# OLED DISPLAY MODULE

## Product Specification

| | | |
|---|---|---|
| **CUSTOMER** | **Standard** | |
| **PRODUCT NUMBER** | **DD-160128FC-1A** | |
| **CUSTOMER APPROVAL** | | **Date** |

| INTERNAL APPROVALS | | |
|---|---|---|
| Product Mgr | Doc. Control | Electr. Eng |
| **Bruno Recaldini** | **Anthony Perkins** | **Bazile Peter** |
| Date: 09/02/10 | Date: 09/02/10 | Date: 09/02/10 |

☐ **Approval for Specification only**

☐ **Approval for Specification and Sample**

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REVISION RECORD

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| A | 10-Jul-06 | | | First Issue | |
| B | 09-Feb-10 | 4 | 1 | Update panel size | |
| | | 6 | 2.2 | Update mechanical drawing | |
| | | 9 | 3.3 | Update pin definition | |
| | | 11 | 3.4 | Update block diagram | |
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| C | 28 Nov 12 | 29 | 10 | Add chapter 10 supported accessories | |
| | | | | Change Densitron logo at Header | |
| | | | | | |

# 1 MAIN FEATURES

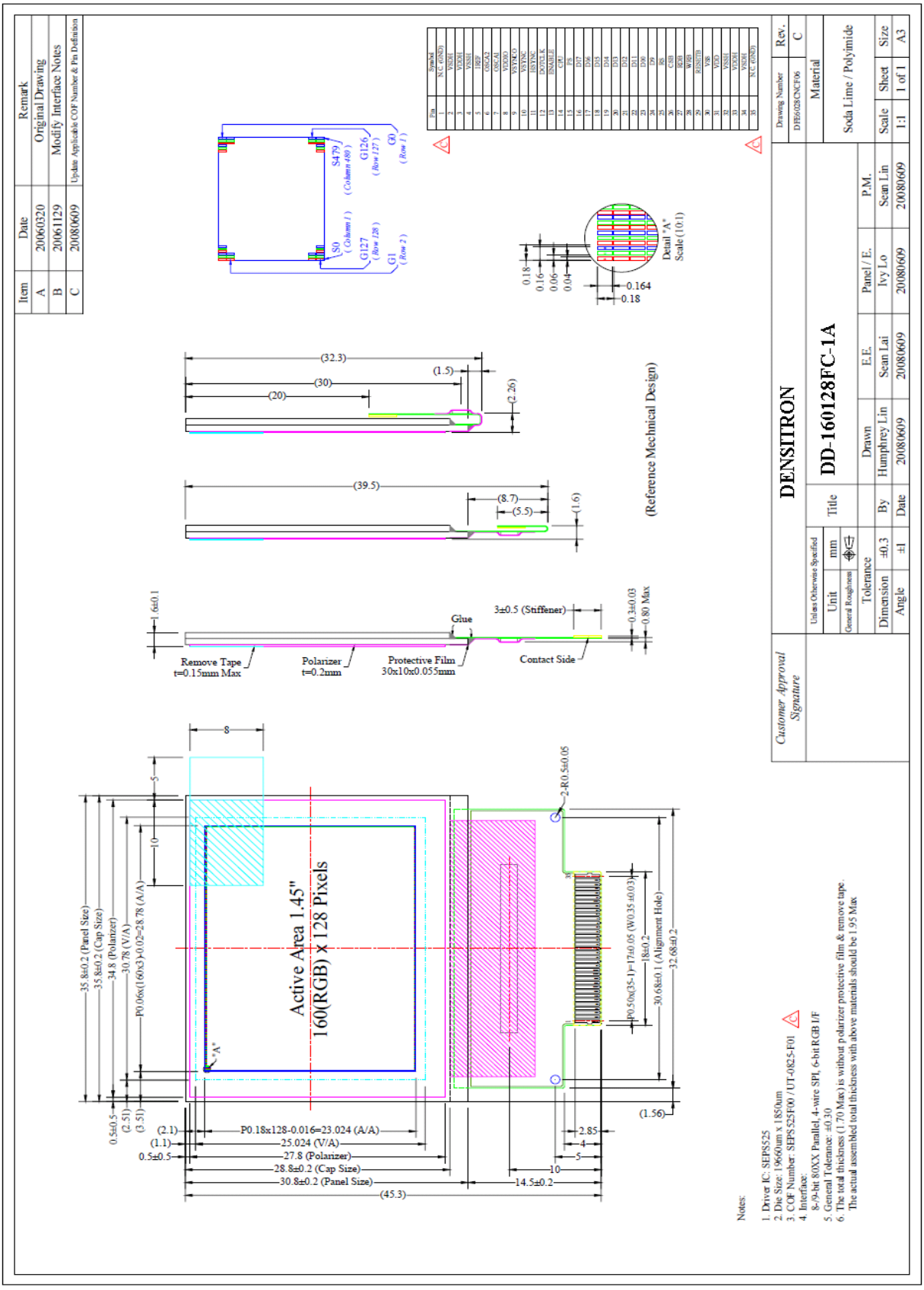
| ITEM | CONTENTS |
|---|---|
| Display Format | 160 (RGB) x 128 Dots |
| Overall Dimensions | Glass 35.8 x 30.8 x 1.6 mm |
| Colour | 262,144 Colour |
| Active Area | 28.78 x 23.024 mm |
| Viewing Area | 30.78 x 25.02 mm |
| Display Mode | Passive Matrix (1.45”) |
| Driving Method | 1/128 duty |
| Driver IC | SEPS525F |
| Operating temperature | -20 ~ +70 |
| Storage temperature | -30 ~ +80 |

# 2 MECHANICAL SPECIFICATION

## *2.1 MECHANICAL CHARACTERISTICS*

| ITEM | CHARACTERISTIC | UNIT |
|---|---|---|
| Display Format | 160 (RGB) x 128 | Dots |
| Overall Dimensions | 35.80 x 30.80 x 1.6 | mm |
| Viewing Area | 30.78 x 25.02 | mm |
| Active Area | 28.78 x 23.024 | mm |
| Dot Size | 0.04 x 0.164 | mm |
| Dot Pitch | 0.06 x 0.18 | mm |
| Weight | 3.6 | g |
| IC Controller/Driver | SEPS525F (COF) | |

## 2.2 MECHANICAL DRAWING



# 3 ELECTRICAL SPECIFICATION

## *3.1 ABSOLUTE MAXIMUM RATINGS*

VSS = 0 V, Ta = 25 °C

| Item | Symbol | Min | Max | Unit | Note |
|---|---|---|---|---|---|
| Power Supply Voltage | $V_{DD}$ | -0.3 | 4 | V | Note 1, 2 |
| Supply Voltage for I/O Pins | $V_{DDIO}$ | -0.3 | 4 | V | |
| OLED Power Supply | $V_{DDH}$ | -0.3 | 16 | V | |
| Operating Temperature | Top | -30 | 70 | °C | |
| Storage Temperature | Tst | -40 | 80 | °C | |
| Static Electricity | Be sure that you are grounded when handling displays. | | | | |

Note 1: All the above voltages are on the basis of "VSS=0V".

Note 2: When this module is used beyond the above absolute maximum ratings, permanent damage to the module may occur. Also for normal operations it's desirable to use this module under the conditions according to Section 3.2 "Electrical Characteristics". If this module is used beyond these conditions the module may malfunction and the reliability could deteriorate.

