Contents

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	2 / 33

* Revision History

Date	Rev. No	Page	Summary
Mar. 03, 2009	000	-	**First Issued**
May. 26, 2009	001	-	• C-PBA Changing for preventing no display. Model Code Changed : LTY[Z]520HE11-001 → LTY[Z]520HE11-002
Sep. 04, 2009	002	-	• Optical Sheet and Lamp Electrode Changing Model Code Changed : LTY[Z]520HE11-002 → LTY[Z]520HE11-003

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	3 / 33

General Description

Description

LTY[Z]520HE11 is a color active matrix liquid crystal display (LCD) that uses amorphous silicon TFT(Thin Film Transistor) as switching components. This model is composed of a TFT LCD panel, a driver circuit and a back light unit. The resolution of a 52.0" is 1920 x 1080 and this model can display up to 16.7 million colors with wide viewing angle of 89° or higher in all directions. This panel is intended to support applications to provide a excellent performance for Flat Panel Display such as Home-alone Multimedia TFT-LCD TV, Display terminals for AV application products, and High Definition TV (HDTV).

Features

- RoHS compliance (Pb-free)
- High contrast ratio, high aperture ratio, fast response time
- SPVA (Super Patterned Vertical Align) mode
- Wide viewing angle ($\pm$89°)
- High speed response
- Full HD(1920 x 1080 pixels) resolution (16:9)
- Low Power consumption
- 28 CCFTs (Cold Cathode Fluorescent Tube)
- LVDS (Low Voltage Differential Signaling) interface

General Information

Items	Specification	Unit	Note
Module Size	1226.0(H_{TYP}) x 719.2(V_{TYP})	mm	$\pm$1.0mm
	40.2(D_{MAX})		
Weight	18000(Max)	g	
Pixel Pitch	0.600(H) x 0.200(W)*3	mm	
Active Display Area	1152.0(H) x 648.0(V)	mm	
Surface Treatment	Haze 7%, Hard Coating 3H		
Display Colors	16.7 million (True 8 Bit)	colors	
Number of Pixels	1920 x 1080	pixel	
Pixel Arrangement	RGB vertical stripe		
Display Mode	Normally Black		
Luminance of White	500	cd/m^2	Refer to Page 6

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	4 / 33

1. Absolute Maximum Ratings

If the condition exceeds maximum ratings, it can cause malfunction or unrecoverable damage to the device.

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	GND-0.5	*13*	V	(1)
Storage temperature	T_{STG}	-20	65	℃	(2)
Operating Temperature	T_{OPR}	0	50	℃	(2)
Panel surface temperature	T_{SUR}	0	65	℃	(3)
Shock (non - operating)	S_{NOP}	-	30	G	(4)
Vibration (non - operating)	V_{NOP}	-	1.5	G	(5)

Note (1) Ta= 25 $\pm$ 2 ℃
   (2) Temperature and relative humidity range are shown in the figure below.
      a. 93.8 % RH Max. (Ta $\leq$ 40 ℃)
      b. Maximum wet-bulb temperature at 40 ℃ or less. (Ta $\leq$ 40 ℃)
      c. No condensation
   (3) Polarizer will not be damaged in this range, even though abnormal visual problems occur
      in T_{SUR} range.
   (4) 11ms, sine wave, one time for $\pm$X, $\pm$Y, $\pm$Z axis
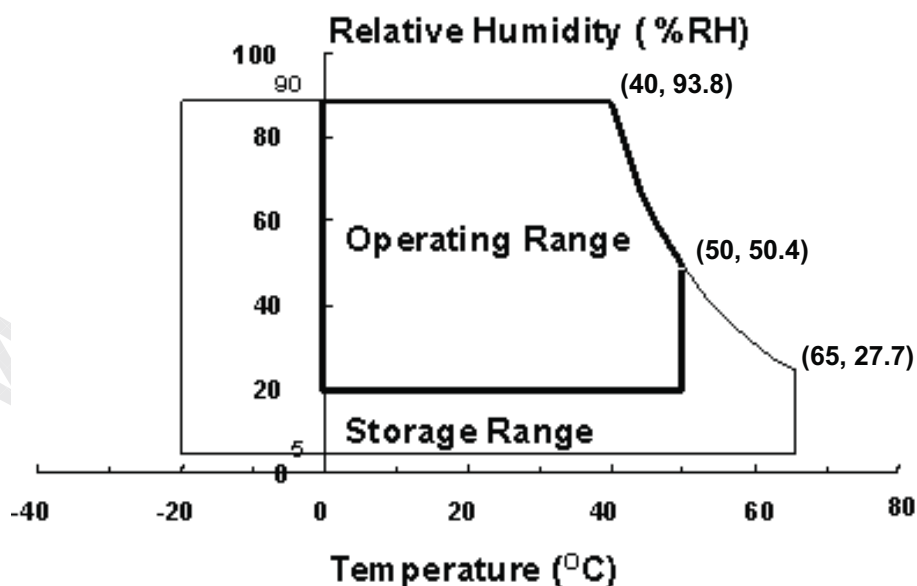   (5) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

Fig. Temperature and Relative humidity range

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	5 / 33

2. Optical Characteristics

The optical characteristics should be measured in a dark room or equivalent.
Measuring equipment : TOPCON BM-7,SPECTRORADIOMETER SR-3

(Ta = 25 $\pm$ 2°C, VDD=12V,   fv= 60Hz, f_{DCLK}=148.5MHz, Dim = 100%)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center of screen)		C/R		* 2500	5000	-		(3) SR-3
Response Time	Rising	Tr		-	8	13	msec	(5) BM-7
	Falling	Tf		-	6	7		
	G-to-G	Tg		-	8	-		
Luminance of White (Center of screen)		Y_L	Normal θL,R=0 θU,D=0 Viewing Angle	430	500	-	cd/m^2	(6) SR-3
Color Chromaticity (CIE 1931)	Red	Rx			0.643			(7),(8) SR-3
		Ry			0.330			
	Green	Gx			0.283			
		Gy		TYP. -0.03	0.608	TYP. +0.03		
	Blue	Bx			0.145			
		By			0.062			
	White	Wx			0.280			
		Wy			0.290			
Color Gamut		-		-	72	-	%	(7) SR-3
Color Temperature		-		-	10000	-	K	(7) SR-3
Gamma		ɣ		-	2.2	-		
Viewing Angle	Hor.	θ_L	C/R≥10	79	89	-	Degree	(8) SR-3
		θ_R		79	89	-		
	Ver.	θ_U		79	89	-		
		θ_D		79	89	-		
Brightness Uniformity (9 Points)		B_{uni}		-	-	23	%	(4) SR-3

* marked Items Value does not Specification above when "White stain" occurs at Center Point [Point ⑤ of Note 2.]

Note (1) Test Equipment Setup

The measurement should be executed in a stable, windless and dark room between
40min and 60min after lighting the back light at the given temperature for stabilization
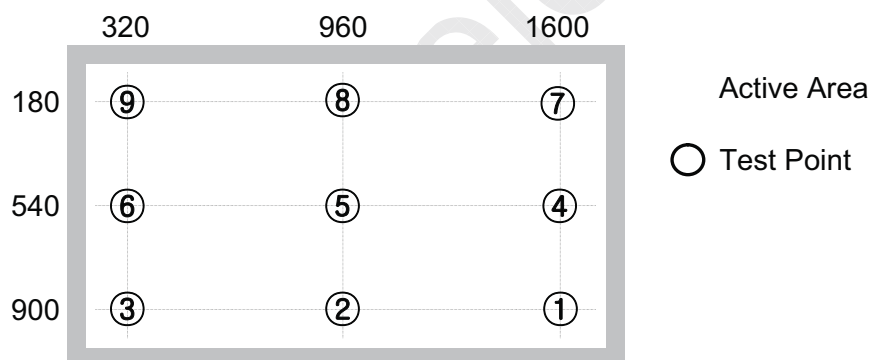of the back light. This should be measured in the center of screen.

Single lamp current @ Dim = 100%
Environment condition : Ta = 25 $\pm$ 2 °C

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	6 / 33

Photo detector	Field
SR-3	1°
BM-7	2°

Photo detector

Field

SR-3 : 50㎝
BM-7 : 50㎝

TFT - LCD Module

LCD Panel

The center of the screen
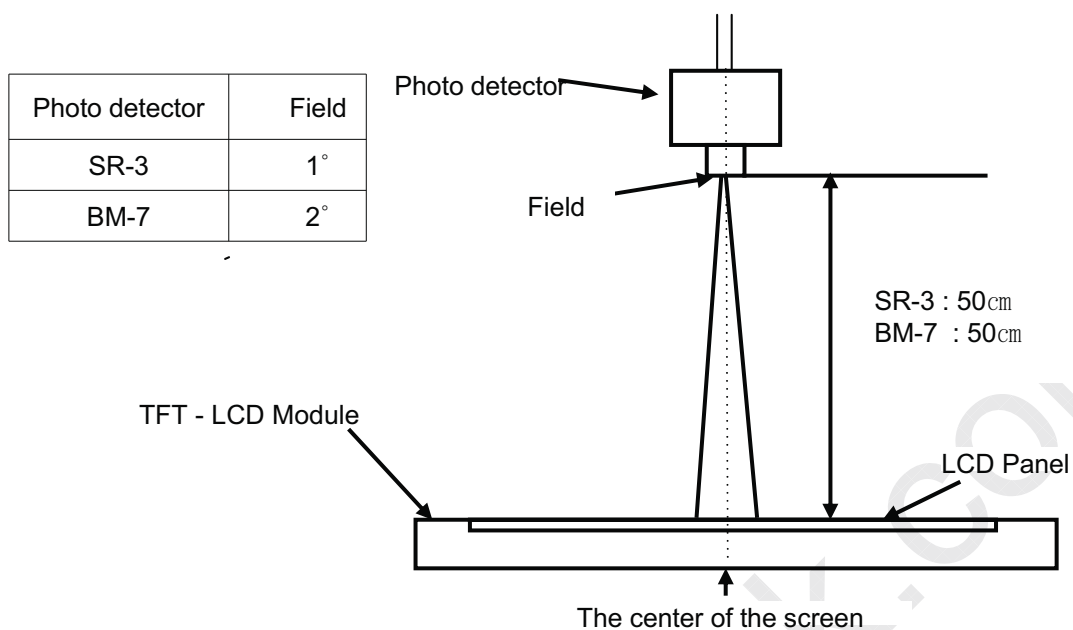
Note (2) Definition of test point

