INNOLUX DISPLAY CORPORATION

LCD MODULE

SPECIFICATION

Customer:

Model Name:AT102TN01
Date: Nov., 2003
Version:2.0

☐ **Preliminary Specification**

■ **Final Specification**

For Customer's Acceptance

Approved by	Comment

Approved by	Reviewed by	Prepared by
Dec. 8. 2003	Rudi. Su 2003. Dec. 08	jansen. jang 2003. Dec. 06

Innolux Display Corporation,
2F, No.16, Ke-Tung Road 3, Science-Based Industrial Park, Chu-Nan 350, Mao-Li County, Taiwan
Tel: 886-37-586000 Fax: 886-37-586060

Record of Revision

Version	Revise Date	Page	Contents
1	2003/11/26		Initial release
2	2003/12/6	3	To revise the prodct weight from 305g to 345g
		4	To revise the power Voltage AVDD from (8.4)V to (8.8)V
		6	To revise the CLK pulse width from 8ns to 6 ns
		6	To revise the Supply Voltage from (8.4)V to (8.8)V
		20	To revise the backlight cable length from 50mm to 40mm
		20	To update the drawing

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A. General specifications

NO.	Item	Specification	Remark
1	Display resolution(dot)	800RGB(W)×480(H)	
2	Active area(mm)	222.0(W)×132.48(H)	
3	Screen size(inch)	10.2(Diagonal)	
4	Pixel pitch(mm)	0.2775(W)×0.276(H)	
5	Color configuration	R. G. B. stripe	
6	Overall dimension(mm)	235.0(W)×145. 8(H)×6.3(D)	Note 1
7	Weight(g)	345 ±10	
8	Surface treatment	Anti-Glare	
9	Backlight unit	CCFL	

Note 1: Refer to Fig.1 and Fig.2

B. Electrical specifications

1. Absolute maximum ratings

Items	Symbol	Product Specification			Unit
		Min.	Typ.	Max.	
Power Voltage	Vcc	-0.5		5	V
	AVDD	-0.5		12	V
	VGH	-0.3		18	V
	VGL	-15		0.3	V
	VGH-VGL			33	V
Input Signal Voltage	Vi	-0.3		Vcc+0.3	V
	Vref(V1~V7)	0.4AVDD		AVDD+0.3	V
	Vref(V8~V14)	-0.3		0.6AVDD	V
	Vcom		(4.2)		V
Operating Temperature	Topa	-20		70	℃
Storage Temperature	Tstg	-30		85	℃

2. Typical operating conditions (GND=AVSS=0V)

Items	Symbol	Product Specification			Unit
		Min.	Typ.	Max.	
Power Voltage	Vcc	3.0	3.3	3.6	V
	AVDD	(8.2)	(8.8)	(9.2)	V
	VGH	14.3	15	15.7	V
	Vcom		(4.2)		V
	VGL	-10.5	-10	-9.5	V
Input Reference Voltage	V1~V7	0.4AVDD	—	AVDD-0.3	V
	V8~V14	0.1	—	0.6AVDD	V
Input H/L level Voltage	VIH	0.8VCC	—	VCC	V
	VIL	0	—	0.2VCC	V

3. Current consumption conditions (GND=Avss=0V)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Current For Driver	IGH	VGH=15V		(50)	(100)	uA
	IGL	VGL=-10V		(-0.2)	(-0.6)	uA
	ICC	VCC=3.3V		(3.5)	(5)	mA
	IDD	AVDD=(8.4)V		(20)	(30)	mA

4. Backlight driving conditions

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Lamp Life Time	-	-	20,000	30,000	-	Hours
Voltage	V_L			770	830	Vrms
Current	I_L			6.0	7.0	mA
Frequency	F_L			60	80	KHz
Lamp Start Voltage	T=25℃				1,420	Vrms
	T=0℃				1,850	Vs
	T=-20℃				TBD	Vrms

The" Lamp life time" is defined as the module brightness decrease to 50% original brightness at Ta=25℃ , I_L=6mA.

