

| | | |
|----------|------------------------|--------------|
| CUSTOMER | | |
| MODEL | WC320240A-FCI-N | |
| APPROVAL | BY: | DATA: |

| SALES BY | APPROVED BY | CHECKED BY | PREPARED BY |
|----------|-------------|------------|-------------|
| | | | |

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1. Module Classification Information

W C 3 2 0 2 4 0 A - F C I - N
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧

① Brand : DB LECTRO Inc.

② Display Type : H→Character Type, G→Graphic Type, C→ Color

③ Display Font : 320 * 240 Dots

④ Model serials number

⑤ Backlight Type : N→Without backlight

B→EL, Blue green

A→LED, Amber

D→EL, Green

R→LED, Red

W→EL, White

O→LED, Orange

F→CCFL, White

G→LED, Green

Y→LED, Yellow Green

⑥ LCD Mode :

B→TN Positive, Gray

T→FSTN Negative

N→TN Negative,

C→STN Color

G→STN Positive, Gray

Y→STN Positive, Yellow Green

M→STN Negative, Blue

F→FSTN Positive

⑦ LCD Polarize Type/
 Temperature range/
 View direction

A→Reflective, N.T, 6:00

H→Transflective, W.T,6:00

D→Reflective, N.T, 12:00

K→Transflective,
 W.T,12:00

G→Reflective, W. T, 6:00

C→Transmissive, N.T,6:00

J→Reflective, W. T, 12:00

F→Transmissive, N.T,12:00

B→Transflective, N.T,6:00

I→Transmissive, W. T, 6:00

E→Transflective, N.T.12:00

L→Transmissive, W.T,12:00

⑧ Special Code

N:Without Built in negative voltage

2. Precautions in Use of LCD Module

- (1) Avoid applying excessive shocks to the module or making any alterations or modifications to it.
- (2) Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD Module.
- (3) Don't disassemble the LCM.
- (4) Don't operate it above the absolute maximum rating.
- (5) Don't drop, bend or twist LCM.
- (6) Soldering: only to the I/O terminals.
- (7) Storage: please storage in anti-static electricity container and clean environment.

3. General Specification

| ITEM | STANDARD VALUE | UNIT |
|-------------------|-------------------------------|------|
| Number of dots | 320RGB x240 | dots |
| Outline dimension | 154.6(W)x 114.8(H)x 8.5max(T) | mm |
| View area | 118.18(W)x 89.33(H) | mm |
| Active area | 115.18(W)x 86.33(H) | mm |
| Dot Size | 0.09 x 0.33 | mm |
| Dot Pitch | 0.12 RGW x 0.36 | mm |
| LCD type | FSTN Color transmissive | |
| View direction | 6 o'clock | |
| Backlight | CCFL | |

4. Absolute Maximum Ratings

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT |
|--------------------------|------------------|------|------|----------|------|
| Operating Temperature | T_{OP} | -20 | — | +70 | °C |
| Storage Temperature | T_{ST} | -20 | — | +70 | °C |
| Input Voltage | V_I | -0.3 | — | V_{dd} | V |
| Supply Voltage For Logic | $V_{DD}-V_{SS}$ | 0 | — | 6.5 | V |
| Supply Voltage For LCD | $V_{LCD}-V_{SS}$ | 0 | — | 30 | V |

5. Electrical Characteristics

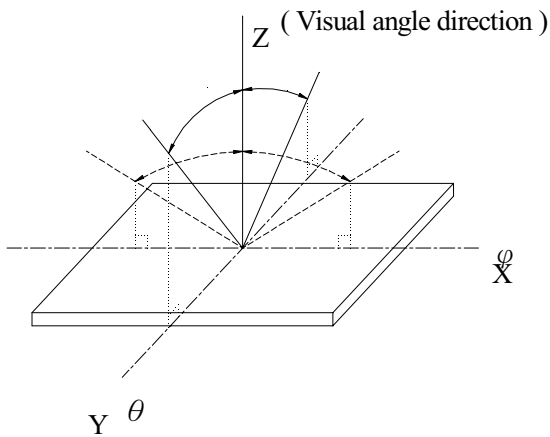
| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|------------------------|------------------|-----------|--------------|------|-------------|------|
| Logic Voltage | $V_{DD}-V_{SS}$ | — | 4.75 | 5.0 | 5.25 | V |
| Supply Voltage For LCD | $V_{LCD}-V_{SS}$ | Ta=-20°C | — | — | — | V |
| | | Ta=25°C | — | 26.2 | — | V |
| | | Ta=70°C | — | — | — | 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 | I_{LCD} | — | — | 7.5 | 11.0 | mA |