	320	960	1600
180	⑨	⑧	⑦
540	⑥	⑤	④
900	③	②	①

Active Area

◯ Test Point

Note (3) Definition of Contrast Ratio (C/R)
: Ratio of gray max (Gmax) & gray min (Gmin) at the center point ⑤ of the panel

$$C/R = \frac{G\max}{G\min}$$

Gmax : Luminance with all pixels white
Gmin : Luminance with all pixels black

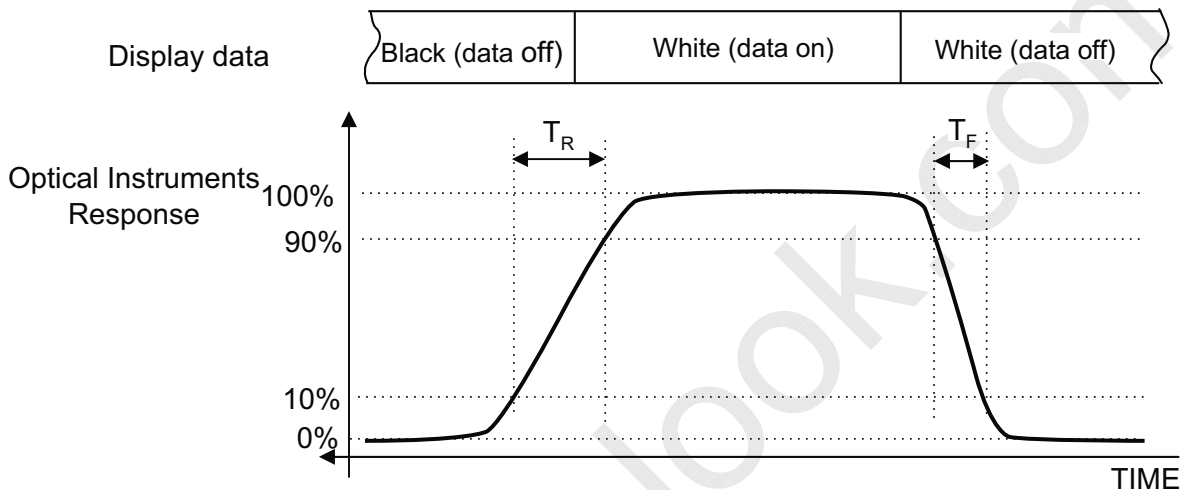| MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	7 / 33

Note (4) Definition of 9 points brightness uniformity

$$Buni = 100 * \frac{(B\max - B\min)}{B\max}$$

Bmax : Maximum brightness
Bmin : Minimum brightness

Note (5) Definition of Response time : Sum of Tr, Tf

Display data
| Black (data off) | White (data on) | White (data off) |

Optical Instruments Response

100%
90%

T_R T_F

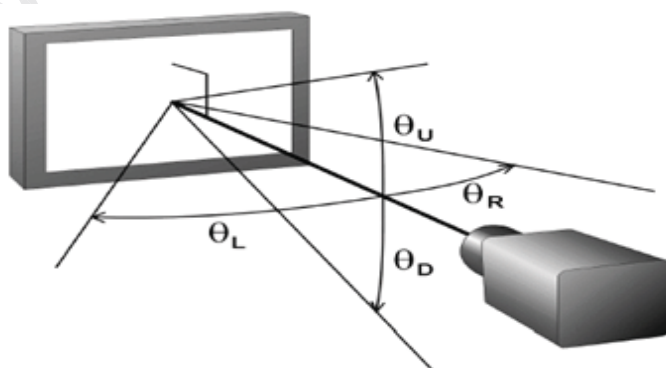10%
0%

TIME

Note (6) Definition of Luminance of White : Luminance of white at center point ⑤

Note (7) Definition of Color Chromaticity (CIE 1931)
Color coordinate of Red, Green, Blue & White at center point ⑤

Note (8) Definition of Viewing Angle
: Viewing angle range (C/R ≥10)

Θ_U
Θ_R
Θ_L
Θ_D

| MODEL | LTY[Z]520HE11 | Doc. No | 05-002-S-090904 | Page | 8 / 33 |

3. Electrical Characteristics

3.1 TFT LCD Module

The connector for display data & timing signal should be connected.

Ta = 25°C $\pm$ 2 °C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	11	12	13	V	(1)
Current of Power Supply	(a) Black	I_{DD}	-	1040	-	mA	(2),(3)
	(b) White		-	1080	1300		
	(c) Mosaic		-	1060	-		
	(d) Max Pattern		-	2360	3000		
Vsync Frequency		f_V	-	60	-	Hz	
Hsync Frequency		f_H	-	67.5	-	kHz	
Main Frequency		f_{DCLK}	-	148.5	-	MHz	
Rush Current		I_{RUSH}	-	-	5	A	(4)

Note (1) The ripple voltage should be controlled under 10% of V_{DD}.

(2) f_V=60Hz, f_{DCLK} = 148.5Hz, V_{DD} = 12.0V, DC Current.

(3) Power dissipation check pattern (LCD Module only)
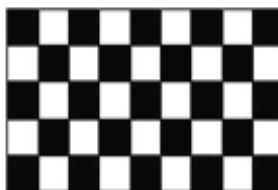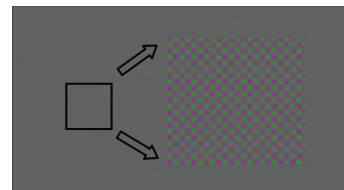
a) Black Pattern   b) White Pattern   c) Mosaic   d) Max. Pattern(Checker)
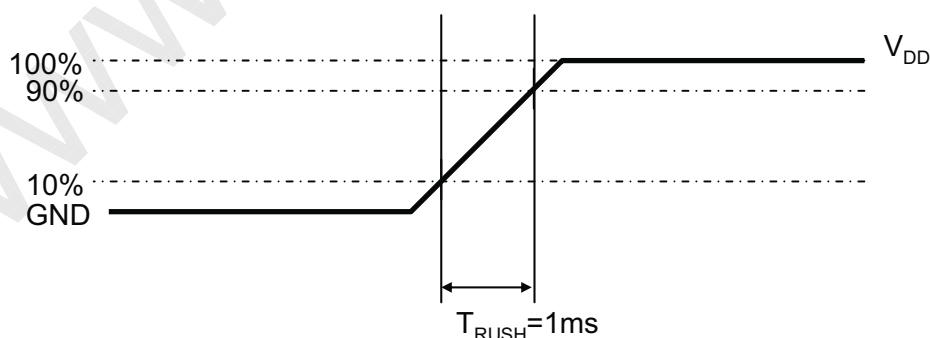
(4) Measurement Conditions

T_{RUSH}=1ms

Rush Current I_{RUSH} can be measured when T_{RUSH}. is 1ms.

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	9 / 33

3.2 Back Light Unit

The back light unit contains 28 CCFTs (Cold Cathode Fluorescent Tube).
The characteristics of lamps are shown in the following tables.

Ta=25 ± 2°C

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Life Time	Hr	50,000	-	-	Hour	(1)
Lamp Current	IL	4.0	-	10.0	mA	single

Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value.

[Operating condition : Ta = 25±2℃, I_L =6.5mArms(typ.), For single lamp only.]

