Chunghwa Picture Tubes, Ltd.
Technical Specification

To :
Date :

CPT TFT-LCD

CLAA150XG09

ACCEPTED BY：
TENTATIVE 2

APPROVED BY	CHECKED BY	PREPARED BY
		TFT-LCD Plant Application Div.

Prepared by : TFT-LCD Application Division

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

1.OVERVIEW

CLAA150XG09(with LVDS interface) 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, 1024X 768, 16.2M(6 Bit+FRC)-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 specification 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	16.2M(6 Bit+FRC)
Brightness(cd/m^2)	(250)cd/m^2(Typ.)
Viewing Angle	-60~60(H),-55~45(V) (Typ.)
Surface Treatment	Anti-glare,3H
Electrical Interface	LVDS , 1Ch
Total Module Power(W)	(Typ.)
Optimum Viewing Angle	6 o'clock
Module Size(mm)	326.0(W)X251.0(H)X12.0(D)
Module Weight(g)	1200
Backlight Unit	CCFL, 2 tables, edge-light(top*1/bottom*1)

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
Power Supply Voltage for LCD	VCC	-	4.0	V
ICC Rush Current	I_{RUSH}		3.5	A
Operation Temperature *1)	Top	0	50	℃
Storage Temperature *1)	Tstg	-20	60	℃

Note:

*1)Humidity

Relative Humidity ≦90% (Ta≦ 40℃)

Wet Bulb Temperature ≦40℃(Ta≧40℃)

3. ELECTRICAL CHARACTERISTICS

(a)TFT-LCD

ITEM		SYMBOL	MIN	TYP	MAX	UNIT	Remark
Power Supply Voltage for LCD		VCC	3.0	3.3	3.6	V	Note1
Power Supply Current for LCD		ICC	-	T.B.D	T.B.D	mA	Note2
Permissive Input Ripple Voltage		VRP	-	-	100	mVp-p	Vcc=3.3V
Differential impedance		Zm	90	100	110	Ω	
Input Threshold Voltage	High	VIH	3.0	3.3	3.6	V	
	Low	VIL	0	-	0.8	V	

[Note 1] Power and Data sequence

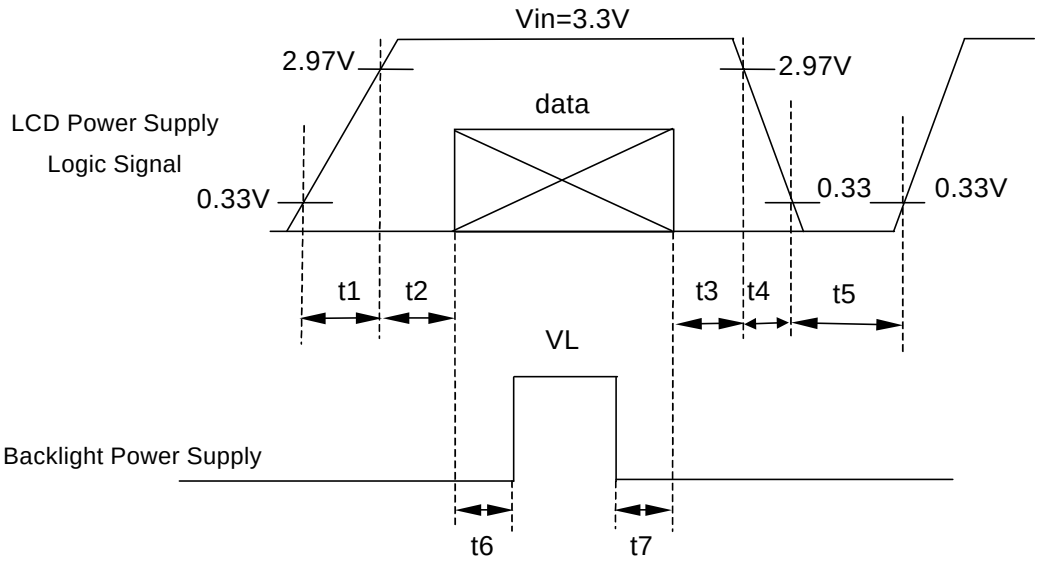
VCC-turn-on conditions:

t1≦10ms 1 sec≦t5

0＜t2≦50ms 200ms≦t6

0＜t3≦50ms 200ms≦t7

0＜t4≦10ms



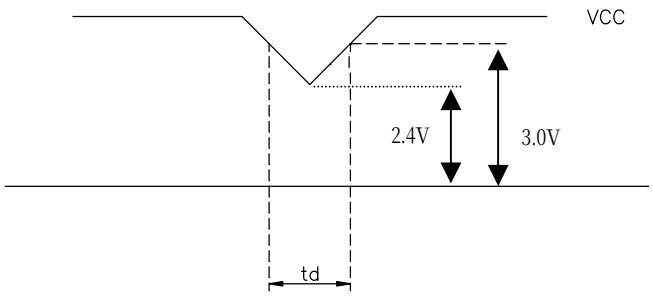
Data: RGB DATA, DCLK, DENA

VCC-dip conditions

1)When 2.4V≦Vin(min)<3.0V td≦10 ms

2)When Vin <2.4V, it works abnormal that must reset power.

