

PRODUCT : LCD MODULE**MODEL NO.** : MST-G320240DBSW-213W-E**SUPPLIER** : TRULY SEMICONDUCTORS LTD.**DATE** : May.5.2006CERT. No. 946535
(ISO9001)CERT. No. H002005
(ISO14001)

SPECIFICATION

Revision: 0.3

MST-G320240DBSW-213W-E

preliminary

This specification maybe changed without any notice in order to improve performance or quality etc. Please contact TRULY R&D department for update specification and product status before design for this product or release the order.

TRULY SEMICONDUCTORS LTD:**CUSTOMER:**

Quality Assurance Department: _____

Approved by:

Technical Department: _____

Approved by:

CONTENTS

- n GENERAL INFORMATION
- n EXTERNAL DIMENSIONS
- n ABSOLUTE MAXIMUM RATINGS
- n ELECTRICAL CHARACTERISTICS
- n TIMING OF POWER SUPPLY
- n BACKLIGHT CHARACTERISTICS
- n ELECTRO-OPTICAL CHARACTERISTICS
- n INTERFACE DESCRIPTION
- n REFERENCE APPLICATION CIRCUIT
- n REFERENCE INITIAL CODE
- n RELIABILITY TEST
- n INSPECTION CRITERION
- n PRECAUTIONS FOR USING LCD MODULES
- n PRIOR CONSULT MATTER
- n FACTORY CONTACT INFORMATION

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n GENERAL INFORMATION

| Item | Contents | Unit |
|--------------------|-----------------------------|-----------------|
| LCD type | STN | / |
| Viewing direction | 6:00 | O' Clock |
| Glass area (W × H) | 166.8 × 109.0 | mm ² |
| Viewing area (W×H) | 122.0 × 92.0 | mm ² |
| Active area (W×H) | 115.17 × 86.37 | mm ² |
| Number of Dots | 320 × 240 | / |
| Dot size (W × H) | 0.33 × 0.33 | mm ² |
| Dot pitch (W × H) | 0.36 × 0.36 | mm ² |
| Driver IC | NT7701H-TABF3\NT7702H-TABF4 | / |
| Backlight Type | LED | / |
| Interface Type | Parallel | |
| Input voltage | 5.0 | V |

nABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Min | Max | Unit |
|--------------------------|------------------|------|----------------------|------|
| Supply voltage for logic | V _{DD} | -0.3 | 7.0 | V |
| voltage for LCD | V _{LCD} | -0.3 | 30 | V |
| Input voltage | V _{IN} | -0.3 | V _{DD} +0.3 | V |
| Operating temperature | T _{OP} | -20 | 70 | °C |
| Storage temperature | T _{ST} | -30 | 80 | °C |
| Humidity | RH | | 90% (Max60°C) | RH |

nELECTRICAL CHARACTERISTICS

DC CHARACTERISTICS

| Parameter | Symbol | Min | Typ | Max | Unit |
|---------------------------|----------------------------------|----------------------|-----|--------------------|------|
| Supply voltage for logic | V _{DD} -V _{SS} | --- | 5.0 | --- | V |
| Input Current | I _{dd} | --- | TBD | --- | mA |
| Operating voltage for LCD | V _{LCD} | --- | 23 | --- | V |
| Input voltage 'H' level | V _{IH} | 0.8V _{DD} | --- | --- | V |
| Input voltage 'L' level | V _{IL} | --- | --- | 0.2V _{DD} | V |
| Output voltage 'H' level | V _{OH} | V _{DD} -0.4 | --- | --- | V |
| Output voltage 'L' level | V _{OL} | --- | --- | 0.4 | V |

n TIMING OF POWER SUPPLY

PLEASE REFER TO THE DRIVER IC SPECIFICATION.

