SPECIFICATIONS FOR NICHIA **WARM WHITE** LED

MODEL : **NSPLR70CSS**

NICHIA CORPORATION

1.SPECIFICATIONS

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

Item	Symbol	Absolute Maximum Rating	Unit
Forward Current	I_F	40	mA
Pulse Forward Current	I_{FP}	120	mA
Reverse Voltage	V_R	5	V
Power Dissipation	P_D	152	mW
Operating Temperature	T_{opr}	-30 ~ + 85	°C
Storage Temperature	T_{stg}	-40 ~ +100	°C
Dice Temperature	T_j	100	°C
Soldering Temperature	T_{sld}	Dip Soldering : 265°C for 5sec. Hand Soldering : 350°C for 3sec.	

I_{FP} Conditions : Pulse Width ≤ 10msec. and Duty ≤ 1/10

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

Item		Symbol	Condition	Typ.	Max.	Unit
Forward Voltage		V_F	I_F=30[mA]	(3.4)	3.8	V
Reverse Current		I_R	V_R= 5[V]	-	50	μA
Luminous Flux		ϕ_V	I_F=30[mA]	(8.0)	-	lm
Chromaticity Coordinate	x	-	I_F=30[mA]	0.41	-	-
	y	-	I_F=30[mA]	0.39	-	-

∗ Forward Voltage Measurement allowance is ± 3%.

∗ Luminous flux 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 Flux	Rank P5	ϕ_V	I_F=30[mA]	10.7	12.7	lm
	Rank P4			9.0	10.7	
	Rank P3			7.6	9.0	
	Rank P2			6.4	7.6	
	Rank P1			5.4	6.4	

∗ Luminous Flux Measurement allowance is ± 10%.

Color Ranks (I_F=30mA,Ta=25°C)

	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

∗ 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.

Correspondence table of Color Coordinates – Luminous Flux ranks

Ranking by Luminous Flux / Ranking by Color Coordinates	P1	P2	P3	P4	P5
d1, d2, e1, e2					
f3, f4, f5, f6					

∗ Shaded ranks are available.

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 packaging in stick.
Please refer to “STICK DIMENSIONS” and “PACKING ”on the following pages.
The label on the 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 (8 for 2008, 9 for 2009)

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

×××× - Nichia's Product Number

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

6.RELIABILITY

(1) TEST ITEMS AND RESULTS

Test Item	Standard Test Method	Test Conditions	Note	Number of Damaged
Resistance to Soldering Heat	JEITA ED-4701 300 302	Tsld=260 ± 5°C, 5sec. 1.6mm from the base of the stopper (Pre treatment 30°C,70%,168hrs.)	1 time	0/50
Solderability	JEITA ED-4701 303 303A	Tsld=245 ± 5°C, 5sec. using flux Lead-free Solder (Sn-3.0Ag-0.5Cu)	1 time over 95%	0/50
Temperature Cycle	JEITA ED-4701 100 105	-40°C ~ 25°C ~ 100°C ~ 25°C 30min. 5min. 30min. 5min.	100 cycles	0/50
Moisture Resistance Cyclic	JEITA ED-4701 200 203	25°C ~ 65°C ~ -10°C 90%RH 24hrs./1cycle	10 cycles	0/50
Terminal Strength (bending test)	JEITA ED-4701 400 401	Load 5N (0.5kgf) 0° ~ 90° ~ 0° bend 2 times	No noticeable damage	0/50
Terminal Strength (pull test)	JEITA ED-4701 400 401	Load 10N (1kgf) 10 ± 1 sec.	No noticeable damage	0/50
High Temperature Storage	JEITA ED-4701 200 201	Ta=100°C	1000hrs.	0/50
Temperature Humidity Storage	JEITA ED-4701 100 103	Ta=60°C, RH=90%	1000hrs.	0/50
Low Temperature Storage	JEITA ED-4701 200 202	Ta=-40°C	1000hrs.	0/50
Steady State Operating Life Condition 1		Ta=25°C, I_F=40mA	1000hrs.	0/50
Steady State Operating Life Condition 2		Ta=35°C, I_F=30mA	1000hrs.	0/50
Steady State Operating Life of High Humidity Heat		60°C, RH=90%, I_F=20mA	500hrs.	0/50
Steady State Operating Life of Low Temperature		Ta=-30°C, I_F=30mA	1000hrs.	0/50