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

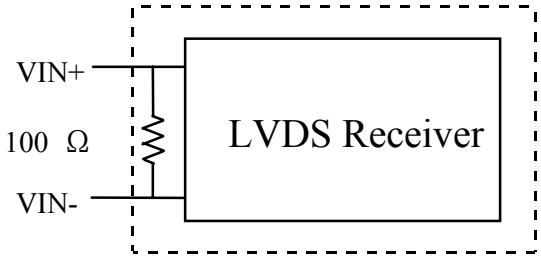


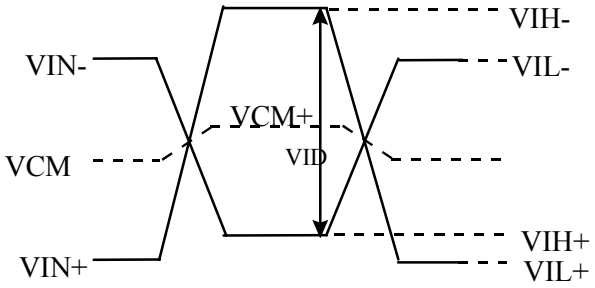
[Note 2] Typical current situation : 256 gray level, 1024 line mode,

VCC=3.3V,Fh=48.5Khz,Fv=60Hz,Fclk=65 MHz .

[Note 3]

LVDS Signal definition :





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

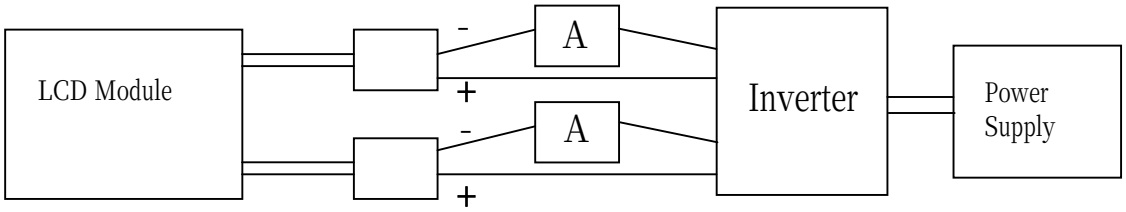
VIN- = Negative differential DATA & CLK Input

(b)Backlight Ta=25℃

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	REMARK
Lamp Voltage	VL	--	650	--	V	IL=7.0mA
Lamp Current	IL	5.0	7.0	8.0	mA	Note1
Interter Frequency	FL	40	50	60	kHz	Note2
Starting Lamp Voltage	VS	1,300	--	-	V	Ta=0℃
		1,100	--	-	V	Ta=25℃
Lamp life Time	LT	35,000	45,000	-	hr	Note3 IL=7.0mA

[Note 1]

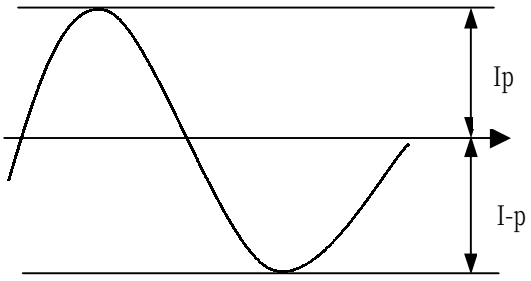
Lamp Current measurement method (The current meter is inserted in cold line)



[Note 2] 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.

[Note 3] Lamp life time is defined as the time either when the brightness becomes 50% of the initial value,or when the starting lamp voltage does not meet the value specified in this table .

