OLED DISPLAY MODULE

Product Specification Preliminary

CUSTOMER	**STANDARD**	
PRODUCT NUMBER	**DD-6448BE-2A**	
CUSTOMER APPROVAL		**Date**

INTERNAL APPROVALS		
Product Mgr	Elec Eng	Doc Control
Bruno Recaldini	**Bazile Peter**	**Anthony Perkins**
Date: 18/04/07	Date: 18/04/07	Date: 18/04/07

☐ **Approval for Specification only**

☐ **Approval for Specification and Sample**

TABLE OF CONTENTS

REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECR no.
A	14/03/07			Replaces DD-6448BE-1B Rev B	

1 MAIN FEATURES

ITEM	CONTENTS
Display Format	64 x 48 Dots
Overall Dimensions(W*H*T)	18.46 x 18.10 x 2.10 mm
Active Area(W*H)	13.42 x 10.06 mm
Viewing Area(W*H)	15.42 x 12.06 mm
Display Mode	Passive Matrix (0.66”)
Display Colour	Blue
Driving Method	1 / 48 duty
Driver IC	SSD1305Z
Operating temperature	-30℃ ~ +70℃
Storage temperature	-40℃ ~ +80℃

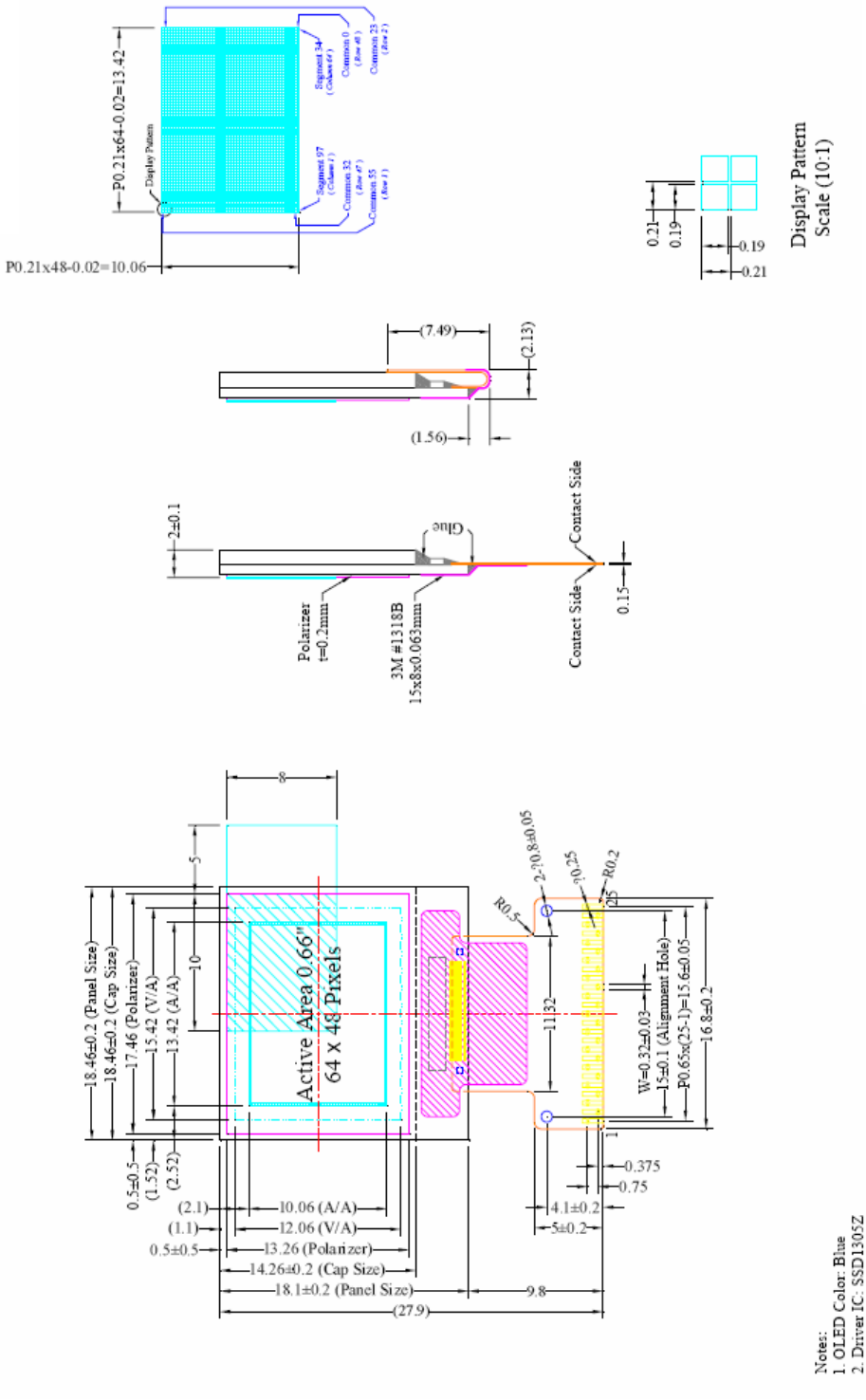
2 MECHANICAL SPECIFICATION

2.1 MECHANICAL CHARACTERISTICS

ITEM	CHARACTERISTIC	UNIT
Display Format	64 x 48	Dots
Overall Dimensions	18.46 x 18.10 2.10	mm
Active Area	13.42 x 10.06	mm
Viewing Area	15.42 x 12.06	mm
Dot Size	0.19 x 0.19	mm
Dot Pitch	0.21 x 0.21	mm
Weight	1.3	g
IC Controller/Driver	SSD1305Z	

