NICHIA CORPORATION

# SPECIFICATIONS FOR UV LED

## NCSU033B(T)

- Pb-free Reflow Soldering Application
- Built-in ESD Protection Device
- RoHS Compliant

# SPECIFICATIONS

## (1) Absolute Maximum Ratings

| Item | Symbol | Absolute Maximum Rating | Unit |
|---|---|---|---|
| Forward Current | $I_F$ | 700 | mA |
| Pulse Forward Current | $I_{FP}$ | 1000 | mA |
| Allowable Reverse Current | $I_R$ | 85 | mA |
| Power Dissipation | $P_D$ | 3.08 | W |
| Operating Temperature | $T_{opr}$ | -10~85 | °C |
| Storage Temperature | $T_{stg}$ | -40~100 | °C |
| Junction Temperature | $T_J$ | 130 | °C |

* Absolute Maximum Ratings at $T_S$=25°C.

* $I_{FP}$ conditions with pulse width ≤10ms and duty cycle ≤10%.

## (2) Initial Electrical/Optical Characteristics

| Item | Symbol | Condition | Typ | Unit |
|---|---|---|---|---|
| Forward Voltage | $V_F$ | $I_F$=500mA | 3.8 | V |
| Radiant Flux | $\Phi_e$ | $I_F$=500mA | 325 | mW |
| Peak Wavelength | $\lambda_p$ | $I_F$=500mA | 365 | nm |
| Spectrum Half Width | $\Delta\lambda$ | $I_F$=500mA | 9.0 | nm |

* Characteristics at $T_S$=25°C.

* Radiant Flux value as per CIE 127:2007 standard.

* For stabilizing the LED characteristics, it is recommended to operate at greater than 10% nominal current.

# RANKS

| Item | Rank | Min | Max | Unit |
|---|---|---|---|---|
| Forward Voltage | H | 4.0 | 4.4 | V |
| | M | 3.6 | 4.0 | |
| | L | 3.2 | 3.6 | |
| Radiant Flux | P9 | 350 | 390 | mW |
| | P8 | 310 | 350 | |
| | P7 | 270 | 310 | |
| Peak Wavelength | Ua | 360 | 370 | nm |

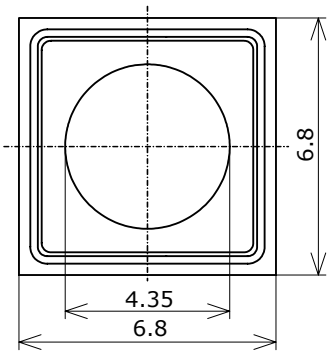
* Ranking at $T_S$=25°C.
* Tolerance of measurements of the Forward Voltage is ±0.05V.
* Tolerance of measurements of the Radiant Flux is ±10%.
* Tolerance of measurements of the Peak Wavelength is ±3nm.
* A shipment shall consist of LEDs in a combination of the above ranks.
  The percentage of each rank in the shipment shall be determined by Nichia.

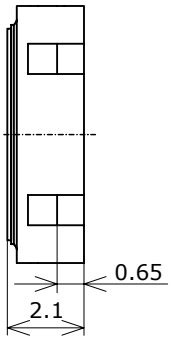
# OUTLINE DIMENSIONS

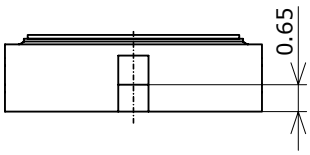
* 本製品はRoHS指令に適合しております。
This product complies with RoHS Directive.

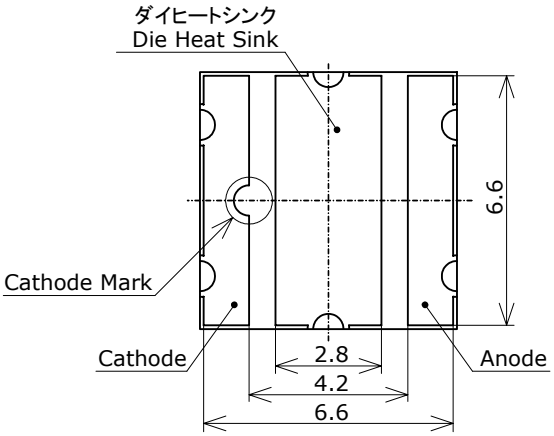
NCSU033x
管理番号 No. STS-DA7-0454A

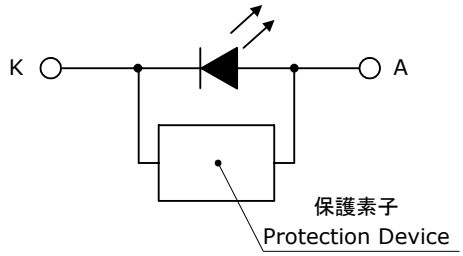
(単位 Unit: mm，公差 Tolerance: ±0.2)



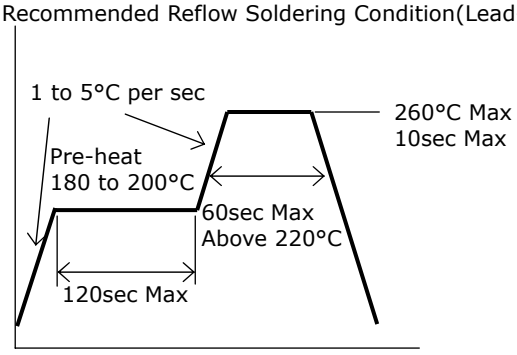



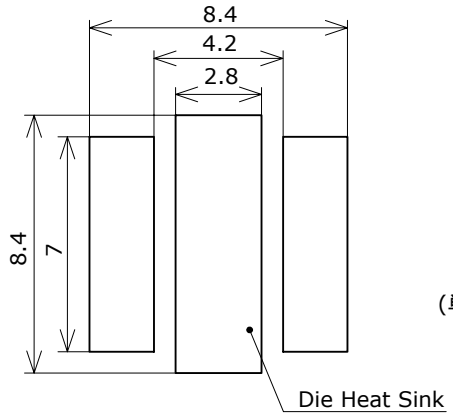

| 項目 Item | 内容 Description |
|---|---|
| パッケージ材質<br>Package Materials | セラミックス<br>Ceramics |
| ガラス窓材質<br>Glass Materials | 硬質ガラス/コバール<br>Hard Glass/Kovar |
| 電極材質<br>Electrodes Materials | 金メッキ<br>Au-plated |
| ダイヒートシンク材質<br>Die Heat Sink Materials | 金メッキ<br>Au-plated |
| 質量<br>Weight | 0.29g(TYP) |

