

### Thermal Design of NVSU233x-Dx (U385) LEDs

#### 1. Objective

The LEDs' light output can be affected by the heat generated from the LEDs/LED-assembled products. Also, the reliability performance can be seriously degraded, if the LEDs are operated over the absolute maximum rated junction temperature ( $T_j$ ).

It is critical to design the heat dissipation performance not to exceed the  $T_{jmax}$  for NVSU233x-Dx, to deliver high reliability/performance.

This document shows the  $T_j$  evaluation results by demonstrating two heat dissipation conditions. Please use the data for reference to your thermal design.

#### 2. $T_j$ Calculation

$T_j$  can be calculated by the following formula:

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

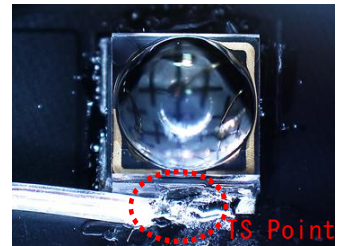
$T_j$ : Junction Temperature

$T_s$ : Soldering Temperature ( $^{\circ}C$ )

$R_{thj-s}$ : Thermal resistance ( $^{\circ}C/W$ ) from the die to the  $T_s$  measuring point

\*  $R_{thj-s}$  (NVSU233x-Dx):  $5.7^{\circ}C/W$

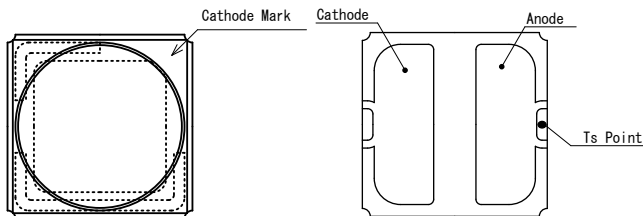
$P_D$ : Input Power (W)



Picture 1  $T_s$  Measuring Point

The thermocouple was solder-attached to the  $T_s$  measuring point for the evaluation.

#### 3. $T_s$ Measuring Point



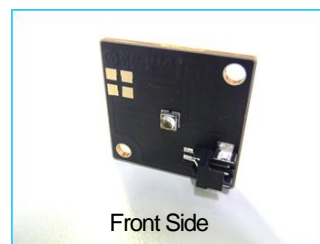
#### 4. $T_j$ Evaluation Result

Example 1. Copper Board + Heat Sink B

$I_F$ (A)	$T_S$ ( $^{\circ}C$ )	$V_F$ (V)	$T_j$ ( $^{\circ}C$ )
1.0	49.2	3.5	69
1.4	59.5	3.6	88

Example 2. Copper Board + Heat Sink C

$I_F$ (A)	$T_S$ ( $^{\circ}C$ )	$V_F$ (V)	$T_j$ ( $^{\circ}C$ )
1.0	43.8	3.6	64
1.4	52.7	3.7	82

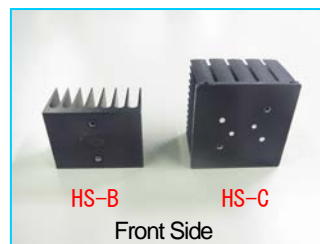


Front Side

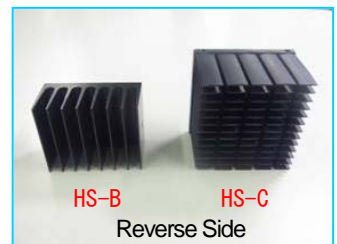


Reverse Side

Picture 2 Copper Board



HS-B HS-C  
Front Side



HS-B HS-C  
Reverse Side

Picture 3 Copper Board + Heat Sink

**5. Heat Dissipating Materials**

Metal-based Board: Copper, 30mm × 30mm × 1.7mm

Heat Sink B: 50mm × 38mm × 25mm (H), Base Thickness: 5 mm, Fin: 8 pcs.(1mm × 38mm, Array: 1 × 8)

Heat Sink C: 54mm × 54mm × 35mm (H), Base Thickness: 4mm, Fin=64 pcs.(0.8mm × 9mm, Array: 5 × 13)

**Note**

We specified the absolute maximum ratings for NVSU233x-Dx;  $I_F = 1.4A$  and  $T_{jmax} = 130^{\circ}C$ .

We cannot guarantee the usage over these ratings.

We appreciate your understanding and cooperation.