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# Datasheet

## Disea

**ZW-T024LQS-01**

DE-06-003

# PRODUCT SPECIFICATIONS

For Customer: _____    ☐ : APPROVAL FOR SPECIFICATION

Customer Model No.:_____    ☐ : APPROVAL FOR SAMPLE

Module No.:___ZW-T024LQS-01_____    Date :___2017-08-31_____

## Table of Contents

## For Customer's Acceptance:

| Approved By | Comment |
|-------------|---------|
| | |

| PREPARED | CHECKED | VERIFIED BY QA DEPT | VERIFIED BY R&D DEPT |
|----------|---------|---------------------|----------------------|
| John | Techshu | | Dmjiang |

## 2. Revision Record

| Date | Rev.No. | Page | Revision Items | Prepared |
|---|---|---|---|---|
| 2017-08-31 | V0 | | The first release | JOHN |
| | | | | |

## 3. General Specifications

ZW-T024LQS-01 is a TFT-LCD module. It is composed of a TFT-LCD panel, driver IC, FPC, a back light unit. The 2.4′′ display area contains 240 x 320pixels and can display up to 262K colors. This product accords with RoHS environmental criterion.

| Item | Contents | Unit | Note |
|---|---|---|---|
| LCD Type | TFT/Transflective | - | |
| Display color | 262K | | |
| Viewing Direction | Full viewing angle | O'Clock | |
| Operating temperature | -20~+70 | ℃ | |
| Storage temperature | -30~+80 | ℃ | |
| Module size | 42.92x60.26x2.45 | mm | |
| Active Area(W×H) | 36.72X48.96 | mm | |
| Number of Dots | 240X320 | dots | |
| Controller | ST7789V | - | |
| Power Supply Voltage | 2.8 | V | |
| Backlight | 4-LEDs (white) | pcs | |
| Weight | --- | g | |
| Interface | MCU-16bit | - | |

Note 1:   Color tune is slightly changed by temperature and driving voltage.
Note 2:   Without FPC and Solder.

