MULTI-INNO TECHNOLOGY CO., LTD.

LCD MODULE SPECIFICATION

Model : MI0350ACT

Revision	1.0
Engineering	
Date	
Our Reference	

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REVISION RECORD

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1.0	2011-10-26	Initial Release	

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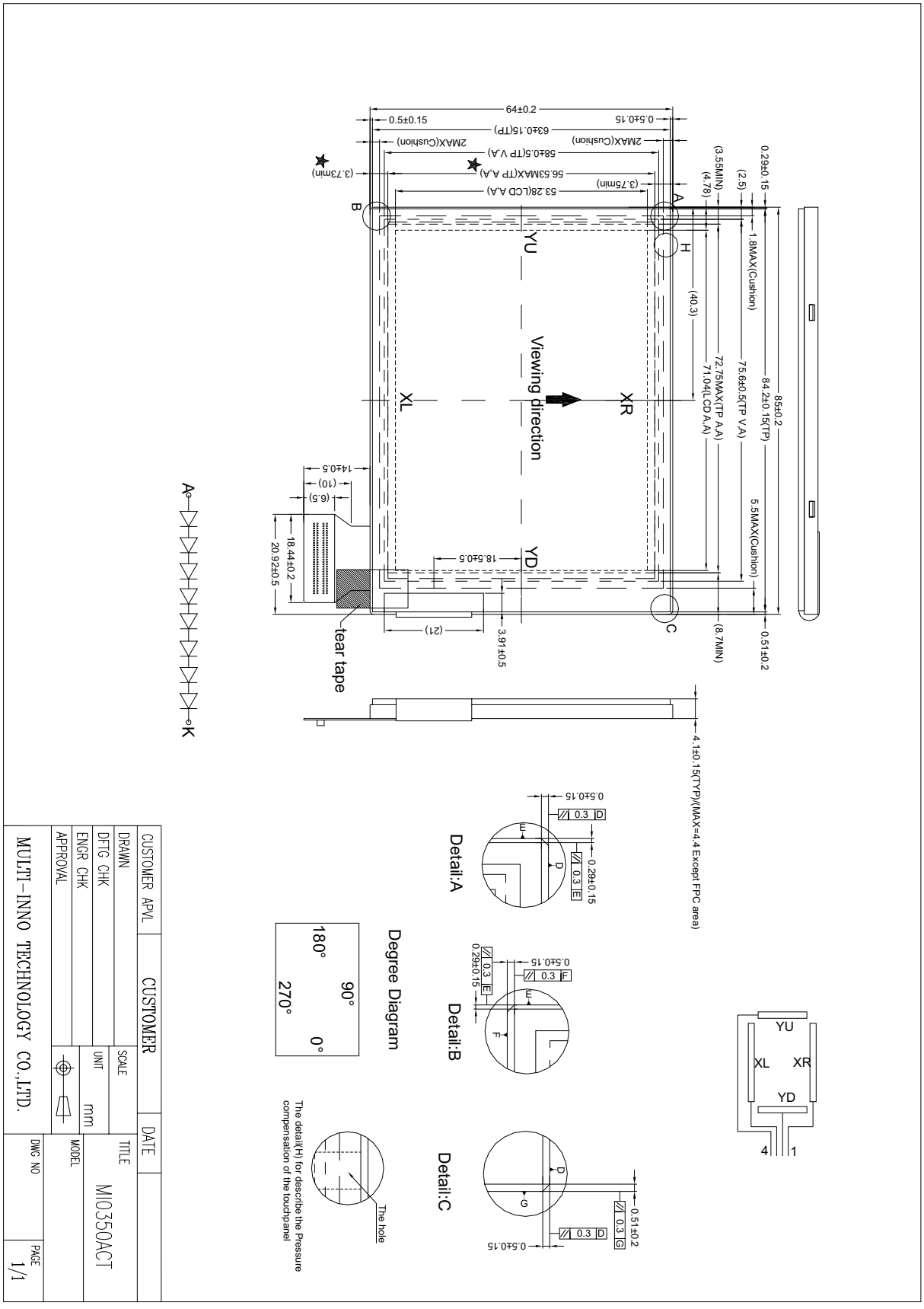
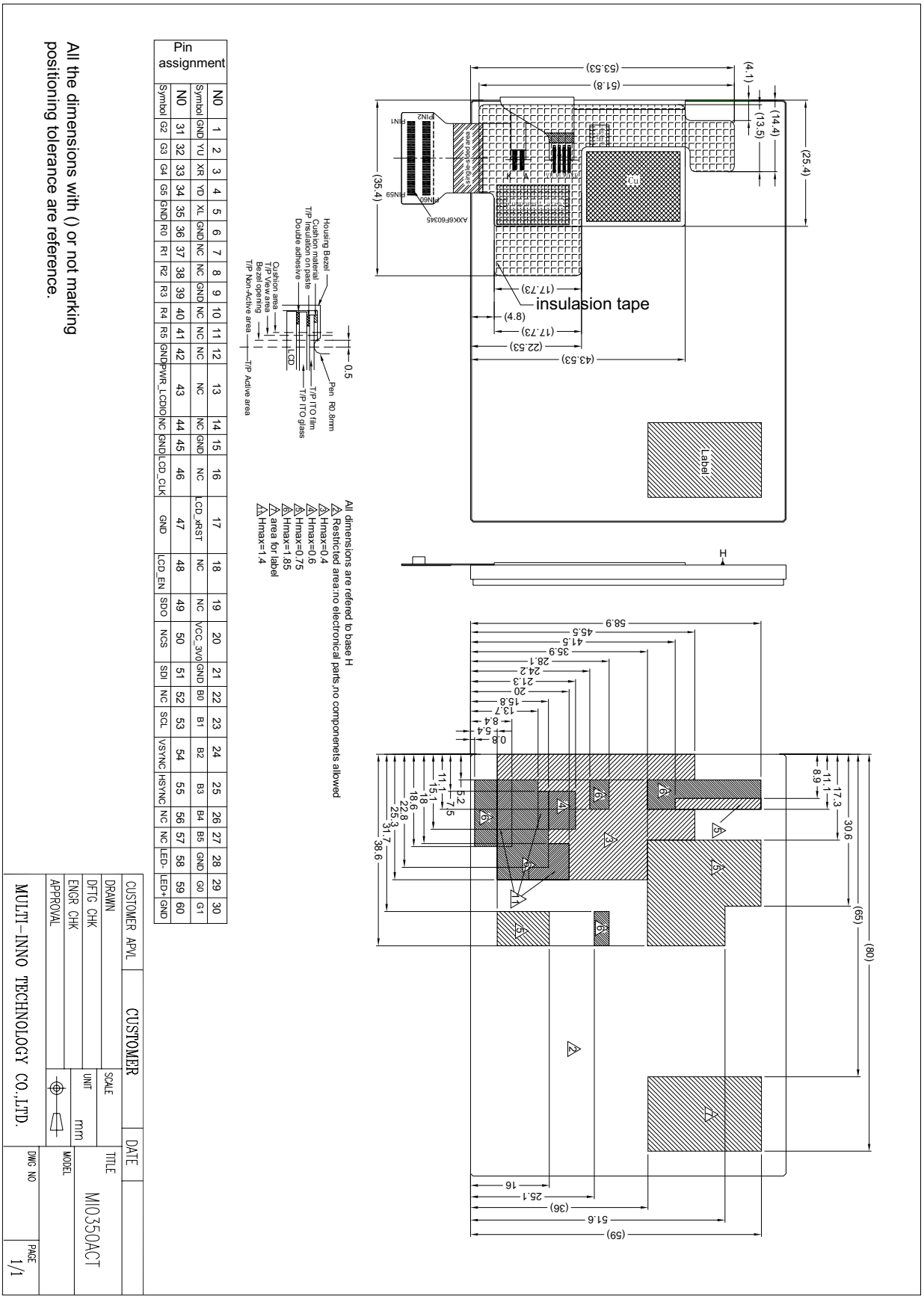
■ GENERAL INFORMATION

Item	Contents	Unit
LCD Type	TFT/Transmissive/TN/Normally	/
Size	3.50	Inch
Viewing direction	6:00	O' Clock
LCM size(W × Hx T)	85.00 ×64.00x4.10	mm^3
Active area (W×H)	71.04 × 53.28	mm^2
Pixel pitch (W×H)	0.111x0.111	mm^2
Number of Dots	480x (RGB)×640	/
Backlight Type	8LEDs	/
Interface Type	18-bit RGB	/
Input voltage	3.0	V
Color depth	262K	/
Driver IC	HX8363	/
Module Power consumption	--	mw
With/Without TSP	With TSP	/
Weight	--	g

■ EXTERNAL DIMENSIONS





Pin assignment																														
NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Symbol	GND	YU	XR	YD	XL	GND	NC	NC	GND	NC	NC	NC	NC	NC	GND	NC	LCD_xRST	NC	NC	VCC_3V0	GND	B0	B1	B2	B3	B4	B5	GND	G0	G1
NO	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Symbol	G2	G3	G4	G5	GND	R0	R1	R2	R3	R4	R5	GND	PWR_LCD	NC	GND	LCD_CLK	GND	LCD_EN	SDO	NCS	SDI	NC	SCL	VSYNC	HSYNC	NC	NC	LED-	LED+	GND

■ABSOLUTE MAXIMUM RATINGS

Parameter		Symbol	Min	Max	Unit
Supply voltage	Logic	VDD	-0.3	5.0	V
	Analog	VCI	-0.3	4.6	V
Power supply voltage		DDVDH-AGND	-0.3	6.5	V
Power supply voltage		AGND-VCL	-0.3	4.6	V
Power supply voltage		DDVDH-VCL	-0.3	9.0	V
Power supply voltage		ANG-VGL	-0.3	14.0	V
Power supply voltage		VGH-VGL	-0.3	33.0	V
LED forward voltage		V_F	-	3.4	V
LED forward current		I_F	-	20	mA
Operating temperature		TOP	-30	70	°C
Storage temperature		TST	-40	80	°C
Humidity		RH	-	90%(Max60°C)	RH

Note 1: If Ta below 50ºC, the maximal humidity is 90%RH, if Ta over 50ºC, absolute humidity should be less than 60%RH.