Socket   **Socket**

Lamp 1   Lamp 1

Lamp 2   Lamp 2

**LCD
Module**

Lamp 27   Lamp 27

Lamp 28   Lamp 28

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	10 / 33
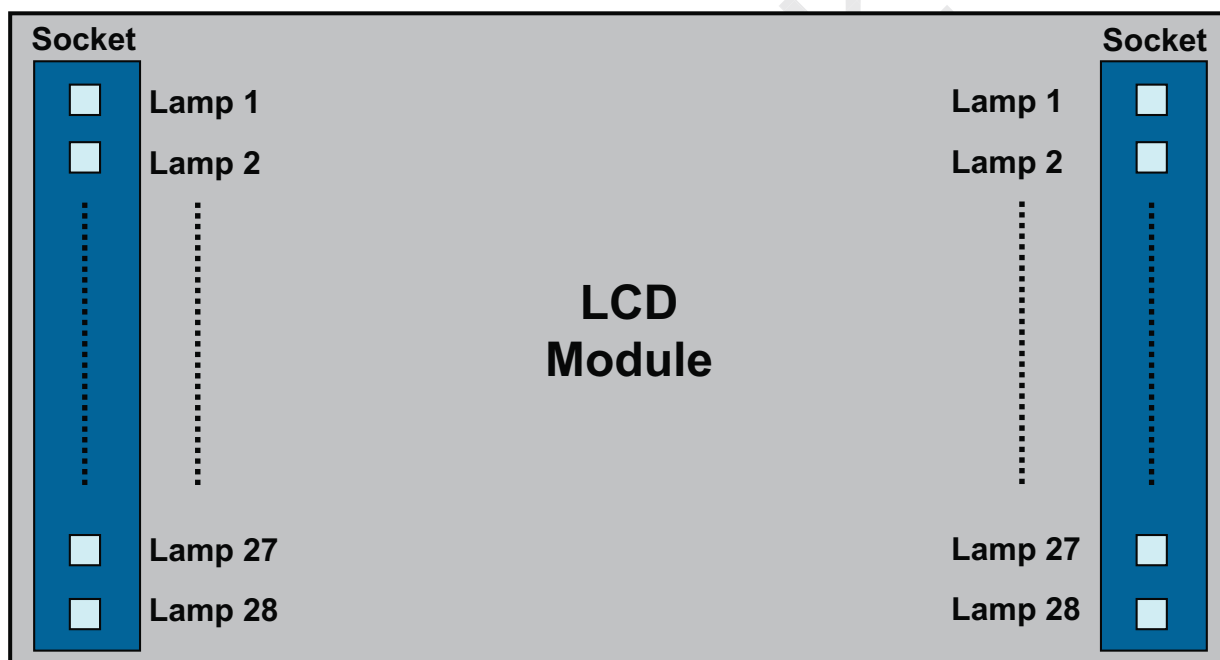
4. Block Diagram
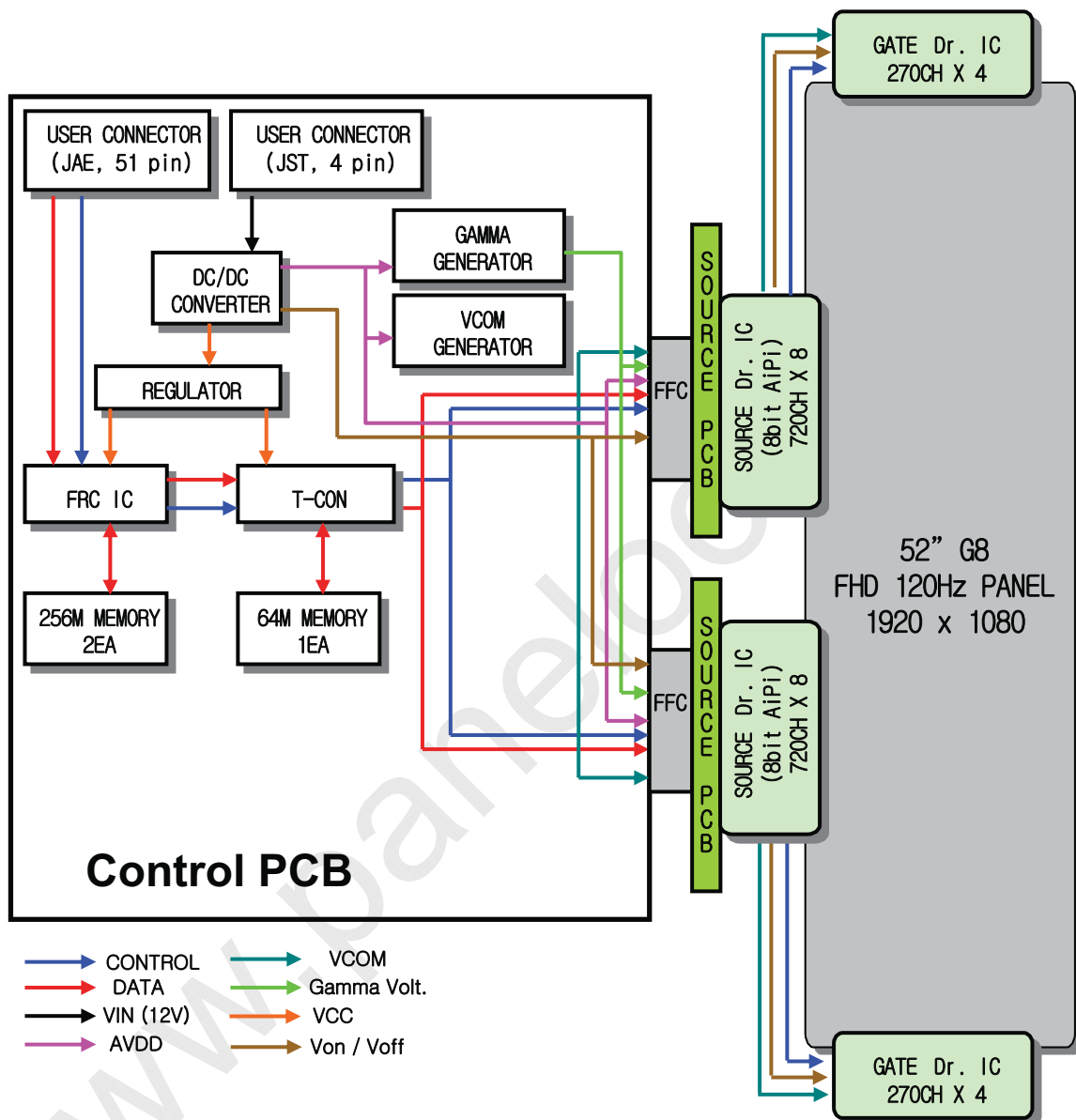
5. Input Terminal Pin Assignment

5.1 Input Signal & Power

1. 51 Pin Connector : JAE(FI-RE51S)

PIN No.	Signal	Description	PIN No.	Signal	Description
1	N.C.	N.C.	26	RE[0]P	Even LVDS Signal +
2	N.C.	N.C.	27	RE[1]N	Even LVDS Signal -
3	N.C.	N.C.	28	RE[1]P	Even LVDS Signal +
4	N.C.	N.C.	29	RE[2]N	Even LVDS Signal -
5	N.C.	N.C.	30	RE[2]P	Even LVDS Signal +
6	N.C.	N.C.	31	GND	GND
7	GND	GND	32	RECLK-	Even LVDS Clock-
8	GND	GND	33	RECLK+	Even LVDS Clock+
9	GND	GND	34	GND	GND
10	RO[0]N	Odd LVDS Signal -	35	RE[3]N	Even LVDS Signal -
11	RO[0]P	Odd LVDS Signal +	36	RE[3]P	Even LVDS Signal +
12	RO[1]N	Odd LVDS Signal -	37	RE[4]N	Even LVDS Signal -
13	RO[1]P	Odd LVDS Signal +	38	RE[4]P	Even LVDS Signal +
14	RO[2]N	Odd LVDS Signal -	39	GND	GND
15	RO[2]P	Odd LVDS Signal +	40	SCL	I2C SCL
16	GND	GND	41	SDA	I2C SDA
17	ROCLK-	Odd LVDS CLK -	42	VSYNC	*Balance board Sync Signal
18	ROCLK+	Odd LVDS CLK +	43	BUS_SW	Bus Switching
19	GND	GND	44	FRC_NVM_BINT	Bus release for FRC NVM
20	RO[3]N	Odd LVDS Signal -	45	Set_On2	DC/DC On Signal
21	RO[3]P	Odd LVDS Signal +	46	SA_MODE	SA Mode Sel Signal
22	RO[4]N	Odd LVDS Signal -	47	Panel On	T-con Reset signal
23	RO[4]P	Odd LVDS Signal +	48	FRC IC_RST	FRC IC Reset
24	GND	GND	49	N.C.	N.C.
25	RE[0]N	Even LVDS Signal -	50	TCON_RDY	T-Con Ready
			51	SEL1	SEC Internal Use Only

Note. '*' Output Vsync X 1.33

2. JST 4PIN CONNECTOR (SM04B-PASS)

PIN No.	Signal	Description
1	Power	V_DD
2	Power	V_DD
3	GND	GND
4	GND	GND

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	12 / 33

■ Option Pin Description

■ BUS_SW : I2C BUS Switching : Pull Down 100Ω/10kΩ

Operation	Description
L/OPEN	SDA/SCL LINE BECOME HI-Z
H	USER CAN ACCESS I2C DEVICES ON CONTROL BOARD

■ SET On2 : Pull down 10kΩ/10kΩ

Operation	Description
Low → High	Operation Start
High → Low	Operation Stop

■ SA_MODE : Pull up 0Ω/10kΩ

Operation	Description
Low	SET MODE
High	SA_MODE

■ Panel On : Pull down 0Ω/10kΩ

Operation	Description
Low → High	T-con Reset start
High → Low	T-con stop the operation

■ FRC RST : Pull down 100Ω/10kΩ

Operation	Description
Low → High	FRC Reset start
High → Low	FRC stop the operation

