

**SPECIFICATION
OF
LCD MODULE**

MODULE NO.: HL070T15-01

Customer Approval:

☐ **Accept**

☐ **Reject**

	SIGNATURE	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

DOCUMENT REVISION HISTORY

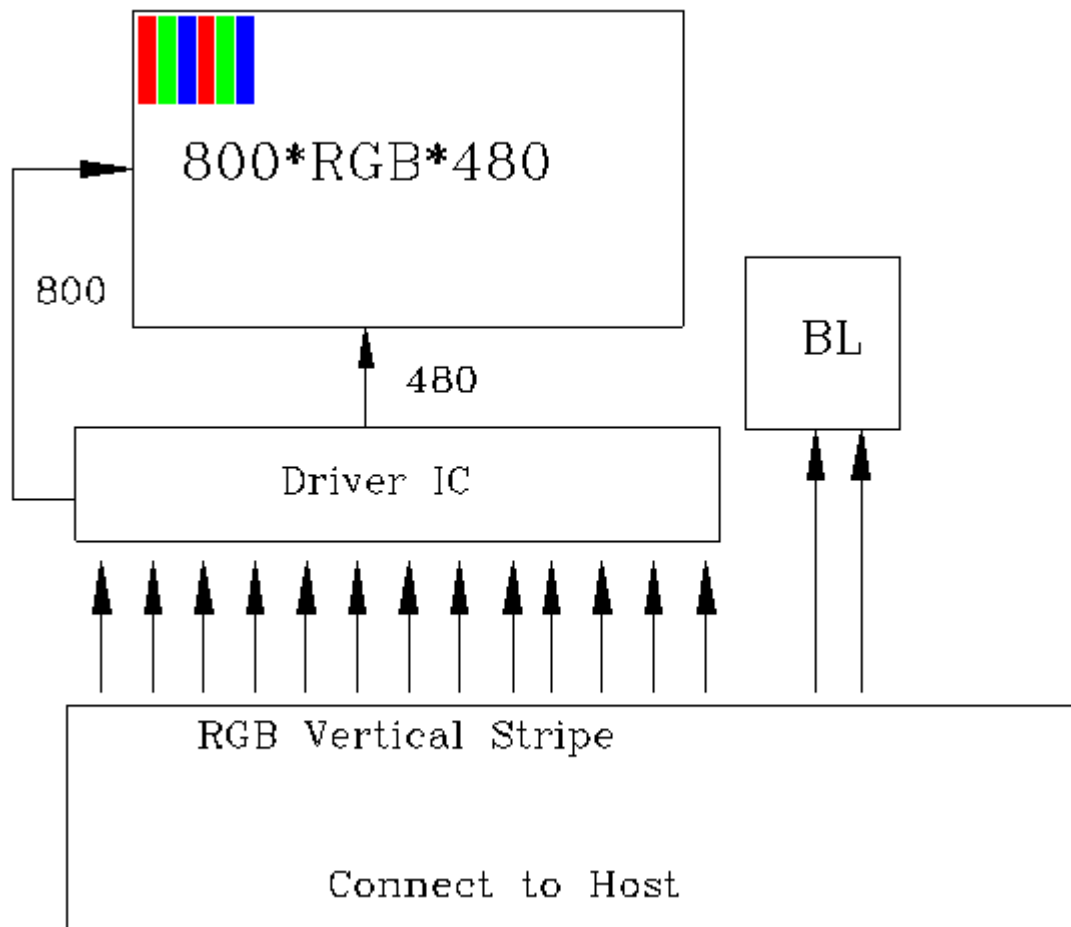
Sample Version	Doc. Version	DATE	DESCRIPTION	CHECKED BY
0001	A0 A1	2014-04-29 2015-5-7	First Release. Modify BL configure	

