

TENTATIVE

ALL information in this technical data sheet is tentative
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8.4" VGA

TECHNICAL SPECIFICATION

AA084VB01

Advanced Display Inc.

Date: Oct. 3, '97

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1. OVERVIEW

AA084VB01 is 8.4" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, and backlight.

By applying 6bit digital data 640 x 480 260K -color images are displayed on the 8.4" diagonal screen. Input power voltage is single 3.3 V 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)	170.9 X 128.2 (8.4-inch diagonal)
Number of pixels	640 X 480 (V)
Pixel pitch (mm)	0.267 (H) X 0.267 (V)
Color Pixel Arrangement	RGB vertical stripe
Display Mode	normally white
Number of colors	260k
Contrast ratio	150
Optimum Viewing Angle	12 o'clock
Brightness(cd/m ²)	200
Module size (mm)	221.0 (W) X 152.4 (H) X 10.58 (D)
Module Weight (g)	420 (TYP.)
Backlight Unit	CCF, 2 tube,replaceable

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 MAXIMUN RATINGS

ITEM	SYMBOL	MIN.	MAX.	UNIT
Power Supply Voltage for LCD	VDD	0	5.5	V
Logic Input Voltage	VIN	0	7	V
Operation Temperature ^{note1,2}	T _{op}	0	50	°C
Storage Temperature ^{note1,2}	T _{stg}	-20	60	°C

note 1:The temperature of the LCD module, not the temperature of atmosphere.

note 2:Humidity ≤ 85% RH. No condensation

3. ELECTRICAL CHARACTERISRICS

(a) TFT-LCD

Ta=25°C

ITEM		SYMBOL	MIN.	TYP.	MAX.	UNIT	Remark
Power Supply Voltage for LCD		VDD	3.0	3.3	3.6	V	(Note 1)
Power Supply Current for LCD		IDD		240	400	mA	(Note 2)
Permissive input ripple Voltage		VRP			100	mVp-p	VDD = +3.3V
Logic Input Voltage	Hi	VLH	2.4		5.5	V	VDD=MAX.
	Low	VLL	0		0.8	V	VDD=MIN.

note 1,2: See page 6

(b) Backlight

Ta=25°C

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	Remark
Lamp Voltage	VL		440		V	IL=5mA
Lamp Current	IL		5 ^{note1}		mA	
Frequency	fL	45	50	55	kHz	
Starting Lamp Voltage	Vs	1100			V	

note 1: For typical luminance of 200cd/m²

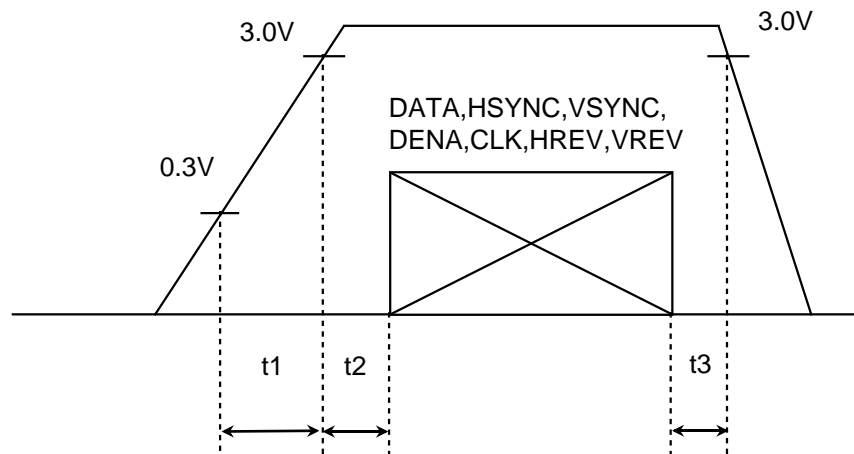
note 2: The table shows the data of one lamp. The module has two same lamps connected in parallel.

