

BOLYMIN

**SPECIFICATIONS FOR
LCD MODULE**

MODEL NO.
BP160160B~87a series
VER.02

FOR MESSRS:

ON DATE OF:

APPROVED BY:

BOLYMIN, INC.
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History of Version

| Version | Contents | Date | Note |
|---------|------------------------------------|------------|-------|
| 01 | NEW VERSION | 2007/10/08 | SPEC. |
| 02 | ADD LED BLUE BACKLIGHT INFORMATION | 2008/03/11 | |
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C O N T E N T S

1. Numbering System
2. General Specification
3. Absolute Maximum Rating
4. Electrical Characteristics
5. Optical Characteristics
6. Interface Pin Function
7. Outline Drawing
8. Timing Characteristics
9. Instruction Set
10. Power supply for LCD Module and LCD operating voltage adjustment
11. Block Diagram
12. Backlight information
13. Touch panel Information
14. Quality Assurance
15. Reliability

1. Numbering System

| | | | | | | | | | |
|-----------------|-----------------|----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------------------|
| <u>B</u> | <u>P</u> | <u>160160</u> | <u>B</u> | <u>F</u> | <u>P</u> | <u>E</u> | <u>:</u> | <u>B</u> | <u>xxx</u> |
| 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 |
| 2 | Format | 2002=20 characters, 4 lines 12232= 122 x 32 dots |
| 3 | Version No. | A type |
| 4 | LCD Color | G=STN/gray Y=STN/yellow-green C=color STN B=STN/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=LEDEdge/yellow-green F=RGB D=LED edge/blue E=EL/white B=EL/blue C=CCFL/white Y=LED Bottom/yellow O=LED array/orangr K=LED edge/green |
| 7 | CGRAM Font (applied only on character type) | J=English/Japanese Font E=English/European Font C=English/Cyrillic Font H=English/Hebrew 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 |
| 9 | Special Code | 3=3 volt logic power supply n=negative voltage for LCD c=cable/connector xxx=to be assigned on data sheet t=temperature compensation for LCD p=touch panel |

2. General Specification

(1) Mechanical Dimension

| Item | Standard Value | Unit |
|-------------------|--|------|
| Number of dots | 160x160 | dots |
| Outline dimension | 69.0(W)x 69.5(H)x 5.5max(T) 69.0(W)x 69.5(H)x 8.5max(T)-LED | mm |
| View area | 60.1(W)x 60.0(H) | mm |
| Active area | 55.985(W)x 55.985(H) | mm |
| Dot size | 0.335(W)x 0.335(H) | mm |
| Dot pitch | 0.35(W)x 0.35(H) | mm |

(2) Controller IC: RAIO RA8835

(3) Temperature Range

| | Normal | Wide |
|-----------|-------------|------------|
| Operating | 0 ~+50°C | -20 ~+70°C |
| Storage | -10 ~+ 60°C | -30 ~+80°C |

(4) Polarizer

FSTN / black / Negative : Anti-glare Polarizer

3. Absolute Maximum Ratings

| Item | Symbol | Min | Typ | Max | Unit |
|--------------------------|----------------------------------|-----|-----|-----------------|------|
| Operating Temperature | T _{OP} | -20 | - | +70 | °C |
| Storage Temperature | T _{ST} | -30 | - | +80 | °C |
| Input Voltage | V _I | 0 | - | V _{DD} | V |
| Supply Voltage For Logic | V _{DD} | 0 | - | 6.5 | V |
| Supply Voltage For LCD | V _{DD} -V _{EE} | 0 | - | 32 | V |

4. Electrical Characteristics

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------------------|------------------|-----------|--------------|------|-------------|------|
| Logic Voltage | $V_{DD}-V_{SS}$ | — | 3.0 | 5.0 | 5.5 | V |
| Supply Voltage For LCD | $V_{ADJ}-V_{SS}$ | Ta=-20°C | - | 18.5 | - | V |
| | | Ta=25°C | - | 17.0 | - | V |
| | | Ta=+70°C | - | 15.5 | - | V |
| Input High Volt. | V_{IH} | - | $0.8V_{DD}$ | - | V_{DD} | V |
| Input Low Volt. | V_{IL} | - | 0 | - | $0.2V_{DD}$ | V |
| Output High Volt. | V_{OH} | - | $V_{DD}-0.4$ | - | - | V |
| Output Low Volt. | V_{OL} | - | - | - | 0.4 | V |
| Supply Current(EL ON) | I_{DD} | - | - | - | 100 | mA |
| | I_{EE} | - | - | - | 1.0 | mA |

