

# Specification for BT 21605VSS-FSTF-LED05W(1 DIE)-HQ

Version July 2003

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**DOCUMENT REVISION HISTORY 1:**

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A	2002.01.09	First Release	PHILIP CHENG	Z.B.HE
A B	2003.07.30	(Based on Test Specification VL-TS-BTHQ 21605VSS-XX REV. D 2003-05-31).  Item 1 to 3 were updated:  1) Module specification drawing was updated to the newest version. 2) Timing Diagram of VDD against V0 was updated. 3) (Page 3). Page numbers were updated.	SUNNY LEE	HE ZUO BING

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**Specification  
of  
LCD Module Type  
Item No.: BTHQ 21605VSS-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.
- 'SAMSUNG' KS0070BP-00CC (Die form) LCD Controller & Driver or equivalent.
- White LED05 backlight.

**2. Mechanical Specifications**

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

Table 1

Parameter	Specifications	Unit
Outline dimensions	84.0(W) x 44.0(H) x 14.0 MAX.(D)	mm
Effective viewing area	61.0(W) x 15.8(H)	mm
Active area	56.20(W) x 11.50(H)	mm
Display format	16 characters x 2 lines	-
Character size	2.95(W) x 5.55(H) (5 x 8 dots)	mm
Character spacing	0.60(W) x 0.40(H)	mm
Character pitch	3.55(W) x 5.95(H)	mm
Dot size	0.578(W) x 0.681(H)	mm
Dot spacing	0.015(W) x 0.015(H)	mm
Dot pitch	0.593(W) x 0.696(H)	mm
Weight:	TBD	grams

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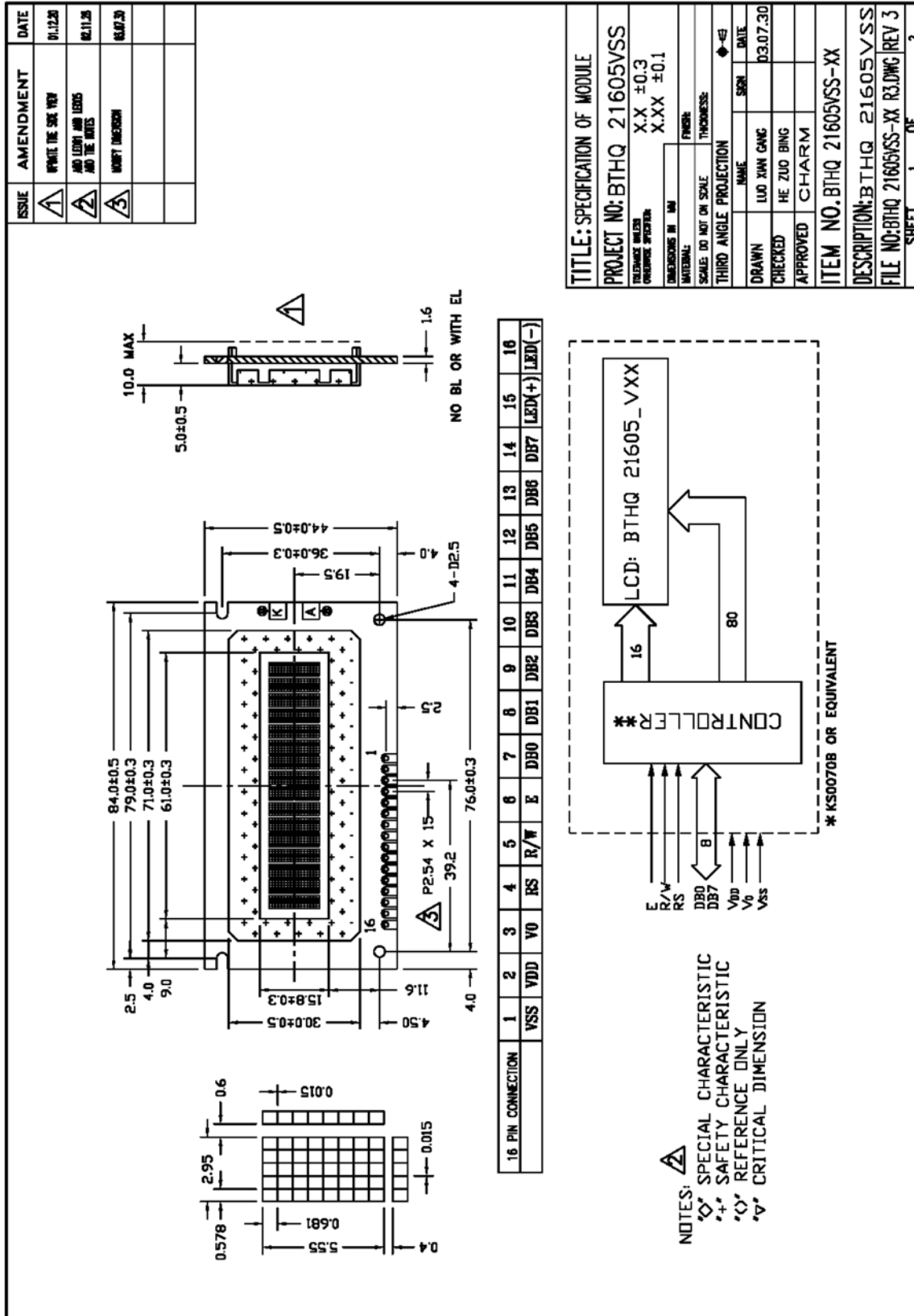


