



PRODUCT SPECIFICATION

Part Number

PG320240F-O Series

| | |
|----------------------|--|
| CUSTOMER | |
| CUSTOMER PART NUMBER | |
| DESCRIPTION | |
| APPROVED BY | |
| DATE | |

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[illegible]

1. Part number breakdown

P _ _ - _ _ - _ - _ - _

1 2 3 4 5 6 7 8 9

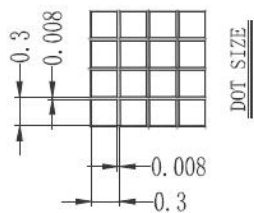
Replace each Space (_) with the following letters and or numbers

| | | |
|---|--|--|
| 1. P-tec LCD Type | C = Character G = Graphic COG = Chip On Glass | COF = Chip On Flex TAB = Tape Automated Bonding TFT = Thin-film Transistor |
| 2. LCD Model | Example for Character: 2002A = 20 Characters x 2 Lines w/ Pins on Left side and 116mm x 37 x 12.7mm overall size Example for Graphic: 12864B = 128 Dots per row x 64 Dots per Column w/ Pins on lower side and 93mm x 70 x 8.8mm overall size | |
| 3. Fluid Type | T = TN/Grey Y = STN/Yellow Green G = STN/ Grey | B = STN/ Blue F = FSTN/ White N = FSTN/ Black |
| 4. Backlight/polorizer | NF = None/Transflective NM = None/Transmissive NR = None/Reflective EF = EL/Transflective EM = EL/Transmissive | LF = LED/Transflective LM = LED/Transmissive CF = CCFL/Transflective CM = CCFL=Transmissive |
| 5. Backlight Color | (If no backlight provided move on to viewing angle [6.]) B = Blue/Green Y = Yellow G = Green | |
| 6. Viewing Angle | D = 6:00 U = 12:00 | R = 3:00 L = 9:00 |
| 7. Internal Number | Single Letter for internal purposes | |
| 8. Extended Temperature | This space is blank if operating temperature is standard 0°C to 50°C An X will be visible if the LCD is Extended operating temperature | |
| 9. Customer Specials or List of Value-added items | Usually blank unless customer requests some modifications. Can be several Letters long. | |

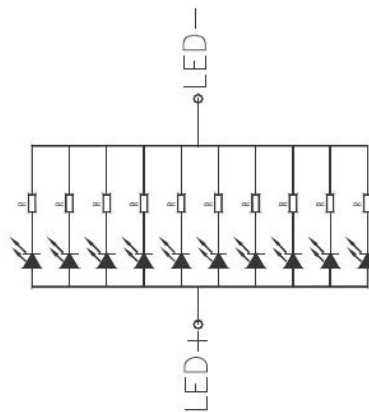
2 General Specifications

| Item | Standard Value | Unit |
|------------------------------|---|------|
| Display Pattern | <input checked="" type="checkbox"/> Graphic <input type="checkbox"/> Character <input type="checkbox"/> Segment <input type="checkbox"/> _____ <input type="checkbox"/> with ICON | |
| Color | <input type="checkbox"/> Mono. <input checked="" type="checkbox"/> Grayscale <input type="checkbox"/> _____ | |
| Module Dimension (W x H x T) | 142.1x106.05x14.5(max) | mm |
| Viewing Area (W x H) | 103x79 | mm |
| Active Area (W x H) | 95.97 x71.97 | mm |
| Character Size (W x H) | / | mm |
| Character Pitch (W x H) | / | mm |
| DOT Size (W x H) | 0.292x0.292 | mm |
| DOT Pitch (W x H) | 0.30x0.30 | mm |
| LCD Type | <input type="checkbox"/> TN, Positive <input type="checkbox"/> TN, Negative <input type="checkbox"/> HTN, Positive <input type="checkbox"/> HTN, Negative <input type="checkbox"/> STN, Yellow-Green <input type="checkbox"/> STN, Gray <input type="checkbox"/> STN, Blue <input checked="" type="checkbox"/> FSTN, Positive <input type="checkbox"/> FSTN, Negative <input type="checkbox"/> _____ <input type="checkbox"/> FM LCD <input type="checkbox"/> Color STN | |
| Polarizer Type | <input checked="" type="checkbox"/> Transflective <input type="checkbox"/> Transmissive <input type="checkbox"/> Reflective <input type="checkbox"/> Anti-Glare | |
| View Direction | <input checked="" type="checkbox"/> 6H <input type="checkbox"/> 12H <input type="checkbox"/> _____ | |
| LCD Controller & Driver | RA8803S & NT7086 | |
| LCD Driving Method | 1/2401duty, 1/14bias | |
| Interface Type | Serial <input type="checkbox"/> I ² C <input type="checkbox"/> 4-line SPI <input type="checkbox"/> 3-line SPI <input type="checkbox"/> _____ Parallel <input type="checkbox"/> 6800 <input checked="" type="checkbox"/> 8080 <input type="checkbox"/> 4-bit <input type="checkbox"/> _____ | |
| Backlight Type | <input type="checkbox"/> LED <input type="checkbox"/> Bottom <input checked="" type="checkbox"/> Single Side <input type="checkbox"/> Dual Side <input type="checkbox"/> _____ <input type="checkbox"/> EL <input type="checkbox"/> CCFL | |
| Backlight Color | <input type="checkbox"/> Yellow-Green <input checked="" type="checkbox"/> White <input type="checkbox"/> Amber <input type="checkbox"/> Blue <input type="checkbox"/> Red <input type="checkbox"/> _____ | |
| EL/CCFL Driver type | <input type="checkbox"/> Build-in <input type="checkbox"/> External | |
| DC-DC Converter | <input type="checkbox"/> Build-in <input checked="" type="checkbox"/> External | |
| Operation Temperature | T _{OPL} = -20 T _{OPH} = +70 | °C |
| Storage Temperature | T _{STL} = -30 T _{STH} = +80 | °C |

