



Chunghwa Picture Tubes, Ltd.

Technical Specification

To :

Date :

CPT TFT-LCD

CLAA150XP 01

ACCEPTED BY :

(TENTATIVE 1)

APPROVED BY	CHECKED BY	PREPARED BY
		TFT-LCD Product Planning Management General Division

CHUNGHWA PICTUER TUBES, LTD.

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

Doc.No:		Issue Date:	
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1. OVERVIEW

CLAA150XP 01 is 15.0" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit board and backlight. By applying 8 bit digital data, 1024×768, 16.2M-color(6Bit+FRC) images are displayed on the 15.0" diagonal screen. Input power voltage is 3.3V for LCD driving and interface of data and control signals is LVDS. General specification are summarized in the following table:

ITEM	SPECIFICATION
Display Area(mm)	304.1 (H) × 228.1 (V) (15.0 inch diagonal)
Number of Pixels	1024(H) × 768(V)
Pixel Pitch(mm)	0.297(H) × 0.297(V)
Color Pixel Arrangement	RGB vertical strip
Display Mode	Normally White, TN
Number of Colors	16.2M (6bits/color + FRC)
Color Gamut	65%
Brightness(cd/m ²)	250(cd/m ²) @8.0mA
Response Time	16ms
Viewing Angle	(-70~70)(H), (-60~60)(V)(Typ.)
Wide Viewing Angle Technology	Super wide view film
Surface Treatment	Hard coating:3H ; Anti-glare
Electrical Interface	LVDS
Total Module Power(W)	12.5 W
Module Size(mm)	326.5 (W) × 253.5 (H) × 11.0 (D) (Typ.)
Module Weight(g)	1060(Typ.)
Backlight Unit	2 CCFLs of edge light(Top/Bottom)

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

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

2. ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT	REMARK
Power Supply Voltage for LCD	VDDD	-	4.0	V	
IDDD Rush Current	IRUSHd	-	4.0	A	Note1
Voltage of Lamp	VL	531.5	643.5	Vrms	
Current of Lamp	IL	6	8.5	mA	
Frequency of Lamp	FL	50	80	kHz	
Operation Temperature *1)	Top	0	50		Note2
Storage Temperature *1)	Tstg	-20	60		Note3

[Note1] 100 μ sec , If rise time of VDDD increases, then I_{RUSH} decrease.

[Note2] Be without condensation while humidity 85% RH.

[Note3] Humidity

Relative Humidity 90% (Ta 40)

Wet Bulb Temperature 39 (Ta 40)

3. ELECTRICAL CHARACTERISTICS

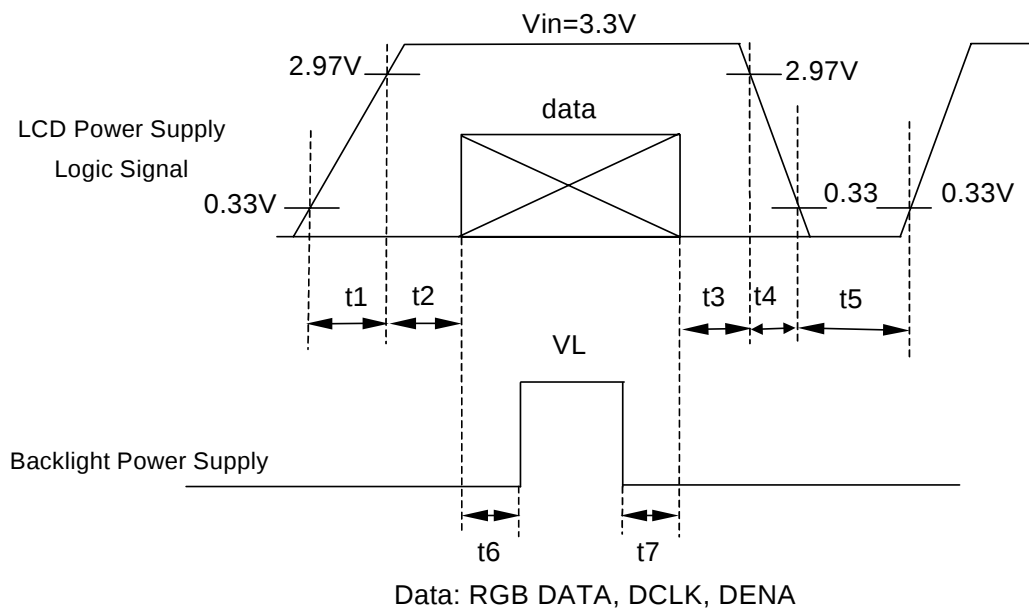
(a)TFT-LCD

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Logic Input Voltage for LCD	VDDD	3.0	3.3	3.6	V	Note1,3
Logic Input Current for LCD	IDDD	--	600	700	mA	Note2
Permissive Input Ripple Voltage	VRPd	--	--	100	mVp-p	Vin=+3.3V
Differential Impedance	Zm	90	100	110	Ω	

