# Crystal Clear Technology

## Product Specification

## G64128X15 series

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2.0 Record of revision

| Rev | Date | Item | Page | Comment | Originator | Checked By |
|---|---|---|---|---|---|---|
| 1.0 | 27/11/08 | | | Initial Release | Syam | Azhar |
| 2.0 | 04/12/08 | | | Deletion of Serial interface and Parallel 6800 interface details | Syam | Azhar |
| 3.0 | 15/12/08 | 3 | 3 | Deletion of Serial interface extension. G64128x15xxx00 now refers to Parallel 8080 interface only. | Syam | Azhar |

3.0 General specification

Display format: Graphics 128 (w) x 64 (h) dots

Dot size: 0.48 (w) x 0.48 (h) mm

Dot pitch: 0.52 (w) x 0.52 (h) mm

View area: 70.7 (w) x 38.8 (h) mm

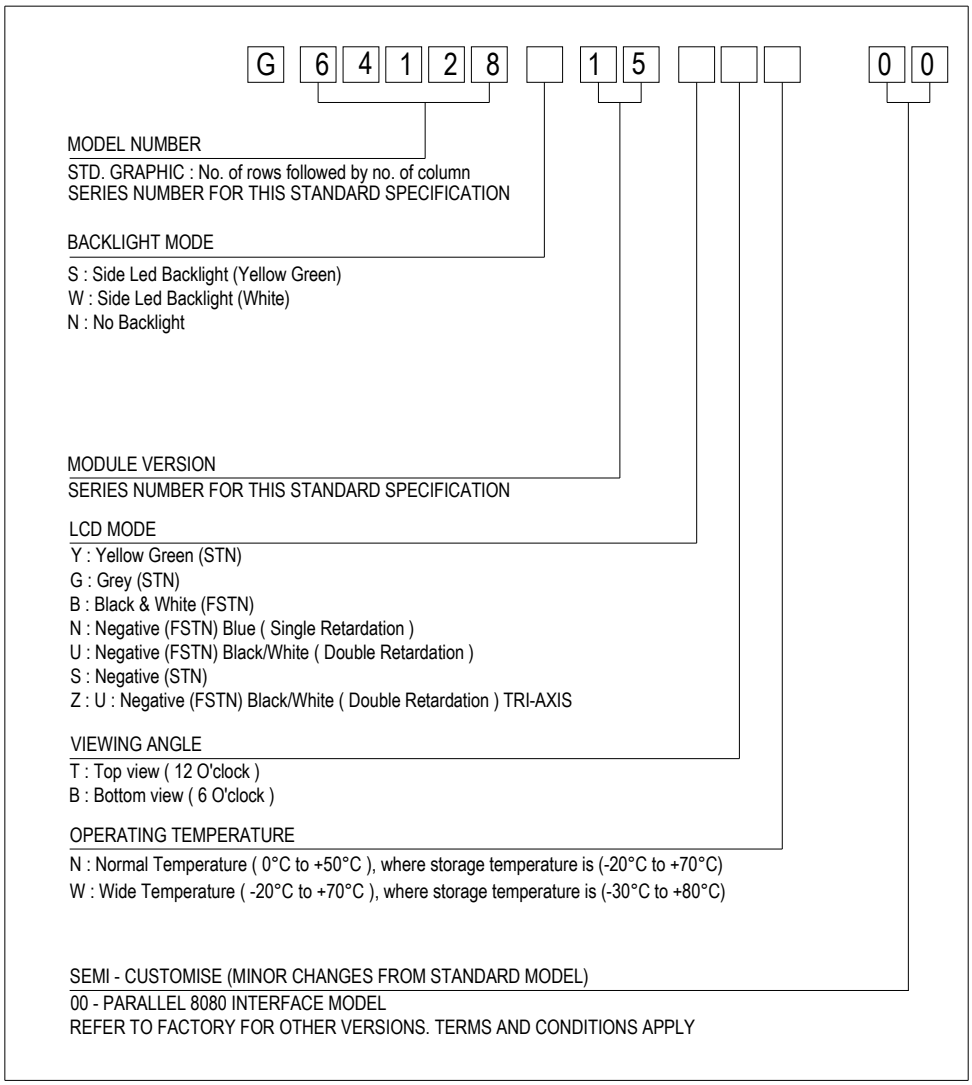
Active area: 66.52 (w) x 33.24 (h) mm

General dimensions: 93.7 (w) x 52.4 (h) x 5.5 (t) mm

Controller/Driver: SPLC501C-C1 or equivalent

Interface: Parallel 8080

Driving method: 1/64 duty, 1/9 bias



4.0 Absolute maximum rating (at Vss = 0V, ambient temperature = 25°C)

| NO | ITEM | SIMBOL | MIN | MAX | UNIT |
|---|---|---|---|---|---|
| 1. | Operating Voltage Range | $V_{DD}$ | -0.3 | 7.0 | V |
| 2. | Operating Temperature | $T_{op}$ | Refer page 3 | | °C |
| 3. | Storage Temperature | $T_{st}$ | Refer page 3 | | °C |

5.0 Electrical characteristics

| NO | ITEM | SYMBOL | CONDITION | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|---|
| 1. | Operating Voltage | $V_{DD}$ | - | 2.7 | 3.0 | 3.3 | V |
| 2. | Power Supply voltage | $V_{LCD}$ | 25°C | 10.0±5% | | | V |
| 3. | Current Supply | $I_{DD}$ | $V_{DD}$ = 3.0V 4x Boosting | - | 120 | 400 | uA |

5.1 Backlight Options

| NO | COLOR | FORWARD VOLTAGE (V) | | | FORWARD CURRENT (mA) | | | MIN BRIGHTNESS (cd/m2) * |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ. | Max | Min | Typ. | Max | |
| 1. | Yellow Green | - | 4.2 | - | - | 80 | 120 | 30 |
| 2. | White | - | 3.1 | - | - | 40 | 70 | 100 |

*Note : 1. Brightness measured at backlight surface.
2. On LCD surface, brightness is only about 10% to 15% of backlight brightness.
3. Lifetime of backlight: For YG = 50K hrs. For White, Blue = 20K hrs

6.0 Environmental requirements

| NO | ITEM | CONDITION |
|---|---|---|
| 1. | Operating Temperature | Refer page 3 |
| 2. | Storage Temperature | Refer page 3 |
| 3. | Operating Humidity | 5% to 95%RH |
| 4. | Cycle Test | 0 C @ 30 min to 50 C @ 30min for 1 cycle run for 10 cycles |
| 5. | Lifetime | 50000 HOURS (excluding backlight) |

Note: The background on LCD has the possibility to be changed in different temperature range.

