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SPECIFICATION FOR LCD MODULE

**MODULE NO.: AFS240320P04-2.8-01
DOC.REVISION 01**

Customer Approval:

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	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)	Alfred	Dec-29-2010
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DOCUMENT REVISION HISTORY

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00	Sep-02-2009	First Issue	
01	Dec-29-2010	Rev. BL	Alfred

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1. Features & Mechanical Specifications

Item	Contents	Unit
	LCD	
LCD Type	TFT / Transmissive / Normally White	--
Viewing direction	12 O'clock	--
Backlight	White LED x4	--
Interface	8080-16bit parallel bus interface	--
Driver IC	ST7781	--
Outline Dimension	50.0(W) × 69.2(H) × 2.8(T)	mm
Glass area (W×H×T)	47.2 × 61.6 / 65.8 × 0.5	mm
Active area (W×H)	43.2 × 57.6	mm
Number of Dots	240(RGB) × 320	--
Dot pitch (W×H)	0.06 × 0.18	mm
Pixel pitch (W×H)	0.18 × 0.18	mm
Operating Temperature	-20 ~ +70	℃
Storage temperature	-30 ~ +80	℃

2. Dimensional Outline

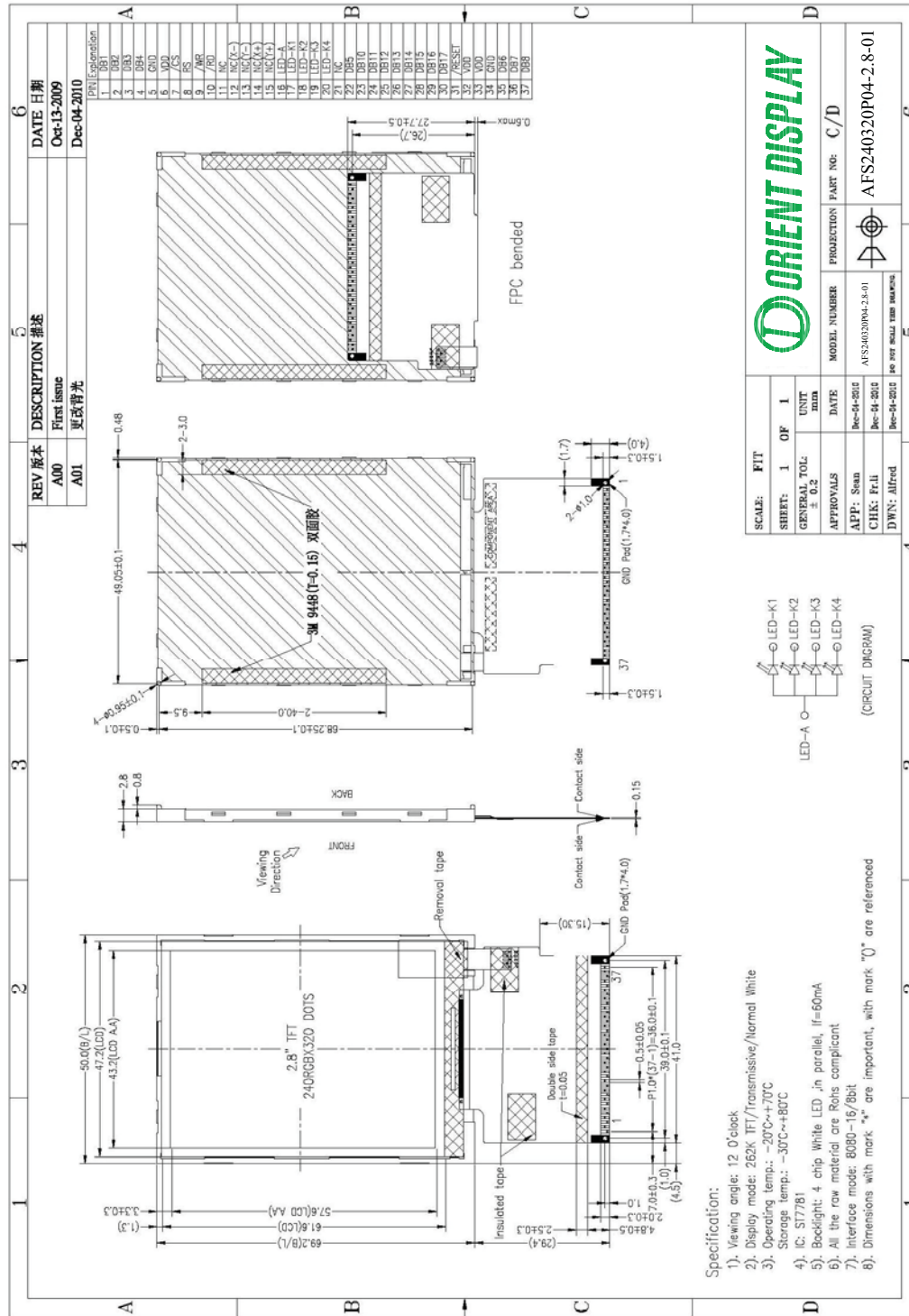


Figure 1. Dimensional outline

3. Block Diagram

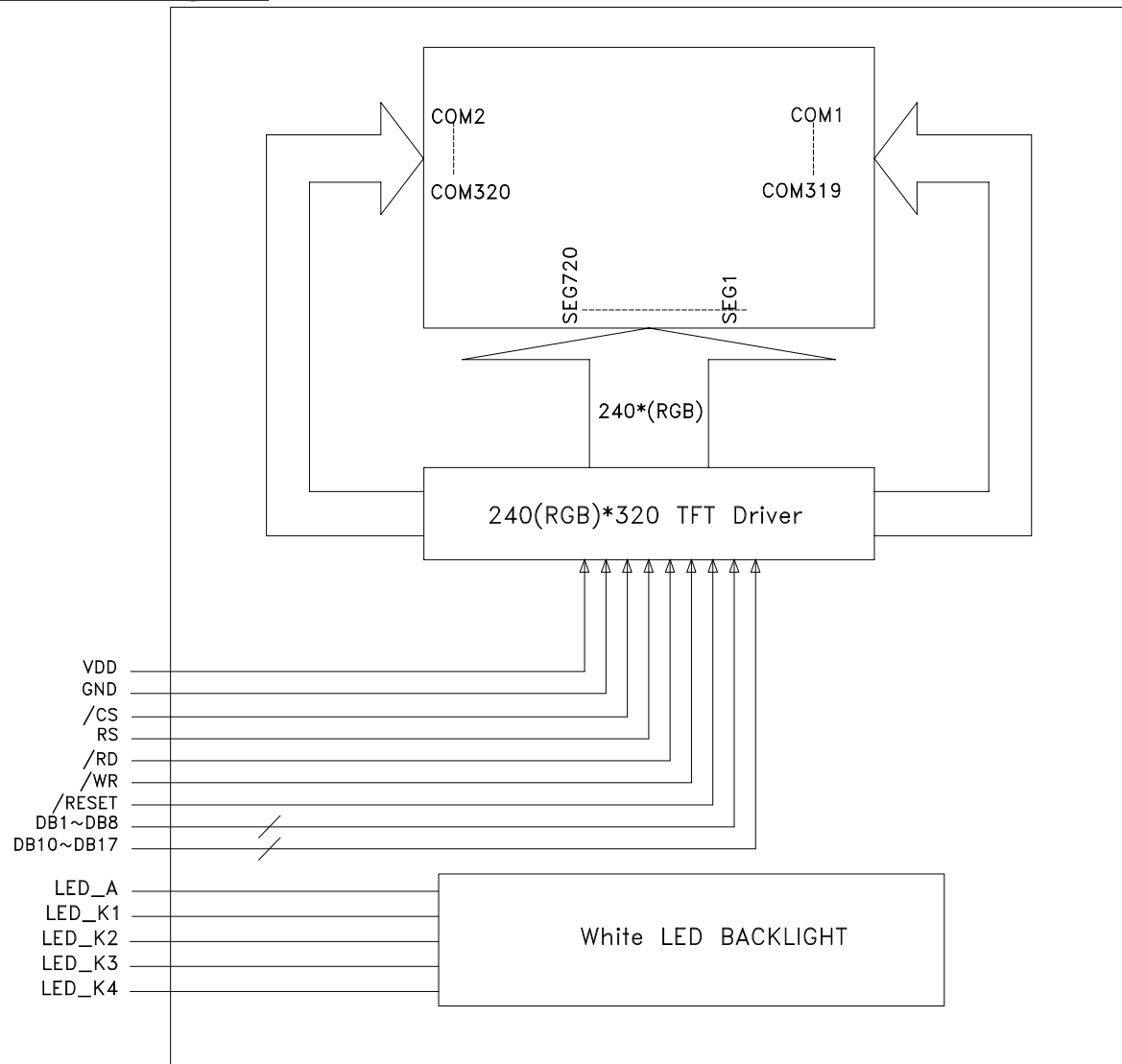


Figure 2. Block diagram

4. Pin Description

