

NICHIA CORPORATION

SPECIFICATIONS FOR WARM WHITE LED

NSPLR70CSS-K1

- Built-in ESD Protection Device
- RoHS Compliant



SPECIFICATIONS

(1) Absolute Maximum Ratings

Item	Symbol	Absolute Maximum Rating	Unit
Forward Current	I_F	60	mA
Pulse Forward Current	I_{FP}	180	mA
Allowable Reverse Current	I_R	85	mA
Power Dissipation	P_D	210	mW
Operating Temperature	T_{opr}	-30~85	°C
Storage Temperature	T_{stg}	-40~100	°C
Junction Temperature	T_J	100	°C

* Absolute Maximum Ratings at $T_A=25^{\circ}\text{C}$.

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

(2) Initial Electrical/Optical Characteristics

Item	Symbol	Condition	Typ	Unit	
Forward Voltage	V_F	$I_F=50\text{mA}$	3.1	V	
Luminous Flux	Φ_v	$I_F=50\text{mA}$	18	lm	
Luminous Intensity	I_v	$I_F=50\text{mA}$	11	cd	
Chromaticity Coordinate	x	-	$I_F=50\text{mA}$	0.41	-
	y	-	$I_F=50\text{mA}$	0.39	-

* Characteristics at $T_A=25^{\circ}\text{C}$.

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

* Chromaticity Coordinates as per CIE 1931 Chromaticity Chart.

RANKS

Item	Rank	Min	Max	Unit
Forward Voltage	-	2.7	3.5	V
Luminous Flux	P9	21.4	25.5	lm
	P8	18.0	21.4	
	P7	15.1	18.0	
	P6	12.7	15.1	
	P5	10.7	12.7	

Color Ranks

	Rank d1					
x	0.3575	0.3610	0.3780	0.3988	0.3897	0.3720
y	0.3612	0.3850	0.3970	0.4116	0.3823	0.3714

	Rank d2					
x	0.3545	0.3575	0.3720	0.3897	0.3822	0.3667
y	0.3408	0.3612	0.3714	0.3823	0.3580	0.3484

	Rank e1					
x	0.3897	0.3988	0.4162	0.4390	0.4255	0.4053
y	0.3823	0.4116	0.4200	0.4310	0.4000	0.3907

	Rank e2					
x	0.3822	0.3897	0.4053	0.4255	0.4129	0.3954
y	0.3580	0.3823	0.3907	0.4000	0.3725	0.3642

	Rank f3			
x	0.4255	0.4390	0.4680	0.4519
y	0.4000	0.4310	0.4385	0.4086

	Rank f4			
x	0.4519	0.4680	0.4970	0.4770
y	0.4086	0.4385	0.4466	0.4137

	Rank f5			
x	0.4129	0.4255	0.4519	0.4355
y	0.3725	0.4000	0.4086	0.3785

	Rank f6			
x	0.4355	0.4519	0.4770	0.4588
y	0.3785	0.4086	0.4137	0.3838

* Ranking at $T_A=25^{\circ}\text{C}$.

* Tolerance of measurements of the Forward Voltage is $\pm 3\%$.

* Tolerance of measurements of the Luminous Flux is $\pm 10\%$.

* Tolerance of measurements of the Chromaticity Coordinate is ± 0.01 .

