

TFT LCD Preliminary Specification

Model No.:P104NV-0A00

Customer : _____

*Approval by:*_____

Note:



Record of Revisions

Ver.	Date	Page	Description of change
1.0	Jan.27.2007	All	Tentative product specification was first issued

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1.0 GENERAL DESCRIPTION

1.1 Introduction

P104NV-0A00 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 back light system. This TFT LCD has a 10.4 (4:3) inch diagonally measured active display area with 1920 x 480 dot (640 horizontal by 480 vertical pixels) resolution.

1.2 Features

- 10.4 (4:3 diagonal) inch configuration
- Main application :Pachinko , Industry controller
- ROHS design

1.3 General information

Item		Specification	Unit
Outline Dimension		246.5(H) x 179.4(V)	mm
Display area		211.2(H) x 158.4(V)	mm
Number of Pixel		640 RGB(H) x480(V)	pixels
Pixel pitch		0.33(H) x 0.33(V)	mm
Pixel arrangement		RGB Vertical stripe	
Display mode		Normally white	
Weight		TBD	
Back-light		CCFL	
Power Consumption	Logic System	TBD	
	B/L System	TBD	

1.4 Mechanical Information

Item		Min.	Typ.	Max.	Unit
Module Size	Horizontal(H)	—	—	—	mm
	Vertical(V)	—	—	—	mm
	Depth(D)	—	—	—	mm
Weight (Without inverter)		—	—	—	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	V_{DD}	-0.3	6	V	GND=0
	V_{GH}	-0.3	40	V	GND=0
	V_{GL}	-20	0.3	V	GND=0
	AV_{DD}	-0.3	13.5	V	AGND=0
Input signal voltage	V_I	-0.5	$V_{DD}+0.5$	V	
	$V_{GMA(1\sim7)}$	0.4	$AV_{DD}+0.3$	V	
	$V_{GMA(8\sim14)}$	0.1	$0.6AV_{DD}$		

2.2 Back-Light Unit

Item	Symbol	Min.	Max.	Unit	Note
Lamp current	I_L	TBD	TBD	mA	
Lamp frequency	f_L	TBD	TBD	KHz	

2.3 Environment Absolute Rating

Item	Symbol	Min.	Max.	Unit	Note
Operating Temperature	T_{opa}	-10	70	°C	
Storage Temperature	T_{stg}	-20	80	°C	

3 OPTICAL CHARACTERISTICS

3.1 Optical specification

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Threshold voltage	V _{sat}	—	—	—	—	V	(5)
	V _{th}	—	—	—	—	V	
Transmittance (With SWV PZ)	T	Θ=0 Normal viewing angle	—	TBD	—	%	
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	—	TBD	—	cd/m ²	
Color gamut	S			50		%	(C-light)
Color chromaticity (CIE1931)	White	W _x		0.303	0.305	0.307	(1)(4) CF glass (C-light)
		W _y		0.330	0.332	0.334	
	Red	R _x		0.576	0.578	0.580	
		R _y		0.314	0.316	0.318	
	Green	G _x		0.298	0.300	0.302	
		G _y		0.557	0.559	0.561	
	Blue	B _x		0.137	0.139	0.141	
		B _y		0.140	0.142	0.144	
Viewing angle	Hor.	Θ _L	CR>10	—	70	—	
		Θ _R		—	70	—	
	Ver.	Θ _U		—	60	—	
		Θ _D		—	60	—	
Optima View Direction	6 O'clock						(6)

