Chunghwa Picture Tubes, Ltd.
Technical Specification

To : **YIH HSING ENTERPRISE CO., LTD**
Date : 2005/9/07

CPT TFT-LCD

CLAA201WA 01Y

ACCEPTED BY：

APPROVED BY	CHECKED BY	PREPARED BY
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1. OVERVIEW

CLAA201WA01 is 20.1”(51.11cm) color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, LVDS driver ICs, control circuit and backlight(CCFL, 6 tubes). By applying 8 bit digital data, 1680×1050, drived by 5 voltages,16.7M-color images are displayed on the 20.1” diagonal screen. The module structure is fixed by iron frame,without the inverter for the backlight. Interface of data and control signals is typ.General specification are summarized in the following table:

ITEM	SPECIFICATION
Display Area (mm)	433.44 (H) × 270.9 (V) (20.1-inch diagonal)
Number of Pixels	1680 (H) × 1050(V)
Pixel Pitch (mm)	0.258(H) × 0.258(V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	NormallyWhite, TN
Number of Colors	16.7M(8bits+RGB)
Optimum Viewing Angle	6 o’clock
Brightness (cd/m^2)	300cd/m^2 (Typ.)(center, 6.0mA)
Viewing Angle	140/130(Typ.)
Wide Viewing Angle Technology	Super Wide View Film
Surface Treatment	Anti-glare,3H,HC
Color Saturation	72%(Typ.)
Total Module Power (W)	34.0(Typ.) (w/o Inverter)
Module Size (mm)	459.4(W) × 296.4(H) × 21.6(D) (Typ.)
Module Weight (g)	3100(max)
Backlight Unit	CCFL, 6 tubes(top × 3/bottom × 3) , Edge light

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	Remark
Power Supply Voltage For LCD	VCC	0	6.5	V	--
Lamp Voltage	VL	(670)	(810)	Vrms	--
Lamp Current	ILO	(3)	(6.5)	mArms	*4). 7)
Lamp Frequency	FL	(40)	(80)	kHz	--
Electrostatic Voltage	VESDt	-200	200	V	*5)
	VESDc	-8000	8000	V	
Operation Temperature (Surrounding)	Top	(0)	(50)	℃	*1). 2). 3). 6)
Storage Temperature	Tstg	(-20)	(60)	℃	*1). 2). 3)
Delayed Discharge Time	TD	--	1	sec	*8)

[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 to effect the result of eye-atching.

*4) Product life-time related to lamp current, pls operate the production follow statement at page 9 CN2, 4 (BACKLIGHT)

*5) The testing conditions are according to IEC 1000-4-2 specification：

VESDt：By using contact-mode to discharge each pin of the connector.

VESDc：By using contact-mode to discharge the module.

*6) If you operate the product 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℃)

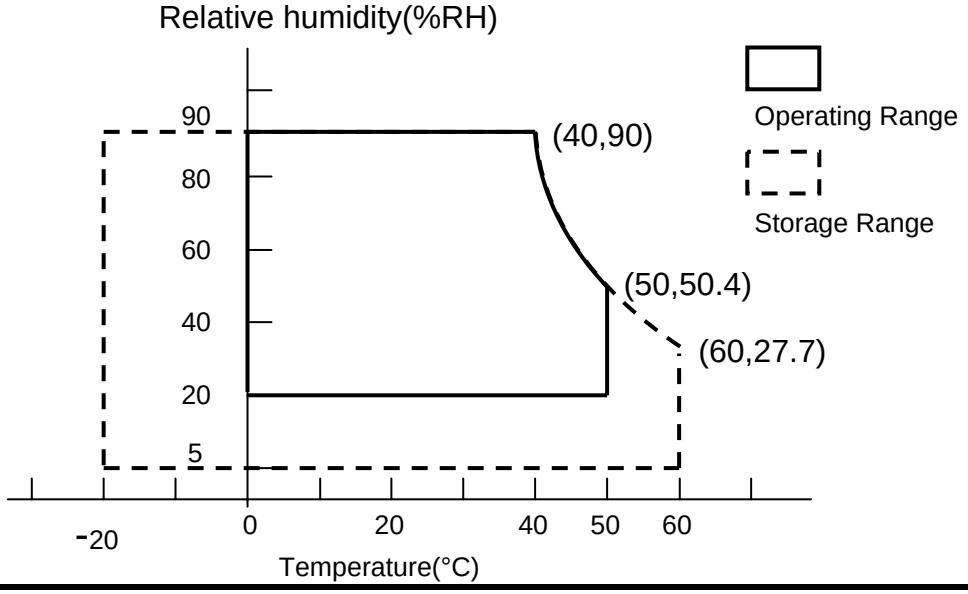
*7) When lamp current over the definition of absolute maximun, product life-time will decay rapidly or operate unusual.

If for special request testing,then the minimun value of current is 2mA.It is not to promise product life-time and lighting in normally situation.

*8) Delayed discharge time test condition:

Starting lamp voltage = 1750Vrms

Before test TD, lamp should operate at least 1min. , and lamp current should follow typical lamp current specification. To place panel at room temp. (25+/- 2℃) below for 24hr, and then to measure TD with the same starting lamp voltage in dark room.



3. ELECTRICAL CHARACTERISTICS

(1) TFT-LCD Ta=25 ℃

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Power Supply Voltage for LCD		VCC	4.5	5.0	5.5	V	*1)
Power Supply Current for LCD		ICC	--	800	1500	mA	*2)
Permissive Ripple Voltage for Logic		VRP	--	--	100	mVp-p	VCC=5.0V
Differential Resistance		Zm	90	100	110	Ω	
LVDS: IN+，IN-	The same motion input Voltage	VCM	1.125	1.25	1.375	V	*3)
	Differential input Voltage	| VID |	250	350	450	mV	
	High electric potential threshold voltage	VTH	-	-	100	mV	
	Low electric potential threshold voltage	VTL	-100	-	-	mV	
LCDInrush Current		Inrush	-	-	3	A	*4)
Power consumption		P	-	4	7.5	W	*2)

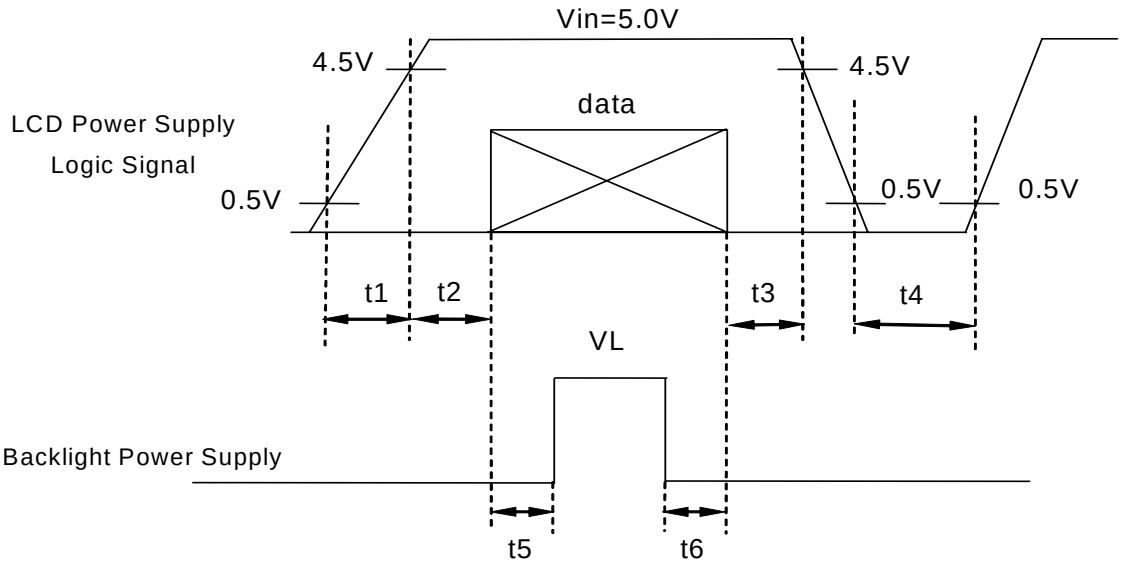
[Note]

