Solid State Relays
SRP1–CC...DH

HVDC Solid-State Relay

Description

The SRP1-CC...DH series is a family of high-voltage DC solid-state relays designed for switching up to 1700 VDC Peak and 70 A. With models based on IGBT or MOSFET technology, these relays are built for high-performance DC control in energy, transportation, and industrial systems.

- Handles up to 1700 VDC for high-power DC switching applications
- IGBT and MOSFET variants to suit different performance and load profiles
- Built-in diode ensures safe operation with inductive loads by managing energy during turn-off

Features & Benefits

FEATURES	BENEFITS
High Voltage Capability (up to 1700 VDC peak)	Suitable for demanding applications in renewable energy, rail systems, and DC infrastructure.
Output Technology: IGBT or MOSFET	IGBT models deliver efficient high-voltage switching; MOSFET model offers fast switching and better transient handling.
Wide Control Voltage Input (5–32 VDC)	Simplifies integration with most control systems, including PLCs and industrial controllers.

Applications

- Battery disconnect and DC switching in solar, marine, and backup power systems
- High-voltage heating in rail and transportation HVAC systems and industrial environments
- DC motors, braking systems, and inductive loads in industrial automation
- Power conversion equipment: UPS, solar inverters, active rectifiers
- Energy storage and smart grid DC systems

Ordering Information

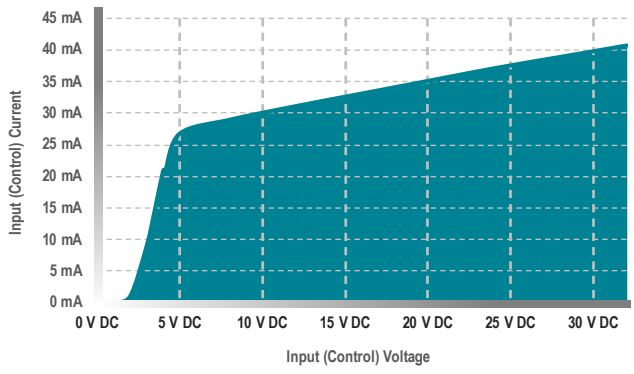
FOR HEATING CONTROL							
CATALOG #	OUTPUT MAX CURRENT	OUTPUT VOLTAGE	PEAK VOLTAGE	OUTPUT SWITCHING STYLE	OUTPUT OVERVOLTAGE PROTECTION	INPUT VOLTAGE RANGE	COMPLIANCE
SRP1-CCDD7-020EC-N	20 A	800 V DC	1700 V DC	DC	-	5-32 V DC	cЯUus, CE
SRP1-CCDD2-050EC-N	50 A	650 V DC	1200 V DC	DC	-	5-32 V DC	cЯUus, CE
SRP1-CCDDH-070EC-N	70 A	350 V DC	600 V DC	DC	-	5-32 V DC	cЯUus, CE
SRP1-CCDDH-020NC-N	20 A	350 V DC	600 V DC	DC	-	5-32 V DC	cЯUus, CE

Input/Control Specifications[1]

GENERAL DATA				
SYMBOL	PARAMETER	RANGE	VALUE	UNIT
Uc	Input (Control) Voltage	Maximum	32	V DC
		Nominal	12-24	V DC
		Minimum	4.5	V DC
Urv	Reverse Voltage	Maximum	-32	V DC
Uc on	Turn-On Voltage (Pick-up/Engage/Activation Voltage)	Minimum	4.3	V DC
Uc off	Turn-Off Voltage (Drop Out/Release/Deactivation Voltage)	Nominal	1.0	V DC
Ic	Input (Control) Current	Maximum	42	mA
		Minimum	25	mA
-	Input Impedance	Nominal	Current Regulated	-
Ton	Turn-On Time	Maximum	610	µs
Toff	Turn-Off Time	Maximum	150	µs

Input Current vs Input Voltage Graphs (for power supply selection)
To ensure the Solid-State Relay (SSR) operates efficiently and reliably, it is essential to understand the relationship between input voltage and input current. The following input current graphs provide detailed information on the current consumption of our SSRs across the specified input voltage range (4.5-32 VDC). This data is crucial for selecting an appropriate power supply and ensuring the relay functions within its safe operating limits. Proper understanding of current consumption is vital for the optimal performance of your application.