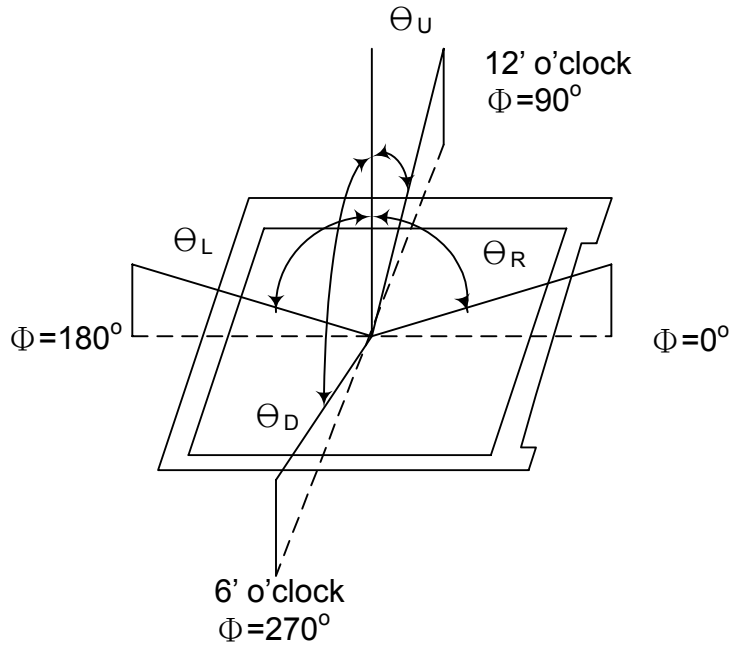
Measuring Condition

- Measuring surrounding : dark room
- Ambient temperature : 25±2°C
- 30min. warm-up time.

3.2 Measuring Equipment

- Otsuka Electric Corp., which utilized MCPD-3000 for Chromaticity and BM-7 for other optical characteristic.
- Measuring spot size : 10 ~ 12 mm

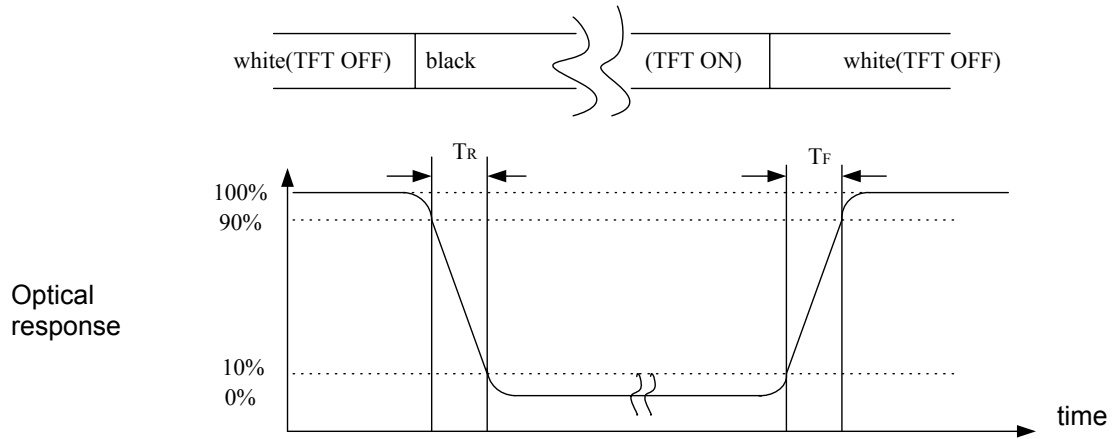
Note (1) Definition of Viewing Angle :



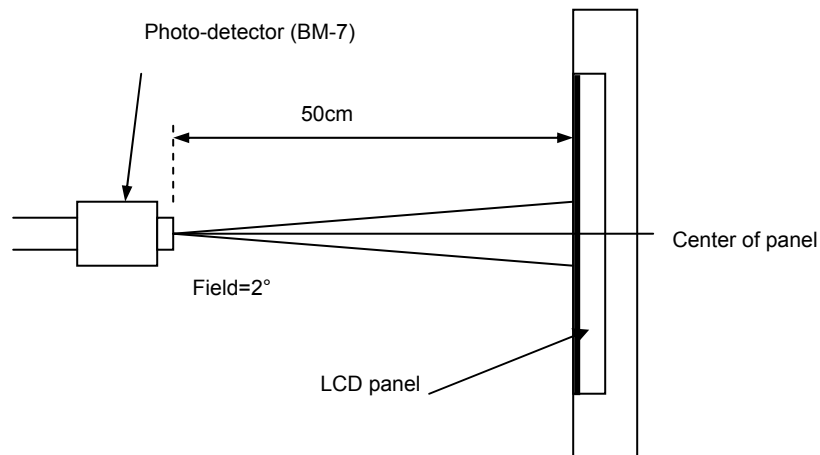
Note (2) Definition of Contrast Ratio(CR) :
 measured at the center point of panel

