

# DATA SHEET

## LCD MODULE

### GMG12864-06D SERIES

*Product specification*

*Version: 00*

**30/Aug/2016**

# GENERAL SPECIFICATION

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MODULE NO. :

GMG12864-06D SERIES

CUSTOMER P/N:

| VERSION NO. | CHANGE DESCRIPTION | DATE       |
|-------------|--------------------|------------|
| 0           | ORIGINAL VERSION   | 2016/08/30 |
|             |                    |            |
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DATE: 2016/08/30

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**1. FUNCTIONS & FEATURES**

- SDGG12864-06D Series LCD type:

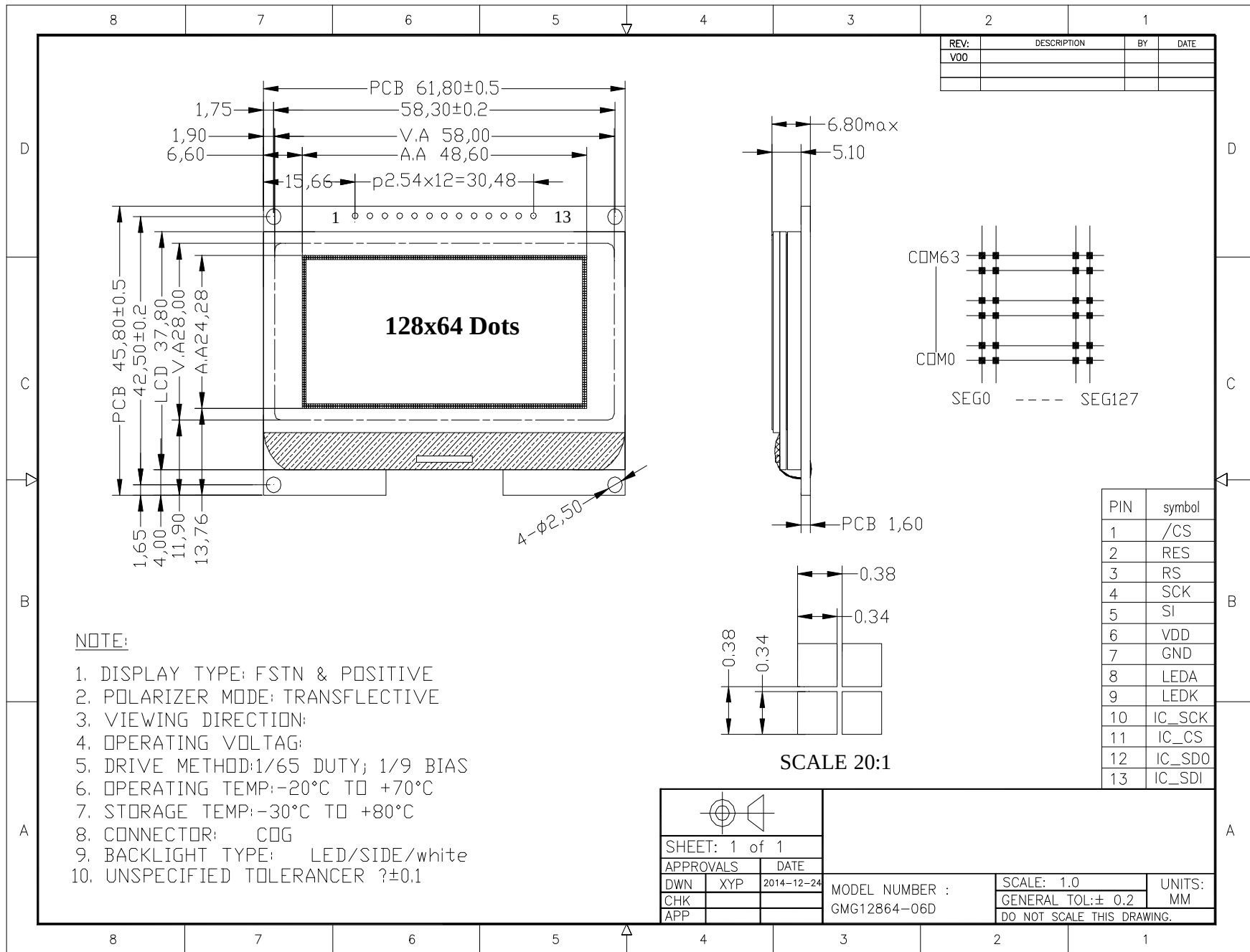
| Module        | LCD Type                         | Remark |
|---------------|----------------------------------|--------|
| SDGG12864-06D | FSTN Transflective Positive Mode |        |

