

SPECIFICATION FOR LCD MODULE

Model No. [TM320240AKGWT1](#)

| | |
|----------------------|--------------|
| Prepared by: | Date: |
| Checked by : | Date: |
| Verified by : | Date: |
| Approved by: | Date: |

TIANMA MICROELECTRONICS CO., LTD

REVISION RECORD

| Date | Ver. | Ref. Page | Revision No. | Revision Items |
|-------------|-------------|------------------|---------------------|-----------------------|
| | | | | |

1. General Specifications:

- 1.1 Display type: COLOR STN with touch panel
- 1.2 Display color*¹:
 - Display color: Decided by the Controller
 - Background*²: Black (Red, Green, Blue dots are off state)
- 1.3 Polarizer mode: Transmissive/Negative
- 1.4 Viewing Angle: 6:00
- 1.5 Driving Method: 1/240 Duty 1/17 Bias
- 1.6 Backlight Type: CCFL
 - Backlight Color: WHITE
 - Backlight Life: 15000 hrs (Min.)
- 1.7 Driver: LH1562F4
- 1.8 Data Transfer: 8 Bit Parallel
- 1.9 Operating Temperature: -10----+60
 - Storage Temperature: -20----+70
- 1.10 Power Supply Voltage: VDD=5.0V
- 1.11 LCD Operating Voltage: VLCD=23.0V
- 1.12 Outline Dimensions: Refer to outline drawing on next page
- 1.13 Dot Matrix: 320 X 3(RGB) X 240 Dots
- 1.14 Dot Size: 0.345(R+G+B) × 0.345(mm²)
- 1.15 Dot Pitch: 0.36 × 0.36 (mm²)
- 1.16 Weight: TBD*³

*¹ Color tone is slightly changed by temperature and driving voltage.

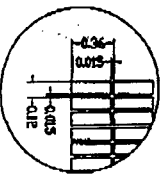
*² Color tone will be changed by backlight.

*³ TBD: To Be Determined.

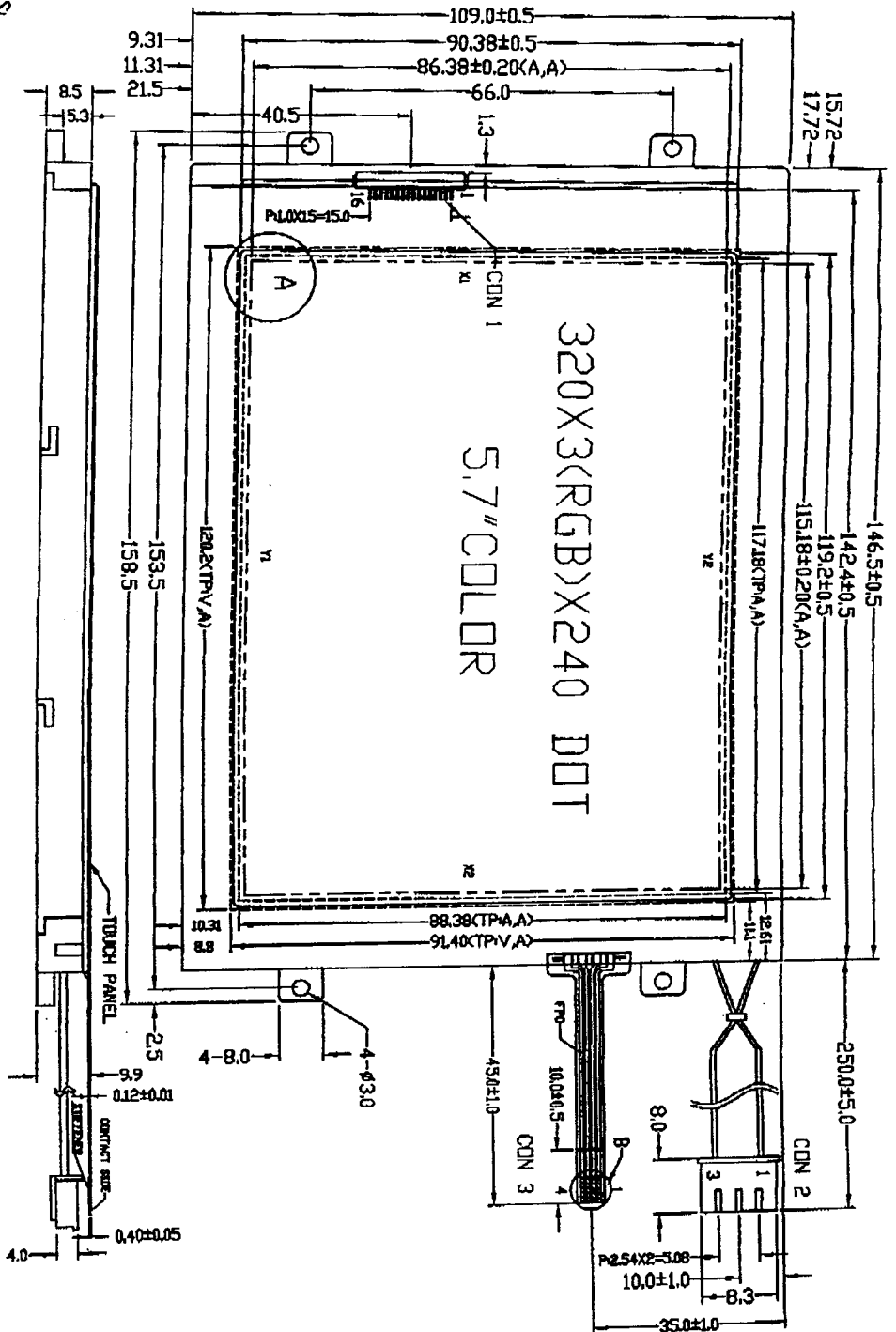
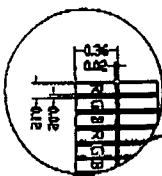
- NOTES:
1. DISPLAY TYPE.
 2. VIEWING DIRECTION.
 3. POLARIZER MODE.
 4. DRIVE METHOD.
 5. VEE.
 6. VDD.
 7. OPERATING TEMP.
 8. STORAGE TEMP.
 9. DRIVER.
 10. BACKLIGHT.
 11. BEZEL IS STAINLESS STEEL
 12. ALL UNMARKED TOLERANCES