# SOLDERING

• Recommended Reflow Soldering Condition(Lead-free Solder)




• Recommended Soldering Pad Pattern



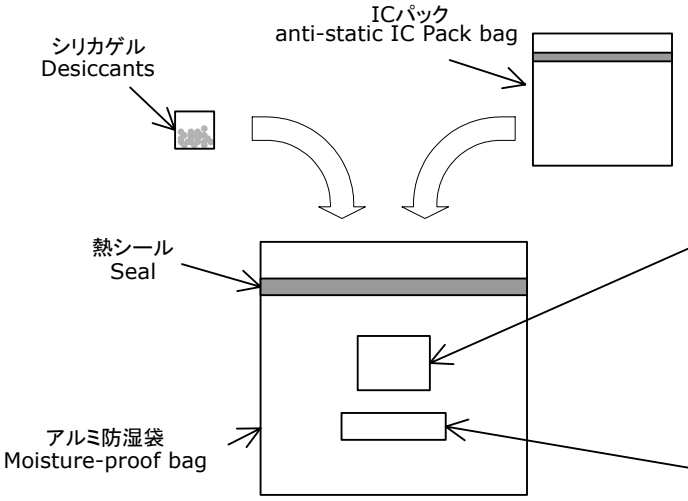

(単位 Unit: mm)

* This LED is designed to be reflow soldered on to a PCB. If dip soldered or hand soldered, Nichia cannot guarantee its reliability.
* Reflow soldering must not be performed more than twice.
* Avoid rapid cooling. Ramp down the temperature gradually from the peak temperature.
* Nitrogen reflow soldering is recommended. Air flow soldering conditions can cause optical degradation, caused by heat and/or atmosphere.
* Repairing should not be done after the LEDs have been soldered. It should be confirmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairing.
* The Die Heat Sink should be soldered to customer PCB. If it is difficult or impossible, use high heat-dissipating adhesive.
* When soldering, do not apply stress to the LED while the LED is hot.

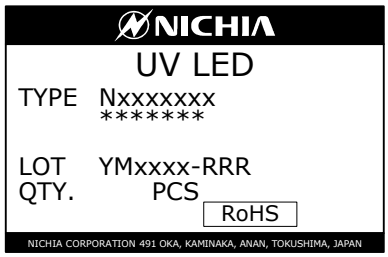
# PACKAGING - BULK

シリカゲルとともにICパックをアルミ防湿袋に入れ、熱シールにより封をします。
Anti-static *IC packs* are shipped with desiccants
in heat-sealed moisture-proof bags.

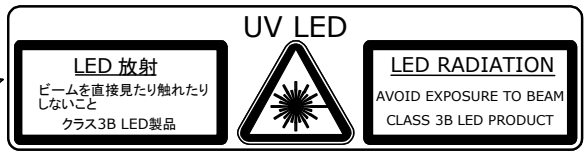
Nxxxxxxx
管理番号 No. STS-DA7-1108A



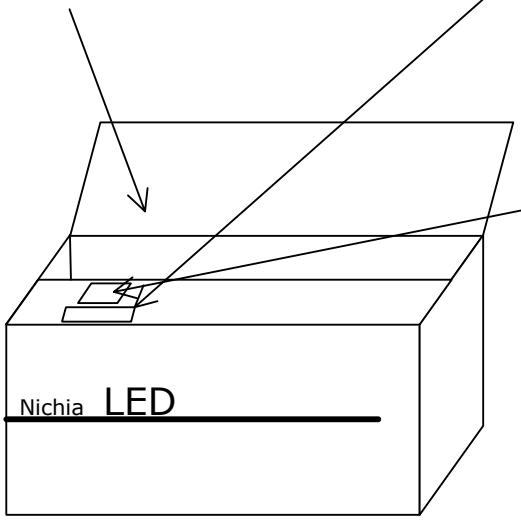

ラベル Label



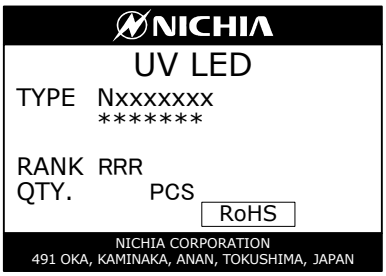

警告ラベル Warning and Explanatory Labels




アルミ防湿袋を並べて入れ、間隔にはクッション材を詰めます。
Moisture-proof bags are packed in cardboard boxes
with shock absorbing materials to fill empty spaces.




ラベル Label




* 客先型名を*******で示します。
客先型名が設定されていない場合は空白です。
******* is the customer part number.
If not provided, it is not indicated on the label.

* ロット表記方法についてはロット番号の項を
参照して下さい。
For details, see "LOT NUMBERING SCHEME"
in this document.

* 本製品はICパックに入れたのち、輸送の衝撃から保護するためダンボールで梱包します。
Products shipped in anti-static *IC packs* are packed in a moisture-proof bag.
They are shipped in cardboard boxes to protect them from external forces during transportation.

* 取り扱いに際して、落下させたり、強い衝撃を与えたりしますと、製品を損傷させる原因になりますので注意して下さい。
Do not drop or shock the box. It may damage the products.

* ダンボールには防水加工がされておりませんので、梱包箱が水に濡れないよう注意して下さい。
Do not expose to water, the box is not water-resistant.

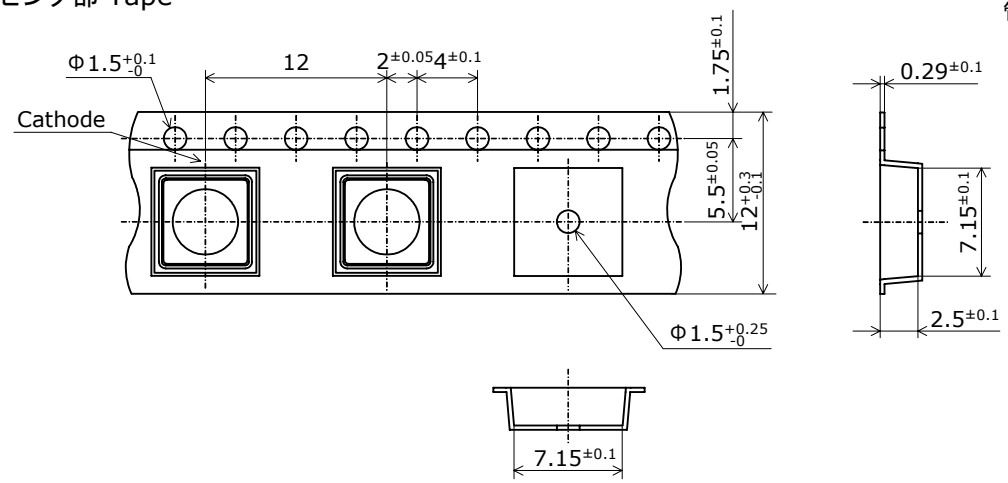
* 輸送、運搬に際して弊社よりの梱包状態あるいは同等の梱包を行って下さい。
Using an original packaging material or equivalent in transit is recommended.