n BACKLIGHT CHARACTERISTICS

| Item | Symbol | Min. | Typ. | Max. | Unit | Condition |
|-----------------|----------------|-----------------|------|------|-------------------|-----------|
| Forward voltage | V _f | --- | 5.0 | --- | V | If=105 mA |
| Luminance | L _v | --- | --- | --- | cd/m ² | |
| Wave length | λ | --- | --- | --- | nm | - |
| Number of LED | - | --- | | | Piece | - |
| Connection mode | S/P | Series/Parallel | | | - | - |

nELECTRO-OPTICAL CHARACTERISTICS

| Item | Symbol | Condition | Min | Typ | Max | Unit | Remark | Note |
|----------------------|-------------------|--|-----|-----|-----|-------------------|--------|------|
| Response time | Tr | $\theta=0^\circ$ $\varnothing=0^\circ$ Ta=25°C | --- | TBD | --- | ms | FIG.3 | 4 |
| | Tf | | --- | TBD | --- | ms | FIG.3 | 4 |
| Contrast ratio | Cr | | --- | TBD | --- | --- | FIG 4. | 1 |
| Luminance uniformity | δ WHITE | | --- | TBD | --- | % | FIG 4. | 3 |
| Surface Luminance | Lv | | --- | TBD | --- | cd/m ² | FIG 4. | 2 |
| Viewing angle range | θ | $\varnothing = 90^\circ$ | --- | TBD | --- | deg | FIG 5 | 5 |
| | | $\varnothing = 270^\circ$ | --- | TBD | --- | deg | | |
| | | $\varnothing = 0^\circ$ | --- | TBD | --- | deg | | |
| | | $\varnothing = 180^\circ$ | --- | TBD | --- | deg | | |

Note 1. Contrast Ratio(CR) is defined mathematically as For more information see FIG 4.:

$$\text{Contrast Ratio} = \frac{\text{Average Surface Luminance with all white pixels (P}_1, \text{P}_2, \text{P}_3, \text{P}_4, \text{P}_5)}{\text{Average Surface Luminance with all black pixels (P}_1, \text{P}_2, \text{P}_3, \text{P}_4, \text{P}_5)}$$

Note 2. Surface luminance is the center point across the LCD surface 500mm from the surface with all pixels displaying white. For more information see FIG 4.

$$L_v = \text{Average Surface Luminance with all white pixels (P}_1, \text{P}_2, \text{P}_3, \text{P}_4, \text{P}_5)$$

Note 3. The uniformity in surface luminance, δ WHITE is determined by measuring luminance at each test position 1 through 5, and then dividing the maximum luminance of 5 points luminance by minimum luminance of 5 points luminance. For more information see FIG 4.

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P}_1, \text{P}_2, \text{P}_3, \text{P}_4, \text{P}_5)}{\text{Maximum Surface Luminance with all white pixels (P}_1, \text{P}_2, \text{P}_3, \text{P}_4, \text{P}_5)}$$

Note 4. Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 3.

Note 5. Viewing angle is the angle at which the contrast ratio is greater than 2. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface. For more information see FIG 5.

