Chunghwa Picture Tubes, Ltd.
Technical Specification

To :

Date : 2005.07.12

CPT TFT-LCD

CLAA320WA01

ACCEPTED BY：

TENTATIVE

APPROVED BY	CHECKED BY	PREPARED BY
		TFT-LCD Product Planning Management General Division

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RECORD OF REVISIONS

Revision No.	Date	Page	Description
Ver1.0	2004/10/18	all	Preliminary specification was first issued .
Ver1.1	2004/10/25	--	Update
Ver1.2	2004/11/15	--	Update
Ver1.3	2004/12/15	10	Specify the power sequence and mode selcetion pins.
Ver 2.0	2005/01/24	--	Writing Modify
Ver 3.0	2005/02/15		Revised Electrical Characteristics for Burst Mode Inverter
Ver 4.0	2005/05/12	8	Lamp Current (Typ.) 5.25 mArms→ 5.0 mArms
Ver 5.0	2005/05/13		Update

CONTENTS

1. OVERVIEW

CLAA320WA01 is 32” color (80.04cm) TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, LVDS driver ICs, control circuit, backlight, and inverter. By applying 8 bit digital data, 1366*768, 16.7 million-color images are displayed on the 32” diagonal screen. General specification are summarized in the following table:

1.1 GENERAL INFORMATION

ITEM	SPECIFICATION	UNIT
Display Area	697.68 (H) × 392.25 (V) (31.51 inch diagonal)	mm
Number of Pixels	1366 (H) × 768 (V)	16:9
Pixel Pitch	0.51075 (H) × 0.51075 (V)	mm
Color Pixel Arrangement	RGB Vertical Strip	
Display Mode	Normally Black	
Number of Colors	16.7M (8bit)	color
Surface Treatment	Hard coating: 3H Anti-Clare + LR <less than 2% reflection.	
Total Module Power	125	W

1.2 MECHANICAL INFORMATION

ITEM			MIN	TYP.	MAX.	UNIT
Module outline dimension	Horizontal (H)		742.0	743.0	744.0	mm
	Vertical (V)		446.0	447.0	448.0	mm
	Depth (D)	without inverter	41.0	42.0	43.0	mm
		with inverter	43.0	44.0	45.0	mm
Module Weight			8100	8300	8500	g

2. ABSOLUTE MAXIMUM RATINGS

The following are maximun values which, if exceeded, may cause faulty operation or damage to the module.

ITEM		SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage For LCD		VCC	-0.3	16.0	V	
Input voltage of inverter		VBL	21.6	26.4	V	
Input current of inverter		IIN	--	5.5	A	
Inverter dimming		VDIM	0	5	Vdc	
Inverter frequency		FL	60.5	66.5	kHz	
Backlight striking time		Ts		1	Sec.	
Backlight on/off control voltage	ON	V_{BLON}	2	5	Vdc	
	OFF		0	0.8	Vdc	
ESD		VESDt	-100	100	V	
		VESDc	-8000	8000	V	
ICC Rush Current		IRUSH	--	8	A	
Operation Ambient		T_{op}	0	50	℃	*1) *2) *3) *4)
Storage Temperature		T_{stg}	-20	60	℃	*1) *2) *3) *4)

[Note]

*1) The range of relative temperature and humidity shown as below sketch

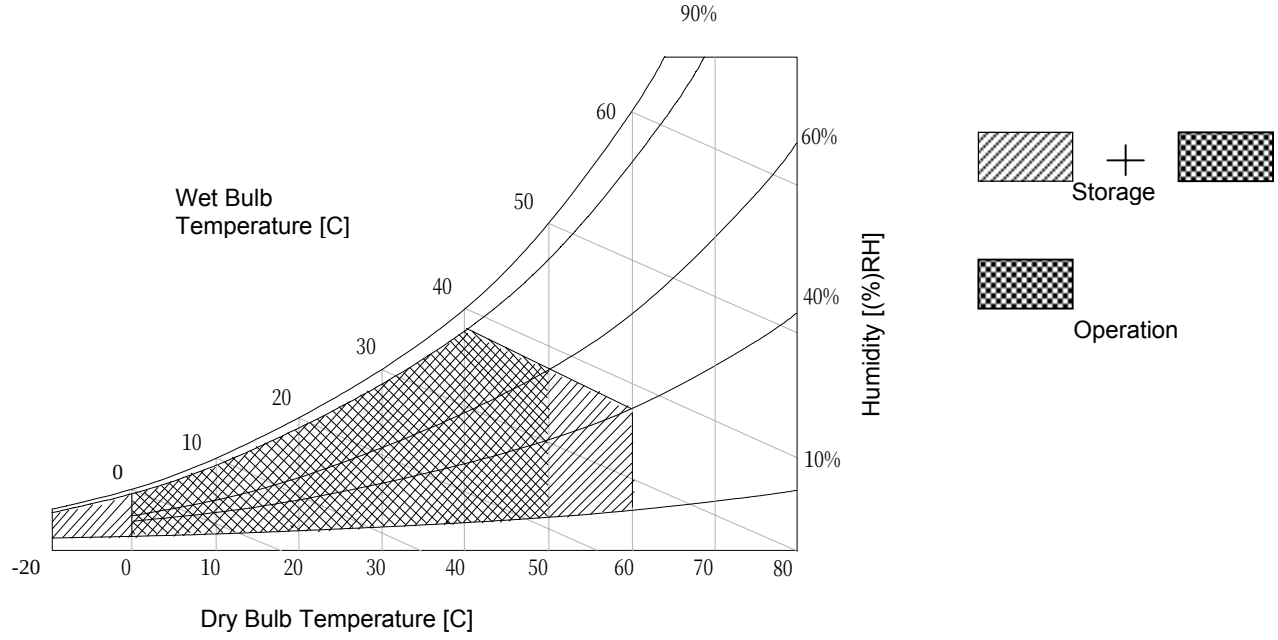
Humidity ≦ 85%RH without condensation

Relative Humidity ≦90% (Ta≦ 40°C), Wet Bulb Temperature ≦39°C (Ta≧40°C)

*2) The maximum wet bulb temperature ≦39°C (Ta＞40°C) and without dewing.

*3) If the module had been used in the environment which over the definition of temperature and humidity too long. It will effect the performance of panel.

*4) If the module had been operated in normal temperature range, the temperatur for the center surface of panel should be under 60°C.



3. ELECTRICAL CHARACTERISTICS

3.1 TFT-LCD MODULE

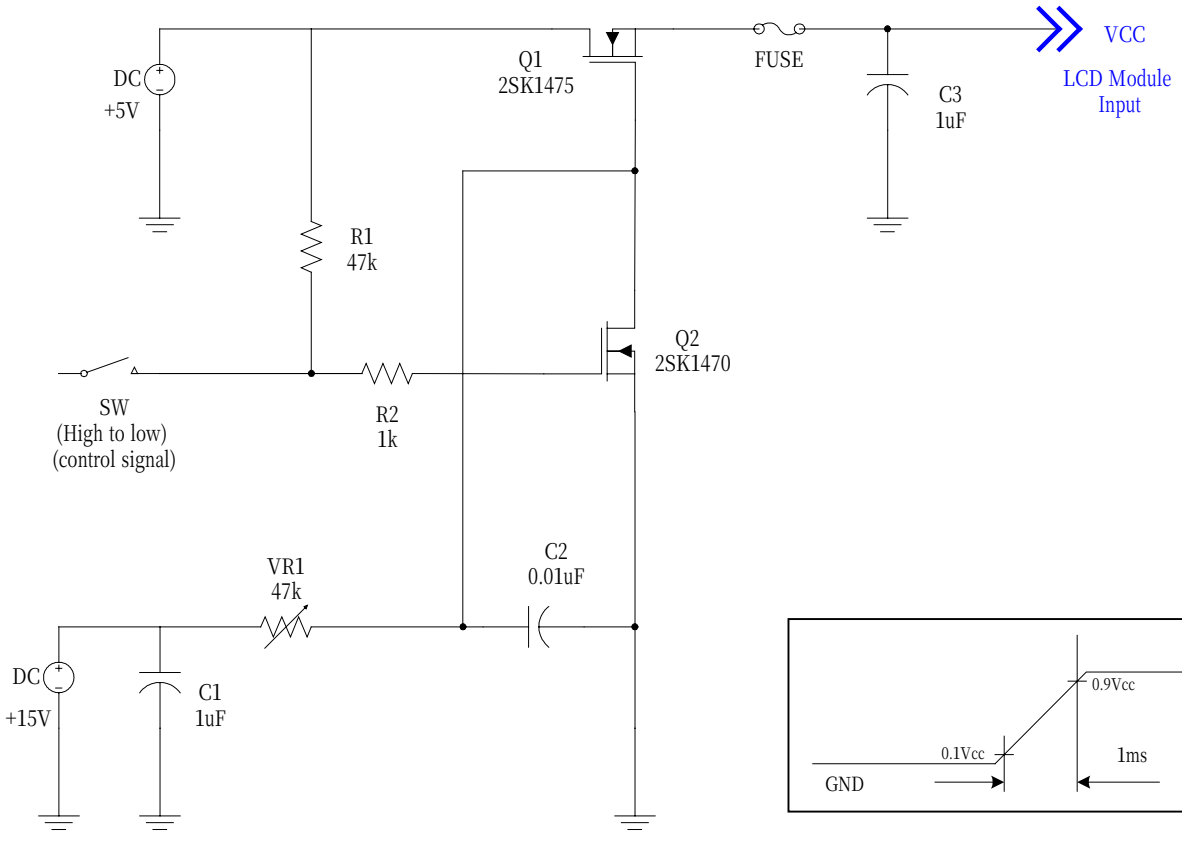
Ta=25℃

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	REMARK
LCD Power Supply Voltage		VCC	11.4	12.0	12.6	V	*1)
Ripple Voltage		Vrpd	--	--	100	mVp-p	VIN=+12.0V
Rush current		Irush	--	--	8	A	*2)
LCD Power Supply Current	White	ICC	--	400	--	mA	*3)
	Black		--	350	--		
	RGB stripe		--	390	--		
LCD power consumption		Pc	--	6.48	9.7	W	
High input voltage of LVDS		V_{IN+}	--	--	100	mV	*4) *5)
Low input voltage of LVDS		V_{IN-}	100	--	--	mV	
Input common voltage of LVDS		VCM	--	1.25	-	V	
Input terminal resist of LVDS		R_T	--	100	--	ohm	

[Note]

*1) The module should be always operated within above ranges.

