# Duobond Display Technology Co.,Ltd

# PRODUCT SPECIFICATION

MODEL NAME: DBT231QA015S

Date: 2016/05/18

Version: 1.0

■ **Preliminary Specification**
□ **Final Specification**

| | |
|---|---|
| FOR CUSTOMER | |
| CUSTOMER APPROVED | |

| PREPARED BY | CHECKED BY | APPROVED BY | DATE |
|---|---|---|---|
| | | | |

## Revision History

| Date | Sheet (New) | Old | New | Reason |
|---|---|---|---|---|
| 2016-5-18 | all | | | Preliminary Specification Release |
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## 1. General Features

| Item | Display Panel | Unit/note |
|---|---|---|
| Display Mode | Normally White, Transmissive LCD | |
| LCM size | 2.31” | |
| Viewing Direction | 12 O’CLOCK | |
| Input Signals | 6-RGB | |
| Outline Dimensions | 47.55 (W)* 55.2(H)*2.8 (T) | mm |
| Active Area | **35.06 (H)**×46.75**(W)** | mm |
| Number of Pixels | 320×RGB×240 | Pixels |
| Pixel Arrangement | RGB Vertical stripes | |
| Drive IC | ILI9342 | |
| Input voltage | 2.8 | V |

## 2. Absolute Maximum Ratings

| ITEM | Symbol | Min. | Typ. | Max. | Unit | Remark |
|---|---|---|---|---|---|---|
| Power for Circuit Driving | Vcc | -0.3 | - | 4.6 | V | |
| Power for Circuit Logic | Vt | -0.3 | - | Vcc+0.3 | V | |
| LC Operating Voltage *1) | Vop | - | 5 | - | V | |
| Storage Humidity | $H_{ST}$ | 10 | - | *2) | %RH | At 25±5℃ |
| Storage Temperature | $T_{ST}$ | -30 | - | 80 | ℃ | |
| Operating Ambient Humidity | $H_{OP}$ | 10 | - | *3) | %RH | |
| Operating Ambient temperature | $T_{OP}$ | -20 | - | 70 | ℃ | |

## 3. Electrical Specification

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

| Properties | | Sym. | Min | Typ. | Max | Unit | Note |
|---|---|---|---|---|---|---|---|
| Power for Circuit Driving | | Vcc | 1.5 | 1.8 | 3.5 | V | Note |
| Power for Circuit Logic | | Vt | 2.7 | 3.2 | 3.5 | V | Note |
| BLU Driving Logic | | Vbat | - | 3.2 | - | V | |
| Logic Input Voltage | Low Voltage | VIL | -0.3 | - | 0.2Vcc | V | |
| | High Voltage | VIH | 0.8Vcc | - | Vcc | V | |
| Logic Output Voltage | Low Voltage | VOL | 0 | - | 0.2Vcc | V | |
| | High Voltage | VOH | 0.8Vcc | - | - | V | |

| Item | Symbol | Specification | | | Unit | Remark |
|---|---|---|---|---|---|---|
| | | Min | Typ | Max | | |
| TFT gate on voltage | VGH | - | 15 | - | V | |
| TFT gate off voltage | VGL | - | -10 | - | V | |

Note:
(1) Vcom must be adjusted to optimize display quality: cross talk, contrast ratio and etc.
(2) VGH is TFT gate operating voltage
(3) VGL is TFT gate operating voltage
The storage capacitance structure of this product is Cst(Storage on Common).
The low voltage level of VGL signal must be fluctuated with same phase as Vcom, in case of Storage on Gate structure.
(4) Environmental condition : 25℃.

# 4. TIMING OF POWER SUPPLY

Please refer to the driver IC specification.

## 5. BACKLIGHT CHARACTERISTICS

| Properties | Sym. | Min | Typ. | Max | Unit | Note |
|---|---|---|---|---|---|---|
| Forward voltage | Vf | 3.0 | 3.2 | 3.4 | V | |
| Luminance | Lv | 150 | 180 | | cd/m2 | |
| Electric current | If | 30 | | 40 | mA | |
| Number of LED | - | 2 | | | Piece | - |
| Connection mode | P | parallel | | | - | |

# 6. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25 ℃. The values specified are at an approximate distance 500mm from the LCD surface at a viewing angle of Φ and θ equal to 0°.

