ALL SHORE INDUSTRIES

ASI-O-145HAEEE90/M

No.	Items	Specification	Unit
1	Display Mode	Passive Matrix OLED	-
2	Display Color	262,144 Colors (Maximum)	-
3	Duty	1/128	-
4	Resolution	160 (H) x 128 (V)	Pixel
5	Active Area	28.78 (W) x 23.024 (H)	mm
6	Outline Dimension	35.80 (W) x 30.80 (H) x 1.60 (D)	mm
7	Pixel Pitch	0.06 (W) x 0.18 (H)	mm
8	Pixel Size	0.04 (W) x 0.164 (H)	mm
9	Driver IC	SEPS525	-
10	Interface	8/9bit CPU,6bit RGB,4-wire SPI	-
11	Weight	3.6	g

REVISION RECORD

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2009-08-11	Preliminary	
1.1	2012-12-19	Update life time	
1.2	2013-12-02	Update operating temperature and storage temperature	
2.0	2014-06-03	Old part # ASI-O-14516012BR-OQ-F-S/M	

CONTENT

■ PHYSICAL DATA

No.	Items	Specification	Unit
1	Display Mode	Passive Matrix OLED	-
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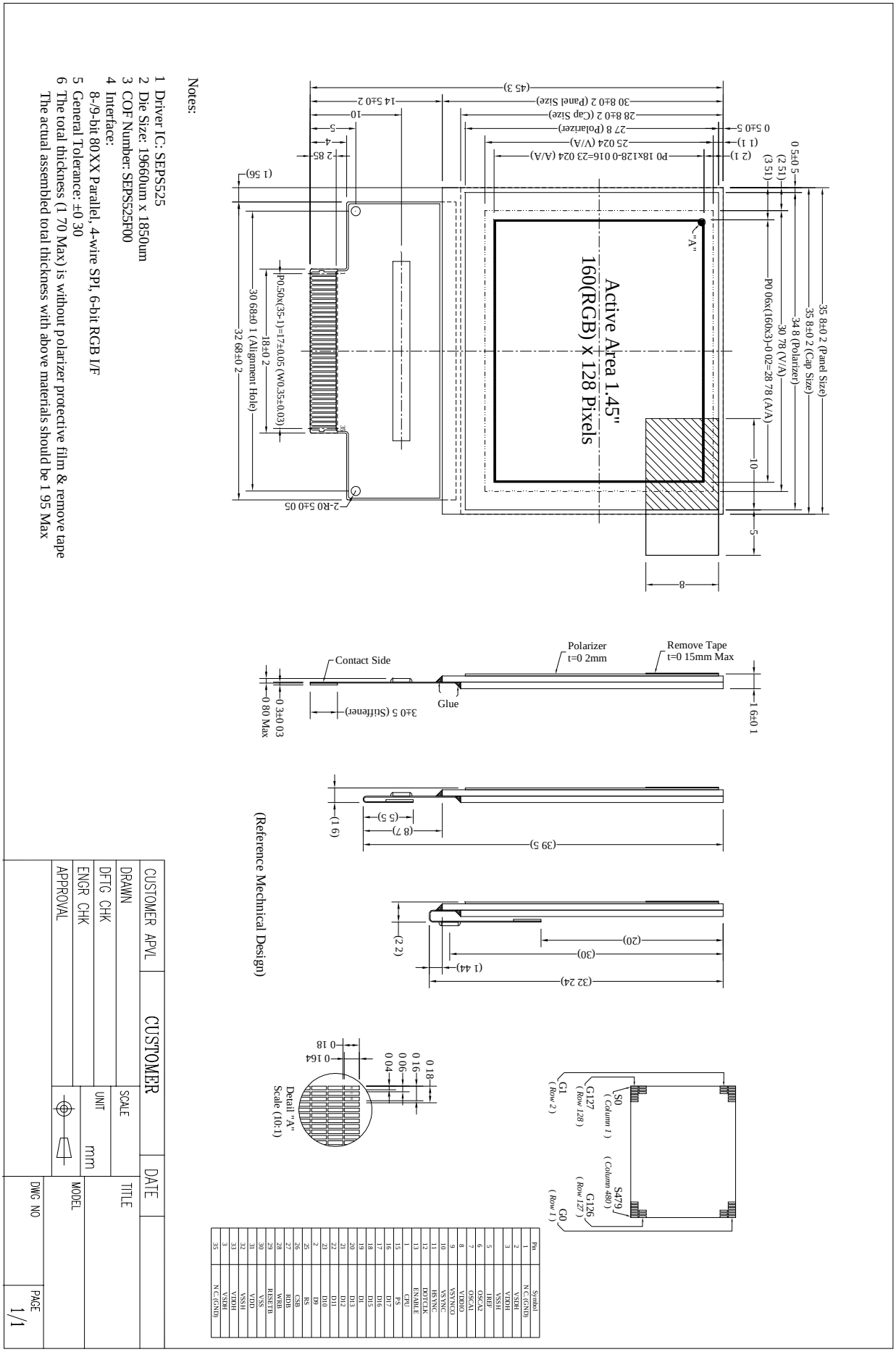
9	Driver IC	SEPS525	-
10	Interface	8/9bit CPU,6bit RGB,4-wire SPI	-
11	Weight	3.6	g