2.2 MECHANICAL DRAWING

Pin	Symbol
1	NC
2	VCC
3	VSS
4	VDD
5	VDDIO
6	BS1
7	BS2
8	CS
9	RES
10	D/C
11	WR
12	RD
13	D0
14	D1
15	D2
16	D3
17	D4
18	D5
19	D6
20	D7
21	IREF
22	VCOMH
23	VCC
24	VSS
25	NC



3 ELECTRICAL SPECIFICATION

3.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Max	Unit	Note
Supply Voltage	V_{DD}	-0.3	4	V	Note 1,2
Supply Voltage for I/O pins	V_{DDIO}	-0.3	V_{DD}+0.5	V	
Driver Supply Voltage	V_{CC}	0	15	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 voltage are on the basis of "GND=0V".

Note 2: When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. Also, for normal operations, it's desirable to use this module under the conditions according to Section 3 "Electrical Characteristics". If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.

3.1.1 Regarding the Gradation

Although this module possesses the gradation function, respective gradation levels will vary depending on the production conditions etc. Also, the temperature range where the grading function can be guaranteed will be -10~60°C.

3.2 ELECTRICAL CHARACTERISTICS

3.2.1 DC CHARACTERISTICS

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	V_{DD}		2.6	2.8	3.5	V
Supply Voltage for I/O pins	V_{DDIO}		1.6	2.8	V_{DD}	V
Driver Supply Voltage	V_{CC}		8.5	9	9.5	V
Operating Current for V_{DD} & V_{DDIO}	I_{DD} & $_{DDIO}$	Note 1	-	0.1	0.2	mA
		Note 2	-	0.1	0.2	mA
Operating Current for V_{CC}	I_{CC}	Note 1	-	1.5	2.2	mA
		Note 2	-	2.5	3.5	mA
Sleep Mode Current for V_{DD} & V_{DDIO}	I_{DD} & $_{DDIO\ SLEEP}$		-	-	10	µA
Sleep Mode Current for V_{CC}	$I_{CC\ SLEEP}$		-	-	10	µA
High Level Input	V_{IH}		$0.8xV_{DD}$	-	V_{DD}	V
Low Level Input	V_{IL}		0	-	$0.2xV_{DD}$	V
High Level Output	V_{OH}	Iout=100µA, 3.3Mhz	$0.9xV_{DD}$	-	V_{DD}	V
Low Level Output	V_{OL}		0	-	$0.1xV_{DD}$	V

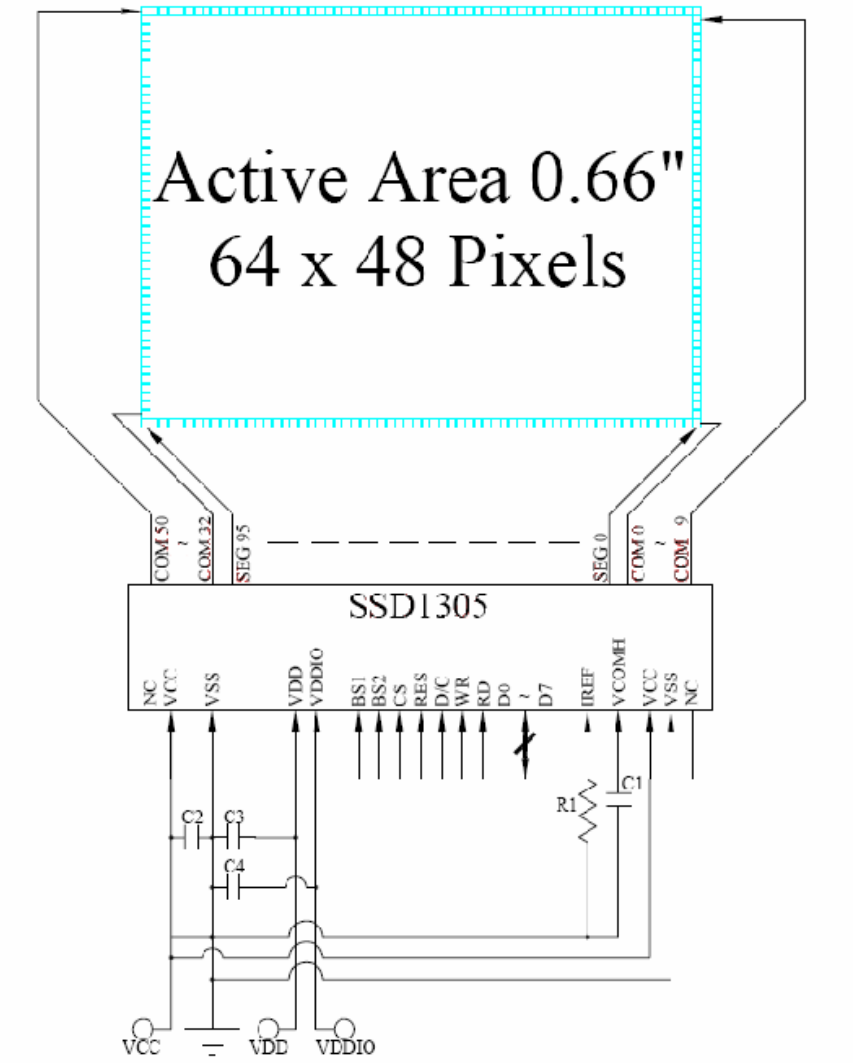
Note1: V_{DD} = 2.8V, V_{CC} = 9V, Frame rate = 190Hz, contrast setting = 0x2D, 50% display area turn on.
Note 2: V_{DD} = 2.8V, V_{CC} = 9V, Frame rate = 190Hz, contrast setting = 0x2D, 100% display area turn on.

