**San Technology, Inc.**

# SPECIFICATION
# FOR
# LCD Module

**Customer P/N:**

**Santek P/N: ST0240A1WY-RSLW-F**

**DOC. Revision: RS01**

**Customer Approval:**

| | SIGNATURE | DATE |
|---|---|---|
| **PREPARED BY** | Aaron Lu | **2019-03-12** |
| **CHECKED BY** | Andy Song | **2019-5-22** |
| **APPROVED BY** | | 2019.May.23th |

Document Revision History

| Version | Revise Date | Description | Changed by |
|---------|-------------|-------------|------------|
| RS01 | 2019-03-12 | First issue | Aaron Lu |

# Table of Contents

# 1. GENERAL SPECIFICATION

### 1.1 Description

The ST0240A1WY-RSLW-F is a color active matrix Thin Film Transistor (TFT) Liquid Crystal Display (LCD) that uses amorphous silicon(a-Si) TFT as a switching device. This model is composed of a single 2.4 inches transmissive type main TFT-LCD panel. The resolution of the panel is 240 x 320 pixels and can display up to 65K color.
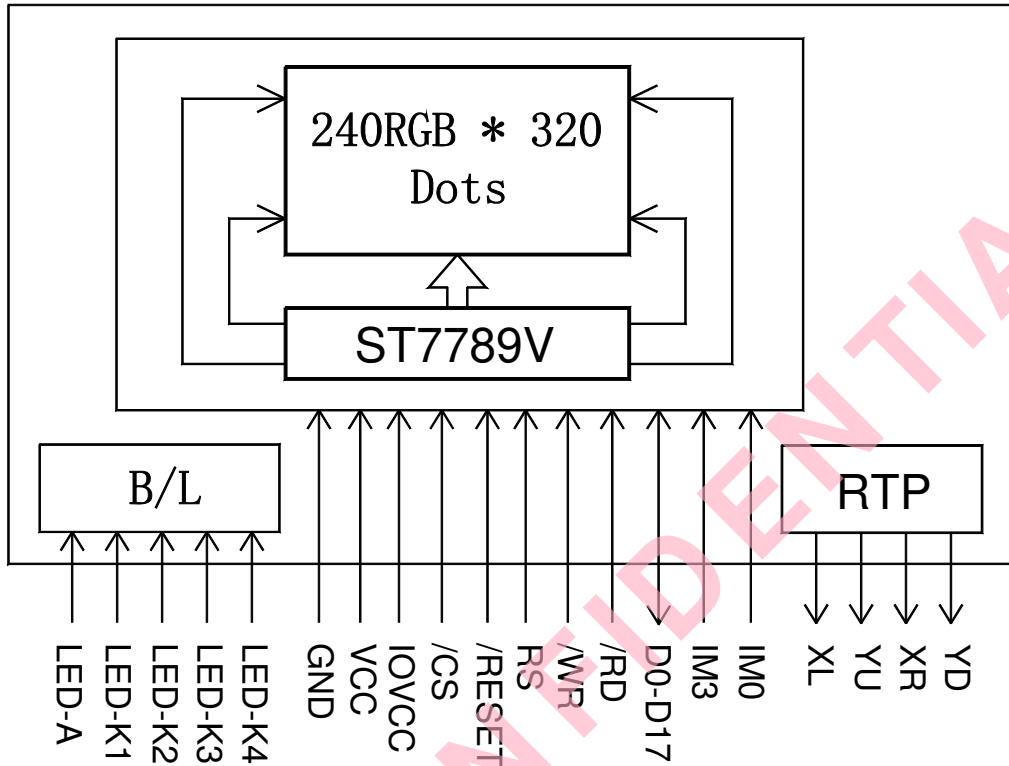
### 1.2 Feature