## 3.2 ELECTRICAL CHARACTERISTICS

| Characteristics | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Supply Voltage | $V_{DD}$ | | 2.6 | 2.8 | 3.3 | V |
| Supply Voltage x I/O pins | $V_{DDIO}$ | | 1.6 | 2.8 | 3.3 | V |
| Supply Voltage for Display | $V_{DDH}$ | Note 3 | 12.5 | 13 | 13.5 | V |
| High Level Input | $V_{IH}$ | | 0.8x$V_{DD}$ | - | $V_{DD}$ | V |
| Low Level Input | $V_{IL}$ | | 0 | - | 0.4 | V |
| High Level Output | $V_{OH}$ | $I_{OH}$ =-0.4mA | $V_{DD}$-0.4 | - | - | V |
| | | $I_{OH}$ =-0.4mA | | | | |
| Low Level Output | $V_{OL}$ | $I_{OL}$ =-0.1mA | - | - | 0.4 | V |
| | | $I_{OL}$ =-0.1mA | | | | |
| $V_{DD}$ Current | $I_{DD}$ | Note 1 | - | 2.5 | 3.5 | mA |
| | | Note 2 | | | | |
| $V_{CC}$ Current | $I_{CC}$ | Note 1 | - | 16 | 19 | mA |
| | | Note 2 | - | 27 | 32 | mA |

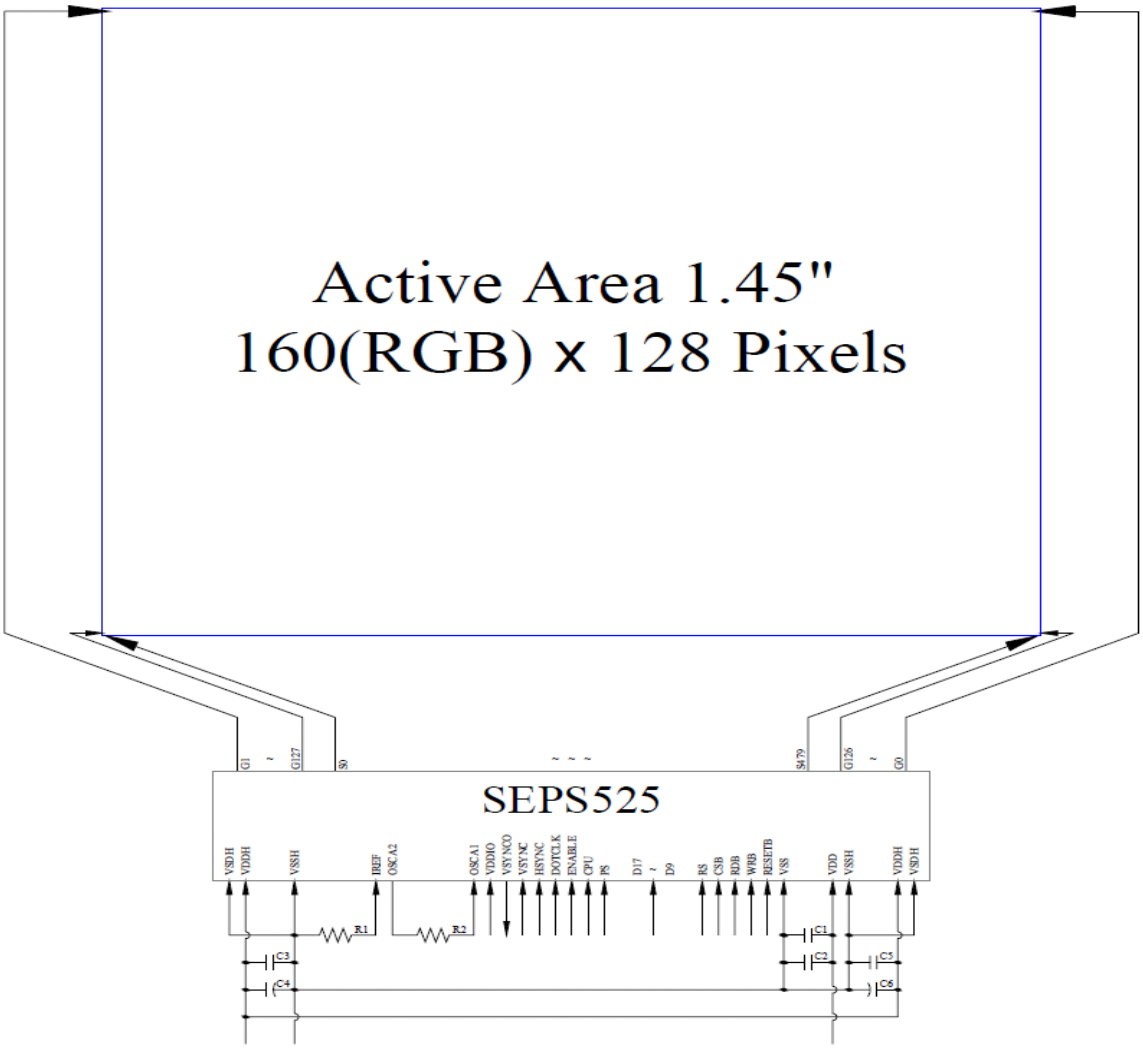
Note 1 $V_{DD}$ = 2.8V, $V_{CC}$ = 13V, Software initial setting follow chapter 5.4, 50% Display area turned on.
Note 2 $V_{DD}$ = 2.8V, $V_{CC}$ = 13V, Software initial setting follow chapter 5.4, 100% Display area turned on
Note 3 Brightness (Lbr) and driver supply voltage (VDDH) could be changed to customer request.

## 3.3 INTERFACE PIN ASSIGNMENT

| No. | Symbol | I/O | Function |
|---|---|---|---|
| 1 | N.C. (GND) | - | *Reserved Pin (Supporting Pin).*<br>The supporting pin can reduce the influence from stress on the function pins. This pin must be connected to external ground. |
| 2 | VSDH | P | *Ground of OEL Panel*<br>This is a ground pin for analogue circuits. It must be connected to external ground<br>VSDH: Segment (Data Drive) |
| 3 | VDDH | P | *Power Supply for OEL Panel*<br>This is the most positive supply pin of the chip. This must be connected to external source. |
| 4. | VSSH | P | *Ground of OEL Panel*<br>This is a ground pin for analogue circuits. It must be connected to external ground<br>VSSH: Common (Scan Drive) |
| 5 | IREF | I/O | *Current Reference for Brightness Adjustment*<br>This pin is segment (data) current reference pin. A 68KΩ resistor should be connected between this pin and VSS. |
| 6 | OSCA2 | O | *Fine Adjustment for Oscillation*<br>The frequency is controlled by external 10KΩ resistor between OSCA1 and OSCA2. The oscillator signal is used for system clock generation.<br>When the external clock mode is selected, OSCA1 is used external clock input |
| 7 | OSCA1 | I | |
| 8 | VDDIO | P | *Power Supply for I/O Pin*<br>This pin is a voltage supply pin. It should be match with MCU interface voltage level. It must always be equal or lower than VDD. |
| 9 | VSYNCO | O | *Vertical Synchronization Triggering Signal* |
| 10 | VSYNC | I | *Vertical Synchronization Input* |
| 11 | HSYNC | I | *Horizontal Synchronization Input* |
| 12 | COTCLK | I | *Dot Clock Input* |
| 13 | ENABLE | I | *Video Enable Input* |
| 14 | CPU | I | *Select the CPU type*<br>**Low**: 80-Series MCU<br>**High**: 68-Series MCU |
| 15 | PS | I | *Select Parallel/Serial type*<br>**Low**: Serial Interface<br>**High**: Parallel Interface |
| 16 | D17 | I/O | *Host Data Input/Output Bus*<br>These pins are 9-bit bi-directional data bus to be connected to the microprocessor's data bus.<br>**PS** \| **Description** |
| 17 | D16 | | |
| 18 | D15 | | |
| 19 | D14 | | |
| 20 | D13 | | |

