

APPLICATIONS

This specification is applied to the following TFT Liquid Crystal Display Module with Back-light unit.

Note : Inverter device for Back-light is not built in so it should be prepared by yourself.

- Type name : TX31D27VC1CBC
- Display Area : H246×V184.5 [mm]
- Display Dots : H(800×3)×V600 [dots]
(Display Pixels) (H800×V600 pixels)
- Color Pixel Arrangement : R·G·B Vertical Stripe
- Display Mode : Transmissive Mode
Normally White Mode
- Color Number : 262k Colors
- Viewing Angle : 6:00 Direction
- Dimensions Outline : H275.5(typ.)×V199.0(typ.)×t6.9(max.) [mm]
- Weight : Approximately 420 [g]

1. ABSOLUTE MAXIMUM RATINGS

1.1 ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

| ITEM | OPERATING | | STORAGE | | UNIT | NOTE |
|----------------------------|----------------|------------|----------------|-----------|------------------|------|
| | MIN. | MAX. | MIN. | MAX. | | |
| Ambient Temperature | 5 | 40 | -20 | 60 | °C | 1) |
| Humidity | 2) | | 2) | | %RH | 1) |
| Vibration | — | 4.9 (0.5G) | — | 19.6 (2G) | m/s ² | 3) |
| Shock | — | 29.4 (3G) | — | 490 (50G) | | 4) |
| Corrosive Gas | NOT ACCEPTABLE | | NOT ACCEPTABLE | | — | |
| Illuminance of LCD surface | — | 50,000 | — | 50,000 | lx | |

Note 1) Environmental temperature and humidity of this unit, not of system installed with this unit.
At low temperature the brightness of CFL drop and the life time of CFL become to be short.

2) Ambient temp. $T_a \leq 40^\circ\text{C}$: 85%RH MAX. Without condensation.
 $T_a > 40^\circ\text{C}$: Absolute humidity must be lower than the humidity of 85%RH at 40°C . Without condensation.

3) 20~50Hz.

4) 7ms.

1.2 ELECTRICAL ABSOLUTE MAXIMUM RATINGS

(1) TFT LIQUID CRYSTAL DISPLAY MODULE

$V_{SS}=0\text{V}$

| ITEM | SYMBOL | MIN. | MAX. | UNIT | NOTE |
|---------------------------|------------|-----------|--------------|------|--------|
| Power Supply Voltage | V_{DD} | 0 | 4.3 | V | |
| Input Voltage | V_I | -0.2 | $V_{DD}+0.2$ | V | 1) |
| Electro-static Durability | V_{ESD0} | ± 100 | | V | 2), 3) |
| | V_{ESD1} | ± 8 | | kV | 2), 4) |

Note 1) V_{sync} , H_{sync} , $DIMG$, $DCLK$, RD , GD , BD , are subjected.

2) 200pF-250Ω, 25°C-70%RH.

3) I/F connector pins are subjected.

4) The surface of Metal bezel and LCD panel are subjected.

(2) BACK-LIGHT UNIT

$GND=0\text{V}$

| ITEM | SYMBOL | MIN. | MAX. | UNIT |
|--------------|--------|------|-------|------|
| Lamp Current | I_L | 0 | 7 | mA |
| Lamp Voltage | V_L | 0 | 2,000 | V |

2. OPTICAL CHARACTERISTICS

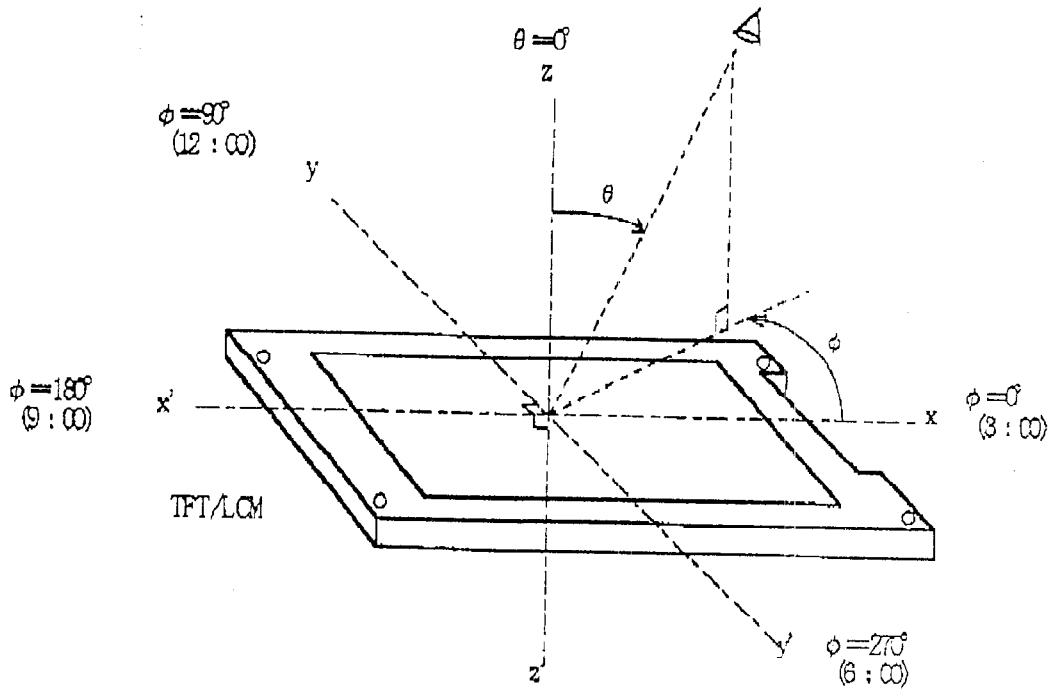
The following items are measured when the conditions of this unit (TFT panel and Back-light) and measuring systems are stable. The ambient light excluding Back-light is nothing.