-TN type for main TFT-LCD panel
-Structure COG+FPC+BL+RTP
-Full, Normal (Still), Partial, Sleep, Standby mode are available
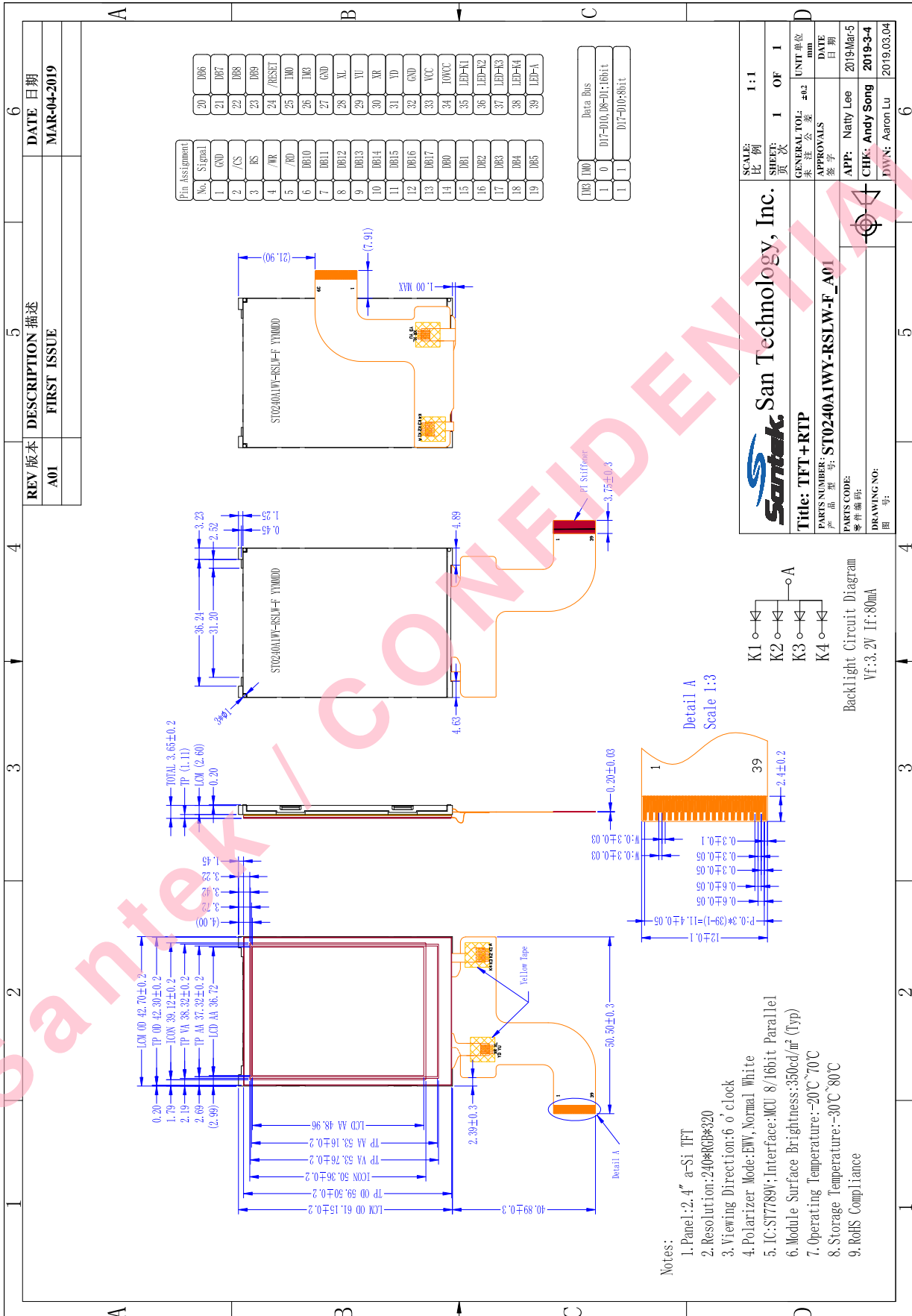
### 1.3 General Specification

| No. | Item | Specification | Unit | Remark |
|-----|------|---------------|------|--------|
| 1 | LCD Size | 2.4 | inch | - |
| 2 | Panel Type | a-Si TFT　TRANSMISSIVE | - | - |
| 3 | Resolution | 240 x (RGB) x 320 | pixel | - |
| 4 | Display Mode | Normally White,Transmissive | - | - |
| 5 | Display Number of Colors | 65K | - | - |
| 6 | Viewing Direction | 6 o'clock | - | Note |
| 7 | Contrast Ratio | 500(Typ) | -- | |
| 8 | Luminance | 350(Typ) | cd/m2 | - |
| 9 | Module Size | 42.70(W ) x 61.15(L) x3.65(T) | mm | Note |
| 10 | Active Area | 36.72(W) x 48.96(L) | mm | Note |
| 11 | Pixel Pitch | 0.153(W ) x 0.153（L） | mm | - |
| 12 | Weight | 17(Reference) | g | - |
| 13 | Driver IC | ST7789V | - | - |
| 14 | Driver IC RAM Size | 240X320X18 | bits | - |
| 15 | Light Source | 4 LEDs White | - | - |
| 16 | Interface | 8/16 bit parallel | - | - |
| 17 | Operating Temperature | -20~70 | ℃ | - |
| 18 | Storage Temperature | -30~80 | ℃ | - |

Note: Please refer to the mechanical drawing.

## 2. BLOCK DIAGRAM

# 3. MECHANICAL DRAWING

San Technology, Inc.

**Title: TFT+RTP**

PARTS NUMBER 产 品 型 号: **ST0240A1WY-RSLW-F_A01**

PARTS CODE 零件编码:

DRAWING NO 图 号:

| SCALE 比例: | | 1:1 | | |
|---|---|---|---|---|
| SHEET 页次: | 1 | | OF | 1 |
| GENERAL TOL. 未注公差 | | | ±0.2 | UNIT 单位 mm |
| APPROVALS 签字 | | | | DATE 日期 |
| APP: | Natty Lee | | | 2019-Mar-5 |
| CHK: | Andy Song | | | 2019-3-4 |
| DWN: | Aaron Lu | | | 2019.03.04 |

