

MODEL NO. : TM097TDH02ISSUED DATE: 2011-5-12VERSION : Ver. 1.0☒ Preliminary Specification☐ Final Product Specification

Customer : _____

| Approved by | Notes |
|-------------|-------|
| | |

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This technical specification is subjected to change without notice

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Record of Revision

[illegible]



1 General Specifications

| Feature | | Spec |
|----------------------------|---------------------------------|-------------------------|
| Display Spec | Size | 9.7 inch |
| | Resolution | 1024 (RGB) x 768 |
| | Interface | LVDS 6-bit |
| | Color Depth | 16.7M |
| | Technology Type | a-Si |
| | Pixel Pitch (mm) | 0.192 (H) x 0.192 (V) |
| | Pixel Configuration | R.G.B. Vertical Stripe |
| | Display Mode | TM with Normally White |
| | Surface Treatment(Up Polarizer) | Anti Glare(3H) |
| | Viewing Direction | 3 o'clock |
| | Gray Scale Inversion Direction | 9 o'clock |
| Mechanical Characteristics | Active Area(mm) | 196.61 (W) x 147.46 (H) |
| | With /Without TSP | Without TSP |
| | Weight (g) | TBD |
| | LED Numbers | 36 LEDs |

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: RoHS

Note 3: LCM weight tolerance: +/- 5%



2 Input/Output Terminals

2.1 CN1 of FPC

| Pin No. | Symbol | I/O | Function | Remarks |
|---------|---------------------|-----|---------------------------------------|---------|
| 1 | GND | P | Ground | - |
| 2 | VCC | P | Power supply 3.3V | - |
| 3 | VCC | P | Power supply 3.3V | - |
| 4 | V EEDID | P | DDC 3.3V | - |
| 5 | GSP | - | GSP | - |
| 6 | Clk EEDID | I | DDC clock | - |
| 7 | Data EEDID | I | DDC data | - |
| 8 | R _{IN} 0- | I | Negative LVDS differential data input | - |
| 9 | R _{IN} 0+ | I | Positive LVDS differential data input | - |
| 10 | GND | P | Ground | - |
| 11 | R _{IN} 1- | I | Negative LVDS differential data input | - |
| 12 | R _{IN} 1+ | I | Positive LVDS differential data input | - |
| 13 | GND | P | Ground | - |
| 14 | R _{IN} 2- | I | Negative LVDS differential data input | - |
| 15 | R _{IN} 2+ | I | Positive LVDS differential data input | - |
| 16 | GND | P | Ground | - |
| 17 | Clk _{IN} - | I | Negative LVDS differential data input | - |
| 18 | Clk _{IN} + | I | Positive LVDS differential data input | - |
| 19 | GND | P | Ground | - |
| 20 | NC | - | No connection | - |
| 21 | Vdc | P | LED Anode (positive) | - |
| 22 | Vdc | P | LED Anode (positive) | - |
| 23 | NC | - | No connection | - |
| 24 | Vdc 1 | P | LED Anode (Negative) | - |
| 25 | Vdc 2 | P | LED Anode (Negative) | - |
| 26 | Vdc 3 | P | LED Anode (Negative) | - |
| 27 | Vdc 4 | P | LED Anode (Negative) | - |
| 28 | Vdc 5 | P | LED Anode (Negative) | - |
| 29 | Vdc 6 | P | LED Anode (Negative) | - |
| 30 | NC | - | No connection | - |

Note: I/O definition.

I---Input pin, O---Output pin, P--- Power/Ground, N--- No Connection



3 Absolute Maximum Ratings

AGND= GND=0V, Ta = 25°C

| Item | Symbol | Min | Max | Unit | Remark |
|-----------------------|------------------|--------|------|------|--------|
| Power Voltage | DVDD | -0.5 | 5.0 | V | |
| | AVDD | -0.5 | 13.5 | V | |
| | VGH | -0.3 | +42 | V | |
| | VGL | VGH-42 | +0.3 | V | |
| Operating Temperature | T _{OPR} | -20 | 70 | °C | |
| Storage Temperature | T _{STG} | -30 | 80 | °C | |



4 Electrical Characteristics

4.1 Recommended Operating Condition

AGND=GND=0V, Ta = 25°C

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---------------------------------|--------|-----|--------|-----|------|--------|
| Digital Supply Voltage | DVDD | 3.0 | 3.3 | 3.6 | V | |
| Analog Supply Voltage | AVDD | - | 11 | - | V | |
| Gate On Voltage | VGH | - | 22.375 | - | V | |
| Gate Off Voltage | VGL | - | -7.0 | - | V | |
| Common Electrode Driving Signal | VCOM | - | 3.9 | - | V | |

Note: The value is for design stage only.



