ZHONG YU HENG

# APPROVAL SHEET

# 承 认 书

记录编号： 版本：A

| | |
|---|---|
| Customer<br>客户名称 | |
| Part NO.<br>产品型号 | MT230TMAK-01 |
| Product type<br>产品内容 | Mode: Transmissive type .Normally white.<br>TFT LCD Module<br>LCD Module: Graphic 220RGB*176Dot-matrix |
| Remarks<br>备注栏 | □APPROVAL FOR SEPCIFICATIONS ONLY<br>■APPROVAL FOR SEPCIFICATIONS AND SAMPLE |
| Signature by Customer:<br>客户确认签章 | |

## 设计部确认

| 核准 | 审核 | 定制 |
|---|---|---|
| | | |

## 客户确认

| 核准 | 审核 | 审核 |
|---|---|---|
| | | |

ZHONG YU HENG

# TABLE OF Contents

# 1. General Description

MT230TMAK-01 is a 220RGB*176 dots matrix TFT LCD module. It has a TFT panel composed of 660 sources and 176 gates. The LCM can be easily accessed by micro-controller.

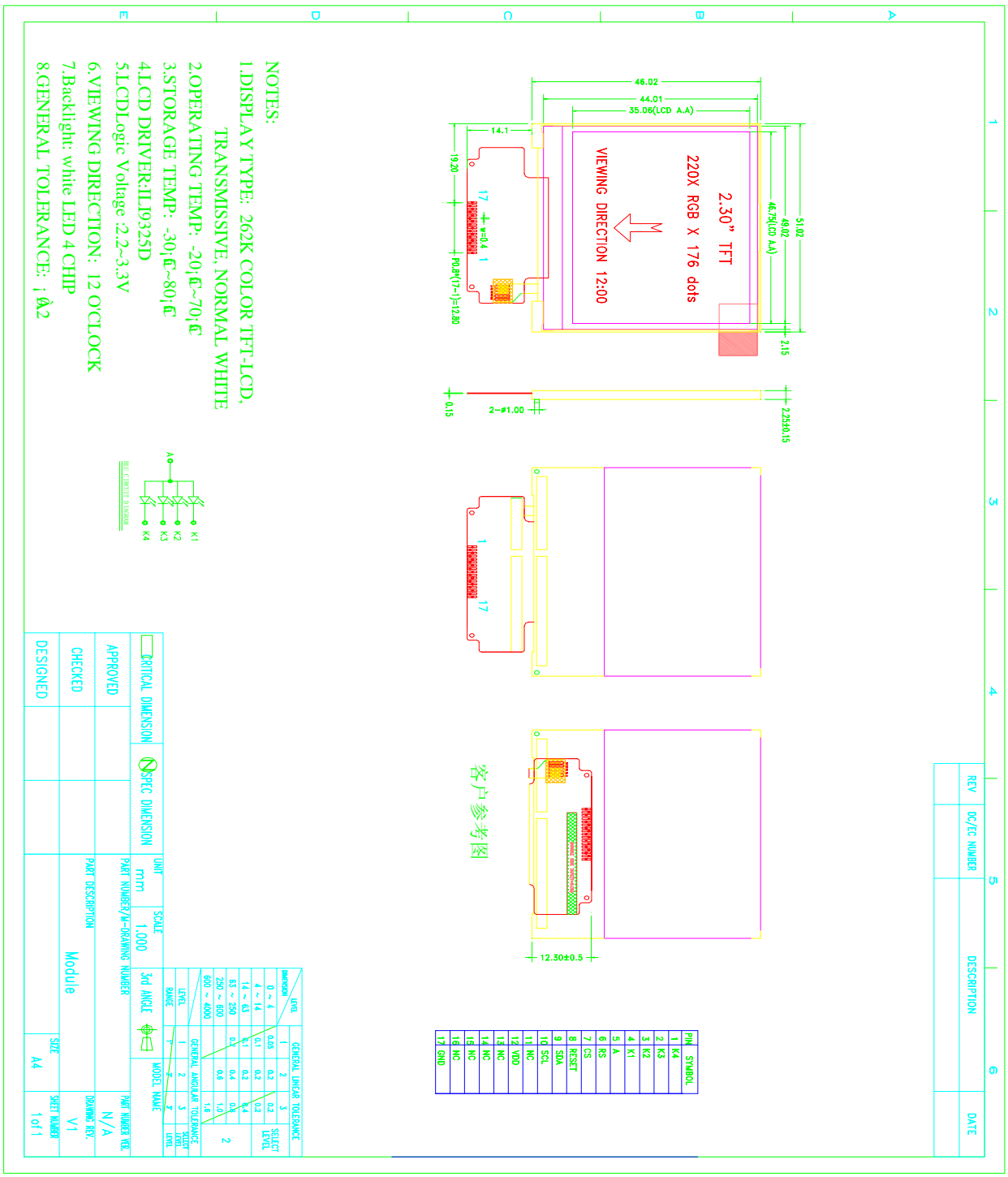
# 2. Features

| | |
|---|---|
| Display Mode | Transmissive |
| | a-TFT |
| Display Format | Graphic 220RGB*176 Dot-matrix |
| Input Data | 3/4 Line SPI interface by MPU |
| Viewing Direction | 6 o'clock |
| Drive | ILI9325D |

# 3. Mechanical Specification

| Item | Specifications | Unit |
|---|---|---|
| Dimensional outline | 51.02(W)*46.02(H)*2.25max.(T)<br>(FPC not include) | mm |
| Resolution | 220RGB*176 | dots |
| LCD Active area | 46.75(W)*35.06(H) | mm |
| Pixel size | 0.2125(W)*0.2125(H) | mm |

