



ASI-T-350ZB2BT/A

Item	Contents	Unit
LCD type	TFT/Transmissive/Normally white	/
Size	3.5	Inch
Viewing direction	6:00 (without image inversion and least brightness change)	O' Clock
Gray scale inversion direction	12:00 (contrast peak located at)	O' Clock
LCM (W × H × D)	54.66×82.90×3.45	mm ³
Active area (W×H)	48.96×73.44	mm ²
Pixel pitch (W×H)	0.153×0.153	mm ²
Number of dots	320 (RGB) × 480	/
Driver IC	ILI9488	/
Backlight type	6 LEDs	/
Interface type	(1)3-/4- wire SPI	/
	(2)16-/18-bit RGB + 3-/4- wire SPI	/
	(3)8-/9-/16-/18-bit parallel CPU	/
Color depth	262K	/
Pixel configuration	R.G.B vertical stripe	/
Input voltage	2.8	V
With/Without TSP	With TSP	/
Weight	TBD	g

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■ GENERAL INFORMATION

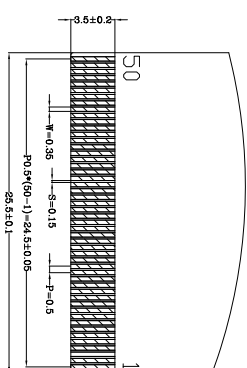
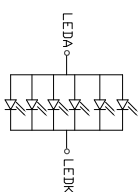
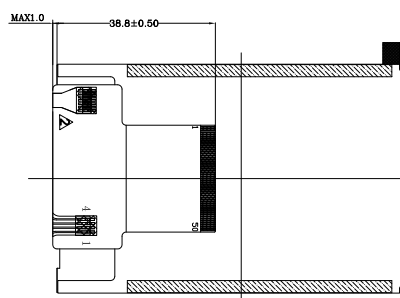
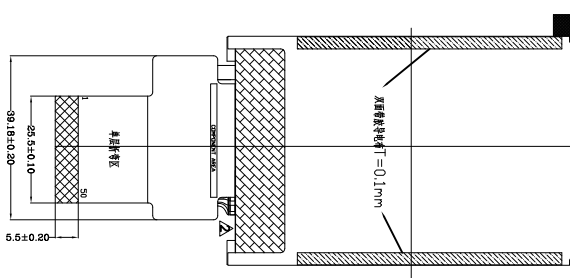
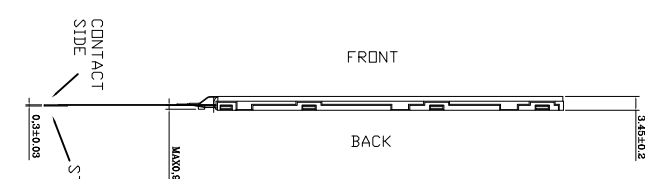
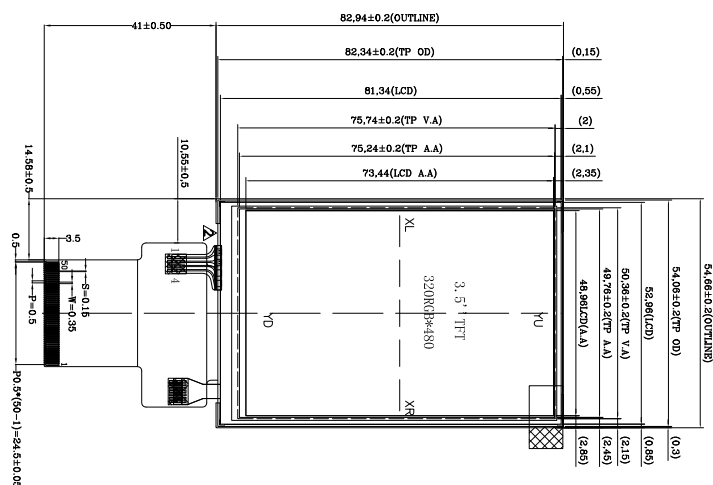
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	(3)8-/9-/16-/18-bit parallel CPU	/
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Pixel configuration	R.G.B vertical stripe	/
Input voltage	2.8	V
With/Without TSP	With TSP	/
Weight	TBD	g

Note 1: RoHS compliant;

Note 2: LCM weight tolerance: ± 5% .

■ EXTERNAL DIMENSIONS



2	LEDA
3	LEDA
4	LEDA
5	LEDA
6	IM0
7	IM1
8	IM2
9	IM3
10	RESET
11	VSVMC
12	HSVMC
13	DDTCLK
14	DE7
15	DB7
16	DB6
17	DB5
18	DB4
19	DB3
20	DB2
21	DB11
22	DB10
23	DB9
24	DB8
25	DB6
26	DB5
27	DB4
28	DB3
29	DB2
30	DB1
31	DB0
32	DB0
33	SU0
34	SU1
35	RD
36	WRXSEL
37	DCX
38	DCX
39	TE
40	VD01
41	VD01
42	VCI
43	GND
44	X-DB7
45	X-DB6
46	X-DB5
47	X-DB4
48	X-DB3
49	GND





NOTES:

1. DISPLAY TYPE: TFT, TRANSMISSIVE, NORMAL WHITE
2. DRIVING VOLTAGE: VDD1/VCI=2.8V
3. VIEWING DIRECTION: 6 O'CLOCK.
4. IC DRIVER: ILI9488
5. OPERATING TEMP: -20°C ~ 70°C.
6. STORAGE TEMP: -30°C ~ 80°C.
7. INTERFACE: 8/9/16/18-BIT 8080 or RGB or SPI.
8. LED BACKLIGHT: 6-LED WHITE
9. SURFACE LUMINANCE: 290cd/m².
10. GENERAL TOLERANCE: ±0.2.
11. RECOMMENDED CASE OPEN AREA SHOULD BE LESS THAN MODULE V.A.
12. RECOMMENDED CUSHION ADHERENT AREA: TP V.A+1.6mm.
13. ROHS COMPLIANT.

CIRCUIT DIAGRAM

02	Modify the PPC design	2016.10.12	CHECKED BY:		UNIT:	DESCRIPTION: TFT MODULE
01	First issue	2014.03.10	APPROVED BY:			
VER.	REVISED DESCRIPTION	DATE	VERSION NO.	02	 	

DRAWN BY:	RITA	2016.10.12	SCALE : 1/1	MODULE P/N:
CHECKED BY:				
APPROVED BY:				
VERSION NO:	02			
		UNIT:		
		mm		
				DESCRIPTION:
				TFT MODULE

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Supply voltage for logic	VDDI	-0.3	3.3	V
Input voltage for analog	VCI	-0.3	3.3	V
Supply current (one LED)	I _{LED}	-	30	mA
Operating temperature	T _{OP}	-20	70	°C
Storage temperature	T _{ST}	-30	80	°C

■ ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min	Typ	Max	Unit
Supply voltage for logic	VDDI	1.8	2.8	3.3	V
Supply voltage for analog	VCI	2.5	2.8	3.3	V
Input voltage 'H' level	V _{IH}	0.8VDDI	-	VDDI	V
Input voltage 'L' level	V _{IL}	-0.3	-	0.2VDDI	V
Input leakage current	I _{LKG}	-	-	-	μA