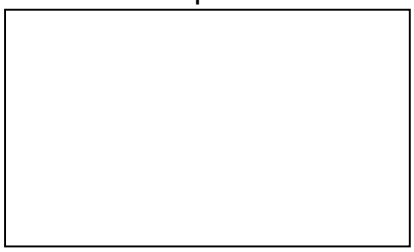
*2) Measure conditions:



Vcc rising time is 1 ms

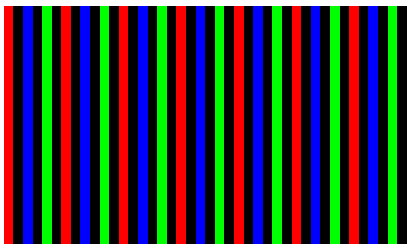
*3) The specified power supply current is under condition at Vcc=12V, Ta=25+/-2℃, f_v=60Hz, whereas a power dissipation check pattern below is displayed.

a. White pattern



b. Black pattern

c. RGB Stripe pattern



*4) Power and signal sequence:

1ms <t1≦30ms

20ms＜t2＜50ms

0＜t3≦50ms

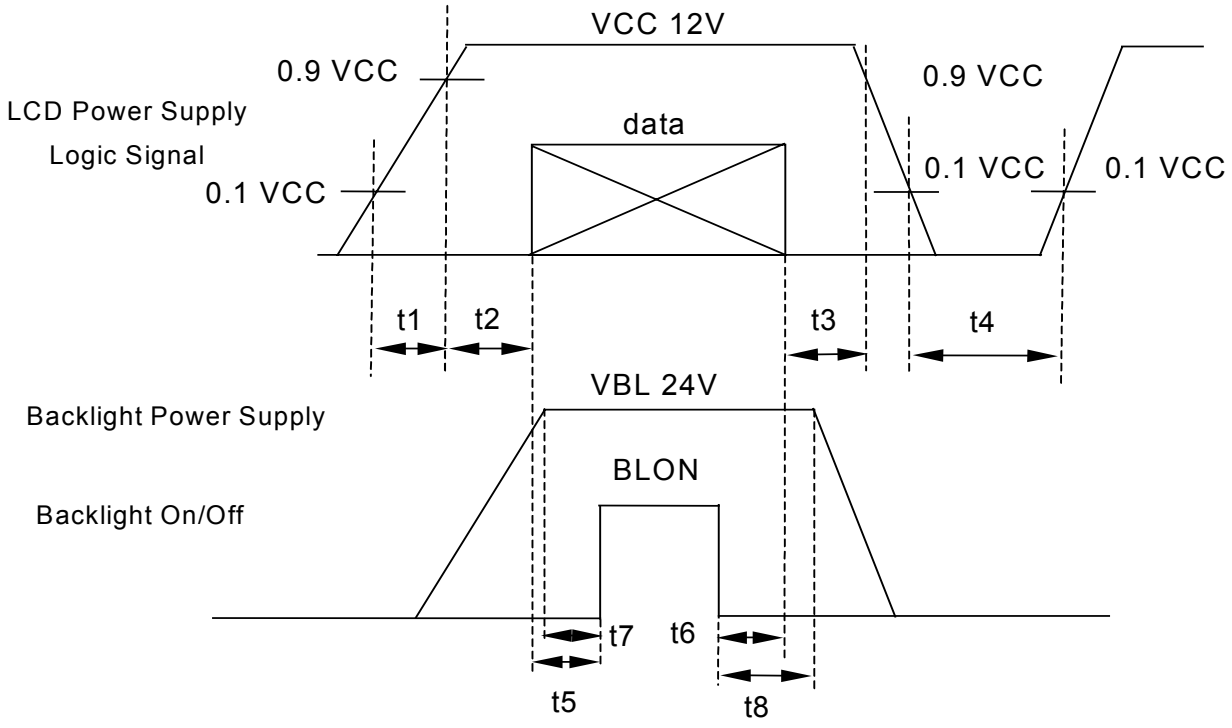
300ms≦t4

500ms≦t5

100ms≦t6

300ms≦t7≦500ms

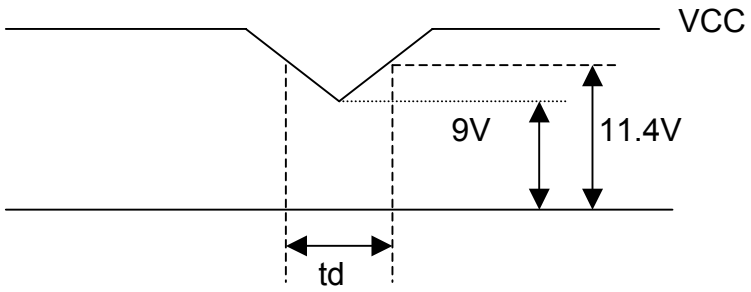
100ms≦t8≦500ms



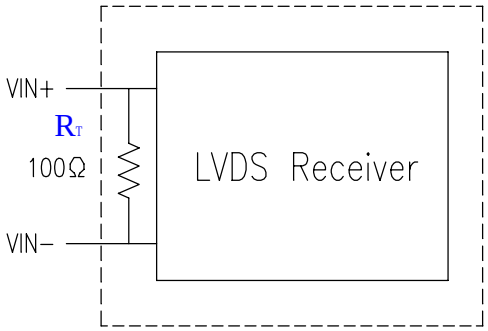
Data: RGB DATA, DCLK, DENA, Hsync, Vsync

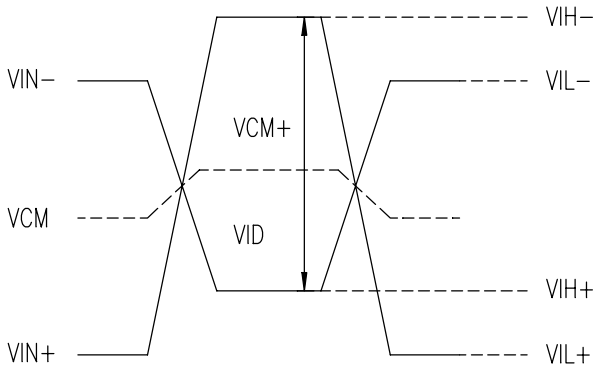
VCC-dip State:

1) When 9V≦VCC＜11.4 V, td≦10 ms.
2) VCC ＞ 11.4V, VCC-dip condition should also follow the VCC-turn-off condition.



*5) LVDS Signal Definition:





VID = VIN_+ – VIN-,

△VCM = ｜VCM_+–VCM-｜,

△VID = ｜VID_+–VID-｜,

VID+ = ｜VIH_+–VIH-｜,

VID- = ｜VIL_+–VIL-｜,

VCM = (VIN_++VIN-) / 2,

VCM+ = (VIH_++VIH-) / 2,

VCM- =(VIL_++VIL-) / 2,

VIN+: Positive differential DATA & CLK input

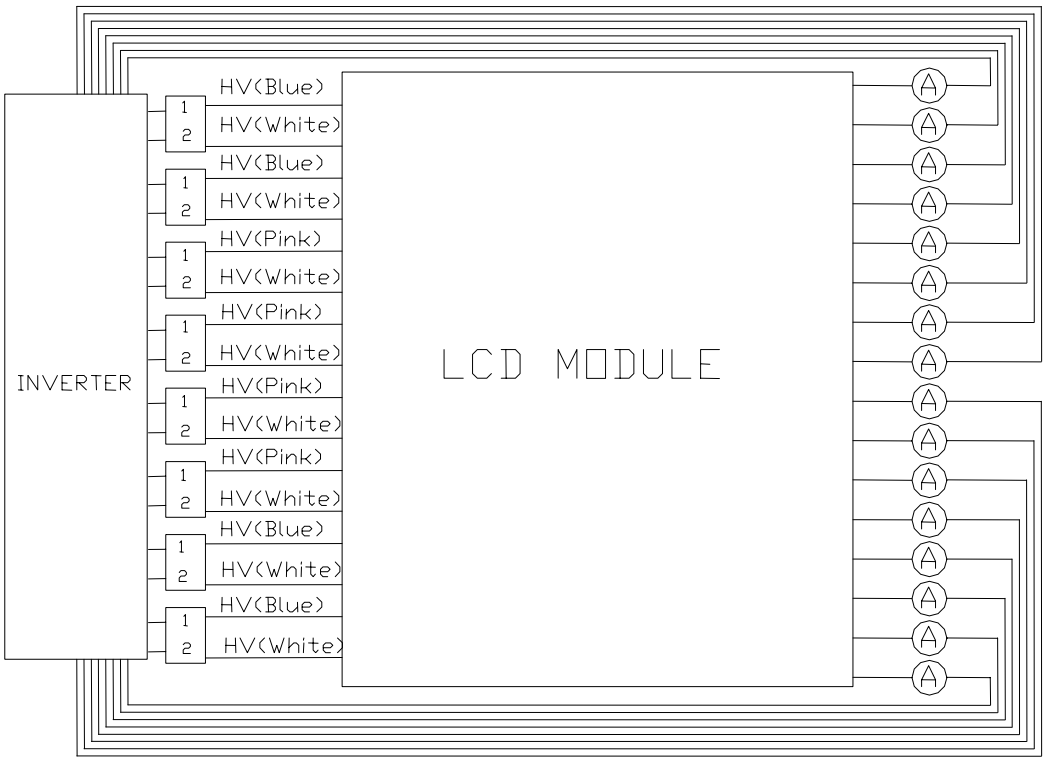
VIN-: Negative differential DATA & CLK input

3.2 BACKLIGHT Ta=25℃

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Lamp Voltage		VL	--	1150	--	Vrms	IL=4.5mA
Lamp Current		IL	4.0	4.5	5.0	mArms	*1)
Lamp life time		LT	50,000	60,000	--	hr	*2)
Input voltage of inverter		VBL	21.6	24	26.4	V	*3)
Input current of inverter		IIN	0	4.8	5	A	
Input frequency of inverter		FL	60.5	63.5	66.5	KHz	*4)
Inverter dimming		VDIM	0	--	5	Vdc	*5)
Dimming Frequency		FB	150	160	170	Hz	
Inverter duty ratio		--	20	--	100	%	VDIM=5V(MAX.)
Inverter opening voltage		Vopen	1900	--	--	Vrms	
Backlight on /of control voltage	ON	V_{BLON}	2.0	--	--	V	*6)
	OFF		0	--	0.8		
Power consumption (Panel+ Backlight)		BLW	--	115	120	W	After starting 30 mins
Start up Voltage	Ta=0℃	Vs	--	--	2410	Vrms	
	Ta=25℃		--	--	2320		

[Note]

*1) Lamp Current measurement method (The current meter is connected to low voltage end) Take the average of 16 CCFL's lamp current as V_{DIM} = 5V.



