

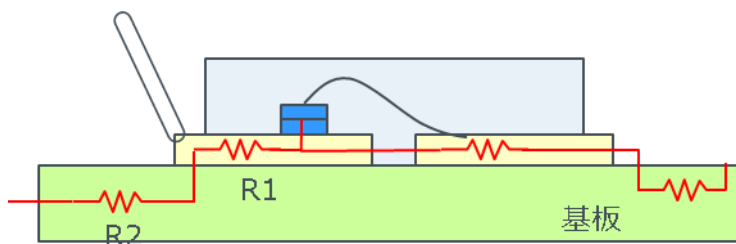
thermal resistance

About Thermal Resistance

The temperature at which LEDs can be used is determined by the junction temperature (T_j) of each LED. This can lead to defects such as the following. For this reason, product design that does not exceed T_{jMax} is necessary, and thermal resistance is a product item that is required for thermal design. Thermal resistance is explained here.

LED Heat Transfer Path

The following is an image of how the heat generated by LEDs is transferred from the LED element to the surrounding atmosphere through the die bond, product pattern, electrodes, solder, and mounting board.



$$\begin{aligned}
 R1 &= R_{th(j-C)} \\
 R1+R2 &= R_{th(j-C)}+R_{th(c-a)} \\
 &= R_{th(j-a)}
 \end{aligned}$$

There are two types of thermal resistance (R_{th}) as follows

$R_{th}(j-C)$: thermal resistance between junction and case (terminal).

$R_{th}(j-a)$: thermal resistance between the junction and the atmosphere

The heat dissipation path of the surface mount type chip LEDs is LED element, die bonding, pattern, pattern, terminal, solder, mounting board and atmosphere.

Calculation of junction temperature (T_j) using thermal resistance

The thermal resistance $R_{th}(J-a)$ between the junction and the atmosphere varies depending on the state, since the value of R_2 varies depending on the pattern size and thickness of the mounting board. In order to calculate the junction temperature (T_j) of mounted LED products, it is recommended to use the thermal resistance $R_{th}(j-c)$ between the junction and the terminal, which does not vary much depending on the mounting state, and use the terminal temperature of the side where the LED elements are mounted.

Example: SML-D1 series
 Mounted substrate: FR4, single-sided
 substrate t=0.8 mm, Cu thickness 0.035 mm

PCB size (mm)	Rth(j-a) (°C/W)
None	458
10 × 10	209
15 × 15	151
20 × 20	121
40 × 40	83
50 × 50	70

Rth(j-a) is
 To the state of the
 mounting board
 More changes.

Example: How to calculate Tj temperature
 Tc (temperature of the LED chip mounted terminal) and Rth(J-C) for Tj (junction temperature).

$$T_j = T_c + R_{th(j-C)} \times P$$

$$P: I_f \times V_f$$

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