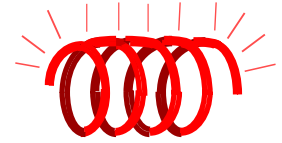




## Solid State Relays for heating applications AC-51

### APPLICATION NOTE



Heating applications with regulation need high frequency ON/OFF.

Zero cross Solid State Relays are very well adapted for such application.

For the SSR choice, mains voltage, heating power, but also value of the resistance in cold conditions must be taken into account. Some types of resistances have important difference values between cold and hot conditions.

For example, some resistances with nickel-chrome or constantan,... can have inrush current at cold conditions = 1,4 times the nominal current.

Standards give for AC-51 loads a reference with a starting current in cold conditions = 1,4 x the nominal current.

In fact, keep a small margin in terms of current and have a correct heatsink improve the thermal stress and increase the lifetime of the product.

SO9 range is well adapted for such applications.

At the end of life of the resistances, generally the load is opened. We can detect this problem with our SOD range.

But sometimes resistance becomes in short-circuit. To respect rules, it is necessary to add a correct protection of the system.

The minimum is to protect the installation in case of short-circuit, but with a normal short-circuit protection, the SSR can be damaged. For a correct protection of the SSR, it is necessary to protect the installation with fast fuses or with fast circuit breakers.

In case of important surge voltages, we advise to use voltage protection with VDRs.

SO8 range with very low zero cross level are built in standard with internal VDRs. VDR is optional for SO9 range, because often the protection of the mains is made inside the installation.



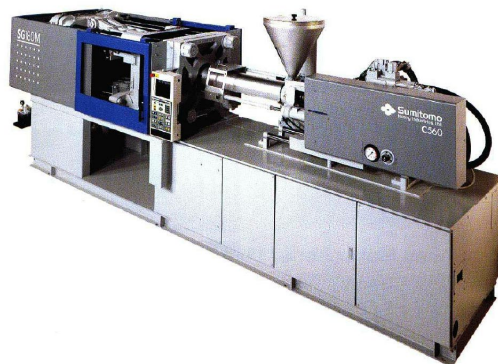
**Following pages give some advises for the choice of components : SSRs, heatsinks, protection, .... in compliance with your mains and power heating applications.**

**The specifications are given in hard conditions for a permanent current without ventilation, with an ambient temperature of 40°C and a maximum rise temperature of 50°C according IEC60947-4-3 standard.**

#### Typical applications :

##### Industry

- \* Plastic machines
- \* Furnaces
- \* Textile machines
- \* .....



##### Domestic and food applications

- \* Heating
- \* Coffee machines
- \* Cookers
- \* .....

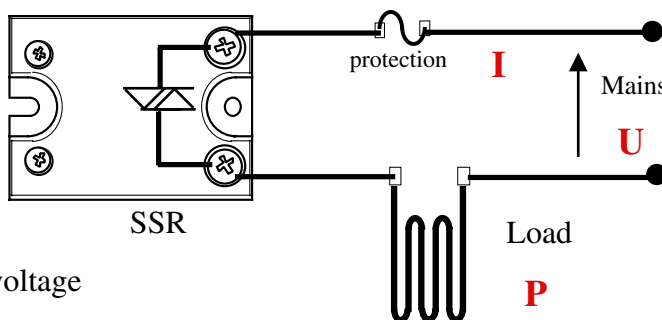


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## 1- ONE POLE

Mains  
230/240VRMS  
50/60hz



$$I = P/U$$

Current (A) = Power Load (W) / Mains voltage (V)

This table is designed with **okpac** range. For other sizes of SSR, please consult us.