■ EXTERNAL DIMENSIONS



Pin	Symbol
1	N.C. (GND)
2	VSDH
3	VDDH
4	VSSH
5	HREF
6	OSCA2
7	OSCA1
8	VDDIO
9	VSYNCO
10	VSYNC
11	HSYNC
12	DOTCLK
13	ENABLE
14	CPU
15	PS
16	D17
17	D16
18	D15
19	D14
20	D13
21	D12
22	D11
23	D10
24	D9
25	RS
26	CSB
27	RDB
28	WRB
29	RESETB
30	VDD
31	VSSH
32	VDDH
33	VSDH
34	VSDH
35	N.C. (GND)

■ ABSOLUTE MAXIMUM RATINGS

Items	Symbol	Min	Typ.	Max	Unit	Notes
Supply voltage	VDD	-0.3	-	4	V	1,2
Supply voltage for I/O pins	VDDIO	-0.3	-	4	V	1,2
Driver supply voltage	VDDH	-0.3	-	16.0	V	1,2
Operating temperature	TOP	-40	-	70	℃	3
Storage temperature	TST	-40	-	85	℃	3
Life time(100cd/m^2)	-	10,000	-	-	hour	4
Life time(80cd/m^2)	-	15,000	-	-	hour	-
Life time(60cd/m^2)	-	20,000	-	-	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 electro-optical 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℃

Note 4: V_{CC} = 13.0V, T_a = 25°C, 50% Checkerboard.
Software configuration follows Actual Application Example .
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.

◆

■ ELECTRICAL CHARACTERISTICS

DC Characteristics

Items	Symbol	Conditions	Min	Typ.	Max	Unit
Supply voltage	V_{DD}		2.4	2.8	3.3	V
Supply voltage for I/O pins	V_{DDIO}		1.6	2.8	3.3	V
Driver supply voltage	V_{DDH}	Note 5	12.5	13	13.5	V
High level input	V_{IH}		0.8 x V_{DD}	-	V_{DD}	V
Low level input	V_{IL}		0	-	0.4	V
High level output	V_{OH}	I_{OH} =0.4mA	V_{DD} -0.4	-	-	V
Low level output	V_{OL}	I_{OL} =0.1mA	-	-	0.4	V
Operating current for V_{DD}	I_{DD}		-	2.5	3.5	mA
Operating current for V_{DDH}	I_{DDH}	Note 6	-	11	13.8	mA
		Note 7	-	16	19	mA
		Note 8	-	27	32	mA
Sleep mode current for V_{DD}	$I_{DD,SLEEP}$		-	3	5	μA
Sleep mode current for V_{DDH}	$I_{DDH,SLEEP}$		-	1	5	μA

Note 5: Driver Supply Voltage (V_{CC}) is subject to the change of the panel characteristics and the customer s request.

Note 6: V_{DD}= 2.8V, V_{CC} = 13.0V, 30% Display Area Turn on.

