

Display Elektronik GmbH

DATA SHEET

TFT MODULE

**DEM 1024600E TMH-PW-N
(A-TOUCH)**

7,0“ TFT + Touch

Product Specification

Ver.: 0

23.02.2017

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1. General Description and Features

This is a 7.0" color TFT-LCD (Thin Film Transistor Liquid Crystal Display) module composed of LCD panel, driver ICs, control circuit, Touch panel and LED backlight. By applying 1024×600 images are displayed on the 7.0" diagonal screen. Display 16.7M colors by R.G.B signal input.

1.1. Features

- 1024 x 600 pixels resolution.
- Display in 16.7M colors.
- 4-wire Touch Panel
- RoHS Compliance

1.2. LCD Module

| Item | Specification | Unit |
|--------------------|----------------------------|----------|
| Screen Size | 7.0 Inches | Diagonal |
| Display Resolution | 1024 x RGB x 600 | Dot |
| Active Area | 154.21 x 85.92 | mm |
| Outline Dimension | 170.00 x 110.00 x 7.74 | mm |
| Display Mode | Normally White | -- |
| Pixel Arrangement | RGB-Vertical Stripe | -- |
| Pixel Size | 0.1506 × 0.1432 | mm |
| Surface Treatment | Anti-Glare | -- |
| Display Color | 16.7 Million | -- |
| Viewing Direction | 6 o'clock (Gray Inversion) | -- |
| Input Interface | LVDS | -- |

2. Mechanical Information

| Item | | Min. | Typ. | Max. | Unit | Note |
|-------------|----------------|--------|--------|--------|------|------|
| Module Size | Horizontal (H) | 169.70 | 170.00 | 170.30 | mm | -- |
| | Vertical (V) | 109.70 | 110.00 | 110.30 | mm | |
| | Thickness (T) | 7.44 | 7.74 | 8.04 | mm | (1) |
| Weight | | -- | t.b.d. | -- | g | -- |

Note (1) Not include Component.

Refer to the Outline Dimension for further information.

3. Absolute Max. Ratings**3.1 Absolute Ratings of Environment**

If the operating condition exceeds the following absolute maximum ratings, the TFT LCD module may be damaged permanently.

(Ta=25±2°C, V_{SS}=GND=0)

| Item | Symbol | Min. | Max. | Unit | Note |
|-----------------------|------------------|------|------|------|---------|
| Storage Temperature | T _{STG} | -30 | 80 | °C | (1) |
| Operating Temperature | T _{OPR} | -20 | 70 | °C | (1,2,3) |

Note (1) 95 % RH Max. (40 °C ≥ Ta). Maximum wet-bulb temperature at 39°C or less. (Ta > 40°C)
No condensation.

Note (2) In case of below 0°C, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one. Level of retardation depends on temperature, because of LC's character

Note (3) Only operation is guaranteed at operating temperature. Contrast, response time, another display quality are evaluated at +25°C.

3.2 Electrical Absolute Rating

The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

(V_{SS}=GND=0)

| Item | Symbol | Min. | Max. | Unit | Note |
|--------------------------|---|------|-------|------|------|
| Digital Supply Voltage | DVDD DVDD_LVDS | -0.3 | 3.96 | V | |
| Analog Supply Voltage | AVDD | -0.5 | 14.85 | V | |
| Gate On Voltage | VGH | -0.3 | 40 | V | |
| Gate Off Voltage | VGL | -20 | 0.3 | V | |
| Gate On-Gate Off Voltage | VGH-VGL | 12 | 40 | V | |
| Signal Input Voltage | NIND0 ~ NIND3 PIND0 ~ PIND3 NINC,PINC | -0.5 | 5 | V | |
| Forward Current(Per LED) | If | - | 70 | mA | |
| Reverse Voltage(Per LED) | VR | - | 5 | V | |

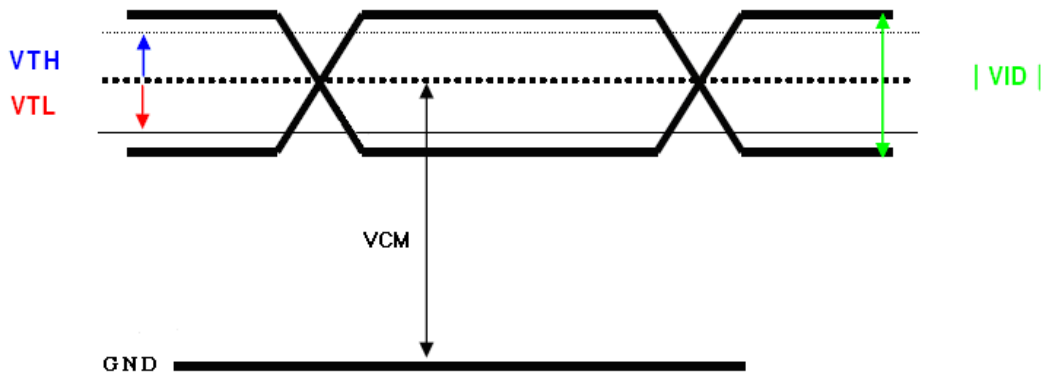
4. Electrical Characteristics

4.1. TFT-LCD Module

4.1.1. Typical Operation Conditions

| ITEM | SYMBOL | MIN | TYP | MAX | UNIT | NOTE |
|--------------------------------------|--------|-------------------|-----|-------------------------|------|-------------------|
| Digital Power Supply Voltage For LCD | DVDD | 3 | 3.3 | 3.6 | V | |
| Logic Input Voltage (LVDS:IN+,IN-) | VCM | $\frac{ VID }{2}$ | - | $2.4 - \frac{ VID }{2}$ | V | Note1 |
| | VID | 200 | - | 600 | mV | Note1 |
| | VTH | - | - | 100 | mV | VCM=1.2V Note1 |
| | VTL | -100 | - | - | mV | |
| Analog Power Supply Voltage | AVDD | 9.4 | 9.6 | 9.8 | V | |
| Gate On Power Supply Voltage | VGH | 17 | 18 | 19 | V | |
| Gate Off Power Supply Voltage | VGL | -6.6 | -6 | -5.4 | V | |
| Common Power Supply Voltage | VCOM | 3.7 | 3.9 | 4.1 | V | Note2 |
| Logic Input Voltage | VIH | 0.7*DVDD | - | DVDD | V | |
| | VIL | GND | - | 0.3*DVDD | V | |

【Note1】 LVDS signal



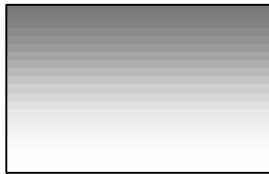
【Note2】 Please adjust VCOM to make the flicker level be minimum.

