

SPECIFICATIONS FOR NICHIA CHIP TYPE LED

MODEL : **NHSB046T-N5**

NICHIA CORPORATION

1.SPECIFICATIONS

(1) Absolute Maximum Ratings (Ta=25°C)

| Item | Symbol | Absolute Maximum Rating | Unit |
|---------------------------|--------|---|------|
| Forward Current | IF | 10 | mA |
| Pulse Forward Current | IFP | 30 | mA |
| Allowable Reverse Current | IR | 85 | mA |
| Power Dissipation | PD | 30 | mW |
| Operating Temperature | Topr | -40 ~ +100 | °C |
| Storage Temperature | Tstg | -40 ~ +100 | °C |
| Soldering Temperature | Tsld | Reflow Soldering : 260°C for 10sec. Dip Soldering : 260°C for 10sec. Hand Soldering : 350°C for 3sec. | |

IFP Conditions : Pulse Width ≤ 10msec. and Duty ≤ 1/10

(2) Initial Electrical/Optical Characteristics (Ta=25°C)

| Item | Symbol | Condition | Typ. | Max. | Unit | |
|-------------------------|--------|-----------|----------|-------|------|---|
| Forward Voltage | VF | IF=5[mA] | (2.9) | 3.1 | V | |
| Luminous Intensity | Iv | IF=5[mA] | (75) | - | mcd | |
| Chromaticity Coordinate | x | - | IF=5[mA] | 0.214 | - | - |
| | y | - | IF=5[mA] | 0.394 | - | - |

* Forward Voltage Measurement allowance is ± 0.05V.

* Luminous intensity value is traceable to the CIE 127:2007-compliant national standards.

* Please refer to CIE 1931 chromaticity diagram.

(3) Ranking (Ta=25°C)

| Item | Symbol | Condition | Min. | Max. | Unit |
|--------------------|--------|-----------|------|------|------|
| Luminous Intensity | Rank R | IF=5[mA] | 90 | 125 | mcd |
| | Rank Q | | 63 | 90 | |
| | Rank P | | 45 | 63 | |

* Luminous Intensity Measurement allowance is ± 10%.

Color Rank (IF=5mA, Ta=25°C)

| | Rank N520 | | | | | |
|---|-----------|-------|-------|-------|-------|-------|
| x | 0.215 | 0.204 | 0.199 | 0.212 | 0.223 | 0.227 |
| y | 0.378 | 0.379 | 0.394 | 0.410 | 0.408 | 0.394 |

* Color Coordinates Measurement allowance is ± 0.01.

* Basically, a shipment shall consist of the LEDs of a combination of the above ranks.

The percentage of each rank in the shipment shall be determined by Nichia.

2.INITIAL OPTICAL/ELECTRICAL CHARACTERISTICS

Please refer to “CHARACTERISTICS” on the following pages.

3.OUTLINE DIMENSIONS AND MATERIALS

Please refer to “OUTLINE DIMENSIONS” on the following page.

4.PACKAGING

- The LEDs are packed in cardboard boxes after taping.
Please refer to “TAPING DIMENSIONS” and “PACKING ”on the following pages.
The label on the minimum packing unit shows ; Part Number, Lot Number, Ranking, Quantity
- In order to protect the LEDs from mechanical shock, we pack them in cardboard boxes for transportation.
- The LEDs may be damaged if the boxes are dropped or receive a strong impact against them,
so precautions must be taken to prevent any damage.
- The boxes are not water resistant and therefore must be kept away from water and moisture.
- When the LEDs are transported, we recommend that you use the same packing method as Nichia.

5.LOT NUMBER

The first six digits number shows **lot number**.

The lot number is composed of the following characters;

○□×××× - ◇◇◇

○ - Year (9 for 2009, A for 2010)

□ - Month (1 for Jan., 9 for Sep., A for Oct., B for Nov.)

