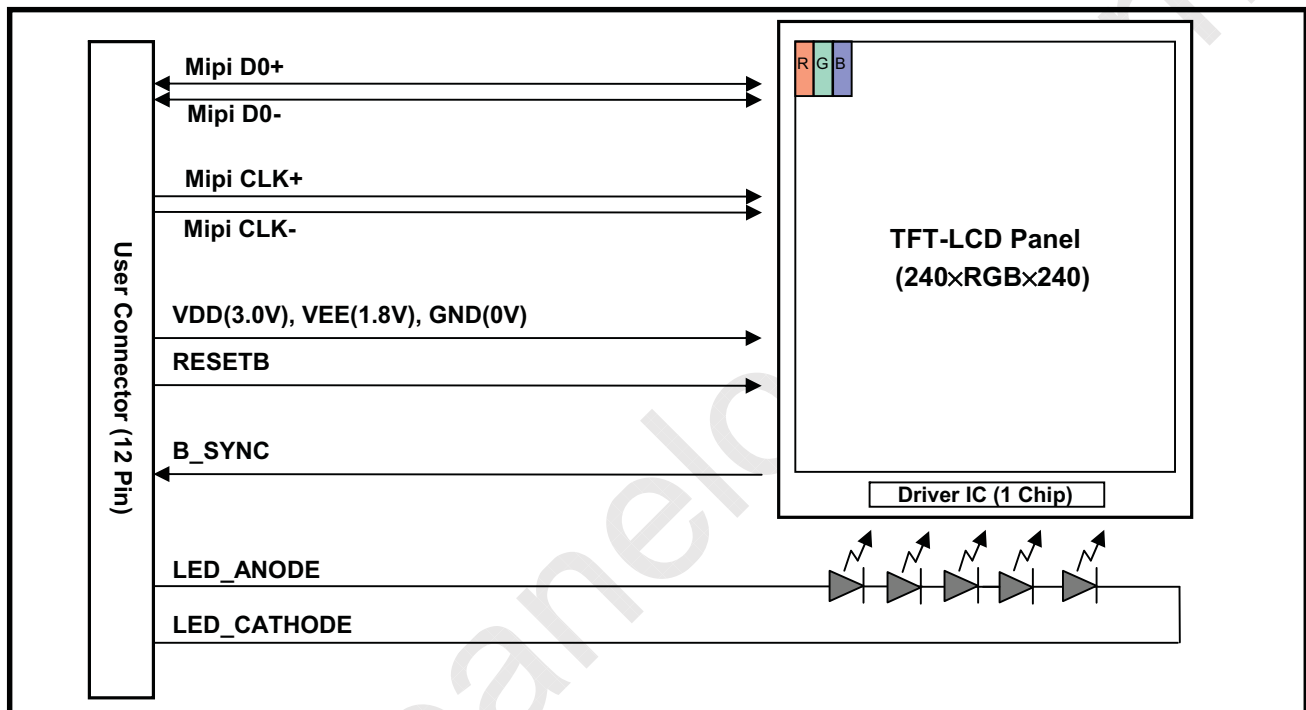


**LH154Q01**  
**Liquid Crystal Display****Product Specification****1. GENERAL DESCRIPTION**

The LH154Q01 is a Color Active Matrix Liquid Crystal Display with Light Emission Diode(LED) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is transmissive type display operating in the normally white mode. This TFT-LCD has 1.54 inch diagonally measured active display area with (240\*RGB\*240) resolution. Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes.

**Block Diagram****Fig 1.1 Block Diagram of TFT-LCD Module with LED Backlight Unit****General Features**

| Item               | Specification  |
|--------------------|--|
| Active Screen Size | 1.54" diagonal   |
| Outline Dimension  | 31.82 (H) x 33.72 (V) x 1.147 (T) Typ.                         |
| Pixel Pitch        | 0.1155(H) × 0.1155(V)  |
| Pixel Format       | 240(H) X 240 (V) (RGB Stripe)                                  |
| Color Depth        | 18-bits (R6, G6, B6)   |
| Interface          | MIPI 1-lane 24-bits (D-PHY version 0.92, DSI version 1.01 r11) |
| Power Consumption  | 205mW (max. B/L on @ 11.0mA), 25mW (max. B/L off)              |
| Luminance          | 450nit(typ.) @ 11.0mA  |
| Viewing Direction  | 6:30 o'clock (Non-inversion)                                   |

