# *Beverly Display Solutions*

**Module No. : BD070RDH12**

**Revision : Ver 1.0**

**Customer** _____

| Approved By | Date | Notes |
|---|---|---|
| | | |

| Rev | Issued Date | Description | Editor |
|---|---|---|---|
| 1.0 | 2013-1-2 | Preliminary Specification Release | |
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## 1. General Description

- 7”, Normally Black with Auti-Glare, 16.7M Colors, MVA TFT dot matrix LCD module.
- Viewing Angle: 12 o’clock
- Logic Voltage : 3.3V(Type)
- Data Interface: Analog RGB Interface.

## 2. Mechanical Specifications

The mechanical detail is shown in Fig. 2 and summarized in Table 1 below.

Table 1

| Parameter | | Specifications | Unit |
|---|---|---|---|
| Outline dimensions | | 164.9(W) x 100.0(H) x 5.70(D) | mm |
| Color TFT 240xRGBx320 | Active area | 154.08(W) x 85.92(H) | mm |
| | Display format | 800 (RGB) x 480 | dots |
| | Color configuration | RGB stripe | - |
| | Dot pitch | 0.1926 (RGB) (W) x 0.1790(H) | mm |
| Weight | | TBD | gram |

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

Note 2: Requirements on Environmental Protection: Q/S0002

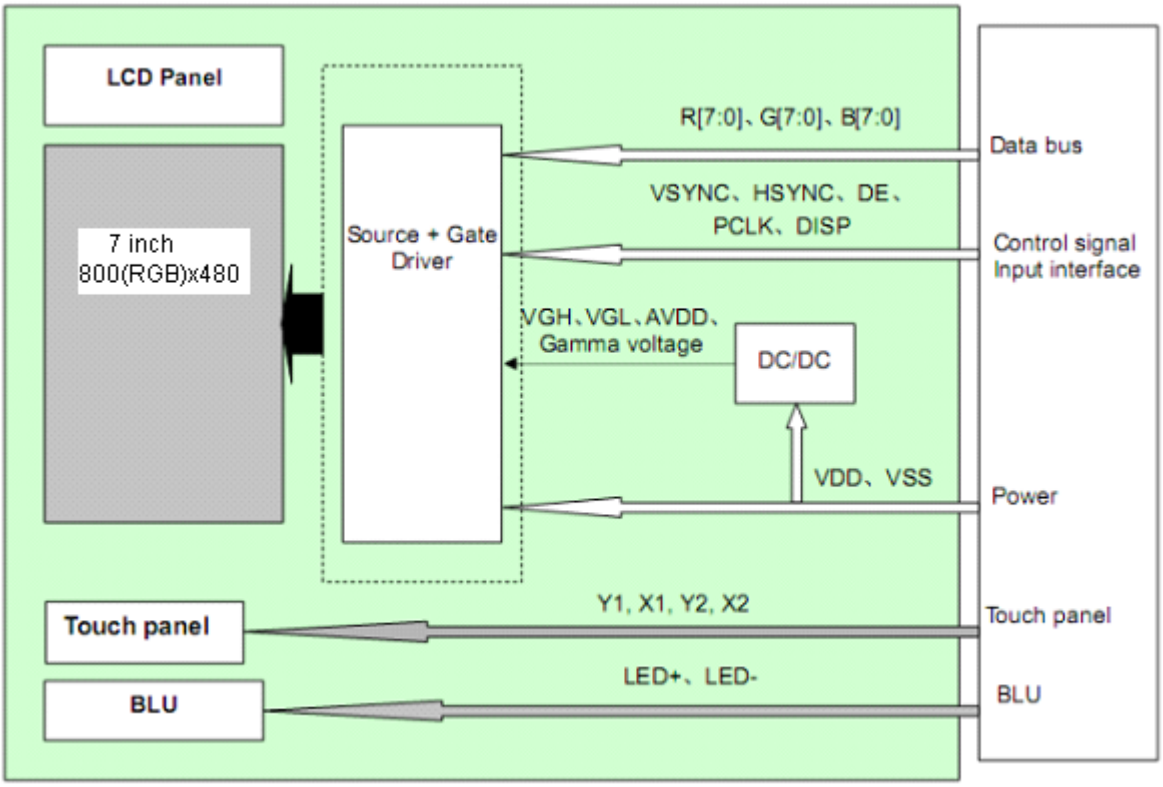



Figure 1: Block Diagram

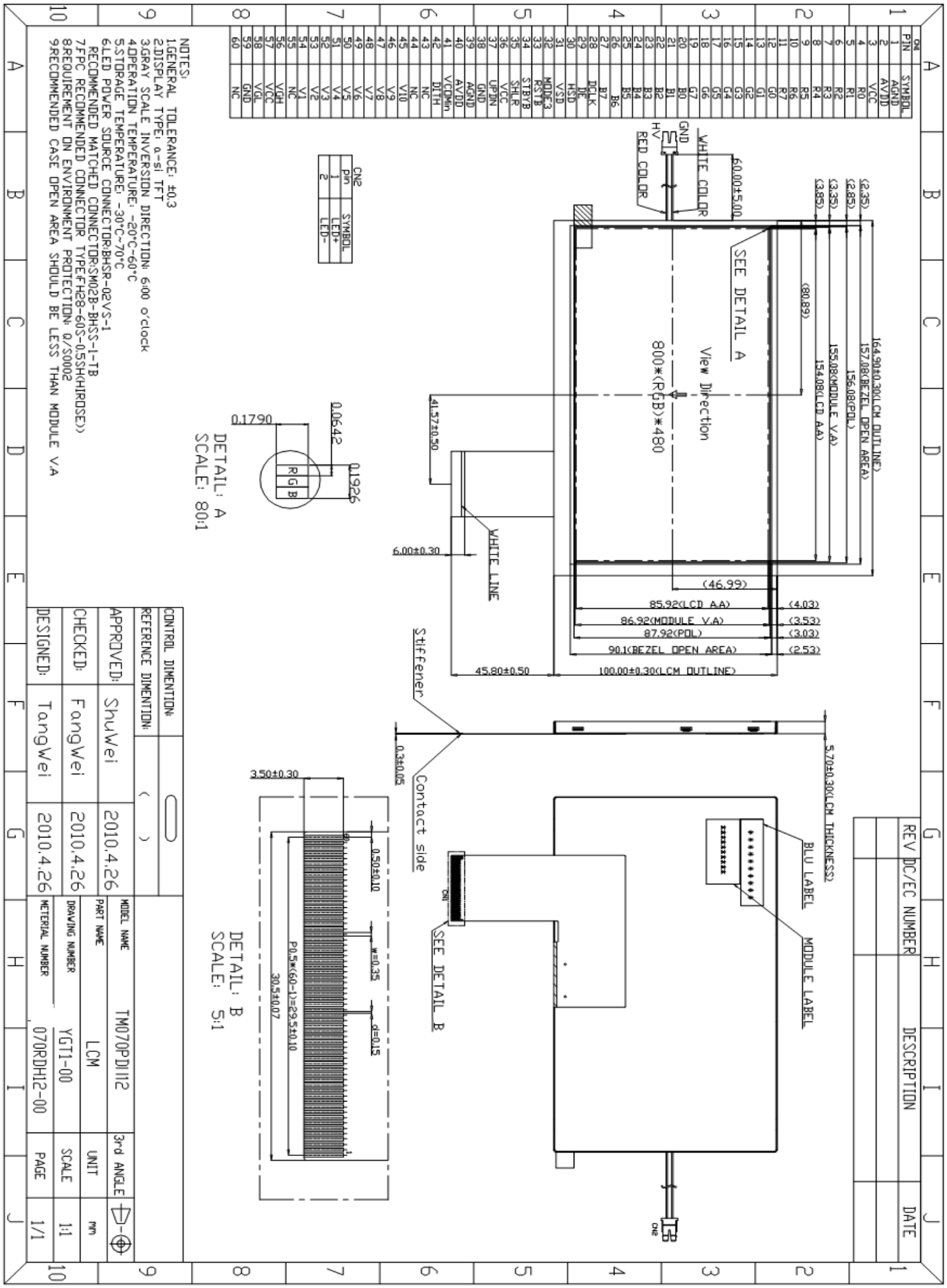



Figure 2: Module Specification

## 3. Interface Signals

Table 2: Pin assignment

| Pin No. | Symbol | Description |
|---|---|---|
| 1 | GND | Ground. |
| 2 | IOVDD | Analog power supply. |