×××× - Nichia's Product Number

◇◇◇ - Ranking by Color Coordinates, Ranking by Luminous Intensity

6.RELIABILITY

(1) TEST ITEMS AND RESULTS

| Test Item | Standard Test Method | Test Conditions | Note | Number of Damaged |
|--|---------------------------|---|------------------------------|-------------------|
| Resistance to Soldering Heat (Dip Soldering) | JEITA ED-4701 300 301 | Tsld=260°C, 10sec. (Pre treatment 30°C,70%,168hrs.) | 1 time | 0/22 |
| Resistance to Soldering Heat (Reflow Soldering) | JEITA ED-4701 300 301 | Tsld=260°C, 10sec. (Pre treatment 30°C,70%,168hrs.) | 2 times | 0/22 |
| Solderability (Dip Soldering/ Reflow Soldering) | JEITA ED-4701 303 303A | Tsld=245 ± 5°C, 5sec. using flux Lead-free Solder (Sn-3.0Ag-0.5Cu) | 1 time over 95% | 0/22 |
| Thermal Shock | JEITA ED-4701 300 307 | -40°C ~ 100°C 1min. (10sec.) 1min. (Pre treatment 30°C,70%,168hrs.) | 100 cycles | 0/100 |
| Temperature Cycle | JEITA ED-4701 100 105 | -40°C ~ 25°C ~ 100°C ~ 25°C 30min. 5min. 30min. 5min. | 100 cycles | 0/100 |
| Moisture Resistance Cyclic | JEITA ED-4701 200 203 | 25°C ~ 65°C ~ -10°C 90%RH 24hrs./1cycle | 10 cycles | 0/100 |
| High Temperature Storage | JEITA ED-4701 200 201 | Ta=100°C | 1000 hrs. | 0/100 |
| Temperature Humidity Storage | JEITA ED-4701 100 103 | Ta=60°C, RH=90% | 1000 hrs. | 0/100 |
| Low Temperature Storage | JEITA ED-4701 200 202 | Ta=-40°C | 1000 hrs. | 0/100 |
| Steady State Operating Life ** | | Ta=25°C, IF=10mA | 1000 hrs. | 0/100 |
| Steady State Operating Life of High Temperature ** | | Ta=85°C, IF=5mA | 1000 hrs. | 0/100 |
| Steady State Operating Life of High Humidity Heat ** | | 60°C, RH=90%, IF=5mA | 1000 hrs. | 0/100 |
| Steady State Operating Life of Low Temperature ** | | Ta=-40°C, IF=5mA | 1000 hrs. | 0/100 |
| Permanence of Marking | JEITA ED-4701 500 501 | Solvent : Isopropyl Alcohol Solvent Temperature : 20 ~ 25°C Dipping Time : 5 min. | 1 time | 0/22 |
| Vibration | JEITA ED-4701 400 403 | 100 ~ 2000 ~ 100Hz Sweep 4min. 200m/s ² 3directions, 4cycles | 48min. | 0/10 |
| Drop | | 75cm | 3 times | 0/10 |
| Electrostatic Discharge | JEITA ED-4701 300 304 | R=1.5kΩ, C=100pF Test Voltage=2kV | 3 times Negative/Positive | 0/22 |

(2) CRITERIA FOR JUDGING DAMAGE

| Item | Symbol | Test Conditions | Criteria for Judgement | |
|-----------------------------------|----------------|---------------------|------------------------|----------------|
| | | | Min. | Max. |
| Forward Voltage | V _F | I _F =5mA | - | U.S.L.*) × 1.1 |
| Luminous Intensity Condition 1 | I _V | I _F =5mA | L.S.L.***) × 0.7 | - |
| Luminous Intensity Condition 2 ** | I _V | I _F =5mA | L.S.L.***) × 0.5 | - |

*) U.S.L. : Upper Standard Level

**) L.S.L. : Lower Standard Level

** These test items are judged by the criteria of Luminous Intensity Condition 2.

7.CAUTIONS

The LEDs are devices which are materialized by combining Blue LEDs and special phosphors. Consequently, the color of the LEDs is changed a little by an operating current. Care should be taken after due consideration when using LEDs.

(1) Moisture Proof Package

- When moisture is absorbed into the SMT package it may vaporize and expand during soldering. There is a possibility that this can cause exfoliation of the contacts and damage to the optical characteristics of the LEDs. For this reason, the moisture proof package is used to keep moisture to a minimum in the package.
- The moisture proof package is made of an aluminum moisture proof bag. A package of a moisture absorbent material (silica gel) is inserted into the aluminum moisture proof bag. The silica gel changes its color from blue to red as it absorbs moisture.

(2) Storage

· Storage Conditions

Before opening the package :

The LEDs should be kept at 30°C or less and 90%RH or less. The LEDs should be used within a year. When storing the LEDs, moisture proof packaging with absorbent material (silica gel) is recommended.

After opening the package :

The LEDs should be kept at 30°C or less and 70%RH or less. The LEDs should be soldered within 168 hours (7days) after opening the package. If unused LEDs remain, they should be stored in moisture proof packages, such as sealed containers with packages of moisture absorbent material (silica gel). It is also recommended to return the LEDs to the original moisture proof bag and to reseal the moisture proof bag again.

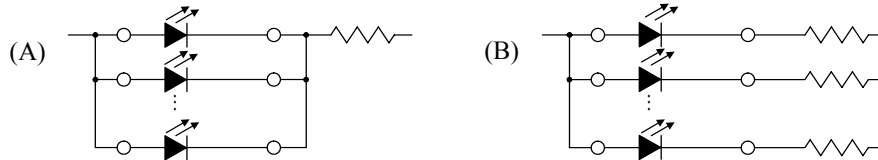
- If the moisture absorbent material (silica gel) has faded away or the LEDs have exceeded the storage time, baking treatment should be performed using the following conditions.

Baking treatment : more than 24 hours at $65 \pm 5^{\circ}\text{C}$

- Nichia LED electrodes are silver plated copper alloy. The silver surface may be affected by environments which contain corrosive substances. Please avoid conditions which may cause the LED to corrode, tarnish or discolor. This corrosion or discoloration may cause difficulty during soldering operations. It is recommended that the customer use the LEDs as soon as possible.
- Please avoid rapid transitions in ambient temperature, especially in high humidity environments where condensation can occur.