PIN No.	SYMBOL	Function
1~4	DB1~DB4	Data Bus
5	GND	Ground
6	VDD	Power supply
7	/CS	Chip Select Signal (“Low” enable)
8	RS	Display data or command selection pin RS = '1': display data or parameter. RS = '0': command.
9	/WR	Write signal.
10	/RD	Read signal.
11	NC	No Connection
12	NC(X-)	No Connection
13	NC(Y-)	No Connection
14	NC(X+)	No Connection
15	NC(Y+)	No Connection
16	LED_A	Backlight LED Anode
17	LED_K1	Backlight LED1 Cathode
18	LED_K2	Backlight LED2 Cathode
19	LED_K3	Backlight LED3 Cathode
20	LED_K4	Backlight LED4 Cathode
21	NC	No Connection
22	DB5	Data Bus
23~30	DB10~DB17	Data Bus
31	/RESET	Reset pin. (Active Low)
32,33	VDD	Power supply
34	GND	Ground
35~37	DB6~DB8	Data Bus

Interface Note:

R1	R2	Interface Mode
Open	Short	8080-8bit interface: DB17~DB10
Short	Open	8080-16bit interface: DB17~DB10, DB8~DB1 (Default Mode)

1. Unused pins should connect to GND.
2. R1, R2 are SMT component on LCM FPC.

5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply Voltage range	VDD	-0.3 to +4.6	V
Operating Temperature range	TOP	-20 to +70	°C
Storage Temperature range	TST	-30 to +80	°C

6. Electrical Characteristics

DC Characteristics

Item	Symbol	Min.	Type.	Max.	Unit
Logic Supply Voltage	VDD	2.5	-	3.3	V

7. Backlight Characteristics

White LED × 4

(Ta = 25°C)

