

HITACHI

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FOR MESSRS : STD

DATE : Oct.06,2005

CUSTOMER'S ACCEPTANCE SPECIFICATIONS

TX09D70VM1CAA

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*When product will be discontinued, customer will be informed by HITACHI with twelve months prior announcement.

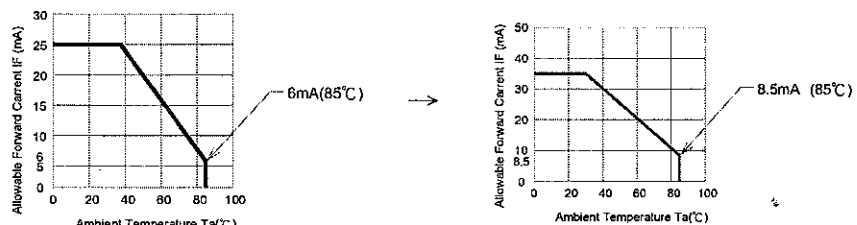
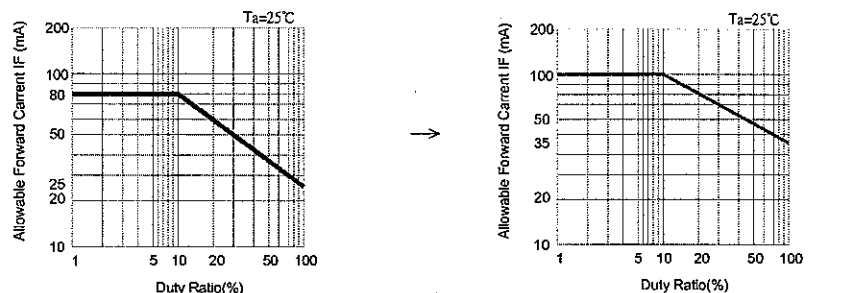
ACCEPTED BY: _____

PROPOSED BY: J. Sugaya

RECORD OF REVISION

| DATE | SHEET No. | SUMMARY | | | | | | | | | | | | | | | | | | | | | | |
|--|---|---|--------|-------------------------|---------|---------|-------|------|------|---------------------|-------|---------------------|--------|--------|---------|-------------------------|-----|------|-------|-----|-----|-------|-----|-------|
| Jul.08,'05 | 7B64PS 2704- TX09D70VM1CAA-2 PAGE 4-2/2 | 4.3 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS Revised | | | | | | | | | | | | | | | | | | | | | | |
| | | <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th rowspan="2">ITEM</th> <th colspan="2">OPERATING</th> <th colspan="2">STORAGE</th> </tr> <tr> <th>Min.</th> <th>Max.</th> <th>Min.</th> <th>Max.</th> </tr> </thead> <tbody> <tr> <td>Ambient Temperature</td> <td>(-5°C)</td> <td>(60°C)</td> <td>(-20°C)</td> <td>(70°C)</td> </tr> </tbody> </table> <p style="text-align: center;">↓</p> | ITEM | OPERATING | | STORAGE | | Min. | Max. | Min. | Max. | Ambient Temperature | (-5°C) | (60°C) | (-20°C) | (70°C) | | | | | | | | |
| | | ITEM | | OPERATING | | STORAGE | | | | | | | | | | | | | | | | | | |
| | | | Min. | Max. | Min. | Max. | | | | | | | | | | | | | | | | | | |
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| ITEM | | OPERATING | | STORAGE | | | | | | | | | | | | | | | | | | | | |
| | Min. | Max. | Min. | Max. | | | | | | | | | | | | | | | | | | | | |
| Ambient Temperature | -20°C | 70°C | -30°C | 80°C | | | | | | | | | | | | | | | | | | | | |
| 7B64PS 2705- TX09D70VM1CAA-2 PAGE 5-1/2 | 5.1 ELECTRICAL CHARACTERISTICS Revised | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>ITEM</th> <th>SYMBOL</th> <th>TYP.</th> </tr> </thead> <tbody> <tr> <td rowspan="4">Power supply Current</td> <td>IDD</td> <td>0.52</td> </tr> <tr> <td>IAVDD</td> <td>2.5</td> </tr> <tr> <td>IGH</td> <td>0.028</td> </tr> <tr> <td>IGL</td> <td>0.028</td> </tr> </tbody> </table> <p style="text-align: center;">↓</p> <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>ITEM</th> <th>SYMBOL</th> <th>TYP.</th> </tr> </thead> <tbody> <tr> <td rowspan="4">Power supply Current</td> <td>IDD</td> <td>0.56</td> </tr> <tr> <td>IAVDD</td> <td>2.3</td> </tr> <tr> <td>IGH</td> <td>0.033</td> </tr> <tr> <td>IGL</td> <td>0.028</td> </tr> </tbody> </table> | ITEM | SYMBOL | TYP. | Power supply Current | IDD | 0.52 | IAVDD | 2.5 | IGH | 0.028 | IGL | 0.028 | ITEM | SYMBOL | TYP. | Power supply Current | IDD | 0.56 | IAVDD | 2.3 | IGH | 0.033 | IGL | 0.028 |
| ITEM | SYMBOL | TYP. | | | | | | | | | | | | | | | | | | | | | | |
| Power supply Current | IDD | 0.52 | | | | | | | | | | | | | | | | | | | | | | |
| | IAVDD | 2.5 | | | | | | | | | | | | | | | | | | | | | | |
| | IGH | 0.028 | | | | | | | | | | | | | | | | | | | | | | |
| | IGL | 0.028 | | | | | | | | | | | | | | | | | | | | | | |
| ITEM | SYMBOL | TYP. | | | | | | | | | | | | | | | | | | | | | | |
| Power supply Current | IDD | 0.56 | | | | | | | | | | | | | | | | | | | | | | |
| | IAVDD | 2.3 | | | | | | | | | | | | | | | | | | | | | | |
| | IGH | 0.033 | | | | | | | | | | | | | | | | | | | | | | |
| | IGL | 0.028 | | | | | | | | | | | | | | | | | | | | | | |
| 7B64PS 2708- TX09D70VM1CAA-2 PAGE 8-3/10 | 8.1 INTERFACE TIMING Revised all of page for Source and Gate Driver setting. | | | | | | | | | | | | | | | | | | | | | | | |
| 7B64PS 2708- TX09D70VM1CAA-2 PAGE 8-4/10 | 8.1 INTERFACE TIMING Revised Horizontal Timing Sequence of CL1 and CL2. | | | | | | | | | | | | | | | | | | | | | | | |
| 7B64PS 2708- TX09D70VM1CAA-2 PAGE 8-5/10 | 8.2 POWER ON/OFF SEQUENCE Deleted PCI setting and Note. | | | | | | | | | | | | | | | | | | | | | | | |
| 7B64PS 2708- TX09D70VM1CAA-2 PAGE 8-9/10 | 8.5 POWER SUPPLY CIRCUIT FOR LED BL Added Power Supply Circuit for LED BL | | | | | | | | | | | | | | | | | | | | | | | |
| Sep.08,'05 | 7B64PS 2705- TX09D70VM1CAA-3 PAGE 5-1/2 | 5.1 ELECTRICAL CHARACTERISTICS Added the MIN. & MAX. value of AVDD | | | | | | | | | | | | | | | | | | | | | | |

RECORD OF REVISION

| DATE | SHEET No. | SUMMARY | | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|------|--------|--------|------|------------|-----------------|-----|-------|-----------------------|-----------------|----|------|-------------|--------|------|------------|-----------------|------|-------------|-----------------------|-----------------|-----|
| Sep.08,'05 | 7B64PS 2706-TX09D70VM1CAA-3 PAGE 6-1/2 | 6.1 OPTICAL CHARACTERISTICS OF LCD Revised <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th>ITEM</th> <th>SYMBOL</th> <th>TYP.</th> <th>TYP.</th> </tr> </thead> <tbody> <tr> <td>Brightness</td> <td>B</td> <td>340</td> <td>(320)</td> </tr> <tr> <td rowspan="4">Viewing Angle</td> <td>θx</td> <td>65</td> <td>(70)</td> </tr> <tr> <td>$\theta x'$</td> <td>65</td> <td>(70)</td> </tr> <tr> <td>θy</td> <td>80</td> <td>(80)</td> </tr> <tr> <td>$\theta y'$</td> <td>40</td> <td>(60)</td> </tr> </tbody> </table> Added the MIN. & MAX. of Color Tone. | ITEM | SYMBOL | TYP. | TYP. | Brightness | B | 340 | (320) | Viewing Angle | θx | 65 | (70) | $\theta x'$ | 65 | (70) | θy | 80 | (80) | $\theta y'$ | 40 | (60) | |
| | ITEM | SYMBOL | TYP. | TYP. | | | | | | | | | | | | | | | | | | | | |
| | Brightness | B | 340 | (320) | | | | | | | | | | | | | | | | | | | | |
| | Viewing Angle | θx | 65 | (70) | | | | | | | | | | | | | | | | | | | | |
| $\theta x'$ | | 65 | (70) | | | | | | | | | | | | | | | | | | | | | |
| θy | | 80 | (80) | | | | | | | | | | | | | | | | | | | | | |
| $\theta y'$ | | 40 | (60) | | | | | | | | | | | | | | | | | | | | | |
| 7B64PS 2708-TX09D70VM1CAA-3 PAGE 8-5/10 | 8.3 POWER OM/OFF SEQUENCE Added the timing of DISP. | | | | | | | | | | | | | | | | | | | | | | | |
| 7B64PS 2708-TX09D70VM1CAA-3 PAGE 8-8/10 | 8.5 POWER SUPPLY CIRCUIT FOR LCD Removed V4 | | | | | | | | | | | | | | | | | | | | | | | |
| 7B64PS 2708-TX09D70VM1CAA-3 PAGE 8-10/10 | 8.7 INTERNAL PIN CONNECTION Revised the function of PIN2(DISP) & PIN32(V4) Added Note1 ~ 3 | | | | | | | | | | | | | | | | | | | | | | | |
| Oct.06,'05 | 7B64PS 2704-TX09D70VM1CAA-4 PAGE 4-1/2 | 4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF LCD Revised <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th colspan="2">ITEM</th> <th>SYMBOL</th> <th>MAX.</th> </tr> </thead> <tbody> <tr> <td rowspan="2">LED</td> <td>Forward Current</td> <td>IF</td> <td>25</td> </tr> <tr> <td>Pulse Forward Current</td> <td>I_{FP}</td> <td>80</td> </tr> </tbody> </table> <table border="1" style="margin: 10px auto; border-collapse: collapse;"> <thead> <tr> <th colspan="2">ITEM</th> <th>SYMBOL</th> <th>MAX.</th> </tr> </thead> <tbody> <tr> <td rowspan="2">LED</td> <td>Forward Current</td> <td>IF</td> <td>35</td> </tr> <tr> <td>Pulse Forward Current</td> <td>I_{FP}</td> <td>100</td> </tr> </tbody> </table> | ITEM | | SYMBOL | MAX. | LED | Forward Current | IF | 25 | Pulse Forward Current | I _{FP} | 80 | ITEM | | SYMBOL | MAX. | LED | Forward Current | IF | 35 | Pulse Forward Current | I _{FP} | 100 |
| | | ITEM | | SYMBOL | MAX. | | | | | | | | | | | | | | | | | | | |
| LED | Forward Current | IF | 25 | | | | | | | | | | | | | | | | | | | | | |
| | Pulse Forward Current | I _{FP} | 80 | | | | | | | | | | | | | | | | | | | | | |
| ITEM | | SYMBOL | MAX. | | | | | | | | | | | | | | | | | | | | | |
| LED | Forward Current | IF | 35 | | | | | | | | | | | | | | | | | | | | | |
| | Pulse Forward Current | I _{FP} | 100 | | | | | | | | | | | | | | | | | | | | | |
| Note 4 :  | | | | | | | | | | | | | | | | | | | | | | | | |
| Note 5 : IFP Conditions : pulse width ≤ 10ms and Duty ≤ 1/10 | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | | | | | |

RECORD OF REVISION

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|---|---|--|------------|-----------------------------|-----------|-------|-------------------|------|-------------------|----|---------|-----|---------------------|-----|---------------------|----|----|----|----|----|
| Oct.06,'05 | 7B64PS 2705- TX09D70VM1CAA-4 PAGE 5-1/2 | 5.2 ELECTRICAL CHARACTERISTICS OF BACK LIGHT Revised | | | | | | | | | | | | | | | | | | |
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| | | ITEM | SYMBOL | CONDITION | MAX. | TYP. | MAX. | | | | | | | | | | | | | |
| | | LED Input Voltage | VF | IF=20mA | - | 3.75 | 4.2 | | | | | | | | | | | | | |
| | | LED Forward Current | IF | - | - | 20 | 20 | | | | | | | | | | | | | |
| | | ↓ | | | | | | | | | | | | | | | | | | |
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| ITEM | SYMBOL | CONDITION | MAX. | TYP. | MAX. | | | | | | | | | | | | | | | |
| LED Input Voltage | VF | IF=20mA | - | 3.2 | 3.5 | | | | | | | | | | | | | | | |
| LED Forward Current | IF | - | - | 20 | 25 | | | | | | | | | | | | | | | |
| 7B64PS 2706- TX09D70VM1CAA-4 PAGE 6-1/2 | 6.1 OPTICAL CHARACTERISTICS OF LCD Revised Brightness and Color Tone of SPEC | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | |
| KAOHSIUNG HITACHI ELECTRONICS CO.,LTD. | DATE | Oct.06,'05 | Sh. No. | 7B64PS 2701-TX09D70VM1CAA-4 | PAGE | 2-3/3 | | | | | | | | | | | | | | |

3.GENERAL DATA

The specifications are applied to the following TFT-LCD (Transmissive with micro reflectance) module with Back-light unit and Touch Panel .

