


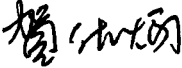

Available from Midas Components LTD  
 Telephone Number: +44(0) 1493 602602  
 Website: www.midascomponents.co.uk  
 Email: sales@midascomponents.co.uk

DOCUMENT NUMBER AND REVISION  
**VL-FS-BTHQ 21603VSS-02 REV.A**  
**(BTHQ 21603V-FSTF-LED05W(1 DIE)-CONN.)**

DOCUMENT TITLE:  
**SPECIFICATION**  
**OF**  
**LCD MODULE TYPE**  
**ITEM NO.: BTHQ 21603VSS-02**

APPROVALS:

EFFECTIVE DATE

DEPARTMENT	NAME	SIGNATURE	DATE
MARKETING (TECHNICAL SUPPORT)	PHILIP CHENG		2002.1.9
LCM(DSIGN)	Z.B.HE		2002.1.9
MARKETING (TECHNICAL SUPPORT)	CYRUS CHEUNG		2002/1/9

Page No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Rev. No.	A	A	A	A	A	A	A	A	A	A	A	A	A

Page No.	14	15	16
Rev. No.	A	A	A

**DOCUMENT REVISION HISTORY 1:**

DOCUMENT REVISION FROM TO	DATE	DESCRIPTION	CHANGED BY	CHECKED BY
A	2002.01.11	First Release	PHILIP CHENG	Z.B.HE

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**Specification  
of  
LCD Module Type  
Item No.: BTHQ 21603VSS-02**

**1. General Description**

- 16 characters (5x8 dots) x 2 lines FSTN Positive Black & White Transflective Dot Matrix LCD module.
- Viewing Angle: 6 O'clock direction.
- Driving scheme: 1/16 Duty, 1/5 bias.
- 'NOVATEK' NT3881DH-01/AI (Die form) LCD Controller and Driver or equivalent.
- 'SAMSUNG' KS0065B-PCC (Die form) 40-Channel Segment/Common Driver for Dot Matrix LCD or equivalent.
- Connector: 16 pins ZIF SMD connector (CON-IL-402).
- White LED05 backlight.

**2. Mechanical Specifications**

The mechanical detail is shown in Fig. 1 and summarized in Table 1 below.

Table 1

Parameter	Specifications	Unit
Outline dimensions	53.0(W) x 20.0(H) x 8.5 MAX.(D) (Excluded connector)	mm
Effective viewing area	36.0(W) x 10.0(H)	mm
Active area	34.10(W) x 7.40(H)	mm
Display format	16 characters x 2 lines	-
Character size	1.85(W) x 3.15(H) (5 x 8 dots)	mm
Character spacing	0.30(W) x 1.10(H)	mm
Character pitch	2.15(W) x 4.25(H)	mm
Dot size	0.358(W) x 0.381(H)	mm
Dot spacing	0.015(W) x 0.015(H)	mm
Dot pitch	0.373(W) x 0.396(H)	mm
Weight:	TBD	grams



### 3. Interface signals

Table 2

Pin No.	Symbol	Description
1	VSS	Ground(0V).
2	VDD	Power supply for logic (+5V)
3	V0	Power supply for LCD driver
4	RS	Register Select Input: "High" for Data register (for read and write) "Low" for Instruction register (for write), Busy flag, address counter (for read)
5	R/W	Read/Write signal: " High" for Read mode. "Low" for Write mode.
6	E	Enable. Start signal for data read /write.
7	DB0	Data input/output (LSB)
8	DB1	Data input/output
9	DB2	Data input/output
10	DB3	Data input/output
11	DB4	Data input/output
12	DB5	Data input/output
13	DB6	Data input/output
14	DB7	Data input/output (MSB)
15	LED(+)	Anode of LED backlight
16	LED(-)	Cathode of LED backlight

## 4. Absolute Maximum Ratings

### 4.1 Electrical Maximum Ratings(Ta = 25 °C)

Table 3

Parameter	Symbol	Min.	Max.	Unit
Power Supply voltage (Logic)	VDD - VSS	-0.3	+7.0	V
Power Supply voltage (LCD drive)	VLCD=VDD – V0	-0.3	+13.5	V
Input voltage	Vin	-0.3	VDD +0.3	V

Note:

The modules may be destroyed if they are used beyond the absolute maximum ratings.

All voltage values are referenced to VSS = 0V.

