

DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 240128C1 FGH-PW

Product Specification

Version : 3

17.07.2018

GENERAL SPECIFICATION

MODULE NO. :

DEM 240128C1 FGH-PW

CUSTOMER P/N

| Version No. | Change Description | Date |
|-------------|--|------------|
| 0 | Original Version | 10.08.2017 |
| 1 | Change P/N | 14.08.2017 |
| 2 | Add the lifetime in the BL drawing on page 9 | 02.05.2018 |
| 3 | Correct model number on page 2 | 17.07.2017 |
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PREPARED BY: PS

DATE: 17.07.2018

APPROVED BY: MHO

DATE: 17.07.2018

CONTENTS

1. FUNCTIONS & FEATURES..... 2

2. MECHANICAL SPECIFICATIONS 2

3. EXTERNAL DIMENSIONS 3

4. BLOCK DIAGRAM 4

5. PIN ASSIGNMENT 5

6. POWER SUPPLY 6

7. ABSOLUTE MAXIMUM RATINGS(VSS=0V, TA=25°C)..... 6

8. PCB DRAWING AND DESCRIPTION 7

9. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS 9

10. ELECTRICAL CHARACTERISTICS..... 10

11. COMMAND DEFINITIONS 12

12. QUALITY DESCRIPTION 14

13. MODULE ACCEPT QUALITY LEVEL (AQL)..... 15

14. RELIABILITY TEST 15

15. LCD MODULES HANDLING PRECAUTIONS 16

16. OTHERS..... 16

1. FUNCTIONS & FEATURES

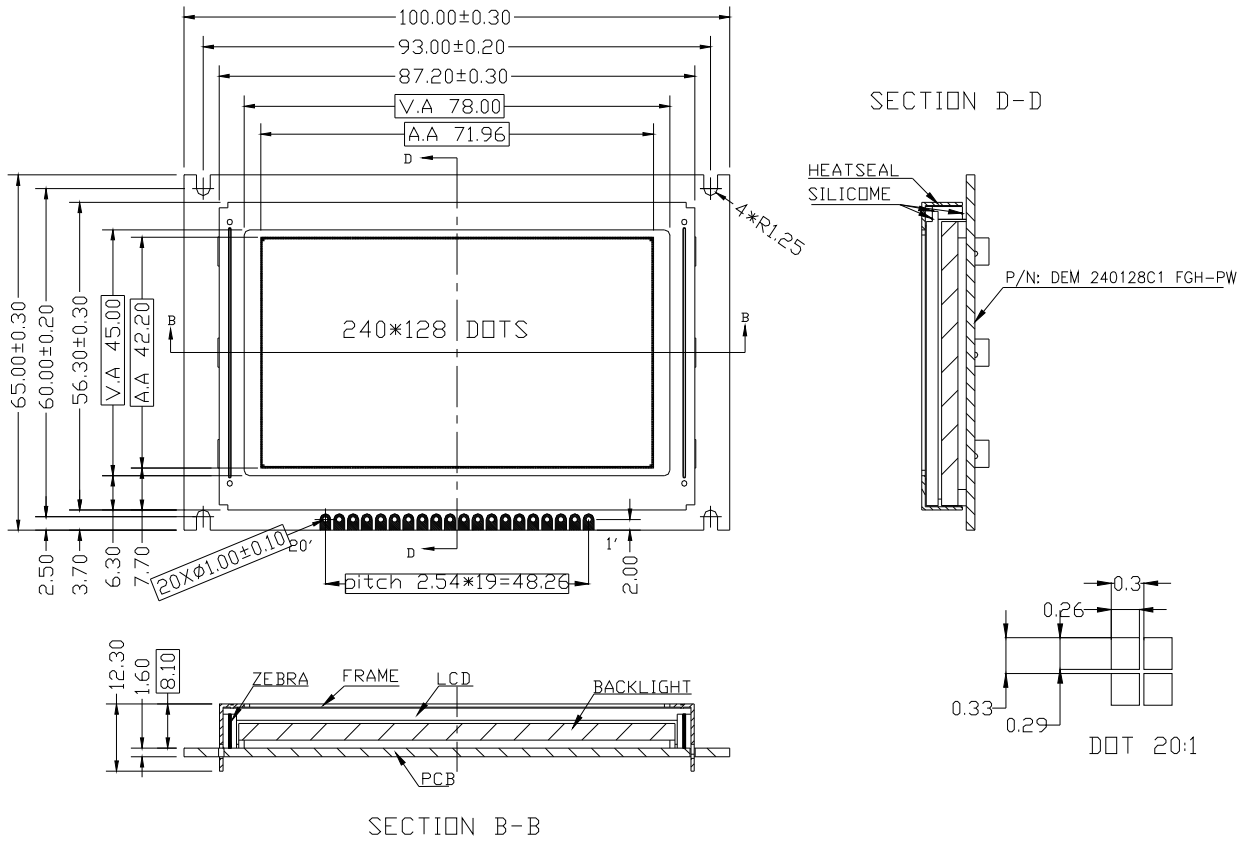
| MODULE NAME | LCD TYPE |
|---------------------|----------------------------------|
| DEM 240128C1 FGH-PW | FSTN Transflective Positive Mode |

