


| | | | |
|----------------------|-------------|------------------|------------|
| MDT0400GIH-LVDS | 1920 x 1080 | LVDS Interface | TFT Module |
| Specification | | | |
| Version: 1 | | Date: 14/04/2023 | |
| Revision | | | |
| 1 | 12/04/2023 | First issue | |

| Display Features | |  | |
|-----------------------|-------------------------|---|------------------|
| Display Size | 4.00" | | |
| Resolution | 1920 x 1080 | | |
| Orientation | Landscape | | |
| Appearance | RGB | | |
| Logic Voltage | 3.3V | | |
| Interface | LVDS | | |
| Brightness | 1100 cd/m ² | | |
| Touchscreen | --- | | |
| Module Size | 94.87 x 62.22 x 2.73 mm | | |
| Operating Temperature | -20°C ~ +70°C | | |
| Pinout | 50 way FFC | | Box Quantity |
| Pitch | 0.50mm | | Weight / Display |
| | | --- | |
| | | --- | |

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* - For full design functionality, please use this specification in conjunction with the SC5010 specification.(Provided Separately)

| Display Accessories | |
|---------------------|---|
| Part Number | Description |
| MPBV5 | 50 Way FFC to cable and wires. Driven by any driver board that can be wired to a 1mm pitch SHDR-50V-S-B receptacle. |
| MDIB-CC1 | The MDIB-CC1 is a interconnect board for standard pitch pinouts to fine pitch wires. Ideal for prototyping of TFT and COG LCDs. |
| | |

| Optional Variants | |
|-------------------|---------|
| Appearances | Voltage |
| | |



*** Description**

This is a color active matrix LTPS LCD using Low Temperature Poly-silicon TFT's (Thin Film Transistors) as an active switching devices. This module is composed of a Transmissive type LTPS-LCD Panel, driver circuit, back-light unit. The resolution of a 4.0 " LTPS-LCD contains 1920X1080 pixels, and can display up to 16.7M colors.

*** Features**

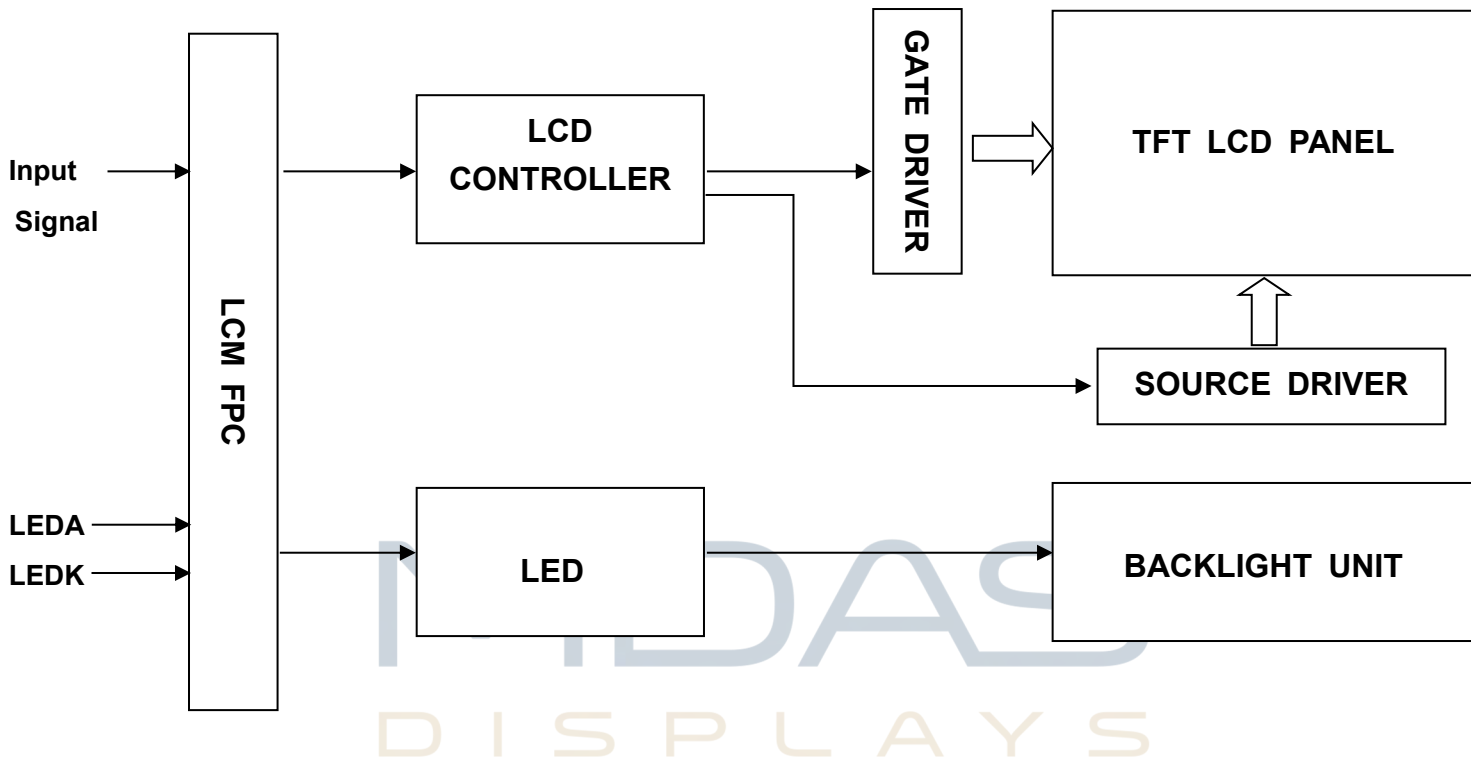
| General Information Items | Specification | Unit | Note |
|---------------------------|----------------------------------|---------|------|
| | Main Panel | | |
| Display area(AA) | 88.5888(H)*49.8312(V) (4.0 inch) | mm | |
| Driver element | LTPS | - | |
| Display colors | 16.7M | colors | |
| Number of pixels | 1920(RGB)*1080 | dots | |
| Pixel arrangement | RGB vertical stripe | - | |
| Pixel pitch | 0.04614(H)*0.04614(V) | mm | |
| Viewing angle | ALL | o'clock | |
| Controller IC | SC5010 | - | |
| LCM Interface | 1 or 2 Port LVDS, VESA mode | - | |
| Display mode | Transmissive /Normally Black | - | |
| Operating temperature | -20~+70 | °C | |
| Storage temperature | -30~+80 | °C | |

*** Mechanical Information**

| Item | | Min. | Typ. | Max. | Unit | Note |
|-------------|---------------|------|-------|------|------|------|
| Module size | Horizontal(H) | - | 94.87 | - | mm | |
| | Vertical(V) | - | 62.22 | - | mm | |
| | Depth(D) | - | 2.73 | -- | | |
| Weight | | - | 34 | - | g | |



