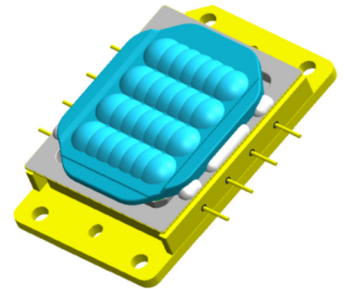


# Part No. *NURM36E*



## Features

- Typical Optical Output Power: 38W
- Typical Dominant Wavelength: 639/643nm
- Multi-transverse Mode
- Collimated Beam



## Absolute Maximum Ratings

Item	Symbol	Absolute Maximum Ratings	Unit
Forward Current <sup>1</sup>	I <sub>F</sub>	Figure 1	A
Allowable Reverse Current	I <sub>R</sub>	85	mA
Storage Temperature	T <sub>stg</sub>	-40 ~ 85	°C
Operating Temperature	T <sub>m</sub>	0 ~ 55	°C

<sup>1</sup> The maximum rating provided in Figure 1 should not be exceeded.

As the forward current and/or the operating case temperature become higher, the lifetime of the LD will become shorter.

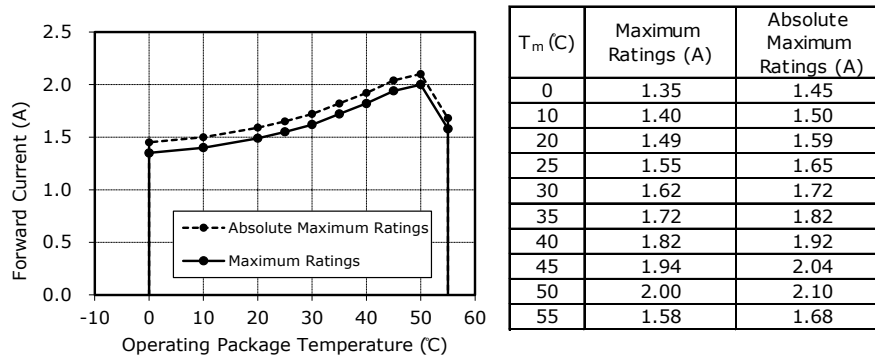


Figure 1. Derating Characteristics

## Initial Electrical/Optical Characteristics<sup>2,3</sup>

Item	Symbol	Condition	Min	Typ.	Max	Unit	
Optical Output Power	P <sub>O</sub>	I <sub>F</sub> = 1.5A	34.5	(38.0)	41.5	W	
Dominant Wavelength <sup>4</sup>	λ <sub>d</sub>	I <sub>F</sub> = 1.5A	635	(639) (643)	647	nm	
Threshold Current	I <sub>th</sub>	-	200	-	350	mA	
Slope Efficiency	η	-	-	(31)	-	W/A	
Forward Voltage <sup>5</sup>	V <sub>F</sub>	I <sub>F</sub> = 1.5A	55.0	(60.5)	66.0	V	
Beam Pointing Tilt Angle <sup>6</sup>	Δθ	I <sub>F</sub> = 1.5A	-	-	1.1	°	
Beam Divergence <sup>7</sup>	Parallel	θ <sub>∥</sub>	I <sub>F</sub> = 1.5A	0.1	(0.5)	0.9	°
	Perpendicular	θ <sub>⊥</sub>	I <sub>F</sub> = 1.5A	-1.5	(0)	1.5	°

<sup>2</sup> Characteristics values are values measured under Nichia's measurement conditions/environments; there may be variations for the measurement repeatability/reproducibility of these values. The values in parentheses are for reference purposes only.

<sup>3</sup> Characteristics at T<sub>m</sub> = 25°C and measured in CW mode.

<sup>4</sup> The LD are from two different typical dominant wavelengths.

<sup>5</sup> Characteristics measured with the twenty-eight LD chips connected in series.