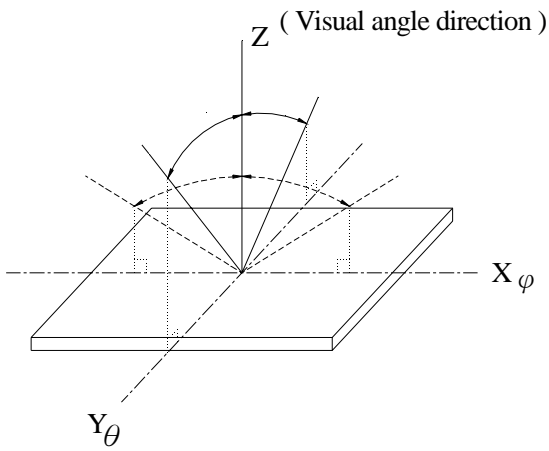
5. Optical Characteristics

FSTN

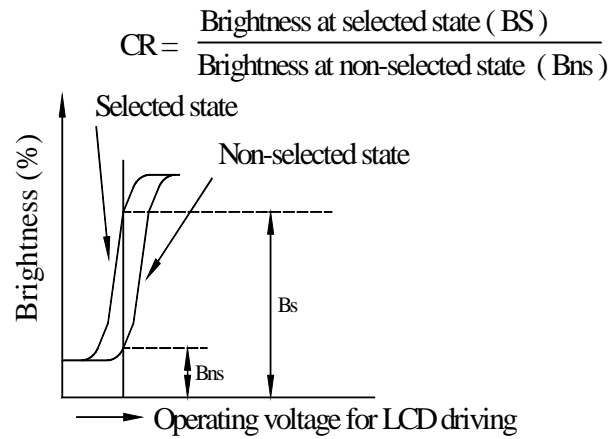
| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--------------------|---------------|-------------|------|------|------|------|
| View Angle | (V) θ | $CR \geq 3$ | 10 | | 60 | deg |
| | (H) φ | $CR \geq 3$ | -45 | | 45 | deg |
| Contrast Ratio | CR | — | | 5 | | — |
| Response Time 25°C | T rise | — | | 100 | 150 | ms |
| | T fall | — | | 150 | 200 | ms |

