

# Application Note for Thermal Management

## Tj Dependence on Heat Release for NC4U13x

### [ Introduction ]

LEDs require higher current for greater light output. However, the higher current is applied to LEDs, the more heat is generated from a LED junction, which leads to light output deterioration. Therefore, thermal management is critical for an effective use of NC4U13x. This application note provides examples of heat-releasing (Case 1, 2 and 3) for the better use of NC4U13x. Please treat this data as the reference.

### [ Tj Calculation Method ]

The following equation is used for Tj calculation.

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

- Tj: Temperature of LED junction (°C)
- Ts: Temperature of soldering point (°C)\*
- Rthj-s: Thermal resistance from LED junction to Ts measurement point (°C/W)\*\*
- PD: Input power (W)

\*Ts measuring point: the red circled point in Fig.1

\*\*Rthj-s for NC4U13x : 4°C/W

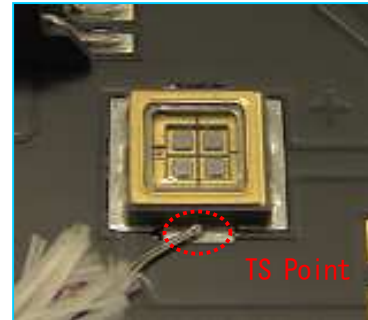


Figure 1 Tj Measurement Point

### [ Tj Measurement Results ]

Case1. Copper Board + HS(Heat Sink)-A

I <sub>F</sub> (A)	T <sub>S</sub> (°C)	V <sub>F</sub> (V)	T <sub>J</sub> (°C)
0.3	70	13.3	86
0.5	93	13.5	120
0.7	117	13.7	155

Case2. Copper Board + HS(Heat Sink)-B

I <sub>F</sub> (A)	T <sub>S</sub> (°C)	V <sub>F</sub> (V)	T <sub>J</sub> (°C)
0.3	53	13.4	69
0.5	67	13.7	94
0.7	79	14.0	118

Case3. Copper Board + HS(Heat Sink)-C

I <sub>F</sub> (A)	T <sub>S</sub> (°C)	V <sub>F</sub> (V)	T <sub>J</sub> (°C)
0.3	51	13.4	68
0.5	64	13.7	91
0.7	77	14.0	116

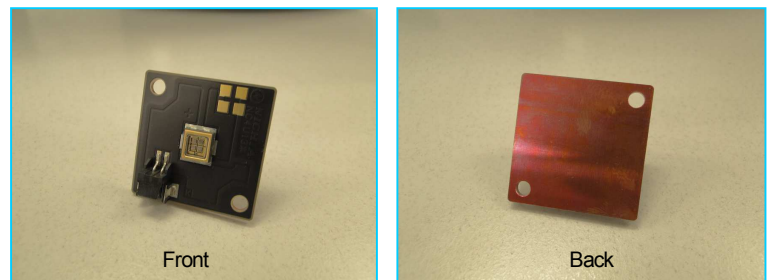


Figure 2 Copper Board

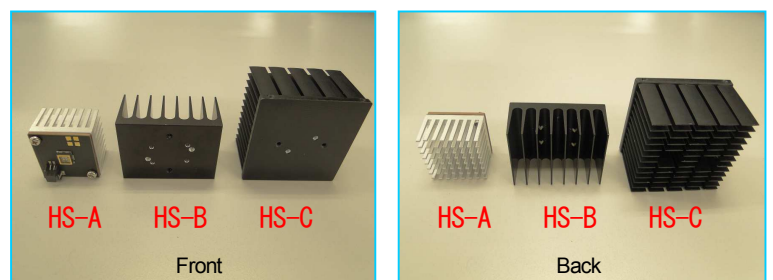


Figure 3 Copper Board + Heat Sink

### [ Heat Release Equipment ]

- |                     |   |                                  |                   |
|---------------------|---|----------------------------------|-------------------|
| • Metal based Board | Main Material: Copper                     | Outer Dimension: 30mm×30mm×1.6mm |                   |
| • Heat Sink-A       | Product#: 30SQ20H20 (LSI COOLER Co., Ltd) | Base thickness: 4mm              | Number of fins:64 |
| • Heat Sink-B       | Product#: 50SQ38H25 (ALPHA Co., Ltd)      | Base thickness: 5mm              | Number of fins:8  |
| • Heat Sink-C       | Product#: 54SQ54H35 (ALPHA Co., Ltd)      | Base thickness: 4mm              | Number of fins:65 |

#### Note: Absolute Maximum Rating

Absolute Maximum Rating: I<sub>F</sub>= 0.7A, T<sub>J</sub>=130°C

The operating conditions exceeding the above absolute maximum ratings are not covered by the warranty.