

INNOLUX DISPLAY CORPORATION
LCD MODULE
SPECIFICATION

Customer: _____

Model Name: AT070TN08

SPEC NO.: A070-08-TT-01

Date: 2006/07/05

Version: 01

Preliminary Specification

Final Specification

For Customer's Acceptance

| Approved by | Comment |
|-------------|---------|
| | |

| Approved by | Reviewed by | Prepared by |
|---|---|--|
|  |  |  |

Record of Revision

| Version | Revise Date | Page | Content |
|---------|-------------|------|------------------|
| 1 | 2006/07/05 | | Initial release. |

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1. General Specifications

| No. | Item | Specification | Remark |
|-----|-----------------------------|------------------------------|--------|
| 1 | LCD size | 7.0 inch(Diagonal) | |
| 2 | Driver element | a-Si TFT active matrix | |
| 3 | Resolution | 800X3(RGB)X480 | |
| 4 | Display mode | Normally white, Transmissive | |
| 5 | Dot pitch | 0.0635(W)X0.1905(H) mm | |
| 6 | Active area | 152.4 (W)X91.44 (H) mm | |
| 7 | Module size | 165(W)X104(H)X5.5(D) mm | Note 1 |
| 8 | Surface treatment | Anti-Glare | |
| 9 | Color arrangement | RGB-stripe | |
| 10 | Interface | Digital | |
| 11 | Backlight power consumption | TBD | |
| 12 | Panel power consumption | TBD | |
| 13 | Weight | TBD | |

Note 1: Refer to Mechanical Drawing.

2. Pin Assignment

2.1. TFT LCD Panel Driving Section

| Pin No. | Symbol | I/O | Function | Remark |
|---------|------------------|-----|--|----------|
| 1 | POL | I | Polarity selection | |
| 2 | STVD | I/O | Vertical start pulse input when U/D= H | Note 1 |
| 3 | OEV | I | Output enable | |
| 4 | CKV | I | Vertical clock | |
| 5 | STVU | I/O | Vertical start pulse input when U/D= L | Note 1 |
| 6 | GND | P | Power ground | |
| 7 | EDGSL | I | Select rising edge or falling edge | |
| 8 | V _{CC} | P | Power supply for digital circuit | |
| 9 | V ₉ | I | Gamma voltage level 9 | |
| 10 | V _{GL} | P | Gate OFF voltage | |
| 11 | V ₂ | I | Gamma voltage level 2 | |
| 12 | V _{GH} | P | Gate ON voltage | |
| 13 | V ₆ | I | Gamma voltage level 6 | |
| 14 | U/D | I | Up/down selection | Note 1,2 |
| 15 | V _{COM} | I | Common voltage | |
| 16 | GND | P | Power ground | |
| 17 | AV _{DD} | P | Power supply for analog circuit | |
| 18 | V ₁₄ | I | Gamma voltage level 14 | |
| 19 | V ₁₁ | I | Gamma voltage level 11 | |
| 20 | V ₈ | I | Gamma voltage level 8 | |

| | | | | |
|----|-----------------|-----|--|--------|
| 21 | V5 | I | Gamma voltage level 5 | |
| 22 | V3 | I | Gamma voltage level 3 | |
| 23 | GND | P | Power ground | |
| 24 | R5 | I | Red data(MSB) | |
| 25 | R4 | I | Red data | |
| 26 | R3 | I | Red data | |
| 27 | R2 | I | Red data | |
| 28 | R1 | I | Red data | |
| 29 | R0 | I | Red data(LSB) | |
| 30 | GND | P | Power ground | |
| 31 | GND | P | Power ground | |
| 32 | G5 | I | Green data(MSB) | |
| 33 | G4 | I | Green data | |
| 34 | G3 | I | Green data | |
| 35 | G2 | I | Green data | |
| 36 | G1 | I | Green data | |
| 37 | G0 | I | Green data(LSB) | |
| 38 | STHL | I/O | Horizontal start pulse input when R/L = H | Note 1 |
| 39 | REV | I | Control signal are inverted or not | Note3 |
| 40 | GND | I | Power ground | |
| 41 | DCLK | I | Sample clock | |
| 42 | V _{CC} | P | Power supply for digital circuit | |
| 43 | STHR | I/O | Horizontal start pulse input when R/L = L | Note 1 |
| 44 | LD | I | Latches the polarity of outputs and switches the new data to outputs | |
| 45 | B5 | I | Blue data (MSB) | |

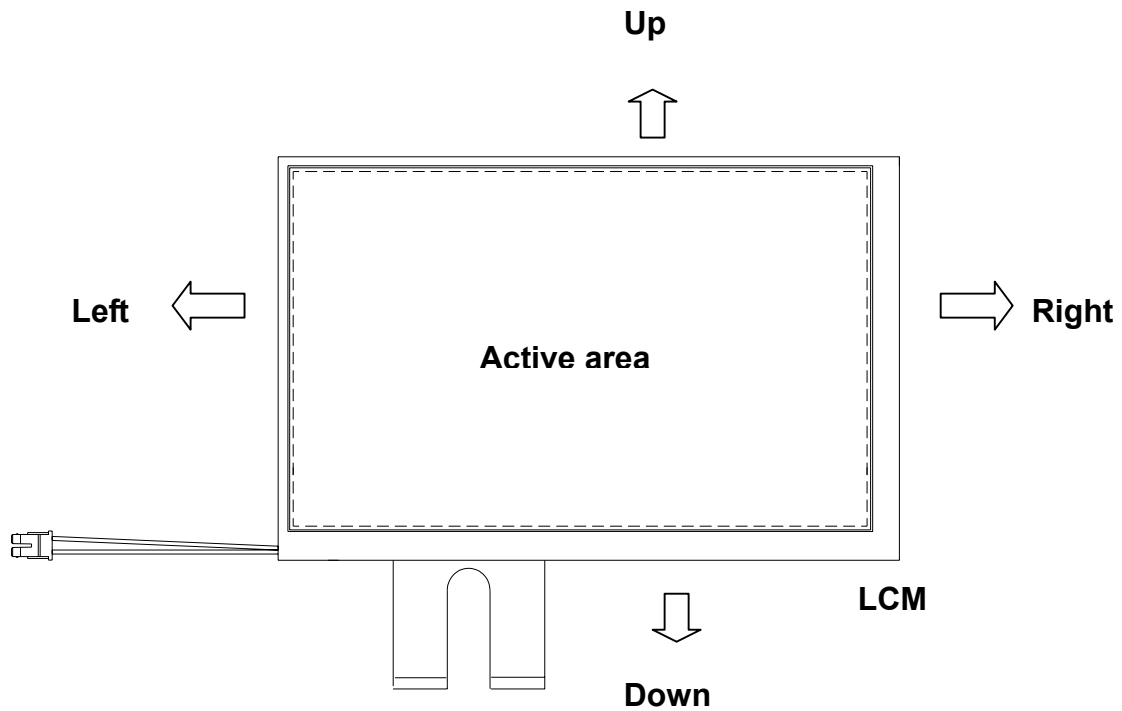
| | | | | |
|----|------------------|---|---------------------------------|----------|
| 46 | B4 | I | Blue data | |
| 47 | B3 | I | Blue data | |
| 48 | B2 | I | Blue data | |
| 49 | B1 | I | Blue data | |
| 50 | B0 | I | Blue data (LSB) | |
| 51 | R/L | I | Right/ left selection | Note 1,2 |
| 52 | V1 | I | Gamma voltage level 1 | |
| 53 | V4 | I | Gamma voltage level 4 | |
| 54 | V7 | I | Gamma voltage level 7 | |
| 55 | V10 | I | Gamma voltage level 10 | |
| 56 | V12 | I | Gamma voltage level 12 | |
| 57 | V13 | I | Gamma voltage level 13 | |
| 58 | AV _{DD} | P | Power supply for analog circuit | |
| 59 | GND | P | Power ground | |
| 60 | V _{COM} | I | Common voltage | |

I: input, O: output, P: Power

Note 1: Selection of scanning mode

| Setting of scan control input | | IN/OUT state for start pulse | | | | Scanning direction |
|-------------------------------|-----------------|------------------------------|------|------|------|---------------------------|
| U/D | R/L | STVD | STVU | STHR | STHL | |
| GND | V _{CC} | O | I | O | I | Up to down, left to right |
| V _{CC} | GND | I | O | I | O | Down to up, right to left |
| GND | GND | O | I | I | O | Up to down, right to left |
| V _{CC} | V _{CC} | I | O | O | I | Down to up, left to right |

Note 2: Definition of scanning direction.
Refer to the figure as below:



Note 3: When REV="L", normally
REV="H", these data will be inverted.