■ TCON Ready : Direct 100Ω

Operation	Description
Low → High	Normal Operation
High → Low	Error Operation

■ SCL : Pull up 100Ω/4.7kΩ

■ SDA : Pull up 100Ω/4.7kΩ
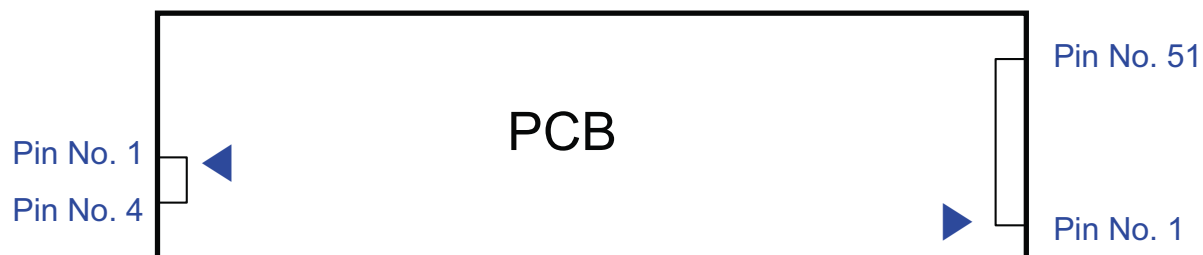
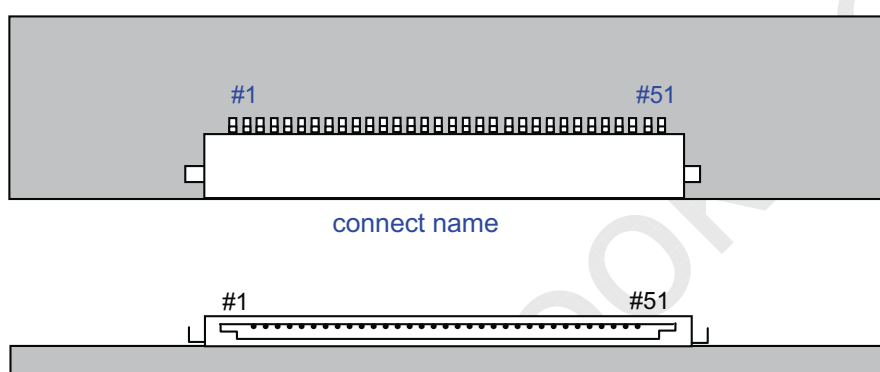■ VSYNC : Direct 100Ω

■ FRC_NVM_BINT : Pull down 0Ω/330kΩ

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	13 / 33

■ I2C Control

1) DCC Selection

Pin No.	SEL2	SEL1	SEL0	Description
Address	I2C Slave Addr :0x18 _SubAddr:0x00e4[2]	I2C Slave Addr :0x18 _SubAddr:0x00e4[1]	I2C Slave Addr :0x18 _SubAddr:0x00e4[1]	LUT
Select Bit	0	0	0	For 120Hz
	0	0	1	For 120Hz by Low Temp
	0	1	0	For 60Hz
	0	1	1	For 60Hz by Low Temp
	1	0	0	For 98/100Hz
	1	0	1	For 98/100Hz by Low Temp
	1	1	0	For 48/50Hz
	1	1	1	Over Drive 0 (DCC off)

Note) ACC and DCC are always turned on in T-con.

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	14 / 33

Note(1) Pin number starts from Right side

PCB

Pin No. 51

Pin No. 1

Pin No. 1

Pin No. 4

A. 51 Pin

#1   #51

connect name

#1   #51
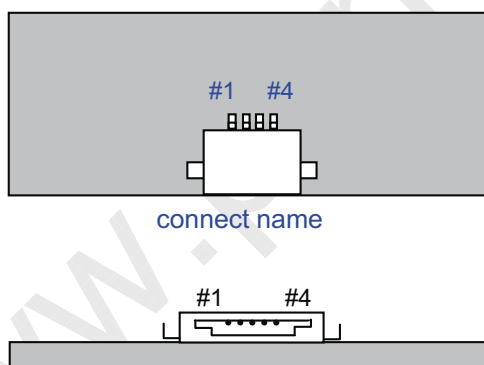
B. 4 Pin

#1   #4

connect name

#1   #4

Fig. Connector diagram

a. All GND pins should be connected together and also be connected to the LCD's metal chassis.

b. All power input pins should be connected together.

c. All NC pins should be separated from other signal or power.

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	15 / 33

5.2. Balance Board

5.2.1 Recommended Operation Condition

Item	Symbol	Recommendation			Unit	Note	Remark
		Min.	Typ.	Max.			
Inverter Frequency	F_{OP}	51	52	53	KHz		Switching Frequency
Dimming Frequency	F_{PWM}	140	-	160	Hz		
Dim Duty Ratio	D_{PWM}	20	-	100	%		Bright Control
Striking Voltage	HV_{Strike}	2040	-	-	Vrms	(1)	

Note.

Asymmetric ratio must less than 10% [｜Ip – I_p｜ / Irms < 0.1]

Crest factor must be from 90% to 110% [0.9 〈 Ip or I_p / (Irms X √2) < 1.1]
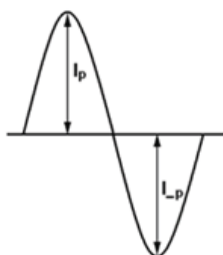
* Unbalance rate :

｜Ip – I_p｜ / Irms·100

* Distortion rate :

Ip or I_p / Irms

(1) Striking Voltage[HVSTRIKE] based on CCFL spec. at 0℃ ambient temperature.

Striking Mode Operation Requirement

- Soft Start Time[TSST] < 200msec

- No Current flows in PWM Dimming Off Period
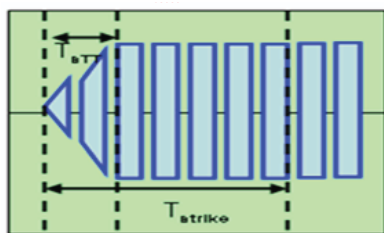
Normal PWM Dimming Operation
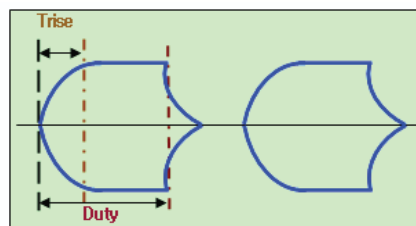
- PWM Dimming Rising Time < 800usec

Falling Time < 500usec

Trise can be turned for minimizing Acoustic Noise Emission

IP and Balance Board Should be turned without oscillation waveform

Lamp Current [Striking Mode]   Lamp Current [PWM Dimming Mode]

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	16 / 33

5.2.2 Balance Board Input Pin Configuration

1. HV Input Connector : MDF51SU-2P-13V (Hirose)

PIN NO.	SYMBOL	REMARK
1	HOT	+ High Voltage
2	HOT	- High Voltage

2. HV Input Connector :MDF61-4P-13V (Hirose)

PIN NO.	SYMBOL	REMARK
1	HOT	+ High Voltage
2	HOT	+ High Voltage
3	HOT	- High Voltage
4	HOT	- High Voltage

3. Feed Back Interface : KN30-7P-1.25H (Hirose)

PIN NO.	SYMBOL	REMARK
1	VCC	Power Supply for Protection Circuit
2	NC	NC
3	NC	NC
4	GND	Signal Ground
5	GND	Signal Ground
6	LD	CCFL Connector Open & Non-Lighting Signal
7	LD	

4. HV Input Connector : KN37-2P-2.5H (Hirose)

PIN NO.	SYMBOL	REMARK
1	HOT	+ High Voltage
2	HOT	+ High Voltage

5. HV Input Connector : KN37-3P-2.5H (Hirose)

PIN NO.	SYMBOL	REMARK
1	HOT	- High Voltage
2	HOT	- High Voltage
3	HOT	- High Voltage

5.2.3 Feedback I/O Specification

ITEM		SYMBOL	Recommendation			UNIT	REMARKS
			Min.	Typ.	Max.		
Supply Voltage		V_{CC}	10	12	14	V	
Input current Of Vcc		I_{OC}	-	-	100	mA	
Lamp Detection	High (Normal)	V_{LD}	Vcc-0.5	-	-	V	Normal : High Abnormal : Low
	Low (LD)		-	-	1		

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	18 / 33

5.3 LVDS Interface

	LVDS pin	Odd Data	Even Data
TxOUT/RxIN0	TxIN/RxOUT0	R4	R4
	TxIN/RxOUT1	R5	R5
	TxIN/RxOUT2	R6	R6
	TxIN/RxOUT3	R7	R7
	TxIN/RxOUT4	R8	R8
	TxIN/RxOUT6	R9	R9
	TxIN/RxOUT7	G4	G4
TxOUT/RxIN1	TxIN/RxOUT8	G5	G5
	TxIN/RxOUT9	G6	G6
	TxIN/RxOUT12	G7	G7
	TxIN/RxOUT13	G8	G8
	TxIN/RxOUT14	G9	G9
	TxIN/RxOUT15	B4	B4
	TxIN/RxOUT18	B5	B5
TxOUT/RxIN2	TxIN/RxOUT19	B6	B6
	TxIN/RxOUT20	B7	B7
	TxIN/RxOUT21	B8	B8
	TxIN/RxOUT22	B9	B9
	TxIN/RxOUT24	HSYNC	HSYNC
	TxIN/RxOUT25	VSYNC	VSYNC
	TxIN/RxOUT26	DEN	DEN
TxOUT/RxIN3	TxIN/RxOUT27	R2	R2
	TxIN/RxOUT5	R3	R3
	TxIN/RxOUT10	G2	G2
	TxIN/RxOUT11	G3	G3
	TxIN/RxOUT16	B2	B2
	TxIN/RxOUT17	B3	B3
	TxIN/RxOUT23	RESERVED	RESERVED
TxIn/RxIn4	TxIn/RxOUT28	R0	R0
	TxIn/RxOUT29	R1	R1
	TxIn/RxOUT30	G0	G0
	TxIn/RxOUT31	G1	G1
	TxIn/RxOUT32	B0	B0
	TxIn/RxOUT33	B1	B1
	TxIn/RxOUT34	RESERVED	RESERVED