Note 2: The response time will be extremely slow when the operating temperature is around -10℃, and the back ground will become darker at high temperature operating.

■ELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

Parameter		Symbol	Min	Typ	Max	Unit
Supply voltage	Logic	VDD	1.65	3.0	3.3	V
	Analog	VCI	2.5	3.0	3.3	V
Input voltage ' H ' level		V_{IH}	0.7VDD	-	VDD	V
Input voltage ' L ' level		V_{IL}	0	-	0.3VDD	V
Output voltage ' H ' level		V_{OH}	0.8VDD	-	VDD	V
Output voltage ' L ' level		V_{OL}	0	-	0.2VDD	V
Current consumption all white	Logic Analog	$I_{CC}+I_{IN}$	-	12	-	mA
Current consumption all black	Logic Analog	$I_{CC}+I_{IN}$	-	38	-	mA
Current consumption RGB	Logic Analog Analog	$I_{CC}+I_{IN}$	-	31	-	mA

■ BACKLIGHT CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	V_F	Ta=25 ºC, I_F=15mA/LED	-	3.2*8	-	V
Forward Current	I_F	Ta=25 ºC, V_F=3.2V/LED	-	15	27	mA
Reverse Voltage	V_R		-	5.0	-	V
Reverse current	I_R		-	-	50	uA
Power dissipation	P_D		-	384	-	mW
Uniformity	Avg		80	-	-	%
Drive method	Constant current					
LED Configuration	8 White LEDs in Serial					

■ELECTRO-OPTICAL CHARACTERISTICS

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark	Note
Response time		Tr+Tf	θ=0° ∅=0° Ta=25℃	---	40	60	ms	FIG 1.	4
Contrast ratio		Cr		---	500	---	---	FIG 2.	1
Luminance uniformity		δ WHITE		70	75	---	%	FIG 2.	3
Surface Luminance		Lv		---	400	---	cd/m^2	FIG 2.	2
Viewing angle range		θ	∅ = 90°	---	70	---	deg	FIG 3.	6
			∅ = 270°	---	50	---	deg	FIG 3.	
			∅ = 0°	---	70	---	deg	FIG 3.	
			∅ = 180°	---	70	---	deg	FIG 3.	
CIE (x, y) chromaticity	Red	x	θ=0° ∅=0° Ta=25℃	---	0.640	---		FIG 2.	5
		y		---	0.321	---			
	Green	x		---	0.293	---			
		y		---	0.579	---			
	Blue	x		---	0.134	---			
		y		---	0.142	---			
	White	x		---	0.299	---			
		y		---	0.355	---			
NTSC Ratio		S		---	50	---	%		

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

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P1, P2, P3, P4, P5)}}{\text{Average Surface Luminance with all black pixels (P1, P2, P 3,P4, P5)}}$$

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

Lv = Average Surface Luminance with all white pixels (P1, P2, P 3, 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.

$$\delta\ \text{WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)}}{\text{Maximum Surface Luminance with all white pixels (P1, P2, P 3, P4, P5)}}$$

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 conrast 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".

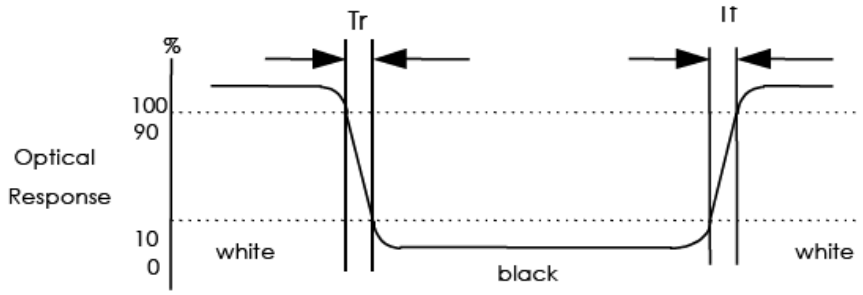
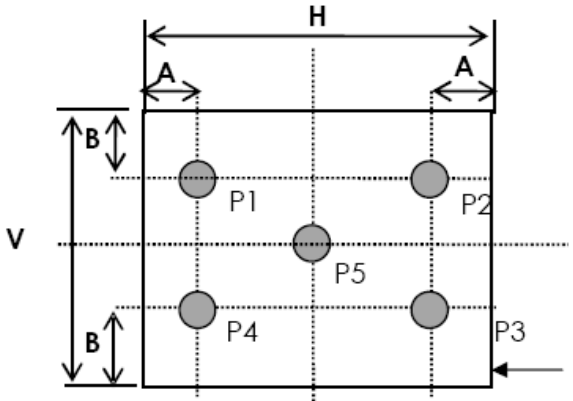
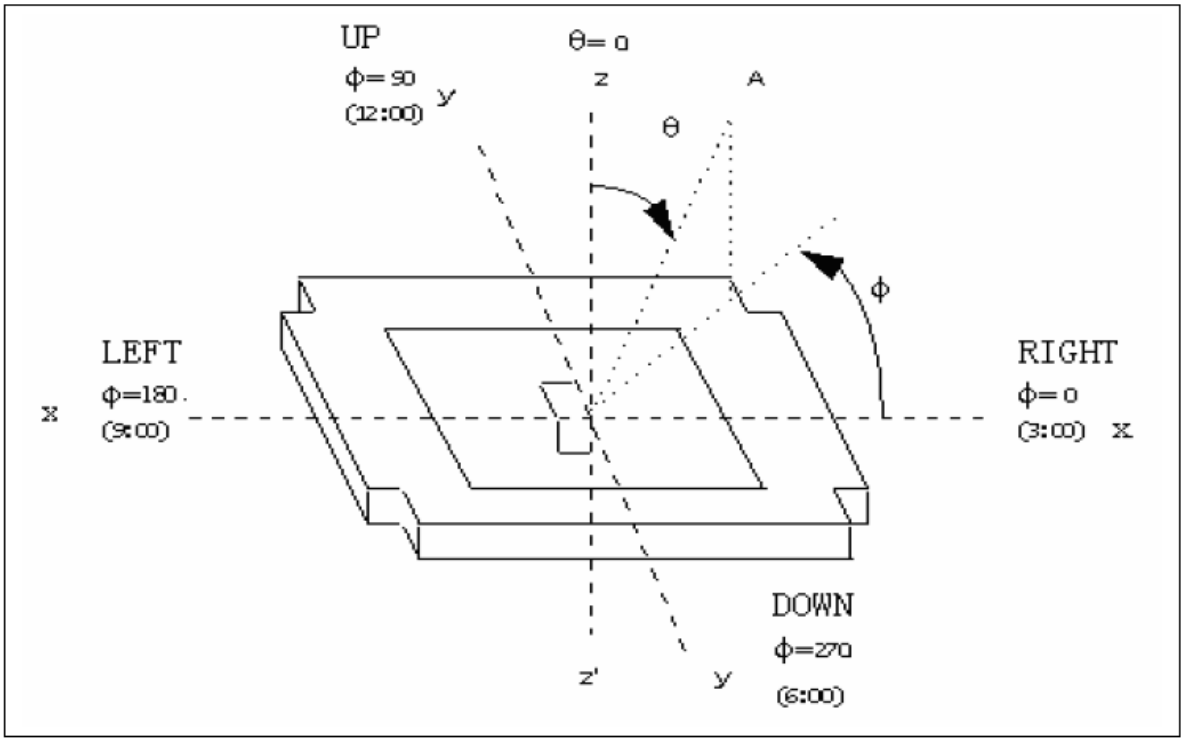


