

SPECIFICATIONS FOR LCD MODULE

MODEL NO.
BG320240A-FPHNHNS
VER.01



FOR MESSRS:

ON DATE OF:

APPROVED BY:

BOLYMIN, INC.

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1. Numbering System

B	G	320240	A	-	F	P	H	N	H	N	\$	-
0	1	2	3		4	5	6	7	8	9	10	11

0	Bolymin	B										
1	Module Type	C	Character type	P	TAB /TCP type							
		F	COF type	R	Color STN							
		G	Graphic type	L	OLED							
		O	COG type	Z	Customize							
2	Format	2004		20 character type,4lines								
		12232		122 × 32 dots								
3	Version No.	A										
		-										
4	LCD Color	B	STN / Blue, OLED/Blue	H	HTN							
		C	Color	T	TN							
		F	FSTN	Y	STN/Yellow-green							
		G	STN/Grey	D	OLED/Blue+Yellow							
		A	OLED/Blue+Yellow+Green	E	OLED/Yellow							
		L	OLED/Green	R	OLED/RED							
		W	OLED/White	J	ASTN							
		K	DFSTN	V	VA LCD							
5	LCD Type	R	Positive/reflective	M	Positive/ transmissive							
		P	Positive/transflective	N	Negative/ transmissive							
		T	Negative/ transflective									
6	Backlight type/color	L	(LED)Array/yellow-green	G	(LED)Edge/yellow-green							
		M	(LED)Array/amber	H	(LED)Edge/white							
		R	(LED)Array/red	D	(LED)Edge/blue							
		U	(LED)Array/blue	E	(EL)white							
		W	(LED)Array/white	B	(EL)blue							
		C	(CCFL) white	F	(LED)Array/RGB							
		Y	(LED)Array/yellow	N	No backlight							
		O	(LED)Array/orange	K	(LED)Edge/green							
		A	(LED)Edge/amber	Q	(LED)Edge/red							
		J	(LED)Array/green	I	(LED)Edge/RGB							

		Z	(LED) arrayred/green	P	(LED)Edge/orange
		S	(LED)edge/RGW	T	(LED)edge red/green
		V	EL blue/green	X	(LED) Edgewhite /red
7	CGRAM Font	J	English/Japanese Font	C	English/Cyrillic Font
		G	Chinese(simple)	H	English/Hebrew Font
		E	English/European Font (ST7066U0B-BB)	S	English/European Font (ST7066U-0E-BB)
		F	Chinese(traditional)	M	Japanese-Kanji
		Z	Z=Chinese(simple)+Chinese (traditional)+Japanese+Korean	K	Korean (only for BG16032A BG24064C)
		A	English/Arabic Font	D	Chinese (simple/traditional) English/Japanese
		B	English/Japanese/European	N	None
8	View Angle /Operation Temperature	B	Bottom/Normal Temperature 06:00	W	Top/Wide Temperature 12:00
		H	Bottom/Wide Temperature 06:00	E	Top/Ultra Temperature 12:00
		C	9H/Normal Temperature 09:00	U	Bottom/Ultra wide Temperature 06:00
		T	Top/Normal Temperature 12:00	F	9H/Ultra wide Temperature 09:00
		G	3H/Wide Temperature 3:00	D	9H/Wide Temperature 09:00
		I	3H/ Ultra Wide Temperature 3:00		
9	Special Code	N	Negative voltage for LCD	T	Negative voltage and Temperature compensation for LCD
		P	Touch panel	3/5	3/5 voltage logic power supply
10	RoHS	\$			
11	Customer Code	<u>00</u> 0 ~ <u>99</u> 0 、 <u>AA</u> 0 ~ <u>ZZ</u> 0			

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°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°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.

2.6 MTBF

- 2.6.1 .By specific test condition, MTBF based on 30°C normal operation temperature is 50,000hours.

2.6.2 Test Condition:

2.6.2.1 Supply Voltage for LCM: Typical Vdd

2.6.2.2 CC (Constant Current) mode and typical current is applied for LED.

2.6.2.3 Run-Patterns: by Bolymin's test program that has defined patterns and cyclic period.

2.6.2.4 Humidity: 60%RH

2.6.3 Test Criteria:

Attenuation of average brightness: $\leq 50\%$

Increasing of current consumption for LCM/Backlight: $\leq 20\%$

Display function at room temperature: Normal

Appearance: Normal

3.General Specification

(1) Mechanical Dimension

Item	Standard Value	Unit
Number of dots	320x240	dots
Module dimension (L x W x H)	160.0(W)x 109.0(H)x 11.0max(T)-LED	mm
View area	122.0(W)x 92.0(H)	mm
Active area	115.18(W)x 86.38(H)	mm
Dot size	0.34(W)x 0.34(H)	mm
Dot pitch	0.36(W)x 0.36(H)	mm

(2) Controller IC:No built-in Controller

4.Absolute Maximum Rating

Item	Symbol	Min	Typ	Max	Unit
Input Voltage	V_I	VSS	—	Vdd	V
Supply Voltage For Logic	Vdd-Vss	-0.3	—	+7	V
Supply Voltage For LCD	Vdd-Vo	0	—	28	V