Note : Driving circuit for LED , timing controller and power unit are not built in this module.

| | |
|-----------------------------|--|
| (1) Part Name | TX09D70VM1CAA |
| (2) Module Dimensions | 64.0(W)mm x 86.0(H)mm x 4.0(D)mm typ. (Except FPC Area) |
| (3) Effective Display Area | 53.64(W)mm x 71.52(H)mm (Diagonal:9cm) |
| (4) Dot Pitch | 0.0745mm x 3(R,G,B)(W) x 0.2235(H)mm |
| (5) Resolution | 240 x 3(R,G,B)(W) x 320 (H) dots |
| (6) Color Pixel Arrangement | R,G,B Vertical Stripe |
| (7) LCD Type | Transmissive Color TFT LCD (Normally White) |
| (8) Display Type | Active Matrix |
| (9) Number of Colors | 262 ^K Colors (R,G,B 6 Bit Digital each) |
| (10) Backlight | Light Emitting Diode (LED) x 6 |
| (11) Weight | 44g |
| (12) Interface | 50 pin C-MOS |
| (13) Viewing Direction | 6 O'clock (The direction it's hard to be discolored) |
| (14) Touch Panel | Resistance type . The surface is glare |

4. ABSOLUTE MAXIMUM RATINGS

4.1 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF LCD

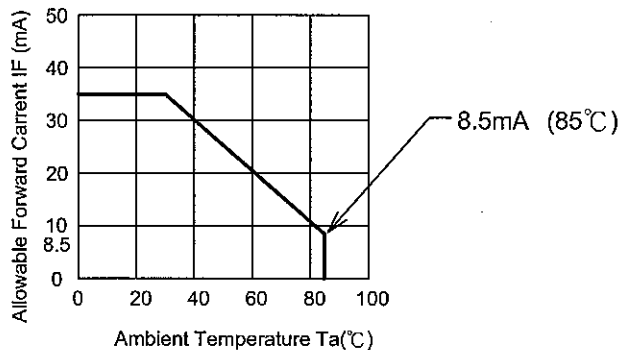
| ITEM | | SYMBOL | MIN. | MAX. | UNIT | REMARKS | |
|------------------------|-----------------------|-----------------|-----------------|----------|---------------------|---------|-----|
| Power Supply for Logic | | DVDD | -0.3 | 4.6 | V | | |
| Source | Power Supply for LCD | AVDD | -0.3 | 11.0 | V | (1) | |
| | Input Voltage | High | V _{IH} | -0.3 | AVDD+0.3 | V | (2) |
| | | Low | V _{IL} | -0.3 | DVDD+0.3 | V | |
| Gate | Power Supply for Gate | High | V _{GH} | -0.3 | V _{GL} +35 | V | |
| | | Low | V _{GL} | -10 | +0.3 | V | |
| | Input Voltage | V _{IG} | -0.3 | DVDD+0.3 | V | (3) | |
| LED | Forward Current | I _F | - | 35 | mA | (4) | |
| | Pulse Forward Current | I _{FP} | - | 100 | mA | (5) | |
| | Reverse Voltage | V _R | - | 5 | V | | |
| Static Electricity | | - | - | ±2 | kV | (6) (7) | |

Note (1) $AVDD-0.2 \geq V_0$, $V_9 \geq GND+0.2$

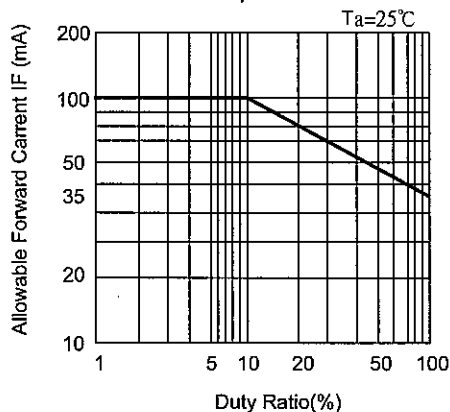
(2) LOAD(CL1), CL2, R0~R5, G0~G5, B0~B5, M, POL, STH

(3) CL3, DISP, STV

(4)



I_{FP} Conditions : pulse width ≤ 10ms and Duty ≤ 1/10



(6) Make certain you are grounded when handling LCM.

(7) Testing condition : 200pF - 0 Ω, 25°C - 70%RH.

4.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS OF TOUCH PANEL

| ITEM | SPECIFICATION | UNIT | CONDITION | REMARKS |
|-------------------|---------------|------|-----------|----------|
| Supply Voltage | 7.0 | V | DC | |
| Endurance Voltage | 25 | V | DC | (Note 1) |

Note 1 : Waiting 1 minute.

4.3 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM | OPERATING | | STORAGE | | REMARKS |
|---------------------|----------------|---------------------------------|----------------|---------------------------------|----------------------|
| | Min. | Max. | Min. | Max. | |
| Ambient Temperature | -20°C | 70°C | -30°C | 80°C | (Note 2,3,6,7,9,10) |
| Humidity | (Note 1) | | (Note 1) | | Without condensation |
| Vibration | - | 2.45m/s ² (0.25G) | - | 11.76m/s ² (1.2G) | (Note 4,5) |
| Shock | - | 29.4m/s ² (3G) | - | 490m/s ² (50G) | (Note 5,8) |
| Corrosive Gas | Not Acceptable | | Not Acceptable | | |

Note 1 : $T_a \leq 40^\circ\text{C}$: 85%RH max.

$T_a > 40^\circ\text{C}$: Absolute humidity must be lower than the humidity of 85%RH at 40°C .

Note 2 : For storage condition T_a at $-30^\circ\text{C} < 48\text{h}$, at $80^\circ\text{C} < 100\text{h}$.

For operating condition T_a at $-20^\circ\text{C} < 100\text{h}$

Note 3 : Background color changes slightly depending on ambient temperature.

This phenomenon is reversible.

Note 4 : 5Hz~100Hz(Except resonance frequency)

Note 5 : This LCM will resume normal operation after finishing the test.

Note 6 : The response time will be slower as low temperature.

Note 7 : Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at $+25^\circ\text{C}$.

Note 8 : Pulse Width : 10ms

Note 9 : This is panel surface temperature , not ambient temperature.

Note 10 : If LED is drive by high current , the life time of LED will be reduced , also high temperature and high humidity.

5. ELECTRICAL CHARACTERISTICS

5.1 ELECTRICAL CHARACTERISTICS OF LCD

Ta=25°C

| I T E M | | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT |
|--------------------------|--------|--------|---------------------------|------|-------|------|------|
| Power Supply for Logic | | DVDD | - | 2.3 | 3.3 | 3.6 | V |
| Power Supply for LCD | Source | AVDD | - | 7.5 | 8.48 | 9.5 | V |
| | Gate | VGH | - | 13.0 | 15.0 | 17.0 | |
| | | VGL | - | -8.0 | -5.0 | -2.0 | |
| Power Supply Current | | IDD | 16 Vertical Gray scale | - | 0.56 | 2.0 | mA |
| | | IAVDD | | - | 2.3 | 4.0 | |
| | | IGH | | - | 0.033 | 0.06 | |
| | | IGL | | - | 0.028 | 0.06 | |
| Frame Frequency (Note 1) | | fFLM | - | 52 | 60 | 68 | Hz |

Note 1 : Need to make sure of flickering and rippling of display when setting the frame frequency in your set.

5.2 ELECTRICAL CHARACTERISTICS OF BACK LIGHT

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | REMARKS |
|------------------------|--------|-----------|------|------|------|------|------------|
| LED Input Voltage | VF | IF=20mA | - | 3.2 | 3.5 | V | LED / Part |
| LED Forward Current | IF | - | - | 20 | 25 | mA | LED / Part |
| LED Reverse Current | IR | VR=5V | - | - | 50 | μA | LED / Part |

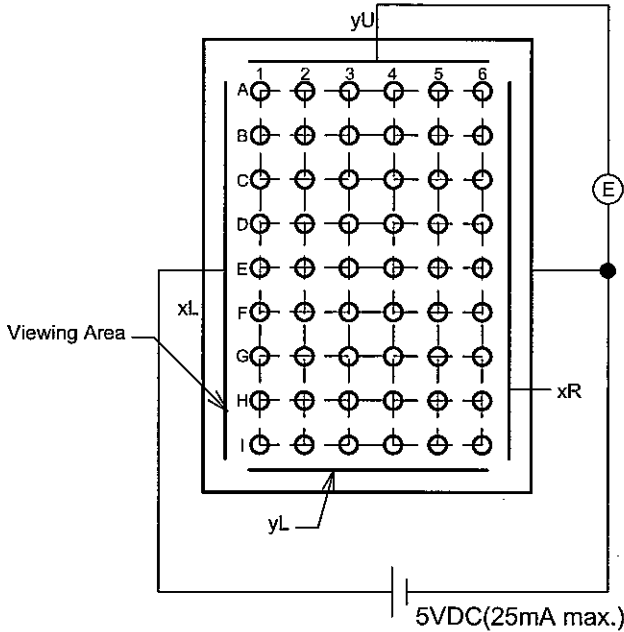
5.3 ELECTRICAL CHARACTERISTICS OF TOUCH PANEL

| ITEM | | SPECIFICATION | UNIT |
|-------------------------------|---------|---------------|------|
| Resistance between Terminal | xR - xL | 200 - 650 | ohm |
| | yU - yL | 250 - 500 | ohm |
| Insulance Resistance (Note 1) | x - y | 10M min. | ohm |
| Linearity (Note 2,3) | x | 1.5 max. | % |
| | y | 1.5 max. | % |
| Chattering | | 10 max. | ms |

Note 1 : Operating Voltage 25V DC.

Note 2 : Test Condition.

(a) Y axis linearity testing method (with tip radius 0.8, polaycetal pen). $V_{xL-xR}=5V$, $V_{OUT}=V_{yU}$.

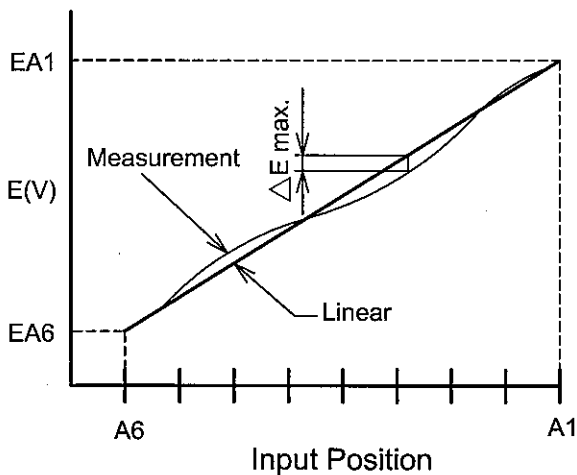


(b) X axis linearity method $V_{yU-yL}=5V$, $V_{OUT}=V_{xL}$.

