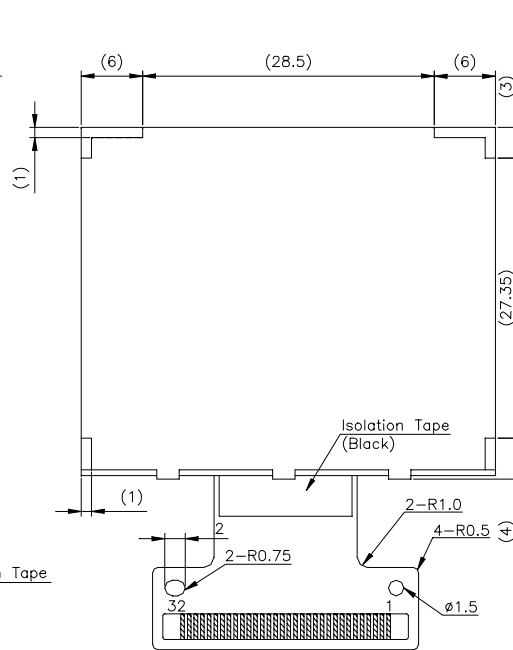


SPECIFICATIONS
GM0100
(GPG120X80-NFPCELY)

| DESIGN DEP. | | |
|-------------|--|--|
| | | |

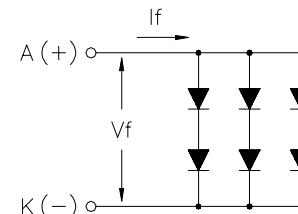
| REV. | Revision Item | Date |
|------|---------------|------------|
| A | NEW | 8/Jun/2001 |
| B | | |
| C | | |
| D | | |
| E | | |
| F | | |
| G | | |
| H | | |
| I | | |



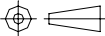
NOTE :

LED Back-Light Spec.

1. $V_f=4.1V$
2. $I_f=30mA$
3. Color:Yellow Green



| Pin No. | Symbol | Description | Pin No. | Symbol | Description | |
|---------|--------|-----------------------------------|------------------------|-----------------|--------------------------------|----------------------|
| 1 | VR | Voltage Regulator Input | 18 | D7 | 8-Bit Data Bus Lines | |
| 2 | V0 | Power Supply for LCD | 19 | D6 | | |
| 3 | V1 | | 20 | D5 | | |
| 4 | V2 | | 21 | D4 | | |
| 5 | V3 | | 22 | D3 | | |
| 6 | V4 | | 23 | D2 | | |
| 7 | INTRS | Regulator Resistor Select | 24 | D1 | | |
| 8 | CAP4+ | DC/DC Voltage Converter Capacitor | 25 | D0 | | |
| 9 | CAP2- | | 26 | \overline{RD} | Read Signal for 8080 MPU | |
| 10 | CAP2+ | | | E | Enable Clock for 6800 MPU | |
| 11 | CAP1+ | | 27 | \overline{WR} | Write Signal for 8080 MPU | |
| 12 | CAP1- | | | R/W | Read/Write Signal for 6800 MPU | |
| 13 | CAP3+ | | 28 | D/C | Data/Command Select | |
| 14 | CAP5+ | | 29 | RES | Reset Signal | |
| 15 | VOUT | | 30 | \overline{CS} | Chip Select (Active Low) | |
| 16 | VSS | | Power Supply (GND) | 31 | PS1 | MPU Interface Select |
| 17 | VDD | | Power Supply for Logic | 32 | PS0 | |

| | | | | |
|---|------------|-----------------|--------------------|---|
| 國喬光電科技股份有限公司 Grand Pacific Optoelectronics Corporation | | | | |
| MODEL | | GM0100 | | |
| DWG NAME | | Outline Drawing | | |
| DWG NO. | | G01000DA | | |
| SCALE 2:1 | UNIT mm | TOL. ±0.3 | DATE 2001.05.23 |  |
| APPROVED | CHECKED | DESIGN | DRAWN B.S.Liu | |

1. Basic Specification

1.1. Display Specifications

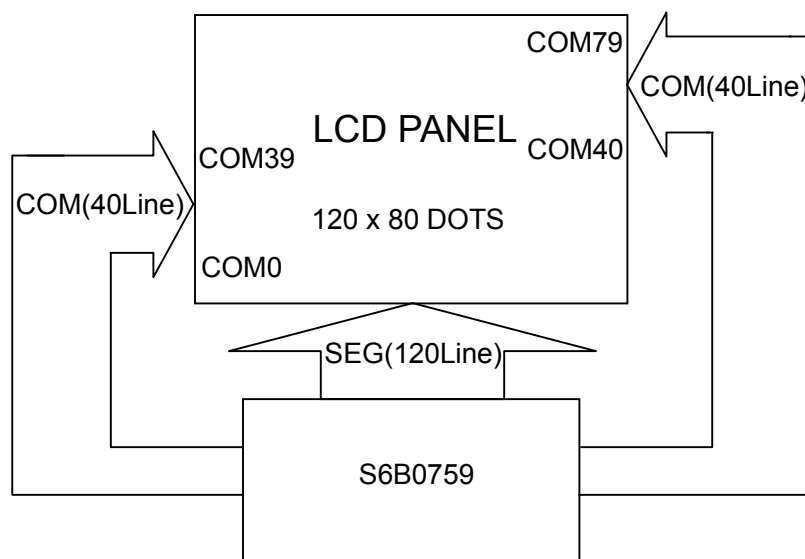
- A) Display Mode ; F-STN , Positive , Transflective
- B) Display Color(*1) ; Display Data "1" = Black
; Display Data "0" = White
- C) Viewing Angle ; 6 O'clock Direction
- D) Duty ; 1/80 Duty
- E) Bias ; 1/8 Bias
- F) Driver IC ; S6B07590A01-BOCY
- G) Display Surface ; Glare

(*1) Color tone is slightly changed by temperature and driving voltage.

