

DISPLAY Elektronik GmbH

DATA SHEET

TFT MODULE

**DEM 320240G1 TMH-PW-N
(A-TOUCH)**

3,5" + TP

Product Specification

Version:2

14.06.2016

GENERAL SPECIFICATION

MODULE NO. :

DEM 320240G1 TMH-PW-N(A-TOUCH)

CUSTOMER

| VERSION NO. | CHANGE DESCRIPTION | DATE |
|-------------|--------------------------|------------|
| 0 | ORIGINAL VERSION | 03.06.2016 |
| 1 | CHANGE MODULE DRAWING | 03.06.2016 |
| 2 | ADD TOUCH PANEL FEATURES | 14.06.2016 |
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PREPARED BY: YH

DATE: 14.06.2016

APPROVED BY: MH

DATE: 14.06.2016

CONTENTS

1. GENERAL SPECIFICATIONS..... 2

2. EXTERNAL DIMENSIONS 2

3. BLOCK DIAGRAM 5

4. PIN ASSIGNMENT 6

5. OPTICAL CHARACTERISTICS 7

6. ABSOLUTE MAXIMUM RATINGS..... 10

7. ELECTRICAL CHARACTERISTICS..... 10

8. RELIABILITY TEST..... 14

9. LCD MODULES HANDLING PRECAUTIONS..... 15

10. OTHERS 15

1. GENERAL SPECIFICATIONS

| Item | Contents | Unit |
|--------------------------------|------------------|---------|
| LCD TYPE | TFT/TRANSMISSIVE | |
| MODULE SIZE (W*H*T) | 76.90*63.90*4.70 | MM |
| ACTIVE SIZE (W*H) | 70.08*52.56 | MM |
| PIXEL PITCH (W*H) | 0.219*0.219 | MM |
| NUMBER OF DOTS | 320 *RGB *240 | |
| DIVER IC | HX8238D | |
| INTERFACE TYPE | 24BIT RGB+SPI | |
| TOP POLARIZER TYPE | ANTI-GLARE | |
| RECOMMEND VIEWING DIRECTION | 12:00 | O'CLOCK |
| GRAY SCALE INVERSION DIRECTION | 6:00 | O'CLOCK |
| COLORS | 16.7 Million | |
| BACKLIGHT TYPE | 6-DIES WHITE LED | |
| TOUCH PANEL TYPE | WITH 4-LINE RTP | |

TOUCH PANEL FEATURES:

| | |
|------------|--------------------------------------|
| Type | 4-Wire Analogy Resistive Touch Panel |
| Input Mode | Stylus or Finger |
| ITO Film | 200μm |
| ITO Glass | 1.1T |
| Connector | FPC |

TOUCH PANEL MECHANICAL CHARACTERISTICS

Surface Hardness: 3H or more (according to JIS-K5400).

TOUCH PANEL OPTICAL CHARACTERISTICS

Transmittance: 80% Typical.

TOUCH PANEL RATING**1. Maximum Voltage**

Less than DC 7 volts.

2. Operating Temperature Range

- 20□ to 60□ (Humidity: 20% RH to 70% RH, No condensation of dew).

3. Storage Temperature Range

- 30□ to 70□ (Humidity: 20% RH to 80% RH, No condensation of dew).