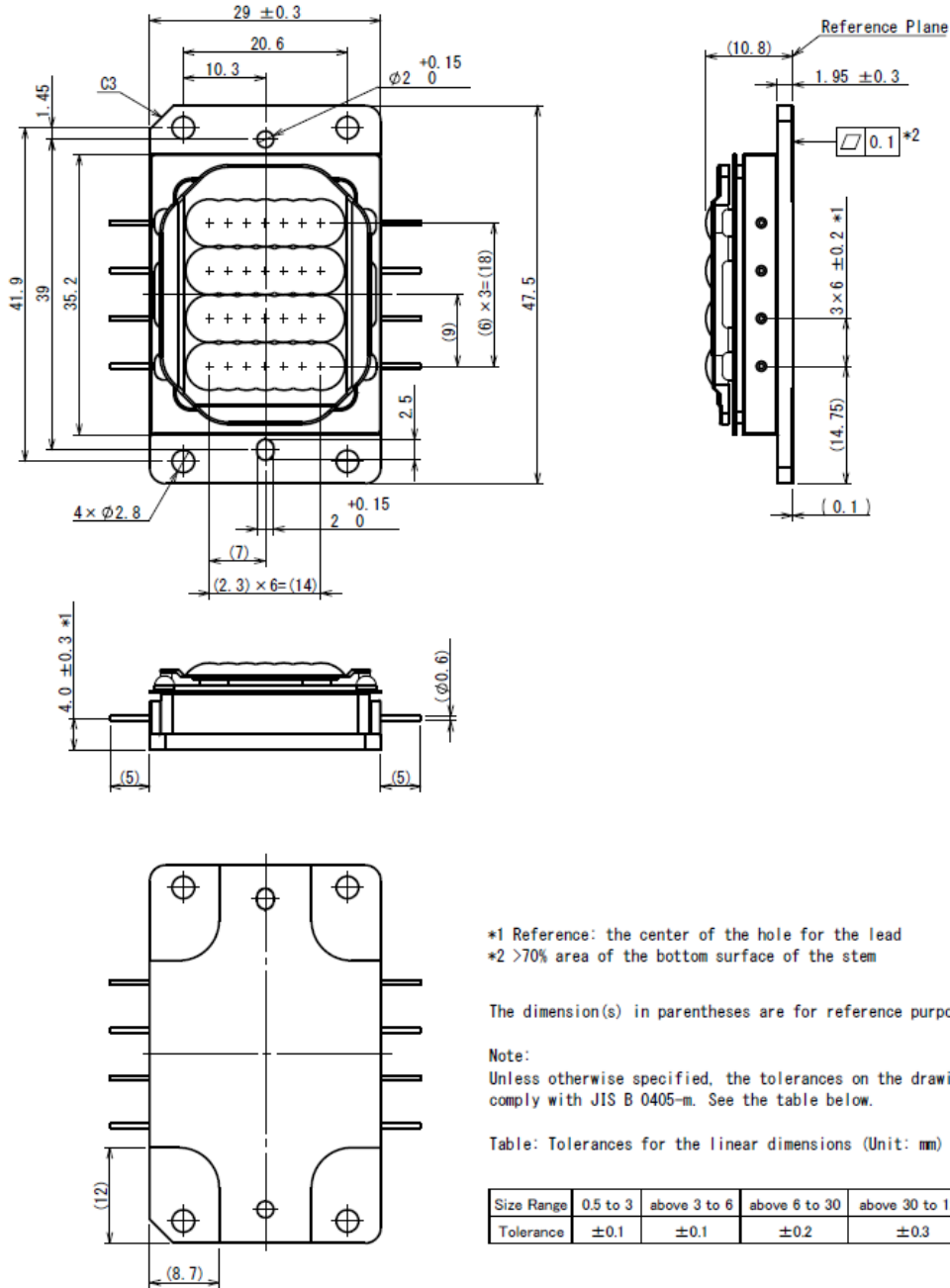
<sup>6</sup>  $\Delta\theta = \sqrt{\Delta\theta_{\parallel}^2 + \Delta\theta_{\perp}^2}$  (Δθ is the value of the total emission of all the LD chips)

<sup>7</sup> Full angle at 1/e<sup>2</sup> of peak intensity for the total emission of all the LD chips.

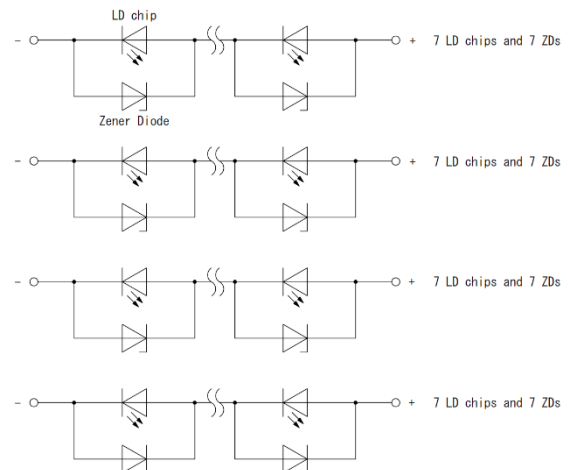
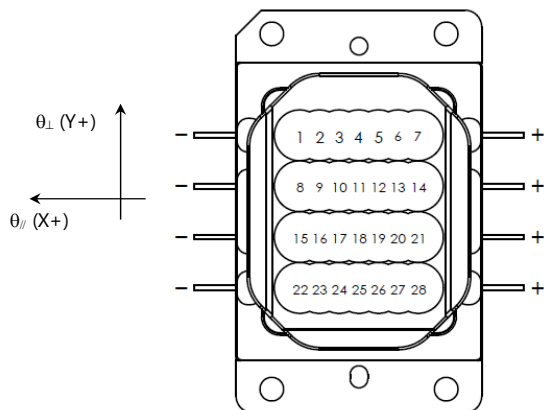
**This model is an Engineering Sample for evaluation or design purposes only. Lifetime is not guaranteed. The above specifications are for reference purposes only and are subject to change without prior notice.**

## Outline Dimensions

(Unit: mm)



## LD Chip Location Number & Drive Circuit



This LD has a Zener Diode built in as a protection circuit against static electricity.