(Note1)

Vdd-turn-on conditions: $t1 \leq 10\text{msec}$

$0 < t2 \leq 50\text{msec}$

$0 < t3 \leq 50\text{msec}$



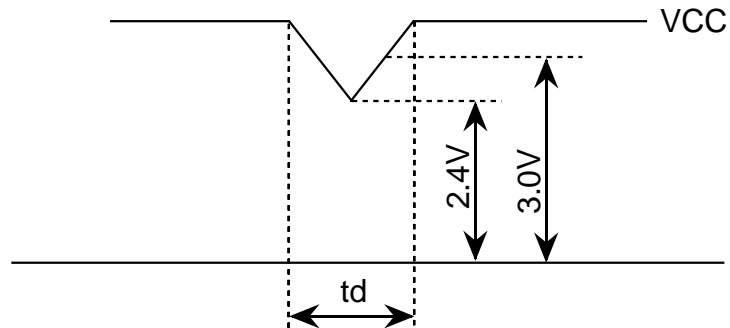
Vdd-dip conditions

1) $2.4\text{V} \leq Vdd < 3.0\text{V}$

$t_d \leq 10\text{msec}$

2) $Vdd < 2.4\text{V}$

Vdd-dip conditions should also follow the Vdd-turn-on conditions



(Note2)

Typical current situation: 64-gray-bar pattern

480 line mode

$Vdd = +3.3\text{V}$

4.INTERFACE PIN CONNECTION

CN1(INTERFACE SIGNAL)

Used connector: IL-FPR-40S-VF-E1500(JAE)

pin	Symbol	Function
1	VDD	
2	VDD	
3	N.C.	
4	VSS	
5	TEST	This should be electrically opened during operation
6	TEST	This should be electrically opened during operation
7	HREV	Horizontal reverse scan
8	VREV	Vertical reverse scan
9	VSS	
10	DENA	Data enable signal (to settle the viewing area)
11	VSS	
12	B5	BLUE data signal (MSB)
13	B4	BLUE data signal
14	B3	BLUE data signal
15	VSS	
16	B2	BLUE data signal
17	B1	BLUE data signal
18	B0	BLUE data signal (LSB)
19	VSS	
20	G5	GREEN data signal(MSB)
21	G4	GREEN data signal
22	G3	GREEN data signal
23	VSS	
24	G2	GREEN data signal
25	G1	GREEN data signal
26	G0	GREEN data signal (LSB)
27	VSS	
28	R5	RED data signal (MSB)
29	R4	RED data signal
30	R3	RED data signal
31	VSS	
32	R2	RED data signal
33	R1	RED data signal
34	R0	RED data signal (LSB)
35	VSS	
36	HSYNC	Horizontal sync signal
37	VSYNC	Vertical sync signal
38	VSS	
39	CLK	Clock signal for sampling catch data signal
40	VSS	

*The shielding case is connected with VSS.

CN2,CN3(BACKLIGHT)

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

Inverter-side connector: SM02(8.0)B-BHS-1-TB(JST)[for SMT]