4.5-32 VDC



Output/Load Specifications[1]

GENERAL DATA

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE FOR 20A EC VERSION	VALUE FOR 50A EC VERSION	VALUE FOR 70A EC VERSION	VALUE FOR 20A NC VERSION	UNIT
-	Output Configuration	-	-	SPST-NO	SPST-NO	SPST-NO	SPST-NO	-
f	Operating Frequency	47-63Hz	Maximum	200	200	700	700	Hz
Ue	Recommended Operating Voltage	Depends on protection clamping voltage*	Maximum	820	650	350	350	V DC
Utp	Absolute Maximum Rating (Non-repetitive peak voltage)		Minimum	1700	1200	600	600	V DC
-Ut	Reverse voltage drop (internal diode at OFF state)	Ie = 25A / 50A / 100A / 47A, Uc=0	Nominal	2.09	1.4	1.4	1.2	V
PWM	Pulse Width Modulation (PWM) Frequency	-	Maximum	200	200	700	700	Hz
VCEsat	On-State Voltage Drop	At Rated Current	Maximum	3.76	1.7	1.45		Vrms
RDS-ON	On-State Dynamic Resistance	-	Maximum	-	-	-	140	mΩ
Idmax	Transient Over-Current (Surge/Overload/Non-Repetitive Current)	t = 1ms (EC version) t= 0,1ms (NC version)	Nominal	40	320	450	110	Apk
Ilk	Leakage Current (Off-State)	At Umax, Tjmax	Maximum	1.5	1	1	0.25	mArms
Rthj/c	Thermal Resistance Junction to Case (Rjc)	-	Maximum	0.68	0.365	0.385	0.4	°C/W

* See Diagram for details

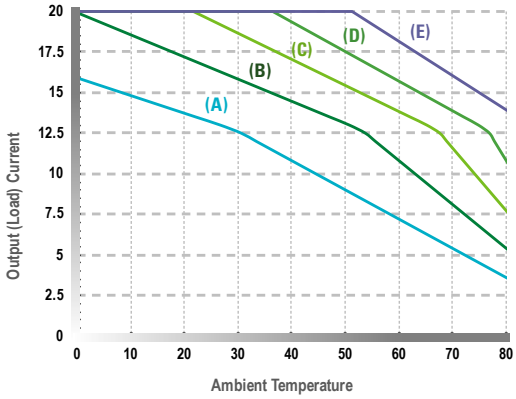
Littelfuse SSRs are designed for various DC applications and can manage specific load types effectively. The maximum continuous current value provided in this datasheet applies to non-inductive or slightly inductive loads (DC-1 type), such as DC heating elements, or small solenoids.

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE FOR 20A EC VERSION	VALUE FOR 50A EC VERSION	VALUE FOR 70A EC VERSION	VALUE FOR 20A NC VERSION	UNIT
Ie (DC-1)	Load Current (Continuous) – Non-inductive or slightly inductive loads (DC-1)	At 40 °C	Maximum[3]	25	50	100	40	A DC
			Minimum	5	5	5	5	A DC

Thermal Derating Curves (for heatsink selection)

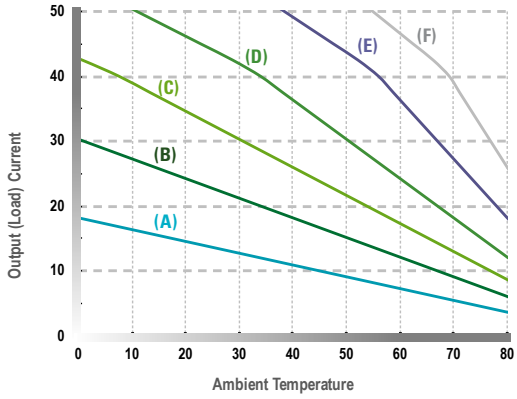
To operate the Solid-State Relay (SSR) at its specified ratings, the use of a heatsink is mandatory. The following thermal derating curves illustrate the maximum load current that our SSRs can manage under varying ambient temperatures and heatsink sizes. It is crucial to select a heatsink that is most suitable for your specific application.

