



湖南飞优特电子科技有限公司

Hunan Future Electronics Technology Co. Ltd

**SPECIFICATION
FOR
LCD MODULE**

Customer : _____
Product Model: FUT0430WQ07Q-LCM-A0
Sample code: _____

Designed by	Checked by	Approved by

Final Approval by Customer

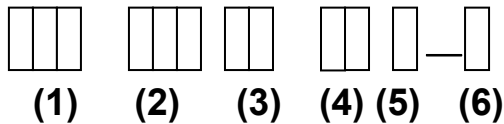
<input type="checkbox"/> LCM Machinery OK Checked By _____ <input type="checkbox"/> LCM Display OK Checked By _____	<input type="checkbox"/> LCM OK <input type="checkbox"/> NG, Problem survey: Approved By _____
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※ The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

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1. Numbering System



No	Definition	Specifications
(1)	TFT LCM Productor No.	FUT ---- Hunan Future Electronics Technology Co. Ltd
(2)	Display monitor opposite angle line size	Unit : inch
(3)	Product Resolution	... QQ: QQVGA 128*160 CC: QCIF 186*220 QV: QVGA 240*320, HV: HVGA320*480, WV:WVGA 480*800, QH:QHD 540*960 HD:720*1280, FHD1080*1920 ...
(4)	Product Development Series No.	By two figures characters expression from 01 to 99
(5)	LCD Type	A----AUO ; M----CMI ; C----CPT; B----BOE; G----LG; S---CTC; H----HSD; T----Tianma; Y----Hydis; I----INNOLUX; L---- IVO
(6)	Productor Development edition No.	By The English litters : A~ Z

2. Scope

This specification applies to the TFT LCD module which is designed and manufactured by LCM Factory of Hunan Future Electronics Technology Co. Ltd

3. Normative Reference

GB/T4619-1996 《Liquid Crystal Display Test Method》

GB/T2424 《Basic environmental Testing Procedures for Electric and Electronic Products.》

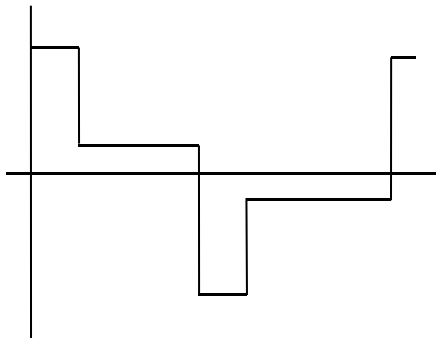
GB/T2423 《Basic Testing Procedures for Electric and Electronic Products》

IEC61747-1 《SIXTH PART GB2828`2829-87 《National Standard of PRC》

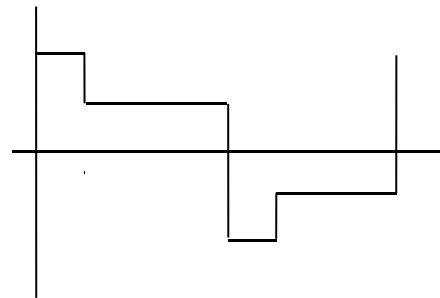
4. Definitions

4.1 Definitions of Vop

The definitions of threshold voltage V_{th1} , V_{th2} the following typical waveforms are applied on liquid crystal by the method of equalized voltage for each duty and bias.



【 selected waveform 】



【 non-selected waveform 】

① V_{th1} : The voltage which the brightness of segment indicates 50% of saturated value on the conditions of selected waveform

($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

② V_{th2} : The voltage which the brightness of segment indicates 50% of saturated value on the conditions of non-selected waveform

($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

③ V_{op} : $(V_{th1}(50\%)+V_{th2}(50\%))/2$ ($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

4.2 Definition of Response Time T_r , T_d

① T_r : The time required which the brightness of segment becomes 10% from 100% when waveform is switched to selected one from non-selected one. ($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

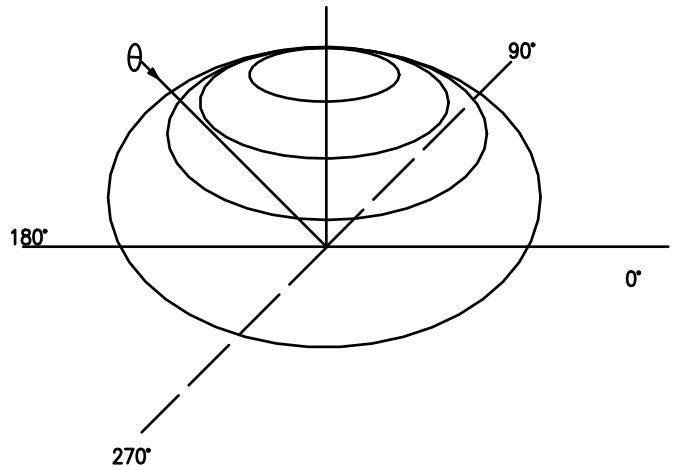
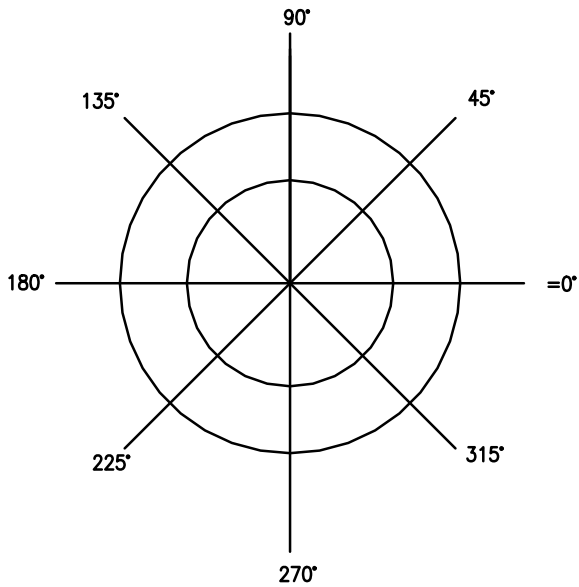
② T_d : The time required which the brightness of segment becomes 90% from 10% when waveform is switched to selected one from selected one. ($f_r=80\text{Hz}$, $\Phi=10^\circ$ $\theta=270^\circ$ at 25°C)