FIG. 1 Optical Characteristic Measurement Equipment and Method

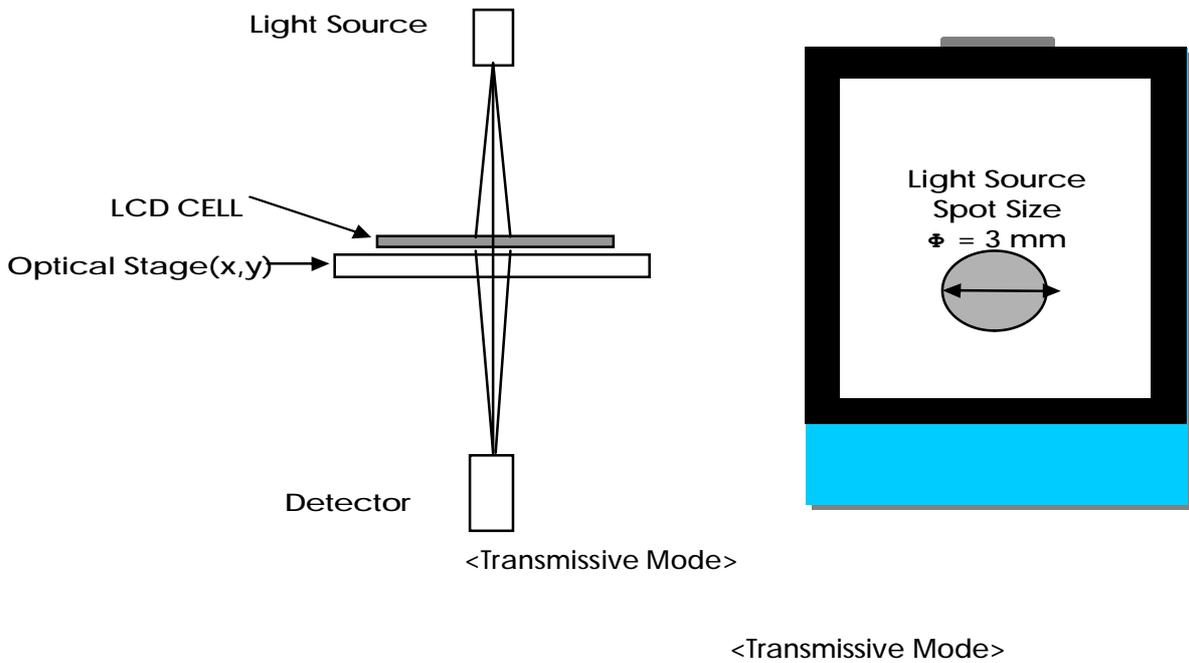


FIG. 2 Measuring method for optical characteristics in Reflective mode

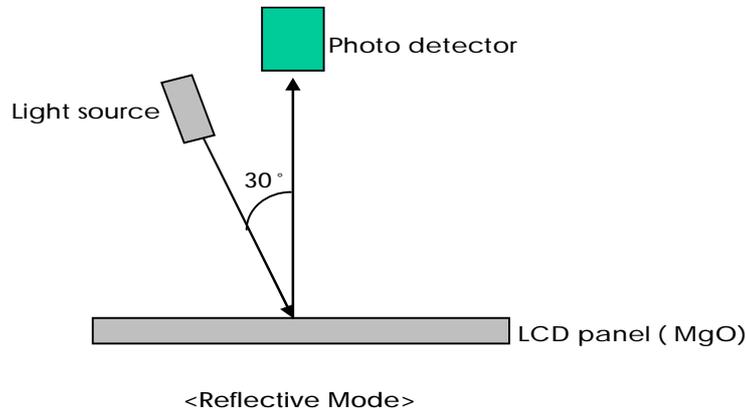
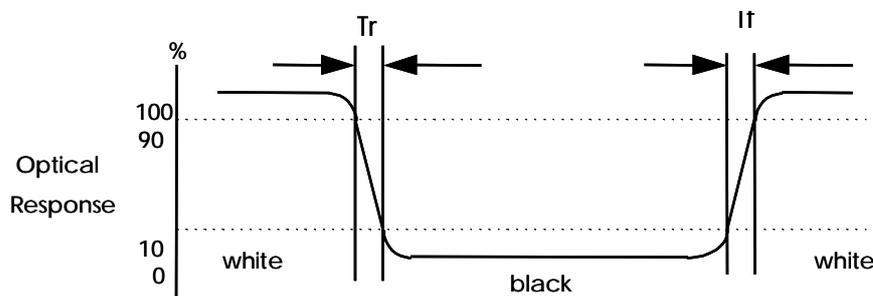


FIG. 3 The definition of Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.

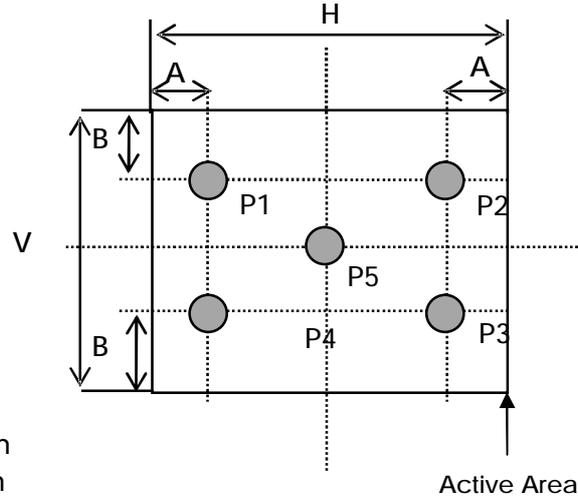


The values specified are at an approximate distance 500 mm from the LCD surface at a viewing angle of Φ and θ equal to 0° . Measurement condition : Refer to next pages (B - light source , Halogen Lamp, with polarizer)

FIG. 4 Measuring method for Contrast ratio, surface luminance, **Luminance** uniformity, CIE (x, y) chromaticity

