Chunghwa Picture Tubes, Ltd.
Technical Specification

To : **TPK**

Date : 2009-06-05

CPT TFT-LCD

CLAA 150XP01Q

ACCEPTED BY：

APPROVED BY	CHECKED BY	PREPARED BY
Jason Wu	**Neptune Kang**	**Randy Lin**

Prepared by : Design General Division

CHUNGHWA PICTUER TUBES, LTD.

No. 1, Huaying Rd., Sanho Tsun, Lungtan Shiang, Taoyuan, Taiwan, 325, R.O.C.

TEL: +886-3-4805678 FAX: +886-3-4800589

Modification Record List

NO.	Issue Date	Modification Index	Modifier
1	2008/11/17	First edition for customer	Chih-Ho Hsieh
2	**2009/06/05**	**Modify Vertical Viewing Angle Typ./Min (125/105)→P16.**	Chih-Ho Hsieh

Table Of Content

1. OVERVIEW

CLAA150XP01Q is 15.0” color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit and backlight. By applying 8 bit digital data (6 bit+Hi-FRC),1024×768, 16.7M-color images are displayed on the 15.0” diagonal screen. Input power voltage is 3.3V for LCD driving. Inverter for backlight is not included in this module. General specifications are summarized in the following table:

ITEM	SPECIFICATION
Display Area(mm)	304.1(H)x228.1(V) (15.0-inch diagonal)
Number of Pixels	1024(H)x768(V)
Pixel Pitch(mm)	0.297 (H)x0.297 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	normally white, TN
Number of Colors	16.7M (6 Bit+Hi-FRC)
Brightness(cd/m^2)	250 cd/m^2(Typ.)(Center point, Lamp current=8.0 mA)
Viewing Angle	140 /125(Typ.)
Surface Treatment	Anti-glare
Power consumption(W)	12.5 (Typ.)
Module Size(mm)	326.5 (W)x253.5 (H)x11.0(D)(TYP)
Module Weight(g)	1300g(max)
Backlight Unit	CCFL, 2 tables, edge-light(top*1/bottom*1)

2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD	VCC	0	4.0	V	
Lamp Voltage	VL	-	786	Vrms	
Lamp Current	ILO	3	8.5	mArms	*4). 7)
Lamp Frequency	VESDt	-200	200	V	
static electricity	VESDc	-8000	8000	V	*5)
	VESDt	-200	200	V	
Operation Temperature	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-aching.

4). The life time of the lamp is related to the current of the lamp, so please according to the description of the "(b) backlight" on page 8.

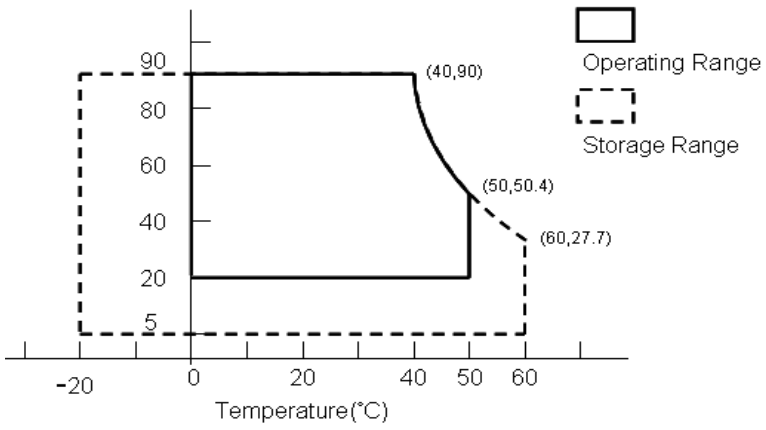
5). Test Condition: IEC 1000-4-2

VESDt: Contact discharge to input connector; $VESD_C$: Contact discharge to module

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

7). When lamp current is out of the absolute maximum range, the life will fall rapidly or shown unusual sign.
IL min **2**mA only for test only, but we can't guarantee the lifetime and performance.

8). 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

(1).TFT-LCD

Ta=25℃

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	Remark
Power Supply Voltage for LCD		Vcc	3.0	3.3	3.6	V	*1)
Power Supply Current for LCD		Icc	-	700	1000	mA	*2)
Permissive Input Ripple Voltage		VRP	-	-	100	mVp-p	Vin=+3.3V
Differential impedance		Zm	70	100	110	Ω	
Logic input voltage LVDS:IN+，IN-	Common Mode Voltag	1.125	1.25	1.375	V		
	Differential Input Voltage	250	350	450	mV		
	Threshold Voltage(High)	-	-	100	mV	*3)	*3)
	Threshold Voltage(Low)	-100	-	-	mV		
LCD Inrush Current		Inrush			2	A	*4)
Power consumption		P		2.1	2.5	W	*2)

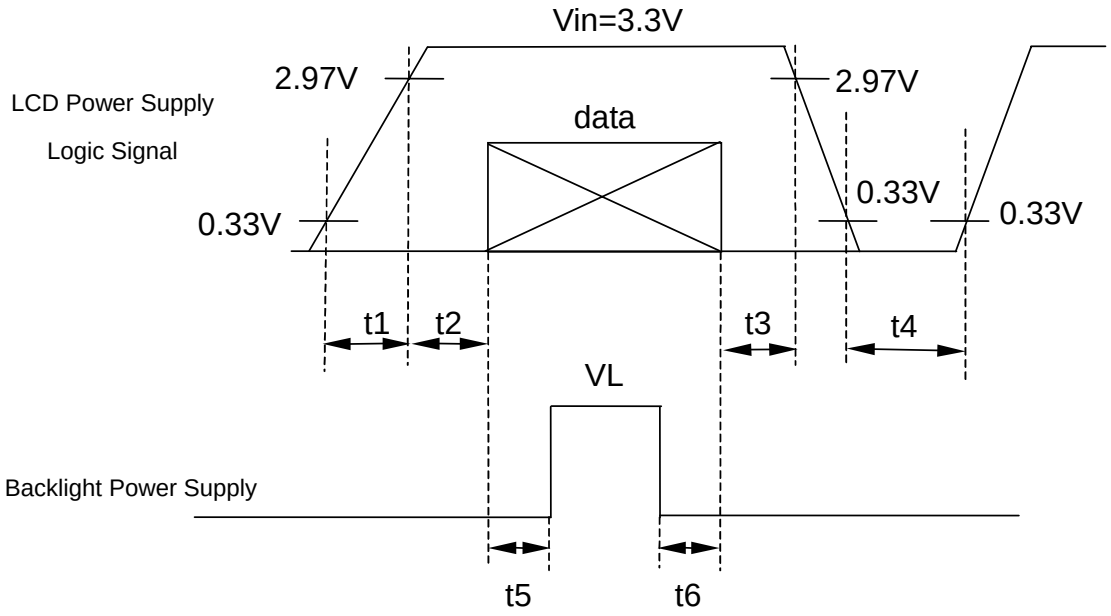
[Note]

1).VCC-turn-on conditions:

0.5ms≦t1≦10ms　　500ms≦t4

0≦t2≦50ms　　200ms≦t5

0≦t3≦50ms　　200ms≦t6



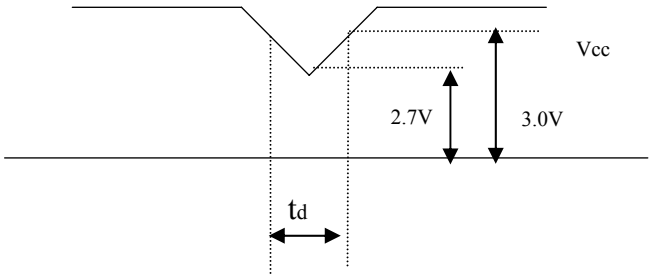
Data: RGB DATA, DCLK, DENA

,

VCC-dip conditions:

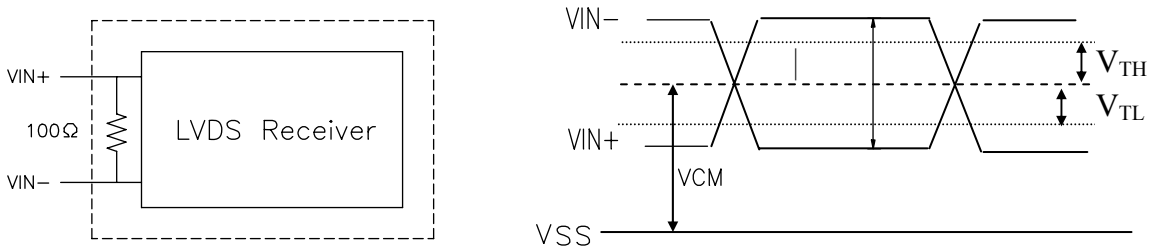
(1) When 2.7V≦Vcc (min) <3.0V: td≦10 ms, module works well.

(2) When VCC <3.0 V, it works abnormal that must reset power. VCC -dip conditions should also follow the VCC-turn-on conditions.



2).Typical current situation: 64 gray scale level,1024 line mode, VCC=3.3V, Fh=64Khz,Fv=60Hz, f_{CLK}=65 MHz.

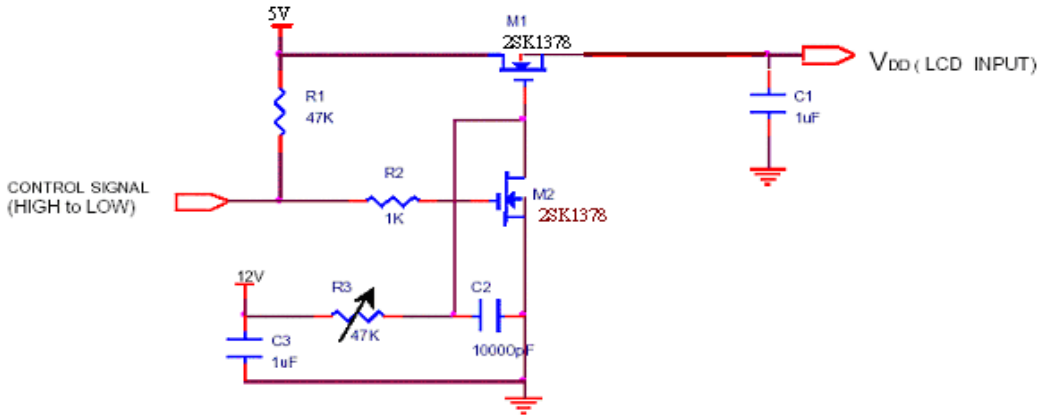
3).LVDS Signal definition:

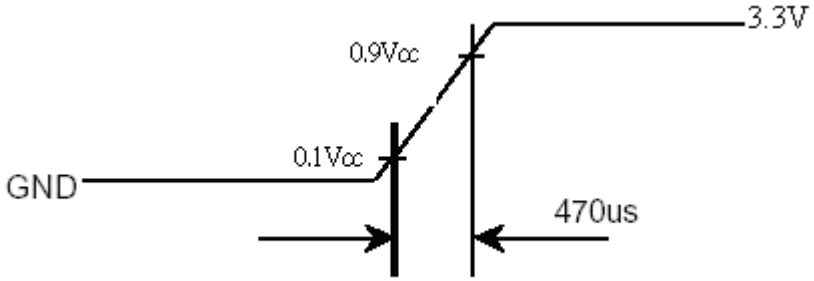


VIN+：Positive differential DATA & CLK Input

VIN-： Negative differential DATA & CLK Input

4).Irush Measurement Condition





(2).Backlight

1. Electrical specification

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
B/L Voltage	VL	540	600	660	Vrms	IL=8.0mA Ta=25℃
B/L Current	IL	7.5	8.0	8.5	mArms	*1) Ta=25℃
B/L operating current	ILO	3	8.0	8.5	mArms	*1) Ta=25℃
B/L power consumption	WL	--	9.6	--	W	IL=8.0mA Ta=25℃
Inverter Frequency	FI	40	--	60	kHz	*2) Ta=25℃
Starting Lamp Voltage	VS	1350	--	--	Vrms	Ta=0℃
		1050	--	--	Vrms	Ta=25℃

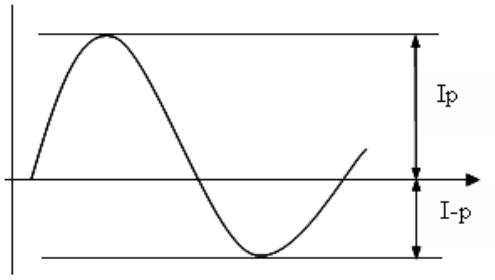
2. Lamp life time

ITEM		IL at 2.0 mA	IL at 3.0 mA	IL at 7.5 mA	IL at 8.0 mA	IL at 8.5 mA	UNIT	REMARK
Lamp life Time	STI	--	Min. 50,000	Min. 35,000	Min. 30,000 Typ. 40,000	Min. 20,000	hr	Continuous Operation *3)
Rated time (turn on/off)		--	--	Min.100,000	--	--	time	*4)

[Note] Measuring inverter Type：(QF61V4.53), Frequency=50 kHz.

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

- The degrees of unbalance： ＜10%
- The ratio of wave height：＜√2 ±10%



Ip：high side peak

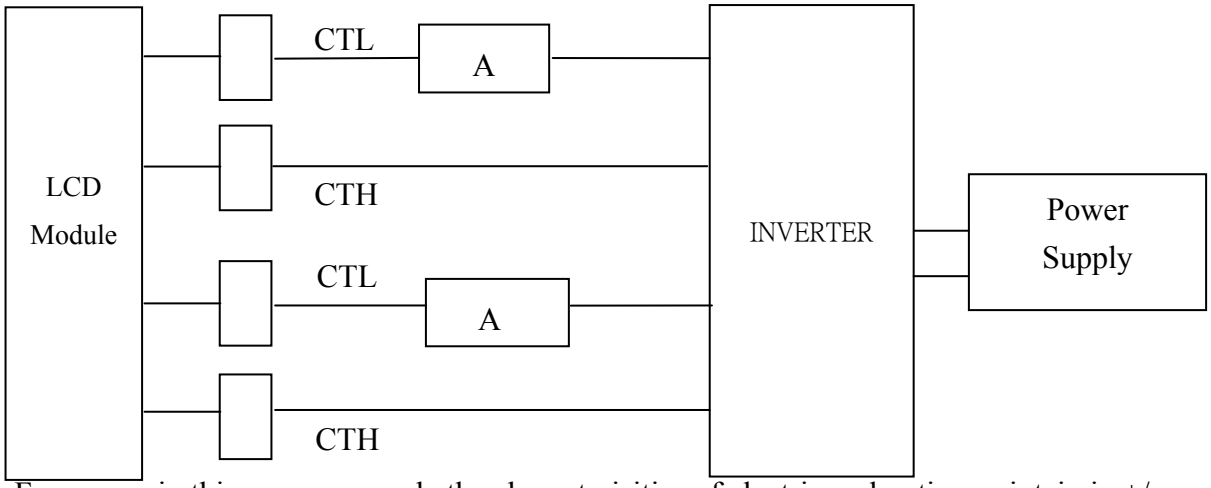
I-p：low side peak

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

The lamp work current(I_{cyc})of any period of light up-driving wave-form can not more than the maximum value of lamp standard work current(IL)，so the situation can not happened when designed Inverter.