5. Timing conditions

AC Electrical Characteristics (VCC=3.3V, AVDD=8.4V, AVSS=GND=0V, TA=25℃)

Parameter	Symbol	Min.	Typ.	Max.	Unit
CLK frequency	Fclk		40	45	MHz
CLK pulse width	TCW	6			ns
Data set-up time	Tsu	4			ns
Data hold time	Thd	2			ns
Propagation delay of DIO2/1	Tphl	6	10	15	ns
Time that the last data to LD	Tld	1			Tcw
Pulse width of LD	Twld	2			Tcw
Time that LD to DIO1/2	Tlds	5			Tcw
POL set-up time	Tpsu	6			ns
POL hold time	Tphd	6			ns
OEV pulse width	TOEV		12		Tcw
CKV pulse width	TCKV	16	28	40	Tcw
Horizontal display start	TSH		0		Tcw/3
Horizontal display timing range	TDH		800		Tcw/3
STV setup time	TSUV	400			ns
STV hold time	THDV	400			ns
STV pulse width	TSTV			1	TDH
Horizontal lines per field	TV	512	525	610	TDH
Vertical display start	TSV		3		TDH
Vertical display timing range	TDV		480		TDH

DC Electrical Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	Vcc	3.0	3.3	3.6	V
Low Level Input Voltage	Vil	0	-	0.3*Vcc	V
High Level Input Voltage	Vih	0.7*Vcc	-	Vcc	V
High Level Output Voltage	Voh	Vcc-0.4	-	-	V
Low Level Output Voltage	Vol	GND	-	GND+0.4	V
Supply Voltage	AVDD	(6.5)	(8.8)	(10)	V
Sinking Current of Outputs	IOL	|-80|	-	-	uA
Driving Current of Outputs	IOH	80	-	-	uA