Figure 1(a): Outline Drawing

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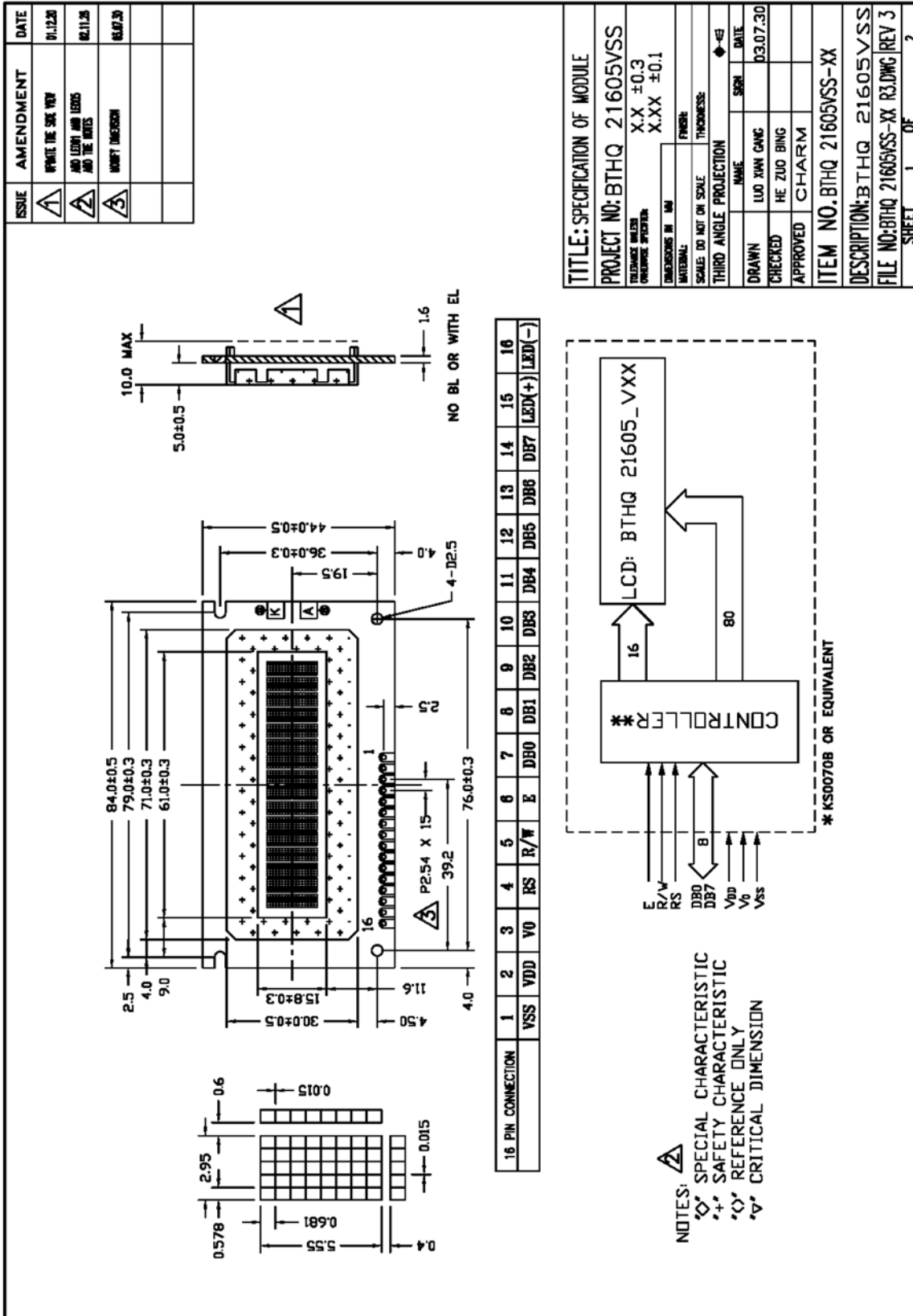


