TFT LCD Preliminary Specification

Model No.:P090WD-0A03

Customer : _____

Approval by: _____

Note:

Record of Revisions

Ver.	Date	Page	Description of change
1.0	Jan.23.2007	All	Tentative product specification was first issued .

Contents

1.0 GENERAL DESCRIPTION

1.1 Introduction

P090WD-0A03 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT LCD panel, a driving circuit and a LED back light system. This TFT LCD has a 9.0 (16:9) inch diagonally measured active display area with 1920 x 234 dot (640 horizontal by 234 vertical pixels) resolution.

1.2 Features

- 9 (16:9 diagonal) inch configuration
- Portable DVD Player/TV
- ROHS design

1.3 General information

Item		Specification	Unit
Outline Dimension		206.6(H) x 122(V)	mm
Display area		197.76(H) x 111.735(V)	mm
Number of Pixel		640 RGB(H) x234(V)	pixels
Pixel pitch		0.309(H) x 0.4775(V)s	mm
Pixel arrangement		RGB Vertical stripe	
Display mode		Normally white	
Weight		273	g
Back-light		LED	
Power Consumption	Logic System	TBD	
	B/L System	TBD	

1.4 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	—	210.7	—	mm
	Vertical(V)	—	126.4	—	mm
	Depth(D)	3.95	4.1	4.25	mm
Weight (Without inverter)		-	273	–	g

2.0 ABSOLUTE MAXIMUM RATINGS

2.1 Electrical Absolute Rating

2.1.1 TFT LCD Module

Item	Symbol	Min.	Max.	Unit	Note
Power supply voltage	DV_{DD}	-0.3	6.0	V	GND=0
	V_{GH}	-0.3	40	V	GND=0
	V_{GL}	-20	0.3	V	GND=0
	V_{GH} - V_{GL}	-0.3	40	V	
	AV_{DD}	-0.3	7.0	V	AGND=0
	V_{COM}	-1.6	5.2	V	
Analog Signal Input Level	V_R, V_G, V_B	-0.2	AV_{DD}+0.2	V	
Logic Signal Input Level	V_I	-0.3	DV_{DD} +0.3	V	

Note (1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.
(2) Ta =25±2℃

2.2 Back-Light Unit

Item	Symbol	Min.	Max.	Unit	Note
Lamp current	I_L	--	160	mA	(1) (2)
Lamp frequency	f_L	9.9	10.5	V	(1) (2) (3)

Note (1) Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.
(2) Ta =25±2℃
(3) Test Condition：LED current 160mA

2.3 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T_{opa}	-20	70	℃	
Storage Temperature	T_{stg}	-30	80	℃	

3 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Threshold voltage		Vsat	—	—	2.6	—	V	(7)
		Vth	—	—	1.4	—	V	
Transmittance (With SWV PZ)		T	Θ=0 Normal viewing angle	—	9.4	—	%	
Contrast Ratio		CR		—	500	—	—	(1)(2)
Response time		T_{R+} T_F		—	25	—	msec	(1)(3)
White luminance (Center)		Y_L	Θ=0 Normal viewing angle	—	250	—	cd/m^2	(1)(4) (I_L=160mA)
Color gamut		S			45		%	(C-light)
Color chromaticity (CIE1931)	White	W_x		0.300	0.315	0.330		(1)(4) CF glass (C-light)
		W_y		0.331	0.346	0.361		
	Red	R_x		0.588	0.603	0.618		
		R_y		0.329	0.344	0.359		
	Green	G_x		0.306	0.321	0.336		
		G_y		0.522	0.537	0.552		
	Blue	B_x		0.123	0.138	0.153		
		B_y		0.146	0.161	0.176		
Viewing angle	Hor.	$Θ_L$	CR>10	—	70	—		
		$Θ_R$		—	70	—		
	Ver.	$Θ_U$		—	65	—		
		$Θ_D$		—	65	—		
Brightness uniformity		B_{UNI}	Θ=0	70	—	—	%	(5)
Optima View Direction		6 O'clock						(6)

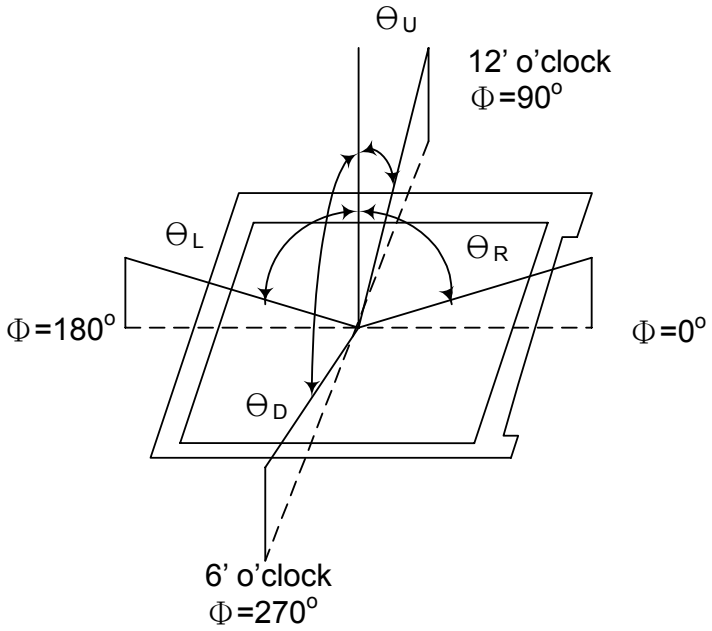
Measuring Condition

- ■ Measuring surrounding : dark room
- ■ LED current 160±mA(rms)
- ■ Ambient temperature : 25±2^{o}C
- ■ 30min. warm-up time.