• Measuring equipment : TOPCON BM-7, Prichard 1980A, or equivalent

Temperature of LCD=25°C, V_{DD}=3.3V, f_v=60Hz, I_L=3.0mA

| ITEM | SYMBOL | CONDITION | MIN. | TYP. | MAX. | UNIT | NOTE | | |
|--------------------|-----------------|-------------------|-------------------|-------|------|------|-------------------|-----------------------|--|
| Contrast Ratio | CR | θ = 0° Note 1) | 100 | (150) | — | — | 2) | | |
| Response Time | RISE | | tr | — | 30 | — | ms | 3) | |
| | FALL | | tf | — | 20 | — | | | |
| Brightness (White) | T _{wh} | | θ = 0° Note 1) | — | 70 | — | cd/m ² | I _L =3.0mA | |
| | | | | — | 150 | — | | I _L =7.0mA | |
| Color of CIE | Red | | | x | — | 0.59 | — | — | |
| | | | | y | — | 0.35 | | | |
| | Green | | | x | — | 0.29 | | | |
| | | | | y | — | 0.55 | | | |
| | Blue | | | x | — | 0.15 | | | |
| | | | | y | — | 0.14 | | | |
| | White | | | x | — | 0.32 | | | |
| | | y | | — | 0.33 | | | | |

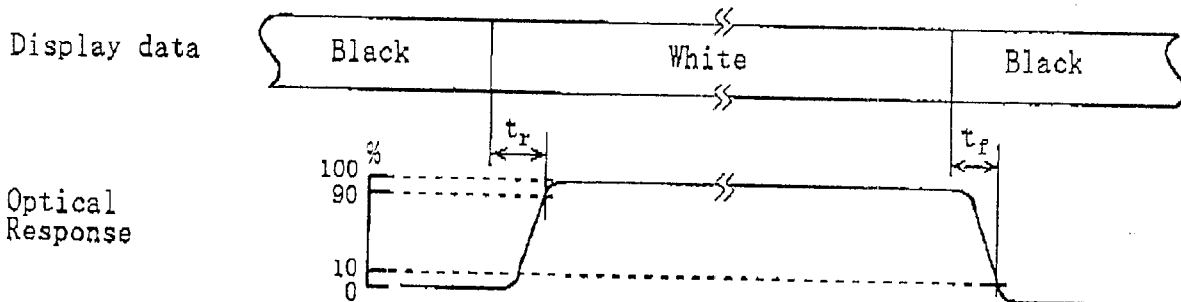
Note 1) Definition of Viewing Angle



Note 2) Definition of Contrast Ratio (CR)

$$CR = \frac{\text{Brightness when displaying White raster}}{\text{Brightness when displaying Black raster}}$$

Note 3) Definition of Response Time



3. ELECTRICAL CHARACTERISTICS

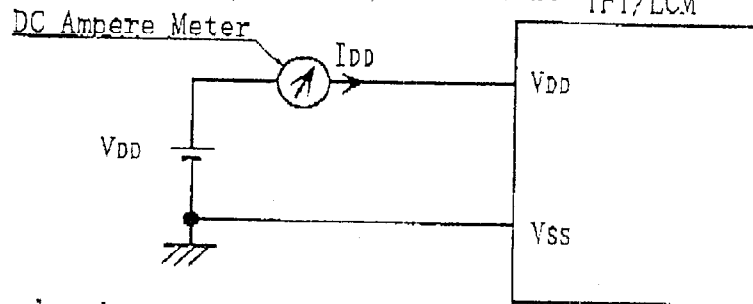
(1) TFT LIQUID CRYSTAL DISPLAY MODULE

Ta=25°C, V_{SS}=0V

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT | NOTE |
|----------------------------------|------------------|-----------------|-----------------|------|-----------------|--------|
| Power Supply Voltage | V _{DD} | 3.0 | 3.3 | 3.6 | V | |
| Input Voltage for Logic Circuits | Hi | V _{IH} | 2.0 | — | V _{DD} | 1) |
| | Lo | V _{IL} | V _{SS} | — | 0.8 | |
| Power Supply Current | I _{DD} | — | 270 | 550 | mA | 2), 3) |
| Vsync Frequency | f _V | 55 | 60 | 65 | Hz | |
| Hsync Frequency | f _H | — | 37.5 | 39.2 | kHz | |
| DCLK Frequency | f _{CLK} | — | 38.4 | 40 | MHz | |

Note 1) Display data pins and Timing signal pins are subjected.

2) f_V=60Hz, f_{CLK}=38.4MHz, V_{DD}=3.3V, DC Current TFT/LCM



Typical value is measured when displaying Black raster.

Maximum is measured when displaying Vertical-stripe pattern.

3) Current capacity for V_{DD} power source should be larger than 3A.

(2) BACK-LIGHT UNIT

Ta=25°C

| ITEM | SYMBOL | MIN. | TYP. | MAX. | UNIT | NOTE |
|-----------------------|----------------|------|------|------|-------------------|------|
| Lamp Current | I _L | 2.5 | 3.0 | 7.0 | mA _{rms} | 1) |
| Lamp Voltage | V _L | — | 646 | — | V _{rms} | |
| Frequency | f _L | 50 | — | 70 | kHz | 2) |
| Starting Lamp Voltage | V _s | 990 | — | — | V _{rms} | 3) |
| | | 1600 | — | — | | |

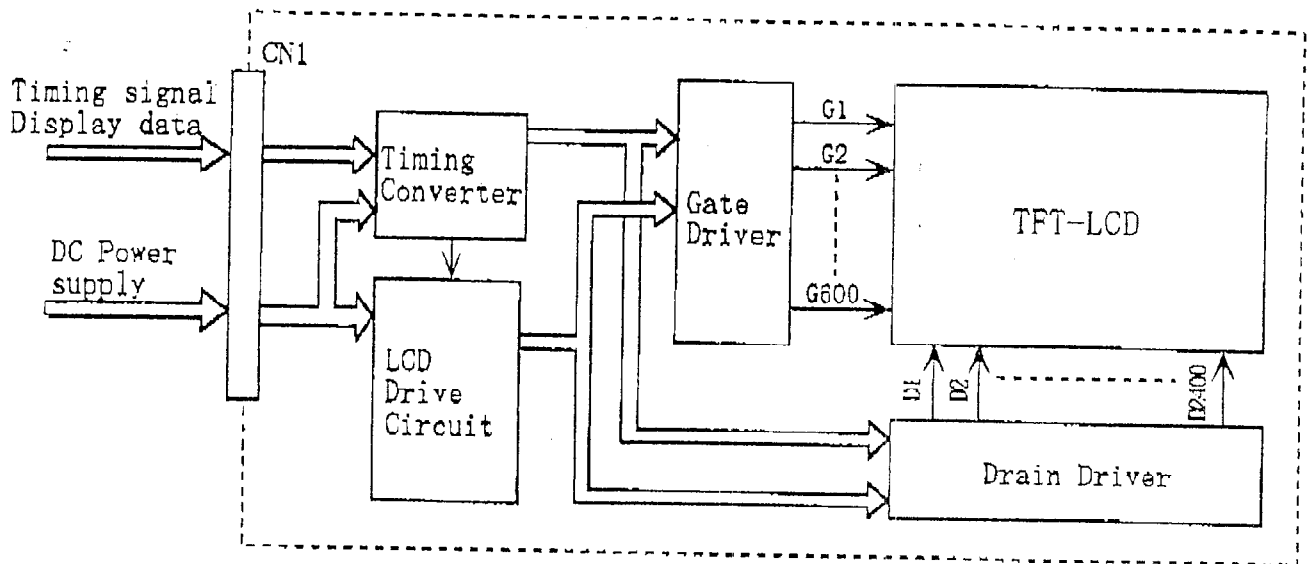
NOTE 1) Higher I_L cause the short life time of CFL.

