

# **PRODUCT SPECIFICATION** **FOR LCD MODULE**

**Revision:** 1.0`

**Model No:** LS028T34-S-V1

**Module Type:** COG+FPC+B/L

**APPROVED SIGNATURE**

- Approved Product Specification only
- Approved Product Specification and Samples

| <b><u>Prepared By</u></b> | <b><u>Checked By</u></b> | <b><u>Approved By</u></b> |
|---------------------------|--------------------------|---------------------------|
|                           |                          |                           |

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# 1. General Description

LS028T34-S-V1 is a transmissive type a-Si TFT-LCD (amorphous silicon thin film transistor liquid crystal display) module, which is composed of a TFT-LCD panel, a driver circuit and a backlight unit. The panel size is 2.8 inch and the resolution is 240(RGB)\*320, the panel can display up to 262k colors.

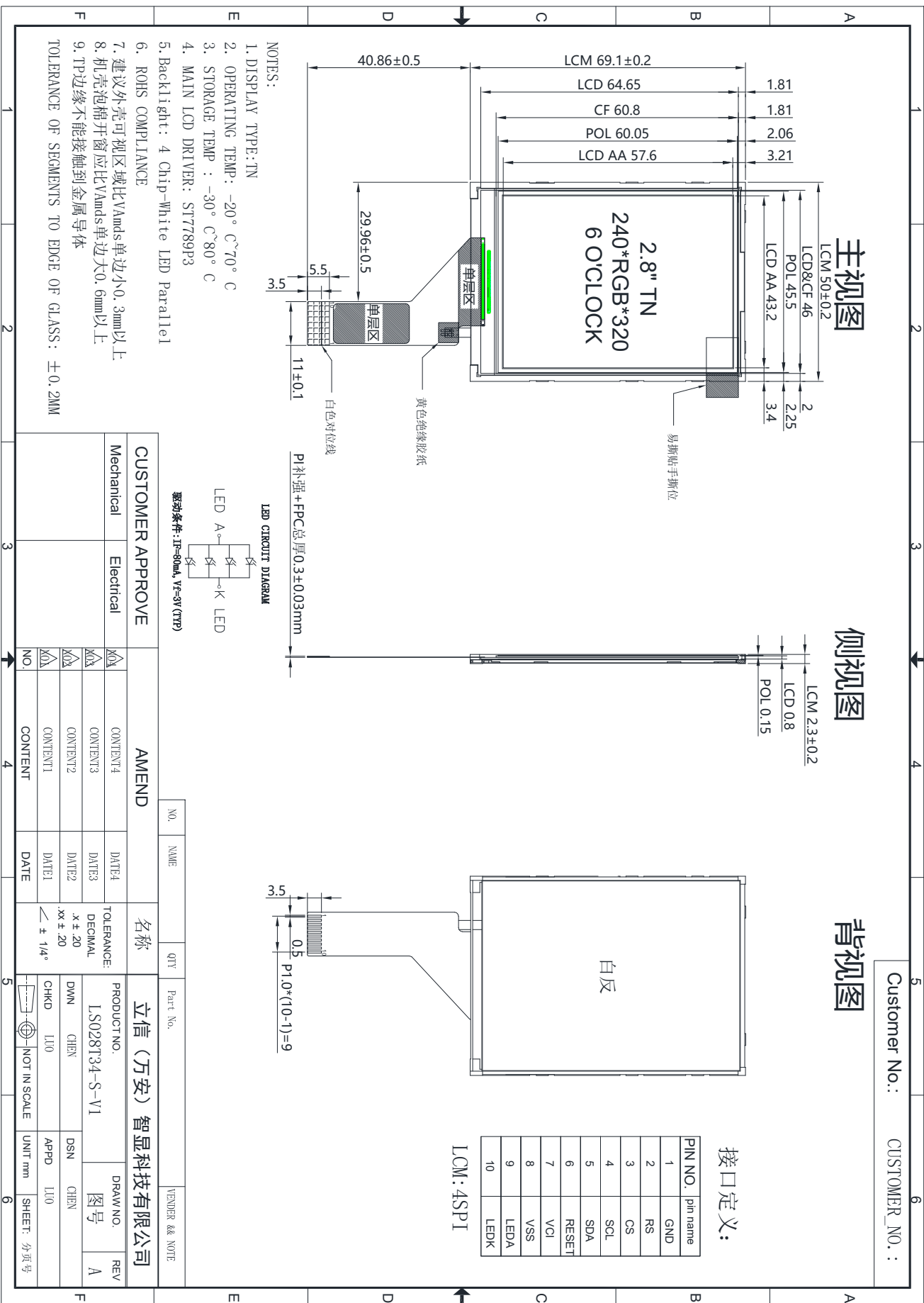
## 2. Physical Features

|                                            |                                      |
|--------------------------------------------|--------------------------------------|
| Display Mode                               | TFT-LCD Module                       |
|                                            | Active matrix TFT, Transmissive type |
| Display Format                             | Graphic 240(RGB)×320 Dot-matrix      |
| Input Data                                 | SPI                                  |
| Viewing Direction<br>(Grayscale Inversion) | TN                                   |
| Drive                                      | ST7789P3                             |

