

DATA SHEET



**KEEN SIDE**  
electronics

**LCD MODULE**

MODULE NO. :

**KSECB4002XXX-R01**

**Customer:**

Approved by:

| Approved by | Checked by | Prepared by |
|-------------|------------|-------------|
|             |            |             |



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**1. MODULE CLASSIFICATION INFORMATION****KSE C B 4002 X X X - R 01**

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨

① KSE: COMPONET, Ltd

② C: Character Type, G: Graphic Type

③ B: COB, G: COG

④ Display Font: 40 \* 2

⑤ LCD Mode:        B→ STN-Blue Negative        F→ FSTN Positive  
                          G→ STN Gray Positive        Y→ STN Yellow Green Positive⑥ Backlight Type: N→ Without backlight        A→ Amber LED backlight  
                          B→ Blue LED backlight        G→ Green LED backlight  
                          R→ Red LED backlight        W→ Withe LED backlight  
                          Y→ Yellow-Green LED backlight

⑦ LCD Polarizer Type/Temperature range/View direction :

D→ Transflective, W.T, 12:00        E→ Transmissive, W.T, 6:00  
P→ Reflective, W. T, 6:00        Q→ Transmissive, W.T, 12:00  
Z→ Transflective, W.T, 6:00

⑧ Character Bank :

A→ English / Japan        B→ English / European  
R→English / Cyrillic / Portuguese / Russian  
T→ English / Russian        G→ Hebrew

⑨ Model serials no. :

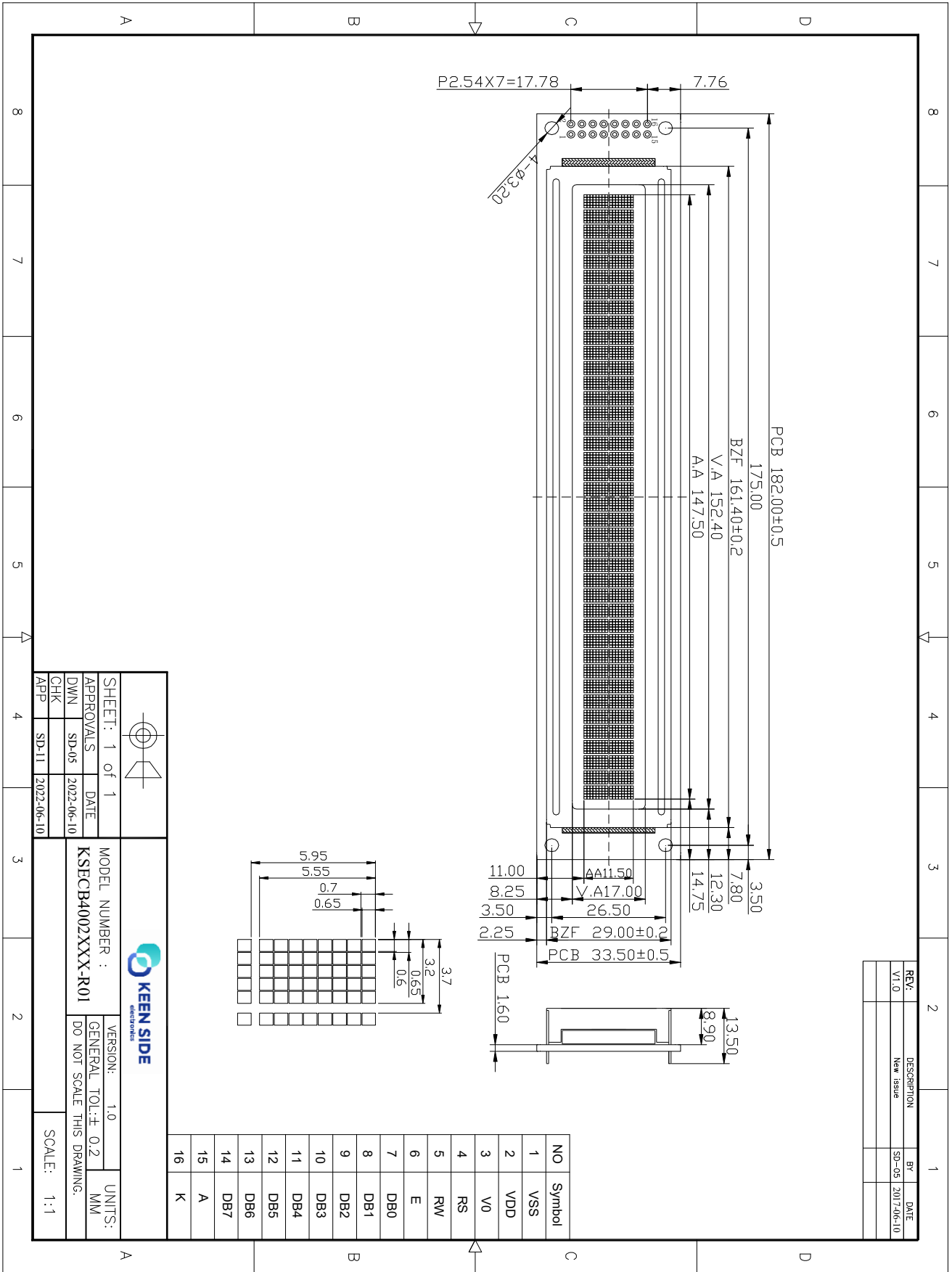
**2.FUNCTIONS & FEATURES**

- KSECB4002XXX-R01 Series LCD type:
- Display Contents : 40\* 2 Characters (5\*8 dots )
- Driving Scheme : 1/16 Duty; 1/5Bias
- Driver IC : AIP31066-002
- Interface : Parallel
- Operating Temperature : -20°C — + 70°C
- Storage Temperature : -30°C — + 80°C
- RoHS Compliant


**3. MECHANICAL SPECIFICATIONS**

- Outline Dimensions : 182.00(W) x 33.50(L) x 13.50(H)(mm)
- Viewing Area : 152.00 (W) x 17.00(L)(mm)
- Active Area : 147.50 (W) x 11.50 (L)(mm)
- Character Size : 3.20 (W) x 5.55 (L)(mm)
- Character Pitch : 3.40 (W) x 5.95 (L)(mm)
- Weight : TBD