**Pin Assignment**

| No. | Signal |
|---|---|
| 1 | GND |
| 2 | /CS |
| 3 | RS |
| 4 | /WR |
| 5 | /RD |
| 6 | DB10 |
| 7 | DB11 |
| 8 | DB12 |
| 9 | DB13 |
| 10 | DB14 |
| 11 | DB15 |
| 12 | DB16 |
| 13 | DB17 |
| 14 | DB0 |
| 15 | DB1 |
| 16 | DB2 |
| 17 | DB3 |
| 18 | DB4 |
| 19 | DB5 |
| 20 | DB6 |
| 21 | DB7 |
| 22 | DB8 |
| 23 | DB9 |
| 24 | /RESET |
| 25 | IM0 |
| 26 | IM3 |
| 27 | GND |
| 28 | XL |
| 29 | YU |
| 30 | XR |
| 31 | YD |
| 32 | GND |
| 33 | VCC |
| 34 | LOVCC |
| 35 | LED-K1 |
| 36 | LED-K2 |
| 37 | LED-K3 |
| 38 | LED-K4 |
| 39 | LED-A |

| | IM3 | IM0 | Data Bus |
|---|---|---|---|
| | 1 | 0 | D17~D10,D8~D1;16bit |
| | 1 | 1 | D17~D10:8bit |

**Backlight Circuit Diagram**

K1, K2, K3, K4 → A

Vf:3.2V If:80mA

Detail A Scale 1:3

Yellow Tape

Notes:
1. Panel:2.4" a-Si TFT
2. Resolution:240*RGB*320
3. Viewing Direction:6 o'clock
4. Polarizer Mode:BW,Normal White
5. IC:ST7789V;Interface:MCU 8/16bit Parallel
6. Module Surface Brightness:350cd/m² (Typ)
7. Operating Temperature:-20°C~70°C
8. Storage Temperature:-30°C~80°C
9. RoHS Compliance

| REV 版本 | DESCRIPTION 描述 | DATE 日期 |
|---|---|---|
| A01 | FIRST ISSUE | MAR-04-2019 |

## 4. INTERFACE ASSIGNMENT

| PIN NO. | SYMBOL | FUNCTION DESCRIPTIONS |
|---------|--------|------------------------|
| 1 | GND | Ground. |
| 2 | /CS | Chip select signal. |
| 3 | RS | Register select signal. |
| 4 | /WR | Write signal. |
| 5 | /RD | Read signal. |
| 6~13 | DB10~DB17 | Data bus. |
| 14~23 | DB0~DB9 | Data bus. |
| 24 | /RESET | System reset pin. |
| 25 | IM0 | Interface mode select signal. |
| 26 | IM3 | <table><tr><td>IM3</td><td>IM0</td><td>Data Bus</td></tr><tr><td>1</td><td>0</td><td>D17-D10,D8-D1;16bits</td></tr><tr><td>1</td><td>1</td><td>D17-D10;8bits</td></tr></table> |
| 27 | GND | Ground. |
| 28 | XL | The left side signal of touch panel. |
| 29 | YU | The up side signal of touch panel. |
| 30 | XR | The right side signal of touch panel. |
| 31 | YD | The down side signal of touch panel. |
| 32 | GND | Ground. |
| 33 | VCC | Power supply. |
| 34 | IOVCC | I/O Power supply. |
| 35 | LED-K1 | LED Cathode 1. |
| 36 | LED-K2 | LED Cathode 2. |
| 37 | LED-K3 | LED Cathode 3. |
| 38 | LED-K4 | LED Cathode 4. |
| 39 | LED-A | LED Anode. |