## 3. Mechanical Specification

| Item                | Specification   | Unit  |
|---------------------|-----------------|-------|
| Module size (H×V×D) | 50.0 ×69.1 ×2.3 | mm    |
| Number of dots      | 240(RGB) ×320   | pixel |
| Active area (H×V)   | 43.2×57.6       | mm    |

## 4. Outline Dimension



## 5. Absolute Maximum Ratings

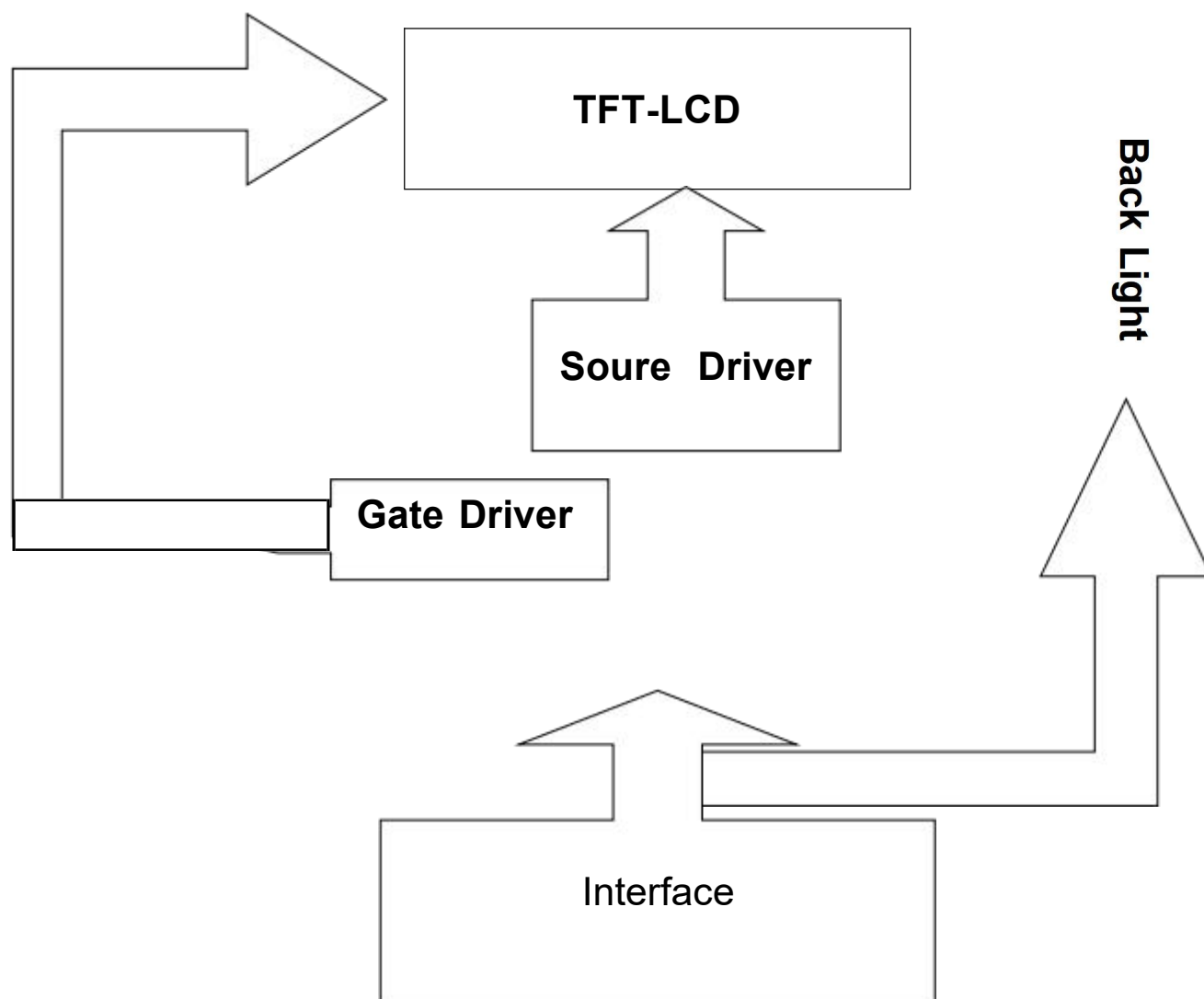
| Item                  | Symbol | Min  | Max | Unit | Remark         |
|-----------------------|--------|------|-----|------|----------------|
| Supply voltage        | VCC    | -0.3 | 4.6 | V    | Note1<br>Note2 |
| Supply voltage        | IOVCC  | -0.3 | 4.6 | V    |                |
| Operating temperature | TOPR   | -10  | 60  | °C   |                |
| Storage temperature   | TSTR   | -20  | 70  | °C   |                |