[Note 1]

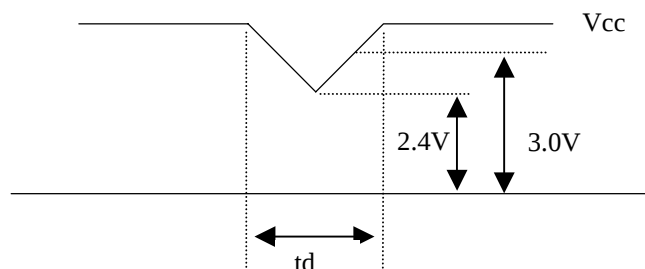
1) VCC-turn-on conditions:

t1	10ms	0 < t4	10ms	200ms	t7
0 < t2	50ms	1 sec	t5		
0 < t3	50ms	200ms	t6		



2) VCC-dip conditions

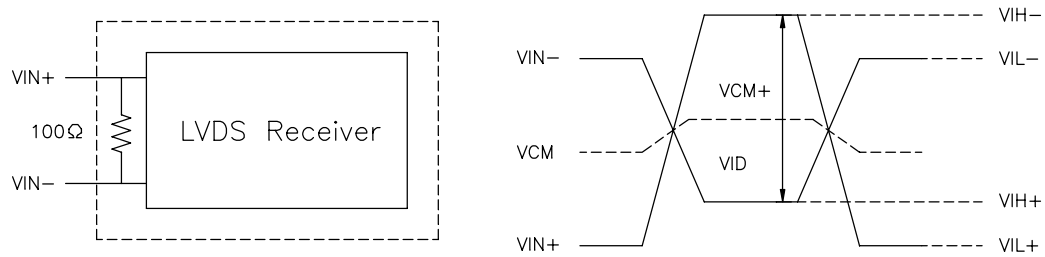
- When 2.4V $V_{DDD} < 3.0V$, then $t_d = 10\text{ ms}$
 - $V_{CC} > 3.0V$
- VCC-dip conditions should also follow the VCC-turn-on conditions.



[Note 2] Typical current situation

256-gray-bar pattern, 768 line mode, 3.3 V , $f_H=48.5\text{ kHz}$, $f_V=60\text{ Hz}$, $f_{CLK}=65\text{ MHz}$

[Note 3] LVDS signal definition



VIN₊ = Positive differential DATA & CLK Input

VIN₋ = Negative differential DATA & CLK Input

$$VID = VIN_+ - VIN_-$$

$$VCM = |VCM_+ - VCM_-|$$

$$VID_+ = |VIH_+ - VIH_-|$$

$$VCM = (VIN_+ + VIN_-)/2$$

$$VCM_+ = (VIH_+ + VIH_-)/2$$

$$VID = |VID_+ - VID_-|$$

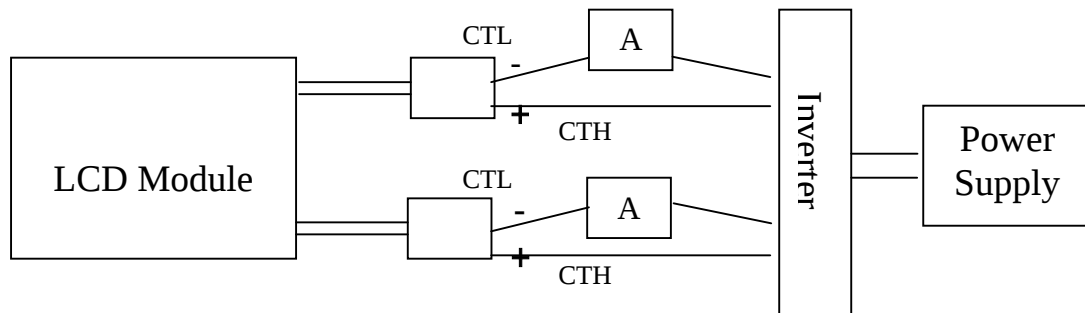
$$VID_- = |VIL_+ - VIL_-|$$

$$VCM_- = (VIL_+ + VIL_-)/2$$

(b) Backlight

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Lamp Voltage	VL	531.5	585	643.5	Vrms	IL=8.0mA
Lamp Current	IL	6	8.0	8.5	mA	Note1,4
Lamp Frequency	FL	45	50	70	kHz	Note2,4
Starting Lamp Voltage	VS	1250	--	--	Vrms	Ta=0
		960	--	--	Vrms	Ta=25
Lamp life Time	LT	30,000	40,000	--	hr	IL=8.0mA Continuous Operation

