

REVISION HISTORY

REVISION FROM	TO	DATE		CHANGED BY	CHECKED BY
	A	2002.01.28	First Release	PHILIP CHENG	Z.B.HE

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**Specification
of
LCD Module Type
ITEM NO.: BTHQ 21608VSS-02**

1. General Description

- 16 characters (5 x 8 dots) x 2 lines FSTN Positive Black & White Transflective LCD Character 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 and summarized in Table 1 below.

Table 1

Parameter	Specifications	Unit
Outline dimensions	122.0(W) x 43.0(H) x 13.0 MAX.(D)	mm
Effective viewing area	99.0(W) x 23.0(H)	mm
Display format	16 characters x 2 lines	-
Character size	4.84(W) x 9.23(H) (5 x 8 dots)	mm
Character spacing	1.16(W) x 0.53(H)	mm
Character pitch	6.00(W) x 9.76(H)	mm
Dot size	0.955(W) x 1.140(H)	mm
Dot spacing	0.015(W) x 0.015(H)	mm
Dot pitch	0.970(W) x 1.155(H)	mm
Weight:	TBD	Grams

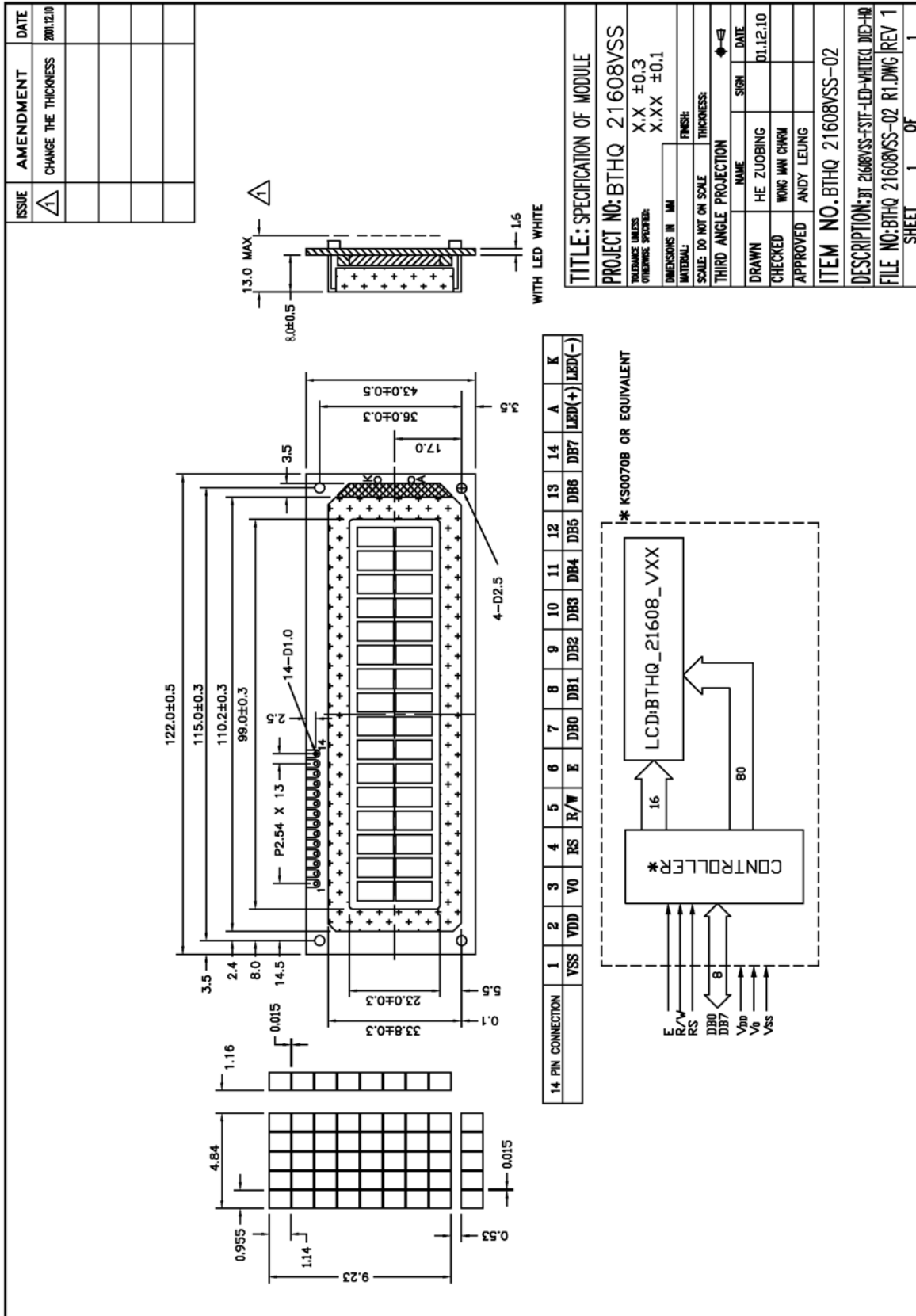


Figure 1: Outline Drawing.

3. Interface signals

Table 2

Pin No.	Symbol	Description
1	VSS	Ground (0V).
2	VDD	Power supply for logic (+5.0V)
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)
A	LED(+)	Anode of LED Backlight.
K	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	+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 ² = 100g Number of shocks:3 shocks in 3 mutually perpendicular axes.				3 directions

5. Electrical Specifications

5.1 Typical Electrical Characteristics

At $T_a = +25\text{ }^\circ\text{C}$, $V_{DD} = +5V \pm 5\%$, $V_{SS} = 0V$.

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 = 5V, Note 1	4.1	4.6	5.1	V
Input signal voltage 1 for E,DB0-DB7,R/W,RS	V _{IH1}	“High” level	2.2	-	VDD	V
	V _{IL1}	“Low” level	-0.3	-	0.6	V
Input signal voltage 2 for OSC1	V _{IH2}	“High” level	VDD -1.0	-	VDD	V
	V _{IL2}	“Low” level	-	-	1.0	V
Supply Current (Logic & LCD)	IDD	Character mode, Note 1	-	1.8	2.9	mA
Supply Current (LCD)	I0	Character mode, Note 1	-	1.0	1.5	mA
Forward 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 $T_a = 0\text{ }^{\circ}\text{C}$ 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

