

SPECIFICATION FOR LCD MODULE

Customer Approval:

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	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)	Khan.wan	2009-12-09
PREPARED BY (QA ENGINEER)		
CHECKED BY		
APPROVED BY		

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
01	2009-12-09	New desgin	Khan.wan

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1. Features & Mechanical Specifications

Item	Contents	Unit
	LCD	
LCD Type	TFT Transmissive Normal White	--
Viewing direction	12:00	--
Backlight	White LED x4 in parallel	--
Interface	8/16bit parallel bus 8080- interface	--
Driver IC	OTM3225A	--
Outline Dimension	42.72(W) × 60.26 (H) × 3.7(T)	mm
Glass area (W×H×T)	40.58 × 56.96 × 1.0	mm
Active area (W×H)	36.72 × 48.96	mm
Number of Dots	240(RGB) × 320	--
Dot pitch (W×H)	0.051 × 0.153	mm
Pixel pitch (W×H)	0.153 × 0.153	mm
Operating Temperature	-20 ~ +70	°C
Storage temperature	-30 ~ +80	°C

3. Block Diagram

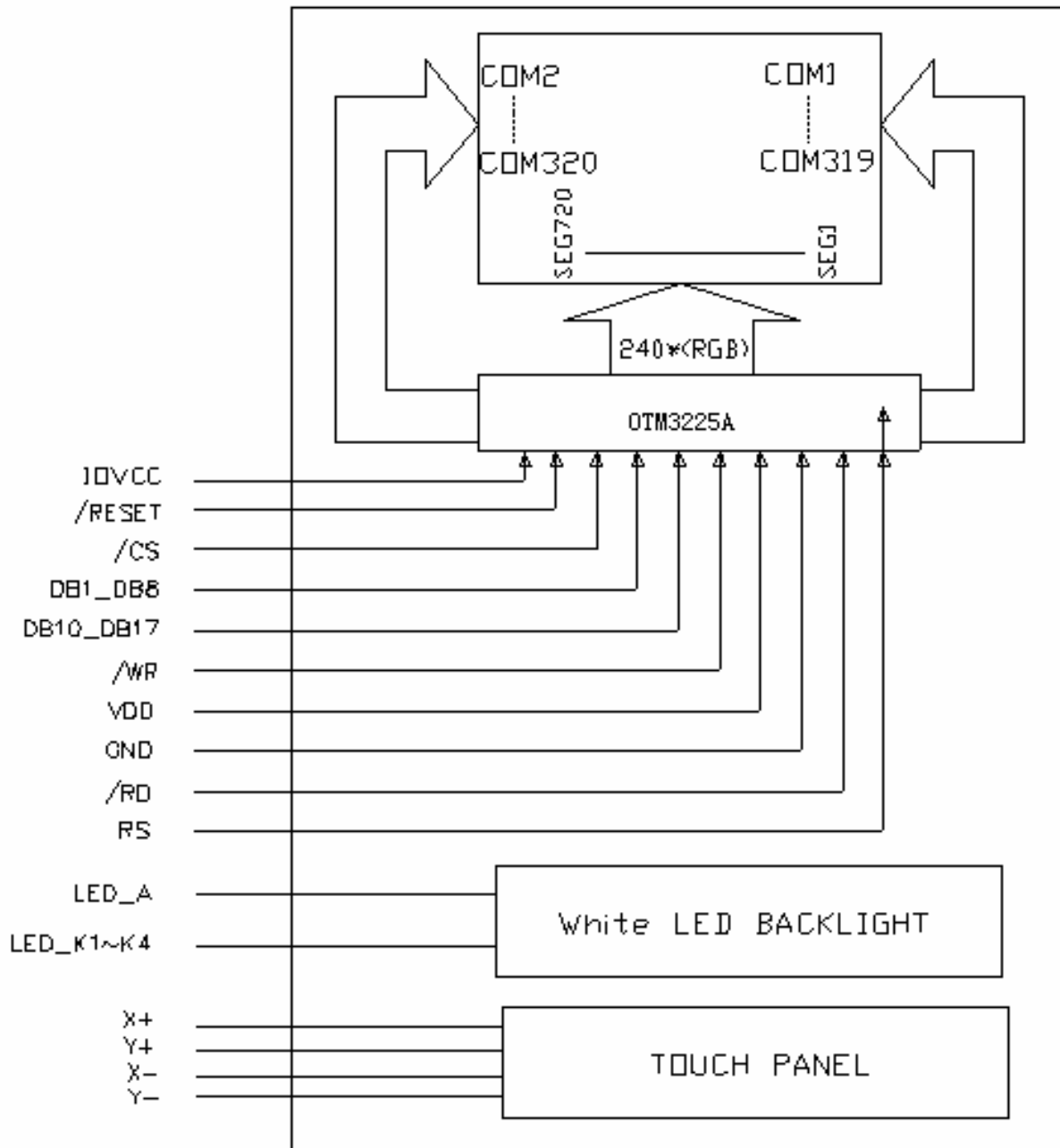


Figure 2. Block diagram

4. Pin Description

PIN No.	SYMBOL	Function
1	DB0	Data bus
2	DB1	
3	DB2	
4	DB3	
5	GND	System Ground
6	VCC	Power supply
7	/CS	Chip Select input pin. (Active Low)
8	RS	Data or command select pin. "H": Date, "L": Command.
9	/WR	Write signal input pin. (Active Low)
10	/RD	Read signal input pin. (Active Low)
11	IM0	IM0=0, Select 16bit interface; IM0=1, Select 8bit interface
12	XL	Touch panel output pins
13	YU	
14	XR	
15	YD	
16	LEDA	Backlight LED Anode.
17	LEDK1	Backlight LED Cathode.
18	LEDK2	
19	LEDK3	
20	LEDK4	
21	IM3	NC
22	DB4	Data bus
23	DB10	
24	DB11	
25	DB12	
26	DB13	
27	DB14	
28	DB15	
29	DB16	