2) Lamp frequency may produce interference with Hsync frequency, causing beat or flicker on the display. Therefore lamp frequency shall be as different as possible from Hsync frequency, to avoid interference.

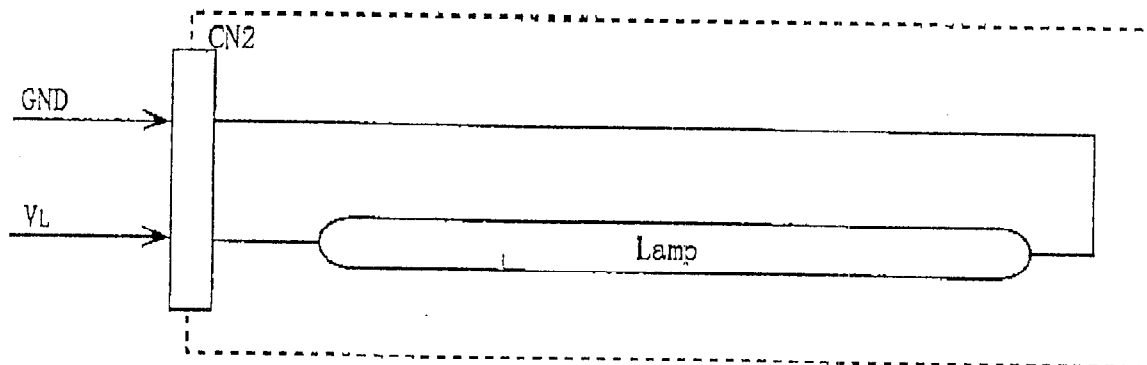
3) Ta=5°C

4. BLOCK DIAGRAM

(1) TFT LIQUID CRYSTAL DISPLAY MODULE



(2) BACK-LIGHT UNIT



5. INTERFACE PIN ASSIGNMENT

(1) TFT LIQUID CRYSTAL DISPLAY MODULE

CN1 «HIROSE ; DF9B-41P-1V or Equivalent»

| Pin No | SYMBOL | DESCRIPTION | NOTE |
|--------|--------|----------------------------|------|
| 1 | Vss | GND (0V) | |
| 2 | DCLK | Dot Clock | 1) |
| 3 | Vss | GND (0V) | |
| 4 | Hsync | Horizontal Synchronization | 1) |
| 5 | Vsync | Vertical Synchronization | |
| 6 | Vss | | |
| 7 | Vss | GND (0V) | 1) |
| 8 | Vss | | |
| 9 | R0 | | |
| 10 | R1 | Red Data | |
| 11 | R2 | | |
| 12 | Vss | GND (0V) | 1) |
| 13 | R3 | | |
| 14 | R4 | Red Data | |
| 15 | R5 | | |
| 16 | Vss | | |
| 17 | Vss | GND (0V) | 1) |
| 18 | Vss | | |
| 19 | G0 | | |
| 20 | G1 | Green Data | |
| 21 | G2 | | |
| 22 | Vss | GND (0V) | 1) |
| 23 | G3 | | |
| 24 | G4 | Green Data | |
| 25 | G5 | | |
| 26 | Vss | | |
| 27 | Vss | GND (0V) | 1) |
| 28 | Vss | | |
| 29 | B0 | | |
| 30 | B1 | Blue Data | |
| 31 | B2 | | |
| 32 | Vss | GND (0V) | 1) |
| 33 | B3 | | |
| 34 | B4 | Blue Data | |
| 35 | B5 | | |
| 36 | Vss | GND (0V) | 1) |
| 37 | DIMG | Display Timing | |
| 38 | NC | Non-Connect | |
| 39 | Vcc | | |
| 40 | Vcc | Power Supply (+3.3V) | 2) |
| 41 | TC | | 3) |

Note 1) All Vss pins should be connected to GND(0V).
Metal bezel is connected internally to Vss.

2) All Vcc pins should be connected to +3.3V.

3) Keep open. Hitachi test use only.

(2) BACK-LIGHT UNIT

CN2 «JST ; BHSR-02VS-1»

| Pin No | SYMBOL | DESCRIPTION |
|--------|----------------|--------------|
| 1 | V _L | Power Supply |
| 2 | GND | GND (0V) |

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RELATIONSHIP BETWEEN DISPLAYED COLOR AND INPUT DATA.

| INPUT DATA | | R DATA | | | | | G DATA | | | | | B 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 |

Note 1) Definition of gray scale :