# 5. ELECTRICAL SPECIFICATION
## 5.1. Application Circuit
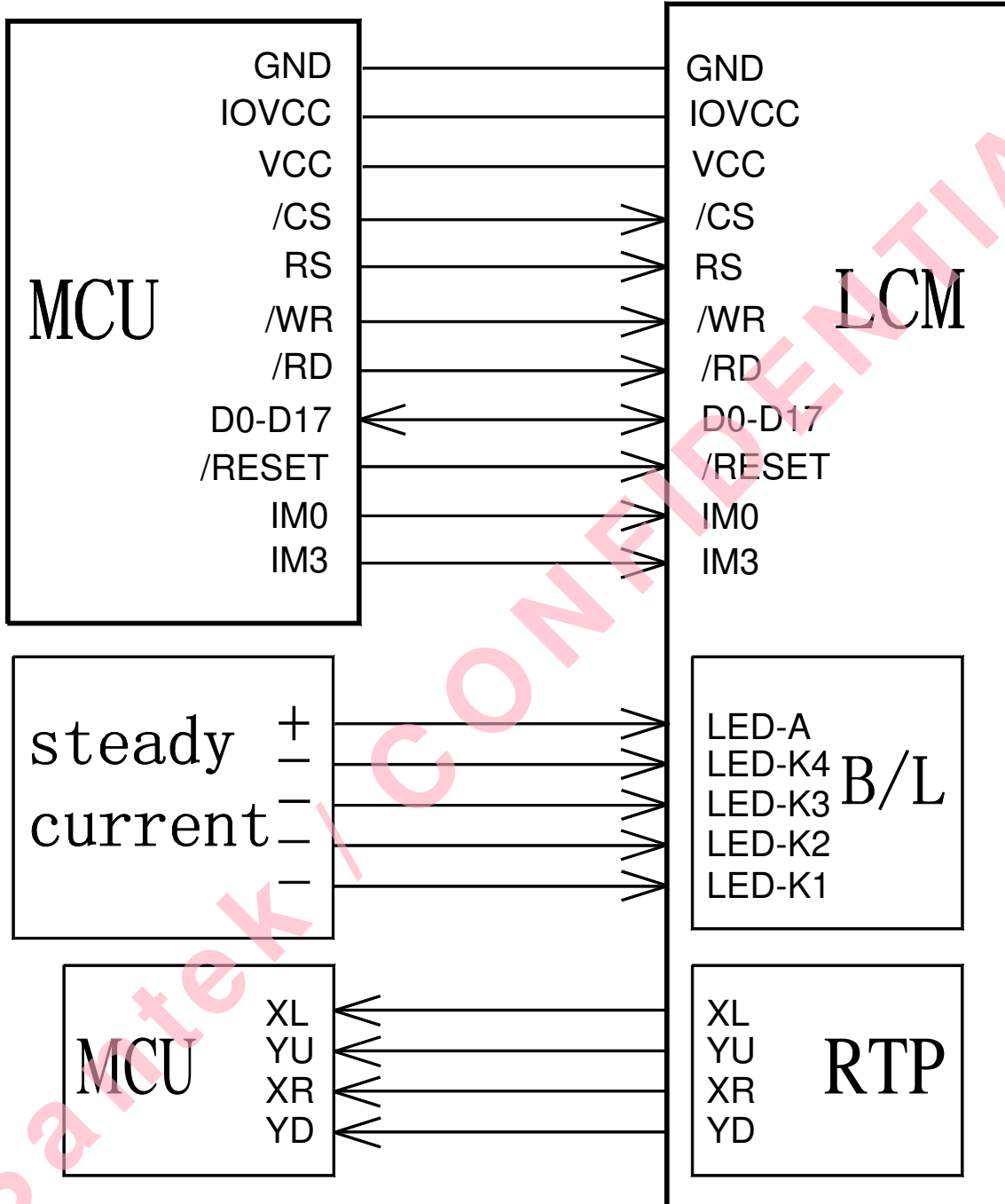
### 5.2. Absolute Maximum Ratings

| Item | Symbol | Rating | Unit |
|---|---|---|---|
| Supply Voltage | VCC | - 0.3 ~ +4.6 | V |
| Supply Voltage (Logic) | IOVCC | - 0.3 ~ +4.6 | V |
| Driver Supply Voltage | VGH-VGL | -0.3 ~ +30.0 | V |
| Logic Input Voltage Range | VIN | -0.3 ~ VDDI + 0.5 | V |
| Logic Output Voltage Range | VO | -0.3 ~ VDDI + 0.5 | V |
| Operating Temperature Range | TOPR | -20 ~ +70 | ℃ |
| Storage Temperature Range | TSTG | -30 ~ +80 | ℃ |

Note: Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is applied.

### 5.3. Typical Operation Condition

5.3.1 DC Characteristics

| ITEM | SYMBOL | CONDITION | STANDARD VALUE | | | UNIT |
|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | |
| Power Supply for Analog | VCC | Ta=25 ℃ | 2.4 | 2.75 | 3.3 | V |
| Power Supply for Digital IO | IOVCC | Ta=25 ℃ | 1.65 | 1.8 | 3.3 | V |
| Input Signal "H" Level | $V_{IH}$ | - | 0.7IOVCC | - | IOVCC | V |
| Input Signal "L" Level | $V_{IL}$ | - | 0 | - | 0.3IOVCC | V |
| Output Signal "H" Level | $V_{OH}$ | $I_{OH}$=-0.1mA | 0.8IOVCC | - | IOVCC | V |
| Output Signal "L" Level | $V_{OL}$ | $I_{OL}$=0.1mA | 0 | - | 0.2IOVCC | V |

Note: To prevent IC latch up or DC operation in LCD panel, the power on/off sequence should follow the driver IC specification.

