Chunghwa Picture Tubes, Ltd.
Technical Specification

To :

Date : 2005/10/28

CPT TFT-LCD

CLAA201WA03

ACCEPTED BY：

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APPROVED BY	CHECKED BY	PREPARED BY

Prepared by : TFT-LCD Application Division

CHUNGHWA PICTUER TUBES, LTD.

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1. OVERVIEW

CLAA201WA03 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 (6bits+FRC), 1680x1050, drived by 5 voltages,16.2M-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	16.2M(6bits+FRC)
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
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

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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	(680)	(840)	Vrms	--
Lamp Current	ILO	3	6.5	mArms	*4). 7)
Lamp Frequency	FL	(45)	(75)	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℃)

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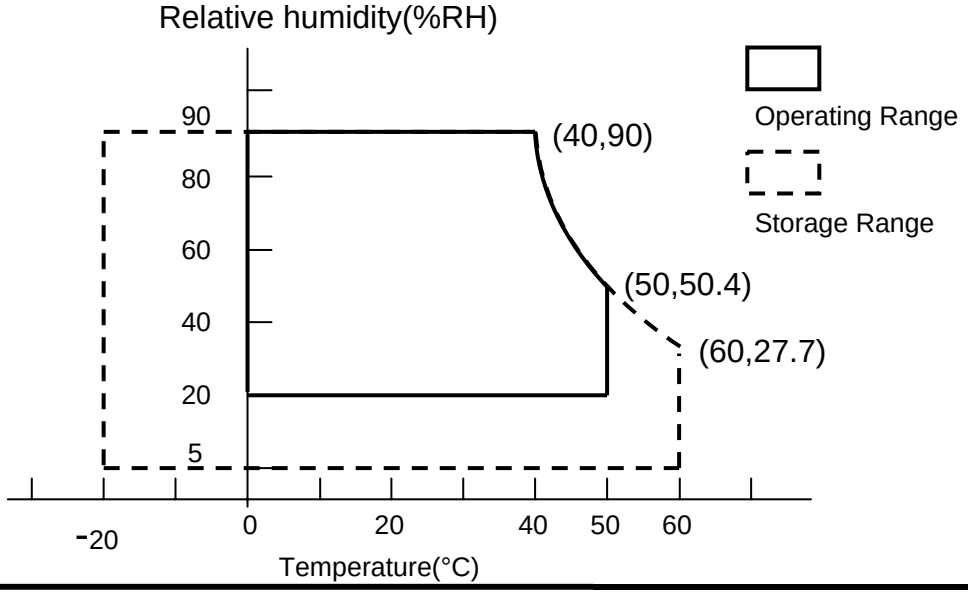
*7) When lamp current over the definition of absolute maximun, product life-time will decay rapidly or operate unusual. If lamp current is under 3.0mA, the lamp could be abnormal-starting.

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 = 1820Vrms

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°C

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	--	900	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	-	4.5	7.5	W	*2)

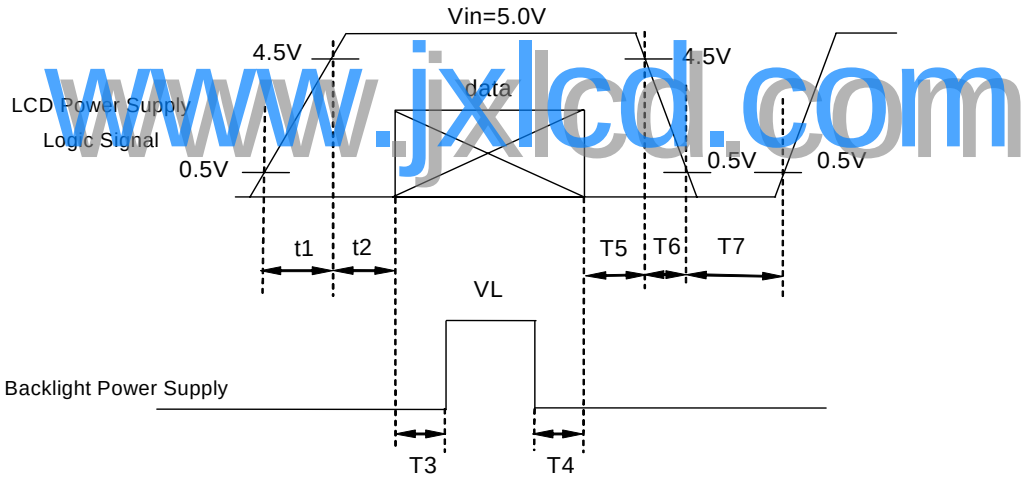
[Note]

*1)Power、data sequence

0.5ms＜t1＜10ms　　t4＞200ms　　t7＞1sec

0＜t2＜50ms　　0＜t5＜50ms

t3＞250ms　　＜t6＜10ms　0.01ms

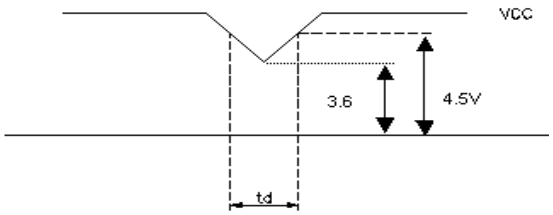


Data: RGB DATA, DCLK, DENA

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.