| 3 | VDD | Power supply to the liquid crystal power supply analog circuit. Connect to an external power supply. |
| 4~11 | R0~R7 | Red Data bus. |
| 12~19 | G0~G7 | Green Data bus. |
| 20~27 | B0~B7 | Blue Data bus. |
| 28 | DCLK | Dot Data Clock |
| 29 | DEN | Data Enable Signal |
| 30 | HSYNC | Horizontal Synchronous Signal |
| 31 | VSYNC | Vertical Synchronous Signal |
| 32 | MODE | DE/SYNC mode select. H: DE mode; L: SYNC mode |
| 33 | RESET | Reset signal. Setting either pin low initializes the LSI. Must be reset after power is supplied. |
| 34 | STBYB | High: normally operation; Low: source driver output. |
| 35 | R/L | Set horizontal scan direction. Low/NC: left to right; High: right to left. |
| 36 | VDD | Power supply to the liquid crystal power supply analog circuit. Connect to an external power supply. |
| 37 | U/D | Set vertical scan direction. High/NC: up to down; Low: down to up. |
| 38,39 | GND | Ground. |
| 40 | IOVDD | Analog power supply. |
| 41 | Vcom | Common voltage input. |
| 42 | DITHB | Dithering setting. H: 6 bit resolution; L: 8 bit resolution. |
| 43~55 | NC | Dummy pin, Please let it float. |
| 56 | VGH | Positive power of TFT. |
| 57 | VDD | Power supply to the liquid crystal power supply analog circuit. Connect to an external power supply. |
| 58 | VGL | Negative power of TFT. |
| 59 | GND | Ground. |
| 60 | NC | Dummy pin, Please let it float. |

