

**BOLYMIN**

**SPECIFICATIONS FOR  
LCD MODULE**

**MODEL NO.  
BTF035A-AWN\$  
VER.01**

FOR MESSRS:

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ON DATE OF:

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APPROVED BY:

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**BOLYMIN, INC.**

**5F, No. 38, Keya Rd., Daya Dist., Central Taiwan Science Park, Taichung City, 42881, Taiwan.**

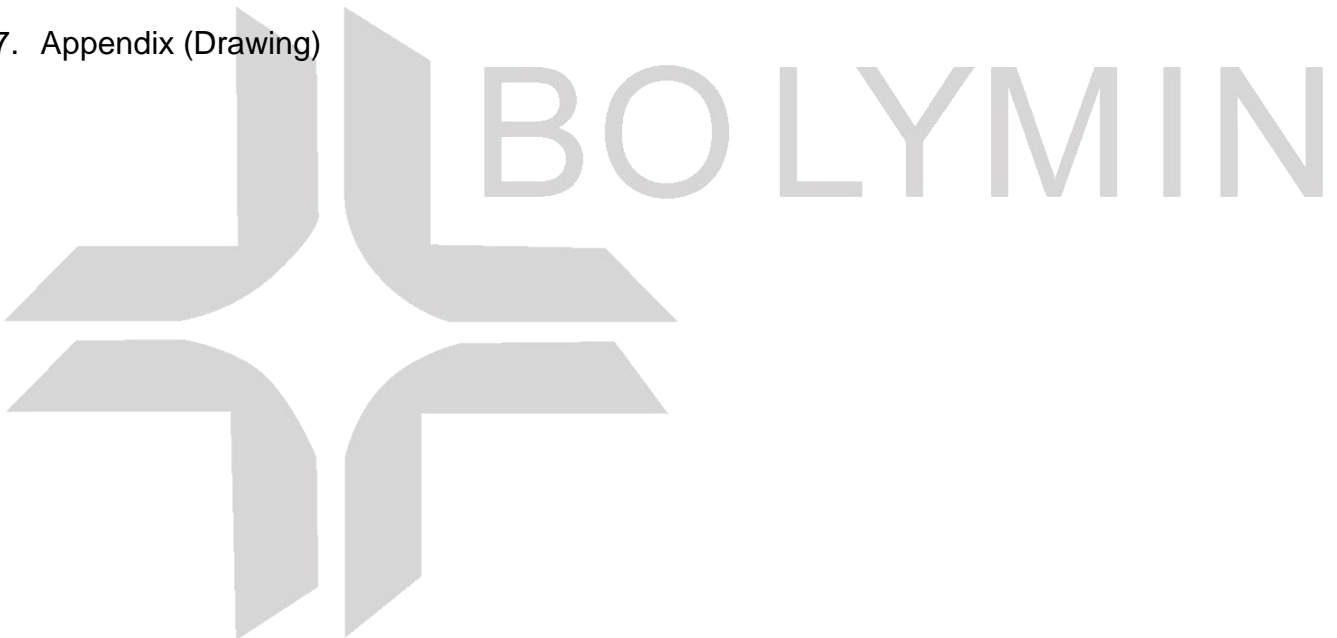
**Web Site:<http://www.bolymin.com.tw> TEL:+886-4-25658689 FAX:+886-4-25658698**

## History of Version

Version	Contents	Date	Note
01	NEW VERSION	2019/07/10	SPEC.

## CONTENTS

1. Numbering System
2. General Specification
3. Electrical Characteristics
4. Optical Characteristics
5. Interface Pin Function
6. Timing Characteristics
7. Appendix (Drawing)



## 1. Numbering System

<u>B</u>	<u>I</u>	<u>F</u>	<u>035</u>	<u>A</u>	:	<u>A</u>	<u>W</u>	<u>N</u>	<u>\$</u>	Customer code
1	2	3	4	5		6	7	8	9	10

1	Brand	Bolymin DISPLAY	
2	Module Type	T=TFT	
3	Function Type	C= TFT Controller H= TFT / HDMI B= TFT / Bar Z= Customize	A= TFT / AD Board G= TFT / HMI / GUI F= TFT / LCD
4	Module Size	025= 2.5 inch 070= 7.0 inch	
5	Version No.	A type	
6	TFT Interface	A= TTL / RGB C= LVDS E= PARALLEL(MCU) G= SPI(MCU) I= VGA / CVBS / HDMI (AD Board)	B= TTL / MCU D= HDMI F= I <sup>2</sup> C(MCU) H= UART/RS232/RS485 (HMI / GUI)
7	View Angle/ Operating Temperature	B=6:00 /Normal Temperature H=6:00 /Wide Temperature U=6:00/ Ultra wide Temperature	T=12:00//Normal Temperature W=12:00/Wide Temperature E=12:00/ultra wide temperature
8	Touch Panel	R=Resistive Touch Panel C=Capacitive Touch Panel	N=No Touch Panel
9	RoHS	\$=RoHS	
10	Customer code		

## 2. Handling Precaution

### 2.1 Precaution in use of LCD Module

- 2.1.1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure and/or sharp tools on the surface of display area.
- 2.1.2. The polarizer placed on the display surface is easily scratched and damaged. Extreme care should be taken when handling it. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol, do not use water, ketone or aromatics to clear display surface, and never scrub it hard.
- 2.1.3. Keep LCD panels away from direct sunlight. The storage environment should be dust-free, clean, dry, temperature is  $25^{\circ}\text{C}\pm 10^{\circ}\text{C}$  and the humidity is below 55% RH.
- 2.1.4. Do not input any signal before power is turned on.
- 2.1.5. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
- 2.1.6. It's important to control soldering temperature and time. RoHS compliant materials might need higher temperature and time, but try to keep temperature under  $350^{\circ}\text{C}$  and time in 3-5 sec.
- 2.1.7. EL is manufactured from the organic film, and is easily affected by temperature, humidity and other environmental impact. Long time storage might cause low quality of the case. Therefore, please start production in 3 months after reception of the LCM. If in any case, long time storage over 3 months is necessary, please keep EL in vacuum package or at least in humidity  $< 35\%$  RH, and temperature  $25^{\circ}\text{C}\pm 10^{\circ}\text{C}$ .  
Note: 2.1.7. is applied to EL backlight only.

### 2.2 Static Electricity Precautions:

- 2.2.1. The LCD module contains a C-MOS LSI. People who operate the LCM should wear ESD protection equipment to prevent ESD hurt on products.
- 2.2.2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
- 2.2.3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
- 2.2.4. The modules should be kept in anti-static bags or trays for storage.
- 2.2.5. Only properly grounded soldering irons should be used.
- 2.2.6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
- 2.2.7. The normal static prevention measures should be observed for work clothes and working benches.
- 2.2.8. Since dry air(almost low RH) is inductive to static, a humidity of 50-60% RH is recommended in assembly line.

### 2.3 Operation Precautions:

- 2.3.1. DC voltage applied on LCM causes electrochemical reactions, which will deteriorate the display over time. The applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
- 2.3.2. LCD driving voltage should be kept within specified range; excess voltage will shorten display life, while less voltage may not turn on LCM.
- 2.3.3. LCM response time will be extremely delayed in low operating temperature(such as  $-20^{\circ}\text{C}$ ) than in room operating temperature. Therefore, higher LCD driving voltage is required in low operating temperature; On the other hand, in high operating temperature (such as  $+70^{\circ}\text{C}$ ) LCD shows dark background color, therefore lower LCD driving voltage is required. Be sure to use the specified LCD driving voltage in different operating temperature.

