Chunghwa Picture Tubes, Ltd.
Technical Specification

Date : 2004/05/05

CPT TFT-LCD

CLAA150XP 02

ACCEPTED BY：

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

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NEW

REVISION STATUS

Revision Notice	Description	Rev. Date
Ver1	-	2003/12/30

1. OVERVIEW

CLAA150XP 02 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 6 bit digital data, 1024×768, 262K-color 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 RSDS. 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	262144
Color Gamun	65%
Brightness(cd/m^2)	250(cd/m^2) @8.0mA
Response Time	16ms
Viewing Angle	(-70~70)(H), (-65~60)(V)(Typ.)
Wide Viewing Angle Technology	Super wide view film
Surface Treatment	Hard coating:3H ; Anti-glare
Electrical Interface	RSDS
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	-	5.0	A	Note1
Voltage of Lamp	VL	522	700	Vrms	
Current of Lamp	IL	3	8.5	mArms	
Frequency of Lamp	FL	40	80	kHz	
Operation Temperature	Top	0	50	℃	Note2,3,4,5
Storage Temperature	Tstg	-20	60	℃	Note2,3,4

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

[Note2] Be without condensation while humidity ≦90% RH, as below .

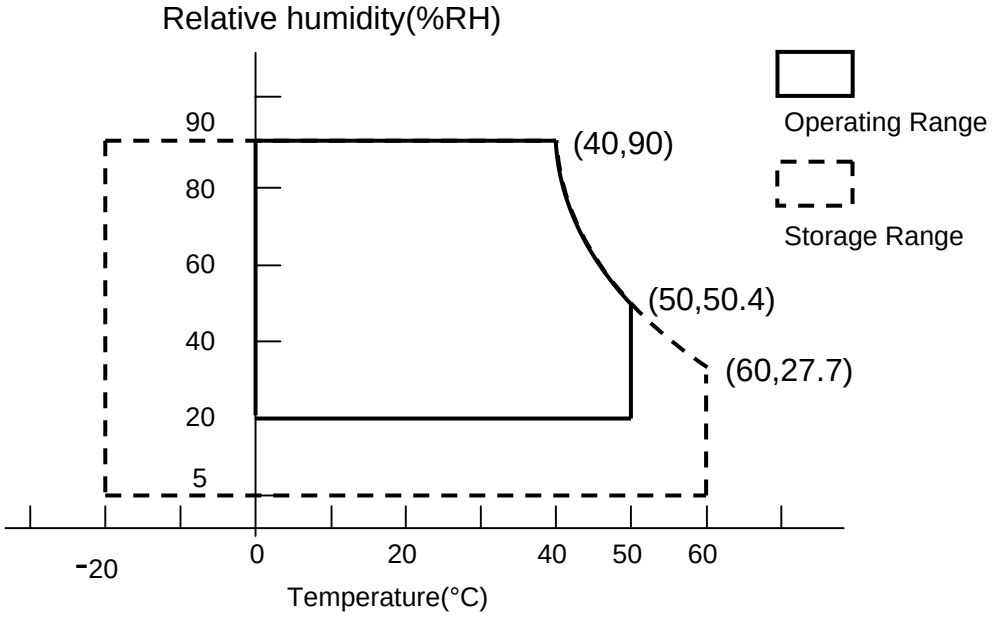
[Note3] Humidity

Relative Humidity ≦90% (Ta≦ 40℃)

Wet Bulb Temperature ≦39℃(Ta≧40℃)

[Note4] The performance becomes bad when the environment temperature or humidity is out of range.

[Note5] The surface temperature of display center ≦ 60℃ in operating.



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	

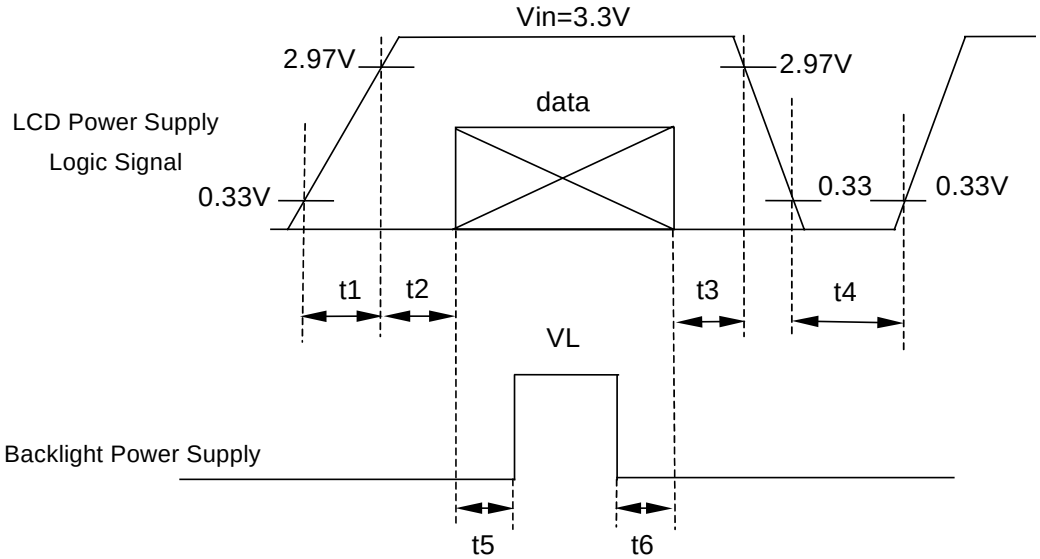
[Note 1]