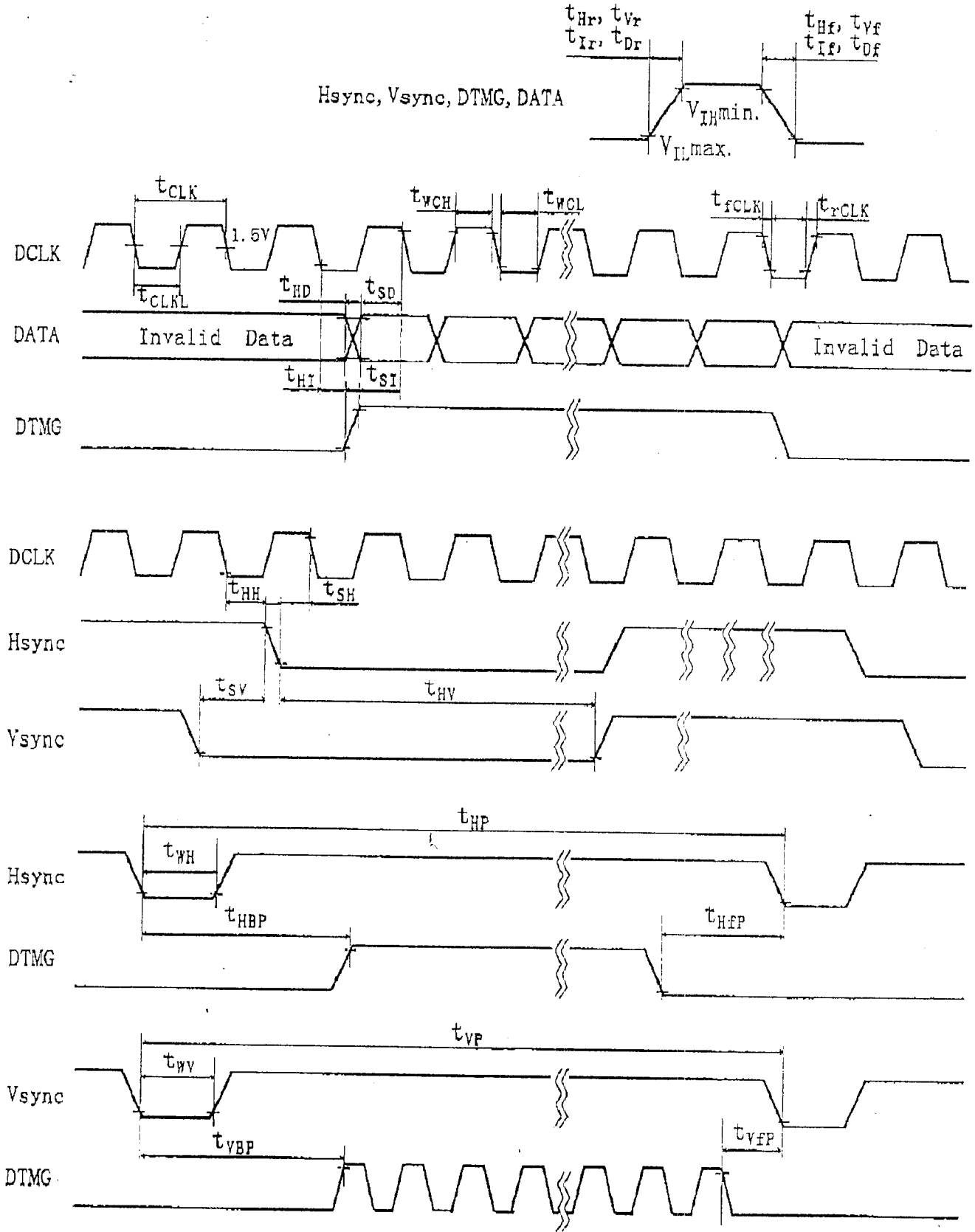
Color(n) — n indicates gray scale level. Lower n means brighter level.

2) Data : 1:Hi, 0:Lo

6. INTERFACE TIMING

6.1 TIMING CHART

(Data : Latched at Fall edge of DCLK)