(2) CRITERIA FOR JUDGING DAMAGE

Item	Symbol	Test Conditions	Criteria for Judgement	
			Min.	Max.
Forward Voltage	V_F	I_F=30mA	-	U.S.L.*)× 1.1
Reverse Current	I_R	V_R=5V	-	U.S.L.*)× 2.0
Luminous Flux	ϕ_V	I_F=30mA	L.S.L.**)× 0.7	-

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

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) 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 85°C

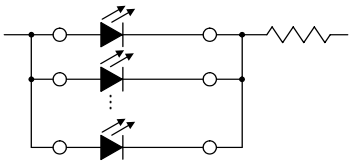
· Nichia LED leadframes are silver plated copper alloy. The silver surface may be affected by environments which contain corrosive substances. Please avoid conditions which may cause the LED to corrode, tarnish or discolor. This corrosion or discoloration may cause difficulty during soldering operations. It is recommended that the LEDs be used as soon as possible.

· Please avoid rapid transitions in ambient temperature, especially, in high humidity environments where condensation can occur.

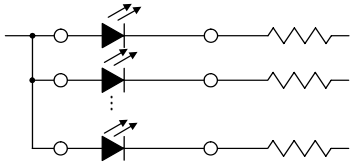
(2) Recommended circuit

· 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.

(A)



(B)



· 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.

(3) Circuit Design

· The LEDs should not be constantly subjected to reverse voltage.

(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.

· Please determine the operating current with consideration of the ambient temperature local to the LED and refer to the plot of Ambient temperature vs. Allowable Forward Current on CHARACTERISTICS in this specifications. Please also take measures to remove heat from the area near the LED to improve the operational characteristics of the LED.

· The equation ① indicates correlation between Tj and Ta, and the equation ② indicates correlation between Tj and Ts1.

$Tj=Ta + Rja \cdot W$ ····· ①　　$Tj=Ts1 + Rjs1 \cdot W$ ····· ②

∗Tj = Dice Temperature : °C, Ta = Ambient Temperature : °C,
Ts1 = Solder Temperature (Cathode Side) : °C,
Rja = Heat resistance from Dice to Ambient temperature : °C /W,
Rjs1 = Heat resistance from Dice to Ts1 measuring point : °C /W,
W = Inputting Power ($I_F \times V_F$) : W

(5) Soldering Conditions

· Nichia LEDs uses a copper alloy lead frame which provides a high thermal conductivity. Thermal stress such as soldering heat may reduce the reliability of the product; particular caution should be used to avoid damage prior to and during soldering. The recommended soldering conditions are listed in the following table.

· Solder the LED no closer than 1.6mm from the base of the stopper.

· The mechanical stress by clinching will cause degradation of the reliability on the LEDs. It is important to minimize the mechanical stress on the LEDs. It should be confirmed beforehand that it will not cause any problem when using it.

· Recommended soldering conditions

Dip Soldering		Hand Soldering	
Pre-Heat	120°C Max.	Temperature	350°C Max.
Pre-Heat Time	60 seconds Max.	Soldering Time	3 seconds Max.
Solder Bath Temperature	260°C Max.	Position	No closer than 1.6 mm from the base of the stopper.
Dipping Time	5 seconds Max.		
Dipping Position	No lower than 1.6 mm from the base of the stopper.		

· Although the recommended soldering conditions are specified in the above table, 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.

· Dip soldering should not be done more than one time.

· Hand soldering should not be done more than one time.

· Do not apply any stress to the lead particularly when heated.

· The LEDs must not be repositioned after soldering.

· After soldering the LEDs, the epoxy bulb should be protected from mechanical shock or vibration until the LEDs return to room temperature.

· Direct soldering onto a PC board should be avoided. Mechanical stress to the resin may be caused from warping of the PC board or from the clinching and cutting of the leadframes. When it is absolutely necessary, the LEDs may be mounted in this fashion but the customer will assume responsibility for any problems. Direct soldering should only be done after testing has confirmed that no damage, such as wire bond failure or resin deterioration, will occur. Nichia's LEDs should not be soldered directly to double sided PC boards because the heat will deteriorate the epoxy resin.