INTERFACE PIN ASSIGNMENT

<table>
<tr><th>No.</th><th>Symbol</th><th>I/O</th><th>Function</th></tr>
<tr><td>1</td><td>N.C.</td><td>-</td><td>Reserved Pin (Supporting Pin).
The supporting pins can reduce the influences from stresses on the function pins.</td></tr>
<tr><td>2</td><td>VCC</td><td>P</td><td>Power Supply for OLE system.
This is the most positive voltage supply pin of the chip. It must be connected to external source.</td></tr>
<tr><td>3</td><td>VSS</td><td>P</td><td>Ground for OLED panel.
This is a ground pin. It also acts as a reference for the logic pins, the OLED driving voltages and the analog circuits. It must be connected to external ground.</td></tr>
<tr><td>4</td><td>VDD</td><td>P</td><td>Power Supply for Core Logic operation
This is a voltage supply pin. It must be connected to external source.</td></tr>
<tr><td>5</td><td>VDDIO</td><td>P</td><td>Power Supply for Interface Logic level.
This is a voltage supply pin. It should be match with MCU interface voltage level. VDDIO must allways be equal or lower than VDD</td></tr>
<tr><td>6</td><td>BS1</td><td>I</td><td rowspan="2">Communicating Protocol Select.
These pins are MCU interface selection input. See the following table:
<table>
<tr><th></th><th>I²C</th><th>6800-parallel</th><th>8080-parallel</th><th>Serial</th></tr>
<tr><td>BS1</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>BS2</td><td>0</td><td>1</td><td>1</td><td>0</td></tr>
</table>
Note “0” is connected to Vss “1” is connected to VDDIO</td></tr>
<tr><td>7</td><td>BS2</td><td>I</td></tr>
<tr><td>8</td><td>CS</td><td>I</td><td>Chip Select.
This pin is the chip select input. The chip is enabled for MCU communication only when CS# is pulled low.</td></tr>
<tr><td>9</td><td>RES</td><td>I</td><td>Power Reset for Controller and Driver.
This pin is reset signal input. When the pin is low, initialization of the chip executed.</td></tr>
<tr><td>10</td><td>D/C</td><td>I</td><td>Data/Command Control.
This pin is Data/Command control pin. When the pin is pulled high, the input at D7~D0 is treated as display data. When the pin is pulled low, the input at D7~D0 will be transferred to the command register. For detail relationship to MCU interface signal, please refer to the Timing Characteristics Diagrams.</td></tr>
<tr><td>11</td><td>WR</td><td>I</td><td>Read/Write Select or Write
This pin is MCU interface input. When interfacing to a 68xx series microprocessor, this pin will be used as Read/Write (R/W#) selection input. Pull this pin to “High” for read mode and pull it to “Low” for write mode.
When 80xx interface mode is selected, this pin will be the write (W/R#) input. Data write operation is initiated when this pin is pulled low and the CS# is pulled low.</td></tr>
</table>

12	RD	I	Read/Write Enable or Read. This pin is MCU interface input. When interfacing to a 68xx series microprocessor, this pin will be used as the Enable (E) signal. Read/write operation is initiated when this pin is pulled high and the CS# is pulled low. When connecting to an 80xx microprocessor, this pin receives the Read (RD#) signal. Data read operation is initiated when this pin is pulled low and CS# is pulled low.
13~20	D0~D7	I/O	Host Data Input / Output Bus These pins are 8 bit bi directional data bus to be connected to the microprocessor's data bus. When serial mode is selected, D1 with be the serial data input SDIN and D0 will be the serial clock input SCLK.
21	IREF	I	Current Reference for Brightness adjustment This pin is segment current reference pin. A resistor should be connected between this pin and VSS. Set the current at 10µA
22	VCOMH	O	Voltage Output High Level for COM signal This pin is the input pin for the voltage output high level for COM signals. A capacitor should be connected between this pin and VSS.
23	VCC	P	Power Supply for OLE sytem This is the most positive voltage supply pin of the chip. It must be connected to external source.
24	VSS		Ground for OLED panel. This is a ground pin. It also acts as a reference for the logic pins, the OLED driving voltages and the analog circuits. It must be connected to external ground.
25	NC		Reserved Pin (Supporting Pin). The supporting pins can reduce the influences from stresses on the function pins.