### PROTECTION WITH A FUSE

Load POWER	Current (I) with 230 VAC mains (50/60hz)	SSR	Power dissipation on the SSR (Watts)	Heatsink calculation with Tambient = 40°C	celduc Heatsink for DIN rail with a permanent current and without ventilation	FUSES for SEMICONDUCTORS gR (gRB/gRC); aR or URD FERRAZ, SIBA ....
< 1000W	4,5	SOx41xxx	4,3	< 13 K/W	1LD12020	gR10 or 12A I <sup>2</sup> <sub>t</sub> < 72A <sup>2</sup> <sub>s</sub>
1500W	6,6	SOx41xxx	6,9	< 8,7 K/W	1LD12020	gR10 or 12A I <sup>2</sup> <sub>t</sub> < 72A <sup>2</sup> <sub>s</sub>
2000W	9	SOx42xxx	8,2	< 7,3 K/W	1LD12020	gR16A I <sup>2</sup> <sub>t</sub> < 310A <sup>2</sup> <sub>s</sub>
3000W	13,2	SOx42xxx	12,9	< 4,6 K/W	WF151200	gR20A I <sup>2</sup> <sub>t</sub> < 310A <sup>2</sup> <sub>s</sub>
4000W	17,5	SOx43xxx	18,8	< 3,2 K/W	WF151200	gR32A I <sup>2</sup> <sub>t</sub> < 800A <sup>2</sup> <sub>s</sub>
6000W	26,1	SOx43xxx	31,4	< 1,9 K/W	WF121000 or WF108110	gR32A I <sup>2</sup> <sub>t</sub> < 800A <sup>2</sup> <sub>s</sub>
8000W	35	SOx45xxx	43	< 1,4 K/W	WF121000 or WF108110	gR50A I <sup>2</sup> <sub>t</sub> < 1500A <sup>2</sup> <sub>s</sub>
10 000W	44	SOx47xxx	44,4	< 1,3 K/W	WF121000 or WF108110	gR63A I <sup>2</sup> <sub>t</sub> < 5000A <sup>2</sup> <sub>s</sub>
12 000W	53	SOx47xxx	55,5	< 1 K/W	WF115110	gR63A I <sup>2</sup> <sub>t</sub> < 5000A <sup>2</sup> <sub>s</sub>
15 000W	66	SOx48xxx	68,7	< 0,8 K/W	WF070000 or WF031100	gR80A I <sup>2</sup> <sub>t</sub> < 11000A <sup>2</sup> <sub>s</sub>
18 000W	78,3	SOx48xxx	84,9	< 0,6 K/W	WF070000 or WF031100	gR100A I <sup>2</sup> <sub>t</sub> < 11000A <sup>2</sup> <sub>s</sub>
20 000 W	87	SOx49xxx	86	< 0,6 K/W	WF050000 or WF031100	gR125A I <sup>2</sup> <sub>t</sub> < 20000A <sup>2</sup> <sub>s</sub>
22 000W	96	SOx49xxx	96,2	< 0,5 K/W	WF031100	gR125A I <sup>2</sup> <sub>t</sub> < 20000A <sup>2</sup> <sub>s</sub>

### PROTECTION WITH A CIRCUIT BREAKER

Load POWER	Current (I) with 230 and 240VAC mains (50/60hz)	SSR	Power dissipation on the SSR (Watts)	Heatsink calculation with Tambient = 40°C	celduc Heatsink for DIN rail with a permanent current and without ventilation	Miniature Circuit Breaker for semiconductor ABB/ MOELLER/ MERLIN GERIN
< 1000W	4,5	SOx47xxx	3,8	< 16 K/W	1LD12020	Z16
1500W	6,6	SOx47xxx	5,6	< 10,8 K/W	1LD12020	Z16
2000W	9	SOx47xxx	7,7	< 7,8 K/W	1LD12020	Z16
3000W	13,2	SOx47xxx	11,5	< 5,2 K/W	WF151200	Z25
4000W	17,5	SOx47xxx	15,6	< 3,8 K/W	WF151200	Z40
6000W	26,1	SOx48xxx	22,6	< 2,5 K/W	WF151200	Z40
8000W	35	SOx48xxx	32,7	< 1,8 K/W	WF121000 or WF108110	Z50



