# LCM Specification

| | |
|---|---|
| **PRODUCT TYPE:** | **2.8TFT SerialModule** |
| **PRODUCT P/N:** | **FBS028AT10-N01-SPEC** |
| **VERSION:** | **V00** |

| Customer（客户） | | |
|---|---|---|
| **INSPECTIONRESULT**<br>检测结果 | **TESTED BY**<br>检测人 | **APPROVED BY**<br>确认人 |
| | | |

| Supplier(屏厂) | | |
|---|---|---|
| **DESIGNED BY** | **CHECKED BY** | **APPROVED BY** |
| | | |

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## Revision History

| Date | Rev. | Reason |
|---|---|---|
| 2018.12.12 | V00 | NEW ISSUE |
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# CONTENTS

## ■ GENERAL DESCRIPTION

**FBS028AT10-N01** is a TFT dot matrix LCD module.It is composed of a PCBA,color-LCD panel, driver IC, FPC and a backlight unit. The module display area contains 240x320 pixels. This product accords with RoHS environmental criterion.

## ■ LCM PARAMETER

| Item | Contents | Unit | Notes |
|---|---|---|---|
| LCD Type | TFT TRANSMISSIVE | / | / |
| Viewing direction | 12:00 | O' Clock | / |
| PCBA Outside | 50.00(W)*85.00(H)*11.80(T) | mm | / |
| LCM Outside Dimensions | 50.00(W)*69.20(H)*2.40(T) | mm | / |
| Active Area (WxH) | 43.20(W)*57.60(H) | mm | / |
| Number of Dots | 240x320 | / | / |
| Driver IC | LT268A | / | Vcc=3.3V |
| Colors | 262K | / | / |
| Touch Type | NC | / | / |
| Backlight Type | 1*4=4LEDS / White | / | Vbl=3.1V |
| Backlight Luminance | 250 | cd/m2 | / |
| Interface Type | **TTL UART (TXD/RXD)** | / | 5PIN（2.54） |
| Input Voltage | 5.0V（VDD） | V | 2A |

## ■ SERAL CHARACTERISTIC

| Item | MIN | Typical | MAX | Unit | Notes |
|---|---|---|---|---|---|
| Operating Voltage | 4.75 | 5.0 | 5.5 | V | VDD |
| Operating Current | --- | 250 | --- | mA | 5V Power |
| Operating Temperature | -20 | 25 | 70 | ° C | / |
| Storage Temperature | -30 | 25 | 80 | ° C | / |
| Serial Baud Rate | 2400 | 9600 | 115200 | bps | Standards |
| Serial Output Leve | 3.0 | 3.2 | 3.3 | V | H |
| Serial Input Leve | 3.0 | 3.3 | 5.0 | V | H |
| ExtendFlash | 16M | 64M | 128M | bits | Nor Flash |
| Flash Memory | --- | 64K | --- | bits | MCU |
| SRAMMemory | --- | 8K | --- | bits | MCU |
| MCU Frequency | --- | 72M | --- | Hz | MCU |

## ■ ABSOLUTE MAXIMUM RATINGS(TFT,非PCBA)

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Power for Circuit Driving | VCC | -0.3 | 4.6 | V |
| Power for Circuit Logic | IOVCC | -0.3 | 4.6 | V |
| Input voltage | Vin | -0.3 | VCC + 0.3 | V |
| Operating temperature | Top | -20 | 70 | ℃ |
| Storage temperature | Tst | -30 | 80 | ℃ |
| Humidity | RH | / | 90%(Max60℃) | RH |

## ■ ELECTRICAL SPECIFICATIONS(TFT,非PCBA)

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Power for analog/logic | Vcc -GND | 2.65 | 3.3 | 3.6 | V |
| I/O power supply | IOVCC | 1.65 | 3.3 | 3.6 | V |
| Input Current | Idd | TBD | TBD | TBD | mA |
| Input voltage ' H ' level | Vih | 0.7IOVCC | / | IOVCC | V |
| Input voltage ' L ' level | Vil | GND | 0 | 0.3IOVCC | V |
| Output voltage ' H ' level | Voh | 0.8IOVCC | / | IOVCC | V |
| Output voltage ' L ' level | Vol | GND | 0 | 0.2IOVCC | V |

