

# Product Specification

Part Name : OEL Display Module  
Customer Part ID :  
WiseChip Part ID : UC-1602ASWCS10  
Doc No. : SAS1-0V003-C

Customer:
Approved by

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From: WiseChip Semiconductor Inc.
Approved by

## WiseChip Semiconductor Inc.

8, Kebei RD 2, Science Park, Chu-Nan, Taiwan 350, R.O.C.

### Notes:

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2. The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by WiseChip Semiconductor Inc. for any intellectual property claims or other problems that may result from application based on the module described herein.



Revised History

Part Number	Revision	Revision Content	Revised on
UC-1602ASWCS10	A	New	December 25,2012
UC-1602ASWCS10	B	Page 1 Section 1.2 Add Module Size Add Panel Size remark Add Weight tolerance Page 2 Section 1.4 Update Mechanical drawing Page 6 Section 3.2 Update DC characteristics Page 7 Section 3.3.1 Update AC characteristics Page 12 Section 4.4 Update Power up Sequence Page 13 Section 4.4 Update Power down Sequence Update Entering Standby Mode Sequence Update Exiting Standby Mode Sequence Page 17 Section 4.5 Add ROM D table Page 24 Section 7 Updated Package Specifications	August 22, 2013
UC-1602ASWCS10	C	Page 6 Section 3.2 Update DC characteristics Page 24 Section 7 Updated Package Specifications	November 13, 2013

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## 1. Basic Specifications

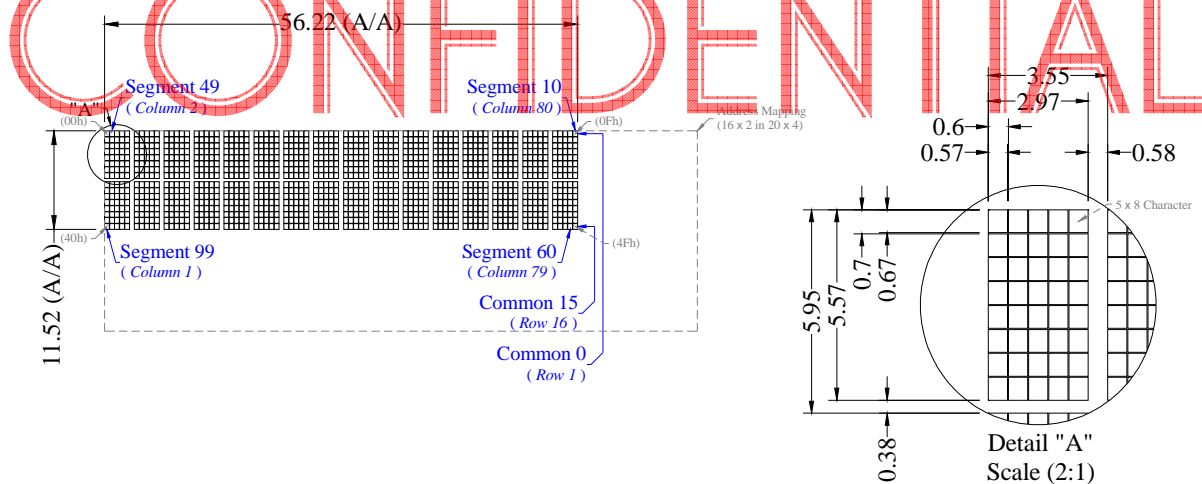
### 1.1 Display Specifications

- 1) Display Mode : Passive Matrix
- 2) Display Color : Monochrome (White)
- 3) Drive Duty : 1/16 Duty

### 1.2 Mechanical Specifications

- 1) Outline Drawing : According to the annexed outline drawing
- 2) Number of Characters : 16 Characters ( 5 × 8 ) × 2 Lines
- 3) Module Size : 80.00 × 36.00 × Max. 9.70 (mm)
- 4) Panel Size : 68.50 × 17.50 × 2.00 (mm) including "Anti-Glare Polarizer"
- 5) Active Area : 56.22 × 11.52 (mm)
- 6) Character Pitch : 3.55 × 5.95 (mm)
- 7) Character Size : 2.97 × 5.57 (mm)
- 8) Pixel Pitch : 0.60 × 0.70 (mm)
- 9) Pixel Size : 0.57 × 0.67 (mm)
- 10) Weight : 21.88 (g) ± 10%

### 1.3 Active Area / Address Mapping & Character Construction



**Address Mapping**

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Line 1	00h	01h	02h	03h	04h	05h	06h	07h	08h	09h	0Ah	0Bh	0Ch	0Dh	0Eh	0Fh
Line 2	40h	41h	42h	43h	44h	45h	46h	47h	48h	49h	4Ah	4Bh	4Ch	4Dh	4Eh	4Fh

1.4 Mechanical Drawing

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Pin	Symbol
1	VSS
2	VDD
3	N.C.
4	D/C#
5	R/W(W/R#)
6	ER(D#)
7	D0
8	D1
9	D2
10	D3
11	D4
12	D5
13	D6
14	D7
15	N.C.
16	N.C.

Item		Date	Remark
A	20101026	Original Drawing	
B	20111216	Modify Protective Tape Size	
C	20120202	Add 3.0 Double Side Tape	
D	20120723	Modify Notes: 4. Interface	
E	20130820	Modify PCB hole and add Bezel	

**Notes:**

- Color: White
- Driver IC: US2066
- FPC Number: UT-0166-P01
- Interface: 8-bit 68XX Parallel
- General Tolerance: ±0.30

<b>WiseChip Semiconductor Inc.</b>			
Drawing Number DMX1602PNP803	Rev. E		
Material Soda Lime / Polyimide			
UC-1602ASWC510 OEL Display Module Pixel Number: Character 16 x 2, Monochrome, PCB Package			
Drawn Vicky Tu	E.E. Ting Kuo Hu	Panel / E. Dora Yang	P.M. Tina Chen
Dimension ±0.3	Tolerance ±1	Date 20130820	Scale 1:1
Customer Approval Signature	Title	Sheet 1 of 1	Size A3

The drawing contained herein is the exclusive property of WiseChip. It is not allowed to copy, reproduce and or disclose in any formats without permission of WiseChip.

