



深圳市华远显示器件有限公司
SHENZHEN HUAYUAN DISPLAY CO.,LTD.

液晶显示模块规格书

Specification for Liquid Crystal Display Module

HYG32016001G-FFC2L-VA

Prepared By	Reviewed By	Approved By
Date:	Date:	Date:

	Title HYG32016001G-FFC2L-VA SPECIFICATION	DOC#:	Rev. : R00
		Effective Date: 2011-12-15	

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1.0 GENERAL DESCRIPTION

The HYG32016001G-FFC2L-VA is a 320x160 dots dot-matrix LCD module. It has a FSTN panel composed of 320 segments and 160 commons.

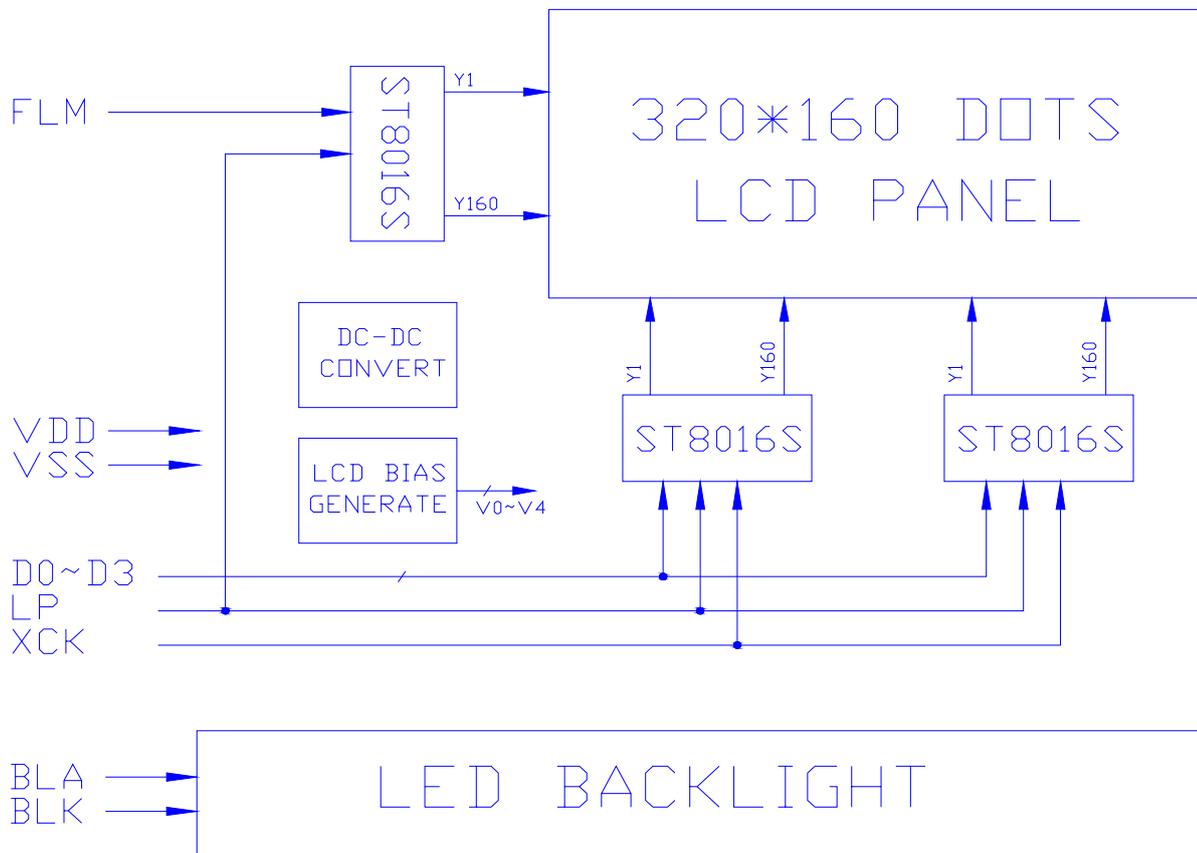
2.0 FEATURES

Display Format	320x 160 dots
LCD Type	FSTN-POSITIVE
Polarizer Mode	TRANSFLECTIVE
Drive Method	1/160 Duty, 1/13 Bias
Viewing Direction	12 O'clock
LCD Driver	ST8016S
Interface	4-Bit Parallel Interface
Backlight	White Side-Light Type LED Backlight

