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a seacomp company

TFT LCD Module Product Specification

DT035BTFT-TS

**3.5" (320(RGB) x 240 DOTS) TFT Module
with Resistive Touch Screen**

November 25, 2015

Remark:

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Revision Record

| REV | CHANGES | DATE |
|-------------------------------|----------------|--------------|
| 0.0 (Ref. 1.0 20151125) | First release | Nov 25, 2015 |
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1. Scope

This data sheet is to introduce the specification of DT035BTFT-TS, active matrix TFT module. It is composed of a color TFT-LCD panel, driver ICs, FPC, resistive touch panel and a backlight unit. The 3.5" display area contains 320 (RGB) x 240 pixels.

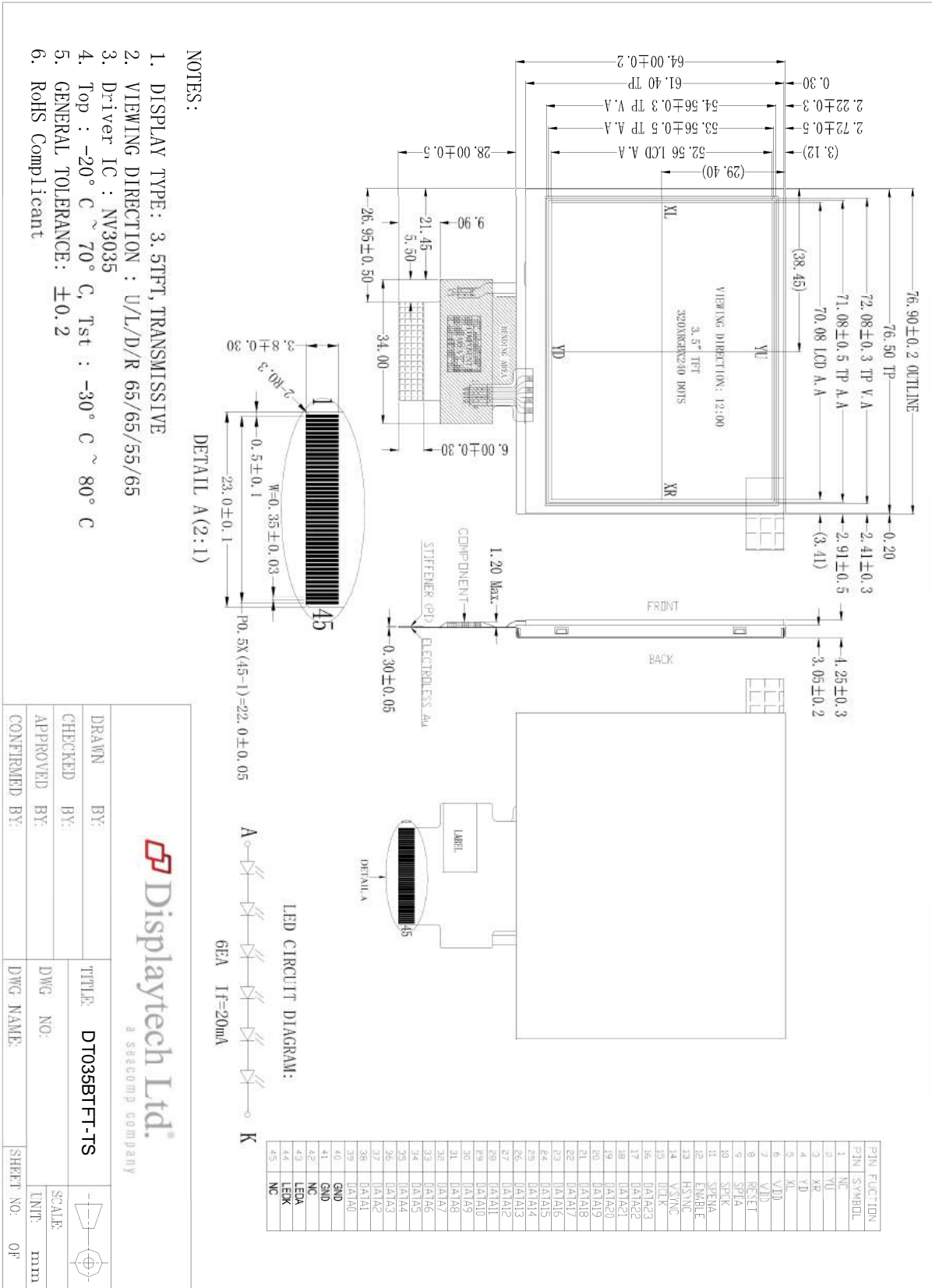
2. Application

Digital equipment which need color display, mobile phone, mobile navigator/video systems.