## 6. Electrical Characteristics

| Item           |         | Symbol | Rating    |      |           | Unit | Remark |
|----------------|---------|--------|-----------|------|-----------|------|--------|
|                |         |        | Min       | Typ  | Max       |      |        |
| Supply voltage |         | VCC    | 2.4       | 2.75 | 3.3       | V    | Note1  |
| Supply voltage |         | IOVCC  | 1.65      | 1.8  | 3.3       | V    |        |
| Input Voltage  | L level | VIL    | 0         | ---  | 0.3*IOVCC | V    |        |
|                | H level | VIH    | 0.7*IOVCC | ---  | IOVCC     | V    |        |

## 7. Module Function Description

### 7- 1. Block Diagram Of LCM



## 7-2. Pin Description

| PIN NO. | Symbol | I/O | Description                     |
|---------|--------|-----|---------------------------------|
| 1       | GND    | P   | Ground                          |
| 2       | RS     | I   | Command and Data select pin     |
| 3       | CS     | I   | Chip select pin                 |
| 4       | SCL    | I   | Serial clock pin                |
| 5       | SDA    | I/O | Serial data input/output PIN    |
| 6       | RESET  | I   | Reset pin.                      |
| 7       | VCI    | P   | power supply                    |
| 8       | VSS    | P   | Ground                          |
| 9       | LED A  | P   | Power for LED backlight anode   |
| 10      | LED K  | P   | Power for LED backlight cathode |

## 7-3 Timing Character

### 7.4.3 Serial Interface Characteristics (4-line serial):

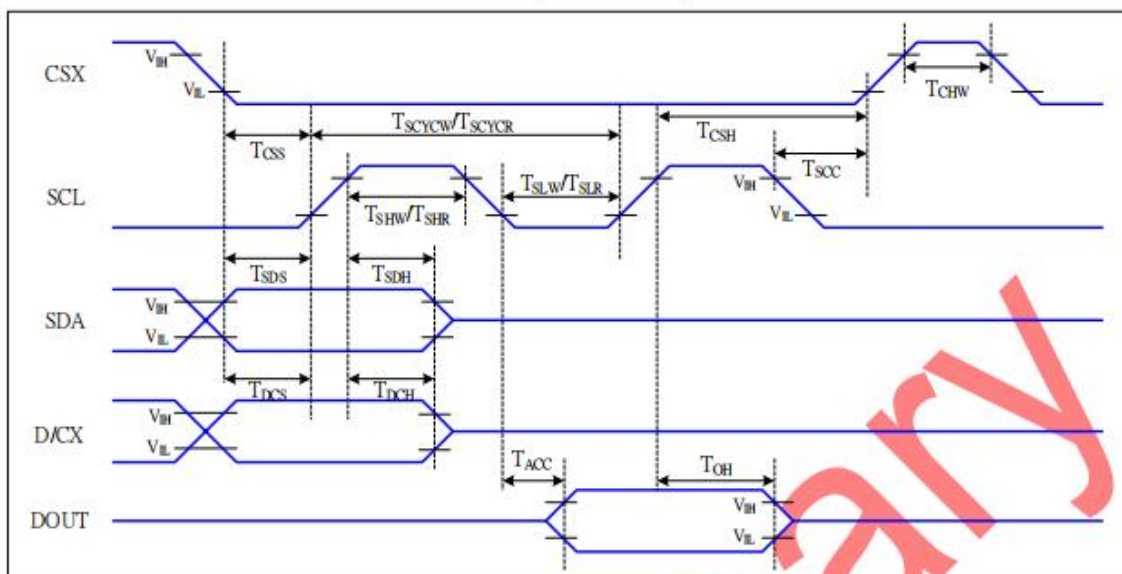


Figure 5 4-line serial Interface Timing Characteristics

$V_{DDI}=1.65$  to  $3.3V$ ,  $V_{DD}=2.4$  to  $3.3V$ ,  $AGND=DGND=0V$ ,  $T_a=25^{\circ}C$