[Note 4] 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

4. INTERFACE PIN CONNECTION

(a) CN1(Data Signal and Power Supply)

Used connector: DF14H-20P-1.25H (HIROSE)

Matting cinnector: DF14-20S-1.25C (HIROSE)

Pin NO.	Symbol	Function
1	VCC	+3.3V power supply
2	VCC	+3.3V power supply
3	GND	GND (It must be connected ground)
4	GND	GND (It must be connected ground)
5	RXIN0-	LVDS Receiver Signal(-)
6	RXIN0+	LVDS Receiver Signal(+)
7	GND	GND (It must be connected ground)
8	RXIN1-	LVDS Receiver Signal(-)
9	RXIN1+	LVDS Receiver Signal(+)
10	GND	GND (It must be connected ground)
11	RXIN2-	LVDS Receiver Signal(-)
12	RXIN2+	LVDS Receiver Signal(+)
13	GND	GND (It must be connected ground)
14	RXCLK IN-	LVDS Clock Signal(-)
15	RXCLK IN+	LVDS Clock Signal(+)
16	GND	GND (It must be connected ground)
17	RXIN3-	LVDS Receiver Signal(-)
18	RXIN3+	LVDS Receiver Signal(+)
19	GND	GND (It must be connected ground)
20	NC	No connect (Don't connect ground)

(B)CN2,3(BACKLIGHT)

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

Inverter-side connector: SM02(8.0)B-BHS-1(JST)

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

[Note]VBLH-VBLL = VL

5. INTERFACE TIMING

(a)Timing Specifications

ITEM			SYMBOL	MIN	TYP	MAX	UNIT
LCD Timing	DCLK	Frequency	f_{CLK}	-	65	80	MHz
		Period	t_{CLK}	12.5	15.3	-	ns
	DATA Enable DENA	Horizontal Total Time	t_H	1180	1344	1370	t_{CLK}
		Horizontal Active Time	t_{HA}	-	(1024)	-	t_{CLK}
		Horizontal Blank Time	t_{HB}	156	320	346	t_{CLK}
		Frame Rate	Fr	55	60	75	Hz
		Vertical Total Time	t_V	794	806	860	t_H
		Vertical Active Time	t_{VA}		768		t_H
		Vertical Blank Time	t_{VB}	26	38	92	t_H

[Note]

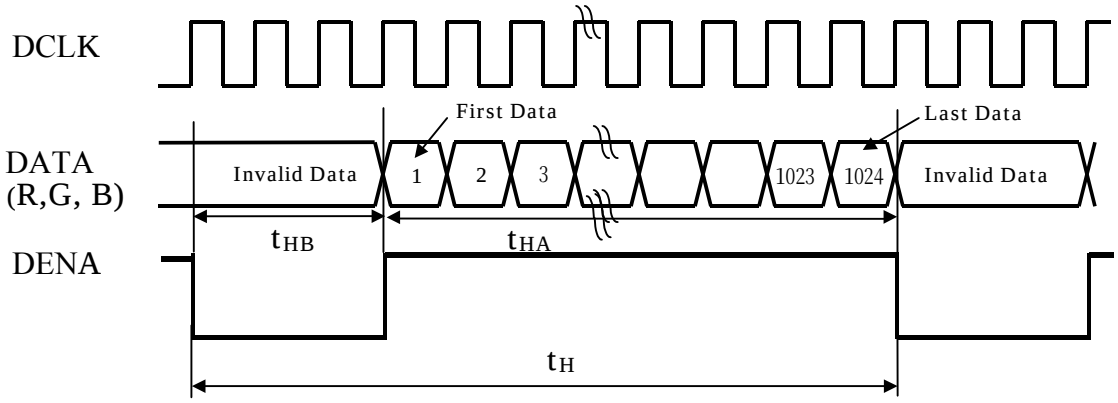
1)Polaritites of HD and VD are negative in this specification.

2)DENA (Data Enable) should always be positive polarity as shown in the timing specification.

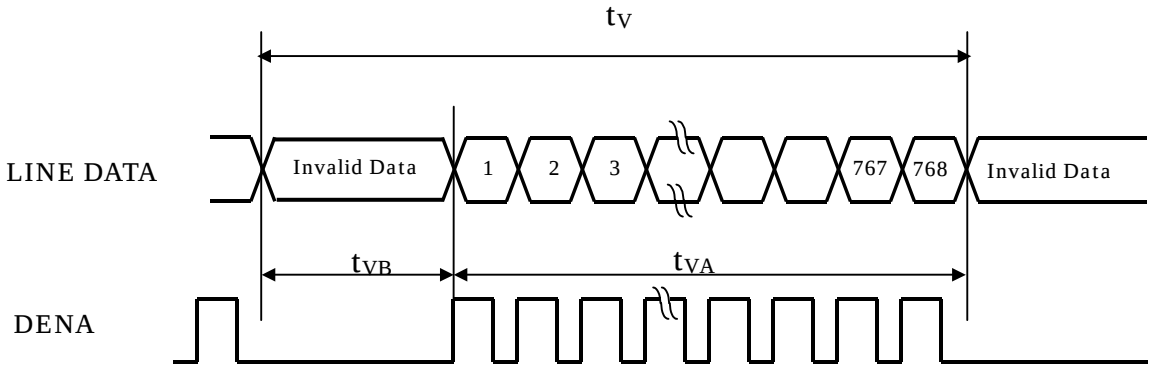
3)DCLK should appear during all blanking period, and HD should appear during blanking period of frame cycle.