20A VERSIONS



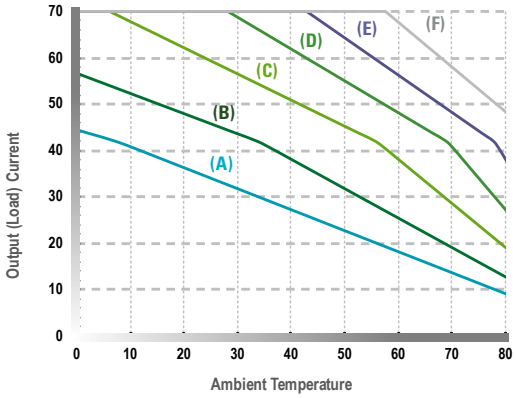
(A) 1.5 °C/W: Heatsink (C) 0.7 °C/W: Heatsink (E) 0.3 °C/W: Heatsink
(B) 1 °C/W: Heatsink (D) 0.5 °C/W: Heatsink

50A VERSIONS



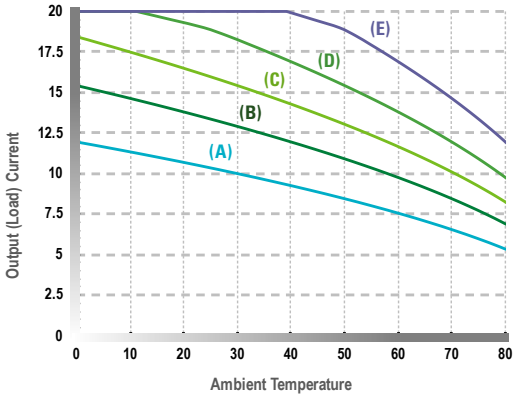
(A) 5 °C/W: Heatsink (C) 2.1 °C/W: Heatsink (E) 1 °C/W: Heatsink
(B) 3 °C/W: Heatsink (D) 1.5 °C/W: Heatsink (F) 0.7 °C/W: Heatsink

70A VERSIONS



(A) 2.1 °C/W: Heatsink (C) 1 °C/W: Heatsink (E) 0.5 °C/W: Heatsink
(B) 1.5 °C/W: Heatsink (D) 0.7 °C/W: Heatsink (F) 0.3 °C/W: Heatsink

20A | 600V VERSIONS



(A) 5 °C/W: Heatsink (C) 2.1 °C/W: Heatsink (E) 1 °C/W: Heatsink
(B) 3 °C/W: Heatsink (D) 1.5 °C/W: Heatsink

Considerations - Switching Type

DC output SSRs are versatile and can be used to control various types of loads, including resistive loads such as heating elements, and inductive loads like DC motors and valves. This flexibility makes them suitable for a wide range of industrial and commercial applications.

Considerations - Inrush Current

When dealing with DC loads, it's important to consider the inrush current, especially for inductive loads such as motors and valves:

- DC motors and valves can generate inrush currents that are 3-4 times their steady-state current. To accommodate this, it is recommended to select an SSR with a current rating 3-4 times the nominal current of the load, or to operate the SSR at 25%-35% of its maximum capacity to help manage these high currents and protect the relay and other components.
- For DC resistive loads, inrush current is generally less of a concern compared to inductive loads. However, it's still prudent to account for any potential surges, especially if the load includes capacitive elements. Ensuring the SSR operates within 80%-90% of its maximum capacity can enhance reliability and lifespan.

NOMINAL SSR CURRENT RATING	MAXIMUM RECOMMENDED CURRENT RESISTIVE LOADS	MAXIMUM RECOMMENDED CURRENT INDUCTIVE LOADS
20 A	16 - 18 A	2 - 5A*
50 A	40 - 45 A	4 - 7A*
70 A	56 - 63 A	8 - 12,5A*

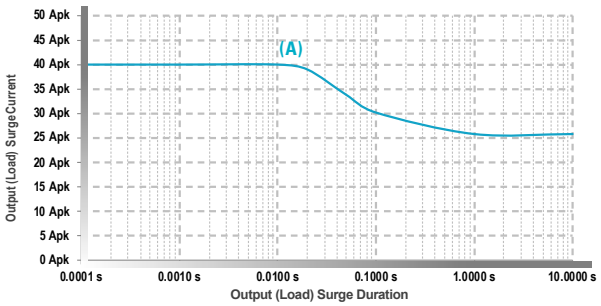
*Calculations must be made for each application in order to define the correct protection components.
Many factors must be taken into account to verify the compatibility of the product with the applications (Voltage, Current and Protections).
Other value possible under certain conditions, contact your local distributor for more details.