Figure 1(b): Outline Drawing

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### 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

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**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	+15.0	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

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## 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	-	0.6	V
Input signal voltage 2 for OSC1.	V <sub>IH2</sub>	“H” level	VDD -1.0	-	VDD	V
	V <sub>IL2</sub>	“L” level	-	-	1.0	V
Supply Current (Logic & LCD)	IDD	Character mode, Note 1	-	1.0	1.5	mA
		Checker board mode, Note 1	-	1.1	1.6	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 =25mA  Number of LED dies =1	3.4	3.7	4.0	V

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

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## 5.2 Timing Specifications

At  $T_a = 0\text{ }^{\circ}\text{C}$  To  $+50\text{ }^{\circ}\text{C}$  ,  $V_{DD} = +5V \pm 5\%$ ,  $V_{SS} = 0V$ .

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

Table 6

Parameter	Symbol	Min.	Max.	Unit	Test pin
E cycle time	$t_C$	500	-	ns	E
E rise time	$t_R$	-	25	ns	E
E fall time	$t_F$	-	25	ns	E
E pulse width (High, Low)	$t_W$	220	-	ns	E
R/W and RS set-up time	$t_{SU1}$	40	-	ns	R/W,RS
R/W and RS hold time	$t_{H1}$	10	-	ns	R/W, RS
Data set-up time	$t_{SU2}$	60	-	ns	DB0-DB7
Data hold time	$t_{H2}$	10	-	ns	DB0-DB7

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

Table 7

Parameter	Symbol	Min.	Max.	Unit	Test pin
E cycle time	$t_C$	500	-	ns	E
E rise time	$t_R$	-	25	ns	E
E fall time	$t_F$	-	25	ns	E
E pulse width	$t_W$	220	-	ns	E
R/W and RS set-up time	$t_{SU}$	40	-	ns	R/W,RS
R/W and RS hold time	$t_H$	10	-	ns	R/W, RS
Data output delay time	$t_D$	-	120	ns	DB0-DB7
Data hold time	$t_{DH}$	20	-	ns	DB0-DB7

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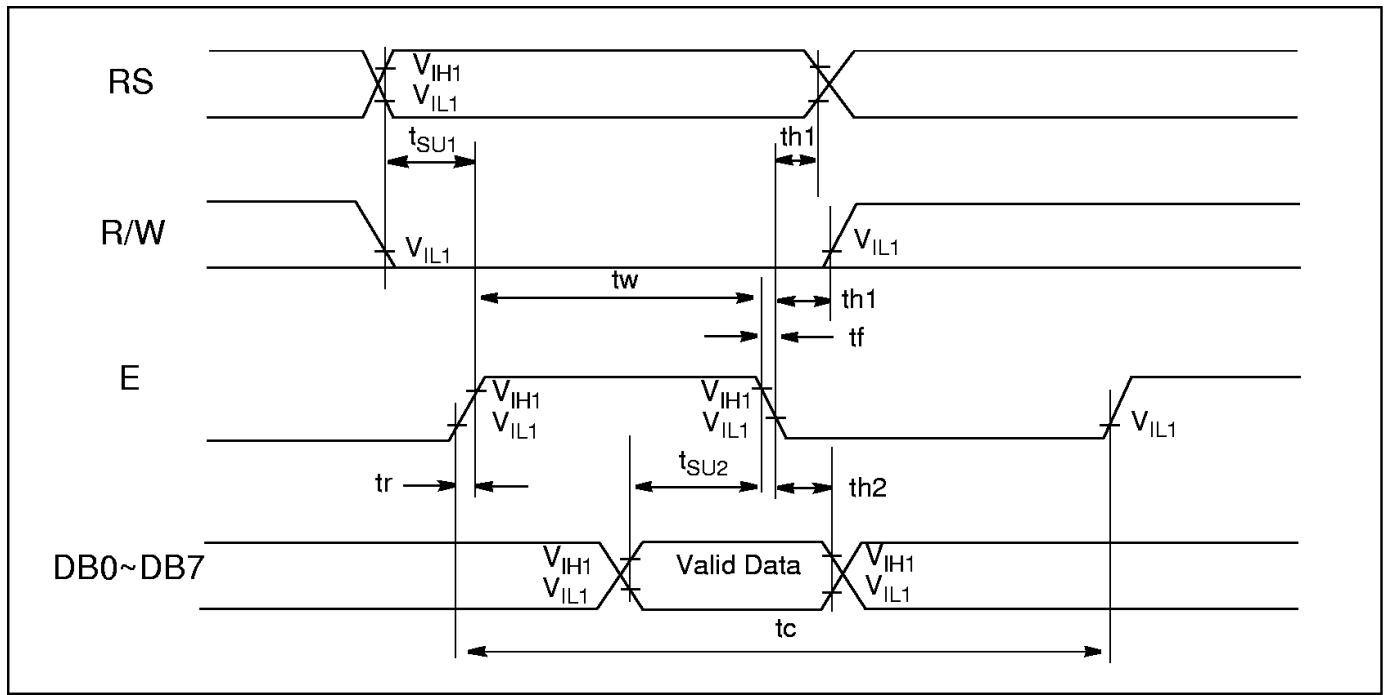