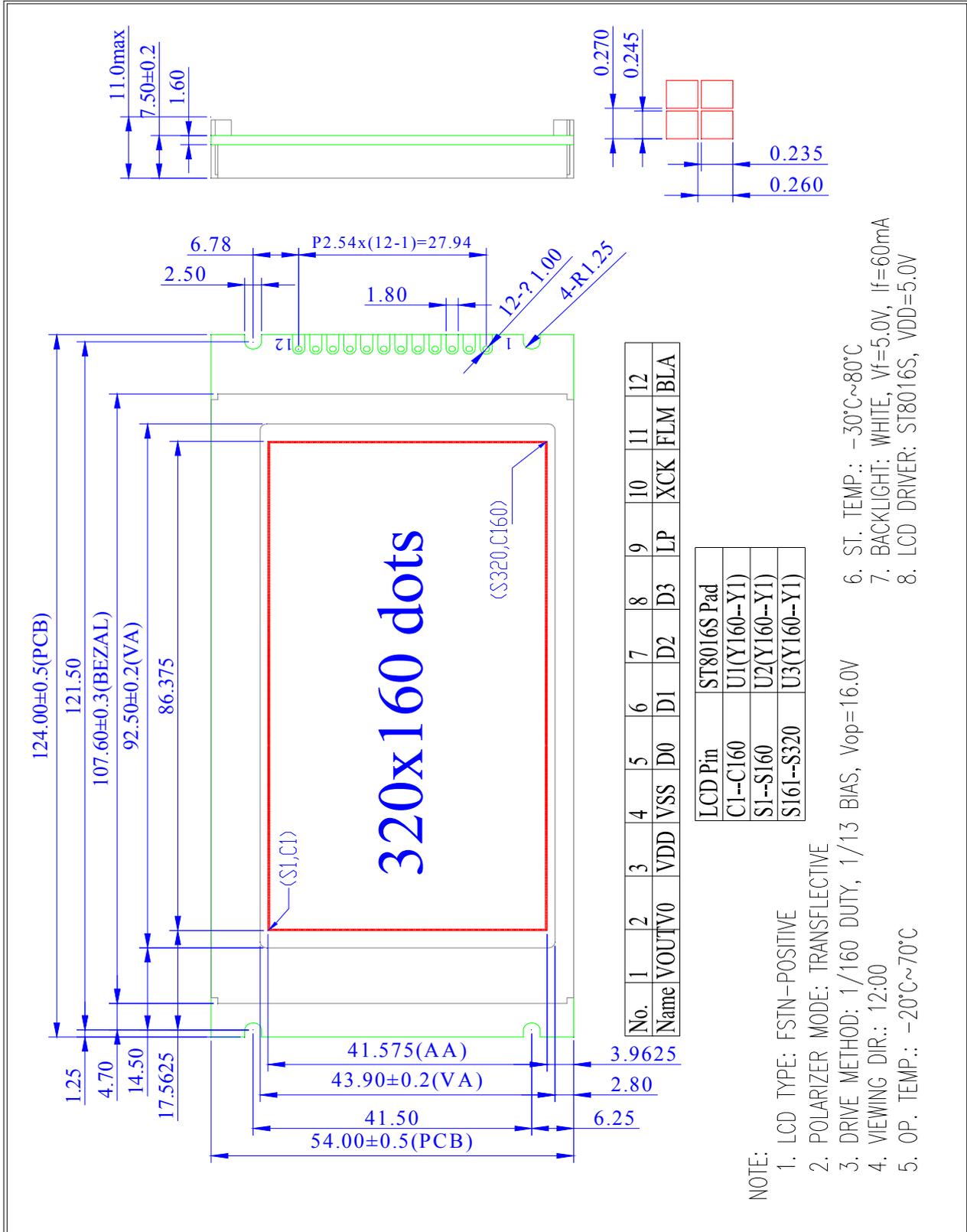
3.0 MECHANICAL SPECIFICATION

Item	Description	Unit
Module Dimension	124.0(W) × 54.0(H) × 11.0(Max)(T)	mm
Viewing Area	92.5(W) × 43.9(H)	mm
Active Area	86.375(W) × 41.575(H)	mm
Dot Size	0.245(W) × 0.235(H)	mm
Dot Pitch	0.270(W) × 0.260 (H)	mm
Character Size	—	mm

4.0 BLOCK DIAGRAM



5.0 EXTERNAL DIMENSIONS



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6.0 INTERFACE PIN DESCRIPTIONS

PIN No.	Symbol	Level	Description
1	VOUT	P	Built-in DC-DC Booster Voltage Output
2	V0	P	Power supply for LCD Driver(+16.5V)
3	V _{DD}	P	Power supply for logic(+5.0V)
4	VSS	P	Power Ground
5	D0	H/L	Display data input
6	D1	H/L	
7	D2	H/L	
8	D3	H/L	
9	LP	H/L	Latch pulse input pin for display data LP is a falling-edge triggered signal, and pulses once every display line.
10	XCK	H/L	Clock input pin for taking display data The falling edge of XCK latches the data on D0 to D3 into the input shift registers of the X-drivers.
11	FLM	H/L	Data Pulse Input for Y Drivers.
12	BLA	P	Power supply for LED Backlight (+5.0V)



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7.0 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit
Supply Voltage (Logic)	V_{DD}	-0.3	7.0	V
Supply Voltage (LCD)	V_0	-0.3	33.0	V
Input Voltage	V_I	-0.3	$V_{DD}+0.3$	V
Operating Temperature	T_{opr}	-20	70	°C
Storage Temperature	T_{stg}	-30	80	°C

