HM028QV101TV

2.8" Color TFT-LCD

FUNCTIONAL DRAFT SPECIFICATION

(This document is meant for customers' approval)

Release Date
16th Jan 2021

HIGHNESS MICROELECTRONICS PVT. LTD
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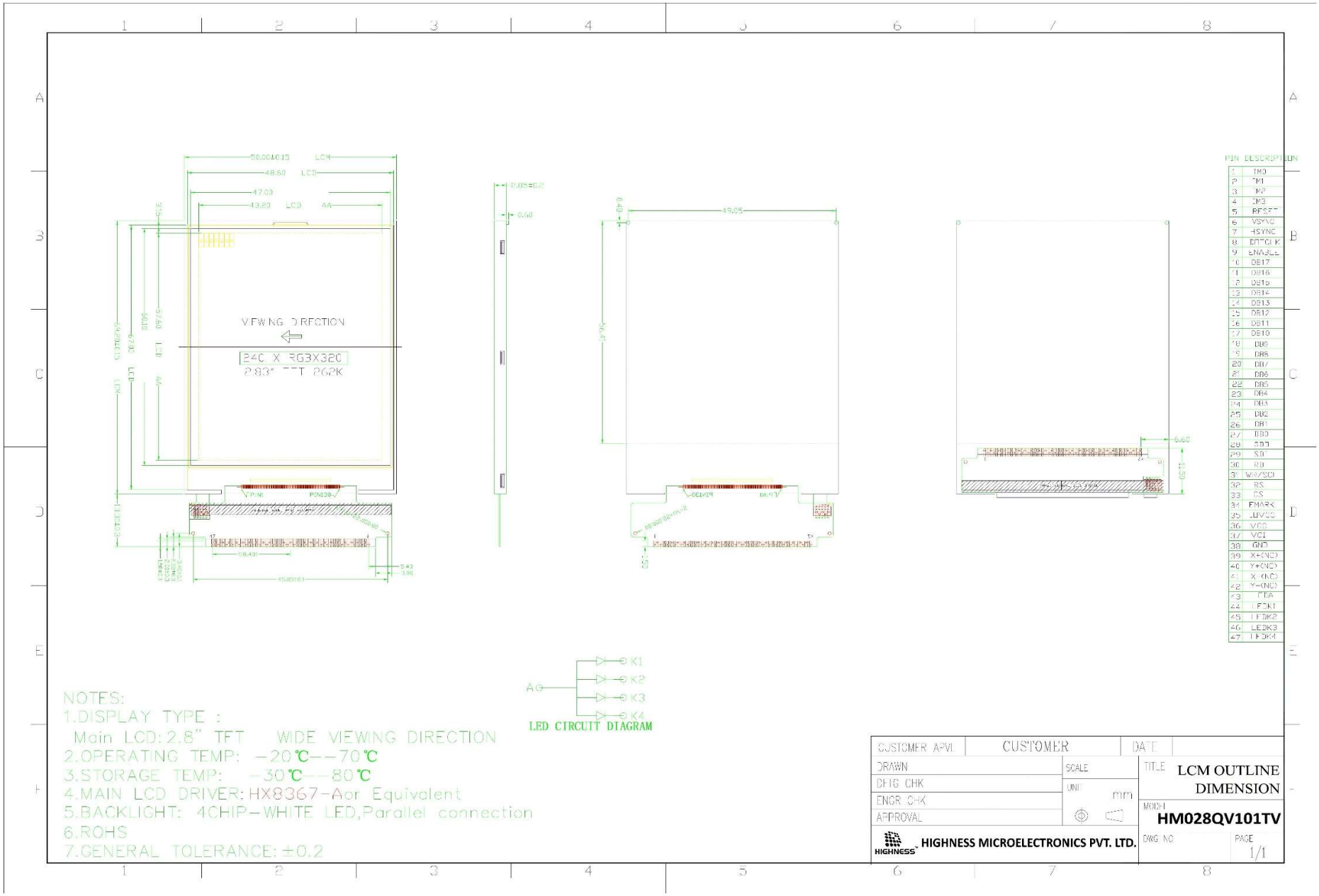
1. General Description