(3) Recommended circuit

- In designing a circuit, the current through each LED must not exceed the absolute maximum rating specified for each LED. It is recommended to use Circuit B which regulates the current flowing through each LED. In the meanwhile, when driving LEDs with a constant voltage in Circuit A, the current through the LEDs may vary due to the variation in forward voltage (V_F) of the LEDs. In the worst case, some LED may be subjected to stresses in excess of the absolute maximum rating.



- This product should be operated in forward bias. A driving circuit must be designed so that the product is not subjected to either forward or reverse voltage while it is off. In particular, if a reverse voltage is continuously applied to the product, such operation can cause migration resulting in LED damage.

(4) Heat Generation

- Thermal design of the end product is of paramount importance. Please consider the heat generation of the LED when making the system design. The coefficient of temperature increase per input electric power is affected by the thermal resistance of the circuit board and density of LED placement on the board, as well as other components. It is necessary to avoid intense heat generation and operate within the maximum ratings given in this specification.
- The operating current should be decided after considering the ambient maximum temperature of LEDs.

(5) Soldering Conditions

- The LEDs can be soldered in place using the reflow soldering method and the dip soldering method.
- Recommended soldering conditions

| Reflow Soldering | | | Dip Soldering | | Hand Soldering | |
|------------------|-----------------------------------|--|-------------------------|--------------|----------------|-----------------|
| | Lead Solder | Lead-free Solder | | | | |
| Pre-heat | 120 ~ 150°C | 180 ~ 200°C | Pre-heat | 100°C Max. | Temperature | 350°C Max. |
| Pre-heat time | 120 sec. Max. | 120 sec. Max. | Pre-heat time | 60 sec. Max. | Soldering time | 3 sec. Max. |
| Peak temperature | 240°C Max. | 260°C Max. | Solder bath temperature | 260°C Max. | | (one time only) |
| Soldering time | 10 sec. Max. | 10 sec. Max. | Dipping time | 10 sec. Max. | | |
| Condition | refer to Temperature - profile ①. | refer to Temperature - profile ②. (N ₂ reflow is recommended.) | | | | |

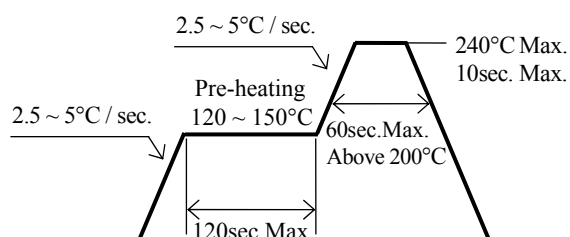
* Although the recommended soldering conditions are specified in the above table, reflow, dip or hand soldering at the lowest possible temperature is desirable for the LEDs.

* A rapid-rate process is not recommended for cooling the LEDs down from the peak temperature.

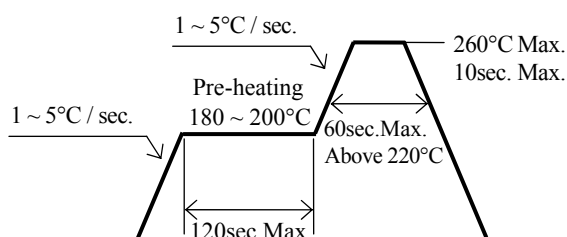
[Temperature-profile (Surface of circuit board)]

Use the conditions shown to the under figure.

<① : Lead Solder>

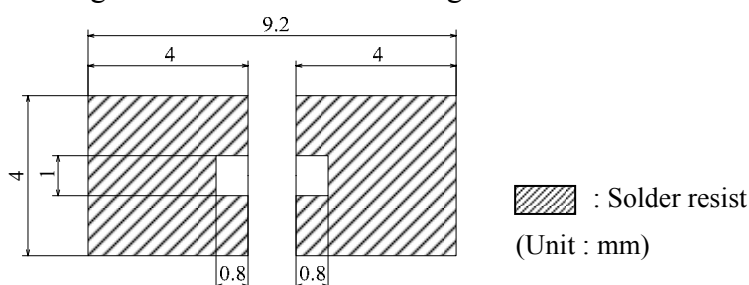


<② : Lead-free Solder>



[Recommended soldering pad design]

Use the following conditions shown in the figure.



- Occasionally there is a brightness decrease caused by the influence of heat or ambient atmosphere during air reflow. It is recommended that the customer use the nitrogen reflow method.
- Repairing should not be done after the LEDs have been soldered. When repairing is unavoidable, a double-head soldering iron should be used. It should be confirmed beforehand whether the characteristics of the LEDs will or will not be damaged by repairing.
- Reflow soldering should not be done more than two times.
- Dip soldering should not be done more than one time.
- When soldering, do not put stress on the LEDs during heating.
- After soldering, do not warp the circuit board.

(6) Cleaning

- It is recommended that isopropyl alcohol be used as a solvent for cleaning the LEDs. When using other solvents, it should be confirmed beforehand whether the solvents will dissolve the package and the resin or not. Freon solvents should not be used to clean the LEDs because of worldwide regulations.
- Do not clean the LEDs by the ultrasonic. When it is absolutely necessary, the influence of ultrasonic cleaning on the LEDs depends on factors such as ultrasonic power and the assembled condition. Before cleaning, a pre-test should be done to confirm whether any damage to the LEDs will occur.