Output Surge Current Withstand Graphs (for transient protection)

To ensure the Solid-State Relay (SSR) can handle sudden increases in current without damage, it is essential to understand its surge current capacity. The following surge current graphs illustrate the maximum surge current that our SSRs can withstand over various durations. This information is crucial for selecting an SSR that can endure transient overcurrent events, ensuring the reliability and safety of your electrical system. Proper understanding of surge current capacity helps in preventing equipment failure and maintaining optimal performance in your application.

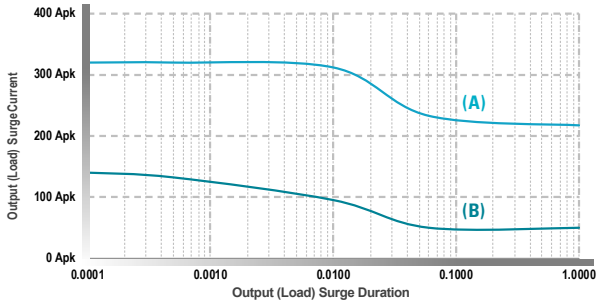
The graphs include a Single Pulse Surge Current curve used to define the protection offered by fuses, helping in the selection of appropriate protective devices. Additionally, is important to ensure that the Repetitive Surge Current curve is not exceeded during normal operation, as frequent overload currents can decrease the life expectancy of the SSR. Therefore, caution is advised to maintain the longevity and reliability of the SSR.

20A VERSIONS



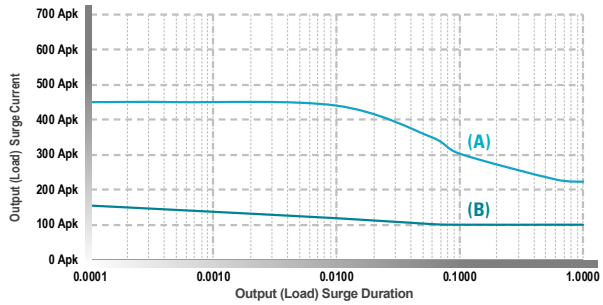
(A) Single Pulse Surge: Initial SSR internal temperature at **175°C**

50A VERSIONS



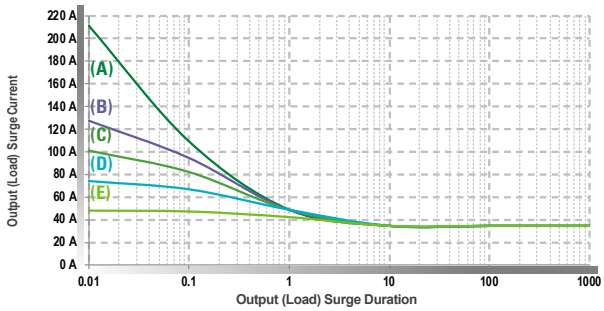
(A) Single Pulse Surge: Initial SSR internal temperature at **175°C**
(B) Repetitive Surges: Initial SSR internal temperature **125°C**

70A VERSIONS



(A) Single Pulse Surge: Initial SSR internal temperature at **175°C**
(B) Repetitive Surges: Initial SSR internal temperature **125°C**

20A | 600V VERSIONS



(A) Single Pulse Surge: Initial SSR internal temperature at **150°C**
(B) Repetitive Surges: Initial SSR internal temperature **150°C (5% Duty Cycle)**
(C) Repetitive Surges: Initial SSR internal temperature **150°C (10% Duty Cycle)**
(D) Repetitive Surges: Initial SSR internal temperature **150°C (20% Duty Cycle)**
(E) Repetitive Surges: Initial SSR internal temperature **125°C (50% Duty Cycle)**

General Specifications[1]