FIG. 2 Measuring method for Contrast ratio, surface luminance, Luminance uniformity , CIE (x, y) chromaticity



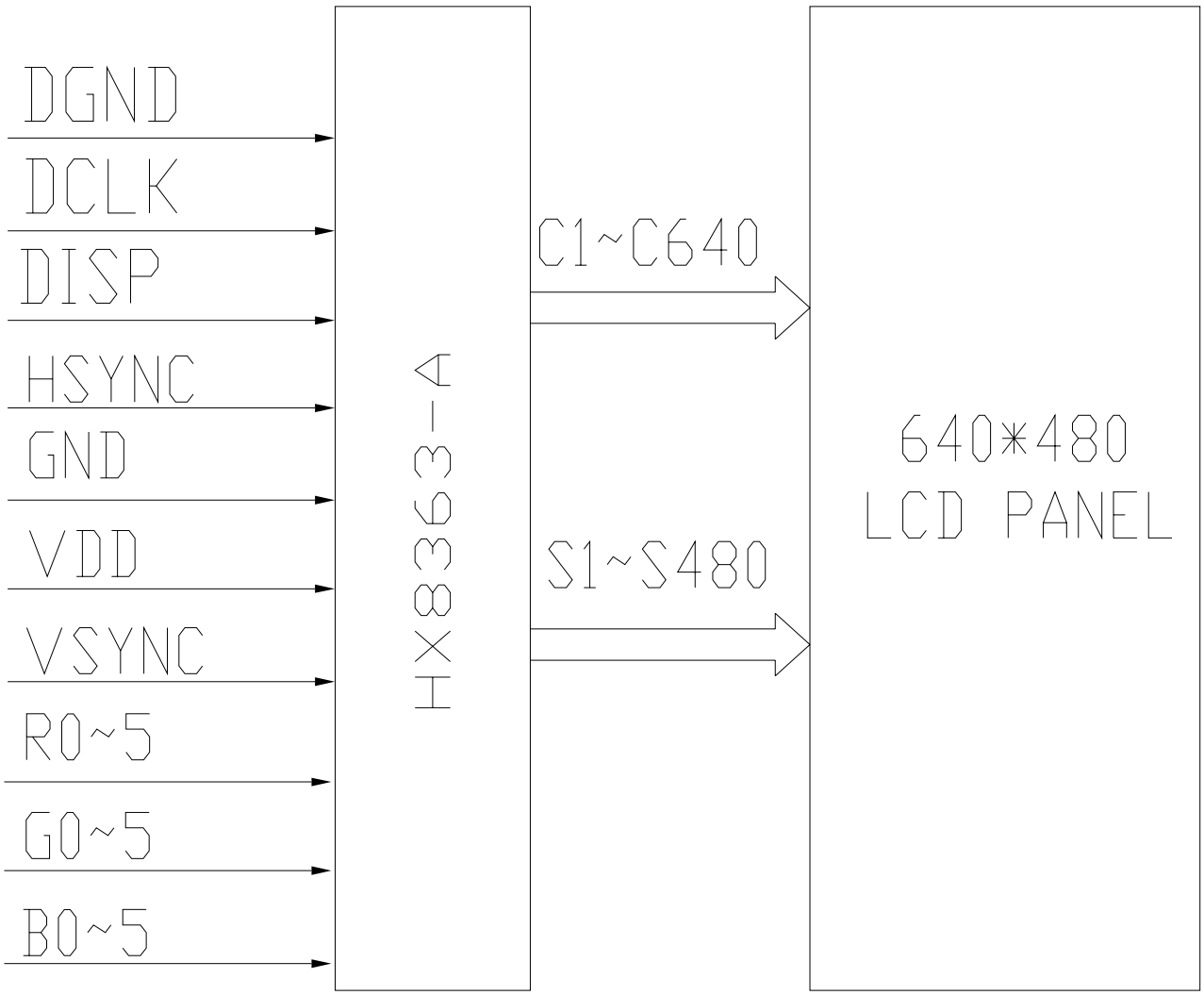
A : 5 mm
B : 5 mm
H,V : Active Area
Light spot size ∅=7mm, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-5

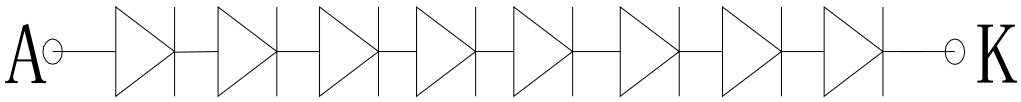
FIG. 3 The definition of viewing angle



■ INTERFACE DESCRIPTION

1. Block Diagram and Power Supply





2. Interface Pins Definition

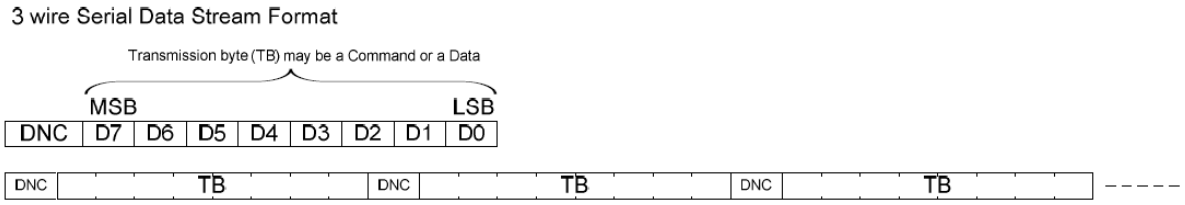
No.	Symbol	Function	No.	Symbol	Function
1	GND	Digital GND	31	G2	Green data
2	YU	Y axis pos. Top	32	G3	
3	XR	X axis pos. Right	33	G4	
4	YD	Y axis pos. Bottom	34	G5	
5	XL	X axis pos. Left	35	GND	Digital GND
6	GND	Digital GND	36	R0	Red data
7	open	NC	37	R1	
8	open	NC	38	R2	
9	GND	Digital GND	39	R3	
10	open	NC	40	R4	
11	open	NC	41	R5	
12	open	NC	42	GND	Digital GND
13	open	NC	43	PWR_LCDIO	Logic Supply voltage
14	open	NC	44	open	NC
15	GND	Digital GND	45	GND	Digital GND
16	open	NC	46	LCD_CLK	Clock Signal
17	LCD_xRST	Reset Signal	47	GND	Digital GND
18	open	NC	48	LCD_EN	Data Enable
19	open	NC	49	SDO	Serial interface data output
20	VCC_3V0	Power Supply for booster	50	NCS	Chip select signal.
21	GND	Digital GND	51	SDI	Serial interface data input
22	B0	Blue data	52	open	NC
23	B1		53	SCL	Serial interface clock input
24	B2		54	VSYNC	Vertical sync input
25	B3		55	HSYNC	Horizontal sync input
26	B4		56	open	NC
27	B5		57	open	NC
28	GND	Digital GND	58	LED-	Cathode of LED
29	G0	Green data	59	LED+	Anode of LED
30	G1		60	GND	Digital GND

■ APPLICATION NOTES

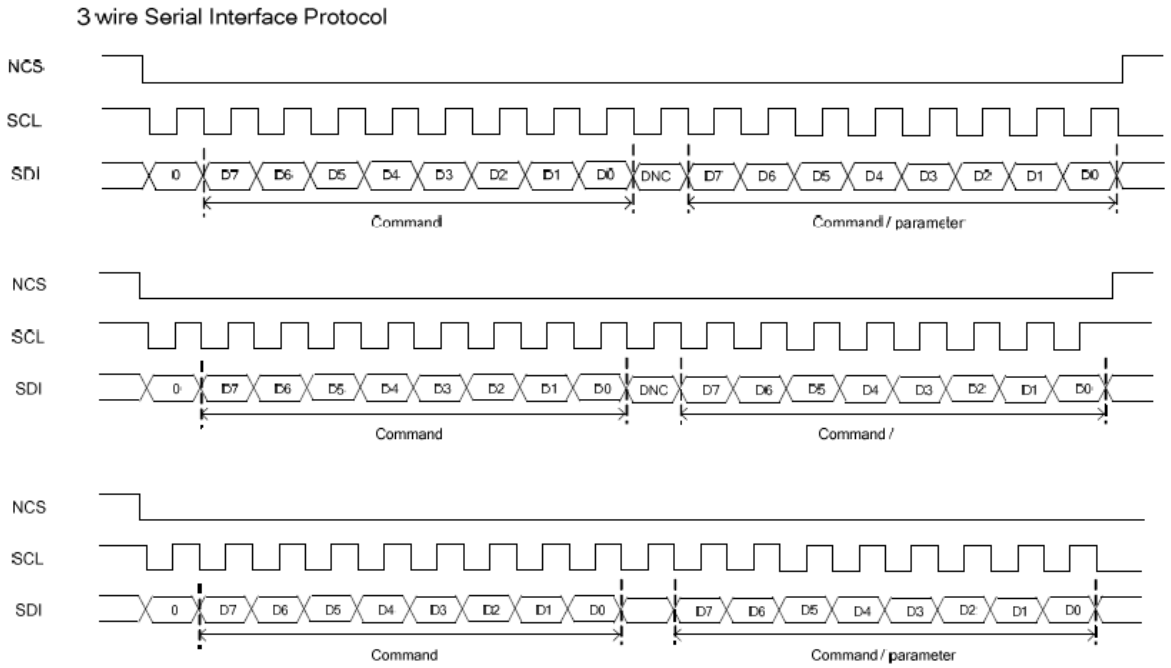
3. AC Characteristics

3.1. Recommended Input Timing of SPI-3 Transmitter

The 3-Pin serial data packet contains a control bit DNC and a transmission byte. If DNC is low, the transmission byte is command byte. If DNC is high, the transmission byte is stored to command register. The MSB is transmitted first. The serial interface is initialized when NCS is high. In this state, SCL clock pulse or SDI/SDO data have no effect. A falling edge on NCS enables the serial interface and indicates the start of data transmission.



