

DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 128128B1 FGH-PW

Product Specification

Version: 1

15.08.2017

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1. FUNCTIONS &FEATURES

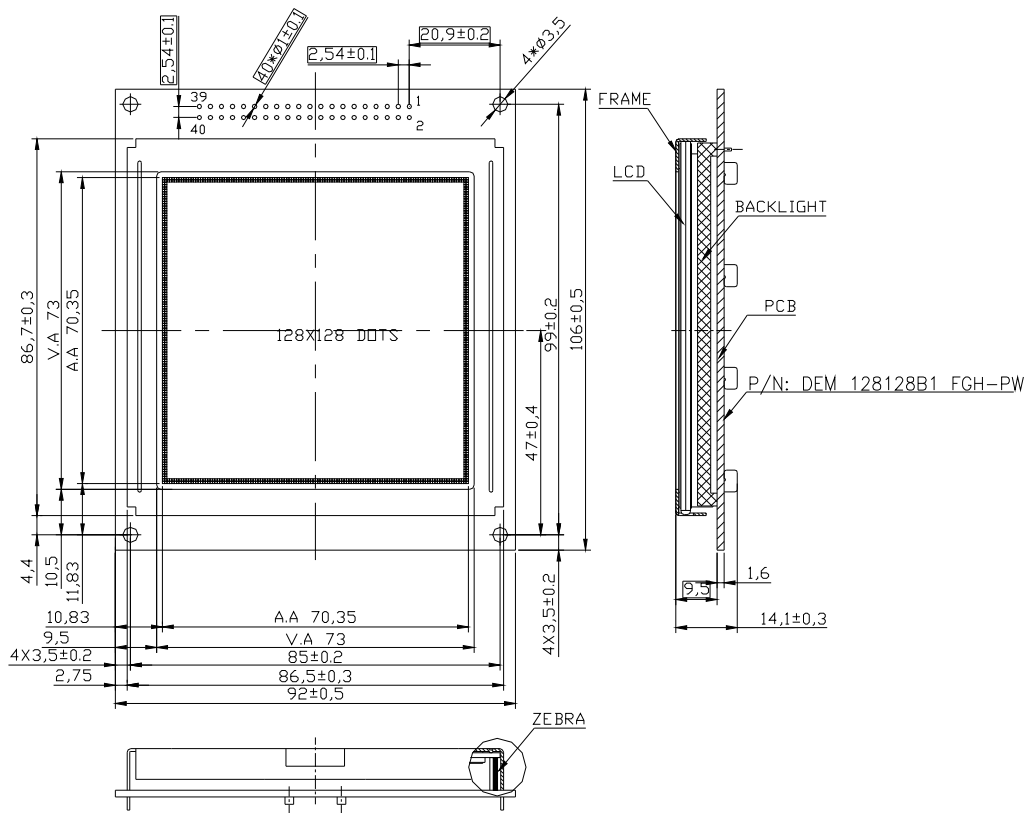
| MODULE NAME | LCD Type |
|---------------------|----------------------------------|
| DEM 128128B1 FGH-PW | FSTN Transflective Positive Mode |

- Glass Thickness : 1.1mm
- Viewing Direction : 6 O'clock
- Driving Scheme : 1/128Duty, 1/12 Bias
- Power Supply for logic : 5.0 Volt (typ.)
- Backlight Color : LED, White
- Display Content : 128 x 128 Dots
- V_{LCD} : 18.5 Volt (typ.)
- Operation Temperature : -20°C to +70°C
- Storage temperature : -25°C to +75°C
- Controller IC : UCi6963
- Driver IC : NT7086

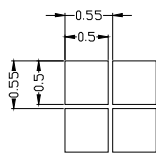
2. MODULE ARTWORK

- Module Size : 106.00 x 92.00 x 14.10 mm
- Viewing Area : 73.00 x 73.00 mm
- Active Area : 70.35 x 70.35 mm
- Dot Pitch : 0.55 x 0.55 mm
- Dot Size : 0.50 x 0.50 mm
- Dot Gap : 0.05 mm