[Note1] Measurement Method of Lamp Current (the current meter is inserted in low voltage line)



[Note2] The influence of lamp frequency

This frequency range can keep the electrical and optical character within 10% variation. Lamp frequency may interfere with horizontal synchronous frequency (or vertical synchronous frequency), and then cause ripple noise on the display. Therefore, please adjust the frequency of lamp input, be removed inverter from module as possible, or use electronic shielding between inverter and module to avoid the interference.

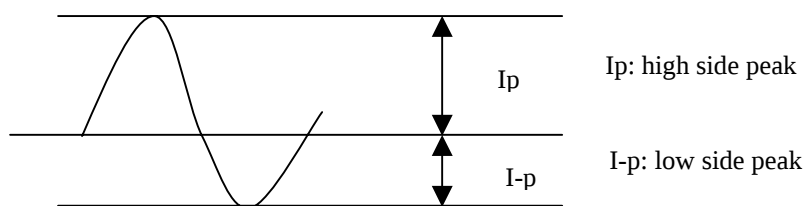
[Note3] Definition of the lamp life

The luminance reduced to 50% of initial value.

[Note4] Wave request

The degrees of unbalance: less than 10%

The ratio of wave height: less than $\sqrt{2} \pm 10\%$



The degrees of unbalance = $\frac{|I_p - I-p|}{I_{rms}} \times 100(\%)$

The ratio of wave height = $I_p(\text{or } I-p) / I_{rms}$

4. INTERFACE PIN CONNECTION

(a) CN1(TFT-LCD signal)

Used connector: DF14H-20P-1.25H

Corresponding connector type : DF14 –20S-1.25C (reference)

Pin	Symbol	Function
1	VDDD	Power supply,+3.3V
2	VDDD	Power supply,+3.3V
3	GND	Ground
4	GND	Ground
5	RXIN0-	Negative LVDS differential data input
6	RXIN0+	Positive LVDS differential data input
7	GND	Ground
8	RXIN1-	Negative LVDS differential data input
9	RXIN1+	Positive LVDS differential data input
10	GND	Ground
11	RXIN2-	Negative LVDS differential data input
12	RXIN2+	Positive LVDS differential data input
13	GND	Ground
14	RXCLK IN-	Negative LVDS differential clock input
15	RXCLK IN+	Positive LVDS differential clock input
16	GND	Ground
17	RXIN3-	Negative LVDS differential data input
18	RXIN3+	Positive LVDS differential data input
19	GND	Ground
20	NC	

- GND pin must be grounded.
- Please don't ground NC pin.

(b) CN2 ,3(Back Light)

Backlight-side connector : BHSR-03VS-1(JST made)

Inverter-side connector : SM03B-BHS-1-TB(JST made)

Pin No.	Symbol	Function
1	CTH1	VBLH1 (High voltage)
2	CTL1	VBL1 (Low voltage)