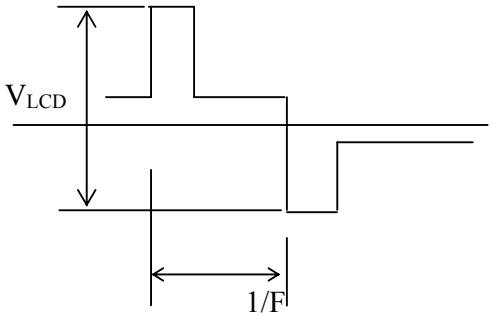
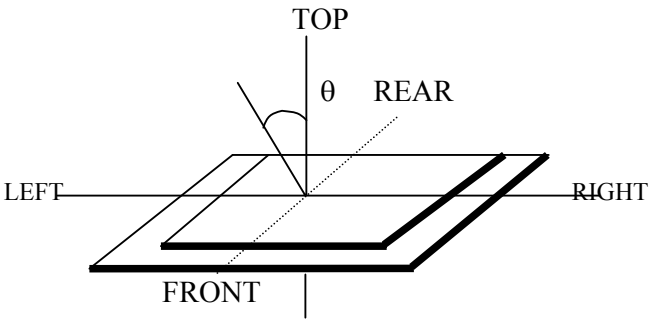
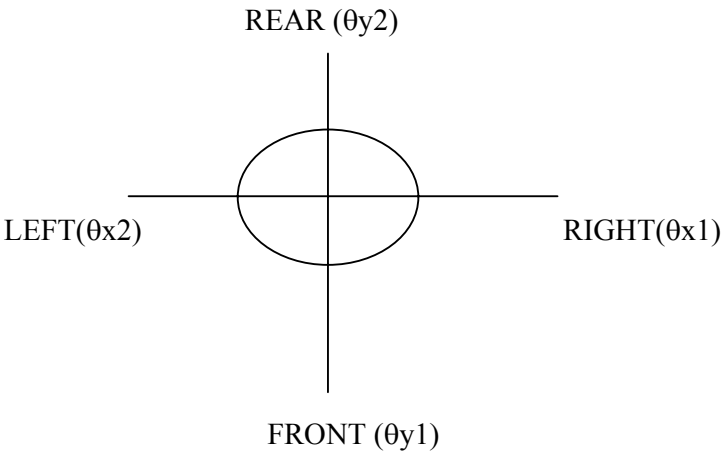
7.0 LCD specification

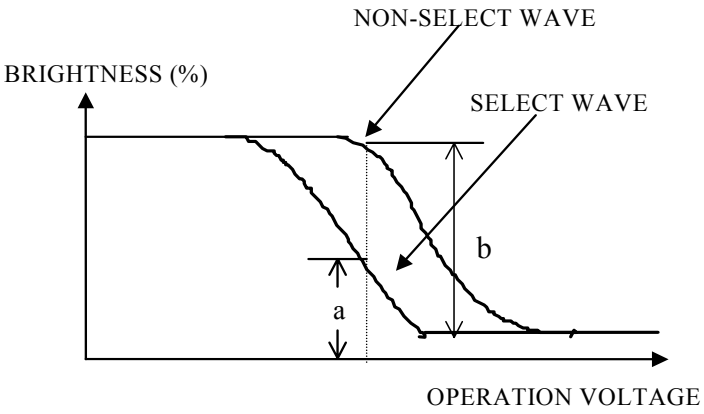
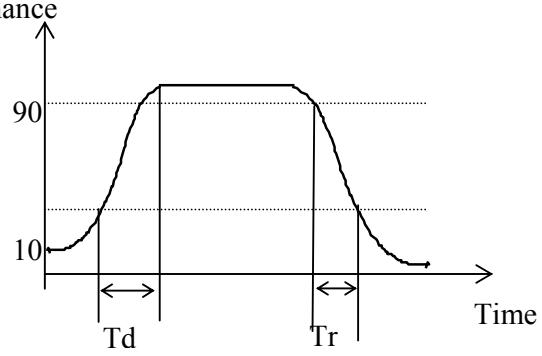
7.1 Electro-optical characteristics (at ambient temperature = 25°C)

| NO | ITEM | SYMBOL | CONDITION | LCD TYPE | | | | | | | REF. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | STN YG | STN GREY | STN -VE BLUE/ PURPLE | FSTN +VE B/W | FSTN –VE BLUE | FSTN -VE TRUE B/W | FSTN -VE TRI AXIS | |
| 1 | Operating Voltage (Volt) | $V_{LCD}$ | θ = 0<br>Cr = max | 10.0 ± 5% | | | | | | | 7.1.1 |
| 2 | Viewing Angle (Deg) | θ x 1 | CR ≥ 2<br>$V_{LCD}$ = 14.7V | +25 | +20 | +35 | +25 | +35 | +35 | +40 | 7.1.2 |
| | | θ x 2 | | -25 | -20 | -35 | -25 | -35 | -40 | -40 | |
| | | θ y 1 | | -30 | -25 | -35 | -30 | -35 | -35 | -50 | |
| | | θ y 2 | | +30 | +25 | +35 | +30 | +35 | +35 | +30 | |
| 3 | Contrast Ratio | CR | $\theta = 0^0$<br>$V_{LCD}$ =14.7V | 3.0 | 2.3 | 6.0 | 3.0 | 6.0 | 20 | 20 | 7.1.3 |
| 4 | Response Time (msec) | Rise Time (Tr) | $\theta = 0^0$ | 200 | | | | | | | 7.1.4 |
| | | Decay Time (Td) | $\theta = 0^0$ | 250 | | | | | | | |

Note:

1. Viewing angle data is based on bottom view product by default. Should it be a top view product, values are then swap.
2. Contrast ratio is based on typical data when using white colour as backlight.
3. Equipment Used Eldim; Ez Contrast 120R , Spot Size = 2mm

| NO | CHARACTERISTICS | DEFINITIONS |
|---|---|---|
| *7.1.1* | ***Definition of Operating Voltage ($V_{LCD}$)*** |  $V_{LCD}$ : Operating Voltage<br>F : Frame Frequency |
| *7.1.2* | ***Definition of Viewing Angle*** |  <br>  |

| | | |
|---|---|---|
| *7.1.3* | ***Definition of Contrast Ratio*** |  <br>Contrast Ratio = Brightness of non-selected state (b) / Brightness of selected state (a)<br>***Conditions***<br>(a) Operating Voltage: $V_{LCD}$<br>(b) Temperature: 25°C<br>(c) Viewing Angle, $\theta = 0^o$ |
| *7.1.4* | *Response Time* | Luminance (%)<br>  <br>Tr: Measured between 10% and 90% of LCD segment maximum response with $V_{ON.}$<br>Td: With voltage switches to zero and the instant LCD segment reaches 10% of its maximum response. |

