RECORD OF REVISIONS

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1. OVERVIEW

CLAA320WF01U 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			697.684(H) × 392.256(V) (31.51 inch diagonal)	mm
Number of Pixels			1366×3(H)×768(V)	16:9
Pixel Pitch			0.51075(H) × 0.51075(V)	mm
Bezel Opening Area			703.6×398.3	mm
Color Pixel Arrangement			RGB Vertical Strip	
Display Mode			Normally Black	
Number of Colors			16.7M (8bits)	color
Wide View Tech.			E-MVA	
Electrical Interface			LVDS	
Total Module Power			114 (Typ.) (B/L with inverter105W)	W
Module Outline Dimension	Horizontal(H)		760.0 (Typ)	mm
	Vertical(V)		450.0 (Typ)	mm
	Depth (D)	without inverter	38.0 (Typ)	mm
		with inverter	45.0 (Typ)	mm
Module Weight			7500 (Typ)	g
Backlight Unit			7U-CCFL	
Surface Treatment			Hard coating, Anti-glare Surface-hardness: 3H	

The LCD products listed on this document are not suitable for use of aerospace equipment, submarine cables, and nuclear reactor control system and life support systems. If customers intend to use these LCD products for above application or not listed in "Standard" as follows, please contact our sales people in advance.

Standard : Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tool, Industrial robot, Audio and Visual equipment, & Other consumer products.

2. ABSOLUTE MAXIMUM RATINGS

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

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage For LCD	VCC	-0.3	14.0	V	
Input Voltage of Inverter	VBL	-0.3	27.0	V	
Invert Dimming	VDIM	-0.3	3.5	Vdc	
BL on/off	BL ON	-0.3	5.5	Vdc	
ESD for Connector	VESD	-250	250	V	*5)
ESD for Module	VESD	-15	15	KV	*5)
Operation Temperature (Surrounding)	Top	0	50	℃	*1) *2) *3) *4)
Storage Temperature	Tstg	-20	60	℃	*1) *2) *3) *4)
Delayed Discharge Time	TD	--	1	sec	*6)

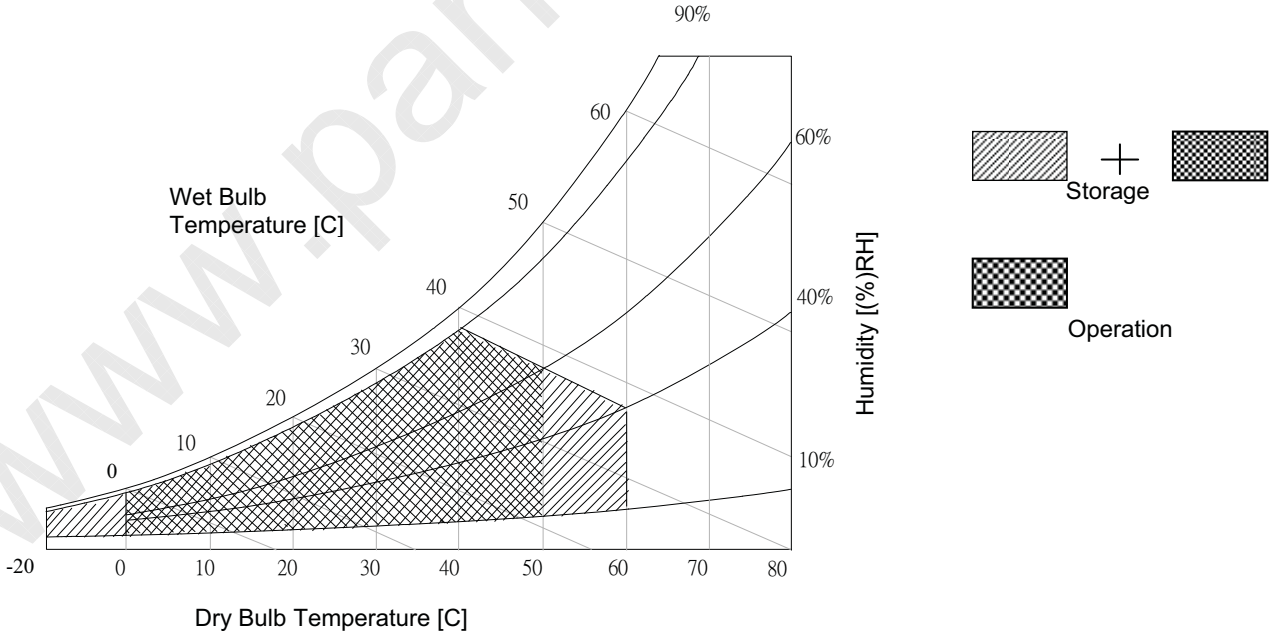
[Note]

*1) The relative temperature and humidity range are as below sketch.(90%RHMax / Ta≦40℃)

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

*3) If you use the product in a environment which over the definition of temperature and humidity too long, and it will effect the result of visible inspection.

*4) While the product operates in normal temperature range, the center surface of panel should be under 60℃.
Humidity ≦85%RH without condensation.
Relative Humidity ≦90% (Ta≦ 40℃)
Wet Bulb Temperature ≦39℃ (Ta≧40℃)



*5) Test Condition: IEC 1000-4-2 VESDt: Contact discharge to input connector; VESDC: Contact discharge to module.

*6) Delay lighting testing needs the volt above start voltage Vrms. Before the procedure tube needs typical lighting for 1 minute and stay in the temperature 25±2℃ for 24 hours and then testing in the same condition in dark room.