Serial Data stream, write mode



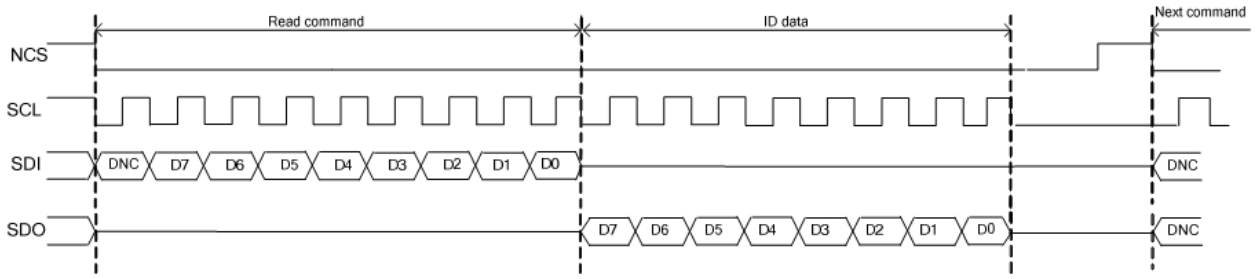
Serial Interface Protocal 3 wire serial interface (write mode)

Serial Data Read Mode

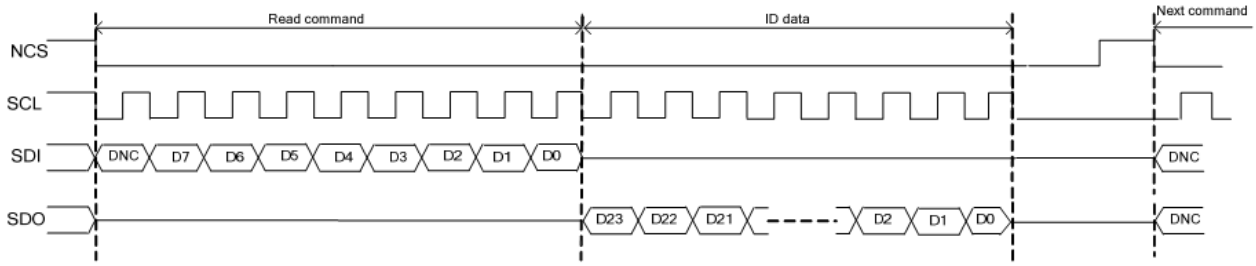
The micro controller firstly has to send a command and then the following byte is transmitted in the opposite direction. The read mode has three types of command data transmitted (8-/24- /32-bit) according command code.

3 wire Serial Interface Protocol

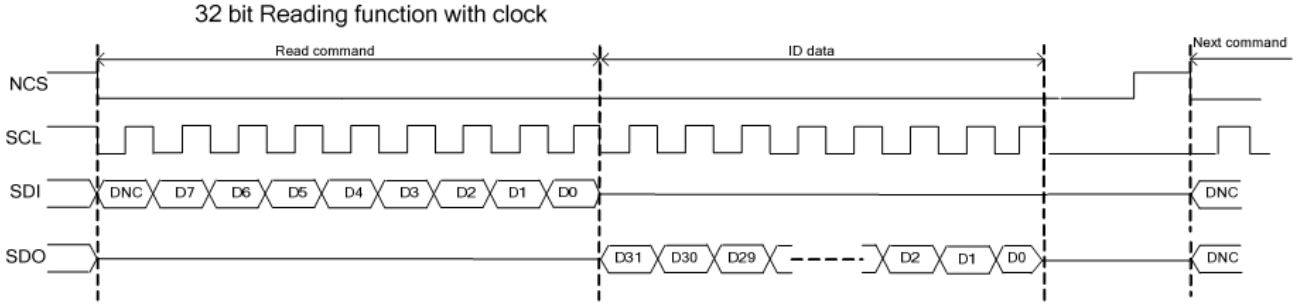
8 bit Reading function with clock



24 bit Reading function with clock

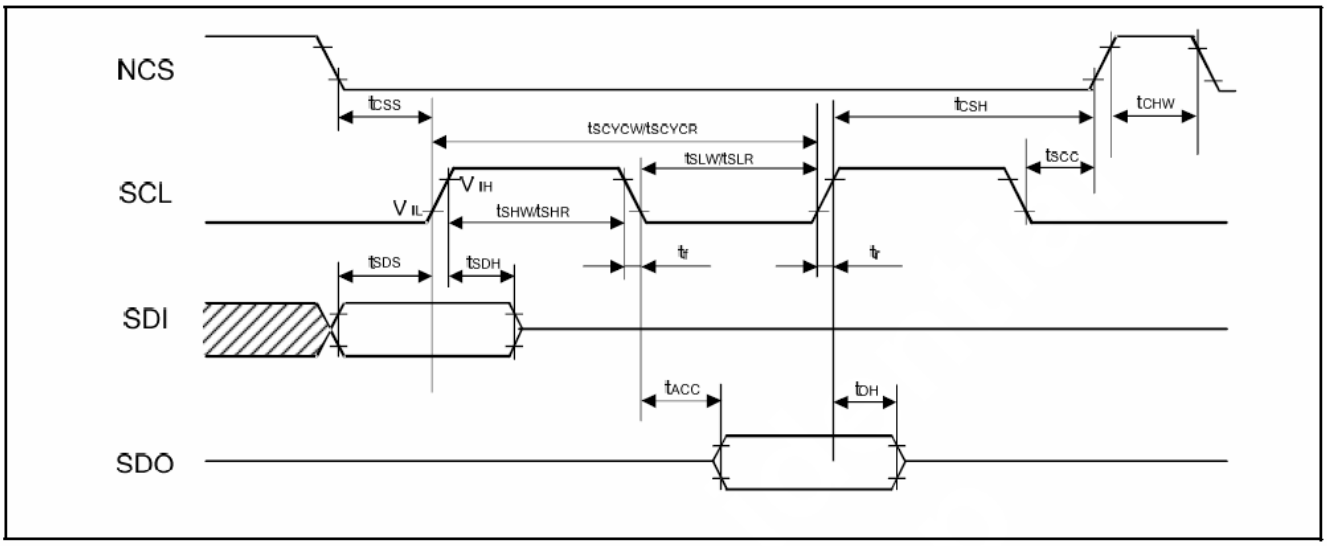


32 bit Reading function with clock



3 wire Serial Interface protocol,read mode

Serial Interface Characteristics (3-Pin Serial)

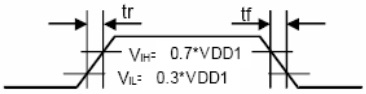


(VSSA=VSSD=0V, VDD1=1.65V to 1.95V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T_A = -30 to 70℃)

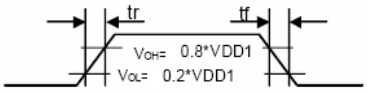
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Serial clock cycle (Write) SCL "H" pulse width (Write) SCL "L" pulse width (Write)	t_{SCYCW} t_{SHW} t_{SLW}	SCL	80 30 30	- - -	- - -	ns
Data setup time (Write) Data hold time (Write)	t_{SDS} t_{SDH}	SDI	10 10	- -	- -	ns
Serial clock cycle (Read) SCL "H" pulse width (Read) SCL "L" pulse width (Read)	t_{SCYCR} t_{SHR} t_{SLR}	SCL	150 60 60	- - -	- - -	ns
Access rime	t_{ACC}	SDO For maximum C_L=30pF For maximum C_L=8pF	10	-	60	ns
Output disable time	t_{OH}	SDO For maximum C_L=30pF For maximum C_L=8pF	15	-	100	ns
SCL to Chip select	t_{SCC}	NCS	30	-	-	ns
NCS "H" pulse width	t_{CHW}	NCS	60	-	-	ns
NCS-SCL time (write) NCS-SCL time (write	t_{CSS} t_{CSH}	NCS	30 30	- -	-	ns
NCS-SCL time (Read) NCS-SCL time (Read)	t_{CSS} t_{CSH}	NCS	60 65	- -	-	ns

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of VDD1 for Input signals.