<measuring point for luminance variation>

<measuring point for surface luminance>



A : 5 mm

B : 5 mm

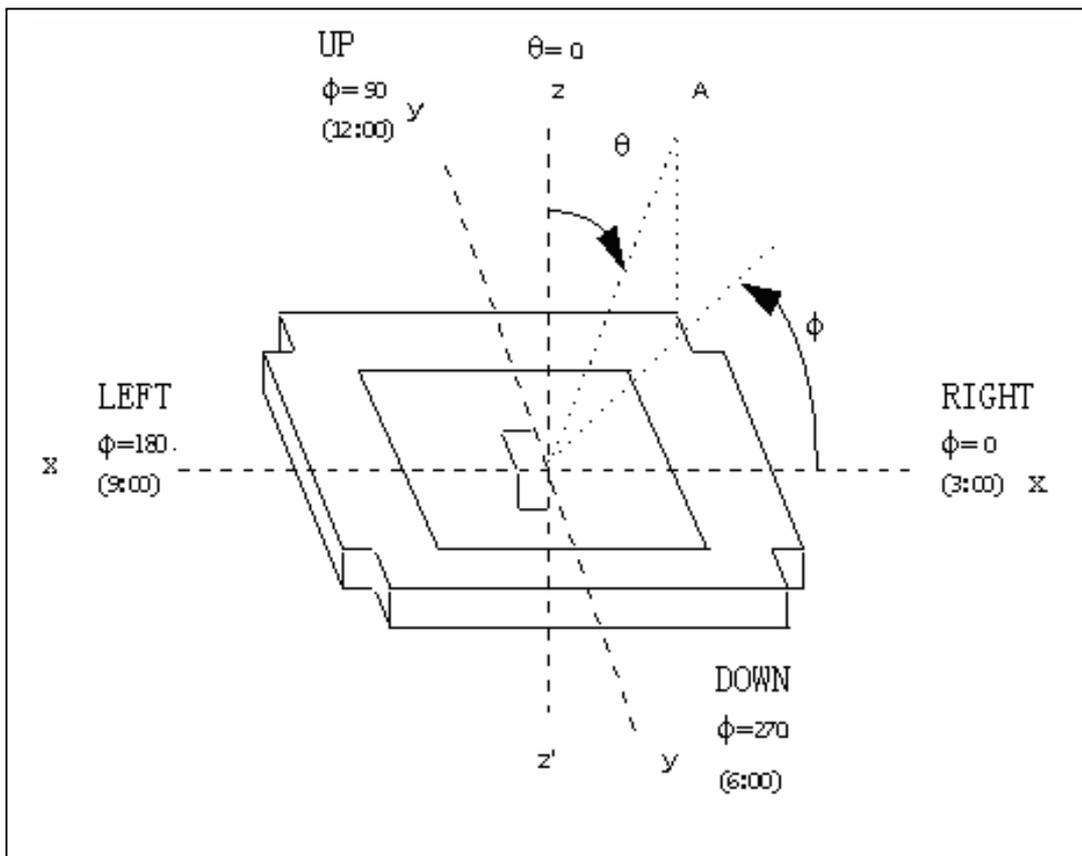
Light source spot size $\varnothing=2\text{mm}$

H,V : Active Area

measurement device is TOPCON luminance meter BM-7

FIG. 5 The definition of viewing angle

<dimension of viewing angle range>



n INTERFACE DESCRIPTION

| Pin No. | Symbol | Level | Description |
|---------|--------|-------|---------------------------------------|
| 1 | VSS | 0V | Ground |
| 2 | VDD | 5.0V | Supply logic power |
| 3 | NC | --- | No connector |
| 4 | /WR | H/L | Write signal |
| 5 | /RD | H/L | Read signal |
| 6 | /CS | H/L | Chip select signal |
| 7 | A0 | H/L | Selection display data or instruction |
| 8 | RES | H/L | Reset the system |
| 9 | DB0 | H/L | data bit0 |
| 10 | DB1 | H/L | data bit1 |
| 11 | DB2 | H/L | data bit2 |
| 12 | DB3 | H/L | data bit3 |
| 13 | DB4 | H/L | data bit4 |
| 14 | DB5 | H/L | data bit5 |
| 15 | DB6 | H/L | data bit6 |
| 16 | DB7 | H/L | data bit7 |
| 17 | LEDA | 5V | LED light anode |
| 18 | LEDK | 0V | LED light cathode |

n APPLICATION CIRCUIT

Please consult our technical department for detail information.

n INITIAL CODE

Please consult our technical department for detail information.