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

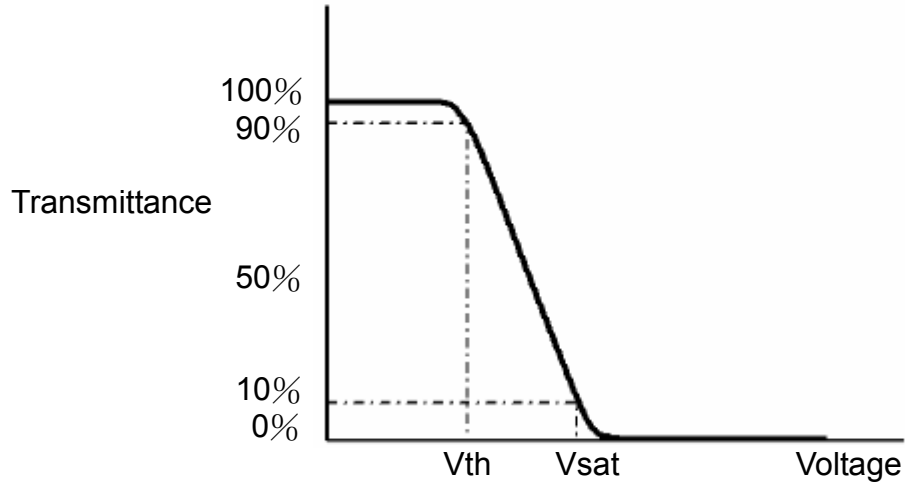
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup

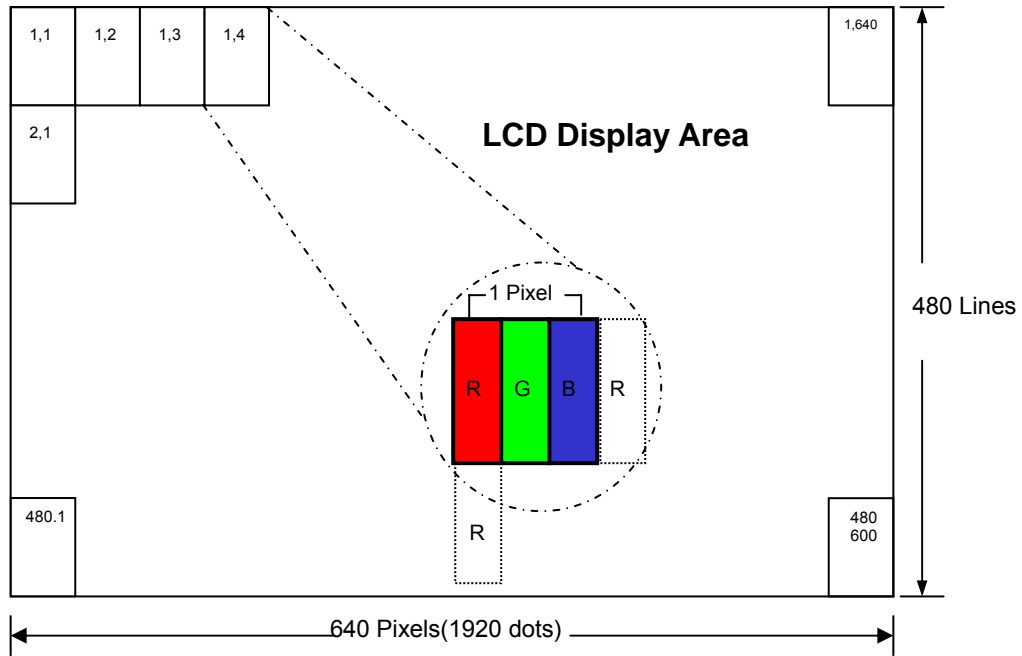


Note (5) Definition of V_{th} and V_{sat} (at 20°C)



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

4.0 Pixel Format



5.0 INTERFACE PIN CONNECTION

5.1 System pin assignment

Pad No.	Pad Name	Description
1	GND	Ground
2	CLK	Clock signal
3	Hsync	Horizontal synchronous signal
4	Vsync	Vertical synchronous signal
5	GND	Ground
6	R0	RED data signal
7	R1	RED data signal
8	R2	RED data signal
9	R3	RED data signal
10	R4	RED data signal
11	R5	RED data signal
12	GND	Ground
13	G0	GREEN data signal
14	G1	GREEN data signal
15	G2	GREEN data signal
16	G3	GREEN data signal
17	G4	GREEN data signal
18	G5	GREEN data signal
19	GND	Ground
20	B0	BLUE data signal
21	B1	BLUE data signal
22	B2	BLUE data signal
23	B3	BLUE data signal
24	B4	BLUE data signal
25	B5	BLUE data signal
26	GND	Ground
27	ENAB	Data enable signal
28	Vcc	Power supply +5.0V
29	Vcc	Power supply +5.0V
30	R/L	Horizontal Display node select
31	NC	NC
32	U/D	Vertical Display mode select