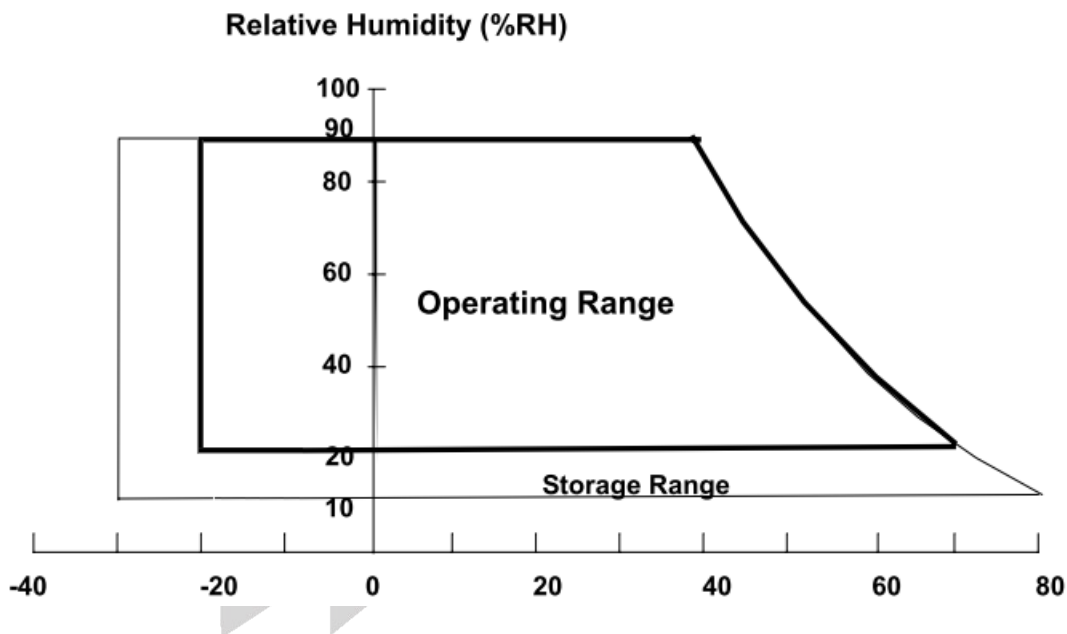
4.2 Environmental Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit	Note
Operating Temperature	TOP	-20	70	°C	(1)
Storage Temperature	TST	-30	80	°C	(1) 、 (2)

Note (1)

- (a) 90 %RH Max. ($T_a \leq 40 \text{ }^\circ\text{C}$).
- (b) Wet-bulb temperature should be $39 \text{ }^\circ\text{C}$ Max. ($T_a > 40 \text{ }^\circ\text{C}$).
- (c) No condensation.

Note (2) The temperature of panel surface should be $-20 \text{ }^\circ\text{C}$ min. and $70 \text{ }^\circ\text{C}$ max.



5. Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage For Logic	Vdd-Vss	—	4.75	5.0	5.25	V
Supply Voltage For LCD	Vdd-Vo	Ta=25°C	23.5	23.8	24.1	V
Input High Vol	V _{IH}	—	0.8V _{DD}	—	V _{DD}	V
Input Low Vol	V _{IL}	—	0	—	0.2V _{DD}	V
Output High Vol	V _{OH}	—	V _{DD} -0.4	—	—	V
Output Low Vol.	V _{OL}	—	—	—	0.4	V
Supply Current	I _{dd}	Vdd=5V	—	65	—	mA
LCM Surface Luminance Ta=25°C	L	I _{LED} =160mA Display all OFF	65	97	—	cd/m ²