## 4.Outline.Drawing
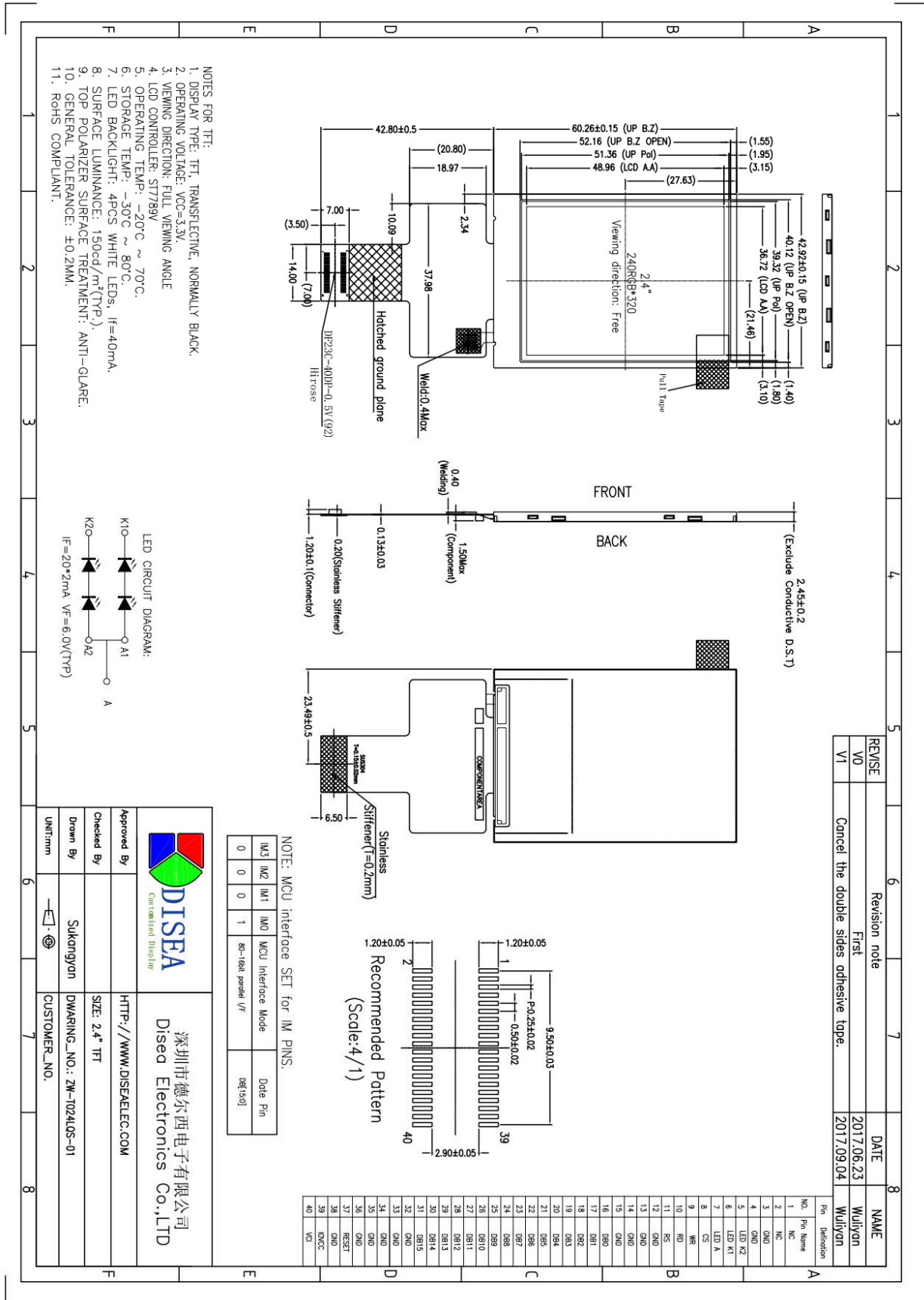
## 5. Absolute Maximum Ratings(Ta=25℃)

### 5.1 Electrical Absolute Maximum Ratings.(Vss=0V ,Ta=25℃)

| Item | Symbol | Min. | Max. | Unit | Note |
|---|---|---|---|---|---|
| Power Supply Voltage | $IOV_{CC}$ | -0.3 | 3.6 | V | 1，2 |
| | VCI | -0.3 | 3.6 | V | |

*Notes:*

*1. If the module is above these absolute maximum ratings. It may become permanently damaged. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability.*

*2. $V_{CI}>V_{SS}$ must be maintained.*

*3. Please be sure users are grounded when handing LCD Module.*

### 5.2 Environmental Absolute Maximum Ratings.

| Item | Storage | | Operating | | Note |
|---|---|---|---|---|---|
| | MIN. | MAX. | MIN. | MAX. | |
| Ambient Temperature | -30℃ | 80℃ | -20℃ | 70℃ | 1,2 |
| Humidity | - | - | - | - | 3 |

*1. The response time will become lower when operated at low temperature.*

*2. Background color changes slightly depending on ambient temperature.*

   *The phenomenon is reversible.*

*3. Ta<=40℃:85%RH MAX.*

   *Ta>=40℃:Absolute humidity must be lower than the humidity of 85%RH at 40℃.*

## 6. Electrical Specifications and Instruction Code

### 6.1 Electrical characteristics(Vss=0V ,Ta=25℃)

| Parameter | | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Power supply | | VCI | Ta=25℃ | 2.4 | 2.8 | 3.6 | V | |
| | | IOVCC | | 1.65 | 1.8 | 3.6 | V | |
| Input voltage | 'H' | $V_{IH}$ | $V_{CI}$=3.3V | $0.8V_{CI}$ | - | $V_{CI}$ | V | |
| | 'L' | $V_{IL}$ | $V_{CI}$=3.3V | 0 | - | $0.2V_{CI}$ | V | |
| Current Consumption | | $I_{CC1}$ | Normal mode | - | - | - | mA | 1 |
| | | $I_{CC2}$ | Sleep mode | - | - | - | mA | 1 |

Note:

1: Tested in 1×1 chessboard pattern.

