

DISPLAY Elektronik GmbH

DATA SHEET

LCD MODULE

DEM 128064T SBH-PW-N

Product Specification

Version: 1

22.02.2013

GENERAL SPECIFICATION

MODULE NO. :

DEM 128064T SBH-PW-N

| VERSION NO. | CHANGE DESCRIPTION | DATE |
|-------------|--------------------------------|------------|
| 0 | ORIGINAL VERSION | 07.02.2013 |
| 1 | CHANGE OPTICAL CHARACTERISTICS | 22.02.2013 |
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PREPARED BY: AH

DATE: 22.04.2013

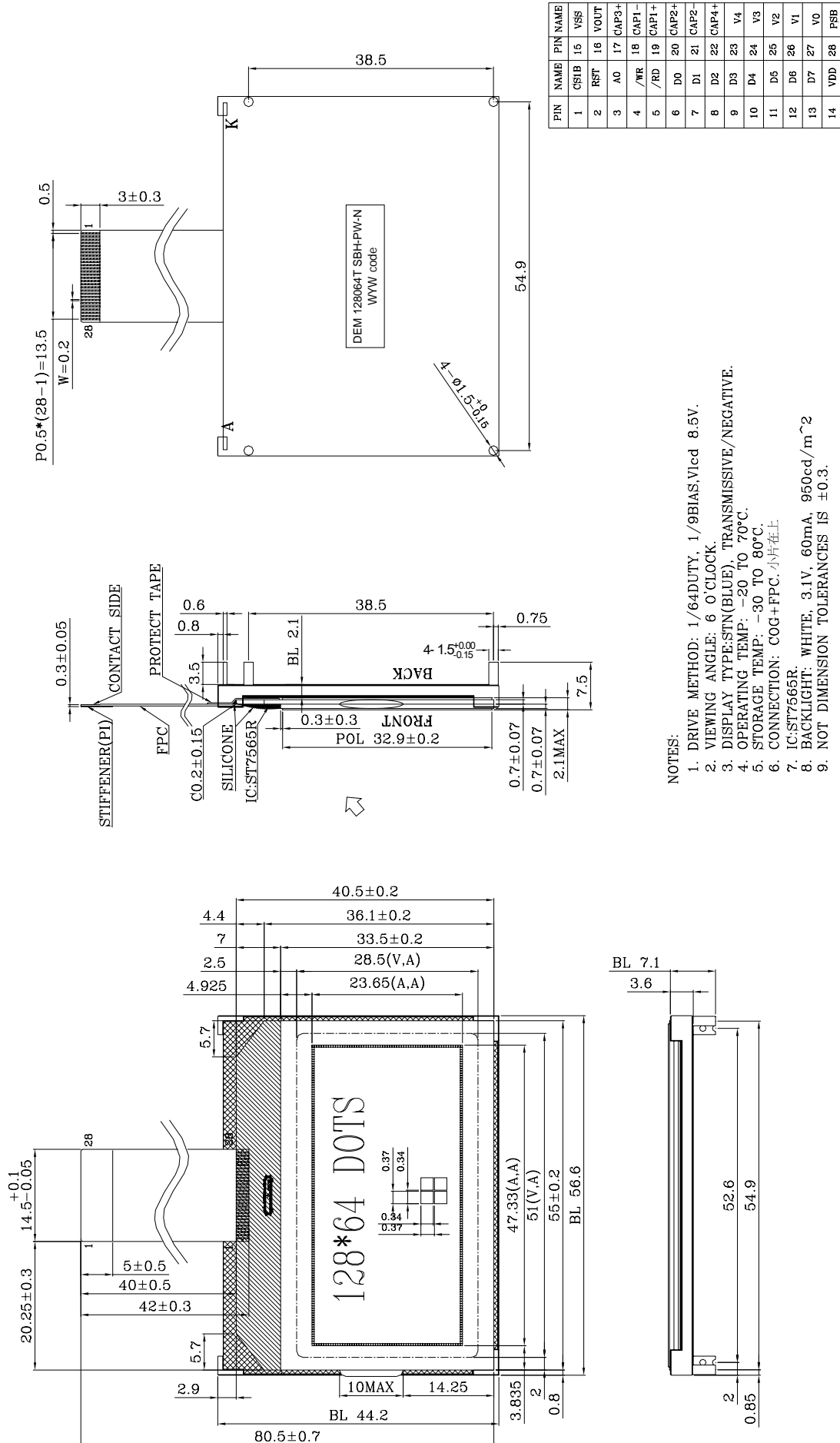
APPROVED BY: MH

DATE: 22.04.2013

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1. LCD DRAWING



- NOTES:
1. DRIVE METHOD: 1/64DUTY, 1/9BIAS,Vlcd 8.5V.
 2. VIEWING ANGLE: 6 O'CLOCK
 3. DISPLAY TYPE:STN(BLUE), TRANSMISSIVE/NEGATIVE.
 4. OPERATING TEMP: -20 TO 70°C.
 5. STORAGE TEMP: -30 TO 80°C.
 6. CONNECTION: COG+FPC. 小片在上.
 7. IC:ST7565R.
 8. BACKLIGHT: WHITE, 3.1V, 60mA, 950cd/m²
 9. NOT DIMENSION TOLERANCES IS ±0.3.