4.1.2. Current Consumption

| ITEM | SYMBOL | CONDITION | MIN | TYPE | MAX | UNIT | NOTE |
|-------------------------|--------|-------------|-----|------|-----|------|-------|
| Gate On Power Current | IVGH | VGH =18V | -- | 0.5 | 1 | mA | Note1 |
| Gate Off Power Current | IVGL | VGL= -6V | -- | 0.5 | 1 | mA | Note1 |
| Digital Power Current | IDVDD | DVDD = 3.3V | -- | 30 | 45 | mA | Note1 |
| Analog Power Current | IAVDD | AVDD = 9.6V | -- | 35 | 45 | mA | Note1 |
| Total Power Consumption | PC | | -- | 447 | 604 | mW | Note1 |

【Note1】 Typ. specification : Gray-level test Pattern

Max. specification : Black test Pattern



256 gray pattern

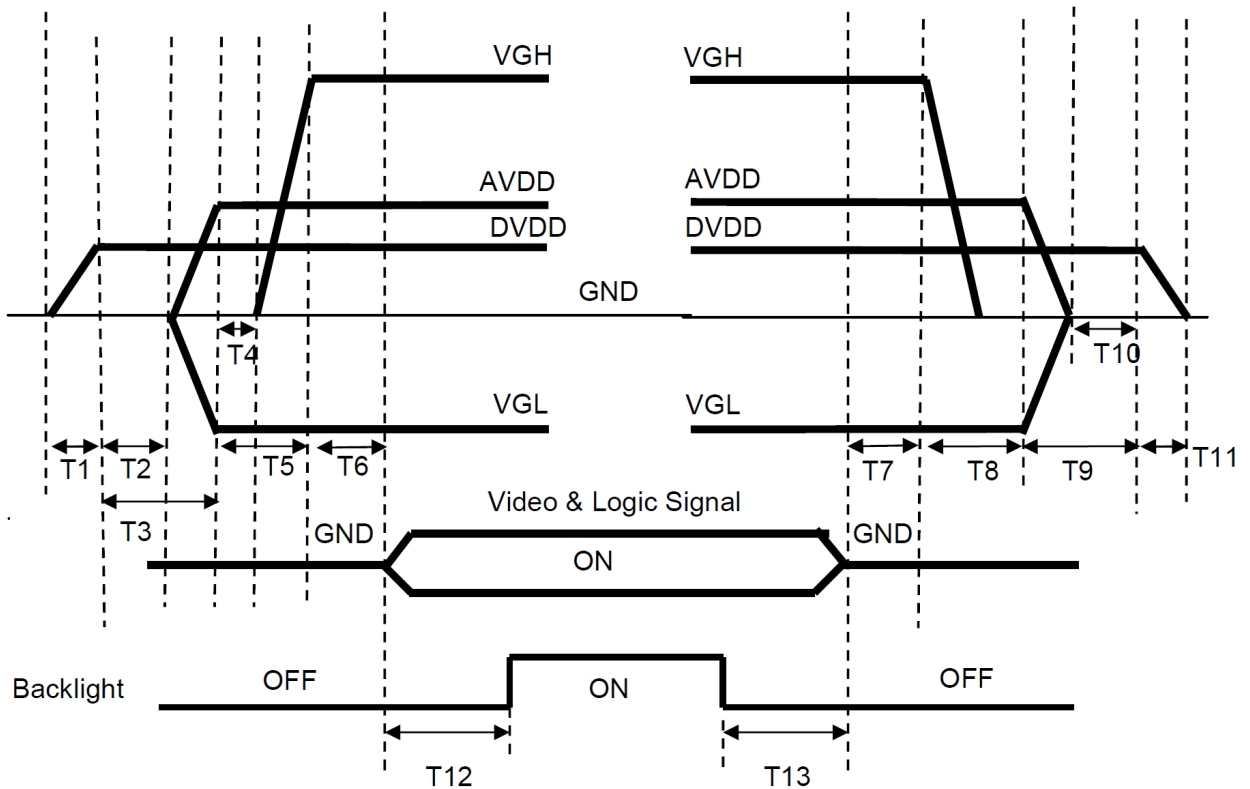


Black Pattern

4.1.3. Power - Signal Sequence

Power On : DVDD→AVDD/VGL →VGH →Video & Logic Signal→Backlight

Power Off : Backlight→Video & Logic Signal→ VGH→AVDD/VGL→DVDD



$0 < T1 \leq 10\text{ms}$
 $T2 > 0\text{ms}$
 $T3 > 20\text{ms}$
 $T4 > 0\text{ms}$
 $T5 > 10\text{ms}$
 $0 < T6 \leq 10\text{ms}$
 $T12 \geq 200\text{ms}$