■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Voltage for LED backlight	VL	3.0	3.2	3.4	V	
Current for LED backlight	IL	-	120	-	mA	
LED life time	-	30,000	50,000	-	Hr	

■ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time		Tr+Tf	$\theta=0^{\circ}$ $\varnothing=0^{\circ}$ Ta=25°C	-	16	32	ms	FIG 1.	4
Contrast ratio		Cr		400	500	-	---	FIG 2.	1
Luminance uniformity		δ WHITE		80	85	-	%	FIG 2.	3
Surface Luminance		Lv		-	290	-	cd/m ²	FIG 2.	2
Viewing angle range		θ	$\varnothing = 90^{\circ}$	60	70	-	deg	FIG 3.	6
			$\varnothing = 270^{\circ}$	40	60	-	deg	FIG 3.	
			$\varnothing = 0^{\circ}$	60	70	-	deg	FIG 3.	
			$\varnothing = 180^{\circ}$	60	70	-	deg	FIG 3.	
CIE (x, y) chromaticity	Red	x	$\theta=0^{\circ}$ $\varnothing=0^{\circ}$ Ta=25°C	-	0.633	-	FIG 2.	5	
		y		-	0.329	-			
	Green	x		-	0.297	-			
		y		-	0.577	-			
	Blue	x		-	0.133	-			
		y		-	0.129	-			
	White	x		-	0.290	-			
		y		-	0.330	-			

Note 1. Contrast Ratio(CR) is defined mathematically as For more information see FIG 2.

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P3, P4, P5)}}$$

Note 2. Surface luminance is the LCD surface from the surface with all pixels displaying white. For more information see FIG 2.

$$L_v = \text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}$$

Note 3. The uniformity in surface luminance , δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see FIG 2.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}$$

Note 4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1. The test equipment is Autronic-Melchers's ConoScope. Series.

Note 5. CIE (x, y) chromaticity, The x, y value is determined by measuring luminance at each test position 1 through 5, and then make average value.

Note 6. Viewing angle is the angle at which the contrast ratio is greater than 2. For TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 3.

Note 7. For viewing angle and response time testing, the testing data is base on Autronic-Melchers's ConoScope. Series Instruments For contrast ratio, Surface Luminance, Luminance uniformity, CIE The test data is base on TOPCON's BM-5 photo detector.

FIG. 1 The definition of Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.

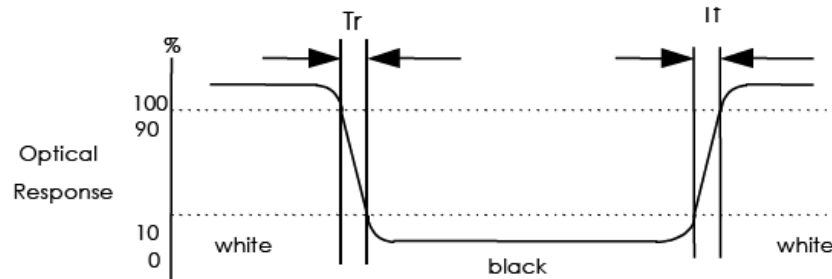


FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity

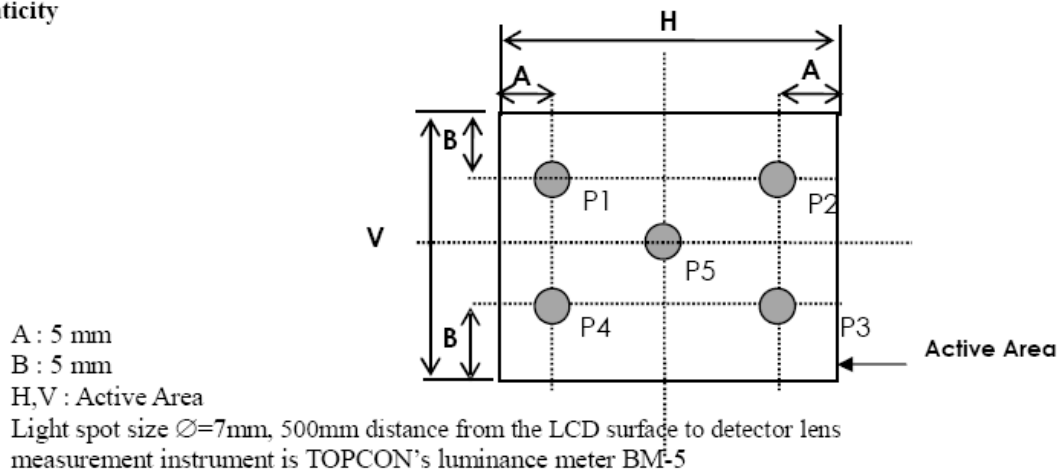
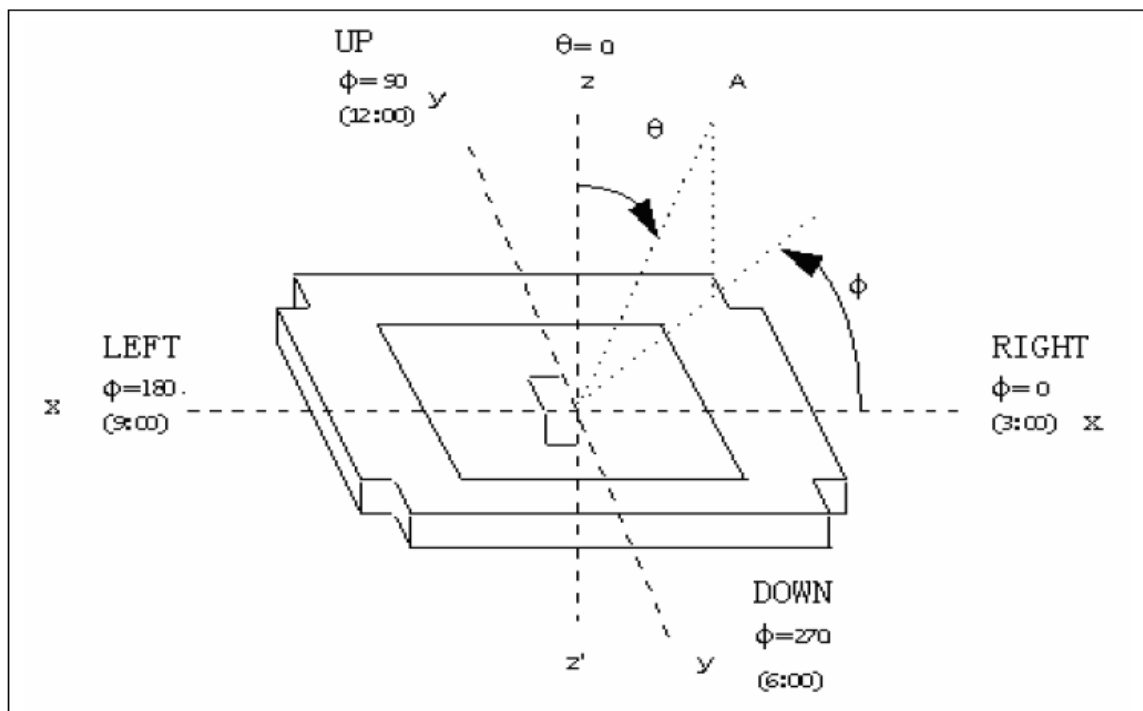