*1) Power、data sequence

t1≦10ms 1 sec≦t4

0＜t2≦50ms 200ms≦t5

0＜t3≦50ms 200ms≦t6

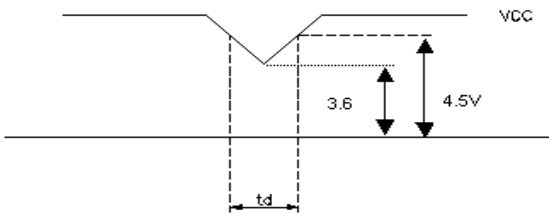


Data: RGB DATA, DCLK, DENA

VCC-dip State：

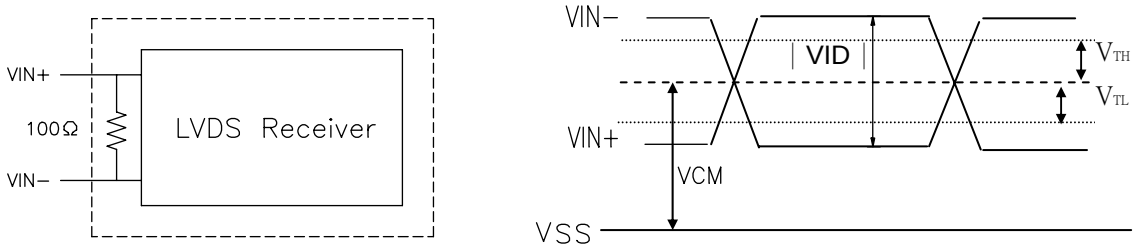
3.6 V≦VCC＜4.5V，td≦10 ms

VCC＜3.6V，it works abnormal that must reset power. VCC dip conditions should follow VCC turn on conditions.



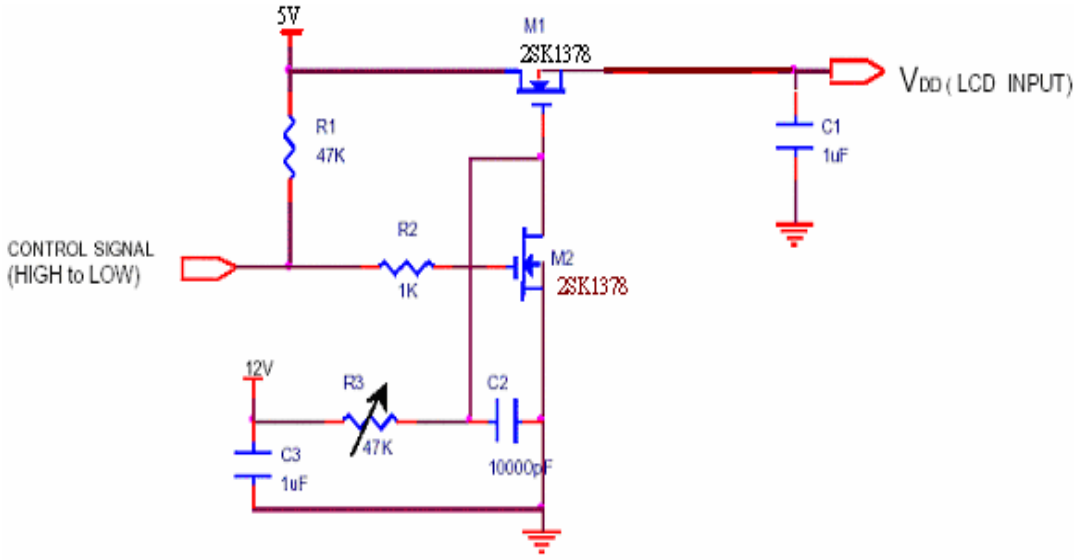
*2) Typical value is measured when displaying horizontal gray scale line pattern:
64 gray level, 1680 line mode
VCC=5.0 V，f_H=65 kHz，f_V=60 Hz，f_{CLK}=73.5 MHz

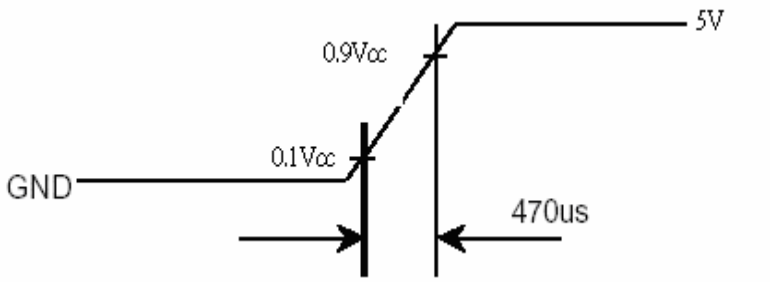
*3) LVDS Signal definition :



VIN+：Positive differential DATA & CLK Input
VIN-： Negative differential DATA & CLK Input

*4) Inrush Measurement Condition





(2) Backlight

(a) Electrical Characteristics

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Lamp Voltage	VL	–	(780)	–	Vrms	IL=6.0mA Ta=25℃
Lamp Current(Standar)	IL	5.5	6.0	6.5	mArms	*1) Ta=25℃
Lamp Current(Operation)	ILO	(3.0)	6.0	6.5	mArms	*1) Ta=25℃
Lamp Power Consumption*6) (for reference)	WL	–	(28)	–	W	IL=6.0mA Ta=25℃
Inverter Frequency	FI	(40)	(50)	(60)	kHz	*1) Ta=25℃
Starting Lamp Voltage	VS	(1750)	–		Vrms	Ta=0℃
		(1630)	–		Vrms	Ta=25℃

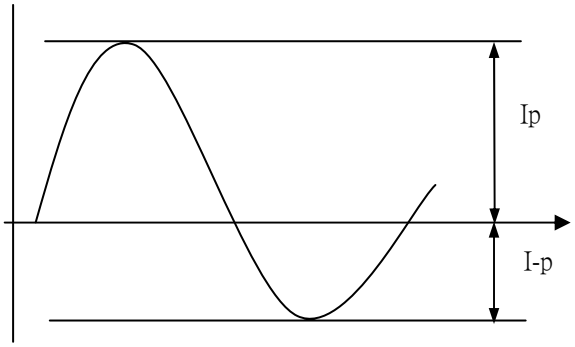
(b) Lamp Life Time

ITEM	IL at 3.0 mA	IL at 6.0 mA	IL at 6.5 mA	UNIT	REMARK
Lamp Life Time	--	Min. 50,000	--	hr	Continuous Operation*3)
Turn-on and Turn-off Operation	--	Min.100,000	--	time	Continuous Operation*4)