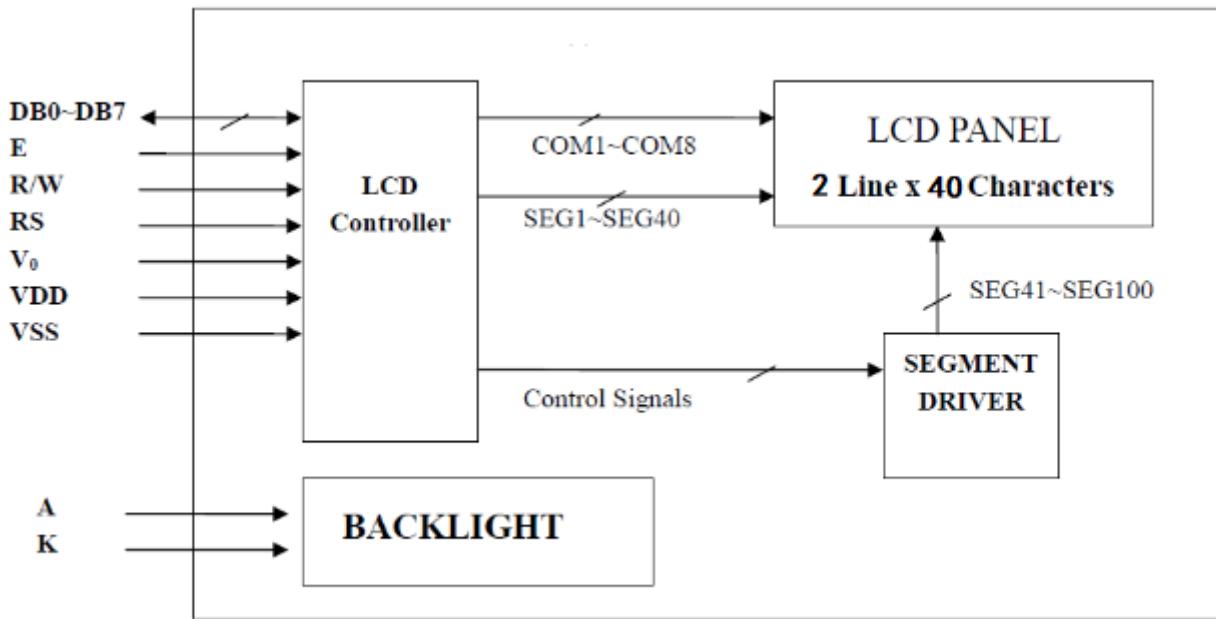
**3. EXTERNAL DIMENSIONS**



| REV. | DESCRIPTION | BY    | DATE       |
|------|-------------|-------|------------|
| V1.0 | New Issue   | SD-05 | 2017-06-10 |

|                                                                                     |                  |
|-------------------------------------------------------------------------------------|------------------|
|  |                  |
| MODEL NUMBER : KSECB4002XXX-R01                                                     |                  |
| VERSION: 1.0                                                                        | UNITS: MM        |
| GENERAL TOL:± 0.2                                                                   |                  |
| DO NOT SCALE THIS DRAWING.                                                          |                  |
| SCALE: 1:1                                                                          |                  |
| SHEET: 1 of 1                                                                       | DATE: 2022-06-10 |
| APPROVALS: DWN                                                                      | SD-05            |
| CHK: APP                                                                            | SD-11            |

**4. BLOC`K DIAGRAM**



**5. PIN ASSIGNMENT**

| Pin No. | Symbol         | Function                                                                                                                                                                                                                                           |
|---------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | VSS            | Ground terminal of module.                                                                                                                                                                                                                         |
| 2       | VDD            | Power terminal of module                                                                                                                                                                                                                           |
| 3       | V <sub>0</sub> | Power Supply for liquid crystal drive.                                                                                                                                                                                                             |
| 4       | RS             | Register select<br>RS = 0...Instruction register<br>RS = 1...Data register                                                                                                                                                                         |
| 5       | R/W            | Read /Write<br>R/W = 1...Read<br>R/W = 0...Write                                                                                                                                                                                                   |
| 6       | E              | Read/Write Enable Signal                                                                                                                                                                                                                           |
| 7       | DB0            | Bi-directional data bus, data transfer is performed once, thru DB0 to DB7, in the case of interface data. Length is 8-bits; and twice, thru DB4 to DB7 in the case of interface data length is 4-bits. Upper four bits first then lower four bits. |
| 8       | DB1            |                                                                                                                                                                                                                                                    |
| 9       | DB2            |                                                                                                                                                                                                                                                    |
| 10      | DB3            |                                                                                                                                                                                                                                                    |
| 11      | DB4            |                                                                                                                                                                                                                                                    |
| 12      | DB5            |                                                                                                                                                                                                                                                    |
| 13      | DB6            |                                                                                                                                                                                                                                                    |
| 14      | DB7            |                                                                                                                                                                                                                                                    |
| 15      | A              | Anode of Backlight                                                                                                                                                                                                                                 |
| 16      | K              | Cathode of Backlight                                                                                                                                                                                                                               |

**6. BACKLIGHT ELECTRICAL/OPTICAL SPECIFICATIONS**

| ITEM                     | SYMBOL         | MIN. | TYP. | MAX. | UNIT              | CONDITIONS            |
|--------------------------|----------------|------|------|------|-------------------|-----------------------|
| Forward Voltage          | V <sub>f</sub> | 4.8  | 5.0  | 5.2  | V                 | If= 15x4 mA           |
| Reverse Current          | I <sub>r</sub> |      |      | 100  | μA                | V <sub>r</sub> =5.0 V |
| Dominant wave length     | λ <sub>D</sub> | 569  | 572  | 575  | nm                | If= 15x4 mA           |
| Spectral Line Half width | Δ λ            |      | 25   |      | nm                | If= 15x4 mA           |
| Luminous                 | L <sub>v</sub> | 75   | 80   |      | cd/m <sup>2</sup> | If= 15x4 mA           |

**7. DISPLAY DATA RAM (DDRAM)**

|          |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Display  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| Position |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| DDRAM    | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |
| Address  | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F |

|                |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|----------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| For Shift Left | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F | 10 |
|                | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E | 4F | 50 |

|                 |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| For Shift Right | 27 | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E |
|                 | 67 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 4A | 4B | 4C | 4D | 4E |

**8. MAXIMUM ABSOLUTE POWER RATINGS**

| ITEM                    | SYMBOL | STANDARD VALUE   | UNIT |
|-------------------------|--------|------------------|------|
| Power supply voltage(1) | VDD    | -0.3~+7.0        | V    |
| Power supply voltage(2) | VLCD   | VDD-10.0~VDD+0.3 | V    |
| Input voltage           | VIN    | -0.3~VDD+0.3     | V    |
| Operating temperature   | Topr   | -20~+70          | °C   |
| Storage temperature     | Tstg   | -30~+80          | °C   |