- Display Contents :128 x 64 Dots
- Driving Scheme : 1/65Duty; 1/9Bias
- Viewing Direction :6 O' clock
- Power Supply Voltage : 3.0V.
- Driver IC :ST7565R
- Interface : SPI
- Backlight :white
- Operating Temperature : -20℃ — + 70℃
- Storage Temperature : -30℃ — + 80℃
- RoHS Compliant

**2. MECHANICAL SPECIFICATIONS**

- Outline Dimensions : 61.80(W) x 45.80(L) x 6.80(H)(mm)
- Viewing Area : 58.00 (W) x 28.00(L)(mm)
- Active Area : 48.60 (W) x 24.28 (L)(mm)
- Dot Pitch : 0.38 (W) x 0.38 (L)(mm)
- Dot Size : 0.34 (W) x 0.34 (L)(mm)
- Weight : TBD

## 3. EXTERNAL DIMENSIONS



| PIN | SYMBOL | Descriptions                                                                                                                    |
|-----|--------|---------------------------------------------------------------------------------------------------------------------------------|
| 1   | CS     | Chip Select. Chip is selected when CS0 = "L".                                                                                   |
| 2   | RST    | Hardware reset input pin. When RSTB is "L", internal initialization is executed and the internal registers will be initialized. |
| 3   | CD     | Select Control data or Display data for read/write operation.<br>"L": Control data "H": Display data                            |
| 4   | SCK    | Serial clock input.                                                                                                             |
| 5   | SDA    | Serial data input.                                                                                                              |
| 6   | VDD    | This is a voltage supply pin. It must be connected to external source.                                                          |
| 7   | GND    | Ground of Logic Circuit                                                                                                         |
| 8   | LEDA   | Backlight Anode                                                                                                                 |
| 9   | LEDK   | Backlight Cathode                                                                                                               |
| 10  | IC_SCK | Serial clock input for GT20L16S1Y                                                                                               |
| 11  | IC_CS  | Chip enable input for GT20L16S1Y                                                                                                |
| 12  | IC_SD0 | Serial data output for GT20L16S1Y                                                                                               |
| 13  | IC_SDI | Serial data input for GT20L16S1Y                                                                                                |

## 6. MAXIMUM ABSOLUTE POWER RATINGS

| Item                    | Symbol          | Standard value | Unit |
|-------------------------|-----------------|----------------|------|
| Power supply voltage(1) | $V_{DD}$        | -0.3~+3.6      | V    |
| Power supply voltage(2) | $V_{OUT}, V_0,$ | -0.3 ~ 13.5    | V    |
| Power supply voltage(3) | $V_{IN}$        | -0.3 ~ $V_0$   | V    |
| Operating temperature   | $T_{opr}$       | -20~+70        | °C   |
| Storage temperature     | $T_{stg}$       | -30~+80        | °C   |