[Note] Inverter vender : Sampo, model : DIVLCP0459D66－－

If the waveform of light up-driving is asymmetric, the distribution of mercury inside the lamp tube will become unequally or will deplete the Ar gas in it. Then it may cause the abnormal phenomenon of lighting-up. Therefore, designers have to try their best to fulfill the conditions under the inverter designing-stage as below:

- The degrees of unbalance： ＜10%
- The ratio of wave height：＜$\sqrt{2}$ ±10%



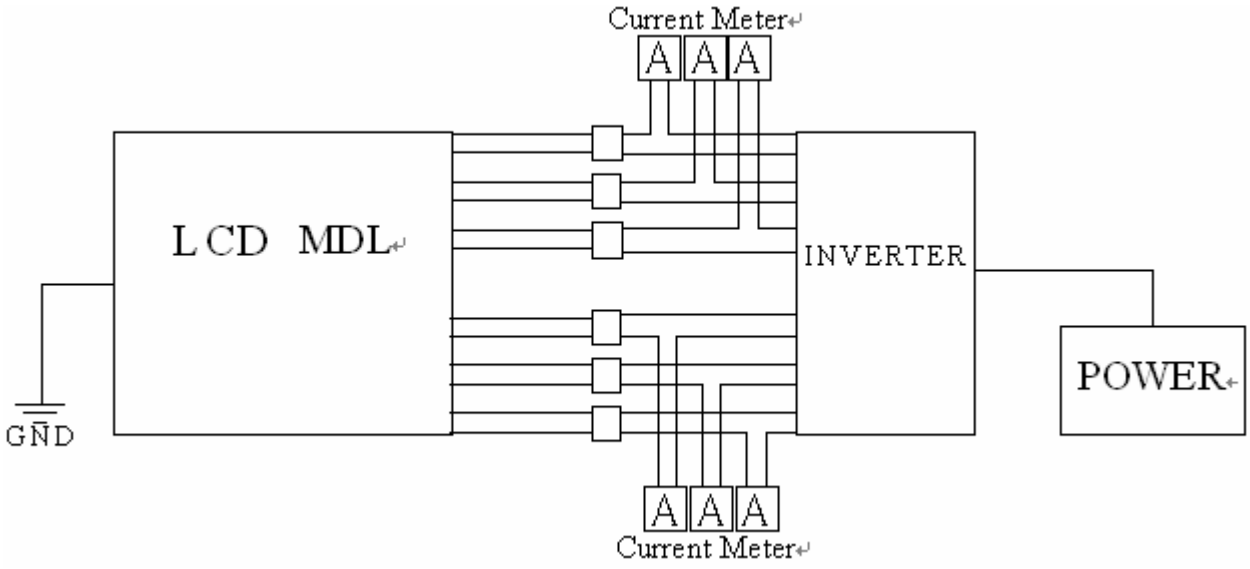
Ip：high side peak

I-p：low side peak

A：The degrees of unbalance = ｜Ip – I-p｜/ Irms ×100 (%)

B：The ratio of wave height = Ip (or I-p) / Irms

*1) Lamp Current measurement method (The current meter is inserted in cold line)



*2) Frequency in this range can make the characterisitics of electric and optics maintain in +/- 10% except hue.
Lamp frequency of inverter may produce interference with horizontal synchronous frequency,and this may cause horizontal beat on the display. Therefore, please adjust lamp frequency, and keep inverter as far from module as possible or use electronic shielding between inverter and module to avoid the interference.
Under optimum operate frequency range (50~80 KHz), will not effect panel life-time and relability .

*3) Definition of the lamp life time：
a. Luminance (L) under 50% of specification starting lamp voltage
b. Starting Lamp Voltage: over130% of the initial value. Ta=25℃

*4) The condition of Turn-on and Turn-off operation is as below:
a. Lamp current is 6.0mA
b. Frequency is 10 sec.(on)/10 sec.(off)
c. Repeat it for 100 thousand times
d. The lamp hue variation must smaller than 0.03
e. It should not have motion fail when starting lamp voltage is lower than 130%of the initial value.

*5) For keeping good lighting situation ,when design the inverter,it must be considered that the voltage large than starting lamp voltage.

*6) WL=IL x VL x 6。(IL=6mA，Ta=25℃)

4. INTERFACE PIN CONNECTION

(1) CN1

Outlet connector: FI-XB30SSL-HF15(JAE) (or equivalent)

PIN NO.	REMARK	FUNCTION
1	RXO0-	minus signal of odd channel 0(LVDS)
2	RXO0+	plus signal of odd channel 0(LVDS)
3	RXO1-	minus signal of odd channel 1(LVDS)
4	RXO1+	plus signal of odd channel 1(LVDS)
5	RXO2-	minus signal of odd channel 2(LVDS)
6	RXO2+	plus signal of odd channel 2(LVDS)
7	GND	GND
8	RXOC-	minus signal of odd clock channel (LVDS)
9	RXOC+	plus signal of odd clock channel (LVDS)
10	RXO3-	minus signal of odd channel 3(LVDS)
11	RXO3+	plus signal of odd channel 3(LVDS)
12	RXE0-	minus signal of even channel 0(LVDS)
13	RXE0+	plus signal of even channel 0(LVDS)
14	GND	GND
15	RXE1-	minus signal of even channel 1(LVDS)
16	RXE1+	plus signal of even channel 1(LVDS)
17	GND	GND
18	RXE2-	minus signal of even channel 2(LVDS)
19	RXE2+	plus signal of even channel 2(LVDS)
20	RXEC-	minus signal of even clock channel (LVDS)
21	RXEC+	plus signal of even clock channel (LVDS)
22	RXE3-	minus signal of even channel 3(LVDS)
23	RXE3+	plus signal of even channel 3(LVDS)
24	GND	GND
25	NC	NC
26	NC	Test pin (Can't connect to GND)
27	NC	NC
28	VCC	Power supply input voltage(5.0 V)
29	VCC	Power supply input voltage(5.0 V)
30	VCC	Power supply input voltage(5.0 V)

1) Keep the NC Pin and don't connect it to GND or other signals.
2) GND Pin must connect to the ground, don't let it be a vacant pin.