(b) Timing Chart

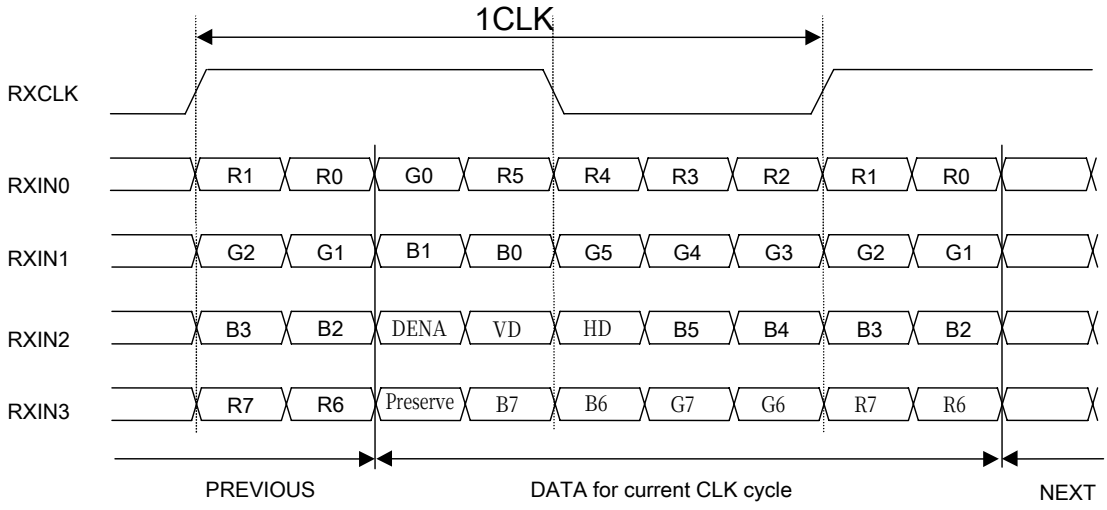
a. Horizontal Timing Chart



b. Vertical Timing Chart



(C) Data mapping



(D)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.

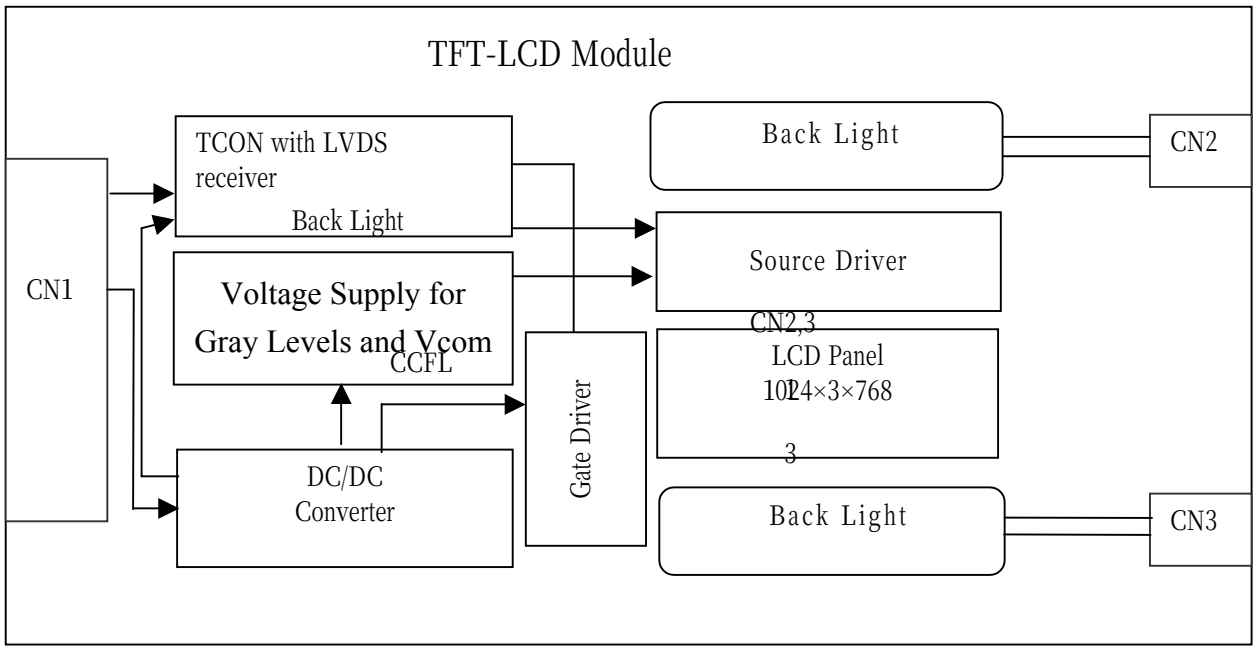
Higher n means brighter level.