1. MECHANICAL SPECIFICATIONS:

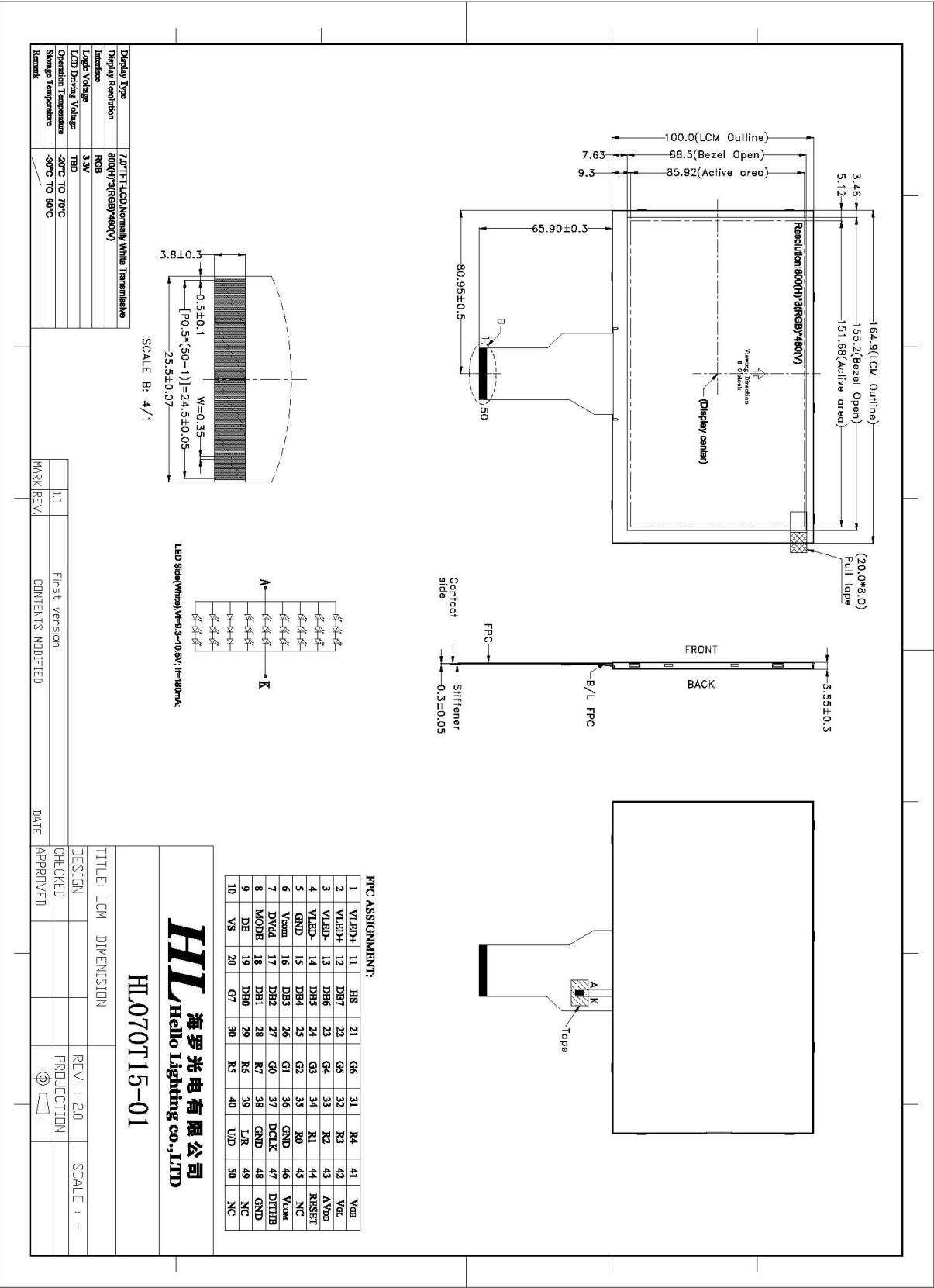
ITEM	SPECIFICATION	UNIT
OUTLINE DIMENSIONS	164.9(W) X100.0(H) X3.55(D)	mm
DISPLAY SIZE	7.0	inch
DOT PITCH	0.19268mmX0.1790mm	mm
NUMBER OF DOTS	800* (RGB) *480	-
DRIVER IC	/	-
LCD TYPE	TFT(16.7M) TRANSMISSIVE	-
BACKLIGHT TYPE	LED White	-
VIEWING DIRECTION	6 O'clock	-

***See attached drawing for details.**

2.BLOCK DIAGRAM:



3.DIMENSIONAL



4. PIN DESCRIPTION:

NO.	PIN NAME	I/O	Description
1	VLED+	P	Power for LED backlight (Anode)
2	VLED+	P	Power for LED backlight (Anode)
3	VLED-	P	Power for LED backlight (Cathode)
4	VLED-	P	LED backlight (Cathode)
5	GND	P	Power ground
6	VCOM	P	Common voltage
7	DVDD	P	Power for Digital Circuit
8	MODE	I	DE/SYNC mode select
9	DE	I	Data Enable
10	VS	I	Vertical Sync Input
11	HS	I	Horizontal Sync Input
12	B7	I	Blue data(MSB)
13	B6	I	Blue Data
14	B5	I	Blue Data
15	B4	I	Blue Data
16	B3	I	Blue Data
17	B2	I	Blue Data
18	B1	I	Blue Data
19	B0	I	Blue Data 0
20	G7	I	Green data
21	G6	I	Green Data
22	G5	I	Green Data
23	G4	I	Green Data
24	G3	I	Green Data
25	G2	I	Green Data
26	G1	I	Green Data
27	G0	I	Green Data
28	R7	I	Red Data(MSB)
29	R6	I	Red Data
30	R5	I	Red Data
31	R4	I	Red Data
32	R3	I	Red Data
33	R2	I	Red Data
34	R1	I	Red Data
35	R0	I	Red Data 0
36	GND	P	Power Ground
37	DCLK	I	Sample clock
38	GND	I	Power Ground
39	L/R	I	Left / right selection, Note4,5
40	U/D	I	Up/down selection Note4,5
41	VGH	P	Gate ON Voltage
42	VGL	P	Gate OFF Voltage

43	AVDD	P	Power for Analog Circuit
44	RESET	I	Global reset pin.
45	NC	-	No connection
46	VCOM	P	Common Voltage
47	DITHB	I	Dithering function
48	GND	P	Power Ground
49	NC	-	No connection
50	NC	-	No connection

Note 1: DE/SYNC mode select. Normally pull high.

When select DE mode, MODE="1", VS and HS must pull high.

When select SYNC mode, MODE="0", DE must be grounded.

Note 2: When input 18 bits RGB data, the two low bits of R,G and B data must be grounded.

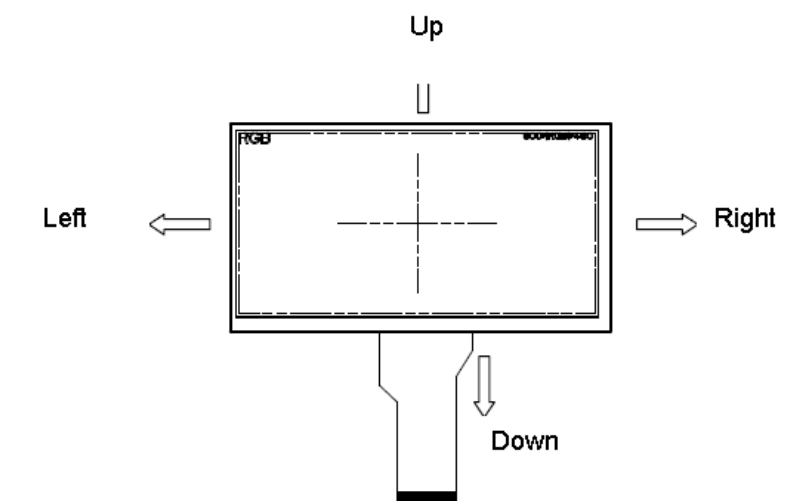
Note 3: Data shall be latched at the falling edge of DCLK.