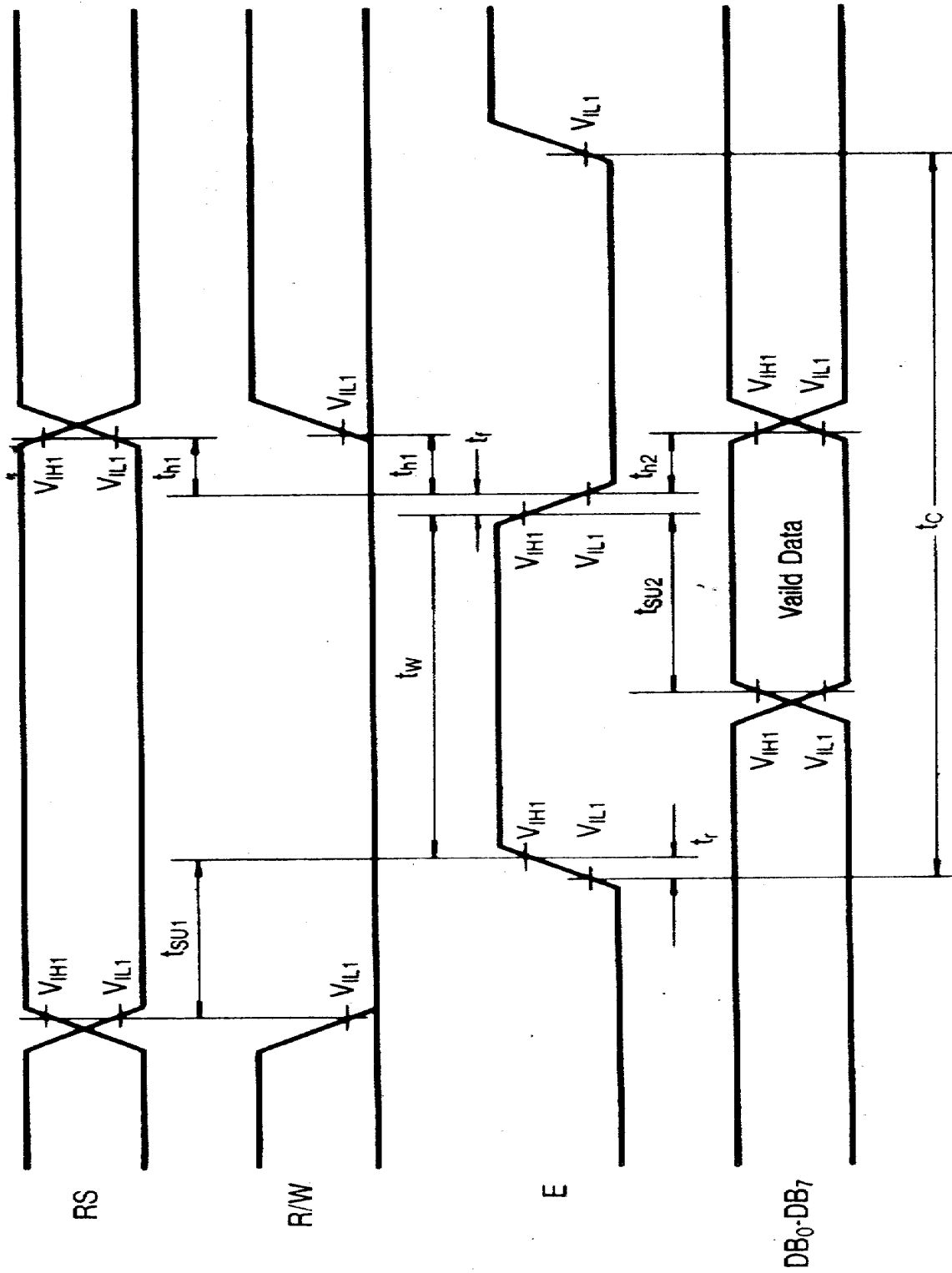


Figure 2: The bus timing diagram for write mode .