[Note] I_{cyc} is a Cycle RMS value read by an oscilloscope

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



2) a.Frequency in this range can mala the characterisitics of electric and optics maintain in +/- 10% except hue.

b.If the lamp frequency can be maintain in 50~60KHz, the better charactristics of the electrical and the optical can be presented.

c.If the operating frequency is 40~80 KHz, the life time and the reliability of the lamp will not be affect.

d.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.

3) Definition of the lamp life time：Luminance (L) under 50% of specification starting lamp voltage or starting lamp voltage is more than 110% of the initial value. When lamp current over 8.5mA, lamp life time will drop rapidly. If over 8.5mA, it will come up safety issue. But if it lower than 3.0mA, the lamp will be damaged.

4) The condition of Turn-on and Turn-off operation is as below:

a. Lamp current is 8.0mA. Ta=25℃.

b. Frequency is 10 sec.(on)/10 sec.(off)

c. Repeat it for 100 thousand times

d. The lamp life time still match the definition*3).

It should not have motion fail when starting lamp voltage is lower than 110% of the initial value.

5) It is necessary to consider the maximal value when design inverter，in order to assure lighting.

6) The equation of power consumption WL=IL x VL x 2.(IL=8.0mA，Ta=25℃)

7) The voltage above VS should be applied to the lamps for more than 1 second for start-up. (Inverter open voltage must be more than lamp starting voltage.)

8)The maximum value of starting lamp voltage is defined as the probably biggest value of starting lamp voltage, hence the design of starting lamp voltage for inverter must be equal to or higher than maximum starting lamp voltage.

4. INTERFACE PIN CONNECTION

(1) CN1 (Data Signal and Power Supply)
Outlet connector: MSB240420 (STM) or equivalent
Plug connector: DF14-20S-1.25C (Hirose) or equivalent

PIN #	SYMBOL	FUNCTION
1	VCC	+3.3V Power Supply
2	VCC	+3.3V Power Supply
3	GND	GND
4	GND	GND
5	RXIN0-	Negative LVDS Differential Data Input
6	RXIN0+	Positive LVDS Differential Data Input
7	GND	GND
8	RXIN1-	Negative LVDS Differential Data Input
9	RXIN1+	Positive LVDS Differential Data Input
10	GND	GND
11	RXIN2-	Negative LVDS Differential Data Input
12	RXIN2+	Positive LVDS Differential Data Input
13	GND	GND
14	RXCLK	Negative LVDS Differential Clock Input
15	RXCLK	Positive LVDS Differential Clock Input
16	GND	GND
17	RXIN3-	Negative LVDS Differential Data Input
18	RXIN3+	Positive LVDS Differential Data Input
19	GND	GND
20	NC	Reserved

1) Please 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 (BACKLIGHT)

Backlight-side connector: BHR-03VS-1 (JST)
Inverter-side connector: SM03B-BHS-1 (JST)