3. ELECTRICAL CHARACTERISTICS

3.1 TFT-LCD MODULE

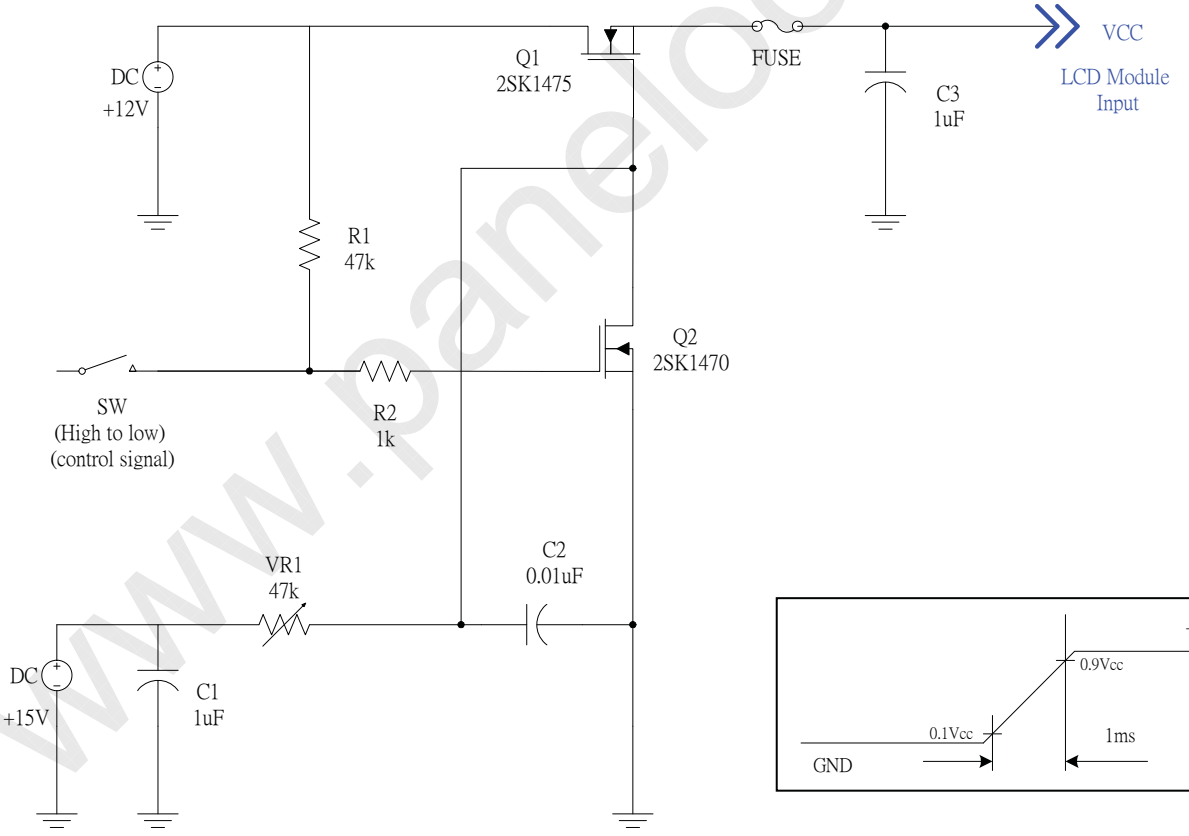
Ta=25℃

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	VCC=+12.0V
Rush Current		Irush	--	--	4	A	*2)
LCD Power Supply Current	White	ICC	--	700	900	mA	*3)
	Black		--	450	600		
	RGB stripe		--	700	900		
LCD Power Consumption		Pc	--	9	12	W	
High Input Voltage of LVDS		V_{IN+}	--	--	100	mV	[Note 4]
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.

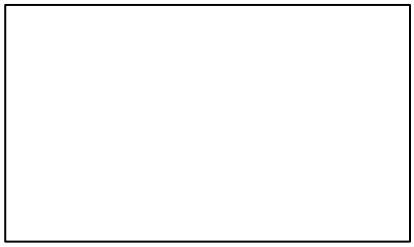
*2) Measure conditions:



VCC rising time is 0.5 ms

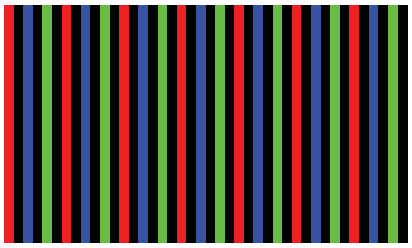
*3) The specified power supply current is under condition at Vcc=12V, Ta=25±2℃, f_v=60Hz, whereas a power dissipation check pattern below is displayed.

a. White pattern

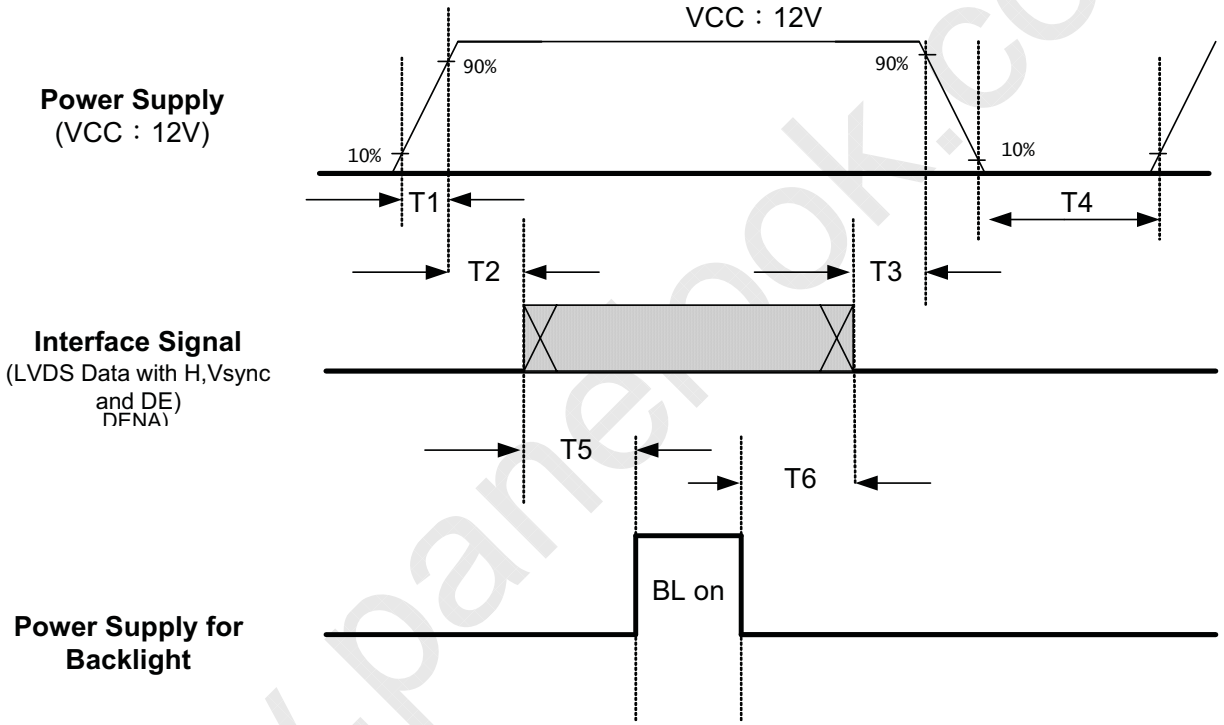


b. Black pattern

c. RGB Stripe pattern



*4) Power and Signal Sequence:



Power Sequence Table

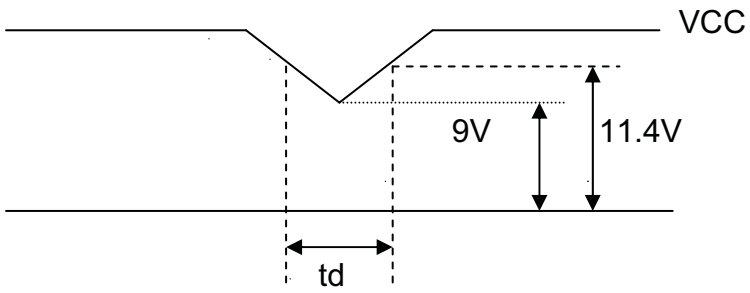
Parameter	Value			Unit
	Min	Typ	Max	
T1	0.5	---	30	ms
T2	1	---	50	ms
T3	0	---	50	ms
T4	2000	---		ms
T5	110	---		ms
T6	100	---		ms

Notes:

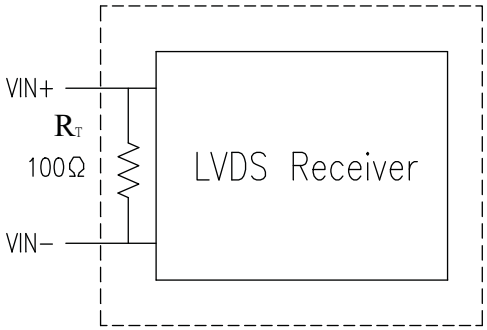
- Please avoid floating state of interface signal at invalid period.
- When the interface signal is invalid, be sure to pull down the power supply for LCD to 0V.
- Lamp power must be turn off after power supply for LCD interface signal valid.