COLOR STN
600
TRANSMISSIVE/NEGATIVE
1/240 DUTY 1/15 BIAS
21.6V
5.0V
-10°C~+55°C
-20°C~+65°C
LH562F4
CCFL(WHITE)
±0.3mm

DETAIL A



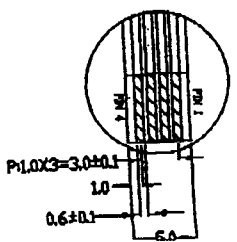
COLOR FILTER
BLACK MASK



| CON 1 | | CON 2 | |
|-------|---------|-------|--------|
| PIN | SYMBOL | PIN | SYMBOL |
| 1 | H | 1 | VFL1 |
| 2 | YD | 2 | NC |
| 3 | LP | 3 | VFL2 |
| 4 | XCK | | |
| 5 | RESERVE | | |
| 6 | VDD | | |
| 7 | VSS | | |
| 8 | VEE | | |
| 9 | D7 | | |
| 10 | D6 | | |
| 11 | D5 | | |
| 12 | D4 | | |
| 13 | D3 | | |
| 14 | D2 | | |
| 15 | D1 | | |
| 16 | D0 | | |

| CON 3 | |
|-------|--------|
| PIN | SYMBOL |
| 1 | Y2 |
| 2 | Y2 |
| 3 | Y1 |
| 4 | X1 |

DETAIL B

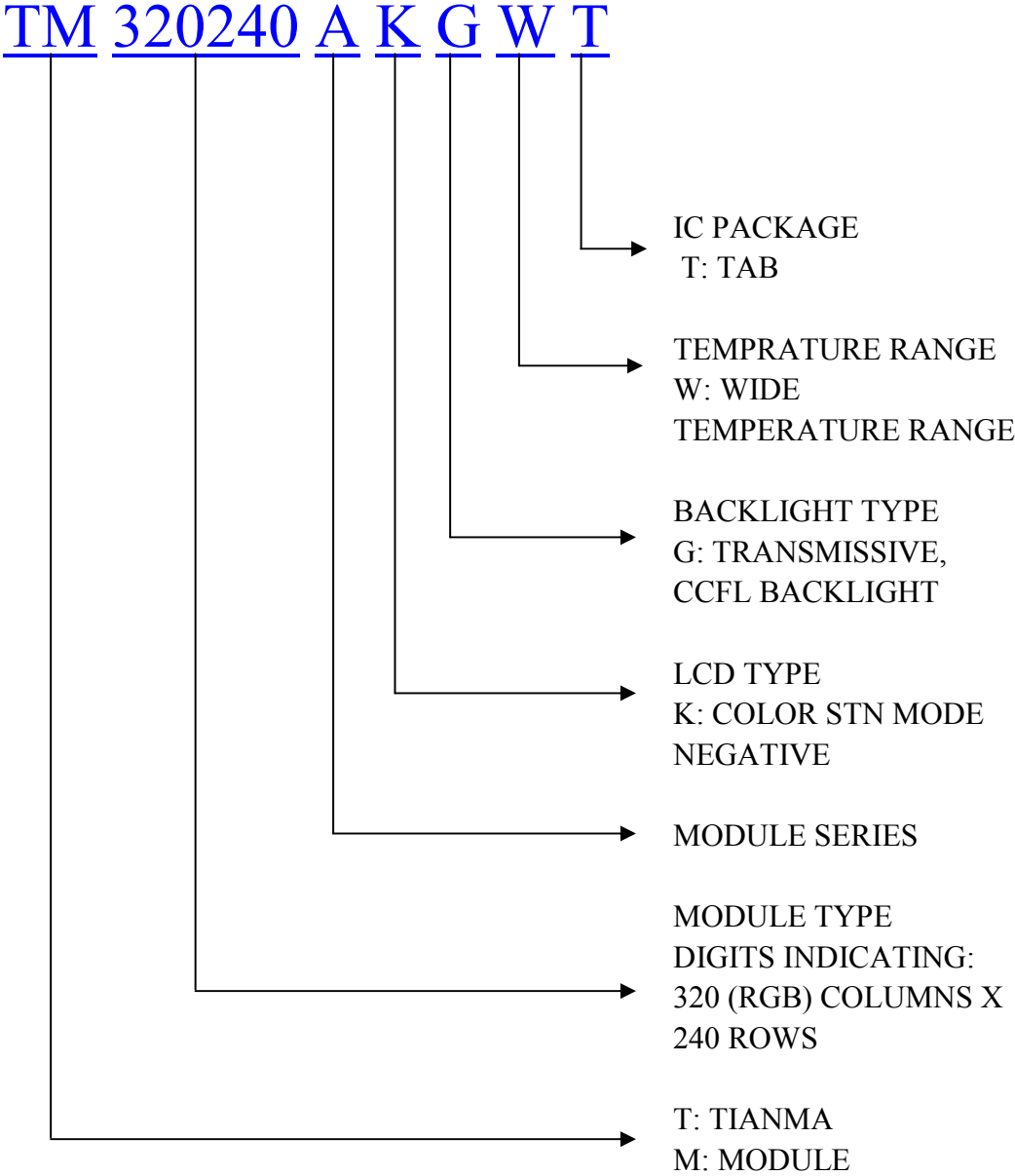


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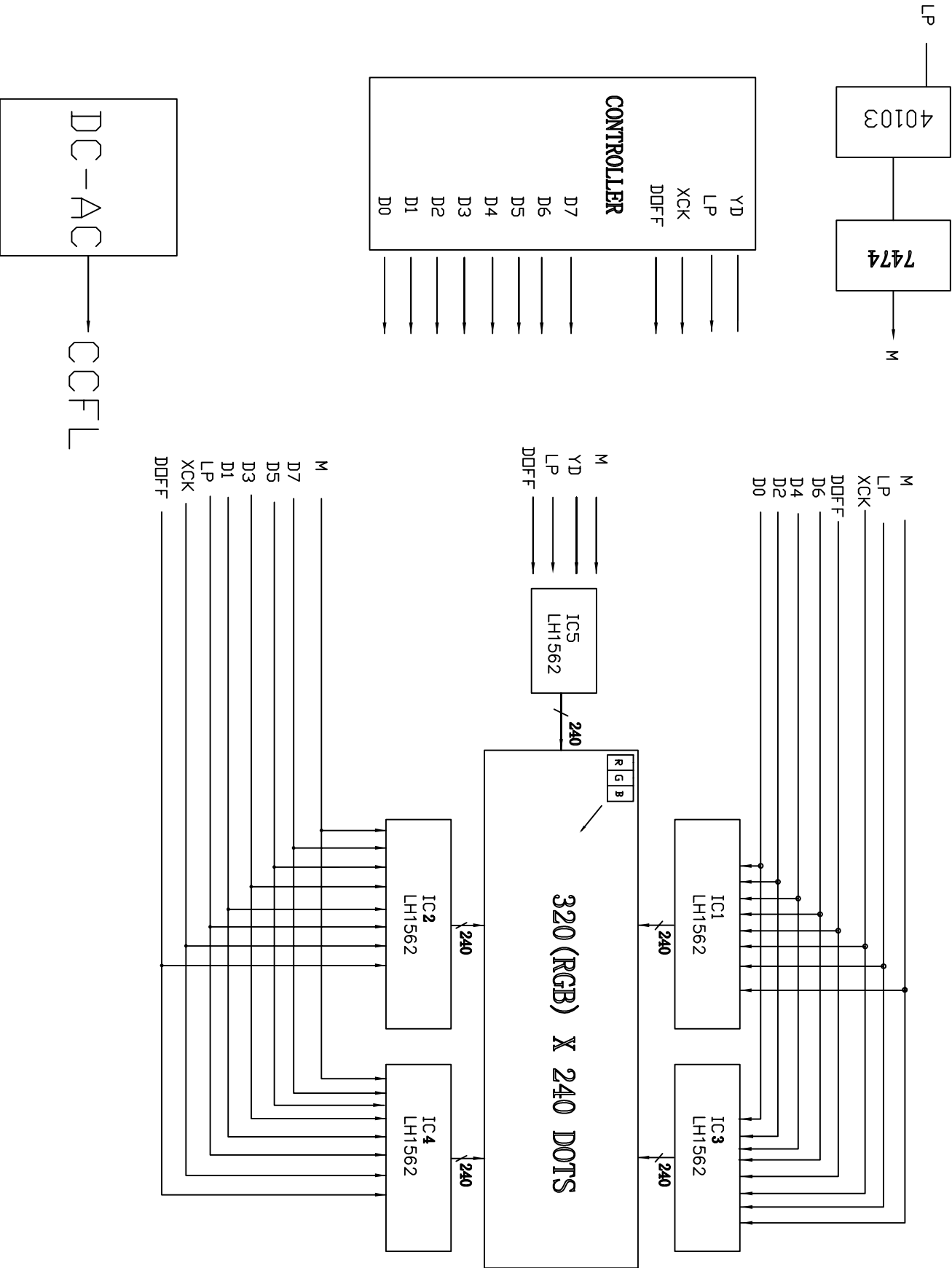
DRAWN BY: *[Signature]* 2008-08-02
CHECKED BY: *[Signature]* 2008-08-02
APPROVED BY: *[Signature]* 2008-08-02
CONTRIBUTOR BY: *[Signature]* 2008-08-02

TYPE: TM320240AKGV11
DWG NO: G-1
SCALE: 1:1
UNIT: mm
SHEET NO: 1 OF 1

3. LCD Module Part Numbering System



4. Circuit Block Diagram



5. Absolute Maximum Ratings

Ta=25

| Item | Symbol | Min. | Max. | Unit | Remark |