## ■ Cautions

### (1) Laser Hazard

- This LD is a laser diode classified as Class 4 per JIS C 6802, IEC 60825-1, and FDA/CDRH 21 CFR Part 1040.10; this is the most hazardous class. Ensure that the latest editions of IEC 60825-1 and/or applicable standards for general safety requirements and guidance for laser products are complied with.
- There is a risk of serious injury to the skin/eyes if they are exposed to the LD light. Even diffused/reflected light is harmful. It must be ensured that the maximum permissible exposure is not exceeded; use proper safety glasses for the wavelength and optical output power of the LD.
- This LD emits collimated light. Collimated light propagates over a long distance while maintaining a high energy density; the skin/eyes must not be exposed to the light.



### (2) Storage

- To avoid condensation, the LDs must not be stored in areas where temperature and humidity fluctuate greatly both before and after opening the antistatic, moisture-proof bag. The LDs must be stored under an environment of 5-35°C, 40-75% RH.
- This LD has plated parts. If the LDs are exposed to a corrosive environment, it may cause the plated surface to tarnish causing issues (e.g. electric connection failures). Once the antistatic, moisture-proof bag is opened, ensure that the LDs are assembled into the chosen application/heatsink immediately; if they are not used immediately, they must be stored in a hermetically sealed container (e.g. the original antistatic, moisture-proof bag).
- Do not store the LDs in a dusty environment.
- Do not expose the LDs to direct sunlight and/or an environment over a long period of time where the temperature is higher than normal room temperature.

### (3) Design Consideration

- This LD is a semiconductor device that has a high current density during operation in the emission layer. Exceeding the Absolute Maximum Ratings may damage the LD. The circuit must be designed to ensure that the Absolute Maximum Ratings (see Absolute Maximum Ratings and Figure 1) are not exceeded even if the LDs are operated only for a short period of time.
- Since the lifetime of the LD will become shorter as the operating current and/or the optical output power becomes larger, the maximum ratings provided in Figure 1 should not be exceeded.
- This LD should be operated in an automatic current control (ACC) circuit. Additionally, the circuit to operate the LDs should be designed taking into consideration the current rise time. If no measures are incorporated into the circuit and the current rise time is too short, even though there seems to be no issues (e.g. inrush current, etc.) with the waveform of the current when observed with an oscilloscope, it may cause the LDs to emit excessive light resulting in it being damaged.
- When the LD is operated in ACC mode, if it is operated at a higher operating package temperature ( $T_m$ ), the optical output power of the LD will become lower and the lifetime of the LD will become shorter; ensure that the thermal design of the chosen application is appropriate for the required heat dissipation performance.
- The forward voltage ( $V_F$ ) and the optical output power vary depending on the operating package temperature ( $T_m$ ). Additionally, the optical output power will gradually decrease over time as the operating time increases.
- When the power supply is turned on or off, the circuit may have issues (e.g. chattering, current spikes, inrush current, etc.) resulting in the Absolute Maximum Rating Current being exceeded. The circuit must be designed to prevent this from occurring.
- The failure modes for this LD can be either a short circuit or an open circuit and this is very important to understand when designing the circuit. If the LD chips become short-circuited during operation, the forward voltage ( $V_F$ ) may fluctuate resulting in damage to the circuit. To ensure that there are no issues with the designed circuit when these failure modes occur in the LDs, perform a sufficient verification prior to use. This verification should be performed taking into consideration the conditions/environments in which the end-product containing these LDs will actually be used.
- In this LD, the lens array is attached to the cap using adhesive(s). The adhesion strength is sufficient for the operating conditions within the specifications described in this specification. However, the lens array might be removed/shifted depending on the environments and/or the design of the chosen application where the LD is operated, etc. If the lens array becomes removed/shifted during operation, uncollimated light may be emitted and/or the direction of the laser light emission may be affected causing the light to hit an unintended place/object resulting in the occurrence of smoke, fire, and leakage of laser light; for safety, the chosen application must be designed to prevent the leakage of light and to de-energize the LD when uncollimated light is emitted and/or the light is emitted in an unintended direction.
- Depending on the environments where the LDs are operated, dust/particles may be attracted by the light of the LDs (i.e. optical dust collection effect) and adhere to the surface of the lens array resulting in an adverse effect on the optical characteristics.

