SPECIFICATION
OF
LCD MODULE

MODULE NO.：HL070T20-01

Customer Approval:

☐ **Accept**   ☐ **Reject**

	SIGNATURE	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

DOCUMENT REVISION HISTORY

Sample Version	Doc. Version	DATE	DESCRIPTION	CHECKED BY
0001	A0	2017-04-29	First Release.	

1. <u>MECHANICAL SPECIFICATIONS:</u>

ITEM	SPECIFICATION	UNIT
OUTLINE DIMEMSIONS	164.9(W) X100(H) X3.35(D)	mm
DISPLAY SIZE	7.0	inch
DOT PITCH	0.150mmX0.150mm	mm
NUMBER OF DOTS	1024*（RGB）*600	-
DRIVER IC	/	-
LCD TYPE	TFT(16.7M) TRANSMISSIVE	-
BACKLIGHT TYPE	LED White	-
VIEWING DIRECTION	FREE	-
TOUCH PANEL	Without TP	

*See attached drawing for details.

2.BLOCK DIAGRAM:

3.DIMENSIONAL

49.30
100.0±0.2(LCM Outline)
7.33
89.1(Bezel Open)
9.3
85.92(Active area)
52.26
2.71
3.92
164.9±0.2(LCM Outline)
156.7(Bezel Open)
154.08(Active area)
80.96
66.80

Resolution:1024(H)*3(RGB)*600(V)

(Display center)

Contact side
FPC
FRONT
Pull tape
Stiffener
0.3±0.05
3.35±0.3

A
k

First version
CONTENTS MODIFIED

REV.			DATE
MARK	REV.		
1.0			

FPC ASSIGNMENT:

1	VCOM	11	RXIN1-	21	RXIN3+	31	LED-
2	VDD	12	RXIN1+	22	GND	32	LED-
3	VDD	13	GND	23	NC	33	LR
4	NC	14	RXIN2-	24	NC	34	UD
5	RESET	15	RXIN2+	25	GND	35	VGL
6	STBYB	16	GND	26	NC	36	NC
7	GND	17	RXCLK-	27	DIMO	37	NC
8	RXIN0-	18	RXCLK+	28	SELB	38	VGH
9	RXIN0+	19	GND	29	AVDD	39	LED+
10	GND	20	RXIN3-	30	GND	40	LED+

20.50
1
40
A
K
Tape

Display Type	7" TFT-LCD,transmissive, normal black
Display Resolution	1024GB(H)*600(V)
Interface	LVDS
Logic Voltage	3.3V
Operation Temperature	-20°C TO 70°C
Storage Temperature	-30°C TO 80°C
Remark	

HL 博罗光电有限公司
Hello Lighting co.,LTD

TITLE: LCM DIMENISION

HL070T20-01

DESIGN		REV.: 2.0	SCALE:--
CHECKED			
APPROVED		PROJECTION:	

4. PIN DESCRIPTION:

NO.	PIN NAME	I/O	Description
1	VCOM	P	Common voltage
2	VDD	P	Digital power
3	VDD	P	Digital power
4	NC	-	Not connection
5	RESET	I	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (R=10KΩ , C=0.1μ F)
6	STBYB	I	Standby mode, normally pull high STBYB="1", normal operation STBYB="0",timing control, source driver will turn off, all output are high-Z
7	GND	P	Power ground
8	RXIN0-	I	Negative LVDS differential data inputs
9	RXIN0+	I	Positive LVDS differential data inputs
10	GND	P	Power ground
11	RXIN1-	I	Horizontal Sync Input
12	RXIN1+	I	Positive LVDS differential data inputs
13	GND	P	Power ground
14	RXIN2-	I	Negative LVDS differential data inputs
15	RXIN2+	I	Positive LVDS differential data inputs
16	GND	P	Power ground
17	RXCLKIN-	I	Negative LVDS differential clock inputs
18	RXCLKIN+	I	Positive LVDS differential clock inputs
19	GND	P	Power ground
20	RXIN3-	I	Negative LVDS differential data inputs
21	RXIN3+	I	Positive LVDS differential data inputs
22	GND	P	Power ground
23	NC	-	Not connection
24	NC	-	Not connection
25	GND	P	Power ground
26	NC	-	Not connection
27	DIMO	-	Backlight CABC controller signal output
28	SELB	I	6bit/8bit mode select. 1 for 6bits, 0 for 8bits.
29	AVDD	P	Power for Analog Circuit
30	GND	P	Power ground
31	LED-	P	LED Cathode
32	LED-	P	LED Cathode
33	L/R	I	Horizontal inversion
34	U/D	I	Vertical inversion
35	VGL	P	Negative power for TFT
36	NC	-	No connection
37	NC	-	No connection
38	VGH	P	Positive power for TFT
39	LED+	P	LED Anode
40	LED+	P	LED Anode

Note 1: Selection of scanning mode

L/R	U/D	Function
1	0	Normal display
0	0	left and Right opposite
1	1	Up and Down opposite
0	1	Left and Right opposite, Up and Down opposite

Note 2: Definition of scanning direction.
Refer to the figure as below:
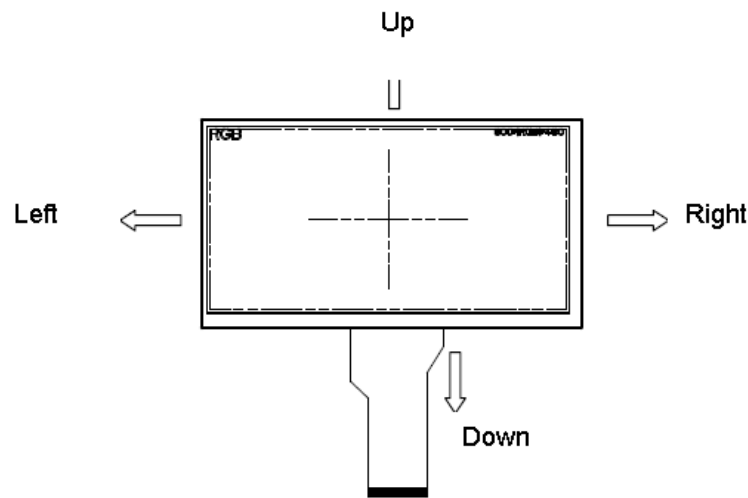
Note 3: When CABC_EN="00", CABC OFF.

When CABC_EN="01", user interface image.

When CABC_EN="10", still picture.

When CABC_EN="11", moving image.