2. PRODUCT SPECIFICATIONS

2.1 General

- 128 × 64 Dot Matrix LCD
- STN-BLUE, Negative Mode
- Transmissive, Wide Temperature Type
- 6 o'clock
- Multiplexing Driving : 1/64duty, 1/9bias
- Controller IC ST7565R (Sitronix)
- Backlight : Edge LED, White

2.2 Mechanical Characteristics

| Item | Characteristic |
|--|----------------------|
| Dot Configuration | 128 x 64 |
| Dot Dimensions(mm) | 0.34 x 0.34 |
| Dot Spacing (mm) | 0.37 x 0.37 |
| Module Dimensions (Horizontal × Vertical × Thickness, mm) | 56.60 x 44.20 x 7.50 |
| Viewing Area (Horizontal × Vertical, mm) | 51.00 x 28.50 |
| Active Area (Horizontal × Vertical, mm) | 47.33 x 23.65 |
| Backlight Outline Dimension | 56.60 x 44.20 x 3.60 |

2.3 Absolute Maximum Ratings (without LED Backlight)

| Characteristic | Symbol | Unit | Value |
|---------------------------|----------|------|----------------------|
| Operating Voltage (logic) | V_{DD} | V | -0.3 to +5.0 |
| Input Voltage | V_{IN} | V | -0.3 to $V_{DD}+0.3$ |

Note 1: Referenced to $V_{SS}=0V$

2.4 Electrical Characteristics (without LED Backlight)

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Unit |
|--------------------------|-----------------|-----------------|-------------|------|-------------|------|
| Operating Voltage(logic) | $V_{DD}-V_{SS}$ | -- | 3.0 | 3.3 | 3.6 | V |
| Input Voltage | V_{IH} | -- | $0.8V_{DD}$ | -- | V_{DD} | V |
| | V_{IL} | -- | V_{SS} | -- | $0.2V_{DD}$ | |
| Output Voltage | V_{OH} | $I_{OH}=-0.1mA$ | $0.8V_{DD}$ | -- | V_{DD} | V |
| | V_{HL} | $I_{OL}=0.1mA$ | V_{SS} | -- | $0.2V_{DD}$ | |
| Current Consumption | I_{DD} | $V_{IN}=V_{DD}$ | -- | 0.05 | 1 | mA |

2.5 Optical Characteristics Absolute Maximum Ratings

| Item | Symbol | Rating | Unit |
|-----------------------------|--------|----------|------|
| Operating temperature range | Top | -20 ~ 70 | °C |
| Storage temperature range | Tst | -30 ~ 80 | °C |

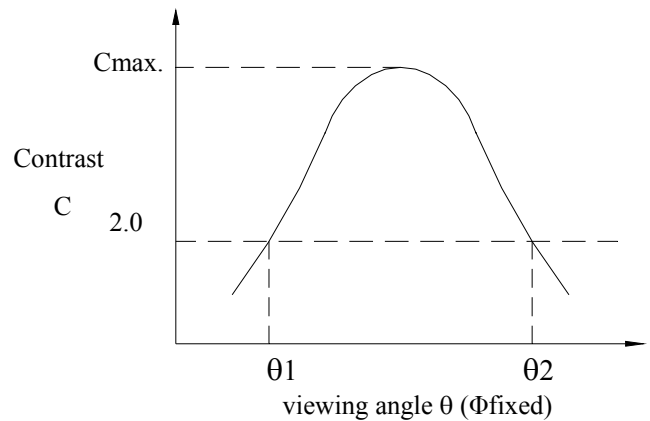
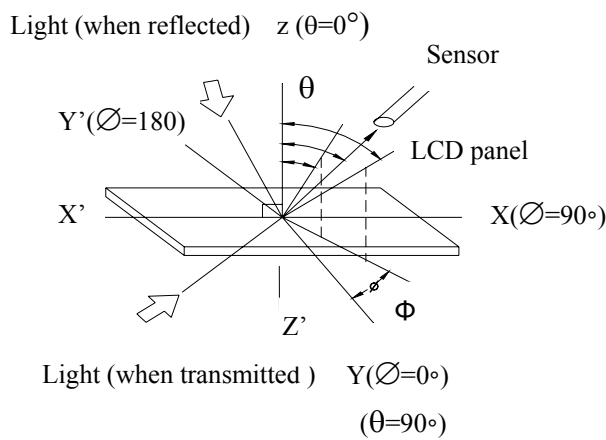
2.6 Optical Characteristics

