Chunghwa Picture Tubes, Ltd.
Technical Specification

To : Hui Ying
Date : 2008/04/18

CPT TFT-LCD

CLAA 154WP04A

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Modification Record List

NO.	Issue Date	Modification Index	Modifier
1	2008/04/18	Final version.	

Table Of Content

1. OVERVIEW

CLAA154WP04A is 15.4″ color (39.116cm) TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, LVDS driver ICs, control circuit and backlight. By applying 6 bit digital data, 1440×RGB(3)×900, 262K-color images are displayed on the 15.4″ diagonal screen. Interface of data and control signals is Typ. General specifications are summarized in the following table：

ITEM	SPECIFICATION
Display Area (mm)	331.56 (H) x 207.225 (V) (15.4-inch diagonal)
Number of Pixels	1440×3(H)×900(V)
Pixel Pitch (mm)	0.23025(H)×0.23025(V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	Normally white
Number of Colors	262,144(6bits)(RSDS)
Gamut	45%(typ)
Optimum Viewing Angle	6 o′clock
Response Time (ms)	8ms
Viewing Angle (L/R/U/D)	60°、60° /45°、55° (Typ.)
Brightness (cd/m^2)	250 cd/m^2 (5point)/6 mA (Typ.) 220 cd/m^2 (5point)/6 mA (Min.)
Consumption of Power (W)	6.7（Max）(w/o Inverter)
Uniformity (Min)	5point：80% 13point：65%
Module Size (mm)	344.5(W)×222.5(H)×6.2(D)（Max）
Module Weight (g)	545 (max)

The LCD Products listed on this document are not suitable for use of aerospace equipment, submarine cable, and nuclear reactor control system and life support systems. If customers intend to use these LCD products for applications listed above or those not included in the "Standard" list as follows, please contact our sales 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 maximum value, 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	4.0	V	
Lamp voltage	VL	630	920	Vrms	
Lamp current	IL	2	6.5	mArms	*1). 2)
Lamp frequency	FL	40	80	kHz	
Operation Temperature	Top	0	50	℃	*3). 4). 5). 6)
Storage Temperature	Tstg	-25	65	℃	*3). 4). 5)
Delayed Discharge Time	TD	--	1	sec	*7)

【Note】

*1) Product life-time relate to lamp current, please operate production follow statement at page 9 〝(b)back light〞.

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

*3) The relative temperature and humidity range are as below sketch, 90%RH Max. (Ta≦40℃)

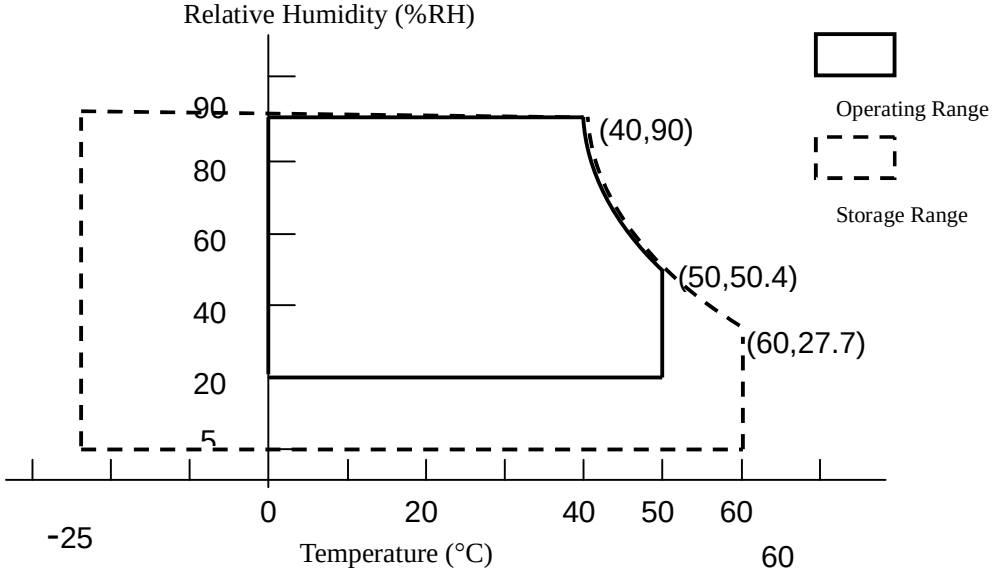
*4) The maximum wet bulb temperature ≦39℃(Ta＞40℃) and without dewing.

*5) If product in environment which over the definition of the relative temperature and humidity out of range too long, it will affect visual of LCD.

*6) If you operate LCD in normal temperature range, the center surface of panel should be under 60℃.

*7) Delay discharge time test condition ：starting lamp voltage=1650Vrms.(please follow statement at page 9 〝(b)back light〞

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 24hrs.,and then to measure TD with the same starting lamp voltage in dark room.



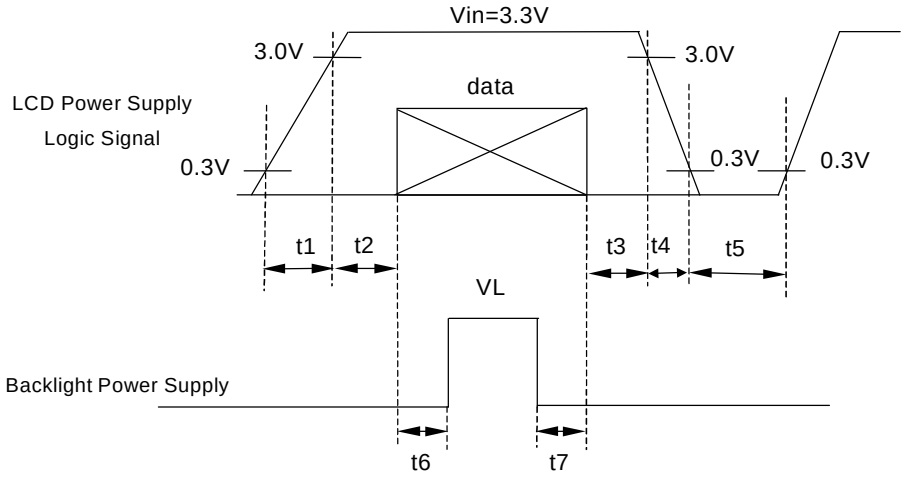
3. ELECTRICAL CHARACTERISTICS

(A) TFT LCD

TEM		SYMBOL	MIN	TYP	MAX	UNIT	REMARK
LCD POWER VOLTAGE		VCC	3.0	3.3	3.6	V	[Note 1]
LCD POWER CURRENT		ICC	-	500	600	mA	[Note 2]
Rush CRRENT		Irush	-	-	3	A	[Note 4]
LOGIC INPUT VOLTAGE (LVDS: IN+,IN-) [Note 3]	INPUT VOLTAGE	VIN	0	-	VCC	V	
	COMMON VOLTAGE	VCM	1.125	1.25	1.375	V	
	DIFFRENTIAL INPUT VOLTAGE	| VID |	250	350	450	mV	
	THRESHOLD VOLTAGE (HIGH)	VTH	-	-	100	mV	When VCM = +1.2V
	THRESHOLD VOLTAGE (LOW)	VTL	-100	-	-	mV	
DIFFRENTIAL INPUT VOLTAGE TOLERANCE		△VID	-	-	35	mV	
COMMON VOLTAGE TOLERANCE		△VCM	-	-	35	mV	