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

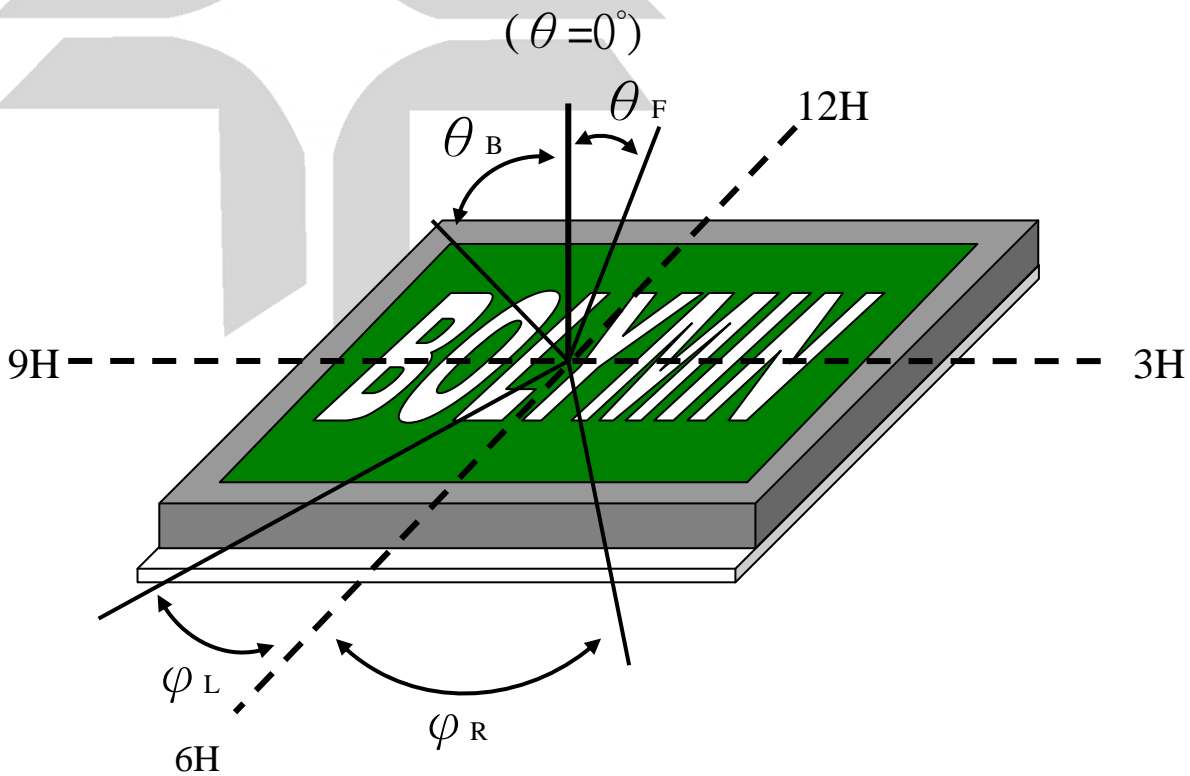
BOLYMIN

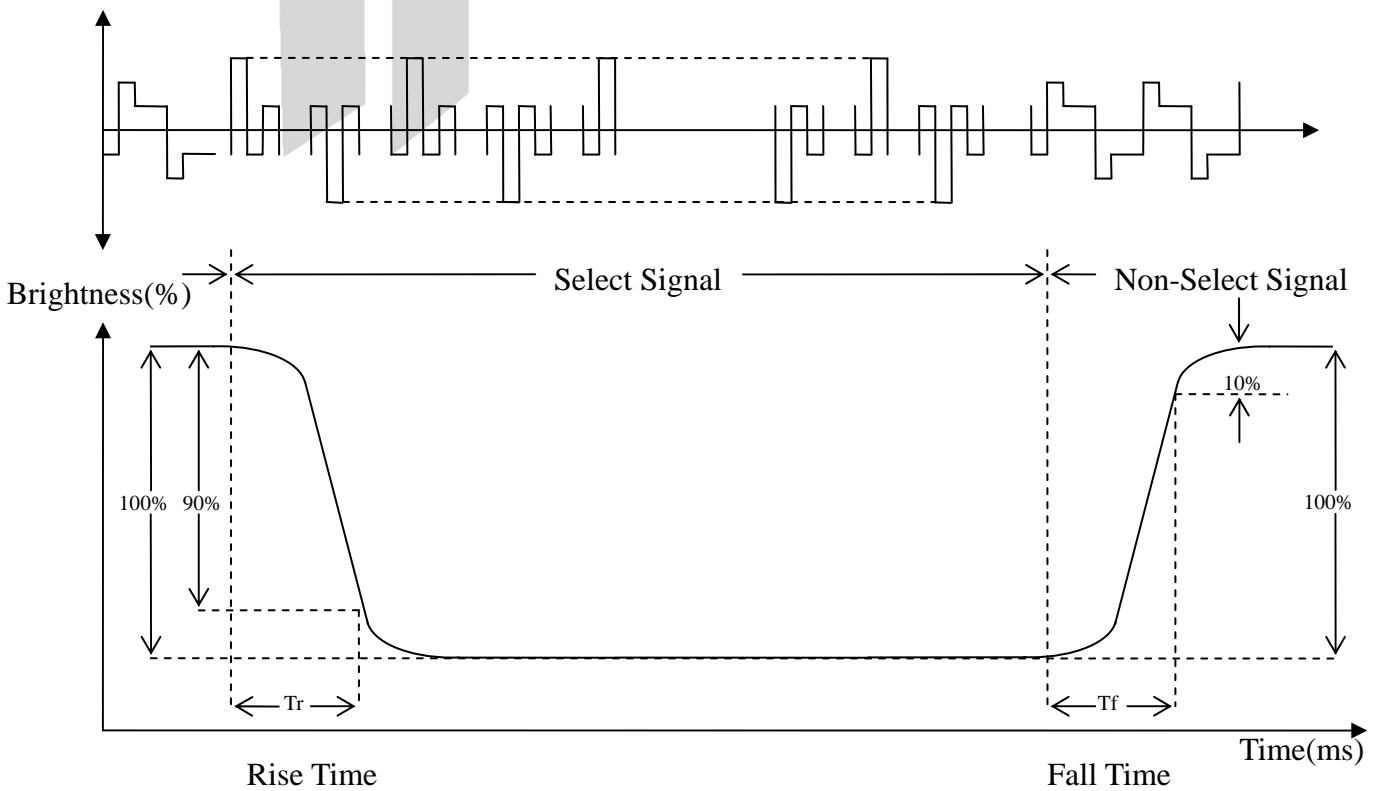
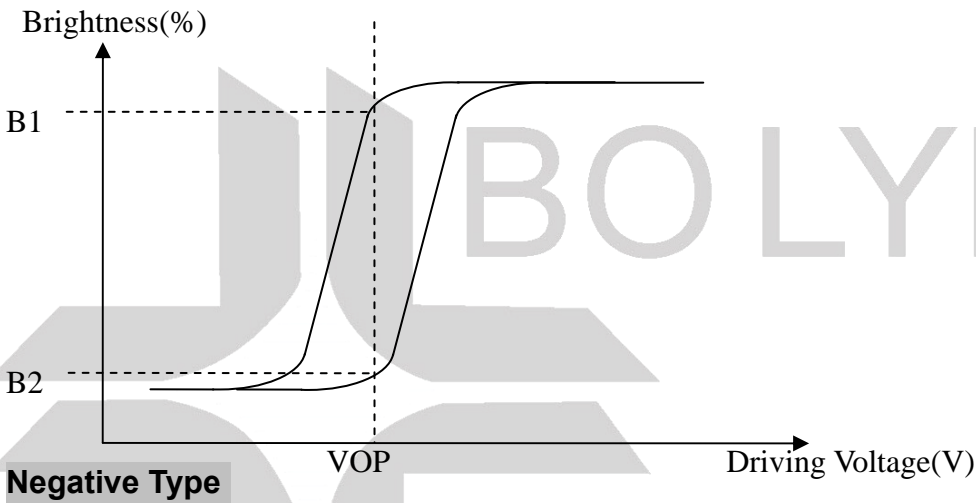
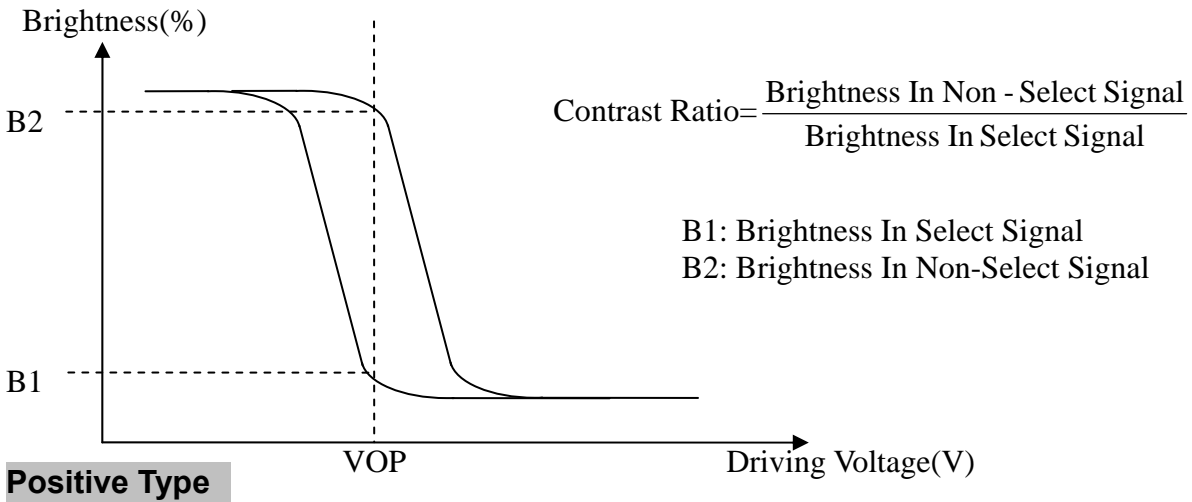
6. Optical Characteristics