GENERAL DATA

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE FOR 020EC & 020NC	VALUE FOR 020EC & 020NC	UNIT
-	LED for Input (Control) Status Indicator	-	-	Continuously ON Green LED, when control input is applied	Continuously ON Green LED, when control input is applied	-
Ui	Isolation (Dielectric Strength)	Input to Output (50/60 HZ)	Nominal	4,000	4,000	Vrms
		Input/Output to Ground (50/60 HZ)	Nominal	4,000	4,000	
Ri	Insulation Resistance	@ 500 V DC	Minimum	1	1	GΩ
-	Coupling Capacitance	Input / Output	Maximum	8	8	pF
Uimp	Impulse Withstand Voltage	-	Nominal	-	-	Vrms
-	Short Circuit Current Rating (SCCR)	-	-	5	5	kA
-	Endurance according to American Standard UL508		Typical	6,000	6,000	Cycles
-	MTTFd **(Mean Time to Dangerous Failure)** (Calculated in accordance with the guidelines for safety-related parts of control systems, as specified by the international standard ISO 13849-1)	-	-	55	44	Years
-	MTBF[8] **(Mean Time Between Failures)** (Calculated in accordance with the Military Handbook Guidelines for Reliability Prediction of Electronic Equipment, as specified by the US Department of Defense Standard MIL-HDBK-217)	@ 40°C ambient	-	34	26	Years
		@ 60°C ambient	-	23	18	

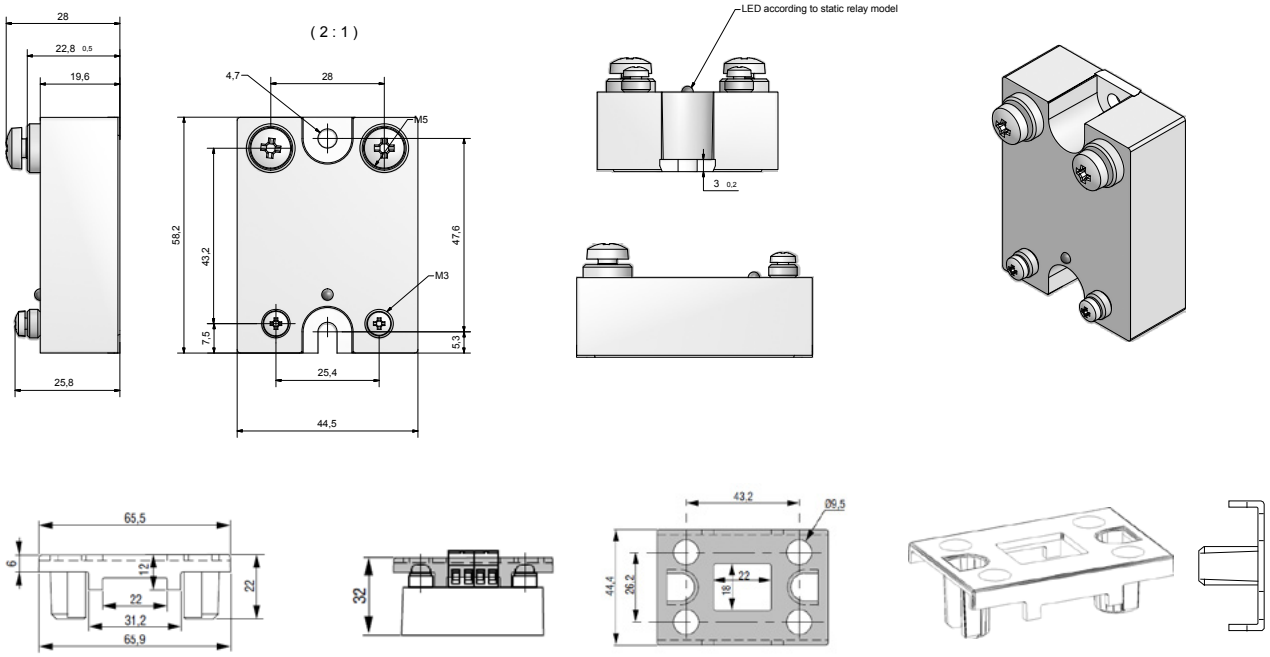
ENVIRONMENTAL DATA

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE	UNIT
-	Vibration (Test conducted in accordance with the Vibration Environmental Testing Guidelines of the International Standard *IEC 60068-2-6)*	5-100Hz	Nominal	10	g
-	Shock (Test conducted in accordance with the Shock Environmental Testing Guidelines of the International Standard *IEC 60068-2-27*)	11ms	Nominal	50	g
-	Ambient Temperature - Operating (Working)[7]	No icing, no condensation	Maximum	90 (194)	°C (°F)
			Minimum	-40 (-40)	°C (°F)
-	Ambient Temperature - Storage	No icing, no condensation	Maximum	100 (212)	°C (°F)
			Minimum	-40 (-40)	°C (°F)
HR	Relative Ambient Humidity (Per international standard *IEC/EN 60068-2-78*)	Non-condensing @ 40 °C	Nominal	93	%
-	Pollution Degree	Non-conductive pollution with condensation possibilities	Nominal	2	