# 4. Mechanical Dimension


NOTES:
1.DISPLAY TYPE: 262K COLOR TFT-LCD,
TRANSMISSIVE, NORMAL WHITE
2.OPERATING TEMP: -20¡ãC~70¡ãC
3.STORAGE TEMP: -30¡ãC~80¡ãC
4.LCD DRIVER:ILI9325D
5.LCDLogic Voltage :2.2~3.3V
6.VIEWING DIRECTION: 12 O'CLOCK
7.Backlight: white LED 4 CHIP
8.GENERAL TOLERANCE: ¡À0.2
2.30" TFT
220X RGB X 176 dots
VIEWING DIRECTION 12:00
46.02
44.01
35.06(LCD A.A)
14.1
19.20
51.02
49.02
46.75(LCD A.A)
2.15
0.15
2-ø1.00
2.23±0.15
12.30±0.5
客户参考图
PIN SYMBOL
1 K4
2 K3
3 K2
4 K1
5 A
6 RS
7 CS
8 RESET
9 SDA
10 SCL
11 NC
12 VDD
13 NC
14 NC
15 NC
16 NC
17 GND
REV
DC/EC NUMBER
DESCRIPTION
DATE
CRITICAL DIMENSION
SPEC DIMENSION
UNIT mm
SCALE 1.000
3rd ANGLE
MODEL NAME
PART NUMBER/A-DRAWING NUMBER
PART DESCRIPTION Module
SIZE A4
SHEET NUMBER 1 of 1
PART NUMBER REV. N/A
DRAWING REV. V1
APPROVED
CHECKED
DESIGNED
GENERAL LINEAR TOLERANCE
GENERAL ANGULAR TOLERANCE
SELECT LEVEL

## 5. Maximum Ratings

| Item | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Supply voltage | V | -0.3 | 4.6 | V | |
| Operating temperature | $V_T$ | -0.3 | Vcc+0.3 | V | |
| Storage temperature | $T_{OPR}$ | -20 | 70 | ℃ | |
| Storage temperature | $T_{STR}$ | -30 | 80 | ℃ | |

## 6. Electrical Characteristics

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| Supply voltage | Logic | $V_{CC}$ | | 2.8 | 3.3 | 3.6 | V |
| Input Voltage | H level | $T_{IH}$ | | 0.8*IOVCC | | IOVCC | V |
| | L level | $T_{IL}$ | | -0.3 | | 0.2* IOVCC | |
| Storage temperature | | $I_{DD}$ | With internal voltage generation $V_{CC}$=2.8V; $T_{emp}$=25℃ | | | TBD | mA |

## 7. Backlight Characteristic

| Item | Symbol | Min | Typical | Max | Unit |
|---|---|---|---|---|---|
| LED module Forward voltage | $V_{LED}$ | 3.0 | 3.2 | 3.4 | V |
| LED module current | $V_{LED}$ | | 60 | | mA |
| L/G Surface Luminance ★1 | $L_S$ | 3800 | | | $Cd/m^3$ |
| LCM Surface brightness uniform ★2 | $L_D$ | 80 | | | % |

★ 1Test condition is:

(a) Center point on active area.

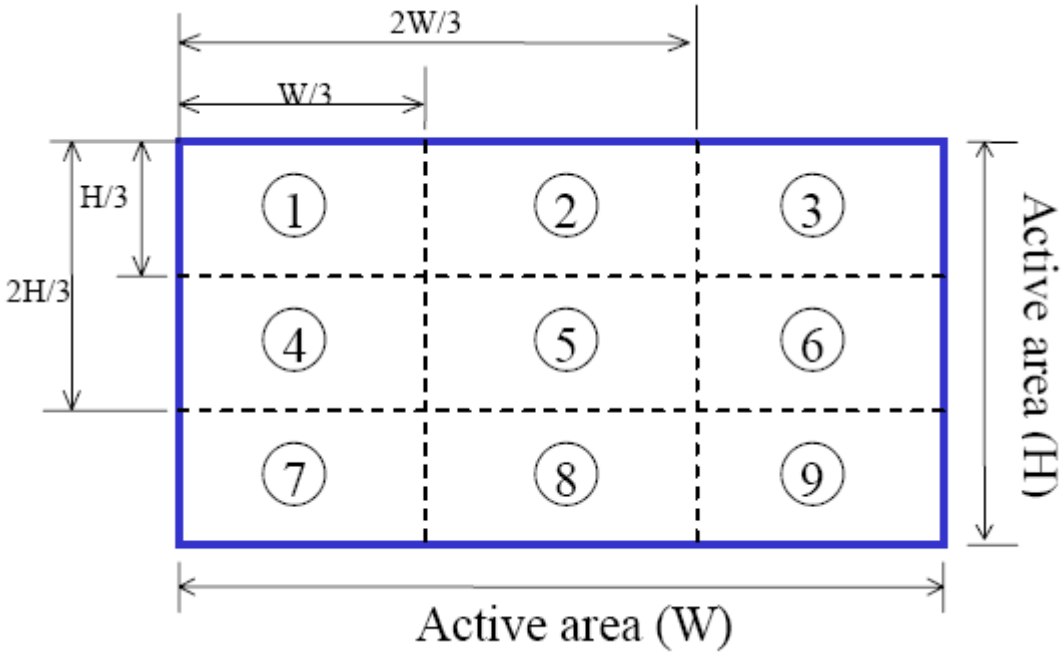
(b)Best Contrast.