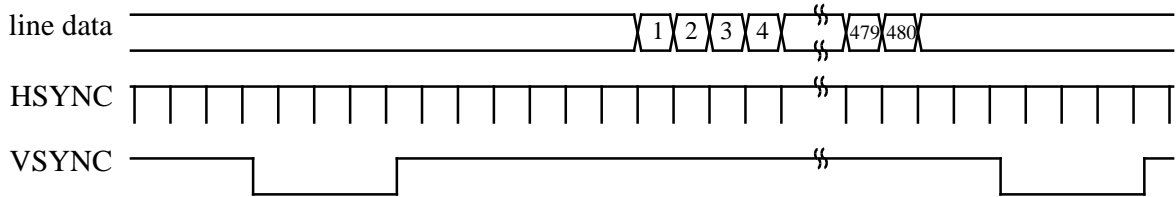
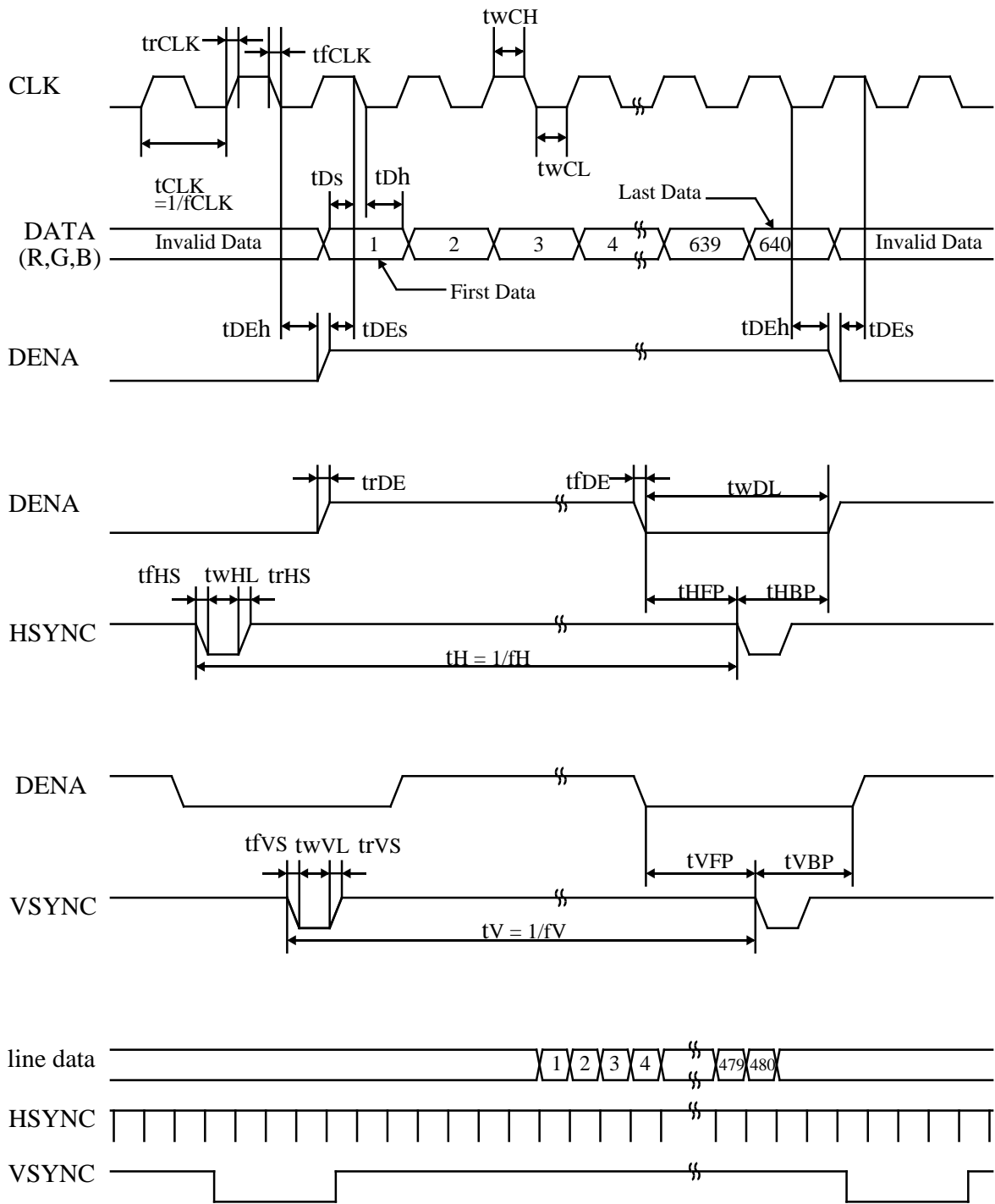
BHMR-03V(JST)[for discrete wire]

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

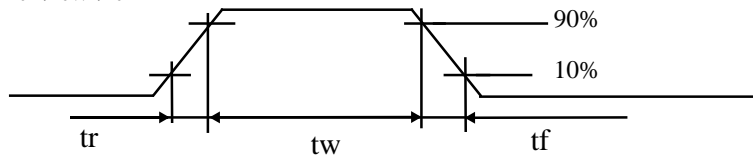
[Note]: VBLH-VBLL=VL

5.INTERFACE TIMING

(a) Timing Chart



definition of tr / tw / tf



(b)Timing Specifications

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	
CLK	Frequency	fCLK	20	25	30	MHz
	Period	tCLK	33.3	40	50	ns
	Width-Low	twCL	10	--	--	ns
	Width-High	twCH	10	--	--	ns
	Rise Time	trCLK	--	--	5	ns
	Fall Time	tfCLK	--	--	5	ns
DATA (R,G,B)	Set up Time	tDs	5	--	--	ns
	Hold Time	tDh	5	--	--	ns
DENA	Set up Time	tDEs	5	--	--	ns
	Hold Time	tDEh	5	--	--	ns
	Low Time	twDL	90	--	168	tCLK
	Rise Time	trDE	--	--	5	ns
	Fall Time	tfDE	--	--	5	ns
	Horizontal Front Porch	tHFP	0	--	--	tCLK
	Horizontal Back Porch	tHBP	7	--	--	tCLK
	Vertical Front Porch	tVFP	1	20	--	tH
	Vertical Back Porch	tVBP	8	20	--	tH
HSYNC	Frequency	fH	27	31.5	38	kHz
	Period	tH	730	--	808	tCLK
	Width Low	twHL	5	--	--	tCLK
	Rise Time	trHS	--	--	10	ns
	Fall Time	tfHS	--	--	10	ns
VSYNC	Frequency	fV	55	60	70	Hz
	Period	tV	489	--	--	tH
	Width Low	twVL	3	--	--	tH
	Rise Time	trVS	--	--	10	ns
	Fall Time	tfVS	--	--	10	ns

