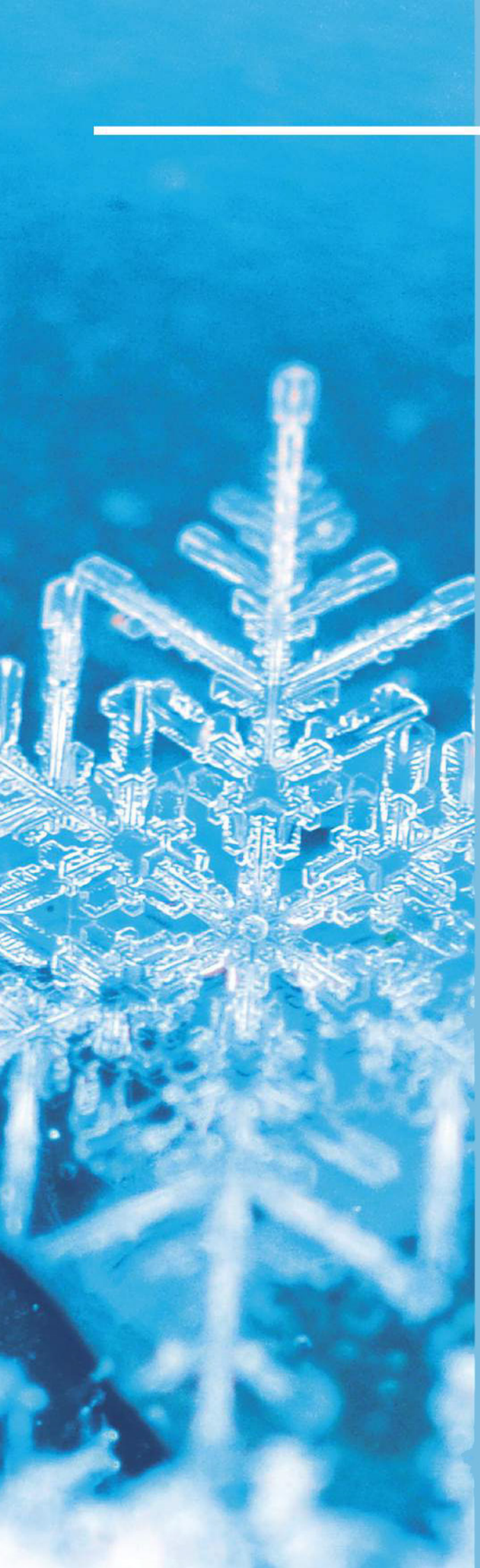


Crystal花形散热片
Crystal Heat Sink

警告/WARNING

散热片装置用于LED灯散热。
LED灯温度在连接处达到最高，因此有强制性规定，该点的温度不得超过制造商规定的温度限值（Tj）。

由于Tj极难直接测得，因此制造商给出了另一点，将这一点的温度Tc（外壳温度）视为LED灯的最高工作温度。

LED灯的安装和使用必须遵循制造商要求进行。

为确保正确的热量流，LED表面和散热片之间必须采用介面散热材料（TIM）。

介面散热材料填充于（LED和散热片）接触表面间隙中，用于排除其中的空气，因为空气散热性能不佳。
此外，为提高散热效率，还必须改善散热片上空气的自然流动，因此安装时应避免狭小空间，避免其他物体阻碍空气流动。

灯具制造商必须充分验证散热片是否能够达到具体预期用途要求。

如何根据给定的THS（散热器温度）计算TC：

制造商规定的外壳温度Tc受介面散热材料的影响极大。

不同介面散热材料的耐热性Rth　TIM各不相同，材料耐热性变化范围很大，基本取决于介面散热材料的组成、形状与厚度。

可用以下公式（1）根据Ths准确计算Tc：

$$Tc=Ths+Rth\ TIM*Q \qquad (1)$$

由此可得：

$$Ths=Tc-Rth\ TIM*Q \qquad (2)$$

其中：
-Ths [°C] = 与介面散热材料接触的散热片的表面温度;

- Rth TIM [°C/W] = 散热介面的耐热性，计算公式如下:

$$Rth\ TIM=sp/(S*k) \qquad (3)$$

- sp [m] = 介面散热材料厚度;
- S [m^2] = 介面散热材料表面积;
- k [W/m°C] = 制造商提供的介面散热材料导热性.

- Q [W] = 制造商提供的介面散热材料导热性
请注意：并非LED所有电功率都转化成了热功率。在选用不同散热片时，必须考虑采用不同的功率转化比例，具体视LED光源的效率而定，其公式如下(η_{LED})：

$$Q = (1-\eta_{LED})*Pel \qquad (4)$$

Heat sinks are devices to dissipate the heat emitted by LED lights.
The hottest point in a LED is to be found at the junction, where it is compulsory that the temperature does not exceed the limit stated by the manufacturer (Tj).
Since it is very difficult measuring the Tj directly, manufacturers give a different point, the Tc (Case Temperature), which then constitutes the highest operating temperature of the LED.
The LED must be installed and work in accordance with the manufacturer's guidelines.
In order to ensure the correct flow of the heat, a Thermal Interface Material (TIM) must be placed between the surface of the LED and the heat sink.
The TIM fills in the gaps between surfaces of the LED and heat sink, thus displacing the air, which is a thermal insulator.
In order to ensure maximum heat dissipation, the natural flow of the air over the heat sink must be optimized, i.e. by avoiding installation in narrow spaces or avoiding obstacles.
Lighting manufacturers must duly check the adequacy of the heat sink for their specific and intended applications.