■ **Timing Diagram 1 (CHNSL="1" , Default)**

<< EDGSL= "0", Default >>

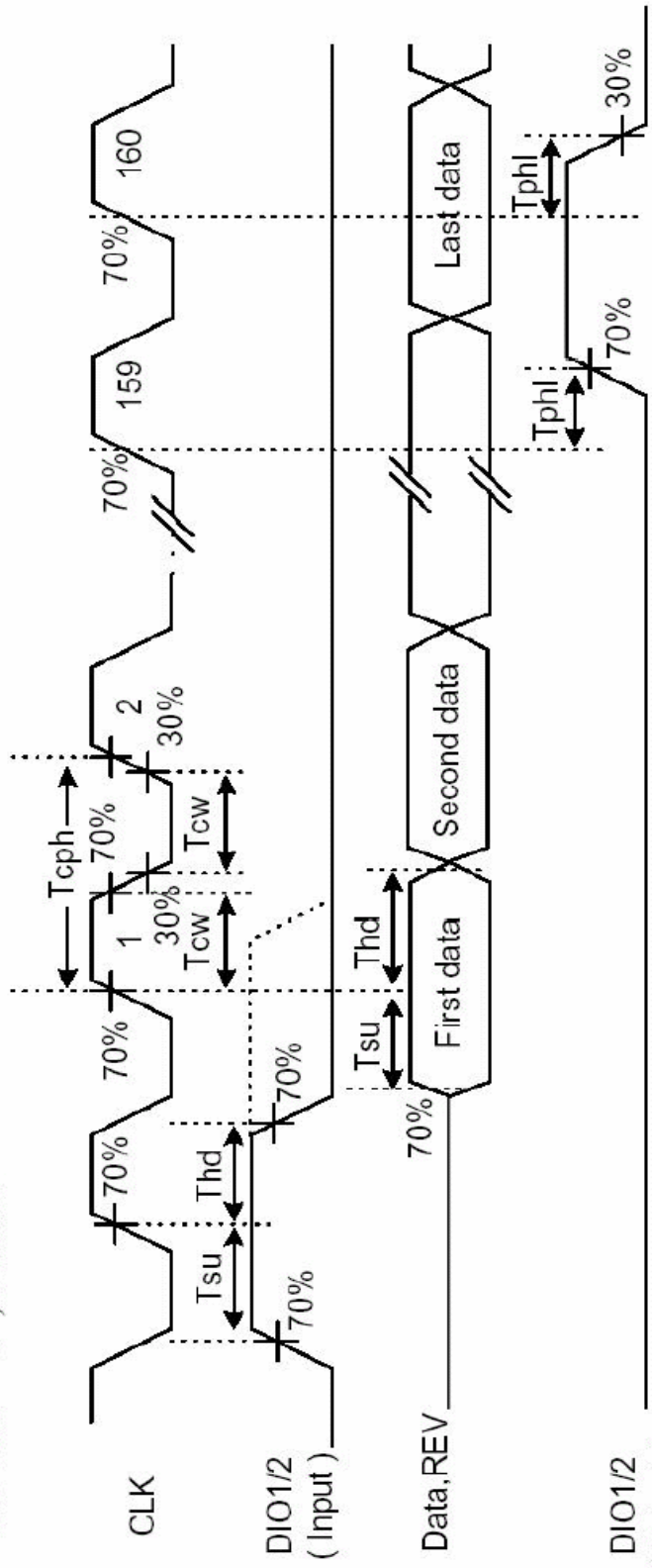


Fig.3 Operation Mode 1

