JEWEL HILL ELECTRONIC CO.,LTD.

# SPECIFICATIONS FOR LCD MODULE

## Module No. JH50480800A

JEWEL HILL

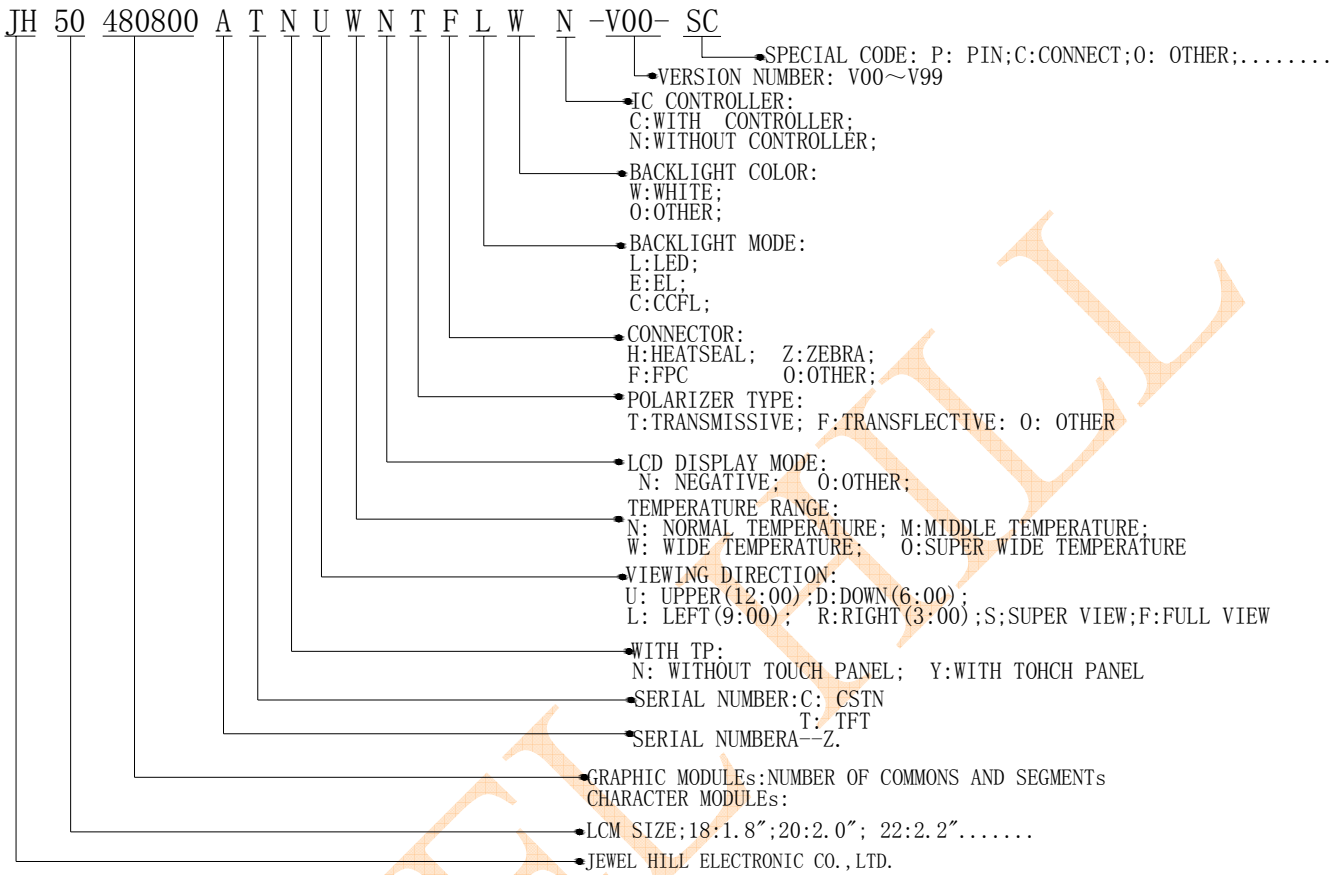
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# LCM Number System




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## 1. GENERAL DESCRIPTION.

The JH50480800A model is a Color TFT LCD. This main Module has a **5.0** inch diagonally measured active display area with 480(RGB)×800 resolution. Each pixel is divided into Red, Green and Blue sub-pixels and dots which are arranged in vertical stripes.

The LCD color is determined with 16.7M colors signal for each pixel.

The JH50480800A has been designed to apply the interface method that enables low power, high speed, and high contrast.

The JH50480800A is intended to support applications where thin thickness, wide viewing angle and low power are critical factors and graphic displays are important.

## 2. GENERAL FEATURES.

| Item | Display Panel | Remark |
|---|---|---|
| Display Mode | Normally White, Transmissive LCD | |
| Viewing Direction | 12H | |
| Input Signals | SPI-RGB | |
| Outside Dimensions | 71.02mm(W)*120.40mm(H)*2.2mm(N) | |
| Effective Area | - | |
| Active Area | 64.80mm(W)×108.00mm(H) | |
| Number of Pixels | 480×RGB×800Pixels | |
| Pixel Pitch | 0.135mm(H)×0.135mm(W) | |
| Pixel Arrangement | RGB Vertical stripes | |
| Drive IC | NT35510/OTM8009A | |

## 3.Absolute Maximum Ratings

The following are maximum values which, if exceeded may cause operation or damage to the unit.