HOW TO CALCULATE THE Tc, BASED ON THE GIVEN Ths (HEAT SINK TEMPERATURE):

The Case Temperature Tc stated by the manufacturer is highly affected by the presence of a TIM.
Each TIM has a different thermal resistance Rth TIM, which may vary considerably and highly depending on the material of which the TIM is made, on its shape and thickness.
The following equation (1) allows to calculate the exact Tc on the basis on Ths:

$$Tc=Ths+Rth\ TIM*Q \qquad (1)$$

And similarly:

$$Ths=Tc-Rth\ TIM*Q \qquad (2)$$

Whereas:
- Ths [°C] = temperature of the surface of the heat sink, which is in contact with the TIM;
- Rth TIM [°C/W] = thermal resistance of the thermal interface, calculated as follows:

$$Rth\ TIM=sp/(S*k) \qquad (3)$$

- sp [m] = TIM thickness;
- S [m^2] = TIM surface;
- k [W/m°C] = TIM thermal conductivity as stated by the manufacturer.

- Q [W] = LED thermal power to be dissipated.
Please note that not all electric power emitted by a LED is converteded into thermal power. A different percentage of power must be taken into account when choosing a heat sink depending on the efficiency of LED light sources (η_{LED}).

$$Q = (1-\eta_{LED})*Pel \qquad (4)$$

警告/WARNING

例如:

Example:

Pel [W]	η_{LED}=15% Q [W]	η_{LED}=17% Q [W]	η_{LED}=20% Q [W]
4,6	3,91	3,81	3,68

温度影响:
环境温度是影响散热片性能的参数之一，其计算方法如下:

$$Q= (Tc-Ta)/Rhs \quad (5)$$

其中:
- Q [W] = 散热片散热功率;
- Rhs [°C/W] = 散热片与介面散热材料的散热性;
- Tc [°C] = 制造商提供的LED外壳温度;
- Ta [°C] = 环境温度。

散热片工作位置影响:
倾角会影响通过散热片的气流，从而影响空气与散热片之间以及空气与周围空气之间的传热能力。

因此，工作位置角度是影响散热片性能的参数之一。

举例:

从LED制造商的数据表中可得:
Tc max= 85 °C，电功率 = 10 W，LED效率 = 17%.
从介面散热材料的数据表中可得:
Rth TIM = 0.5 °C/W.
工作环境:
T a = 35 °C，散热片置于自由对流空气中，光源头朝下。

所需散热功率:

$$Q = (1-\eta_{LED})*Pel= (1-0.17)*10 = 8.3 \text{ W}$$

$$Ths = Tc-Rth\ TIM*Q = 85 - 0.5*8.3 = 80.85 \text{ °C}$$

根据下图中的数据，即可依据不同需求选择正确的散热片尺寸。

在本例中:

Q = 8.3 W
Ths = 80.85 °C
Ta = 35 °C

相关数据对照散热片图表，可确认符合性能要求的最佳尺寸。

INFLUENCE OF AMBIENT TEMPERATURE:
A parameter that affects the performance of an heat sink is the ambient temperature in which it operates, calculated as follows:

$$Q= (Tc-Ta)/Rhs \quad (5)$$

Whereas:
- *Q [W] = thermal power dissipated by the heat sink;*
- *Rhs [°C/W] = resistance of the heat sink and of the TIM;*
- *Tc [°C] = temperature of the LED stated by the manufacturer;*
- *Ta [°C] = ambient temperature.*

INFLUENCE OF THE HEAT SINK WORKING POSITION:
The angle of inclination affects the air flow through the fins, thus influencing the flow of the air to lower the thermal power of the heat sink and disperse it in the surrounding space.
Therefore, a different working position angle is a parameter affecting the performance of the heat sink.

Example:

From the LED manufacturer data sheet:
Tc max= 85 °C , electric power= 10 W , LED efficiency= 17%.
From the TIM manufacturer data sheet:
Rth TIM = 0.5 °C/W.
Conditions in the surrounding space:
T ambient = 35 °C, heat sink is placed in a free air flow, with the light source downwards.

Thermal power to be dissipated:

$$Q = (1-\eta_{LED})*Pel= (1-0.17)*10 = 8.3 \text{ W}$$

$$Ths= Tc-Rth\ TIM*Q = 85 - 0.5*8.3 = 80.85 \text{ °C}$$

Verifying the data in the graphic here below, it is possible to shape the heat sink with the correct dimension depending on the different needs.
The chart shows three different room temperatures to choose from.