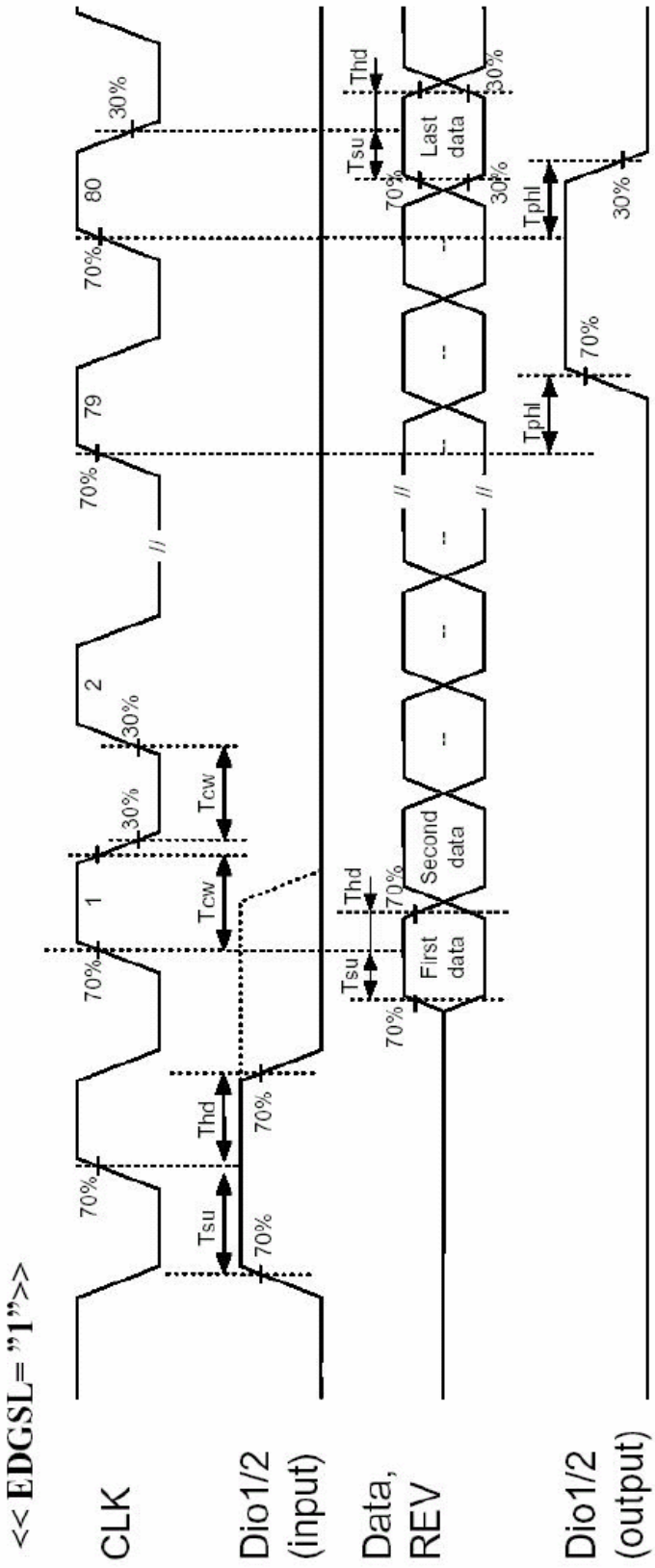


Fig.4 Operation Mode 2

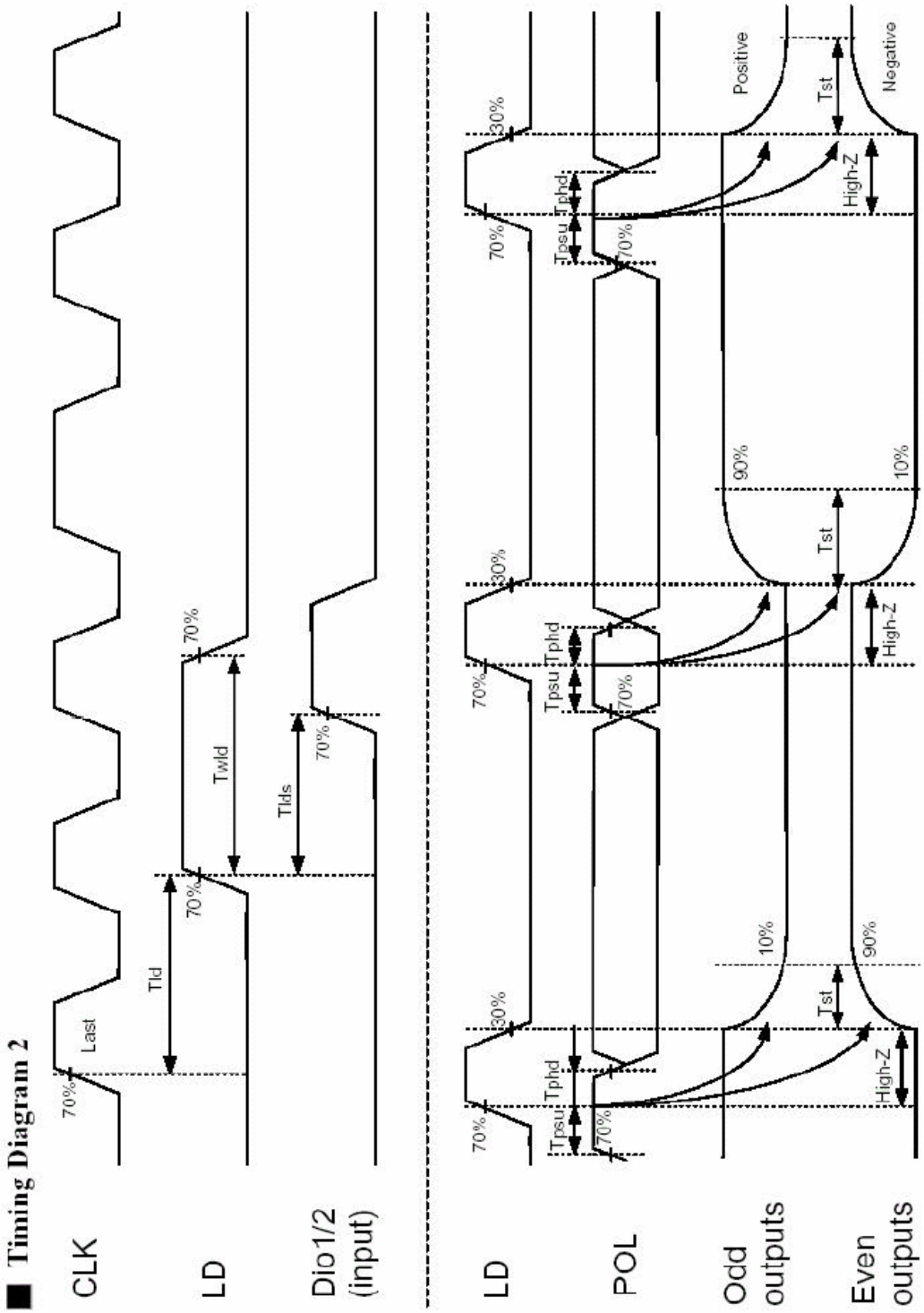


Fig.5 Horizontal timing