3. EXTERNAL DIMENSIONS

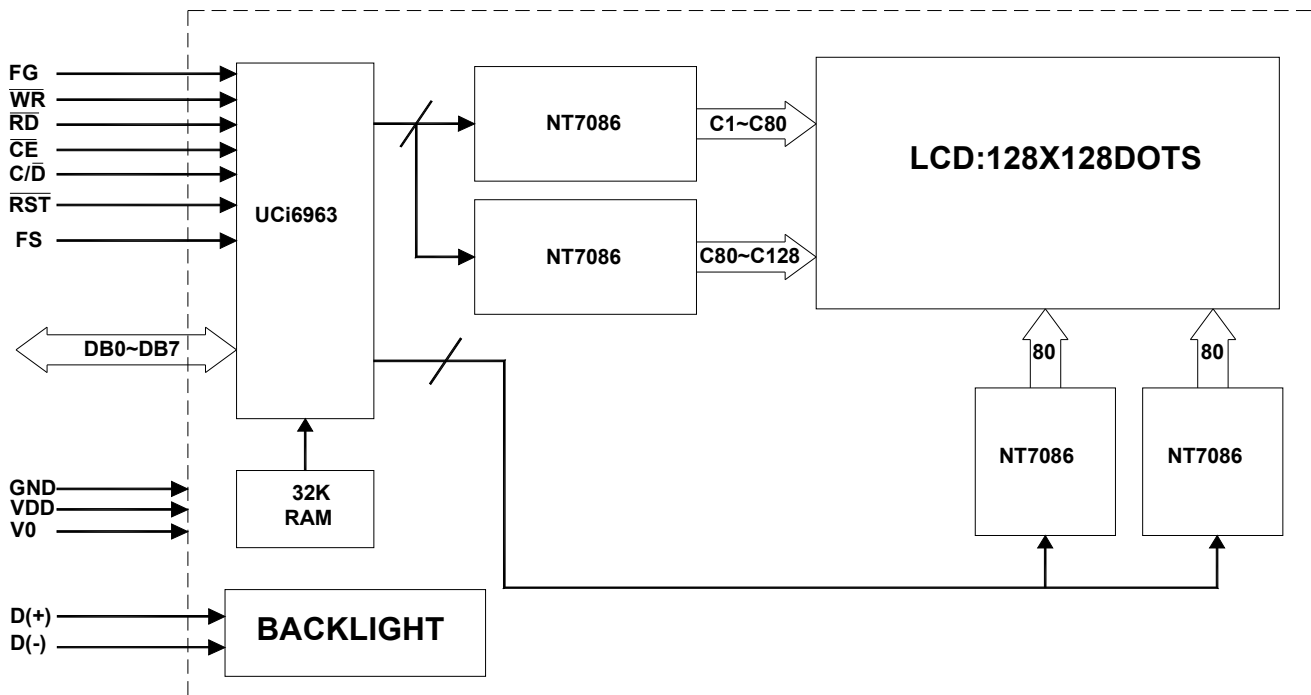


Remarks:
 1, Unmarked Tolerance ± 0.30
 2, All material comply with RoHs.