Measurement condition:

*1):with Polarizer
*2):without Polarizer
*3):only color filter glass

| Item | | Symbol | Condition | Min. | Typ. | Max. | Unit | Note |
|---|---|---|---|---|---|---|---|---|
| Transmittance (without Polarizer) | | T(%) | — | — | 15.20% | — | — | |
| Contrast Ratio | | CR | Θ=0 | 400 | 500 | — | — | (1)(2) |
| Response time | Rising | $T_R$ | Normal viewing angle | — | 4 | 8 | msec | (1)(3) |
| | Falling | $T_F$ | — | — | 12 | 20 | | |
| Color gamut | | S(%) | — | | 50 | | % | |
| Color chromaticity (CIE1931) | White | $W_x$ | | 0.283 | 0.303 | 0.323 | | (1)(4) CF glass |
| | | Wy | | 0.304 | 0.324 | 0.344 | | |
| | Red | Rx | | 0.589 | 0.609 | 0.629 | | |
| | | Ry | | 0.310 | 0.330 | 0.350 | | |
| | Green | Gx | | 0.267 | 0.287 | 0.307 | | |
| | | Gy | | 0.507 | 0.527 | 0.547 | | |
| | Blue | Bx | | 0.127 | 0.147 | 0.167 | | |
| | | By | | 0.118 | 0.138 | 0.158 | | |
| Viewing angle | Hor. | $\Theta_L$ | CR>10 | 60 | 70 | — | | Viewing Angle base on using EWV Polarizer, Reference Only |
| | | $\Theta_R$ | | 60 | 70 | — | | |
| | Ver. | $\Theta_U$ | | 60 | 70 | — | | |
| | | $\Theta_D$ | | 50 | 60 | — | | |
| Optima View Direction | | 12 O'clock | | | | | | (5) |

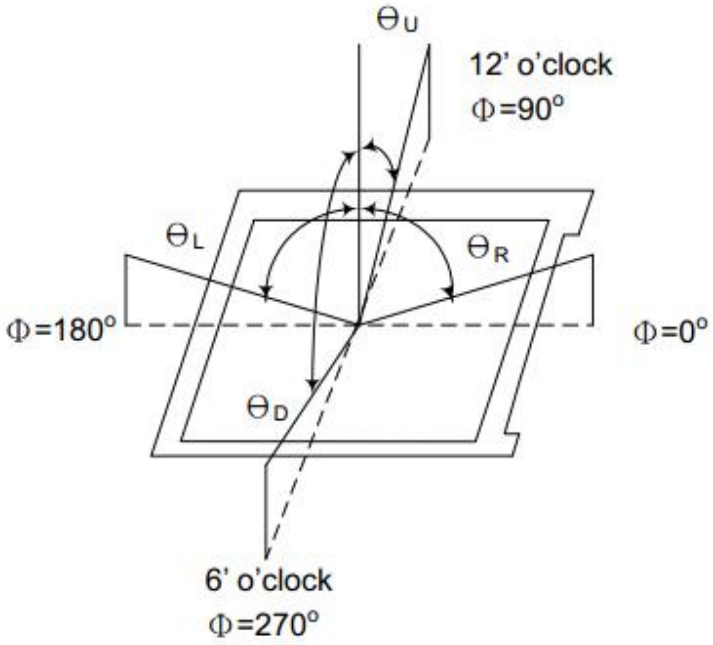
**Measuring Condition**

- Measuring surrounding : dark room
- Ambient temperature : 25±2°C
- 15min. warm-up time.

**Measuring Equipment**

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

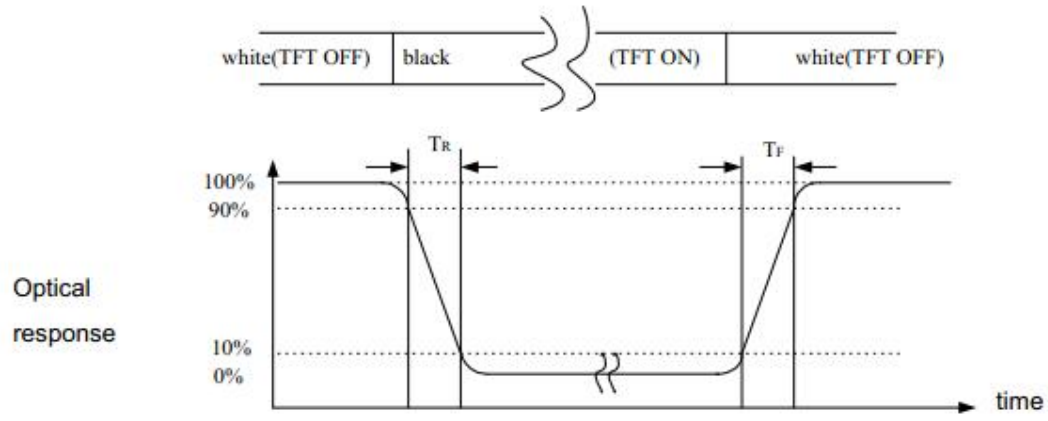
**Note (1)** Definition of Viewing Angle :