3.2 Measuring Equipment

- Otsuka Electrics Corp., which utilized MCPD-3000 for Chromaticity and BM-5 for other optical characteristic.
- Measuring spot size : 10 ~ 12 mm

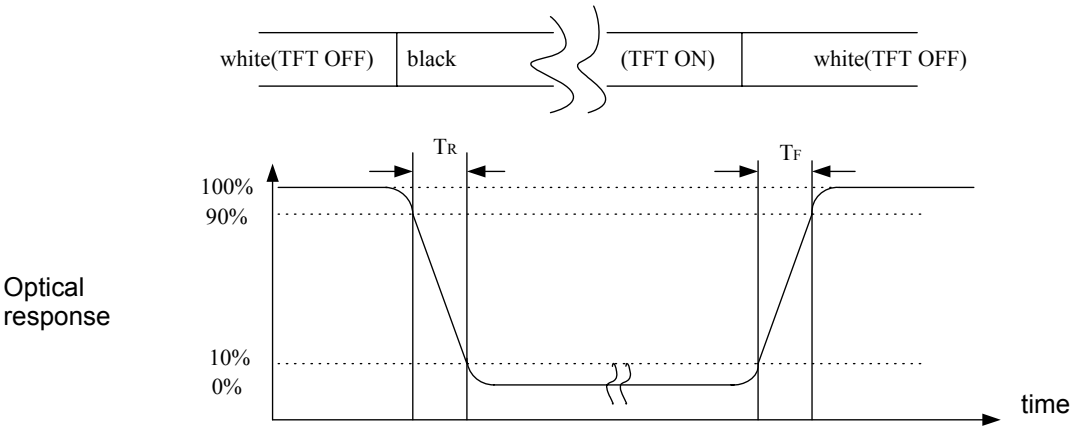
Note (1) Definition of Viewing Angle :



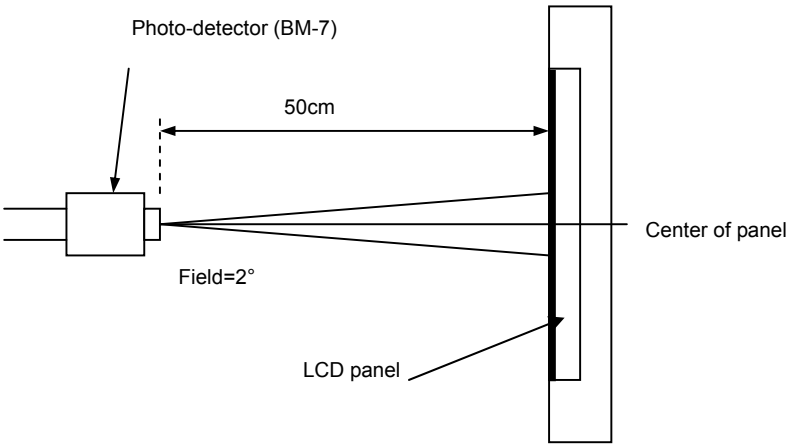
Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

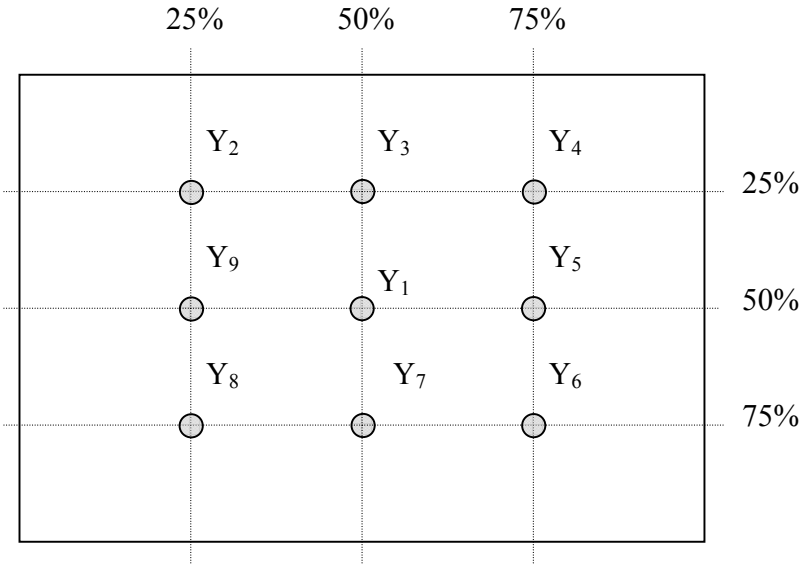
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