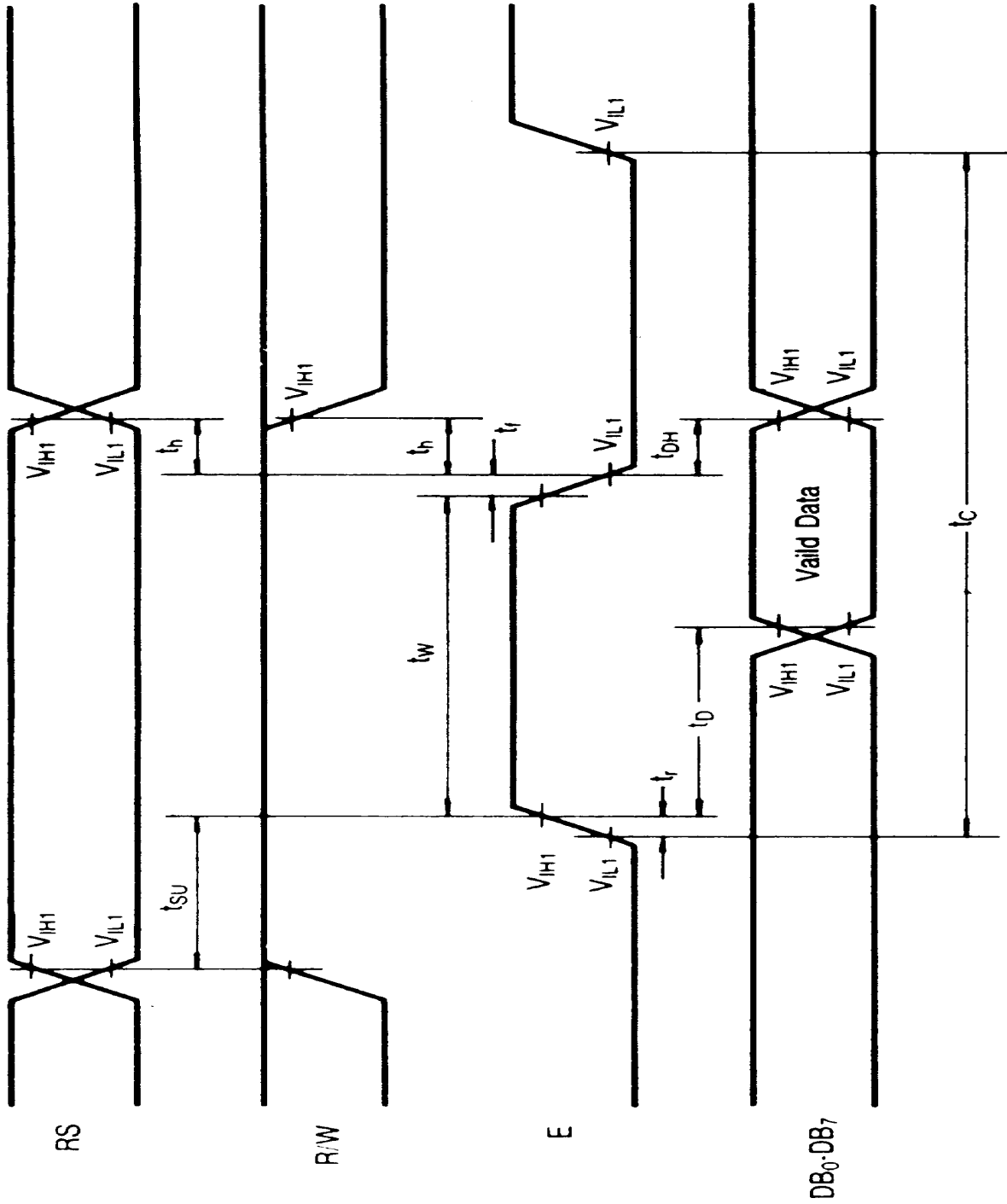


Figure 3: The bus timing diagram for read mode .

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.