When CABC off, don't connect DIMO, else connect it to backlight

5. MAXIMUM ABSOLTE LIMIT:

Item	Symbol	Value	Unit
Power supply voltage for logic	DVDD	-0.3~5	V
Power for analog	AVDD	-0.3 ~ 13.5	V
Gate on voltage	VGH	-0.3 ~ 40	V
Gate off voltage	VGL	-20 ~ 0.3	V
Input voltage	Vin	V_{DD}+0.3	V
Operating temperature	Topr	-20 to 60	°C
Storage temperature	Tstg	-30 to 70	°C

Note: Note1: Absolute maximum rating is the limit value beyond which the IC maybe broken.
They do not assure operations.

Note2: Background color changes slightly depending on ambient temperature. This
Phenomenon is reversible.

Ta ≅ 70℃: 75%RH max

Ta>70℃: absolute humidity must be lower than the humidity of 75%RH at 70℃

Note3: Ta at -30℃ will be <48hrs, at 80 ℃ will be <120hrs

6.ELECTRICAL CHARACTERISTICS

6-1 DC Characteristics (V_{DD}=2.8V,Ta=25°C)

Item	Symbol	Min	Type	Max	Unit	Test condition
Operating voltage	V_{DD}	3.0	3.3	3.6	V	-
Supply current	I_{DD}	-	TBD	-	mA	V_{DD}=3.3V,Ta=25°C
Input voltage	V_{IH}	0.7VDD	-	VDD	V	-
	V_{IL}	0	-	0.3VDD	V	
Input leakage current	I_{IL}	-1.0	-	1.0	μA	$V_{IN}=V_{DD}$ or V_{SS}
Power voltage	AVDD	10.8	11	11.2	V	
	VGH	19.7	20	20.3	V	
	VGL	-6.5	-6.8	-7.1	V	
	VCOM	2.7	3.7	4.7	V	

Note 1: Be sure to apply DVDD and VGL to the LCD first, and then apply VGH.

Note 2: DVDD setting should match the signals output voltage (refer to Note 3) of customer's
system board.

Note 3: LVDS, Reset.

Note 4: Typ. VCOM is only a reference value, it must be optimized according to each LCM.Be

sure to use VR;
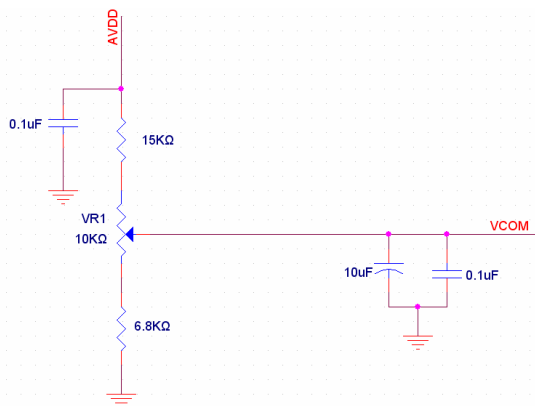
6-2 Backlight Electrical-optical Characteristics

1. Stander Lamp Styles(Edge Lighting Type):

The LED chips are distributed over the edge light area of the illumination unit, which gives the less power consumption:

2. The Main Advantages of the LED Backlight are as following:

2.1 The brightness of the backlight can simply be adjusted by a resistor or a potentiometer.

3. Data About LED Backlight:

Item	Symbol	MIN	TYP	MAX	UNIT	Test Condition	Note
Supply Voltage	Vf	-	9.3	10.2	V		-
Supply Current	If	-	200	-	mA	-	-
Life Time	-	30000	-	-	Hr		-
Backlight Color	White						

NOTE：

1. Average Luminous Intensity of P1-P9

2. Uniformity = Min/Max * 100%

3.LED life time defined as follows: The final brightness is at 70% of original brightness

Measured Method: (X*Y: Light Area)(Left Draft as follow)

Internal Circuit Diagram(Right Draft as follow)

(Effective spatial Distribution)

Hole Diameter ø 3mm ; 1 to 9 per Position Measured Luminous:
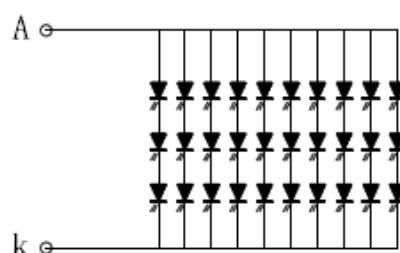
7.AC TIMING
7-1 AC Electrical Characteristics

Parameter	Symbol	Values			Unit	Remark
		Min.	Typ.	Max.		
Clock frequency	R_{xFCLK}	40.8	51.2	71	MHz	
Input data skew margin	T_{RSKM}	500	-	-	ps	
Clock high time	T_{LVCH}	-	$4/(7* R_{xFCLK})$	-	ns	
Clock low time	T_{LVCL}	-	$3/(7* R_{xFCLK})$	-	ns	