(7) Static Electricity

- Static electricity or surge voltage damages the LEDs. It is recommended that a wrist band or an anti-electrostatic glove be used when handling the LEDs.
- All devices, equipment and machinery must be properly grounded. It is recommended that precautions be taken against surge voltage to the equipment that mounts the LEDs.
- When inspecting the final products in which LEDs were assembled, it is recommended to check whether the assembled LEDs are damaged by static electricity or not. It is easy to find static-damaged LEDs by a light-on test or a VF test at a lower current (below 1mA is recommended).
- Damaged LEDs will show some unusual characteristics such as the forward voltage becomes lower, or the LEDs do not light at the low current.

Criteria : (VF > 2.0V at IF=0.5mA)

(8) Safety Guideline for Human Eyes

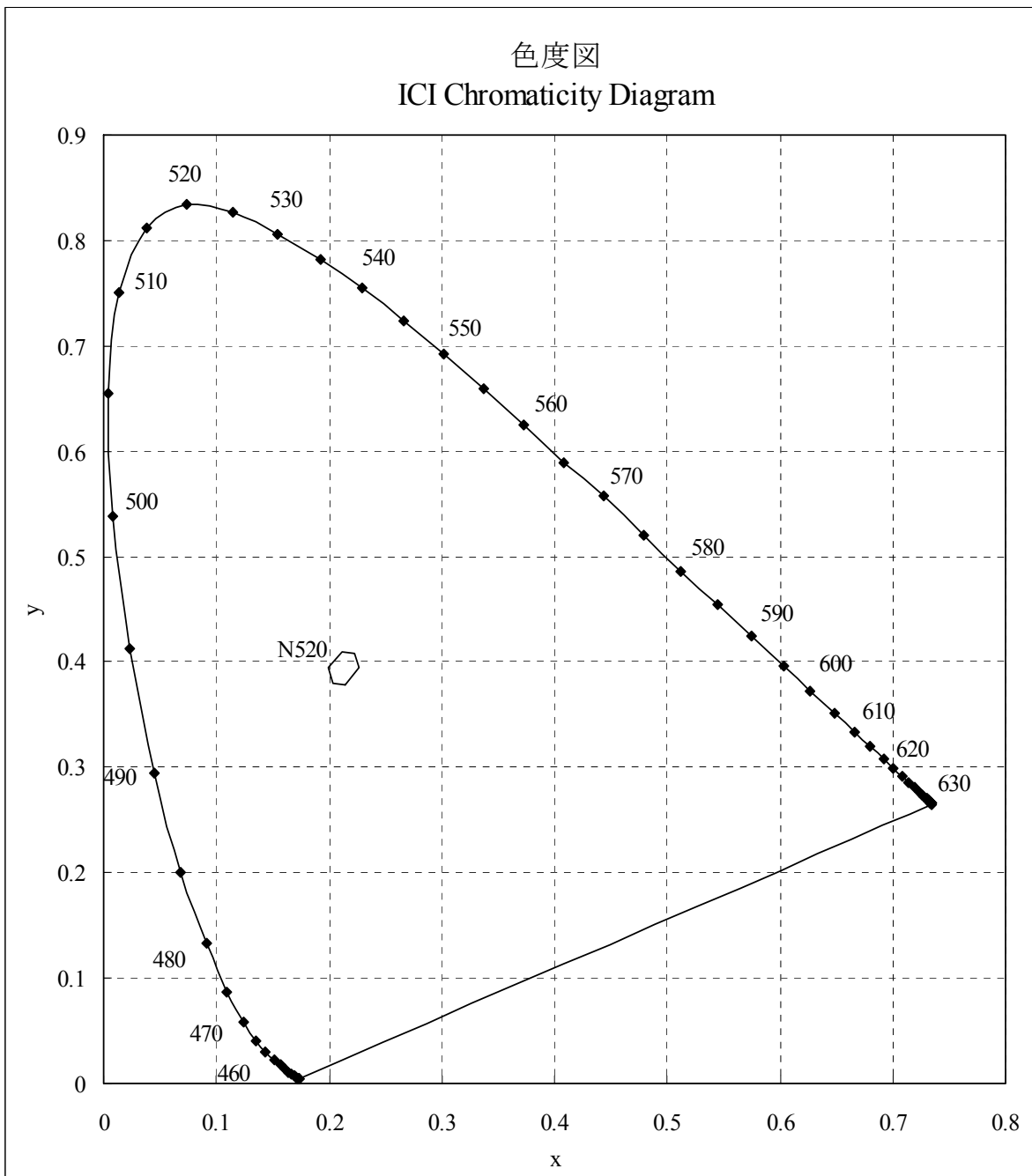
- The International Electrical Commission (IEC) published in 2006 IEC 62471:2006 *Photobiological safety of lamps and lamp systems* which includes LEDs within its scope. Meanwhile LEDs were removed from the scope of the IEC 60825-1:2007 laser safety standard, the 2001 edition of which included LED sources within its scope. However, keep in mind that some countries and regions have adopted standards based on the IEC laser safety standard IEC 60825-1:2001 which includes LEDs within its scope.