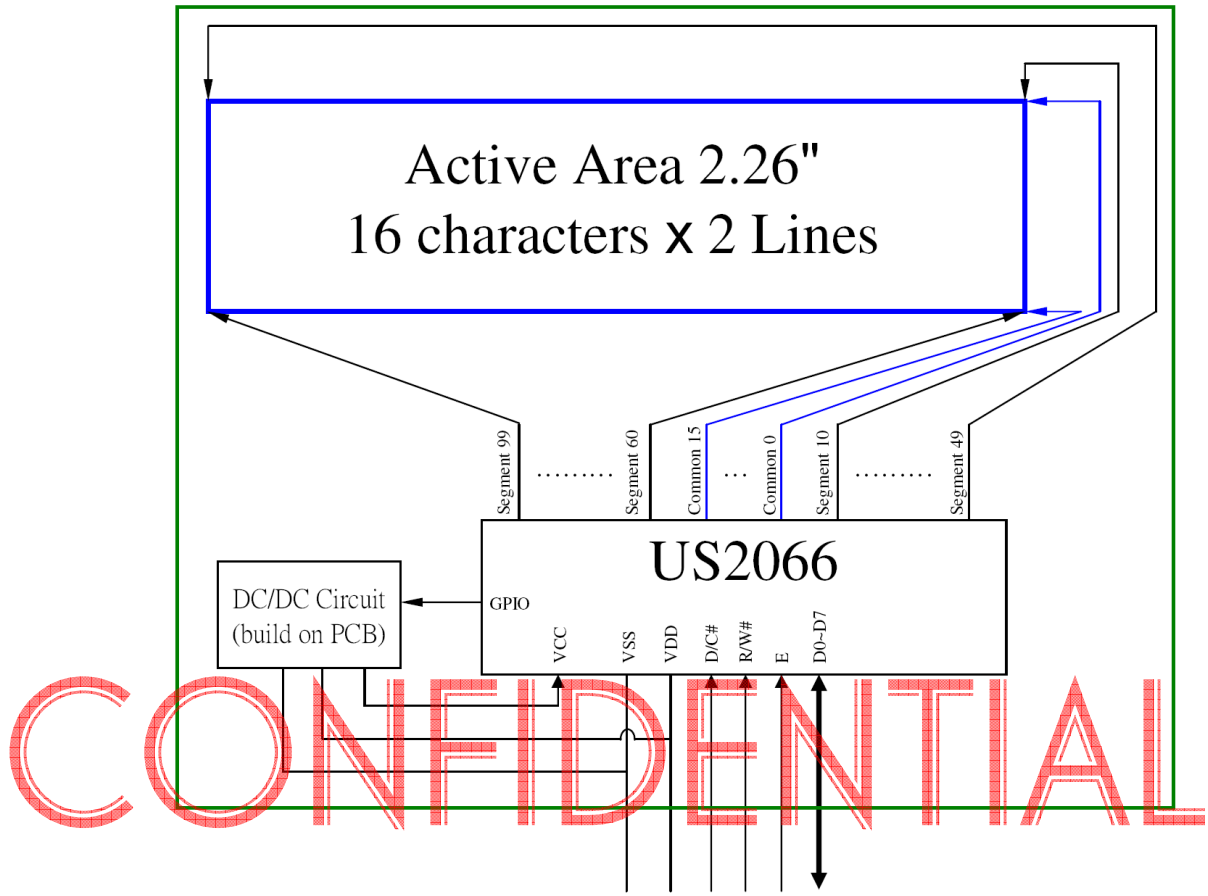
**1.5 Pin Definition**
**1.5.1 IF1, IF2**

Pin Number	Symbol	I/O	Function
<b>Power Supply</b>			
1	VSS	P	<b>Ground of OEL System</b> 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.
2	VDD	P	<b>Power Supply for OLED Module</b> This is a voltage supply pin. It should match with the MCU interface voltage level and must be connected to external source. It will also generate the power supply to the OLED driver through the DC/DC booster on the PCBA.
<b>Interface</b>			
4	D/C#	I	<b>Data/Command Control</b> This pin is Data/Command control pin. When the pin is pulled high, the input at D7~D0 will be interpreted 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.
5	R/W#	I	<b>Read/Write Select or Write</b> 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.
6	E	I	<b>Read/Write Enable or Read</b> 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.
7~14	D0~D7	I/O	<b>Host Data Input/Output Bus</b> These pins are 8-bit bi-directional data bus to be connected to the microprocessor's data bus.
<b>Reserve</b>			
3, 15, 16	N.C.	-	<b>Reserved Pin</b> These pins are recommended to keep floating.

**1.5.1 IF4**

IF4 is reserved design. Please Keep these pins floating.

**1.6 Block Diagram**



Pins connected to MCU interface: D/C#, R/W#, E, and D0~D7

## 2. Absolute Maximum Ratings

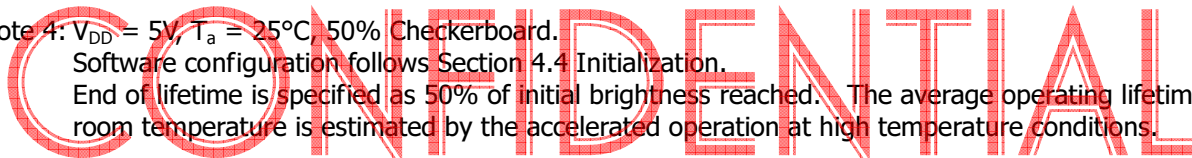
Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage for OLED Module	$V_{DD}$	-0.3	6	V	1, 2
Operating Temperature	$T_{OP}$	-40	85	°C	3
Storage Temperature	$T_{STG}$	-40	90	°C	3
Life Time (120 cd/m <sup>2</sup> )		30,000	-	hour	4
Life Time (100 cd/m <sup>2</sup> )		50,000	-	hour	

Note 1: All the above voltages are on the basis of " $V_{SS} = 0V$ ".

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. "Optics & 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: The defined temperature ranges do not include the polarizer. The maximum withstood temperature of the polarizer should be 80°C.

Note 4:  $V_{DD} = 5V$ ,  $T_a = 25^\circ C$ , 50% Checkerboard.  
 Software configuration follows Section 4.4 Initialization.  
 End of lifetime is specified as 50% of initial brightness reached. The average operating lifetime at room temperature is estimated by the accelerated operation at high temperature conditions.





### 3. Optics & Electrical Characteristics

#### 3.1 Optics Characteristics

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Brightness	$L_{br}$		100	120	-	cd/m <sup>2</sup>
C.I.E. (White)	(x) (y)	C.I.E. 1931	0.25 0.27	0.29 0.31	0.33 0.35	
Dark Room Contrast	CR		-	>10,000:1	-	
Viewing Angle			-	Free	-	degree

\* Optical measurement taken at  $V_{DD} = 5.0V$ .  
Software configuration follows Section 4.4 Initialization.

#### 3.2 DC Characteristics

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage for OLED Module	$V_{DD}$		4.4	5.0	5.5	V
High Level Input	$V_{IH}$	$I_{OUT} = 100\mu A, 3.3MHz$	$0.8 \times V_{DD}$	-	$V_{DD}$	V
Low Level Input	$V_{IL}$	$I_{OUT} = 100\mu A, 3.3MHz$	0	-	$0.2 \times V_{DD}$	V
High Level Output	$V_{OH}$	$I_{OUT} = 100\mu A, 3.3MHz$	$0.9 \times V_{DD}$	-	$V_{DD}$	V
Low Level Output	$V_{OL}$	$I_{OUT} = 100\mu A, 3.3MHz$	0	-	$0.1 \times V_{DD}$	V
Operating Current for $V_{DD}$	$I_{DD}$	Note 5		36.4	45.5	mA
		Note 6		54.5	68.1	mA
		Note 7		93.2	116.5	mA
Standby Mode Current for $V_{DD}$	$I_{DD, STANDBY}$		-	400	600	$\mu A$

Note 5:  $V_{DD} = 5.0V$ , 30% Display Area Turn on.  
Note 6:  $V_{DD} = 5.0V$ , 50% Display Area Turn on.  
Note 7:  $V_{DD} = 5.0V$ , 100% Display Area Turn on.