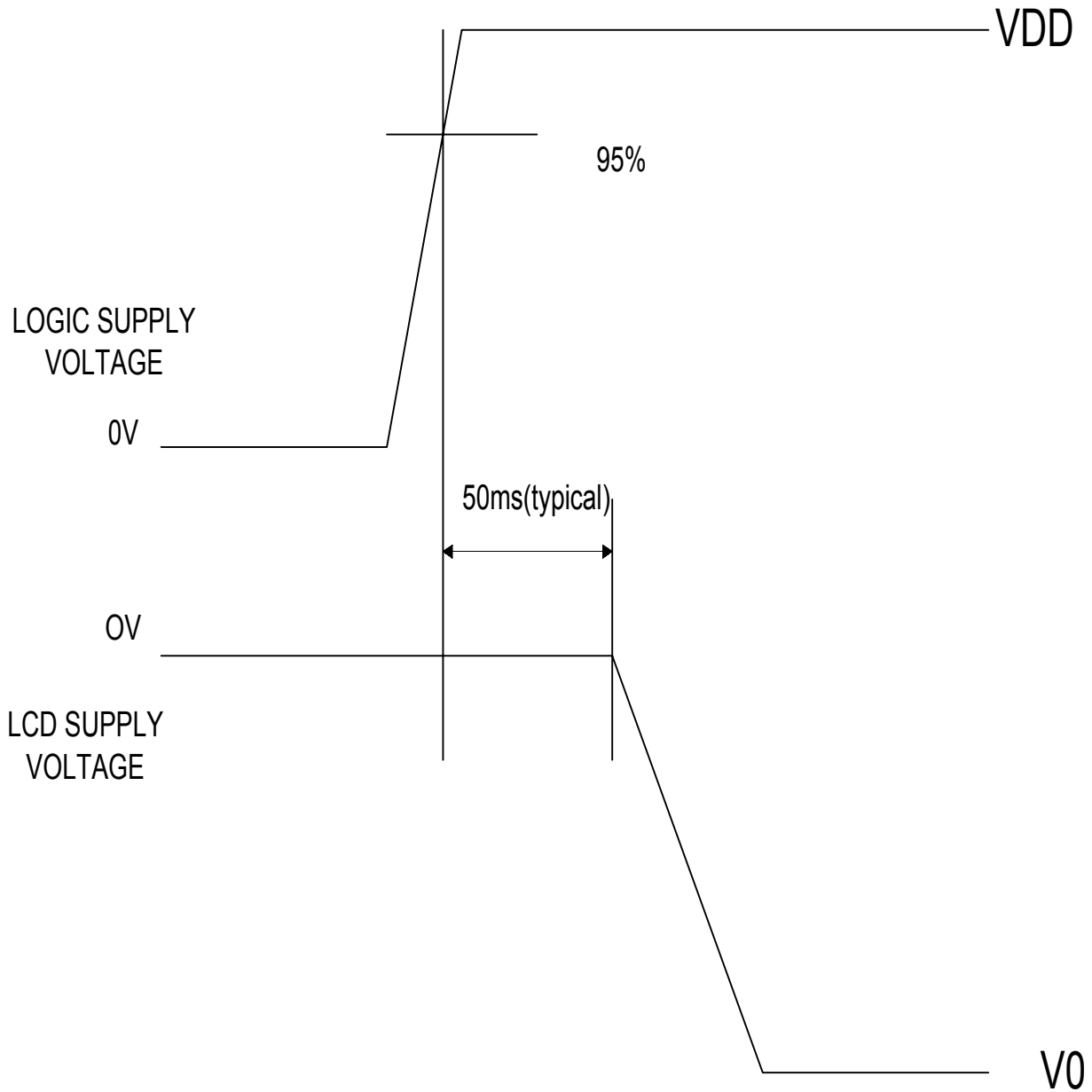


Figure 4: Timing diagram of VDD against V0.

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.