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

(E) Color Data Assignment

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)

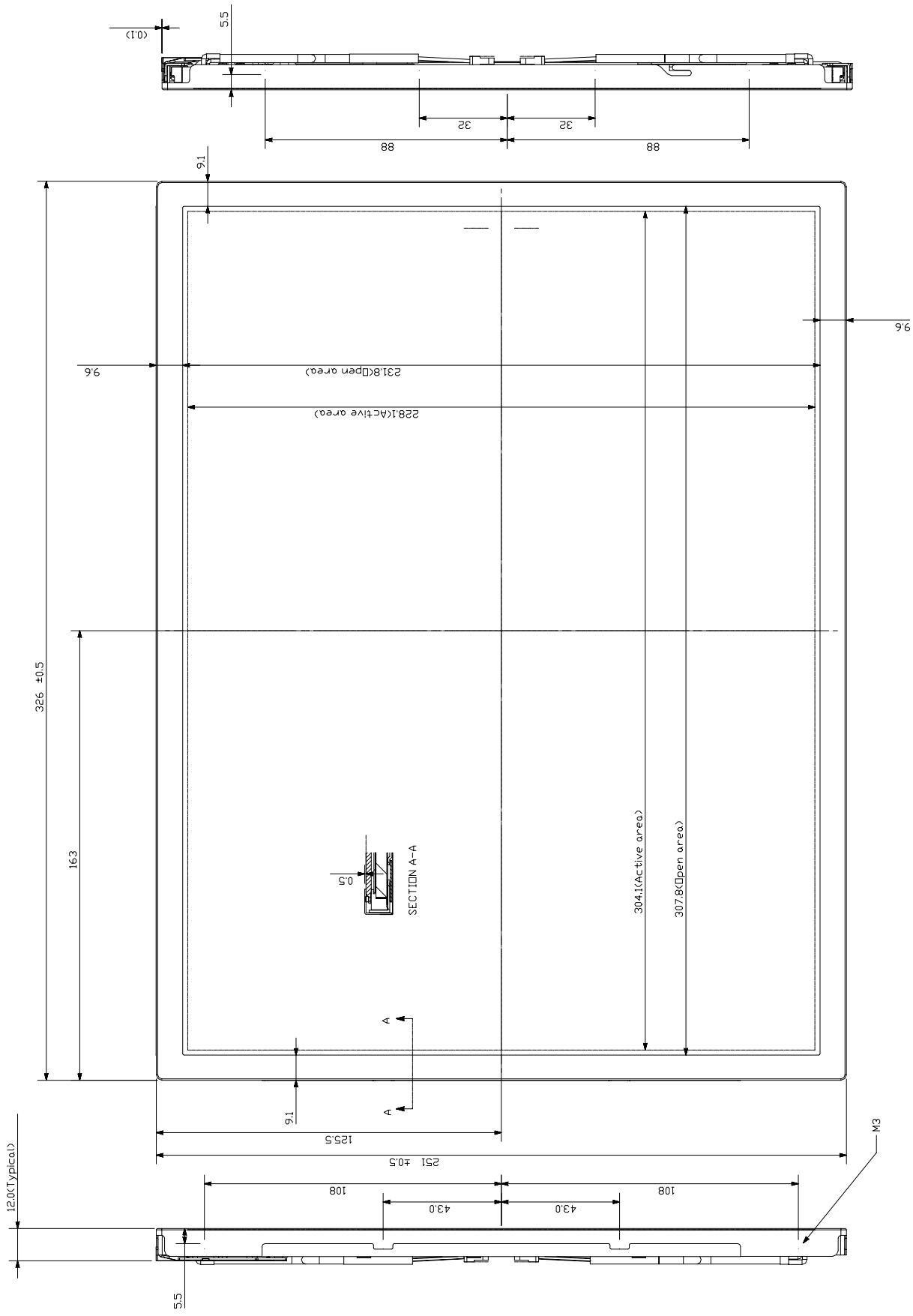
6. BLOCK DIAGRAM



7. MECHANICAL SPECIFICATION

(a) Front side

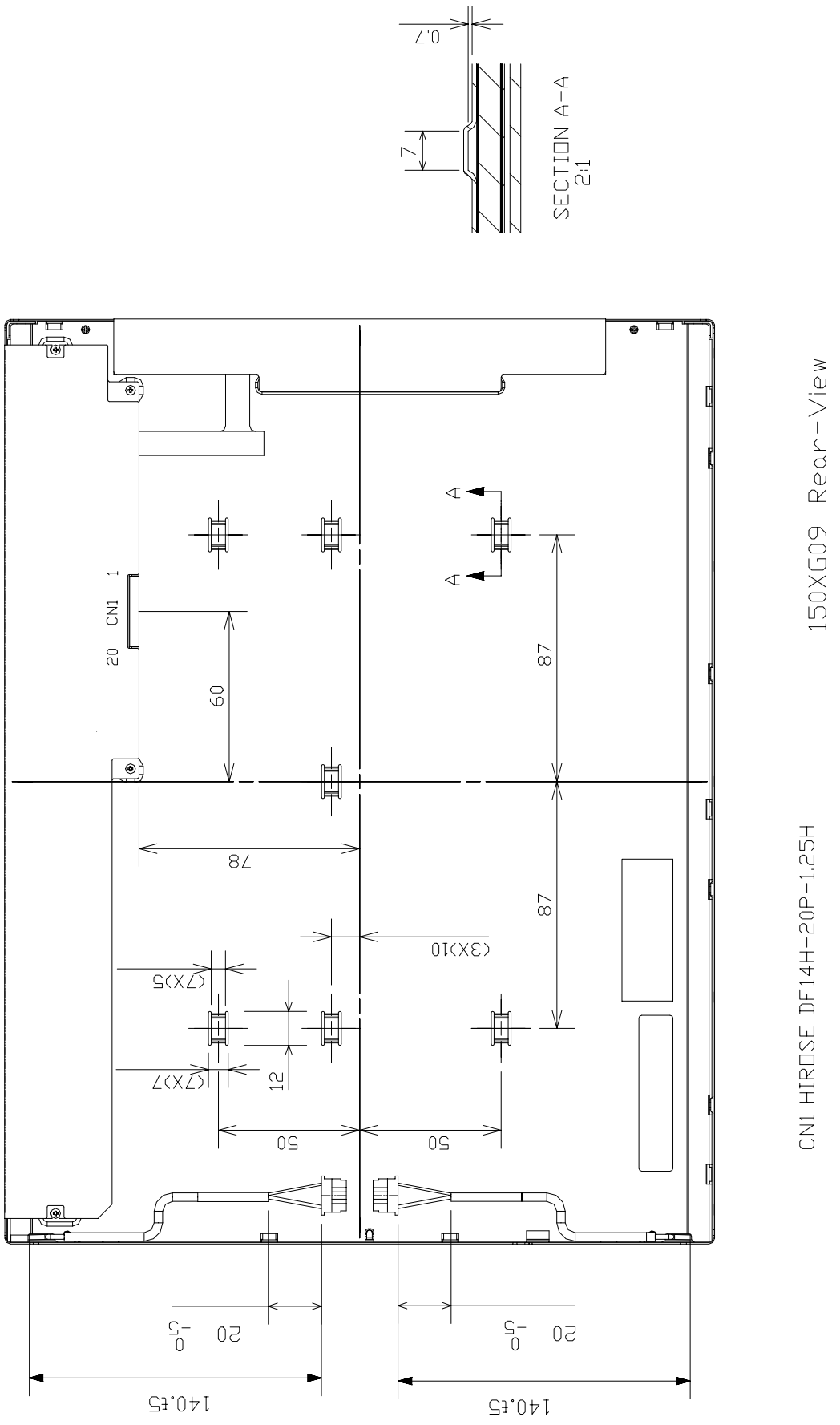
Unit: mm



[Note] Undefined tolerances to be ±0.5 mm

(b) Rear side

Unit: mm



[Note] Undefined tolerances to be ±0.5 mm

8.OPTICAL CHARACTERISTICS

Ta=25

ITEM			SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Contrast Ratio			CR	θ= ψ =0°	TBD	(400)	--	--
Luminance	Center		L	θ= ψ =0°	TBD	TBD	--	cd/m²
	5 point	Normal	L	θ= ψ =0°	(200)	(250)	--	
		Uniformit	ΔL	θ= ψ =0°	--	--	25	%
	9 point	Normal	L	θ= ψ =0°	TBD	TBD	--	
		Uniformit	ΔL	θ= ψ =0°	--	--	TBD	%
Response Time			Tr	θ= ψ =0°	--	(9)	--	ms
			Tf	θ= ψ =0°	--	(16)	--	ms
Image Sticking			Tis	2hour	--	--	2	sec
Viewing Angle	Horizontal		ψ	CR≧5	TBD	TBD	--	°
	Vertical		θ		TBD	TBD	--	°
	Horizontal		ψ	CR≧10	TBD	(-60~60)	--	°
	Vertical		θ		TBD	(-55~45)	--	°
Cross talk			CMR*6)	θ=ϕ =0°*3)	--	--	1	%
Color Coordinates	White		Wx Wy	θ= ψ =0°	(0.283) (0.299)	(0.313) (0.329)	(0.343) (0.359)	--
	Red		Rx Ry		TBD	TBD	TBD	
	Green		Gx Gy		TBD	TBD	TBD	
	Blue		Bx By		TBD	TBD	TBD	