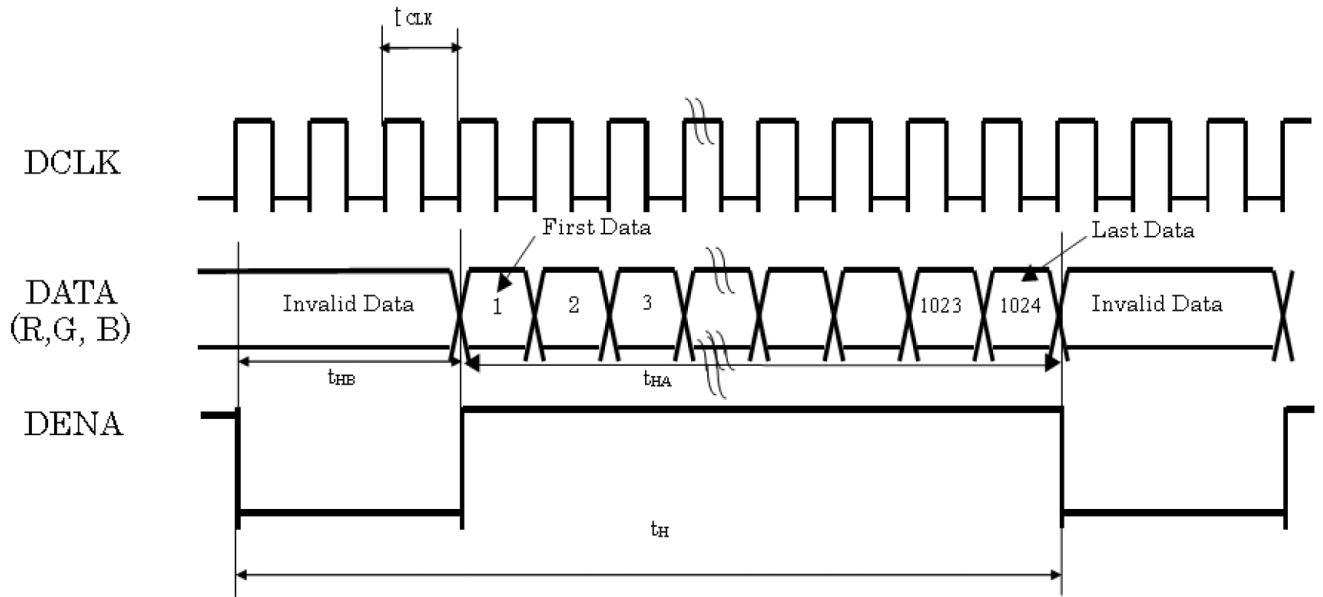
$T7 > 0\text{ms}$
 $T8 > 0\text{ms}$
 $T9 > 0\text{ms}$
 $T10 > 0\text{ms}$
 $0 < T11 \leq 10\text{ms}$
 $T13 \geq 200\text{ms}$

4.1.4. Timing Characteristics of Input Signals

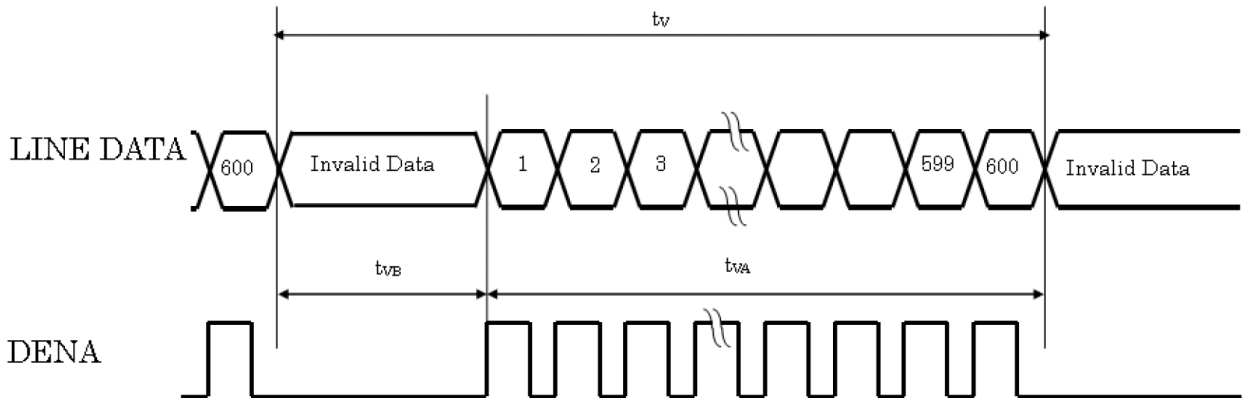
| ITEM | | SYMBOL | MIN | TYP | MAX | UNIT | |
|--|---------------|---------------------------|-----|------|------|------|------|
| LVDS input signal sequence | CLK Frequency | tclk | 45 | 51.2 | 57 | MHz | |
| LCD input signal sequence (Input LVDS Transmitter) | Horizontal | Horizontal total Time | tH | 1324 | 1344 | 1364 | tCLK |
| | | Horizontal effective Time | tHA | 1024 | | | tCLK |
| | | Horizontal Blank Time | tHB | 300 | 320 | 340 | tCLK |
| | Vertical | Vertical total Time | tV | 625 | 635 | 645 | tH |
| | | Vertical effective Time | tVA | 600 | | | tH |
| | | Vertical Blank Time | tVB | 25 | 35 | 45 | tH |

