

INNOLUX DISPLAY CORPORATION

LCD MODULE

SPECIFICATION

Customer: _____

Model Name: AT070TN06

SPEC NO: A070-06-TT-02

Date: Dec., 2004

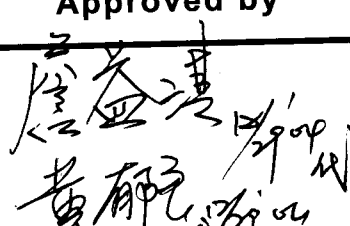
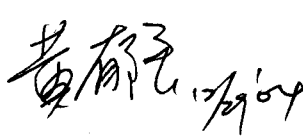

Version: 2

Preliminary Specification

Final Specification

For Customer's Acceptance

Approved by	Comment

Approved by	Reviewed by	Prepare by
 12/29/04	 12/29/04	 12/29/04

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Record of Revision

Version	Revise Date	Page	Content
1	2004/12/06		Initial Release
2	2004/12/27	16	Update Mechanical dimensions

InnoLux
General

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1. General Specifications

NO.	Item	Specification	Remark
1	LCD size	7.0 inch	
2	Driver element	a-Si TFT active matrix	
3	Resolution	480X3(RGB)X234	
4	Display mode	Normally white, Transmissive	
5	Dot pitch	0.107(W) X 0.370(H) mm	
6	Active area	154.08(W) X 86.58(H) mm	
7	Module size	164.9(W) X 100.0(H) X 5.7(D) mm	
8	Surface treatment	Anti-Glare	
9	Weight	160 g	

2. Electrical Characteristics

(1). Absolute maximum ratings

Item	Symbol	Condition	Values		Unit	Remark
			Min.	Max.		
Power voltage	V_{CC}	GND=0	-0.3	7	V	
	AV_{DD}	AVSS=0	-0.3	7	V	
	V_{GH}	GND=0	-0.3	18	V	
	V_{GL}		-15	0.3	V	
	$V_{GH} - V_{GL}$	-	-	33	V	
Input signal voltage	V_i	-	-0.3	$AV_{DD} + 0.3$	V	Note 1
	V_l	-	-0.3	$V_{CC} + 0.3$	V	Note 2
Operation temperature	Top	-	-30	85	°C	
Storage temperature	Tst	-	-30	85	°C	

Note:

- VR, VG, VB.
- STHL, STHR, OEH, L/R, CPH1~CPH3, STVR, STVL, OEV, CKV, U/D.

(2). Pin assignment

(a). TFT LCD panel driving section

Pin no	Symbol	IO	Function	Remark
1	GND	P	Ground for logic circuit	
2	V_{CC}	P	Supply voltage of logic control circuit for scan driver	
3	V_{GL}	P	Negative power for scan driver	
4	V_{GH}	P	Positive power for scan driver	

5	STVR	I/O	Vertical start pulse	Note 1
6	STVL	I/O	Vertical start pulse	Note 1
7	CKV	I	Shift clock input for scan driver	
8	U/D	I	UP/DOWN scan control input	Note 1,2
9	OEV	I	Output enable control for scan driver	
10	VCOM	P	Common electrode driving signal	
11	VCOM	P	Common electrode driving signal	
12	L/R	I	LEFT/RIGHT scan control	Note 1,2
13	MOD	I	Sequential sampling and simultaneous sampling setting	Note 3
14	OEH	I	Output enable control for data driver	
15	STHL	I/O	Start pulse for horizontal scan line	Note 1
16	STHR	I/O	Start pulse for horizontal scan line	Note 1
17	CPH3	I	Sampling and shifting clock pulse for data driver	
18	CPH2	I	Sampling and shifting clock pulse for data driver	
19	CPH1	I	Sampling and shifting clock pulse for data driver	
20	V _{CC}	P	Supply voltage of logic control circuit for data driver	
21	GND	P	Ground for logic circuit	
22	VR	I	Alternated video signal (Red)	
23	VG	I	Alternated video signal (Green)	
24	VB	I	Alternated video signal (Blue)	
25	AV _{DD}	P	Supply voltage for analog circuit	
26	AV _{SS}	P	Ground for analog circuit	

Note:

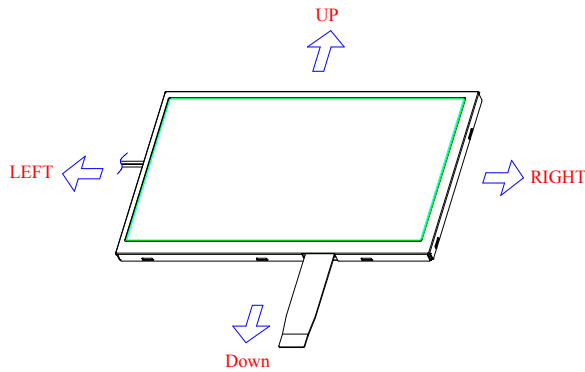
1. Selection of scanning mode (please refer to the following table)

Setting of scan control input		IN/OUT state for start pulse				Scanning direction
U/D	L/R	STVR	STVL	STHR	STHL	
GND	V _{CC}	O	I	O	I	Up to down, left to right
V _{CC}	GND	I	O	I	O	Down to up, right to left
GND	GND	O	I	I	O	Up to down, right to left
V _{CC}	V _{CC}	I	O	O	I	Down to up, left to right

I: input, O: output

2. Definition of Scanning Direction.

Refer to figure as below:



3. MOD=H: Simultaneous sampling.

MOD=L: Sequential sampling.