Note 3 : Calculation

(a) Y axis linearity

$$\text{Linearity} = \frac{\Delta E \text{ max.}}{EA1 - EA6} \times 100(\%)$$



5.4 MECHANICAL CHARACTERISTICS OF TOUCH PANEL

| ITEM | SPECIFICATION | UNIT | REMARKS |
|--------------------|---------------|------|-----------------------|
| Pen Input Pressure | 0.1 - 1.3 | N | R0.8mm Polyacetal pen |
| Surface Hardness | 3H min. | - | JIS K 5400 |

6. OPTICAL CHARACTERISTICS

6.1 OPTICAL CHARACTERISTICS OF LCD (BACK LIGHT ON)

Ta=25°C

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE | |
|-------------------------------|-------------|-------------------------------|-------------------------------|------|------|-------------------|-------------|-----|
| Brightness | B | $\phi=0^\circ \theta=0^\circ$ | - | 320 | - | cd/m ² | (1) | |
| Uniformity | - | $\phi=0^\circ \theta=0^\circ$ | 70 | - | - | % | (2),(3),(4) | |
| Viewing Angle | θx | $\phi=0^\circ, K \geq 5.0$ | - | 70 | - | deg | (5),(6) | |
| | $\theta x'$ | $\phi=180^\circ, K \geq 5.0$ | - | 70 | - | | | |
| | θy | $\phi=90^\circ, K \geq 5.0$ | - | 80 | - | | | |
| | $\theta y'$ | $\phi=270^\circ, K \geq 5.0$ | - | 60 | - | | | |
| Contrast Ratio | K | $\phi=0^\circ \theta=0^\circ$ | 180 | 300 | - | - | (4) | |
| Response Time (rise-fall) | tr+tf | $\phi=0^\circ \theta=0^\circ$ | - | (30) | - | ms | (8) | |
| Color Tone (Primary Color) | Red | x | $\phi=0^\circ \theta=0^\circ$ | 0.55 | 0.60 | 0.65 | - | (4) |
| | | y | | 0.29 | 0.34 | 0.39 | - | |
| | Green | x | | 0.28 | 0.33 | 0.38 | - | |
| | | y | | 0.54 | 0.59 | 0.64 | - | |
| | Blue | x | | 0.09 | 0.14 | 0.19 | - | |
| | | y | | 0.07 | 0.12 | 0.17 | - | |
| | White | x | | 0.27 | 0.32 | 0.37 | - | |
| | | y | | 0.29 | 0.34 | 0.39 | - | |

(Measurement condition : HITACHI standard)

Note 1 : Active area center

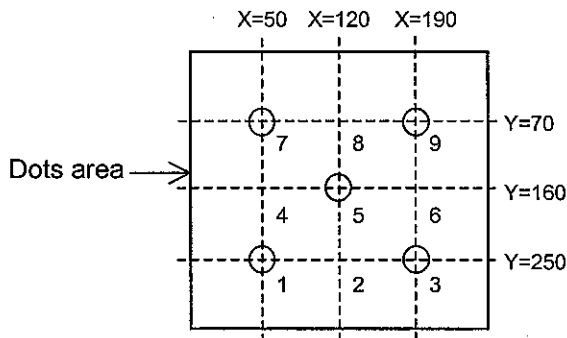
Note (4)~(7) : See page 6-2/2

Note 2 : Driving Condition

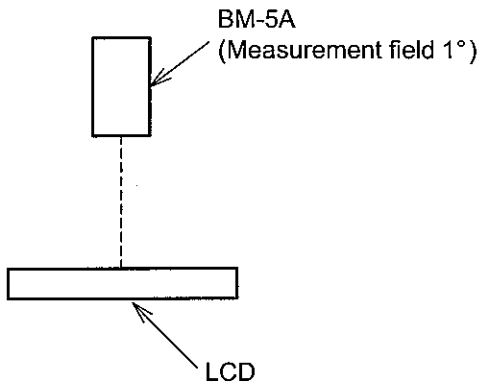
Display Pattern : White Raster
LED Current : 20mA / Part
Measurement of the following
5 places on the display.

Note 3 : Definition of the brightness uniformity

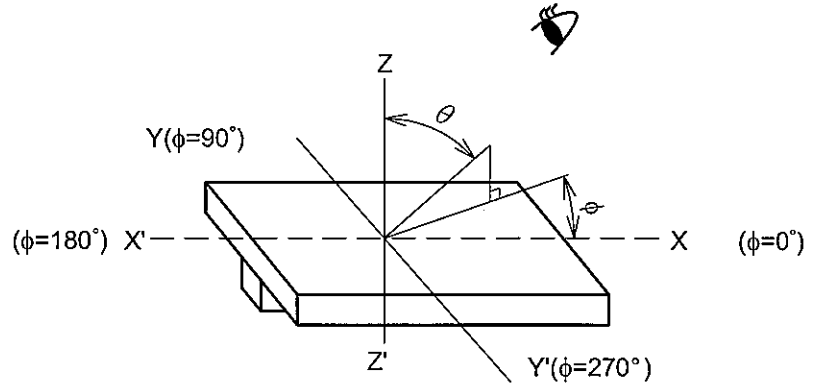
$$\left(\frac{\text{Min. brightness}}{\text{Max. brightness}} \right) \times 100$$



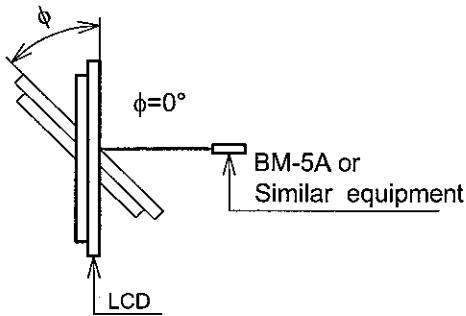
Note 4 : Measurement Condition



Note 5 : Definition of θ and ϕ
(Normal)
Viewing direction



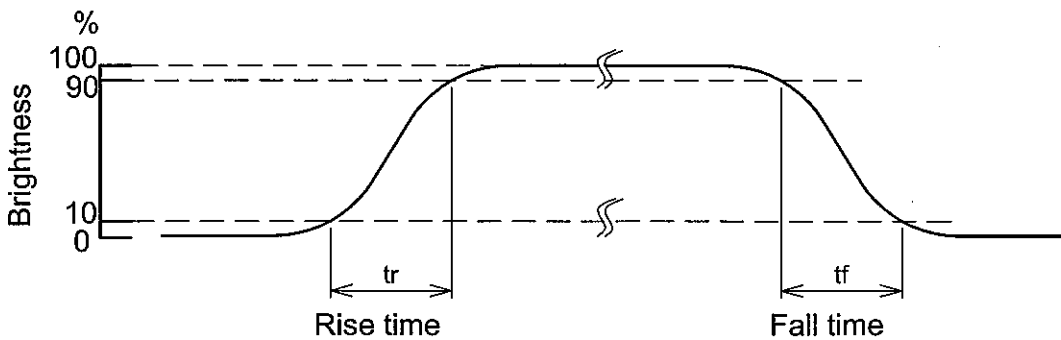
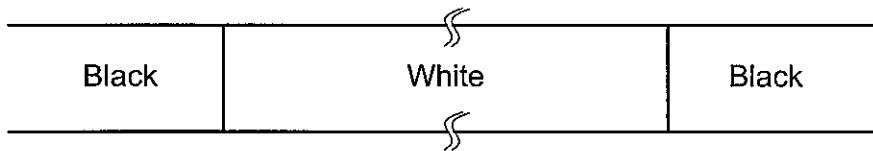
Note 6 : Definition of Viewing angle



Note 7 : Definition of contrast "K"

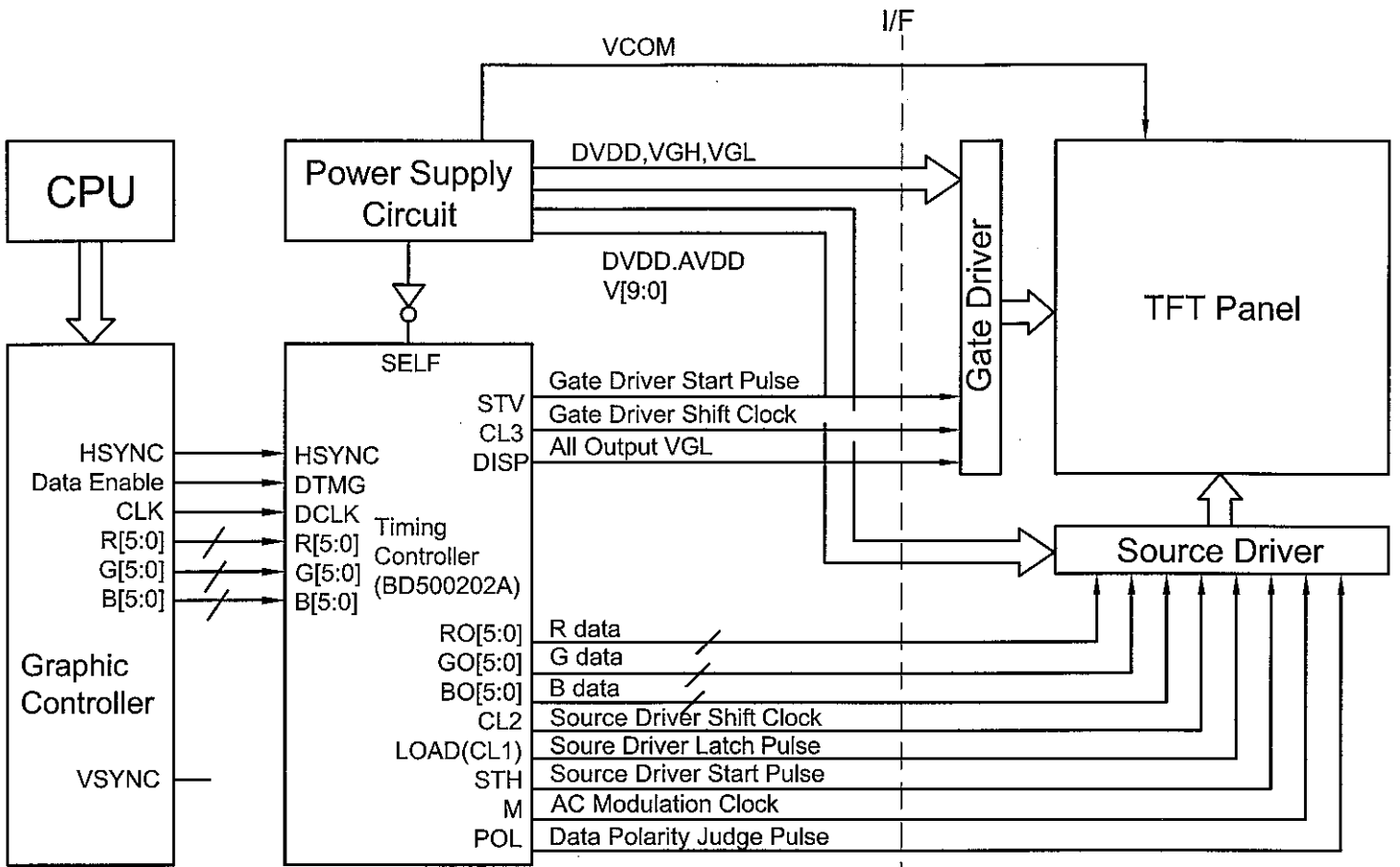
$$K = \frac{\text{White Brightness}}{\text{Black Brightness}}$$