4.1.5. Timing Sequence(Timing Chart)

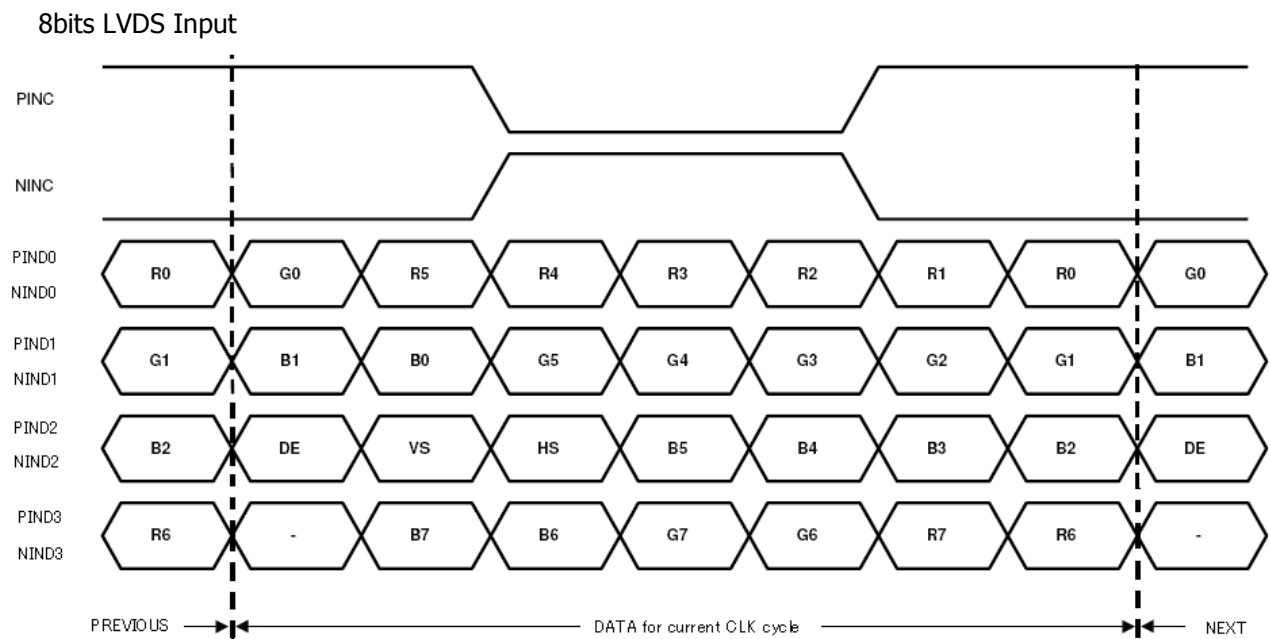
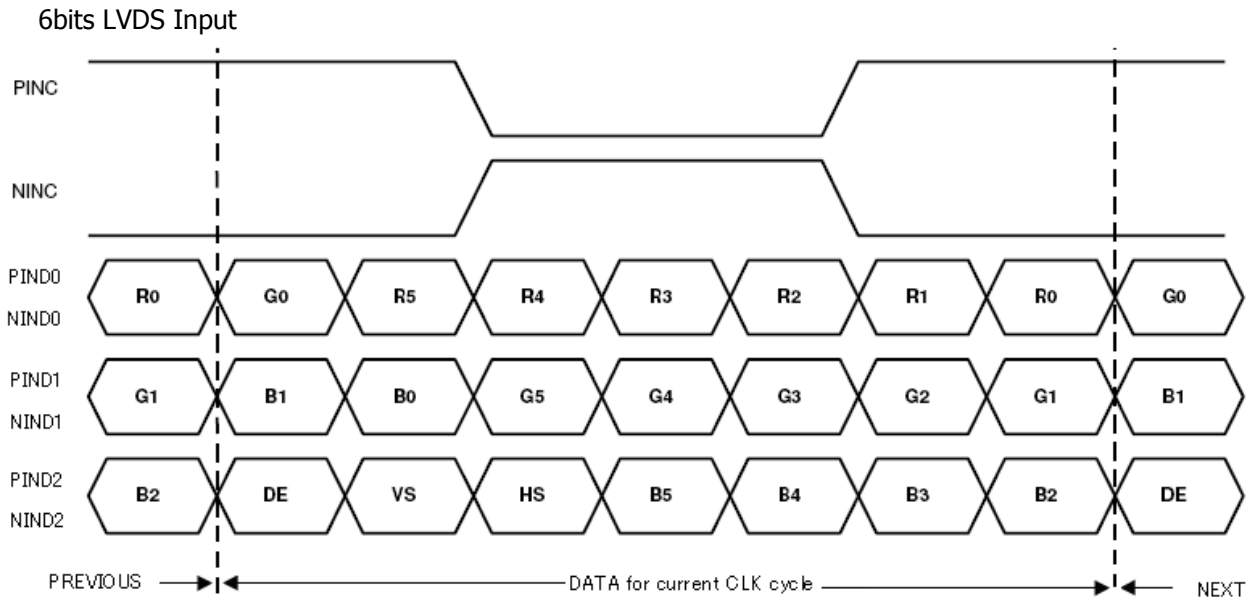
Horizontal Timing Sequence



Vertical Timing Sequence



4.1.6. LVDS Input Data Mapping



4.2. Backlight Unit

(Ta=25±2°C)

| Item | Symbol | Value | | | Unit | Note |
|-------------------------|-----------------|--------|------|------|------|------|
| | | Min. | Typ. | Max. | | |
| LED Total Input Voltage | VL | 8.4 | 9 | 10.2 | V | |
| LED Total Input Current | IL | - | 630 | - | mA | (1) |
| Power Consumption | P _{BL} | - | 5.67 | 6.43 | W | (2) |
| Lifetime | - | 50.000 | - | - | Hrs | (3) |

Note (1) LEDs in 3 series x 14 parallel type.

(2) Where $IL = 630\text{mA}$, $VL = 9$, $P_{BL} = VB \times IB$

(3) The environmental conducted under ambient air flow, at $Ta=25^{\circ}\text{C}\pm 2^{\circ}\text{C}$, $60\%\text{RH}\pm 5\%$

5. Input Terminal Pin Assignment

5.1. Pin Assignment (LCD)

| Pin No. | Symbol | Function | Remark |
|---------|--------|---|--------|
| 1 | VCOM | Common Voltage | |
| 2 | DVDD | Digital Power | |
| 3 | DVDD | Digital Power | |
| 4 | NC | Not Connect | |
| 5 | RESET | Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (R=10K Ω , C=0.1 μ F) | |
| 6 | STBYB | Standby mode, normally pull high STBYB="1", normal operation STBYB="0", timing control, source driver will turn off, all output are high-Z | |
| 7 | GND | Ground | |
| 8 | NIND0 | Negative LVDS differential data input | |
| 9 | PIND0 | Positive LVDS differential data input | |
| 10 | GND | Ground | |
| 11 | NIND1 | Negative LVDS differential data input | |
| 12 | PIND1 | Positive LVDS differential data input | |
| 13 | GND | Ground | |
| 14 | NIND2 | Negative LVDS differential data input | |
| 15 | PIND2 | Positive LVDS differential data input | |
| 16 | GND | Ground | |
| 17 | NINC | Negative LVDS differential clock input | |
| 18 | PINC | Positive LVDS differential clock input | |
| 19 | GND | Ground | |
| 20 | NIND3 | Negative LVDS differential data input | |
| 21 | PIND3 | Positive LVDS differential data input | |
| 22 | GND | Ground | |
| 23 | NC | Not Connect | |
| 24 | NC | Not Connect | |
| 25 | GND | Ground | |
| 26 | NC | Not Connect | |
| 27 | NC | Not Connect | |
| 28 | SELB | 6bit/8bit Mode Select | *1) |
| 29 | AVDD | Power for Analog Circuit | |
| 30 | GND | Ground | |
| 31 | NC | Not Connect | |

| | | | |
|----|------|------------------------|-----|
| 32 | NC | Not Connect | |
| 33 | SHLR | Horizontal Inversion | *2) |
| 34 | UPDN | Vertical Inversion | *2) |
| 35 | VGL | Negative Power for TFT | |
| 36 | NC | Not Connect | |
| 37 | NC | Not Connect | |
| 38 | VGH | Positive Power for TFT | |
| 39 | NC | Not Connect | |
| 40 | NC | Not Connect | |