n RELIABILITY

◇ Content of Reliability Test

| No. | Test Item | Test Condition | Inspection after test |
|-----|----------------------------|---|--|
| 1 | High Temperature Storage | 80±2°C/200 hours | Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Sealleak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current Idd is twice higher than initial value. |
| 2 | Low Temperature Storage | -30±2°C/200 hours | |
| 3 | High Temperature Operating | 70±2°C/120 hours | |
| 4 | Low Temperature Operating | -20±2°C/120 hours | |
| 5 | Temperature Cycle | -20±2°C~25~70±2°C×10cycles (30min.) (5min.) (30min.) | |
| 6 | Damp Proof Test | 50°C±5°C×90%RH/120 hours | |
| 7 | Vibration Test | Frequency: 10Hz~55Hz~10Hz Amplitude: 1.5mm, X, Y, Z direction for total 3hours (Packing condition) | |
| 8 | Drooping test | Drop to the ground from 1m height, one time, every side of carton. (Packing condition) | |
| 9 | ESD test | Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time | |

Remark:

- 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>10MΩ) 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 judge 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.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.

n INSPECTION CRITERIA

This specification is made to be used as the standard acceptance/rejection criteria for Normal LCM Product.

1 Sample plan

Sampling plan according to GB/T2828.1-2003/ISO 2859-1: 1999 and ANSI/ASQC Z1.4-1993, normal level 2 and based on:

Major defect: AQL 0.4

Minor defect: AQL 1.5

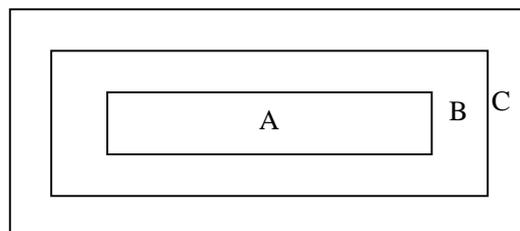
2. Inspection condition

I Viewing distance for cosmetic inspection is about 30cm with bare eyes, and under an environment of 20~40W light intensity, all directions for inspecting the sample should be within 45° against perpendicular line. (Normal temperature 20~25°C and normal humidity 60±15%RH).

I Driving voltage

The Vop value from which the most optimal contrast can be obtained near the specified Vop in the specification (Within ±0.5V of the typical value at 25°C.).

3. Definition of inspection zone in LCD.



Zone A: character/Digit area

Zone B: viewing area except Zone A (ZoneA+ZoneB=minimum Viewing area)

Zone C: Outside viewing area (invisible area after assembly in customer's product)

Fig.1 Inspection zones in an LCD.

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

4. Inspection Standard

4.1 Major Defect

| Item No | Items to be inspected | Inspection Standard | Classification of defects |
|---------|------------------------|---|---------------------------|
| 4.1.1 | All functional defects | 1) No display 2) Display abnormally 3) Missing vertical, horizontal segment 4) Short circuit 5) Back-light no lighting, flickering and abnormal lighting. | Major |
| 4.1.2 | Missing | Missing component | |
| 4.1.3 | Outline dimension | Overall outline dimension beyond the drawing is not allowed. | |

4.2 Cosmetic Defect

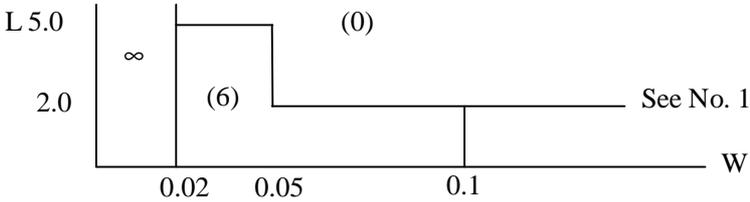
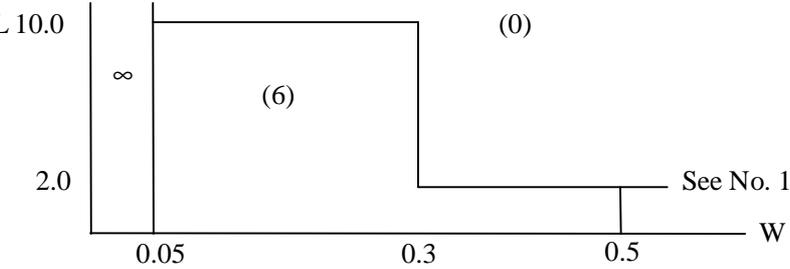
4.2.1 Module Cosmetic Criteria