- 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, Lightguide, White
- Display Format : 240 x 128 Dots
- V_{LCD} : 17.0 Volt (typ.)
- Driver IC : NT7086
- Controller IC : UCi6963

2. MECHANICAL SPECIFICATIONS

- Module Size : 100.00 x 65.00 x 12.30 mm
- Viewing Area : 78.00 x 45.00 mm
- Active Area : 71.96 x 42.20 mm
- Dot Pitch : 0.30 x 0.33 mm
- Dot Size : 0.26 x 0.29 mm
- Dot Gap : 0.04 mm

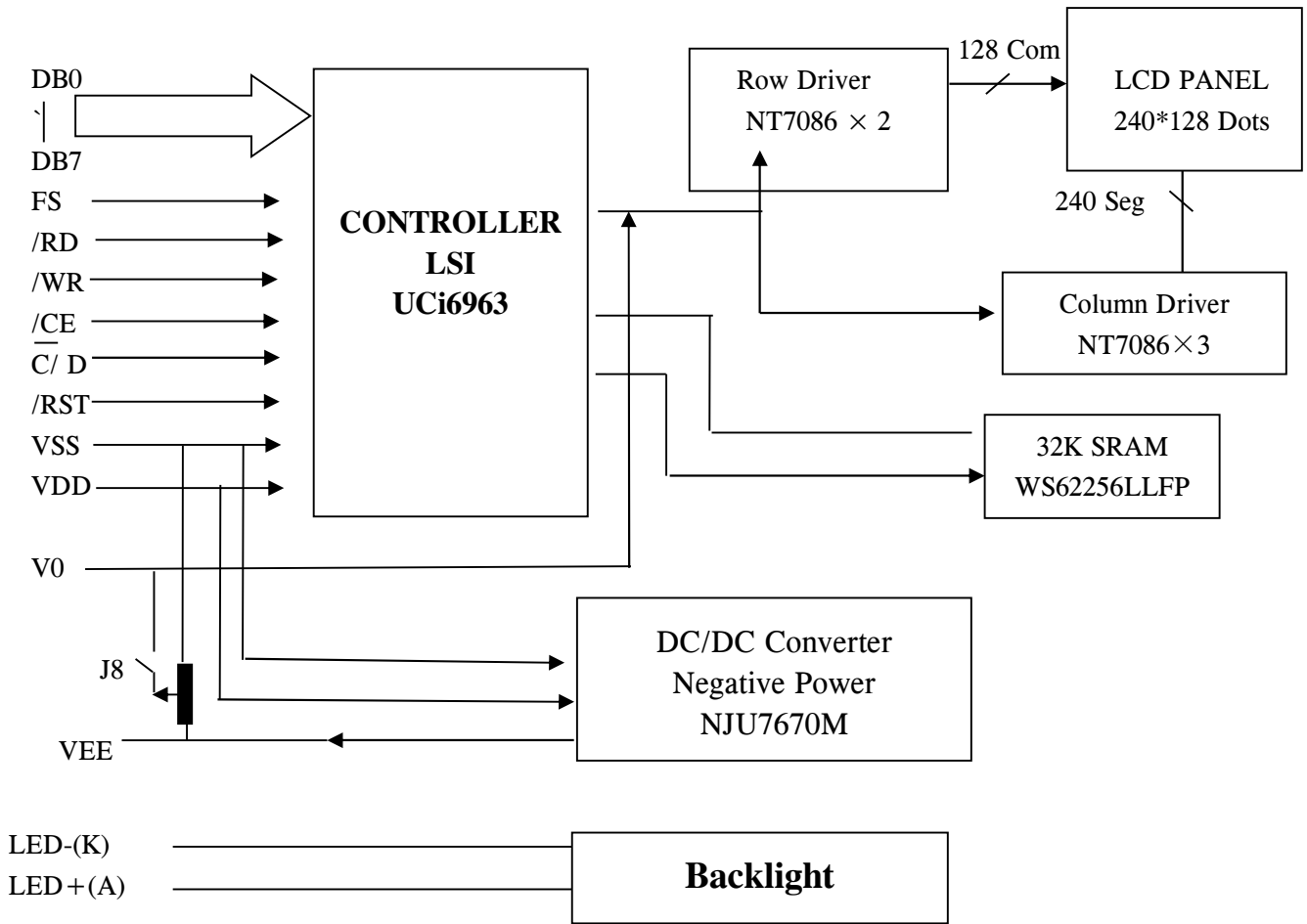
3. EXTERNAL DIMENSIONS



Remarks:

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

4. BLOCK DIAGRAM



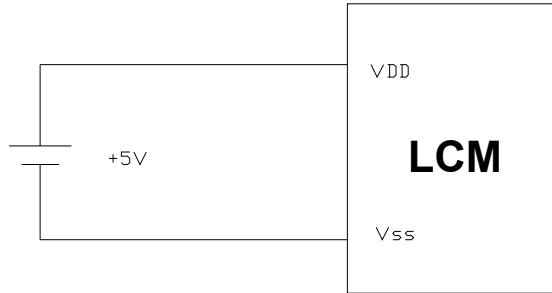
5. PIN ASSIGNMENT

| NO. | SYMBOL | FUNCTION |
|------------|---------------|---|
| 1 | VEE | Power supply output for LCD. |
| 2 | VSS | Ground (0V) |
| 3 | VDD | Power Supply(+5V) |
| 4 | V0 | Power Supply for LCD Drive |
| 5 | /WR | Data write. Write data to controller UCi6963 when “L” |
