

MODEL NO. BP320240E2-FPHNHNP\$ VER.01



FOR MESSRS:

ON DATE OF:

APPROVED BY:

BOLYMIN, INC.

5F, No. 38, Keya Rd., Daya Dist., Central Taiwan Science Park, Taichung City, 42881, Taiwan. Web Site:<u>http://www.bolymin.com.tw</u> TEL:+886-4-25658689 FAX:+886-4-25658698

History of Version

Version	Contents	Date	Note
01	NEW VERSION	2019/11/29	SPEC.
			NI
		VII	

CONTENTS

- 1. Numbering System
- 2. Handling Instruction
- 3. General Specification
- 4. Absolute Maximum Rating
- 5. Electro-optical Characteristics
- 6. Block Diagram
- 7. Interface Pin Function
- 8. Power supply for LCD Module and LCD operating voltage adjustment

BOLYMIN

- 9. Backlight information
- 10. Quality Assurance
- 11. Reliability
- 12. Appendix (Drawing , Timing Characteristics)
 - 12-1 Drawing
 - 12-2 Timing characteristics
 - 12-3 Instruction Set



1. Numbering System

В	Р	320240	E2	_	F	Р	Н	Ν	Н	Ν	P\$	-
0	1	2	3		4	5	6	7	8	9	10	11

0	Bolymin	В				
	, ,	С	Character t	vpe	Р	TAB /TCP type
		F	COF type	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	R	Color STN
1	1 Module Type		Graphic type			OLED
		G O	COG type		L Z	Customize
		0				
			2004	20 character type,4I	ines	
2	Format		12232	122 × 32 dots		
3	Version No.	E2		I		
		В	STN / Blue	, OLED/Blue	н	HTN
		С	Color		Т	TN
		F	FSTN		Y	STN/Yellow-green
		G	STN/Grey		D	OLED/Blue+Yellow
4	LCD Color	А	OLED/Blue	+Yellow+Green	Е	OLED/Yellow
		L	OLED/Green		R	OLED/RED
		W	OLED/Whit	te	J	ASTN
		к	DFSTN		V	VA LCD
		R	Positive/ref	lective	М	Positive/ transmissive
5	LCD Type	Ρ	Positive/tra	nsflective	Ν	Negative/ transmissive
		Т	Negative/ t	ransflective		
		L	(LED)Array/ye	ellow-green	G	(LED)Edge/yellow-green
		М	(LED)Array/a		Н	(LED)Edge/white
		R	(LED)Array/re		D	(LED)Edge/blue
		U W	(LED)Array/bl		E	(EL)white
	Backlight 6 type/color		(LED)Array/w		В	(EL)blue
6			(CCFL) white		F	(LED)Array/RGB
		Y	(LED)Array/yellow		Ν	No backlight
		0	(LED)Array/oi	-	K	(LED)Edge/green
		Α	(LED)Edge/ar	mber	Q	(LED)Edge/red
		J	(LED)Array/gi	reen		(LED)Edge/RGB
		Ζ	(LED) arrayre	d/green	Р	(LED)Edge/orange

	_	-		-	
		S	(LED)edge/RGW	Т	(LED)edge red/green
		V	EL blue/green	Х	(LED) Edgewhite /red
		J	English/Japanese Font	С	English/Cyrillic Font
		G	Chinese(simple)	Н	English/Hebrew Font
		Е	English/European Font (ST7066U0B-BB)	S	English/European Font (ST7066U-0E-BB)
7	CGRAM Font	F	Chinese(traditional)	М	Japanese-Kanji
		Z	Z=Chinese(simple)+Chinese (traditional)+Japanese+Korean	К	Korean (only for BG16032A BG24064C)
		А	English/Arabic Font	D	Chinese (simple/traditional) English/Japanese
		В	English/Japanese/European	Ν	None
		В	Bottom/Normal Temperature06:00	w	Top/Wide Temperature 12:00
		Н	Bottom/Wide Temperature 06:00	Е	Top/Ultra Temperature 12:00
	View Angle /Operation	С	9H/Normal Temperature 09:00	U	Bottom/Ultra wide Temperature 06:00
8	Temperature	Т	Top/Normal Temperature 12:00	F	9H/Ultra wide Temperature 09:00
		G	3H/Wide Temperature 3:00	D	9H/Wide Temperature 09:00
		Т	3H/ Ultra Wide Temperature 3:00		
9	Special Code	N	Positive voltage for LCD	Т	Negative voltage and Temperature compensation for LCD
		Ρ	Touch panel	3/5	3/5 voltage logic power supply
10	RoHS	\$			
11	Customer Code				

BOLYMIN

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.

