

## T<sub>j</sub> Control for Good Heat Dissipation in NVSU333A (U405) with Water Cooling System

### 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<sub>j</sub>).

It is critical to design the heat dissipation performance not to exceed the T<sub>jmax</sub> for NVSU333A, to deliver high reliability/performance.

This document shows the T<sub>j</sub> evaluation results by demonstrating two heat dissipation conditions with a water cooling system. Please use the data for reference to your thermal design.

### 2. T<sub>j</sub> Calculation

T<sub>j</sub> can be calculated by the following formula:

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

T<sub>j</sub>: Junction Temperature

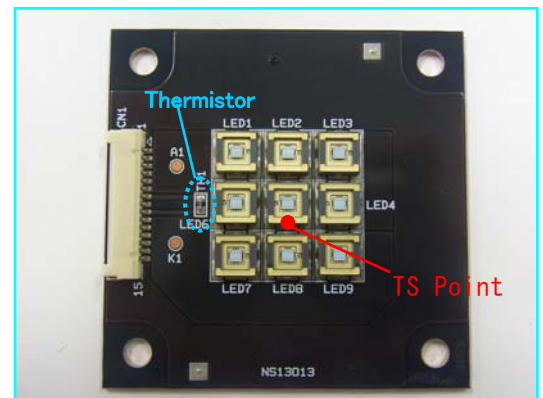
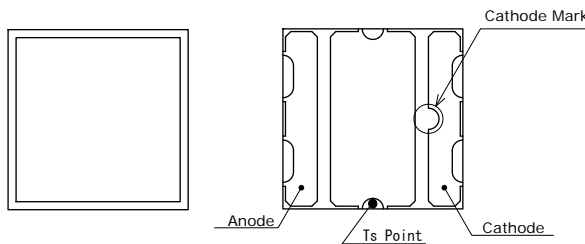
T<sub>s</sub>: Soldering Temperature (°C)

R<sub>thj-s</sub>: Thermal resistance (°C/W) from the die to the T<sub>s</sub> measuring point

\* R<sub>thj-s</sub> (NVSU333A): 2.08°C/W

P<sub>D</sub>: Input Power (W)

### 3. T<sub>s</sub> Measuring Point



Picture 1 T<sub>s</sub> Measuring Point

The thermocouple was solder-attached to the T<sub>s</sub> measuring point for the evaluation. (Board Size: 60mm × 60 mm × 1mm)

### 4. T<sub>j</sub> Evaluation Result

Board	I <sub>F</sub> (A)	Thermistor(°C)	T <sub>s</sub> (°C)	V <sub>F</sub> (V)	T <sub>j</sub> (°C)
Cu	3.5	25	34	3.85	62

### 5. Heat Dissipating Conditions

Input Current [A]	Temperature [°C]	Water Flow [L/min.]	Cooling Heat Sink	LED Pitch [mm]	Internal Circuit	Interface between Heat Sink and Board	
						Thermal Conductivity [W/(m·K)]	Material
3.5	18	2.5	Oxygen-free copper 60mm×60mm×10mm	8.2	9 LEDs connected in series	0.9	Grease

### Note

We specified the absolute maximum ratings for NVSU333A; I<sub>F</sub>=4.5A and T<sub>jmax</sub> = 100°C.

We cannot guarantee the usage over these ratings.

We appreciate your understanding and cooperation.