<table>
<tr><td>21</td><td>D12</td><td rowspan="4"></td><td rowspan="4"><table><tr><td>1</td><td>8-bit Bus: D17 to D10<br>9-bit Bus: D17 to D9</td></tr><tr><td>0</td><td>D[17] SCL: Synchronous Clock Input<br>D[16] SDI: Serial Data Input<br>D[15] SDO: Serial Data Output</td></tr></table></td></tr>
<tr><td>22</td><td>D11</td></tr>
<tr><td>23</td><td>D10</td></tr>
<tr><td>24</td><td>D9</td></tr>
<tr><td>25</td><td>RS</td><td>I</td><td>Data/Command Control<br>Low: Command<br>High: Parameter/data</td></tr>
<tr><td>26</td><td>CSB</td><td>I</td><td>Chip Select<br>Low: SEPS525 is selected and can be accessed<br>High: SEPS525 is not selected and cannot be accessed</td></tr>
<tr><td>27</td><td>RDB</td><td>I</td><td>Read or Read/Write Enable<br>80-System bus interface: Read strobe signal( Active Low)<br>68-System bus interface: Bus enable strobe ( Active High)<br>When serial mode, fix this to VDD or VSS Level</td></tr>
<tr><td>28</td><td>WRB</td><td>I</td><td>Write or Read/Write Select<br>80-System bus interface: Write strobe signal(active Low)<br>68-System bus interface: Read (low)/write (high) select.<br>When serial mode, fix this to VDD or VSS Level</td></tr>
<tr><td>29</td><td>RESETB</td><td>I</td><td>Power Reset for Controller and Driver<br>A reference. When the pin is low, initialization of the chip is executed.</td></tr>
<tr><td>30</td><td>VSS</td><td>P</td><td>Ground of Logic Circuit<br>This is a ground pin. It also acts as a reference for the logic pins. It must be connected to external ground</td></tr>
<tr><td>31</td><td>VDD</td><td>P</td><td>Power Supply for Core Logic Circuit<br>This is a voltage supply pin. It must be connected to external source.</td></tr>
<tr><td>32</td><td>VSSH</td><td>P</td><td>Ground of OEL Panel<br>This is a ground pin for analogue circuits. It must be connected to external ground<br>VSSH: Common (Scan Drive)</td></tr>
<tr><td>33</td><td>VDDH</td><td>P</td><td>Power Supply for OEL Panel<br>This is the most positive supply pin of the chip. This must be connected to external source.</td></tr>
<tr><td>34</td><td>VSDH</td><td>P</td><td>Ground of OEL Panel<br>This is a ground pin for analogue circuits. It must be connected to external ground<br>VSDH: Segment (Data Drive)</td></tr>
<tr><td>35</td><td>N.C. (GND)</td><td>--</td><td>Reserved Pin (Supporting Pin).<br>The supporting pin can reduce the influence from stress on the function pins. This pin must be connected to external ground.</td></tr>
</table>

## 3.4 BLOCK DIAGRAM




MCU Interface Selection: PS and CPU
Pins connected to MCU interface: D17~D9, RS, CSB, RDB, WRB, and RESETB.
Pins connected to RGB interface: D17~D9, VSYNC, HSYNC, DOTCLK, and ENABLE

C1, C3, C5: 0.1 µF
C2: 4.7 µF
C4, C6: 4.7 Mf /25 V Tantalum Capacitor
R1: 68 kΩ
R2: 10 kΩ

## 3.5 TIMING CHARACTERISTICS

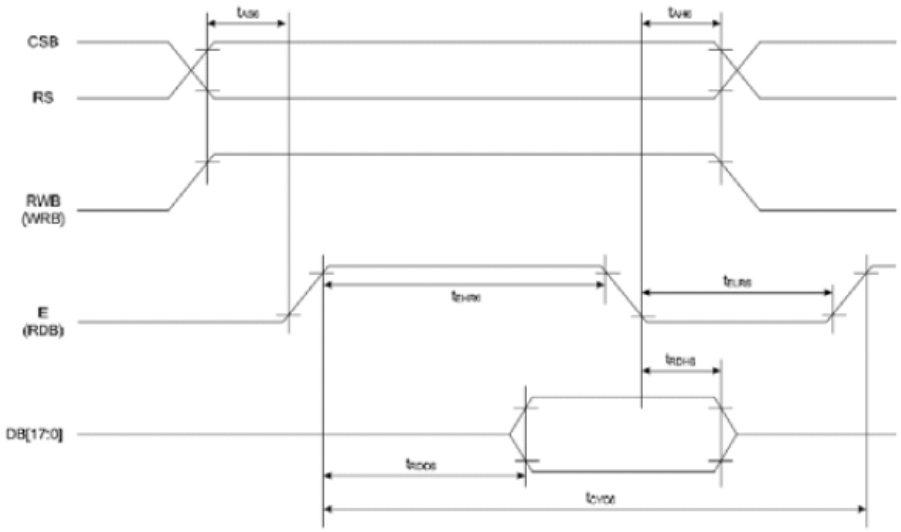
### 3.5.1 AC CHARACTERISTICS

#### 3.5.1.1 6800-Series MPU Parallel Interface Timing Characteristics

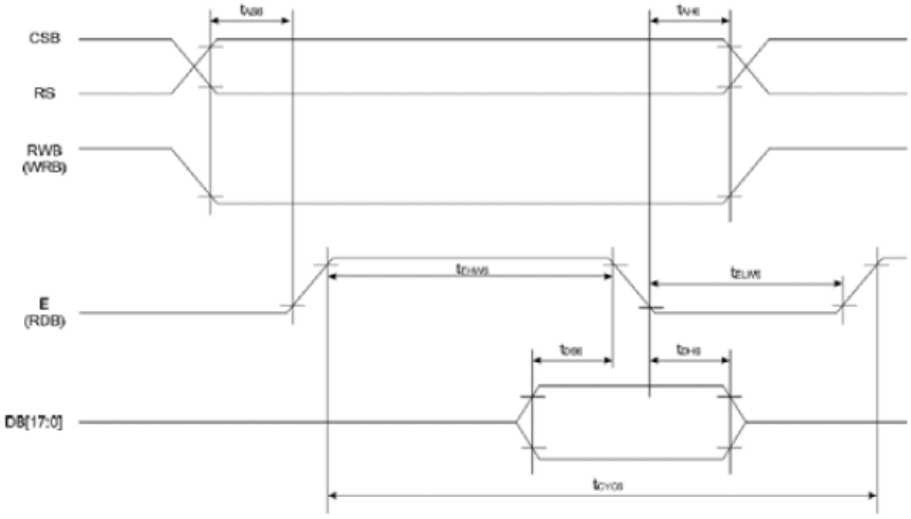
VDD = 2.8V, Ta = 25˚C

| Characteristics | Symbol | Min | Max | Unit | Port |
|---|---|---|---|---|---|
| **Write Timing** | | | | | |
| Address hold timing | tAH6 | 10 | - | nS | CSB |
| Address setup timing | tAS6 | 5 | | | RS |
| System cycle timing Write | tCYC6 | 200 | - | nS | E |
| "L" pulse width Write | tELW6 | 45 | | | |
| "H" pulse width | tEHW6 | 45 | | | |
| Data setup timing | tDS6 | 40 | - | nS | DB[17:0] |
| Data hold timing | tDH6 | 10 | | | |
| **Read Timing** | | | | | |
| Address hold timing | tAH6 | 10 | - | nS | CSB |
| Address setup timing | tAS6 | 5 | | | RS |
| System cycle timing Write | tCYC6 | 200 | - | nS | E |
| "L" pulse width Write | tELW6 | 90 | | | |
| "H" pulse width | tEHW6 | 90 | | | |
| Data setup timing (CL= 15pF) | tDS6 | 0 | 70 | nS | DB[17:0] |
| Data hold timing (CL= 15pF) | tDH6 | | | | |