3.3 BLOCK DIAGRAM



MCU Interface Selection: BS1 and BS2

Pins connected to MCU interface：D7~D0, RD, WR, D/C, RES and CS

C1, C3, C3, C4: 4.7μF

R1： 910kΩ, R1 = (Voltage at IREF – VSS) / IREF

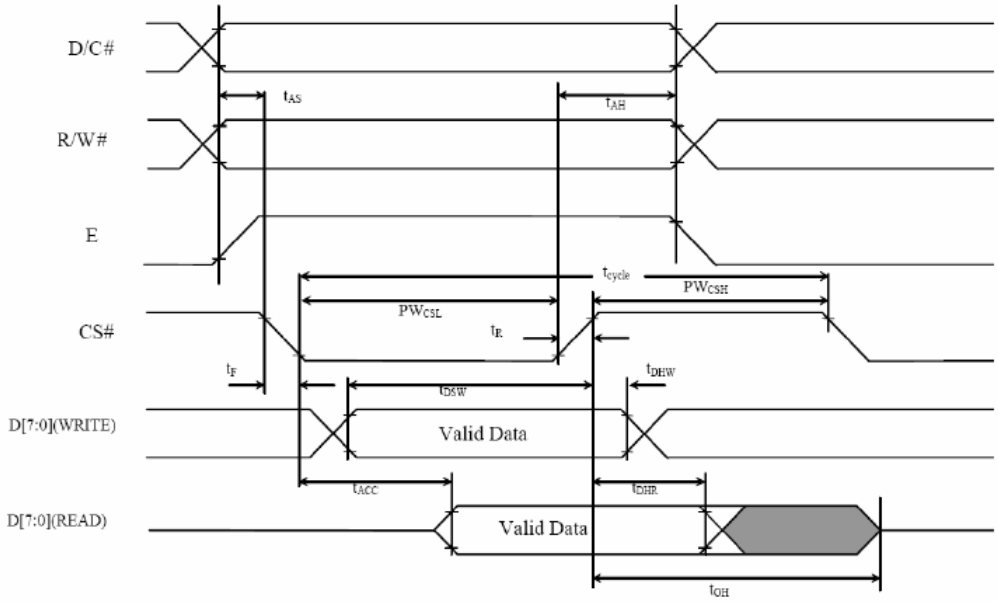
3.4 TIMING CHARACTERISTICS

3.5.1 AC CHARACTERISTICS

3.5.1.1 6800-Series MPU Parallel Interface Timing Characteristics:

Characteristics	Symbol	Min	Max	Unit
Clock Cycle Time	t_{cycle}	300	-	ns
Address Setup Time	t_{AS}	0	-	ns
Address Hold Time	t_{AH}	0	-	ns
Write Data Setup Time	t_{DSW}	40	-	ns
Write Data Hold Time	t_{DHW}	7	-	ns
Read Data Hold Time	t_{DHR}	20	-	ns
Output Disable Time	t_{OH}	-	70	ns
Access Time	t_{ACC}	-	140	ns
Chip Select Low Pulse Width (Read) Chip Select Low Pulse Width (Write)	PW_{CSL}	120 60	-	ns
Chip Select High Pulse Width (Read) Chip Select High Pulse Width (Write)	PW_{CSH}	60 60	-	ns
Rise Time	t_R	-	15	ns
Fall Time	t_F	-	15	ns

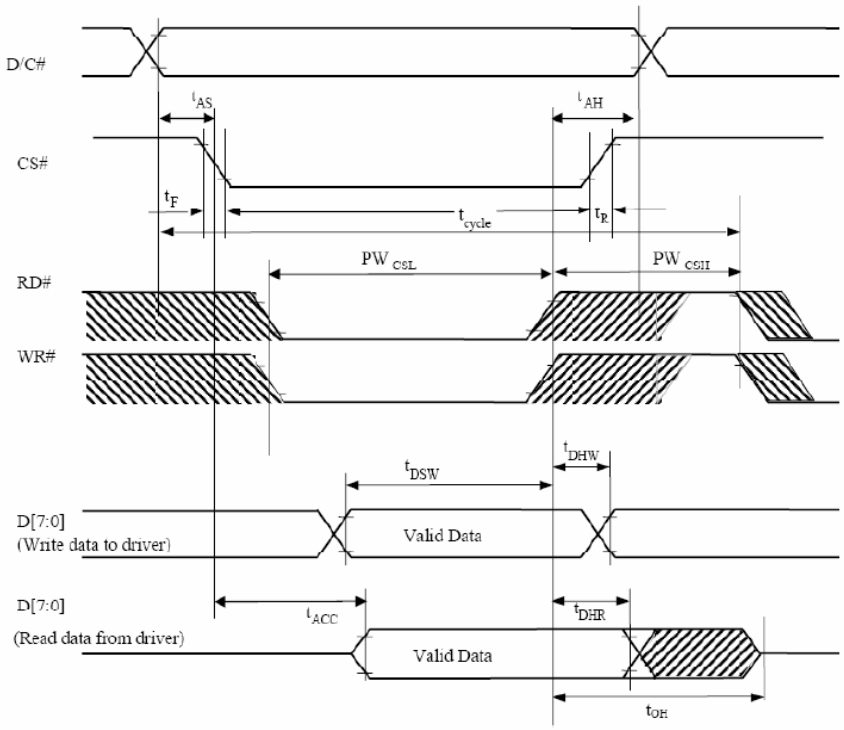
**** V_{DD}- V_{SS} = 2.4 to 3.5V, Ta = 25˚C***



3.5.1.2 8080-Series MPU Parallel Interface Timing Characteristics:

Characteristics	Symbol	Min	Max	Unit
System Cycle Time	t_{cycle}	300	-	ns
Address Setup Time	t_{AS}	0	-	ns
Address Hold Time	t_{AH}	0	-	ns
Write Data Setup Time	t_{DSW}	40	-	ns
Write Data Hold Time	t_{DHW}	7	-	ns
Read Data Hold Time	t_{DHR}	20	-	ns
Output Disable Time	t_{OH}	-	70	ns
Access Time	t_{ACC}	-	140	ns
Chip Select Low Pulse Width (Read) Chip Select Low Pulse Width (Write)	PW_{CSL}	120 60	-	ns
Chip Select High Pulse Width (Read) Chip Select High Pulse Width (Write)	PW_{CSH}	60 60	-	ns
Rise Time	t_R	-	15	ns
Fall Time	t_F	-	15	ns

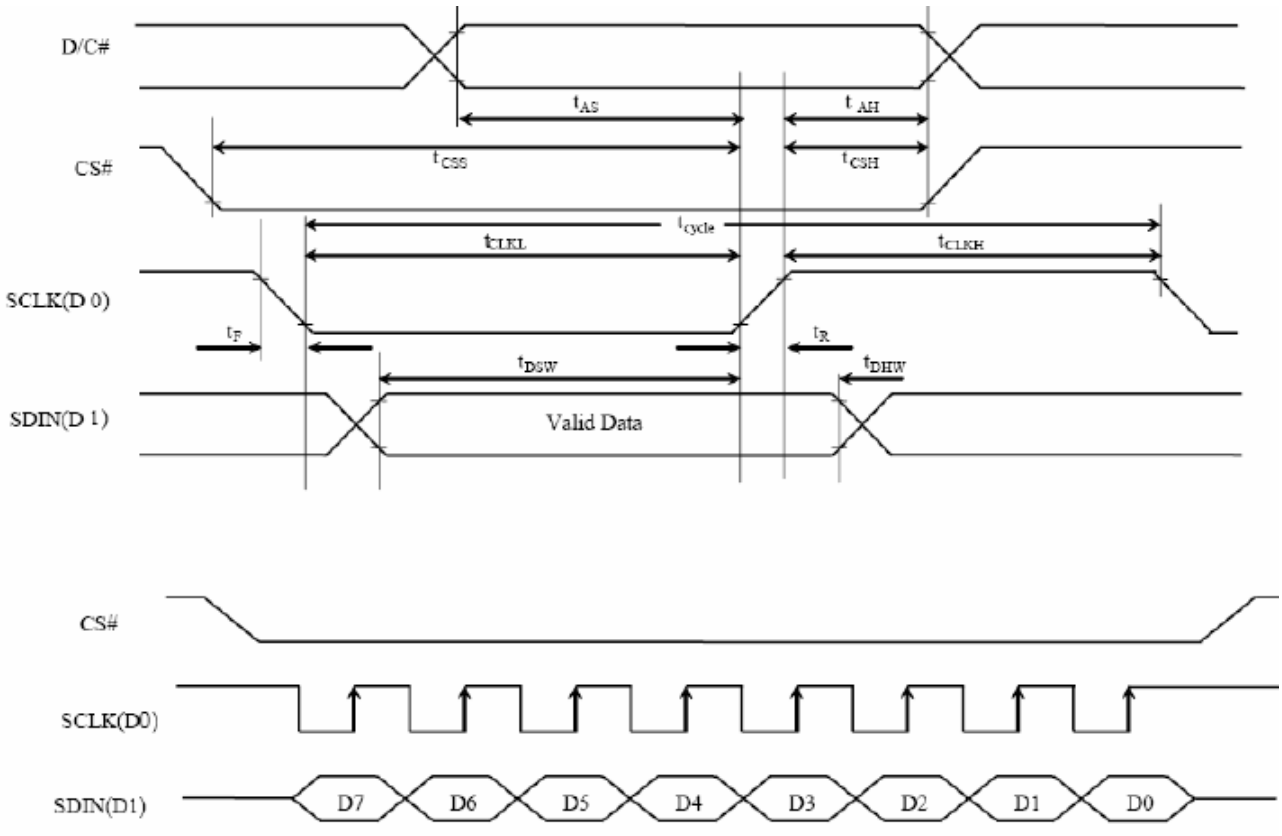
*** V_{DD}~V_{SS} = 2.4 to 3.5V, Ta = 25˚C**



3.5.1.3 Serial Interface Timing Characteristics:

Characteristics	Symbol	Min	Max	Unit
Clock Cycle Time	t_{cycle}	250	-	ns
Address Setup Time	t_{AS}	150	-	ns
Address Hold Time	t_{AH}	150	-	ns
Chip Select Setup Time	t_{CSS}	120	-	ns
Chip Select Hold Time	t_{CSH}	60	-	ns
Write Data Setup Time	t_{DSW}	50	-	ns
Write Data Hold Time	t_{DHW}	15	-	ns
Serial Clock Low Time	t_{CLKL}	100	-	ns
Serial Clock High Time	t_{CLKH}	100		ns
Rise Time	t_R	-	15	ns
Fall Time	t_F	-	15	ns

* VDD~VSS = 2.4 to 3.5V, Ta=25˚C



4 OPTICAL SPECIFICATION

4.1 OPTICAL CHARACTERISTICS

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Brightness	L_{br}	With polarizer	40	60	-	cd/m^2
C.I.E.(Blue)	(X)	Without Polarizer	0.12	0.16	0.20	-
	(Y)		0.24	0.28	0.30	
Dark Room Contrast	CR	Shown as below	-	>1:100	-	-
View Angle			>160	-	-	degree

Note: Optical measurement taken at 1/48 duty 190Hz Frame rate, 0x2D contrast setting

5 APPLICATION NOTES

5.1 COMMANDS

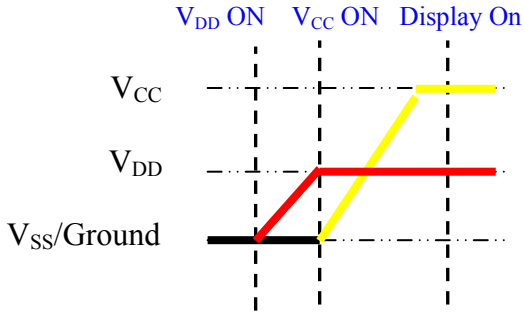
Please refer to the Technical Manual for the SSD1303.