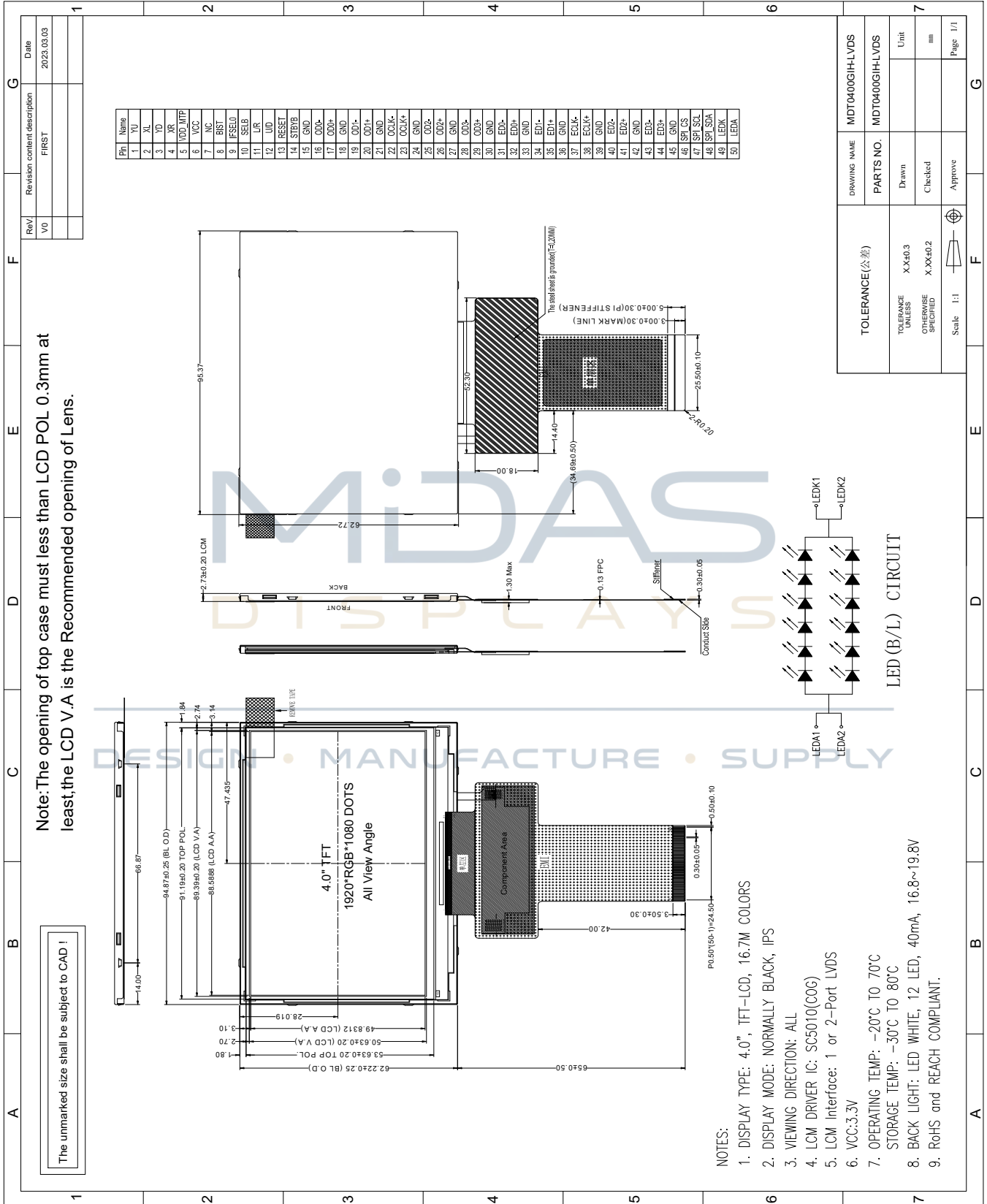
1. Block Diagram



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Outline dimension



| | |
|--------------|-----------------|
| DRAWING NAME | MDT0400GHH-LVDS |
| PARTS NO. | MDT0400GHH-LVDS |
| Drawn | Unit |
| Checked | mm |
| Approve | Page 1/1 |

Input terminal Pin Assignment

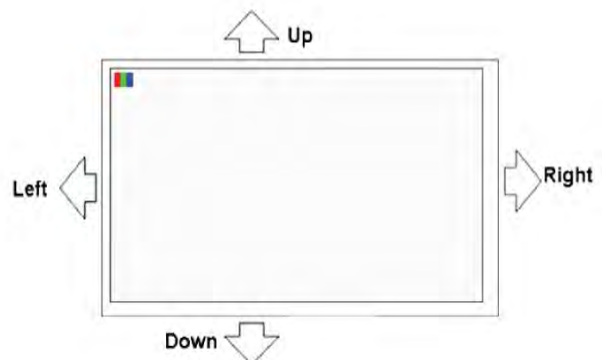
1. TFT PIN Define

| NO. | SYMBOL | DISCRIPTION | I/O |
|-----|---------|---|-------|
| 1 | YU(NC) | Touch panel Top Film Terminal | A/D |
| 2 | XL(NC) | Touch panel LIFT Glass Terminal | A/D |
| 3 | YD(NC) | Touch panel Bottom Film Terminal | A/D |
| 4 | XR(NC) | Touch panel Right Glass Terminal | A/D |
| 5 | VDD_MTP | Please open this PIN. | -- |
| 6 | VCC | Digital power-3.3v | P |
| 7 | NC | -- | -- |
| 8 | BIST | Built-in self test function: "H":Enable "L":Disable | I |
| 9 | IFSEL0 | Interface select: "H":2-Port LVDS "L":1-Port LVDS | I |
| 10 | SELB | Data format: "H":8Bit "L":6Bit | I |
| 11 | L/R | Horizontal shift direction (source output) selection(NOTE1) | Note1 |
| 12 | U/D | Vertical shift direction (gate output) selection(NOTE1) | Note1 |
| 13 | RESET | Reset Pin. Low active. | I |
| 14 | STBYB | Standby mode: 'H': Power on (Default) . 'L': Power off. | I |
| 15 | GND | Ground. | P |
| 16 | OD0- | Odd LVDS Negative data signal (-) | I |
| 17 | OD0+ | Odd LVDS Positive data signal (+) | |
| 18 | GND | Ground. | P |
| 19 | OD1- | Odd LVDS Negative data signal (-) | I |
| 20 | OD1+ | Odd LVDS Positive data signal (+) | |
| 21 | GND | Ground. | P |
| 22 | OCLK- | Odd LVDS Negative CLK signal (-) | I |
| 23 | OCLK+ | Odd LVDS Positive CLK signal (+) | |
| 24 | GND | Ground. | P |



| | | | |
|----|---------|------------------------------------|----|
| 25 | OD2- | Odd LVDS Negative data signal (-) | I |
| 26 | OD2+ | Odd LVDS Positive data signal (+) | |
| 27 | GND | Ground. | P |
| 28 | OD3- | Odd LVDS Negative data signal (-) | I |
| 29 | OD3+ | Odd LVDS Positive data signal (+) | |
| 30 | GND | Ground. | P |
| 31 | ED0- | EVEN LVDS Negative data signal (-) | I |
| 32 | ED0+ | EVEN LVDS Positive data signal (+) | |
| 33 | GND | Ground. | P |
| 34 | ED1- | EVEN LVDS Negative data signal (-) | I |
| 35 | ED1+ | EVEN LVDS Positive data signal (+) | |
| 36 | GND | Ground. | P |
| 37 | ECLK- | EVEN LVDS Negative CLK signal (-) | I |
| 38 | ECLK+ | EVEN LVDS Positive CLK signal (+) | |
| 39 | GND | Ground. | P |
| 40 | ED2- | EVEN LVDS Negative data signal (-) | I |
| 41 | ED2+ | EVEN LVDS Positive data signal (+) | |
| 42 | GND | Ground. | P |
| 43 | ED3- | EVEN LVDS Negative data signal (-) | I |
| 44 | ED3+ | EVEN LVDS Positive data signal (+) | |
| 45 | GND | Ground. | P |
| 46 | SPI_CS | Please open this PIN. | -- |
| 47 | SPI_SCL | Please open this PIN. | -- |
| 48 | SPI_SDA | Please open this PIN. | -- |
| 49 | LEDK | Cathode pin of backlight. | P |
| 50 | LEDA | Anode pin of backlight. | P |

Note1: When L/R="1", set left to right scan direction.
When L/R="0", set right to left scan direction.
When U/D="1", set up to down scan direction.
When U/D="0", set down to up scan direction.