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	19 / 33

5.4 Input Signals, Basic Display Colors and Gray Scale of Each Color

COLOR	DISPLAY (8bit)	R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7	GRAY SCALE LEVEL
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	-
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	-
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
GRAY SCALE OF RED	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R0
	DARK ↑	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1
		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			R3~ R252
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
	↓ LIGHT	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R253
		0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R254
	RED	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R255
GRAY SCALE OF GREEN	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G1
		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			G3~ G252
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
	↓ LIGHT	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G253
		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G254
	GREEN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	G255
GRAY SCALE OF BLUE	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	B1
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	B2
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			B3~ B252
		:	:	:	:	:	:			:	:	:	:	:	:			:	:	:	:	:	:			
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	B253
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	B254
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	B255

Note) Definition of Gray :
   Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)
   Input Signal : 0 = Low level voltage, 1 = High level voltage

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	20 / 33

6. Interface Timing
6.1 Timing Parameters
6.1.1 Stand alone mode

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	NOTE
Clock	Frequency	$1/T_C$	148.5	148.5	148.5	MHz	-
Hsync		F_H	67.5	67.5	67.5	KHz	-
Vsync		F_V	60	60	60	Hz	-
Vertical Display Term	Active Display Period	T_{VD}	1080	1080	1080	lines	-
	Vertical Total	T_{VB}	1125	1125	1125	Lines	-
Horizontal Display Term	Active Display Period	T_{HD}	1920	1920	1920	clocks	-
	Horizontal Total	T_H	2200	2200	2200	clocks	-

(1) Test Point : TTL control signal and CLK at LVDS Tx input terminal in system
(2) Internal V_{DD} = 3.3V

6.2 Timing diagrams of interface signal
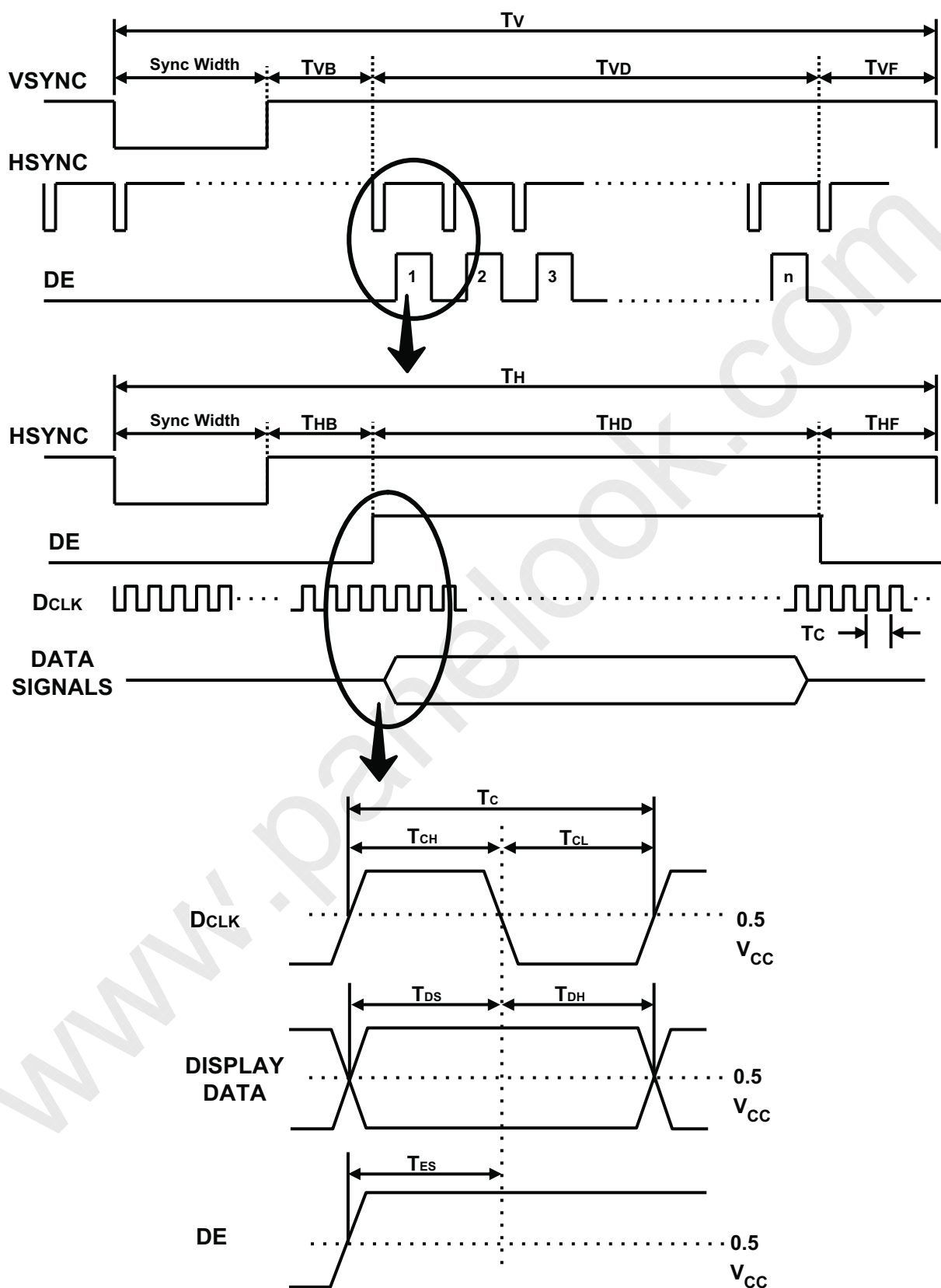
6.3 Power ON/OFF Sequence

To prevent a latch-up or DC operation of the LCD Module, the power on/off sequence should be as the diagram below.

6.3.1 Stand alone Mode

Ellipse 1:
1ms<T1≤10ms
60ms<T2≤120
0ms<T3≤50ms
1000ms ≤T4

Ellipse 2:
950ms≤T5
(Recommend Value)
100ms≤T6
(Recommend Value)
0<T7≤T5-10msec
40ms≤T8
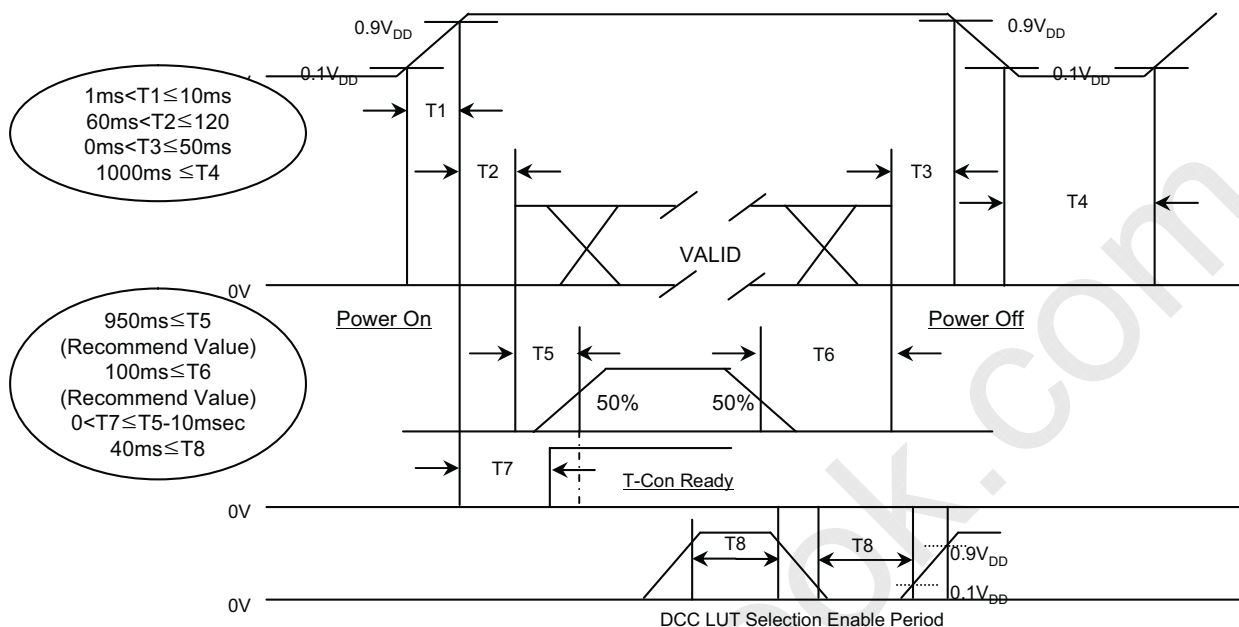
T1 : V$_{DD}$ rising time from 10% to 90%
T2 : The time from V$_{DD}$ to valid data at power ON.
T3 : The time from valid data off to V$_{DD}$ off at power Off.
T4 : V$_{DD}$ off time for Windows restart
T5 : The time from valid data to B/L enable at power ON.
T6 : The time from valid data off to B/L disable at power Off.
T7 : The time from Vin to T-Con Ready

[Valid Data Condition]
1. Input LVDS signals must satisfy "Interface Timing" Specification on p21.
2. LVDS Clock must keep the same frequency.
3. "Temp SEL" signal should be changed within Tcon Reset and Tcon Ready.
4. Data signal should not input during "Fail Safe Mode".