\* Software configuration follows Section 4.4 Initialization.

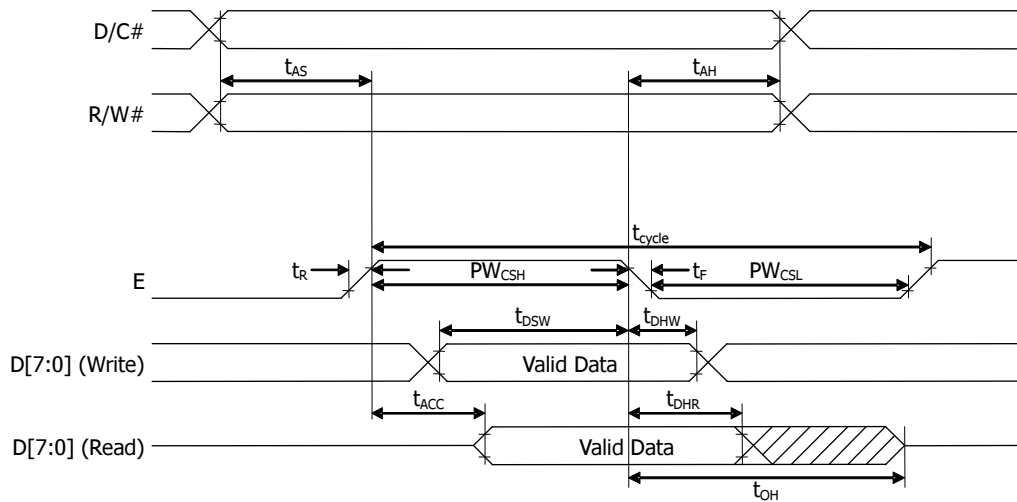
**3.3 AC Characteristics**

3.3.1 68XX-Series MPU Parallel Interface Timing Characteristics:

Symbol	Description	Min	Max	Unit
$t_{cycle}$	Clock Cycle Time (Write Cycle)	400	-	ns
$t_{AS}$	Address Setup Time	13	-	ns
$t_{AH}$	Address Hold Time	17	-	ns
$t_{DSW}$	Write Data Setup Time	35	-	ns
$t_{DHW}$	Write Data Hold Time	18	-	ns
$t_{DHR}$	Read Data Hold Time	13	-	ns
$t_{OH}$	Output Disable Time	-	90	ns
$t_{ACC}$	Access Time (RAM)	-	200	ns
	Access Time (Command)			
$PW_{CSL}$	Chip Select Low Pulse Width (Read RAM)	250	-	ns
	Chip Select Low Pulse Width (Read Command)	250		
	Chip Select Low Pulse width (Write)	50		
$PW_{CSH}$	Chip Select High Pulse Width (Read)	155	-	ns
	Chip Select High Pulse Width (Write)	55		
$t_r$	Rise Time	-	15	ns
$t_f$	Fall Time	-	15	ns

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\* ( $V_{DD} - V_{SS} = 4.4V$  to  $5.5V$ ,  $T_a = 25^\circ C$ )



## 4. Functional Specification

### 4.1 Commands

Command Set														
Command	IS	RE	Instruction Code										Description	
			D/C#	R/W# (WR#)	D7	D6	D5	D4	D3	D2	D1	D0		
Clear Display	X	X	0	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC.
Return Home	X	0	0	0	0	0	0	0	0	0	0	1	*	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.
Entry Mode Set	X	0	0	0	0	0	0	0	0	0	1	I/D	S	Assign cursor / blink moving direction with DDRAM address.  I/D = "1": cursor/ blink moves to right and DDRAM address is increased by 1 (POR)  I/D = "0": cursor/ blink moves to left and DDRAM address is decreased by 1  Assign display shift with DDRAM address.  S = "1": make display shift of the enabled lines by the DS4 to DS1 bits in the shift enable instruction. Left/ right direction depends on I/D bit selection.  S = "0": display shift disable (POR)
														Common bi-direction function. BDC = "0": COM31 -> COM0 BDC = "1": COM0 -> COM31  Segment bi-direction function. BDS = "0": SEG99 -> SEG0, BDS = "1": SEG0 -> SEG99
Display ON / OFF Control	X	0	0	0	0	0	0	0	0	1	D	C	B	Set display/cursor/blink ON/OFF  D = "1": display ON, D = "0": display OFF (POR),  C = "1": cursor ON, C = "0": cursor OFF (POR),  B = "1": blink ON, B = "0": blink OFF (POR).
Extended Function Set	X	1	0	0	0	0	0	0	0	1	FW	B/W	NW	Assign font width, black/white inverting of cursor, and 4-line display mode control bit.  FW = "1": 6-dot font width, FW = "0": 5-dot font width (POR),  B/W = "1": black/white inverting of cursor enable, B/W = "0": black/white inverting of cursor disable (POR)  NW = "1": 3-line or 4-line display mode NW = "0": 1-line or 2-line display mode



4.1 Commands (Continued)

Command Set													
Command	IS	RE	Instruction Code										Description
			D/C#	R/W# (WR#)	D7	D6	D5	D4	D3	D2	D1	D0	
Cursor or Display Shift	0	0	0	0	0	0	0	1	S/C	R/L	*	*	Set cursor moving and display shift control bit, and the direction, without changing DDRAM data.  S/C = "1": display shift, S/C = "0": cursor shift,  R/L = "1": shift to right, R/L = "0": shift to left
Double Height (4-line) / Display-dot shift	0	1	0	0	0	0	0	1	UD2	UD1	*	DH'	UD2~1: Assign different doubt height format (POR=11b)  DH' = "1": display shift enable DH' = "0": dot scroll enable (POR)
Shift Enable	1	1	0	0	0	0	0	1	DS4	DS3	DS2	DS1	DS[4:1]=1111b (POR) when DH' = 1b  Determine the line for display shift.  DS1 = "1/0": 1 <sup>st</sup> line display shift enable/disable DS2 = "1/0": 2 <sup>nd</sup> line display shift enable/disable DS3 = "1/0": 3 <sup>rd</sup> line display shift enable/disable DS4 = "1/0": 4 <sup>th</sup> line display shift enable/disable.
Scroll Enable	1	1	0	0	0	0	0	1	HS4	HS3	HS2	HS1	HS[4:1]=1111b (POR) when DH' = 0b  Determine the line for horizontal smooth scroll.  HS1 = "1/0": 1 <sup>st</sup> line dot scroll enable/disable HS2 = "1/0": 2 <sup>nd</sup> line dot scroll enable/disable HS3 = "1/0": 3 <sup>rd</sup> line dot scroll enable/disable HS4 = "1/0": 4 <sup>th</sup> line dot scroll enable/disable.
Function Set	X	0	0	0	0	0	1	*	N	DH	RE (0)	IS	Numbers of display line, N when N = "1": 2-line (NW=0b) / 4-line (NW=1b), when N = "0": 1-line (NW=0b) / 3-line (NW=1b)  DH = "1/0": Double height font control for 2-line mode enable/ disable (POR=0)  Extension register, RE ("0") Extension register, IS
	X	1	0	0	0	0	1	*	N	BE	RE (1)	REV	CGRAM blink enable BE = 1b: CGRAM blink enable BE = 0b: CGRAM blink disable (POR)  Extension register, RE ("1")  Reverse bit REV = "1": reverse display, REV = "0": normal display (POR)