3. General Information

| Item | Contents | Unit |
|-------------------------------|------------------------------|------|
| Size | 3.5 | inch |
| Resolution | 320(RGB) x 240 | / |
| Interface | CPU | / |
| Technology Type | a-Si TFT | / |
| Pixel Configuration | R.G.B. Vertical Stripe | / |
| Pixel Pitch | 0.219 x 0.219 | mm |
| Outline Dimension (W x H x D) | 76.90 x 64.00 x 4.25 | mm |
| Active Area | 70.08 x 52.56 | mm |
| Display Mode | Transmissive, Normally White | / |
| Backlight Type | LED | / |
| Weight | TBD | g |

4. Outline Drawing



- NOTES:
1. DISPLAY TYPE: 3.5TFT, TRANSMISSIVE
 2. VIEWING DIRECTION : U/L/D/R 65/65/55/65
 3. Driver IC : NV3035
 4. Top : $-20^{\circ} C \sim 70^{\circ} C$, Tst : $-30^{\circ} C \sim 80^{\circ} C$
 5. GENERAL TOLERANCE: ± 0.2
 6. RoHS Compliant

| | | | | | |
|---------------|--|------------------------|--|--------------|--|
| DRAWN BY: | | TITLE: DT035BTFT-TS | | SCALE: | |
| CHECKED BY: | | DWG NO: | | UNIT: mm | |
| APPROVED BY: | | DWG NAME: | | SHEET NO: 0F | |
| CONFIRMED BY: | | a secocomp company | | | |

5. Interface Signals

| No | Symbol | Description | Remark |
|----|--------|--------------------------------|--------|
| 1 | NC | No connection | |
| 2 | YU | Touch panel pin | |
| 3 | XR | Touch panel pin | |
| 4 | YD | Touch panel pin | |
| 5 | XL | Touch panel pin | |
| 6 | VDD | Power supply | |
| 7 | VDD | Power supply | |
| 8 | RESET | Global reset pin | |
| 9 | SPDA | SPI Serial data input/output | |
| 10 | SPCK | SPI interface clock | |
| 11 | SPENA | Serial port data enable signal | |
| 12 | ENABLE | Data enable input | |
| 13 | HSYNC | Horizontal sync input | |
| 14 | VSYNC | Vertical sync input | |
| 15 | DCLK | Data clock | |
| 16 | DATA23 | Data bit | |
| 17 | DATA22 | Data bit | |
| 18 | DATA21 | Data bit | |
| 19 | DATA20 | Data bit | |
| 20 | DATA19 | Data bit | |
| 21 | DATA18 | Data bit | |
| 22 | DATA17 | Data bit | |
| 23 | DATA16 | Data bit | |
| 24 | DATA15 | Data bit | |
| 25 | DATA14 | Data bit | |
| 26 | DATA13 | Data bit | |
| 27 | DATA12 | Data bit | |
| 28 | DATA11 | Data bit | |
| 29 | DATA10 | Data bit | |
| 30 | DATA9 | Data bit | |
| 31 | DATA8 | Data bit | |
| 32 | DATA7 | Data bit | |
| 33 | DATA6 | Data bit | |
| 34 | DATA5 | Data bit | |
| 35 | DATA4 | Data bit | |
| 36 | DATA3 | Data bit | |
| 37 | DATA2 | Data bit | |
| 38 | DATA1 | Data bit | |
| 39 | DATA0 | Data bit | |
| 40 | GND | Power ground | |
| 41 | GND | Power ground | |
| 42 | NC | No connection | |
| 43 | LEDA | LED backlight (Anode) | |
| 44 | LEDK | LED backlight (Cathode) | |
| 45 | NC | No connection | |

6. Absolute Maximum Ratings

6.1 Electrical absolute maximum ratings

| Parameter | Symbol | MIN | MAX | Unit | Remark |
|----------------------|--------|------|-----|------|--------|
| Power supply voltage | VDD | -0.3 | 5.0 | V | |

6.2 Environment conditions

| Parameter | Symbol | MIN | MAX | Unit | Remark |
|-----------------------|--------|-----|-----|------|--------|
| Operating Temperature | TOPR | -20 | +70 | °C | |
| Storage Temperature | TSTG | -30 | +80 | °C | |

7. Electrical Specifications

7.1 Electrical characteristics

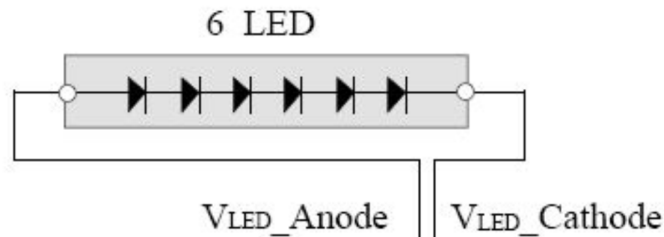
| Item | Symbol | MIN | TYP | MAX | Unit | Remark |
|------------------------------|------------|-----|---------|-----|---------|--------|
| Supply voltage | VDD | 3 | 3.3 | 3.6 | V | |
| Input signal voltage | Low level | VIL | GND | - | 0.1xVDD | V |
| | High level | VIH | 0.8xVDD | - | VDD | V |
| TFT Common electrode Voltage | VcomH | 2.5 | - | 4.5 | V | |
| TFT Gata ON voltage | VcomL | -3 | - | 0 | V | |
| TFT Gata OFF voltage | VcomH | | | 15 | V | |
| TFT Gata OFF voltage | VcomL | -10 | | | V | |

7.2 LED backlight

Ta=25°C

| Item | Symbol | MIN | TYP | MAX | Unit | Remark |
|-----------------|--------|------|--------|------|------|--------|
| Forward current | IF | - | 20 | 25 | mA | |
| Forward voltage | VF | 16.8 | 19.2 | 21.6 | V | |
| LED life time | - | - | 25,000 | - | Hr | |

The figure below shows the connection of LED



8. Command / AC Timing

8.1 AC Electrical Characteristics

Test Condition: (VDD=VDDP=3.3V, VDDA=5.0V, GND=GND A=GNDP=0V, TA= 25°C)