6.0 ELECTRICAL CHARACTERISTICS

6.1 TFT LCD Module

DC Electrical characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V_{DD}	3.0	3.3	3.6	V	
	V_{GH}	10.0		35	V	
	V_{GL}	-15		-3	V	
Low level Input Voltage	V_{il}	0	-	$0.3V_{DD}$	V	
High level Input Voltage	V_{ih}	$0.7V_{DD}$	-	V_{DD}	V	
High level Input Voltage	V_{oh}	$V_{DD}-0.4$	-	-	V	
Low level Input Voltage	V_{ol}	-	-	-	V	
Supply Analog Voltage	AV_{DD}	6.5	10	13.5	V	
Input level V1~V7	$V_{GMA\ 1\sim 7}$	$0.4AV_{DD}$		$AV_{DD}-0.1$	V	
Input level V8~V14	$V_{GMA\ 8\sim 14}$	0.1		$0.6AV_{DD}$	V	

($V_{CC}=2.7V\sim 3.6, AV_{DD}=6.5\sim 13.5V, AV_{SS}=GND=0V, T_A=25^\circ C$)

6.2 AC Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
Clock period	t _{CLK}	-	30	25	ns
CLK Frequency	f _{CLK}	-	33.3	40	MHz
Clock Low Level Width	t _{WCL}	8	-	-	ns
Clock High Level Width	t _{WCH}	8	-	-	ns
Clock Rise , fall Time	t _{CLKr} , t _{CLKf}	-			ns
HSYNC Period	t _{HP}	-	800		t _{CLK}
HSYNC pulse Width	t _{HW}	-	96		t _{CLK}
HSYNC Back Porch	t _{HBP}	-	48		t _{CLK}
Horizontal Back Porch	t _{HV}		640		t _{CLK}
Horizontal valid data Width	t _{HFP}	t _{HP} - t _{HW} -t _{HBP} - t _{HV}			t _{CLK}
HYNC Front Porch	t _{HBK}	t _{HP} - t _{HV}			t _{CLK}
Horizontal Blank	t _{VP}		525		t _{HP}
VSYNC Period	t _{VW}		3		t _{HP}
VSYNC Back Porch	t _{VBP}		33		t _{HP}
Vertical data valid width	t _V		480		t _{HP}
VSYNC Period		t _{VP} - t _V -t _{VBP} - t _V			t _{HP}
Vertical Blank	t _{VBK}	t _{VP} - t _V			t _{HP}
Data Setup	t _{DS}	5			ns
Data Hold Time	t _{DH}	10			ns

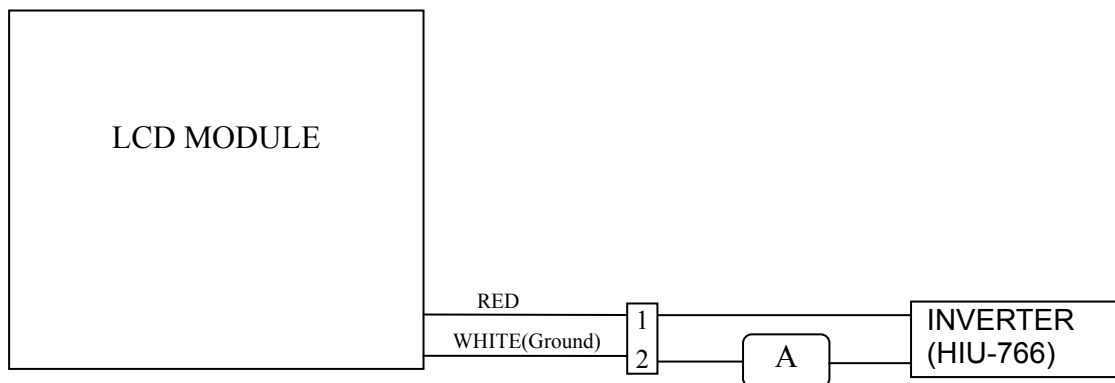
(V_{DD}=3.3V,AV_{DD}=8.4,AV_{SS}= Gnd=0V,Ta=25°C)

6.3 Back-Light Unit

The back-light system is an edge-lighting type with 1CCFL(Cold Cathode Fluorescent Lamp). The characteristics of the lamp is shown in the following tables.

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Lamp current	IL		TBD		Ma(rms)	(1)(6)
Lamp voltage	VL		TBD		V(rms)	(6)IL=6.0mA
Frequency	fL				KHZ	(2)
Operating lamp life time	Hr	TBD			Hour	(3)
Startup voltage	Vs				V(rms)	(4)(5)at 25°C
						(4)(5)at 0°C

Note(2) Lamp current is measured with current meter for high frequency as shown below
 Specified valued are for single lamp



Note (2) Lamp frequency may produce interference with horizontal synchronous frequency and this may cause ripple noise on the display. Therefore lamp frequency shall be kept away from the horizontal synchronous frequency and its harmonics as far as possible in order to avoid interference

Note (3) Lamp 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%.