Please set CPH2 and CPH3 to GND when MOD=H,

(b). Backlight unit

Pin no	Symbol	Function	Remark
1	HI	Power supply for backlight unit (high voltage)	Pink
2	GND	Ground for backlight unit	White

(3). Electrical characteristics

(a). Typical operating conditions (GND=AV_{SS}=0V, Note 4)

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Power supply	V _{CC}	4.8	5	5.2	V	
	AV _{DD}	4.8	5	5.2	V	
	V _{GH}	14.3	15	15.7	V	
	V _{GL}	-10.5	-10	-9.5	V	
Video signal amplitude (VR, VG, VB)	V _{IA}	0.4	-	AV _{DD} -0.4	V	Note 1
	V _{IAC}	-	3.5	-	V	AC component
	V _{IDC}	-	AV _{DD} /2	-	V	DC component
VCOM	V _{CAC}	3.5	5.5	6.5	V	Note 2
	V _{CDC}	1.55	1.75	1.95	V	DC component
Input signal Voltage	H level	V _{IH}	0.8V _{CC}	-	V _{CC}	Note 3
	L level	V _{IL}	0	-	0.2V _{CC}	

Note:

1. Refer to Fig.3-(a).
2. The brightness of LCD panel could be changed by adjusting the AC component of VCOM.
3. SRHL, STHR, OEHL, L/R, CPH1~CPH3, STVR, STVL, OEV, CKV, U/D
4. Be sure to apply GND, V_{CC}, and V_{GL}, to the LCD first, and then apply V_{GH}

(b). Current consumption (GND=AV_{SS}=0V)

Parameter	Symbol	Condition	Values			Unit	Remark
			Min.	Typ.	Max.		
Current for driver	I _{GH}	V _{GH} =15V	-	0.2	0.5	mA	
	I _{GL}	V _{GL} =-10V	-	0.8	1.5	mA	
	I _{CC}	V _{CC} =5V	-	3.0	6.0	mA	
	I _{DD}	AV _{DD} =5V	-	17	30	mA	

(c). Backlight driving conditions

Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Lamp voltage	V _L	-	560	620	Vrms	Note 1,6
Lamp current	I _L	-	6	7	mArms	Note 6
Frequency	F _L	-	60	80	kHz	Note 3
Lamp starting voltage	V _S	-	-	900	Vrms	Note 1,4,6
		-	-	1100	Vrms	Note 2,4,6
Lamp life time		10,000	-	-	Hr	Note 5

Note:

1. Ta=25□
2. Ta=0□
3. The lamp frequency should be selected as different as possible from display horizontal synchronous signal to avoid interference
4. For starting the backlight unit, the output voltage of DC/AC's transformer should be larger than the maximum lamp starting voltage.
5. The "lamp life time" is defined as the module brightness decrease to 50% original brightness at Ta=25□, I_L=6mA
6. Measure inverter type: HIU-742A, C=11pF, Input Voltage=12.0 Vdc.

(4). AC timing

(a). Timing conditions (sequential mode)

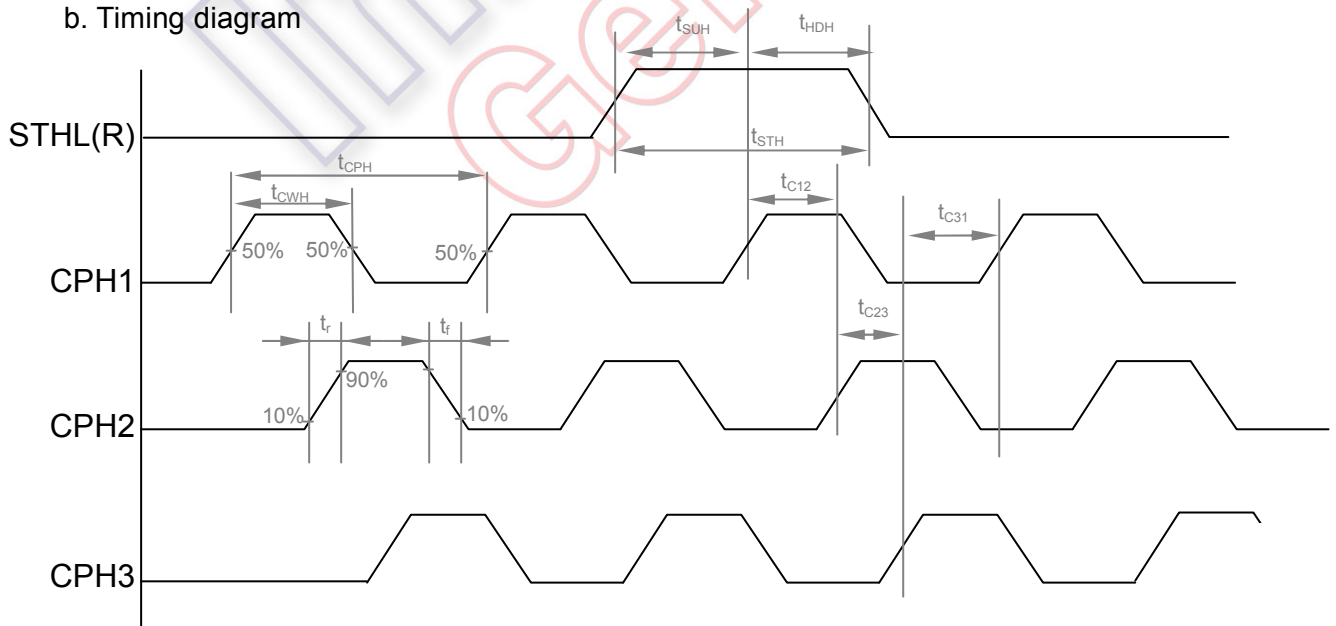
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Rising time	t _r	-	-	10	ns	Note 1
Falling time	t _f	-	-	10	ns	Note 1
High and low level pulse width	t _{CPH}	99	103	107	ns	CPH1~CPH3
CPH pulse duty	t _{CWH}	40	50	60	%	CPH1~CPH3
CPH pulse delay	t _{C12}	30	t _{CPH} /3	t _{CPH} /2	ns	CPH1~CPH3
	t _{C23}					
	t _{C31}					

STH setup time	t_{SUH}	20	-	-	ns	STHR, STHL
STH hold time	t_{HDH}	20	-	-	ns	STHR, STHL
STH pulse width	t_{STH}	-	1	-	t_{CPH}	STHR, STHL
STH period	t_H	61.5	63.5	65.5	μs	STHR, STHL
OEH pulse width	t_{OEH}	-	1.22	-	μs	
Sample and hold disable time	t_{DIS1}	-	8.28	--	μs	
OEV pulse width	t_{OEV}	-	5.40	-	μs	
CKV pulse width	t_{CKV}	-	4.18	-	μs	
Clean enable time	t_{DIS2}	-	3.74	--	μs	
Horizontal display start	t_{SH}	-	0	-	$t_{CPH}/3$	
Horizontal display timing range	t_{DH}	-	1440	-	$t_{CPH}/3$	
STV setup time	t_{SUV}	400	-	-	ns	STVL, STVR
STV hold time	t_{HDV}	400	-	-	ns	STVL, STVR
STV pulse width	t_{STV}	-	-	1	t_H	STVL, STVR
Horizontal lines per field	t_V	256	262	268	t_H	Note 2
Vertical display start	t_{SV}		3	-	t_H	
Vertical display timing range	t_{DV}		234	-	t_H	
VCOM rising time	t_{RCOM}		-	5	μs	
VCOM falling time	t_{FCOM}		-	5	μs	
VCOM delay time	t_{DCOM}		-	3	μs	
RGB delay time	t_{DRGB}		-	1	μs	

