

Thermal Design of NVSU333A (U405) 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 NVSU333A, to deliver high reliability/performance.

This document shows the T_j evaluation results by demonstrating three 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:

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

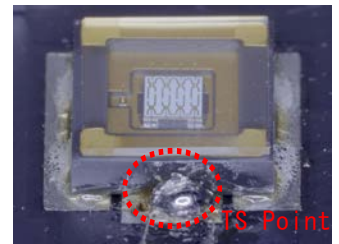
T_j : Junction Temperature

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} (NVSU333A): $2.08^{\circ}C/W$

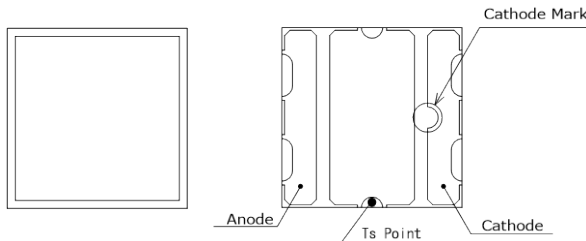
P_D : Input Power (W)



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

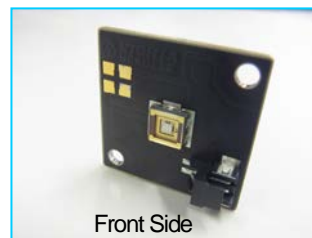
I_F (A)	T_s ($^{\circ}C$)	V_F (V)	T_j ($^{\circ}C$)
1.5	45.4	3.3	56
2.5	61.1	3.4	79
3.5	79.7	3.6	106

Example 2. Copper Board + Heat Sink C

I_F (A)	T_s ($^{\circ}C$)	V_F (V)	T_j ($^{\circ}C$)
1.5	43.2	3.3	54
2.5	57.3	3.5	75
3.5	68.9	3.6	95
4.5	83.1	3.7	117

Example 3. Copper Board + Heat Sink D

I_F (A)	T_s ($^{\circ}C$)	V_F (V)	T_j ($^{\circ}C$)
1.5	32.7	3.4	43
2.5	38.2	3.5	56
3.5	44.9	3.6	71
4.5	52.3	3.7	87

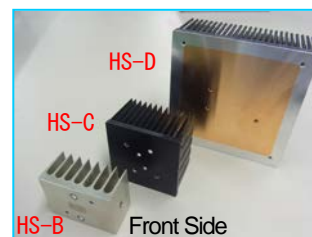


Front Side

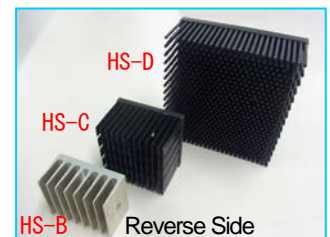


Reverse Side

Picture 2 Copper Board



Front Side



Reverse Side

Picture 3 Copper Board + Heat Sink

This sheet contains tentative information; we may change the contents without notice.

5. PCB Specifications

Type of Board	Land Pattern (μm)	Insulating Layer (μm)	Heat Conductivity (W/(m·K))	Board Thickness (mm)	Notes
Cu	35	120	10	1	The thermal pad is not in contact with the copper base.

6. 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)

Heat Sink D: 100mm × 100mm × 40mm (H), Base Thickness: 7mm, Fin: 707 pcs. (Φ2.1mm, Alignment; 15 × 25 / 14 × 24)

Note

We specified the absolute maximum ratings for NVSU333A; IF= 4.5A and $T_{max} = 100^{\circ}\text{C}$.

We cannot guarantee the usage over these ratings.

We appreciate your understanding and cooperation.