DENSITRON®
DISPLAYS

OLED DISPLAY MODULE

Product Specification

CUSTOMER	**Standard**	
PRODUCT NUMBER	**DD-12832BE-1A**	
CUSTOMER APPROVAL		**Date**

INTERNAL APPROVALS		
Product Mgr	Doc. Control	Electr. Eng
Bazile Peter	**Anthony Perkins**	**Rekha Mani**
Date: 12 May 08	Date: 12 May 08	Date: 12 May 08

TABLE OF CONTENTS

REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECR no.
A	12 May 08			First Issue	

1 MAIN FEATURES

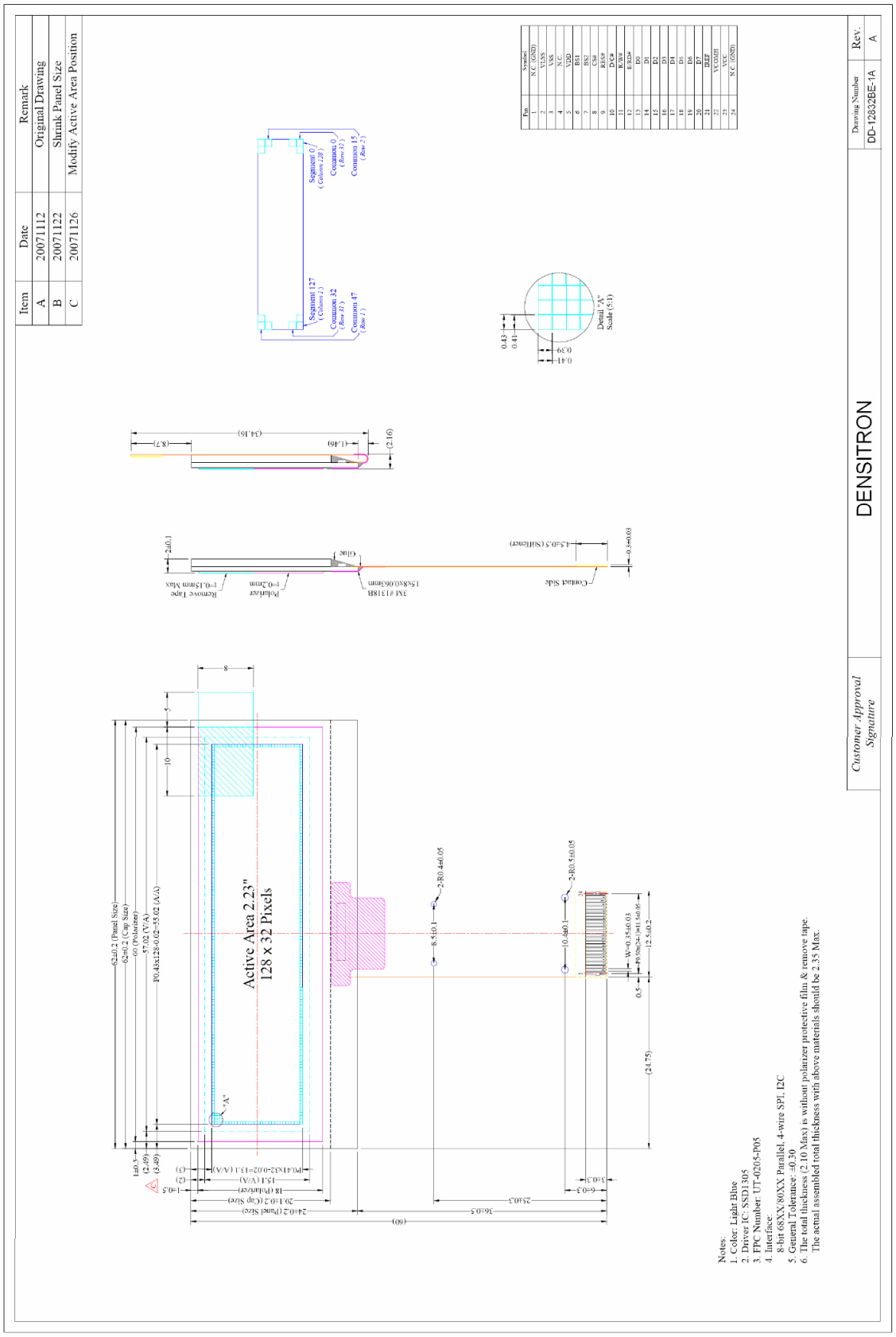
ITEM	CONTENTS
Display Format	128 x 32 Dots
Overall Dimensions	62.00 x 24.00 x 2.00 mm
Colour	Monochrome (Light Blue)
Active Area	55.02 x 13.10 mm
Viewing Area	57.02 x 15.1 mm
Display Mode	Passive Matrix (2.23”)
Driving Method	1/32 duty
Driver IC	SSD1305
Operating temperature	-30 ~ +70
Storage temperature	-40 ~ +80

2 MECHANICAL SPECIFICATION

2.1 MECHANICAL CHARACTERISTICS

ITEM	CHARACTERISTIC	UNIT
Display Format	128 x 32 Dots	Dots
Overall Dimensions	62.00 x 24.00 x 2.00	mm
Viewing Area	57.02 x 15.10	mm
Active Area	55.02 x 13.10	mm
Dot Size	0.41 x 0.39	mm
Dot Pitch	0.43 x 0.41	mm
Weight	5.80	g
IC Controller/Driver	SSD1305	