a. FSTN

(Ta=25°C)

Item	Symbol	Min.	Typ.	Max.	Unit
View Angle (CR>=2)	θ_F	-	36	-	deg
	θ_B	-	36	-	deg
	φ_L	-	38	-	deg
	φ_R	-	40	-	deg
Contrast Ratio	CR	4	5	-	-
Response Time 25°C	T rise	-	200	400	ms
	T fall	-	250	400	ms



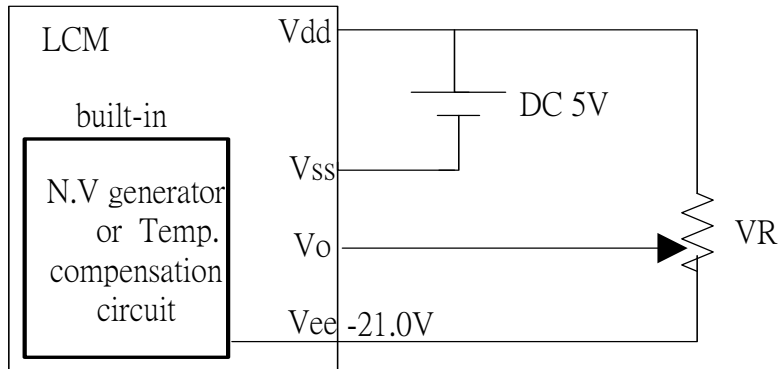


7.Interface Pin Function

Pin No.	Symbol	Level	Description
1	D0	H/L	Display data, bit0
2	D1	H/L	Display data, bit1
3	D2	H/L	Display data, bit2
4	D3	H/L	Display data, bit3
5	$\overline{\text{DISPOFF}}$	H/L	H: DisplayON, L: Display OFF
6	FLM	H/L	Scan start-up signal
7	N.C		No Connection
8	LP	H to L	Data latch pulse
9	CP	H to L	Data shift pulse
10	VDD	5.0V	Power supply for Logic
11	VSS	0V	Ground
12	VEE		Negative voltage input-21.0V
13	V _O	(Variable)	Driving voltage for LCD
14	FGND		Frame Ground

8. Power supply for LCD Module and LCD operating voltage adjustment

* LCM operating on " DC 5V " input.