OLAWIN

- 2.1.3. Keep LCD panels away from direct sunlight. The storage environment should be dust-free, clean, dry, temperature is 25°C±10°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°C±10°C. Note: 2.1.7. is applied to EL backlight only.</p>

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°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.

OLYMIN

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)	85.0*99.3* 8.3 - LED B/L	mm
View area	81.8 (W) × 62.0 (H)	mm
Active area	76.78(W) × 57.58(H)	mm
Dot size	0.225(W) × 0.225(H)	mm
Dot pitch	$0.24(W) \times 0.24(H)$	mm

(2) Controller IC: RAIO 8835

4. Absolute Maximum Rating

4.1 Electrical Absolute Maximum Ratings

(Vss=0V, Ta=25°C)

Item	Symbol	Min	Тур	Max	Unit
Input Voltage	VI	-0.3	_	Vdd+0.3	v
Supply Voltage For Logic	Vdd-Vss	0.3	_	+7	v
Supply Voltage For LCD	VADJ-VSS	0.3	_	+5	V

4.2 Environmental Absolute Maximum Ratings

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

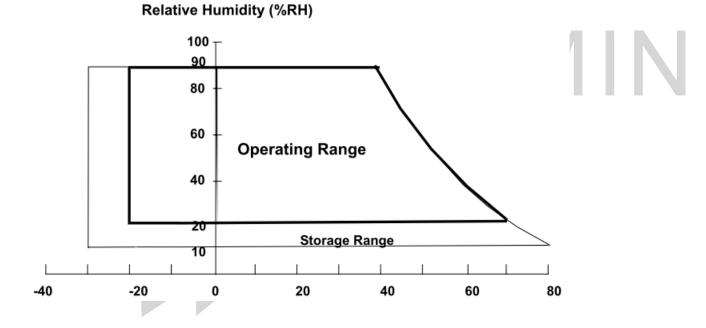
BOLYMIN

Note (1)

- (a) 90 %RH Max. (Ta <= 40 °C).
- (b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation.

Note (2) The temperature of panel surface should be -20 °C min. and 70 °C max.



5. Electro-optical Characteristics

Electronic Characteristics

Parameter	Symbol	Condition	Min	Тур	Max	Unit
Logic Circuit Supply Voltage	VDD-VSS	-	2.7	5	5.5	V
LCD Driving Voltage (25°C)	VADJ-VSS	25°C	-	0.5	-	V
	VIH	-	0.8 Vdd		Vdd	V
Input Voltage	VIL	-	Vss		0.2 Vdd	V
Logic Supply	ldd	Vdd = 5V	-	20	40	mA
LCM Surface Luminance Ta=25℃	L	I _{LED} =60mA Display all ON	15	30	_	cd/m ²

BOLYMIN

%Optimum LCD driving voltage value, referring to above mentioned range, is changed due to