3 Mechanical Diagram

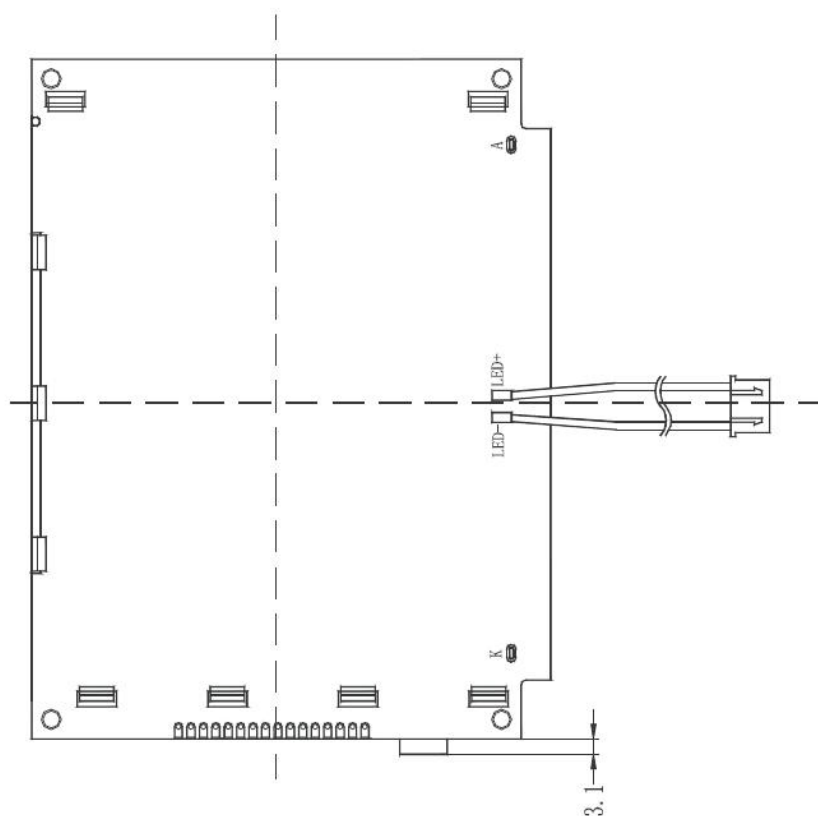


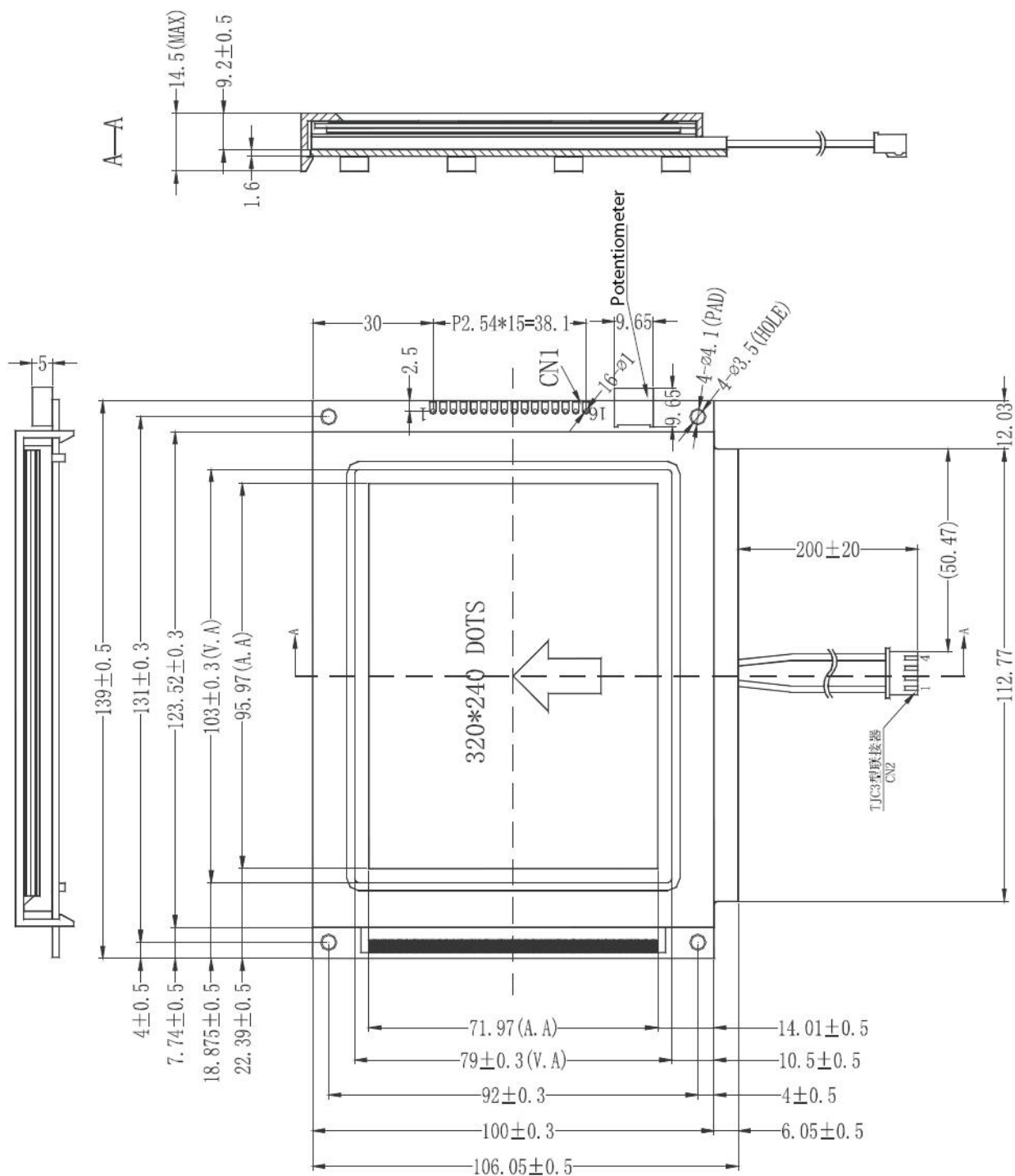
LED Circuit Diagram:



CN1

| | | | |
|------|----|----|------|
| 1 | 2 | 3 | 4 |
| LED+ | NC | NC | LED- |





4 I/O Terminal

4.1 Pin Description

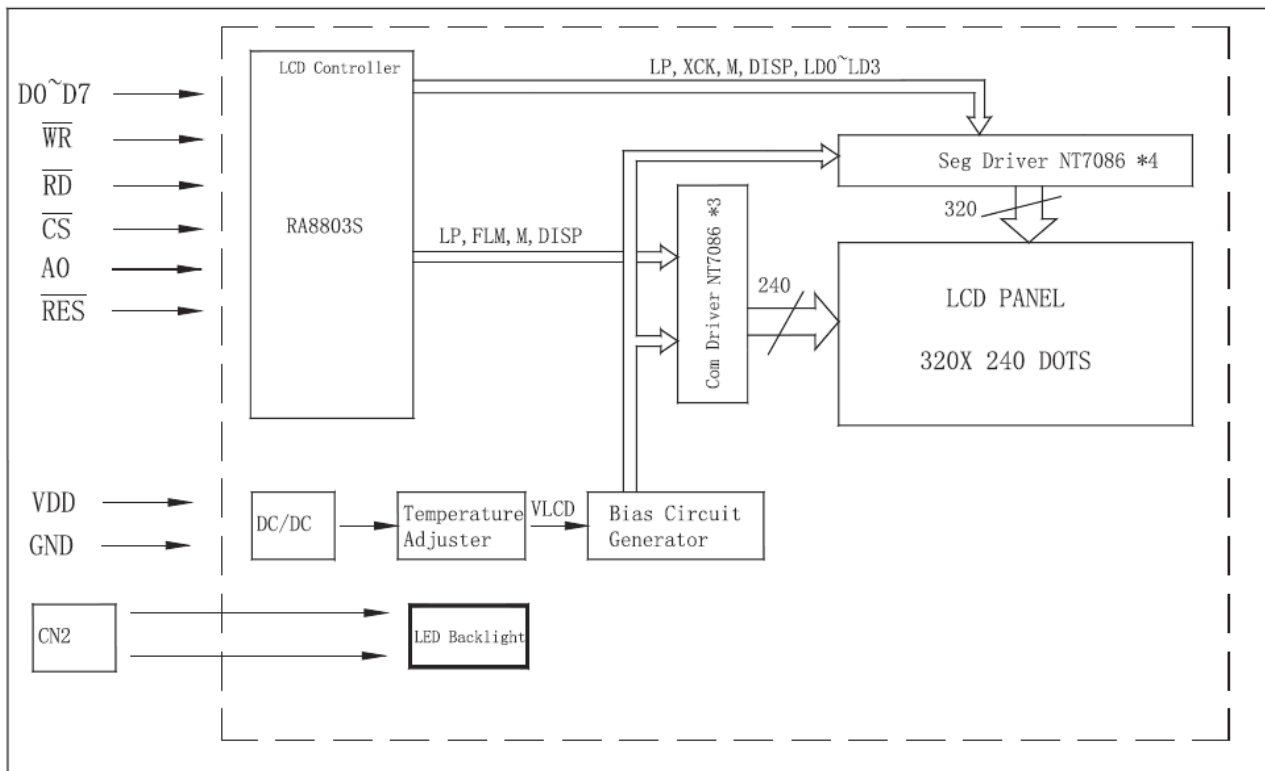
CN1:

| Pin NO. | Symbol | Function Description |
|---------|--------|-----------------------------------|
| 1 | GND | Power Ground |
| 2 | VDD | Supply Logic Power |
| 3 | NC | No Connection |
| 4 | /WR | Write signal |
| 5 | /RD | Read signal |
| 6 | /CS | Chip Select Signal |
| 7 | A0 | Selection Display Data or Command |
| 8 | /RES | System Reset Signal |
| 9 | D0 | 8-bit bi-directional data bus |
| 10 | D1 | |
| 11 | D2 | |
| 12 | D3 | |
| 13 | D4 | |
| 14 | D5 | |
| 15 | D6 | |
| 16 | D7 | |