1) VCC-turn-on conditions:

$t1 \leqq 10ms$ $1\ sec \leqq t4$

$0 < t2 \leqq 50ms$ $200ms \leqq t5$

$0 < t3 \leqq 50ms$ $200ms \leqq t6$

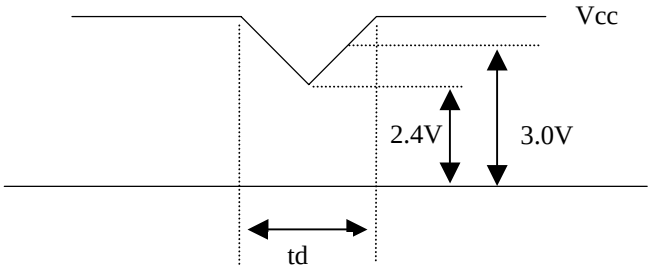


Data: RGB DATA, DCLK, DENA

2) VCC-dip conditions

- When 2.7V≦VDDD<3.0V, then td≦10 ms
- VCC＞3.0V

  VCC-dip conditions should also follow the VCC-turn-on conditions.



[Note 2] Typical current situation

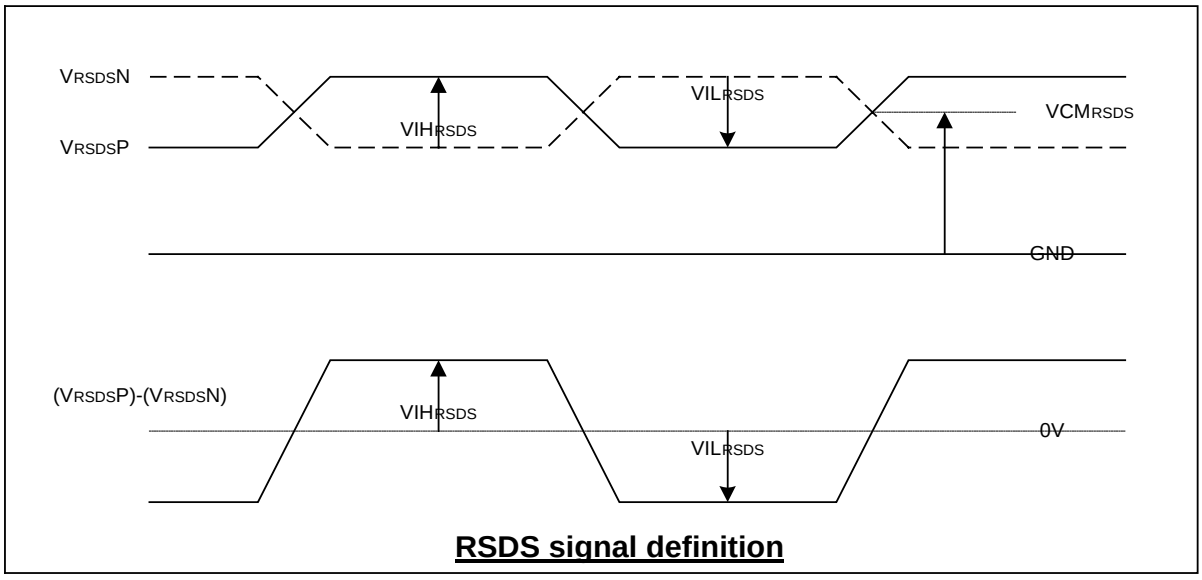
64-gray-bar pattern, 768 line mode, 3.3 V, f_{CLK}=65 MHz

[Note 3] RSDS Characteristic

ITEM	SYMBOL	CONDICTION	MIN	TYP	MAX	UNIT
High input voltage level of RSDS	VIH_{RSDS}	VCM_{RSDS}=+1.2V	100	200	-	mV
Low input voltage level of RSDS	VIL_{RSDS}	VCM_{RSDS}=+1.2V	-	-200	-100	mV
Common mode voltage range of RSDS	VCM_{RSDS}	$VDIFF_{RSDS}$ (2) = 200 mV (minimum value)	1.0	-	1.4	V
Leakage input current of RSDS	IDL	DxxP,DxxN,CLKP,CLKN	-10	-	10	uA

1. VCM_{RSDS} = (VCLKP + VCLKN) / 2 or VCMRSDS = (VDxxP + VDxxN) / 2
2. $VDIFF_{RSDS}$ = VCLKP - VCLKN or VDIFFRSDS = VDxxP – VDxxN

RSDS Standard V-p to Vp value is 400mV from-200mV to +200mV.