Note 8 : Definition optical response time

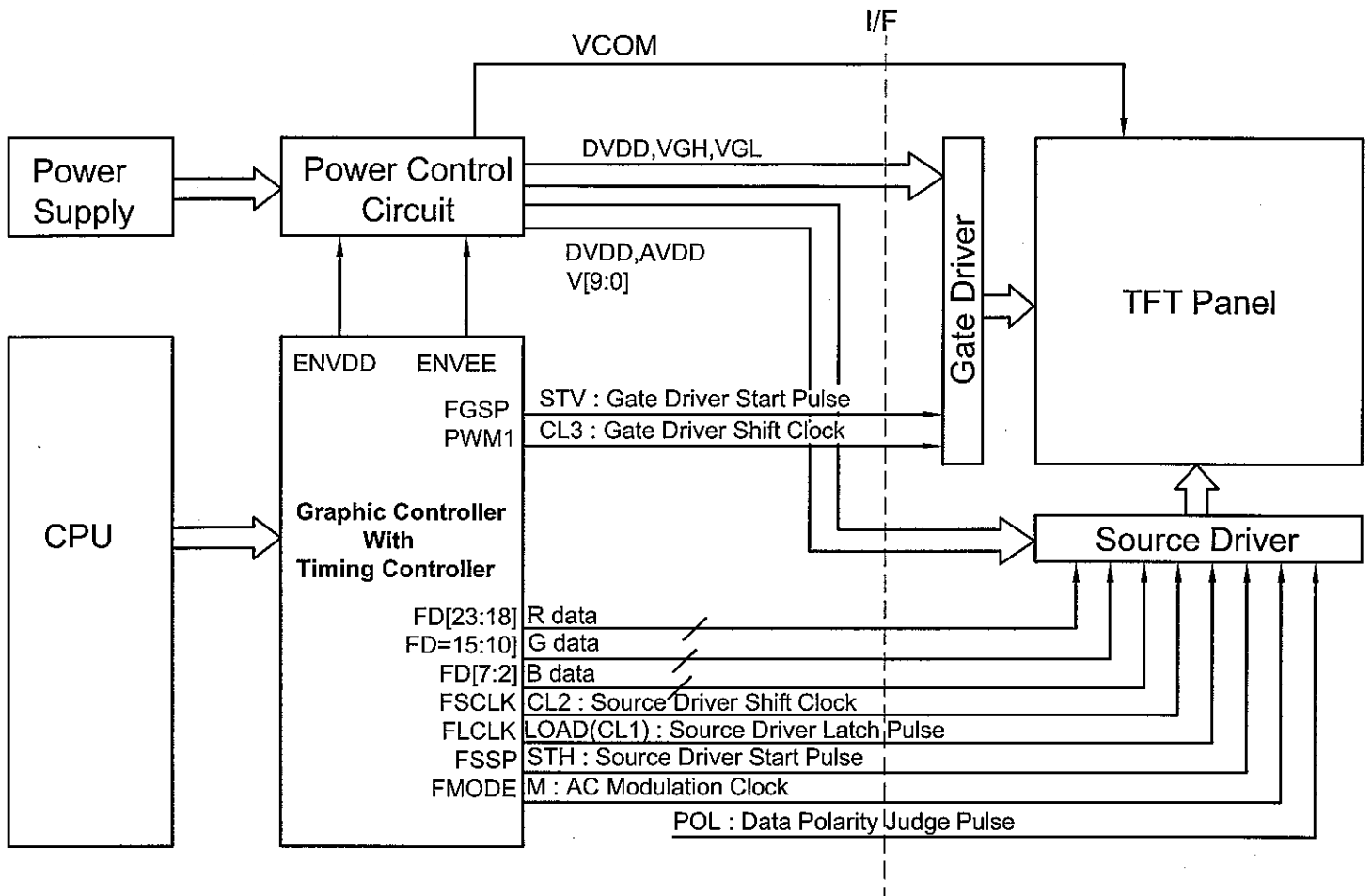


7. BLOCK DIAGRAM (REFERENCE ONLY)

Example 1



Example 2



8. INTERFACE TIMING

8.1 INTERFACE TIMING

| | MIN. | TYP. | MAX. | UNIT | SYMBOL |
|------------------------|------|------|------|-------------|--------|
| Vertical Total | - | 327 | - | Line | T0 |
| Vertical Sync Width | 1 | 1 | - | Line | T1 |
| Vertical Sync Start | - | 322 | - | Line | T2 |
| Vertical Sync End | - | 323 | - | Line | T3 |
| Vertical Blank Time | 5 | 7 | - | Line | T4 |
| Vertical Display End | - | 320 | - | Line | T5 |
| Horizontal Total | 258 | 273 | 509 | Pixel Clock | T6 |
| Horizontal Sync Width | 4 | 5 | 10 | Pixel Clock | T7 |
| Horizontal Sync Start | 246 | 251 | 307 | Pixel Clock | T8 |
| Horizontal Sync End | 250 | 256 | 317 | Pixel Clock | T9 |
| Horizontal Blank Time | 18 | 33 | 269 | Pixel Clock | T10 |
| Horizontal Display End | - | 240 | - | Pixel Clock | T11 |

Note : Vertical Total should be set to odd.

8.1.2 DRIVER TIMING

| | Item | Symbol | Min. | Typ. | Max. | Unit. | Remark |
|----------------------|-------------------------|----------------|------|------|------|-------|--------|
| Source Driver | Clock cycle time | Trate | 100 | - | - | ns | |
| | Clock low level width | Tcwl | 35 | - | - | ns | |
| | Clock high level width | Tcwh | 35 | - | - | ns | |
| | Data set up time | Tds | 25 | - | - | ns | |
| | Data hold time | Tdh | 25 | - | - | ns | |
| | Start pulse set up time | Tss | 25 | - | - | ns | |
| | Start pulse hold time | Tsh | 25 | - | - | ns | |
| | CL1 high level width | Tcl1wh | 10 | - | - | us | |
| | CL1 start pulse | Tscl1 | 100 | - | - | ns | |
| | STH start pulse | Tssth | 100 | - | - | ns | |
| | M set up time | Tms | 50 | - | - | ns | |
| | M hold time | Tmh | 50 | - | - | ns | |
| | Gate Driver | CL3 cycle time | Tcl3 | 2 | 3 | - | us |
| CL3 high level width | | Tcl3wh | 2 | - | - | us | |
| CL3 low level width | | Tcl3wl | 2 | - | - | us | |
| STV set up time | | Tstvs | 250 | - | - | ns | |
| STV hold time | | Tstvh | 250 | - | - | ns | |

8.2 TIMING CHART

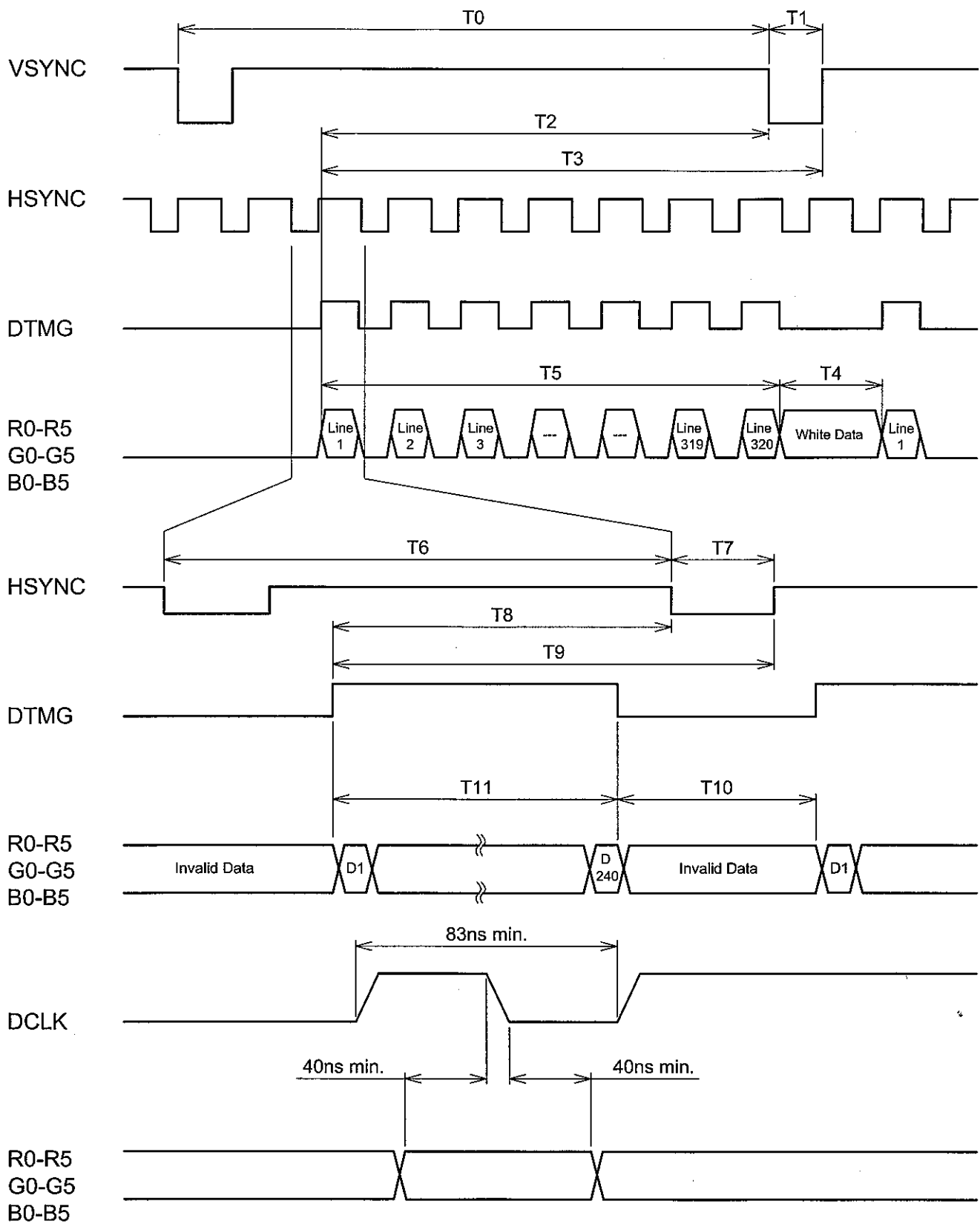


Fig1. Timing sequence for Graphic controller

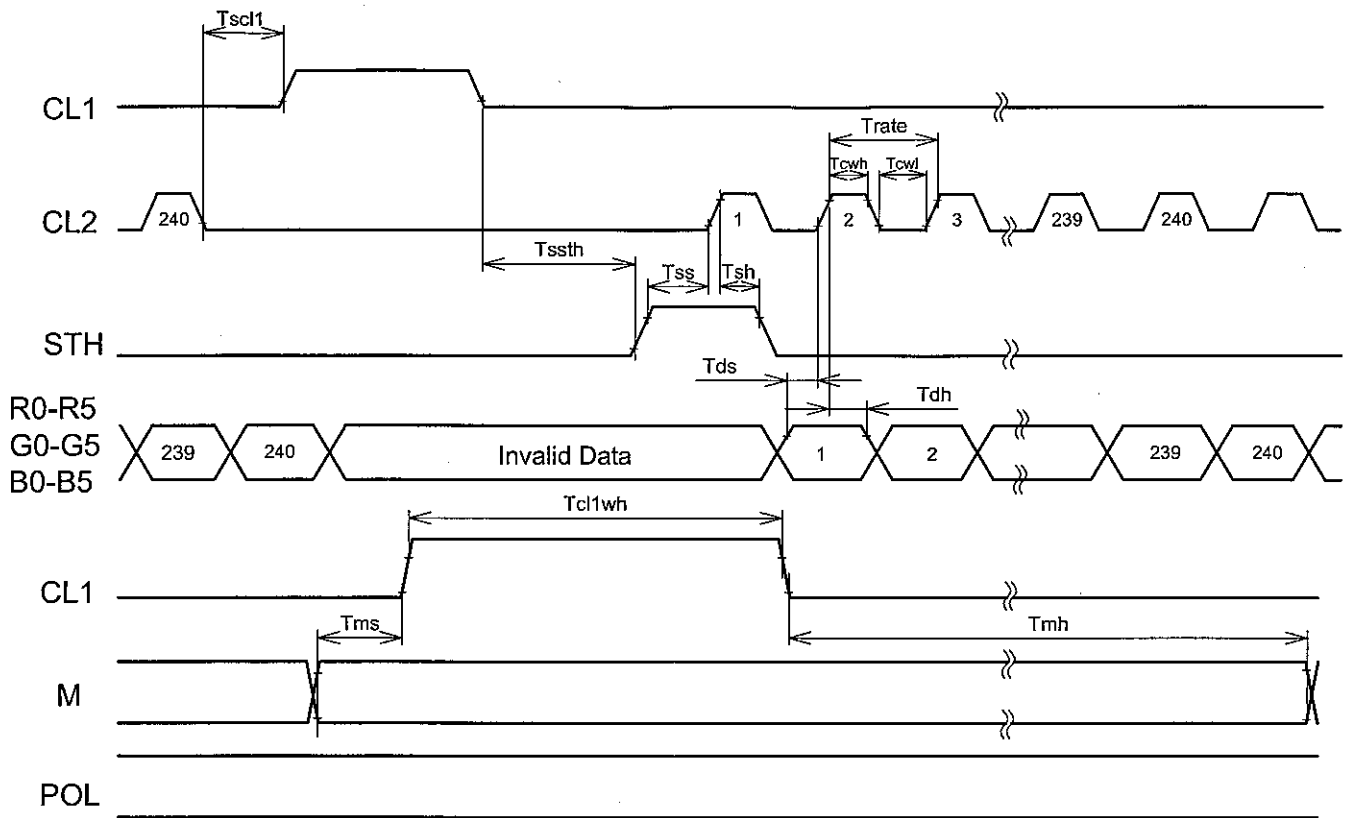


Fig2 . Horizontal Timing Sequence for non Tcon

Note: $\begin{matrix} \nearrow -0.8 \times DVDD \\ \searrow -0.2 \times DVDD \end{matrix}$