\*Voltage greater than above may damage to the Circuit.

$$VDD > V1 > V2 > V3 > V4 > V5$$



**9. ELECTRICAL CHARACTERISTICS**

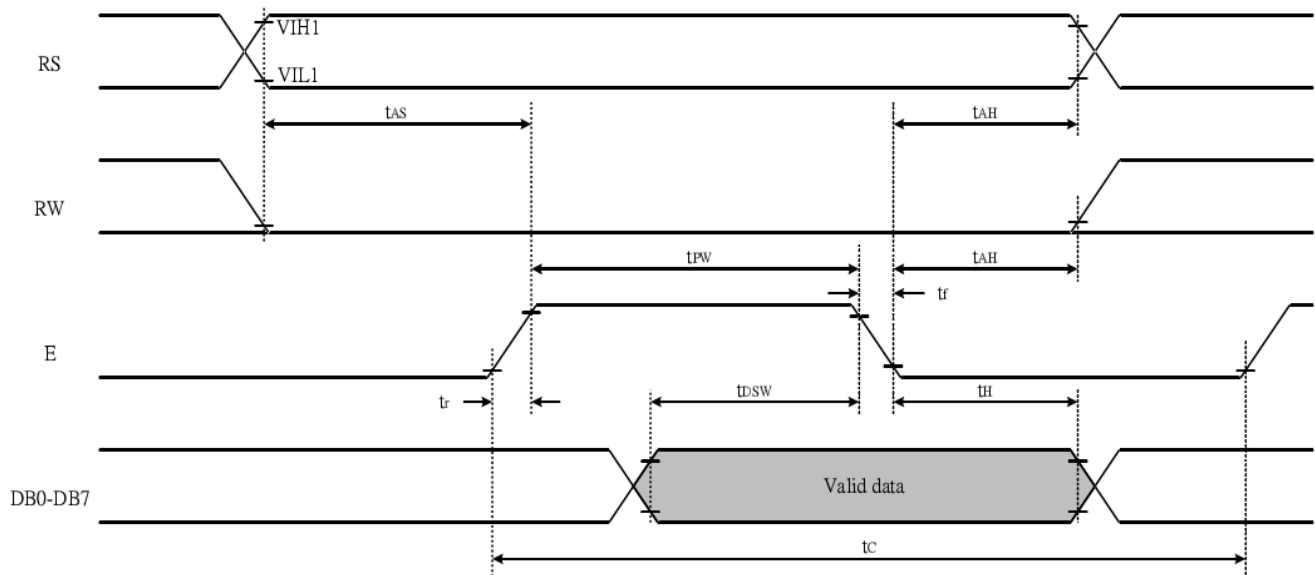
**9-1 DC Characteristics**

| Item                | Symbol           | Standard Value |     |     | Test Condition                                                  | Unit |
|---------------------|------------------|----------------|-----|-----|-----------------------------------------------------------------|------|
|                     |                  | MIN            | TYP | MAX |                                                                 |      |
| Operating Voltage   | V <sub>DD</sub>  | 4.8            | 5.0 | 5.2 | -----                                                           | V    |
| Supply Current      | I <sub>DD2</sub> | ----           | TBD | 0.6 | Resistor oscillation<br>external clock operation<br>fosc=270kHz | V    |
| LCD Driving Voltage | V <sub>LCD</sub> | 4.6            | 4.8 | 5.0 | V <sub>DD</sub> -V <sub>0</sub>                                 | V    |

**9-2 AC Characteristics**

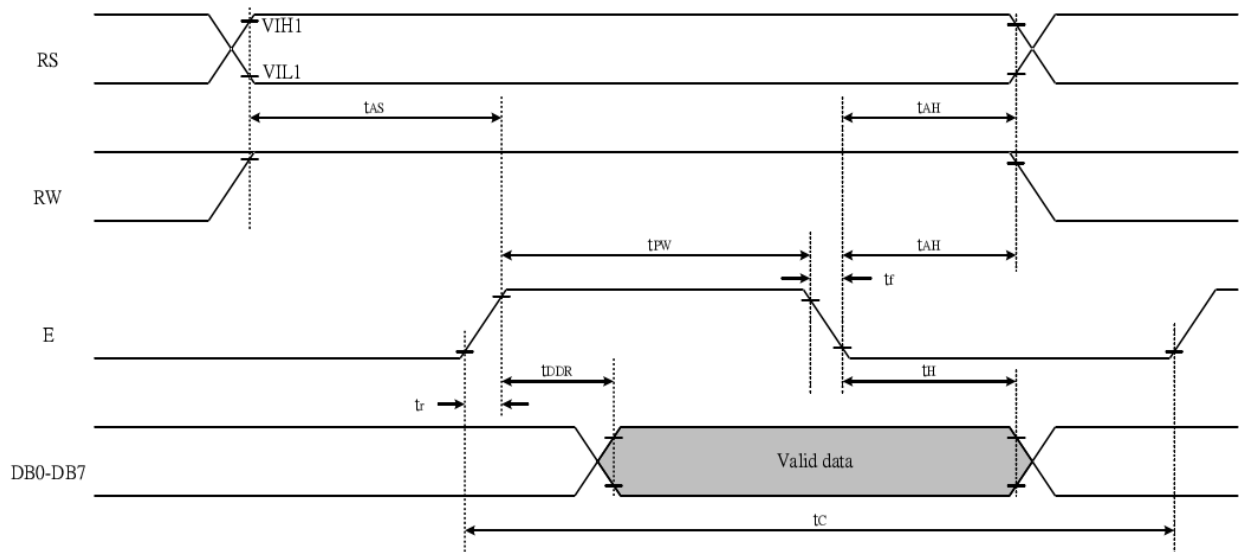
**9.2.1 Write mode**

| Characteristic        | Symbol                          | Min  | Type | Max | Unit | Test PIN |
|-----------------------|---------------------------------|------|------|-----|------|----------|
| Enable Cycle Time     | t <sub>c</sub>                  | 1200 | ---  | --- | ns   | E        |
| Enable Pulse Time     | T <sub>PW</sub>                 | 460  | ---  | --- | ns   | E        |
| Enable Rise/Fall Time | T <sub>R</sub> , T <sub>F</sub> | ---  | ---  | 25  | ns   | E        |
| Address Set-up Time   | T <sub>AS</sub>                 | 0    | ---  | --- | ns   | R/W,RS,E |
| Address Hold Time     | T <sub>AH</sub>                 | 10   | ---  | --- | ns   | R/W,RS,E |
| Data Set-up Time      | T <sub>DSW</sub>                | 80   | ---  | --- | ns   | DB0~DB7  |
| Data Hold Time        | T <sub>H</sub>                  | 10   | ---  | --- | ns   | DB0~DB7  |