5.1 Definitions

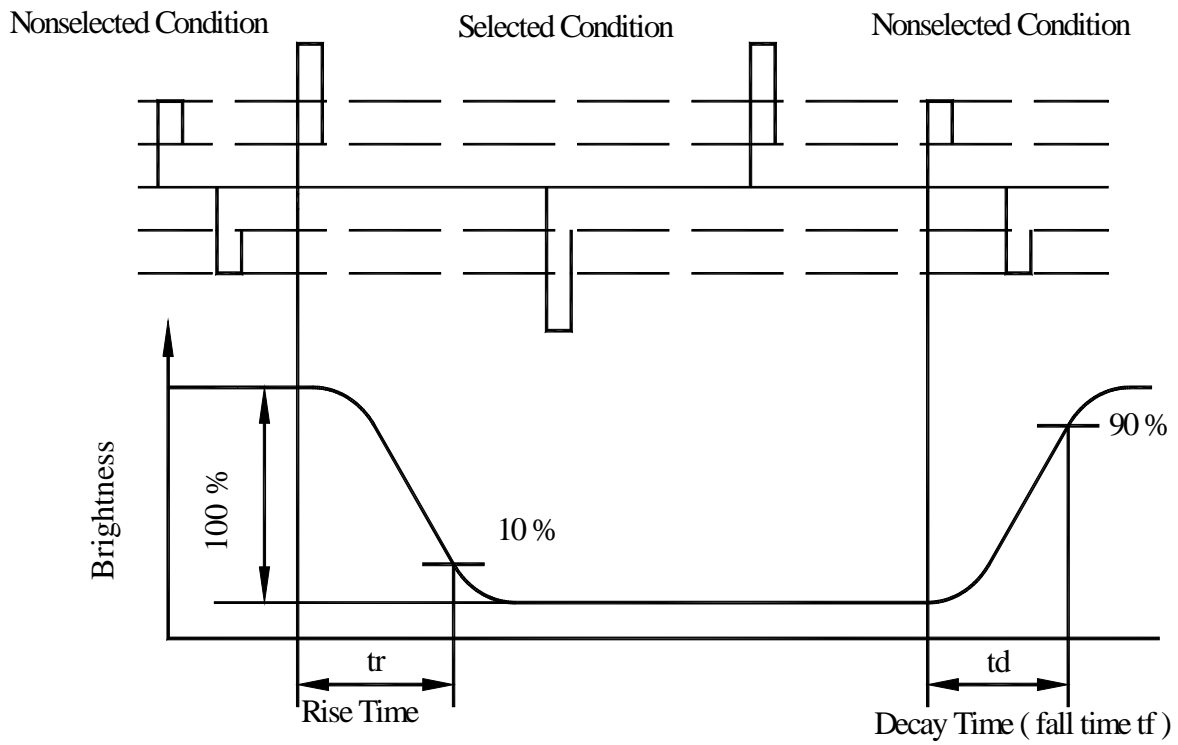
■ View Angles



■ Contrast Ratio



■ Response time



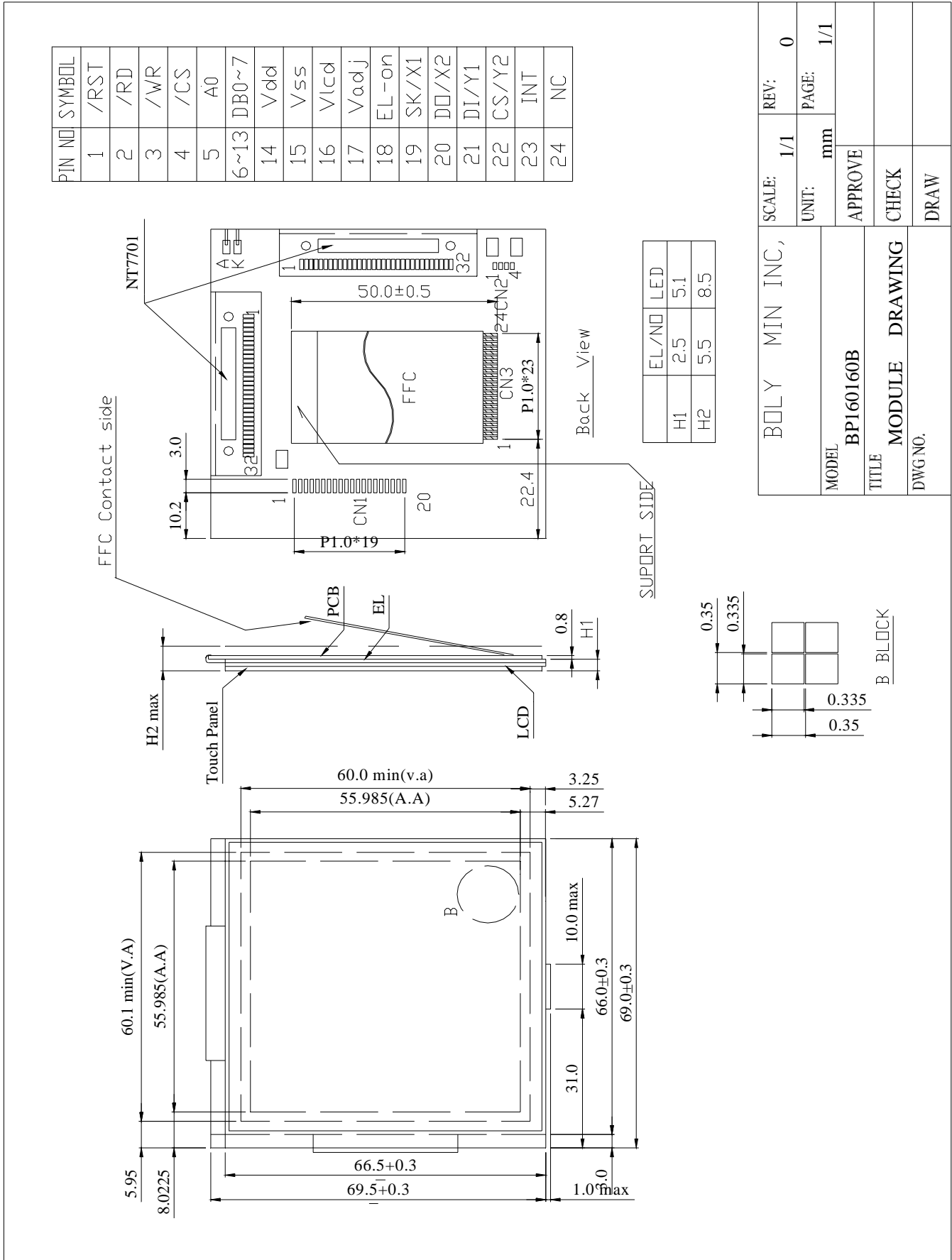
6. Interface Description

| Pin No. | Symbol | Level | Description |
|---------|-------------------------|------------|---|
| 1 | $\overline{\text{RES}}$ | H/L | Controller reset signal, Active L |
| 2 | RD | H/L | 8080 family: Read signal, 6800 family: Enable clock |
| 3 | WR | H/L | 8080 family: Write signal, 6800 family: R/W signal |
| 4 | CS | H/L | Chip select , Active L |
| 5 | 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 |
| 6~13 | DB0~DB7 | H/L | Data bus |
| 14 | V _{DD} | 5.0V | Power supply for Logic (option +3V) |
| 15 | VSS | 0V | Logic Ground |
| 16 | VLCD | 25V | Positive voltage output |
| 17 | VADJ | (Variable) | Driving voltage for LCD |
| 18 | EL-ON | H/L | H:EL(LED) backlight on |
| 19 | SK/X1 | - | Serial clock/Right signal in X axis (For touch panel) |
| 20 | DO/X2 | - | Data output / Left signal in X axis (For touch panel) |
| 21 | DI/Y1 | - | Data input / Upper signal in Y axis (For touch panel) |
| 22 | CS/Y2 | - | Chip select / Lower signal in Y axis (For touch panel) |
| 23 | INT | - | Interrupt for touch panel controller |
| 24 | NV | - | - |

* SK,DO,DI,CS,INT are for touch panel controller IC built in.