2.2 MECHANICAL DRAWING



3 ELECTRICAL SPECIFICATION

3.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Max	Unit	Note
Supply Voltage for logic	V_{DD}	-0.3	4.0	V	Note 1, 2
Supply voltage for Display	Vcc	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 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}		2.4	2.8	3.5	V
Supply Voltage for Display	V_{CC}	Note 3	12	12.5	13.0	V
High Level Input	V_{IH}	I_{OUT}=0.1mA, 3.3MHz	0.8xV_{DD}	-	V_{DD}	V
Low Level Input	V_{IL}		0	-	0.2 x VDD	V
High Level Output	V_{OH}		0.9 x V_{DD}	-	VDD	V
Low Level Output	V_{OL}		0	-	0.1 x V_{DD}	V
Operating current for V_{DD}	I_{DD}	Note 4	-	180	300	µA
		Note 5	-	180	300	
Operating current for V_{CC}	I_{CC}	Note 4	-	20	25	mA
		Note 5	-	28	35	
Sleep mode current for V_{DD}	$I_{DD\ SLEEP}$		-	1	5	µA
Sleep mode current for V_{CC}	$I_{CC\ SLEEP}$		-	1	5	µA

Note 3 Brigthness (L_{br}) and Supply Voltage for Display (V_{CC}) are subject to the change of the panel characteristics and the customers request

Note 4 V_{DD} = 2.8V, V_{CC} = 12.5V, 50% display area turned on.

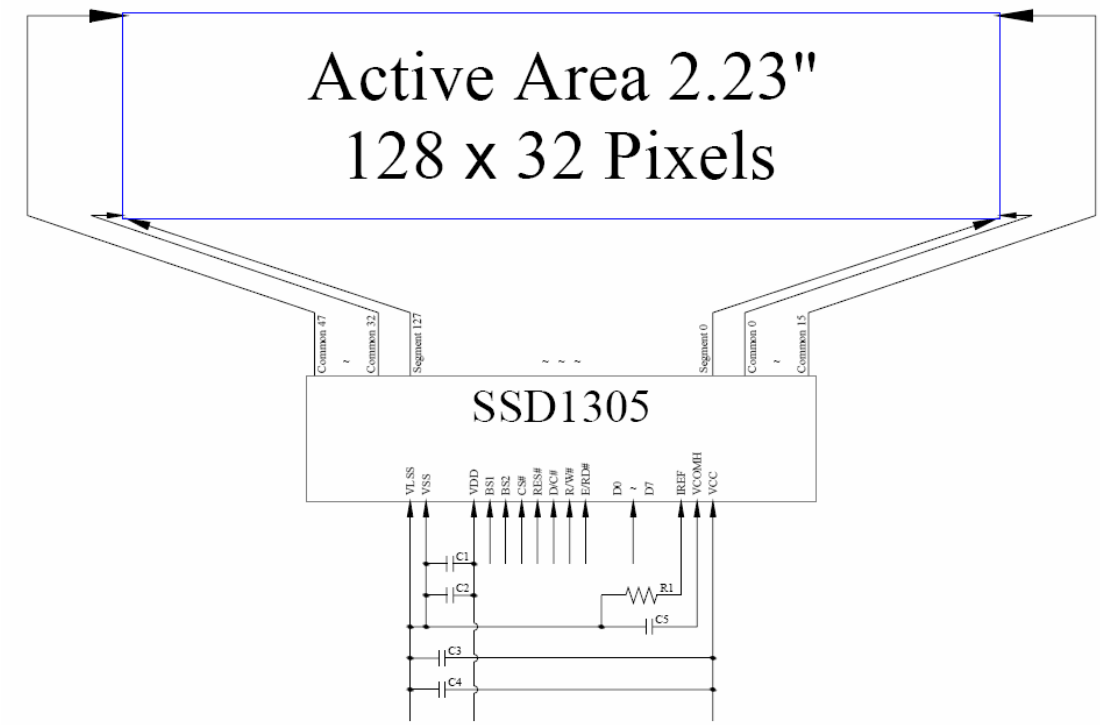
Note 5 V_{DD} = 2.8V, V_{CC} = 12.5V, 100% display area turned on.