30	DB17	

31	/RESET	Reset Signal pin (“Low” is enable)
32	VCC	Power supply
33	VCC	
34	GND	System Ground
35	DB5	Data bus
36	DB6	
37	DB7	

Note:

R1	R2	R3	Interface Mode
NC	Short	NC	8080-8bit interface: DB17~DB10
Short	NC	NC	8080-16bit interface: DB17~DB10 , DB8~DB1
NC	NC	Short	IM0=0, Select 16bit interface; IM0=1,Select 8bit interface

5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply Voltage range	VDD	-0.3 to +3.7	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	VCC	2.45	-	3.3	V

7. Backlight Characteristics

White LED × 4 in parallel

(Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=60mA	2.9	3.2	3.4	V
Uniformity	△Bp	-	80	-	-	%
Luminance for LCD	Lv	IF=20	3200	3500	3800	cd/m ²

8. Electro-Optical Characteristics

Using CMO LC+ Normal Polarizer+Corresponding Backlight, reference only (Note 1-7)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Response Time	Rise	6-0°	-	15	25	ms	Note 4, 8
	Fall		-	20	30	ms	
Contrast Ratio (with HC polarizer only)	CR	At optimized viewing angle	200	300	-		Note 5, 8
NTSC	%		50	55			
Viewing Angle	Top	CR=10	40	50	-	deg.	Note 7
	Bottom		15	20	-		
	Left		40	45	-		
	Right		40	45	-		
Transmittance (without polarizer)			15	15.5	-	%	Typ. 8.2% with HC polarizer only
Chromaticity	Wx	6-0°	0.27	0.31	0.35	Measured by C Light source	
	Wy		0.314	0.354	0.394		
	Rx		0.604	0.644	0.684		
	Ry		0.287	0.327	0.367		
	Gx		0.258	0.298	0.338		
	Gy		0.53	0.57	0.61		
	Bx		0.112	0.152	0.192		
	By		0.149	0.189	0.229		

Note 1: Ambient temperature $-25^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

Note 2: To be measured in the dark room with backlight unit.