Note 4: 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 5: Definition of scanning direction.

Refer to the figure as below:



Note 6: Global reset pin. Active low to enter reset state. Suggest to connect with an RC reset circuit for stability. Normally pull high.

Note 7: Dithering function enable control, normally pull high.

When DITHB="1", Disable internal dithering function,

When DITHB="0", Enable internal dithering function,

5. MAXIMUM ABSOLTE LIMIT:

Item	Symbol	Value	Unit
Power supply voltage for logic	V _{DD}	-0.3~5	V
Input voltage	V _{in}	V _{DD} +0.3	V
Operating temperature	T _{opr}	-20 to 80	°C
Storage temperature	T _{stg}	-30 to 85	°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.

T_a ≤ 70°C: 75%RH max

T_a > 70°C: absolute humidity must be lower than the humidity of 75%RH at 70°C

Note3: T_a at -30°C will be <48hrs, at 80 °C will be <120hrs

6.ELECTRICAL CHARACTERISTICS

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

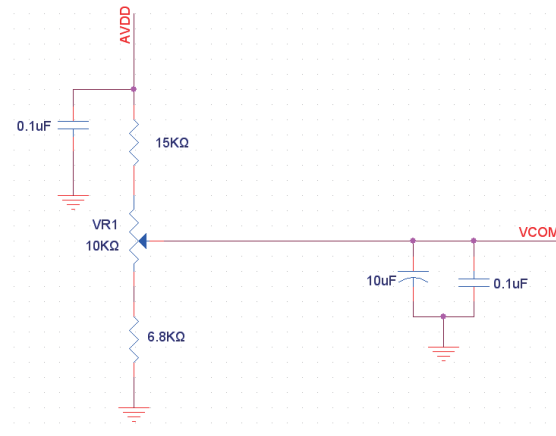
Item	Symbol	Min	Type	Max	Unit	Test condition
Operating voltage	V _{DD}	2.7	3.3	3.6	V	-
Supply current	I _{DD}	-	TBD	-	mA	V _{DD} =3.3V,T _a =25°C
Input voltage	V _{IH}	0.7V _{DD}	-	V _{DD}	V	-
	V _{IL}	0	-	0.3V _{DD}	V	
Input leakage current	I _{IL}	-1.0	-	1.0	μA	V _{IN} =V _{DD} or V _{SS}
Power voltage	AVDD	6.5	8.6	13.5	V	
	VGH	16.5	23	24	V	
	VGL	-8.2	-7.8	-7.4	V	
	VCOM	2.6	2.8	3.0	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: DCLK,HS,VS,RESET,U/D, L/R,DE,R0~R7,G0~G7,B0~B7,MODE,DITHB.

Note 4: Typical VCOM is only a reference value. It must be optimized according to each LCM. Please use VR and base on below application circuit.



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	8.7	9.3	9.9	V		-
Supply Current	If	-	180	-	mA	-	-
Life Time	-	30000	-	-	Hr		-
Backlight Color	White						

NOTE:

1. Average Luminous Intensity of P1-P9

2. Uniformity = Min/Max * 100%

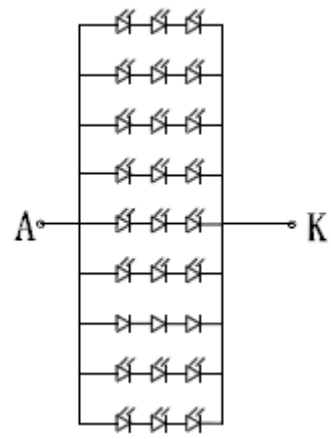
3. LED life time defined as follows: The final brightness is at 70% of original brightness

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

Horizontal timing

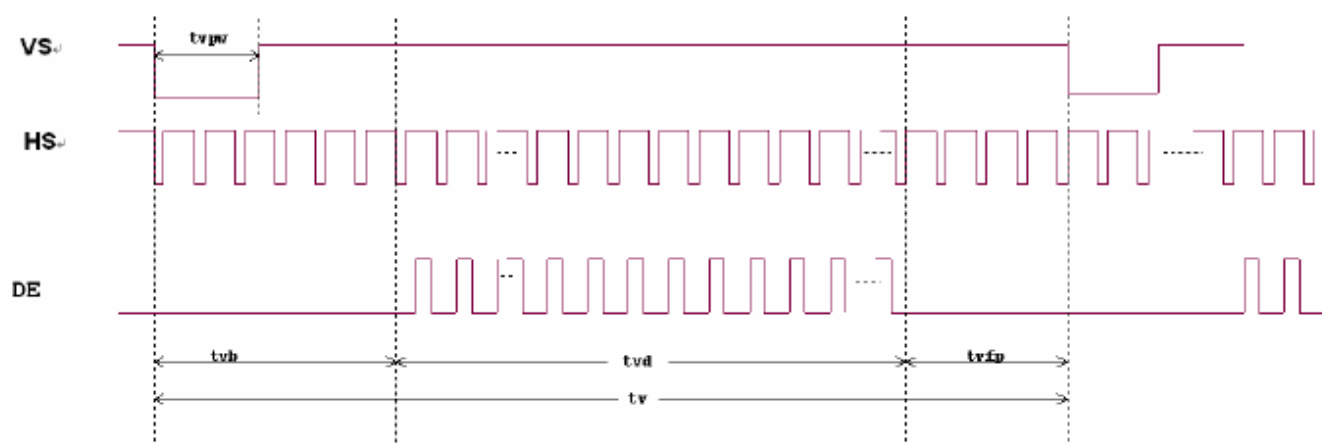
Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Horizontal Display Area	thd		800		DCLK
DCLK frequency	fclk	-	30	50	MHz
One Horizontal Line	th	889	928	1143	DCLK
HS pulse width	thpw	1	48	255	DCLK
HS Back Porch (Blanking)	thb		88		DCLK
HS Front Porch	thfp	1	40	255	DCLK
DE mode Blanking	th-thd	85	128	512	DCLK