· 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 leadframes at room temperature. Cutting the leadframes at high temperatures may cause failure of the LEDs.

(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 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 leak current remarkably increases, the forward voltage becomes lower, or the LEDs do not light at the low current.

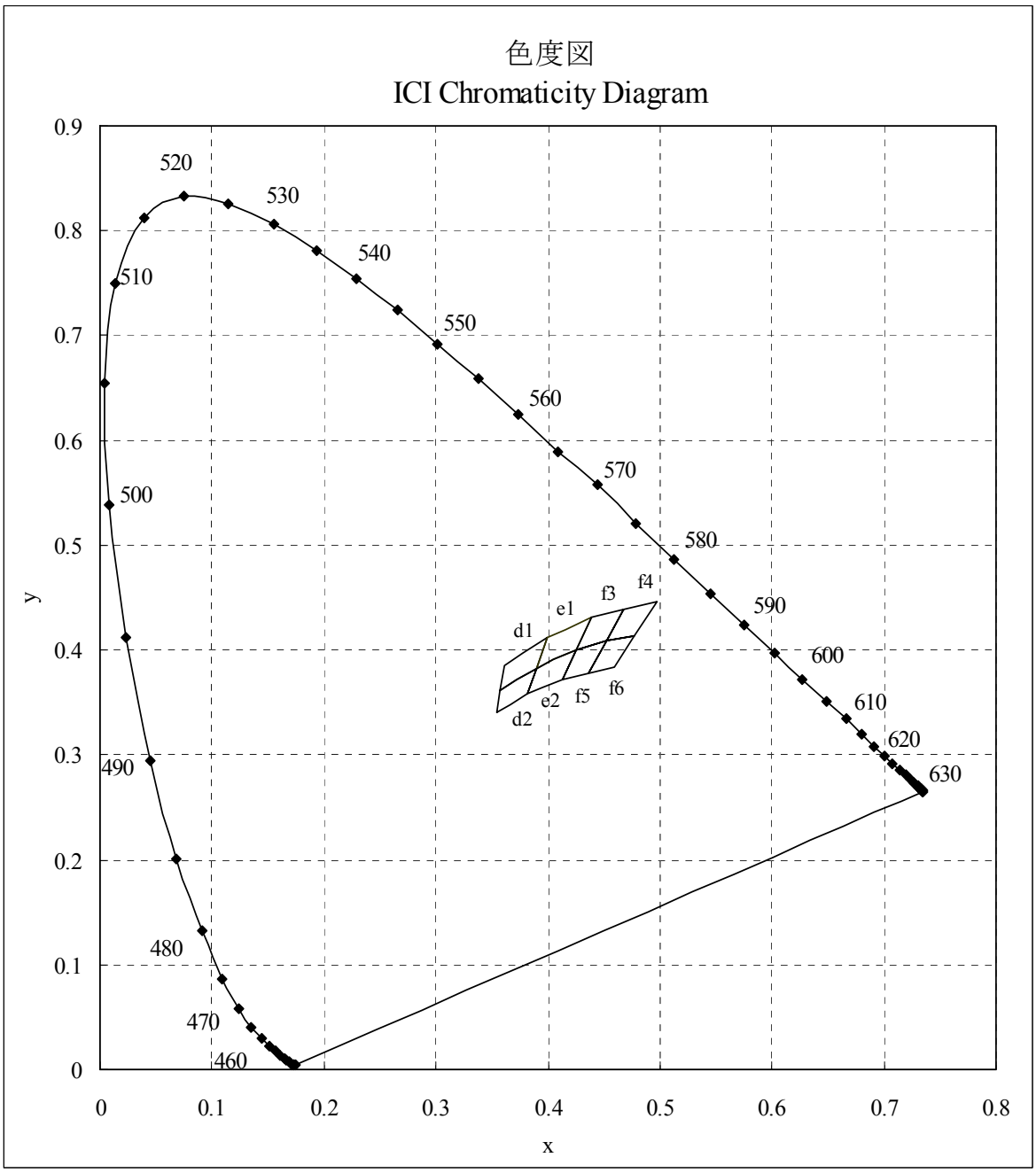
Criteria : (V_F > 2.0V at I_F=0.5mA)