### 6.2 LED backlight specification(VSS=0V ,Ta=25℃)

| Item | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| Supply voltage | Vf | If=40mA | 5.0 | 6.0 | 7.0 | V | |
| Uniformity | △ Bp | If=40mA | 75 | - | - | % | |
| Life Time | time | If=40mA | - | 30000 | - | hours | 1 |
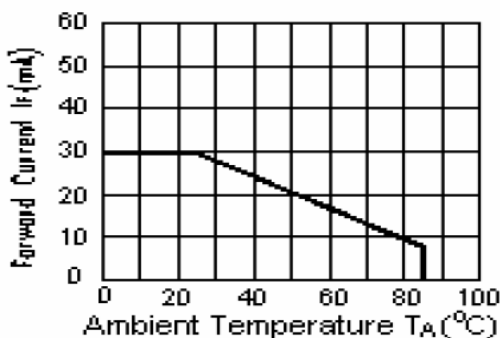
## 6.3 Interface signals

| Pin No. | Symbol | I/O | Function |
|---------|--------|-----|----------|
| 1-2 | NC | - | NO Connection |
| 3-4 | GND | P | Ground. |
| 5-6 | LEDK2-LEDK1 | P | Power Supply For LED backlight(-) |
| 7 | LEDA | P | Power Supply For LED backlight(+) |
| 8 | CS | I | Chip Select Signal |
| 9 | WR | I | Server As A Write Signal And Write Data At The Rising Edge |
| 10 | RD | I | Server As A Read Signal And Read Data At The Low Level |
| 11 | RS | I | The signal for command or parameter select under parallel Select under parallel mode: Low:command High:parameter |
| 12-15 | GND | P | Ground. |
| 16-31 | D0-D15 | I | 16-Data bus. |
| 32-36 | GND | P | Ground. |
| 37 | RESET | I | Reset Pin. |
| 38 | GND | P | Ground. |
| 39 | IOVCC | P | Power supply for I/O system |
| 40 | VCI | P | Power supply for analog. |

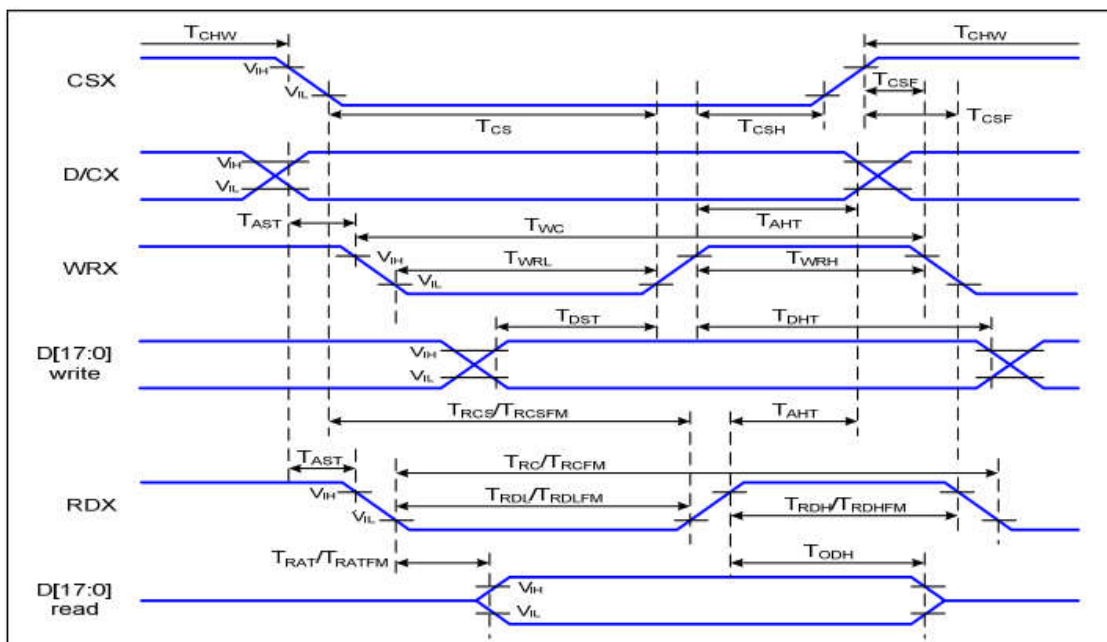## 6.4 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus



**Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)**

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta= -30 to 70 ℃

| 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 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | $T_{DHT}$ | Data hold time | 10 | | ns | |
| | $T_{RAT}$ | Read access time (ID) | | 40 | ns | |
| | $T_{RATFM}$ | Read access time (FM) | | 340 | ns | |
| | $T_{ODH}$ | Output disable time | 20 | 80 | ns | |