- The supply voltage of the external system for the Module input should be the same as the definition of V$_{DD}$.
- Apply the lamp voltage within the LCD operation range. When the back light turns on before the LCD operation or the LCD turns off before the back light turns off, the display may momentarily show abnormal screen.
- In case of V$_{DD}$ = off level, please keep the level of input signals low or keep a high impedance.
- T3 should be measured after the Module has been fully discharged between power off and on period.
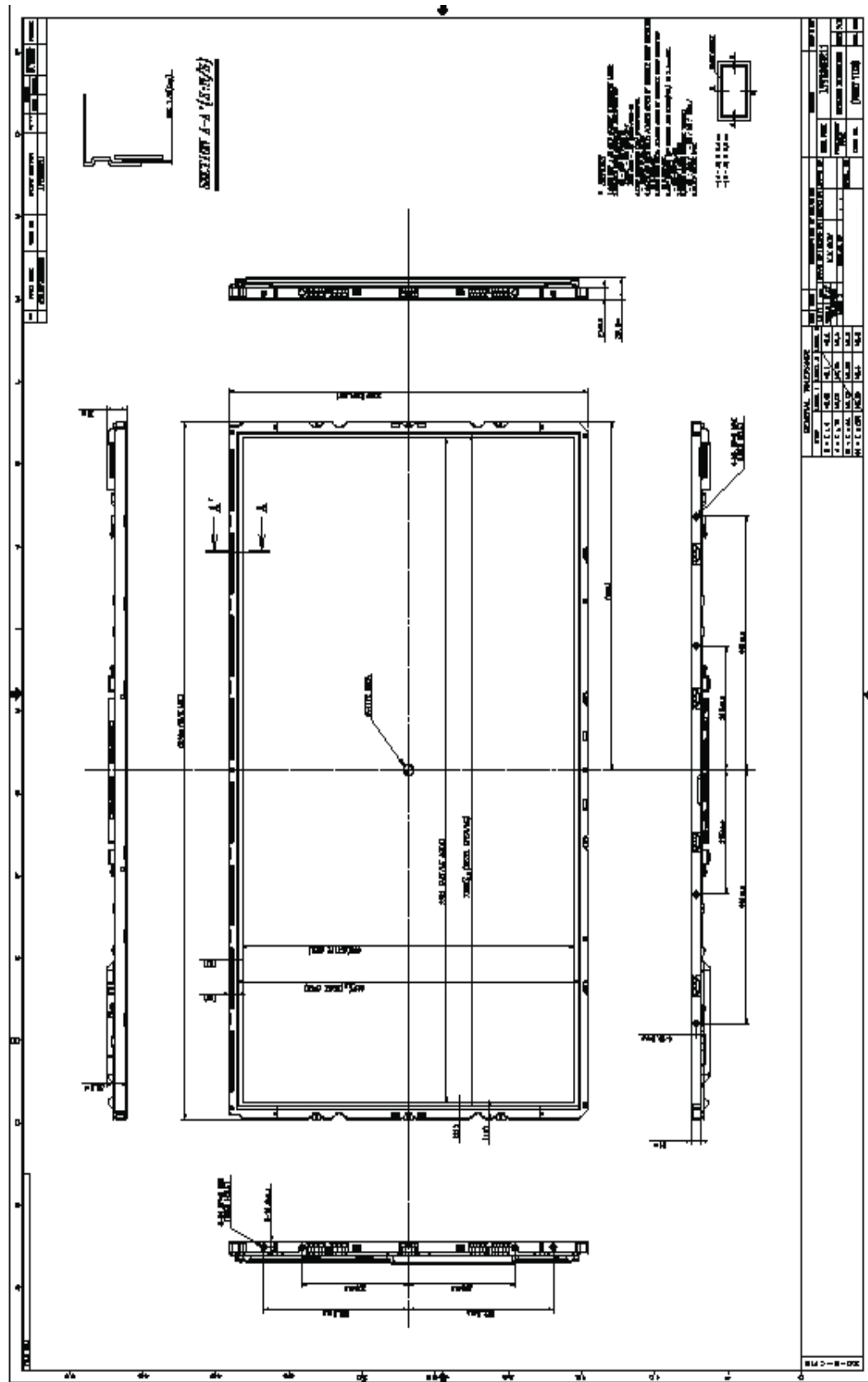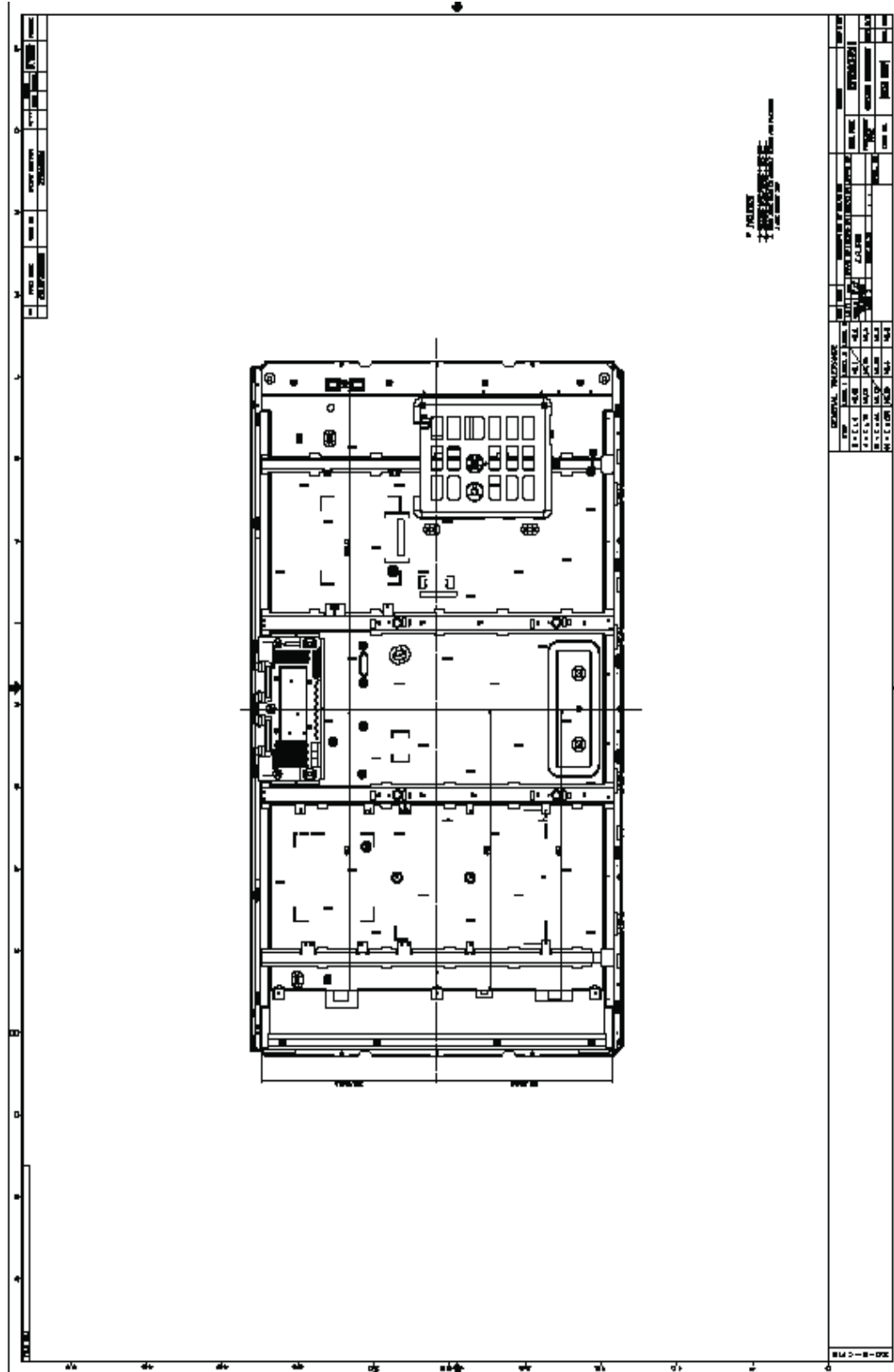- Interface signal should not be kept at high impedance when the power is on.