Item	Standard Value	Unit
LCD Type	Transflective TFT , 262K color	---
Number of Dots	240（RGB）X320	---
Viewing Direction	3:00	o'clock
LCM Outline Dimension	50.00(W) X69.20(H) X2.85(T)	mm
Viewing area	47.00 X60.10	mm
Active area	43.20(W) X57.60(H)	mm
Operating temperature	-20℃~70℃	---
Storage temperature	-30℃~80℃	---
Driving IC	HX8367-A	---
Approx. weight	TBD	g

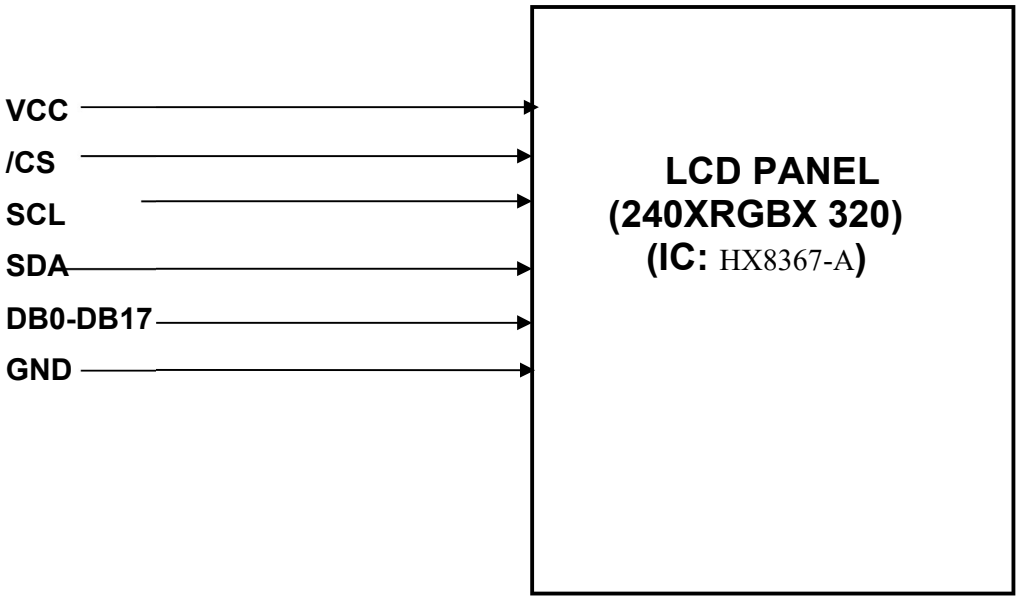
1.1 The backlight electrical-optical characteristics

Item	Symbol	Min	Typ	Max	Unit	Unit
Forward voltage	Vf	-	3.2	-	V	If=60mA/Ta=25℃
Uniformity	△Bp	80			%	
Luminance for LCD	Lv	5500	6000		Cd/mˆ2	If=60mA/Ta=25℃

1.2 EXTERNAL DIMENSIONS



2. BLOCK DIAGRAM



2.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Rating	Unit
Operating temperature	Top	-20-70	℃
Storage temperature	Tst	-30-80	℃
Input voltage	Vin	-0.3-4.6	V
Supply voltage for logic	VCC	-0.3-4.6	V
Driver supply voltage	VGH - VGL	0-30.0	V

NOTE:

1. **If the module is used above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.**
2. **VCC>GND must be maintained.**