1/64 duty, 1/9bias, Vlcd=8.5V, Ta=25°C

| Item | Symbol | Conditions | Min. | Typ. | Max | Reference |
|---------------------|-------------|------------------------------------|------|------|-------|-------------|
| Driving voltage | Vlcd=VDD-VO | | 8.2 | 8.5 | 8.8 | V |
| | Vlcd | -20°C | 8.5 | 8.8 | 9.1 | V |
| | | +25°C | 8.2 | 8.5 | 8.8 | V |
| | | +70°C | 7.9 | 8.2 | 8.5 | V |
| Viewing angle | θ | $C \geq 2.0, \phi = 0^\circ$ | 30° | - | | Notes 1 & 2 |
| Contrast | C | $\theta = 5^\circ, \phi = 0^\circ$ | 3.0 | -- | - | Note 3 |
| Response time(rise) | ton | $\theta = 5^\circ, \phi = 0^\circ$ | - | | 198ms | Note 4 |
| Response time(fall) | toff | $\theta = 5^\circ, \phi = 0^\circ$ | - | - | 176ms | Note 4 |

Note 1: Definition of angles θ and ϕ

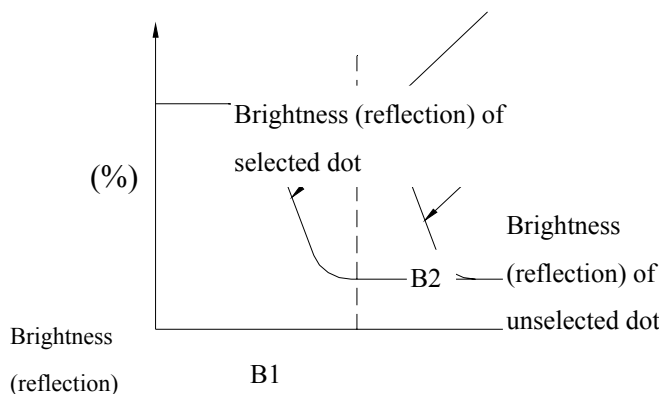
Note 2: Definition of viewing angles θ_1 and θ_2



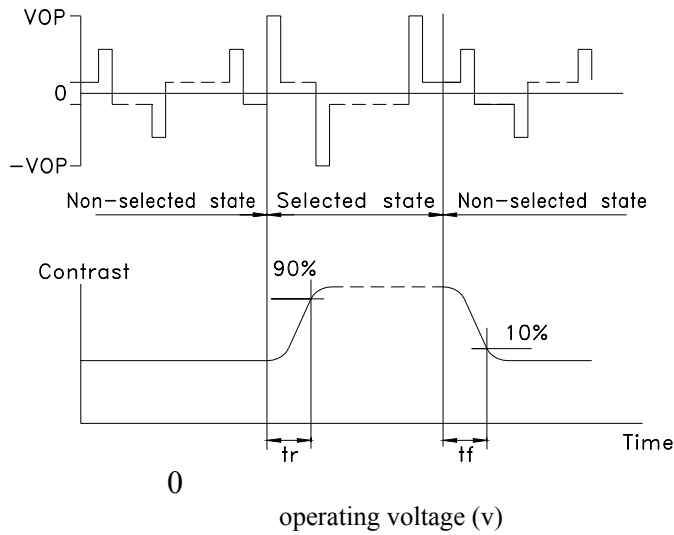
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same

Note 3: Definition of contrast C

$$C = \frac{\text{Brightness (reflection) of unselected dot (B2)}}{\text{Brightness (reflection) of selected dot (B1)}}$$



Note 4: Definition of response time



Note: Measured with a transmissive LCD panel which is displayed 1 cm²

- V_{OPR} : Operating voltage
- f_{FRM} : Frame frequency
- t_{ON} : Response time (rise)
- t_{OFF} : Response time (fall)

2.7 LED Backlight Characteristics

2.7.1 Electrical / optical specifications

Ta = 25°C

| Item | Symbol | Condition | Min. | Typ. | Max. | Unit |
|----------------------------|----------------|-------------------|------|------|------|-------|
| Forward voltage | V _f | If=60mA, White | 2.9 | 3.1 | 3.4 | V |
| LED *Luminous Intensity | I _v | If=60mA, White | 800 | 950 | -- | cd/m2 |
| Chromaticity Coordinate | x | If=60mA, White | 0.26 | 0.29 | 0.32 | |
| | y | | 0.26 | 0.29 | 0.32 | |
| Reverse Current | I _R | VR=5V, White | -- | -- | 0.1 | mA |

Note: * Measured at the bare LED Backlight Unit.