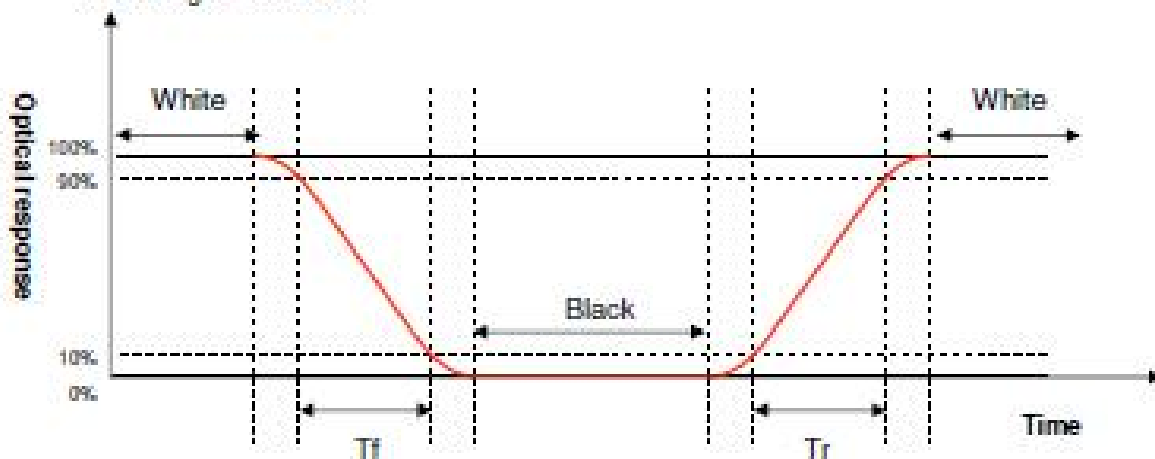
Note 3: To be measured at the center area of panel with a viewing cone of 1° by Topcon luminance meter BM-7, after 10 minutes operation (module).



Note 4: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(rising time) and from "white" to "black"(falling time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.

Refer to figure as below.



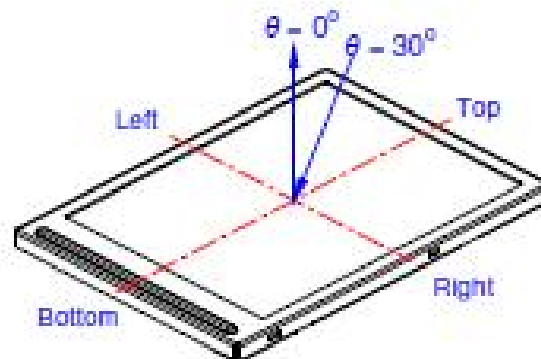
Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula:

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black"}}$$

Note 6. White $V_i = 5.5V$ / Black $V_j = 0.9V$

Note 7. Definition of viewing angle



9. Instruction Description

System Function command List (1)

No.	Registers Name	R/W	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	
SR	Status Read	R	0	L7	L6	L5	L4	L3	L2	L1	L0	0	0	0	0	0	0	0	0	
00h	Driver Code Read	R	1	1	0	0	1	0	0	1	0	0	0	1	0	0	0	1	0	
00h	Start Oscillation	W	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	OSC	
01h	Driver Output Control 1	W	1	0	0	0	0	0	SM	0	SS	0	0	0	0	0	0	0	0	
02h	LCD Driving Control	W	1	0	0	0	0	0	1	B/C	EOR	0	0	0	0	0	0	0	0	
03h	Entry Mode	W	1	TRI	DFM	0	BGR	0	0	HWM	0	ORG	0	I/D1	I/D0	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	0	BASEE	0	0	GON	DTE	CL	0	D1	D0	
08h	Display Control 2	W	1	0	0	0	0	FP3	FP2	FP1	FP0	0	0	0	0	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	FMI2	FMI1	FMI0	
0Ch	RGB Display Interface Control 1	W	1	ENC2	ENC1	ENC0	0	0	0	0	RM	0	0	DM1	DM0	0	0	RIM1	RIM0	
0Dh	Frame Maker Position	W	1	0	0	0	0	0	0	0	FMP8	FMP7	FMP6	FMP5	FMP4	FMP3	FMP2	FMP1	FMP0	
0Fh	RGB Display Interface Control 2	W	1	0	0	0	0	0	0	0	0	0	0	VSPL	HSPL	0	0	DPL	EPL	
10h	Power Control 1	W	1	0	0	0	SAP	BT3	BT2	BT1	BT0	APE	AP2	AP1	AP0	0	DSTB	SLP	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	VCMR	0	0	0	PON	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	Horizontal GRAM Address Set	W	1	0	0	0	0	0	0	0	0	AD7	AD6	AD5	AD4	AD3	AD2	AD1	AD0	
21h	Vertical GRAM Address Set	W	1	0	0	0	0	0	0	0	0	AD16	AD15	AD14	AD13	AD12	AD11	AD10	AD9	AD8
22h	Write Data to GRAM	W	1	RAM write data (WD17-0) / read data (RD17-0) bits are transferred via different data bus lines according to the selected interfaces.																
29h	Power Control 7	W	1	0	0	0	0	0	0	0	0	0	0	0	VCM4	VCM3	VCM2	VCM1	VCM0	
2Bh	Frame Rate and Color Control	W	1	0	0	0	0	0	0	0	0	EXT_R	0	FR_SEL1	FR_SEL0	0	0	0	0	
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	VRP0[4]	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]	