[Note 1] Power Sequence :

0.5 ms < t1 ≦ 10ms　　1 sec ≦ t5
0.01 ms < t2 ≦ 50 ms　　200 ms ≦ t6
0.01 ms < t3 ≦ 50 ms　　200 ms ≦ t7

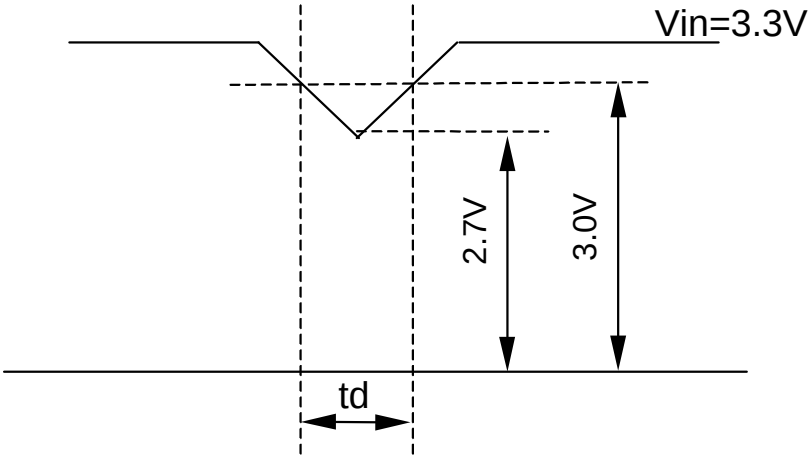


Data: RGB DATA, DCLK, HD, VD, DENA

VCC-dip state

(1)when 3.0＞VCC≧2.7V，td≦10 ms

(2)when VCC＜2.7V，VCC-dip condition should as the VCC-turn-off condition.



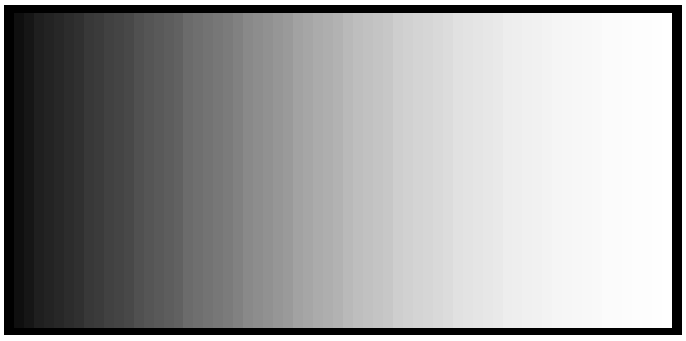
[Note 2]

Typical value is 0～63 gray level.(horizontal line Pattern)

900 line mode，VCC= +3.3V

Circuit condition(Typ.)

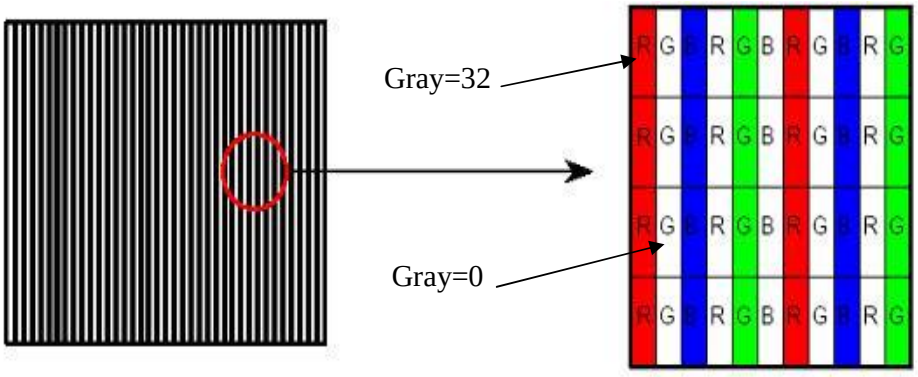
VCC=3.3 V，fV=60 Hz fH=55.56 kHz，fCLK=44.375 MHz



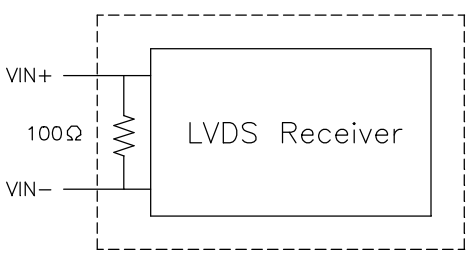
64-Gray :

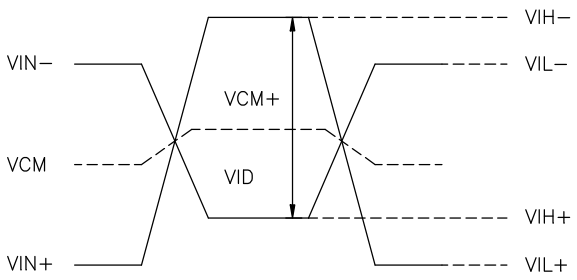
Circuit condition(MAX.)