(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

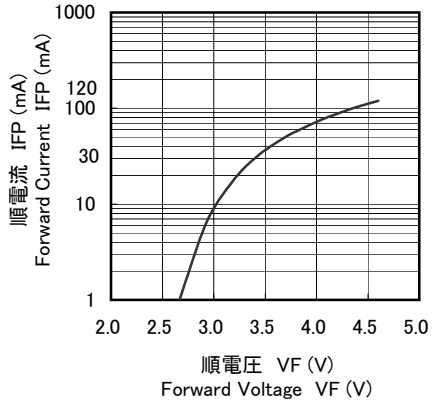
· NSPLR70CS complies with RoHS Directive.
· Care must be taken to ensure that the reverse voltage will not exceed the absolute maximum rating when using the LEDs with matrix drive.
· Flashing lights have been known to cause discomfort in people; you can prevent this by taking precautions during use. 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.
· Please refer to the Nichia LEDs'technical documentation for circuit design or assembly.
http://www.nichia.co.jp/jp/product/technicaldata.html



∗ Color coordinates Measurement allowance is ± 0.01.

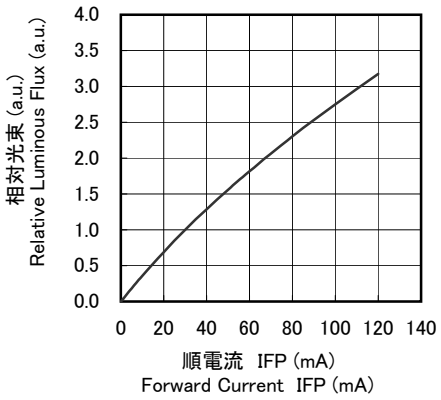
■ 順電圧－順電流特性
Forward Voltage vs.
Forward Current

Ta=25℃



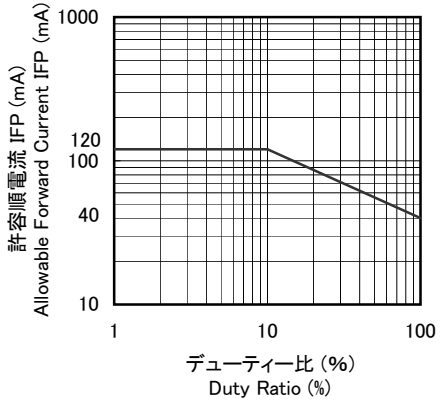
■ 順電流-相対光束特性
Forward Current vs.
Relative Luminous Flux

Ta=25℃



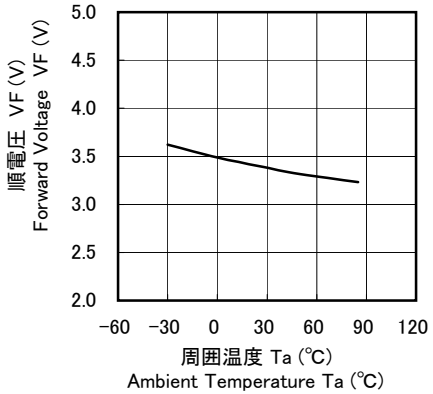
■ デューティー比－許容順電流特性
Duty Ratio vs.
Allowable Forward Current

Ta=25℃



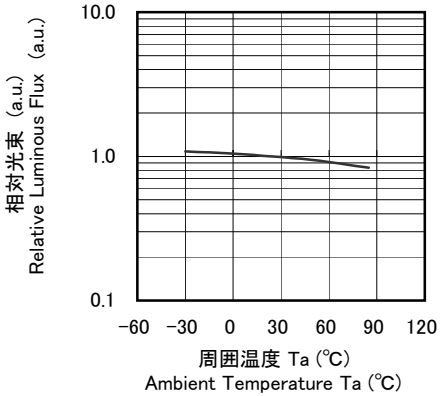
■ 周囲温度-順電圧特性
Ambient Temperature vs.
Forward Voltage