2.7.2 LED Maximum Operating Range

| Item | Symbol | White | Unit |
|-------------------|-----------------|-------|------|
| Power Dissipation | P _{AD} | 272 | mW |
| Forward Current | I _F | 80 | mA |
| Reverse Voltage | V _R | 5 | V |

3. RELIABILITY

3.1 Reliability

| Test item | Test condition | Evaluation and assessment |
|--|--|---|
| Operation at high temperature and humidity | 40 °C±2 °C 90%RH for 500hours | No abnormalities in functions* and appearance** |
| Operation at high temperature | 60 °C±2 °C for 500 hours | No abnormalities in functions* and appearance** |
| Heat shock | -20± ~ +60 °C Left for 1 hour at each temperature, transition time 5 min, repeated 10times | No abnormalities in functions* and appearance** |
| Low temperature | -20±2 °C for 500 hours | No abnormalities in functions* and appearance** |
| Vibration | Sweep for 1 min at 10 Hz, 55Hz, 10Hz, amplitude 1.5mm 2 hrs each in the X,Y and Z directions | No abnormalities in functions* and appearance** |
| Drop shock | Dropped onto a board from a height of 10cm | No abnormalities in functions* and appearance** |

* Dissipation current, contrast and display functions

** Polarizing filter deterioration, other appearance defects

3.2 Liquid Crystal Panel Service Life

100,000 hours minimum at 25 °C±10 °C

3.3 Definition of Panel Service Life

- Contrast becomes 30% of initial value
- Current consumption becomes three times higher than initial value
- Remarkable alignment deterioration occurs in LCD cell layer
- Unusual operation occurs in display functions

4. OPERATING INSTRUCTIONS

4.1 Input signal Function

| Pin No | Symbol | I/O | Function |
|--------|--------|-----|---|
| 1 | CS1B | I | This is the chip select signal. When CS1 = "L" and CS2 = "H," then the chip select becomes active, and data/command I/O is enabled. |
| 2 | RST | I | Reset Signal Input Pin (Low Active). |
| 3 | A0 | I | This is connect to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or a command. A0 = "H": Indicates that D0 to D7 are display data. A0 = "L": Indicates that D0 to D7 are control data. |
| 4 | /WR | I | <ul style="list-style-type: none"> When connected to an 8080 MPU, this is active LOW. (R/W) This terminal connects to the 8080 MPU WR signal. The signals on the data bus are latched at the rising edge of the WR signal. <ul style="list-style-type: none"> When connected to a 6800 Series MPU: This is the read/write control signal input terminal. When R/W = "H": Read. When R/W = "L": Write. |
| 5 | /RD | I | <ul style="list-style-type: none"> When connected to an 8080 MPU, this is active LOW. (E) This pin is connected to the RD signal of the 8080 MPU, and the ST7565S series data bus is in an output status when this signal is "L". <ul style="list-style-type: none"> When connected to a 6800 Series MPU, this is active HIGH. This is the 6800 Series MPU enable clock input terminal. |
| 6-13 | D0- D7 | I/O | This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface is selected (P/S = "L") : D0 to D5 are set to high impedance. D6 : the serial clock input (SCL) ; D7 : serial data input (SI) . When the chip select is not active, D0 to D7 are set to high impedance. |
| 14 | VDD | PWR | Shared with the MPU power supply terminal Vcc. |
| 15 | VSS | PWR | This is a 0V terminal connected to the system GND. |
| 16 | VOUT | PWR | DC/DC voltage converter. Connect a capacitor between this terminal and VSS. |
| 17 | CAP3+ | PWR | DC/DC voltage converter. Connect a capacitor between this terminal and the CAP3+ terminal. |
| 18 | CAP1- | PWR | DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1- terminal. |
| 19 | CAP1+ | PWR | DC/DC voltage converter. Connect a capacitor between this terminal and the CAP1+ terminal. |
| 20 | CAP2+ | PWR | DC/DC voltage converter. Connect a capacitor between this terminal and the CAP2+ terminal. |

