BOLYMIN

SPECIFICATIONS FOR LCD MODULE

MODEL NO.
BG320240FFPHHn87a$
VER.03

RoHS COMPLIANT

FOR MESSRS:

_____

ON DATE OF:

_____

APPROVED BY:

_____

History of Version

Version	Contents	Date	Note
01	**NEW VERSION**	**2010/03/10**	**SPEC.**
02	**Add Handling Instruction** **Update Electrical Characteristics、 Quality Assurance** **and Reliability** **Modify Backlight Information**	**2012/12/04**	
03	**Modify Handling Instruction、Quality Assurance and Reliability**	**2013/06/06**	

C O N T E N T S

1. Numbering System

B	G	320240	F	F	P	H	-	H	n87a$
0	1	2	3	4	5	6	7	8	9

0	Brand	Bolymin	
1	Module Type	C= character type G= graphic type P= TAB/TCP type	O= COG type F= COF type L=PLED/OLED
2	Format	2002=20 characters, 2 lines 12232= 122 x 32 dots	
3	Version No.	A type	
4	LCD Color	G=STN/gray Y=STN/yellow-green PLED/yellow-green C=color STN,OLED/RGB	B=STN/blue,OLED/blue F=FSTN T=TN
5	LCD Type	R=positive/reflective P=positive/transflective	M=positive/transmissive N=negative/transmissive
6	Backlight type/color	L=LED array/ yellow-green H=LED edge/white R=LED array/red G=LED edge/yellow-green F=RGB array I=RGB edge Q=LED edge/red N=No backlight	D=LED edge/blue E=EL/white B=EL/blue C=CCFL/white Y=LED Bottom/yellow O=LED array/orange K=LED edge/green A=LED edge/amber
7	CGRAM Font (applied only on character type)	J=English/Japanese Font E=English/European Font G=Chinese(simple) F=Chinese(traditional)	C=English/Cyrillic Font H=English/Hebrew Font A=English/Arabic Font
8	View Angle/ Operating Temperature	B=Bottom/Normal Temperature H=Bottom/Wide Temperature U=Bottom/Ultra wide Temperature	T=Top/Normal Temperature W=Top/Wide Temperature C=9H/Normal Temperature E=Top/ultra wide temperature
9	Special Code	3=3 volt logic power supply n=negative voltage for LCD c=cable/connector xxx=to be assigned on datasheet 87a= Controller IC=RAIO 8835	t=temperature compensation for LCD p=touch panel $=RoHS

2. Handling Instruction
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 on the surface of display area.

2.1.2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. 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 and never scrub hard.

2.1.3. Store the panel or module in a dark place where the temperature is 20℃±5℃ and the humidity is below 60% RH.

2.1.4. Keep LCD panels away from direct sunlight, also avoid them in high-temperature & high humidity environment for a long period.

2.1.5. Do not input any signal before power is turned on.

2.1.6. 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.

2.1.7. To control temperature and time of soldering is 320±10℃ and 3-5 sec.

2.1.8. EL manufactured from the organic film, and easily affected by temperature, humidity and other environmental impact. Long-term placement in a place will cause low quality of the case. Therefore, unpack the cartons and start the production with the LCM within three months after the reception of them.

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 is inductive to static, a relative humidity of 50-60% is recommended.

2.3 Operation Precautions:
2.3.1. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, 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. Driving voltage should be kept within specified range; excess voltage will shorten display life.

2.3.3. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of -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.

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 $^\circ$Cnormal operation temperature is 50,000hours. Estimator of L(10) is 5,268 hours. Remark: L(10) means accumulative defect rate equals 10% at the time of L(10).

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:

Loss of brightness at specific measured point: $\leqq$ 50%

Loss of brightness at specific measured point: $\leqq$ 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(W)x 109.0(H)x 11.0max(T)	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: RAIO8835

(3) Temperature Range

	Wide
Operating	-20 ~+70℃
Storage	-30 ~+80℃

4.Absolute Maximum Rating

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T_{OP}	-20	—	+70	℃
Storage Temperature	T_{ST}	-30	—	+80	℃
Input Voltage	V_I	-0.3	—	Vdd+0.3	V
Supply Voltage For Logic	Vdd-Vss	0.3	—	+7	V
Supply Voltage For LCD	Vdd-Vo	0.3	—	28	V