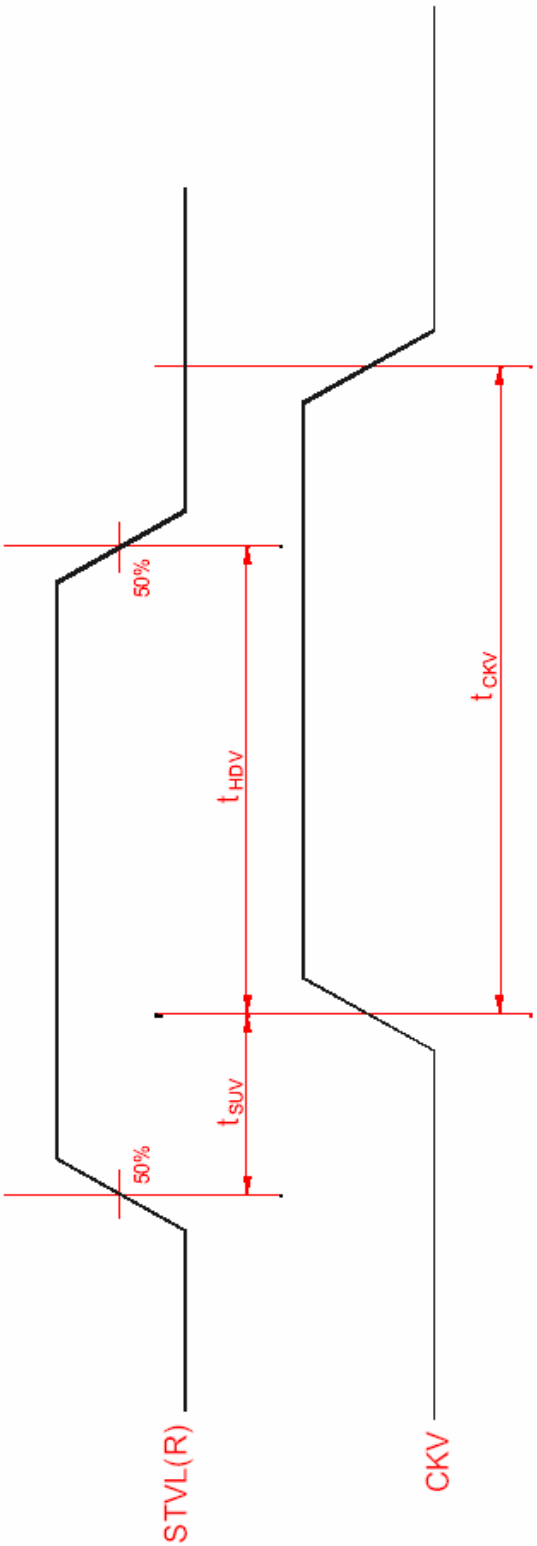


Fig.6 Virtical shift clock timing

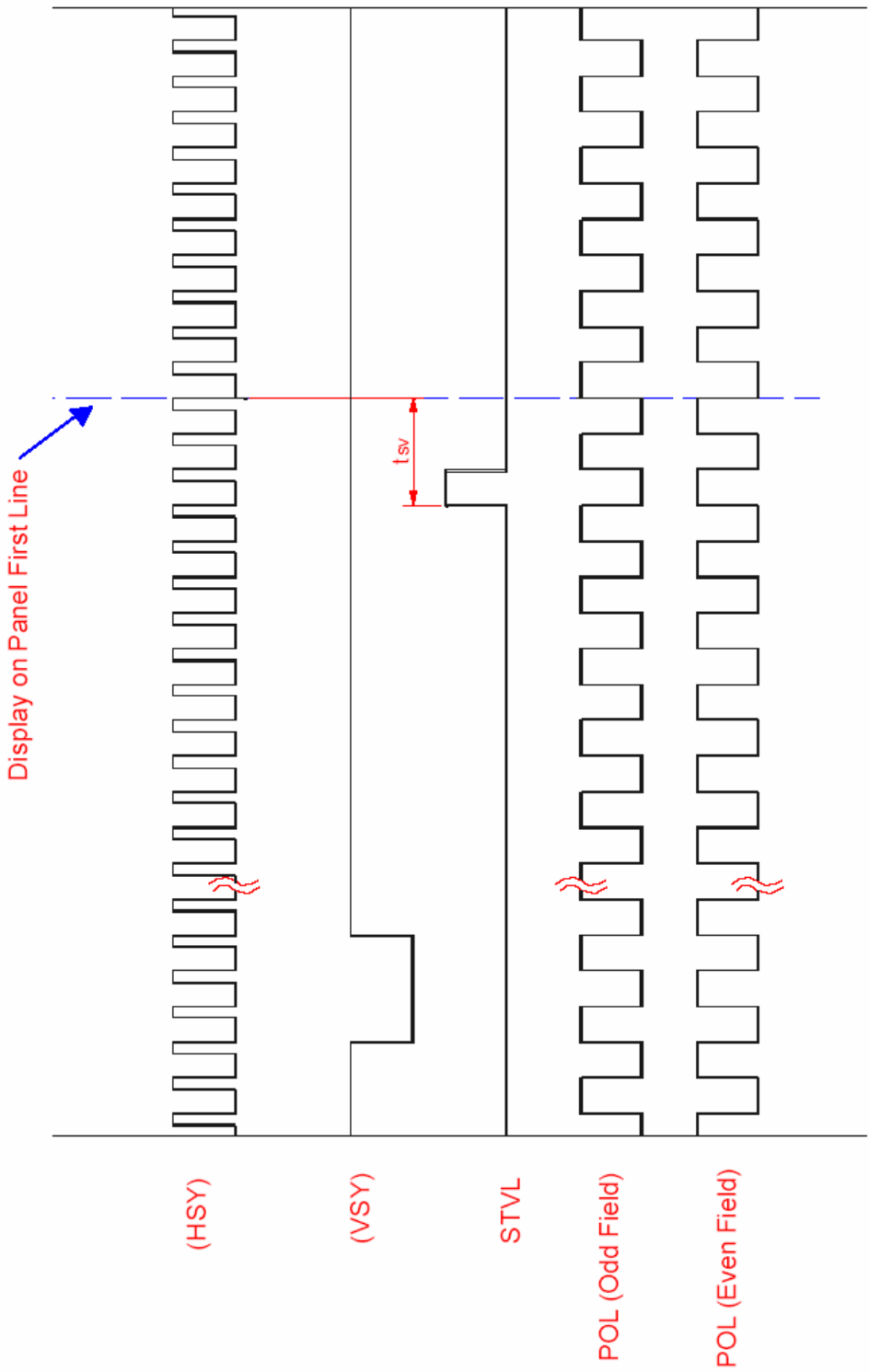


Fig.7 Vertical timing (from up to down)