*2) Definition of the lamp life time:
When lamp luminance is redued to 50% of its initial value.

*3) Ripple voltage that occars at the instant of power-on can't exceed 30V.

*4) Electrical and optical characterisitics color chromaticity is not included can maintain in a range +/- 10% when the inverter operates within this frequency range.

*5) Brightness is the darkest when V_{DIM} = 0V; Brightness is the brightest when V_{DIM} = 5V.

*6) Backlight turns off when V_{BLON} = 0V ; turns on when V_{BLON} = 5V (24V must be input in advance)

4. INTERFACE PIN CONNECTION

4.1 CONNECTOR PART No.: FI-X30SSL-HF(JAE) or compatible

PIN NO	SYMBOL	DESCRIPTION	NOTE
1	VCC	Power supply: +12V	
2	VCC	Power supply: +12V	
3	GND	Ground	
4	GND	Ground	
5	RxIN0-	Data-	
6	RxIN0+	Data+	
7	GND	Ground	
8	RxIN1-	Data-	
9	RxIN1+	Data+	
10	GND	Ground	
11	RxIN2-	Data-	
12	RxIN2+	Data+	
13	GND	Ground	
14	RxCLKIN-	Clock-	
15	RxCLKIN+	Clock+	
16	GND	Ground	
17	RxIN3-	Data-	
18	RxIN3+	Data+	
19	GND	Ground	
20	NC	Reserved	(1)
21	NC	Reserved	(1)
22	PAL/NTSC	50/60Hz option	(3)
23	NC/GND	Reserved	
24	NC/GND	Reserved	
25	DE/Sync	DE/Sync option	(4)
26	NC	Reserved	(1)
27	DMS	LVDS Option	(2)
28	NC/GND	Reserved	
29	NC/GND	Reserved	
30	GND	Ground	

*1) NC: Must let it open.

*2) LVDS OPTION PIN (DMS)：

DMS(Pin 27)	LVDS Format
GND	Non-JEIDA
NC	JEIDA

*3) PAL / NTSC

PAL/NTSC(Pin 22)	Mode
NC	NTSC(60Hz)
GND	PAL(50Hz)

*4) DE / Sync:

DE/Syns(Pin 25)	Mode
NC	DE
GND	Sync

4.2 LVDS INTERFACE:

LVDS RECEIVER: Tcon (LVDS Rx embeded)

	LVDS PIN	JEIDA-DATA	Normal DATA
TxOUT/RxIN0	TxIN/RxOUT0	R2	R0
	TxIN/RxOUT1	R3	R1
	TxIN/RxOUT2	R4	R2
	TxIN/RxOUT3	R5	R3
	TxIN/RxOUT4	R6	R4
	TxIN/RxOUT6	R7	R5
	TxIN/RxOUT7	G2	G0
TxOUT/RxIN1	TxIN/RxOUT8	G3	G1
	TxIN/RxOUT9	G4	G2
	TxIN/RxOUT12	G5	G3
	TxIN/RxOUT13	G6	G4
	TxIN/RxOUT14	G7	G5
	TxIN/RxOUT15	B2	B0
	TxIN/RxOUT18	B3	B1
TxOUT/RxIN2	TxIN/RxOUT19	B4	B2
	TxIN/RxOUT20	B5	B3
	TxIN/RxOUT21	B6	B4
	TxIN/RxOUT22	B7	B5
	TxIN/RxOUT24	HSYNC	HSYNC
	TxIN/RxOUT25	VSYNC	VSYNC
	TxIN/RxOUT26	DENA	DENA
TxOUT/RxIN3	TxIN/RxOUT27	R0	R6
	TxIN/RxOUT5	R1	R7
	TxIN/RxOUT10	G0	G6
	TxIN/RxOUT11	G1	G7
	TxIN/RxOUT16	B0	B6
	TxIN/RxOUT17	B1	B7
	TxIN/RxOUT23	RESERVED	RESERVED

4.3 INVERTER – SIDE CONNECTOR: PHR-14(JST)

PIN NO	SYMBOL	DESCRIPTION	NOTE
1	VBL	Supply Voltage 24V	
2	VBL	Supply Voltage 24V	
3	VBL	Supply Voltage 24V	
4	VBL	Supply Voltage 24V	
5	VBL	Supply Voltage 24V	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	GND	Ground	
10	GND	Ground	
11	NC	NC(Test pin or else)	
12	BLON	ON/OFF Control	*1)
13	VDIM	0V~5V	*2)
14	GND	GND	

[Note]

*1) ON=5V, OFF=0V; when this PIN is disconnecting with power, the Inverter is in OFF status.

*2) Max Brightness =5V, Min Brightness =0V; when this PIN is disconnecting with power, the output status of Inverter is the same as VDIM＝0V.

5. INTERFACE TIMING (DE only mode)

5.1 TIMING SPECIFICATION

ITEM				SYMBOL	MIN.	TYP.	MAX.	UNIT
LCD Timing	DCLK		Freq.	f_{CLK}	68	80	84	MHz
			Cycle	t_{CLK}	14.7	12.5	11.9	ns
	DENA	Horizontal	Line Rate	f_H	43.2	48.5	53.3	kHz
			Horizontal Total Time	t_H	1575	1648	1936	t_{CLK}
			Horiaontal Effective Time	t_{HA}	---	1366	---	t_{CLK}
			Horizontal Blank Time	t_{HB}	209	282	570	t_{CLK}
		Vertical	Frame Rate	Fr	54.6	60	67.5	Hz
			Vertical Total Time	t_V	790	810	888	t_H
			Vertical Effective Time	t_{VA}	768	768	768	t_H
			Vertical Blank Time	t_{VB}	22	42	120	t_H
	Sync Mode	Horizontal	Horizontal sync time	tHsync	---	136	---	t_{CLK}
			Horizontal Back porch	tHBP	---	108	---	t_{CLK}
		Vertical	Vertical sync time	tVsync	---	5	---	t_H
			Vertical Back porch	tVBP	---	22	---	t_H

[Note]

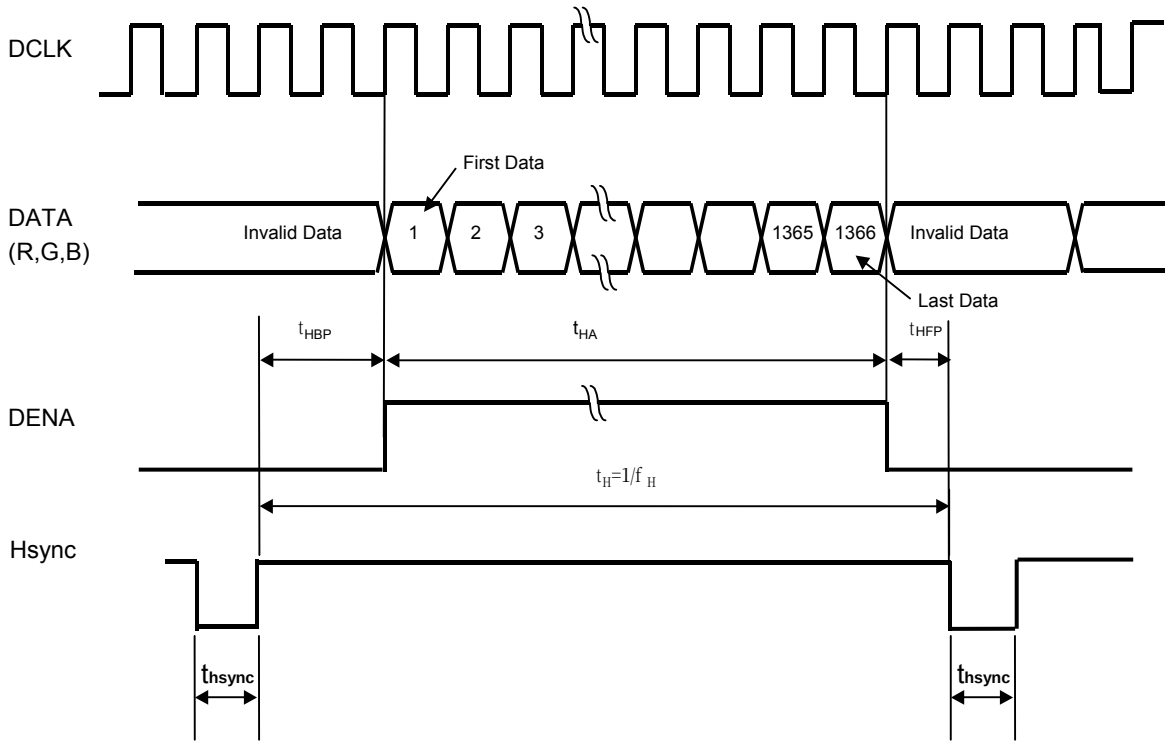
1).The best result of over-driving is in frame rate =60Hz.

