ORIENT DISPLAY

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SPECIFICATION
FOR
TFT MODULE

MODULE NO:AFS176220TG-2.2-U910001
REVISION NO: 03

Customer's Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)	XJZ	2011-12-8
CHECKED BY	YHW	2011-12-8
APPROVED BY	HSH	2011-12-8

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DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	Oct-14-2011	First Issue	Ylh
01	Oct-17-2011	Rev. C/D	Alfred
02	Nov-08-2011	Rev. Interface Definition	Ylh
03	Mar-05-2012	Rev. B/L Brightness & FPC Structure	Ylh

CONTENTS

1. Features & Mechanical Specifications

Item	Contents	Unit
	LCD	
LCD Type	TFT / Transmissive / Normally White	--
Viewing direction	12:00	--
Backlight	White LED x 3 in Parallel	--
Interface	8080-8bit parallel bus interface	--
Driver IC	ILI9225G	--
Outline Dimension	41.7(W) ×56.16(H) × 2.5(T)	mm
Glass area (W×H×T)	38.048(W) × 50.16(H) × 1.0(T)	mm
Active area (W×H)	34.848 × 43.56	mm
Number of Dots	176(RGB) × 220	--
Dot pitch (W×H)	0.066 × 0.066	mm
Pixel pitch (W×H)	0.198 × 0.198	mm
Operating Temperature	-10 ～ +50	℃
Storage temperature	-20 ～ +60	℃