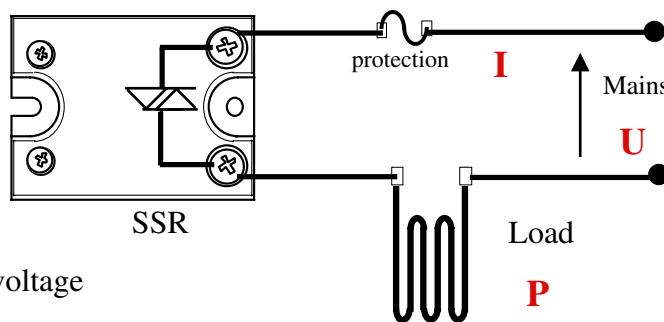
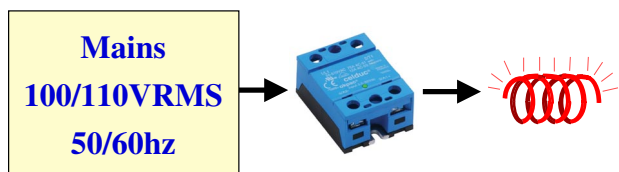
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## 1- ONE POLE



$$I = P/U$$

Current (A) = Power Load (W) / Mains voltage (V)

This table is designed with **okpac** range. For other sizes of SSR, please consult us.

### PROTECTION WITH A FUSE

Load POWER	Current (I) with 100 VAC mains (50/60hz)	SSR	Power dissipation on the SSR (Watts)	Heatsink calculation with Tambient = 40°C	celduc Heatsink for DIN rail with a permanent current and without ventilation	FUSES for SEMICONDUCTORS gR (gRB/gRC); aR or URD FERRAZ, SIBA ....
< 1000W	10	SOx42xxx	9,3	< 6,5 K/W	1LD12020	gR16A I <sup>2</sup> t < 310A <sup>2</sup> s
1500W	15	SOx42xxx	15,1	< 3,8 K/W	WF151200	gR20A/25A I <sup>2</sup> t < 310A <sup>2</sup> s
2000W	20	SOx43xxx	22,2	< 2,7 K/W	WF151200	gR32A I <sup>2</sup> t < 800A <sup>2</sup> s
3000W	30	SOx45xxx	35,1	< 1,7 K/W	WF121000 or WF108110	gR50A I <sup>2</sup> t < 1500A <sup>2</sup> s
4000W	40	SOx47xxx	39,6	< 1,5 K/W	WF121000 or WF108110	gR63A I <sup>2</sup> t < 5000A <sup>2</sup> s
5000W	50	SOx47xxx	51,8	< 1,14 K/W	WF121000 or WF108110	gR63/80A I <sup>2</sup> t < 5000A <sup>2</sup> s
6000W	60	SOx48xxx	61,2	< 0,98 K/W	WF115110	gR80A I <sup>2</sup> t < 11000A <sup>2</sup> s
8000W	80	SOx48xxx	87,2	< 0,57 K/W	WF050000 or WF031100	gR100A I <sup>2</sup> t < 11000A <sup>2</sup> s
10 000W	100	SOx49xxx	101	< 0,44 K/W	WF031100	gR125A I <sup>2</sup> t < 20000A <sup>2</sup> s

### PROTECTION WITH A CIRCUIT BREAKER

Load POWER	Current (I) with 230 and 240VAC mains (50/60hz)	SSR	Power dissipation on the SSR (Watts)	Heatsink calculation with Tambient = 40°C	celduc Heatsink for DIN rail with a permanent current and without ventilation	Miniature Circuit Breaker for semiconductor ABB/ MOELLER/ MERLIN GERIN
< 1000W	10	SOx47xxx	8,5	< 7 K/W	1LD12020	Z16
1500W	15	SOx47xxx	13,2	< 4,6 K/W	WF151200	Z25
2000W	20	SOx47xxx	18	< 3,3 K/W	WF151200	Z25 or Z40
3000W	30	SOx48xxx	27,5	< 2,2 K/W	WF121000 or WF108110	Z40
4000W	40	SOx48xxx	38	< 1,6 K/W	WF121000 or WF108110	Z50