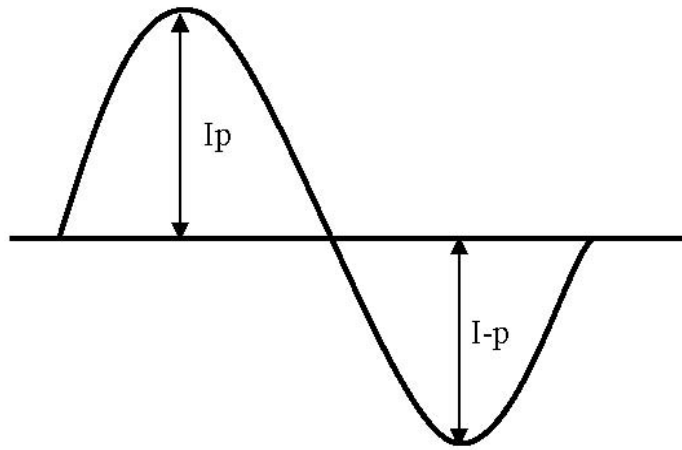
Note (4) CCFL inverter should be able to provide a voltage over specified value (Vs) in the above table. Lamp units need at least Vs value shown above to ignition

Note(5) The voltage over specified value(Vs)should be applied to the lamp more than 1 second after startup. Otherwise, the lamp may not be turned on.
 The used lamp current is the lamp typical current

Note (6) The output voltage waveform and current waveform of the inverter must be symmetrical (Unsymmetrical ratio is less than 10%). Please do not use the inverter which has unsymmetrical voltage and current waveform, and spike waveform. The inverter design which can provide the best optical performance, power efficiency, and lamp life should under the following conditions.

a. The asymmetry rate of the inverter waveform should be less than 10%.

- b. The distortion tae of the waveform should be within $\sqrt{2}\pm 10\%$.
- c. The inverter output waveform should be better similar to the ideal sine wave



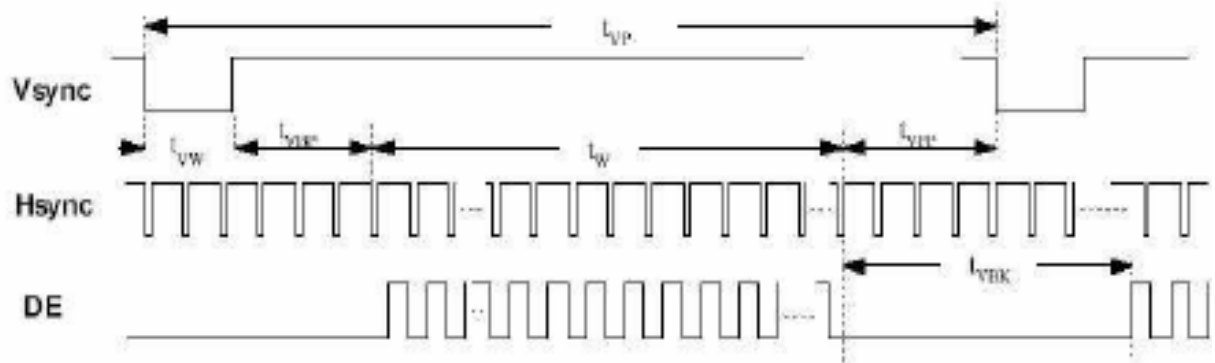
$$\text{Asymmetry rate} = |I_p - I_p| / I_{rms} \times 100\%$$