FIG. 3 The definition of viewing angle



■ INTERFACE DESCRIPTION

Pin No.	Symbol	Description
1	LEDK	Cathode of LED backlight
2	LEDA	Anode of LED backlight
3	LEDA	Anode of LED backlight
4	LEDA	Anode of LED backlight
5	LEDA	Anode of LED backlight
6	IM0	Interface mode select (Note)
7	IM1	
8	IM2	
9	NC	No connect
10	RESET	RESET PIN
11	VSYNC	Vertical signal syn
12	HSYNC	Horizontal signal syn
13	DOTCLK	Pixel clock signal
14	DE	Data enable signal
15-32	DB17-DB0	Data bus.
33	SDO	Serial data output
34	SDI	Serial data input
35	RD	A read strobe signal and enables an operation to read out data when the signal is low.
36	WRX/SCL	A write strobe signal and enables an operation to write data when the signal is low.
37	D/CX	Data or command signal select
38	CS	Chip select
39	TE	Tearing effective syn
40	VDDI	Power supply
41	VDDI	Power supply
42	VCI	Power supply
43	GND	Ground
44	X+ (XR)	TP pin
45	Y- (YD)	TP pin
46	X- (XL)	TP pin
47	Y+ (YU)	TP pin
48	GND	Ground
49	GND	Ground
50	GND	Ground

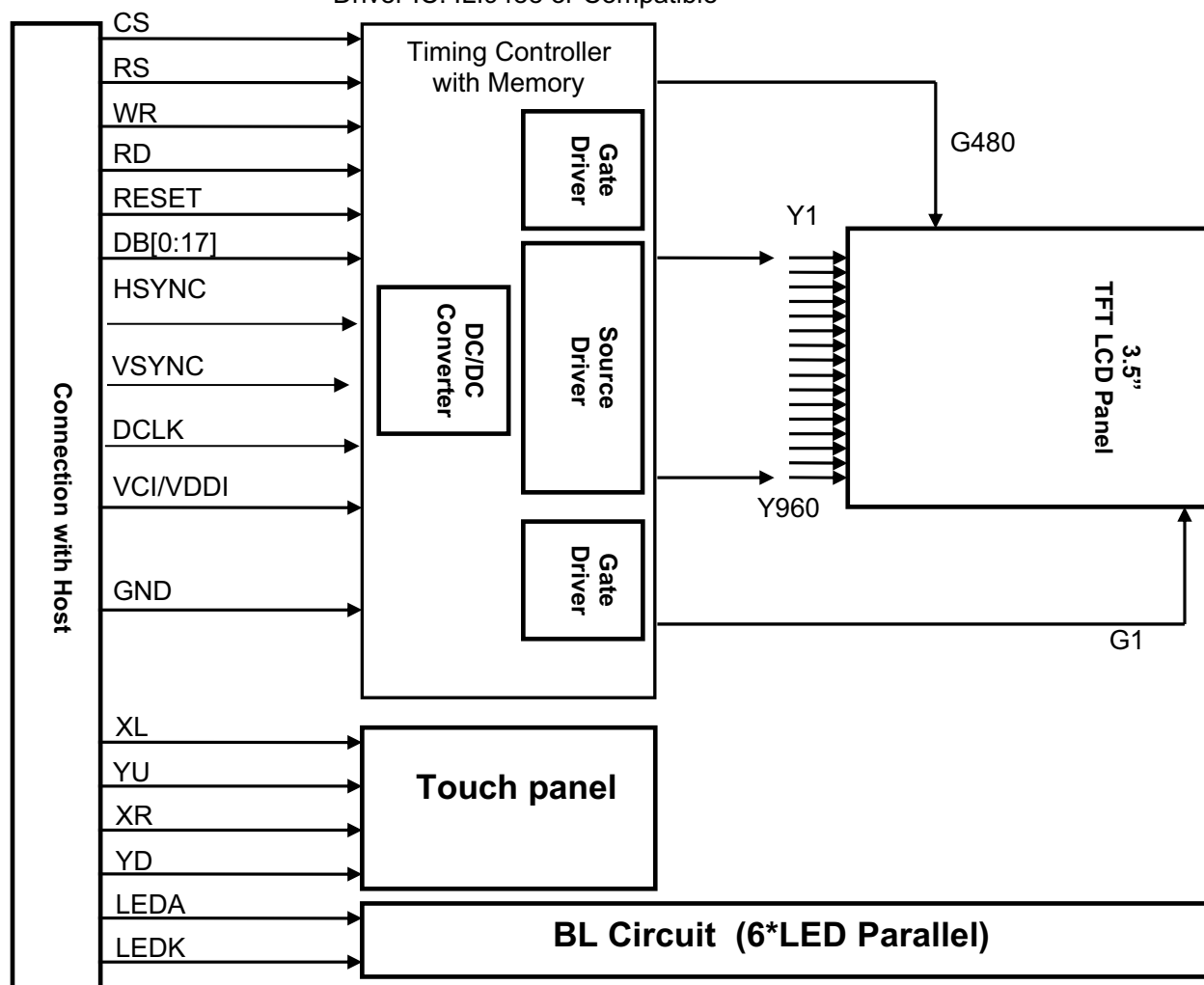
Note :

MIPI-DBI Type B				
IM2	IM1	IM0	Interface	Data Pin in Use
0	0	0	18-bit bus (DB_EN=0)	DB [17:0]
0	0	1	9-bit bus	DB [8:0]
0	1	0	16-bit bus	DB [15:0]
0	1	1	8-bit bus	DB [7:0]

MIPI-DBI Type C				
1	0	1	Option1 (3-line SPI)	SDA,SDO
1	1	1	Option3 (4-line SPI)	SDA,SDO