| 6 | /RD | Data read. Read data from controller UCi6963 when “L” |
| 7 | /CE | Chip enable of controller when “L” |
| 8 | C/ D | Command/Data read/write. “H” for command read/write and “L” for data read/write |
| 9 | /RST | Controller reset when “L” |
| 10 | DB0 | Data input/output(LSB) |
| 11 | DB1 | Data input/output |
| 12 | DB2 | Data input/output |
| 13 | DB3 | Data input/output |
| 14 | DB4 | Data input/output |
| 15 | DB5 | Data input/output |
| 16 | DB6 | Data input/output |
| 17 | DB7 | Data input/output(MSB) |
| 18 | FS | Font select. “H” for 6x8 font & “L” for 8x8 font |
| 19 | LED+(A) | Anode of LED backlight |
| 20 | LED-(K) | Cathode of LED backlight |

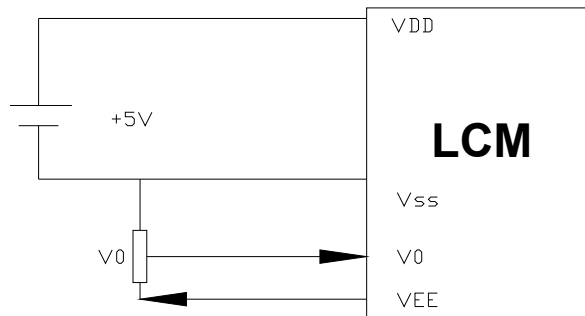
Note: This pin is electrically connected to the metal bezel (frame), but is otherwise not connected. User can choose to connect this pin to ground or leave it open.

