

How to select the suitable heatsink

I- Type of publication

<input type="checkbox"/> Typical application	<input type="checkbox"/> Level 2 use
<input checked="" type="checkbox"/> Best know Method (BKM)	<input type="checkbox"/> Internal use
<input type="checkbox"/> Troubleshooting guide	<input checked="" type="checkbox"/> Customer

II- Product

- Product range :

Zelio Relay ▼

- Product family :

SSR ▼

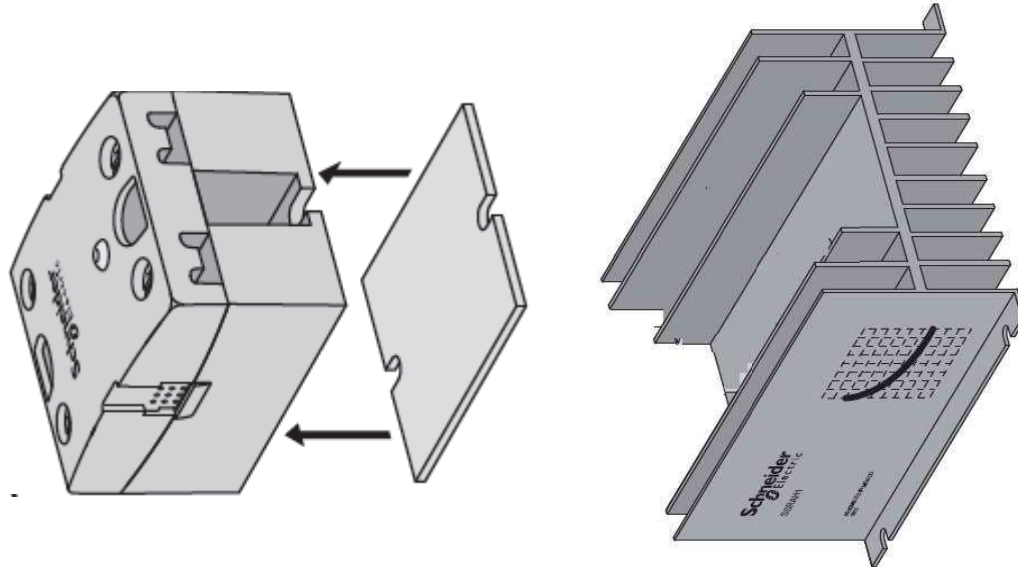
III- Introduction

The forward voltage drop of the output SCRs, induce an internal power loss, depending on the load current.

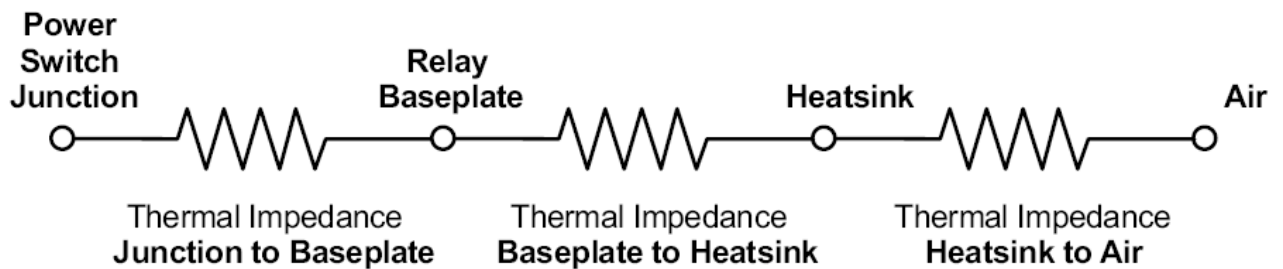
In order to maintain an acceptable power switch junction temperature, panel mounting SSR require an external heatsink to dissipate the heat generated by the power loss, otherwise the life and switching reliability will be compromised.

IV- Method

Method # 1: SSR + Thermal pad + Heatsink



The electrical analogy shown below, identifies the primary thermal impedances from junction to ambient air:



By knowing the three thermal impedance values, and the expected ambient air temperature, the Power Switch Junction temperature must be below 125°C. Most designs are based on a 10 °C margin, keeping the junction temperature, no more than 115°C.

At normal load currents the power loss can be estimated at 1 Watt for every 1 A rms of load current.

The Thermal Resistance Junction to Case value, expressed in °C/W, is given in the catalogue. It is useful to compare the different thermal performance of each SSR, and is also a needed parameter in calculations to determine how much heatsinking is needed.