2.2. Backlight Unit Section

| Pin No. | Symbol | I/O | Function | Remark |
|---------|--------|-----|---|--------|
| 1 | HI | P | Power supply for backlight unit(High voltage) | Pink |
| 2 | GND | P | Ground for backlight unit | White |

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3. Operation Specifications

3.1. Absolute Maximum Rating

(GND=AV_{SS}=0V, Note 2)

| Item | Symbol | Values | | Unit | Remark |
|-----------------------|----------------------------------|----------------------|-----------------------|------|--------|
| | | Min. | Max. | | |
| Power voltage | V _{CC} | -0.3 | 5.0 | V | |
| | AV _{DD} | -0.5 | 13.5 | V | |
| | V _{GH} | -0.3 | 20.0 | V | |
| | V _{GL} | -13.0 | 0.3 | V | |
| | V _{GH} -V _{GL} | - | 33.0 | V | |
| Input signal voltage | V1~V7 | 0.4 AV _{DD} | AV _{DD} +0.3 | V | Note 1 |
| | V8~V14 | -0.3 | 0.6AV _{DD} | V | Note 1 |
| Operation Temperature | T _{OP} | (-30) | (85) | °C | |
| Storage Temperature | T _{ST} | (-40) | (95) | °C | |

Note 1: AV_{DD}-0.1 ≥ V1 ≥ V2 ≥ V3 ≥ V4 ≥ V5 ≥ V6 ≥ V7 ≥ V8 ≥ V9 ≥ V10 ≥ V11 ≥ V12 ≥ V13 ≥ V14 ≥ AV_{SS}+0.1

Note 2: 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.

3.1.1. Typical Operation Conditions

(GND=AV_{SS}=0V, Note 1)

| Item | Symbol | Values | | | Unit | Remark |
|--------------------------|------------------|----------------------|--------|-----------------------|------|--------|
| | | Min. | Typ. | Max. | | |
| Power voltage | V _{CC} | 3.0 | 3.3 | 3.6 | V | Note 2 |
| | AV _{DD} | - | (10.0) | - | V | |
| | V _{GH} | - | (16.0) | - | V | |
| | V _{GL} | - | (-7.0) | - | V | |
| Input signal voltage | V _{COM} | - | TBD | - | V | |
| | V1~V7 | 0.4 AV _{DD} | - | AV _{DD} -0.1 | V | |
| | V8~V14 | 0.1 | - | 0.6 AV _{DD} | V | |
| Input logic high voltage | V _{IH} | 0.7V _{CC} | - | V _{CC} | V | Note 3 |
| Input logic low voltage | V _{IL} | 0 | - | 0.3V _{CC} | V | |

Note 1: Be sure to apply V_{CC} and V_{GL} to the LCD first, and then apply V_{GH}.

Note 2: V_{CC} setting should match the signals output voltage (refer to Note 3) of customer's system board .

Note 3: STHL, STHR, OEH, L/R, CPH1~CPH3, STVD, STVU, OEV, CKV, U/D.

3.1.2. Current Consumption

(GND=AV_{SS}=0V)

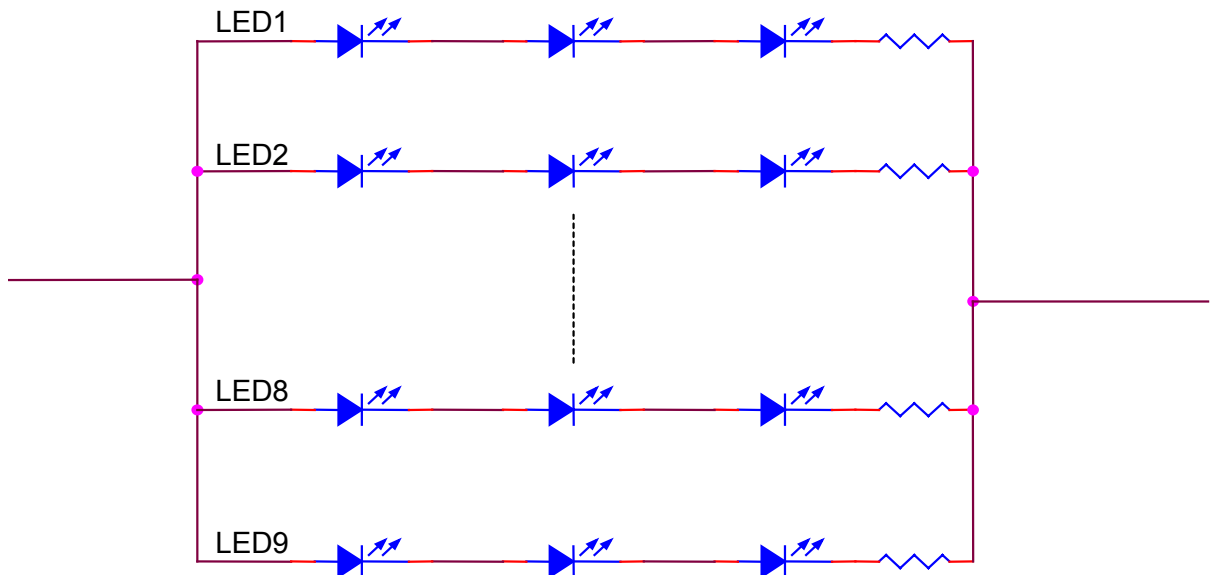
| Item | Symbol | Values | | | Unit | Remark |
|--------------------|-----------------|--------|--------|------|------|---------------------------|
| | | Min. | Typ. | Max. | | |
| Current for Driver | I _{GH} | - | (0.2) | 0.5 | mA | V _{GH} =(16.0V) |
| | I _{GL} | - | (0.2) | 1.0 | mA | V _{GL} = (-7.0V) |
| | I _{CC} | - | (4.0) | 10.0 | mA | V _{CC} =(3.3V) |
| | I _{DD} | - | (25.0) | 50.0 | mA | AV _{DD} =(10.0V) |

3.1.3. Backlight Driving Conditions

| Item | Symbol | Values | | | Unit | Remark |
|---------------|----------------|--------|------|------|------|--------|
| | | Min. | Typ. | Max. | | |
| LED voltage | V _L | - | 9.6 | 12 | V | Note 2 |
| LED current | I _L | - | 20 | - | mA | Note 2 |
| LED life time | - | 20,000 | - | - | Hr | Note 1 |

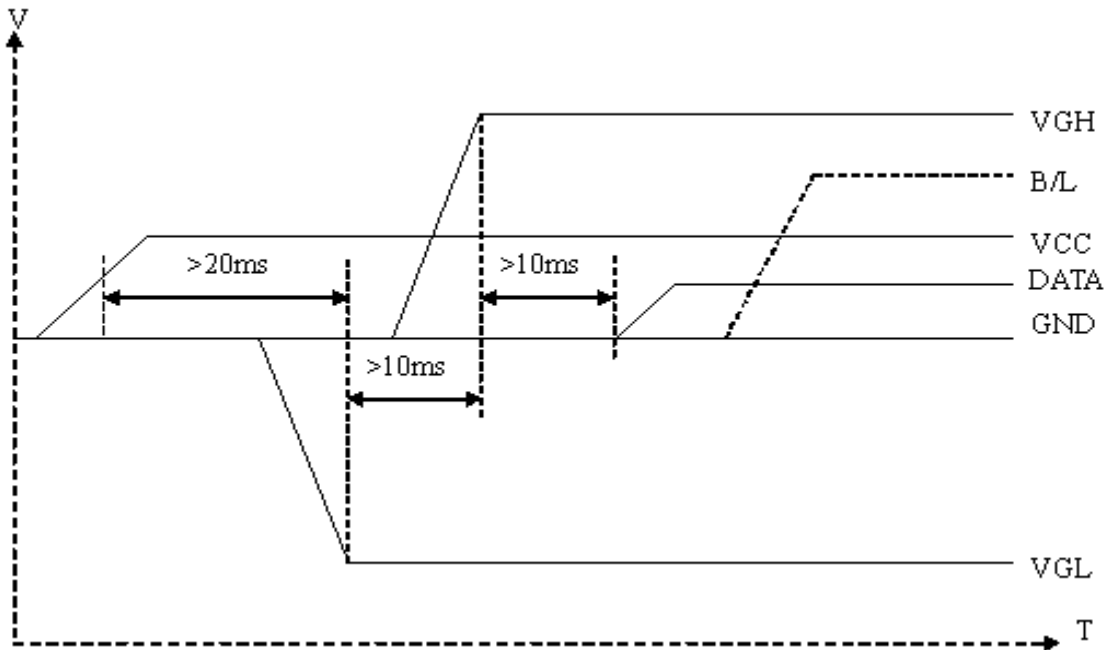
Note 1: The “LED life time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25°C and I_L =20mA.