CN2

PIN #	SYMBOL	FUNCTION
1	CTH1	High Voltage
2	--	Empty
3	CTL1	Low Voltage

CN3

PIN #	SYMBOL	FUNCTION
1	CTH2	High Voltage
2	--	Empty
3	CTL2	Low Voltage

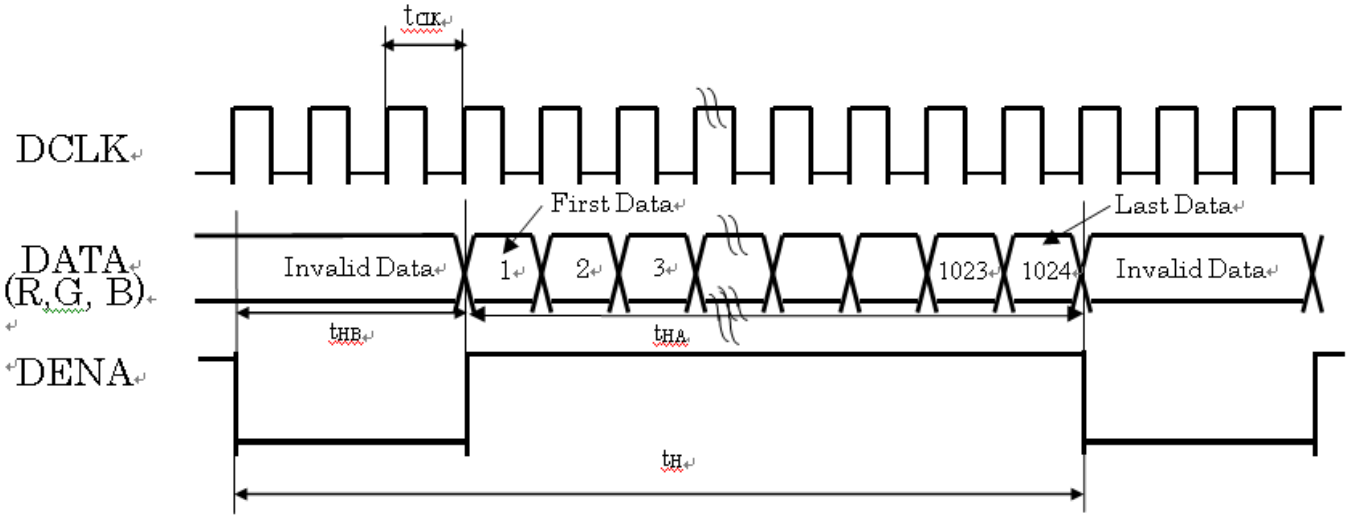
5. INTERFACE TIMING

(1) Timing Specifications

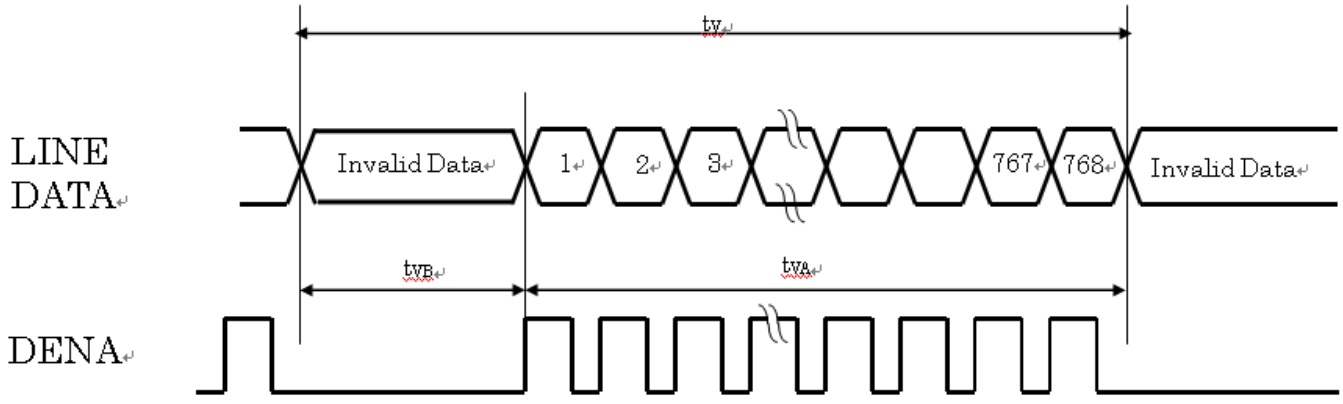
ITEM				SYMBOL	MIN.	TYP.	MAX.	UNIT
LCD Timing	DCLK		Frequency	f_{CLK}	50	65	80	MHz
			Cycle	t_{CLK}	12.5	15.3	20	ns
	DENA	Horizontal	Vertical line rate	f_H	43.48	48.36	58.39	kHz
			Horizontal total time	t_H	1150	1344	1370	t_{CLK}
			Horiaontal effective time	t_{HA}	--	1024	--	t_{CLK}
			Horizontal blank time	t_{HB}	126	320	346	t_{CLK}
		Vertical	Vertical frame Rate	Fr	55	60	75	Hz
			Vertical total time	t_V	794	806	860	t_H
			Vertical effective time	t_{VA}	--	768	--	t_H
			Vertical blank time	t_{VB}	26	38	92	t_H

(2) Timing Chart

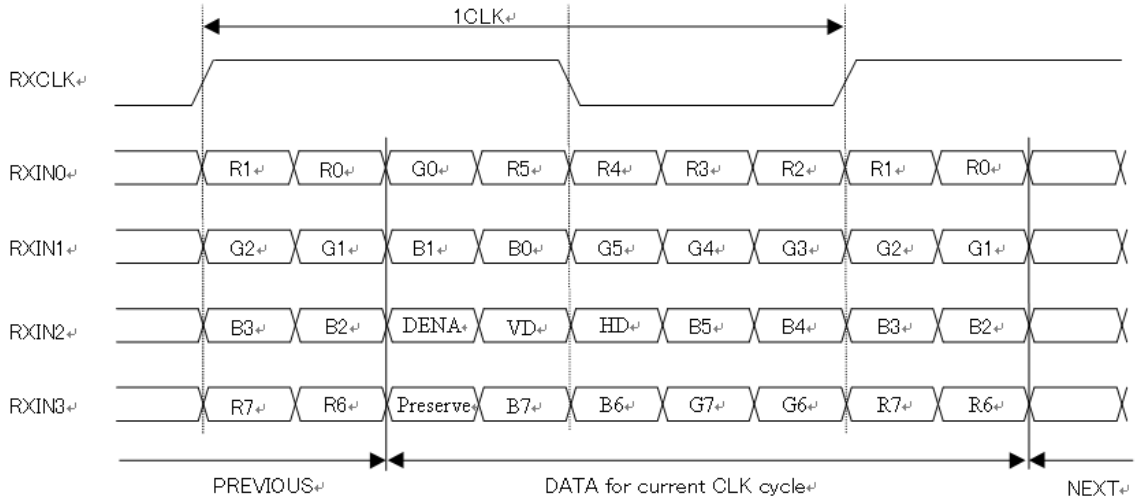
a. Horizontal Timing



b. Vertical Timing



(3) LVDS DATA：Timing Chart



(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]

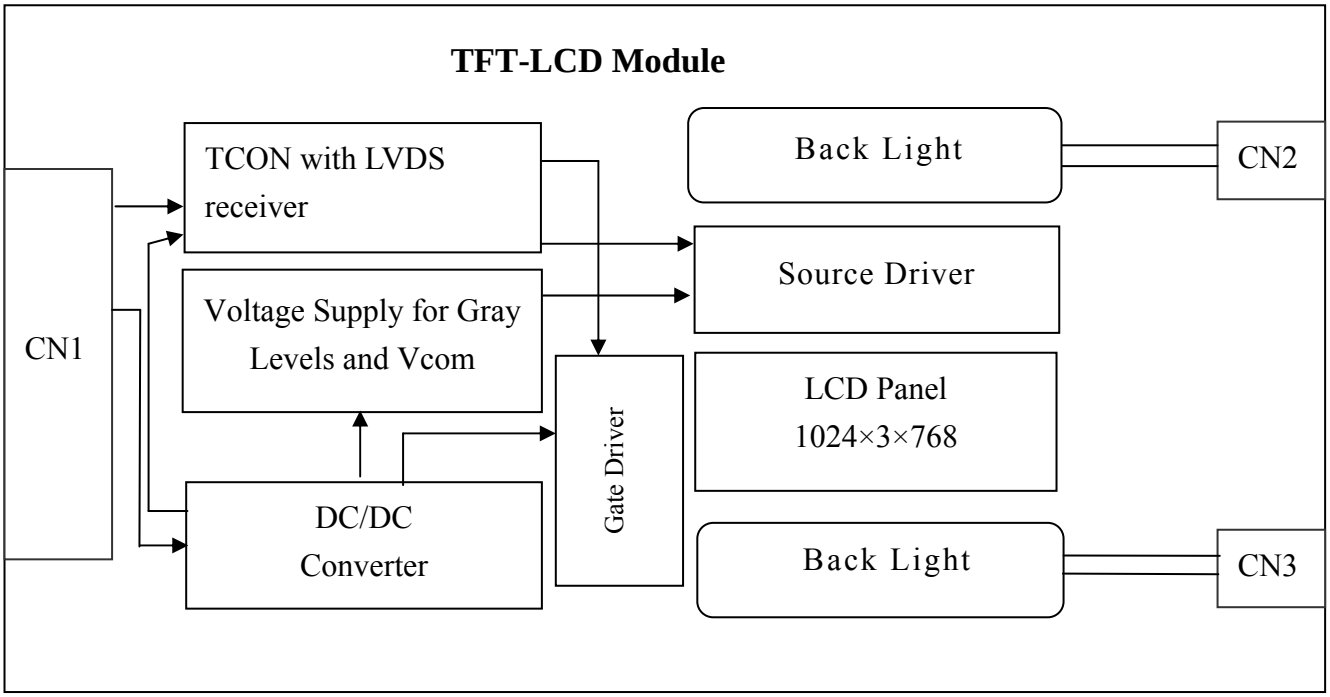
1) Definition of gray scale:

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

2) Data: 1-High, 0-Low.