## ■ BACKLIGHT CHARACTERISTICS

**Usingcondition:constantcurrentdrivingmethod（If=80mA(+/-10%）**

| Item | Symbol | Min | Typ | Max | Unit | Condition |
|---|---|---|---|---|---|---|
| Forward voltage | Vf | 2.9 | 3.1 | 3.3 | V | If=80mA |
| Luminance with LCD | Lv | -- | 250 | -- | cd/m2 | / |
| Number of LED | / | 1*4 = 4 | | | Pcs | / |
| Connection mode | S | 1 Serial4Parallel | | | / | / |

## ■ BLOCK DIAGRAM
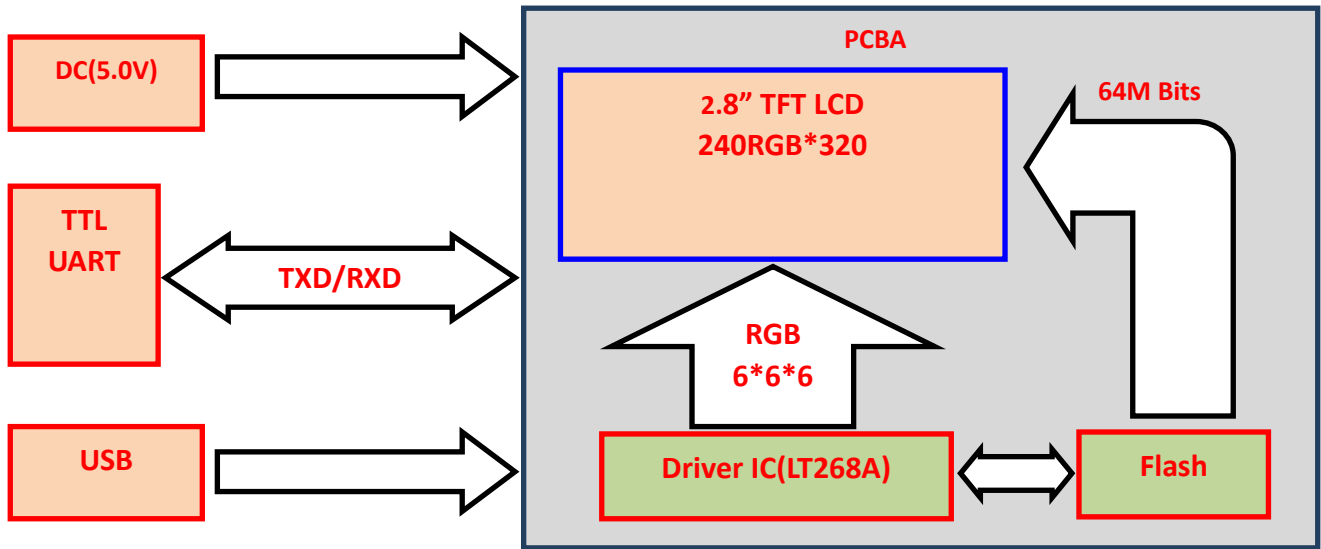


## ■ PIN DESCRIPTION

### CN1:TTL UART（5PIN-2.54mm）

| Pin.No | Symbol | DESCRIPTION |
|---|---|---|
| 1 | VDD | Power Supply Voltage(5.0V+/-0.3V) |
| 2 | TXD | UART transmit data output of serial communication（3.3V） |
| 3 | RXD | UART receiving data input of serial communication（3.3V） |
| 4 | GND | Ground |
| 5 | BUSY | Software burning（L） |