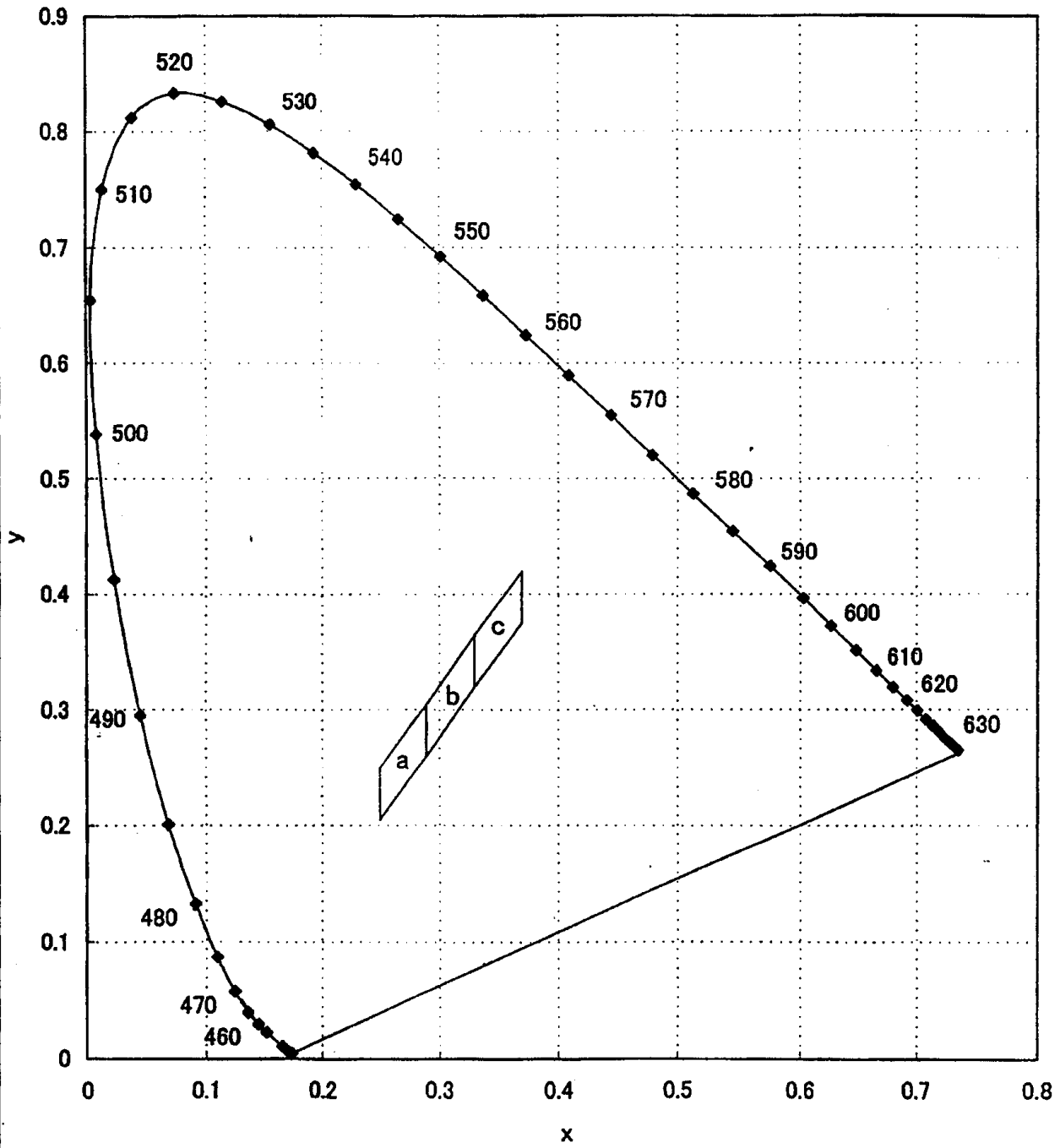
The quantity-ratio of the two ranks is decided by Nichia.