6. Optical Characteristics

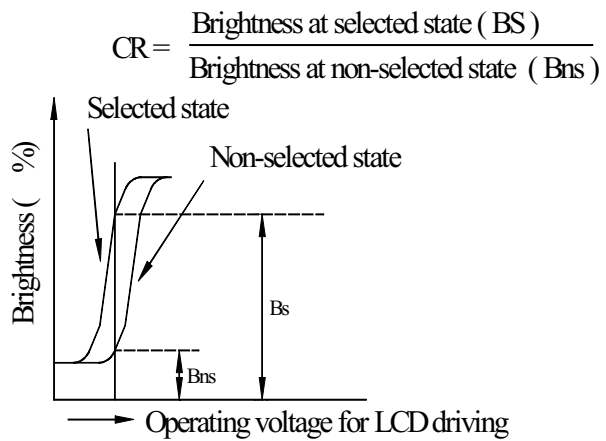
| ITEM | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT |
|----------------|---------------|-------------|-----|-----|-----|------|
| View Angle | (V) θ | $CR \geq 2$ | 10 | — | 105 | deg. |
| | (H) φ | $CR \geq 2$ | -30 | — | 30 | deg. |
| Contrast Ratio | CR | — | — | 8 | — | — |
| Response Time | T rise | — | — | 120 | — | ms |
| | T fall | — | — | 252 | — | ms |