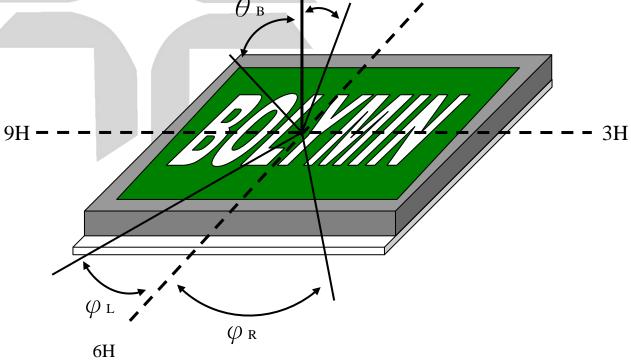
OLYMIN

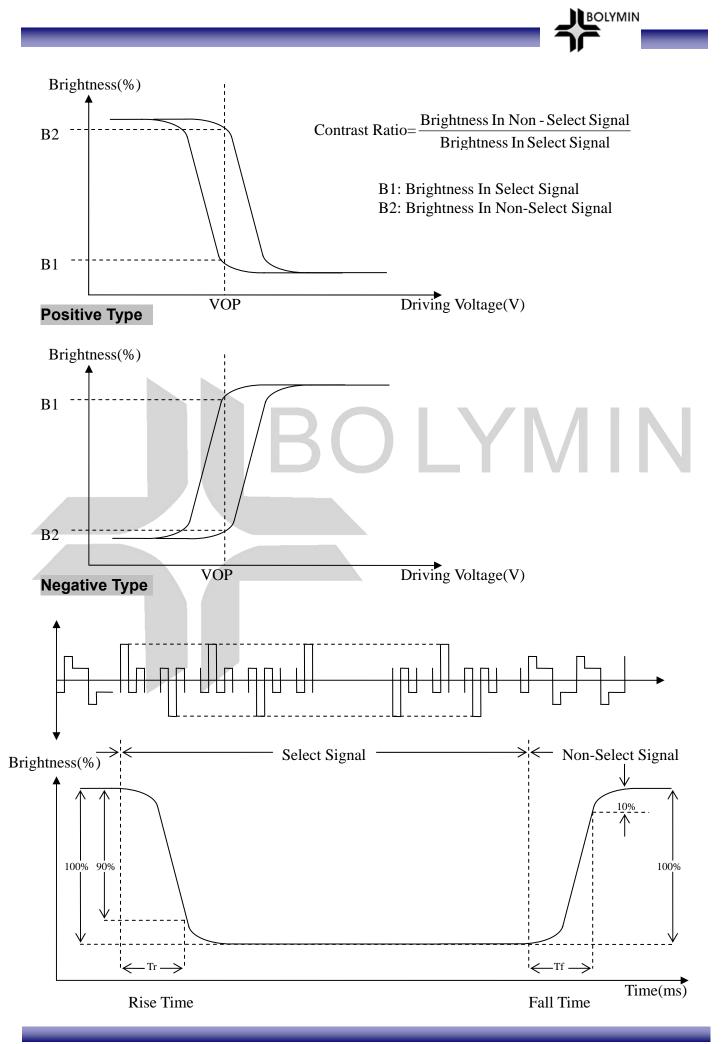
different batch of LCD glass.



Optical Characteristics

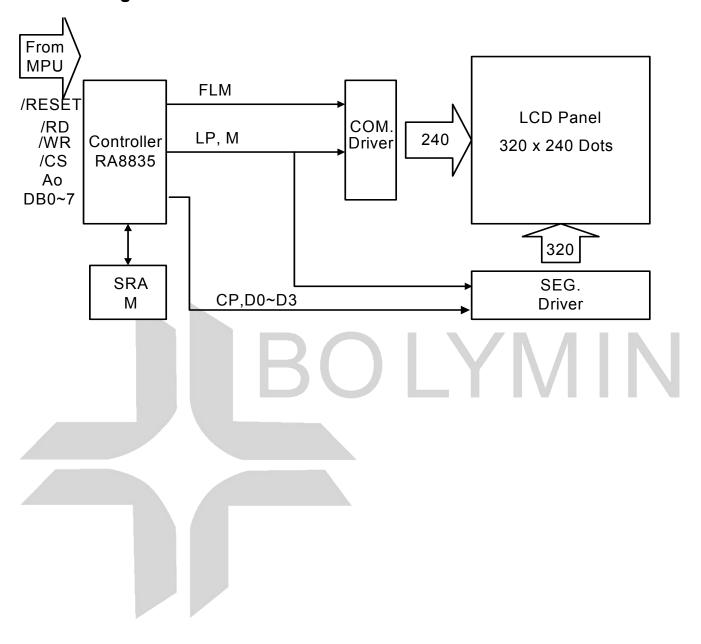
Parameter	Symbol	Condition	Min	Тур	Max	Unit
Contrast	CR	25°C	-	-	-	
Rise Time	Tr	25°C	-	200	400	ms
Fall Time	Tf	25°C	-	250	400	ms
	θF		-	45	-	
	θΒ	25°C &	-	47	-	
Viewing Angle Range	θL	CR≥2	-	40	-	Deg.
	θR		-	45	-	
Frame Frequency	fF	25°C	68	70	72	Hz
	E	$(\theta = 0^{\circ})$	LY	Ń		
	θ		121	ł		