1.2. Mechanical Specifications

- A) Outline Dimension ; Refer to attached outline Dimensions Figure G0100ODA
- B) Dots Format ; 120 x 80 Dots
- C) Dots Size ; 0.264 x 0.264 (mm)
- D) Dots Pitch ; 0.274 x 0.274 (mm)
- E) Weight ; Approx. 7.2 (g)

1.3. Block Diagram



1.4. Terminal Functions

Interface : 0.65mm Pitch 32pins FPC

| No. | Symbol | I/O | Function |
|-----|--------|-----|--------------------------------------|
| 1 | VR | I | Voltage Regulator Input |
| 2 | V0 | I/O | Power Supply For LCD |
| 3 | V1 | I/O | |
| 4 | V2 | I/O | |
| 5 | V3 | I/O | |
| 6 | V4 | I/O | |
| 7 | INTRS | I | Regulator Resistor Select |
| 8 | CAP4+ | O | DC/DC Voltage Converter Capacitor |
| 9 | CAP2- | O | |
| 10 | CAP2+ | O | |
| 11 | CAP1+ | O | |
| 12 | CAP1- | O | |
| 13 | CAP3+ | O | |
| 14 | CAP5+ | O | |
| 15 | VOOUT | I/O | |
| 16 | VSS | I | Power Supply(GND) |
| 17 | VDD | I | Power Supply For Logic |
| 18 | D7 | I/O | 8-Bit Data Bus Lines |
| 19 | D6 | I/O | |
| 20 | D5 | I/O | |
| 21 | D4 | I/O | |
| 22 | D3 | I/O | |
| 23 | D2 | I/O | |
| 24 | D1 | I/O | |
| 25 | D0 | I/O | |
| 26 | RD | I | Read Signal For 8080 MPU |
| | E | I | Enable Clock For 6800 MPU |
| 27 | WR | I | Write Signal For 8080 MPU |
| | R/W | I | Read/Write Signal For 6800 MPU |
| 28 | D/C | I | Data/Command Select |
| 29 | RES | I | Reset Signal |
| 30 | CS | I | Chip Select(Active Low) |
| 31 | PS1 | I | MPU Interface Select |
| 32 | PS0 | I | |

2. Absolute Maximum Ratings

| Items | Symbols | Standard Value | | Unit | Condition |
|-----------------------|---------|----------------|---------|------|-----------|
| | | Min. | Max. | | |
| Power Supply Voltage | VDD-VSS | -0.3 | +7.0 | V | |
| | V0-VSS | -0.3 | +17.0 | V | |
| Input Voltage | VIN | -0.3 | VDD+0.3 | V | |
| Operating Temperature | Top | -20 | 70 | °C | |
| Storage temperature | Tst | -30 | 80 | °C | |

Insure that the voltage levels of V1,V2,V3 and V4 are always such that
 $V0 \geq V1 \geq V2 \geq V3 \geq V4 \geq VSS$

3. Electrical Characteristics

3.1. DC Characteristics

| Item | Symbol | Standard Value | | | Unit | Terminal |
|------------------------------|---------|----------------|------|--------|------|---|
| | | Min. | Typ. | Max. | | |
| Power Supply Voltage | VDD-VSS | 1.8 | - | 3.3 | V | VDD |
| | V0-VSS | 4.0 | - | 15.0 | V | V0 |
| “0”Input Voltage | VIL | 0 | - | 0.2VDD | V | RES, \overline{CS} , $\overline{R/W}$, D/ \overline{C} , PS0, PS1, REF, INTR, E D0~D7 |
| “1”Input Voltage | VIH | 0.8VDD | - | VDD | V | |
| Input Leak Current | ILI | -1.0 | - | 1.0 | μA | |
| Output Leak Current | ILO | -3.0 | - | 3.0 | μA | |
| Power Supply Current (*1) | IDD | - | 400 | 800 | μA | VDD |

(*1) Measuring Condition

(Typ.)

VDD=3.0V , Text Pattern

T=25°C

(Max.)

VDD=3.0V , Checker Pattern

T=25°C

3.2. AC Characteristics

System Bus Read/Write Characteristics 1(For the 8080 Series MPU)

Ta=-20~70°C,VDD=1.8~3.3V

| Item | Signal | Symbol | Condition | Rating | | Units |
|----------------------------|------------------|--------|-----------|--------|-----|-------|
| | | | | Min | Max | |
| Address setup time | $\overline{D/C}$ | tAS80 | | 0 | - | ns |
| Address hold time | | tAH80 | | 0 | - | ns |
| System cycle time | | tCY80 | | 1000 | - | ns |
| Pulse width low for write | \overline{WR} | tPWLW | | 120 | - | ns |
| Pulse width high for write | | tPWHW | | 120 | - | ns |
| Pulse width low for read | \overline{RD} | tPWLR | | 240 | - | ns |
| Pulse width high for read | | tPWHR | | 120 | - | ns |
| Data setup time | D0 To D7 | tDS80 | | 80 | - | ns |
| Data hold time | | tDH80 | | 30 | - | ns |
| Read access time | | TacC80 | CL=100pF | - | 280 | ns |
| Output disable time | | tOD80 | | 10 | 200 | ns |

* All timing is specified using 20% and 80% of VDD as the standard.