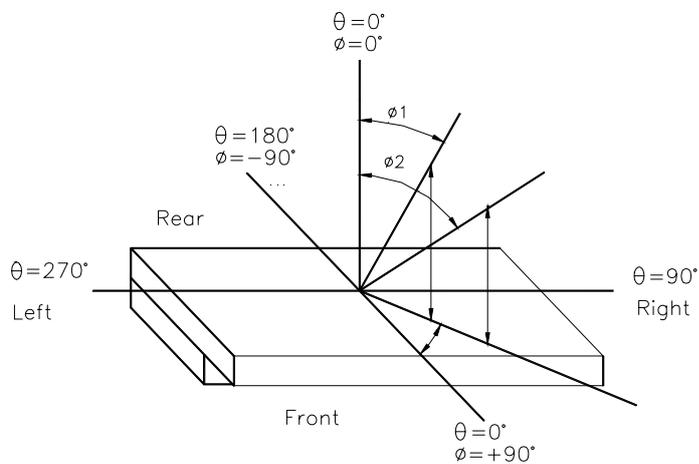
8.0 ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Supply voltage for Logic	V_{DD}	--	4.8	5.0	5.2	V
LCD Operating Voltage	V_0	-20°C				V
		+25°C	15.8	16.0	16.2	V
		+70°C				V
Input voltage H level	V_{IH}		$0.8V_{DD}$	---		V
Input voltage L level	V_{IL}			---	$0.2V_{DD}$	V
Output High Voltage	V_{OH}	$I_{OH} = -0.4 \text{ mA}$	$V_{DD}-0.4$	---	---	V
Output Low Voltage	V_{OL}	$I_{OL} = 0.4 \text{ mA}$	---	---	+0.4	V

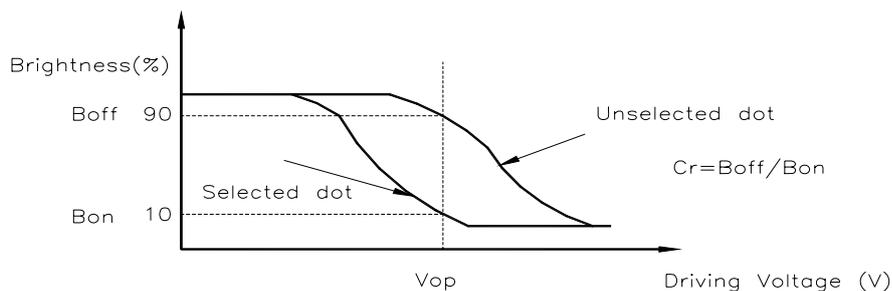
9.0 OPTICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Response time	Ton	$\theta=0^\circ$ and $T_a=-20^\circ\text{C}$		--		ms
		$\theta=0^\circ$ and $T_a=+25^\circ\text{C}$		--		ms
		$\theta=0^\circ$ and $T_a=+70^\circ\text{C}$		--		ms
	Toff	$\theta=0^\circ$ and $T_a=-20^\circ\text{C}$		--		ms
		$\theta=0^\circ$ and $T_a=+25^\circ\text{C}$		--		ms
		$\theta=0^\circ$ and $T_a=+70^\circ\text{C}$		--		ms
Contrast ration	CR(MAX)	$T_a=25^\circ\text{C}$	5	10		---
Viewing Angle	\varnothing	Deg $\theta=0^\circ$	CR \geq 2.0 $T_a=25^\circ\text{C}$	50		Deg
		Deg $\theta=90^\circ$		35		
		Deg $\theta=180^\circ$		30		
		Deg $\theta=270^\circ$		35		
Crosstalk		$T_a=25^\circ\text{C}$		1.2		---

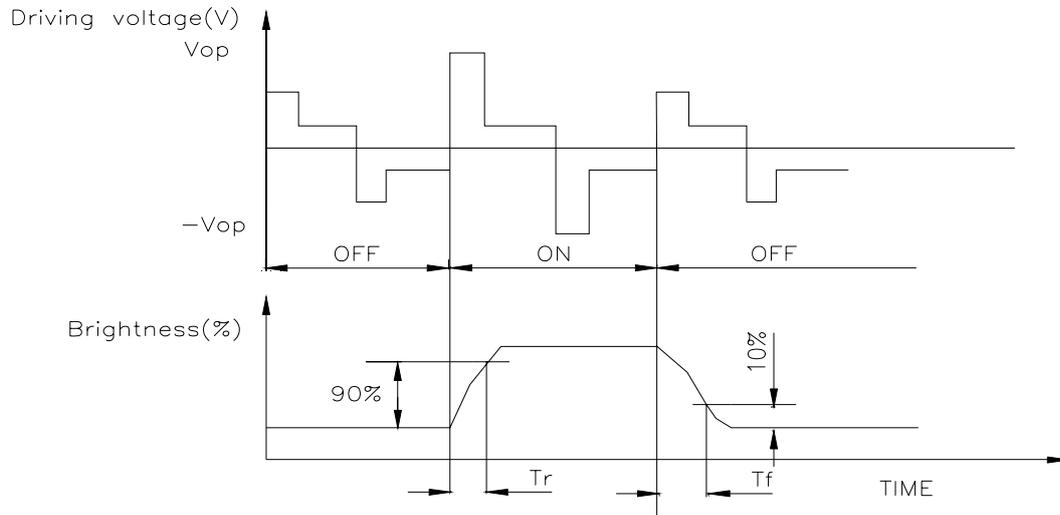
9.1 Viewing Angle θ , \varnothing and Viewing Angle Range: $\Delta\varnothing = |\varnothing_2 - \varnothing_1|$