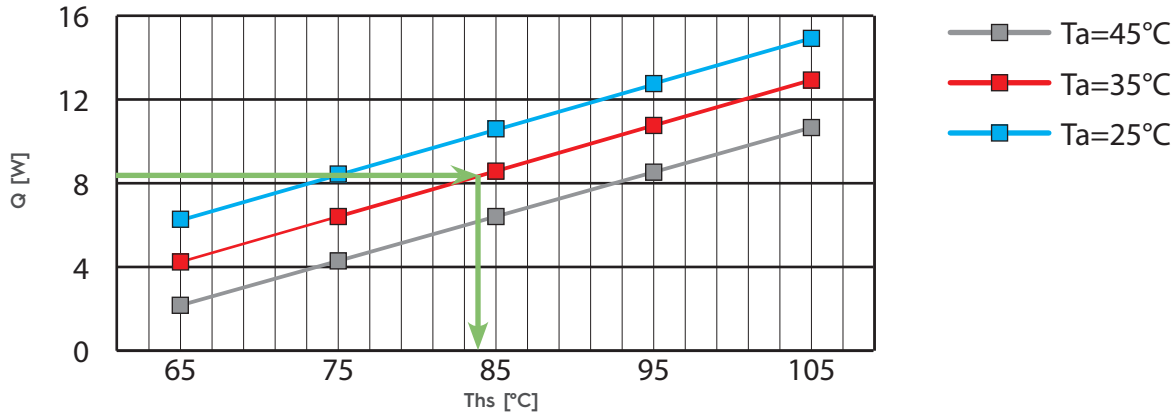
In the example:

Q = 8.3 W
Ths = 80.85 °C
Ta = 35 °C

Seeing the graphic referring to the heat sink in use with the relevant data it is possible to verify which size best suits the performance needed.

警告/WARNING

CRYSTAL 45
高/Height: 50 mm
角度/Orientation: 0°



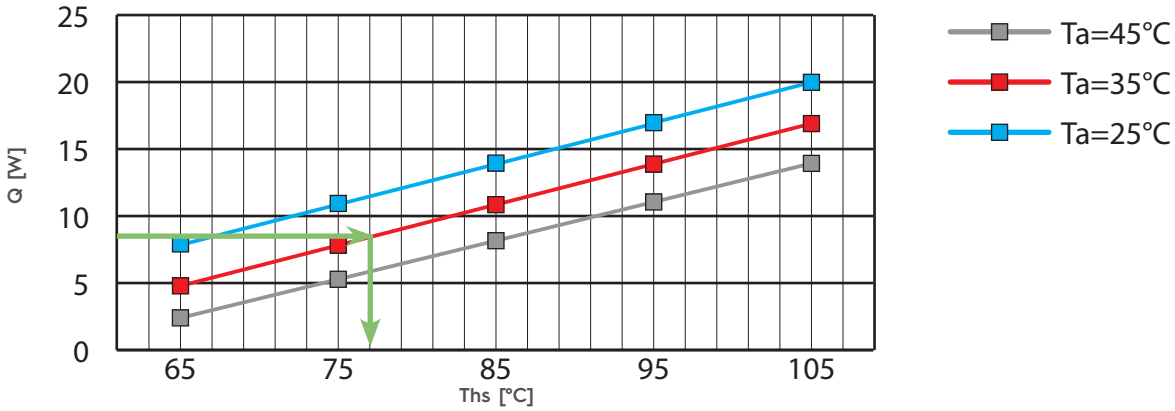
图表显示，所选择的散热片不满足具体要求。

The graphic shows that the chosen heat sink is not suitable to meet the specific needs.

改变散热片高度，对照图表，即可轻松确定最适合的散热片。

Modifying the height of the heat sink, and going through the chart the most suitable heat sink can easily be determined.

CRYSTAL 45
高/*Height*: 80 mm
角度/*Orientation*: 0°



可根据客户需求提供不同使用条件下的热耗散、热功率、散热性有关资料。

More information regarding thermal dissipation, thermal power and resistance for applications in different conditions are available on request.

请注意：图表所列各值均在特定环境条件下测得，即无空气流、相对温度恒定、环境温度恒定。

PLEASE NOTE: The values shown in all charts refer to the performance of heat sinks in a controlled environment, i.e. in the absence of air streams, controlled relative humidity and Ambient Temperature.

散热片性能将受工作环境影响。
我们的散热片具有不同形状和表面，适用于各类LED光源。
我们可根据客户要求进行机加工。

Performance of heat sinks vary depending on operating conditions.
We can provide heat sinks with different shapes and finishes for all kinds of LED light sources.
We can provide additional machining on demand.

我们可根据客户样品或图纸提供定制产品。

We can develop tailor-made projects, based on samples or drawings provided by our clients.

我们可利用热模拟软件在设计阶段提供技术支持。

We can provide technical support in the designing process, thanks to a thermal simulation software.