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**4.1 Commands (Continued)**

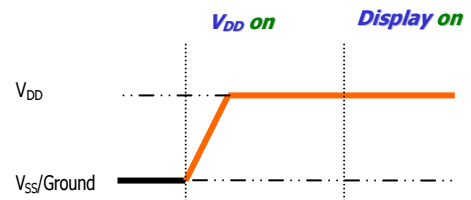
Command Set																												
Command	IS	RE	Instruction Code										Description															
			D/C#	R/W# (WR#)	D7	D6	D5	D4	D3	D2	D1	D0																
Set CGRAM address	0	0	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter. (POR=00 0000)															
Set DDRAM Address	X	0	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter. (POR=000 0000)															
Set Scroll Quantity	X	1	0	0	1	*	SQ5	SQ4	SQ3	SQ2	SQ1	SQ0	Set the quantity of horizontal dot scroll. (POR=00 0000) Valid up to SQ[5:0] = 110000b															
Read Busy Flag and Address/ Part ID	X	X	0	1	BF	AC6 / ID6	AC5 / ID5	AC4 / ID4	AC3 / ID3	AC2 / ID2	AC1 / ID1	AC0 / ID0	Can be known whether during internal operation or not by reading BF. The contents of address counter or the part ID can also be read. When it is read the first time, the address counter can be read. When it is read the second time, the part ID can be read.  BF = "1": busy state BF = "0": ready state															
Write data	X	X	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM / CGRAM).															
Read data	X	X	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM / CGRAM).															
Extended Command Set (Double Byte Command)																												
Command	IS	RE	Instruction Code										Description															
			D/C#	R/W# (WR#)	D7	D6	D5	D4	D3	D2	D1	D0																
Function Selection B	X	1	0	0	0	1	1	1	0	0	1	0	OPR[1:0]: Select the character no. of character generator  <table border="1"> <thead> <tr> <th>OPR[1:0]</th> <th>CGROM</th> <th>CGRAM</th> </tr> </thead> <tbody> <tr> <td>00b</td> <td>240</td> <td>8</td> </tr> <tr> <td>01b</td> <td>248</td> <td>8</td> </tr> <tr> <td>10b</td> <td>250</td> <td>6</td> </tr> <tr> <td>11b</td> <td>256</td> <td>0</td> </tr> </tbody> </table>	OPR[1:0]	CGROM	CGRAM	00b	240	8	01b	248	8	10b	250	6	11b	256	0
			OPR[1:0]	CGROM	CGRAM																							
00b	240	8																										
01b	248	8																										
10b	250	6																										
11b	256	0																										
1	0	*	*	*	*	ROM1	ROM0	OPR1	OPR0	ROM[1:0]: Select character ROM  <table border="1"> <thead> <tr> <th>RO[1:0]</th> <th>ROM</th> </tr> </thead> <tbody> <tr> <td>00b</td> <td>A</td> </tr> <tr> <td>01b</td> <td>B</td> </tr> <tr> <td>10b</td> <td>C</td> </tr> <tr> <td>11b</td> <td>Invalid</td> </tr> </tbody> </table>	RO[1:0]	ROM	00b	A	01b	B	10b	C	11b	Invalid								
RO[1:0]	ROM																											
00b	A																											
01b	B																											
10b	C																											
11b	Invalid																											

\* POR stands for Power on Reset Values, and "\*" and "X" stand for "Don't care".

## 4.2 Power down and Power up Sequence

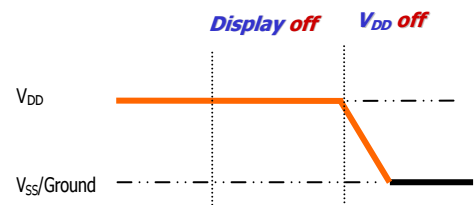
### 4.2.1 Power up Sequence:

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



### 4.2.2 Power down Sequence:

1. Send Display off command
2. Power down  $V_{DD}$



## 4.3 Power on Reset Circuit

After power up, the chip is initialized with the following status automatically:

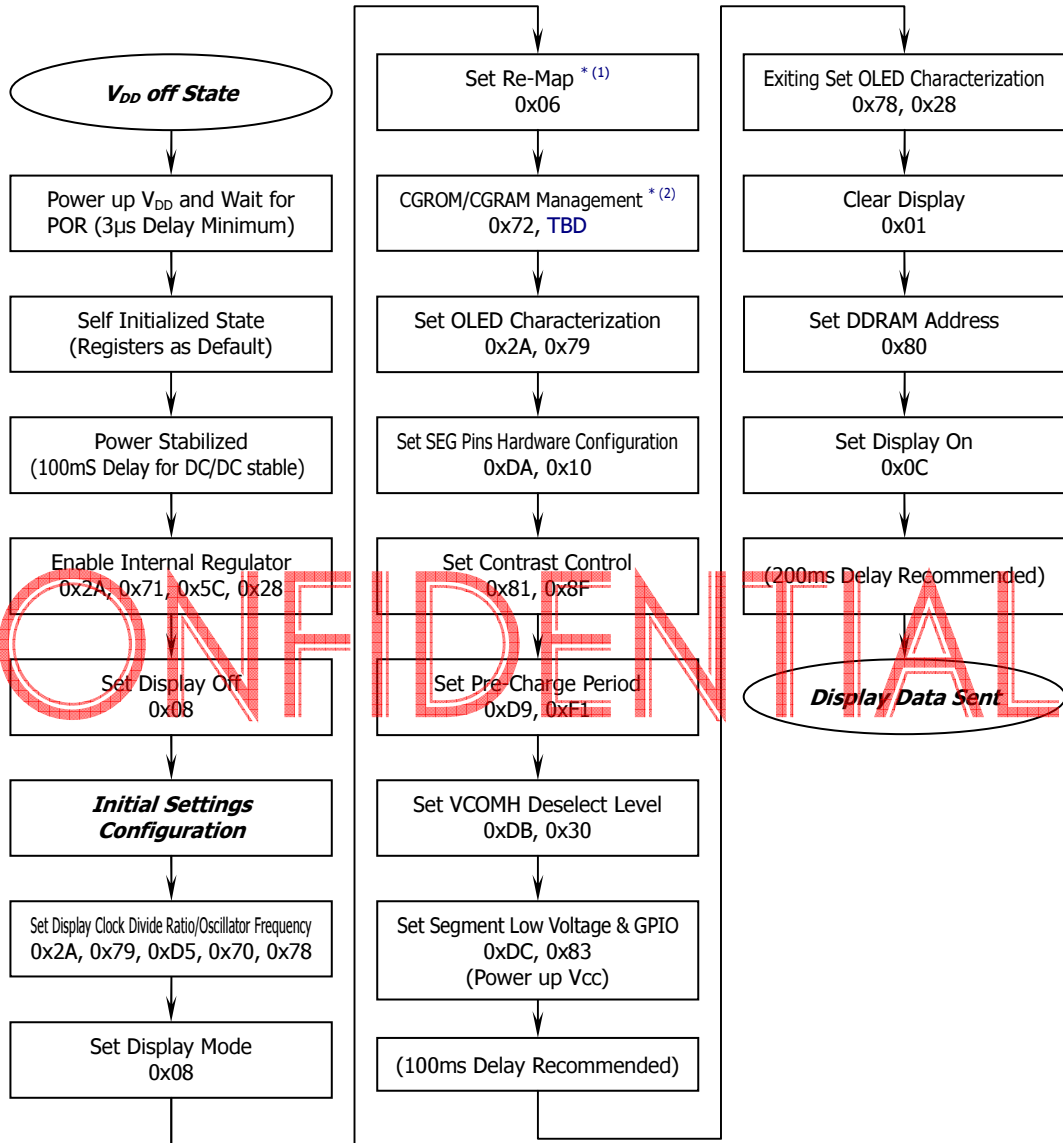
1. Display is OFF
2. 5×8 Character Mode
3. Display start position is set at display RAM address 0
4. CGRAM address counter is set at 0
5. Cursor is OFF
6. Blink is OFF
7. Contrast control register is set at 7Fh
8. OLED command set is disabled

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**4.4 Actual Application Example**

Command usage and explanation of an actual example

<Power up Sequence>



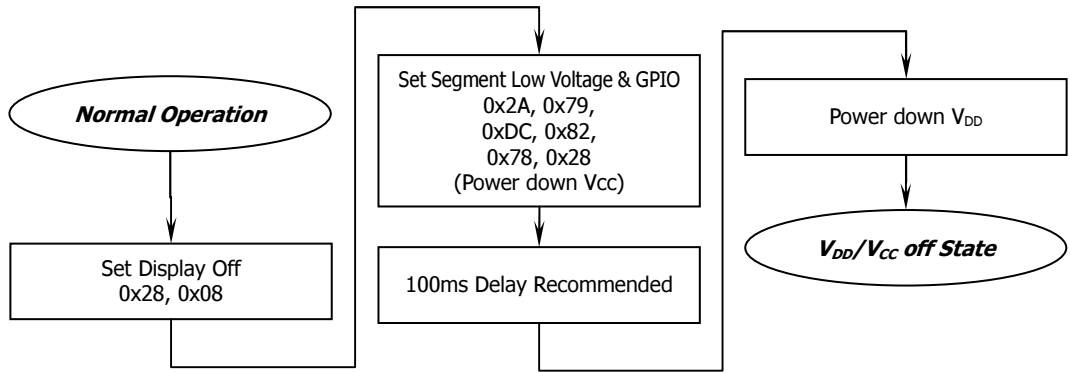
\*(1) This command could be programmable or defined by pin configuration.

\*(2) This command could be programmable or defined by pin configuration.

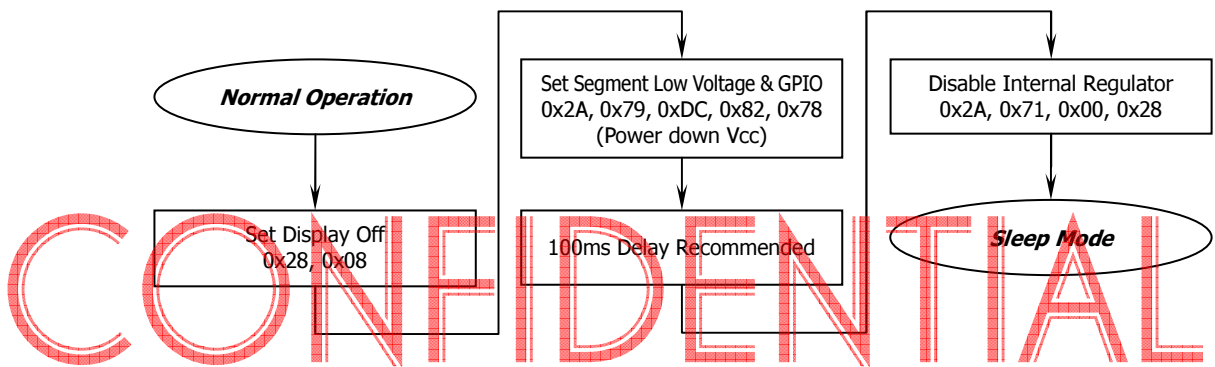
The written value of the parameter should depend on the selection from Section 4.5 & 4.6

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

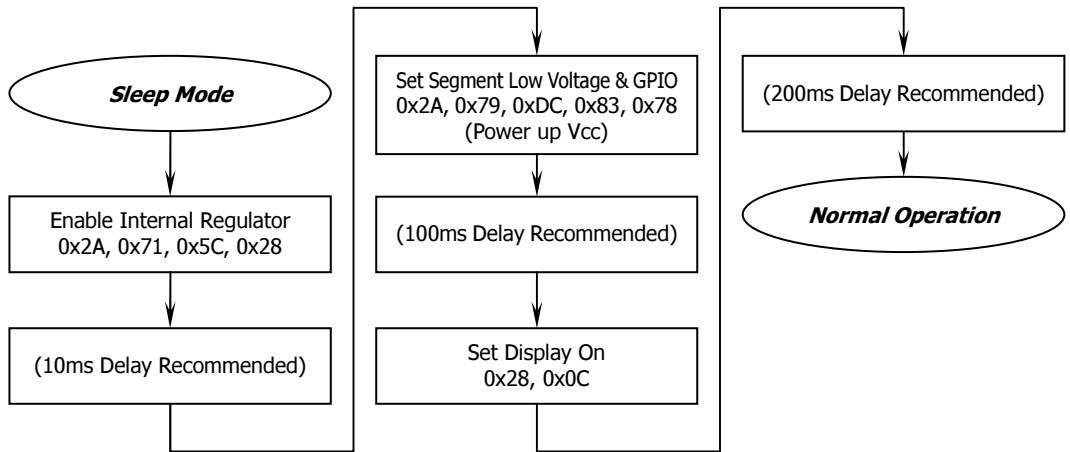
<Power down Sequence>



<Entering Standby Mode>



<Exiting Standby Mode>





4.5 Built-in CGROM (Character Generator ROM)

ROM A (ROM[1:0] = 00b)

b7-4 b3-0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000																
0001																
0010																
0011																
0100																
0101																
0110																
0111																
1000																
1001																
1010																
1011																
1100																
1101																
1110																
1111																

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**Language:** English, Irish, Spanish, Dutch (2), Danish, Norwegian, Swedish, Finnish, Czech (7), Slovene, Hungarian (2), Turkish (1)  
 The number in the parentheses is showing how many letters might be needed to build and define additionally at CGRAM. The darker background is showing the maximum addresses (00h~07h) those could be allocated by OPR[1:0] setting.

