

LCM SPECIFICATION

Customer	
Model No.	TS-350T-003B
Date Issued	19. December. 2005

Supplier Approval			Customer Approval		
Designed	Checked	Approved	Designed	Checked	Approved
					
Remarks :			Remarks :		

[Revision Record]

Rev.No.	Date	Contents	Page	Remarks
A	15. Dec. 2005	Initial Release	All	
B	19. Dec. 2005	Incoming Inspection standards changed	15	

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1. Scope and Warranty

1-1. Scope

This specification defines overall terms and inspection standards for LCD module supplied by 3DOT co.,ltd.

If the event of unexpected problems or unspecified items may occur, we will negotiate and agree to solutions with customer.

1-2 Warranty

3DOT co.,ltd. will guarantee Module products for 1 year after manufactured in our factory, when stored or used or handled according to this specified contents of these sheets, under normal conditions.

But it is impossible to compensate for defectives caused by customer's mistakes such as careless handling or any kind of changing, etc After 1 year warranty term, all replacements for defectives will be charged.

2. Features

Item	Specification
Display Size. (Diagonal)	3.5"
Display Format	320(W) x RGB x 240(H) dots
Display Mode	Transmissive and Normally White
	a-Si TFT
Color Depth	16.7M colors
Viewing Direction	6 o'clock
Interface	24 bit parallel, RGB I/F
LCD driver	HX8218A & HX8615B by Himax
Display RAM capacity	-
Back Light	White-color, 6-chip with Light-guider
Touch Panel	4-Wire TSP

3. Mechanical Specifications

Item		Width	Height	Thickness	Unit
Dimensional Outline.	-	77.8	64.6	4.36MAX	mm
Active area	Main	70.08	52.56	-	
Dots pitch	Main	0.073	0.219		
Weight (Typical)	-	8.84			g

4. Absolute Maximum Ratings

(V_{SS} = 0V)

Item	Symbol	Min.	Max.	Unit	Note
Supply voltage	V _{DD}	-0.3	7.0	V	1), 2)
	V _{CC}	-0.3	7.0		
Operating temperature	T _{OP}	-20	60	°C	-
Storage temperature	T _{ST}	-30	70		-
Humidity	-	-	90	%RH	-

Note 1) V_{DD}/V_{CC} are based on V_{SS} (0V).

Note 2) If voltage supply exceeds absolute maximum rating , LSI may be damaged permanently.

It is desirable to use these LSIs under electrical characteristic conditions during operating.

Otherwise, these LSIs may cause malfunctions or reduced reliabilities.

Note 3) Temp. ≤ 60°C , 90% RH MAX.

Temp. > 60°C , Absolute humidity shall be less than 90% RH at 60°C

5. Electrical Characteristics

5-1. Electrical Characteristics

(V_{ss} = 0V, Ta = -20 ~ 60℃)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Supply Voltage	V _{cc}	-	3.0	3.3	3.6	V	-
Supply Voltage	V _{dd}	-	3.8	5.0	5.5		-
Input voltage	“H” level	V _{IH}	0.7xV _{cc}	-	V _{cc}		-
	“L” level	V _{IL}	V _{SS}	-	0.3xV _{cc}		
Output Voltage	“H” level	V _{OH}	0.8xV _{cc}	-	V _{cc}		-
	“L” level	V _{OL}	V _{SS}	-	0.2xV _{cc}		
Current consumption (TFT)	I _{dd1}	-	-	10	14	mA	1, 2
	I _{dd2}	Sleep mode	-	0.4	0.56		3
Current consumption (Back Light)	I _{bat}	6-LED, Normal on state	-	20	-		-

Note 1) Full Black on state

Note 2) V_{cc} = 3.3V, V_{dd} = 5.0V, POL = 10.87KHz, Ta = 25℃

Note 3) Sleep mode ON

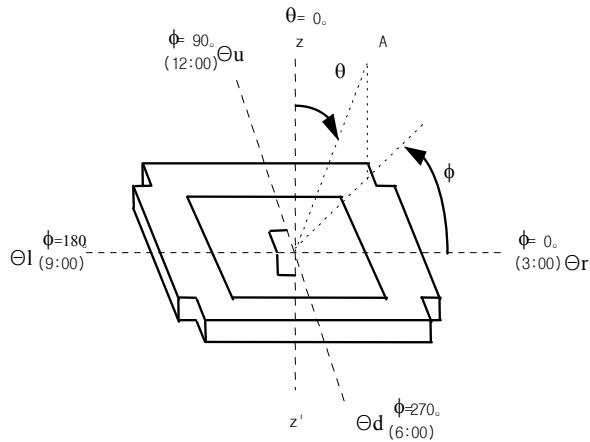
5-2. BLU Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Forward voltage	Vf	If=20mA	-	T.B.D	-	V	a chip
Reverse voltage	Vr	-	-	T.B.D	-		a chip
Luminous color	White						a chip
Chip Part-No, maker.	T.B.D						a chip
Rank	T.B.D						a chip
Chip connection.	6-Chips, Serial Connection.						BLU
Uniformity	-	If=15mA	T.B.D	-	-	%	BLU

6. Electro – Optical Characteristics

Item		Symbol	Temp.	Condition	Min.	Typ.	Max.	Unit	Note
Response time		Tr+Td	25℃	$\Phi=0^{\circ}\text{C}, \theta=0^{\circ}\text{C}$	-	25	-	ms	3)
Viewing angle		θ	25℃ (K≥10)	θ_u	30	40	-	deg.	1),4)
				θ_d	50	60	-		
				θ_l	50	60	-		
				θ_r	50	60	-		
Contrast ratio		K	25℃	$\Phi=0^{\circ}\text{C}, \theta=0^{\circ}\text{C}$	-	200	-		2)
White Luminance			25℃	$\Phi=0^{\circ}\text{C}, \theta=0^{\circ}\text{C}$	-	160	-		
Color Gamut		S(%)	-	$\Phi=0^{\circ}\text{C}, \theta=0^{\circ}\text{C}$	-	65	-	%	5)
Color of CIE coordinate (Transmissive)	Red	X	25℃	$\Phi=0^{\circ}\text{C}, \theta=0^{\circ}\text{C}$	-	0.6289	-	-	6)
		Y			-	0.3490	-	-	
	Green	X			-	0.3006	-	-	
		Y			-	0.5893	-	-	
	Blue	X			-	0.1403	-	-	
		Y			-	0.0726	-	-	
	White	X			-	0.2860	-	-	
		Y			-	0.3131	-	-	