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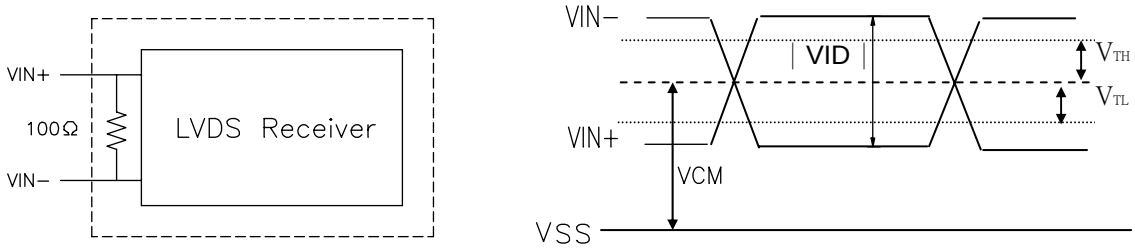
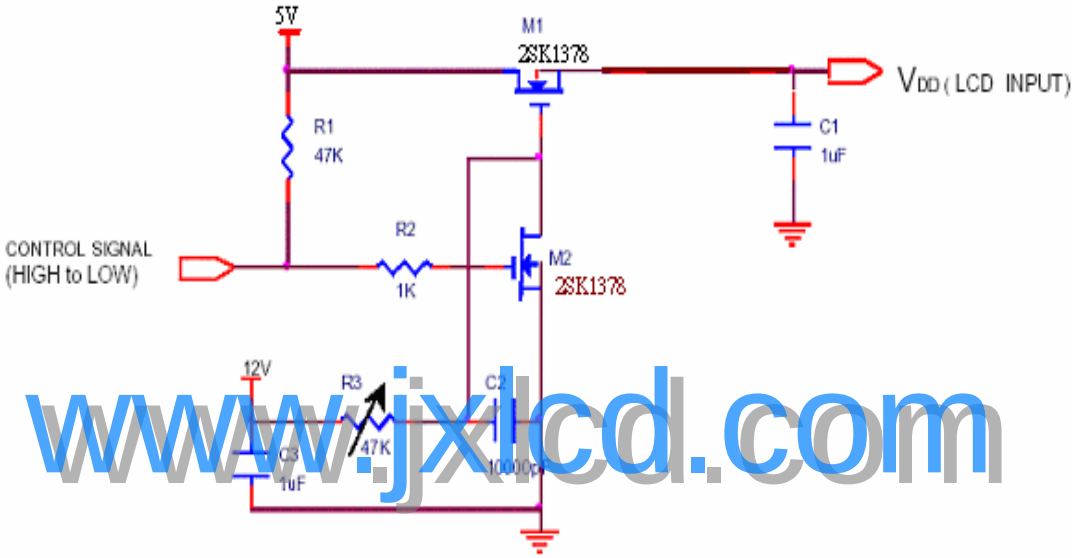
*2) Typical value is measured when displaying horizontal gray scale line pattern:
64 gray level, 1680 line mode
VCC=5.0 V，f_H=65 kHz，f_V=60 Hz，f_{CLK}=73.5 MHz

*3) LVDS Signal definition :



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

*4) Inrush Measurement Condition



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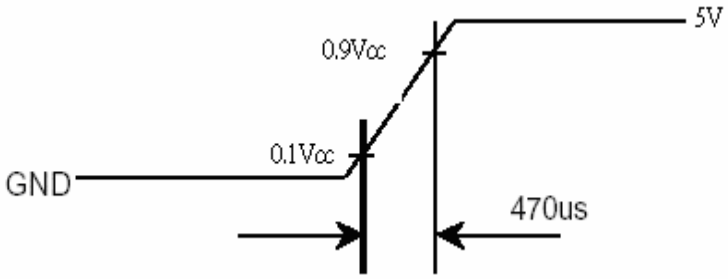

(2) Backlight

(a) Electrical Characteristics

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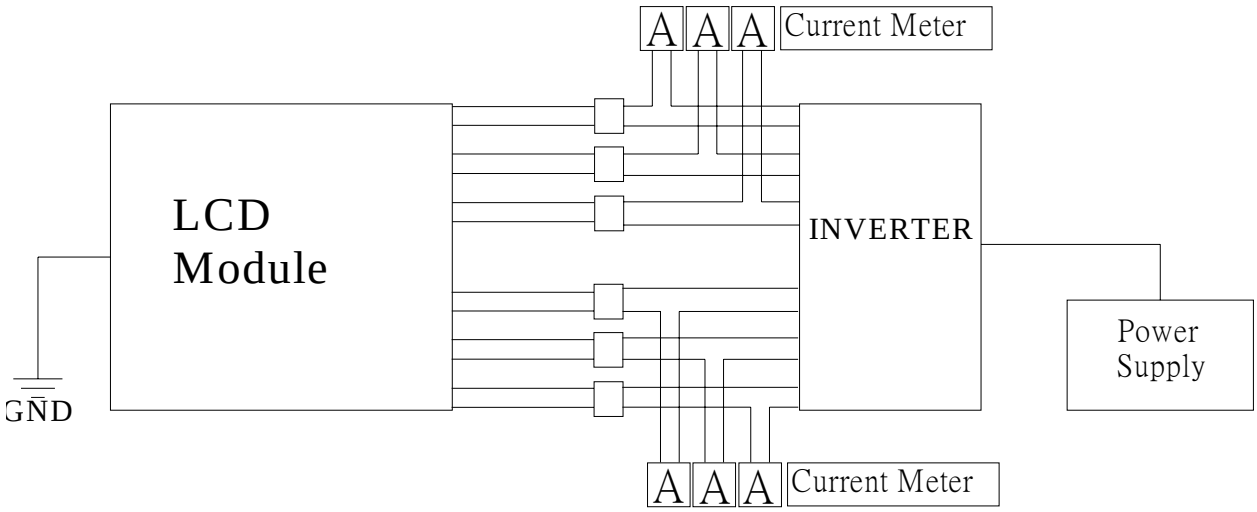
*1) Lamp Current measurement method (The current meter is inserted in cold line)



*2) a. Frequency in this range can make the characterisitics of electric and optics maintain in +/- 10% except color coordinates.
b. Frequency in 50~60kHz can make characteristics of electric and optics better.
c. Frequency in 45~75kHz won't damage the lifetime and reliability of lamp.
d. Lamp frequency of inverter may produce interference with horizontal(or vertical) 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.