3.3 INTERFACE PIN ASSIGNMENT

<table>
<tr><th>No.</th><th>Symbol</th><th>Function</th></tr>
<tr><td>1</td><td>N.C.(GND)</td><td>Reserved Pin (Supporting Pin)
The supporting pins can reduce the influences from stresses on the function pins. These pins must be connected to external ground.</td></tr>
<tr><td>2</td><td>VLSS</td><td>Ground of Analog Circuit
This is an analog ground pin. It should be connected to VSS externally</td></tr>
<tr><td>3</td><td>VSS</td><td>Ground of OEL System
This is a ground pin. It also acts as a reference for the logic pins, the OEL driving voltages, and the analog circuits. It must be connected to external ground.</td></tr>
<tr><td>4</td><td>N.C.</td><td>No Connection</td></tr>
<tr><td>5</td><td>VDD</td><td>Power Supply for Logic Circuit
This is a voltage supply pin. It must be connected to external source.</td></tr>
<tr><td>6</td><td>BS1</td><td rowspan="2">Communicating Protocol Select
These pins are MCU interface selection input. See the following table:
<table>
<tr><th></th><th>68XX-parallel</th><th>80XX-parallel</th><th>Serial</th><th>I2C</th></tr>
<tr><td>BS1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>BS2</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>7</td><td>BS2</td></tr>
<tr><td>8</td><td>CS#</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>Power Reset for Controller and Driver
This pin is reset signal input. When the pin is low, initialization of the chip is executed.</td></tr>
<tr><td>10</td><td>D/C#</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 signals, please refer to the Timing Characteristics Diagrams.
When the pin is pulled high and serial interface mode is selected, the data at SDIN is treated as data. When it is pulled low, the data at SDIN will be transferred to the command register. In I2C mode, this pin acts as SA0 for slave address selection.</td></tr>
<tr><td>11</td><td>R/W#</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 “Low” for write mode.
When 80XX interface mode is selected, this pin will be the Write (WR#) input. Data write operation is initiated when this pin is pulled low and the CS# is pulled low.</td></tr>
<tr><td>12</td><td>E/RD#</td><td>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.</td></tr>
<tr><td>13~20</td><td>D0~D7</td><td>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 will be the serial data input SDIN and D0 will be the serial clock input SCLK. When I2C mode is</td></tr>
</table>

		selected, D2 & D1 should be tied together and serve as SDAout &SDAin in application and D0 is the serial clock input SCL.
21	IREF	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 lower than 10uA
22	VCOMH	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	Power Supply for OEL Panel This is the most positive voltage supply pin of the chip. It must be supplied externally.
24	N.C.(GND)	Reserved Pin (Supporting Pin) The supporting pins can reduce the influences from stresses on the function pins. These pins must be connected to external ground.

3.4 BLOCK DIAGRAM



MCU Interface Selection: BS1 and BS2
Pins connected to MCU interface: D7~D0, E/RD#, R/W#, D/C#, RES# and CS#.

C1, C3: 0.1µF
C2: 4.7µF
C4: 10µF
C5: 4.7µF/25V Tantalum Capacitor
R1: 910 kΩ, R1 = (Voltage at IREF – VSS) / IREF

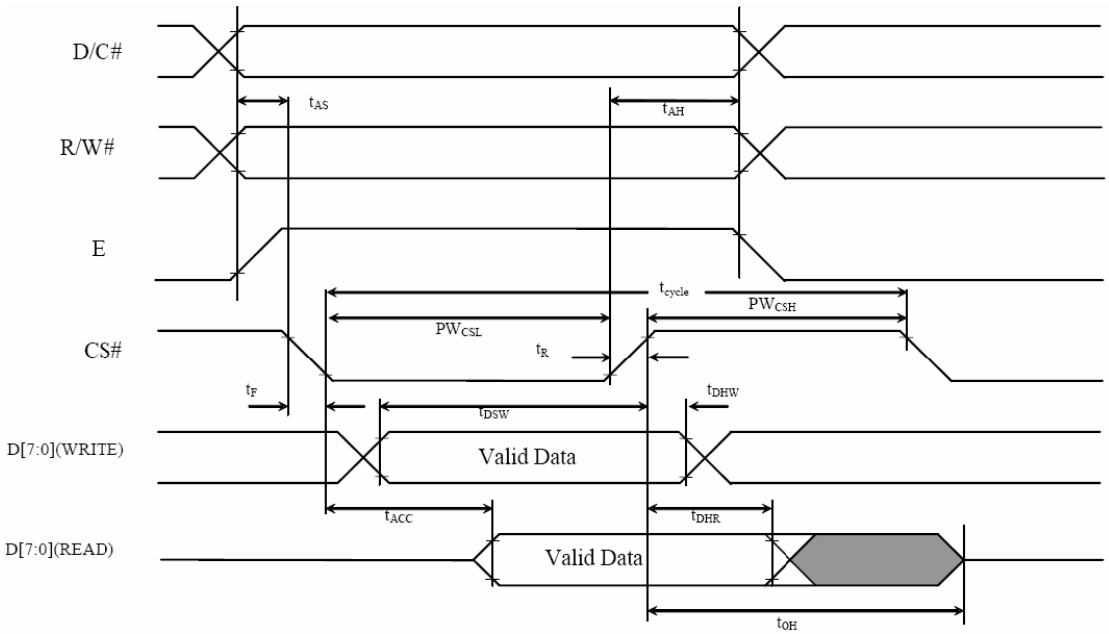
3.5 TIMING CHARACTERISTICS

3.5.1 AC CHARACTERISTICS

3.5.1.1 68XX-Series MPU Parallel Interface Timing Characteristics

V_{DD}-V_{SS} = 2.4V to 3.5V, Ta=25°C

Symbol	Description	Min	Max	Unit
tcycle	System Cycle Time	300	-	ns
tAS	Address Setup Time	0	-	ns
tAH	Address Hold Time	0	-	ns
tDSW	Write Data Setup Time	40	-	ns
tDHW	Write Data Hold Time	7	-	ns
tDHR	Read Data Hold Time	20	-	ns
tOH	Output Disable Time	-	70	ns
tACC	Access Time	-	140	ns
PWCSL	Chip Select Low Pulse Width (Read) Chip Select	120	-	ns
	Low Pulse width (Write)	60		
PWCSH	Chip Select High Pulse Width (Read) Chip Select	60	-	ns
	High Pulse Width (Write)	60		
tR	Rise Time	-	15	ns
tF	Fall Time	-	15	ns