★2Uniform measure condition:

(1)Measure 9 point. Measure location show below;

(2)Uniform=(Min. brightness /Max. brightness)*100%

(3)Best Contrast.




# 8. Module Function Description

## 8.1Pin Descriptions

| | | | |
|---|---|---|---|
| 1 | LEDK4 | Cathode of Backlight | **Notes** |
| 2 | LEDK3 | Cathode of Backlight | |
| 3 | LEDK2 | Cathode of Backlight | |
| 4 | LEDK1 | Cathode of Backlight | |
| 5 | LEDA | Anode of Backlight | |
| 6 | RS | Register select pin 0:Command 1:Data | |
| 7 | CS | Chip select pin | |
| 8 | RESET | LCM reset pin | |
| 9 | SDA | Serial data pin | |
| 10 | SCL | Serial clock pin | |
| 11 | NC | NC | |
| 12 | VDD | Power supply for analog (3.3V) | |
| 13 | NC | NC | |
| 14 | NC | NC | |
| 15 | NC | NC | |
| 16 | NC | NC | |
| 17 | GND | Ground | |

注意：FPC 线上，R2 位置上电阻 0 欧姆，使用 4 线 SPI 串口；R1 上电阻 0 欧姆，使用 3 线 SPI 串口。

R3 上电阻 0 欧姆，表示由 11 脚做选择 3/4 线串口：PIN11=0，3 线 SI，PIN11=1,4 线 SPI

## 8.2Timing characteristics.

**I80-System Interface Timing Characteristics**

**Normal Wrote Mode(IOVCC=1.65~3.3V,Vcc=2.4~3.3V)**

| Item | | Symbol | Unit | Min. | Typ. | Max. | Test Condition |
|---|---|---|---|---|---|---|---|
| Bus cycle time | Write | $t_{CYCW}$ | ns | 100 | | | |
| | Read | $t_{CYCR}$ | ns | 300 | | | |
| Write low-level pulse width | | $PW_{LM}$ | ns | 50 | | 500 | |
| Write high-level pulse width | | $PW_{HW}$ | ns | 50 | | | |
| Read low-level pulse width | | $PW_{LR}$ | ns | 150 | | | |
| Read high -level pulse width | | $PW_{HR}$ | ns | 150 | | | |
| Write/ Read rise/fall time | | $t_{WRr}$ /$t_{WRt}$ | ns | | | 25 | |
| Setup time | Write(RS to nCS,E/nWR) | ns | ns | 10 | | | |
| | Read (RS to nCS,E/nWR) | ns | ns | 5 | | | |
| Address hold time | | $T_{AH}$ | ns | 5 | | | |
| Write data set up time | | $t_{osw}$ | ns | 10 | | | |
| Write data hold time | | $t_H$ | ns | 15 | | | |
| Read data set up time | | $t_{DDR}$ | ns | | | 100 | |
| Read data hold time | | $t_{OHR}$ | ns | 5 | | | |

## Read Timing Characteristics

**Reset Timing Characteristics(VCC=1.8~3.3V.IOVCC=1.65~3.3V)**

| Item | Symbol | Unit | Min. | Typ.. | Max |
|---|---|---|---|---|---|
| Reset low-level width | $t_{RES}$ | ms | 1 | | |
| Reset rise time | $t_{RES}$ | μ s | | | 10 |

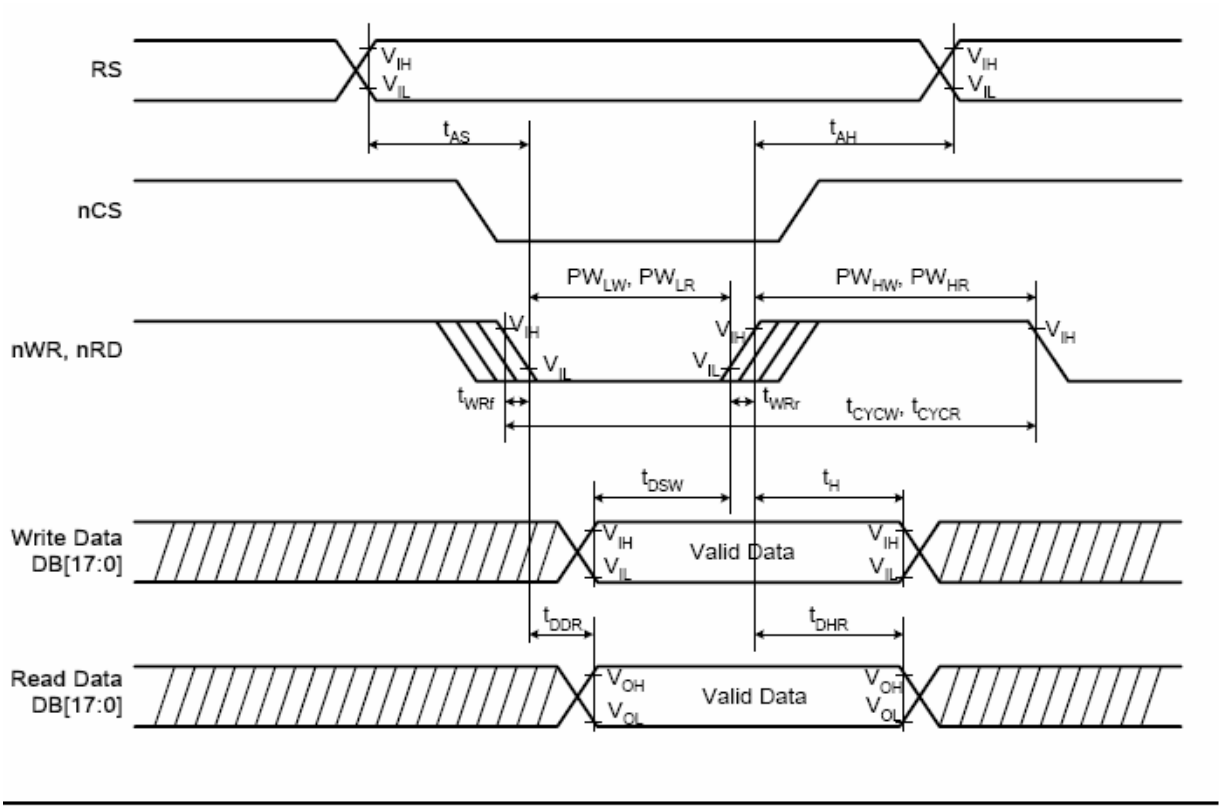
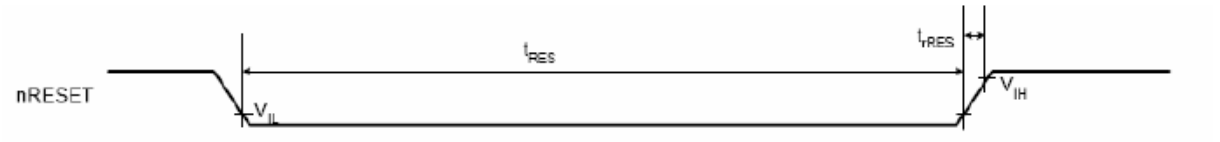