6.1 Definitions

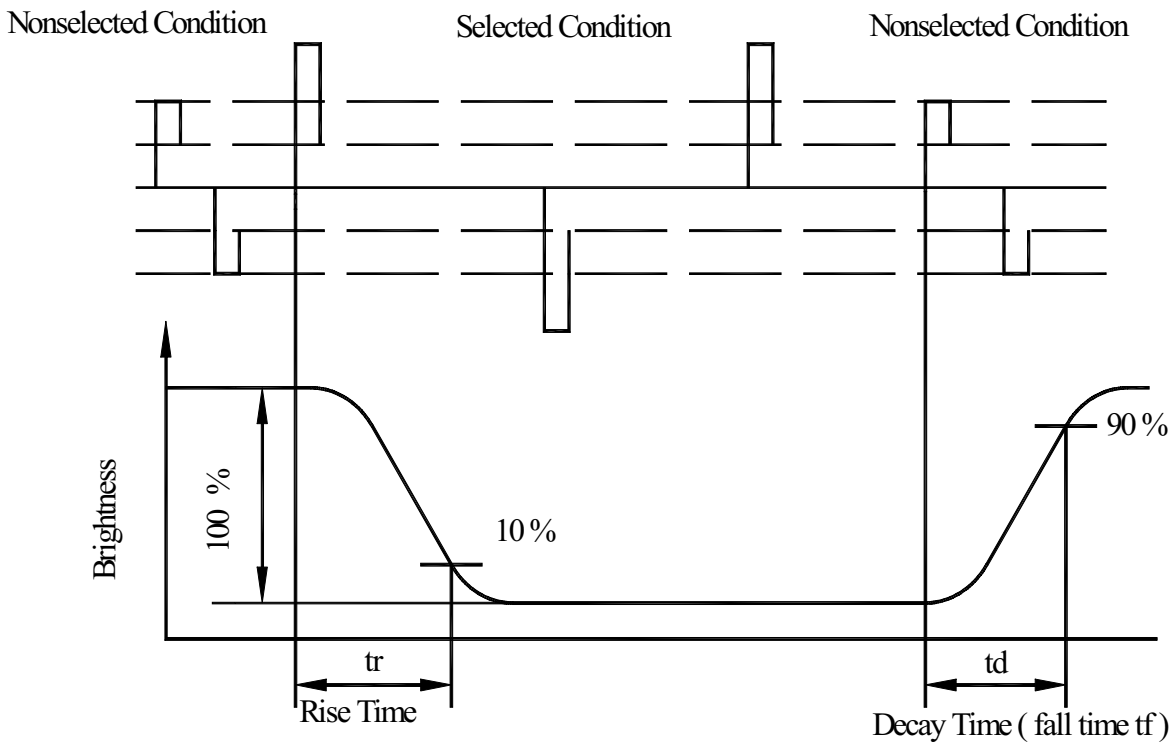
View Angles



Contrast Ratio



Response time

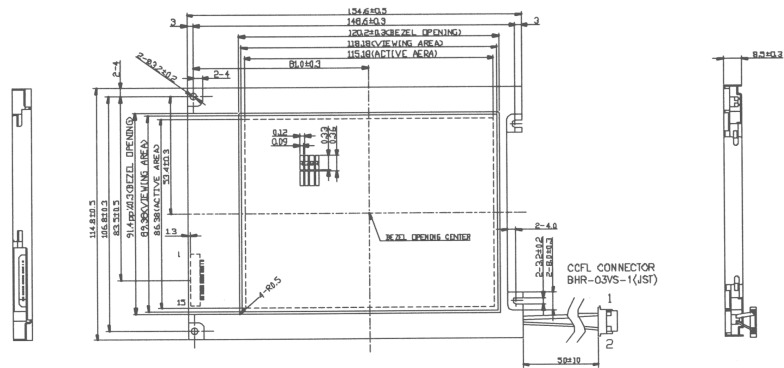


7. Interface Description

| Pin No. | Symbol | Level | Description |
|---------|------------------|------------|-------------------------------|
| 1 | FRM | H | SCAN START-UPSIGNAL |
| 2 | CL1 | H to L | Data latch pulse |
| 3 | CL2 | H to L | Data shift pulse |
| 4 | DISP | H/L | H: Display ON, L: Display OFF |
| 5 | V _{DD} | 5.0V | Power supply for Logic |
| 6 | V _{SS} | 0V | Ground |
| 7 | V _{LCD} | (Variable) | Driving voltage for LCD |
| 8 | D7 | H/L | Display data |
| 9 | D6 | H/L | Display data |