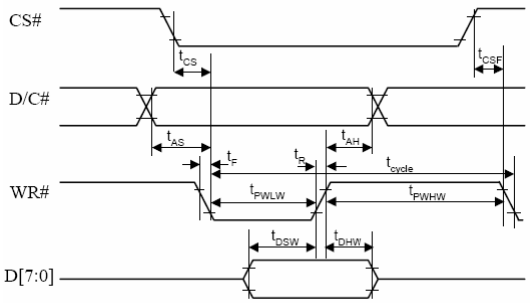


3.5.1.2 8080-Series MPU Parallel Interface Timing Characteristics

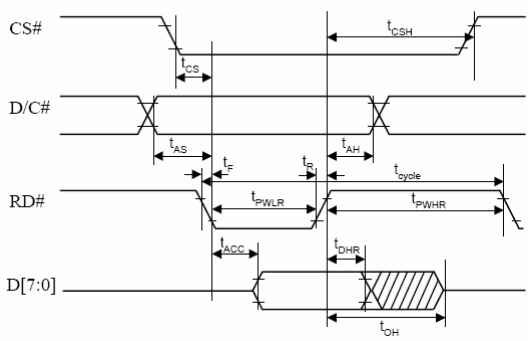
V_{DD}-V_{SS} = 2.4V to 3.5V, Ta=25°C

Symbol	Description	Min	Max	Unit
tcycle	Clock Cycle Time	300	-	ns
tAS	Address Setup Time	10	-	ns
tAH	Address Hold Time	0	-	ns
tDSW	Write Data Setup Time	40	-	ns
tDHW	Write Data Hold Time	7	-	ns
tDHR	Read Data Hold Time	20	-	ns
tOH	Output Disable Time	-	70	ns
tACC	Access Time	-	140	ns
tPWLR	Read Low Time	120	-	ns
tPWLW	Write Low Time	60	-	ns
tPWHR	Read High Time	60	-	ns
tPWHW	Write High Time	60	-	ns
tCS	Chip Select Setup Time	0	-	ns
tCSH	Chip Select Hold Time to Read Signal	0	-	ns
tCSF	Chip Select Hold Time	20	-	ns
tR	Rise Time	-	15	ns
tF	Fall Time	-	15	ns

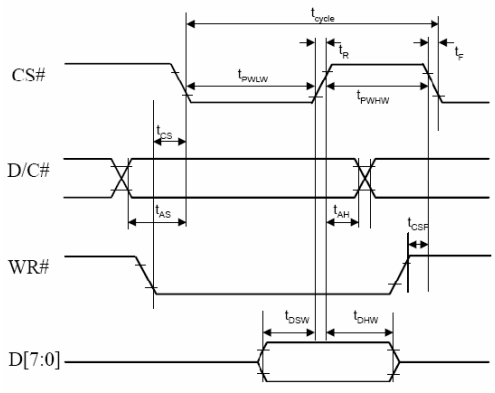
Write cycle (Form 1)



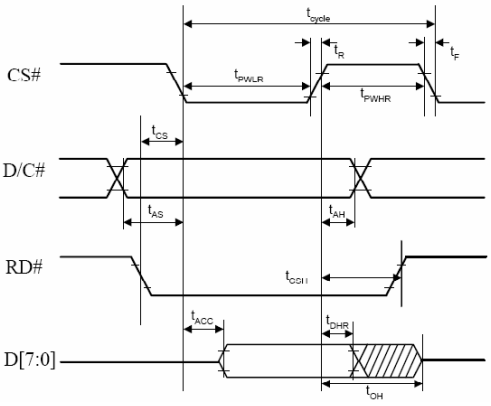
Read cycle (Form 1)



Write cycle (Form 2)