Note 1) Definition of ϕ and Θ

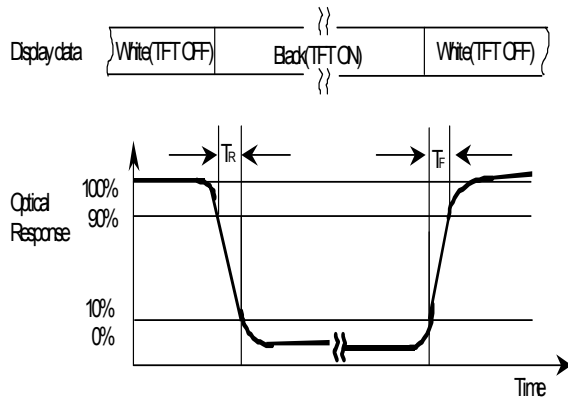


Note 2) Contrast ratio(K)

$$K = \frac{\text{Brightness of White Pixels}}{\text{Brightness of Black Pixels}}$$

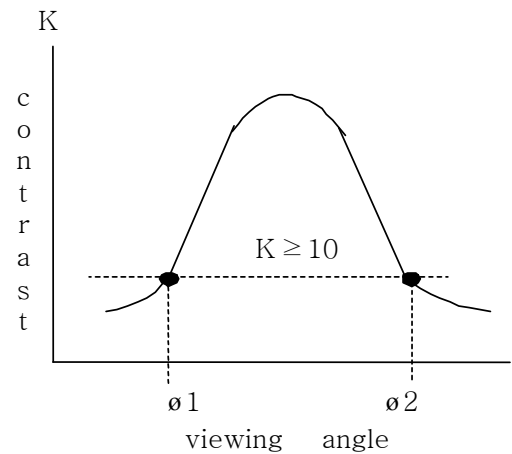
On the Panel

Note 3) Definition of response time



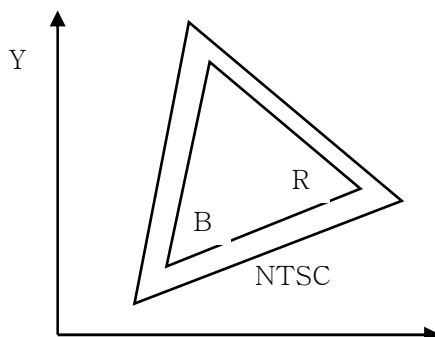
Note 4) Definition of viewing angle ($\Delta\phi$)

$$\Delta\phi = |\phi_1 - \phi_2|$$

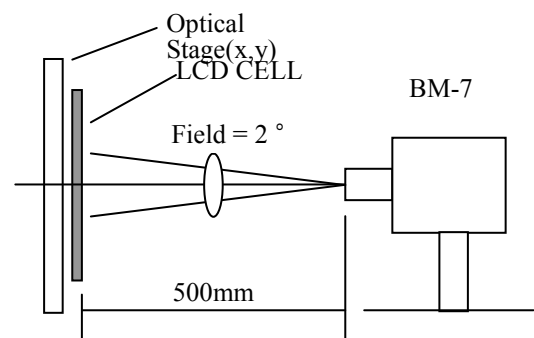


Note 5) The definition of color Gamut

$$\text{Color Gamut: } S(\%) = \frac{\text{RGB Triangle Area}}{\text{NTSC Triangle Area}} \times 100\%$$



Note 6) Optical measuring system
(Temperature regulated chamber)