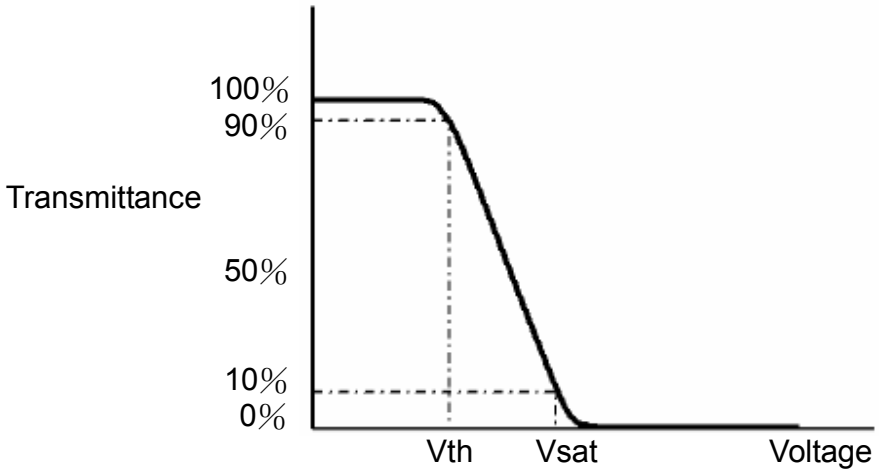
Note (5) Definition of brightness uniformity



$$\text{Luminance uniformity} = \frac{\text{(Min Luminance of 9 points)}}{\text{(Max Luminance of 9 points)}} \times 100\%$$

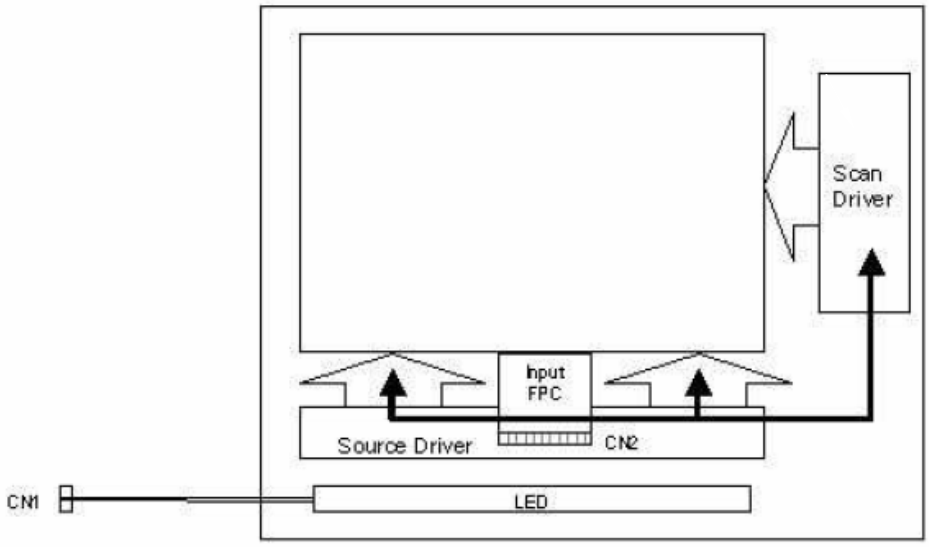
Note (6) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)

Note (7) Definition of Vth and Vsat (at 20℃)

