# AZ DISPLAYS, INC.

*COMPLETE LCD SOLUTIONS*

# SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

**PART NUMBER:** **AGM3232L SERIES**
**DATE:** **APRIL 06, 2007**

## 1 FEATURES

(1) Display format : 320 × 240 dot-matrix, 1/240 duty

(2) Construction : FSTN LCD, Bezel, Heat Seal, Zebra, White Edge LED backlight, Touch Panel, Touch Panel driver (TSC2046) and PCB .

(3) Display type : FSTN LCD, Transflective type, 6 o'clock view.

(4) Controller : E3305F or S1D13700 or RA8835

(5) With temperature compensation circuit.

(6) Power : +5V for logic circuit, Built-in DC/DC converter for LCD driving.

(7) Extended temperature type.

## 2 MECHANICAL DATA

| Parameter | Stand Value | Unit |
|---|---|---|
| Dot size | 0.345(W) × 0.345(H) | mm |
| Dot pitch | 0.36(W) × 0.36(H) | mm |
| Viewing area | 122.0(W) × 92.0(H) | mm |
| Module size (with Touch Panel) | 173.0(W) × 109.0(H) × 14.5 max (T) | mm |

## 3 ABSOLUTE MAXIMUM RATINGS

| Parameter | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| Logic Circuit Supply Voltage | | VDD-VSS | -0.3 | 7.0 | V |
| LCD Driving Voltage | | VDD-VO | -0.3 | 26.0 | V |
| Input Voltage | | $V_I$ | -0.3 | VDD+0.3 | V |
| Extended temp. type | Operating Temp. | $T_{OP}$ | -20 | 70 | °C |
| | Storage Temp. | $T_{STG}$ | -30 | 80 | °C |