LCD Optical Characteristics

1. Optical specification

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit. | Note | |
|---------------------------|---------|-------------|----------------------|-------|-------|-------|-------------|--------|
| Contrast Ratio | CR | $\Theta=0$ | 900 | 1200 | -- | | (1)(2) | |
| Response time | Rising | T_{R+T_F} | Normal viewing angle | -- | 40 | 45 | msec | (1)(3) |
| | Falling | | | | | | | |
| Color Gamut | S(%) | | 39 | 42 | -- | % | | |
| Color Filter Chromacicity | White | W_X | -0.04 | 0.324 | +0.04 | | CA-310 test | |
| | | W_Y | | 0.343 | | | | |
| | Red | R_X | | 0.574 | | | | |
| | | R_Y | | 0.369 | | | | |
| | Green | G_X | | 0.339 | | | | |
| | | G_Y | | 0.512 | | | | |
| | Blue | B_X | | 0.161 | | | | |
| | | B_Y | | 0.095 | | | | |
| Viewing angle | Hor. | Θ_L | 70 | 80 | -- | | (1)(4) | |
| | | Θ_R | 70 | 80 | -- | | | |
| | Ver. | Θ_U | 70 | 80 | -- | | | |
| | | Θ_D | 70 | 80 | -- | | | |
| Option View Direction | | | ALL | | | | | |

Measuring Condition

Measuring surrounding : dark room

Ambient temperature : 25±2°C

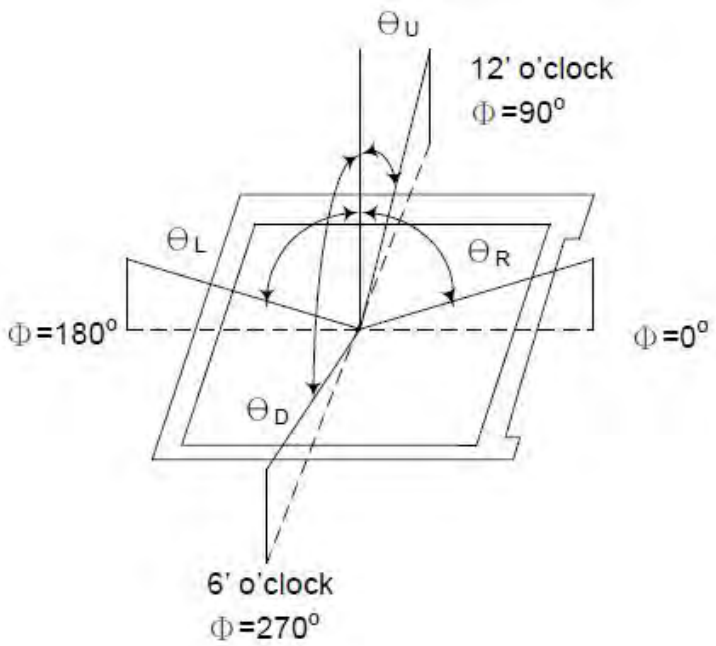
15min. warm-up time.

Measuring Equipment

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



Note (1): Definition of Viewing Angle :

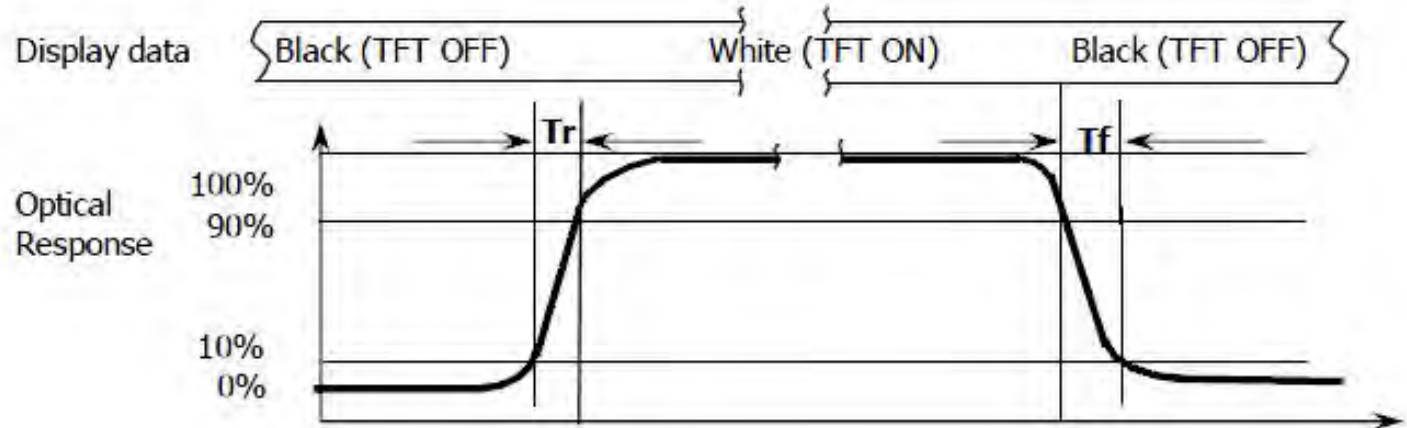


Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

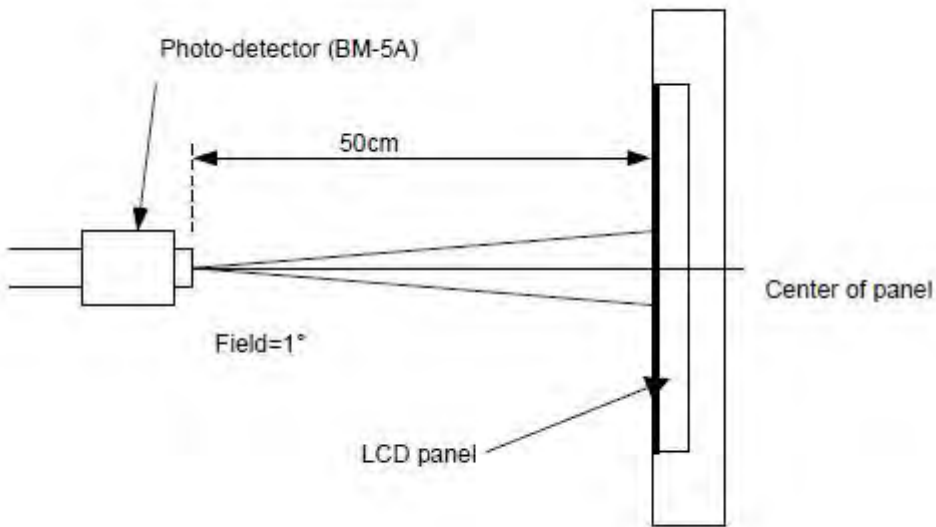
$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

Note (3): Response Time

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Note (4): Definition of optical measurement setup