**Ver. 0.1**

**LH154Q01**  
**Liquid Crystal Display****Product Specification****2. ABSOLUTE MAXIMUM RATINGS**

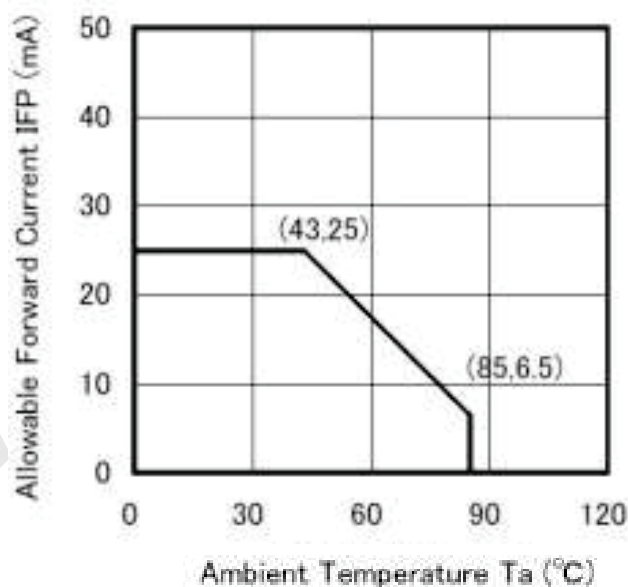
The following are maximum values which, if exceeded, may cause faulty operation or damage to the unit.

**Table 2.1 Absolute Maximum Ratings**

| Parameter          | Symbol    | Values |     | Units | Notes |
|--------------------|-----------|--------|-----|-------|-------|
|                    |           | Min    | Max |       |       |
| Power Supply Input | VDD       | -0.3   | 4.0 | V     |       |
| Power Supply Input | VEE       | -0.3   | 4.0 | V     |       |
| LED Current        | $I_{LED}$ | -      | 25  | mA    | 1, 2  |

Notes:

1. Applies to each LED individually.
2. Allowable forward current is refer to Fig 2.1

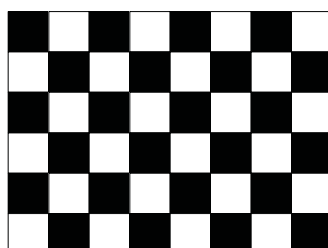
**Fig 2.1 Ambient Temperature vs. Allowable Forward Current**

**LH154Q01**  
**Liquid Crystal Display****Product Specification****3. ELECTRICAL SPECIFICATIONS****3-1. ELECTRICAL CHARACTERISTICS****Table 3.1 Electrical Characteristics Of TFT-LCD Module**

| Parameter                    | Symbol   | Values       |     |              | Units | Notes |
|------------------------------|----------|--------------|-----|--------------|-------|-------|
|                              |          | Min          | Typ | Max          |       |       |
| Power Supply Input (Analog)  | VDD      | 2.9          | 3.0 | 3.1          | V     |       |
| Power Supply Input (Digital) | VEE      | 1.7          | 1.8 | 1.9          | V     |       |
| “H”Level Input Voltage       | $V_{IH}$ | $0.8 V_{EE}$ | -   | -            | V     |       |
| “L”Level Input Voltage       | $V_{IL}$ | -            | -   | $0.2 V_{EE}$ | V     |       |
| Power Consumption, Panel     | $P_B$    |              | 20  | 25           | mW    | 1     |

Notes:

1. Large black/white checker pattern(20 pixel blocks) at 60Hz

White : 64Gray  
Black : 0Gray**3-2. BACK LIGHT UNIT**

The edge-lighting type of back light unit consists of 5 LEDs which is connected in serial.

**Table 3.2 Electrical Characteristics Of Back Light Unit**

| Parameter           | Symbol    | Values |      |      | Units | Notes |
|---------------------|-----------|--------|------|------|-------|-------|
|                     |           | Min    | Typ. | Max  |       |       |
| LED Current         | $I_{LED}$ | -      | 10.5 | 25   | mA    |       |
| LED Forward Voltage | $V_{LED}$ | -      | 15.5 | 17.0 | V     |       |

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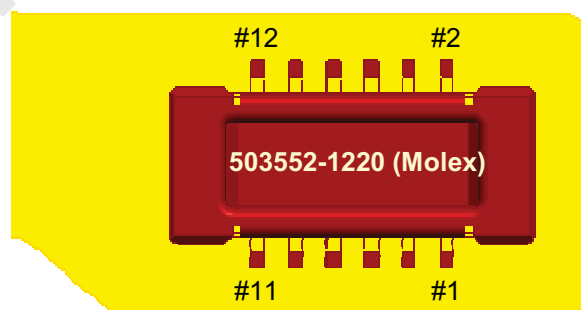
**LH154Q01**  
**Liquid Crystal Display****Product Specification****3-3. INTERFACE CONNECTIONS**

LCD Connector: 503552-1220 (Molex)

System Mating Connector: 503548-1220 (Molex)

**Table 3.3 Module Connector Pin Configuration**

| Pin | Signal | I/O | Description                  |
|-----|--------|-----|------------------------------|
| 1   | CLKP   | I/O | MIPI Clock                   |
| 2   | VDD    | -   | 3.0V Power Supply            |
| 3   | CLKN   | I/O | MIPI Clock                   |
| 4   | VEE    | -   | 1.8V Power Supply            |
| 5   | GND    | -   | Ground                       |
| 6   | B_Sync | O   | Synchronization Pulse Signal |
| 7   | D0P    | I/O | MIPI Data                    |
| 8   | Reset  | I   | Reset (Active Low)           |
| 9   | D0N    | I/O | MIPI Data                    |
| 10  | LED+   | O   | LED Anode                    |
| 11  | GND    | -   | Ground                       |
| 12  | LED-   | O   | LED Cathode                  |

