

OLED DISPLAY MODULE

Product Specification

CUSTOMER	Standard
PRODUCT NUMBER	DD-136160WC-1A

INTERNAL APPROVALS		
Product Mgr	Doc. Control	Electr. Eng
Bazile Peter	Bazile Peter	Thomas Walker
Date: 02/07/15	Date: 02/07/15	Date: 02/07/15

TABLE OF CONTENTS

1	MAIN FEATURES	4
2	MECHANICAL SPECIFICATION	5
2.1	MECHANICAL CHARACTERISTICS	5
2.2	MECHANICAL DRAWING	6
3	ELECTRICAL SPECIFICATION.....	7
3.1	ABSOLUTE MAXIMUM RATINGS	7
3.2	ELECTRICAL CHARACTERISTICS	8
3.3	INTERFACE PIN ASSIGNMENT	9
3.4	BLOCK DIAGRAM	10
3.5	TIMING CHARACTERISTICS	11
4	OPTICAL SPECIFICATION.....	13
4.1	OPTICAL CHARACTERISTICS	13
5	FUNCTIONAL SPECIFICATION	14
5.1	COMMANDS	14
5.2	POWER DOWN AND UP SEQUENCE.....	14
5.3	RESET CIRCUIT	14
5.4	ACTUAL APPLICATION EXAMPLE	15
6	OTHER DOCUMENTATIONS	16
7	PACKAGING.....	17
7.1	LABELLING AND MARKING	17
8	QUALITY ASSURANCE SPECIFICATION	18
8.1	CONFORMITY	18
8.2	DELIVERY ASSURANCE	18
8.3	DEALING WITH CUSTOMER COMPLAINTS	22
9	RELIABILITY SPECIFICATION	23
9.1	RELIABILITY TESTS	23
9.2	LIFE TIME.....	23
10	PRECAUTIONS.....	24
10.1	HANDLING.....	24
10.2	STORAGE	25
10.3	DESIGNING	25
10.4	DISPOSING	25
10.5	OTHER.....	25
11	SUPPORTED ACCESSORIES	27
11.1	DUO KIT.....	27
11.2	TRANSITION BOARD CARD	27
11.3	CONNECTOR BOARD CARD	27

Product No.	DD-136160WC-1A	REV.A

Page	2 / 27
------	--------

REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECR no.
A	02/07/15	--	--	Initial Release	

Product No.	DD-136160WC-1A	REV.A

Page	3 / 27
------	--------

1 MAIN FEATURES

ITEM	CONTENTS
Display Format	136x 160 Dots
Colour	White Monochrome
Panel Dimensions	32.7 (W) × 32.2 (H) × 1.00 (D) mm
Viewing Area	29.18 (W) x 25.1 (H) mm
Screen Size	1.07"
Mode	Passive Matrix
Duty ratio	1/160
Driver IC	SH1108
Operating temperature	-40°C ~ +70°C
Storage temperature	-40°C ~ +85°C