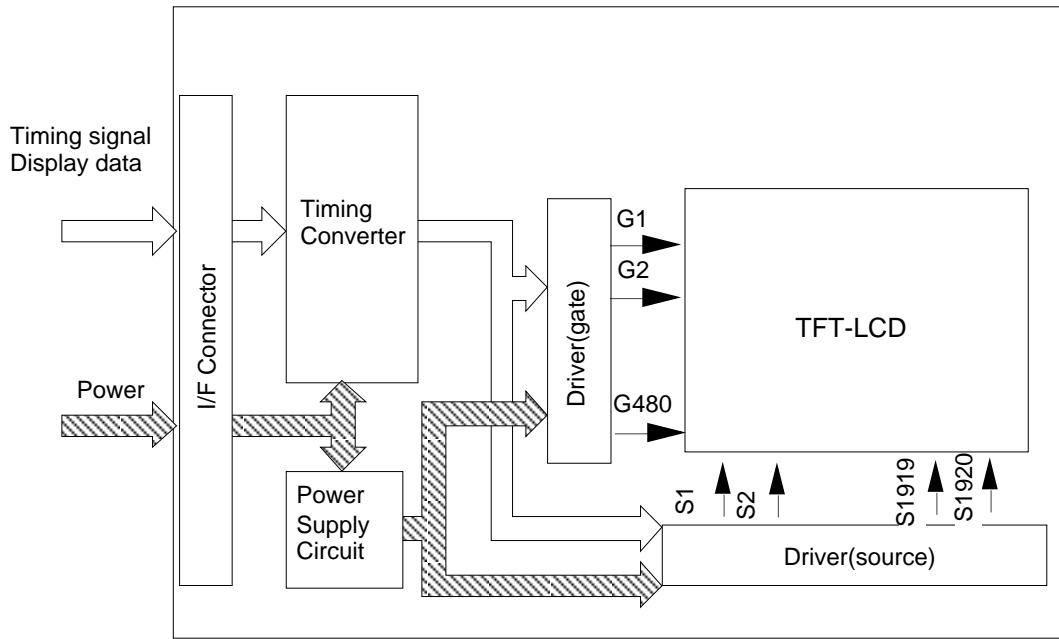
- Note: 1) Data is latched at fall edge of CLK in this timing specification.
2) Polarities of HSYNC and VSYNC are negative in this specification.
3) DENA(Data Enable) should always be positive polarity as shown in the timing specification.
4) CLK should appear during all invalid period, and HD should appear during invalid period of frame cycle
5) Accepted only 640 data and 480 lines.
6) Both HREV and VREV should be stable during operation.

(c)Color Data Assignment

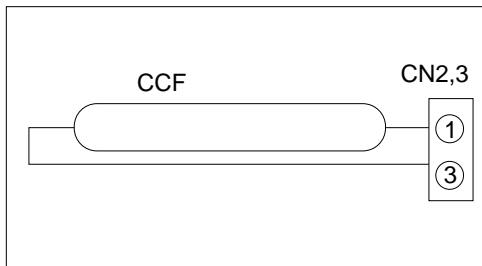
COLOR	INPUT DATA	R DATA						G DATA						B DATA					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
		MSB					LSB	MSB					LSB	MSB					LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	BLUE(63)	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	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	BLUE(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

- Note 1) Definition of gray scale:
 Color (n) ----n indicates gray scale level.
 Higher n means brighter level.
- 2) Data: 1: High, 0:Low