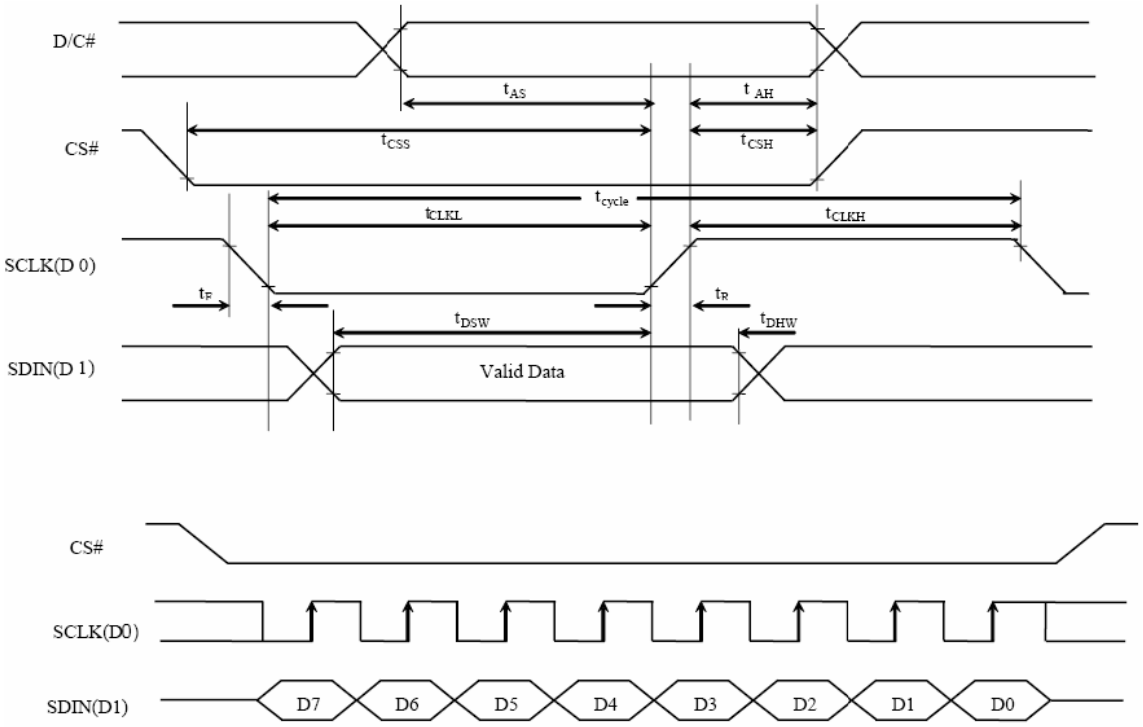
Read cycle (Form 2)



3.5.1.3 Serial Interface Timing Characteristics

V_{DD}-V_{SS} = 2.4V to 3.5V, Ta=25°C

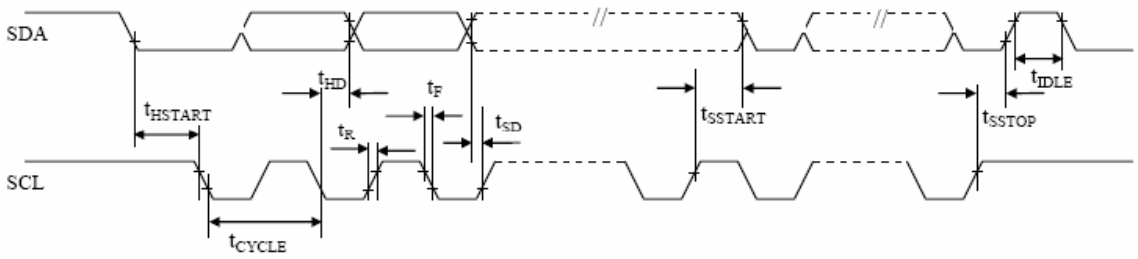
Symbol	Description	Min	Max	Unit
tcycle	Clock Cycle Time	250	-	ns
tAS	Address Setup Time	150	-	ns
tAH	Address Hold Time	150	-	ns
tCSS	Chip Select Setup Time	120	-	ns
tCSH	Chip Select Hold Time	60	-	ns
tDSW	Write Data Setup Time	50	-	ns
tDHW	Write Data Hold Time	15	-	ns
tCLKL	Serial Clock Low Time	100	-	ns
tCLKH	Serial Clock High Time	100	-	ns
tR	Rise Time	-	15	ns
tF	Fall Time	-	15	ns



3.5.1.4 I²C Interface Timing Characteristics

V_{DD}-V_{SS} = 2.4V to 3.5V, Ta=25°C

Symbol	Description	Min	Max	Unit
tcycle	Clock Cycle Time	2.5	-	us
tHSTART	Start Condition Hold Time	0.6	-	us
tHD	Data Hold Time (for "SDAOUT" Pin) Data	0	-	ns
	Hold Time (for "SDAIN" Pin)	300		
tSD	Data Setup Time	100	-	ns
tSSTART	Start Condition Setup Time (Only relevant for a repeated Start condition)	0.6	-	us
tSSTOP	Stop Condition Setup Time	0.6	-	us
tR	Rise Time for Data and Clock Pin		300	ns
tF	Fall Time for Data and Clock Pin		300	ns
tIDLE	Idle Time before a New Transmission can Start	1.3	-	us



4 OPTICAL SPECIFICATION

4.1 OPTICAL CHARACTERISTICS

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Brightness(White)	L_{br}	With Polarizer (Note 3)	100	120	-	cd/m^2
C.I.E.(Blue)	(X)	Without Polarizer	0.12	0.16	0.20	-
	(Y)		0.22	0.26	0.30	
Dark Room Contrast	CR		-	>2000:1	-	-
Viewing Angle			>160	-	-	degree

Optical measurement taken at V_{DD} = 2.8V, V_{CC} = 12.5V.
Software configuration follows Section 5.4 Initialization

5 FUNCTIONAL SPECIFICATION

5.1 COMMANDS

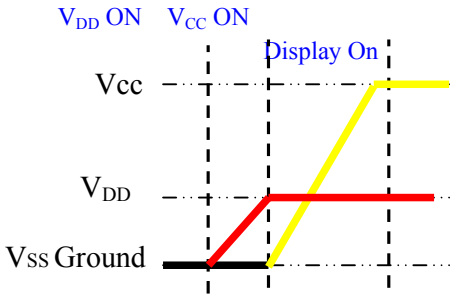
Please refer to the Technical Manual for the SSD1305

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.