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

$$V_{out} > V_0 > V_1 > V_2 > V_3 > V_4$$

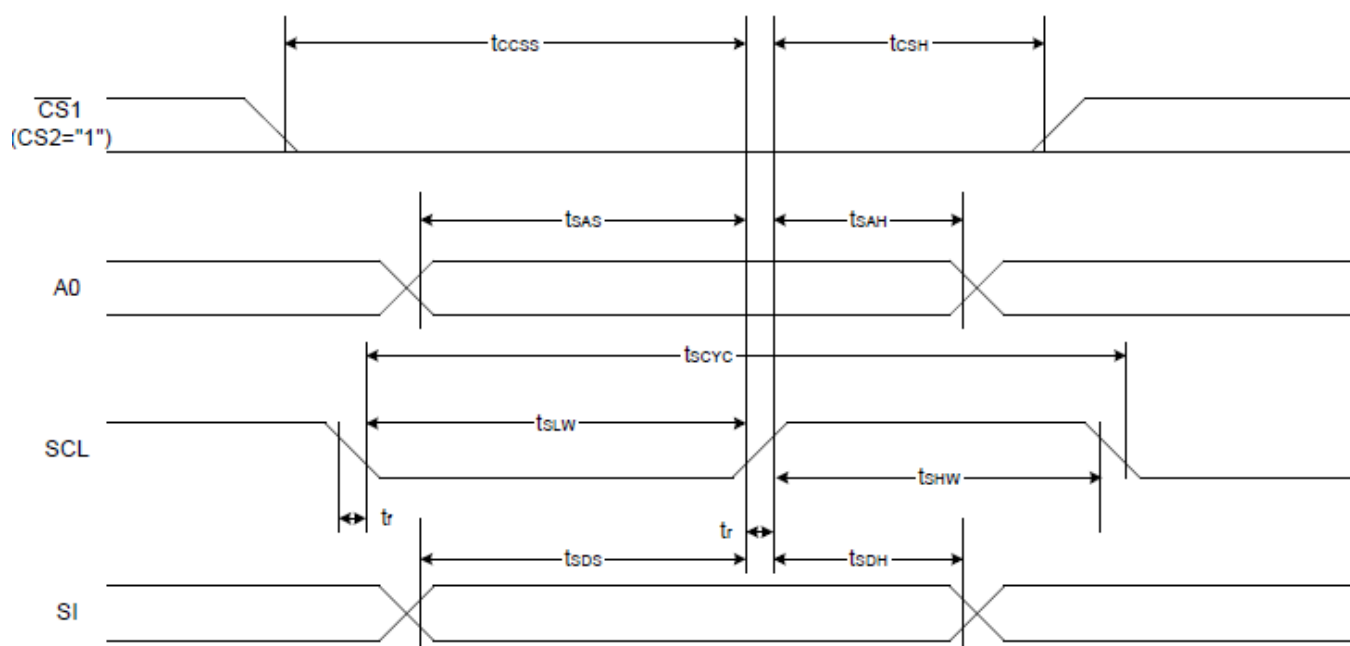
## 7. ELECTRICAL CHARACTERISTICS

### 7-1 DC Characteristics

| Item                | Symbol            | Standard Value |     |     | Test Condition           | Unit |
|---------------------|-------------------|----------------|-----|-----|--------------------------|------|
|                     |                   | Min            | Typ | Max |                          |      |
| Operating Voltage   | $V_{DD} - V_{SS}$ | 2.8            | 3.0 | 3.2 | $T_A = 25^\circ\text{C}$ | V    |
| Supply Current      | $I_{DD}$          | ----           | TBD | 5.0 | --                       | mA   |
| LCD Driving Voltage | $V_0 - V_{SS}$    | 8.8            | 9.0 | 9.2 | $T_A = 25^\circ\text{C}$ | V    |

### 7-2 AC Characteristics

#### The 4-line SPI Interface



| Item                    | Signal | Symbol     | Condition | Rating |      | Units |
|-------------------------|--------|------------|-----------|--------|------|-------|
|                         |        |            |           | Min.   | Max. |       |
| 4-line SPI Clock Period | SCL    | $T_{scyc}$ |           | 50     | —    | ns    |
| SCL "H" pulse width     |        | $T_{shw}$  |           | 25     | —    |       |
| SCL "L" pulse width     |        | $T_{SLW}$  |           | 25     | —    |       |
| Address setup time      | A0     | $T_{sas}$  |           | 20     | —    |       |
| Address hold time       |        | $T_{sah}$  |           | 10     | —    |       |
| Data setup time         | SI     | $T_{sds}$  |           | 20     | —    |       |
| Data hold time          |        | $T_{SDH}$  |           | 10     | —    |       |
| CS-SCL time             | CS     | $T_{css}$  |           | 20     | —    |       |
| CS-SCL time             |        | $T_{csh}$  |           | 40     | —    |       |