7-2 Input Clock and Data Timing Diagram

T_{RSKM}: Receiver strobe margin
R_{SPOS}: Receiver strobe position
T_{SW} : Strobe width (Internal data sampling window)
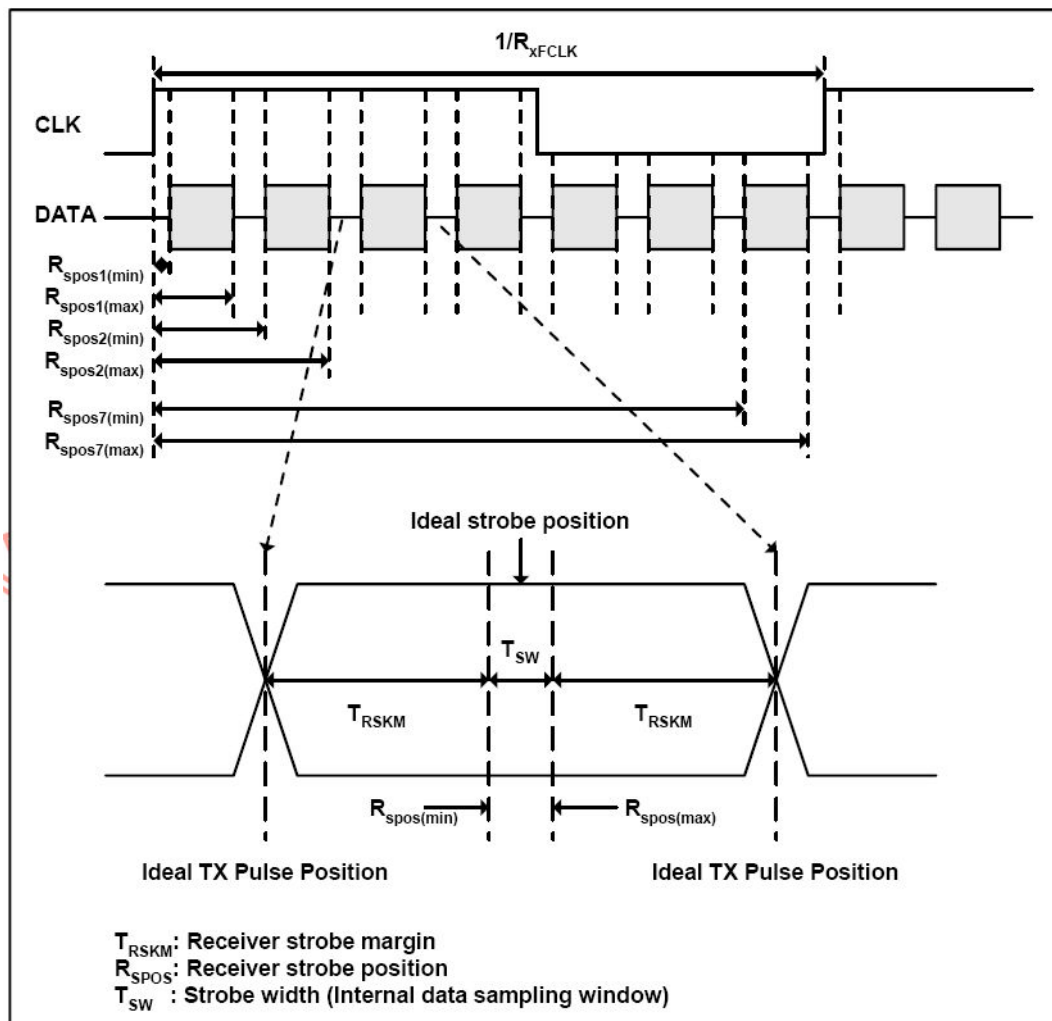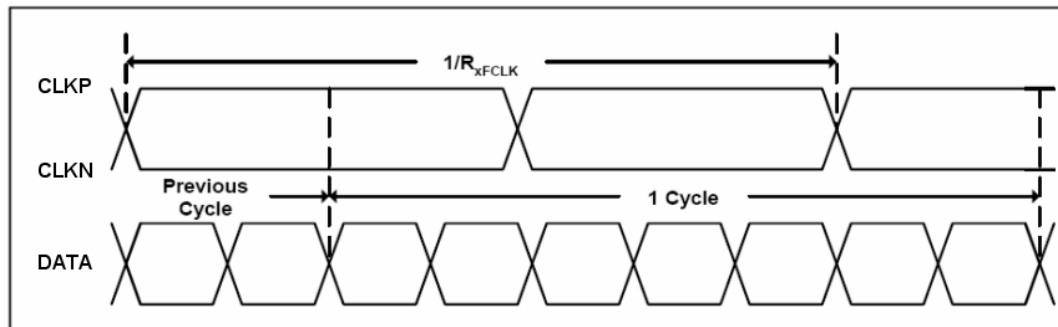
7-3 Input Clock and Data Timing Diagram

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Differential input high Threshold voltage	R_{xVTH}	-	-	+0.1	V	R_{XVCM}=1.2V
Differential input low Threshold voltage	R_{xVTL}	-0.1	-	-	V	
Input voltage range (singled-end)	R_{xVIN}	0	-	2.4	V	
Differential input common mode voltage	R_{xVCM}	$|V_{ID}|/2$	-	$2.4-|V_{ID}|/2$	V	
Differential voltage	$|V_{ID}|$	0.2	-	0.6	V	
Differential input leakage current	RV_{xliz}	-10	-	+10	uA	
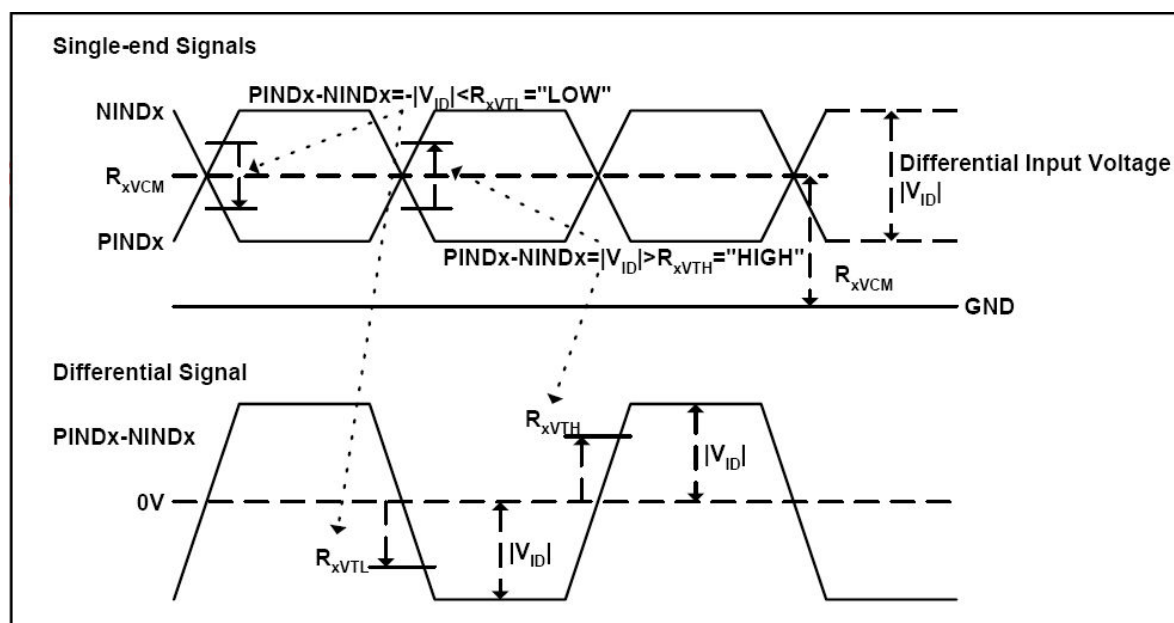
7-4 Timing

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Clock Frequency	fclk	40.8	51.2	67.2	MHz	Frame rate=60Hz
Horizontal display area	thd		1024		DCLK	
HS period time	th	1114	1344	1400	DCLK	
HS Blanking	thb	90	320	376	DCLK	
Vertical display area	tvd		600		H	
VS period time	tv	610	635	800	H	
VS Blanking	thb	10	35	200	H	