4.3 Definition of Contrast Ratio Cr

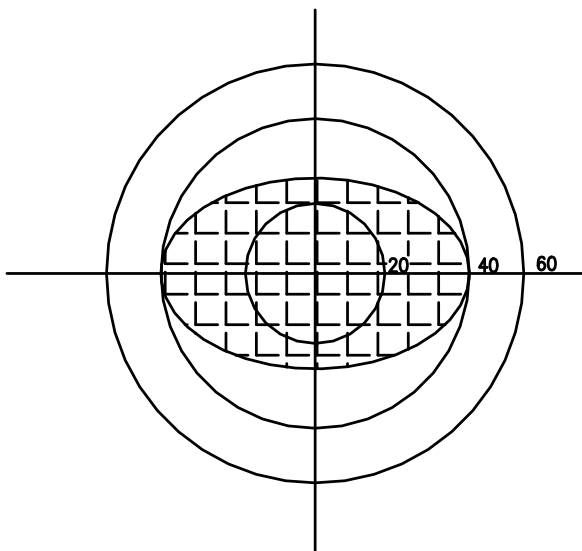
$Cr=A/B$

- ① A: Segments brightness in case of non-selected waveform
- ② B: Segments brightness in case of selected waveform

4.4 Definition of Angle and Viewing Range



Angular Graph: Constrast Ratio



Such as:
Viewing Angle Range:
80(Cr>2) Horizontal
70(Cr>2) Vertical

5. Technology Specifications

5.1 Features

The LCD adopts one backlight with High brightness 7-lamps white LED.

Construction: .4.3" a-Si color TFT-LCD ,With INX Cell, White LED backlight and FPC .

5.2 General Specifications

No.	Item	Specification
1	LCD size	4.3 inch
2	Resolution	480(RGB)X272
3	Display mode	6 o' clock
4	Pixel pitch	66(H) X 198(V) um
5	Active area	95.04(H) X 53.856(V)
6	Module size	105.5(H)X67.2(V)X2.9(D)mm
7	Touch Panel	without
8	Pixel arrangement	RGB-stripe
9	Interface	SPI+RGB 24bit

5.3 Interface Pin Connection

Pin No	Symbol	Description
1	VLED-	LED back light(Cathode)
2	VLED+	LED back light(Anode)
3	GND	Ground
4	VDD	Power supply
5-12	R0-R7	RED Data bus
13-20	G0-G7	GREEN Data bus
21-28	B0-B7	BLUE Data bus
29	GND	Ground
30	PCLK	Dot clock signal for RGB interface operation.
31	DISP	Display on/off
32	HSYNC	Horizontal sync. signal in DPI interface mode
33	VSYNC	Frame synchronizing signal for RGB interface operation.
34	DE	Data ENABLE signal for RGB I/F mode
35	NC	No Connected
36	GND	Ground
37	XR (NC)	Touch panel X-Right
38	YD (NC)	Touch panel Y-Down
39	XL (NC)	Touch panel X-Left
40	YU (NC)	Touch panel Y-Up

5.4 Absolute Max. Rating

Item	Symbol	Values		Unit
		Min.	Max.	
Power Voltage	VDDI	-0.3	4.6	V
	VDD	-0.3	4.6	V
	VIN	-0.3	IOVCC+0.3	V
Backlight forward current	I _{LED}	0	25	mA (For each LED)
Operation Temperature	T _{OP}	-20	70	°C
Storage Temperature	T _{ST}	-30	80	°C

5.5 DC Characteristics

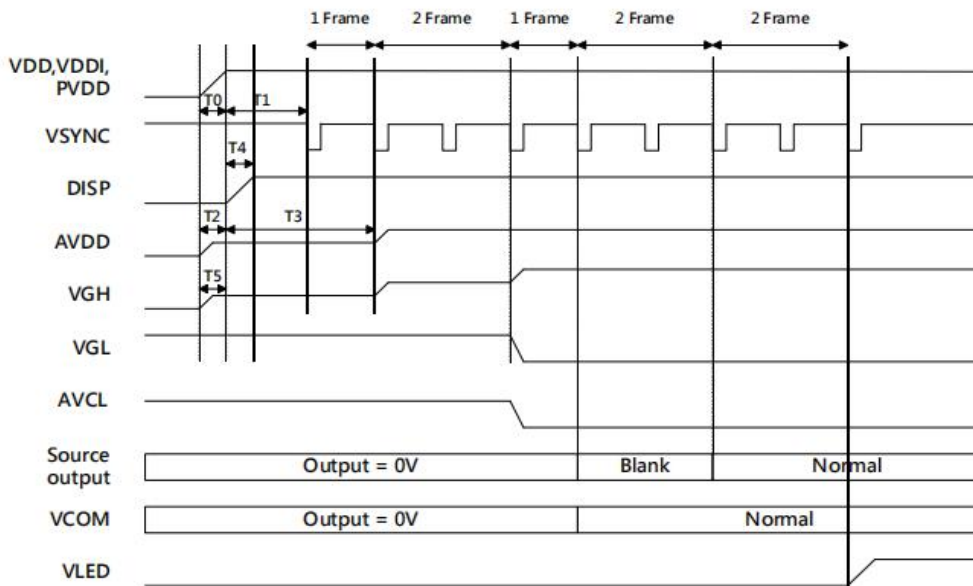
Item	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Logic Supply Voltage	IOVCC	1.65	1.8/2.8	3.3	V	-
Analog Supply Voltage	VDD	3.0	3.3	3.6	V	-
VGL Voltage	VGL	-10.5	-10	-9.5	V	-
VGH Voltage	VGH	14.5	15	15.5	V	-
Input High Voltage	V _{IH}	0.7VDDI	-	VDDI	V	Digital input pins
Input Low Voltage	V _{IL}	GND	-	0.3VDDI	mA	Digital input pins
Output High Voltage	V _{oH}	VDDI-0.4	-	VDDI	mA	Digital input pins
Output Low Voltage	V _{oL}	GND	-	GND+0.4	W	Digital input pins
(Panel+LSI) Power Consumption	Black Mode	-	-	90	mA	VDD=3.3V
	Sleeping Mode	-	-	150	uA	VDD=3.3V