Input Signal Slope



Output Signal Slope

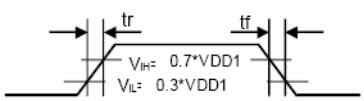


(VSSA=VSSD=0V, VDD1=1.95V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T_A = -30 to 70℃)

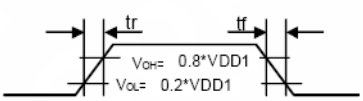
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Serial clock cycle (Write) SCL "H" pulse width (Write) SCL "L" pulse width (Write)	t_{SCYCW} t_{SHW} t_{SLW}	SCL	80 30 30	- - -	- - -	ns
Data setup time (Write) Data hold time (Write)	t_{SDS} t_{SDH}	SDI	10 10	- -	- -	ns
Serial clock cycle (Read) SCL "H" pulse width (Read) SCL "L" pulse width (Read)	t_{SCYCR} t_{SHR} t_{SLR}	SCL	150 60 60	- - -	- - -	ns
Access rime	t_{ACC}	SDO For maximum C_L=30pF For maximum C_L=8pF	5	-	60	ns
Output disable time	t_{OH}	SDO For maximum C_L=30pF For maximum C_L=8pF	8	-	100	ns
SCL to Chip select	t_{SCC}	NCS	30	-	-	ns
NCS "H" pulse width	t_{CHW}	NCS	60	-	-	ns
NCS-SCL time (write) NCS-SCL time (write	t_{CSS} t_{CSH}	NCS	30 30	- -	-	ns
NCS-SCL time (Read) NCS-SCL time (Read)	t_{CSS} t_{CSH}	NCS	60 65	- -	-	ns

Note: The input signal rise time and fall time (tr, tf) is specified at 15 ns or less.
Logic high and low levels are specified as 30% and 70% of VDD1 for Input signals.

Input Signal Slope

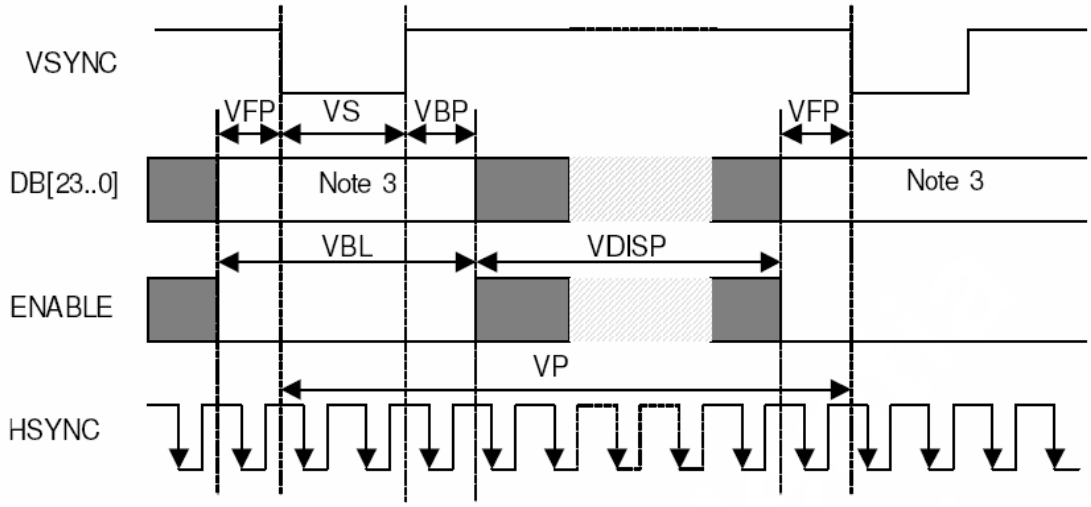


Output Signal Slope



3.2. RGB Interface Timing

Vertical Timings for RGB I/F



(Resolution=480x854, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T_A = -30 to 70℃)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical cycle	VP	-	860	-	864	Line
Vertical low pulse width	VS	-	2	-	4	Line
Vertical front porch	VFP	-	2	-	4	Line
Vertical back porch	VBP	-	2	-	4	Line
Vertical data start point	-	VS+VBP	4	-	8	Line
Vertical blanking period	VBL	VS+VBP+VFP	6	-	10	Line
Vertical active area	-	VDISP	-	854	-	Line
Vertical Refresh rate	VRR	-	50	-	70	Hz

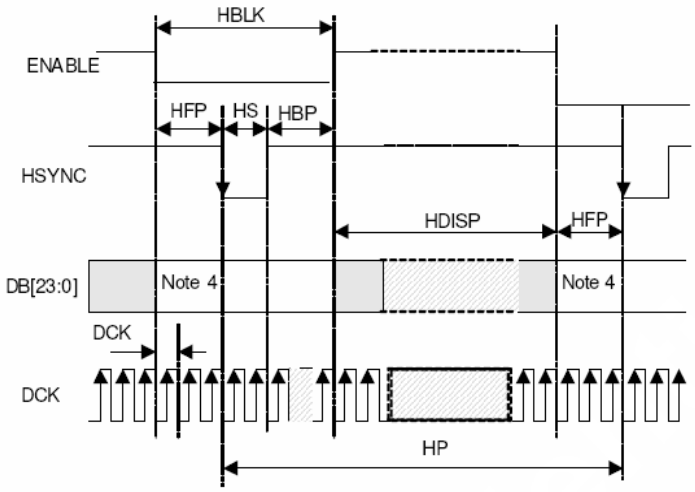
Note: (1) Signal rise and fall times are equal to or less than 20 ns.
(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.
(3) Data lines can be set to "High" or "Low" during blanking time – Don't care.
(4) VRR must keep from 50Hz to 70Hz when adjust other items.

(Resolution=480x800, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T_A = -30 to 70℃)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical cycle	VP	-	806	-	810	Line
Vertical low pulse width	VS	-	2	-	4	Line
Vertical front porch	VFP	-	2	-	4	Line
Vertical back porch	VBP	-	2	-	4	Line
Vertical data start point	-	VS+VBP	4	-	8	Line
Vertical blanking period	VBL	VS+VBP+VFP	6	-	10	Line
Vertical active area	-	VDISP	-	800	-	Line
Vertical Refresh rate	VRR	-	50	-	70	Hz

Note: (1) Signal rise and fall times are equal to or less than 20 ns.
(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.
(3) Data lines can be set to "High" or "Low" during blanking time – Don't care.
(4) VRR must keep from 50Hz to 70Hz when adjust other items.

Horizontal Timings for RGB I/F



(Resolution=480x854, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T_A = -30 to 70℃)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
HS cycle	HP	Note(3)	504	-	568	DCK
HS low pulse width	HS	-	5	-	78	DCK
Horizontal back porch	HBP	-	5	-	78	DCK
Horizontal front porch	HFP	-	5	-	78	DCK
Horizontal data start point	-	HS+HBP	19	-	83	DCK
Horizontal blanking period	HBLK	HS+HBP+HFP	24	-	88	DCK
Horizontal active area	HDISP	-	-	480	-	DCK
Pixel clock frequency When RGB I/F is running	DCK	VRR = Min. 50Hz - Max. 70Hz	21.6	-	34.3	MHz
			29.1	-	46.2	ns

Note: (1) Signal rise and fall times are equal to or less than 20 ns.
(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.
(3) HP is multiples of eight DCK.
(4)Data lines can be set to "High" or "Low" during blanking time – Don't care.
(5) VRR must keep from 50Hz to 70Hz when adjust other items.