## **2.4 Safety:**

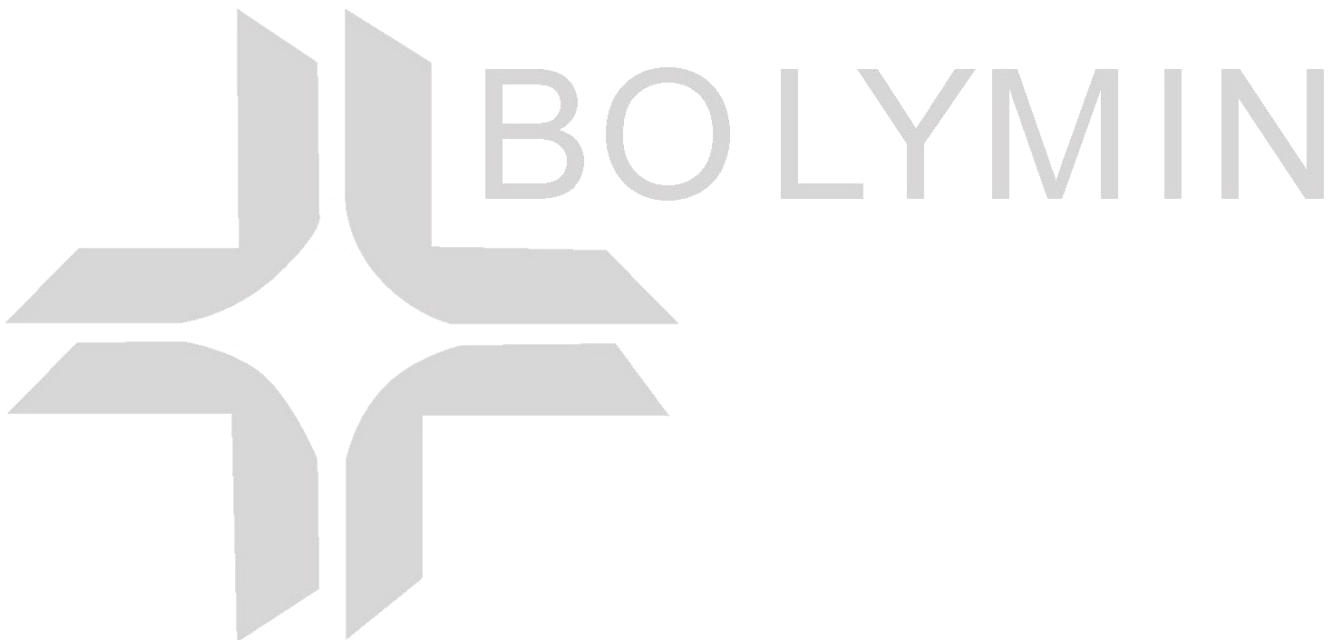
- 2.4.1 If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.  
If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

## **2.5 WARRANTY POLICY**

**Bolymin .Will provide one-year warranty for the products only if under specification operating conditions.**

**If there are functional defects found during the period of warranty, the defective products would be replaced on a one-to-one basis.**

**Bolymin would not be responsible for any direct/indirect liabilities consequential to any parties.**



### 3. General Specification

#### (1) Mechanical Dimension

Item	Standard Value	Unit
LCD TYPE	TFT / Transmissive / Normal White	
Module dimension	76.9 (W)x 63.9 (H)x 3.2 (T)	mm
Active area	70.08 (W)x 52.56 (H)	mm
Pixel pitch	0.219 (W)x 0.219 (H)	mm
Number of dots	320 x RGB x 240	dots
Driver IC	HX8238D	
Interface	SPI+24BIT RGB	
TOP polarizer Type	ANTI-GLARE	
Recommend viewing direction	12	O'clock
Gray scale inversion direction	6	O'clock
Backlight type	6-DIES WHITE LED	
TOUCH PANEL type	Without	

## 4. Absolute Maximum Rating

### 4.1 Electrical Absolute Maximum Ratings

(V<sub>SS</sub>=0V, T<sub>a</sub>=25°C)

Item	Symbol	Min	Max	Unit
Supply Voltage for analog	VDD	-0.3	+4.5	V
Supply Voltage for logic	VDD	-0.3	+4.5	V
Supply current (One LED)	I <sub>LED</sub>	--	30	mA

### 4.2 Environmental Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Note
Operating Temperature	TOP	-20	70	°C	(1)
Storage Temperature	TST	-30	80	°C	(1)

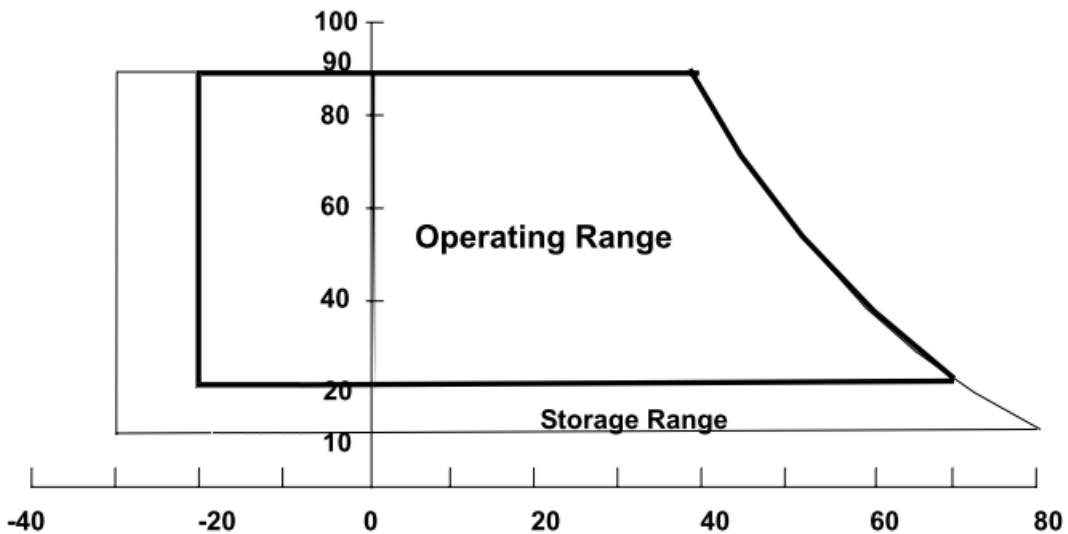
Note (1)

(a) 90 %RH Max. (T<sub>a</sub> ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (T<sub>a</sub> > 40 °C).

(c) No condensation.

Relative Humidity (%RH)





## 5. Electrical Characteristics

### 5.1 Input Power for TFT

Ta=25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage for analog	VDD	—	3.0	3.3	3.6	V
Supply Voltage For Logic	VDD	—	3.0	3.3	3.6	V
Input High Voltage	V <sub>IH</sub>	—	0.7VDD	—	VDD	V
Input Low Voltage	V <sub>IL</sub>	—	GND	—	0.3VDD	V
Supply Current	I <sub>dd</sub>	VDD =3.3V	—	—	—	mA

※Optimum LCD driving voltage value, referring to above mentioned range, is changed due to different batch of LCD glass.