| ITEM | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Power for Circuit Driving | VDD | -0.3 | - | 3.3 | V | |
| Power for Circuit Logic | VCI | -0.3 | - | 4.6 | V | |
| LC Operating Voltage *1) | Vop | | - | | V | |
| LED Forward Voltage | $V_f$ | 15.8 | 16.0 | 16.2 | V | |
| LED Forward Current | If | - | 30 | - | mA | |
| LED Luminance | $B_P$ | 3200 | - | - | $cd/m^2$ | |
| Storage Humidity | $H_{ST}$ | 10 | - | 90 | %RH | At 25±5℃ |
| Storage Temperature | $T_{ST}$ | -30 | - | 80 | ℃ | |
| Operating Ambient Humidity | $H_{OP}$ | 10 | - | 90 | %RH | |
| Operating Ambient temperature | $T_{OP}$ | -20 | - | 70 | ℃ | |

Note:

*1) Liquid Crystal driving voltage.
Due to the characteristics of LC Material, this voltage vary with environmental temperature.

*2) Temp. >60℃, Absolute humidity shall be less than 90%RH at 60℃

*3) Temp. ≤60℃, 90%RH MAX.

# 4.Electrical Specification

## Main Window Display

(Unless specified, the ambient temperature Ta=25℃)

| Properties | | Sym. | Min | Typ. | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| Power for Circuit Driving | | VDD | 1.65 | 2.8 | 3.3 | V | Note |
| Power for Circuit Logic | | VCI | 2.7 | 2.8 | 3.3 | V | Note |
| BLU Driving Logic | | Vbat | - | - | - | V | |
| Logic Input Voltage | Low Voltage | VIL | 0 | - | 0.2VDD | V | |
| | High Voltage | VIH | 0.8VDD | - | VDD | V | |
| Logic Output Voltage | Low Voltage | VOL | 0 | - | 0.1VDD | V | |
| | High Voltage | VOH | 0.9VDD | - | VDD | V | |
| Power Consumption | White | $P_w$ | T.B.D | T.B.D | T.B.D | mW | |
| | Black | $P_b$ | T.B.D | T.B.D | T.B.D | mW | |
| | Vertical Stripe | $P_v$ | T.B.D | T.B.D | T.B.D | mW | |

Note:

The recommended operating conditions refer to a range in which operation of this product is guaranteed. Should this range is exceeded, the operation cannot be guaranteed even if the values may be without the absolute maximum ratings. Accordingly, please make sure that the module is used within this range. And these current values are measured under the condition that all devices are stopped, each component is stable and logic signal is input.

## 5.Optical Specification.

| Item | | Symbol | Conditions | Specifications | | | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | | |
| Transmittance | | T% | Viewing normal angle $\theta_X = \theta_Y = 0°$ | | 4.7 | | % | All left side data are based on CMO's following condition -- NTSC: 60% Light : C light (Machine:BM5A) Normal Polarizer Reference Only |
| Contrast Ratio | | CR | | 150 | 250 | - | - | |
| Response Time | | $T_R$ | | - | 10 | 20 | ms | |
| | | $T_F$ | | - | 20 | 30 | ms | |
| Chromaticity | Red | $X_R$ | | 0.604 | 0.634 | 0.664 | - | |
| | | $Y_R$ | | 0.296 | 0.326 | 0.356 | - | |
| | Green | $X_G$ | | 0.260 | 0.290 | 0.320 | - | |
| | | $Y_G$ | | 0.551 | 0.581 | 0.611 | - | |
| | Blue | $X_B$ | | 0.102 | 0.132 | 0.162 | - | |
| | | $Y_B$ | | 0.096 | 0.126 | 0.156 | - | |
| | White | $X_W$ | | 0.262 | 0.292 | 0.322 | - | |
| | | $Y_W$ | | 0.306 | 0.336 | 0.366 | - | |
| Viewing Angle | Hor. | $\theta_{X+}$ | Center CR≥10 | - | 45 | - | deg. | |
| | | $\theta_{X-}$ | | - | 45 | - | | |
| | Ver. | $\theta_{Y+}$ | | - | 35 | - | | |
| | | $\theta_{Y-}$ | | - | 15 | - | | |

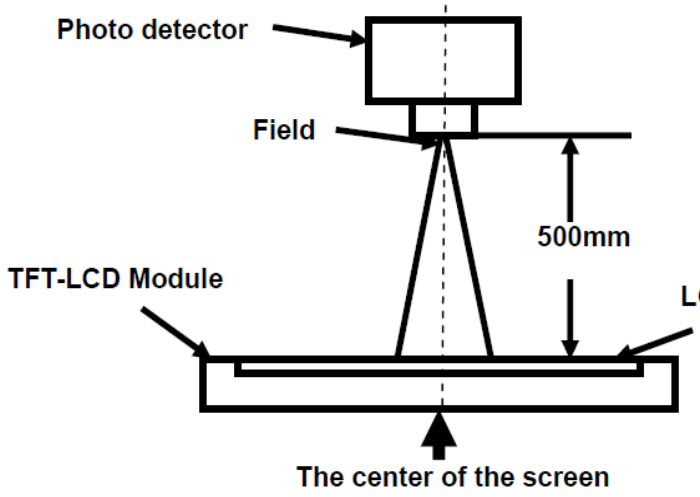
*Note (1) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

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## 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 | SR-3A | 1° |
| Luminance | | |
| Chromaticity | | |
| Lum Uniformity | | |
| Response Time | BM-7A | 2° |