# 4. Absolute Maximum Ratings

## 4.1 Electrical Maximum Ratings – for IC Only

Table 3

| Parameter | Symbol | Min. | Max. | Unit |
|---|---|---|---|---|
| Power supply voltage (VDD) | IOVDD | -0.3 | +5.0 | V |
| Power supply voltage (VDD) | AVDD | -0.3 | +15.0 | V |
| Power for VLCD(VGH) | VGH | -0.3 | +42.0 | V |
| Power for VLCD(VGL) | VGL | -20.0 | +0.3 | V |
| Back Light Forward Current | $I_F$ | | 25 | mA |
| Logic input voltage | VIN | -0.3 | IOVDD+0.5 | V |
| Logic output voltage | VOUT | -0.3 | IOVDD+0.5 | V |

Note 1: GND =0V.

Note2: No condensation allowed under any condition.

## 4.2 Environmental Condition

Table 4

| Item | Operating temperature (Topr) | | Storage temperature (Tstg) (Note 1) | | Remark |
|---|---|---|---|---|---|
| | Min. | Max. | Min. | Max. | |
| Ambient temperature(Ta) | -20°C | +70°C | -30°C | +80°C | Dry |
| Humidity (Note 1) | 90% max.<br>RH for Ta 40<br>C< 50%<br>RH for 40 C < Ta<br>Maximum operating temperature | | | | No condensation |
| Vibration(IEC 68-2-6) cells must be mounted on a suitable connector | Frequency: 10 55 Hz<br>Amplitude: 0.75 mm Duration: 20 cycles in each direction. | | | | 3 directions |
| Shock (IEC 68-2-27) Half -sine pulse shape | Pulse duration: 11 ms<br>Peak acceleration: 981 $m/s^2$ = 100g<br>Number of shocks: 3 shocks in 3 mutually perpendicular axes. | | | | 3 directions |

Note 1: Product cannot sustain at extreme storage conditions for long time.

# 5. Electrical Specifications

## 5.1 Typical Electrical Characteristics

At Ta = 25 °C, VDD=3.3V, GND=0V.

Table 5

| Parameter | Symbol | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Supply voltage | AVDD | | +10.07 | +10.6 | +11.13 | V |
| Analog Supply voltage | IOVDD | | +3.0 | +3.3 | +3.6 | V |
| Gate drive High voltage | VGH | | 14.3 | 16.0 | 17.6 | V |
| Gate drive Low voltage | VGL | | -7.7 | -7.0 | -6.3 | V |
| Gate drive Low voltage | Vcom | | | 4.3 | | V |
| Input signal voltage | $V_{IH}$ | "H" level | 0.7VDD | - | VDD | V |
| | $V_{IL}$ | "L" level | VSS | - | 0.3VDD | V |
| Supply current | ICC+IVDD | VDD= +5.0V, Note1 | - | - | 30 | mA |
| | | VDD = +5.0V, Note 1 | - | - | 30 | mA |
| Supply voltage of white LED backlight | VLED | Forward current =140mA(@25°C)<br><br>Number of LED dies = 21 | - | 9.6 | 11.4 | V |

Note 1: Do not display the fixed pattern for a long time because it may develop image sticking due to the LCD structure. It should change pattern frequently. If the screen is displayed with fixed pattern, use a screen saver.

## 5.2 TFT Panel Characteristics

### 5.2.1 Input Setup Timing

At Ta = 25°C, GND=0V, VDD=3.3V.

| Parameter | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| DCLK frequency | $F_{clk}$ | 28 | 30.0 | 40.0 | MHz | |
| DCLK cycle time | $T_{cph}$ | 25 | 33.3 | 36 | ns | |
| DCLK pulse width | $T_{cw}$ | 40% | 50% | 60% | $T_{cph}$ | |
| VS setup time | $T_{vst}$ | 8 | | | ns | |
| VS hold time | $T_{vhd}$ | 8 | - | - | ns | |
| HS setup time | $T_{hst}$ | 8 | | | ns | |
| HS hold time | $T_{hhd}$ | 8 | - | - | ns | |
| Data setup time | $T_{dsu}$ | 8 | | | ns | Data to DCLK |
| Data hold time | $T_{dhd}$ | 8 | - | - | ns | Data to DCLK |
| DE setup time | $T_{esu}$ | 8 | - | - | ns | |
| DE hold time | $T_{ehd}$ | 8 | - | - | ns | |