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	23 / 33

6.3.2 Set Mode
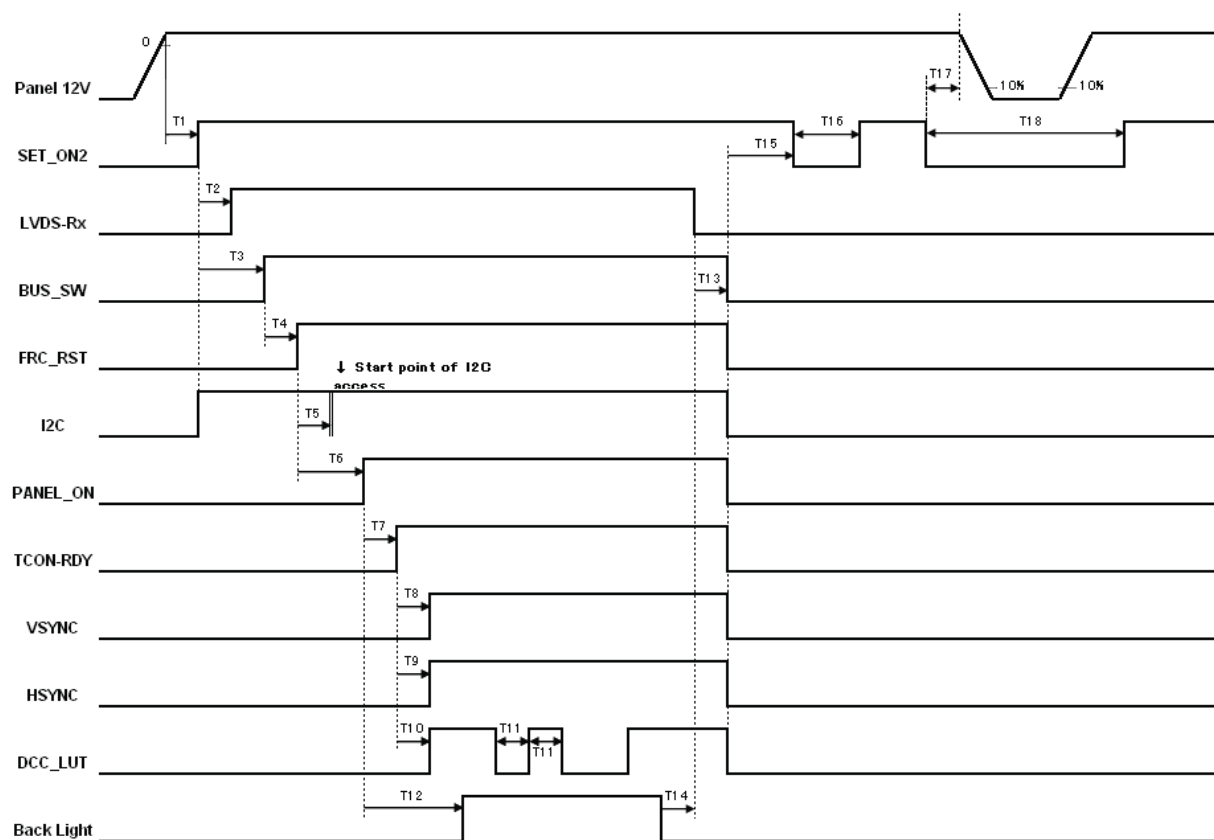
Unit (ms)

	Min	Max			Min	Max
T1	10	-	T10	30	-
T2	10	-	T11	50	-
T3	10	-	T12	800	-
T4	10	-	T13	0	-
T5	14	-	T14	100	-
T6	20	-	T15	0	-
T7	50	300	T16	1500	-
T8	0	30	T17	0	-
T9	0	30	T18	1500	-

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	24 / 33

25 / 33

Page

05-002-S-090904

Doc. No

LTY[Z]520HE11

MODEL

7. Outline dimension (Front view)

Outline dimension (Rear View)

MODEL | LTY[ZJ]520HE11 | Doc. No | 05-002-S-090904 | Page | 26 / 33

8. EMI Recommendation

: -3dB at CISPR22 Class B
   This EMI Recommendation is recommended to be measured at SET Condition.

9. UL Approval

| MODEL | LTY[Z]520HE11 | Doc. No | 05-002-S-090904 | Page | 27 / 33 |

10. Reliability Test

Item	Test condition	Quantity
Temperature Step Stress	0 ～ 50℃,10Cycle determination	4EA
HTOL	50℃, 1000hr (500hr determination)	8EA
LTOL	0℃, 1000hr (500hr determination)	4EA
RTOL	20 ℃, continue ～	4EA
HTS	60℃, 1000hr (500hr determination)	4EA
LTS	-30℃,1000hr (500hr determination)	4EA
THB	40℃ / 95%RH,1000hr (500hr determination)	4EA
WHTS	60℃ / 75%RH, 1000hr (500hr determination)	4EA
T/C	-20 ℃ ~ 60 ℃, 200cycle (100cycle determination)	4EA
ESD (non-operation)	± 10 kV,200pF/100 Ω,9Point,3times/Point	3EA
ESD(operation)	contact ： ± 8 kV ,150pF/330Ω,210Point,1 time/Point non-contact ： ± 15 kV,150pF/330Ω,100Point,1 time/Point	3EA
Input Con. ESD	contact ： ± 2kV,200pF/100,Input Con.Pin,3 times/Pin	3EA
POWER ON/OFF	30sec (on) / 30sec(off) : 12,000 times	4EA
Vibration	10~300Hz/1.5G/10minSR, XYZ, 30min/axis	3EA
Shock	SEC condition： 11msec, ±XYZ 1time/axis 30G	3EA
PALLET Vibration	1.146 Grms, 2~200Hz, Random, Z axis 1Hr	1PALLET(13EA)
PALLET Drop	20cm, Bottom, Front, Rear 1times	1PALLET(13EA)

[Result Evaluation Criteria]

Under the display quality test conditions with normal operation state, these shall be no change which may affect practical display function.

HTOL/ LTOL　: High/Low Temperature Operating Life,
THB　　　　： Temperature Humidity Bias
HTS/LTS　　： High/Low Temperature Storage
WHTS　　　： Wet High Temperature Storage

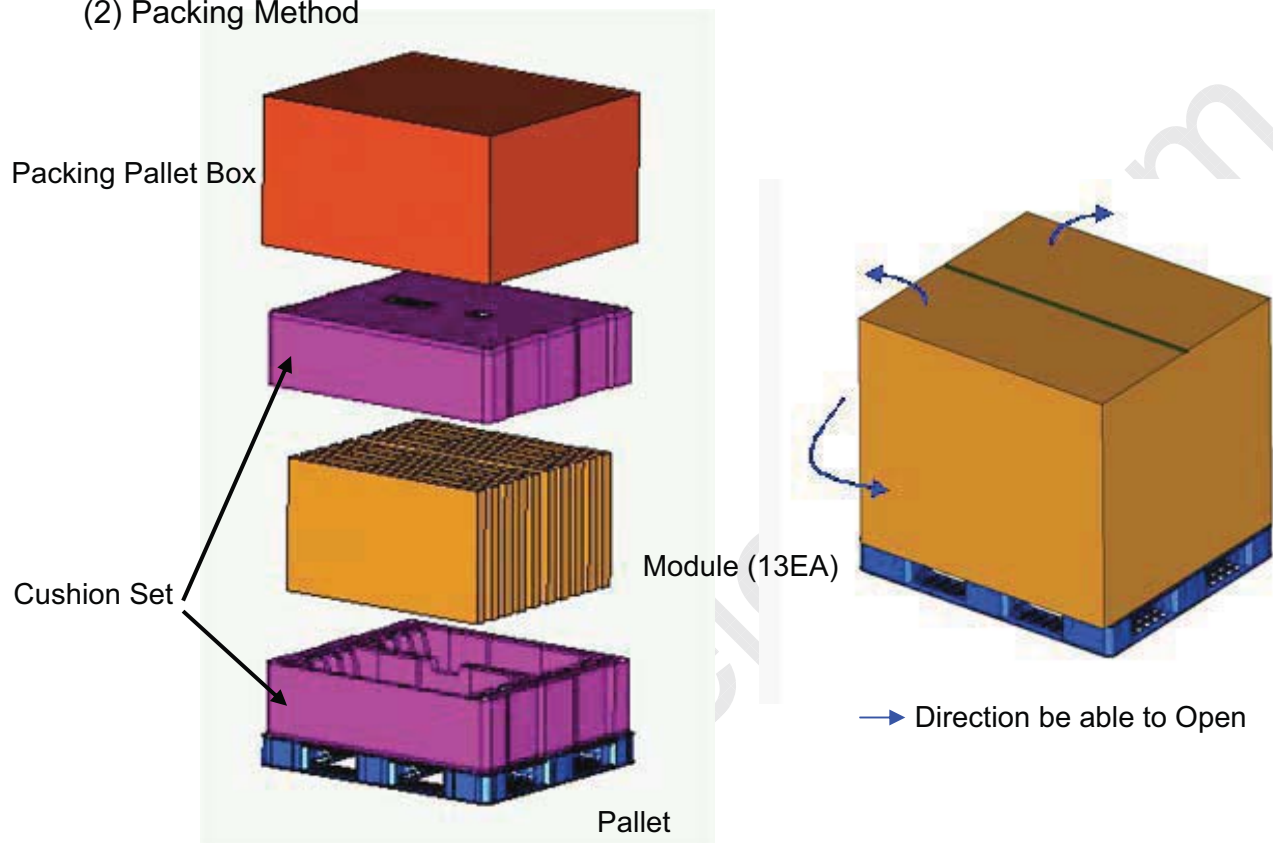| MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	28 / 33

11. PACKING

11.1 CARTON (Internal Package)

(1) Packing Form
   Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method

Packing Pallet Box

Cushion Set

Module (13EA)