Figure 51 i80-System Bus Timing




Reset Timing

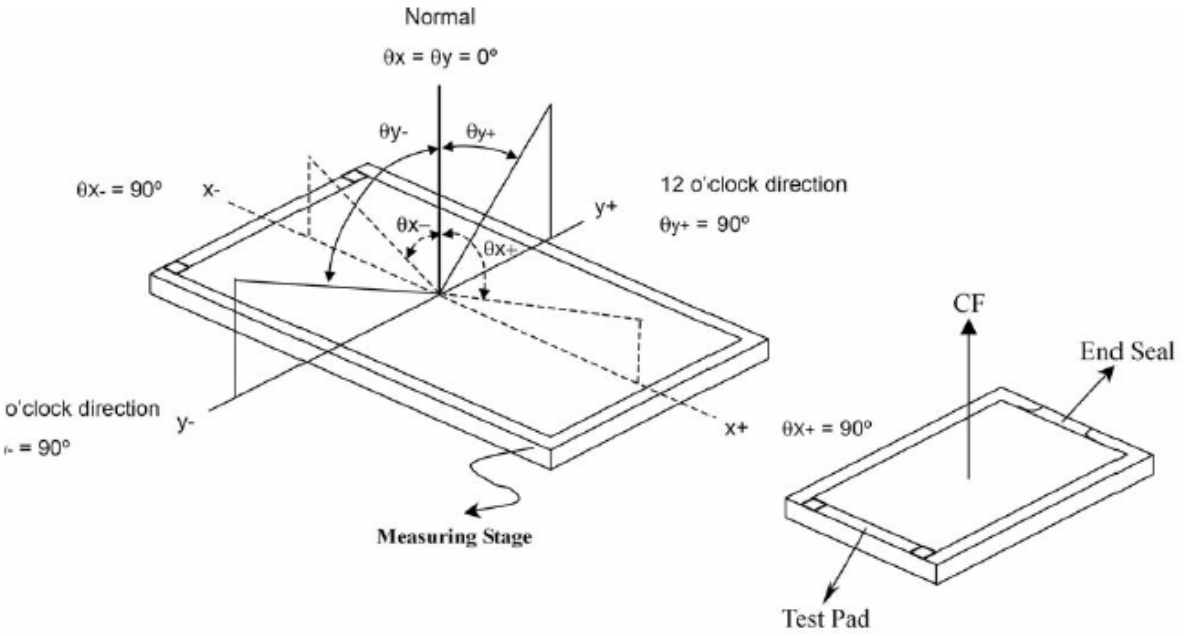
## 9.Electro-optical Characteristics

| Item | Symbol | Conditions | Temp | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Response Time | $T_R$ | θ = ϕ =0 | 25℃ | | TBD | TBD | msec | NOTE2 |
| | $T_F$ | | | | TBD | TBD | | |
| Viewing Angle Range | ϕ =0⁰(6”) | ϕ =90⁰(3”) | ϕ =180⁰(12”) | | | ϕ =270⁰(9”) | | NOTE3 |
| θ（25℃） CR≥10 | TBD | TBD | TBD | | | TBD | | NOTE3 |