7-5 Data input format for LVDS

6bit LVDS data input

IND0	R0	G0	R5	R4	R3	R2	R1	R0	G0
IND1	G1	B1	B0	G5	G4	G3	G2	G1	B1
IND2	B2	DE	-	-	B5	B4	B3	B2	DE

8bit LVDS data input

IND0	R0	G0	R5	R4	R3	R2	R1	R0	G0
IND1	G1	B1	B0	G5	G4	G3	G2	G1	B1
IND2	B2	DE	-	-	B5	B4	B3	B2	DE
IND3	R6	-	B7	B6	G7	G6	R7	R6	-
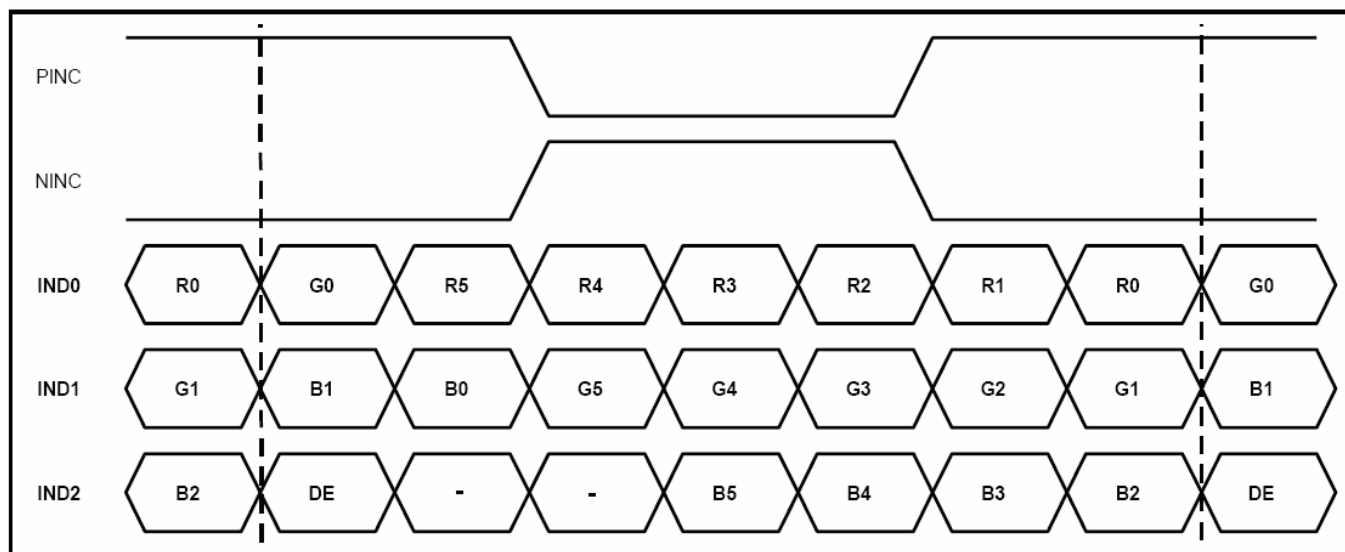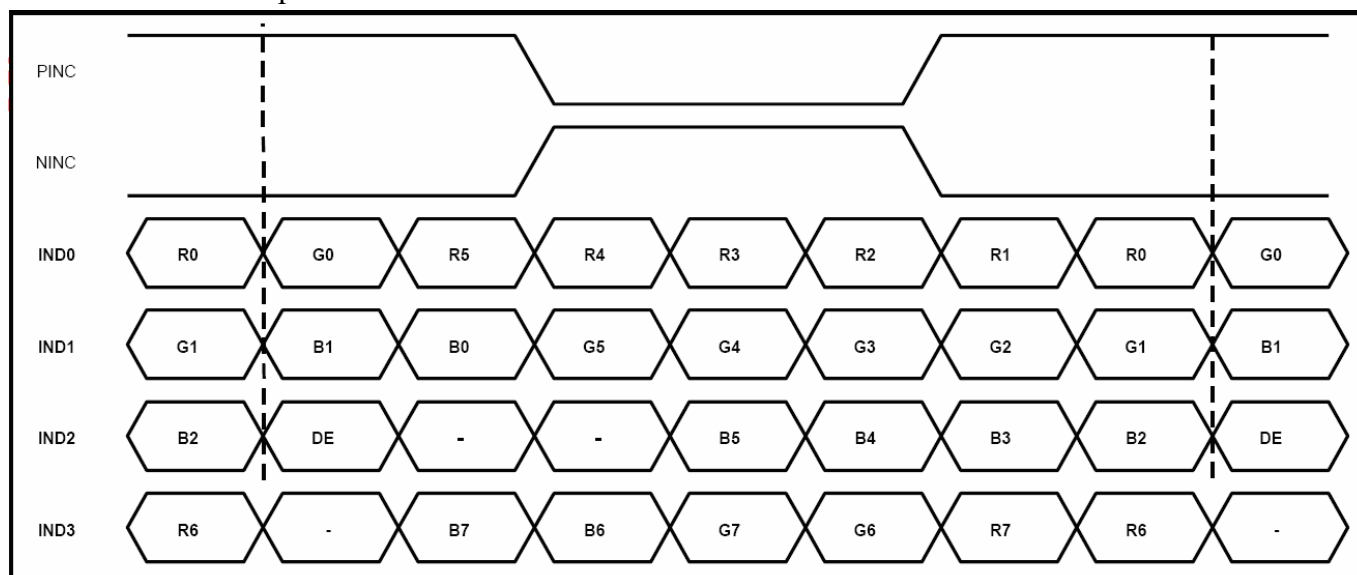
Note: Support DE timing mode only, SYNC mode not supported.

8. OPTICAL CHARACTERISTICS:

Driving the backlight

No.	ITEM		Symbol	Conditions	Specification			Unit	Note
					Min	Typ	Max		
1	Response Time		Tr+Tf	25℃	-	25	50	Ms	(1)(2)
2	Contrast Rate		Cr	θ=0, Normal viewing angle	500	700	-	-	(1)(3)
3	Viewing Angle	Hor.	θL	CR>10	-	80	-	Deg	-
			θR		-	80	-		
		Ver.	Θ+		-	80	-		
			Θ-		-	80	-		
4	Chromaticiry	White	x	Brightness is ON	0.26	0.31	0.36		
			y		0.28	0.33	0.38		
5	luminance		L		800	1000		cd/m2	
6	Uniformity		U		75			%	

Measure Conditions:

1. Measure surrounding : dark room;
2. Ambient temperature: 25±2℃;
3. 30min.warm-up time.

Note Definition:

Note(1)Viewing angle range:

Note(2)Response Time:

Positive Type

No selected waveform → ← Selected waveform → ← No selected waveform

Transmittance

100%   90%   10%

Tr   Tf

Negative Type

No selected waveform → ← Selected waveform → ← No selected

Transmittance

100%   90%   10%

Tr   Tf
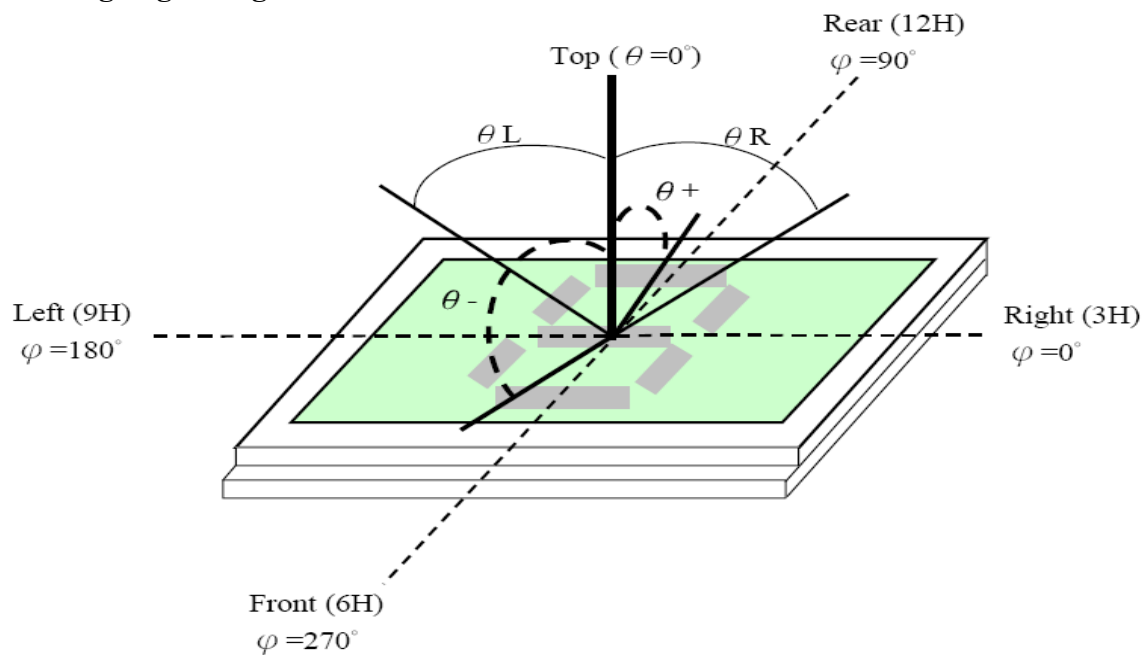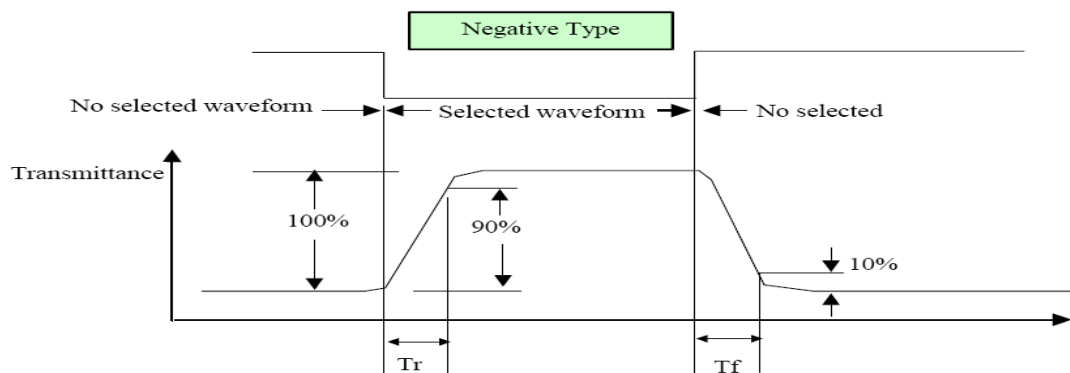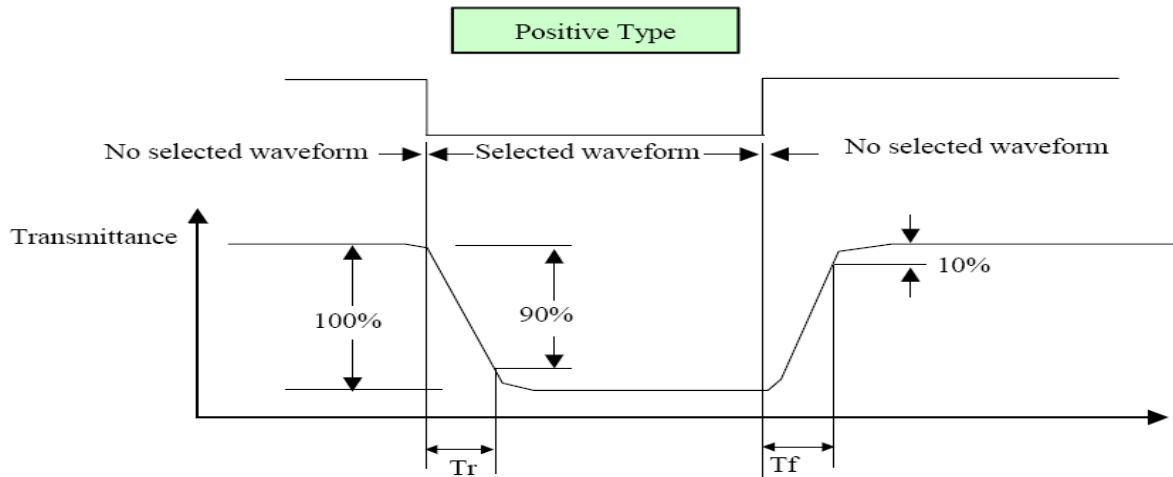
Note(3)Contrast Ratio Definition:

Brightness

Bns

Brightness of Nonselected waveform

Brightness of Selected waveform

Bs

Operating Voltage(Vop)   Perpendicular line(Θ =90°C)
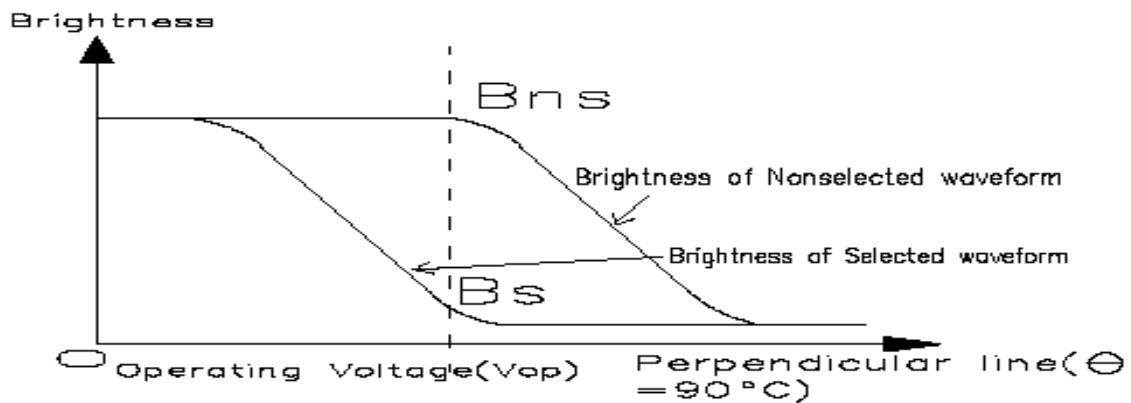
Luminance with all pixel white

Contrast Ratio (Cr)= ――――――――――――――――――――

Luminance with all pixel black

9.PACKAGE.

