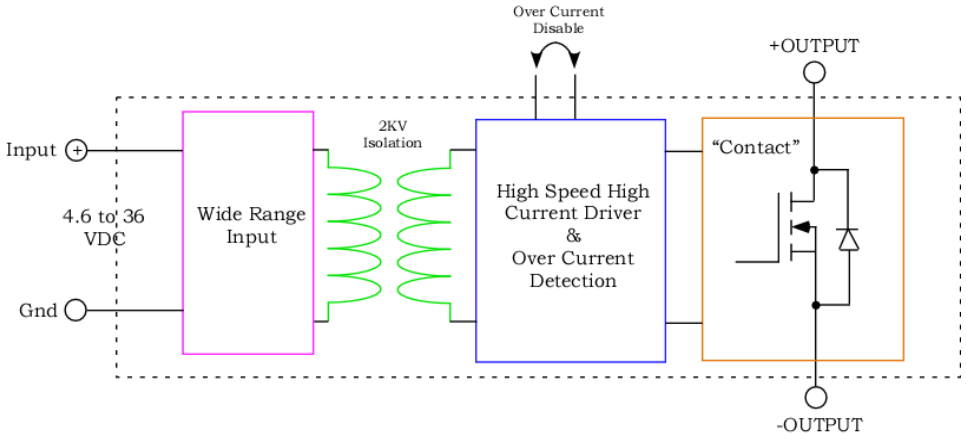


Fig. 3 – Block Diagram

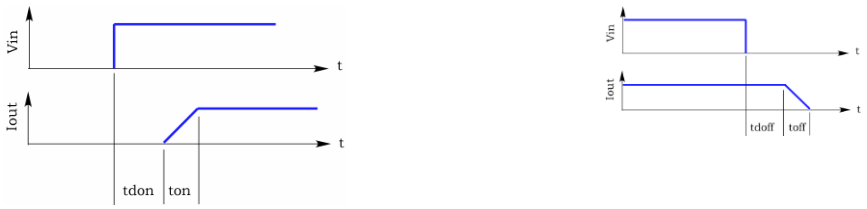


Fig. 4 – Input vs. Output Timing

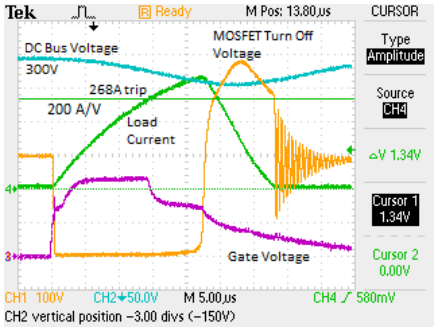


Fig. 5 – Typical Over Current Fault Shut Down for SSR050D060

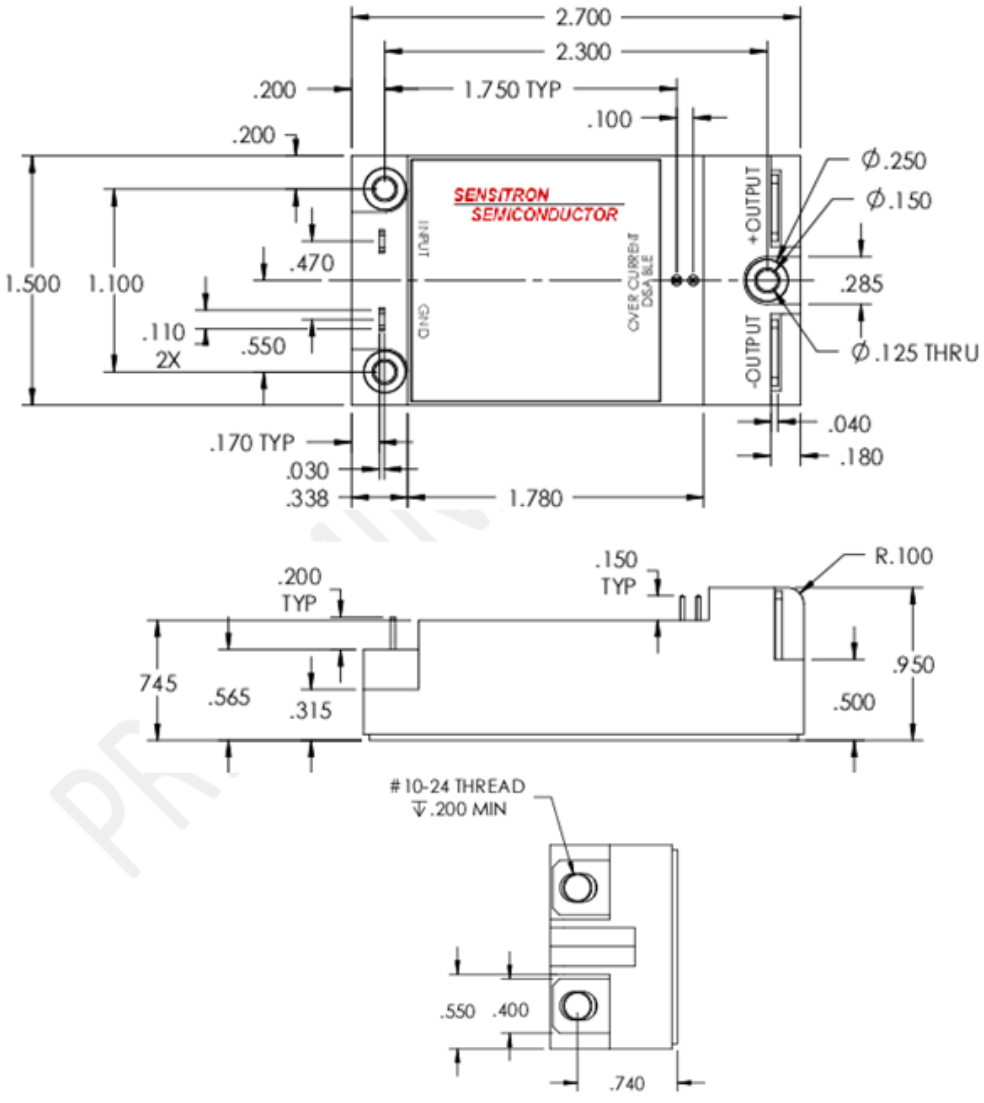
Switching Characteristics:

Parameter	Description	MIN	TYP	MAX	Unit
t_{on}	"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
t_{dlatch}	Delay to latch after detection of Over Current, Iout = I_{latch} +10%, Tj = 25 °C	-	8	-	us
F_{switch}	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
T_J	Operating Temperature (Junction)	-55	-	150	°C
$R_{\theta JC}$	Thermal Resistance (Baseplate – Junction)	-	0.9	1.15	°C/W
	Weight	-	85	-	g

Mechanical Outline



Over Current Disable Pin Diameter = 0.025”

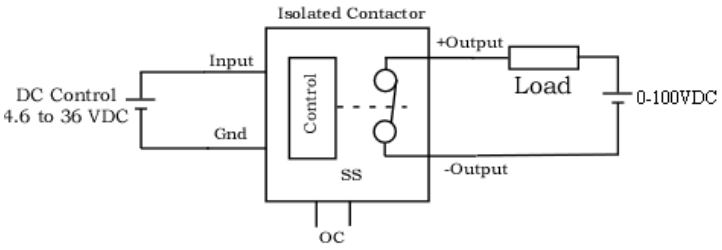
Pin Assigments:

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.

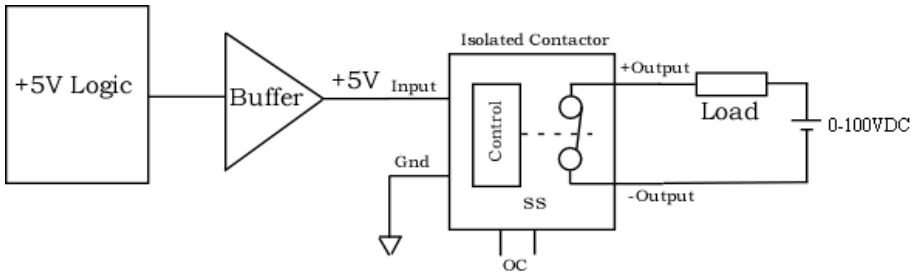
Note:
1. Input pins and output pins are isolated up to 2000VDC
2. The device may be damaged if the input polarity is reversed.
3. The "contact" is uni-polar; a voltage reversal will result in current flow in the internal diode.

Application Notes:

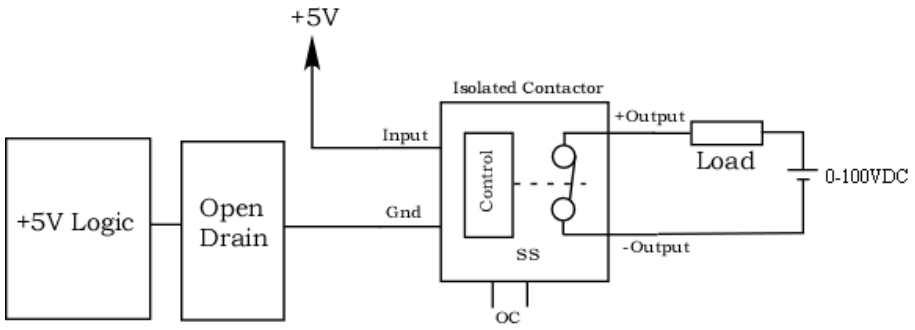
A. Input Bias
The SSR will be energized and the "Contact" will be closed when a positive potential of 4.6VDC to 36VDC is applied between Input and Gnd. The input power consumption will be constant throughout the control voltage range therefore the contactor will draw more current at lower control voltages.