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*3) Definition of the lamp life time :
a. Luminance (L) under 50% of specification
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)

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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、CN5：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
CN5	1	HV	High Voltage Output for CCFL Lamp 6
	2	HV	High Voltage Output for CCFL Lamp 5
	3	NC	NC
	4	LV	Low Voltage Output for CCFL Lamp 6
	5	LV	Low Voltage Output for CCFL Lamp 5

CN3、CN4：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
CN4	1	HV	High Voltage Output for CCFL Lamp 4
	2	LV	Low Voltage Output for CCFL Lamp 4

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5. INTERFACE TIMING

(1) Timing Characteristic

ITEM				SYMBOL	MIN.	TYP.	MAX.	UNIT
LCD Timing	DCLK		Freq.	f_{CLK}	61	73.5	83	MHz
			Cycle	t_{CLK}	12	13.6	16.4	ns
	DENA	Horizontal	Horizontal total time	t_H	1030	1135	1300	t_{CLK}
			Horiaontal effective time	t_{HA}	840	840	840	t_{CLK}
			Horizontal blank time	t_{HB}	190	295	460	t_{CLK}
		Vertical	Vertical frame Rate	Fr	55	60	75	Hz
			Vertical total time	t_V	1060	1080	1300	t_H
			Vertical effective time	t_{VA}	1050	1050	1050	t_H
			Vertical blank time	t_{VB}	10	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

*6) It maybe cause flicker at 55Hz

(2) Timing Chart

a. Horizontal Signal

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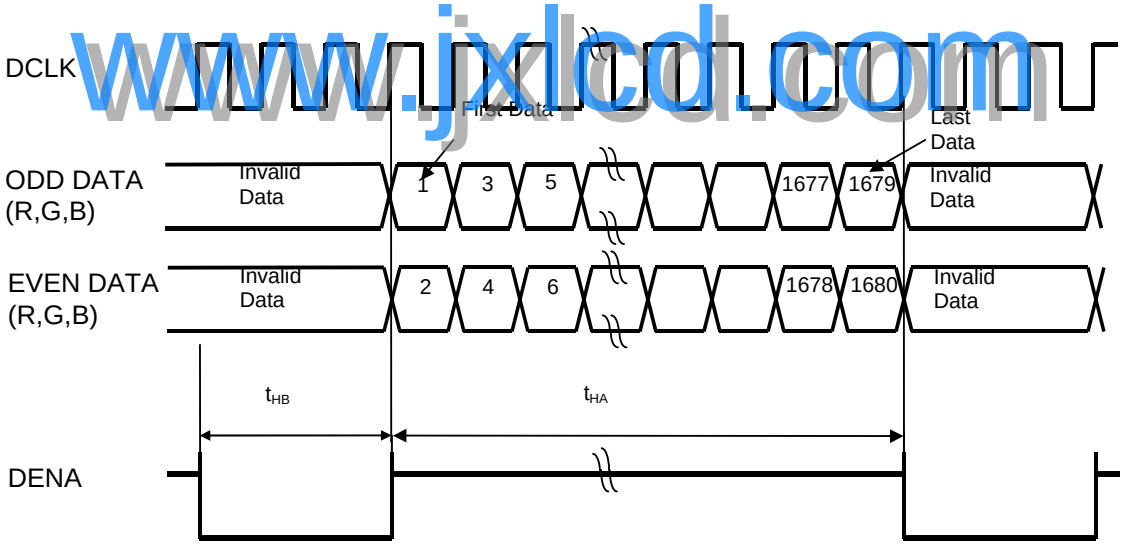
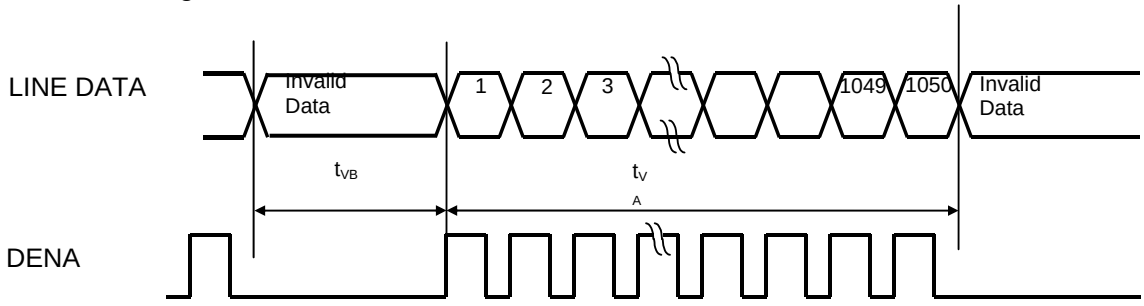
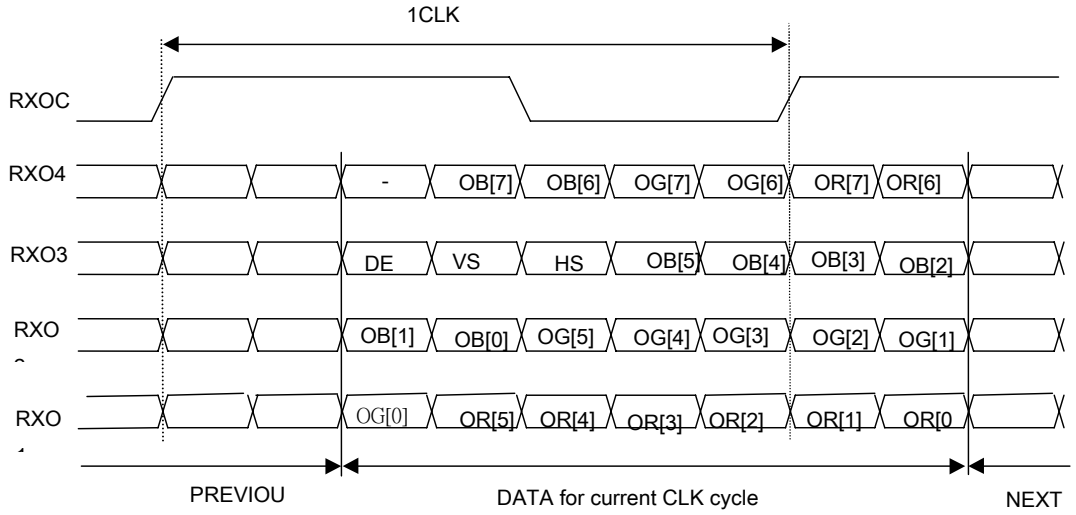