Note:

1. For all of the logic signals
2. Please don't use odd horizontal lines to drive LCD panel for both odd and even field simultaneously.

b. Timing diagram



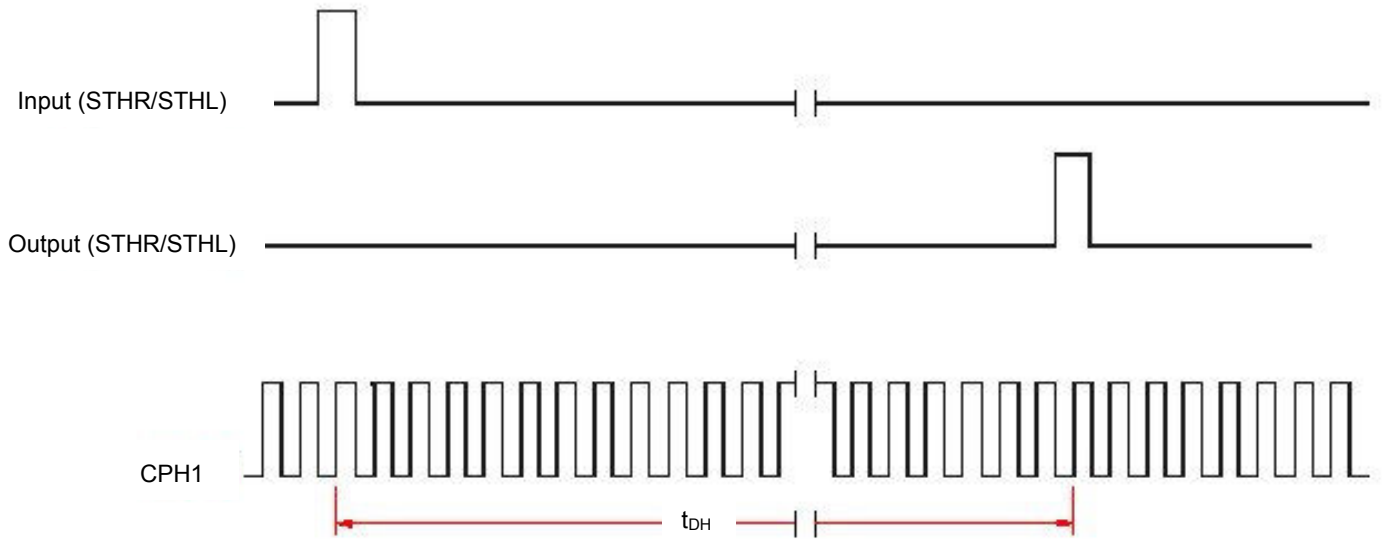