2. Dimensional Outline

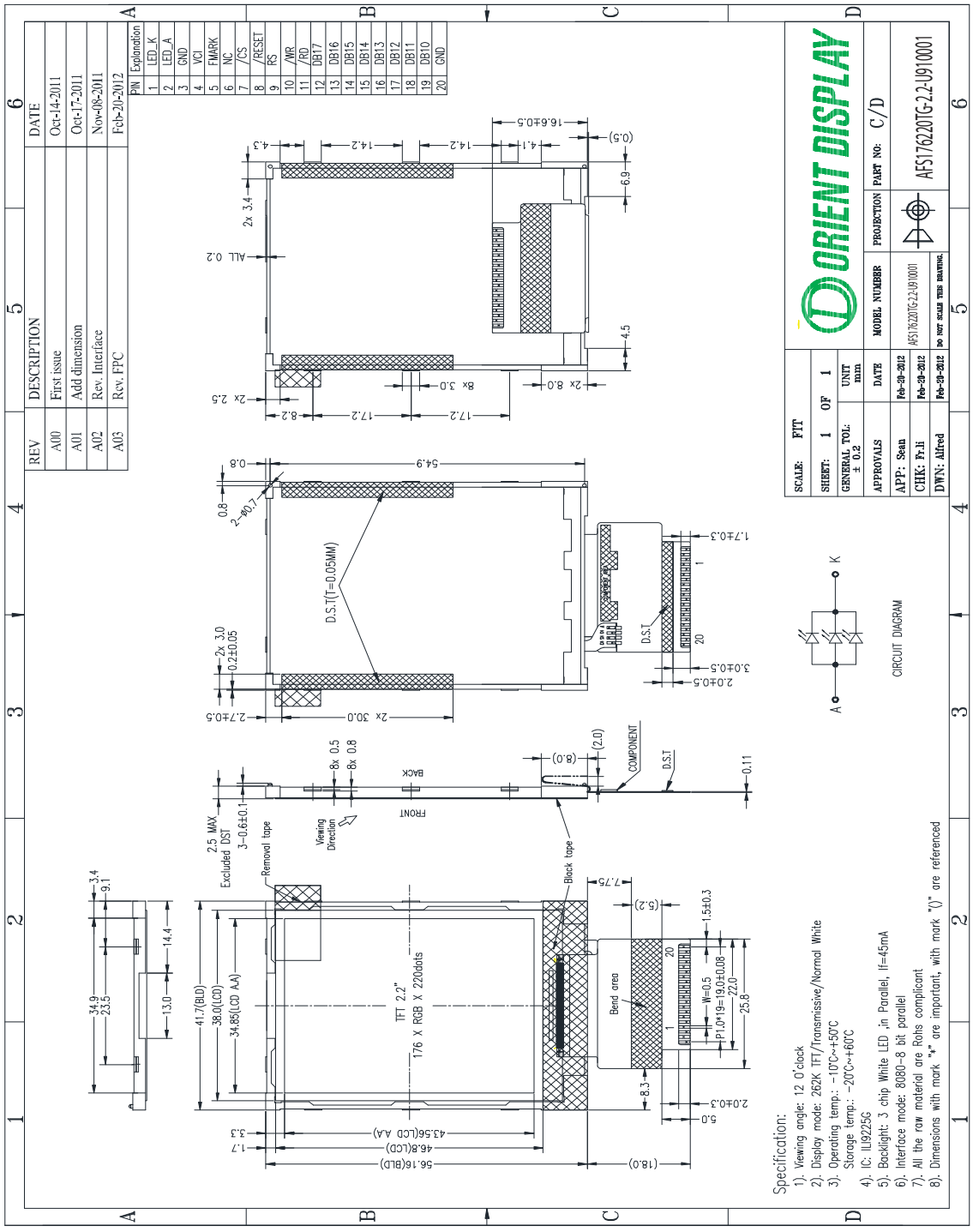


Figure 1. Dimensional outline

3. Block Diagram

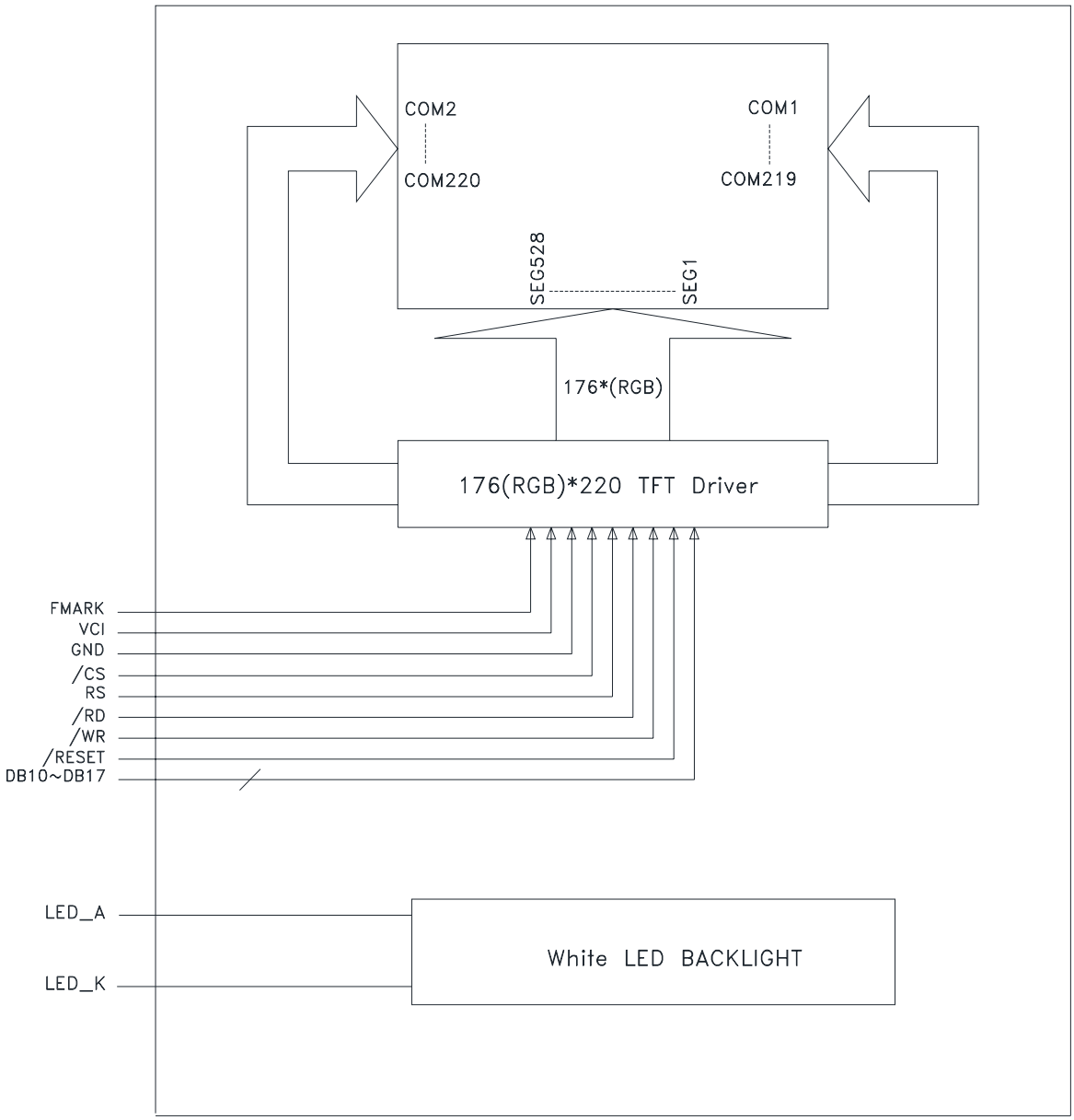


Figure 2. Block diagram

4. Pin Description

PIN No.	SYMBOL	Function
1	LED_K	Backlight LED Cathode
2	LED_A	Backlight LED Anode
3	GND	Ground
4	VCI	A supply voltage to the analog circuit
5	FMARK	Tearing effect output pin to synchronize MCU to frame writing, activated by S/W command. When this pin is not activated, this pin is low. If not used, open this pin.
6	NC	No connection
7	/CS	Chip Select Signal (“Low” enable)
8	/RESET	Reset pin. (Active Low)
9	RS	A register select signal. Low: select an index or status register High: select a control register
10	/WR	Write signal.
11	/RD	Read signal.
12~19	DB17~DB10	Data Bus
20	GND	Ground

5. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply Voltage range	VCI	-0.3 to +4.6	V
Operating Temperature range	TOP	-10 to +50	℃
Storage Temperature range	TST	-20 to +60	℃

6. Electrical Characteristics

DC Characteristics

Item	Symbol	Min.	Type.	Max.	Unit
Driver Supply Voltage	VCI	2.5	-	3.3	V

7. Backlight Characteristics

White LED × 3 in parallel **(Ta = 25°C)**

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=45mA	-	3.2	-	V
Uniformity	△Bp	-	80	-	-	%
Luminance for LCD	Lv	IF=45mA	-	4700	-	cd/m^2

8. Electro-Optical Characteristics

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (without Polarizer)		T(%)	–	–	16.0	–	–	
Contrast Ratio		CR	Θ=0	400	500	–	–	(1)(2)
Response time	Rising	T_R	Normal viewing angle	–	2	4	msec	(1)(3)
	Falling	T_F	–	–	6	12		
			–					
Color gamut		S(%)			60		%	
Color chromaticity (CIE1931)	White	W_x		0.283	0.303	0.323		(1)(4) CF glass
		Wy		0.305	0.325	0.345		
	Red	Rx		0.606	0.626	0.646		
		Ry		0.314	0.334	0.354		
	Green	Gx		0.257	0.277	0.297		
		Gy		0.529	0.549	0.569		
	Blue	Bx		0.122	0.142	0.162		
		By		0.102	0.122	0.142		
Viewing angle	Hor.	Θ_L	CR>10	35	45	–		
		Θ_R		35	45	–		
	Ver.	Θ_U		35	45	–		
		Θ_D		10	20	–		
Optima View Direction		12 O'clock						(5)

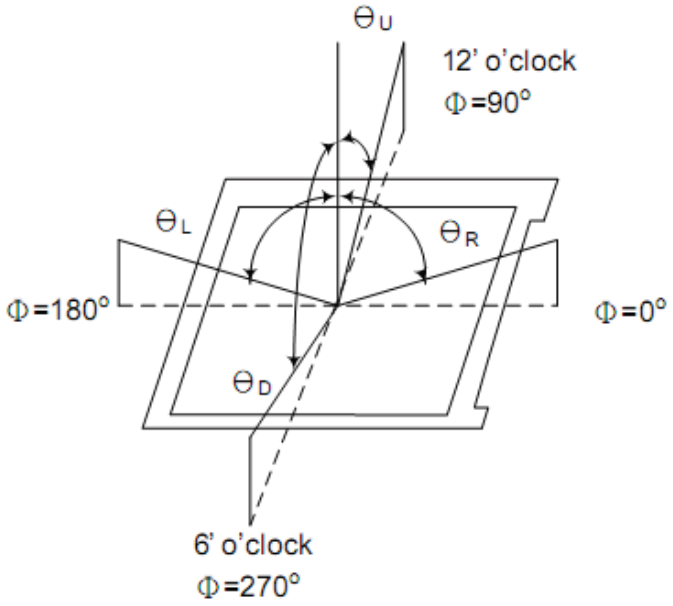
Measuring Condition

- Measuring surrounding : dark room
- Ambient temperature : 25±2°C
- 15min. warm-up time.

Measuring Equipment

- FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

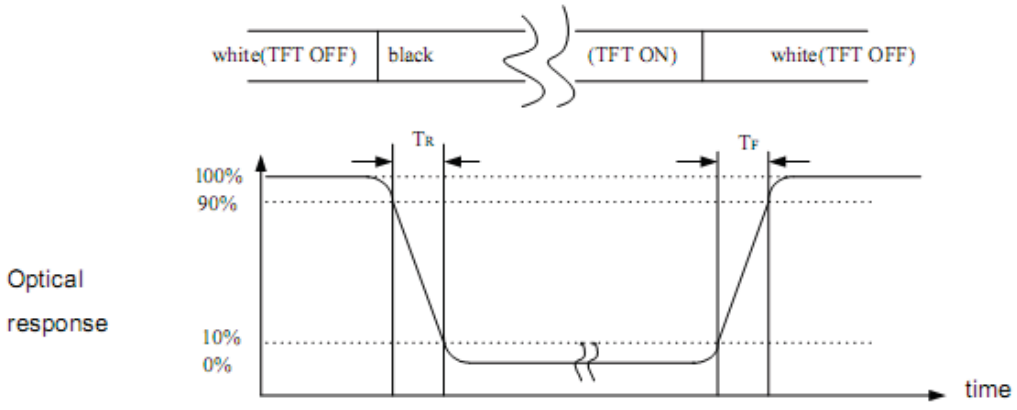
Note (1) Definition of Viewing Angle :