9. Backlight information

9.1 Specification

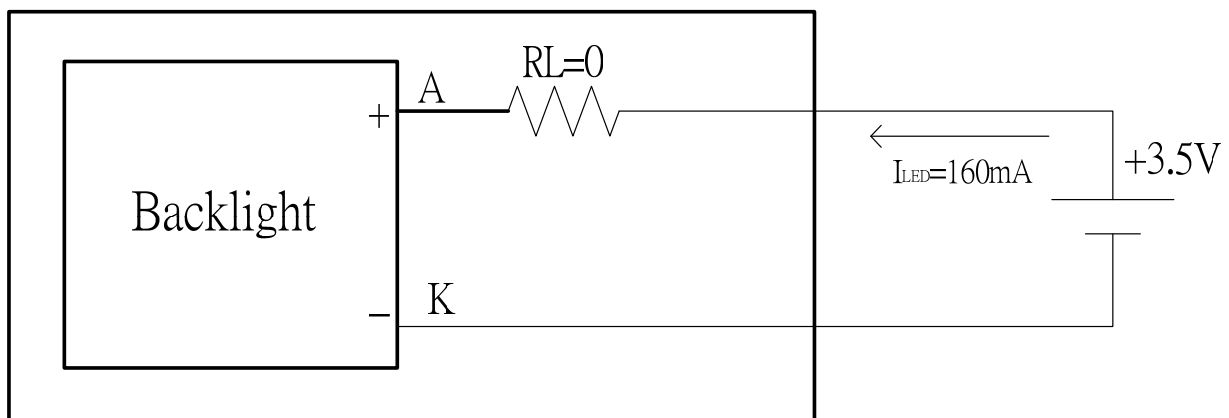
(1) LED edge/ white

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	I _{LED}	—	160	—	mA	V=3.5V
Supply Voltage	V	3.2	3.5	3.8	V	I _{LED} =160mA
Reverse Voltage	VR	—	—	5	V	—
CIE	X	0.28	—	0.35		I _{LED} =160mA
	Y	0.28	—	0.35		
Color	White					

9.2 Backlight driving methods

- a. LED B/L drive from A.K directly edge (white)

LCM



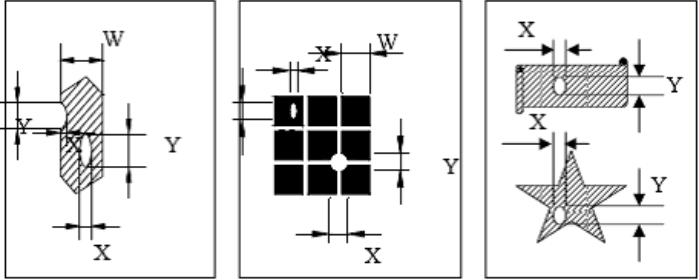
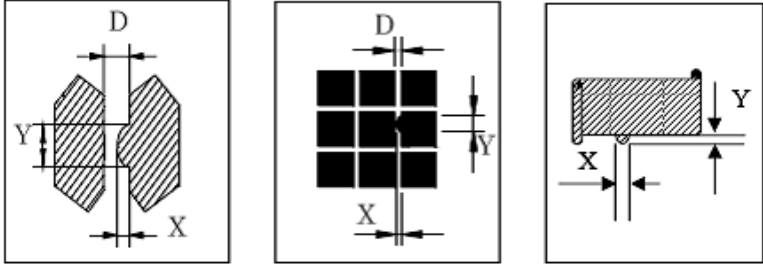
10. Quality Assurance

10.1 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.

10.2 Inspection Parameters

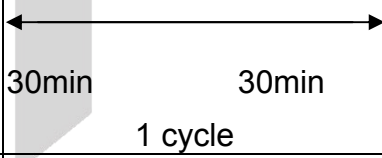
NO.	Parameter	Criteria				
1	Black or White spots (Particle)	Zone		Acceptable Number	Class Of Defects	Acceptable Level
		Dimension				
		$D \leq 0.10$		Disregard	Minor	2.5
		$0.10 < D \leq 0.2$		4		
		$0.2 < D \leq 0.3$		2		
$0.3 < D$		0				
$D = (\text{Long} + \text{Short}) / 2$ Total defects should not exceed 5/module Defect that is located at outside of AA and doesn't affect function is ignored.						
2	Scratch, Substances	Zone		Acceptable Number	Class Of Defects	Acceptable Level
		X(mm)	Y(mm)			
		—	$0.05 \geq W$	Disregard	Minor	2.5
		$4.0 \geq L$	$0.05 \geq W$	4		
		$3.0 \geq L$	$0.1 \geq W$	2		
—	$0.1 < W$	0				
X: Length Y: Width Total defects should not exceed 5/module Defect that is located at outside of AA and doesn't affect function is ignored.						