Pallet

→ Direction be able to Open

11.2 Packing Specification

Item	Specification	Remark
LCD Packing	13 ea / (Packing-Pallet Box)	1. 234Kg/LCD(13ea) 2. 15.6kg/Cushion Set(2ea) 3. 10.5kg/Packing-Pallet Box(1ea) 4. Cushion Material : EPS 5. Packing Pallet Box Material : DW4
Desiccant (Drier)	4ea / LCD	10g/ea, Cobalt-dichloride-free
Pallet	1 Box / Pallet	Pallet weight : 10.5kg
Packing Direction	Vertical	-
Total Pallet Size	H x V x height	1475mm(H) x 1150mm(V) x 995mm(Height)
Total Pallet Weight	270.6 kg	Pallet(10.5kg) + Module(18 x 13 = 234kg) + Cushion(15.6kg) + Pallet-BOX(10.5kg) + Desiccant(0.01kg x 52 = 0.52kg)

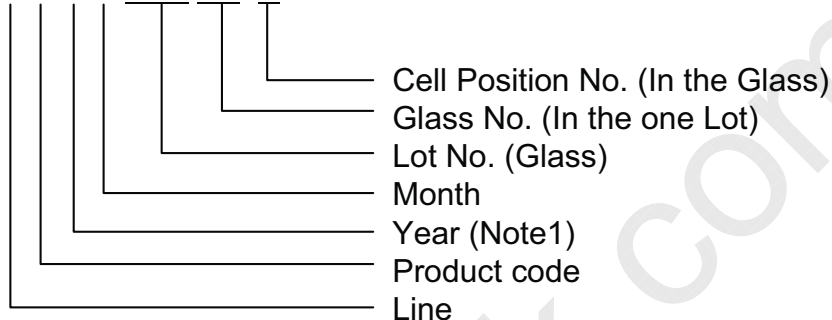| MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	29 / 33

9. MARKING & OTHERS

A nameplate bearing followed by is affixed to a shipped product at the specified location on each product.

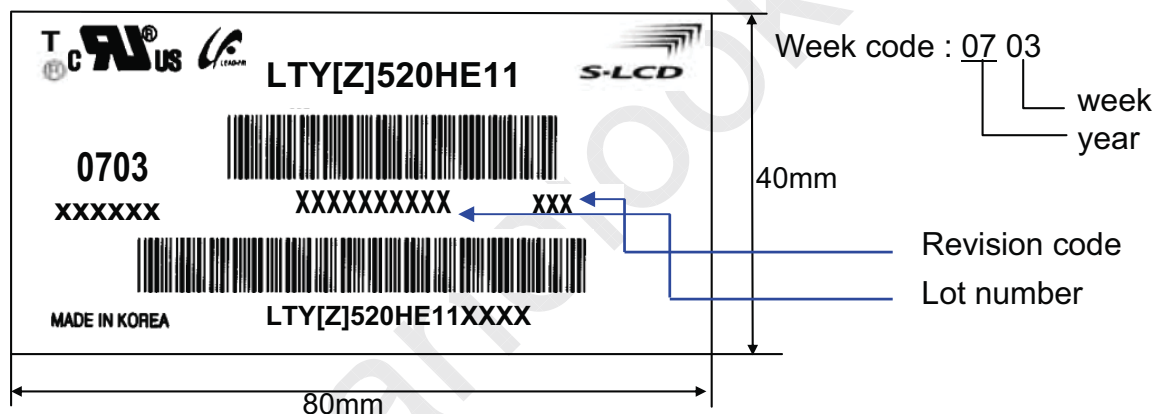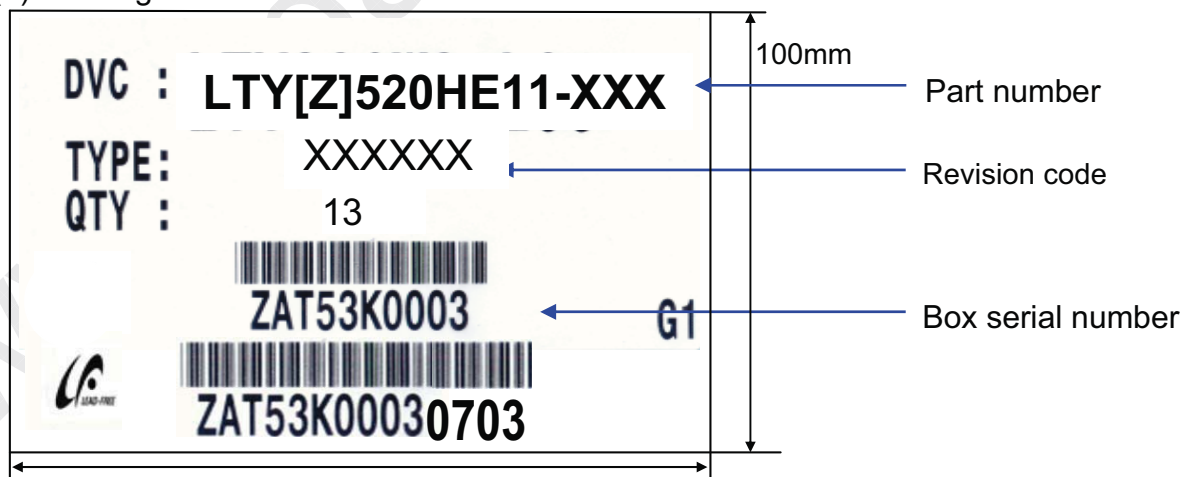   (1) Parts number : LTY[Z]520HE11
    (2) Revision: 3 letters
    (3) Lot number : X X X X XXX XX X

             Cell Position No. (In the Glass)
             Glass No. (In the one Lot)
             Lot No. (Glass)
             Month
             Year (Note1)
             Product code
             Line

(4) Nameplate Indication

LTY[Z]520HE11   S-LCD

0703
XXXXXX   XXXXXXXXXX   XXX

MADE IN KOREA   LTY[Z]520HE11XXXX

80mm   40mm

Week code : 07 03
            week
            year

Revision code
Lot number

(5) Packing box attach

DVC : **LTY[Z]520HE11-XXX**
TYPE: **XXXXXX**
QTY : 13

ZAT53K0003   G1

ZAT53K00030703

100mm

Part number
Revision code
Box serial number

(6) Others
    1. After service part
      Lamps cannot be replaced because of the narrow bezel structure.

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	30 / 33

13. General Precautions

13.1 Handling

(a) When the Module is assembled, it should be attached to the system firmly using all mounting holes. Be careful not to twist and bend the Module.

(b) Because the inverter use high voltage, it should be disconnected from power before it is assembled or disassembled.

(c) Refrain from strong mechanical shock and / or any force to the Module. In addition to damage, this may cause improper operation or damage to the Module and CCFT back light.

(d) Note that polarizers are very fragile and could be damage easily. Do not press or scratch the surface harder than a HB pencil lead.

(e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining or discoloration may occur.

(f) If the surface of the polarizer is dirty, clean it using absorbent cotton or soft cloth.

(g) Desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(h) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth . In case of contact with hands, legs or clothes, it must be washed away with soap thoroughly.

(i) Protect the Module from static, or the CMOS Gate Array IC would be damaged.

(j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(k) Do not disassemble the Module.

(l) Do not adjust the variable resistor located on the Module.

(m) Protection film for polarizer on the Module should be slowly peeled off just before

　use so that the electrostatic charge can be minimized.

(n) Pins of I/F connector should not be touched directly with bare hands.

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	31 / 33

13.2 Storage

(a) Do not leave the Module in high temperature, and high humidity for a long time.
It is highly recommended to store the Module with temperature from 0 to 35℃
and relative humidity of less than 70%.

(b) Do not store the TFT-LCD Module in direct sunlight.

(c) The Module should be stored in a dark place. It is prohibited to apply sunlight or
fluorescent light in storing.

13.3 Operation

(a) No Connection or disconnect the Module in the "Power On" condition.

(b) Power supply should always be turned on/off by the "Power on/off sequence"

(c) Module has high frequency circuits. Sufficient suppression to the electromagnetic
interference should be done by system manufacturers. Grounding and shielding methods
may be important to minimize the interference.

(d) The cable between the back light connector and its inverter power supply should
be connected directly with a minimized length. A longer cable between
the back light and the inverter may cause lower luminance of lamp(CCFT) and
may require higher startup voltage(Vs).

13.4 Operation Condition Guide

(a) The LCD product should be operated under normal conditions.
Normal condition is defined as below;
- Temperature : 20±15℃
- Humidity : 55±20%
- Display pattern : continually changing pattern (Not stationary)

(b) If the product will be used in extreme conditions such as high temperature,
humidity, display patterns or operation time etc.., It is strongly recommended
to contact SEC for Application engineering advice. Otherwise, its reliability and
function may not be guaranteed. Extreme conditions are commonly found at
Airports, Transit Stations, Banks, Stock market, and Controlling systems.

MODEL	LTY[Z]520HE11	Doc. No	05-002-S-090904	Page	32 / 33

13.5 Others

(a) Ultra-violet ray filter is necessary for outdoor operation.

(b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.

(c) Do not exceed the absolute maximum rating value. (supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on)
Otherwise the Module may be damaged.

(d) If the Module keeps displaying the same pattern for a long period of time, the image may be "sticked" to the screen.
To avoid image sticking, it is recommended to use a screen saver.

(e) This Module has its circuitry PCB's on the rear side and should be handled carefully in order not to be stressed.

(f) Please contact SEC in advance when you display the same pattern for a long time.

| MODEL | LTY[Z]520HE11 | Doc. No | 05-002-S-090904 | Page | 33 / 33 |