### 4.2 Environmental Condition

Table 4

Item	Operating Temperature (Topr)		Storage Temperature (Tstg)		Remark
	Min.	Max.	Min.	Max.	
Ambient Temperature	0°C	+50°C	-10°C	+60°C	Dry
Humidity	95% max. RH for Ta ≤ 40°C < 95% RH for Ta > 40°C				no condensation
Vibration (IEC 68-2-6) cells must be mounted on a suitable connector	Frequency: 10 ~ 55 Hz Amplitude: 0.75 mm Duration: 20 cycles in each direction.				3 directions
Shock (IEC 68-2-27) Half-sine pulse shape	Pulse duration : 11 ms Peak acceleration: 981 m/s <sup>2</sup> = 100g Number of shocks : 3 shocks in 3 mutually perpendicular axes.				3 directions

## 5. Electrical Specifications

### 5.1 Typical Electrical Characteristics

At Ta = 25 °C, VDD = 5V±5%, VSS=0V.

Table 5

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply voltage (Logic)	VDD-VSS		4.75	5.0	5.25	V
Supply voltage (LCD)	VLCD =VDD-V0	VDD =5.0V, Note1.	4.1	4.6	5.1	V
Input signal voltage 1 for E,DB0-DB7,R/W,RS.	V <sub>IH1</sub>	"H" level	2.2	-	VDD	V
	V <sub>IL1</sub>	"L" level	-0.3	-	0.8	V
Input signal voltage 2 for OSC1.	V <sub>IH2</sub>	"H" level	VDD -1.0	-	VDD	V
	V <sub>IL2</sub>	"L" level	VSS	-	1.0	V
Supply Current (Logic & LCD)	IDD	Character mode, Note 1	-	1.1	1.6	mA
		Checker board mode, Note 1	-	1.5	2.5	mA
Supply Current (LCD)	I0	Character mode, Note 1	-	0.2	0.3	mA
		Checker board mode, Note 1	-	0.2	0.3	mA
Supply voltage of white LED05 backlight	VLED	Forward current =20mA  Number of LED dies =1	3.1	3.4	3.7	V

Note (1) : There is tolerance in optimum LCD driving voltage during production and it will be within the specified range.

## 5.2 Timing Specifications

At Ta = 0 °C To +50 °C , VDD = +5V±5%, VSS = 0V.

Refer to Fig. 2, the bus timing diagram for write mode.

Table 6

Parameter	Symbol	Min.	Max.	Unit	Remarks
Enable cycle time	t <sub>CYCE</sub>	500	-	ns	
Enable "High" level pulse width	t <sub>WHE</sub>	300	-	ns	
Enable rise time	t <sub>RE</sub>	-	25	ns	
Enable fall time	t <sub>FE</sub>	-	25	ns	
RS, R/W set-up time	t <sub>AS</sub>	60	-	ns	8-bit operation mode
		100			4-bit operation mode
RS, R/W address hold time	t <sub>AH</sub>	10	-	ns	
Data output delay	t <sub>DS</sub>	100	-	ns	
Data hold time	t <sub>DHR</sub>	10	-	ns	

Refer to Fig. 3, the bus timing diagram for read mode .

Table 7

Parameter	Symbol	Min.	Max.	Unit	Remarks
Enable cycle time	t <sub>CYCE</sub>	500	-	ns	
Enable "High" level pulse width	t <sub>WHE</sub>	300	-	ns	
Enable rise time	t <sub>RE</sub>	-	25	ns	
Enable fall time	t <sub>FE</sub>	-	25	ns	
RS, R/W set-up time	t <sub>AS</sub>	60	-	ns	8-bit operation mode
		100			4-bit operation mode
RS, R/W address hold time	t <sub>AH</sub>	10	-	ns	
Read data output delay	t <sub>RD</sub>	-	190	ns	
Read data hold time	t <sub>DHR</sub>	20	-	ns	