Table 6

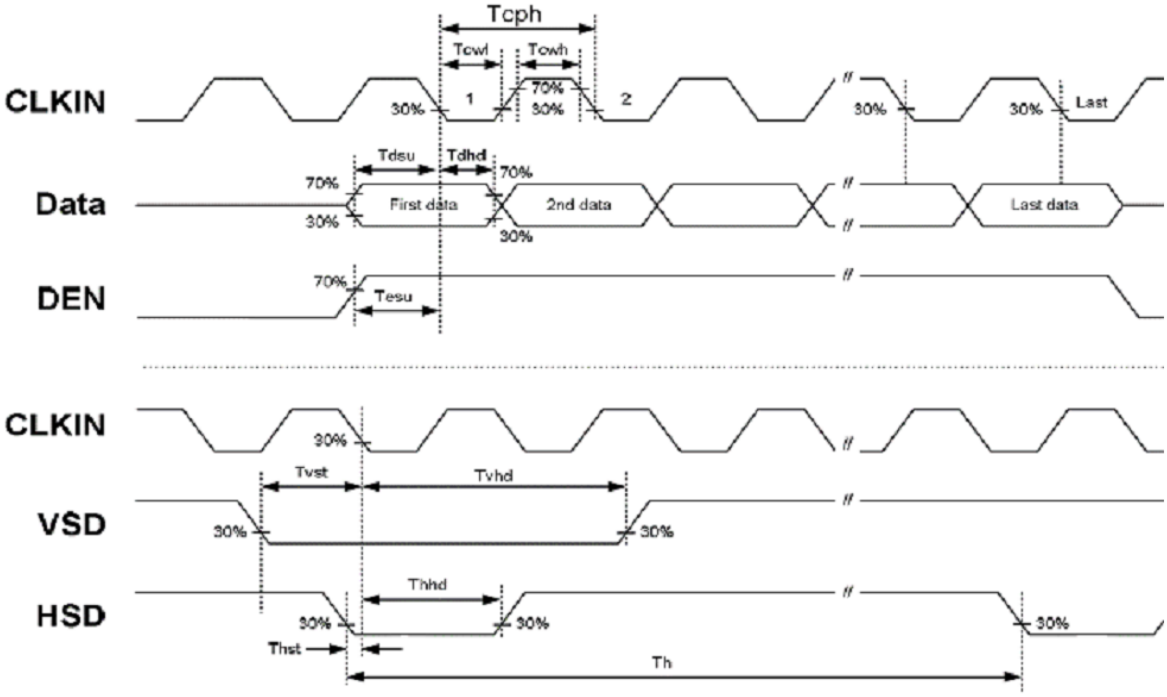



Figure 1: Input Setup Timing

### 5.2.2 Data Input Timing Parameter Setting

At Ta = 25°C, GND=0V, VDD=3.3V.

Table 7

| Parameter | Symbol | Min | Typ | Max | Unit | Remark |
|---|---|---|---|---|---|---|
| DCLK | $F_{clk}$ | 28 | 30.0 | 40.0 | MHZ | |
| | $t_{clk}$ | 25.0 | 33.3 | 36 | ns | |
| HS | $t_h$ | 889 | 928 | 1143 | $t_{clk}$ | |
| | $t_{hd}$ | 800 | 800 | 800 | $t_{clk}$ | |
| | $t_{hpw}$ | 1 | 48 | - | $t_{clk}$ | |
| | $t_{hb}$ | 88 | 88 | 88 | $t_{clk}$ | |
| | $t_{hfp}$ | 1 | 40 | 255 | $t_{clk}$ | |
| VS | $t_v$ | 513 | 525 | 767 | $t_h$ | |
| | $t_{vd}$ | 480 | 480 | 480 | $t_h$ | |
| | $t_{vpw}$ | 3 | 3 | - | $t_h$ | |
| | $t_{vb}$ | 32 | 32 | 32 | $t_h$ | |
| | $t_{vfp}$ | 1 | 13 | 255 | $t_h$ | |

Note 1: DE timing refer to HS, VS input timing.