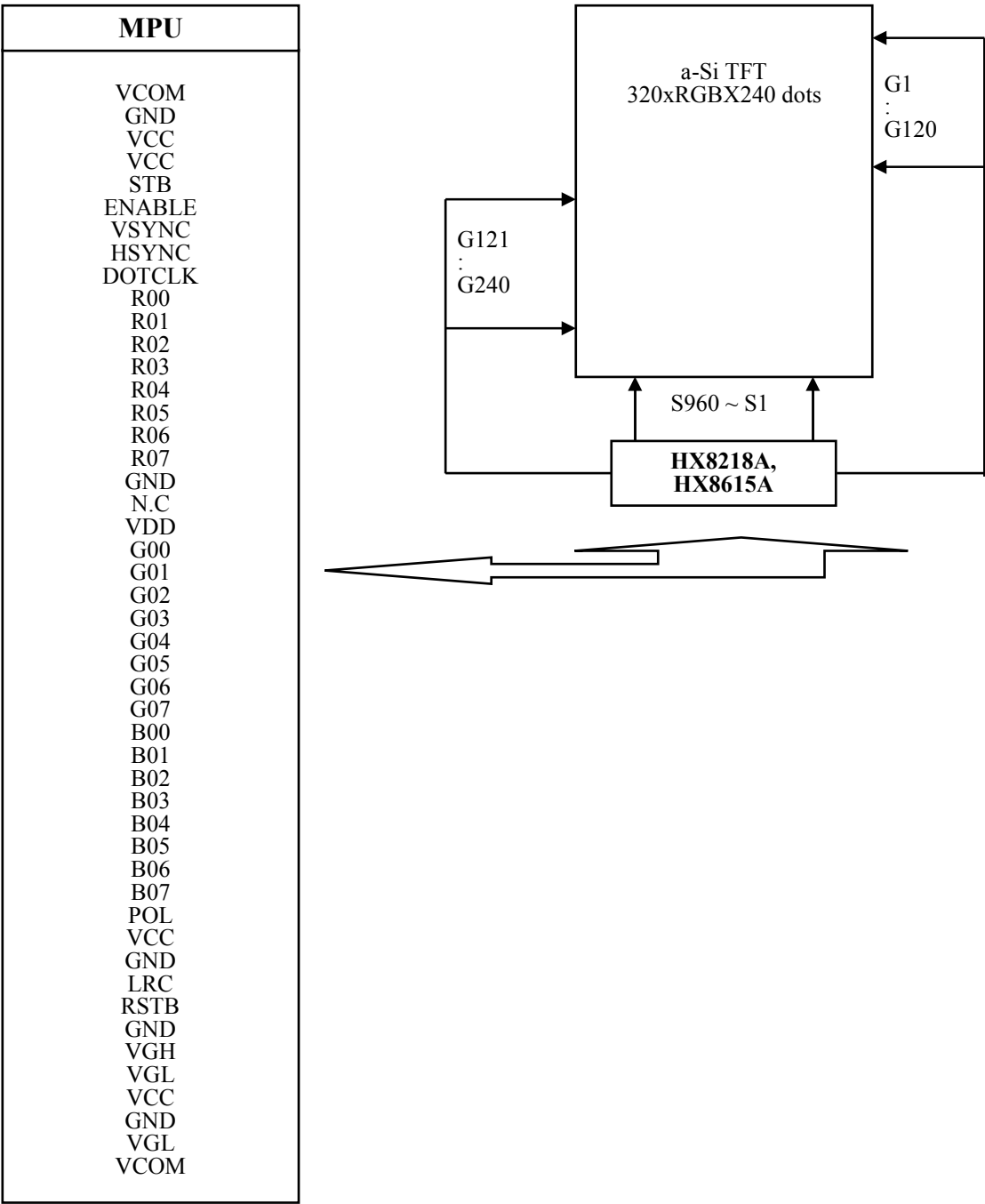


7. I/O Terminals

7-1. I/O connection

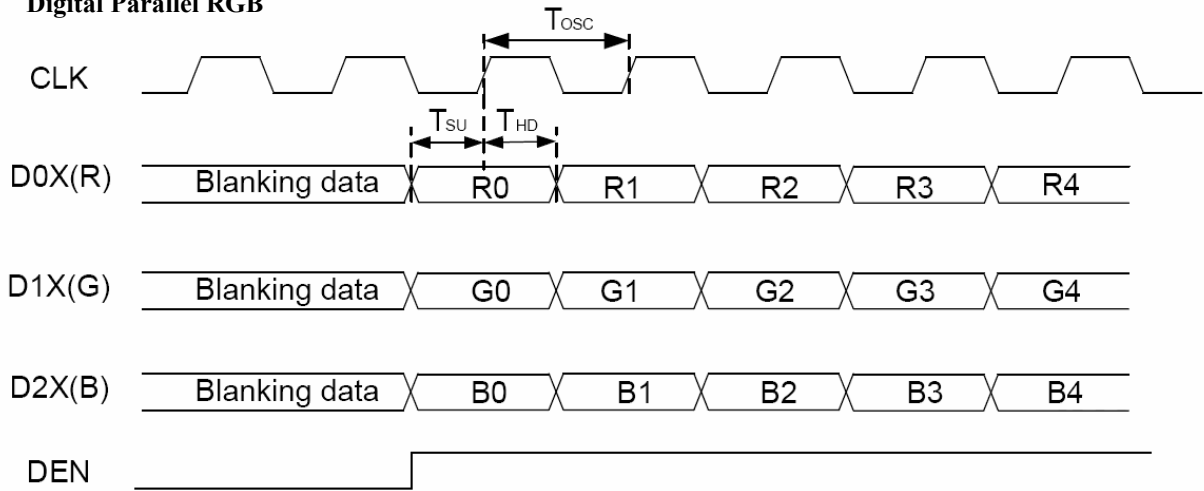
No.	Symbol	I/O	Description
1	VCOM	I	Power supply for the TFT common electrode.
2	GND	P	Ground for Analog/Digital circuit.
3	VCC	P	Power supply for Digital circuit.
4	VCC	P	Power supply for Digital circuit.
5	STB	I	Standby mode control signal input pin.
6	ENABLE	I	Data enable signal input pin.
7	VSYNC	I	Frame synchronizing signal input pin.
8	HSYNC	I	Line synchronizing signal input pin.
9	DOTCLK	I	Dot clock signal input pin.
10	R00	I	24-bit RGB data bus.
11	R01	I	24-bit RGB data bus.
12	R02	I	24-bit RGB data bus.
13	R03	I	24-bit RGB data bus.
14	R04	I	24-bit RGB data bus.
15	R05	I	24-bit RGB data bus.
16	R06	I	24-bit RGB data bus.
17	R07	I	24-bit RGB data bus.
18	GND	P	Ground for Analog/Digital circuit.
19	N.C	-	No Connection.
20	VDD	P	Power supply for analog circuit.
21	G00	I	24-bit RGB data bus.
22	G01	I	24-bit RGB data bus.
23	G02	I	24-bit RGB data bus.
24	G03	I	24-bit RGB data bus.
25	G04	I	24-bit RGB data bus.
26	G05	I	24-bit RGB data bus.
27	G06	I	24-bit RGB data bus.
28	G07	I	24-bit RGB data bus.
29	B00	I	24-bit RGB data bus.
30	B01	I	24-bit RGB data bus.
31	B02	I	24-bit RGB data bus.
32	B03	I	24-bit RGB data bus.
33	B04	I	24-bit RGB data bus.
34	B05	I	24-bit RGB data bus.
35	B06	I	24-bit RGB data bus.
36	B07	P	24-bit RGB data bus.
37	POL	O	Polarity select for the line inversion control signal input pin.
38	VCC	P	Power supply for digital circuit.
39	GND	P	Ground for Analog/Digital circuit.
40	LRC	I	Shift direction of device internal shift register control signal input pin.
41	UD	I	Up/Down scan setting signal input pin.
42	VSET	I	Gamma correction voltage setting signal input pin.
43	RSTB	I	Reset signal input pin.
44	GND	P	Ground for Analog/Digital circuit.
45	VGH	P	Power supply for LCM drive output High.
46	VGL	P	Power supply for LCM drive output Low.
47	VCC	P	. Power supply for digital logic.
48	GND	P	Ground for Analog/Digital circuit.
49	VGL	P	Power supply for LCM drive output Low.
50	VCOM	I	Power supply for the TFT common electrode.