MIDAS
DISPLAYS

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Electrical Characteristics

1. Absolute Maximum Rating

| Characteristics | Symbol | Min. | Max. | Unit | Note |
|------------------------|-----------------|------|------|------|-------|
| Digital Supply Voltage | VCC | -0.3 | 6.0 | V | Note1 |
| Operating temperature | T _{OP} | -20 | +70 | °C | |
| Storage temperature | T _{ST} | -30 | +80 | °C | |

NOTE1: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

2. DC Electrical Characteristics

| Characteristics | Symbol | Min. | Typ. | Max. | Unit | Note |
|---------------------------------|-----------------|---------------------|------|---------------------|------|------|
| Digital Supply Voltage | VCC | 3.0 | 3.3 | 3.6 | V | |
| Normal mode Current consumption | I _{DD} | -- | 111 | 220 | mA | |
| Level input voltage | V _{IH} | 0.7*V _{CC} | -- | VCC | V | |
| | V _{IL} | GND | -- | 0.3*V _{CC} | V | |
| Level output voltage | V _{OH} | 0.8*V _{CC} | -- | VCC | V | |
| | V _{OL} | GND | -- | GND+0.4 | V | |



3. LED Backlight Characteristics

The back-light system is edge-lighting type with 12 chips LED

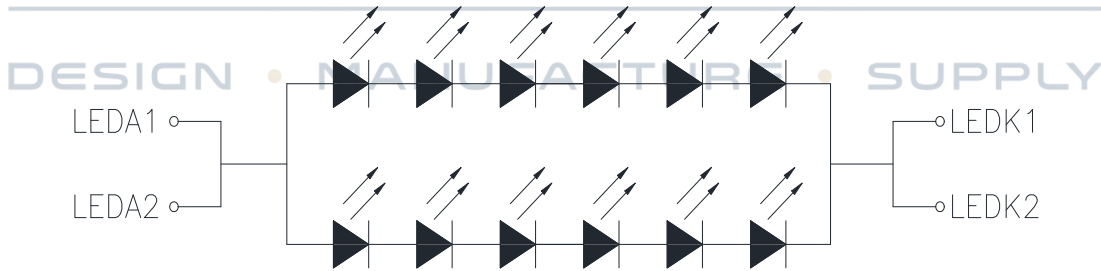
| Item | Symbol | Min. | Typ. | Max. | Unit | Note |
|-----------------|--------|------|-------|------|-------------------|-------------------|
| Forward Current | I_F | -- | 40 | -- | mA | |
| Forward Voltage | V_F | 16.2 | 19.2 | 20.4 | V | |
| LCM Luminance | LV | 1000 | 1100 | -- | cd/m ² | $I_F=40\text{mA}$ |
| LED life time | Hr | -- | 50000 | -- | Hour | Note1,2 |
| Uniformity | Avg | 80 | -- | -- | % | Note3 |

Note1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition:

$T_a=25\pm3\text{ }^\circ\text{C}$, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note 2: The "LED life time" is defined as the module brightness decrease to 50% original brightness at

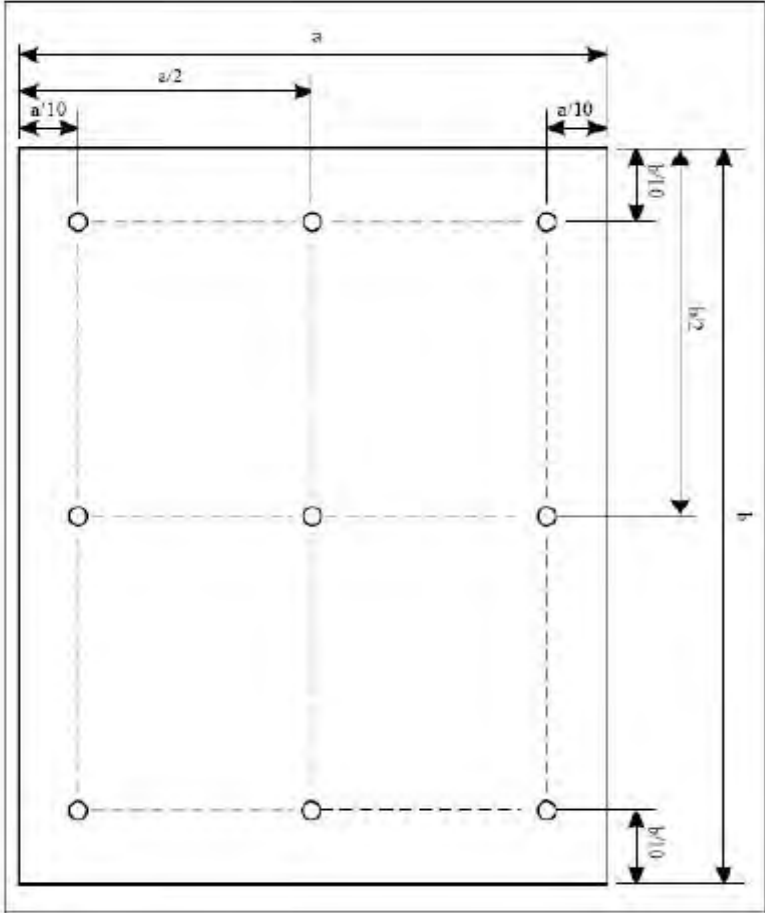
$T_a=25^\circ\text{C}$ and $I_L=40\text{mA}$. The LED lifetime could be decreased if operating I_L is larger than 40mA. The constant current driving method is suggested.



LED (B/L) CIRCUIT



Note (3) Luminance Uniformity of these 9 points is defined as below:



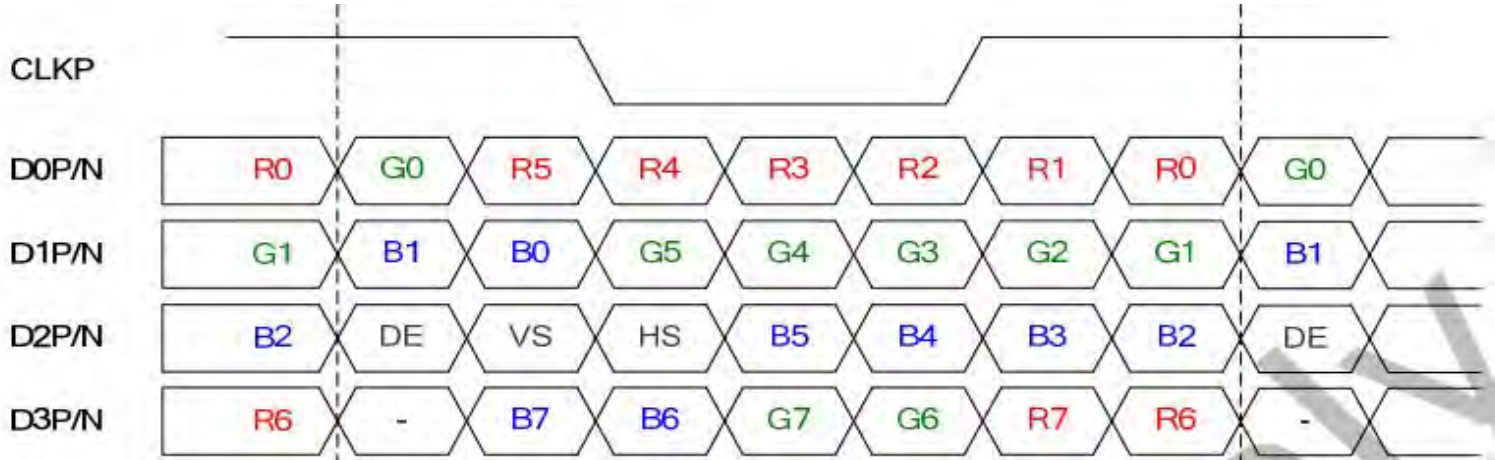
$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$