Following IEC 62471:2006, most of Nichia LEDs can be classified as belonging to either Exempt Group or Risk Group 1. Optical characteristics of a LED such as radiant flux, spectrum and light distribution are factors that affect the risk group determination of the LED. Especially a high-power LED, that emits light containing blue wavelengths, may be in Risk Group 2.

Great care should be taken when viewing directly the LED driven at high current or the LED with optical instruments, which may greatly increase the hazard to your eyes.

(9) Others

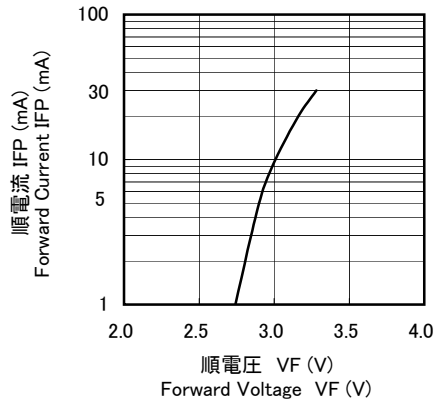
- NHSB046-N5 complies with RoHS Directive.
- Flashing lights have been known to cause discomfort in people; you can prevent this by taking precautions during use. Also, people should be cautious when using equipment that has had LEDs incorporated into it.
- The LEDs described in this brochure are intended 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 systems, 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.
- The formal specifications must be exchanged and signed by both parties before large volume purchase begins.
- The appearance and specifications of the product may be modified for improvement without notice.



* Color coordinates Measurement allowance is ± 0.01 .

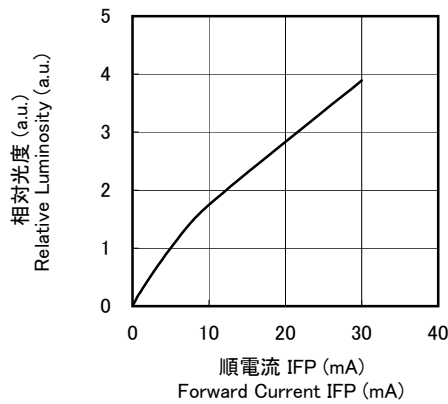
■ 順電圧-順電流特性
Forward Voltage vs.
Forward Current

Ta=25°C



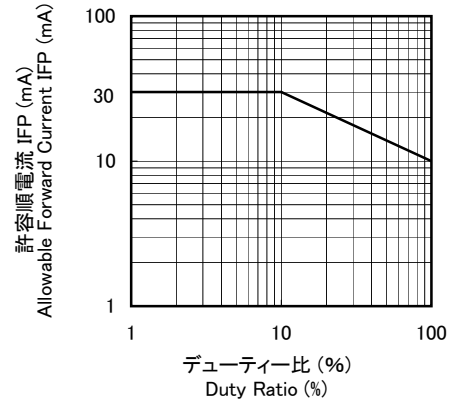
■ 順電流-相対光度特性
Forward Current vs.
Relative Luminosity

Ta=25°C



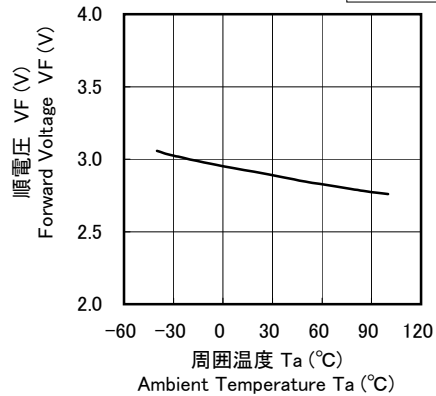
■ デューティー比-許容順電流特性
Duty Ratio vs.
Allowable Forward Current

Ta=25°C



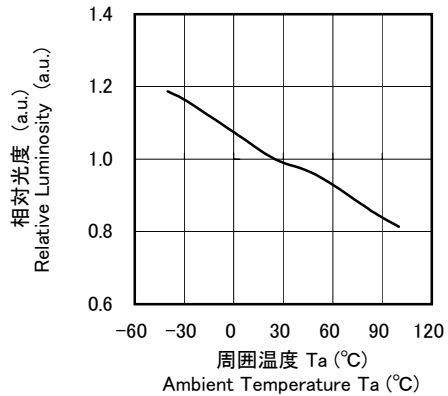
■ 周囲温度-順電圧特性
Ambient Temperature vs.
Forward Voltage