7-2. Block Diagram

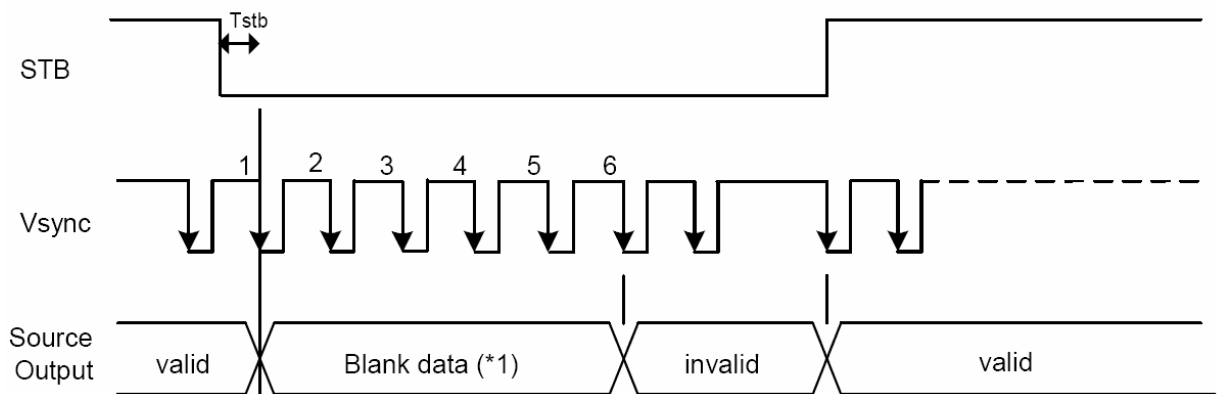


7-3. Timing Controller Timing Chart

Digital Parallel RGB



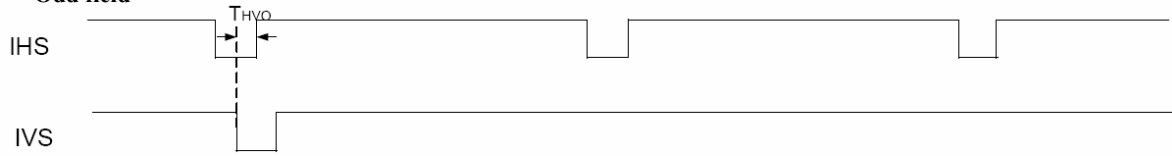
Standby ON/OFF Control



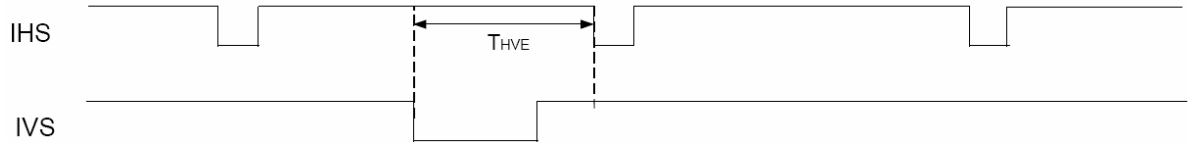
7-4. Digital RGB Timing Waveform

IHS and IVS Timing

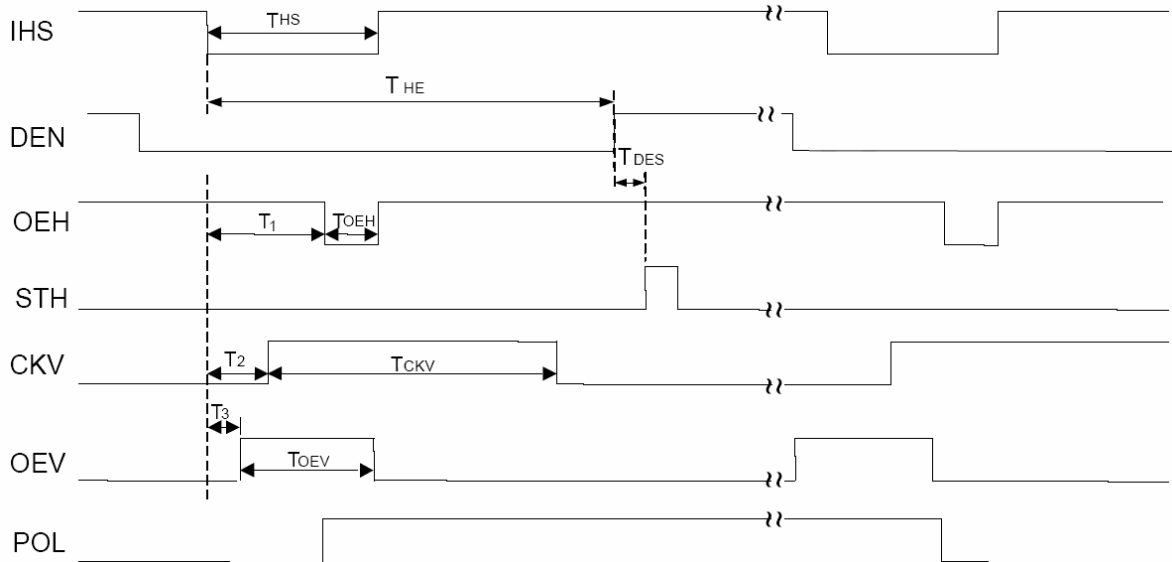
- Odd field



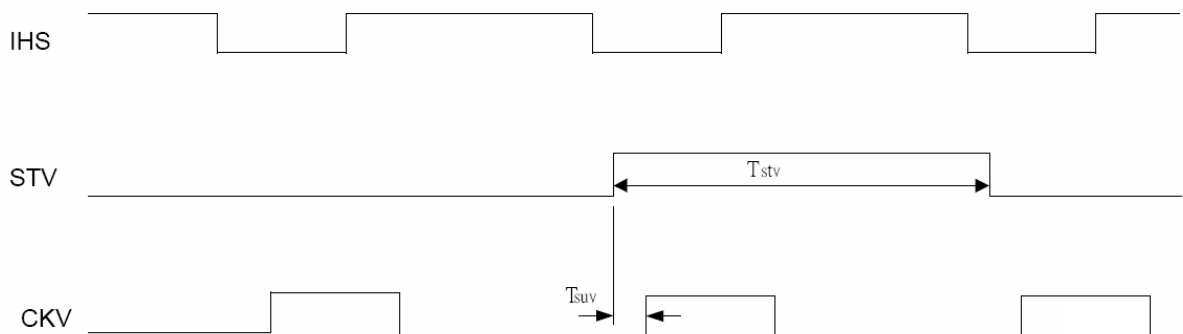
- Even field



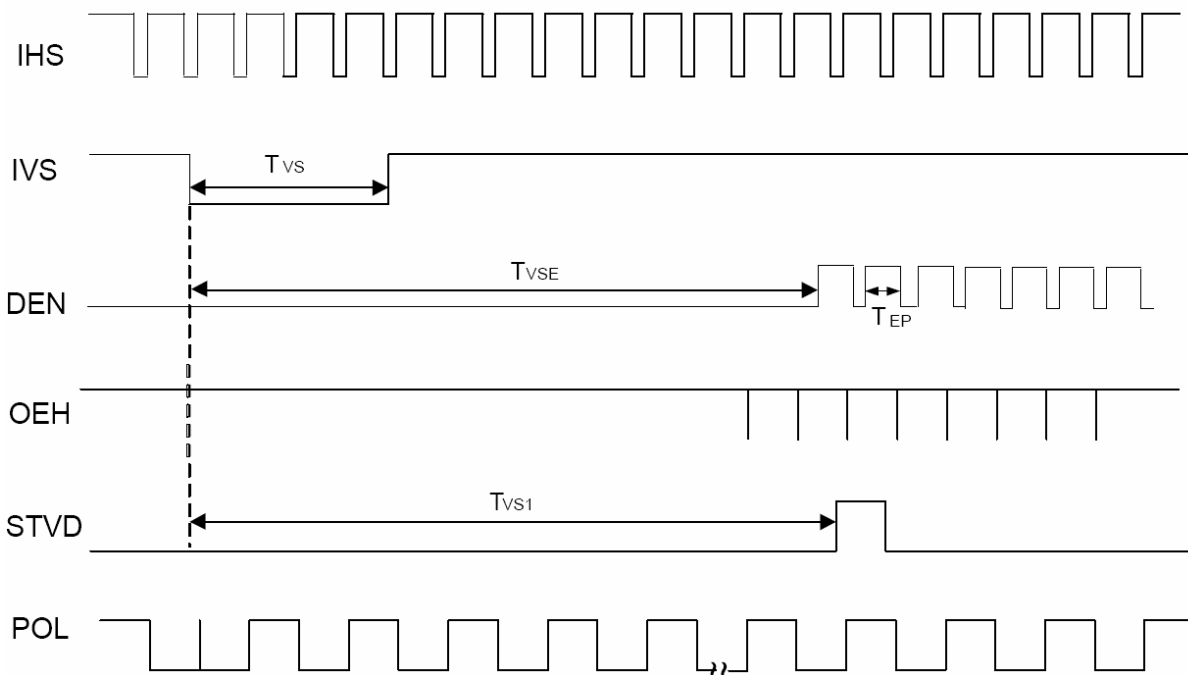
IHS and Horizontal Control Timing Waveform



IHS and Vertical Shift Clock Timing Waveform



IHS and Vertical Control Timing Waveform



Digital Parallel RGB Interface

(VCC= 2.7 to 3.3V)

Item	Symbol	Unit	Min.	Typ.	Max.	Note
CLK period	T_{OSC}	ns	-	156	-	
Data setup time	T_{SU}		12	-	-	
Data hold time	T_{HD}		12	-	-	
IHS period	T_H	T_{OSC}	-	408	-	
IHS pulse width	T_{HS}		5	30	-	
IHS rising time	T_{Cr}	ns	-	-	700	
IHS falling time	T_{Cf}		-	-	300	
IVS pulse width	T_{VS}	T_H	1	3	5	
IVS rising time	T_{Vr}	ns	-	-	700	
IVS falling time	T_{Vf}		-	-	1500	