5.6 LED Back Light Specification (7 White Chips)

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	V _f	I _f =20mA	-	22.4	-	V
Uniformity (with L/G)	Δ B _p	I _f =20mA	75	80	-	%
Luminance for LCM	/	I _f =20mA	-	TBD	-	cd/m ²
Backlight Power Consumption	WBL	I _f =20mA	-	448	-	mW
Backlight Color	White					

5.7 Power Sequence

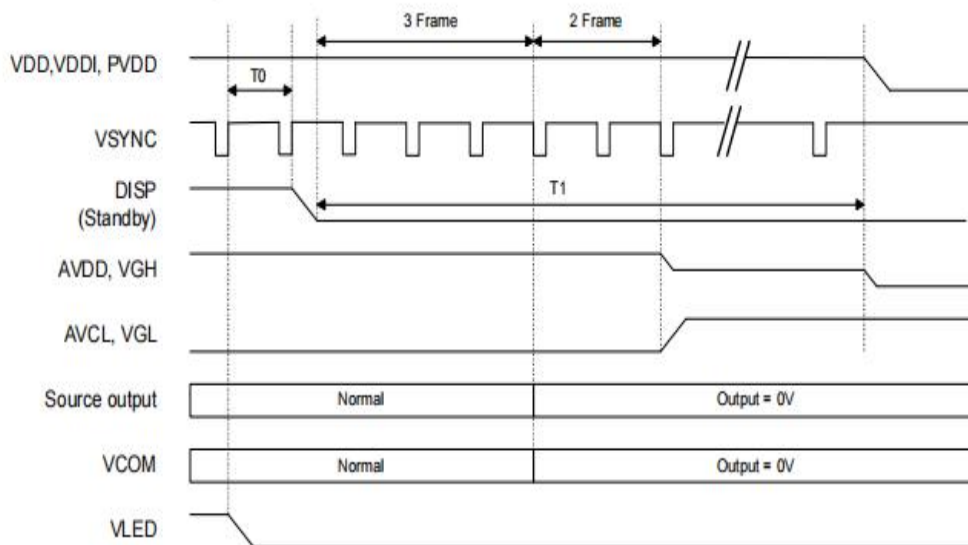
14.1 Power On Sequence



Item	Description	Min. Time
T0	Determined by the external power	
T1	Time from stable VDD, VDDI, PVDD set-up to the first VSYNC	T1=0
T2	Time from AVDD=0V to AVDD=3.3V	T2=T0
T3	Time from AVDD=3.3V to AVDD=6.0V	T3=T1+ (1*Frame)
T4	Time from stable VDD, VDDI, PVDD set-up to DISP asserted	T4=0
T5	Time from VGH=0V to VGH=3.3V	T5=T0

Note: Recommend the LCM power on rise time T0= 0~ 1ms.