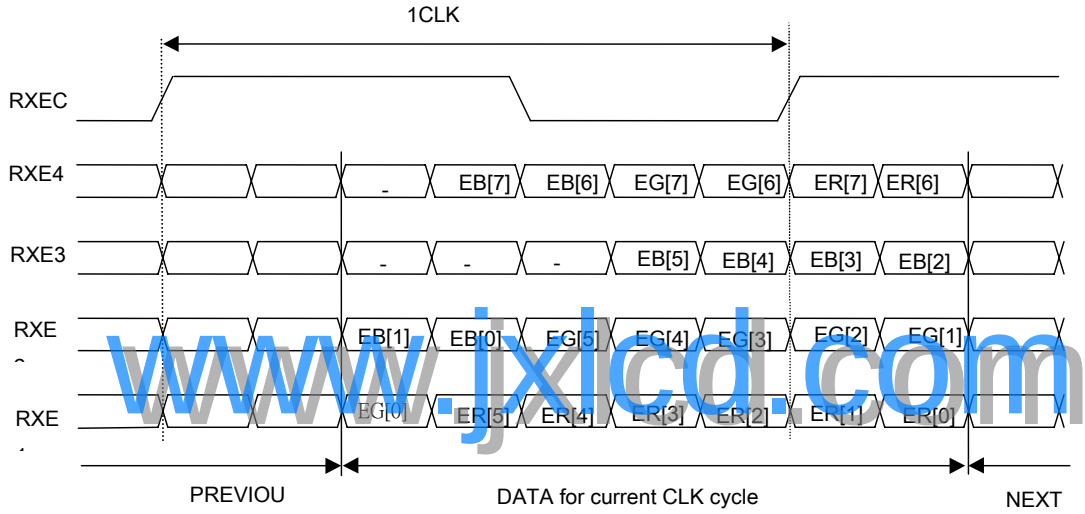
b. Vertical Signal



(3) LVDS Data

For 6Bit+FRC





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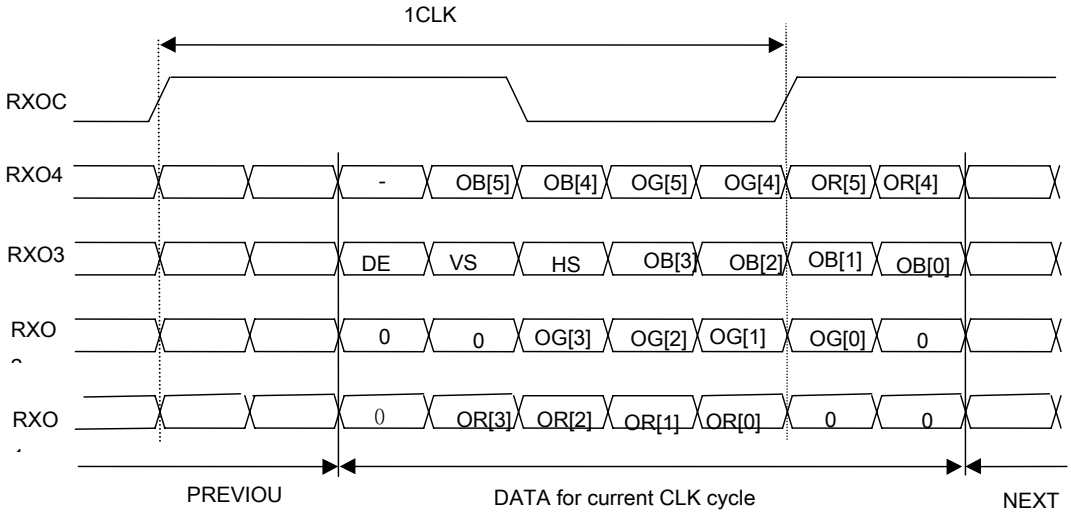
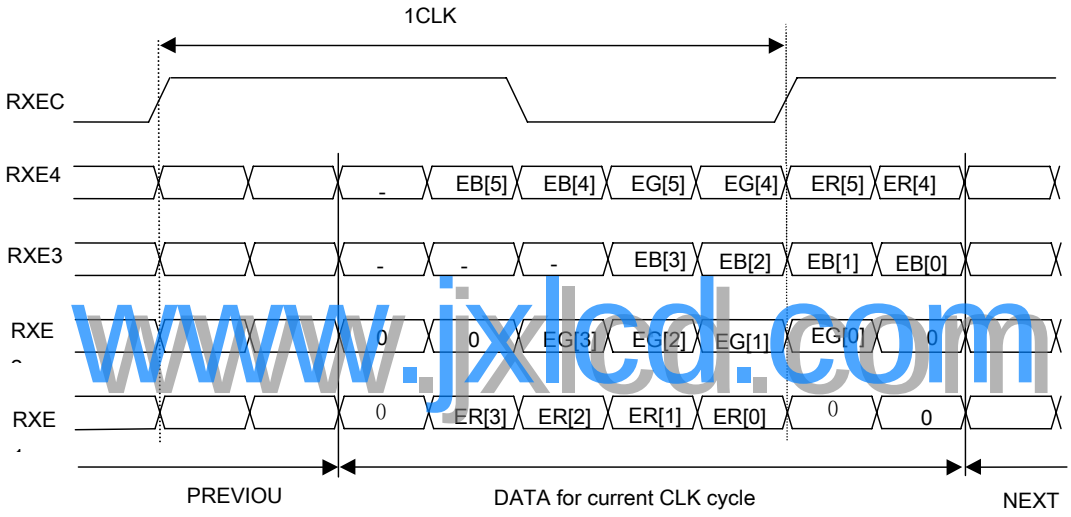
For 6Bit