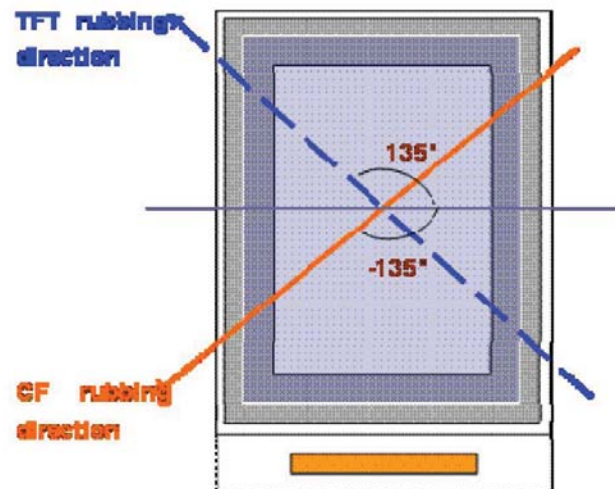
Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF = 60mA	-	3.2	-	V
Uniformity	△Bp	-	80	-	-	%
Luminance for LCD	Lv	IF = 60mA	1000	-	-	cd/m ²

8. Electro-Optical Characteristics

Ta=25°C

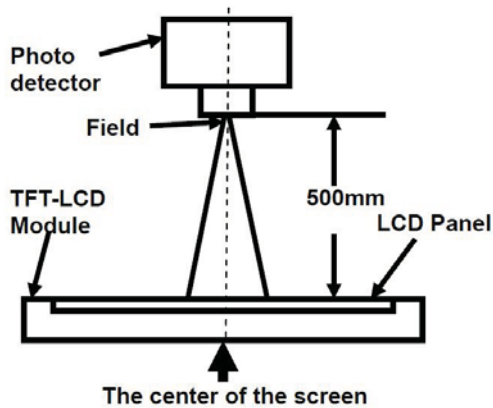
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θT	$CR \geq 10$	30	40	-	Degree	Note 2
	θB		10	20	-		
	θL		30	40	-		
	θR		30	40	-		
Contrast Ratio	CR	$\theta=0^\circ$	-	350	-		Note1,Note3
Response Time	T_{ON}	25°C	-	25	40	ms	Note1,Note4
	T_{OFF}						
Chromaticity	White	x	Backlight is on	-	0.320	-	Note5,Note1
		y		-	0.366	-	
	Red	x		-	0.633	-	
		y		-	0.349	-	
	Green	x		-	0.298	-	
		y		-	0.593	-	
	Blue	x		-	0.132	-	
		y		-	0.165	-	
NTSC			-	55	-	%	Note 5
Transmittance			5.7	6.2	-	%	Note1,Note7

Rubbing Direction



Note 1: Definition of optical measurement system.

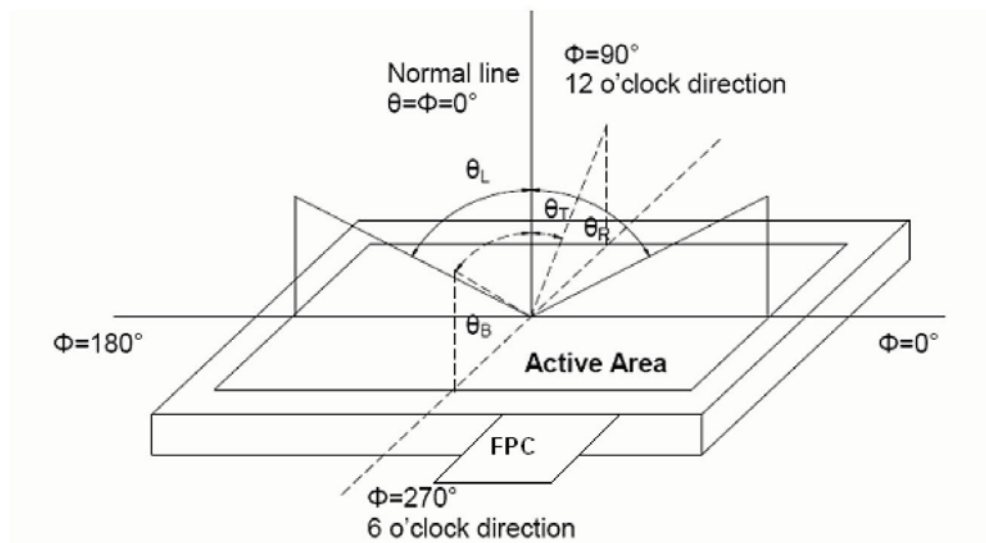
The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).



Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

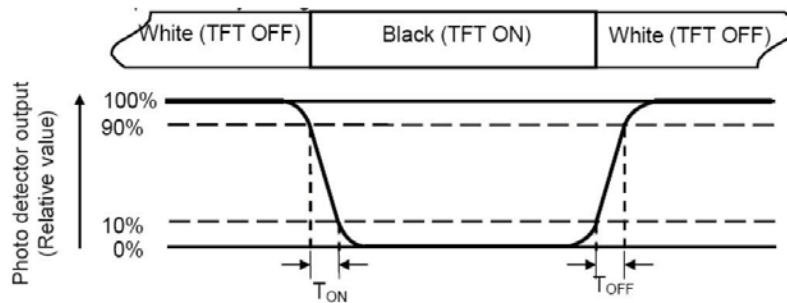
"White state": The state is that the LCD should driven by V_{white} .