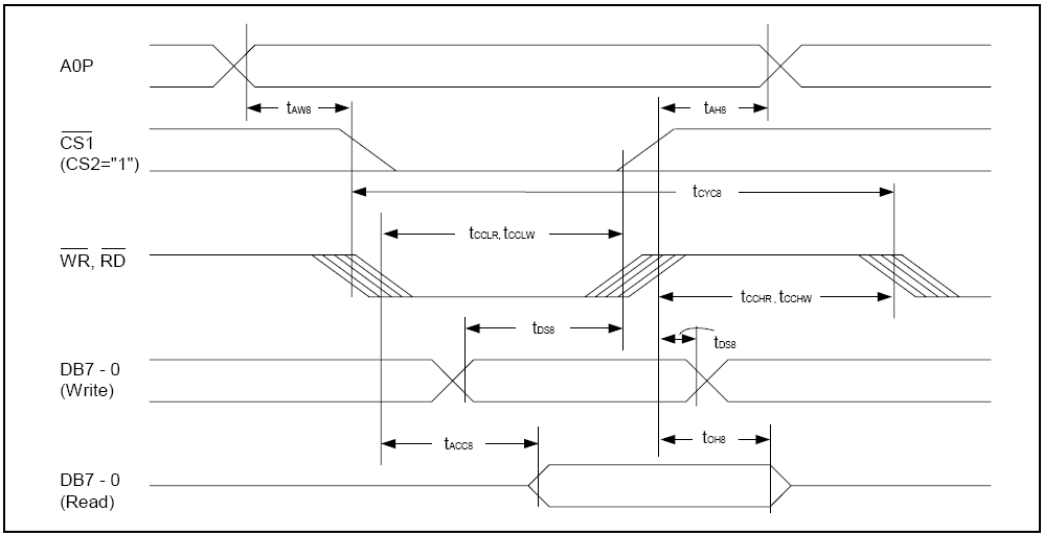
## 8.0 Interface

| ***Display Driver*** | SPLC501C-C1 OR EQUIVALENT | |
|---|---|---|
| **Pin No** | **Symbol** | **Description** |
| 1 | /CS1 | Chip select signal |
| 2 | /RESET | Reset |
| 3 | A0P | Data / instruction signal |
| 4 | /WR | Write signal (8080) |
| 5 | /RD | Read signal (8080) |
| 6 | D0 | Parallel data input |
| 7 | D1 | Parallel data input |
| 8 | D2 | Parallel data input |
| 9 | D3 | Parallel data input |
| 10 | D4 | Parallel data input |
| 11 | D5 | Parallel data input |
| 12 | D6 | Parallel data input |
| 13 | D7 | Parallel data input |
| 14 | VDD | Power supply |
| 15 | VSS | Power supply |
| 16 | VOUT | DC/DC voltage converter |
| 17 | C3N | DC/DC voltage converter |
| 18 | C1P | DC/DC voltage converter |
| 19 | C1N | DC/DC voltage converter |
| 20 | C2N | DC/DC voltage converter |
| 21 | C2P | DC/DC voltage converter |
| 22 | V1 | LCD biasing voltages |
| 23 | V2 | LCD biasing voltages |
| 24 | V3 | LCD biasing voltages |
| 25 | V4 | LCD biasing voltages |
| 26 | V5 | LCD biasing voltages |

# 9.0 Functional Descriptions

## 9.1 Read/Write timing characteristics

Read/Write characteristics (8080 series MPU)




(VDD = 4.5V to 5.5V, $T_A$ = 25℃)

| Item | Signal | Symbol | Condition | Rating | | Units |
|---|---|---|---|---|---|---|
| | | | | Min. | Max. | |
| Address hold time | A0P | $t_{AH8}$ | | 0 | - | ns |
| Address setup time | | $t_{AW8}$ | | 0 | - | ns |
| System cycle time | A0P | $t_{CYC8}$ | | 166 | - | ns |
| Control L pulse width ( $\overline{WR}$ ) | $\overline{WR}$ | $t_{CCLW}$ | | 30 | - | ns |
| Control L pulse width ( $\overline{RD}$ ) | $\overline{RD}$ | $t_{CCLR}$ | | 70 | - | ns |
| Control H pulse width ( $\overline{WR}$ ) | $\overline{WR}$ | $t_{CCHW}$ | | 30 | - | ns |
| Control H pulse width ( $\overline{RD}$ ) | $\overline{RD}$ | $t_{CCHR}$ | | 30 | - | ns |
| Data setup time | DB7 - 0 | $t_{DS8}$ | | 30 | - | ns |
| Address hold time | | $t_{DH8}$ | | 10 | - | ns |
| $\overline{RD}$ access time | | $t_{ACC8}$ | $C_L$ = 100pF | - | 70 | ns |
| Output disable time | | $t_{OH8}$ | | 5.0 | 50 | ns |

| Item | Signal | Symbol | Condition | Rating | | Units |
|---|---|---|---|---|---|---|
| | | | | Min. | Max. | |
| Address hold time | A0P | $t_{AH8}$ | | 0 | - | ns |
| Address setup time | | $t_{AW8}$ | | 0 | - | ns |
| System cycle time | A0P | $t_{CYC8}$ | | 300 | - | ns |
| Control L pulse width ( $\overline{WR}$ ) | $\overline{WR}$ | $t_{CCLW}$ | | 60 | - | ns |
| Control L pulse width ( $\overline{RD}$ ) | $\overline{RD}$ | $t_{CCLR}$ | | 120 | - | ns |
| Control H pulse width ( $\overline{WR}$ ) | $\overline{WR}$ | $t_{CCHW}$ | | 60 | - | ns |
| Control H pulse width ( $\overline{RD}$ ) | $\overline{RD}$ | $t_{CCHR}$ | | 60 | - | ns |
| Data setup time | DB7 - 0 | $t_{DS8}$ | | 40 | - | ns |
| Address hold time | | $t_{DH8}$ | | 15 | - | ns |
| $\overline{RD}$ access time | | $t_{ACC8}$ | $C_L$ = 100pF | - | 140 | ns |
| Output disable time | | $t_{OH8}$ | | 10 | 100 | ns |

(VDD = 2.4V to 2.7V, $T_A$ = 25℃)

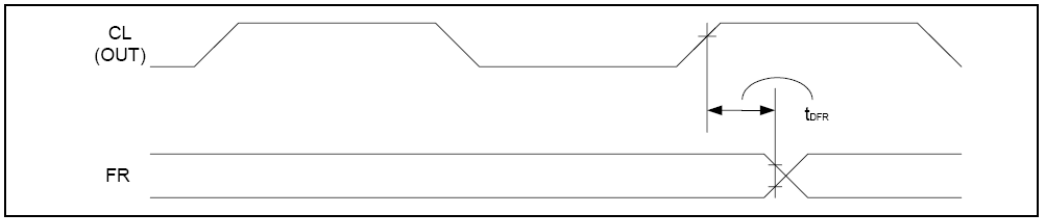
| Item | Signal | Symbol | Condition | Rating | | Units |
|---|---|---|---|---|---|---|
| | | | | Min. | Max. | |
| Address hold time | A0P | $t_{AH8}$ | | 0 | - | ns |
| Address setup time | | $t_{AW8}$ | | 0 | - | ns |
| System cycle time | A0P | $t_{CYC8}$ | | 1000 | - | ns |
| Control L pulse width ( $\overline{WR}$ ) | $\overline{WR}$ | $t_{CCLW}$ | | 120 | - | ns |
| Control L pulse width ( $\overline{RD}$ ) | $\overline{RD}$ | $t_{CCLR}$ | | 240 | - | ns |
| Control H pulse width ( $\overline{WR}$ ) | $\overline{WR}$ | $t_{CCHW}$ | | 120 | - | ns |
| Control H pulse width ( $\overline{RD}$ ) | $\overline{RD}$ | $t_{CCHR}$ | | 120 | - | ns |
| Data setup time | DB7 - 0 | $t_{DS8}$ | | 80 | - | ns |
| Address hold time | | $t_{DH8}$ | | 30 | - | ns |
| $\overline{RD}$ access time | | $t_{ACC8}$ | $C_L$ = 100pF | - | 280 | ns |
| Output disable time | | $t_{OH8}$ | | 10 | 200 | ns |

**Note1:** The input signal rise time and fall time ($t_r$, $t_f$) is specified at 15 ns or less. When the system cycle time is extremely fast, $(t_r + t_f) \leqq (t_{CYC8} - t_{CCLW} - t_{CCHW})$ for $(t_r + t_f) \leqq (t_{CYC8} - t_{CCLR} - t_{CCHR})$ are specified.