Fig.2 Sampling clock timing

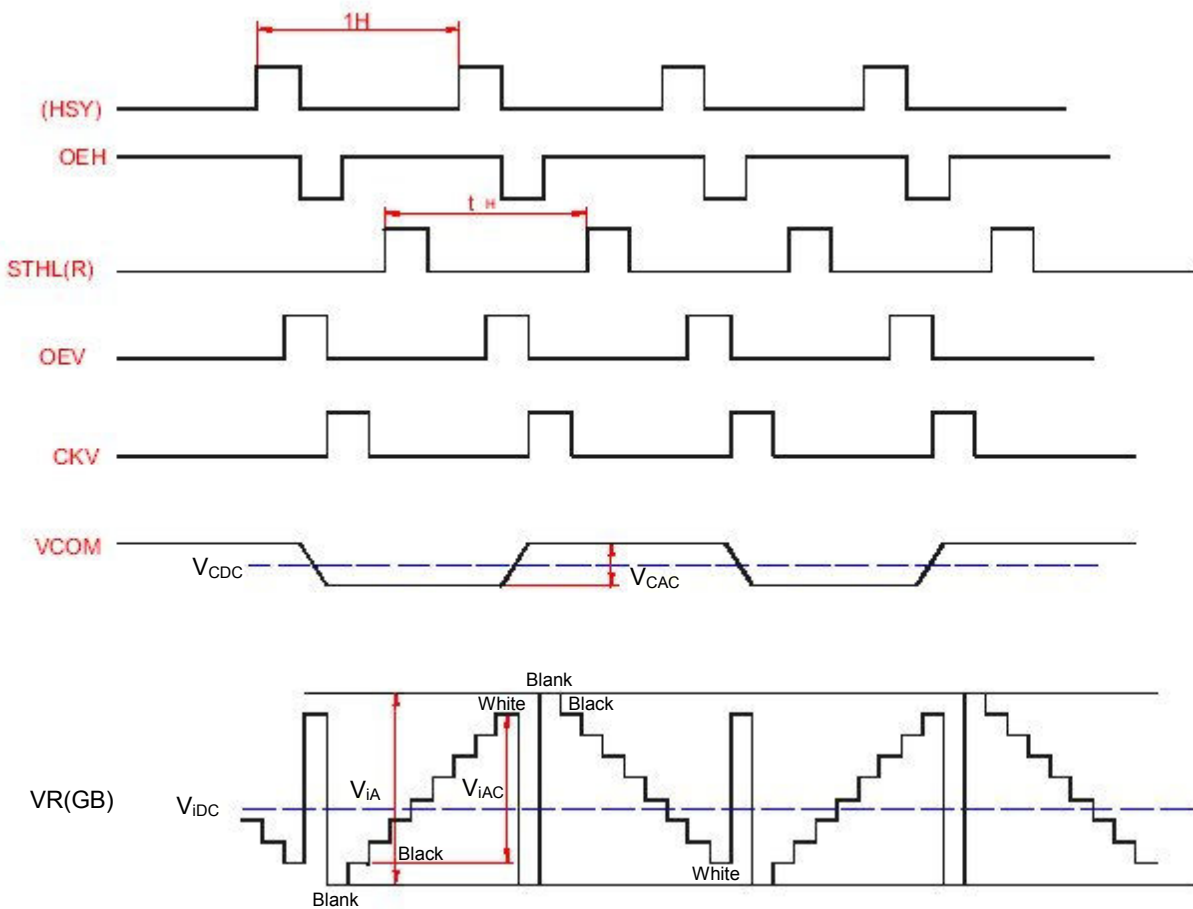
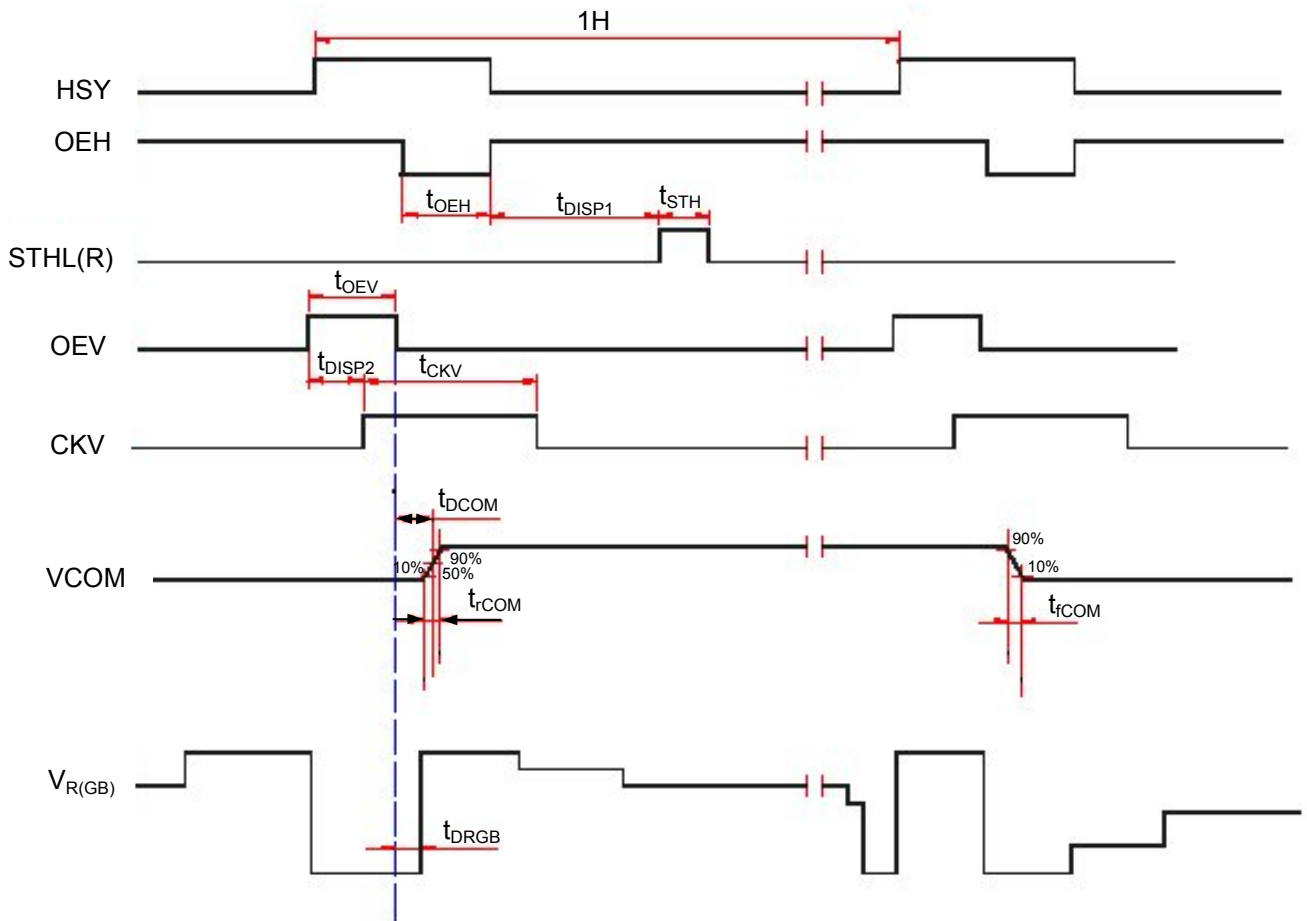


Fig.3-(a) Horizontal timing



Note: The falling edge of OEV should be synchronized with the falling edge of OEH