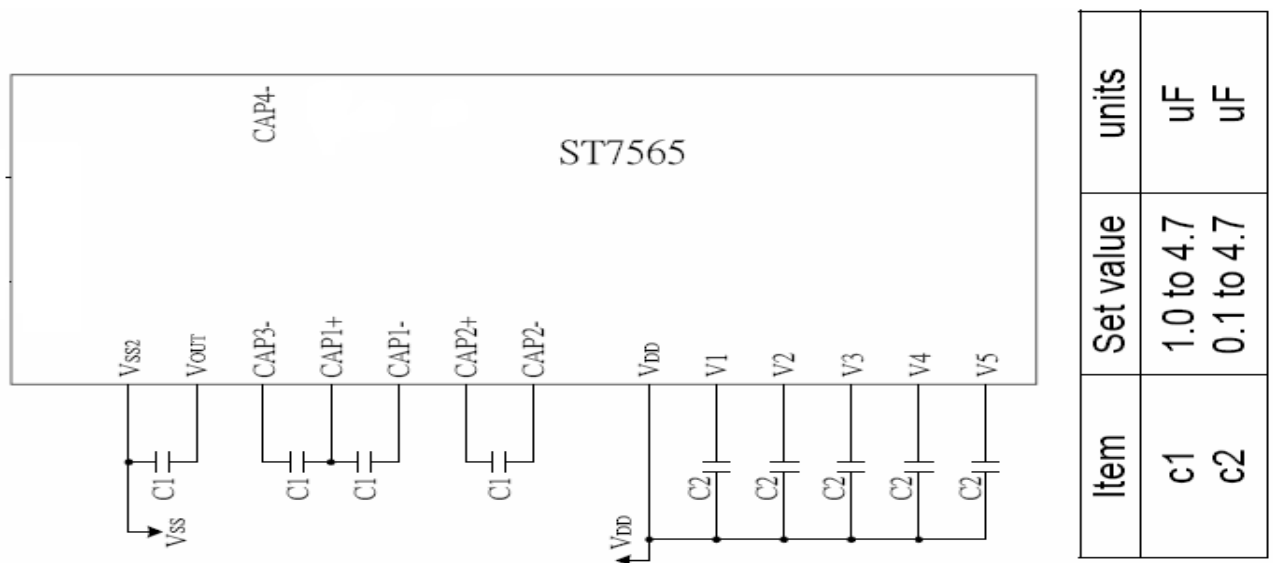
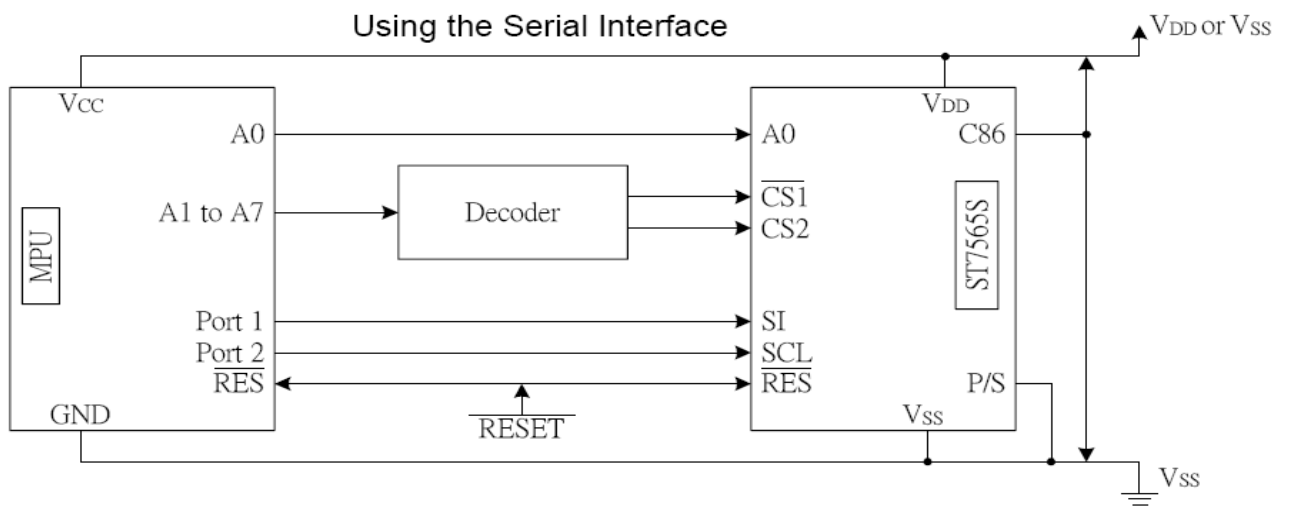
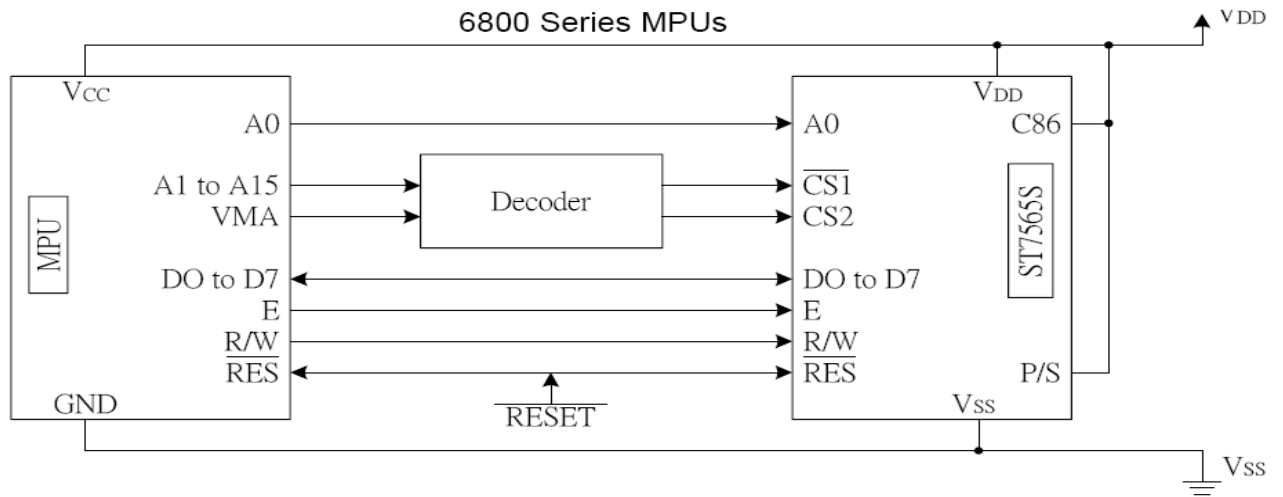
| 21 | CAP2- | PWR | DC/DC voltage converter. Connect a capacitor between this terminal and the CAP2-terminal. | | | | | | | | | | | | | | | |
|-------|--------------|----------|--|--------------|--------------|------|------------|--------------|-----|----|----------|----------|---|-----|----|---------|------------|----------|
| 22 | CAP4+ | PWR | DC/DC voltage converter. Connect a capacitor between this terminal and the CAP4+terminal. | | | | | | | | | | | | | | | |
| 23-27 | V4-V0 | PWR | This is a multi-level power supply for the liquid crystal drive. The voltage Supply applied is determined by the liquid crystal cell, and is changed through the use of a resistive voltage divided or through changing the impedance using an op.amp. Voltage levels are determined based on VDD, and must maintain the relative magnitudes shown below. VDD (= V0) ≥ V1 ≥ V2 ≥ V3 ≥ V4 | | | | | | | | | | | | | | | |