## 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)。

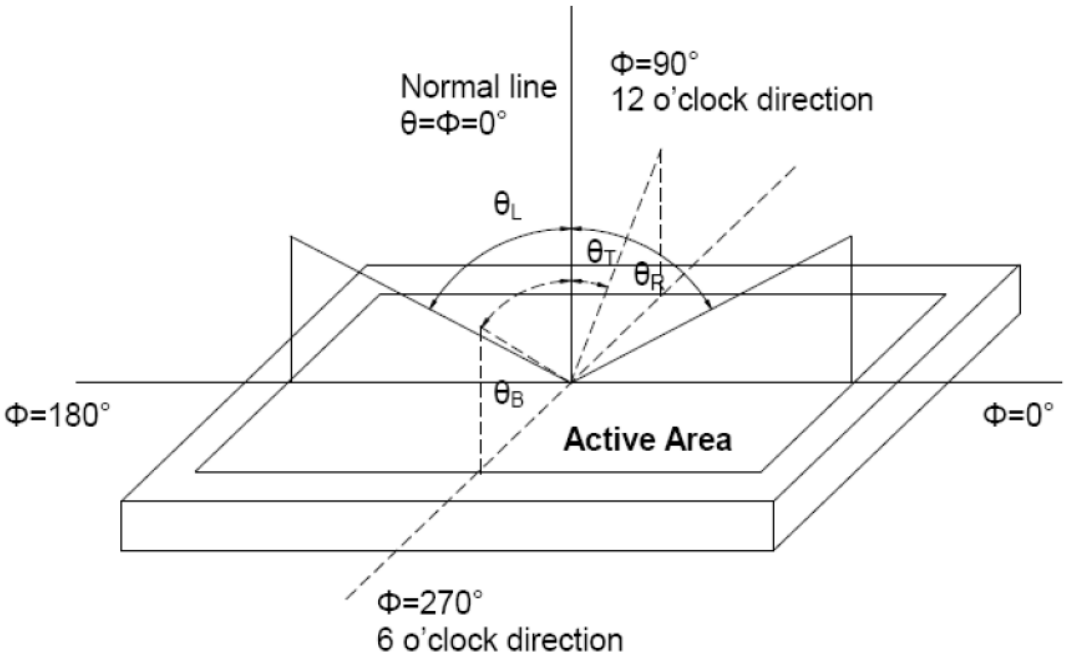



Fig. 1 Definition of viewing angle

## Note 3: Definition of contrast ratio

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

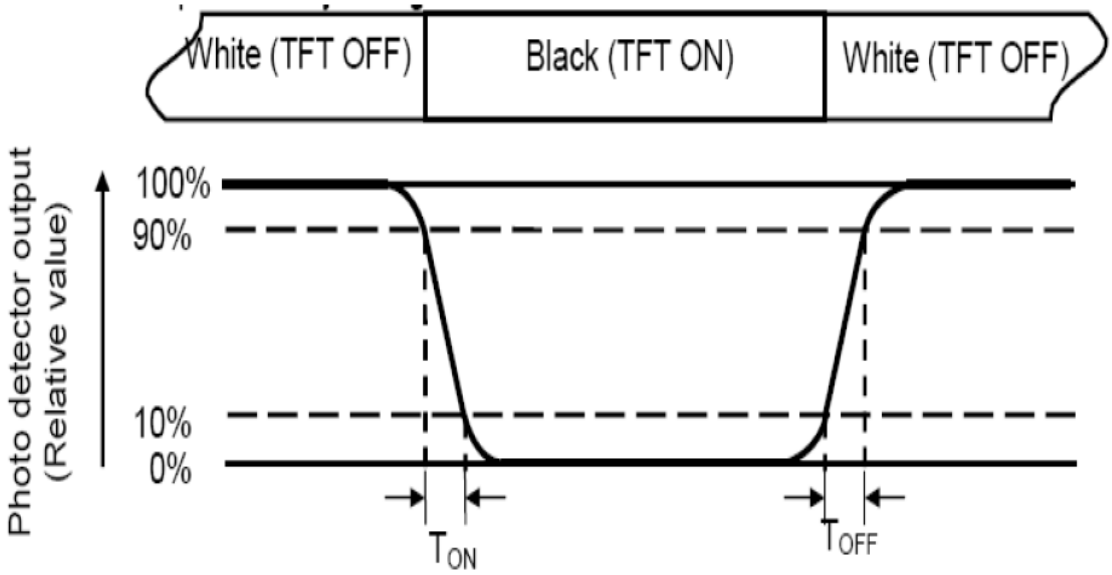
"White state ":The state is that the LCD should driven by Vwhite.

"Black state": The state is that the LCD should driven by Vblack.

Vwhite: To be determined  Vblack: To be determined.