Fig.3-(b) Detail horizontal timing

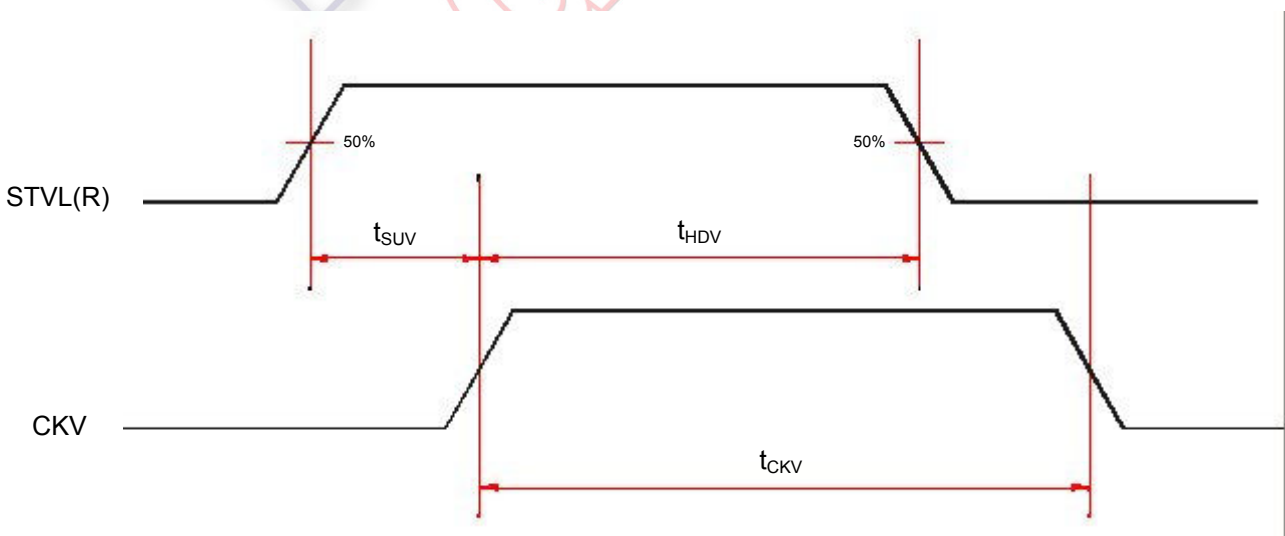


Fig.4 Vertical shift clock timing

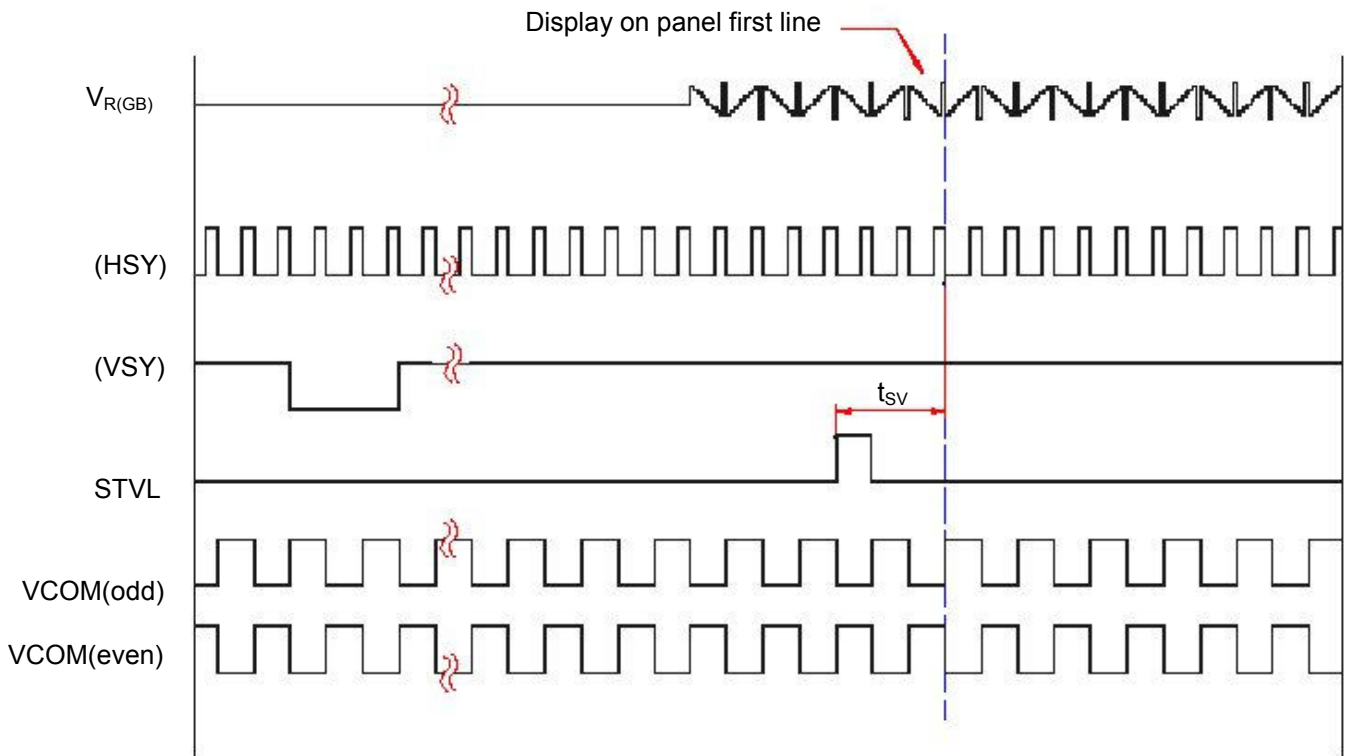


Fig.5-(a) Vertical timing (from up to down)

