Contents

* Revision History

Date	Rev. No	Page	Summary
Nov. 17, 2011	000	-	First Issued

General Description

Description

LTY[Z]320HQ01 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 32.0“ is 1920 x 1080 and this model can display up to 1.07G 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 (±89°)
- Full HD (1920 x 1080 pixels) resolution (16:9)
- Low Power consumption
- WLED (White Light Emitting Diode) Backlight
- LVDS (Low Voltage Differential Signaling) interface

General Information

Items	Specification	Unit	Note
Module Size	727.6(H_{TYP}) x 424.0(V_{TYP})	mm	±0.7mm
	25.2(D_{MAX})		Design Value
Weight	5000(Max)	g	
Pixel Pitch	0.12125(H) * 3 x 0.36375(V)	mm	
Active Display Area	698.4(H) x 392.85(V)	mm	
Surface Treatment	Haze 0.8%, Hard-coating (2H)		
Display Colors	10 bit - 1.07g	colors	
Number of Pixels	1920 x 1080	pixel	
Pixel Arrangement	RGB vertical stripe		
Display Mode	Normally Black		
Luminance of White	450	cd/m^2	Typ.

1. Absolute Maximum Ratings

1-1 Operating Condition

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)
Module 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}	-	50	G	(4)
Vibration (non - operating)	V_{NOP}	-	1.5	G	(5)

Note (1) Ta= 25 ± 2 ˚C

(2) Temperature and relative humidity range are shown in the figure below.

a. 93.8 % RH Max. (Ta ≤ 40 ˚C)

b. Maximum wet-bulb temperature at 40 ˚C or less. (Ta ≤ 40 ˚C)

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 ±X, ±Y, ±Z axis

(5) 10-300 Hz, Sweep rate 10min, 30min for X,Y,Z axis

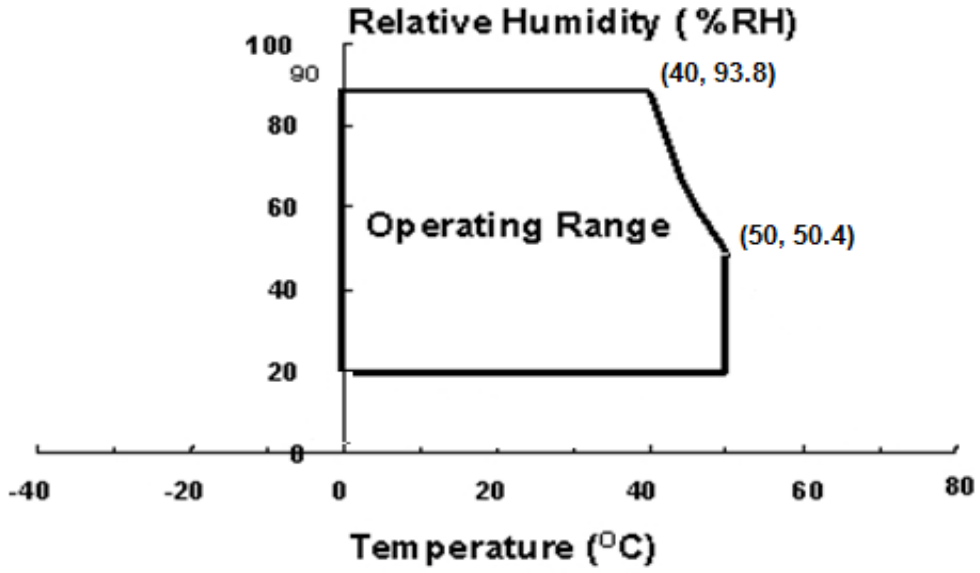
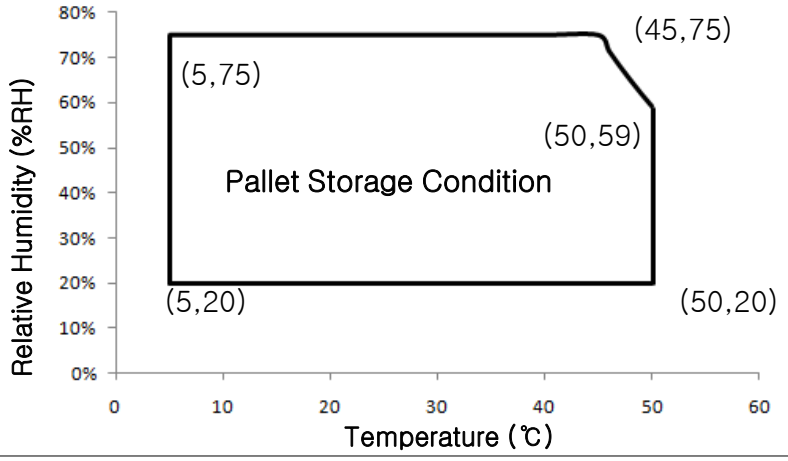


Fig. Temperature and Relative humidity range

1. Absolute Maximum Ratings

1-2 Pallet Storage Condition (Not Included Transportation. ※except for service Panel)

ITEM	Unit	Min.	Max.
Storage Temperature	(℃)		
Storage Humidity	(%rH)		
Storage life from S2-In	12 months		
Storage Condition	- The storage room should provide good ventilation and temperature control. - Products should not be placed on the floor, but on the Pallet away from a wall. - Prevent products from direct sunlight, moisture nor water; Be cautious of a build up of condensation. - Avoid other hazardous environment while storing goods. - If products delivered or kept in conditions of over the storage period of 3 months, the recommended temperature or humidity range, we recommend you leave them at a temperature of 20℃ and a humidity of 50% for 24 hours.		

2. Optical Characteristics

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

(LED Input Current = 110mA, Ta = 25 ± 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*	Normal θ**L,R**=0 θ**U,D**=0 Viewing Angle	3000	5000	-		(3) SR-3
Response Time	Rising	Tr		-	-	-	msec	(5) BM-7
	Falling	Tf		-	-	-		
	G-to-G [AVE]	Tg		-	3.5	-		
Luminance of White (Center of screen)		Y_L		380	450	-	cd/m²	(6) SR-3
Color Chromaticity (CIE 1931)	Red	Rx		TYP. -0.03	0.641	TYP. +0.03		(7),(8) SR-3
		Ry			0.332			
	Green	Gx			0.312			
		Gy			0.611			
	Blue	Bx			0.155			
		By			0.053			
	White	Wx			0.280			
		Wy			0.285			
Color Gamut		-		-	72	-	%	(7) SR-3
Color Temperature		-		-	10000	-	K	(7) SR-3
2Point Gamma		γ	7G ~ 57G (Full = 64G)	1.7	2.2	2.7		(9)
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}		-	-	30	%	(4) SR-3

* CR = (White at point ⑤ of Note 2) / (Most Dark Point of Black Pattern at area ⓐ of Note 2)

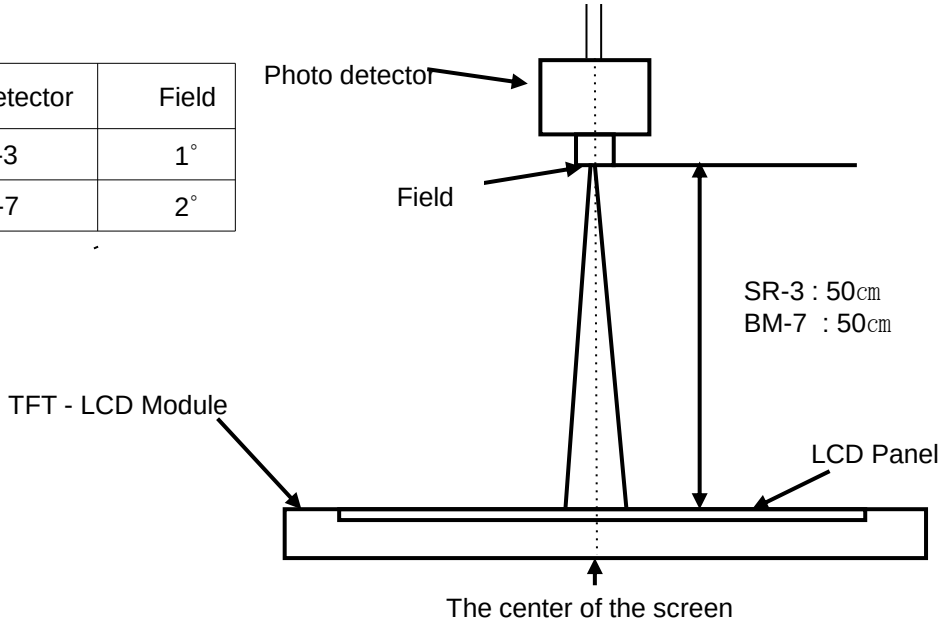
Note (1) Test Equipment Setup

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.