2).This module is operated in DE only mode. Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would be operated abnormally.

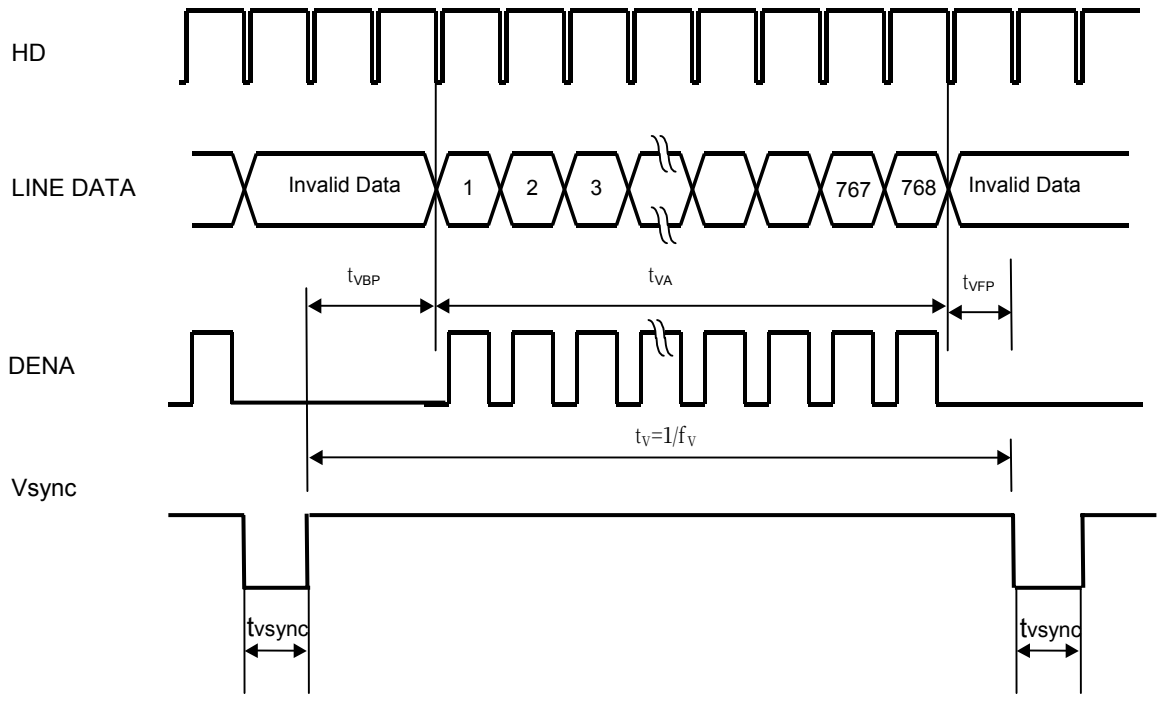
3).DE (DATA ENABLE) is usually in positive.

5.2 TIMING CHART

a. Horizontal Timing

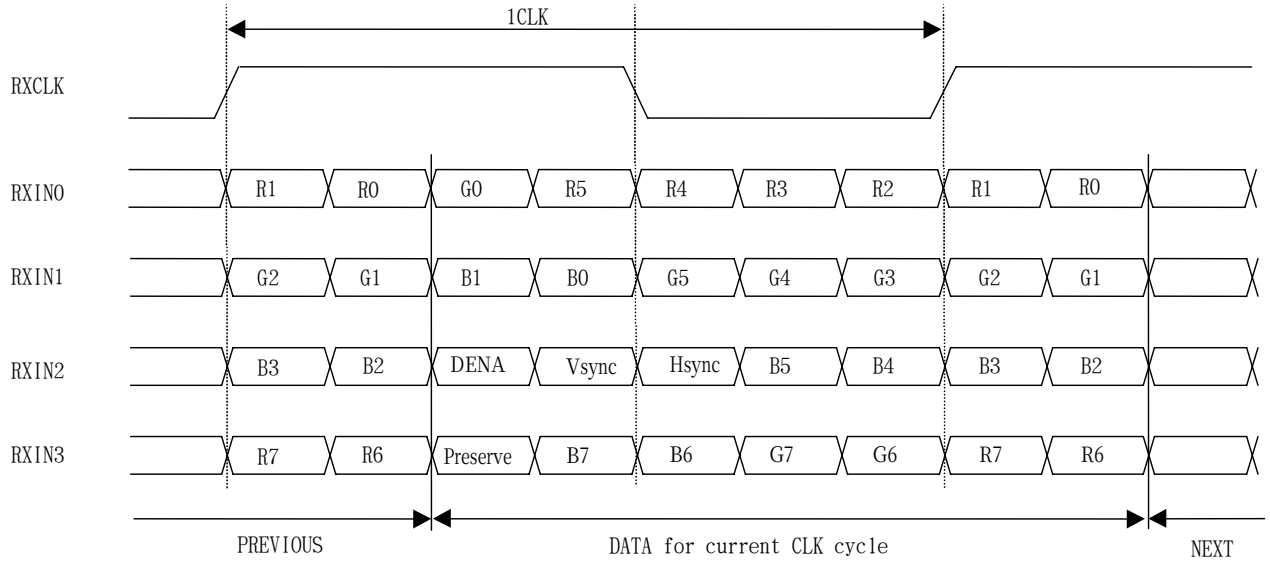


b. Vertical Timing Chart

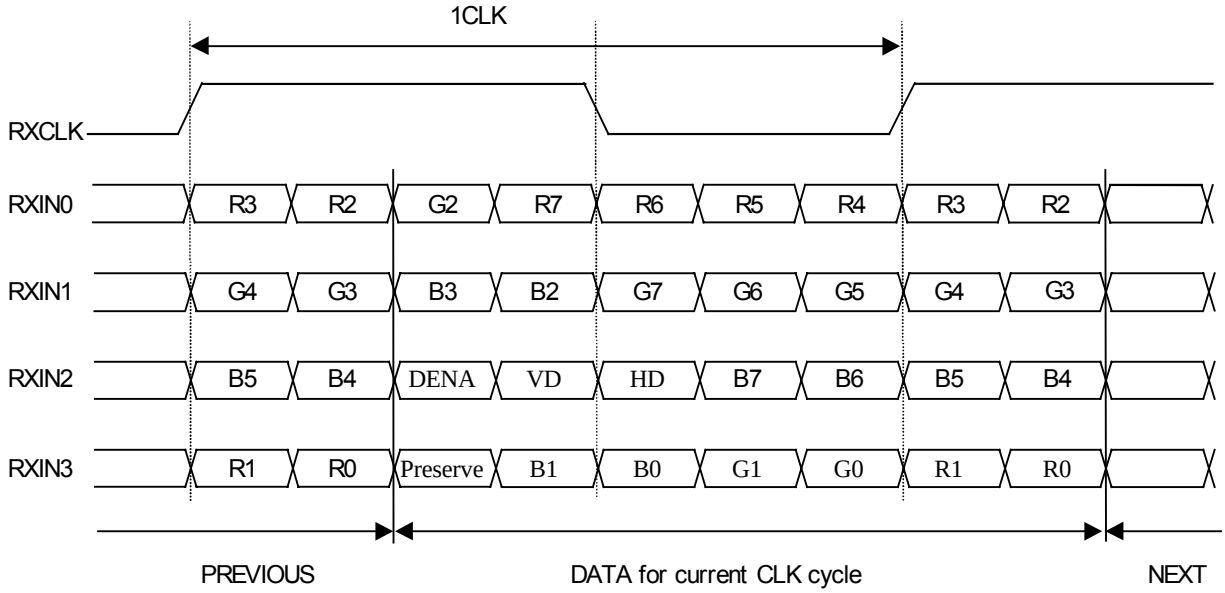


5.3 LVDS DATA MAPPING

a. None-JEIDA normal Specification



b. JEIDA Specification



8bit LSB: R0,G0,B0

Parallel TTL Data Inputs Mapped to LVDS outputs

5.4 LVDS INTERFACE

8bit LSB: R0, G0, B0

Parallel TTL Data Inputs Mapped to LVDS outputs

TRANSMITTER(THC63LVD823)		INTERFACE CONNECTOR		TIMING CONTROLLER INPUT
PIN NO	INPUT DATA	HOST	TFT_LCD	
51	TA0	TxOUT0+ TxOUT0-	TA+ TA-	R2
52	TA1			R3
54	TA2			R4
55	TA3			R5
56	TA4			R6
3	TA5			R7 (MSB)
4	TA6			G2
6	TB0	TxOUT1+ TxOUT1-	TB+ TB-	G3
7	TB1			G4
11	TB2			G5
12	TB3			G6
14	TB4			G7 (MSB)
15	TB5			B2
19	TB6			B3
20	TC0	TxOUT2+ TxOUT2-	TC+ TC-	B4
22	TC1			B5
23	TC2			B6
24	TC3			B7 (MSB)
27	TC4			Hsync
28	TC5			Vsync
30	TC6			DENA
50	TD0	TxOUT3+ TxOUT3-	TD+ TD-	R0 (LSB)
2	TD1			R1
8	TD2			G0 (LSB)
10	TD3			G1
16	TD4			B0 (LSB)
18	TD5			B1
25	TD6			Reserved

5.5 COLOR DATA ASSIGNMENT

COLOR	INPUT DATA	R DATA								G DATA								B DATA							
		R7 MSB	R6	R5	R4	R3	R2	R1	R0 LSB	G7 MSB	G6	G5	G4	G3	G2	G1	G0 LSB	B7 MSB	B6	B5	B4	B3	B2	B1	B0 LSB
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
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	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
	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
RED	RED(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
	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(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
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	GREEN(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE(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(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