6. POWER SUPPLY

Mode (Internal contrast regulation) - J8 is close



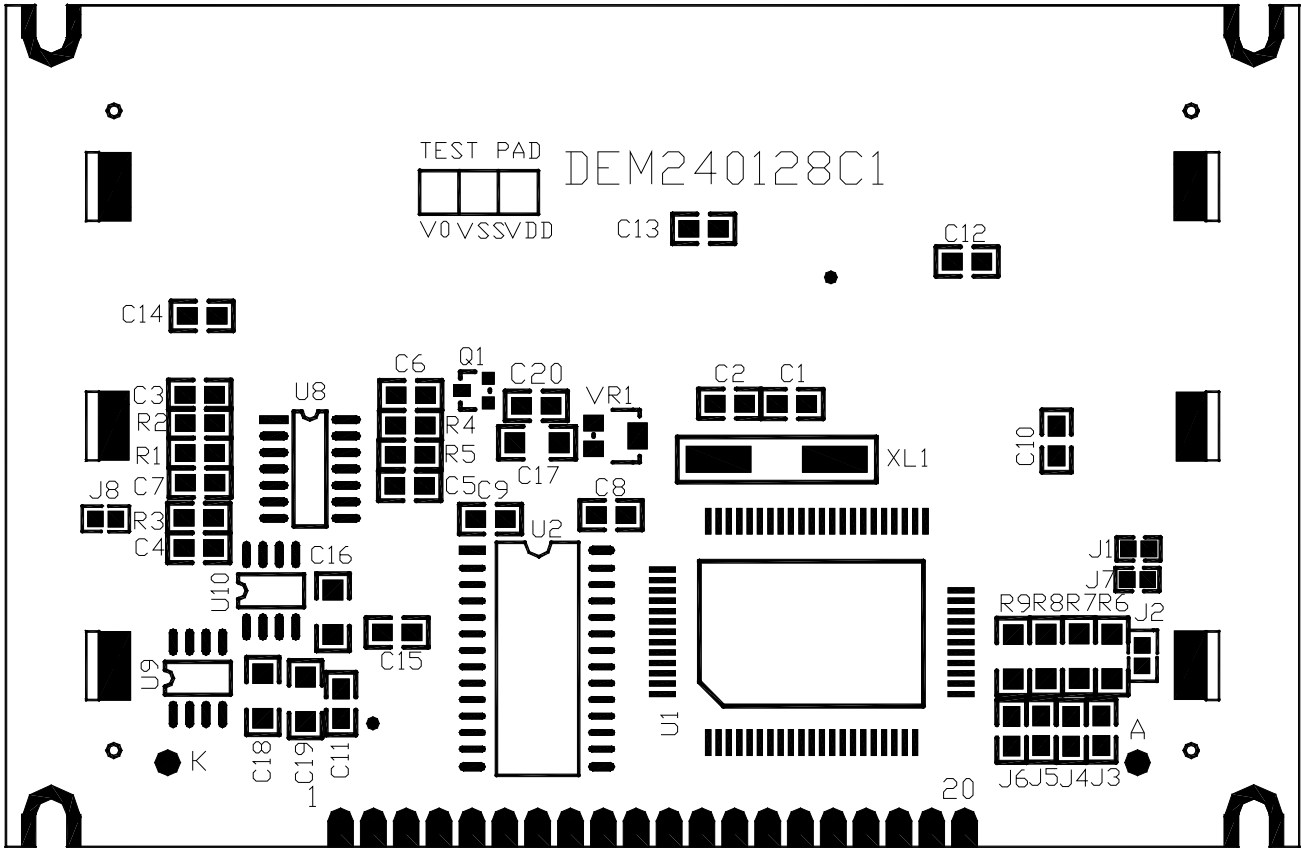
Mode (External contrast regulation) - J8 is open



7. 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} | -25 to +75 | °C |

8. PCB DRAWING AND DESCRIPTION



8.1 DESCRIPTION:

8-1-1. The polarity of the pin 19 and the pin 20:

| J3, J5 | J6, J4 | LED Polarity | |
|-------------|-------------|--------------|---------|
| | | 19Pin | 20 Pin |
| Each closed | Each open | Anode | Cathode |
| Each open | Each closed | Cathode | Anode |

Note: In application J3=J5 =0 Ohm, J4=J6=open.