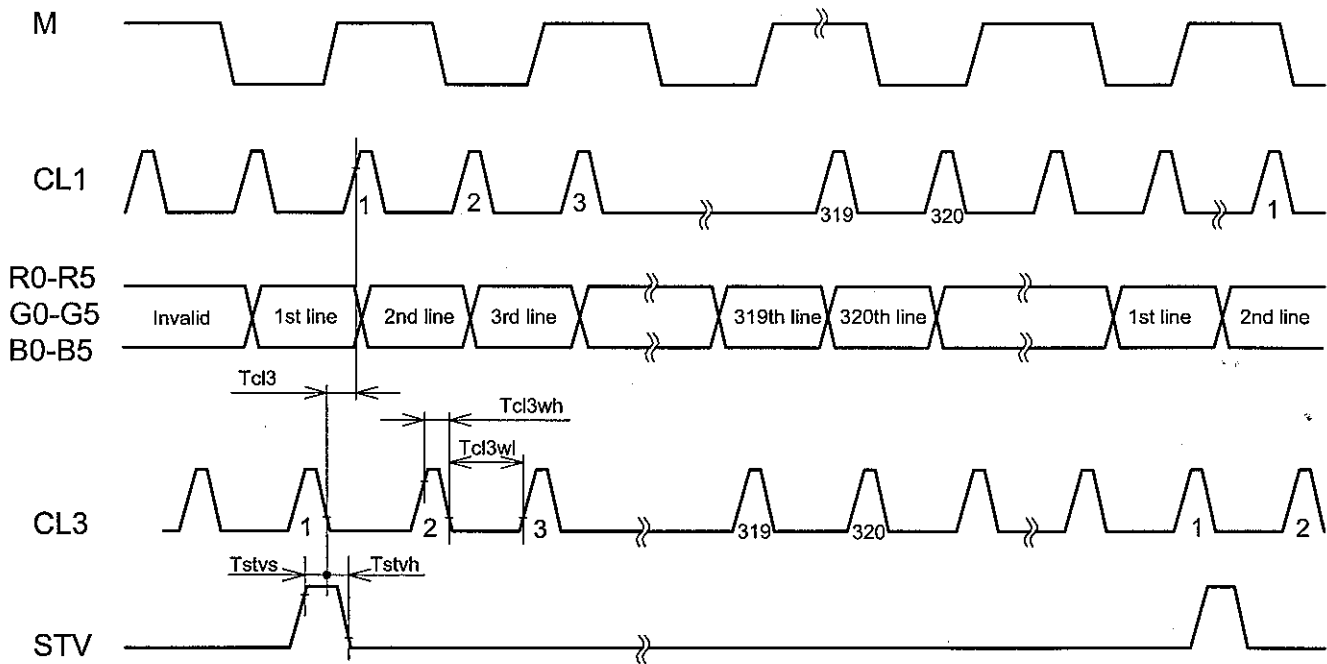
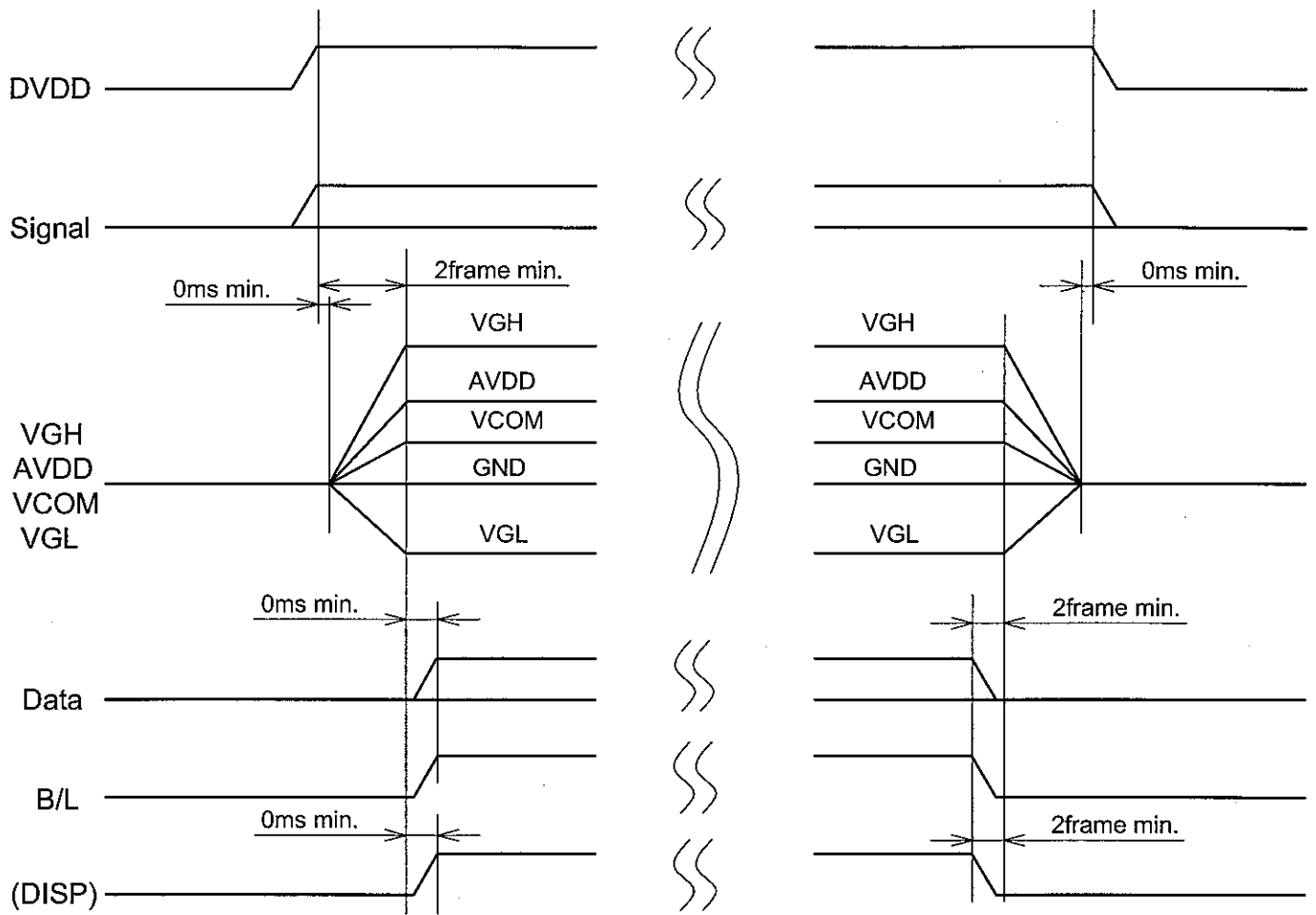


Fig3 . Vertical Timing Sequence for non Tcon

Note: $\begin{matrix} \nearrow -0.8 \times DVDD \\ \searrow -0.2 \times DVDD \end{matrix}$

8.3 POWER ON/OFF SEQUENCE

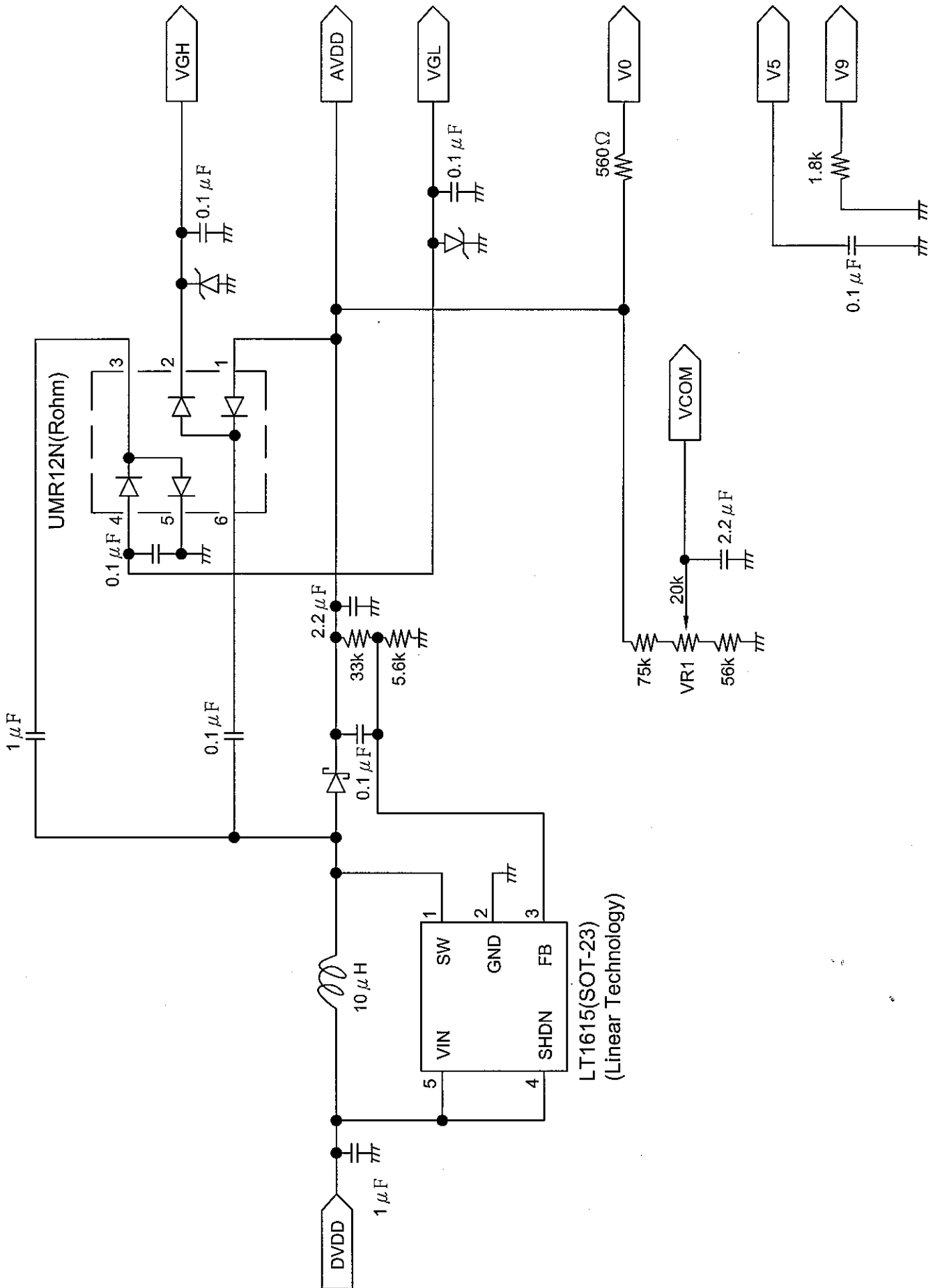


8.4 RELATIONSHIP BETWEEN DISPLAYED COLOR AND INPUT DATA

8.4.1 Display Colors

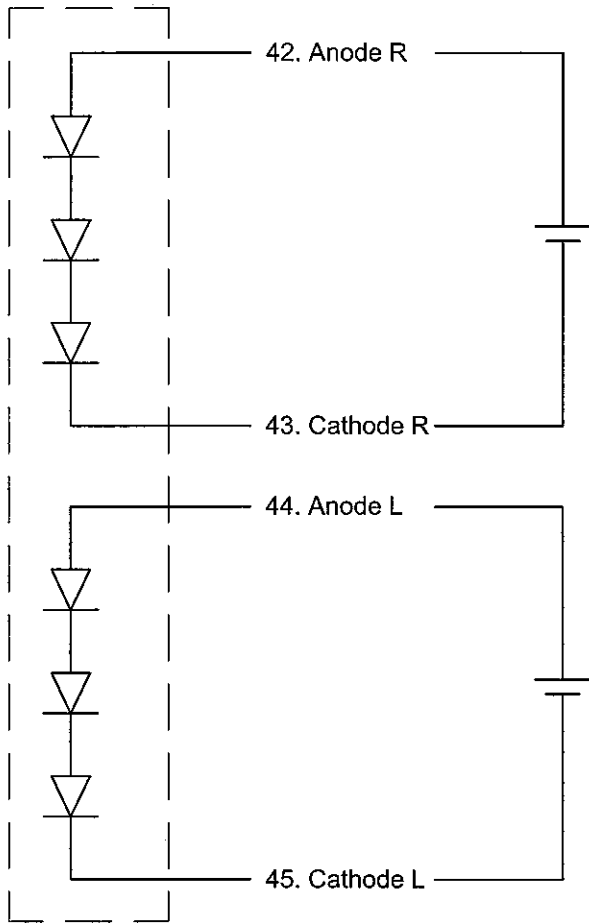
| color | | Input | | Red Data | | | | | | Green Data | | | | | | Blue Data | | | | | |
|-------------|-----------|-------|---|----------|-----|----|----|-----|----|------------|-----|----|----|-----|----|-----------|-----|----|----|----|----|
| | | | | R5 | R4 | R3 | R2 | R1 | R0 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 | B0 |
| | | MSB | | | LSB | | | MSB | | | LSB | | | MSB | | | LSB | | | | |
| Basic Color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Red(0) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Green(0) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Blue(0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| Red | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Red(62) | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Red(61) | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | Red(2) | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Red(1) | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Red(0) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Green | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Green(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Green(61) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | Green(2) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Green(1) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Green(0) | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| Blue | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | |
| | Blue(62) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | | |
| | Blue(61) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | : | | |
| | Blue(2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | | |
| | Blue(1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | | |
| | Blue(0) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | | |

8.5 POWER SUPPLY CIRCUIT FOR LCD (REFERENCE ONLY)

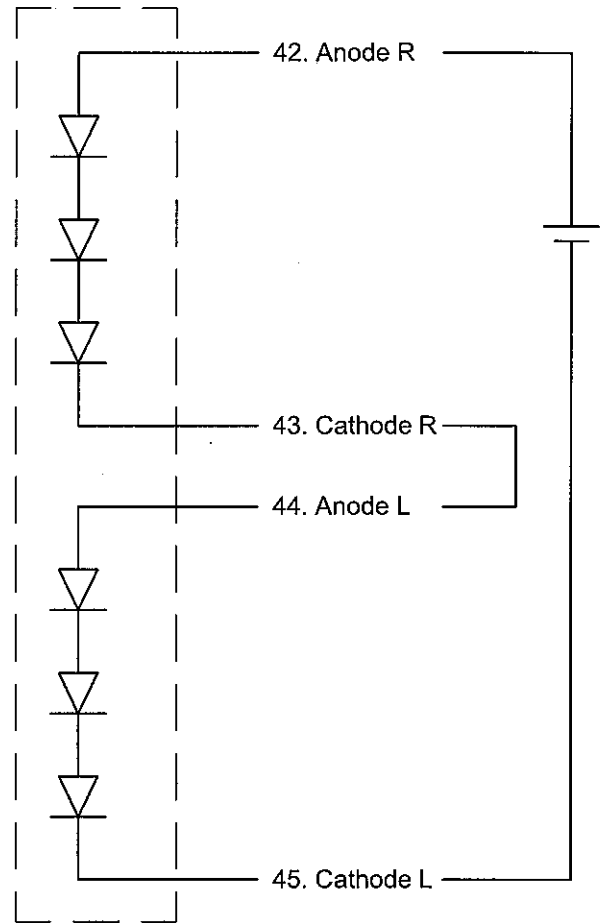


8.6 POWER SUPPLY CIRCUIT FOR LED BL (REFERENCE ONLY)

Example 1.
LED B/L



Example 2.
LED B/L



8.7 INTERNAL PIN CONNECTION

Suitable connector : FH12-50S-0.5P

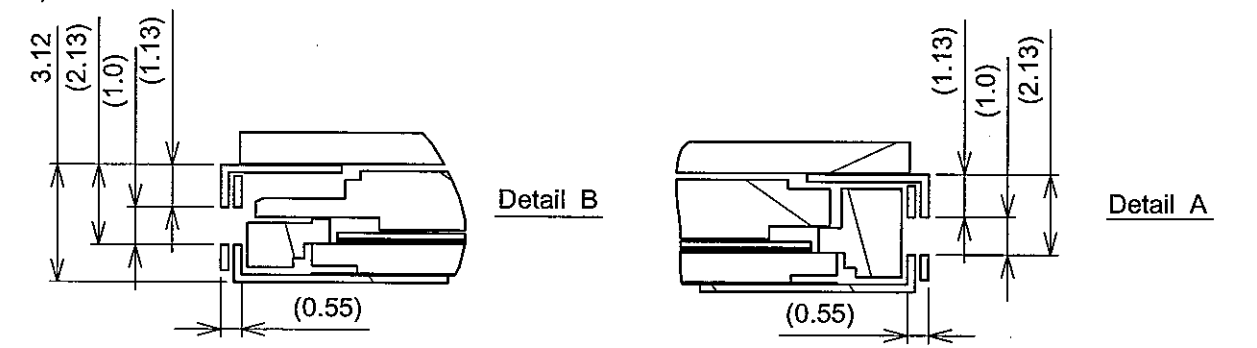
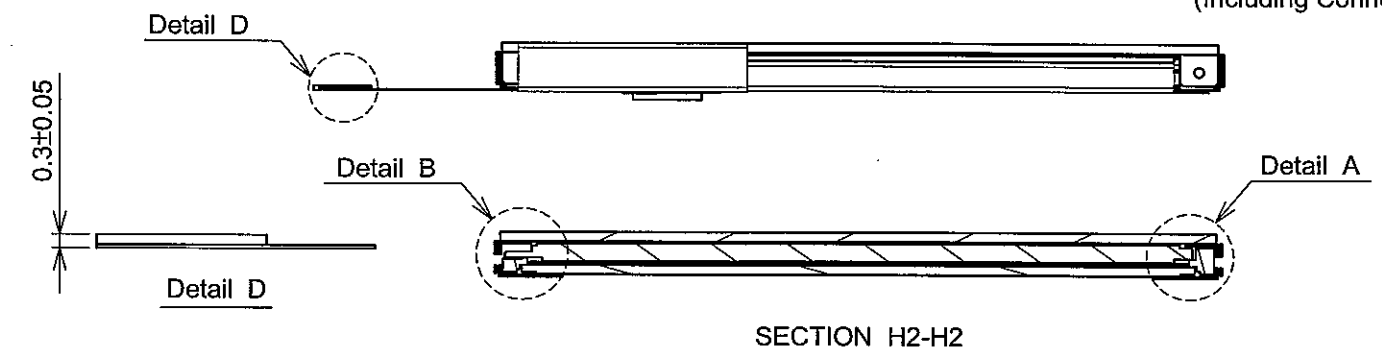
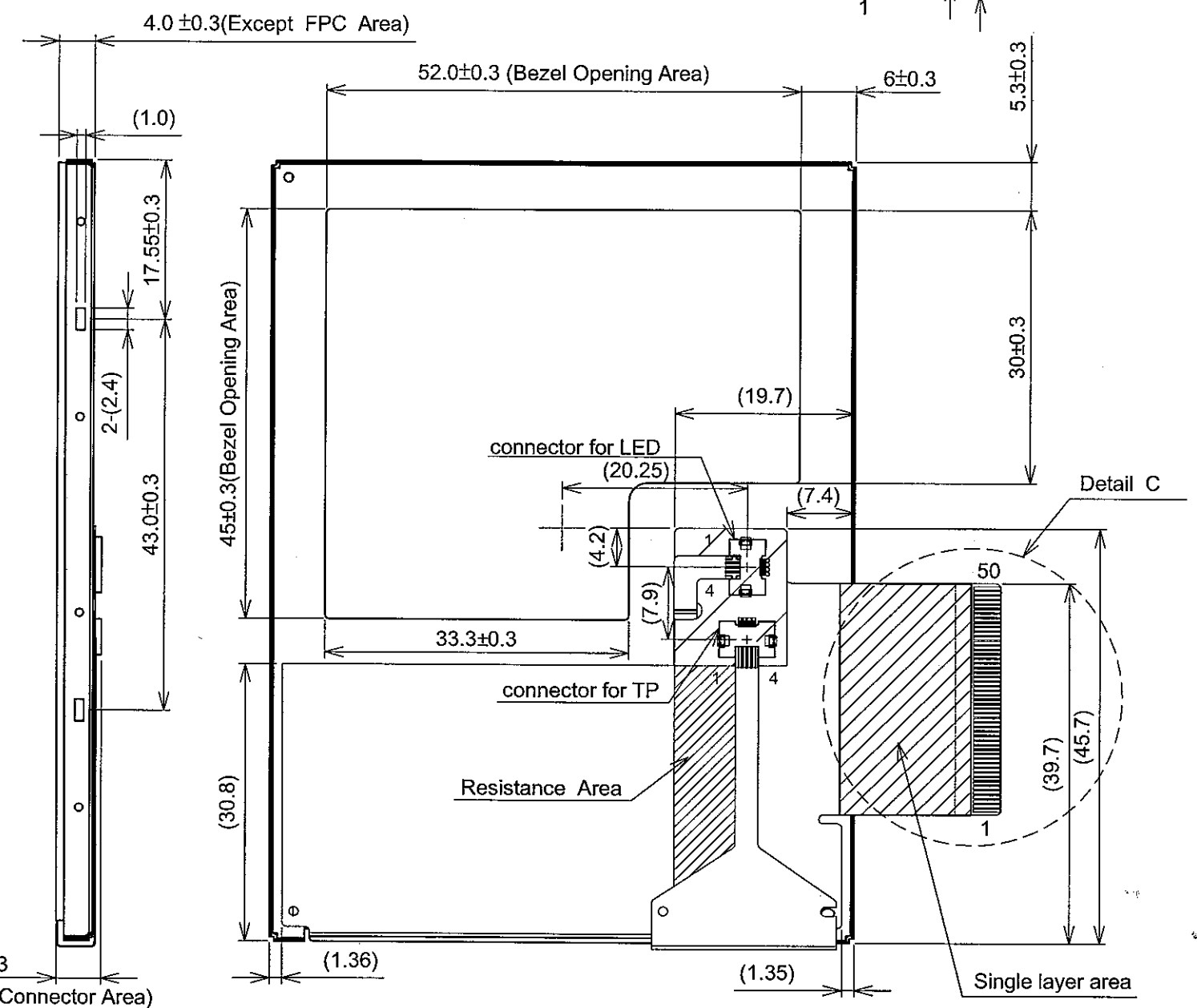
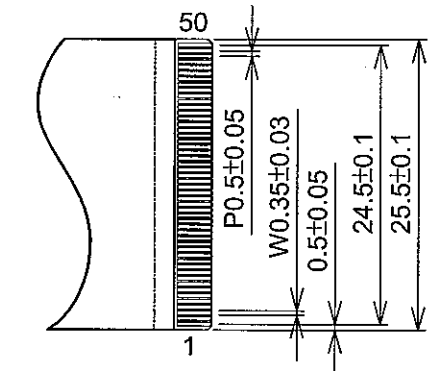
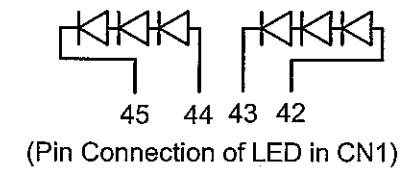
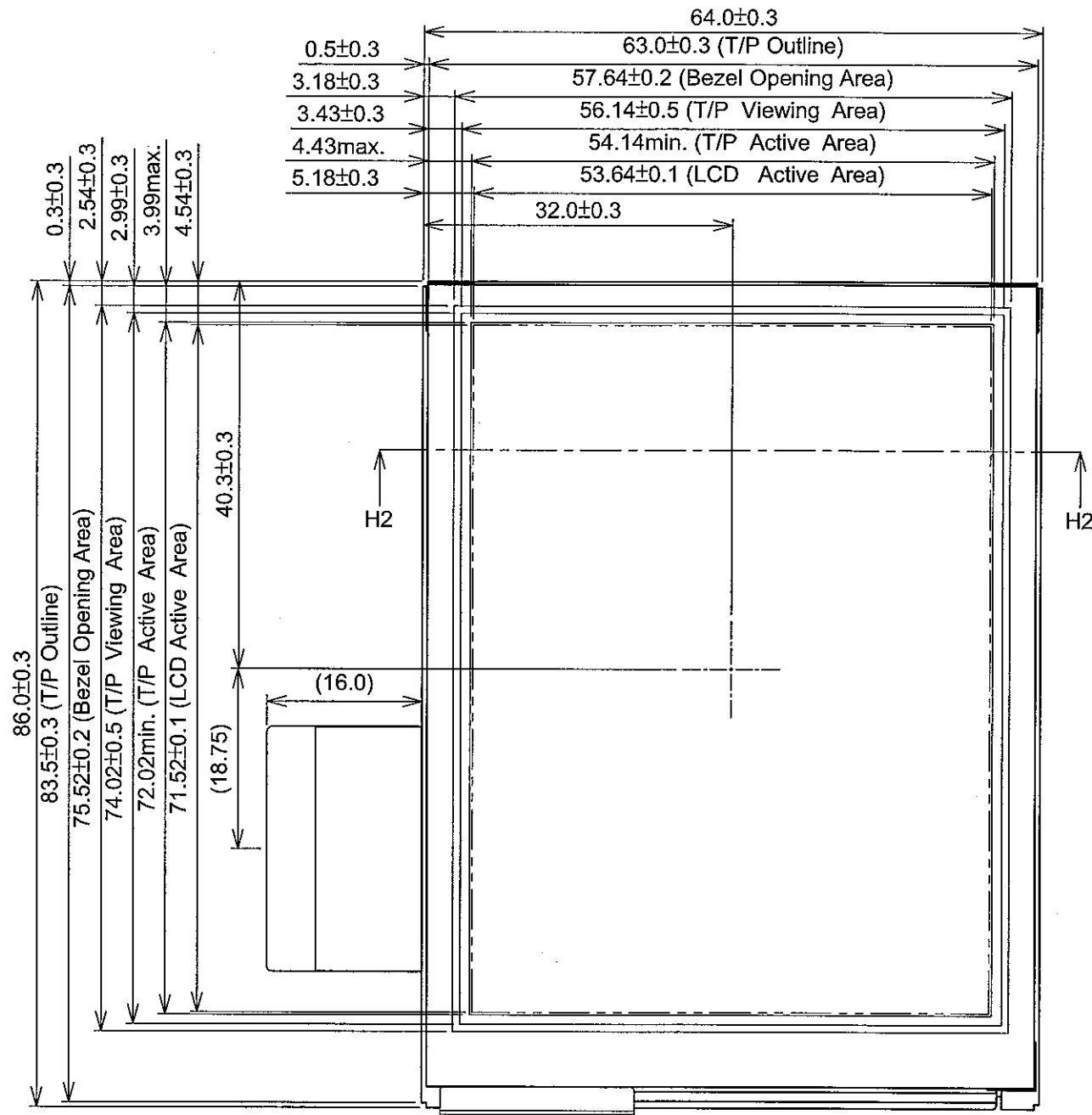
| No | SYMBOL | FUNCTION | No | SYMBOL | FUNCTION |
|----|--------|-------------------------------------|----|-----------|------------------------------------|
| 1 | VGH | Power Supply for Gate Driver (High) | 26 | B5 | Blue Data |
| 2 | DISP | Display on/off (Note1.) | 27 | POL | Data Polarity Judge pulse (Note2.) |
| 3 | CL3 | Gate Driver Shift Clock | 28 | M | AC Modulation Clock |
| 4 | STV | Gate Driver Start Pulse | 29 | LOAD(CL1) | Source Driver Latch Pulse |
| 5 | VSS | GND | 30 | CL2 | Source Driver Shift Clock |
| 6 | VGL | Power Supply for Gate Driver (Low) | 31 | V0 | Gray Scale Voltage |
| 7 | VSS | GND | 32 | V4 | No Connection (Note3.) |
| 8 | STH | Source Driver Start Pulse | 33 | AVDD | Power Supply for Source Driver |
| 9 | R0 | Red Data | 34 | AVDD | Power Supply for Source Driver |
| 10 | R1 | Red Data | 35 | V5 | Gray Scale Voltage |
| 11 | R2 | Red Data | 36 | V9 | Gray Scale Voltage |
| 12 | R3 | Red Data | 37 | DVDD | Power Supply for Logic |
| 13 | R4 | Red Data | 38 | DVDD | Power Supply for Logic |
| 14 | R5 | Red Data | 39 | VCOM | Common Voltage |
| 15 | G0 | Green Data | 40 | VCOM | Common Voltage |
| 16 | G1 | Green Data | 41 | VSS | GND |
| 17 | G2 | Green Data | 42 | Anode R | LED Power Supply (+) |
| 18 | G3 | Green Data | 43 | Cathode R | LED Power Supply (-) |
| 19 | G4 | Green Data | 44 | Anode L | LED Power Supply (+) |
| 20 | G5 | Green Data | 45 | Cathode L | LED Power Supply (-) |
| 21 | B0 | Blue Data | 46 | VSS | GND |
| 22 | B1 | Blue Data | 47 | xR | Touch Panel Right Side |
| 23 | B2 | Blue Data | 48 | yL | Touch Panel Lower Side |
| 24 | B3 | Blue Data | 49 | xL | Touch Panel Left Side |
| 25 | B4 | Blue Data | 50 | yU | Touch Panel Upper Side |