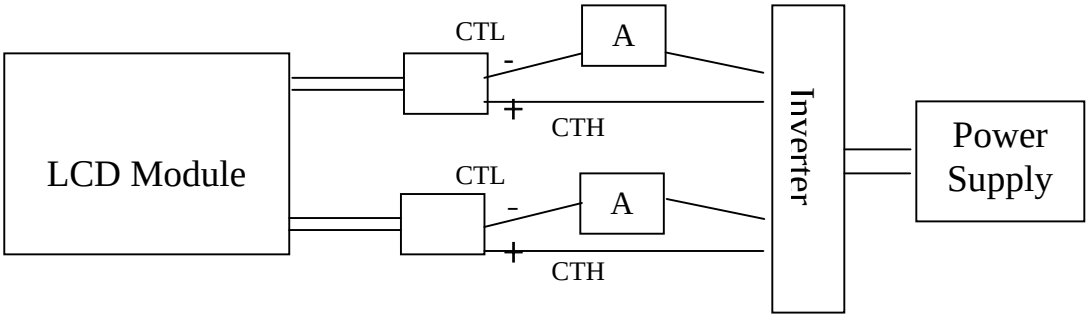


RSDS signal definition

(b)Backlight

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Lamp Voltage	VL	522	580	638	Vrms	IL=8.0mA
Lamp Current	IL	6	8.0	8.5	mArms	Note1,4
Lamp Frequency	FL	40	50	60	kHz	Note2,4
Starting Lamp Voltage	VS	1280	--	--	Vrms	Ta=0℃
		985	--	--	Vrms	Ta=25℃
Lamp life Time	LT	30,000	40,000	--	hr	IL=8.0mA Continuous Operation
Turn On/Off test	-	100,000			times	Note5

[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 vitical synchronous frequency), and then cause ripple noise on the display. Therefore, please adjust the frequency of lamp input, be removed inveter from module as possible, or use electronic shielding between inverter and module to avoid the interference.

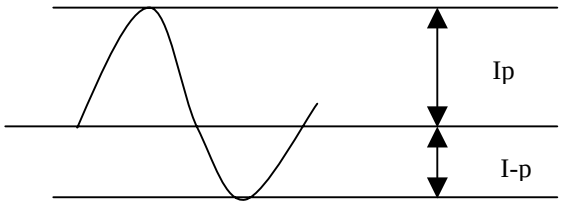
[Note3] Definination of the lamp life

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 $\sqrt{2}$ ±10%



Ip: high side peak

I-p: low side peak

The degrees of umbalance = $|Ip-I-p|/Irms*100(\%)$

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

[Note5] Lamp turn on/off test condition

a. Swiching Frequency: 10s (ON) / 10s(Off)

b. Lamp Current: 8mA

c. Gauge: Variation of the brightness > 50% of initial value

Variation of Color Coordinates < ±0.015 of initial value

4. INTERFACE PIN CONNECTION

(a) CN1(TFT-LCD signal)

Used connector : AF7506-A2GIT (P-TWO)

PIN NO.	Symbol	Function	PIN NO.	Symbol	Function
1	GND		2	B2P	RSDS Blue Data(+)
3	B2N	RSDS Blue Data (-)	4	GND	
5	B1P	RSDS Blue Data (+)	6	B1N	RSDS Blue Data (-)
7	GND		8	B0P	RSDS Blue Data (+)
9	B0N	RSDS Blue Data (-)	10	GND	
11	G2P	RSDS Green Data (+)	12	G2N	RSDS Green Data (-)
13	GND		14	G1P	RSDS Green Data (+)
15	G1N	RSDS Green Data (-)	16	GND	
17	G0P	RSDS Green Data (+)	18	G0N	RSDS Green Data (-)
19	GND		20	CLKP	RSDS CLK (+)
21	CLKN	RSDS CLK (-)	22	GND	
23	R2P	RSDS Red Data	24	R2N	RSDS Red Data (-)
25	GND		26	R1P	RSDS Red Data (+)
27	R1N	RSDS Red Data (-)	28	GND	
29	R0P	RSDS Red Data (+)	30	R0N	RSDS Red Data (-)
31	GND		32	STH	Start pulse
33	LP	Latch Pulse	34	POL	M signal
35	HMS	Data polarity inverting	36	GND	
37	CLKV		38	STV	Shift data pin
39	OE	Gate Driver Output	40	NC	
41	GND		42	3.3V	3.3V
43	3.3V	3.3V	44	3.3V	3.3V
45	GND		46	NC	
47	NC		48	ID0	Panel ID(NC)
49	ID1	Panel ID(GND)	50	ID2	Panel ID(NC)

- GND pin must be grounded.
- Please don’t ground NC pin or contact it with signal.