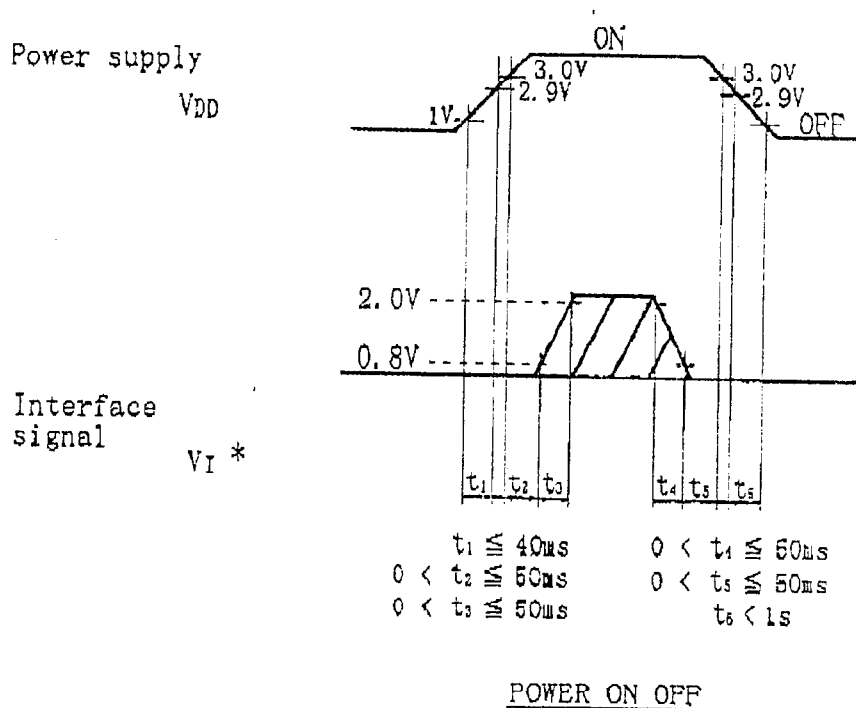


6.2 INTERFACE TIMING SPECIFICATION

| ITEM | | SYMBOL | MIN. | TYP. | MAX. | UNIT | NOTE |
|-------|------------------------|------------------|----------------|------|------|-----------|----------------------|
| DCLK | Period | t_{CLK} | 25 | 26 | — | ns | |
| | Width-Low | t_{wCL} | 8 | — | — | | |
| | Width-Hi | t_{rCH} | 8 | — | — | | |
| | Rise Time | t_{rCLK} | — | — | 25 | | |
| | Fall Time | t_{fCLK} | — | — | 25 | | |
| | Duty | D | 0.45 | 0.5 | 0.55 | — | $D=t_{CLKL}/t_{CLK}$ |
| Hsync | Set up Time | t_{SH} | 6 | — | — | ns | for DCLK |
| | Hold Time | t_{HH} | 6 | — | — | | |
| | Period | t_{HP} | $1052-t_{HBP}$ | 1024 | 1200 | t_{CLK} | |
| | Width-Active | t_{WH} | 8 | — | 130 | | |
| | Rise/Fall Time | t_{Hr}, t_{Hf} | — | — | 30 | ns | |
| Vsync | Set up Time | t_{SV} | 0 | — | — | t_{CLK} | for Hsync |
| | Hold Time | t_{HV} | 2 | — | — | | |
| | Period | t_{VP} | 603 | 625 | 1000 | t_{HP} | |
| | Width-Active | t_{WV} | 1 | — | 24 | | |
| | Rise/Fall Time | t_{Vr}, t_{Vf} | — | — | 50 | ns | |
| DTMG | Set up Time | t_{SI} | 6 | — | — | ns | for DCLK |
| | Hold Time | t_{HI} | 3 | — | — | | |
| | Rise/Fall Time | t_{Ir}, t_{If} | — | — | 30 | ns | |
| | Horizontal Back Porch | t_{HBP} | 32 | — | 215 | t_{CLK} | |
| | Horizontal Front Poach | t_{HFP} | 16 | — | — | | |
| | Vertical Back Porch | t_{VBP} | 4 | — | — | t_{HP} | |
| | Vertical Front Poach | t_{VFP} | 0 | — | — | | |
| DATA | Set up Time | t_{SD} | 6 | — | — | ns | for DCLK |
| | Hold Time | t_{HD} | 6 | — | — | | |
| | Rise/Fall Time | t_{Dr}, t_{Df} | — | — | 25 | ns | |

Note 1) Spectrum Spread off

6.3 TIMING BETWEEN INTERFACE SIGNAL AND POWER SUPPLY

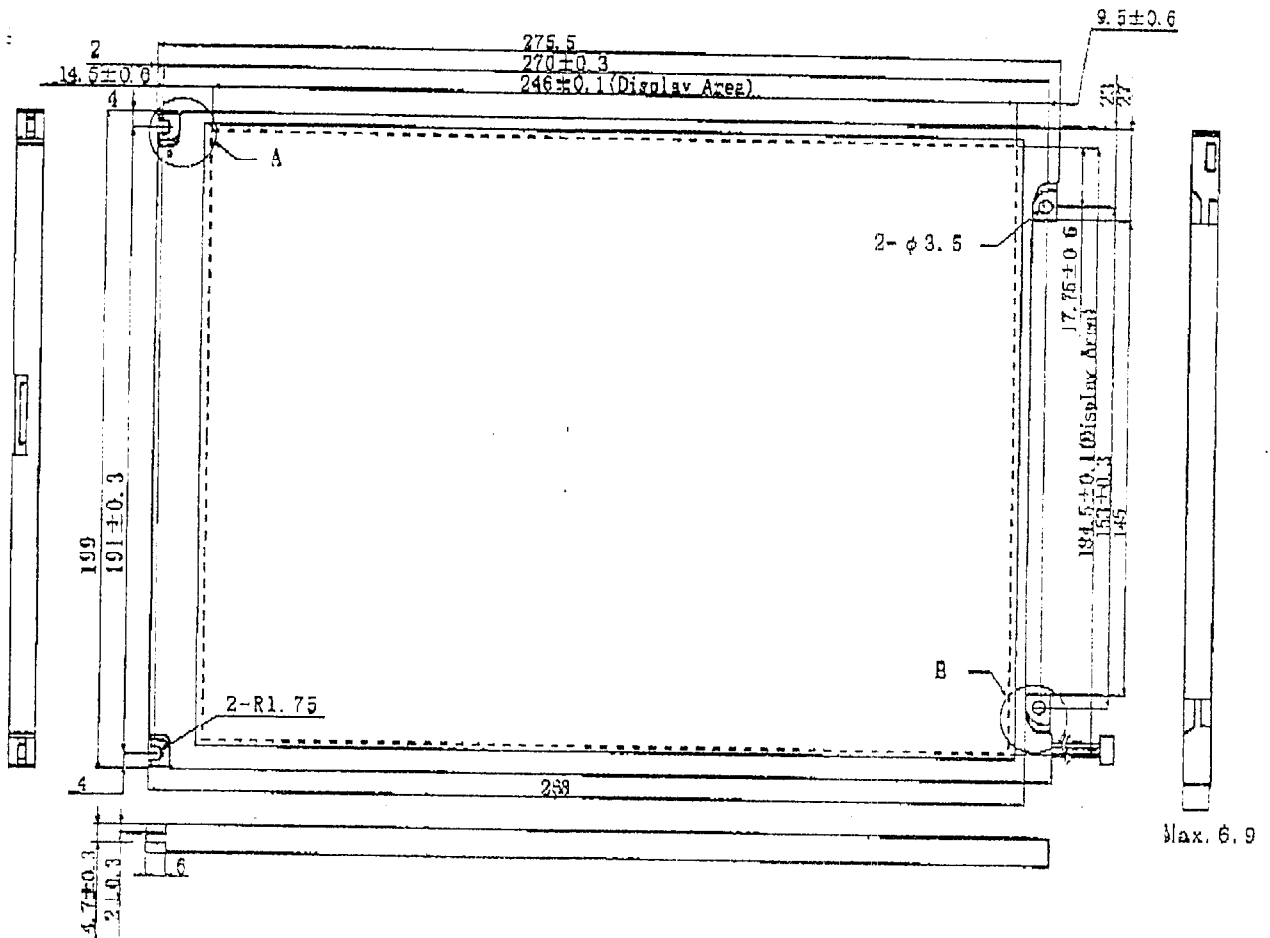


* Set $0V \leq V_I(t) \leq V_{DD}(t)$.
 Here, $V_I(t)$, $V_{DD}(t)$ indicate the transitive state of V_I , V_{DD} when power supply is turned ON or OFF.

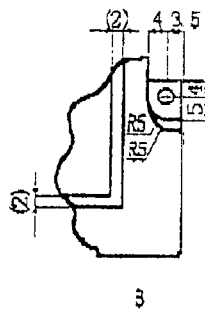
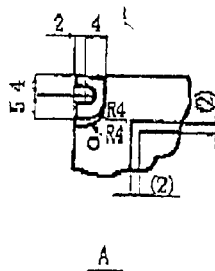
Note 1) Do not keep interface signal high-impedance when power on.