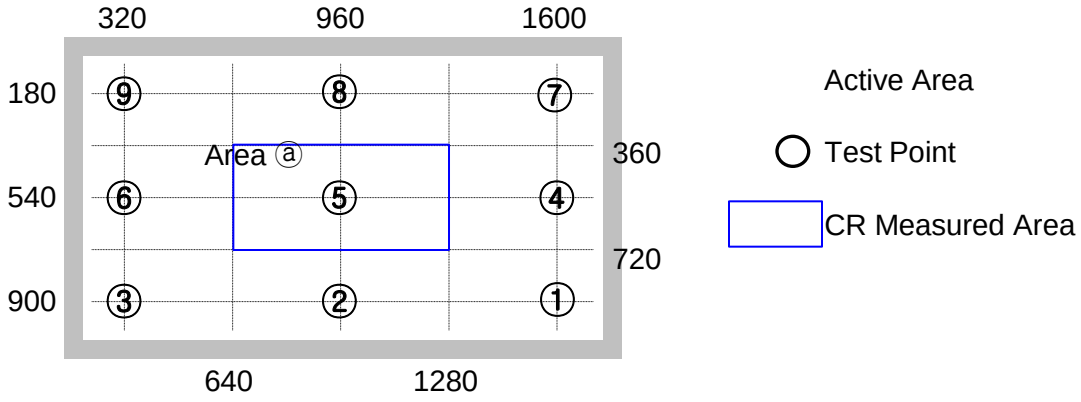
Single LED current @ Vdim = 100%

Environment condition : Ta = 25 ± 2 °C

Photo detector	Field
SR-3	1°
BM-7	2°



Note (2) Definition of 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

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

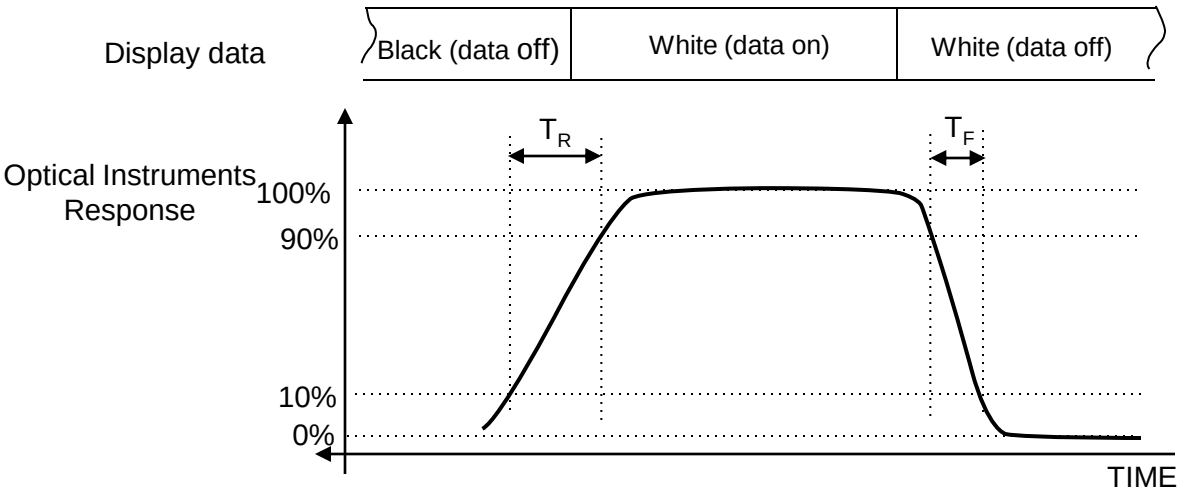
Gmax : Luminance with all pixels white
Gmin : Luminance with all pixels black

Note (4) Definition of 9 points brightness uniformity

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

Bmax : Maximum brightness
Bmin : Minimum brightness

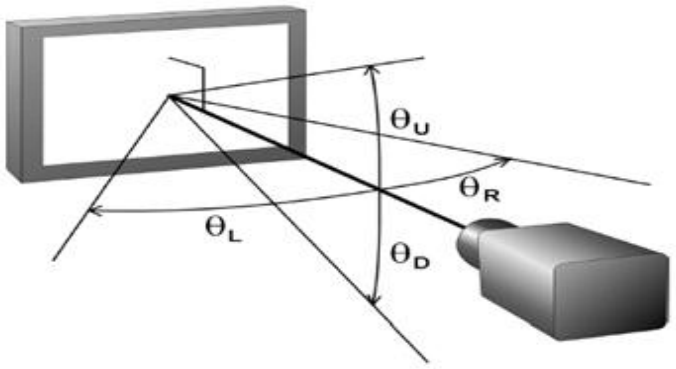
Note (5) Definition of Response time : Sum of Tr, Tf



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)



Note (9) Definition of 2 point Gamma

$$Gamma = \log\left(X_{lum}/100\right)/\log\left(Y/100\right)$$

$$X_{lum} = \left(Z - B_{\min}\right)/\left(B_{\max} - B_{\min}\right) \times 100$$

Y: *Measurement Level* / Z: *Measurement Brightness*

$B_{\max}$: *Maximum Brightness* / $B_{\min}$: *Minimum Brightness*

3. Electrical Characteristics

3.1 TFT LCD Module

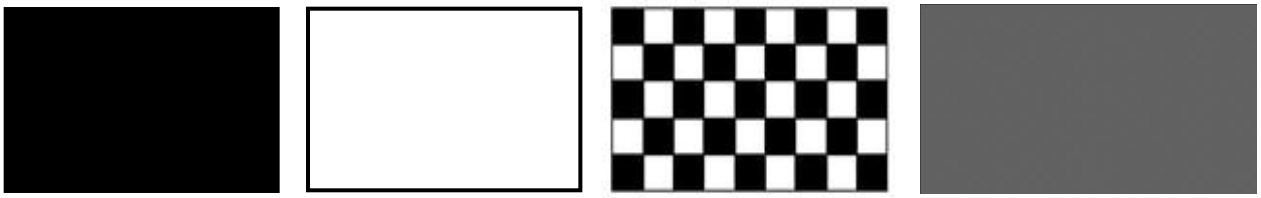
The connector for display data & timing signal should be connected.

Ta = 25˚C ± 2 ˚C

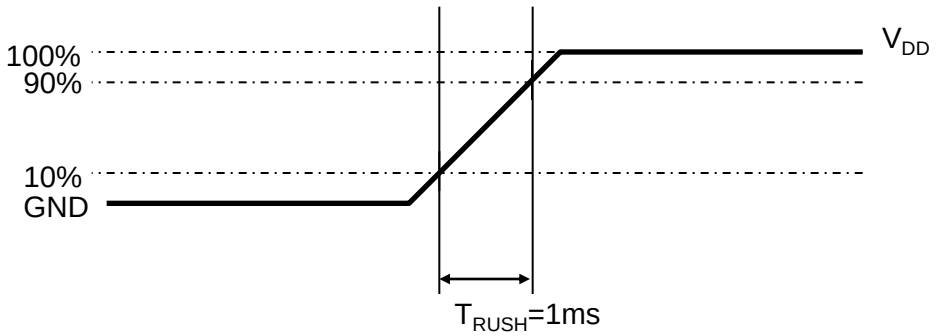
Item		Symbol	Min.	Typ.	Max.	Unit	Note
Voltage of Power Supply		V_{DD}	11	12	13	V	(1)
Current of Power Supply	(a) Black	I_{DD}	-	1320	-	mA	(2),(3)
	(b) White		-	1300	1700		
	(c) Mosaic		-	1340	-		
	(4) Max Pattern		-	1760	-		
Vsync Frequency		f_V	47	60	62	Hz	
Hsync Frequency		f_H	50	67.5	73	kHz	
Main Frequency		f_{DCLK}	130	148.5	155	MHz	
Rush Current		I_{RUSH}	-	-	5	A	(4)

Note (1) The ripple voltage should be controlled under 10% of V_{DD}.
(2) fv=60Hz, f_{DCLK} = 148.5MHz, 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



(4) Measurement Conditions



Rush Current I_{RUSH} can be measured when T_{RUSH}. is1ms

3.2 Back Light Unit

The back light unit contains 60LEDs.
The characteristics of LEDs are shown in the following tables.

Ta=25 ± 2°C

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Operating Life Time		Hr	30,000	-	-	Hour	(1)
Operating Current	Continuous	Iop	-	110	200	mA	
Operating Voltage	Continuous	Vop	171	-	194	V	30LEDs /140mA@Ta 25℃
Range of Voltage		▽Vf	-	-	11.5	V	@140mA(/String)
(Power Consumption)		-	(19.36)		(22)		Iop=110mA @Ta 25℃