**Table 4 8080 Parallel Interface Characteristics**
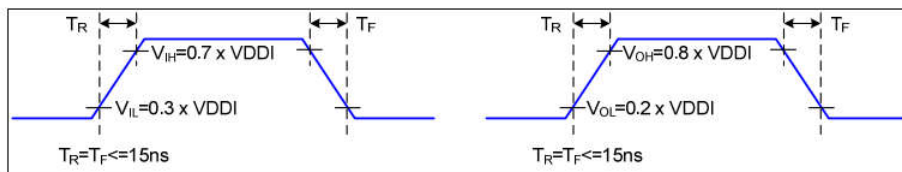


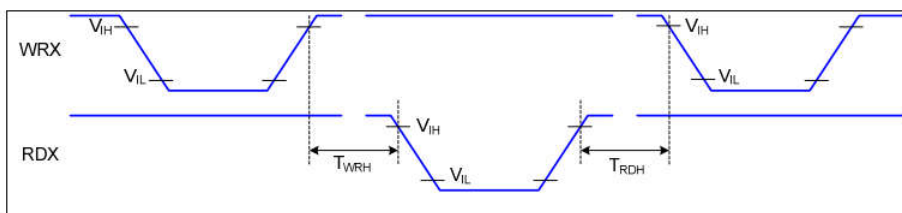**Figure 2 Rising and Falling Timing for I/O Signal**



**Figure 3 Write-to-Read and Read-to-Write Timing**

Note: The rising time and falling time (Tr, Tf) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

## 7. Optical Characteristics

| Item | Symbol | | Condition | Min. | Typ. | Max. | Unit | Note |
|------|--------|--|-----------|------|------|------|------|------|
| Brightness (with TP) | Bp | | $\theta=0°$ $\Phi=0°$ | 100 | 150 | - | Cd/m$^2$ | 1 |
| Uniformity | $\triangle$Bp | | | 75 | - | - | % | 1,2 |
| Viewing Angle | 3:00 | | Cr≥10 | 60 | 80 | - | Deg | 3 |
| | 6:00 | | | 60 | 80 | - | | |
| | 9:00 | | | 60 | 80 | - | | |
| | 12:00 | | | 60 | 80 | - | | |
| Contrast Ratio | Cr | | $\theta=0°$ $\Phi=0°$ | 200 | 300 | | - | 4 |
| Response Time | T$_r$+T$_f$ | | | - | 25 | 50 | ms | 5 |
| | | | | - | | | ms | |
| Color of CIE Coordinate | W | x | $\theta=0°$ $\Phi=0°$ | -0.05 | 0.28 | +0.05 | - | 1,6 |
| | | y | | | 0.33 | | - | |
| | R | x | | | 0.51 | | - | |
| | | y | | | 0.34 | | - | |
| | G | x | | | 0.31 | | - | |
| | | y | | | 0.56 | | - | |
| | B | x | | | 0.15 | | - | |
| | | y | | | 0.14 | | - | |
| NTSC Ratio | S | | | 50 | 60 | - | % | |

Note：The parameter is slightly changed by temperature, driving voltage and materiel

Note 1: The data are measured after LEDs are turned on for 5 minutes. LCM displays full white. The brightness is the average value of 5 measured spots. Measurement equipment BM-7 (Φ5mm)

Measuring condition:
- Measuring surroundings: Dark room.
- Measuring temperature: Ta=25 ℃.
- Adjust operating voltage to get optimum contrast at the center of the display.