|-----------------------------|-----------------------------------|------|-------|------|--------------------|
| Power Supply Voltage | V _{DD} - V _{SS} | -0.3 | +6.0 | V | |
| LCD Driving Voltage | V _{LCD} | -0.3 | +40.0 | | |
| Operating Temperature Range | T _{OP} | -10 | +60 | | No Condensation |
| Storage Temperature Range | T _{ST} | -20 | +70 | | |

6. Electrical Specifications and Instruction Code

6.1 Electrical characteristics

$V_{SS}=0V$, $T_a=25$

| Item | Symbol | Min. | Typ. | Max. | Unit |
|--------------------------------|--------------------------------------|-------------|------|--------------|------------|
| Supply Voltage (Logic) | $V_{DD}-V_{SS}$ | +4.5 | +5.0 | +5.5 | V |
| Supply Voltage (LCD Drive) | V_{LCD} | - | 23.0 | - | V |
| Input Signal Voltage | High V_{IH} ($V_{DD}=5.0$) | $0.8V_{DD}$ | - | V_{DD} | V |
| | Low V_{IL} ($V_{DD}=5.0$) | 0 | - | $0.2 V_{DD}$ | V |
| Supply current (Logic) | I_{DD} ($V_{DD}-V_{SS}=5.0V$) | - | 1.5 | - | mA |
| Supply current (LCD Drive) | I_{EE} | - | 4.5 | - | mA |
| Supply Voltage (CCFL Drive) | V_{CL} ($I_{CL}=5.0mA$) | - | 270 | 350 | V_{rms} |
| Supply current (CCFL Drive) | I_{CL} | - | 5.0 | 6.3 | mA_{rms} |
| Frequency (CCFL Drive) | f_{CL} | - | 36.6 | - | kHz |