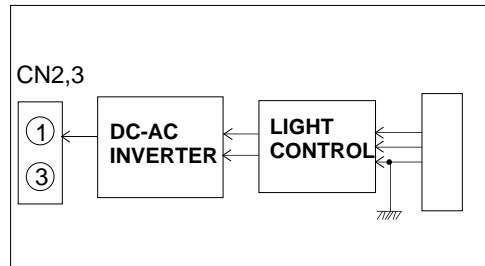
6.BLOCK DIAGRAM



BACK LIGHT

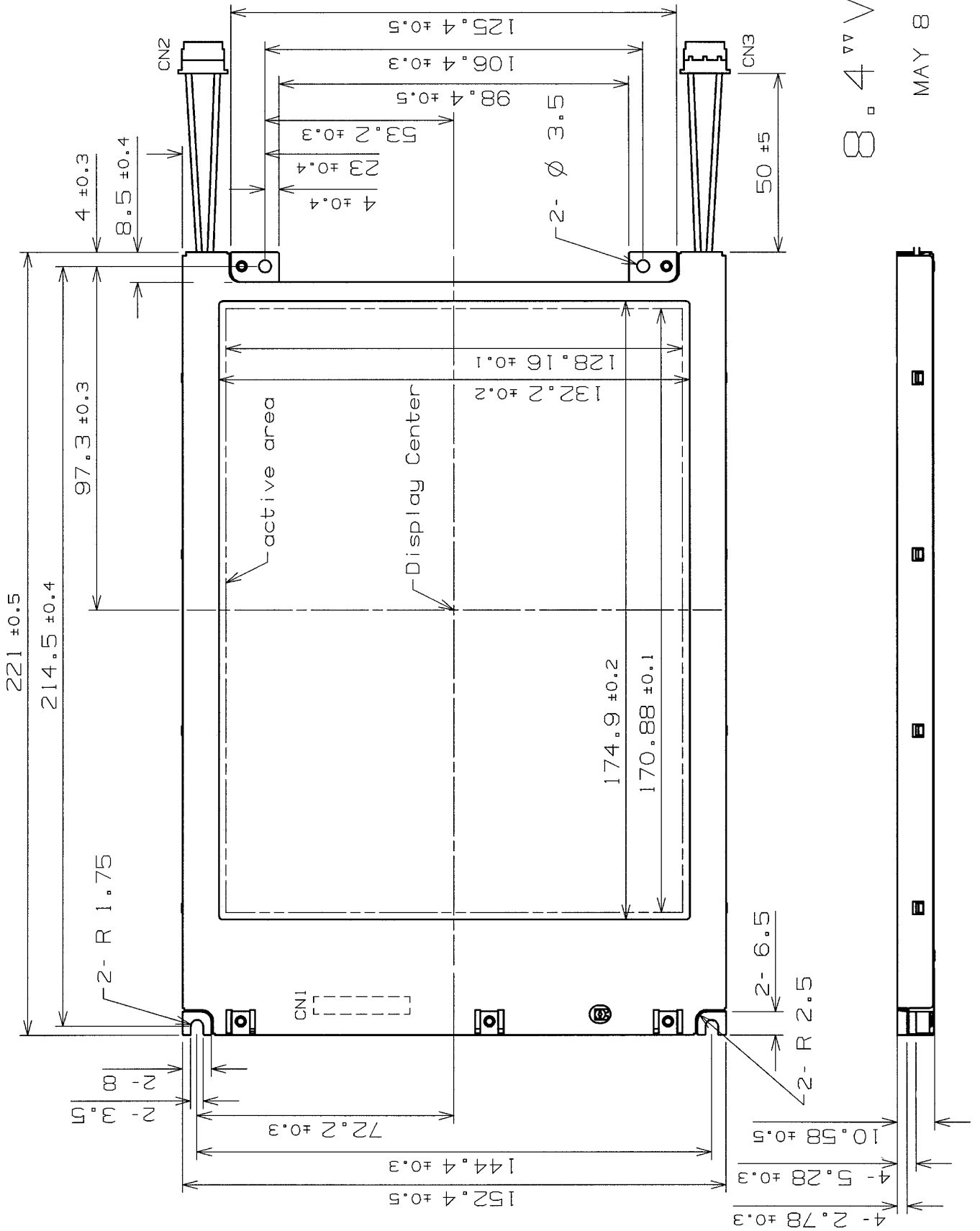


INVERTER CIRCUIT (OUT SIDE)