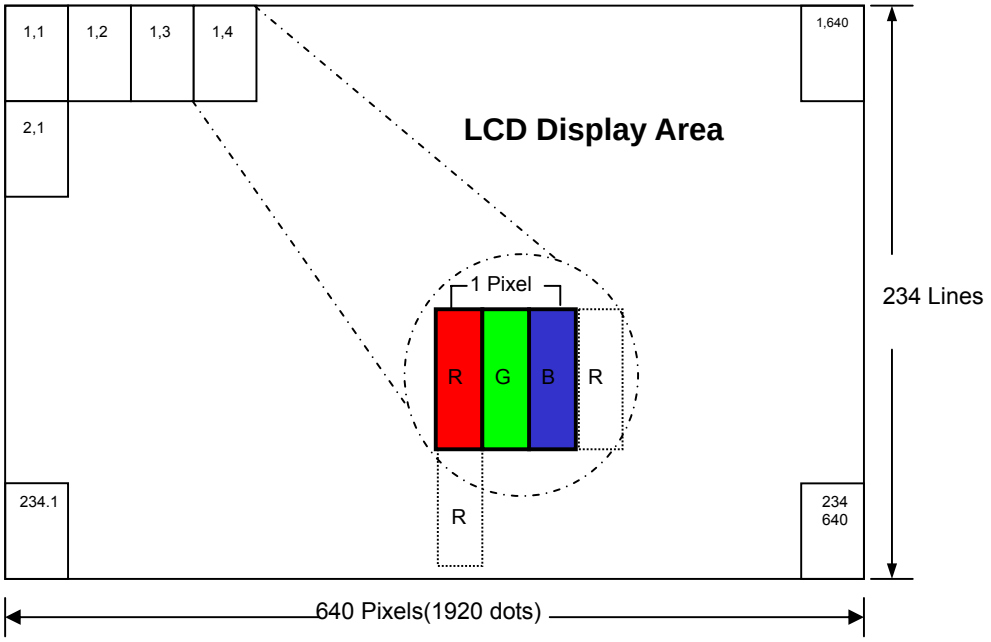


4.0 BLOCK DIAGRAM

4.1 TFT LCD Module



4.2 Pixel Format



5.0 INTERFACE PIN CONNECTION

5.1 TFT LCD Module

Pin No.	Signal	I/O	Description	Note
1	GND	-	GND for logic circuit	
2	VCC	I	Logic power for gate driver	
3	VGL	I	Negative power for gate driver	
4	VGH	I	Positive power for gate driver	
5	STVD	I/O	Vertical start pulse	(1)
6	STVU	I/O	Vertical start pulse	(1)
7	CKV	I	Shift clock input for gate driver	
8	U/D	I	UP/DOWN scan setting	(1)
9	OEV	I	Output enable input for gate driver	
10	VCOM	I	Common electrode driving signal	
11	VCOM	I	Common electrode driving signal	
12	L/R	I	LEFT/RIGHT shift setting	(1)
13	MOD	I	Sequential or simultaneous sampling setting	(2)
14	OEH	I	Output enable input for source driver	
15	STHL	I/O	Horizontal start pulse	(1)
16	STHR	I/O	Horizontal start pulse	(1)
17	CPH3	I	Sampling and shifting CLK pulse	(2)
18	CPH2	I	Sampling and shifting CLK pulse	(2)
19	CPH1	I	Sampling and shifting CLK pulse	
20	VCC	I	Logic power for source driver	
21	GND	-	GND for logic circuit	
22	VR	I	Alternated video input, R	
23	VG	I	Alternated video input, G	
24	VB	I	Alternated video input, B	
25	AVDD	I	Supply voltage for analog circuit	
26	AVSS	-	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	STVD	STVU	STHR	STHL	
GND	DV_{DD}	Output	Input	Output	Input	Up to down, and from left to right.
DV_{DD}	GND	Input	Output	Input	Output	down to up, and from right to left.
GND	GND	Output	Input	Input	Output	Up to down, and from right to left.
DV_{DD}	DV_{DD}	Input	Output	Output	Input	down to up, and from left to right.

Note (2) MOD=H: Simultaneous sampling.(Please check CPH2 and CPH3 to GND when MOD=H)
MOD=L : Sequential sampling.

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

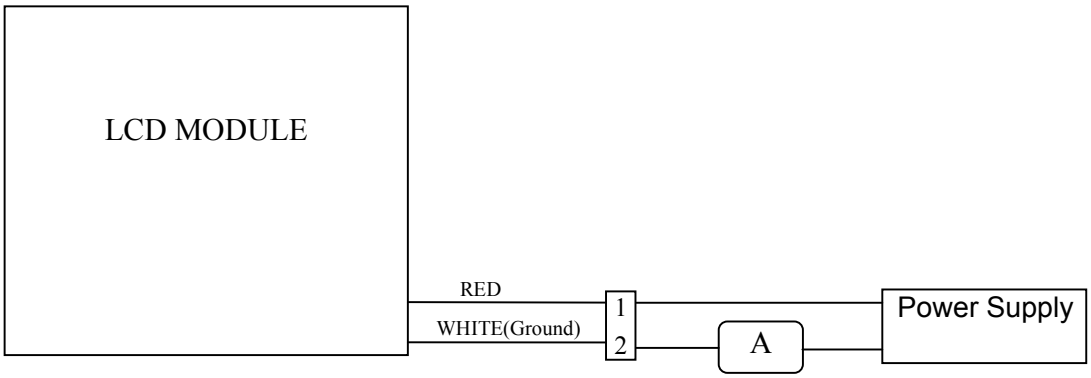
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	DV_{DD}	-	3.3	-	V	
	V_{GH}	-	15	-	V	
	V_{GL}	-	-10	-	V	
	AV_{DD}	3	5	5.5	V	
Video signal amplitude (VR,VG,VB)	V_{iA}	0.4	-	AV_{DD}-0.4	V	
	V_{iAC}	-	3	-	V	AC component,
	V_{iDC}	-	AV_{DD}/2	-	V	DC component
VCOM	V_{CAC}	-	4.7	-	VP-P	AC component
	V_{CDC}	1.6	1.8	2.0	V	DC component, (1)
Input signal voltage	V_{iH}	0.8DV_{DD}	-	DV_{DD}	V	(2)
	V_{iL}	0	-	0.2 DV_{DD}	V	(2)
Current of power supply	I_{DD}	-	150	-	uA	DV_{DD} =3.3V
	I_{ADD}	-	9.0	-	mA	AV_{DD}=5V(Black)
	I_{GH}	-	70	-	uA	V_{GH}=15V
	I_{GL}	-	65	-	uA	V_{GL}=-10V

Note (1): The brightness of LCD panel could be changed by adjusting the AC component of VCOM.
Note (2): STHL, STHR, OEH, L/R, CPH1~CPH3, STVD, STVU, OEV, CKV, U/D
Note (3): Be sure to apply the power voltage as the power sequence spec.
Note (4): DGND=AGND=0V,)