6.2 Interface Signals

6.2.1 CON1

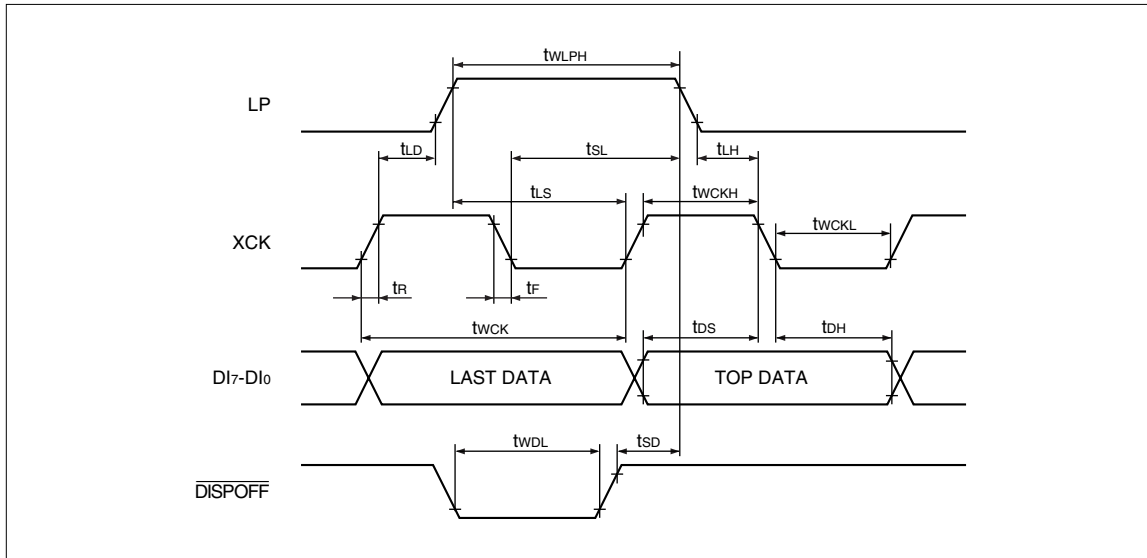
| Pin No. | Symbol | Level | Description |
|---------|----------------|-------|---|
| 1 | M | H/L | Input of signal to AC electrify the liquid crystal drive output |
| 2 | YD | H/L | Scan start pulse |
| 3 | LP | H/L | Display data latch pulse input |
| 4 | XCK | H/L | Display data shift clock input |
| 5 | DISPOFF | H/L | H: Display on, L: Display off |
| 6 | VDD | +5.0V | Supply voltage for logic |
| 7 | VSS | 0V | Ground |
| 8 | VEE | +23V | LCD voltage input |
| 9 | D7 | H/L | Data bit 7 |
| 10 | D6 | H/L | Data bit 6 |
| 11 | D5 | H/L | Data bit 5 |
| 12 | D4 | H/L | Data bit 4 |
| 13 | D3 | H/L | Data bit 3 |
| 14 | D2 | H/L | Data bit 2 |
| 15 | D1 | H/L | Data bit 1 |
| 16 | D0 | H/L | Data bit 0 |

6.2.2 CON2

| Pin No. | Symbol | Level | Description |
|---------|--------|-------|-------------------------|
| 1 | VFL1 | AC | Supply voltage for CCFL |
| 2 | NC | - | No connection |
| 3 | VFL2 | VSS | Supply voltage for CCFL |