| No. | Item | Judgement Criterion | Partition |
|-----|--------------------------------------|---|----------------------|
| 1 | Difference in Spec. | None allowed | Major |
| 2 | Pattern peeling | No substrate pattern peeling and floating | Major |
| 3 | Soldering defects | No soldering missing No soldering bridge No cold soldering | Major Major Minor |
| 4 | Resist flaw on substrate | Invisible copper foil ($\varnothing 0.5\text{mm}$ or more) on substrate pattern | Minor |
| 5 | Accretion of metallic Foreign matter | No soldering dust No accretion of metallic foreign matters (Not exceed $\varnothing 0.2\text{mm}$) | Minor Minor |
| 6 | Stain | No stain to spoil cosmetic badly | Minor |
| 7 | Plate discoloring | No plate fading, rusting and discoloring | Minor |
| 8 | Solder amount | a. Soldering side of PCB Solder to form a 'Filet' all around the lead. Solder should not hide the lead form perfectly. (too much) | Minor |
| | 1. Lead parts | b. Components side (In case of 'Through Hole PCB') Solder to reach the Components side of PCB. | |
| | 2. Flat packages | Either 'Toe' (A) or 'Seal' (B) of the lead to be covered by 'Filet'. Lead form to be assume over solder. | |
| | 3. Chips | $(3/2) H \geq h \geq (1/2) H$ | Minor |

4.2.2 Cosmetic Criteria (Non-Operating)

| No. | Defect | Judgment Criterion | Partition | | | | | | | | | | |
|---------------|-------------------------------|--|-------------|-------------------------------|---------|-----------|---------------|---|---------------|---|---------|---|-------|
| 1 | Spots | In accordance with <i>Screen Cosmetic Criteria (Operating) No.1.</i> | Minor | | | | | | | | | | |
| 2 | Lines | In accordance with <i>Screen Cosmetic Criteria (Operating) No.2.</i> | Minor | | | | | | | | | | |
| 3 | Bubbles in polarizer | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Size : d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>d ≤ 0.3</td> <td>Disregard</td> </tr> <tr> <td>0.3 < d ≤ 1.0</td> <td>3</td> </tr> <tr> <td>1.0 < d ≤ 1.5</td> <td>1</td> </tr> <tr> <td>1.5 < d</td> <td>0</td> </tr> </tbody> </table> | Size : d mm | Acceptable Qty in active area | d ≤ 0.3 | Disregard | 0.3 < d ≤ 1.0 | 3 | 1.0 < d ≤ 1.5 | 1 | 1.5 < d | 0 | Minor |
| Size : d mm | Acceptable Qty in active area | | | | | | | | | | | | |
| d ≤ 0.3 | Disregard | | | | | | | | | | | | |
| 0.3 < d ≤ 1.0 | 3 | | | | | | | | | | | | |
| 1.0 < d ≤ 1.5 | 1 | | | | | | | | | | | | |
| 1.5 < d | 0 | | | | | | | | | | | | |
| 4 | Scratch | In accordance with spots and lines operating cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable. | Minor | | | | | | | | | | |
| 5 | Allowable density | Above defects should be separated more than 30mm each other. | Minor | | | | | | | | | | |
| 6 | Coloration | Not to be noticeable coloration in the viewing area of the LCD panels. Back-lit type should be judged with back-lit on state only. | Minor | | | | | | | | | | |
| 7 | Contamination | Not to be noticeable. | Minor | | | | | | | | | | |