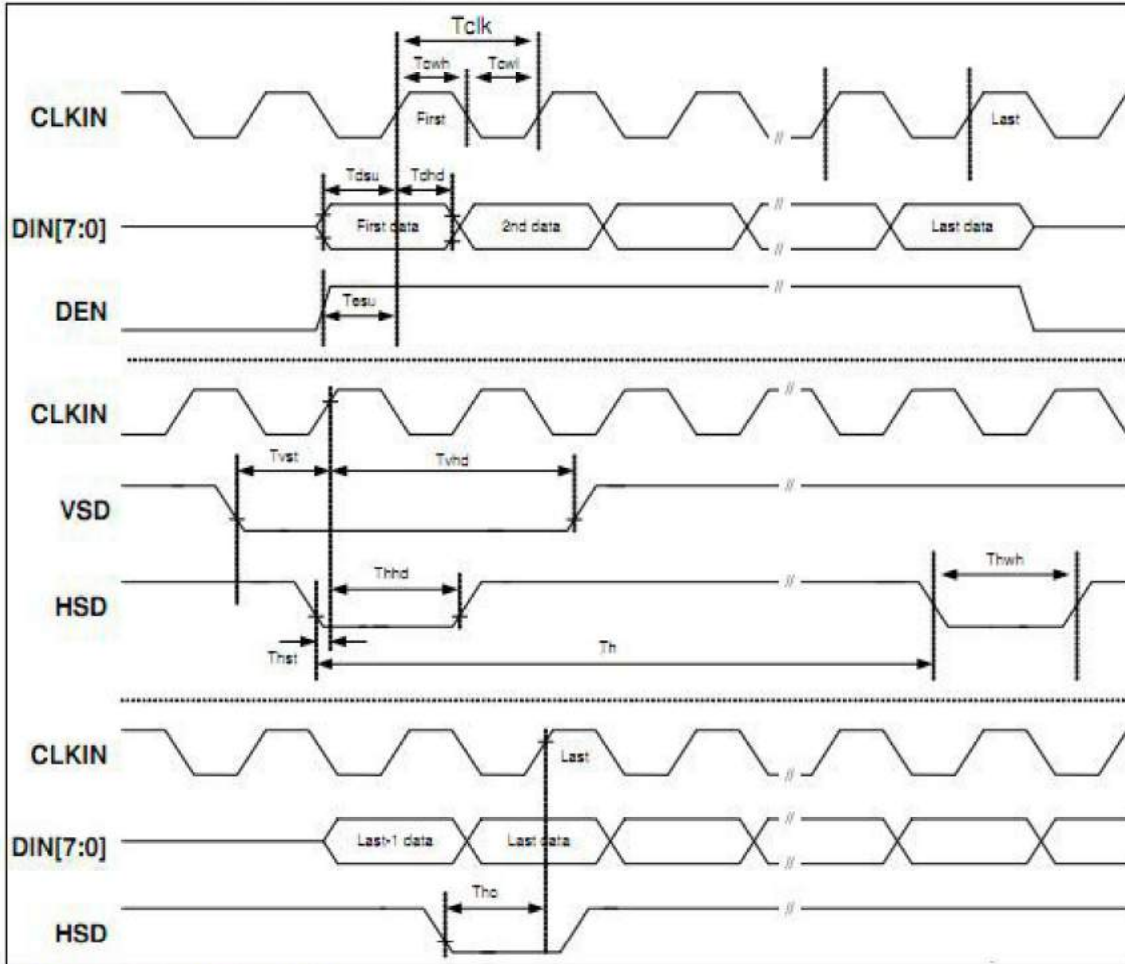
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|-----------------------------|----------|-------|------|-------|--|
| System Operation Timing | | | | | | |
| VDD power source slew time | T _{POR} | | | 1000 | us | From 0V to 90% VDD |
| RSTB active pulse width | T _{RSTB} | 40 | | | us | VDD = 3.3V |
| Input Output Timing | | | | | | |
| CLKIN clock time | T _{clk} | 33.3/125 | - | - | ns | Please refer to timing table(p.32) |
| HSD to CLKIN | T _{hc} | - | - | 1 | CLKIN | |
| HSD width | T _{hwh} | 1 | - | - | CLKIN | |
| VSD width | T _{vwh} | 1 | - | - | Th | |
| HSD period time | T _h | 60 | 63.56 | 67 | us | |
| VSD setup time | T _{vst} | 8 | - | - | ns | |
| VSD hold time | T _{vhd} | 10 | - | - | ns | |
| HSD setup time | T _{hst} | 8 | - | - | ns | |
| HSD hold time | T _{hhd} | 10 | - | - | ns | |
| Data set-up time | T _{dsu} | 8 | - | - | ns | DIN[23:0] to CLKIN |
| Data hold time | T _{dhd} | 10 | - | - | ns | DIN[23:0] to CLKIN |
| DEN setup time | T _{esd} | 12 | - | - | ns | DEN to CLKIN |
| Time that VSD to 1 st line data input | T _{vs} | 2 | 13 | 127 | Th | @CCIR601 / 8bit RGB HV mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0] |
| Time that CCIR_V to 1 st line data input | T _{vs} | 12 | 20 | 28 | Th | @CCIR656 NTSC mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0] |
| Time that CCIR_V to 1 st line data input | T _{vs} 17 25 33 Th | | | | | @CCIR656 PAL mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0] |
| Time that VSD to 1 st line data input | T _{vs} | 2 | 13 | 127 | Th | @24bit RGB HV mode Control by HDLY[6:0] setting T _{vs} = HDLY[6:0] |
| Source output stable time 1 | T _{st} | - | 25 | 30 | us | 96% final, CL=30pF, RL=2K |
| Gate output stable time | T _{gst} | - | 500 | 1000 | ns | 96% final, CL=40pF |
| VCOMOUT output stable time | T _{cst} | - | 4 | 8 | us | 96% final, CL=33nF, RL=100ohm |
| 3-wire serial communication AC timing | | | | | | |
| Serial clock | T _{spck} | 320 | - | - | ns | |
| SPCK pulse duty | | 40 | 50 | 60 | % | T _{ckh} / T _{spck} |
| Serial data setup time | T _{isu} | 120 | - | - | ns | |
| Serial data hold time | T _{ihd} | 120 | - | - | ns | |
| Serial clock high/low | T _{ckh/l} | 120 | - | - | ns | |
| Chip select distinguish | T _{cd} | 1 | - | - | us | |
| SPENB to VSD | T _{cv} | 1 | - | - | us | |
| SPENB input setup time | T _{eck} | 150 | - | - | ns | |
| SPENB input hold time | T _{cke} | 150 | - | - | ns | |