■ BLOCK DIAGRAM

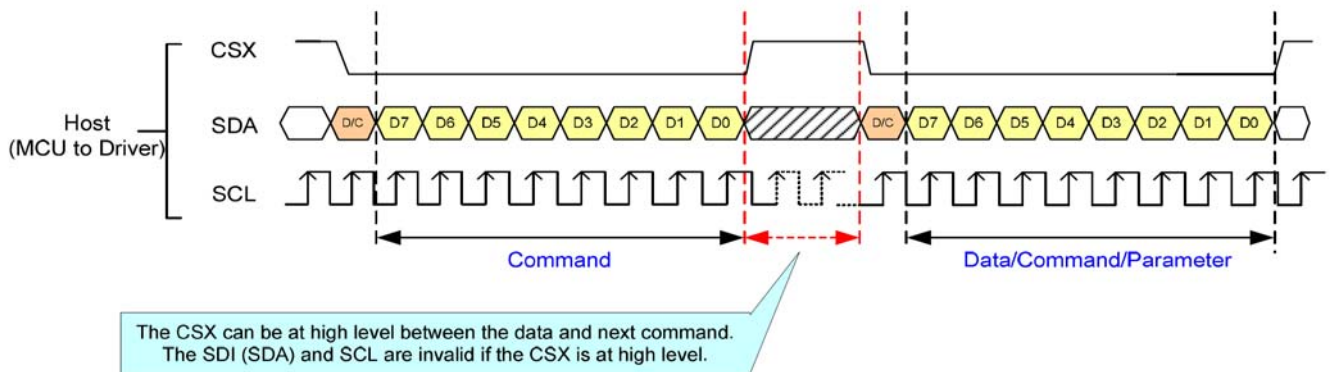
Driver IC: ILI9488 or Compatible



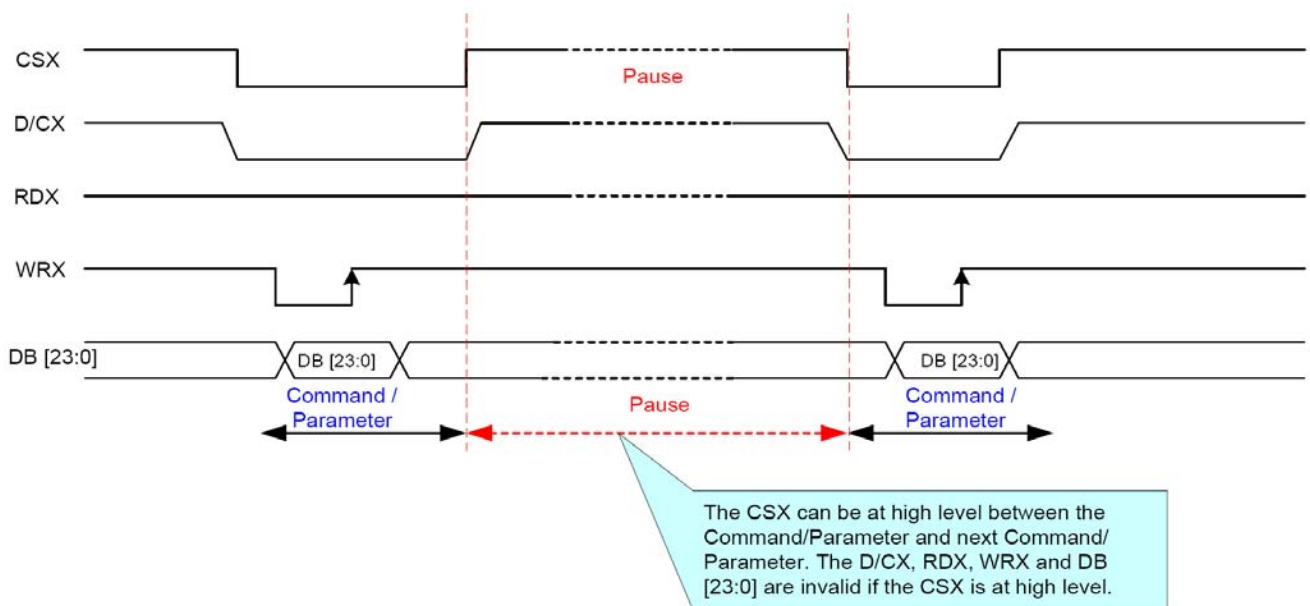
■ APPLICATION NOTES

1 Timing chart

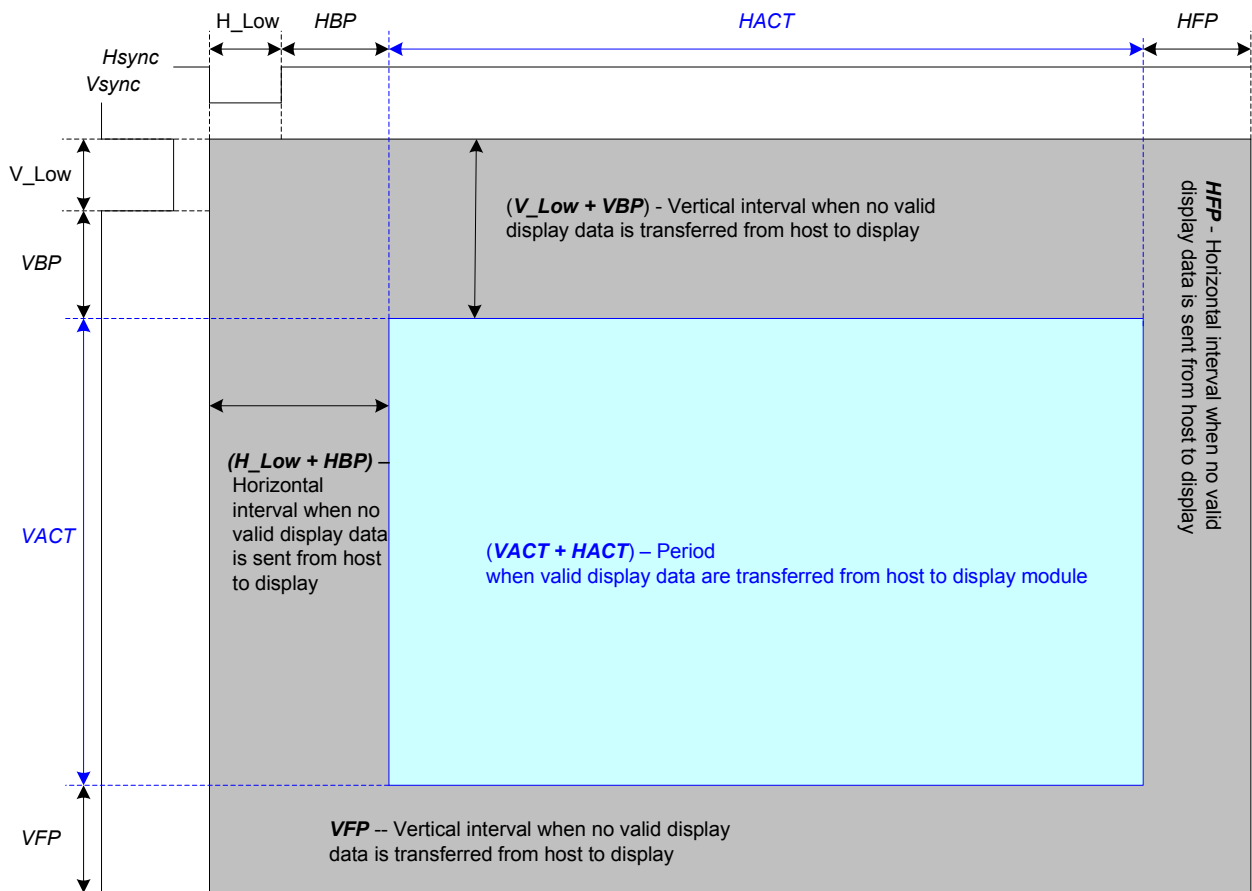
1.1 Serial Interface Pause



1.2 Parallel Interface Pause



1.3 RGB Interface Timing

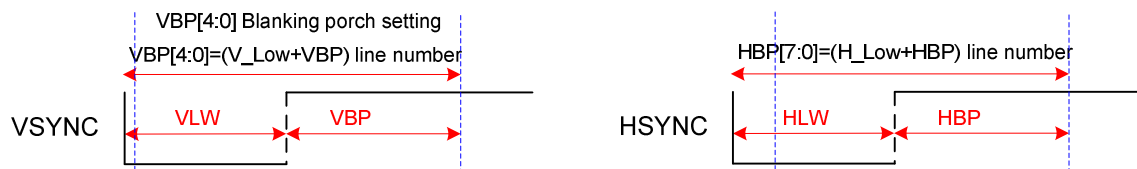


General DPI Timing Diagram

Parameters	Symbols	Min.	Typ.	Max.	Units
Horizontal Synchronization	H_Low	3	-	$H_Low + HBP < 192$	DOTCLK
Horizontal Back Porch	HBP	3	-		DOTCLK
Horizontal Front Porch	HFP	3	-	255	DOTCLK
Horizontal Address	$HACT$	-	320	-	DOTCLK
Horizontal Frequency		-	-	33	KHz
Vertical Synchronization	V_Low	1	-	$V_Low + VBP + VFP < 32$	Line
Vertical Back Porch	VBP	2	-		Line
Vertical Front Porch	VFP	2	-		Line
Vertical Address	$VACT$	-	480	-	Line
Vertical Frequency		60	-	70	Hz
DOTCLK cycle		100	-	50	ns
DOTCLK Frequency		10	-	20	MHz