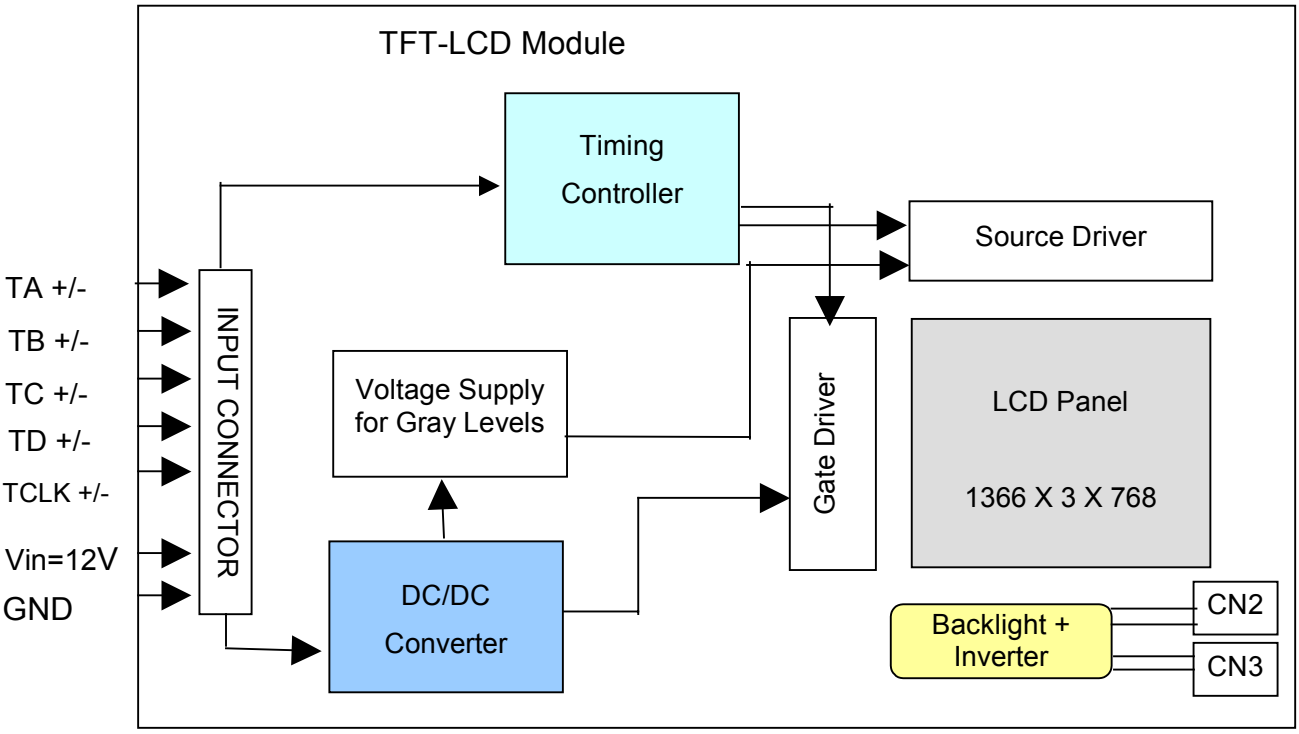
[Note]

1) Definition of gray scale:

Color (n): n indicates gray scale level, higher n means brighter level.

2) Data: 1-High, 0-Low

6. BLOCK DIAGRAM



BACKLIGHT UNIT

Lamp connector

HV(CN2): BHR-02(8.0)VS-1(JST)*8 Mating connector: SM02(8.0)B-BHS-1-TA(JST)

LV1(CN3): DF13-8P-1.25H(HRS)*2 LV2: DF13-8S-1.25H(HRS)*2

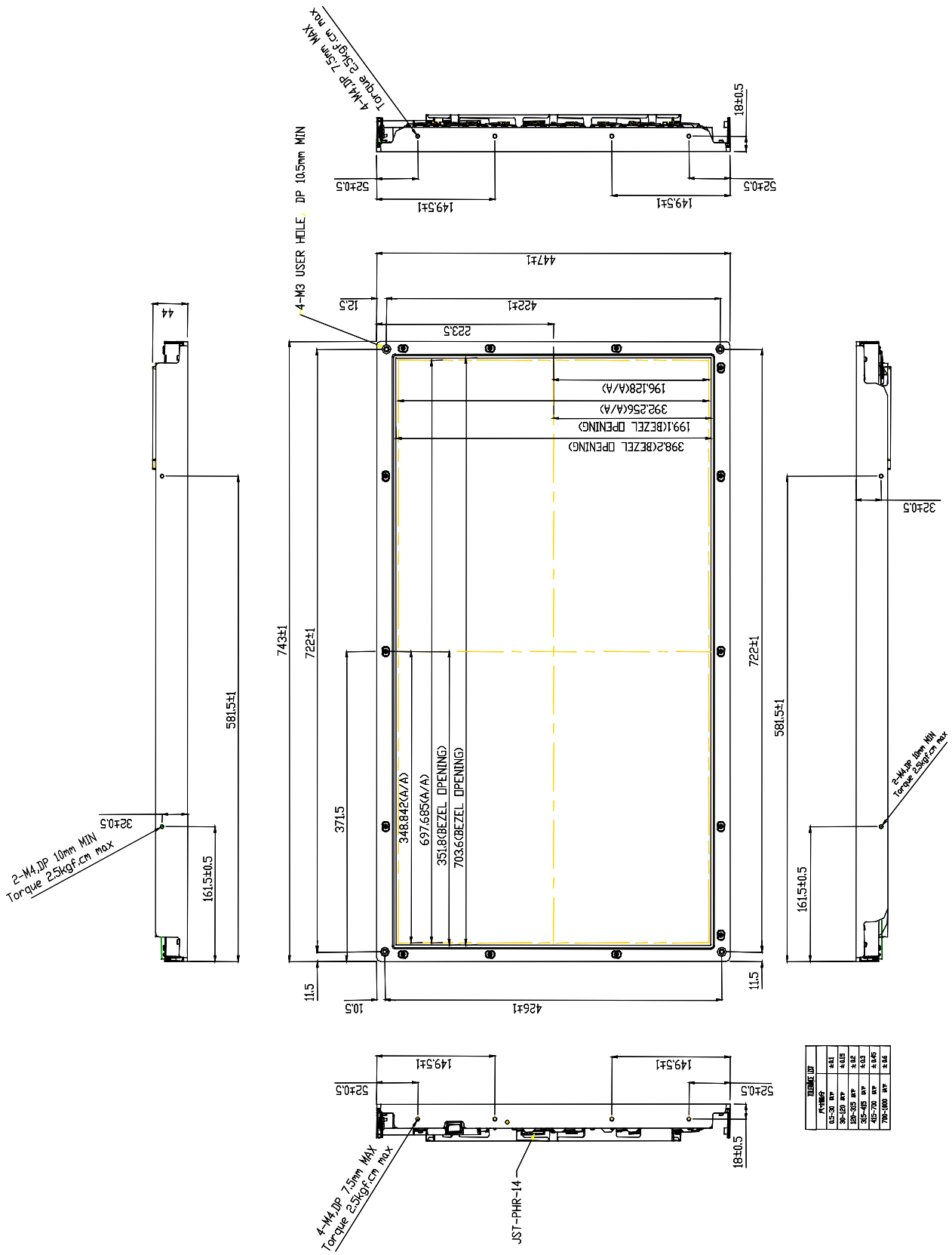
LV3: DF13-8S-1.25H(HRS)*2 Mating connector: DF13-8P-1.25H(HRS)

7. MECHANICAL SPECIFICATION

7.1 FRONT SIDE

(include Inverter, if the dimension did not to eerance, please refer to the table.)

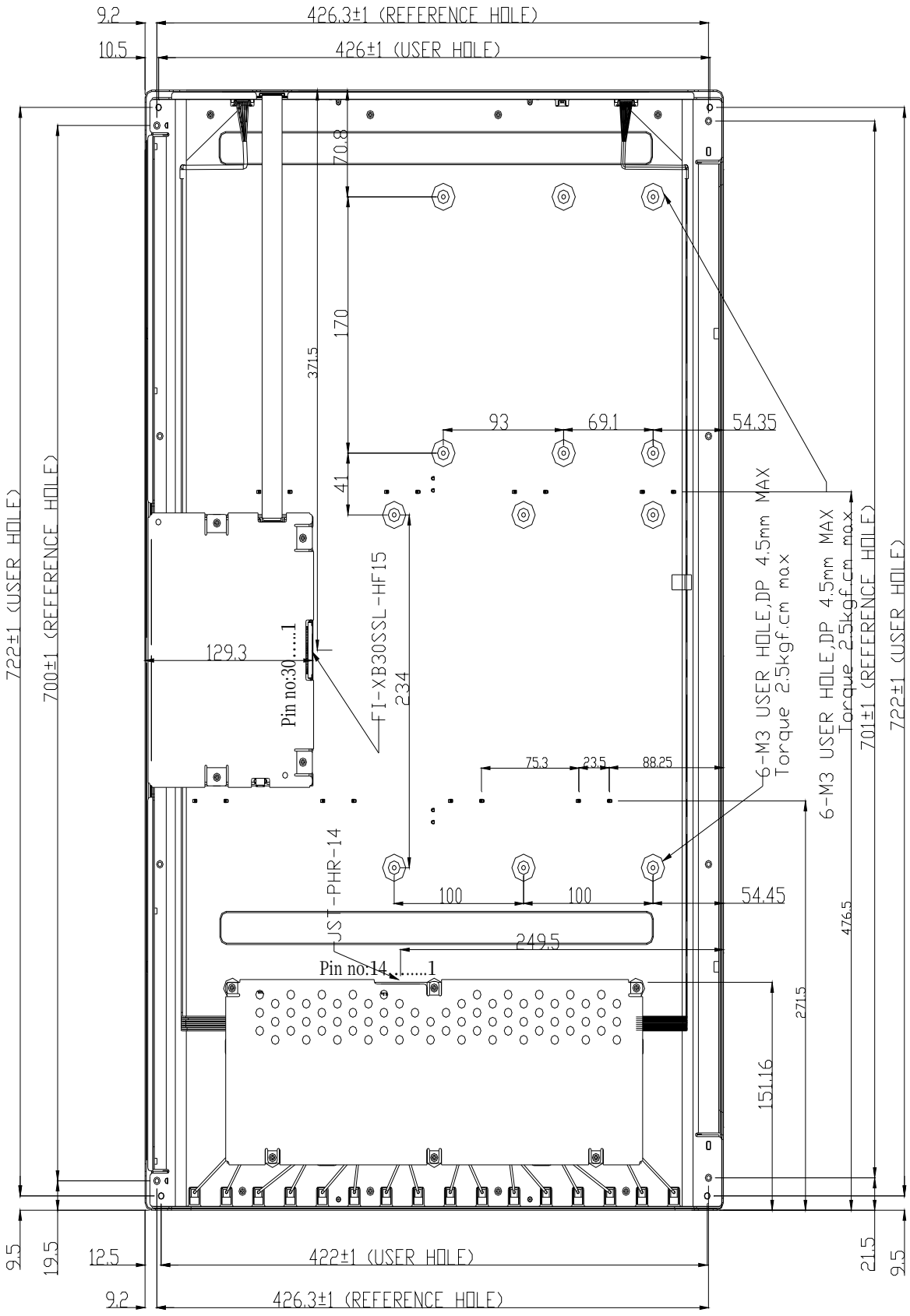
[Unit: mm]