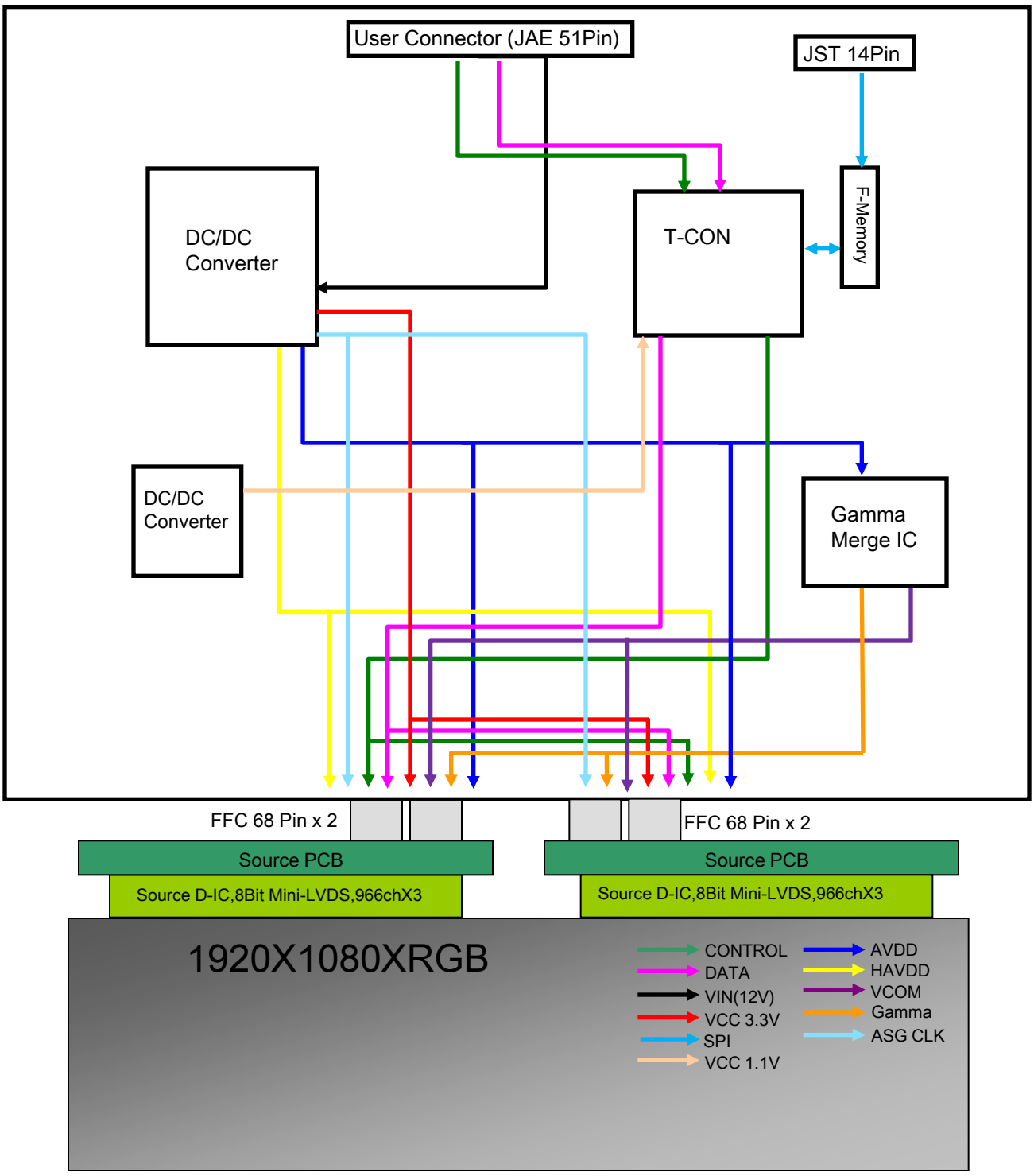
Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value at each String, Iop=.110.0mArms

[Definition of Operating Voltage : At each Strings, I_{op} = 110.0 mArms (typ.)]

3.2.1 Review and Update for Electrical Specification

According to the improvement of efficiency for devices, the electrical specification would be revie wed and revised after initial values had been established.This revision mentioned above should be discussed at appropriate time.

4. Block Diagram



5. Input Terminal Pin Assignment

5.1. Input Signal & Power

1. 51Pin Connector : FI-RNE51SZ-HF (JAE)

PIN No.	Signal	Description	PIN No.	Signal	Description
1	Vin	Power	26	RE[0]P	Even LVDS Signal +
2	Vin	Power	27	RE[1]N	Even LVDS Signal -
3	Vin	Power	28	RE[1]P	Even LVDS Signal +
4	Vin	Power	29	RE[2]N	Even LVDS Signal -
5	Vin	Power	30	RE[2]P	Even LVDS Signal +
6	N.C.	No Connection	31	GND	GND
7	GND	GND	32	RECLKN	Even LVDS CLK -
8	GND	GND	33	RECLKP	Even LVDS CLK +
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_C	I2C SCL
16	GND	GND	41	SDA_C	I2C SDA
17	ROCLKN	Odd LVDS CLK -	42	Option 1	TV SET use only
18	ROCLKP	Odd LVDS CLK +	43	BINT	Bus Release
19	GND	GND	44	Option 2	TV SET use only
20	RO[3]N	Odd LVDS Signal -	45	Option 3	TV SET use only
21	RO[3]P	Odd LVDS Signal +	46	Option 4	TV SET use only
22	RO[4]N	Odd LVDS Signal -	47	Option 5	TV SET use only
23	RO[4]P	Odd LVDS Signal +	48	Option 6	TV SET use only
24	GND	GND	49	Option 7	TV SET use only
25	RE[0]N	Even LVDS Signal -	50	Option 8	TV SET use only
			51	Option 9	TV SET use only

2. 14 Pin Connector : 14FLT-SM2-C-TB (JST)

PIN No.	Signal	Description
1	N.C.	No Connection
2	N.C.	No Connection
3	/WP	SPI_WP
4	/CS	SPI_CS
5	CTRL	SPI_CTRL
6	GND	GND
7	CLK	SPI_CLK
8	GND	GND

PIN No.	Signal	Description
9	DO	SPI_DO
10	GND	GND
11	DI	SPI_DI
12	GND	GND
13	GND	GND
14	GND	GND

■ Option Pin Description

These pins are CMOS interface.

Please use within the range of the following restriction.

VIH：2.4V(min) / 3.5V(max)

VIL：0.0V(min) / 0.4V(max)

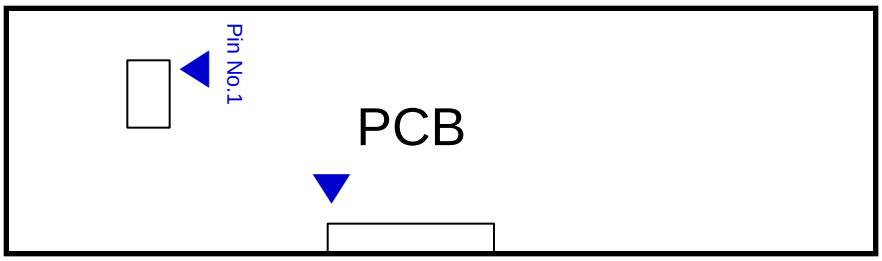
■ B-INT

Operation	Description
Low/OPEN	USER CAN NOT ACCESS EEPROM
HIGH	USER CAN ACCESS EEPROM

■SCL : Pull up 22Ω/ 2.2kΩ

■SDA : Pull up 22Ω/ 2.2kΩ

Note(1) Pin number starts from left side



Pin No.1 Pin No.51

Fig No1. 51Pin

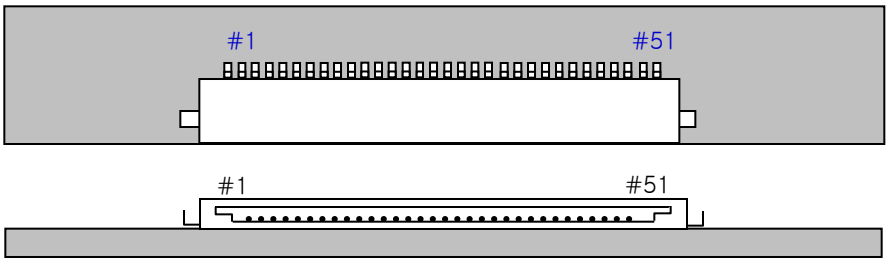


Fig No2. 14Pin

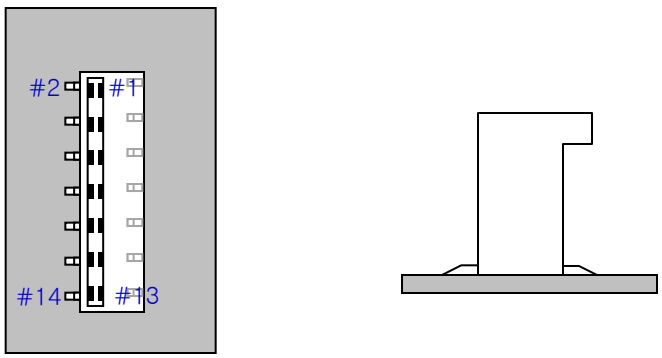


Fig. Connector diagram

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.

5.2. LS Bar Input Pin Configuration

1. CONNECTOR : Morex/51103-040

Pin	Pin Configuration (Function)
1	DC Voltage (+)
2	N.C.
3	N.C.
4	DC Voltage (+)

2. CONNECTOR : Morex/51103-0500

Pin	Pin Configuration (Function)
1	Feedback
2	N.C.
3	N.C.
4	Feedback
5	N.C.

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
TxOUT/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

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

COLOR	DISPLAY (10bit)	DATA SIGNAL																														GRAY SCALE LEVEL
		RED										GREEN										BLUE										
		R0	R1	R2	R3	R4	R5	R6	R7	R8	R9	G0	G1	G2	G3	G4	G5	G6	G7	G8	G9	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	
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	0	0	0	0	0	0	-
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	-
	GREEN	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	-
	CYAN	0	0	0	0	0	0	0	0	0	0	1	1	1	1	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	1	0	0	0	0	0	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	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	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	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	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	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	0	0	0	0	0	0	R2
		:	:	:	:	:	:					:	:		:	:	:	:				:	:		:	:	:		:			R3~ R1020
		:	:	:	:	:	:					:	:		:	:	:	:				:	:		:	:	:		:			
	↓ LIGHT	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1021
		0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1022
	RED	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R1023
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	0	0	0	0	0	0	G0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	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	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G2
		:	:	:	:	:	:					:	:	:	:	:	:					:	:		:	:	:		:			G3~ G1020
		:	:	:	:	:	:					:	:	:	:	:	:					:	:		:	:	:		:			
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	G1021
		0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	G1022
	GREEN	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	G1023
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	0	0	0	0	0	0	B0
	DARK ↑	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	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	0	0	0	0	1	0	0	0	0	0	0	0	0	B2
		:	:	:	:	:	:					:	:	:	:	:	:					:	:	:	:	:	:					B3~ B1020
		:	:	:	:	:	:					:	:	:	:	:	:					:	:	:	:	:	:					
	↓ LIGHT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	B1021
		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	B1022
	BLUE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	B1023

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

6. EDID Information

6.1 EEPROM Data

EEPROM Data					
No	Item	Spec	Address	Data	Remark
1	Panel Product Vender	SEC	00	00	SONY Choice - Note 1
2	Screen Size	32	01	20	16進
3	H-Resolution	1920	02,03	07,80	16進
4	V-Resolution	1080	04,05	04,38	16進
5	Vertical Frequency	200/240Hz	06	02	- Note 2
6	Data Format	10Bit	07	02	- Note 3
7	FRC Revision Information	1st	ED	00	ASCII - Note 4
8	Part Number	LTY320HQ0102	E0~EC	4C,54,59,33,32, 30,48,51,30,31, 30,32,00	ASCII - Note 5, 6

※ Note 1.