(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	CTH1/2	VBLH1 (High voltage)
2	-	Empty
3	CTL1/2	VBLL1 (Low voltage)

5. INTERFACE TIMING

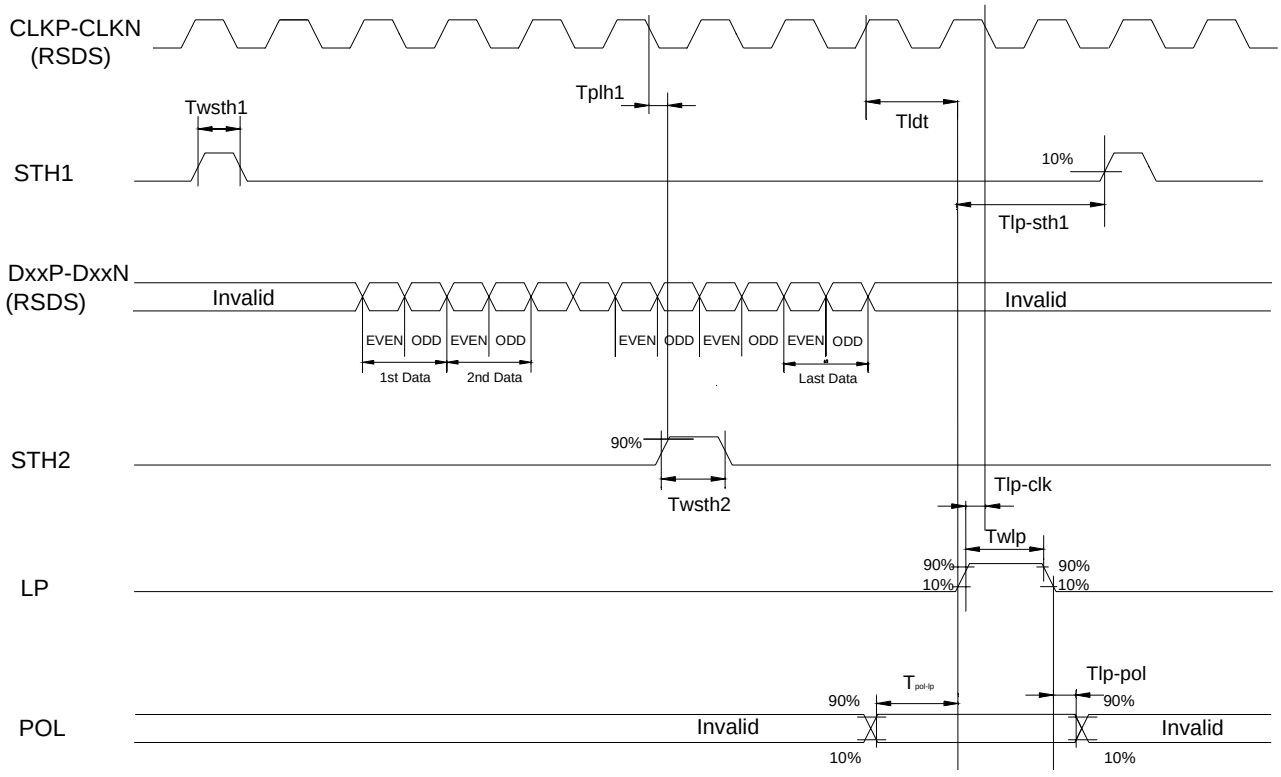
(a)Timing Specifications

	Item	Symbol	Min	Typ	Max	Unit
HD	CLK pulse width	Tw	11.7	15.4	-	ns
	CLK pulse width (H)	Twh	6	-	-	ns
	CLK pulse width (L)	Twl	6	-	-	ns
	DATA set-up time	Tst1	4	-	-	ns
	DATA hold time	Thd1	0.2	-	-	ns
	STH set-up time	Tst2	4	-	-	ns
	STH hold time	Thd2	4	-	-	ns
	STH pulse width	Twsth	1	1	2	CLKP period
	LP pulse width (H)	Twlp	-	8	-	CLKP period
	Last data time	Tldt	1	-	-	CLKP period
	CLK-LP time	Tclk-lp	4	-	-	ns
	LP – STH time	Tlp-sth	6	-	-	CLKP period
	LP-POL time	Tlp-pol	-	695	-	CLKP period
	POL-LP time	Tpol-lp	-	641	-	CLKP period
VD	STV set-up time	tst(STV)	1	-	-	µs
	STV hold time	thd(STV)	1	-	-	µs
	CLKV width	tw(CLKV)	8	-	-	µs
	CLKV pulse width(H)	twH(CLKV)	3.5	-	-	µs
	CLKV pulse width(L)	twL(CLKV)	3.5	-	-	µs
	OE pulse width	Tw(OE)	2.4	2.9	3.4	µs
	OE-CLKV time	tOE-CLKV	1.5	2	3	µs
	LP rise-CLKV rise time	tLP-CLKV	0	0	0	ns