| Signal       | Symbol      | Parameter                      | MIN | MAX | Unit | Description                  |
|--------------|-------------|--------------------------------|-----|-----|------|------------------------------|
| CSX          | $T_{CSS}$   | Chip select setup time (write) | TBD | -   | ns   |                              |
|              | $T_{CSH}$   | Chip select hold time (write)  | TBD | -   | ns   |                              |
|              | $T_{CSS}$   | Chip select setup time (read)  | TBD | -   | ns   |                              |
|              | $T_{SCC}$   | Chip select hold time (read)   | TBD | -   | ns   |                              |
|              | $T_{CHW}$   | Chip select "H" pulse width    | TBD | -   | ns   |                              |
| SCL          | $T_{SCYCW}$ | Serial clock cycle (Write)     | TBD | -   | ns   | -write command & data<br>ram |
|              | $T_{SHW}$   | SCL "H" pulse width (Write)    | TBD | -   | ns   |                              |
|              | $T_{SLW}$   | SCL "L" pulse width (Write)    | TBD | -   | ns   |                              |
|              | $T_{SCYCR}$ | Serial clock cycle (Read)      | TBD | -   | ns   | -read command & data<br>ram  |
|              | $T_{SHR}$   | SCL "H" pulse width (Read)     | TBD | -   | ns   |                              |
|              | $T_{SLR}$   | SCL "L" pulse width (Read)     | TBD | -   | ns   |                              |
| D/CX         | $T_{DCS}$   | D/CX setup time                | TBD | -   | ns   |                              |
|              | $T_{DCH}$   | D/CX hold time                 | TBD | -   | ns   |                              |
| SDA<br>(DIN) | $T_{SDS}$   | Data setup time                | TBD | -   | ns   |                              |
|              | $T_{SDH}$   | Data hold time                 | TBD | -   | ns   |                              |
| DOUT         | $T_{ACC}$   | Access time                    | TBD | TBD | ns   | For maximum $CL=30pF$        |
|              | $T_{OH}$    | Output disable time            | TBD | TBD | ns   | For minimum $CL=8pF$         |

Table 6 4-line serial Interface Characteristics

Note1 : The rising time and falling time ( $T_r$ ,  $T_f$ ) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of  $V_{DDI}$  for Input signals.



#### 7.4.5 Reset Timing:

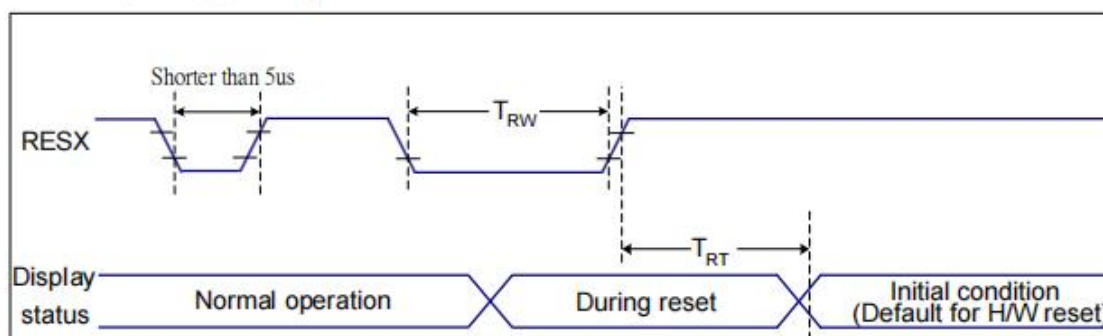


Figure 7 Reset Timing

$V_{DD1}=1.65$  to  $3.3V$ ,  $V_{DD}=2.4$  to  $3.3V$ ,  $AGND=DGND=0V$ ,  $T_a=25^{\circ}C$

| Related Pins | Symbol | Parameter            | MIN | MAX                | Unit |
|--------------|--------|----------------------|-----|--------------------|------|
| RESX         | TRW    | Reset pulse duration | 10  | -                  | us   |
|              | TRT    | Reset cancel         | -   | 5 (Note 1, 5)      | ms   |
|              |        |                      |     | 120 (Note 1, 6, 7) | ms   |