TOUCH PANEL ELECTRICAL CHARACTERISTICS**1. Resistance between Terminals**

Direction "Y": 150~400Ω

Direction "X": 400~1000Ω

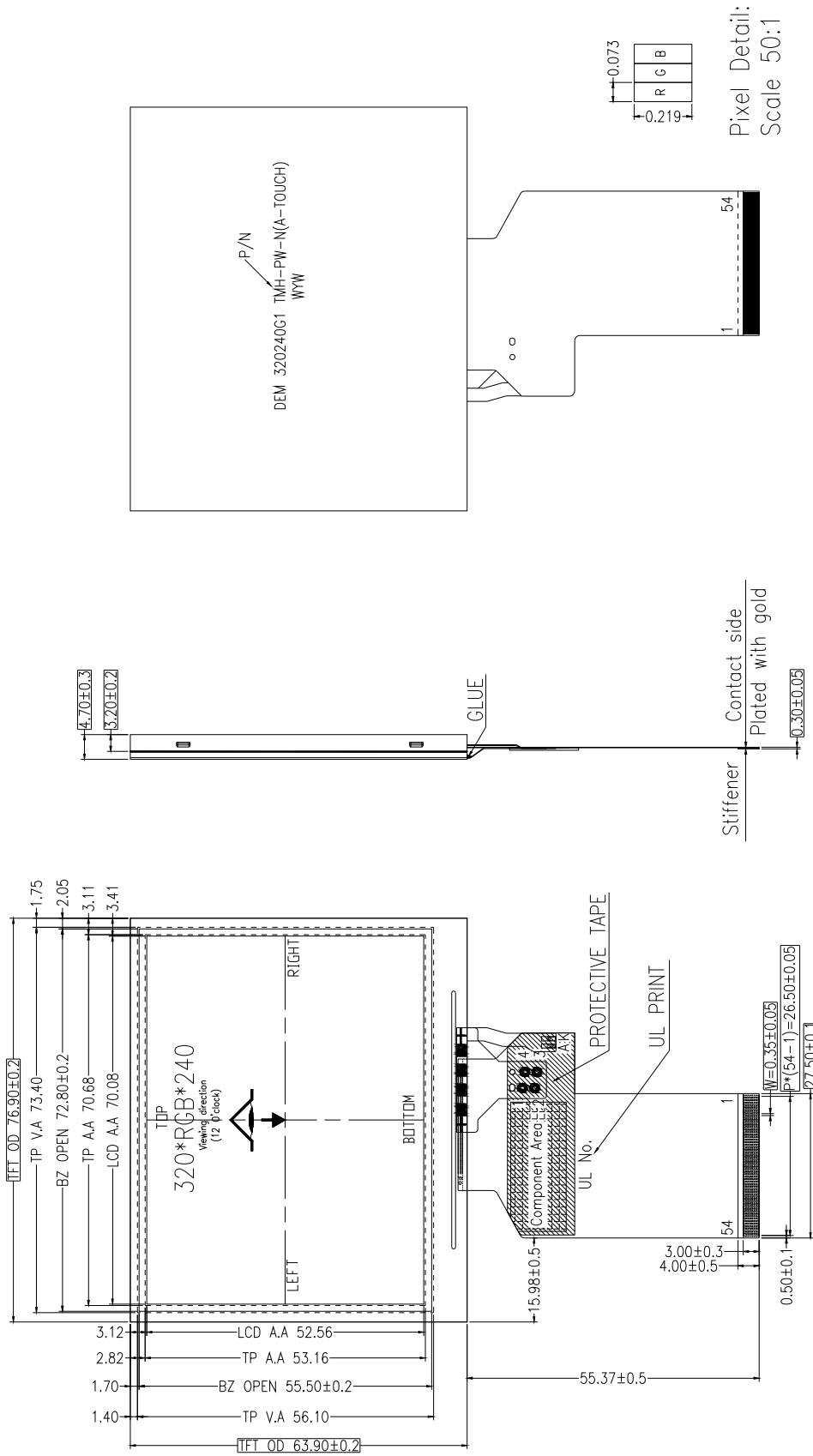
2. Linearity

X axis: ≤±1.5%

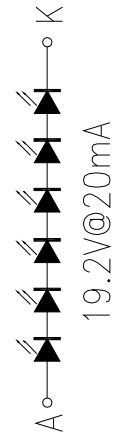
Y axis: ≤±1.5%

3. Insulation Resistance: 20MΩ or more at DC 25 V.**4. Chattering Time: 10 msec or less at 100kΩ Pull-up.**

2. EXTERNAL DIMENSIONS

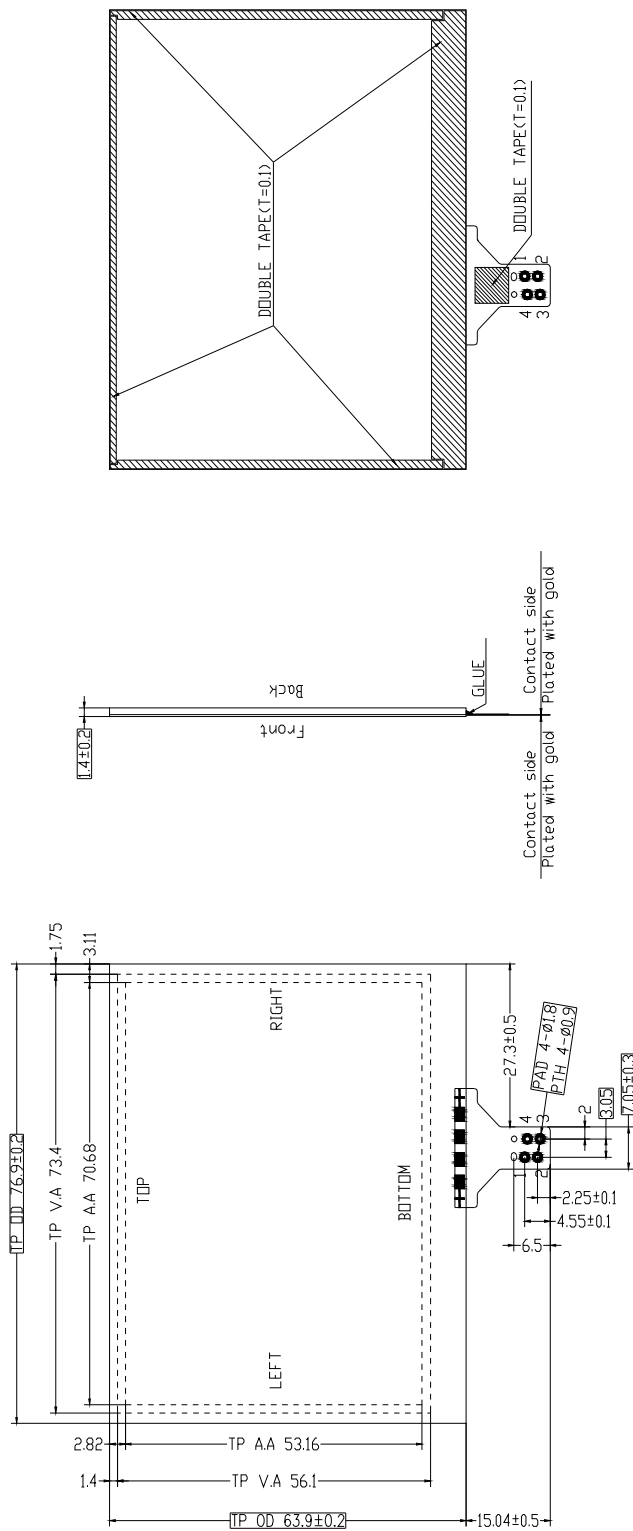


Circuit Diagram



- Remark:
1. Unmarked tolerance is ± 0.3
 2. All materials comply with RoHS
 3. \square ...:critical dimension
 4. WYW:Product date code printing
Format: Y:year ,WW:week.