Data	Panel Vender Code
00	HDLCD(SEC)
01	Others
02	Others
03	Others
04	Others
05	Others

※ Note 2.

Data	V-Frequency
00	50/60Hz
01	100/120HZ
02	200/240Hz

※ Note 3.

Data	Data Format
00	6Bit
01	8Bit
02	10Bit

※ Note 4.
- FRC Revision Code will be Changed from “00” to “41” (A)
  When FRC IC is changed. At First MP. This Code will be “00”

※ Note 5.
- LTYXXXXXXX Only for SEC Model

※ Note 6.
- Rest of them must be “00” (Null)

6.2 EEPROM Data Map

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	00	28	07	80	04	38	02	02	00	00	00	00	00	00	00	00
1	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
2	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
3	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
4	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
5	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
6	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
7	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
8	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
9	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
A	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
B	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
C	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
D	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00
E	4C	54	59	33	32	30	48	51	30	31	30	32	00	00	00	00
F	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00

7. Interface Timing

7.1 Timing Parameters

7.1.1 SET Mode

A. for 48Hz

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	Note
Clock	Frequency	1/Tc	147.00	148.50	150.00	MHz	
Hsync		FH	67.31	67.99	68.67	kHz	Polarity : Positive
Vsync		FV	46.54	48.01	49.50	Hz	Polarity : Positive
Vertical Active	Display Period	TVD	1080	1080	1080	Lines	
	Vertical Total	TV	1386	1416	1446	Lines	
Horizontal Active	Display Period	THD	1920	1920	1920	clocks	
	Horizontal Total	TH	2184	2184	2184	clocks	

B. for 50Hz

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	Note
Clock	Frequency	1/Tc	147.00	148.50	150.00	MHz	
Hsync		FH	67.31	67.99	68.68	kHz	Polarity : Positive
Vsync		FV	48.98	49.99	51.02	Hz	Polarity : Positive
Vertical Active	Display Period	TVD	1080	1080	1080	Lines	
	Vertical Total	TV	1346	1360	1374	Lines	
Horizontal Active	Display Period	THD	1920	1920	1920	clocks	
	Horizontal Total	TH	2184	2184	2184	clocks	

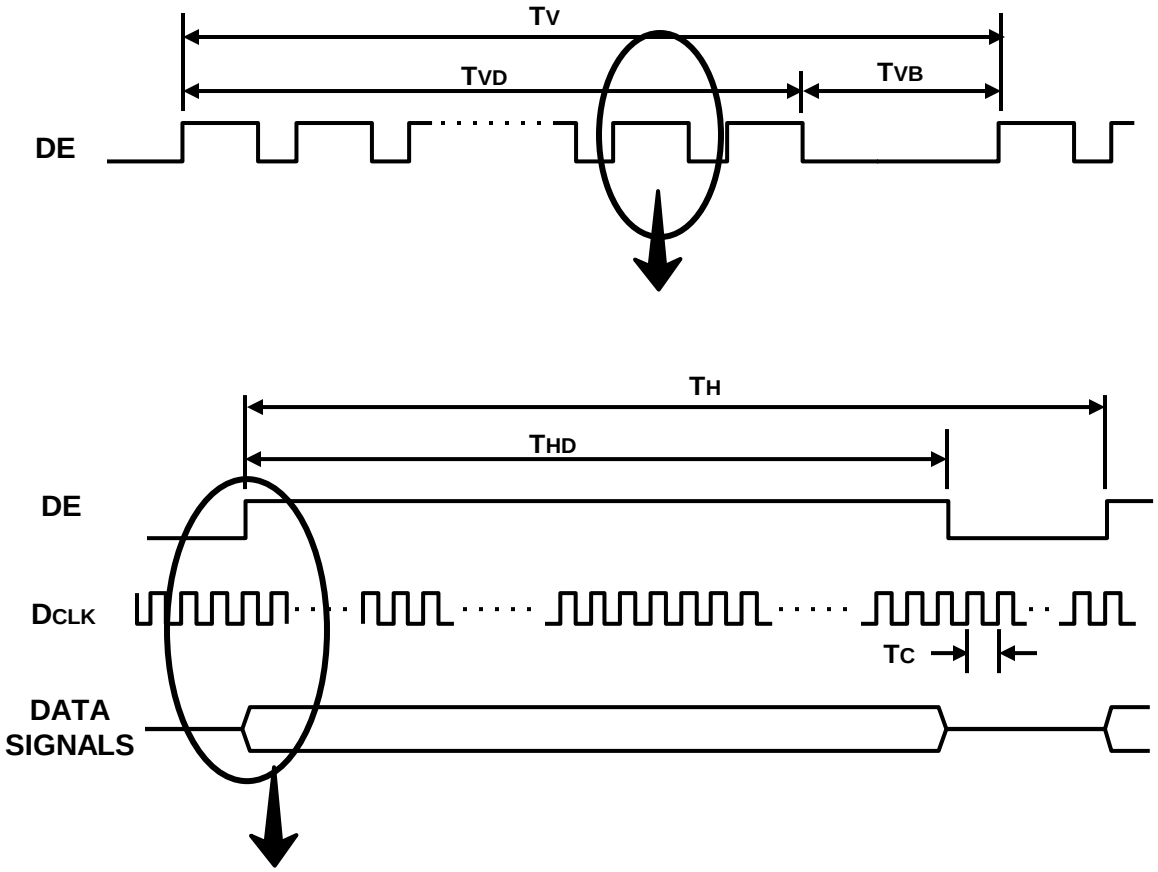
C. for 60Hz

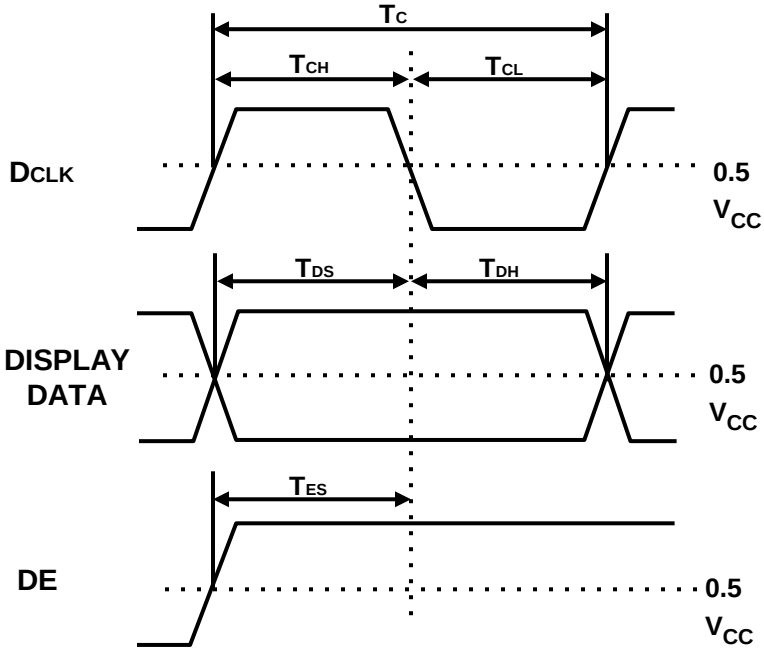
SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	Note
Clock	Frequency	1/Tc	147.00	148.50	150.00	MHz	
Hsync		FH	67.31	67.99	68.67	kHz	Polarity：Positive
Vsync		FV	59.88	59.96	61.08	Hz	Polarity：Positive
Vertical Active	Display Period	TVD	1080	1080	1080	Lines	
	Vertical Total	TV	1124	1134	1144	Lines	
Horizontal Active	Display Period	THD	1920	1920	1920	clocks	
	Hrizontal Total	TH	2184	2184	2184	clocks	

7.1.2 Stand Alone Mode

SIGNAL	ITEM	SYMBOL	MIN.	TYP.	MAX.	Unit	Note
Clock	Frequency	1/Tc	147.00	148.50	150.00	MHz	
Hsync		FH	67.31	67.5	68.67	kHz	Polarity：Negative
Vsync		FV	59.88	60	61.08	Hz	Polarity：Negative
Vertical Active	Display Period	TVD	1080	1080	1080	Lines	
	Vertical Total	TV	1125	1125	1125	Lines	
Horizontal Active	Display Period	THD	1920	1920	1920	clocks	
	Hrizontal Total	TH	2200	2200	2200	clocks	