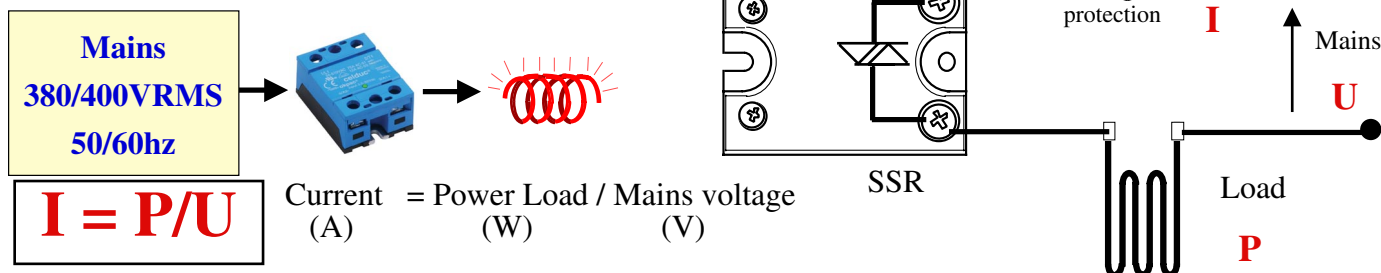
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# 1- ONE POLE



$$I = P/U$$

Current (A) = Power Load (W) / Mains voltage (V)

This table is designed with **okpac** range. For other sizes of SSR, please consult us.

## PROTECTION WITH A FUSE

Load POWER	Current (I) with 380 VAC mains (50/60hz)	SSR	Power dissipation on the SSR (Watts)	Heatsink calculation with Tambient = 40°C	celduc Heatsink for DIN rail with a permanent current and without ventilation	FUSES for SEMICONDUCTORS gR (gRB/gRC); aR or URD FERRAZ, SIBA ....
< 1000W	2,6	SOx63xxx	2,5	< 20 K/W	1LD12020	gR10 or 12A I <sup>2</sup> t < 700A <sup>2</sup> s
2000W	5,3	SOx63xxx	4,7	< 12 K/W	1LD12020	gR10 or 12A I <sup>2</sup> t < 700A <sup>2</sup> s
3000W	7,9	SOx63xxx	7,4	< 8 K/W	1LD12020	gR16A I <sup>2</sup> t < 700A <sup>2</sup> s
4000W	10,5	SOx63xxx	10,2	< 5,9 K/W	WF151200	gR25A I <sup>2</sup> t < 700A <sup>2</sup> s
6000W	15,8	SOx63xxx	16,5	< 3,6 K/W	WF151200	gR25A I <sup>2</sup> t < 700A <sup>2</sup> s
8000W	21	SOx63xxx	23,6	< 2,5 K/W	WF151200	gR32A I <sup>2</sup> t < 700A <sup>2</sup> s
10 000W	26,3	SOx65xxx	29,6	< 2 K/W	WF121000 or WF108110	gR32 or 40A I <sup>2</sup> t < 1500A <sup>2</sup> s
12 000W	31,6	SOx65xxx	37,5	< 1,6 K/W	WF121000 or WF108110	gR50A I <sup>2</sup> t < 1500A <sup>2</sup> s
15 000W	39,5	SOx67xxx	39	< 1,5 K/W	WF121000 or WF108110	gR50A I <sup>2</sup> t < 5000A <sup>2</sup> s
18 000W	47,5	SOx67xxx	48,6	< 1,2 K/W	WF121000 or WF108110	gR63A I <sup>2</sup> t < 5000A <sup>2</sup> s
20 000 W	52,6	SOx67xxx	55	< 1 K/W	WF115110	gR63A I <sup>2</sup> t < 5000A <sup>2</sup> s
25 000W	65,8	SOx68xxx	68,4	< 0,84 K/W	WF070000 or WF031100	gR80A I <sup>2</sup> t < 11000A <sup>2</sup> s
30 000W	79	SOx68xxx	85,8	< 0,59 K/W	WF050000 or WF031100	gR100A I <sup>2</sup> t < 11000A <sup>2</sup> s
40 000W	105	SOx69xxx	107,1	< 0,44 K/W	WF031100	gR125A I <sup>2</sup> t < 20000A <sup>2</sup> s