**Fig 3.1 Connector Diagram**

Note:

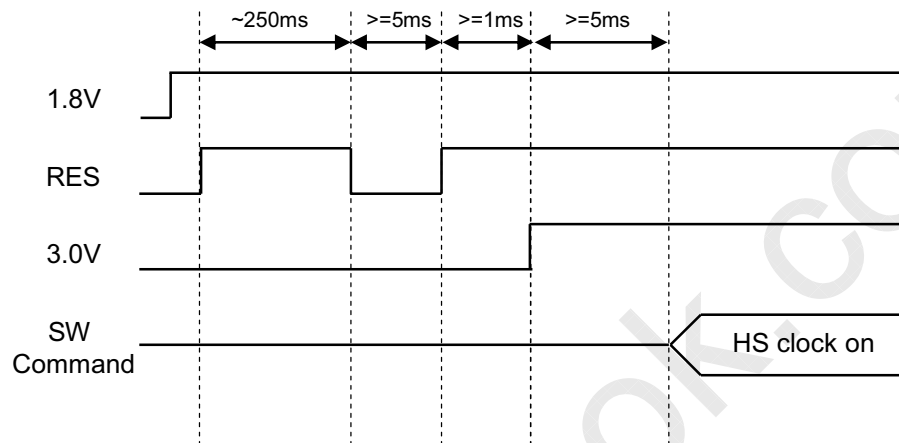
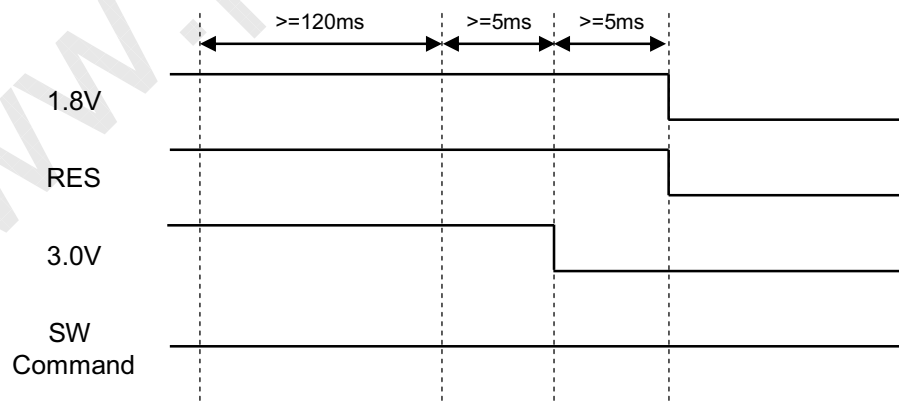
1. All GND(ground) pins should be connected together.

**Ver. 0.1**

**LH154Q01**  
**Liquid Crystal Display****Product Specification****3-4. COLOR INPUT DATA REFERENCE****Table 3.4 Color vs. Data**

| Display Colors   |                              | Data Signal |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |   |   |   |   |   |
|------------------|------------------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|---|---|---|---|---|
|                  |                              | R0          | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 |   |   |   |   |   |   |
| Basic Color      | Black                        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | Blue                         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 |   |
|                  | Green                        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | Cyan                         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 |   |
|                  | Red                          | 0           | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | Magenta                      | 0           | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 | 1 |
|                  | Yellow                       | 0           | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 | 0 |
|                  | White                        | 0           | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 | 1 |
| Red Gray Scale   | Black                        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | GS1                          | 0           | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | Darker<br>↑<br>↓<br>Brighter | 0           | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  |                              | 0           | 0  | •  | •  | •  | •  | •  | •  | 0  | 0  | •  | •  | •  | •  | •  | •  | 0  | 0  | •  | •  | •  | •  | •  | •  | • | • | • | • | • | • |
|                  | 0                            | 0           | 1  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | GS62                         | 0           | 0  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | Red                          | 0           | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
| Green Gray Scale | Black                        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | GS1                          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | Darker<br>↑<br>↓<br>Brighter | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  |                              | 0           | 0  | •  | •  | •  | •  | •  | •  | 0  | 0  | •  | •  | •  | •  | •  | •  | 0  | 0  | •  | •  | •  | •  | •  | •  | • | • | • | • | • | • |
|                  | 0                            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | GS62                         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | Green                        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
| Blue Gray Scale  | Black                        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | GS1                          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  | Darker<br>↑<br>↓<br>Brighter | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0 | 0 | 0 | 0 | 0 |   |
|                  |                              | 0           | 0  | •  | •  | •  | •  | •  | •  | 0  | 0  | •  | •  | •  | •  | •  | •  | 0  | 0  | •  | •  | •  | •  | •  | •  | • | • | • | • | • | • |
|                  | 0                            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 |   |
|                  | GS62                         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 |   |
|                  | Blue                         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1 | 1 | 1 | 1 | 1 |   |