- ***All the timing should be based on 10% and 90% of $V_{DD}$.***




*( Read Timing )*

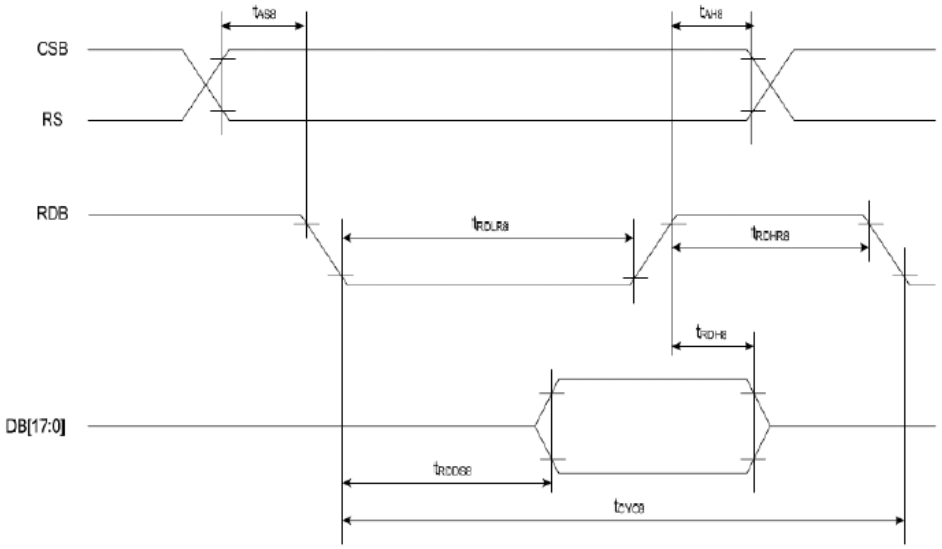



*( Write Timing )*

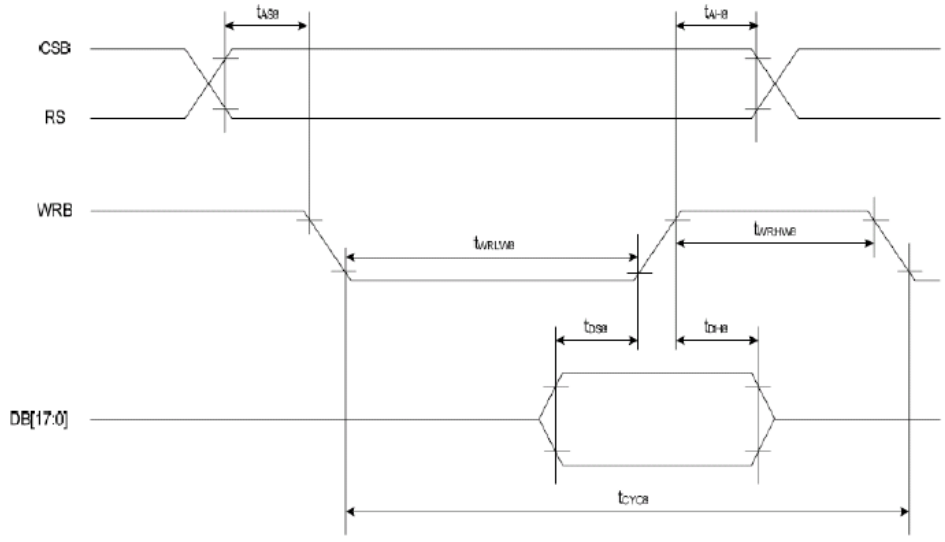
### 3.5.1.2 8080-Series MPU Parallel Interface Timing Characteristics

| Characteristics | Symbol | Min | Max | Unit | Port |
|---|---|---|---|---|---|
| **Write Timing** | | | | | |
| Address hold timing | tAH8 | 5 | - | nS | CSB |
| Address setup timing | tAS8 | 5 | | | RS |
| System cycle timing Write | tCYC8 | 100 | - | nS | WRB |
| "L" pulse width Write | tWRLW8 | 45 | | | |
| "H" pulse width | tWRW8 | 45 | | | |
| Data setup timing | tDS8 | 30 | - | nS | DB[17:0] |
| Data hold timing | tDH6 | 10 | | | |
| **Read Timing** | | | | | |
| Address hold timing | tAH8 | 5 | - | nS | CSB |
| Address setup timing | tAS8 | 5 | | | RS |
| System cycle timing Write | tCYC8 | 200 | - | nS | RDB |
| "L" pulse width Write | tRDLR8 | 90 | | | |
| "H" pulse width | tRDHR8 | 90 | | | |
| Data setup timing (CL= | tDS8 | 0 | 60 | nS | DB[17:0] |
| Data hold timing (CL= 15pF) | tDH8 | | | | |

**** All the timing should be based on 10% and 90% of $V_{DD}$***




*( Read Timing )*



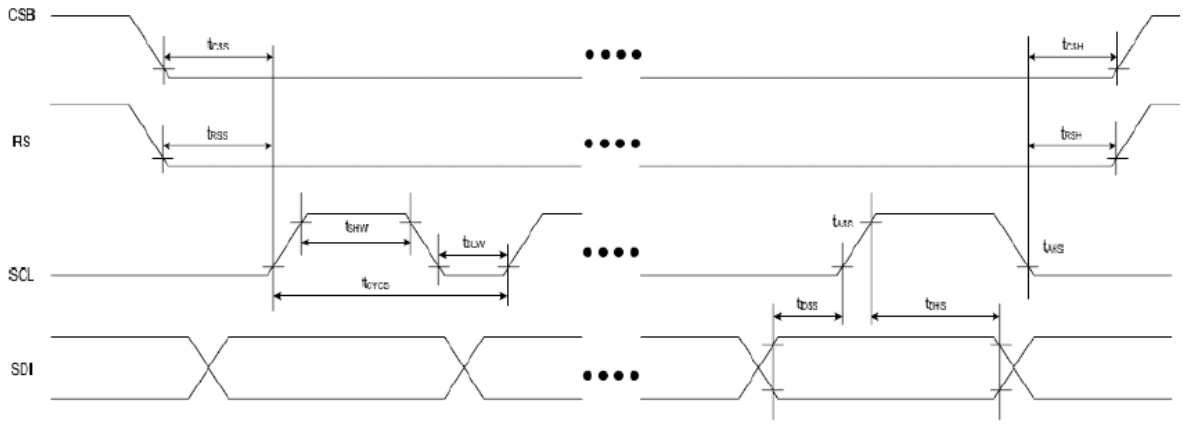

*( Write Timing )*

### 3.5.1.3 Serial Interface Timing Characteristics

| ITEM | SYMBOL | MIN | MAX | UNIT | PORT |
|---|---|---|---|---|---|
| Serial clock cycle SCL | tCYCS | 60 | - | nS | SCL |
| "H" pulse width SCL | tSHW | 25 | | | |
| "L" pulse width | tSLW | 25 | | | |
| Data setup timing Data | tDSS | 25 | - | nS | SDI |
| Hold timing | tDHS | 25 | | | |
| CSB-SCL timing | tCSS | 25 | - | nS | CSB |
| CSB-hold timing | tCSH | 25 | | | |
| RS-SCL Timing | tRSS | 25 | - | ns | RS |
| RS-Hold Timing | tRSH | 25 | - | ns | |