## Note 4: Definition of Response time

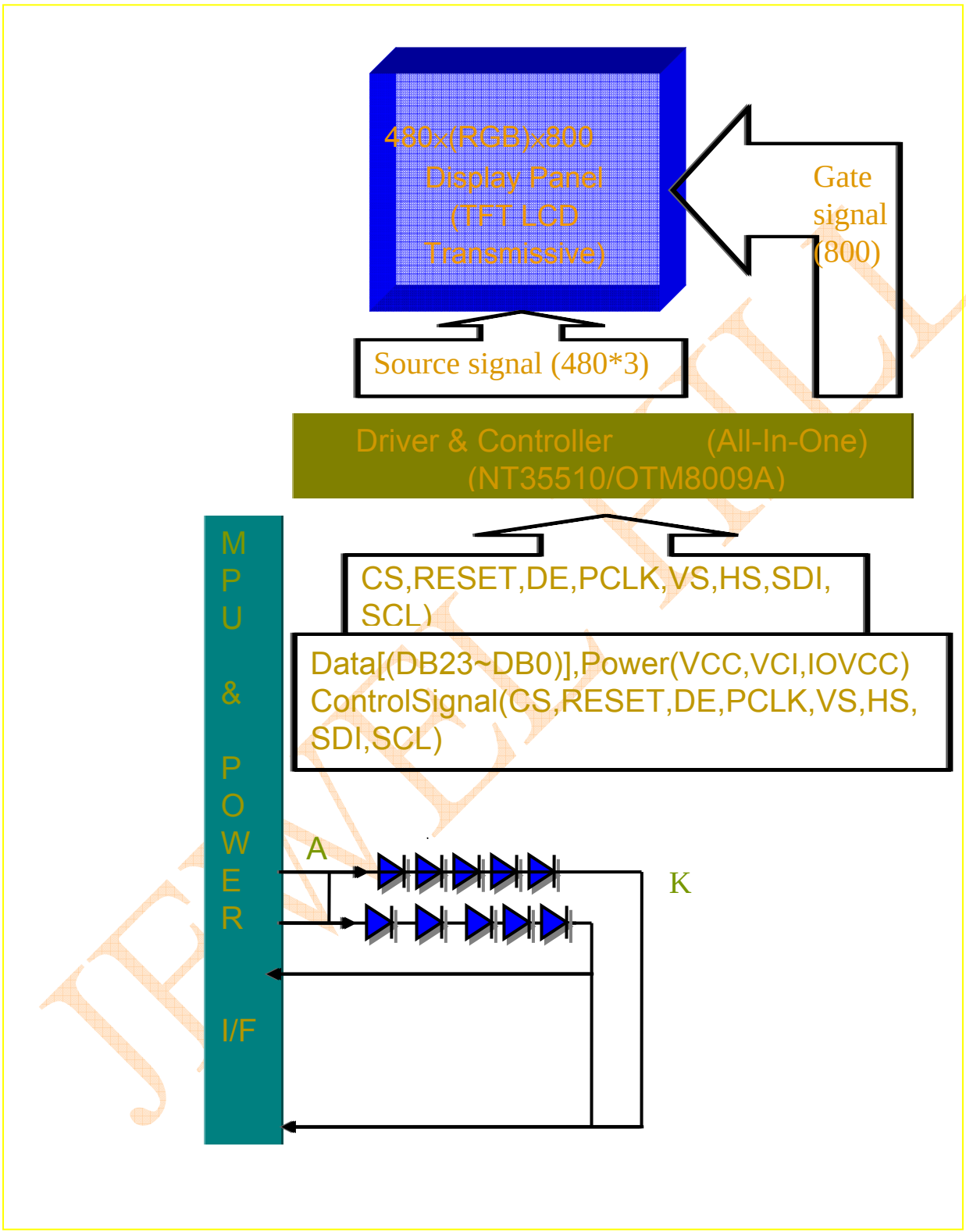
The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.




## Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

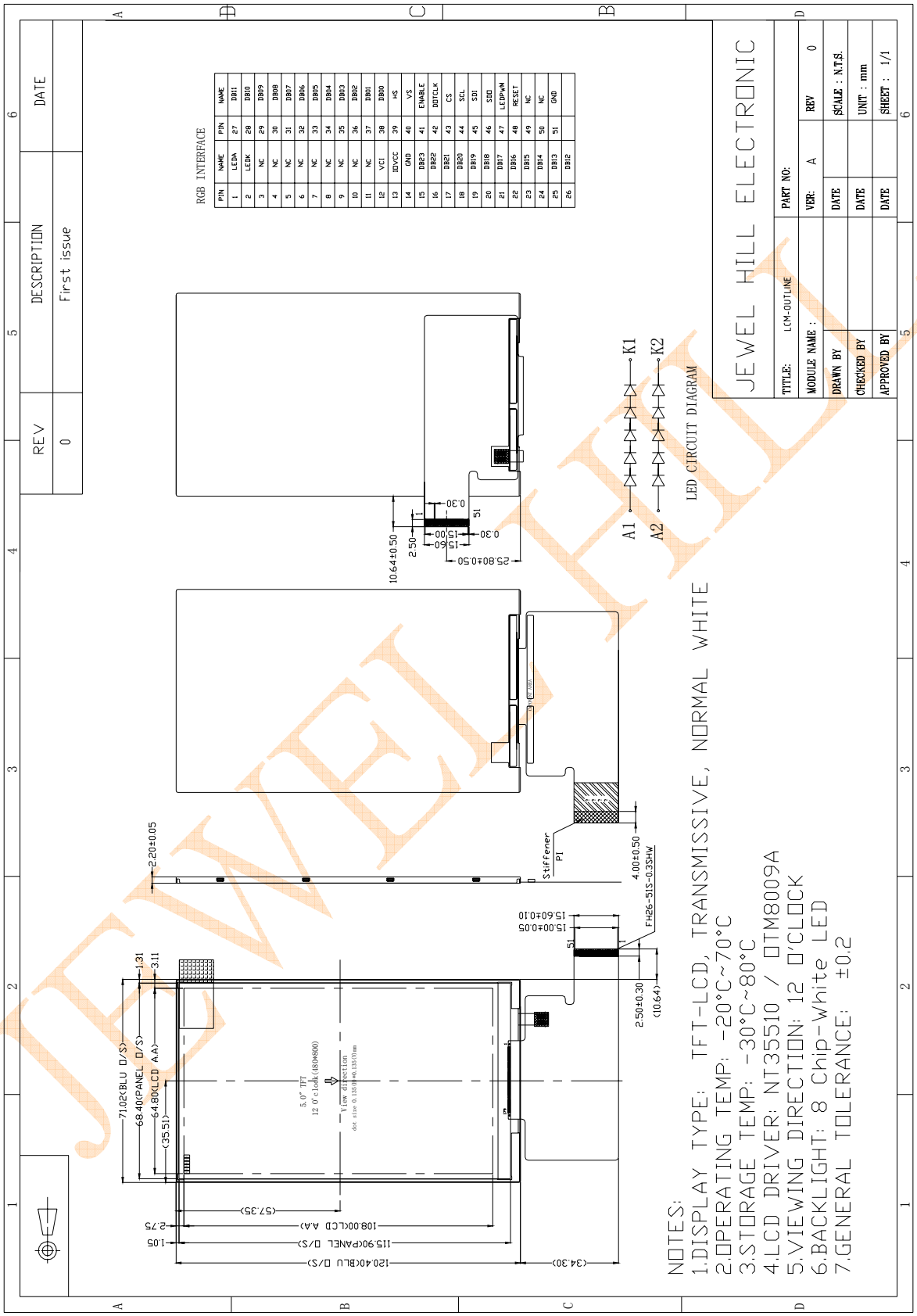
## 6.Block Diagram.