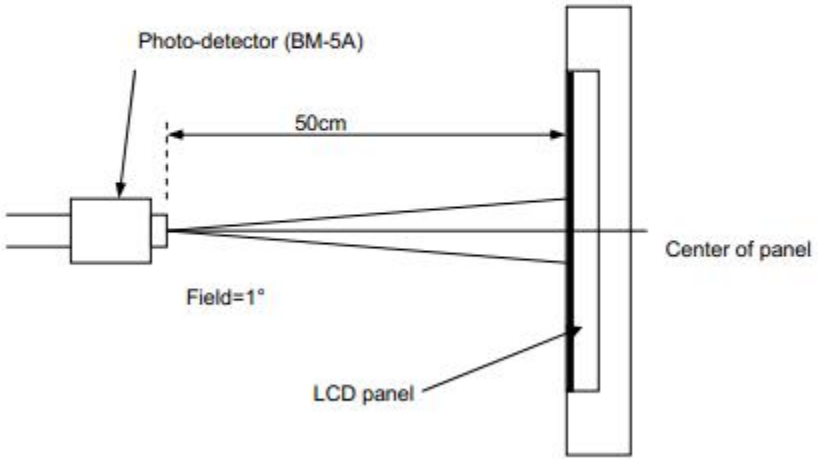

**Note (2)** Definition of Contrast Ratio(CR) :
measured at the center point of panel

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

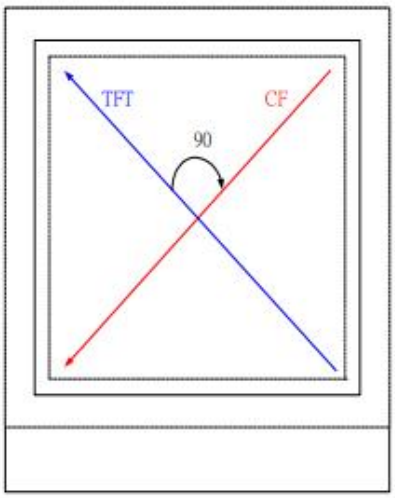
**Note (3)** Definition of Response Time : Sum of $T_R$ and $T_F$