**9.2.2 Read mode**

| Characteristic        | Symbol     | Min  | Type | Max | Unit | Test PIN |
|-----------------------|------------|------|------|-----|------|----------|
| Enable Cycle Time     | $t_C$      | 1200 | ---  | --- | ns   | E        |
| Enable Pulse Time     | $T_{PW}$   | 480  | ---  | --- | ns   | E        |
| Enable Rise/Fall Time | $T_R, T_F$ | ---  | ---  | 25  | ns   | E        |
| Address Set-up Time   | $T_{AS}$   | 0    | ---  | --- | ns   | R/W,RS,E |
| Address Hold Time     | $T_{AH}$   | 10   | ---  | --- | ns   | R/W,RS,E |
| Data Set-up Time      | $T_{DDR}$  | ---  | ---  | 320 | ns   | DB0~DB7  |
| Data Hold Time        | $T_H$      | 10   | ---  | --- | ns   | DB0~DB7  |



## 10. INSTRUCTION TABLE

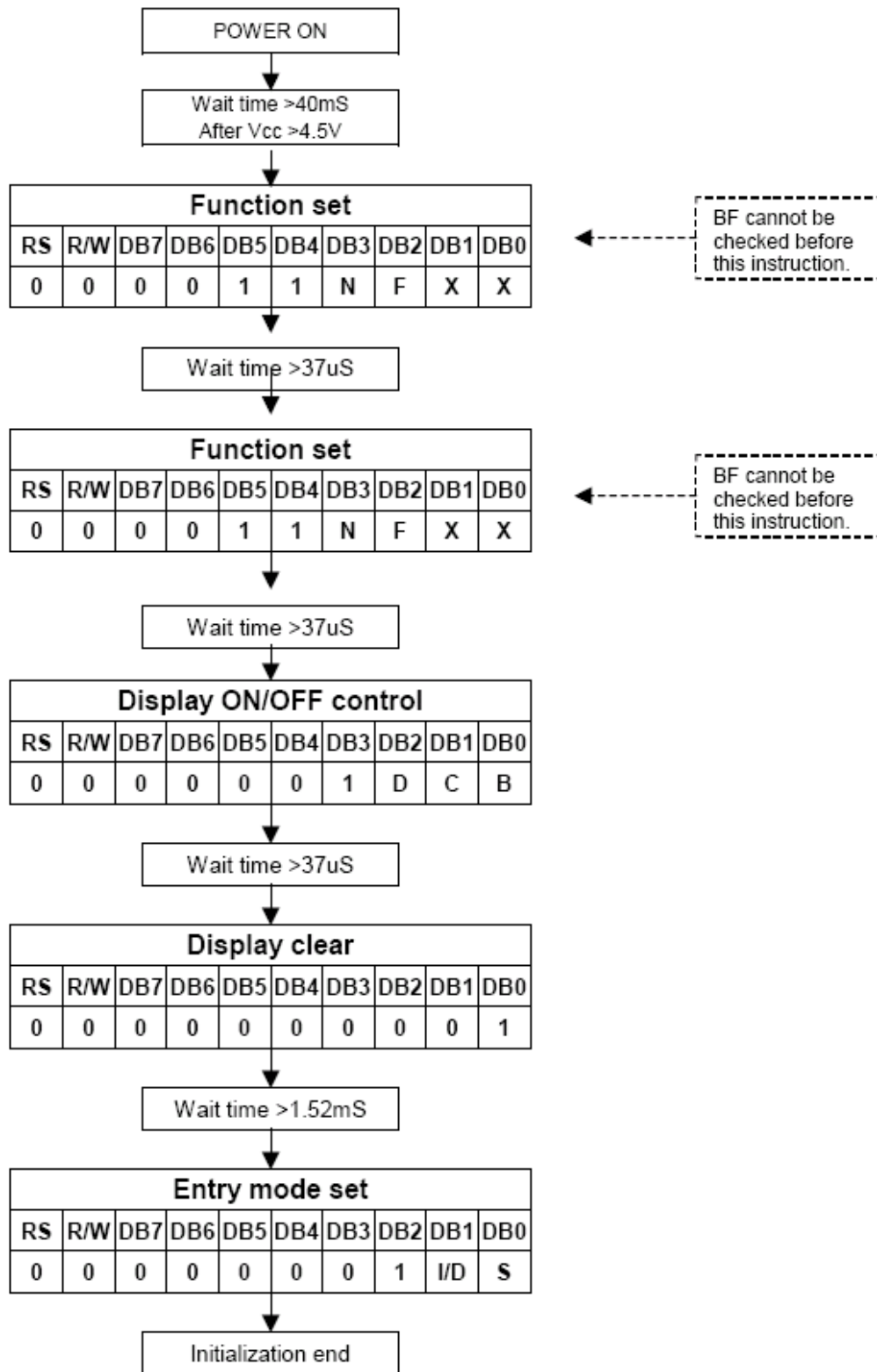
| Command                  | RS | R/W | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | Execution time<br>(fosc=270KHz) | Remark                                                                                                                           |
|--------------------------|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Clear Display            | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | 1.52ms                          | Write "20H" to DDRAM. And set DDRAM address to "00H" from AC                                                                     |
| Return home              | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 1   | x   | 1.52ms                          | Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed. |
| Entry mode Set           | 0  | 0   | 0   | 0   | 0   | 0   | 0   | 1   | I/D | S   | 37us                            | Sets cursor move direction and specifies display shift. These operations are performed during data write and read.               |
| Display on/off control   | 0  | 0   | 0   | 0   | 0   | 0   | 1   | D   | C   | B   | 37us                            | D=1: entire display on<br>C=1: cursor on<br>B=1: cursor position on                                                              |
| Cursor or Display Shift  | 0  | 0   | 0   | 0   | 0   | 1   | S/C | R/L | x   | x   | 37us                            | Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.                                 |
| function Set             | 0  | 0   | 0   | 0   | 1   | DL  | N   | F   | x   | x   | 37us                            | DL: interface data is 8/4 bits<br>N: number of line is 2/1<br>F: font size is 5x11/5x8                                           |
| Set CGRAM address        | 0  | 0   | 0   | 1   | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | 37us                            | Set CGRAM address in address counter                                                                                             |
| Set DDRAM address        | 0  | 0   | 1   | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | 37us                            | Set DDRAM address in address counter                                                                                             |
| Read busy flag & address | 0  | 1   | BF  | AC6 | AC5 | AC4 | AC3 | AC2 | AC1 | AC0 | 0us                             | Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.           |
| Write data to RAM        | 1  | 0   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | 37us                            | Write data into internal RAM (DDRAM/CGRAM)                                                                                       |
| Read data from RAM       | 1  | 1   | D7  | D6  | D5  | D4  | D3  | D2  | D1  | D0  | 37us                            | Read data from internal RAM (DDRAM / CGRAM)                                                                                      |

**Note:**

Be sure the AIP31066 is not in the busy state (BF=00) before sending an instruction from the MPU to the AIP31066. If an instruction is sent without checking the busy flag, the time between the first instruction and next instruction will take much longer than the instruction time itself. Refer to instruction table for the list of each instruction execution time.