Figure 2: The bus timing diagram for write mode .

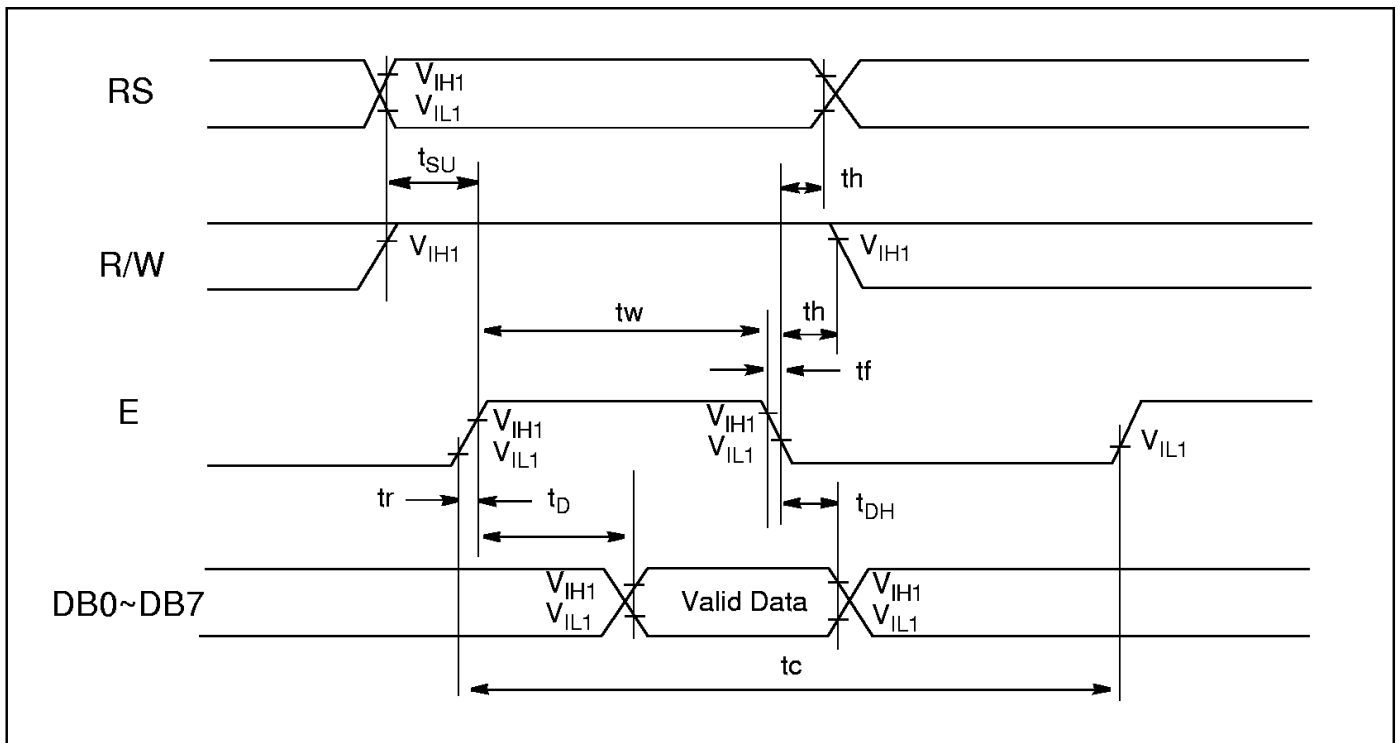


Figure 3: The bus timing diagram for read mode.