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℃	—	23.8	—	V
Input High Vol	V_{IH}	—	0.5Vdd	—	Vdd	V
Input Low Vol	V_{IL}	—	0	—	0.2Vdd	V
Output High Vol	V_{OH}	—	Vdd-0.4	—	—	V
Output Low Vol.	V_{OL}	—	—	—	0.4	V
Supply Current	Idd	Vdd=5V	—	100	110	mA
LCM Surface Luminance Ta=25℃	L	I_{LED}=160mA Display all OFF	65	97	—	cd/m^2
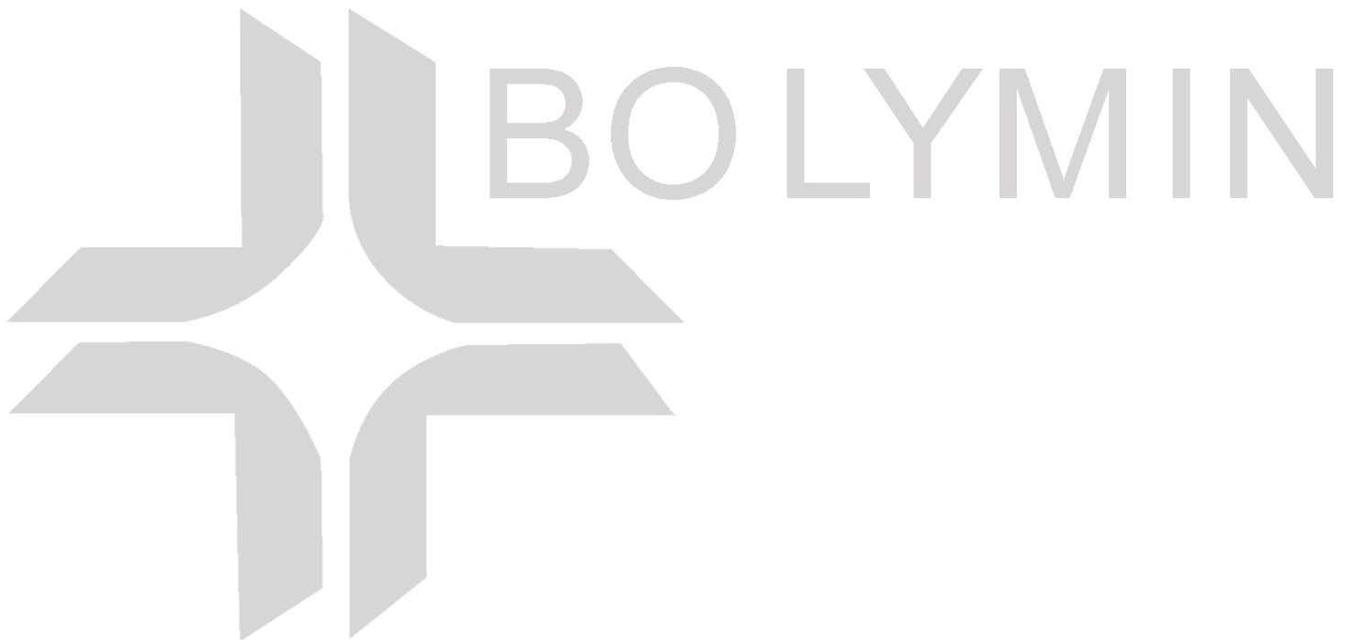
6.Optical Characteristics

a.FSTN

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View Angle	(V) θ	CR$\geq$3	10		60	deg
	(H) φ	CR$\geq$3	-45		45	deg
Contrast Ratio	CR	—		5		—
Response Time	T rise	—		200	400	ms
25℃	T fall	—		250	400	ms

Brightness(%)

B2

$$\text{Contrast Ratio} = \frac{\text{Brightness In Non - Select Signal}}{\text{Brightness In Select Signal}}$$

B1: Brightness In Select Signal
B2: Brightness In Non-Select Signal

B1

VOP   Driving Voltage(V)

Positive Type

Brightness(%)

B1

B2

VOP   Driving Voltage(V)