LCD DOT 20:1

4. BLOCK DIAGRAM

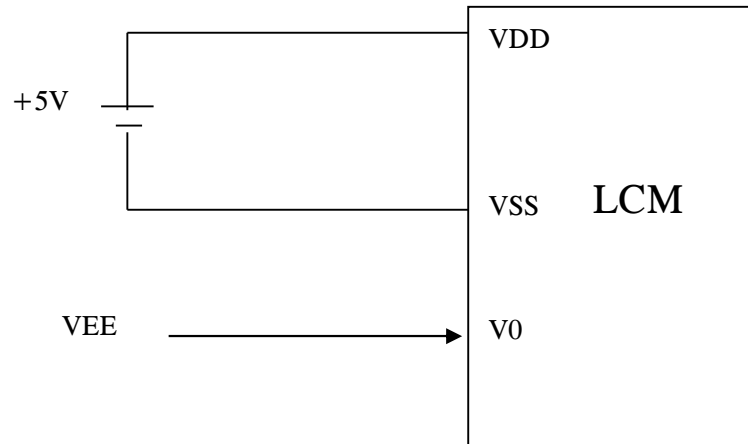


5. PIN ASSIGNMENT

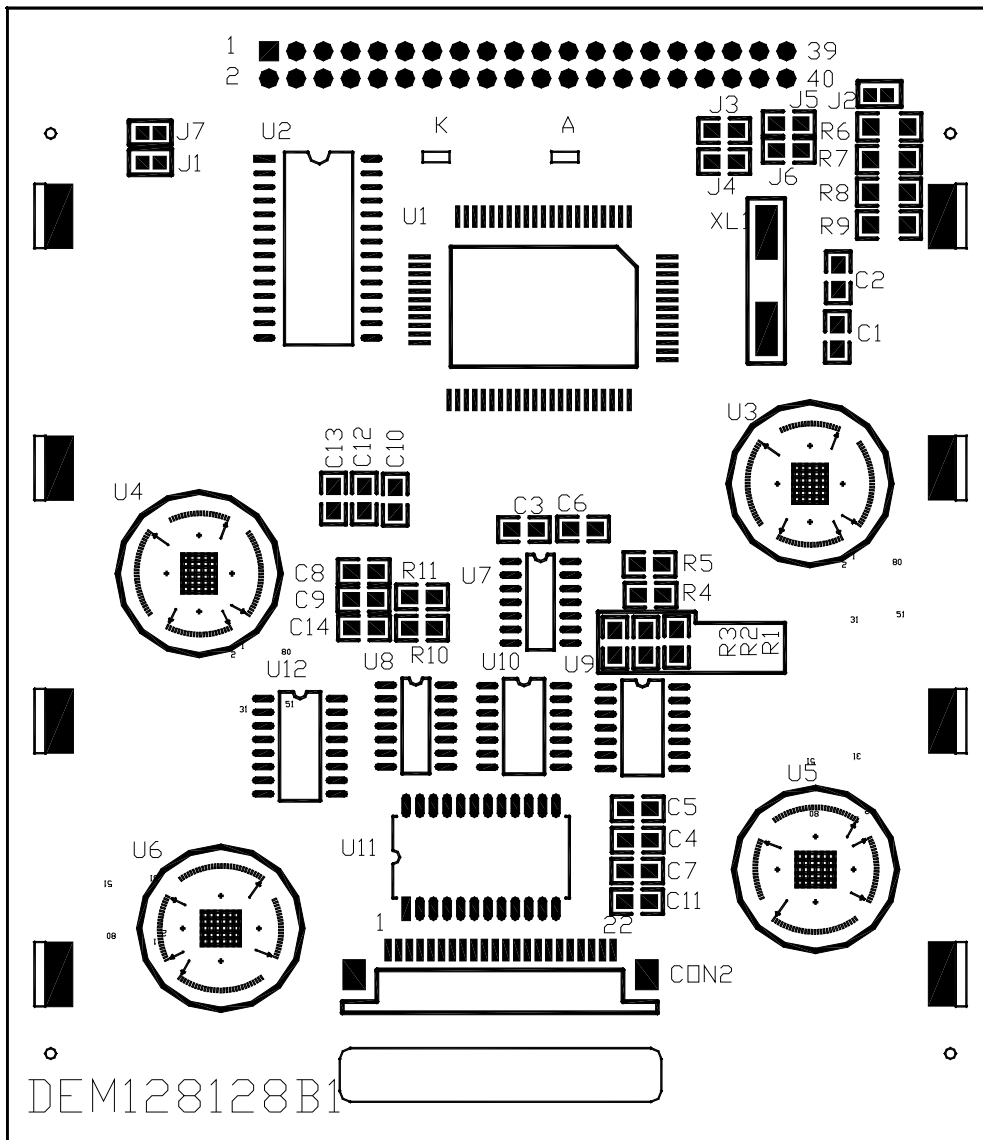
| NO. | SYMBOL | FUNCTION |
|-----|---------|---|
| 1 | FG | Frame ground (see note 1) |
| 3 | VSS | Ground (0V) |
| 5 | VDD | Power Supply(+5V) |
| 7 | V0 | Power Supply for LCD Drive(-13.5V) |
| 9 | /WR | Data write. Write data to controller UCI6963 when “L” |
| 11 | /RD | Data read. Read data from controller UCI6963 when “L” |
| 13 | /CE | Chip enable of controller when “L” |
| 15 | C/ D | Command/Data read/write. “H” for command read/write and “L” for data read/write |
| 17 | /RST | Controller reset when “L” |
| 19 | DB0 | Data input/output(LSB) |
| 21 | DB1 | Data input/output |
| 23 | DB2 | Data input/output |
| 25 | DB3 | Data input/output |
| 27 | DB4 | Data input/output |
| 29 | DB5 | Data input/output |
| 31 | DB6 | Data input/output |
| 33 | DB7 | Data input/output(MSB) |
| 35 | FS | Font select. “H” for 6x8 font & “L” for 8x8 font |
| 37 | LED+(A) | Anode of LED backlight |
| 39 | LED-(K) | Cathode of LED backlight |

Note: This pin is electrically connected to the metal bezel (frame), but is otherwise not connected. User can choose to connect this pin to ground or leave it open.

6. POWER SUPPLY



7 PCB DRAWING AND DESCRIPTION



Note: It is only a draft drawing to show the components on the PCB. We should update the drawing after the PCB sample is approved.

7.1 DESCRIPTION:

7-1-1. The polarity of the pin 37 and the pin 39:

| J3, J5 | J6, J4 | LED Polarity | |
|-------------|-------------|--------------|---------|
| | | 37 Pin | 39 Pin |
| Each closed | Each open | Anode | Cathode |
| Each open | Each closed | Cathode | Anode |

Note: In application module, J3=J5 =closed, J4=J6=J2= open.

7-1-2. The J1 is metal-bezel GND to module GND and J7 is mounting holes GND to module GND.

Note: In application module, J1=closed, J7=closed

7-1-3. The LED resistor should be bridged when J2 is closed

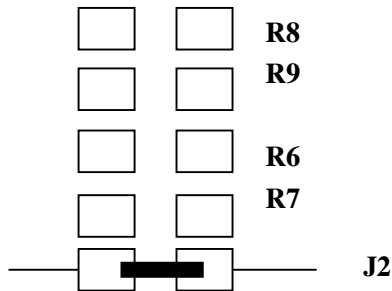
Note: In application module, J2= open

7-1-4. The R6 and the R7, R8, R9 are the LED resistor.

Note: In application module, R6= 47 Ohm, R7=68 Ohm, R8=82 Ohm, R9=open.