| 10 | D5 | H/L | Display data |
| 11 | D4 | H/L | Display data |
| 12 | D3 | H/L | Display data |
| 13 | D2 | H/L | Display data |
| 14 | D1 | H/L | Display data |
| 15 | D0 | H/L | Display data |

LCD Connector : MOLEX53261-1510

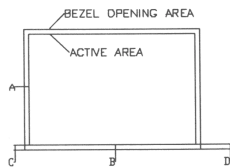
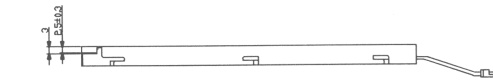
8. Contour Drawing & Block diagram



2) INTERFACE CONNECTOR PIN LAYOUT, MOLEX 53281-1510

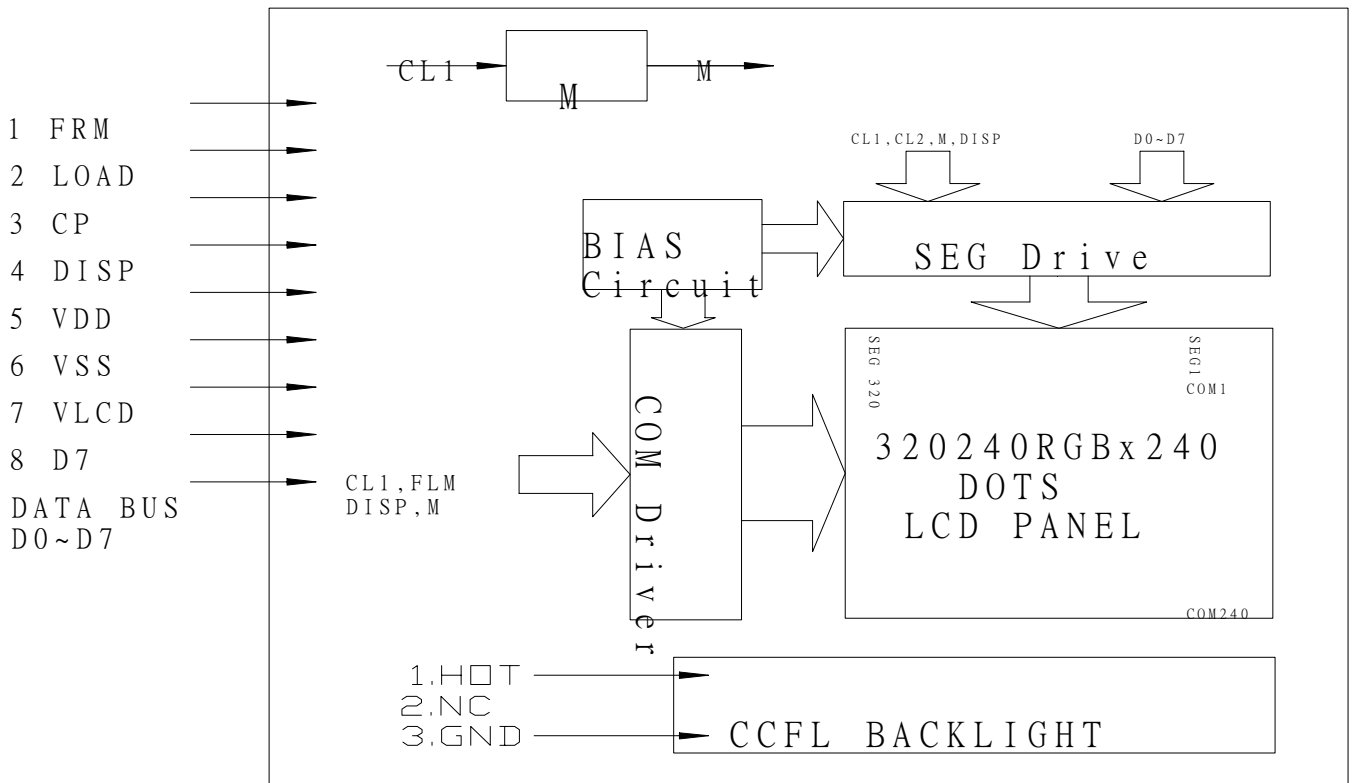
| Pin No. | Pin Name |
|---------|----------|
| 1 | FRM |
| 2 | LOAD |
| 3 | CP |
| 4 | DISP |
| 5 | VDD |
| 6 | VSS |
| 7 | VFF |
| 8 | D7 |
| 9 | D6 |
| 10 | D5 |
| 11 | D4 |
| 12 | D3 |
| 13 | D2 |
| 14 | D1 |
| 15 | DO |