ROM B (ROM[1:0] = 01b for default setting)

b7-4 \ b3-0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000																
0001																
0010																
0011																
0100																
0101																
0110																
0111																
1000																
1001																
1010																
1011																
1100																
1101																
1110																
1111																

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**Language:** English, Irish, Portuguese, Spanish, French (1), Italian, German, Dutch (2), Icelandic, Danish, Norwegian, Swedish, Polish (8), Czech (8), Hungarian (2), Romanian (5), Turkish, Vietnamese (6), Russian (Small Letters)  
 The number in the parentheses is showing how many letters might be needed to build and define additionally at CGRAM. The darker background is showing the maximum addresses (00h~07h) those could be allocated by OPR[1:0] setting.

ROM C (ROM[1:0] = 10b)

b7-4 \ b3-0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000																
0001																
0010																
0011																
0100																
0101																
0110																
0111																
1000																
1001																
1010																
1011																
1100																
1101																
1110																
1111																

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**Language:** English, Dutch (2), Japanese, Greek (Small Letters)

The number in the parentheses is showing how many letters might be needed to build and define additionally at CGRAM. The darker background is showing the maximum addresses (00h~07h) those could be allocated by OPR[1:0] setting.

ROM D (ROM[1:0] = [1:1])

b7~4 b3~0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000																
0001																
0010																
0011																
0100																
0101																
0110																
0111																
1000																
1001																
1010																
1011																
1100																
1101																
1110																
1111																

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**Language:** English, Dutch (1), Greek, Russian, Belorussian, Ukrainian, Serbian (10), Macedonian (10), Bulgarian, Kazakh (12), Mongolian  
 The number in the parentheses is showing how many letters might be needed to build and define additionally at CGRAM. The darker background is showing the maximum addresses (00h~07h) those could be allocated by OPR[1:0] setting.

4.6 Self-Defined CGRAM (Character Generator RAM)

8 Addresses Available for Self-Defined Characters (OPR[1:0] = 00b')

b <sup>3-0</sup>	b <sup>7-4</sup>	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	0000																
0000	0001																

8 Addresses Available for Self-Defined Characters (OPR[1:0] = 01b for default setting)

b <sup>3-0</sup>	b <sup>7-4</sup>	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	0000																
0000	0001																

6 Addresses Available for Self-Defined Characters (OPR[1:0] = 10b)

b <sup>3-0</sup>	b <sup>7-4</sup>	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	0000																
0000	0001																

0 Address Available for Self-Defined Characters (OPR[1:0] = 11b)

b <sup>3-0</sup>	b <sup>7-4</sup>	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	0000																
0000	0001																

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**5. Reliability**

**5.1 Contents of Reliability Tests**

Item	Conditions	Criteria
High Temperature Operation	85°C, 240 hrs	The operational functions work.
Low Temperature Operation	-40°C, 240 hrs	
High Temperature Storage	90°C, 240 hrs	
Low Temperature Storage	-40°C, 240 hrs	
High Temperature/Humidity Operation	60°C, 90% RH, 240 hrs	
Thermal Shock	-40°C ↔ 85°C, 100 cycles 60 mins dwell	

- \* The samples used for the above tests do not include polarizer.
- \* No moisture condensation is observed during tests.

**5.2 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.

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**6. Outgoing Quality Control Specifications**

**6.1 Environment Required**

Customer's test & measurement are required to be conducted under the following conditions:

- Temperature:  $23 \pm 5^{\circ}\text{C}$
- Humidity:  $55 \pm 15\% \text{ RH}$
- Fluorescent Lamp: 30W
- Distance between the Panel & Lamp:  $\geq 50\text{cm}$
- Distance between the Panel & Eyes of the Inspector:  $\geq 30\text{cm}$
- Finger glove (or finger cover) must be worn by the inspector.
- Inspection table or jig must be anti-electrostatic.

**6.2 Sampling Plan**

Level II, Normal Inspection, Single Sampling, MIL-STD-105E

**6.3 Criteria & Acceptable Quality Level**

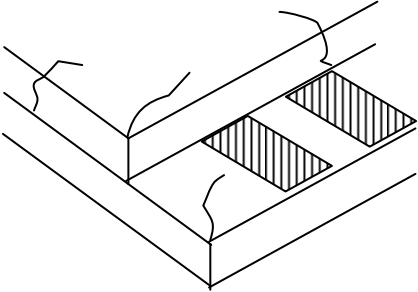

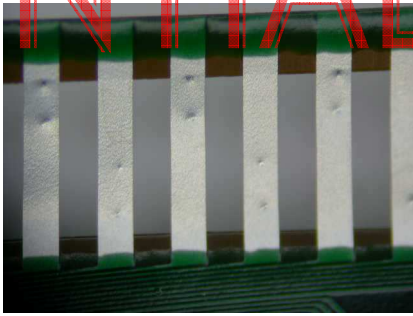
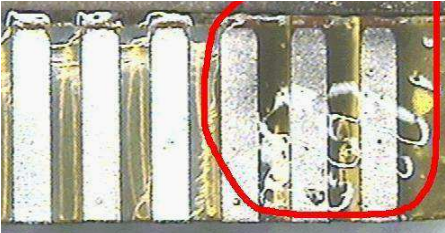
Partition	AQL	Definition
Major	0.65	Defects in Pattern Check (Display On)
Minor	1.0	Defects in Cosmetic Check (Display Off)

6.3.1 Cosmetic Check (Display Off) in Non-Active Area

Check Item	Classification	Criteria
Panel General Chipping	Minor	<p><math>X &gt; 6 \text{ mm}</math> (Along with Edge)  <math>Y &gt; 1 \text{ mm}</math> (Perpendicular to edge)</p>