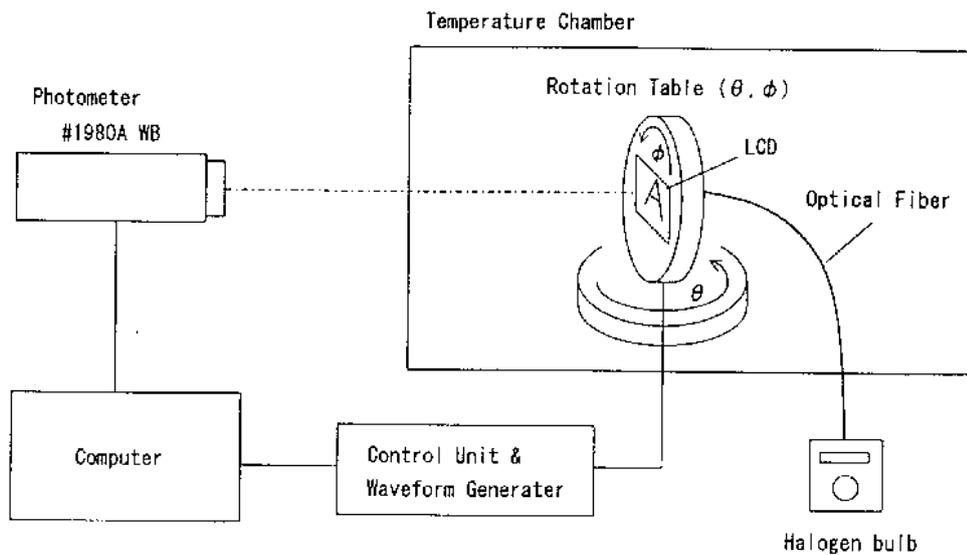
9.2 Contrast ratio(CR)