## PROTECTION WITH A CIRCUIT BREAKER

Load POWER	Current (I) with 230 and 240VAC mains (50/60hz)	SSR	Power dissipation on the SSR (Watts)	Heatsink calculation with Tambient = 40°C	celduc Heatsink for DIN rail with a permanent current and without ventilation	Miniature Circuit Breaker for semiconductor ABB/ MOELLER/ MERLIN GERIN
< 1000W	2,6	SOx67xxx	2,6	< 28 K/W	1LD12020	Z10 or Z16
2000W	5,3	SOx67xxx	4,4	< 13 K/W	1LD12020	Z16
3000W	7,9	SOx67xxx	6,7	< 8,9 K/W	1LD12020	Z16 or Z25
4000W	10,5	SOx67xxx	9	< 6,6 K/W	1LD12020	Z25
6000W	15,8	SOx67xxx	14	< 4,3 K/W	WF151200	Z25 or 32
8000W	21	SOx67xxx	19	< 3,1 K/W	WF151200	Z32
10 000W	26,3	SOx68xxx	24,4	< 2,4 K/W	WF151200	Z40
12 000W	31,6	SOx68xxx	29	< 2 K/W	WF121000 or WF108110	Z50
15 000W	39,5	SOx68xxx	37,5	< 1,6 K/W	WF121000 or WF108110	Z50



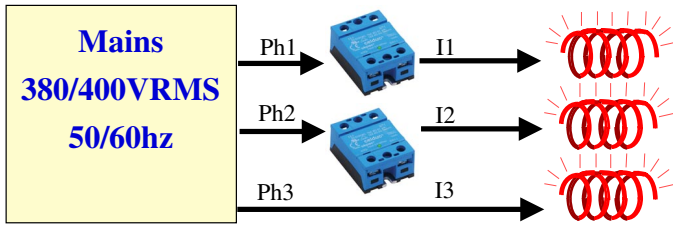
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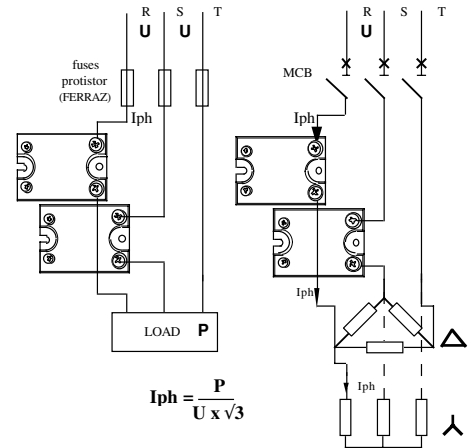
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# 1- Three Phase (2 leg)



$$I = P / (U \times 1,732)$$

Current (A) = Power Load (W) / (Mains voltage (V) x square root 3)



This table is designed with **okpac** range. For other sizes of SSR, please consult us.