Vertical timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tv		480		T _H
VS period time	tv	513	525	767	T _H
VS pulse width	tvpw	3	3	255	T _H
VS Back Porch (Blanking)	tvb		32		T _H
VS Front Porch	tvfp	1	13	255	T _H
DE mode Blanking	tv-tvd	4	45	255	T _H

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
CLKIN Frequency	Fclk	-	40	50	MHz	VDD=3.0V~3.6V
CLKIN Cycle Time	Tclk	20	25	-	ns	-
CLKIN Pulse Duty	Tcwh	40	50	60	%	Tclk
Time from HSD to Source Output	Thso		64		CLKIN	-
Time from HSD to LD	Thld		64		CLKIN	-
Time from HSD to STV	Thstv		2		CLKIN	-
Time from HSD to CKV	Thckv		20		CLKIN	-
Time from HSD to OEV	Thoev		4		CLKIN	-
LD Pulse Width	Twld		10		CLKIN	-
CKV Pulse Width	Twckv		66		CLKIN	-
OEV Pulse Width	Twoev		74		CLKIN	-

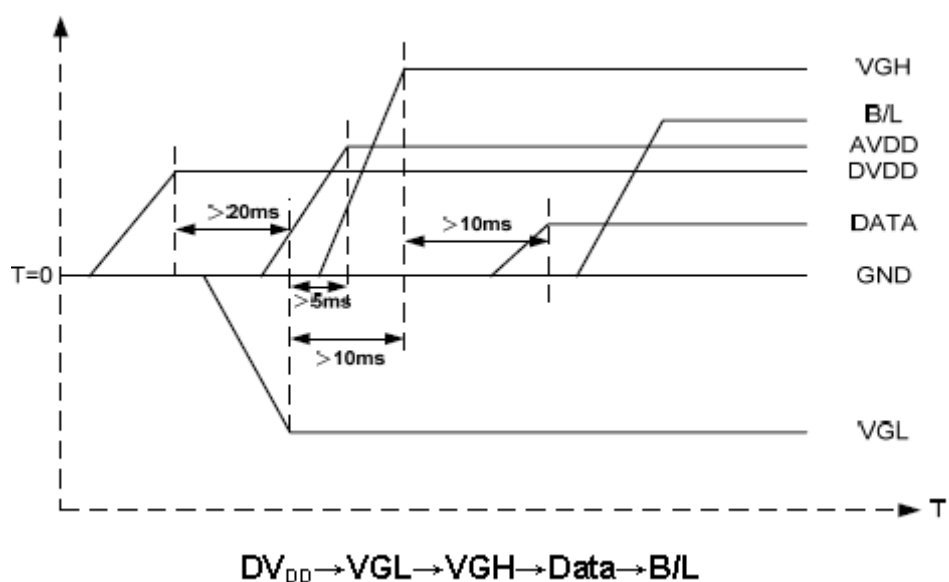
7-3 vertical input timing diagram



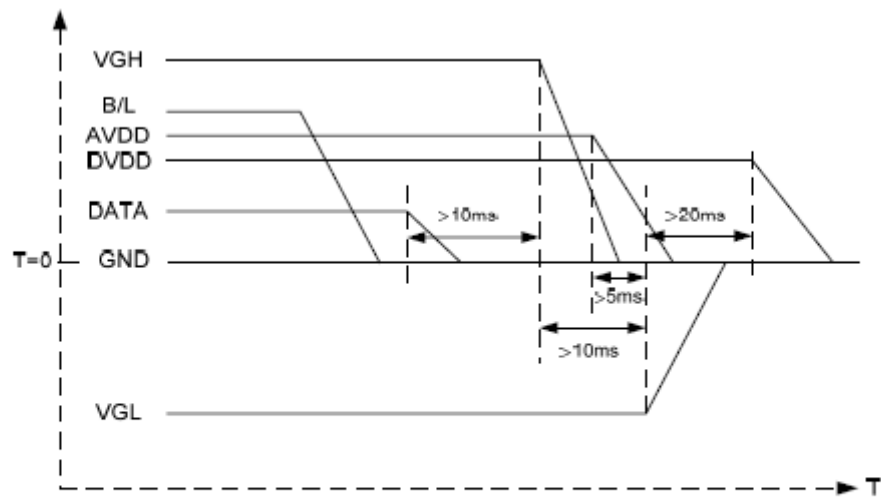
Item	Symbol	Rating			Unit	Remark
		MIN	TYP	MAX		
Vertical Display Area	tvd	-	480	-	TH	
VS period time	tv	510	525	650	TH	
VS pulse width	tvpw	1	-	20	TH	
VS Blanking	tvb	23	23	23	TH	
VS Front Porch	tvfp	7	22	147	TH	

7-2 Power ON/Off Sequence

7-2-1 Power ON Sequence



7-2-2 Power OFF Sequence



B/L → Data → VGH → VGL → DV_{DD}

Note: Data include R0~R7, B0~B7, GO~G7, U/D, L/R, DCLK, HS, VS, DE.