$$\text{Distortion rate} = I_p \text{ (or } I_p) / I_{rms}$$

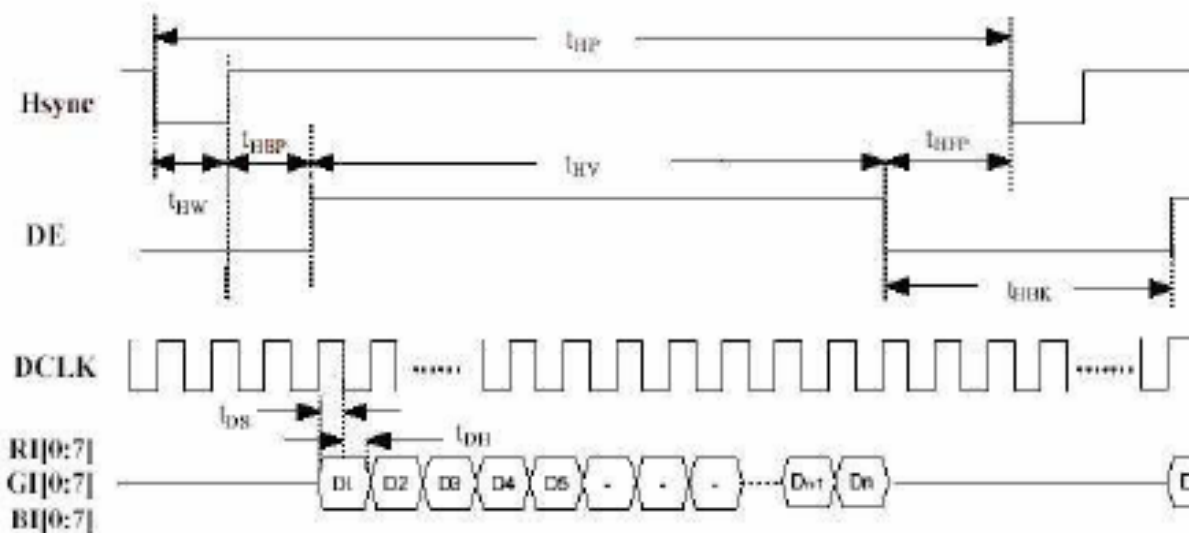
6.4 Timing Diagram of Interface Signal

Input Signal Timing

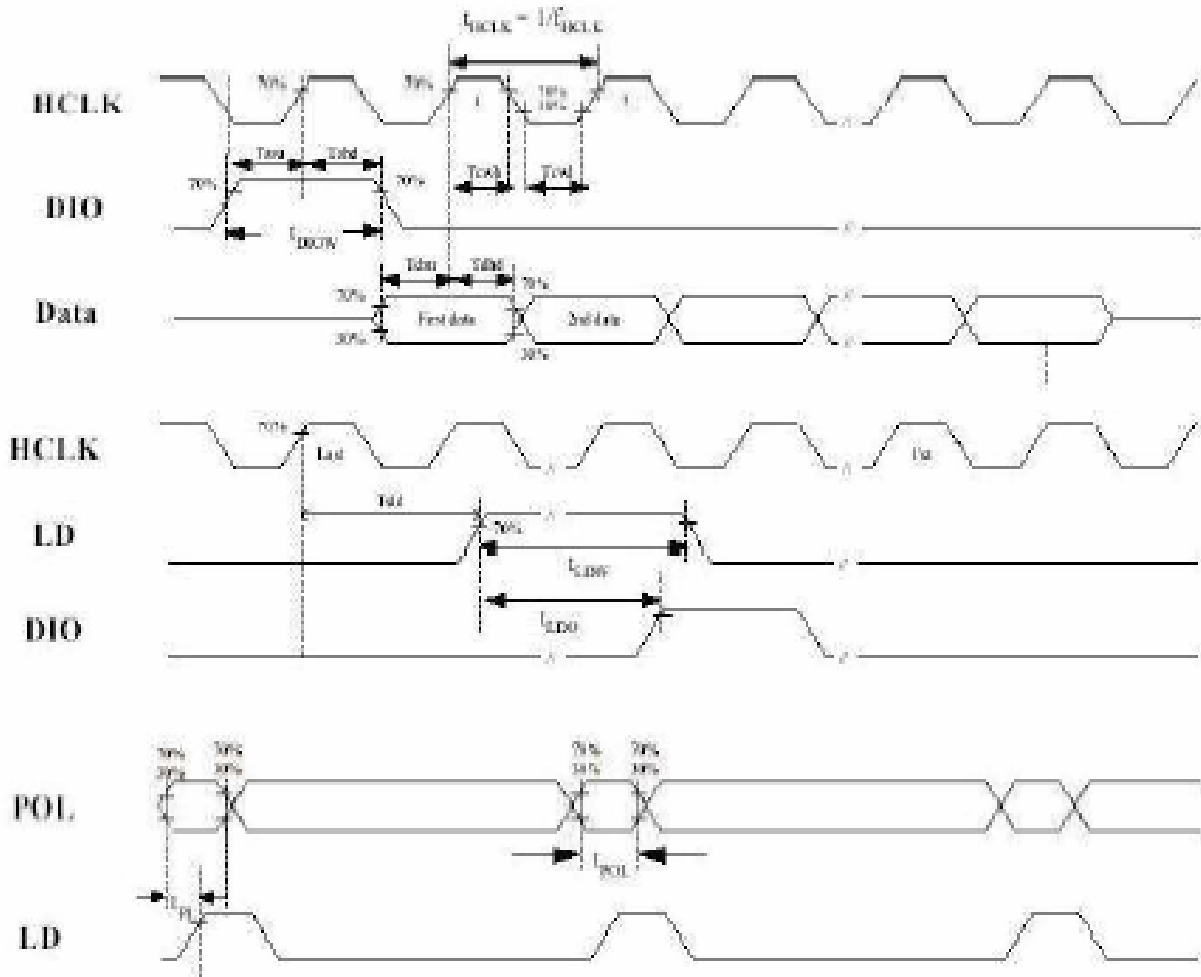