IVS falling to IHS rising time for odd field		T_{HVO}	1	-	-	
IVS falling to IHS falling time for odd field		T_{HVE}	1	-	-	
IVS-DEN time	NTSC	T_{VSE}	T_H	18	-	
	PAL	T_{VSE}		26	-	
IHS-DEN time		T_{HE}	T_{OSC}	36	68	88
DEN pulse width		T_{EP}		-	320	-
DEN-STH time		T_{DES}		-	1	-
IVS period	NTSC		T_H	262.5	-	
	PAL			312.5	-	

8. Quality Specificaions

8-1. Acceptable Quality Level

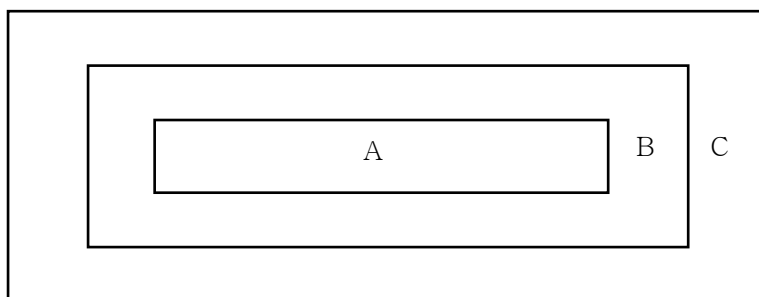
Defect type	Sampling procedures	AQL
Major	MIL-STD-105E Inspection level II normal inspection single sample inspection	0.65
Minor	MIL-STD-105E Inspection level II normal inspection single sample inspection	1.0

- Major defect : A major defect refers to a defect which is not considered to substantially degrade usability for product applications.
- Minor defect : A minor defect refers to a defect which is not considered to substantially degraded product application, or a defect which deviates from existing standards almost unrelated to the effective use of the product or it's operation.