6.3 Interface Timing Chart

6.3.1 Segment mode



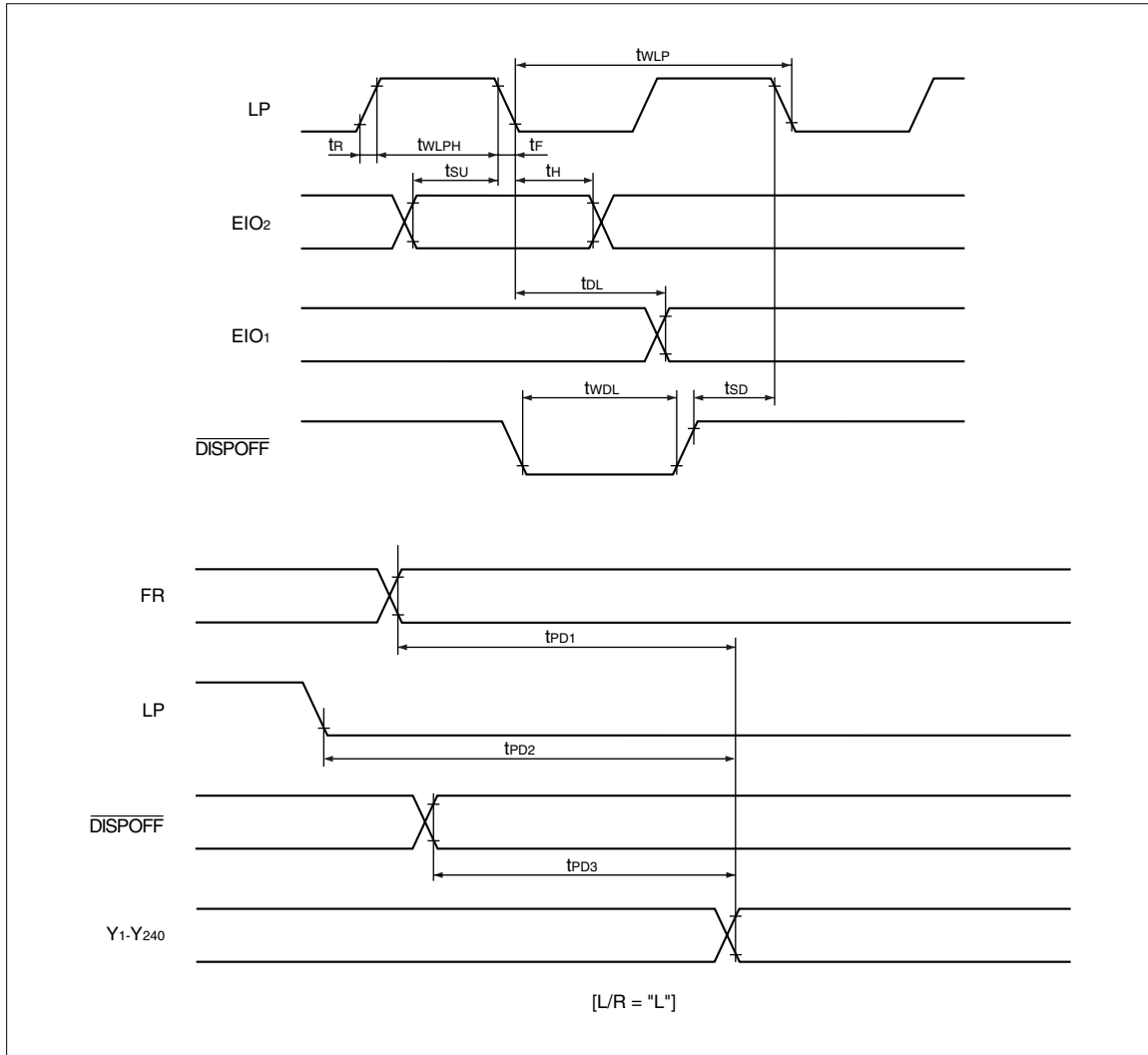
($V_{SS} = V_5 = 0 \text{ V}$, $V_{DD} = +5.0 \pm 0.5 \text{ V}$, $V_0 = +15.0 \text{ to } +42.0 \text{ V}$, $T_{OPR} = -20 \text{ to } +85 \text{ }^\circ\text{C}$)

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNIT | NOTE |
|---|------------|-------------------------------|------|------|------|---------------|------|
| Shift clock period | twCK | $t_r, t_f \leq 10 \text{ ns}$ | 50 | | | ns | 1 |
| Shift clock "H" pulse width | twCKH | | 15 | | | ns | |
| Shift clock "L" pulse width | twCKL | | 15 | | | ns | |
| Data setup time | tDS | | 10 | | | ns | |
| Data hold time | tDH | | 12 | | | ns | |
| Latch pulse "H" pulse width | twLPH | | 15 | | | ns | |
| Shift clock rise to latch pulse rise time | tLD | | 0 | | | ns | |
| Shift clock fall to latch pulse fall time | tSL | | 30 | | | ns | |
| Latch pulse rise to shift clock rise time | tLS | | 25 | | | ns | |
| Latch pulse fall to shift clock fall time | tLH | | 25 | | | ns | |
| Enable setup time | ts | | 10 | | | ns | |
| Input signal rise time | tR | | | | 50 | ns | 2 |
| Input signal fall time | tF | | | | 50 | ns | 2 |
| DISPOFF removal time | tSD | | 100 | | | ns | |
| DISPOFF "L" pulse width | twDL | | 1.2 | | | μs | |
| Output delay time (1) | td | $C_L = 15 \text{ pF}$ | | | 30 | ns | |
| Output delay time (2) | tpD1, tpD2 | $C_L = 15 \text{ pF}$ | | | 1.2 | μs | |
| Output delay time (3) | tpD3 | $C_L = 15 \text{ pF}$ | | | 1.2 | μs | |

NOTES :

1. Takes the cascade connection into consideration.
2. $(twCK - twCKH - twCKL)/2$ is maximum in the case of high speed operation.

6.3.2 Common Mode



($V_{SS} = V_5 = 0\text{ V}$, $V_{DD} = +2.5\text{ to }+5.5\text{ V}$, $V_0 = +15.0\text{ to }+42.0\text{ V}$, $T_{OPR} = -20\text{ to }+85\text{ }^\circ\text{C}$)

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|-----------------------------|--------------------|----------------------------------|------|------|------|---------------|
| Shift clock period | t_{WLP} | $t_R, t_F \leq 20\text{ ns}$ | 250 | | | ns |
| Shift clock "H" pulse width | t_{WLPH} | $V_{DD} = +5.0 \pm 0.5\text{ V}$ | 15 | | | ns |
| Data setup time | t_{SU} | | 30 | | | ns |
| Data hold time | t_H | | 50 | | | ns |
| Input signal rise time | t_R | | | | 50 | ns |
| Input signal fall time | t_F | | | | 50 | ns |
| DISPOFF removal time | t_{SD} | | 100 | | | ns |
| DISPOFF "L" pulse width | t_{WDL} | | 1.2 | | | μs |
| Output delay time (1) | t_{DL} | $C_L = 15\text{ pF}$ | | | 200 | ns |
| Output delay time (2) | t_{PD1}, t_{PD2} | $C_L = 15\text{ pF}$ | | | 1.2 | μs |
| Output delay time (3) | t_{PD3} | $C_L = 15\text{ pF}$ | | | 1.2 | μs |