## Reset Timing

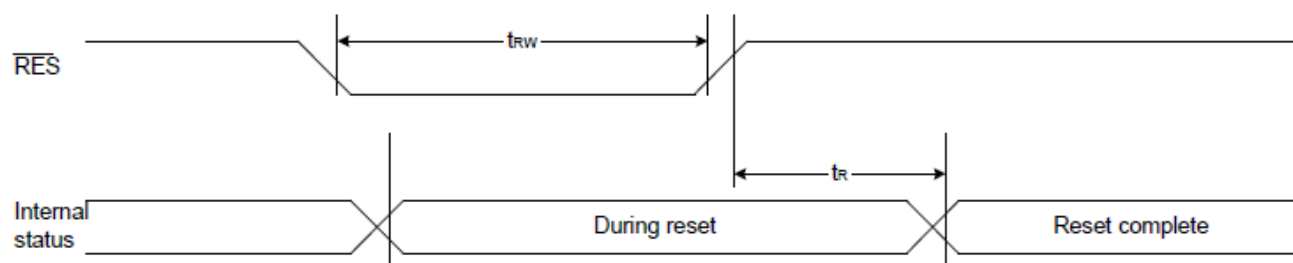


Figure 41

Table 36

(V<sub>DD</sub> = 3.3V, T<sub>a</sub> = -30 to 85°C)

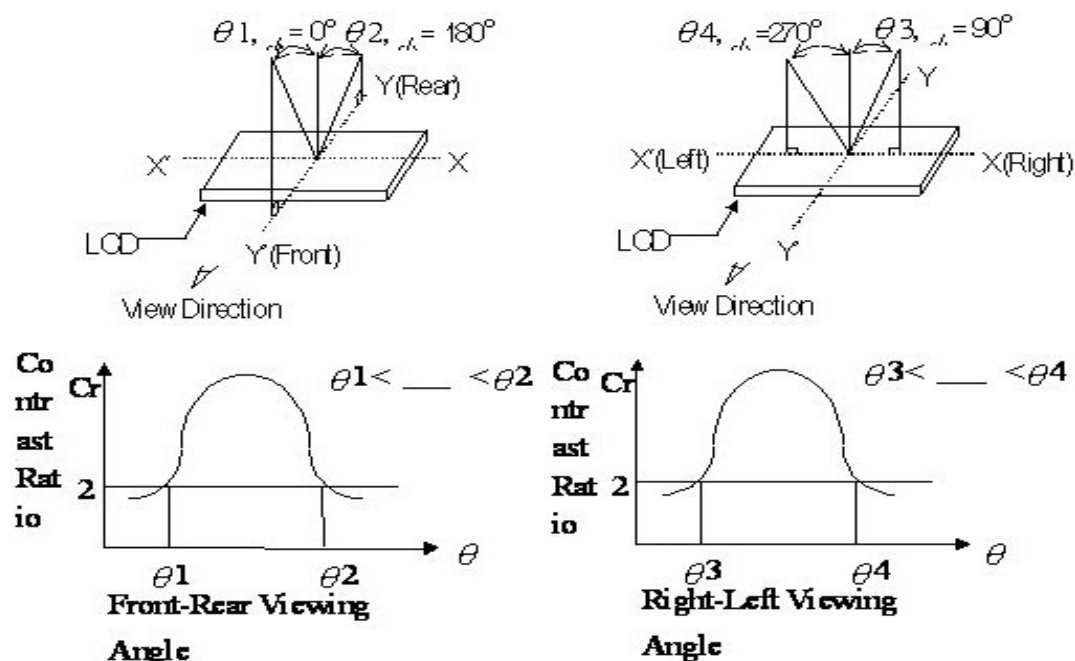
| Item                  | Signal           | Symbol   | Condition | Rating |      |      | Units |
|-----------------------|------------------|----------|-----------|--------|------|------|-------|
|                       |                  |          |           | Min.   | Typ. | Max. |       |
| Reset time            |                  | $t_r$    |           | —      | —    | 1.0  | us    |
| Reset "L" pulse width | $\overline{RES}$ | $t_{rw}$ |           | 1.0    | —    | —    | us    |