4.2 Recommended Driving Condition for Backlight

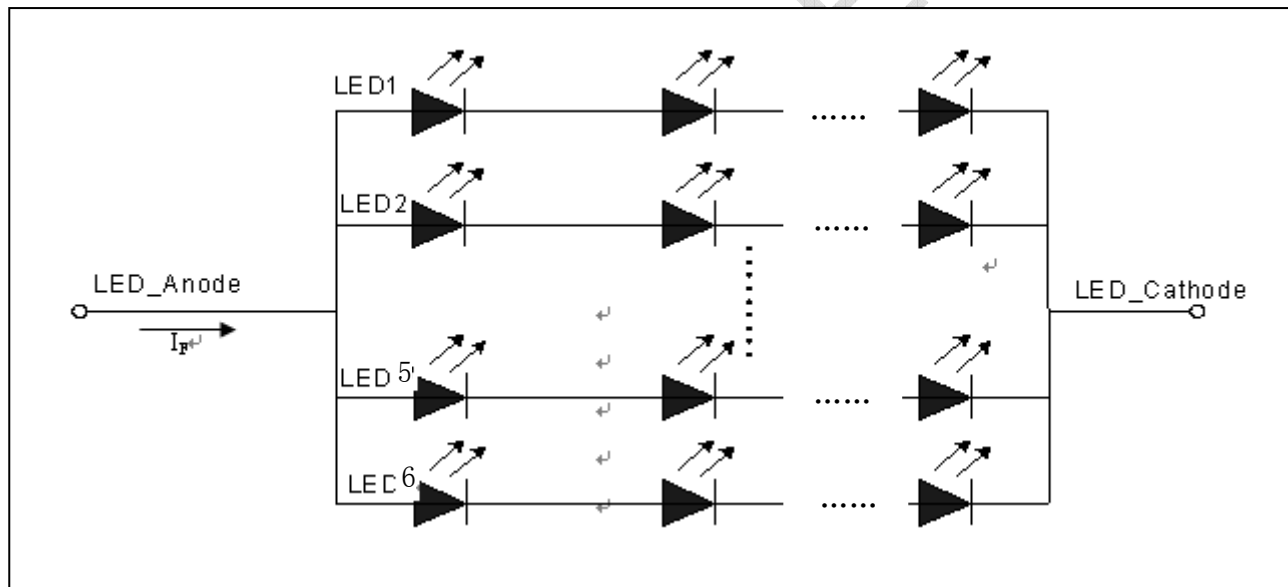
 $T_a=25^{\circ}\text{C}$

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---------------------|--------|-----|-------|-----|------|--|
| Forward Current | I_F | | 120 | | mA | 36 LEDs (6 LED Serial, 6 LED Parallel) |
| Forward Voltage | V_F | | 19.2 | | V | |
| Operating Life Time | - | | 30000 | - | Hrs | |

Note1: For each LED: $I_F (1/6) = 20\text{mA}$, $V_F (1/6) = 3.2\text{V}$.

Note2: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: I_F is defined for one channel LED. Optical performance should be evaluated at $T_a=25^{\circ}\text{C}$ only. If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.



Note4: The LED driving condition is defined for each LED module.



4.3 Power Consumption

AGND=GND=0V, Ta = 25°C

| Item | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|------------------------|-------------|-------------|-----|-----|-----|------|--------|
| Digital Supply Current | I_{DVDD} | DVDD=3.3V | - | TBD | TBD | mA | |
| Analog Supply Current | I_{AVDD} | AVDD=11V | - | TBD | TBD | mA | |
| Gate On Current | I_{VGH} | VGH=22.375V | - | TBD | TBD | mA | |
| Gate Off Current | I_{VGL} | VGL=-7.0V | - | TBD | TBD | mA | |
| Power Consumption | Panel&Gamma | | - | TBD | TBD | mW | |
| | Backlight | | - | TBD | TBD | W | |
| | Total | | - | TBD | TBD | W | |