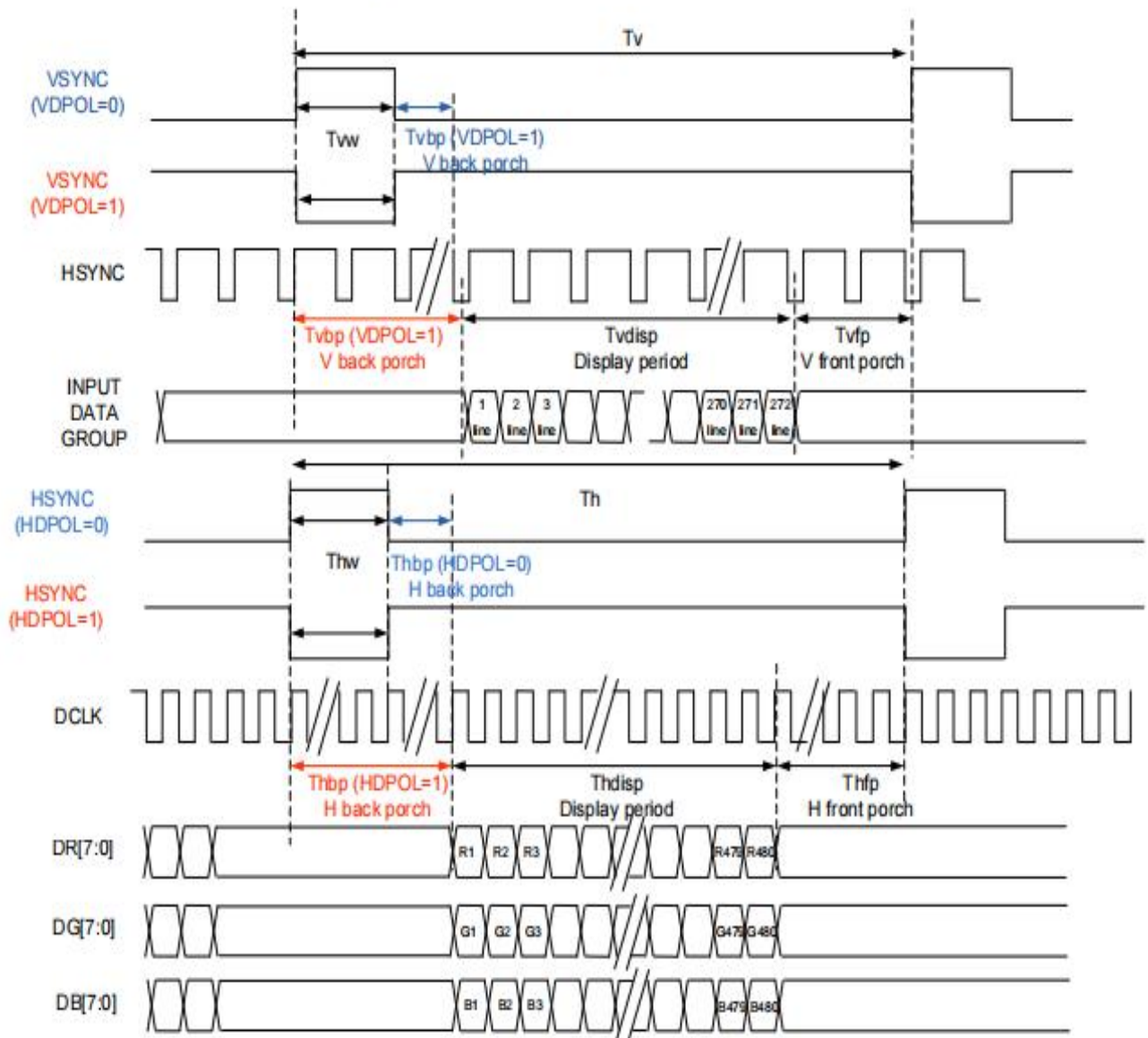
14.2 Power Off Sequence



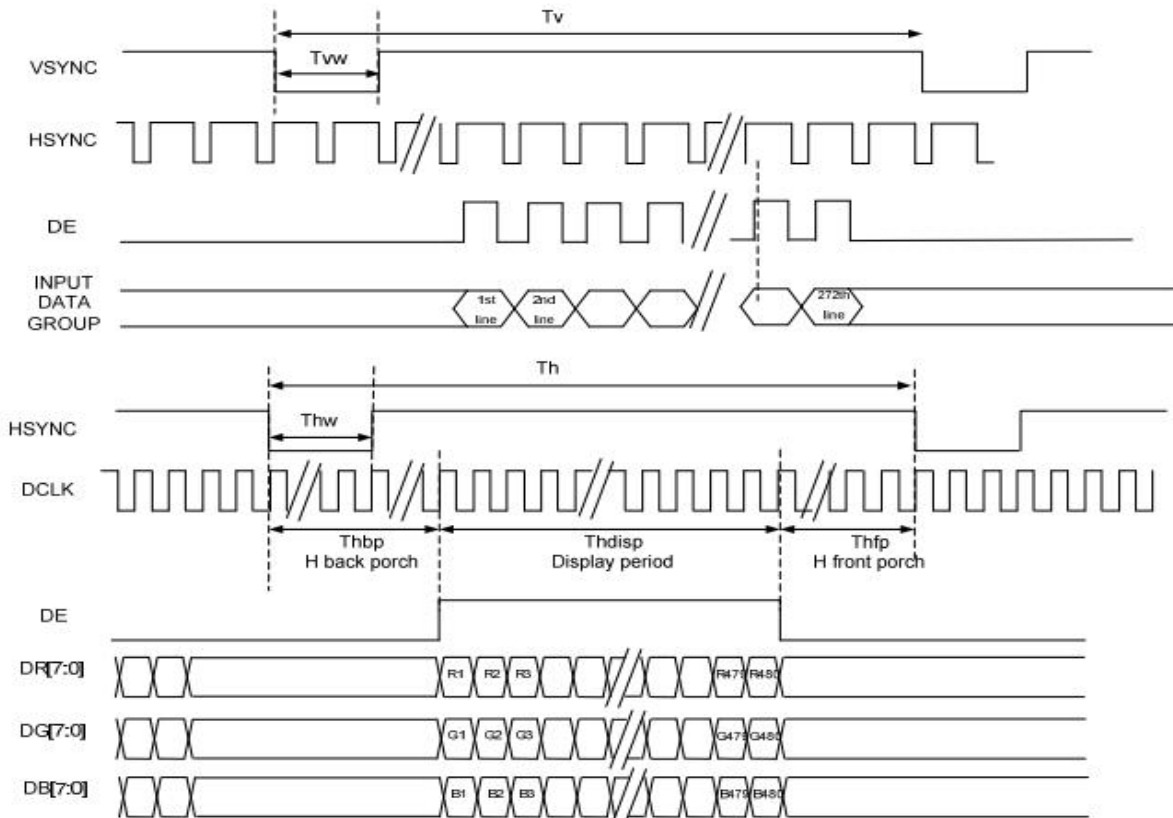
Item	Description	Min. Time
T0	Time from backlight power off to DISP="L"	1*Frame
T1	Time from DISP="L" to LCM Power off	5*Frame