3. ELECTRICAL CHARACTERISTICS

3.1 DC Characteristics

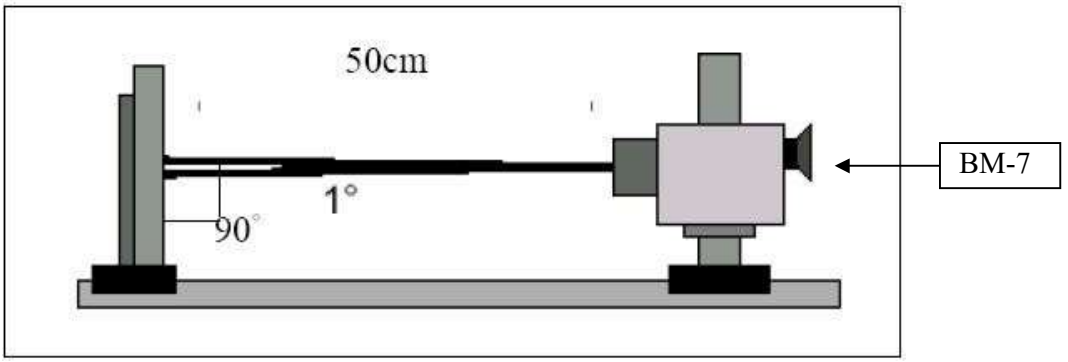
Item	Symbol	Condition	Min	Typ	Max	Unit
Input high voltage	V_{IH}	-	0.7IOVCC	-	IOVCC	V
Input low voltage	V_{IL}	-	0	-	0.3IOVCC	V
Voltage for logic	VCC	Ta=25℃	2.5	2.8	3.3	V
Voltage for analog	VCI	Ta=25℃	2.5	2.8	3.3	V
Voltage for I/O	IOVCC	Ta=25℃	1.65	1.8/2.8	3.3	V
Output high voltage	VOH		0.8IOVCC	-	IOVCC	V
Output low voltage	VOL		0		0.2IOVCC	V
Current consumption for LCD normal operation	I_{DD}	V_{DD} = 2.8	-	TBD		mA

3.2 AC Characteristics

Refer to the SPEC of HX8367-A

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Response time	Tr+Tf	Θ=0°; Φ=0°;	-	35	50	ms	Note4
Contrast ratio	Cr		-	500	-	-	Note3
Luminance uniformity	δ WHITE		80	-	-	%	Note7
Surface luminance	Lv		-	160		cd/㎡	Note6
View angle range (with polarizer)	Top	CR≥10	-	40	-	Degree	Note5
	Bottom		-	20	-		
	Left		-	50	-		
	Right		-	25	-		
CIE (X, Y)	Rx	Θ=0°	0.637	0.657	0.677	-	Note8
	Ry		0.300	0.320	0.340		
	Gx		0.267	0.287	0.307		
	Gy		0.571	0.591	0.611		
	Bx		0.120	0.140	0.160		
	By		0.060	0.080	0.100		
	Wx		0.290	0.310	0.330		
	Wy		0.307	0.327	0.347		

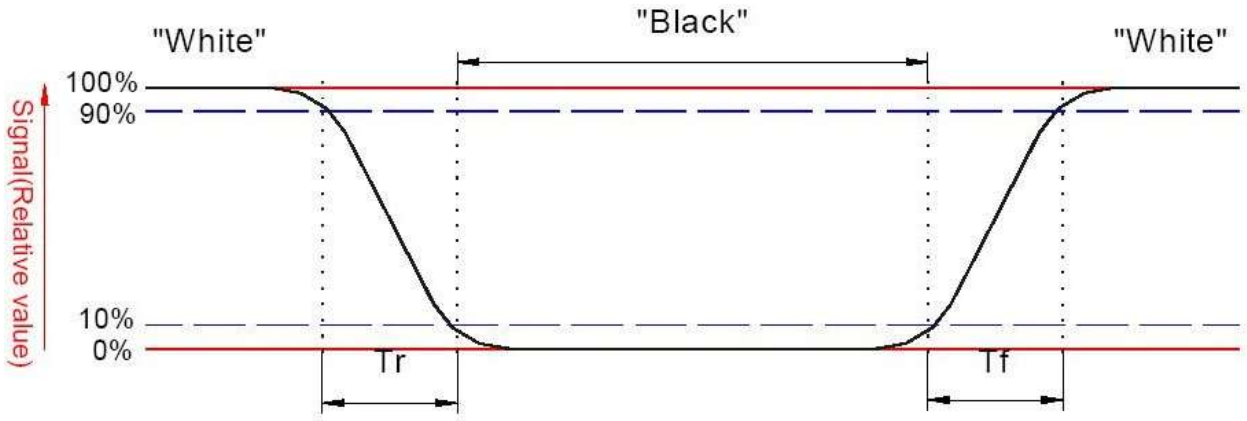
Note 1: Ambient temperature = 25 ± 2 ℃;
Note 2: To be measured in the dark room;
Note 3: To be measured at the center area of the panel with a view cone of 1° by BM-7, after 10 minutes operation (module).