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### 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.

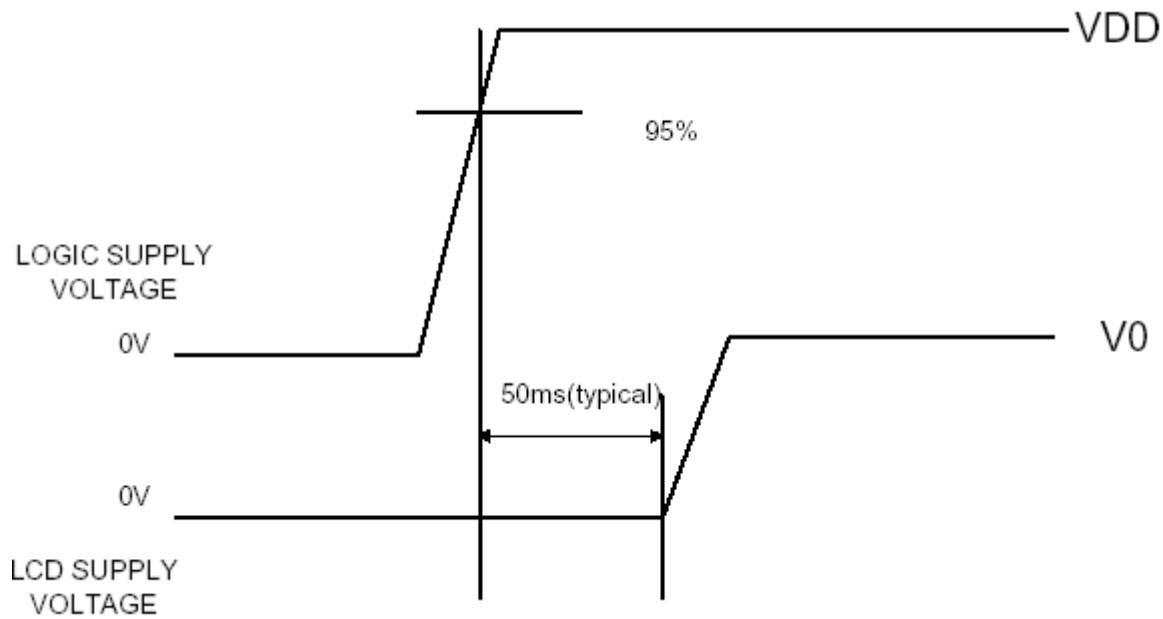


Figure 4: Timing diagram of VDD against V0.

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## 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.