## 7.Pin Description

| Pin NO. | Symbol | Description |
|---|---|---|
| 1 | LEDA | LED+ |
| 2 | LEDK | LED- |
| 3 | NC | NC |
| 4 | NC | NC |
| 5 | NC | NC |
| 6 | NC | NC |
| 7 | NC | NC |
| 8 | NC | NC |
| 9 | NC | NC |
| 10 | NC | NC |
| 11 | NC | NC |
| 12 | VCI | The power supply 2.8V |
| 13 | IOVCC | The power supply 1.8/2.8V |
| 14 | GND | GROUND |
| 15-38 | DB23-DB0 | Data Bus |
| 39 | HS | **RGB I/F line synchronous signal** |
| 40 | VS | **RGB I/F frame synchronous signal** |
| 41 | ENABLE | **Data Enable** |
| 42 | DOTCLK | **Piel Clock** |
| 43 | CS | CHIP SELECT PIN |
| 44 | SCL | **In SPI mode it serves as synchronus clock** |
| 45 | SDI | Serial data input pin |
| 46 | SDO | Serial data output pin |
| 47 | LEDPWM | Control signal for brightness of LED backlight |
| 48 | RESET | RESET pin |
| 49-50 | NC | NC |
| 51 | GND | GROUND |

# 8.Outline Dimension




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# 9.Timing Characteristics

## 9.1. RGB interface operation

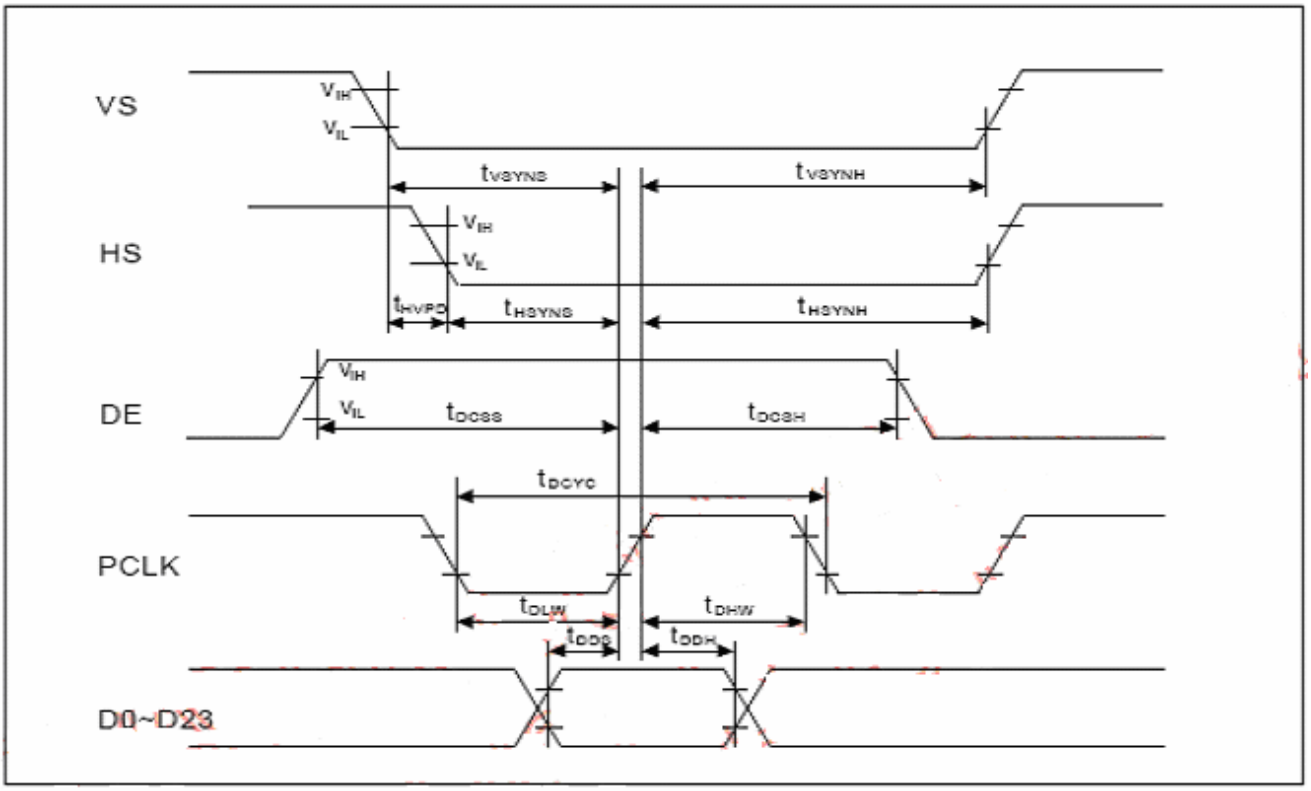



*Fig. 7.6.4 RGB interface characteristics*

## 9.2. Timing Characteristics

**Normal Write Mode(HWM=''0'), IOVcc=1.65V~3.3V,Vcc=2.5V~3.3V**

| Signal | Symbol | Parameter | MIN | TYP | MAX | Unit | Description |
|---|---|---|---|---|---|---|---|
| VS | tVSYNS | VSYNC setup time | 10 | - | - | ns | |
| | tVSYNH | VSYNC hold time | 10 | - | - | ns | |
| HS | tHSYNS | HSYNC setup time | 10 | - | - | ns | |
| | tSCYCR | HSYNC hold time | 10 | - | - | ns | |
| | tHVPD | HSYNC to VSYNC falling edge | 0 | - | - | ns | |
| PCLK | tDCYC | PCLK cycle time | 33 | - | 125 | ns | |
| | tDLW | PCLK "L" pulse width | 11 | - | - | ns | |
| | tDHW | PCLK "H" pulse width | 11 | - | - | ns | |
| | fDFREQ | PCLK frequency | 8 | - | 30 | MHz | |
| DE | tDCSS | DE setup time | 10 | - | - | ns | |
| | tDCSH | DE hold Time | 10 | - | - | ns | |
| D0~D23 | tDDS | RGB Data setup time | 10 | - | - | ns | |
| | tDDH | RGB Data hold time | 10 | - | - | ns | |

## 9. 3 Reset Operation

(VCC=1.65~3.1 V)

Table 13-6

| Item | Symbol | Unit | Min. | Typ. | Max. |
|---|---|---|---|---|---|
| Reset low-level width | tRES | ms | 1 | – | – |
| Reset rise time | trRES | μs | – | – | 10 |

## 10.Reliability and Inspection Standard

| No. | Test Item | | Test Conditions | Remark |
|---|---|---|---|---|
| 1 | High Temperature | Storage | 80℃, 120Hr | Note |
| | | Operation | 70℃, 120Hr | Note |
| 2 | Low Temperature | Storage | -30℃, 120Hr | Note |