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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

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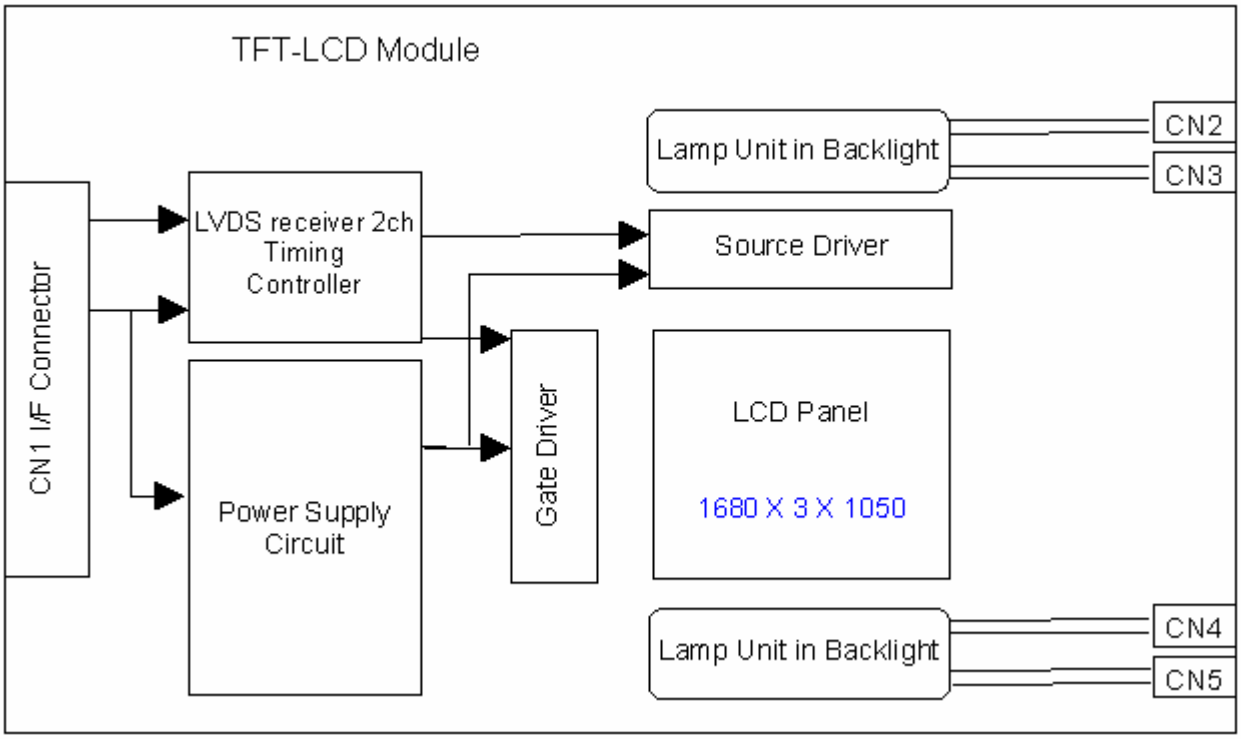
[Note]

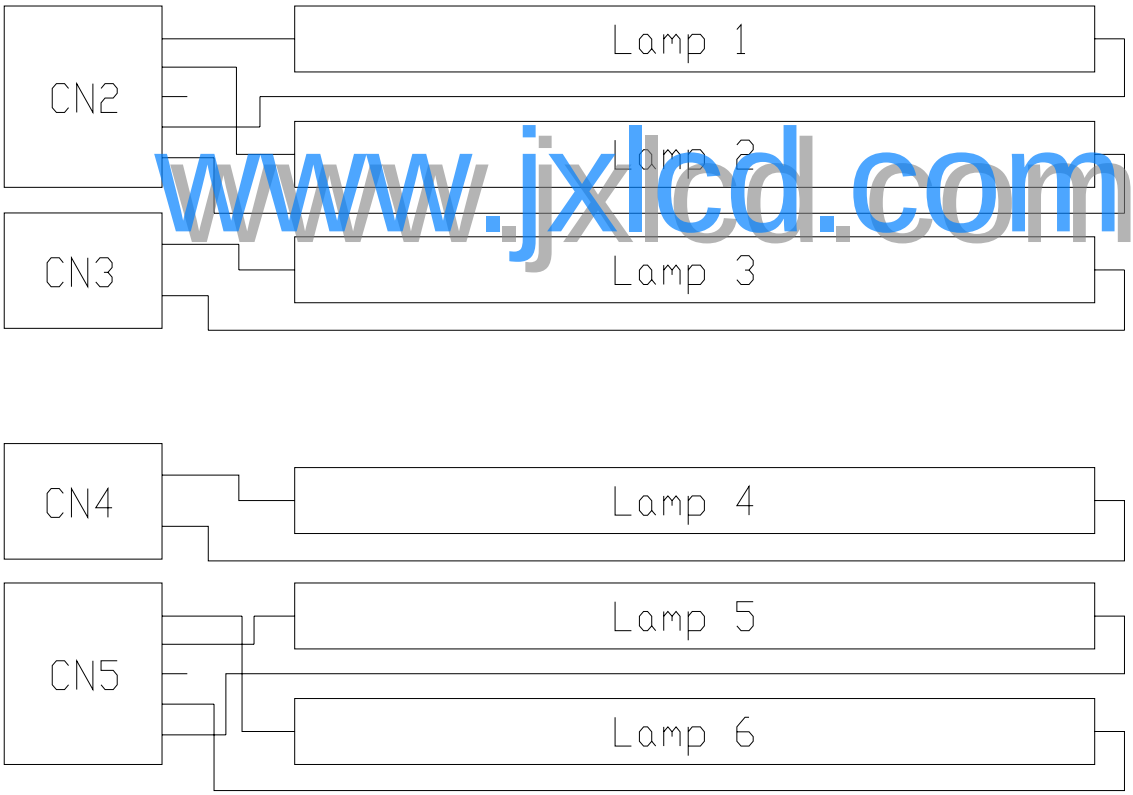
1) Definition of gray scale:
   Color (n): n indicates gray scale level; higher n means brighter level.
2) Data: 1-High, 0-Low.
3) For odd & even data also.