7.2 EXAMPLE APPLICATION

7-2-1. The LED resistor should be bridged as following.



7-2-2. The 37 pin is the anode and the 39 pin is the cathode as following.



7-2-3. The 37 pin is the cathode and the 39 pin is the anode as following.



7-2-4. The metal-bezel is on ground as following.



7-2-5. The holes is on ground as following



8. ABSOLUTE MAXIMUM RATINGS (V_{ss}=0V, T_a=25°C)

| PARAMETER | SYMBOL | RATING | UNIT |
|------------------------|------------------|------------------------------|------|
| Supply Voltage (Logic) | V _{DD} | -0.3 to 7.0 | V |
| Input Voltage | V _{IN} | -0.3 to V _{DD} +0.3 | V |
| Operating Temperature | T _{opr} | -20 to +70 | °C |
| Storage Temperature | T _{stg} | -25to +75 | °C |

9. COMMAMD DEFINITIONS

| No. | Command | C/D | W/R | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Action | Value |
|-----|--|-----|-----|----|----|----|----|----|----|----|----|---|-------|
| 1. | Set Cursor Pointer | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | | 21h |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Set X address | |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Set Y address | |
| 2. | Set Offset Register | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | | 22h |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Data | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 3. | Set Address Pointer | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | | 24h |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Low address | |
| | | 0 | 0 | # | # | # | # | # | # | # | # | High address | |
| 4. | Set Text Home Addr. | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | 40h |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Low address | |
| | | 0 | 0 | # | # | # | # | # | # | # | # | High address | |
| 5. | Set Text Area | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | | 41h |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Columns | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 6. | Set Graphic Home Addr. | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | | 42h |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Low address | |
| | | 0 | 0 | # | # | # | # | # | # | # | # | High address | |
| 7. | Set Graphic Area | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | | 43h |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Columns | |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| 8. | OR mode | 1 | 0 | 1 | 0 | 0 | 0 | - | 0 | 0 | 0 | | 8xh |
| 9. | EXOR mode | 1 | 0 | 1 | 0 | 0 | 0 | - | 0 | 0 | 1 | | |
| 10. | AND mode | 1 | 0 | 1 | 0 | 0 | 0 | - | 0 | 1 | 1 | | |
| 11. | Text Attribute mode | 1 | 0 | 1 | 0 | 0 | 0 | - | 1 | 0 | 0 | | |
| 0 | 0 | - | - | - | - | # | # | # | # | # | # | | |
| 12. | Internal CG ROM mode | 1 | 0 | 1 | 0 | 0 | 0 | 0 | - | - | - | | |
| 13. | External CG RAM mode | 1 | 0 | 1 | 0 | 0 | 0 | 1 | - | - | - | | |
| 14. | Display Mode | 1 | 0 | 1 | 0 | 0 | 1 | # | # | # | # | Switch Graphic/Text/Cursor/Blink ON/OFF | 9xh |
| 15. | Cursor Pattern Select | 1 | 0 | 1 | 0 | 1 | 0 | 0 | # | # | # | Set cursor: 1~8-line | Axh |
| 16. | Data-write and Increase ADP | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | C0h |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Data | |
| 17. | Data-read and Increase ADP | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | | C1h |
| 18. | Data-write and Decrease ADP | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | | C2h |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Data | |
| 19. | Data-read and Decrease ADP | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | | C3h |
| 20. | Data-write and Non-variable ADP | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | | C4h |
| | | 0 | 0 | # | # | # | # | # | # | # | # | Data | |
| 21. | Data-read and Non-variable ADP | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | | C5h |
| 22. | Set Data Auto Write | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | | B0h |
| 23. | Set Data Auto Read | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | | B1h |
| 24. | Auto Reset | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | | B2h |
| 25. | Screen Peek | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | E0h |
| 26. | Screen Copy | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | | E8h |
| 27. | Bit Set/Reset | 1 | 0 | 1 | 1 | 1 | 1 | # | # | # | # | Set/Reset Bit 0~7 | Fxh |
| 28. | Whole Screen Reverse (Triple-byte command) | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | | D0h |
| | | 0 | 0 | - | - | - | - | - | - | - | # | 0: Normal 1: Reverse | |
| | | 0 | 0 | - | - | - | - | - | - | - | - | (Don't Care) | |

| No. | Command | C/D | W/R | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Action | Value |
|-----|---|-----|-----|----|----|----|----|----|----|----|----|---|--------------|
| 29. | Blink Time (Triple-byte command) | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | | 50h |
| | | 0 | 0 | - | - | - | - | - | # | # | # | 000b: 0.066s 100b: 1s 001b: 0.25s 101b: 1.25s 010b: 0.5s 110b: 1.5s 011b: 1.75s 111b: 2s | 010b |
| | | 0 | 0 | - | - | - | - | - | - | - | - | - | (Don't Care) |
| 30. | Cursor Auto Moving (Triple-byte command) | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | | 60h |
| | | 0 | 0 | - | - | - | - | - | - | - | # | 0: disable 1: enable | |
| | | 0 | 0 | - | - | - | - | - | - | - | - | - | (Don't Care) |
| 31. | CGROM Font Select (Triple-byte command) | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | | 70h |
| | | 0 | 0 | - | - | - | - | - | - | # | # | 00b: Don't care 01b: Don't care 10b: CGROM Font-01 11b: CGROM Font-02 | |
| | | 0 | 0 | - | - | - | - | - | - | - | - | - | (Don't Care) |