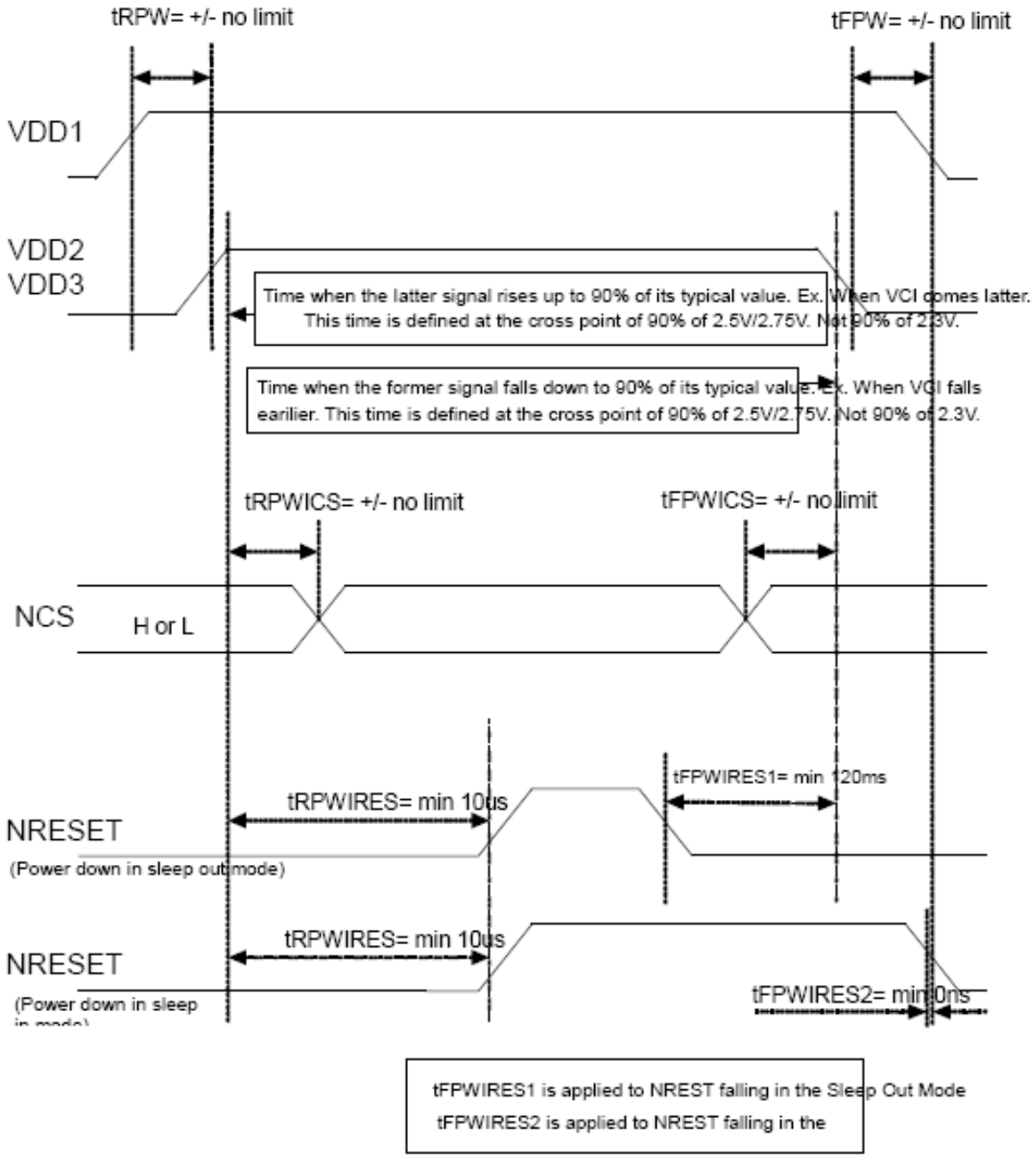
(Resolution=480x800, VSSA=VSSD=0V, VDD1=1.65V to 3.3V, VDD2=2.5 to 3.3V, VDD3=2.5 to 3.3V, T_A = -30 to 70℃)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
HS cycle	HP	Note(3)	504	-	568	DCK
HS low pulse width	HS	-	5	-	78	DCK
Horizontal back porch	HBP	-	5	-	78	DCK
Horizontal front porch	HFP	-	5	-	78	DCK
Horizontal data start point	-	HS+HBP	19	-	83	DCK
Horizontal blanking period	HBLK	HS+HBP+HFP	24	-	88	DCK
Horizontal active area	HDISP	-	-	480	-	DCK
Pixel clock frequency When RGB I/F is running	DCK	VRR = Min. 50Hz - Max. 70Hz	20.3	-	32.2	MHz
			31	-	49.2	ns

Note: (1) Signal rise and fall times are equal to or less than 20 ns.
(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.
(3) HP is multiples of eight DCK.
(4)Data lines can be set to "High" or "Low" during blanking time – Don't care.
(5) VRR must keep from 50Hz to 70Hz when adjust other items.

3.3. Power On/Off sequenc diagram

If NRESET line is held low (and stable) by the host during power on, then the NRESET must be held low for minimum 10µsec after both VDD1, VDD2 and VDD3 have been applied.



Power Off Sequence

The uncontrolled power off means a situation when e.g. there is removed a battery without the controlled power off sequence. There will not be any damages for the display module or the display module will not cause any damages for the host or lines of the interface. At an uncontrolled power off the display will go blank and there will not be any visible effects within 1 second on the display (blank display) and remains
blank until “Power On Sequence” powers it up.

■ RELIABILITY TEST

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80±2℃/96 hours	Inspection after 2~4 hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Sealleak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current Idd is twice higher than initial value.
2	Low Temperature Storage	-40±2℃/96 hours	
3	High Temperature Operating	70±2℃/96 hours	
4	Low Temperature Operating	-30±2℃/96 hours	
5	Temperature Cycle	-20 ± 2 ℃ ~25~70 ± 2 ℃ × 10cycles (30min.) (5min.) (30min.)	
6	Damp Proof Test	60℃±5℃×90%RH/96 hours	
7	Vibration Test	Frequency：10Hz~55Hz~10Hz Amplitude：1.5mm, X，Y，Z direction for total 3hours (Packing condition)	
8	Drooping test	Drop to the ground from 1m height, one time, every side of carton. (Packing condition)	
9	ESD test	Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time	

Remark:
1.The test samples should be applied to only one test item.
2.Sample size for each test item is 5~10pcs.
3.For Damp Proof Test, Pure water(Resistance＞10MΩ) should be used.
4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.
Using ionizer(an antistatic blower) is recommended at working area in order to reduce electro-static voltage.
When removing protection film from LCM panel, peel off the tag slowly(recommended more than one second) while blowing with ionizer toward the peeling face to minimize ESD which may damage electrical circuit.
5.EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and Fluorescence EL has.
6.Please use automatic switch menu(or roll menu) testing mode when test operating mode.

■ INSPECTION CRITERION

OUTGOING QUALITY STANDARD	PAGE 1 OF 7
TITLE:FUNCTIONAL TEST & INSPECTION CRITERIA	

This specification is made to be used as the standard acceptance/rejection criteria for Color mobile phone LCM with touch panel.

1 Sample plan

Sampling plan according to GB/T2828.1-2003/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993, normal level 2 and based on:

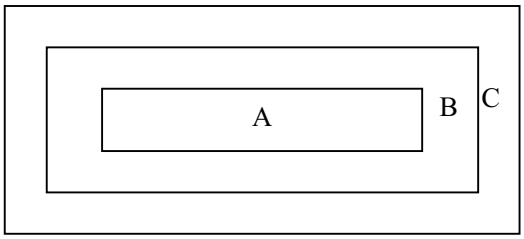
Major defect: AQL 0.65

Minor defect: AQL 1.5

2. Inspection condition

Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line.

3. Definition of inspection zone in LCD.



Zone A: character/Digit area

Zone B: viewing area except Zone A (ZoneA+ZoneB=minimum Viewing area)

Zone C: Outside viewing area (invisible area after assembly in customer's product)

Fig.1 Inspection zones in an LCD.

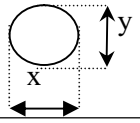
Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

4. Inspection standards

4.1 Major Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.1.1	All functional defects	1) No display 2) Display abnormally 3) Missing vertical，horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting.	Major
4.1.2	Missing	Missing component	
4.1.3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	
4.1.4	linearity	No more than 1.5%	

4.2 Cosmetic Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
4.2.1	**Clear Spots** Black and white Spot defect Pinhole, Foreign Particle, polarizer Dirt	For dark/white spot, size Φ is defined as $\Phi = \frac{(x+y)}{2}$ 	Minor

1.

Size(mm) \ Zone	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.10<Φ≤0.15	**2**		
0.15<Φ≤0.20	**1**		
0.20<Φ	0		

Clear Spots TP Dirt	2.	Minor

Size(mm) \ Zone	Acceptable Qty		
	A	B	C
Φ≤0.1	Ignore		Ignore
0.10<Φ≤0.15	**3**		
0.15<Φ≤0.25	**2**		
0.25<Φ	0		

<table>
<tr><td></td><td>Dim Spots

Circle shaped and dim edged defects</td><td>3.
<table><tr><td>2. Zone
Size(mm)</td><td colspan="3">Acceptable Qty</td></tr><tr><td></td><td>A</td><td>B</td><td>C</td></tr><tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>0.20＜Φ≤0.40</td><td colspan="2">2</td></tr><tr><td>0.40＜Φ≤0.60</td><td colspan="2">1</td></tr><tr><td>0.60＜Φ</td><td colspan="2">0</td></tr></table></td><td>Minor</td></tr>
</table>