Table 9 Reset Timing

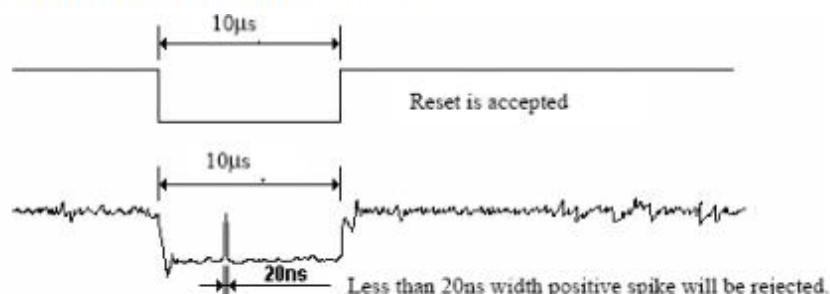
Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time ( $t_{RT}$ ) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

| RESX Pulse          | Action         |
|---------------------|----------------|
| Shorter than 5us    | Reset Rejected |
| Longer than 9us     | Reset          |
| Between 5us and 9us | Reset starts   |

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:



5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

## 8. Electro-Optical Characteristics

| Item                         |            | Symbol | Condition                 | Min. | Typ.  | Max. | Unit | Remark |
|------------------------------|------------|--------|---------------------------|------|-------|------|------|--------|
| Response time                |            | Tr +Tf | $\theta_x = \theta_y = 0$ | ---  | 16    | 25   | ms   | Note 1 |
| Contrast Ratio               |            | CR     |                           | 300  | 500   | ---  | ---  | Note 2 |
| Transmittance                |            | T%     |                           | 5.9  | 4.7   | ---  | %    |        |
| Color Chromaticity (CIE1931) | White      | W x    | $\theta_x = \theta_y = 0$ | ---  | 0.304 | ---  | ---  |        |
|                              |            | W y    |                           | ---  | 0.344 | ---  | ---  |        |
| Viewing angle                | $\theta_T$ |        | CR > 10                   | 35   | 45    | ---  | Deg. | Note 3 |
|                              | $\theta_B$ |        |                           | 35   | 45    | ---  |      |        |
|                              | $\theta_L$ |        |                           | 35   | 50    | ---  |      |        |
|                              | $\theta_R$ |        |                           | 20   | 20    | ---  |      |        |

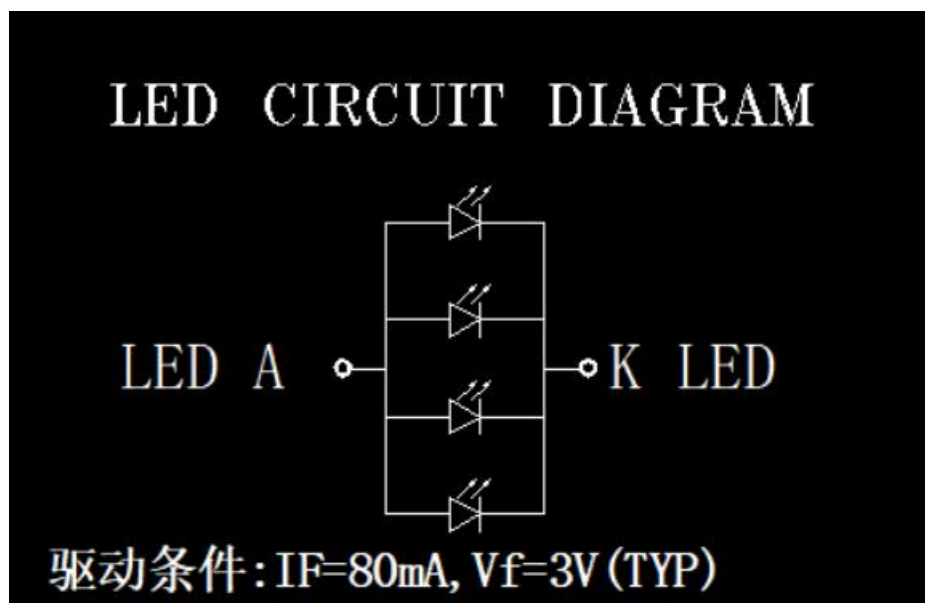
### Note :

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface.
2. Contrast measurements shall be made at viewing angle of  $\theta = 0^\circ$  and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIGURE 1 shown in Appendix) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Center Luminance of white is defined as the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 4 for a total of the measurements per display.
4. The White luminance uniformity on LCD surface is then expressed as :  $\Delta Y = \frac{\text{Minimum Luminance of 9 Points or 5 points}}{\text{Maximum Luminance of 9 Points or 5 points}}$  (See FIGURE 2).
5. The color chromaticity coordinates specified in Table 5. shall be calculated from the spectral data measured with C light. Measurements shall be made at the center of the panel.

**Note(4) Backlight circuit**



## 9.Records Of Version

| Version | Revise Date | Page | Content      |
|---------|-------------|------|--------------|
| 00      | 2026-2-5    | ALL  | New released |
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