To ensure the lowest thermal impedance Baseplate to Heatsink, it is required to use a thermal pad (Typical value: 0,1°C/W). It is important that the surface to which the relay is being assembled is clean, flat, bare metal (**NOT PAINTED**). If an anodized aluminum heatsink is used, the thermal impedance of the anodized surface may be acceptable, depending on the thickness of the anodize.

The Thermal impedance of the Heatsink is a data given in catalogue.

Example:

SSR: SSRPCDS50A1 (0,63°C/W).
 Thermal pad : 0,1°C/W (Typical value).
 Heatsink: SSRAH1 (0,7°C/W).
 Load current: 30 A → 30 W internally generated.
 Ambient environment : 60°C.

The Power Switch Junction temperature = $(0,63°C/W \times 30W) + (0,1°C/W \times 30W) + (0,7°C/W \times 30W) + 60°C = 102,9°C < 125°C$.

Method #2:

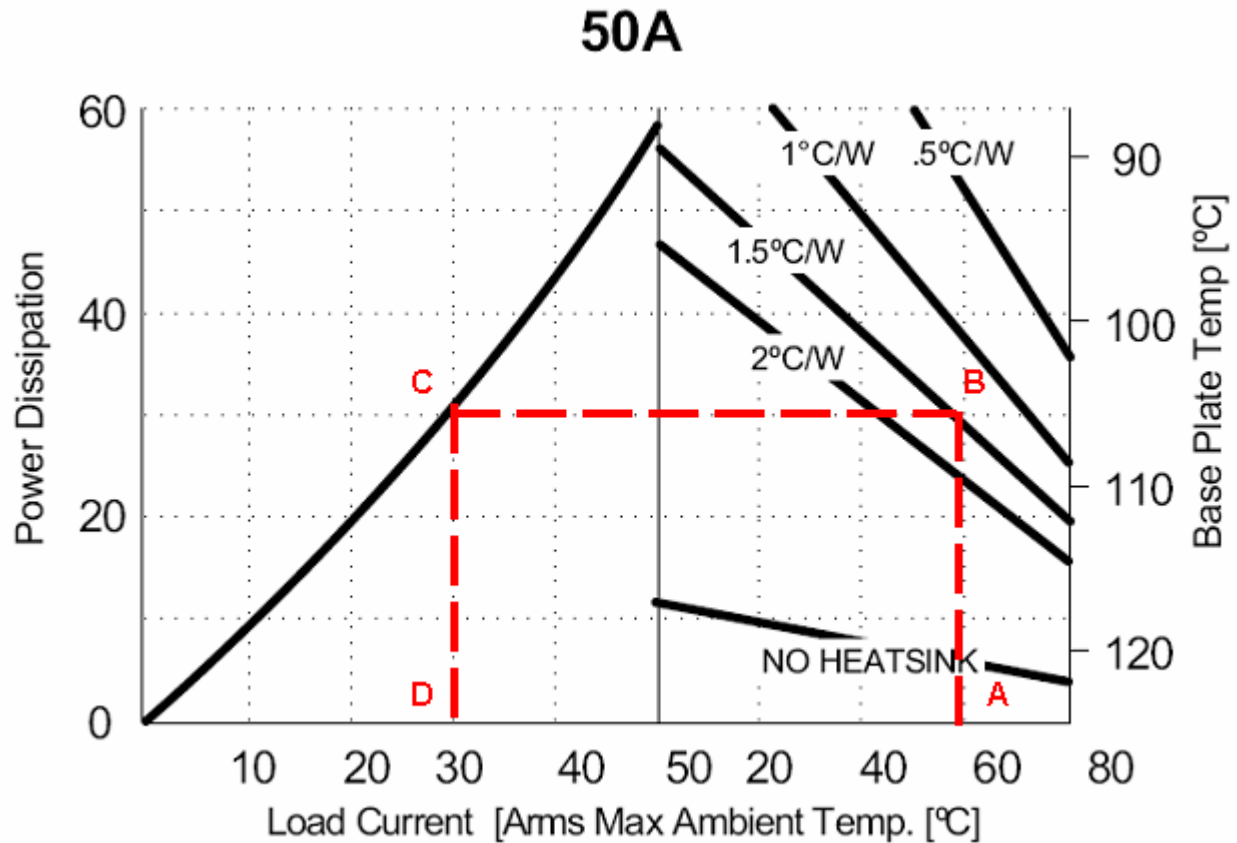
To determine the adequate heatsink system for a particular application, without going through the previous calculations, derating curves are provided for each specific SSR.