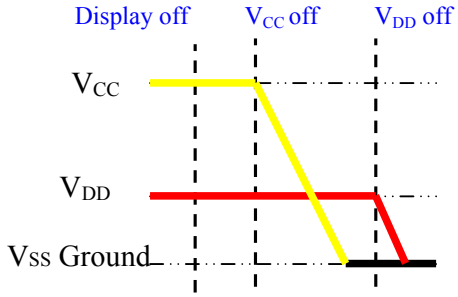
5.2.1 POWER UP SEQUENCE

1. Power up V_{DD}
2. Send Display off command
3. Initialization
4. Clear Screen
5. Power up V_{CC}
6. Delay 100ms
(when VDD is stable)
7. 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} reach 0 and panel is completely discharges)
4. Power down V_{DD}



5.3 RESET CIRCUIT

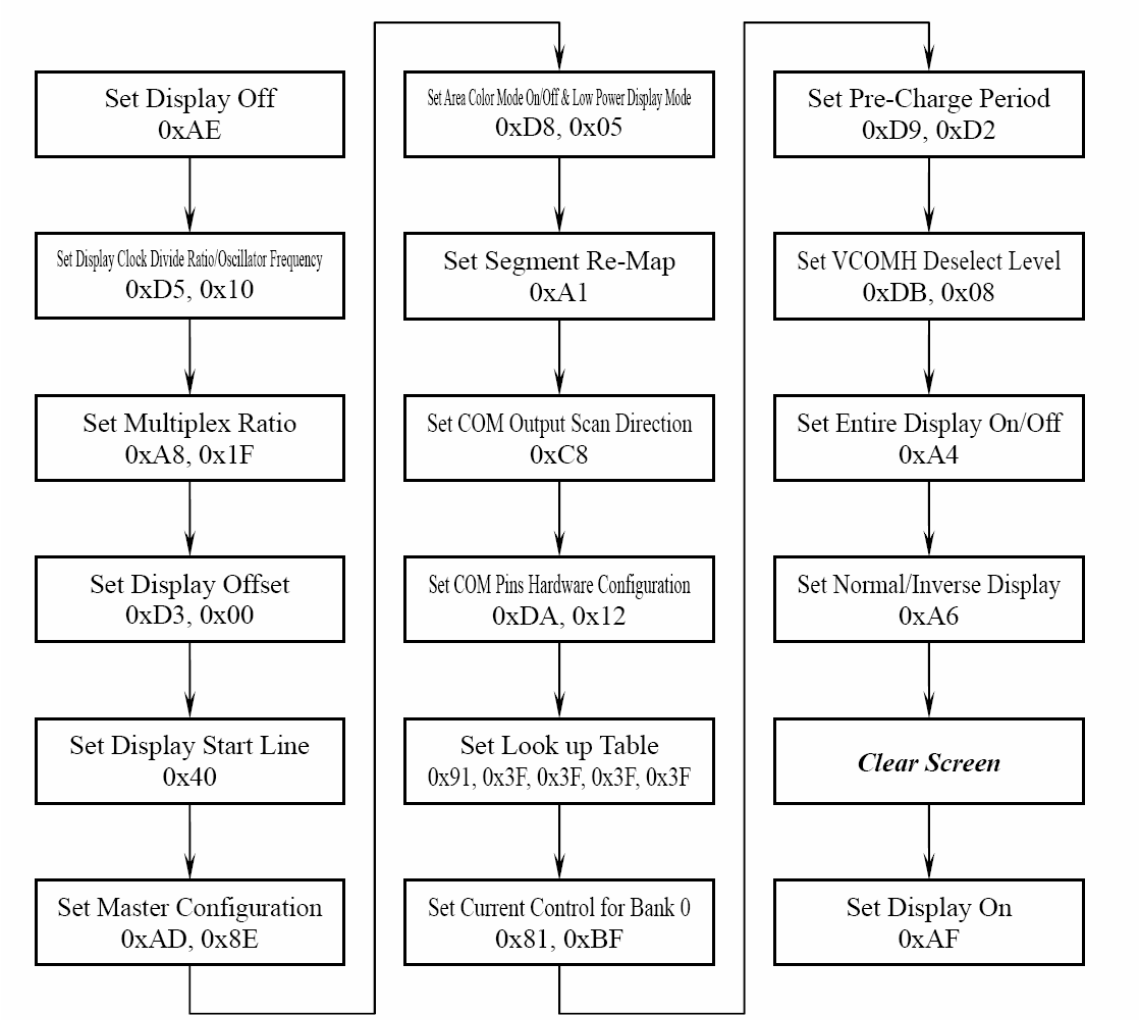
When RES# input is low, the chip is initialized with the following status:

1. Display is OFF
2. 132x64 Display mode
3. Normal segment and display data colume 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 ACTUAL APPLICATION EXAMPLE