**Note2:** All timing is specified using 20% and 80% of VDD as the reference.

**Note3:** $t_{CCLW}$ and $t_{CCLR}$ are specified as the overlap between CS1 being 'L' ( CS2 = 'H') and $\overline{WR}$ and $\overline{RD}$ being at the 'L' level.

## 9.2 Display control output timing




(VDD = 4.5V to 5.5V, $T_A$ = 25℃)

| Item | Signal | Symbol | Condition | Rating | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| FR delay time | FR | $t_{DFR}$ | $C_L$ = 50pF | - | 10 | 40 | ns |

(VDD = 2.7V to 4.5V, $T_A$ = 25℃)

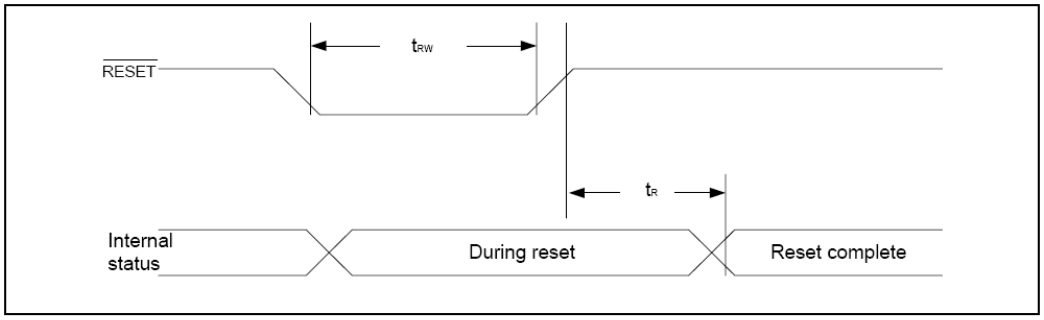
| Item | Signal | Symbol | Condition | Rating | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| FR delay time | FR | $t_{DFR}$ | $C_L$ = 50pF | - | 20 | 80 | ns |

(VDD = 2.4V to 2.7V, $T_A$ = 25℃)

| Item | Signal | Symbol | Condition | Rating | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| FR delay time | FR | $t_{DFR}$ | $C_L$ = 50pF | - | 50 | 200 | ns |

**Note1:** Valid only when the master mode is selected.
**Note2:** All timing is based on 20% and 80% of VDD.

## 9.3 Reset timing




(VDD = 4.5V to 5.5V, $T_A$ = 25℃)

| Item | Signal | Symbol | Condition | Rating | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Reset time | | $t_R$ | - | - | - | 0.5 | µs |
| Reset 'L' pulse width | RES | $t_{RW}$ | | 0.5 | - | - | µs |

(VDD = 2.7V to 4.5V, $T_A$ = 25℃)

| Item | Signal | Symbol | Condition | Rating | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Reset time | | $t_R$ | - | - | - | 1.0 | µs |
| Reset 'L' pulse width | RES | $t_{RW}$ | | 1.0 | - | - | µs |

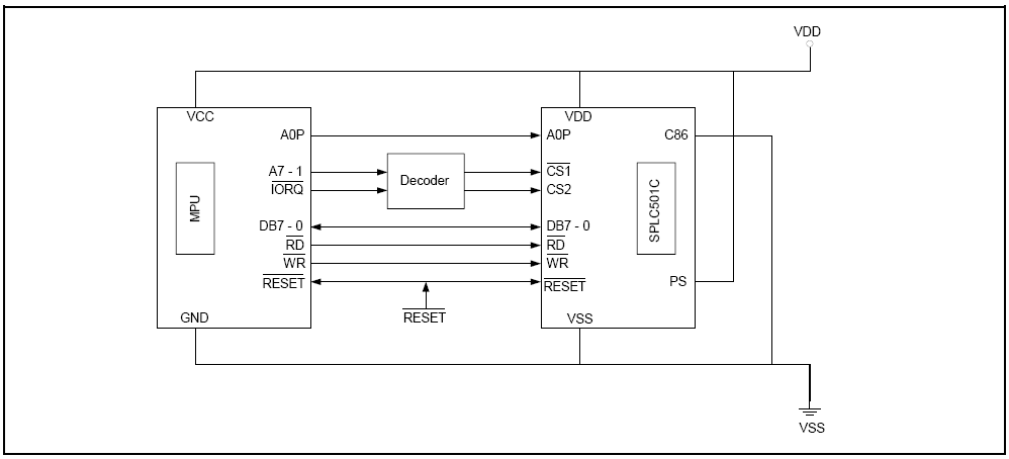
(VDD = 2.4V to 2.7V, $T_A$ = 25℃)

| Item | Signal | Symbol | Condition | Rating | | | Units |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Reset time | | $t_R$ | - | - | - | 1.5 | µs |
| Reset 'L' pulse width | RES | t | | 1.5 | - | - | µs |

