Solid-State Contactor
SCP2-CE Series

2-Pole Solid-State Contactors



Description

The SCP2-CE series of 2-pole solid-state contactors (SSCs) offers an affordable solution for controlling simple 3-phase heating applications. Designed with efficiency in mind, these SSCs provide essential features without compromising on quality.

- Industrial-Grade Build: Crafted for durability, these SSCs are built to withstand demanding environments using back-to-back SCRs to guarantee high quality, reliability, and longevity.
- IP20 Removable Protection: The IP20-rated design ensures protection against dust and accidental contact. Easily remove the cover for maintenance or adjustments.
- 2-Leg Switching: Optimized for Ungrounded Wye (Star, 3-wire) and Closed Delta (3-wire) configurations, where cutting two phases ensures effective control of balanced 3-phase resistive loads.

Features & Benefits

FEATURES	BENEFITS
Zero Cross Switching	Reduces electrical noise and minimizes voltage spikes during switching, enhancing overall system stability
Compliance with International Standards (cЯUus, CE, UKCA)	Ensures that the Solid-State Contactor (SSC) has undergone rigorous testing, providing enhanced safety and product quality
Efficient Design with High Quality	Balances cost-effectiveness with reliable performance, making it an ideal choice for budget-conscious projects

Applications

- Packaging equipment such as shrink tunnels & process dryers
- Plastic processing machinery such as extrusion & thermoforming machines
- Industrial ovens & furnaces for heavy-duty heating applications
- Process heating equipment such as industrial dryers
- HVAC systems such as duct heaters.
- General industrial heating with closed delta or ungrounded wye (star) wiring

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Ordering Information

FOR HEATING CONTROL

CATALOG NUMBER	OUTPUT MAX CURRENT	OUTPUT VOLTAGE	OUTPUT SWITCHING STYLE	OUTPUT OVERVOLTAGE PROTECTION	INPUT VOLTAGE RANGE	COMPLIANCE
SCP2-CEDZH-025VC-N	25 A	24- 640 V ac	Zero Cross	Varistor	4-30 V dc	cЯUus, CE, UKCA
SCP2-CEDZH-050VC-N	50 A	24- 640 V ac	Zero Cross	Varistor	4-30 V dc	cЯUus, CE, UKCA

Input/Control Specifications[1]

GENERAL DATA

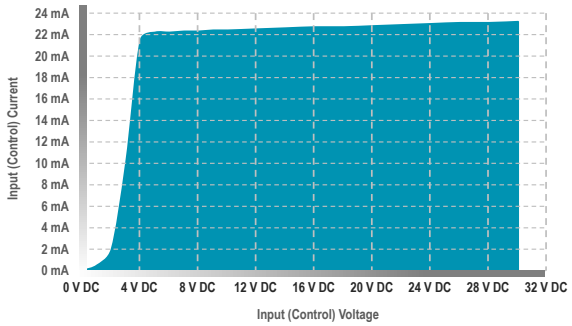
SYMBOL	PARAMETER	RANGE	VALUE	UNIT
Uc	Input (Control) Voltage*	Maximum	30	V dc
		Nominal	5 – 12 – 24	V dc
		Minimum	4	V dc
Urv	Reverse Voltage	Maximum	-30	V dc
Uc on	Turn-On Voltage (Pick-up/Engage/Activation Voltage)	Minimum	4	V dc
Uc off	Turn-Off Voltage (Drop Out/Release/Deactivation Voltage)	Nominal	2	V dc
Ic	Input (Control) Current	Maximum	<25	mA
		Minimum	-	mA
-	Input Impedance	Nominal	Current Regulated	-
Ton	Turn-On Time (Ue typ, 50Hz)	Maximum	10 ms	1/2 Cycle
Toff	Turn-Off Time (Ue typ, 50Hz)	Maximum	10 ms	1/2 Cycle

* Increase Min voltage by 1V for operations from -20 to -40 °C.

Input Current vs Input Voltage Graphs (For Power Supply Selection)

To ensure the Solid-State Contactor (SSC) 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 SSCs across the specified input voltage range (4-30 V dc). This data is crucial for selecting an appropriate power supply and ensuring the Contactor functions within its safe operating limits. Proper understanding of current consumption is vital for the optimal performance of your application.