7. DIMENSIONAL OUTLINE

(1) Front View



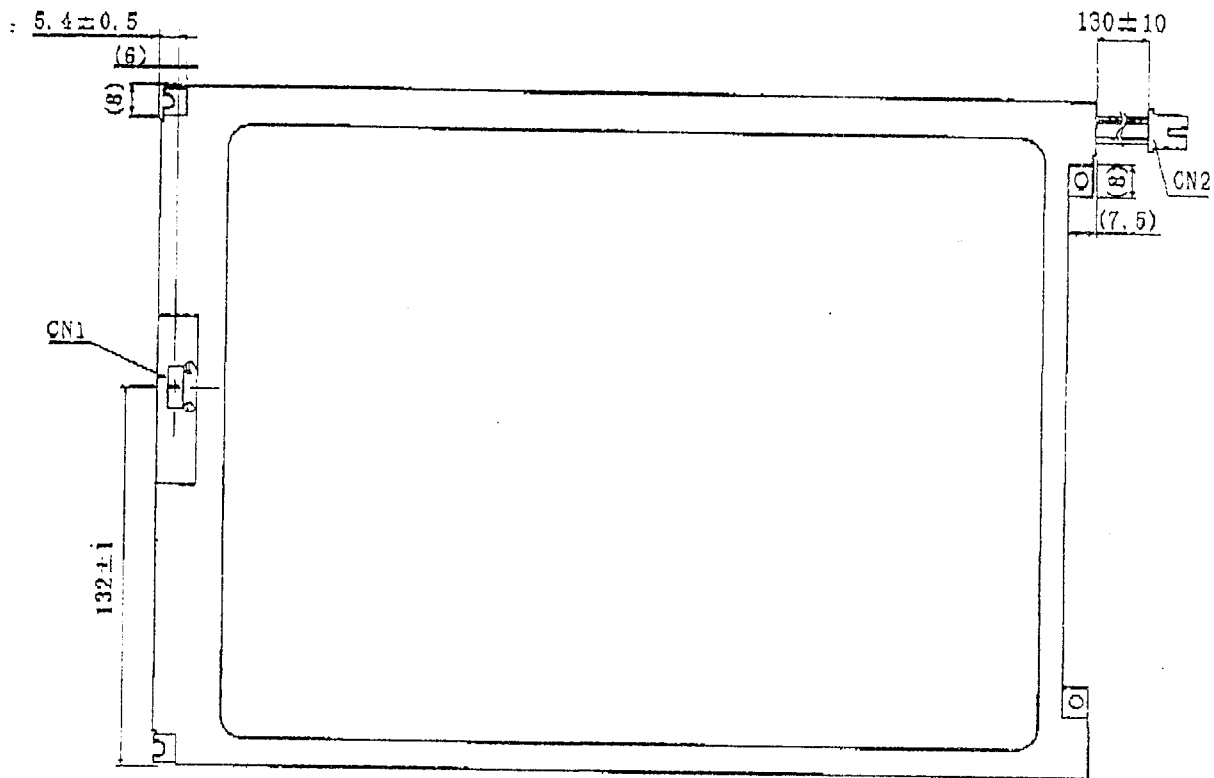
Unit : mm
Scale : NTS



- Note
- 1) CN1 : HIROSE DF9B-41P-1V or equivalent
 - 2) CN2 : JST BHSR-02VS-1 cable length : about 130mm.
 - 3) Tolerance not specified is ± 0.5 mm.
 - 4) Dimensions in parenthesis are reference value.
 - 5) Position, size and form of tab and grooves on Metal bezel not specified.

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(2) Back View

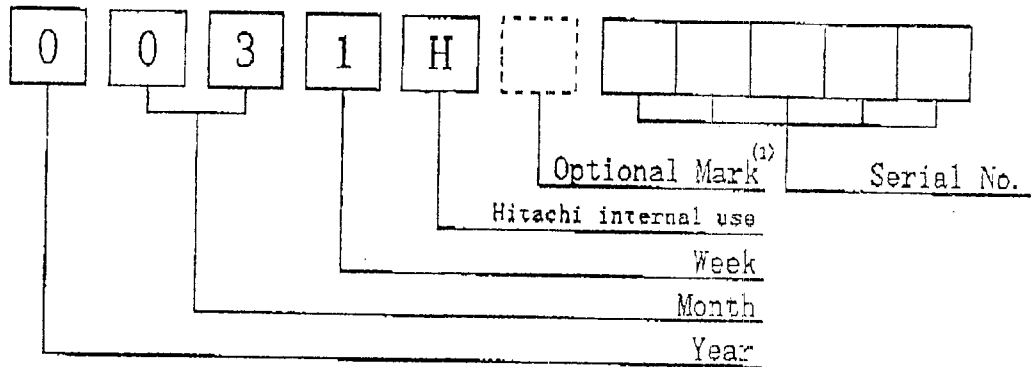


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8. DESIGNATION OF LOT MARK

8.1 LOT MARK

Lot Mark is consisted of 4 digits for production lot and 7 digits for production control.



| Year | Figure in Lot Mark |
|------|--------------------|
| 2000 | 0 |
| 2001 | 1 |
| 2002 | 2 |
| 2003 | 3 |
| 2004 | 4 |

| Week(day in calender) | Figure in Lot Mark |
|-----------------------|--------------------|
| 1~7 | 1 |
| 8~14 | 2 |
| 15~21 | 3 |
| 22~28 | 4 |
| 29~31 | 5 |

Note 1) Optional Mark for Hitachi.

| Month | Figure in Lot Mark | Month | Figure in Lot Mark |
|-------|--------------------|-------|--------------------|
| 1 | 01 | 7 | 07 |
| 2 | 02 | 8 | 08 |
| 3 | 03 | 9 | 09 |
| 4 | 04 | 10 | 10 |
| 5 | 05 | 11 | 11 |
| 6 | 06 | 12 | 12 |

8.2 Serial No.

Serial No. is consisted of 5 digits number (00001~99999).