FLG1

Note 4: Define the response time:

The output signals of photo detector are measured when the input signals are charged from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes. Refer to figure as below.



FLG2

Note 5: Contrast Ratio (CR) is defined mathematically as For more information from FLG3

Contrast Ratio= Average surface luminance with all white pixel (P1,P2,P3,P4,P5,P6,P7,P8,P9)
Average surface luminance with all black pixel(P1,P2,P3,P4,P5,P6,P7,P8,P9)

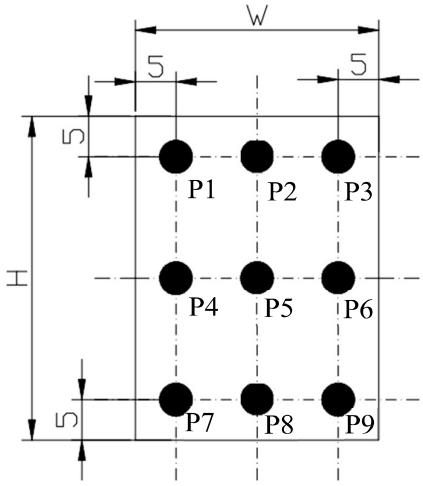
Note 6: Surface luminance is the center point across the LCD surface 500mm from the surface with all pixel displaying white, For more information see the FLG3

Lv= Average Surface luminance with all white pixel(P1,P2,P3,P4,P5,P6,P7,P8,P9)

Note 7: The uniformity in surface luminance, δ white is determined by measuring luminance at each test position 1to 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see FLG3.

δ WHITE= Minimum surface luminance with all white pixel(P1,P2,P3,P4,P5,P6,P7,P8,P9)
Maximum surface luminance with all white pixel(P1,P2,P3,P4,P5,P6,P7,P8,P9)

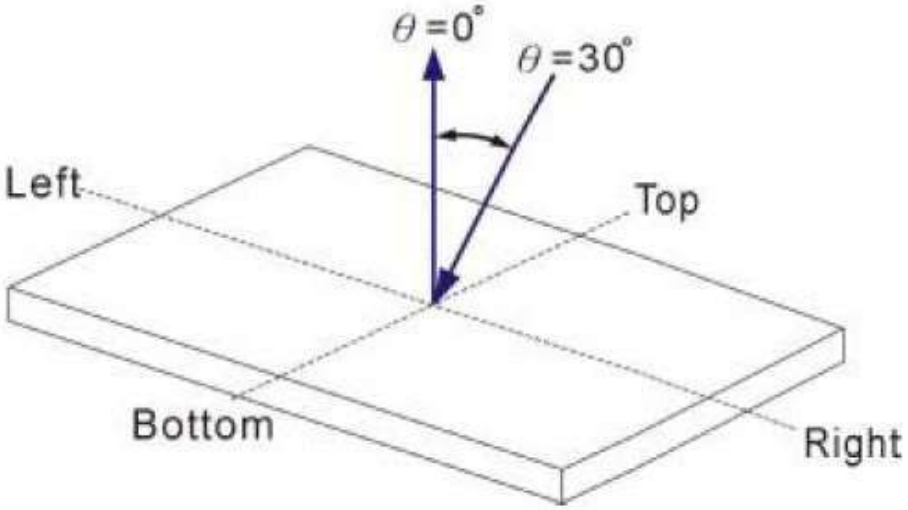
Note 8: CIE(X, Y), the X, Y value is determined by measuring luminance at each test position 1 to 5, and then make average value. For more information see FLG3.