5.2 POWER UP/DOWN SEQUENCE

To protect panel and extend the panel life time, 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.

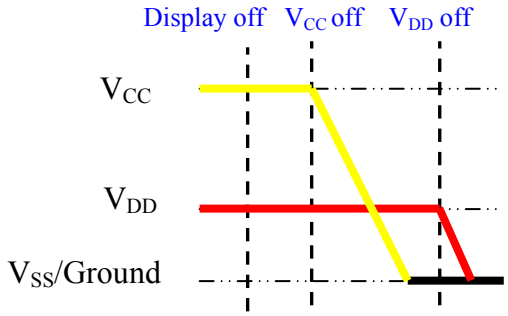
5.2.1 POWER UP SEQUENCE :

1. Power up V_{DD} & V_{DDIO}
2. Send Display off command
3. Clear screen
4. Power up V_{CC}
5. Delay 100ms
   (When V_{DD} is stable)
6. Send Display on command



5.2.2 POWER DOWN SEQUENCE :

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



5.3 RESET CIRCUIT

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

1. Display is off
2. 64x48 Display Mode
3. Normal segment and display data column and row address mapping (SEG0 mapped to column address 00H and COM0 mapped to row address 00H)
4. Shift register data clear in serial interface
5. Display start line is set at display RAM address 0
6. Column address counter is set at 0
7. Normal scan direction of the COM outputs
8. Contrast control register is set at 80H
9. Normal display mode (Equivalent to A4h command)

5.4 APPLICATION EXAMPLE

Command usage and explanation of an actual example

< Initialization Setting >
Set Deactivate Scroll
(00101101)

Set Pre Charge Period
(11011001 with XXXXXXXX)
Set Contrast Control Register
(10000001 with XXXXXXXX)
Set Brightness for Colour Banks
(10000010 with XXXXXXXX)
Set Look Up Table (LUT)
(10010001 with **XXXXXX, **XXXXXX, **XXXXXX, **XXXXXX)
Set Area Colour Mode & Low Power Display Mode
(11011000 with 00XX0X0X)
00000101=>0x05 (Mono & Low Power Save Mode)

Set Segment Re-map
(1010000X)
Set COM Output Scan Direction
(1100X000)
Set COM Pins Hardware Configuration
(11011010 with 00XX0010)
00010010=> 0x12 (Alternative Mode)
Set Display Start Line
(01XXXXXX)
Set Display Offset
(11010011 with **XXXXXX)
Set Multiplex Ratio
(10101000 with **XXXXXX)

Set Display Clock Divide Ratio / Oscillator Frequency
(11010101 with XXXXXXXX)

Set DC/DC On/Off
(10101101 with 1000101X)
10001010=>0x8A (Off)

Set VCOMH Deselect Level
(11011011 with 0XXXXX00)

Set Entire Display On (1010010X)
10100100=> 0xA4 (Normal)
Set Normal/Inverse Display (1010011X)
10100110=>0xA6 (Normal)

Set Display On/Off (1010111X)
10101111 => 0xAF (Turns On)
<Display Boundary Setting>
(00100000 with ******XX)