(2) CN2,3,4,5(BACKLIGHT)

CN2、CN4：BHR-05VS-1(JST)

<Mating connector : SM04(9-E2)B-BHS-1-TB (JST)>

NO.	PIN	SYMBOL	DESCRIPTION
CN2	1	HV	High Voltage Output for CCFL Lamp 1
	2	HV	High Voltage Output for CCFL Lamp 2
	3	NC	NC
	4	LV	Low Voltage Output for CCFL Lamp 1
	5	LV	Low Voltage Output for CCFL Lamp 2
CN4	1	HV	High Voltage Output for CCFL Lamp 4
	2	HV	High Voltage Output for CCFL Lamp 5
	3	NC	NC
	4	LV	Low Voltage Output for CCFL Lamp 4
	5	LV	Low Voltage Output for CCFL Lamp 5

CN3、CN5：BHSR-02VS-1 (JST)

<Mating connector : SM02B-BHSS-1-TB (JST)>

NO.	PIN	SYMBOL	DESCRIPTION
CN3	1	HV	High Voltage Output for CCFL Lamp 3
	2	LV	Low Voltage Output for CCFL Lamp 3
CN5	1	HV	High Voltage Output for CCFL Lamp 6
	2	LV	Low Voltage Output for CCFL Lamp 6

5. INTERFACE TIMING

(1) Timing Characteristic

ITEM				SYMBOL	MIN.	TYP.	MAX.	UNIT
LCD Timing	DCLK		Freq.	f_{CLK}	45	73.5	85	MHz
			Cycle	t_{CLK}	11.8	13.6	22.2	ns
	DENA	Horizontal	Horizontal total time	t_H	1050	1135	1300	t_{CLK}
			Horiaontal effective time	t_{HA}	840	840	840	t_{CLK}
			Horizontal blank time	t_{HB}	210	295	460	t_{CLK}
		Vertical	Vertical frame Rate	Fr	(--)	60	75	Hz
			Vertical total time	t_V	1061	1080	1300	t_H
			Vertical effective time	t_{VA}	1050	1050	1050	t_H
			Vertical blank time	t_{VB}	11	30	250	t_H

[Note]

*1) DENA (data enable) usually is postive

*2) DCLK still inputs during blanking

*3) LVDS transmitter IC: :DS90C383MTD(NS) or SN75LVDS83(TI)

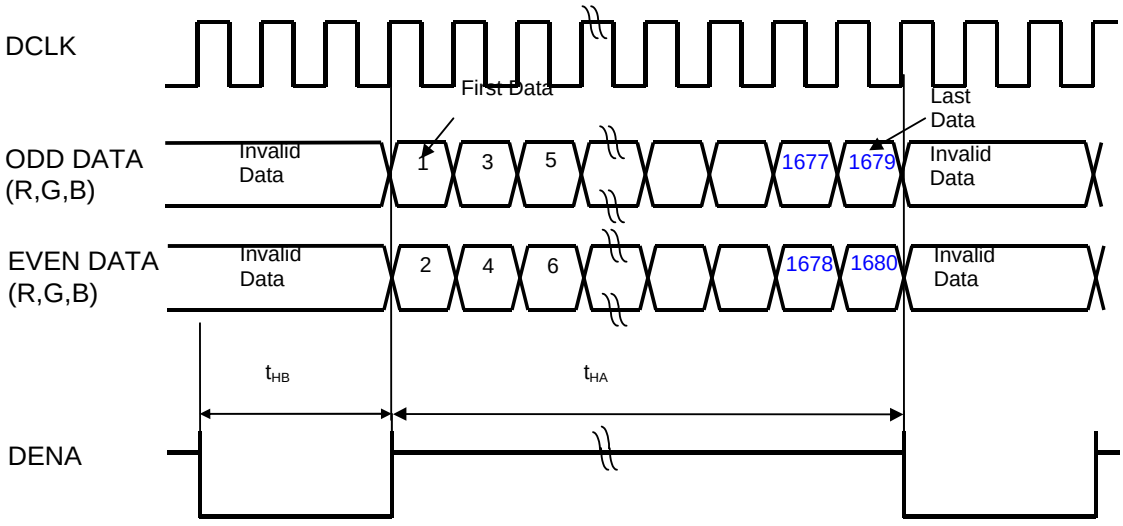
*4) LVDS IC：

Receiver	Transmitter
DS90C384MTD(NS)	DS90C383MTD(NS)
SN75LVDS82(TI)	SN75LVDS83(TI)