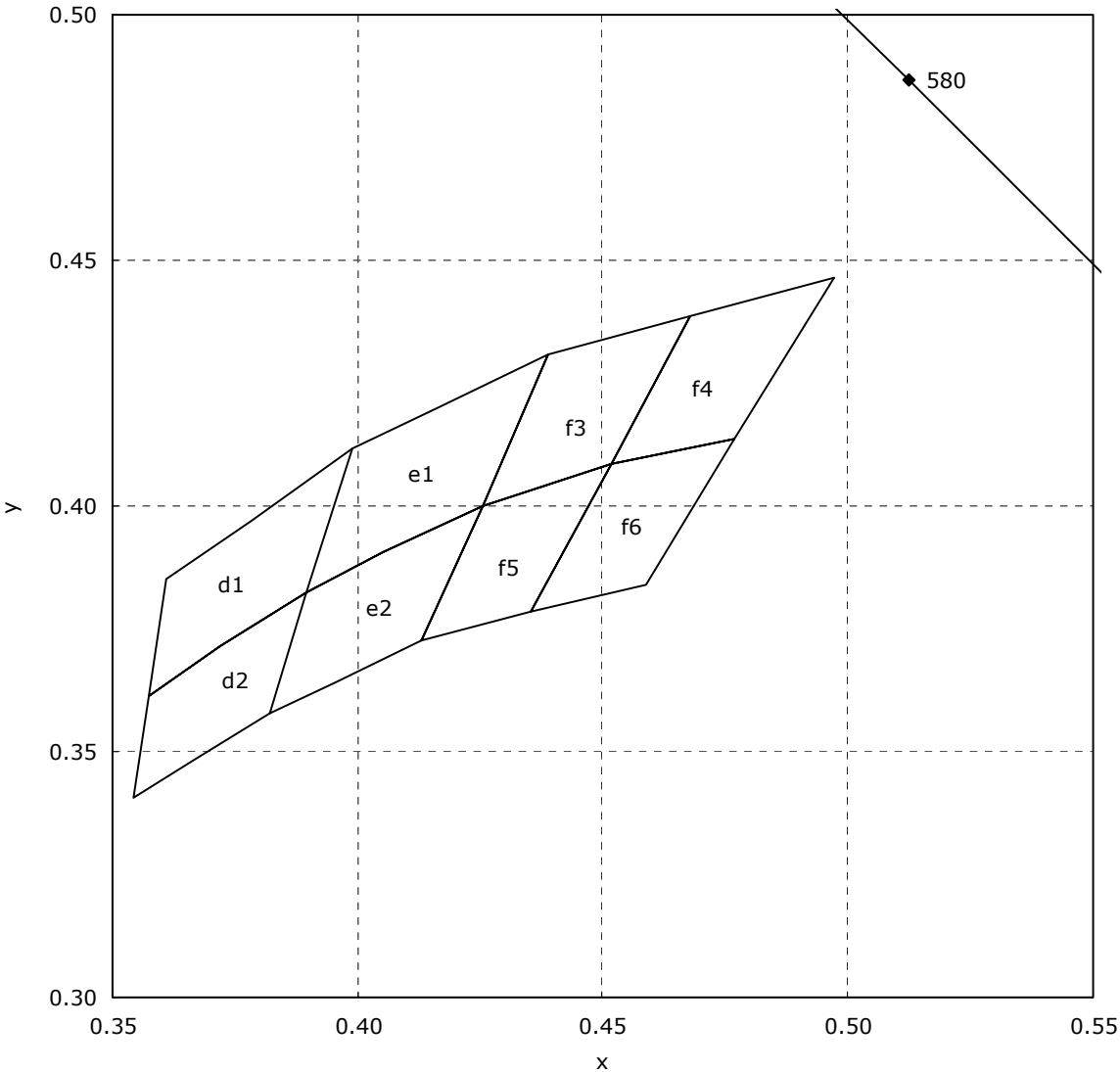
* A shipment shall consist of LEDs in a combination of the above ranks.

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

Luminous Flux Ranks by Color Rank

Ranking by Luminous Flux Ranking by Color Coordinates		Ranking by Luminous Flux				
		P5	P6	P7	P8	P9
d1,d2,e1,e2						
f3,f4,f5,f6						

CHROMATICITY DIAGRAM

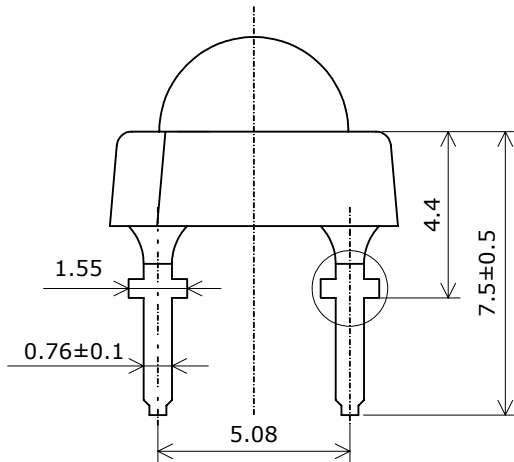
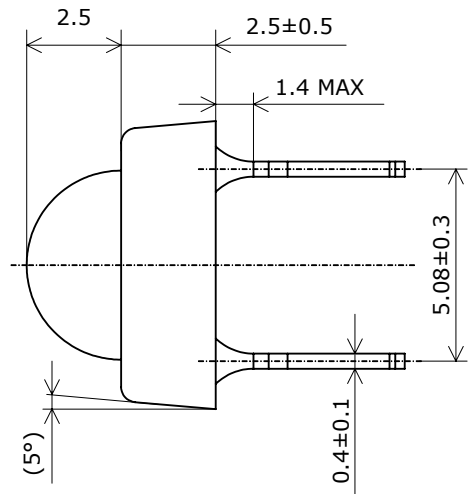
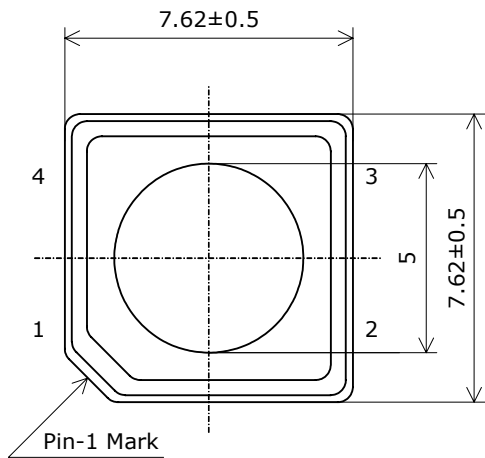