* X1,X2,Y1,Y2 are for touch panel only.

7. Outline drawing



8. Timing Characteristics

8.1 8080 Family Interface Timing

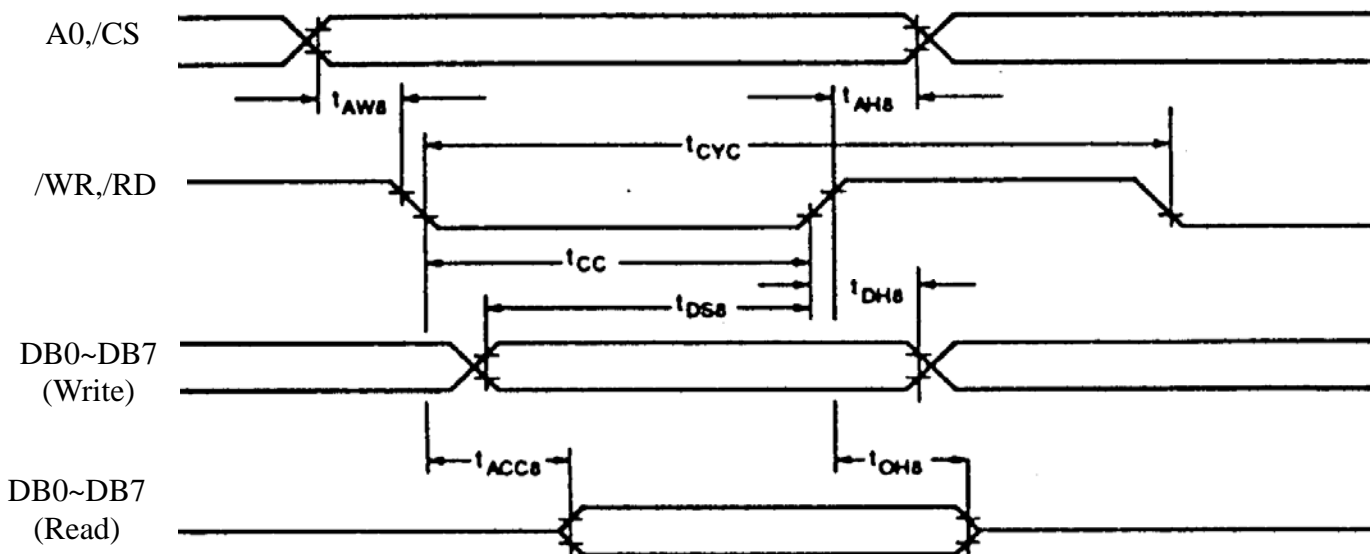
| Parameter | Condition | Symbol | Min | Max | Unit | Remark |
|---------------------|--------------------------|--------|------|-----|------|---------|
| Address Hold Time | CL=100 pF VDD=2.7~4.5 | tAH8 | 10 | - | ns | A0,/CS |
| Address Setup Time | | tAW8 | 0 | - | ns | |
| System Cycle Time | | tCYC | Note | - | ns | /WR,/RD |
| Strobe Pulse Width | | tOC | 150 | - | ns | |
| Data Setup Time | | 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:

$$tCYC8=4tC+tOC+30$$



8.2 6800 Family Interface Timing

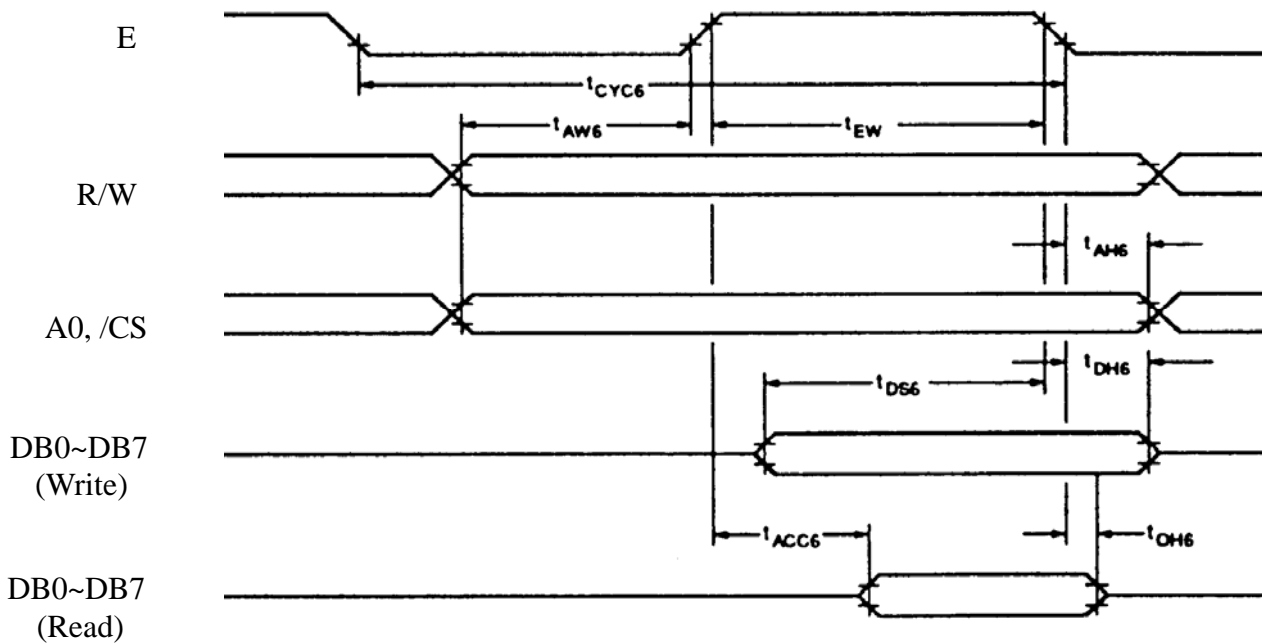
| Parameter | Condition | Symbol | Min | Max | Unit | Remark |
|---------------------|--------------------------|--------|------|-----|------|----------------|
| System Cycle Time | CL=100 pF VDD=2.7~4.5 | tCYC6 | Note | - | ns | A0,/CS, R/W |
| Address Setup Time | | tAW6 | 10 | - | ns | |
| Address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