(4) Color Deta Distribution

D(1,1)	D(2,1)	..	D(X,1)	..	D(1679,1)	D(1680,1)
D(1,2)	D(2,2)	..	D(X,2)	..	D(1679,2)	D(1680,2)
..	..	+	..	+	..	..
D(1,Y)	D(2,Y)	..	D(X,Y)	..	D(1679,Y)	D(1680,Y)
..	..	+	..	+	..	..
D(1,1049)	D(2,1049)	..	D(X,1049)	..	D(1679,1049)	D(1680,1049)
D(1,1050)	D(2,1050)	..	D(X,1050)	..	D(1679,1050)	D(1680,1050)

6. BLOCK DIAGRAM





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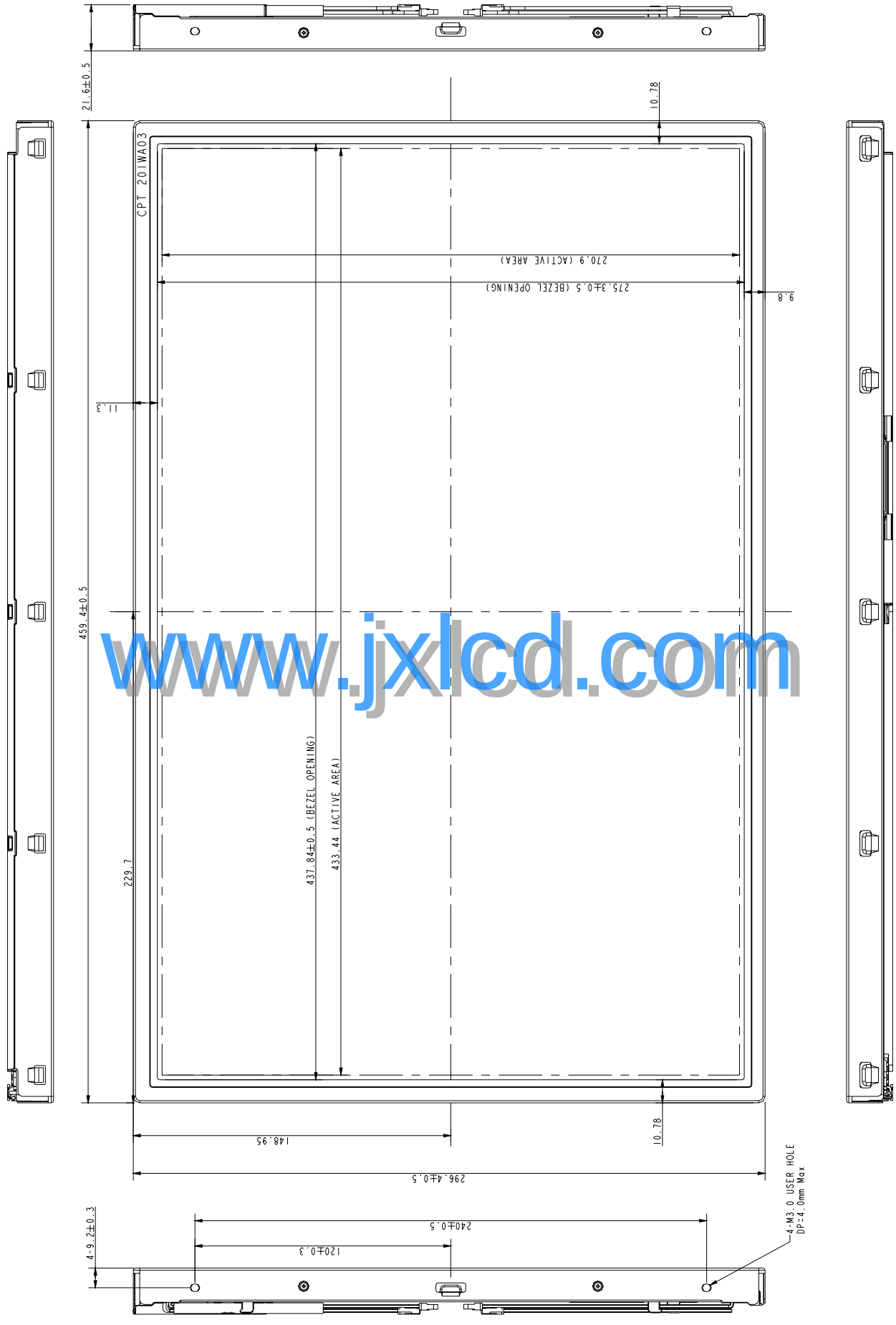
7. MECHANICAL SPECIFICATION