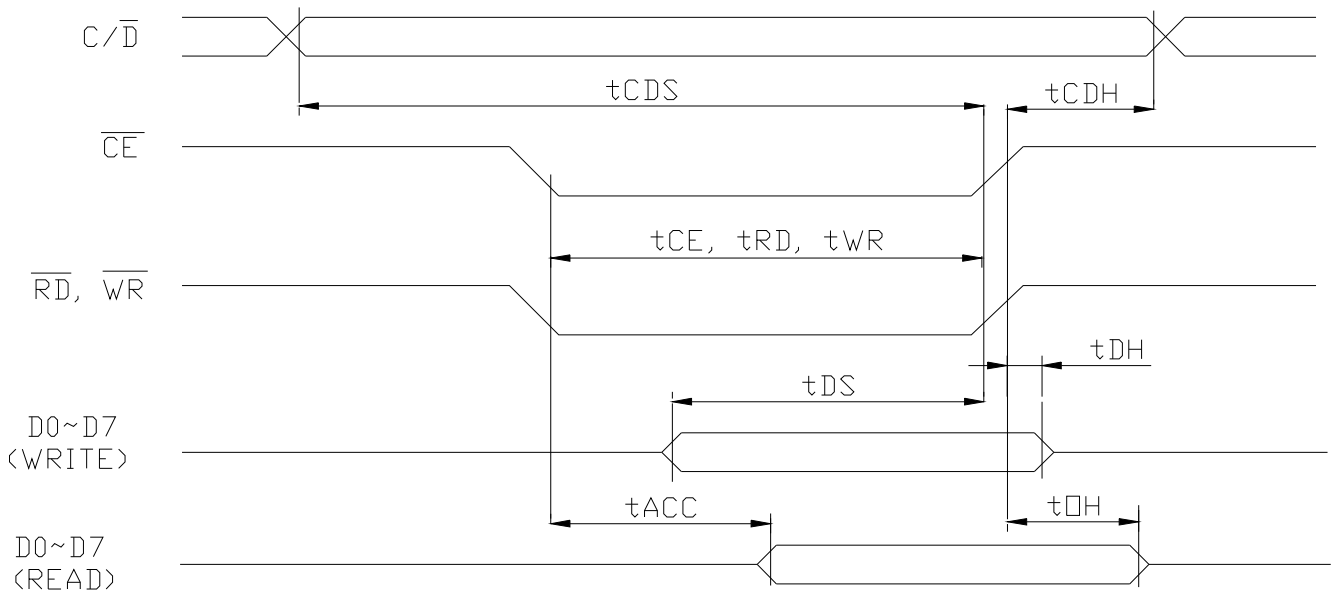
10. ELECTRICAL CHARACTERISTICS

10.1 DC Characteristics

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Units |
|--------------------------------|--------------------|---|----------------------|------|---------------------|-------|
| Supply Voltage (Logic) | V _{DD} | - | 4.7 | 5.0 | 5.3 | V |
| High Level Input Voltage | V _{IH} | - | 0.8V _{DD} | - | V _{DD} | V |
| Low Level Input Voltage | V _{IL} | - | 0 | - | 0.2 V _{DD} | V |
| High Level Output Voltage | V _{OH} | | V _{DD} -0.3 | - | V _{DD} | V |
| Low Level Output Voltage | V _{OL} | | 0 | - | 0.3 | V |
| Current Consumption(Operating) | I _{DD(1)} | V _{DD} =5.0V f _{OSC} = 4.0 MHz | - | 3.0 | 5 | mA |
| Current Consumption(Halt) | I _{DD(2)} | V _{DD} =5.0V | | 1 | 2 | uA |