Note 2: The LED driving condition is defined for each LED module.(3 LED Serial)



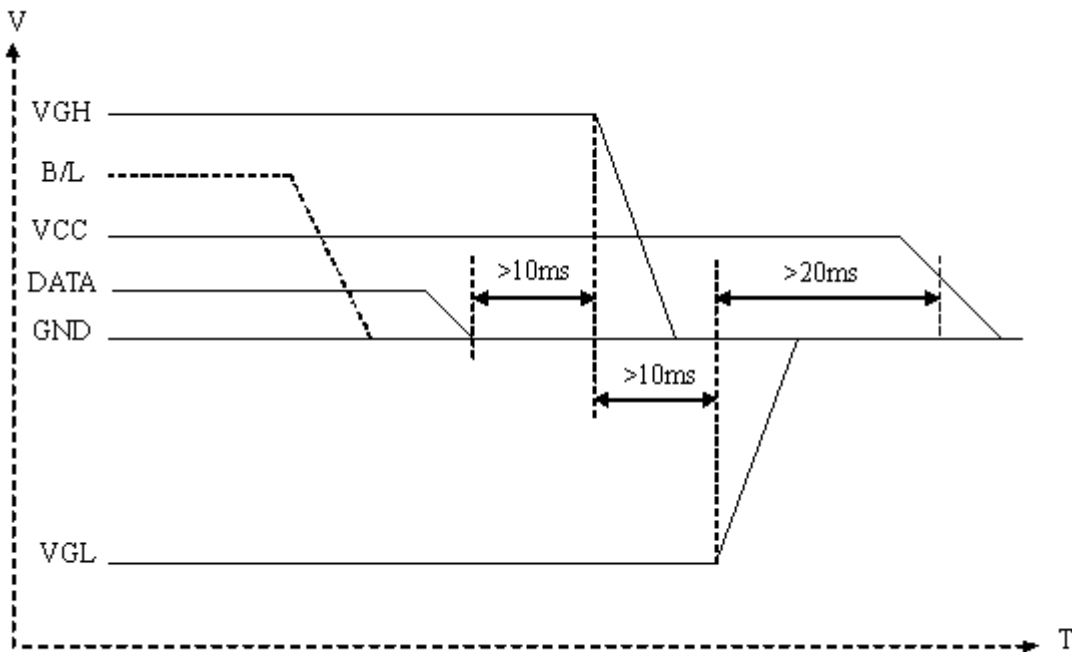
3.2. Power Sequence

3.2.1. Power on:



VCC → VGL → VGH → Data → B/L

3.2.2. Power off:



B/L → Data → VGH → VGL → VCC

3.3. Timing Characteristics

3.3.1. Timing Conditions

| Item | Symbol | Values | | | Unit | Remark |
|---------------------------------|--------|--------|------|------|------|--------|
| | | Min. | Typ. | Max. | | |
| DCLK frequency | Fdclk | - | 40 | 45 | MHz | |
| DCLK cycle | Tcph | 22 | 25 | - | ns | |
| DCLK pulse width | Tcw | 8 | - | - | ns | |
| Data set-up time | Tsu | 4 | - | - | ns | |
| Data hold time | Thd | 2 | - | - | ns | |
| Time that the last data to LD | Tld | 1 | - | - | Tcph | |
| Pulse width of LD | Twld | 2 | - | - | Tcph | |
| Time that LD to STHL/R | Tlds | 5 | - | - | Tcph | |
| POL set-up time | Tpsu | 6 | - | - | ns | |
| POL hold time | Tphd | 6 | - | - | ns | |
| CKV frequency | Fvclk | - | - | 200 | KHz | |
| CKV rise time | Trck | - | - | 100 | ns | |
| CKV falling time | Tfck | - | - | 100 | ns | |
| CKV pulse width | PWCLK | 500 | - | - | ns | |
| Horizontal display timing range | Tdh | - | 800 | - | Tcph | |
| Horizontal timing range | Th | - | 1056 | - | Tcph | |
| STVU/D setup time | Tsuv | 200 | - | - | ns | |
| STVU/D hold time | Thdv | 300 | - | - | ns | |
| STVU/D delay time | Tdt | - | - | 500 | ns | |
| Driver output delay time | Tdo | - | - | 900 | ns | |

| | | | | | | |
|---------------------------------|------|-----|-----|------|-----|--|
| Output rise time | Ttlh | - | 500 | 1000 | ns | |
| Output falling time | Tthl | - | 400 | 800 | ns | |
| OEV pulse width | Twcl | 1 | - | - | us | |
| OEV to Driver output delay time | Toe | - | - | 900 | ns | |
| Horizontal lines per field | Tv | 512 | 525 | 610 | Tdh | |
| Vertical display timing range | Tvd | - | 480 | - | Tdh | |

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3.3.2. Timing Diagram

Timing Diagram1 (CHNSL="1", Default)