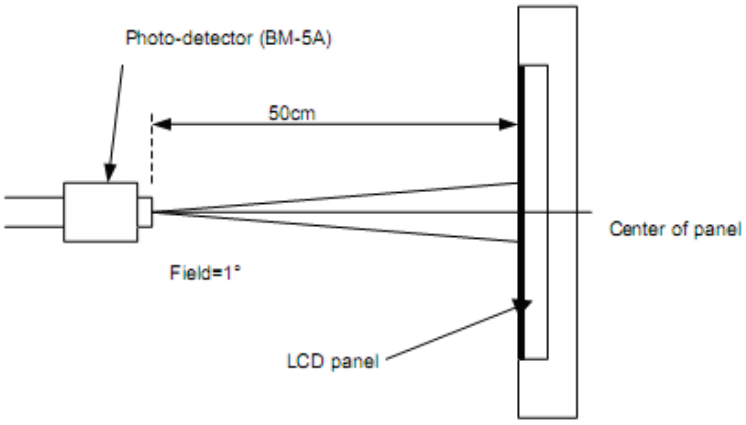
Note (2) Definition of Contrast Ratio(CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

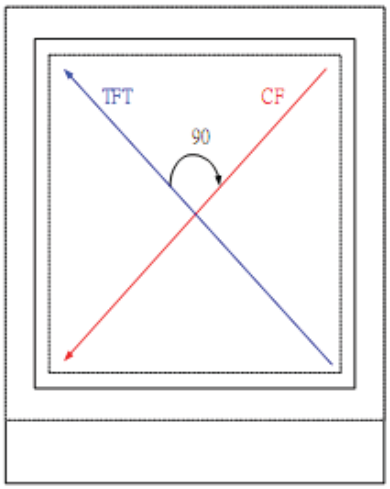
Note (3) Definition of Response Time : Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.



TFT Face up

9. Instruction Description

No.	Registers Name	R/W	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
IR	Index	W	0	0	0	0	0	0	0	0	0	ID7	ID6	ID5	ID4	ID3	ID2	ID1	ID0
00h	Driver Code Read	R	1	1	0	0	1	0	0	1	0	0	0	1	0	0	1	0	1
01h	Driver Output Control	W	1	VSPL (0)	HSPL (0)	DPL (0)	EPL (0)	0	SM (0)	GS (0)	SS (0)	0	0	0	NL4 (1)	NL3 (1)	NL2 (1)	NL1 (0)	NL0 (0)
02h	LCD AC Driving Control	W	1	0	0	0	0	0	0	INV1 (0)	INV0 (1)	0	0	0	0	0	0	0	FLD (0)
03h	Entry Mode	W	1	0	0	0	BGR (0)	0	0	MDT1 (0)	MDT0 (0)	0	0	ID1 (1)	ID0 (1)	AM (0)	0	0	0
07h	Display Control 1	W	1	0	0	0	TEMON (0)	0	0	0	0	0	0	0	GON (0)	CL (0)	REV (0)	D1 (0)	D0 (0)
08h	Blank Period Control 1	W	1	0	0	0	0	FP3 (1)	FP2 (0)	FP1 (0)	FP0 (0)	0	0	0	0	BP3 (1)	BP2 (0)	BP1 (0)	BP0 (0)
0Bh	Frame Cycle Control	W	1	NO3 (0)	NO2 (0)	NO1 (1)	NO0 (1)	SDT3 (0)	SDT2 (0)	SDT1 (0)	SDT0 (1)	0	0	0	0	RTN3 (0)	RTN2 (0)	RTN1 (0)	RTN0 (0)
0Ch	Interface Control	W	1	0	0	0	0	0	0	0	RIM (0)	0	0	0	DM (0)	0	0	RIM1 (0)	RIM0 (0)
0Fh	Oscillation Control	W	1	0	0	0	0	FOSC3 (0)	FOSC2 (1)	FOSC1 (1)	FOSC0 (1)	0	0	0	0	0	0	0	OSC_ON(1)
10h	Power Control 1	W	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	STB (0)
11h	Power Control 2	W	1	0	0	0	APON (0)	0	0	0	0	0	1	0	0	0	0	0	1
12h	Power Control 3	W	1	0	BT2 (0)	BT1 (1)	BT0 (0)	0	0	0	0	0	0	0	1	0	0	1	0
13h	Power Control 4	W	1	0	0	0	0	0	0	0	0	0	GVD6 (1)	GVD5 (1)	GVD4 (0)	GVD3 (0)	GVD2 (1)	GVD1 (1)	GVD0 (0)
14h	Power Control 5	W	1	VCOMG (0)	VCM6 (1)	VCM5 (0)	VCM4 (1)	VCM3 (0)	VCM2 (0)	VCM1 (0)	VCM0 (1)	0	VML6 (1)	VML5 (1)	VML4 (0)	VML3 (1)	VML2 (0)	VML1 (0)	VML0 (1)
20h	RAM Address Set 1	W	1	0	0	0	0	0	0	0	0	AD7 (0)	AD6 (0)	AD5 (0)	AD4 (0)	AD3 (0)	AD2 (0)	AD1 (0)	AD0 (0)
21h	RAM Address Set 2	W	1	0	0	0	0	0	0	0	0	AD15 (0)	AD14 (0)	AD13 (0)	AD12 (0)	AD11 (0)	AD10 (0)	AD9 (0)	AD8 (0)
22h	Write Data to GRAM	W	1	WD[17:0]: Pin assignment varies according to the interface method.															
22h	Read Data to GRAM	R	1	RD[17:0]: Pin assignment varies according to the interface method.															

