

## Thermal Design of NCSU03xx LEDs

### 1. Objective

The light output of LEDs is reduced under the influence of heat generation. When LEDs are operated over the absolute maximum junction temperature ( $T_{jmax}$ ), the performance is severely degraded. It is critical to design the heat dissipation not to exceed the  $T_{jmax}$  for NCSU03xx to achieve a high reliability and a high performance. This document provides the  $T_j$  evaluation results under two conditions by using different heat sinks. Please use the data as reference for NCSU03xx's thermal design at your site.

### 2. $T_j$ Calculation

$T_j$  can be obtained by the following formula:

$$T_j = T_s + R_{thj-s} \times P_D$$

where,  $T_j$ : Junction Temperature [°C]  
 $T_s$ : Soldering Temperature [°C]  
 $R_{thj-s}$ : Thermal resistance between the LED die and the  $T_s$  measuring point [°C/W]  
 \* The  $R_{thj-s}$  of NCSU03xx is Typ:4.4 [°C/W] (Max:7.3 [°C/W])  
 $P_D$ : Input Power [W]

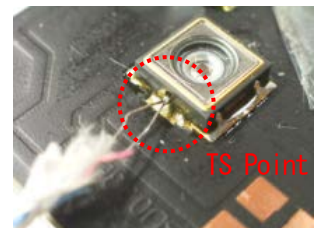


Figure 1  
 $T_s$  Measuring Point

### 3. $T_j$ Measurement Result

Ex.1 Aluminum Board

$I_F$ (A)	$T_s$ (°C)	$V_F$ (V)	$T_j$ (°C)
0.5	75	3.57	83
0.7	95	3.63	106

Ex.2 Aluminum Board + Heat Sink

$I_F$ (A)	$T_s$ (°C)	$V_F$ (V)	$T_j$ (°C)
0.5	54	3.62	62
0.7	66	3.70	77



Front Side

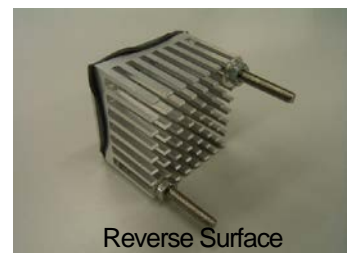


Reverse Surface

Figure 2 Aluminum Board



Front Side



Reverse Surface

Figure 3 Aluminum Board & Heat Sink

### 4. Heat Dissipation Materials

- Metal-based board; Aluminum, Dimension; 30mm × 30mm × 1.6mm
- Heat Sink : 30mm × 30mm × h=20mm, Depth: 4mm, Fin; 64 pcs. (Dimension of Fin; 1.4mm × 2mm, Structure; 8 × 8)

#### Note: Absolute Maximum Ratings

Nichia specifies the absolute maximum ratings for NCSU03xx as  $I_F=0.7A$  and  $T_{jmax}=130°C$ . We cannot assure the performance of the LEDs if they are used above the specified temperature and  $I_F$ . Thank you very much for your cooperation.