# TAPE AND REEL DIMENSIONS

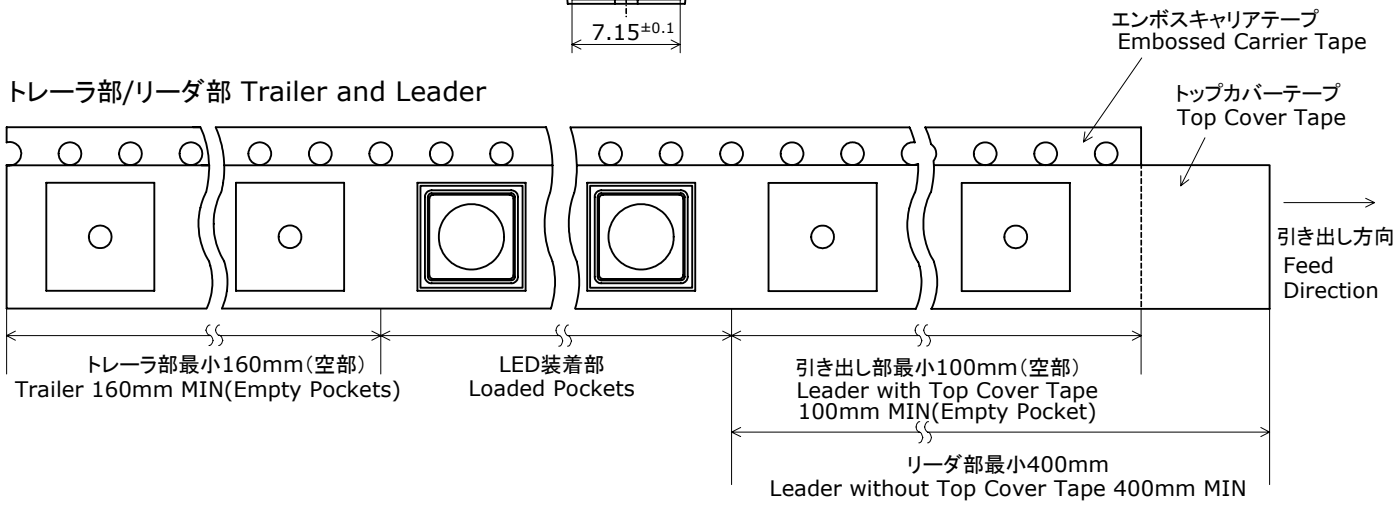
Nxxx033x
管理番号 No. STS-DA7-0181

(単位 Unit: mm)

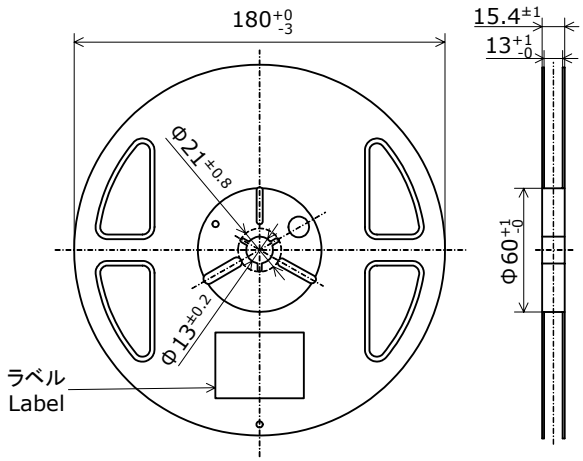
## テーピング部 Tape




## トレーラ部/リーダ部 Trailer and Leader




## リール部 Reel



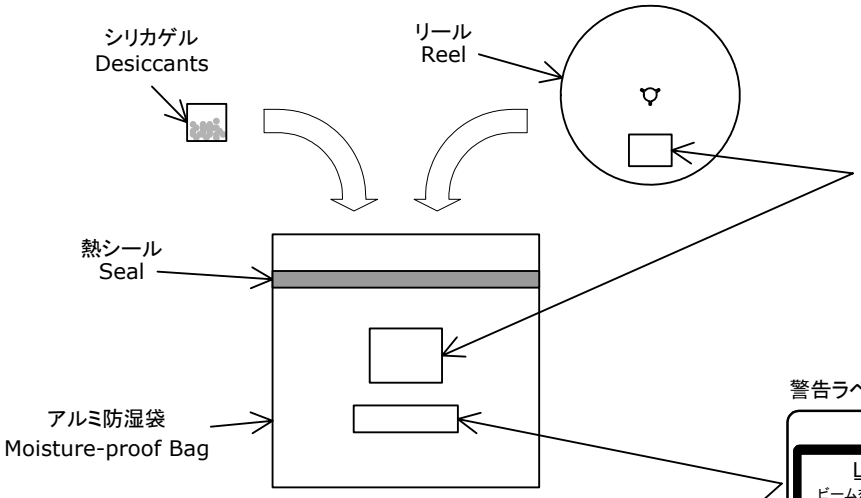

* 数量は1リールにつき 500個入りです。
Quantity per reel=500pcs

* JIS C 0806電子部品テーピングに準拠しています。
The tape packing method complies with JIS C 0806
(Packaging of Electronic Components on Continuous Tapes).

# PACKAGING - TAPE & REEL

シリカゲルとともにリールをアルミ防湿袋に入れ、熱シールにより封をします。
Reels are shipped with desiccants in heat-sealed moisture-proof bags.