Cushion-Spangel

Label

⟹

Box-Carton

NOTE:

1. PET Tray Nappe Circumgyrate 180°

2. LCM Panel Packaging Heads

Vacancy Tray

+

Adhesive Tape

Vacancy Tray

⟹

Box-Inner

Vacancy Tray

+

LCM Enclose Tray

a right angle

⟹

Tray Circumgyrate Nappe

a round angle
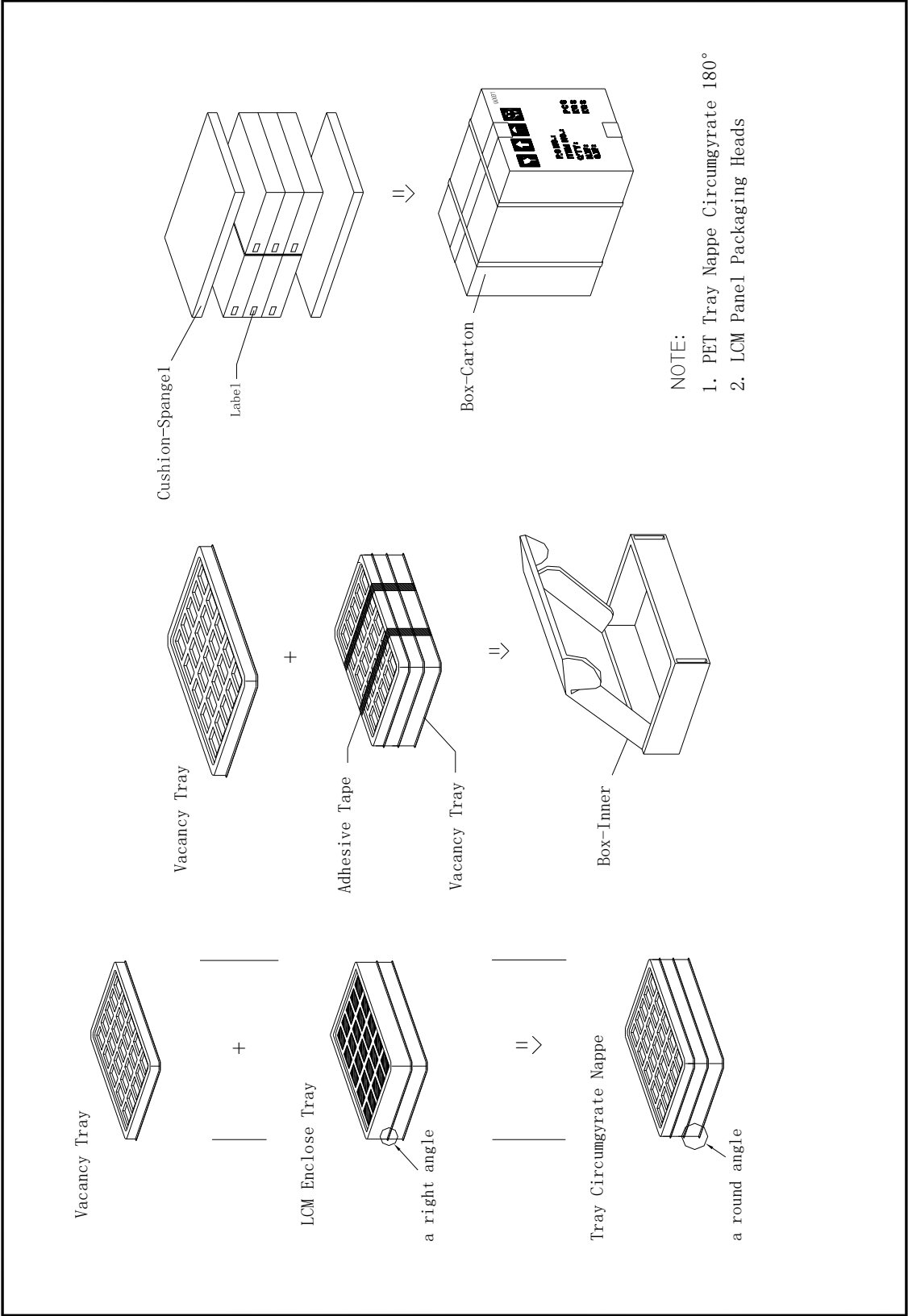
10. STANDARD SPECIFICATION FOR RELIABILITY:

Item	Condition		Time (hrs)	Assessment
High temp. Storage	80°C		120	
High temp. Operating	70°C		120	
Low temp. Storage	-30°C		120	No abnormalities in functions and appearance
Low temp. Operating	-20°C		120	
Humidity	40°C/ 90%RH		120	
Thermal Shock Temp. Cycle	-20°C ← →70°C (0.5hour ← → 0.5 hour)		10cycles	
ESD Testing	HBM:	±8KV		330Ω/150PF
	MM:	±200V		200PF/0Ω

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25±10℃), normal humidity (45±20% RH), and in area not exposed to direct sun light. (Life time of backlight, please refer to Data about backlight.)

Testing Conditions and Inspection Criteria:

For the final test the testing sample must be stored at room temperature for 24 hours, after the tests listed in up Table, Standard specifications for Reliability have been executed in order to ensure stability.

Item	Test Model	In section Criteria
Current Consumption	Refer To Specification	The current consumption should conform to the product specification.
Contrast	Refer To Specification	After the tests have been executed, the contrast must be larger than half of its initial value prior to the tests.
Appearance	Visual inspection	Defect free.

11.SPECIFICATION OF QUALITY ASSURANCE:

11.1 Purpose

This standard for Quality Assurance should affirm the quality of LCD Module products to supply to purchaser.