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**LH154Q01**  
**Liquid Crystal Display****Product Specification****3-5. Power On/Off Sequence****Power On Sequence****Fig 3.2 Power On Requirements****Power Off Sequence****Fig 3.3 Power Off Requirements**

**LH154Q01**  
**Liquid Crystal Display****Product Specification****3-7. Software Flow**

| Power on |          |       |       |  |
|----------|----------|-------|-------|--|
| Step     | Register | Data  | Delay | Command                                |
| 1        |          |       |       | VEE on (Typ 1.8V)                      |
|          |          |       | 10us  |  |
| 2        |          |       |       | H/W reset set to HIGH                  |
|          |          |       | 1ms   | D-IC Logic power settlement            |
| 3        |          |       |       | VDD on (Typ 3.0V)                      |
|          |          |       | 5ms   | OSC stabilization & NVM loading        |
| 4        |          |       |       | Turn on high-speed clock (HS clock on) |
|          |          |       | 10us  | For settlement                         |
| 5        | 0x11     |       |       | Sleep Out                              |
|          |          |       | 120ms |  |
|          |          |       | 40ms  | Wait 2 frames                          |
| 6        | 0x36     | 0x08  |       | RGB/BGR order change                   |
| 7        | 0x2C     | Image |       | Start to send image data (HS data on)  |
| 8        | 0x29     |       |       | Display On                             |
| 9        |          |       |       | Turn on Backlight                      |

| Power off |          |      |       |  |
|-----------|----------|------|-------|--|
| Step      | Register | Data | Delay | Command                                  |
| 1         |          |      |       | Turn off Backlight                       |
|           |          |      | 1ms   |  |
| 2         | 0x28     |      |       | Display off                              |
|           |          |      | 5ms   |  |
| 3         | 0x10     |      |       | Sleep In                                 |
|           |          |      | 120ms | Discharge time                           |
| 4         |          |      |       | Stop to send image data (HS data off)    |
| 5         |          |      |       | Turn off high-speed clock (HS clock off) |
|           |          |      | 10us  |  |
| 6         |          |      |       | VDD off (Typ 3.0V)                       |
|           |          |      | 5ms   | For settlement                           |
| 7         |          |      |       | HW reset set to LOW                      |
|           |          |      | 5ms   |  |
| 8         |          |      |       | VEE off (Typ 1.8V)                       |

**Table 3.5 Software Flowchart****Ver. 0.1**



**LH154Q01**  
**Liquid Crystal Display**

**Product Specification**

**4. OPTICAL CHARACTERISTICS**

**4-1. Optical Characteristics – Backlight On**

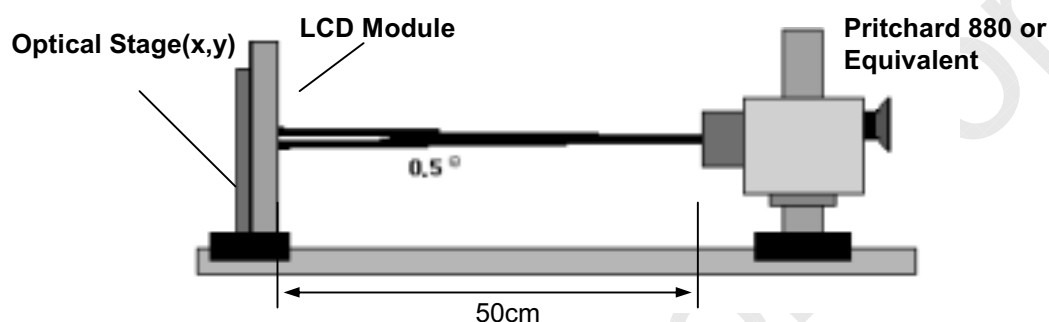
| Parameter             | Symbol            | Condition                                | Min. | Typ.  | Max. | Unit              | Remarks           |
|-----------------------|-------------------|--|------|-------|------|-------------------|-------------------|
| Viewing Angle Range   | $\Theta_{UP}$     | $CR \geq 10$                             | 40   | 50    |      | °(degree)         | Note 3            |
|                       | $\Theta_{DOWN}$   |  | 40   | 50    |      | °(degree)         | Note 3            |
|                       | $\Theta_{LEFT}$   |  | 40   | 50    |      | °(degree)         | Note 3            |
|                       | $\Theta_{RIGHT}$  |  | 40   | 50    |      | °(degree)         | Note 3            |
| Contrast Ratio        | CR                | Optimal                                  | 100  | 150   |      | --                | Note 2            |
| Brightness            | Y                 | $I_{LED} = 11.0mA$                       | 400  | 450   |      | cd/m <sup>2</sup> | Note 1<br>[PR880] |
| Brightness Uniformity | Y                 | $I_{LED} = 11.0mA$                       | 80   |       |      | %                 | Note 5<br>[PR880] |
| Flicker               | F                 | Optimal                                  |      |       | 10   | %                 | Note 6            |
| Response Time         | $\tau_f + \tau_r$ | $\Theta = 0^\circ$<br>$T_a = 25^\circ C$ |      | 35    | 50   | ms                | Note 4            |
| White Chromaticity    | Wx                | $\Theta = 0^\circ$<br>$T_a = 25^\circ C$ |      | 0.309 |      |                   | Note 1<br>[PR650] |
|                       | Wy                |  |      | 0.324 |      |                   |                   |
| Red Chromaticity      | Rx                |  |      | 0.610 |      |                   |                   |
|                       | Ry                |  |      | 0.345 |      |                   |                   |
| Green Chromaticity    | Gx                |  |      | 0.320 |      |                   |                   |
|                       | Gy                |  |      | 0.555 |      |                   |                   |
| Blue Chromaticity     | Bx                |  |      | 0.150 |      |                   |                   |
|                       | By                |  |      | 0.120 |      |                   |                   |
| Color Gamut           | NTSC              |  |      | 50    |      | %                 |                   |