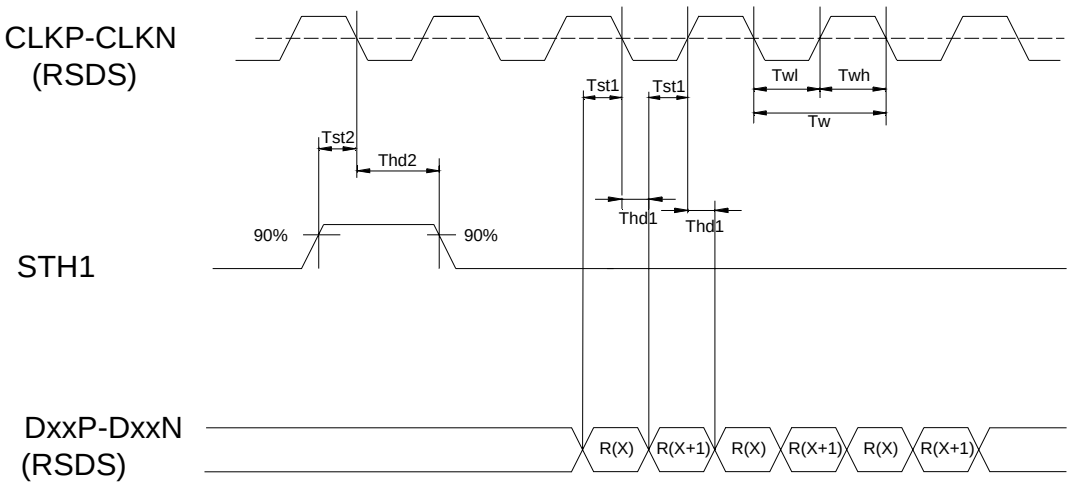
(b)Timing Chart

1) Horizontal Timing Chart

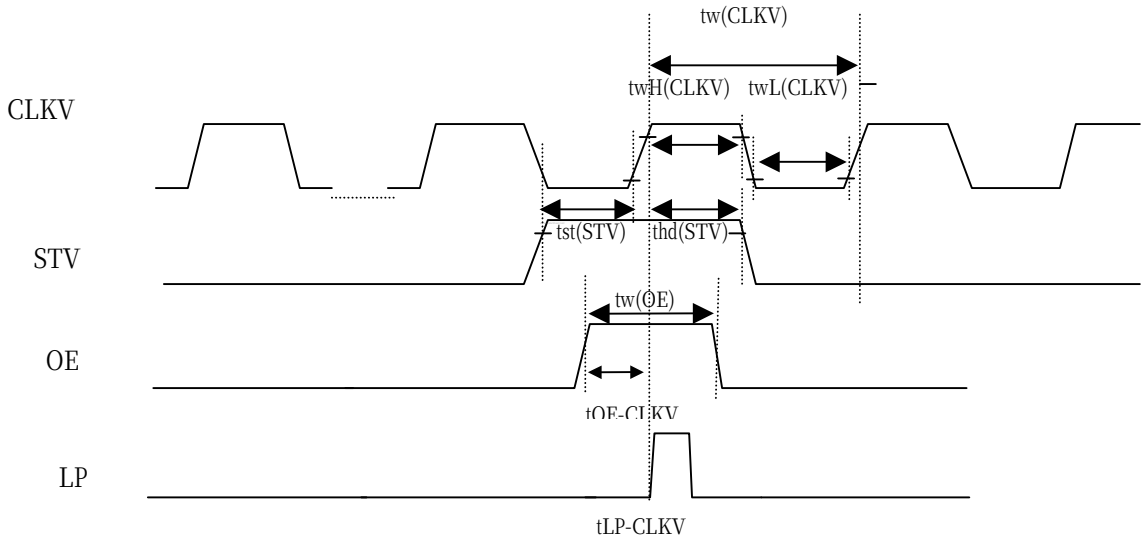
Timing Diagram 1



Timing Diagram 2



2) Vertical Timing Chart



(c)Color Data Assignment

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	1	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

1) Definition of gray scale:

Color(n) : n indicates gray scale level.

Higher n means brighter level.

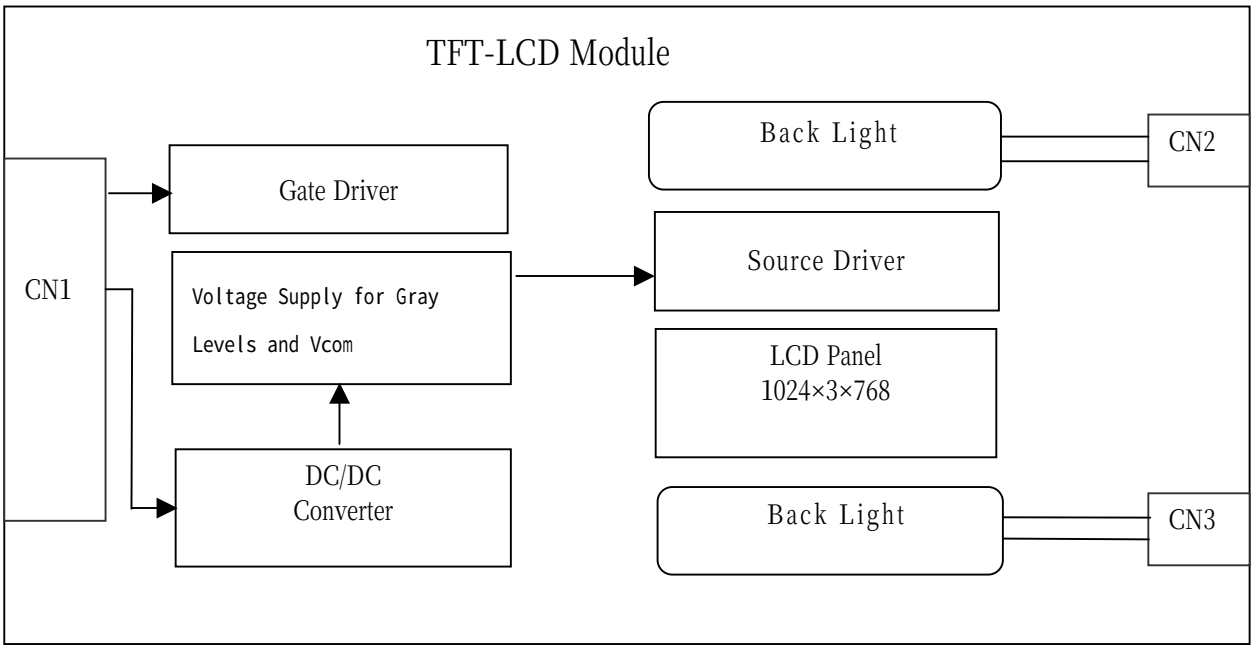
2) Data:1-High, 0-Low.