4-30 VDC



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Output/Load Specifications[1]

GENERAL DATA

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE FOR 25A VERSIONS	VALUE FOR 50A VERSIONS	UNIT
-	Output Configuration	-	-	SPST-NO	SPST-NO	-
f	Operating Frequency	-	Minimum	0.1	0.1	Hz
			Nominal	50 – 60	50 – 60	
			Maximum	400	400	
Ue	Operating Voltage	47-63Hz	Minimum	24	24	Vrms
			Nominal	120 - 240 - 400	120 - 240 - 400	
			Maximum	640	640	
Usync	Zero Cross Level (Zero Voltage Turn-on)	-	Maximum	10	10	V
Ua	Latching Voltage	At Ue Nominal	Minimum	10	10	V
V	On-State Voltage Drop	At Rated Current	Maximum	0,9 + 0,014 x Ie	1 + 0,0075 x Ie	Vrms
Vto	Threshold Voltage (Power Loss Calculations only)	Tvj = 150 °C	Maximum	0.90	1.00	V
rt	On state dynamic resistance (Power Loss Calculations only)	Tvj = 150 °C	Maximum	2.0	7.5	mΩ
Up	Transient Over-Voltage* (Peak/Blocking/Non-Repetitive Voltage)	-	Maximum	1600	1600	Vpk
Itsm	Transient Over-Current (Surge/Overload/Non-Repetitive Current)	Max 1 Cycle Tp = 10ms	Minimum	320	700	Apk
			Nominal	380	750	
Ilk	Leakage Current (Off-State)	At Rated Voltage	Maximum	1	1	mArms
dv/dt	Critical dV/dt (Off-State)	At Maximum Rated Voltage	Minimum	500	500	V/µsec
di/dt	Non-repetitive di/dt	-	Maximum	50	50	A/µsec
I^2t	I^2t Value for Fusing	½ Cycle at 50/60Hz (Tvj=45 °C)	Minimum	510	2450	A^2 sec
			Nominal	720	2800	
Pf	Minimum Power Factor	At Maximum Load	Minimum	0.5	0.5	-
Pd	Power Dissipation	@ Rated Current	Maximum	0,81 x Ie + 0,014 x Ie^2	0,9 x Ie + 0,0075 x Ie^2	W
Rthj/c	Thermal Resistance Junction to Case (Rjc)	-	Maximum	1.1	0.45	°C/W

* Output will self trigger between 450-600Vpk not suitable for capacitive loads.

The maximum continuous current value given in this datasheet is only for resistive loads (specifically AC-1 type), which are mainly used for heating control.

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE FOR 25A VERSIONS	VALUE FOR 50A VERSIONS	UNIT
Ie (AC-51)	Load Current (Continuous) – Heating Elements (AC-1)	At 40 °C	Maximum*	25	50	Arms
			Minimum	0.005	0.005	Arms

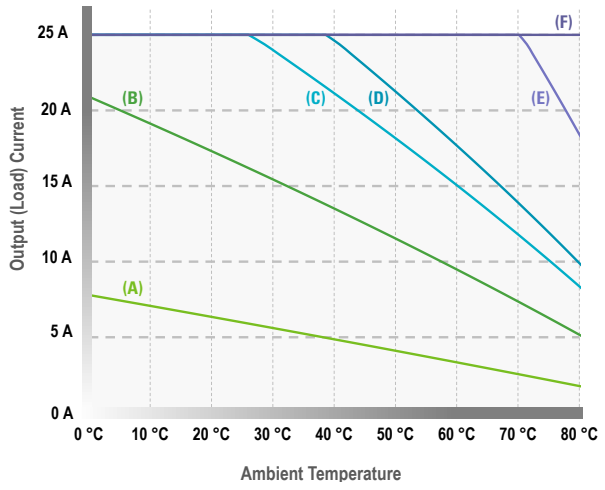
* Heat sinking required, see derating curves.

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Thermal Derating Curves (For Heatsink Selection)

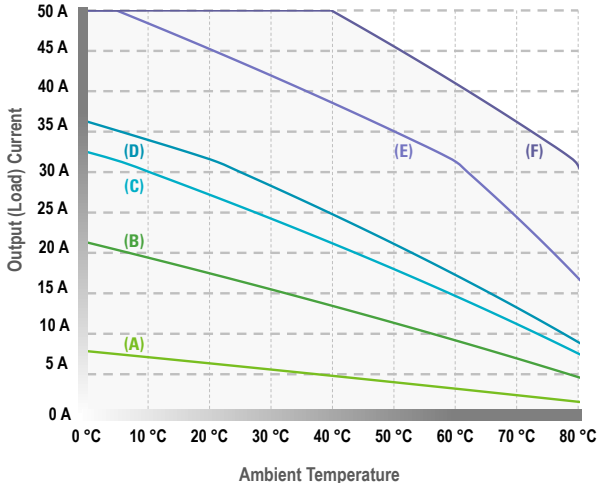
To operate the Solid-State Contactor (SSC) at its specified ratings, the use of a heatsink is mandatory. The following thermal derating curves illustrate the maximum load current that our SSCs can manage under varying ambient temperatures and heatsink sizes. It is crucial to select a heatsink that is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