### 5.2 Backlight Driving Conditions

Ta=25°C

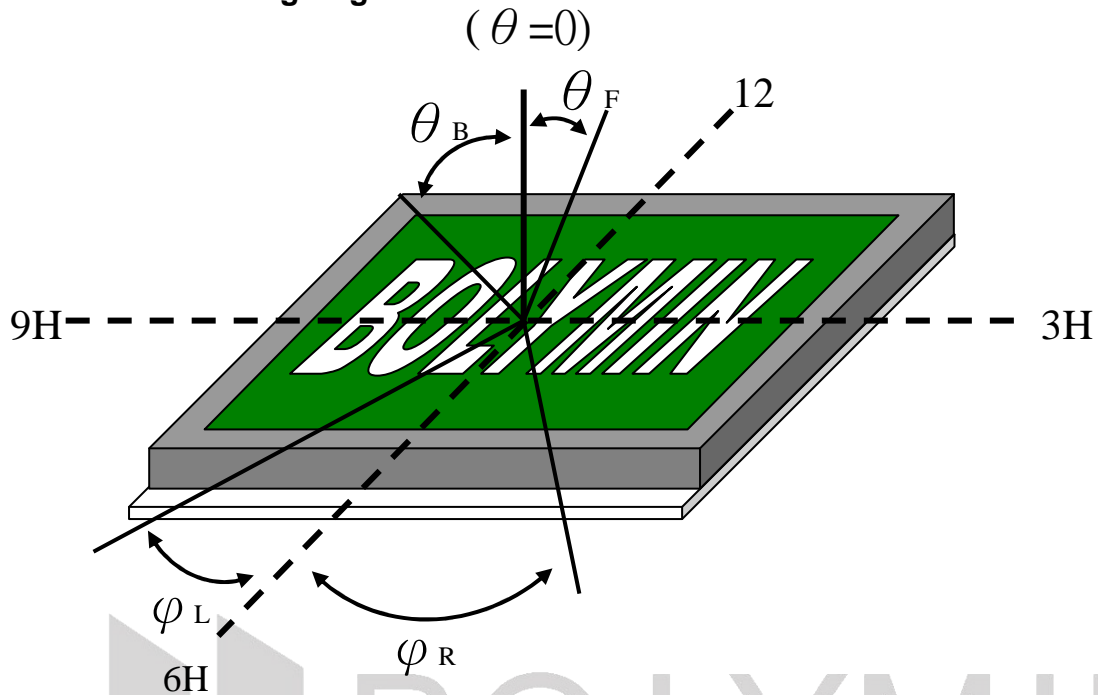
Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Voltage for LED Backlight	V <sub>F</sub>	I <sub>L</sub> =40mA	—	19.2	—	V
Current for LED Backlight	I <sub>L</sub>	—	—	20	30	mA
Power Consumption	P	—	—	0.384	—	W
LED Life Time		—	30000	50000	—	Hrs

## 6. Optical Characteristics

(Ta=25°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Luminance	L	IL=20mA	200	250	300	cd/m <sup>2</sup>
Contrast Ratio	CR	$\Theta=0$	200	300	-	-
Response Time	Ton			40	80	ms
	Toff					
CIE	RED	(x,y)	-	-	-	
	GREEN		-	-	-	
	BLUE		-	-	-	
	WHITE		0.258,0.287	-	0.298,0.327	
View Angle	$\theta F$	(CR $\geq$ 10)	-	50	-	deg
	$\theta B$		-	60	-	deg
	$\phi L$		-	60	-	deg
	$\phi R$		-	60	-	deg
Uniformity	Un		80			%

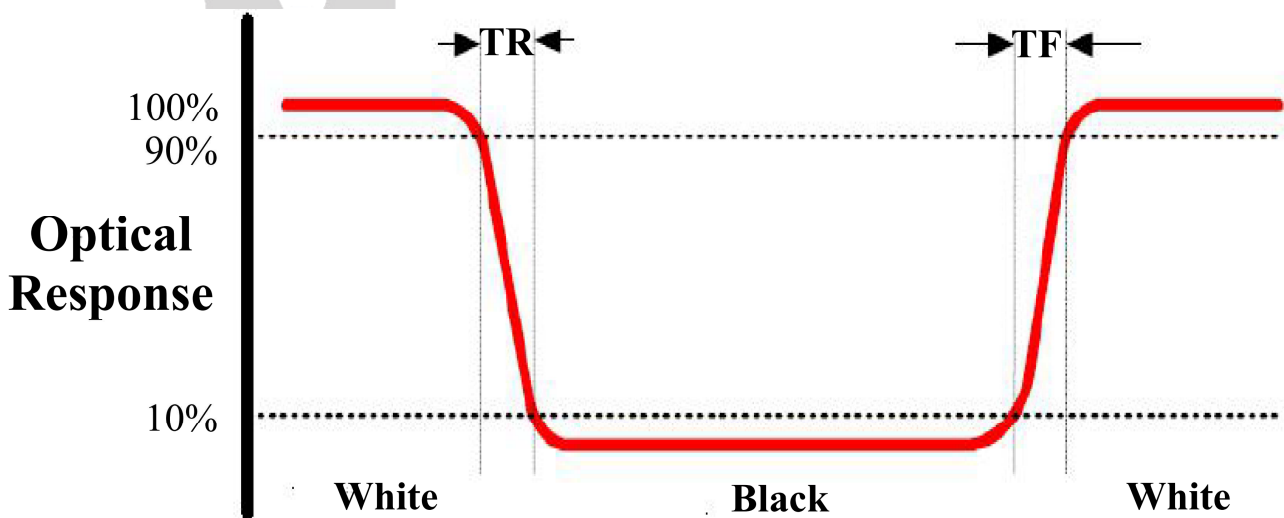
**Note 1: Definition of Viewing Angle**



**Note 2: Definition of contrast ratio CR:**

$$CR = \frac{\text{Luminance of white state}}{\text{Luminance of black state}}$$

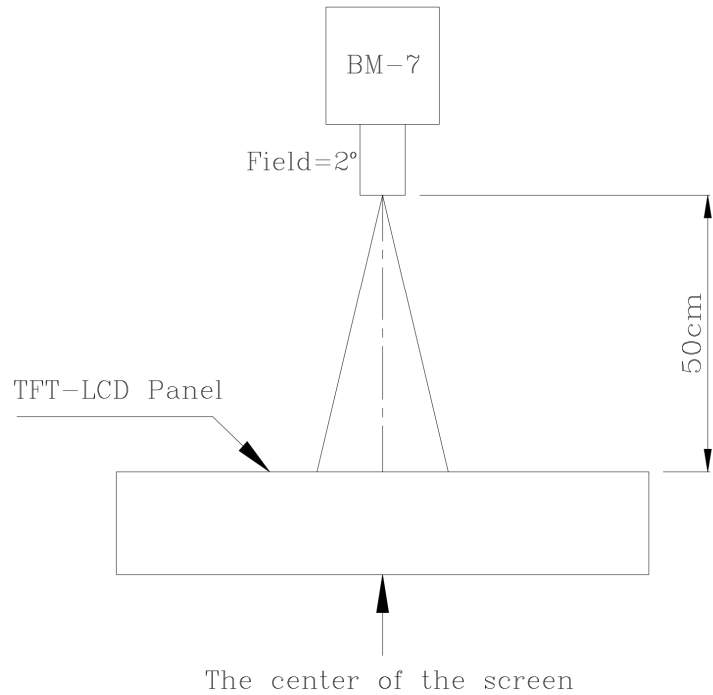
**Note 3: Definition of Response Time (Tr, Tf)**