6. Pin assignment

a. TFT-LCD panel driving section

(1.) FH12-30S-0.5SH(Hirose) — FPC I/O Pin Assignment

Pin no	Symbol	I/O	Description	Remark
1	POL	I	Polarity selection	
2	DIO2	I/O	Vertical start pulse signal input or output	
3	OE	I	Output enable	
4	CPV	I	Vertical clock	
5	DIO1	I/O	Vertical start pulse signal input or output	
6	GND	I	Power ground	
7	EDGSL	I	Select rising edge or rising/falling edge	
8	VCC	I	Digital voltage for source driver	
9	V9	I	Gamma voltage level 9	
10	VGL	I	Gate OFF voltage	
11	V2	I	Gamma voltage level 2	
12	VGH	I	Gate ON voltage	
13	V6	I	Gamma voltage level 6	
14	U/D	I	Up/down selection	
15	VCOM	I	Common voltage	
16	GND	I	Power ground	
17	AVDD	I	Power supply for analog circuit	
18	V14	I	Gamma voltage level 14	
19	V11	I	Gamma voltage level 11	
20	V8	I	Gamma voltage level 8	
21	V5	I	Gamma voltage level 5	
22	V3	I	Gamma voltage level 3	
23	GND	I	Power ground	
24	R5	I	Red data(MSB)	
25	R4	I	Red data	
26	R3	I	Red data	
27	R2	I	Red data	
28	R1	I	Red data	
29	R0	I	Red data(LSB)	
30	GND	I	Power ground	

Pin no	Symbol	I/O	Description	Remark
31	GND	I	Power ground	
32	G5	I	Green data(MSB)	
33	G4	I	Green data	
34	G3	I	Green data	
35	G2	I	Green data	
36	G1	I	Green data	
37	G0	I	Green data(LSB)	
38	STHL	I/O	Horizontal start pulse signal input or output	
39	INV	I	Control signal are inverted or not	
40	GND	I	Power ground	
41	DCLK	I	Sample clock	
42	DVDD	I	Voltage for digital circuit	
43	STHR	I/O	Horizontal start pulse signal input or output	
44	LD	I	Latches the polarity of outputs and switches the new data to outputs	
45	B5	I	Blue data (MSB)	
46	B4	I	Blue data	
47	B3	I	Blue data	
48	B2	I	Blue data	
49	B1	I	Blue data	
50	B0	I	Blue data (LSB)	
51	R/L	I	Right/ left selection	
52	V1	I	Gamma voltage level 1	
53	V4	I	Gamma voltage level 4	
54	V7	I	Gamma voltage level 7	
55	V10	I	Gamma voltage level 10	
56	V12	I	Gamma voltage level 12	
57	V13	I	Gamma voltage level 13	
58	AVDD	I	Voltage for analog circuit	
59	GND	I	Power ground	
60	VCOM	I	Common voltage	

C. Optical specification

The following items are measured under stable conditions. The optical characteristics should be measured in dark room or equivalent state with the methods shown in Note 1.

Ta=25±2℃, I_L=6mA

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
Response time		T_R	Θ=0	-	12	24	ms	Note2
		T_F		-	18	36	ms	
Contrast ratio		CR	At optimized viewing angle	250	300			Note3
Brightness		Y_L	Θ=0	350	400		Cd/m^2	Note4
Color Chromaticity	White	W_x	Θ=0	0.26	0.31	0.36		Note4
		W_y		0.28	0.33	0.38		
Viewing Angle	Hor.	$Θ_R$	CR≥10	50	60		Degree	Note5
		$Θ_L$		50	60			
	Ver.	$Φ_H$		35	45			
		$Φ_L$		50	60			