1. Optical Test Equipment & Method Refer to Note 1,2,3,4,5,6.



**LH154Q01**  
**Liquid Crystal Display****Product Specification****[Note 1] Optical Test Equipment Setup**

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm from the LCD surface. In case of backlight on, measured on the center area of the panel by PHOTO RESEARCH photometer PR-880&PR650 or Equivalent.

**Fig 4.1 Backlight On (Optical Characteristic Measurement Equipment and Method)****[Note 2]**

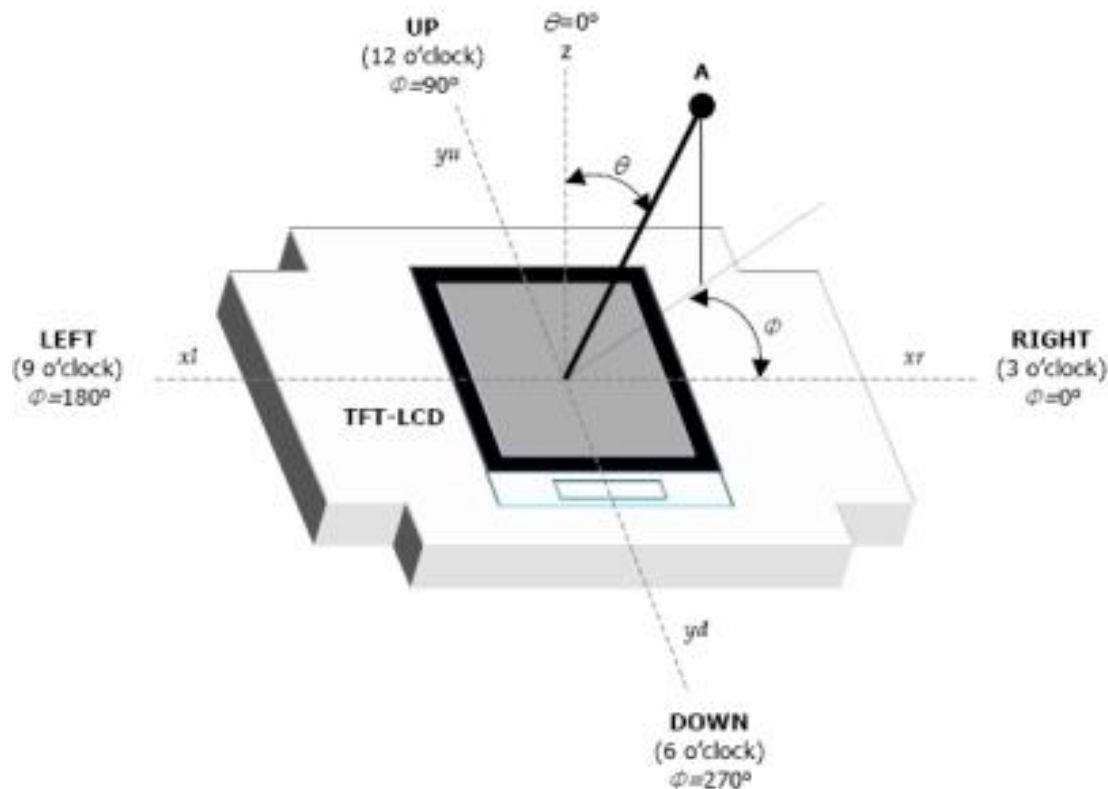
Contrast Ratio is defined as follows ;

$$\text{Contrast Ratio(CR)} = \frac{\text{Photo detector output with LCD being "White"}}{\text{Photo detector output with LCD being "Black"}}$$

**LH154Q01**  
**Liquid Crystal Display****Product Specification**

[Note 3]