AC Characteristics

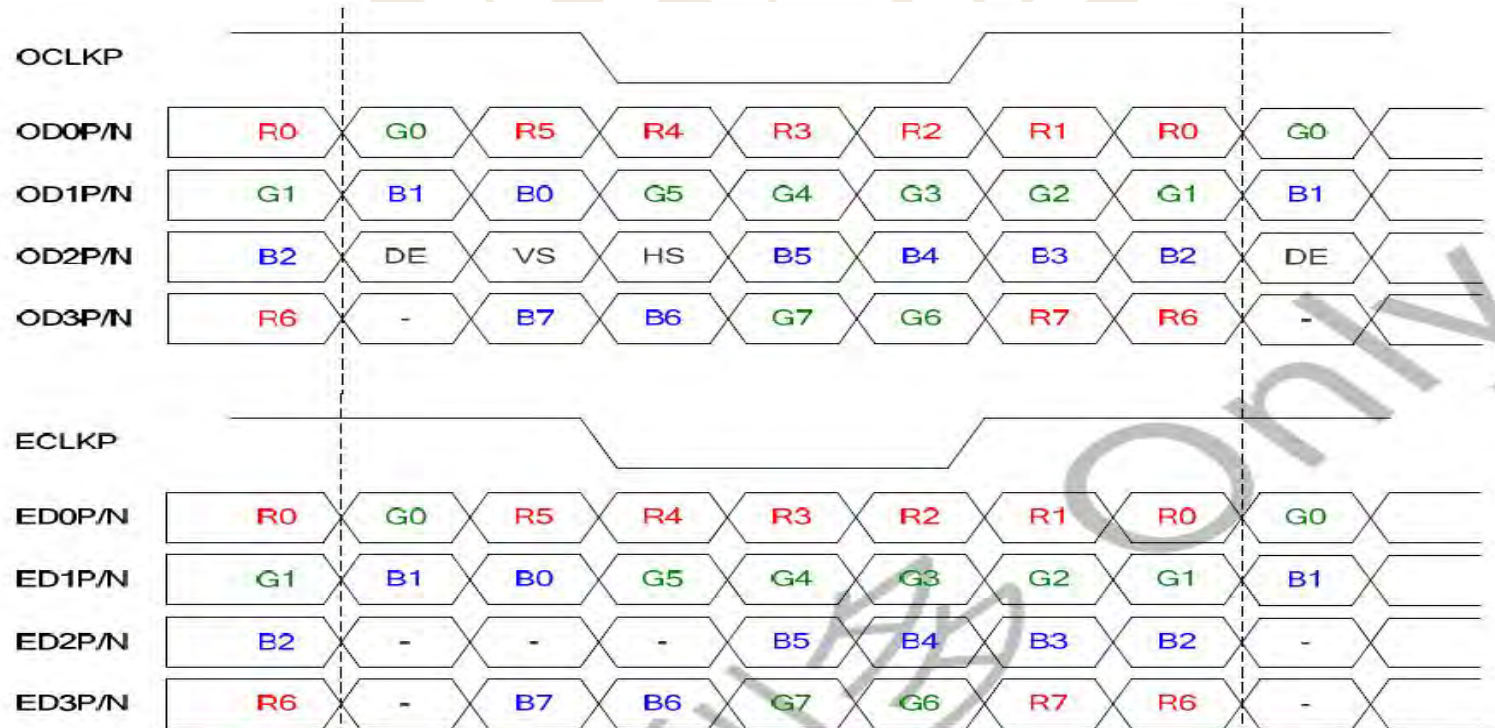
1. LVDS Interface

1.1 1-Port LVDS VESA Data Mapping



Note 1 : for 6 bit mode, MSB are R/G/B[5] and R/G/B[0] are LSB
 Note 2 : for 8 bit mode, MSB are R/G/B[7] and R/G/B[0] are LSB

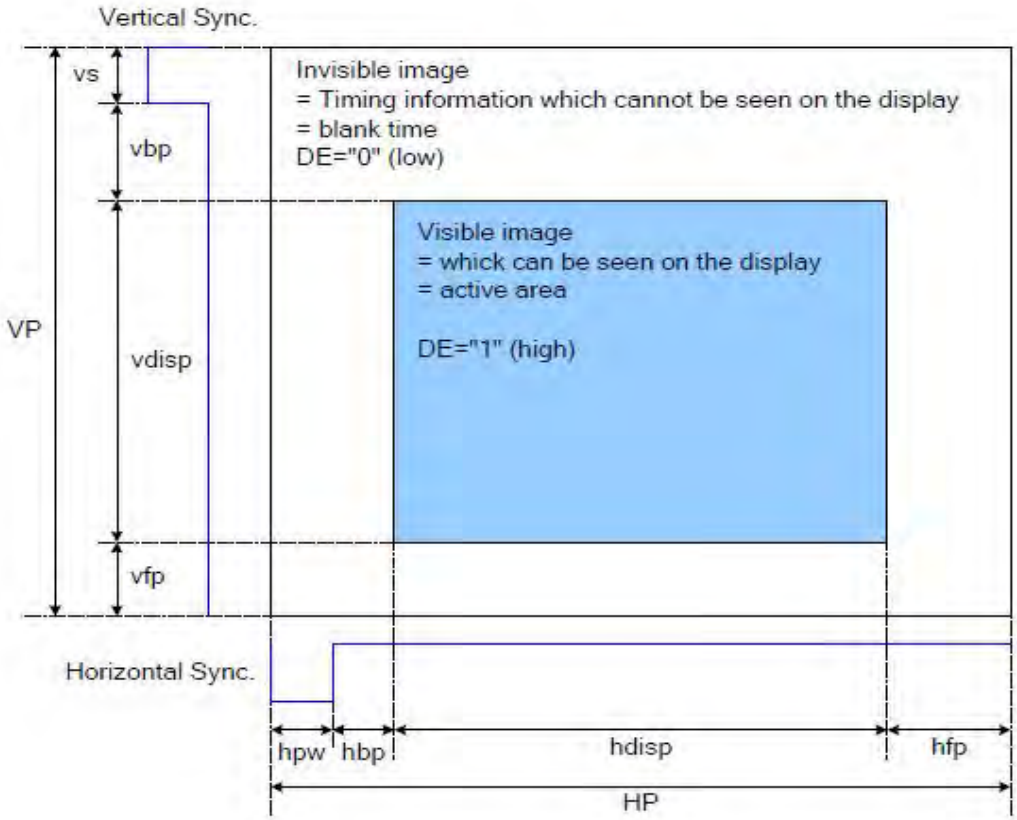
1.2 2-Port LVDS VESA Data Mapping



Note 1 : for 6 bit mode, MSB are R/G/B[5] and R/G/B[0] are LSB
 Note 2 : for 8 bit mode, MSB are R/G/B[7] and R/G/B[0] are LSB