| 28 | PSB | I | <p>This is the parallel data input/serial data input switch terminal. PSB = H: Parallel data input PSB = L: Serial data input The following applies depending on the PSB(P/S) status:</p> <table border="1"> <thead> <tr> <th>P/S</th> <th>Data/Command</th> <th>Data</th> <th>Read/Write</th> <th>Serial Clock</th> </tr> </thead> <tbody> <tr> <td>"H"</td> <td>A0</td> <td>D0 to D7</td> <td>/RD, /WR</td> <td>X</td> </tr> <tr> <td>"L"</td> <td>A0</td> <td>SI (D7)</td> <td>Write only</td> <td>SCL (D6)</td> </tr> </tbody> </table> <p>When PSB = L, D0 to D5 fixed to H. /RD (E) and /WR (R/W) are fixed to either H or L. With serial data input, It is impossible read data from RAM.</p> | P/S | Data/Command | Data | Read/Write | Serial Clock | "H" | A0 | D0 to D7 | /RD, /WR | X | "L" | A0 | SI (D7) | Write only | SCL (D6) |
| P/S | Data/Command | Data | Read/Write | Serial Clock | | | | | | | | | | | | | | |
| "H" | A0 | D0 to D7 | /RD, /WR | X | | | | | | | | | | | | | | |
| "L" | A0 | SI (D7) | Write only | SCL (D6) | | | | | | | | | | | | | | |