VCC=3.3 V，f_V=60 Hz f_H=55.56 kHz，f_{CLK}=44.375 MHz



[Note 3] LVDS Signal Definite：





VID = VIN+ – VIN-,

△VCM = | VCM+–VCM- |,

△VID = | VID+–VID- |,

VID+ = | VIH+–VIH- |,

VID- = | VIL+–VIL- |,

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

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

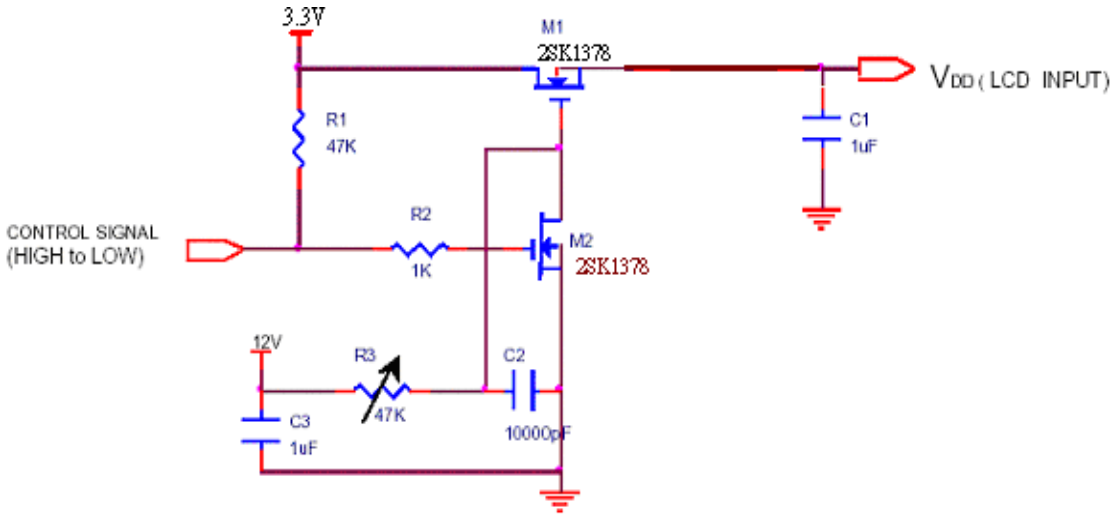
VCM- =(VIL+ +VIL-)/2,

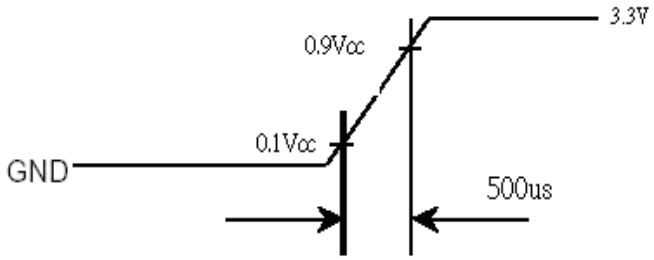
VIN+ ：Positive differential DATA & CLK Input

VIN- ：Negative differential DATA & CLK Input

4) Refer to Inverter rated voltage

[Note 4] Irush measure condition


3.3V
M1
2SK1378
VDD (LCD INPUT)
R1
47K
C1
1uF
CONTROL SIGNAL
(HIGH to LOW)
R2
1K
M2
2SK1378
12V
R3
C2
C3
1uF
47K
10000pF


3.3V
0.9Vcc
0.1Vcc
GND
500us

(B) BACK LIGHT

(a.) ELECTRICAL CHARACTERISTICS
STI Lamp:

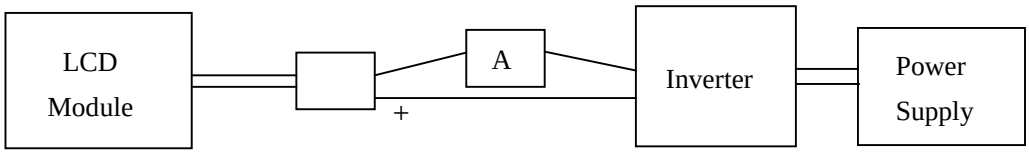
Ta=25℃

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Lamp Voltage(IL=6.0mA)	VL	630	700	770	Vrms	IL=6.0mA
Lamp Current	IL	5.5	6.0	6.5	mArms	*1)
Inverter Frequency	FI	40	--	60	kHz	*2)
Lamp Initial Voltage	VS	1300	--		Vrms	Ta=25℃
		1600	--		Vrms	Ta=0℃

(b) LAMP LIFE – TIME
STI Lamp:

ITEM	IL at 2.0 mA	IL at 6.0 mA	IL at 6.5 mA	UNIT	REMARK
LAMP LIFE-TIME (LT)	Min. 15,000	Min. 15,000	Min.10,000	hr	Continuous Operation*3)
Turn-on and turn-off Operation	--	Min.100,000	--	times	Continuous Operation *4)

*1)Measure method：galvanometer connect to low voltage



*2) Frequency in this range can make the characteristic 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 (40~80 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) For keeping good lighting situation, when design the inverter, it must be considered that the voltage large than starting lamp voltage.

4. Connector Interface PIN & Function

(a) CN1 (Interface signal)

Connector Type: P-two 187056-30091, FOXCONN GS23302-0011S-7F

Pin No.	SYMBOL	FUNCTION
1	Vss	Ground
2	Vin	+3.3V Power
3	Vin	+3.3V Power
4	V_EDID	EDID VCC
5	BIST	Build in self-test pattern High:Enable Low:Disable
6	CLK_EDID	EDID Clock
7	DATA_EDID	EDID Data
8	RO0M	minus signal of Odd channel 0(LVDS)
9	RO0P	plus signal of Odd channel 0(LVDS)
10	Vss	Ground
11	RO1M	minus signal of Odd channel 1(LVDS)
12	RO1P	plus signal of Odd channel 1(LVDS)
13	Vss	Ground
14	RO2M	minus signal of Odd channel 2(LVDS)
15	RO2P	plus signal of Odd channel 2(LVDS)
16	Vss	Ground
17	ROCLKM	minus signal of Odd clock channel (LVDS)
18	ROCLKP	plus signal of Odd clock channel (LVDS)
19	Vss	Ground
20	RE0M	minus signal of Even channel 0(LVDS)
21	RE0P	plus signal of Even channel 0(LVDS)
22	Vss	Ground
23	RE1M	minus signal of Even channel 1(LVDS)
24	RE1P	plus signal of Even channel 1(LVDS)
25	Vss	Ground
26	RE2M	minus signal of Even channel 2(LVDS)
27	RE2P	plus signal of Even channel 2(LVDS)
28	Vss	Ground
29	RECLKM	minus signal of Even clock channel (LVDS)
30	RECLKP	plus signal of Even clock channel (LVDS)

(b) CN2 (BACKLIGHT)

Backlight-side connector: BHSR-02VS-1 (JST)

Inverter-side connector: SM02B-BHSS-1 (JST)

Pin No.	Symbol	Function
1	CTH	VBLH (High)
2	CTL	VBLL (Low)