### CN2: USB Software Upgrade（MCU and Flash）

| Pin.No | Symbol | DESCRIPTION |
|---|---|---|
| 1 | VDD | Power Supply Voltage（5.0V+/-0.3V） |
| 2 | DM | USB Data Terminal（Positive） |
| 3 | DP | USB Data Terminal（Negative） |
| 4 | GND | Ground |
| 5 | GND | Ground |

### CN3: DAC Audio Output（2.54mm）

| Pin.No | Symbol | DESCRIPTION |
|---|---|---|
| 1 | VCC_3.3V | IC Power Supply Voltage（3.3V+/-0.3V） |
| 2 | GND | Ground |
| 3 | TXD | UART transmit data output of serial communication（3.3V） |
| 4 | RXD | UART receiving data input of serial communication（3.3V） |
| 5 | /RST | MCU Reset output signal |
| 6 | PWM01 | LT268A PWM output |

# ■ OUTLINE DIMENSION



**LCD-PIN**

| PIN | NAME |
|-----|------|
| 1 | DB0 |
| 2 | DB1 |
| 3 | DB2 |
| 4 | DB3 |
| 5 | GND |
| 6 | IOVCC(1.8/2.8V) |
| 7 | /CS |
| 8 | RS |
| 9 | /WR |
| 10 | /RD |
| 11 | NC(IM0) |
| 12 | YL(NC) |
| 13 | YU(NC) |
| 14 | XR(NC) |
| 15 | YD(NC) |
| 16 | LED-A |
| 17 | LED-K1 |
| 18 | LED-K2 |
| 19 | LED-K3 |
| 20 | LED-K4 |
| 21 | NC |
| 22 | DB4 |
| 23 | DB8 |
| 24 | DB9 |
| 25 | DB10 |
| 26 | DB11 |
| 27 | DB12 |
| 28 | DB13 |
| 29 | DB14 |
| 30 | DB15 |
| 31 | /RESET |
| 32 | VCC2.8V |
| 33 | IOVCC(1.8/2.8V) |
| 34 | GND |
| 35 | DB5 |
| 36 | DB6 |
| 37 | DB7 |

TFT 2.8" 262K
240RGB×320 DOTS

VIEWING DIRECTION

CIRCUIT DIAGRAM   LED-A —   — LED-K

**NOTES:**
1. DISPLAY TYPE:  2.8 TFT(262K COLOR)
2. VIEWING DIRECTION: 12:00
3. POLARIZER MODE:  TRANSMISSIVE/POSITIVE
4. DRIVER IC: LT268A
5. BACK LIGHT: 4CHIP-WHITE LED; PARALLEL CONNECTION
6. OPERATING TEMP.:  −20°C~70°C
7. STORAGE TEMP.:  −30°C~80°C
8. UNMARKED TOLERANCE:±0.2

**CN1(TTL-UART)**

| 1 | VDD(5.0V) |
|---|-----------|
| 2 | GND |
| 3 | TXD |
| 4 | RXD |
| 5 | BUSY |

**CN2(USB-Upgrade)**

| 1 | VBUS |
|---|------|
| 2 | USBD- |
| 3 | USBD+ |
| 4 | GND |
| 5 | GND |

**CN3(SOFTWARE)**

| 1 | VCC(3.3V) |
|---|-----------|
| 2 | GND |
| 3 | TXD |
| 4 | RXD |
| 5 | /RST |
| 6 | PWM01 |

UNLESS OTHERWISE NOTED:

DRAWING TYPE: **TTL UART**   REV: A0

DRAWING No.: FBS028AT10-N01

CHECKED BY:          DATE:

THIRD ANGLE PROJECTION

SCALE 1 : 1    SHEET: 1 OF 1

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## ■ OPTICAL SPECIFICATIONS

| Item | | Symbol | Condition | Min | Typ | Max | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Response time | | Tr+Tf | θ=0°<br>Φ=0°<br>Ta=25℃ | - | 20 | 40 | ms | / |
| Contrast ratio | | Cr | | - | 350 | - | - | / |
| Luminanceuniformity | | δ WHITE | | 80 | - | - | % | / |
| Viewing angle range | | θ | Φ=0° | - | 60 | - | deg | / |
| | | | Φ=90° | - | 60 | - | deg | |
| | | | Φ=180° | - | 60 | - | deg | |
| | | | Φ=270° | - | 40 | - | deg | |
| CIE(x,y) chromaticity | Red | x | θ=0°<br>Φ=0°<br>Ta=25℃ | - | 0.610 | - | / | / |
| | | y | | - | 0.329 | -- | | |
| | Green | x | | - | 0.299 | - | | |
| | | y | | - | 0.567 | - | | |
| | Blue | x | | - | 0.143 | - | | |
| | | y | | - | 0.111 | - | | |
| | White | x | | - | 0.308 | - | | |
| | | y | | - | 0.327 | - | | |

## Definition of Viewing Angle θ and Φ



Normal:θ =0°

Φ=90°

θ

Φ=180°    Φ=0°

9 O'clock Direction    3 O'clock Direction

Φ

Φ=270°

Viewing Direction：6 O'clock Direction
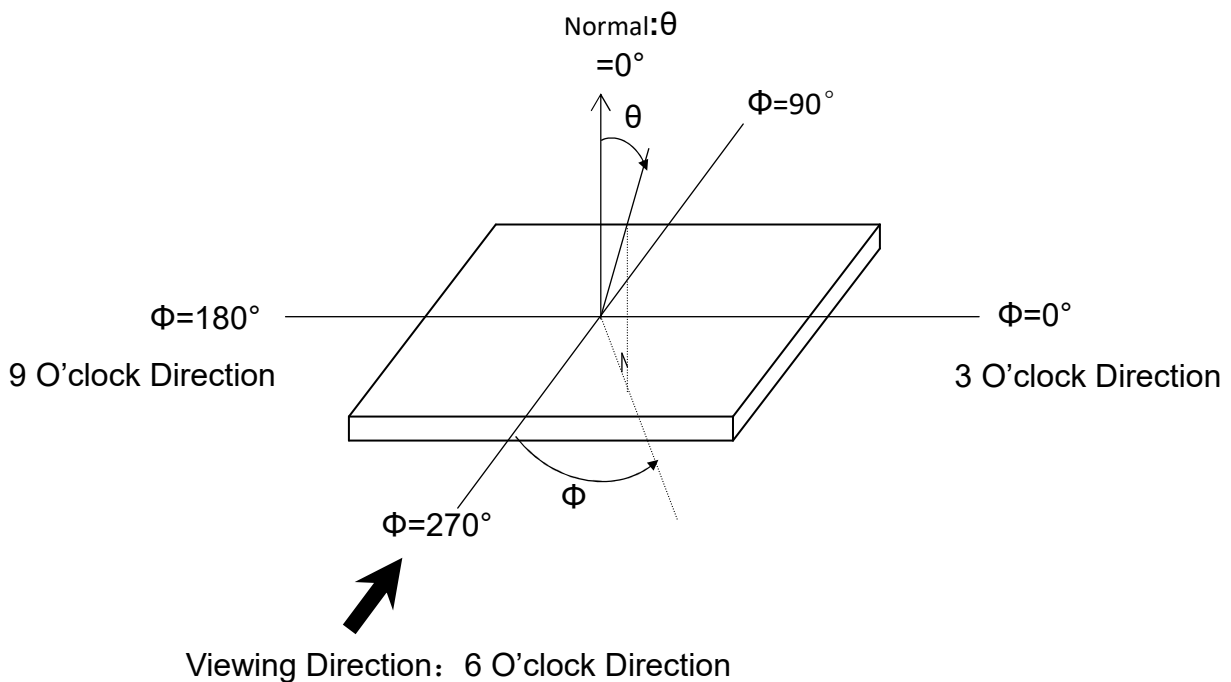
## ■ TIMING CHARACTERISTICS