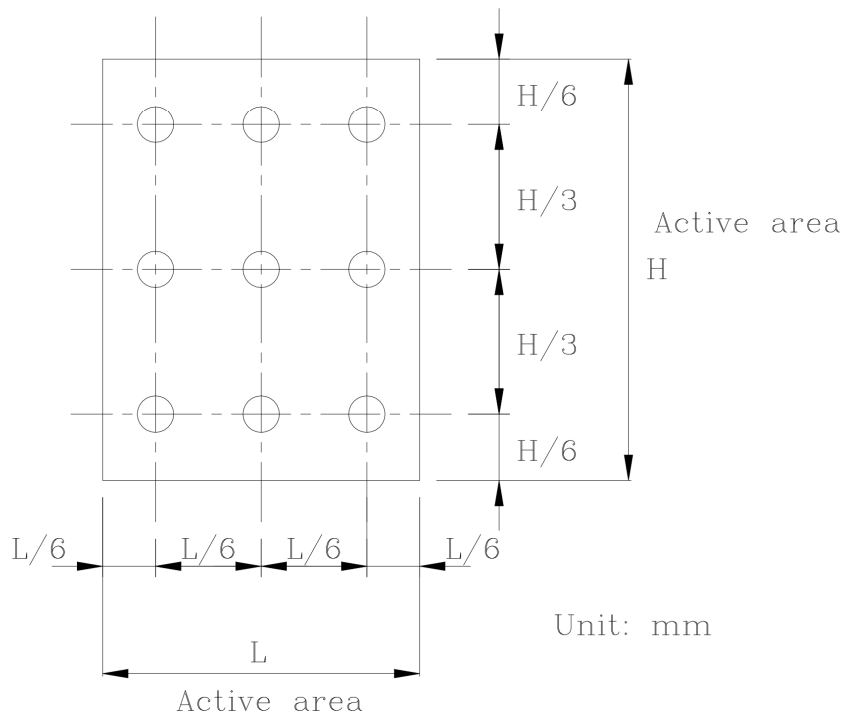
**Note 4: Definition of Luminance**

**①The Brightness Test Equipment Setup**

Field=2° (As measuring “black” image, field=2° is the best testing condition)



**②The Brightness Test Point Setup**



## 7. Interface Pin Function

Pin No.	Symbol	Description
1	LEDK	Cathode of LED backlight
2	LEDK	Cathode of LED backlight
3	LEDA	Anode of LED backlight
4	LEDA	Anode of LED backlight
5	NC	No connect
6	NC	No connect
7	NC	No connect
8	RESET	RESET PIN
9	SPENA	Chip select of serial interface
10	SPCLK	Clock pin of serial interface
11	SPDAT	Data input pin of serial interface
12~19	B0~B7	Blue data bus
20~27	G0~G7	Green data bus
28~35	R0~R7	Red data bus
36	HSYNC	Horizontal sync signal; negative polarity
37	VSYNC	Vertical sync signal; negative polarity
38	DCLK	Clock signal; latching data at the falling edge
39	NC	No connect
40	NC	No connect
41	VDD	Power supply
42	VDD	Power supply
43	NC	No connect
44	NC	No connect
45	NC	No connect
46	NC	No connect
47	NC	No connect
48	SEL2	Interface mode select(note)
49	SEL1	
50	SEL0	
51	NC	No connect
52	DEN	Display enable pin from controller
53	GND	Power ground
54	GND	Power ground

Note:

1. The mode control (SEL2) not use, it can't control CCIR601 interface, If not use CCIR601, it can floating.
2. For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If DE signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC mode is used. Suggest used SYNC mode!!Suggest the DE signal usually pull low.
3. IF select serial RGB or CCIR601/656 input mode is selected, only DX0-DX7 used, and the other short to GND, Only selected serial RGB、CCIR601/656 interface, DX BUS will enable, Digital input mode DX0 is LSB and DX7 is MSB.

Interface select table

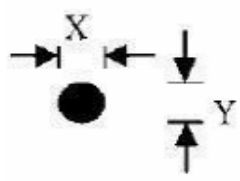
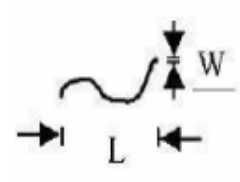
SEL2	SEL1	SEL0	Interface Mode
0	0	0	Parallel-RGB Data format interface (only support stripe type color filter)
0	0	1	Serial-RGB data format
0	1	0	CCIR 656 data format (640RGB)
0	1	1	CCIR 656 data format (720RGB)
1	0	0	YUV mode A data format(Cr-Y-Cb-Y)
1	0	1	YUV mode A data format(Cr-Y-Cb-Y)
1	1	0	YUV mode B data format(Cb-Y-Cr-Y)
1	1	1	YUV mode B data format(Cb-Y-Cr-Y)

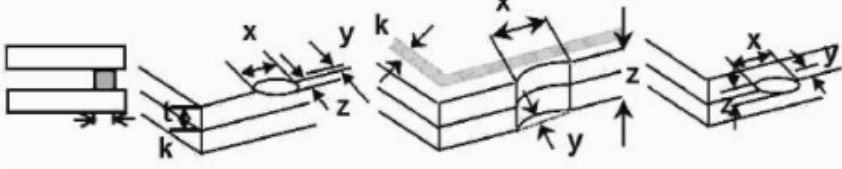
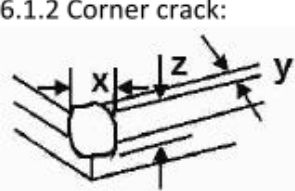
## 8. Quality Assurance

### 8.1 Inspection conditions

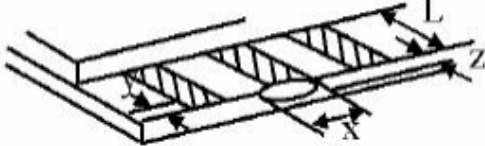
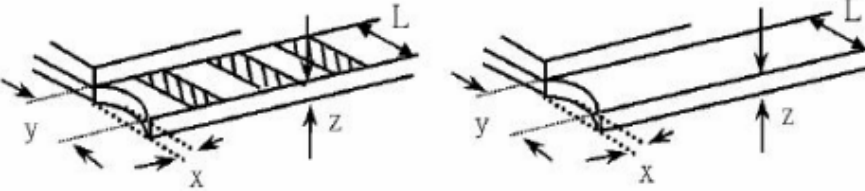
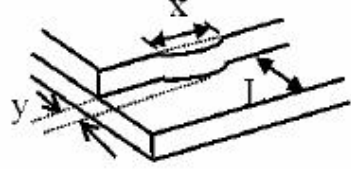
1. The LCD shall be inspected under 20~40W white fluorescent light.
2. Checking Direction shall be in the 40 degree from perpendicular line of specimen surface.
3. Checker shall see over 30 cm.
4. Inspect about 5 seconds for each side.
5. Defect that is located at outside of VA and doesn't affect function is ignored.