As in the case with the calculation method, using the derating curves given in the instruction sheets and catalogue, help to determine any of the variables that the system designer wants to deal with. (i.e. maximum current at a particular ambient, what heatsink to use for a set current and ambient, what is the max. ambient for a particular system, etc.)

Example :

If a SSRPCDS50A1 (50A), is mounted on a heatsink with a thermal resistance of 1,5°C/W and must operate in an ambient of 60°C.

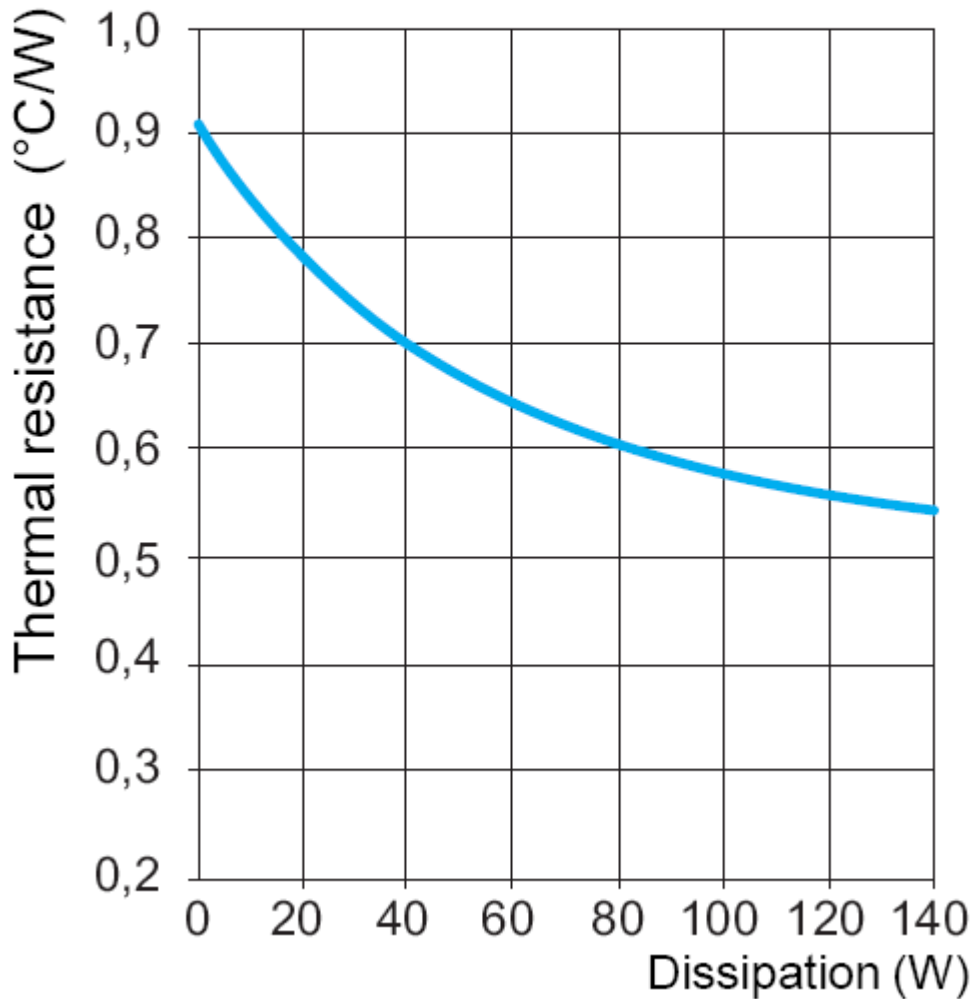
Regarding the thermal derating curves below, and following the route A,B,C,D, the allowable load current is 30A.



Note :

Heatsink ratings are not a constant. Their efficiency improves, ($^{\circ}\text{C}/\text{W}$ rating gets smaller), as the power they are dissipating increases.

Heat sink dissipation curve



These derating curves can create confusion.

So today, the suppliers of heatsink do not give this data, but the Thermal resistance at 40°C .

SSRAH1 has a fixed value of $0,7^{\circ}\text{C}/\text{W}$ thermal resistance.

Considering that if the temperature is higher than 40°C , the thermal resistance will be also better, and if temperature is lower than 40°C , the thermal resistance will be higher but in the meantime the work conditions are better.