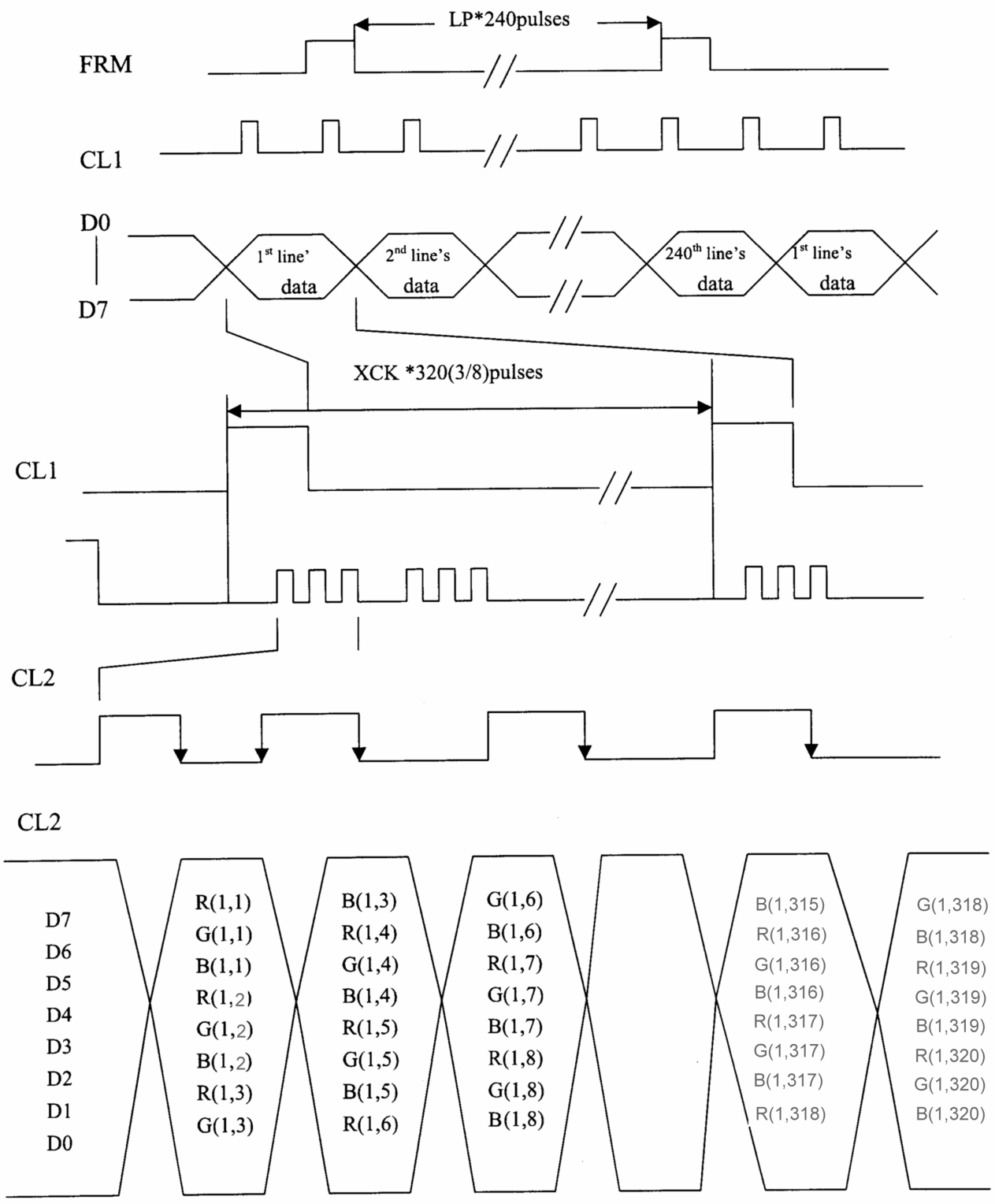
| | | |
|---|-----------------------|----------------------|
| 1 | Lead Type | COLOR RGB |
| 2 | Viewing Direction | 6 O'CLOCK |
| 3 | Drive Method | 1/240 DUTY 1/17 BIAS |
| 4 | Operating Temperature | -20°C~70°C |
| 5 | Storage Temperature | -30°C~80°C |
| 6 | Frame | 7Hz |