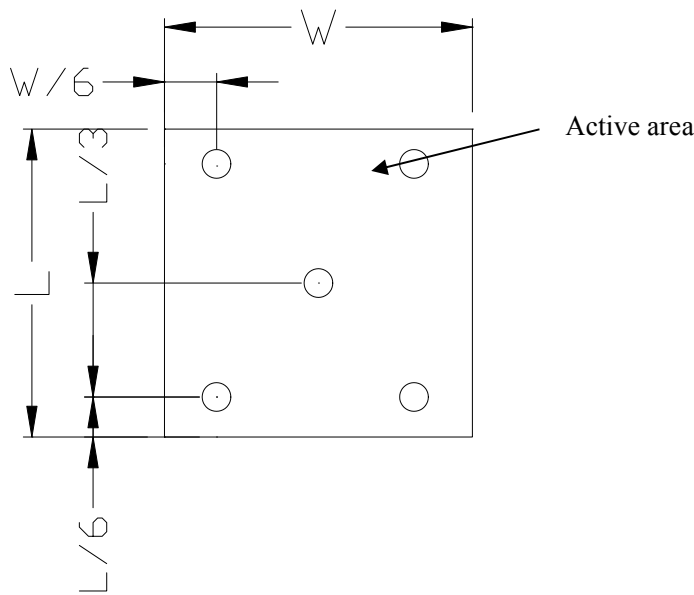Measured value at the center point of LCD panel after more than 5 minutes while backlight turning on.
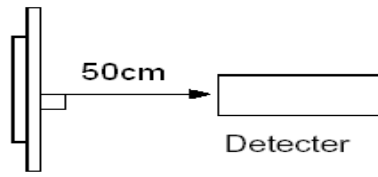
*Note 2: The luminance uniformity is calculated by using following formula.*
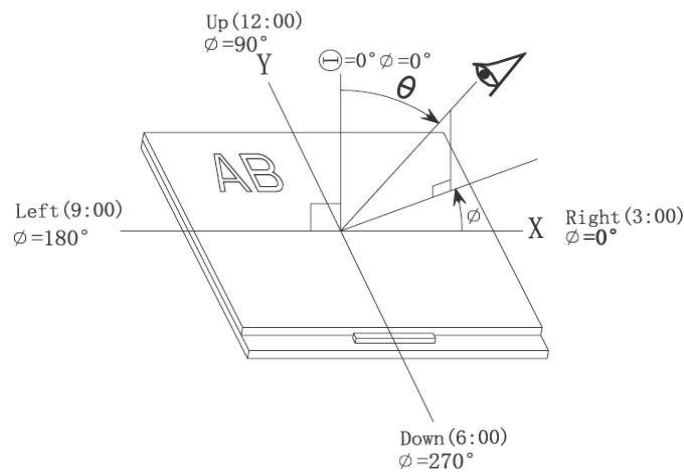
$\angle Bp = Bp\ (Min.)\ /\ Bp\ (Max.)\times100\ (\%)$

*Bp (Max.) = Maximum brightness in 5 measured spots*

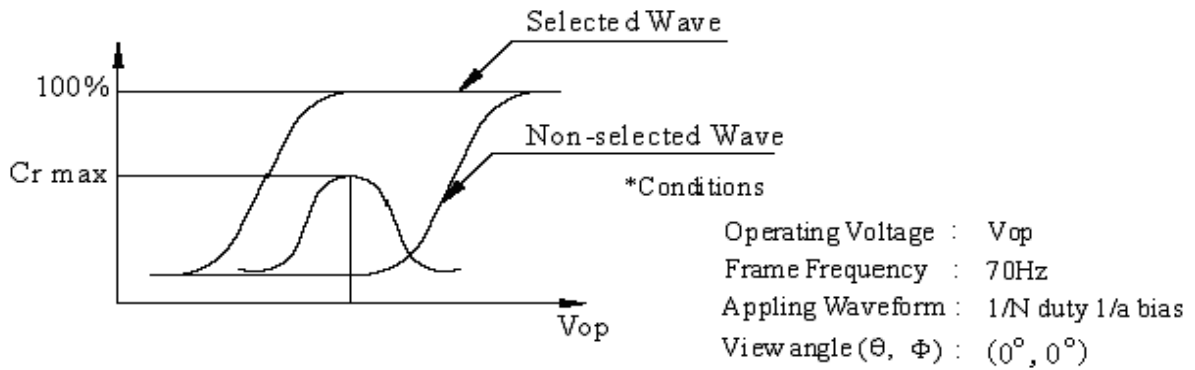*Bp (Min.) = Minimum brightness in 5measured spots.*



*Note 3: The definition of viewing angle:*

*Refer to the graph below marked by ϑ and Φ*



*Note 4: Definition of contrast ratio.( Test LCD using DMS501)*

$$Contrast\ \ ratio(Cr) = \frac{Brightness\ \ of\ \ selected\ \ dots}{Brightness\ \ of\ \ non-selected\ \ dots}$$

Note 5: Definition of Response time. (Test LCD using DMS501):