**Note:** All timing is specified with 20% and 80% of VDD as the standard.

## 9.2 Application Circuits

### 9.2.1 8080 MPU Interface

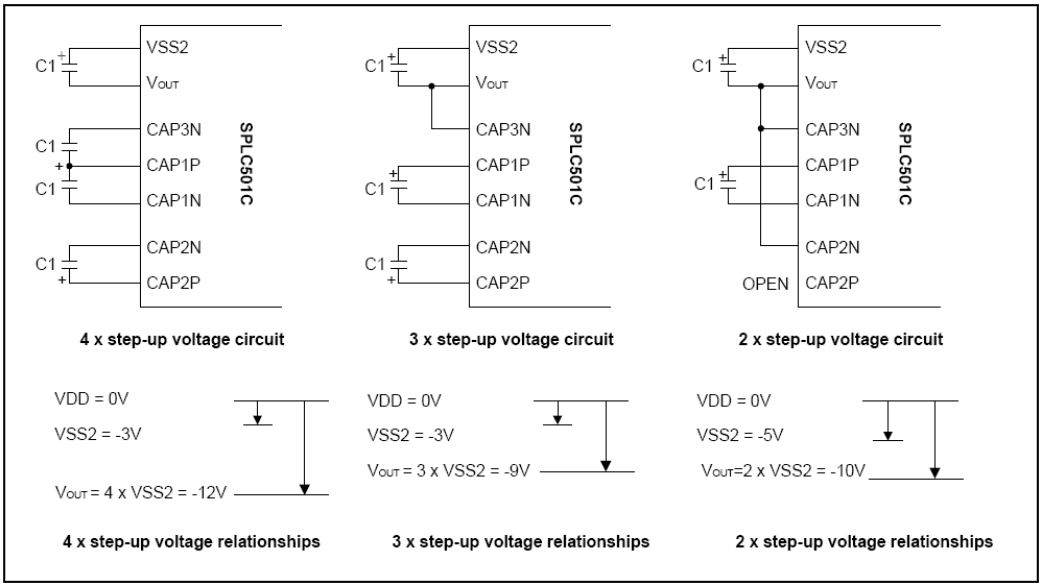


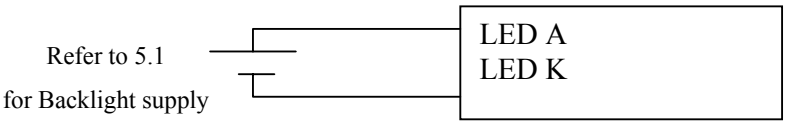
## 10. Instruction Set

| Command | Command Code | | | | | | | | | | | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | A0P | $\overline{RD}$ | $\overline{WR}$ | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | |
| 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 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | Most significant column address | | | | Sets the most significant 4 bits of the display RAM column address. |
| Column address set lower bit | 0 | 1 | 0 | 0 | 0 | 0 | 0 | Least significant column address | | | | Set 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 driver voltage bias ratio<br>SPLC501C…….0:1/9, 1:1/7 |
| 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<br>1 | * | * | * | 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). $V_5$ 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 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | Set the $V_5$ output voltage electronic volume register |
| Electronic volume register set | 0 | 1 | 0 | * | * | Electronic volume value | | | | | | |

| Command | Command Code | | | | | | | | | | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | A0P | $\overline{RD}$ | $\overline{WR}$ | DB7 | DB6 | DB5 | DB4 | DB3 | DB2 | DB1 | DB0 | |
| 19). Static indicator ON/OFF | | | | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0<br>1 | 0: OFF, 1: ON |
| Static indicator Register set | | | | * | * | * | * | * | * | Mode | | Set the flashing mode |
| 20). Page Blink | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | |
| Page selection | 0 | 1 | 0 | P7 | P6 | P5 | P4 | P3 | P2 | P1 | P0 | P7 - 0: 1 - blinking page<br>0 - no blinking, normal display |
| 21). Driving Mode Set | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | Set the driving mode register |
| Mode selection | 0 | 1 | 0 | D1 | D0 | 0 | 0 | 0 | 0 | 0 | 0 | Driving capability (D1, D0): (1,1)>(0,0)>(0,1)>(1,0) |
| 22). Power saver | | | | | | | | | | | | Display OFF and display all points ON compound command |
| 23). NOP | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | Command for non-operation |
| 24). Test | 0 | 1 | 0 | 1 | 1 | 1 | 1 | * | * | * | * | Command for IC test. Do not use this command |
| | | | | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | |

11. Power Supply

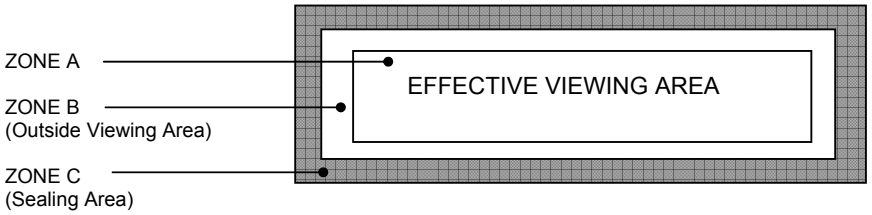



For backlight version only

12.0 Quality Assurance

## 12.1 ZONE DEFINITION

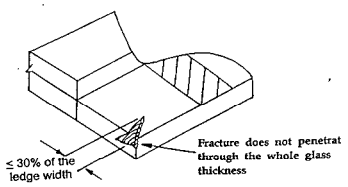


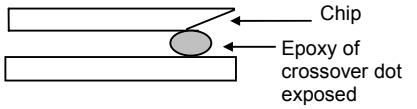
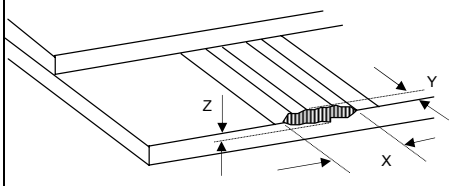
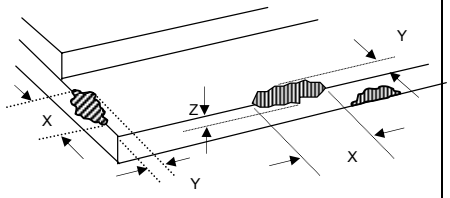
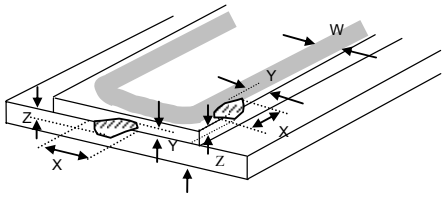
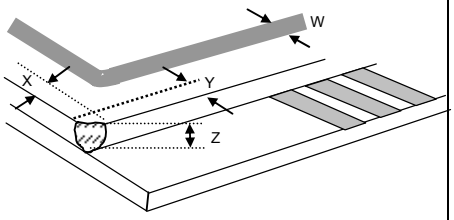

## 12.2 REJECTION CRITERIA

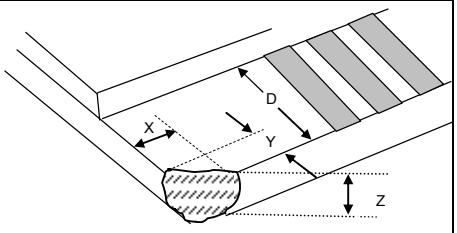
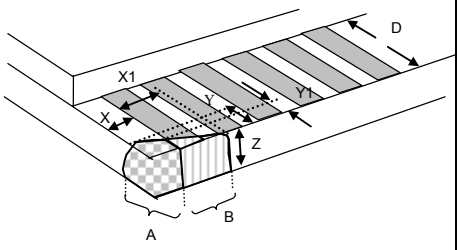
12.2.1 DIMENSIONAL DEFECTS

| Defect Category | Defect Description | Criterion | Drawing Specification |
|---|---|---|---|
| Glass Size | Dimensions of LCD, do not conform to the drawing | Reject | Refer to LCD Physical Dimension Drawing |
| Perimeter Seal Extension | Perimeter seal epoxy enters the effective viewing area | Reject | |
| End Seal Size | Size of end seal does not meet drawing specification | Reject | Refer to LCD Physical Dimension Drawing |

12.2.2 VISUAL DEFECTS

| Defect Category | Defect Description | Criterion | Drawing Specification |
|---|---|---|---|
| Fracture | A type of glass breakage containing running cracks. Inspectors should attempt to remove it with fingernail. If removed, evaluate as chip | Reject – if the size is $\geq$ 30% of the contact ledge width. |  |