IFP=5mA

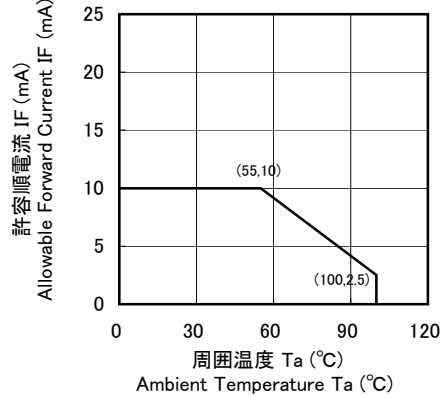


■ 周囲温度-相対光度特性
Ambient Temperature vs.
Relative Luminosity

IFP=5mA

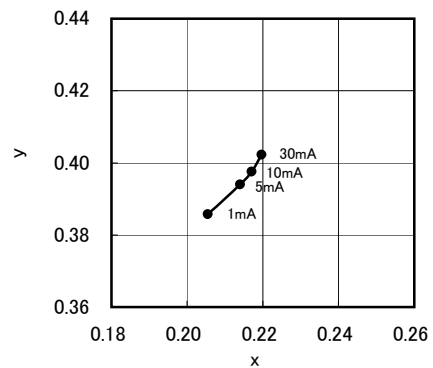


■ 周囲温度-許容順電流特性
Ambient Temperature vs.
Allowable Forward Current

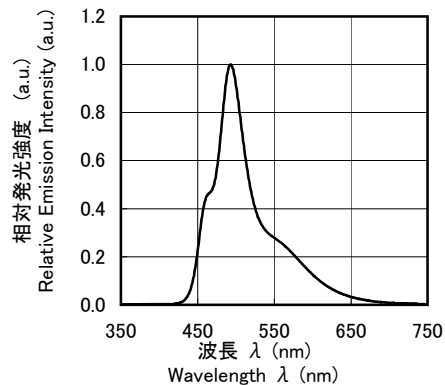


| | |
|----------------------------------|---|
| 型名 Model NHSB046-N5 | 名称 Title 初期電気/光学特性 CHARACTERISTICS |
| 日亜化学工業 (株) NICHIA CORPORATION | 管理番号 No. 100316057301 |

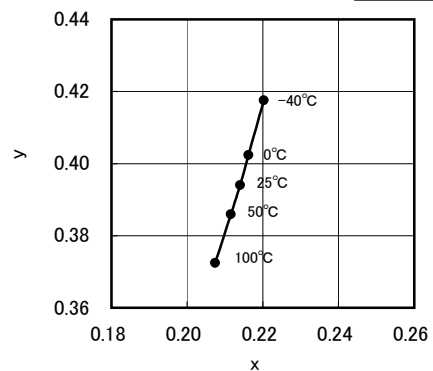
■ 順電流-色度特性
Forward Current vs.
Chromaticity Coordinate
Ta=25°C



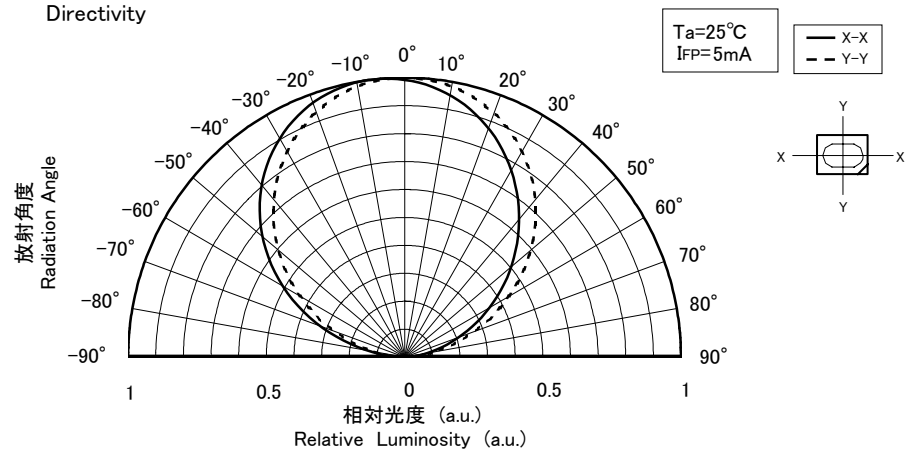
■ 発光スペクトル
Spectrum
Ta=25°C
If=5mA



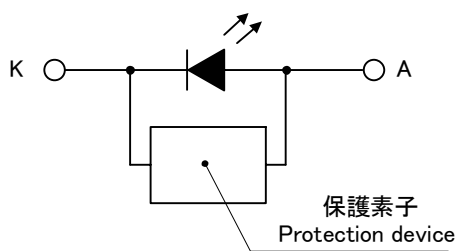
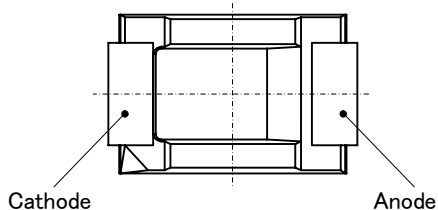
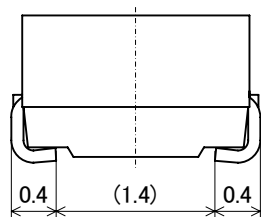
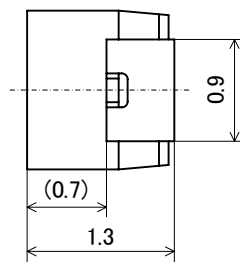
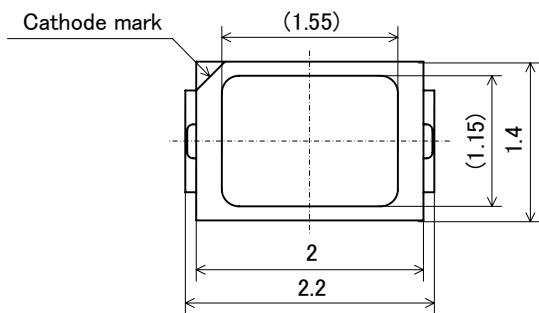
■ 周囲温度-色度特性
Ambient Temperature vs.
Chromaticity Coordinate
IfP=5mA