5.8 Timing Conditions AC Characteristics

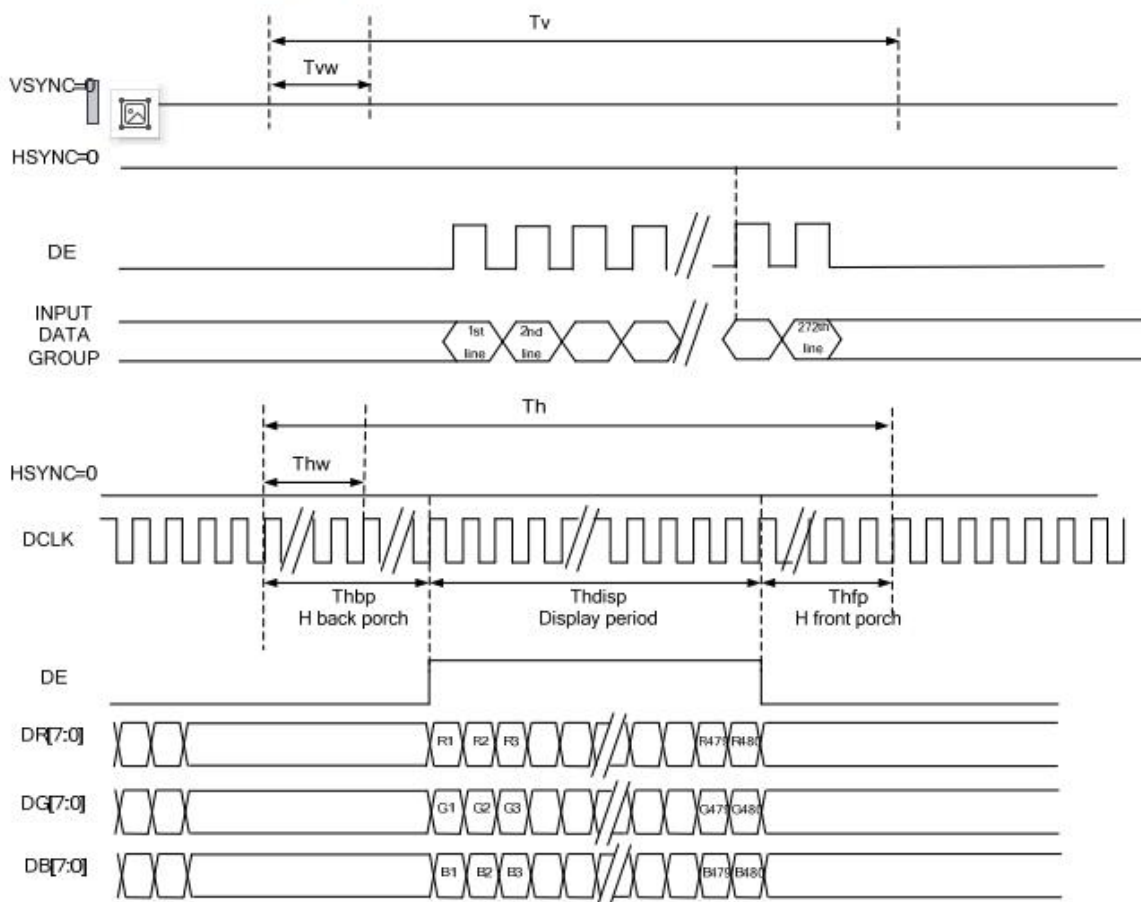
10.2 SYNC Mode Timing Diagram



10.3 SYNC-DE Mode Timing Diagram



10.4 DE Mode Timing Diagram



5.9 Optical specifications

Item		Symbol	Conditions	Specifications			Unit
				Min.	Typ.	Max.	
Transmittance (w/o APCF)		T%	Viewing normal angle $\theta_x = \theta_y = 0$		5.84	-	%
Contrast Ratio		CR		-	500	-	-
Response Time		$T_{on} + T_{off}$		--	25	50	ms
Viewing Angle	Hor.	θ_{x+}	Center CR>10		70	-	deg.
		θ_{x-}			70	-	
	Ver.	θ_{y+}			50	-	
		θ_{y-}			60	-	
CF only Color Chromaticity (CIE 1931)	Red	Rx	Viewing normal angle $\theta_x = \theta_y = 0$	0.597	0.627	0.657	-
		Ry		0.311	0.341	0.371	-
	Green	Gx		0.278	0.307	0.337	-
		Gy		0.509	0.539	0.569	-
	Blue	Bx		0.108	0.138	0.168	-
		By		0.066	0.096	0.126	-
	White	Wx		0.285	0.315	0.345	-
		Wy		0.296	0.326	0.356	-
	Color Gamut				-	55.4	-

Note 1: Definition of viewing angle range

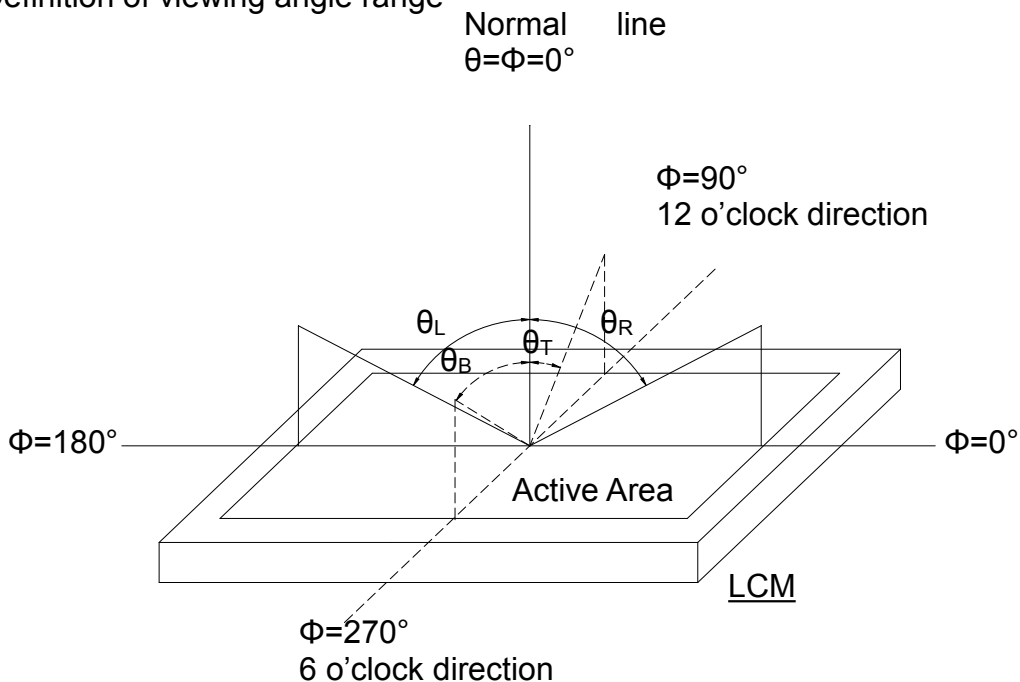


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Viewing angle is measured by ELDIM-EZ contrast/Height :1.2mm ,Response time is measured by Photo detector TOPCON BM-5A, other items are measured by BM-7A/Field of view: 1° /Height: 500mm.)

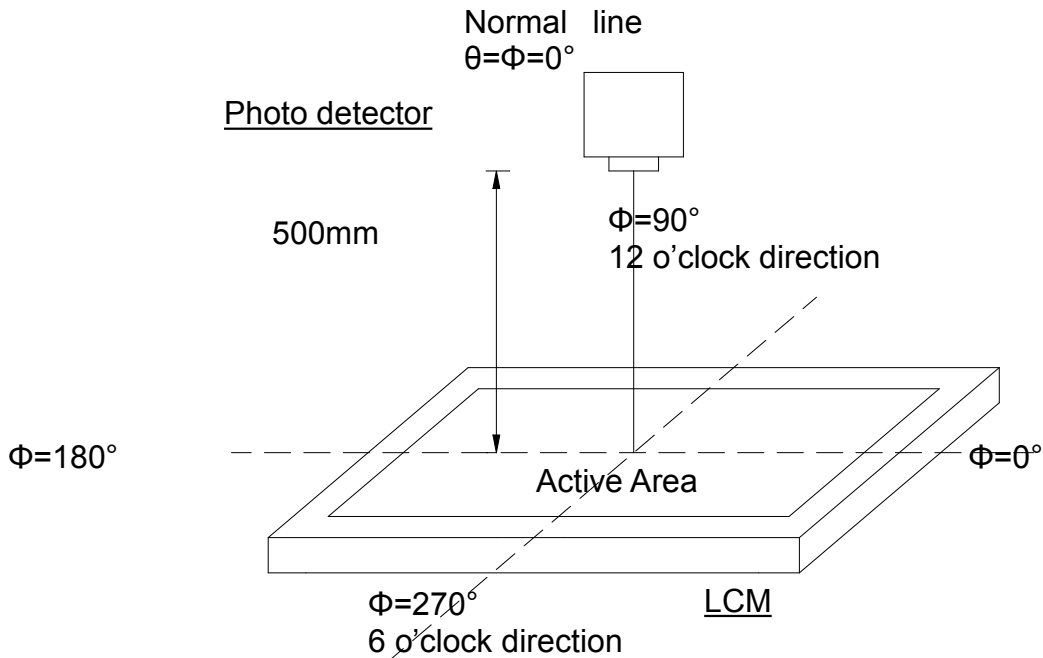


Fig. 4-2 Optical measurement system setup

Note 3: 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%.