"Black state": The state is that the LCD should driven by V_{black} .

V_{white}: To be determined V_{black}: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

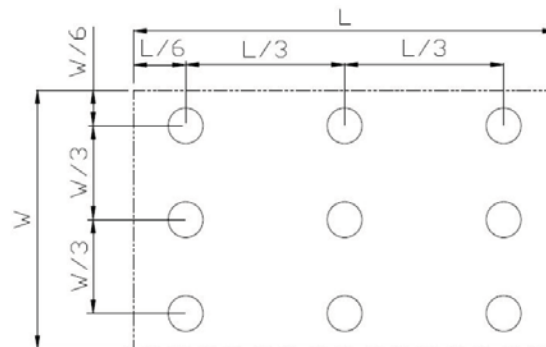
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity}(U) = L_{\min} / L_{\max}$$

L-----Active area length W----- Active area width



L_{max}: The measured maximum luminance of all measurement position.

L_{min}: The measured minimum luminance of all measurement position.

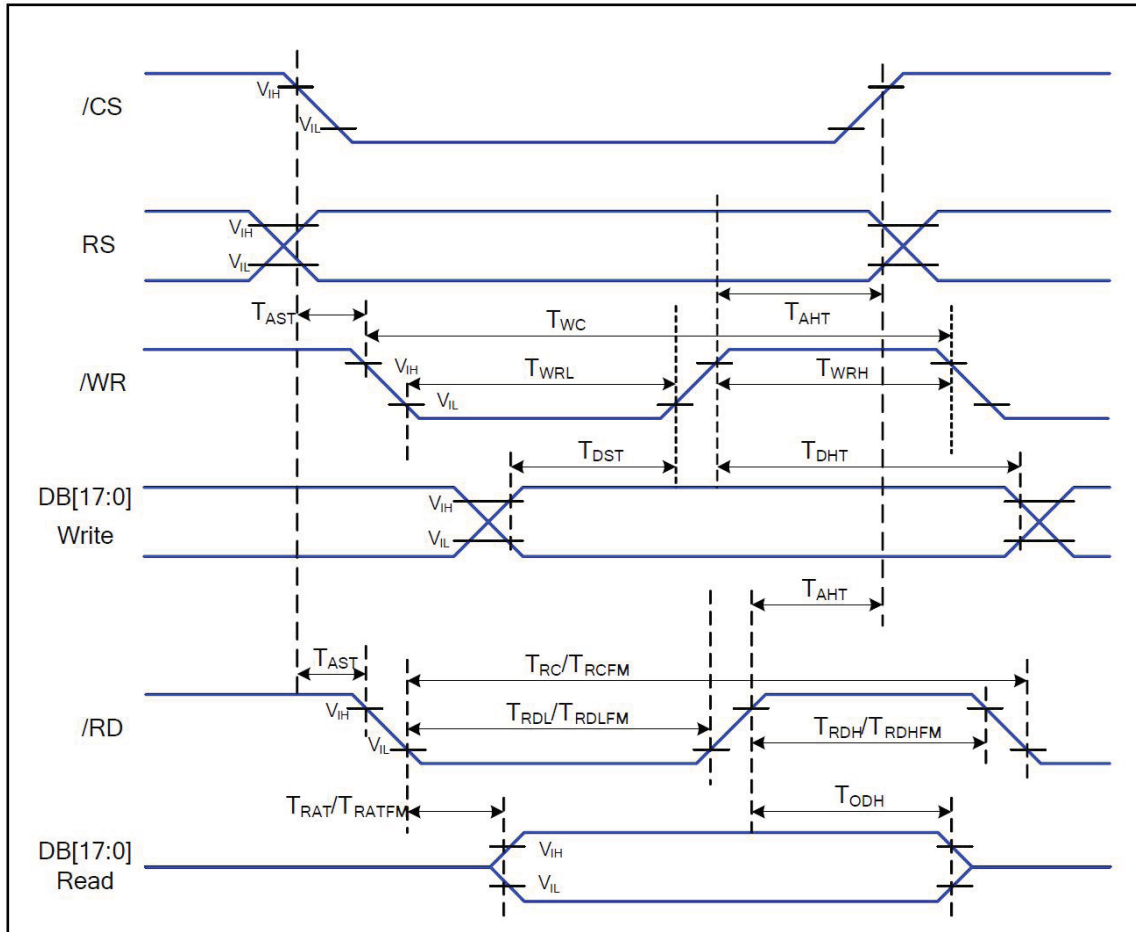
Note 7: Definition of Luminance :

Measure the luminance of white state at center point.