11.2 Standard for Quality Test

a. Inspection:

Before delivering, the supplier should take the following tests, and affirm the quality of product.

b. Electro-Optical Characteristics:

According to the individual specification to test the product.

c. Test of Appearance Characteristics:

According to the individual specification to test the product.

d. Test of Reliability Characteristics:

According to the definition of reliability on the specification for testing products.

e. Delivery Test:

Before delivering, the supplier should take the delivery test.

(i) Test method: According to MIL-STD105E.General Inspection Level Ⅱ take a single time.

(ii) The defects classify of AQL as following:

Major defect: AQL = 0.65

Minor defect: AQL = 2.5

Total defects: AQL = 2.5

11.3. Nonconforming Analysis & Deal With Manners

a. Nonconforming Analysis:

(i) Purchaser should supply the detail data of non- conforming sample and the non- conforming.

(ii) After accepting the detail data from purchaser, the analysis of nonconforming should be finished in two weeks.

(iii) If supplier can not finish analysis on time, must announce purchaser before two weeks.

b. Disposition of nonconforming:

(i) If find any product defect of supplier during assembly time, supplier must change the good product for every defect after recognition.

(ii) Both supplier and customer should analyze the reason and discuss the disposition of nonconforming when the reason of nonconforming is not sure.

11.4. Agreement items

Both sides should discuss together when the following problems happen.

a. There is any problem of standard of quality assurance, and both sides think that it must be modified.

b. There is any argument item which does not record in the standard of quality assurance.

c. Any other special problem.

11.5 Standard of The Product Appearance Test

a. Manner of appearance test: This specification should be applied for both light on and off situation.

(i) The test must be under 20W × 2 or 40W fluorescent light, and the distance of view must

be at 30±5cm.

(ii) When test the model of transmissive product must add the reflective plate.

(iii)The test direction is base on about around 10° of vertical line (Left graph)

(iiii)Temperature: 25±5℃ Humidity: 65±10%RH
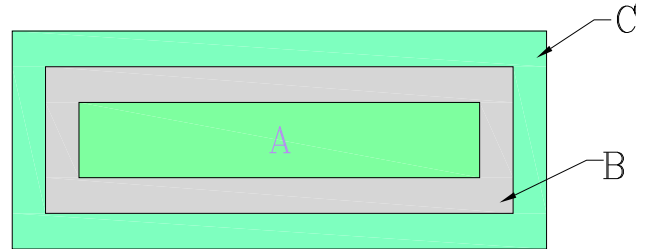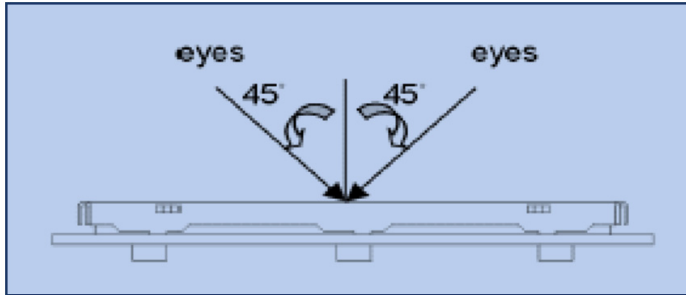
 (iv) Definition of area (Right graph)

A. Area: Viewing area.　　　B. Area: Out of viewing area.(Outside viewing area)

b. Basic principle:

(i) It will accord to the AQL when the standard can not be described.

(ii) The sample of the lowest acceptable quality level must be discussed by both supplier and customer when any dispute happened.

(iii) Must add new item on time when it is necessary.

c. Standard of inspection: (Unit: mm)

Allowable limits defined in follow Dot defect Table should be met for each white, black , R, G, B raster. The limits apply to the entire area. Missing white in 60% or more of typical (one color, R or G or B) pixel aperture is defined as a bright defect, less than 60% is acceptable .Black spot in 60% or more of typical pixel aperture is defined as a dark defect, less than 60% is acceptable.

Dot defect table:

Item		White dot defect	Black dot defect	Total
1	Defect counts	3	3	3
2	Combined defect Counts	No combined dot defect allowed. Two Single dot defect that within 5mm during each dot defect should becounted as combined dot defect.		
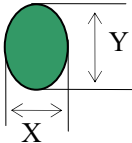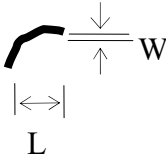
11.6 Inspection specification
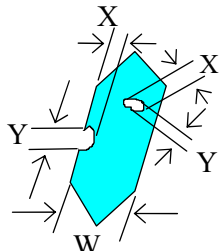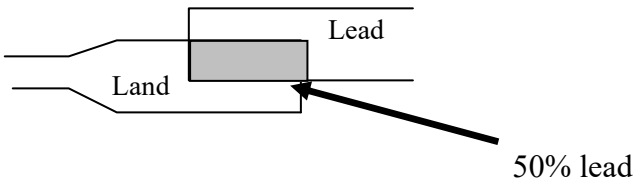
AQL inspection standard

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

Classify		Item	Note	AQL
Major	Display state	Short or open circuit	1	0.65
		Contrast defect (dim, ghost)		
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction	2	
		Wrong Back-light	7	
	Non-display	Flat cable or pin reverse	9	
		Wrong or missing component	10	
Minor	Display state	Background color deviation	2	2.5
		Black spot and dust	3	
		Line defect	4	
		Scratch		
		Rainbow	5	
		Pin hole	6	
	Polarizer	Bubble and foreign material	3	
		Scratch	4	
	PCB,FPC	Scratch	4	
	Soldering	Poor connection	8	
	Wire	Poor connection	9	
	LCD	CHIP OUT	11	

Note on defect classification：

No.	Item	Criterion
1	Short or open circuit LC leakage Flickering No display Wrong viewing direction Wrong Back-light	Not allow
2	Contrast defect Background color deviation	Refer to approval sample
3	Point defect, Black spot, dust (incl. Polarizer) ex.: dirt under polarizer, Pinhole of reflector ,glass scratch, dirt under glass,scratch on polarizer $\phi = (X+Y)/2$	 Unit：mm
4	Line defect	 Unit: mm
5	Rainbow	Not more than two color changes across the viewing area

Table for item 3:

Point Size	Acceptable Qty.
$\phi \leq 0.20$	Disregard
$0.20 < \phi \leq 0.25$	3
$0.25 < \phi \leq 0.30$	2
$\phi > 0.30$	0

Table for item 4:

L	Line W	Acceptable Qty.
---	$0.015 \geq W$	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

| No.	Item	Criterion
6	**Segment pattern** **W = Segment width** **$\phi = (X+Y)/2$**	**(1) Pin hole** $\phi < 0.10$mm is acceptable. 	Point Size	Acceptable Qty	 $\phi \leq 1/4W$ → Disregard $1/4W < \phi \leq 1/2W$ → 1 $\phi > 1/2W$ → 0 Unit: mm
7	**Back-light**	(1) The color of backlight should correspond its specification. (2) Not allow flickering
8	**Soldering**	(1) Not allow heavy dirty and solder ball on PCB or FPC. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land. 50% lead
9	**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.
10	**PCB,FPC**	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.