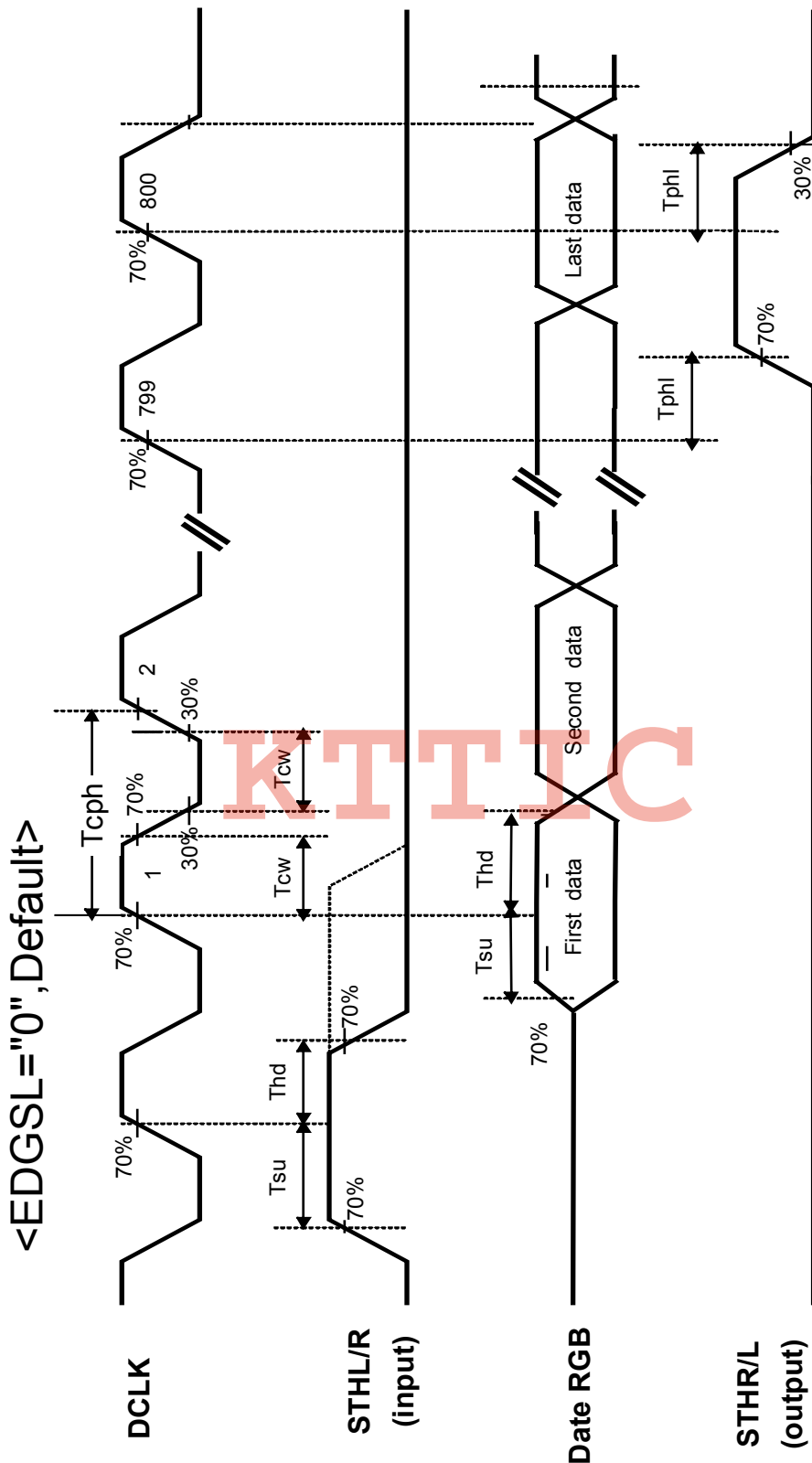


Fig.3-1 operation model 1

< EDGSL = "1">

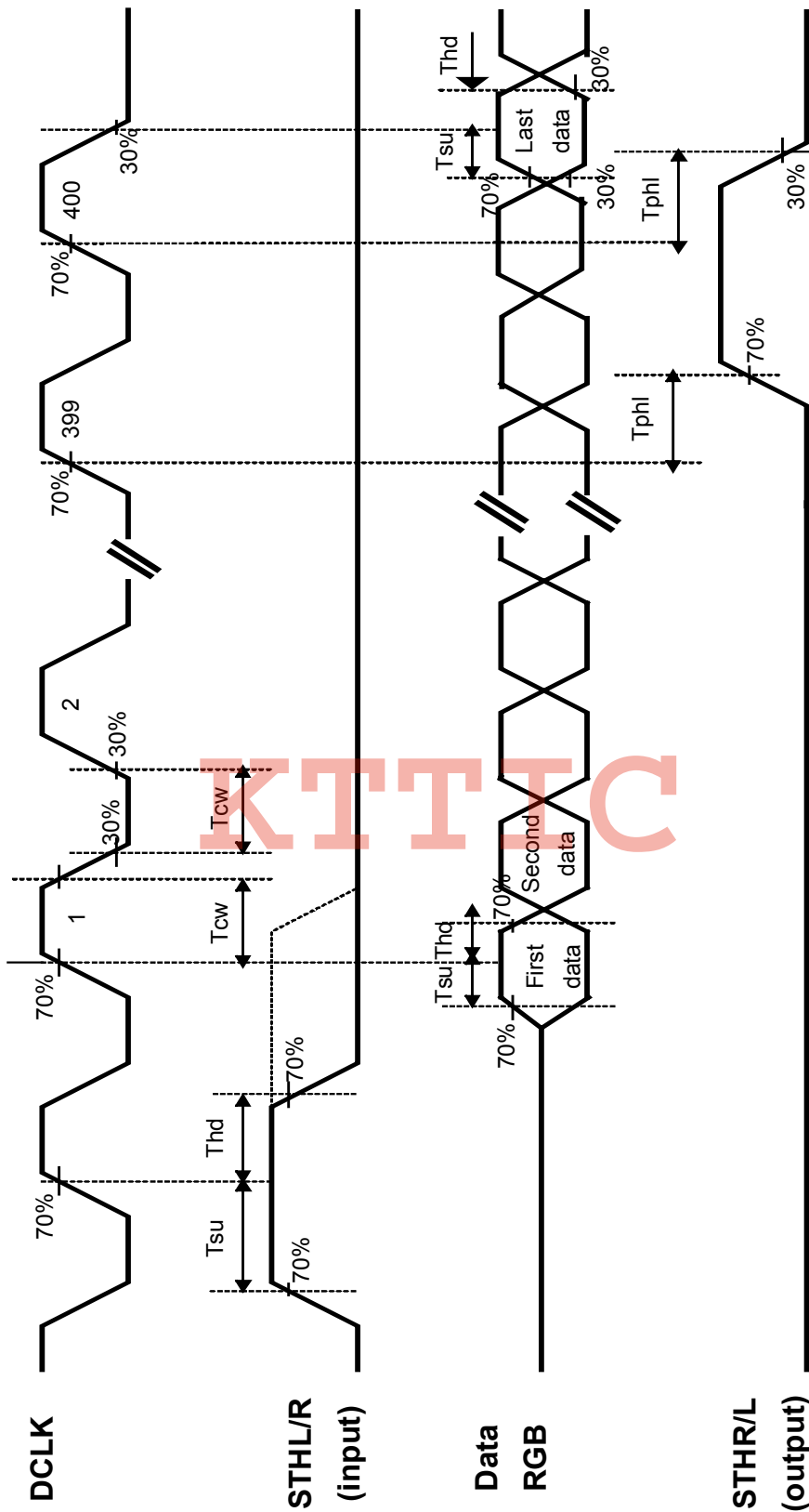


Fig.3-2 operation model 2

Timing Diagram 2

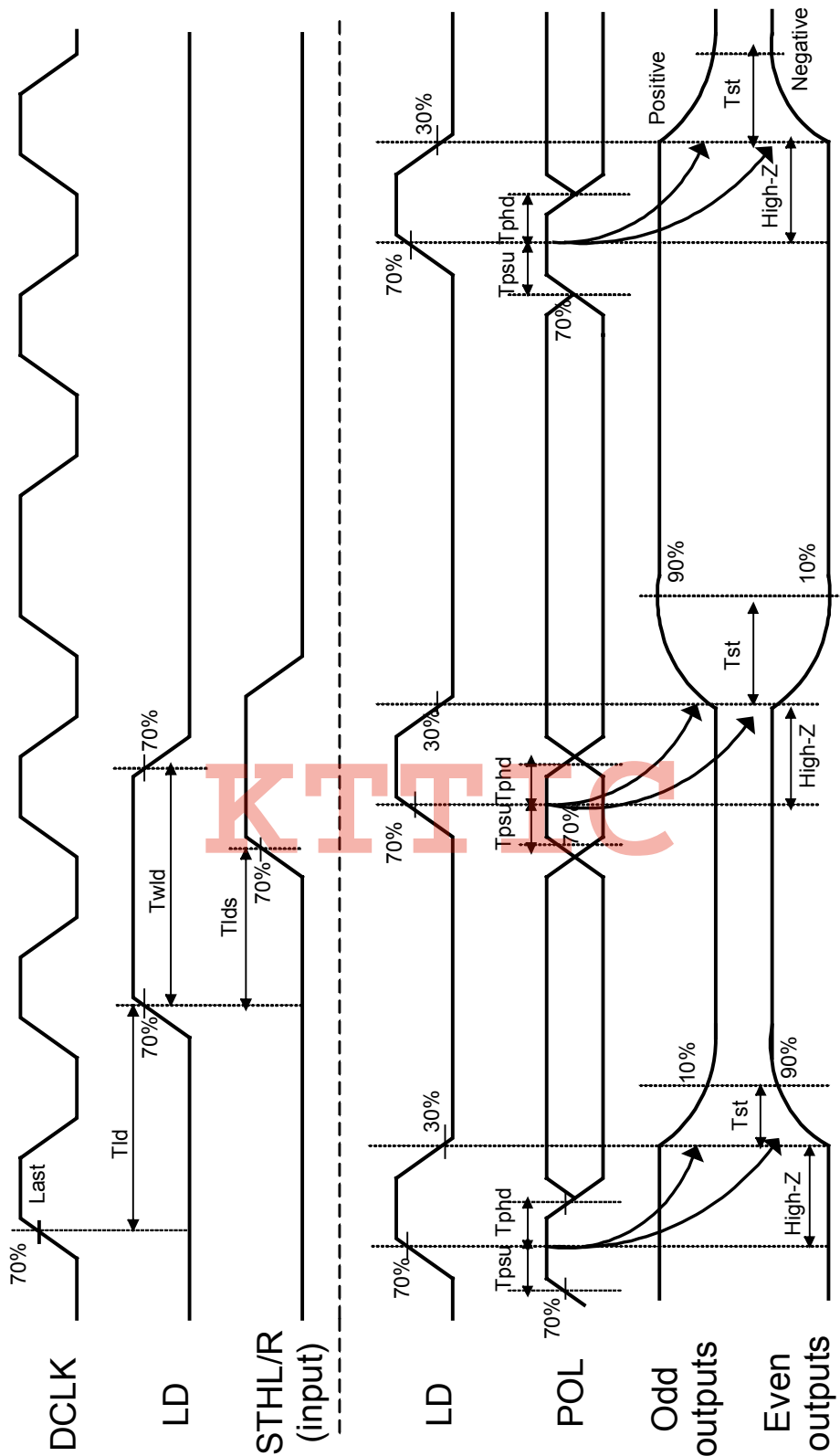


Fig.3-3 Horizontal timing 1

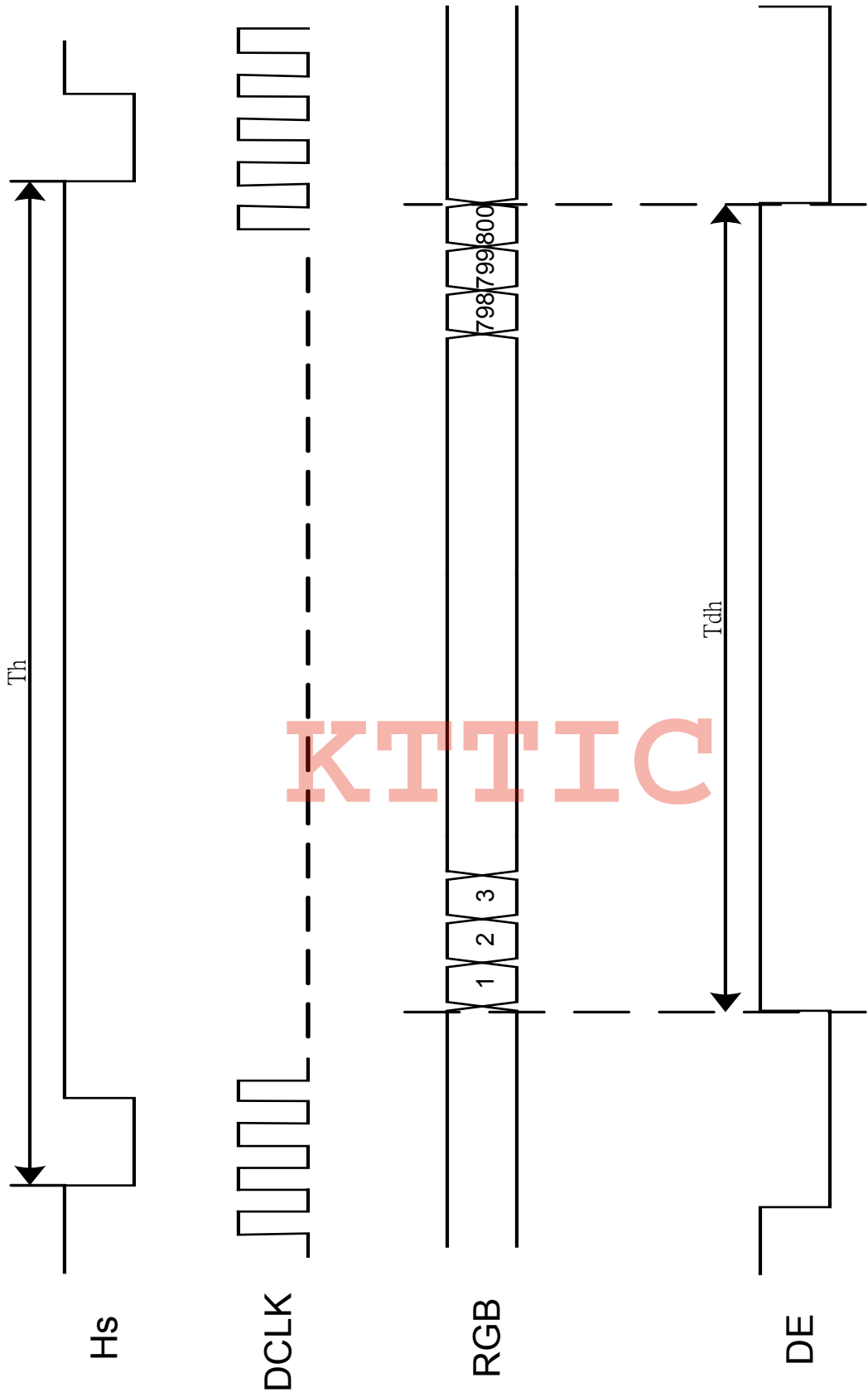


Fig.3-4 Horizontal timing 2

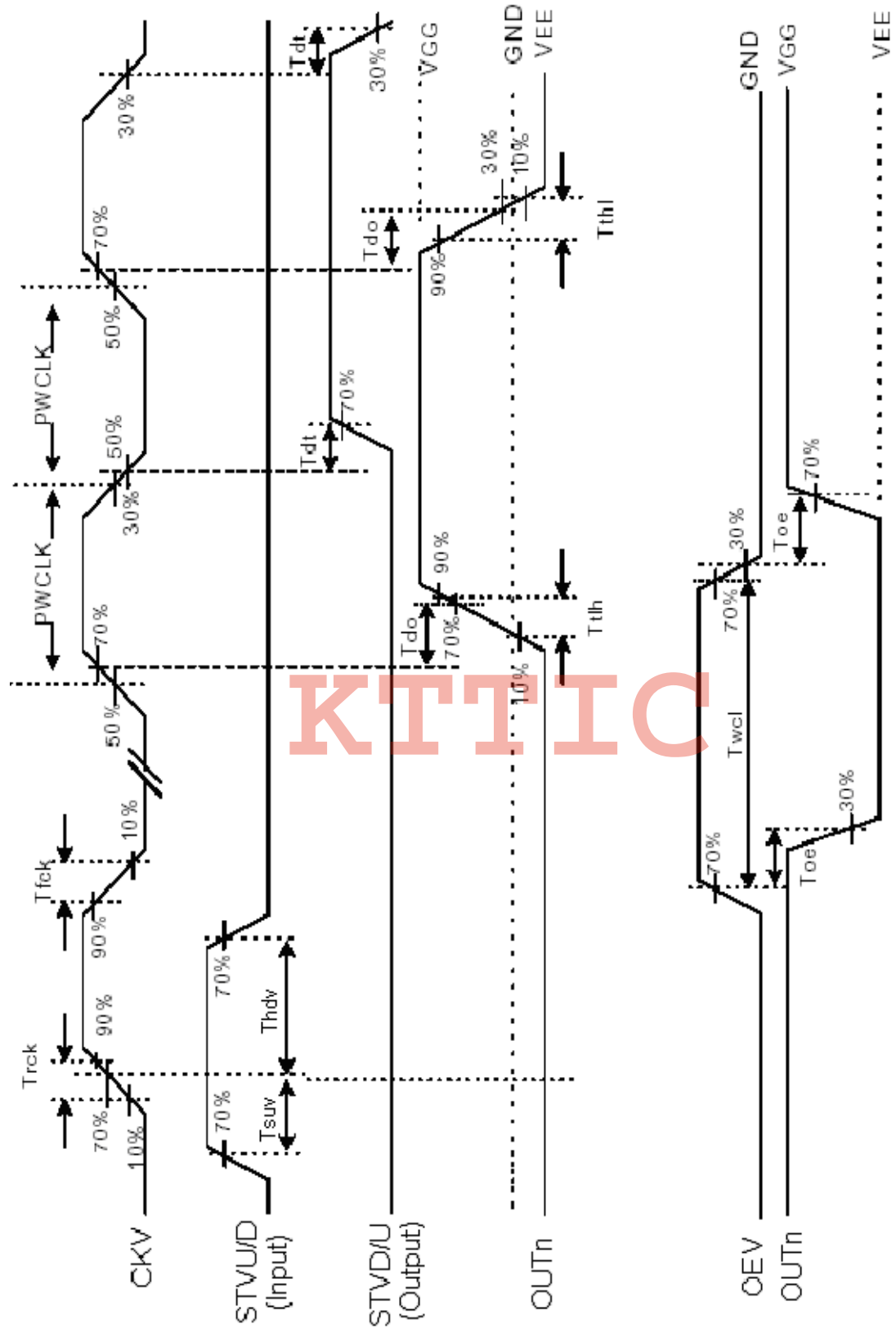


Fig.3-5 Vertical shift clock timing

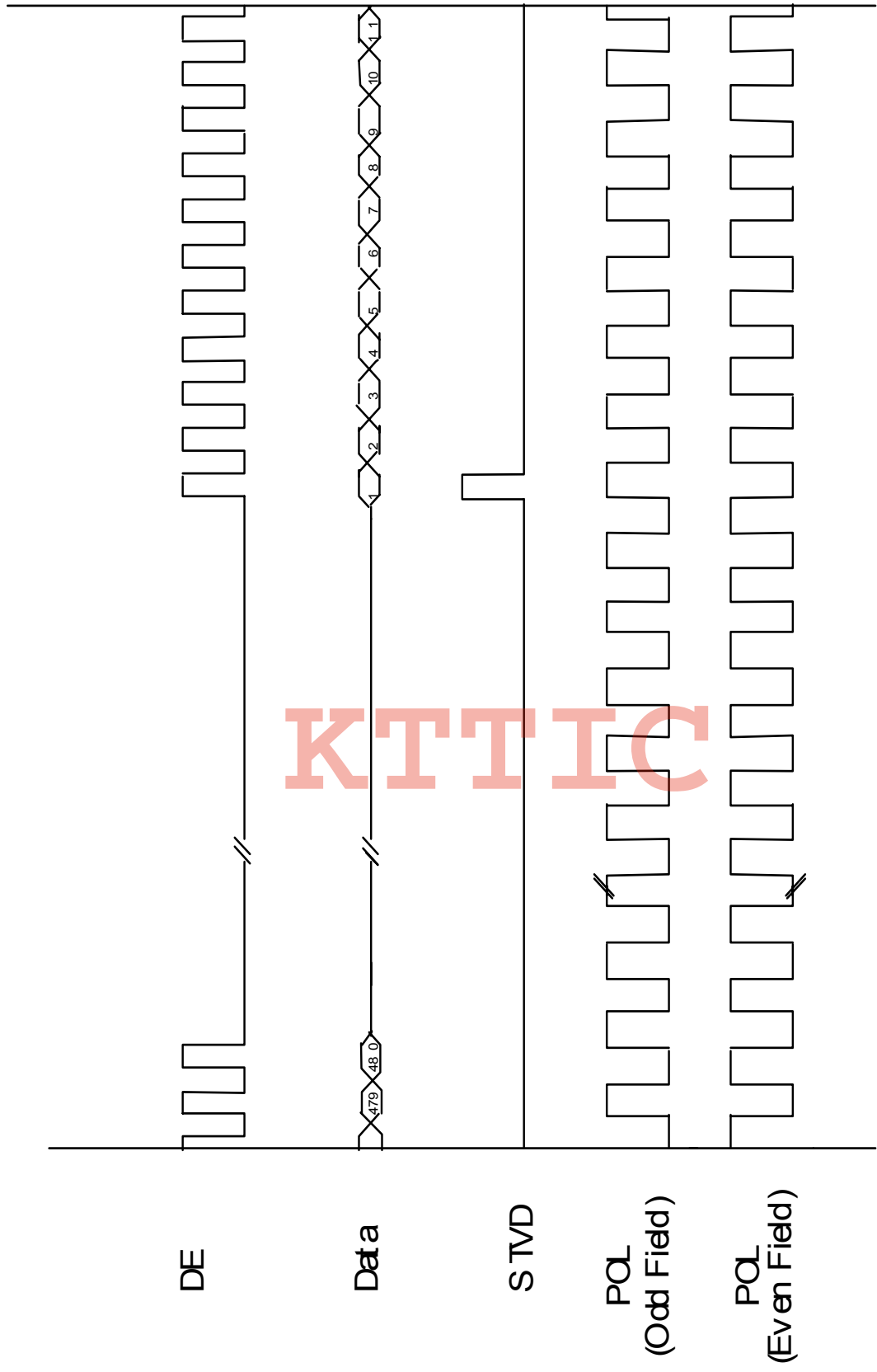


Fig.3-6 Vertical timing (from up to down)

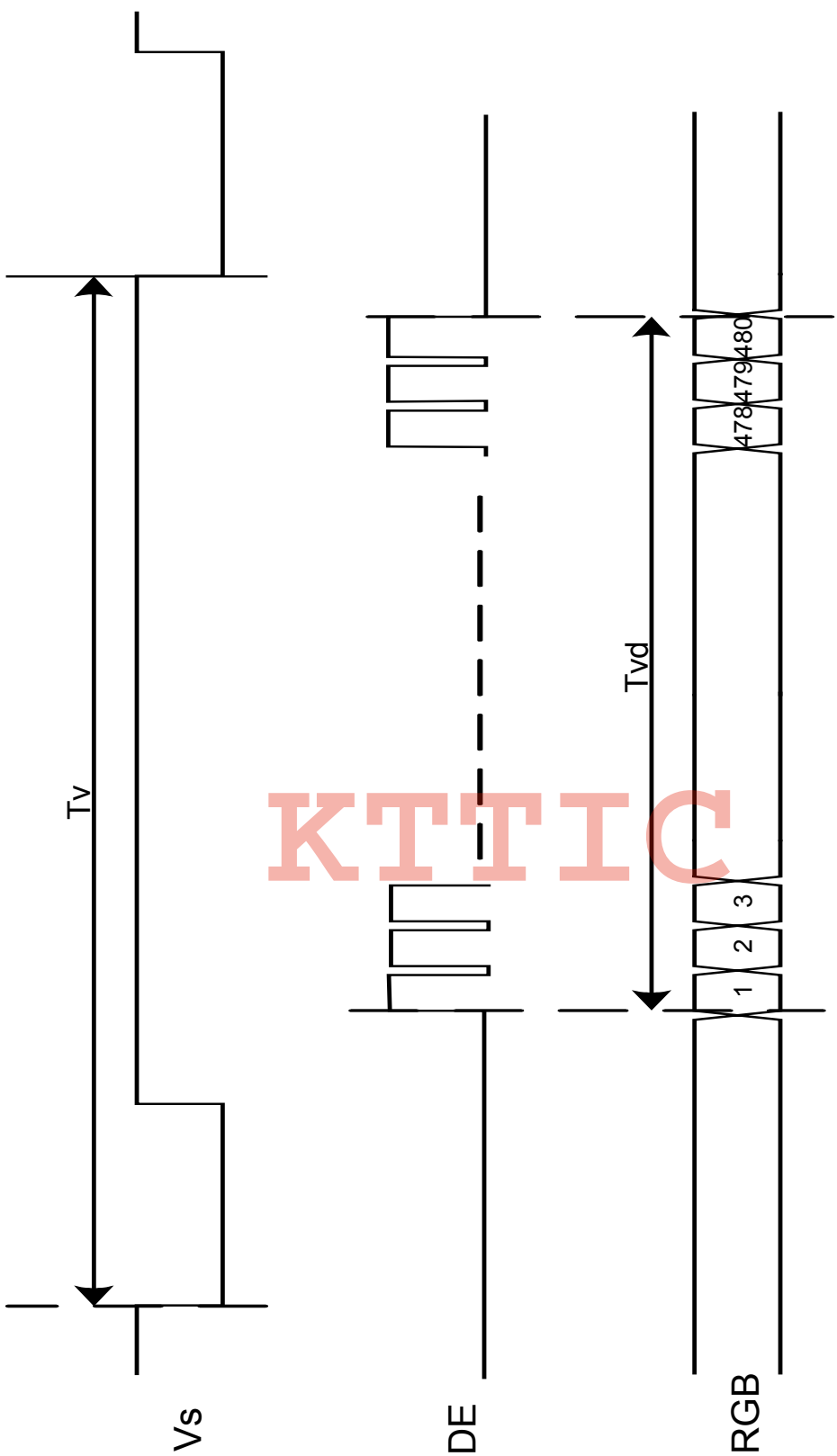


Fig.3-7 Vertical timing