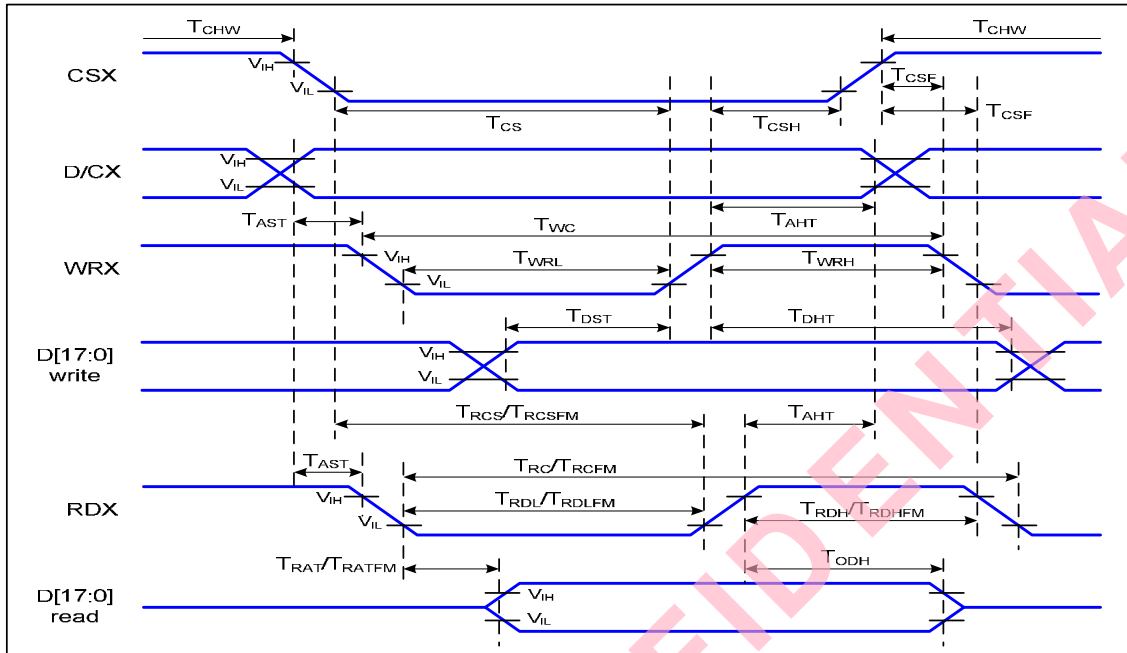## 5.4. Backlight Specification

### 5.4.1 Backlight Circuit
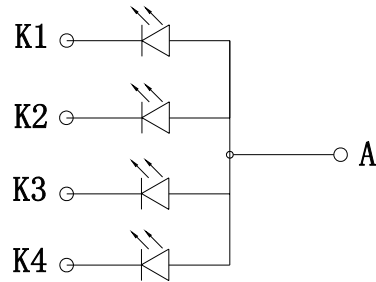


LED CIRCUIT DIAGRAM

### 5.4.2 Electrical Characteristics(T=25℃)

| PARAMETER | SYMBOL | CONDITION | STANDARD VALUE | | | UNIT |
|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | |
| FORWARD VOLTAGE (Single Chip) | VF | IF=80mA | 2.8 | 3.2 | 3.4 | V |

## 5.5. INTERFACE TIMING CHARACTERISTICS

### 5.5.1 8080 Series MCU Parallel Interface Characteristics: 8/16-bit Bus



| Signal | Symbol | Parameter | Min | Max | Unit | Description |
|--------|--------|-----------|-----|-----|------|-------------|
| D/CX | $T_{AST}$ | Address setup time | 0 | | ns | - |
| | $T_{AHT}$ | Address hold time (Write/Read) | 10 | | ns | |
| CSX | $T_{CHW}$ | Chip select "H" pulse width | 0 | | ns | - |
| | $T_{CS}$ | Chip select setup time (Write) | 15 | | ns | |
| | $T_{RCS}$ | Chip select setup time (Read ID) | 45 | | ns | |
| | $T_{RCSFM}$ | Chip select setup time (Read FM) | 355 | | ns | |
| | $T_{CSF}$ | Chip select wait time (Write/Read) | 10 | | ns | |
| | $T_{CSH}$ | Chip select hold time | 10 | | ns | |
| WRX | $T_{WC}$ | Write cycle | 66 | | ns | |
| | $T_{WRH}$ | Control pulse "H" duration | 15 | | ns | |
| | $T_{WRL}$ | Control pulse "L" duration | 15 | | ns | |
| RDX (ID) | $T_{RC}$ | Read cycle (ID) | 160 | | ns | When read ID data |
| | $T_{RDH}$ | Control pulse "H" duration (ID) | 90 | | ns | |
| | $T_{RDL}$ | Control pulse "L" duration (ID) | 45 | | ns | |
| RDX (FM) | $T_{RCFM}$ | Read cycle (FM) | 450 | | ns | When read from frame memory |
| | $T_{RDHFM}$ | Control pulse "H" duration (FM) | 90 | | ns | |
| | $T_{RDLFM}$ | Control pulse "L" duration (FM) | 355 | | ns | |
| D[17:0] | $T_{DST}$ | Data setup time | 10 | | ns | For CL=30pF |

## 6. TOUCH PANEL SPECIFICATION

- Product Type: Film+Glass

  Film: Clear and Hard Coating

- Operating Voltage: DC5V

- Operating force: 10~100g

- Insulation Resistance: ≥20MΩ,25V(DC)

- Linearity: ≤1.5%

- Service Life: Notes Life: ≥20,000

                 Input Life: ≥1,000,000

- Chatting Times: <10ms

- Surface Handness: ≥3H

- Terminal Resistance: X: 100~500Ω

                       Y: 300~900Ω

- All Materials is Complied with RoHS
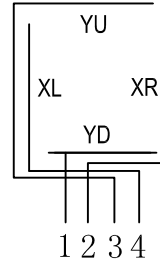
| PIN | Logic |
|-----|-------|
| 1 | YD |
| 2 | XR |
| 3 | YU |
| 4 | XL |