Remarks :

*1)if LVDS input data is 6bits , SELB must must be set to High

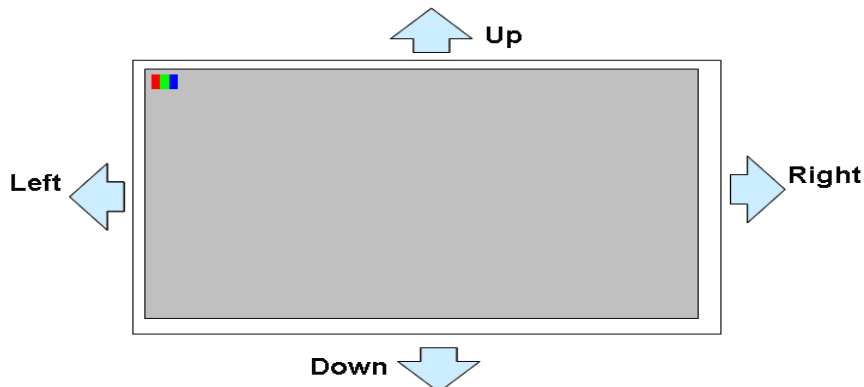
if LVDS input data is 8bit , SELB must be set to Low

*2)UPDN and SHLR control function

| UPDN | SHLR | FUNCTION |
|------|------|---|
| 0 | 1 | Normal Display |
| 0 | 0 | Inverse Left and Right |
| 1 | 1 | Inverse Up and Down |
| 1 | 0 | Inverse Left and Right Inverse Up and Down |

| SHLR | UPDN | Data shifting |
|------|------|-------------------------------|
| DVDD | GND | Left→Right , Up→Down(default) |
| GND | GND | Right→Left , Up→Down |
| DVDD | DVDD | Left→Right , Down→Up |
| GND | DVDD | Right→Left , Down→Up |

Definition of scanning direction.



5.2. Pin Assignment (Backlight unit)

| Pin No. | Symbol | Function | Remark |
|---------|--------|---------------------------------|--------|
| 1 | A | Power for LED backlight anode | Red |
| 2 | K | Power for LED backlight cathode | Black |

6. Optical Characteristics

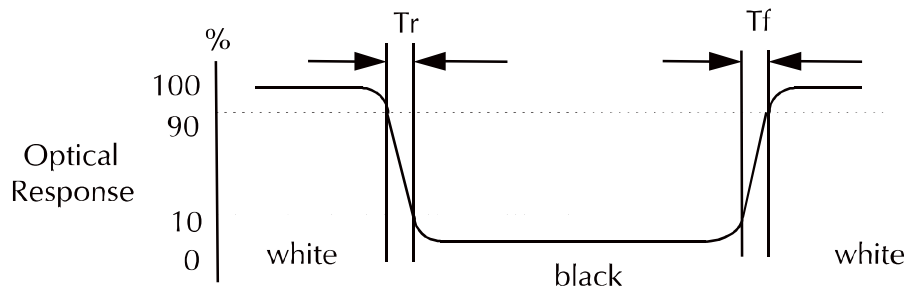
| Item | Symbol | Condition | Min | Type | Max | Unit | Note | |
|-------------------------------|------------|----------------------------|--|-------|-------|-------------------|--------|-------|
| Brightness | B | | 1080 | 1200 | -- | cd/m ² | | |
| Response Time (White - Black) | Tr +Tf | $\theta=0^\circ$ | -- | 25 | 40 | ms | | |
| Contrast Ratio | CR | At optimized viewing angle | 600 | 800 | -- | -- | | |
| Luminance Uniformity | ΔL | | 75 | 80 | | % | | |
| Color Chromaticity (CIE 1931) | White | Wx | $\theta=0^\circ$ Normal Viewing Angle | 0.273 | 0.313 | 0.353 | -- | BM-7A |
| | | Wy | | 0.289 | 0.329 | 0.369 | | |
| Viewing Angle (6H) | Ver. | θ_U | CR \geq 10 | 60 | 70 | -- | Degree | |
| | | θ_D | | 50 | 60 | -- | | |
| | Hor. | θ_R | | 70 | 80 | -- | | |
| | | θ_L | | 70 | 80 | -- | | |

a. Test equipment setup

After stabilizing and leaving the panel alone shall be warmed up for the stable operation of LCM, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7(fast) with a viewing angle of 2° at a distance of 50cm and normal direction.

b. Definition of response time: Tr and Tf

The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white".

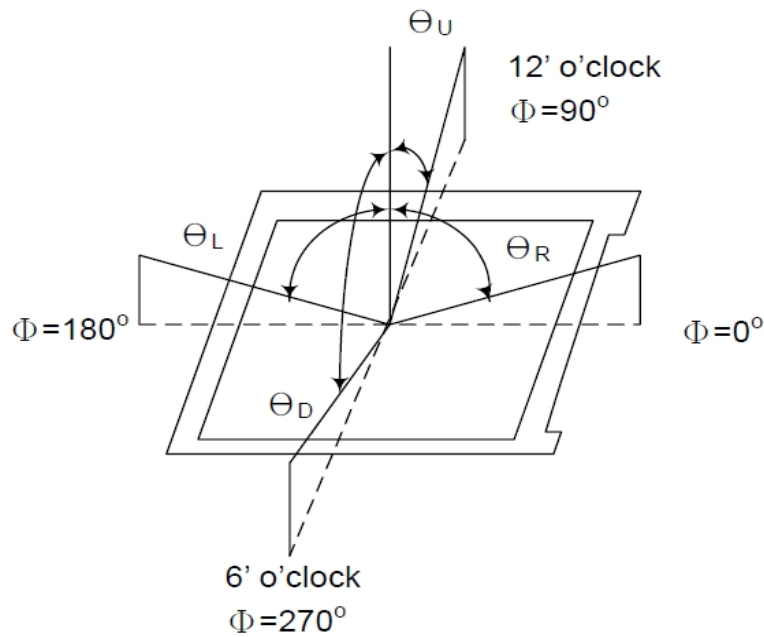


c. Definition of contrast ratio:

$$\text{Contrast Ratio (CR)} = \frac{\text{Brightness measured when LCD is at "white state"}}{\text{Brightness measured when LCD is at "black state"}}$$

d. Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

e. View Angle



f. Definition of Luminance of White: Luminance of white at the center points

| | |
|---------------------------------|----------|
| Light Source of Back-Light Unit | LED Type |
|---------------------------------|----------|