BP320240E2-FPHNHNP\$ VER.01

6. Block Diagram



BOLYMIN

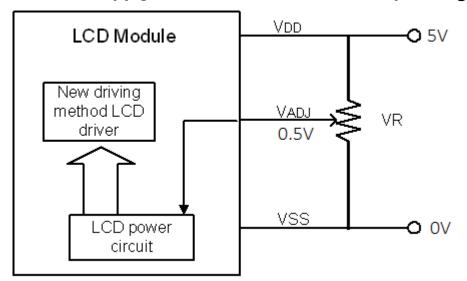


7. Interface Pin Function

PIN NO.	SIGNAL	LEVEL	FUNCTION
1	/RESET	H/L	Reset Signal
2	/RD	H/L	80 Series: Read Signal 68 Series: Enable Signal (E)
3	/WR	H/L	80 Series: Write Signal 68 Series: R/W Signal
4	/CS	H/L	Chip Select Signal
5	A0	H/L	Data Type Selection
6 ~ 13	DB0~DB7	H/L	Data Input (8 bits)
14	VCC	-	Power Supply for Logic
15	VSS	-	Power Supply (Ground : 0V)
16	Vadj	-	Contrast Adjustment Input
17	NC		No Connection
18*	X1	-	Touch Panel Left Signal in X Axis
19*	X2	-	Touch Panel Right Signal in X Axis
20*	Y1	-	Touch Panel Upper Signal in Y Axis
21*	Y2	-	Touch Panel Lower Signal in Y Axis
22*	INT	-	Interrupt
23	А		Power supply for LED backlight (+3.1V)
24	K		Power supply for LED backlight (Ground:0V)

18~22: SK, DO, DI, CS, INT for Touch Panel controller ADS7846 Input interface: 80 mode 8. Power supply for LCD Module and LCD operating voltage adjustment

BOLYMIN



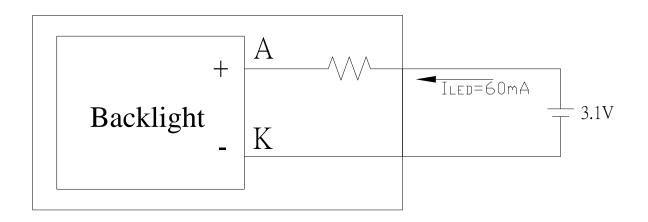
Note: VR = 20 K

9. Backlight information

9. Backlight in (1)LED edge / Whit			2($\mathbf{V}\mathbf{N}\mathbf{I}$	
Parameter	Symbol	Min	Тур	Max	Unit	Test Condition	
Supply Current	ILED	-	60	_	mA	V=3.1V	
Supply Voltage	V	2.9	3.1	3.3	V	ILED=60mA	
Reverse Voltage	VR	-	_	5	V		
CIE	X	0.27		0.31		ILED=60mA	
CIL	Y	0.27	_	0.31			
Color				Whit	e		

(2) Backlight driving methods

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



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.

BOLYMIN

- 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							
		Zone	Acceptable Number	Class Of Defects	Acceptable Level				
1	Black or White spots (Particle)	$ \begin{array}{c c} D \leq 0.10 \\ \hline 0.10 < D \leq 0.2 \\ \hline 0.2 < D \leq 0.3 \\ \hline 0.3 < D \end{array} $	Disregard 4 2 0	Minor	2.5	IN			
		Total defects sho	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 gnored.						
		Zone X(mm) Y(mm	Acceptab						
2	Scratch, Substances	$ \begin{array}{c c} - & 0.05 \ge \\ 4.0 \ge L & 0.05 \ge \\ 3.0 \ge L & 0.1 \ge 1 \end{array} $	W 4	d Minor	2.5				
	Substances	- 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)	Zone DimensionAcceptable NumberClass Of DefectsAcceptable Level $D \leq 0.2$ Disregard 0.2 < D ≤ 0.5 0 $0.2 < D \leq 0.5$ 3Minor2.5 $0.5 < D$ 00Total 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 $\Phi(mm)$ Criteria d < 0.1 Disregard $0.1 < \Phi \le 0.2$ 2 $0.2 < \Phi \le 0.25$ 1 $0.25 < \Phi$ 0 $1 < \Phi \le 0.25$ 1 $0.25 < \Phi$ 0 $1 = \frac{1}{\sqrt{x}}$ $1 = \frac{1}{\sqrt{x}}$ $1 = \frac{1}{\sqrt{x}}$ $1 = \frac{1}{\sqrt{x}}$ 0 = (x+Y)/2 3. Deformation Dimension $\Phi(mm)$ Criteria $\frac{1}{\sqrt{x}}$ $\frac{1}{\sqrt{x}}$ $\frac{1}{$
Othor	In an action ata	ndard reference Bolymin standard

BOLYMIN

Other Inspection standard reference Bolymin standard.