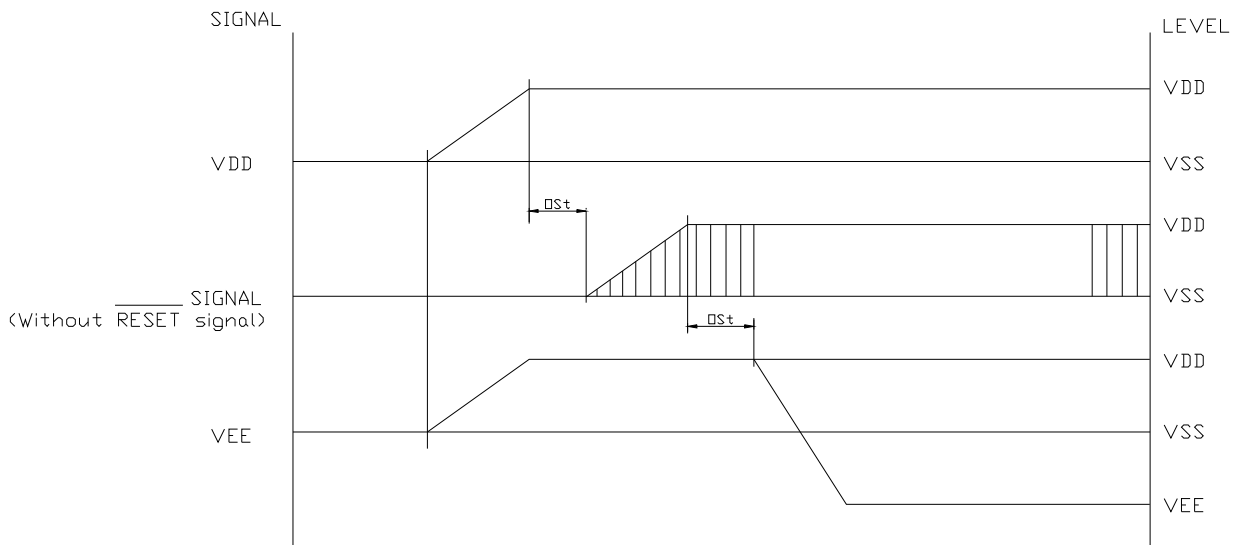
10.2 AC Characteristics

| Parameter | Symbol | Min. | Max. | Units |
|------------------------|---|------|------|-------|
| C/D Setup Time | t _{CDS} | 100 | - | ns |
| C/D Hold Time | t _{CDH} | 10 | - | ns |
| CE, RD, WR Pulse Width | t _{CE} , t _{RD} , t _{WR} | 80 | - | ns |
| Data Setup Time | t _{DS} | 80 | - | ns |
| Data Hold Time | t _{DH} | 40 | - | ns |
| Access Time | t _{ACC} | - | 150 | ns |
| Output Hold Time | t _{OH} | 10 | 50 | ns |