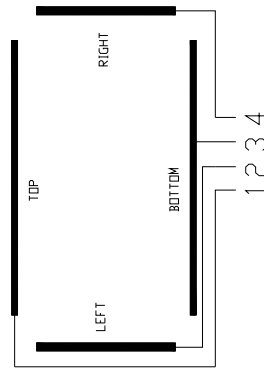
TOUCH PANEL DRAWING:



SIGNAL ASSIGNMENT

| PIN | NAME |
|-----|--------|
| 1 | TOP |
| 2 | LEFT |
| 3 | BOTTOM |
| 4 | RIGHT |

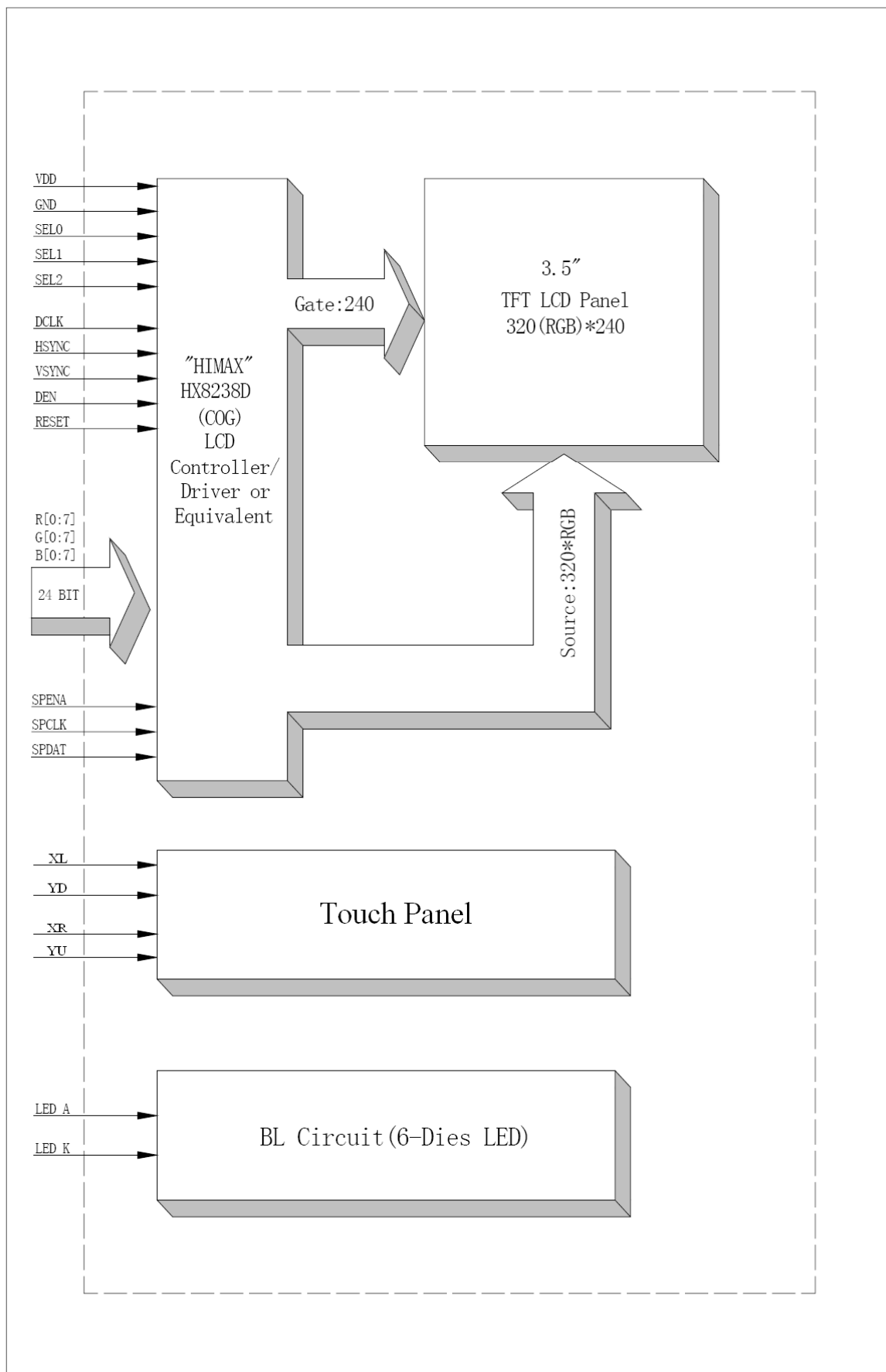
CIRCUIT DIAGRAM



REMARK:

1. Glass THK:1.1mm
2. Total THK:1.4±0.2mm
3. Linearity:±1.5% or less
4. Transmittance:80% Typical
5. Resistance
400<X<1000 ohm
150<Y<400 ohm
6. Connector:FPC
7. For prevention of detach of FPC from Glass,add taping and gluing(Like LCD module)
8. Operating Force:20~100g
Silicon Rubber Measuring Head Contact Area: φ0.3mm~φ0.8mm
9. General Tolerance:±0.3mm.
10. All materials comply with RoHS
11. □:critical dimension.

3. BLOCK DIAGRAM



4. PIN ASSIGNMENT

| Pin No. | Symbol | Description |
|---------|--------|---|
| 1 | LEDK | Cathode of LED backlight |
| 2 | LEDK | Cathode of LED backlight |
| 3 | LEDA | Anode of LED backlight |
| 4 | LEDA | Anode of LED backlight |
| 5 | XR | Touch panel control |
| 6 | YD | Touch panel control |
| 7 | NC | No connect |
| 8 | RESET | RESET PIN |
| 9 | SPENA | Chip select of serial interface |
| 10 | SPCLK | Clock pin of serial interface |
| 11 | SPDAT | Data input pin of serial interface |
| 12~19 | B0~B7 | Blue data bus |
| 20~27 | G0~G7 | Green data bus |
| 28~35 | R0~R7 | Red data bus |
| 36 | HSYNC | Horizontal sync signal; negative polarity |
| 37 | VSYNC | Vertical sync signal; negative polarity |
| 38 | DCLK | Clock signal; latching data at the falling edge |
| 39 | NC | No connect |
| 40 | NC | No connect |
| 41 | VDD | Power supply |
| 42 | VDD | Power supply |
| 43 | XL | Touch panel control |
| 44 | YU | Touch panel control |
| 45 | NC | No connect |
| 46 | NC | No connect |
| 47 | NC | No connect |
| 48 | SEL2 | Interface mode select(*Note) |
| 49 | SEL1 | |
| 50 | SEL0 | |
| 51 | NC | No connect |
| 52 | DEN | Display enable pin from controller |
| 53 | GND | Power ground |
| 54 | GND | Power ground |