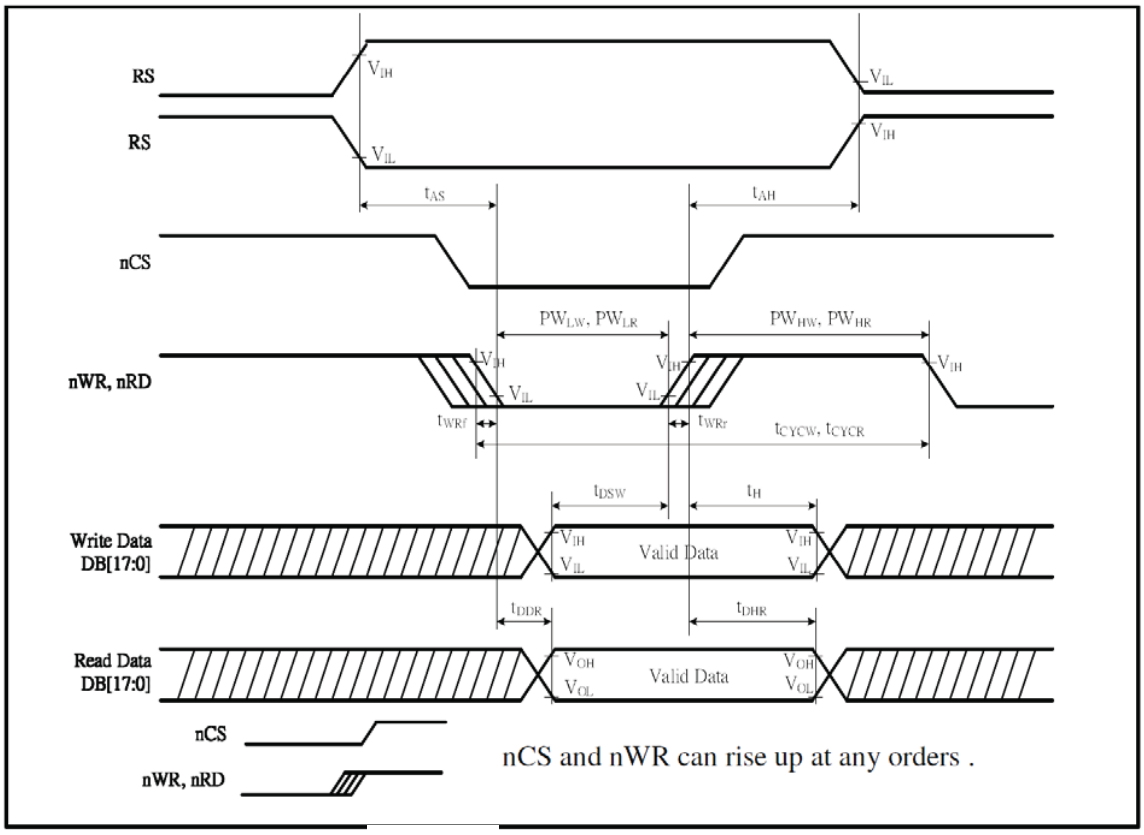
No.	Registers Name	R/W	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
30h	Gate Scan Control	W	1	0	0	0	0	0	0	0	0	0	0	0	SCN4 (0)	SCN3 (0)	SCN2 (0)	SCN1 (0)	SCN0 (0)
31h	Vertical Scroll Control 1	W	1	0	0	0	0	0	0	0	0	SEA7 (1)	SEA6 (1)	SEA5 (0)	SEA4 (1)	SEA3 (1)	SEA2 (0)	SEA1 (1)	SEA0 (1)
32h	Vertical Scroll Control 2	W	1	0	0	0	0	0	0	0	0	SSA7 (0)	SSA6 (0)	SSA5 (0)	SSA4 (0)	SSA3 (0)	SSA2 (0)	SSA1 (0)	SSA0 (0)
33h	Vertical Scroll Control 3	W	1	0	0	0	0	0	0	0	0	SST7 (0)	SST6 (0)	SST5 (0)	SST4 (0)	SST3 (0)	SST2 (0)	SST1 (0)	SST0 (0)
34h	Partial Driving Position -1	W	1	0	0	0	0	0	0	0	0	SE17 (1)	SE16 (1)	SE15 (0)	SE14 (1)	SE13 (1)	SE12 (0)	SE11 (1)	SE10 (1)
35h	Partial Driving Position -2	W	1	0	0	0	0	0	0	0	0	SS17 (0)	SS16 (0)	SS15 (0)	SS14 (0)	SS13 (0)	SS12 (0)	SS11 (0)	SS10 (0)
36h	Horizontal Window Address -1	W	1	0	0	0	0	0	0	0	0	HEA7 (1)	HEA6 (0)	HEA5 (1)	HEA4 (0)	HEA3 (1)	HEA2 (1)	HEA1 (1)	HEA0 (1)
37h	Horizontal Window Address -2	W	1	0	0	0	0	0	0	0	0	HSA7 (0)	HSA6 (0)	HSA5 (0)	HSA4 (0)	HSA3 (0)	HSA2 (0)	HSA1 (0)	HSA0 (0)
38h	Vertical Window Address -1	W	1	0	0	0	0	0	0	0	0	VEA7 (1)	VEA6 (1)	VEA5 (0)	VEA4 (1)	VEA3 (1)	VEA2 (0)	VEA1 (1)	VEA0 (1)
39h	Vertical Window Address -2	W	1	0	0	0	0	0	0	0	0	VSA7 (0)	VSA6 (0)	VSA5 (0)	VSA4 (0)	VSA3 (0)	VSA2 (0)	VSA1 (0)	VSA0 (0)
50h	Gamma Control 1	W	1	0	0	0	0	KP13 (0)	KP12 (0)	KP11 (0)	KP10 (0)	0	0	0	0	KP03 (0)	KP02 (0)	KP01 (0)	KP00 (0)
51h	Gamma Control 2	W	1	0	0	0	0	KP33 (1)	KP32 (0)	KP31 (0)	KP30 (0)	0	0	0	0	KP23 (1)	KP22 (0)]	KP21 (0)	KP20 (0)
52h	Gamma Control 3	W	1	0	0	0	0	KP53 (1)	KP52 (0)	KP51 (0)	KP50 (0)	0	0	0	0	KP43 (1)	KP42 (0)	KP41 (1)	KP40 (0)
53h	Gamma Control 4	W	1	0	0	0	0	RP13 (0)	RP12 (0)	RP11 (0)	RP10 (0)	0	0	0	0	RP03 (1)	RP02 (0)	RP01 (1)	RP00 (0)
54h	Gamma Control 5	W	1	0	0	0	0	KN13 (1)	KN12 (0)	KN11 (1)	KN10 (0)	0	0	0	0	KN03 (1)	KN02 (0)	KN01 (0)	KN00 (0)
55h	Gamma Control 6	W	1	0	0	0	0	KN33 (1)	KN32 (0)	KN31 (0)	KN30 (0)	0	0	0	0	KN23 (1)	KN22 (0)	KN21 (0)	KN20 (0)
56h	Gamma Control 7	W	1	0	0	0	0	KN53 (0)	KN52 (0)	KN51 (0)	KN50 (0)	0	0	0	0	KN43 (0)	KN42 (0)	KN41 (0)	KN40 (0)
57h	Gamma Control 8	W	1	0	0	0	0	RN13 (1)	RN12 (0)	RN11 (1)	RN10 (0)	0	0	0	0	RN03 (0)	RN02 (0)	RN01 (0)	RN00 (0)