* The input signal rise time and fall time (tr,tr) is specified at 15 ns or less.

System Bus Read/Write Characteristics 2(For the 6800 Series MPU)

Ta=-20~70°C,VDD=1.8~3.3V

| Item | Signal | Symbol | Condition | Rating | | Units |
|-----------------------------|------------------|--------|-----------|--------|-----|-------|
| | | | | Min | Max | |
| Address setup time | $\overline{D/C}$ | tAS68 | | 0 | - | ns |
| Address hold time | R/W | tAH68 | | 0 | - | ns |
| System cycle time | | tCY68 | | 500 | - | ns |
| Enable width high for write | E | tEWHW | | 60 | - | ns |
| Enable width low for write | | tEWLW | | 60 | - | ns |
| Enable width high for read | E | tEWHR | | 120 | - | ns |
| Enable width low for read | | tEWLR | | 60 | - | ns |
| Data setup time | D0 To D7 | tDS68 | | 30 | - | ns |
| Data hold time | | tDH68 | | 5 | - | ns |
| Read access time | | tACC68 | CL=100pF | - | 60 | ns |
| Output disable time | | tOD68 | | 10 | 50 | ns |

* All timing is specified using 20% and 80% of VDD as the standard.

* The input signal rise time and fall time (tr,tr) is specified at 15 ns or less.

The Serial Interface

Ta=-20~70°C, VDD=1.8~2.6V

| Item | Signal | Symbol | Condition | Rating | | Units |
|---------------------|--------------|--------|-----------|--------|-----|-------|
| | | | | Min | Max | |
| Serial Clock cycle | SCLK (D6) | tSCY | | 111 | - | ns |
| SCL "H" pulse width | | tSHW | | 60 | - | ns |
| SCL "L" pulse width | | tSLW | | 60 | - | ns |
| Address setup time | RS | tASS | | 60 | - | ns |
| Address hold time | | tAHS | | 60 | - | ns |
| Data setup time | SID (D7) | tdSS | | 60 | - | ns |
| Data hold time | | tdHS | | 60 | - | ns |
| CS setup time | CS | tcSS | | 60 | - | ns |
| CS hold time | | tCHS | | 60 | - | ns |

Ta=-20~70°C, VDD=2.6~3.3V

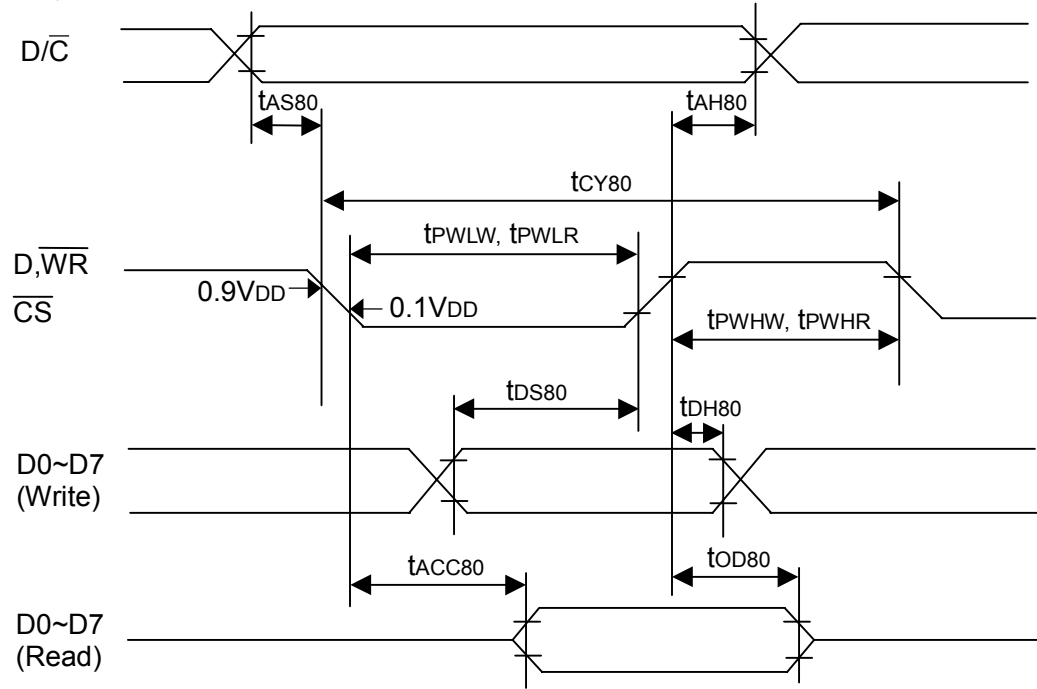
| Item | Signal | Symbol | Condition | Rating | | Units |
|---------------------|--------------|--------|-----------|--------|-----|-------|
| | | | | Min | Max | |
| Serial Clock cycle | SCLK (D6) | tSCY | | 58.8 | - | ns |
| SCL "H" pulse width | | tSHW | | 30 | - | ns |
| SCL "L" pulse width | | tSLW | | 30 | - | ns |
| Address setup time | RS | tASS | | 30 | - | ns |
| Address hold time | | tAHS | | 30 | - | ns |
| Data setup time | SID (D7) | tdSS | | 30 | - | ns |
| Data hold time | | tdHS | | 30 | - | ns |
| CS setup time | CS | tcSS | | 30 | - | ns |
| CS hold time | | tCHS | | 30 | - | ns |

* All timing is specified using 20% and 80% of VDD as the standard.