[Note]： VBLH-VBLL=VL

[Note]

BIST (Build in self-test pattern)

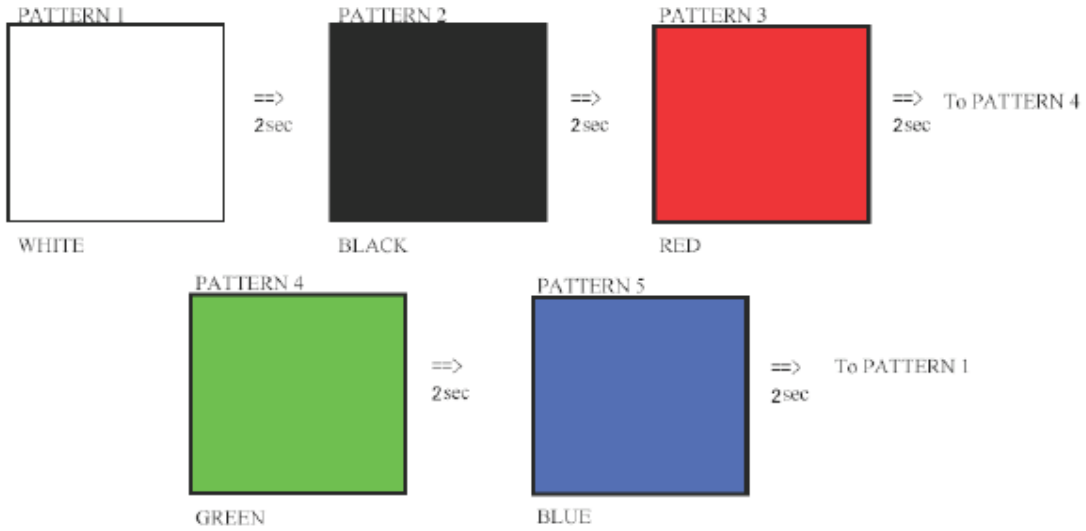
BIST pin = Low(GND)：Normal

BIST pin = High(VCC)：Self-test mode

1) Self-test Display Pattern change When pin 5 is high and no LVDS input signals detected, as followed patterns runs continuously.(White, Black, Red, Green and Blue).

2) Pattern sequence

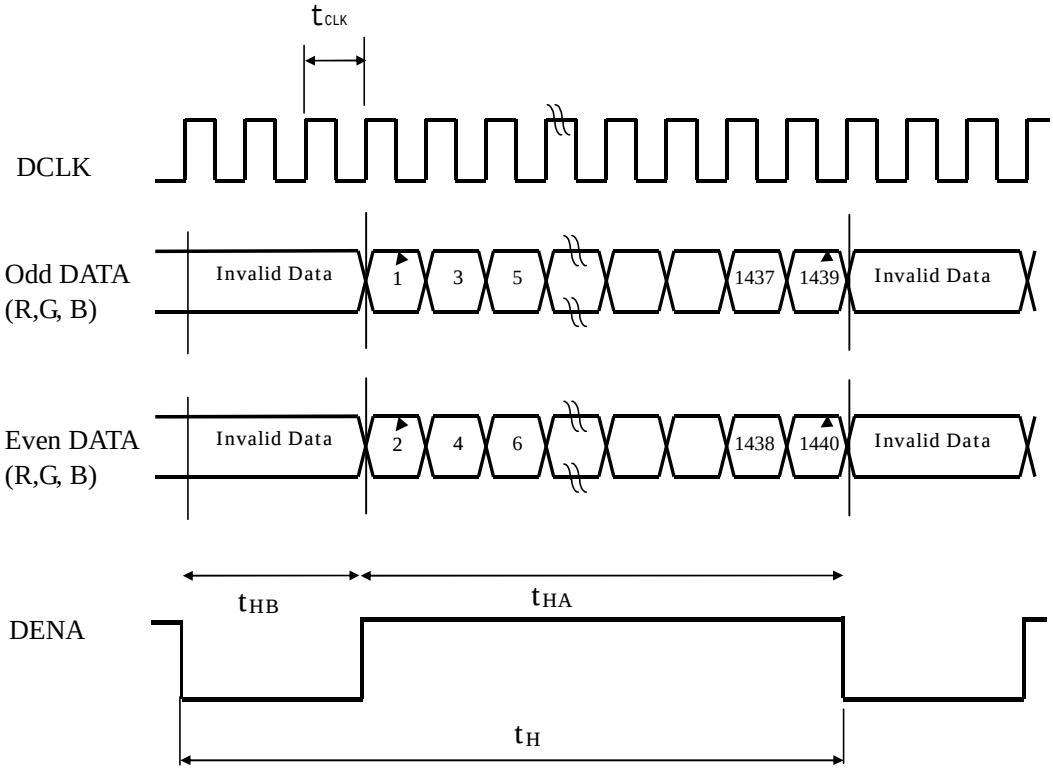
Pattern1 **à** Pattern2 **à** Pattern3 **à** Pattern4 **à** Pattern5 **à** Pattern1 **à** .....