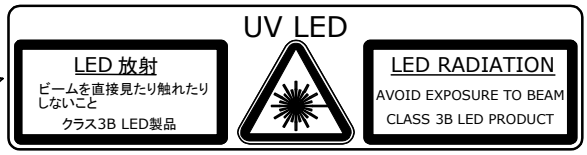
Nxxxxxxx
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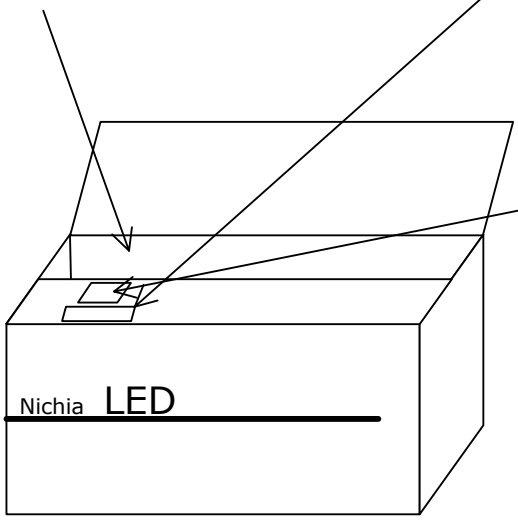

ラベル Label

NICHIA
UV LED
TYPE Nxxxxxxx
*******
LOT YMxxxx-RRR
QTY. PCS
RoHS
NICHIA CORPORATION 491 OKA, KAMINAKA, ANAN, TOKUSHIMA, JAPAN

警告ラベル Warning and Explanatory Labels




アルミ防湿袋を並べて入れ、ダンボールで仕切ります。
Moisture-proof bags are packed in cardboard boxes with corrugated partitions.




ラベル Label

NICHIA
UV LED
TYPE Nxxxxxxx
*******
RANK RRR
QTY. PCS
RoHS
NICHIA CORPORATION
491 OKA, KAMINAKA, ANAN, TOKUSHIMA, JAPAN

* 客先型名を*******で示します。
客先型名が設定されていない場合は空白です。
******* is the customer part number.
If not provided, it is not indicated on the label.

* ロット表記方法についてはロット番号の項を参照して下さい。
For details, see "LOT NUMBERING SCHEME" in this document.

* 本製品はテーピングしたのち、輸送の衝撃から保護するためダンボールで梱包します。
Products shipped on tape and reel are packed in a moisture-proof bag.
They are shipped in cardboard boxes to protect them from external forces during transportation.

* 取り扱いに際して、落下させたり、強い衝撃を与えたりしますと、製品を損傷させる原因になりますので注意して下さい。
Do not drop or shock the box. It may damage the products.

* ダンボールには防水加工がされておりませんので、梱包箱が水に濡れないよう注意して下さい。
Do not expose to water, the box is not water-resistant.

* 輸送、運搬に際して弊社よりの梱包状態あるいは同等の梱包を行って下さい。
Using an original packaging material or equivalent in transit is recommended.

# LOT NUMBERING SCHEME

Lot Number is presented by using the following alphanumeric code.

YMxxxx - RRR

Y - Year

| Year | Y |
|---|---|
| 2009 | 9 |
| 2010 | A |
| 2011 | B |
| 2012 | C |
| 2013 | D |
| 2014 | E |

M - Month

| Month | M | Month | M |
|---|---|---|---|
| 1 | 1 | 7 | 7 |
| 2 | 2 | 8 | 8 |
| 3 | 3 | 9 | 9 |
| 4 | 4 | 10 | A |
| 5 | 5 | 11 | B |
| 6 | 6 | 12 | C |

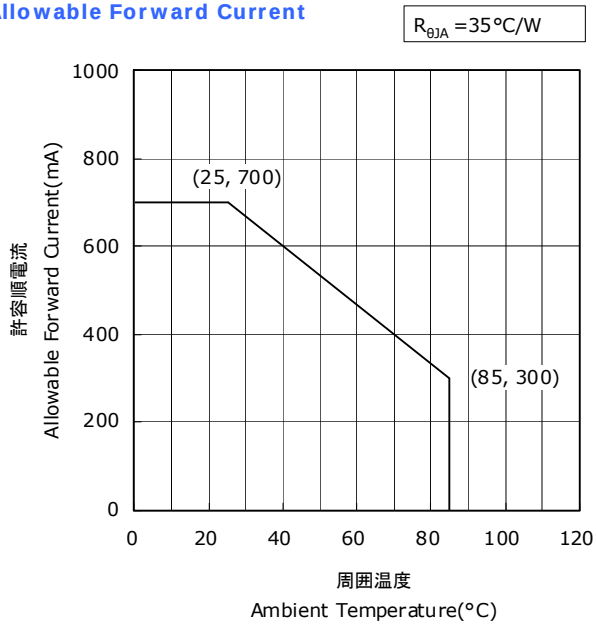
xxxx-Nichia's Product Number

RRR-Ranking by Wavelength, Ranking by Radiant Flux, Ranking by Forward Voltage

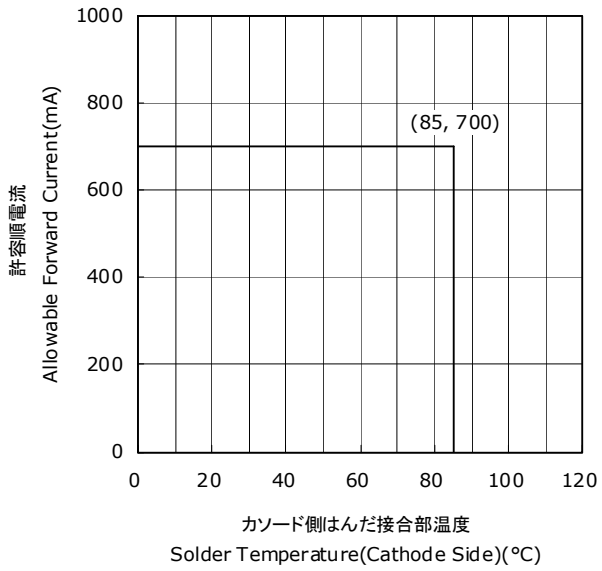
# DERATING CHARACTERISTICS

NCSU033B
管理番号 No. STS-DA7-2588

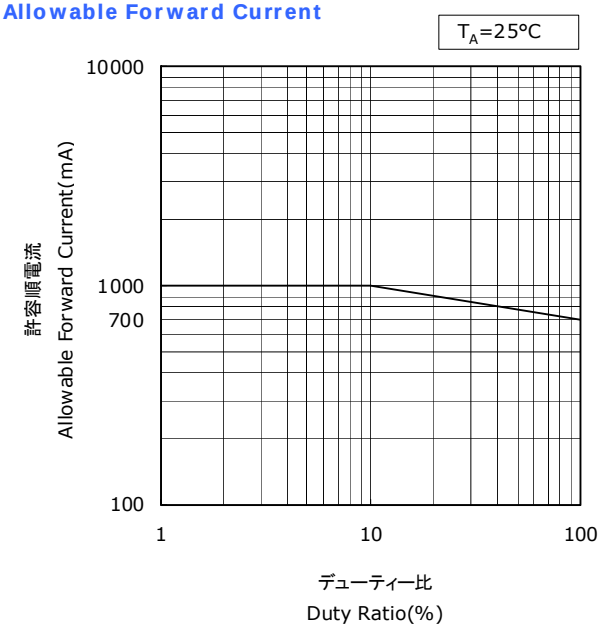
### 周囲温度−許容順電流特性
### Ambient Temperature vs Allowable Forward Current