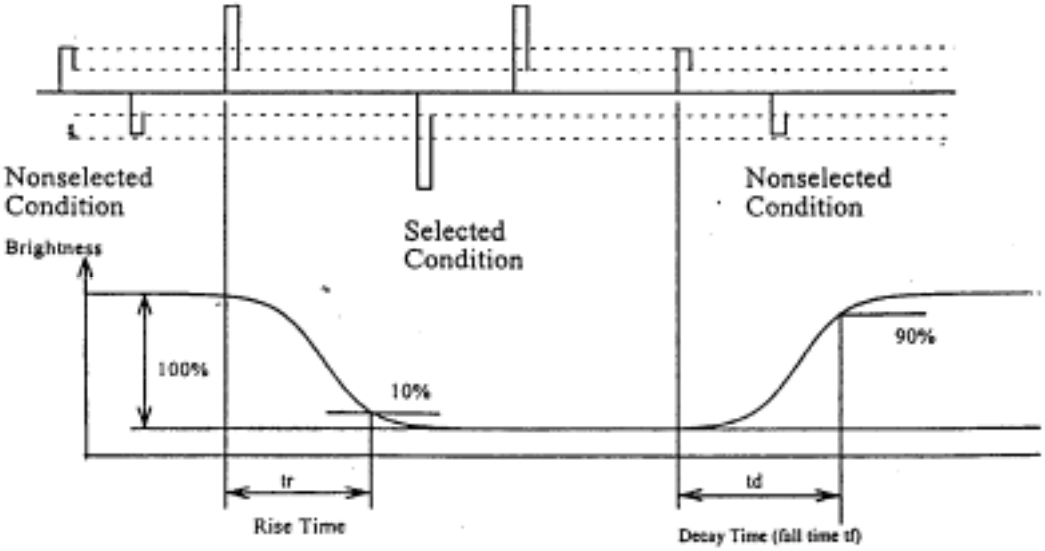
## 4 ELECTRO-OPTICAL CHARACTERISTICS

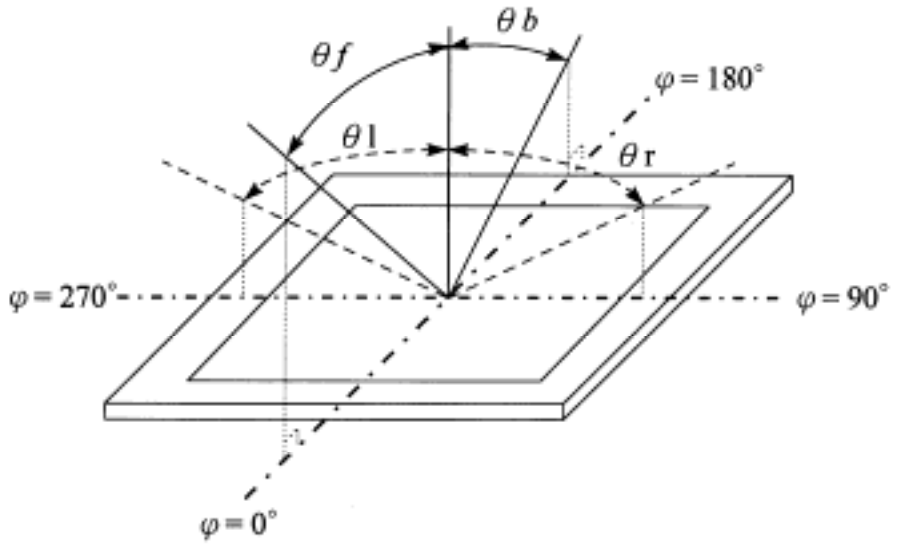
| Parameter | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| ----- Electronic Characteristics ----- | | | | | | | |
| Logic Circuit Supply Voltage | VDD-VSS | -- | 3.3 | -- | 5.5 | V | |
| LCD Driving Voltage | VDD-VO | 25 °C | 22.8 | 24.0 | 25.2 | V | |
| Input Voltage | VIH | -- | 0.7 VDD | -- | VDD | V | |
| | VIL | -- | VSS | -- | 0.3 VDD | V | |
| Logic Supply Current | IDD | VDD = 5V | -- | 40 | -- | mA | |
| ----- Optical Characteristics ----- | | | | | | | |
| Contrast | CR | FSTN type | -- | 8 -- | | | Note 1 |
| Rise Time | tr | 25°C | -- | 1 10 | 170 | ms | Note 2 |
| Fall Time | tf | 25°C | -- | 1 10 | 170 | ms | |
| Viewing Angle Range | θf | 25°C & CR ≥2 | -- | 40 -- | | Deg. | Note 3 |
| | θb | | -- | 35 -- | | | |
| | θl | | -- | 35 -- | | | |
| | θr | | -- | 35 -- | | | |
| Frame Frequency | fF | 25°C | -- | 64 -- | | Hz | |

(NOTE 1) Contrast ratio :

CR = (Brightness in OFF state) / (Brightness in ON state)

(NOTE 2) Response time :


Nonselected
Condition
Selected
Condition
Nonselected
Condition
Brightness
100%
10%
90%
tr
Rise Time
td
Decay Time (fall time tf)


θ b
θ f
φ = 180°
θ l
θ r
φ = 270°
φ = 90°
φ = 0°

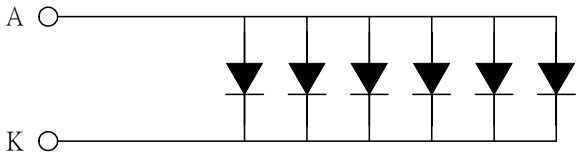
| Parameter | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| Forward Current | IF | -- | -- | 90 | 120 | mA | Note 4 |
| LCM Luminous intensity | | IF=90mA | -- | 11 | -- | cd/m$^2$ | Note 4 |
| Forward Voltage | VF | IF=90mA | -- | 3.2 | 3.5 | V | Supply Voltage between A& K Note 5 |
| LED C.I.E | X | IF=90mA | 0.28 | 0.31 | 0.34 | | Note 6 |
| | Y | IF=90mA | 0.29 | 0.32 | 0.35 | | |