6.2 Back-Light Unit

The back-light system is an edge-lighting type with 24 LED.
The characteristics of the LED is shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
LED current	IL	–	-	160	mA	
LED voltage	VL	–	10.5	12	V	
Operating LED life time	Hr	–	30000	–	Hour	(1)



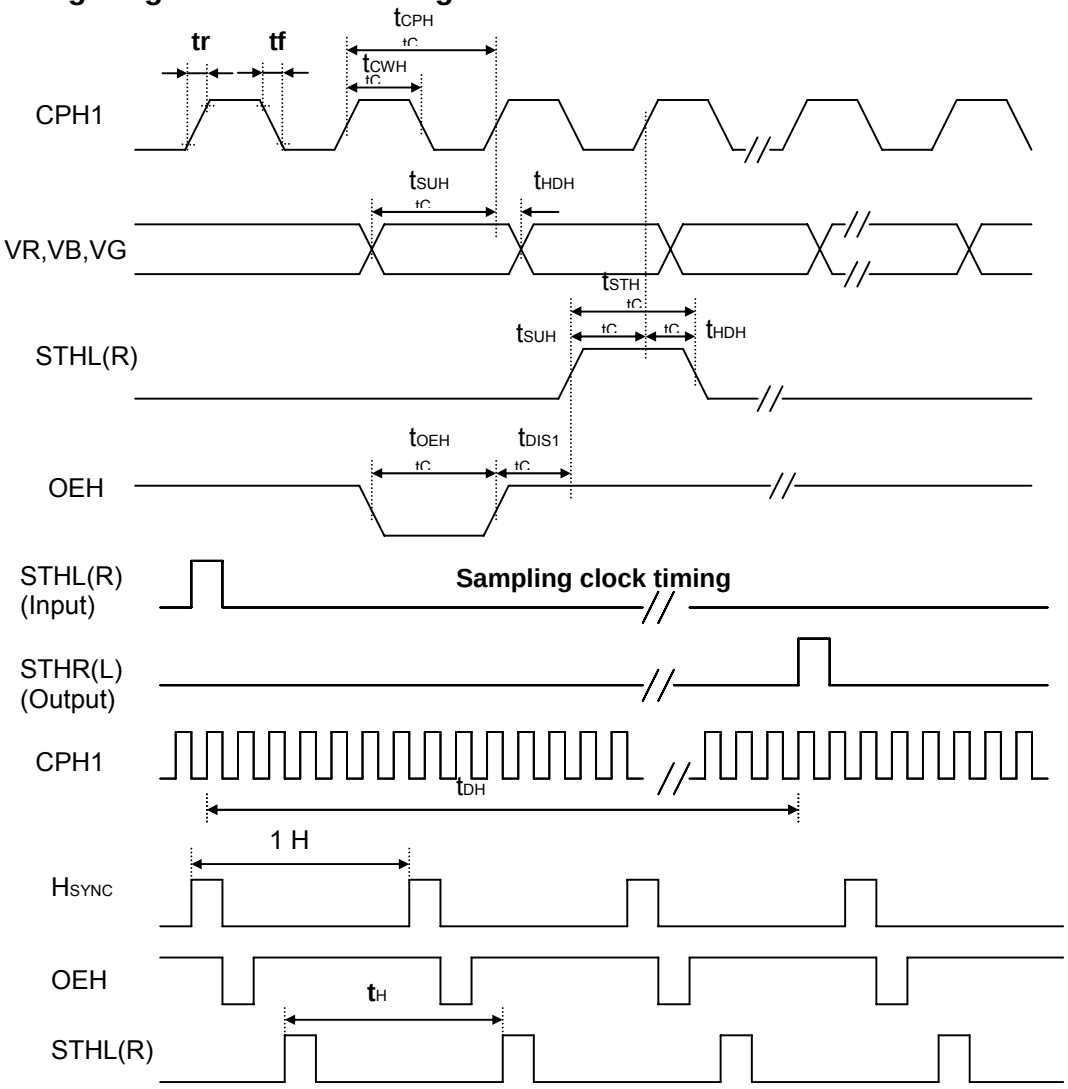
Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition : Ta=25±3 °C, typical IL value indicated in the above table and fL=50kHz until the brightness becomes less than 50%.