6.3.1 Cosmetic Check (Display Off) in Non-Active Area (Continued)

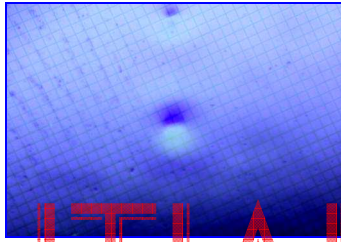
Check Item	Classification	Criteria
Panel Crack	Minor	Any crack is not allowable. 
Copper Exposed (Even Pin or Film)	Minor	Not Allowable by Naked Eye Inspection
Film or Trace Damage	Minor	
Terminal Lead Prober Mark	Acceptable	
Glue or Contamination on Pin (Couldn't Be Removed by Alcohol)	Minor	
PCB	Major	Wrong parts, missing parts or excess parts.
	Major	Short circuits in components on PCB.
	Minor	Oxidation or contamination PCB terminals.
	Minor	The solder gets on bezel tab pads, OLED pad or screw hold pad are not smooth.
	Minor	Cold solder joints, missing solder connections, oxidation or icicle.
	Minor	Residue or solder balls on PCB.
Ink Marking on PCBA (Exclude on COG module)	Acceptable	Ignore for Any

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6.3.2 Cosmetic Check (Display Off) in Active Area

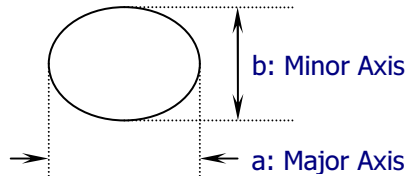
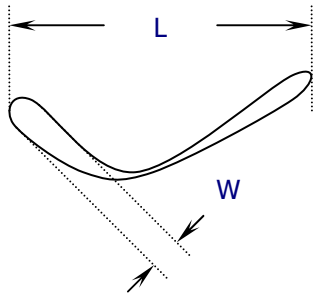
It is recommended to execute in clear room environment (class 10k) if actual in necessary.

Check Item	Classification	Criteria
Any Dirt & Scratch on Polarizer's Protective Film	Acceptable	Ignore for not Affect the Polarizer
Scratches, Fiber, Line-Shape Defect (On Polarizer)	Minor	$W \leq 0.1$ Ignore $W > 0.1$ $L \leq 2$ $n \leq 1$ $L > 2$ $n = 0$
Dirt, Black Spot, Foreign Material, (On Polarizer)	Minor	$\Phi \leq 0.1$ Ignore $0.1 < \Phi \leq 0.25$ $n \leq 1$ $0.25 < \Phi$ $n = 0$
Dent, Bubbles, White spot (Any Transparent Spot on Polarizer)	Minor	$\Phi \leq 0.5$ → Ignore if no Influence on Display $0.5 < \Phi$ $n = 0$ 
Fingerprint, Flow Mark (On Polarizer)	Minor	Not Allowable

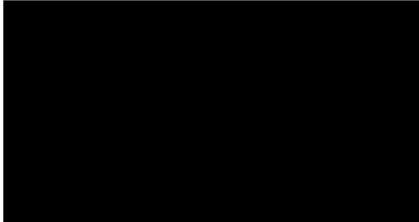
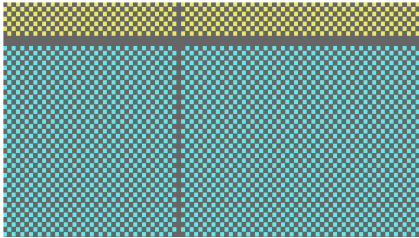
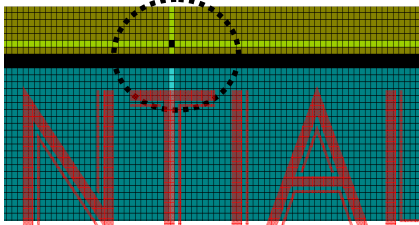
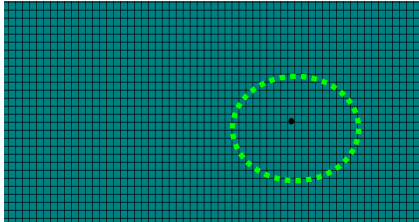
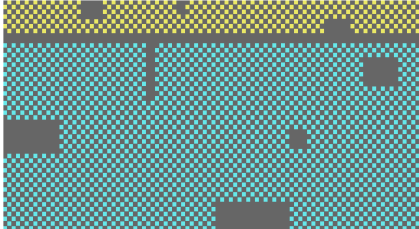
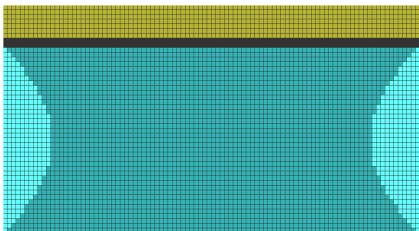
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\* Protective film should not be tear off when cosmetic check.