5. INTERFACE TIMING CHART

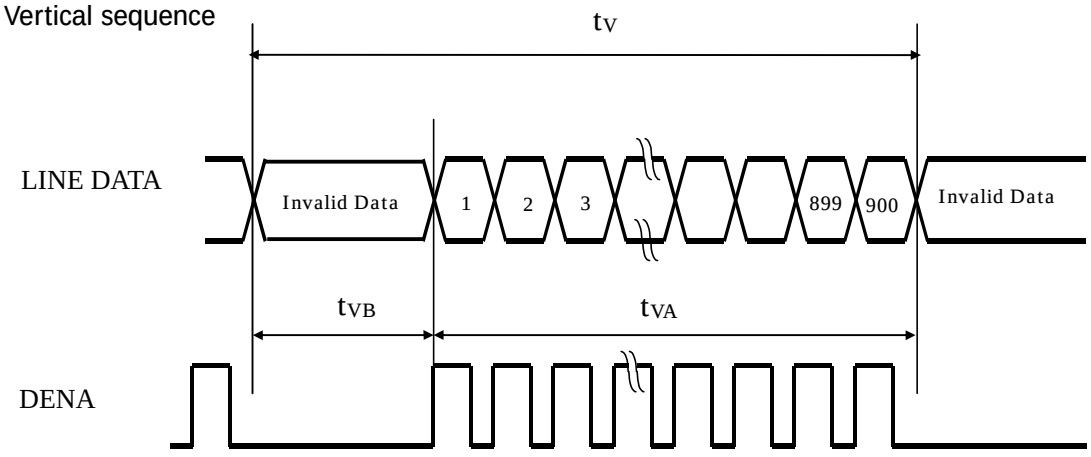
(1)(a). LVDS input time sequence

Horizontal sequence



(b) LCD input time sequence

Vertical sequence



(2) Timing Chart

ITEM				SYNBOL	MIN	TYP	MAX	UNIT
LCD Timing	DCLK		Frequency	f_{CLK}	41.5	44.37	59.85	MHz
			Period	t_{CLK}	24.09	22.53	16.70	ns
	DENA	Horizontal	Horizontal total time	t_H	760	800	950	t_{CLK}
			Horizontal Active time	t_{HA}	720	720	720	t_{CLK}
			Horizontal Blank time	t_{HB}	40	80	230	t_{CLK}
		Vertical	Vertical total time	t_V	910	926	1050	t_H
			Vertical Active time	t_{VA}	900	900	900	t_H
			Vertical Blank time	t_{VB}	10	26	150	t_H

[Note]

*1) DENA (DATA ENABLE) usually is positive.

*2) During the whole blank period, DCLK should keep input.

(3) DATA mapping

Color	Input Data	R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
RED	RED(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	1	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	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
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	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
	Blue(1)	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	1	0
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

[Note]

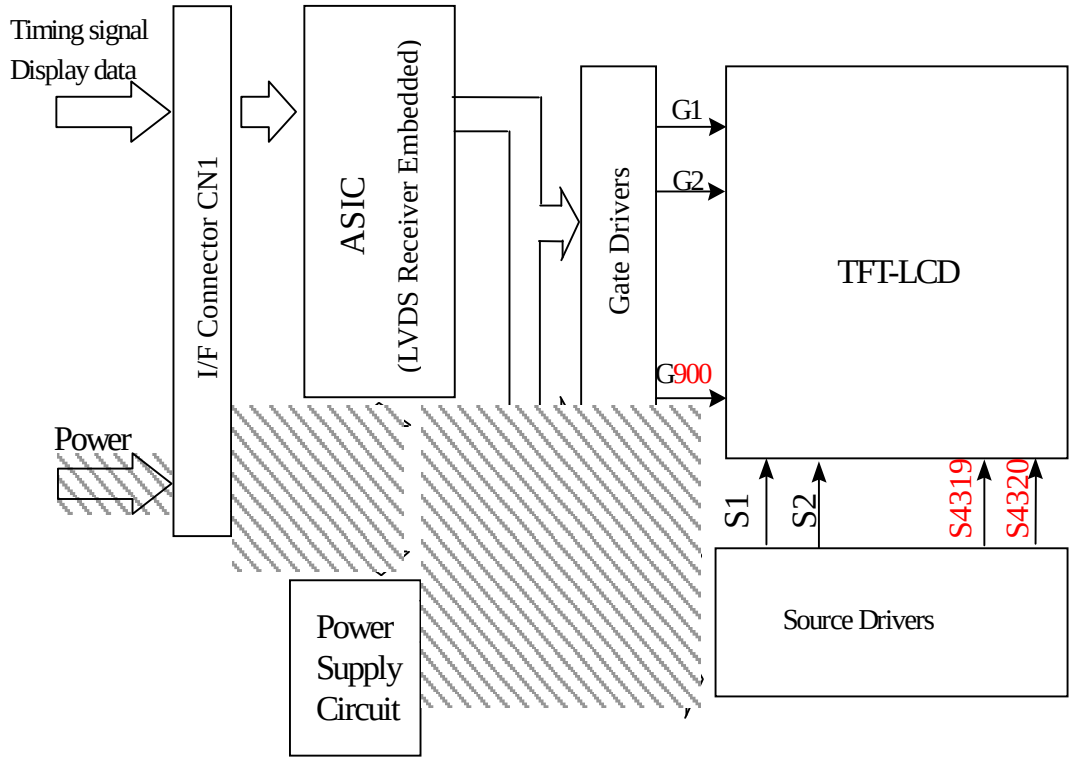
1) Gray level:

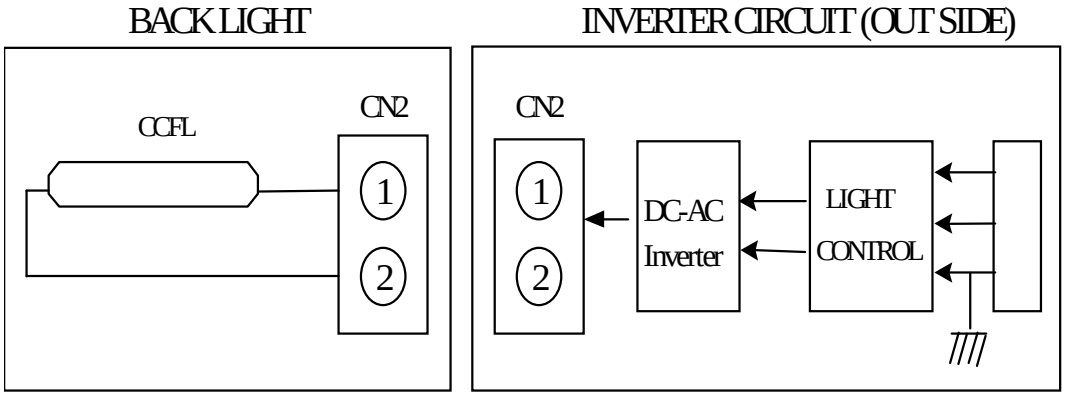
Color(n)：n is level order; higher n means brighter level.