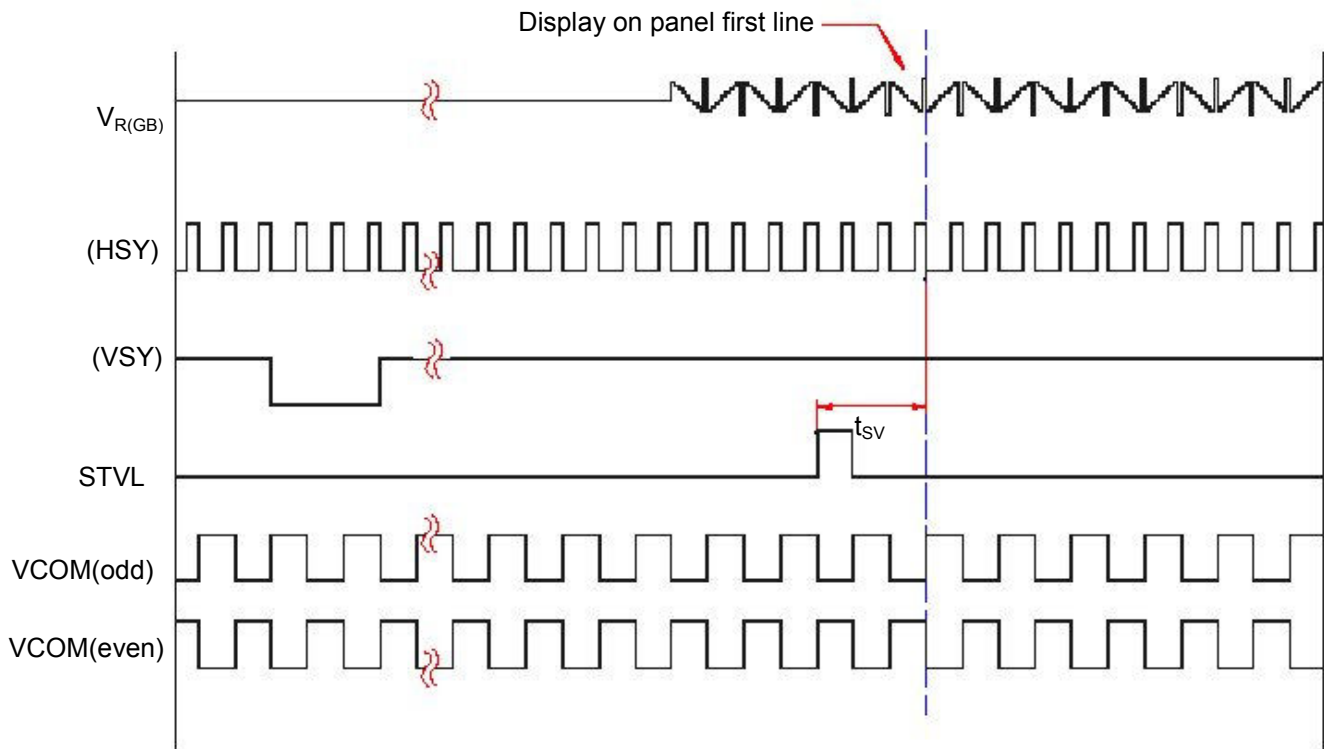
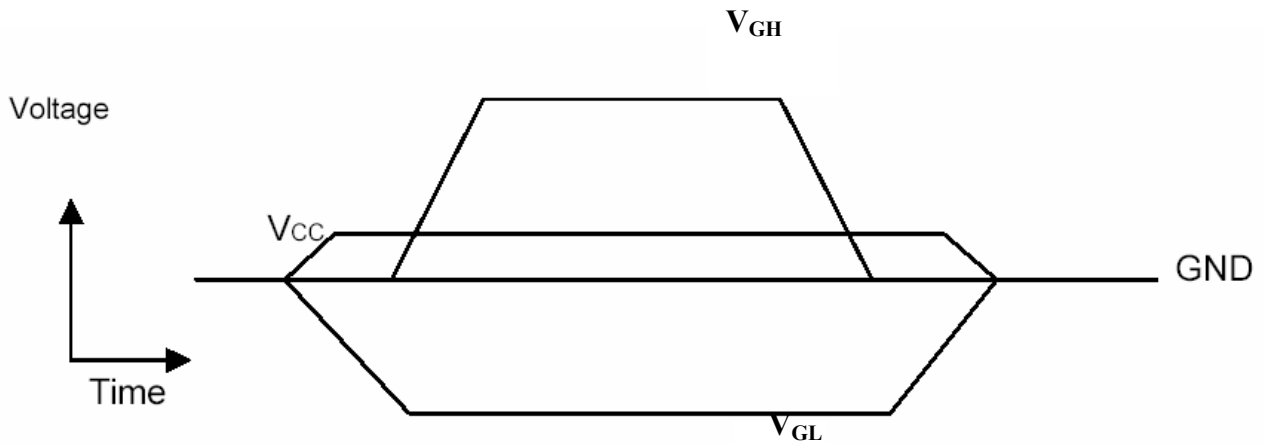


Fig.5-(b) Horizontal timing (from down to up)

(5) Power sequence

This module adopts high voltage driver IC, so it may be damaged by a large current flow if a wrong power on/off sequence is used! The recommend power sequence is to connect V_{CC} first, then connect power to driver gate power, V_{GL} and V_{GH} . When shutting off the power, shut off the driver gate power, V_{GL} and V_{GH} , then shut off the logic power, V_{CC} , or shut off the power simultaneously!



3. Optical Specifications

The following items are measured under stable conditions. The optical characteristics should be measured in dark room or equivalent state.(Note 2)

$T_a=25\pm 2^\circ\text{C}$, $I_L=6\text{mA}$

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Response time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	10	50	ms	Note3
	T_{OFF}		-	20	60	ms	
Contrast ratio	CR		200	300	-		Note4
Brightness	L		400	500	-	Cd/m ²	Note6
Color chromaticity	W_x		0.26	0.31	0.36		Note 5 Note 6 (CIE1931)
	W_y		0.28	0.33	0.38		
Viewing angle (CR \geq 10)	θ_L		$\Phi=180^\circ$ (9o'clock)	50	60	-	Degree
	θ_R	$\Phi= 0^\circ$ (3o'clock)	50	60	-		
	θ_T	$\Phi= 90^\circ$ (12o'clock)	30	40	-		
	θ_B	$\Phi=270^\circ$ (6o'clock)	50	60	-		
Luminance uniformity	Yu		70%	75%	-		Note7

Note 1 : Definition of viewing angle range

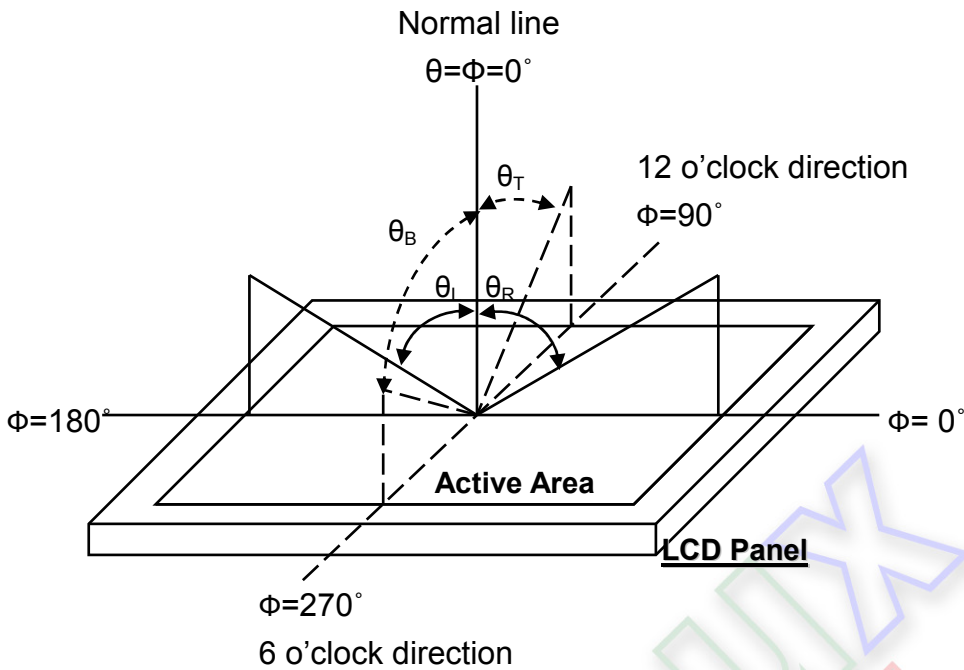


Fig. 5-1 Definition of viewing angle

Note 2 : Definition of optical measurement system.(TFT)

The optical characteristics should be measured in dark room and with ambient temperature $T_a=25^\circ\text{C}$. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Equipment : Photo detector TOPCON BM-5A or BM-7 /Field of view: 1° /Height: 500mm.)