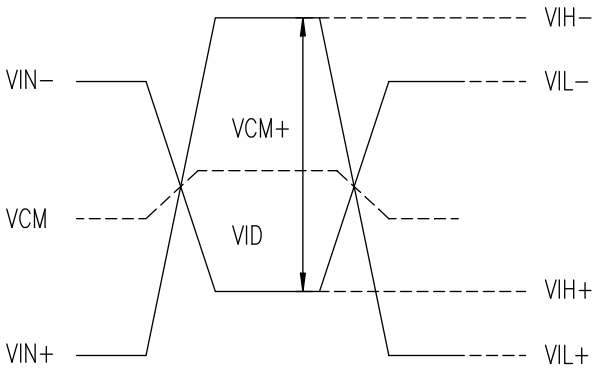
VCC-dip state :

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,

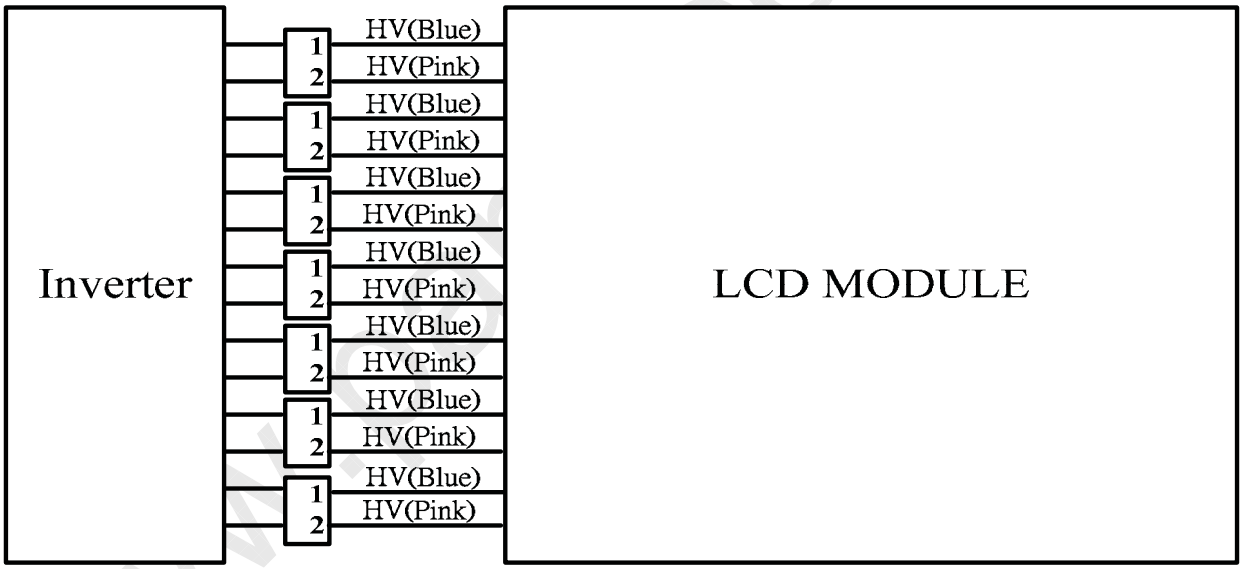
VIN+: Positive Polarity differential DATA & CLK input

VIN-: Negative Polarity differential DATA & CLK input

3.2 BACKLIGHT

Ta = 25°C,VCC=12V, Turn on for 30 minutes

Item		Symbol	Min.	Typ.	Max.	Unit	Note
Lamp Life Time		LT	50000	--	--	hr	*1)
Input Voltage		VIN	21.6	24.0	26.4	V	*2)
Input Current		IIN	--	4.38	5.2	A	*3)
Internal Dimming Control Voltage		PDIM	0	--	3.3	V	*4)
Inverter Duty Ratio		D	20	--	100	%	
PWM Dimming Control Frequency		FPWM	100	180	350	Hz	
ON/OFF Control Voltage	ON	ON/OFF	2.0		5.0	V	
	OFF		0		0.8		
Power Consumption (Backlight)		BLW	--	105	132	W	*3)



*1) Definition of the lamp life time: When lamp luminance redue to 50% or lower than its initial value.
*2) Ripple voltage that occur at the instant of power-on can't exceed 27V.
*3) Max value of the power consumption and input current is measured at initial turn on of the backlight.
*4) Internal PWM control with Analog input voltage.
Brightness is the darkest when P_{DIM} = 0V;
Brightness is the brightest when P_{DIM} = 3.3V

4. INTERFACE PIN CONNECTION

4.1 Connector Part No.: 20364-030E(I-PEX)

Pin NO	Symbol	Description	Note
1	NC	Reserved	*1)
2	NC	Reserved	*1)
3	NC	Reserved	*1)
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	DMS	LVDS DATA MAPPING	*2)
22	NC	NC	*1)
23	GND	Ground	
24	GND	Ground	
25	GND	Ground	
26	VCC	12V	
27	VCC	12V	
28	VCC	12V	
29	VCC	12V	
30	VCC	12V	

[Note 1] NC : Must let it open

[Note 2] LVDS OPTION PIN (DMS) :

DMS (Pin 21)	LVDS format
Low / Open	JEIDA
High 3.3V	Non- JEIDA

4.2 LVDS Interface :

LVDS Receiver : Tcon (LVDS Rx merged)

	LVDS pin	JEIDA-DATA	Non-JEIDA-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 – CONNECTOR:

Connector (Receptacle): 20022WR -14AML (YEONHO) or compatible.
Mating connector (Plug): 20022HS -14L (YEONHO) or compatible.