\*\* Definition of W & L &  $\Phi$  (Unit: mm):  $\Phi = (a + b) / 2$

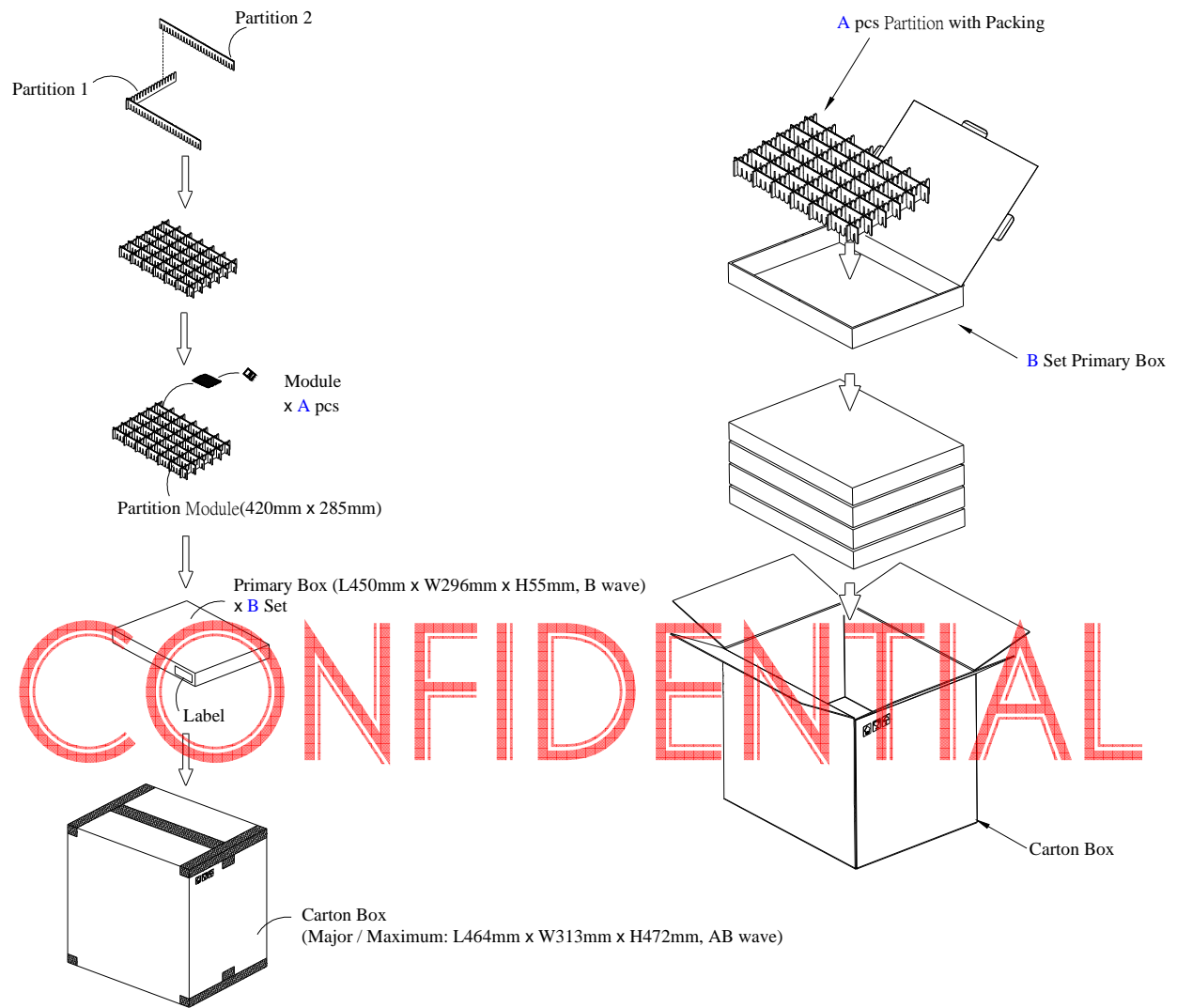


6.3.3 Pattern Check (Display On) in Active Area

Check Item	Classification	Criteria
No Display	Major	
Missing Line	Major	
Pixel Short	Major	
Darker Pixel	Major	
Wrong Display	Major	
Un-uniform	Major	

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**7. Package Specifications**

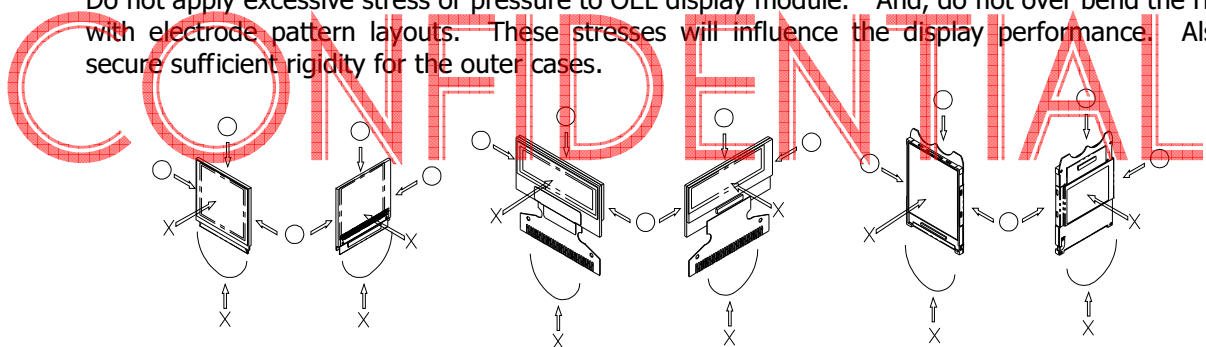


Item	Quantity
<b>Module (A)</b>	<b>36 per Primary Box</b>
<b>Primary Box (B)</b>	<b>1~8 per Carton ( 8 as Major / Maximum)</b>

## 8. Precautions When Using These OEL Display Modules

### 8.1 Handling Precautions

- 1) Since the display panel is being made of glass, do not apply mechanical impacts such as dropping from a high position.
- 2) If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance.
- 3) If pressure is applied to the display surface or its neighborhood of the OEL display module, the cell structure may be damaged and be careful not to apply pressure to these sections.
- 4) The polarizer covering the surface of the OEL display module is soft and easily scratched. Please be careful when handling the OEL display module.
- 5) When the surface of the polarizer of the OEL display module has soil, clean the surface. It takes advantage of by using following adhesion tape.
  - \* Scotch Mending Tape No. 810 or an equivalent
 Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since the surface of the polarizer will become cloudy.  
 Also, pay attention that the following liquid and solvent may spoil the polarizer:
  - \* Water
  - \* Ketone
  - \* Aromatic Solvents
- 6) Hold OEL display module very carefully when placing OEL display module into the system housing. Do not apply excessive stress or pressure to OEL display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient rigidity for the outer cases.



- 7) Do not apply stress to the driver IC and the surrounding molded sections.
- 8) Do not disassemble nor modify the OEL display module.
- 9) Do not apply input signals while the logic power is off.
- 10) Pay sufficient attention to the working environments when handling OEL display modules to prevent occurrence of element breakage accidents by static electricity.
  - \* Be sure to make human body grounding when handling OEL display modules.
  - \* Be sure to ground tools to use or assembly such as soldering irons.
  - \* To suppress generation of static electricity, avoid carrying out assembly work under dry environments.
  - \* Protective film is being applied to the surface of the display panel of the OEL display module. Be careful since static electricity may be generated when exfoliating the protective film.
- 11) Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the OEL display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above Section 5).
- 12) If electric current is applied 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 to avoid the above.

### 8.2 Storage Precautions

- 1) When storing OEL display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps. and, also, avoiding high temperature and high

humidity environment or low temperature (less than 0°C) environments. (We recommend you to store these modules in the packaged state when they were shipped from WiseChip Semiconductor Inc.)

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

- 2) 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.

### 8.3 Designing Precautions

- 1) 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.
- 2) To prevent occurrence of malfunctioning by noise, pay attention to satisfy the  $V_{IL}$  and  $V_{IH}$  specifications and, at the same time, to make the signal line cable as short as possible.
- 3) We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit ( $V_{DD}$ ). (Recommend value: 0.5A)
- 4) Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices.
- 5) As for EMI, take necessary measures on the equipment side basically.
- 6) When fastening the OEL display module, fasten the external plastic housing section.
- 7) 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.
- 8) The electric potential to be connected to the rear face of the IC chip should be as follows: US2066
  - \* Connection (contact) to any other potential than the above may lead to rupture of the IC.

### 8.4 Precautions when disposing of the OEL display modules

- 1) 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.

### 8.5 Other Precautions

- 1) 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 left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module.
- 2) 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 FPC
- 3) 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.
- 4) 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.
- 5) 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.

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***Warranty:***

The warranty period shall last twelve (12) months from the date of delivery. Buyer shall be completed to assemble all the processes within the effective twelve (12) months. WiseChip Semiconductor Inc. shall be liable for replacing any products which contain defective material or process which do not conform to the product specification, applicable drawings and specifications during the warranty period. All products must be preserved, handled and appearance to permit efficient handling during warranty period. The warranty coverage would be exclusive while the returned goods are out of the terms above.

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