H,V: Active area
Light source spot size: Φ=2.0mm
Measure device: BM-7

FLG3

Note 9: Viewing angle is the angle at which the contrast ratio is greater than 2, TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see the FLG 4.



FLG4

4. INTERFACE PIN CONNECTIONS

NO.	Symbol	Level	Function
1-4	IM0-IM3	I	Select a mode to interface to host processor. (Amplitude: IOVCC ~GND),Refer TO NOTE1
5	RESET	I	Reset signal. The R61505W is initialized when this signal is at low level. Make sure to execute a power-on reset when turning on power supply (Amplitude: IOVCC-GND).
6	VSYNC	I	Frame synchronizing signal.
7	HSYNC	I	Frame synchronizing signal.
8	DOTCLK	I	Dot clock signal.
9	ENABLE	I	Data enable signal for RGB interface operation. (Amplitude: IOVCC-GND). Low: accessible (select) High: Not accessible (Not select) The polarity of ENABLE signal can be inverted by setting the EPL bit. (Amplitude: IOVCC-GND).
10-27	DB17-DB0	I/O	18-bit parallel bi-directional data bus for 80-system interface operation (Amplitude: IOVCC-GND). 8-bit I/F: DB[17:10] are used. 9-bit I/F: DB[17:9] are used. 16-bit I/F: DB[17:10] and DB[8:1] are used. 18-bit I/F: DB[17:0] are used. 18-bit parallel bi-directional data bus for RGB interface operation (Amplitude: IOVCC-GND). 16-bit I/F: DB[17:13] and DB[11:1] are used. 18-bit I/F: DB[17:0] are used.
28	SDO	O	Serial data output (SDO) pin in serial interface operation. The data is outputted on the falling edge of the SCL signal.Amplitude: IOVCC-GND
29	SDI	I	Serial data input (SDI) pin in serial interface operation. The data is inputted on the rising edge of the SCL signal. Amplitude: IOVCC-GND
30	RD	I	Read strobe signal in 80-system bus interface operation and enables read operation when RDX is low. Amplitude: IOVCC-GND
31	WR/SCL	I	Write strobe signal in 80-system bus interface operation and enables write operation when WRX is low. Synchronous clock signal (SCL) in serial interface operation. Amplitude: IOVCC-GND
32	RS	I	Register select signal. Amplitude: IOVCC-GND Low: select Index register High: select control register.

33	**CS**	**I**	Chip select signal. Amplitude: IOVCC-GND Low: the R61505W is selected and accessible High: the R61505W is not selected and not accessible
34	**FMARK**	**O**	Frame head pulse signal, which is used when writing data to the internal frame memory. (Amplitude: IOVCC-GND).
35	**IOVCC**	**-**	interface voltage(1.65V~3.3V)
36	**VCC**	**-**	Logic regulator power supply. (2.5V~3.3V)
37	**VCI**	**I**	liquid crystal drive power supply voltage(2.5V~3.3V)
38	**GND**	**-**	POWER GROUND
39	**Y(u)**	**NC**	NO CONNECT
40	**X(L)**	**NC**	NO CONNECT
41	**Y(D)**	**NC**	NO CONNECT
42	**X(R)**	**NC**	NO CONNECT
43	**LEDA**	LED driver	LED ANODE
44	**LEDK1**	LED driver	LED CATHODE
45	**LEDK2**	LED driver	LED CATHODE
46	**LEDK3**	LED driver	LED CATHODE
47	**LEDK4**	LED driver	LED CATHODE