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## 7. OPTICAL CHARACTERISTICS

| Item | | Symbol | Condition | Values | | | Unit | Remark |
|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | | |
| Viewing Angle Range | Left | $\theta_L$ | CR$\geqq$10 | 35 | 45 | - | degree | Note 1,2 |
| | Right | $\theta_R$ | | 35 | 45 | - | | |
| | Top | $\Phi_T$ | | 35 | 45 | - | | |
| | Bottom | $\Phi_B$ | | 10 | 20 | - | | |
| Response Time | | $T_{on} + T_{off}$ | Normal $\theta=\Phi=0°$ | - | 30 | - | ms | Note 2,3 |
| Contrast Ratio | | CR | Normal $\theta=\Phi=0°$ | 300 | 500 | - | - | Note 2,4 |
| Luminance | | L | Normal $\theta=\Phi=0°$ | 280 | 350 | - | cd/m$^2$ | Note 2,5 |
| Color Chromaticity (CIE1931) | White | Wx | Normal $\theta=\Phi=0°$ | 0.2459 | 0.2959 | 0.3459 | - | Note 2,6 |
| | | Wy | | 0.2792 | 0.3292 | 0.3792 | | |
| | Red | Rx | | 0.5246 | 0.5746 | 0.6246 | | |
| | | Ry | | 0.2938 | 0.3438 | 0.3938 | | |
| | Green | Gx | | 0.2924 | 0.3424 | 0.3924 | | |
| | | Gy | | 0.5663 | 0.6163 | 0.6663 | | |
| | Blue | Bx | | 0.0978 | 0.1478 | 0.1978 | | |
| | | By | | 0.0157 | 0.0657 | 0.1157 | | |
| Color Gamut | | NTSC | CIE1931 | - | 60 | - | % | - |
| Luminance Uniformity | | $U_L$ | Normal $\theta=\Phi=0°$ | 75 | 80 | - | % | Note 2,7 |

Note 1: Definition of viewing angle range

Normal line
θ=Φ=0°

θ_T

12 o'clock direction
Φ=90°

θ_B

θ_L θ_R

Φ=180°

Φ=0°

Active Area

LCD Panel

Φ=270°
6 o'clock direction
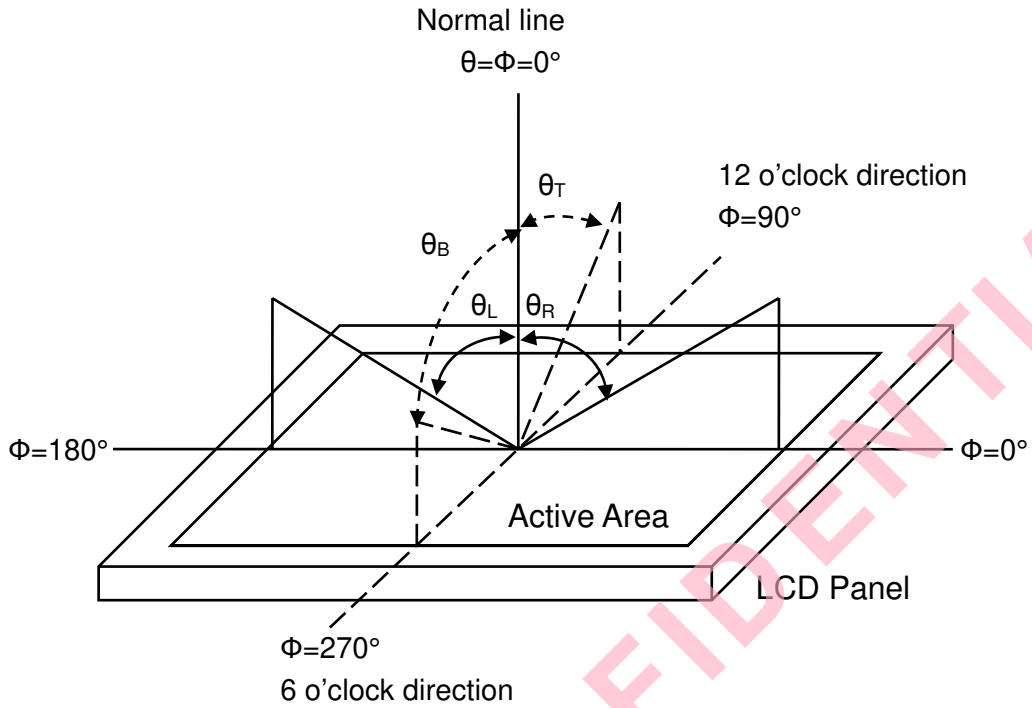
Fig. 1 Definition of viewing angle
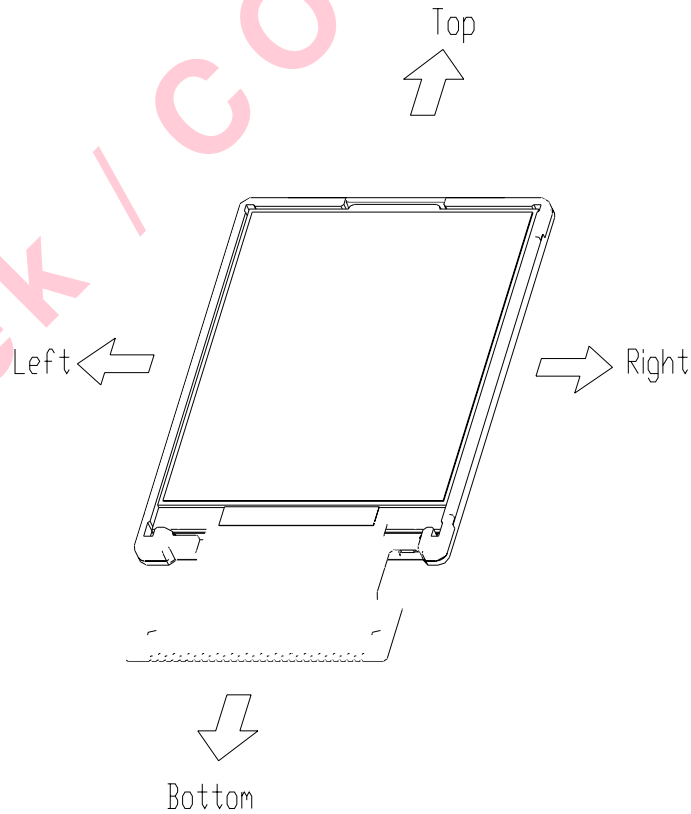
Top