(d) Pixel Mapping

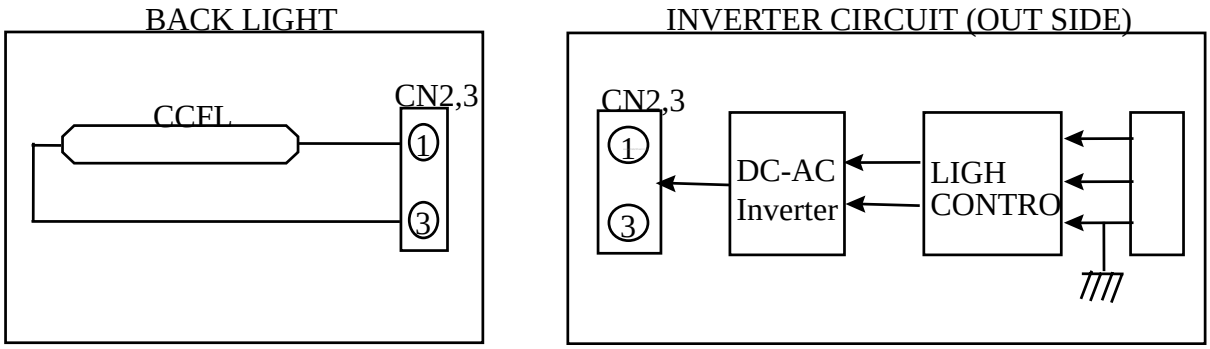
D(1, 1)	D(2, 1)	---	D(X, 1)	---	D(1023, 1)	D(1024, 1)
D(1, 2)	D(2, 2)	---	D(X, 2)	---	D(1023, 2)	D(1024, 2)
¦	¦	+	¦	+	¦	¦
D(1, Y)	D(2, Y)	---	D(X, Y)	---	D(1023, Y)	D(1024, Y)
¦	¦	+	¦	+	¦	¦
D(1,767)	D(2,767)	---	D(X,767)	---	D(1023,767)	D(1024,767))
D(1,768)	D(2,768)	---	D(X,768)	---	D(1023,768)	D(1024,768)