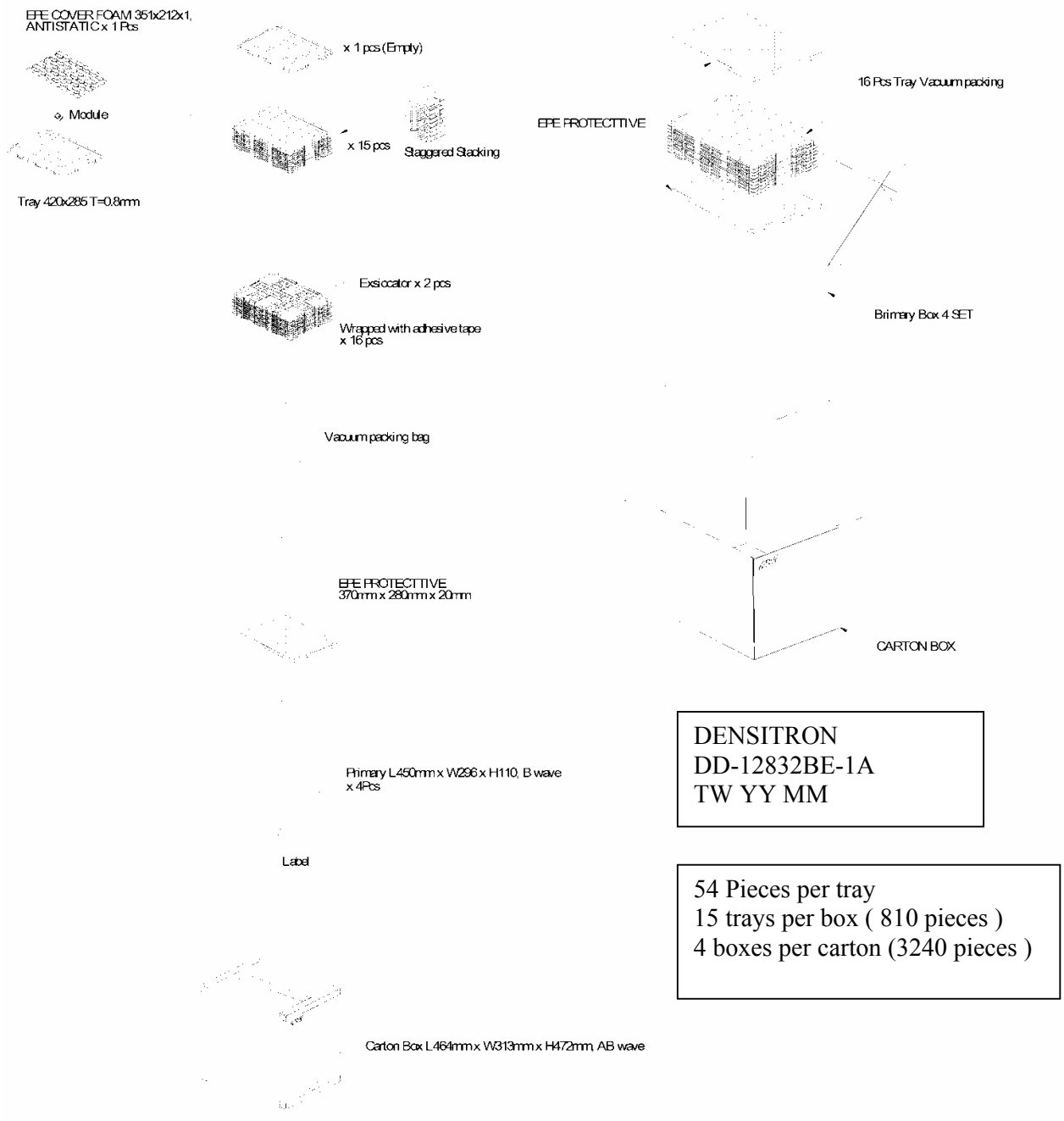
Command usage and explanation of an actual example

<Initialisation Setting>



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



DENSITRON
DD-12832BE-1A
TW YY MM

54 Pieces per tray
15 trays per box (810 pieces)
4 boxes per carton (3240 pieces)

7 QUALITY ASSURANCE SPECIFICATION

7.1 CONFORMITY

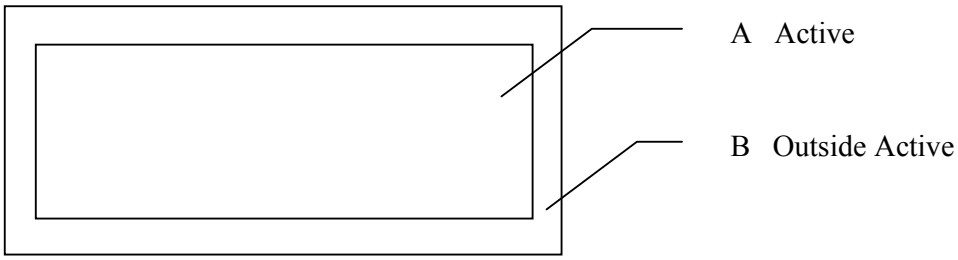
The performance, function and reliability of the shipped products conform to the Product Specification.