**** All the timing should be based on 10% and 90% of $V_{DD}$***

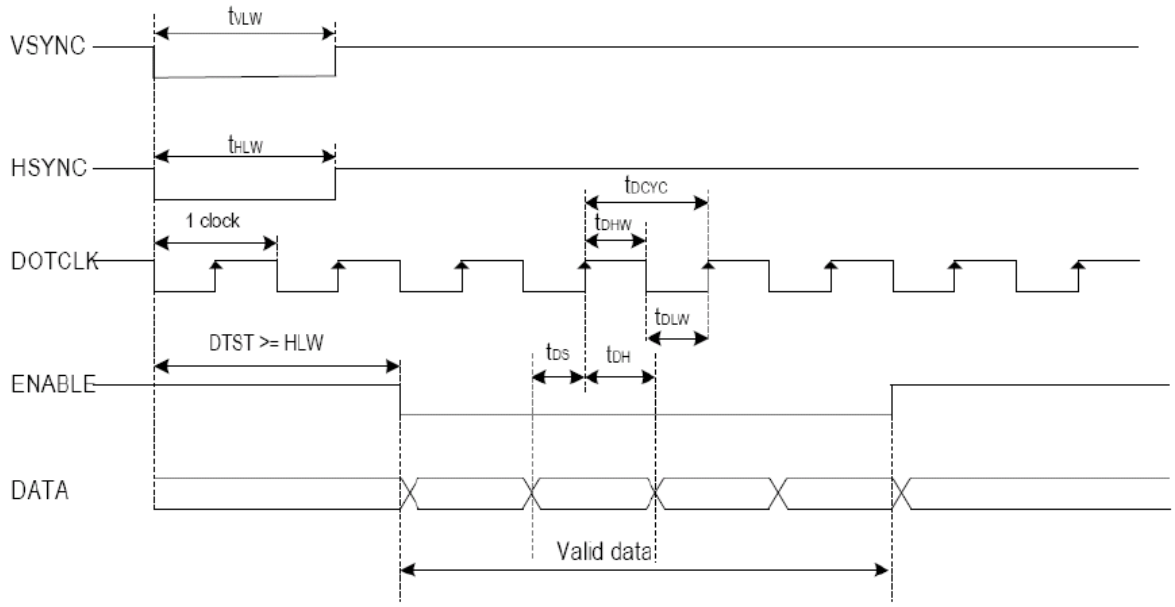
**Serial Interface Timing**



### 3.5.1.4 RGB Interface Timing Characteristics

| Symbol | Item | Min | Max | Unit | Port |
|---|---|---|---|---|---|
| tDCYC | Dot Clock Cycle | 100 | - | ns | |
| tDLW | Dot “L” Pulse Width | 50 | - | ns | DOTCLK |
| tDHW | Dot “H” Pulse Width | 50 | - | ns | |
| tDS | Data Setup Timing | 5 | -- | ns | D[17:12] |
| tDH | Data Hold Timing | 5 | | ns | |
| tVLW | Vsync Pulse Width | 1 | - | DOTCLK | VSYNC |
| tHLW | Hsync Pulse Width | 1 | - | DOTCLK | HSYNC |

**** All the timing should be based on 10% and 90% of $V_{DD}$***




DTST: Setup Time for Data Transmission

* VSYNC, HSYNC, ENABLE, and D[17:12] should be transmitted by 3 clocks for one pixel (RGB).

# 4 OPTICAL SPECIFICATION

## 4.1 OPTICAL CHARACTERISTICS

| Characteristics | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Brightness(White) | $L_{br}$ | Display Average Note 1 | 75 | 100 | - | $cd/m^2$ |
| C.I.E.(White) | (X) | | 0.26 | 0.30 | 0.34 | - |
| | (Y) | | 0.29 | 0.33 | 0.37 | |
| C.I.E.(Red) | (X) | | 0.60 | 0.64 | 0.68 | - |
| | (Y) | | 0.30 | 0.34 | 0.38 | |
| C.I.E.(Green) | (X) | | 0.27 | 0.31 | 0.35 | - |
| | (Y) | | 0.58 | 0.62 | 0.66 | |
| C.I.E.(Blue) | (X) | | 0.10 | 0.14 | 0.18 | - |
| | (Y) | | 0.12 | 0.16 | 0.20 | |
| Dark Room Contrast | CR | | - | >2000:1 | - | - |
| Viewing Angle | | | >160 | - | - | degree |

Optical measurement, follow the software initial setting on chapter 5.4

**Note 1:** Brightness (Lbr) and driver supply voltage (VCC) could be changed to customer request.

# 5 FUNCTIONAL SPECIFICATION

## 5.1 COMMANDS

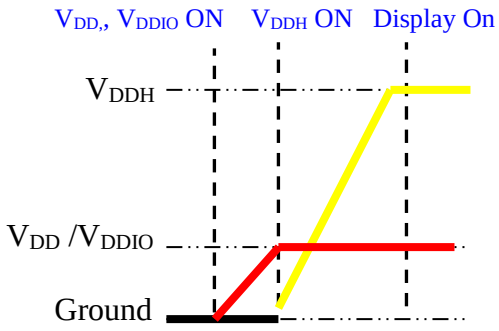
Please refer to the Technical Manual for the SEPS525F

## 5.2 POWER UP/DOWN SEQUENCE

To protect panel and extend the panel lifetime, the driver IC power up/down routine should include a delay period between high voltage and low voltage power sources during turn on/off. It gives the panel enough time to complete the action of charge and discharge before/after the operation.

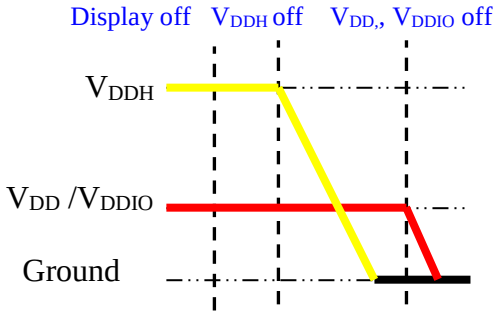
### 5.2.1 POWER UP SEQUENCE

1. Power up $V_{DD}$ & $V_{DD\ IO}$
2. Send Display off command
3. Initialization
4. Clear Screen
5. Power up $V_{DDH}$
6. Delay 100ms (When $V_{DDH}$ is stable)
7. Send Display on command




### 5.2.2 POWER DOWN SEQUENCE

1. Send Display off command
2. Power down $V_{DDH}$
3. Delay 100ms
   (When $V_{DDH}$ reach 0 and panel is completely discharges)
4. Power down $V_{DD}$ & $V_{DDIO}$