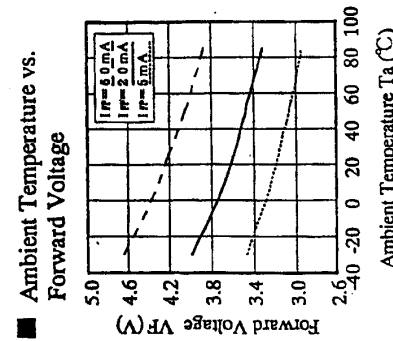
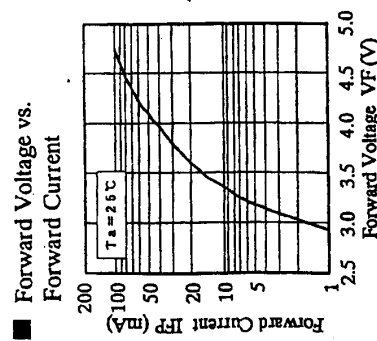
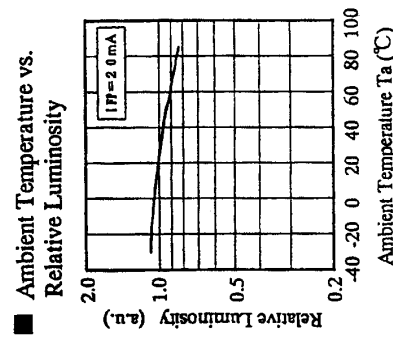
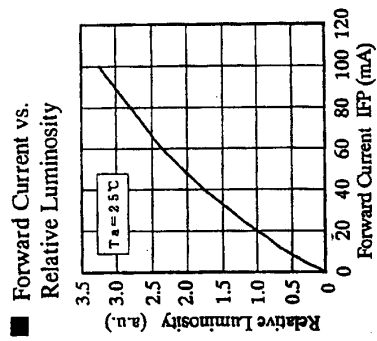
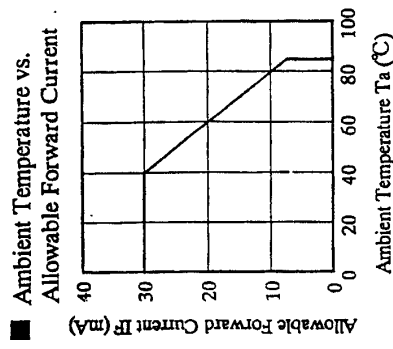
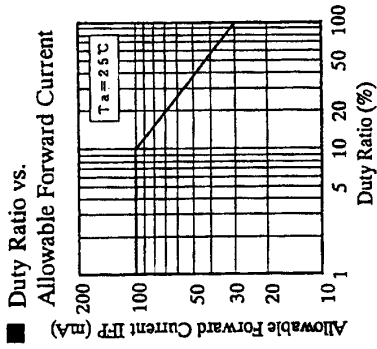
Measurement Uncertainty of the Color Coordinates : ±0.02

2. TYPICAL INITIAL OPTICAL/ELECTRICAL CHARACTERISTICS

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

ICI Chromaticity Diagram

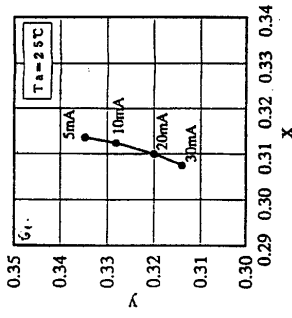




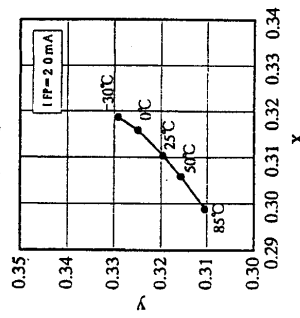
Rev.1	Section	Approve	Check	Draw
Rev.2	ST	Bando	Yamanaka	Tamura
Rev.3	Date	Jun.1,1999		
Rev.4	Model	NSPWxxxx		
NICHIA CORPORATION				
Title TYP.CHARACTERISTICS				
No.				STLZ-A906042



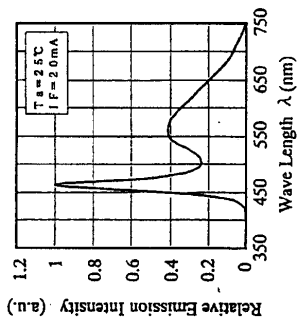
■ Forward Current vs. Chromaticity diagram



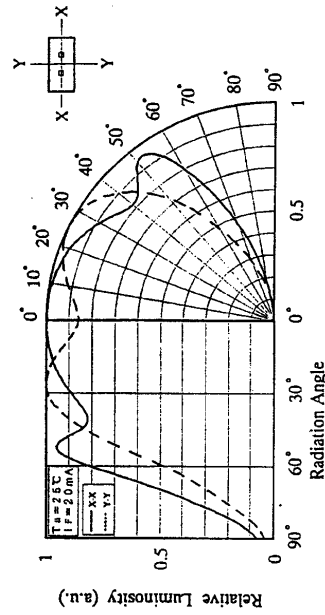
■ Ambient Temperature vs. Chromaticity diagram



■ Spectrum



■ Directivity (NSPWF50BS)



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