2) DATA:

1: high，0: low

6. BLOCK DIAGRAM

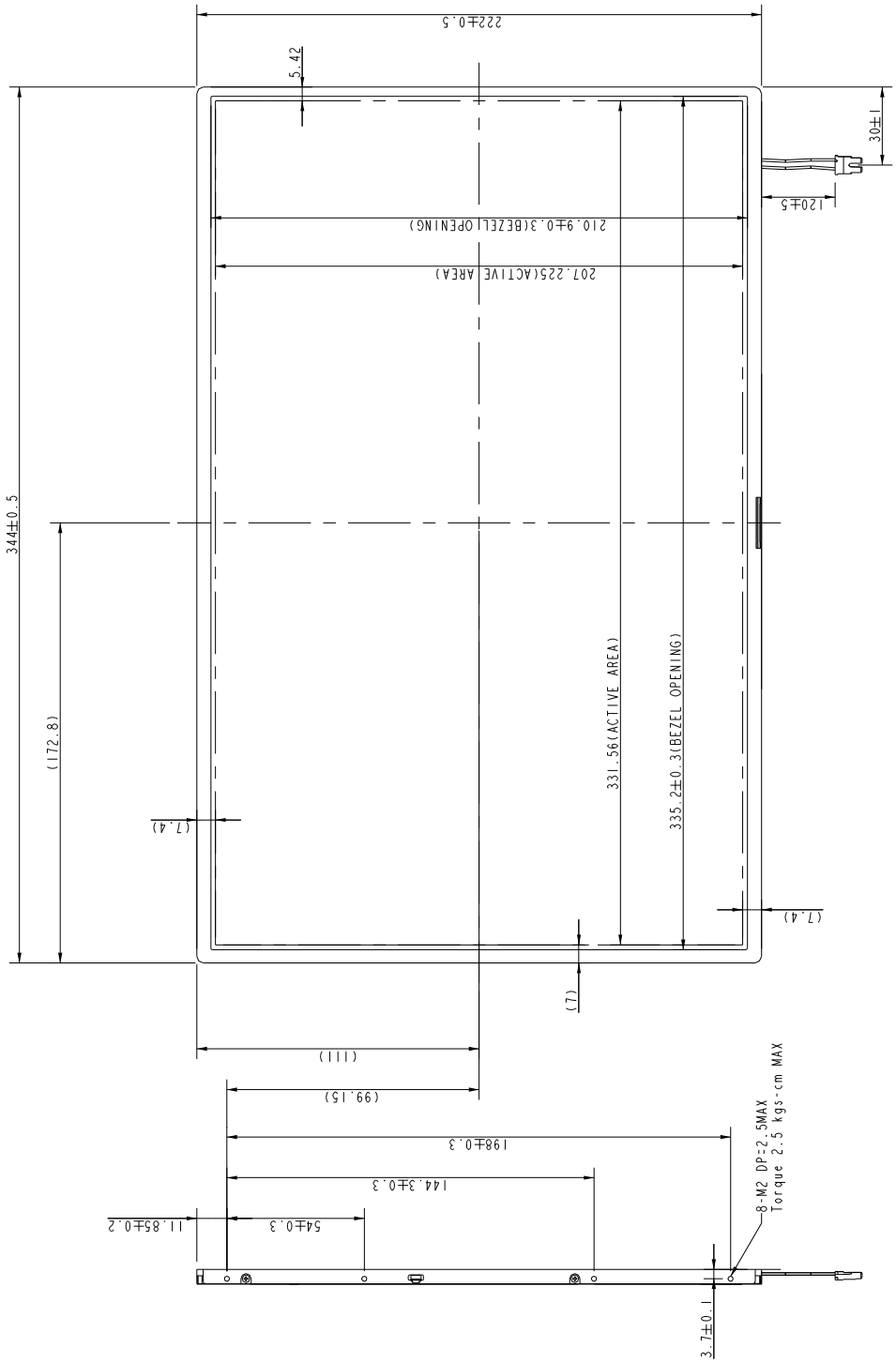




7. MECHANICAL SPECIFICATION

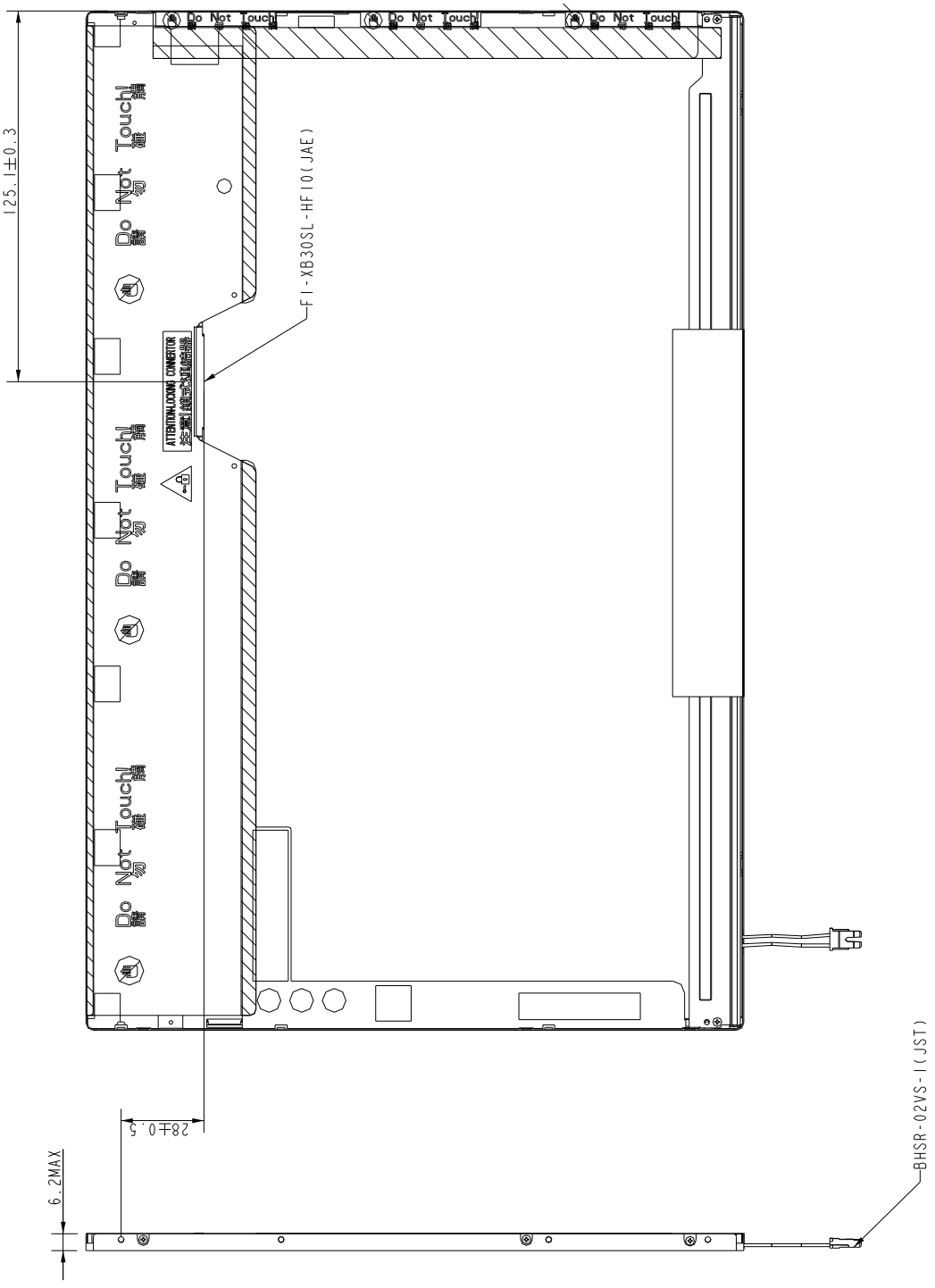
(1) Front side

The tolerance, not show in the figure, is ±0.5mm. [Unit：mm]