■Content of Reliability Test

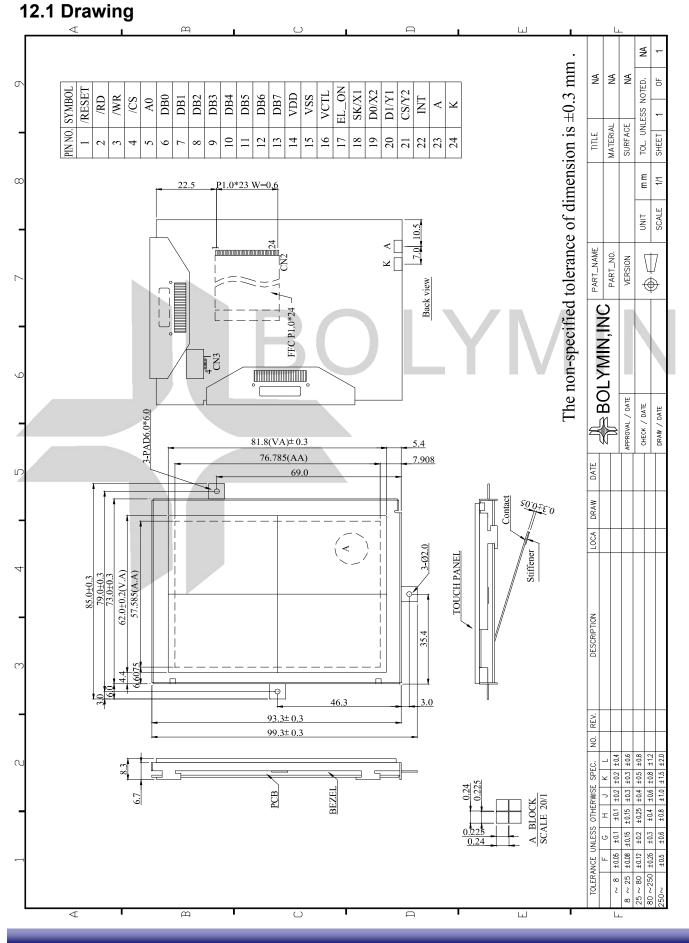
Environmental Test										
No	Test Item	Content of Test	Test Condition	Applicable Standard						
1	High Temperature storage	Endurance test applying the high storage temperature for a long time.	80°C 96 hrs							
2	Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-30℃ 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℃ 96 hrs							
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.								
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℃ 80℃	-30℃/80℃ 10 cycles							
		30min 30min 1 cycle								
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							

BOLYMIN

%Assess after placing at normal temperature and humidity for 4 hour \circ No abnormalities in functions and appearance \circ

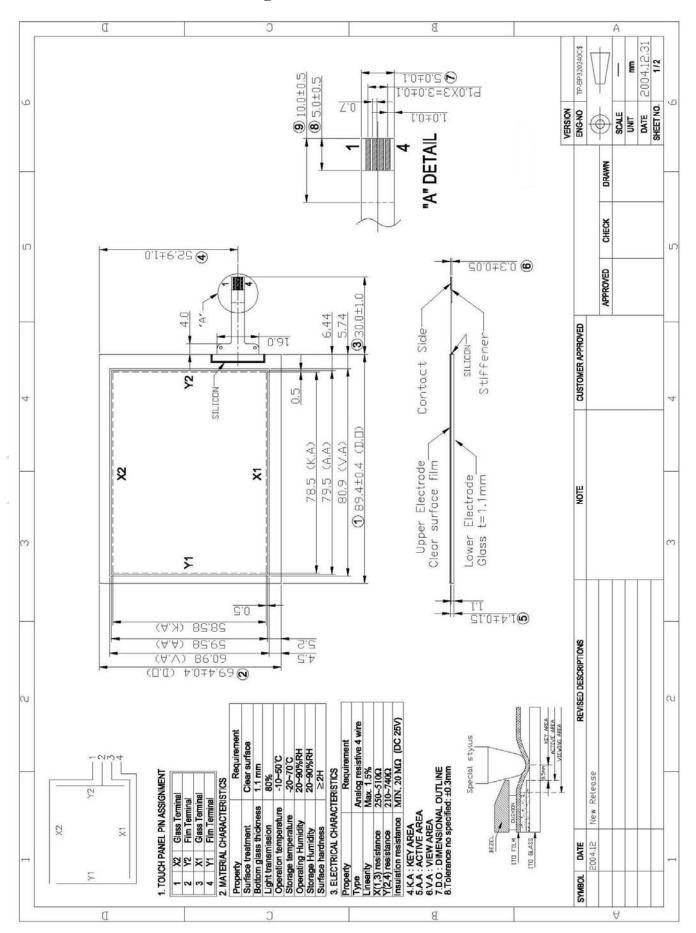
12. Appendix (Drawing , Touch panel Information, Timing Characteristics Instruction Set)