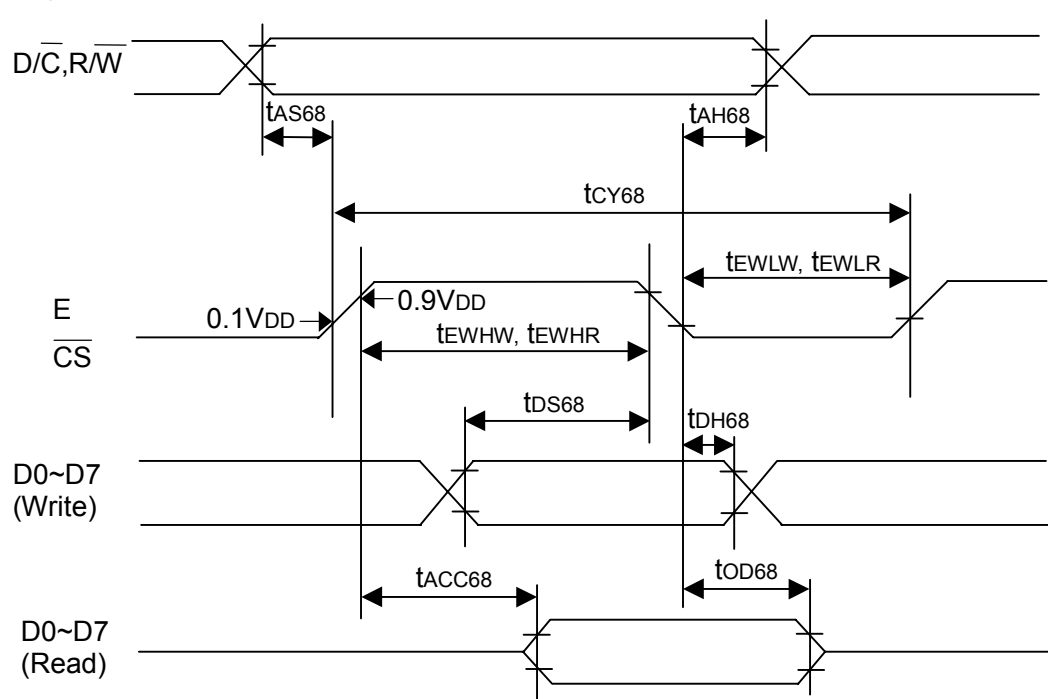
* The input signal rise time and fall time (tr,tf) are specified at 15 ns or less.

3.3. Timing Chart

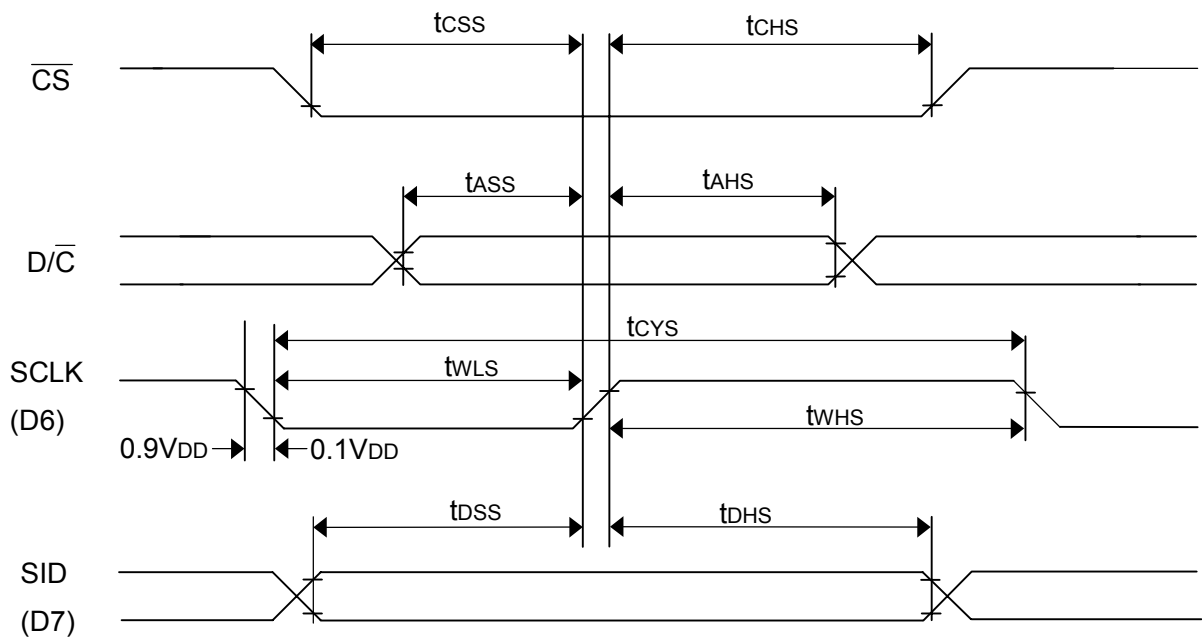
System Bus Read/Write Characteristics 1(For the 8080 Series MPU)