9. Instruction Description

No	Registers	W/R	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	
IR	Index Register	W	0	-	-	-	-	-	-	-	-	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0	
00h	Driver ID Code Read	R	1	0	1	1	1	0	1	1	1	1	0	0	0	0	0	1	1	
01h	Driver Output Control	W	1	0	0	0	0	0	SM	0	SS	0	0	0	0	0	0	0	0	
02h	LCD Driving Wave Control	W	1	0	0	0	0	0	1	BC0	EOR	0	0	0	0	0	0	0	0	
03h	Entry Mode	W	1	TRI	DFM	0	BGR	0	0	HWM	0	0	0	ID1	ID0	AM	0	0	0	
04h	Resize Control	W	1	0	0	0	0	0	0	RCV1	RCV0	0	0	RCH1	RCH0	0	0	RSZ1	RSZ0	
07h	Display Control 1	W	1	0	0	PTDE1	PTDE0	0	0	BASEE	0	0	GON	DTE	CL	0	0	D1	D0	
08h	Display control 2	W	1	0	FP6	FP5	FP4	FP3	FP2	FP1	FP0	0	BP6	BP5	BP4	BP3	BP2	BP1	BP0	
09h	Display Control 3	W	1	0	0	0	0	0	PTS2	PTS1	PTS0	0	0	PTG1	PTG0	ISC3	ISC2	ISC1	ISC0	
0Ah	Display Control 4	W	1	0	0	0	0	0	0	0	0	0	0	0	0	FMARKOE	FM12	FM11	FM10	
0Dh	Frame Marker Position	W	1	0	0	0	0	0	0	0	FMP6	FMP7	FMP6	FMP5	FMP4	FMP3	FMP2	FMP1	FMP0	
10h	Power Control 1	W	1	0	0	0	SAP	0	BT2	BT1	BT0	APE	AP2	AP1	AP0	0	0	STB	0	
11h	Power Control 2	W	1	0	0	0	0	0	DC12	DC11	DC10	0	DC02	DC01	DC00	0	VC2	VC1	VC0	
12h	Power Control 3	W	1	0	0	0	0	0	0	0	0	VCIRE	0	0	0	VRH3	VRH2	VRH1	VRH0	
13h	Power Control 4	W	1	0	0	0	VDV4	VDV3	VDV2	VDV1	VDV0	0	0	0	0	0	0	0	0	
20h	DRAM Horizontal Address Set	W	1	0	0	0	0	0	0	0	0	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0	
21h	DRAM Vertical Address Set	W	1	0	0	0	0	0	0	0	AD16	AD15	AD14	AD13	AD12	AD11	AD10	AD9	AD8	
22h	Write Data to DRAM	W	1	DRAM Write Data (WD17-0) / Read Data (RD17-0)																
22h	Read Data from DRAM	R	1																	
28h	VCOMH Control	W	1	0	0	0	0	0	0	0	0	0	0	VCM5	VCM4	VCM3	VCM2	VCM1	VCM0	
2Bh	Frame Rate and Color Control	W	1	0	0	0	0	0	0	0	0	0	0	0	0	FRS3	FRS2	FRS1	FRS0	
30h	Gamma Control 1	W	1	0	0	0	0	0	KP1[2]	KP1[1]	KP1[0]	0	0	0	0	0	KP0[2]	KP0[1]	KP0[0]	
31h	Gamma Control 2	W	1	0	0	0	0	0	KP3[2]	KP3[1]	KP3[0]	0	0	0	0	0	KP2[2]	KP2[1]	KP2[0]	
32h	Gamma Control 3	W	1	0	0	0	0	0	KP5[2]	KP5[1]	KP5[0]	0	0	0	0	0	KP4[2]	KP4[1]	KP4[0]	
35h	Gamma Control 4	W	1	0	0	0	0	0	RP1[2]	RP1[1]	RP1[0]	0	0	0	0	0	RP0[2]	RP0[1]	RP0[0]	
36h	Gamma Control 5	W	1	0	0	0	VRP1[4]	VRP1[3]	VRP1[2]	VRP1[1]	VRP1[0]	0	0	0	0	0	VRP0[3]	VRP0[2]	VRP0[1]	VRP0[0]
37h	Gamma Control 6	W	1	0	0	0	0	0	KN1[2]	KN1[1]	KN1[0]	0	0	0	0	0	KN0[2]	KN0[1]	KN0[0]	
38h	Gamma Control 7	W	1	0	0	0	0	0	KN3[2]	KN3[1]	KN3[0]	0	0	0	0	0	KN2[2]	KN2[1]	KN2[0]	
39h	Gamma Control 8	W	1	0	0	0	0	0	KN5[2]	KN5[1]	KN5[0]	0	0	0	0	0	KN4[2]	KN4[1]	KN4[0]	
3Ch	Gamma Control 9	W	1	0	0	0	0	0	RN1[2]	RN1[1]	RN1[0]	0	0	0	0	0	RN0[2]	RN0[1]	RN0[0]	
3Dh	Gamma Control 10	W	1	0	0	0	VRN1[4]	VRN1[3]	VRN1[2]	VRN1[1]	VRN1[0]	0	0	0	0	0	VRN0[3]	VRN0[2]	VRN0[1]	VRN0[0]
60h	Horizontal Address Start Position	W	1	0	0	0	0	0	0	0	0	HSA7	HSA6	HSA5	HSA4	HSA3	HSA2	HSA1	HSA0	
61h	Horizontal Address End Position	W	1	0	0	0	0	0	0	0	0	HEA7	HEA6	HEA5	HEA4	HEA3	HEA2	HEA1	HEA0	
62h	Vertical Address Start Position	W	1	0	0	0	0	0	0	0	0	VSA8	VSA7	VSA6	VSA5	VSA4	VSA3	VSA2	VSA1	VSA0
63h	Vertical Address End Position	W	1	0	0	0	0	0	0	0	0	VEA8	VEA7	VEA6	VEA5	VEA4	VEA3	VEA2	VEA1	VEA0
60h	Gate Scan Control 1	W	1	GS	0	NL5	NL4	NL3	NL2	NL1	NL0	0	0	0	SCN5	SCN4	SCN3	SCN2	SCN1	SCN0
61h	Gate Scan Control 2	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	NDL	VLE	REV	
80h	Partial Image 1 Display Position	W	1	0	0	0	0	0	0	0	PTDP08	PTDP07	PTDP06	PTDP05	PTDP04	PTDP03	PTDP02	PTDP01	PTDP00	
81h	Partial Image 1 Start Address	W	1	0	0	0	0	0	0	0	PTSA08	PTSA07	PTSA06	PTSA05	PTSA04	PTSA03	PTSA02	PTSA01	PTSA00	
82h	Partial Image 1 End Address	W	1	0	0	0	0	0	0	0	PTEA08	PTEA07	PTEA06	PTEA05	PTEA04	PTEA03	PTEA02	PTEA01	PTEA00	
83h	Partial Image 2 Display Position	W	1	0	0	0	0	0	0	0	PTDP18	PTDP17	PTDP16	PTDP15	PTDP14	PTDP13	PTDP12	PTDP11	PTDP10	
84h	Partial Image 2 Start Address	W	1	0	0	0	0	0	0	0	PTSA18	PTSA17	PTSA16	PTSA15	PTSA14	PTSA13	PTSA12	PTSA11	PTSA10	
85h	Partial Image 2 End Address	W	1	0	0	0	0	0	0	0	PTEA18	PTEA17	PTEA16	PTEA15	PTEA14	PTEA13	PTEA12	PTEA11	PTEA10	
90h	Panel Interface Control 1	W	1	0	0	0	0	0	0	DIV11	DIV10	0	RTN6	RTN5	RTN4	RTN3	RTN2	RTN1	RTN0	
92h	Panel Interface Control 2	W	1	0	0	0	0	0	0	NOW12	NOW11	NOW10	0	0	0	0	0	0	0	
D2h	EEPROM ID Code	W	1	0	0	0	0	0	0	0	0	0	ID6	ID5	ID4	ID3	ID2	ID1	ID0	
D9h	EEPROM Control Status	W	1	0	0	0	0	0	0	0	0	0	ID EN	VCM EN	0	0	0	0	0	
DFh	EEPROM Write Command	W	1	0	0	0	0	0	0	0	0	0	EE_IB7	EE_IB6	EE_IB5	EE_IB4	EE_IB3	EE_IB2	EE_IB1	EE_IB0
				0	0	0	0	0	0	0	0	0	EE_CMD7	EE_CMD6	EE_CMD5	EE_CMD4	EE_CMD3	EE_CMD2	EE_CMD1	EE_CMD0
				0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1
FAh	EEPROM Enable	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	MTTPROG	0
FEh	EEPROM VCOM Offset	W	1	0	0	0	0	0	0	0	0	0	0	0	0	VCMF4	VCMF3	VCMF2	VCMF1	VCMF0
FFh	FAh/FEh Enable	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	FXEN