Example : DOTCLK = 20Mhz, TE=70Hz, $V_Low + VBP = 2$, $VFP = 2$, $H_Low + HBP = 100$, $HFP = 170$.

Note: $VBP[4:0]/HBP[7:0]$ (Blanking Porch Control, RB5h) define as follows:



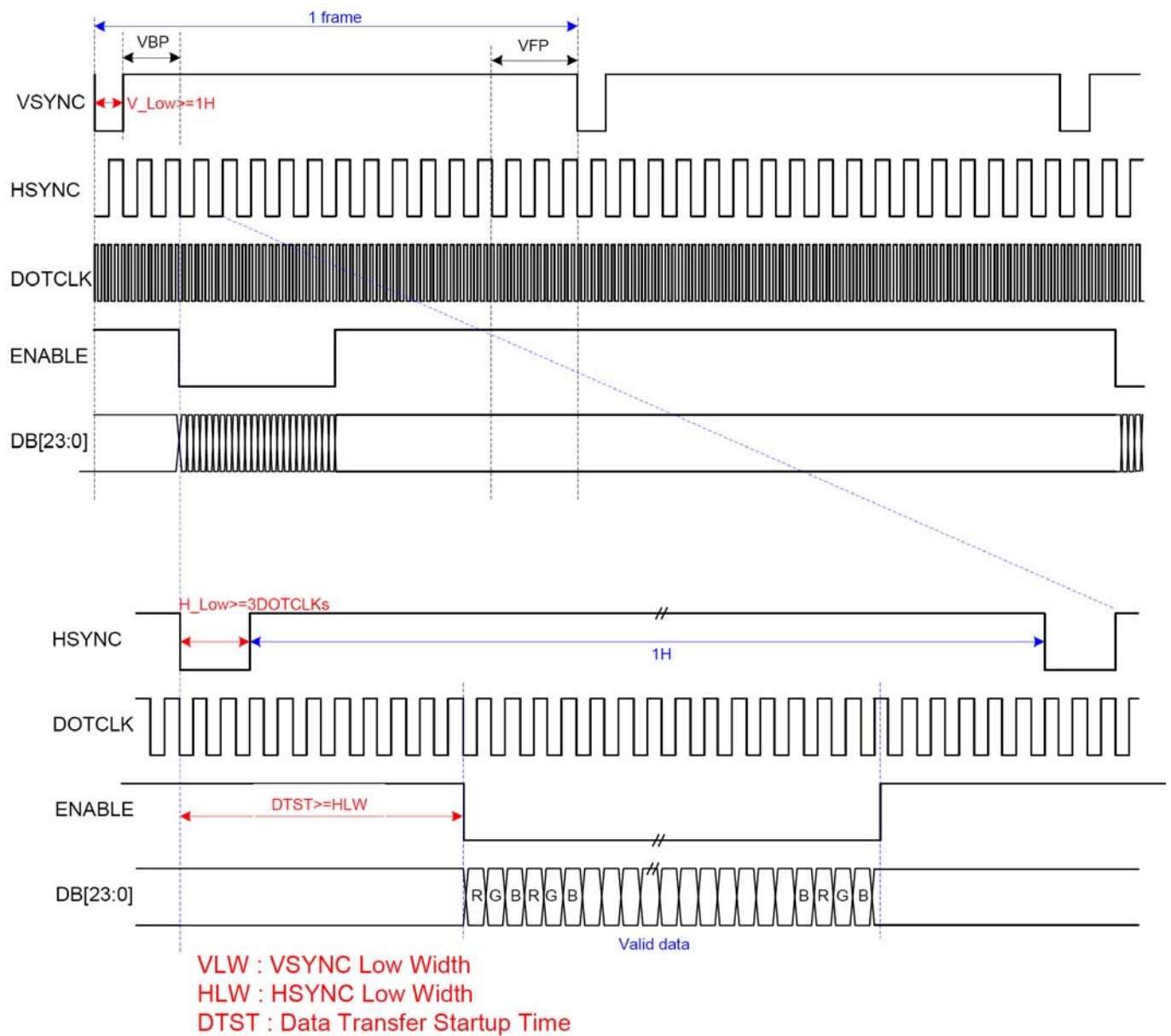


Figure 19: DPI Interface Timing Diagram

Note: VSPL = 0, HSPL = 0, DPL = 0 and EPL = 0 of Interface Mode Control B0h command.

■ TOUCH PANEL SPECIFICATIONS

1 Electrical Characteristics

ITEM	SPECIFICATIONS			UNIT	REMARK
	MIN.	TYP.	MAX.		
Linearity	-1.5	-	1.5	%	After environment & life test
Terminal Resistance	-	400	-	ohm	X(Film side)
	350	-	500	ohm	Y(Glass side)
Insulation Resistance	20	-	-	Mohm	DC 25V 1min
Operating Voltage	-	5	-	V	DC

2 Optical Characteristics

ITEM	SPECIFICATIONS			UNIT	REMARK
	MIN.	TYP.	MAX.		
Response Time	-	-	10	ms	100kohm pull-up
Light Transparency	75	-	-	%	

3 Mechanical Characteristics

ITEM	SPECIFICATIONS			UNIT	REMARK
	MIN.	TYP.	MAX.		
Operation Force	-	100	-	gf	Note1
Surface Hardness	3	-	-	H	
Pen Sliding Durability	100,000			times	Note2
Hitting Durability	1,000,000			times	Note3

Note 1: Do not operate it with a thing except a polyacetal pen (tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

Depending on the pitch & the dimension of the spacer dots in between.

Note 2: Measurement for surface area.

-Scratch 100,000 times straight line on the film with a stylus change every 20,000 times.

-Force: 100gf.

-Speed: 60mm/sec.

-Stylus: R0.8 polyacetal tip.

Note 3: Hit 1,000,000 times on the film with an R12.5mm tip.

-Force: 250gf.

-Speed: 2 times/sec.