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	ERR.	Error Detection High : NG Low : Normal	
12	ON/OFF	B/L On: NC / High (2.0 ~ 5.0V) B/L Off: GND (0~0.8V)	
13	IPW	Internal PWM with analog input (Max : 3.3V; Min : 0V)	*1)
14	NC	NC	

[Note]

*1) Internal PWM is DC level signal using Saw Tooth Wave control. PWM duty control Input for +3.3V TTL Level Signal. This Input Signal is Continuous Pulse Signal with +3.3V, TTL Level Signal Spec. If this is NC or +3.3V, 100% Duty (i.e. +3.3V, DC level), Back Light should perform 100% Luminance. Duty Ratio of this Input signal should be proportional relationship in certain range of control without any kind of inherent side effect like Waterfall effect on Screen. Guaranteed Duty Range and Dimming Ratio should be specified with supplementary measurement result.

5. INTERFACE TIMING (DE Mode Only)

5.1 TIMING SPECIFICATION

ITEM				SYMBOL	MIN.	TYP.	MAX.	UNIT
LCD Timing	DCLK		Freq.	f_{CLK}	62	80	84	MHz
			Cycle	t_{CLK}	14.7	12.5	11.9	ns
	DENA Mode	Horizontal	Line Rate	f_H	37.1	48.6	56	kHz
			Horizontal Total Time	t_H	1575	1648	1936	t_{CLK}
			Horiaontal Effective Time	t_{HA}	1366	1366	1366	t_{CLK}
			Horizontal Blank Time	t_{HB}	209	282	570	t_{CLK}
		Vertical	Frame Rate	Fr	47	60	63	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

[Note]

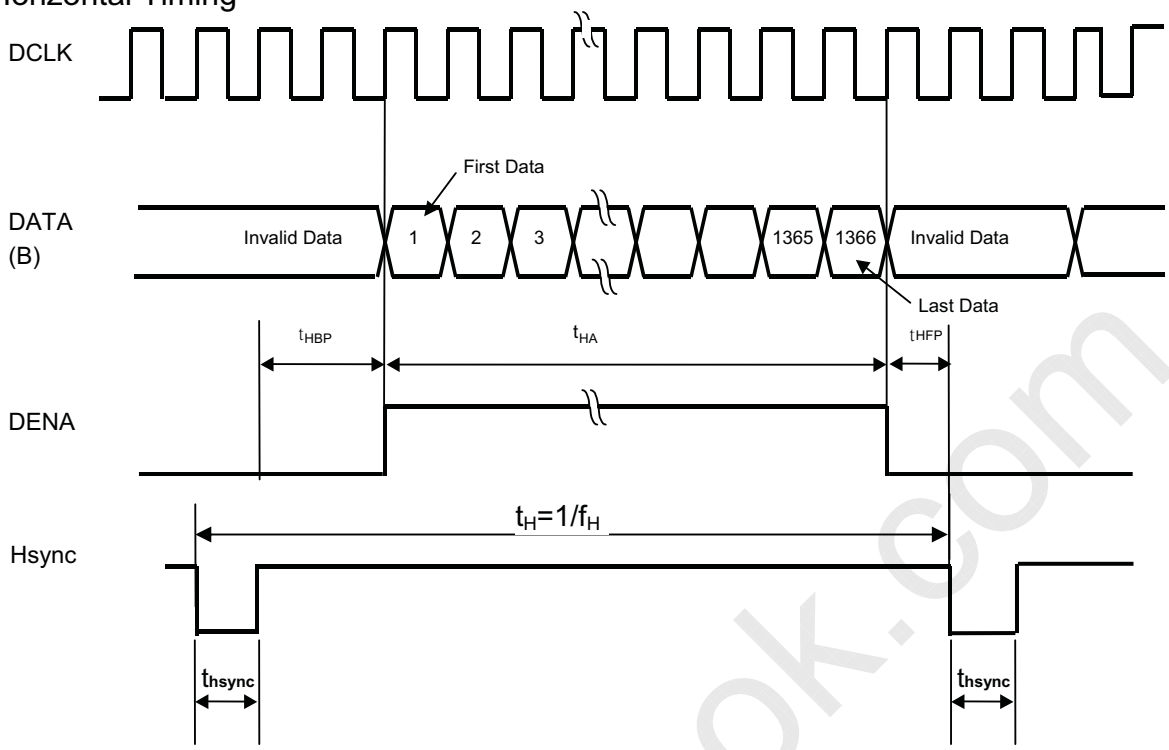
*1) The best result of over-driving is in frame rate = 60Hz.

*2) PAL: 47~53Hz, NTSC: 57~63Hz.

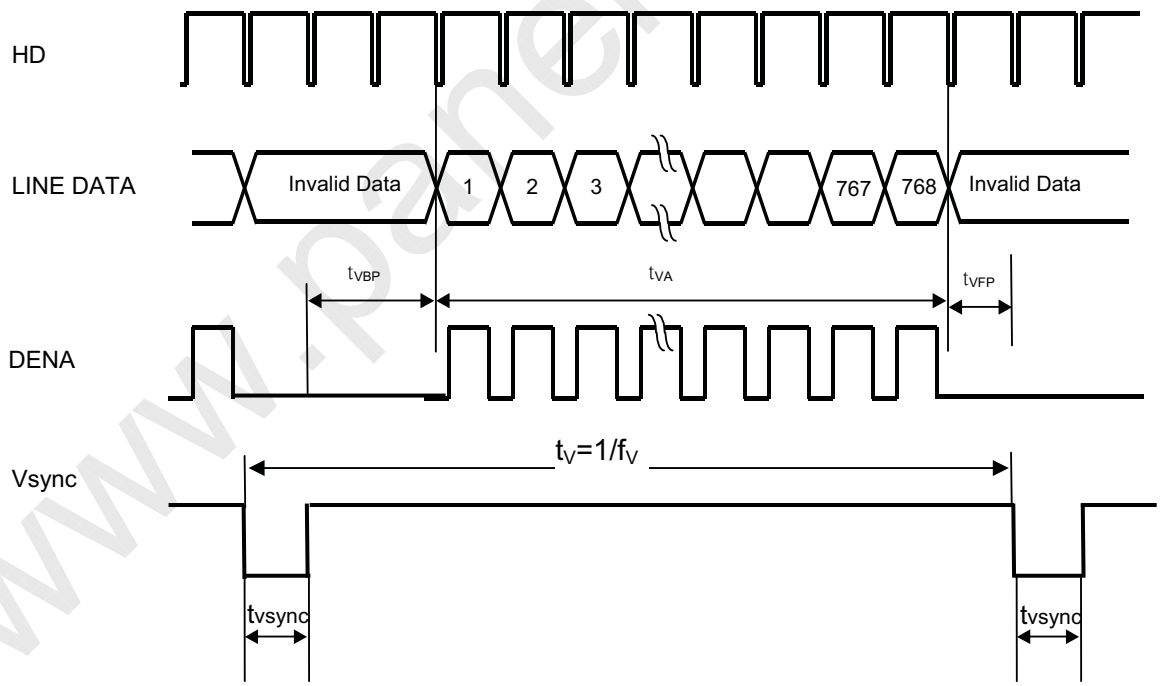
*3) Vsync and Hsync should be keep the above specification.