Negative Type

Brightness(%)   Select Signal   Non-Select Signal

100% 90%   10%

                                            100%

Tr   Tf

Rise Time   Fall Time   Time(ms)
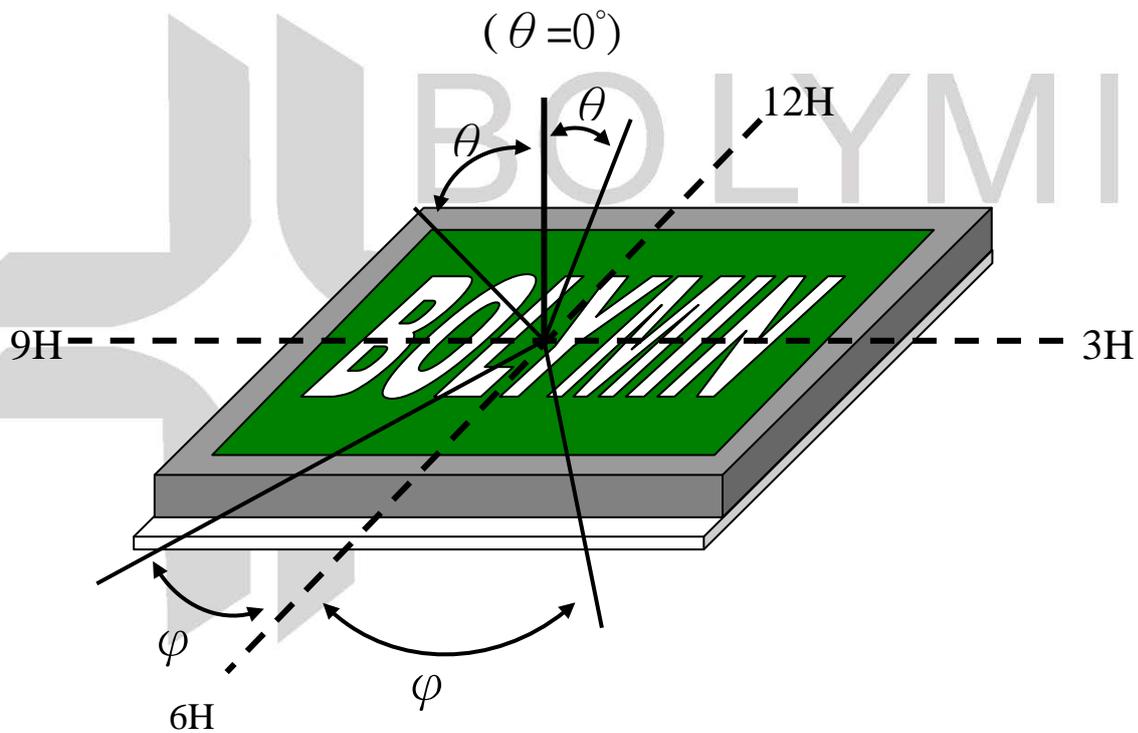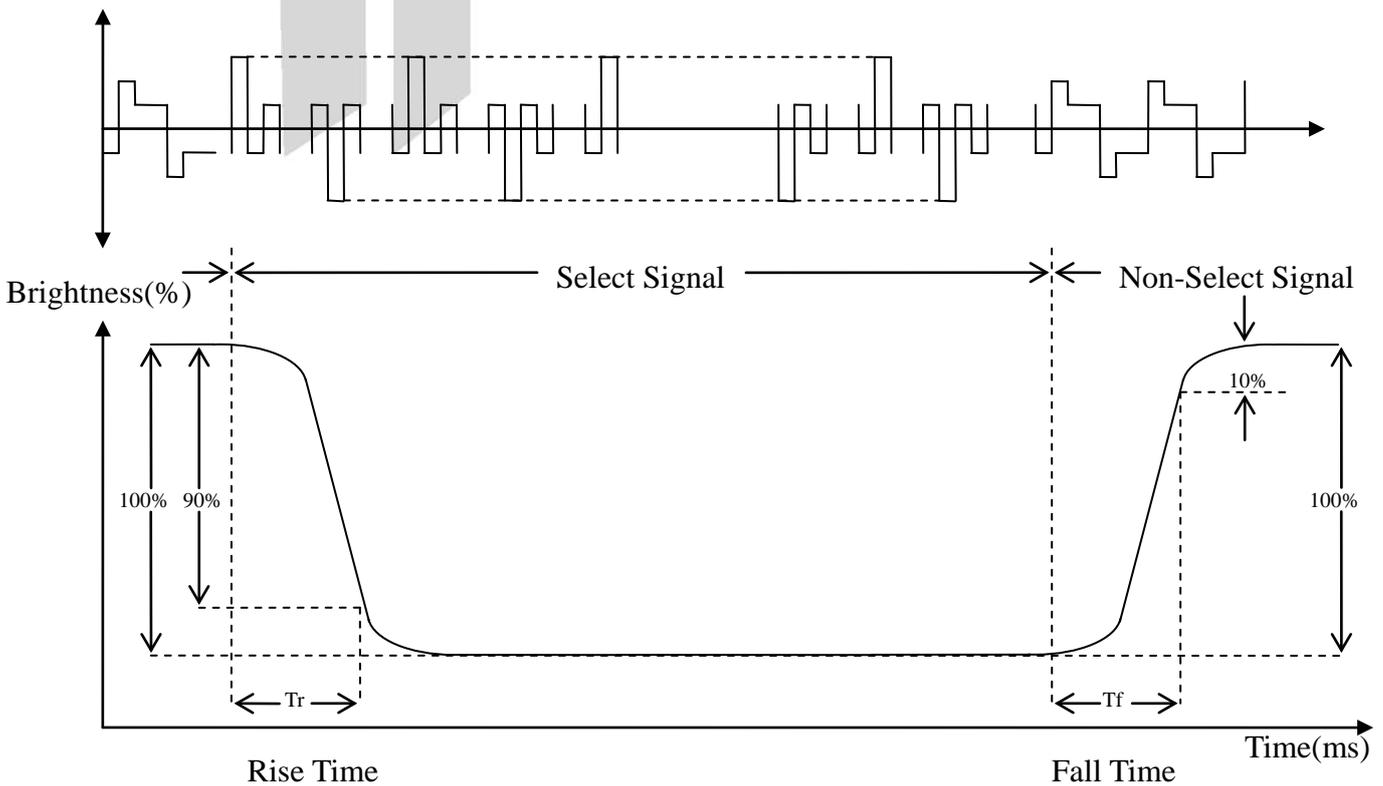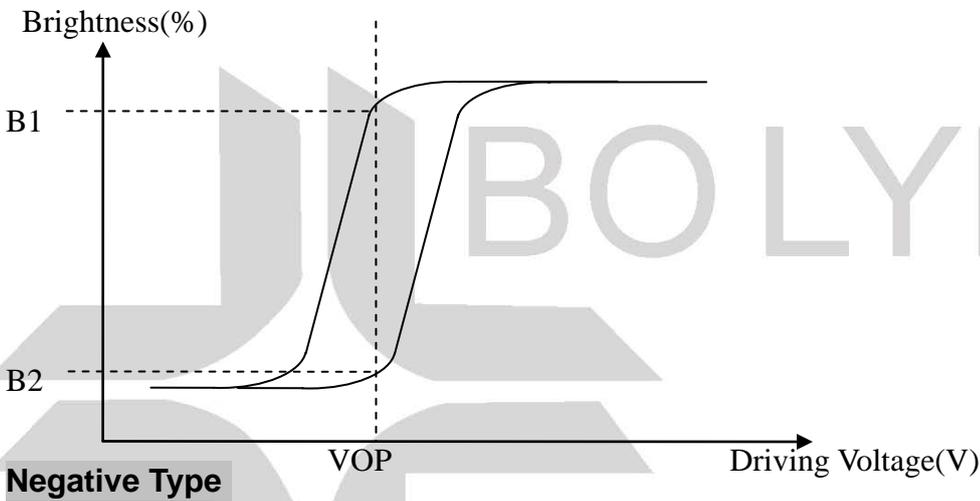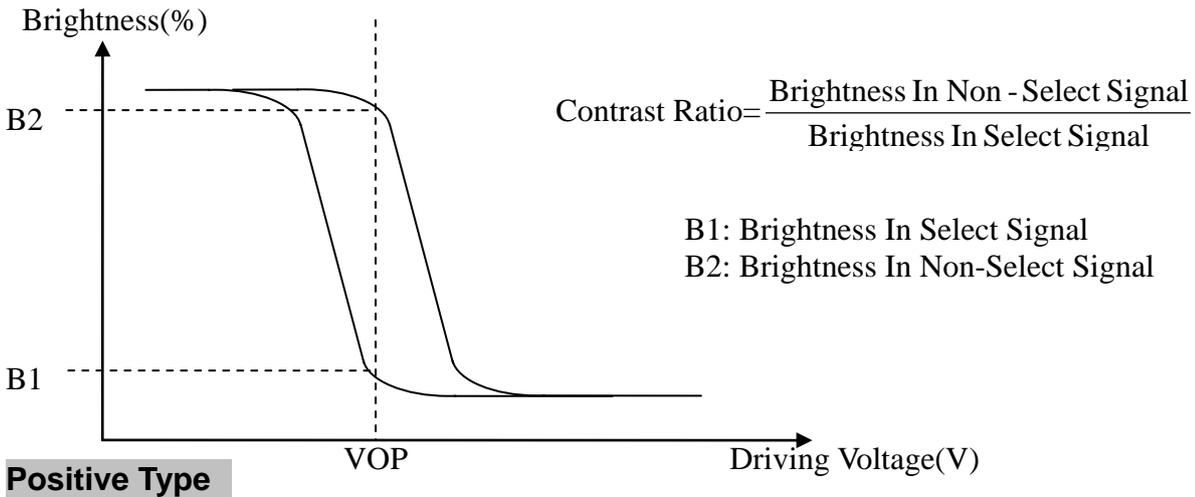
7.Interface Pin Function