Product No.	DD-136160WC-1A	REV.A

Page	4 / 27
------	--------

2 MECHANICAL SPECIFICATION

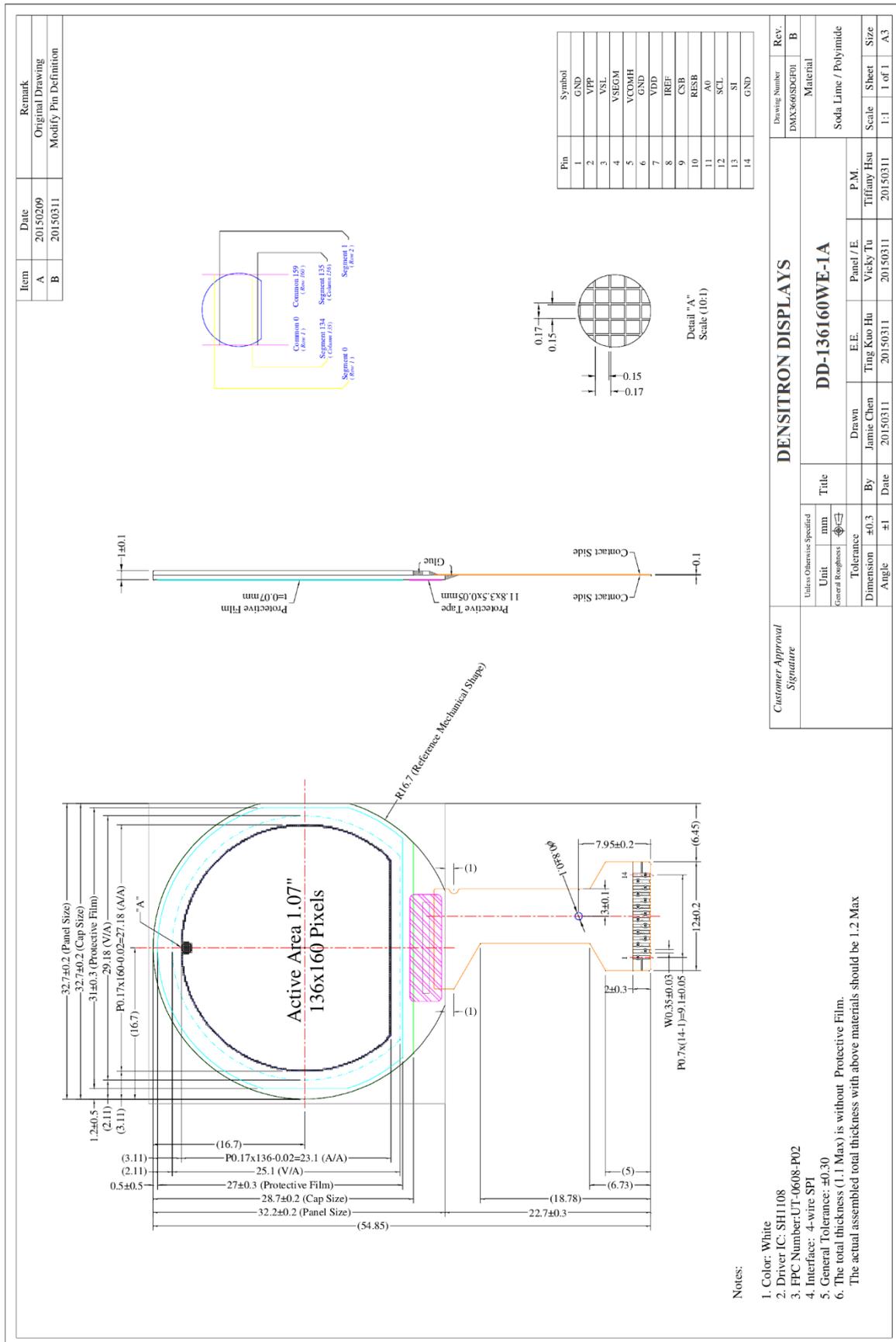
2.1 MECHANICAL CHARACTERISTICS

ITEM	CHARACTERISTIC	UNIT
Display Format	136 x 160	Dots
Panel Dimensions	32.70 (W) × 32.2 (H) × 1.00 (D) mm	mm
Viewing Area	29.18 (W) x 25.1 (H) mm	mm
Active Area	27.18 (W) x 23.1 (H)	mm
Dot Size	0.15 (W) 0.15(H)	mm
Dot Pitch	0.17 (W) 0.17 (H)	mm
Weight	TBD	g
IC Controller/Driver	SSH1108	

Product No.	DD-136160WC-1A	REV.A

Page	5 / 27
------	--------

2.2 MECHANICAL DRAWING



Product No.	DD-136160WC-1A	REV.A
-------------	----------------	-------

Page	6 / 27
------	--------

3 ELECTRICAL SPECIFICATION

3.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min	Max	Unit	Note
Supply Voltage for Display	V _{PP}	0	10	V	1, 2
Supply Voltage for Logic	V _{DD}	-0.3	3.6	V	1, 2
Operating Temperature	T _{op}	-40	+70	°C	
Storage Temperature	T _{st}	-40	+85	°C	
Life Time (200 cd/m ²)		15,000	-	Hour	3
Static Electricity	Be sure that you are grounded when handling displays.				

Note 1: All the above voltages 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 is desirable to use this module under the conditions according to Section 3.2 “Electrical Characteristics”. If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.

Note 3: V_{PP} = 12.0V, T_a = 25°C, 50% of initial brightness reached. The average operating lifetime at room temperature is estimated by accelerated operation at high temperature conditions.

Product No.	DD-136160WC-1A	REV.A

Page	7 / 27
------	--------

3.2 ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	V _{DD}		1.65	2.8	3.5	V
Supply Voltage for Display	V _{PP}	Note 4	11.5	12	12.5	V
High Level Input	V _{IHC}		0.8xV _{DD}	--	V _{DD}	V
Low Level Input	V _{ILC}		0	--	0.2xV _{DD}	V
High Level Output	V _{OHC}	I _{OH} =-500μA	0.8xV _{DD}	--	V _{DD}	V
Low Level Output	V _{OLC}	I _{OL} =500μA	0	--	0.2xV _{DD}	V
Operating Current for V _{DD}	I _{DD}		-	170	250	μA
Operating Current for V _{PP}	I _{PP}	Note 5	-	10.7	13.4	mA
		Note 6	-	15.8	19.8	mA
		Note 7	-	26.6	33.3	mA
Sleep Mode Current for V _{DD}	I _{DD,SLEEP}		-	2	5	μA
Sleep Mode Current for V _{PP}	I _{PP,SLEEP}		-	1	5	μA

Note 4: Brightness (L_{br}) and Supply Voltage for Display (V_{PP}) are subject to the change of panel characteristics and the customers request.

Note 5: V_{DD} = 2.8V, V_{PP} = 12V, 30% Display Area Turn on.

Note 6: V_{DD} = 2.8V, V_{PP} = 12V, 50% Display Area Turn on.

Note 7: V_{DD} = 2.8V, V_{PP} = 12V, 100% Display Area Turn on.