## 8. INSTRUCTION TABLE

| Command                                                           | Command Code |     |     |            |    |                         |    |                                  |                |    | Function                                               |                                                                                 |
|-------------------------------------------------------------------|--------------|-----|-----|------------|----|-------------------------|----|----------------------------------|----------------|----|--------------------------------------------------------|---------------------------------------------------------------------------------|
|                                                                   | A0           | /RD | /WR | D7         | D6 | D5                      | D4 | D3                               | D2             | D1 |                                                        | D0                                                                              |
| (1) Display ON/OFF                                                | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 1                                | 1              | 1  | 0<br>1                                                 | LCD display ON/OFF<br>0: OFF, 1: ON                                             |
| (2) Display start line set                                        | 0            | 1   | 0   | 0          | 1  | Display start address   |    |                                  |                |    | Sets the display RAM display start line address        |                                                                                 |
| (3) Page address set                                              | 0            | 1   | 0   | 1          | 0  | 1                       | 1  | Page address                     |                |    |                                                        | Sets the display RAM page address                                               |
| (4) Column address set upper bit<br>Column address set lower bit  | 0            | 1   | 0   | 0          | 0  | 0                       | 1  | Most significant column address  |                |    |                                                        | Sets the most significant 4 bits of the display RAM column address.             |
|                                                                   |              |     |     | 0          | 0  | 0                       | 0  | Least significant column address |                |    |                                                        | Sets the least significant 4 bits of the display RAM column address.            |
| (5) Status read                                                   | 0            | 0   | 1   | Status     |    |                         |    | 0                                | 0              | 0  | 0                                                      | Reads the status data                                                           |
| (6) Display data write                                            | 1            | 1   | 0   | Write data |    |                         |    |                                  |                |    | Writes to the display RAM                              |                                                                                 |
| (7) Display data read                                             | 1            | 0   | 1   | Read data  |    |                         |    |                                  |                |    | Reads from the display RAM                             |                                                                                 |
| (8) ADC select                                                    | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 0                                | 0              | 0  | 0<br>1                                                 | Sets the display RAM address SEG output correspondence<br>0: normal, 1: reverse |
| (9) Display normal/reverse                                        | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 0                                | 1              | 1  | 0<br>1                                                 | Sets the LCD display normal/ reverse<br>0: normal, 1: reverse                   |
| (10) Display all points ON/OFF                                    | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 0                                | 1              | 0  | 0<br>1                                                 | Display all points<br>0: normal display<br>1: all points ON                     |
| (11) LCD bias set                                                 | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 0                                | 0              | 1  | 0<br>1                                                 | Sets the LCD drive voltage bias ratio<br>0: 1/9 bias, 1: 1/7 bias (ST7565R)     |
| (12) Read-modify-write                                            | 0            | 1   | 0   | 1          | 1  | 1                       | 0  | 0                                | 0              | 0  | 0                                                      | Column address increment<br>At write: +1<br>At read: 0                          |
| (13) End                                                          | 0            | 1   | 0   | 1          | 1  | 1                       | 0  | 1                                | 1              | 1  | 0                                                      | Clear read/modify/write                                                         |
| (14) Reset                                                        | 0            | 1   | 0   | 1          | 1  | 1                       | 0  | 0                                | 0              | 1  | 0                                                      | Internal reset                                                                  |
| (15) Common output mode select                                    | 0            | 1   | 0   | 1          | 1  | 0                       | 0  | 0                                | *              | *  | *                                                      | Select COM output scan direction<br>0: normal direction<br>1: reverse direction |
| (16) Power control set                                            | 0            | 1   | 0   | 0          | 0  | 1                       | 0  | 1                                | Operating mode |    | Select internal power supply operating mode            |                                                                                 |
| (17) V <sub>0</sub> voltage regulator internal resistor ratio set | 0            | 1   | 0   | 0          | 0  | 1                       | 0  | 0                                | Resistor ratio |    | Select internal resistor ratio(Rb/Ra) mode             |                                                                                 |
| (18) Electronic volume mode set<br>Electronic volume register set | 0            | 1   | 0   | 1          | 0  | 0                       | 0  | 0                                | 0              | 0  | 1                                                      | Set the V <sub>0</sub> output voltage electronic volume register                |
|                                                                   |              |     |     | 0          | 0  | Electronic volume value |    |                                  |                |    |                                                        |                                                                                 |
| (19) Static indicator ON/OFF<br>Static indicator register set     | 0            | 1   | 0   | 1          | 0  | 1                       | 0  | 1                                | 1              | 0  | 0<br>1                                                 | 0: OFF, 1: ON                                                                   |
|                                                                   |              |     |     | 0          | 0  | 0                       | 0  | 0                                | 0              | 0  | 0                                                      | Mode                                                                            |
| (20) Booster ratio set                                            | 0            | 1   | 0   | 1          | 1  | 1                       | 1  | 1                                | 0              | 0  | 0<br>0<br>step-up value                                | select booster ratio<br>00: 2x,3x,4x<br>01: 5x<br>11: 6x                        |
| (21) Power save                                                   | 0            | 1   | 0   |            |    |                         |    |                                  |                |    | Display OFF and display all points ON compound command |                                                                                 |
| (22) NOP                                                          | 0            | 1   | 0   | 1          | 1  | 1                       | 0  | 0                                | 0              | 1  | 1                                                      | Command for non-operation                                                       |
| (23) Test                                                         | 0            | 1   | 0   | 1          | 1  | 1                       | 1  | *                                | *              | *  | *                                                      | Command for IC test. Do not use this command                                    |