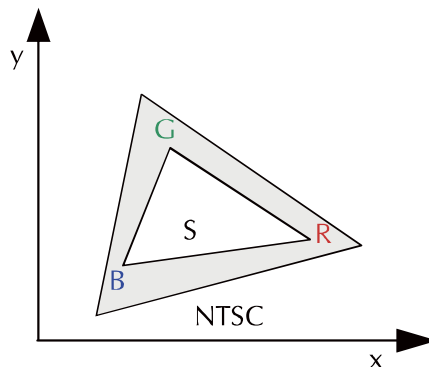
g. Definition of White Uniformity

$$\text{White Uniformity} = \frac{\text{Min. luminance of white among 9-points}}{\text{Max. luminance of white among 9-points}} \times 100\%$$

h. The definition of Color Gamut -Color Chromaticity CIE 1931

Color coordinate of white & red, green, blue at center point.

Color Gamut : NTSC(%) = (RGB Triangle Area / NTSC Triangle Area) x 100



7. Touch Screen Panel Specifications**7.1. Electrical Characteristics**

| Item | Min. | Typ. | Max. | Unit | Note |
|-----------------------|------|------|------|------------|---------------------------|
| Linearity | -1.5 | - | 1.5 | % | Analog X and Y directions |
| Terminal Resistance | 200 | - | 400 | Ω | Y(Glass side) |
| | 200 | - | 800 | Ω | X(Film side) |
| Insulation Resistance | 20 | - | - | M Ω | DC 25V |
| Voltage | 3 | - | 15 | V | 1mA |
| Response Time | - | 15 | - | ms | |
| Transparency | - | 78 | - | % | Non-glare |

Caution (1): Do not operate it with a thing except a polyacetal pen (tip R0.8mm or less) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

7.2. Mechanical & Reliability Characteristics

| Item | Min. | Typ. | Max. | Unit | Note |
|--------------------|-----------|------|------|-------|-----------|
| Activation Force | - | - | 100 | g | (1) (3) |
| Hitting Durability | 1,000,000 | - | - | times | (2) |
| Sliding Durability | 100,000 | - | - | times | |
| Surface Hardness | 3 | - | - | H | JIS K5400 |

Note (1) Input: Finger or polyacetal pen 0.8R

Note (2) Pit 1,000,000 times on the Film with a R8.0 (Hardness 60°) silicon rubber.

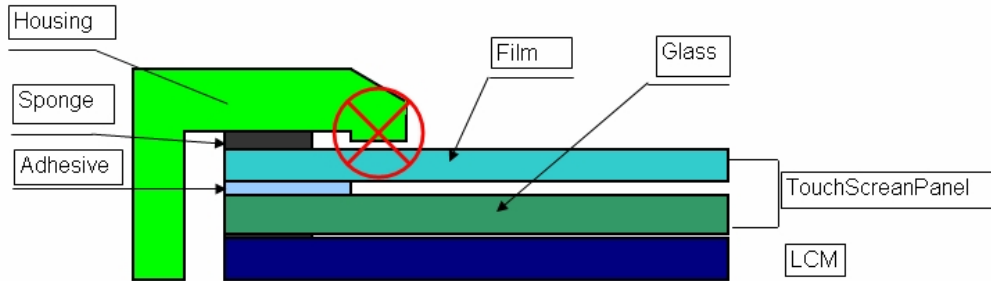
- Force: Force: 250g
- Frequency: 2 times/sec

Note (3) Operating force need to increase on edge of active area inward 2mm, but use on edge would be made shorter of life time.

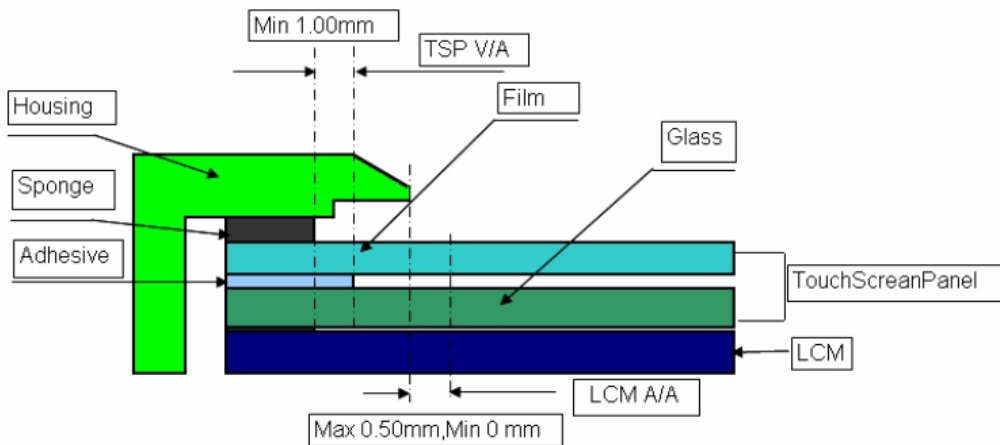
7.3. Housing Design Guide

Housing design follow as below.

- 1) Avoid the design that housing overlap and press on the active area of the LCM.
- 2) Give enough gap(over 0.5mm at compressed) between the housing and TSP to protect wrong operating.



- 3) Use a buffer material(Gasket) between the TSP and housing to protect damage and wrong operating.
- 4) Avoid the design that buffer material overlap and press on the inside of TSP view area.