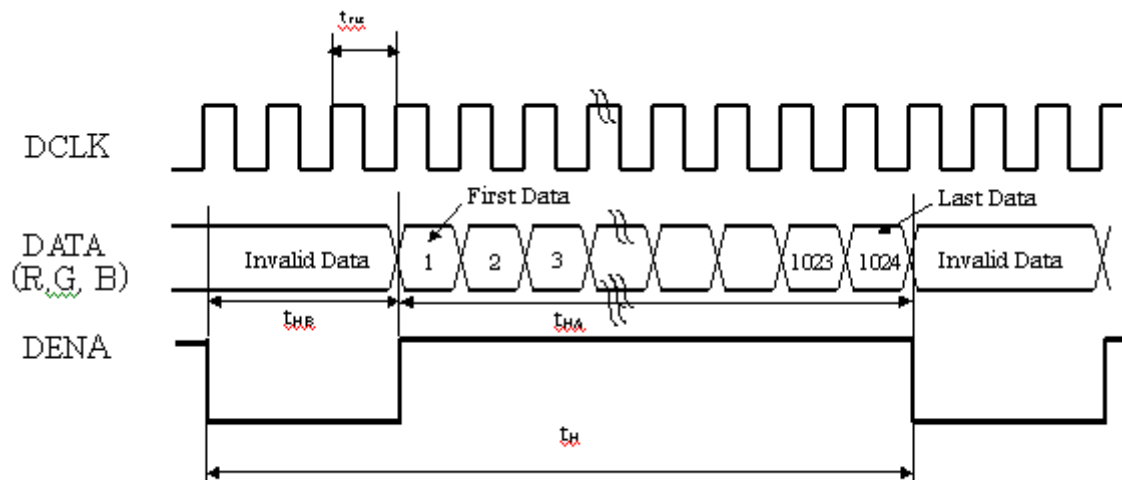
5. INTERFACE TIMING

(a) Timing Specifications

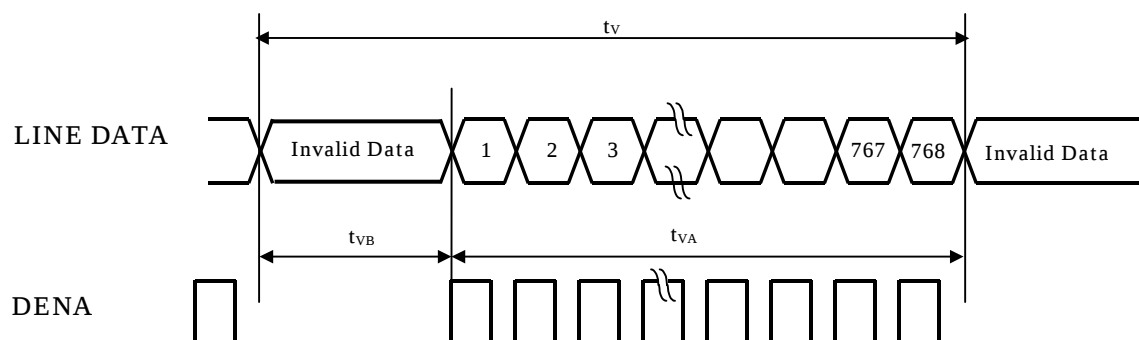
ITEM		SYMBOL	MIN	TYP	MAX	UNIT
DCLK	Frequency	f_{CLK}	-	65	80	MHz
	Period	t_{CLK}	12.5	15.3	-	ns
DATA Enable	Horizontal	Horizontal Total Time	t_H	1150	1344	t_{CLK}
		Horizontal Active Time	t_{HA}	-	1024	t_{CLK}
		Horizontal Blank Time	t_{HB}	126	320	t_{CLK}
	Vertical	Frame Rate	Fr	55	60	Hz
		Vertical Total Time	t_V	794	806	t_H
		Vertical Active Time	t_{VA}	-	768	t_H
		Vertical Blank Time	t_{VB}	26	38	t_H