- 1> TOLERANCE X-DIRECTION A=2.51±0.6
- 2> TOLERANCE Y-DIRECTION B=2.51±0.6
- 3> OBLIQUITY OF DISPLAY AREA (C-D)<0.6

- NOTES: 1.RESOLUTION : 320RGB X 240 DOTS
- 2.BACKLIGHT COLOR : WHITE(CCFL)
- 3.TOLERANCE NO SPECIFIED : ±0.5mm
- 4. Matching Connector : 51021-1500(Molex) SM02-(8.0)B-BHS-1(JST)





9. Timing Characteristics

9.1. Common & Segment interface timing:

| ITEM | symbol | Test Condition | Min. | Typ. | Max. | Units |
|--------------------|---------|----------------|------|------|------|-------|
| Clock Cycle | tC | Fig.1 | 500 | — | — | ns |
| CP Pulse Width | tWC | Fig.1 | 240 | — | — | ns |
| LP Pulse Width | tWL | Fig.1 | 240 | — | — | ns |
| Data Set Up Time | tDSU | Fig.1 | 240 | — | — | ns |
| Data Hold Time | tDHD | Fig.1 | 240 | — | — | ns |
| CP Rise/Fall Time | tr,tf | Fig.1 | — | — | 50 | ns |
| CP to LOAD | tCL | Fig.1 | 240 | — | — | ns |
| LOAD to CP | tLC | Fig.1 | 240 | — | — | ns |
| LP Pulse Width | tLW | Fig.1 | 240 | — | — | ns |
| CL1 Pulse Width | tCW | Fig.2 | 170 | — | — | ns |
| Data Set Up Time | tDSU2 | Fig.2 | 240 | — | — | ns |
| Data Hold Time | tDHD2 | Fig.2 | 170 | — | — | ns |
| CL1 Rise/Fall Time | tr2,tf2 | Fig.2 | — | — | 50 | ns |