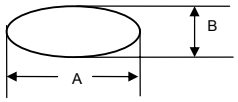
| Defect Category | Defect Description | Criterion | Drawing Specification |
|---|---|---|---|
| Chip | Chip in cross over area | 1) Reject - if the chip causes crossover dot to be exposed<br><br>2) Chip on outside edge of the glass plate but is greater than 50% of glass thickness at crossover dot is reject able. |  |
| Chip | Chip in contact pad area | Accept if:-<br>a) X ≤ 2.0mm<br>b) Y ≤ 0.5mm<br>c) Z disregard |  |
| | Chip in non-contact pad area | Accept if:-<br>a) X ≤ 6.0mm<br>b) Y ≤ 1.0mm<br>c) Z disregard |  |
| | Chip in perimeter seal area | Accept if:-<br>a) Y ≤ 1/3 of perimeter seal width (W)<br>b) X ≤ 3.0mm<br>c) Z disregard<br>d) X and Y not touch crossover dot |  |
| Corner Chip | Corner chip within seal area | Accept if:-<br>a) X ≤ 1/3 of perimeter seal width (W)<br>b) Y ≤ 1/3 of perimeter seal width (W)<br>c) Z disregard |  |

| Defect Category | Defect Description | Criterion | Drawing Specification |
|---|---|---|---|
| | Corner chip not effecting contact pad / ITO | Accept if:-<br>a) XY ≤ 4mm$^2$<br>AND<br>b) Y ≤ D and X ≤ 2.0mm<br>c) Z disregard |  |
| | Corner chip effecting contact pad / ITO | A) Accept if:-<br>a) XY ≤ 4mm$^2$<br>AND<br>b) Y ≤ D and X ≤ 2.0mm<br><br>B) Accept if:-<br>a) X1 ≤ 2.0mm<br>b) Y1 ≤ 0.5mm<br><br>Z disregard |  |
| Glass flare | A thin layer of glass flare at contact area | Accept if:-<br>a) Flare thickness ≤ ¼ W when W ≤ 3mm<br><br>b) Flare thickness ≤ 1mm when W > 3mm<br><br>W: Contact ledge width | |
| Glass burr | A rough edge(s) left along the scribing edge (i.e. along the edges of display) | Reject – if the burr cause undersize or oversize of the LCD | Refer to LCD Physical Dimension Drawing |
| Rainbow | Colored ring in sharp blotches observed | Reject – if 3 or more colored rings in sharp blotches of color are observed. (Limit samples should be used when applicable) | |

| Defect Category | Defect Description | Criterion | Drawing Specification |
|---|---|---|---|
| Discoloration | | Reject - if the discolorations enter the active viewing area of LCD. Color of the LCD shall follow product specification as specified in the manufacturing specification | |
| Air Void | LC does not fulfill the display | Reject | |
| Fill end contamination | Discoloration at end seal area | Reject if discoloration exceeded the baffle (for display with baffle) or viewing area (for display without baffle) | |

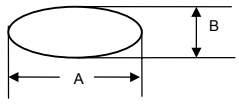
12.2.3 POLARIZER DEFECT

| Defect Category | Defect Description | Criterion | Drawing Specification |
|---|---|---|---|
| Polarizer defect | Polarizer coverage | 1- Polarizer should cover effective viewing area of display.<br>2- It is acceptable if perimeter seal bolder at all sides could be seen.<br>3- It is acceptable if polarizer attaching position meeting the tolerance mentioned in the drawing.<br>4- It is reject able if polarizer edge jagged and not even | Refer to LCD Physical Dimension Drawing |
| | Polarizer Peeling / delamination | 1- Reject if any edge or corner of the polarizer is lifted up or not adheres to the glass | |
| | Polarizer Scratches | 1- Any scratch should be acceptable if it is not visible from viewing distance at head of position<br>2-Polarizer scratch in viewing area is reject able if it is visible from the specified viewing distance<br>3-Defect, which is visible under surface glare, should be disregard | |
| | Polarizer damage | 1-Stain mark or depression in front polarizer surface should be acceptable if it is not visible from viewing distance at head on position.<br>2-Defect, which is visible under surface glare, should be disregard | |

<table>
<tr><th>Defect Category</th><th>Defect Description</th><th>Criterion</th><th>Drawing Specification</th></tr>
<tr><td></td><td>Polarizer bubble / Foreign material</td><td>
<table>
<tr><td>Zone /</td><td colspan="3">A</td></tr>
<tr><td>Dimension</td><td colspan="3">Acceptable No.</td></tr>
<tr><td>D ≤ 0.15mm</td><td>NC</td><td>B</td><td>C</td></tr>
<tr><td>0.15 < D ≤ 0.30mm</td><td>3</td><td>NC</td><td>NC</td></tr>
<tr><td>0.30 < D ≤ 0.50mm</td><td>2</td><td>5</td><td>NC</td></tr>
<tr><td>0.50 < D ≤ 1.0mm</td><td>0</td><td>3</td><td>NC</td></tr>
<tr><td>NC: No count</td><td></td><td>1</td><td>NC</td></tr>
<tr><td colspan="4">D: Mean Diameter of Defect</td></tr>
<tr><td colspan="4">Accept - if air bubble at the seal area does not propagate into effective viewing area</td></tr>
</table>
</td><td> 

D = (A + B)/2</td></tr>
</table>

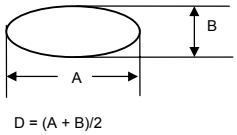
12.2.4 FUNCTIONAL DEFECT

<table>
<tr><th>Defect Category</th><th>Defect Description</th><th>Criterion</th><th>Drawing Specification</th></tr>
<tr><td>Missing common</td><td>Part of the pattern does not light up</td><td>Reject</td><td></td></tr>
<tr><td>Missing segment</td><td>One or few segment does not light up</td><td>Reject</td><td></td></tr>
<tr><td>Common-common short</td><td>Common and common connected</td><td>Reject</td><td></td></tr>
<tr><td>Segment-segment short</td><td>Segment and segment connected</td><td>Reject</td><td></td></tr>
<tr><td>Common – segment short</td><td>Common and segment connected</td><td>Reject</td><td></td></tr>
<tr><td>Wrong viewing angle</td><td>Wrong viewing angle</td><td>Reject if display viewing angle not conform to customer requirement</td><td></td></tr>
<tr><td>Metal residue</td><td>Extra spot lights up at the border of the segment.</td><td>Accept if ≤ 0.20mm (mean diameter)</td><td></td></tr>
<tr><td>Slow response</td><td>Response of the display on one side slower than the other side</td><td>Reject if it is visible at 30cm distance</td><td></td></tr>
<tr><td>Reverse twist/ tilt</td><td>Segment are darker or clearer than other area of the same segment</td><td>Reject</td><td></td></tr>
<tr><td>Misalignment</td><td>Segment fatter or smaller or extra segment</td><td>Reject if > 10% of designed segment width and visible at 30cm distance</td><td></td></tr>
<tr><td>Pin Hole</td><td>Pin hole / void at light up segment</td><td>
<table>
<tr><td>Zone /</td><td colspan="3">Acceptable No.</td></tr>
<tr><td>Dimension</td><td>A</td><td>B</td><td>C</td></tr>
<tr><td>D ≤ 0.10mm</td><td>NC</td><td>NC</td><td>NC</td></tr>
<tr><td>0.10<D ≤ 0.20mm</td><td>3</td><td>3</td><td>NC</td></tr>
<tr><td colspan="4">NC: No count<br><br>D: Mean Diameter of Defect</td></tr>
</table>
</td><td> 