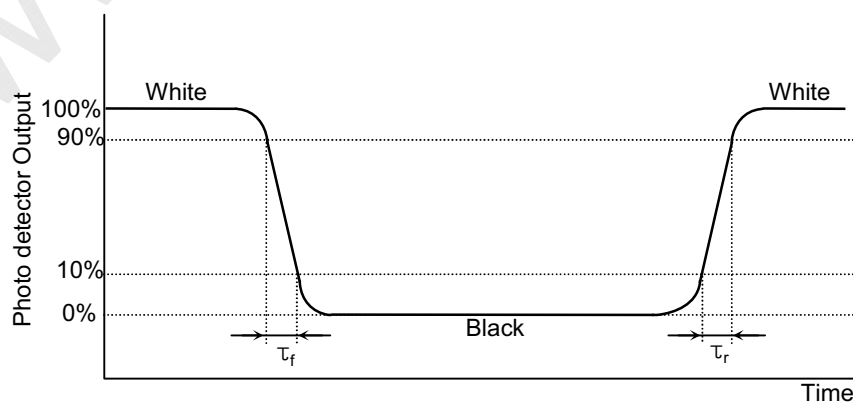
Viewing Angle Range is defined as follows;



**Fig 4.2 Viewing Angle Definitions**

[Note 4]

Response time is obtained by measuring the transition time of photo detector output, when input signals are applied so as to make the area "black" to and from "white".



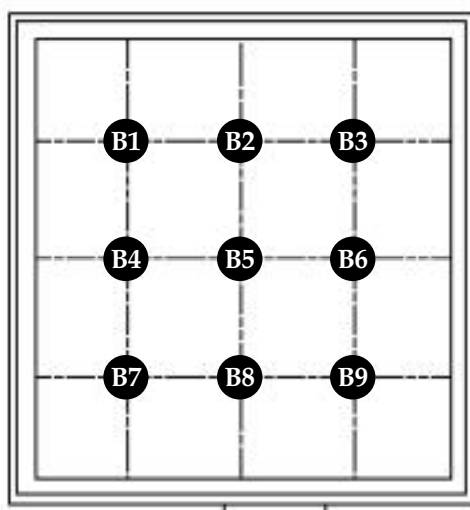
**Fig 4.3 Response Time Definition**

**LH154Q01**  
**Liquid Crystal Display****Product Specification**

[Note 5]

The brightness measurement is taken at point B5.

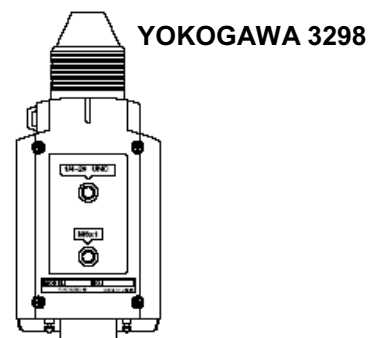
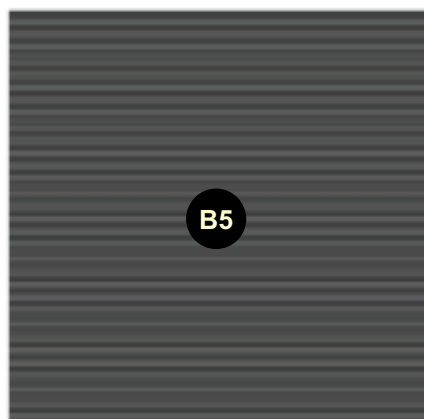
$$\text{Brightness Uniformity} = \frac{\text{Minimum photo detector output for B1-B9 with all pixels white}}{\text{Maximum photo detector output for B1-B9 with all pixels white}} \times 100$$



**Fig 4.4 Brightness Measurement Points**

[Note 6]

The Flicker measurement is taken at center area of the panel (B5).  
Measurement equipment is YOKOGAWA 3298.  
Measurement patten is Black and Middle gray horizontal.



**Fig 4.5 Flicker Measurement Points**

**LH154Q01**  
**Liquid Crystal Display****Product Specification****5. MECHANICAL CHARACTERISTICS**

The contents provide general mechanical characteristics for the model.

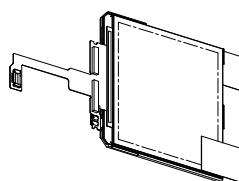
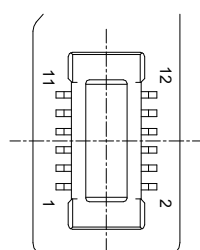
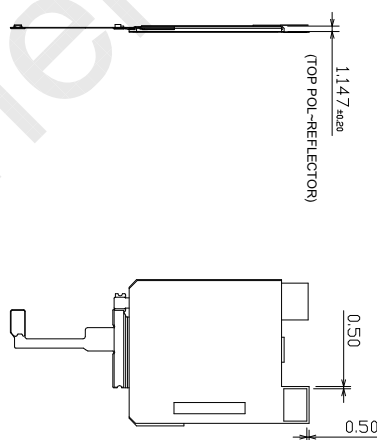
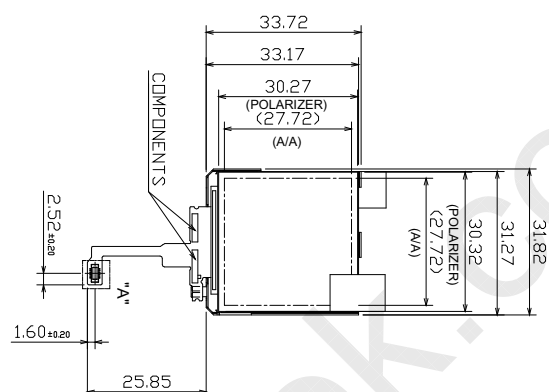
In addition the figures in the next page are detailed mechanical drawing of the LCD.