CN2:

| Pin NO. | Symbol | Function Description |
|---------|--------|----------------------|
| 1 | LED+ | Backlight Anode |
| 2 | NC | No Connection |
| 3 | NC | No Connection |
| 4 | LED- | Backlight Cathode |

4.2 Block Diagram



5 Electro-optical Specifications

5.1 Absolute Maximum Ratings

| No | Item | Symbol | Min. | Max. | Unit |
|----|-------------------------------|-------------------|------|----------------|------|
| 1 | Supply Voltage For Logic | $V_{DD} - V_{SS}$ | -0.3 | 7.0 | V |
| 2 | Supply Voltage For LCD Driver | V_{LCD} | 0 | 30 | V |
| 3 | Input Voltage | V_{IN} | -0.3 | $V_{DD} + 0.3$ | V |

Note: Operating Temperature and Storage Temperature can be found in 1. General Specifications.

5.2 Optical Characteristics⁽¹⁾

| No | Item | Symbol | Condition | Min. | Type. | Max. | Unit |
|----|----------------------|--------|-------------------------------|------|-------|------|-------|
| 1 | Contrast Ratio | Cr | Ta=23+3°C VLCD = Type. (2) | - | 7 | - | - |
| 2 | Response time | TR | Ta=23+3°C | - | 160 | - | ms |
| 3 | Response time | TF | Ta=23+3 oC | - | 240 | - | ms |
| 4 | Viewing Angle | 3H | Cr ≥ 2 Ta=23+3°C | - | 50 | - | Deg. |
| | | 9H | | - | 40 | - | Deg. |
| | | 6H | | - | 40 | - | Deg. |
| | | 12H | | - | 40 | - | Deg. |
| 5 | Module luminance | | Ta=23+3 °C Iled=150mA | - | 200 | - | cd/m2 |
| 6 | Luminance uniformity | Lu | | 70 | - | - | % |

Note:

(1) See Appendix Definition of Optical Characteristics for detail.

(2) V_{LCD} can be found in 4.2 Electrical Characteristics *Supply Voltage for LCD Driver*

5.3 Electrical Characteristics

| No | Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----|----------------------------------|-------------------|---------------------------------------|----------------|------|--------------|------|
| 1 | Supply Voltage for Logic | $V_{DD} - V_{SS}$ | - | 4.9 | 5.0 | 5.1 | V |
| 2 | Supply Voltage for LCD Driver | V_{LCD} | Ta=25°C | 22.8 | 23 | 23.2 | V |
| 3 | Supply Current for Logic | I_{DD} | -.... | - | - | 50 | mA |
| 4 | Input High Voltage | V_{IH} | - | 0.8 V_{DD} | - | V_{DD} | V |
| 5 | Input Low Voltage | V_{IL} | - | V_{SS} | - | 0.2 V_{DD} | V |
| 6 | Output High Voltage | V_{OH} | $I_{OH} = -0.4mA$ | $V_{DD} - 0.4$ | - | - | V |
| 7 | Output Low Voltage | V_{OL} | $I_{OH} = -0.4mA$ | - | - | 0.4 | V |
| 8 | Supply Current for LED Backlight | I_{LED} | $V_{LED} = \text{Type.}$ Ta=23±3°C | - | 150 | - | mA |
| 9 | Supply Voltage for LED Backlight | V_{LED} | $I_{LED} = \text{Type.}$ Ta=23±3°C | 4.8 | 5.0 | 5.2 | V |

5.4 Timing Characteristics

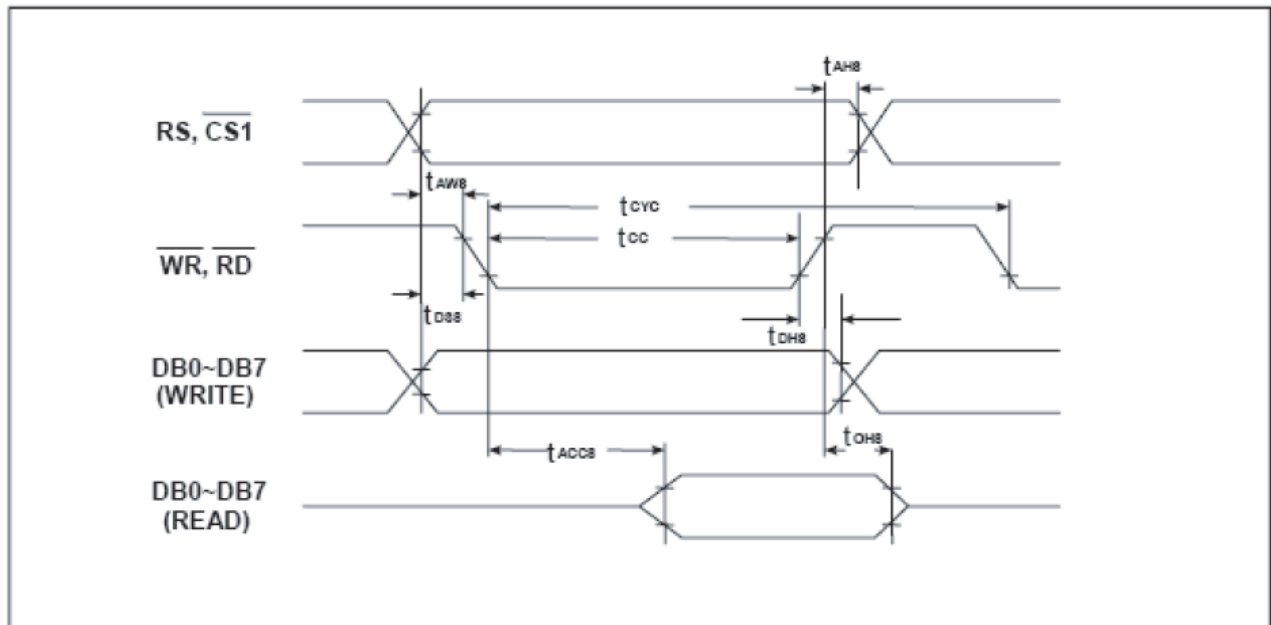


Figure 2-2 : 8-Bit 8080 MPU Access RA8803/8822 Register/Memory

Table 2-1

| Signal | Symbol | Parameter | Rating | | Unit | Condition |
|------------|------------|---------------------|--------|-----|------|--|
| | | | Min | Max | | |
| RS, CS1# | t_{AH8} | Address hold time | 10 | -- | ns | System Clock: 8MHz Voltage: 3.3V |
| | t_{AW8} | Address setup time | 63 | -- | ns | |
| WR#, RD# | t_{CYC} | System cycle time | 800 | -- | ns | |
| | t_{CC} | Strobe pulse width | 400 | -- | ns | |
| DB0 to DB7 | t_{DS8} | Data setup time | 63 | -- | ns | |
| | t_{DH8} | Data hold time | 10 | -- | ns | |
| | t_{ACC8} | RD access time | -- | 330 | ns | |
| | t_{OH8} | Output disable time | 10 | -- | ns | |