**Note (4)** Definition of optical measurement setup



**Note (5)** Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.

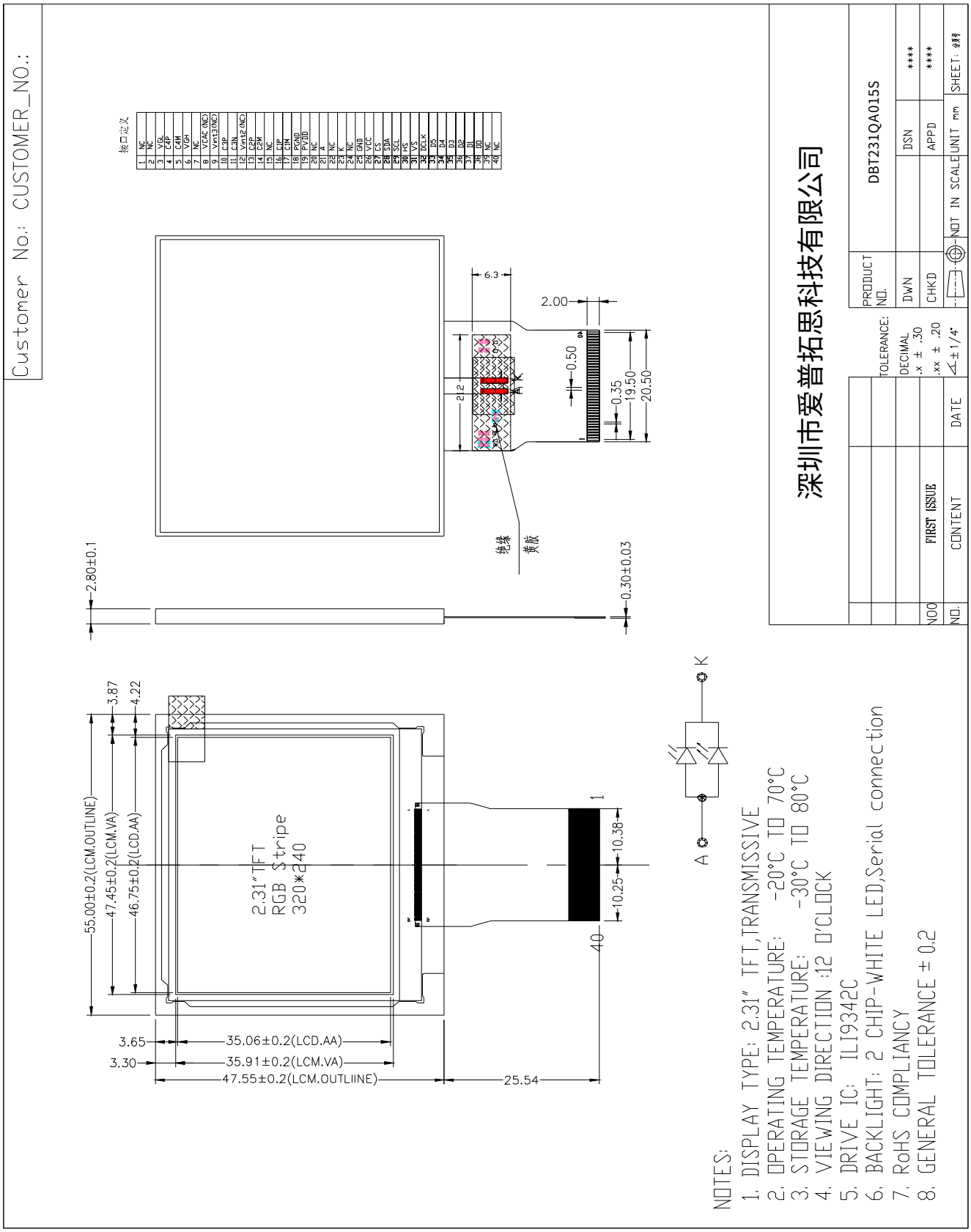



TFT Face up

## 7. Interface Description

| Pin No. | Symbol | Description | When not in use |
|---|---|---|---|
| 1 | NC | Dummy | Open |
| 2 | NC | Dummy | Open |
| 3 | VGL | Capacitor for power setting | -- |
| 4 | C4P | Capacitor for charge pump | -- |
| 5 | C4M | Capacitor for charge pump | -- |
| 6 | VGH | Capacitor for power setting | -- |
| 7 | NC | Dummy | Open |
| 8 | VCAC | Capacitor for power setting | -- |
| 9 | Vint3 | Capacitor for power setting | -- |
| 10 | C3P | Capacitor for charge pump | -- |
| 11 | C3N | Capacitor for charge pump | -- |
| 12 | Vint2 | Capacitor for power setting | -- |
| 13 | C2P | Capacitor for charge pump | -- |
| 14 | C2M | Capacitor for charge pump | -- |
| 15 | NC | Dummy | |
| 16 | C1P | Power transistor gate signal for the boost converter | -- |
| 17 | C1M | Main boost regulator feedback input. | -- |
| 18 | PGND | Ground | -- |
| 19 | PVDD | Power supply | -- |
| 20 | NC | Dummy | Open |
| 21 | LED+ | B/L positive pin | -- |
| 22 | NC | Dummy | Open |
| 23 | LED- | B/L negative pin | -- |
| 24 | NC | Dummy | Open |
| 25 | GND | Digital GND | |
| 26 | VCC | Digital Power supply | -- |
| 27 | CS | Serial communication chip select | -- |
| 28 | SDA | Serial communication data input/output clock input | -- |
| 29 | SCL | Serial communication | -- |
| 30 | HSYNC | Horizontal sync input | -- |
| 31 | VSYNC | Vertical sync input | -- |
| 32 | DCLK | Clock input | -- |
| 33-38 | D5-D0 | 6 bits data bus input | -- |
| 39-40 | NC | Dummy | Open |

# 8. Outline Dimension



# 9. initialization Setup

Please consult our technical department for detail information.