5.2 TIMING CHART

a. Horizontal Timing

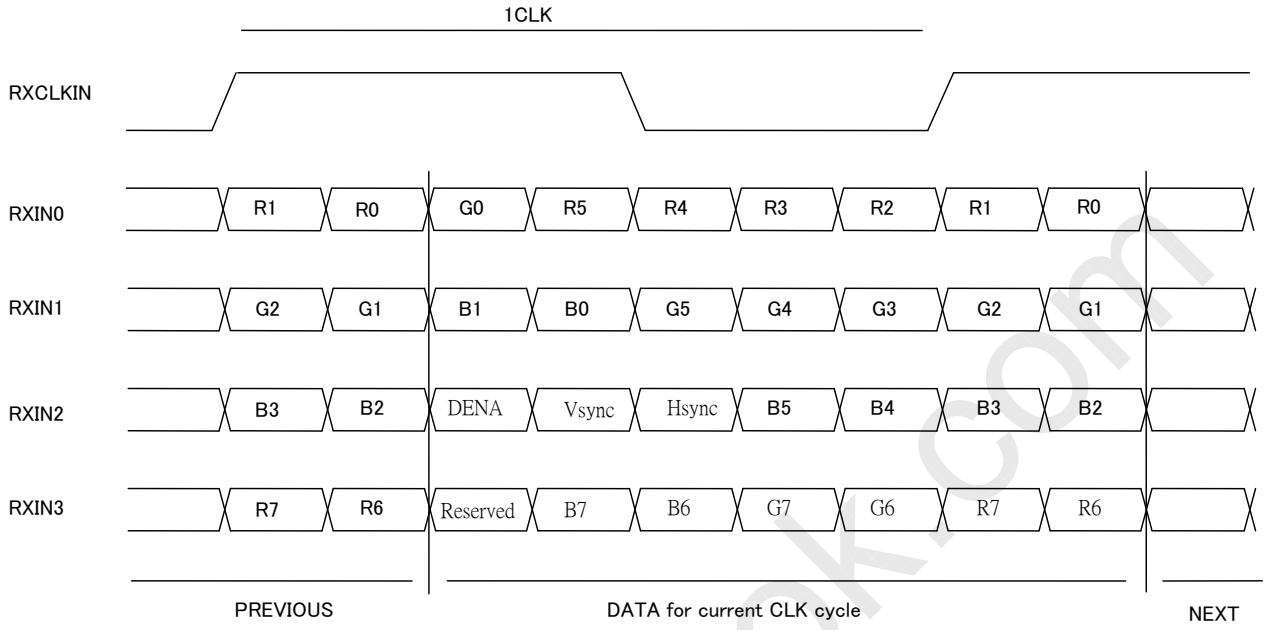


b. Vertical Timing Chart

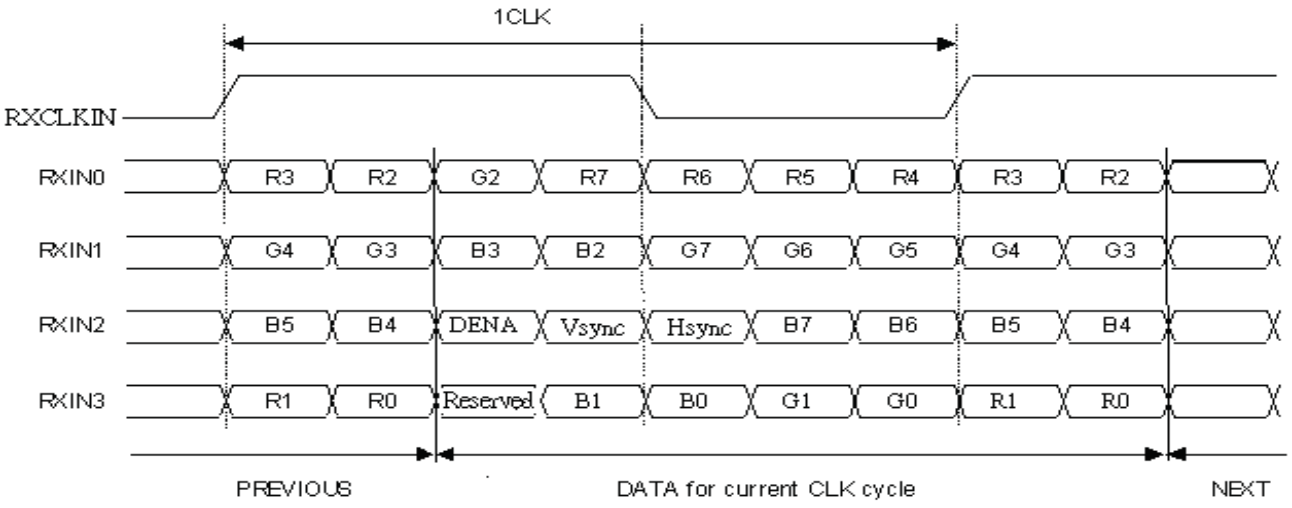


5.3 LVDS DATA MAPPING

a.Non-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
JEIDA : 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-	RxIN0+ RxIN0-	R2
52	TA1			R3
54	TA2			R4
55	TA3			R5
56	TA4			R6
3	TA5			R7 (MSB)
4	TA6			G2
6	TB0	TxOUT1+ TxOUT1-	RxIN1+ RxIN1-	G3
7	TB1			G4
11	TB2			G5
12	TB3			G6
14	TB4			G7 (MSB)
15	TB5			B2
19	TB6			B3
20	TC0	TxOUT2+ TxOUT2-	RxIN2+ RxIN2-	B4
22	TC1			B5
23	TC2			B6
24	TC3			B7 (MSB)
27	TC4			Hsync
28	TC5			Vsync
30	TC6			DENA
50	TD0	TxOUT3+ TxOUT3-	RxIN3+ RxIN3-	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	B DATA								G DATA								B DATA							
		B7 MSB	B6	B5	B4	B3	B2	B1	B0 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