Pin No.	Symbol	Level	Description
1	V$_{SS}$	0V	Ground
2	V$_{DD}$	5.0V	Power supply for Logic (option +3V)
3	V$_O$	(Variable)	Driving voltage for LCD
4	A0	H/L	RD=L WR=H ,A0=L :Data Read AO=H :Status read RD=H WR=L ,A0=L :Data Write AO=H :Command write
5	$\overline{WR}$	H/L	8080 family: Write signal, 6800 family: R/W signal
6	$\overline{RD}$	H/L	8080 family: Read signal, 6800 family: Enable clock
7~14	DB0~DB7	H/L	Data bus
15	$\overline{CS}$	H/L	Chip select , Active L
16	$\overline{RES}$	H/L	Controller reset signal, Active L
17	V$_{EE}$		Negative voltage output –21.3V (Optional)
18	SEL1		H:6800 ,L:8080
19	FGND		Frame Ground
20	NC		No connection

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

LCM operating on "DC 5V" input with built-in negative voltage
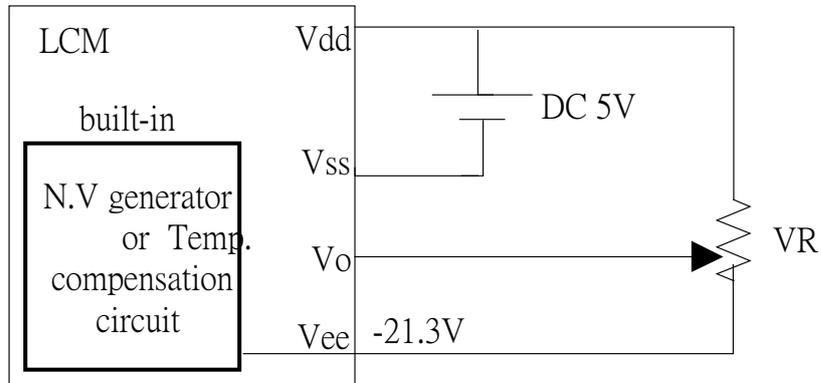
9.Backlight information

(1)LED edge / white

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	ILED	−	160	−	mA	V=3.5V
Supply Voltage	V	3.2	3.5	3.8	V	ILED=160mA
Reverse Voltage	VR	−	−	5	V	−
CIE	X	0.28	−	0.35	nm	ILED=160mA
	Y	0.28	−	0.35		
Color	white					

(2) Backlight driving methods

a. LED B/L drive from A.K directly
a.1 edge/white

LCM
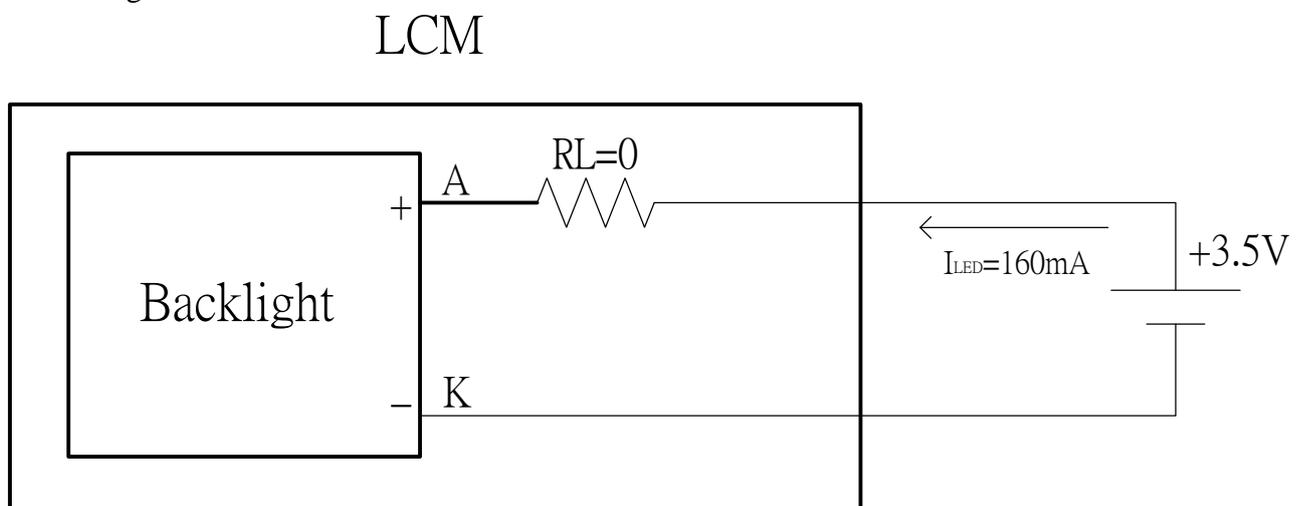
10. Quality Assurance

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.