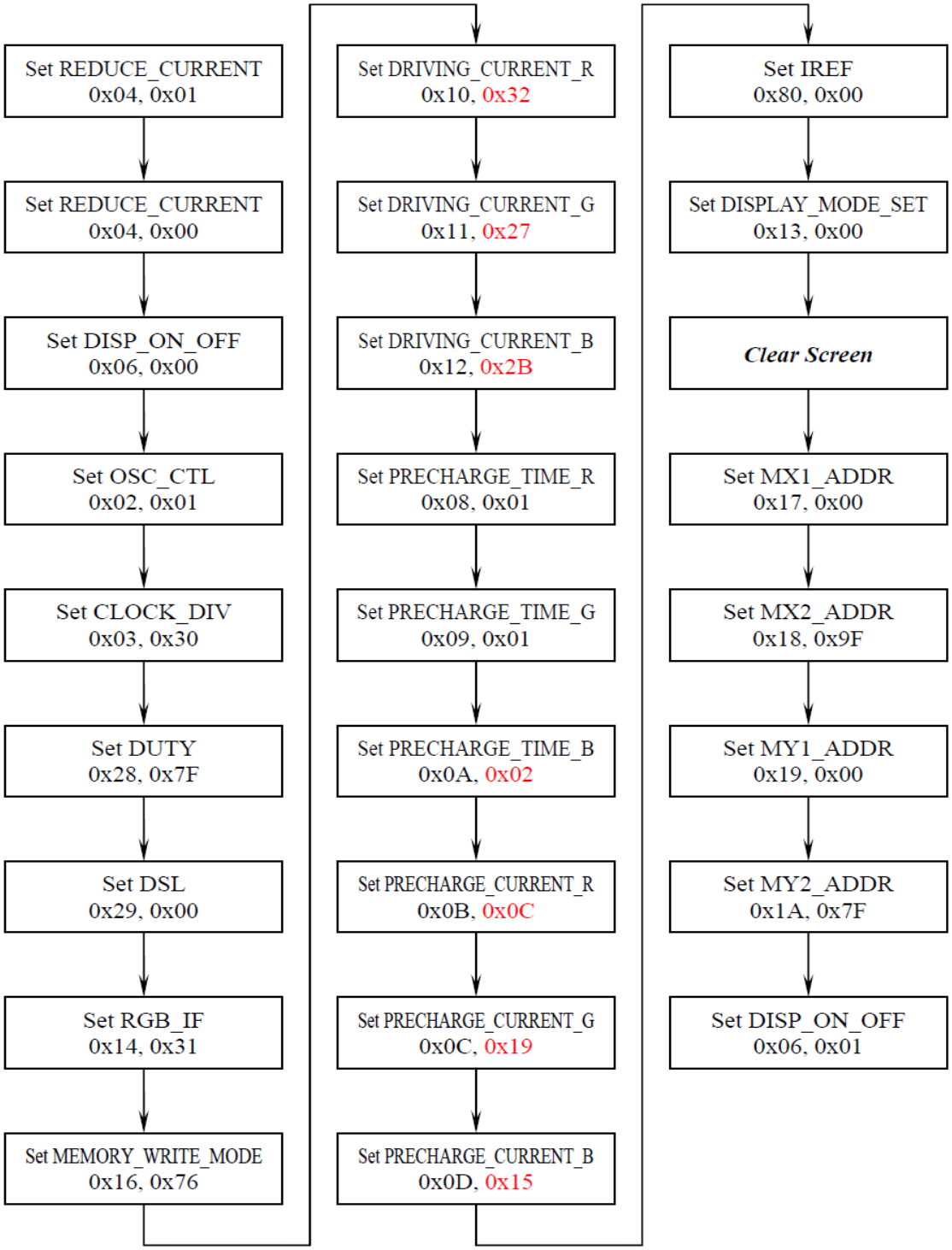

## 5.3 RESET CIRCUIT

When RESETB input is low, the chip is initialized with the following status:

1. Frame frequency: 90Hz
2. OSC: internal OSC ON
3. DDRAM write horizontal address: MX1 = 00h, MX2 = 9Fh
4. DDRAM write vertical address: MY1 = 00h, MY2 = 7Fh
5. Display data RAM write: HC = 1, VC = 1, HV = 0
6. RGB data swap: OFF
7. Row scan shift direction: G0, G1, … , G126, G127
8. Column data shift direction: S0, S1, … , S478, S479
9. Display ON/OFF: OFF
10. Panel display size: FX1 = 00h, FX2 = 9Fh, FY1 = 00h, FY2 = 7Fh
11. Display data RAM read column/row address: FAC = 00h, FAR = 00h
12. Pre-charge time(R/G/B): 0 clock
13. Pre-charge current(R/G/B): 0 uA
14. Driving current(R/G/B): 0 uA

## 5.4 ACTUAL APPLICATION EXAMPLE

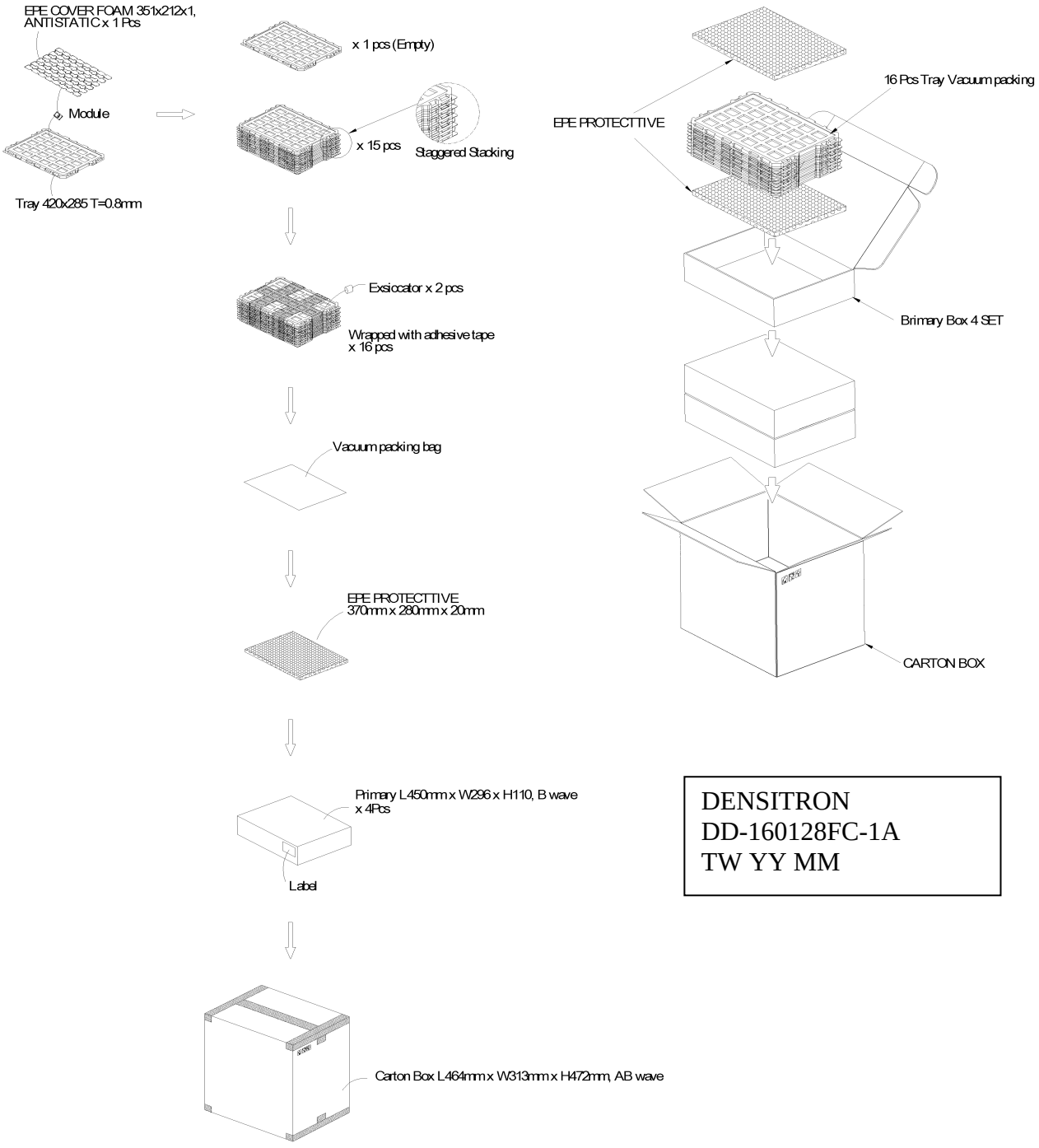
<Initialization>




If the noise is accidentally occurred at the displaying window during the operation, please reset the display in order to recover the display function.