6.3 AC Characteristics

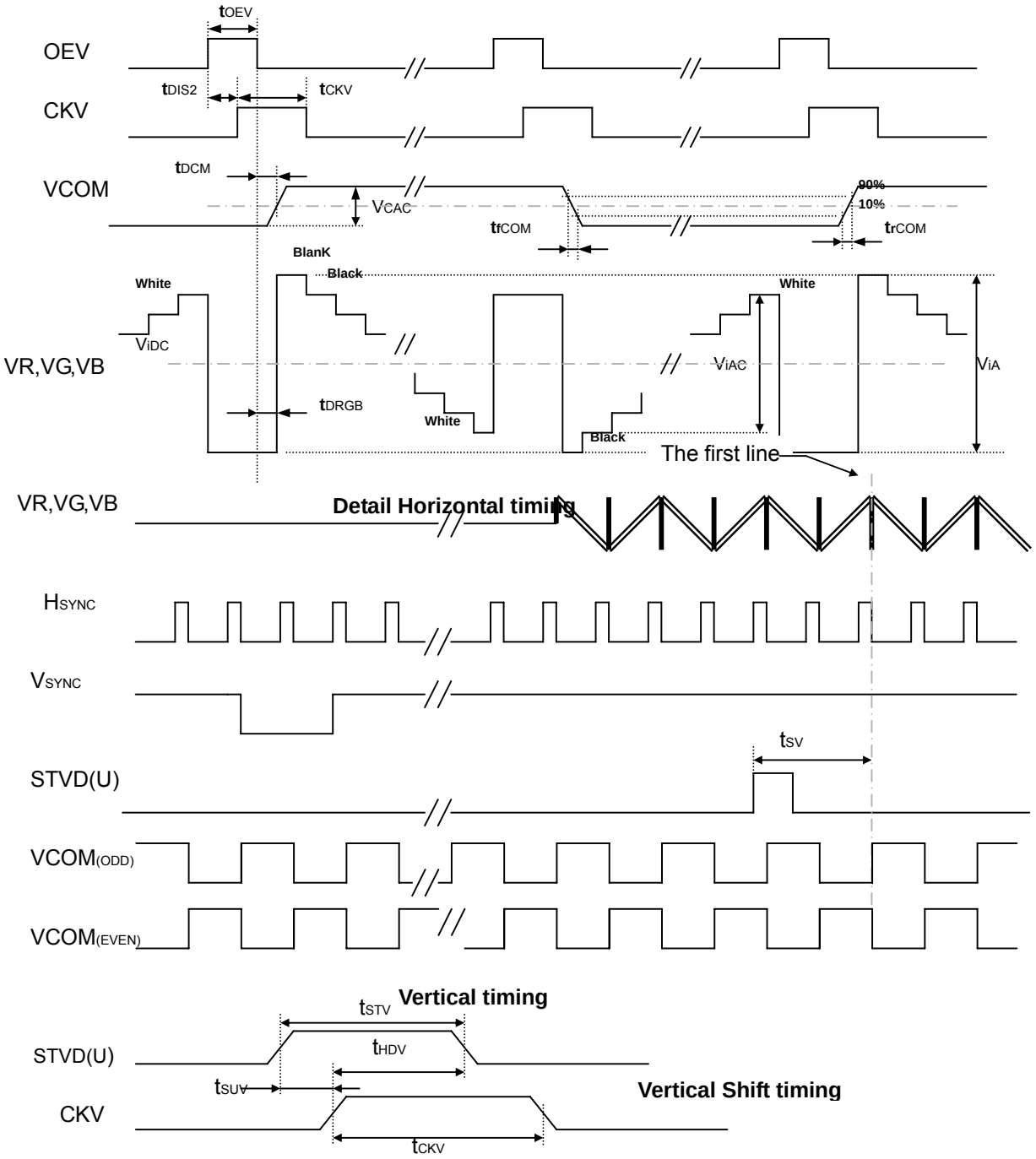
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Rising time	t_r	-	-	10	ns	(1)
Falling time	t_f	-	-	10	ns	(1)
High and low level pulse duty	t_{CPH}	100	103	-	ns	CPH1~CPH3
CPH pulse duty	t_{CWH}	40	50	60		CPH1~CPH3
STH setup time	t_{SUH}	20	-	-	ns	STHR,STHL
STH hold time	t_{HDH}	20	-	-	ns	STHR,STHL
STH pulse width	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}	-	1.23	-	µs	OEH
Sample and hold disable time	t_{DIS1}	-	8.19	-	µs	
OEV pulse width	t_{OEV}	-	4.77	-	µs	OEV
CKV pulse width	t_{CKV}	-	3.91	-	µs	CKV
Clean enable time	t_{DIS2}	-	3.90	-	µs	
Horizontal display timing range	t_{DH}	-	1920	-	t_{CPH}/3	
STV setup time	t_{SUV}	200	-	-	ns	STVD,STVU
STV hold time	t_{HDV}	300	-	-	ns	STVD,STVU
STV pulse width	t_{STV}	-	1	-	t_H	STVD,STVU
Horizontal line per field	t_V	256	262	268	t_H	(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.
Note (2): Please don't use odd horizontal lines to drive LCD panel for both odd and even filed simultaneously.