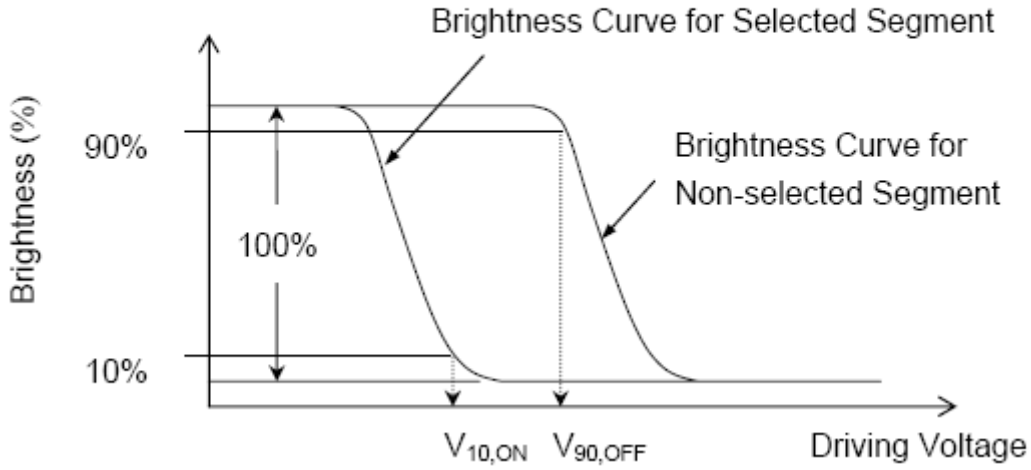
The above “viewing angle” is the measuring position with the largest contrast ratio. Not for good image quality. Viewing direction for good image quality is 12 O’clock.

●For panel only

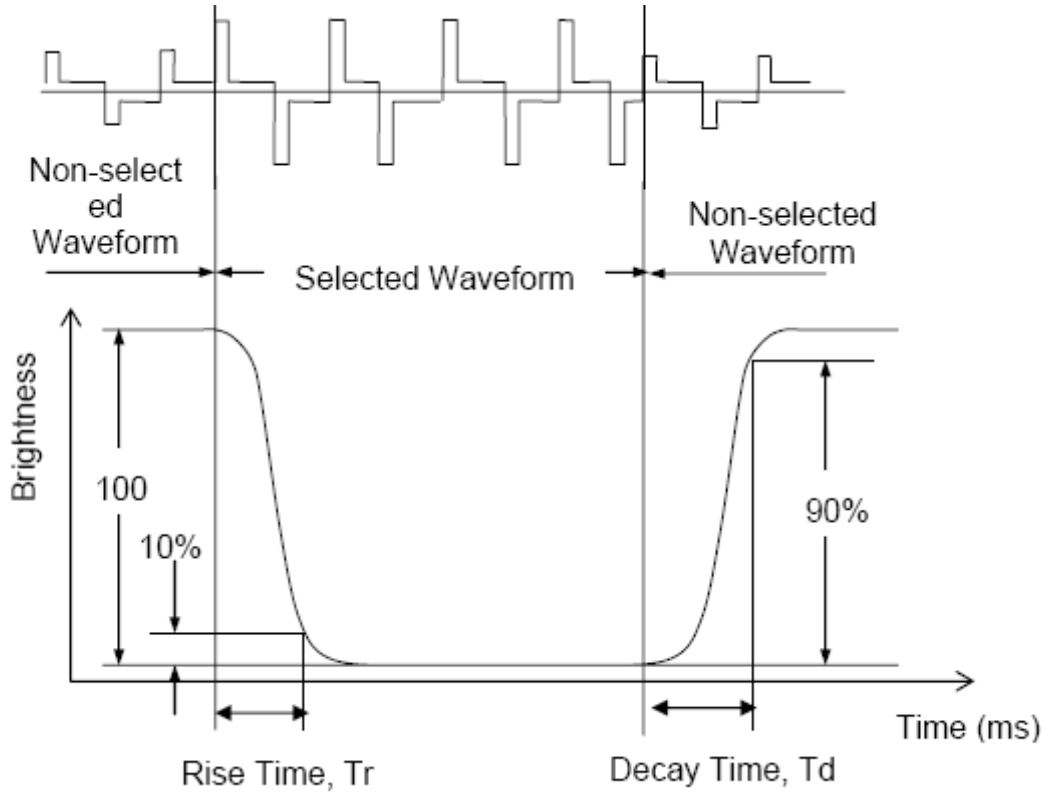
●Electro-Optical Characteristics Test Method