6 Register Table

| Reg. No | Reg. Name | R/W | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | Default Data |
|---------|-----------|-----|------|------|------|------|------|------|------|------|--------------|
| 00h | WLCR | R/W | PW1 | PW0 | SR | -- | CG | DP | DK | DV | C9h |
| 01h | MISC | R/W | -- | CKN | -- | PLR | -- | -- | CKB1 | CKB0 | F0h |
| 02h | APSR | R/W | -- | -- | SP1 | SP0 | OAR | -- | SRFS | -- | 10h |
| 03h | ADSR | R/W | -- | -- | -- | -- | DADR | AUCM | AUSG | SGCM | 80h |
| 10h | WCCR | R/W | ARI | ALG | WDI | WBC | AWI | CP | CK | CSD | 6Fh |
| 11h | CHLD | R/W | CR3 | CR2 | CR1 | CR0 | DY3 | DY2 | DY1 | DY0 | 22h |
| 12h | MAMR | R/W | GIM | RM2 | RM1 | RM0 | OP1 | OP2 | WM1 | WM0 | 91h |
| 20h | AWRR | R/W | -- | -- | X5 | X4 | X3 | X2 | X1 | X0 | 27h |
| 21h | DWRR | R/W | -- | -- | A5 | A4 | A3 | A2 | A1 | A0 | 27h |
| 30h | AWBR | R/W | Y7 | Y6 | Y5 | Y4 | Y3 | Y2 | Y1 | Y0 | EFh |
| 31h | DWBR | R/W | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 | EFh |
| 40h | AWLR | R/W | -- | -- | SS5 | SS4 | SS3 | SS2 | SS1 | SS0 | 00h |
| 41h | DWLR | R/W | -- | -- | C5 | C4 | C3 | C2 | C1 | C0 | 00h |
| 50h | AWTR | R/W | SC7 | SC6 | SC5 | SC4 | SC3 | SC2 | SC1 | SC0 | 00h |
| 51h | DWTR | R/W | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 | 00h |
| 60h | CPXR | R/W | -- | -- | RS5 | RS4 | RS3 | RS2 | RS1 | RS0 | 00h |
| 61h | BGSG | R/W | -- | -- | DS5 | DS4 | DS3 | DS2 | DS1 | DS0 | 00h |
| 70h | CPYR | R/W | RC7 | RC6 | RC5 | RC4 | RC3 | RC2 | RC1 | RC0 | 00g |
| 71h | BGCM | R/W | CB7 | CB6 | CB5 | CB4 | CB3 | CB2 | CB1 | CB0 | 00h |
| 72h | EDCM | R/W | CD7 | CD6 | CD5 | CD4 | CD3 | CD2 | CD1 | CD0 | EFh |
| 80h | BTMR | R/W | BT7 | BT6 | BT5 | BT4 | BT3 | BT2 | BT1 | BT0 | 33h |
| 81h | FRCA | R/W | -- | -- | -- | -- | -- | -- | -- | -- | 00h |
| 90h | SCCR | R/W | CK7 | CK6 | CK5 | CK4 | CK3 | CK2 | CK1 | CK0 | 04h |
| 91h | FRCB | R/W | -- | -- | -- | -- | -- | -- | -- | -- | 00h |
| A0h | INTR | R/W | INK | INT | INX | INY | MSK | MST | MSX | MSY | 00h |
| A1h | KSCR | R/W | KEN | KSZ | KDT1 | KDT0 | -- | KF2 | KF1 | KF0 | 00h |
| A2h | KSDR | RO | KS7 | KS6 | KS5 | KS4 | KS3 | KS2 | KS1 | KS0 | 00h |
| A3h | KSER | RO | KD7 | KD6 | KD5 | KD4 | KD3 | KD2 | KD1 | KD0 | 00h |
| B0h | INTX | R/W | -- | -- | IX5 | IX4 | IX3 | IX2 | IX1 | IX0 | 27h |
| B1h | INTY | R/W | IY7 | IY6 | IY5 | IY4 | IY3 | IY2 | IY1 | IY0 | EFh |
| C0h | TPCR | R/W | AZEN | AZOE | -- | SCAN | AS3 | AS2 | AS1 | AS0 | 00h |
| C1h | TPSR | R/W | ARDY | ADET | 1 | 1 | AF1 | AF0 | -- | -- | 0Fh |
| C8h | TPXR | RO | TPX9 | TPX8 | TPX7 | TPX6 | TPX5 | TPX4 | TPX3 | TPX2 | 00h |
| C9h | TPYR | RO | TPY9 | TPY8 | TPY7 | TPY6 | TPY5 | TPY4 | TPY3 | TPY2 | 00h |
| CAh | TPZR | RO | TPX1 | TPX0 | -- | -- | TPY1 | TPY0 | -- | -- | 00h |
| D0h | LCCR | R/W | DZEN | -- | -- | DAC4 | DAC3 | DAC2 | DAC1 | DAC0 | 8Fh |
| E0h | PNTR | R/W | FD7 | FD6 | FD5 | FD4 | FD3 | FD2 | FD1 | FD0 | 00h |
| F0h | FNCR | R/W | TNS | BNK | RM1 | RM0 | FDA | ASC | ABS1 | ABS0 | 92h |
| F1h | FVHT | R/W | FH1 | FH0 | FV1 | FV0 | 1 | 1 | 1 | 1 | 0Fh |

Appendix

1 Packing Method

□ Method 1

ESD Bag + Product Box + Plastic Bag + Carton

1. Quantity

| QUANTITY | UNIT |
|----------|---------------|
| 1 | PCS / ESD Bag |
| | PCS / Box |
| | Box / Carton |
| | PCS / Carton |

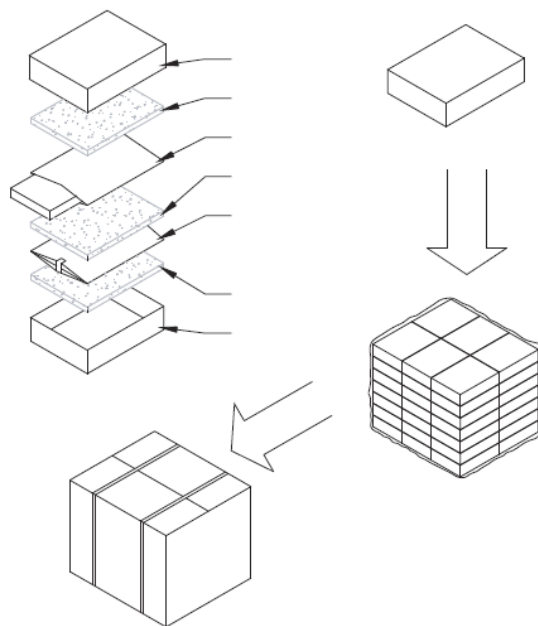
2. Material

| Material | Size (LXWXH) mm |
|-------------|-----------------|
| ESD Bag | |
| Product Box | |
| Carton | |

3. Label

PRODUCT ID:
PART NO:
QUANTITY:
GROSS WEIGHT:
MEASUREMENTS:

4. Packing Method



Note: see table 1. Quantity for detail.

■ Method 2

ESD Tray + Plastic Bag + Carton

1. Quantity

| QUANTITY | UNIT |
|----------|---------------|
| | PCS / Tray |
| | Tray / Carton |
| | PCS / Carton |

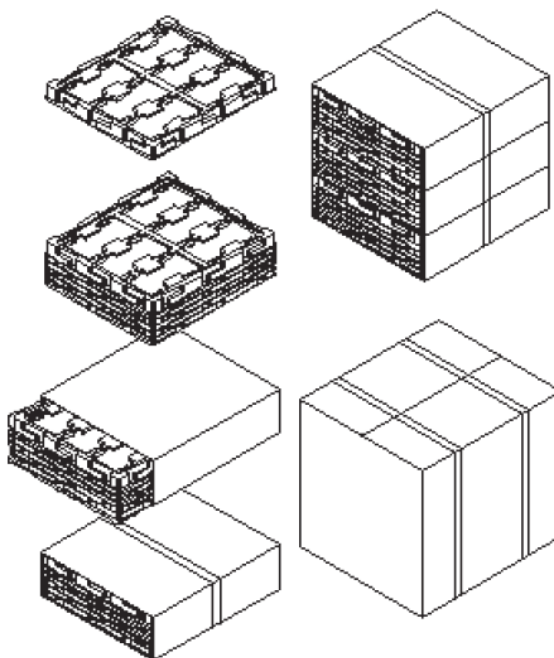
2. Material

| Material | Size (LXWXH) mm |
|----------|-----------------|
| ESD Tray | |
| Carton | |

3. Label

PRODUCT ID:
PART NO:
QUANTITY:
GROSS WEIGHT:
MEASUREMENTS:

4. Packing Method



Note: see table 1. Quantity for detail.