System Function command List (2)

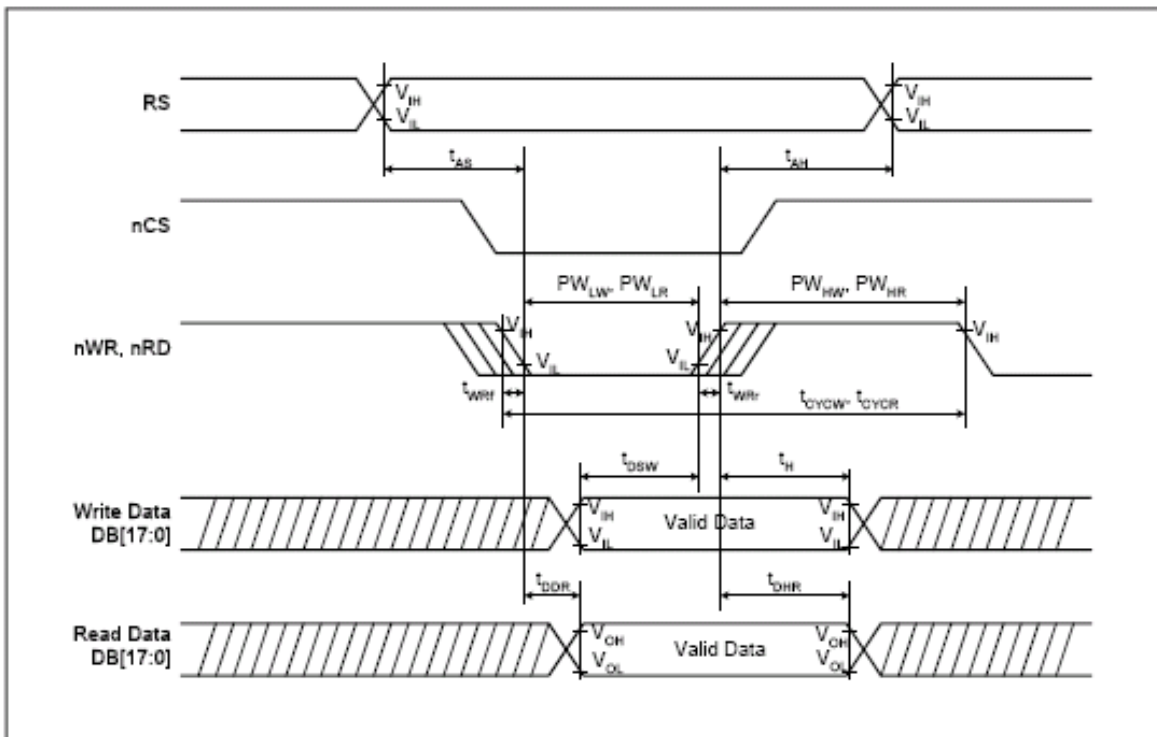
No.	Registers Name	RW	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
30h	Gamma Control 10	W	1	0	0	0	VRN1[4]	VRN1[3]	VRN1[2]	VRN1[1]	VRN1[0]	0	0	0	VRN0[4]	VRN0[3]	VRN0[2]	VRN0[1]	VRN0[0]
50h	Horizontal Address Start Position	W	1	0	0	0	0	0	0	0	0	HSA7	HSA6	HSA5	HSA4	HSA3	HSA2	HSA1	HSA0
51h	Horizontal Address End Position	W	1	0	0	0	0	0	0	0	0	HEA7	HEA6	HEA5	HEA4	HEA3	HEA2	HEA1	HEA0
52h	Vertical Address Start Position	W	1	0	0	0	0	0	0	0	0	VSA8	VSA7	VSA6	VSA5	VSA4	VSA3	VSA2	VSA1
53h	Vertical Address End Position	W	1	0	0	0	0	0	0	0	0	VEA8	VEA7	VEA6	VEA5	VEA4	VEA3	VEA2	VEA1
60h	Driver Output Control 2	W	1	GS	0	NL5	NL4	NL3	NL2	NL1	NL0	0	0	SCN5	SCN4	SCN3	SCN2	SCN1	SCN0
61h	Base Image Display Control	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	NDL	VLE	REV
6Ah	Vertical Scroll Control	W	1	0	0	0	0	0	0	0	0	VL8	VL7	VL6	VL5	VL4	VL3	VL2	VL1
80h	Partial Image 1 Display Position	W	1	0	0	0	0	0	0	0	0	PTDP08	PTDP07	PTDP06	PTDP05	PTDP04	PTDP03	PTDP02	PTDP01