**TCON Vertical Input Timing Diagram HV**

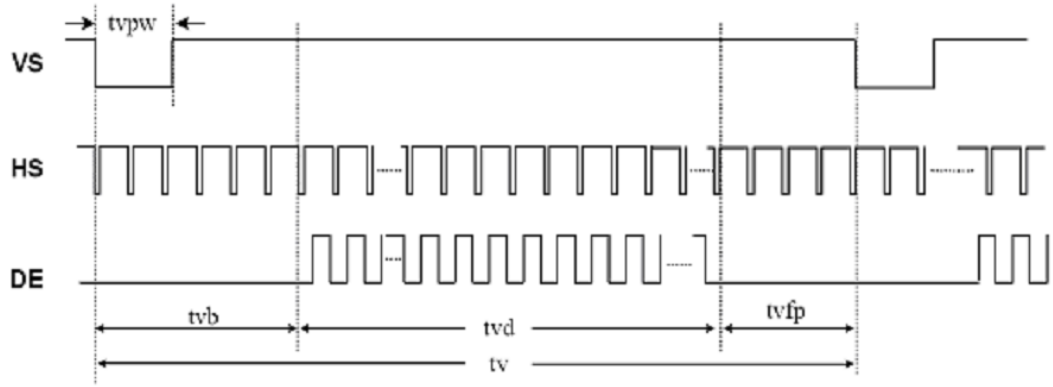



Figure 2: Data Input Timing

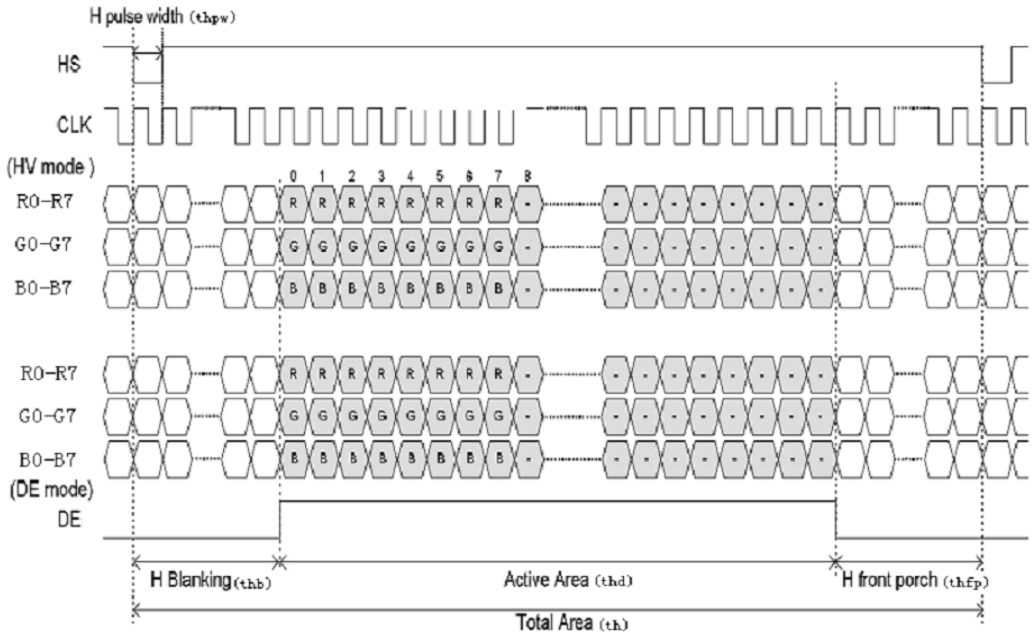


Figure 3: TCON Mode Interface Characteristics

## 6. Optical Characteristics (for panel only)

Table 8: Optical characteristics

| Items | | Symbol | Condition | | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|---|
| Response Time | | $T_R + T_F$ | Ta=25°C | Viewing normal angle θ=ϕ=0° | - | - | 50 | ms | (Note 1) |
| Viewing angle | 12’ | 2 | Ta=25°C | Center CR≥10 | - | 60 | - | deg. | (Note 2) |
| | 6’ | 1 | | | - | 70 | - | | |
| | 9’ | 2 | | | - | 70 | - | | |
| | 3’ | 1 | | | - | 70 | - | | |
| Contrast Ratio | | CR | Ta=25°C | Viewing normal angle θ=ϕ=0° | 400 | 500 | - | - | (Note 3) |
| Luminance (on the module surface) | | Br | Ta=25°C | | 280 | 350 | - | $cd/m^2$ | |
| Transmittance | | % | | | - | 6.5 | - | % | |
| Chromaticity | Red | $x_R$ | Ta=25°C | Viewing normal angle θ=ϕ=0° | | 0.590 | | - | (Note 4) |
| | | $y_R$ | | | | 0.350 | | - | |
| | Green | $x_G$ | | | | 0.348 | | - | |
| | | $y_G$ | | | | 0.580 | | - | |
| | Blue | $x_B$ | | | | 0.150 | | - | |
| | | $y_B$ | | | | 0.100 | | - | |
| | White | $x_W$ | | | | 0.320 | | - | |
| | | $y_W$ | | | | 0.340 | | - | |

Note 1: The electro-optical response time measurements shall be made as Figure 5 by switching the “data” input signal OFF and ON. The times needed for the luminance to change from 10% to 90% s $T_r$, and 90% to 10% is $T_f$.

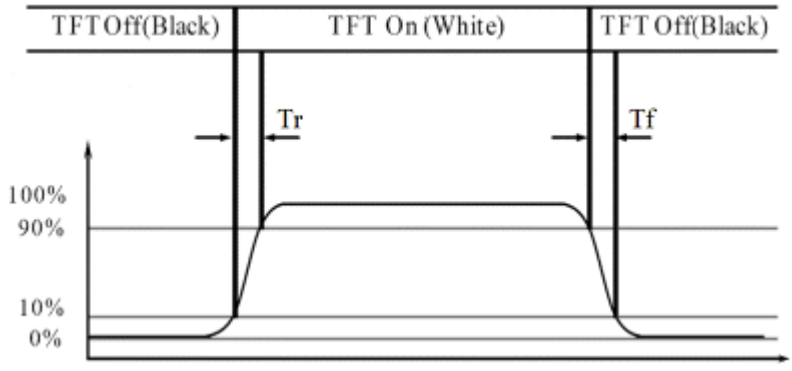



Figure 5: Response Time Testing

Note 2: The definitions of viewing angle.