8. OPTICAL CHARACTERISTICS:

Driving the backlight

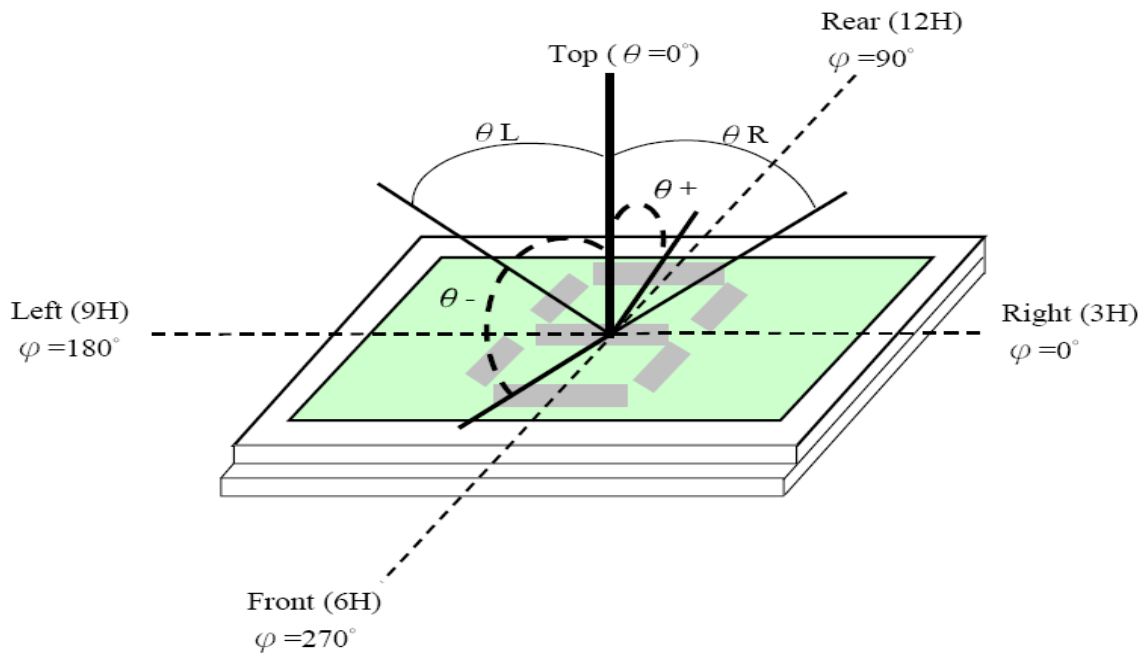
No.	ITEM		Symbol	Conditions	Specification			Unit	Note
					Min	Typ	Max		
1	Response Time		Tr+Tf	25℃	-	25	50	Ms	(1)(2)
2	Contrast Rate		Cr	θ=0, Normal viewing angle	400	500	-	-	(1)(3)
3	Viewing Angle	Hor.	θL	CR>10	60	70	-	Deg	-
			θR		60	70	-		
		Ver.	Θ+		40	50	-		
			Θ-		60	70	-		
4	Chromaticiry	White	x	Brightness is ON	0.26	0.31	0.36		
			y		0.28	0.33	0.38		
5	luminance		L		400	500		cd/m2	
6	Uniformity		U		80			%	

Measure Conditions:

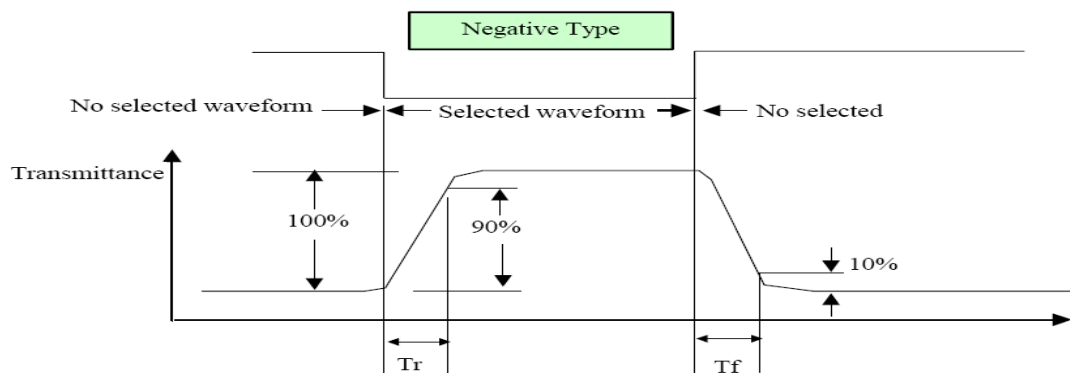
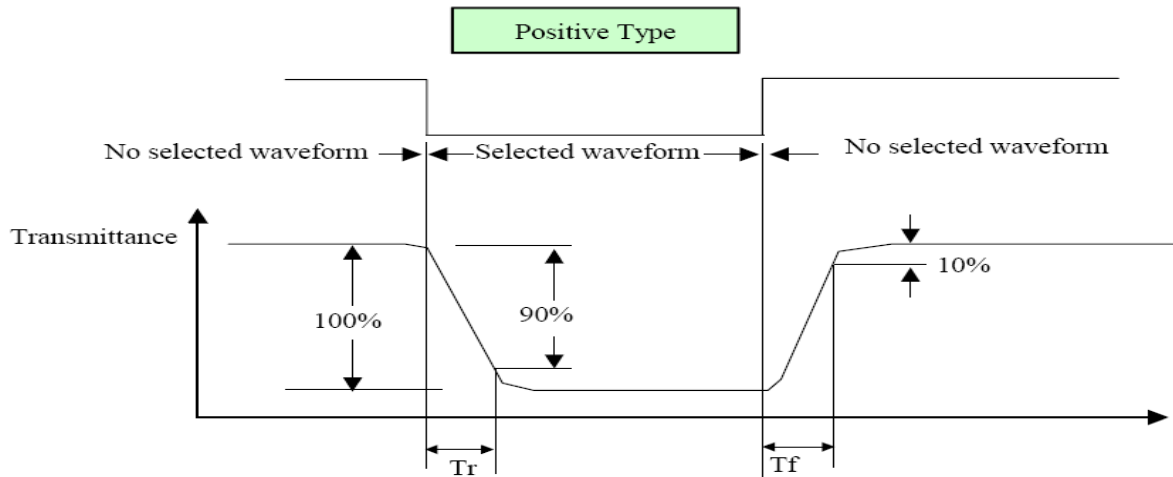
1. Measure surrounding : dark room;
2. Ambient temperature: $25\pm 2^{\circ}\text{C}$;
3. 30min.warm-up time.