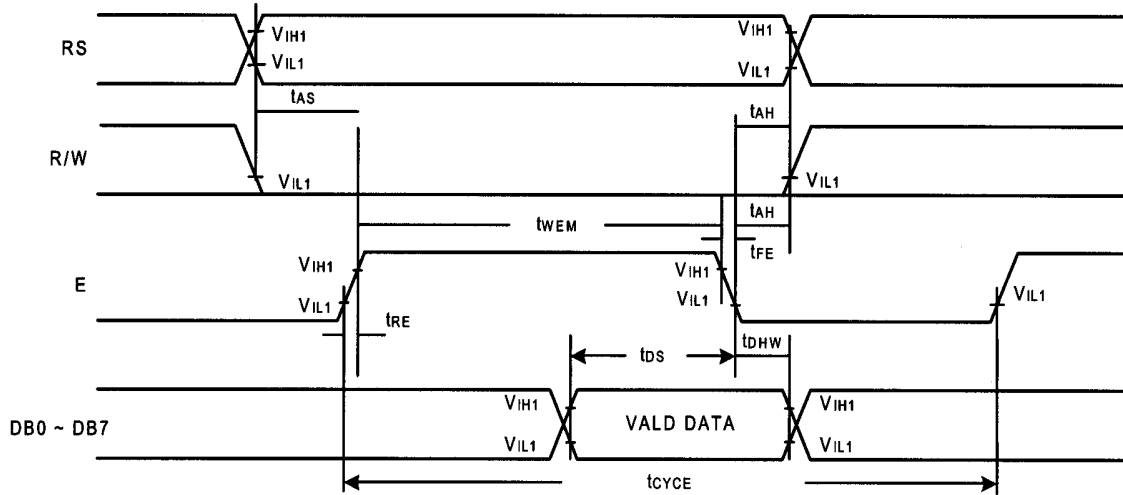


Figure 2: Bus write operation sequence (Writing data from MPU to NT3881).

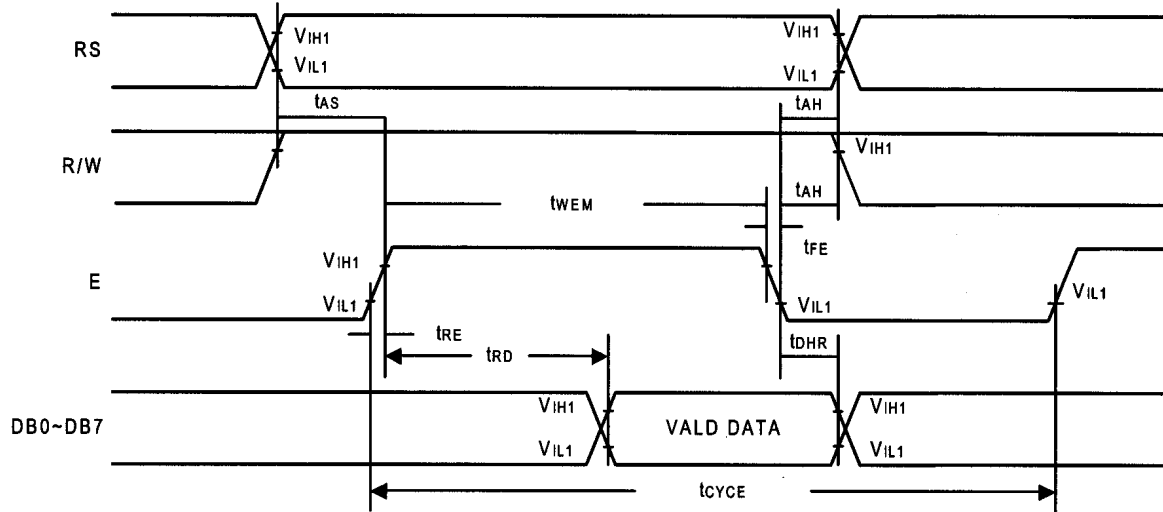


Figure 3: Bus read operation sequence (Reading out data from NT3881 to MPU).

**5.3 Timing Diagram of VDD against V0.**

Power on sequence shall meet the requirement of Figure 4, the timing diagram of VDD against V0.