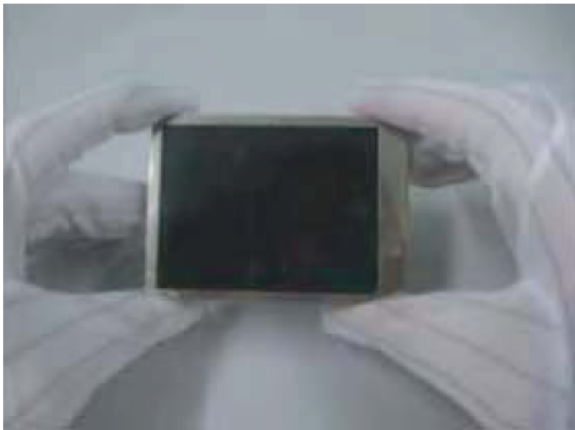
2 Classification

N/A

3 Handling precaution for LCM

LCM is easy to be damaged. Please note below and be careful for handling!

Correct handling:

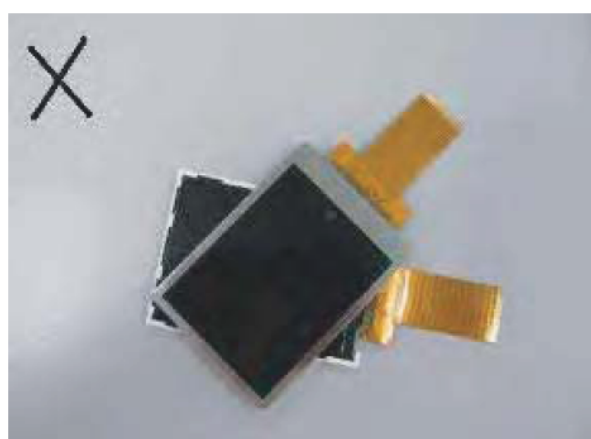


As above picture, please handle with anti-static gloves around LCM edges.

Incorrect handling:



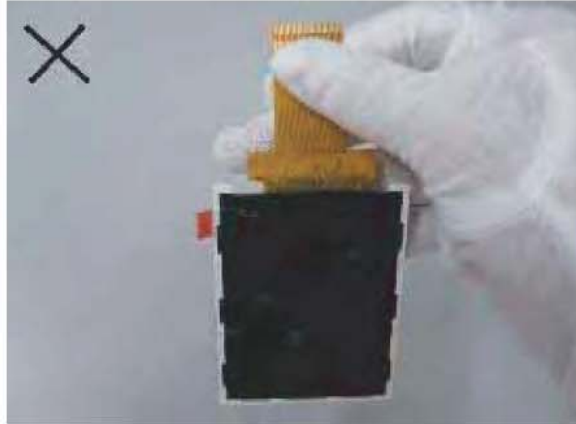
Please don't touch the IC directly.



Please don't stack LCM.



Please don't hold the surface of panel.



Please don't stretch interface of output ,
such as FPC cable

4 Definitions of Optical Characteristic

4.1 Contrast Ratio Test

Contrast Ratio (CR) is the comparison of the display screen's maximum white luminance (white screen) to its minimum luminance (black screen).

Contrast Ratio is measured perpendicular to the display at the screen's five (5) points

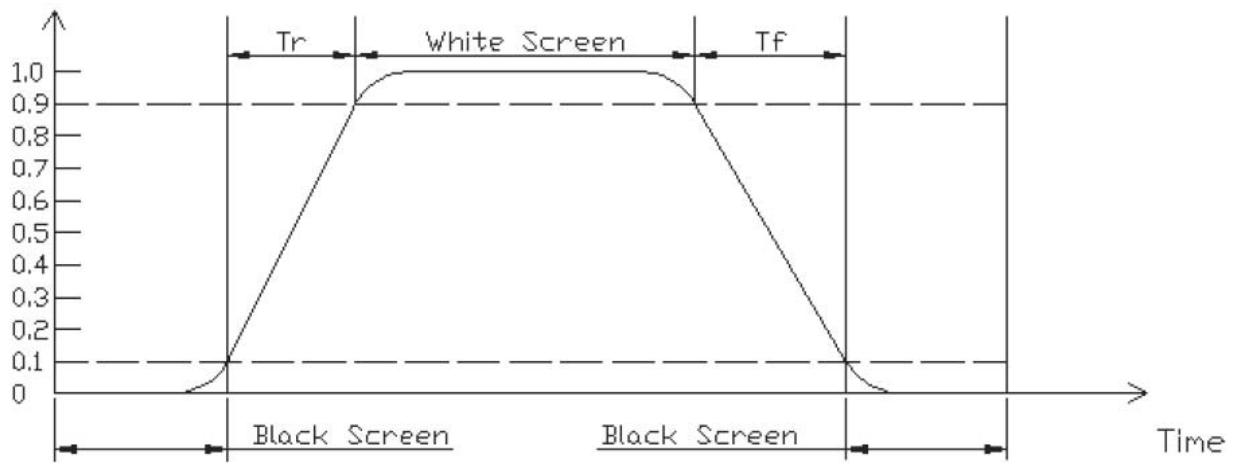
A full white screen and a full black screen are used when measuring luminance for contrast ratio.

$$CR(1,2,3,4,5) = \frac{\text{Surface Luminance of all white screen (1,2,3,4,5)}}{\text{Surface Luminance of all black screen (1,2,3,4,5)}}$$

4.2 Response time

Response time is the measurement of the total time takes to turn a pixel "On" and "Off". pixel is determined to be "On" when its drive voltage reaches 90% of maximum and "Off" when the voltage level drops to 10%. "On" and "Off" are also referred to as "Rise" and "Fall" times.