System Bus Read/Write Characteristics 2(For the 6800 Series MPU)



The Serial Interface



3.4. Microprocessor Interface

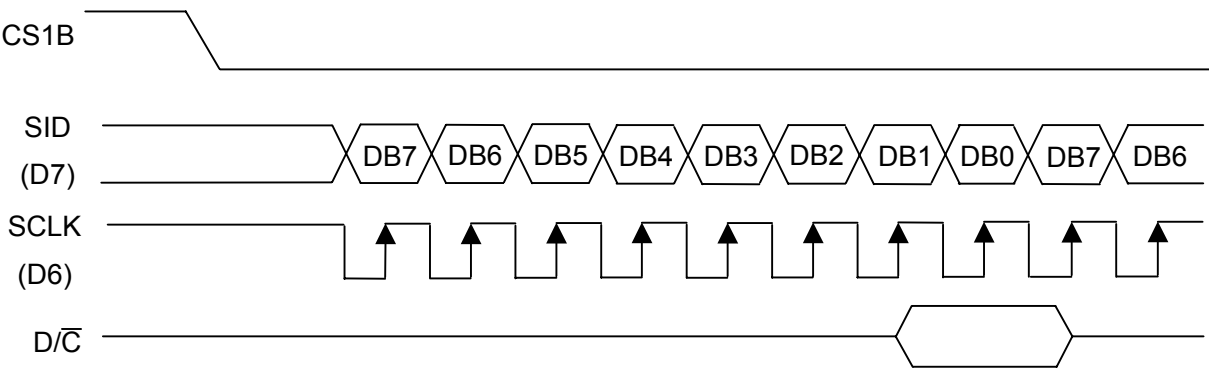
3.4.1 Parallel Interface(PS0="H")

| Common | 6800 Series (PS1=H) | | 8080 Series (PS1=L) | | Function |
|--------|---------------------|-----|---------------------|----|--|
| D/C | E | R/W | RD | WR | |
| 1 | 1 | 1 | 0 | 1 | Display data read out |
| 1 | 1 | 0 | 1 | 0 | Display data write |
| 0 | 1 | 1 | 0 | 1 | Register status read |
| 0 | 1 | 0 | 1 | 0 | Writes to internal register(instruction) |

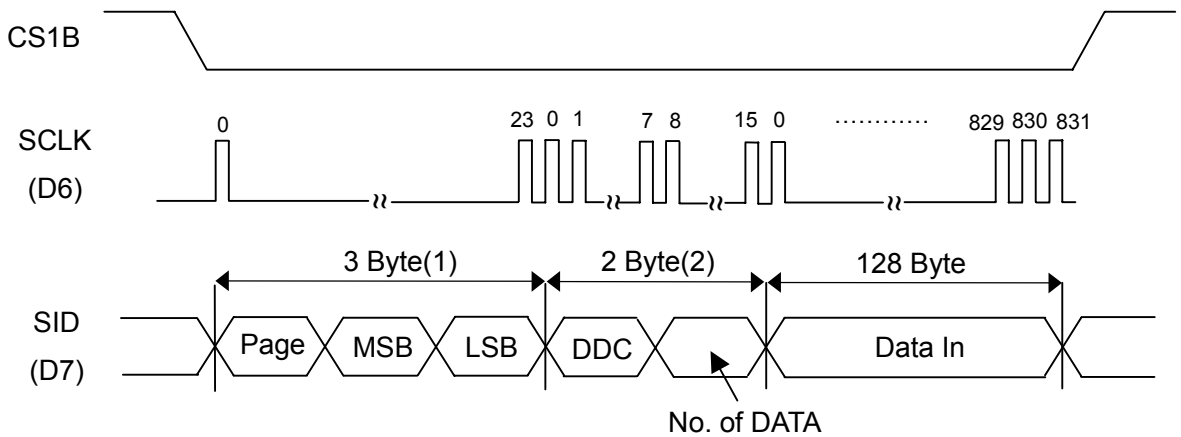
3.4.2 Serial Interface(PS0="L")

When the driver is active(CS1B="L"),serial data(D7) and serial clock(D6) inputs are Enabled.

4 Pin-SPI Interface(PS0="L",PS1="H")



3 Pin-SPI Interface(PS0="L",PS1="L")



(1) Set Page and Column Address.

Set Page Address :1 0 1 1 P3 P2 P1 P0
Set Column Address MSB :0 0 0 1 0 Y6 Y5 Y4
Set Column Address LSB :0 0 0 0 Y3 Y2 Y1 Y0

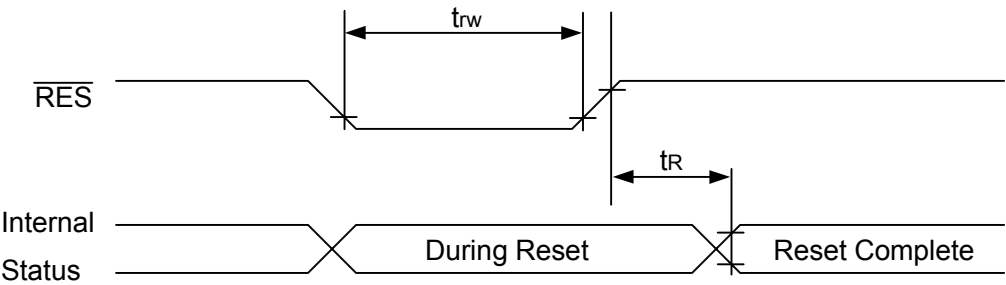
(2) Set DDC(Data Direction Command) and No. of Data Bytes.