IFP= 30mA

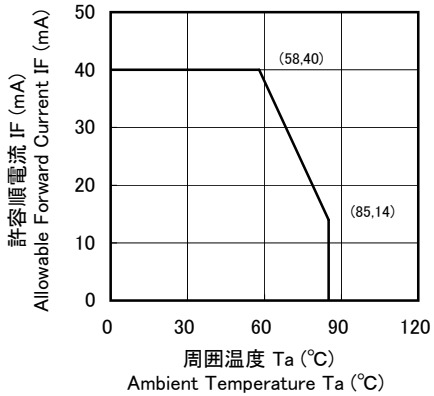


■ 周囲温度-相対光束特性
Ambient Temperature vs.
Relative Luminous Flux

IFP= 30mA



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

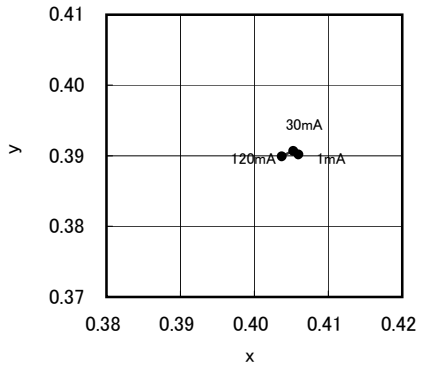


型名 Model	名称 Title
NSPLR70CS	初期電気/光学特性 CHARACTERISTICS
日亜化学工業（株） NICHIA CORPORATION	管理番号 No. 090511941701

Nichia STS-DA1-0790A
<Cat.No.090529>

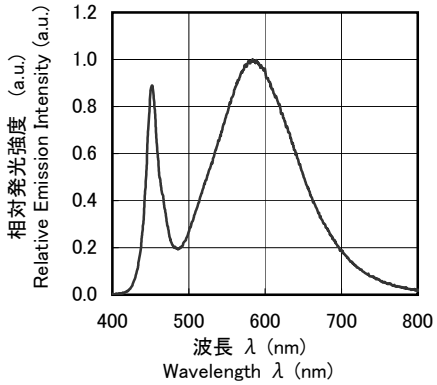
■ 順電流-色度特性
Forward Current vs.
Chromaticity Coordinate

Ta=25℃



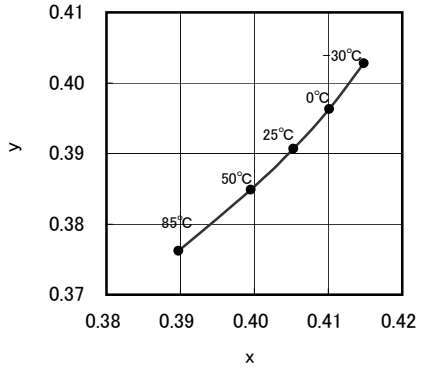
■ 発光スペクトル
Spectrum

Ta=25℃
IF= 30mA



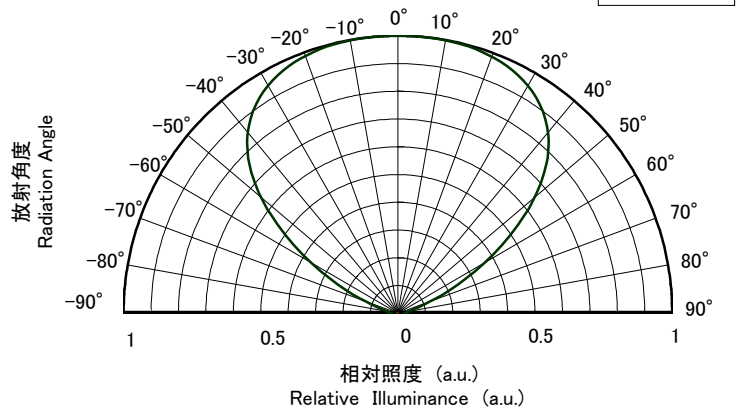
■ 周囲温度-色度特性
Ambient Temperature vs.
Chromaticity Coordinate