(b) Timing Chart

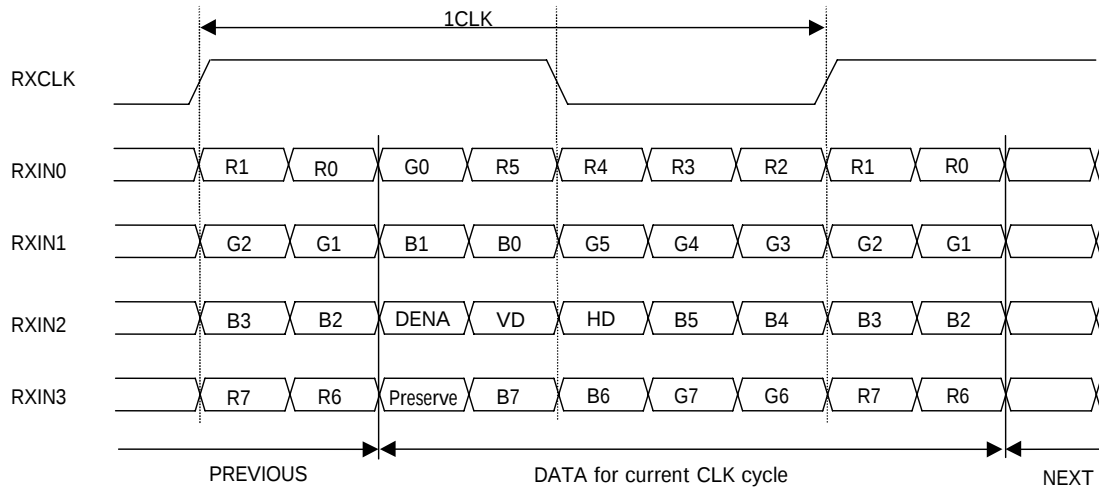
1) Horizontal Timing Chart



2) Vertical Timing Chart



(c) LVDS Data mapping



(d) Color Data Assignment

COLOR	INPUT DATA	R DATA								G DATA								B DATA							
		R7 MSB	R6	R5	R4	R3	R2	R1	R0 LSB	G7 MSB	G6	G5	G4	G3	G2	G1	G0 LSB	B7 MSB	B6	B5	B4	B3	B2	B1	B0 LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	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	
	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	
	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	
	CYAN	0	0	0	0	0	0	0	0	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	
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	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	
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	
	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	
	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	
	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	
	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	
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	
	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	
	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	
	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	
	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	
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	
	BLUE(1)	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	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	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) Definition of gray scale:

Color(n) : n indicates gray scale level.

Higher n means brighter level.

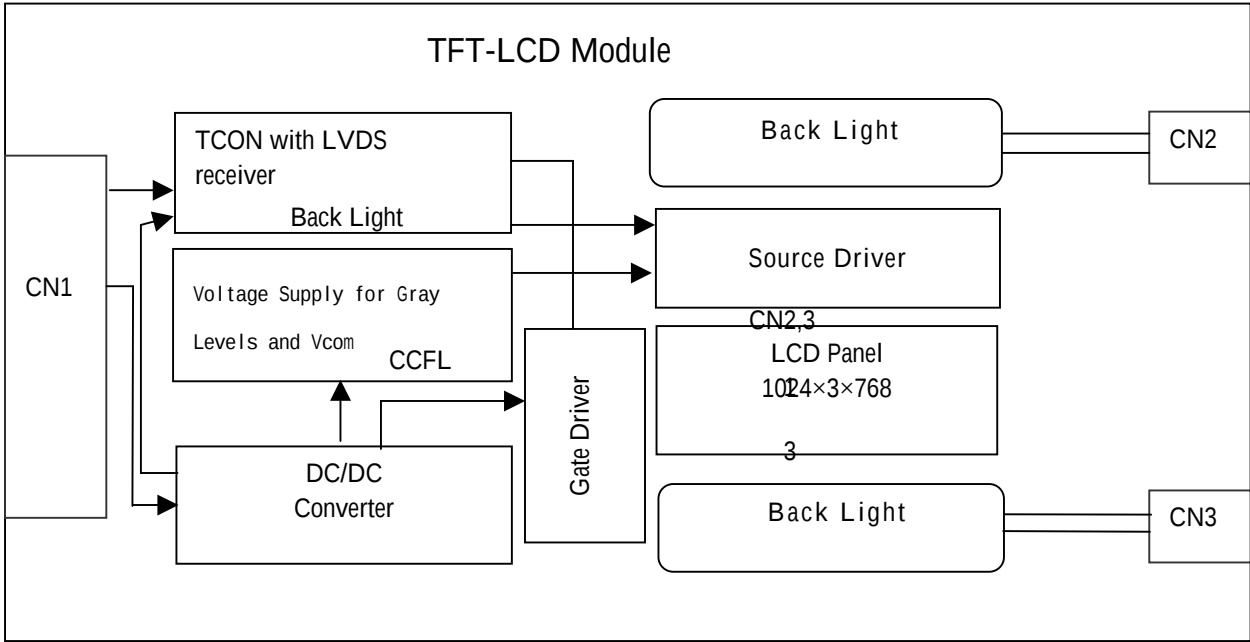
2) Data:1-High, 0-Low.

(f) Pixel Mapping

D(1, 1)	D(2, 1)	---	D(X, 1)	---	D(1023, 1)	D(1024, 1)
D(1, 2)	D(2, 2)	---	D(X, 2)	---	D(1023, 2)	D(1024, 2)
		+		+		
D(1, Y)	D(2, Y)	---	D(X, Y)	---	D(1023, Y)	D(1024, Y)
		+		+		
D(1,767)	D(2,767)	---	D(X,767)	---	D(1023,767)	D(1024,767))
D(1,768)	D(2,768)	---	D(X,768)	---	D(1023,768)	D(1024,768)