**TBD**

## ■ TFT serial screen protocol table without master terminal

表 2-1：串口屏指令集

| 主功能 | 细项功能 | 指令码(1Byte) | 主功能 | 细项功能 | 指令码(1Byte) |
|---|---|---|---|---|---|
| 显示图片 | 单张/多张图片 | 80h | 几何图形 | 画点 | DFh |
| | 循环拨放 | 81h | | 直线 | E0h |
| | 弹出图片 | D8h | | 空心圆形 | E1h |
| | 循环卷动 | D9h | | 实心圆形 | E2h |
| | GIF 动画 | 88h | | 带框实心圆形 | E3h |
| | 数字图片 | 90h | | 空心椭圆 | E4h |
| 显示控件图片 | 显示单一控件图片 | A0h | | 实心椭圆形 | E5h |
| | 取消单一控件图片 | A1h | | 带框实心椭圆 | E6h |
| 指标与造图 | 进度条指标图 | B0h | | 空心矩形 | E7h |
| | 环形指标图 | DCh | | 实心矩形 | E8h |
| 显示字库 | 字库-1 | C0h | | 带框矩形 | E9h |
| | 字库-2 | C1h | | 空心圆角矩形 | EAh |
| | 字库-3 | C2h | | 实心圆角矩形 | EBh |
| | 字库-4 | C3h | | 带框圆角矩形 | ECh |
| 背光亮度 | 设置亮度 | BAh | | 空心三角形 | EDh |
| | On/Off | BCh | | 实心三角形 | EEh |
| 版本侦测 | 版本侦测 | BFh | | 带框三角形 | EFh |
| 开机指令 | 开机指令 | 9Ah | | 圆柱体 | F4h |
| 电阻屏校验 | 电阻屏校验指令 | 8Bh | | 表格视窗 | F6h |
| 串口屏侦测 | 联机检查 | BEh | | | |

## 表 2-2：上位机与 LT268A 串口屏协议表

| 主功能 | 细项功能 | 主控端发送（工业串口屏接收） | | | | | | 主控端接收（工业串口屏发送） | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 起始码(1Bytes) | 指令码(1Byte) | 序号(1Byte) | 指令参数 | CRC码(2Bytes) | 结束码(4Bytes) | 起始码(1Bytes) | 指令码(1Byte) | 信息码/反馈码(1Bytes) | CRC码(2Bytes) | 附加信息(2Bytes) | 结束码(4Bytes) |
| 显示图片 | 单张/多张图片 | Start | 80h | nn | | CRC | End | Start | 80h | 信息码 | CRC | | End |
| | 循环拨放 | Start | 81h | nn | | CRC | End | Start | 81h | 信息码 | CRC | | End |
| | 弹出图片 | Start | D8h | nn | | CRC | End | Start | D8h | 信息码 | CRC | | End |
| | 循环卷动 | Start | D9h | nn | | CRC | End | Start | D9h | 信息码 | CRC | | End |
| | GIF 动画 | Start | 88h | nn | | CRC | End | Start | 88h | 信息码 | CRC | | End |
| | 数字图片 | Start | 90h | nn | ddd.d | CRC | End | Start | 90h | 信息码 | CRC | | End |
| 显示控件图片 | 显示单一控件图片 | Start | A0h | nn | | CRC | End | Start | A0h | 信息码 | CRC | | End |
| | | 按下控件图片时 | | | | | | Start | A0h | 控件图片ID 号+01h | CRC | | End |
| | | 放开控件图片时 | | | | | | Start | A0h | 控件图片ID 号+00h | CRC | CCM1~8 (32 Bytes) | End |
| | 取消单一控件图片 | Start | A1h | nn | | CRC | End | Start | A1h | 信息码 | CRC | | End |
| 指标与造图 | 进度条指标图 | Start | B0h | nn | Vaule (2 Bytes) | CRC | End | Start | B0h | 信息码 | CRC | | End |
| | 环形指标图 | Start | DCh | nn | S_Angle, A_Angle | CRC | End | Start | DCh | 信息码 | CRC | | End |
| 显示字串 | 字库-1 | Start | C0h | nn | 字符串 String | CRC | End | Start | C0h | 信息码 | CRC | | End |
| | 字库-2 | Start | C1h | nn | 字符串 String | CRC | End | Start | C1h | 信息码 | CRC | | End |
| | 字库-3 | Start | C2h | nn | 字符串 String | CRC | End | Start | C2h | 信息码 | CRC | | End |
| | 字库-4 | Start | C3h | nn | 字符串 String | CRC | End | Start | C3h | 信息码 | CRC | | End |
| 背光亮度 | 设置亮度 | Start | BAh | | BL (00~0Fh) | CRC | End | Start | BAh | 信息码 | CRC | | End |
| | On/Off | Start | BCh | | 00 或 01 | CRC | End | Start | BCh | 信息码 | CRC | | End |
| 合并指令/开机指令 | 合并/开机指令 | Start | 9Ah | nn | | CRC | End | Start | COM1~COM8 (32 Bytes) | | | | End |
| | | | | | | | | | 9Ah | 信息码 | CRC | | |
| 电阻屏校验 | 电阻屏校验 | Start | 8Bh | | | CRC | End | Start | 8Bh | 信息码 | CRC | | End |