OUTLINE DIMENSIONS

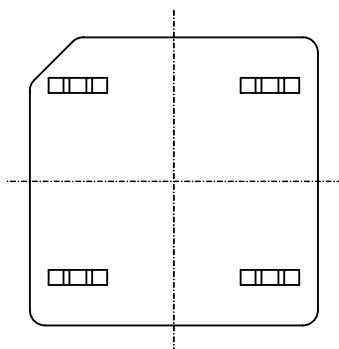
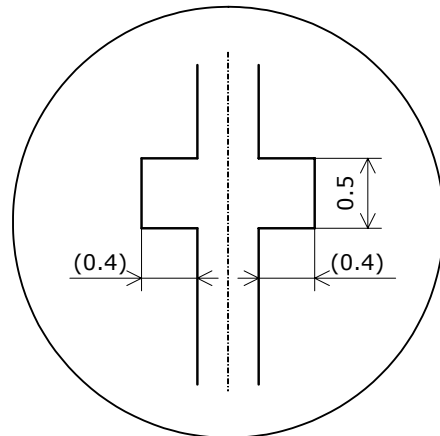
* 本製品はRoHS指令に適合しております。
This product complies with RoHS Directive.

NSPxR70CS-K1
管理番号 No. STS-DA7-0409A

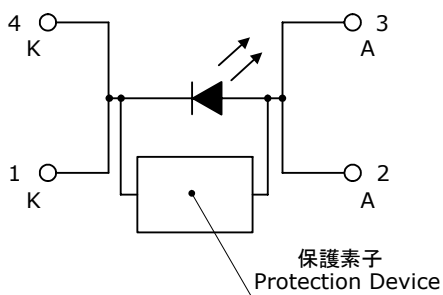
(単位 Unit: mm, 公差 Tolerance: ±0.2)



ストッパー部詳細図
Lead Standoff



項目 Item	内容 Description
樹脂材質 Resin Materials	エポキシ樹脂 (一部拡散剤+蛍光体入り) Epoxy Resin (partly using diffuser and phosphor)
リードフレーム材質 Lead Frame Materials	銅合金+銀メッキ Ag-plated Copper Alloy
質量 Weight	0.30g(TYP)



* タイバーを切り取った部分は銅合金が露出しております。
またLEDには鋭利な部分があります。特にリード部分は、人体を傷つける
ことがありますので、取り扱いに際には十分注意して下さい。
The tie bar cut-end surface exhibits exposed copper alloy base metal.
Care must be taken to handle the LEDs, as it may contain sharp parts
such as lead, and can cause injury.

SOLDERING

• Recommended Hand Soldering Condition

Temperature	350°C Max
Soldering Time	3sec Max
Position	No closer than 1.6mm under the standoff.

• Recommended Dip Soldering Condition

Pre-Heat	120°C Max
Pre-Heat Time	60sec Max
Solder Bath Temperature	260°C Max
Dipping Time	5sec Max
Dipping Position	No closer than 1.6mm under the standoff.

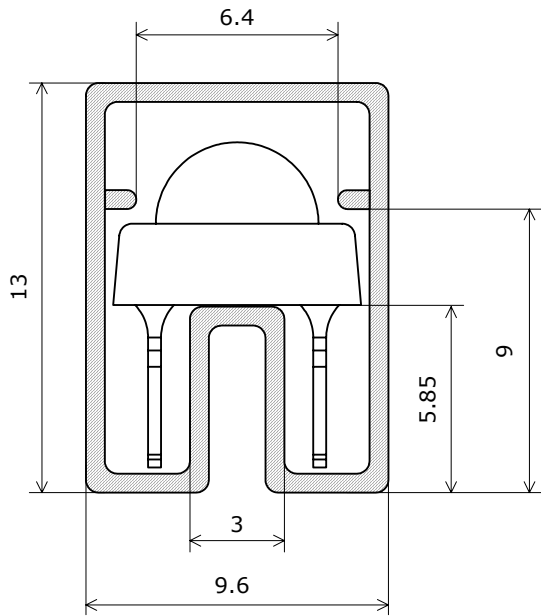
- * For a better thermal performance, copper alloy is used for the leadframe of the product.
Care must be taken for the soldering conditions and handling of the products after soldering.
- * Solder the LED no closer than 1.6mm under the lead standoff.
- * Dip soldering/hand soldering must not be performed more than once.
- * Care should be taken to avoid cooling at a rapid rate and ensure the peak temperature ramps down slowly.
- * When soldering, do not apply stress to the lead frame while the LED is hot.
- * After soldering, the LED position must not be corrected.
- * After soldering, NO mechanical shock or vibration should be applied to LED lens until the LEDs cool down to room temperature.
- * In order to avoid damage on the lens during cutting and clinching the leads, it is not recommended to solder the LEDs directly on customer PCB without any gap between the lens and the board. If it is unavoidable, customer is advised to check whether such soldering will not cause wire breakage or lens damage. Direct soldering to double-sided PCBs must be avoided due to an increased effect of heat on the lens.
- * When it is necessary to clamp the LEDs to prevent soldering failure, it is important to minimize the mechanical stress on the LEDs.
- * Cut the LED lead frames at room temperature. Cutting the lead frames at high temperature may cause failure of the LEDs.