Note1. If you don't use Tcon IC, please follow the page 8-5/10 to set the DISP's timing.

Note2. If you don't use Tcon IC, the POL must be connected to GND.

Note3. Keep open electrically, please follow the page 8-8/10.

9. DIMENSIONAL OUTLINE



Scale : NTS
Unit : mm

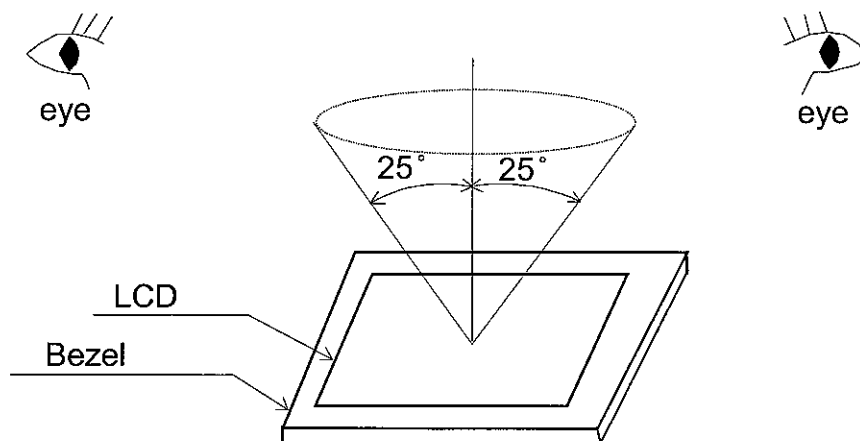
10. APPEARANCE STANDARD

10.1 APPEARANCE INSPECTION CONDITION

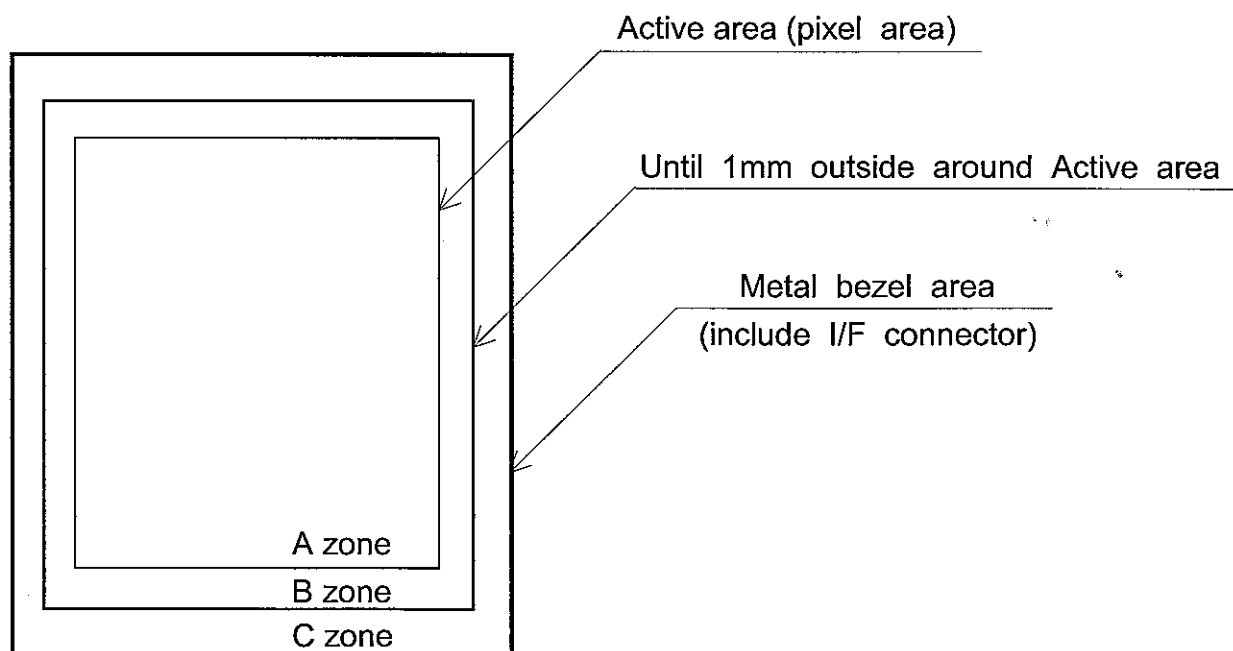
Visual inspection should be done under the following condition.

- (1) The inspection should be done in a dark room.(More than 1000(lx) and non-directive)
- (2) The distance between eyes of an inspector and the LCD module is 30cm.
- (3) The viewing zone is shown the figure.

Viewing angle $\leq 25^\circ$



10.2 DEFINITION OF ZONE



10.3 APPEARANCE SPECIFICATION

(1)LCD Appearance

*) If the problem related to this section occurs about this item, the responsible persons of both party (Customer and HITACHI) will discuss the matter in detail.

| No. | ITEM | CRITERIA | | | APPLIED ZONE |
|------------------|---------------------------------------|---|---------------------------------|------------------------------|--------------|
| L C D | Scratches | Length L(mm) | Width W(mm) | Maximum number acceptable | A,B |
| | | $L \leq 2.0$ | $W \leq 0.03$ | ignored | |
| | | $L \leq 2.0$ | $0.03 < W \leq 0.05$ | 4 | |
| | | $L > 2.0$ | $0.05 < W$ | none | |
| | Dent | Distinguished one is acceptable (To be judged by HITACHI standard) | | | A |
| | Wrinkles in Polarizer | Same as above | | | A |
| | Bubbles | Average diameter D(mm) | Maximum number acceptable | | A |
| | | $D \leq 0.3$ | 2 | | |
| | | $0.3 < D$ | none | | |
| | Stains Foreign Materials | Filamentous (Line shape) | | | A,B |
| | | Length L(mm) | Width W(mm) | Maximum number acceptable | |
| | | $L < 2.0$ | $W \leq 0.05$ | 4 | |
| | Dark spot | $L \leq 1.0$ | $0.05 < W \leq 0.1$ | 2 | A,B |
| | | Round(Dot shape) | | | |
| | | Average diameter D(mm) | Maximum number acceptable | | |
| | | $D \leq 0.15$ | 6 | | |
| | | $0.15 < D \leq 0.2$ | 4 | | |
| | | $0.2 < D$ | none | | |
| | | The total number | Filamentous + Round=9 | | |
| | Those wiped out easily are acceptable | | | | |
| | Color Tone | To be judged by HITACHI STANDARD | | | A |
| Color Uniformity | Same as above | | | A | |
| Dot Defect | | | Maximum number acceptable | A, B | |
| | Sparkle mode | 1 dot | 4 | | |
| | | 2 dots | 2(sets) | | |
| | | Total | 4 | | |
| | Black mode | 1 dot | 4 | | |
| | | 2 dots | 2(sets) | | |
| | | Total | 4 | | |
| | Sparkle mode & Black mode | 2 dots | 2(sets) | | |
| Total | 6 | | | | |

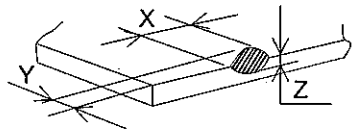
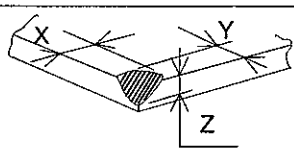
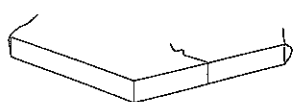
(2) Touch panel appearance

Visual inspection should be done under the following condition.

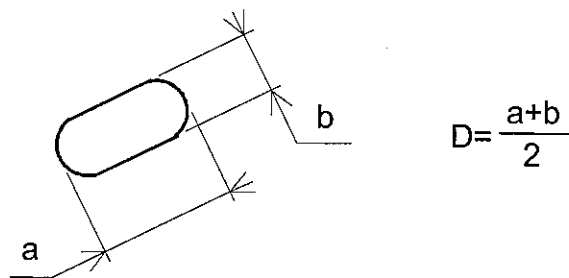
- *) The inspection should be done in a dark room. (more than 500 lx) and non-directive)
- *) The distance between eyes of an inspector and the LCD module is 30 cm.
- *) The viewing angle $\leq 60^\circ$.

| No. | ITEM | CRITERIA | | | APPLIED ZONE |
|-----------------|----------------------------------|----------------------------------|------------------------|---------------------------|--------------|
| | | Length L(mm) | Width W(mm) | Maximum number acceptable | |
| TOUCH PANEL | Scratches | - | $W < 0.05$ | ignored | A,B |
| | | $10 < L$ | $0.05 \leq W < 0.1$ | none | |
| | | - | $0.1 \leq W$ | none | |
| | | Filamentous (Line shape) | | | |
| | Foreign Materials | Length L(mm) | Width W(mm) | Maximum number acceptable | A,B |
| | | - | $W < 0.05$ | Ignored | |
| | | $L > 3$ | $0.05 \leq W \leq 0.1$ | none | |
| | | - | $W \geq 0.1$ | Round | |
| | Dark Spot | Round(Dot shape) | | | A,B |
| | | Average diameter D(mm) | | Maximum number acceptable | |
| | | $D \leq 0.25$ | | ignored | |
| | | $0.25 < D \leq 0.35$ | | 6 | |
| | | $0.35 < D$ | | none | |
| | Newton Ring (Touch Panel) | To be judged by HITACHI standard | | | A,B |
| | Touch Panel Uncleaness | No conspicuous dirt | | | A |
| Rubbing Scratch | To be judged by HITACHI standard | | | - | |

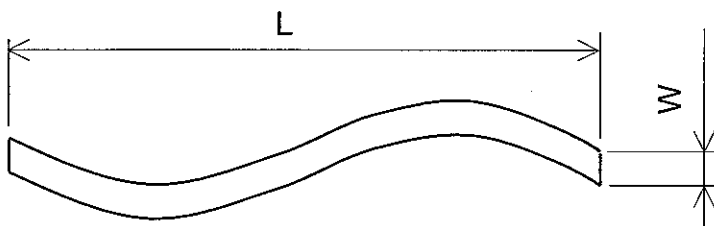
(3) Glass indentation

| ITEM | SPECIFICATIONS | | | | | | |
|--------------------|--|----------|---|---|------------|------------|----------|
| Common Indentation |  <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>≤ 5.0</td> <td>≤ 3.0</td> <td>$\leq t$</td> </tr> </table> | X | Y | Z | ≤ 5.0 | ≤ 3.0 | $\leq t$ |
| X | Y | Z | | | | | |
| ≤ 5.0 | ≤ 3.0 | $\leq t$ | | | | | |
| Corner Broken |  <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>X</td> <td>Y</td> <td>Z</td> </tr> <tr> <td>≤ 3.0</td> <td>≤ 3.0</td> <td>$\leq t$</td> </tr> </table> | X | Y | Z | ≤ 3.0 | ≤ 3.0 | $\leq t$ |
| X | Y | Z | | | | | |
| ≤ 3.0 | ≤ 3.0 | $\leq t$ | | | | | |
| Proceeding Crack |  <p style="text-align: center;">None</p> | | | | | | |

Note 1 : Definition of average diameter (D)

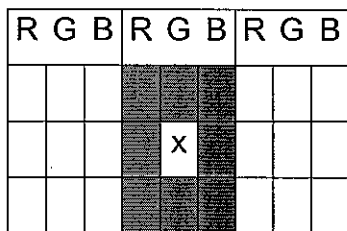


Note 2 : Definition of length (L) and width (W)




Note 3 : Definition of dot defect

- (a) Dot Defect : Defect Area > 1/2 dot
- (b) Sparkle mode : Brightness of dot is more than 30% at Black raster.
- (c) Black mode : Brightness of dot is less than 70% at R.G.B raster.
- (d) 1 dot : Defect dot is isolated , not attached to other defect dot.
- (e) N dot : N defect dots are consecutive .
(N means the number of defect dots.)