BOLYMIN



- 19 -

12.1.2 Touch Panel Drawing



BOLYMIN

12.2 Timing characteristics

8080 Family Interface	Fiming					
Parameter	Condition	Symbol	Min	Max	Unit	Remark
Address Hold Time		tAH8	10		ns	A0,/CS
Address Setup Time		tAW8	0		ns	A0,/C5
System Cycle Time		tCYC	Note		ns	/WR,/RD
Strobe Pulse Width	CL=100 pF	tOC	150		ns	/ W K,/ KD
Data Setup Time	VDD=2.7~4.5	tDS8	120		ns	
Data Hold Time		tDH8	5		ns	DB0~DB7
/RD Access Time		tACC8	-	80	ns	
Output Disable Time		tOH8	10	55	ns	

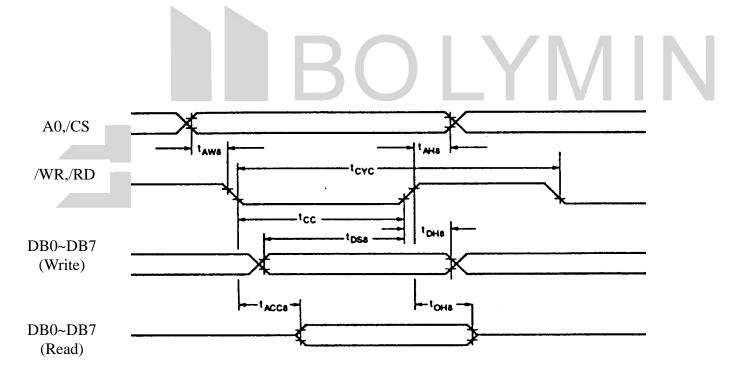
BOLYMIN

Note: For memory control and system control commands:

tCYC8=2tC+tOC+tCEA+75 > tACV + 245

For all other commands:

tCYC8=4tC+tOC+30





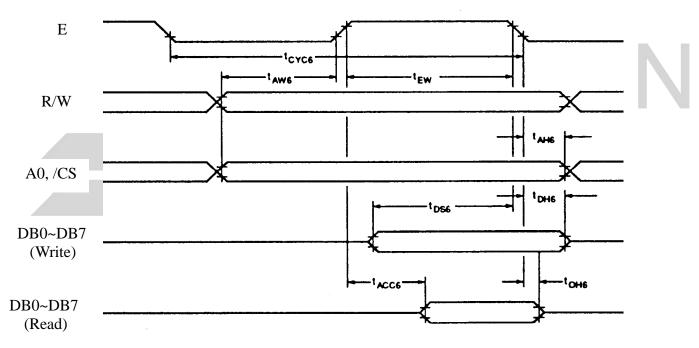
6800 Family Interface Timing

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



12.3 Instruction Set

Class	Command	Code											Hex		Command read parameters	
Class		/RD	/W R	A0	D7	D6	D5	D4	D3	D2	D1	D0	пех	Command Description	Number of bytes	
System	SYSTEM SET	1	0	1	0	1	0	0	0	0	0	0	40	Initialized Device and display	8	
Control	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter Standby mode	0	
	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	
Display Control	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	CD 1	CD 0	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	
Drawin	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	set cursor address	2	
g Control	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	read cursor address	2	
Memor	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	write to display memory	-	
y Control	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 RA8835 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 RA8835 LCD Controller Data Book for detail.