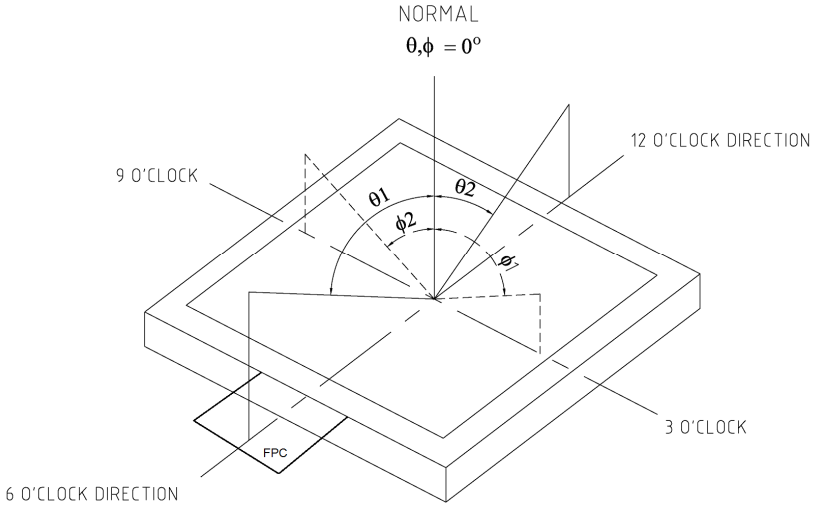



Figure 6

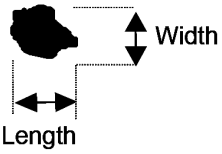
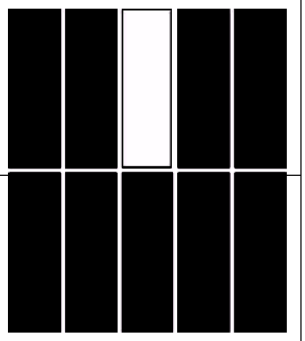
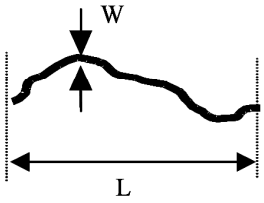
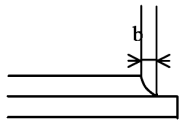
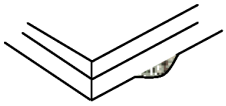
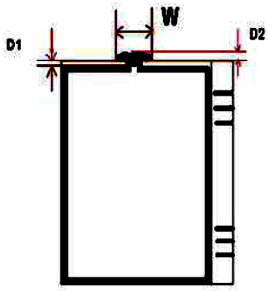
Note 3: Contrast measurements shall be made at viewing angle of $\theta=0^{o}$ and at the center of the LCD surface by using DMS. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See figure 6)

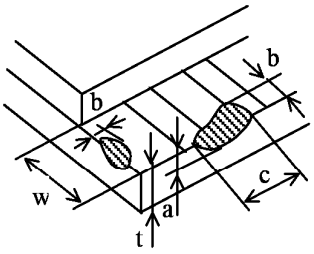
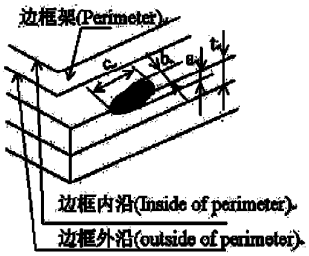
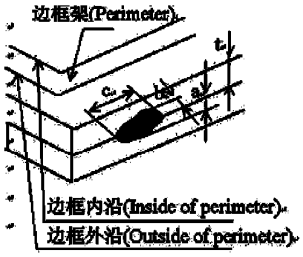
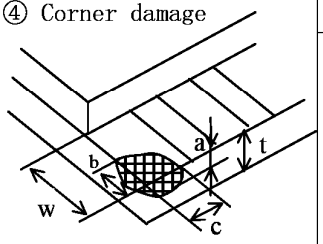
Luminace Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

Note 4: The color chromaticity coordinates specified in Table 9 shall be updated from later actual spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