4.2.3 Cosmetic Criteria (Operating)

| No. | Defect | Judgment Criterion | Partition | | | | | | | | | | | | | | | | | | | | |
|--------------------|-------------------------------|---|-------------|-------------------------------|--------------|-----------|--------------------|---|--------------------|---|-----------|---|-------------|-------------------------------|--------------|-----------|--------------------|---|--------------------|---|-----------|---|-------|
| 1 | Spots | <p>A) Clear</p> <table border="1" data-bbox="496 349 1273 533"> <thead> <tr> <th>Size : d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>$d \leq 0.1$</td> <td>Disregard</td> </tr> <tr> <td>$0.1 < d \leq 0.2$</td> <td>6</td> </tr> <tr> <td>$0.2 < d \leq 0.3$</td> <td>2</td> </tr> <tr> <td>$0.3 < d$</td> <td>0</td> </tr> </tbody> </table> <p>Note : Including pin holes and defective dots which must be within one pixel size.</p> <p>B) Unclear</p> <table border="1" data-bbox="464 689 1241 873"> <thead> <tr> <th>Size : d mm</th> <th>Acceptable Qty in active area</th> </tr> </thead> <tbody> <tr> <td>$d \leq 0.2$</td> <td>Disregard</td> </tr> <tr> <td>$0.2 < d \leq 0.5$</td> <td>6</td> </tr> <tr> <td>$0.5 < d \leq 0.7$</td> <td>2</td> </tr> <tr> <td>$0.7 < d$</td> <td>0</td> </tr> </tbody> </table> | Size : d mm | Acceptable Qty in active area | $d \leq 0.1$ | Disregard | $0.1 < d \leq 0.2$ | 6 | $0.2 < d \leq 0.3$ | 2 | $0.3 < d$ | 0 | Size : d mm | Acceptable Qty in active area | $d \leq 0.2$ | Disregard | $0.2 < d \leq 0.5$ | 6 | $0.5 < d \leq 0.7$ | 2 | $0.7 < d$ | 0 | Minor |
| Size : d mm | Acceptable Qty in active area | | | | | | | | | | | | | | | | | | | | | | |
| $d \leq 0.1$ | Disregard | | | | | | | | | | | | | | | | | | | | | | |
| $0.1 < d \leq 0.2$ | 6 | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < d \leq 0.3$ | 2 | | | | | | | | | | | | | | | | | | | | | | |
| $0.3 < d$ | 0 | | | | | | | | | | | | | | | | | | | | | | |
| Size : d mm | Acceptable Qty in active area | | | | | | | | | | | | | | | | | | | | | | |
| $d \leq 0.2$ | Disregard | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < d \leq 0.5$ | 6 | | | | | | | | | | | | | | | | | | | | | | |
| $0.5 < d \leq 0.7$ | 2 | | | | | | | | | | | | | | | | | | | | | | |
| $0.7 < d$ | 0 | | | | | | | | | | | | | | | | | | | | | | |
| 2 | Lines | <p>A) Clear</p>  <p>Note : () - Acceptable Qty in active area L - Length (mm) W - Width (mm) ∞ - Disregard</p> <p>B) Unclear</p>  <p>‘Clear’ = The shade and size are not changed by V_{op}. ‘Unclear’ = The shade and size are changed by V_{op}.</p> | Minor | | | | | | | | | | | | | | | | | | | | |

| | | | |
|---|--|--|-------|
| 3 | Rubbing line | Not to be noticeable. | Minor |
| 4 | Allowable density | Above defects should be separated more than 10mm each other. | Minor |
| 5 | Rainbow | Not to be noticeable. | Minor |
| 6 | Dot size | To be 95% ~ 105% of the dot size (Typ.) in drawing. Partial defects of each dot (ex. pin-hole) should be treated as 'Spot'. (see <i>Screen Cosmetic Criteria (Operating) No.1</i>) | Minor |
| 7 | Uneven brightness (only back-lit type module) | Uneven brightness must be $B_{MAX} / B_{MIN} \leq 2$ - B_{MAX} : Max. value by measure in 5 points - B_{MIN} : Min. value by measure in 5 points Divide active area into 4 vertically and horizontally. Measure 5 points shown in the following figure. <div style="text-align: center;"> <p>i : Measuring points</p> </div> | Minor |

Note :

- (1) Size : $d = (\text{long length} + \text{short length}) / 2$
- (2) The limit samples for each item have priority.
- (3) Complex defects are defined item by item, but if the numbers of defects are defined in above table, the total number should not exceed 10.
 - (4) In case of 'concentration', even the spots or the lines of 'disregarded' size should not allowed. Following three situations should be treated as 'concentration'.
 - 7 or over defects in circle of $\varnothing 5\text{mm}$.
 - 10 or over defects in circle of $\varnothing 10\text{mm}$.
 - 20 or over defects in circle of $\varnothing 20\text{mm}$.

n PRECAUTIONS FOR USING LCD MODULES

◇ Handling Precautions

- (1) The display panel is made of glass. 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.
- (4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- (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
- (6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
 - Water
 - Ketone
 - Aromatic solvents
- (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) To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - Be sure to ground the body when handling the LCD modules.
 - Tools required for assembling, such as soldering irons, must be properly grounded.
 - To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions.
 - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

◇ Storage Precautions

When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

◇ 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.

n USING LCD MODULES

◇ Liquid Crystal Display Modules

LCD is composed of glass and polarizer. Pay attention to the following items when handling.