## 10. Reliability and Inspection Standard

| 1. No | Test Item | Condition | Remarks |
|---|---|---|---|
| 1 | High Temperature Operation | Ts = +70℃, 120 hours | IEC60068-2-1:2007 GB2423.2-2008 |
| 2 | Low Temperature Operation | Ta = -20℃, 120 hours | IEC60068-2-1:2007 GB2423.1-2008 |
| 3 | High Temperature Storage | Ta = +80℃, 120 hours | IEC60068-2-1:2007 GB2423.2-2008 |
| 4 | Low Temperature Storage | Ta = -30℃, 120 hours | IEC60068-2-1:2007 GB2423.1-2008 |
| 5 | Storage at High Temperature and Humidity | Ta = +60℃, 90% RH max,120hours | IEC60068-2-78 :2001 GB/T2423.3—2006 |
| 6 | Thermal Shock (non-operation) | -30℃ 30 min~+80℃ 30 min, Change time:5min, 20 Cycle | Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002 |
| 7 | ESD | C=150pF,R=330Ω,5point/panel Air:±8Kv,5times; Contact:±4Kv,5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa) | IEC61000-4-2:2001 GB/T17626.2-2006 |
| 8 | Vibration Test | Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) | IEC60068-2-6:1982 GB/T2423.10—1995 |
| 9 | Mechanical Shock (Non Op) | Half Sine Wave 60G 6ms, ±X,±Y,±Z 3times for each direction | IEC60068-2-27:1987 GB/T2423.5—1995 |
| 10 | Package Drop Test s | Height:80cm,1corner,3edges,6surface | IEC60068-2-32:1990 GB/T2423.8—1995 |

Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of samples.

# 11. Inspection Criterion

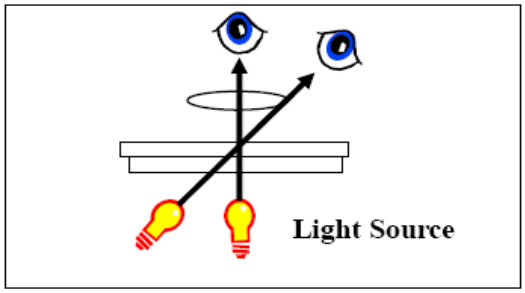
## 11.1. Sampling Method

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.

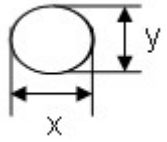



## 11.3. Inspection Criteria

### 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 |

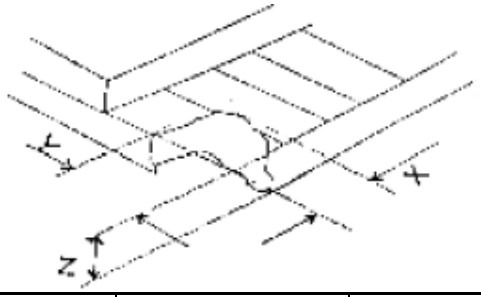
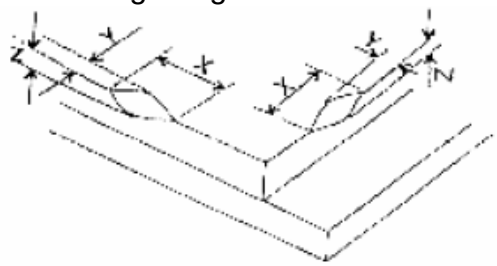
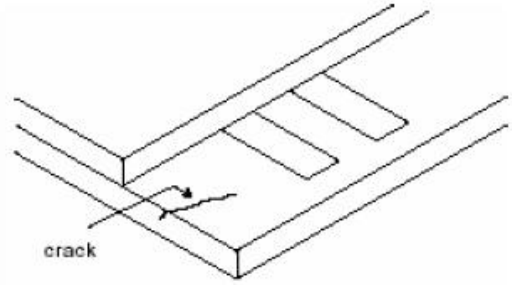
### 11.3.2. Cosmetic Defect

<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: 