Note Definition:

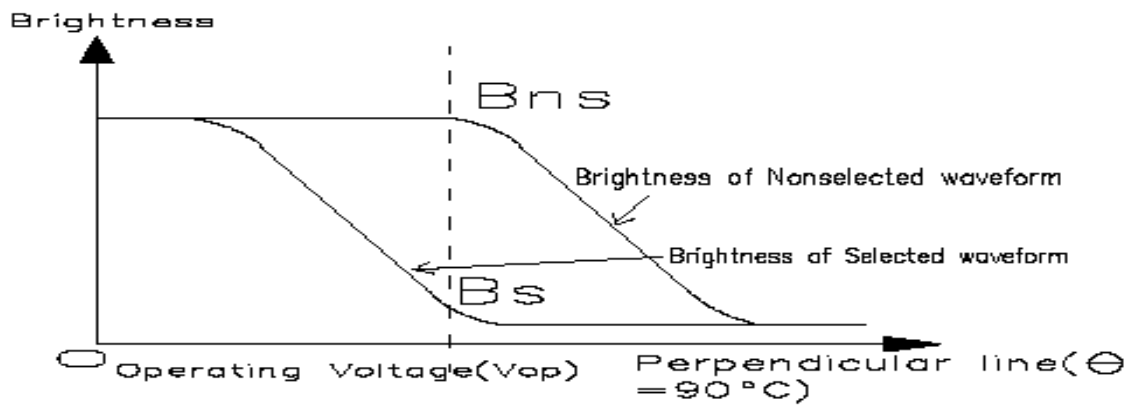
Note(1)Viewing angle range:



Note (2) Response Time:

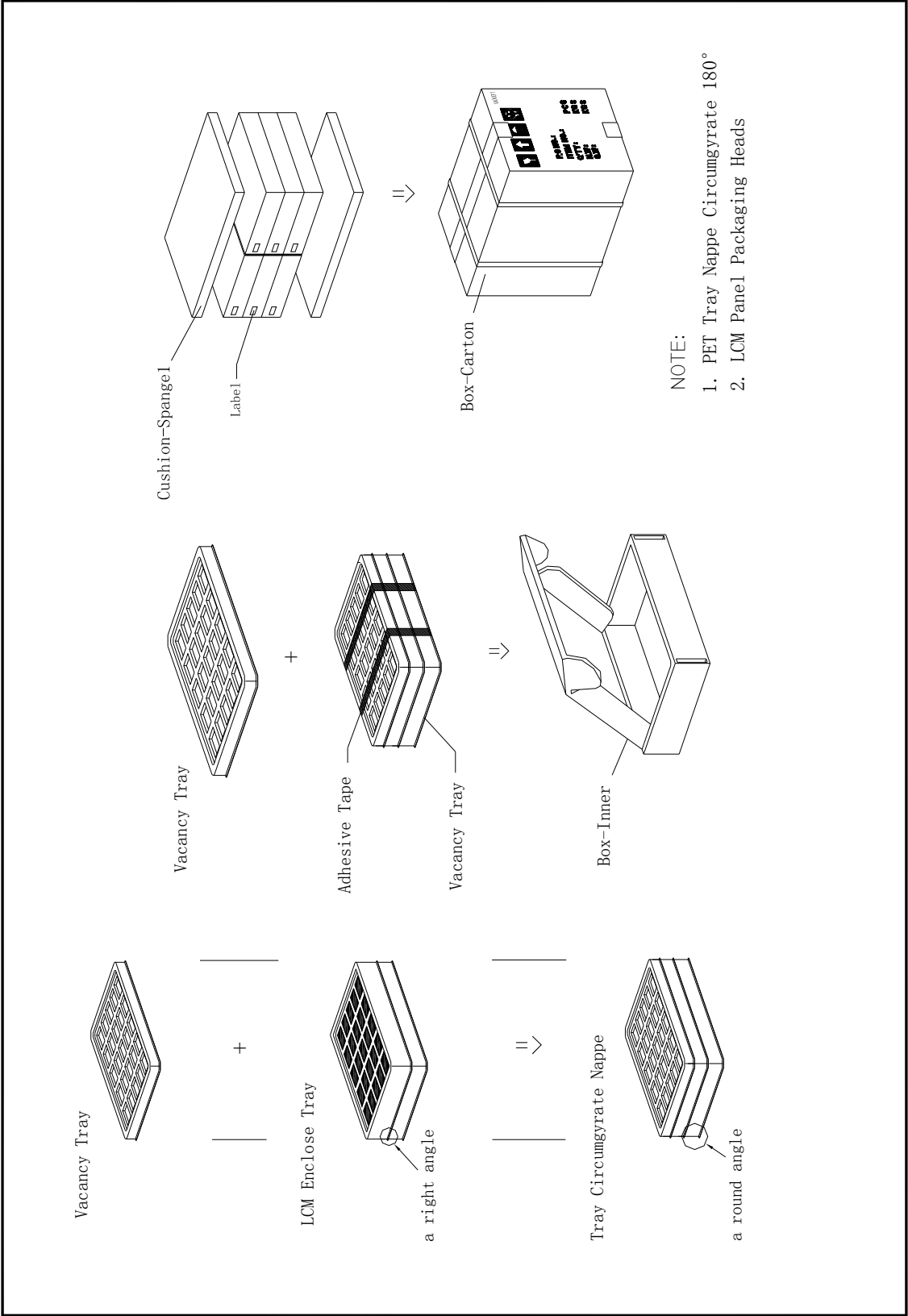


Note(3) Contrast Ratio Definition:



$$\text{Contrast Ratio (Cr)} = \frac{\text{Luminance with all pixel white}}{\text{Luminance with all pixel black}}$$

9.PACKAGE.