$$t_{CYC6} = 2t_C + t_{EW} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC6} = 4t_C + t_{EW} + 30$$



AC Electrical Characteristics

9 Instruction Set

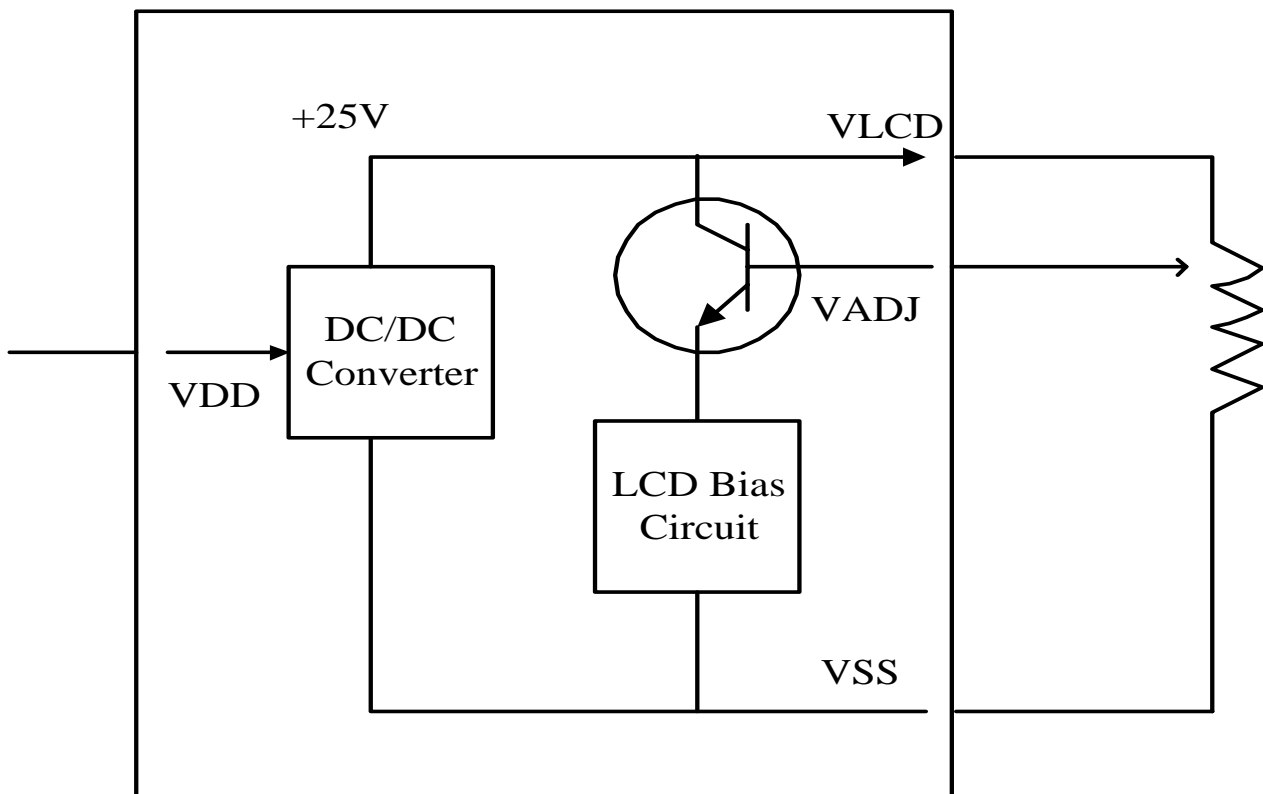
| Class | Command | Code | | | | | | | | | | | Hex | Command Description | Command read parameters | | |
|-----------------|-------------|------|-----|----|----|----|----|----|----|----|----|----|----------|---|--------------------------------|---------|-------|
| | | /RD | /WR | A0 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | | | Number of byters | Section | |
| System Control | SYSTEM SET | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | Initialized Device and display | 8 | 8.2.1 |
| | SLEEP IN | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 53 | Enter Standby mode | 0 | 8.2.2 | |
| 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 | 8.3.1 | |
| | SCROLL | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 44 | set Display start address and display regions | 10 | 8.3.2 | |
| | CSRFORM | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 5D | Set cursor byte | 2 | 8.3.3 | |
| | CGRAM ADDR. | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 5C | Set start address of character generator RAM | 2 | 8.3.6 | |
| | CSRDIR | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | CD | CD | 4C to 4F | Set direction of cursor movement | 0 | 8.3.4 | |
| | HDOT SCR | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | | 1 | 0 | 5A | set horizontal scroll position | 1 | 8.3.7 | |
| | OVLAY | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 5B | set display overlay format | 1 | 8.3.5 | |
| Drawing Control | CSRW | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 46 | set cursor address | 2 | 8.4.1 | |
| | CSRR | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 47 | read cursor address | 2 | 8.4.2 | |
| Memory Control | MWRITE | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 42 | write to display memory | - | 8.5.1 | |
| | MREAD | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 43 | read from display memory | - | 8.5.2 | |