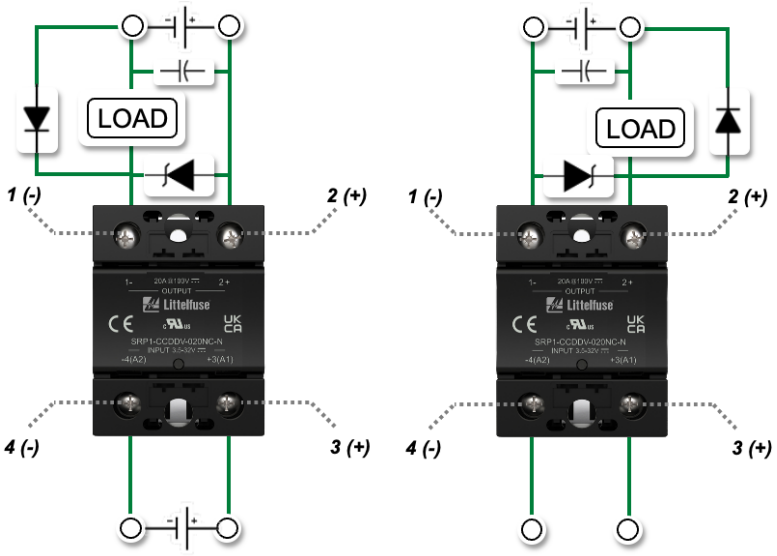
MECHANICAL DATA

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE	UNIT
-	Product Weight	-	Typical	100	g (lbs)
-	Housing Material (In accordance with the American Standard UL-94 for Safety of Flammability of Plastic Materials for Parts in Devices and Appliances)	-	-	Plastic UL 94 V-O	-
-	Baseplate Material	-	-	Aluminum	-
	Touch Protection Level (Test conducted in accordance with the IP Code of Degrees of Protection Testing Guidelines of the International Standard *IEC 60529*)			IP20	
-	Screw Torque Range	Input (Control) Terminals	Minimum	0.8 (7)	Nm (in-lb)
			Maximum	0.8 (7)	
		Output (Load) Terminals	Minimum	1.2 (11)	Nm (in-lb)
			Maximum	1.8 (16)	
		SSR Mounting	Minimum	1.2 (11)	Nm (in-lb)
			Maximum	1.8 (16)	
-	Screw Thread Size	Input Terminals	-	M3 x 0.8	-
		Output Terminals	-	M5 x 1	-
		SSR Mounting	-	M4 x 0.7 or #8-32 Pan Head	-

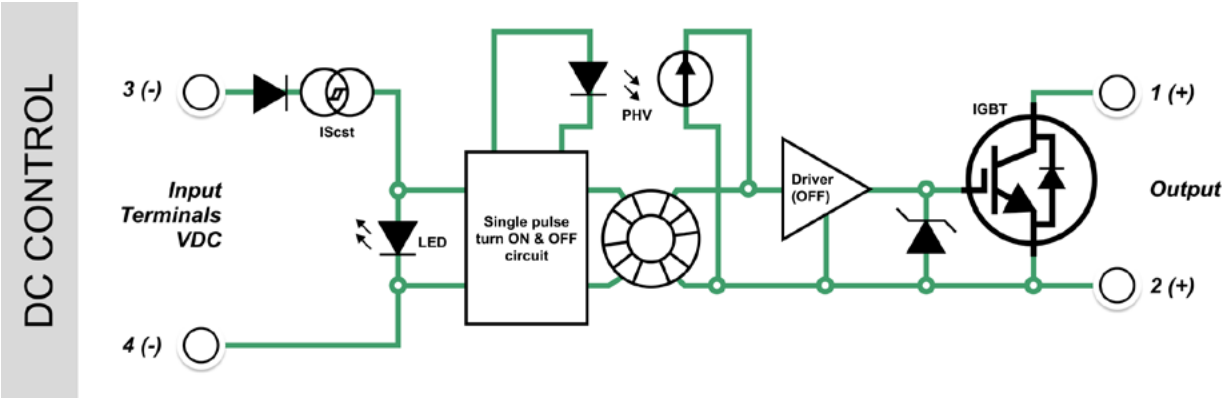
Product Dimensions (Millimeters)