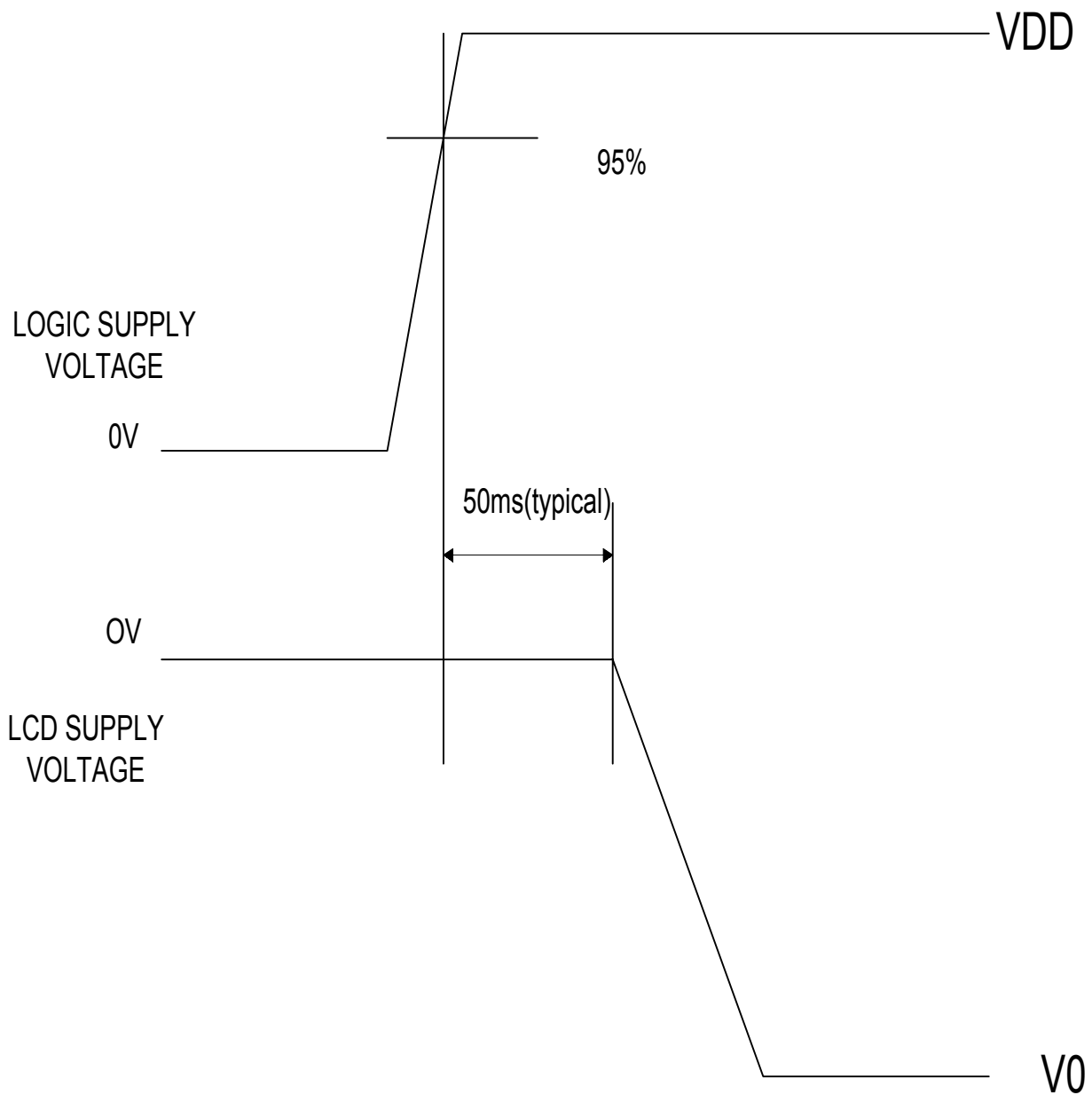


Figure 4: Timing diagram of VDD against V0.

**5.4 Correspondence between Character Codes and Character Patterns**  
**(NOVATEK Standard NT3881D-01)**

		Higher 4-bit (D4 to D7) of Character Code (Hexadecimal)																
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	
Lower 4-bit (D0 to D3) of Character Code (Hexadecimal)	0	CG RAM (1)			0	a	P	`	P					一	夕	三	α	P
	1	CG RAM (2)		!	1	A	Q	a	9			。	ア	チ	△	ä	9	
	2	CG RAM (3)		"	2	B	R	b	r			「	イ	ツ	×	β	θ	
	3	CG RAM (4)		#	3	C	S	c	s			」	ウ	テ	τ	ε	ω	
	4	CG RAM (5)		\$	4	D	T	d	t			、	エ	ト	†	μ	Ω	
	5	CG RAM (6)		%	5	E	U	e	u			。	オ	ナ	1	δ	Ü	
	6	CG RAM (7)		&	6	F	V	f	v			ヲ	カ	ニ	ヨ	ρ	Σ	
	7	CG RAM (8)		'	7	G	W	g	w			ア	キ	ヌ	ラ	9	π	
	8	CG RAM (1)		(	8	H	X	h	x			イ	ク	ネ	リ	5	×	
	9	CG RAM (2)		)	9	I	Y	i	y			ウ	ケ	ル	ル	´	4	
	A	CG RAM (3)		*	:	J	Z	j	z			エ	コ	ン	レ	J	〒	
	B	CG RAM (4)		+	;	K	[	k	[			オ	サ	ヒ	ロ	*	万	
	C	CG RAM (5)		,	<	L	¥	l	l			カ	シ	フ	ワ	Φ	円	
	D	CG RAM (6)		-	=	M	]	m	]			ユ	ズ	ゝ	ン	ト	÷	
	E	CG RAM (7)		.	>	N	^	n	→			ヨ	セ	ホ	°	ñ		
	F	CG RAM (8)		/	?	O	_	o	+			ッ	リ	マ	°	ö		