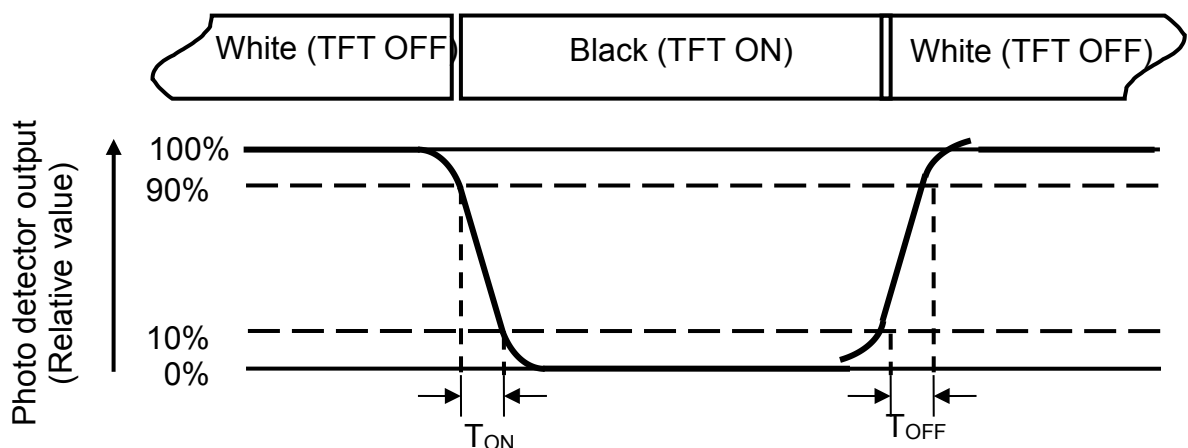


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

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

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel. The LED driving condition is $I_{LED}=60mA$.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{min}}{B_{max}}$$

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

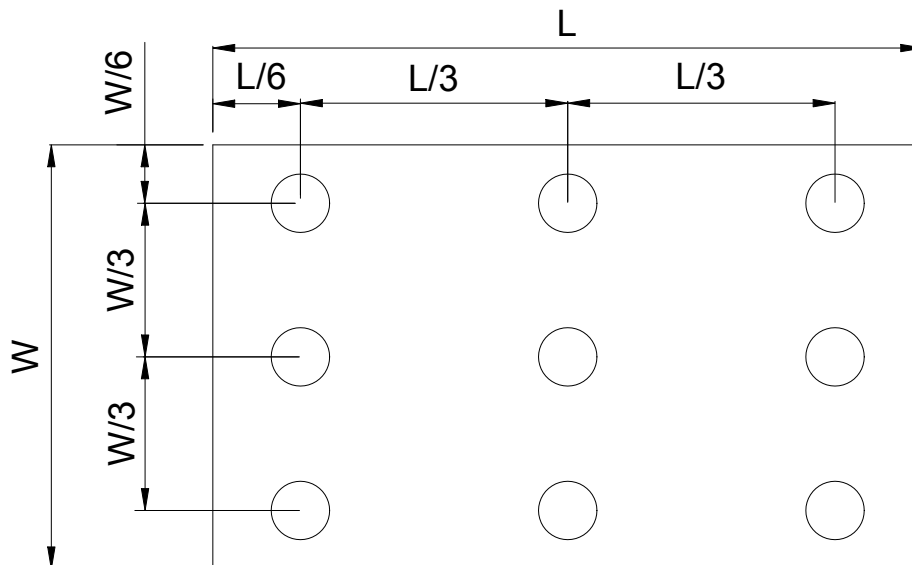


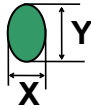
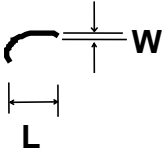
Fig. 4-4 Definition of measuring points

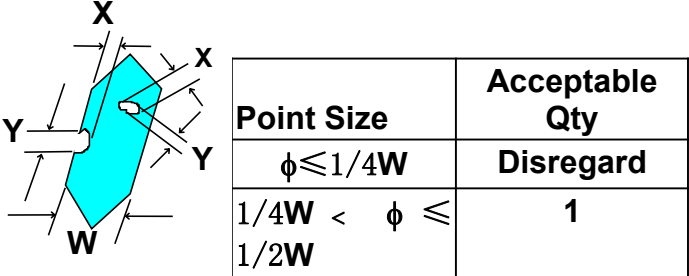
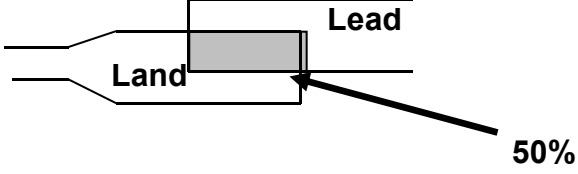
B_{max} : The measured maximum luminance of all measurement position.