Note:

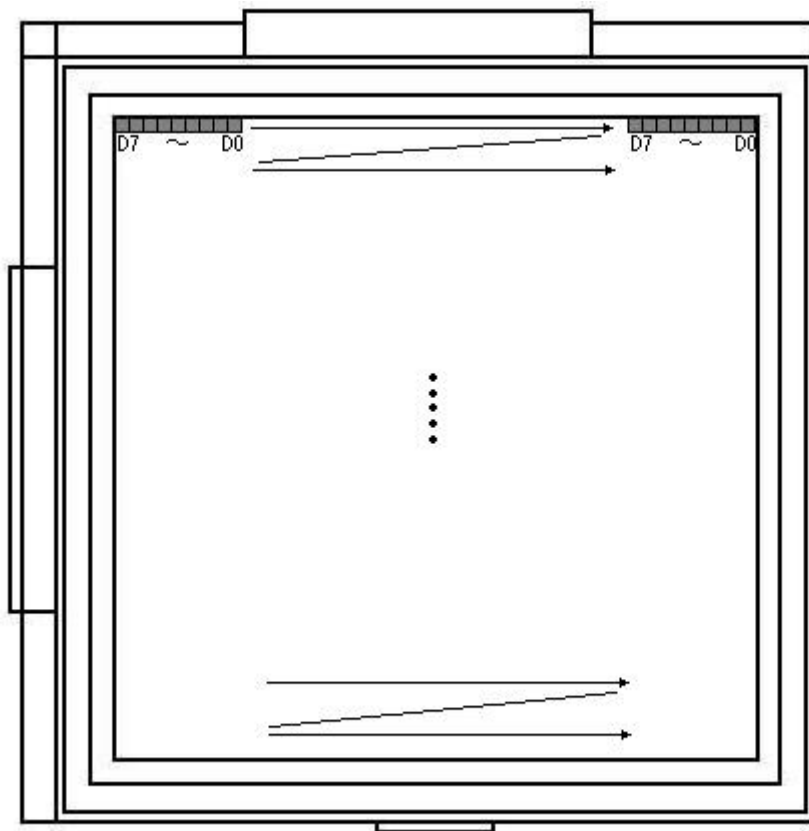
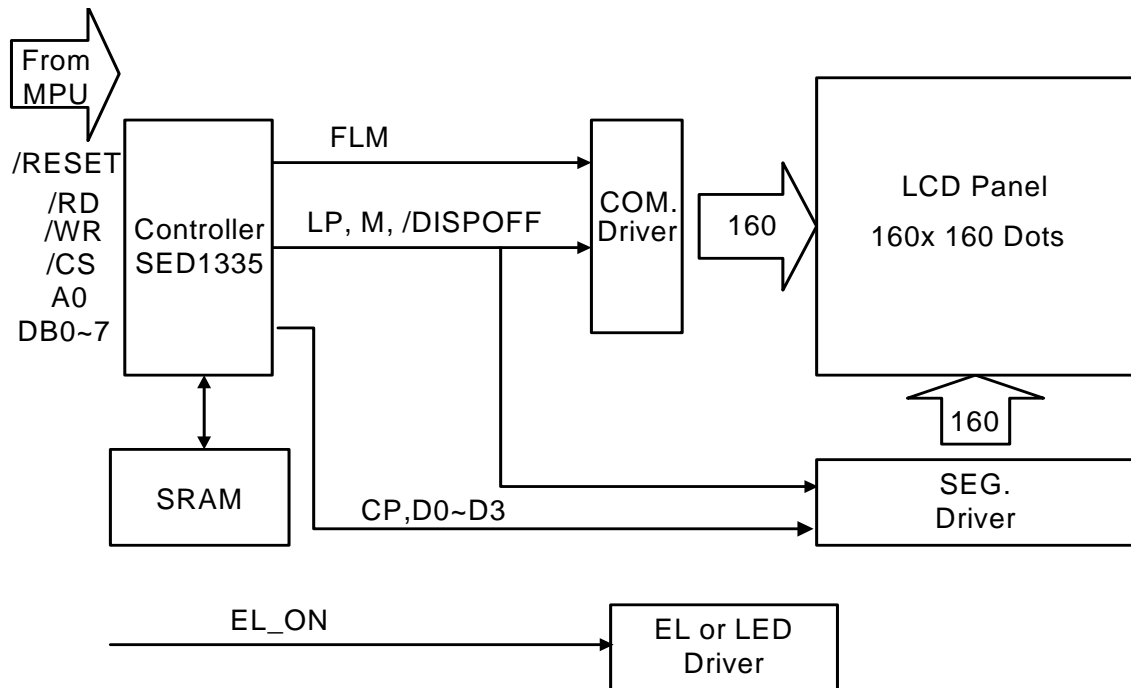
- In general, the internal registers of the RA8835 are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new command before all parameters have been input. The internal registers for the parameters that have been 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:
 - CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.
 - 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.
- APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.
- Please refer to SED1335F LCD Controller Data Book for detail.