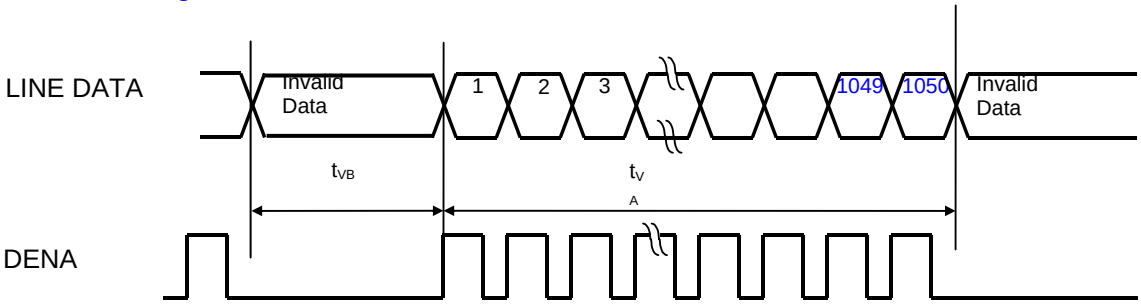
*5) DE mode only

(2) Timing Chart

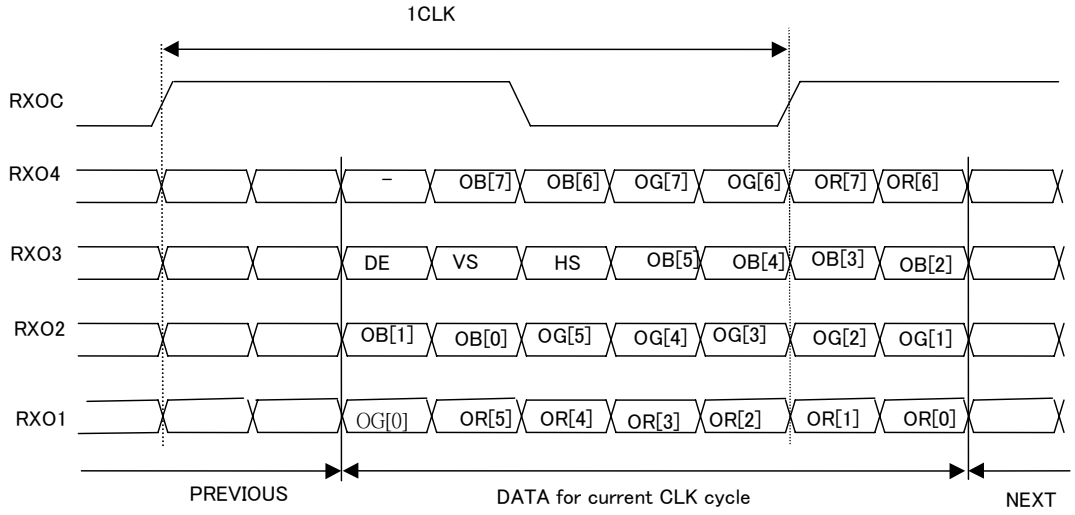
a. Horizontal Signal

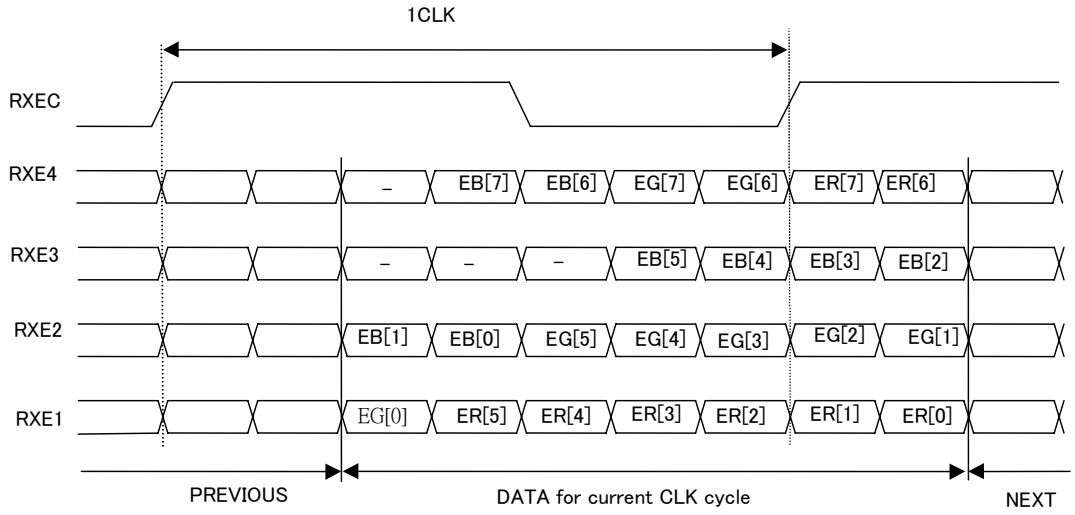


b. Vertical Signal



(3) LVDS Data


1CLK
RXOC
RXO4
RXO3
RXO2
RXO1
–
OB[7]
OB[6]
OG[7]
OG[6]
OR[7]
OR[6]
DE
VS
HS
OB[5]
OB[4]
OB[3]
OB[2]
OB[1]
OB[0]
OG[5]
OG[4]
OG[3]
OG[2]
OG[1]
OG[0]
OR[5]
OR[4]
OR[3]
OR[2]
OR[1]
OR[0]
PREVIOUS
DATA for current CLK cycle
NEXT


1CLK
RXEC
RXE4
RXE3
RXE2
RXE1
–
EB[7]
EB[6]
EG[7]
EG[6]
ER[7]
ER[6]
–
–
–
EB[5]
EB[4]
EB[3]
EB[2]
EB[1]
EB[0]
EG[5]
EG[4]
EG[3]
EG[2]
EG[1]
EG[0]
ER[5]
ER[4]
ER[3]
ER[2]
ER[1]
ER[0]
PREVIOUS
DATA for current CLK cycle
NEXT

(4) Color Data Assignment

COLOR	INPUT DATA	R DATA								G DATA								B DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB							LSB	MSB							LSB	MSB							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(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(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(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

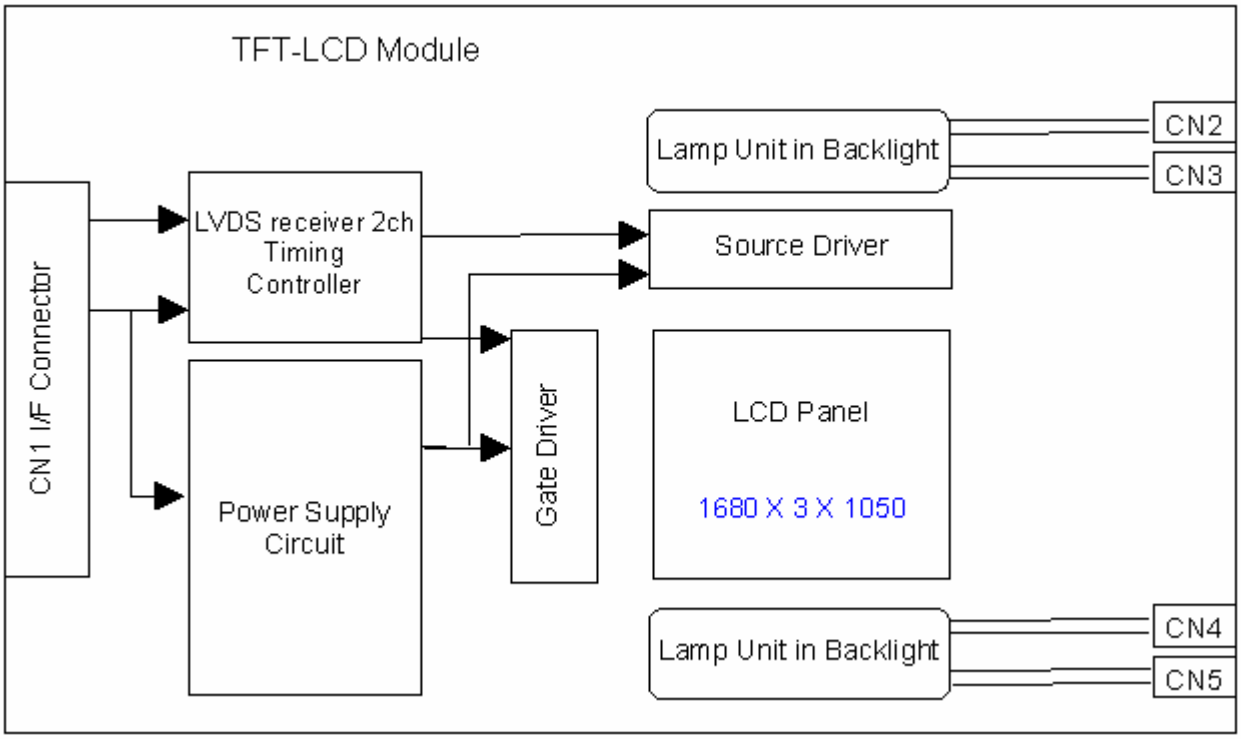
[Note]

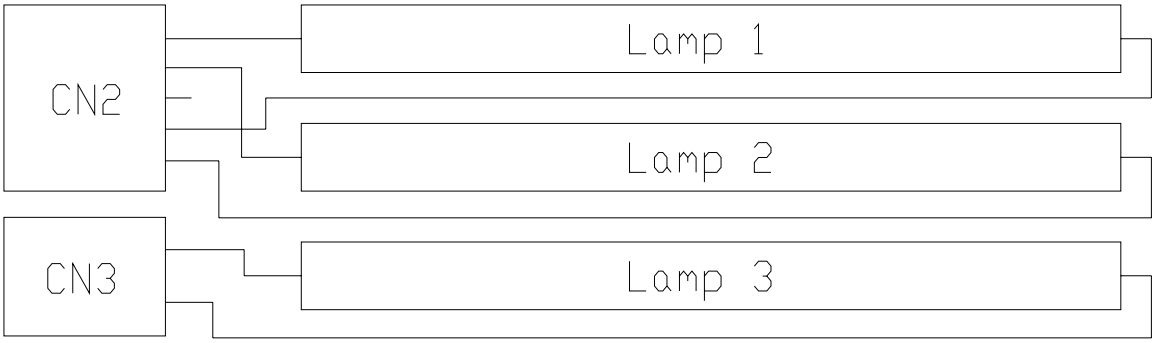
1) Definition of gray scale:
   Color (n): n indicates gray scale level; higher n means brighter level.
2) Data: 1-High, 0-Low.
3) For odd & even data also.