Set Data Direction Command(For SPI mode only):
1 1 1 0 1 0 0 0
Set No. of Data Bytes(DDL) :D7 D6 D5 D4 D3 D2 D1 D0

3.5. Reset Timing

Ta=-20~70°C,VDD=1.8~3.3V

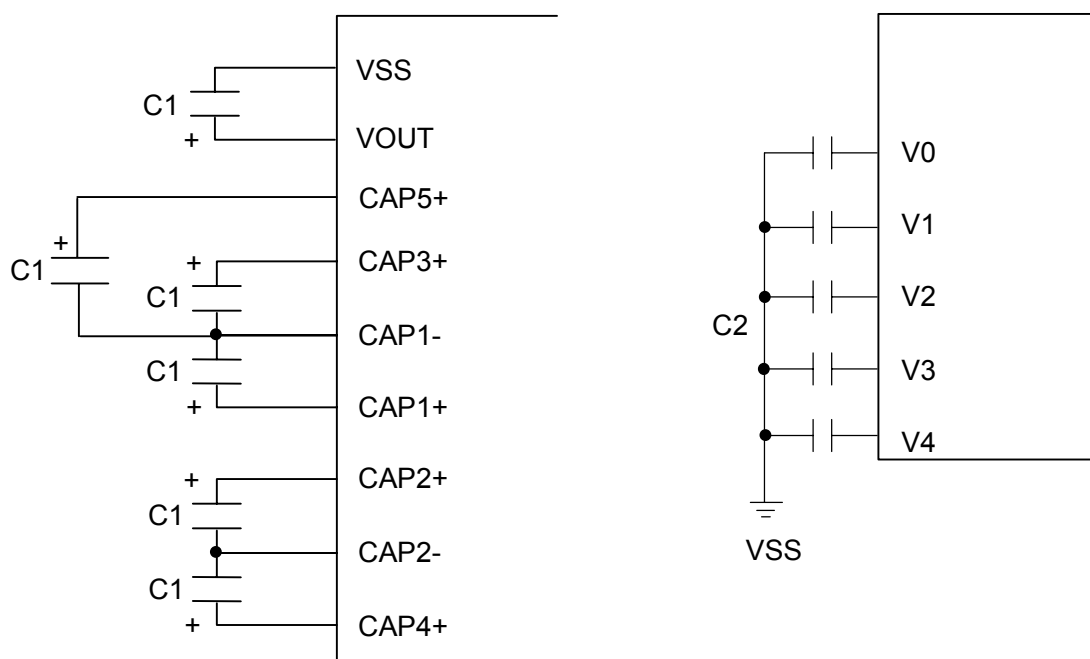
| Item | Symbol | Standard Value | | Unit | Condition |
|---------------------|--------|----------------|------|------|-----------|
| | | Min. | Max. | | |
| Reset Time | tr | - | 1 | μs | |
| Reset“L”Pulse width | trw | 1 | - | μs | |



3.6. The set-up voltage circuits

Connect capacitor C1 between CAP1+ and CAP1-, between CAP2+ and CAP2-, between CAP2- and CAP4+, between CAP1- and CAP3+, and between VSS and VOUT, to produce a voltage level in the positive direction at the VOUT terminal that is 5 times the voltage level between VDD and VSS. When connect capacitor C1 between CAP5+ and CAP1-, it will produce the 6 times voltage level between VDD and VSS.

(Reference: C1=1.0 to 4.7 μ F ; C2=0.47 to 2.2 μ F)



3.7 Explanation of Command

For the details of command explanation, please refer to the data sheet of driver IC S6B7059 .

4. Optical Characteristics

4.1. Optical Characteristics

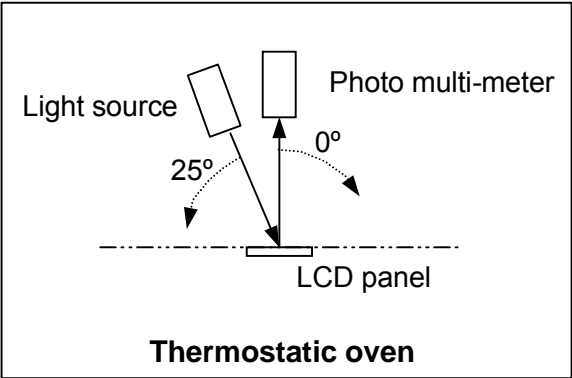
(Reflective mode)

| Item | Symbol | Temp | Standard Value | | | Unit | Condition | |
|----------------|--------|------|----------------|-------|-------|------|--------------------|---------------|
| | | | Min | Typ | Max | | | |
| Vop | V0-VSS | -20 | 10.2 | 10.7 | 11.2 | V | | |
| | | 25 | 8.8 | 9.3 | 9.8 | V | | |
| | | 70 | 8.0 | 8.4 | 8.8 | V | | |
| Response Time | Tr | 25 | - | 300 | 450 | ms | | |
| | | -20 | - | 14200 | 21300 | ms | | |
| | Tf | 25 | - | 250 | 380 | ms | | |
| | | -20 | - | 7000 | 10500 | ms | | |
| Contrast Ratio | K | 25 | 7 | 15 | - | | | |
| Viewing angle | Φ | 25 | - | 40 | - | deg. | $\theta=0^\circ$ | CR \geq 2.0 |
| | | | - | 40 | - | deg. | $\theta=90^\circ$ | |
| | | | - | 50 | - | deg. | $\theta=180^\circ$ | |
| | | | - | 45 | - | deg. | $\theta=270^\circ$ | |