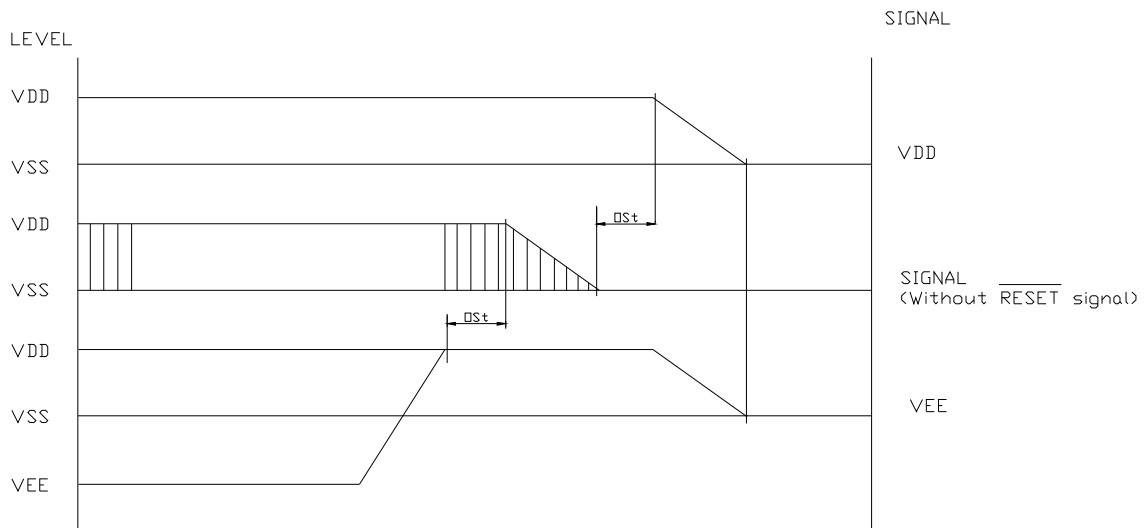


10.3 Power Supply ON/OFF Sequence

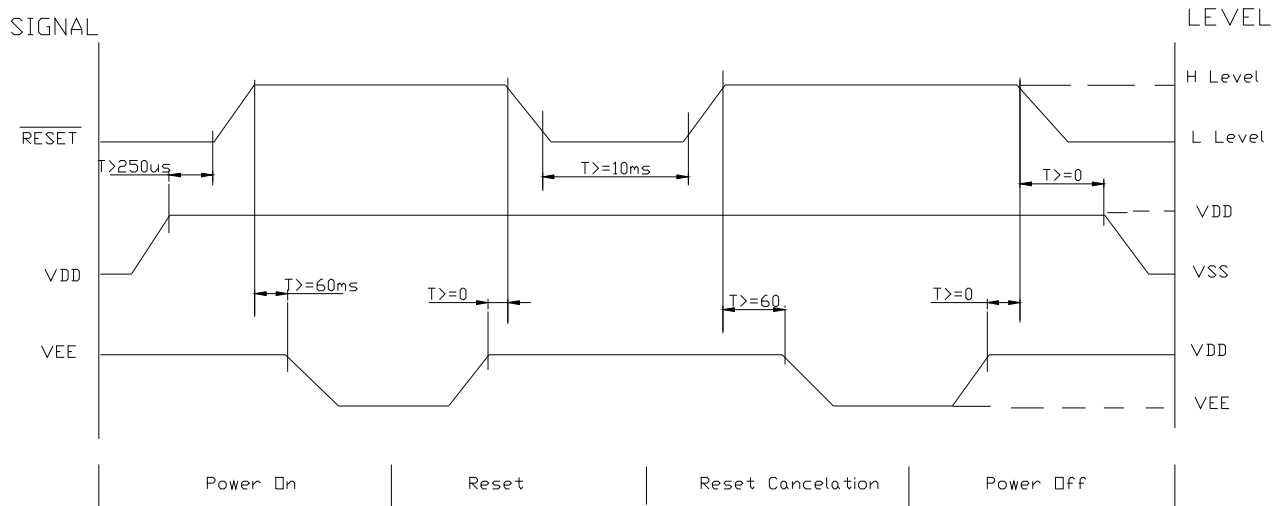
ON Sequence



OFF Sequence



Reset Sequence



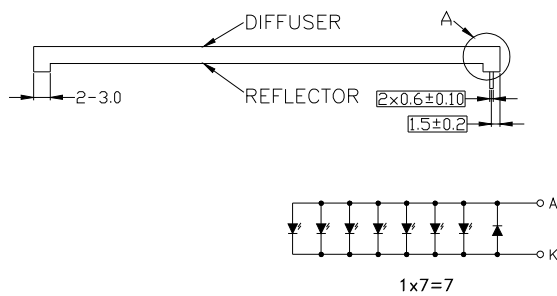
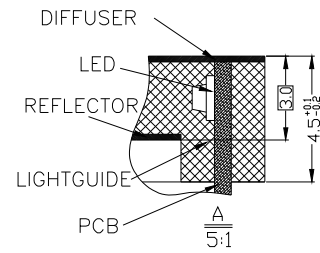
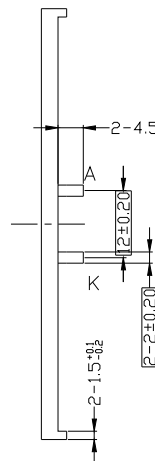
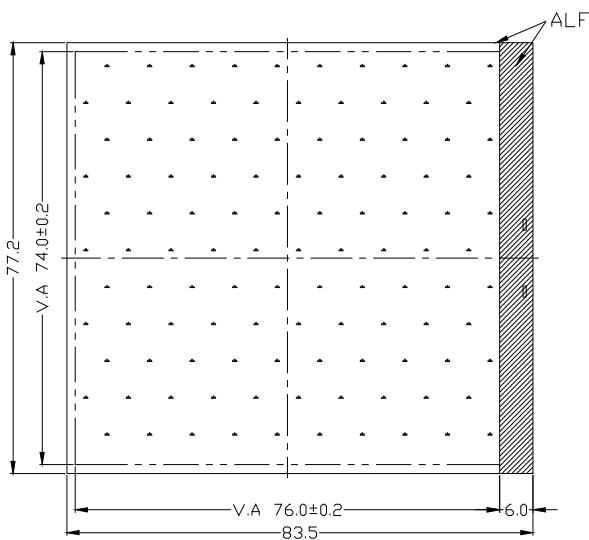
Please maintain the above sequence when turning on and off the power supply of the module.

If VEE is supplied to the module while internal alternate signal for LCD driving (M) is unstable or RESET is active, DC component will be supplied to the LCD panel. This may cause damage to the LCD module.

11. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS

ELECTRICAL–OPTICAL CHARACTERISTICS

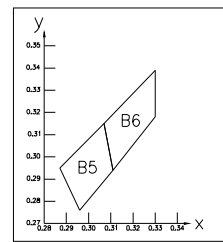
| Item | Symbol | min. | typ. | max. | Unit | Condition |
|-----------------------------|-----------------|------|------|------|-------------------|------------|
| Forward Voltage | Vf | 2.9 | 3.2 | 3.5 | V | If= 105 mA |
| Reverse Current | Ir | | 30 | | μ A | Vr= 0.8 V |
| Chromaticity Uniformity | | 65 | 75 | | | |
| Spectral Line Half width | $\Delta\lambda$ | | | | nm | If= mA |
| Luminance | Lv | 175 | 250 | | cd/m ² | If= 105 mA |
| Operating Temperature Range | Topr | | | | -30~+70 | °C |
| Storage Temperature Range | Tstg | | | | -40~+80 | °C |