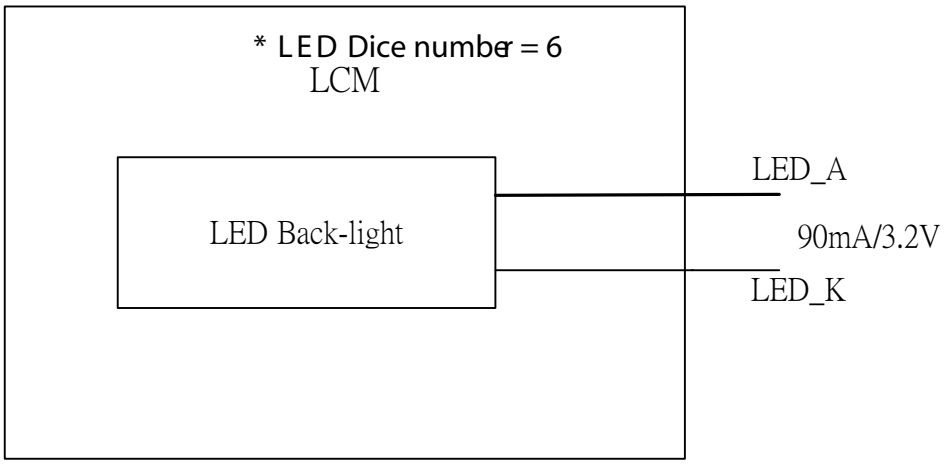
Note 4: Luminous intensty is decided by forward current of White LED.

Note 5: White LEDs are with voltage tolerance

Note 6: White LEDs are with color tolerance

* LED Dice number = 6



## 5 Touch Panel Electrical Specification

| Parameter | Condition | Standard Value |
|---|---|---|
| Terminal Resistance | X Axis | 400 ~ 900 Ω |
| | Y Axis | 200 ~ 500 Ω |
| Insulating Resistance | DC 25 V | More than 10MΩ |
| Linearity -- | | ±1.5 % |
| Notes life by Pen | Note a | 100,000 times(min) |
| Input life by finger | Note b | 1,000,000 times (mi |

Note A .

Notes area for pen noteslife test is 10 x 9 mm.