No.	Registers Name	R/W	RS	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
58h	Gamma Control 9	W	1	0	0	0	VRP14 (0)	VRP13 (0)	VRP12 (1)	VRP11 (1)	VRP10 (1)	0	0	0	VRP04 (1)	VRP03 (0)	VRP02 (0)	VRP01 (0)	VRP00 (0)
59h	Gamma Control 10	W	1	0	0	0	VRN14 (0)	VRP13 (0)	VRP12 (1)	VRP11 (1)	VRP10 (1)	0	0	0	VRN04 (1)	VRN03 (0)	VRN02 (0)	VRN01 (0)	VRN00 (0)
60h	NV Memory Data Programming	W	1	0	0	0	0	0	0	0	0	NVM_ D7	NVM_ D6	NVM_ D5	NVM_ D4	NVM_ D3	NVM_ D2	NVM_ D1	NVM_ D0
61h	NV Memory Control	W	1	0	0	0	0	0	0	0	VCM_ SEL	0	0	0	0	0	0	ID_PGM_ EN	VCM_ PGM_EN
62h	NV Memory Status	W	1	0	0	PGM_ CNT2	PGM_ CNT1	0	0	0	0	0	VCM_ D6	VCM_ D5	VCM_ D4	VCM_ D3	VCM_ D2	VCM_ D1	VCM_ D0
63h	NV Memory Protection Key	R		KEY 15	KEY 14	KEY 13	KEY 12	KEY 11	KEY 10	KEY 9	KEY 8	KEY 7	KEY 6	KEY 5	KEY 4	KEY 3	KEY 2	KEY 1	KEY 0
65h	ID Code	R		0	0	0	0	0	0	0	0	0	0	0	0	ID3	ID2	ID1	ID0
66h	SPI Read/Write Control	R		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	R/W X (0)