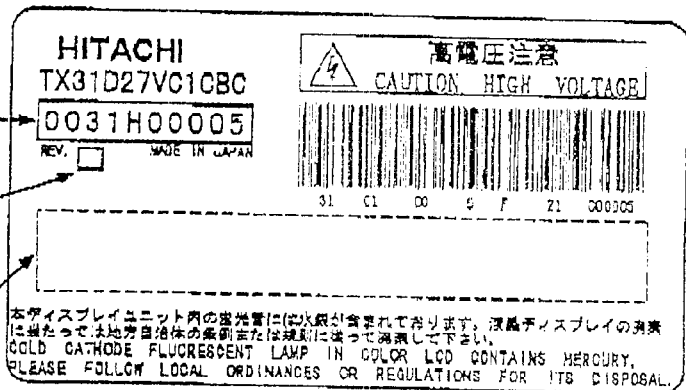
8.2 LOCATION OF LOT MARK

Label is being attached on the back side of module.

Lot No. &
Production Control No.

Revision Mark

Optional Area (2)



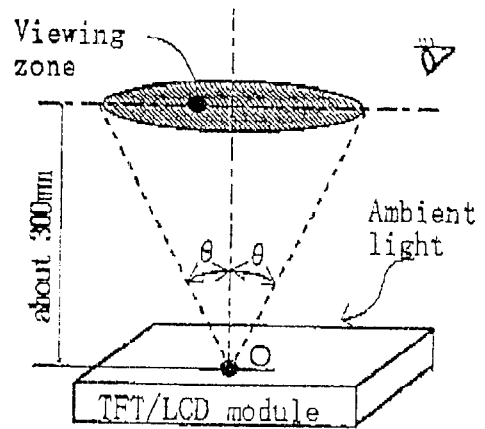
Note 2) Optional Area for Hitachi

9. COSMETIC SPECIFICATIONS

9.1 CONDITIONS FOR COSMETIC INSPECTION

(1) Viewing zone

- i) The figure shows the correspondence between eyes (of inspector) and TFT/LCD module.
 - $\theta \leq 45^\circ$ when non-operating inspection
 - $\theta \leq 5^\circ$ when operating inspection
- ii) Inspection should be executed only from front side, and only A-zone. Cosmetic of B-zone and C-zone are ignore.
(refer to 9.2 DEFINITION OF ZONE)



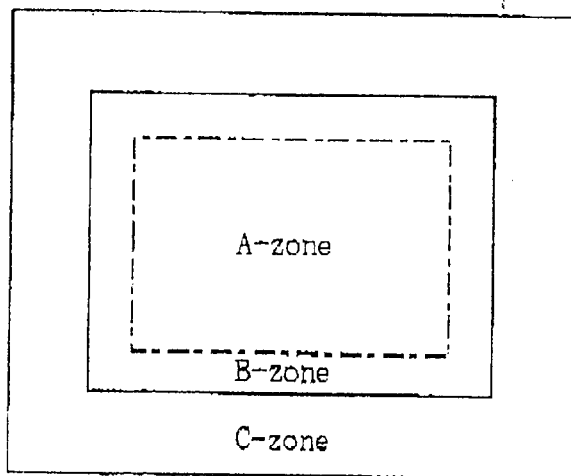
(2) Environmental

- i) Temperature : 25°C
When operating inspection, surface temperature of LCD panel is 25°C .
- ii) Ambient light : about 2000 [lx] and non-directive.
- iii) Back-light : When non-operating inspection, Back-light should be off.

(3) Operating inspection

Operating inspection should be done with 8 color mode (without gray scale).

9.2 DEFINITION OF ZONE



- A-zone : Display area (pixel area).
- B-zone : Area between A-zone and C-zone.
- C-zone : Metal bezel area.
(Include I/F connector)

9.3 COSMETIC SPECIFICATIONS

When displaying condition is not stable (ex. at turn on or off), the following specifications are not applied.

| No. | ITEM | | MAXMUM ACCEPTABLE NUMBER | | NOTE | | |
|-----|----------------------|---------------|--------------------------|---------------|----------------|------------|-------------|
| | | | A-zone | UNIT | | | |
| 1 | Dot Defect | Sparkle mode | 1dot | 2 | pcs | 1), 2), 4) | |
| | | | 2dots | 1 | | | |
| | | | 3dots | 0 | units | | |
| | | | 4dots | 0 | | | |
| | | | Density | 2 | pcs/ ϕ 20 | | 1), 2), 6) |
| | | | Total | 2 | pcs | | |
| | | Black mode | 1dot | 3 | pcs | 1), 3), 4) | |
| | | | 2dots | 1 | | | |
| | | | 3dots | 0 | units | | |
| | | | 4dots | 0 | | | |
| | | | Density | 3 | pcs/ ϕ 20 | | 1), 3), 6) |
| | | | Total | 3 | pcs | | |
| | | Total | | 5 | pcs | 1) | |
| 2 | Line Defect | | Serious one is no good. | - | - | | |
| 3 | Uneven Brightness | | | | | | |
| 4 | Stain Inclusion | Line shape | $W \leq 0.02$ | L: Ignore | Ignore | pcs | |
| | | | $W \leq 0.03$ | $L \leq 2.0$ | | | 10 |
| | | $L > 2.0$ | | 0 | | | |
| | | $W \leq 0.06$ | $L \leq 1.0$ | 10 | | | |
| | | | $L > 1.0$ | 0 | | | |
| 5 | Stain Inclusion | Dot shape | D: average dia. [mm] | $D \leq 0.22$ | Ignore | pcs | |
| | | | | $D \leq 0.33$ | | | 5 |
| | | | | $D > 0.33$ | | | 0 |
| 6 | Scratch on polarizer | Line shape | $W \leq 0.01$ | L: Ignore | Ignore | pcs | |
| | | | | $W \leq 0.02$ | | | $L \leq 40$ |
| | | $L > 40$ | 0 | | | | |
| | | $W \leq 0.04$ | $L \leq 20$ | 10 | | | |
| | | | $L > 20$ | 0 | | | |
| 7 | Scratch on polarizer | Dot shape | D: average dia. [mm] | $D \leq 0.2$ | Ignore | pcs | |
| | | | | $D \leq 0.4$ | | | 10 |
| | | | | $D > 0.4$ | | | 0 |

| No. | ITEM | MAXIMUM ACCEPTABLE NUMBER | | NOTE |
|-----|--|----------------------------|--------|-----------|
| | | A-zone | UNIT | |
| 8 | Bubbles, Peeling in Polarizer D: average dia. (mm) | D ≤ 0.3 | Ignore | pcs 8) |
| | | D ≤ 0.5 | 10 | |
| | | D ≤ 1.0 | 5 | |
| | | D > 1.0 | 0 | |
| 9 | Wrinkles on Polarizer | Serious one is no good. | | - |