Note :

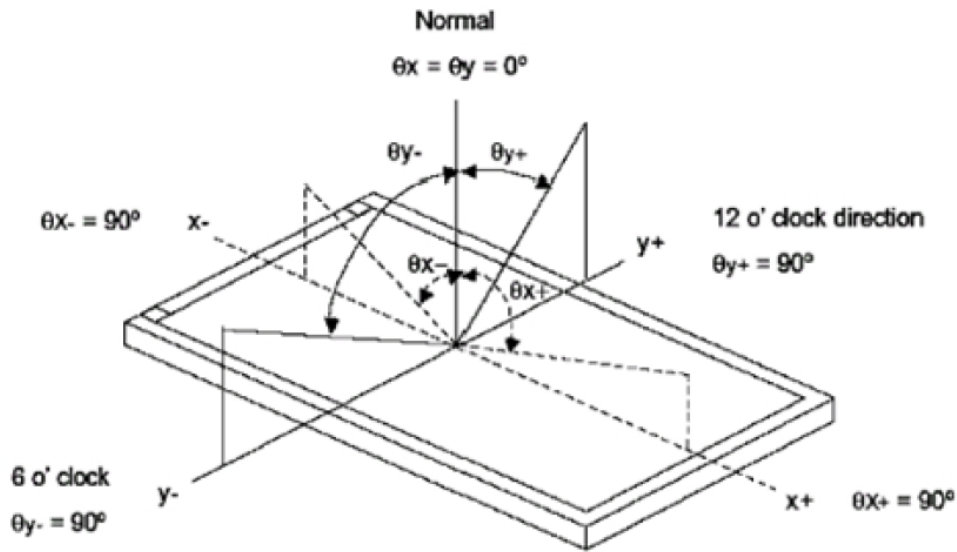
1. The mode control (SEL2) not use ,it can' t control CCIR601 interface , If not use CCIR601 ,it can floating.
 2. For digital RGB input data format, both SYNC mode and DE+SYNC mode are supported. If DE signal is fixed low, SYNC mode is used. Otherwise, DE+SYNC mode is used.Suggest used SYNC mode!!Suggest the DE signal usually pull low.
 3. IF select serial RGB or CCIR601/656 input mode is selected,only DX0-DX7 used,and the other short to GND, Only selected serial RGB、 CCIR601/656 interface,DX BUS will enable,Digital input mode DX0 is LSB and DX7 is MSB.
- interface select table

| SEL2 | SEL1 | SEL0 | Interface Mode |
|------|------|------|---|
| 0 | 0 | 0 | Parallel-RGB Data format interface (only support stripe type color filter) |
| 0 | 0 | 1 | Serial-RGB data format |
| 0 | 1 | 0 | CCIR 656 data format (640RGB) |
| 0 | 1 | 1 | CCIR 656 data format (720RGB) |
| 1 | 0 | 0 | YUV mode A data format(Cr-Y-Cb-Y) |
| 1 | 0 | 1 | YUV mode A data format(Cr-Y-Cb-Y) |
| 1 | 1 | 0 | YUV mode B data format(Cb-Y-Cr-Y) |
| 1 | 1 | 1 | YUV mode B data format(Cb-Y-Cr-Y) |

5. OPTICAL CHARACTERISTICS

| ITEM | SYMBOL | CONDITIONS | SPECIFICATIONS | | | UNIT | NOTE |
|----------------------|-----------|---------------------|----------------------|------|--------|-----------------|------|
| | | | MIN | TYP. | MAX | | |
| Luminance | L | $I_L = 20\text{mA}$ | | 240 | | Cd/m^2 | |
| Contrast Ratio | CR | $\theta = 0^\circ$ | 200 | 300 | | | |
| Response Time | T_{ON} | 25°C | | 15 | 30 | ms | |
| | T_{OFF} | | | 35 | 50 | | |
| CIE Color Coordinate | Red | X_R | Viewing normal angle | | 0.6063 | | |
| | | Y_R | | | 0.3636 | | |
| | Green | X_G | | | 0.3341 | | |
| | | Y_G | | | 0.6040 | | |
| | Blue | X_B | | | 0.1412 | | |
| | | Y_B | | | 0.0908 | | |
| | White | X_W | | | 0.2842 | | |
| | | Y_W | | | 0.3182 | | |
| Viewing Angle | Hor. | θ_{X+} | $CR \geq 10$ | 50 | 60 | Degree | |
| | | θ_{X-} | | 50 | 60 | | |
| | Ver. | θ_{Y+} | | 30 | 40 | | |
| | | θ_{Y-} | | 50 | 60 | | |
| Uniformity | Un | | | 80 | | % | |

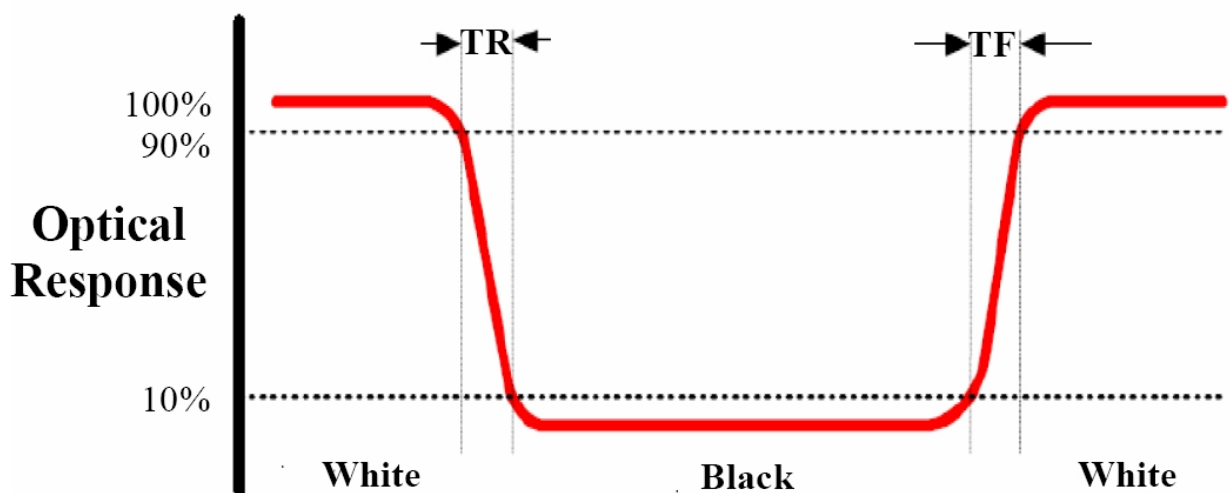
Note 1: Definition of Viewing Angle θ_x and θ_y :