# 6 PACKAGING AND LABELLING SPECIFICATION

## *6.1 LABELLING & MARKING*



# 7 QUALITY ASSURANCE SPECIFICATION

## 7.1 CONFORMITY

The performance, function and reliability of the shipped products conform to the Product Specification.

## 7.2 DELIVERY ASSURANCE

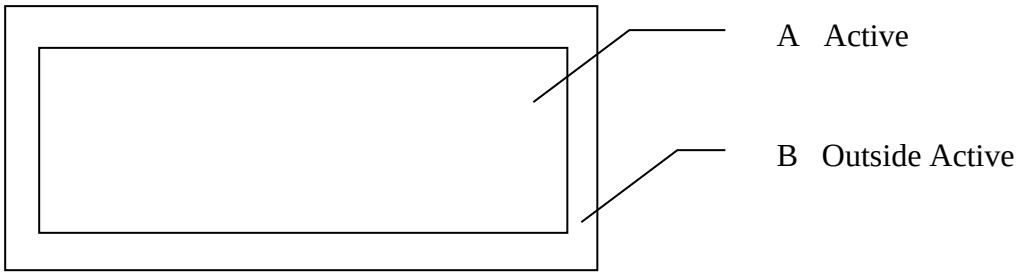
### 7.2.1 DELIVERY INSPECTION STANDARDS

MIL-STD-105E, general inspection level II, single sampling level;
IPC-AA610 rev. C, class 2 electronic assemblies standard

The quality assurance levels are shown below:

| Class | AQL (%) |
|---|---|
| Critical defect | 0.5% |
| Major defect | 1.0% |
| Minor defect | 1.5% |
| TOTAL | 2.0% |

### 7.2.2 Zone definition



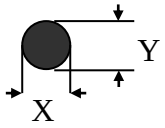
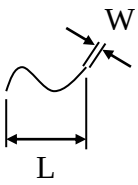
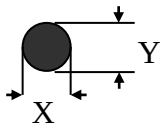

### 7.2.3 Visual inspection

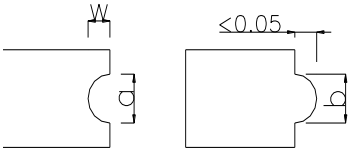
Test and measurement to be conducted under following conditions：

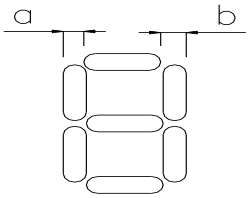
| | |
|---|---|
| Temperature: | 23±5℃ |
| Humidity: | 55±15%RH |
| Fluorescent lamp: | 30 W |
| Distance between the Panel & Eyes of the Inspector: | ≧30cm |
| Distance between the Panel & the lamp: | ≧50cm |

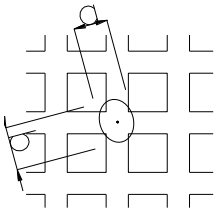
### 7.2.4 Standard of appearance inspection

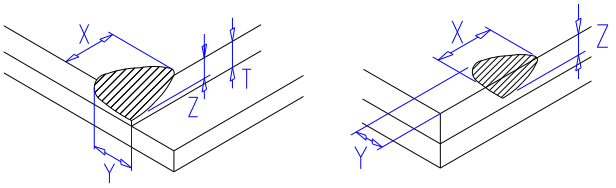
Units: mm

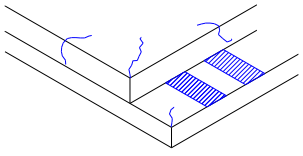
<table>
<tr><th>Class</th><th>Item</th><th>Criteria</th></tr>
<tr><td>Minor</td><td rowspan="2">Packing & Label</td><td>Outside & inside package | Presence of product no., lot no., quantity</td></tr>
<tr><td>Critical</td><td>Product must not be mixed with others and quantity must not be different from that indicated on the label</td></tr>
<tr><td>Major</td><td>Dimension</td><td>Product dimensions must be according to specification and drawing</td></tr>
<tr><td>Major</td><td>Electrical</td><td>Product electrical characteristics must be according to specification</td></tr>
<tr><td>Critical</td><td>OLED Display</td><td>Missing lines, short circuits or wrong patterns on OLED display are not allowed</td></tr>
<tr><td>Minor</td><td>Black spot, white spot, dust</td><td>Round type: as per following drawing<br>∅ = (X+Y)/2<br>  <br><br><table><tr><th colspan="3">Acceptable quantity</th></tr><tr><th>Size</th><th>Zone A</th><th>Zone B</th></tr><tr><td>∅<0.1</td><td>Any number</td><td rowspan="4">Any number</td></tr><tr><td>0.1<∅<0.2</td><td>3</td></tr><tr><td>0.2<∅<0.25</td><td>1</td></tr><tr><td>0.25<∅</td><td>0</td></tr></table><br>Line type: as per following drawing<br>  <br><br><table><tr><th colspan="4">Acceptable quantity</th></tr><tr><th>Length</th><th>Width</th><th>Zone A</th><th>Zone B</th></tr><tr><td>- -</td><td>W≤0.05</td><td>Any number</td><td rowspan="3">Any number</td></tr><tr><td>L≤2.0</td><td>W≤0.1</td><td>3</td></tr><tr><td>L>2.0</td><td></td><td>0</td></tr></table><br>Total acceptable quantity: 3</td></tr>
<tr><td>Minor</td><td>Polariser scratch</td><td>Scratch on protective film is permitted<br>Scratch on polariser: same as No. 1</td></tr>
<tr><td>Minor</td><td>Polariser bubble</td><td>∅ = (X+Y)/2<br>  <br><br><table><tr><th colspan="3">Acceptable quantity</th></tr><tr><th>Size</th><th>Zone A</th><th>Zone B</th></tr><tr><td>∅<0.5</td><td>Any number</td><td rowspan="2">Any number</td></tr><tr><td>∅>0.5</td><td>0</td></tr></table></td></tr>
</table>

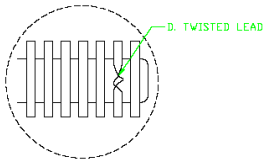
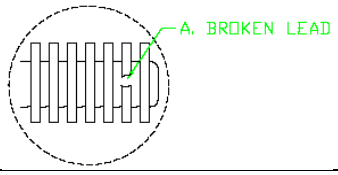
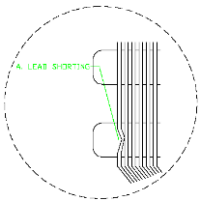
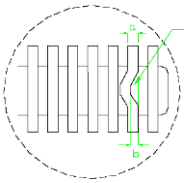
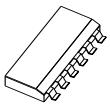
<table>
<tr><th>Class</th><th>Item</th><th>Criteria</th></tr>
<tr><td>Minor</td><td>Segment deformation</td><td>
1b. Pin hole on dot matrix display<br>


<table>
<tr><td colspan="2">Acceptable quantity</td></tr>
<tr><td>Size</td><td></td></tr>
<tr><td>a,b<0.1</td><td>Any number</td></tr>
<tr><td>(a+b)/2≤0.1</td><td>Any number</td></tr>
<tr><td>0.5<∅<1.0</td><td>3</td></tr>
</table>
Total acceptable quantity: 7<br><br>
2. Segments / dots with different width<br>


<table>
<tr><td colspan="2">Acceptable</td></tr>
<tr><td>a≥b</td><td>a/b≤4/3</td></tr>
<tr><td>a<b</td><td>a/b>4/3</td></tr>
</table>
<br>
3. Alignment layer defect<br>
∅ = (a+b)/2<br>