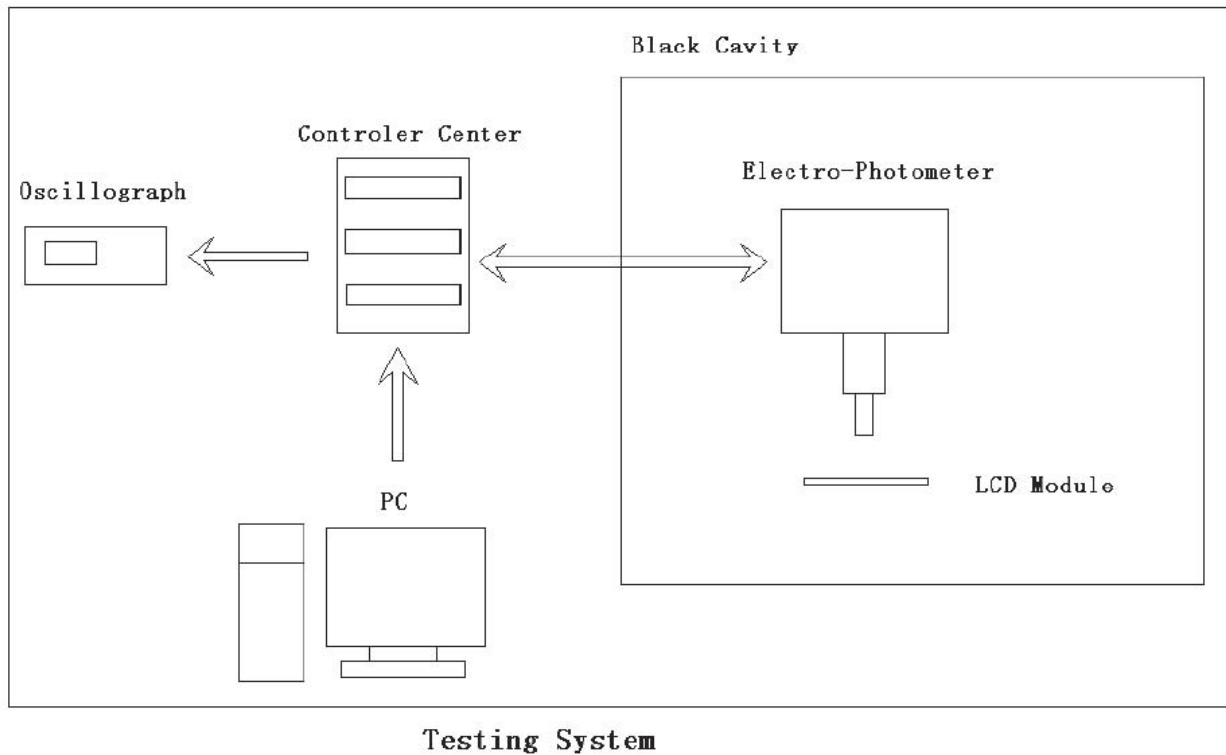
The response time is defined as the total time takes to turn the screen switching White and Black. Measurements are made at the five (5) points perpendicular to the display surface (Normal Line).



X axis: Time

Y axis: Optical Response by the screen switching "Black" and "White"

$$\text{Response Time} = T_r + T_f$$



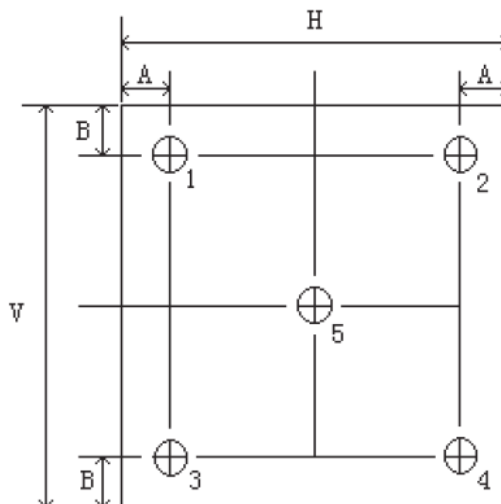
4.3 Luminance Measurement

Luminance is a cd/m^2 (nits) measurement of the display's white color (white screen).

All measurements are performed in a dark ambient.

Display luminance is defined as the average value of five (5) white screen measurements. The location of these 5 measurement points is shown in the drawing below.

$$\text{Display Luminance} = \frac{\text{Surface Luminance of all white screen (1 + 2 + 3 + 4 + 5)}}{5}$$



Screen Luminance Measurement Points (5)

A: 5mm

B: 5mm

H V: Active Area

Measuring Equipment: DMS505

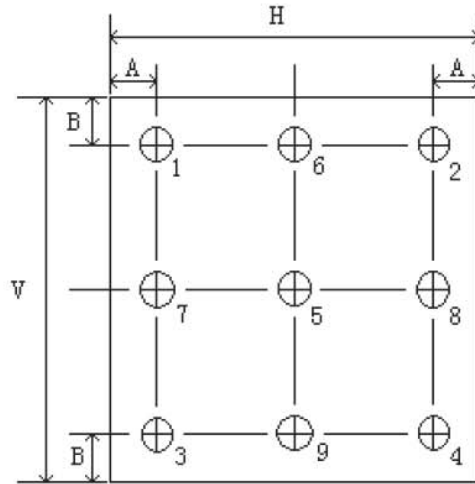
Measurement point diameter: 3mm

4.4 White Uniformity Measurement

White luminance uniformity is a cd/m^2 (nits) measurement of the display's white color across the display screen.

All measurements are performed in a dark ambient.

Display luminance uniformity is defined as the percent (%) of luminance value variation over nine (9) white screen measurements. The location of these 9 measurement points is shown in the drawing below.



A: 5mm

B: 5mm

H,V: Active Area

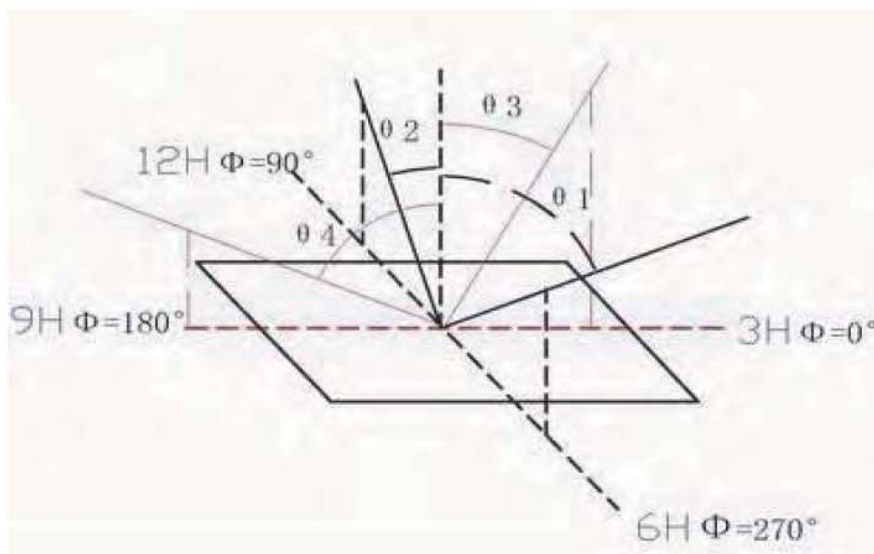
Measuring Equipment: DMS505

Measurement point diameter: 3mm

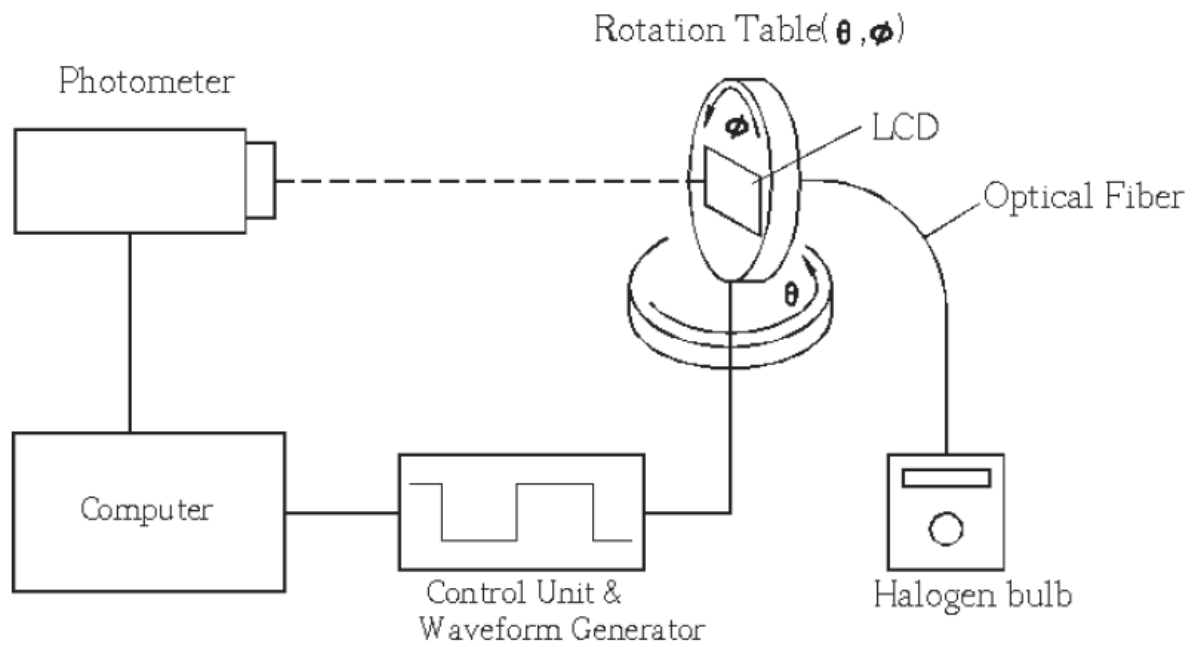
$$\text{Luminance Uniformity} = \frac{\text{Min Luminance(9Pts.1 - 9)}}{\text{Max Luminance(9Pts.1 - 9)}} \times 100\%$$