Wiring Diagrams



Equivalent Circuit Block Diagrams



Short-Circuit Protection by Fuse

To safeguard solid-state relays (SSRs) against load short circuits, the use of fuses is essential, especially fast-acting ones. Here are the key considerations:

- Fuse Selection: The I^2t value (energy withstand capability) of the fuse should be less than half of the I^2t value of the relay. Standard fuses are inadequate because they cannot react swiftly enough to prevent fault currents from exceeding the maximum levels that thyristors (used in SSRs) can handle. Therefore, we strongly recommend employing ultra-fast fuses.
- Fuse Placement: Position the fuse in front of the SSR in the circuit. This strategic placement ensures that if the relay must unexpectedly break the earth insulation (due to overheating, case damage, or leakage with the heatsink), the fuse will protect the entire circuit from firing.
- Resource for Fuse Options: For the most suitable fuse options, consider checking the **Littelfuse website.**

Standards Conformity & Certifications

Product Safety Certifications

Products tested, compliant and certified to the following standards that states the requirements for electrical products to ensure they are safe for consumers to use.

CERTIFICATION BODY MARK	CERTIFICATION BODY NAME	CERTIFICATION DESCRIPTION	STANDARDS COVERED BY THE CERTIFICATION
c UL us No. E183688	cЯUus	North American certificate of compliance with the Safety requirements for Industrial Control Equipment	**UL508** American Standard of Safety for Industrial Control Equipment. **CAN/CSA C22.2 No.14-18** Canadian Standard of Safety for Industrial Control Equipment.
CE	CE	Conformity with the European safety, health, and environmental protection requirements.	**LVD Directive 2014/35/EU** EU Directive of Safety for Low Voltage Gear Equipment. In accordance with the Low Voltage Gear Testing Guidelines of the International Standard IEC 60947-4-3 **EMC Directive 2014/30/EU** EU Directive of Electromagnetic Compatibility. In accordance with the Low Voltage Gear Testing Guidelines of the International Standard IEC 60947-4-3 **RoHS Directive 2015/863/EU** EU Directive of Hazardous Substances Restriction. In accordance with the Assessment of electrical and electronic products with respect to the restriction of Hazardous substances Guidelines of the International Standard IEC 63000
UK CA	UKCA	Conformity with the UK product safety regulations	**SI 1101** UK Regulations of Safety for Electrical Equipment. In accordance with the Low Voltage Gear Testing Guidelines of the International Standard IEC 60947-4-3 **SI 1091** EU Directive of Electromagnetic Compatibility. In accordance with the Low Voltage Gear Testing Guidelines of the International Standard IEC 60947-4-3 **SI 3032** EU Directive of Hazardous Substances Restriction. In accordance with the Assessment of electrical and electronic products with respect to the restriction of Hazardous substances Guidelines of the International Standard IEC 63000

EMC Compliance (Electro-magnetic compatibility)

Radiated Emissions

-	STANDARD NAME	STANDARD DESCRIPTION	STANDARD NUMBER	LEVELS
IEC	Radiated RF	Radio interference field emission (radiated)	International Standard CISPR 11	Class B: 30M – 1GHz
IEC	Conducted RF	Radio interference voltage emissions (conducted)	International Standard CISPR 11	Class B (with external filter): 150k – 30MHz

Immunity

-	STANDARD NAME	STANDARD DESCRIPTION	STANDARD NUMBER	LEVELS
IEC	ESD	Immunity to Electrostatic Discharge (ESD)	International Standard IEC 61000-4-2	Level 3 -Contact Discharge: 6 kV -Air Discharge: 8 kV
IEC	Radiated RF	Immunity to Radiated Radio Frequency	International Standard IEC 61000-4-3	-Level 3: 10 V/m (80MHz-2GHz) -Level 2 3 V/m (2GHz-6GHz)
IEC	Burst	Immunity Electrical Fast Transients (Burst)	International Standard IEC 61000-4-4	Level 3: 2 kV