■ 指向特性
Directivity



| | |
|----------------------------------|---|
| 型名 Model NHSB046-N5 | 名称 Title 初期電気/光学特性 CHARACTERISTICS |
| 日亜化学工業 (株) NICHIA CORPORATION | 管理番号 No. 101105057312 |

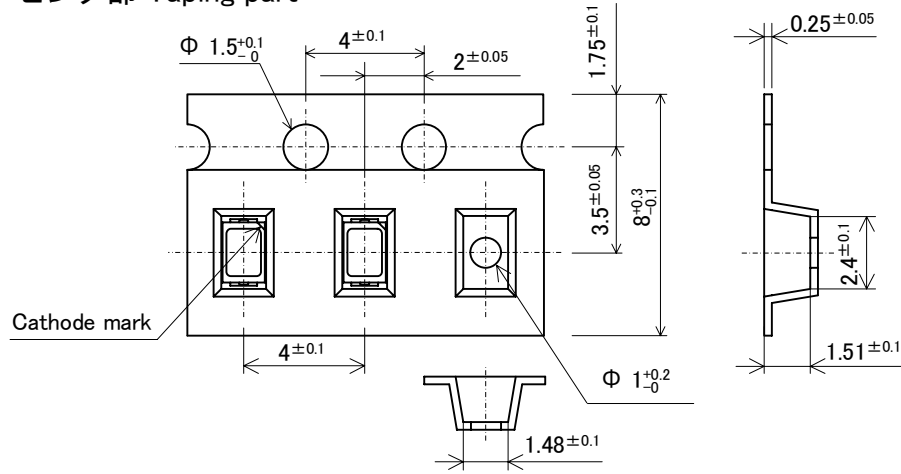


| 項目 Item | 材質 Materials |
|-----------------------------|--|
| パッケージ材質 Package | 耐熱性ポリマー Heat-Resistant Polymer |
| 封止樹脂 Encapsulating Resin | エポキシ樹脂 (拡散剤 + 蛍光体入り) Epoxy Resin (with Diffused + Phosphor) |
| 電極 Electrodes | 銅合金 + 銀メッキ Ag Plating Copper Alloy |

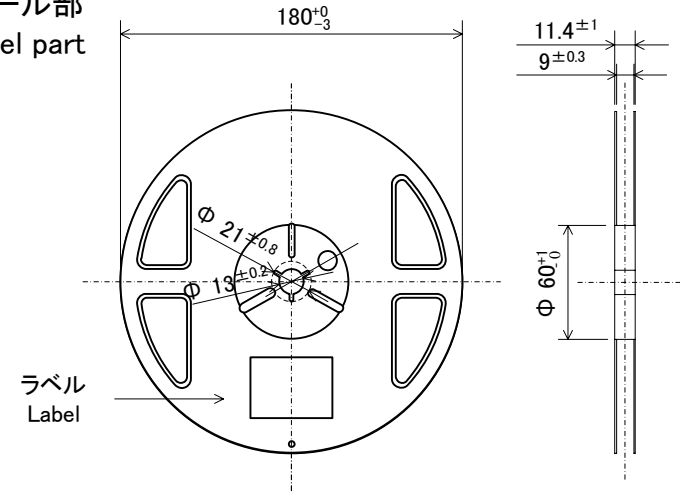
(注) 本製品には静電気に対する保護素子が内蔵されています。
 (NOTE) NHSB046x-Nx has a protection device built in as a protection circuit against static electricity.

| | | |
|----------------------------------|--|------------------|
| 型名 Model NHSB046x-Nx | 名称 外形寸法図 Title OUTLINE DIMENSIONS | 単位 Unit mm |
| 日亜化学工業 (株) NICHIA CORPORATION | 管理番号 No. 091102951051 | 公差 Allow ±0.1 |