4.5 Viewing Angle

A) Viewing angle is definition



B) System Block Diagram

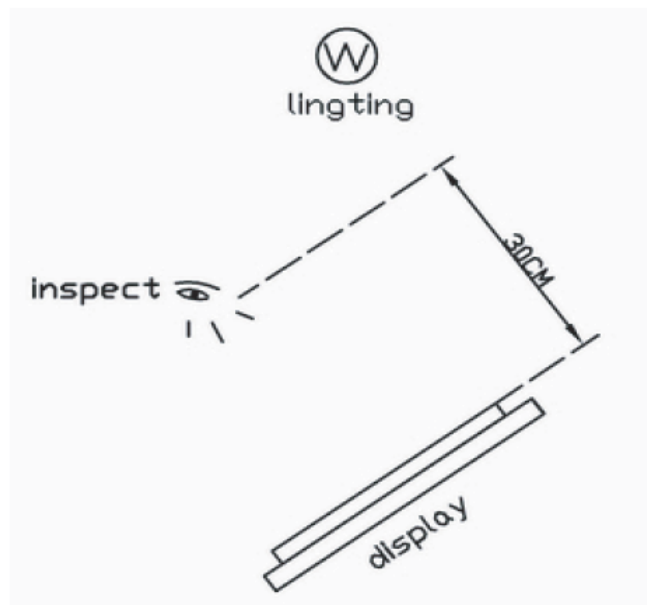


5 QUALITY UNITS

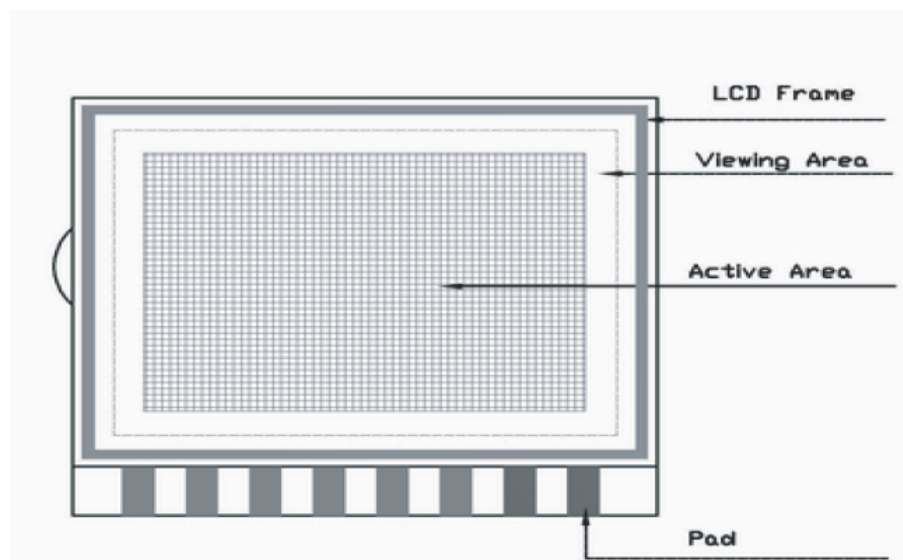
5.1 Visual and Technological Inspection

- Visual inspection must be performed with naked eye on display.
- Distance between observer and display should be about 30 cm.
- Perform inspection at OFF state and ON state
- Ambient lighting should be 1000 lux
- Transmissive, transreflective and negative type specimens should be inspected in backlight

(i) Inspecting method:



(ii) Definition of area:

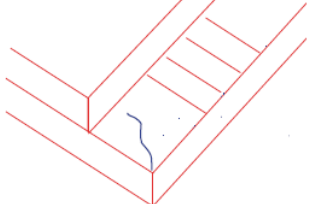
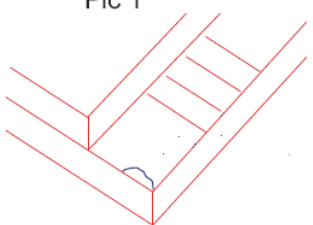
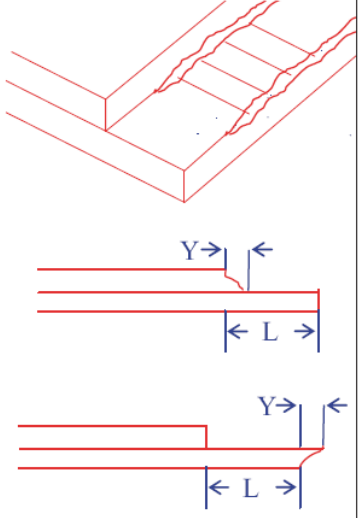


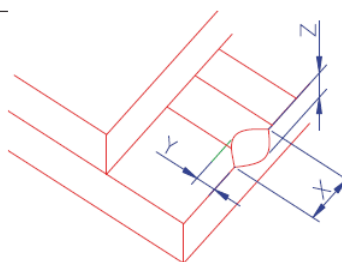
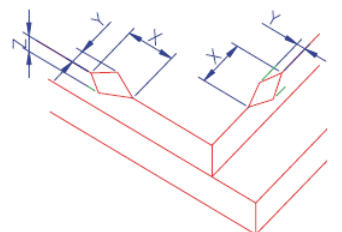
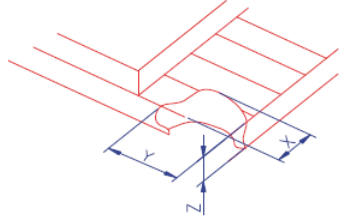
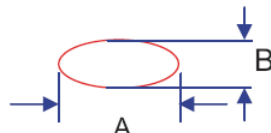
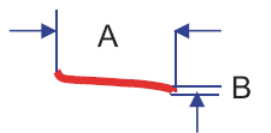
Note: The drawing is a general sketch map only. If want to see the product outline detail, please see the product outline drawing.

5.2 Visual Inspection Standard:

Table1

(Unit: mm)