Note 2: Definition of contrast ratio CR:

$$CR = \frac{\text{Luminance of white state}}{\text{Luminance of black state}}$$

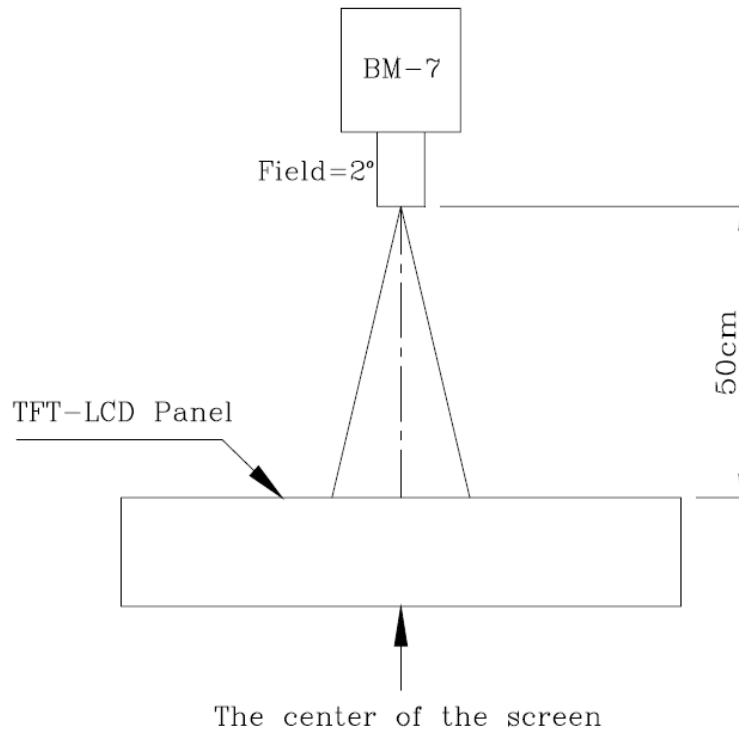
Note 3: Definition of Response Time (T_r, T_f)



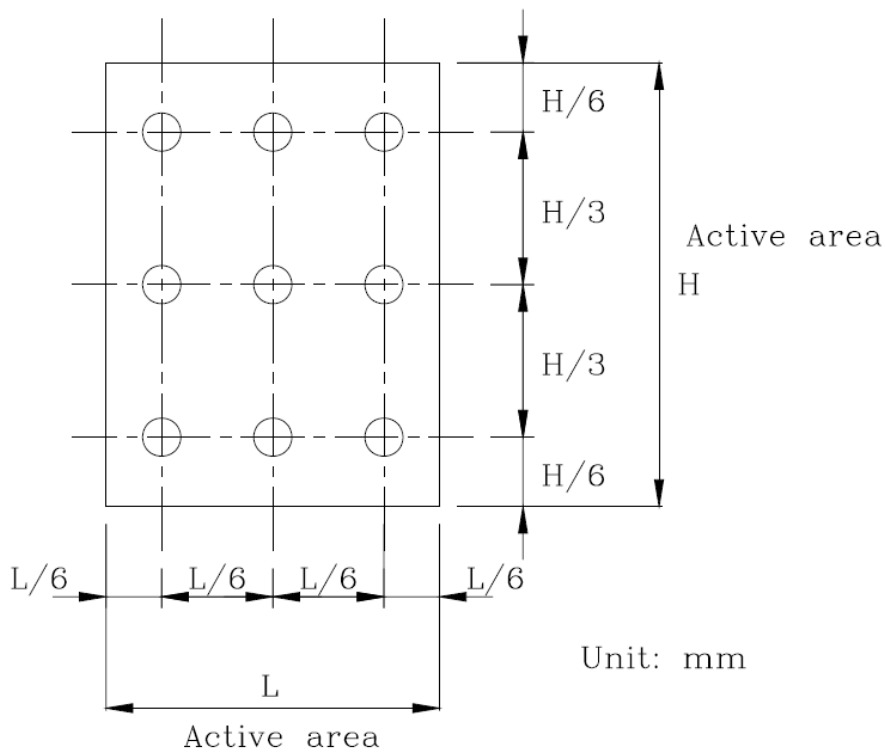
Note 4: Definition of Luminance

①The Brightness Test Equipment Setup

Field=2° (As measuring “black” image, field=2° is the best testing condition)



②The Brightness Test Point Setup



6. ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Min | Max | Unit |
|---------------------------|------------------|------|-----|------|
| Supply voltage for analog | VDD | -0.3 | 4.5 | V |
| Supply voltage for logic | VDD | -0.3 | 4.5 | V |
| Supply current (One LED) | I _{LED} | | 30 | mA |
| Operating temperature | T _{OP} | -20 | +70 | °C |
| Storage temperature | T _{ST} | -30 | +80 | °C |