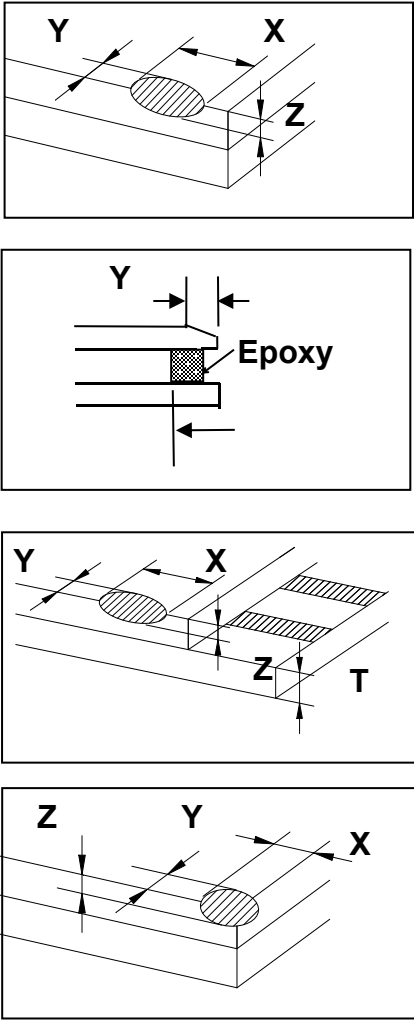
B_{min} : The measured minimum luminance of all measurement position.

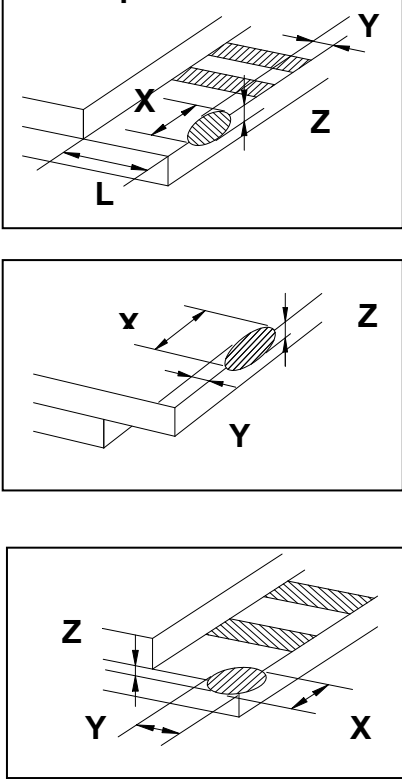
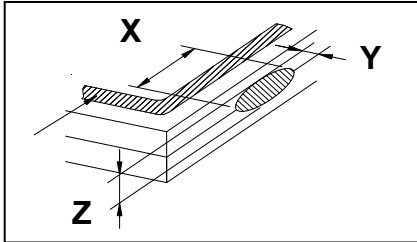
Note 8: Testing equipment **BM-7**

6、Inspection Standards

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/White /Died spot, dust,eyewinker (incl. Polarizer) $\phi = (X+Y)/2$	 <table border="1" data-bbox="906 958 1342 1272"> <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>1</td> </tr> <tr> <td>$\phi > 0.20$</td> <td>0</td> </tr> </tbody> </table> <p style="text-align: right;">Unit: mm</p>	Point Size	Acceptable Qty.	$\phi \leq 0.10$	Disregard	$0.10 < \phi \leq 0.15$	2	$0.15 < \phi \leq 0.20$	1	$\phi > 0.20$	0					
Point Size	Acceptable Qty.																
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$0.15 < \phi \leq 0.20$	1																
$\phi > 0.20$	0																
4	Line defect	 <table border="1" data-bbox="834 1440 1382 1760"> <thead> <tr> <th colspan="2">Line</th> <th>Acceptable Qty.</th> </tr> <tr> <th>L</th> <th>W</th> <th></th> </tr> </thead> <tbody> <tr> <td>---</td> <td>$0.015 \geq W$</td> <td>Disregard</td> </tr> <tr> <td>$2.0 \geq L$</td> <td>$0.025 \geq W$</td> <td>2</td> </tr> <tr> <td>$1.0 \geq L$</td> <td>$0.05 \geq W$</td> <td>1</td> </tr> </tbody> </table> <p style="text-align: right;">Unit: mm</p>	Line		Acceptable Qty.	L	W		---	$0.015 \geq W$	Disregard	$2.0 \geq L$	$0.025 \geq W$	2	$1.0 \geq L$	$0.05 \geq W$	1
Line		Acceptable Qty.															
L	W																
---	$0.015 \geq W$	Disregard															
$2.0 \geq L$	$0.025 \geq W$	2															
$1.0 \geq L$	$0.05 \geq W$	1															
5	Rainbow	Not more than two color changes across the viewing area.															

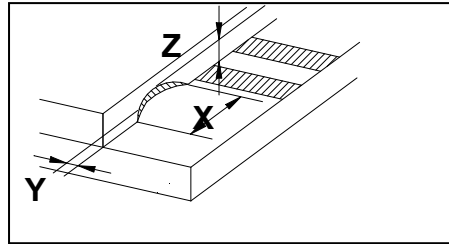
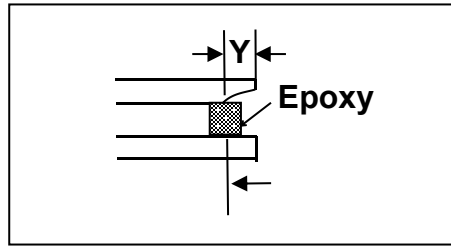
No.	Item	Criterion						
6	Segment pattern W = Segment width $\phi = (X+Y)/2$	<p>(1) Pin hole $\phi < 0.10\text{mm}$ is acceptable.</p>  <table border="1" data-bbox="900 510 1358 725"> <thead> <tr> <th>Point Size</th> <th>Acceptable Qty</th> </tr> </thead> <tbody> <tr> <td>$\phi \leq 1/4W$</td> <td>Disregard</td> </tr> <tr> <td>$1/4W < \phi \leq 1/2W$</td> <td>1</td> </tr> </tbody> </table>	Point Size	Acceptable Qty	$\phi \leq 1/4W$	Disregard	$1/4W < \phi \leq 1/2W$	1
Point Size	Acceptable Qty							
$\phi \leq 1/4W$	Disregard							
$1/4W < \phi \leq 1/2W$	1							
7	Back-light	<p>(1) The color of backlight should correspond its specification.</p> <p>(2) Not allow flickering</p>						
8	Soldering	<p>(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect)</p> <p>(2) Over 50% of lead should be soldered on Land.</p> 						
9	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>						
10	PCB	<p>(1) Not allow screw rust or damage.</p> <p>(2) Not allow missing or wrong putting of component.</p>						