IEC	Surge	Immunity to Electrical Surges	International Standard IEC 61000-4-5	Level 3: -Line to line: 1 kV -Line to ground: 2 kV
IEC	Conducted RF	Immunity to Conducted Radio Frequency	International Standard IEC 61000-4-6	Level 3: 10V/m (0.15 - 80 MHz)
IEC	Dips	Immunity to Voltage Dips	International Standard IEC 61000-4-11	-0% for 0.5, 1 cycle, Performance Criteria A -40% for 10/12 cycles, Performance Criteria A -70% for 25/30 cycles, Performance Criteria A -80% for 250/300 cycles, Performance Criteria A
IEC	Interruptions	Immunity to Voltage Interruptions	International Standard IEC 61000-4-11	0% for 250/300 cycles, Performance Criteria B

While these products are designed to meet high industrial standards for Class A equipment, ensuring robust performance in demanding environments, they may cause radio interference when used in domestic settings. To mitigate this, additional noise reduction measures, such as filters or shielding, may be necessary. Ensure that the entire setup where the SSR is installed complies with all relevant EMC regulations required by the application.

Environmental Compliance[4]

Products comply to the following environmental standard requirements for electrical products to ensure they are safe for consumers to use.

-	STANDARD NAME	STANDARD DESCRIPTION	STANDARD NUMBER
RoHS	RoHS	Conformity with the European Restriction of Hazardous Substances in electrical and electronic products	European Directive 2015/863/EU (IEC 63000)
REACH	REACH	Conformity with the Registration, Evaluation, Authorization and Restriction of Chemicals regulation to ensure safe use of chemicals	European Directive 1907/2006
WEEE	WEEE	Conformity with the Waste Electrical and Electronic Equipment regulation to ensure proper disposal and recycling of e-waste	Regulation 2002/96/EC

Notes:
1. All parameters at 25 °C unless otherwise specified.
3. Products without protection (TVS or varistor) or only protected by a diode must be equipped with an external overvoltage protection. The maximum operating voltage is usually equal to half the specified maximum switchable voltage.
5. The environmental compliance data reflects the most current information available and adheres to our rigorous standards for quality and sustainability. These specifications are valid from the product's initial release and are subject to change with ongoing improvements.
6. If no heatsink is used then the baseplate has to be exposed to free ambient air.
7. AC input option minimum operating temperature is -40 (-40).

Accessories

IMAGE	CATALOG #	TYPE	DESCRIPTION
	SADH-C1N600	DIN Rail Adapter	Allows SSR to be mounted on a 35 mm DIN type rail. It has a 6ºC/W Thermal Resistance
	C103PM	DIN Rail	35 mm aluminum DIN rail available in a 36 in. (91.4 cm) length.
	SADH-NN210	Heatsink	2.1ºC/W Thermal Resistance
	SADH-NN175	Heatsink	1.75ºC/W Thermal Resistance
	SADH-NN120	Heatsink	1.2ºC/W Thermal Resistance
	SADH-NN100	Heatsink	1.0ºC/W Thermal Resistance
	SADH-NN050	Heatsink	0.5ºC/W Thermal Resistance
	SADH-ND030	Heatsink	0.3ºC/W Thermal Resistance, 24 VDC
	SADH-NA030	Heatsink	0.3ºC/W Thermal Resistance, 230 VAC
	SANT-C1NM40	Mounting Screws	Screw Kit for heatsink mounting
	SANP-C1N030	Thermal Interface	Thermal Pad (Usable for 1 relay)
	SANG-CNN090	Thermal Interface	Heat Sink Thermal Paste 20 ml (Usable for 60+ relays)
	P0200-20	Thermal Interface	Heat Sink Compound 100 grams (Usable for 50+ relays)
	P0200-19	Thermal Interface	Heat Sink Compound 2 grams (Usable for 1 relay)

Warning Information

Caution: Material Damage, Electric Shock, and Arc Flash Hazard. Before installing or working with this product, take the following precautions:
1. **Disconnect all power:** Ensure that all power sources are disconnected.
2. **Verify connections:** Double-check all connections.

Failure to adhere to these instructions may lead to **serious injury or damage** of equipment.