**11. INITIALIZING BY INSTRUCTION**

8-bit interface mode (fosc=270kHz)

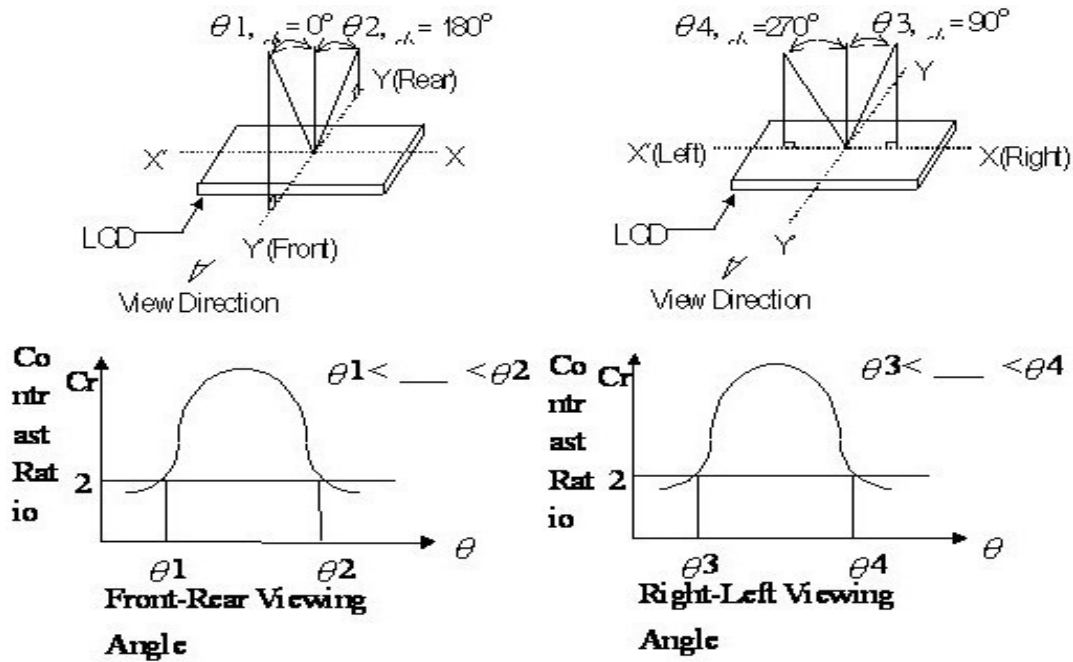


**12. CHARACTER GENERATOR ROM**

| b7-b4<br>b3-b0 | 0000             | 0001 | 0010 | 0011 | 0100 | 0101 | 0110 | 0111 | 1000 | 1001 | 1010 | 1011 | 1100 | 1101 | 1110 | 1111 |
|----------------|------------------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0000           | CG<br>RAM<br>(1) |      |      | 0    | a    | P    | `    | P    |      |      | B    | W    | 4    | .    | д    | М    |
| 0001           | (2)              |      | !    | 1    | Q    | a    | q    |      |      | Г    | Я    | W    | .    | ц    | Я    |      |
| 0010           | (3)              |      | "    | 2    | R    | b    | r    |      |      | Е    | Б    | ь    | u    | ш    | Я    |      |
| 0011           | (4)              |      | #    | 3    | S    | c    | s    |      |      | Ж    | В    | ы    | и    | а    | я    |      |
| 0100           | (5)              |      | \$   | 4    | T    | d    | t    |      |      | З    | Г    | ь    | ъ    | ф    | Н    |      |
| 0101           | (6)              |      | %    | 5    | U    | e    | u    |      |      | И    | ё    | э    | х    | ц    | Г    |      |
| 0110           | (7)              |      | &    | 6    | F    | V    | v    |      |      | Й    | ж    | ю    | ъ    | ш    | Я    |      |
| 0111           | (8)              |      | '    | 7    | G    | w    | w    |      |      | Л    | Э    | я    | і    | ı    | Е    |      |
| 1000           | (1)              |      | (    | 8    | X    | h    | x    |      |      | П    | М    | о    | и    | ı    | Ж    |      |
| 1001           | (2)              |      | )    | 9    | I    | y    | y    |      |      | У    | Д    | о    | т    | ı    | Я    |      |
| 1010           | (3)              |      | *    | =    | J    | Z    | j    | z    |      |      | Ф    | К    | u    | ↓    | é    | ı    |
| 1011           | (4)              |      | +    | :    | K    | L    | k    | l    |      |      | Ч    | а    | "    | W    | q    | ı    |
| 1100           | (5)              |      | ,    | <    | L    | l    | l    | l    |      |      | Ш    | Н    | Н    | М    | U    | ı    |
| 1101           | (6)              |      | -    | =    | M    | I    | m    | i    |      |      | б    | Н    | с    | М    | #    | ı    |
| 1110           | (7)              |      | .    | >    | N    | ^    | n    | e    |      |      | Ы    | П    | ф    | ъ    | o    | ı    |
| 1111           | (8)              |      | /    | ?    | O    | _    | o    | e    |      |      | Э    | Т    | е    | ı    | o    | ı    |