10. Power Supply for LCD Module and LCD Operating Voltage a Adjustment

LCM operating on " DC 3V or 5V " input with built-in positive voltage.



11. Block Diagram



12. Backlight Information

EL / white

| Parameter | Symbol | Min | Typ | Max | Unit | Test Condition |
|--------------------------|--------------------|-----|----------|-----|------|-------------------|
| Voltage | Vrms | - | 110 (AC) | - | - | - |
| Frequency | HZ | - | 400 | - | - | - |
| Brightness* | cd/m ² | 48 | 60 | - | - | 110Vrms 1000Hz |
| CIE Chromaticity Diagram | X | - | 0.330 | | - | |
| | Y | - | 0.335 | | - | |
| Current Dissipation | mA/cm ² | - | 1.33 | | - | |
| Power Dissipation | mW/cm ² | - | 26.29 | - | - | |
| Color | white | | | | | |

- With EL backlight drive circuit built in,
- Input 5Vdc on Interface pin18(EL-ON), the EL backlight will be light on.

LED edge/white

| PARAMETER | Symbol | Condition | Min | Typ | Max | Unit | Note |
|------------------------|--------|-----------|-----|-----|-----|-------------------|----------------|
| Forward Voltage | VF | - | - | 3.2 | 3.4 | V | Supply Voltage |
| Forward Current | IF | VF=3.2V | - | 60 | - | mA | - |
| LCM Luminous intensity | | VF=3.2V | - | 80 | - | cd/m ² | - |
| Color | White | | | | | | |

- Input 5Vdc on Interface pin18(EL-ON), the LED backlight will be light on.

LED edge/Blue

| PARAMETER | Symbol | Condition | Min | Typ | Max | Unit | Note |
|------------------------|--------|-----------|-----|-----|-----|-------------------|----------------|
| Forward Voltage | VF | - | - | 3.2 | - | V | Supply Voltage |
| Forward Current | IF | VF=3.2V | - | 100 | - | mA | - |
| LCM Luminous intensity | | VF=3.2V | - | 15 | - | cd/m ² | - |
| Color | Blue | | | | | | |

- **Input 5Vdc on Interface pin18(EL-ON), the LED backlight will be light on.**

13.Touch panel Information

As shown on TPBP160160B touch panel spec.

Touch panel controller IC information shown onADS7846 spec.