7.2 REAR SIDE

(include Inverter, if the dimension did not to eerance, please refer to the table.)

[Unit: mm]



8.OPTICAL CHARACTERISTICS

Ta = 25°C, VCC=5V

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARKS
Contrast (CEN)		CR	θ = ψ = 0° Point-5	700	1000	--	--	*1)*2)*3)
Luminance	Central luminance	Lwc	θ = ψ = 0°	450	550	--	cd/m^2	
	5P Luminance (AVG)	Lw9	θ = ψ = 0°	--	500	--	cd/m^2	*2)*3)
	Uniformity	△Lw	θ = ψ = 0°	75	--	--	%	*2)*3)
Response Time (White – Black)		tr	θ = ψ = 0°	--	7	15	ms	*3)*4)
		tf	θ = ψ = 0°		9	15	ms	*3)*4)
Response Time (Gray to gray average)		trg, tfg		--	10	15	ms	*5)
Image sticking		tis	2 h	--	--	**8**	sec	*6)
View angle	Horizontal	ψ	CR ≧ 10 Point-5	-80~80	-85~85	--	°	*2)*3)
	Vertical	θ		-80~80	-85~85	--	°	*2)*3)
Crosstalk Ratio		CMR	θ = ψ = 0°	--	--	1	%	*3)*7)
Color Chromaticity	Red	Rx Ry	θ = ψ = 0° Point-5	0.628 0.283	0.658 0.313	0.688 0.343	--	*2)*3)
	Green	Gx Gy		0.255 0.575	0.285 0.605	0.315 0.635		
	Blue	Bx By		0.113 0.050	0.143 0.080	0.173 0.110		
	White	Wx Wy		0.253 0.267	0.283 0.297	0.313 0.327		
Color Temperature		Tc		--	9300	--	K	*3)
Color Gamut		CG		--	75	--	%	*8)

[Note]

These items are measured using: BM-5A (TOPCON) [under the dark room condition (no ambient light).]

Measurement Condition:

After lighting on the panel 30 mins, you can proceed the Measurement testing.

The definiton of Typical value is under the status of lamp current = 4.5 mArms.(AVG)

Definition of these measurement items is as follows:

*1) Definition of Contrast Ratio:〔These items are measured using BM-5A (TOPCON) under the dark room condition (no ambient light).〕

CR=ON (White) Luminance/OFF (Black) Luminance

*2) Definition of Luminance, Luminance uniformity, Contrast, and the Deviation of Color Coordinate:

Luminance and Contrast: To measure at the center position “5” on the screen (NO.5), see Figure.8-1 below.

Luminance uniformity: Lw (MAX) and Lw(MIN) are the maximum and minimum luminance value measure at the position “1~5” on the screen (NO.1~5), see Figure.8-1 and below show equation:

ΔLw＝[(Lw(MIN)) / Lw(MAX)] × 100%

The Deviation of Color Coordinate: To measure at the position “1~5” on the screen (NO.1~5), see Figure.8-1 below.

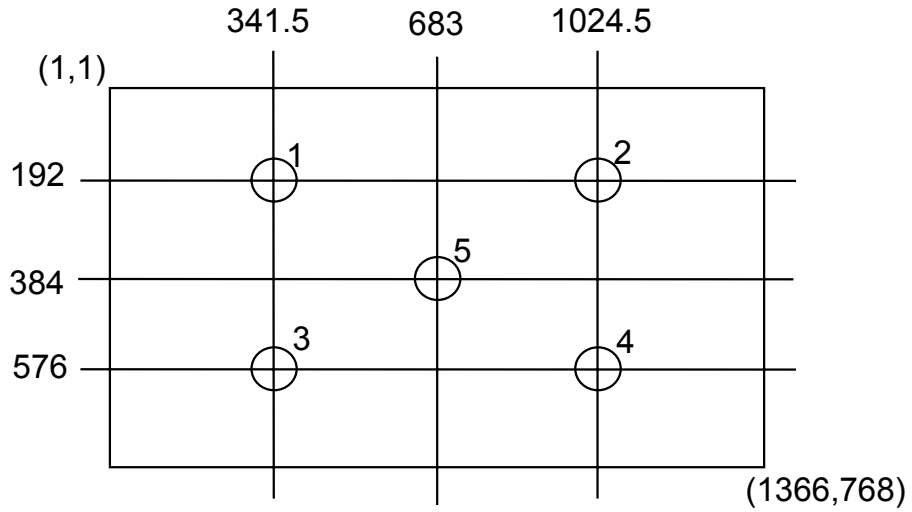


Figure 8-1. Measurement Positions

*3) Definition of Viewing Angle (θ, ψ):

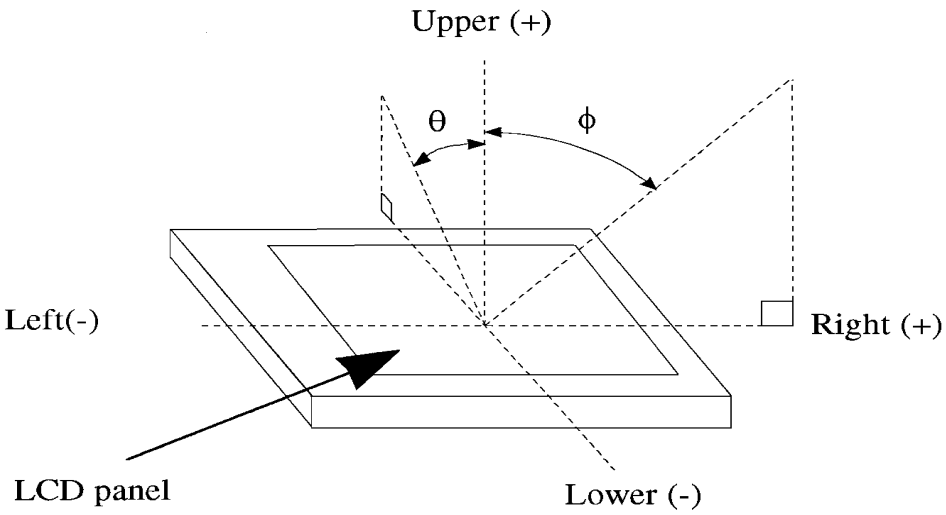


Figure 8-2. Definition of Viewing Angle

*4) Definition of Response Time (White – Black)

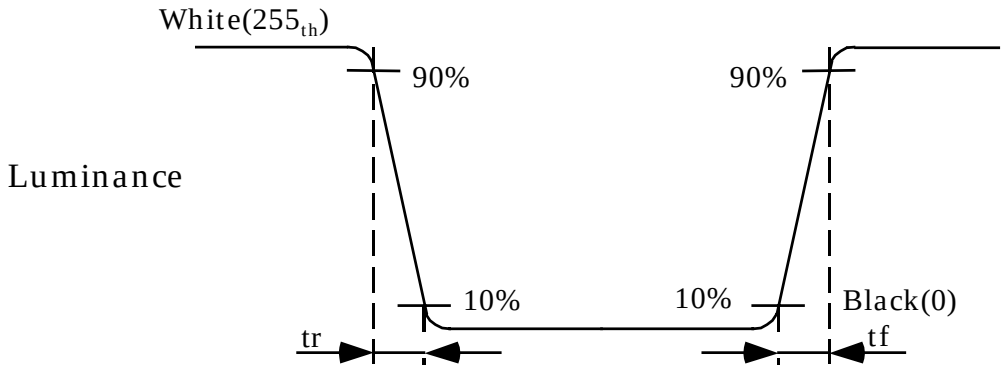


Figure 8-3. Definition of Response Time (White – Black)

*5) Definition of Response Time (Gray to Gray, Average)

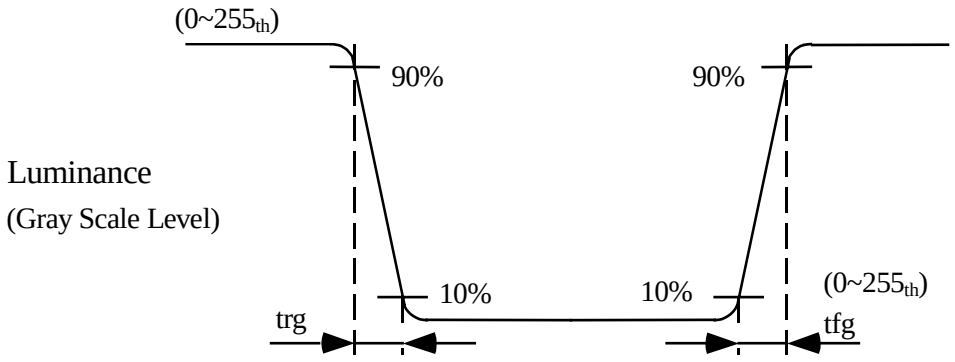


Figure 8-4. Definition of Response Time (Gray to Gray)

The driving signal time means the signal of gray level 0, 31, 63, 95, 127, 159, 191, 223, 255. Gray to gray average means the average switching time of gray level 0, 31, 63, 95, 127, 159, 191, 223, 255 to each other.