Product No.	DD-136160WC-1A	REV.A

Page	8 / 27
------	--------

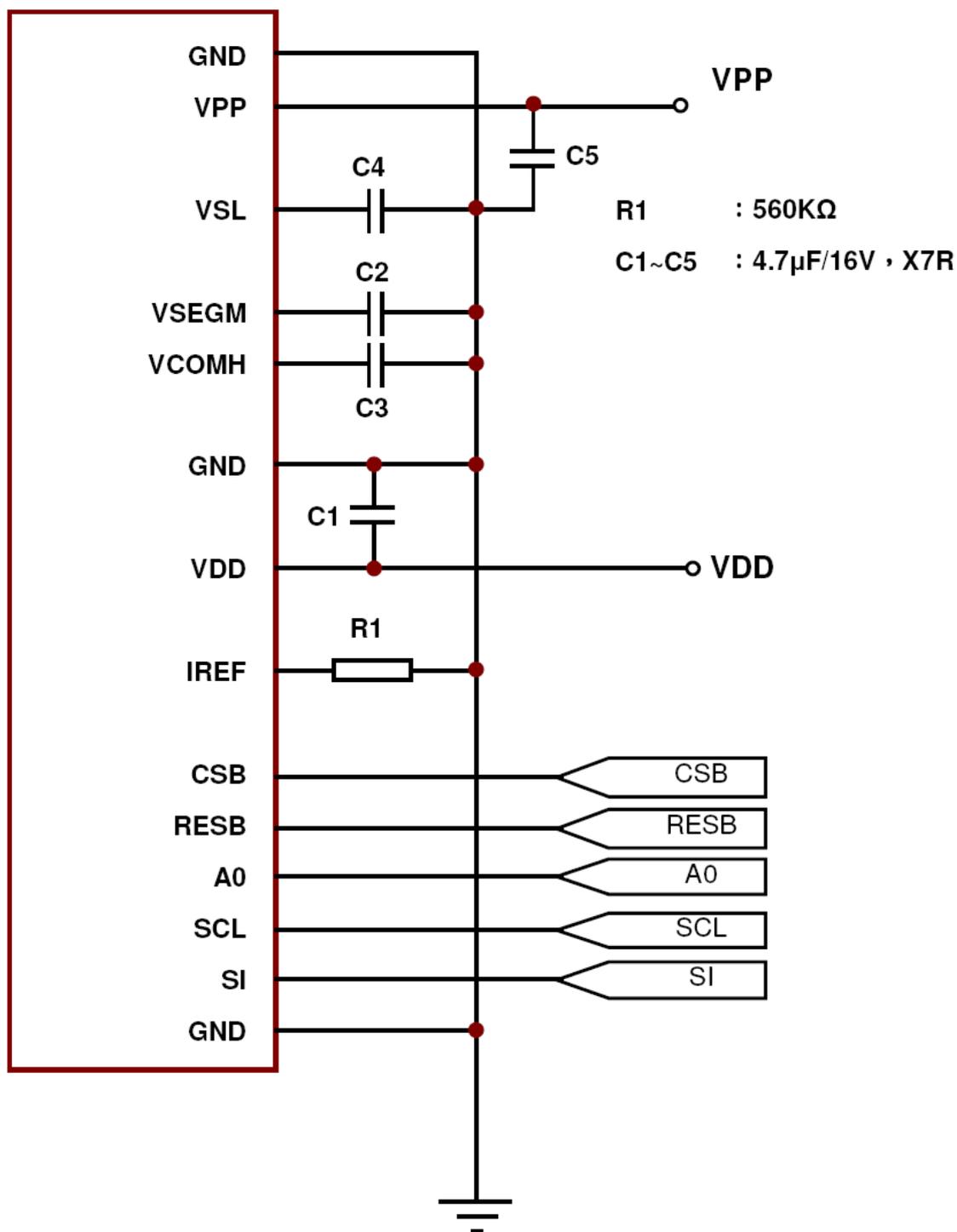
3.3 INTERFACE PIN ASSIGNMENT

No.	Symbol	I/O	Function
1	GND	--	Reserved Pin (Supporting Pin). The supporting pins can reduce the influences from stresses on the function pins. This pin must be connected to external ground.
2	VPP	P	Power Supply for OEL Panel This is the most positive voltage supply pin of the chip. It must be supplied externally.
3	VSL	P	Voltage Reference of Segment This pin is segment voltage reference pin. A capacitor should be connected between this pin and GND.
4	VSEGM	O	Voltage Output High Level for Segment Pre-Charge This pin is for the voltage output high level for SEG pre-charge. A capacitor should be connected between this pin and GND
5	VCOMH	O	Voltage Output High Level for COM Signal This pin is for the voltage output high level for COM signals. A capacitor should be connected between this pin and GND.
6	GND	P	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 analogue circuits. It must be connected to external ground.
7	VDD	P	Power Supply for Logic This is a voltage supply pin. It must be connected to external source.
8	IREF	O	Current Reference for Brightness Adjustment This pin is segment current reference pin. A resistor should be connected between this pin and GND. Set the current at 15.625 μ A maximum.
9	CSB	I	Chip Select This pin is the chip select input. The chip is enabled for MCU communication only when CSB is pulled low.
10	RESB	I	Power Reset for Controller and Driver This pin is reset signal input. When the pin is low, initialisation of the chip is executed.
11	A0	I	Data/Command Control When the pin is pulled high and the serial interface mode is selected, the data at SI is treated as data. When it is pulled low, the data at SI will be transferred to the command register.
12	SCL	I	Serial Clock Input Signal The transmission of information in the bus is following a clock signal. Each transmission of data bit is taken place during a single clock period of this pin.
13	SI	I	Serial Data Input Signal This pin acts as a communication channel. The input data through SI are latched at the rising edge of SCL in the sequence of MSB first and converted to 8-bit parallel data and handled at the rising edge of the last serial clock. SI is identified to the display data or command by A0 bit data at the rising of first SCL
14	GND	I	Reserved Pin (Supporting Pin) The supporting pins can reduce the influences from stresses on the function pins. This pin must be connected to external ground.