IFP=30mA



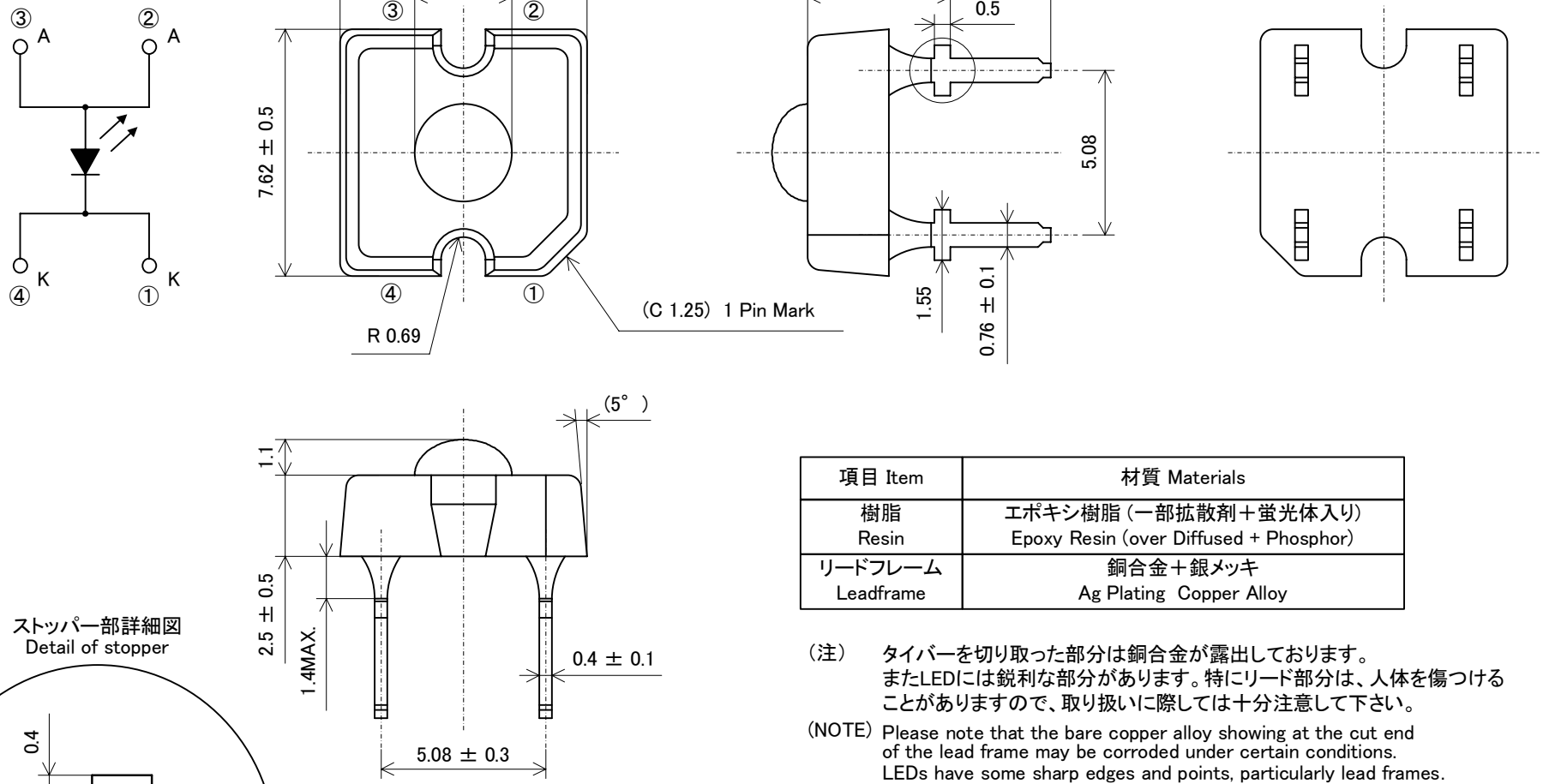
■ 指向特性
Directivity

Ta=25℃
IFP= 30mA

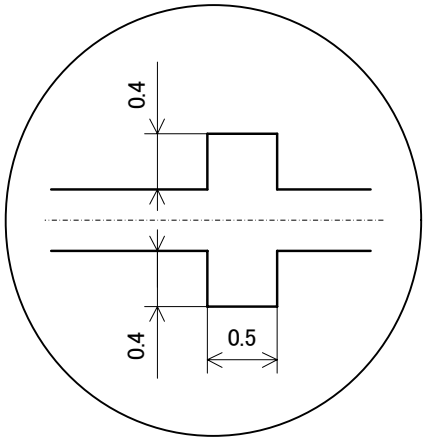


型名 Model	名称 Title
NSPLR70CS	初期電気/光学特性 CHARACTERISTICS
日亜化学工業（株） NICHIA CORPORATION	管理番号 No. 090511941711

Nichia STS-DA1-0790A
<Cat.No.090529>



ストッパー部詳細図
Detail of stopper



項目 Item	材質 Materials
樹脂 Resin	エポキシ樹脂（一部拡散剤＋蛍光体入り） Epoxy Resin (over Diffused + Phosphor)
リードフレーム Leadframe	銅合金＋銀メッキ Ag Plating Copper Alloy

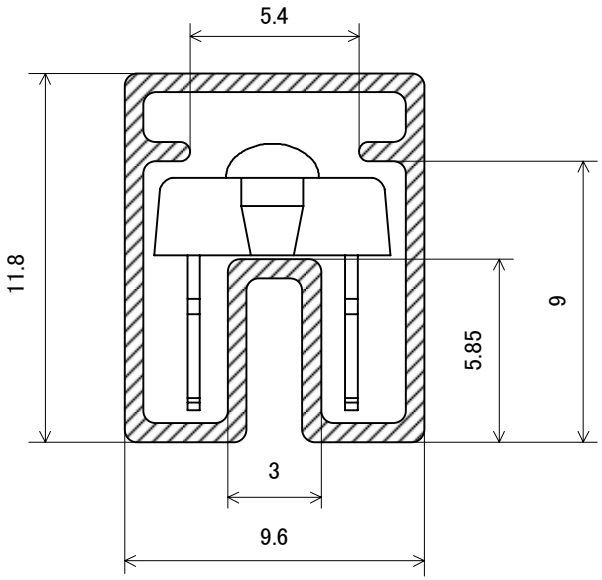
（注） タイバーを切り取った部分は銅合金が露出しております。
またLEDには鋭利な部分があります。特にリード部分は、人体を傷つける