8-1-2. The J1 is metal-bezel GND to module GND and J7 is mounting holes GND to module GND.

Note: In application J1=0 Ohm, J7=0 Ohm.

8-1-3. The LED resistor should be bridged when J2 is closed

Note: In application module, J2= open

8-1-4. The R6 and the R7, R8, R9 are the LED resistor.

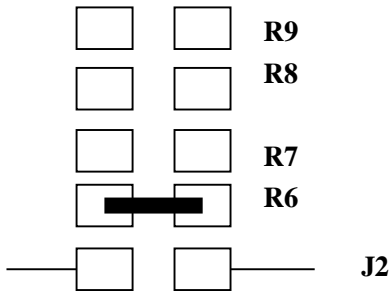
Note: In application module, R6=10 Ohm ; R7= R8= R9=open

8-1-5. The module use internal contrast regulation when J8 is closed.

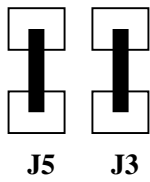
Note: In application J8 is open, but potentiometer is calibrated by the factory

8.2 Example application

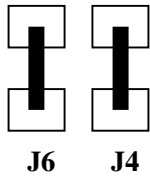
8-2-1. The LED resistor should be bridged as following.



8-2-2. The 19 pin is the anode and the 20 pin is the cathode as following.



8-2-3. The 19 pin is the cathode and the 20 pin is the anode as following.



8-2-4. The metal-bezel is on ground as following.



8-2-5. The mounting holes is on ground as following



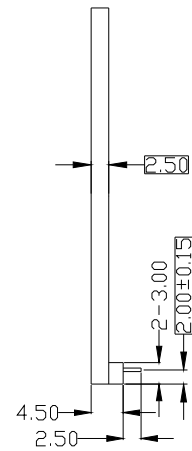
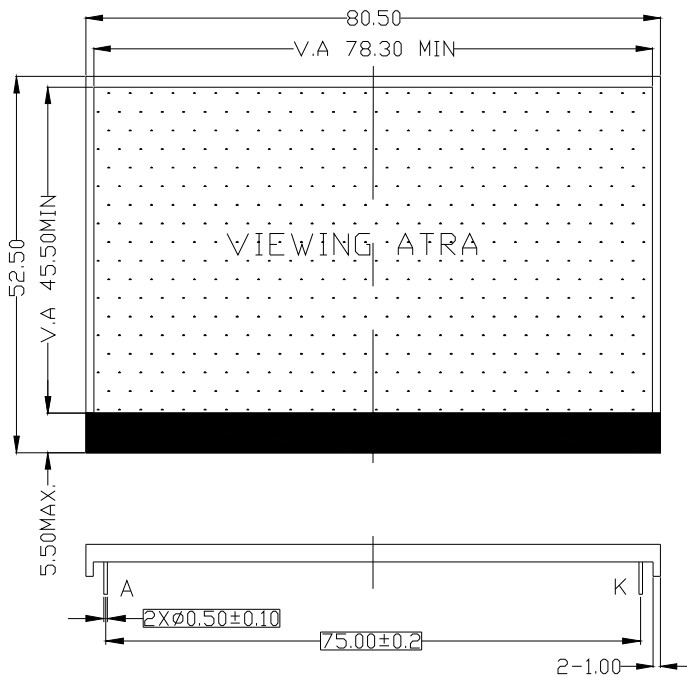
8-2-6. The module use internal contrast regulation as following.



9. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS

ELECTRICAL–OPTICAL CHARACTERISTICS

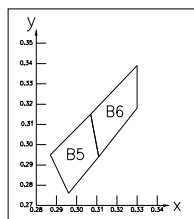
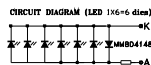
| Item | Symbol | min. | typ. | max. | Unit | Condition |
|--------------------------|--------------------------------------|------|------|------|-------------------|-----------|
| Forward Voltage | Vf | 3.8 | 4.1 | 4.4 | V | If= 90 mA |
| Reverse Current | Ir | | 30 | | μA | Vr= 0.8 V |
| Dominant wave length | λD | | | | nm | If= 90 mA |
| Spectral Line Half width | Δλ | | | | nm | If= 90 mA |
| Luminance | Lv | 277 | 370 | | cd/m ² | If= 90 mA |
| Lifetime | 50000 hours (brightness reduce half) | | | | | |



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 ±0.30;
 2, Color: White
 3, All material comply with RoHs.

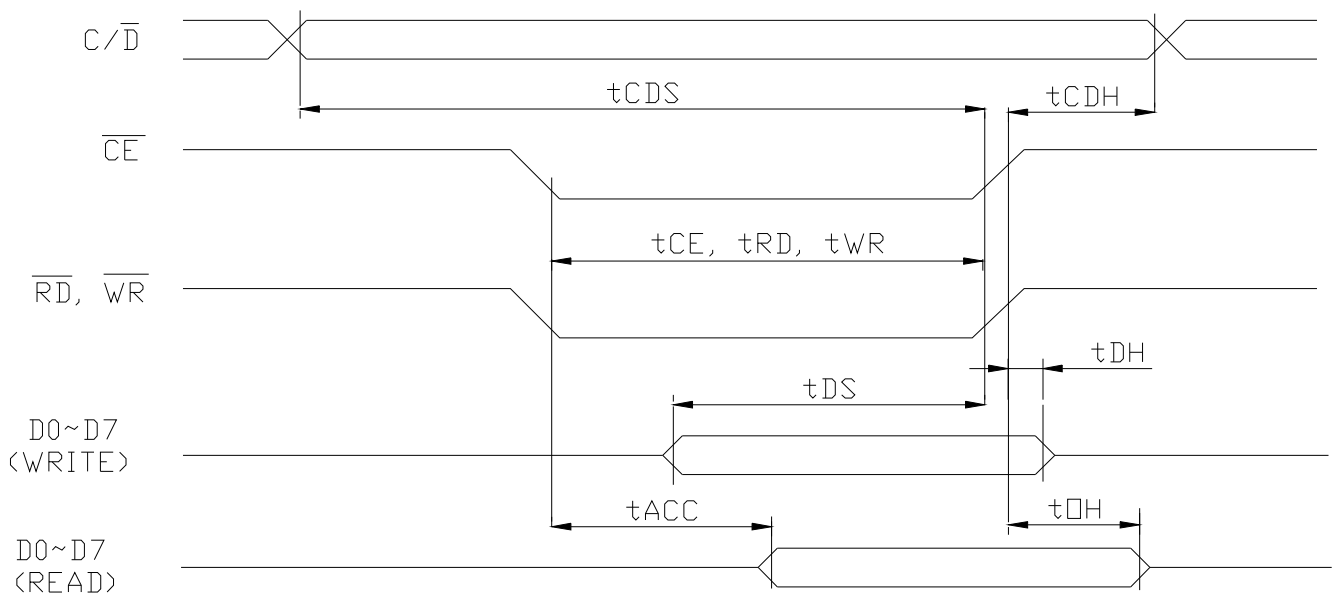
10. ELECTRICAL Characteristics

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 | μA |

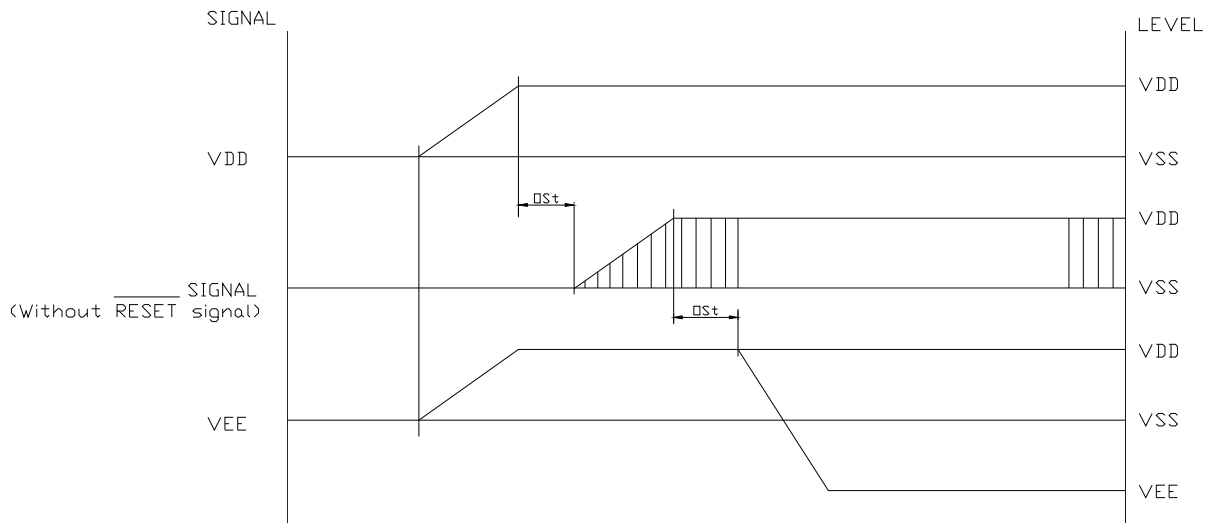