### 8.2 Inspection Parameters

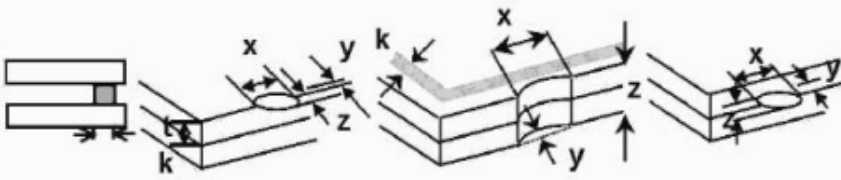
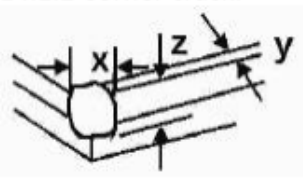
NO.	Item	Criterion	AQL
01	Electrical Testing	1.1 Missing vertical, horizontal segment, segment contrast defect. 1.2 Missing character, dot or icon. 1.3 Display malfunction. 1.4 No function or no display. 1.5 Current consumption exceeds product specifications. 1.6 LCD viewing angle defect. 1.7 Mixed product types. 1.8 Flicker	0.65
02	Black or White spots or Bright spots or Color spots on LCD (Display only)	① White and black or color spots on display $\cong 0.25\text{mm}$ , no more than Five spots. ② Densely spaced: No more than three spots within 3mm.	1.5
03	LCD and Touch Panel black spots, white spots, contamination (non-display)	3.1 Round type: As following drawing $\Phi = (X+Y) / 2$  <p>* Densely spaced: No more than two spots within 3mm.</p>	1.5
		3.2 Line type: (As following drawing)  <p>* Densely spaced: No more than two lines within 3mm.</p>	1.5

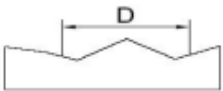
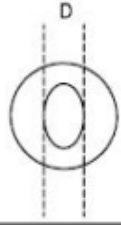
NO.	Item	Criterion		AQL							
04	Polarizer bubbles	If bubbles are visible, judge using black spot specifications, not easy to find, must check in specify direction	Size $\Phi$ (mm)	Acceptable Q'ty	1.5						
			$\Phi \leq 0.30$	Accept no dense							
			$0.30 < \Phi \leq 0.50$	0							
			$0.50 < \Phi \leq 1.00$	0							
			$1.00 < \Phi$	0							
			Total Q'ty	0							
05	Scratches	Follow NO.3 -2 Line Type.									
06	Chipped glass	Symbols: x: Chip length    y: Chip width    z: Chip thickness k: Seal width    t: Glass thickness    a: LCD side length L: Electrode pad length		1.5							
		6.1 General glass chip:									
		6.1.1 Chip on panel surface and crack between panels:									
											
<table border="1"> <thead> <tr> <th>z: Chip thickness</th> <th>y: Chip width</th> <th>x: Chip length</th> </tr> </thead> <tbody> <tr> <td><math>Z \leq 1/2t</math></td> <td>Not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> <tr> <td><math>1/2t &lt; z \leq 2t</math></td> <td>Not exceed <math>1/3k</math></td> <td><math>x \leq 1/8a</math></td> </tr> </tbody> </table>		z: Chip thickness	y: Chip width	x: Chip length	$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$	$1/2t < z \leq 2t$	Not exceed $1/3k$	$x \leq 1/8a$	
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$1/2t < z \leq 2t$	Not exceed $1/3k$	$x \leq 1/8a$									
<ul style="list-style-type: none"> <li>⊙ Unit: mm</li> <li>⊙ If there are 2 or more chips, x is the total length of each chip</li> </ul>											
6.1.2 Corner crack:											
											
<table border="1"> <thead> <tr> <th>z: Chip thickness</th> <th>y: Chip width</th> <th>x: Chip length</th> </tr> </thead> <tbody> <tr> <td><math>Z \leq 1/2t</math></td> <td>Not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> <tr> <td><math>1/2t &lt; z \leq 2t</math></td> <td>Not exceed <math>1/3k</math></td> <td><math>x \leq 1/8a</math></td> </tr> </tbody> </table>		z: Chip thickness	y: Chip width	x: Chip length	$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$	$1/2t < z \leq 2t$	Not exceed $1/3k$	$x \leq 1/8a$	
z: Chip thickness	y: Chip width	x: Chip length									
$Z \leq 1/2t$	Not over viewing area	$x \leq 1/8a$									
$1/2t < z \leq 2t$	Not exceed $1/3k$	$x \leq 1/8a$									
<ul style="list-style-type: none"> <li>⊙ Unit: mm</li> <li>⊙ If there are 2 or more chips, x is the total length of each chip</li> </ul>											



NO.	Item	Criterion	AQL																
07	Glass crack	<p>Symbols:            x: Chip length    y: Chip width    z: Chip thickness            k: Seal width    t: Glass thickness    a: LCD side length            L: Electrode pad length</p> <p>7.2 Protrusion over terminal:            7.2.1 Chip on electrode pad:</p>  <table border="1" data-bbox="550 689 1193 837"> <tr> <td>y: Chip width</td> <td>x: Chip length</td> <td>z: Chip thickness</td> </tr> <tr> <td><math>y \leq 0.5\text{mm}</math></td> <td><math>x \leq 1/8a</math></td> <td><math>0 &lt; z \leq t</math></td> </tr> </table> <p>7.2.2            Non-conductive portion:</p>  <table border="1" data-bbox="550 1198 1193 1346"> <tr> <td>y: Chip width</td> <td>x: Chip length</td> <td>z: Chip thickness</td> </tr> <tr> <td><math>y \leq L</math></td> <td><math>x \leq 1/8a</math></td> <td><math>0 &lt; z \leq t</math></td> </tr> </table> <p>⊙ If there chipped area touches the ITO terminal, over 2/3 of the ITO must remain and be inspected according to electrode terminal specifications.            ⊙ If the product will be heat sealed by the customer, the alignment mark must not be damaged.</p> <p>7.2.3 Substrate protuberance and internal crack</p>  <table border="1" data-bbox="861 1662 1276 1798"> <tr> <td>y: width</td> <td>x: length</td> </tr> <tr> <td><math>y \leq 1/3L</math></td> <td><math>x \leq a</math></td> </tr> </table>	y: Chip width	x: Chip length	z: Chip thickness	$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$	y: Chip width	x: Chip length	z: Chip thickness	$y \leq L$	$x \leq 1/8a$	$0 < z \leq t$	y: width	x: length	$y \leq 1/3L$	$x \leq a$	1.5
y: Chip width	x: Chip length	z: Chip thickness																	
$y \leq 0.5\text{mm}$	$x \leq 1/8a$	$0 < z \leq t$																	
y: Chip width	x: Chip length	z: Chip thickness																	
$y \leq L$	$x \leq 1/8a$	$0 < z \leq t$																	
y: width	x: length																		
$y \leq 1/3L$	$x \leq a$																		

NO.	Item	Criterion	AQL
08	Cracked glass	No crack is allowed.	1.5
09	Backlight elements	9.1 Illumination source flickers when lit. 9.2 Spots or scratches that appear when lit must be judged. Using LCD spot, lines and contamination standards. 9.3 Backlight doesn't light or color is wrong.	1.5 1.5 0.65
10	Bezel	No scratches with $W > 0.1$ and $Length > 2.5mm$ .	1.5
11	PCB、COB	11.1 COB seal may not have pinholes larger than 0.2mm or contamination. 11.2 COB seal surface may not have pinholes through to the IC. 11.3 The height of the COB should not exceed the height indicated in the assembly diagram. 11.4 There may not be more than 2mm of sealant outside the seal area on PCB. And there should be no more than three places. 11.5 Parts on PCB must be the same as on the production characteristic chart, There should be no wrong parts, missing parts or excess parts. 11.6 The jumper on the PCB should conform to the product characteristic chart.	1.5 1.5 1.5 1.5 0.65 0.65
12	FPC	12.1 FPC terminal damage $\cong 1/2$ FPC terminal width and can not affect the function , we judge accept. 12.2 FPC alignment hole damage $\cong 1/2$ alignment area and can not affect the function , we judge accept.	1.5 1.5
13	Soldering	13.1 No cold solder joints, missing solder connections, oxidation or icicle. 13.2 No short circuits in components on PCB or FPC.	1.5 0.65