■ RELIABILITY TEST

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	$80 \pm 2^{\circ}\text{C}/240\text{hours}$	1. Functional test is OK. Missing Segment, short, unclear segment, non-display, display abnormally and liquid crystal leak are un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temperature Storage	$-30 \pm 2^{\circ}\text{C}/240\text{hours}$	
3	High Temperature Operating	$70 \pm 2^{\circ}\text{C}/240\text{hours}$	
4	Low Temperature Operating	$-20 \pm 2^{\circ}\text{C}/240\text{hours}$	
5	Temperature Cycle	$-20 \pm 2^{\circ}\text{C} \sim 25 \sim 70 \pm 2^{\circ}\text{C} \times 10\text{cycles}$ (30min.) (5min.) (30min.)	
6	Damp Proof Test	$40^{\circ}\text{C} \pm 5^{\circ}\text{C} \times 90\%\text{RH}/240\text{hours}$	1. Function test is OK. 2. No glass crack, chipped glass, end seal loose and fall, epoxy frame crack 3. No structure loose and fall.
7	Vibration Test	Frequency: 10Hz~55Hz Amplitude: 1.0mm, Each direction on X,Y axe 0.5 hours, circle 2 hours	
8	Dropping test	Drop to the ground from 80cm height, one time, every side of carton.	

■ INSPECTION CRITERION

1. Inspection Conditions

Inspection performed under the following conditions is recommended.

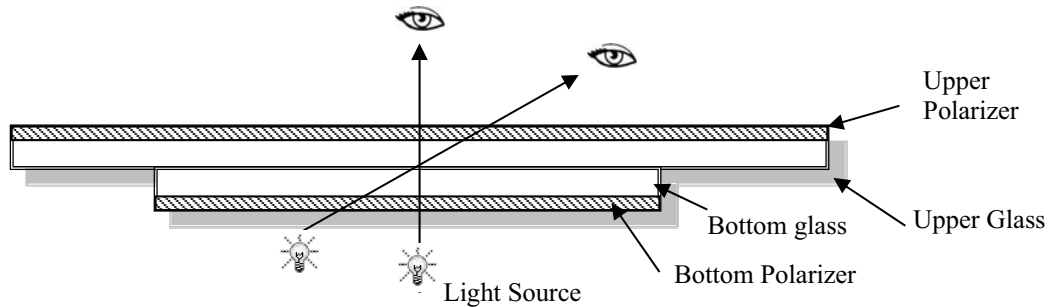
Temperature : $25 \pm 5^{\circ}\text{C}$

Humidity : $65\% \pm 10\% \text{RH}$

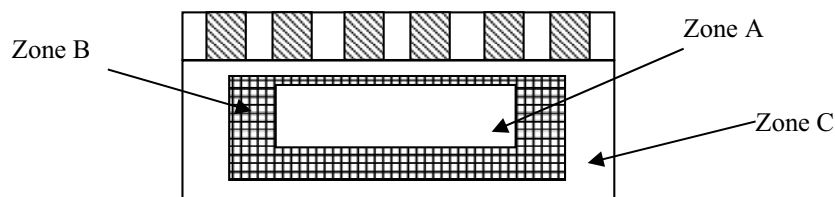
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance: 30-50cm



2. Definition



Zone A : Effective Viewing Area (Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note:

As a general rule , visual defects in Zone C can be ignored when it doesn' t effect product function
or appearance after assembly by customer.

3. Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II

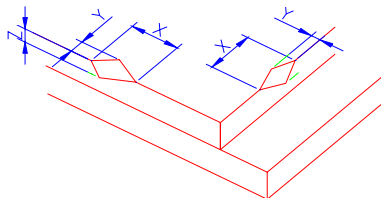
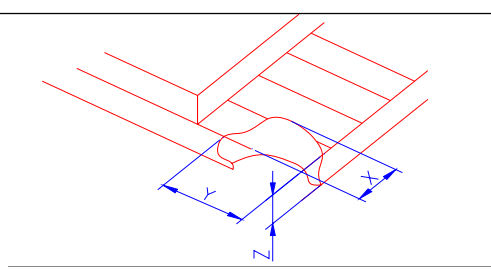
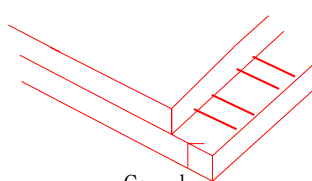
AQL:

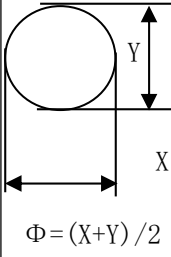
Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module




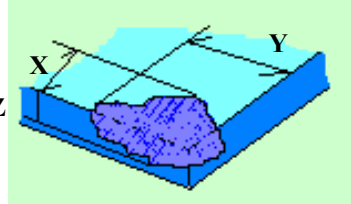
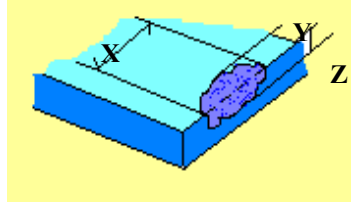
No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

4. Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD	(1) The edge of LCD broken	<div></div> <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
(2)LCD corner broken	<div></div> <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
(3) LCD crack	<div></div> <div>Crack Not allowed</div>							

Number	Items	Criteria (mm)																																																								
2.0	<div>Spot defect</div> <div></div> <div>① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)</div> <table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$\Phi \leq 0.10$</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.10 < \Phi \leq 0.15$</td><td colspan="2">3(distance $\geq 10\text{mm}$)</td></tr><tr><td>$0.15 < \Phi \leq 0.2$</td><td colspan="2">1</td></tr><tr><td>$0.2 < \Phi$</td><td colspan="2">0</td></tr></table> <div>②Dim spot (LCD/TP/Polarizer dim dot, light leakage、dark spot)</div> <table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$\Phi \leq 0.1$</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.1 < \Phi \leq 0.2$</td><td colspan="2">2(distance $\geq 10\text{mm}$)</td></tr><tr><td>$0.2 < \Phi \leq 0.3$</td><td colspan="2">1</td></tr><tr><td>$\Phi > 0.3$</td><td colspan="2">0</td></tr></table> <div>③ Polarizer accidented spot</div> <table><tr><th rowspan="2">Zone Size (mm)</th><th colspan="3">Acceptable Qty</th></tr><tr><th>A</th><th>B</th><th>C</th></tr><tr><td>$\Phi \leq 0.2$</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.2 < \Phi \leq 0.5$</td><td colspan="2">2(distance $\geq 10\text{mm}$)</td></tr><tr><td>$\Phi > 0.5$</td><td colspan="2">0</td></tr></table>	Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.10$	Ignore		Ignore	$0.10 < \Phi \leq 0.15$	3(distance $\geq 10\text{mm}$)		$0.15 < \Phi \leq 0.2$	1		$0.2 < \Phi$	0		Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.1$	Ignore		Ignore	$0.1 < \Phi \leq 0.2$	2(distance $\geq 10\text{mm}$)		$0.2 < \Phi \leq 0.3$	1		$\Phi > 0.3$	0		Zone Size (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore		Ignore	$0.2 < \Phi \leq 0.5$	2(distance $\geq 10\text{mm}$)		$\Phi > 0.5$	0	
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	Line defect (LCD/TP /Polarizer black/white line, scratch, stain)	<table><tr><td rowspan="2">Width (mm)</td><td rowspan="2">Length (mm)</td><td colspan="3">Acceptable Qty</td></tr><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>$\Phi \leq 0.03$</td><td>Ignore</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.03 < W \leq 0.05$</td><td>$L \leq 3.0$</td><td colspan="2">$N \leq 2$</td></tr><tr><td>$0.05 < W \leq 0.08$</td><td>$L \leq 2.0$</td><td colspan="2">$N \leq 2$</td></tr><tr><td>$0.08 < W$</td><td colspan="4">Define as spot defect</td></tr></table>				Width (mm)	Length (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.03$	Ignore	Ignore		Ignore	$0.03 < W \leq 0.05$	$L \leq 3.0$	$N \leq 2$		$0.05 < W \leq 0.08$	$L \leq 2.0$	$N \leq 2$		$0.08 < W$	Define as spot defect			
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3.0	Polarizer Bubble	<table><tr><td rowspan="2"><div>Size (mm) \ Zone</div></td><td colspan="3">Acceptable Qty</td></tr><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>$\Phi \leq 0.2$</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.2 < \Phi \leq 0.4$</td><td colspan="2">2 (distance $\geq 10\text{mm}$)</td></tr><tr><td>$0.4 < \Phi \leq 0.6$</td><td colspan="2">1</td></tr><tr><td>$0.6 < \Phi$</td><td colspan="2">0</td></tr></table>				<div>Size (mm) \ Zone</div>	Acceptable Qty			A	B	C	$\Phi \leq 0.2$	Ignore		Ignore	$0.2 < \Phi \leq 0.4$	2 (distance $\geq 10\text{mm}$)		$0.4 < \Phi \leq 0.6$	1		$0.6 < \Phi$	0							
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4.0	SMT	According to IPC-A-610C class II standard . Function defect and missing part are major defect ,the others are minor defect.																													
		<div>TP bubble/ accident spot</div>	<table><tr><td rowspan="2">Size Φ (mm)</td><td colspan="3">Acceptable Qty</td></tr><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>$\Phi \leq 0.1$</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>$0.1 < \Phi \leq 0.2$</td><td colspan="2">2</td></tr><tr><td>$0.2 < \Phi \leq 0.3$</td><td colspan="2">1</td></tr><tr><td>$0.3 < \Phi$</td><td colspan="2">0</td></tr></table>			Size Φ (mm)	Acceptable Qty			A	B	C	$\Phi \leq 0.1$	Ignore		Ignore	$0.1 < \Phi \leq 0.2$	2		$0.2 < \Phi \leq 0.3$	1		$0.3 < \Phi$	0							
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	Assembly deflection	beyond the edge of backlight $\leq 0.15\text{mm}$																													