6. BLOCK DIAGRAM

(a) TFT-LCD Module



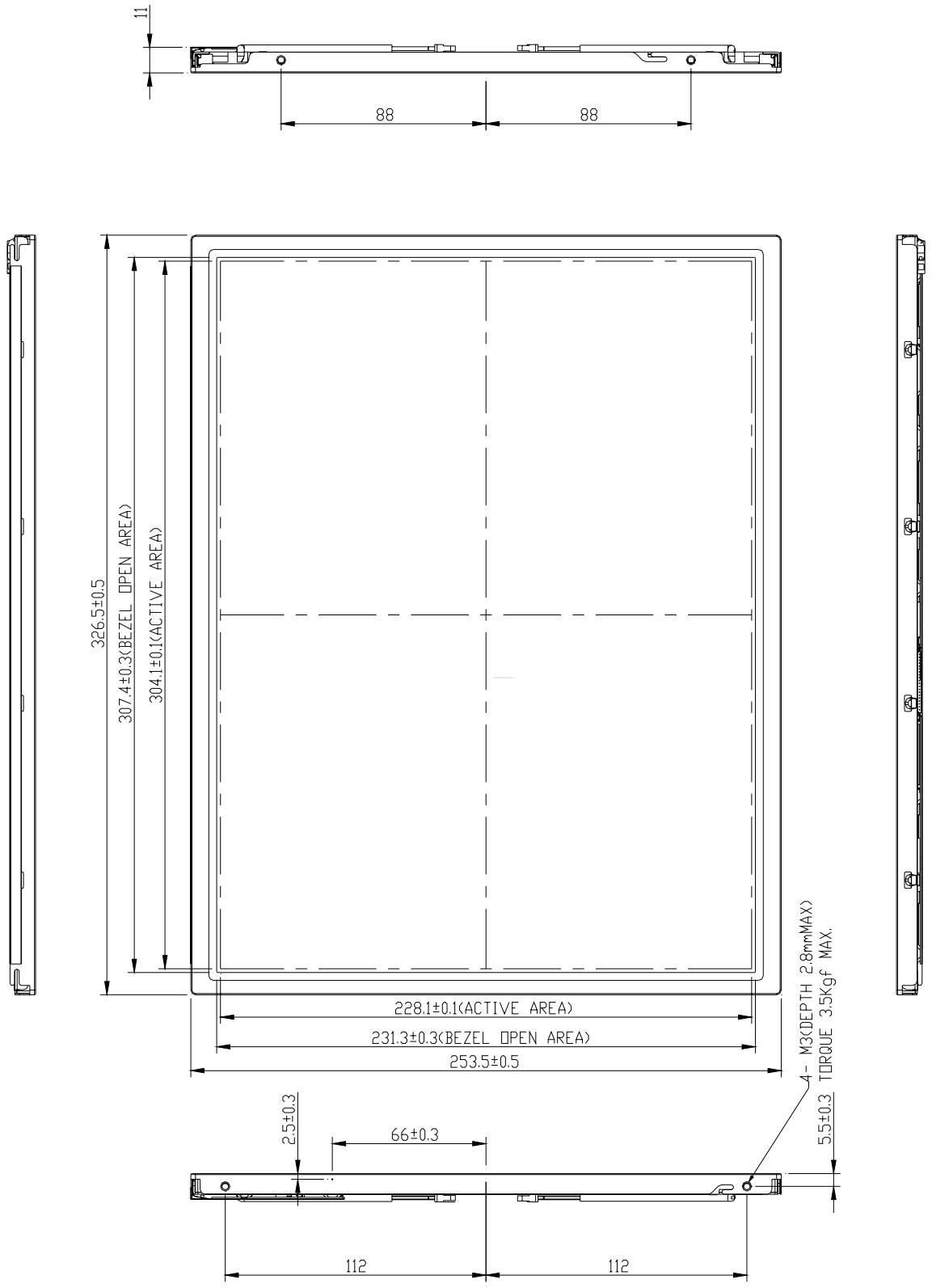
(b) B/L Unit



7. MECHANICAL SPECIFICATION

(a) Front side

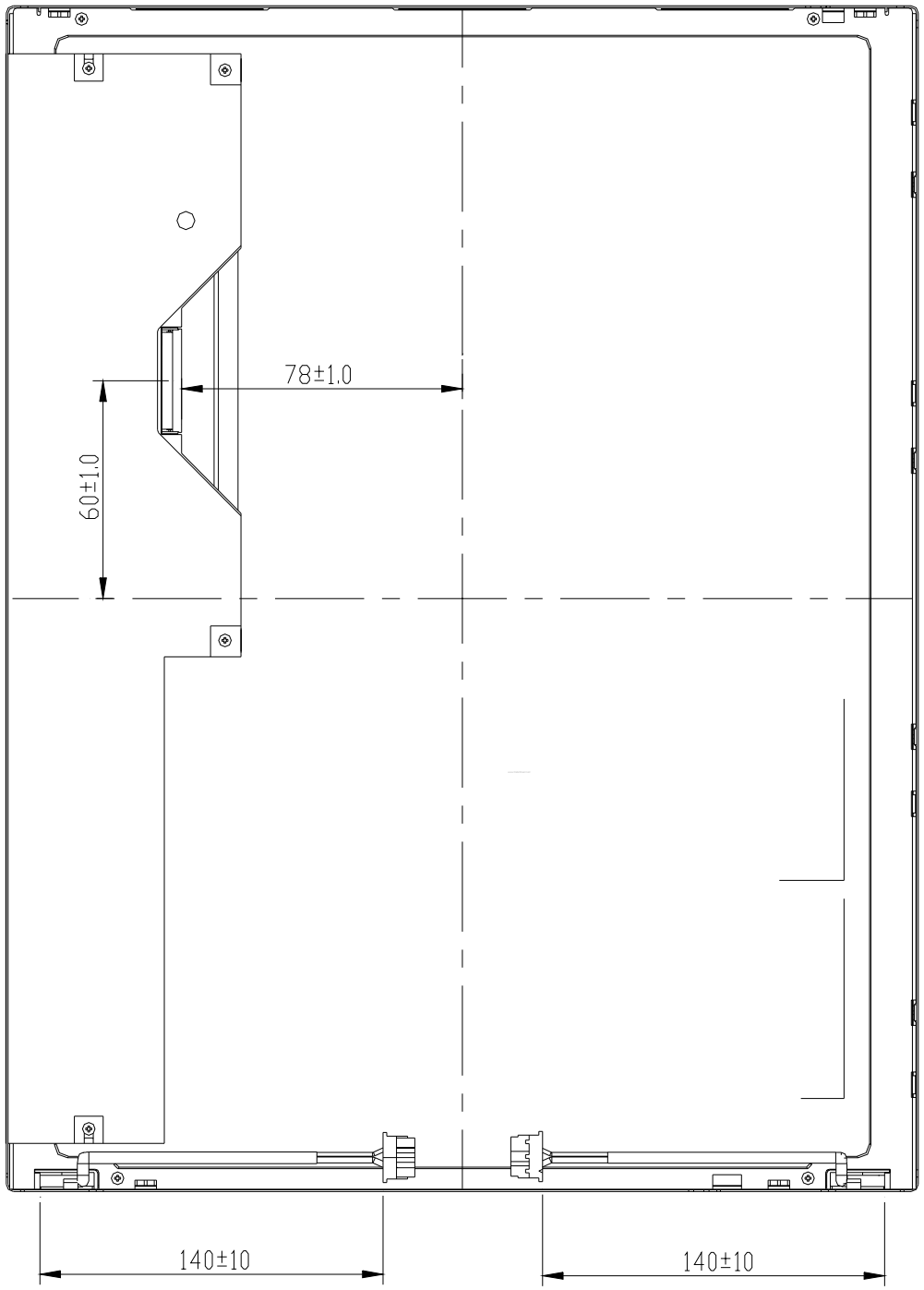
Unit: mm



(Tolerance is ±0.5mm unless noted)