| DIMENSION  | MIN   | TYP   | MAX   | UNIT |
|------------|-------|-------|-------|------|
| HORIZONTAL | 31.52 | 31.82 | 32.12 | mm   |
| VERTICAL   | 33.42 | 33.72 | 34.02 | mm   |
| THICKNESS  | 0.947 | 1.147 | 1.347 | mm   |

**Ver. 0.1**

**LH154Q01**  
**Liquid Crystal Display****Product Specification****[ Outline Dimension ]**

- NOTES
1. Unspecified Dimension Tolerances are  $\pm 0.3\text{mm}$
  2. Weight: 2.5g(Typ.), 3.0g(Max.)
  3. Designer's Approval is Required before Mass Production
  4. All Material should comply with Halogen free



**LH154Q01**  
**Liquid Crystal Display****Product Specification****6. RELIABILITY TEST**

| No. | Test Items                                   | Test Condition        | Remark |
|-----|--|-----------------------|--------|
| 1   | Low Temperature Storage                      | Ta = -30℃ 240hrs      |        |
| 2   | High Temperature Storage                     | Ta = 70℃ 240hrs       |        |
| 3   | Low Temperature Operation                    | Ta = -20℃ 240hrs      |        |
| 4   | High Temperature Operation                   | Ta = 60℃ 240hrs       |        |
| 5   | High Temperature and High Humidity Operation | Ta = 50℃ 90%RH 120hrs |        |
| 6   | High Temperature and Humidity Storage        | Ta = 60℃ 90%RH 120hrs |        |

## { Result Evaluation Criteria }

TFT-LCD Panel should be at room temperature for 2 hours after the reliability test is over.  
There should be no particular change which might affect the practical display function  
and the display quality should be conducted under normal operating condition.

**Ver. 0.1**

**LH154Q01**  
**Liquid Crystal Display****Product Specification****7. International Standards****7-1. Safety**

- a) UL 60950-1, Second Edition, Underwriters Laboratories Inc.  
Information Technology Equipment - Safety - Part 1 : General Requirements.
- b) CAN/CSA C22.2 No.60950-1-07, Second Edition, Canadian Standards Association.  
Information Technology Equipment - Safety - Part 1 : General Requirements.
- c) EN 60950-1:2006 + A11:2009, European Committee for Electrotechnical Standardization (CENELEC).  
Information Technology Equipment - Safety - Part 1 : General Requirements.