8-2. Inspection conditions

- The environmental conditions for inspection shall be as follows.
Room temperature : $25 \pm 3^{\circ}\text{C}$
Humidity : $65 \pm 10\%\text{RH}$
- The external visual inspection
The inspection shall be performed by using a single 20W fluorescent lamp non-directive for illumination and the distance from LCD to eyes of the inspector should be 30-50cm.

8-3. Definition of inspection zone in LCD



Zone A: Active area.

Zone B: Viewing area. (Except zone A)

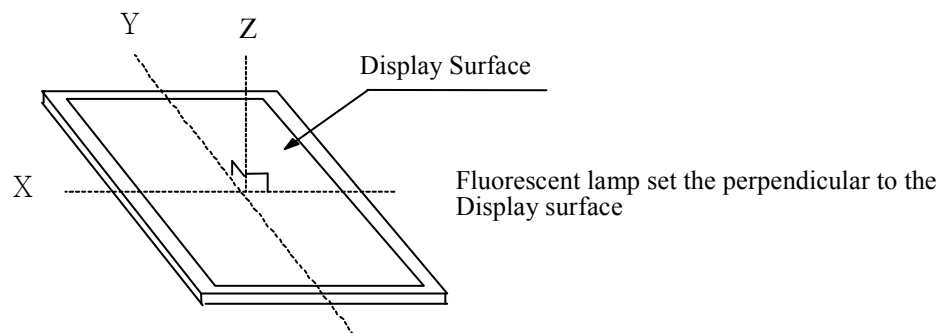
Zone C: Outside viewing area. (Invisible area after assembly in customer's products)

8-4. Inspection method

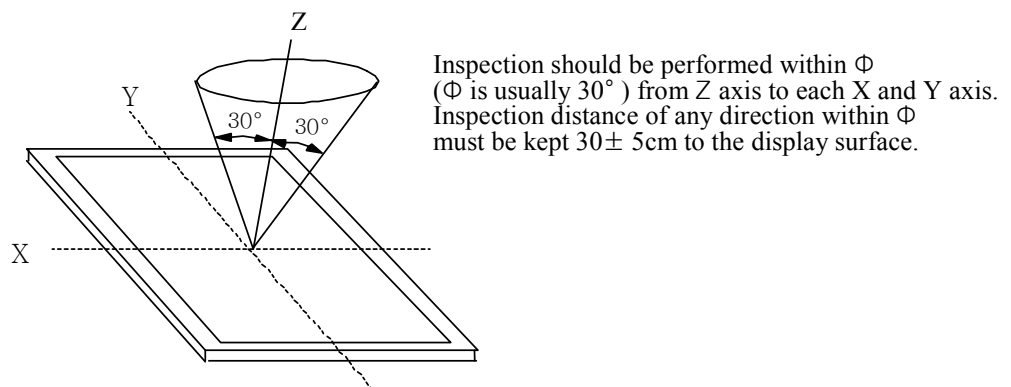
8.4.1. Definition of Black/White Spot or Line

Item	Criterion for defects
Black/White Spot (Stain Dust)	Points on the display which appear Black/White and remain unchanged in size
Black/White Line (lint)	Lines on the display which appear Black/White and remain unchanged in size