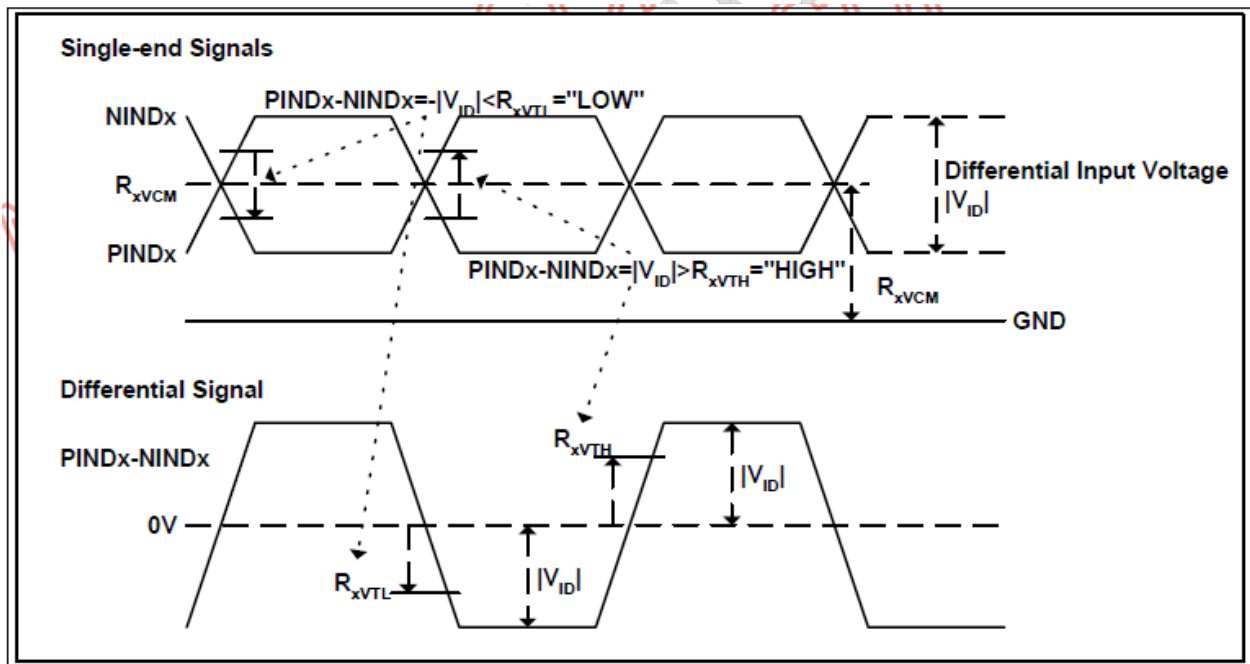


5 Timing Chart

5.1 TFT-LCD Input Timing

DC specification

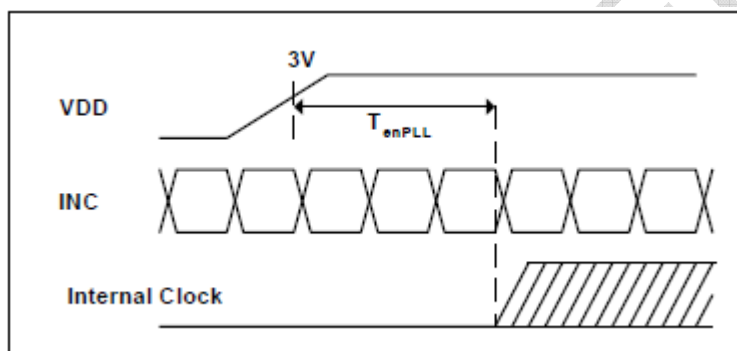
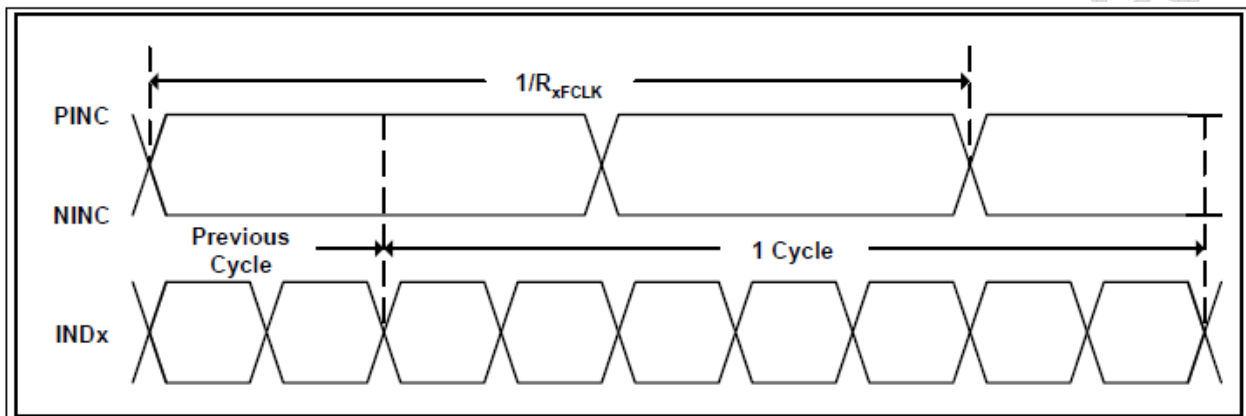
| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|---|--------------|--------------|------|--------------------|---------|-----------------------------------|
| Differential input high threshold voltage | R_{xVTH} | | | +0.1 | V | $R_{xVCM} = 1.2V$ |
| Differential input low threshold voltage | R_{xVTL} | -0.1 | | | V | |
| Input voltage range (singled-end) | R_{xVIN} | 0 | | 2.4 | V | |
| Differential input common mode voltage | R_{xVCM} | $ V_{ID} /2$ | | $2.4 - V_{ID} /2$ | V | |
| Differential input voltage | $ V_{ID} $ | 0.2 | | 0.6 | V | |
| Differential input leakage current | RV_{xliz} | -10 | | +10 | μA | |
| LVDS Digital Operating Current | I_{ddlvds} | - | 40 | 50 | mA | Fclk=65 MHz, VDD=3.3V |
| LVDS Digital Stand-by Current | I_{stlvds} | - | 10 | 50 | μA | Clock & all Functions are stopped |