5. RELIABILITY

NO	Test Item	Description	Test Condition
1	High temperature storage	Endurance test applying the high storage temperature for a long time	80℃,200 H
2	Low temperature storage	Endurance test applying the low storage temperature for a long time	-30℃,200H
3	High temperature operation	Endurance test applying the electric stress under high temperature for a long time	70℃,120H
4	Low temperature operation	Endurance test applying the electric stress under low temperature for a long time	-20℃,120H
5	High temperature /humidity storage	Endurance test applying the high temperature and high humidity storage for a long time	50℃，90% R.H 200H
6	High temperature /humidity operation	Endurance test applying electric stress under high temperature and high humidity for a long time	40℃ 90% R.H 96H
7	Temperature Cycle	Endurance test applying the low and high temperature cycle -20℃ → 25℃ → 70℃ →25℃ 30min 5min 30min 5min one cycle	-20℃/70℃ 10 cycles
8	Vibration test	Endurance test applying the vibration during transportation and using	Frequency:10Hz~55Hz~10Hz Amplitude:1.5mm X,Y,Z direction for total 3hours (parking condition)
9	Fall test	Endurance test dropping the LCM from a high place	600mm height
10	Static electricity test	Endurance test applying static electric stress to terminal	Air discharge 10 times R=330Ω, C=150pF. ±8KV **Remark**: if malfunction can be recovered to normal state after reset or power on, it wil be judged to be a good part

6. SPECIFICATION OF QUALITY ASSURANCE

- **Summary**

The customer should check and accept the products of HIGHNESS within one month after reception. This standard for Quality Assurance should affirm the quality of LCD products to supply to purchaser by HIGHNESS Entire process is controlled according to ISO9000.

- **Standard for quality test**

1、 Inspection

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

2、 Electro-Optical Characteristics

According to the individual specification to test the product.

3、 Test of Appearance Characteristics:

According to the individual specification to test the product.

4、 Test of Reliability Characteristics

According to the definition of reliability on specification for test product.

5、 Delivery Test

Before delivering, the supplier should take the delivery test

6、 Sampling Method: GB/T2828.1-2003, Level II

7、 The defects classify of AQL as following

Major defect: AQL=0.65

Minor defect: AQL=1.5

- **Nonconforming Analysis & Deal With Manners**

✧ Nonconforming Analysis

1、 Purchaser should supply the detail data of nonconforming sample and the non-suitable state.

2、 After accepting the detail data from purchaser ,the analysis of nonconforming should be finished in two weeks.

3、 If supplier can not finish analysis on time ,must announce purchaser before two weeks.

✧ Disposition of nonconforming

1、 If find any supplier defect during assembly line, supplier must change the good product for every defect after recognition.

2、Both supplier and customer should analysis the reason and discuss the disposition of nonconforming when the reason of nonconforming is not sure.

- **Agreement items.**

Both sides should discuss together when the following problems happen:

1、 There is any problem of standard of quality assurance, and both sides think that must be modifier.

2、There is any argument item which does not record in the quality assurance.

3、Any other special problem.

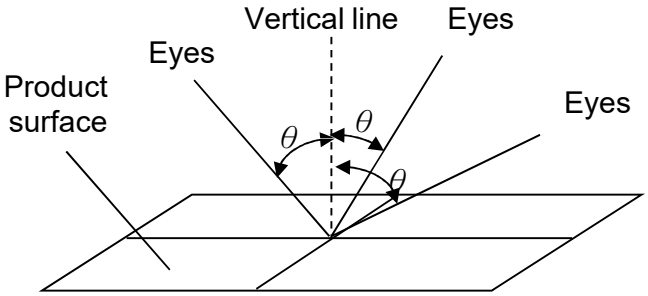
- **Standard of the Product Appearance Test**

■ Manner of appearance test

1、 The test must be under 20W*2 or 40W fluorescent light, and the distance of view must be at 30±5 cm.

2、 When test the model of Transmissive product must add the reflective plate.

3、 The test direction is based on about around 30 degree (within θ range)of vertical line.