TUBE DIMENSIONS

スティック断面図 Cross Section

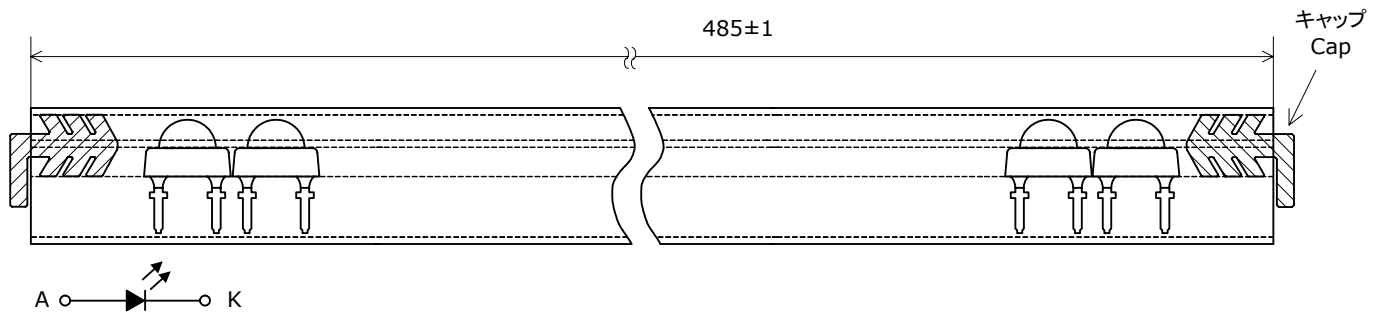
NxxxR70xxx-Kx
管理番号 No. STS-DA7-0507A

(単位 Unit: mm, 公差 Tolerance: ±0.2)



- * $t=0.6\pm0.1$ mm
- * 反り: 1mm以下
- Warp: 1mm MAX

スティック全体図 Overview

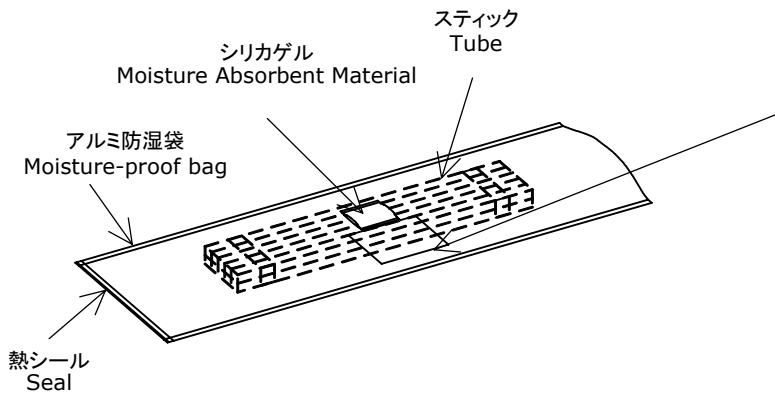


- * 数量は1スティックにつき 60個入りです。
Quantity per tube=60pcs

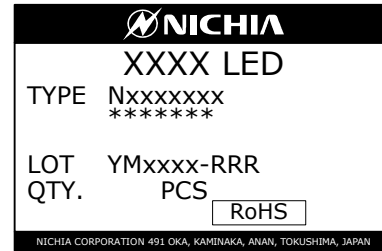
PACKAGING - TUBE PACK

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

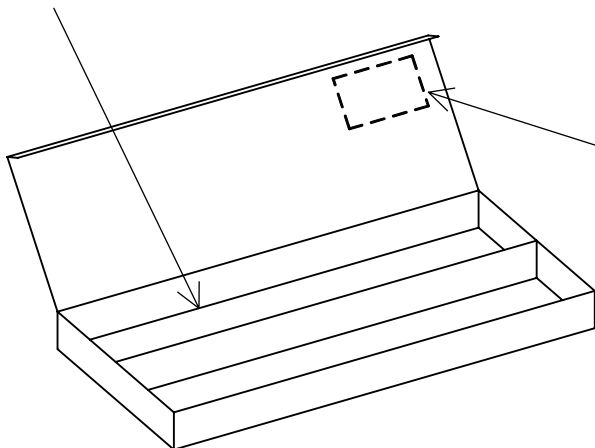
Nxxxxxxx
管理番号 No. STS-DA7-0005C



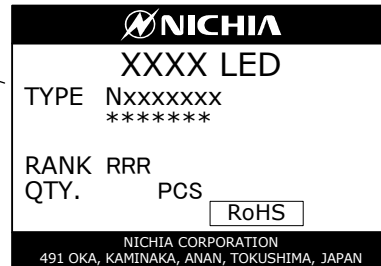
ラベル Label



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



- * 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.