9.3 Response Time



9.4 Optical Measurement System



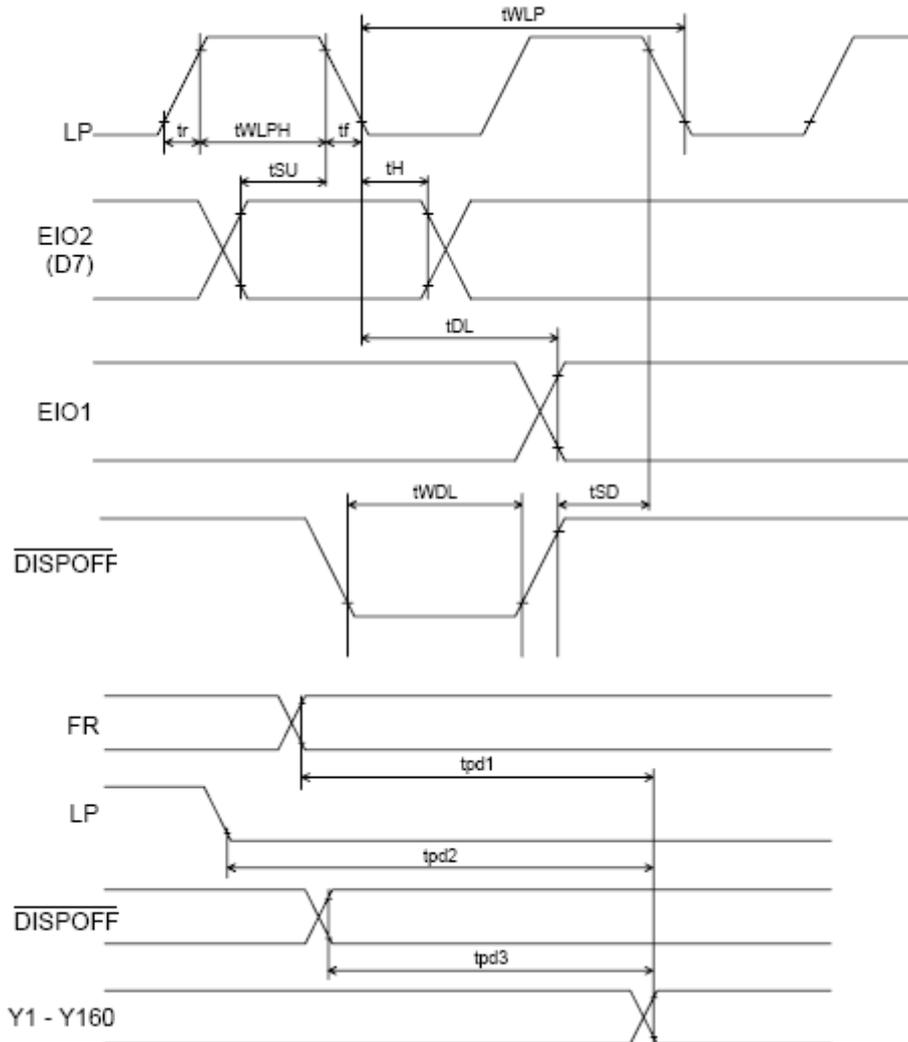


Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	tWCK	71	-		ns	$t_r, t_f \leq 10\text{ns}$, Note 1
Shift clock "H" pulse width	tWCKH	23	-		ns	
Shift clock "L" pulse width	tWCKL	23	-		ns	
Data setup time	tDS	10	-		ns	
Data hole time	tDH	20	-		ns	
Latch pulse "H" pulse width	tWLPH	23	-		ns	
Shift clock rise to Latch pulse rise time	tLD	0	-		ns	
Shift clock fall to Latch pulse fall time	tSL	25	-		ns	
Latch pulse rise to Shift clock rise time	tLS	25	-		ns	
Latch pulse fall to Shift clock rise time	tLH	25	-		ns	
Input signal rise time	t_r		-	50	ns	Note 2
Input signal fall time	t_f		-	50	ns	Note 2
Enable setup time	tS	21	-		ns	
DISPOFF Removal time	tSD	100	-		ns	
DISPOFF enable pulse width	tWDL	1.2	-		μs	
Output delay time (1)	tD		-	40	ns	CL = 15pF
Output delay time (2)	tpd1, tpd2		-	1.2	μs	CL = 15pF
Output delay time (3)	tpd3		-	1.2	μs	CL = 15pF

Note

1. Take the cascade connection into consideration.
2. $(T_{ck} - t_{WCKH} - t_{WCKL})/2$ is the maximum in the case of high speed operation.

10.2 Timing Characteristics of Common Mode





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Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Shift clock period	tWLP	250	-	-	ns	tr, tf ≤ 20ns
Shift clock "H" pulse width	tWLPH	15	-	-	ns	VDD = +5.0V
Data setup time	tSU	30	-	-	ns	
Data hole time	tH	50	-	-	ns	
Input signal rise time	tr		-	50	ns	
Input signal fall time	tf		-	50	ns	
DISPOFF Removal time	tSD	100	-	-	ns	
DISPOFF enable pulse width	tWDL	1.2	-	-	μs	
Output delay time (1)	tDL	-	-	200	ns	CL = 15pF
Output delay time (2)	tpd1, tpd2	-	-	1.2	μs	CL = 15pF
Output delay time (3)	tpd3	-	-	1.2	μs	CL = 15pF



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11.0 BACKLIGHT CHARACTERISTICS

11.1 ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

Item	Symbol	Condition	Rating	Unit
Reverse Voltage	Vr		5	V
Absolute maximum forward current	Ifm		225	mA
Forward Current	If	Vf=5.0V	180	mA
Power Description	Pd		540	mW
Operating temperature range	Topr		-20~+70	°C
Storage temperature range	Tst		-30~+80	°C

11.2 ELECTRICAL/OPTICAL CHARACTERISTICS

(Ta=25°C)

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward Voltage	Vf	4.8	5.0	5.1	V	If=180mA
Reverse Current	Ir		90		uA	Vr=5 V
Dominant wave length	λ_p				nm	If=180mA
Spectral Line Half width	$\Delta\lambda$					If=180 mA
Luminance	Lv				cd/m ²	If=180 mA
Color Coordinate	X		WHITE			If=180 mA
	Y					

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12.0 QUALITY GUARANTEE

12.1 ACCEPTABLE QUALITY LEVEL

Inspection items	Sampling procedures	AQL
Visual-operating (Electro-optical)	GB2828-81 Inspection level II Normal inspection Single sample inspection	0.65
Visual-not operating	GB2828-81 Inspection level II Normal inspection Single sample inspection	1.5
Dimension measurement	GB2828-81 Inspection level II Normal inspection Single sample inspection	1.5

12.2 Conditions of Cosmetic Inspection

- Environmental condition

The inspection should be performed at the 1m of height from the LCD module under 2 pieces of 40W white fluorescent lamps (Normal temperature 20 ~ 25°C and normal humidity 60 ~ 15 % RH).

- Inspection method

The visual check should be performed vertically at more than 30cm distance from the LCD panel.