2). AC Characteristics

| 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 |

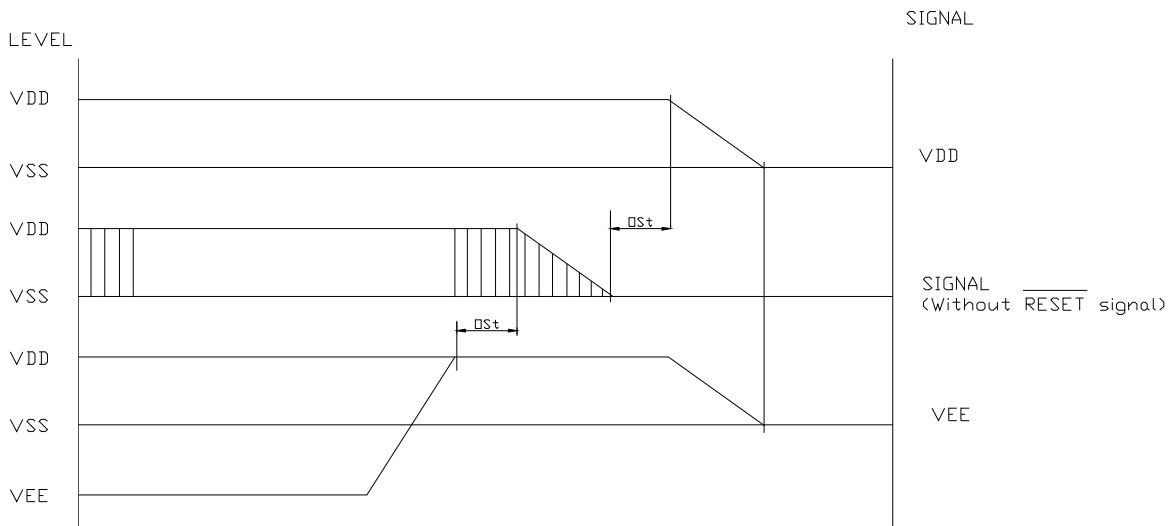


3). Power Supply ON/OFF/RESET Sequence

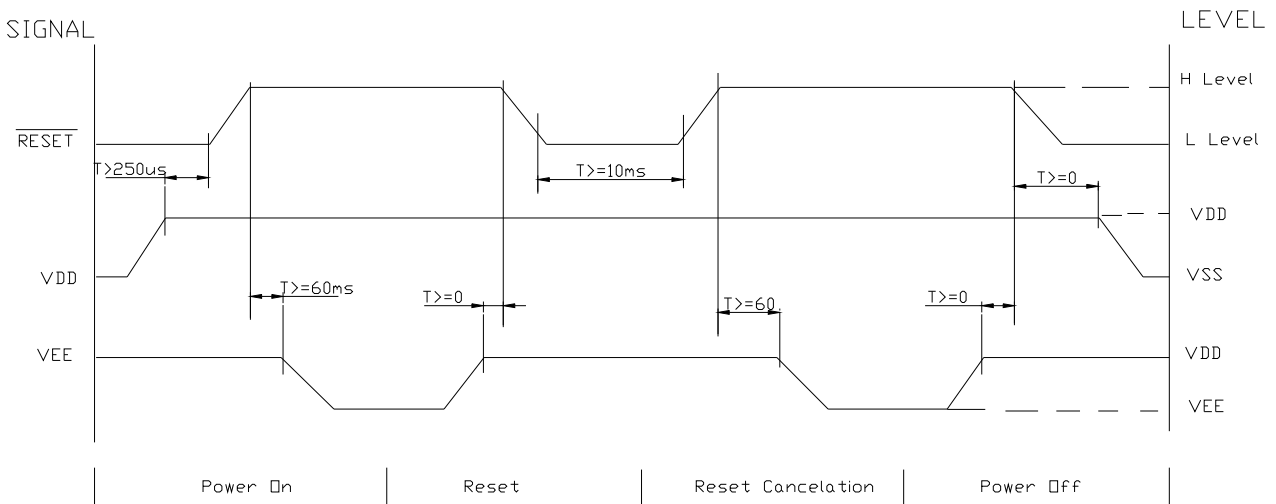
● **ON Sequence**



● **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. COMMAND 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 | | 00h |
| 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 | | |
| 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 | | |
| 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) | |

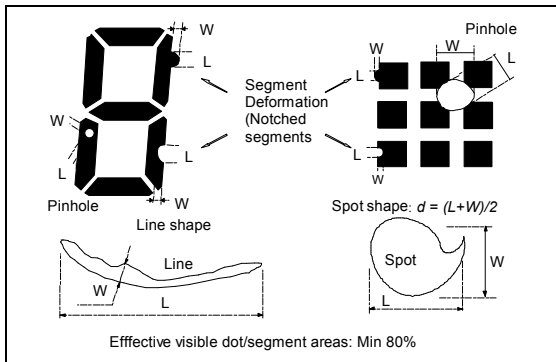
| No. | Command | C/D | W/R | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Action | Value |
|-----|---|-----|-----|----|----|----|----|----|----|----|----|---|--------------|
| 29. | Blink Time (Triple-byte command) | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | | 50h |
| | | 0 | 0 | - | - | - | - | - | # | # | # | 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) |