- * 本製品はスティックに入れたのち、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 tubes 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きませんので、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

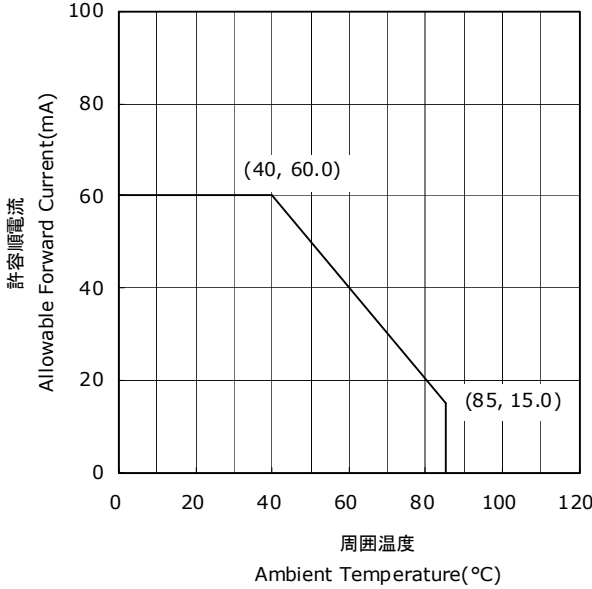
xxxx-Nichia's Product Number

RRR-Ranking by Color Coordinates, Ranking by Luminous Flux

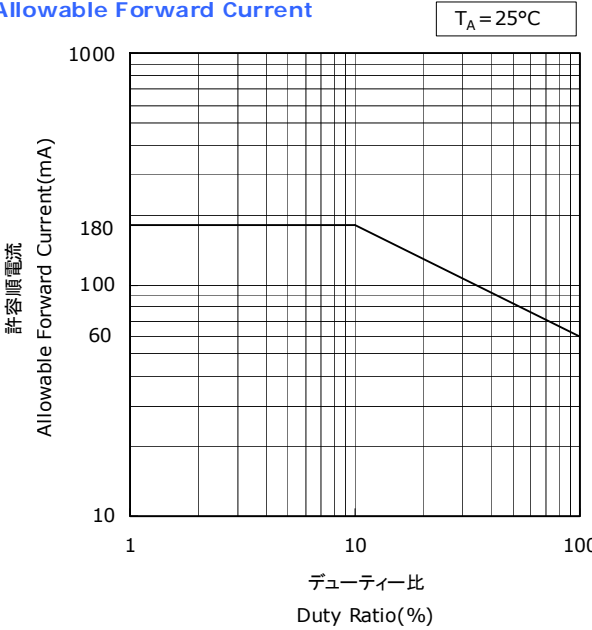
DERATING CHARACTERISTICS

NSPxR70CS-K1
管理番号 No. STS-DA7-0758A

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



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