Size of word is 7.5 x 6.72

Shape of penend : R0.8

Load : 250 g

Note B

By Silicon rubber tapping at same point

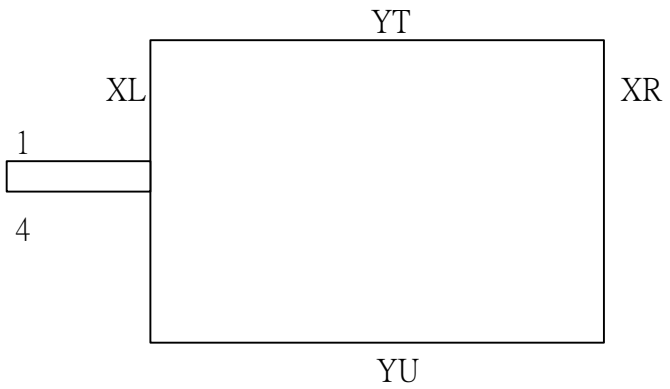
Shape of rubber end : R8

Load : 200g

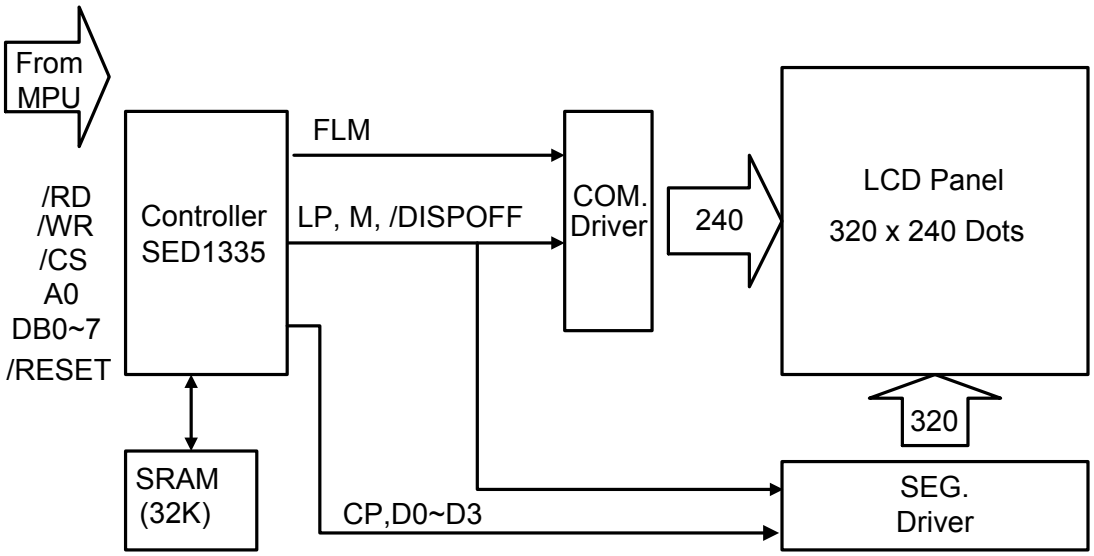
Frequency : 5 Hz

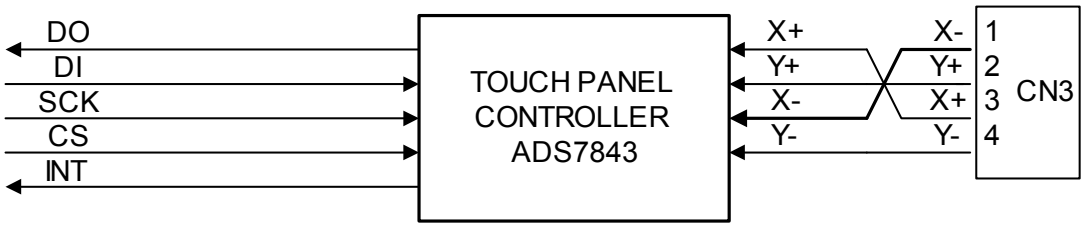
Interface

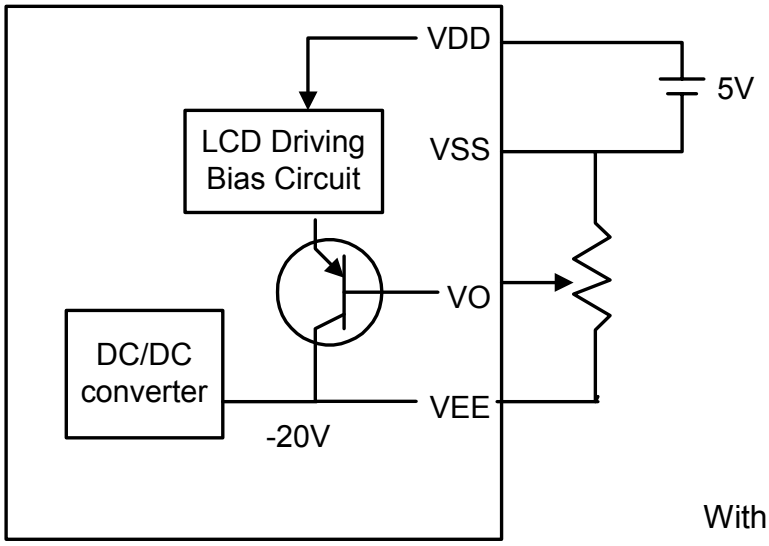
| No. | Symbol | Function |
|---|---|---|
| 1 | XR | Touch Panel Right Signal in X Axis |
| 2 | YT | Touch PanelTop Signal in Y Axis |
| 3 | XL | Touch PanelLeft Signal in X Axis |
| 4 | YB | Touch Panel Bottom Signal in Y Axis |