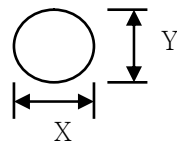
(1) Light method



(2) Inspection distance and angle



8-5. Incoming Inspection standards

Item	Criterion for defects	Type																												
1) Display on Inspection	<ul style="list-style-type: none">- Non display is not allowed.- Irregular (abnormal) operations are not allowed.- Shorts pattern, pattern missing are not allowed.- Over current is not acceptable.- No Back lighting is reject.- Backlight flickering abnormal lighting are reject.- Out of Maximum rating	Major																												
2) Black & White Spot/ Pin hole/ Particle (Ø = (X+Y)/2) 	<table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Q'ty</th></tr><tr><th>A,</th><th>B</th><th>C</th></tr><tr><td>Ø ≤ 0.10</td><td>Acceptable</td><td>Acceptable</td><td rowspan="3">Acceptable</td></tr><tr><td>0.10 < Ø ≤ 0.25</td><td>3</td><td>3</td></tr><tr><td>0.25 < Ø</td><td>0</td><td>0</td></tr></table> <p>Note : NG if three or more spot crowd together.</p>	Zone Size (mm)	Acceptable Q'ty			A,	B	C	Ø ≤ 0.10	Acceptable	Acceptable	Acceptable	0.10 < Ø ≤ 0.25	3	3	0.25 < Ø	0	0	Minor											
Zone Size (mm)	Acceptable Q'ty																													
	A,	B	C																											
Ø ≤ 0.10	Acceptable	Acceptable	Acceptable																											
0.10 < Ø ≤ 0.25	3	3																												
0.25 < Ø	0	0																												
3) Black/White Line/ Scratch	<table><tr><th colspan="2">Size (mm)</th><th colspan="3">Acceptable Q'ty</th></tr><tr><th>Width (mm)</th><th>Length (mm)</th><th>A</th><th>B</th><th>C</th></tr><tr><td>W ≤ 0.03</td><td>-</td><td colspan="2">Acceptable</td><td rowspan="3">Acceptable</td></tr><tr><td>0.03 ≤ W ≤ 0.05</td><td>L ≤ 3.0</td><td colspan="2">3</td></tr><tr><td>0.05 ≤ W ≤ 0.1</td><td>L ≤ 2.0</td><td colspan="2">2</td></tr><tr><td>0.1 ≤ W</td><td>-</td><td colspan="3">Counted as spot defect</td></tr></table> <p>Note: Linear shaped bubble will be considered as scratch.</p>	Size (mm)		Acceptable Q'ty			Width (mm)	Length (mm)	A	B	C	W ≤ 0.03	-	Acceptable		Acceptable	0.03 ≤ W ≤ 0.05	L ≤ 3.0	3		0.05 ≤ W ≤ 0.1	L ≤ 2.0	2		0.1 ≤ W	-	Counted as spot defect			Minor
Size (mm)		Acceptable Q'ty																												
Width (mm)	Length (mm)	A	B	C																										
W ≤ 0.03	-	Acceptable		Acceptable																										
0.03 ≤ W ≤ 0.05	L ≤ 3.0	3																												
0.05 ≤ W ≤ 0.1	L ≤ 2.0	2																												
0.1 ≤ W	-	Counted as spot defect																												
4) Dent on polarizer	<table><tr><th rowspan="2">Size (mm)</th><th colspan="3">Acceptable Q'ty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Ø ≤ 0.20</td><td colspan="3" rowspan="4">Acceptable</td></tr><tr><td>0.20 ≤ Ø ≤ 0.30</td></tr><tr><td>0.30 ≤ Ø ≤ 0.50</td></tr><tr><td>0.50 < Ø</td></tr></table>	Size (mm)	Acceptable Q'ty			A	B	C	Ø ≤ 0.20	Acceptable			0.20 ≤ Ø ≤ 0.30	0.30 ≤ Ø ≤ 0.50	0.50 < Ø	Minor														
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Ø ≤ 0.20	Acceptable																													
0.20 ≤ Ø ≤ 0.30																														
0.30 ≤ Ø ≤ 0.50																														
0.50 < Ø																														
5) Bubble in polarizer	<table><tr><th rowspan="2">Size (mm)</th><th colspan="3">Acceptable Q'ty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>Ø ≤ 0.15</td><td colspan="2" rowspan="4">Acceptable</td><td rowspan="4">Acceptable</td></tr><tr><td>0.15 < Ø ≤ 0.30</td></tr><tr><td>0.30 < Ø ≤ 0.50</td></tr><tr><td>0.50 < Ø</td></tr></table>	Size (mm)	Acceptable Q'ty			A	B	C	Ø ≤ 0.15	Acceptable		Acceptable	0.15 < Ø ≤ 0.30	0.30 < Ø ≤ 0.50	0.50 < Ø	Minor														
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Ø ≤ 0.15	Acceptable		Acceptable																											
0.15 < Ø ≤ 0.30																														
0.30 < Ø ≤ 0.50																														
0.50 < Ø																														
6) Dot defect (TFT)	<table><tr><th>Item</th><th>Acceptable Q'ty</th></tr><tr><td>Bright Dot</td><td>0</td></tr><tr><td>Dark Dot</td><td>2</td></tr></table>	Item	Acceptable Q'ty	Bright Dot	0	Dark Dot	2	Minor																						
Item	Acceptable Q'ty																													
Bright Dot	0																													
Dark Dot	2																													

7) Stains on LCD panel surface	Stains which cannot be removed even when wiped Lightly with a soft cloth or similar cleaning too are reject	Minor
8) Back-light	1)The brightness and color of Backlight should Correspond it is in specification 2) Dust and black dot on Back light : $\phi \leq 0.20$.	Minor
9) Defect of land surface contact (Poor soldering)	Evident crevices which is visible are reject	Minor
10) Parts mounting	1) Failure to mount parts 2) Parts not in the specifications are mounted 3) Polarity is reversed	Minor
11) Parts alignment	1) LSI, IC lead width is more then 50% beyond pad outline. 2) Chip component is off center and more then 50% of the leads is off the pad outline.	Major
12) Solder Ball, Solder chip	1) $0.45 < \phi$, $N \geq 1$ 2) $0.30 < \phi \leq 0.45$, $N \geq 1$ 3) $0.50 < L$, $N \geq 1$ - ϕ : Average diameter of solder ball (unit: mm) - L: Average length of solder chip (unit: mm)	Major Minor Minor
13) Faulty PWB correction	1) Failure to stamp or label error, or not legible (all acceptable if legible) 2) The separation is more than 1/3 forbidden indication, Discoloration, In which the characters can be checked	Minor

9. Reliability

- Operating life time : Longer than 50,000 Hrs.

All test result of items should be judged in one hour recovery time.

Item	Conditions	Criteria
High temperature operating	60℃ , 96 hrs	<ul style="list-style-type: none"> - After testing, cosmetic and operational defects should not happen. - Contrast ratio should be within 90% of initial value. - Total current consumption should be below double of initial value.
Low temperature operating	-20℃ , 96 hrs	
High temperature storage	70℃ , 96 hrs	
Low temperature storage	-30℃ , 96 hrs	
Humidity	50℃ , 90%RH, 96 hrs	
Thermal shock	25℃→-30℃→25℃→80℃ 5(min) 30(min) 5(min) 30(min) 5 cycle, 55～60%RH	
Temperature Humidity cycle	JIS.C.0028.1, 5 cycles	<ul style="list-style-type: none"> - Not allowed cosmetic & electrical defects - Test will be performed at state of carton box, not each module.
Vibration	Time : 2hrs Direction : x, y, z Frequency : 10~55~10Hz Amplitude : 1.5mm(double)	
Static electricity	150 Pf, 330 ohm , ±8kV 10 times, air discharge	

10. General Precautions

10-1. Handling

- Assembled LCD module should be firmly attached to the set.
Do not bent or twist.
- Refrain from strong mechanical shock and forces to the module.
It may cause improper operating or damage to the module.
- Do not touch, press or rub the display panel with hard or stiff tools or subjects.
The polarizer is easily damaged.
- Wipe off water or oil drop immediately
If you leave drop for a long time, stain and discoloration may occur.
- When cleaning the surface of polarizer, use soft cloth with solvent like Isopropyl or Ethyl alcohol or Hexane.
Do not use Water, Ketone, Acetone, Ethyl alcohol, Toluene, Ethyl acid, Methyl chloride.
- Be care full of applying HCFC, Chlorine(CL), Salfur(S), Spittle, Fingerprint to ITO pattern.
These may cause ITO corrosion.
- When handling the LCD module, put on a soft glover like finger-glover.
- Protection film on the polarizer shall be slowly peeled off just before use,
so that the electrostatic charge can be minimized.
- Do not touch pads or pins of interface directly with bare hands.
- Protect the module from static electricity, it may cause damage to CMOS LSI.
- If the liquid crystal leaks from the panel it should be kept away from the eyes and mouths.
In case of contact with skins, wash away thoroughly with soap and water.