7.2 Timing diagrams of interface signal (DE only mode)

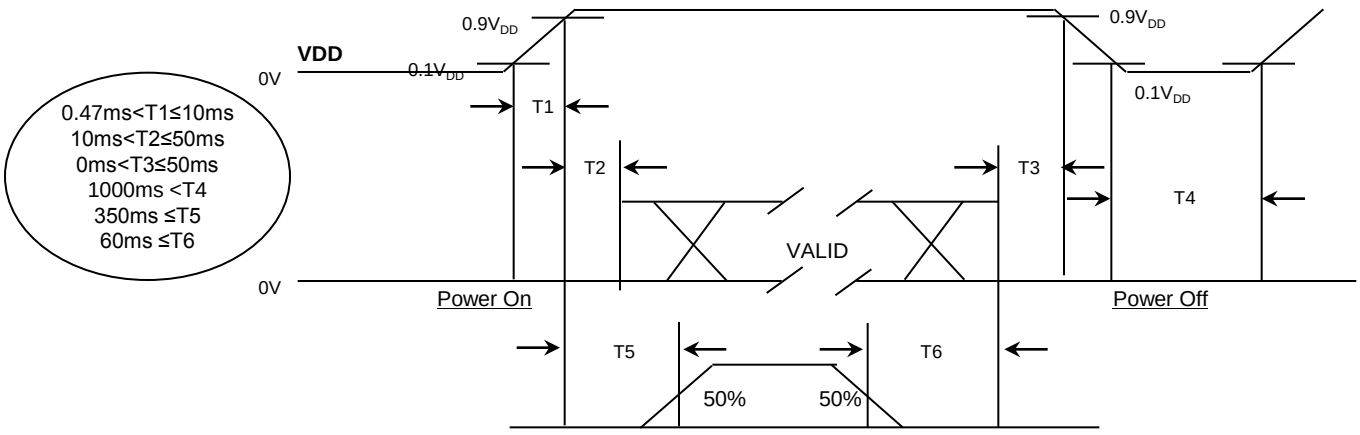




7.3 Power ON/OFF Sequence

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

7.3.1 Stand Alone Mode



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.

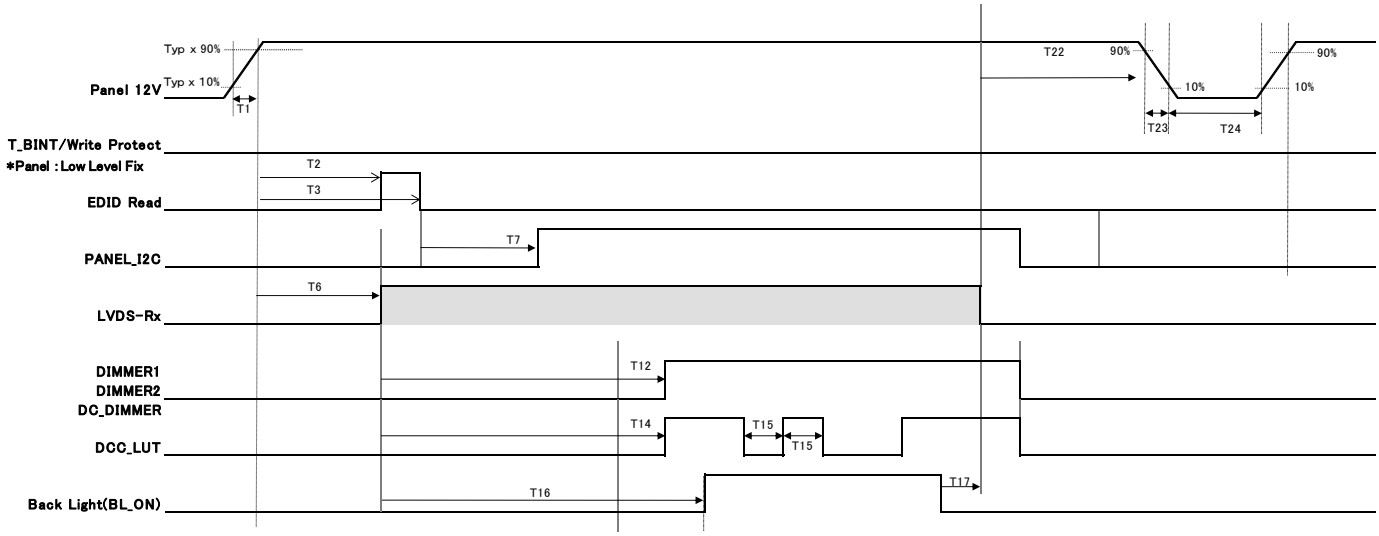
[Valid Data Condition]
1. Input LVDS signals must satisfy "Interface Timing" Specification on p23.
2. LVDS Clock must keep the same frequency.
3. Data signal should not input during "Fail Safe Mode".

- The supply voltage of the external system for the Module input should be the same as the definition of V_{DD}.
- Apply the LED 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.