| 主功能 | 细项功能 | 主控端发送（工业串口屏接收） | | | | | | 主控端接收（工业串口屏发送） | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 起始码(1Bytes) | 指令码(1Byte) | 序号(1Byte) | 指令参数 | CRC码(2Bytes) | 结束码(4Bytes) | 起始码(1Bytes) | 指令码(1Byte) | 信息码/反馈码(1Bytes) | CRC码(2Bytes) | 附加信息(2Bytes) | 结束码(4Bytes) |
| 几何图形 | 画点 | Start | DFh | nn | | CRC | End | Start | DFh | 信息码 | CRC | | End |
| | 直线 | Start | E0h | nn | | CRC | End | Start | E0h | 信息码 | CRC | | End |
| | 空心圆形 | Start | E1h | nn | | CRC | End | Start | E1h | 信息码 | CRC | | End |
| | 实心圆形 | Start | E2h | nn | | CRC | End | Start | E2h | 信息码 | CRC | | End |
| | 空心椭圆 | Start | E4h | nn | | CRC | End | Start | E3h | 信息码 | CRC | | End |
| | 实心椭圆形 | Start | E5h | nn | | CRC | End | Start | E5h | 信息码 | CRC | | End |
| | 带框实心椭圆 | Start | E6h | nn | | CRC | End | Start | E6h | 信息码 | CRC | | End |
| | 空心矩形 | Start | E7h | nn | | CRC | End | Start | E7h | 信息码 | CRC | | End |
| | 实心矩形 | Start | E8h | nn | | CRC | End | Start | E8h | 信息码 | CRC | | End |
| | 带框矩形 | Start | E9h | nn | | CRC | End | Start | E9h | 信息码 | CRC | | End |
| | 空心圆角矩形 | Start | EAh | nn | | CRC | End | Start | EAh | 信息码 | CRC | | End |
| | 实心圆角矩形 | Start | EBh | nn | | CRC | End | Start | EBh | 信息码 | CRC | | End |
| | 带框圆角矩形 | Start | ECh | nn | | CRC | End | Start | ECh | 信息码 | CRC | | End |
| | 空心三角形 | Start | EDh | nn | | CRC | End | Start | EDh | 信息码 | CRC | | End |
| | 实心三角形 | Start | EEh | nn | | CRC | End | Start | EEh | 信息码 | CRC | | End |
| | 带框三角形 | Start | EFh | nn | | CRC | End | Start | EFh | 信息码 | CRC | | End |
| | 圆柱体 | Start | F4h | nn | | CRC | End | Start | F4h | 信息码 | CRC | | End |
| | 表格视窗 | Start | F6h | nn | | CRC | End | Start | F6h | 信息码 | CRC | | End |
| 串口屏侦测 | 联机检查 | Start | BEh | | | CRC | End | Start | 5Ah | | CRC | | End |
| | | | | | | | | Start | BEh | 信息码 | CRC | | End |
| | 版本检查 | Start | BFh | | | CRC | End | Start | MCU Code(5Bytes) + Module Info. (42Bytes) | | CRC | | End |
| | | | | | | | | Start | BFh | 信息码 | CRC | | End |
| LT268A 复位 | Reset LT268A | Start | BDh | | | CRC | End | Start | BDh | 信息码 | CRC | | End |

|  |  |
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## ■ INSPECTION CRITERION