6.4Timing Diagram of Interface Signal

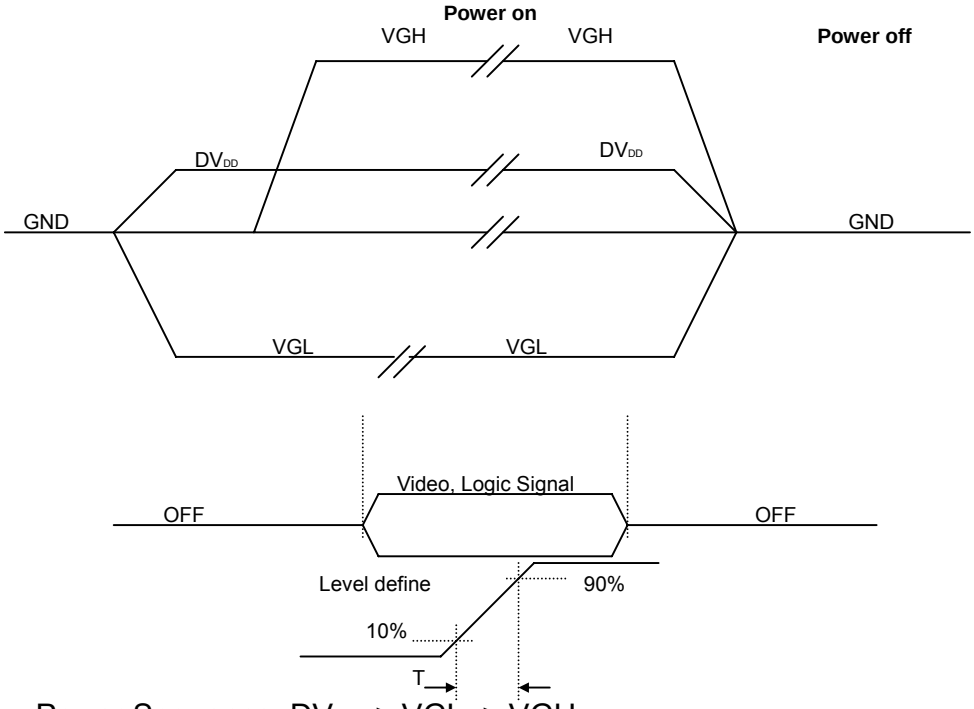


Horizontal display timing range


tOEV
OEV
tDIS2
tCKV
CKV
tDCM
VCOM
VCAC
90%
10%
trCOM
tfCOM
BlanK
Black
White
VIDC
VR,VG,VB
tDRGB
White
Black
White
VIAC
VIA
The first line
VR,VG,VB
Detail Horizontal timing
HSYNC
VSYNC
tSV
STVD(U)
VCOM(ODD)
VCOM(EVEN)

tSTV
Vertical timing
STVD(U)
tHDV
tSUV
Vertical Shift timing
CKV
tCKV

6.5 Power Sequence



Power Sequence: DV_{DD} -> VGL -> VGH

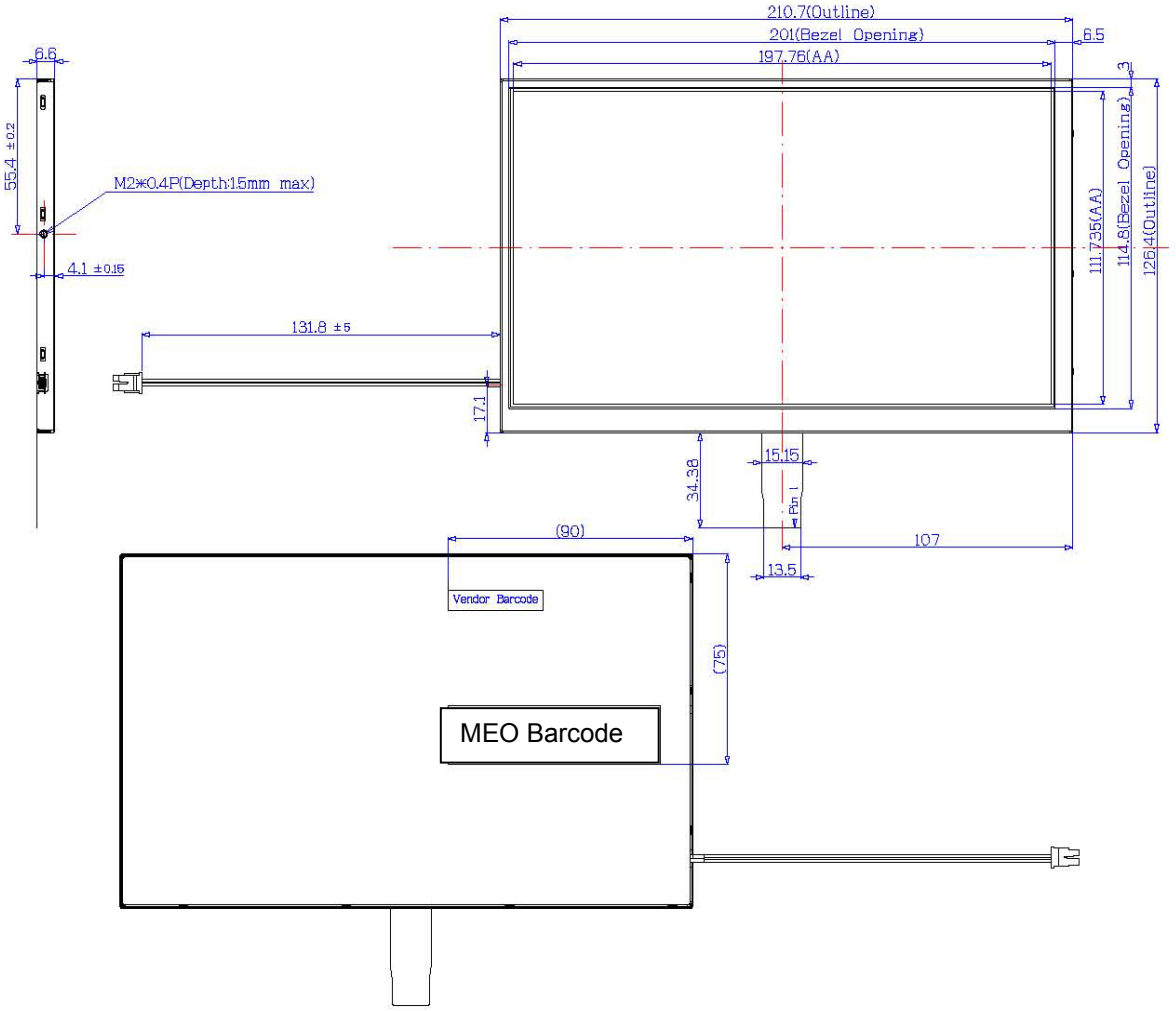
Note Apply the lamp volatge within the LCD operation range. When the back-light turns on before the LCD operation or the LCD truns off before the back-light turns off. the display may momentarily become white.