10. STANDARD SPECIFICATION FOR RELIABILITY:

Item	Condition		Time (hrs)	Assessment
High temp. Storage	80°C		120	No abnormalities in functions and appearance
High temp. Operating	70°C		120	
Low temp. Storage	-30°C		120	
Low temp. Operating	-20°C		120	
Humidity	40°C/ 90%RH		120	
Thermal Shock Temp. Cycle	-30°C ← →70°C (0.5hour ← → 0.5 hour)		10cycles	
ESD Testing	HBM:	±8KV		330Ω/150PF
	MM:	±200V		200PF/0Ω
Shock Test	Shock Level: 100G Waveform: Half Sinusoidal Wave Shock Time: 6ms Number of Shocks: 3 times for each ±X, ±Y, ±Z direction With package			PASS
Vibration	Frequency 5Hz~100Hz Acceleration 9.8m/s2 Deflection 0.075mm Cycles per axle 45min With package			PASS

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25±10°C), 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.

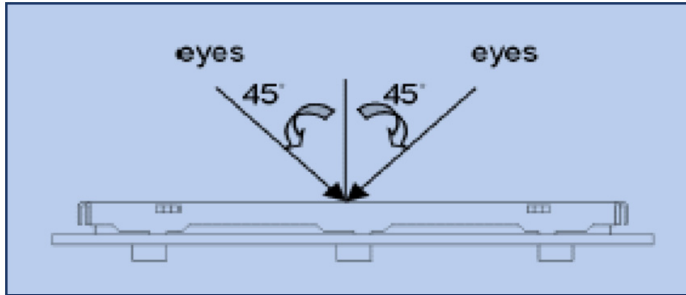
(i) The test must be under 20W × 2 or 40W fluorescent light, and the distance of view must

be at 30 ± 5 cm.

(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)

(iii) Temperature: $25 \pm 5^\circ\text{C}$ Humidity: $65 \pm 10\% \text{RH}$



(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 becouned as combined dot defect.		

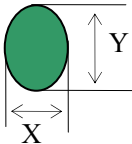
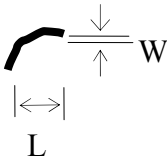
11.6 Inspection specification

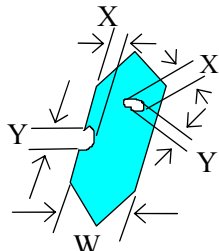
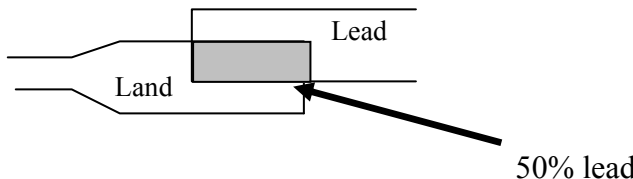
AQL inspection standard

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:

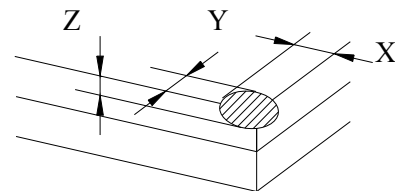
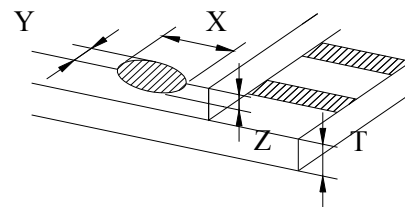
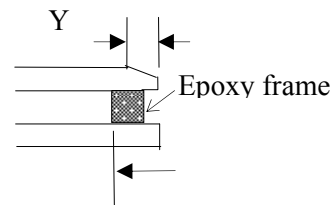
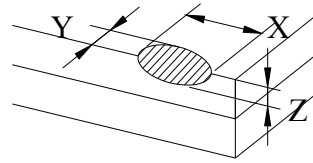
No.	Item	Criterion																				
1	Short or open circuit	Not allow																				
	LC leakage																					
	Flickering																					
	No display																					
	Wrong viewing direction																					
	Wrong Back-light																					
2	Contrast defect	Refer to approval sample																				
	Background color deviation																					
3	Point defect, Black spot, dust (incl. Polarizer) ex.: dirt under polarizer, Pinhole of reflector ,glass scratch, dirt under glass,scratch on polarizer $\phi = (X+Y)/2$	 <table><tr><td>Point</td><td>Acceptable Qty.</td></tr><tr><td>Size</td><td></td></tr><tr><td>$\phi \leq 0.20$</td><td>Disregard</td></tr><tr><td>$0.20 < \phi \leq 0.25$</td><td>3</td></tr><tr><td>$0.25 < \phi \leq 0.30$</td><td>2</td></tr><tr><td>$\phi > 0.30$</td><td>0</td></tr></table> Unit: mm	Point	Acceptable Qty.	Size		$\phi \leq 0.20$	Disregard	$0.20 < \phi \leq 0.25$	3	$0.25 < \phi \leq 0.30$	2	$\phi > 0.30$	0								
Point	Acceptable Qty.																					
Size																						
$\phi \leq 0.20$	Disregard																					
$0.20 < \phi \leq 0.25$	3																					
$0.25 < \phi \leq 0.30$	2																					
$\phi > 0.30$	0																					
4	Line defect	 <table><tr><td></td><td>Line</td><td>Acceptable Qty.</td></tr><tr><td>L</td><td>W</td><td></td></tr><tr><td>---</td><td>$0.015 \geq W$</td><td>Disregard</td></tr><tr><td>$3.0 \geq L$</td><td>$0.03 \geq W$</td><td rowspan="2">2</td></tr><tr><td>$2.0 \geq L$</td><td>$0.05 \geq W$</td></tr><tr><td>$1.0 \geq L$</td><td>$0.1 > W$</td><td>1</td></tr><tr><td>---</td><td>$0.05 < W$</td><td>Applied as point defect</td></tr></table> Unit: mm		Line	Acceptable Qty.	L	W		---	$0.015 \geq W$	Disregard	$3.0 \geq L$	$0.03 \geq W$	2	$2.0 \geq L$	$0.05 \geq W$	$1.0 \geq L$	$0.1 > W$	1	---	$0.05 < W$	Applied as point defect
	Line	Acceptable Qty.																				
L	W																					
---	$0.015 \geq W$	Disregard																				
$3.0 \geq L$	$0.03 \geq W$	2																				
$2.0 \geq L$	$0.05 \geq W$																					
$1.0 \geq L$	$0.1 > W$	1																				
---	$0.05 < W$	Applied as point defect																				
5	Rainbow	Not more than two color changes across the viewing area																				