CHROMATICS COORDINATES

| | | | | |
|---|-------|-------|-------|-------|
| x | 0.296 | 0.287 | 0.330 | 0.330 |
| y | 0.276 | 0.295 | 0.339 | 0.318 |

TOLERANCE IS ±0.01



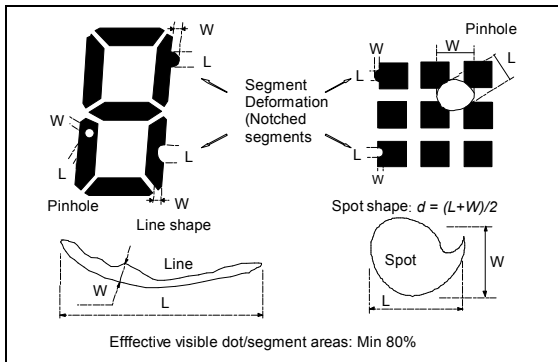
- Remarks:
 1, Unmarked tolerance is ±0.3;
 2, The color is white;
 3, All material is lead-free

12. QUALITY DESCRIPTION

DEFECT SPECIFICATION:

Specific type-related items are covered in this sheet.

- a: Table for Cosmetic defects
(Note: nc = not counted).
Sizes and number of defects
(Max. Qty)



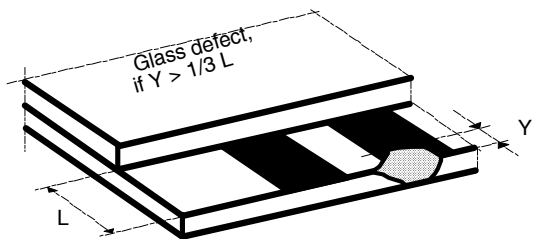
Shapes

- b: Glass defects
- b1: Glass defects at contact ledge

b2: Glass chipping in other areas shall not be in conflict with the product's function.

| Defect Type | Max. defect size [μm] d or L W | Max. Quantity |
|--------------------------|---|---------------|
| Black or White Spots | $d \leq 150$ | nc |
| | $150 < d \leq 300$ | 5 |
| Black or White Lines | -- $W \leq 10$ | nc |
| | $L \leq 5000$ $W \leq 30$ | 3 |
| | $L \leq 2000$ $W \leq 50$ | 2 |
| Pinhole | $d \leq 150$ | nc |
| | $150 < d \leq 300$ | 1/segment |
| (Total defects) | | (5) |
| Segment Deformation | $W \leq 100$ | nc |
| Bubble (e.g. under pola) | $d \leq 150$ | nc |
| | $200 < d \leq 400$ | 3 |
| | $400 < d \leq 600$ | 1 |

Examples/



13. MODULE ACCEPT QUALITY LEVEL (AQL)

13.1 AQL Standard Value: Fatal Defect =0.1, Major Defect=0.65; Minor Defect =2.5.

13.2 Curtailed Inspection Scheme

| Type | Batch Qty | inspection Qty | AQL value | pass | Reject |
|----------------|------------------|----------------|-----------|------|---|
| module product | 350PCS < 1000PCS | 125pcs | 0.1 | 0 | 1 |
| | | | 0.65 | 2 | 3 |
| | | | 2.5 | 7 | 8 |
| | 200PCS < 350PCS | 80pcs | 0.1 | 0 | 1 |
| | | | 0.65 | 1 | 2 |
| | | | 2.5 | 5 | 6 |
| | <200PCS | 32pcs | 0.1 | 0 | 1 |
| | | | 0.65 | 0 | 1 |
| | | | 2.5 | 4 | 5 |
| Module sample | <200PCS | All inspected | / | / | The sample will be reject when the fatal defect>2pcs or main defect>5pcs. |
| | >200PCS | 125pcs | | | |

- Notes:**
- 1). Batch QTY is the production amount that Production department ship to QA department.
 - 2). All of product will be inspected if the batch QTY less than inspected QTY.
 - 3). Each batch fixed to be 500pcs.

14. RELIABILITY TEST

Operating life time: Longer than 50000 hours (at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

| TEMPERATURE TESTS | NORMAL GRADE |
|---------------------------------|---|
| High Temperature Storage | +75°C *96hrs |
| Low Temperature Storage | -25°C * 96hrs |
| High Temperature Operation | +70°C *96hrs |
| Low Temperature Operation | -20°C *96hrs |
| High Temperature, High Humidity | +70°C* 95%RH *96hrs |
| Thermal Shock | -20°C *30min. ← 10s ↓ 5Cycles +70°C *30min. — |
| Vibration Test | Frequency *Swing * Time 40Hz * 4mm * 4hrs |
| Drop Test | Drop height*Times 1.0m * 6times |

15. LCD MODULES HANDLING PRECAUTIONS

- Please remove the protection foil of polarizer before using.
- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD module.
 - Tools required for assembly, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions
When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

16. OTHERS

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
 - Exposed area of the printed circuit board
 - Terminal electrode sections