Outline

SHARP high-powered ZENIGATA LED, comprising LED chips mounted on an 18mm-square ceramic substrate, ensures broad luminous flux, high light-emitting efficiency and radiation performance, and achieves high reliability.

ZENIGATA LED is suitable for lighting apparatuses shown below.

- Incandescent lamp
- Spotlight
- Downlight
- Pendant light
- Landscape light
- Road lighting

Since the light emission from ZENIGATA LED includes less infrared light (heat ray) than that from a conventional incandescent lamp, ZENIGATA LED is adaptable to the lighting of commodities susceptible to damages caused by temperature rise. It is also suitable for the lighting of goods of concern for bad influences due to ultraviolet ray, including discoloration, since the light from ZENIGATA LED is free from ultraviolet ray.

In these days, amid mounting environment concerns, light sources having broader luminous flux per electric power and longer service life leading to less replacement intervals are required. LEDs, having features such as superior light emitting efficiency and longer life allowed by high reliability, are expected to make contributions to environmental conservation, including energy-saving and reduction of wastes. ZENIGATA LED, combining favorable features of LEDs, such as high light-emitting efficiency and longer life, has potential of an environmental-friendly key lighting device in a new era.

This guide introduces characteristics of ZENIGATA LED and describes some notes on use showing reference case examples.

Environmental performance

ZENIGATA LED, contributing to reduction of CO₂ consumption arise from lighting, is free from lead, mercury, and cadmium, and observes ROHS Directive.
### ZENIGATA LED Lineup

Four types of colors are available in 3.6W and 6.7W.

<table>
<thead>
<tr>
<th>Power consumption (Forward voltage, forward current)</th>
<th>Color</th>
<th>Color temp. (TYP.)</th>
<th>Luminous flux (TYP.)</th>
<th>Average color rendering index (Ra TYP.)</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3.6W</strong> (10.2V 360mA)</td>
<td>White</td>
<td>5 000K</td>
<td>280 lm</td>
<td>60</td>
<td>GW5BWC15L02</td>
</tr>
<tr>
<td></td>
<td>Warm White</td>
<td>2 800K</td>
<td>200 lm</td>
<td>70</td>
<td>GW5BDC15L02</td>
</tr>
<tr>
<td></td>
<td>High CRI</td>
<td>5 000K</td>
<td>190 lm</td>
<td>90</td>
<td>GW5BNC15L02</td>
</tr>
<tr>
<td></td>
<td>High CRI</td>
<td>6 500K</td>
<td>190 lm</td>
<td>90</td>
<td>GW5BNC15L12</td>
</tr>
<tr>
<td><strong>6.7W</strong> (10.5V 640mA)</td>
<td>White</td>
<td>5 000K</td>
<td>540 lm</td>
<td>60</td>
<td>GW5BWF15L00</td>
</tr>
<tr>
<td></td>
<td>Warm White</td>
<td>2 800K</td>
<td>400 lm</td>
<td>70</td>
<td>GW5BDF15L00</td>
</tr>
<tr>
<td></td>
<td>High CRI</td>
<td>5 000K</td>
<td>350 lm</td>
<td>90</td>
<td>GW5BNF15L00</td>
</tr>
<tr>
<td></td>
<td>High CRI</td>
<td>6 500K</td>
<td>350 lm</td>
<td>90</td>
<td>GW5BNF15L10</td>
</tr>
</tbody>
</table>

* The case temperature Tc, 25°C, is the value measured 20ms after rated current is applied.
* The values of forward voltage, luminous flux, and average color rendering index Ra are references, and are not guaranteed.

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**Comparison of hue between White, High CRI and Warm White**

[Images of fruit bowls in White, High CRI, and Warm White colors]
**Configuration and wiring of ZENIGATA LED**

ZENIGATA LED comprises 30 pcs. (3.6W) or 48 pcs. (6.7W) of LED chips mounted on an 18mm-square ceramic substrate. For 3.6W type, three LED chips in series and ten in parallel are arranged. For 6.7W type, three LED chips in series and sixteen LED chips in parallel are arranged, as shown in the internal circuit drawing below.

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**Internal circuit**

3.6W

- Anode (Connection terminal)
- Cathode (Connection terminal)
- Fixing screw position
  - M2.6 screw head dia.: 4.5 mm or less
- Fluorescent material area (emission area)

- 3 series × 10 parallel = 30 pcs. chips

6.7W

- Anode (Connection terminal)
- Cathode (Connection terminal)

- 3 series × 16 parallel = 48 pcs. chips
Characteristics of ZENIGATA LED

The characteristics shown below are the values measured at Tc = 25°C. They are references, and as for the distribution of the characteristics, consult us.

- **Forward current-Luminous flux characteristics**
- **Forward current-Forward voltage characteristics**

- **Directional characteristics**
Temperature characteristics of ZENIGATA LED

Since the luminous flux, forward voltage and color of LED fluctuate depending on the temperature, temperature (range) in actual use must be recognized for design. Be sure to design it so that the temperature is within the range shown in page 7.

Increase in temperature or current may accelerate degradation of LED, and lead reduction of light emission and efficiency, and fluctuation in color temperature. Thus, operation of LED in high temperature is unfavorable, and sufficient provision of radiation design by heat sink is recommended.