10.2 Inspection Parameters

NO.	Parameter	Criteria			
1	Black or White spots	**Dimension \ Zone**	**Acceptable Number**	**Class Of Defects**	**Acceptable Level**
		$D \leq 0.10$	Disregard	Minor	2.5
		$0.10 < D \leq 0.2$	4		
		$0.2 < D \leq 0.3$	2		
		$0.3 < D$	0		
		D=(Long + 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.			

		Zone Dimension	Acceptable Number	Class Of Defects	Acceptable Level
3	Air Bubbles (between glass & polarizer)	D≦0.2	Disregard	Minor	2.5
		0.2＜D≦0.5	3		
		0.5＜D	0		

Total defects shall not excess 3/module.
Defect that is located at outside of AA and doesn't affect function is ignored.
Bobble is sawn only under reflection light is disregarded.

4	Displaying Pattern				

1. Incomplete or broken line is not allowed.
2. Pinholes

Dimension Φ(mm)	Criteria	Class Of Defects	Acceptable Level
Φ＜0.1	Disregard	Minor	2.5
0.1＜Φ≦0.2	2		
0.2＜Φ≦0.25	1		
0.25＜Φ	0		
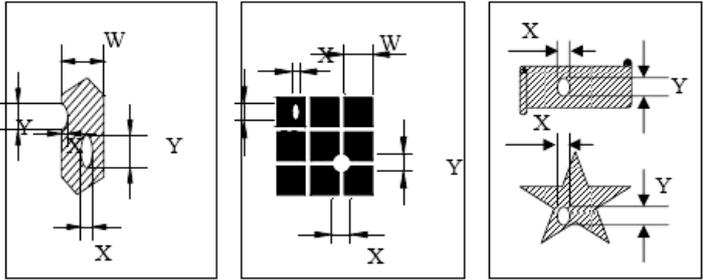
$$\varnothing = (X+Y)/2$$

3. Deformation

Dimension Φ(mm)	Criteria	Class Of Defects	Acceptable Level
Φ＜0.15	Disregard	Minor	2.5
Φ≦0.25 and X≦1/2D	3		
Φ＞0.25and X＞1/2D	0		

D：間距 $\varnothing = (X+Y)/2$

Other Inspection standard reference Bolymin standard.

11.Reliability
■Content of Reliability Test

No	Test Item	Content of Test	Test Condition	Applicable Standard
Environmental Test				
1	High Temperature storage	Endurance test applying the high storage temperature for a long time.	80℃ 168 hrs	――
2	Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-30℃ 168 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℃ 168 hrs	――
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	-20℃ 168 hrs	――
5	Humidity Test	Endurance test applying the high humidity storage for a long time.	40℃,90%RH 96 hrs	――
6	Temperature cycle (Non-operation)	Endurance test applying the low and high temperature cycle. -30℃ 80℃ ⟵————————⟶ 30min 30min 1 cycle	-30℃/ 80℃ 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	――

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

PIN NO.	SYMBOL
1	Vss
2	Vdd
3	Vo
4	A0
5	$\overline{WR}$
6	$\overline{RD}$
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	$\overline{CS}$
16	$\overline{RES}$
17	Vee
18	SEL1
19	FGND
20	NC

11.0MAX
6.5
1.0
200.0±10.0

LED(WHITE) B/L

200.0

CON2 20
1

20
1

160.0±0.5
152.0
141.0
122.0(VA)
115.18(AA)

320*240 Dots

160.0±0.5

Conduct on Buttom side (pitch 1.0mm FFC)

4-φ3.5

11.0
25.0
28.41

4.0
11.31
8.5
2.6
4.0

86.38(AA)
92.0(VA)
103.8
101.0
109.0±0.5

DOT SIZE
SCALE 10/1
0.34
0.34
0.36
0.36

寶麗明股份有限公司
BOLYMIN ,INC.

The non-specified tolerance of dimension is ±0.3 mm .

| SCALE: | 2/3 | REV: | 0 |
| UNIT: | mm | PAGE: | 1/1 |

MODEL | BG320240F
TITLE | LCM DRAWING
DWG NO.