D = (A + B)/2</td></tr>
</table>

| Defect Category | Defect Description | Criterion | Drawing Specification |
|---|---|---|---|
| Segment Smearing | Light up segment smear | Reject | |
| Dim segment | Display shows poor contrast at pre set voltage | Reject | |

12.2.5 BLACK SPOT, WHITE SPOT AND FOEREIGN MATERIAL

| Defect Category | Defect Description | Criterion | | | | Drawing Specification |
|---|---|---|---|---|---|---|
| Black Spot, White Spot and Foreign Material | Black Spot, White Spot and Foreign Material | Zone / Dimension | Acceptable No. | | |  |
| | | | A | B | C | |
| | | D ≤ 0.10mm | NC | NC | NC | |
| | | 0.10<D ≤ 0.20mm | 3 | 3 | NC | |
| | | 0.20 < D ≤ 0.30mm | 1 | 2 | NC | |
| | | D > 0.30 mm | 0 | 0 | NC | |
| | | NC: No count<br>D: Mean Diameter of Defect | | | | |



12.2.6 LINE SHAPE AND SCRATCHES

| Defect Category | Defect Description | Criterion | | | | | Drawing Specification |
|---|---|---|---|---|---|---|---|
| Line shape and scratches | Line shape and scratches | Zone /Dimension | | Acceptable No. | | | |
| | | X | Y | A | B | C | |
| | | - | <0.01mm | NC | NC | NC | |
| | | < 2 mm | < 0.02mm | 1 | 1 | NC | |
| | | <1 mm | < 0.0 2mm | 1 | 2 | NC | |

Note: Total defects shall not exceed five

## 13. Precaution for using LCM

1. Liquid Crystal Display (LCD)

LCD is made up of glass, organic sealant, organic fluid and polymer based polarizers. The following precautions should be taken when handling.

b) Keep the temperature within the range of use and storage. Excessive temperature and humidity could cause polarization degredation, polarizer peel off or bubble.

c) Do not contact the exposed polarizer with anything harder than HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzin.

d) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or colour fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.

e) Glass can be easily chipped or cracked from rough handling, especially at corners and edges.

f) Do not drive LCD with DC voltage.

2. Liquid Crystal Display Modules.

2.1 Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modification. The following should be noted.

a) Do not tamper in any way with the tabs on the metal frame.

b) Do not modify the PCB by drilling extra holes, changing its outline, moving its component or modifying its pattern.

c) Do not touch the elastomer connector, especially insert a backlight panel (for example, EL)

d) When mounting a LCM make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.

a) Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

2.2 Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

a) The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.

b) The modules should be kept in antistatic bags or other containers to static for storage.

c) Only properly grounded soldering irons should be used.

d) If an electric screwdriver is used, it should be well grounded and shielded from commutator spark.

e) The normal static prevention measures should be observed for work clothes and working benches, the latter conductive (rubber) mat is recommended.

f) Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

2.3 Soldering

a) Solder only to the I/O terminals.

b) Use only soldering irons with proper grounding and no leakage.

c) Soldering temperature: 280 °C

d) Soldering time: 3 to 4 sec

e) Use eutectic solder with resin flux fill.

f) If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed afterwards.

2.4 Operation

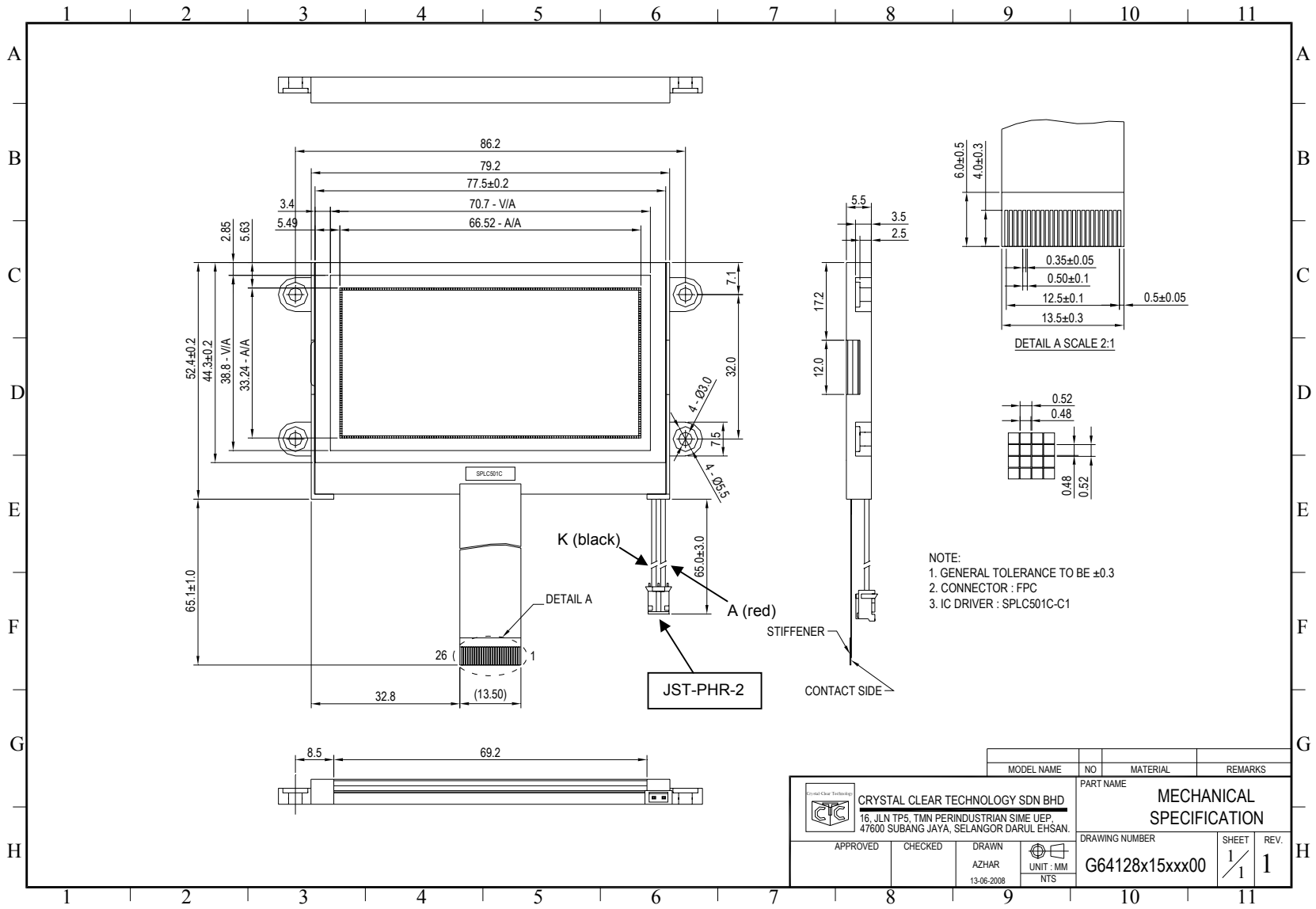
a) The contras can be adjusted by varying the LCD driving voltage V0
b) Driving voltage should be kept within specified range, excess voltage shortens display life.
c) Response time increases with decrease in temperature.
d) Display may turn black or dark blue at temperature above its operational range, this is (however not pressing on the viewing area) may cause the segments to appear "fractured".
e) Mechanical disturbance during operation ( such as pressing on the viewing area) may cause the segments to appear "fractured".