PROTECTION WITH A FUSE						
Load POWER	Current (A) (I1 = I2 = I3) with 380 VAC mains (50/60hz)	SSR 1 phase 1 1 phase 2	Power dissipation on the SSR (Watts)	Heatsink calculation with Tambient = 40°C 1 heatsink per SSR	celduc Heatsink for DIN rail with a permanent current and without ventilation	FUSES for SEMICONDUCTORS gR (gRB/gRC); aR or URD FERRAZ, SIBA ....
<3000W	4,5	SOx63xxx	4	< 15 K/W	1LD12020	gR16A I <sup>2</sup> t < 700A <sup>2</sup> s
4000W	6	SOx63xxx	5,4	< 11 K/W	1LD12020	gR16A I <sup>2</sup> t < 700A <sup>2</sup> s
6000W	9,1	SOx63xxx	8,6	< 7 K/W	1LD12020	gR16A I <sup>2</sup> t < 700A <sup>2</sup> s
8000W	12,2	SOx63xxx	12,1	< 5 K/W	WF151200	gR25A I <sup>2</sup> t < 700A <sup>2</sup> s
10 000W	15,2	SOx63xxx	15,7	< 3,8 K/W	WF151200	gR25A I <sup>2</sup> t < 700A <sup>2</sup> s
12 000W	18,2	SOx63xxx	19,7	< 3 K/W	WF151200	gR25/32A I <sup>2</sup> t < 700A <sup>2</sup> s
15 000W	22,8	SOx63xxx	26,2	< 2,3 K/W	WF151200	gR32A I <sup>2</sup> t < 700A <sup>2</sup> s
18 000W	27,3	SOx65xxx	31	< 1,9 K/W	WF121000 or WF108110	gR40/50A I <sup>2</sup> t < 1500A <sup>2</sup> s
20 000 W	30,4	SOx65xxx	35,7	< 1,7 K/W	WF121000 or WF108110	gR40/50A I <sup>2</sup> t < 1500A <sup>2</sup> s
25 000W	38	SOx67xxx	37,3	< 1,6 K/W	WF121000 or WF108110	gR50A I <sup>2</sup> t < 5000A <sup>2</sup> s
30 000W	45,6	SOx67xxx	46,3	< 1,3 K/W	WF121000 or WF108110	gR50/63A I <sup>2</sup> t < 5000A <sup>2</sup> s
40 000W	60,8	SOx67xxx	65,9	< 0,8 K/W	WF070000 or WF031100	gR80A I <sup>2</sup> t < 5000A <sup>2</sup> s
50 000W	76	SOx68xxx	81,8	< 0,64 K/W	WF050000 or WF031100	gR100A I <sup>2</sup> t < 11000A <sup>2</sup> s
60 000W	91,2	SOx69xxx	90,5	< 0,6 K/W	WF031100	gR125A I <sup>2</sup> t < 11000A <sup>2</sup> s

PROTECTION WITH A CIRCUIT BREAKER						
Load POWER	Current (I1 = I2 = I3) with 380 VAC mains (50/60hz)	SSR	Power dissipation on the SSR (Watts)	Heatsink calculation with Tambient = 40°C	celduc Heatsink for DIN rail with a permanent current and without ventilation	Miniature Circuit Breaker for semiconductor ABB/ MOELLER/ MERLIN GERIN
<4000W	6	SOx67xxx	5,5	< 12 K/W	1LD12020	Z10 or Z16
6000W	9,1	SOx67xxx	7,7	< 7,7 K/W	1LD12020	Z16 or Z25
8000W	12,2	SOx67xxx	10,6	< 5,7 K/W	WF151200	Z25
10 000W	15,2	SOx67xxx	13,4	< 4,5 K/W	WF151200	Z25 or 32
15 000W	22,8	SOx67xxx	20,8	< 2,9 K/W	WF151200	Z32
18 000W	27,3	SOx67xxx	25,4	< 2,4 K/W	WF151200	Z40
20 000 W	30,4	SOx68xxx	27,9	< 2,2 K/W	WF121000 or WF108110	Z40
25 000W	38	SOx68xxx	35,8	< 1,7 K/W	WF121000 or WF108110	Z50

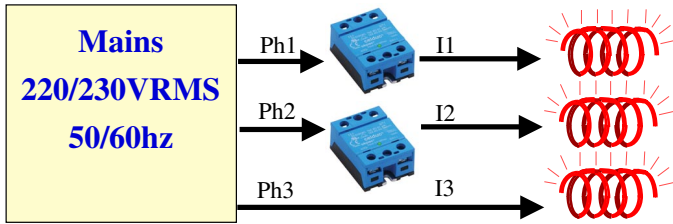


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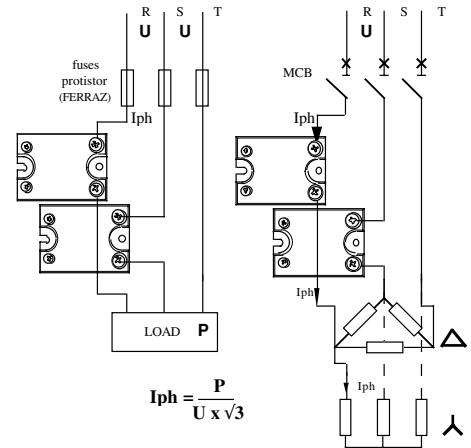
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# 1- Three Phase (2 leg)



$$I = P / (U \times 1,732)$$

Current (A) = Power Load (W) / (Mains voltage (V) x square root 3)



This table is designed with **okpac** range. For other sizes of SSR, please consult us.