10. AC Characteristics



VDDI=1.65 to 3.3V, VDD=2.5 to 3.3V, AGND=DGND=0V, Ta=25 °C

Signal	Symbol	Parameter	Min	Max	Unit	Description
RS	T_{AST}	Address Setup Time	10	-	ns	
	T_{AHT}	Address Hold Time (Write/Read)	5	-	ns	
/WR	T_{WC}	Write Cycle	100	-	ns	
	T_{WRH}	Control Pulse "H" Duration	50	-	ns	
	T_{WRL}	Control Pulse "L" Duration	50	-	ns	
/RD (ID)	T_{RC}	Read Cycle (ID)	150	-	ns	Read ID Data
	T_{RDH}	Control Pulse "H" Duration (ID)	50	-	ns	
	T_{RDL}	Control Pulse "L" Duration (ID)	100	-	ns	
/RD (FM)	T_{RCFM}	Read Cycle (FM)	300	-	ns	Read Frame Memory
	T_{RDHFM}	Control Pulse "H" Duration (RAM)	150	-	ns	
	T_{RDLFM}	Control Pulse "L" Duration (RAM)	150	-	ns	
DB[17:0]	T_{DST}	Data Setup Time	10	-	ns	T_{RAT} , T_{RATFM} : 3K ohm Pullup or Down and 30pF Parallel Cap. To GND. T_{ODH} : 3K ohm Pullup or Down.
	T_{DHT}	Data Hold Time	15	-	ns	
	T_{RAT}	Read Access Time (ID)	-	100	ns	
	T_{RATFM}	Read Access Time (FM)	-	100	ns	
	T_{ODH}	Output Disable Time	50	-	ns	

11.Quality Specifications

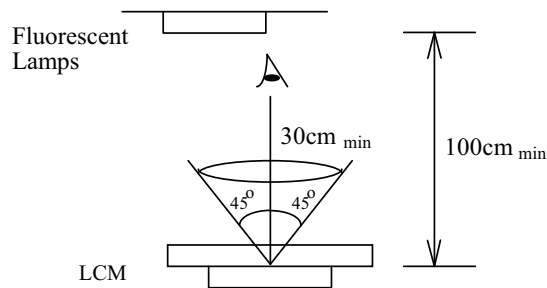
All The raw material are Rohs complicant.

11.1 Standard of the product appearance test

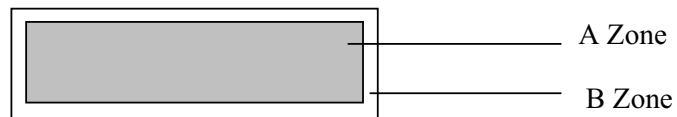
Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps.

Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



A Zone: viewing area

B Zone: outside viewing area

11.2 Specification of quality assurance


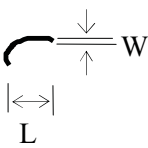
AQL inspection standard

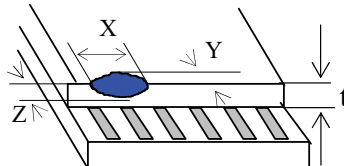
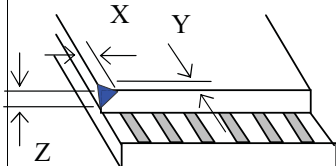
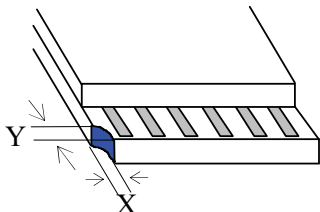
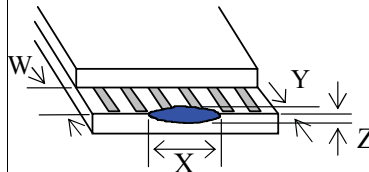
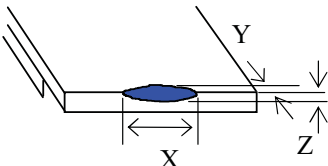
Sampling method: MIL-STD-105E, Level II, single sampling

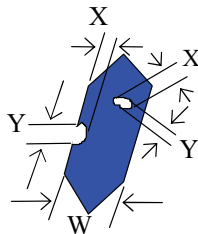
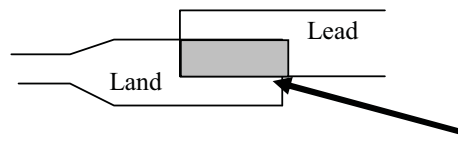
Defect classification (Note: * is not including)

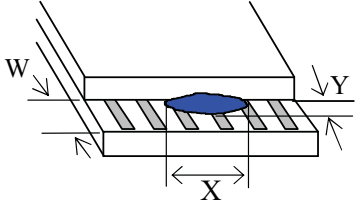
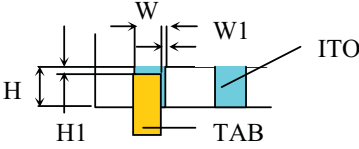
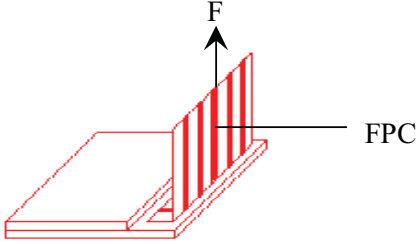
Classify	Item		Note	AQL	
Major	Display state	Short or open circuit	1	0.65	
		LC leakage			
		Flickering			
		No display			
		Wrong viewing direction			
		Contrast defect (dim, ghost)	2		
		Back-light	1,8		
	Non-display	Flat cable or pin reverse	10		
		Wrong or missing component	11		
Minor	Display state	Background color deviation	2	1.0	
		Black spot and dust	3		
		Line defect, Scratch	4		
		Rainbow	5		
		Chip	6		
		Pin hole	7		
	Polarizer	Protruded	12		
		Bubble and foreign material	3		
	Soldering	Poor connection	9		
	Wire	Poor connection	10		
	TAB	Position, Bonding strength	13		

Note on defect classification

No.	Item	Criterion																				
1	Short or open circuit	Not allow																				
	LC leakage																					
	Flickering																					
	No display																					
	Wrong viewing direction																					
	Wrong Back-light																					
2	Contrast defect	Refer to approval sample																				
	Background color deviation																					
3	<div>Point defect, Black spot, dust (including Polarizer)</div> <div>  <table> <tr> <th>Point Size</th> <th>Acceptable Qty.</th> </tr> <tr> <td>$\varnothing \leq 0.10$</td> <td>Disregard</td> </tr> <tr> <td>$0.10 < \varnothing \leq 0.20$</td> <td>3</td> </tr> <tr> <td>$0.20 < \varnothing \leq 0.25$</td> <td>2</td> </tr> <tr> <td>$0.25 < \varnothing \leq 0.30$</td> <td>1</td> </tr> <tr> <td>$\varnothing > 0.30$</td> <td>0</td> </tr> </table> <div> $\varnothing = (X+Y)/2$ </div> </div> <td> <div>Unit: mm</div> </td>	Point Size	Acceptable Qty.	$\varnothing \leq 0.10$	Disregard	$0.10 < \varnothing \leq 0.20$	3	$0.20 < \varnothing \leq 0.25$	2	$0.25 < \varnothing \leq 0.30$	1	$\varnothing > 0.30$	0	<div>Unit: mm</div>								
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4	<div>Line defect, Scratch</div> <div>  <table> <tr> <th colspan="2">Line</th> <th>Acceptable Qty.</th> </tr> <tr> <th>L</th> <th>W</th> <th></th> </tr> <tr> <td>---</td> <td>$0.015 \geq W$</td> <td>Disregard</td> </tr> <tr> <td>$3.0 \geq L$</td> <td>$0.03 \geq W$</td> <td rowspan="2">2</td> </tr> <tr> <td>$2.0 \geq L$</td> <td>$0.05 \geq W$</td> </tr> <tr> <td>$1.0 \geq L$</td> <td>$0.1 > W$</td> <td>1</td> </tr> <tr> <td>---</td> <td>$0.05 \leq W$</td> <td>Applied as point defect</td> </tr> </table> </div> <td> <div>Unit: mm</div> </td>	Line		Acceptable Qty.	L	W		---	$0.015 \geq W$	Disregard	$3.0 \geq L$	$0.03 \geq W$	2	$2.0 \geq L$	$0.05 \geq W$	$1.0 \geq L$	$0.1 > W$	1	---	$0.05 \leq W$	Applied as point defect	<div>Unit: mm</div>
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5	Rainbow	Not more than two color changes across the viewing area.																				