<table>
<tr><td colspan="2">Acceptable quantity</td></tr>
<tr><td>Size</td><td></td></tr>
<tr><td>∅≤0.4</td><td>Any number</td></tr>
<tr><td>0.4<∅≤1.0</td><td>5</td></tr>
<tr><td>1.0<∅≤1.5</td><td>3</td></tr>
<tr><td>1.5<∅≤2.0</td><td>2</td></tr>
</table>
Total acceptable quantity: 7
</td></tr>
<tr><td>Minor</td><td>Panel Chipping</td><td>
X ≤ 1/6 Panel length<br>
Y ≤ 1<br>
Z ≤ T<br>


</td></tr>
<tr><td>Minor</td><td>Panel Cracking</td><td>
Cracks not allowed<br>

</td></tr>
<tr><td>Minor</td><td>Cupper exposed (pin or film)</td><td>Not allowed if visible by eye inspection</td></tr>
<tr><td>Minor</td><td>Film or Trace Damage</td><td>Not allowed if affect electrical function</td></tr>
</table>

<table>
<tr><th>Class</th><th>Item</th><th>Criteria</th></tr>
<tr><td>Minor</td><td>Contact<br>Lead Twist</td><td>Not allowed<br>  </td></tr>
<tr><td>Minor</td><td>Contact<br>Lead<br>Broken</td><td>Not allowed<br>  </td></tr>
<tr><td rowspan="2">Minor</td><td rowspan="2">Contact<br>Lead Bent</td><td>Not allowed if<br>bent lead causes<br>short circuit<br>  </td></tr>
<tr><td>Not allowed if bent lead<br>extends horizontally<br>more than 50%<br>of its width<br>  </td></tr>
<tr><td>Minor</td><td>Colour<br>uniformity</td><td>Level of sample for approval set as limit sample</td></tr>
<tr><td>Major</td><td rowspan="4">PCB<br>  </td><td>No unmelted solder paste should be present on PCB</td></tr>
<tr><td>Critical</td><td>Cold solder joints, missing solder connections, or oxidation are not allowed</td></tr>
<tr><td>Minor</td><td>No residue or solder balls on PCB are allowed</td></tr>
<tr><td>Critical</td><td>Short circuits on components are not allowed</td></tr>
<tr><td>Minor</td><td>Tray<br>particles</td><td>
<table>
<tr><th></th><th>Size</th><th>Quantity</th></tr>
<tr><td rowspan="2">On tray</td><td>∅<0.2</td><td>Any number</td></tr>
<tr><td>∅>0.25</td><td>4</td></tr>
<tr><td rowspan="2">On display</td><td>∅≥0.25</td><td>2</td></tr>
<tr><td>L = 3</td><td>1</td></tr>
</table>
</td></tr>
</table>

## *7.3 DEALING WITH CUSTOMER COMPLAINTS*

### 7.3.1 Non-conforming analysis

Purchaser should supply Densitron with detailed data of non-conforming sample.
After accepting it, Densitron should complete the analysis in two weeks from receiving the sample.
If the analysis cannot be completed on time, Densitron must inform the purchaser.

### 7.3.2 Handling of non-conforming displays

If any non-conforming displays are found during customer acceptance inspection which Densitron is clearly responsible for, return them to Densitron.
Both Densitron and customer should analyse the reason and discuss the handling of non-conforming displays when the reason is not clear.
Equally, both sides should discuss and come to agreement for issues pertaining to modification of Densitron quality assurance standard.

# 8 RELIABILITY SPECIFICATION

## *8.1 RELIABILITY TESTS*

| Test Item | Test Condition | Evaluation and assessment |
|---|---|---|
| High Temperature Operation | 70°C±2, 240 hours | No abnormalities in function and appearance |
| Low Temperature Operation | -30°C±2, 240 hours | No abnormalities in function and appearance |
| High Temperature Storage | 80°C±2, 240 hours | No abnormalities in function and appearance |
| Low Temperature Storage | -40°C±2, 240 hours | No abnormalities in function and appearance |
| High Temperature & High Humidity Storage(Operation) | 60°C±2, 90%RH, 120 hours | No abnormalities in function and appearance |
| Thermal Shock | 24 cycle of<br>-40°C 1 Hour,<br>85°C 1 Hour | No abnormalities in function and appearance |

- The brightness should be greater than 50% of the initial brightness.
- The samples used for above tests do not include polarizer.
- No moisture condensation is observed during tests.

### 8.1.1 FAILURE CHECK STANDARD

After the completion of the described reliability test, the samples were left at room temperature for 2 hrs prior to conducting the failure teat at 23±5 °C; 55±15% RH

## *8.2 LIFE TIME*

| Item | Description |
|---|---|
| 1 | Function, performance, appearance, etc. shall be free from remarkable deterioration more than 10,000 hours under 100 CD/m² brightness and storage conditions of room temperature (25 °C), normal humidity (50 RH), and in area not exposed to direct sunlight. |
| 2 | End of lifetime is specified as 50% of initial brightness. |

# 9 HANDLING PRECAUTIONS

*Safety*
If the panel breaks, be careful not to get the organic substance in your mouth or in your eyes.
If the organic substance touches your skin or clothes, wash it off immediately using soap and plenty of water.

*Mounting and Design*
Place a transparent plate (e.g. acrylic, polycarbonate or glass) on the display surface to protect the display from external pressure. Leave a small gap between the transparent plate and the display surface.
Design the system so that no input signal is given unless the power supply voltage is applied.

*Caution during OLED cleaning*
Lightly wipe the display surface with a soft cloth soaked with Isopropyl alcohol, Ethyl alcohol or Trichlorotriflorothane.
Do not wipe the display surface with dry or hard materials that will damage the polariser surface.
Do not use aromatic solvents (toluene and xylene), or ketonic solvents (ketone and acetone).

*Caution against static charge*
As the display uses C-MOS LSI drivers, connect any unused input terminal to $V_{DD}$ or $V_{SS}$. Do not input any signals before power is turned on.
Also, ground your body, work/assembly table and assembly equipment to protect against static electricity.

*Packaging*
Displays use OLED elements, and must be treated as such. Avoid strong shock and drop from a height.
To prevent displays from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

*Caution during operation*
It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life.

*Other Precautions*
When a display module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur.
Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored.
Also, there will be no problem in the reliability of the module.

*Storage*
Store the display in a dark place where the temperature is 25°C ± 10°C and the humidity below 50%RH.
Store the display in a clean environment, free from dust, organic solvents and corrosive gases.
Do not crash, shake or jolt the display (including accessories).

# 10 SUPPORTED ACCESSORIES

## 10.1 DUO KIT

Densitron has developed an easy to use yet powerful development and demonstration tool for driving its range of Passive Matrix OLED displays from the USB port of a PC.
DUO (Densitron USB OLED) kit is hot pluggable and does not require extra cables or power supply to run, allowing users to be up and running in minutes.

The kit consists of an OLED display with transition Board, USB controller card, mini USB cable and a CD with software application and drivers.


**Part number: PDK-N-160128FC-1A**

## 10.2 TRANSITION BOARD CARD

A Transition board card is like a daughterboard which is meant to be a circuit board for connections between the baseboards (DUO).
It has connector pins for interfacing between the display and the baseboards.
It also includes the OLED display.
**Part number: PDT-N-160128FC-1A**

## 10.3 CONNECTOR BOARD CARD

A Connector board card is also a daughterboard which is a circuit board for connection between a microprocessor or microcontroller (customer's system).
**Part number: EVK-CONNECT-010**

## 10.4 CONNECTOR

Type: ZIF connector

| No. of connections | Pitch (mm) | Manufacturer | Manufacturer part no. | Distributor part no. |
|---|---|---|---|---|
| 35 | 0.50 | Omron | XF2M-3515-1A | Farnell/1112561<br>Digikey/ OR727CT-ND |