3	Air Bubbles (between glass & polarizer)	<table border="1"> <tr> <th>Zone Dimension</th> <th>Acceptable Number</th> <th>Class Of Defects</th> <th>Acceptable Level</th> </tr> <tr> <td>$D \leq 0.2$</td> <td>Disregard</td> <td rowspan="3">Minor</td> <td rowspan="3">2.5</td> </tr> <tr> <td>$0.2 < D \leq 0.5$</td> <td>3</td> </tr> <tr> <td>$0.5 < D$</td> <td>0</td> </tr> </table>	Zone Dimension	Acceptable Number	Class Of Defects	Acceptable Level	$D \leq 0.2$	Disregard	Minor	2.5	$0.2 < D \leq 0.5$	3	$0.5 < D$	0														
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$0.5 < D$	0																											
<p>Total defects shall not excess 3/module. Defect that is located at outside of AA and doesn't affect function is ignored. Bobbie is sawn only under reflection light is disregarded.</p>																												
4	Displaying Pattern	<p>1. Incomplete or broken line is not allowed. 2. Pinholes</p> <table border="1"> <thead> <tr> <th>Dimension Φ(mm)</th> <th>Criteria</th> <th>Class Of Defects</th> <th>Acceptable Level</th> </tr> </thead> <tbody> <tr> <td>$\Phi < 0.1$</td> <td>Disregard</td> <td rowspan="4">Minor</td> <td rowspan="4">2.5</td> </tr> <tr> <td>$0.1 < \Phi \leq 0.2$</td> <td>2</td> </tr> <tr> <td>$0.2 < \Phi \leq 0.25$</td> <td>1</td> </tr> <tr> <td>$0.25 < \Phi$</td> <td>0</td> </tr> </tbody> </table>  <p style="text-align: center;">$\emptyset = (X+Y)/2$</p> <p>3. Deformation</p> <table border="1"> <thead> <tr> <th>Dimension Φ(mm)</th> <th>Criteria</th> <th>Class Of Defects</th> <th>Acceptable Level</th> </tr> </thead> <tbody> <tr> <td>$\Phi < 0.15$</td> <td>Disregard</td> <td rowspan="3">Minor</td> <td rowspan="3">2.5</td> </tr> <tr> <td>$\Phi \leq 0.25$ and $X \leq 1/2D$</td> <td>3</td> </tr> <tr> <td>$\Phi > 0.25$ and $X > 1/2D$</td> <td>0</td> </tr> </tbody> </table>  <p style="text-align: center;">D : 間距 $\emptyset = (X+Y)/2$</p>	Dimension Φ (mm)	Criteria	Class Of Defects	Acceptable Level	$\Phi < 0.1$	Disregard	Minor	2.5	$0.1 < \Phi \leq 0.2$	2	$0.2 < \Phi \leq 0.25$	1	$0.25 < \Phi$	0	Dimension Φ (mm)	Criteria	Class Of Defects	Acceptable Level	$\Phi < 0.15$	Disregard	Minor	2.5	$\Phi \leq 0.25$ and $X \leq 1/2D$	3	$\Phi > 0.25$ and $X > 1/2D$	0
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$0.25 < \Phi$	0																											
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Other Inspection standard reference Bolymin standard.