ことがありますので、取り扱いに際しては十分注意して下さい。

(NOTE) Please note that the bare copper alloy showing at the cut end
of the lead frame may be corroded under certain conditions.
LEDs have some sharp edges and points, particularly lead frames.
Please handle with care so as to avoid injuries.

型名 Model	名称 Title	単位 Unit
NSPxR70xS	外形寸法図 OUTLINE DIMENSIONS	mm
日亜化学工業（株） NICHIA CORPORATION	管理番号 No. 090511941721	公差 Allow ±0.2

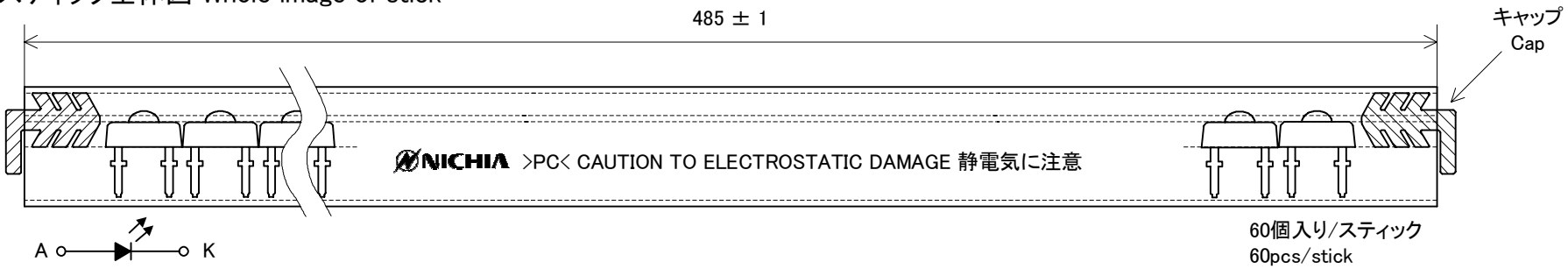
Nichia STS-DA1-0790A
<Cat.No.090529>

スティック断面図 Cross Sectional image of stick



＊　t=0.6±0.1mm
＊＊　反り：1mm以下
Warp:1mm Max.