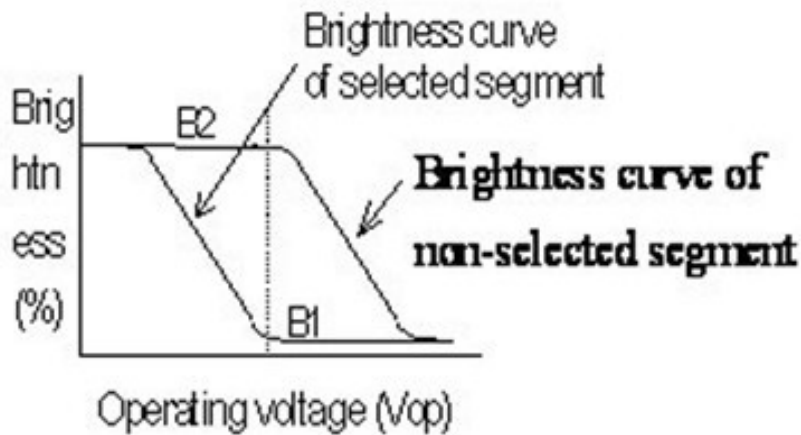
### 13. Optical Characteristics

#### 13.1 Definition of Viewing Angle

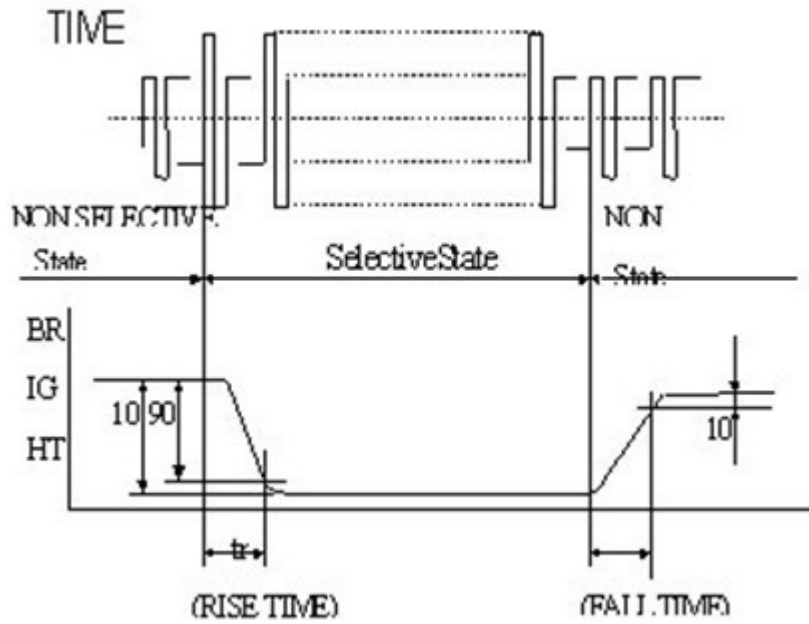


#### 13.2 Definition of Contrast

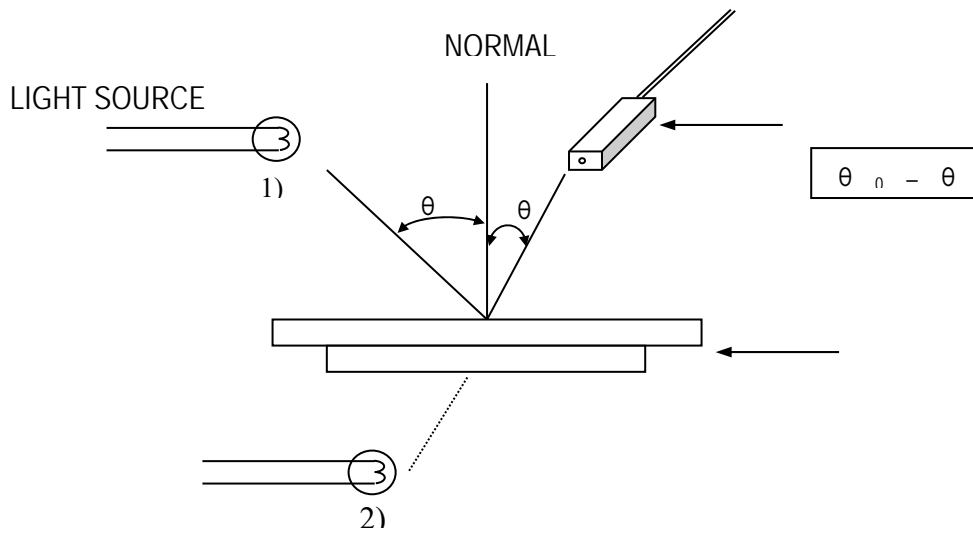
$$C.R = \frac{\text{Brightness of nonselected segment (E2)}}{\text{Brightness of selected segment}}$$



**13.3 Definition of Response**



**13.4 Measuring Instruments For Elector-optical Characteristics**



**\* Note:**

- 1) Light source position for measuring the reflective type of LCD panel;
- 2) Light source position for measuring the transfective / transmissive types of LCD panel.

**14. MODULE ACCEPT QUALITY LEVEL (AQL)**

14.1 AQL Standard Value: Critical Defect =0.1, Major Defect=0.65; Minor Defect =2.5.

14.2 Inspection Standard: MIL-STD-105E Table Normal Inspection Single Sampling Level II

**15. RELIABILITY TEST**

Operating life time: Longer than 75,000 hours

(at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

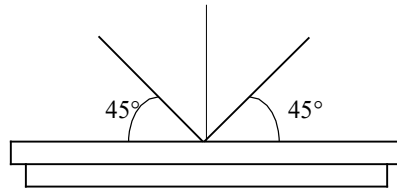
| No. | Test Item                          | Content of Test                                                                                                                                                                                                                                                                                                                                                                                               | Test Condition                 |
|-----|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 1   | High Temperature Storage           | Endurance test applying the high storage temperature for a long time                                                                                                                                                                                                                                                                                                                                          | +80°C 96H                      |
| 2   | Low Temperature Storage            | Endurance test applying the low storage temperature for a long time                                                                                                                                                                                                                                                                                                                                           | -30°C 96H                      |
| 3   | High Temperature Operation         | Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time                                                                                                                                                                                                                                                                                         | +70°C 96H                      |
| 4   | Low Temperature Operation          | Endurance test applying the electric stress under low temperature for a long time                                                                                                                                                                                                                                                                                                                             | -20°C 96H                      |
| 5   | High Temperature/ Humidity Storage | Endurance test applying the high temperature and humidity storage for a long time                                                                                                                                                                                                                                                                                                                             | 40°C 90%RH<br>96H              |
| 6   | Temperature Cycle                  | Endurance test applying the low and high temperature cycle<br>$  \begin{array}{ccccccc}  -20^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} & \longleftrightarrow & 70^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} \\  30\text{min} & & 5\text{min} & & 30\text{min} & & 5\text{min} \\  \longleftarrow & & & & & & \longrightarrow \\  & & & & & & \text{1 cycle}  \end{array}  $ | -20°C/70°C<br>5 cycles         |
| 7   | Vibration Test (Package State)     | Endurance test applying the vibration during transportation                                                                                                                                                                                                                                                                                                                                                   | 10Hz—55Hz,<br>50m/s, 15min     |
| 8   | Shock Test (Package State)         | Endurance test applying the shock during transportation                                                                                                                                                                                                                                                                                                                                                       | Half-sinewave,<br>100m/s, 11ms |
| 9   | Atmospheric Pressure Test          | Endurance test applying the atmospheric pressure during transportation by air                                                                                                                                                                                                                                                                                                                                 | 40 kPa<br>16 H                 |