25A Versions:



(A) 6,0°C/W: Heatsink (C) 1,2 °C/W: Heatsink (E) 0,5 °C/W: Heatsink
(B) 2,0°C/W: Heatsink (D) 1,0 °C/W: Heatsink (F) 0,3 °C/W: Heatsink

50A Versions:



(A) 6,0°C/W: Heatsink (C) 1,2 °C/W: Heatsink (E) 0,5 °C/W: Heatsink
(B) 2,0°C/W: Heatsink (D) 1,0 °C/W: Heatsink (F) 0,3 °C/W: Heatsink

Considerations – Switching Type

In applications requiring precise temperature management, solid-state Contactors (SSCs) play a crucial role. Specifically, the Zero Cross Switching type of SSC is commonly employed to regulate heaters based on signals from a temperature controller. This technology proves particularly valuable in scenarios where high-frequency switching occurs—such as when a heater cycles on and off frequently over short intervals for extended periods.

Considerations – Inrush Current

It's essential to recognize that variations exist between different types of heating elements, especially in hot or cold conditions. While it is generally expected that heating elements exhibit no inrush current, in certain heating elements cold conditions can lead to an inrush current equivalent to 1.4 times the nominal current. To mitigate this, we highly recommend oversizing the current rating and ensuring an appropriately sized heatsink. Doing so improves the Contactor's thermal endurance and extends its operational lifespan.

So, when selecting an SSC, consider using one with a capacity approximately 1.4 times that of the heater or operating the SSC at only 75%-80% of its maximum capacity. The following table provides guidance for choosing the right SSC for a specific heater load.

NOMINAL SSC CURRENT RATING	MAXIMUM RECOMMENDED HEATER CURRENT	HEATER POWER AT 208 VAC	HEATER POWER AT 240 VAC	HEATER POWER AT 400 VAC	HEATER POWER AT 480 VAC	HEATER POWER AT 600 VAC
25 A	20 A	~4.2 kW	~8.3 kW	~13.9 kW	~16.6 kW	~20.8 kW
50 A	40 A	~8.3 kW	~16.6 kW	~27.7 kW	~33.3 kW	~41.6 kW

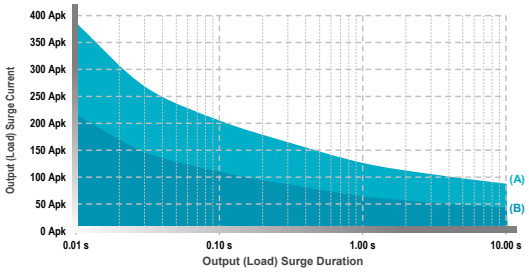
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Output Surge Current Withstand Graphs (For Transient Protection)

To ensure the Solid-State Contactor (SSC) 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 SSCs can withstand over various durations. This information is crucial for selecting an SSC 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.

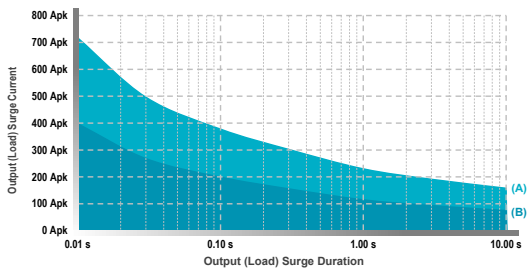
The graphs include a Single Pulse Surge Current curve used to define the protection offered by fuses, helping in the selection of appropriate protective devices. Additionally, is important to ensure that the Repetitive Surge Current curve is not exceeded during normal operation, as frequent overload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

25A Versions



(A) Single Pulse Surge: Initial SSC internal temperature at 25°C (cooler state from minimal or no operation).
(B) Repetitive Surges: Initial SSC internal temperature 70°C (warmer state from continuous operation).

50A Versions



(A) Single Pulse Surge: Initial SSC internal temperature at 25°C (cooler state from minimal or no operation).
(B) Repetitive Surges: Initial SSC internal temperature 70°C (warmer state from continuous operation).