Table 1

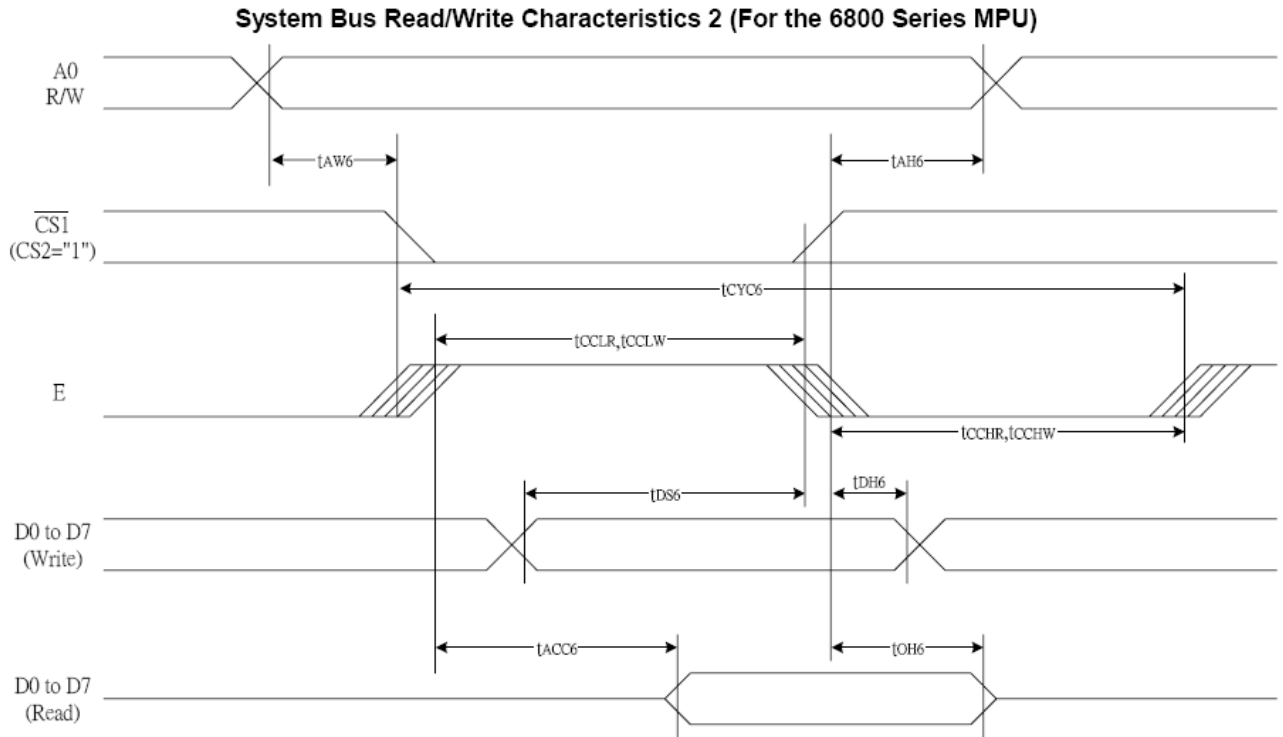
| P/S | /CS1 | CS2 | A0 | /RD | /WR | C86 | D7 | D6 | D5~D0 |
|-------------------|------|-----|----|-----|-----|-----|----|-----|-------|
| H: Parallel Input | /CS1 | CS2 | A0 | /RD | /WR | C86 | D7 | D6 | D5~D0 |
| L: Serial Input | /CS1 | CS2 | A0 | — | — | — | SI | SCL | (HZ) |

“—” indicates fixed to either “H” or to “L”