10. AC Characteristics

Normal Write Mode (IOVCC = 1.65~3.3V, VCI=2.5~3.3V)

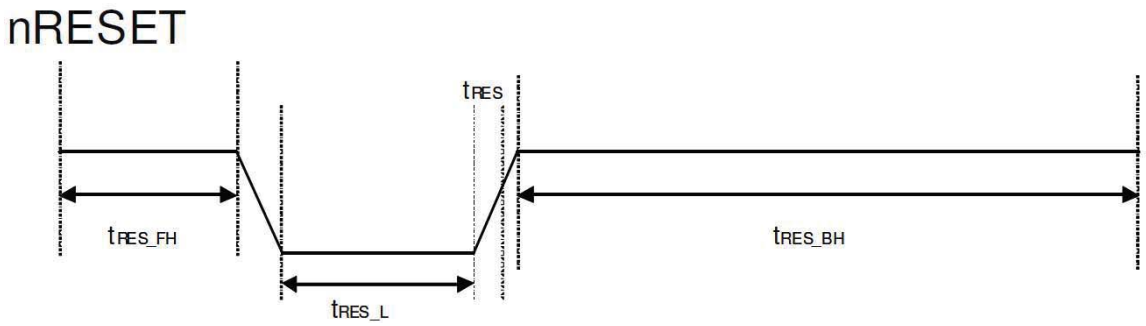
Item		Symbol	Unit	Min.	Max.	Test Condition
Bus cycle time	Write	t_{CYCW}	ns	66	-	-
	Read	t_{CYCR}	ns	300	-	-
Write low-level pulse width		PW_{LW}	ns	35	500	-
Write high-level pulse width		PW_{HW}	ns	35	-	-
Read low-level pulse width		PW_{LR}	ns	150	-	-
Read high-level pulse width		PW_{HR}	ns	150	-	
Write / Read rise / fall time		t_{WRr}/t_{WRf}	ns	-	15	
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	-	



i80-System Bus Timing

Reset Timing Charateristics (IOVCC = 1.65 ~ 3.3V)

Item	Symbol	Unit	Min.	Typ.	Max
Reset front high-levelwith	t_{RES_FH}	ms	1		
Reset low-level width	t_{RES_L}	us	10		
Reset back high-level width	t_{RES_BH}	ms	50		
Reset rise time	t_{rRES}	us			10



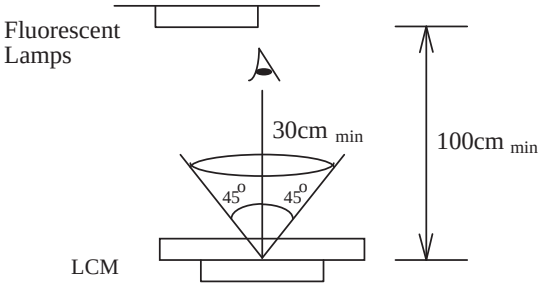
11.Quality Specifications

All The raw material are Rohs complicant.

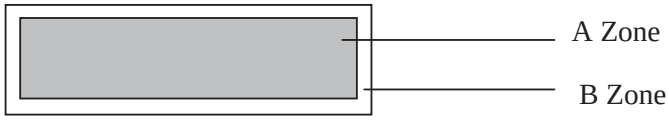
11.1 Standard of the product appearance test

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)

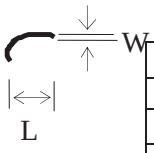
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background 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

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td rowspan="6">1</td><td>Short or open circuit</td><td rowspan="6">Not allow</td></tr>
<tr><td>LC leakage</td></tr>
<tr><td>Flickering</td></tr>
<tr><td>No display</td></tr>
<tr><td>Wrong viewing direction</td></tr>
<tr><td>Wrong Back-light</td></tr>
<tr><td rowspan="2">2</td><td>Contrast defect</td><td rowspan="2">Refer to approval sample</td></tr>
<tr><td>Background color deviation</td></tr>
<tr><td>3</td><td>Point defect,
Black spot, dust
(including Polarizer)

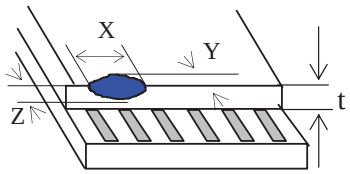
$\phi = (X+Y)/2$</td><td> 

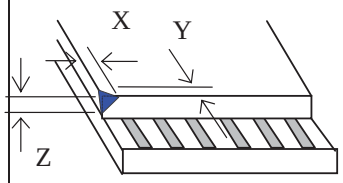
<table>
<tr><th>Point
Size</th><th>Acceptable Qty.</th></tr>
<tr><td>$\phi \leq 0.10$</td><td>Disregard</td></tr>
<tr><td>$0.10 < \phi \leq 0.20$</td><td>3</td></tr>
<tr><td>$0.20 < \phi \leq 0.25$</td><td>2</td></tr>
<tr><td>$0.25 < \phi \leq 0.30$</td><td>1</td></tr>
<tr><td>$\phi > 0.30$</td><td>0</td></tr>
</table>
Unit：mm</td></tr>
<tr><td>4</td><td>Line defect,