General Specifications[1]

GENERAL DATA

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE	UNIT
-	LED for Input (Control) Status Indicator	-	-	Continuously ON Green LED, when control input is applied	-
Ui	Isolation (Dielectric Strength)	Input to Output (50/60 HZ)	Nominal	4000	Vrms
		Input/Output to Ground (50/60 HZ)	Nominal	4000	
Ri	Insulation Resistance	@ 500 V dc	Minimum	1	GΩ
Ci	Coupling Capacitance	Input/Output	Maximum	0.8	pF
Uimp	Impulse Withstand Voltage	-	Nominal	4000	Vrms
-	Short Circuit Current Rating (SCCR)	-	-	5	kA
-	Endurance according to American Standard UL508	-	Typical	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)	-	-	57	Years
-	MTBF* (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	-	48	Years
		@ 60 °C ambient	-	37	

*All parameters at 50% power rating and 100% duty cycle.

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General Specifications[1] (Continued)

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	30 / 50	g
-	Ambient Temperature - Operating (Working)*	No icing, no condensation	Maximum Minimum	100 (212) -40 (-40)†	°C (°F) °C (°F)
-	Ambient Temperature - Storage	No icing, no condensation	Maximum Minimum	125 (257) -40 (-40)†	°C (°F) °C (°F)
HR	Relative Ambient Humidity (Per international standard IEC/EN 60068-2-78)	Non-condensing @ 40 °C	Nominal	40 to 85	%
-	Pollution Degree	Non-conductive pollution with condensation possibilities	Nominal	2	-

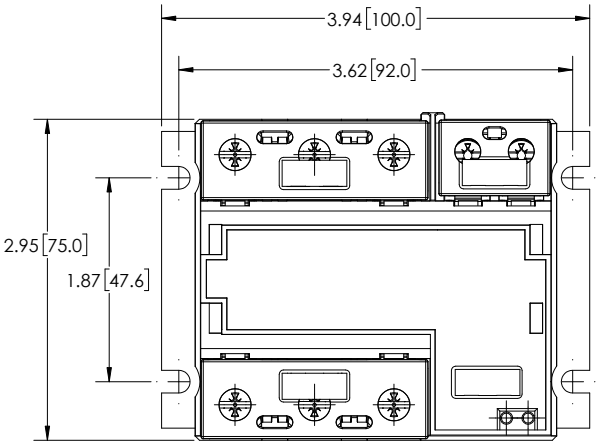
* AC input option minimum operating temperature is -20 to 80 °C (-4 to 176 °F).
† Value for 10A, 20A, 40A and 50A versions is -55 (-67) °C (°F).

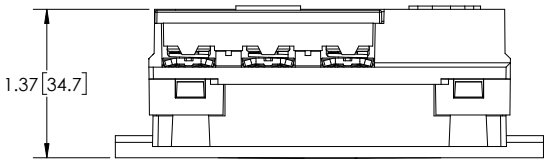
MECHANICAL DATA

SYMBOL	PARAMETER	CONDITION	RANGE	VALUE	UNIT
-	Product Weight	-	Typical	80 (0.18)	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-0	-
-	Baseplate Material	-	-	Aluminum, Tinned-plated	-
-	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 Maximum	1.2 (11) 2.0 (18)	Nm (in-lb)
		Output (Load) Terminals	Minimum Maximum	2 (18) 3 (26)	Nm (in-lb)
		SSR Mounting	Minimum Maximum	1.2 (11) 1.8 (16)	Nm (in-lb)
-	Screw Thread Size	Input Terminals Output Terminals SSR Mounting	- - -	M4 x 12mm M5 x 13mm M4 x 12mm or #8-32 Pan Head	- - -