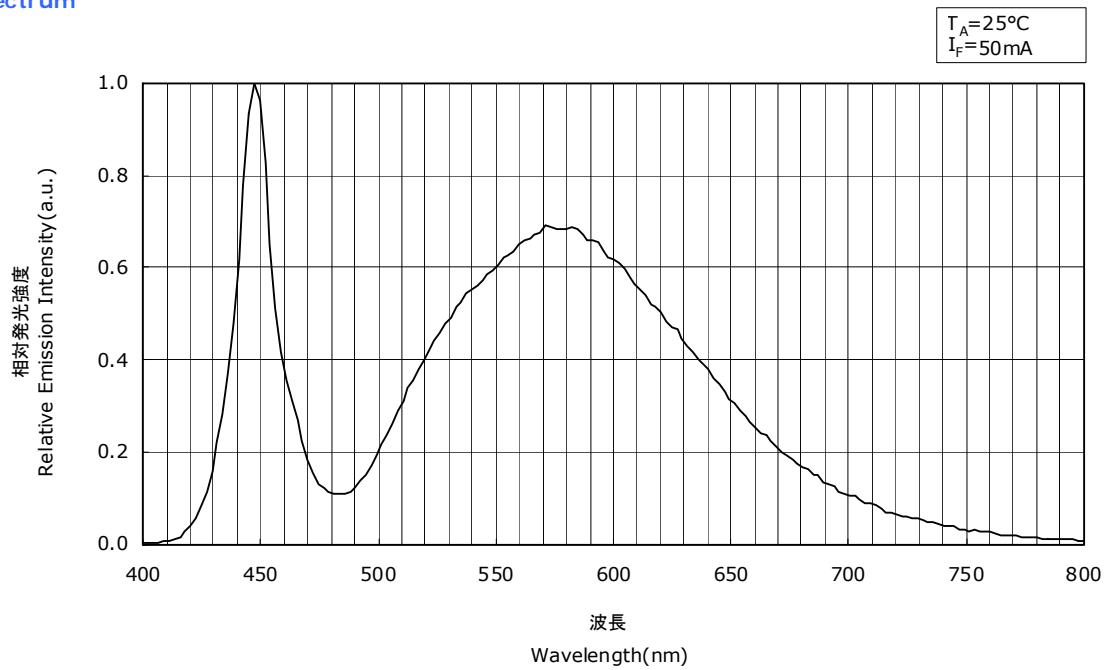


OPTICAL CHARACTERISTICS

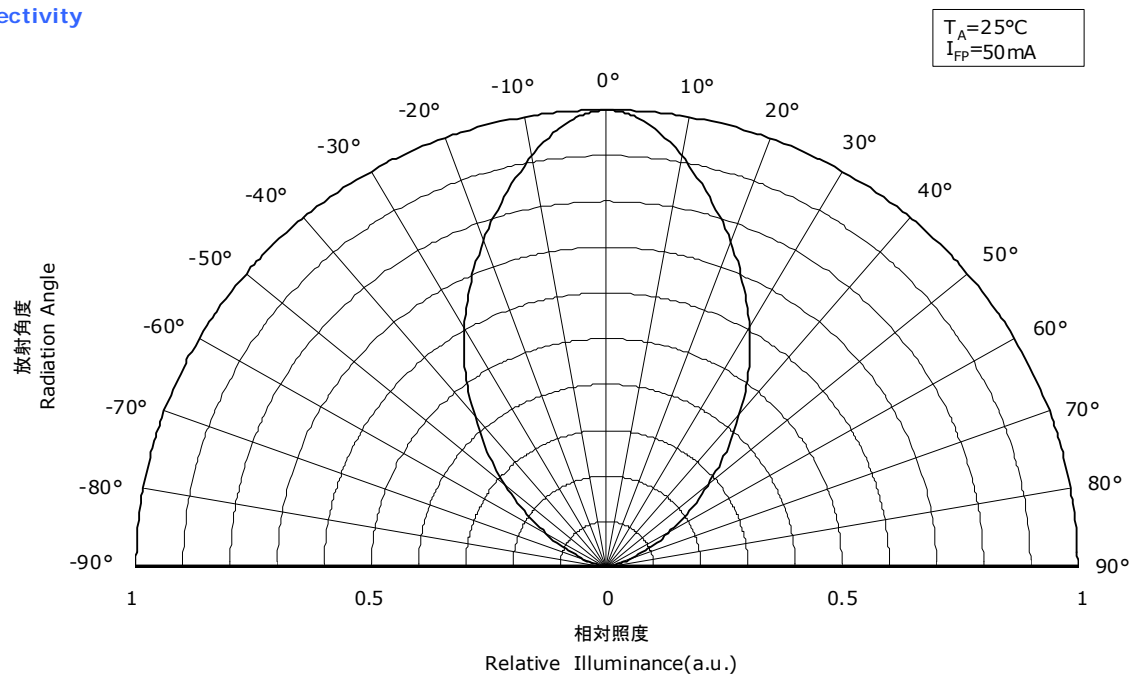
* 本特性は参考です。
All characteristics shown are for reference only and are not guaranteed.

NSPLR70CS-K1
管理番号 No. STS-DA7-2808

発光スペクトル Spectrum



指向特性 Directivity

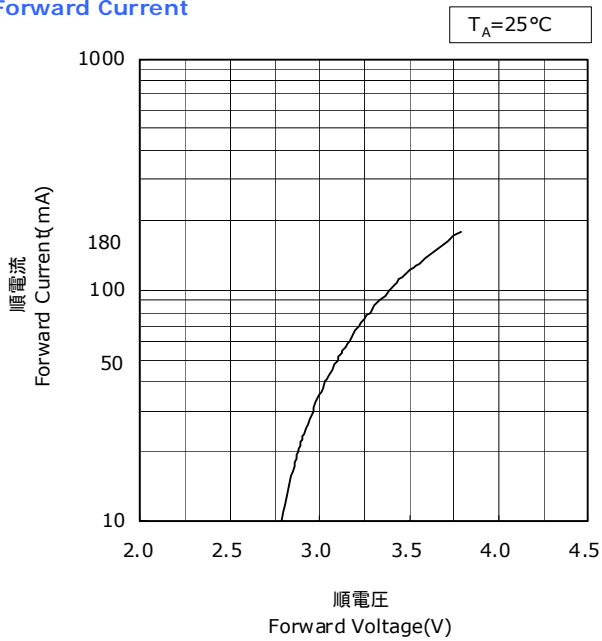


FORWARD CURRENT CHARACTERISTICS / TEMPERATURE CHARACTERISTICS

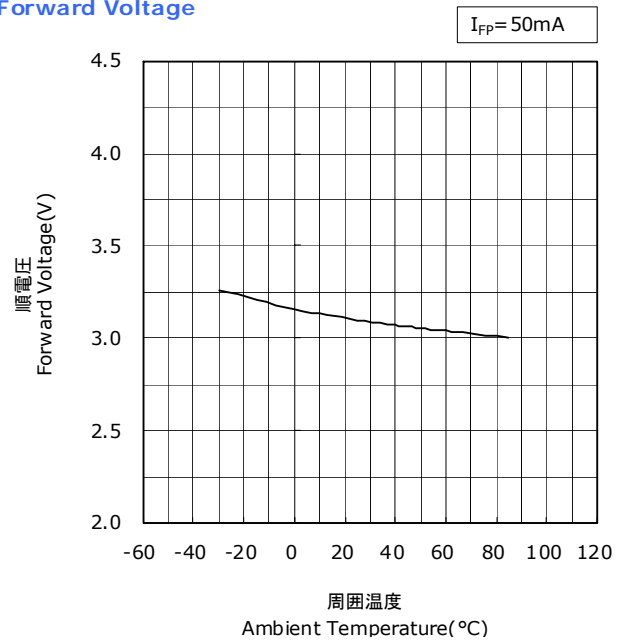
* 本特性は参考です。
All characteristics shown are for reference only and are not guaranteed.