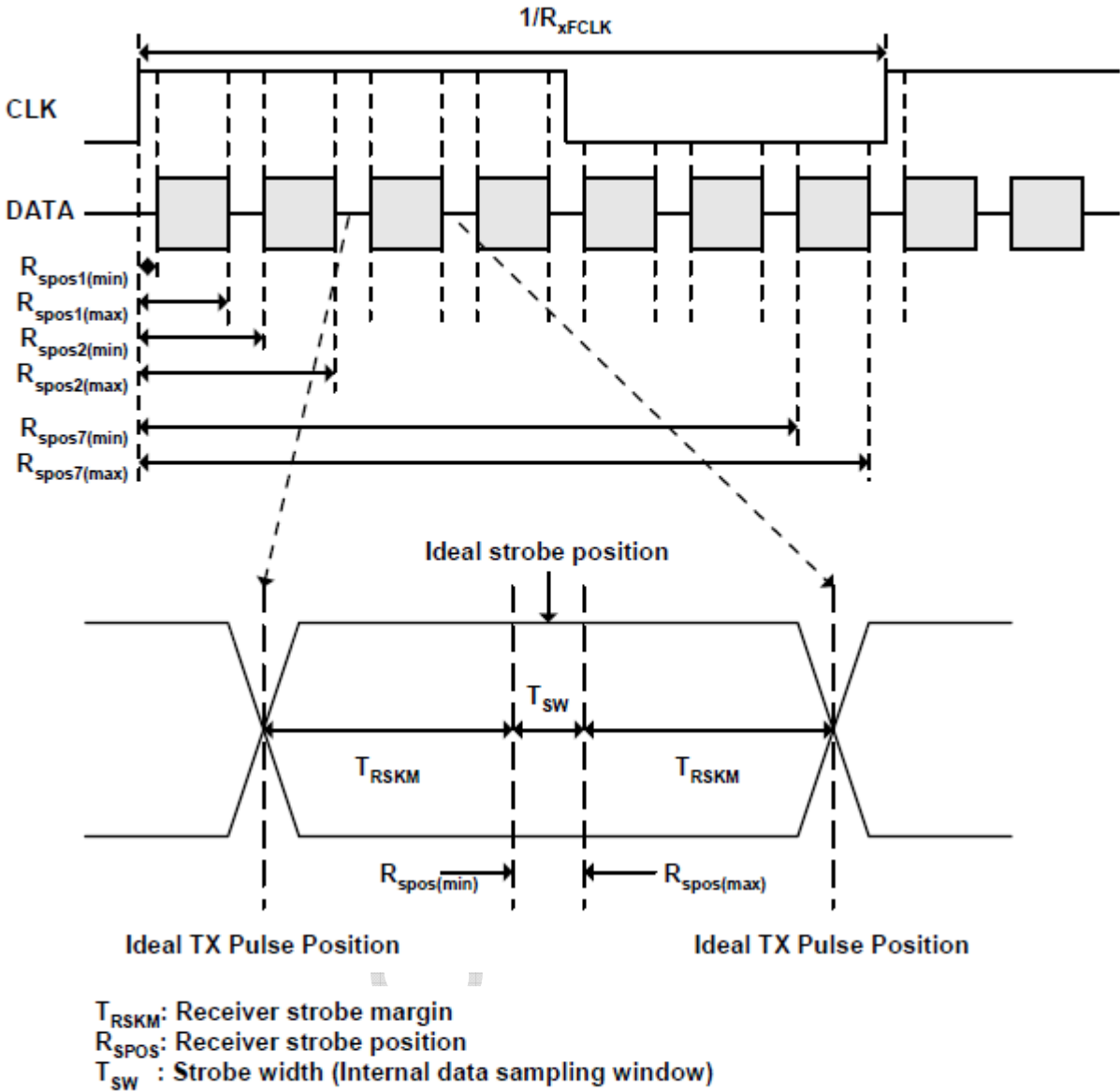




AC specification

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Condition |
|------------------------|-------------|------|--------------------|------|------|--|
| Clock frequency | R_{xCLK} | 20 | | 71 | MHz | |
| Input data skew margin | T_{RSKM} | 500 | | | pS | $ V_{ID} = 400mV$ $R_{xVCM} = 1.2V$ $R_{xCLK} = 71 MHz$ |
| Clock high time | T_{LVCH} | | $4/(7 * R_{xCLK})$ | | ns | |
| Clock low time | T_{LVCL} | | $3/(7 * R_{xCLK})$ | | ns | |
| PLL wake-up time | T_{enPLL} | | | 150 | uS | |