No	Item	Criterion																																
6	Chip Remark: X: Length direction Y: Short direction Z: Thickness direction t: Glass thickness W: Terminal Width	<div><p>Acceptable criterion</p><table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤ 2</td><td>0.5mm</td><td>$\leq t/2$</td></tr></table></div> <div><p>Acceptable criterion</p><table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤ 2</td><td>0.5mm</td><td>$\leq t$</td></tr></table></div> <div><p>Acceptable criterion</p><table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤ 3</td><td>≤ 2</td><td rowspan="2">$\leq t$</td></tr><tr><td colspan="2">shall not reach to ITO</td></tr></table></div> <div><p>Acceptable criterion</p><table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>Disregard</td><td>≤ 0.2</td><td>$\leq t$</td></tr></table></div> <div><p>Acceptable criterion</p><table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤ 5</td><td>≤ 2</td><td>$\leq t/3$</td></tr></table></div>	X	Y	Z	≤ 2	0.5mm	$\leq t/2$	X	Y	Z	≤ 2	0.5mm	$\leq t$	X	Y	Z	≤ 3	≤ 2	$\leq t$	shall not reach to ITO		X	Y	Z	Disregard	≤ 0.2	$\leq t$	X	Y	Z	≤ 5	≤ 2	$\leq t/3$
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No.	Item	Criterion								
7	Segment pattern W = Segment width $\bar{\phi} = (X+Y)/2$	<p>(1) Pin hole</p> <p>$\bar{\phi} < 0.10\text{mm}$ is acceptable.</p> <div><table><tr><th>Point Size</th><th>Acceptable Qty</th></tr><tr><td>$\bar{\phi} \leq 1/4W$</td><td>Disregard</td></tr><tr><td>$1/4W < \bar{\phi} \leq 1/2W$</td><td>1</td></tr><tr><td>$\bar{\phi} > 1/2W$</td><td>0</td></tr></table><p>Unit: mm</p></div>	Point Size	Acceptable Qty	$\bar{\phi} \leq 1/4W$	Disregard	$1/4W < \bar{\phi} \leq 1/2W$	1	$\bar{\phi} > 1/2W$	0
Point Size	Acceptable Qty									
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$\bar{\phi} > 1/2W$	0									
8	Back-light	<p>(1) The color of backlight should correspond its specification.</p> <p>(2) Not allow flickering</p>								
9	Soldering	<p>(1) Not allow heavy dirty and solder ball on PCB.</p> <p>(The size of dirty refer to point and dust defect)</p> <p>(2) Over 50% of lead should be soldered on Land.</p> <div></div>								
10	Wire	<p>(1) Copper wire should not be rusted</p> <p>(2) Not allow crack on copper wire connection.</p> <p>(3) Not allow reversing the position of the flat cable.</p> <p>(4) Not allow exposed copper wire inside the flat cable.</p>								
11*	PCB	<p>(1) Not allow screw rust or damage.</p> <p>(2) Not allow missing or wrong putting of component.</p>								

No	Item	Criterion
12	Protruded W: Terminal Width	 <p>Acceptable criteria: $Y \leq 0.4$</p>
13	TAB	<p>1. Position</p>  <p>ITO TAB</p> <p>$W1 \leq 1/3W$ $H1 \leq 1/3H$</p> <p>2 FPC bonding strength test</p>  <p>FPC</p> <p>$P (=F/FPC \text{ bonding width}) \geq 650\text{gf/cm}$,(speed rate: 1mm/min) 5pcs per SOA (shipment)</p>
14	Total no. of acceptable Defect	<p>A. Zone</p> <p>Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm</p> <p>B. Zone</p> <p>It is acceptable when it is no trouble for quality and assembly in customer's end product.</p>

11.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	60°C	48	No abnormalities in functions and appearance
High temp. Operating	50°C	48	
Low temp. Storage	-20°C	48	
Low temp. Operating	-10°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	-20°C ← 25°C → 80°C (60 min ← 5 min → 60min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature ($20 \pm 8^{\circ}\text{C}$), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

11.4 Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol or trichlorotrifluoroethane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting Orient Display
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

1. The viewing angle can be adjusted by varying the LCD driving voltage V_o .
2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
4. Response time increases with decrease in temperature.
5. Display color may be affected at temperatures above its operational range.
6. Keep the temperature within the specified range usage and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

Orient Display LCDs and modules are not consumer products, but may be incorporated by Orient Display's customers into consumer products or components thereof, Orient Display does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of Orient Display is limited to repair or replacement on the terms set forth below. Orient Display will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between Orient Display and the customer. Orient Display will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with Orient Display general LCD inspection standard (copies available on request).

2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.

3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.