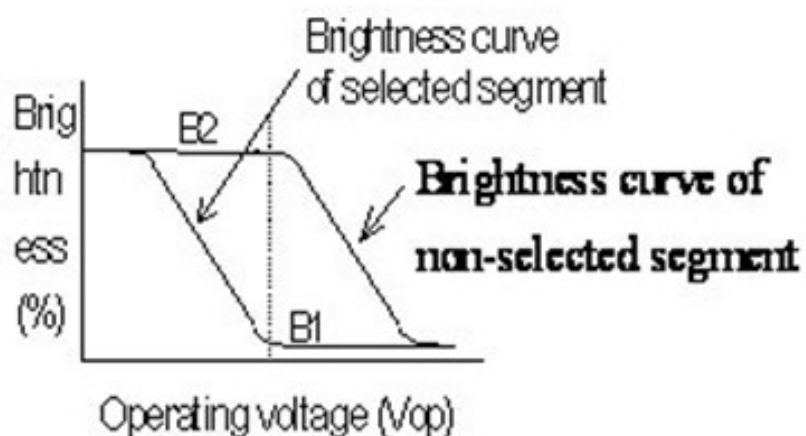
## 9. Optical Characteristics

### 9.1 Definition of Viewing Angle

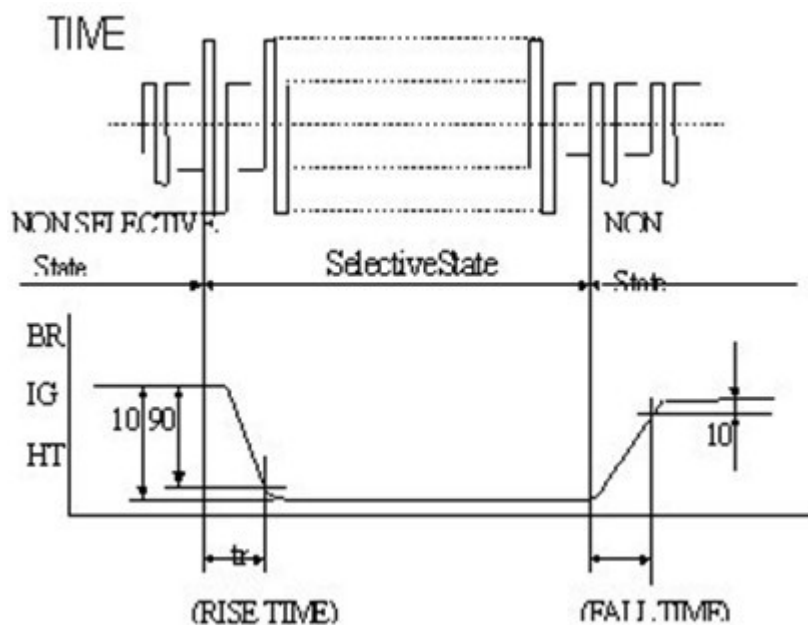


### 9.2 Definition of Contrast

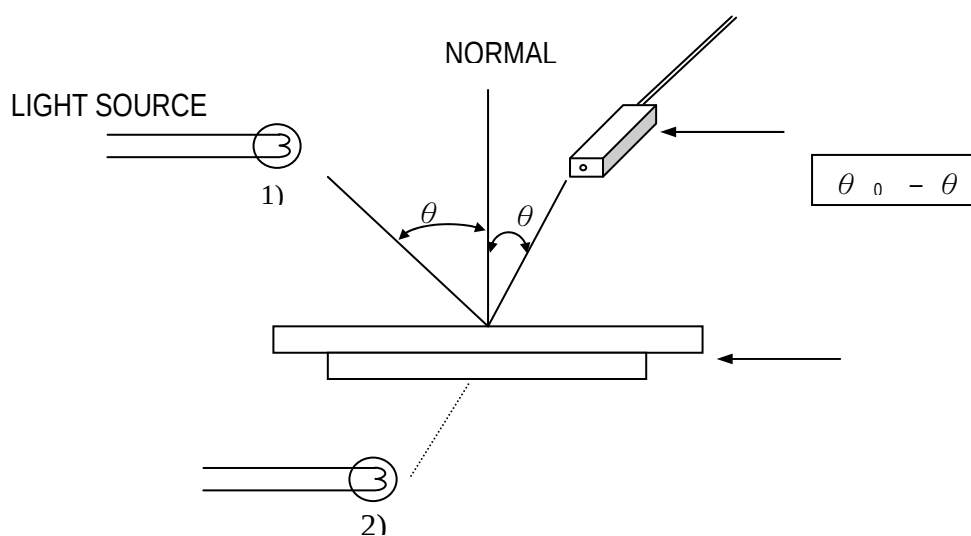
$$\text{C.R.} = \frac{\text{Brightness of nonselected segment (E2)}}{\text{Brightness of selected segment}}$$



## 9.3 Definition of Response



## 9.4 Measuring Instruments For Electro-optical Characteristics

**\* Note:**

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

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

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

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

**11. RELIABILITY TEST**

Operating life time: Longer than 50,000 hours

(at room temperature without direct irradiation of sunlight)

Reliability characteristics shall meet following requirements.

| No. | Test Item                          | Content of Test                                                                                                                                                                                                                                                                                                                                                                                                | Test Condition                 |
|-----|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 1   | High Temperature Storage           | Endurance test applying the high storage temperature for a long time                                                                                                                                                                                                                                                                                                                                           | +80°C 96H                      |
| 2   | Low Temperature Storage            | Endurance test applying the low storage temperature for a long time                                                                                                                                                                                                                                                                                                                                            | -30°C 96H                      |
| 3   | High Temperature Operation         | Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time                                                                                                                                                                                                                                                                                          | +70°C 96H                      |