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed

after lighting Backlight for 1 hour in a windless room.

*6) Image sticking test method:

Continuously display the test pattern shown in the figure below for specified time. To change the module frame to gray pattern (gray 127 pattern), and it's displaying grade still under specfication.

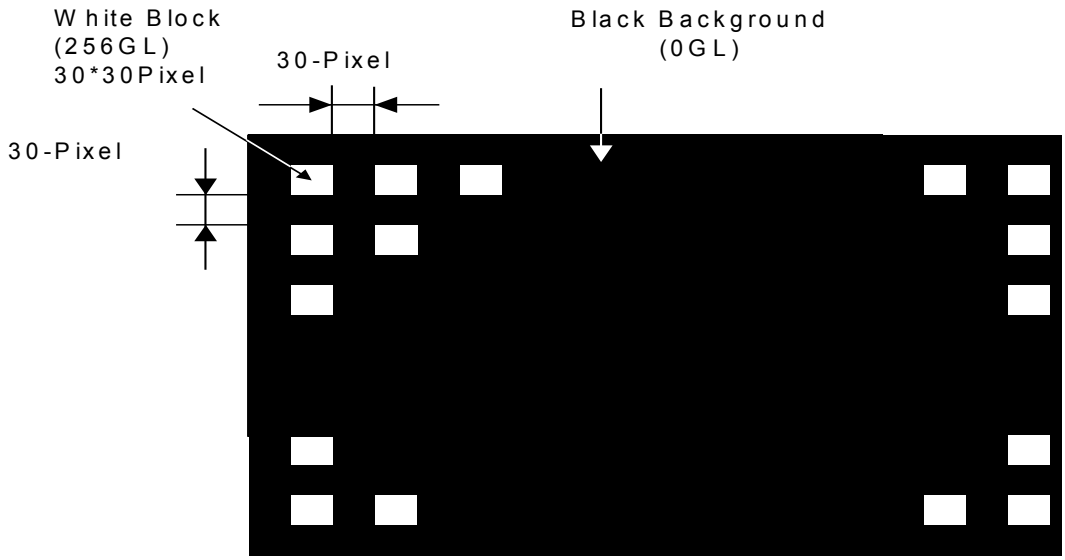


Figure 8-5. The Pattern of Image Sticking Test

*7) Definition of Cross talk Ratio

CMR = MAX (***(| (LB1-LA) / LC |) × 100 %, (| (LB2 – LA) / LC |) × 100 %***)

LA: Pattern A(Half-Tone pattern) Measure point Luminance

LB1, LB2: Pattern B1, Pattern B2 Measure point Luminance

LC: Pattern C(white pattern) Measure point Luminance

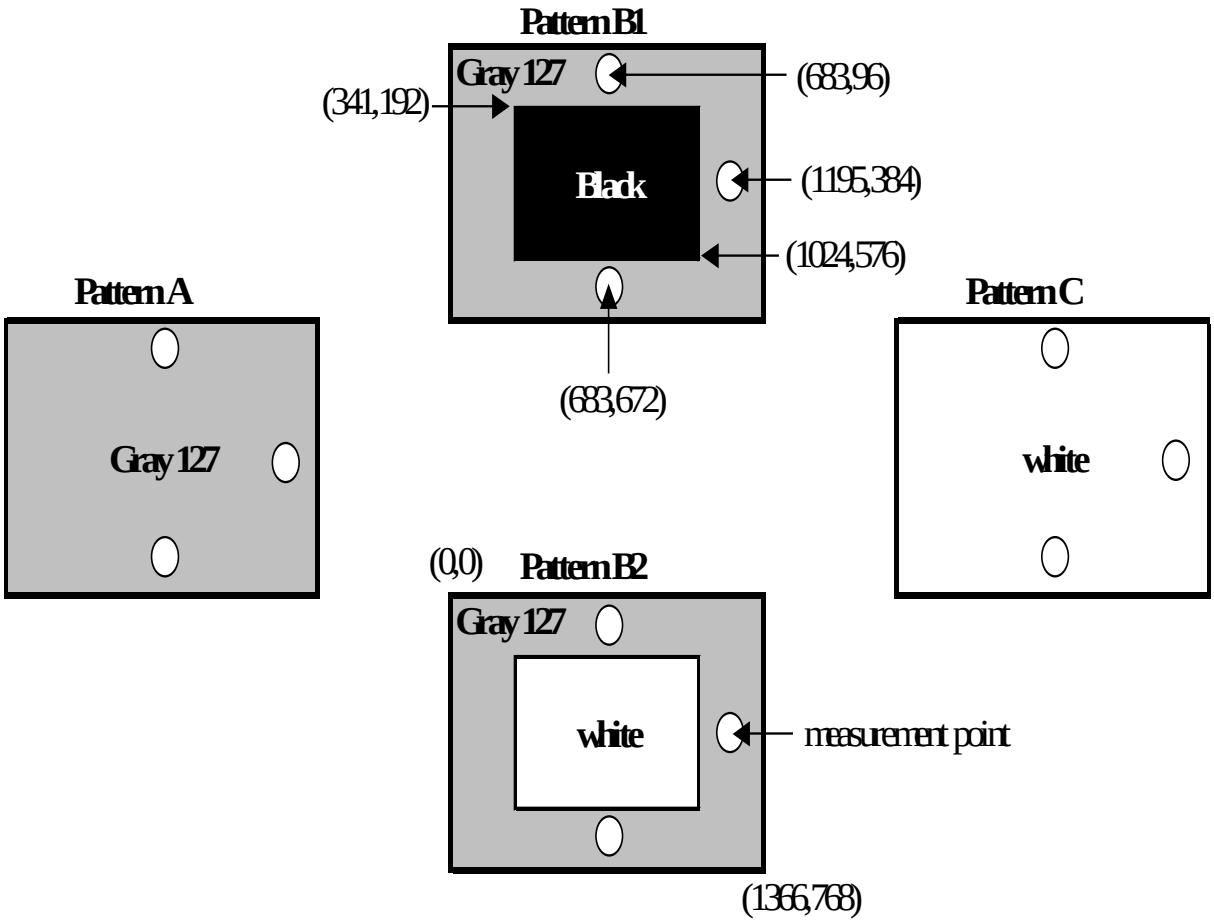


Figure 8-6. The Pattern of Cross talk Test

*8) Definition of Color Gamut:

To measure RGB three sub-pixels color gamut coordinate at CIE coordinate chart from the center of module, to form a triangle area = A_{RGB}.

RGB three sub-pixels of NTSC at CIE coordinate chart to form a triangle area = N_{RGB}.

$$CG = \frac{A_{RGB}}{N_{RGB}} \times 100$$

9.RELIABILITY TEST CONDITIONS

9.1 TEMPERATURE AND HUMIDITY

TEST ITEMS	CONDITIONS
High Temperature Operation	50℃; 240hrs
High Temperature Storage	60℃; 240hrs
High Temperature High Humidity Operation	50℃; 90% RH; 240 hrs (No condensation)
Low Temperature Operation	0℃; 240 hrs
Low Temperature Storage	-20℃; 240 hrs

9.2 SHOCK AND VIBRATION

ITEMS	CONDITIONS
Shock (Non-Operation)	Shock level: 980m/s^2 (100G) Waveform: half sinusoidal wave, 2ms Number of shocks: one shock input in each direction of three mutually perpendicular axes for a total of six shock inputs.
Vibration (Non-Operation)	Vibration level: 9.8m/s^2 (1.0G) zero to peak Waveform: sinusoidal Frequency range: 10 to 300 Hz Frequency sweep rate: 0.5 octave/min Duration: one sweep from 10 to 300Hz in each of three mutually perpendicular axis (each x, y, z axis:10 min, total 30 mins)

9.3 JUDGMENT STANDARD

The judgment of the above test should be made as follow:

Pass: Normal display image with no obvious non-uniformity and no line defect.

Partial transformation of the module parts shall be ignored.

Fail: No display, obvious non-uniformity, or line defects.

10. PACKAGING

10.1 PACKING SPECIFICATIONS

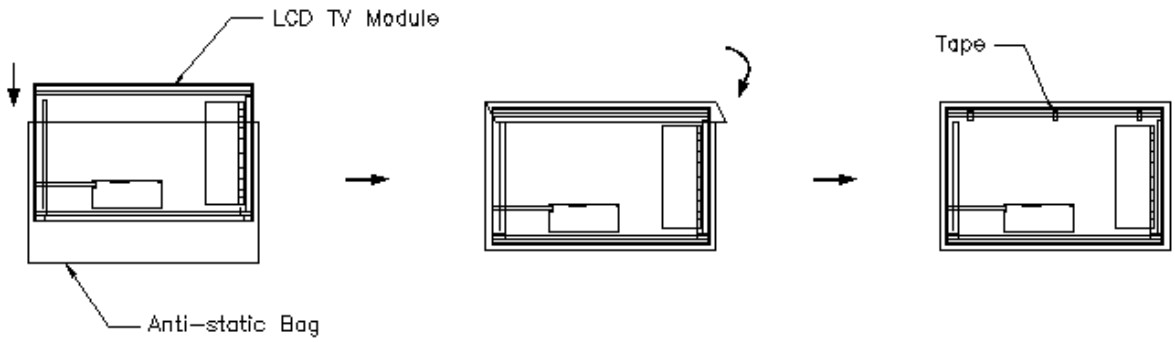
(1) 3 LCD TV modules/1 Box

(2) Box dimensions: 975(L) x 375(W) x 562(H)

(3) Weight: approximately 31.9kg (3 modules per box)

10.2 PACKING METHOD

Figure 1 and Figure 2 are the packing method.