| | | Operation | -20℃, 120Hr | |
| 3 | High Temperature and High Humidity | | 60℃, 90%RH, 120Hr | Note |
| 4 | Temperature Cycle | Storage | -10℃(1Hr)→25℃(5min)→60℃(1Hr) 32 Cycles | Note |
| | | Operation | -20℃(1Hr)→25℃(5min)→60℃(1Hr) 25 Cycles | |
| 5 | Peeling Off (Storage) | | ≧500gf/cm | Note |
| 6 | FPC Bending Test | | ≧6,000 times, 2/sec | Note |
| 7 | Vibration Test(Storage) | | 50HZ, 30min, Amplitude: 2 cm, X/Y/Z directions | Note |
| 8 | Drop Test | | 60cm/ 3Corner/ 8Face, 1Cycle | Note |

Note:

1) The test samples should be applied to only one test item.
2) Sample size for each test item is 5~10pcs.
3) For Damp Proof Test, pure water(Resistance>1MΩ) should be used.
4) In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
5) EL evaluation should be excepted from reliability test with humidity and temperature: Some defects such as black spot/blemish can happen by natural chemical reaction with humidity and fluorescence EL has.
6) After the reliability test, the test samples should be inspected after 2 hours at least.
7) Functional test is OK. Missing segment, shorts, unclear segment, non display, display abnormally, liquid crystal leak are not allowed.
8) After testing, the current Idd should be within initial value ±20%.
9) No low temperature bubbles ,end seal loose and fall, frame rainbow, ACF bubble growing are allowable in the appearance test.

# 11.Inspection Criterion

## 11.1. Sampling Method

Unless otherwise agreed upon in writing, the sampling inspection shall be applied to the Customer's incoming inspection.

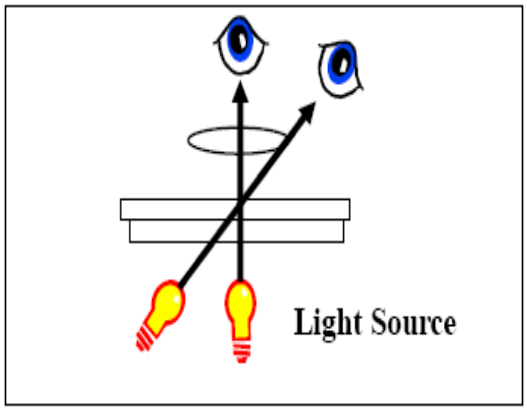
1) Lot size: Quantity per shipment lot
2) Sampling type: Normal inspection , single sampling
3) Inspection level: Ⅱ
4) Sampling table: MIL-STD-105D
5) Acceptable Quality Level(AQL): Major=0.65 Minor=1.5

## 11.2. 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.

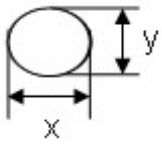


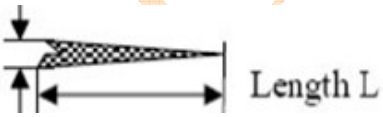

## 11.3. Inspection Criteria

### 11.3.1. Major defect

| No. | Item | Inspection Standard | Classification of defects |
|---|---|---|---|
| 1 | All functional defects | 1) No display<br>2) Display abnormally<br>3) Open or missing segment<br>4) Short circuit<br>5) Excess power consumption<br>6) Backlight no lighting, flickering and abnormal lighting | Major |
| 2 | Missing | Missing component | Major |
| 3 | Outline dimension | Overall outline dimension beyond the drawing is not allowed | Major |