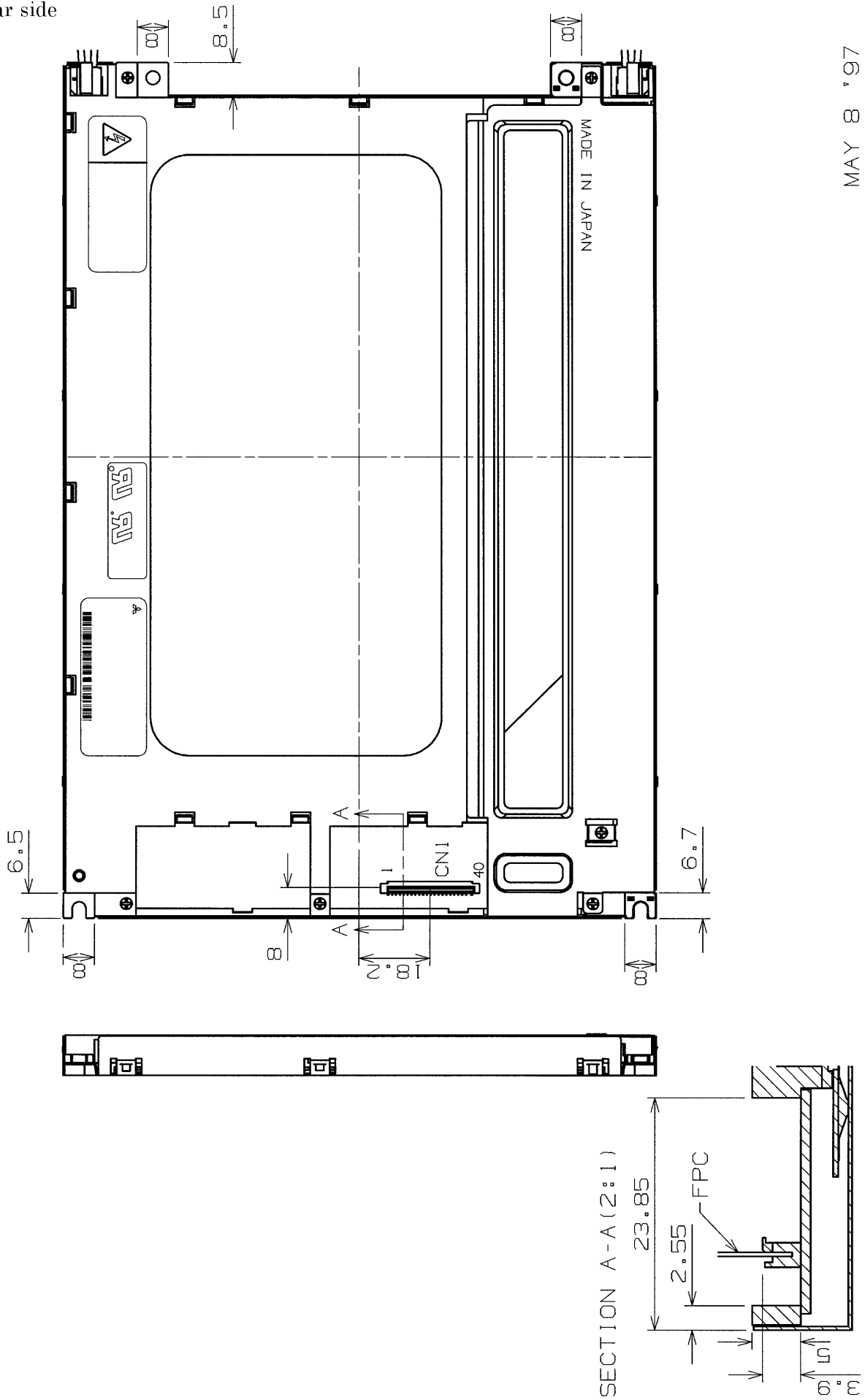


7.MECHANICAL SPECIFICATION

(a) Front side



(b) Rear side



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8.OPTICAL CHARACTERITICS

Ta=25°C VDD=3.3V

ITEM		SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Contrast Ratio		CR	$\theta = \phi = 0^\circ$	--	150	--	--
Luminance		L	$\theta = \phi = 0^\circ$	--	200	--	cd/m ²
Response Time		tr	$\theta = \phi = 0^\circ$	--	20	--	ms
		tf	$\theta = \phi = 0^\circ$	--	30	--	ms
Viewing angle	Horizontal	ϕ	CR \geq 10	--	-60 ~ 60	--	°
	Vertical	θ		--	-40 ~ 50	--	°
Color Coordinates	Red	x	$\theta = \phi = 0^\circ$	--	0.544	--	--
		y		--	0.375	--	
	Green	x	$\theta = \phi = 0^\circ$	--	0.303	--	
		y		--	0.525	--	
	Blue	x	$\theta = \phi = 0^\circ$	--	0.156	--	
		y		--	0.135	--	
	White	x	$\theta = \phi = 0^\circ$	--	0.305	--	
		y		--	0.333	--	
Haze value of polarizer		H			12		