NO.	Item	Criterion	AQL												
14	Touch Panel Chipped glass	<p>Symbols:            x: Chip length    y: Chip width    z: Chip thickness            k: Seal width    t: Touch Panel Total thickness    a: LCD side length            L: Electrode pad length</p> <p>14.1 General glass chip:            14.1.1 Chip on panel surface and crack between panels:</p>  <table border="1" data-bbox="454 689 1217 891"> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td><math>z \leq t</math></td> <td><math>\leq 1/2 k</math> and not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> </table> <p>⊙ Unit: mm            ⊙ If there are 2 or more chips, x is the total length of each chip</p> <p>14.1.2 Corner crack:</p>  <table border="1" data-bbox="454 1265 1217 1467"> <tr> <td>z: Chip thickness</td> <td>y: Chip width</td> <td>x: Chip length</td> </tr> <tr> <td><math>z \leq t</math></td> <td><math>\leq 1/2 k</math> and not over viewing area</td> <td><math>x \leq 1/8a</math></td> </tr> </table> <p>⊙ Unit: mm            ⊙ If there are 2 or more chips, x is the total length of each chip</p>	z: Chip thickness	y: Chip width	x: Chip length	$z \leq t$	$\leq 1/2 k$ and not over viewing area	$x \leq 1/8a$	z: Chip thickness	y: Chip width	x: Chip length	$z \leq t$	$\leq 1/2 k$ and not over viewing area	$x \leq 1/8a$	1.5
z: Chip thickness	y: Chip width	x: Chip length													
$z \leq t$	$\leq 1/2 k$ and not over viewing area	$x \leq 1/8a$													
z: Chip thickness	y: Chip width	x: Chip length													
$z \leq t$	$\leq 1/2 k$ and not over viewing area	$x \leq 1/8a$													

NO.	Item	Criterion	AQL										
15	Touch Panel(Fish eye、dent and bubble on film)	<table border="1"> <thead> <tr> <th>SIZE(mm)</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \cong 0.2</math></td> <td>Accept no dense</td> </tr> <tr> <td><math>0.2 &lt; D \cong 0.4</math></td> <td>5</td> </tr> <tr> <td><math>0.4 &lt; D \cong 0.5</math></td> <td>2</td> </tr> <tr> <td><math>0.5 &lt; D</math></td> <td>0</td> </tr> </tbody> </table>  	SIZE(mm)	Acceptable Q'ty	$\Phi \cong 0.2$	Accept no dense	$0.2 < D \cong 0.4$	5	$0.4 < D \cong 0.5$	2	$0.5 < D$	0	1.5
SIZE(mm)	Acceptable Q'ty												
$\Phi \cong 0.2$	Accept no dense												
$0.2 < D \cong 0.4$	5												
$0.4 < D \cong 0.5$	2												
$0.5 < D$	0												
16	Touch Panel Newton ring	Newton ring dimension $\cong 1/2$ touch panel area and not affect font and line distortion( $\cong 2.5\%$ ) , it is acceptable.	1.5										
17	Touch Panel Linearity	Less than 1.5% is acceptable.	1.5										
18	LCD Ripple	Touch the touch panel , can not see the LCD ripple. Pen: R 1.0mm silicon rubber. Operation Force: 80g	1.5										
19	General appearance	19.1 Pin type must match type in specification sheet. 19.2 LCD pin loose or missing pins. 19.3 Product packaging must the same as specified on packaging specification sheet. 19.4 Product dimension and structure must conform to product specification sheet.	0.65 0.65 0.65 0.65										

Other Inspection standard reference Bolymin standard.

## 9. Reliability

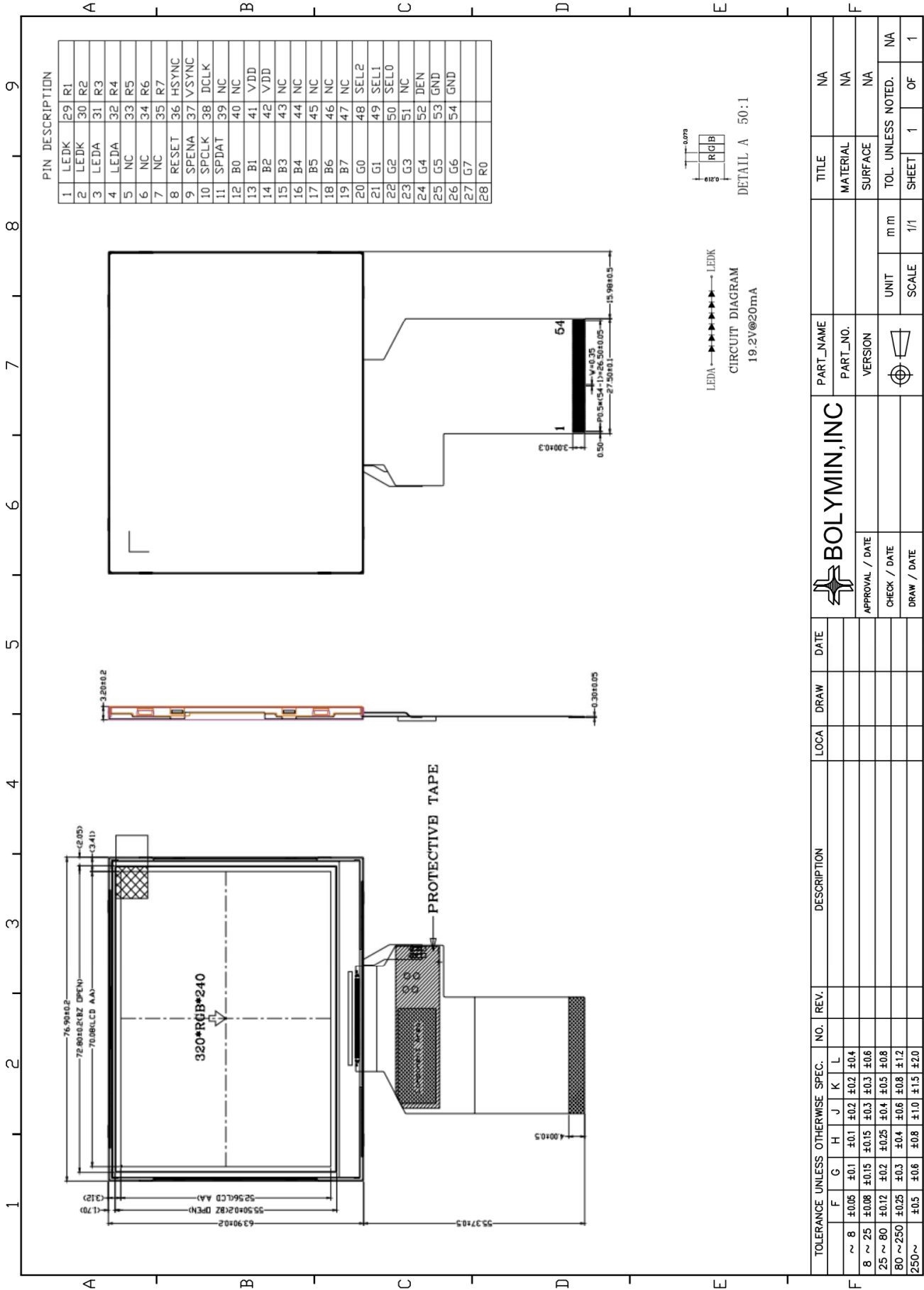
### ■Content of Reliability Test

Environmental Test				
No	Test Item	Content of Test	Test Condition	Applicable Standard
1	High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 96 hrs	—
2	Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-30°C 96 hrs	—
3	High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	70°C 96 hrs	—
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20°C 96 hrs	—
5	Humidity Test	Endurance test applying the high humidity storage for a long time.	40°C, 90%RH 96hrs	—
6	Temperature cycle (Non-operation)	Endurance test applying the low and high temperature cycle. 	-30°C/80°C 10 cycles	—
7	Vibration test	Endurance test applying the vibration during transportation and using.	Total Fixed Amplitude: 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 direction of X,Y,Z for each 15minutes	—