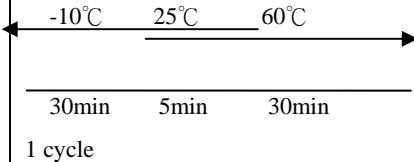
14. Quality Assurance

◆ Screen Cosmetic Criteria

| No. | Defect | Judgement Criterion | Partition | | | | | | | | | | | | | | | | | | | | |
|--------------------|-------------------------------|--|------------|-------------------------------|--------------|-----------|--------------------|---|--------------------|---|-----------|---|------------|-------------------------------|--------------|-----------|--------------------|---|--------------------|---|-----------|---|-------|
| 1 | Spots | <p>A)Clear</p> <table border="1"> <thead> <tr> <th>Size: d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>$d \leq 0.1$</td> <td>Disregard</td> </tr> <tr> <td>$0.1 < d \leq 0.2$</td> <td>6</td> </tr> <tr> <td>$0.2 < d \leq 0.3$</td> <td>2</td> </tr> <tr> <td>$0.3 < d$</td> <td>0</td> </tr> </tbody> </table> <p>Note: Including pin holes and defective dots which must be within one pixel size.</p> <p>B)Unclear</p> <table border="1"> <thead> <tr> <th>Size: d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>$d \leq 0.2$</td> <td>Disregard</td> </tr> <tr> <td>$0.2 < d \leq 0.5$</td> <td>6</td> </tr> <tr> <td>$0.5 < d \leq 0.7$</td> <td>2</td> </tr> <tr> <td>$0.7 < d$</td> <td>0</td> </tr> </tbody> </table> | Size: d mm | Acceptable Qty in active area | $d \leq 0.1$ | Disregard | $0.1 < d \leq 0.2$ | 6 | $0.2 < d \leq 0.3$ | 2 | $0.3 < d$ | 0 | Size: d mm | Acceptable Qty in active area | $d \leq 0.2$ | Disregard | $0.2 < d \leq 0.5$ | 6 | $0.5 < d \leq 0.7$ | 2 | $0.7 < d$ | 0 | Minor |
| Size: d mm | Acceptable Qty in active area | | | | | | | | | | | | | | | | | | | | | | |
| $d \leq 0.1$ | Disregard | | | | | | | | | | | | | | | | | | | | | | |
| $0.1 < d \leq 0.2$ | 6 | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < d \leq 0.3$ | 2 | | | | | | | | | | | | | | | | | | | | | | |
| $0.3 < d$ | 0 | | | | | | | | | | | | | | | | | | | | | | |
| Size: d mm | Acceptable Qty in active area | | | | | | | | | | | | | | | | | | | | | | |
| $d \leq 0.2$ | Disregard | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < d \leq 0.5$ | 6 | | | | | | | | | | | | | | | | | | | | | | |
| $0.5 < d \leq 0.7$ | 2 | | | | | | | | | | | | | | | | | | | | | | |
| $0.7 < d$ | 0 | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Bubbles Polarize in | <table border="1"> <thead> <tr> <th>Size: d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>$d \leq 0.3$</td> <td>Disregard</td> </tr> <tr> <td>$0.3 < d \leq 1.0$</td> <td>3</td> </tr> <tr> <td>$1.0 < d \leq 1.5$</td> <td>1</td> </tr> <tr> <td>$1.5 < d$</td> <td>0</td> </tr> </tbody> </table> | Size: d mm | Acceptable Qty in active area | $d \leq 0.3$ | Disregard | $0.3 < d \leq 1.0$ | 3 | $1.0 < d \leq 1.5$ | 1 | $1.5 < d$ | 0 | Minor | | | | | | | | | | |
| Size: d mm | Acceptable Qty in active area | | | | | | | | | | | | | | | | | | | | | | |
| $d \leq 0.3$ | Disregard | | | | | | | | | | | | | | | | | | | | | | |
| $0.3 < d \leq 1.0$ | 3 | | | | | | | | | | | | | | | | | | | | | | |
| $1.0 < d \leq 1.5$ | 1 | | | | | | | | | | | | | | | | | | | | | | |
| $1.5 < d$ | 0 | | | | | | | | | | | | | | | | | | | | | | |
| 3 | Scratch | In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable. | Minor | | | | | | | | | | | | | | | | | | | | |
| 4 | Allowable Density | Above defects should be separated more than 30mm each other. | Minor | | | | | | | | | | | | | | | | | | | | |
| 5 | Coloration | Not to be noticeable coloration in the viewing area of the LCD panels. Back-light type should be judged with back-light on state only. | Minor | | | | | | | | | | | | | | | | | | | | |

14. 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. | 60°C 200hrs | - |
| 2 | Low Temperature storage | Endurance test applying the high storage temperature for a long time. | -10°C 200hrs | - |
| 3 | High Temperature Operation | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time. | 50°C 200hrs | - |
| 4 | Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time. | 0°C 200hrs | - |
| 5 | High Temperature/ Humidity Storage | Endurance test applying the high temperature and high humidity storage for a long time. | 60°C, 90%RH 96hrs | - |
| 6 | High Temperature/ Humidity Operation | Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time. | 50°C, 90%RH 96hrs | - |
| 7 | Temperature Cycle | Endurance test applying the low and high temperature cycle.  | -10°C/60°C 10 cycles | - |
| Mechanical Test | | | | |
| 8 | Vibration test | Endurance test applying the vibration during transportation and using. | 10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs | - |
| 9 | Shock test | Constructional and mechanical endurance test applying the shock during transportation. | 50G Half sign wave 11 msdc 3 times of each direction | - |
| 10 | Atmospheric pressure test | Endurance test applying the atmospheric pressure during transportation by air. | 115mbar 40hrs | - |
| Others | | | | |
| 11 | Static electricity test | Endurance test applying the electric stress to the terminal. | VS=800V, RS=1.5kΩ CS=100pF 1 time | - |

***Supply voltage for logic system=5V. Supply voltage for LCD system =Operating voltage at 25°C