<< Input vertical timing >>



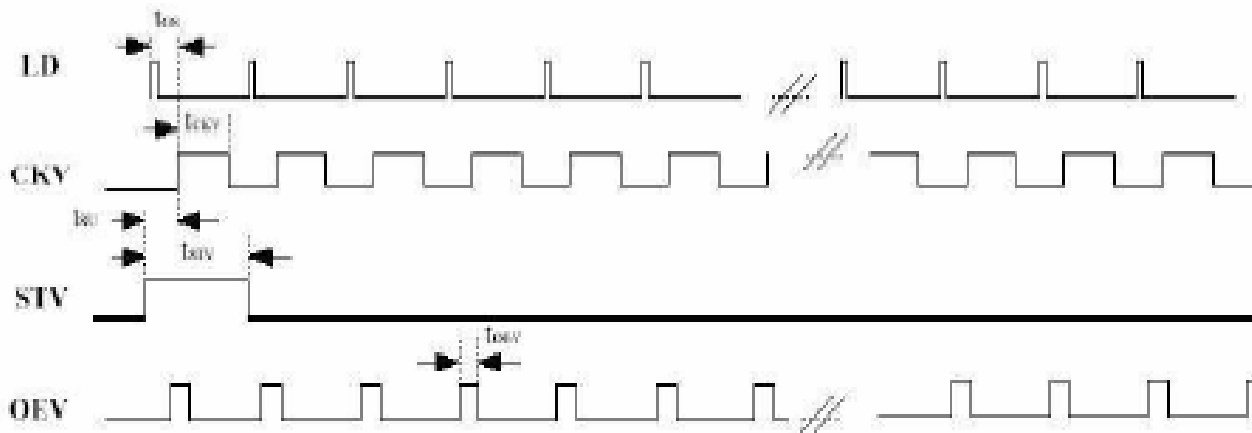
<< Input horizontal timing >>



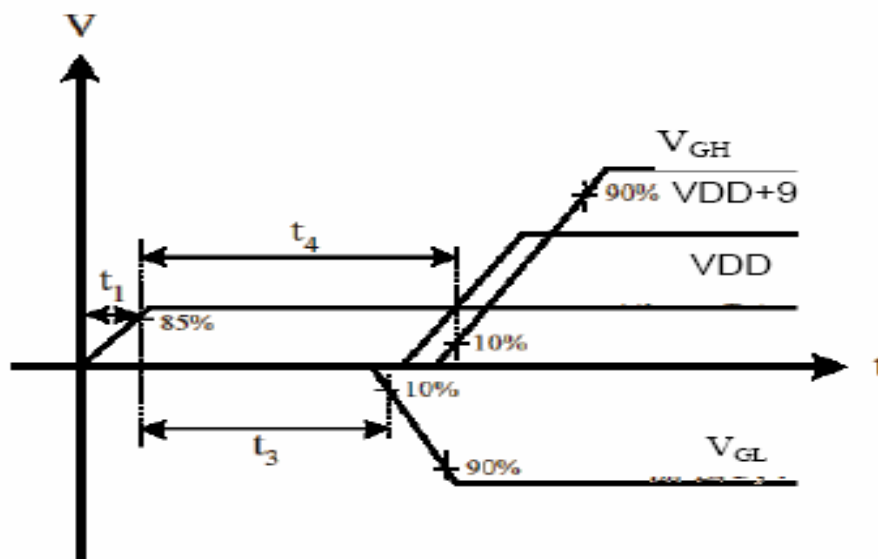
Output Signal Timing for LD, DIO, POL and HCLK