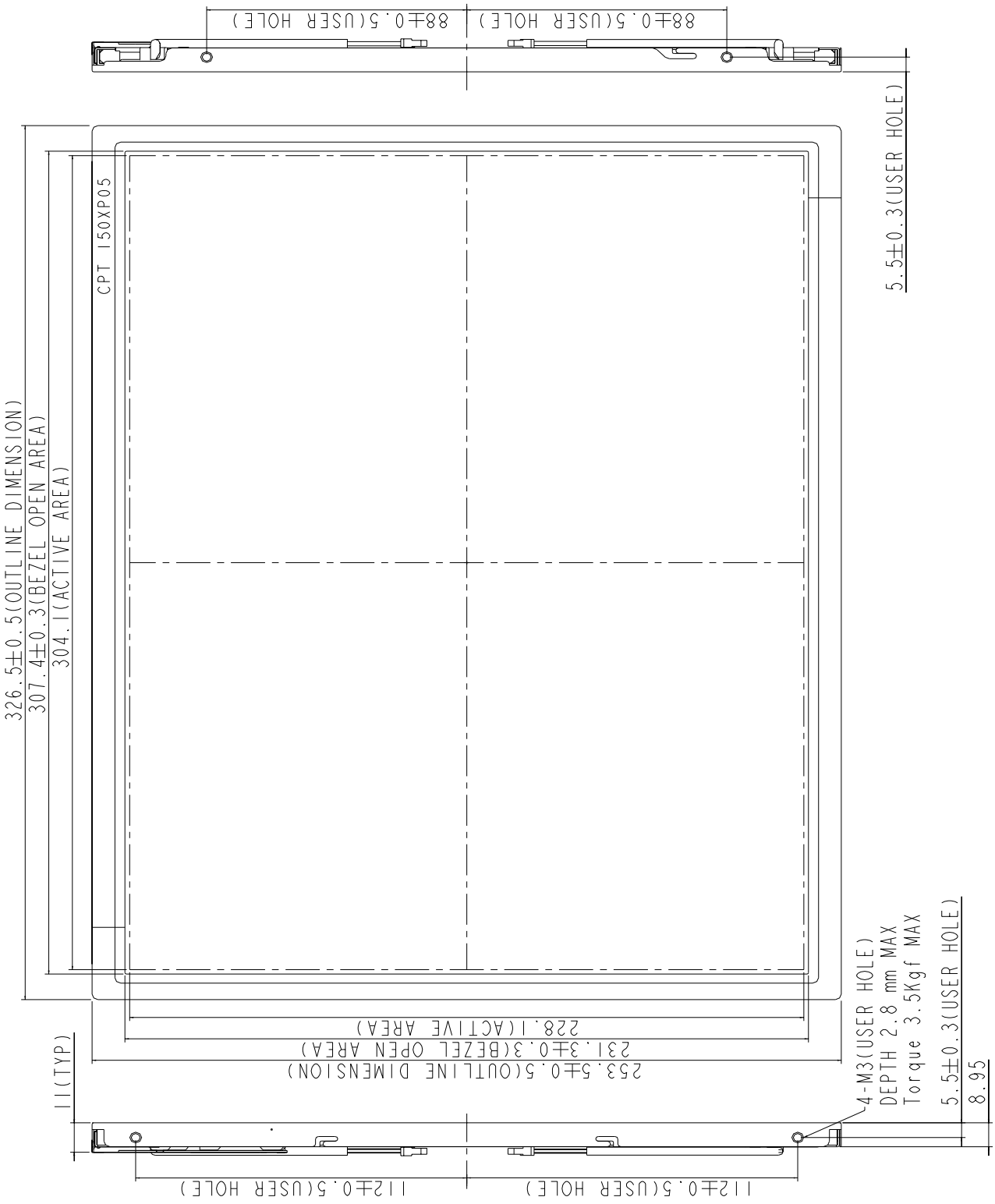
3) This assignment is applied to both odd and even data.