4.2 Cosmetic Defect

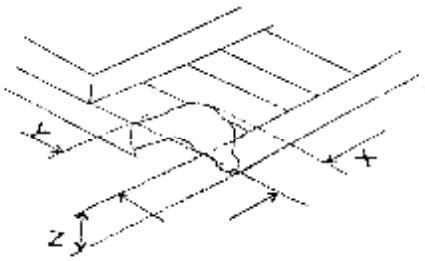
<table>
<tr><td>Item No</td><td>Items to be inspected</td><td>Inspection Standard</td><td>Classification of defects</td></tr>
<tr><td rowspan="2">4.2.2</td><td>Line defect
Black line, White line, Foreign material on polarizer</td><td><table><tr><td colspan="2">size(mm)</td><td colspan="3">Acceptable Qty</td></tr><tr><td rowspan="2">L(Length)</td><td rowspan="2">W(Width)</td><td colspan="3">zone</td></tr><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>Ignore</td><td>W≤0.02</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr><tr><td>L≤3.0</td><td>0.02＜W≤0.03</td><td colspan="2">2</td></tr><tr><td>L≤2.0</td><td>0.03＜W≤0.05</td><td colspan="2">1</td></tr><tr><td></td><td>0.05＜W</td><td colspan="2">Define as spot defect</td></tr></table></td><td rowspan="2">Minor</td></tr>
<tr><td>Foreign material on TP film</td><td>The line can be seen after mobile phone in the operating condition:
<table><tr><td colspan="2">size(mm)</td><td colspan="3">Acceptable Qty</td></tr><tr><td rowspan="2">L(Length)</td><td rowspan="2">W(Width)</td><td colspan="3">zone</td></tr><tr><td>A</td><td>B</td><td>C</td></tr><tr><td>Ignore</td><td>W≤0.03</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>L≤5.0</td><td>0.03＜W≤0.05</td><td colspan="2">3</td></tr><tr><td></td><td>0.05＜W</td><td colspan="2">Define as spot defect</td></tr></table></td></tr>
<tr><td></td><td></td><td>If the scratch can be seen after mobile phone cover assembling or in the operating condition, judge by the line defect of 4.2.2.
If the scratch can be seen only in non-operating condition or some special angle, judge by the following.</td><td></td></tr>
</table>

4.2.3	**Dim line defect** Polarizer scratch TP film scratch	See table below	Minor
4.2.4	Polarize Air bubble	Air bubbles between glass & polarizer See table below	Minor

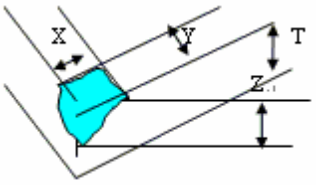
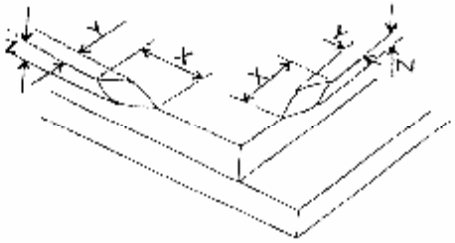
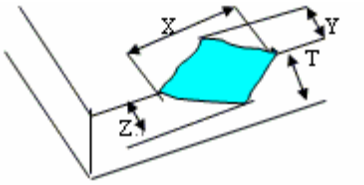
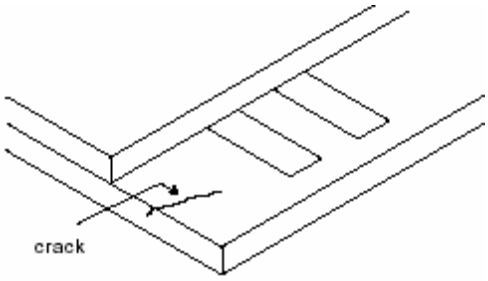
Size(mm)		Acceptable Qty		
L(Length)	W(Width)	Zone		
		A	B	C
Ignore	W≤0.03	Ignore		Ignore
5.0<L≤10.0	0.03<W≤0.05	2		
L≤5.0	0.05<W≤0.08	1		
	0.08<W	0		

2. Zone / Size(mm)	Acceptable Qty		
	A	B	C
Φ≤0.2	Ignore		Ignore
0.20<Φ≤0.30	2		
0.30<Φ≤0.50	1		
0.50<Φ	0		

4.3. Cosmetic Defect

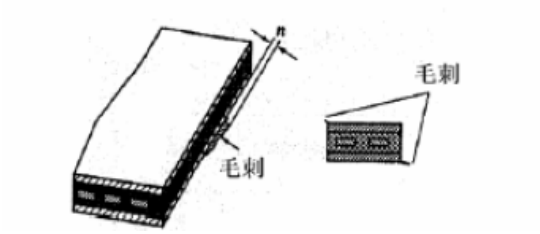
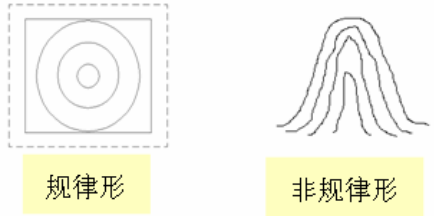
Item No	Items to be inspected	Inspection Standard	Classification of defects
		(i) Chips on corner A:LCD Glass defect  See table below Notes: S=contact pad length Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.	Minor

X	Y	Z
≤2.0	≤S	Disregard

4.3.5	Glass defect	B:TP Glass defect  X(mm) ≤3.0 / Y(mm) ≤3.0 / Z(mm) Disregard	
		(ii)Usual surface cracks A:LCD Glass defect  X ≤3.0 / Y <Inner border line of the seal / Z Disregard B:TP Glass defect  X(mm) ≤6.0 / Y(mm) <2.0 / Z(mm) Disregard	Minor
		(iii) Crack Cracks tend to break are not allowed.  	Major

4.4 Parts Defect

Item No	Items to be inspected	Inspection Standard	Classification of defects
	4.4.1 Parts contraposition	1、Not allow IC and FPC/heat-seal lead width is more than 50% beyond lead pattern. 2、Not allow chip or solder component is off center more than 50% of the pad outline.	Major
	4.4.2 SMT	According to the <Acceptability of electronic assemblies> IPC-A-610C class 2 standard. Component missing or function defect are Major defect, the others are Minor defect.	

	4.4.3 TP Defect	1、 Pattern font： Pattern fonts are clear and symmetrical， pattern fonts filter lightly are allowed; The fort line is not allow to thinner or thicker than 1/3of normal size, and swing is not more than 0.1mm. the line is smooth and not broken.  图案字体 Pattern font 2、The wing forward in the side of Visual Area： The length of wing forward inside of the Visual Area: n≤0.2mm； Not excess 3 point， and the distanceD≥20mm。  3、Film impression:With operation, must be invisibility. 4、Touch panel knob：if writing function normally,it could be allowed.  TP鼓 TP knob 5、 Newton ring Without operation, the color circle of Regularity or Non-regularity from the normal or slope angle of view. 1、**Regularity：** The area of the newton ring is less than 1/3 area of the touch panel; and no character affected and line distorted after touch panel lightening. It’s ok. 2、 **Non-regularity** ： The area of the Newton ring is less than the 1/2 area of touch panel with lightening. And no character affected and line  	Minor

■ PRECAUTIONS FOR USING LCD MODULES

Handing 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.

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.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the 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.

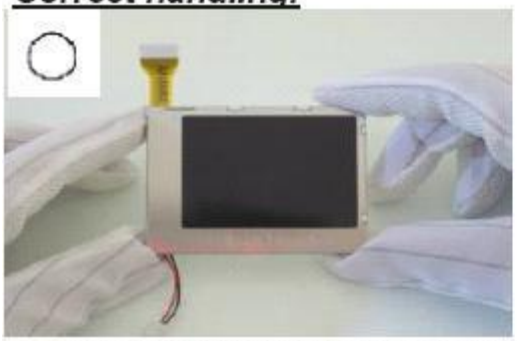
To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

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

Handling precaution for LCM

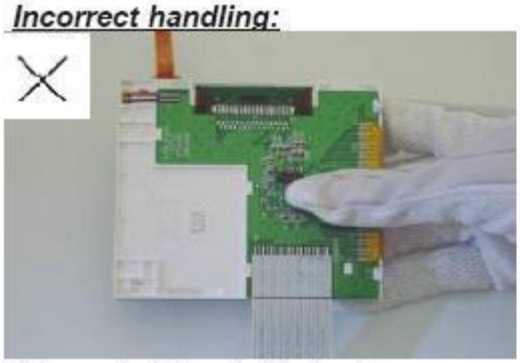
LCM is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

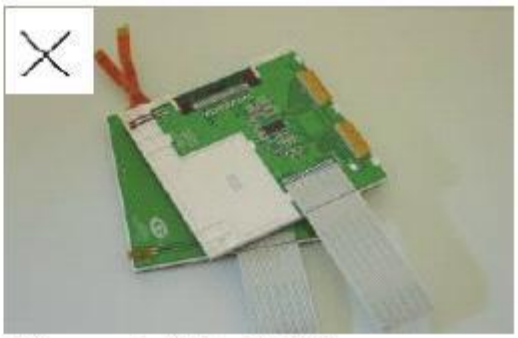


As above picture, please handle with anti-static gloves around LCM edges.