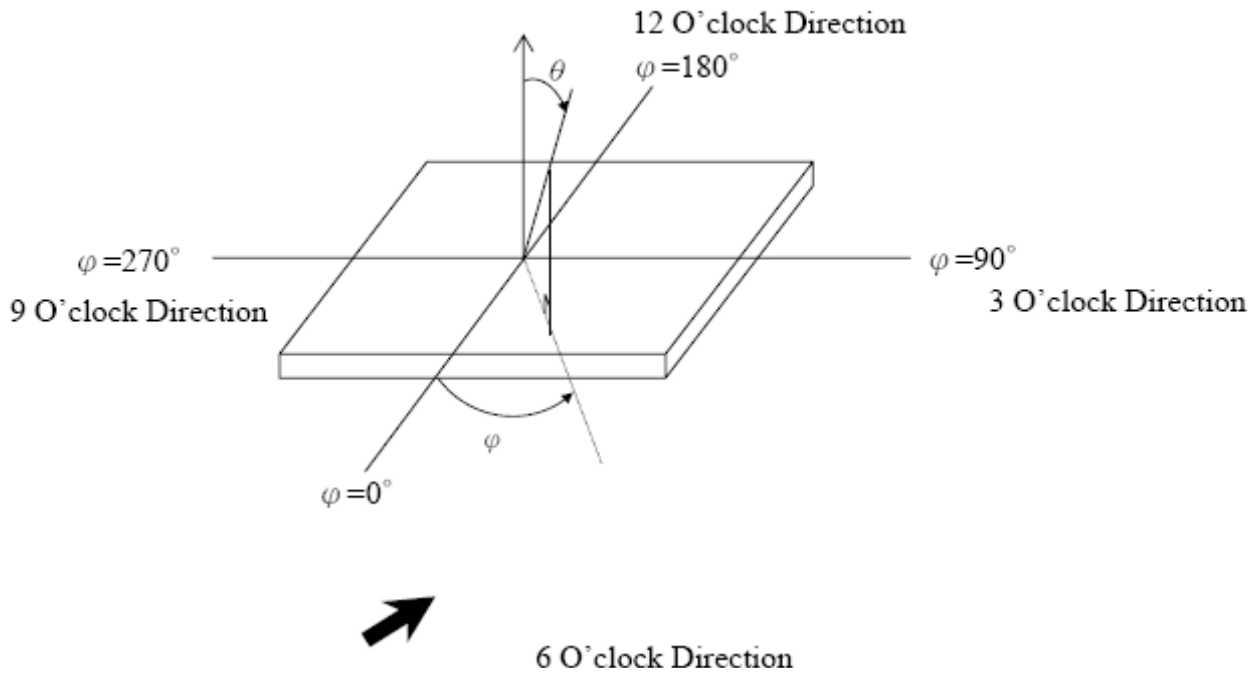

$$Vop = (V_{10,\,ON} + V_{90,\,OFF})/2$$




## .Note2.Definition of Optical Response Time:

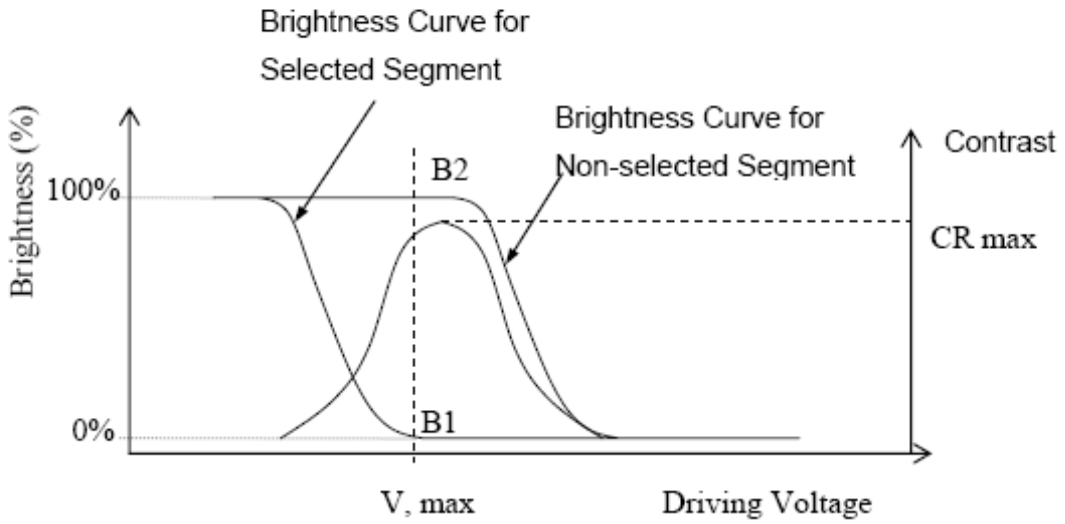



**.Note3.Definition of Viewing Angle θ and ϕ :**




## Note4.Definition of Contrast ratio (CR):

$$CR = \frac{\text{Brightness of Non-selected Segment (B2)}}{\text{Brightness of Selected Segment (B1)}}$$




## 10. Reliability

## 10.1Mtbf

The LCD module shall be designed to meet a minimum MTBF value of 50000 hours with normal

## 10.2Test condition

| NO. | ITEM | CONDITION | CRITERION |
|---|---|---|---|
| 1 | High Temperature Non-Operating Test | 80℃*240Hrs | 。No Defect Of Operational Function In Room Temperature Are Allowable<br>。IDD of LCM in Pre-and Post-Test Should Follow Specification |
| 2 | Low Temperature Non-Operating Test | -30℃*240Hrs | |
| 3 | High Temperature/Humidity Non Operating Test | 60℃*90%RH*240Hrs | |
| 4 | High Temperature Operating Test | 70℃*240Hrs | |
| 5 | Low Temperature Operating Test | -20℃*240Hrs | |
| 6 | Thermal Shock Test | -20 ℃ (30Min) v70 ℃ (30Min) *10CYCLES | |

Notes:

1. Judgments should be made after exposure in room temperature for two hours.
2. The distill water is used for the high temperature/humidity test.
3. The sample above is individually for every reliability tests condition.

## 11.Inspection standards

1.AQL(Acceptable Quality Level

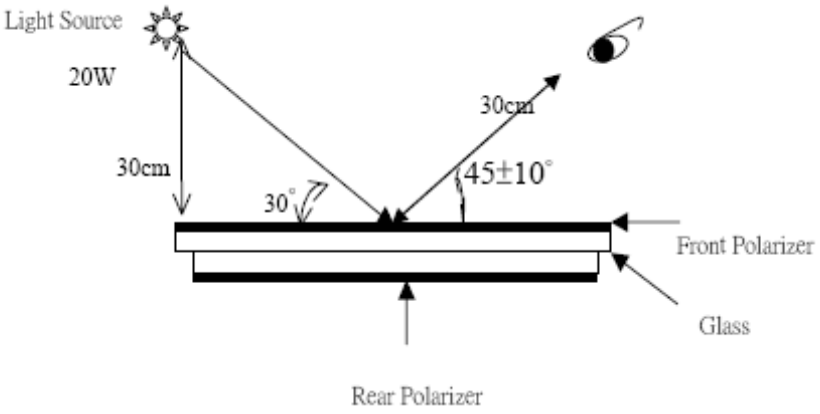
AQL of major and minor defect.

| | MAJOR DEFECT | MINOR DEFECT |
|---|---|---|
| AQL | 0.65 | 1.5 |

**2. Basic conditions for inspection**

The LCM face to us, in normal environment, the lux is 1000±200.(Darkroom's lux: 100±50),About an angle of incidence 30,a distance of 30 cm with an angle of 45 degree to check the products without uncovering the film!