8.2 24 Bit RGB Mode (@ SEL[3:0] = 1100 or 1101)

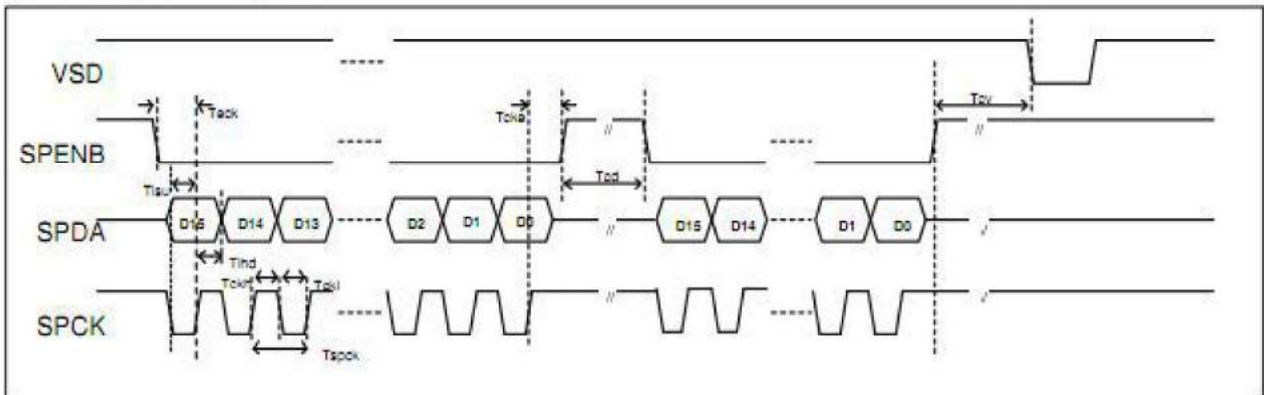
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|---|------------------|------|------|------|-------|------------------------------|
| CLKIN frequency | F _{clk} | 6.1 | 6.4 | 8.0 | MHz | VDD = 3.0 ~3.6V |
| CLKIN cycle time | T _{clk} | 125 | 156 | 164 | ns | |
| CLKIN pulse duty | T _{cwh} | 40 | 50 | 60 | % | T _{clk} |
| Time that HSD to 1 st data input(NTSC) | T _{hs} | 40 | 70 | 255 | CLKIN | DDLY =70, Offset = 0 (fixed) |