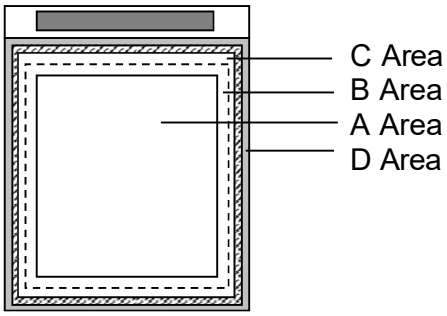
4、Definition of Area:

A Area: Active area

B Area: Viewing area

C Area: Out of viewing area

D Area: Seal area



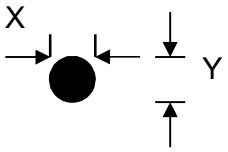
■ Basic principle:

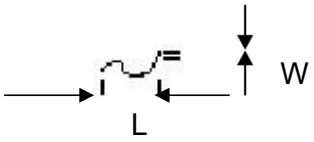
1、It will accord to the AQL when the standard cannot be described.

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

3、Must add new item on time when it is necessary.

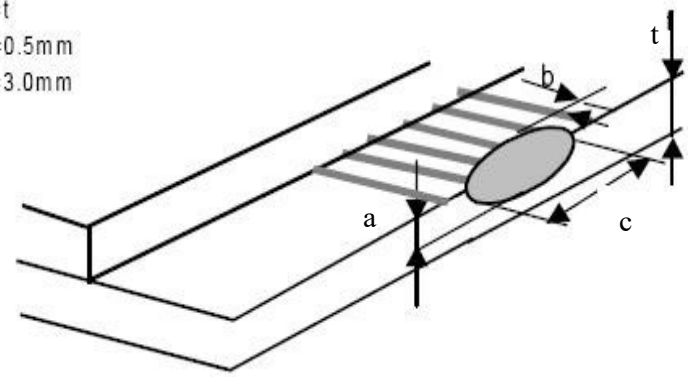
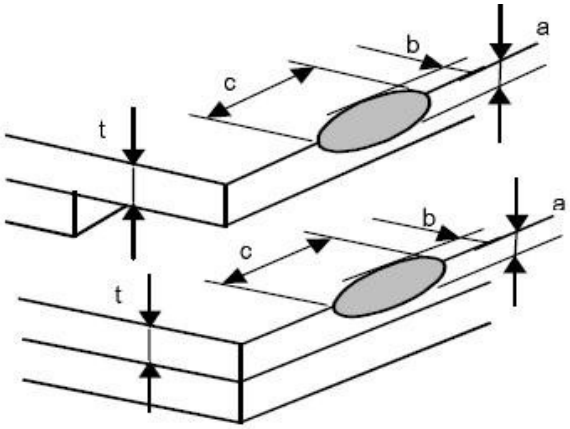
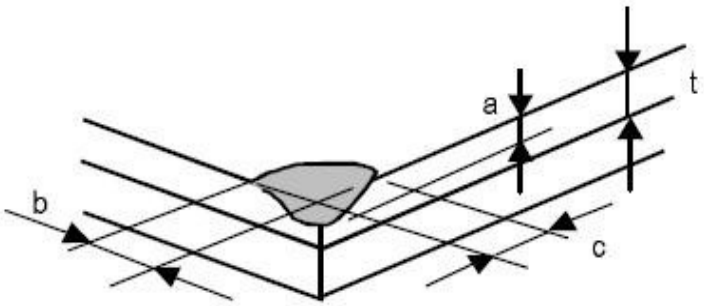
4 Inspection specification

<table>
<tr><th>NO</th><th>Item</th><th>Criterion</th><th>AQL</th></tr>
<tr><td>01</td><td>Electrical Testing</td><td>1.1 Missing vertical, horizontal segment, segment contrast defect.
1.2 Missing character, dot or icon.
1.3 Display malfunction.
1.4 No function or no display.
1.5 Current consumption exceeds product specifications.
1.6 LCD viewing angle defect.
1.7 Contrast defect</td><td>0.65</td></tr>
<tr><td>02</td><td>LCD black spots, white spots, color spots, contamination, scratches (display/non-display)</td><td>2.1 Round type: As following drawing
φ=(x+y)/2
 