7.3.2 Set Mode

Panel Information				
Size	Vender	Frequency	HFR-IC	Bit
FHD	SLCD	240Hz	Caraway	10

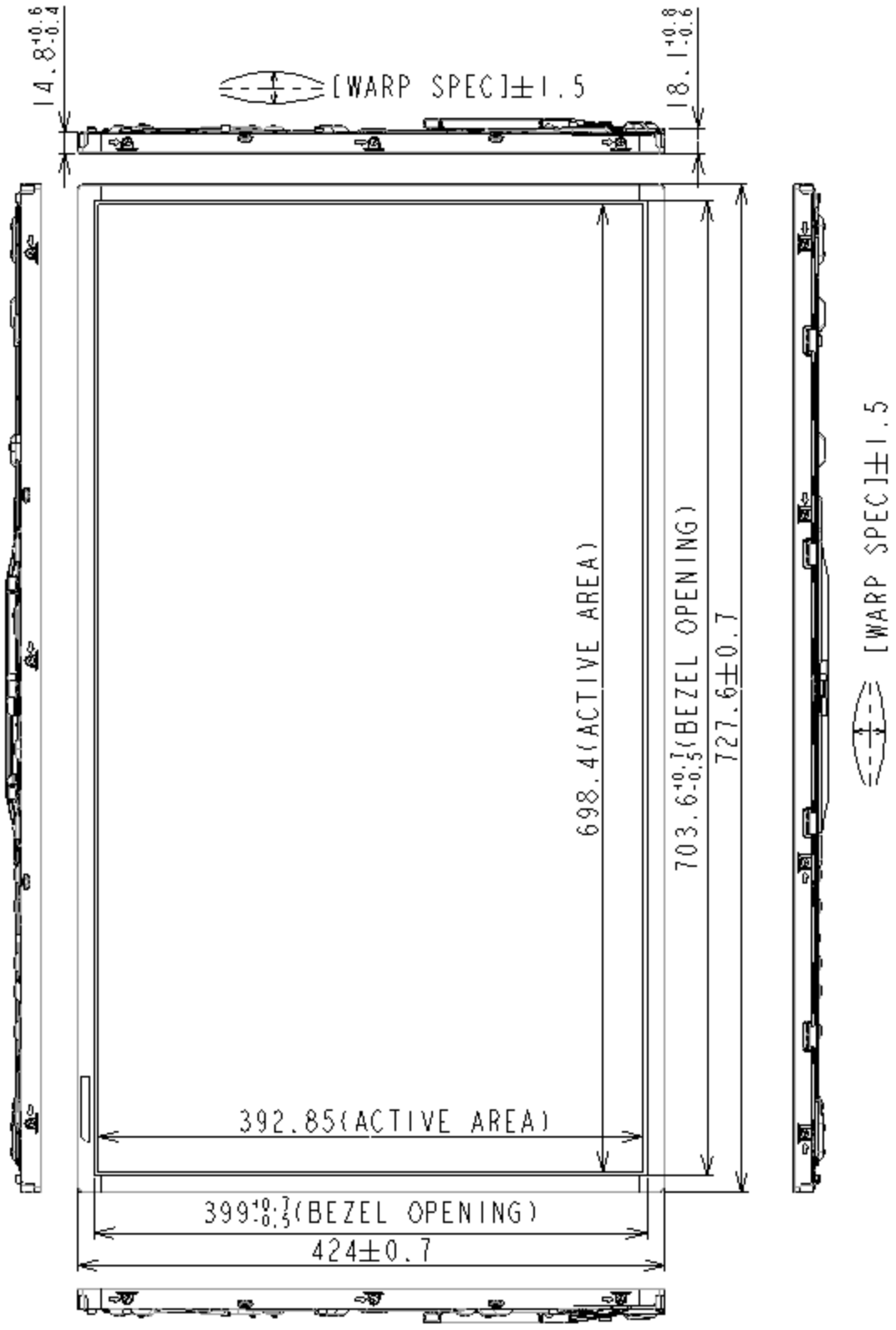
Panel Sequence for WQL



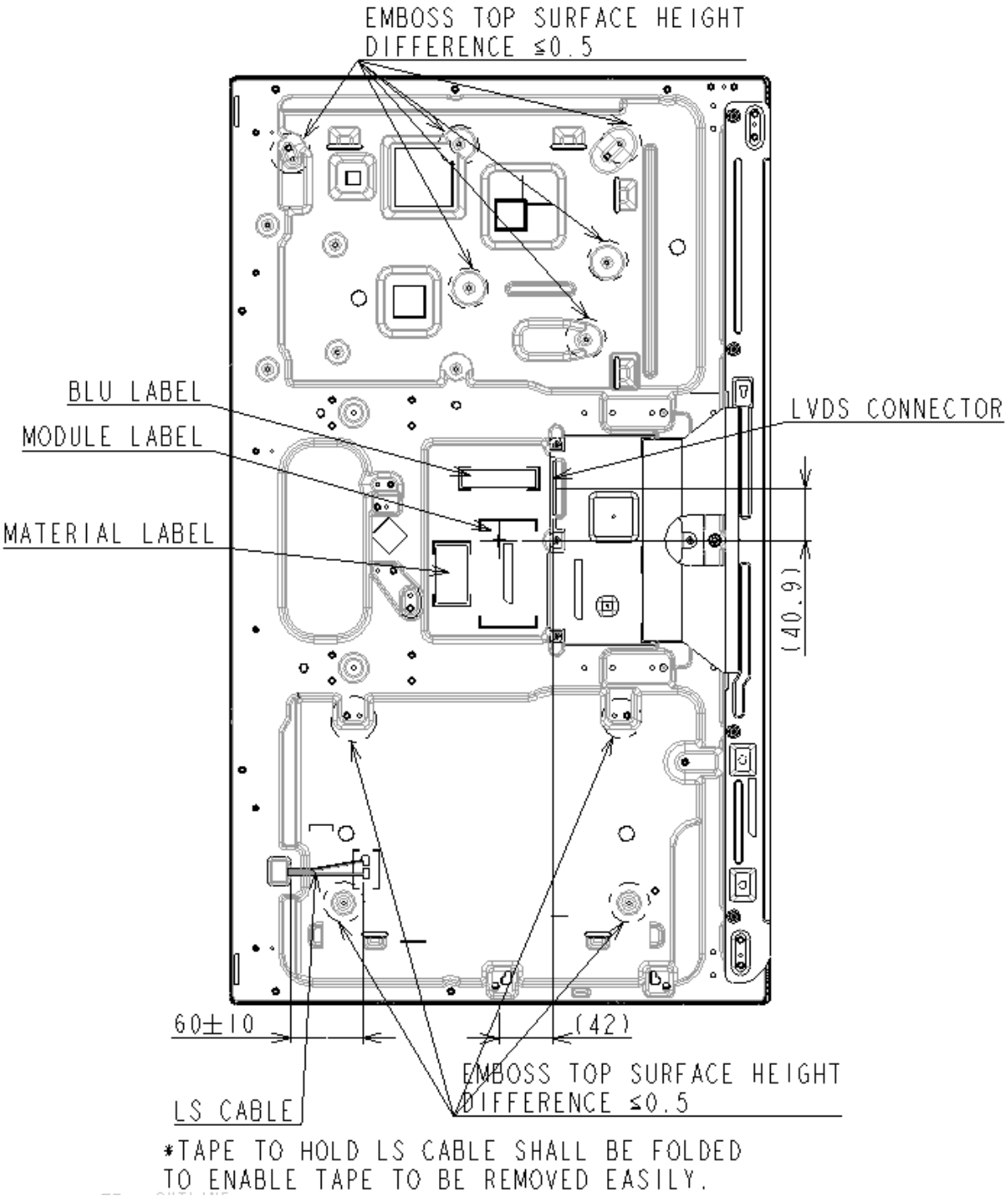
T1		T2		T3		T6	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
0.47	10	100	-	-	170	-	50
T7		**T12**		**T14**		**T15**	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
10	-	0	30	0	-	0	-
T16		**T17**		**T22**		**T23**	
Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
250		100	-	45	-	0	300

T24	
Min.	Max.
1000	-

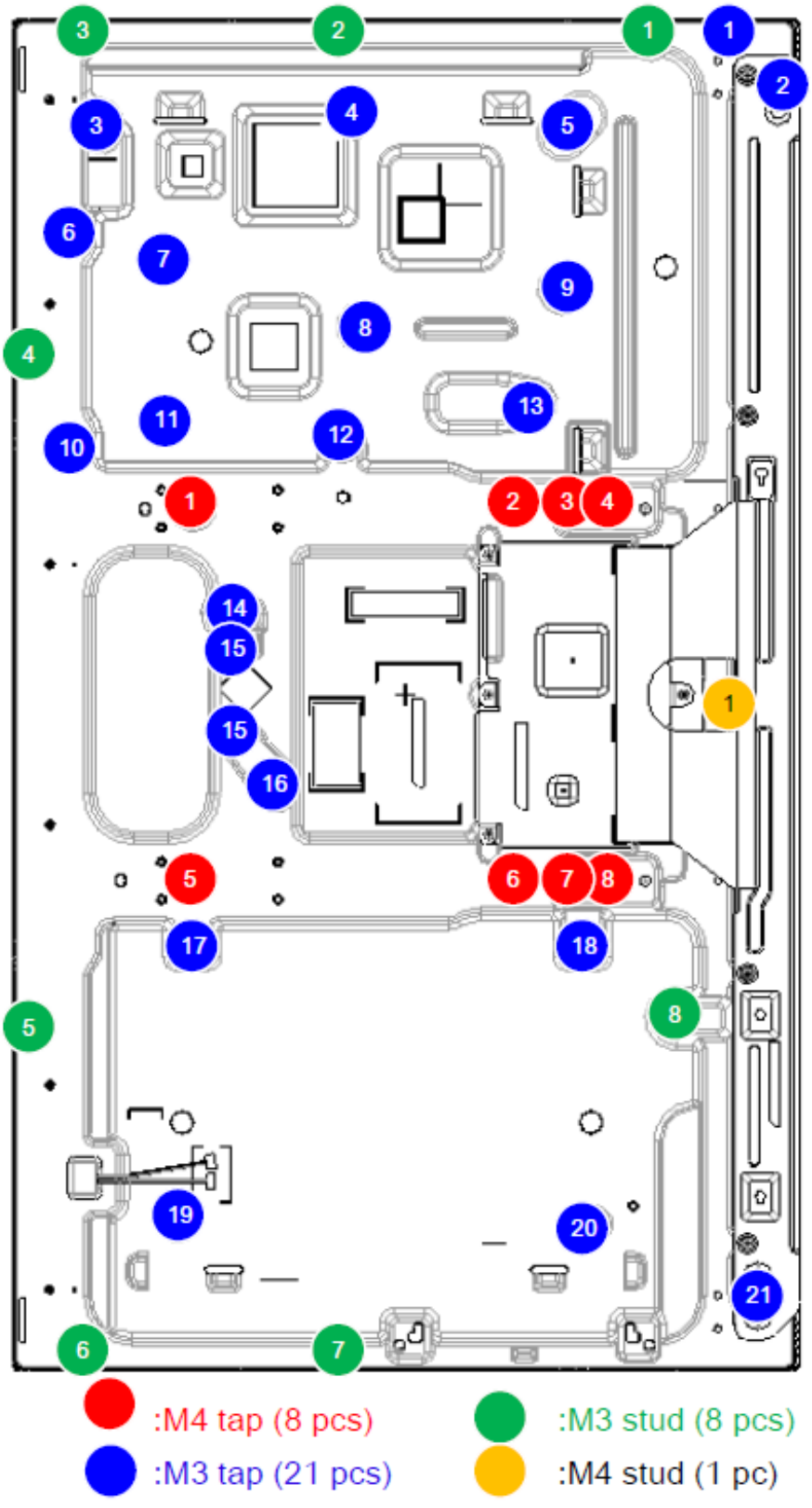
8.1 Outline dimension (Front view)



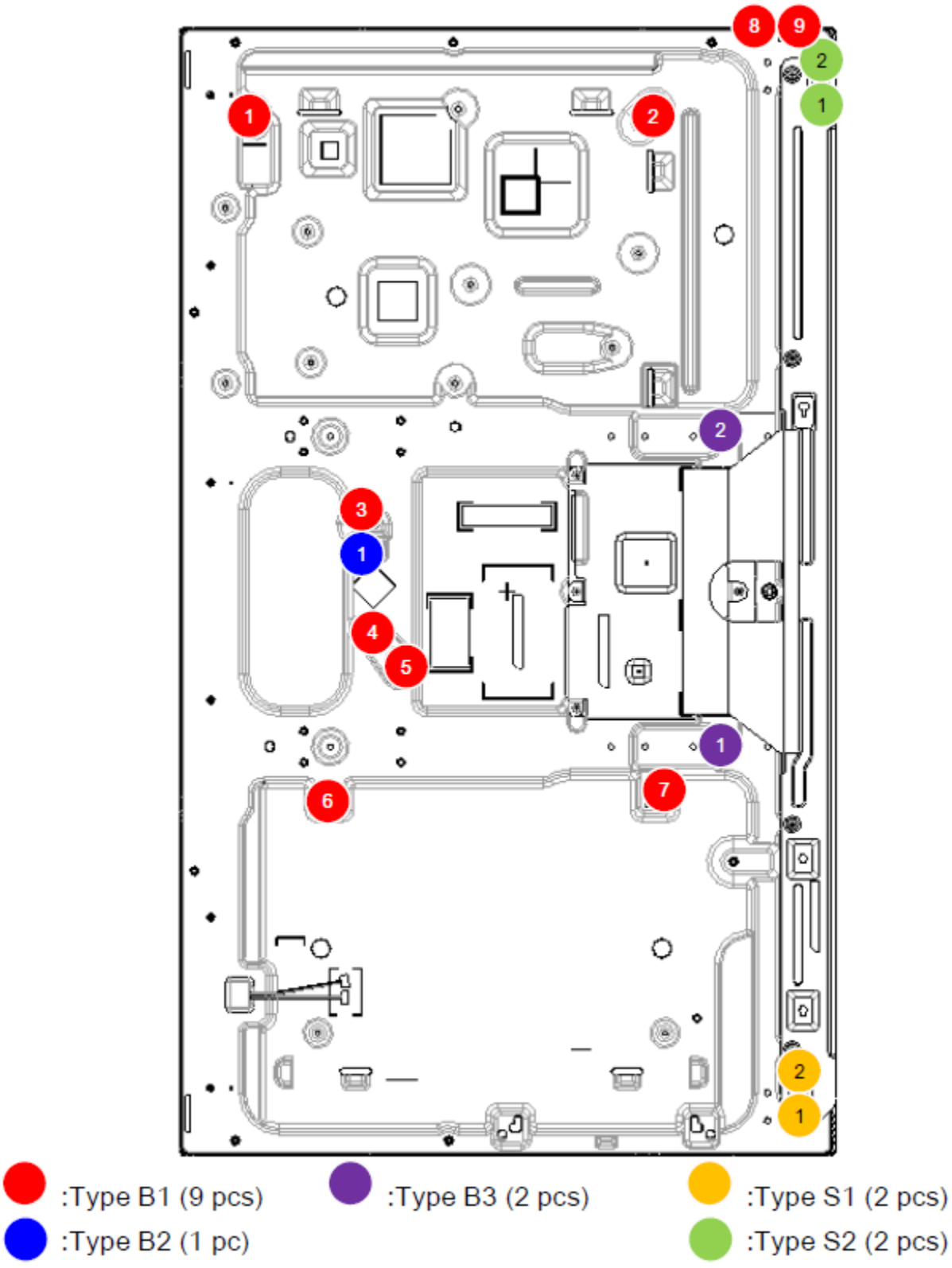
8.1 Outline dimension (Rear view)