10-2. Operation

- Do not input any signals before power is turned on.
- Do not connect or disconnect the module on the state of Power-ON.
- Power supply should be turned on or off according to Power ON/OFF sequence.
- Supply voltage within the specified voltage limit, the maximum rating, higher voltage cause the shorter LCD life or damaged.
- Avoid condensation of water, It may cause improper operation or disconnection of electrode.
- Do not leave LCD module in direct sunlight and strong ultraviolet ray for many hours.
At that time the liquid crystal shall be deteriorated by ultraviolet.

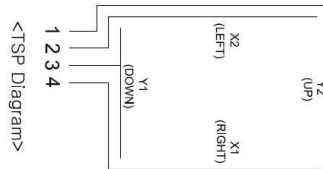
10-3. Storage

- Do not leave the module in high temperature and humidity for a long time.
It is recommended to store the module in the place with temperature from 0 to 35 °C and relative humidity of less than 70%.
- Do not store the LCD module in the direct sunlight.
- Store the module in a dark place without sunlight and fluorescent.
- Avoid intensive shock and falls from a height.
- Please keep the LCDs in the specified, original packing boxes when storage.

11. Dimensional Outline

50PIN TABLE

NO.	SYMBOL
1	VCOM
2	IND
3	VCC
4	VCC
5	STR
6	ENABLE
7	VSYNC
8	HSYNC
9	DOTCLK
10	R0R
11	R01
12	R02
13	R03
14	R04
15	R05
16	R06
17	R07
18	IND
19	ND
20	VDD
21	G00
22	G01
23	G02
24	G03
25	G04
26	G05
27	G06
28	G07
29	B00
30	B01
31	B02
32	B03
33	B04
34	B05
35	B06
36	B07
37	POL
38	VCC
39	GND
40	LRC
41	UD
42	VSTRT
43	RSTB
44	GND
45	VGH
46	VGL
47	VCC
48	GND
49	VGL
50	VCOM



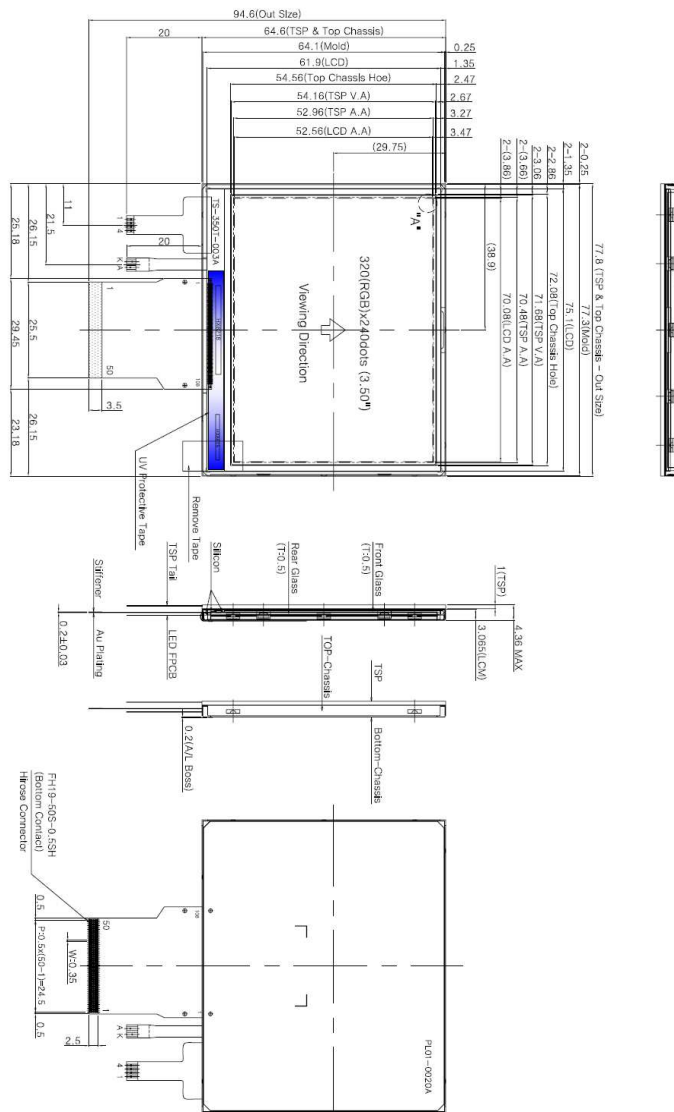
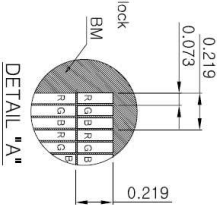
1 2 3 4
<TSP Diagram>

1	Y2 (YU)
2	X2 (XL)
3	Y1 (YD)
4	X1 (XR)

<TSP PIN>

NOTES

1. Display type
: TFT(3.50"), 16.7M-Color, T/M, Negative, 6.0 clock
2. Driver LSI
: HX8218 (Source), HX6815 (Gate)
3. Operating Temperature
: -20°C TO 60°C
4. Storage Temperature
: -30°C TO 70°C
5. Backlight
: 6-Chip(1-WAY), Serial
6. Interface mode
: Digital RGB 24bit

[illegible]

12. Packing Specification