Left

Right

Bottom

Fig. 2 Definition of viewing angle for display

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Note 2: Definition of optical measurement system

The optical characteristics should be measured in a dark room with ambient temperature $T_a=+25°C$. The optical properties are measured at the center point of the LCD screen after 5 minutes operation. (Equipment: Photo detector TOPCON BM-7 Field of view: 1°/Height: 500mm.)
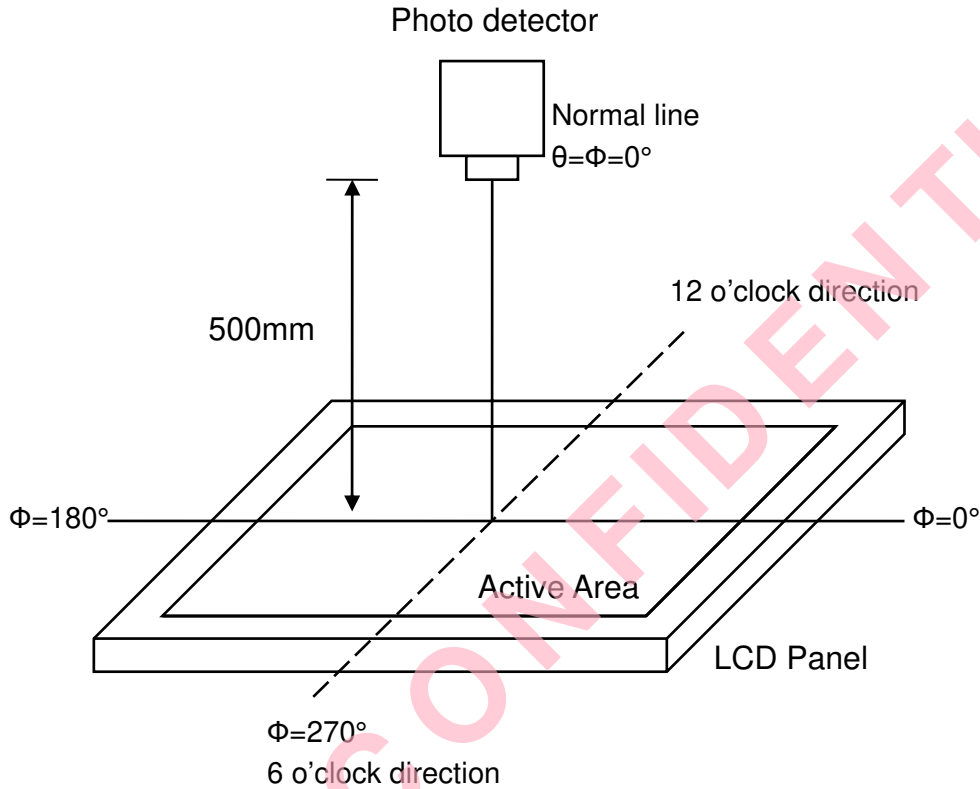
Fig. 3 Optical measurement system setup

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%.
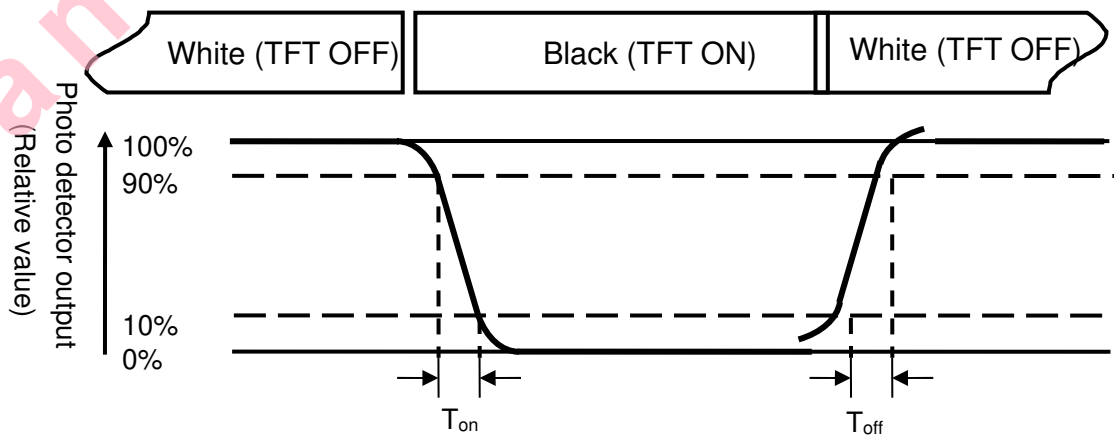
Fig. 4 Definition of response time

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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 luminance

      Measured at the center area of the panel when LCD panel is driven at "white" state.