Product No.	DD-136160WC-1A	REV.A

Page	9 / 27
------	--------

3.4 BLOCK DIAGRAM



Product No.	DD-136160WC-1A	REV.A

Page	10 / 27
------	---------

3.5 TIMING CHARACTERISTICS

3.5.1 AC Characteristics

Symbol	Description	Min	Max	Unit
t _{SCYC}	Serial Clock Cycle Time	250	-	ns
t _{SAS}	Address Setup Time	150	-	ns
t _{SAH}	Address Hold Time	150	-	ns
t _{SDS}	Data Setup Time	100	-	ns
t _{SDH}	Data Hold Time	100	-	ns
t _{CSS}	Chip Select Setup Time	120	-	ns
t _{CSH}	Chip Select Hold Time	60	-	ns
t _{SLW}	Serial Clock L Pulse Width	100	-	ns
t _{SHW}	Serial Clock H Pulse Width	100	-	ns
t _R	Rise Time	-	15	ns
t _F	Fall Time	-	15	ns

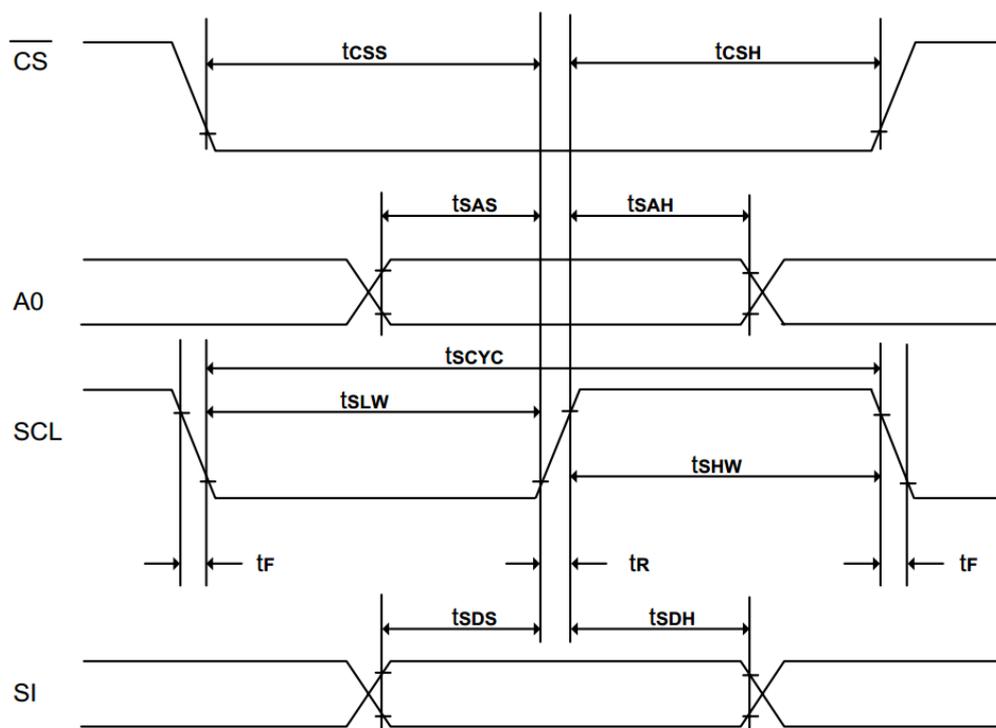
(V_{DD-GND}= 1.65V to 1.8V, T_a = 25°C)

Symbol	Description	Min	Max	Unit
t _{SCYC}	Serial Clock Cycle Time	200	-	ns
t _{SAS}	Address Setup Time	120	-	ns
t _{SAH}	Address Hold Time	120	-	ns
t _{SDS}	Data Setup Time	80	-	ns
t _{SDH}	Data Hold Time	80	-	ns
t _{CSS}	Chip Select Setup Time	96	-	ns
t _{CSH}	Chip Select Hold Time	48	-	ns
t _{SLW}	Serial Clock L Pulse Width	80	-	ns
t _{SHW}	Serial Clock H Pulse Width	80	-	ns
t _R	Rise Time	-	12	ns
t _F	Fall Time	-	12	ns

(V_{DD-GND}= 1.8V to 3.5V, T_a = 25°C)

Product No.	DD-136160WC-1A	REV.A

Page	11 / 27
------	---------



($V_{DD-GND} = 1.8V$ to $3.5V$, $T_a = 25^\circ C$)

PRELIMINARY

Product No.	DD-136160WC-1A	REV.A

Page	12 / 27
------	---------

4 OPTICAL SPECIFICATION

4.1 OPTICAL CHARACTERISTICS

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Brightness	L _{br}	Note	150	200	-	cd/m ²
C.I.E. (White)	(x) (y)	C.I.E. 1931	0.25 0.27	0.29 0.31	0.33 035	
Dark Room Contrast	CR		-	>10,000:1	-	
View Angle			Free	-	-	degree

Note : Optical measurement taken at V_{DD} = 2.8V, V_{PP} = 12V
 Software configuration follows Section 4.4 Initialization.