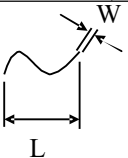
**16. Inspection specification**

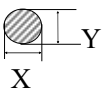
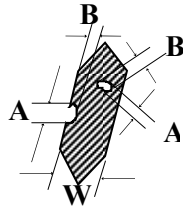
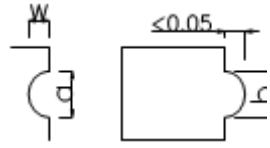
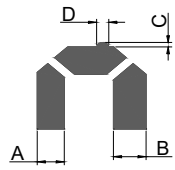
**16.1 Visual Inspection**

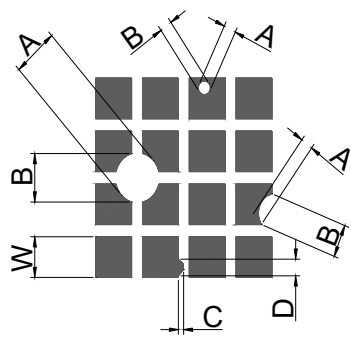
- 1) Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).
- 2) Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk on screen).
- 3) Inspect the module at 45° right and left, top and bottom.
- 4) Use the optimum viewing angle during the contrast inspection.



**16.2 Standard of Appearance Inspection**

| No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Item                             | Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--|--------|-------|--------|--------|--------------|---------------|------------|--------------------|--------------|----------------------|---|---------------|----------------------|---------------|---|------------|
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Black spot<br>White spot<br>Dust | Round type: as per following drawing<br>$\Phi = (X+Y)/2$<br> <table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="3">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td><math>\Phi &lt; 0.1</math></td> <td>Any number</td> <td rowspan="4">Any number</td> </tr> <tr> <td><math>0.1 &lt; \Phi &lt; 0.2</math></td> <td>2</td> </tr> <tr> <td><math>0.2 &lt; \Phi &lt; 0.25</math></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \Phi</math></td> <td>0</td> </tr> </tbody> </table> | Acceptable quantity |  |        | Size  | Zone A | Zone B | $\Phi < 0.1$ | Any number    | Any number | $0.1 < \Phi < 0.2$ | 2            | $0.2 < \Phi < 0.25$  | 1 | $0.25 < \Phi$ | 0                    |               |   |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                  | Acceptable quantity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| Size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Zone A                           | Zone B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| $\Phi < 0.1$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Any number                       | Any number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| $0.1 < \Phi < 0.2$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| $0.2 < \Phi < 0.25$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| $0.25 < \Phi$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| Line type: as per following drawing<br><table border="1" style="margin-left: 20px;"> <thead> <tr> <th colspan="4">Acceptable quantity</th> </tr> <tr> <th>Length</th> <th>Width</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td>—</td> <td><math>W \leq 0.02</math></td> <td>Any number</td> <td rowspan="4">Any number</td> </tr> <tr> <td><math>L \leq 3.0</math></td> <td><math>0.02 &lt; W \leq 0.03</math></td> <td>2</td> </tr> <tr> <td><math>L \leq 2.5</math></td> <td><math>0.03 &lt; W \leq 0.05</math></td> <td rowspan="2">As round type</td> </tr> <tr> <td>—</td> <td><math>0.05 &lt; W</math></td> </tr> </tbody> </table>  | Acceptable quantity              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  | Length | Width | Zone A | Zone B | —            | $W \leq 0.02$ | Any number | Any number         | $L \leq 3.0$ | $0.02 < W \leq 0.03$ | 2 | $L \leq 2.5$  | $0.03 < W \leq 0.05$ | As round type | — | $0.05 < W$ |
| Acceptable quantity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| Length                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Width                            | Zone A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Zone B              |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $W \leq 0.02$                    | Any number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Any number          |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| $L \leq 3.0$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $0.02 < W \leq 0.03$             | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| $L \leq 2.5$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $0.03 < W \leq 0.05$             | As round type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| —                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | $0.05 < W$                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                  | Total acceptable quantity: 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Polariser scratch                | Scratch on protective film is permitted<br>Scratch on polariser: same as No. 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Polariser bubble                 | $\Phi = (X+Y)/2$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |  |        |       |        |        |              |               |            |                    |              |                      |   |               |                      |               |   |            |