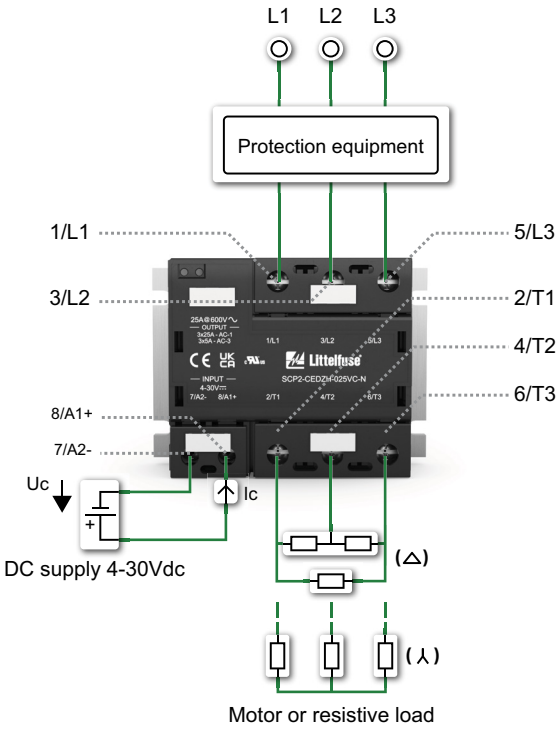
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Product Dimensions [Millimeters]

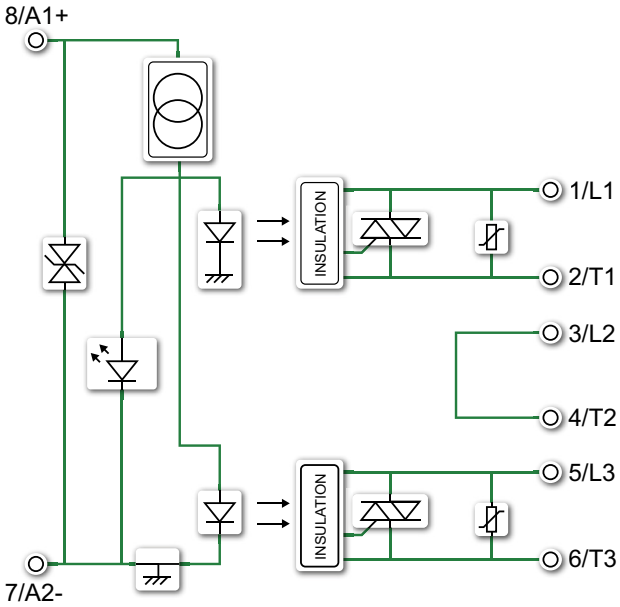




Wiring Diagram



Equivalent Circuit Block



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Short-Circuit Protection by Fuse

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



- Fuse Selection: The I²t value (energy withstand capability) of the fuse should be less than half of the I²t value of the Contactor. Standard fuses are inadequate because they cannot react swiftly enough to prevent fault currents from exceeding the maximum levels that thyristors (used in SSCs) can handle. Therefore, we strongly recommend employing ultra-fast fuses.
- Fuse Placement: Position the fuse in front of the SSC in the circuit. In 2-leg SSCs, protection is normally provided on the two controlled phases (two fuses in total). This strategic placement ensures that if the Contactor 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	cRUus	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** UK Regulations of Electromagnetic Compatibility. In accordance with the Low Voltage Gear Testing Guidelines of the International Standard IEC 60947-4-3 **SI 3032** UK Regulations 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

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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 A: 30M – 1GHz
IEC	Conducted RF	Radio interference voltage emissions (conducted)	International Standard CISPR 11	Class A (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 -Performance Criteria: A
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) Performance Criteria: A
IEC	Burst	Immunity Electrical Fast Transients (Burst)	International Standard IEC 61000-4-4	2 kV Performance Criteria: B
IEC	Surge	Immunity to Electrical Surges	International Standard IEC 61000-4-5	2 kV Performance Criteria: B
IEC	Conducted RF	Immunity to Conducted Radio Frequency	International Standard IEC 61000-4-6	Level 3: 10V/m (0.15 - 80 MHz) Performance Criteria: A
IEC	Dips	Immunity to Voltage Dips	International Standard IEC61000-4-11	-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.

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Environmental Compliance[2]

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

Accessories

IMAGE	CATALOG NUMBER	TYPE	DESCRIPTION
	SADH-NN120	Heatsink	1.2 °C/W Thermal Resistance
	SADH-NN100	Heatsink	1.0 °C/W Thermal Resistance
	SADH-ND030	Heatsink	0.3 °C/W Thermal Resistance, 24 VDC
	SADH-NA030	Heatsink	0.3 °C/W Thermal Resistance, 230 VAC
	SANG-CNN090	Thermal Interface	Thermal Paste

Notes:

[1]All parameters at 25 °C unless otherwise specified.

[2]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.

Warning Information

Caution: Material Damage, Electric Shock, and Arc Flash Hazard. Before installing or working with this equipment, 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.

Disclaimer Notice – Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at **www.littelfuse.com/product-disclaimer.**

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