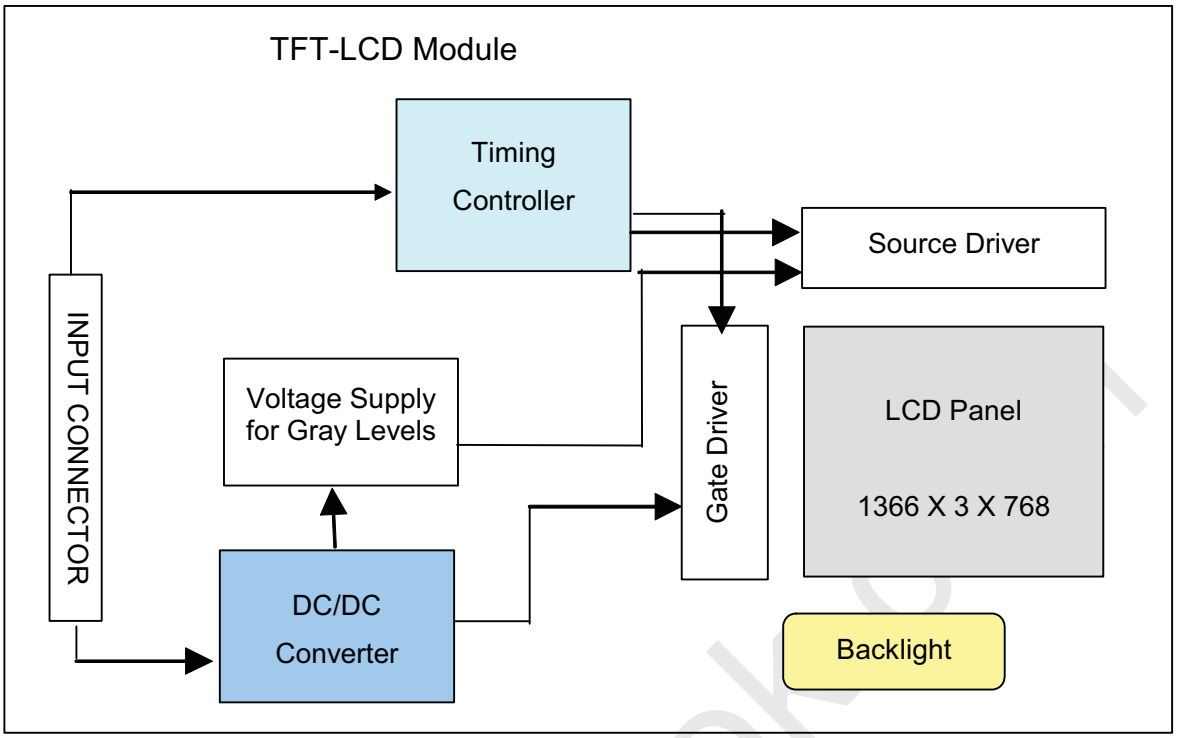
[Note]

1) Definition of gray scale:

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

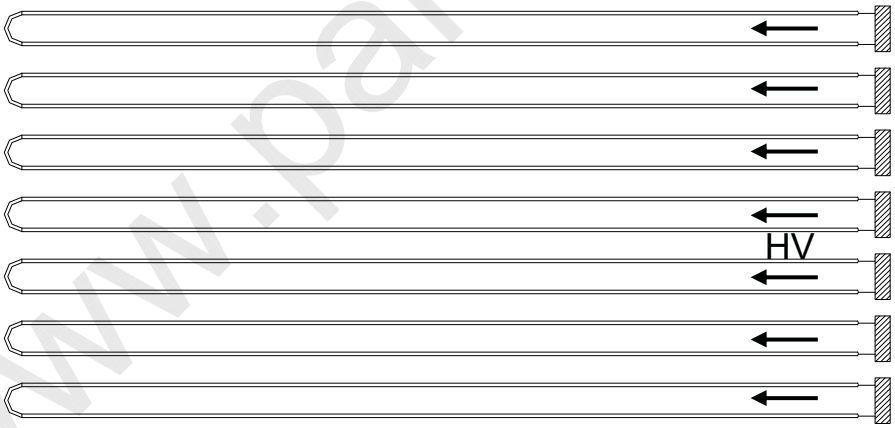
2) Data: 1-High level voltage, 0-Low level voltage

6. BLOCK DIAGRAM



BACKLIGHT UNIT

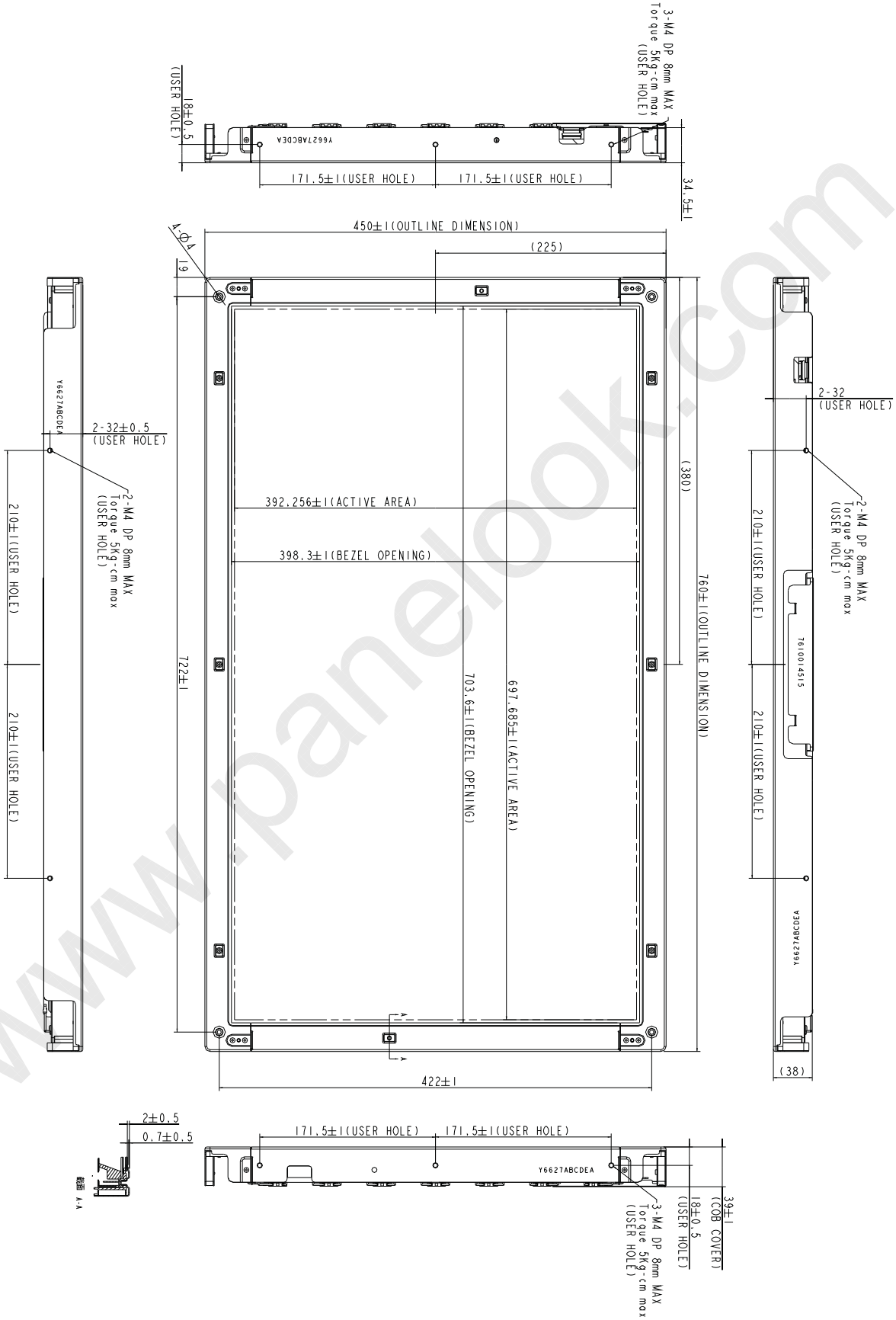
Lamp connector
HV : CP0404SL000 (CVILUX)*7 or compatible
Mating connector : CP042CP1ML0-LF (CVILUX)*7 or compatible