7.4. Pin Assignments and Definitions.

| Item | Name | Function | Remark |
|------|------|-------------------|--------|
| 1 | Y2 | Touch Panel Up | |
| 2 | X2 | Touch Panel Right | |
| 3 | Y1 | Touch Panel Down | |
| 4 | X1 | Touch Panel Left | |

8. Reliability Condition

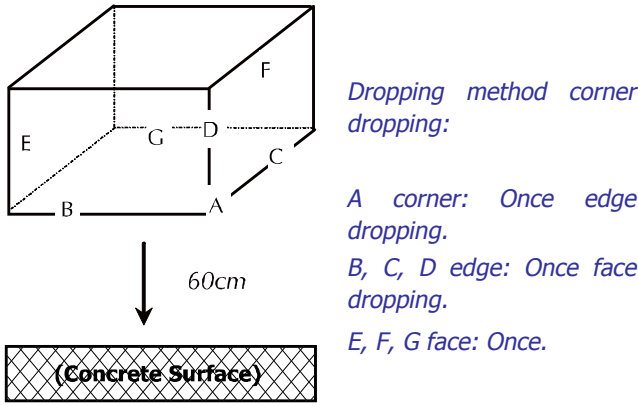
No change on display and in operation under the following test condition.

Condition: Unless otherwise specified, tests will be conducted under the following condition.

Temperature: 20±5°C.

Humidity: 65±5%RH.

Tests will be not conducted under functioning state.

| No. | Parameter | Condition | Notes |
|-----|---|--|-------|
| 1 | High Temperature Operating | 70°C±2°C, 240hrs (Operation state). | |
| 2 | Low Temperature Operating | -20°C±2°C, 240hrs (Operation state). | 1 |
| 3 | High Temperature Storage | 80°C±2°C, 240hrs. | 2 |
| 4 | Low Temperature Storage | -30°C±2°C, 240hrs. | 1,2 |
| 5 | High Temperature and High Humidity Operation Test | 60°C±2°C, 90%, 240hrs. | 1,2 |
| 6 | Vibration Test | Total fixed amplitude: 1.5mm. Vibration Frequency: 10~55Hz. One cycle 60 seconds to 3 direction of X, Y, Z each 15 minutes. | 3 |
| 7. | Drop Test | To be measured after dropping from 60cm high on the concrete surface in packing state.  | |

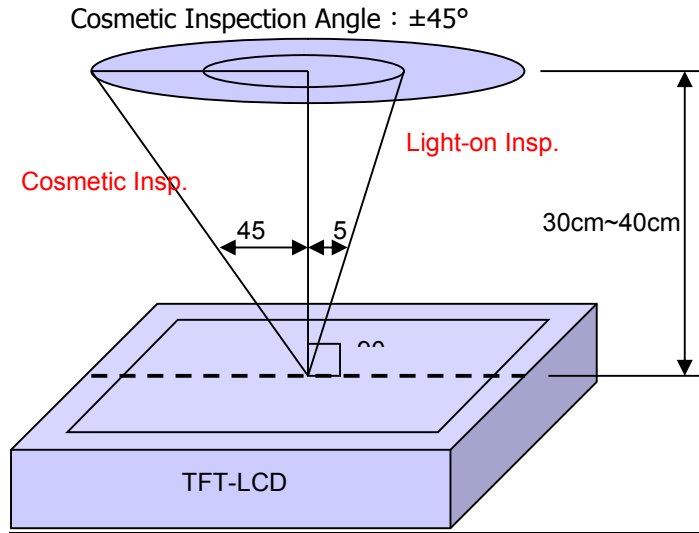
- Notes:
1. No dew condensation to be observed.
 2. The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.
 3. Vibration test will be conducted to the product itself without putting I in a container.

10. Incoming Inspection Standards

10.1. Inspection and Environment Conditions

10.1.1. Inspection Conditions:

- (1) Inspection Distance: 35 cm±5cm
- (2) View Angle : Light-on Inspection Angle : ±5°



(perpendicular to LCD panel surface)

10.1.2. Environment Conditions:

| | | |
|----------------------|-----------------------|-------------------|
| Ambient Temperature | | 23°C ±5°C |
| Ambient Humidity | | 55±10%RH |
| Ambient Illumination | Cosmetic Inspection | more than 600 Lux |
| | Functional Inspection | 300~500 Lux |

10.1.3. Sampling Conditions:

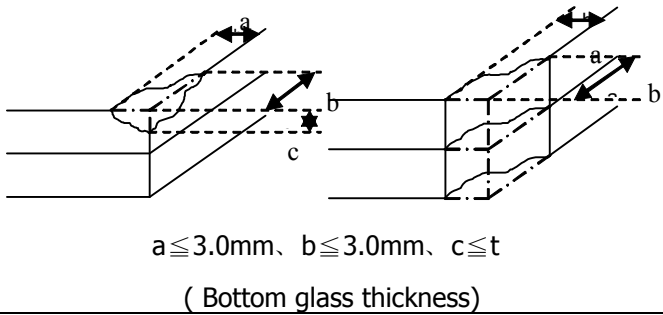
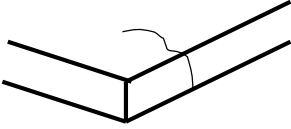
- (1) Lot Size: Quantity of shipment lot per model
- (2) Sampling Method:

| | | |
|---------------|--------------|------------------------------------|
| Sampling Plan | | MIL-STD-105E |
| | | Normal Inspection, Single Sampling |
| | | Level II |
| AQL | Major Defect | 1.0% |
| | Minor Defect | 1.5% |

- (3) The classification of Major(MA) and Minor(MI) defects is shown as 3. Inspection Criteria.