<table>
<tr><th rowspan="2">Size</th><th colspan="2">Acceptable QTY</th><th rowspan="2">Remark</th></tr>
<tr><th>A.A</th><th>V.A</th></tr>
<tr><td>φ≦0.20</td><td>Ignore</td><td>Ignore</td><td rowspan="5">No more than two spots within 5mm</td></tr>
<tr><td>0.20<φ≦0.25</td><td>2</td><td>3</td></tr>
<tr><td>0.25 ≦φ≦0.30</td><td>1</td><td>2</td></tr>
<tr><td>0.30<φ</td><td>0</td><td>0</td></tr>
<tr><td>Total</td><td>3</td><td>5</td></tr>
</table>
2.2 Line Type: (As following drawing)
 

<table>
<tr><th>Length</th><th>Width</th><th colspan="2">Acceptable QTY</th><th>Remark</th></tr>
<tr><td></td><td></td><td>A.A</td><td>V.A</td><td></td></tr>
<tr><td>---</td><td>W≦0.03</td><td>Ignore</td><td>Ignore</td><td></td></tr>
<tr><td>L≦2.5</td><td>0.03< W≦0.05</td><td rowspan="2">2</td><td rowspan="2">3</td><td rowspan="2">No more than two lines within 5mm</td></tr>
<tr><td>L≦1.5</td><td>0.05< W≦0.08</td></tr>
<tr><td>---</td><td>0.08< W</td><td>0</td><td>0</td><td></td></tr>
</table></td><td>1.5</td></tr>
</table>

<table>
<tr>
<td>03</td>
<td>Polarizer bubbles</td>
<td>If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction.
<table>
<tr><td rowspan="2">Size</td><td colspan="2">Acceptable QTY</td></tr>
<tr><td>A.A</td><td>V.A</td></tr>
<tr><td>φ≦0.30</td><td>Ignore</td><td>Ignore</td></tr>
<tr><td>0.30<φ≦0.60</td><td>2</td><td>3</td></tr>
<tr><td></td><td>0</td><td>0</td></tr>
</table>
</td>
<td>1.5</td>
</tr>
</table>

04	Chipped glass	Symbols: a: Chip length b: Chip width c: Chip thickness t: Glass thickness 4.1 ITO electrode a<=t b<=0.5mm c<=3.0mm  4.2 General ,corner portion a<= t b<=1.0mm c<=5.0mm  *Effective width of seal area shall be more than 0.3mm.  	1.5

05	Cracked glass	The LCD with extensive crack is not acceptable.	0.65
06	Backlight elements	6.1 Illumination source flickers when lit. 6.2 Spots or scratches that appear when lit must be judged using LCD spot, lines and contamination standards. 6.3 Backlight doesn't light or color is wrong	0.65 1.5 0.65
07	Soldering	7.1 No unmelted solder paste may be present on the PCB. 7.2 No cold solder joints, missing solder connections, oxidation or icicle. 7.3 No residue or solder balls on PCB. 7.4 No short circuits in components on PCB.	1.5 1.5 1.5 0.65
08	General appearance	8.1 No oxidation, contamination, curves or, bends on interface pin (OLB) of TCP. 8.2 No cracks on interface pin(OLB) of TCP 8.3 NO contamination, solder residue or solder balls on product. 8.4 The IC on the TCP may not be damaged, circuits. 8.5 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color. 8.6 Sealant on top of the ITO circuit has not hardened 8.7 Pin type must match type in specification sheet. 8.8 LCD pin loose or missing pins. 8.9 Product packaging must the same as specified on packaging specification sheet. 8.10 Product dimension and structure must conform to product specification sheet.	1.5 0.65 1.5 0.65 1.5 1.5 0.65 0.65 0.65 0.65