## 6. APPENDIX

These specifications shall be applied to the White LED-Lamp (LED or LEDs), NSPWF50BS, which is supplied by Nichia Corporation (Nichia).

### 1. SPECIFICATIONS

#### (1) Absolute Maximum Rating (Ta=25°C)

Item	Symbol	Absolute Maximum Rating	Unit
Forward Current	IF	30	mA
Pulse Forward Current	IFP	100	mA
Reverse Voltage	VR	5	V
Power Dissipation	PD	120	mW
Operating Temperature	Topr	-30 ~ +85	°C
Storage Temperature	Tstg	-40 ~ +100	°C
Lead Soldering Temperature	Tsol	260±5°C for 5sec. (3.0mm from the base of the epoxy bulb)	

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

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

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Forward Voltage	VF	IF=20[mA]	—	3.6	4.0	V	
Reverse Current	IR	VR= 5[V]	—	—	50	μA	
Luminous Intensity	Rank S	Iv	IF=20[mA]	300	360	420	mcd
	Rank R	Iv	IF=20[mA]	210	260	300	mcd
	Rank Q	Iv	IF=20[mA]	150	180	210	mcd

※ One delivery will include three different ranks of products. The quantity-ratio of the three ranks is decided by Nichia.

Measurement Uncertainty of the Luminous Intensity : ±10%

#### Color Ranks

(IF=20mA, Ta=25°C)