Note : The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

7. ELECTRICAL CHARACTERISTICS

7.1 Input Power

| Item | Symbol | Min | Typ. | Max | Unit | Applicable terminal |
|---------------------------|------------------|---------|------|--------|------|---------------------|
| Supply Voltage for Analog | VDD | 3.0 | 3.3 | 3.6 | V | |
| Supply Voltage for Logic | VDD | 3.0 | 3.3 | 3.6 | V | |
| Input Voltage | V _{IL} | GND | - | 0.3VCC | V | |
| | V _{IH} | 0.7 VCC | - | VCC | | |
| Input leakage Current | I _{LKG} | -1 | | 1 | μA | |

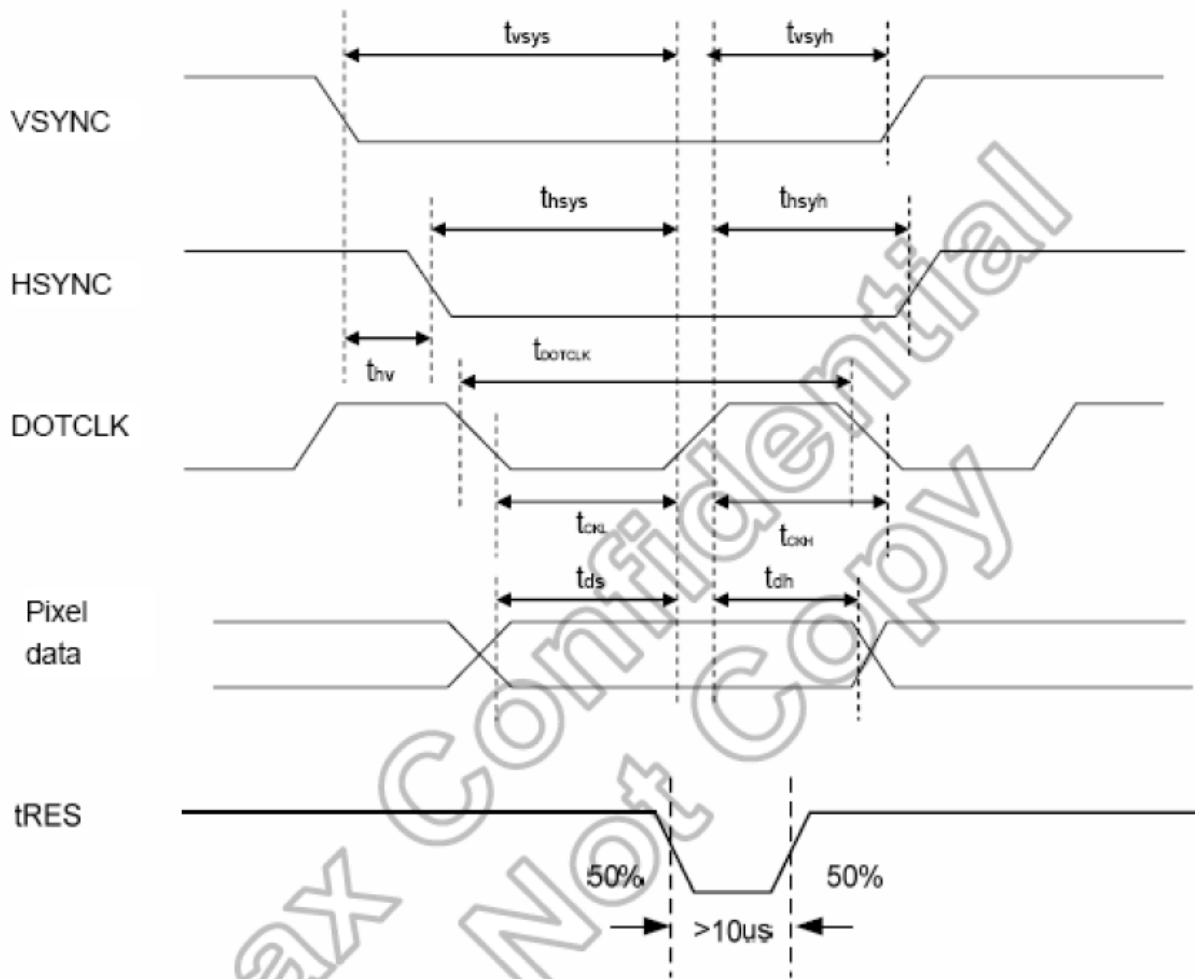
7.2 BLACKLIGHT DRIVING CONDITIONS

| Item | Symbol | Value | | | Unit | Remark |
|---------------------------|----------------|--------|--------|------|------|----------------------|
| | | Min. | Typ. | Max. | | |
| Voltage for LED Backlight | V _F | - | 19.2 | - | V | I _L =20mA |
| Current for LED Backlight | I _L | | 20 | 30 | mA | |
| Power Consumption | P | | 0.384 | | W | |
| LED Life Time | | 30,000 | 50,000 | | Hr | Note |

Note: Brightness to be decreased to 50% of the initial value at ambient temperature TA=25°C