No.	Item	Criterion								
6	Segment pattern W = Segment width $\phi = (X+Y)/2$	(1) Pin hole $\phi < 0.10\text{mm}$ is acceptable.  <table><tr><th>Point Size</th><th>Acceptable Qty</th></tr><tr><td>$\phi \leq 1/4W$</td><td>Disregard</td></tr><tr><td>$1/4W < \phi \leq 1/2W$</td><td>1</td></tr><tr><td>$\phi > 1/2W$</td><td>0</td></tr></table> Unit: mm	Point Size	Acceptable Qty	$\phi \leq 1/4W$	Disregard	$1/4W < \phi \leq 1/2W$	1	$\phi > 1/2W$	0
Point Size	Acceptable Qty									
$\phi \leq 1/4W$	Disregard									
$1/4W < \phi \leq 1/2W$	1									
$\phi > 1/2W$	0									
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. 								
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.								

11

LCD

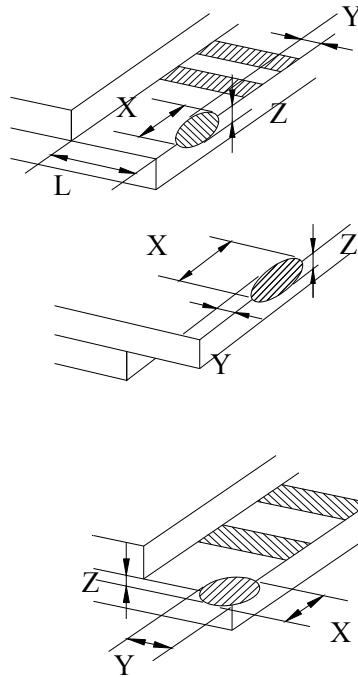
2.1.1 chip on the surface



Note: A: LCD Length

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	$\leq 1/2T$

2.1.2 Chip on the terminal

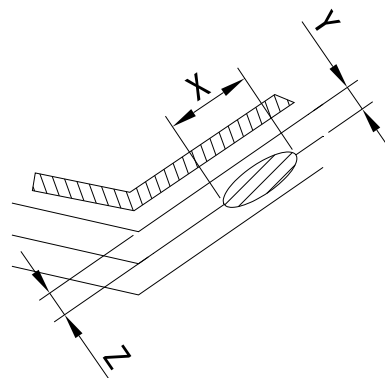


X	Y	Z
$> 1/8A$	$\leq 0.3\text{mm}$	$\leq 1/2T$
$\leq 1/8A$	$\leq 1/2L$	$\leq T$
$\leq 1/8A \& \leq 1\text{mm}$	$\leq L$	$\leq T$
$\leq 1/8A \& \leq 2\text{mm}$	$\leq L$	$\leq 1/2T$

Note: A: LCD Length.

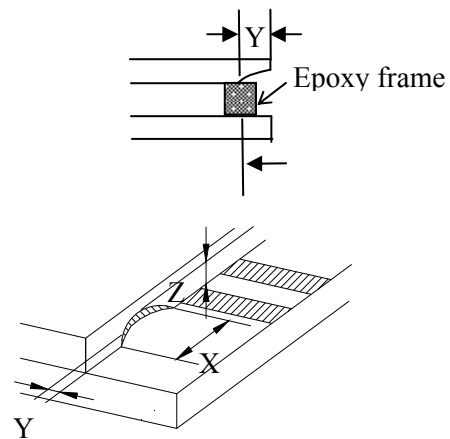
the distance between crack and contact pad must be greater than the width of 1st contact pad.

2.1.3 Chip out on between side



11

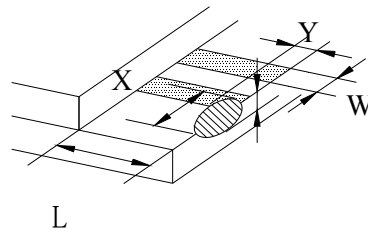
LCD



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

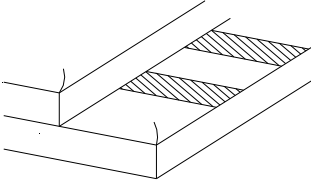
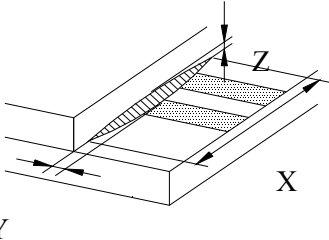
Note: A : LCD Length

2.1.4 including corner chip and side chip



Note: A:LCD Length

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

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 $>1\text{mm}$ or $Z<T$ length $>2\text{mm}$ 4) The chip out at ITO will be rejected. 2.3 Poor cutting  <table border="1" data-bbox="676 943 1158 1189"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>$>1/8$ A</td><td>≤ 0.3</td><td>$\leq 1/2T$</td></tr> <tr> <td>$\leq 1/8$ A</td><td>According to drawing</td><td>$1/2T \leq Z \leq T$</td></tr> </tbody> </table> Note : A: LCD Length.	X	Y	Z	$>1/8$ A	≤ 0.3	$\leq 1/2T$	$\leq 1/8$ A	According to drawing	$1/2T \leq Z \leq T$
X	Y	Z									
$>1/8$ A	≤ 0.3	$\leq 1/2T$									
$\leq 1/8$ A	According to drawing	$1/2T \leq Z \leq T$									
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
- Trichlorotrifluoroethane

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.

Hello Lighting co., ltd reserves the right to change this specification.

www.hello-lighting.com

- END -