### カソード側はんだ接合部温度−許容順電流特性
### Solder Temperature(Cathode Side) vs Allowable Forward Current




### デューティー比−許容順電流特性
### Duty Ratio vs Allowable Forward Current

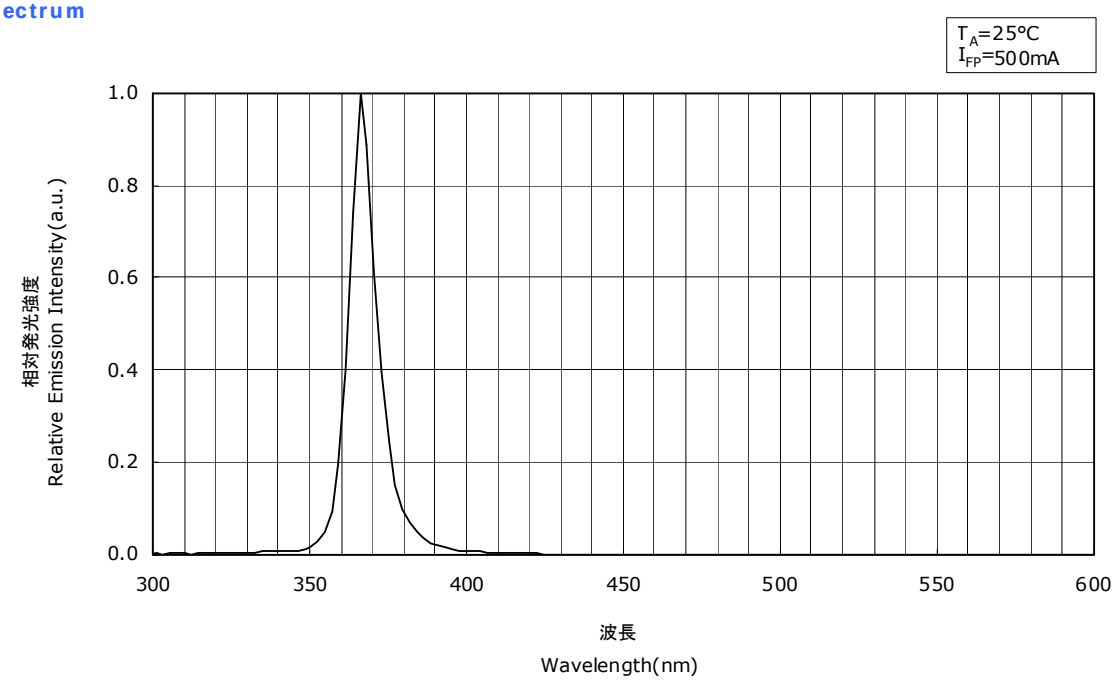


# OPTICAL CHARACTERISTICS

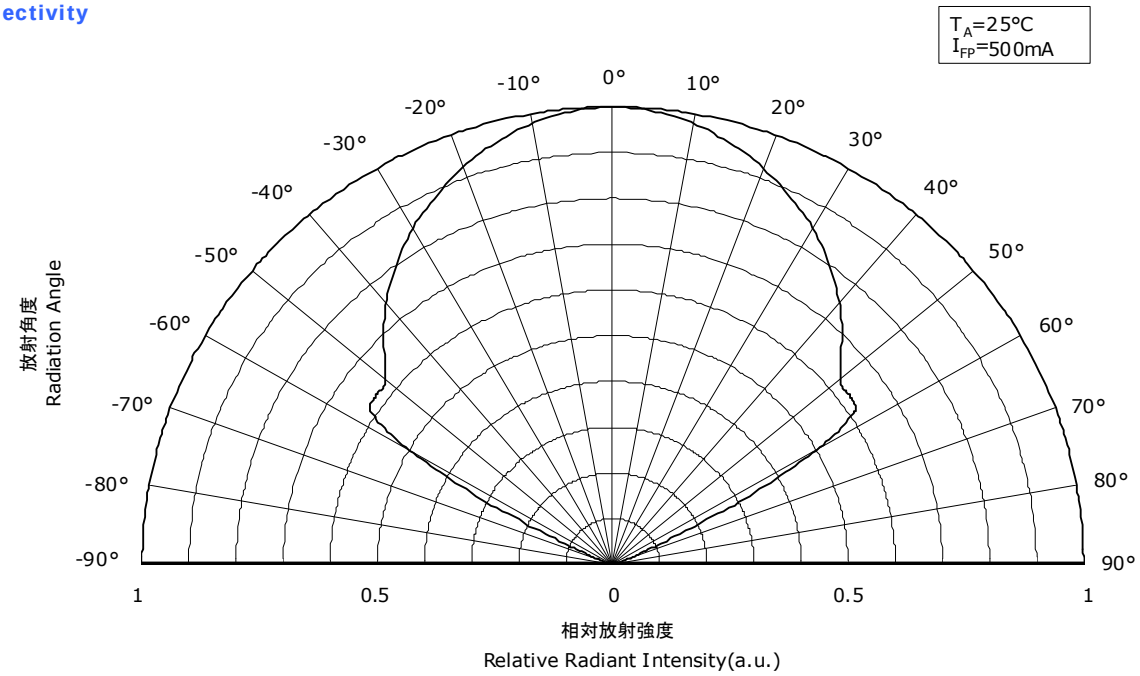
＊ 本特性は参考です。
All characteristics shown are for reference only and are not guaranteed.