Product No.	DD-136160WC-1A	REV.A

Page	13 / 27
------	---------

5 FUNCTIONAL SPECIFICATION

5.1 COMMANDS

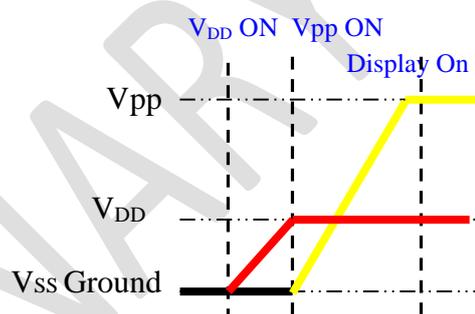
Refer to the Technical Manual for the SH1108

5.2 POWER DOWN AND UP SEQUENCE

To protect the 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. Such that panel has enough time to charge and discharge before/after operation.

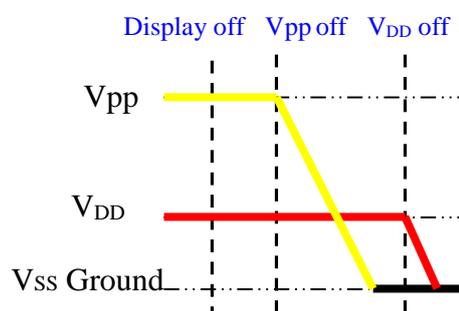
5.2.1 POWER UP SEQUENCE

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



5.2.2 POWER DOWN SEQUENCE

1. Send Display off command
2. Power down V_{pp}
3. Delay 100ms
(When V_{pp} reaches 0 and panel is completely discharged)
4. Power down V_{DD}



5.3 RESET CIRCUIT

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

1. Display is OFF
2. 160 x 160 Display Mode
3. Normal segment and display data column and row address mapping (SEGO 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. Internal booster is selected

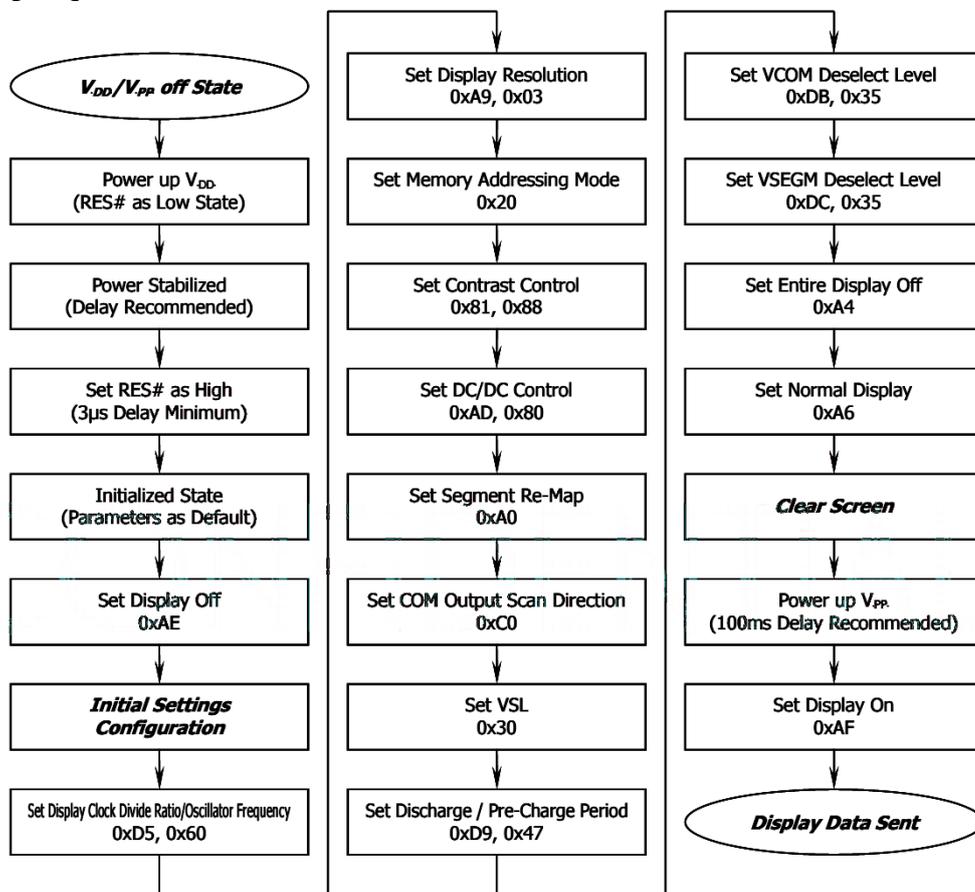
Product No.	DD-136160WC-1A	REV.A

Page	14 / 27
------	---------

5.4 ACTUAL APPLICATION EXAMPLE

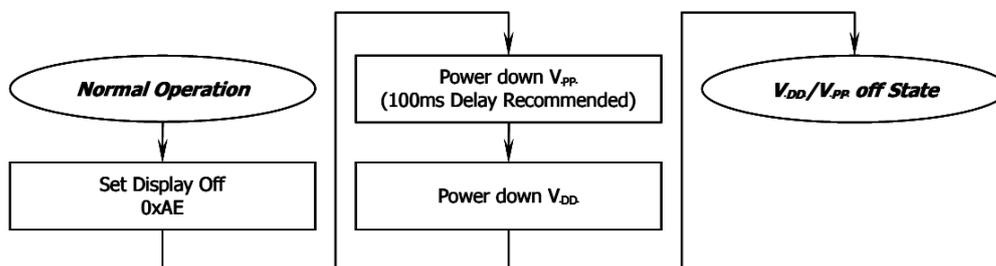
Command usage and explanation of an actual example