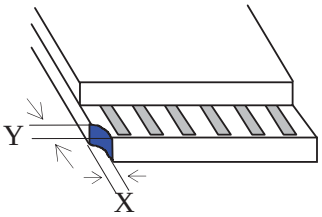
Scratch</td><td> 

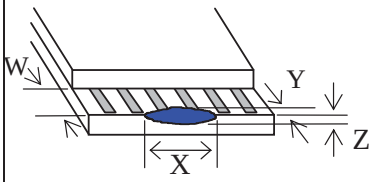
<table>
<tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr>
<tr><td>L</td><td>W</td><td></td></tr>
<tr><td>---</td><td>$0.02 \geq W$</td><td>Disregard</td></tr>
<tr><td>$4.0 \geq L$</td><td>$0.03 \geq W > 0.02$</td><td rowspan="2">2</td></tr>
<tr><td>$2.0 \geq L$</td><td>$0.05 \geq W > 0.03$</td></tr>
<tr><td>$1.0 \geq L$</td><td>$0.1 > W > 0.05$</td><td>1</td></tr>
<tr><td>---</td><td>$0.1 < W$</td><td>Applied as point defect</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>5</td><td>Rainbow</td><td>Not more than two color changes across the viewing area.</td></tr>
</table>

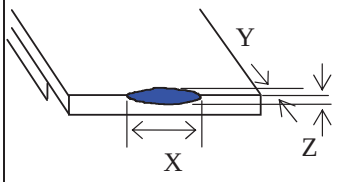
<table>
<tr><th>No</th><th>Item</th><th>Criterion</th></tr>
<tr><td>6</td><td>Chip

Remark:
X: Length direction
Y: Short direction
Z: Thickness direction
t: Glass thickness
W: Terminal Width</td><td>


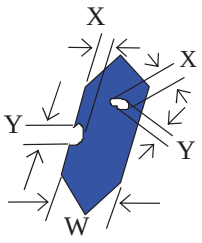
Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤2</td><td>0.5mm</td><td>≤t/2</td></tr>
</table>


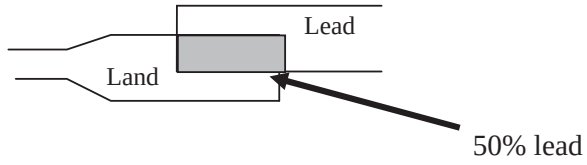
Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤2</td><td>0.5mm</td><td>≤t</td></tr>
</table>


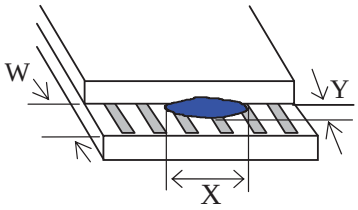
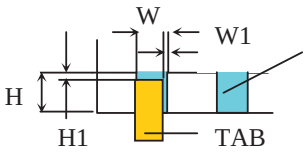
Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤3</td><td>≤2</td><td rowspan="2">≤t</td></tr>
<tr><td colspan="2">shall not reach to ITO</td></tr>
</table>


Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>Disregard</td><td>≤0.2</td><td>≤t</td></tr>
</table>


Acceptable criterion
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>≤5</td><td>≤2</td><td>≤t/3</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>No.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>7</td><td>Segment
pattern
W = Segment width
ϕ = (X+Y)/2</td><td>(1) Pin hole
ϕ < 0.10mm is acceptable.
 

<table>
<tr><th>Point Size</th><th>Acceptable Qty</th></tr>
<tr><td>ϕ≤1/4W</td><td>Disregard</td></tr>
<tr><td>1/4W< ϕ≤1/2W</td><td>1</td></tr>
<tr><td>ϕ>1/2W</td><td>0</td></tr>
</table>
Unit: mm</td></tr>
<tr><td>8</td><td>Back-light</td><td>(1) The color of backlight should correspond its specification.
(2) Not allow flickering</td></tr>
<tr><td>9</td><td>Soldering</td><td>(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.
 
</td></tr>
<tr><td>10</td><td>Wire</td><td>(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.</td></tr>
<tr><td>11*</td><td>PCB</td><td>(1) Not allow screw rust or damage.
(2) Not allow missing or wrong putting of component.</td></tr>
</table>

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

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	-10°C	48	
Low temp. Operating	0°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	-10°C ← 25°C →60°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 isoproply alcohol, ethyl alcohol or trichlorotriflorothane, 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 made any modification on the PCB without consulting OD.
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°C±10°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 Vo.
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

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

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