2 dots defect included defect dot "X" is defined as follows.

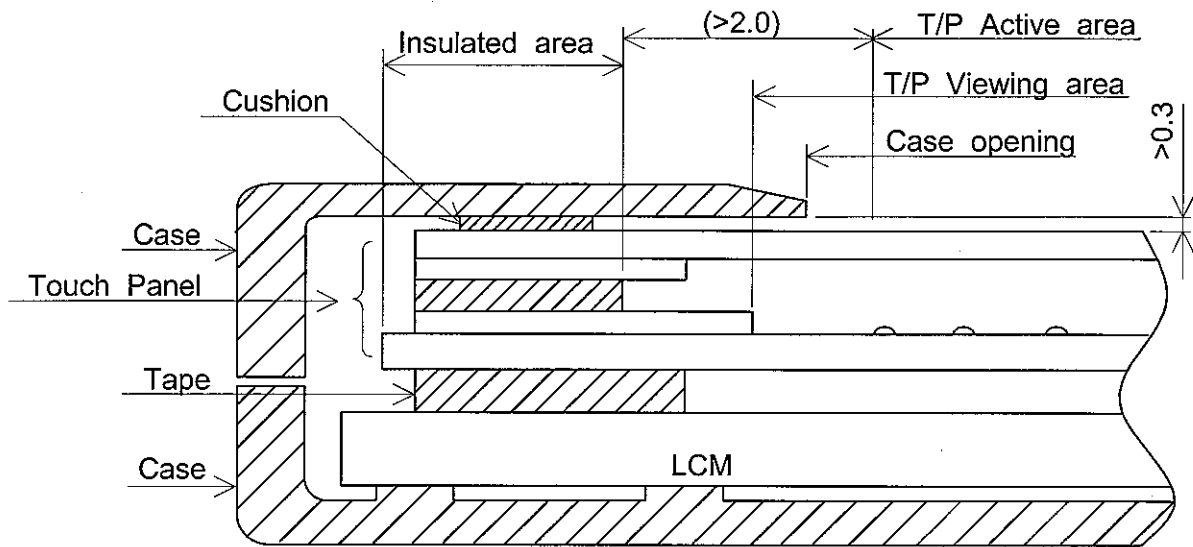
Adjacent dots to defect dot "X" : 

- (f) Counting definition of adjacent dots(1 sets) : same as 1 dot defect.
- (g) Those wiped out easily are acceptable

11. PRECAUTION IN DESIGN

11.1 MOUNTING PRECAUTION

(1) When assembling the Touch Panel and you case, please refer to the figure below.



- (2) The clearance between the Touch Panel and case shall be designed so that the case edge never presses the input screen when it is deformed by heat or other causes.
- (3) The case shall be designed not to touch the tail portion (FPC for Touch Panel).
- (4) The boundary space between the effective area and the insulated area is unstable. Touching this area may effect the operation of the Touch Panel. The case must be designed so that it does not touch the boundary space.

11.2 PRECAUTIONS AGAINST ELECTROSTATIC DISCHARGE

As this module contains C-MOS LSIs, it is not strong against electrostatic discharge. Make certain that the operator's body is connected to the ground through a list band, etc. And don't touch I/F pins directly.

11.3 HANDLING PRECAUTIONS

- (1) Since the Touch Panel on the top, and the frame on the bottom tend to be easily damaged, they should be with full care so as not to get them touched, pushed or rubbed by a piece on glass, tweezers and anything else which are harder a pencil lead 3H.

- (2) As the adhesives used for adhering upper/lower polarizer's and frame are made of organic substances which will be deteriorated by a chemical reaction with such chemicals as acetone, toluene, ethanol and isopropyl alcohol. The following are recommended for use :
normal hexane

Please contact with us when it is necessary for you to use chemicals other than the above.

- (3) Lightly wipe to clean the dirty surface with absorbent cotton or other soft material like chamois, soaked in the recommended chemicals without scrubbing it hardly.
Always wipe the surface horizontally or vertically. Never give a wipe in a circle. To prevent the display surface from damage and keep the appearance in good state, it is sufficient, in general, to wipe it with absorbent cotton.
- (4) Immediately wipe off saliva or water drop attached on the display area because it may cause deformation or faded color.
- (5) Foggy dew deposited on the surface may cause a damage, stain or dirt to the polarizer.
When you need to take out the LCD module from some place at low temperature for test, etc.
It is required to be warmed them up to temperature higher than room temperature before taking them out.
- (6) Touching the display area or I/F pins with bare hands or contaminating them are prohibited, because the stain on the display area and poor insulation between terminals are often caused by being touched with bare hands.
(Some cosmetics are detrimental to polarizer's.)
- (7) In general, the glass is fragile so that, especially on its periphery, tends to be cracked or chipped in handling. Please not give the LCD module sharp shocks by falling , etc.
- (8) Maximum pressure to the surface must be less than 1.96×10^4 Pa.
And if the pressure area is less than 1cm^2 , maximum pressure must be less than 1.96N.
- (9) Since the metal width is narrow on these locations (see page 9-1/1), please careful with handling.
- (10) Top sheets shall be cleaned gently using a soft cloth such as those used for glasses.
Hard wiping accumulated dust will leave scars on the surface even using a cloth.

11.4 OPERATION PRECAUTION

- (1) Using a LCM module beyond its maximum ratings may result in its permanent destruction.
LCM module's should usually be used under recommended operating conditions shown in chapter 4 and chapter 5. Exceeding any of these conditions may adversely affect its reliability.

- (2) Response time will be extremely delayed at lower temperature than the specified operating temperature range and on the other hand LCD's shows dark blue at higher temperature.
However those phenomena do not main defects of the LCD module. Those phenomena will disappear in the specified operating temperature range.
- (3) If the display area is pushed hard during operation, some display patterns will be abnormally display.
- (4) A slight dew depositing on terminals may cause electrochemical reaction which leads to terminal open circuit. Please operate the LCD module under the relative condition of 40°C 85%RH.
- (5) Resistance range : Your controller shall be set up to allow the resistance range of Touch Panel specified in our CAS.
- (6) Pointed position of Touch Panel may shift owing to a change in resistance of Touch Panel depending on the operation condition . To compensate this shift, the set shall be given a calibration function.
- (7) Input shall be made with a stylus pen (polyacetal , R0.8). Chances are very high that use of a metal piece including a ball point pen or sharp edge will impair accuracy.
- (8) The Touch Panel is an auxiliary input device. The system shall be designed to have other input device.

11.5 STORAGE

In case of storing LCD module for a long period of time (for instance, for years) for the purpose of replacement use, the following precautions necessary.

- (1) Store the LCD modules in a dark place; do not expose them to sunlight or ultraviolet rays.
- (2) Keep the temperature between -30°C and 80°C at normal humidity.
- (3) Store the LCD modules in the container which is used for shipping from us.
- (4) No articles shall be left on the surface over an extended period of time.

11.6 SAFETY

Wear finger cots or gloves whenever handling or assembling a Touch Panel its glass edges are sharp.

12. DESIGNATION OF LOT MARK

12.1 LOT MARK

Lot mark is consisted of 4 digits for production lot 6 digits for production control..

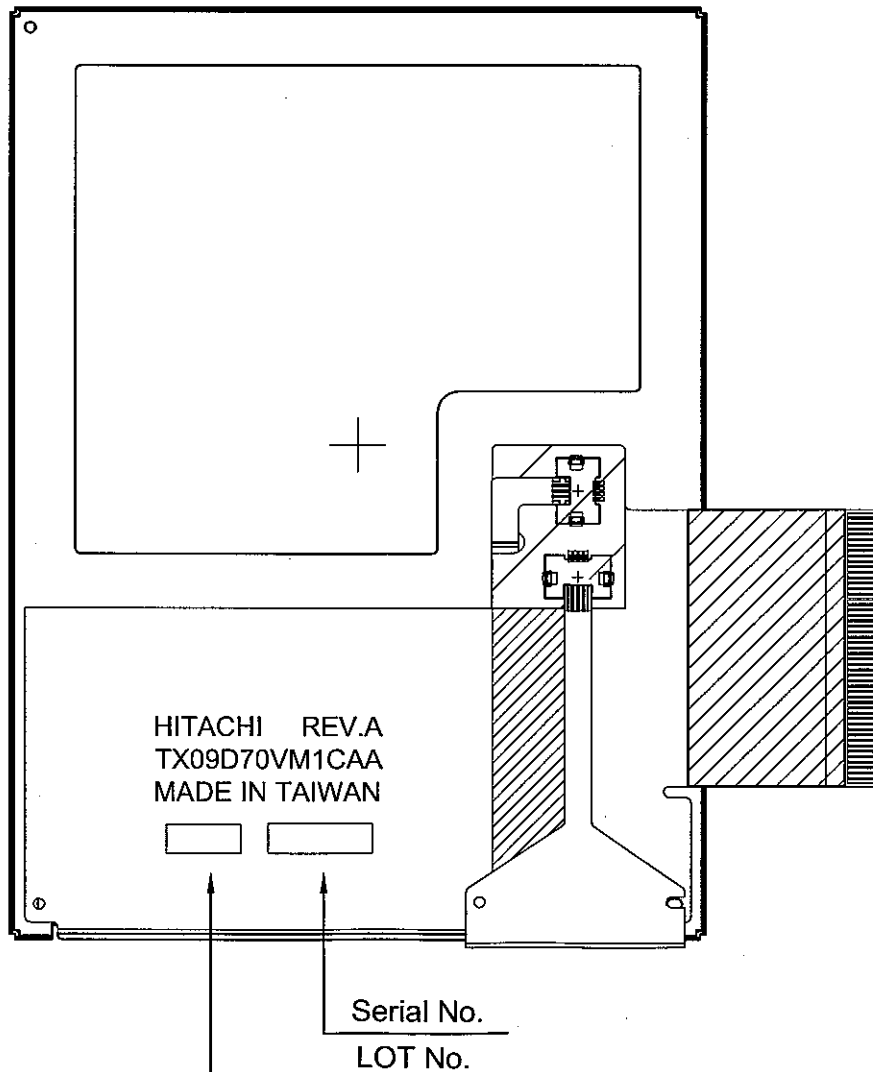


| Year | Mark |
|------|------|
| 2005 | 5 |
| 2006 | 6 |
| 2007 | 7 |
| 2008 | 8 |
| 2009 | 9 |

| Month | Jan. | Feb. | Mar. | Apr. | May | Jun. |
|-------|------|------|------|------|------|------|
| Mark | 01 | 02 | 03 | 04 | 05 | 06 |
| Month | Jul. | Aug. | Sep. | Oct. | Nov. | Dec. |
| Mark | 07 | 08 | 09 | 10 | 11 | 12 |

| Week (Day In Calendar) | Figure In Lot Mark |
|------------------------|--------------------|
| 01~07 | 1 |
| 08~14 | 2 |
| 15~21 | 3 |
| 22~28 | 4 |
| 29~31 | 5 |

12.2 Location of lot mark : On the FPC



13. PRECAUTION FOR USE

(1) A limit sample should be provided by the both parties on an occasion when the both parties agree to its necessity.

Judgement by a limit sample shall take effect after the limit sample has been established and confirmed by the both parties.

(2) On the following occasions, the handling of the problem should be decided through discussion and agreement between responsible persons of the both parties.

1) When a question is arisen in the specifications.

2) When a new problem is arisen which is not specified in this specifications.

3) When an inspection specifications change or operating condition change by customer is reported to HITACHI, and some problem is arisen in the specification due to the change.

4) When a new problem is arisen at the customer's operating set for sample evaluation.

(3) Regarding the treatment for maintenance and repairing, both parties will discuss it in six months later after latest delivery of this product.

The precaution that should be observed when handling LCM have been explained above.

If any points are unclear or if you have any requests, please contact with HITACHI.