|                     |                                       |  <table border="1" data-bbox="766 235 1428 548"> <thead> <tr> <th colspan="3">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Zone A</th> <th>Zone B</th> </tr> </thead> <tbody> <tr> <td><math>\Phi &lt; 0.2</math></td> <td>Any number</td> <td rowspan="3">Any number</td> </tr> <tr> <td><math>0.2 &lt; \Phi &lt; 0.5</math></td> <td>2</td> </tr> <tr> <td><math>0.5 &lt; \Phi &lt; 1.0</math></td> <td>1</td> </tr> <tr> <td><math>1.0 &lt; \Phi</math></td> <td>0</td> <td></td> </tr> </tbody> </table> <p>Total acceptable quantity: 3</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Acceptable quantity |  |       | Size     | Zone A       | Zone B                               | $\Phi < 0.2$ | Any number                            | Any number          | $0.2 < \Phi < 0.5$ | 2    | $0.5 < \Phi < 1.0$ | 1            | $1.0 < \Phi$ | 0                  |            |                    |   |            |  |            |                |         |             |
|---------------------|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--|-------|----------|--------------|--------------------------------------|--------------|---------------------------------------|---------------------|--------------------|------|--------------------|--------------|--------------|--------------------|------------|--------------------|---|------------|--|------------|----------------|---------|-------------|
| Acceptable quantity |                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| Size                | Zone A                                | Zone B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $\Phi < 0.2$        | Any number                            | Any number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $0.2 < \Phi < 0.5$  | 2                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $0.5 < \Phi < 1.0$  | 1                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $1.0 < \Phi$        | 0                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| 4                   | Segment deformation                   | <p>4.1 Pin hole on segmented display<br/> <math>W</math>: segment width<br/> <math>\Phi = (A+B)/2</math></p>  <table border="1" data-bbox="837 784 1428 1019"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Width</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td><math>W \leq 0.4</math></td> <td><math>\Phi \leq 0.2</math> and <math>\Phi \leq 1/2W</math></td> </tr> <tr> <td><math>W &gt; 0.4</math></td> <td><math>\Phi \leq 0.25</math> and <math>\Phi \leq 1/3W</math></td> </tr> </tbody> </table> <p>Total acceptable quantity: 1 defect per segment<br/> Pin holes with <math>\Phi</math> under 0.10 mm are acceptable</p> <p>4.2 Pin hole on dot matrix display</p>  <table border="1" data-bbox="981 1209 1428 1444"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td><math>a, b &lt; 0.1</math></td> <td>Any number</td> </tr> <tr> <td><math>(a+b)/2 \leq 0.1</math></td> <td>Any number</td> </tr> <tr> <td><math>0.5 &lt; \Phi &lt; 1.0</math></td> <td>3</td> </tr> </tbody> </table> <p>Total acceptable quantity: 7</p> <p>4.3 Segments / dots with different width</p>  <table border="1" data-bbox="981 1612 1340 1736"> <thead> <tr> <th colspan="2">Acceptable</th> </tr> </thead> <tbody> <tr> <td><math>a \geq b</math></td> <td><math>a/b \leq 4/3</math></td> </tr> <tr> <td><math>a &lt; b</math></td> <td><math>a/b &gt; 4/3</math></td> </tr> </tbody> </table> <p>4.4 Alignment layer defect<br/> <math>\Phi = (A+B)/2</math></p> | Acceptable quantity |  | Width | Quantity | $W \leq 0.4$ | $\Phi \leq 0.2$ and $\Phi \leq 1/2W$ | $W > 0.4$    | $\Phi \leq 0.25$ and $\Phi \leq 1/3W$ | Acceptable quantity |                    | Size | Quantity           | $a, b < 0.1$ | Any number   | $(a+b)/2 \leq 0.1$ | Any number | $0.5 < \Phi < 1.0$ | 3 | Acceptable |  | $a \geq b$ | $a/b \leq 4/3$ | $a < b$ | $a/b > 4/3$ |
| Acceptable quantity |                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| Width               | Quantity                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $W \leq 0.4$        | $\Phi \leq 0.2$ and $\Phi \leq 1/2W$  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $W > 0.4$           | $\Phi \leq 0.25$ and $\Phi \leq 1/3W$ |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| Acceptable quantity |                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| Size                | Quantity                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $a, b < 0.1$        | Any number                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $(a+b)/2 \leq 0.1$  | Any number                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $0.5 < \Phi < 1.0$  | 3                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| Acceptable          |                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $a \geq b$          | $a/b \leq 4/3$                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |
| $a < b$             | $a/b > 4/3$                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |       |          |              |                                      |              |                                       |                     |                    |      |                    |              |              |                    |            |                    |   |            |  |            |                |         |             |

|                       |                   |  <p style="text-align: center;">Total acceptable quantity: 7</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td><math>\Phi \leq 0.4</math></td> <td>Any number</td> </tr> <tr> <td><math>0.4 &lt; \Phi \leq 1.0</math></td> <td>5</td> </tr> <tr> <td><math>1.0 &lt; \Phi \leq 1.5</math></td> <td>3</td> </tr> <tr> <td><math>1.5 &lt; \Phi \leq 2.0</math></td> <td>2</td> </tr> </tbody> </table> | Acceptable quantity |  | Size | Quantity | $\Phi \leq 0.4$ | Any number | $0.4 < \Phi \leq 1.0$ | 5            | $1.0 < \Phi \leq 1.5$ | 3             | $1.5 < \Phi \leq 2.0$ | 2          |                  |   |         |   |
|-----------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--|------|----------|-----------------|------------|-----------------------|--------------|-----------------------|---------------|-----------------------|------------|------------------|---|---------|---|
| Acceptable quantity   |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| Size                  | Quantity          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| $\Phi \leq 0.4$       | Any number        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| $0.4 < \Phi \leq 1.0$ | 5                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| $1.0 < \Phi \leq 1.5$ | 3                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| $1.5 < \Phi \leq 2.0$ | 2                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| 5                     | Colour uniformity | Level of sample for approval set as limit sample                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| 6                     | Backlight         | The backlight colour should correspond to the product specification<br>Flashing and or unlit backlight is not allowed<br>Dust larger than 0.25 mm is not allowed                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| 7                     | COB               | Exposed wire bond pad is not allowed<br>Insufficient covering with resin is not allowed (wire bond line exposed) Dust or bubble on the resin are not allowed                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| 8                     | PCB               | No unmelted solder paste should be present on PCB<br>Cold solder joints, missing solder connections, or oxidation are not allowed<br>No residue or solder balls on PCB are allowed<br>Short circuits on components are not allowed                                                                                                                                                                                                                                                                                                                                                                                                         |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| 9                     | Tray particles    | <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th colspan="3">Acceptable quantity</th> </tr> <tr> <th></th> <th>Size</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td rowspan="2">On tray</td> <td><math>\Phi &lt; 0.2</math></td> <td>Any number</td> </tr> <tr> <td><math>\Phi &gt; 0.25</math></td> <td>4</td> </tr> <tr> <td rowspan="2">On display</td> <td><math>\Phi \geq 0.25</math></td> <td>2</td> </tr> <tr> <td><math>L = 3</math></td> <td>1</td> </tr> </tbody> </table>                                                                                                              | Acceptable quantity |  |      |          | Size            | Quantity   | On tray               | $\Phi < 0.2$ | Any number            | $\Phi > 0.25$ | 4                     | On display | $\Phi \geq 0.25$ | 2 | $L = 3$ | 1 |
| Acceptable quantity   |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
|                       | Size              | Quantity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| On tray               | $\Phi < 0.2$      | Any number                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
|                       | $\Phi > 0.25$     | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
| On display            | $\Phi \geq 0.25$  | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |
|                       | $L = 3$           | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                     |  |      |          |                 |            |                       |              |                       |               |                       |            |                  |   |         |   |

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**17. LCD MODULES HANDLING PRECAUTIONS**

- Please remove the protection foil of polarizer before using.
- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- 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 module.
  - Tools required for assembly, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembly 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 designed to prevent static electricity charging under low temperature / normal humidity conditions (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.

**18. OTHERS**

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from 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