NSPLR70CS-K1
管理番号 No. STS-DA7-2809

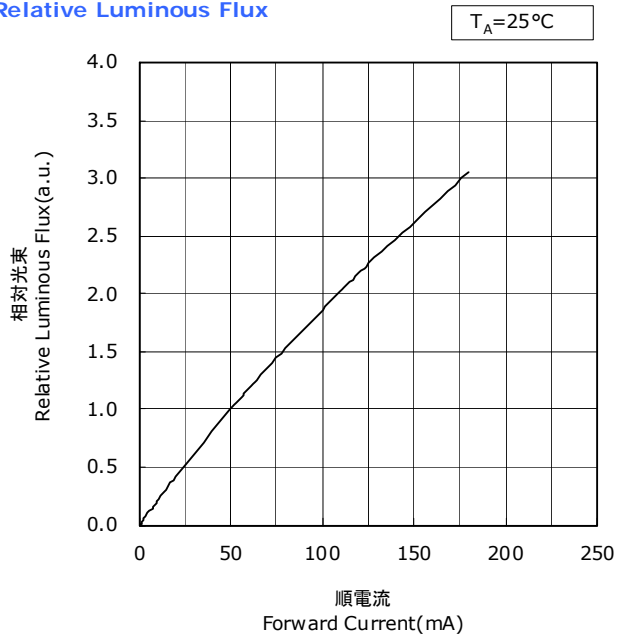
順電圧-順電流特性
Forward Voltage vs
Forward Current



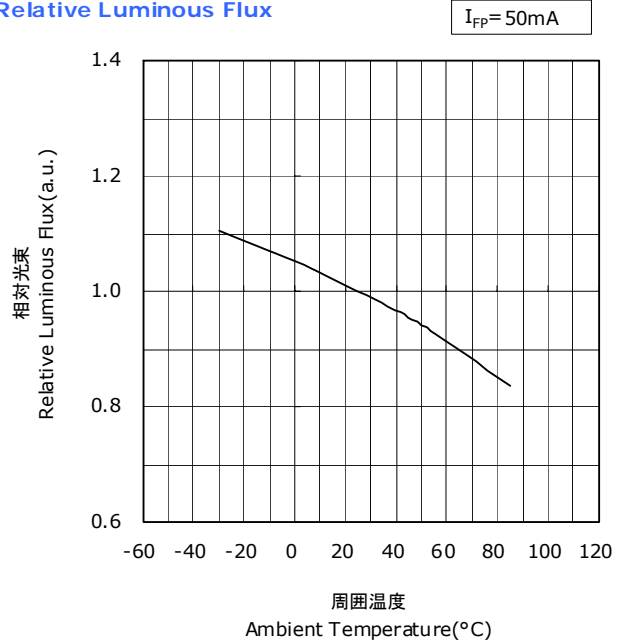
周囲温度-順電圧特性
Ambient Temperature vs
Forward Voltage



順電流-相対光束特性
Forward Current vs
Relative Luminous Flux



周囲温度-相対光束特性
Ambient Temperature vs
Relative Luminous Flux

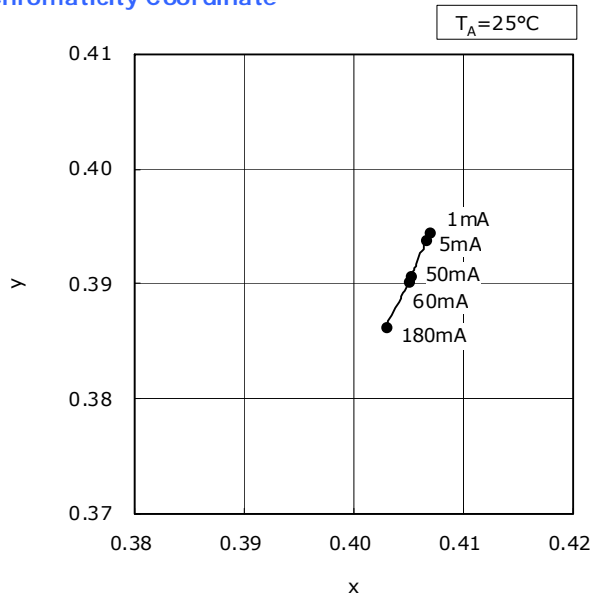


FORWARD CURRENT CHARACTERISTICS / TEMPERATURE CHARACTERISTICS

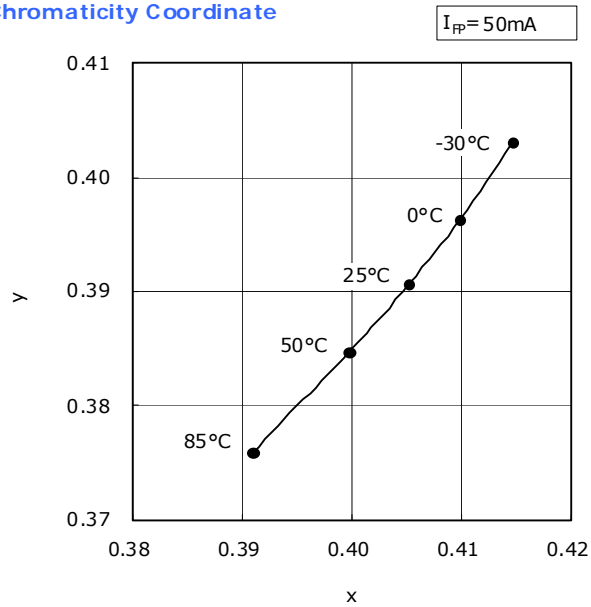
* 本特性は参考です。
All characteristics shown are for reference only and are not guaranteed.