スティック全体図 Whole image of stick

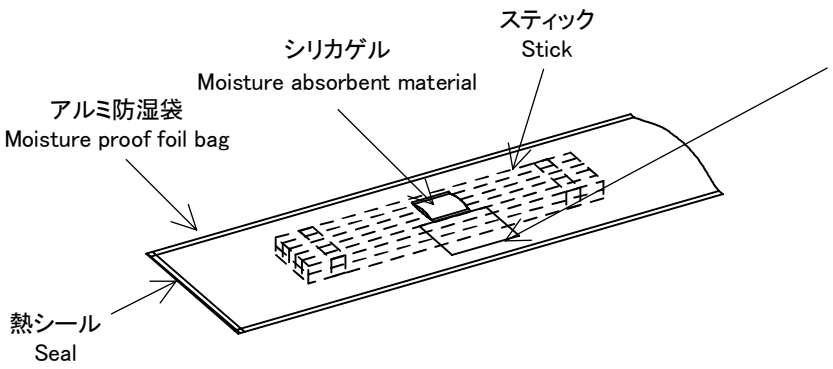


60個入り/スティック
60pcs/stick

型名 Model NxPxR70xSS	名称 Title スティック仕様図 STICK DIMENSIONS	単位Unit mm
日亜化学工業（株） NICHIA CORPORATION	管理番号 No. 090216936811	公差 Allow ±0.2

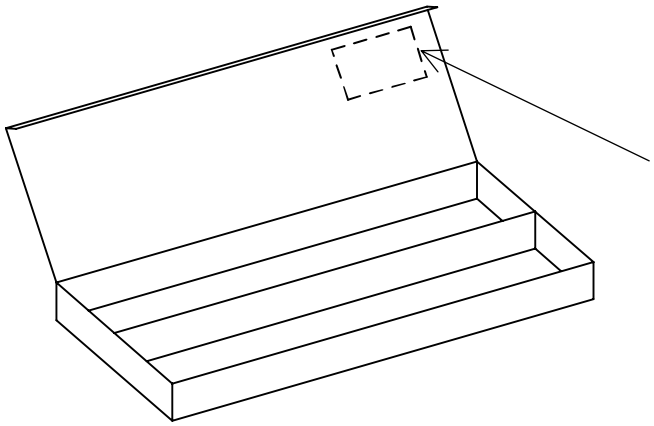
Nichia STS-DA1-0790A
<Cat.No.090529>

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



ラベル Label

NICHIA
XXXX LED
TYPE NxPxR70xSS
LOT xxxxxx-◇◇◇
QTY. PCS
RoHS
NICHIA CORPORATION 491 OKA, KAMINAKA, ANAN, TOKUSHIMA, JAPAN



ラベル Label

NICHIA
XXXX LED
TYPE NxPxR70xSS
RANK ◇◇◇
QTY. PCS
RoHS
NICHIA CORPORATION
491 OKA, KAMINAKA, ANAN, TOKUSHIMA, JAPAN

基本梱包単位 Packing Unit

	スティック数 Stick/bag	個数 Quantity/bag(pcs)
アルミ防湿袋 Moisture proof foil bag	10 stick Max.	600 MAX.

梱包箱(段ボール) Cardbord box	箱の寸法 Dimensions(mm)	スティック数 Stick/box	個数 Quantity/box(pcs)
M	590×277×120×4t	100 stick MAX.	6,000 MAX.
1/2L	613×298×268×7t	200 stick MAX.	12,000 MAX.
L	613×298×518×7t	400 stick MAX.	24,000 MAX.

型名 Model NxPxR70xSS	名称 Title	梱包仕様図 PACKING
日亜化学工業（株） NICHIA CORPORATION	管理番号 No.	090331936822