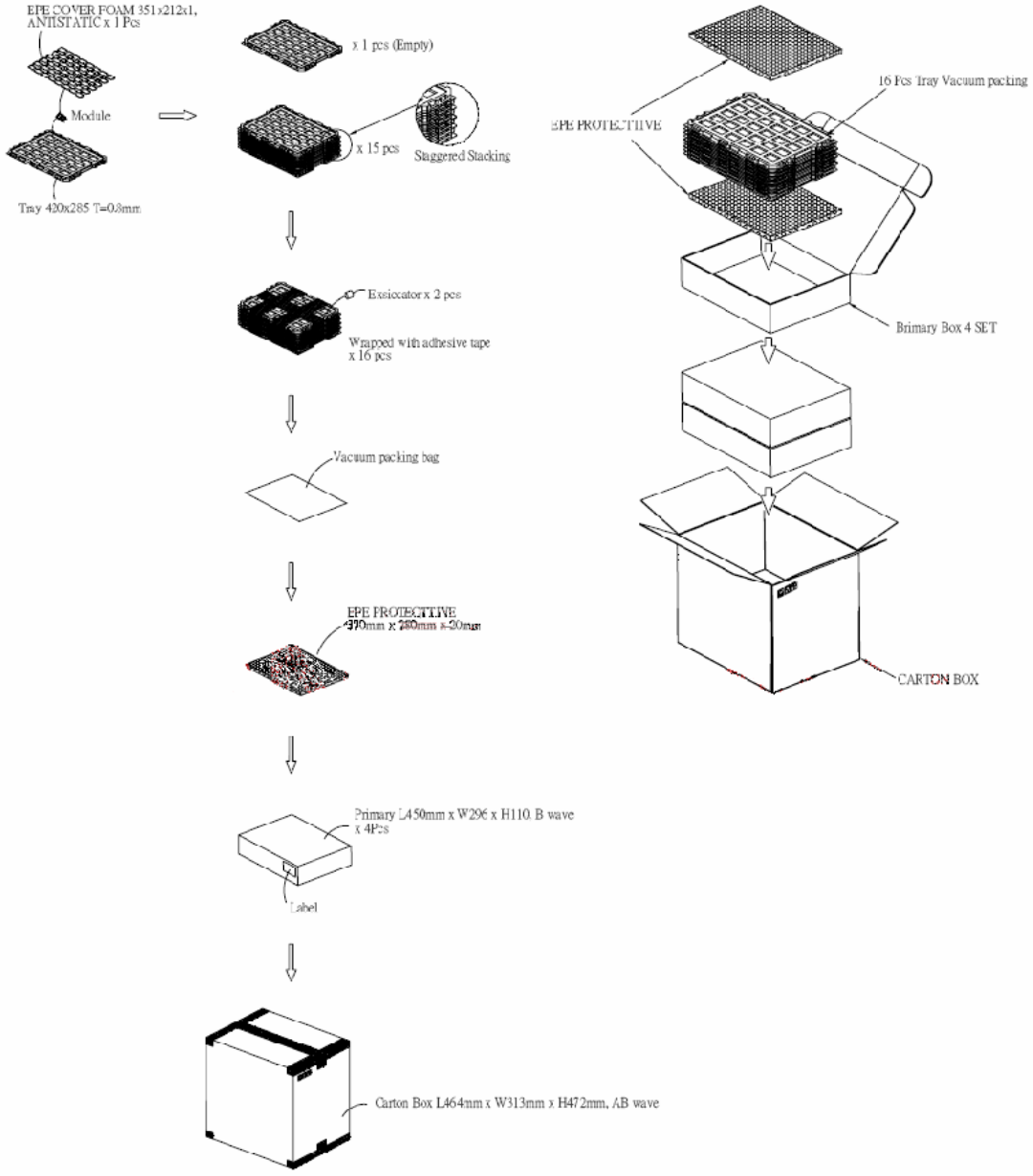
<Page Addressing Mode Setting>
Set Page Start Address for Page Addressing Mode (10110XXX)
10110000 =>0xB0
Set Lower Column Address for Page Addressing Mode
(0000XXXX)
Set Higher Column Address for page Addressing Mode
(0001XXXX)

<Horizontal or Vertical Addressing Mode Setting>
Set Column Address
(00100001 with XXXXXXXX, XXXXXXXX)
Set Page Address
(00100010 with *****XXX, *****XXX)

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 & LABELLING SPECIFICATION

6.1 PACKAGING



6.2 LABELLING & MARKING

DENSITRON DD-6448BE-2A TW YY MM

7 QUALITY ASSURANCE SPECIFICATION

7.1 CONFORMITY

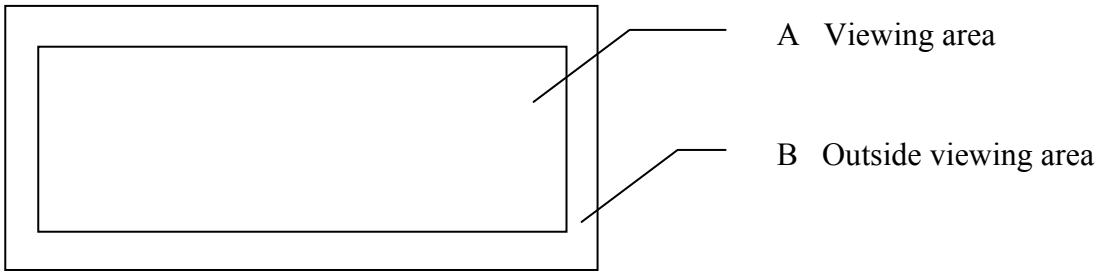
The performance, function and reliability of the shipped products conform to the Product Specification.

7.2 DELIVERY ASSURANCE

7.2.1 Delivery inspection standards

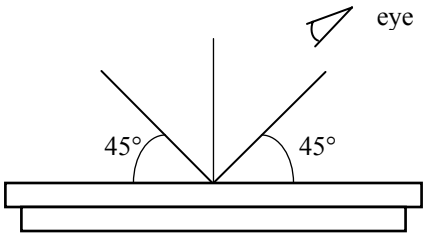
- IPC-AA610 class 2 electronic assemblies standard

7.2.2 Zone definition



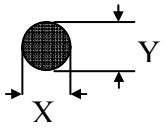
7.2.3 Visual inspection

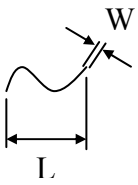
- Inspect under 30W fluorescent lamp leaving 50 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).
- Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk on screen).
- Inspect the module at 45° right and left, top and bottom.
- Use the optimum viewing angle during the contrast inspection.