| SSC tolerance of LVDS receiver | | | | | | |
|--------------------------------|----------------------|-------------------------------------|------|------|---------|-------|
| Symbol | parameter | condition | Min. | Typ. | Max. | Units |
| SSCMF | Modulation Frequency | | 23 | | 93 | KHz |
| SSCMR | Modulation Rate | LVDS clock = 71MHz center spread | | | ± 3 | % |

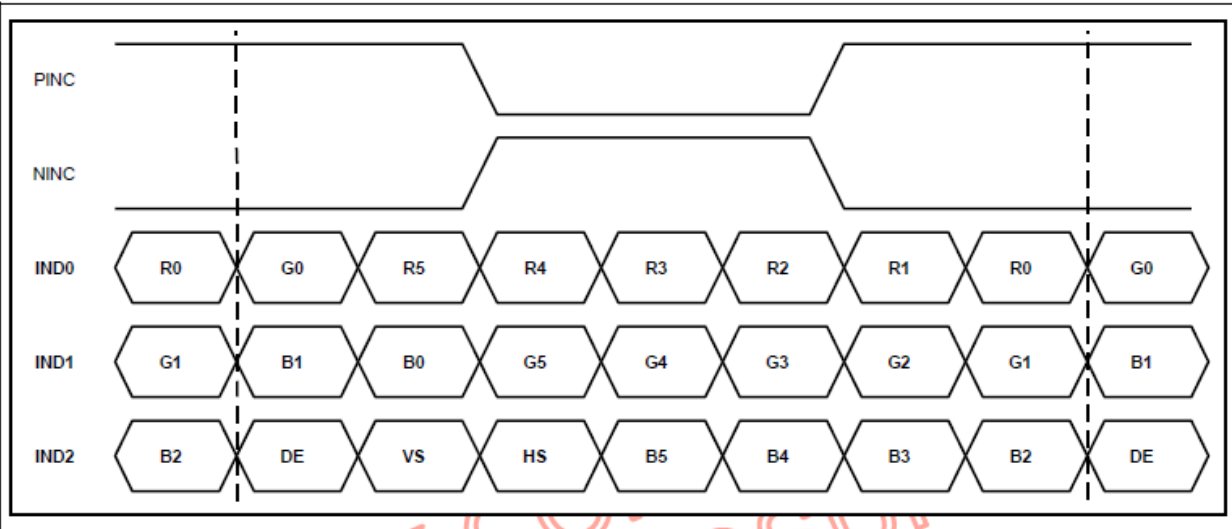


5.2 Timing Setting Of Signal

Input Timing Of Connector

| Parameter | Symbol | Min | Typ | Max | Unit | Remark |
|-----------|------------------|------|--------|------|------------------|--------|
| DCLK | F _{clk} | 97 | 100.03 | 103 | MHZ | |
| Hsync | T _{hp} | 1024 | 1024 | 1024 | t _{clk} | |
| | t _{WH} | 1960 | 2084 | 2223 | t _{clk} | |
| | t _{WHA} | 240 | 320 | 400 | t _{clk} | |
| Vsync | T _{hp} | 768 | 768 | 768 | t _{hp} | |
| | t _{WV} | 776 | 800 | 824 | t _{hp} | |
| | t _{WVA} | 3 | 10 | 17 | t _{hp} | |

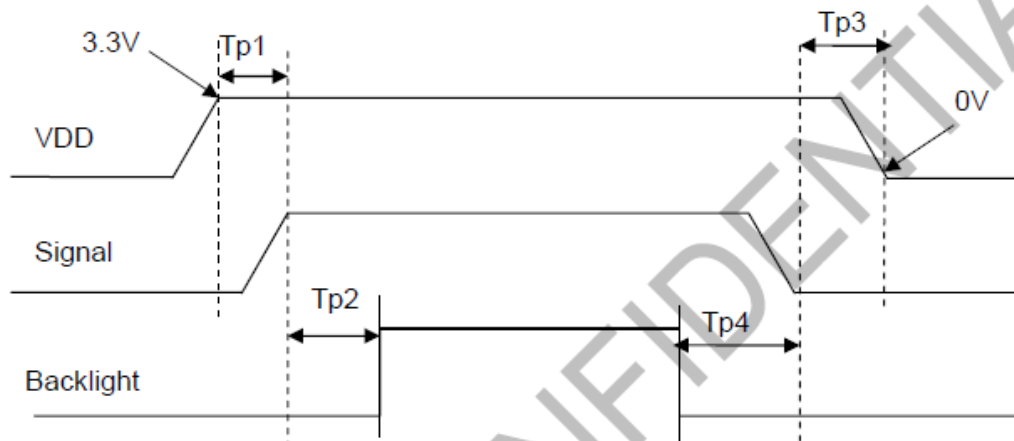
Date input:





5.3 POWER ON/OFF SEQUENCE

| Item | Symbol | Min | Typ | Max | Unit | Remark |
|---------------------------------|--------|-----|-----|-----|------|--------|
| VDD to signal starting | Tp1 | 5 | - | 50 | ms | |
| Signal starting to backlight on | Tp2 | 150 | - | - | ms | |
| Signal off to VDD 3.0V | Tp3 | 5 | - | 50 | ms | |
| Backlight off to signal off | Tp4 | 150 | - | - | ms | |





6 Optical Characteristics

Ta=25℃

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|----------------|-------|------------------|-----------------|-----|-------|-----|-------------------|----------------|
| View Angles | | θT | CR≥10 | | 70 | - | Degree | Note 2 |
| | | θB | | | 70 | - | | |
| | | θL | | | 70 | - | | |
| | | θR | | | 60 | - | | |
| Contrast Ratio | | CR | θ=0° | | 500 | - | | Note1 Note3 |
| Response Time | | T _{ON} | 25℃ | - | 20 | | ms | Note1 Note4 |
| | | T _{OFF} | | | | | | |
| Chromaticity | White | x | Backlight is on | - | 0.313 | - | | Note1 Note5 |
| | | y | | - | 0.329 | - | | |
| | Red | x | | - | TBD | - | | |
| | | y | | - | TBD | - | | |
| | Green | x | | - | TBD | - | | |
| | | y | | - | TBD | - | | |
| | Blue | x | | - | TBD | - | | |
| | | y | | - | TBD | - | | |
| Uniformity | | U | | - | 75 | -- | % | Note1 Note6 |
| NTSC | | | | - | 50 | - | % | Note 5 |
| Luminance | | L | | - | 350 | - | cd/m ² | Note1 Note7 |

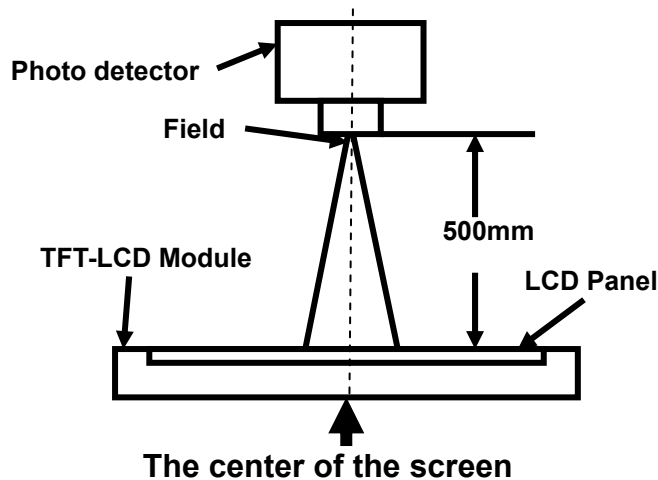
Test Conditions:

1. $I_F = 120 \text{ mA}$, $V_F = 19.2 \text{ V}$ and the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.



Note 1: Definition of optical measurement system.

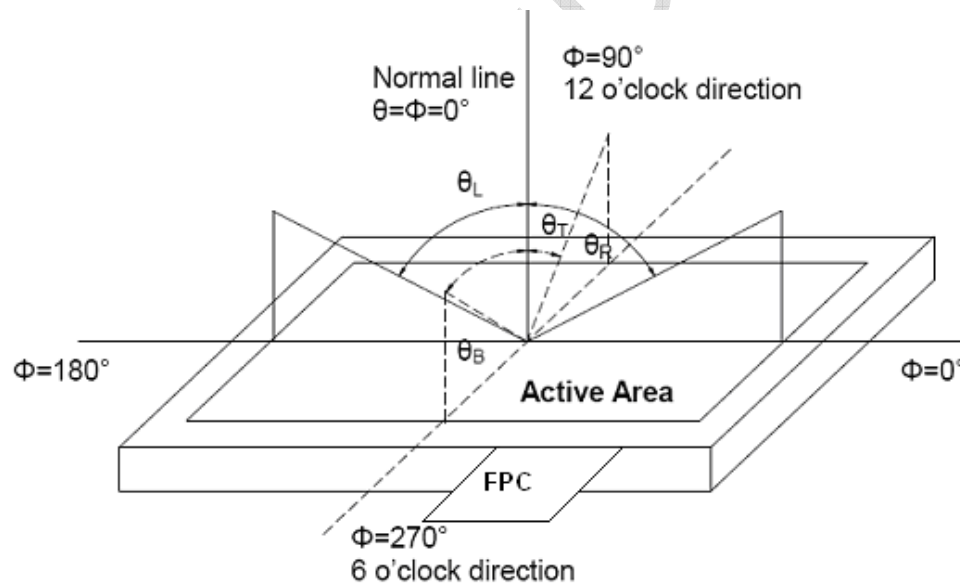
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