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



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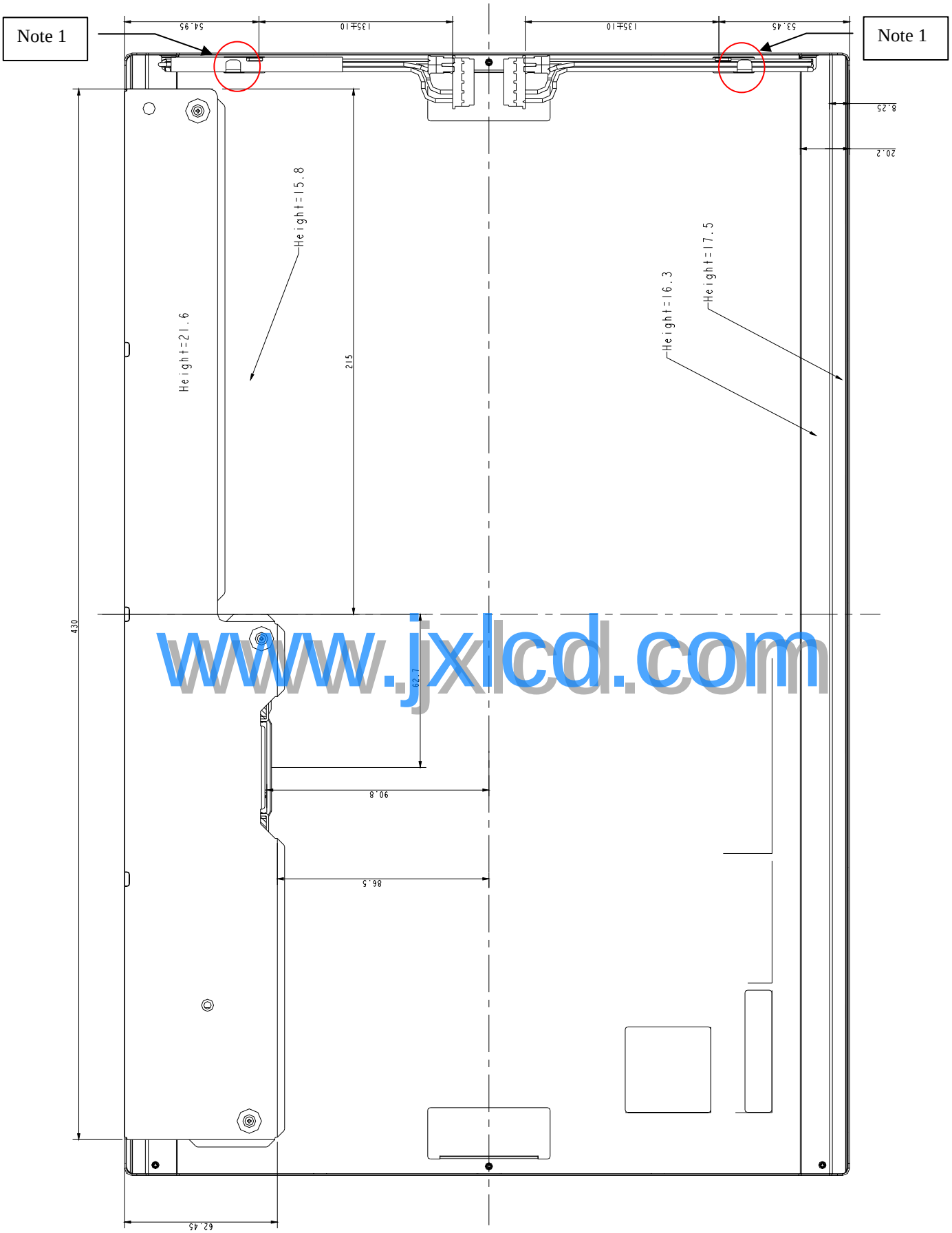
(2) Rear side (Tolerance is ±0.5mm unless noted) [Unit: mm]



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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+Tf	θ= ϕ= 0°	--	8	12	ms	*4)
Image sticking		Tis	2 hours	0	--	2	s	*5)
Cross talk		CT	θ= ϕ= 0°	0	--	1	%	*6)
View angle	Horizontal	ϕ	CR≧10	130	140	--	Deg.	*3)
	Vertical	θ		120	130	--	Deg.	
	Horizontal	ϕ	CR≧5	150	160	--	Deg.	
	Vertical	θ		150	160	--	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)

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[Note]

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

Measurement Condition: IL=6.0mA × 6

Inverter: Sampo, model: DIVLCP0459D66－－ , Frequency=65kHz.

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. And the measure time is 30 minites after discharged.

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

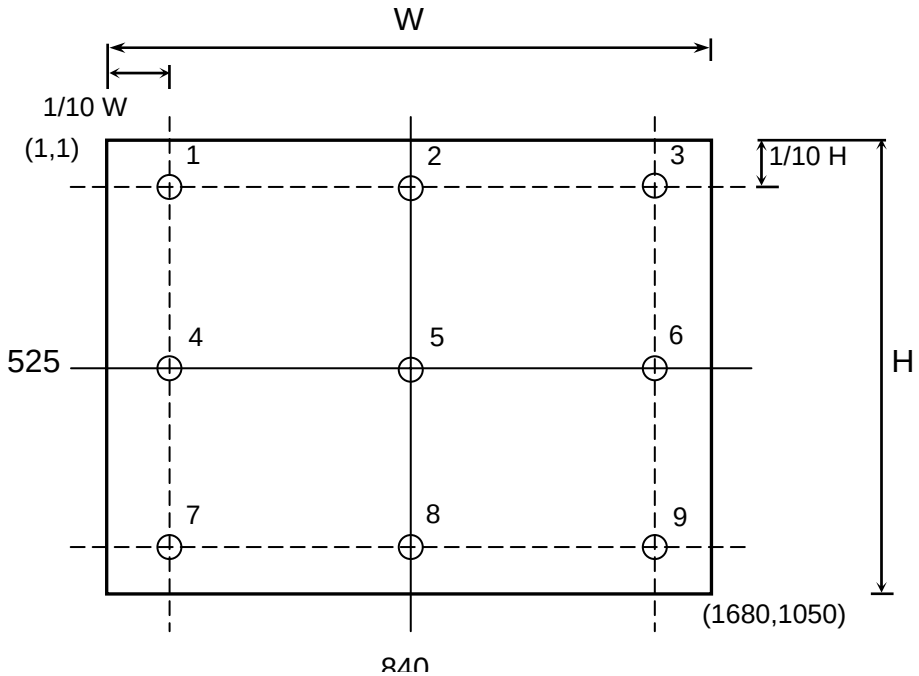
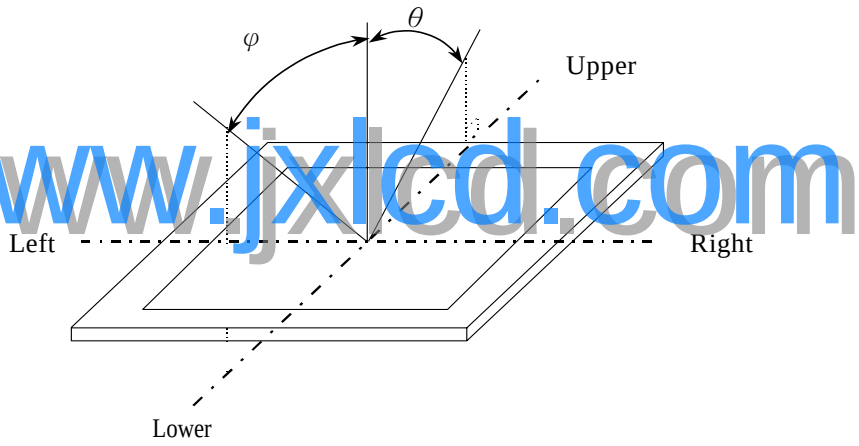