5.0	TP Related			 1 规律性						
		Newton Ring	Newton Ring area>1/3 TP area NG Newton Ring area≤1/3 TP area OK	 2 非规律性						
				 似牛顿环						
		TP corner broken X: length Y: width Z: height	<table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>X≤3.0mm</td><td>Y≤3.0mm</td><td>Z<LCD thickness</td></tr></table> <p>* Circuitry broken is not allowed.</p>	X	Y	Z	X≤3.0mm	Y≤3.0mm	Z<LCD thickness	
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X	Y	Z								
X≤6.0mm	Y≤2.0mm	Z<LCD thickness								

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed

■ PRECAUTIONS FOR USING LCD MODULES

Handling Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Electro-Static Discharge Control, Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.

- Tools required for assembling, such as soldering irons, must be properly grounded. make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential

- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated



(13) Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

Handling precaution for LCM

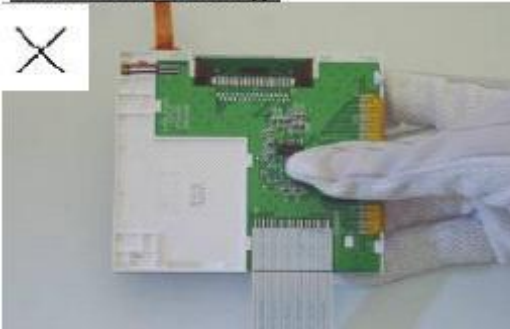
LCM is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

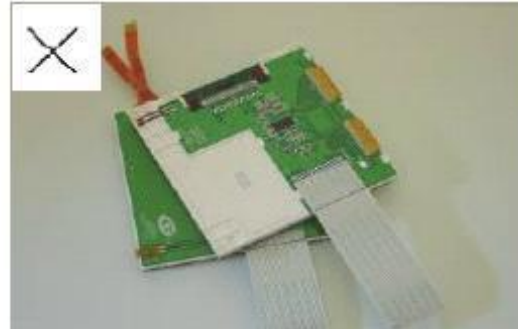


As above picture, please handle with anti-static gloves around LCM edges.

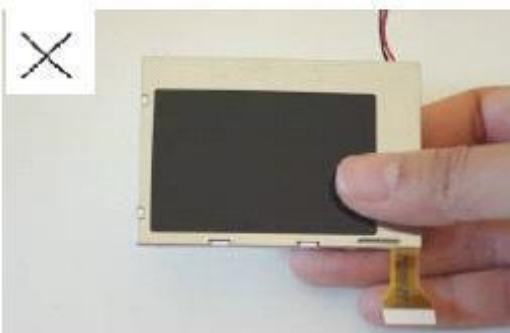
Incorrect handling:



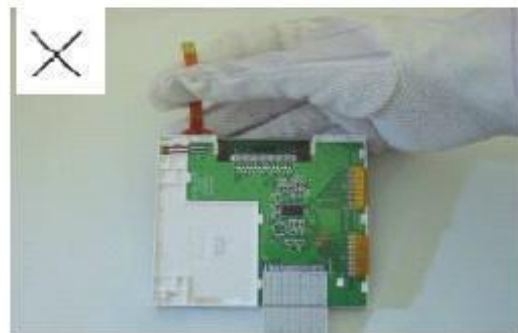
Please don't touch IC directly.



Please don't stack LCM.



Please don't hold the surface of panel.

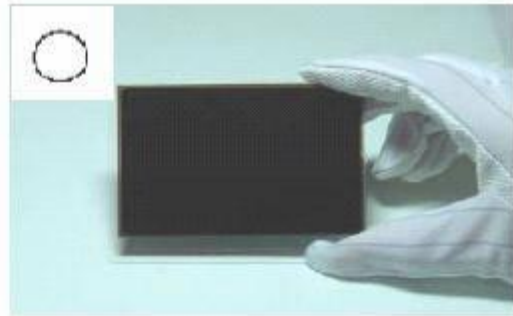


Please don't stretch interface of output, such as FPC cable.

Handling precaution for LCD

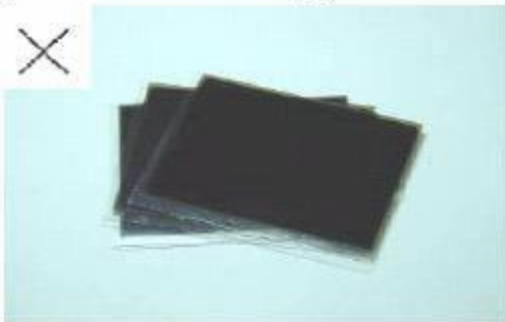
LCD is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

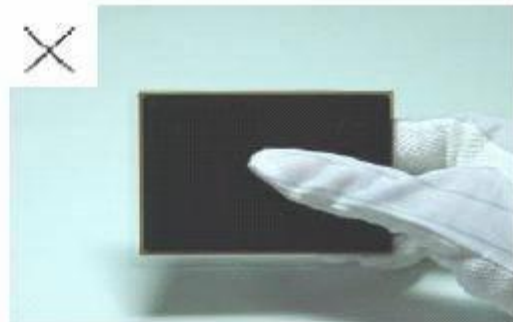


As above photo, please handle with anti-static gloves around LCD edges.