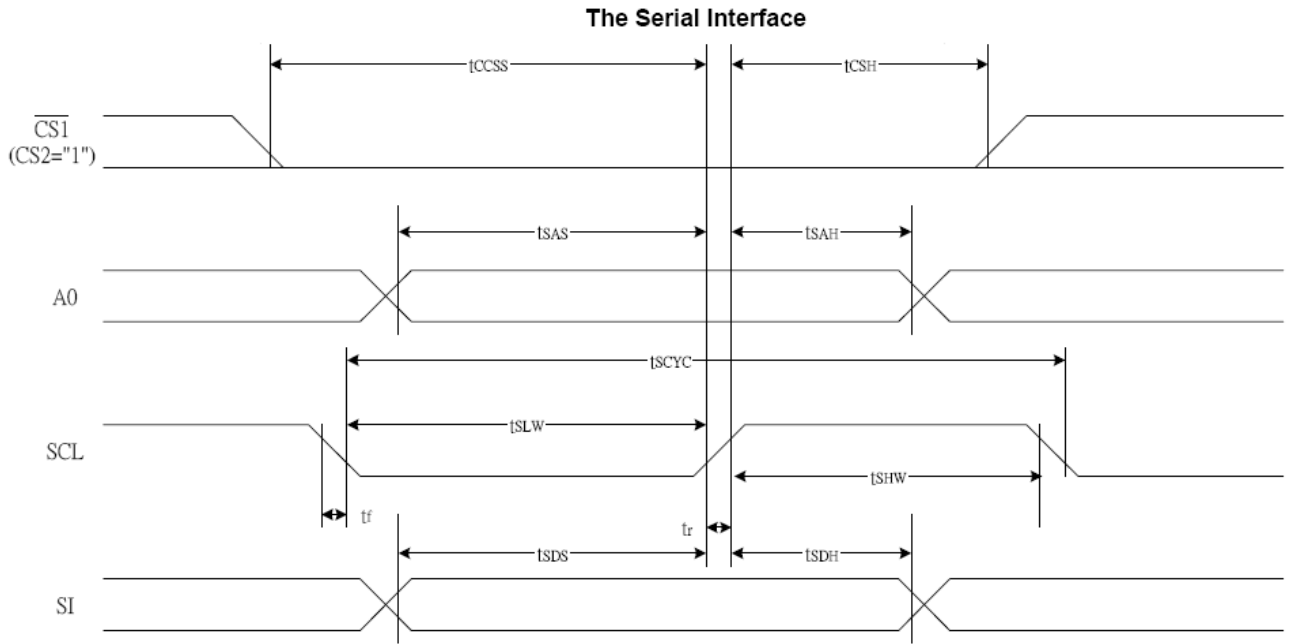
4.2 Voltage Generator Circuit



4.3 Timing Diagram



| Item | Signal | Symbol | Condition | Rating | | Units |
|----------------------------|----------|------------|-------------|--------|------|-------|
| | | | | Min | Max. | |
| Address hold time | A0 | t_{AH8} | -- | 0 | -- | ns |
| Address setup time | | t_{AW8} | | 0 | -- | ns |
| System cycle time | A0 | t_{CYC8} | -- | 240 | | |
| Control L pulse width (WR) | WR | t_{CCLW} | -- | 80 | -- | ns |
| Control L pulse width (RD) | RD | t_{CCLR} | | 140 | -- | ns |
| Control H pulse width (WR) | WR | t_{CCHW} | | 80 | -- | ns |
| Control H pulse width (RD) | RD | t_{CCHR} | | 80 | -- | ns |
| RD access time | D0 to D7 | t_{DS8} | -- | 40 | -- | ns |
| | | t_{DH8} | | 10 | -- | ns |
| Output disable time | D7 | t_{ACC8} | $C_L=100pF$ | -- | 70 | ns |
| | | t_{OH8} | | 5 | 50 | ns |



| Item | Signal | Symbol | Condition | Rating | | Units |
|---------------------|--------|--------|-----------|--------|------|-------|
| | | | | Min | Max. | |
| Serial Clock Period | SCL | Tseyc | | 50 | -- | ns |
| SCL "H" pulse width | | Tshw | | 25 | -- | ns |
| SCL "L" pulse width | | TSLW | | 25 | -- | ns |
| Address setup time | A0 | TSAS | | 20 | -- | ns |
| Address hold time | | Tsah | | 10 | -- | ns |
| Data setup time | SI | Tsds | | 20 | -- | ns |
| Data hold time | | TSDH | | 10 | -- | ns |
| CS-SCL time | CS | Tess | | 20 | -- | ns |
| CS-SCL time | | Tesh | | 40 | -- | ns |

5. NOTES

Safety

- If the LCD panel breaks, be careful not to get the liquid crystal in your mouth. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Handling

- Avoid static electricity as this can damage the CMOS LSI.
- The LCD panel is plate glass; do not hit or crush it.
- Do not remove the panel or frame from the module.
- The polarizing plate of the display is very fragile; handle it very carefully

Mounting and Design

- Mount the module by using the specified mounting part and holes.
- To protect the module from external pressure, leave a small gap by placing transparent plates (e.g. acrylic or glass) on the display surface, frame, and polarizing plate
- Design the system so that no input signal is given unless the power-supply voltage is applied.
- Keep the module dry. Avoid condensation, otherwise the transparent electrodes may break.

Storage

- Store the module in a dark place where the temperature is $25^{\circ}\text{C}\pm 10^{\circ}\text{C}$ and the humidity below 65% RH.
- Do not store the module near organic solvents or corrosive gases.
- Do not crush, shake, or jolt the module (including accessories).

Cleaning

- Do not wipe the polarizing plate with a dry cloth, as it may scratch the surface.
- Wipe the module gently with soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetone) or aromatic solvents (toluene and xylene), as they may damage the polarizing plate.

6. OPERATION PRECAUTIONS

Any changes that need to be made in this specification or any problems arising from it will be dealt with quickly by discussion between both companies.