2. Timing for LVDS mode



DRAM Access Area by RGB Interface

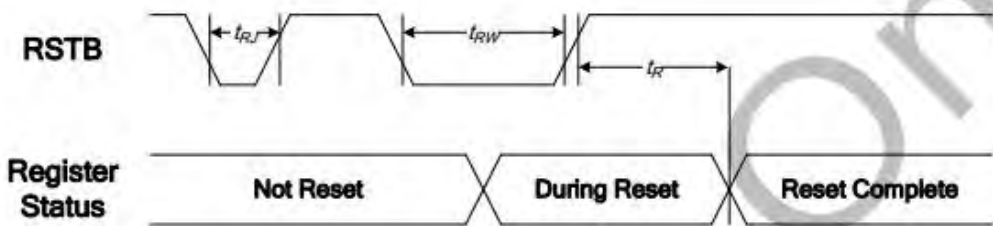
Please refer to the following table for the setting limitation of RGB interface signals.(Only 2-Port)

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|------------------------------|--------|------|-------|------|------|
| DCLK frequency | FCLK | -- | (132) | -- | MHz |
| Horizontal display area | HDISP | -- | 1920 | -- | Line |
| Horizontal Sync. Width | hpw | 1 | 4 | -- | Line |
| Horizontal Sync. Back Porch | hbp | 1 | 10 | - | Line |
| Horizontal Sync. Front Porch | hfp | 1 | 40 | -- | Line |
| Vertical display area | VDISP | -- | 1080 | -- | Line |
| Vertical Sync. Width | vs | 2 | 4 | -- | Line |
| Vertical Sync. Back Porch | vbp | 2 | 10 | -- | Line |
| Vertical Sync. Front Porch | vfp | 2 | 20 | -- | Line |
| Frame-Rate | | -- | 60 | -- | Hz |

Note: Typical value are related to the setting frame rate is 60Hz.

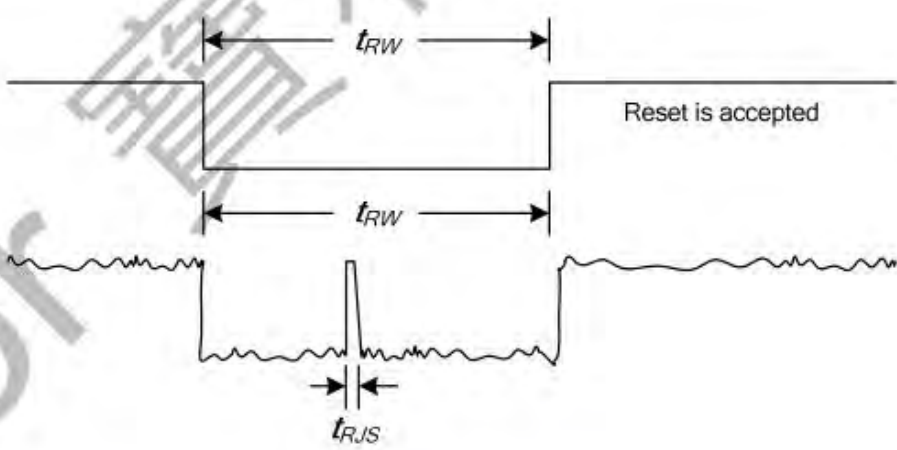


3. Hardware Reset Timing



VSSI = VSSRX = VSSP = 0V, VDDI = VDDP= VDDR_X = 3.0 ~ 3.3V, T_a = -40 ~ 85°C

| Item | Signal | Symbol | Condition | Rating | | Unit |
|-----------------------------------|--------|------------------|-----------|--------|------|------|
| | | | | Min. | Max. | |
| Reset time | RSTB | t _R | | — | 5 | us |
| Reset "L" pulse width | | t _{RW} | | 15 | — | |
| Reset rejection | | t _{RJ} | | — | 5 | |
| Reset rejection (for noise spike) | | t _{RJS} | | — | 10 | ns |



Note:

- For PROM related operation, it takes 50ms at least for PROM Registers to load PROM contents. Do not use any PROM related command during this period.
- When the system issues a RSTB low pulse, the reset procedure of IC will start if the low pulse is longer than t_{RW} specified above. If the low pulse is less than t_{RJ} specified above, the reset procedure of IC will not start. If the low pulse is longer than t_{RJ} and less than t_{RW}, the reset procedure of IC is not guaranteed.



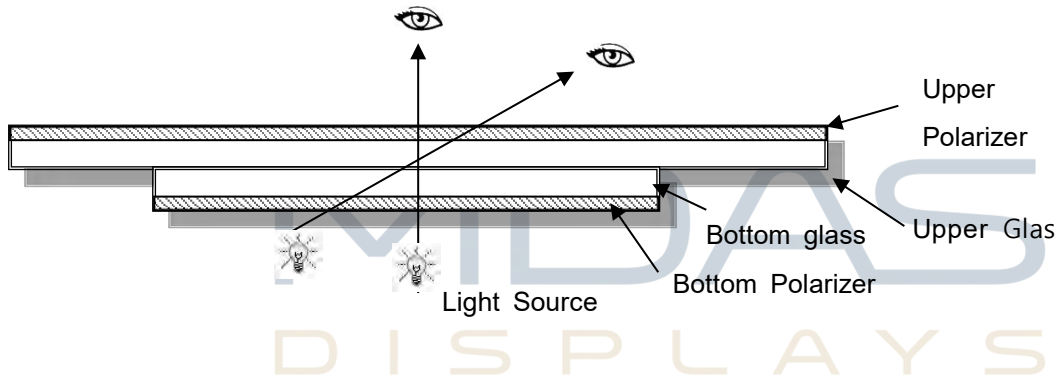
LCD Module Out-Going Quality Level

1. VISUAL & FUNCTION INSPECTION STANDARD

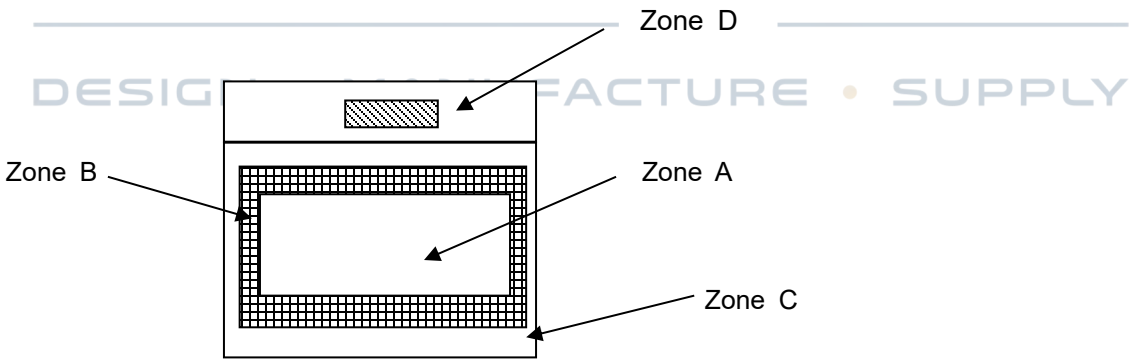
1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

- Temperature : $25 \pm 5^{\circ}\text{C}$
- Humidity : $65\% \pm 10\% \text{RH}$
- Viewing Angle : Normal viewing Angle.
- Illumination: Single fluorescent lamp (300 to 700Lux)
- Viewing distance: 30-50cm



1.2 Definition



- Zone A : Effective Viewing Area(Character or Digit can be seen)
- Zone B : Viewing Area except Zone A
- Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer
- Zone D : IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer



1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class II

AQL:

| | |
|--------------|--------------|
| Major defect | Minor defect |
| 0.65 | 1.5 |