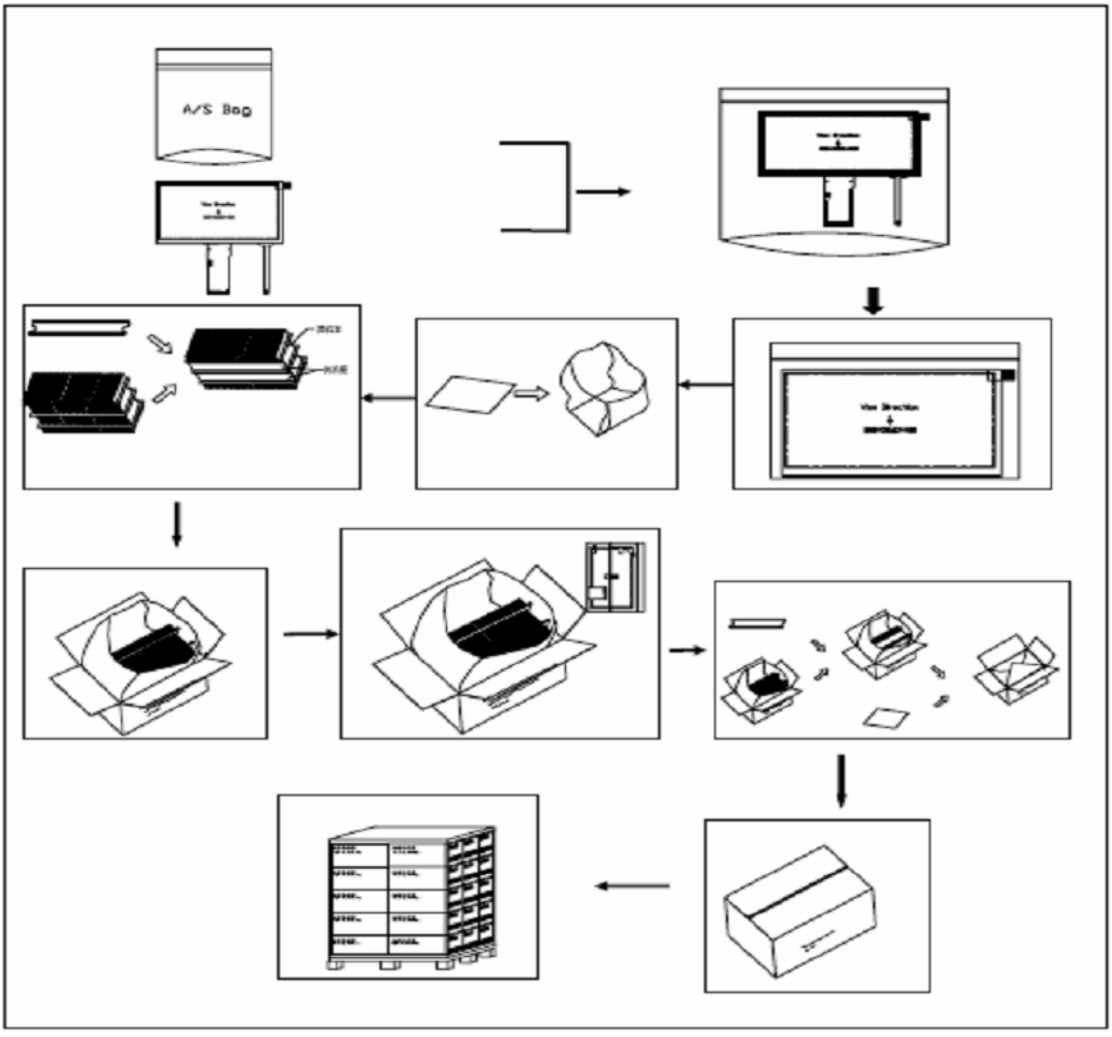
## 7. TFT Panel Inspection Specifications

| Failure mode | Illustration | Category(Unit: mm) | | Acceptable count | |
|---|---|---|---|---|---|
| | | | | Viewing area | non-Viewing area |
| Black spot<br>White spot |  <br>Φ= (Length+width)/2 | A | Φ≦0.10 | Not count | Not count |
| | | B | 0.10<Φ≦0.15 | 2, The gap between the two spots should be 5 mm and above. | |
| | | C | 0.15<Φ≦0.20 | 1 | |
| | | D | 0.20<Φ | 0 | |
| Bright spot(Red spot,green spot and blue spot caused by damaged colour filter) |  | A | Area≦1 sub-pixel | 1 | N/A |
| Black line<br>White line |  | A | W≦0.03 | Not count | Not count |
| | | B | 0.03<W≦0.05, L≦3.0 | 2 | |
| | | C | 0.05<W | Judged by spot spec | |
| Below are cosmetic inspection specifications | | | | | |
| Excess glass |  | b≦1.0, this defect shall not affect the outline dimension or assembly process.(Remarks: For COG process, the defect size is decided by the dimension of LCD panel.) | | | |
| |  | This defect shall not affect the outline dimension or assembly process. | | | |
| The depth of UV glue entered in LCD cell |  | a. D1≥0.2，not enter into viewing area<br>b. D2≦0.8,<br>c. W=End mouth width + (2~6 mm) | | | |

<table>
<tr><td rowspan="5">Glass defect(scratch ,damage)</td><td>① LCD ledge damage<br>  <br></td><td colspan="2">Category</td></tr>
<tr><td></td><td>A</td><td>The defect shall not affect the outline dimension or assembly process at non ITO zone.</td></tr>
<tr><td></td><td>B</td><td>b≦1/4w, a & c not count (at ITO zone)</td></tr>
<tr><td></td><td>C</td><td>Alignment mark on LCD ledge shall not be damaged.</td></tr>
<tr><td>② Outside of perimeter damage<br>  <br></td><td colspan="2">b can’t reach inside of perimeter.</td></tr>
<tr><td>③ Joint glass damage<br>  <br></td><td colspan="2">b can’t reach outside of perimeter or ITO layout.</td></tr>
<tr><td>④ Corner damage<br>  <br></td><td>A</td><td>a ≦ t， b ≦ 3.0， c ≦ 3.0</td></tr>
<tr><td colspan="3">B. Alignment mark on LCD ledge shall not be damaged.</td></tr>
<tr><td colspan="4">Remark: a stands for thickness of damage, b for width, c for length and t for glass thickness. (Unit: mm)</td></tr>
</table>