NCSU033B
管理番号 No. STS-DA7-2589

**発光スペクトル**
**Spectrum**




**指向特性**
**Directivity**

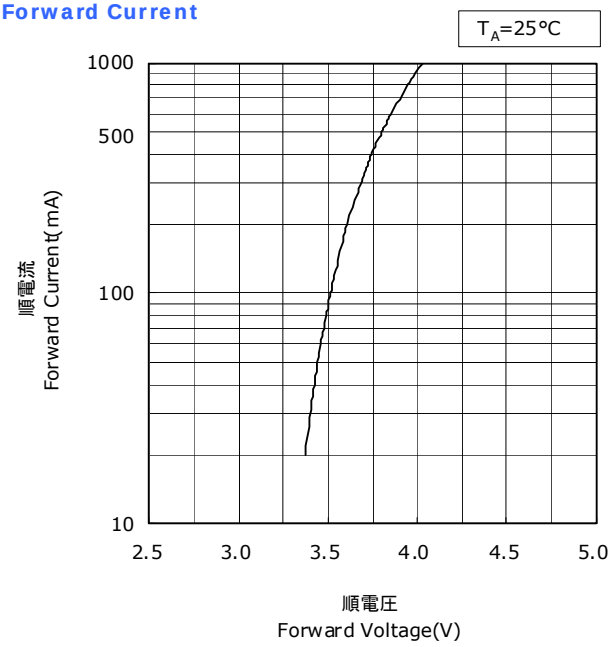


# FORWARD CURRENT CHARACTERISTICS / TEMPERATURE CHARACTERISTICS

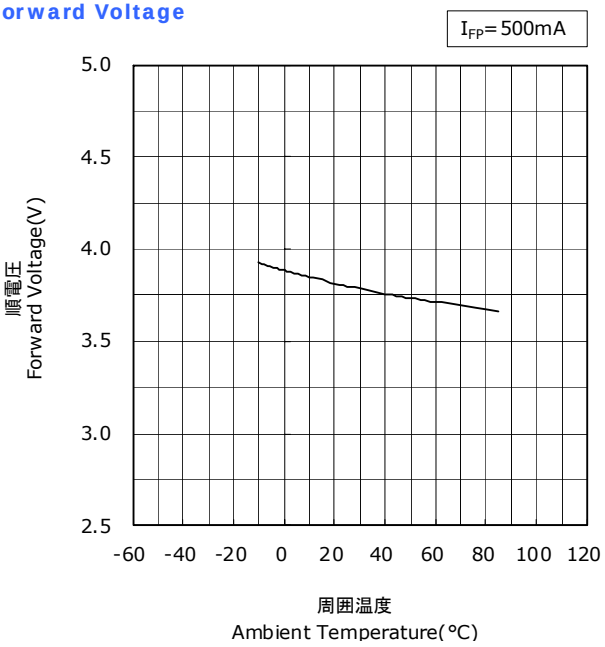
＊ 本特性は参考です。
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NCSU033B
管理番号 No. STS-DA7-2590

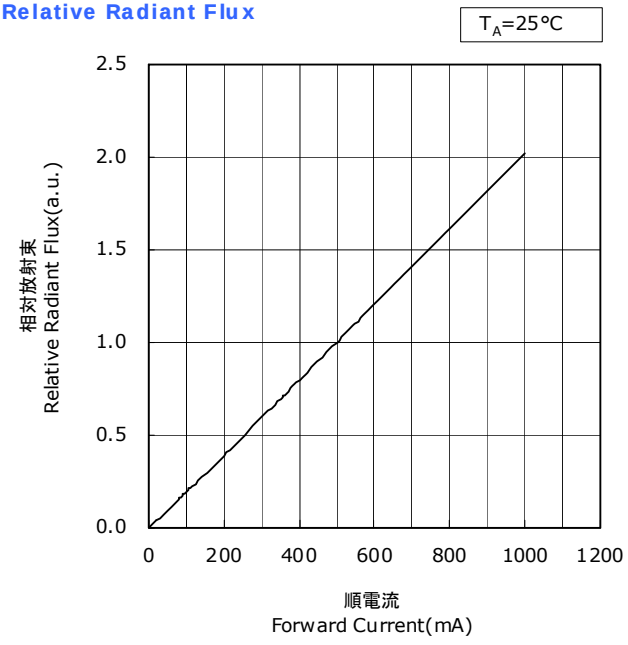
### 順電圧-順電流特性
### Forward Voltage vs Forward Current