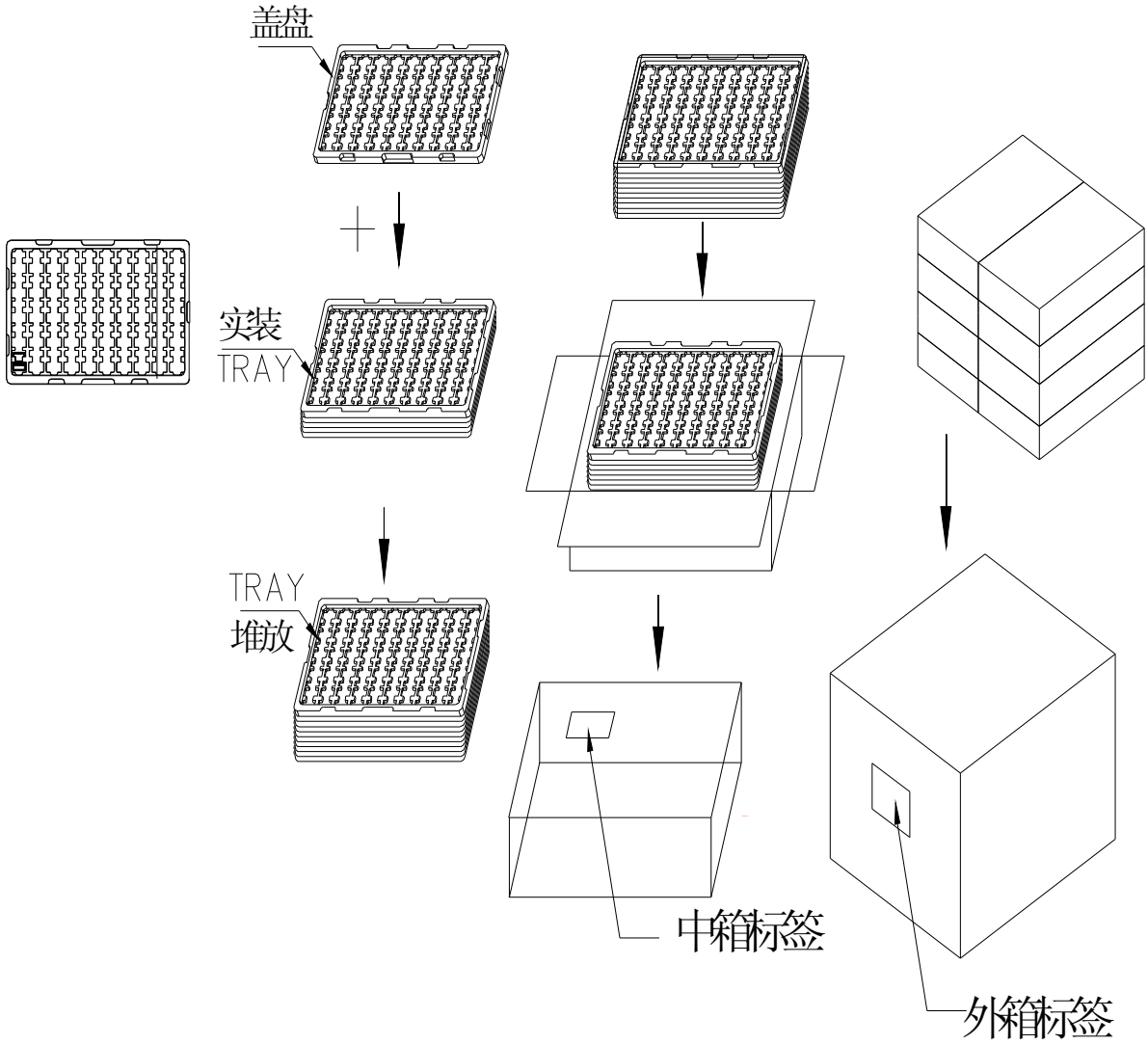
<table>
<tr><th>Width(mm)</th><th>Length(mm);Acceptable Qty</th></tr>
<tr><td>Φ≤0.03</td><td>Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤3.0; N≤2</td></tr>
<tr><td>0.05<W≤0.1</td><td>L≤2.0; N≤2</td></tr>
<tr><td>0.1<W</td><td>Define as spot defect</td></tr>
</table></td><td>Minor</td></tr>
<tr><td>3</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>Ignore</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.<br>  <br></td><td>Minor</td></tr>
</table>

# 12. Packing Dimension

Packaging Quantity:
One tray Include: 17pcs module;
One B-F Box Include: 10 pcs tray; 170 pcs Module;
One Carton Include: TBD-set B-F Box; TBDpcs tray; TBD pcs Module



# 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.