DC Supply



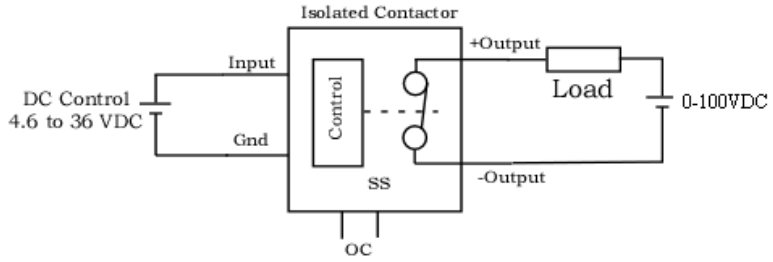
TTL with Buffer



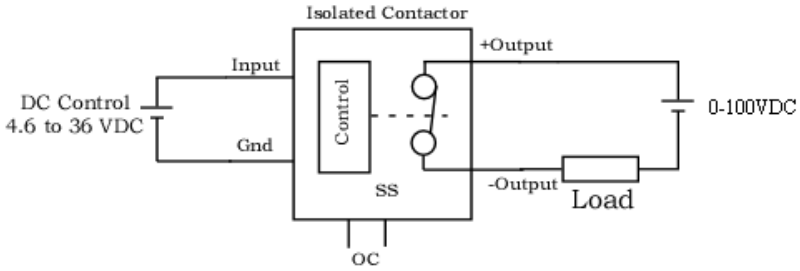
Input Driven from TTL with Open Drain Driver

B. Output Load Connection

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



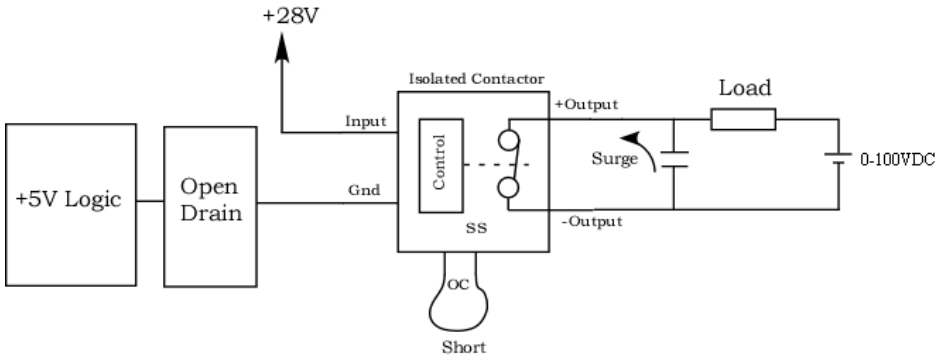
Load connected to +Output Terminal



Load Connected to –Output Terminal

C. Over Current Disable

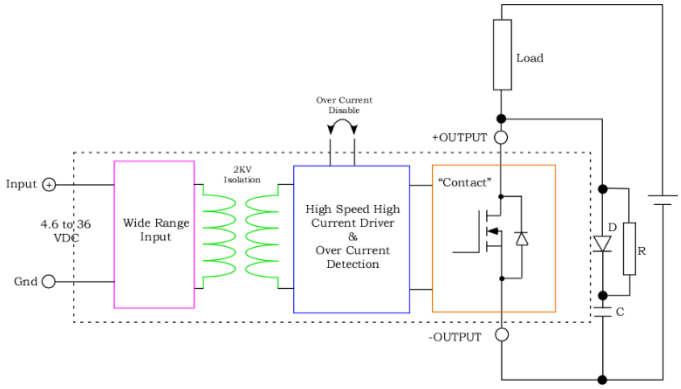
The SSR contains an Over Current latch which disables (opens) the contact whenever a large current in excess of the latching current is detected. The Over Current latch can only be reset be removing and re-applying the input control power. In noisy environments and in applications where high surge currents 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

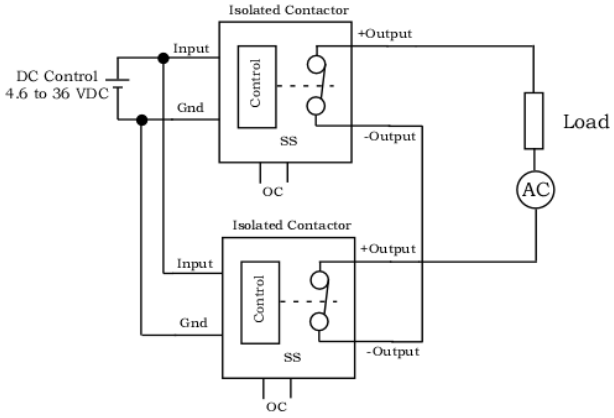
D. Contact Protection

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