	Rank a			
x	0.250	0.250	0.290	0.290
y	0.205	0.250	0.305	0.260

	Rank b			
x	0.290	0.290	0.330	0.330
y	0.260	0.305	0.365	0.320

	Rank c			
x	0.330	0.330	0.370	0.370
y	0.320	0.365	0.420	0.375

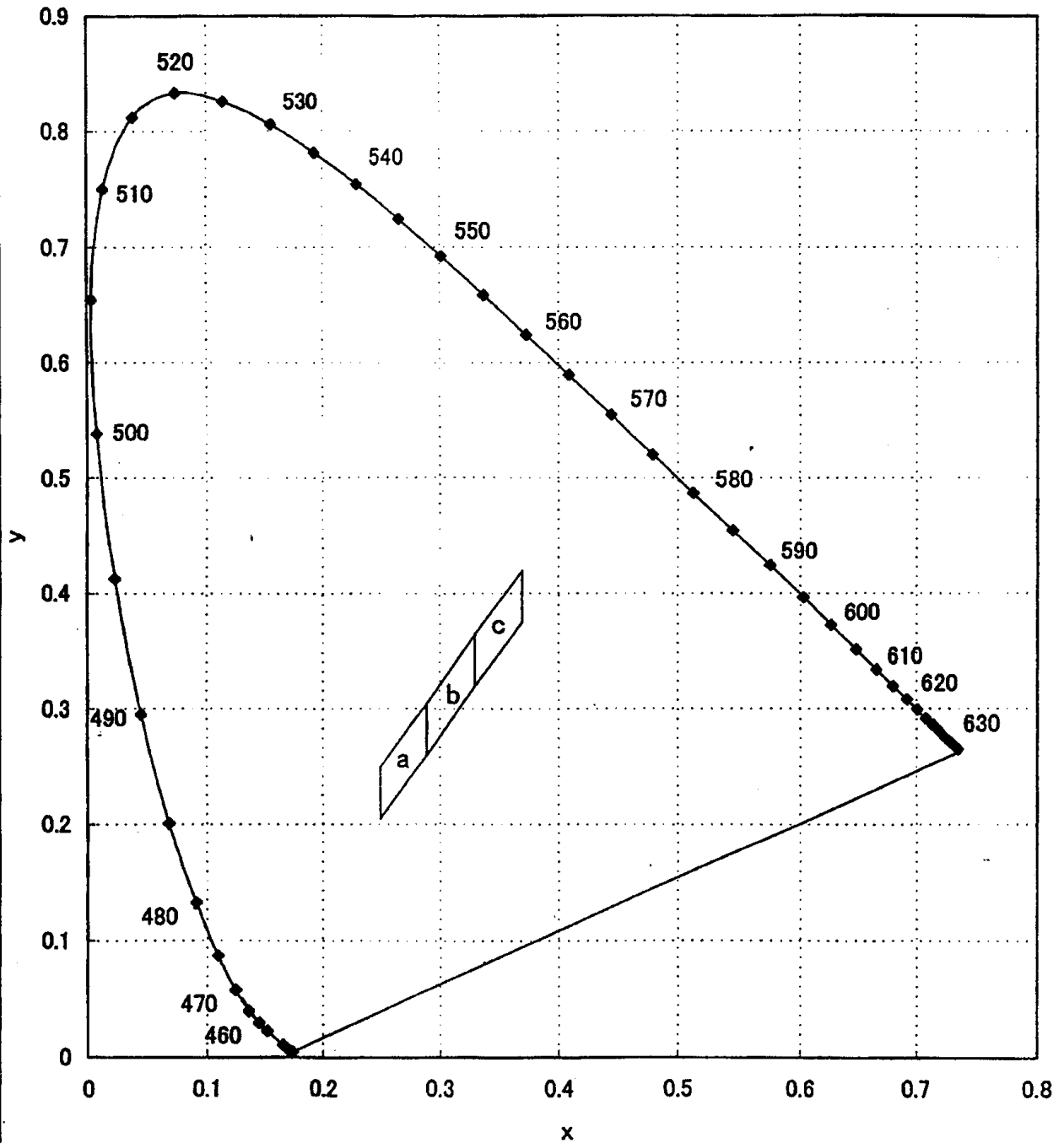
※ One delivery will include the consecutive two ranks of products. The quantity-ratio of the two ranks is decided by Nichia.

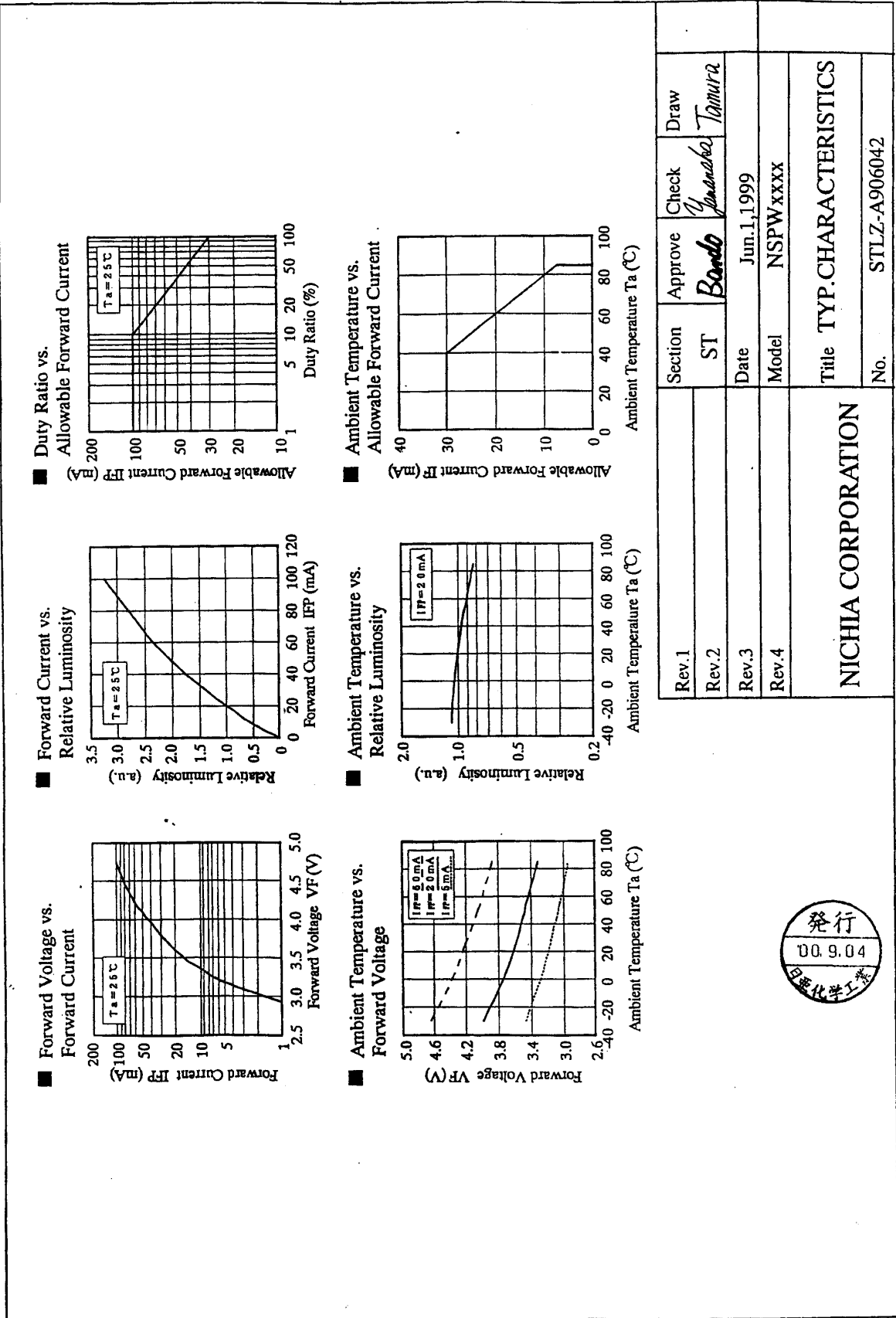
Measurement Uncertainty of the Color Coordinates : ±0.02