7. Optical Characteristics

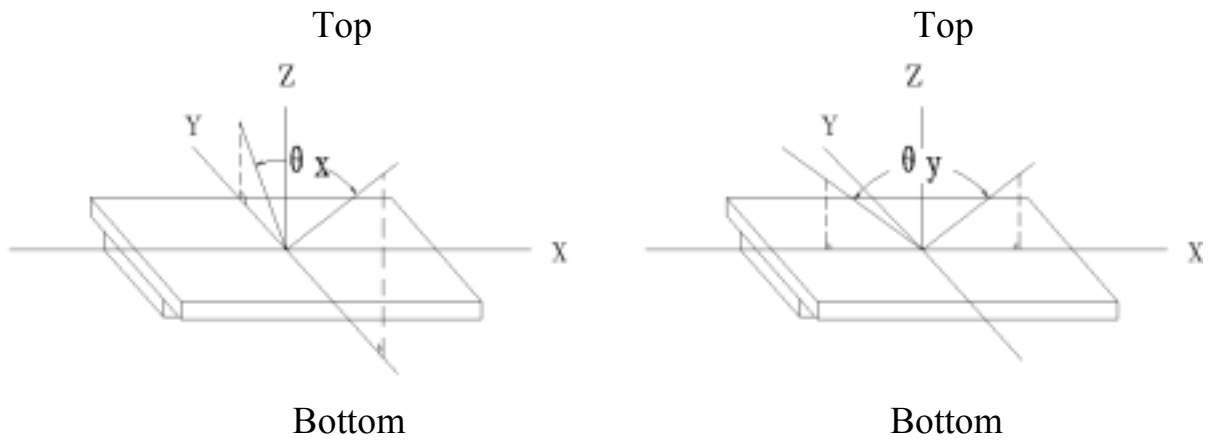
7.1 Optical Characteristics

V_{LCD}=23V Ta=25

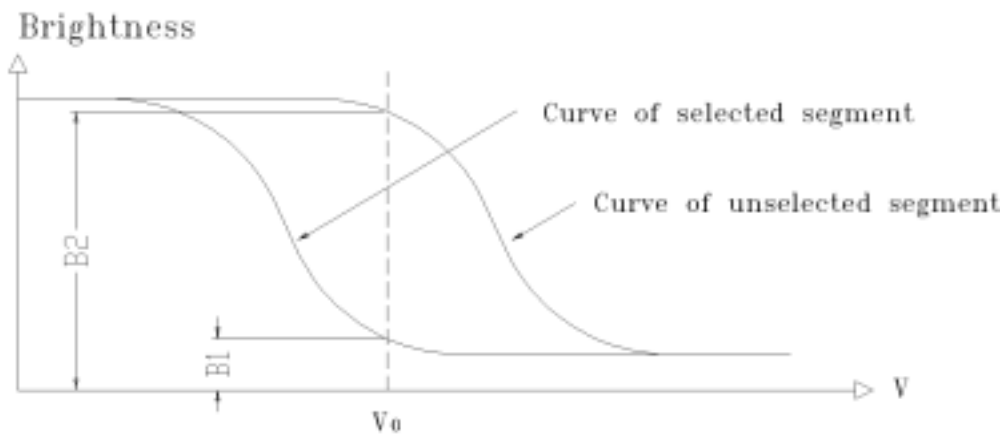
| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--------------------------|----------|--------|----------------|-------|------------|------|-------------------|
| Viewing Angle | | x | Cr≥2 | y=0 ° | -50 -- +40 | | Deg |
| | | y | | x=0 ° | -40 -- +40 | | |
| Contrast Ratio | | Cr | x=0 ° y=0 ° | - | 50 | - | |
| Response Time | Turn on | Ton | x=0 ° y=0 ° | - | 150 | - | ms |
| | Turn off | Toff | | - | 150 | - | |
| Color Of CIE Coord-Inate | Red | Y | x=0 ° y=0 ° | - | TBD | - | cd/m ² |
| | | x | | - | TBD | - | |
| | | y | | - | TBD | - | |
| | Green | Y | x=0 ° y=0 ° | - | TBD | - | cd/m ² |
| | | x | | - | TBD | - | |
| | | y | | - | TBD | - | |
| | Blue | Y | x=0 ° y=0 ° | - | TBD | - | cd/m ² |
| | | x | | - | TBD | - | |
| | | y | | - | TBD | - | |

7.2 Definition of Optical Characteristics

7.2.1 Definition of Viewing Angle



7.2.2 Definition of Contrast Ratio

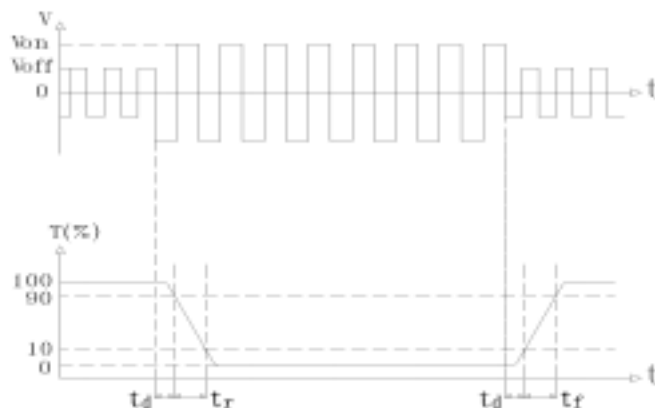


$$\text{Contrast Ratio} = B2/B1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

- 1) Ambient Temperature: 25 ; 2) Frame frequency: 64Hz

7.2.3 Definition of Response time



Turn on time: $t_{on} = t_d + t_r$ Turn off time: $t_{off} = t_d + t_r$

Measuring Condition:

- 1) Operating Voltage: 23.0V 2) Frame frequency: 64Hz

7.3 Brightness Characteristic

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|------------|--------|-----------|------|------|------|-------------------|
| Brightness | Bp | Ta=25 ±3 | 58.9 | - | 79.2 | cd/m ² |
| Uniformity | Bp | 30-80%RH | - | 75 | - | % |

Note:

1. The data is measured after CCFLs are turned on for 5 minutes.
2. Testing conditions CCFL: V_{CF} = 270 V (AC)
 LCD: All dots are on (White color)
3. Brightness in the center of the LCD panel.
4. Definition of Uniformity (Bp)
 $Bp = Bp (\text{Min.}) / Bp (\text{Max.}) \times 100 (\%)$
 Bp (Max.) = Maximum brightness in 9 measurement spots
 Bp (Min.) = Minimum brightness in 9 measurement spots

8. Reliability

8.1 Content of Reliability Test

Ta=25

| No. | Test Item | Content of Test | Test condition |
|-----|------------------------------------|--|---|
| 1 | High Temperature Storage | Endurance test applying the high storage temperature for a long time | 70 ±2 240H Restore 4H at 25 |
| 2 | Low Temperature Storage | Endurance test applying the low storage temperature for a long time | -20 ±2 240H Restore 4H at 25 |
| 3 | High Temperature /Humidity Storage | Endurance test applying the high temperature and high humidity storage for a long time | 60 ±2 90%RH 240H Restore 4H at 25 |
| 4 | Temperature Cycle | Endurance test applying the low and high temperature cycle -20 25 70 25 30min 5min 30min 5min 1 cycle | -20 /70 10 cycles Restore 4H at 25 |
| 5 | Vibration Test (package state) | Endurance test applying the vibration during transportation | 10Hz~150Hz, 100m/s ² , 120min |
| 6 | Shock Test (package state) | Endurance test applying the shock during transportation | Half- sine wave, 300m/s ² , 18ms |
| 7 | Atmospheric Pressure Test | Endurance test applying the atmospheric pressure during transportation by air | 25kPa 16H Restore 2H |

8.2 Failure Judgment Criterion

| Criterion Item | Test Item No. | | | | | | | | | Failure Judgement Criterion |
|--------------------------|--|---|---|---|---|---|---|---|---|-------------------------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| Basic Specification | √ | √ | √ | √ | √ | √ | √ | √ | √ | Out of the basic Specification |
| Electrical specification | √ | √ | √ | √ | √ | | | | | Out of the electrical specification |
| Mechanical Specification | | | | | | | √ | √ | | Out of the mechanical specification |
| Optical Characteristic | √ | √ | √ | √ | √ | √ | | | √ | Out of the optical specification |
| Note | For test item refer to 8.1 | | | | | | | | | |
| Remark | Basic specification = Optical specification + Mechanical specification | | | | | | | | | |

9. Quality Level

| Examination or Test | At $T_a=25$ (unless otherwise stated) | Inspection | | | | |
|---|--|----------------|------|------|----|------------------------------|
| | | Min. | Max. | Unit | IL | AQL |
| External Visual Inspection | Under normal illumination and eyesight condition, the distance between eyes and LCD is 25cm. | See Appendix A | | | II | Major 1.0 Minor 2.5 |
| Display Defects | Under normal illumination and eyesight condition, display on inspection. | See Appendix B | | | II | Major 1.0 Minor 2.5 |
| Note: Major defects: Open segment or common, Short, Serious damages, Leakage Miner defects: Others Sampling standard conforms to GB2828 | | | | | | |

10. Precautions for Use of LCD Modules

10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

10.1.7 If the logic circuit power is off, do not apply the input signals.

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

- a. Be sure to ground the body when handling the LCD Modules.
- b. Tools required for assembly, such as soldering irons, must be properly ground.
- c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
- d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0 ~ 40



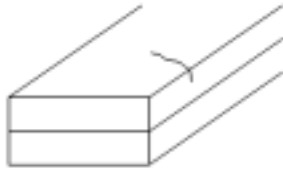
Relatively humidity: 80%

10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

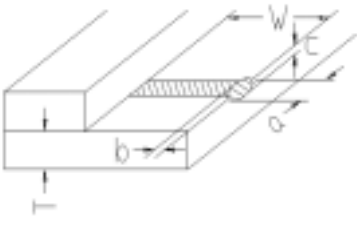
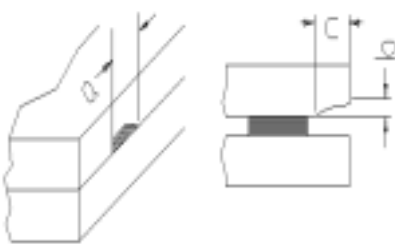
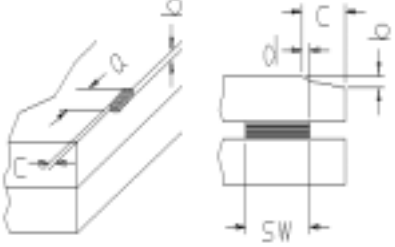
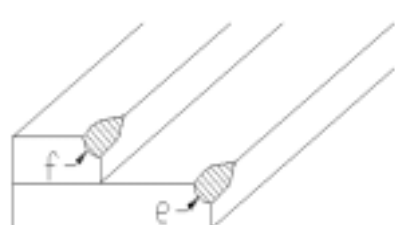
Appendix A