[Note]

These items are measured using CS-1000 (MINOLUTA) OR BM-5A(TOPCON)under the dark room condition(no ambient light) after more than 30 minutes from turning on the lamp unless noted.

Condition: IL=7.0*2mA, Inverter Frequency=50kHz , Definition of these measurement items are as follows:

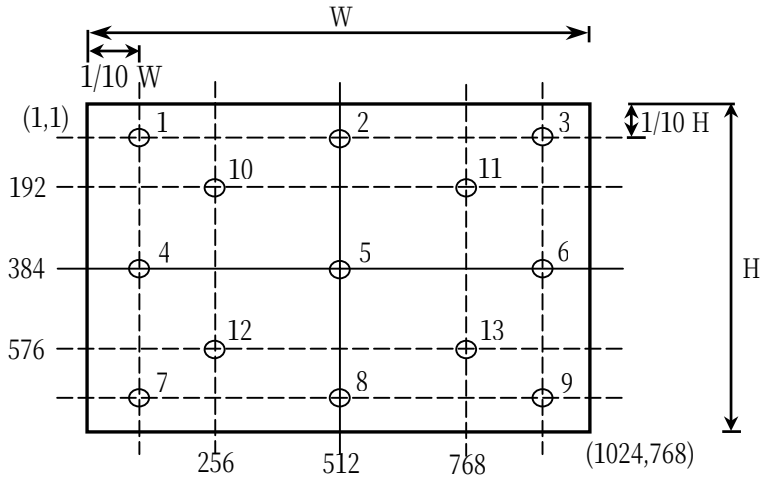
(1)Definition of Contrast Ratio： CR=ON(White)Luminance/OFF(Black)Luminance

(2)Definition of Luminance and Luminance uniformity

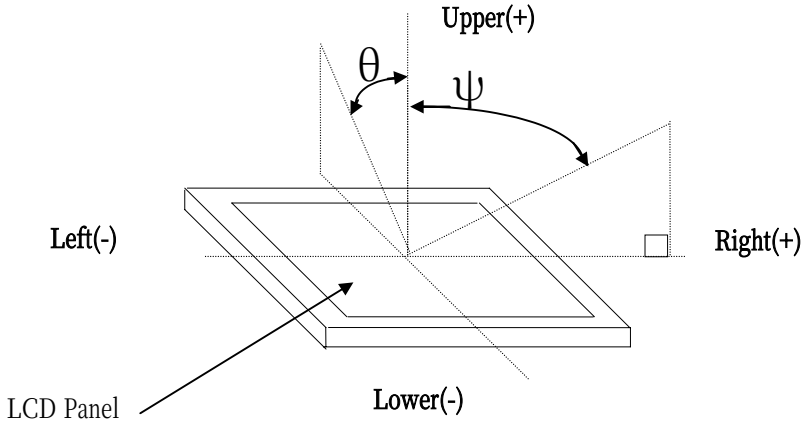
Measure White Luminance on the below center(5), 5 point(5,10,11,12,13) and 9 point(1~9).

Uniformity： 5 point：Δ L = [(L_{MAX} - L_{MIN})/L_{MIN}]X100%

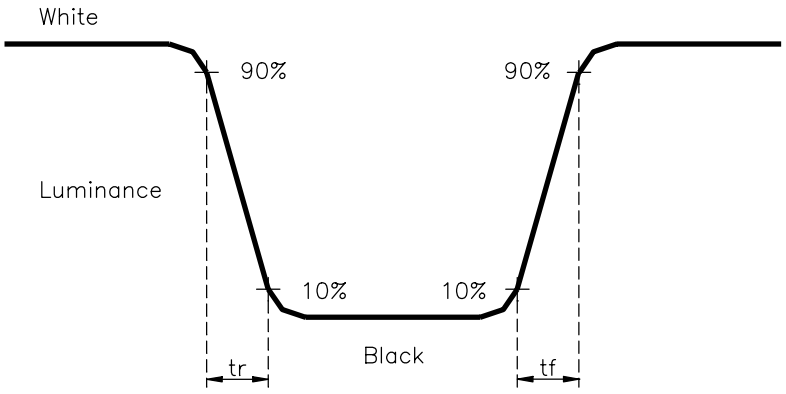
9 point：Δ L = (L_{MIN} /L_{MAX}) X100%



(3)Definition of Viewing Angle(θ , ψ)