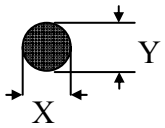


7.2.3.1 Standard of appearance inspection

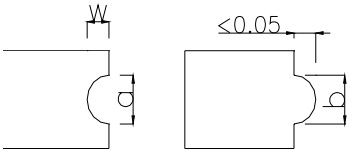
Units: mm

<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 or wrong patterns on display are not allowed</td></tr>
<tr><td>Minor</td><td>Black spot, white spot, dust</td><td>Round type: as per following drawing
∅ = (X+Y)/2
 

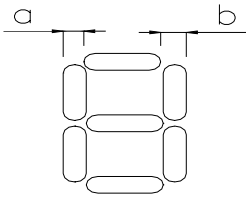
<table><tr><th colspan="3">Acceptable quantity</th></tr><tr><th>Size</th><th>Zone A</th><th>Zone B</th></tr><tr><td>∅<0.1</td><td>Any number</td><td rowspan="4">Any number</td></tr><tr><td>0.1<∅<0.2</td><td>3</td></tr><tr><td>0.2<∅<0.25</td><td>1</td></tr><tr><td>0.25<∅</td><td>0</td></tr></table>
Line type: as per following drawing
 

<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>
Total acceptable quantity: 3</td></tr>
<tr><td>Minor</td><td>Polariser scratch</td><td>Scratch on protective film is permitted
Scratch on polariser: same as No. 1</td></tr>
<tr><td>Minor</td><td>Polariser bubble</td><td>∅ = (X+Y)/2
 

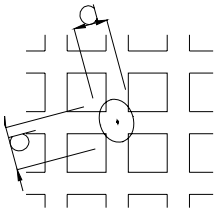
<table><tr><th colspan="3">Acceptable quantity</th></tr><tr><th>Size</th><th>Zone A</th><th>Zone B</th></tr><tr><td>∅<0.5</td><td>Any number</td><td rowspan="2">Any number</td></tr><tr><td>∅>0.5</td><td>0</td></tr></table>
Total acceptable quantity: 3</td></tr>
</table>

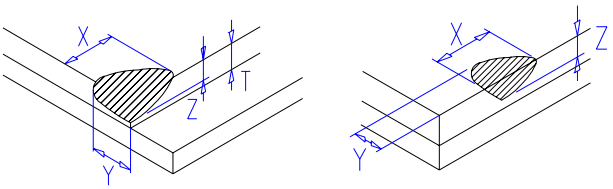
<table>
<tr><th>Class</th><th>Item</th><th>Criteria</th></tr>
<tr><td>Minor</td><td>Segment deformation</td><td>
1b. Pin hole on dot matrix display


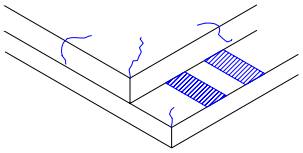
<table>
<tr><td colspan="2">Acceptable quantity</td></tr>
<tr><td>Size</td><td></td></tr>
<tr><td>a,b<0.1</td><td>Any number</td></tr>
<tr><td>(a+b)/2≤0.1</td><td>Any number</td></tr>
<tr><td>0.5<∅<1.0</td><td>3</td></tr>
</table>
Total acceptable quantity: 7

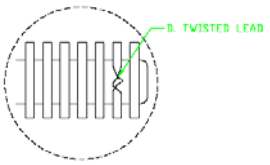
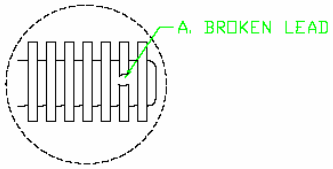
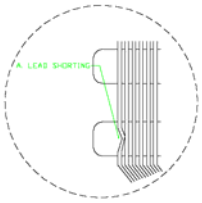
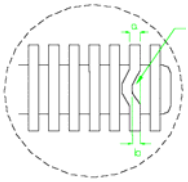
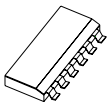
2. Segments / dots with different width


<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>

3. Alignment layer defect
∅ = (a+b)/2


<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
Y ≤ 1
Z ≤ T


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

</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 affects electrical function</td></tr>
</table>

<table>
<tr><th>Class</th><th>Item</th><th>Criteria</th></tr>
<tr><td>Minor</td><td>Contact
Lead Twist</td><td>Not allowed  </td></tr>
<tr><td>Minor</td><td>Contact
Lead
Broken</td><td>Not allowed  </td></tr>
<tr><td rowspan="2">Minor</td><td rowspan="2">Contact
Lead Bent</td><td>Not allowed if
bent lead causes
short circuit  </td></tr>
<tr><td>Not allowed if bent lead
extends horizontally
more than 50%
of its width  </td></tr>
<tr><td>Minor</td><td>Colour
uniformity</td><td>Level of sample for approval set as limit sample</td></tr>
<tr><td>Major</td><td rowspan="4">PCB  </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
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 CONTENTS OF 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	60°C±2, 90%RH, 240 hours	No abnormalities in function and appearance
Thermal Shock	24 cycle of -40°C 60 min, R.T. 5 min, 85°C 60 min	No abnormalities in function and appearance

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

8.2 LIFE TIME

Item	Description
1	Function, performance, appearance, etc. shall be free from remarkable deterioration more than 10,000 hours under ordinary operating and storage conditions of room temperature (25±10 °C), normal humidity (45±20% RH), and in area not exposed to direct sunlight.
2	End of lifetime is specified as 50% of initial brightness.
3	The storage period is warrantable of more than 20,000hr from the date of invoice under normal room conditions as stated below. Temperature: 23 ± 5°C. Humidity: 55 ± 15 %RH. In case of the seal of cartoon not opened

8.3 FAILURE CHECK STANDARD

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

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).