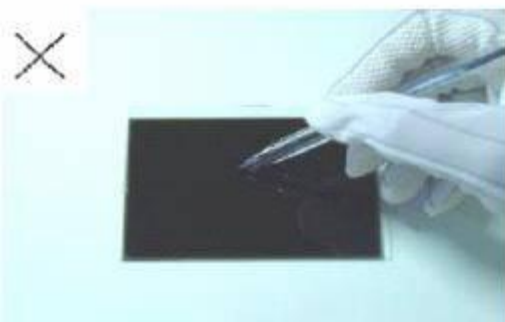
Incorrect handling:



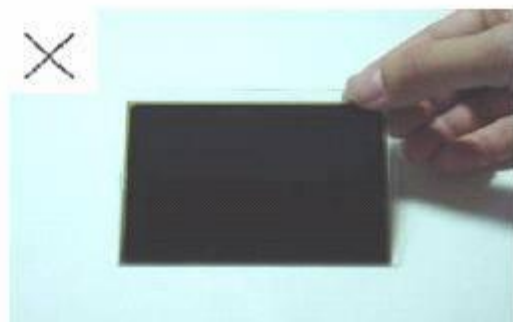
Please don't stack the LCDS.



Please don't hold the surface of LCD.



Please don't operate with sharp stick such as pens.



Please don't touch ITO glass without anti-static gloves.

Storage Precautions

When storing the LCD modules, the following precaution is necessary.

- (1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.
- (2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C, and keep the relative humidity between 40%RH and 60%RH.
- (3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the anti-static electricity container in which they were shipped.

Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

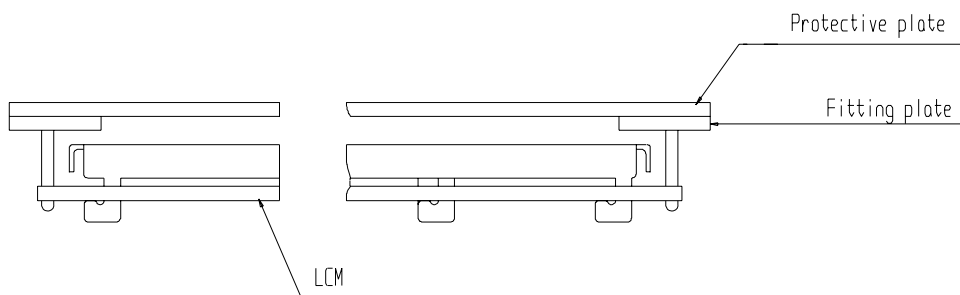
- Exposed area of the printed circuit board.
- Terminal electrode sections.

USING LCD MODULES

Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

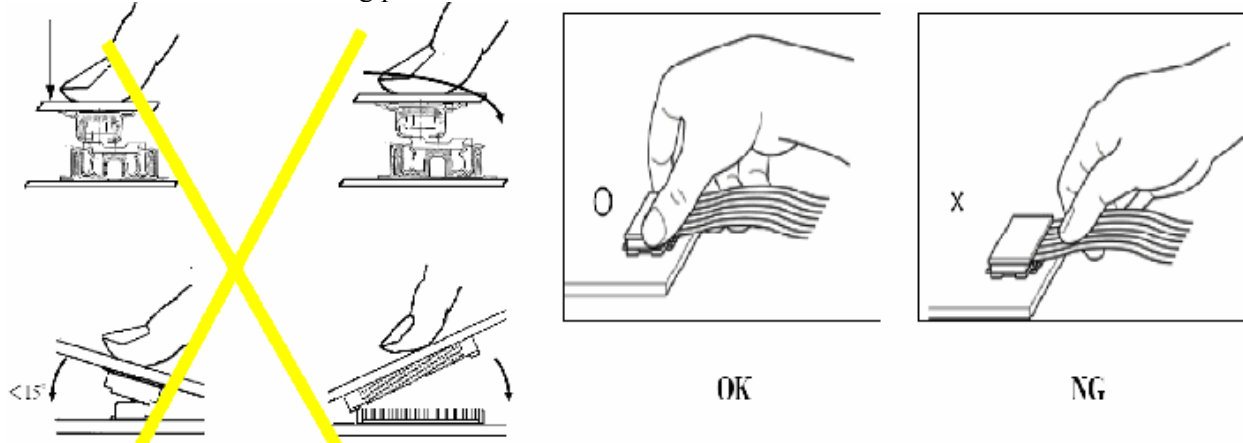
- (1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



- (2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be $\pm 0.1\text{mm}$.

Precaution for assemble the module with BTB connector:

Please note the position of the male and female connector position, don't assemble or assemble like the method which the following picture shows



Precaution for soldering to the LCM

	Hand soldering	Machine drag soldering	Machine press soldering
No ROHS product	290°C ~350°C. Time : 3-5S.	330°C ~350°C. Speed : 4-8 mm/s.	300°C ~330°C. Time : 3-6S. Press: 0.8~1.2Mpa
ROHS product	340°C ~370°C. Time : 3-5S.	350°C ~370°C. Time : 4-8 mm/s.	330°C ~360°C. Time : 3-6S. Press: 0.8~1.2Mpa

(1) If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

(2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

(3) When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

Precautions for Operation

(1) Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

(2) It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

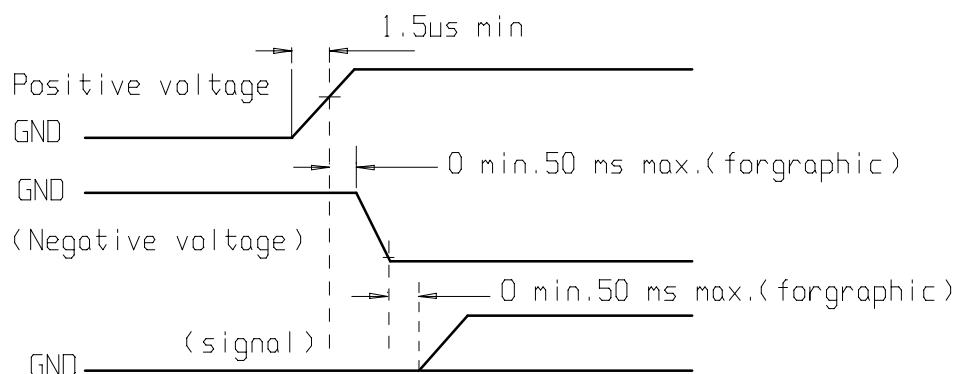
(3) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, Which will come back in the specified operating temperature.

(4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

(5) A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%RH or less is required.

(6) Input each signal after the positive/negative voltage becomes stable.

(7) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.





Safety

(1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

(2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

Limited Warranty

Unless agreed between All Shore and customer, All Shore will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with All Shore LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to All Shore within 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability of All Shore is limited to repair and /or replacement on the terms set forth above. All Shore will not be responsible for any subsequent or consequential events.

Return LCM under warranty

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet is damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- Soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.