### (4) Handling Precautions

- This LD is hermetically sealed; ensure that excessive force is not applied to the lead and/or the cap when handling the LDs. If the cap and/or the sealing glass at the base of the lead is damaged, the hermetic seal for the LD may fail causing reduction in the optical output power and/or change in the shape of the beam to be accelerated and eventually the LD not to illuminate. Note that if the LD is dropped, it may also break the hermetic seal for the LD.
- Ensure that excessive force is not applied to this LD. Otherwise, it may cause the stem, the cap, and/or the lens array to be deformed and/or damaged resulting in the characteristics of the LD not to meet the specification.

- Do not solder the stem of this LD directly to a heatsink.
- The pull and push force applied to the lead of this LD must be  $\leq 5N$ .
- When bending the lead, securely hold the lead on the side closer to the stem from where the bending occurs in order to reduce the load that is applied to the base of the lead. Bending must be done only once.
  - Maximum Bending Angle:  $90^\circ$
  - Bending location: No closer than 2mm from the base of the lead

#### (5) Soldering

- This LD is designed to be hand soldered. If reflow soldered, Nichia will not guarantee the reliability of the LDs.
- Ensure that the hand soldering is done under the conditions below:
  - Soldering temperature:  $\leq 350^\circ C$ ,  $\leq 3$  sec
  - Soldering location: 2mm from the base of the lead
- Ensure that the tip of the soldering iron does not touch the sealing glass at the base of the lead.
- Ensure that solder does not attach to the sealing glass at the base of the lead.

#### (6) Shape of the Beam

- This LD emits elliptical-shaped parallel light through the lens array. Adjust the shape of the beam emitted from the LD with a lens that is suitable for the chosen application when using the LD.
- Ensure that the lens array is not damaged/contaminated when handling the LDs. Otherwise, this may reduce the optical output power and/or change the shape of the beam.
- The lens array is attached to the cap using adhesive(s). The lens array might be removed/shifted if the LD is operated under high temperature and high humidity conditions, or the reflected light continuously hits the lens array and/or adhesive; this may change the shape of the beam.

#### (7) Electrostatic Discharges (ESD) and Electrical Surges

- This LD is sensitive to transient excessive voltages (e.g. ESD, lightning surge). If this excessive voltage occurs in the circuit, it may cause the LD chip to be damaged causing issues (e.g. the LD chip to become dimmer or not to illuminate). Ensure that when handling the LDs, necessary measures are taken to protect them from ESD.

#### (8) Thermal Management

- The temperature of the LDs while in operation may vary depending on the thermal resistance of the heatsink and other materials (e.g. thermal interface materials, etc.), the condition of the contact surface of the heatsink (e.g. holes/opening, cavities/recesses, foreign materials, etc.), and how the LDs are attached to the heatsink (e.g. with/without grease, etc.). Once the heatsink and other materials are selected, sufficient verification should be performed to ensure that adequate adhesion is achieved and that the Absolute Maximum Operating Package Temperature ( $T_m$ ) is not exceeded.
- When thermal grease is used, ensure that it does not adversely affect the electrical characteristics of the LD and that the volatile compounds from the grease do not have an effect on the optical characteristics.

#### (9) Miscellaneous

- This LD is intended to be used for household appliances and electronic devices (e.g. mobile communication devices) laser diodes have been used in; it is not designed or manufactured for use in applications that require safety critical functions (e.g. automobiles, trains, vessels, aircraft, spacecraft, submarine repeaters, nuclear reactor control systems, traffic control equipment, combustion equipment, life support systems, safety devices, etc.). If the LDs are planned to be used for these applications, unless otherwise detailed in the specification, Nichia will neither guarantee that the LD is fit for that purpose nor be responsible for any resulting property damage, injuries and/or loss of life/health. This LD does not comply with IATF 16949 and is not intended for automotive applications.
- When using this LD for the chosen application (e.g. equipment, devices, etc.), design for safety must be considered to ensure that any LD failure does not cause any injuries to the human body and/or damage to property.
- This LD can fail at a certain rate. The failure rate and/or failure mode of the LD can vary depending on several factors (e.g. circuit, environmental conditions, etc.).
- Without prior written permission from Nichia, the Customer will not reverse engineer, disassemble or otherwise attempt to extract knowledge/design information from the LD. In the case of any incident that appears not to conform to the foregoing specifications, the local Nichia sales representative should be notified to discuss instructions on how to proceed while ensuring that the LD in question is not disassembled.
- Both the Customer and Nichia will agree on the official specifications for the supplied LDs before any programs are officially launched. Without this agreement in writing (i.e. the Customer Specific Specification), changes to the content of this specification may occur without notice (e.g. changes to the foregoing specifications and appearance, discontinuation of the LDs, etc.).
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