6. BLOCK DIAGRAM

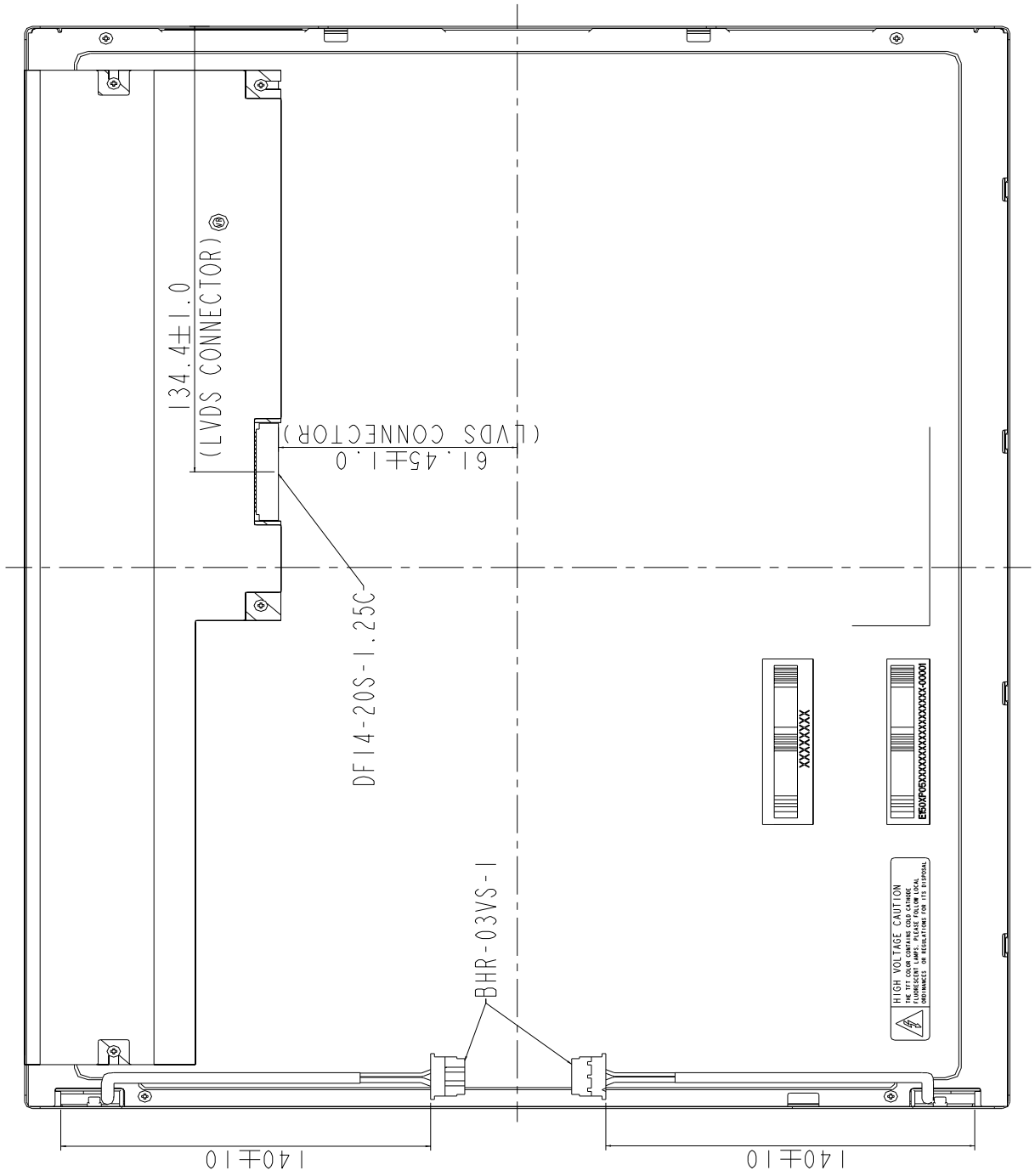


7. MECHANICAL SPECIFICATION

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



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



8. OPTICAL CHARACTERISTICS

Ta=25℃，VCC=3.3V

ITEM		SYMBOL	CONDITION	min	typ	max	UNIT	REMARK
Contrast Ratio		CR	θ=ψ= 0°	450	500	--	--	*1) 2)
Luminance(CEN)		L	θ=ψ= 0°	200	250	--	cd/m^2	*1) 3)
9P Uniformity		ΔL	θ=ψ= 0°	75	--	--	%	*1) 3)
Response Time		Tr	θ=ψ= 0°	--	2	4	ms	*5)
		Tf	θ=ψ= 0°	--	6	10		
Crosstalk		CT	θ=ψ= 0°	0	--	1	%	*6)
Viewing Angle	Horizontal	ψ	CR≧10	120	140	--	Deg.	*4)
	Vertical	θ		105	125	--	Deg.	
Color Coordinates	White	X Y	θ=ψ= 0°	0.283 0.299	0.313 0.329	0.343 0.359	Color Coordinates	*3)
	Red	X Y		0.613 0.305	0.643 0.335	0.673 0.365		
	Green	X Y		0.270 0.555	0.300 0.585	0.330 0.615		
	Blue	X Y		0.113 0.049	0.143 0.079	0.173 0.109		
Gamut		CG	θ=ψ= 0°	55	65	--	%	--
Gamma		γ	VESA	2.0	2.2	2.4	--	*7)

[Note]

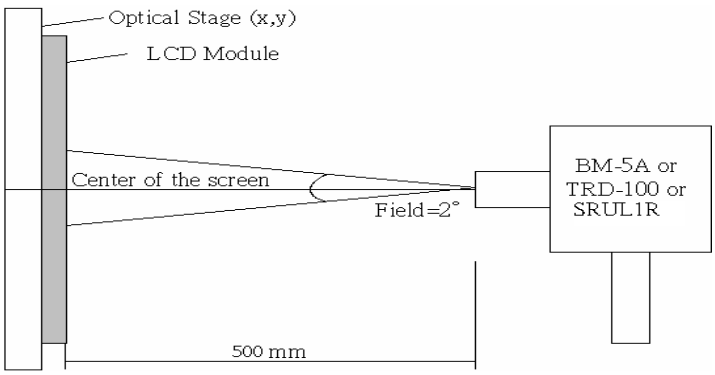
All optical specification condition:

Equipment: Color coordinate and color gamut are measured by SRUL1R, and all the other items are measured by BM-5A (TOPCON).

Condition: IL=8.0 (each lamp) mA, Inverter: (QF61V4.53), Frequency=50 kHz.

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:

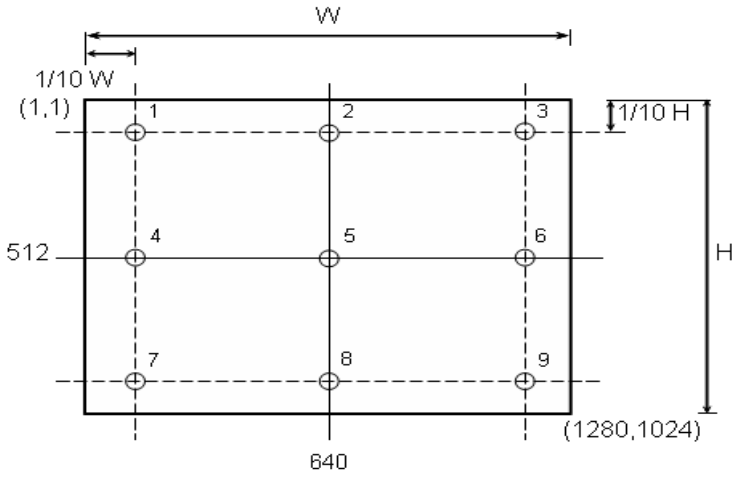
CR=ON (White) Luminance/OFF (Black) Luminance

3).Definition of Luminance and Luminance uniformity:

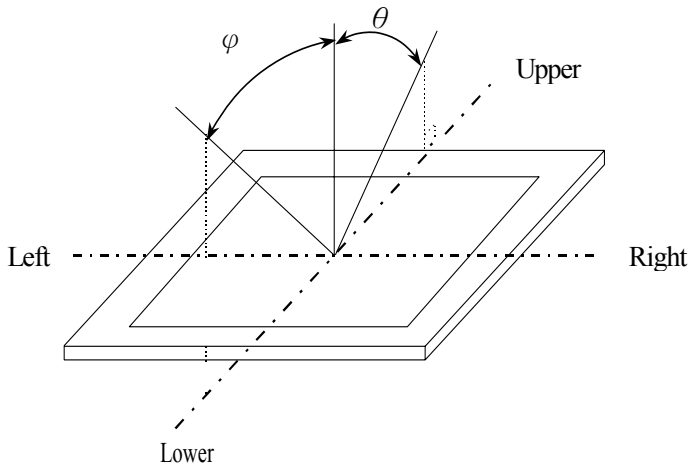
Center Luminance: measuring the luminance of the point no. 5

Average Luminance: measuring average luminance of points no.1-no.9

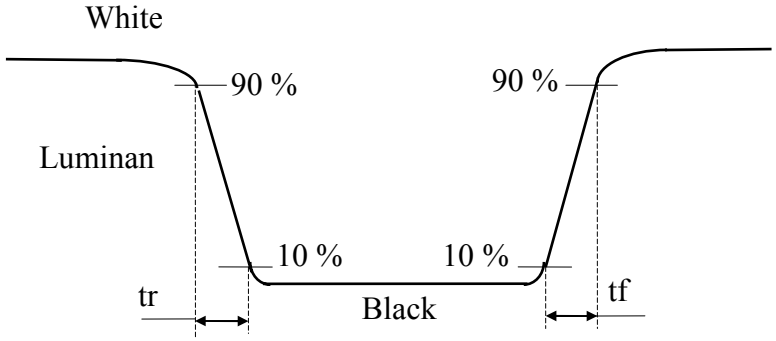
Uniformity: ΔL= [L (Min)/L (Max)] ×100 %



4).Definition of Viewing Angle (θ,ψ):



5) Definition of Response Time:

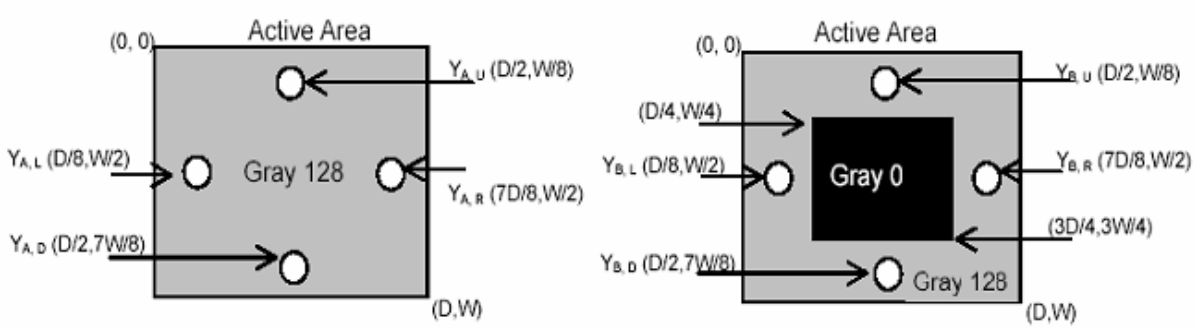


6) Definition of crosstalk:

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

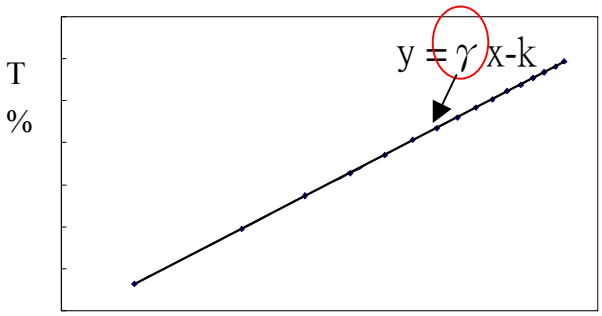
Y_A : The luminance of measured position at pattern A

Y_B : The luminance of measured position at pattern B with Gray level 0



Pattern A Pattern B

7) Definition of Gamma (γ), follow VESA standard sampling every 16 gray level (0,16,32,…..224,240,255)



Gray level (LOG)

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(1.25G) 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

POSITION	CONDITION(MDL turn off)
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, 25 times for each test point

(4) Low Pressure test

TEST ITEM	CONDITION
Low Pressure test(Storage)	0℃,260HPa (30000 ft.)；24 Hr
Low Pressure test(Operation)	-30℃,260HPa (30000 ft.)；24 Hr

(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.

10. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

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

(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 guide lines.
   a) 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.
   b) 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.
   c) 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.
   d) 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.
   e) 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 cloth 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.

(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 charge 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.

(3) PRECAUTFONSWITHELECTROSTATICS

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.

(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℃.

(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 thoroughly with soap and water.

(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:
   a) 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.

b) Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.

c) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.

d) 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.)

Chunghwa Picture Tubes, Ltd.
Inspection Specification

To : **TPK**
Date : 2009.06.05

CPT TFT-LCD
Incoming Inspection Standards

Model : CLAA150XP01Q

ACCEPTED BY：

APPROVED BY	CHECKED BY	PREPARED BY
Jason Wu	**Neptune Kang**	**Randy Lin**

Prepared by : Product Planning Management General Division TFT Business Unit

CHUNGHWA PICTUER TUBES, LTD.

1127 Hopin Rd., Padeh, Taoyuan, Taiwan 334, R.O.C.
TEL: +886-3-3675151 FAX: +886-3-377-3001

INCOMING INSPECTION STANDARDS

Incoming Inspection Clause

(1) The Incoming Inspection Standard will be agreed and signed by both sides(Customer and CPT) before CPT receives the PO(Purchase Order) *forward 7days*.

(2) If there are any external fail statuses on the LCD Panel after Customer assembled, it will be judged to *Customer Responsibility*.

Warranty Period:

The warranty period is 18 month after arriving customer's factory.

1.Inspection instruments:

(1)Pattern generator: CPT TFT LCD tester.

(2)Video board: CPT Video board or equivalent. (The output signal should be meet CPT specification)

(3)Luminance colorimeter: Topcon BM-5A or equivalent model.

2. Inspection conditions is as follows:

(1) Viewing distance is approximately 35 ~ 40 cm

(2) Viewing angle is normal to the LCD panel as Fig _1(10°)

(3) Ambient temperature is approximately 25 ± 5℃

(4) Ambient humidity is 60 ± 5% RH

(5) Ambient illuminance is from 300 ~ 500 Lux.

(6) Input signal timing should be typical value.

(7) When judging the defeat, take off protective film of polarizer.

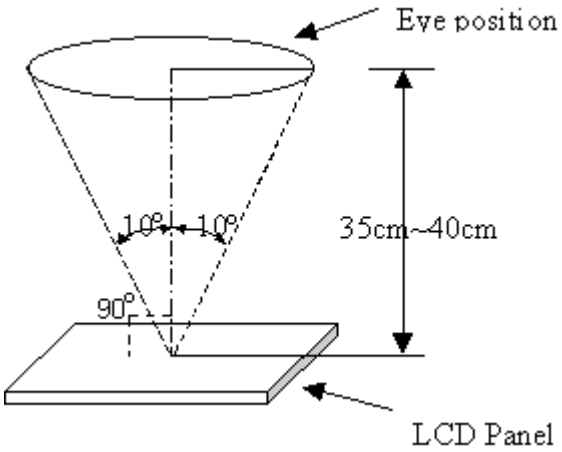


Fig _ 1

3. Special condition

(1) Viewing distance is close for inspection of adjacent dots and distance between defect dots.

(2) Viewing condition of "Shot block non-uniformity from oblique angle" is as Fig _2.

(3) Exceptional case: View angle ± 40° while inspected image-sticking.

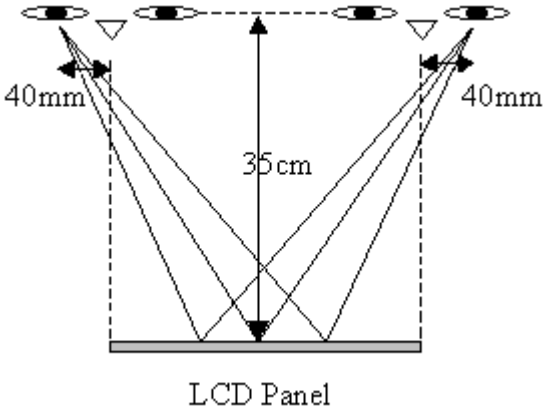


Fig _ 2

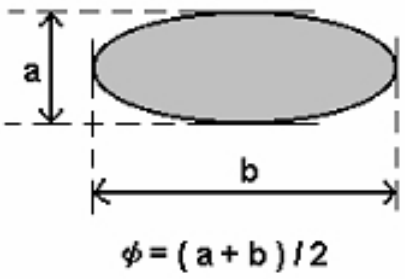
4. Inspection Criteria

a. VISUAL DEFECT

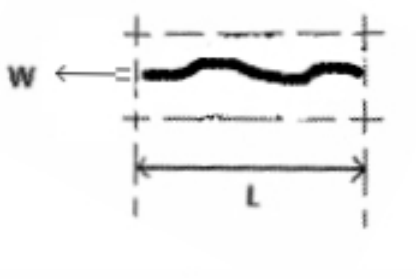
No.	Inspection Item	Specitication	Note
1	SCRATCH	0.05mm≦W≦0.1mm, L≦10mm; N≦4	Note1
2	SPOT (DARK,BRIGHT)	0.15mm≦ φ ≦0.5mm; N≦4	Note1, Note2
3	FIBER	0.01mm≦W≦0.1mm; L≦5.0mm; N≦4	Note1, Note2
4	POLARIZER BUBBLE	0.15mm≦ φ ≦0.5mm; N≦4	Note1, Note2