Figure 1. Measurement Position

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



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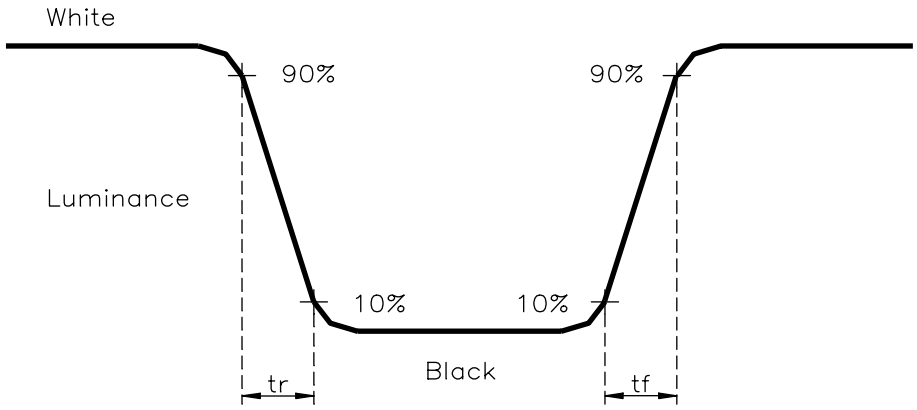
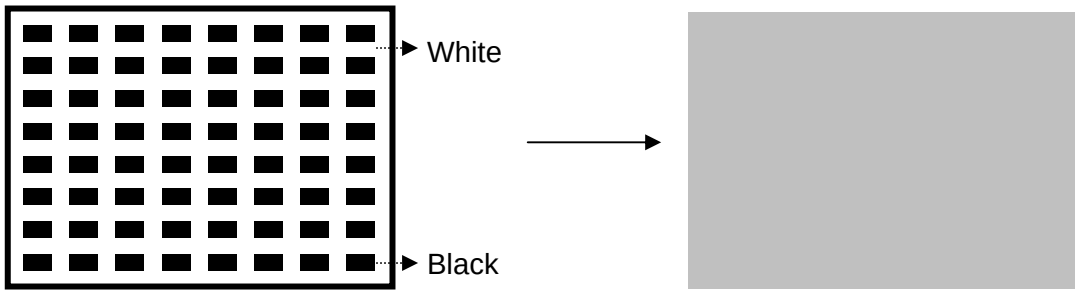
*4) Definition of Response Time



*5) Image sticking:

Continuously display the test pattern shown in the figure below for two-hours and then change to 128 gray level pattern. The previous image shall not persist more than two seconds at 25℃.



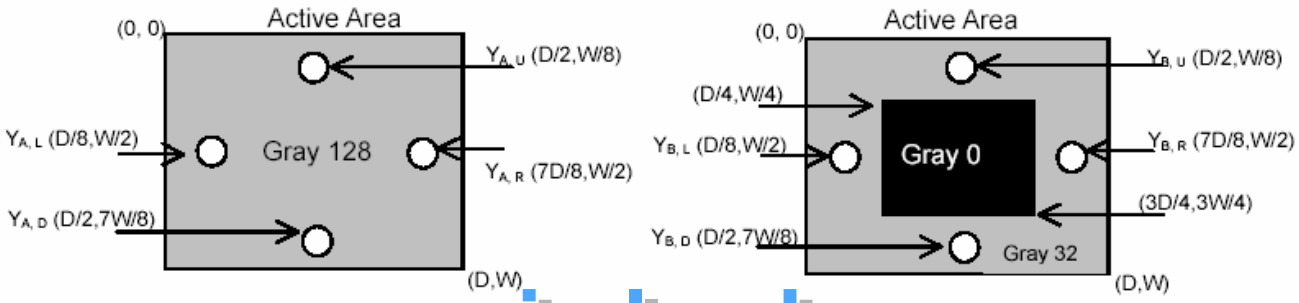
*6) Crosstalk Modulation Ratio:

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)



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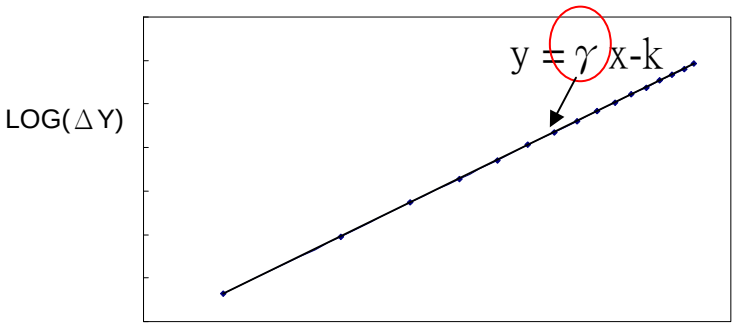
*7) Defination Gamma(VESA)

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: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: 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)

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(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.