4. Optical Specifications

| Item | Symbol | Condition | Values | | | Unit | Remark |
|---------------------------|------------|---------------------------------|--------|--------|--------|--------|------------------|
| | | | Min. | Typ. | Max. | | |
| Viewing angle (CR≥ 10) | θ_L | $\Phi=180^\circ$ (9 o'clock) | (70) | (80) | - | degree | Note 1 |
| | θ_R | $\Phi=0^\circ$ (3 o'clock) | (70) | (80) | - | | |
| | θ_T | $\Phi=90^\circ$ (12 o'clock) | (70) | (80) | - | | |
| | θ_B | $\Phi=270^\circ$ (6 o'clock) | (70) | (80) | - | | |
| Response time | T_{ON} | Normal $\theta=\Phi=0^\circ$ | - | (10) | (20) | msec | Note 3 |
| | T_{OFF} | | - | (15) | (30) | msec | Note 3 |
| Contrast ratio | CR | | (400) | (500) | - | - | Note 4 |
| Color chromaticity | W_X | | (0.26) | (0.31) | (0.36) | - | Note 2 |
| | W_Y | | (0.28) | (0.33) | (0.38) | - | Note 5 Note 6 |
| Luminance | L | | (250) | (300) | - | - | Note 6 |
| Luminance uniformity | Y_U | | 70 | 75 | - | % | Note 7 |

Test Conditions:

1. $V_{CC}=3.3V$, $I_L=20mA$ (Backlight current), the ambient temperature is $25^\circ C$.
2. The test systems refer to Note 2.