2) Rear side

The tolerance, not show in the figure, is ±0.5mm. [Unit：mm]



8. OPTICAL CHARACTERISTICS

Ta=25℃，VDD=3.3V

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REMARK
Contrast Ratio		CR	θ = ψ= 0°	400	500		--	*1)
Luminance (5P)		L	θ = ψ= 0°	220	250		cd/m^2	*2)
Uniformity(5P)		ΔL	θ = ψ= 0°	80			%	*2)
Uniformity(13P)		ΔL	θ = ψ= 0°	65			%	
Response Time		Tr	θ = ψ= 0°		2.5	6	Ms	*4)
		Tf	θ = ψ= 0°		5.5	10	Ms	*4)
Image sticking		Tis	16 hours		-	20	Min	*5)
Cross talk		CT	θ = ϕ= 0°*3			1	%	*6)
View angle	Horizontal	ψ	CR≧10	50/-50	60/-60		°	*3)
	Vertical	θ		35/-45	45/-55		°	*3)
Color Temperature Coordinate	W	X	θ = ψ= 0°	0.293	0.313	0.333		*2)
		Y		0.309	0.329	0.349		
	R	X		0.560	0.580	0.600		
		Y		0.320	0.340	0.360		
	G	X		0.290	0.310	0.330		
		Y		0.530	0.550	0.570		
	B	X		0.135	0.155	0.175		
		Y		0.135	0.155	0.175		
Gamut			θ = ψ= 0°		45%		%	
Gamma		γ	GL	2.0	2.2	2.4		*7)

Color coordinate and color gamut are measured by CS-1000, and all the other items are measured by BM-5A (TOPCON). All these items are measured under the dark room condition (no ambient light).

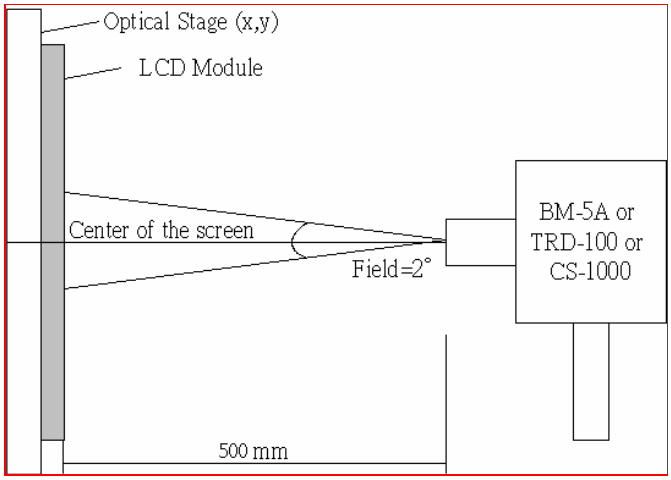
Measurement Condition: IL = 6.0 mA (SMB_DATA=FFH)

Inverter：SUMIDA / IV11145/T

Definition of these measurement items is as follows:

1) Setup of Measurement Equipment

The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 20 minutes and in a dark room.



***2) Definition of Contrast Ratio**

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

***3) 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 5、10、11、12、13, see Fig.1 below

5P Uniformity: Δ L = (Lmin / Lmax) ×100%

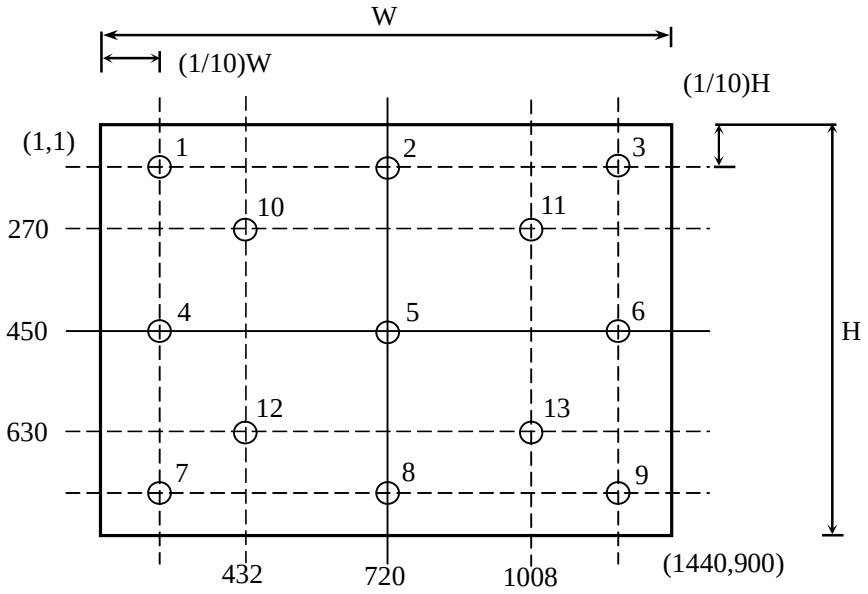
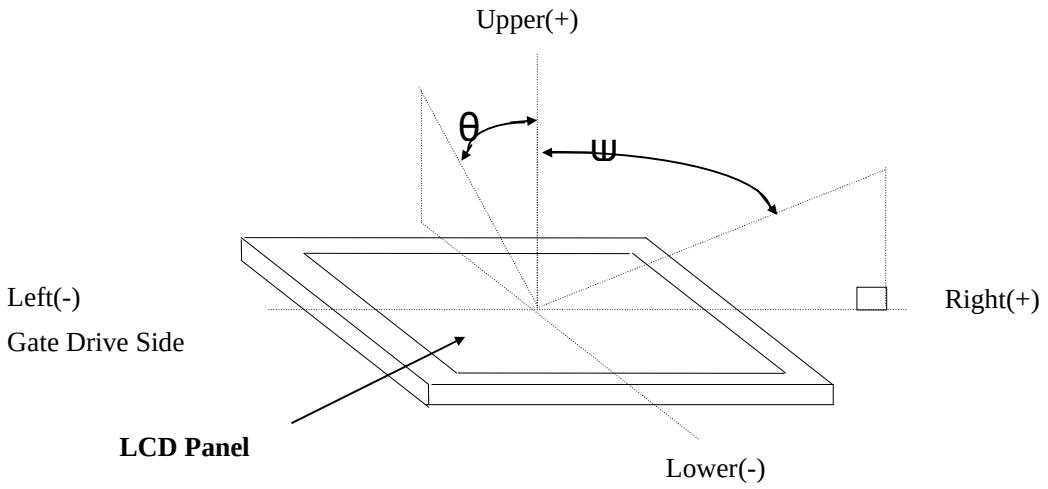
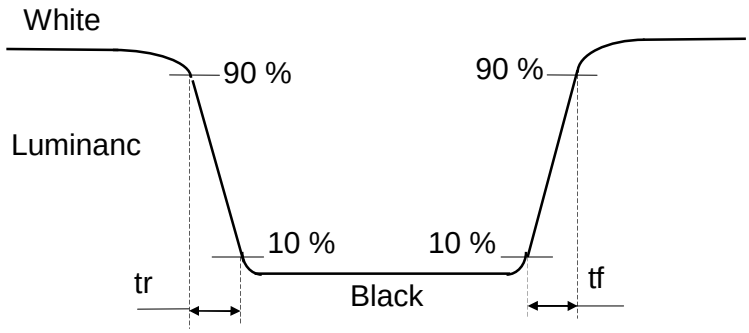