NSPLR70CS-K1
管理番号 No. STS-DA7-2810

順電流-色度特性
Forward Current vs
Chromaticity Coordinate



周囲温度-色度特性
Ambient Temperature vs
Chromaticity Coordinate



RELIABILITY

(1) Tests and Results

Test	Reference Standard	Test Conditions	Test Duration	Failure Criteria #	Units Failed/Tested
Resistance to Soldering Heat	JEITA ED-4701 300 302	$T_{\text{sid}}=260\pm 5^{\circ}\text{C}$, 5sec, 1dip 1.6mm under the lead standoff Precondition: 30°C, 70%RH, 168hr		#1	0/22
Solderability	JEITA ED-4701 303 303A	$T_{\text{sid}}=245\pm 5^{\circ}\text{C}$, 5sec, Lead-free Solder(Sn-3.0Ag-0.5Cu)		#2	0/22
Temperature Cycle	JEITA ED-4701 100 105	-40°C(30min)~25°C(5min)~ 100°C(30min)~25°C(5min)	100cycles	#1	0/50
Moisture Resistance (Cyclic)	JEITA ED-4701 200 203	25°C~65°C~-10°C, 90%RH, 24hr per cycle	10cycles	#1	0/50
Terminal Bend Strength	JEITA ED-4701 400 401	5N, 0°~90°~0°bend, 2bending cycles		#1	0/50
Terminal Pull Strength	JEITA ED-4701 400 401	10N, 10±1sec		#1	0/50
High Temperature Storage	JEITA ED-4701 200 201	$T_A=100^{\circ}\text{C}$	1000hours	#1	0/50
Temperature Humidity Storage	JEITA ED-4701 100 103	$T_A=60^{\circ}\text{C}$, RH=90%	1000hours	#1	0/50
Low Temperature Storage	JEITA ED-4701 200 202	$T_A=-40^{\circ}\text{C}$	1000hours	#1	0/50
Room Temperature Operating Life		$T_A=25^{\circ}\text{C}$, $I_F=60\text{mA}$	1000hours	#1	0/50
Temperature Humidity Operating Life		60°C, RH=90%, $I_F=30\text{mA}$	500hours	#1	0/50
Low Temperature Operating Life		$T_A=-30^{\circ}\text{C}$, $I_F=50\text{mA}$	1000hours	#1	0/50
Electrostatic Discharges	JEITA ED-4701 300 304	HBM, 2kV, 1.5kΩ, 100pF, 3pulses, alternately positive or negative		#1	0/22

NOTES:

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)	$I_F=50\text{mA}$	>U.S.L.×1.1
	Luminous Flux(Φ_V)	$I_F=50\text{mA}$	<L.S.L.×0.7
#2	Solderability	-	Less than 95% solder coverage

U.S.L. : Upper Specification Limit L.S.L. : Lower Specification Limit

CAUTIONS

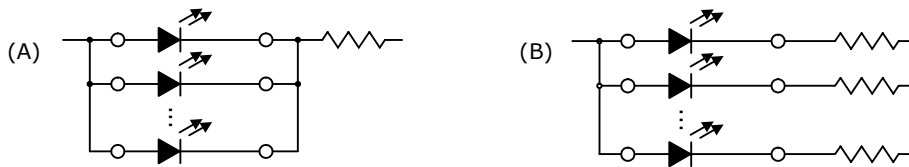
(1) Storage

Conditions		Temperature	Humidity	Time
Storage	Before Opening Aluminum Bag	≤30°C	≤90%RH	Within 1 Year from Delivery Date
	After Opening Aluminum Bag	≤30°C	≤70%RH	≤168hours
Baking		85°C	-	≥24hours

- Nichia LED leadframe are silver plated copper alloy. This 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 operation. It is recommended that the LEDs be used as soon as possible.
- To avoid condensation, the products must not be stored in the areas where temperature and humidity fluctuate greatly.

(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.

(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.
- 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

- 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.

(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 or a light-up test at low current ($\leq 1\text{mA}$).
- ESD damaged LEDs may have current flow at a low voltage or no longer illuminate at a low current.
Failure Criteria: $V_F < 2.0\text{V}$ at $I_F = 0.5\text{mA}$

(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.

(7) Cleaning

- If required, isopropyl alcohol (IPA) should be used. Other solvents may cause premature failure to the LEDs due to the damage to the resin portion. The effects of such solvents should be verified prior to use.
In addition, the use of CFCs such as Freon is heavily regulated.
- 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 60825-1:2011/2001, 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.

(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.