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)



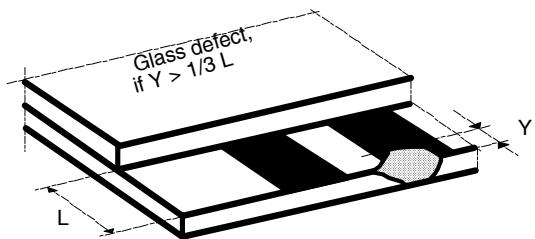
Shapes

- 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: Critical Defect =0.1, Major Defect=0.65; Minor Defect =2.5.

13.2 Inspection Plan: MIL-STD-105E, Normal Inspection Level II, Single Sampling Plan

14. RELIABILITY TEST

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

Reliability characteristics shall meet following requirements.

| Test Item | Test Condition |
|---------------------------------|--|
| High Temperature Storage | +75°C x 96hrs |
| Low Temperature Storage | -25°C x 96hrs |
| High Temperature Operation | +70°C x 96hrs |
| Low Temperature Operation | -20°C x 96hrs |
| High Temperature, High Humidity | +60°C x 95%RH x 96hrs |
| Thermal Shock | -20°C x 30min → +25°C x 10s → +70°C x 30min 5Cycles |
| Vibration Test | Frequency x Swing x Time 40Hz x 4mm x 4hrs |
| Drop Test | Drop height x No. of drops 1.0m x 6drops |

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