For item 6, the point size table:

Point Size	Acceptable Qty
$\phi \leq 1/4W$	Disregard
$1/4W < \phi \leq 1/2W$	1
$\phi > 1/2W$	0

Unit: mm

11	LCD	**2.1.1 chip on the surface**

2.1.1 chip on the surface
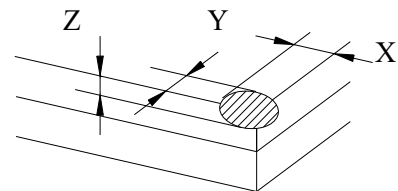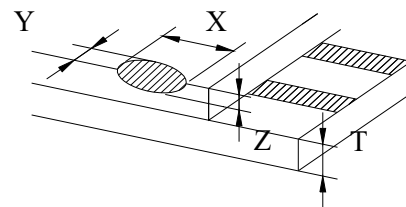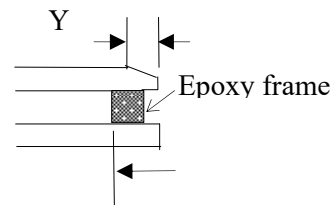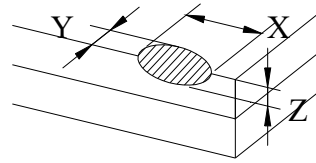
Note: A:LCD Length

X	Y	Z
>1/8A	≤0.3mm	≤1/2T
≤1/8A	Not enter into epoxy frame	≤T
	Not enter into the inner edge of epoxy	≤1/2T

2.1.2 Chip on the terminal
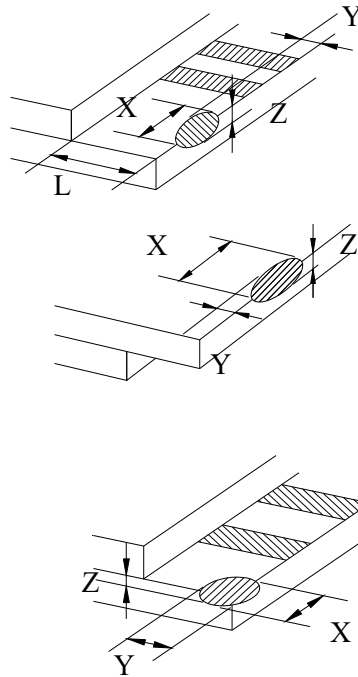
X	Y	Z
>1/8A	≤ 0.3mm	≤ 1/2T
≤ 1/8A	≤ 1/2L	≤ T
≤ 1/8A&≤ 1mm	≤ L	≤ T
≤ 1/8A&≤ 2mm	≤ L	≤ 1/2T

Note: A:LCD Length.

the distance between crack and contact pad must be greater than

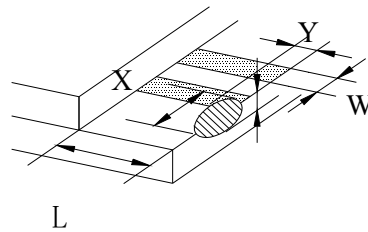the width of 1st contact pad.

2.1.3 Chip out on between side
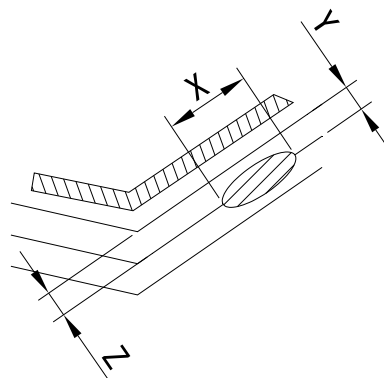
11	**LCD**
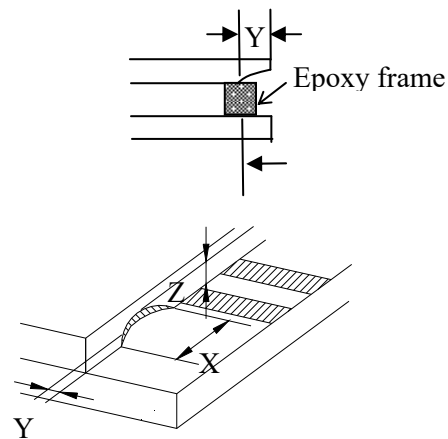
11	**LCD**	Epoxy frame

<table>
<tr><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td rowspan="2">≤ 1/8A</td><td>Not enter into epoxy frame</td><td>Z≤ 2T</td></tr>
<tr><td>Not enter into 1/2 epoxy frame</td><td>Z≤ 1/2T</td></tr>
</table>
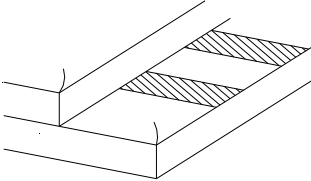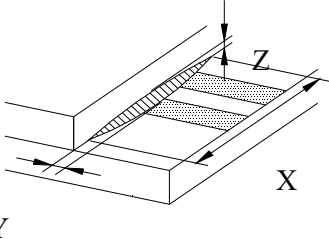
Note: A : LCD Length

2.1.4 including corner chip and side chip

L

Note: A:LCD Length

X	Y	Z
>1/8A	≤1/6L	
≤1/8A	≤1/3L	≤1/2T
≤1/4W	≤2/3L	

11	LCD	**2.2 Chip out**

1) Chip out is that crackles extend to inner edge.
2) Crackles round epoxy frame will be rejected.
3) Chip out on the terminal will be rejected: Z=T length >1mm or Z<T length >2mm
4) The chip out at ITO will be rejected.

2.3 Poor cutting

X	Y	Z
>1/8 A	≤0.3	≤1/2T
≤1/8 A	According to drawing	1/2T≤Z≤T

Note : A: LCD Length.

12	**SMT**	According to the <Acceptable of electronic assemblies> IPC-A-610C class 2 stander. Component missing or function defect are Major defect ,the others are Minor defect.

Any one out of the specification will be rejected.

12. GENERAL PRECAUTIONS

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifloroethane

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

- Water
- Ketone
- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging

Modules use 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.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.
- 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 operating temperature range.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- As light dew depositing on terminals is a cause for electro-chemical reaction resulting in

terminal open circuit.

Usage under the relative condition of 40°C, 50%RH or less is required.

(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 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 is.

Keeping temperature in the specified 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)

(7) Safety

- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

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END