## 6 BLOCK DI AGRAM & POWER SUP PLY




With DC/DC converter

## 7 PIN CONNECTIONS

CN2 : SED1335 Controller

| PIN NO. | SIGNAL | LEVEL | FUNCTION |
|---|---|---|---|
| 1 | /RESET | H/L | Reset Signal |
| 2 | /RD | H/L | 80 Series: Read Signal<br>68 Series: Enable Signal(E) |
| 3 | /WR | H/L | 80 Series: Write Signal<br>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 | VDD | - | Power Supply for Logic(+5.0V) |
| 15 | VSS | - | Power Supply(Ground : 0V) |
| 16 | VEE | - | With DC/DC Negative voltage output (-20V) |
| 17 | VO | - | Contrast Adjustment Input |
| 18* | SK / X1 | - | Serial Clock<br>Touch Panel Left Signal in X Axis |
| 19* | DO / X2 | - | Data Output<br>Touch Panel Right Signal in X Axis |
| 20* | DI / Y1 | - | Data In<br>Touch Panel Upper Signal in Y Axis |
| 21* | CS / Y2 | - | Chip Select<br>Touch Panel Lower Signal in X Axis |
| 22* | INT | - | Interrupt |
| 23~24 | NC | - | No connection |

18~22 : SK, DO, DI, CS, INT for Touch Panel controller TSC2046 /
X1, X2, Y1, Y2 for Touch Panel (without TSC2046)

JP3 short for Bezel connected to GND.

# 8 TIMING CHARACTERISTICS

## 8.1 8080 Family Interface Timing

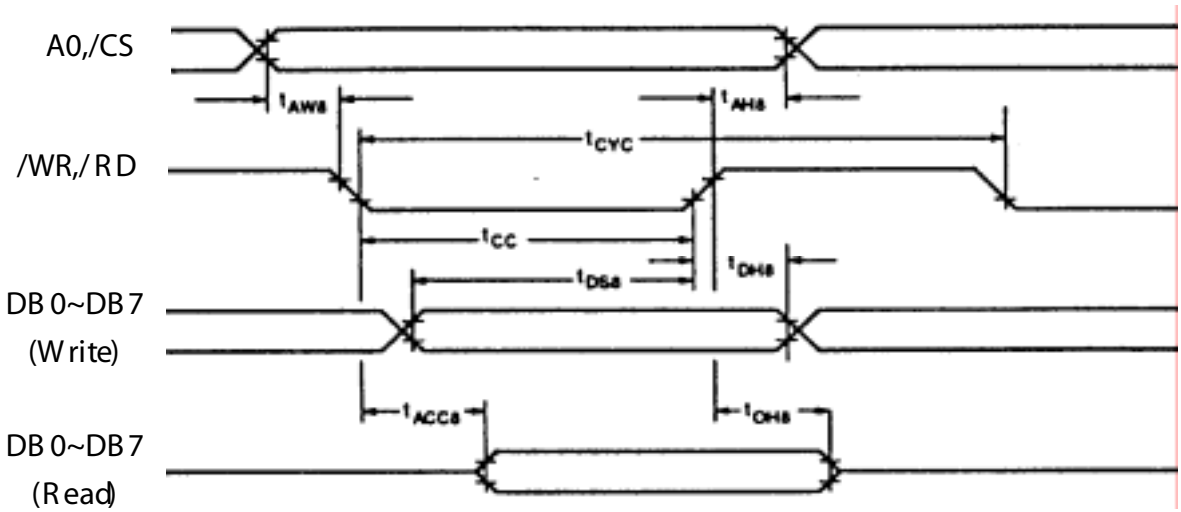
| Parameter | Condition | Symbol | Min | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| Address Hold Time | CL=100 pF VDD=2.7~4.5 | tAH8 | 10 | | ns | A0,/CS |
| Address Setup Time | | tAW8 | 0 | | ns | |
| System Cycle Time | | tCYC | Note | | ns | /WR,/RD |
| Strobe Pulse Width | | tOC | 150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