7.3 AC CHARACTERISTICS

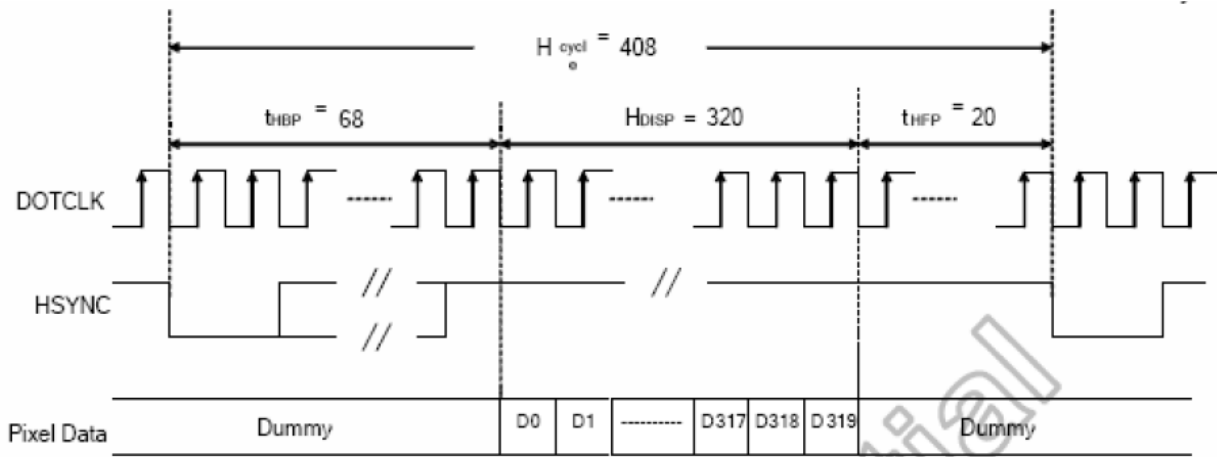
7.3.1 Pixel Timing Diagram



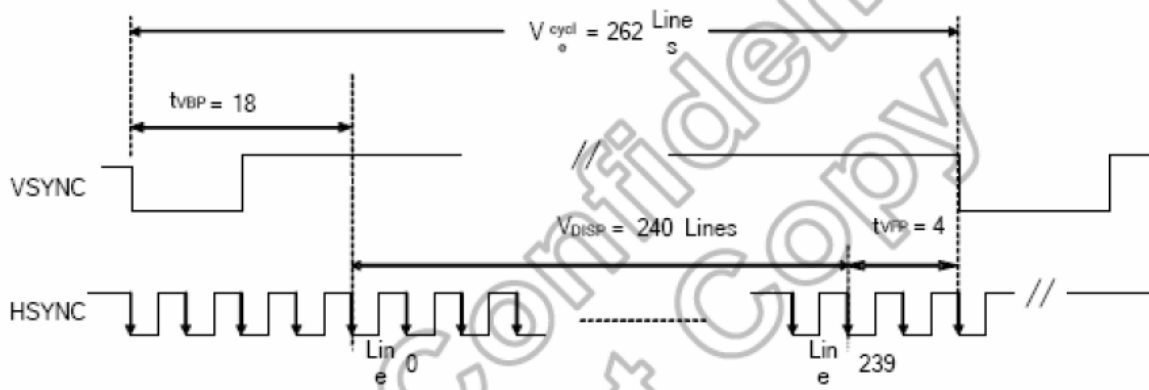
| Characteristics | Symbol | Min. | | Typ. | | Max. | | Unit |
|--|---------|--------|-------|--------|-------|--------|-------|---------|
| | | 24 bit | 8 bit | 24 bit | 8 bit | 24 bit | 8 bit | |
| DOTCLK Frequency | fDOTCLK | - | - | 6.5 | 19.5 | 10 | 30 | MHz |
| DOTCLK Period | tDOTCLK | 100 | 33.3 | 154 | 51.3 | - | - | ns |
| Vertical Sync Setup Time | tvsys | 20 | 10 | - | - | - | - | ns |
| Vertical Sync Hold Time | tvsyh | 20 | 10 | - | - | - | - | ns |
| Horizontal Sync Setup Time | thsys | 20 | 10 | - | - | - | - | ns |
| Horizontal Sync Hold Time | thsyh | 20 | 10 | - | - | - | - | ns |
| Phase difference of Sync Signal Falling Edge | thv | 1 | | - | | 240 | | tDOTCLK |
| DOTCLK Low Period | tCKL | 50 | 15 | - | - | - | - | ns |
| DOTCLK High Period | tCKH | 50 | 15 | - | - | - | - | ns |
| Data Setup Time | tds | 12 | 10 | - | - | - | - | ns |
| Data hold Time | tdh | 12 | 10 | - | - | - | - | ns |
| Reset pulse width | tRES | 10 | | - | | - | | µs |

Note: External clock source must be provided to DOTCLK pin of HX8238-D. The driver will not operate if absent of the clocking signal.