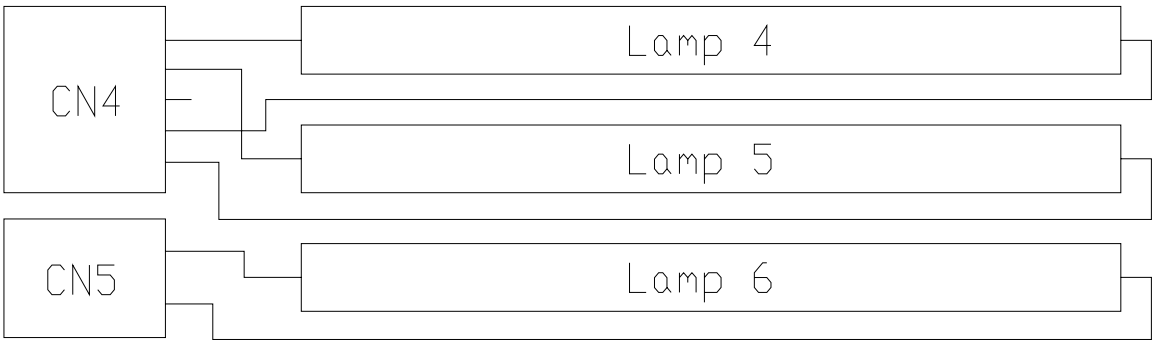
(5) Color Deta Distribution

D(1,1)	D(2,1)	..	D(X,1)	..	D(1279,1)	D(1280,1)
D(1,2)	D(2,2)	..	D(X,2)	..	D(1279,2)	D(1280,2)
..	..	+	..	+	..	..
D(1,Y)	D(2,Y)	..	D(X,Y)	..	D(1279,Y)	D(1280,Y)
..	..	+	..	+	..	..
D(1,1023)	D(2,1023)	..	D(X,1023)	..	D(1279,1023)	D(1280,1023)
D(1,1024)	D(2,1024)	..	D(X,1024)	..	D(1279,1024)	D(1280,1024)