7.2 DELIVERY ASSURANCE

7.2.1 DELIVERY INSPECTION STANDARDS

IPC-AA610, class 2 electronic assemblies standard

7.2.2 Zone definition



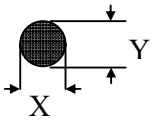
7.2.3 Visual inspection

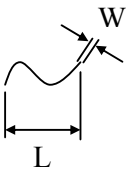
Test and measurement to be conducted under following conditions□

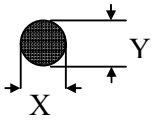
Temperature:	23±5℃
Humidity:	55±15%RH
Fluorescent lamp:	30 W
Distance between the Panel & Eyes of the Inspector:	≧30cm
Distance between the Panel & the lamp:	≧50cm

7.2.4 Standard of appearance inspection

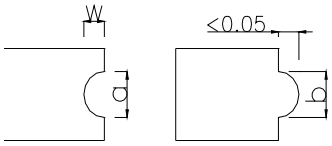
Units: mm

<table>
<tr><th>Class</th><th>Item</th><th colspan="4">Criteria</th></tr>
<tr><td>Minor</td><td rowspan="2">Packing & Label</td><td>Outside & inside package</td><td colspan="3">Presence of product no., lot no., quantity</td></tr>
<tr><td>Critical</td><td colspan="4">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 colspan="4">Product dimensions must be according to specification and drawing</td></tr>
<tr><td>Major</td><td>Electrical</td><td colspan="4">Product electrical characteristics must be according to specification</td></tr>
<tr><td>Critical</td><td>OLED Display</td><td colspan="4">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 colspan="4">Round type: as per following drawing
∅ = (X+Y)/2
 

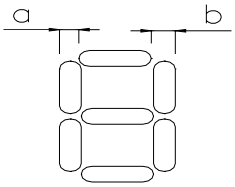
<table><tr><th colspan="3">Acceptable quantity</th></tr><tr><th>Size</th><th>Zone A</th><th>Zone B</th></tr><tr><td>∅<0.1</td><td>Any number</td><td rowspan="4">Any number</td></tr><tr><td>0.1<∅<0.2</td><td>3</td></tr><tr><td>0.2<∅<0.25</td><td>1</td></tr><tr><td>0.25<∅</td><td>0</td></tr></table>
Line 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 colspan="4">Scratch on protective film is permitted
Scratch on polariser: same as No. 1</td></tr>
<tr><td>Minor</td><td>Polariser bubble</td><td colspan="4">∅ = (X+Y)/2
 

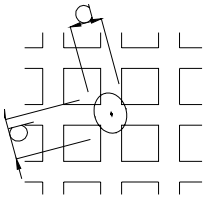
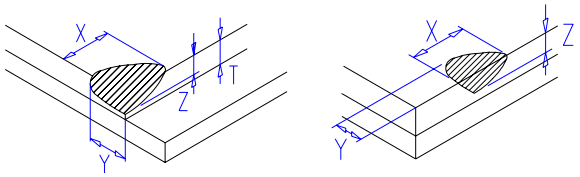
<table><tr><th colspan="3">Acceptable quantity</th></tr><tr><th>Size</th><th>Zone A</th><th>Zone B</th></tr><tr><td>∅<0.5</td><td>Any number</td><td rowspan="2">Any number</td></tr><tr><td>∅>0.5</td><td>0</td></tr></table></td></tr>
</table>

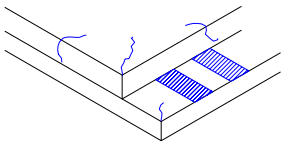
<table>
<tr><th>Class</th><th>Item</th><th>Criteria</th></tr>
<tr><td>Minor</td><td>Segment deformation</td><td>
1b. Pin hole on dot matrix display


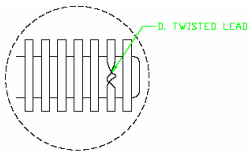
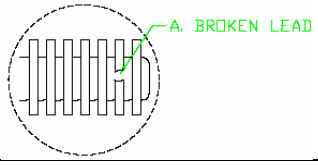
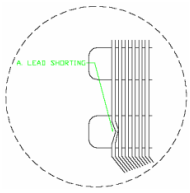
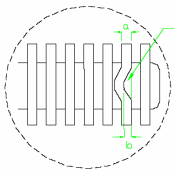
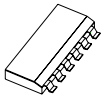
<table>
<tr><td colspan="2">Acceptable quantity</td></tr>
<tr><td>Size</td><td></td></tr>
<tr><td>a,b<0.1</td><td>Any number</td></tr>
<tr><td>(a+b)/2≤0.1</td><td>Any number</td></tr>
<tr><td>0.5<∅<1.0</td><td>3</td></tr>
</table>
Total acceptable quantity: 7

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 affect 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 RELIABILITY TESTS

Test Item	Test Condition	Evaluation and assessment
High Temperature Operation	85°C, 500 hours	No abnormalities in function and appearance
Low Temperature Operation	-30°C, 500 hours	No abnormalities in function and appearance
High Temperature Storage	90°C, 500 hours	No abnormalities in function and appearance
Low Temperature Storage	-40°C, 500 hours	No abnormalities in function and appearance
High Temperature & High Humidity Storage	60°C, 90%RH, 500 hours	No abnormalities in function and appearance
Thermal Shock	100 cycle of -40°C ↔85°C 30 Mins dwell	No abnormalities in function and appearance

- 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 120 cd/m² brightness and 50% Checkerboard, 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).

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