- (1) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble

generation or polarizer peel-off may occur with high temperature and high humidity.

(2) Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).

(3) N-hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by chemicals such as acetone, toluene, ethanol and isopropylalcohol.

(4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzin. Do not scrub hard to avoid damaging the display surface.

(5) Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading.

(6) Avoid contacting oil and fats.

(7) Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.

(8) Do not put or attach anything on the display area to avoid leaving marks on.

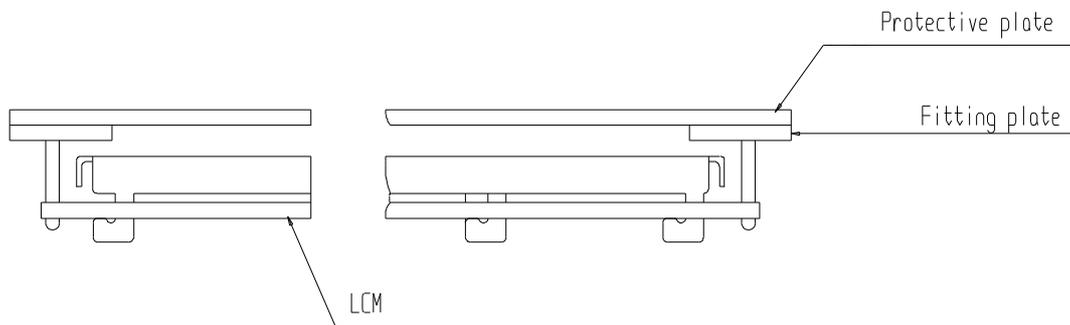
(9) Do not touch the display with bare hands. This will stain the display area and degradate insulation between terminals (some cosmetics are determinated to the polarizers).

(10) As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring.

◇ Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

(1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



(2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be ± 0.1 mm.

◇ Precaution for Handing LCD Modules

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.

(1) Do not alter, modify or change the the shape of the tab on the metal frame.

(2) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.

(3) Do not damage or modify the pattern writing on the printed circuit board.

(4) Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.

(5) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.

(6) Do not drop, bend or twist LCM.

◇ Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

(1) Make certain that you are grounded when handing LCM.

(2) Before remove LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential.

- (3) When soldering the terminal of LCM, make certain the AC power source for the soldering iron does not leak.
- (4) When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- (5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
- (6) To reduce the generation of static electricity be careful that the air in the work is not too dried. A relative humidity of 50%-60% is recommended.

◇ **Precaution for soldering to the LCM**

- (1) Observe the following when soldering lead wire, connector cable and etc. to the LCM.
 - Soldering iron temperature : $280^{\circ}\text{C} \pm 10^{\circ}\text{C}$.
 - Soldering time : 3-4 sec.
 - Solder : eutectic solder.

If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

- (2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

- (3) When remove the electoluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

◇ **Storage**

When storing LCDs as spares for some years, the following precaution are necessary.

- (1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for 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.)
- (4) Environmental conditions :
 - Do not leave them for more than 168hrs. at 90°C .
 - Should not be left for more than 48hrs. at -20°C .

◇ **Safety**

- (1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- (2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

◇ **Limited Warranty**

Unless agreed between TRULY and customer, TRULY will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with TRULY LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects must be returned to TRULY within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of TRULY limited to repair and/or replacement on the terms set forth above. TRULY will not be responsible for any subsequent or consequential events.

◇ **Return LCM under warranty**

No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

- Broken LCD glass.
- PCB eyelet's damaged or modified.
- PCB conductors damaged.
- Circuit modified in any way, including addition of components.
- PCB tampered with by grinding, engraving or painting varnish.
- soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient

description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet's, conductors and terminals.

n PRIOR CONSULT MATTER

WE WILL ENFORCE OF CHANGING MATERIAL, METHOD, PROCESS AND OTHERS FOR THIS PRODUCT AFTER PRIOR CONSULTATION.

IF YOU HAVE DOUBTS ABOUT CONDITION OF RELIABILITY, WE WOULD CONFER WITH YOU.

n FACTORY

FACTORY NAME: TRULY SEMICONDUCTORS LTD.

FACTORY ADDRESS: Truly Industrial Area, ShanWei City,GuangDong,China

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