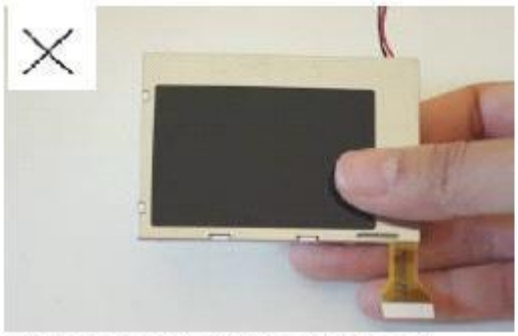
Incorrect handling:



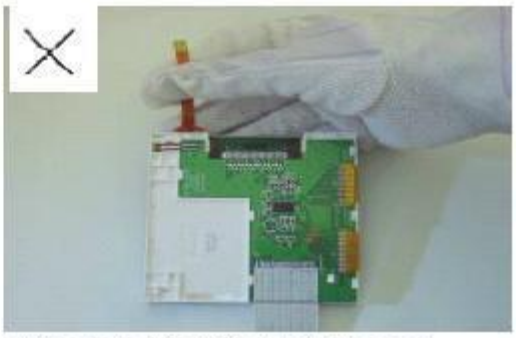
Please don't touch IC directly.



Please don't stack LCM.



Please don't hold the surface of panel.

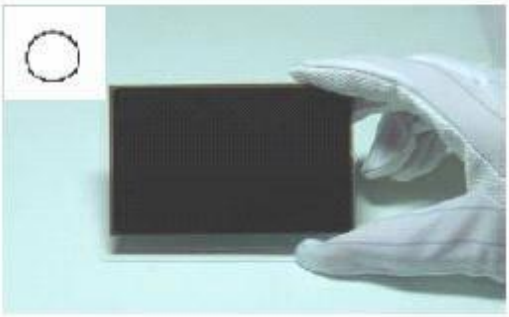


Please don't stretch interface of output, such as FPC cable.

Handling precaution for LCD

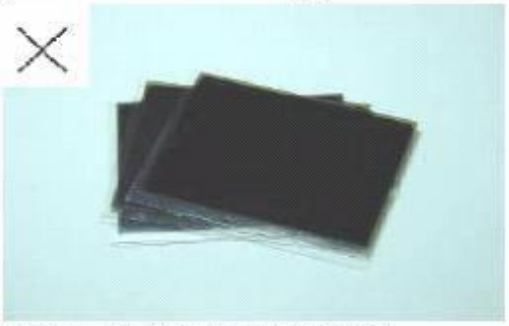
LCD is easy to be damaged.
Please note below and be careful for handling!

Correct handling:

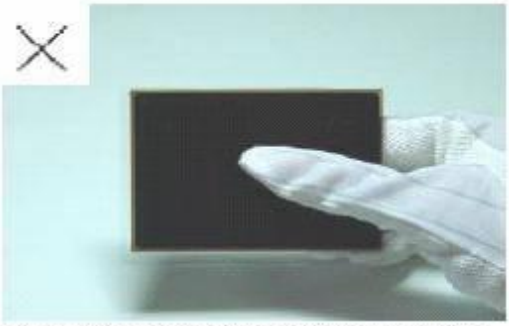


As above photo, please handle with anti-static gloves around LCD edges.

Incorrect handling:

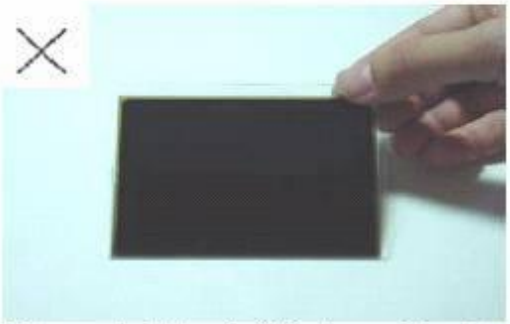


Please don't stack the LCDS.



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.

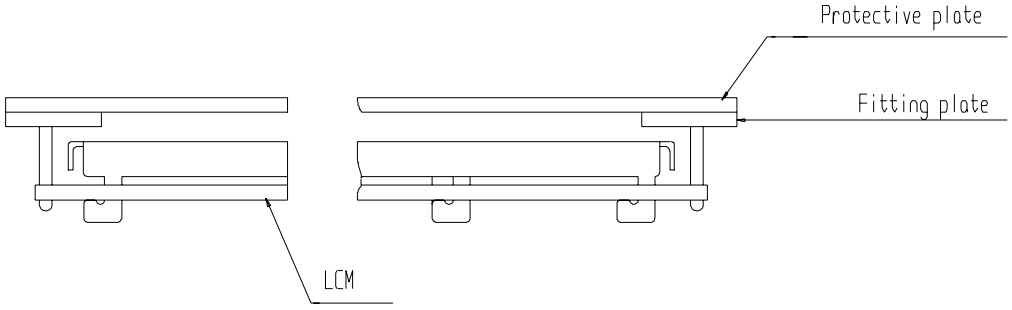
- Exposed area of the printed circuit board.
-Terminal electrode sections.

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.

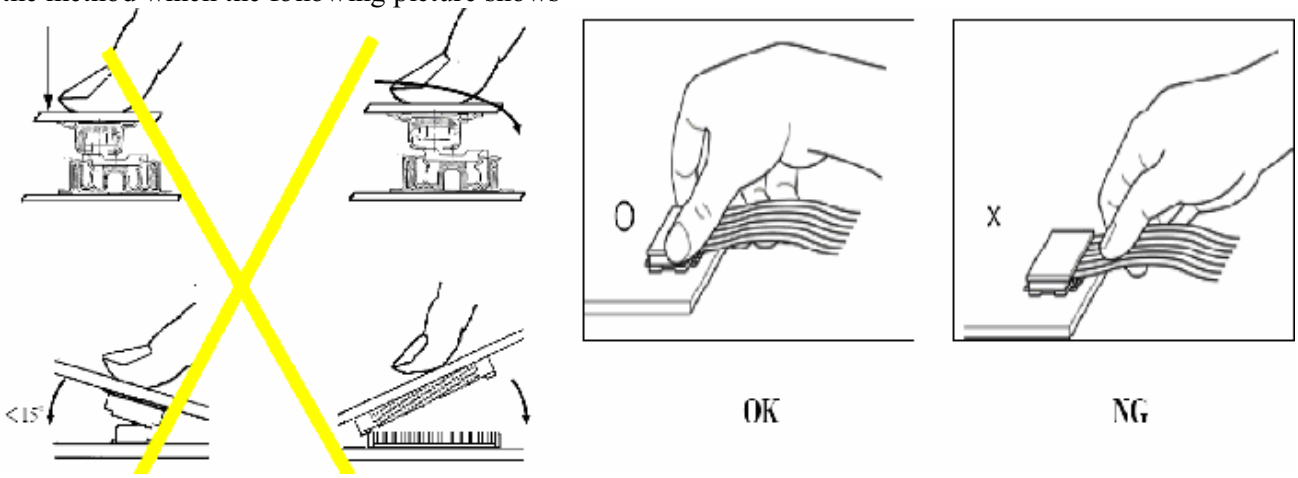
(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



(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 ±0.1mm.

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.

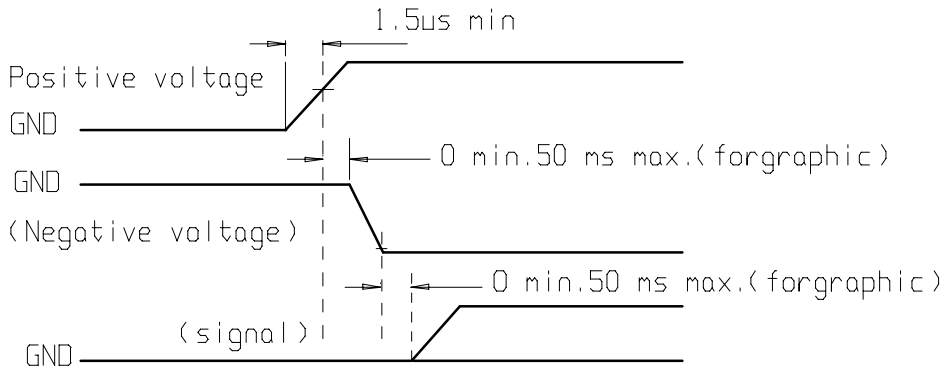
(3) Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, Which will come back in the specified operating 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 betweenMulti-Inno and customer,Multi-Inno will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Multi-Inno LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to Multi-Inno within 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability ofMulti-Inno limited to repair and/or replacement on the terms set forth above. Multi-Inno 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.

■ PRIOR CONSULT MATTER

1.①For Multi-Inno standard products, we keep the right to change material, process ... for improving the product property without notice on our customer.

②For OEM products, if any change needed which may affect the product property, we will consult with our customer in advance.

2. If you have special requirement about reliability condition, please let us know before you start the test on our samples.