- Driving voltage

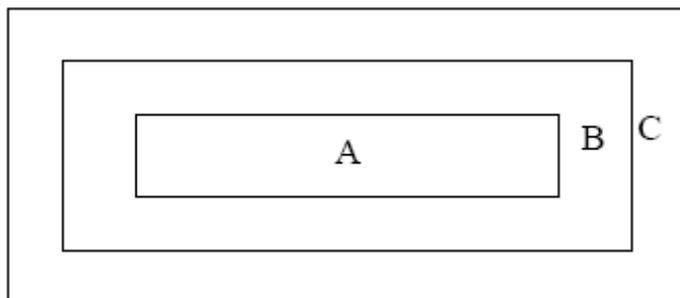
The V₀ value which the most optimal contrast can be obtained near the specified V₀ in the specification. (Within ±0.5V of the typical value at 25°C.).

12.3 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)



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.

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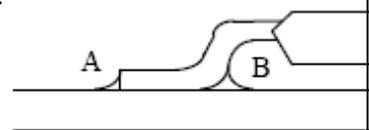
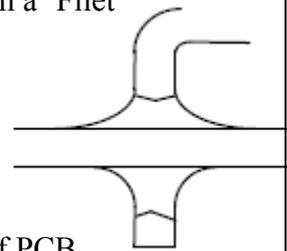
12.4 Inspection Standard

● Major Defect

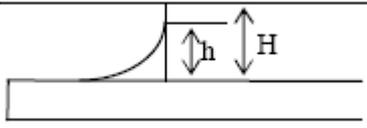
Item No	Items to be inspected	Inspection Standard	Classification of defects
1	All functional defects	1) No display 2) Display abnormally 3) Missing vertical, horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting.	Major
2	Missing	Missing component	
3	Outline dimension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

● Module Cosmetic Criteria

No.	Item	Judgment Criterion	Partition
1	Difference in Spec.	None allowed	Major
2	Pattern peeling	No substrate pattern peeling and floating	Major
3	Soldering defects	No soldering missing No soldering bridge No cold soldering	Major Major Minor
4	Resist flaw on substrate	Invisible copper foil ($\varnothing 0.5\text{mm}$ or more) on substrate pattern	Minor
5	Accretion of metallic Foreign matter	No soldering dust No accretion of metallic foreign matters (Not exceed $\varnothing 0.2\text{mm}$)	Minor Minor
6	Stain	No stain to spoil cosmetic badly	Minor
7	Plate discoloring	No plate fading, rusting and discoloring	Minor
8	1. Solder amount Lead parts	a. Soldering side of PCB Solder to form a 'Filet' all around the lead. Solder should not hide the lead form perfectly. (too much) b. Components side (In case of 'Through Hole PCB') Solder to reach the Components side of PCB.	Minor
	2. Flat packages	Either 'Toe' (A) or 'Seal' (B) of the lead to be covered by 'Filet'. Lead form to be assume over solder.	



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No.	Item	Judgment Criterion	Partition
8	3. Chips	$(3/2) H \geq h \geq (1/2) H$ 	Minor

● Screen Cosmetic Criteria (Non-Operating)

No.	Defect	Judgement Criterion	Partition															
1	Spots	In accordance with <i>Screen Cosmetic Criteria (Operating) No.1.</i>	Minor															
2	Lines	In accordance with <i>Screen Cosmetic Criteria (Operating) No.2.</i>	Minor															
3	Bubbles in polarizer	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Size : d</th> <th>mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>d</td> <td>≤ 0.3</td> <td>Disregard</td> </tr> <tr> <td>0.3 < d</td> <td>≤ 1.0</td> <td>3</td> </tr> <tr> <td>1.0 < d</td> <td>≤ 1.5</td> <td>1</td> </tr> <tr> <td>1.5 < d</td> <td></td> <td>0</td> </tr> </tbody> </table>	Size : d	mm	Acceptable Qty in active area	d	≤ 0.3	Disregard	0.3 < d	≤ 1.0	3	1.0 < d	≤ 1.5	1	1.5 < d		0	Minor
Size : d	mm	Acceptable Qty in active area																
d	≤ 0.3	Disregard																
0.3 < d	≤ 1.0	3																
1.0 < d	≤ 1.5	1																
1.5 < d		0																
4	Scratch	In accordance with spots and lines operating cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor															
5	Allowable density	Above defects should be separated more than 30mm each other.	Minor															
6	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-lit type should be judged with back-lit on state only.	Minor															
7	Contamination	Not to be noticeable.	Minor															

Note: Size : d = (long length + short length) / 2



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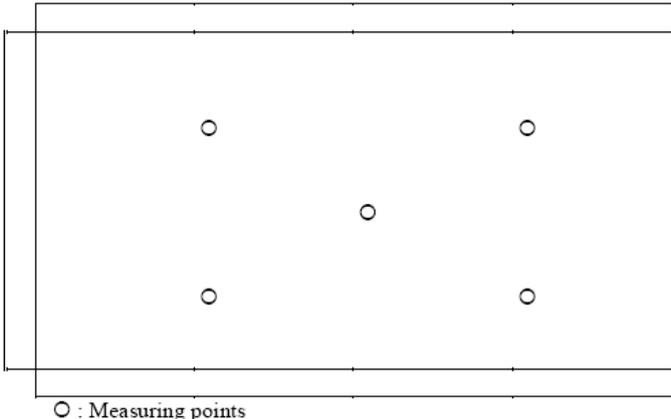
● Screen Cosmetic Criteria (Operating)