8.3 Timing Diagram

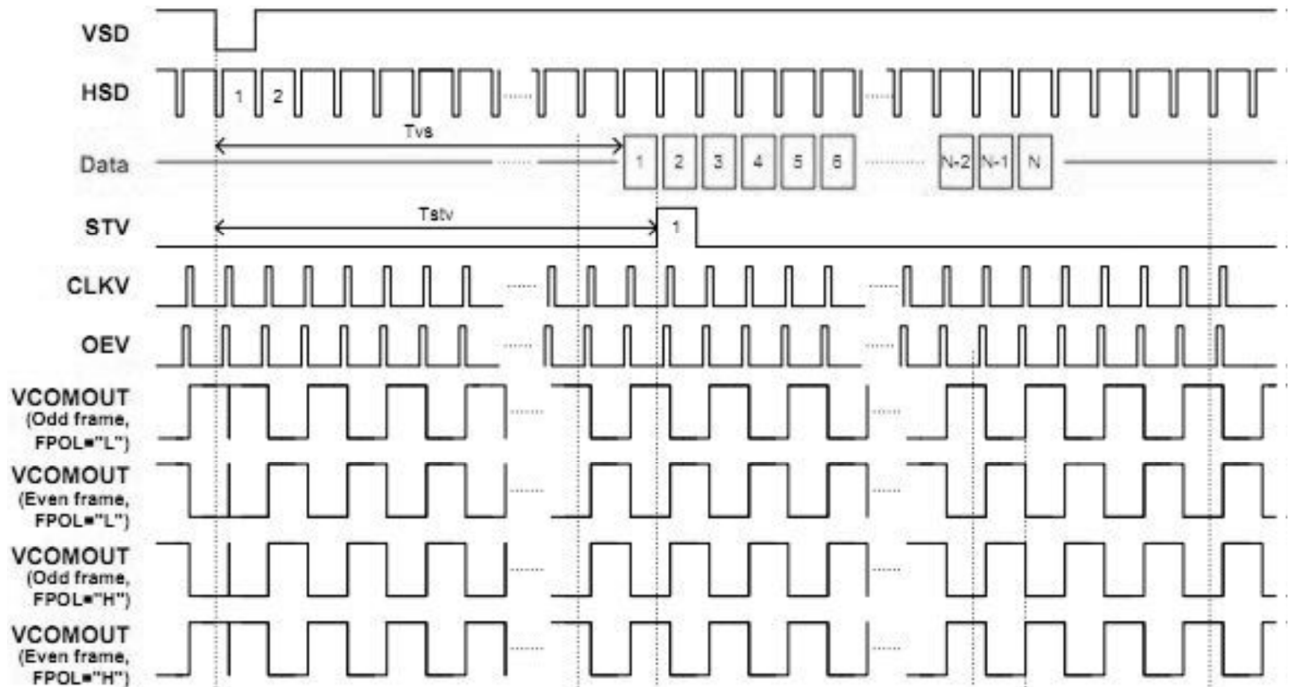
Clock and Data Input Timing Diagram



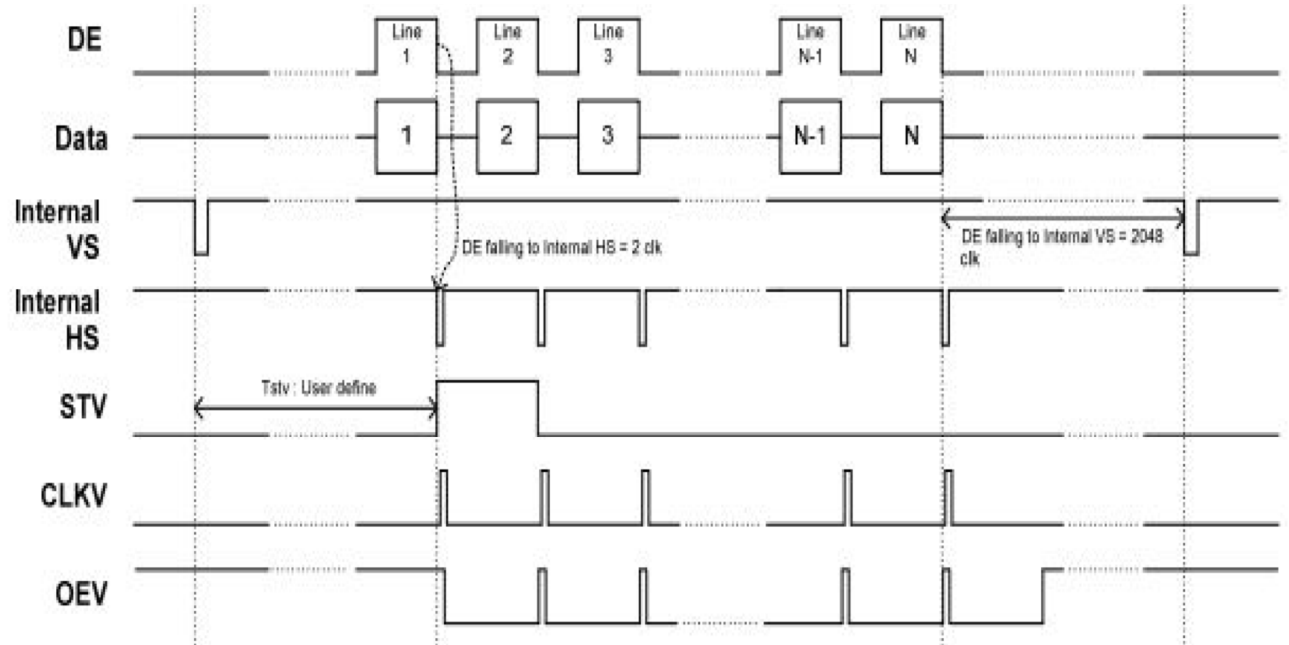
3-Wire Timing Diagram



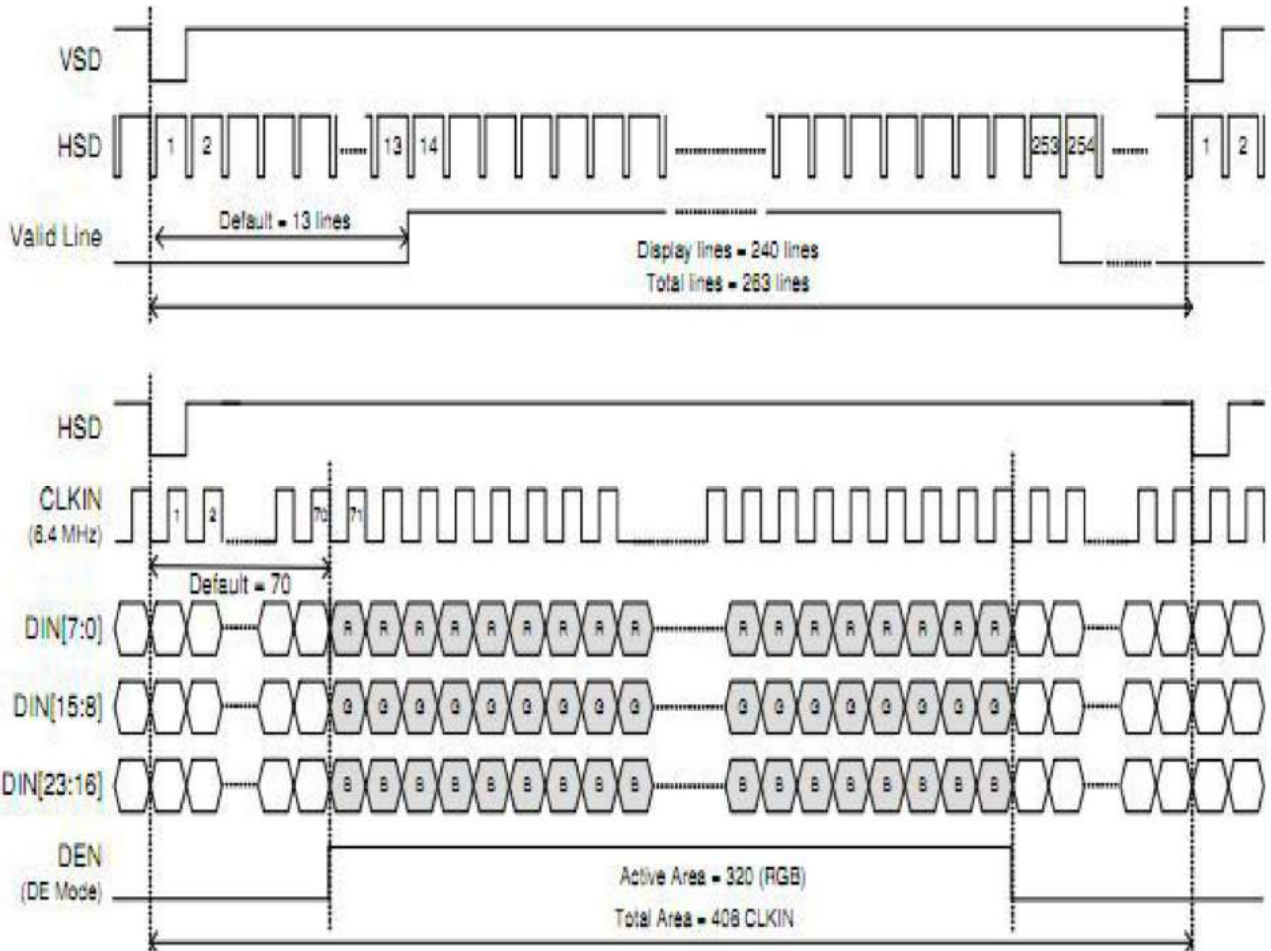
8.4 Vertical Timing Diagram (HV Mode)



8.5 Vertical Timing Diagram (DE Mode)



8.6 Input Data Timing (24 bit RGB mode for 960 x 240 @ SEL[3:0] = 1100b)



9. Optical Specification

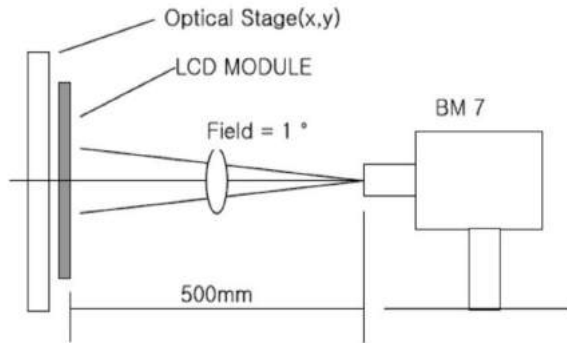
Ta=25°C

| Item | Symbol | Condition | MIN | TYP | MAX | Unit | Remark |
|----------------|------------|------------------|-----|------|-----|-------------------|-----------|
| Contrast ratio | CR | $\theta=0^\circ$ | 350 | 500 | - | | Note 1, 2 |
| Response time | Tr / Tf | 25°C | - | 10 | - | ms | Note 1, 3 |
| View angles | ΘT | CR ≥ 10 | - | 65 | - | Degree | Note 4 |
| | ΘB | | - | 55 | - | | |
| | ΘL | | - | 65 | - | | |
| | ΘR | | - | 65 | - | | |
| Chromaticity | Red | Brightness is on | x | 0.51 | - | Note 1, 5 | |
| | | | y | 0.34 | - | | |
| | Green | | x | 0.31 | - | | |
| | | | y | 0.56 | - | | |
| | Blue | | x | 0.15 | - | | |
| | | | y | 0.14 | - | | |
| White | x | 0.28 | - | | | | |
| | y | 0.33 | - | | | | |
| NTSC | | | 50 | 60 | | % | Note 5 |
| Luminance | L | | - | 480 | - | cd/m ² | Note 1, 6 |
| Uniformity | U | | 75 | 80 | - | % | Note 1, 7 |

Note 1: Definition of optical measurement system.