**(As shown below)**

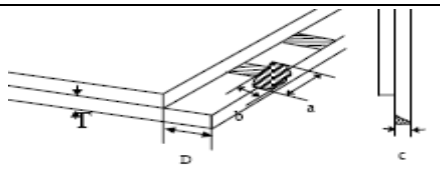
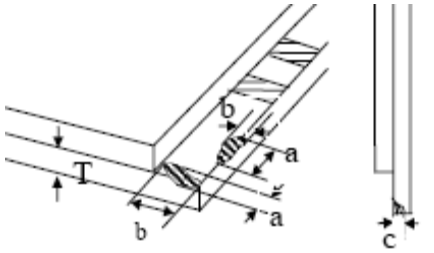
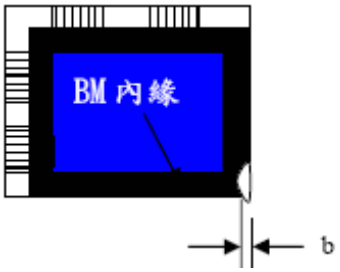



**3.Inspection item and criteria**

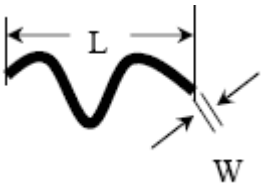
**3.1 Visual inspection criterion in immobility**

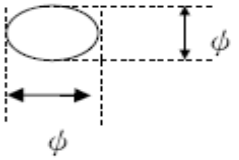
**3.1.1Glass defect**

| NO | Defect item | Criteria | Remark |
|---|---|---|---|
| 1 | Dimension Unconformity (Major defect) | By Engineering Drawing | |
| 2 | Cracks (Major defect) | 1. Linear cracks panel 【Reject】<br>2. Nonlinear crack contrast by limited sample |  |
| 3 | Glass extrude the conductive area (minor defect) | a: disregards and no influence assemblage.<br>1) b≤1/3Pin width(non bonding area) 【Accept】<br>2)bonding area≤0. 5mm 【Accept】 | A: Length, b: Width |
| 4 | Pin-side ,conductive area damaged (minor defect) | (a c: disregards)<br>b≤1/3of effective length for bonding electrode | a: length, b: Width, c: Thickness |

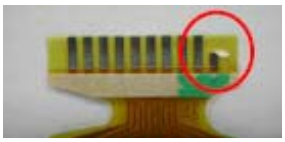
| | | | |
|---|---|---|---|
| | | 【Accept】 |  |
| 5 | Pin-side,non-conductive area damaged (minor defect) | 1)Damage area don't touch the ITO (Inclueling contraposition mark, except scribing mark) 【Accept】 2)C<T b≦BM1/3of width 【Accept】 3)c=T b not touch the seal glue 【Accept】 4)a disregards | a: Length, b: Width c: Thickness  |
| 6 | Non-pin-side damage (minor defect) | c<T 1)b exceeds 1/3Bm 【Reject】 c=T b not touch the seal glue 【Reject】 | c: Thickness b: width of   damage |

3.1.2LCD appearance defect(View area)

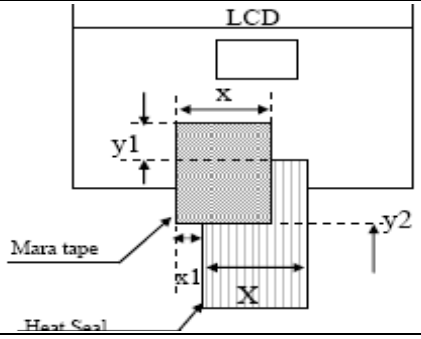
| NO | Defect item | Criteria | | Remark |
|---|---|---|---|---|
| 1 | Fiber、glass cratch、polarizer scratch/folded (minor defect) | Specification | Allowable | note1:L: Length, W: Width note2: disregard if out of AA   |
| | | W≦0.03mm | disregard | |
| | | 0.03mm<W≦0.05mm; L≦3.0mm | 2 | |
| | | 0.05mm<W≦0.1mm; L≦3.0mm | 1 | |
| | | W>0.1mm;L>3.0mm | 0 | |
| 2 | Polarizer bubble、concave and convex (minor defect) | φ≦0.2mm | disregard | note1: φ=(L+W)/2, L:Length, W :Width note2:disregard if out of AA |
| | | 0.2mm<φ≦0.3mm | 2 | |
| | | 0.3mm<φ≦0.5mm | 1 | |
| | | 0.5mm<φ | 0 | |
| 3 | Black dots、dirty dots、impurities、eye winker | φ≦0.15mm | disregard | note2:disregard if out of AA |
| | | 0.15mm<φ≦0.25mm | 2 | |

| | | | | |
|---|---|---|---|---|
| | (minor defect) | 0.25mm< ϕ ≦0. 3㎜ | 1 |  |
| | | 0.3mm< ϕ | 0 | |
| 4 | Polarizer prick (minor defect) | ϕ ≦0.1mm | disregard | note1: ϕ=(L+W)/2, L=Length, W=Width<br>note2:the distance between two dots>5mm |
| | | 0.1mm< ϕ ≦0. 25㎜ | 3 | |
| | | ϕ >0. 25㎜ | 0 | |