(High CRI type)
Reliability of ZENIGATA LED

As ZENIGATA LED is developed for lighting, ceramic substrate and resin are adopted for ZENIGATA LED to prevent of reduction in brightness during use in a long period. The graph below shows fluctuations in luminous flux. As shown in the graph below, the luminous flux is restrained for a long period, and it proves high reliability of the ZENIGATA LED.

![Long term operating test](image)

- Ir = 400mA
- Tc = 90°C

Graph: Relative Luminous Intensity [%] vs. Operating Time [h]
Heat design of ZENIGATA LED

Operation temperature of ZENIGATA LED is detected at the soldering pad position as case temperature $T_c$. When mounting ZENIGATA LED, case temperature $T_c$ must be controlled within the forward current reduction curve.

Since ceramic is an insulating substrate, ZENIGATA LED can be directly mounted on a heat sink. To make sure heat radiation, radiation silicone paste or radiation sheet must be insulted between ZENIGATA LED and heat sink.

The drawing left below shows the mounting status. Viewing through thermography, it shows temperature of ceramic substrate portion is close to that of heat sink. It means heat generated from LED translates to heat sink smoothly.

$\triangle T \sim 25^\circ C$ after 30min. 360mA operation.

$\phi 50mm \times h30mm$

Solution with Ryosan Company, Limited
Optical design of ZENIGATA LED

Light from ZENIGATA LED can be controlled by using lens or reflector.

Heat such as downlight, requires higher lighting intensity underneath, the following lens or reflector can be useful. Heat radiation can be also ensured by adopting an aluminum reflector. For an application such as light bulb, glass ball diffuser enables soft lighting.

Distribution of lighting intensity measured at the point from light source by 1m when using 3.6W White ZENIGATA

Reflector type1
Lens type1
Lens type2
Glass ball diffuser

*1: Solution with Diffractive Optics Ltd.
*2: Solution with IDEALED S.R.L
Chromaticity distribution

Circuit Design

ZENIGATA LED is used for applications such as bulb, dawn light and street light by optimum circuit design. Constant voltage power supply runs off more than specified current amount due to lowered VF caused by temperature rise. Constant current power supply is recommended to drive. In designing a circuit, please make sure not to give reverse voltage to the LEDs at any time. When ZENIGATA LEDs are connected in series, adapt protection device like zener for each ZENIGATA LED. Make sure to be confident of the safety standards or regulations in each location and area.

Featured Application
Precautions

■ Usage conditions
The products are not designed for the use under any of the following conditions. Please confirm their performance and reliability well enough if you use under any of the following conditions;
• In a place with a lot of moisture, dew condensation, briny air, and corrosive gas (C1, H2S, NH3, SO2, NOx, etc.).
• Under the direct sunlight, outdoor exposure, and in a dusty place.
• In water oil, medical fluid, and organic solvent.

■ Installation
Material of board is alumina ceramic. If installed inappropriately, trouble of no radiation may occur due to board crack. Please take particular notice of install method.
Further information on installation, refer to the following cautions.
• Apply ether screws or adhesives, or both of them when installed to heat radiator.
  In case of applying adhesive only, check the effectiveness before fixing.
  In case of screw, apply thread locker in order to prevent loosening.
If LED comes off from the heat radiator, unusual temperature rise entails hazardous phenomena including device deterioration coming off of solder at leads and emitting smoke.
• Screw torque: Within 0.2Nm
  If it is inefficient to tighten screws, apply locker to prevent loosening.
• It is recommended to apply screws which use low corrosive materials such as Stainless steel.
  Avoid applying flat-head screws, which cause board crack due to applying stress to screw holes.
• Avoid convexly uneven boards.
  Those convex boards are subject to crack when tightening screws.
• It is recommended to apply thermal conductive sheet or grease with adhesiveness and heat radiating-adhesives, because of thermal and mechanical combination between module and heat radiator.
  However, depending on their thickness, board crack may be entailed by warped board, which is caused when tightening screws. So please check your actual conditions carefully as for the screw torque.

■ Connecting method
In case of solder connecting method, apply solder to the leads by soldering iron with thermo controller (tip temperature 380°C), within 10 seconds per one place.
Put the board on materials whose conductivity is poor enough not to radiate heat of soldering.
Avoid touching yellow phosphor with soldering iron.
This product is not designed for reflow and flow soldering.

■ Safety
Looking directly at LEDs for a long time may result in hurt your eyes.
In case that excess current (over ratings) are supplied to the device, hazardous phenomena including abnormal heat generation, emitting smoke, or catching fire can be caused.
Take appropriate measures to excess current and voltage.
In case of solder connecting method, there is a possibility of fatigue failure by heat.
Please fix the leads in such case to protect from short circuit or leakage of electricity caused by contact.
Please confirm the safety standards or regulations of application devices.
(Notice)
In the absence of confirmation by device specification sheets, SHARP takes no responsibility for any defects that may occur in equipment using any SHARP devices shown in catalogs, data books, etc.
Contact SHARP in order to obtain the latest device specification sheets before using any SHARP device.

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