Temperature = 25°C(±3°C)

LED back-light: ON, Environment brightness < 150 lx

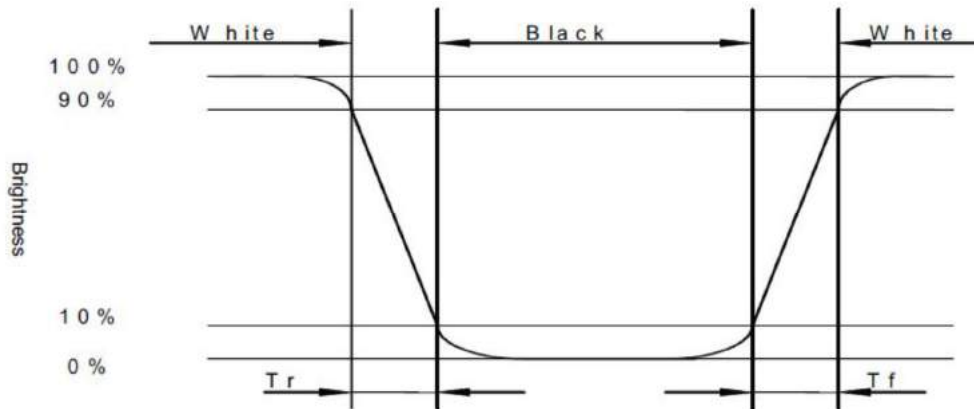


Note 2: Contrast ratio is defined as follow:

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

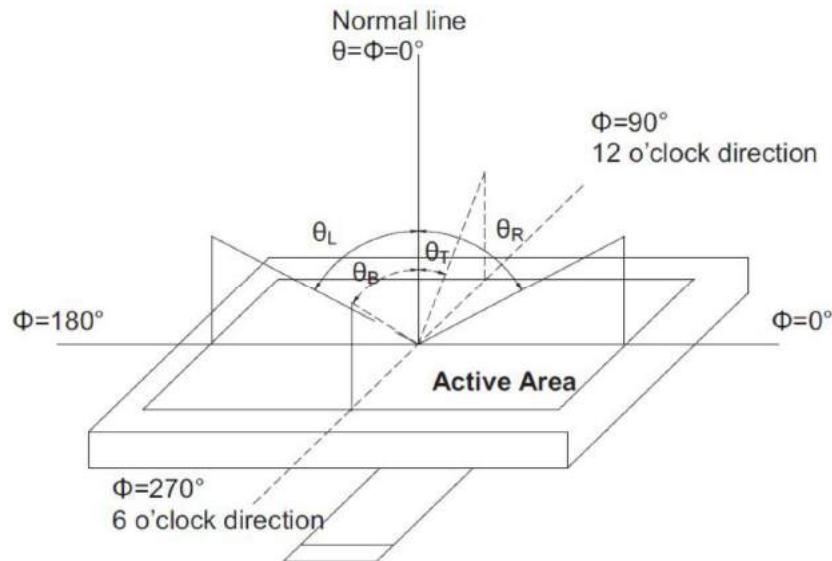
Note 3: Response time is defined as follow:

Response time is the time required for the display to transition from black to white (Rise time, T_r) and from white to black (Decay Time, T_f).



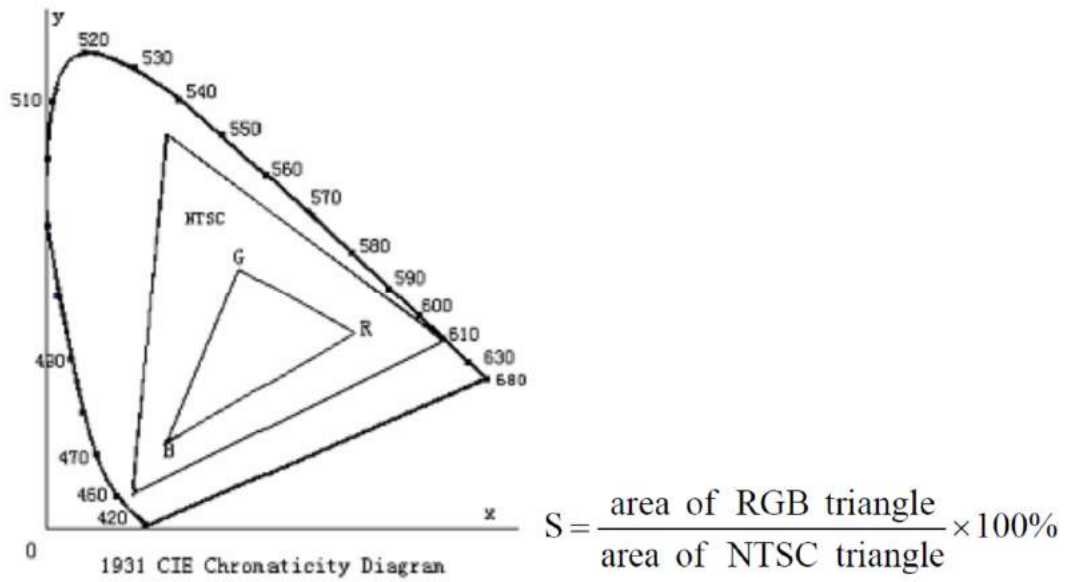
Note 4: Viewing angle range is defined as follow:

Viewing angle is measured at the center point of the LCD.



Note 5: Color chromaticity is defined as follow (CIE1931)

Color coordinates measured at center point of LCD.



Note 6: Luminance is defined as follow:

Luminance is defined as the brightness of all pixels “White” at the center of display area on optimum contrast.