(b) Rear side (with inverter)

Unit: mm



(Tolerance is ±0.5mm unless noted)

8.OPTICAL CHARACTERISTICS

Ta=25°C,VCC=5.0V

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	Notes
Contrast Ratio		CR	θ = ϕ = 0°	400	500	--	-	*1)*2)*3)
Luminance	Center	Lw	θ = ϕ = 0°	200	250	--	cd/m^2	*2)*3)
	Average	LA	θ = ϕ = 0°	180	225	--		
	Uniformity	ΔLw	θ = ϕ = 0°	75	80	--	%	*2)*3)
Response Time		tr	θ = ϕ = 0°	--	5	10	ms	*3)*4)
		tf	θ = ϕ = 0°	--	11	20	ms	*3)*4)
Viewing Angle	Horizontal	ϕ	CR≧10	-55~55	-70~70	--	°	*2)*3)
	Vertical	θ		-50~45	-65~60	--	°	*2)*3)
Color Coordinates	Red	x y	θ = ϕ = 0°	0.616 0.303	0.646 0.333	0.676 0.363	-	*2)*3)
	Green	x y		0.271 0.555	0.301 0.585	0.331 0.615		
	Blue	x y		0.114 0.049	0.144 0.079	0.174 0.109		
	White	x y		0.283 0.299	0.313 0.329	0.343 0.359		
Color Temperature					6500		K	

- 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 condiction : IL=8.0 ±0.1mA; 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

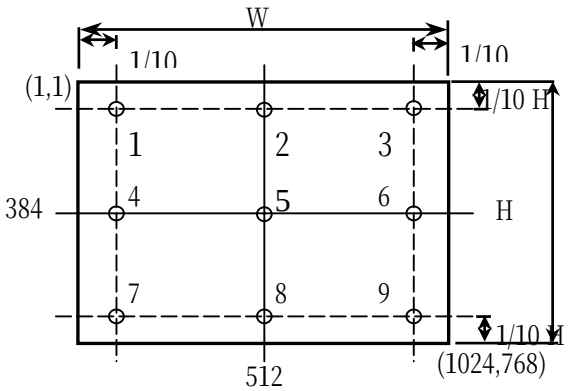
(a) Measured the 5th point on the below for Lw and CR

(b) Measured the 1~ 9th points on the below for LA and ΔLw

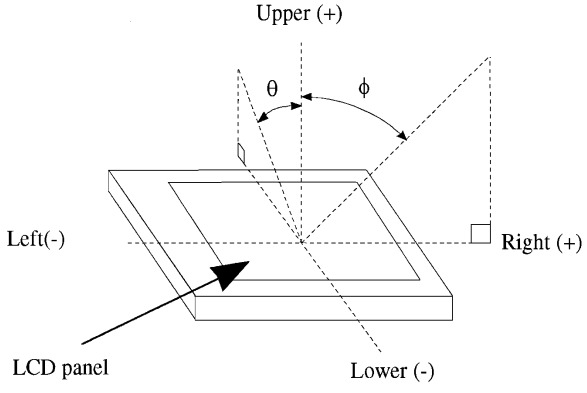
ΔLw=[L(MIN)/L(MAX)] ×100

(c) Measured points as below.

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

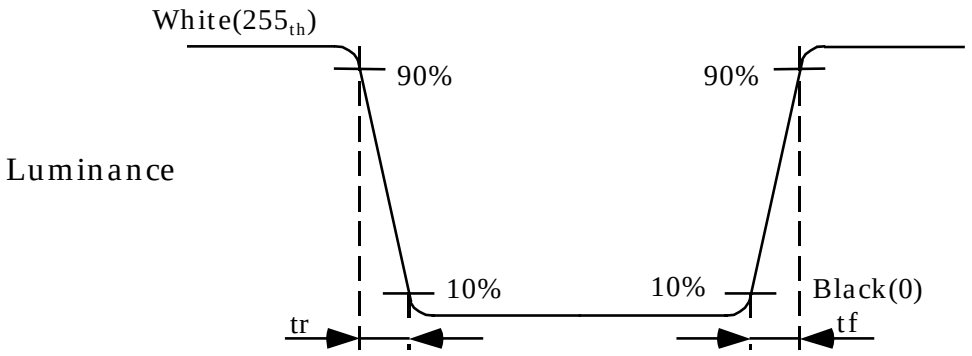


Measurement Points



Viewing Angle(θ , ψ)

*4) Definition of Response Time (White - Black)
Measurement equipment: Westar TDR-100.



9.RELIABILITY TEST CONDITIONS

(1)Temperature and Humidity

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

(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.)