Tj Control for Good Heat Dissipation in NVSU333A (U405)

1. Objective

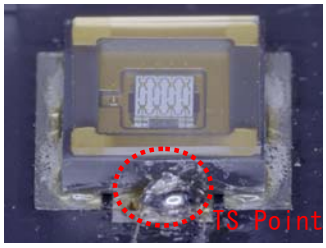
The LEDs' light output can be affected by the heat generated from the LEDs/LED-assembled products.
Also, the reliability performance can be seriously degraded, if the LEDs are operated over the absolute maximum rated junction temperature (Tj).
It is critical to design the heat dissipation performance not to exceed the T_{jmax} for NVSU333A, to deliver high reliability/performance.
This document shows the Tj evaluation results by demonstrating three heat dissipation conditions. Please use the data for reference to your thermal design.

2. Tj Calculation

Tj can be calculated by the following formula:

$$Tj = Ts + Rthj\text{-}s \times P_D$$

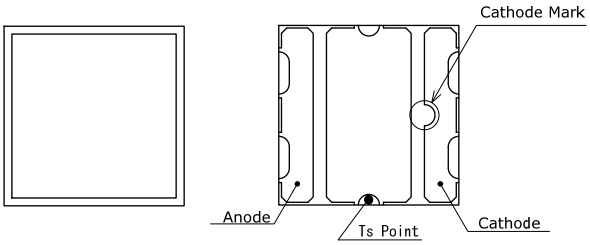
Tj: Junction Temperature
Ts: Soldering Temperature (°C)
Rthj-s: Thermal resistance (°C/W) from the die to the Ts measuring point
* Rthj-s (NVSU333A): 2.08°C/W
PD: Input Power (W)



Picture 1 Ts Measuring Point

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

3. Ts Measuring Point



4. Tj Evaluation Result

Example 1. Copper Board + Heat Sink B

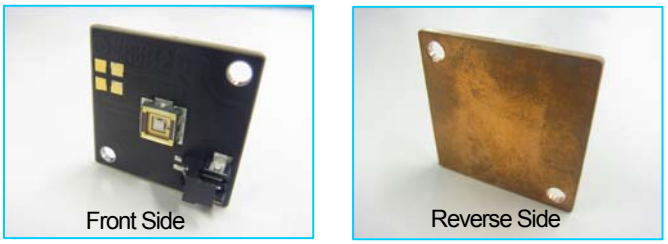
I_F(A)	T_S (°C)	V_F(V)	T_j (°C)
1.5	45.4	3.3	56
2.5	61.1	3.4	79
3.5	79.7	3.6	106

Example 2. Copper Board + Heat Sink C

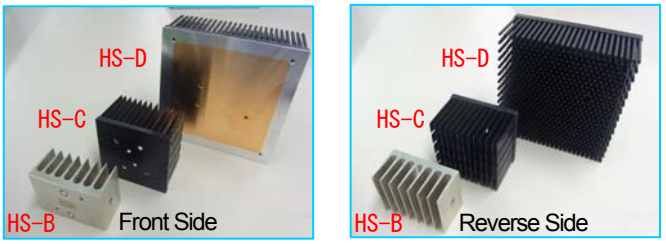
I_F(A)	T_S (°C)	V_F(V)	T_j (°C)
1.5	43.2	3.3	54
2.5	57.3	3.5	75
3.5	68.9	3.6	95
4.5	83.1	3.7	117

Example 3. Copper Board + Heat Sink D

I_F(A)	T_S (°C)	V_F(V)	T_j (°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



Picture 2 Copper Board



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_{jmax} = 100°C.

We cannot guarantee the usage over these ratings.

We appreciate your understanding and cooperation.