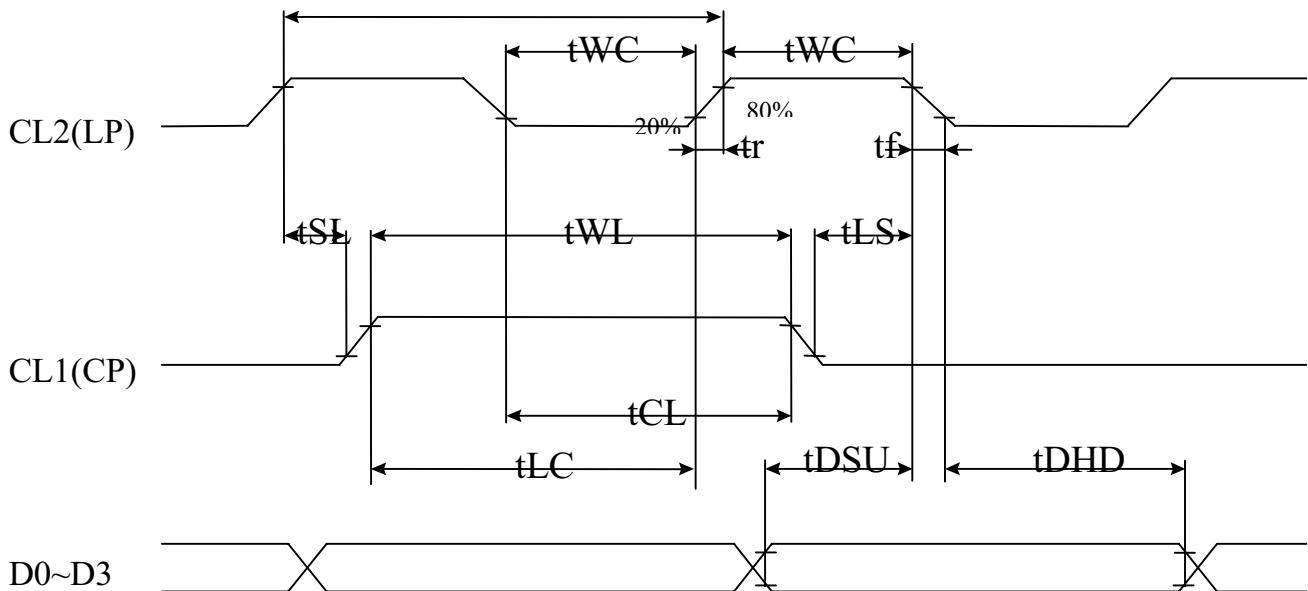


Fig 1. SEGMENT TIMING

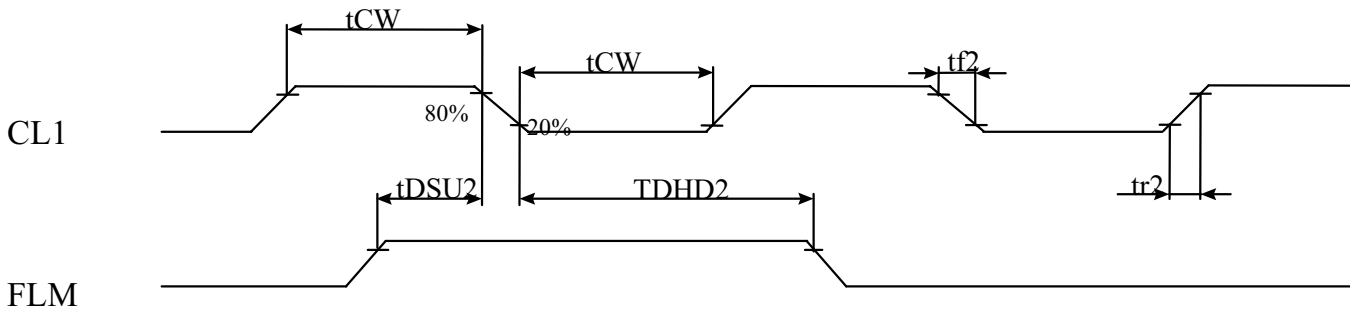
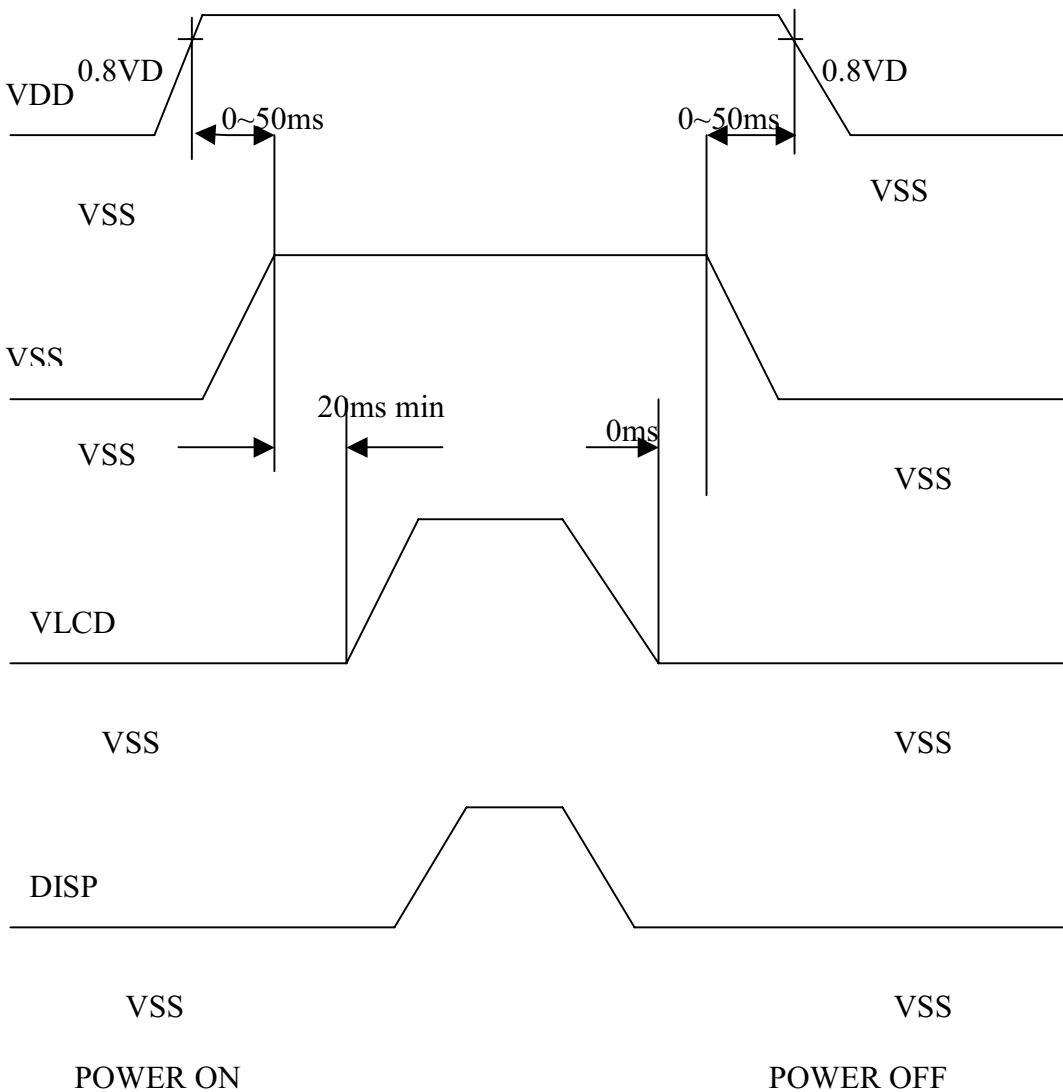