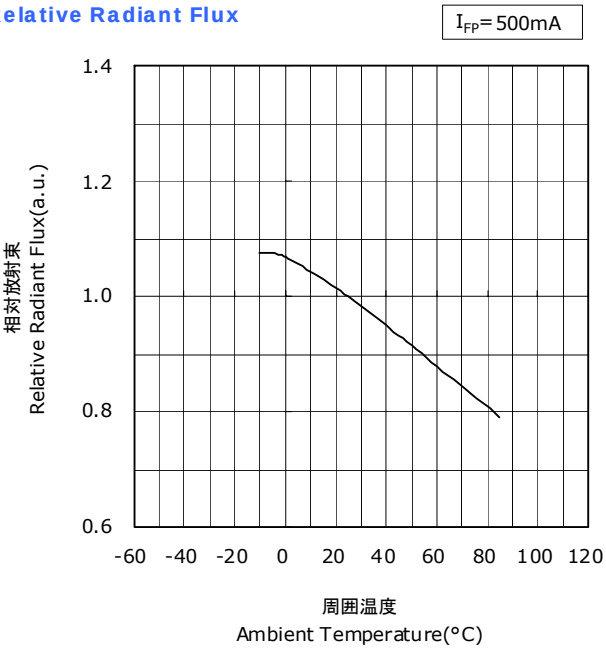

### 周囲温度-順電圧特性
### Ambient Temperature vs Forward Voltage




### 順電流-相対放射束特性
### Forward Current vs Relative Radiant Flux




### 周囲温度-相対放射束特性
### Ambient Temperature vs Relative Radiant Flux

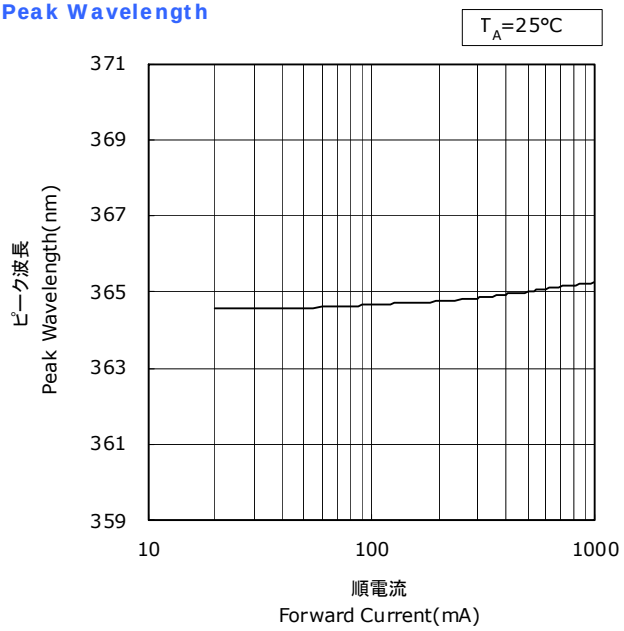


# FORWARD CURRENT CHARACTERISTICS / TEMPERATURE CHARACTERISTICS

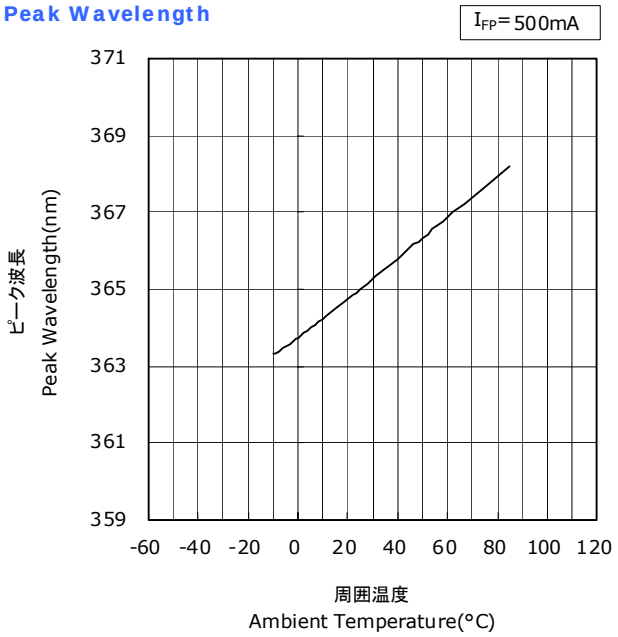
＊ 本特性は参考です。
All characteristics shown are for reference only and are not guaranteed.

NCSU033B
管理番号 No. STS-DA7-2591

**順電流-ピーク波長特性**
**Forward Current vs Peak Wavelength**




**周囲温度-ピーク波長特性**
**Ambient Temperature vs Peak Wavelength**



# RELIABILITY

## (1) Tests and Results

| Test | Reference Standard | Test Conditions | Test Duration | Failure Criteria # | Units Failed/Tested |
|---|---|---|---|---|---|
| Resistance to Soldering Heat (Reflow Soldering) | | $T_{sld}$=260°C, 10sec, 2reflows | | #1 | 0/10 |
| Temperature Cycle | JEITA ED-4701 100 105 | -40°C(30min)~25°C(5min)~ 100°C(30min)~25°C(5min) | 100cycles | #1 | 0/10 |
| High Temperature Storage | JEITA ED-4701 200 201 | $T_A$=100°C | 1000hours | #1 | 0/10 |
| Low Temperature Storage | JEITA ED-4701 200 202 | $T_A$=-40°C | 1000hours | #1 | 0/10 |
| Room Temperature Operating Life Condition 1 | | $T_A$=25°C, $I_F$=500mA | 1000hours | #1 | 0/10 |
| Room Temperature Operating Life Condition 2 | | $T_A$=25°C, $I_F$=700mA | 1000hours | #1 | 0/10 |
| High Temperature Operating Life | | $T_A$=85°C, $I_F$=300mA | 1000hours | #1 | 0/10 |
| Temperature Humidity Operating Life | | 60°C, RH=90%, $I_F$=450mA | 500hours | #1 | 0/10 |
| Low Temperature Operating Life | | $T_A$=-10°C, $I_F$=500mA | 1000hours | #1 | 0/10 |
| Vibration | JEITA ED-4701 400 403 | 200m/s$^2$, 100~2000~100Hz, 4cycles, 4min, each X, Y, Z | 48minutes | #1 | 0/10 |
| Electrostatic Discharges | JEITA ED-4701 300 304 | HBM, 2kV, 1.5kΩ, 100pF, 3pulses, alternately positive or negative | | #1 | 0/10 |

NOTES:

1) $R_{\theta JA}$≈35°C/W

2) Measurements are performed after allowing the LEDs to return to room temperature.

## (2) Failure Criteria

| Criteria # | Items | Conditions | Failure Criteria |
|---|---|---|---|
| #1 | Forward Voltage($V_F$) | $I_F$=500mA | >Initial value×1.1 |
| | Radiant Flux($\Phi_E$) | $I_F$=500mA | <Initial value×0.7 |

# CAUTIONS

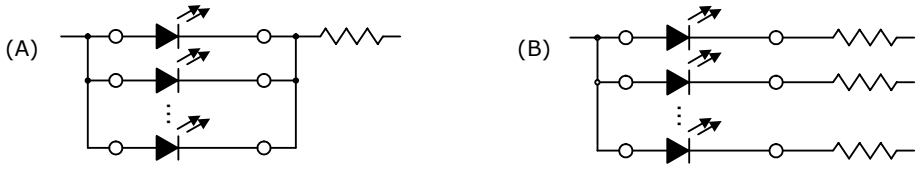
## (1) Storage

| Conditions | | Temperature | Humidity | Time |
|---|---|---|---|---|
| Storage | Before Opening Aluminum Bag | ≤30°C | ≤90%RH | Within 1 Year from Delivery Date |

- Absorbed moisture in LED packages can vaporize and expand during soldering, which can cause interface delamination and result in optical performance degradation. Products are packed in moisture-proof aluminum bags to minimize moisture absorption during transportation and storage.
  Included silica gel desiccants change from blue to red if moisture had penetrated bags.
- Although the leads or electrode pads (anode and cathode) of the product are plated with gold, prolonged exposure to a corrosive environment might cause the gold plated the leads or electrode pads to tarnish, and thus leading to difficulties in soldering. If unused LEDs remain, they must be stored in a hermetically sealed container.
  Nichia recommends using the original moisture-proof bag for storage.
- Do not use sulfur-containing materials in commercial products. Some materials, such as seals and adhesives, may contain sulfur. The contaminated plating of LEDs might cause an open circuit. Silicone rubber is recommended as a material for seals.
  Bear in mind, the use of silicones may lead to silicone contamination of electrical contacts inside the products, caused by low molecular weight volatile siloxane.
- To prevent water condensation, please avoid large temperature and humidity fluctuations for the storage conditions.

## (2) Directions for Use

- When designing a circuit, the current through each LED must not exceed the Absolute Maximum Rating.
  Operating at a constant current per LED is recommended. In case of operating at a constant voltage, Circuit B is recommended.
  If the LEDs are operated with constant voltage using Circuit A, the current through the LEDs may vary due to the variation in Forward Voltage characteristics of the LEDs.