Fig.1 Measure Point

***4) Definition of view angle(θ，ψ)**



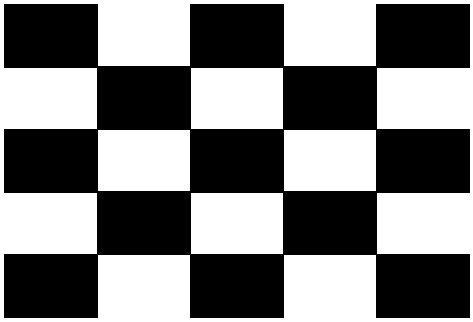
***5) Definition of response time**



***6) Definition of image sticking**

Continuously display the test pattern shown in the figure below for 16 hrs.at 25℃.
To change the picture to gray pattern (gray 32 pattern), and the previous image shall not persist during 20 min .

White：63 Gray
Black：0 Gray



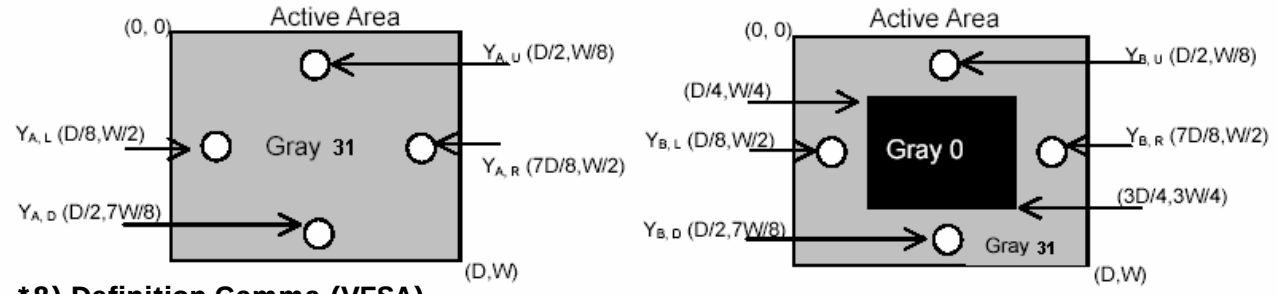
***7) Crosstalk Modulation Ratio:**

CT= | Y_B-Y_A | / Y_{Ax}× 100%

Y_A、Y_B measure position and definition

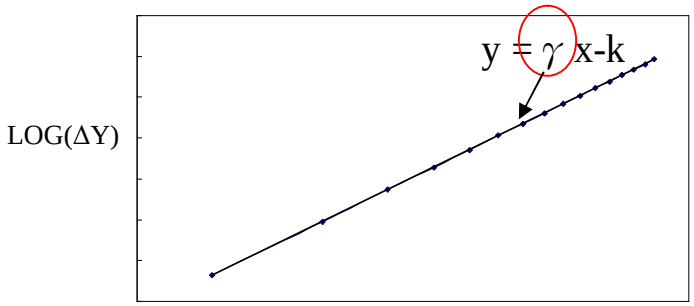
Y_A means luminance at gray level 32(exclude gray level 0 pattern)

Y_B means luminance at gray level 32(include gray level 0 pattern)



***8) Definition 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、4、8-----、60、63).



9. RELIABILITY TEST CONDITIONS

(1) Temperature and Humidity

TEST ITEMS	CONDITIONS
High Temperature Operation	50°C ; 250Hrs
High Temperature Storage	65°C ; 250Hrs
High Temperature High Humidity Operation	40°C ; 95% RH ; 250Hrs
High Temperature High Humidity Storage	60°C ; 95% RH ; 48 Hrs
Low Temperature Operation	0°C ; 250 Hrs
Low Temperature Storage	-25°C ; 250 Hrs
Thermal Shock	-40°C (30 Mins)～65°C (30 Mins)， Ramp<20℃，100 CYCLE
Temperature & Pressure Storage	0°C ; 260hPa(about 10000m)，24 Hrs

(2) Shock & Vibration

TEST ITEMS	CONDITIONS
Shock (Non-Operation)	Shock level : 2450m/s^2 (250G), Waveform : half sinusoidal wave, 2ms, 6 axis (± X,± Y,± Z) per cycle
Vibration (Non-Operation)	Vibration level : 14.7m/s^2 (1.5G), sinusoidal wave (each x,y,z axis : 1hr, total 3hrs) Frequency range : 5～500 Hz Sweep speed : 0.5 Octave/min.

(3) ESD

	Surface discharge(Panel display area、Frame、PWB、Panel back side)		Electrics capacity of Connector
	Contact	Air	Contact
Capacity	150 pF	150 pF	200 pF
Resistance	330 Ω	330 Ω	0 Ω
Voltage	±8kV	±8kV/±15kV	±250 V
Interval	1 sec	1 sec	1 sec
Times(single point)	25	25	1

(4) MTBF without B/L: 200,000 Hrs (min) lifetime.

(5) 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.