### 2. TYPICAL INITIAL OPTICAL/ELECTRICAL CHARACTERISTICS

Please refer to figures No.STLZ-A906042, No.STLZ-A801473.

ICI Chromaticity Diagram

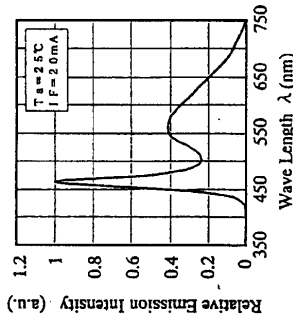




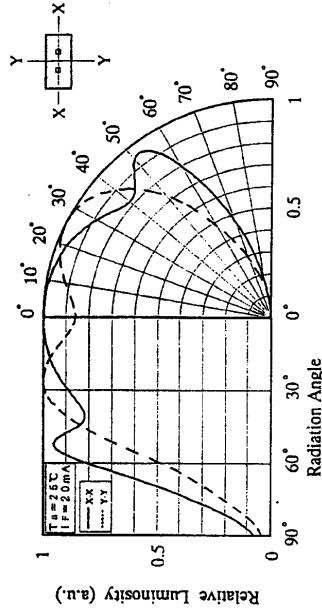
Rev.1	Section	Approve	Check	Draw
Rev.2	ST	Bando	Yanase	Tamura
Rev.3	Date	Jun.1,1999		
Rev.4	Model	NSPWxxxx		
<b>NICHIA CORPORATION</b>				
Title TYP.CHARACTERISTICS				
				No. STLZ-A906042



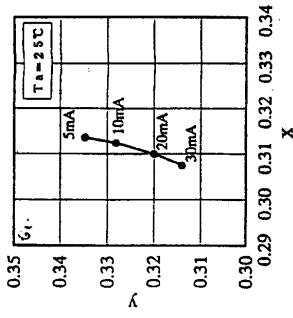
■ Spectrum



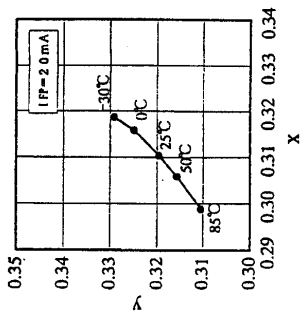
■ Directivity (NSPWF50BS)



■ Forward Current vs. Chromaticity diagram



■ Ambient Temperature vs. Chromaticity diagram



Rev.1	Section	Approve	Check	Draw
Rev.2	ST	<i>Sanaka</i>	<i>Yamada</i>	<i>Takeji</i>
Rev.3	Date	Jun.1.1999		
Rev.4	Model	NSPWF50BS		
<b>NICHIA CORPORATION</b>				
Title TYP.CHARACTERISTICS				
				No.
				STLZ-A801473