7.3.2 SYNC mode Timing Diagram



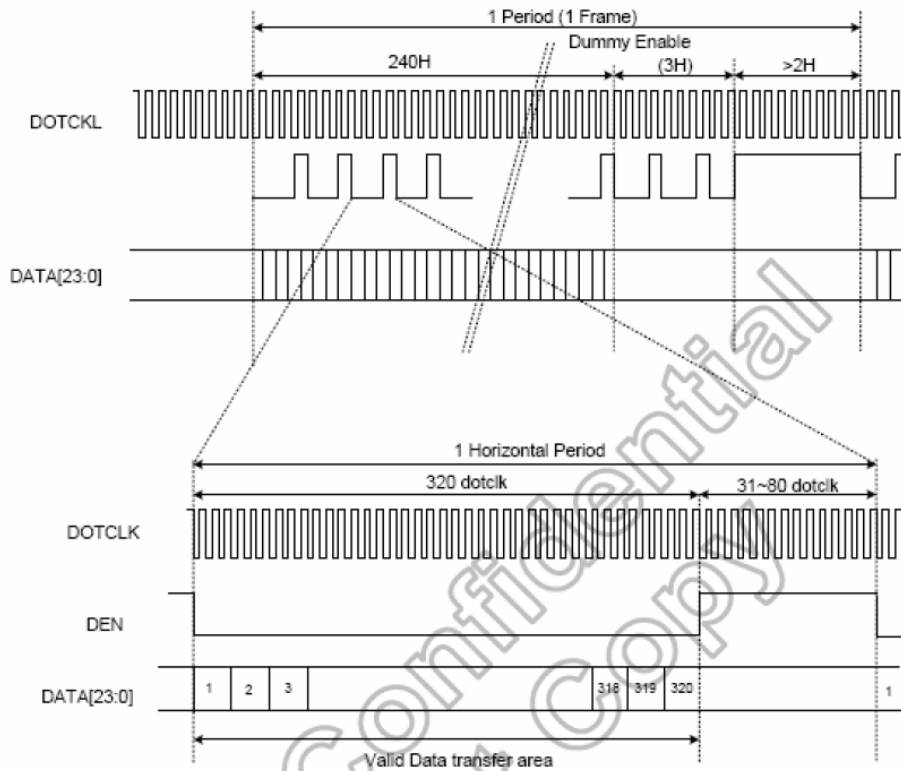
(a) Horizontal Data Transaction Timing



(b) Vertical Data Transaction Timing

| Characteristics | Symbol | Min. | | Typ. | | Max. | | Unit |
|------------------------------|-------------------------------------|--------|-------|-------------|-------|--------|-------|---------------------|
| | | 24 bit | 8 bit | 24 bit | 8 bit | 24 bit | 8 bit | |
| DOTCLK Frequency | f _{DOTCLK} | - | - | 6.5 | 19.5 | 10 | 30 | MHz |
| DOTCLK Period | t _{DOTCLK} | 100 | 33.3 | 154 | 51.3 | - | - | ns |
| Horizontal Frequency (Line) | f _H | - | - | 14.9 | | 22.35 | | KHz |
| Vertical Frequency (Refresh) | f _V | - | - | 60 | | 90 | | Hz |
| Horizontal Back Porch | t _{HBP} | - | - | 68 | 204 | - | - | t _{DOTCLK} |
| Horizontal Front Porch | t _{HFP} | - | - | 20 | 60 | - | - | t _{DOTCLK} |
| Horizontal Data Start Point | t _{HBP} | - | - | 68 | 204 | - | - | t _{DOTCLK} |
| Horizontal Blanking Period | t _{HBP} + t _{HFP} | - | - | 88 | 264 | - | - | t _{DOTCLK} |
| Horizontal Display Area | H _{DISP} | - | - | 320 | 960 | - | - | t _{DOTCLK} |
| Horizontal Cycle | H _{cycle} | - | - | 408 | 1224 | 450 | 1350 | t _{DOTCLK} |
| Vertical Back Porch | t _{VBP} | - | - | 18 | | - | - | Lines |
| Vertical Front Porch | t _{VFP} | - | - | 4 | | - | - | Lines |
| Vertical Data Start Point | t _{VBP} | - | - | 18 | | - | - | Lines |
| Vertical Blanking Period | t _{VBP} + t _{VFP} | - | - | 22 | | - | - | Lines |
| Vertical Display Area | NTSC | - | - | 240 | | - | - | Lines |
| | PAL | | | 280(PALM=0) | | | | |
| | PAL | | | 288(PALM=1) | | | | |
| Vertical Cycle | NTSC | - | - | 262 | | 350 | - | Lines |
| | PAL | | | 313 | | | | |

7.3.3 DE mode Timing Diagram



| Characteristics | Symbol | Min. | | Typ. | | Max. | | Unit |
|----------------------------|-------------|--------|-------|--------|-------|--------|-------|---------|
| | | 24-bit | 8-bit | 24-bit | 8-bit | 24-bit | 8-bit | |
| DOTCLK Frequency | fDOTCLK | - | - | 6.5 | 19.5 | 10 | 30 | MHz |
| DOTCLK Period | tDOTCLK | 100 | 33.3 | 154 | 51.3 | - | - | ns |
| Horizontal Blanking Period | tHBP + tHFP | 52 | 146 | 88 | 264 | 180 | 960 | tDOTCLK |
| Horizontal Display Area | HDISP | - | - | 320 | 960 | - | - | tDOTCLK |
| Horizontal Cycle | Hcycle | 372 | 1106 | 408 | 1224 | 500 | 1920 | tDOTCLK |
| Vertical Blanking Period | tVBP + tVFP | 2 | - | - | - | 47 | - | Lines |
| Vertical Display Area | VDISP | - | - | 240 | - | - | - | Lines |
| Vertical Cycle | Vcycle | 242 | - | - | - | 287 | - | Lines |

Note: The above parallel RGB interface timing sequence is for reference only. For the other interface timing sequence, please refer to the driver IC (HX8238D) data sheet.

8. RELIABILITY TEST

| No. | Item | Description |
|-----|-----------------------------|---|
| 01 | High temperature operation | The sample should be allowed to stand at 70°C for 120 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours. |
| 02 | Low temperature operation | The sample should be allowed to stand at -20°C for 120 hours under driving condition and then returning it to normal temperature condition, and allowing it stand for 2 hours. |
| 03 | High temperature storage | The sample should be allowed to stand at 80°C for 240 hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 2 hours. |
| 04 | Low temperature storage | The sample should be allowed to stand at -30°C for 240 hours under no-load condition, then returning it to normal temperature condition, and allowing it stand for 2 hours. |
| 05 | Moisture storage | The sample should be allowed to stand at 60°C,90%RH MAX for 240 hours under no-load condition, then taking it out and drying it at normal temperature for 2 hours. |
| 06 | Thermal shock storage | The sample should be allowed to stand the following 10 cycles : -30°C for 30 minutes → normal temperature for 5 minutes → +80°C for 30 minutes → normal temperature for 5 minutes, as one cycle. |
| 07 | Packing vibration | Frequency range : 10Hz ~ 55Hz Amplitude of vibration : 1.5mm Sweep time: 12 min X,Y,Z 2 hours for each direction. |
| 08 | Packing drop test | According to ASTM-D-5327. |
| 09 | Electrical Static Discharge | Air: ±4KV 150pF/330Ω 5 times |
| | | Contact: ±2KV 150pF/330Ω 5 time |

*Sample size for each test item is 3~5pcs

9. LCD MODULES HANDLING PRECAUTIONS

- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD module.
 - Tools required for assembly, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- Storage precautions
When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

10. OTHERS

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
 - Exposed area of the printed circuit board
 - Terminal electrode sections.