10.1.4. Inspection Criteria

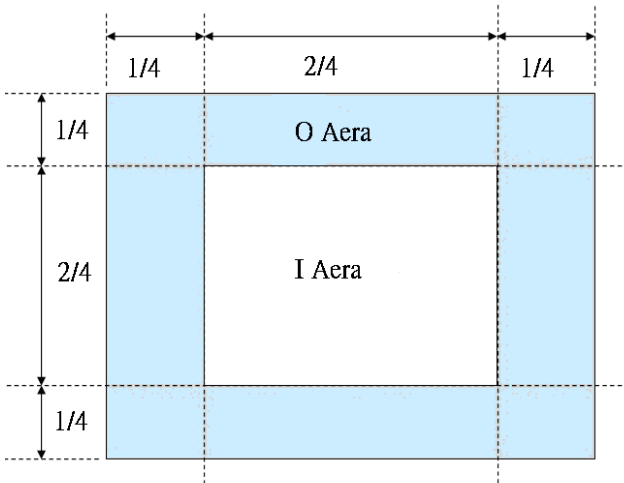
10.1.4.1. Cosmetic Inspection(Panel):

| Item | Judgment Criteria | Classification |
|---------------------------------------|---|----------------|
| Chipping on Panel |  <p>$a \leq 3.0\text{mm}$, $b \leq 3.0\text{mm}$, $c \leq t$ (Bottom glass thickness)</p> | MA |
| Scratch on Panel *Note-2 | <p>$W \leq 0.05\text{mm}$ or $L < 5\text{mm}$: Ignored $0.05\text{mm} < W \leq 0.1\text{mm}$ and $L \leq 5\text{mm}$: $N \leq 5$ $W > 0.1\text{mm}$ or $L > 5\text{mm}$: Not allowed</p> | MI |
| Bubble or Dent on Panel *Note-3 | <p>$D \leq 0.2\text{mm}$: Ignored $0.2\text{mm} < D \leq 0.3\text{mm}$: $N \leq 5$ $D > 0.3\text{mm}$: Not allowed</p> | MI |
| Panel Crack |  <p>Not Allowed crack</p> | MA |
| Bezel Deformation | Obvious deformation is not allowed. | MI |
| Bezel Oxidation | Not allowed if it rusts continuously over 1 cm (It is out of warranty with rusted tin plate) | MI |
| Bezel Scratch | $L \leq 20\text{mm}$, $W \leq 0.2$, $N \leq 3$ | MI |
| Metal Squash Dent /Flange(Front Side) | $D(W) \leq 1, L \leq 3, N \leq 3$; | MI |
| B/L High Voltage Wire Denudation | Not allowed | MA |
| Polarizer flaw or leak out resin | Defect is defined as the active area. | MI |
| Outline Dimension | Must in Spec, refer to related product spec. | MI |

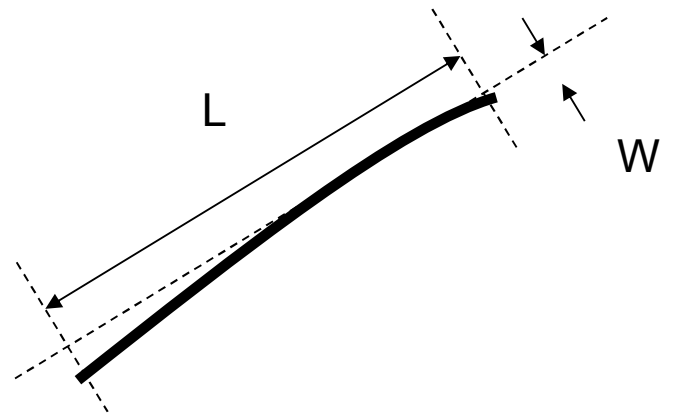
10.1.4.2. Functional Inspection:

| Item | Judgment Criteria | | | Classification | |
|--|--|--|---------------------|----------------|----|
| | Area(Note1) | I | O | | |
| Point Defect | Bright dot | Random | 2 | | MI |
| | | 2 dots adjacent | 0 | 0 | |
| | | 3 dots adjacent or more | 0 | 0 | |
| | Dark dot | Random | 3 | | |
| | | 2 dots adjacent | 1 | | |
| | | 3 dots adjacent or more | 0 | 0 | |
| | Total Dot Defect | | 5 | | |
| | Distance | Distance between Bright and Bright dot | $L \geq 5\text{mm}$ | | |
| | | Distance between Bright and Dark dot | $L \geq 5\text{mm}$ | | |
| | | Distance between Dark dot | $L \geq 5\text{mm}$ | | |
| (1) It is defined as Point Defect if defect area > 0.5dot (2) It is ignored if defect area $\leq 0.5\text{dot}$ (3)Weak point defect will be defined as Bright Dot if it can be observed through ND filter 5%(Full Screen Black Inspection) | | | | | |
| Line Defect | Obvious vertical or horizontal line defect is not allowed. | | | MA | |
| Mura | Not allowed if it can be observed through ND Filter 5 % | | | MI | |
| Foreign Material in spot shape *Note-3 | $D \leq 0.2\text{mm}$: Ignored $0.2\text{mm} < D \leq 0.5\text{mm}$: $N \leq 8$ $D > 0.5\text{mm}$: Not allowed | | | MI | |
| Foreign Material in line or spiral shape *Note-4 | $W \leq 0.05\text{mm}$ or $L \leq 5\text{mm}$: Ignored $0.05\text{mm} < W \leq 0.2\text{mm}$ and $L 1.0\text{mm} \leq 5\text{mm}$: $N \leq 8$ $W > 0.2\text{mm}$ or $L > 5\text{mm}$: Not allowed | | | MI | |
| Display Function Abnormal | No Malfunction can be allowed | | | MA | |

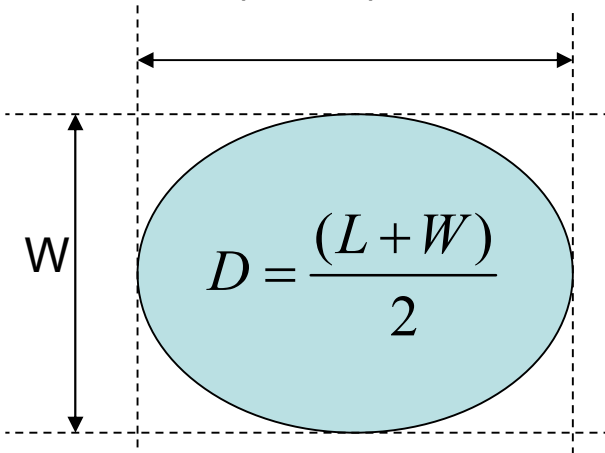
Note-1 : I/O Area Definition



Note-2 : Polarizer Scratch



Note-3 : Spot Foreign Material
($W \geq L / 4$)



Note-4 : Line or Spiral Foreign Material
($W < L / 4$)