Note 7: Luminance Uniformity is defined as follow:

Active area is divided into 9 measuring areas (Refer Fig.2). Every measuring point is placed at the center of each measuring area.

$$\text{Uniformity (U)} = \frac{\text{Minimum Luminance(brightness) in 9 points}}{\text{Maximum Luminance(brightness) in 9 points}}$$

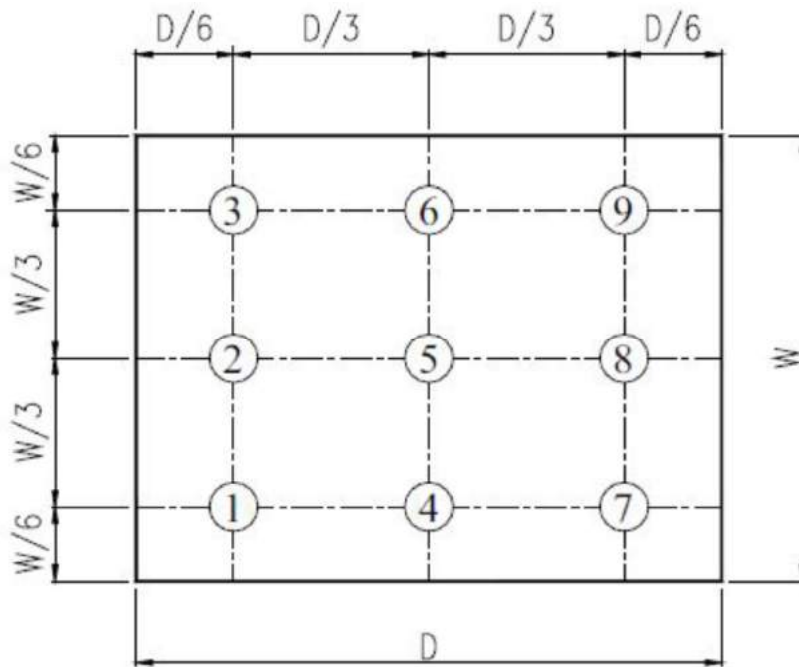


Fig. 2 Definition of uniformity

10. Environmental / Reliability Tests

| No | Test Item | Condition | Judgment Criteria |
|----|-----------------------------------|---|---|
| 1 | High Temp Operation | Ta=+70°C, 120hrs | Per table below |
| 2 | Low Temp Operation | Ta=-20°C, 120hrs | Per table below |
| 3 | High Temp Storage | Ta=+80°C, 120hrs | Per table below |
| 4 | Low Temp Storage | Ta=-30°C, 120hrs | Per table below |
| 5 | High Temp & High Humidity Storage | Ta=+60°C, 90% RH, 120hrs | Per table below (polarizer discoloration is excluded) |
| 6 | Thermal Shock (Non-operation) | -30°C 30 min ~ +80°C 30 min, Change time: 5 min, 10 cycles | Per table below |
| 7 | ESD (Operation) | C=150pF, R=330Ω, 5points/panel Air:±8KV, 5 times; Contact:±4KV, 5 times | Per table below |
| 8 | Vibration (Non-operation) | Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. | Per table below |
| 9 | Shock (Non-operation) | 60G 6ms, ±X, ±Y, ±Z, 3 times, for each direction | Per table below |
| 10 | Package Drop Test | Height: 80cm, 1 corner, 3 edges, 6 surfaces | Per table below |

| Inspection | Criterion (after test) |
|------------------------|---|
| Appearance | No crack on the FPC, on the LCD panel |
| Alignment of LCD panel | No bubbles in the LCD panel No other defects of alignment in active area |
| Electrical current | Within device specifications |
| Function / Display | No broken circuit, no short circuit or no black line No other defects of display |

11. Precautions for Use of LCD Modules

11.1 Safety

The liquid crystal in the LCD is poisonous. Do not put it in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water.

11.2 Handling

- The LCD and touch panel is made of plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
- Do not handle the product by holding the flexible pattern portion in order to assure the reliability.
- Transparency is an important factor for the touch panel. Please wear clear finger sacks, gloves and mask to protect the touch panel from finger print or stain and also hold the portion outside the view area when handling the touch panel.
- Provide a space so that the panel does not come into contact with other components.
- To protect the product from external force, put a covering lens (acrylic board or similar board) and keep an appropriate gap between them.
- Transparent electrodes may be disconnected if the panel is used under environmental conditions where dew condensation occurs.
- Property of semiconductor devices may be affected when they are exposed to light, possibly resulting in IC malfunctions.

- h. To prevent such IC malfunctions, your design and mounting layout shall be done in the way that the IC is not exposed to light in actual use.

11.3 Static electricity

- Ground soldering iron tips, tools and testers when they are in operation.
- Ground your body when handling the products.
- Power on the LCD module before applying the voltage to the input terminals.
- Do not apply voltage which exceeds the absolute maximum rating.
- Store the products in an anti-electrostatic bag or container.

11.4 Storage

- Store the products in a dark place at $+25^{\circ}\text{C}\pm 10^{\circ}\text{C}$ with low humidity (40% RH to 60% RH). Don't expose to sunlight or fluorescent light.
- Storage in a clean environment, free from dust, active gas, and solvent.

11.5 Cleaning

- Do not wipe the touch panel with dry cloth, as it may cause scratch.
- Wipe off the stain on the product by using soft cloth moistened with ethanol. Do not allow ethanol to get in between the upper film and the bottom glass. It may cause peeling issue or defective operation. Do not use any organic solvent or detergent other than ethanol.

11.6 Cautions for installing and assembling

Bezel edge must be positioned in the area between the Active area and View area. The bezel may press the touch screen and cause activation if the edge touches the active area. A gap of approximately 0.5mm is needed between the bezel and the top electrode. It may cause unexpected activation if the gap is too narrow. There is a tolerance of 0.2 to 0.3mm for the outside dimensions of the touch panel and tail. A gap must be made to absorb the tolerance in the case and connector.