LCD: Liquid Crystal Display , LCM: Liquid Crystal Module,

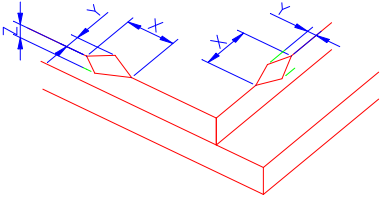
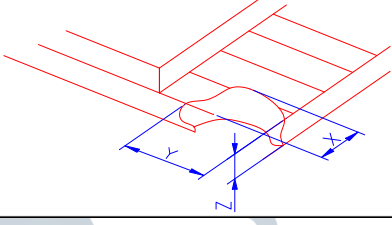
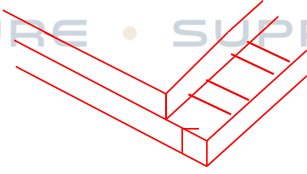
| No | Items to be inspected | Criteria | Classification of defects |
|----|-----------------------|--|---------------------------|
| 1 | Functional defects | 1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. etc... | Major |
| 2 | Missing | Missing components and etc... | |
| 3 | Outline dimension | Overall outline dimension beyond the drawing is not allowed, deformation and etc... | |
| 4 | Color tone | Color unevenness, refer to limited sample | Minor |
| 5 | Spot/Line defect | Light dot, Dim spot, (Note1) Polarizer Air Bubble, Polarizer accidented spot and etc. | |
| 6 | Soldering appearance | Good soldering , Peeling off is not allowed and etc. | |
| 7 | LCD/Polarizer | Black/White spot/line, scratch, crack, etc. | |

Note1: a) Light dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.

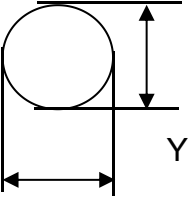
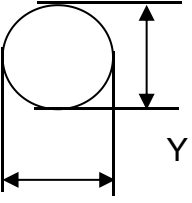
b) Dim dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.




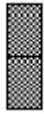
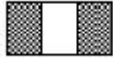
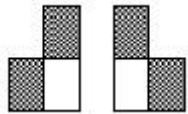
1.4 Criteria (Visual)

| Number | Items | Criteria(mm) | | | | | | |
|---|---|---|----|---|--------|--------|--------------------------------|----|
| 1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of IT O, T: Height of LCD | (1) The edge of LCD broken |  <table border="1" data-bbox="756 600 1453 745"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td><Inner border line of the seal</td> <td>≤T</td> </tr> </tbody> </table> | X | Y | Z | ≤3.0mm | <Inner border line of the seal | ≤T |
| | X | Y | Z | | | | | |
| | ≤3.0mm | <Inner border line of the seal | ≤T | | | | | |
| (2) LCD corner broken |  <table border="1" data-bbox="836 1055 1374 1155"> <thead> <tr> <th>X</th> <th>Y</th> <th>Z</th> </tr> </thead> <tbody> <tr> <td>≤3.0mm</td> <td>≤L</td> <td>≤T</td> </tr> </tbody> </table> | X | Y | Z | ≤3.0mm | ≤L | ≤T | |
| X | Y | Z | | | | | | |
| ≤3.0mm | ≤L | ≤T | | | | | | |
| (3) LCD crack |  <p style="text-align: center;">Crack Not allowed</p> | | | | | | | |




| 2.0 | Spot defect | ① light dot (black/white spot , pinhole, stain , etc.) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------------------|---|--|---|-------------------------|-------------------|----------------|--|--|---|---|---|------------------|--------|--|--|-------------------------|--------|--|--|------------------------|-------------------------|--|--------------|-------------------------|--|--|--------------|---|--|--|
| |  | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.15$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.15 < \Phi \leq 0.25$</td> <td colspan="3" rowspan="2" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.25 < \Phi \leq 0.4$</td> <td colspan="2" style="text-align: center;">3(distance \geq 6mm)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.4$</td> <td colspan="3" style="text-align: center;">2(distance \geq 6mm)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.4$</td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> | | | Zone Size (mm) | Acceptable Qty | | | A | B | C | $\Phi \leq 0.15$ | Ignore | | | $0.15 < \Phi \leq 0.25$ | Ignore | | | $0.25 < \Phi \leq 0.4$ | 3(distance \geq 6mm) | | $\Phi > 0.4$ | 2(distance \geq 6mm) | | | $\Phi > 0.4$ | 0 | | |
| | Zone Size (mm) | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | $\Phi \leq 0.15$ | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.15 < \Phi \leq 0.25$ | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.25 < \Phi \leq 0.4$ | | | | 3(distance \geq 6mm) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.4$ | 2(distance \geq 6mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.4$ | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi = (X+Y)/2$ | ② Dim spot (light leakage, dent, dark spot , etc) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| |  | <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Zone Size (mm)</th> <th colspan="3" style="text-align: center;">Acceptable Qty</th> </tr> <tr> <th style="text-align: center;">A</th> <th style="text-align: center;">B</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">$\Phi \leq 0.15$</td> <td colspan="3" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.15 < \Phi \leq 0.25$</td> <td colspan="3" rowspan="2" style="text-align: center;">Ignore</td> </tr> <tr> <td style="text-align: center;">$0.25 < \Phi \leq 0.4$</td> <td colspan="2" style="text-align: center;">3(distance \geq 6mm)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.4$</td> <td colspan="3" style="text-align: center;">2(distance \geq 6mm)</td> </tr> <tr> <td style="text-align: center;">$\Phi > 0.4$</td> <td colspan="3" style="text-align: center;">0</td> </tr> </tbody> </table> | | | Zone Size (mm) | Acceptable Qty | | | A | B | C | $\Phi \leq 0.15$ | Ignore | | | $0.15 < \Phi \leq 0.25$ | Ignore | | | $0.25 < \Phi \leq 0.4$ | 3(distance \geq 6mm) | | $\Phi > 0.4$ | 2(distance \geq 6mm) | | | $\Phi > 0.4$ | 0 | | |
| Zone Size (mm) | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi \leq 0.15$ | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.15 < \Phi \leq 0.25$ | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.25 < \Phi \leq 0.4$ | | | | 3(distance \geq 6mm) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.4$ | 2(distance \geq 6mm) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.4$ | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ③ Polarizer accidented spot | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Zone Size (mm) | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi \leq 0.2$ | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < \Phi \leq 0.5$ | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.5$ | | | | 2(distance \geq 6mm) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.5$ | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | ④ Polarizer Bubble | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Zone Size (mm) | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | A | B | C | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi \leq 0.2$ | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.2 < \Phi \leq 0.4$ | Ignore | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.4$ | | | | 3(distance \geq 6mm) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $\Phi > 0.4$ | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