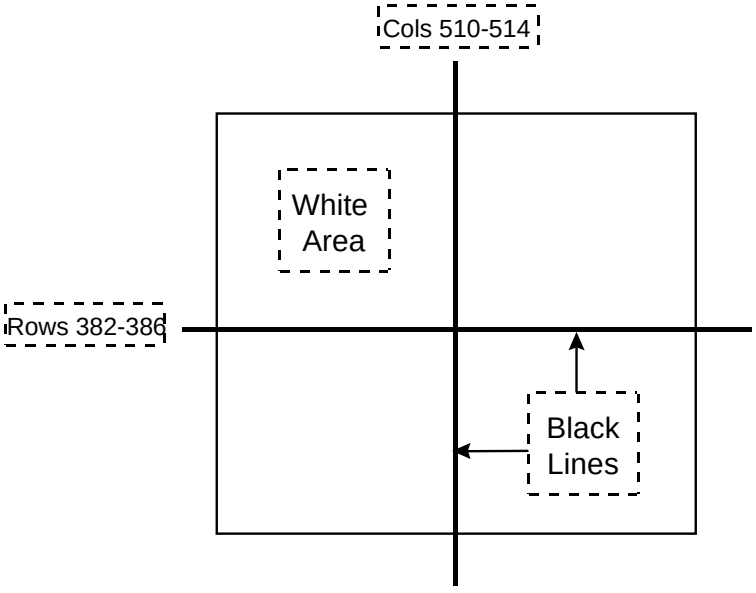
(4)Definition of Response Time



(5)Image sticking:

Continuously display the test pattern shown in the figure below for two-hours. Then display a completely white screen. The previous image shall not persist more than two seconds at 25℃.

TEST PATTERN FOR IMAGE STICKING TEST



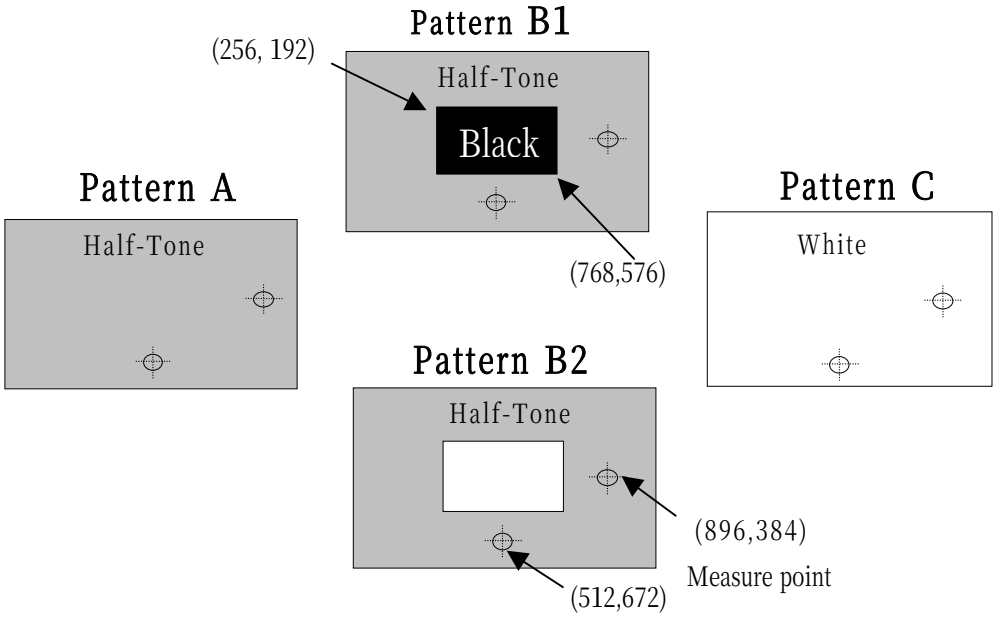
(6) Definition of Crosstalk Ratio

CMR = MAX (***(| (LB1-LA) / LC |) ×100*** , ***(| (LB2 – LA) / LC |) ×100***)

LA：Pattern A(Half-Tone pattern) Measure point Luminance

LB1,LB2： Pattern B1、 Pattern B2 Measure point Luminance

LC：Pattern C(white pattern) Measure point Luminance



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 500Hz 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*C 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.)