Inspection items and criteria for appearance defects

| Items | Contents | Criteria | | |
|---------------------------------|---|---------------------------------|----------------------------|------------------------------|
| Leakage | | Not permitted | | |
| Rainbow | | According to the limit specimen | | |
| Polarizer | Wrong polarizer attachment | Not permitted | | |
| | Bubble between polarizer and glass | Not counted | Max. 3 defects allowed | |
| | | $\phi < 0.3\text{mm}$ | 0.3mm ϕ 0.5mm | |
| | Scratches of polarizer | According to the limit specimen | | |
| Black spot (in viewing area) |  | Not counted | Max. 3 spots allowed | Max. 3 spots (lines) allowed |
| | | $X < 0.2\text{mm}$ | 0.2mm X 0.5mm | |
| | | $X = (a+b)/2$ | | |
| Black line (in viewing area) |  | Not counted | Max. 3 lines allowed | Max. 3 spots (lines) allowed |
| | | $a < 0.02\text{mm}$ | 0.02mm a 0.05mm b 2.0mm | |
| Progressive cracks |  | Not permitted | | |

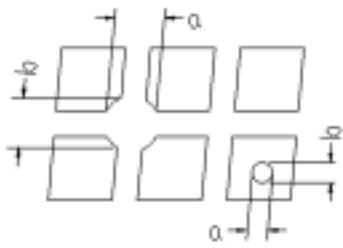
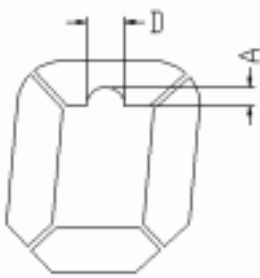
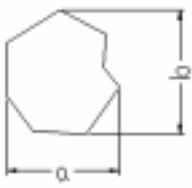
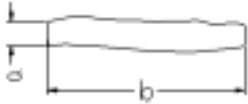
Appendix A

Inspection item and criteria for appearance defects (continued)

| Items | Contents | Criteria | | | | | | | |
|--|---|------------------------------------|---------------|-----------------------|-----------------------|-----------------------|--|--|--|
| Glass Cracks | Cracks on pads  | a | b | c | Max. 2 cracks allowed | Max. 5 cracks allowed | | | |
| | | 3mm | W/5 | T/2 | | | | | |
| | | 2mm | W/5 | $T/2 < C < T$ | | | | | |
| | Cracks on contact side  | a | b | | Max. 2 cracks allowed | | | | |
| | | 3mm | T/2 | | | | | | |
| | | 2mm | $T/2 < b < T$ | | | | | | |
| | | C shall be not reach the seal area | | | | | | | |
| | Cracks on non-contact side  | a | b | | Max. 2 cracks allowed | | | | |
| | | 3mm | T/2 | | | | | | |
| | | 2mm | $T/2 < b < T$ | | | | | | |
| | C 0.5mm | | | | | | | | |
| | d SW/3 | | | | | | | | |
| Corner cracks  | $e < 2.0\text{mm}^2$ $f < 2.0\text{mm}^2$ | | | Max. 3 cracks allowed | | | | | |

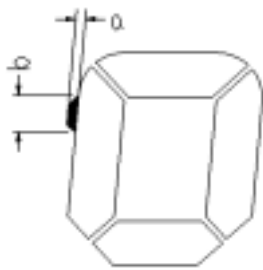
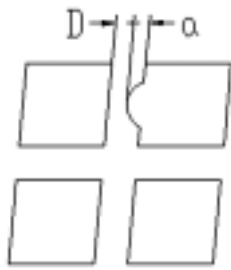
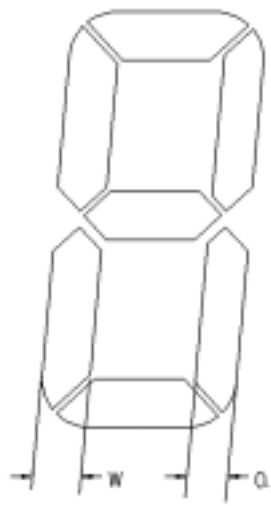
Appendix B

Inspection items and criteria for display defects

| Items | Contents | Criteria | | | |
|---------------------------------------|---|--------------------------------------|----------------------------|--|-----------------------------|
| Open segment or open common | | Not permitted | | | |
| Short | | Not permitted | | | |
| Wrong viewing angle | | Not permitted | | | |
| Contrast ratio uneven | | According to the limit specimen | | | |
| Crosstalk | | According to the limit specimen | | | |
| Pin holes and cracks in segment (DOT) |  | Not counted | Max.3 dots allowed | | Max.3 dots allowed |
| | | $X < 0.1\text{mm}$ | 0.1mm X 0.2mm | | |
| | | $X = (a+b)/2$ | | | |
| |  | Not counted | Max.2 dots allowed | | |
| $A < 0.1\text{mm}$ | | 0.1mm A 0.2mm $D < 0.25\text{mm}$ | | | |
| Black spot (in viewing area) |  | Not counted | Max.3 spots allowed | | Max.3 spots (lines) allowed |
| | | $X < 0.1\text{mm}$ | 0.1mm X 0.2mm | | |
| | | $X = (a+b)/2$ | | | |
| Black line (in viewing area) |  | Not counted | Max.3 lines allowed | | |
| | | $a < 0.02\text{mm}$ | 0.02mm a 0.05mm b 0.5mm | | |

Appendix B

Inspection items and criteria for display defects (continued)

| Items | Content | Criteria | | | |
|---------------------------|---|---|--------------------------|-----------------------|--|
| Transformation of segment |  | Not counted | Max. 2 defects allowed | Max.3 defects allowed | |
| | | $x < 0.1\text{mm}$ | 0.1mm x 0.2mm | | |
| | | $x = (a+b)/2$ | | | |
| |  | Not counted | Max. 1 defects allowed | | |
| | | $a < 0.1\text{mm}$ | 0.1mm a 0.2mm $D > 0$ | | |
| |  | Max.2 defects allowed $0.8W \leq a \leq 1.2W$ a=measured value of width W=nominal value of width | | | |