8.1 Outline dimension (Stud and Tap Type)



8.1 Outline dimension (Dowel Type)

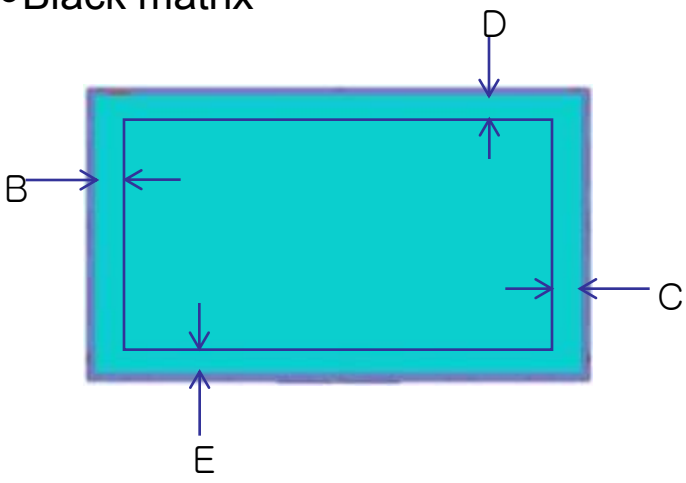


8.2 General item

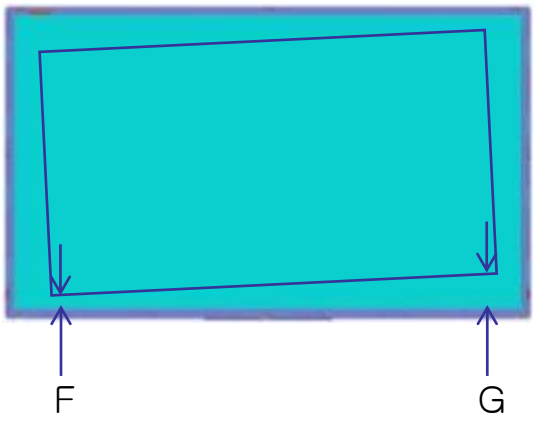
- General tolerance

Distance (mm)	X ≤ 16	16 < X ≤ 64	64 < X ≤ 256	256 < X≤ 512	512 < X≤ 1024	1024 < X	Bending Angle
Tolerance	±0.1	±0.2	±0.3	±0.45	±0.6	±0.8	±1°

- Black matrix



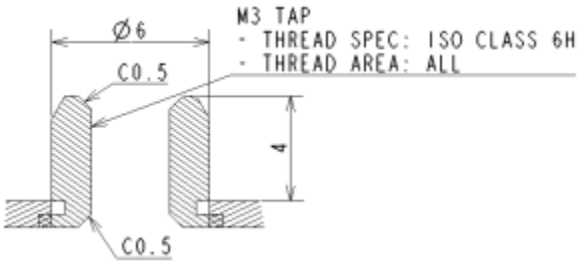
|B-C|	① Max 2
|D-E|	② Max 2



|F-G|	③ Max 2

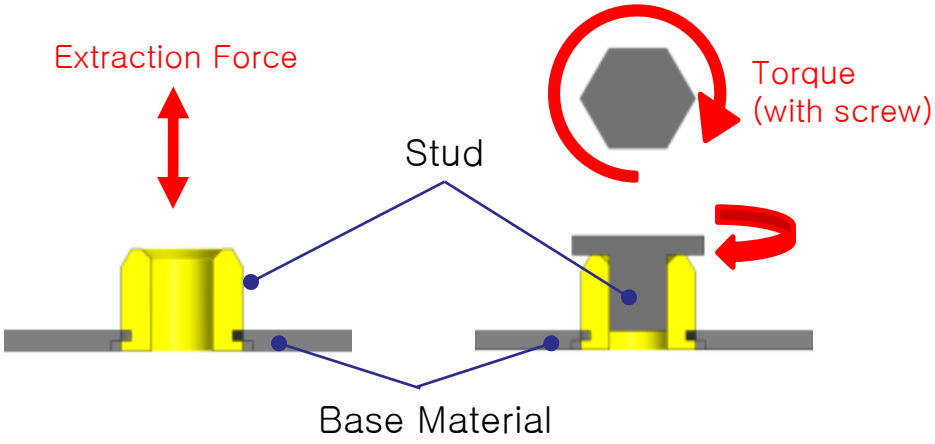
8.3 Stud

- Stud dimension
  - M3 stud

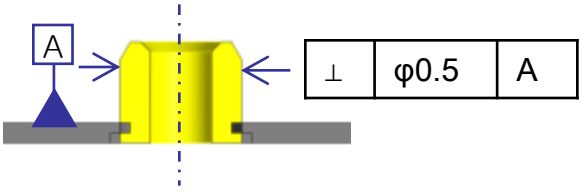


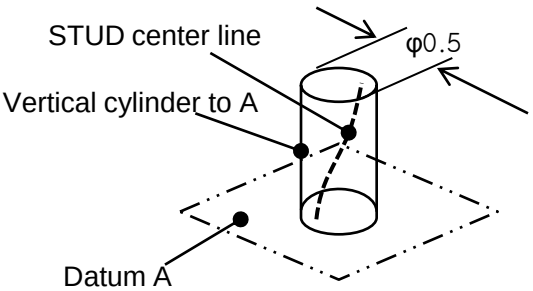
- Stud durability

Stud Type	Base Material	Extraction Force kN(kgf)	Torque N・m(kgf・cm)
		Min	Min
M3	Al	0.25(25)	2.1(21)
M4		0.42(43)	2.9(30)
M5	SECC	0.42(43)	5.9(60)
M6		0.84(86)	5.9(60)



- Stud squareness tolerance



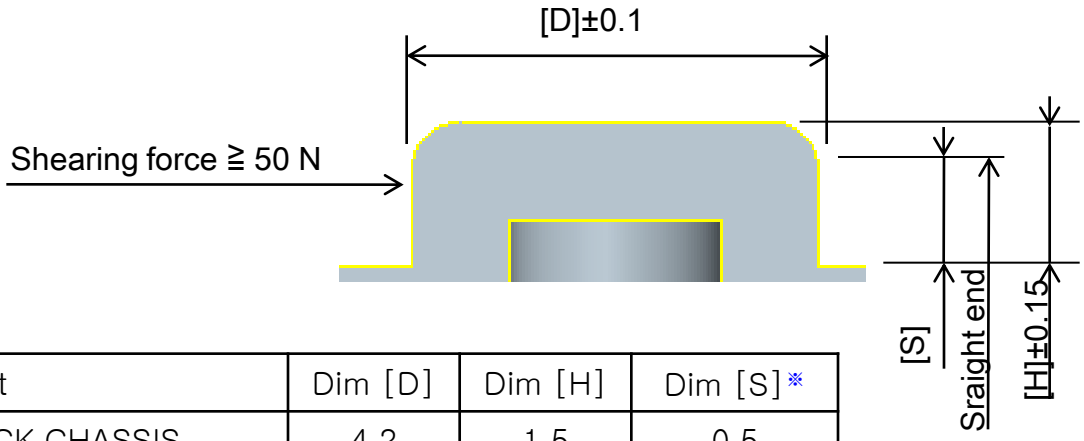


*) STUD center line should be in the vertical cylinder of φ0.5 to A.

Squareness definition

8.4 Dowel and Tap

- Dowel dimension and durability



[mm]

Type	Part	Dim [D]	Dim [H]	Dim [S]※
B1	BACK CHASSIS	4.2	1.5	0.5
B2	BACK CHASSIS	3.7	1.5	0.5
B3	BACK CHASSIS	6.0	3.0	1.0
S1	SOURCE SHIELD (R)	4.2	0.7	0.3
S2	SOURCE SHIELD (L)	4.2	0.9	0.3

※[S] is guaranteed by JIG inspection presented by MIF, not by value.

- Tap dimension
  - Thread compliant to ISO class 6H
- Tap durability

■The screw torque must satisfy the following.