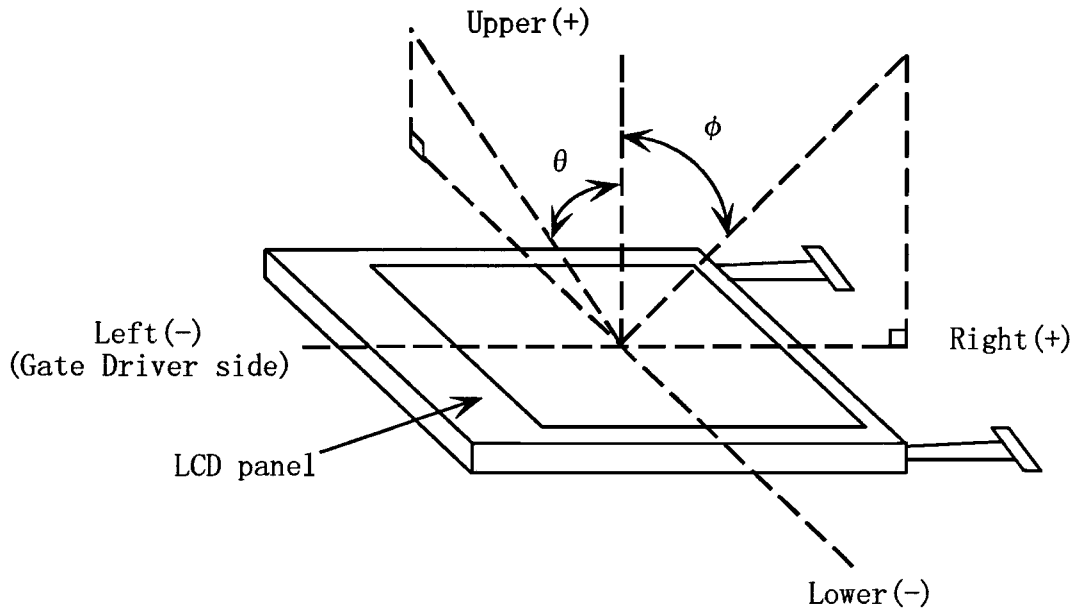
Note: These items except haze value of polarizer are measured using BM-5A(TOPCON) or LCD-7000 (Otsuka Electronic) under the dark room condition(no ambient light).

Definition of these items are as follows:

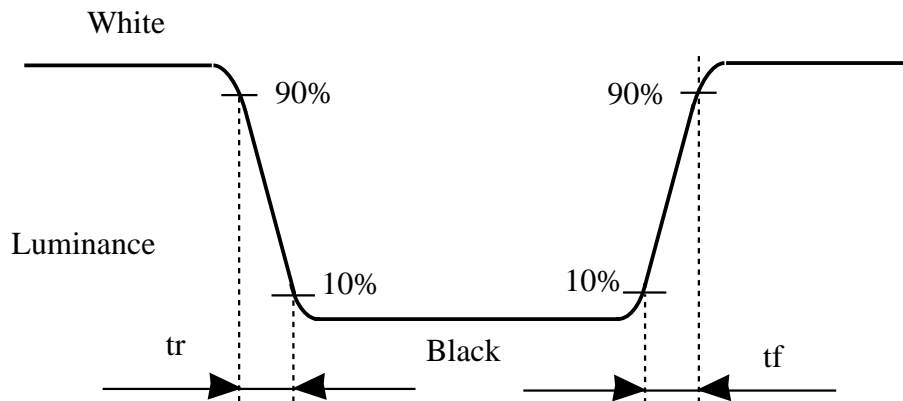
1) Definition of Contrast Ratio

$$CR = \text{ON (White) Luminance} / \text{OFF (Black) Luminance}$$

2) Definition of Viewing Angle (θ , ϕ)



3) Definition of Response Time



9.LIFE TIME OF THE BACKLIGHT

The definition of life time is as follows:

The luminance becomes half of the initial value or

The lamp does not turn on under 1100V ($T_a = 25^\circ\text{C}$, $I_L = 5\text{mA}$).

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	Remark
Life Time	TL	25000			Hour	note 1

note 1: The conditions are following

$T_a = 25^\circ\text{C}$

$I_L = 5\text{mA}$

10. RELIABILITY TEST CONDITION

(1) Temperature and Humidity

TEST ITEM	CONDITIONS
High temperature & high humidity operation	40°C 90%RH 500 hour
High temperature & high humidity storage	60°C 90%RH 96hour
Low temperature storage	-20°C 96 hour
Thermal shock	Between -20°C (1hour) and 60°C(1hour)5cycles

(2)Shock & Vibration

TEST ITEM	CONDITIONS
Shock (non-operating)	Shock level: 100G Waveform: half sinusoidal wave, 2 ms Number of shocks: one shock input in each direction of three mutually perpendicular axis for a total of six shock inputs
Vibration (non-operating)	Vibration level: 1.0G(Zero to peak) Waveform: sinusoidal Frequency range: 5 to 500Hz Frequency sweep rate: 0.5 octave/min Duration: one sweep from 5 to 500 to 5Hz in each of three mutually perpendicular axis(total 3hr)

(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.