11. Reliability

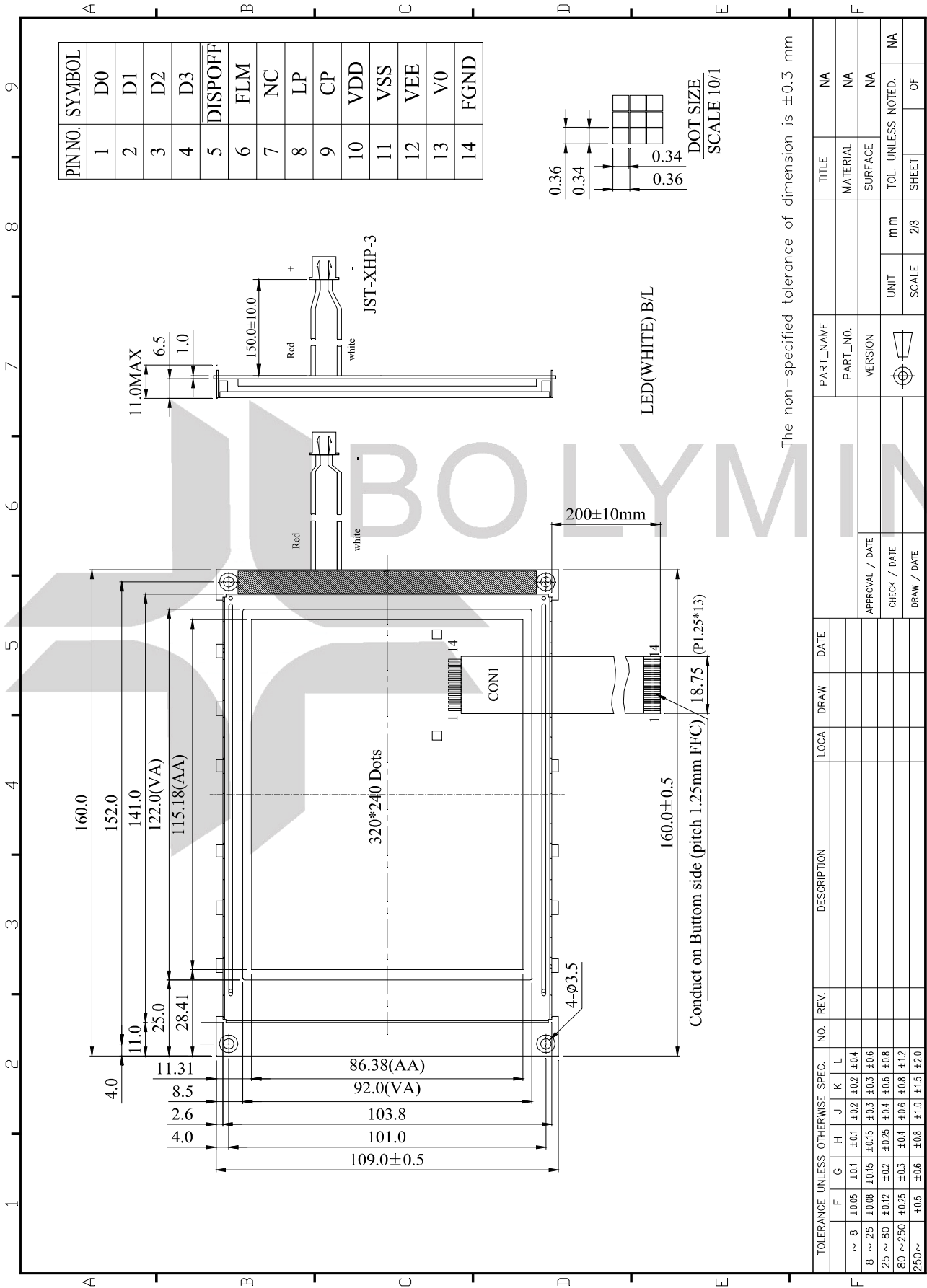
■ Content of Reliability Test

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 	-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 ◦