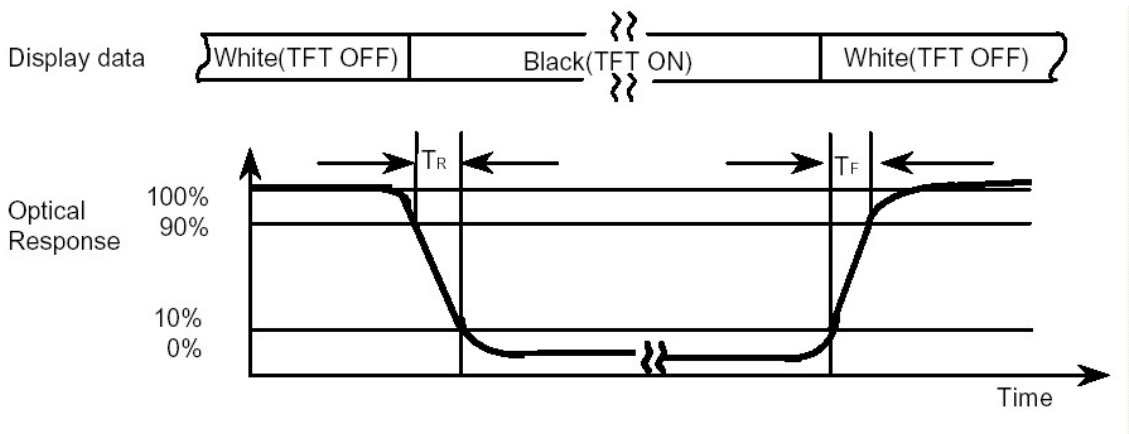
Note:

1. Test equipment setup

After stabilizing and leaving the panel alone at a given temperature for 30 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-5A with a viewing angle of 1° at a distance 0f 50cm and normal direction.

2. Definition of response time: T_R and T_F

The figure below is the output signal of the photo detector.



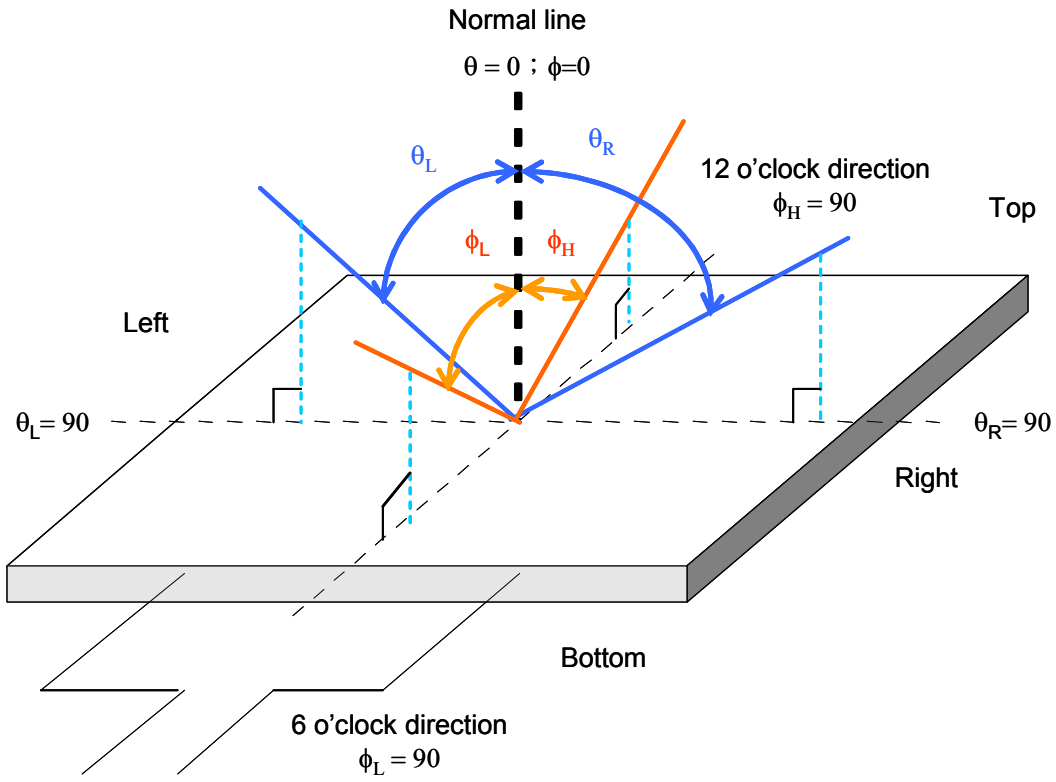
3.