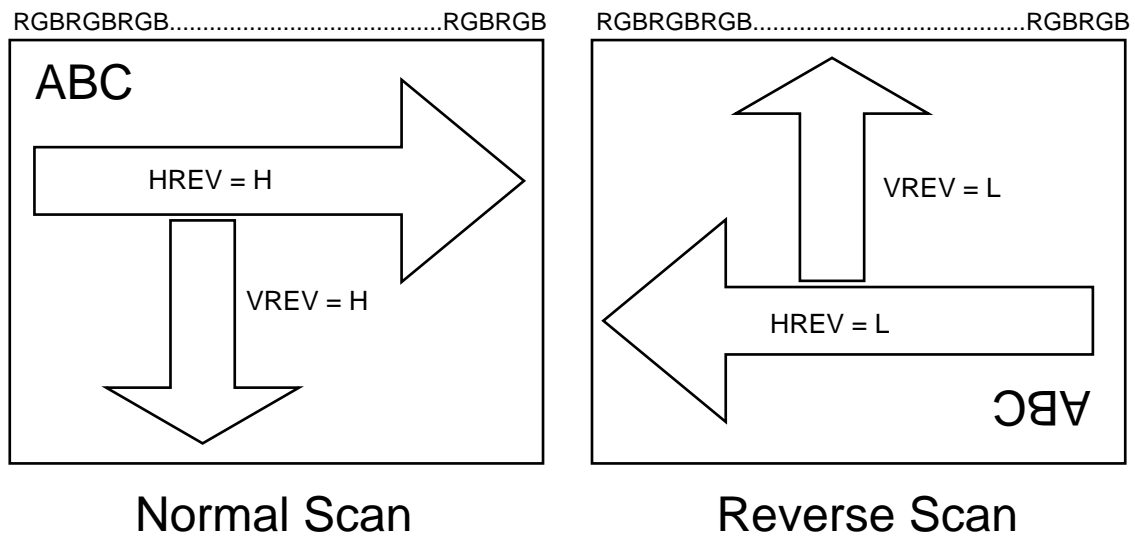
11. INVERTED SCAN CAPABILITY

This module has the capability of inverting scan direction by signaling from controller.

Both horizontal and vertical scan direction can be selected independently. Note that scan direction cannot be changed during operation.

The following figure shows how to scan the display image data on the LCD screen.

The both image data sequences are the same.



The scan direction is determined by the following table.

	Normal	Reverse
HREV	H	L
VREV	H	L

12. HANDLING PRECAUTIONS FOR TFT-LCD MODULE

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

12-1 ASSEMBLY PRECAUTION

- (1) Please use the mounting hole on the module corners in installing and do not bending 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 designed 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 1.0mm 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 interfere the LCD module by the lamp cable.
 - (2 - 5) Keep sufficient clearance between LCD module and the other parts, such as inverter and speaker so as not to interfere the LCD module. Approximately 1.0mm of the clearance in the design is recommended.
- (3) Please do not place anything, such as label or gasket, on the back light reflector sheet, since it might deform the reflector sheet. Otherwise, the optical performance in specification is not guaranteed.
- (4) Please do not push or scratch LCD panel surface with anything hard. And do not soil LCD panel surface by touching with bare hands. (Polarizer film, surface of LCD panel is easy to be flawed.)
- (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. Please pay attention to handling lead wire of backlight so that it is not tugged in connecting with inverter.

12 - 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.

12 - 3 PRECAUTIONS WITH ELECTROSTATICS

- (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 preventing from electrostatics occurrence.

12 - 4 STORAGE PRECAUTIONS

- (1) When you store LCDs for a long time, it is recommended to keep the temperature between 0°C~40°C 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°C90%RH.
- (3) Please do not leave the LCDs in the environment of low temperature; below -20°C.

12 - 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.

12 - 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 piling them up more than 5 boxes. (They are not designed so.) And please do not turn over.
 - (3 - 3) Please handling packaging box with care not to give them sudden shock and vibrations. And also please do not throw them up.
 - (3 - 4) Packaging 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.)