### Sampling Method

Unless otherwise agreed upon in writing, the sampling inspection shall be applied to the Customer's incoming inspection.
1 Lot size: Quantity per shipment lot
2 Sampling type: Normal inspection , single sampling
3 Inspection level: Ⅱ
4 Sampling table: MIL-STD-105D
5 Acceptable Quality Level(AQL): Major=0.65 Minor=1.5

### Inspection Method

1) Ambient Condition:
    a. Temperature: Room temperature 25±5℃
    b. Illumination: Single fluorescent lamp non-directive(300 to 700 Lux)
2) Viewing distance
    The distance between the LCD and the inspector's eyes shall be at least 30-50cm.
3) Viewing Angle
    The inspection shall be conducted within normal viewing angle range.
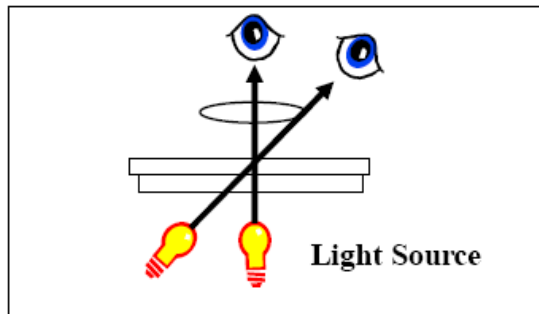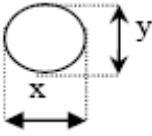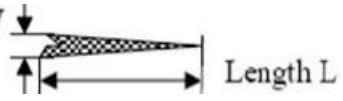


### Major Defect
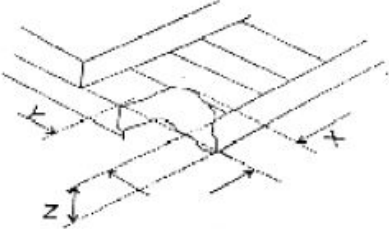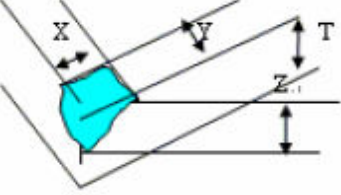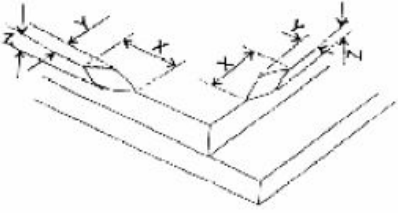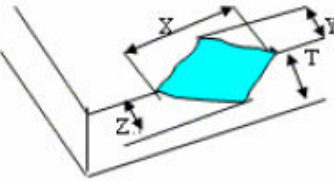
| No | Items | Inspection Standard | Classification of defects |
|---|---|---|---|
| 1 | All functional defects | 1.No display<br>2.Display abnormally<br>3.Missing vertical，horizontal segment<br>4.Short circuit<br>5. Back-light no lighting, flickering and abnormal lighting. | Major |
| 2 | Missing | Missing component | |
| 3 | Outline dimension | Overall outline dimension beyond the drawing is not allowed. | |
| 4 | linearity | No more than 1.5% | |