Definition of contrast ratio:

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

4. Measured at the center area of the panel when all the input terminal of LCD panel are electrically opened.

5. Definition of viewing angle:



D. Reliability test items (Note 2):

No.	Test items	Conditions	Remark
1	High temperature storage	Ta= 85℃ 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	Ta= 60℃, 90% RH 240Hrs	Operation
6	Heat shock	-30℃~85℃/100 cycles 1Hrs/cycle	Non-operation
7	Electrostatic discharge	±200V,200pF(0Ω), once for each terminal	Non-operation
8	Vibration	Frequency range : 8~33.3Hz Stoke : 1.3mm Sweep : 2.9G, 33.3 ~ 400Hz Cycle : 15 minutes 2 hours for each direction of X,Z 4 hours for Y direction	JIS C7021, A-10 condition A
9	Mechanical shock	100G, 6ms, ±X,±Y,±Z 3 times for each direction	JIS C7021, A-7 condition C
10	Vibration (with carton)	Random vibration: 0.015G2/Hz from 5~200Hz –6dB/octave from 200~500Hz	IEC 68-34
11	Drop (with carton)	Height: 60cm 1 corner, 3 edges, 6 surfaces	JIS Z0202

Note1: Ta: Ambient temperature.

Note2: In the standard conditions, there is not display function NG issue occurred. All the cosmetic specification is judged before the reliability stress.

E. Quality assurance standards

1. Sampling plan:

Unless there is other agreement , sampling plan for incoming inspection should follow MIL-STD-105E.

1.1 Lot size: Quantity per shipment as one lot (different model as different lot .)

1.2 Sampling type: Normal inspection, single sampling.

1.3 Sampling level: Level II.

1.4 AQL: Acceptable Quality Level

Major defect: AQL=0.65%

Minor defect: AQL=1.0%.

2. Panel inspection condition:

2.1 Environment:

Room Temperature: 25±5 . ℃

Humidity: 65±5% RH.

Illumination: 300 ~ 700 Lux.

2.2 Inspection Distance: 35±5 cm

2.3 Inspection Angle: the vision of inspector should be perpendicular to the surface of the module.

3. Display quality

3.1 Function Related: the function defects such as line defect, abnormal display, no display are considered the major defects.

3.2 Bright/dark dots

Defect Type	**Specification**	**Major**	**Minor**
Bright Dots	N ≤ 2		●
Dark Dots	N ≤ 4		●
Total Bright and Dark Dots	N ≤ 5		●
Distance between Bright and Bright dot	L ≥ 15 mm		●
Distance between Bright and Dark dot	L ≥ 5 mm		●
Distance between Dark dot	L ≥ 5 mm		●

Note 1: Dot defect is defined as the defective area is larger than 50% of the dot area.
Bright Dot is defined 5% transmission ND filter.

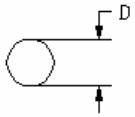
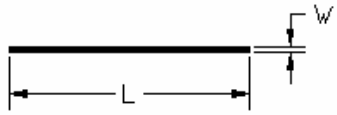
Note 2: Light Leakage: There shall not be visible light around the customer's bezel after assembly in normal View angle.

3.3 Pixel definition

R G B R G B R G B	Dot Defective
R G B R G B R G B	Defective Pixel
R G B R G B R G B	Defective Adjacent Sub-Pixels
	Defective Adjacent Pixels

Note: In cases where partial sub-pixel or pixel defects exceed 50% of the affected sub-pixel or pixel area, it will be counted as 1 defect.

3.4 Visual Inspection specification

Defect Type		**Specification Size**	**Count(N)**	**Major**	**Minor**
Dot Shape (Particle、Scratch and Bubbles in display area) 		D ≤ 0.25 mm	Ignored		●
		0.25mm < D ≤ 0.5mm	N ≤ 3		
		D > 0.5mm	N=0		
Line Shape (Particles、Scratch、Lint and Bubbles in display area) 		W ≤ 0.1 mm	Ignored		●
		0.1< W ≤ 0.5mm and L ≤ 3mm	N ≤ 3		
		W >0.5mm or L>3mm (Lint)	N=0		
		0.1< W≤ 0.5mm and L ≤ 10mm	N ≤ 3		
		W > 0.1 L > 10 mm	N=0		
Bubble in cell (active area)		It should be found by eyes			●
Bezel	Scratch	No harm			●
	Dirt				●
	Wrap	No harm			
	Sunken	No harm			
Label	No label	No			●
	Invert label				●
	Broken				●
	Dirt	Word can be read.			●
	Not clear				●
	Word out of shape				●
	Mistake	No			●
	Position	Be attached on right position			●

Screw	Not enough	No		
	Limp	No		
Connector	Connection status	No bend on pins and damage		
FPC/FFC	Broken	No		

Note

Extraneous substance and scratch de not affect the display of image, for instance , the extraneous substance under polarizer film but outside the display area, scratch on metal bezel and backlight module or polarizer film. Outside of the display area are not counted.

F. 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℃±10℃ , low humidity (65%RH or less).
2) **DO NOT** store the products in an atmosphere containing organic solvents or corrosive gases.

5Cleaning

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.

G. Mechanical dimensions