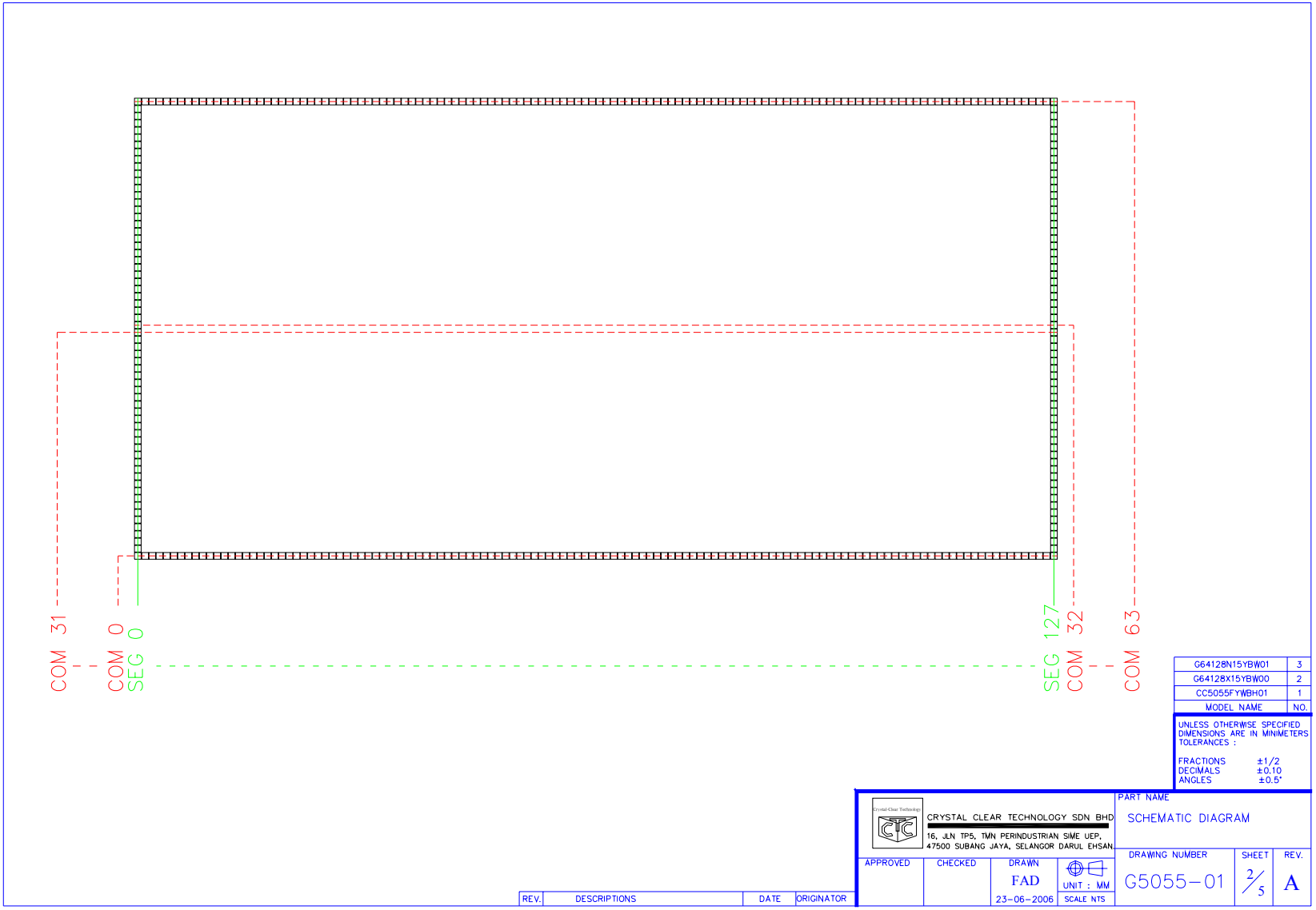
2.5 Storage

If any fluid leaks out of the damage glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

2.6 Limited Warranty

Unless otherwise agreed between Crystal Clear Technology and customer, Crystal Clear Technology will replace or repair any of its LCD and LCM which is found to be defective electrically and visually when inspected in accordance with Crystal Clear Technology acceptance standards, for a period of one year from date of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of Crystal Clear Technology is limited to repair and/or replacement on the terms set forth above. Crystal Clear Technology will not responsible for any subsequent or consequential events.


86.2
79.2
77.5±0.2
70.7 - V/A
66.52 - A/A
3.4
5.49
2.85
5.63
7.1
32.0
52.4±0.2
44.3±0.2
38.8 - V/A
33.24 - A/A
4 - Ø3.0
7.5
4 - R0.5
SPLC501C
K (black)
A (red)
65.0±3.0
65.1±1.0
DETAIL A
26
1
32.8
(13.50)
JST-PHR-2
8.5
69.2
5.5
3.5
2.5
17.2
12.0
STIFFENER
CONTACT SIDE
6.0±0.5
4.0±0.3
0.35±0.05
0.50±0.1
12.5±0.1
13.5±0.3
0.5±0.05
DETAIL A SCALE 2:1
0.52
0.48
0.48
0.52
NOTE:
1. GENERAL TOLERANCE TO BE ±0.3
2. CONNECTOR : FPC
3. IC DRIVER : SPLC501C-C1
MODEL NAME
NO
MATERIAL
REMARKS
CRYSTAL CLEAR TECHNOLOGY SDN BHD
16, JLN TP5, TMN PERINDUSTRIAN SIME UEP,
47600 SUBANG JAYA, SELANGOR DARUL EHSAN.
PART NAME
MECHANICAL SPECIFICATION
APPROVED
CHECKED
DRAWN
AZHAR
13-06-2008
UNIT : MM
NTS
DRAWING NUMBER
G64128x15xxx00
SHEET
1/1
REV.
1


COM 31
COM 0
SEG 0
SEG 127
COM 32
COM 63
G64128N15YBW01 3
G64128X15YBW00 2
CC5055FYWBH01 1
MODEL NAME NO.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MINIMETERS
TOLERANCES :
FRACTIONS ±1/2
DECIMALS ±0.10
ANGLES ±0.5°
CRYSTAL CLEAR TECHNOLOGY SDN BHD
16, JLN TP5, TMN PERINDUSTRIAN SIME UEP,
47500 SUBANG JAYA, SELANGOR DARUL EHSAN.
PART NAME
SCHEMATIC DIAGRAM
APPROVED
CHECKED
DRAWN
FAD
23-06-2006
UNIT : MM
SCALE NTS
DRAWING NUMBER
G5055-01
SHEET
2/5
REV.
A
REV.
DESCRIPTIONS
DATE
ORIGINATOR

## Crystal Clear Technology

**16 Jalan TP5—Taman Perindustrian Sime UEP**
**47600 Subang Jaya—Selangor DE**
**Malaysia**