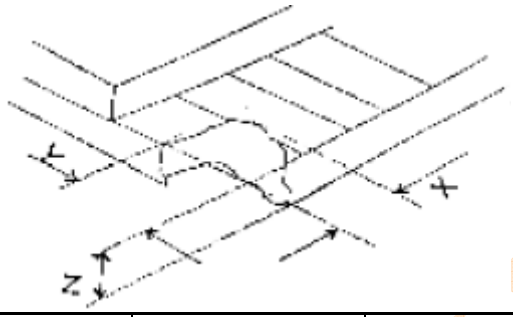
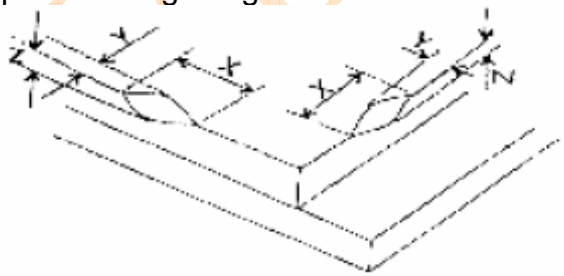
### 11.3.2. Cosmetic Defect

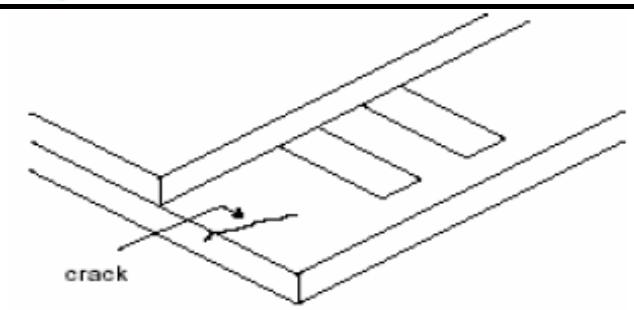
<table>
<tr><th>No.</th><th>Item</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td>1</td><td>(spot defect) Black and White spot pinhole</td><td>For dark/white spot, size Φ is defined as Φ=(x+y)/2<br>

<table>
<tr><th>Size Φ (mm)</th><th>Acceptable Quantity</th></tr>
<tr><td>Φ≤0.1</td><td>Ignore</td></tr>
<tr><td>0.10≤Φ≤0.15</td><td>2</td></tr>
<tr><td>0.15≤Φ≤0.2</td><td>1</td></tr>
<tr><td>0.2<Φ</td><td>0</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>2</td><td>(line defect) Black and White line Polarizer scratch</td><td>Define:<br>

<table>
<tr><th>Width(mm)</th><th>Length(mm);Acceptable Qty</th></tr>
<tr><td>Φ≤0.03</td><td>Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤3.0; N≤2</td></tr>
<tr><td>0.05<W≤0.1</td><td>L≤2.0; N≤2</td></tr>
<tr><td>0.1<W</td><td>Define as spot defect</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>3</td><td>Polarizer defect</td><td>Dent or bubble(between the polarizer and glass)
<table>
<tr><th>Size Φ(mm)</th><th>Acceptable Qty</th></tr>
<tr><td>Φ≤0.10</td><td>Ignor</td></tr>
<tr><td>0.10<Φ≤0.20</td><td>2</td></tr>
<tr><td>0.20<Φ≤0.30</td><td>1</td></tr>
<tr><td>0.30<Φ</td><td>0</td></tr>
</table></td><td>Minor</td></tr>
</table>