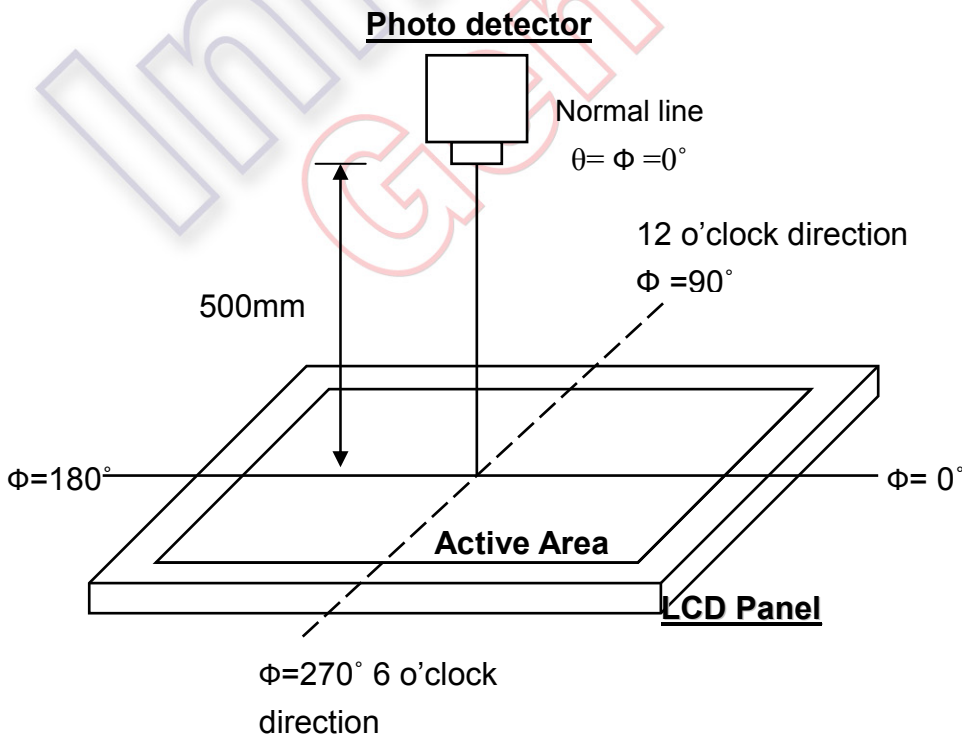


Fig. 5-2 Optical measurement system setup

Note 3 : Definition of Response time.

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (Ton) is the time between photo detector output intensity changed from 90% to 10%. And fall time (Toff) is the time between photo detector output intensity changed from 10% to 90%.

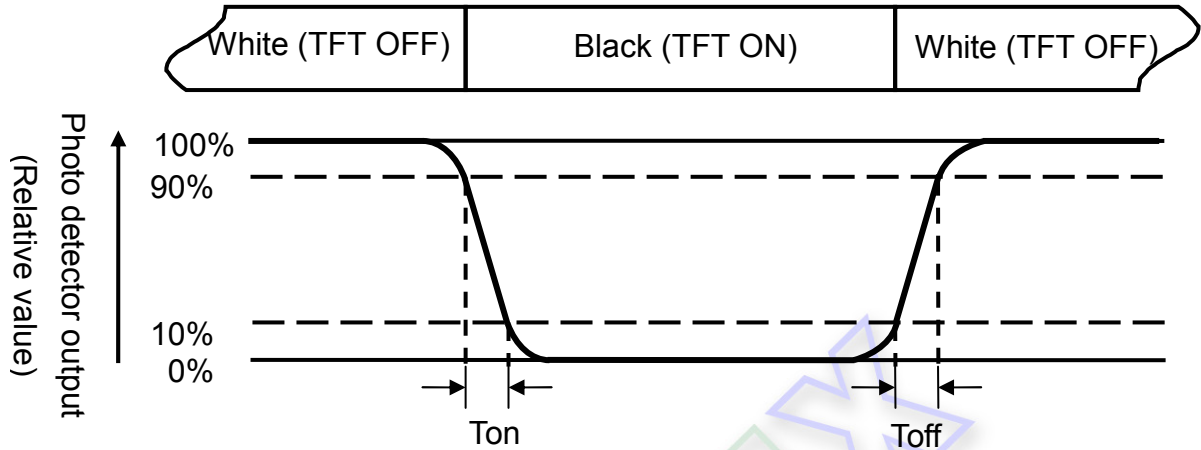


Fig. 5-3 Definition of response time

Note 4: Definition of contrast ratio:

$$\text{Contrast ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white"}}{\text{Brightness measured when LCD is at "black"}}$$

$$\text{White } V_i = V_{i50\%} \pm 1.5 \text{ V}$$

$$\text{Black } V_i = V_{i50\%} \mp 2.0 \text{ V}$$

"±" means that the analog input signal swings in phase with VCOM signal.

"∓" means that the analog input signal swings out of phase with VCOM signal.

$V_{i50\%}$: The analog input voltage when transmission is 50%

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 5 : Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD.