6. BLOCK DIAGRAM

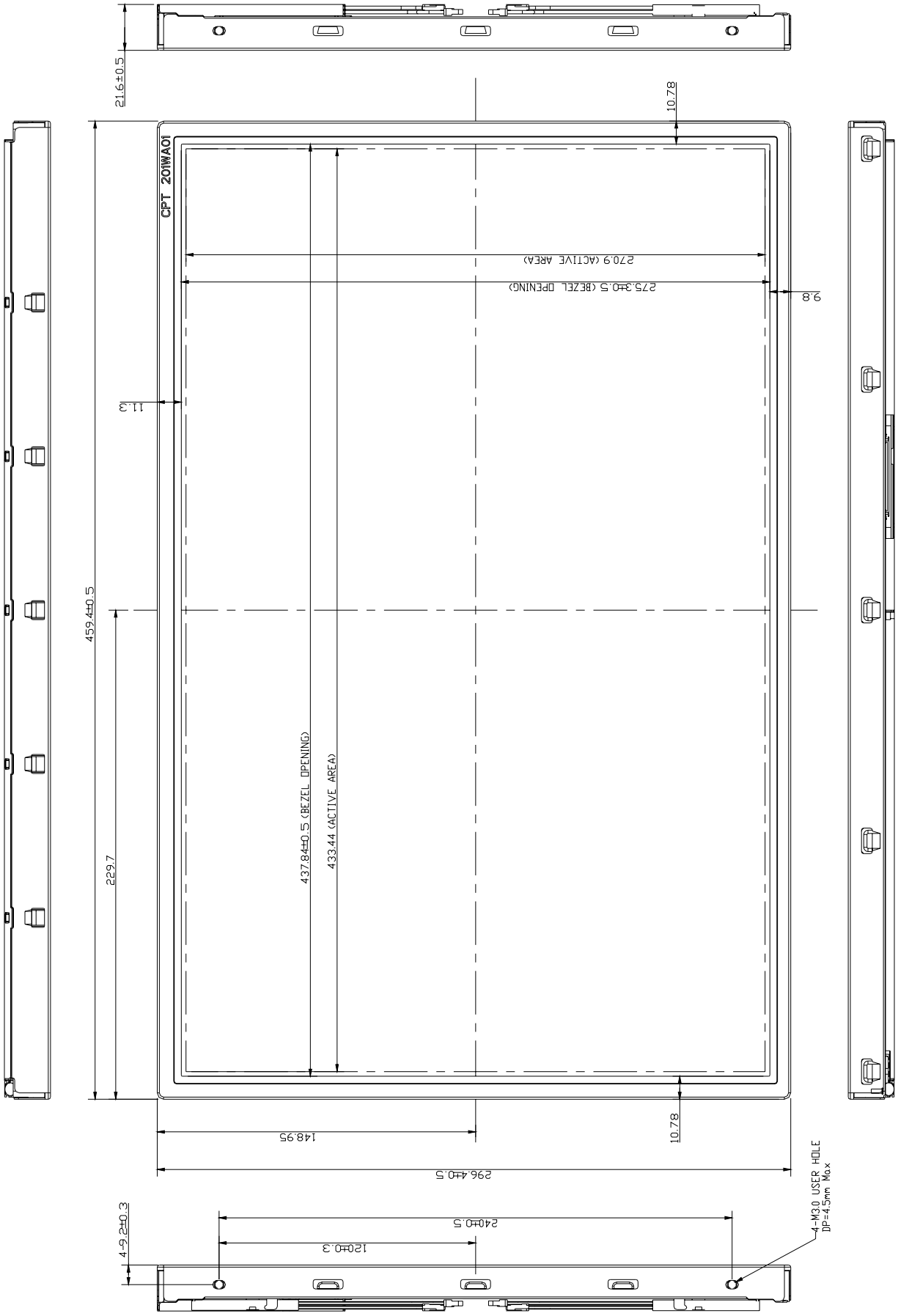




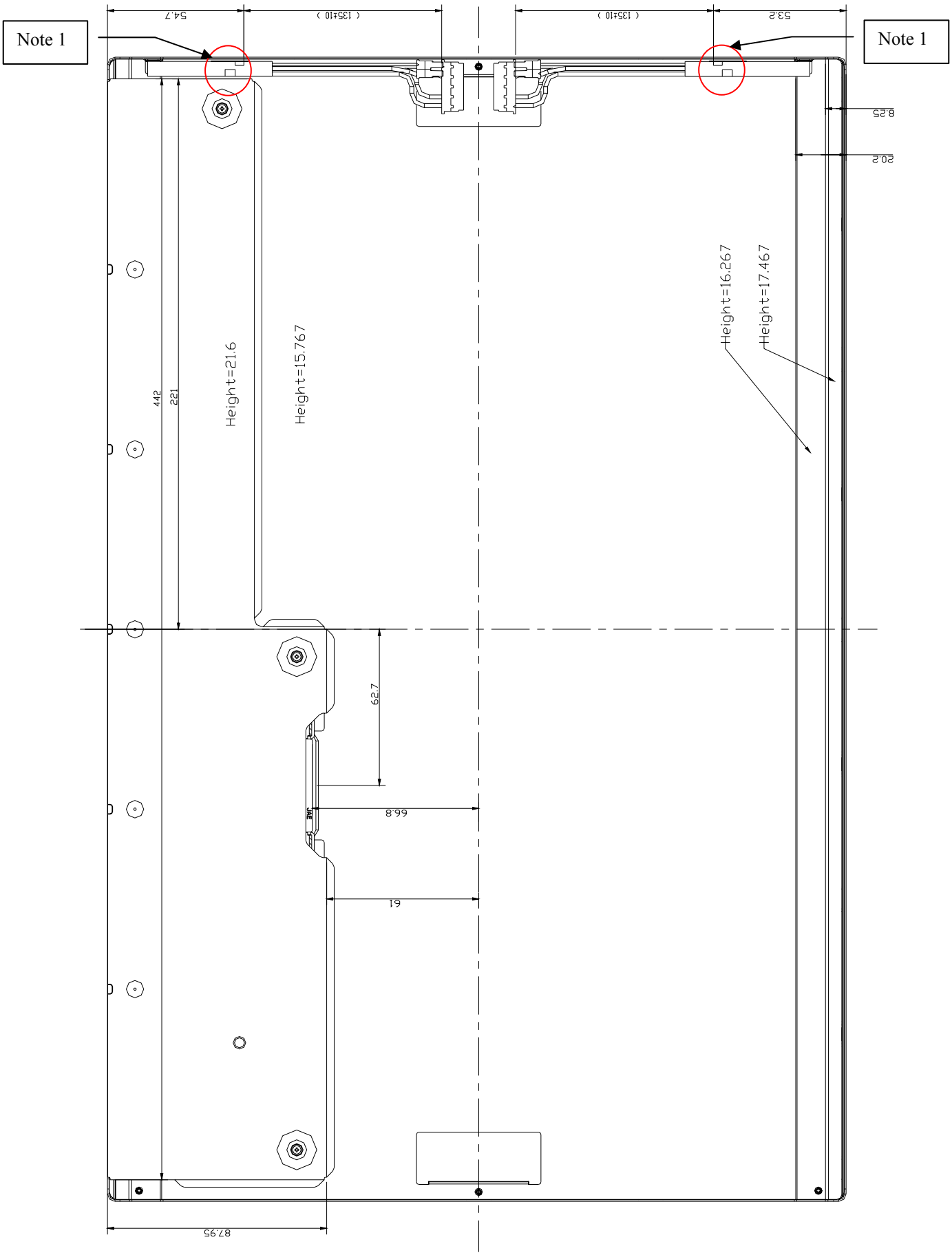


7. MECHANICAL SPECIFICATION

(1) Front side (Tolerance is ± 0.5mm unless noted) [Unit: mm]



(2) Rear side (Tolerance is ±0.5mm unless noted) [Unit: mm]



Note 1: Please don't take the wire off this buckle, since it might break the lamp or hurt the surface of the wire.

8. OPTICAL CHARACTERISTICS

Ta = 25°C, VCC=3.3V

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Contrast (CEN)		CR	θ= ϕ= 0°	450	600	--	--	*1)
Luminance (CEN)		L	θ= ϕ= 0°	250	300	--	cd/m^2	*2)
9P Uniformity		ΔL	θ= ϕ= 0°	75	80	--	%	*2)
Response Time		Tr	θ= ϕ= 0°	--	3	5	Ms	*4)
		Tf	θ= ϕ= 0°	--	5	7	Ms	
Image sticking		Tis	2 hours	0	--	2	S	*5)
Cross talk		CT	θ= ϕ= 0°	0	--	1	%	*6)
View angle	Horizontal	ϕ	CR≧10	-65 ~ 65	-70 ~ 70	--	Deg.	*3)
	Vertical	θ		-65 ~ 55	-70 ~ 60	--	Deg.	
	Horizontal	ϕ	CR≧5	-80 ~ 80	-85 ~ 85	--	Deg.	
	Vertical	θ		-80 ~ 80	-85 ~ 85	--	Deg.	
Color Coordinates	White	X Y	θ= ϕ= 0°	0.283 0.299	0.313 0.329	0.343 0.359	--	*2)
	Red	X Y		--	--	--		
	Green	X Y		--	--	--		
	Blue	X Y		--	--	--		
Gamut		CG	θ= ϕ= 0°	70	72		%	
Gamma		γ	VESA	2.0	2.2	2.4	--	*7)

[Note]

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

Measurement Condition: IL=6.0×6mA

Inverter: Sampo, model: DIVLCP0459D66－－ , Frequency=55kHz.

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

Central luminance: The white luminance is measured at the center position “5” on the screen, see Fig.1 below.

5P Luminance (AVG): The white luminance is measured at measuring points 1、3、5、7、9, see Fig.1 below.

9P Luminance (AVG): The white luminance is measured at measuring points 1 to 9, see Fig.1 below.

9P Uniformity: $\Delta L = (L_{MIN} / L_{MAX}) \times 100\%$

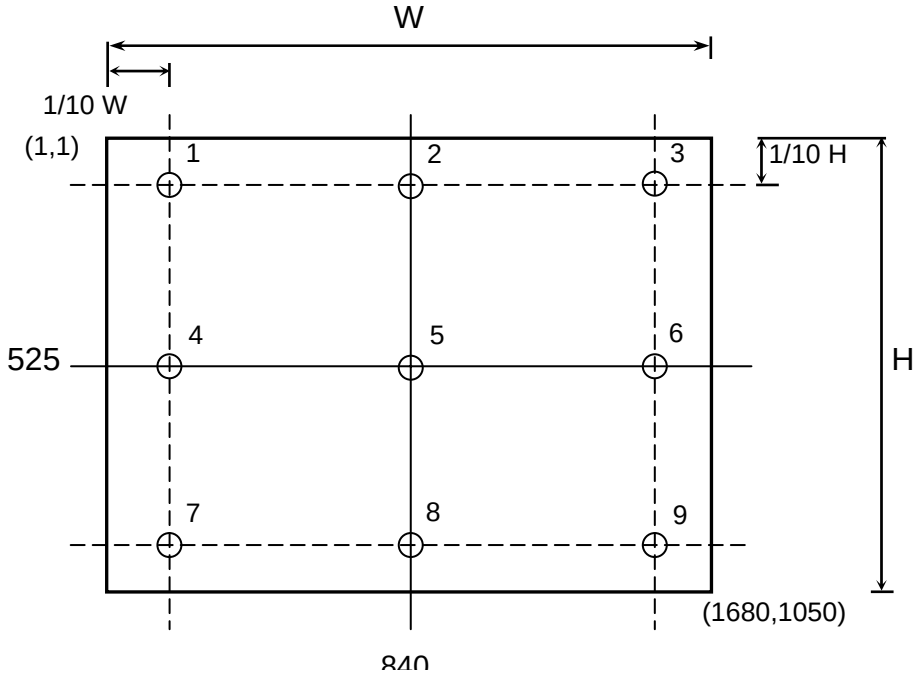
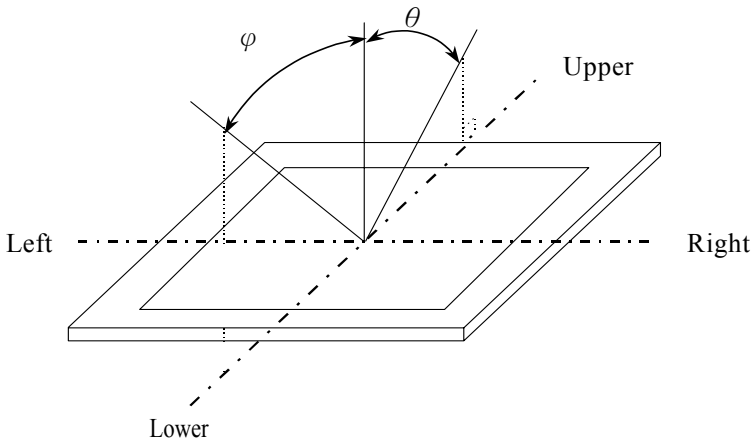
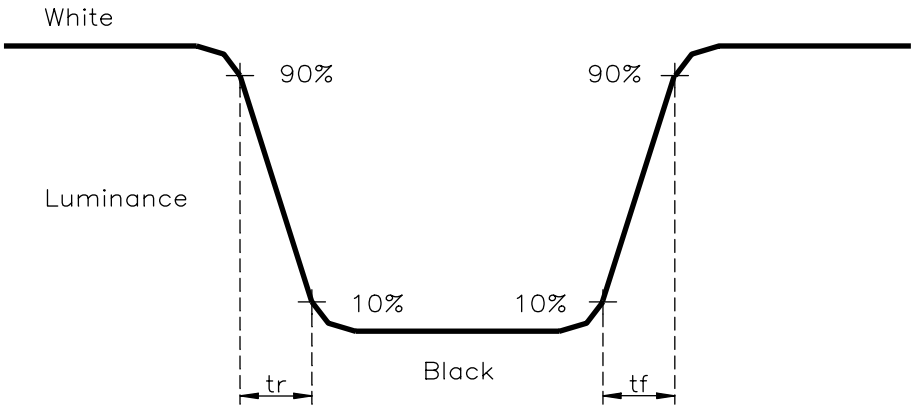