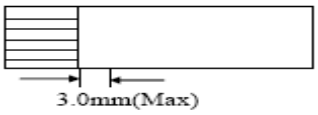
## 3.1.3FPC

| NO | Defect item | Criteria | | Remark |
|---|---|---|---|---|
| 1 | Copper screen peel (minor defect) | Copper screen peel 【Reject】 | |  |
| 2 | No release tape or peel | No release tape or peel 【Reject】 | | |
| 3 | Dirty dot and impurity of FPC for customer using side (minor defect) | Specification | Allowable | Note1: Cannot have stride ITO impurities |
| | | ϕ ≦0.25mm | 2 | |
| | | ϕ >0. 25 | 0 | |

## 3.1.4Black tape &Mara tape

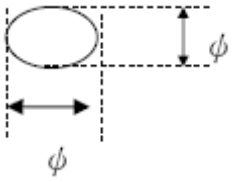
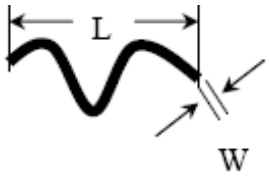
| NO | Defect item | Criteria | Remark |
|---|---|---|---|
| 1 | FPC or H/S black tape (minor defect) | 1. shift spec:<br>1) glue to the polarize 【Reject】<br>2) IC bare 【Reject】<br>2. left-and-right spec:<br>1)exceed of FPC edge or H-S edge【Reject】<br>2) IC bare 【Reject】 |  |
| 2 | No black tape (major defect) | No black tape 【Reject】 | |
| 3 | Tape position mistake (minor defect) | Not by engineering drawing | |
| 4 | Mara tape defect (minor defect) | Peel before pulling the protecting film 【Reject】 | |

### 3.1.5Silicon and Taffy glue

| NO | Defect item | Criteria | Remark |
|---|---|---|---|
| 1 | Quantity of silicon (major defect) | Uncover the ITO and circuit area 【Reject】 | note: compared by engineering |
| 2 | Taffy glue (major defect) | 1.Uncover the reveal copper area【Reject】 2.Cover layer 0.3mm(Min)~3.0mm(Max) 【Reject】 | note: if customer has special requirement, refer to the technical document   |
| 3 | Depth of glue covering (major defect) | Depth of glue covering overtop front Polarizer 【Reject】 | Except of the special requirement |

## 3.2Electrical criteria

| NO | Defect item | Criteria | Remark | |
|---|---|---|---|---|
| 1 | No display (major defect) | No display 【Reject】 | | |
| 2 | Missing line (major defect) | Missing line 【Reject】 | | |
| 3 | Seg-com light and dark (major defect) | Seg-com light and dark 【Reject】 | ND filter 2% test | |
| 4 | No display in immobility (major defect) | No display in immobility 【Reject】 | | |
| 5 | Flicker of Pattern (major defect) | Flicker of Pattern 【Reject】 | | |
| 6 | Mura (major defect) | ND filter 2%test | | |
| 7 | Over current (major defect) | Over current 【Reject】 | | |
| 8 | Voltage out of specification (major defect) | Voltage out of specification 【Reject】 | | |
| 9 | Pattern blur, error code (major defect) | Pattern blur, error code 【Reject】 | | |
| 10 | Dark light, Flicker (major defect) | Dark light, Flicker 【Reject】 | | |
| 11 | Black/white dots 、 Dirty | Specification | Allowable | Note1:disregard if out of AA |

| | | | | |
|---|---|---|---|---|
| | dots、eye winker (major defect) | Φ≦0.15mm | disregard |  |
| | | 0.15mm<Φ≦0.25mm | 2 | |
| | | 0.25mm<Φ≦0.3mm | 1 | |
| | | 0.3mm<Φ | 0 | |
| 12 | Fiber、glass crutch、Polarizer scratch/folded (major defect) | W≦0.03mm | disregard | Note1:L: Length, W: Width<br>Note2: disregard if out of AA<br>  |
| | | 0.03mm<W≦0.0.05mm L≦3.0mm | 2 | |
| | | 0.05mm<W≦0.1mm L≦3.0mm | 1 | |
| | | W>0.1mm;L>3.0mm | 0 | |

# 12.Precautions for using LCD modules.

## 12.1 Safety

(1)Do mot swallow any liquid crystal ,even if there is no proof that liquid crystal is poisonous.
(2)If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
(3)If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

## 12.2Srorang Conditions

(4)Store the panel or module in a dark place where the temperature is 23±5℃and the humidity is below 45 ±20%RH.
(5)Store in anti-static electricity container.
(6)Store in clean environment, free from dust, active gas, and solvent.
(7)Do not place the module near organics solvents or corrosive gases.
(8) )Do not crush, shake, or jolt the module.

## 12.3Handling Precautions

(9)Avoid static electricity, which can damage the CMOS LSI.
(10)The polarizing plate of the display is very fragile, please handle if very carefully.
(11)Do not give external shock.
(12)DO mot apply excessive force on the surface.
(13)Bo not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
(14)Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a

cleaning naphtha solvent.
(15)Do not operate it above the absolute maximum rating.
(16)Do not remove the panel or frame from the module.

## 12.4Warranty

The period is within twelve months since the date of shipping out under normal using and storage conditions.

# 13.Factory

**FACTORY NAME:**
**FACTORY ADDRESS:**
**FACTORY PHONE:**

# 14.Revision history

| Version | Revise record | Date |
|---|---|---|
| **A** | **Original version** | **2010-11-27** |
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