| Item | Photo detector | Field |
|----------------|----------------|-------|
| Contrast Ratio | BM-5A | 1° |
| Luminance | | |
| Lum Uniformity | | |
| Chromaticity | SR-3A | - |
| Response Time | TRD100 | |

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80).



Note 3: Definition of contrast ratio

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

"White state ": The state is that the LCD should drive by V_{white}.

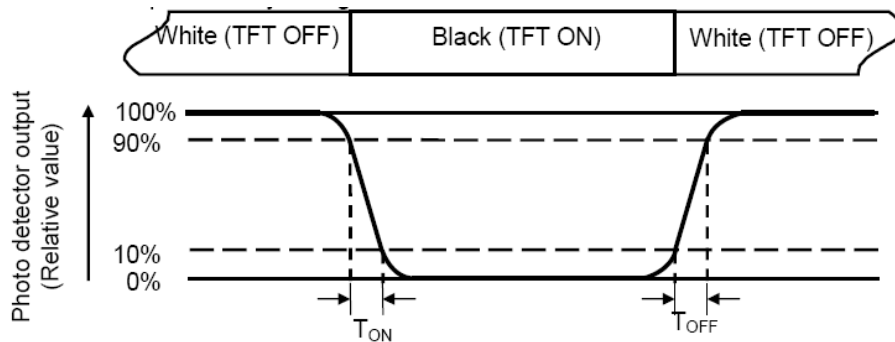
"Black state": The state is that the LCD should drive by V_{black}.

V_{white}: To be determined V_{black}: To be determined.

Note 4: 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%.



Note 5: Definition of color chromaticity (CIE1931)

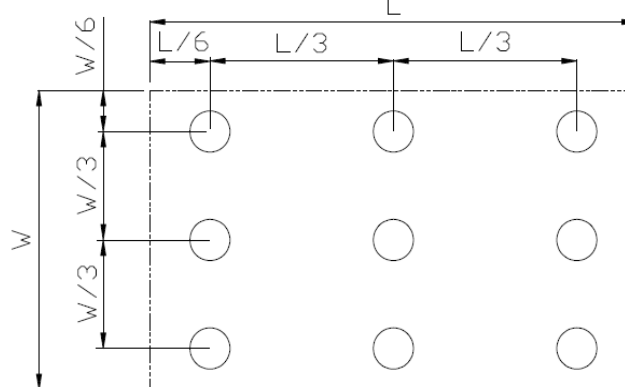
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

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

$$\text{Luminance Uniformity (U)} = L_{\min} / L_{\max}$$

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



L_{\max} : The measured Maximum luminance of all measurement position.

L_{\min} : The measured Minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.