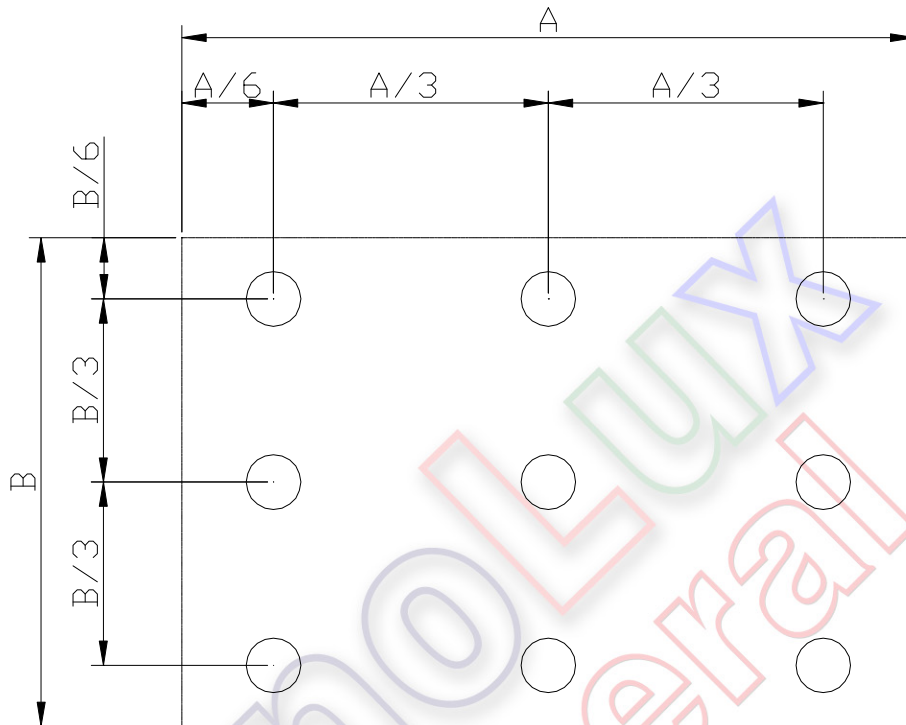
Note 6 : Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

Note 7: Definition of Luminance Uniformity

To test for uniformity, the tested area, which is inside the active area, is divided into 3 rows and 3 columns. The measurement spot is placed at the center of each box.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{min}}{B_{max}}$$

A-----Active area length B----- Active area width



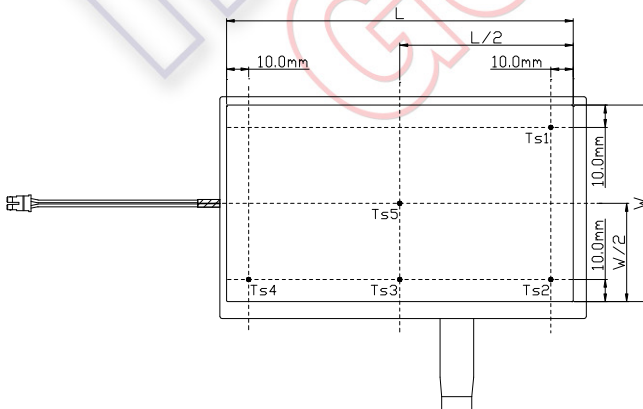
B_{max} : The measured maximum luminance of all measurement position.

B_{min} : The measured minimum luminance of all measurement position.

4. Reliability Test Items

Test Items	Test Conditions	Remark
High Temperature Storage	Ta = 85□ 240 hrs	
Low Temperature Storage	Ta = - 30□ 240hrs	
High Temperature Operation	Ts = 85□ 240hrs	
Low Temperature Operation	Ta = - 30□ 240hrs	
Operate at High Temperature and Humidity	+60□±3□, 90%±3%RH max. for 240 hours	
Thermal Shock	-30□/30 min ~ +85□/30 min for a total 100 cycles, Start with cold temp and end with high temp	
Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X. Y. Z. (6 hours for total)	JIS C7021 A-10 Condition A
Mechanical Shock	100G 6ms,±X, ±Y, ±Z 3 times for each direction	JIS C7021 A-7 Condition C
Package Vibration Test	Random Vibration : 0.015G*G/Hz from 5-200HZ, -6dB/Octave from 200-500HZ 2 hours for each direction of X. Y. Z. (6 hours for total)	IEC 68-34
Package Drop Test	Height:60 cm 1 corner, 3 edges, 6 surfaces	JIS Z0202
Electro Static Discharge	± 2KV, Human Body Mode, 100pF/1500Ω	EIA/JESD22-A114

- Note: 1. Ta is the ambient temperature of samples.
 2. Ts is the temperature of panel's surface.
 $Ts=(Ts1+Ts2+Ts3+Ts4+Ts5)/5.$



L is the length of Top Bezel open window,
 W is the width of Top Bezel open window.

3. In the standard condition, there shall be no practical problem that may affect the display function.

5. Handling Precautions

1 Safety

The liquid crystal in the LCD is poisonous. **DO NOT** put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

2 Handling

- 1) The LCD panel is plate glass. **DO NOT** subject the panel to mechanical shock or to excessive force on its surface.
- 2) The polarizer attached to the display is very easy to damage, handle it with careful attention.
- 3) To avoid contamination on the display surface, **DO NOT** touch the display surface with bare hands.
- 4) Provide a space so that the LCD panel does not come into contact with other components.
- 5) To protect the LCD panel from external pressure, put covering glass (acrylic board or similar board) keeping appropriate gap between them.
- 6) Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where dew condensation occurs.
- 7) Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in malfunctioning of the ICs.
- 8) To prevent such malfunctioning of the ICs, your design and mounting layout done are so that the IC is not exposed to light in actual use.

3 Static electricity

- 1) Ground soldering iron tips, tools and testers when you operate.
- 2) Ground your body when handling the products.
- 3) **DO NOT** apply voltage to the input terminal without applying power supply.
- 4) **DO NOT** apply voltage which exceeds the absolute maximum rating.
- 5) Store the products in an anti-electrostatic container.

4 Storage

- 1) Store the products in a dark place at $+25 \pm 10$, low humidity (65%RH or less).
- 2) **DO NOT** store the products in an atmosphere containing organic solvents or corrosive gases.

5 Cleaning

- 1) **DO NOT** wipe the polarizer with dry cloth, as it might cause scratch.
- 2) Wipe the polarizer with a soft cloth soaked with petroleum IPA, other chemical might damage.

7. Packing Specifications

(1). Packaging material table

Per carton

No.	Item	Model (Material)	Dimensions (mm)	Unit Weight (Kg)	Quantity	Remark
1	LCM module	AT070TN06	164.9*100*5.7	0.160	45	
2	EPP tray	EPP	516*346*26	0.495	9	Anti-static
3	Cover tray	EPP	516*346*26	0.055	1	Anti-static
4	A/S Bag	PE	160*178*0.06	0.1206	45	
4	Carton	Carton	530*355*255	1.1	1	
5	Total weight	8.970 Kg ± 5%				

(2). Packaging quantity

(1) LCM quantity per tray: 2 row x 2 column + 1row x 1column = 5
(2) Total LCM quantity in Carton: 9 x quantity per tray 5 = 45

(3). Packaging drawing