## PROTECTION WITH A FUSE

Load POWER	Current (A) (I1 = I2 = I3) with 220 VAC mains (50/60hz)	SSR 1 phase 1 1 phase 2	Power dissipation on the SSR (Watts)	Heatsink calculation with Tambient = 40°C 1 heatsink per SSR	celduc Heatsink for DIN rail with a permanent current and without ventilation	FUSES for SEMICONDUCTORS gR (gRB/gRC); aR or URD FERRAZ, SIBA ....
<3000W	7,8	SOx42xxx	7	< 8,6 K/W	1LD12020	gR16A I <sup>2</sup> t < 310A <sup>2</sup> s
4000W	10,5	SOx42xxx	9,8	< 6,1 K/W	WF151200	gR20A/25A I <sup>2</sup> t < 310A <sup>2</sup> s
6000W	15,8	SOx43xxx	16	< 3,5 K/W	WF151200	gR25A I <sup>2</sup> t < 800A <sup>2</sup> s
8000W	21	SOx43xxx	23,6	< 2,5 K/W	WF151200	gR32A I <sup>2</sup> t < 800A <sup>2</sup> s
10 000W	26,2	SOx43xxx	31,5	< 1,9 K/W	WF121000 or WF108110	gR32/40A I <sup>2</sup> t < 800A <sup>2</sup> s
12 000W	31,5	SOx45xxx	37,4	< 1,6 K/W	WF121000 or WF108110	gR40A I <sup>2</sup> t < 1500A <sup>2</sup> s
15 000W	39,4	SOx47xxx	39,8	< 1,5 K/W	WF121000 or WF108110	gR50A I <sup>2</sup> t < 5000A <sup>2</sup> s
18 000W	47,3	SOx47xxx	48,4	< 1,2 K/W	WF121000 or WF108110	gR63A I <sup>2</sup> t < 5000A <sup>2</sup> s
20 000 W	52,5	SOx47xxx	54,9	< 1 K/W	WF115100	gR63/80A I <sup>2</sup> t < 5000A <sup>2</sup> s
25 000W	65,6	SOx48xxx	68,2	< 0,85 K/W	WF070000 or WF031100	gR80A I <sup>2</sup> t < 11000A <sup>2</sup> s
30 000W	78,7	SOx48xxx	85,4	< 0,6 K/W	WF050000 or WF031100	gR100A I <sup>2</sup> t < 11000A <sup>2</sup> s
40 000W	105	SOx49xxx	107,1	< 0,44 K/W	WF031100	gR125A I <sup>2</sup> t < 20000A <sup>2</sup> s

## PROTECTION WITH A CIRCUIT BREAKER

Load POWER	Current (I1 = I2 = I3) with 380 VAC mains (50/60hz)	SSR	Power dissipation on the SSR (Watts)	Heatsink calculation with Tambient = 40°C	celduc Heatsink for DIN rail with a permanent current and without ventilation	Miniature Circuit Breaker for semiconductor ABB/ MOELLER/ MERLIN GERIN
<3000W	7,8	SOx67xxx	6,6	< 9,1 K/W	1LD12020	Z10 or Z16
4000W	10,5	SOx67xxx	9	< 6,7 K/W	WF151200	Z16
6000W	15,8	SOx67xxx	14	< 4,3 K/W	WF151200	Z25
8000W	21	SOx67xxx	19	< 3,1 K/W	WF151200	Z32
10 000W	26,2	SOx67xxx	24,3	< 2,4 K/W	WF151200	Z32
12 000W	31,5	SOx68xxx	29	< 2 K/W	WF121000 or WF108110	Z40
15 000W	39,4	SOx68xxx	37,4	< 1,6 K/W	WF121000 or WF108110	Z50



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