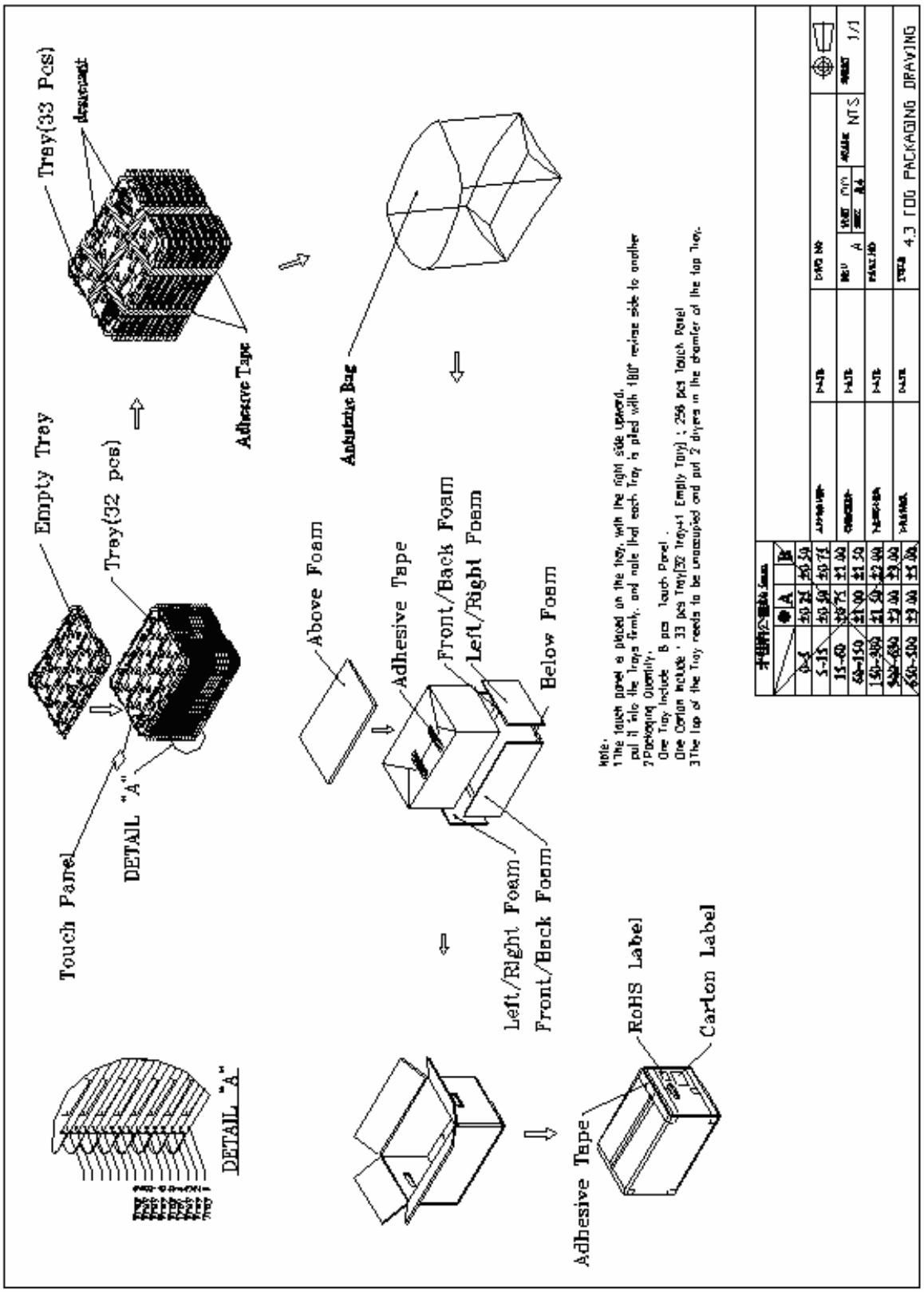
### 11.3.3. Cosmetic Defect

<table>
<tr><th>No.</th><th>Item</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Glass defect</td><td>1) Chip on the corner<br><br><table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0</td><td>≤S</td><td>≤T</td></tr></table><br>Remark: S=contact pad length;<br>T=the thickness of glass<br>Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal. Acceptable Quantity N≤2.</td><td>Minor</td></tr>
<tr><td>2) Chip on the edge of glass<br><br><table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>Ignore</td><td>≤0.5</td><td>≤T</td></tr></table><br>Acceptable Quantity: N≤2</td><td>Minor</td></tr>
<tr><td>3) Creak<br>Creaks tend to break are not allowed.</td><td>Minor</td></tr>
</table>

| | | | |
|---|---|---|---|
| | |  | |

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## 12. PACKAGE INFORMATION.



## 13.ROHS COMPLIANT WARRANTY.

RoHs Hazardous substances including:

- Cd< 100 ppm
- Pb< 1000 ppm
- Hg< 1000 ppm
- Cr +6 < 1000 ppm
- PBDE < 1000 ppm
- PBB < 1000 ppm

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# 14.PRECAUTIONS FOR USING LCD MODULES

## 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.

## 15. REVISION HISTORY.

| Version | Revise record | Date |
|---|---|---|
| 1.0 | Original version | 13-08-15 |
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JEWEL HILL

# SAMPLE APPROVED REPORT
## (样品确认单)

| | |
|---|---|
| SAMPLE MODEL NO. (样品型号) | JH50480800A |
| SAMPLE SERIES NUMBER NO. (样品序号) | |
| SAMPLE QUANTITY (样品数量) | |
| COLOR/TYPE (底色/类型) | TFT/NEGATIVE |
| VIEWING DIRECTION (视角) | 12H |
| DRIVING METHOD (驱动参数) | 1/800DUTY |
| LOGIC VOLTAGE (工作电压) | 2.8V |
| LCD VOP (LCD 驱动电压) | |
| OPERATING TEMP. (操作温度) ℃ | -20 ~ 70℃ |
| STORAGE TEMP. (储存温度) ℃ | -30 ~ 80℃ |
| POLARIZER----FRONT (首偏光片) | |
| POLARIZER----BACK (后偏光片) | TRANSMISSIVE |
| CONTROLLER/DRIVER IC(控制/驱动 IC) | NT35510/OTM8009A（COG） |
| BACKLIGHT COLOR/TYPE (背光源类型/颜色) | WHITE |
| DRAWING REV/NO./QUANTITY (图纸版本/数量) | |
| SPECIFICATION (规格书　份数) | |

REMARKS:
(备注)
WRIT BY: _____ DATE: _____ APROV BY: _____ DATE: _____

CUSTOMER'S APPROVAL (客户确认):

1） FUNCTION （功能）: ☐ OK ☐ N.G.
2） DRIVER CONDITION （驱动条件）: ☐ OK ☐ N.G.
3） DISPLAY MODE （显示模式）: ☐ OK ☐ N.G.
4） VIEWING ANGLE （视角）: ☐ OK ☐ N.G.
5） BACKLIGHT （背光源）: ☐ OK ☐ N.G.
6） DISPLAYING PATTERN （显示效果）: ☐ OK ☐ N.G.

CUSTOMER'S CONCLUSIONS (客户意见): _____
_____
_____

CUSTOMER'S SIGNATURE（客户签名）: _____ DATE (日期): _____

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