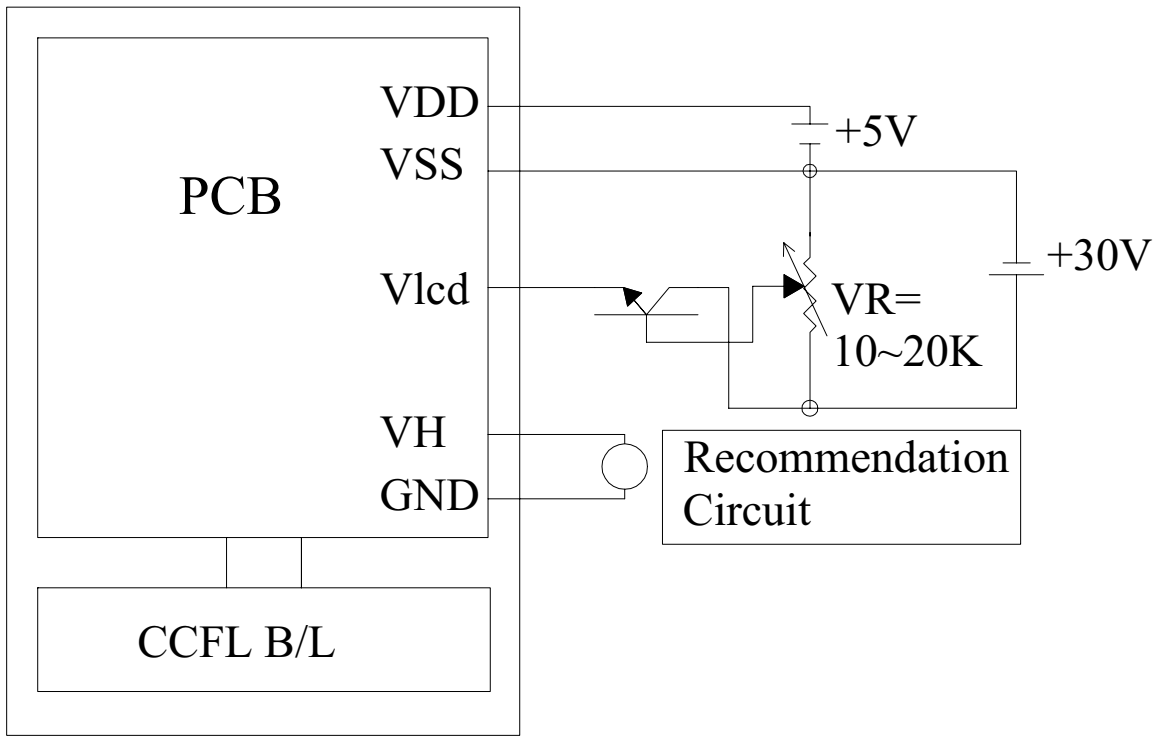
Fig 2 COMMON TIMING

9.2 POWER ON/OFF TIMING



The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

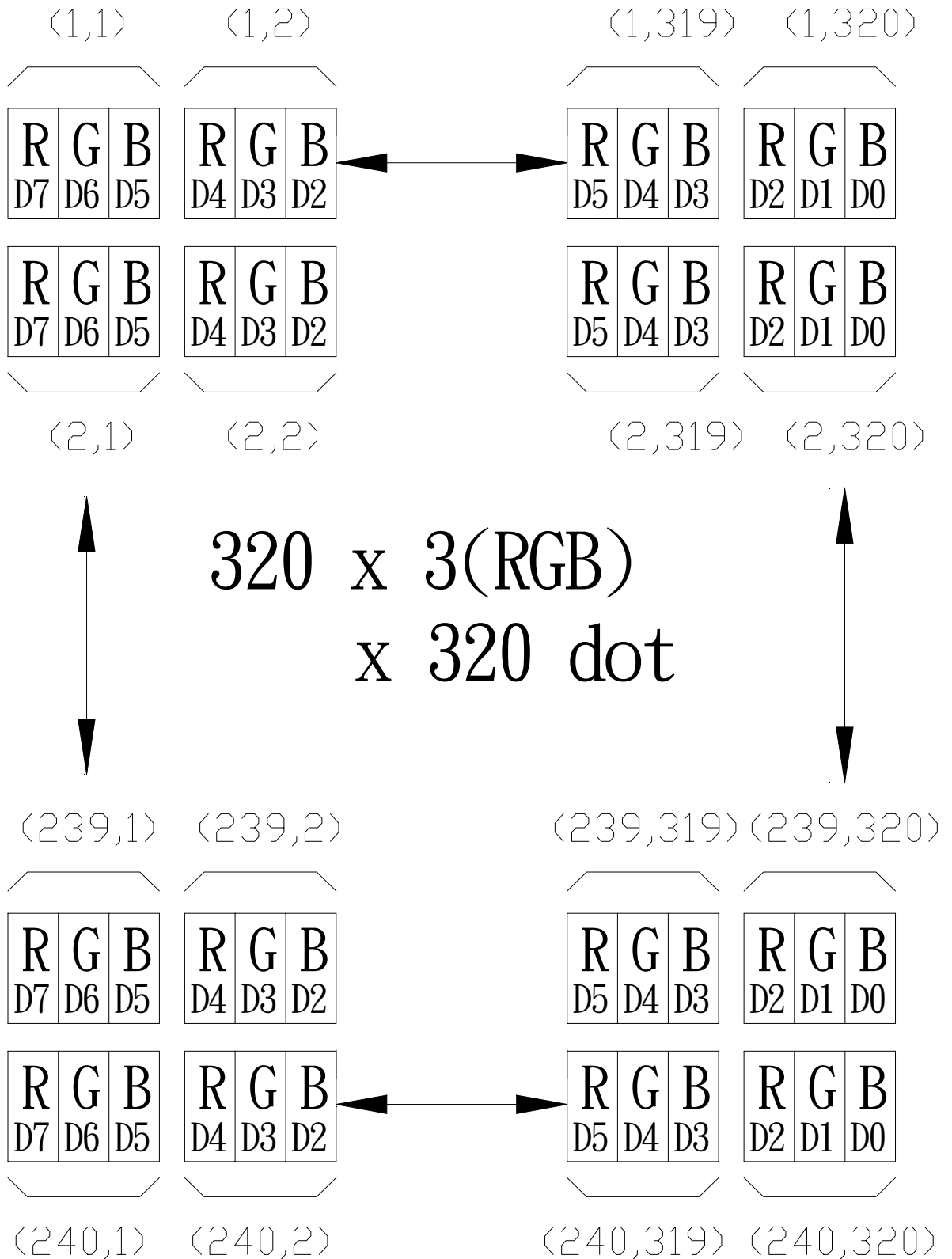
10. POWER SUPPLY



11. DISPLAY PATTERN

segment

Common



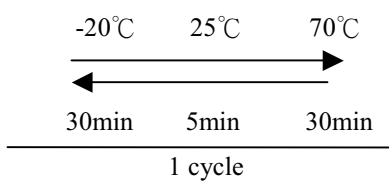
12. Quality Assurance

◆ 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 in Polarize | <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 | | | | | | | | | | | | | | | | | | | | |

13. 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. | 70°C 120hrs | — |
| 2 | Low Temperature storage | Endurance test applying the high storage temperature for a long time. | -20°C 120hrs | — |
| 3 | High Temperature Operation | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time. | 70°C 120hrs | — |
| 4 | Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time. | -20°C 120hrs | — |
| 5 | High Temperature/ Humidity Storage | Endurance test applying the high temperature and high humidity storage for a long time. | 70°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. | 70°C,90%RH 96hrs | — |
| 7 | Temperature Cycle | Endurance test applying the low and high temperature cycle.  | -20°C/70°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

14. Backlight Information

(Ta=25°C)

CCFL backlight Specification

(Ta=25°C)

| Item | Symbol | Specification | | | Unit | Condition |
|---|------------------|---------------|-------|-----|-------------------|---|
| | | Min | Typ | Max | | |
| Driving Voltage | V _{FL} | — | 500 | — | Vrms | — |
| Input current | I _{FL} | 4.5 | 5.0 | 5.5 | mArms | — |
| Power consumption | W | — | 2.5 | — | W | — |
| Starting Voltage | V _{FLS} | — | 630 | — | Vrms | — |
| Luminance | L | — | 550 | — | Cd/m ² | $\varphi, \theta = 0 \text{ deg}, I_{FL} = 5.0\text{mArms}$ |
| Chromaticity | x | — | 0.340 | — | — | — |
| | y | — | 0.370 | — | — | — |
| Luminance Uniformity (Testing 9 point) | — | 75% | — | — | % | $\varphi, \theta = 0 \text{ deg}, I_{FL} = 5.0\text{mArms}$ |
| Life time | — | 10000 | — | — | hrs | — |

CCFL Connector: BHR-03VS-1(JST)