# Cosmetic Defect

| No | Items | Inspection Standard | | Classification of defects |
|---|---|---|---|---|
| 1 | Clear Spot, Black Spot, white Spot, defect Pinhole, Foreign Particle, polarizer Dirt TP Dirt | For dark/white spot, size Φ is defined as Φ=(x+y)/2 | | Minor |
| | | Size(mm) | Acceptable Qty | |
| | | Φ≤0.15 | Ignore | |
| | | 0.15＜Φ≤0.20 | 2 | |
| | | 0.20＜Φ≤0.30 | 1 | |
| | | Φ＞0.30 | 0 | |
| 2 | (line defect) Black and White line Polarizer scratch | Define: Width W Length L | | Minor |
| | | Width(mm) | Length(mm);Acceptable Qty | |
| | | W≤0.03 | Ignore | |
| | | 0.03<W≤0.05 | L≤3.0; N≤2 | |
| | | 0.05<W≤0.1 | L≤2.0; N≤2 | |
| | | 0.1<W | Define as spot defect | |
| 3 | Dim Spots Circle shaped and dim edged defects | / | | Minor |
| | | Size(mm) | Acceptable Qty | |
| | | Φ≤0.2 | Ignore | |
| | | 0.20＜Φ≤0.40 | 2 | |
| | | 0.40＜Φ≤0.60 | 1 | |
| | | Φ＞0.60 | 0 | |

| No | Items | Inspection Standard | Classification of defects |
|---|---|---|---|
| 4 | Glass defect TP defect | **（1）Chips on corner（A:LCD Glass defect）**<br><br><br><br>| X(mm) | Y(mm) | Z(mm) |<br>\|---\|---\|---\|<br>\| ≤2.0 \| ≤S \| Disregard \|<br><br>Notes: S=contact pad length<br>Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.<br><br>**（2）Chips on corner （TP Glass defect）**<br><br><br><br>\| X(mm) \| Y(mm) \| Z(mm) \|<br>\|---\|---\|---\|<br>\| ≤3.0 \| ≤3.0 \| Disregard \|<br><br>**（3）Usual surface cracks（LCD Glass defect）**<br><br><br><br>\| X(mm) \| Y(mm) \| Z(mm) \|<br>\|---\|---\|---\|<br>\| ≤3.0 \| <Inner border line of the seal \| Disregard \|<br><br>**（4）Usual surface cracks（TP Glass defect）**<br><br><br><br>\| X(mm) \| Y(mm) \| Z(mm) \|<br>\|---\|---\|---\|<br>\| ≤6.0 \| ＜2.0 \| Disregard \|<br><br>**（5）Crack（Cracks tend to break are not allowed.）** | Minor |

## ■ RELIABILITY

| N0. | TEST ITEM | CONDITIONS |
|---|---|---|
| 1 | High Temperature Storage | 80℃；72hrs |
| 2 | Low Temperature Storage | -30℃；72hrs |
| 3 | HighTemperature Operation | 70℃；72hrs |
| 4 | Low Temperature Operation | -20℃；72hrs |
| 5 | High Temperature and HighHumidity Operation | 50℃, 90% RH；120 hrs |
| 6 | Thermal shock(Storage) | -20℃(0.5Hr)→70℃(0.5Hr)<br>100 Cycles |

**NOTE:**

1. All judgement of display are performed after temperature of panel return to room temperature.
2. Display function should be no change under normal operating condition.
3. Under no condensation of dew.
4. WE only guarantee the above 6 test items, and without guarantee the others.

## ■ PRECAUTIONS

### Handing Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile, it tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents
- Isopropyl alcohol
- Ethyl alcohol
Do not scrub hard to avoid damaging the display surface.
(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
- Water
- Ketone
- Aromatic solvents
Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.
(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.
(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.
(9) Do not attempt to disassemble or process the LCD module.
(10) NC terminal should be open. Do not connect anything.
(11) If the logic circuit power is off, do not apply the input signals.
(12) Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.
- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

## Storage Precautions

When storing the LCD modules, the following precaution is necessary.
(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.
(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0° C and 35° C.
(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

## Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

|  |  |
|  |  |

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.
To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.
- Exposed area of the printed circuit board.
-Terminal electrode sections.