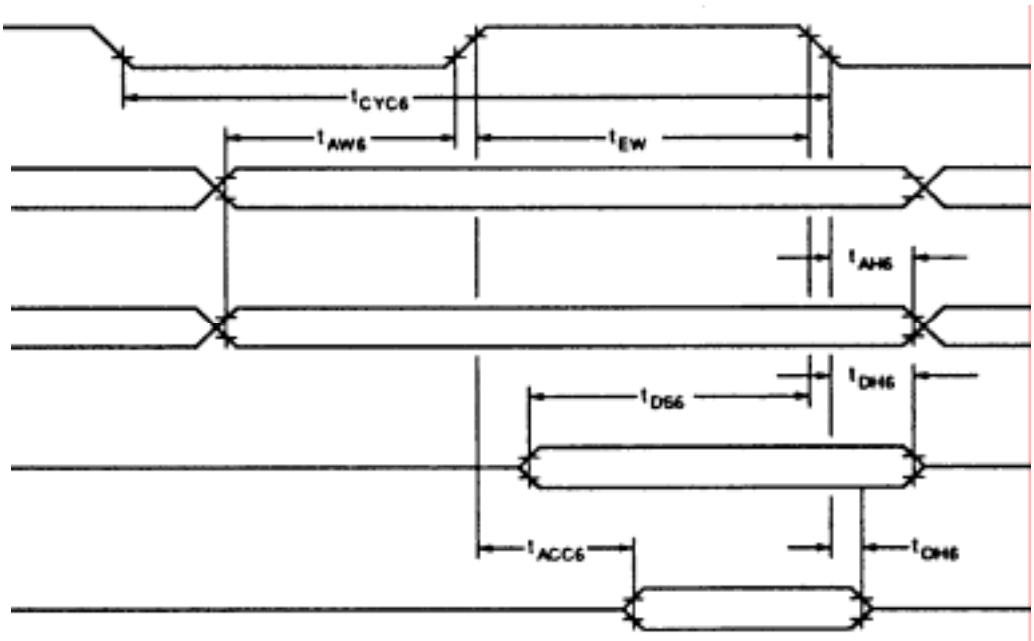
tCYC8=2tC+tOC+tCEA+75 > tACV +245

For all other commands:

tCYC8=4tC+tOC+30



| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |


tCYC6
tAW6
tEW
tAH6
tDH6
tDS6
tACC6
tDH6

# 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 | 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 1 | CD 0 | 4C to 4F | Set direction of cursor movement | 0 | 8. 3.4 |
| | HDOTSCR | 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:

1. In general, the internal registers of the SED1335F 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.

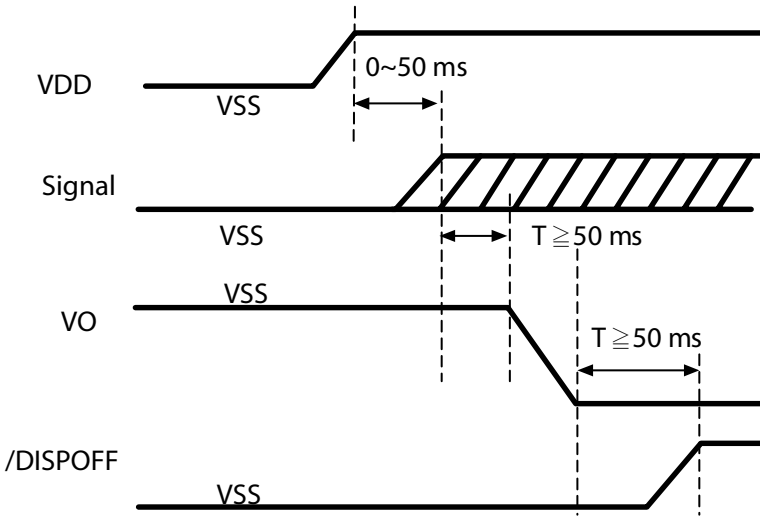
   2 bytes parameters( where two bytes are treated as 1 data item) are handled as following:

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

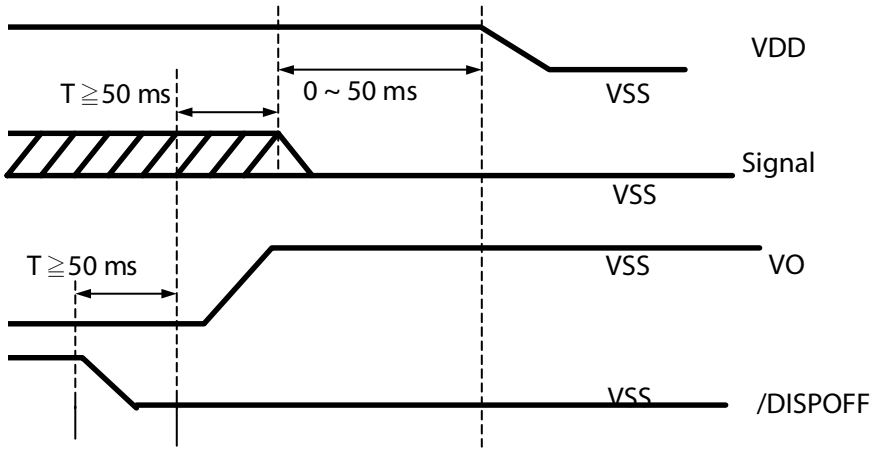
   b. SYSTEM SET , SCROLL, CGRAM ADR. : Both parameter bytes are processed together. If the command is changed after half of the parameter has been input, the single byte is ignored.

2. APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.
3. Please refer to SED1335F LCD Controller Data Book for detail.

POWER ON SEQUENCE




POWER OFF SEQUENCE



## 10 JUMPER SETTIN G

| Item | Option | Jumper Setting | Remark |
|---|---|---|---|
| MPU | 80 family (default) | Pin 1,2 short on JP6 | |
| | 68 family | Pin 2,3 short on JP6 | |

## 11 QUALI TY AND RELI ABILI TY

### 11.1 TEST CONDITIONS

Tests should be conducted under the following conditions :

Ambient temperature : 25 ± 5°C

Humidity : 60 ± 25% RH.

### 11.2 SAMPLING PLAN

Sampling method shall be in accordance with MIL-STD-105E , level II, normal single sampling plan .

### 11.3 ACCEPT ABLE QU ALITY LE VEL

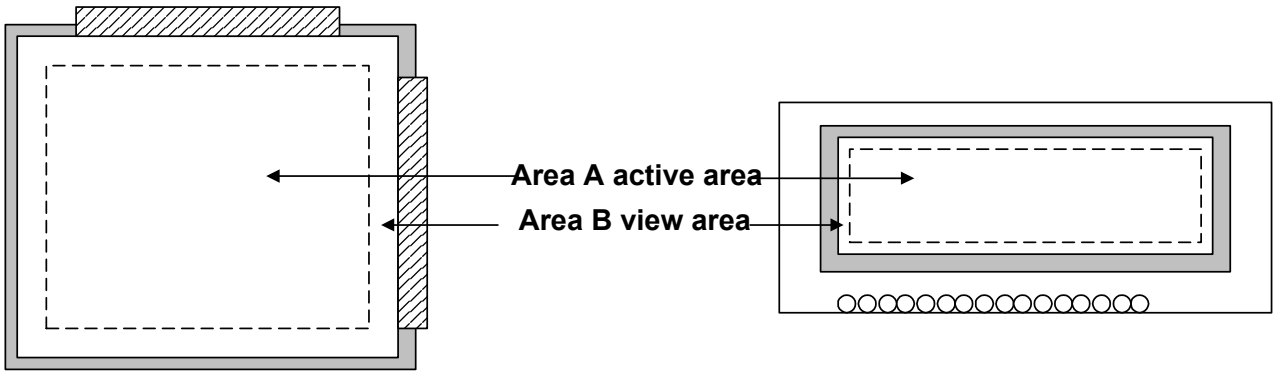
A major defect is defined as one that could cause failure to or materially reduce the usability of the unit for its intended purpose. A minor defect is one that does not materially reduce the usability of the unit for its intended purpose or is an infringement from established standards and has no significant bearing on its effective use or operation.