Output Signal Timing for STV, OEV and CKV



6.5 Power Sequence



- 輸出順序: $V_{DD} \rightarrow V_{GL}(V_{DD}+9) \rightarrow V_{GH}$
- $t_1 < 100\text{ms}$
- $t_3 < t_4$

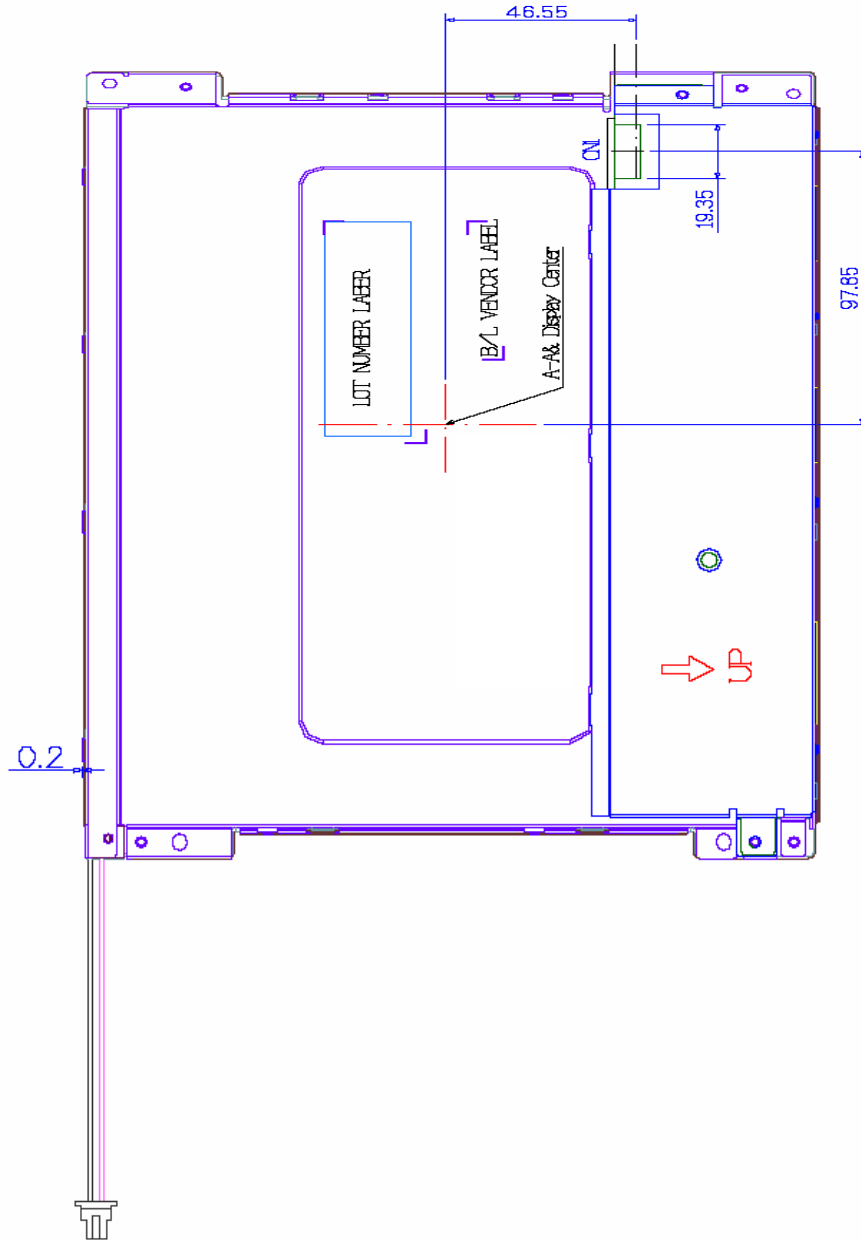
Note Apply the lamp voltage within the LCD operation range. When the back-light turns on before the LCD operation or the LCD turns off before the back-light turns off, the display may momentarily become white.

7.0 Reliability

No.	Item	Conditions	Remark
1	High temperature storage	Ta=+85°C,240hrs	
2	low temperature storage	Ta=-40°C,240hrs	
3	high temperature operation	Ta=+85°C,240hrs	
4	Low temperature operation	Ta=-30°C,240hrs	
5	High temperature and high humidity (operating)	Ta=+60°C,90%RH,240hrs	
6	Thermal cycling test (non operation)	-40°C (0.5hr)→+85°C (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°C)	
9	Altitude test(operation)	10000ft,02hr(25°C)	
10	Pressure cooker test	121°C,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.



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 and 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