- panel only characteristics
- 1/80Duty,1/8Bias

4.2. Definition of Optical Characteristics

4.2.1. Optical Measuring Equipment

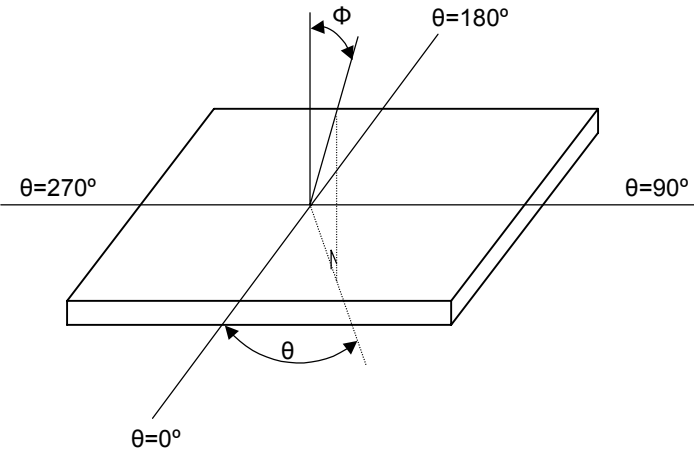


Specification Measuring Condition

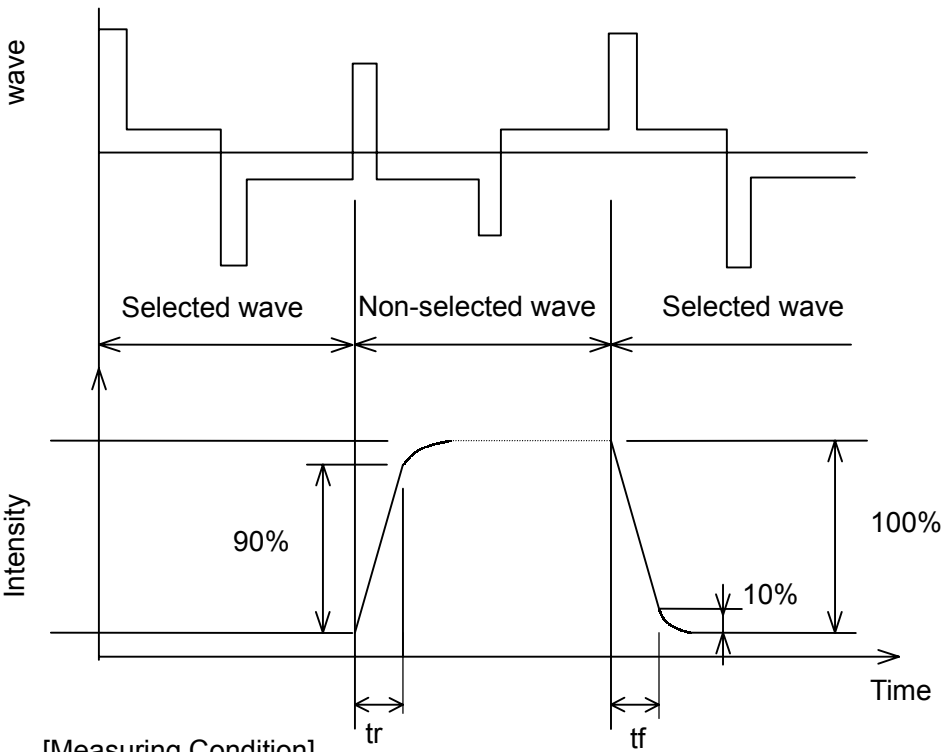
Luxmeter ; LCD-5100(OTSUKA ELECTRONICS)

Brightness Measuring Spot Diameter ; $\Phi=3.0\text{mm}$

4.2.2. Definition of Viewing Angle



4.2.3. Definition of Response Time

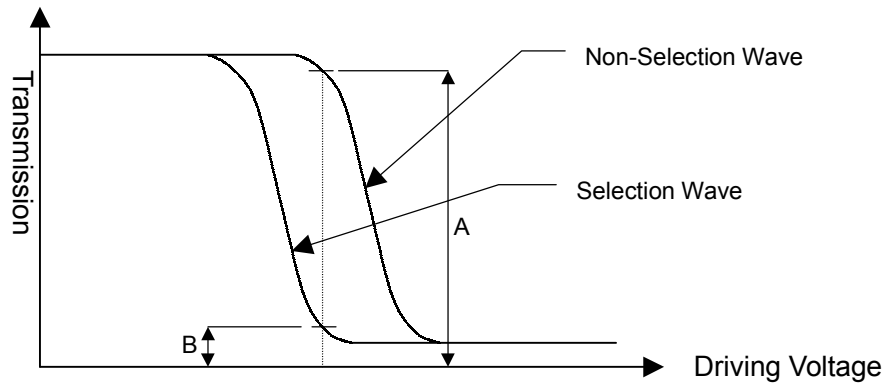


[Measuring Condition]