### 11.4 APPEARANCE

An appearance test should be conducted by human sight at approximately 30 cm distance from the LCD module under flouescent light. The inspection area of LCD panel shall be within the range of following limits.

## 11.5 INSPECTION QUALITY CRITERIA

| Item | Description of defects | | | Class of Defects | Acceptable level (% ) |
|---|---|---|---|---|---|
| Function | Short circuit or Pattern cut | | | Major | 0.65 |
| Dimension | Deviation from drawings | | | Major | 1.5 |
| Black spots | Ave . dia . D | area A | area B | Minor | 2.5 |
| | D 0.2 | Disregard | | | |
| | 0.2<D 0.3 | 3 | 4 | | |
| | 0.3<D 0.4 | 2 | 3 | | |
| | 0.4<D 0 | | 1 | | |
| Black lines | Width W, Length L | A | B | Minor | 2.5 |
| | W 0.03 | disregard | | | |
| | 0.03<W 0.05 | 3 | 4 | | |
| | 0.05<W 0.07 , L 3.0 | 1 | 1 | | |
| | See line criteria | | | | |
| Bubbles in polarizer | Average diameter D 0.2 < D < 0.5 mm for N = 4 , D > 0.5 for N = 1 | | | Minor | 2.5 |
| Color uniformity | Rainbow color or newton ring. | | | Minor | 2.5 |
| Glass Scratches | Obvious visible damage. | | | Minor | 2.5 |
| Contrast ratio | See note 1 | | | Minor | 2.5 |
| Response time | See note 2 | | | Minor | 2.5 |
| Viewing angle | See note 3 | | | Minor | 2.5 |



## 11.6 RELIABILITY

| Test Item | Test Conditions | Note |
|---|---|---|
| | Extended Temp. type | |
| High Temperature Operation | 70 3 C , t=96 hrs | |
| Low Temperature Operation | -20 3 C , t=96 hrs | |
| High Temperature Storage | 80 3 C , t=96 hrs | 1,2 |
| Low Temperature Storage | -30 3 C , t=96 hrs | 1,2 |
| Temperature Cycle | -30 C ~ 25 C ~ 80 C<br>30 m in. 5 min. 30 min. ( 1 cycle )<br>Total 5 cycle | 1,2 |
| Humidity Test | 40 C, Humidity 90%, 96 hrs | 1,2 |
| Vibration Test (Packing) | Sweep frequency : 10 ~ 55 ~ 10 Hz/1min<br>Amplitude : 0.75mm<br>Test direction : X.Y.Z/3 axis<br>Duration : 30min/each axis | 2 |

Note 1 : Condensation of water is not permitted on the module.

Note 2 : The module should be inspected after 1 hour storage in normal conditions (15-35°C , 45-65%RH).

Definitions of life end point :

Current drain should be smaller than the specific value.

Function of the module should be maintained.

Appearance and display quality should not have degraded noticeably.

Contrast ratio should be greater than 50% of the initial value.

## 12 HANDLI NG PRECAUTI ONS

(1) A LCD module is a fragile item and should not be subjected to strong mechanical shocks.

(2) Avoid applying pressure to the module surface. This will distort the glass and cause a change in color.

(3) Under no circumstances should the position of the bezel tabs or their shape be modified.

(4) Do not modify the display PCB in either shape or positioning of components.

(5) Do not modify or move location of the zebra or heat seal connectors.

(6) The device should only be soldered to during interfacing. Modification to other areas of the board should not be carried out.

(7) In the event of LCD breakage and resultant leakage of fluid do not inhale, ingest or make contact with the skin. If contact is made rinse immediately.

(8) When cleaning the module use a soft damp cloth with a mild solvent, such as Isopropyl or Ethyl alcohol. The use of water, ketone or aromatic is not permitted.

(9) Prior to initial power up input signals should not be applied.

(10) Protect the module against static electricity and observe appropriate anti-static precautions.

## 13 OUTLINE DIMENSION