- LEDs should be operated in forward bias. Driving circuits must not subject LEDs to either forward or reverse voltage while off.
  Continuous reverse voltage can cause migration and LED damage.
- For stabilizing the LED characteristics, it is recommended to operate at greater than 10% nominal current.
- For outdoor use, necessary measures should be taken to prevent water, moisture and salt air damage.
- This LED also emits visible light. Please take notice of visible light spectrum, in case you use this LED as light source of sensors etc.

## (3) Handling Precautions

- Do not handle LEDs with bare hands, it may contaminate the LED surface and affect optical characteristics.
  In the worst case, catastrophic failure from excess pressure through wire-bond breaks and package damage may result.
- When handling the product with tweezers, be careful not to apply excessive force to the resin.
  Otherwise, The resin can be cut, chipped, delaminate or deformed, causing wire-bond breaks and catastrophic failures.
- Dropping the product may cause damage.
- Do not stack assembled PCBs together. Failure to comply can cause the resin portion of the product to be cut, chipped, delaminated and/or deformed. It may cause wire to break, leading to catastrophic failures.

## (4) Design Consideration

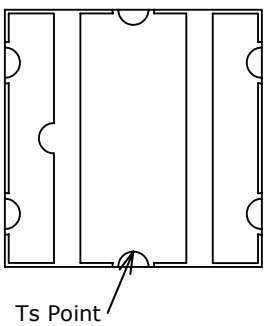
- Although Nichia recommends using a copper PCB for this product, customer is advised to verify the PCB with the products before use. Stress during soldering can cause the glass lens to break and/or the solder joints to crack.
- PCB warpage after mounting the products onto a PCB can cause the package to break.
  The LED should be placed in a way to minimize the stress on the LEDs due to PCB bow and twist.
- The position and orientation of the LEDs affect how much mechanical stress is exerted on the LEDs placed near the score lines.
  The LED should be placed in a way to minimize the stress on the LEDs due to board flexing.
- Board separation must be performed using special jigs, not using hands.
- If an aluminum PCB is used, customer is advised to verity the PCB with the products before use.
  Thermal stress during use can cause the solder joints to crack.

## (5) Electrostatic Discharge (ESD)

- The products are sensitive to static electricity or surge voltage. ESD can damage a die and its reliability.
  When handling the products, the following measures against electrostatic discharge are strongly recommended:
  Eliminating the charge
  Grounded wriststrap, ESD footwear, clothes, and floors
  Grounded workstation equipment and tools
  ESD table/shelf mat made of conductive materials
- Proper grounding is required for all devices, equipment, and machinery used in product assembly.
  Surge protection should be considered when designing of commercial products.
- If tools or equipment contain insulating materials such as glass or plastic,
  the following measures against electrostatic discharge are strongly recommended:
  Dissipating static charge with conductive materials
  Preventing charge generation with moisture
  Neutralizing the charge with ionizers
- The customer is advised to check if the LEDs are damaged by ESD
  when performing the characteristics inspection of the LEDs in the application.
  Damage can be detected with a forward voltage measurement at low current (≤1mA).
- ESD damaged LEDs may have current flow at a low voltage.
  Failure Criteria: $V_F$<2.0V at $I_F$=0.5mA

## (6) Thermal Management

- Proper thermal management is an important when designing products with LEDs. LED die temperature is affected by PCB thermal resistance and LED spacing on the board. Please design products in a way that the LED die temperature does not exceed the maximum Junction Temperature ($T_J$).
- Drive current should be determined for the surrounding ambient temperature ($T_A$) to dissipate the heat from the product.
- The following equations can be used to calculate the junction temperature of the products.
  1) $T_J=T_A+R_{\theta JA}\cdot W$  2) $T_J=T_S+R_{\theta JS}\cdot W$
  *$T_J$=LED junction temperature: °C
  $T_A$=Ambient temperature: °C
  $T_S$=Soldering temperature (cathode side): °C
  $R_{\theta JA}$=Thermal resistance from junction to ambient: °C/W
  $R_{\theta JS}$=Thermal resistance from junction to $T_S$ measuring point≈7°C/W
  W=Input power($I_F\times V_F$): W



## (7) Cleaning

- The LEDs should not be cleaned. Other cleaning agents except for Freon solvent should be tested prior to use whether they will not affect the package and the glass. Please note that Freon solvent is prohibited worldwide.
- Ultrasonic cleaning is not recommended since it may have adverse effects on the LEDs depending on the ultrasonic power and how LED is assembled.
  If ultrasonic cleaning must be used, the customer is advised to make sure the LEDs will not be damaged prior to cleaning.

## (8) Eye Safety

- In 2006, the International Electrical Commission (IEC) published IEC 62471:2006 Photobiological safety of lamps and lamp systems, which added LEDs in its scope.
  On the other hand, the IEC 60825-1:2007 laser safety standard removed LEDs from its scope.
  However, please be advised that some countries and regions have adopted standards based on the IEC laser safety standard IEC 60825-1:20112001, which still includes LEDs in its scope.
  Most of Nichia's LEDs can be classified as belonging into either the Exempt Group or Risk Group 1.
  High-power LEDs, that emit light containing blue wavelengths, may be classified as Risk Group 2.
  Please proceed with caution when viewing directly any LEDs driven at high current, or viewing LEDs with optical instruments which may greatly increase the damages to your eyes.
- Viewing a flashing light may cause eye discomfort. When incorporating the LED into your product, please be careful to avoid adverse effects on the human body caused by light stimulation.
- The products are UV light LEDs, and radiate intense UV light during operation. Since UV light can be harmful to eyes, do NOT look directly into the UV light, even through an optical instrument. In case of the light reflection, UV protective glasses are required to use in order to avoid damage by the light.

## (9) Others

- The LEDs described in this brochure are intended to be used for ordinary electronic equipment (such as office equipment, communications equipment, measurement instruments and household appliances).
  Consult Nichia's sales staff in advance for information on the applications in which exceptional quality and reliability are required, particularly when the failure or malfunction of the LEDs may directly jeopardize life or health (such as for airplanes, aerospace, submersible repeaters, nuclear reactor control system, automobiles, traffic control equipment, life support systems and safety devices).
- The customer shall not reverse engineer by disassembling or analysis of the LEDs without having prior written consent from Nichia. When defective LEDs are found, the customer shall inform Nichia directly before disassembling or analysis.
- Both the customers and Nichia will agree on official specifications of supplied products before a customer's volume production.
- Specifications and appearance subject to change for improvement without notice.