M3 : 0.7N・m X 10 times

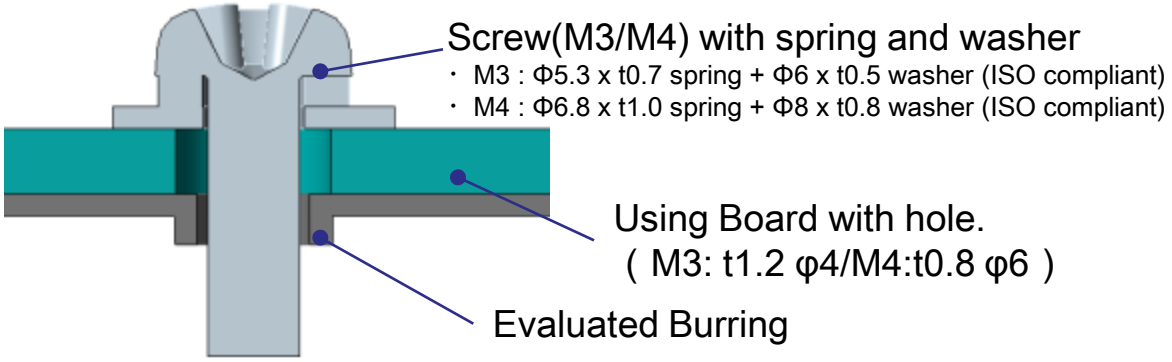
M4 : 1.0N・m X 10 times

※Standard driver : Nitto Kohki / Delvo DLV8231-EJN

■Evaluate all of burring tap using following board.

M3 Burring : Board thickness t1.2 / Hole size φ4

M4 Burring : Board thickness t0.8 / Hole size φ6



9. EMI Specification

: -3dB at CISPR22 Class B

This EMI Recommendation is recommended to be measured as SET Condition.

10. UL Approval

11. Reliability Test

Item	Test condition	Quantity
Temperature Step Stress	0 ~ 50℃,439Cycle determination	4EA
HTOL	50℃, 1000hr (500hr determination)	8EA
LTOL	0℃, 1000hr (500hr determination)	4EA
RTOL	20 ℃, continue ~	4EA
HTS	70℃, 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,200㎊/100 Ω,9Point,3times/Point	3EA
ESD(operation)	contact : ±8 kV ,150㎊/330Ω,210Point,1 time/Point non-contact : ±15 kV,150㎊/330Ω,100Point,1 time/Point	3EA
Input Con. ESD	contact : ±2kV,200㎊/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	Condition : 11msec, ±XYZ 1time/axis 50G	3EA
PALLET Vibration	1.05 Grms, 2~200Hz, Random, Z axis 1Hr	1PALLET
PALLET Drop	20cm, Bottom, Front, Rear 1times	1PALLET

[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

[Moving Distance Assurance]

This test is assumed that ground moving distance is 1000km.

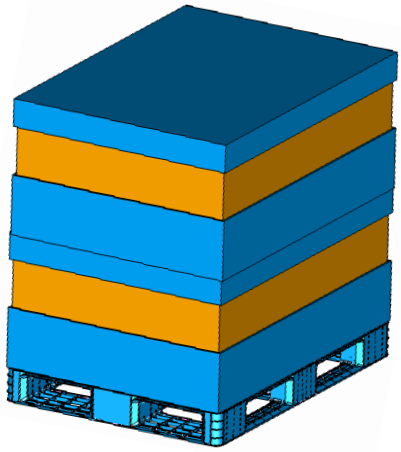
12. PACKING

12.1 CARTON (Internal Package)

(1) Packing Form

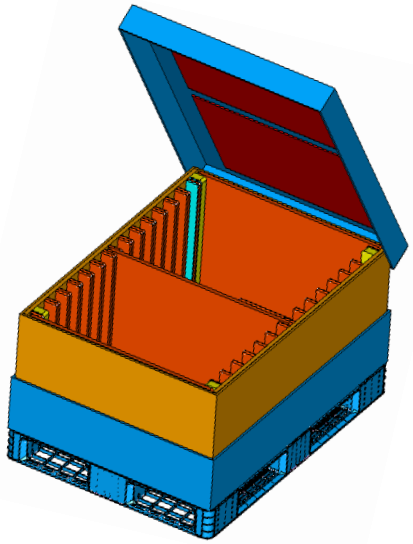
Corrugated fiberboard box and corrugated cardboard as shock absorber

(2) Packing Method



Module(52EA)

Pallet



→ Direction be able to Open

12.2 Packing Specification

Item	Specification	Remark
LCD Packing	26 ea / (Packing Box)	1. 249.6Kg/LCD(52ea) 2. 30kg/Packing Box(2set) 3. Packing Box Material : Paper
Desiccant (Drier)	4ea/LCD	10g/ea, Cobalt-dichloride-free
Pallet	2 Box / Pallet	Pallet weight : 5.3kg
Packing Direction	Vertical	-
Total Pallet Size	H x V x height	1150mm x 850mm x 1069mm
Total Pallet Weight	286.98kg	Pallet(5.3kg) + Module(52 x 4.8 = 249.6kg) + Packing BOX(15 x 2 = 30kg) + Desiccant(0.04kg x 52 = 2.08kg)
Stack Layer	3 layer in warehouse. 2 layer in container.	
Shielding Bag	Compound PE / Sealing / 70㎛	Material / Adhesive tape / Thickness

13. MARKING & OTHERS

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

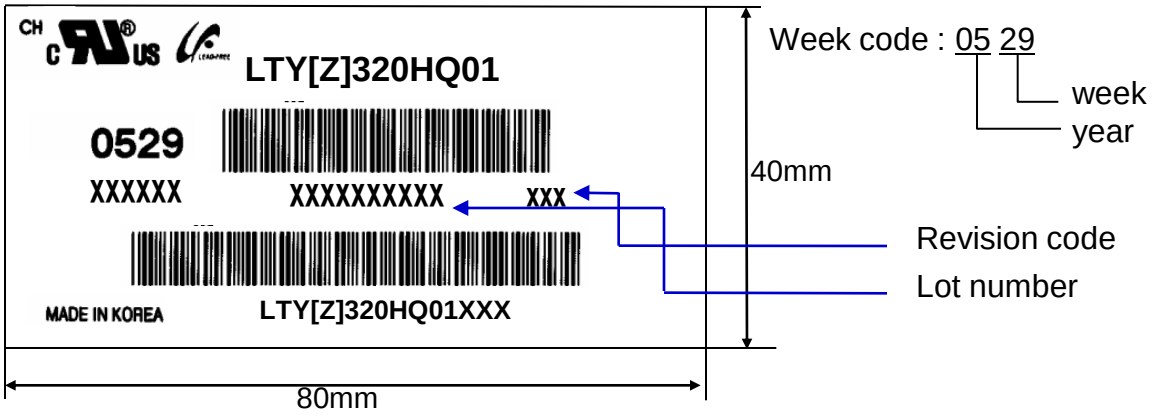
(1) Parts number : LTY[Z]320HQ01-XXX

(2) Revision: One letters

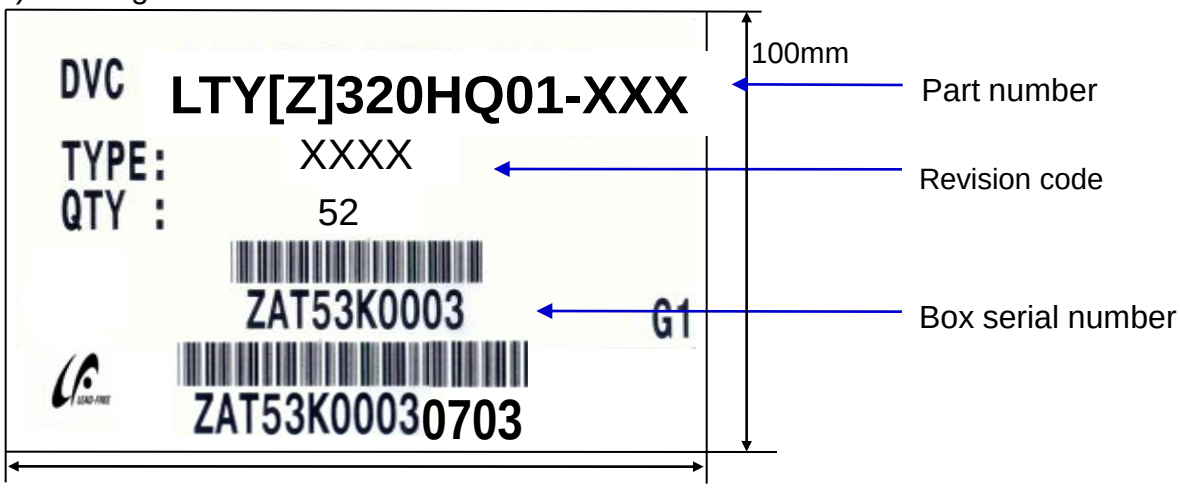
(3) Lot number : X X X X XXX XX X

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

(4) Nameplate Indication



(5) Packing box attach



14. General Precautions

14.1 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 converter 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 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) Using dried towel is strongly recommended for cleaning screen. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride, water, IPA(Isopropyl Alcohol) or Hexane and so on.

(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 pull or fold the LED FFC.

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

(n) Protection film for polarizer on the Module should be slowly peeled off just before use so that the electrostatic charge can be minimized.

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

14.2 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 5 to 40℃ 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.

(d) Storage period is recommended not to exceed 1 year.

14.3 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 Converter 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 LED and may require higher startup voltage(Vs).

14.4 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.

14.5 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.