81h	Partial Image 1 Area (Start Line)	W	1	0	0	0	0	0	0	0	0	PTSA08	PTSA07	PTSA06	PTSA05	PTSA04	PTSA03	PTSA02	PTSA01
82h	Partial Image 1 Area (End Line)	W	1	0	0	0	0	0	0	0	0	PTEA08	PTEA07	PTEA06	PTEA05	PTEA04	PTEA03	PTEA02	PTEA01
83h	Partial Image 2 Display Position	W	1	0	0	0	0	0	0	0	0	PTDP18	PTDP17	PTDP16	PTDP15	PTDP14	PTDP13	PTDP12	PTDP11
84h	Partial Image 2 Area (Start Line)	W	1	0	0	0	0	0	0	0	0	PTSA18	PTSA17	PTSA16	PTSA15	PTSA14	PTSA13	PTSA12	PTSA11
85h	Partial Image 2 Area (End Line)	W	1	0	0	0	0	0	0	0	0	PTEA18	PTEA17	PTEA16	PTEA15	PTEA14	PTEA13	PTEA12	PTEA11
90h	Panel Interface Control 1	W	1	0	0	0	0	0	0	DIV1	DIV0	0	0	0	0	RTN3	RTN2	RTN1	RTN0
92h	Panel Interface Control 2	W	1	0	0	0	0	0	NOW2	NOW1	NOW0	0	0	0	0	0	0	0	0
93h	Panel Interface Control 3	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	MCP2	MCP1	MCP0
95h	Panel Interface Control 4	W	1	0	0	0	0	0	0	DIVE1	DIVE0	0	0	RTNE5	RTNE4	RTNE3	RTNE2	RTNE1	RTNE0
97h	Panel Interface Control 5	W	1	0	0	0	0	0	NOWE3	NOWE2	NOWE1	NOWE0	0	0	0	0	0	0	0
98h	Panel Interface Control 6	W	1	0	0	0	0	0	0	0	0	0	0	0	0	0	MCPE2	MCPE1	MCPE0