| 3.0 | LCD Pixel defect | <p>Pixel bad points</p> <table border="1"> <thead> <tr> <th data-bbox="512 309 719 360">Item</th> <th data-bbox="719 309 1233 360">Zone A</th> <th data-bbox="1233 309 1520 360">Acceptable Qt</th> </tr> </thead> <tbody> <tr> <td data-bbox="512 360 719 521" rowspan="3">Bright dot</td> <td data-bbox="719 360 1233 416">Random</td> <td data-bbox="1233 360 1520 416">N≤2</td> </tr> <tr> <td data-bbox="719 416 1233 468">2 dots adjacent</td> <td data-bbox="1233 416 1520 468">N≤0</td> </tr> <tr> <td data-bbox="719 468 1233 521">3 dots adjacent</td> <td data-bbox="1233 468 1520 521">N≤0</td> </tr> <tr> <td data-bbox="512 521 719 689" rowspan="3">Dark dot</td> <td data-bbox="719 521 1233 577">Random</td> <td data-bbox="1233 521 1520 577">N≤2</td> </tr> <tr> <td data-bbox="719 577 1233 633">2 dots adjacent</td> <td data-bbox="1233 577 1520 633">N≤0</td> </tr> <tr> <td data-bbox="719 633 1233 689">3 dots adjacent</td> <td data-bbox="1233 633 1520 689">N≤0</td> </tr> <tr> <td data-bbox="512 689 719 1003">Distance</td> <td data-bbox="719 689 1233 1003"> 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. </td> <td data-bbox="1233 689 1520 1003">5mm</td> </tr> <tr> <td colspan="2" data-bbox="512 1003 1233 1059">Total bright and dark dot</td> <td data-bbox="1233 1003 1520 1059">N≤4</td> </tr> </tbody> </table> <p>Note:</p> <p>A) Bright dot: Dots appear bright and unchanged in size in which LCD panel is displaying under black pattern.</p> <p>B) Dark dot: Dots appear dark and unchanged in size in which LCD panel is displaying under pure red, green, blue picture.</p> <p>C) 2 dot adjacent = 1 pair = 2 dots</p> <p>Picture:</p> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;">  <p>2 dot adjacent</p> </div> <div style="text-align: center;">  <p>2 dot adjacent (vertical)</p> </div> <div style="text-align: center;">  <p>2 dot adjacent</p> </div> <div style="text-align: center;">  <p>2 dot adjacent (slant)</p> </div> </div> | Item | Zone A | Acceptable Qt | Bright dot | Random | N≤2 | 2 dots adjacent | N≤0 | 3 dots adjacent | N≤0 | Dark dot | Random | N≤2 | 2 dots adjacent | N≤0 | 3 dots adjacent | N≤0 | Distance | 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. | 5mm | Total bright and dark dot | | N≤4 |
|---------------------------|---|--|------|--------|---------------|------------|--------|-----|-----------------|-----|-----------------|-----|----------|--------|-----|-----------------|-----|-----------------|-----|----------|---|-----|---------------------------|--|-----|
| Item | Zone A | Acceptable Qt | | | | | | | | | | | | | | | | | | | | | | | |
| Bright dot | Random | N≤2 | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 dots adjacent | N≤0 | | | | | | | | | | | | | | | | | | | | | | | |
| | 3 dots adjacent | N≤0 | | | | | | | | | | | | | | | | | | | | | | | |
| Dark dot | Random | N≤2 | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 dots adjacent | N≤0 | | | | | | | | | | | | | | | | | | | | | | | |
| | 3 dots adjacent | N≤0 | | | | | | | | | | | | | | | | | | | | | | | |
| Distance | 1. Minimum Distance Between Bright dots. 2. Minimum Distance Between dark dots 3. Minimum Distance Between dark and bright dot. | 5mm | | | | | | | | | | | | | | | | | | | | | | | |
| Total bright and dark dot | | N≤4 | | | | | | | | | | | | | | | | | | | | | | | |



| 4.0 | <p>Line defect (LCD /Polarizer backlight black/white line, scratches, stain)</p>  <p>W: width. L : length</p> <p>N : Count</p> | <table border="1"> <thead> <tr> <th rowspan="2">Width(mm)</th> <th rowspan="2">Length(m)</th> <th colspan="3">Acceptable Qty</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.03$</td> <td>Ignore</td> <td colspan="2">Ignore</td> <td rowspan="3">Ignore</td> </tr> <tr> <td>$0.03 < W \leq 0.04$</td> <td>$L \leq 3.0$</td> <td colspan="2">$N \leq 2$</td> </tr> <tr> <td>$0.04 < W \leq 0.05$</td> <td>$L \leq 2.0$</td> <td colspan="2">$N \leq 1$</td> </tr> <tr> <td>$W > 0.05$</td> <td colspan="4">Define as spot defect</td> </tr> </tbody> </table> | Width(mm) | Length(m) | Acceptable Qty | | | A | B | C | $\Phi \leq 0.03$ | Ignore | Ignore | | Ignore | $0.03 < W \leq 0.04$ | $L \leq 3.0$ | $N \leq 2$ | | $0.04 < W \leq 0.05$ | $L \leq 2.0$ | $N \leq 1$ | | $W > 0.05$ | Define as spot defect | | | |
|----------------------|---|--|--------------|------------|----------------|----------------|--|---|---|---|------------------|--------|--------|--|--------|----------------------|--------------|------------|--|----------------------|--------------|------------|--|------------|-----------------------|--|--|--|
| | | Width(mm) | | | Length(m) | Acceptable Qty | | | | | | | | | | | | | | | | | | | | | | |
| | | | A | B | | C | | | | | | | | | | | | | | | | | | | | | | |
| | | $\Phi \leq 0.03$ | Ignore | Ignore | | Ignore | | | | | | | | | | | | | | | | | | | | | | |
| | | $0.03 < W \leq 0.04$ | $L \leq 3.0$ | $N \leq 2$ | | | | | | | | | | | | | | | | | | | | | | | | |
| $0.04 < W \leq 0.05$ | $L \leq 2.0$ | $N \leq 1$ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| $W > 0.05$ | Define as spot defect | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.0 | Electronic Components SMT. | Not allow missing parts , solderless connection , cold solder joint , mismatch , The positive and negative polarity opposite | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.0 | Display color & Brightness. | <p>1. Color : Measuring the color coordinates, The measurement standard according to the datasheet or samples.</p> <p>2. Brightness : Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.</p> | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7.0 | LCD Mura/Waving/Hot spot | Not visible through 5% ND filter in 50% gray or judge by limit sample if necessary. | | | | | | | | | | | | | | | | | | | | | | | | | | |

Criteria (functional items)

| Number | Items | Criteria (mm) |
|--------|-----------------------|---------------|
| 1 | No display | Not allowed |
| 2 | Missing segment | Not allowed |
| 3 | Short | Not allowed |
| 4 | Backlight no lighting | Not allowed |



Reliability Test Result

| Item | Condition | Inspection after test |
|--|--|--|
| High Temperature Operating | 70°C,96HR | Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value. |
| Low Temperature Operating | -20°C, 96HR | |
| High Temperature Storage | 80°C, 96HR | |
| Low Temperature Storage | -30°C, 96HR | |
| High Temperature & High Humidity Operating | +60°C, 90% RH ,96 hours. | |
| Thermal Shock (Non-operation) | -30°C,30 min ↔ +80°C,30 min, Change time:5min 20CYC. | |
| ESD test | C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±6KV, 5 times; (Environment: 15°C~35°C, 30%~60%). | |
| Vibration (Non-operation) | Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition). | |
| Box Drop Test | 1 Corner 3 Edges 6 faces,80cm(MEDIUM BOX) | |

Remark:

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 5~10pcs.
- 3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.
- 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
- 5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. The color fading mura of polarizing filter should not care.



Cautions and Handling Precautions

1. Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.

Do not warp or twist the module during assembly work.

(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.

(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.

(4) Do not allow drops of water or chemicals to remain on the display surface.

If you have the droplets for a long time, staining and discoloration may occur.

(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.

Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static; it may cause damage to the CMOS ICs.

(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.

(10) Do not disassemble the module.

(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.

(12) Pins of I/F connector shall not be touched directly with bare hands.

(13) Do not connect, disconnect the module in the "Power ON" condition.

(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence & 6.2 Power Off Sequence

2. Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.

It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%

(2) Do not store the TFT-LCD module in direct sunlight.

(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.

(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.

In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.

(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