## 8. Packing demonstrate

| No | Item | Model (Material) | Dimensions(mm) | Unit Weight(Kg) | Quantity | Remark |
|---|---|---|---|---|---|---|
| 1 | LCM module | TM070RBH10 | 164.90x100.00x6.80 | 0.195 | 50 | |
| 2 | Partition_1 | Corrugated Paper | 513x333x215 | 2.0 | 1 | |
| 3. | Anti-Static Bag | PE | 200x175x0.05 | 0.01 | 50 | Anti-static |
| 4 | Dust-Proof Bag | PE | 700x545 | 0.0600 | 1 | |
| 5 | Partition_2 | Corrugated Paper | 505x332 | 0.1 | 2 | |
| 6 | Corrugated Bar | Corrugated Paper | 513x148 | 0.06 | 4 | |
| 7 | Beauty-grain | Tape | 30x10 | 0.001 | 50 | |
| 8 | Dessicant | Dessicant | 45x35 | 0.002 | 8 | |
| 9 | Carton | Corrugated Paper | 530x350x250 | 1.1000 | 1 | |
| 10 | Total weight | 13.9±5% | | | | |



## 9. PRECAUTIONS FOR LCM

Beverly Display Solutions LCMs have been assembled and accurately calibrated before delivery. Please observe the following criteria when handling.

### 9.1 Static electricity warning

A. Do not take the LCM from its anti-static bag until it's to be assembled.

LCM's are individually packaged in bags specially treated to resist static electricity. When storing, keep the LCM packed in the original bags, or store them in a container processed to be resistant to static electricity, or in an electric conductive container.

B. Always use a ground strap when handling a LCM.

Always use a ground strap while working with the module, from the time it is taken out of the anti-static bag until it is assembled. If it is necessary to transfer the LCM, once it has been taken out of the bag, always place it in an electric conductive container. Avoid wearing clothes made of chemical fibers, the use of cotton or conductive treated fiber clothing is recommended.

C. Use a no-leak iron for soldering the LCM.

The soldering iron to be used for soldering the I/O terminals to the LCM are to be insulated or grounded at the iron tip.

D. Always ground electrical apparatuses required for assembly.

Electrical apparatuses required to assemble the LCM into a product, i.e. electrical screw drivers, are to be first grounded to avoid transmitting spike noises from the motor.

E. Assure that the work bench is properly grounded.

F. Peel off the LCM protective film slowly.

The module is attached with a film to protect the display surface from contamination, damage, adhesion of flux, etc. Peeling off this film abruptly could cause static electricity to be generated, so peel the tape slowly.

G. Pay attention to the humidity in the work area.

50~60% RH is recommended.

### 9.2 Precautions for the soldering of a LCM

The following procedures should be followed when soldering the LCM:

A. Solder only to the I/O terminal.

B. Use a no leakage soldering iron and pay particular attention to the following:

(1) Conditions for soldering I/O terminals

Temperature at iron tip: 280℃ + 10℃

Soldering time: 3~4 sec/terminal

Type of solder: Eutectic solder (rosin flux filled)

Note: (Avoid using flux, because it could penetrate the module and the module may get contaminated during cleaning.) Peel off protective film after soldering the I/O terminals. By following this procedure, the surface contamination caused by the dispersion of flux while soldering can be avoided.

(2) Removing the wiring

(When a lead wire, or a connector to the I/O terminal of the module is to be removed, remove it only after the solder at the connection has sufficiently melted since the I/O terminal is a through hole.) If it is forcefully removed, it could cause the terminal to break or peel. The recommended procedure is to use a suction-type solder remover. Caution: do not reheat the I/O terminal more than 3 times.

**9.3 Long-term storage**

If the correct method of storage is not followed, deterioration of the display material (polarizer) and oxidation of the I/O terminal plating may make the process of soldering difficult. Please comply with the following procedure.

A. Store in the shipping container.

B. If the shipping container is not available, place in anti-static bags and seal the opening.

C. Store the modules where they are not subjected to direct sunlight or a fluorescent lamp.

D. Store in a temperature range of 0℃ - 35℃ with low relative humidity.

**9.4 Precautions in use of LCD modules**

A. Do not give any external shock.

B. Do not wipe the surface with hard materials.

C. Do not apply excessive force on the surface.

D. Do not expose to direct sunlight or fluorescent light for a long time.

E. Avoid storage in high temperature and high humidity.

F. When storage for a long time at 40℃ or higher is required, R/H should be less than 60%.

G. Liquid in LCD is hazardous substance. Do not lick, swallow when the liquid is attached to your hands, skin, clothes etc. Wash it out thoroughly.