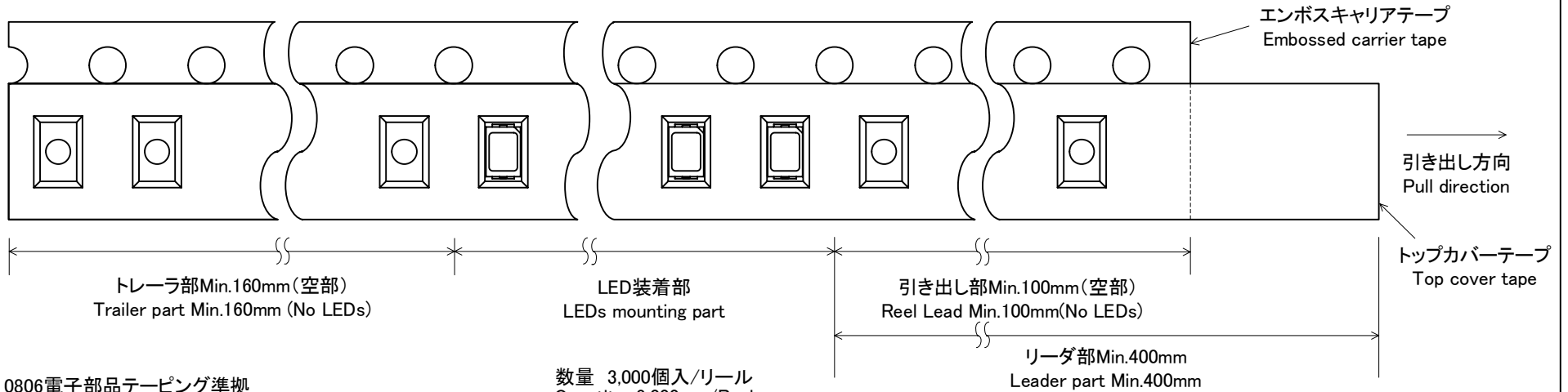
テーピング部 Taping part



リール部 Reel part



トレーラ部/リーダ部 Trailer Part/Leader Part



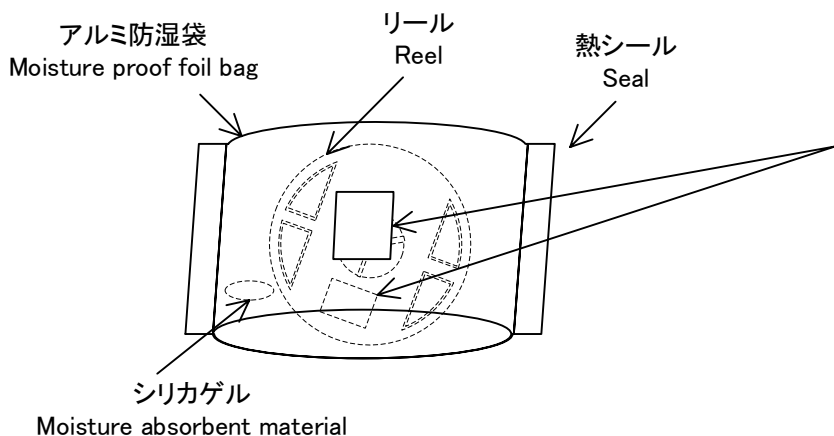
JIS C 0806電子部品テーピング準拠
Taping is based on the JIS C 0806 : Packaging of Electronic Components on Continuous Tapes.

数量 3,000個入/リール
Quantity 3,000pcs/Reel

| | | |
|----------------------------------|--|---------------|
| 型名 Model NHSB046xT-Nx | 名称 Title テーピング仕様図 TAPING DIMENSIONS | 単位 Unit mm |
| 日亜化学工業 (株) NICHIA CORPORATION | 管理番号 No. 090714946001 | |

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する。

The reel and moisture absorbent material are put in the moisture proof foil bag and then heat sealed.

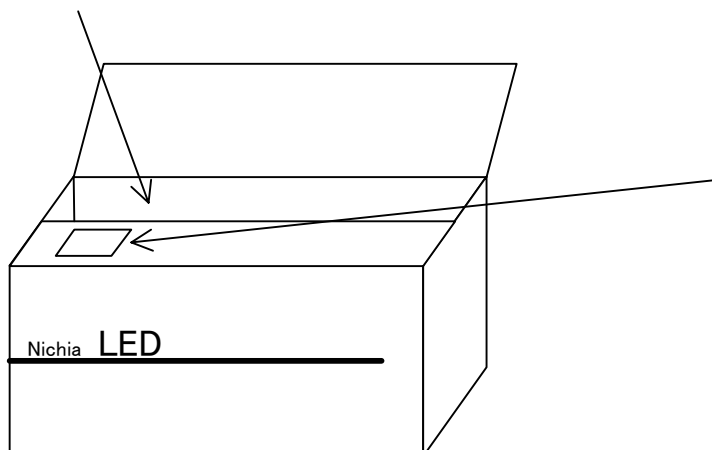


ラベル Label



ダンボールで仕切りをする

The box is partitioned with the cardboard.



ラベル Label



基本梱包単位 Packing Unit

| | リール数 Reel/bag | チップ个数 Quantity/bag(pcs) |
|-----------------------------------|------------------|----------------------------|
| アルミ防湿袋 Moisture proof foil bag | 1reel | 3,000 MAX. |

| 梱包箱(段ボール) Cardbord box | 箱の寸法 Dimensions(mm) | リール数 Reel/box | チップ个数 Quantity/box(pcs) |
|---------------------------|------------------------|------------------|----------------------------|
| S | 291 × 237 × 120 × 8t | 7reel MAX. | 21,000 MAX. |
| M | 259 × 247 × 243 × 5t | 15reel MAX. | 45,000 MAX. |
| L | 444 × 262 × 259 × 8t | 30reel MAX. | 90,000 MAX. |

| | |
|----------------------------------|-------------------------------------|
| 型名 Model NHSB046xT-Nx | 名称 Title 梱包仕様図 PACKING |
| 日亜化学工業 (株) NICHIA CORPORATION | 管理番号 No. 090714946011 |