No.	Defect	Judgment Criterion	Partition																				
1	Spots	<p>A) Clear</p> <table border="1"> <thead> <tr> <th>Size : d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>$d \leq 0.1$</td> <td>Disregard</td> </tr> <tr> <td>$0.1 < d \leq 0.2$</td> <td>6</td> </tr> <tr> <td>$0.2 < d \leq 0.3$</td> <td>2</td> </tr> <tr> <td>$0.3 < d$</td> <td>0</td> </tr> </tbody> </table> <p>Note : Including pin holes and defective dots which must be within one pixel size.</p> <p>B) Unclear</p> <table border="1"> <thead> <tr> <th>Size : d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>$d \leq 0.2$</td> <td>Disregard</td> </tr> <tr> <td>$0.2 < d \leq 0.5$</td> <td>6</td> </tr> <tr> <td>$0.5 < d \leq 0.7$</td> <td>2</td> </tr> <tr> <td>$0.7 < d$</td> <td>0</td> </tr> </tbody> </table>	Size : d mm	Acceptable Qty in active area	$d \leq 0.1$	Disregard	$0.1 < d \leq 0.2$	6	$0.2 < d \leq 0.3$	2	$0.3 < d$	0	Size : d mm	Acceptable Qty in active area	$d \leq 0.2$	Disregard	$0.2 < d \leq 0.5$	6	$0.5 < d \leq 0.7$	2	$0.7 < d$	0	Minor
Size : d mm	Acceptable Qty in active area																						
$d \leq 0.1$	Disregard																						
$0.1 < d \leq 0.2$	6																						
$0.2 < d \leq 0.3$	2																						
$0.3 < d$	0																						
Size : d mm	Acceptable Qty in active area																						
$d \leq 0.2$	Disregard																						
$0.2 < d \leq 0.5$	6																						
$0.5 < d \leq 0.7$	2																						
$0.7 < d$	0																						
2	Lines	<p>A) Clear</p> <p>Note :</p> <ul style="list-style-type: none"> () - Acceptable Qty in active area L - Length (mm) W - Width (mm) ∞ - Disregard <p>B) Unclear</p> <p>‘Clear’ = The shade and size are not changed by Vop. ‘Unclear’ = The shade and size are changed by Vop.</p>	Minor																				

Note: Size : d = (long length + short length) / 2

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● Screen Cosmetic Criteria (Operating) (Continued)

No.	Defect	Judgment Criterion	Partition
3	Rubbing line	Not to be noticeable.	Minor
4	Allowable density	Above defects should be separated more than 10mm each other.	Minor
5	Rainbow	Not to be noticeable.	Minor
6	Dot size	To be 95% ~ 105% of the dot size (Typ.) in drawing. Partial defects of each dot (ex. pin-hole) should be treated as pot'. (see <i>Screen Cosmetic Criteria (Operating) No.1</i>)	Minor
7	Uneven brightness (only back-lit type module)	<p>Uneven brightness must be $B_{MAX} / B_{MIN} \leq 2$</p> <ul style="list-style-type: none"> - B_{MAX} : Max. value by measure in 5 points - B_{MIN} : Min. value by measure in 5 points <p>Divide active area into 4 vertically and horizontally. Measure 5 points shown in the following figure.</p>  <p>○ : Measuring points</p>	Minor

Note :

- (1) The limit samples for each item have priority.
- (2) Complex defects are defined item by item, but if the numbers of defects are defined in above table, the total number should not exceed 10.
- (3) In case of 'concentration', even the spots or the lines of 'disregarded' size should not allowed. Following three situations should be treated as 'concentration'.
 - 7 or over defects in circle of $\varnothing 5\text{mm}$.
 - 10 or over defects in circle of $\varnothing 10\text{mm}$.
 - 20 or over defects in circle of $\varnothing 20\text{mm}$.

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13.0 RELIABILITY

13.1 Content of Reliability Test

No.	Test Item	Test Condition	Inspection after test
1	High Temperature Storage	80°C±2°C/200 hours	Inspection after 2~4hours 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	-30°C±2°C/200 hours	
3	High Temperature Operating	70°C±2°C/120 hours	
4	Low Temperature Operating	-20°C±2°C/120 hours	
5	Temperature Cycle	-20°C±2°C~25~70°C±2°C×10cycles (30min.) (5min.) (30min.)	
6	High Temperature Humidity operation /	50°C±5°C×90%RH/120 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, and every side of carton. (Packing condition)	
9	Static electricity 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.
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. Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

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14.0 PRECAUTIONS FOR USING LCD MODULES

14.1 Handling Precautions

(1) The display panel is made of glass. 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.