The output signals of photo detector are measured when the input signals are changed from "black" to "white"(falling time) and from "white" to "black"(rising time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.Refer to figure as below.
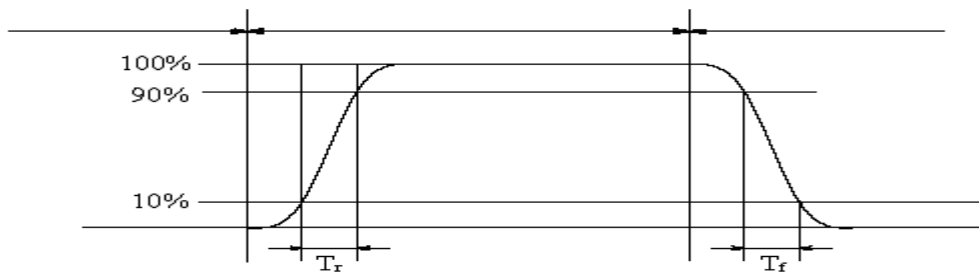


The definition of response time

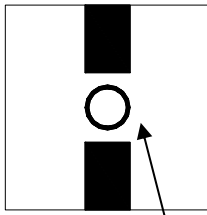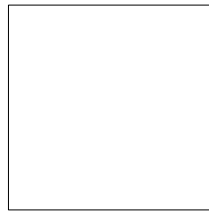Note 6: Definition of Color of CIE Coordinate and NTSC Ratio.
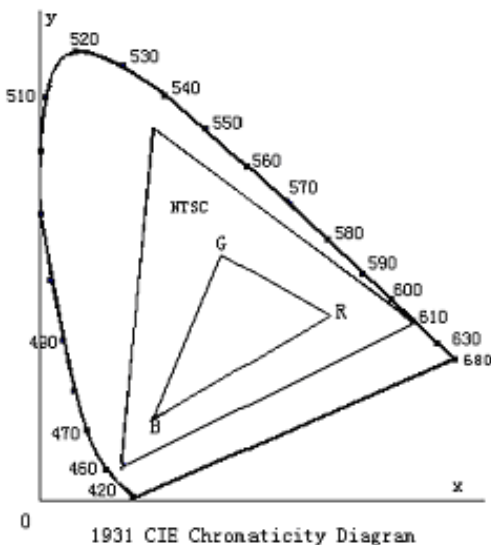


Color gamut:

$$S = \frac{area\ \ of\ \ RGB\ \ triangle}{area\ \ of\ \ NTSC\ \ triangle} \times 100\%$$

Note 7: Definition of cross talk.

Cross talk ratio(%)=|pattern A Brightness-pattern B Brightness|/pattern A Brightness*100

Pattern A       Pattern B

*Measurement point(center)*

*Electric volume value=3F+/-3Hex*

## 8. Reliability Test Items and Criteria

| No | Test Item | Test condition | Criterion |
|----|-----------|----------------|-----------|
| 1 | High Temperature Storage | 80℃±2℃ 96H<br>Restore 2H at 25℃<br>Power off | 1. After testing, cosmetic and electrical defects should not happen.<br>2. Total current consumption should not be more than twice of initial value. |
| 2 | Low Temperature Storage | -30℃±2℃ 96H<br>Restore 2H at 25℃<br>Power off | |
| 3 | High Temperature Operation | 70℃±2℃ 96H<br>Restore 2H at 25℃<br>Power on | |
| 4 | Low Temperature Operation | -20℃±2℃ 96H<br>Restore 4H at 25℃<br>Power on | |
| 5 | High Temperature/Humidity Operation | 60℃±2℃ 90%RH 96H<br>Power on | |
| 6 | Temperature Cycle | –30℃◄———————►80℃<br><br>30min  5min   30min<br><br>after 5 cycle, Restore 2H at 25℃<br>Power off | |
| 7 | Vibration Test | 10Hz~150Hz, 100m/s$^2$, 120min | Not allowed cosmetic and electrical defects. |
| 8 | Shock Test | Half- sine wave,300m/s$^2$,11ms | |

Note: Operation: Supply 2.8V for logic system.

The inspection terms after reliability test, as below

| ITEM | Inspection |
|------|------------|
| Contrast | CR>50% |
| IDD | IDD<200% |
| Brightness | Brightness>60% |
| Color Tone | Color Tone+/-0,05 |

# 9. Precautions for Use of LCD Modules

## 9.1 Handling Precautions

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

9.1.2 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.

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

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

9.1.5 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

9.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

    d. 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.

## 9.2 Storage precautions

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

9.2.2 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%

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

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

*END*

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