Power up sequence



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

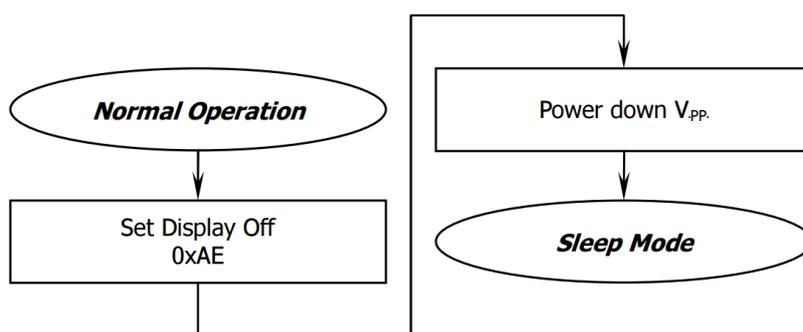
Power down Sequence



Product No.	DD-136160WC-1A	REV.A

Page	15 / 27
------	---------

Entering Sleep Mode



Exiting Sleep Mode

6 OTHER DOCUMENTATIONS

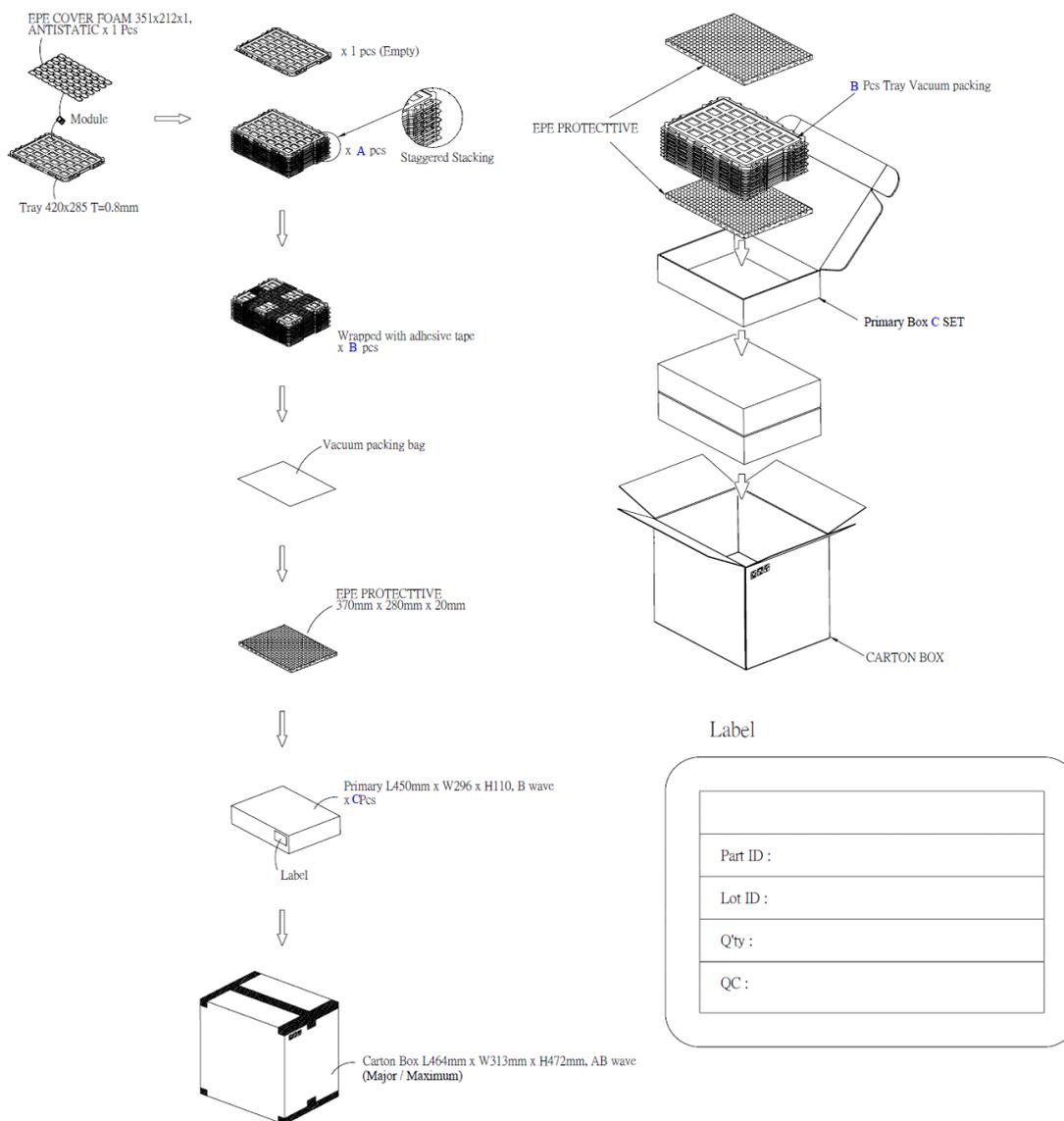
Application notes, software and driver IC specs are available on demand.