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

(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

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

- Water
- Ketone
- Aromatic solvents

(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) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- Be sure to ground the body when handling the LCD modules.
- Tools required for assembling, such as soldering irons, must be properly grounded.
- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
- 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.

14.2 Storage Precautions

When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

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14.3 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.

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15.0 USING LCD MODULES

15.1 About Liquid Crystal Display Modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

(1) 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.

(2) Do not touch, push or rub the exposed polarizer with anything harder than an HB pencil lead (glass, tweezers, etc.).

(3) N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizer and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropyl alcohol.

(4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzine. Do not scrub hard to avoid damaging the display surface.

(5) Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

(6) Avoid contacting oil and fats.

(7) 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.

(8) Do not put or attach anything on the display area to avoid leaving marks on.

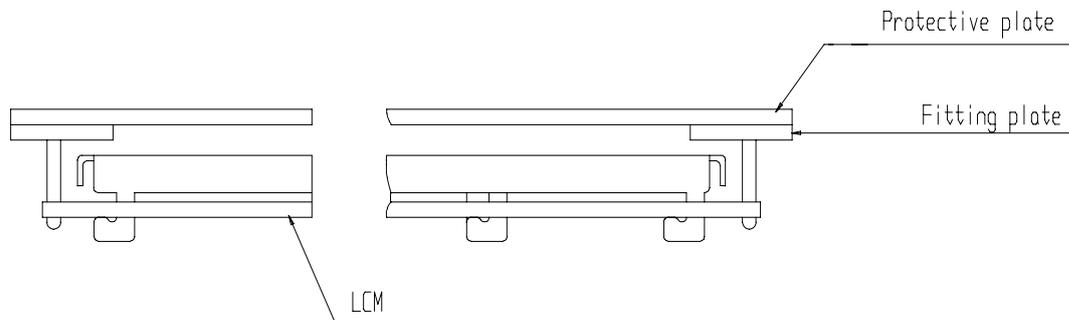
(9) Do not touch the display with bare hands. This will stain the display area and degrade insulation between terminals (some cosmetics are determinate to the polarizer).

(10) As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring.

15.2 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 ± 0.1 mm.

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15.3 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.

- (1) Make certain that you are grounded when handing LCM.
- (2) 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.
- (3) When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.
- (4) 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 commutation of the motor.
- (5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
- (6) 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.

15.4 Soldering to the LCM

- (1) Observe the following when soldering lead wire, connector cable and etc. to the LCM.
 - Soldering iron temperature : $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$.
 - Soldering time : 3-4 sec.
 - Solder : eutectic solder.

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 dur 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.

15.5 Operation

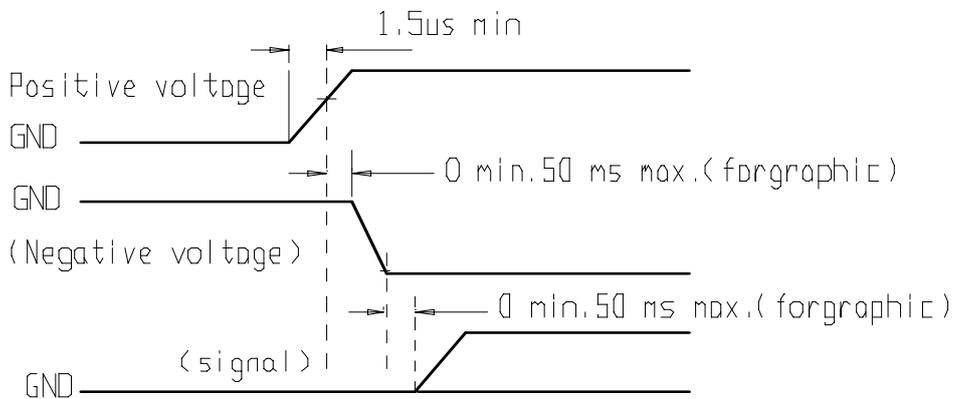
- (1) Viewing angle varies with the change of liquid crystal driving voltage (VO). Adjust VO to show the best contrast.
- (2) Driving the LCD in the voltage above the limit shortens its life.
- (3) Response time is greatly delayed at temperature below the operating temperature range. However, this does not mean the LCD will be out of the order. It will recover when it returns to the specified temperature range.
- (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) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit.



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Therefore, it must be used under the relative condition of 40°C , 50% RH.

(6) When turning the power on, input each signal after the positive/negative voltage becomes stable.



15.6 Storage

When storing LCDs as spares for some years, the following precaution are necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for 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.)

(4) Environmental conditions :

- Do not leave them for more than 168hrs. at 60°C.
- Should not be left for more than 48hrs. at -20°C.

15.7 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.

15.8 Limited Warranty

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

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15.9 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's 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.