Note 1: Definition of viewing angle range

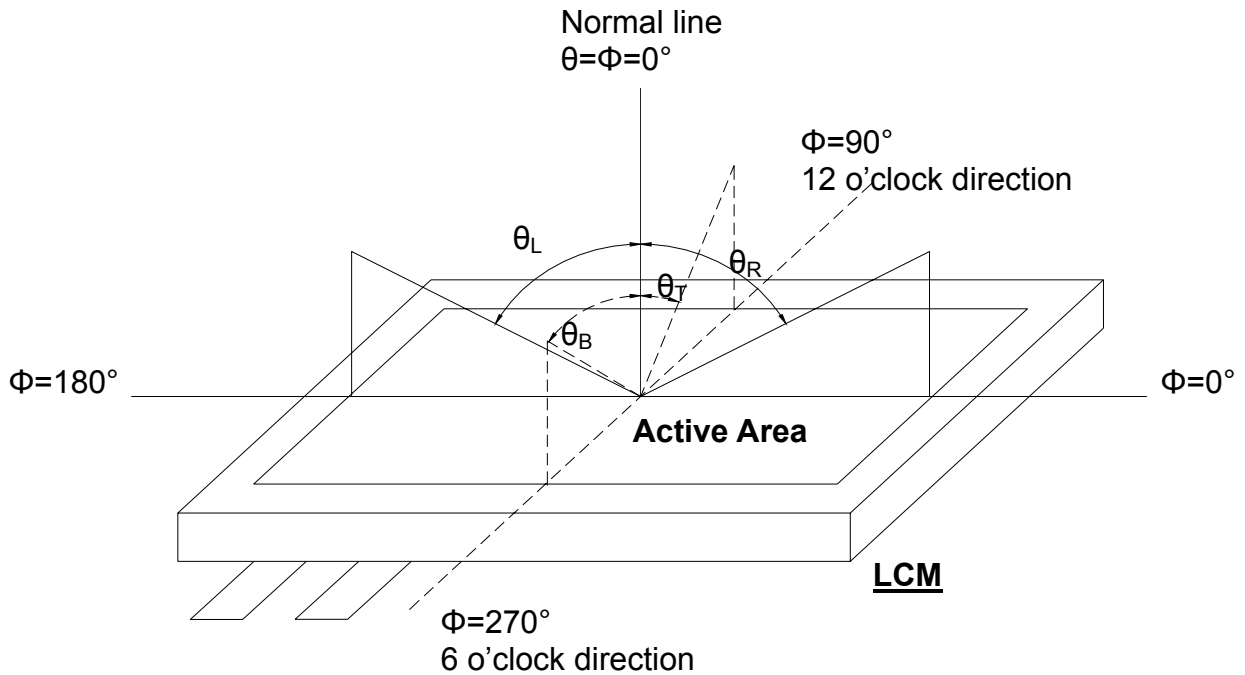


Fig. 4-1 Definition of viewing angle

Note 2: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 30 minutes operation, the optical properties are measured at the center point of the LCD screen. (Response time is measured by Photo detector TOPCON BM-7, other items are measured by BM-5A/Field of view: 1° /Height: 500mm.)

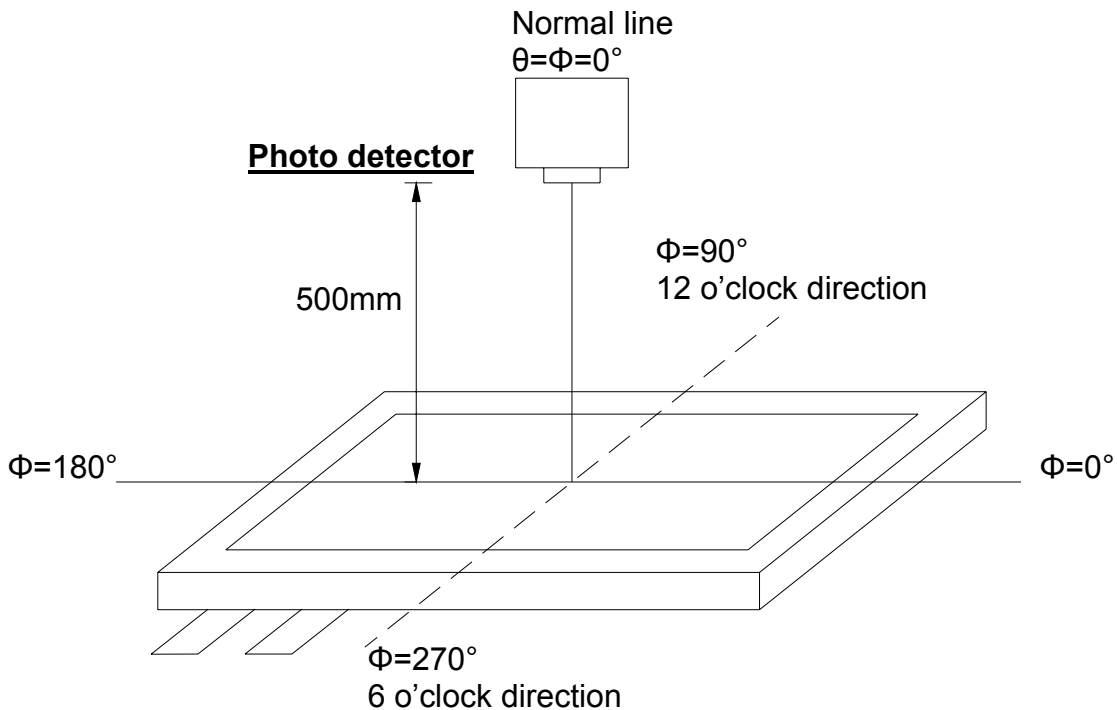


Fig. 4-2 Optical measurement system setup

Note 3: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.

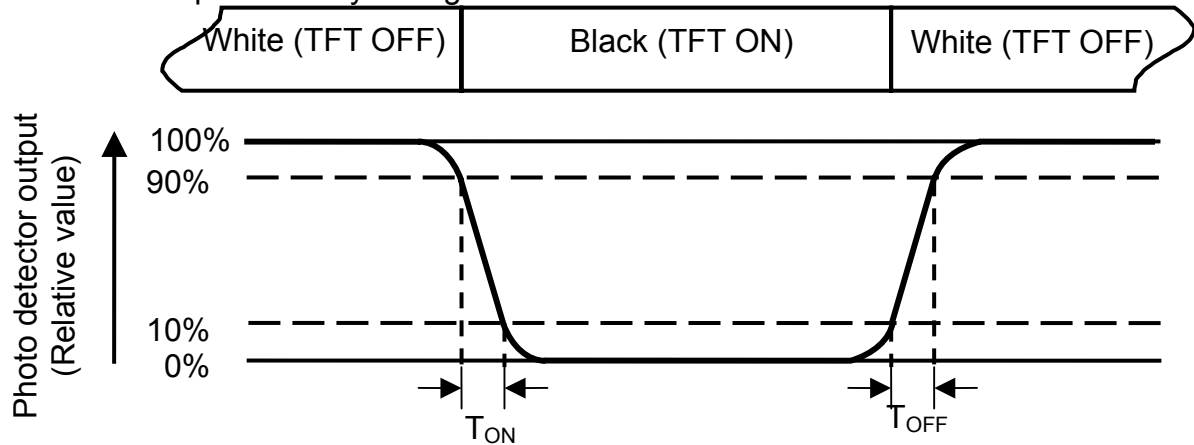


Fig. 4-3 Definition of response time

Note 4: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: All input terminals LCD panel must be ground while measuring the center area of the panel.

Note 7: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer to Fig. 4-4).Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (Yu)} = \frac{B_{min}}{B_{max}}$$

L-----Active area length W----- Active area width

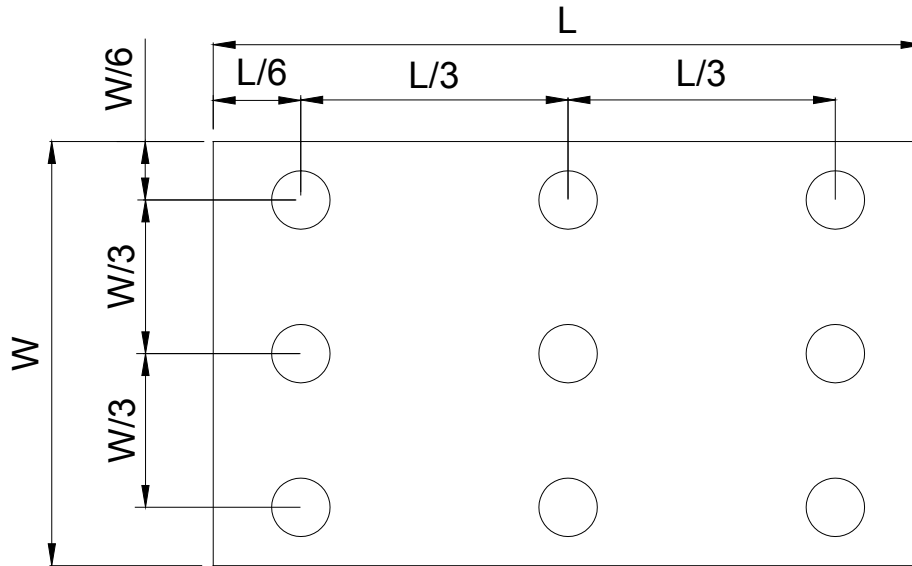


Fig. 4-4 Definition of measuring points

B_{max}: The measured maximum luminance of all measurement position.