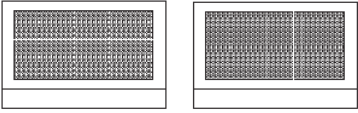
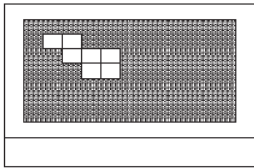
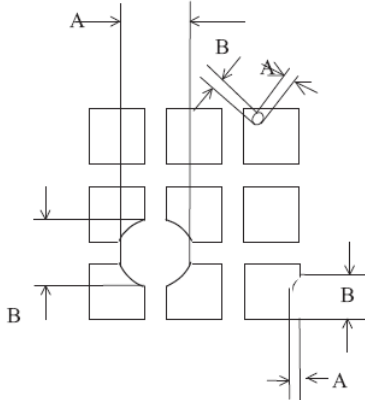
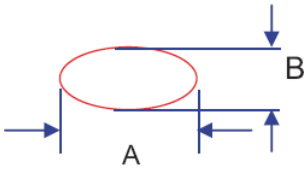
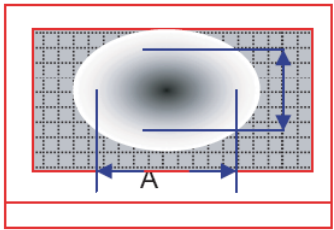
| No | Defect Item | | | Criterion | |
|---------|--|----------|---------------|--|--------------------------|
| | Defect describe | Position | classify | Section | Acceptable Number(N)(*3) |
| 1 | Liquid Crystal Leakage | | | | Not acceptable |
| 2 | Bubble in Liquid Crystal | | | | Not acceptable |
| 3 | Rainbow | | Slight? *1?? | | Acceptable |
| | | | Obvious? *2?? | | Not acceptable |
| 4 | ITO Glass Crackle | | Slight | Pic 1: Enter into the glass | Not acceptable |
| |  Pic 1 | | | | |
| |  Pic 2 | | Slight | Pic 2: not Enter into the glass | 2 |
| 5? *4?? | ITO Glass Protrusion:  | | Slight | 1??smaller glass: $Y \leq L/4$, X ignore, $Z \leq t$ 2: larger glass: no influence upon outline dimension?? assemble,display funtion; | 2 |
| 6? *4?? | Chipped Glass: | pad Edge | Slight | $X \leq 4$, $Y \leq 1/3L$, $Z \leq t$?? or chip don't touch one third of Pad width. | 3 |

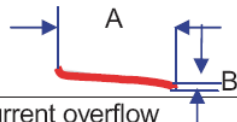
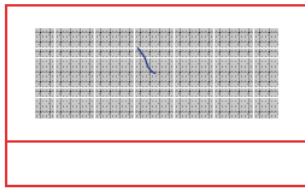
| | | | | | |
|------|--|---------------|--------|---|----------------------------------|
| |  | Non-Pad Edge | Slight | $X \leq 5, Y \leq 1.5, Z \leq t$, Y can't enter into active area and can't touch the sealant | 3 |
| |  | Corner | Slight | $X \leq 2, Y \leq 2, Z \leq t$ | 3 |
| |  | | | | |
| 7 | <p>Black/White Spots (Include LCD and Backlight):</p>  <p>Virtual Diameter: $\phi_o = \frac{a+b}{2}$ mm</p>  | Circular Type | Slight | $\Phi \leq 0.1$ | Acceptable |
| | | | | $0.1 < \Phi \leq 0.3$ | 4 |
| | | | | $\phi_o > 0.3$ | Not acceptable |
| | | Linear Type | Slight | $B \leq 0.02, A$ neglect | Acceptable |
| | | | | $B \leq 0.1, A \leq 3$ | 4 |
| | | | | $B > 0.1$ | According to the spot's standard |
| 8 | Polarizer Bubble | | | $\Phi \leq 0.2$ | Acceptable |
| | | | | $0.2 < \Phi \leq 0.4$ | 4 |
| | | | | $0.4 < \Phi \leq 0.5$ | 2 |
| Note | <p>1. Slight rainbow: rainbow outside of Viewing Area, or concolorous rainbow inside of Viewing Area but don't go beyond the limited sample which affirmed by purchaser.</p> <p>2. Obvious rainbow: double color rainbow in Viewing area and go beyond the limited sample which affirmed by purchaser.</p> <p>3. Acceptable Number(N) is the defects number in the LCD that will be defined according to the defects distributing density. In this table, the acceptable number is $\leq 1/(cm)^2$. If purchaser has different suggest, please discuss with us.</p> | | | | |

5.3 Display Inspection Standard:

Table2

(Unit: mm)

| No | Defect Item | Criterion | |
|----|---|--|----------------------------------|
| | | Section | Acceptable Number(N) (*1) |
| 1 | Non display | | Not acceptable |
| 2 | Display missing  | | Not acceptable |
| 3 | Short Circuit | | Not acceptable |
| 4 | Abnormal display  | | Not acceptable |
| 5 | Pin Hole & Gap in displaying segment or Dot Matrix:  | $\Phi \leq 0.1$ | Acceptable |
| | | $0.1 < \Phi \leq 0.2$ | 3 |
| | | $0.2 < \Phi \leq 0.3$ | 1 |
| | | $\Phi > 0.3$ | Not acceptable |
| 6 | Display Black/White Spots   | The spot's dimension and color don't alter with the voltage alteration | |
| | | $\phi \leq 0.10$ | acceptable |
| | | $0.10 < \phi \leq 0.2$ | 3 |
| | | $0.2 < \phi \leq 0.3$ | 1 |
| | | $\phi > 0.3$ | Not acceptable |
| | | The spot's dimension and color alter with the voltage alteration | |
| | | $\phi \leq 0.3$ | acceptable |
| | | $0.3 < \phi \leq 0.5$ | 3 |
| 7 | Display Black/White lines | $0.5 < \phi \leq 0.8$ | 1 |
| | | $\phi > 0.8$ | Not acceptable |
| | | The Line's dimension and color don't alter with the voltage alteration | |
| | | $B \leq 0.05 \quad A \leq 2$ | acceptable |
| | | $0.05 < B \leq 0.1 \quad A \leq 2$ | 3 |
| | | $B > 0.1$ | According to the spot's standard |



The Line's dimension and color alter with the voltage alteration

| | |
|---------------------------------|----------------------------------|
| $B \leq 0.07$ $A \leq 5$ | acceptable |
| $0.07 < B \leq 0.15$ $A \leq 5$ | 3 |
| $0.15 < B \leq 0.3$ $A \leq 5$ | 1 |
| $B > 0.3$ | According to the spot's standard |

| | | | |
|------|---|--|----------------|
| 8 | The current overflow | | Not acceptable |
| Note | 1.when the width value of Segment or Dot Matrix is less than 3.0 mm, no default is acceptable 2.No more than 5 defaults are acceptable in 1cm^2 area. | | |

6 Reliability-TEST

6.1 Standard Specifications for Reliability

6.1-1 Test method

There should be no existing conspicuous failure of functions and appearance in LCD after the following tests.

| NO | Item | Description |
|----|----------------------------|--|
| 1 | Low Temperature Operating | The sample should be allowed to stand at $(-20 \pm 2)^{\circ}\text{C}$ for 96 Hours under driving condition. |
| 2 | High Temperature Operating | The sample should be allowed to stand at $(70 \pm 2)^{\circ}\text{C}$ for 96 Hours under driving condition. |
| 3 | Low Temperature Storage | The sample should be allowed to stand at $(-40 \pm 3)^{\circ}\text{C}$ for 96 Hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 24 hours |
| 4 | High Temperature Storage | The sample should be allowed to stand at $(80 \pm 2)^{\circ}\text{C}$ for 96Hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 24 hours |
| 5 | Moisture resistance | The sample should be allowed to stand at $(40 \pm 2)^{\circ}\text{C}$, $(95 \pm 2)\%\text{RH}$ for 96Hours under no-load condition excluding the polarizer, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours |
| 6 | Thermal Shock Resistance | The sample should be allowed to stand the following 5 cycles of operation: T_{STL} * for 30 minutes -> normal temperature for 5 minutes -> T_{STH} * for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours |

Note:

T_{STL} : Lowest Storage Temperature.

T_{STH} : Highest Storage Temperature.

6.1-2 Testing Conditions and Inspection Criteria:

For the final test, the testing sample must be stored at room temperature for 24 hours, after the

tests listed above; Standard specifications for Reliability have been executed in order to ensure stability.

| NO | Item | Inspection Criteria |
|----|---------------------|---|
| 1 | Current Consumption | The current consumption should be under double of initial test. |
| 2 | Contrast | The contrast must be larger than half of initial test. |
| 3 | Appearance | Appearance defects should not happen. |

6.2 Life Time

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature ($25\pm 10^{\circ}\text{C}$), normal humidity ($45\pm 20\%\text{RH}$), and in area not exposed to direct sunlight.