6. BLOCK DIAGRAM

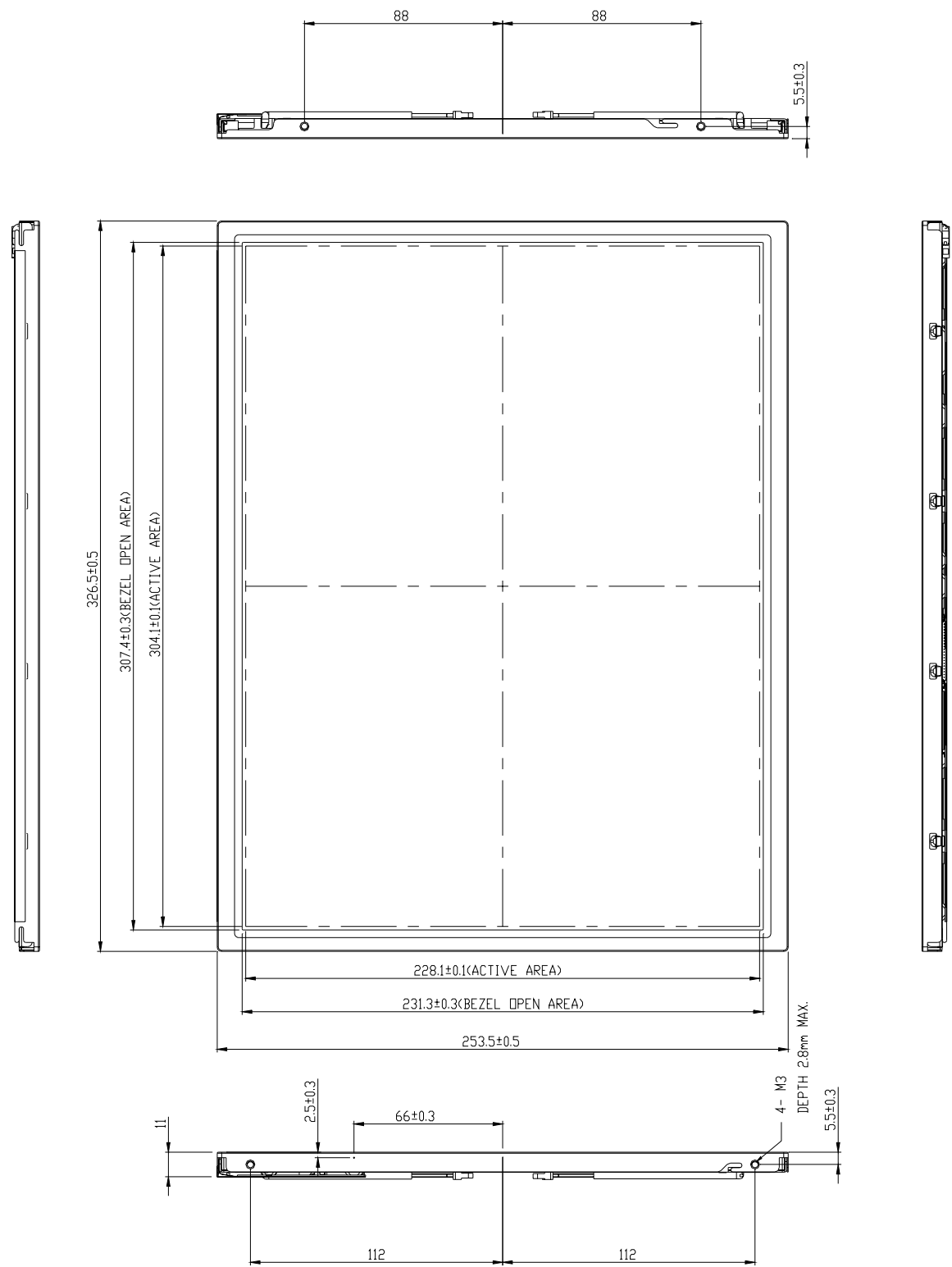
(a) TFT-LCD Module



7. MECHANICAL SPECIFICATION

(a) Front side

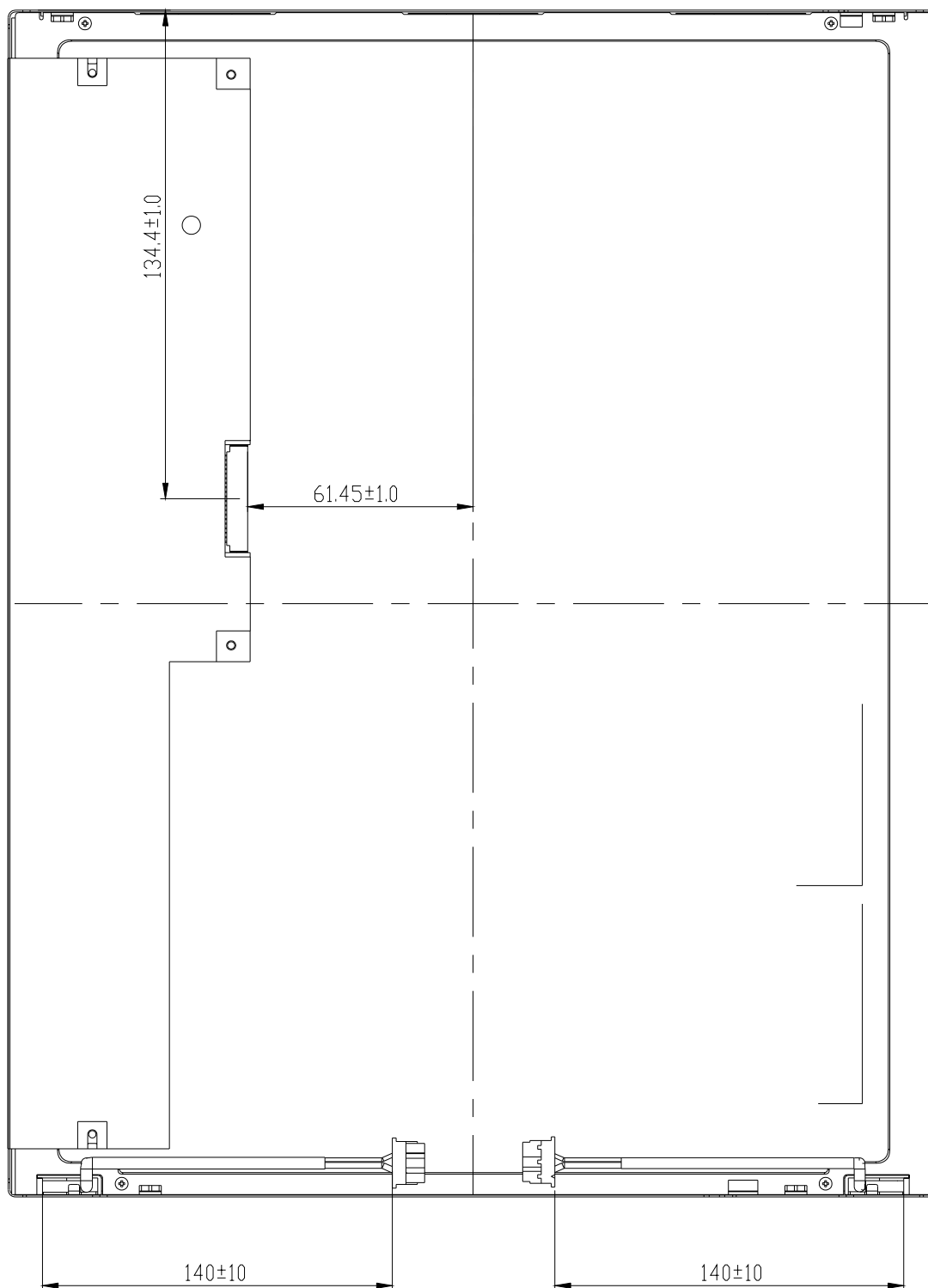
Unit: mm



(Tolerance is ±0.5mm unless noted)

(b) Rear side (with inverter)

Unit: mm

(Tolerance is $\pm 0.5\text{mm}$ unless noted)

8.OPTICAL CHARACTERISTICS

Ta=25 ,VCC=5.0V

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	Notes
Contrast Ratio		CR	$\theta = \phi = 0^\circ$	450	500	550	-	*1)*2)*3)
Luminance	Center	Lw	$\theta = \phi = 0^\circ$	200	250	--	cd/m ²	*2)*3)
	Average	LA	$\theta = \phi = 0^\circ$	180	(225)	--		
	Uniformity	ΔLw	$\theta = \phi = 0^\circ$	--	25	33	%	*2)*3)
Response Time		tr	$\theta = \phi = 0^\circ$	--	(5)	--	ms	*3)*4)
		tf	$\theta = \phi = 0^\circ$	--	(11)	--	ms	*3)*4)
Viewing Angle	Horizontal	ϕ	CR 10	--	(-70~70)	--	°	*2)*3)
	Vertical	θ		--	(-60~60)	--	°	*2)*3)
Color Coordinates	Red	x y	$\theta = \phi = 0^\circ$	--	TBD	--	-	*2)*3)
	Green	x y		--	TBD	--		
	Blue	x y		--	TBD	--		
	White	x y		0.283 0.299	0.313 0.329	0.343 0.359		

- These items are measured by BM-5A(TOPCON) or CS-1000 (MINOLUTA) in the dark room (no ambient light) after putting panel in normal temperature 10 minutes and lighting the lamps 20 minutes.