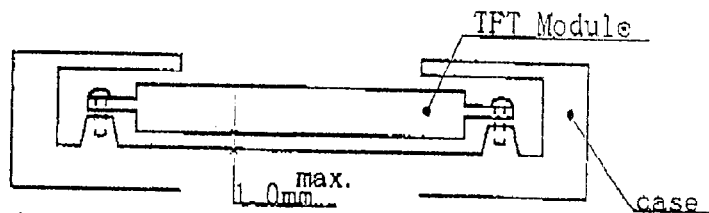
- Note
- 1) Dot Defect : Defect area > 1/2 dot
 - 2) Sparkle mode : Brightness of dot is more than 30%
at Black raster. (Visible to eye)
 - 3) Black mode : Brightness of dot is less than 70%
at white raster. (Visible to eye)
 - 4) 1 dot : defect dot is isolated, not attached to other
defect dot.
 - 5) N dots : N defect dots are consecutive.
(N means the number of defect dots.)
 - 6) Density : Number of defect dots inside of $\phi 20\text{mm}$.
 - 7) Those stains which can be wiped out easily are acceptable.
 - 8) Polarizer area inside of B-zone is not applied.

10. PRECAUTIONS

Please pay attention to the followings when you use this TFT/LCD module with Back-light unit.

10.1 MOUNTING PRECAUTION

- (1) You must mount Module using mounting holes arranged in 4 corners.
- (2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to Module. And the case which Module is mounted should have sufficient strength so that external force is not transmitted directly to Module.
- (3) To improve the strength of module against the mechanical shock the space between module and the case should be less than 1.0mm.



- (4) Please attach the surface with a transparent protective plate in order to protect the polarizer and LC cell. Transparent protective plate should have sufficient strength in order to avoid external force.
- (5) You should adopt radiation structure to satisfy the temperature specification.
- (6) Acetic acid type and choline type materials for the cover case are not desirable because the former generate corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (7) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub by dustclothes with chemical treatment. Do not touch the surface of polarizer with bare hand or greasy close. (Some cosmetics are detrimental to the polarizer.)
- (8) When the surface become dusty, please wipe gently with absorbent cotton or other soft materials chamois soaked petroleum benzin. Normal-Hexane is recommended for cleaning the adhesives used to attach front /rear polarizers. Do not use acetone, toluen and alchol because they cause chemical damage to the polarizer.
- (9) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (10) Do not open the case because inside circuits have not sufficient strength.
- (11) Use fingerstalls of soft gloves in order to keep clean display quality, when you handle the device for incoming inspection and assembly.
- (12) Do not pull or do not fold the CFL cable.

10.2 OPERATING PRECAUTION

- (1) The spike noise causes the mis-operation of circuits. Recommended condition of spike noise level is as follows :
VDD=±200mV, Vr=±200mV (Over and under shoot voltage)
- (2) Responce time depends on the temperature. (In lower temperature, it becomes longer).
And also Transmittance and Color depend on the temperature.
- (3) Brightness depends on the temperature. (In lower temperature, it becomes lower).
And in lower temperature, responce time (required time that brightness is stable after turn on) becomes longer.
- (4) Be carefull for condensation at sudden temperature change.
Condensation make damage to polarizer or electrical contact part.
And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed at long times, afterimage is likely to occur.
- (6) Module has high frequency circuit. If you need to shield the electromagnetic noise, please do in yours.
- (7) When Back-light unit is operating, it sounds.
If you need to shield the noise, please do in yours.
- (8) Please connect the Back-light connector to the inverter circuit directly.
The long cable between CFL and the inverter may cause the brightness drop of CFL and may cause the rise of starting lamp Voltage(Vs).
- (9) Do not connect or remove the module from main system with power applied.

10.3 ELECTROSTATIC DISCHARGE CONTROL

Since Module is composed with electronic circuit, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through list band etc.. And don't touch I/F pin directly.

10.4 PRECAUTION FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

10.5 STORAGE

When storing Module as spares for long time, the following precautions are necessary.

- (1) Store them in a dark place ; do not expose them to sunlight or fluorescent light.

Keep the temperature between 5°C and 35°C at normal humidity.

- (2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

10.6 HANDLING PRECAUTIONS FOR PROTECTION FILM

- (1) When the protection film is peeled off, static electricity is generated between the film and the polarizer.

This film should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.

- (2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain more on the polarizer. So please carefully peel off the protection film without rubbing it against the polarizer.

- (3) When the Module with protection film attached is stored for long time, sometimes there remains a very small amount of glue, still on the polarizer after the protection film is peeled off.

Please refrain from storing the Module at the high temperature and high humidity for glue is apt to remain in these condition.

- (4) The Glue may be taken for the Modules failure, but you can remove the Glue easily.

When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with Normal-hexane.

| | | | | | | |
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10.7 SAFETY

- (1) If Module is broken, be careful to handle not to injure. (TFT/LCD and Lamp are made of glass.)

Please wash hands sufficiently when you touch the liquid crystal coming out from broken LCDs.

- (2) As it is possible for PCB or other electronic parts of module to smell to smoke and to take fire because of the short circuit.

Please design the circuit of your instrument not to flow the electric current to TFT/LCD module more than 1A (by apply the fuse for example).

- (3) As Back-light unit has high voltage circuit internal, do not open the case and do not insert foreign materials in the case.

- (4) The LCD modules include Cold Cathode Fluorescent Lamp (CFL). CFL contains a small amount of mercury. Please follow local ordinances or regulations for disposal.

- (5) The CFL inverter should be designed to include the function of output shutdown in case the output overcurrent happen due to any backlight trouble. The shutdown function should be assured to work in abnormal condition at the actual system.