10. AC Characteristics

8080-series MCU interface Timing Characteristics

Normal Write Mode (IOVCC = 1.65~3.3V, VCC=2.4~3.3V)

Item	Symbol	Unit	Min.	Typ.	Max.	Test Condition
Bus cycle time	Write	t_{CYCW}	ns	100	-	-
	Read	t_{CYCR}	ns	300	-	-
Write low-level pulse width	PW_{LW}	ns	50	-	500	-
Write high-level pulse width	PW_{HW}	ns	50	-	-	-
Read low-level pulse width	PW_{LR}	ns	150	-	-	-
Read high-level pulse width	PW_{HR}	ns	150	-	-	-
Write / Read rise / fall time	t_{WR}/t_{WR}	ns	-	-	25	-
Setup time	Write (RS to nCS, E/nWR)	t_{AS}	ns	10	-	-
	Read (RS to nCS, RW/nRD)			5	-	-
Address hold time	t_{AH}	ns	5	-	-	-
Write data set up time	t_{DSW}	ns	10	-	-	-
Write data hold time	t_H	ns	15	-	-	-
Read data delay time	t_{DDR}	ns	-	-	100	-
Read data hold time	t_{DHR}	ns	5	-	-	-



11. Quality Specifications

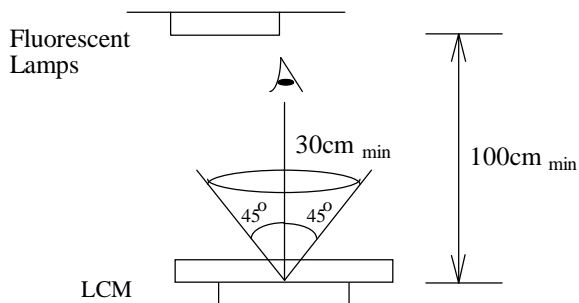
All The raw material are Rohs compllicant.

11.1 Standard of the product appearance test

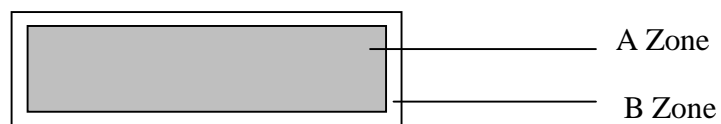
Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps.

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

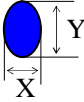
Sampling method: MIL-STD-105E, Level II, single sampling

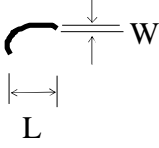
Defect classification (Note: * is not including)

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	Point defect, Black spot, dust (including Polarizer) $\phi = (X+Y)/2$	<div style="display: flex; align-items: center; justify-content: center;">  <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty.</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 0.10$</td> <td>Disregard</td> </tr> <tr> <td>$0.10 < \phi \leq 0.15$</td> <td>2</td> </tr> <tr> <td>$0.15 < \phi \leq 0.20$</td> <td>2</td> </tr> <tr> <td>$\phi > 0.20$</td> <td>0</td> </tr> </tbody> </table> </div> <p style="text-align: right; margin-top: 10px;">Unit: mm</p>	Point Size	Acceptable Qty.	$\phi \leq 0.10$	Disregard	$0.10 < \phi \leq 0.15$	2	$0.15 < \phi \leq 0.20$	2	$\phi > 0.20$	0
Point Size	Acceptable Qty.											
$\phi \leq 0.10$	Disregard											
$0.10 < \phi \leq 0.15$	2											
$0.15 < \phi \leq 0.20$	2											
$\phi > 0.20$	0											

4	Line defect, Scratch	 <table border="1" data-bbox="826 448 1359 698"> <thead> <tr> <th colspan="2">Line</th> <th rowspan="2">Acceptable Qty.</th> </tr> <tr> <th>L</th> <th>W</th> </tr> </thead> <tbody> <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>$0.05 < W$</td> <td>Applied as point defect</td> </tr> </tbody> </table> <p style="text-align: center;">Unit: mm</p>	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	---	$0.05 < W$	Applied as point defect
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																			
---	$0.05 < W$	Applied as point defect																			
5	Rainbow	Not more than two color changes across the viewing area.																			

No	Item	Criterion
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6 Chip

Remark:

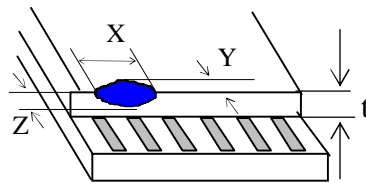
X: Length direction

Y: Short direction

Z: Thickness direction

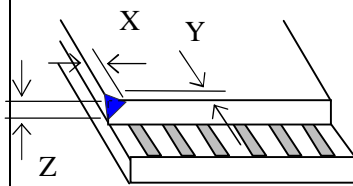
t: Glass thickness

W: Terminal Width



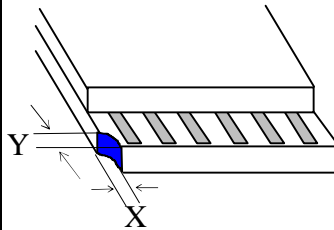
Acceptable criterion

X	Y	Z
≤ 2	0.5mm	$\leq t/2$



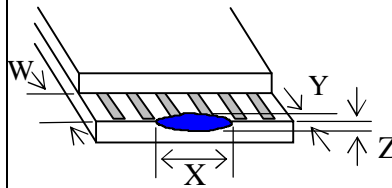
Acceptable criterion

X	Y	Z
≤ 2	0.5mm	$\leq t$



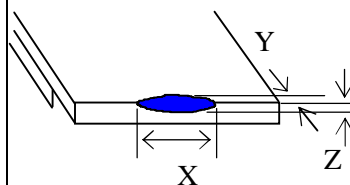
Acceptable criterion

X	Y	Z
≤ 3	≤ 2	$\leq t$
shall not reach to ITO		



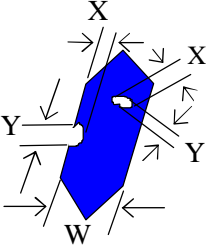
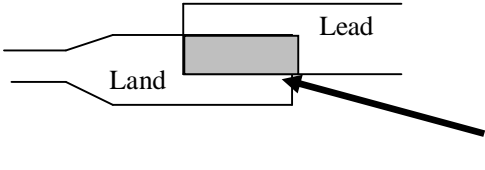
Acceptable criterion

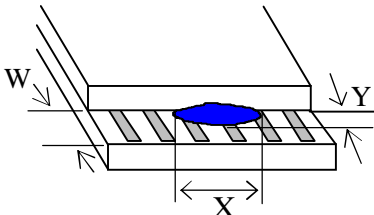
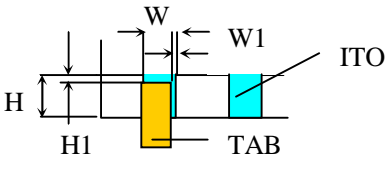
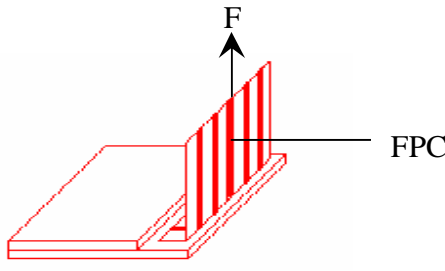
X	Y	Z
Disregard	≤ 0.2	$\leq t$



Acceptable criterion

X	Y	Z
≤ 5	≤ 2	$\leq t/3$

No.	Item	Criterion								
7	Segment pattern $W = \text{Segment width}$ $\phi = (X+Y)/2$	(1) Pin hole $\phi < 0.10\text{mm}$ is acceptable.  <table border="1" data-bbox="890 660 1337 828"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 1/4W$</td> <td>Disregard</td> </tr> <tr> <td>$1/4W < \phi \leq 1/2W$</td> <td>1</td> </tr> <tr> <td>$\phi > 1/2W$</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: center;">Unit: mm</p>	Point Size	Acceptable Qty	$\phi \leq 1/4W$	Disregard	$1/4W < \phi \leq 1/2W$	1	$\phi > 1/2W$	0
Point Size	Acceptable Qty									
$\phi \leq 1/4W$	Disregard									
$1/4W < \phi \leq 1/2W$	1									
$\phi > 1/2W$	0									
8	Back-light	(1) The color of backlight should correspond its specification. (2) Not allow flickering								
9	Soldering	(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land. 								
10	Wire	(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.								
11*	PCB	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.								

No	Item	Criterion
12	Protruded W: Terminal Width	 <p>Acceptable criteria: $Y \leq 0.4$</p>
13	TAB	<p>1. Position</p>  <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-left: auto; margin-right: auto;"> $W1 \leq 1/3W$ $H1 \leq 1/3H$ </div> <p>2 FPC bonding strength test</p>  <p> $P (=F/FPC \text{ bonding width}) \geq 650gf/cm$,(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>
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11.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	No abnormalities in functions and appearance
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	
Low temp. Operating	-20°C	48	
Humidity	60°C/ 90%RH	48	
Temp. Cycle	-30°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±8°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 SUNYEE.
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

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

1. The liability of SUNYEE is limited to repair or replacement on the terms set forth below. SUNYEE 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 SUNYEE and the customer, SUNYEE will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with SUNYEE 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.