11	LCD	<p>2.1.1 chip on the surface</p>  <table border="1" data-bbox="762 1568 1340 1877"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>$>1/8A$</td> <td>$\leq 0.3\text{mm}$</td> <td>$\leq 1/2T$</td> </tr> <tr> <td rowspan="2">$\leq 1/8A$</td> <td>Not enter into epoxy frame</td> <td>$\leq T$</td> </tr> <tr> <td>Not enter into the inner edge of epoxy</td> <td>$\leq 1/2T$</td> </tr> </tbody> </table>	X	Y	Z	$>1/8A$	$\leq 0.3\text{mm}$	$\leq 1/2T$	$\leq 1/8A$	Not enter into epoxy frame	$\leq T$	Not enter into the inner edge of epoxy	$\leq 1/2T$
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	Not enter into the inner edge of epoxy	$\leq 1/2T$											

11	LCD	<p>2.1.2 chip on the terminal</p>  <table border="1" data-bbox="683 1077 1347 1370"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>$>1/8A$</td> <td>$\leq 0.3\text{mm}$</td> <td>$\leq 1/2T$</td> </tr> <tr> <td>$\leq 1/8A$</td> <td>$\leq 1/2L$</td> <td>$\leq T$</td> </tr> <tr> <td>$\leq 1/8A$ 且 $\leq 1\text{mm}$</td> <td>$\leq L$</td> <td>$\leq T$</td> </tr> <tr> <td>$\leq 1/8A$ 且 $\leq 2\text{mm}$</td> <td>$\leq L$</td> <td>$\leq 1/2T$</td> </tr> </tbody> </table> <p>Note: the distance between crack and contact pad</p> <p>2.1.3 chip out on between side</p> 	X	Y	Z	$>1/8A$	$\leq 0.3\text{mm}$	$\leq 1/2T$	$\leq 1/8A$	$\leq 1/2L$	$\leq T$	$\leq 1/8A$ 且 $\leq 1\text{mm}$	$\leq L$	$\leq T$	$\leq 1/8A$ 且 $\leq 2\text{mm}$	$\leq L$	$\leq 1/2T$
X	Y	Z															
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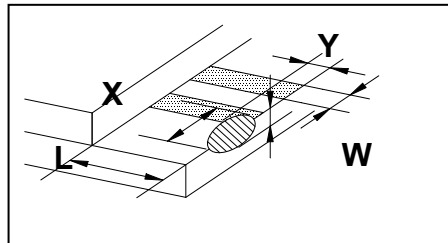
11

LCD



X	Y	Z
$\leq 1/8A$	Not enter into epoxy frame	$Z \leq 2T$
	Not enter into 1/2 epoxy frame	$Z \leq 1/2T$

2.1.4 including corner chip and side chip



X	Y	Z
$> 1/8A$	$\leq 1/6L$	$\leq 1/2T$
$\leq 1/8A$	$\leq 1/3L$	
$\leq 1/4W$	$\leq 2/3L$	

7. Reliability Test Conditions And Methods

Item	Test Conditions	Remark
High Temperature Storage	Ta = 80°C 48hrs	
Low Temperature Storage	Ta = -30°C 48hrs	
High Temperature Operation	Ts = 70°C 48hrs	
Low Temperature Operation	Ta = -20°C 48hrs	
Operate at High Temperature and Humidity	60°C, 90%RH max. 48hrs	Operation
Thermal Shock	-20°C~ +70°C 10 cycles 1Hrs/cycle	Non-operation
Vibration Test	Frequency:10Hz~55Hz~10Hz Amplitude:1.5mm X,Y,Z direction for total 3hours (Packing Condition)	
Drooping Test	Drop to the ground from 1M height one time every side of carton. (Packing Condition)	
Electrostatic Discharge	Contact=±4KV, class B Air=±8KV, class B	

8. Handling Precautions

8.1 Mounting method

The LCD panel of FEXDA LCD module consists of two thin glass plates with polarizers which easily be damaged. And since the module is so constructed as to be fixed by utilizing fitting holes in the printed circuit board.

Extreme care should be needed when handling the LCD modules.

8.2 Caution of LCD handling and cleaning

When cleaning the display surface, Use soft cloth with solvent [recommended below] and wipe lightly

- Isopropyl alcohol
- Ethyl alcohol

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Aromatics

Do not wipe ITO pad area with the dry or hard materials that will damage the ITO patterns

Do not use the following solvent on the pad or prevent it from being contaminated:

- Soldering flux
- Chlorine (Cl) , Sulfur (S)

If goods were sent without being silicon coated on the pad, ITO patterns could be damaged due to the corrosion as time goes on.

If ITO corrosion happens by miss-handling or using some materials such as Chlorine (Cl), Sulfur (S) from customer, Responsibility is on customer.

8.3 Caution against static charge

The LCD module uses C-MOS LSI drivers, so we recommend that you:

Connect any unused input terminal to V_{dd} or V_{ss}, do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

8.4 packing

- Module employs LCD elements and must be treated as such.
- Avoid intense shock and falls from a height.
- To prevent modules from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity

8.5 Caution for operation

- It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life.
- An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.
- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operation temperature.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.
Usage under the maximum operating temperature, 50%Rh or less is required.

8.6 storage

In the case of storing for a long period of time for instance, for years for the purpose or replacement use, the following ways are recommended.

- Storage in a polyethylene bag with the opening sealed so as not to enter fresh air outside in it . And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light's keeping the storage temperature range.
- Storing with no touch on polarizer surface by the anything else.
[It is recommended to store them as they have been contained in the inner container at the time of delivery from us

8.7 Safety

- It is recommendable to crash damaged or unnecessary LCD's into pieces and wash off liquid crystal by either of solvents such as acetone and ethanol, which should be burned up later.
- When any liquid leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water

9. Precaution for use

9.1

A limit sample should be provided by the both parties on an occasion when the both parties agreed its necessity. Judgment by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

9.2

On the following occasions, the handing of problem should be decided through discussion and agreement between responsible of the both parties.

- When a question is arisen in this specification
- When a new problem is arisen which is not specified in this specifications
- When an inspection specifications change or operating condition change in customer is reported to FEXDA , and some problem is arisen in this specification due to the change
- When a new problem is arisen at the customer's operating set for sample evaluation in the customer site.

10. Package Drawing