※Assess after placing at normal temperature and humidity for 4 hour ◦ No abnormalities in functions and appearance ◦

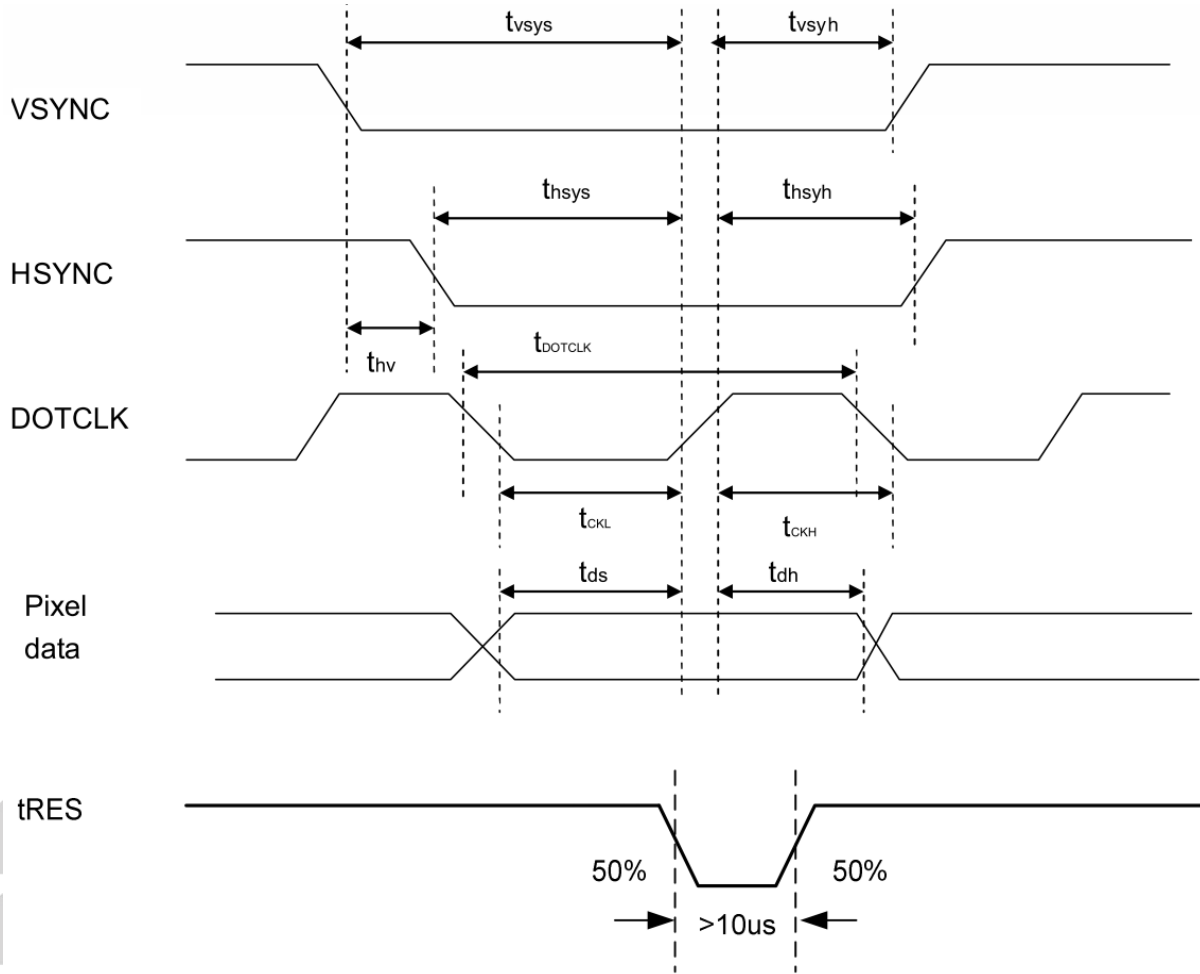
# 10. Appendix (Drawing, Timing Characteristics)