| 4   | Low Temperature Operation          | Endurance test applying the electric stress under low temperature for a long time                                                                                                                                                                                                                                                                                                                              | -20°C 96H                      |
| 5   | High Temperature/ Humidity Storage | Endurance test applying the high temperature and humidity storage for a long time                                                                                                                                                                                                                                                                                                                              | 60°C 90%RH<br>96H              |
| 6   | Temperature Cycle                  | Endurance test applying the low and high temperature cycle<br>$  \begin{array}{ccccccc}  -20^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} & \longleftrightarrow & 70^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} \\  30\text{min} & & 5\text{min} & & 30\text{min} & & 5\text{min} \\  \longleftarrow & & & & & & \longrightarrow \\  & & & & & & 1 \text{ cycle}  \end{array}  $ | -20°C/70°C<br>5 cycles         |
| 7   | Vibration Test (Package State)     | Endurance test applying the vibration during transportation                                                                                                                                                                                                                                                                                                                                                    | 10Hz—55Hz,<br>50m/s, 15min     |
| 8   | Shock Test (Package State)         | Endurance test applying the shock during transportation                                                                                                                                                                                                                                                                                                                                                        | Half-sinewave,<br>100m/s, 11ms |
| 9   | Atmospheric Pressure Test          | Endurance test applying the atmospheric pressure during transportation by air                                                                                                                                                                                                                                                                                                                                  | 40 kPa<br>16 H                 |

**12. QUALITY DESCRIPTION & APPLICATION NOTE**

Please refer to "General Inspection Criteria" document.