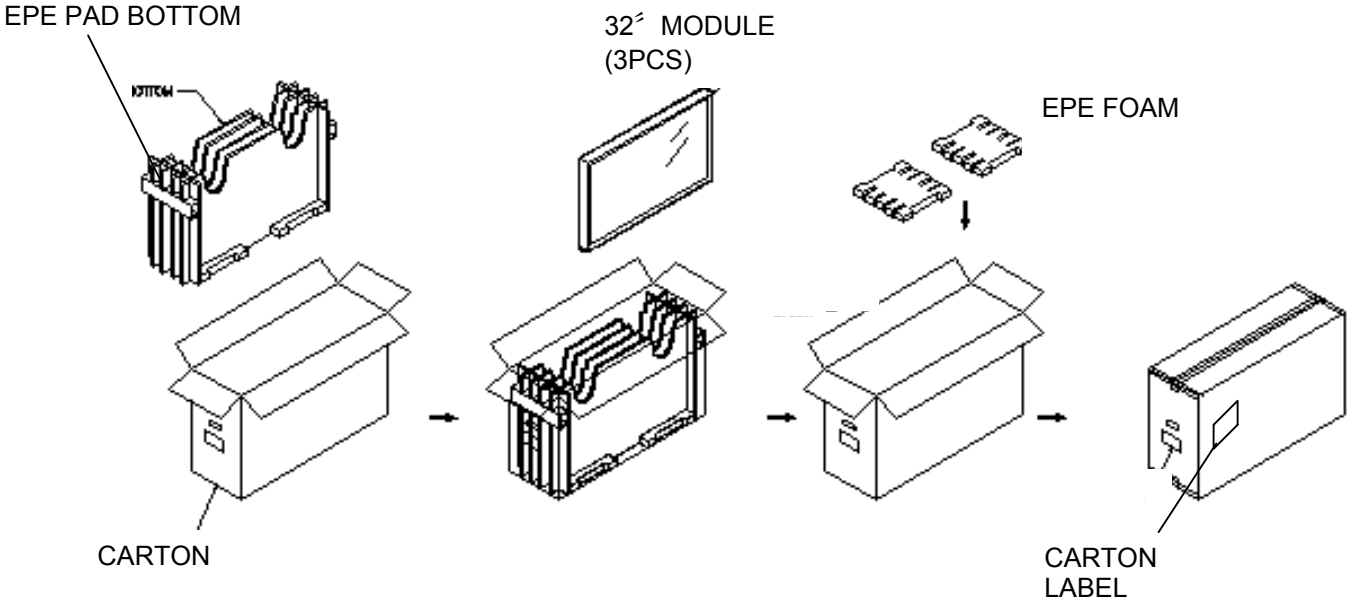


Figure 1 Packing Method

(1) Corner protector: L1125 x 50mm x 50mm
(2) Pallet: L1000 x W1150 x H130mm
(3) Bottom Cap: 1000 x W1150 x H130mm
(4) Pallet Stack: 1000 xW1150 x H1250mm
(5) Gross: 273kg

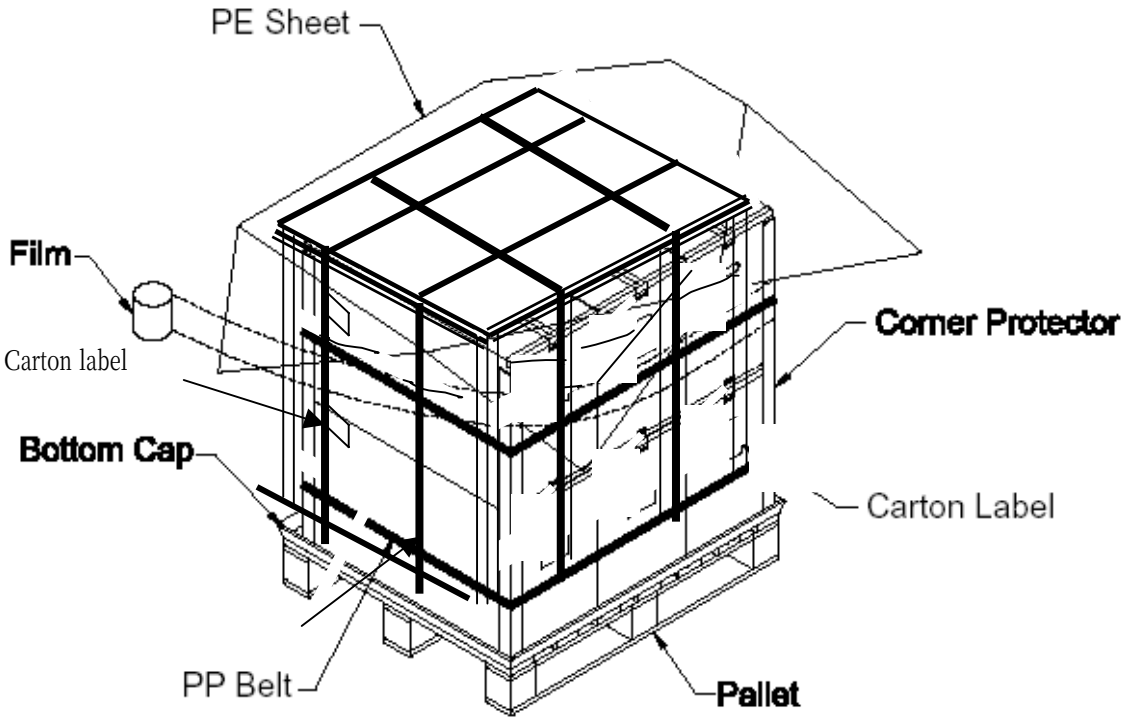


Figure 2 Packing Method

11. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

Please pay attention to the followings in handling TFT-LCD products.

11.1 ASSEMBLY PRECAUTION

(1) Please use the mounting hole on the module side in installing and do not beading or wrenching
LCD in assembling. And please do not drop, bend or twist LCD module in handling.

(2) Please design display housing in accordance with the following guidelines.

- Housing case must be destined carefully and do not to put stresses on LCD all sides or wrench module. The stresses may cause non-uniformity even if there is no non-uniformity statically.
- Keep sufficient clearance between LCD module back surface and housing when the LCD module is mounted. Approximately 1.0 mm of the clearance in the design is recommended taking into account the tolerance of LCD module thickness and mounting structure height on the housing.
- When some parts, such as, FPC cable and ferrite plate, are installed underneath the LCD module, still sufficient clearance is required, such as 0.5mm. This clearance is, especially, to be reconsidered when the additional parts are implemented for EMI countermeasure.
- Design the inverter location and connector position carefully so as not to put stress on lamp cable.
- Keep sufficient clearance between LCD module and the other parts, such as inverter and speaker so as not to interface the LCD module. Approximately 1.0mm of the clearance in the design is recommended.

(3) Please do not push or scratch LCD panel surface with any-thing hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film and surface of LCD panel are easy to be flawed.)

(4) Please do not press any parts on the rear side such as source TCP, gate TCP, control circuit board and FPC during handling the LCD module. If pressing rear part could not be avoided, handle the LCD module with care not to damage them.

(5) Please wipe out LCD panel surface with absorbent cotton or soft clothe in case of it being soiled.

(6) Please wipe out drops of adhesives like saliva and water on LCD panel surface immediately. They might damage to cause panel surface variation and color change.

(7) Please do not take a LCD module to pieces and reconstruct it. Resolving and reconstructing modules may cause them not to work well.

(8) Please do not touch metal frames with bare hands and soiled gloves. A color change of the metal frames can happen during a long preservation of soiled LCD modules.

(9) Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

11.2 OPERATING PRECAUTIONS

(1) Please be sure to turn off the power supply before connecting and disconnecting signal input cable.

(2) Please do not change variable resistance settings in LCD module. They are adjusted to the most suitable value. If they are changed, it might happen LCD does not satisfy the characteristics specification.

(1) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.

(2) A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.

(3) Please pay attention to displaying the same pattern for a very long time. Image might stick on LCD. If then, time going on can make LCD work well.

(4) Please obey the same caution descriptions as ones that need to pay attention to ordinary electronic parts.

11.3 PRECAUTIONS WITH ELECTROSTATICS

(1) This LCD module use CMOS-IC on circuit board and TFT-LCD panel, and so it is easy to be affected by electrostatics. Please be careful with electrostatics by the way of your body connecting to the ground and so on.

(2) Please remove protection film very slowly on the surface of LCD module to prevent from electrostatics occurrence.

11.4 STORAGE PRECAUTIONS

(1) When you store LCD for a long time, it is recommended to keep the temperature between 0℃ ~40℃ without the exposure of sunlight and keep the humidity less than 90%RH.

(2) Please do not leave the LCD in the environment of high humidity and high temperature such as 60℃ 90%RH.

(3) Please do not leave the LCD in the environment of low temperature(can not lower than -20℃).

11.5 SAFETY PRECAUTIONS

(1) When you waste LCD, it is recommended to crush damaged or unnecessary LCD into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged-glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

11.6 OTHERS

(1) A strong incident light into LCD panel might cause display characteristics' changing inferior because of polarizer film, color filter, and other materials becoming inferior. Please do not expose LCD module direct sunlight Land strong UV rays.

(2) Please pay attention on the side of LCD module do not contact with other materials in preserving it alone.

(3) For the packaging box, please pay attention to the followings:

- Packaging box and inner case for LCD are designed to protect the LCD from the damage or scratching during transportation. Please do not open except picking LCD up from the box.
- Please do not pile them up more than 3 boxes. (They are not designed so.) And please do not turn over.
- Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
- Packing box and inner case for LCD are made of cardboard. So please pay attention not to get them wet. (Such as keep them way the high humidity or wet place.)