$V_0 - V_{SS}$ = operating Voltage

$\theta_X = \theta_Y = 0^\circ$

4.2.4. Definition of Contrast Ratio



$$\text{Contrast Ratio} = \frac{\text{Transmission A of Non Selection DOT}}{\text{Transmission B of Selection DOT}}$$

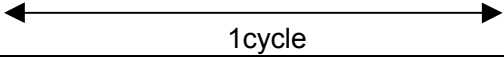
[Measuring Condition]

V0-VSS = operating Voltage

$\theta X = \theta Y = 0^\circ$

5. Reliability Test

5.2. Content of Reliability Test

| NO | Test Item | Content of test | Condition |
|--------------------|---------------------------------------|---|----------------------|
| Environmental test | | | |
| 1 | High Temperature Storage | Endurance test applying the high temperature for along time. | 80°C 200H |
| 2 | Low Temperature Storage | Endurance test applying the Low temperature for along time. | -30°C 200H |
| 3 | High Temperature/ Humidity Storage | Endurance test applying the high temperature and high humidity for a long time. | 50°C & 90%RH 200H |
| 4 | Heat shock | Endurance test applying the low and high temperature cycles. -30°C ⇔ 25°C ⇔ 80°C ⇔ 25°C (30min) (10sec) (30min) (10sec)  | -30/80°C 10 Cycle |

5.3. Failure judgment criterion

After the above-mentioned test

A) There should not exist conspicuous failure of display quality and appearance.

Contrast ratio should be 50% of the initial contrast ratio.

B) There should not have any abnormality of function.

6. Precautions for use of LCD Module

6.1. Handling precautions

- A) The display panel is made of glass. do not subject it to a mechanical shock by dropping it from a high place ,etc.
- B) If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth. If the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- C) Do not apply excessive force on the surface of display or the adjoining area of LCD module since this may cause the color tone to vary.
- D) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- E) If the display surface of LCD module becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of following solvents.

Isopropyl alcohol

Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer .

Especially, do not use water, ketone and aromatic solvents.

- F) When mounting the LCD module, Make sure that it is free of twisting, warping, and direction. Distortion has great influence upon display quality. Also keep the shiftiness enough regarding the outer case.
- G) When install the LCD module, do not forcibly pull or bend the I/O cable.
- H) Touching the IC of LCD module may cause on abnormal display that cannot be corrects, should not touching the IC of LCD module.
- I) Do not attempt to disassemble or process the LCD module.
- J) NC terminal should be open. Do not connect anything.
- K) If the logic circuit power is off, do not apply the input signals.
- L) To prevent destruction of the elements by static electricity be careful to maintain an optimum work environment.
Be sure to ground the body when handling the LCD module.
Tools required for assembly, such as soldering irons, must be properly grounded.
To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.
- M) Please handle carefully, because the glass has a sharp edge.

6.2. Storage precautions

- A) Exercise care to minimize corrosion of the electrode. Moisture condensation or a current flow in a high humidity environment accelerates corrosion of the electrodes.
- B) When storing the LCD module, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the LCD module in bags designed to prevent static electricity charging under low temperature/normal humidity conditions(avoid high temperature /high humidity and low temperature below 0°C).

Whenever possible, the LCD module should be stored in the same conditions in which they were shipped from our company.

6.3. Design precautions

- A) The absolute maximum ratings represent the rated value beyond which LCD module can not exceed. When the LCD module are used in excess of this fated value, their operating characteristics may be adversely affected.
- B) To prevent the occurrence of erroneous operation caused by the noise, attention must be paid to satisfy VIL, VIH specification values, including taking the precaution of using signal cables that are short.
- C) The liquid crystal display exhibits temperature dependency characteristics. Since recognition of the display becomes difficult when the LCD is used outside its designated operating temperature range, be sure to use the LCD within this range.
- D) We recommended that power supply lines (VDD) have over-current protection line. (Fuse etc.)
- E) Sufficiently notice the mutual noise interference occurred by peripheral devices.
- F) To cope with EMI, take measures basically on outputting side.
- G) When fixing LCD module, which is consisted of glass panel, FPC fixes it at plastic case side. In case PCB is fixed, there is the possibility that the disconnection is occurred by somewhat stress.

6.4. Other

- A) Liquid crystal solidify under low temperatures (below the storage temperature range) leading to defective orientation or the generation of air bubbles.
Air bubbles may also be generated if the LCD module is subjected to a strong shock at a low temperature.
- B) If the LCD module has been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contract irregularity may also appear. A normal operating status can be regained by

suspending use for some time it should be noted that this phenomenon does not adversely affect performance reliability.

- C) To minimize the performance degradation of the LCD modules resulting from destruction caused sections by static electricity, etc., exercise care to avoid touching the following sections when handling the module.

Terminal electrode sections

Part of pattern wiring on FPC, etc.

6.5. COG Precautions

- A) This is built-in a protecting terminal for static electricity on all pin. But if it gains larger level of static electricity than its permission level, this terminal may happen a short circuit. Therefore, you must handle carefully. We suggest that you should ground the body when you handle it.

- B) Generally the characteristics of semiconductor device will be changed by irradiating the light. This may cause uncertain operation for IC.

Design and assembly in the shading system of the structure for IC in working.

Circumstance design for shading system of IC at inspection process.

Shading against the surface, the back and the side, when you handle it.