[Note1] Judge area: active area

[Note2] W : Width[mm], L : Length[mm], N : Number, φ : Average Diameter



1. (White, black) Spot
2. Polarizer Bubble



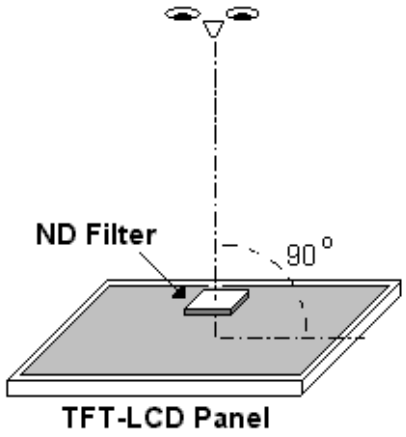
1. Fiber

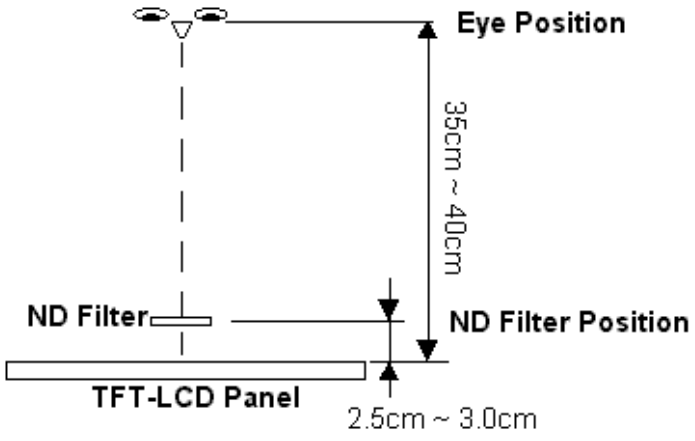
b. ELECTRICAL DEFECT

No.	Inspection Item	Specitication	Note
1	BRIGHT DOTS	N≦3	Note1
2	DARK DOTS	N≦4	Note1
3	TOTAL DOTS	N≦5	Note1
4	TWO ADJACENT DOT (bright dots, dark dots, or bright, and dark dots; vertical, horizontal, and oblique)	≦2 PAIRS	Note2
5	THREE OR MORE ADJACENT DOT	≦0 PAIRS	Note2
6	DISTANCE BETWEEN TWO BRIGHT DOTS	≧10 mm	Note3
7	DISTANCE BETWEEN TWO DARK DOTS	≧10 mm	Note3
8	DISTANCE BETWEEN BRIGHT, AND DARK DOTS	≧10 mm	Note3
9	LINE DEFECT (BRIGHT, DARK)	NOT ALLOWED	-

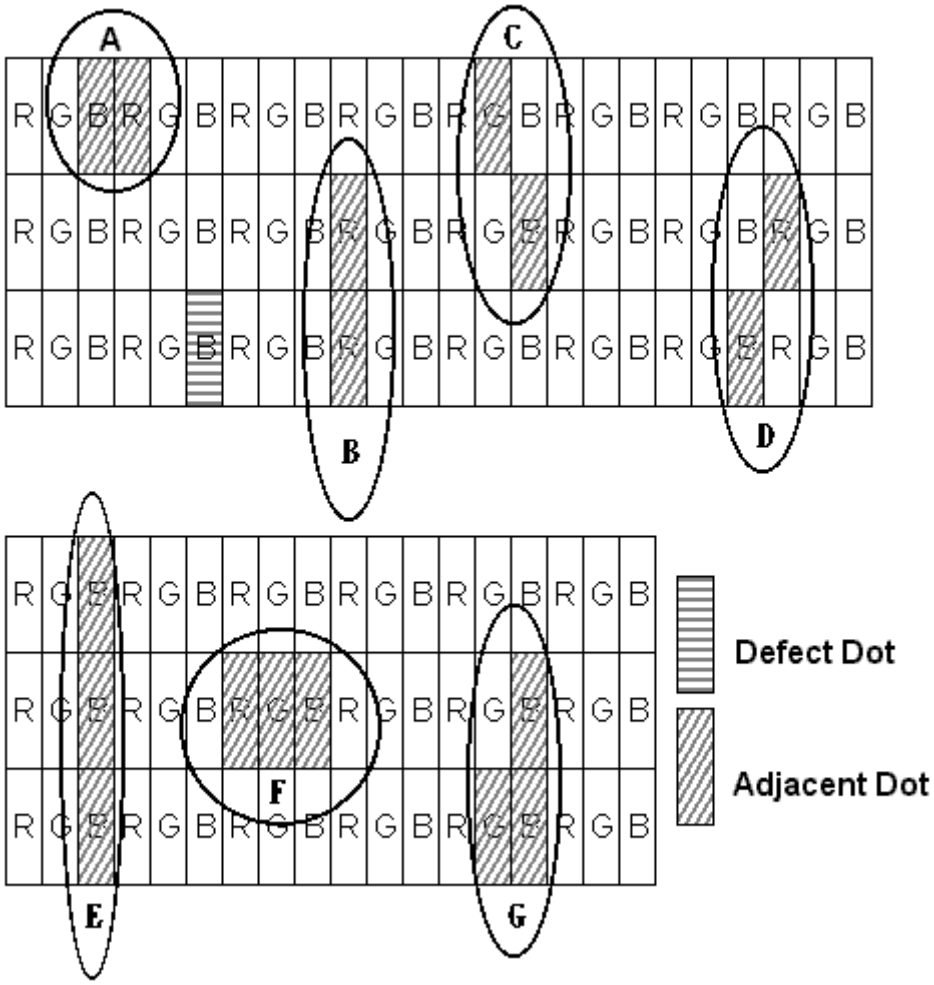
One pixel consists of 3 sub-pixels, including R,G, and B dot.(Sub-pixel = Dot)

[Note1] Bright dot is defined through 5% transmission ND Filter as following; mura is defined through 5% transmission ND Filter.



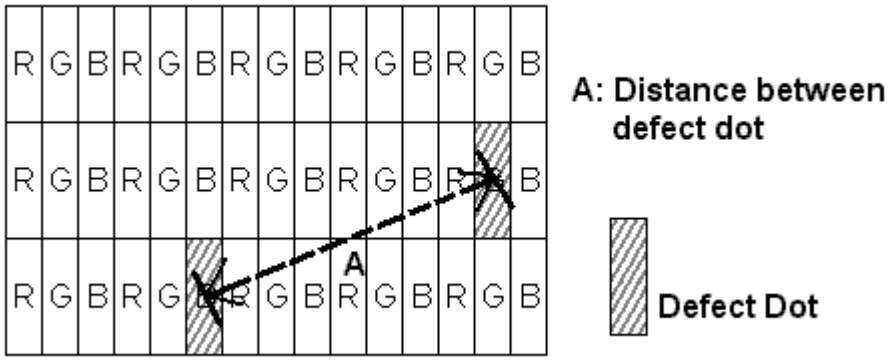


[Note2] Judge defect dot and adjacent dot as following. Allow below (as A, B, C and D status) two adjacent defect dots, including bright and dark dot. And they will be counted 2 defect dots in total quantity.



Allow above (as E, F and G status) three adjacent defect dots, including bright and dart dot. And they will be counted 3 defect dots in total quantity.

[Note3] Definition of distance between defect dot as following.



[Note4] Other

(1) The defects that are not defined above and considered to be problem shall be reviewed and discussed by both parties.

(2) Defects on the Black Matrix, out of Display area, are not considered as a defect or counted.

6. Handling precaution

(1) Don’t disassemble and reassemble the module by self.

(2) Acid, alkali, alcohol or touched directly by hand will damage the display.

(3) Static electricity will damage the module. Please configure grounding device.

(4) The strong vibration, shock, twist or bend will cause material damage, even module broken.

(5) It is easy to cause image sticking while displaying the same pattern for very long time.

(6) The response time, brightness and performance will vary from different temperature.