## 10.1 Drawing



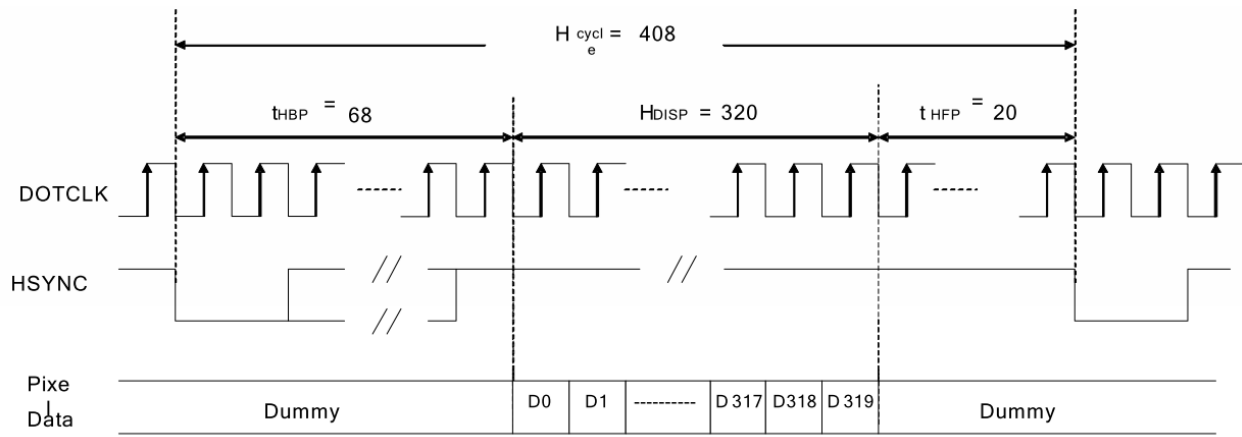
## 10.2 Timing characteristics

### 10.2.1 Pixel Timing Diagram

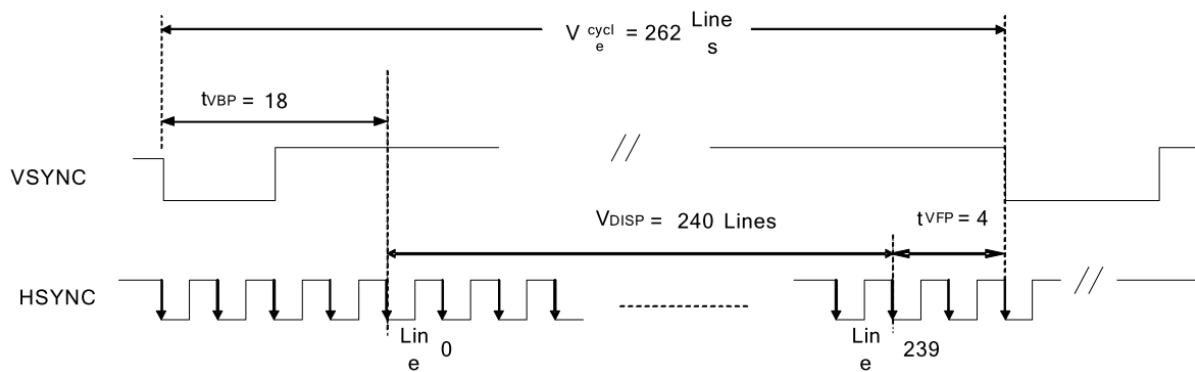


Characteristics	Symbol	Min.		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	$f_{DOTCLK}$	-	-	6.5	19.5	10	30	MHz
DOTCLK Period	$t_{DOTCLK}$	100	33.3	154	51.3	-	-	ns
Vertical Sync Setup Time	$t_{vsys}$	20	10	-	-	-	-	ns
Vertical Sync Hold Time	$t_{vsyh}$	20	10	-	-	-	-	ns
Horizontal Sync Setup Time	$t_{hsys}$	20	10	-	-	-	-	ns
Horizontal Sync Hold Time	$t_{hsyh}$	20	10	-	-	-	-	ns
Phase difference of Sync Signal Falling Edge	$t_{hv}$	1		-		240		$t_{DOTCLK}$
DOTCLK Low Period	$t_{CKL}$	50	15	-	-	-	-	ns
DOTCLK High Period	$t_{CKH}$	50	15	-	-	-	-	ns
Data Setup Time	$t_{ds}$	12	10	-	-	-	-	ns
Data hold Time	$t_{dh}$	12	10	-	-	-	-	ns
Reset pulse width	$t_{RES}$	10		-		-		us

## 10.2.2 SYNC mode Timing Diagram



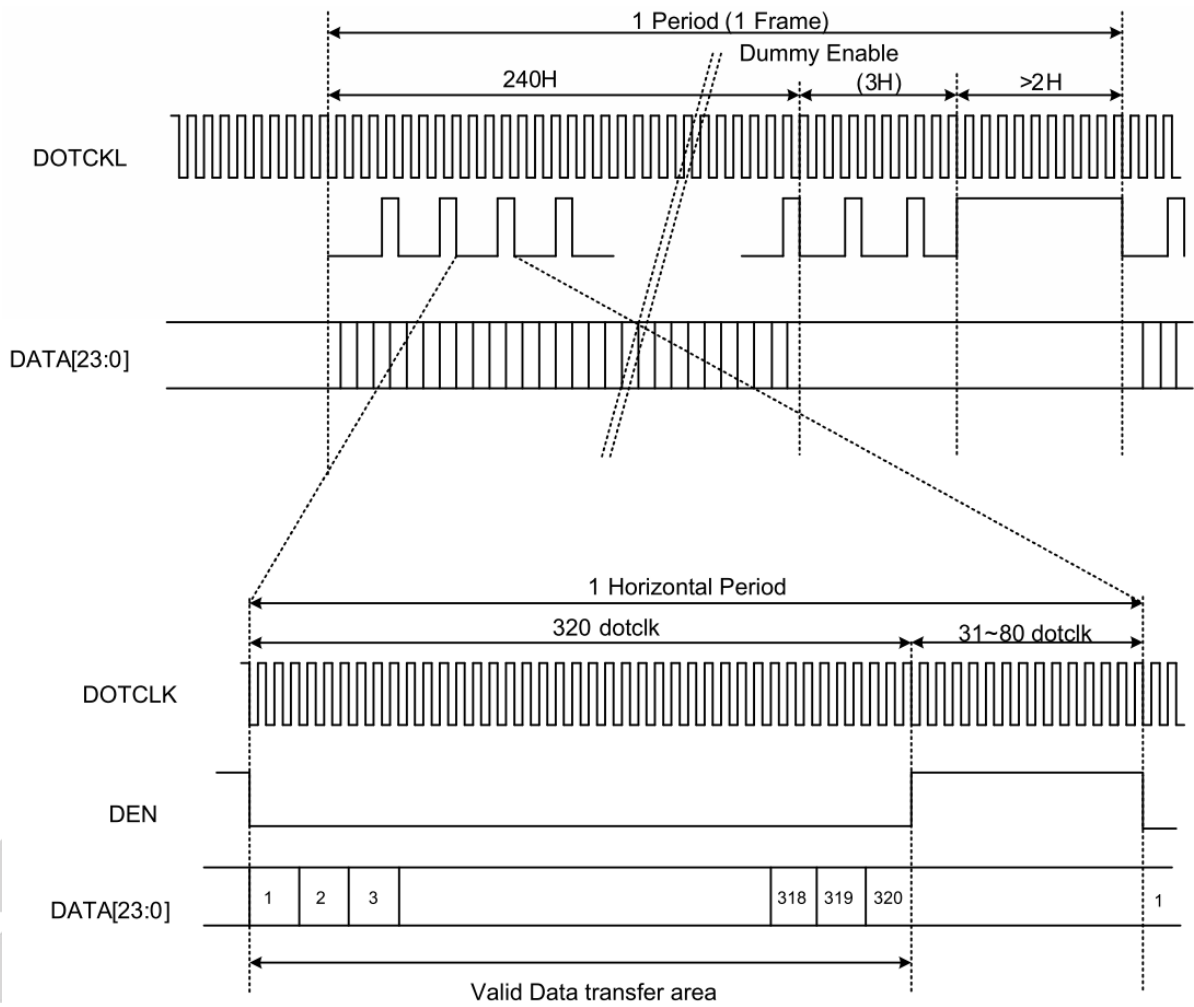
a) Horizontal Data Transaction Timing



Characteristics	Symbol	Min-		Typ.		Max.		Unit
		24 bit	8 bit	24 bit	8 bit	24 bit	8 bit	
DOTCLK Frequency	fDOTCLK	-	-	6.5	19.5	10	30	MHz
DOTCLK Period	tDOTCLK	100	33.3	154	51.3	-	-	ns
Horizontal Frequency (Line)	fH	-	-	14.9		22.35		KHz
Vertical Frequency (Refresh)	fV	-	-	60		90		Hz
Horizontal Back Porch	tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Front Porch	tHFP	-	-	20	60	-	-	tDOTCLK
Horizontal Data Start Point	tHBP	-	-	68	204	-	-	tDOTCLK
Horizontal Blanking Period	tHBP + tHFP	-	-	88	264	-	-	tDOTCLK
Horizontal Display Area	H_DISP	-	-	320	960	-	-	tDOTCLK
Horizontal Cycle	Hcycle	-	-	408	1224	450	1350	tDOTCLK
Vertical Back Porch	tVBP	-	-	18		-	-	Lines
Vertical Front Porch	tVFP	-	-	4		-	-	Lines
Vertical Data Start Point	tVBP	-	-	18		-	-	Lines
Vertical Blanking Period	tVBP + tVFP	-	-	22		-	-	Lines
Vertical Display Area	NTSC	-		240		-		Lines
	PAL			280(PALM=0)				
				288(PALM=1)				
Vertical Cycle	NTSC	-		262		350		Lines
	PAL			313				



### 10.2.3 DE mode Timing Diagram



Note: For more detail information, please refer to HX8238D datasheet.