Figure 1. Measurement Position

*3) Definition of Viewing Angle(θ , ϕ)

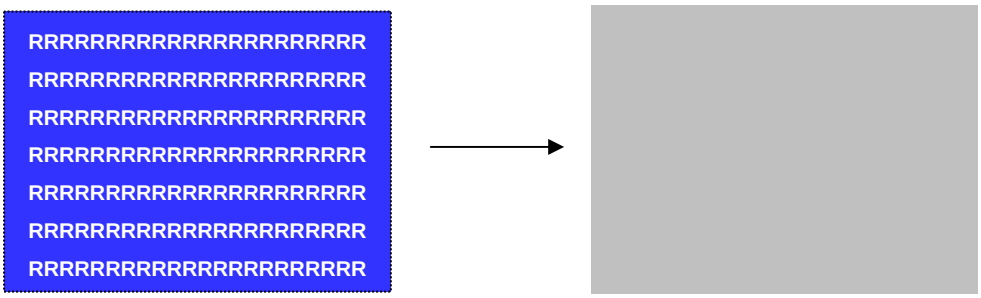


*4) Definition of Response Time



*5) Image sticking:

Continuously display the test pattern shown in the figure below (white “R” with blue background) for two-hours and then change to 128 gray level pattern. The previous image shall not persist more than two seconds at 25℃.



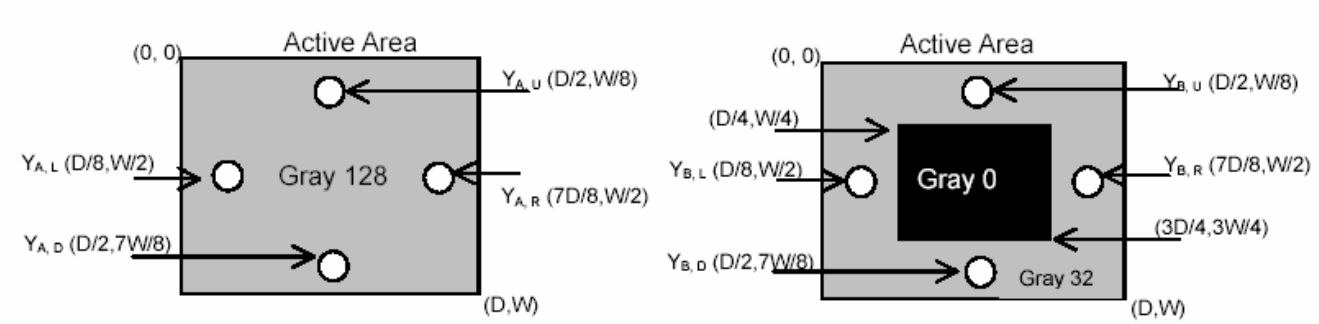
*6) Crosstalk Modulation Ratio:

CT= $|Y_B - Y_A| / Y_A \times 100\%$

Y_A、Y_B measure position and definition

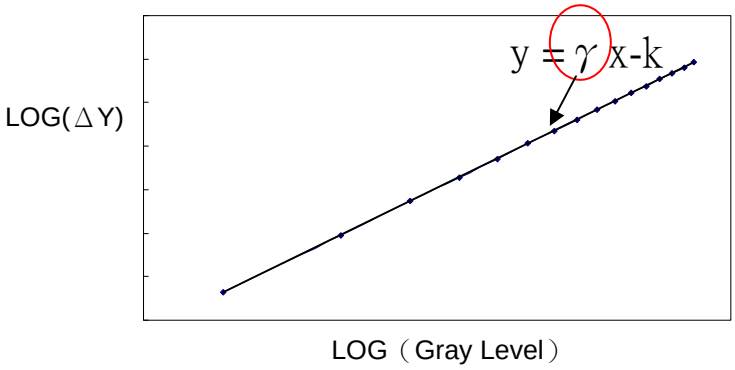
Y_A means luminance at gray level 28(exclude gray level 0 pattern)

Y_B means luminance at gray level 28(include gray level 0 pattern)



*7) Defination Gamma(VESA)

Based on Customer Sample, take the average value as a standard center value and the variation range of Gamma value caused by loop voltage error should be between +/- 0.2. the bellow figure shows how to obtain the gamma curve and γ (from gray level: 0、16、32-----224、240、255).



9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature High Humidity Operation	50℃; 90%RH; 240hrs (No condensation)
High Temperature High Humidity Storage	60℃; 90%RH; 48hrs (No condensation)
High Temperature Operation	50℃; 240hrs
High Temperature Storage	60℃; 240hrs
Low Temperature Operation	0℃; 240hrs
Low Temperature Storage	-20℃; 240hrs
Thermal Shock	Between -20℃(1hr) ~ 60℃(1hr); 100 Cycles

(2) Shock & Vibration

ITEMS	CONDITIONS
Shock (Non-Operation)	Shock level: 1470m/s^2(150G) 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: 5 to 500 Hz Frequency sweep rate: 0.5 octave/min Duration: one sweep from 5 to 500Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hour, total 3 hours)

(3) ESD testing

Test Item	Test statements
Connector	1. 200 pF，0 Ω，±250 V 2. Contact mode for each pin
Module	1. 150 pF，330 Ω，±15K V 2. Air mode, test 25 times for each test point 3. Contact mode, test 25 times for each test point

(4) 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 should be ignored.

Fail: No display image, 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. (Such like keeping them in high humidity or wet place can occur getting them wet.)