7.0 Reliability

No.	Item	Conditions	Remark
1	High temperature storage	Ta=+80℃,240hrs	
2	low temperature storage	Ta=-30℃,240hrs	
3	high temperature operation	Ta=+70℃,240hrs	
4	Low temperature operation	Ta=-20℃,240hrs	
5	High temperature and high humidity (operating)	Ta=+60℃,90％RH,240hrs	
6	Thermal cycling test (non operation)	-30℃(0.5hr)→+80℃(0.5hr),200cycles	
7	Packing	1.Sine,1.5G,5~200hz1hrX,Y,Z direction 2.Random,1.5Grms,5~200Hz,15min/X,Y,Z direction 3.Half-Sine,70G,11ms+X axis,2 Times 4.Half-Sine,200G,2ms+X axis,2 Times 5.90 degree topple to dash against the hard-face of table.	
8	Altitude test(non operation)	50000ft,24hr(25℃)	
9	Altitude test(operation)	10000ft,02hr(25℃)	
10	Pressure cooker test	121℃,100％R.H.,2atm,16hr/20hr	
11	Electrostatic discharge	±200V,200pF,0Ω	

Note：All test above are practiced at mod type.
There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

8.0 OUTLINE DIMENSION



9.0 GENERAL PRECAUTION

9.1 Use Restriction

This product is not authorized for use in life supporting systems, aircraft navigation control systems, military systems and any other application where performance failure could be life-threatening or otherwise catastrophic.

9.2 Disassembling or Modification

Do not disassemble or modify the module. It may damage sensitive parts inside LCD module, and may cause scratches or dust on the display. MEO does not warrant the module, if customers disassemble or modify the module.

9.3 Breakage of LCD Panel

9.3.1 If LCD panel is broken and liquid crystal spills out, do not ingest or inhale liquid crystal, and do not contact liquid crystal with skin.

9.3.2 If liquid crystal contacts mouth or eyes, rinse out with water immediately.

9.3.3 If liquid crystal contacts skin or cloths, wash it off immediately with alcohol and rinse thoroughly with water.

9.3.4 Handle carefully with chips of glass that may cause injury, when the glass is broken.

9.4 Absolute Maximum Ratings and Power Protection Circuit

9.4.1 Do not exceed the absolute maximum rating values, such as the supply voltage variation, input voltage variation, variation in parts' parameters, environmental temperature, etc., otherwise LCD module may be damaged.

9.4.2 Please do not leave LCD module in the environment of high humidity and high temperature for a long time.

9.4.3 It's recommended to employ protection circuit for power supply.

9.5 Operation

9.5.1 Do not touch, push or rub the polarizer with anything harder than HB pencil lead.

9.5.2 Use fingerstalls of soft gloves in order to keep clean display quality, when persons handle the LCD module for incoming inspection or assembly.

9.5.3 When the surface is dusty, please wipe gently with absorbent cotton or other soft material.

9.5.4 Wipe off saliva or water drops as soon as possible. If saliva or water drops contact with polarizer for a long time, they may cause deformation or color fading.

9.5.5 When cleaning the adhesives, please use absorbent cotton wetted with a little petroleum benzine or other adequate solvent.

9.6 Static Electricity

9.6.1 Protection film must remove very slowly from the surface of LCD module to prevent from electrostatic occurrence.

9.6.2 Because LCD module use CMOS-IC on circuit board and TFT-LCD panel, it is very weak to electrostatic discharge. Please be careful with electrostatic discharge.

9.6.3 Persons who handle the module should be grounded through adequate methods.

9.7 Disposal

When disposing LCD module, obey the local environmental regulations.

9.8 OTHERS

9.8.1 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

9.8.2 Please pay attention to a panel side of LCD module not to contact with other materials in preserving it alone

9.8.3 For the. packaging box. Please pay attention to the followings:

9.8.3.1 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

9.8.3.2 Please do not pile them up more than 6 boxes (they are not designed so) And please do not turn over

9.8.3.3 Please handle packaging box with care not to give them sudden shock and vibration. And also please do not throw them up

9.8.3.4 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