**7-2. Environment**

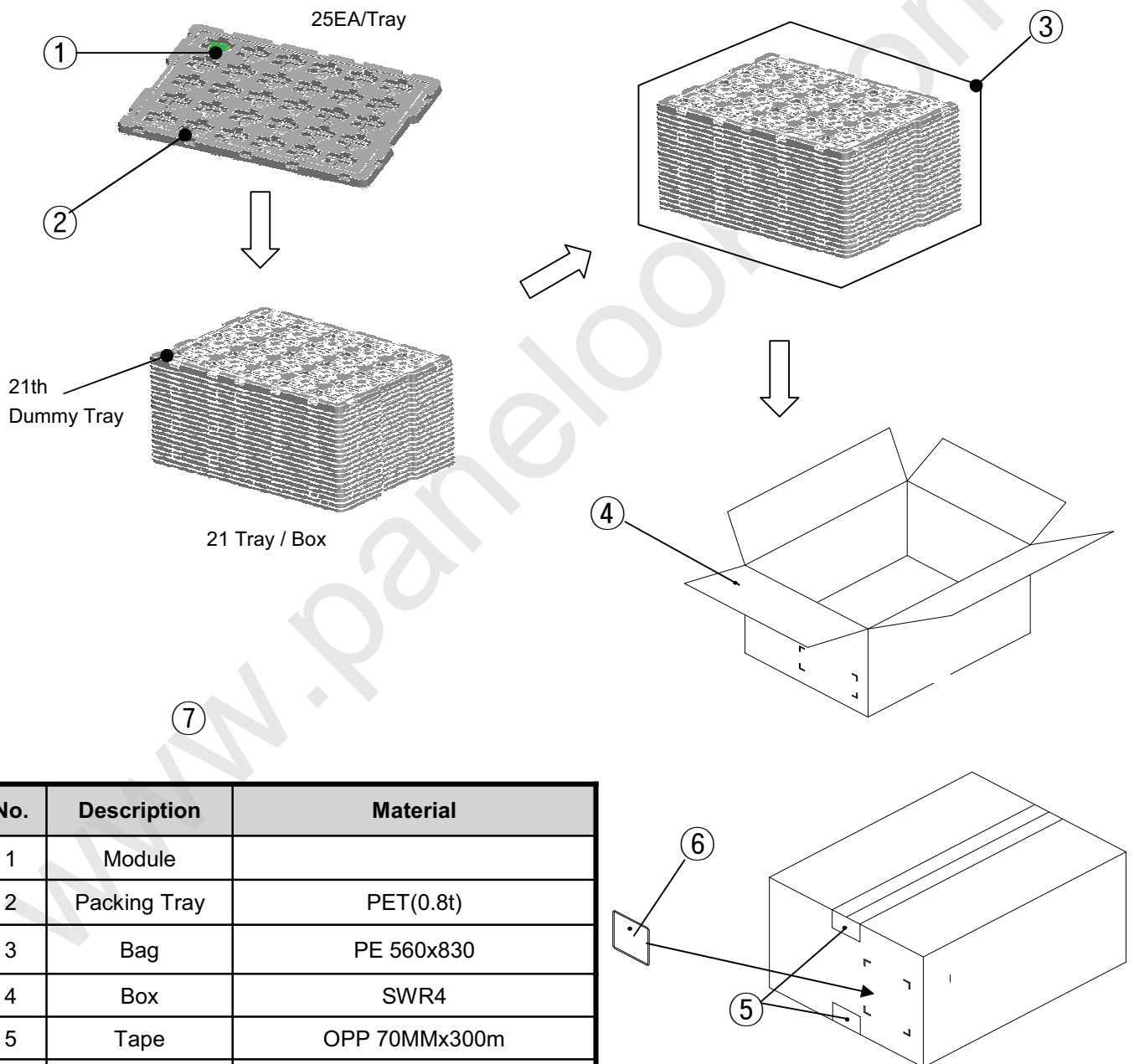
- a) RoHS, Directive 2002/95/EC of the European Parliament and of the council of 27 January 2003

**7-3. EMC**

- a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz." American National Standards Institute(ANSI), 1992
- b) CISPR22 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special Committee on Radio Interference.
- c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization.(CENELEC), 1998  
( Including A1: 2000 )

**LH154Q01**  
**Liquid Crystal Display****Product Specification****8. PACKING**

- a) Package Quantity in One Box : 500 pcs
- b) Box Size : 475mm X 348mm X 210mm
- c) 1Box = 20(Full Tray) + 1(Dummy / Top Tray) = 21 Tray



| No. | Description  | Material         |
|-----|--------------|------------------|
| 1   | Module       |                  |
| 2   | Packing Tray | PET(0.8t)        |
| 3   | Bag          | PE 560x830       |
| 4   | Box          | SWR4             |
| 5   | Tape         | OPP 70MMx300m    |
| 6   | Label        | Art Paper 100x70 |



**LH154Q01**  
**Liquid Crystal Display****Product Specification****9. PRECAUTIONS**

Please pay attention to the following when you use this TFT LCD module.

**9-1. ASSEMBLY PRECAUTIONS**

- (1) Please attach a transparent protective plate to the surface in order to protect the polarizer.  
Transparent protective plate should have sufficient strength in order to resist external force.
- (2) You should adopt radiation structure to satisfy the temperature specification.
- (3) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuit break by electro-chemical reaction.
- (4) Do not touch, push or rub the exposed polarizers with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment.  
Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics deteriorate the polarizer.)
- (5) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaked with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (6) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (7) Do not open the case because inside circuits do not have sufficient strength.
- (8) The metal case of a module should be contacted to electrical ground of your system.

**9-2. OPERATING PRECAUTIONS**

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :  
 $V = \pm 200\text{mV}$  (Over and under shoot voltage)
- (2) Response time depends on the temperature. (In lower temperature, it becomes longer.)
- (3) Brightness depends on the temperature. (In lower temperature, it becomes lower.)  
And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (4) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (5) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (6) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

**LH154Q01**  
**Liquid Crystal Display****Product Specification****9-3. ELECTROSTATIC DISCHARGE CONTROL**

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

**9-4. PRECAUTIONS FOR STRONG LIGHT EXPOSURE**

Strong light exposure causes degradation of polarizer and color filter.

**9-5. STORAGE**

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5°C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object.  
It is recommended that they be stored in the container in which they were shipped.

**9-6. HANDLING PRECAUTIONS FOR PROTECTION FILM**

- (1) When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc.
- (2) The protection film is attached to the polarizer with a small amount of glue. If some stress is applied to rub the protection film against the polarizer during the time you peel off the film, the glue is apt to remain on the polarizer.  
Please carefully peel off the protection film without rubbing it against the polarizer.
- (3) When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the polarizer after the protection film is peeled off.
- (4) You can remove the glue easily. When the glue remains on the polarizer surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.