- Brightness condition : IL=8.0mA; FL=50KHz

- Definition of these measurement items are as follows:

*1) Definition of Contrast Ratio

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

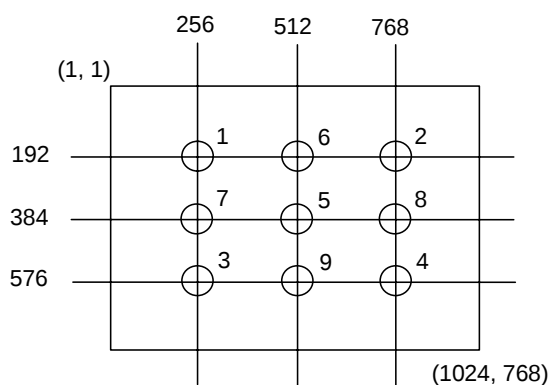
*2) Defintion of luminance and contrast ratio measured position

(a) Measured the 5th point on the below for Lw and CR

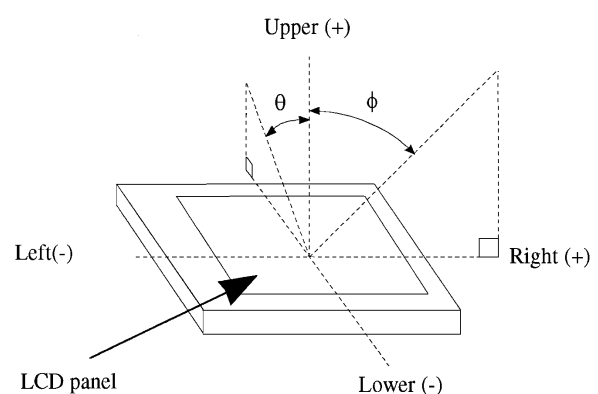
(b) $\Delta Lw = [L(\text{MAX})/L(\text{MIN}) - 1] \times 100$

(c) Measured points as below.

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

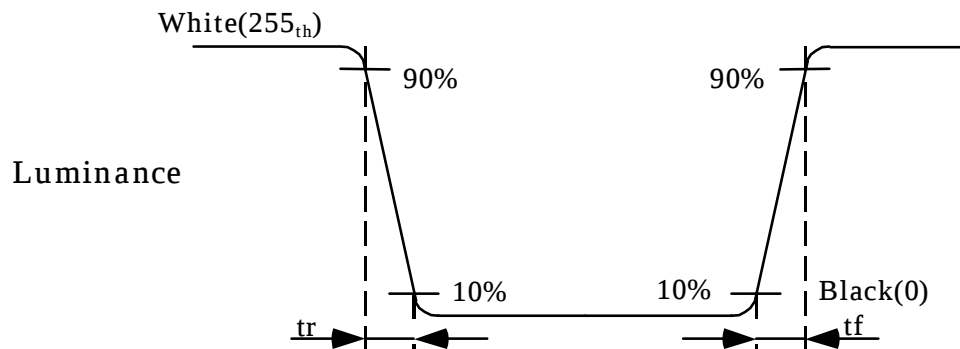


Measurement Points



Viewing Angle(θ , ψ)

*4) Definition of Response Time (White - Black)

**9.RELIABILITY TEST CONDITIONS**

(1)Temperature and Humidity

TEST ITEMS	CONDITIONS
HIGH TEMPERATURE HIGH HUMIDITY OPERATION	40 , 95%RH, 240h (No condensation)
HIGH TEMPERATURE HIGH HUMIDITY STORAGE	60 ,90%RH, 48h (No condensation)
HIGH TEMPERATURE OPERATION	50 , 240h
LOW TEMPERATURE STORAGE	-20 , 240h
THERMAL SHOCK	BETWEEN -20 (1hr)AND 60 (1hr),100 CYCLES
HIGH TEMPERATURE STORAGE	60 , 240h
LOW TEMPERATURE OPERATION	0 , 240h

(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 500 to 5 Hz in each of three mutually perpendicular axis(each x,y,z axis: 1 hour, total 3 hours)

(3)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.
 - (2.1) 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.
 - (2.2) 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.
 - (2.3) 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.
 - (2.4) 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.
 - (2.5) 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 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.

3 PRECAUTIONS WITH ELECTROSTATICS

- (1) This LCD module uses 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 and 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:
 - (3.1) 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.
 - (3.2) Please do not pile them up more than 5 boxes. (They are not designed so.) And please do not turn over.
 - (3.3) Please handle packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
 - (3.4) 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.)