7. MECHANICAL SPECIFICATION

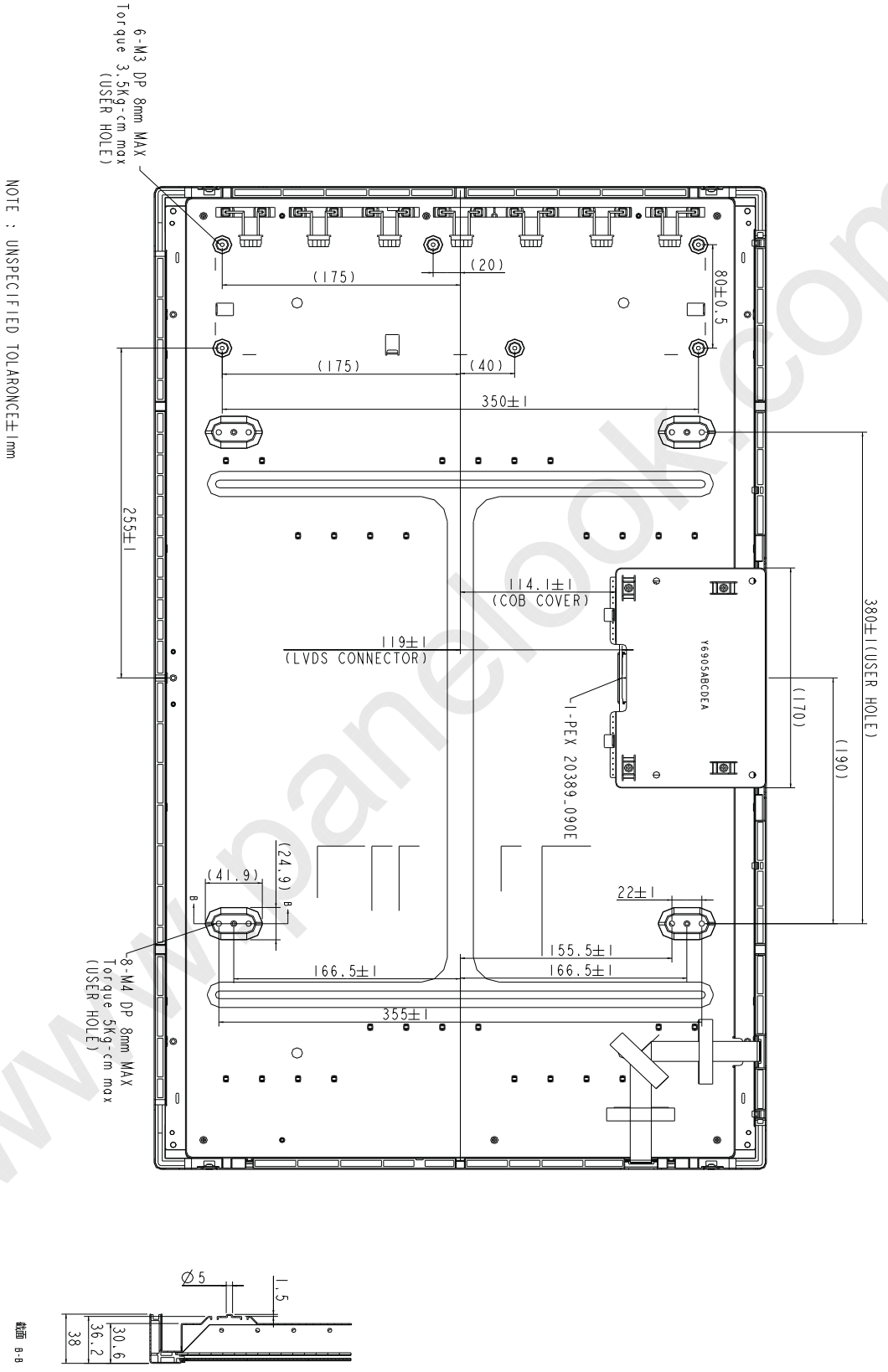
7.1 FRONT SIDE (include inverter, if the sizes of a panel don't show the differential value, please follow the values show as differential range table.)

[Unit: mm]



7.2 REAR SIDE

(include inverter, if the sizes of a panel don't show the differential value, please follow the values show as differential range table.) [Unit: mm]



8.OPTICAL CHARACTERISTICS

Ta = 25°C, VCC=12V Turn on for 30 minutes

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	Remarks
Contrast (CEN)		CR	θ=ψ= 0° Point-5	1000	1500	--	--	*1)*2)*3)
Luminance	Central Luminance	Lwc	θ=ψ= 0°	380	500	--	cd/m^2	*6)
	5P Luminance (AVG)	Lw5	θ=ψ= 0°	--	430	--	cd/m^2	*2)*3)
Response Time (Gray to Gray Average)		trg , tfg	θ=ψ= 0°	--	8	15	ms	*4)
View Angle	Horizontal	Ψ	CR ≧ 20 Point-5	-80~80	-88~88	--	°	*2)*3)
	Vertical	θ		-80~80	-88~88	--	°	*2)*3)
Color Temperature Coordinate	Red	Rx Ry	θ=ψ= 0° Point-5	0.030 0.310	0.650 0.340	0.680 .0.370	--	*2)*3)
	Green	Gx Gy		0.249 0.580	0.279 0.610	0.309 0.640		
	Blue	Bx By		0.115 0.039	0.145 0.069	0.175 0.099		
	White	Wx Wy		0.250 0.260	0.280 0.290	0.310 0.320		
Color Temperature		Tc		--	10000	--	K	*3)
Color Gamut		CG		--	75	--	%	*5)

[Note]

Color Temperature Coordinate

These items are measured using : BM-5A (TOPCON)

[Under the dark room condition (no ambient light)]

Definition of these measurement items is as follows:

*1) Definition of Contrast Ratio :
CR=ON (White) Luminance/OFF (Black) Luminance

*2) Definition of Luminance and Luminance uniformity and 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.