PRELIMINARY

Product No.	DD-136160WC-1A	REV.A

Page	16 / 27
------	---------

7 PACKAGING



7.1 LABELLING AND MARKING

DENSITRON
DD-136160WC-1A
TW YYMM

Product No.	DD-136160WC-1A	REV.A
-------------	----------------	-------

Page	17 / 27
------	---------

8 QUALITY ASSURANCE SPECIFICATION

8.1 CONFORMITY

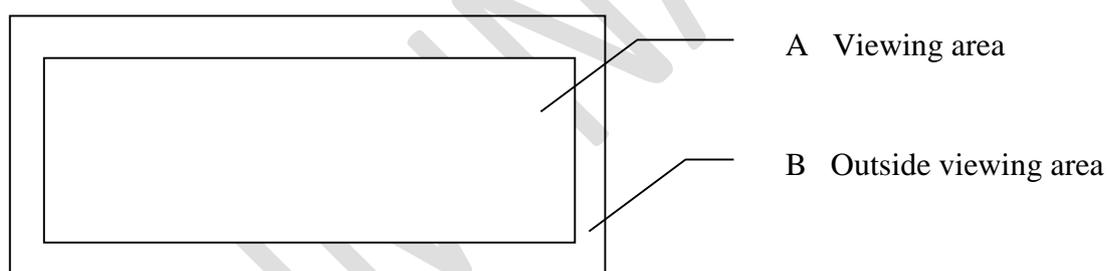
The performance, function and reliability of the shipped products conform to the Product Specification.

8.2 DELIVERY ASSURANCE

8.2.1 Delivery inspection standards

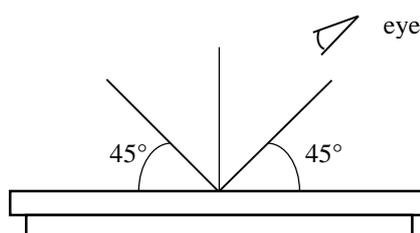
- IPC-AA610 rev. C, class 2 electronic assemblies standard

8.2.2 Zone definition



8.2.3 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.

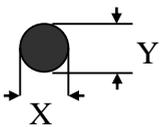
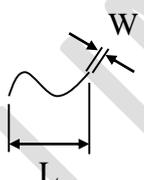
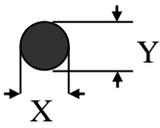


Product No.	DD-136160WC-1A	REV.A
-------------	----------------	-------

Page	18 / 27
------	---------

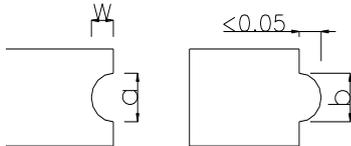
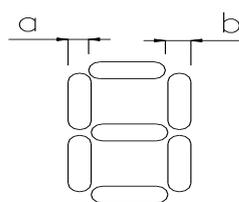
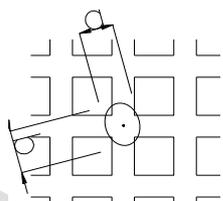
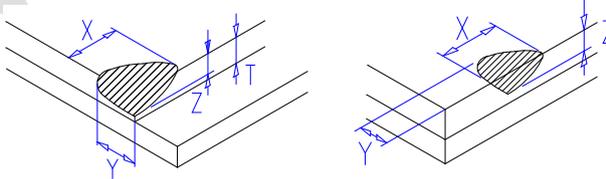
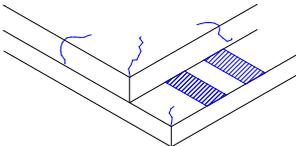
8.2.3.1 Standard of appearance inspection

Units: mm

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

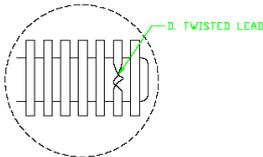
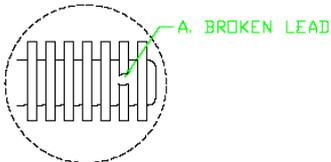
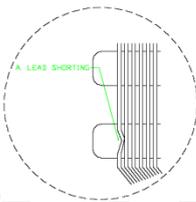
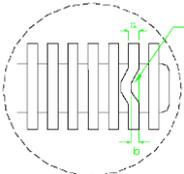
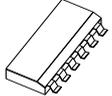
Product No.	DD-136160WC-1A	REV.A