B_{min}: The measured minimum luminance of all measurement position.

6. General Precautions

6.1. Safety

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

6.2. Handling

1. The LCD panel is plate glass. Do not subject the panel to mechanical shock or to excessive force on its surface.
2. The polarizer attached to the display is easily damaged. Please handle it carefully to avoid scratch or other damages.
3. To avoid contamination on the display surface, do not touch the module surface with bare hands.
4. Keep a space so that the LCD panels do not touch other components.
5. Put cover board such as acrylic board on the surface of LCD panel to protect panel from damages.
6. Transparent electrodes may be disconnected if you use the LCD panel under environmental conditions where the condensation of dew occurs.
7. Do not leave module in direct sunlight to avoid malfunction of the ICs.

6.3. Static Electricity

1. Be sure to ground module before turning on power or operating module.
2. Do not apply voltage which exceeds the absolute maximum rating value.

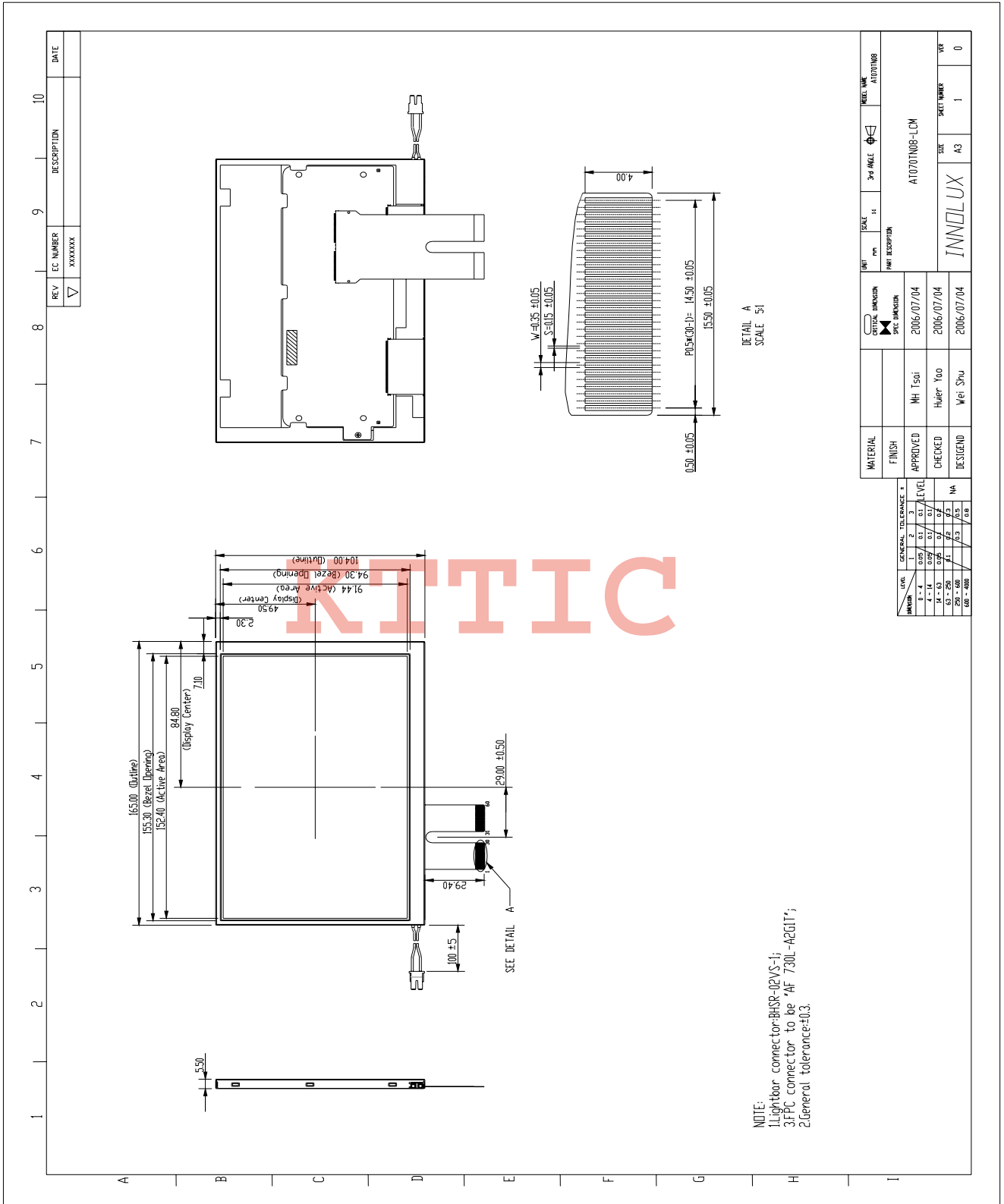
6.4. Storage

1. Store the module in a dark room where must keep at $25\pm 10^{\circ}\text{C}$ and 65%RH or less.
2. Do not store the module in surroundings containing organic solvent or corrosive gas.
3. Store the module in an anti-electrostatic container or bag.

6.5. Cleaning

1. Do not wipe the polarizer with dry cloth. It might cause scratch.
2. Only use a soft sloth with IPA to wipe the polarizer, other chemicals might permanent damage to the polarizer.

7. Mechanical Drawing



NOTE:
 1 Lightbar connector-BHSR-02/S-1j
 2 FPC connector to be "AF 7301-A2G1T";
 3 General tolerance ± 0.3 .

DETAIL A
 SCALE 5:1

| REV | EC NUMBER | DESCRIPTION | DATE |
|-----|-----------|-------------|------|
| ▽ | XXXXXX | | |

| | | | |
|------------|------------|------------|------------|
| DATE | SCALE | 3rd ANGLE | WELD LINE |
| 2006/07/04 | 1:1 | 1:1 | AT070T08 |
| APPROVED | CHK | INSP | DATE |
| MH Tsai | 2006/07/04 | 2006/07/04 | 2006/07/04 |
| CHECKED | Hsueh Tsoo | 2006/07/04 | 2006/07/04 |
| DESIGNED | Wei Shu | 2006/07/04 | 2006/07/04 |

| LEVEL | GENERAL TOLERANCE | | |
|-------------|-------------------|-----|------|
| | 1 | 2 | 3 |
| B-4 | 0.05 | 0.1 | 0.15 |
| A-3 | 0.05 | 0.1 | 0.15 |
| A-2 | 0.05 | 0.1 | 0.15 |
| A-1 | 0.05 | 0.1 | 0.15 |
| 0.5 - 0.05 | 0.3 | 0.5 | 0.8 |
| 0.05 - 0.00 | 0.3 | 0.5 | 0.8 |

| | | | | | |
|----------|--------|----------|------------|------------|------------|
| MATERIAL | FINISH | APPROVED | CHK | INSP | DATE |
| | | MH Tsai | 2006/07/04 | 2006/07/04 | 2006/07/04 |
| | | CHECKED | Hsueh Tsoo | 2006/07/04 | 2006/07/04 |
| | | DESIGNED | Wei Shu | 2006/07/04 | 2006/07/04 |

| | | | |
|--------------|-------|-----------|-----------|
| WAVE | SCALE | 3rd ANGLE | WELD LINE |
| AT070T08-LCM | 1:1 | 1:1 | AT070T08 |
| DATE | SCALE | 3rd ANGLE | WELD LINE |
| 2006/07/04 | 1:1 | 1:1 | AT070T08 |

8. Package Drawing

8.1. Packaging Material Table

| No. | Item | Model (Material) | Dimensions(mm) | Unit Weight (kg) | Quantity | Remark |
|-----|----------------|---------------------|----------------|------------------|----------|--------|
| 1 | LCM Module | AT070TN08 | 165X104X5.5 | TBD | 50pcs | |
| 2 | Partition | BC Corrugated Paper | 512×349×226 | 1.466 | 1 set | |
| 3 | Corrugated Bar | B Corrugated Paper | 512X11X3 | 0.046 | 4 set | |
| 4 | Dust-Proof Bag | PE | 700X530 | 0.048 | 1 pcs | |
| 5 | A/S Bag | PE | 180×160×0.05 | 0.002 | 50 pcs | |
| 6 | Carton | Corrugated paper | 530*355*255 | 1.100 | 1 pcs | |
| 7 | Total weight | TBD | | | | |

8.2. Packaging Quantity

| | | | | |
|--|----------|------------------|----|------|
| Total LCM quantity in Carton: no. of Partition | 2 Rows x | quantity per Row | 25 | = 50 |
|--|----------|------------------|----|------|

8.3. Packaging Drawing

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