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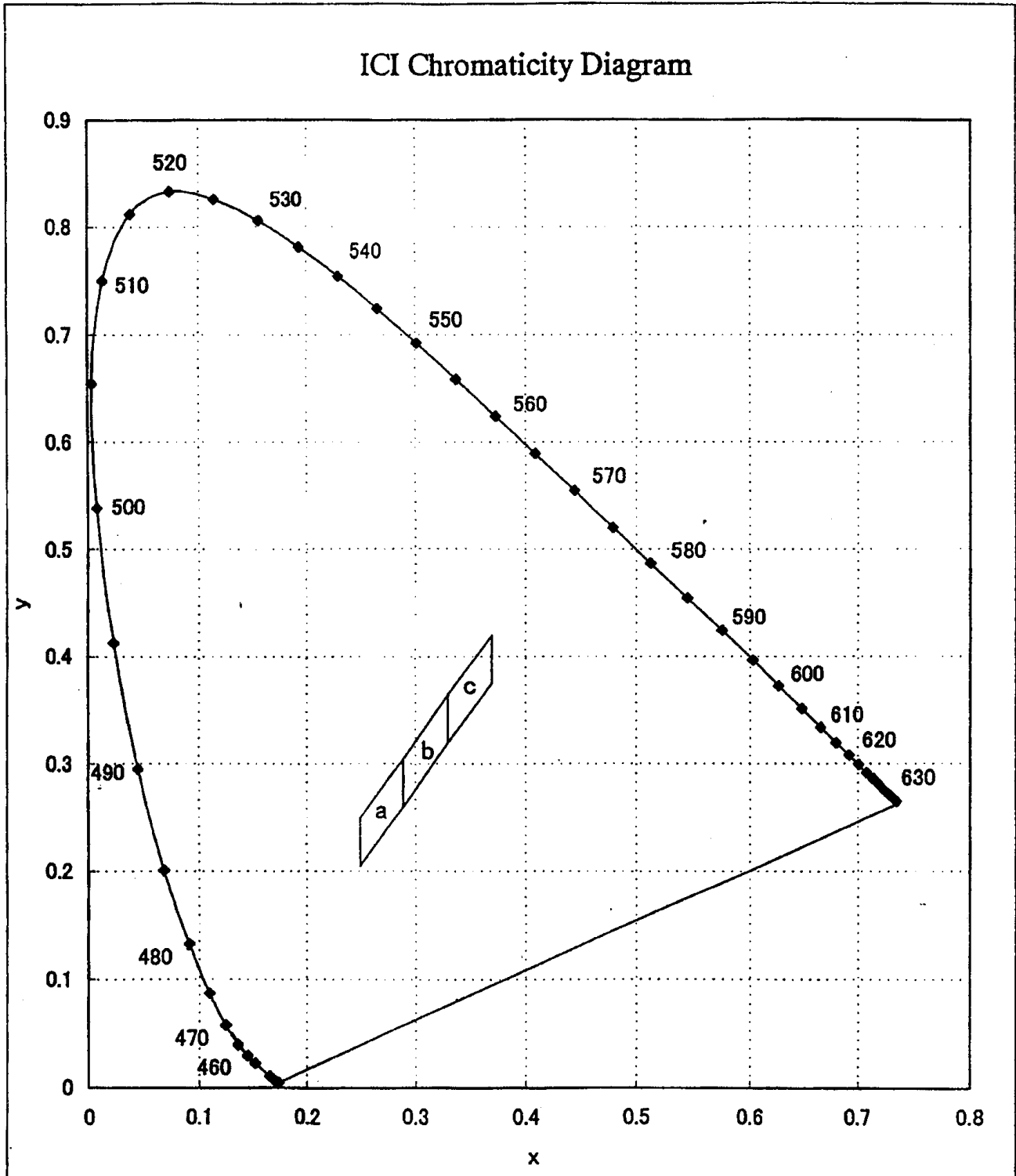
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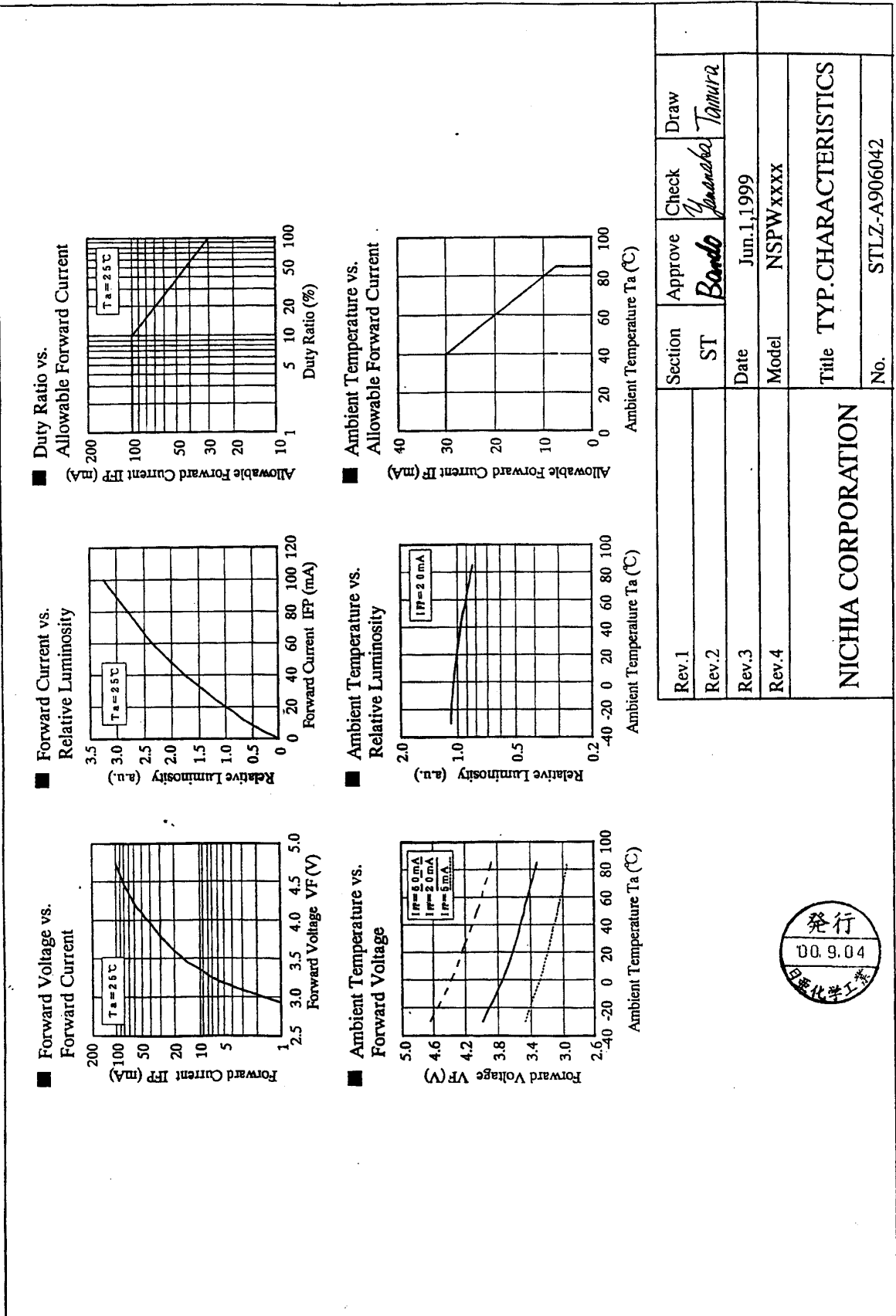
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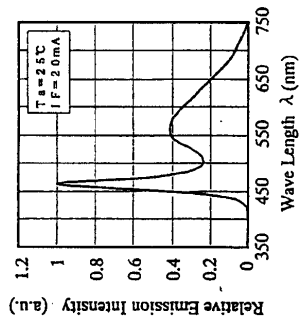
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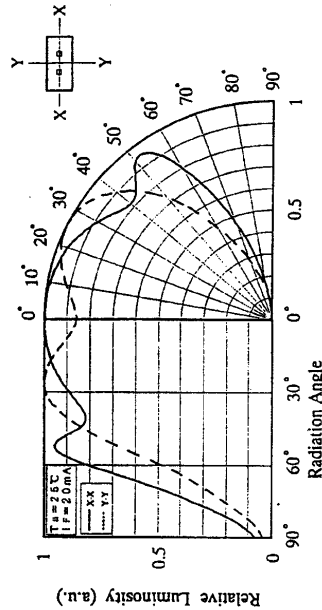
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Rev.2	ST	Bando	Yanaseki	Tamura
Rev.3	Date	Jun.1,1999		
Rev.4	Model	NSPWxxxx		
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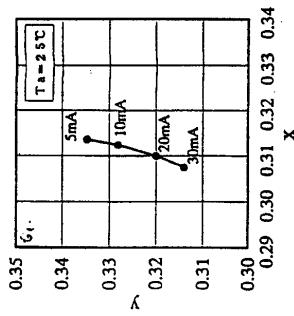
■ Spectrum



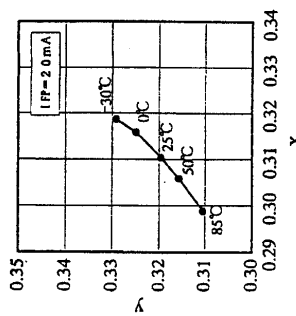
■ Directivity (NSPWF50BS)



■ Forward Current vs. Chromaticity diagram



■ Ambient Temperature vs. Chromaticity diagram



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Rev.2	ST	<i>Bando</i>	<i>Yamashita</i>	<i>Takeji</i>
Rev.3	Date	Jun.1.1999		
Rev.4	Model	NSPWF50BS		
NICHIA CORPORATION		Title TYP.CHARACTERISTICS		
		No. STLZ-A801473		

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