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

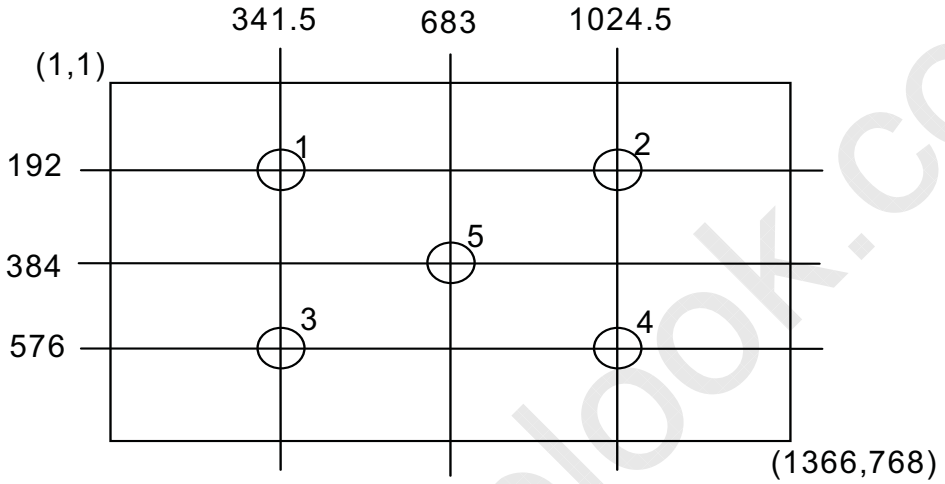


Figure 8-1. Measurement positions

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

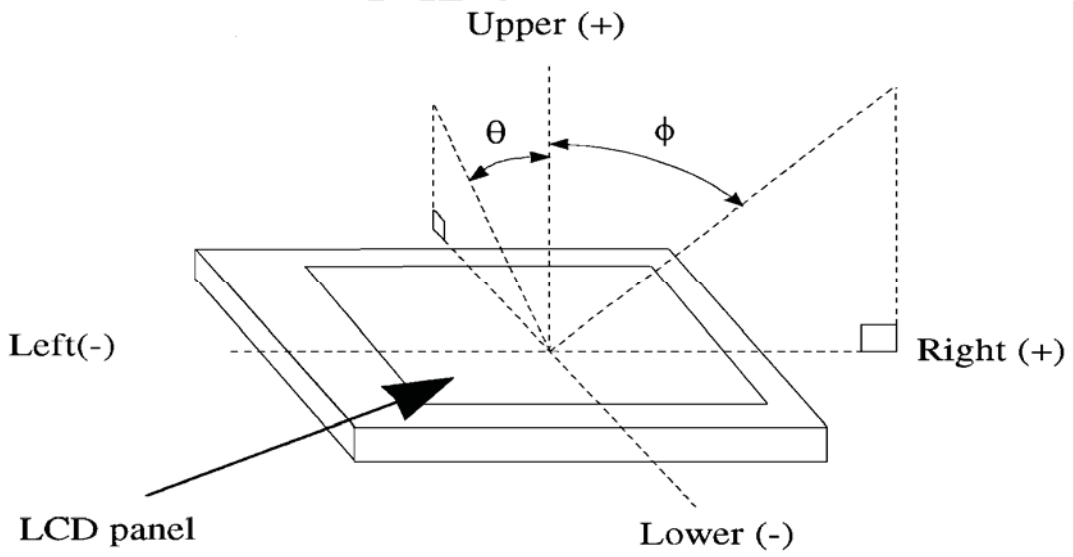


Figure 8-2. Definition of Viewing Angle

*4) Definition of Response Time (Gray to Gray Average)

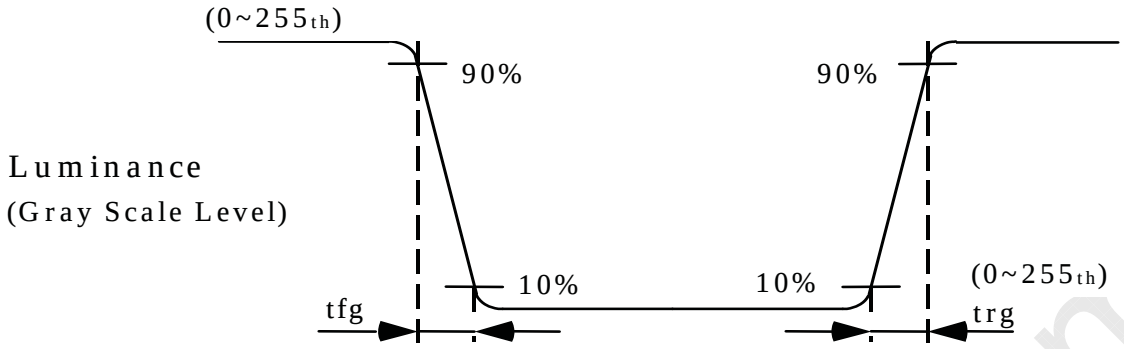


Figure 8-3. Definition of Response Time (Gray Scale Level)

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.

*5) 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}.

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

*6) Definition of Central Luminance:
After lighting on the panel 30 mins, you can proceed the Central Luminance testing.
The definiton of Typ value is under status of Inverter Dimming Voltage=3.3V.

9.RELIABILITY TEST CONDITIONS

9.1 ENVIRONMENT TEST CONDITION

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 & 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: each x, y, z axis : 10 min, total 30 mins

9.3 ESD TEST

Test Item	Test statements
Connector	200 pF, 0 Ω, ±250 V By using contact-mode to discharge each pin one time and then check the module frame.
Module	150pF, 330Ω, ±15KV 1.Under test conditions, by using air-mode to discharge each test point 25 times continuously and then check the module frame. 2.Under test conditions, by using contact-mode to discharge each test point of panel frame 25 times continuously and then check the module frame.

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. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

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

10.1 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 so as not to put stresses on LCD all sides and not to 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 give stress to lamp cable, or not to interface the LCD module by the lamp cable.
- Keep sufficient clearance between LCD module and the others 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, surface of LCD panel is 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 FPCs during handling LCD module. If pressing rear part is unavoidable, 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.

10.2 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.
(3) Please consider that LCD backlight takes longer time to become stable of radiation characteristics in low temperature than in room temperature.
(4) A condensation might happen on the surface and inside of LCD module in case of sudden change of ambient temperature.
(5) Please pay attention to displaying the same pattern for very long time. Image might stick on LCD. If then, time going on can make LCD work well.
(6) Please obey the same caution descriptions as ones that need to pay attention to ordinary electronic parts.

10.3 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.

10.4 STORAGE PRECAUTIONS

(1) When you store LCDs for a long time, it is recommended to keep the temperature between 0℃ ~40℃ without the exposure of sunlight and to keep the humidity less than 90%RH.
(2) Please do not leave the LCDs in the environment of high humidity and high temperature such as 60℃ 90%RH.
(3) Please do not leave the LCDs in the environment of low temperature; below -20℃.

10.5 SAFETY PRECAUTIONS

(1) When you waste LCDs, it is recommended to crush damaged or unnecessary LCDs 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 throughly with soap and water.

10.6 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 to a panel side of LCD module not to 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 LCDs from the damage or scratching during transportation. Please do not open except picking LCDs 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 LCDs are made of cardboard. So please pay attention not to get them wet or keeping them in high humidity or wet place.