12. Appendix (Drawing ,Block Diagram, Timing Characteristics)

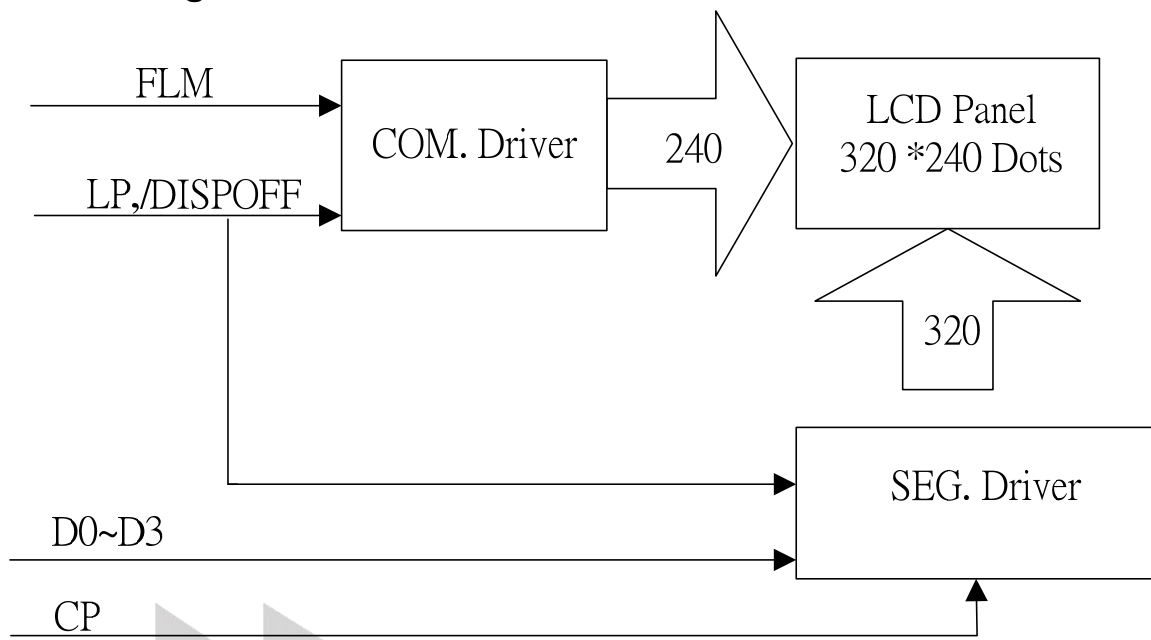
12.1 Drawing



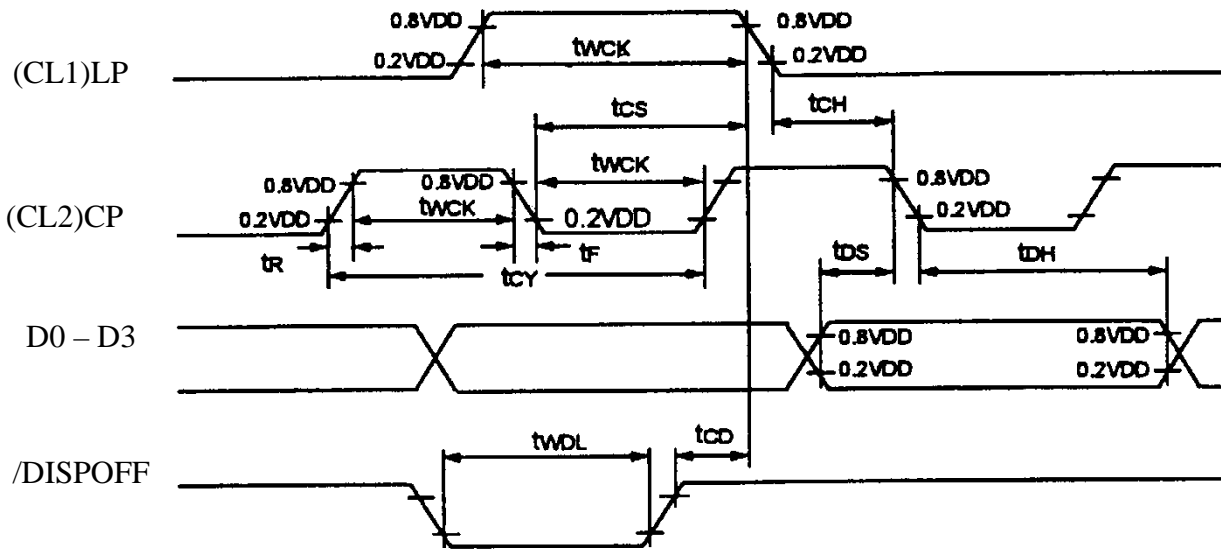
TOLERANCE UNLESS OTHERWISE SPEC.	NO.	REV.	DESCRIPTION	LOCA	DRAW	DATE	
~ 8	F	±0.05	±0.1	±0.1	±0.2	±0.2	±0.4
8 ~ 25	G	±0.08	±0.15	±0.15	±0.3	±0.3	±0.6
25 ~ 80	H	±0.12	±0.2	±0.25	±0.4	±0.5	±0.8
80 ~ 250	I	±0.25	±0.3	±0.4	±0.6	±0.8	±1.2
250 ~	J	±0.5	±0.6	±0.8	±1.0	±1.5	±2.0

PART_NAME	TITLE	NA
PART_NO.	MATERIAL	NA
VERSION	SURFACE	NA
UNIT	TOL. UNLESS NOTED.	NA
SCALE	SHEET	OF
m m	2/3	

12.2 Block Diagram



12.3 Timing characteristics

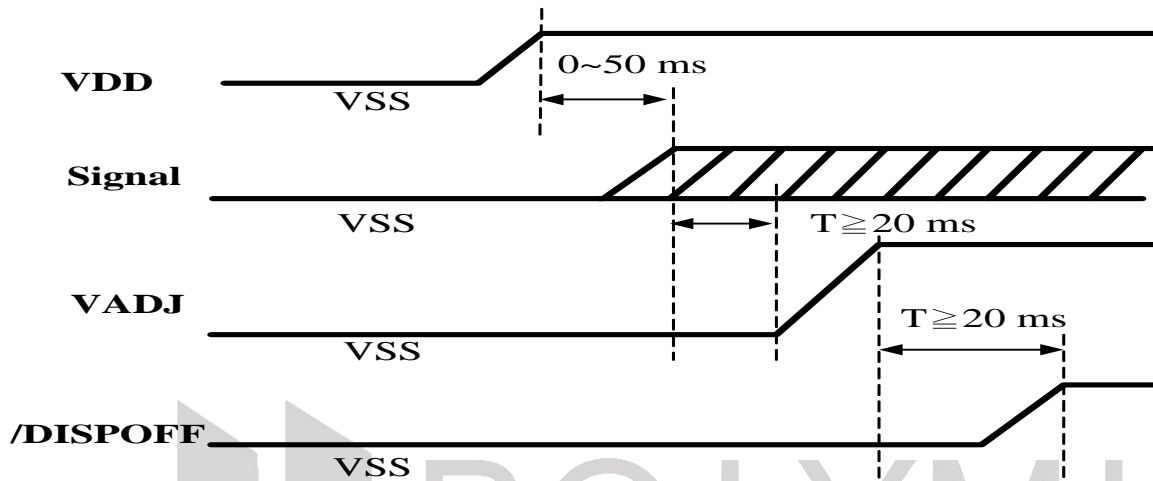


Characteristic	Symbol	Min.	Max.	Unit
Clock cycle time	t_{cy}	125	--	ns
Clock pulse width	t_{wck}	45	--	
Data set up time	t_{ds}	30	--	
Data hold time	t_{dh}	30	--	
Clock set-up time	t_{cs}	80	--	
Clock hold time	t_{ch}	80	--	
DISPOFF low pulse width	t_{wdl}	1200	--	
DISPOFF clear time	t_{cd}	100	--	

Power ON/OFF Sequence

Please maintain the blow sequence when turning on and off the power supply of the module. If /DISPOFF is supplied to the module while internal alter signal for LCD driving (M) is unstable, DC component will be supplied to the LCD panel. This may cause damage the LCD module.

POWER ON SEQUENCE



POWER OFF SEQUENCE