APPROVE
CHECK
DRAW | Steven 2012.05.08

12.2 Block Diagram

12.3 Timing characteristics

a.8080 Family Interface Timing

Parameter	Condition	Symbol	Min	Max	Unit	Remark
Address Hold Time		tAH8	10		ns	A0,/CS
Address Setup Time		tAW8	0		ns	
System Cycle Time		tCYC	Note		ns	/WR,/RD
Strobe Pulse Width	CL=100 pF	tOC	150		ns	
Data Setup Time	VDD=2.7~4.5	tDS8	120		ns	DB0~DB7
Data Hold Time		tDH8	5		ns	
/RD Access Time		tACC8	-	80	ns	
Output Disable Time		tOH8	10	55	ns	

Note: For memory control and system control commands:
tCYC8=2tC+tOC+tCEA+75 > tACV +245
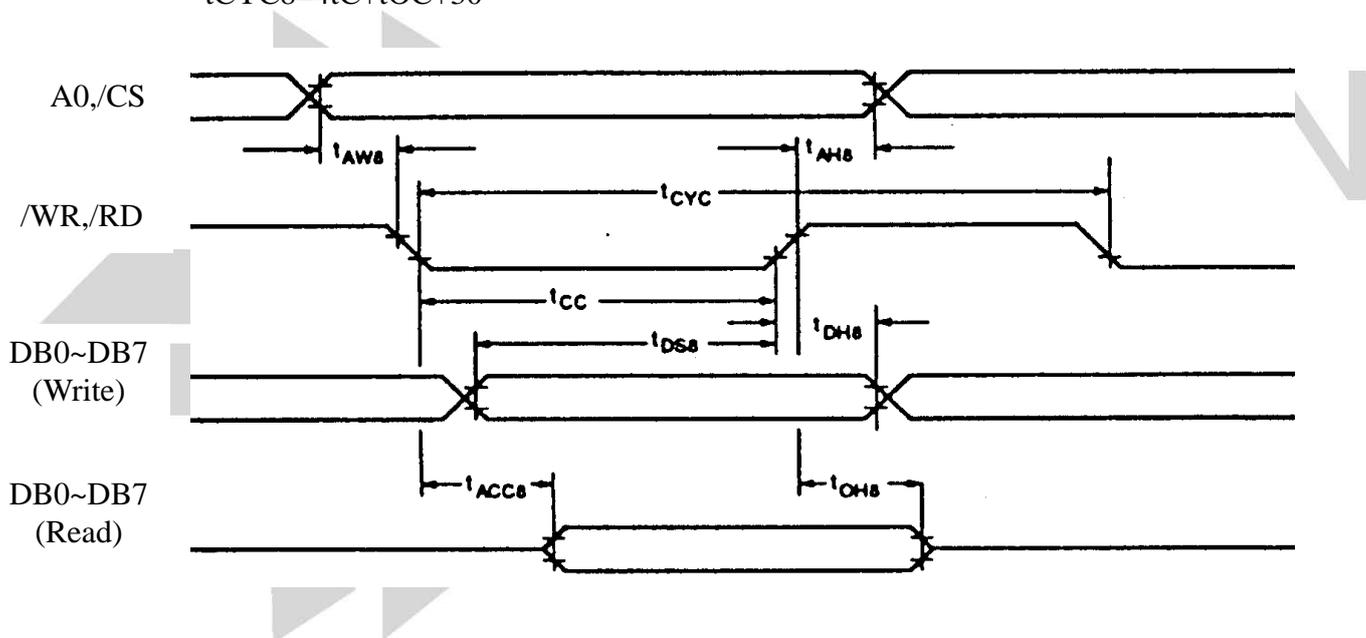For all other commands:
tCYC8=4tC+tOC+30

b. 6800 Family Interface Timing

Parameter	Condition	Symbol	Min	Max	Unit	Remark
System Cycle Time		tCYC6	Note		ns	A0,/CS, R/W
Address Setup Time		tAW6	10		ns	A0,/CS, R/W
Address Hold Time		tAH6	0		ns	A0,/CS, R/W
Data Setup Time	CL=100 pF VDD=2.7~4.5	tDS6	120		ns	DB0~DB7
Data Hold Time		tDH6	0		ns	DB0~DB7
Output Disable Time		tOH6	10	75	ns	DB0~DB7
Access Time		tACC6	-	130	ns	DB0~DB7
Enable Pulsewidth		tEW	150	-	ns	E