Note 6: Definition of color chromaticity (CIE1931)

Color coordinates measured at the center point of LCD when panel is driven at "White", "Red", "Green" and "Blue" state respectively.

Note 7: Definition of luminance uniformity

To test for uniformity, the tested area is divided into 3 rows and 3 columns. The measurement spot is placed at the center of each circle as below.

$$\text{Luminance Uniformity } (U_L) = \frac{L_{min}}{L_{max}}$$

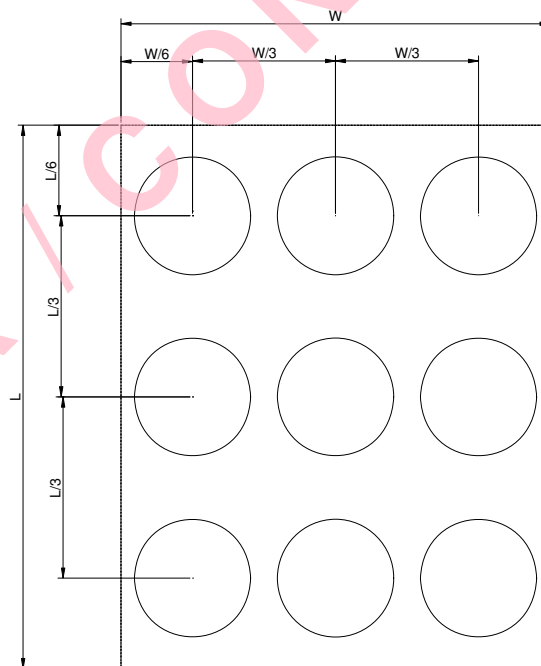L-------Active area length      W----- Active area width



Fig. 5 Definition of luminance uniformity

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

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

## 8. RELIABILITY TESTS

| ITEM | CONDITION | CRITERION |
|---|---|---|
| Operating Temperature Test | High Temperature: +70 ºC, 120 hrs | No defects in display and operational functions |
| | Low Temperature: -20 ºC, 120 hrs | |
| Storage Temperature Test | High Temperature: +80 ºC, 120 hrs | No defects in display and operational functions |
| | Low Temperature: -30 ºC, 120 hrs | |
| Humidity Endurance Test | 60 ºC±3℃, 90%±3%RH, 120 hrs | No defects in display and operational functions |
| Thermal Shock Test | -30 ºC (30mins)～ +80 ºC (30mins) 10 cycles | No defects in display and operational functions |
| Package Vibration Test | Random Vibration : Frequency:10~55Hz 1 hour for each direction of X. Y. Z. (3 hours for total) | No defects in display and operational functions |
| Package Drop Test | Height :72cm(Weight≦10kg); 60cm(Weight≧10kg) 1 corner, 3 edges, 6 surfaces | No defects in display and operational functions |
| Electro Static Discharge | ± 2KV,　Human Body Mode, 100pF/1500Ω | No defects in display and operational functions |

NOTE:

1) The samples must be free from defect before test, must be restored at room condition at least for 2 hours after reliability test before any inspection.

2) Before test the function of TP, the sample must be placed in room temperature for 24hrs after RA test.

3) After a long period of high temperature,the surrounding edge of the LCM all-black image will appear MURA phenomenon,which is a normal phenomenon.

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# 9. PRECAUTIONS

## 9.1. Handing

9.1.1. Polarizer Cleaning, Petroleum ether (or N-hexane) is recommended for cleaning the front/rear polarizers and reflectors, acetone, toluene and ethanol are not allowed.

9.1.2. Body grounding, must wear Anti-ESD wrist strap while pick up LCDs.

9.1.3. FPC Soldering, less than 300°C/3S, solder must be grounding on grounding bench.

9.1.4. If use electric Screwdriver to do assembly, screwdriver must be grounding.

## 9.2. Storage

9.2.1. Keep in a sealed polyethylene bag.

9.2.2. Keep in a dark place.

9.2.3. Keep in temperature between 0°C and 35°C.

**NOT** allowed at 70°C for more than 160 Hours, or at -20°C for more than 48 Hrs.

## 9.3. Safety

If liquid crystal leak out of a damaged glass cell, **DO NOT** put it in your mouth or touch eyes, if the liquid crystal touch your skin or clothes, please wash it off immediately using soap and water.

# 10. LIMITED WARRANTY

Unless otherwise agreed between Santek and customer, Santek will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with Santek LCD acceptance standards(copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects over specs must be returened to Santek within 30 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Santek limited to repair and/or replacement on the terms set forth replacement on the terms setforth above.Santek shall not be responsible for any subsequent or consequential events.

## 10.1. Returning LCM Under Warranty – Terms and Conditions

10.1.1. No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

      - Broken LCD glass.

      - Circuit modified in any way, including addition of components.

10.1.2. Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB's eyelet, conductors and terminals.