7 Environmental / Reliability Test

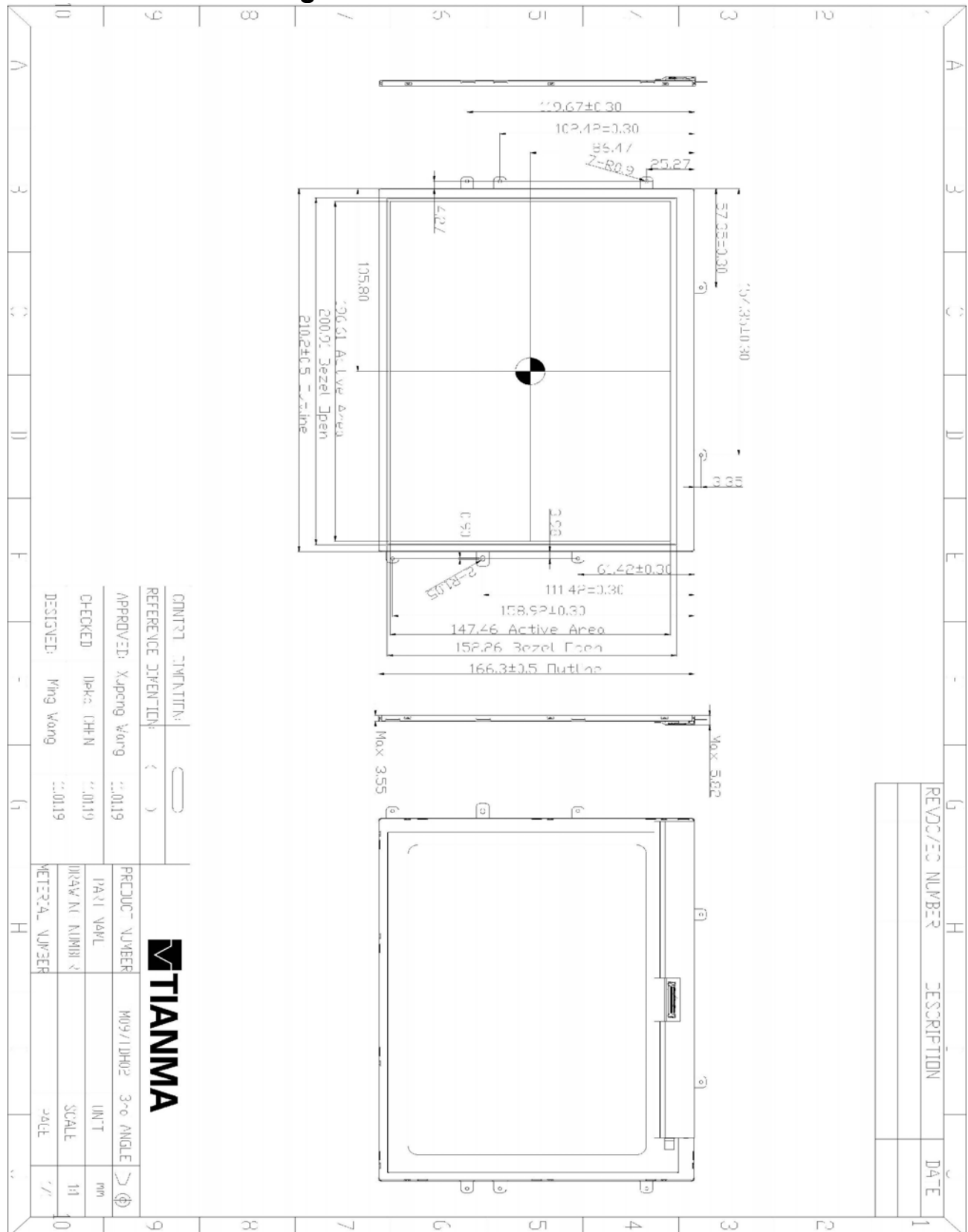
| No | Test Item | Condition | Remarks |
|----|--|--|---|
| 1 | High Temperature Operation | Ts = +70℃, 240 hours | IEC60068-2-1:2007 GB2423.2-2008 |
| 2 | Low Temperature Operation | Ta = -20℃, 240 hours | IEC60068-2-1:2007 GB2423.1-2008 |
| 3 | High Temperature Storage | Ta = +80℃, 240 hours | IEC60068-2-1:2007 GB2423.2-2008 |
| 4 | Low Temperature Storage | Ta = -30℃, 240 hours | IEC60068-2-1:2007 GB2423.1-2008 |
| 5 | Storage at High Temperature and Humidity | Ta = +60℃, 90% RH max, 240 hours | IEC60068-2-78 :2001 GB/T2423.3—2006 |
| 6 | Thermal Shock (non-operation) | -30℃ 30 min~+80℃ 30 min, Change time:5min, 20 Cycle | Start with cold temperature, End with high temperature, IEC60068-2-14:1984,G B2423.22-2002 |
| 7 | ESD | C=150pF,R=330Ω,5point/panel Air:±8Kv,5times; Contact:±4Kv,5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa) | IEC61000-4-2:2001 GB/T17626.2-2006 |
| 8 | Vibration Test | Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) | IEC60068-2-6:1982 GB/T2423.10—1995 |
| 9 | Mechanical Shock (Non Op) | Half Sine Wave 60G 6ms, ±X,±Y,±Z 3times for each direction | IEC60068-2-27:1987 GB/T2423.5—1995 |
| 10 | Package Drop Test | Height:80cm, 1corner,3edges,6surfaces | IEC60068-2-32:1990 GB/T2423.8—1995 |

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of samples.



8 Mechanical Drawing





9 Packing drawing

TBD

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10 Precautions for Use of LCD Modules

10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

- Isopropyl alcohol
- Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
- Ketone
- Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

10.1.7 If the logic circuit power is off, do not apply the input signals.

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8.1 Be sure to ground the body when handling the LCD Modules.

10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ~ 40℃ Relatively humidity: ≤80%

10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 Transportation Precautions

10.3.1 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.