Note: For memory control and system control commands:
$$tCYC6 = 2tC + tEW + tCEA + 75 > tACV + 245$$
For all other commands:
$$tCYC6 = 4tC + tEW + 30$$
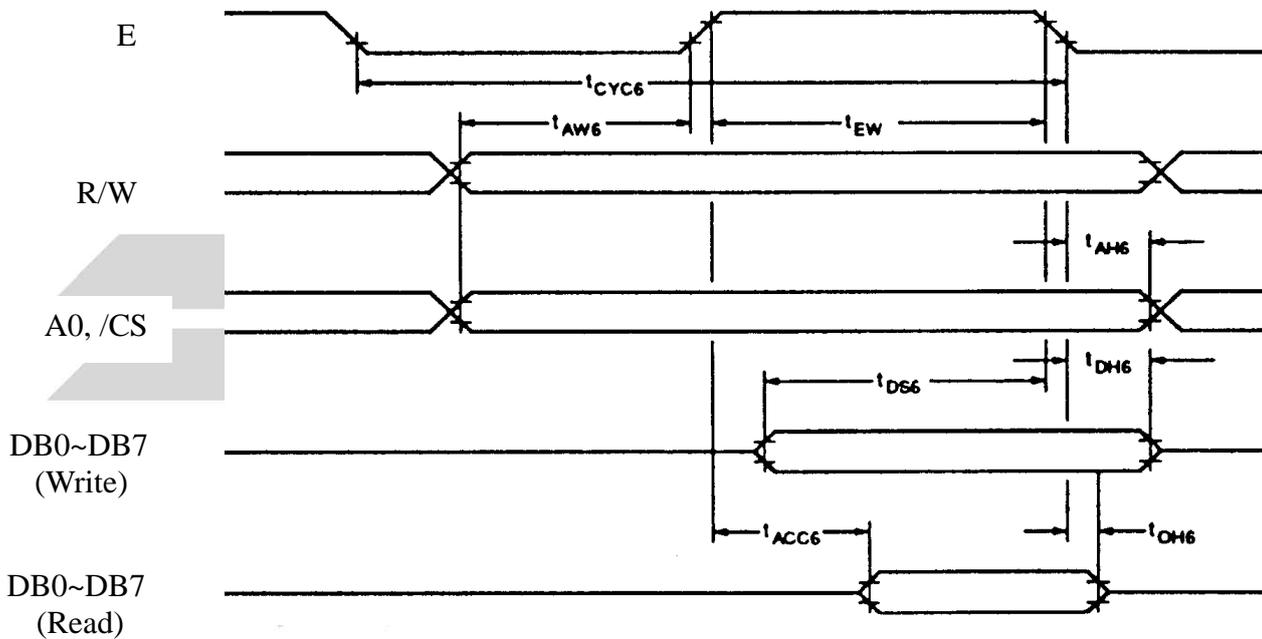
AC Electrical Characteristics

12.4 RAIO 8835A controller

Instruction Set

Class	Command	Code /RD	/WR	A0	D7	D6	D5	D4	D3	D2	D1	D0	Hex	Command Description	Command read parameters Number of bytes
System Control	SYSTEM SET	1	0	1	0	1	0	0	0	0	0	0	40	Initialized Device and display	8
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter Standby mode	0
Display Control	DISP ON/OFF	1	0	1	0	1	0	1	1	0	0	D	58, 59	Enable and disable display and display flashing	1
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	set Display start address and display regions	10
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor byte	2
	CGRAM ADDR.	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2
	CSRDIR	1	0	1	0	1	0	0	1	1	CD1	CD0	4C to 4F	Set direction of cursor movement	0
	HDOT SCR	1	0	1	0	1	0	1	1		1	0	5A	set horizontal scroll position	1
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	set display overlay format	1
Drawing Control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	set cursor address	2
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	read cursor address	2
Memory Control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	write to display memory	-
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	read from display memory	-

Note:

1. In general, the internal registers of the RAIO 8835A are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new command before all parameters have been input.   The internal registers for the parameters that have been input will have been changed but the remaining parameter registers are unchanged.

   2 bytes parameters(where two bytes are treated as 1 data item) are handled as following:

   a. CSRW, CSRR: Each byte is processed individually.   The microprocessor may read or write just the low byte of the cursor address.

   b. SYSTEM SET, SCROLL, CGRAM ADR. : Both parameter bytes are processed together.   If the command is changed after half of the parameter has been input, the single byte is ignored.

2. APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.

3. Please refer to RAIO 8835A LCD Controller Data Book for detail.