Page	19 / 27
------	---------

Class	Item	Criteria																												
Minor	Segment deformation	<p>1b. Pin hole on dot matrix display</p>  <table border="1" data-bbox="1021 302 1420 481"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th></th> </tr> </thead> <tbody> <tr> <td>$a, b < 0.1$</td> <td>Any number</td> </tr> <tr> <td>$(a+b)/2 \le 0.1$</td> <td>Any number</td> </tr> <tr> <td>$0.5 < \varnothing < 1.0$</td> <td>3</td> </tr> </tbody> </table> <p>Total acceptable quantity: 7</p> <p>2. Segments / dots with different width</p>  <table border="1" data-bbox="1021 683 1420 795"> <thead> <tr> <th colspan="2">Acceptable</th> </tr> </thead> <tbody> <tr> <td>$a \geq b$</td> <td>$a/b \leq 4/3$</td> </tr> <tr> <td>$a < b$</td> <td>$a/b > 4/3$</td> </tr> </tbody> </table> <p>3. Alignment layer defect</p> <p>$\varnothing = (a+b)/2$</p>  <table border="1" data-bbox="1021 862 1420 1086"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th></th> </tr> </thead> <tbody> <tr> <td>$\varnothing \leq 0.4$</td> <td>Any number</td> </tr> <tr> <td>$0.4 < \varnothing \leq 1.0$</td> <td>5</td> </tr> <tr> <td>$1.0 < \varnothing \leq 1.5$</td> <td>3</td> </tr> <tr> <td>$1.5 < \varnothing \leq 2.0$</td> <td>2</td> </tr> </tbody> </table> <p>Total acceptable quantity: 7</p>	Acceptable quantity		Size		$a, b < 0.1$	Any number	$(a+b)/2 \le 0.1$	Any number	$0.5 < \varnothing < 1.0$	3	Acceptable		$a \geq b$	$a/b \leq 4/3$	$a < b$	$a/b > 4/3$	Acceptable quantity		Size		$\varnothing \leq 0.4$	Any number	$0.4 < \varnothing \leq 1.0$	5	$1.0 < \varnothing \leq 1.5$	3	$1.5 < \varnothing \leq 2.0$	2
Acceptable quantity																														
Size																														
$a, b < 0.1$	Any number																													
$(a+b)/2 \le 0.1$	Any number																													
$0.5 < \varnothing < 1.0$	3																													
Acceptable																														
$a \geq b$	$a/b \leq 4/3$																													
$a < b$	$a/b > 4/3$																													
Acceptable quantity																														
Size																														
$\varnothing \leq 0.4$	Any number																													
$0.4 < \varnothing \leq 1.0$	5																													
$1.0 < \varnothing \leq 1.5$	3																													
$1.5 < \varnothing \leq 2.0$	2																													
Minor	Panel Chipping	<p>$X \leq 1/6$ Panel length $Y \leq 1$ $Z \leq T$</p> 																												
Minor	Panel Cracking	<p>Cracks not allowed</p> 																												
Minor	Copper exposed (pin or film)	Not allowed if visible by eye inspection																												
Minor	Film or Trace Damage	Not allowed if affects electrical function																												

Product No.	DD-136160WC-1A	REV.A

Page	20 / 27
------	---------

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

Product No.	DD-136160WC-1A	REV.A

Page	21 / 27
------	---------

8.3 DEALING WITH CUSTOMER COMPLAINTS

8.3.1 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.

8.3.2 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.

Product No.	DD-136160WC-1A	REV.A

Page	22 / 27
------	---------

9 RELIABILITY SPECIFICATION

9.1 RELIABILITY TESTS

Test Item	Test Condition	Evaluation and assessment
High Temperature Operation	70°C, 240 hrs	The operational functions work.
Low Temperature Operation	-40°C, 240 hrs	
High Temperature Storage	85°C, 240hrs	
Low Temperature Storage	-40°C, 240 hrs	
High Temperature & High Humidity Storage	60°C, 90% RH, 120 hrs	
Thermal Shock Storage	-40°C ↔ 85°C, 24 cycles 60 min. dwell	

- All operation tests are conducted in all display on pattern.
- The samples used for above tests do not include polarizer.
- No moisture condensation is observed during tests.

9.1.1 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 test at 23±5 °C; 55±15% RH

9.2 LIFE TIME

Item	Description
1	Function, performance, appearance, etc. shall be free from remarkable deterioration within 20,000 hours under 200 cd/m ² 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.

Product No.	DD-136160WC-1A	REV.A
-------------	----------------	-------

Page	23 / 27
------	---------

10 PRECAUTIONS

10.1 HANDLING

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 Trichlorotrifluoroethane.

Do not wipe the display surface with dry or hard materials that will damage the polarizer 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 $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ 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).

Product No.	DD-136160WC-1A	REV.A

Page	24 / 27
------	---------

10.2 STORAGE

When storing OEL display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps, etc. and, also, avoiding high temperature and high humidity environments or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from Factory.)

At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them.

If electric current is applied when water drops are adhering to the surface of the OEL display module, when the OEL display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above.

10.3 DESIGNING

The absolute maximum ratings are the ratings which cannot be exceeded for OEL display module, and if these values are exceeded, panel damage may be happen.

To prevent occurrence of malfunctioning by noise: pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible.

We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VCI). (Recommend value: 0.5A)

Pay sufficient attention to avoid occurrence of mutual noise interference with the neighbouring devices.

As for EMI, take necessary measures on the equipment side basically.

When fastening the OEL display module, fasten the external plastic housing section.

If power supply to the OEL display module is forcibly shut down by such errors as taking out the main battery while the OEL display panel is in operation, we cannot guarantee the quality of this OEL display module.

The electric potential to be connected to the rear face of the IC chip should be as follows: SSD1351

* Connection (contact) to any other potential than the above may lead to rupture of the IC.

10.4 DISPOSING

Request the qualified companies to handle industrial wastes when disposing of the OEL display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations.

10.5 OTHER

When an OEL 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

Product No.	DD-136160WC-1A	REV.A

Page	25 / 27
------	---------

left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module.

To protect OEL display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the OEL display modules.

- * Pins and electrodes
- * Pattern layouts such as the COF

With this OEL display module, the OEL driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this OEL driver is exposed to light, malfunctioning may occur.

- * Design the product and installation method so that the OEL driver may be shielded from light in actual usage.
- * Design the product and installation method so that the OEL driver may be shielded from light during the inspection processes.

Although this OEL display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design.

We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise.

PRELIMINARY

Product No.	DD-136160WC-1A	REV.A

Page	26 / 27
------	---------

11 SUPPORTED ACCESSORIES

11.1 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: PAK-N-136160WC-1A

11.2 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: PAT-N-136160WC-1A

11.3 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: TBD

Product No.	DD-136160WC-1A	REV.A

Page	27 / 27
------	---------