Note 7: V_{DD}= 2.8V, V_{CC} = 13.0V, 50% Display Area Turn on.

Note 8: V_{DD}= 2.8V, V_{CC} = 13.0V, 100% Display Area Turn on.

Software configuration follows Actual Application Example .

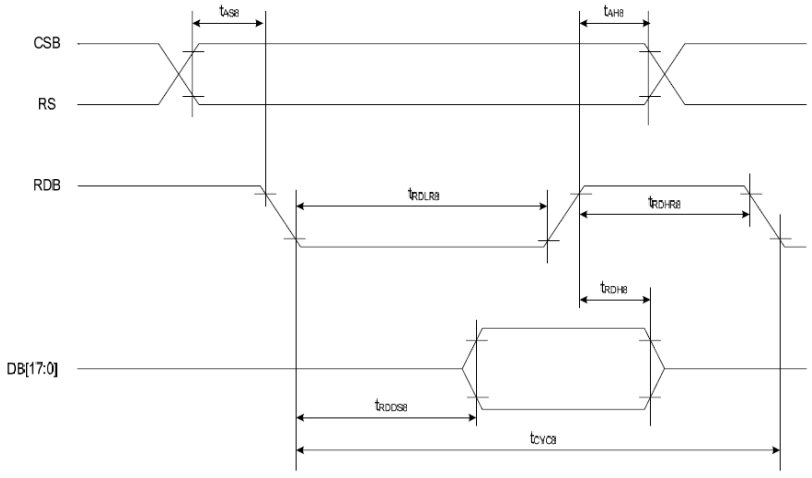
◆AC Characteristics

1. 80XX-Series MPU Parallel Interface Timing Characteristics:

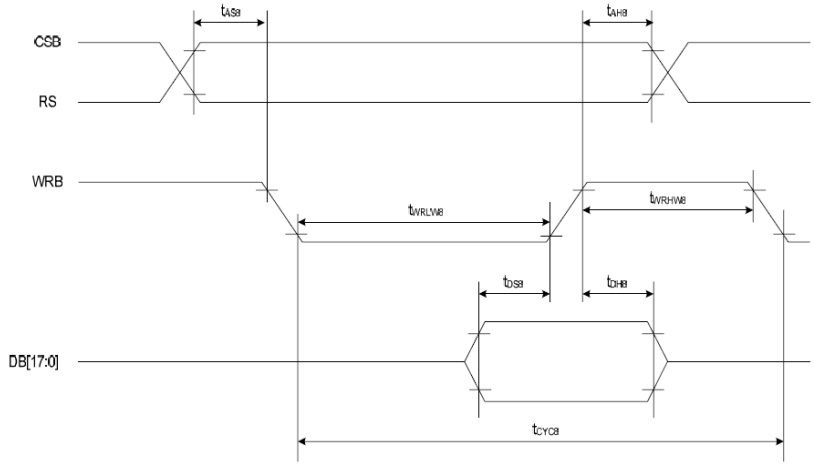
(V_{DD} 2.8V, T_a 25°C)

Symbol	Description	Min	Max	Unit	Port
t_{AS8}	Address Setup Timing	5		ns	CSB RS
t_{AH8}	Address Hold Timing	5		ns	
t_{CYC8}	System Cycle Timing(Read)	200		ns	RDB
t_{RDLR8}	Read "L" Pulse Width	90		ns	
t_{RDHR8}	Read "H" Pulse Width	90		ns	
t_{CYC8}	System Cycle Timing(Write)	100		ns	WRB
t_{WRLW8}	Write "L" Pulse Width	45		ns	
t_{WRHW8}	Write "H" Pulse Width	45		ns	
t_{RDD8}	Read Data Output Delay Time * CL 15pF		60	ns	D[17:9]
t_{RDH8}	Data Hold Timing(Read)	0	60	ns	
t_{DS8}	Data Setup Timing	30		ns	
t_{DH8}	Data Hold Timing(Write)	10		ns	

* All the timing reference is 10% and 90% of V_{DDIO}



(***Read Timing***)



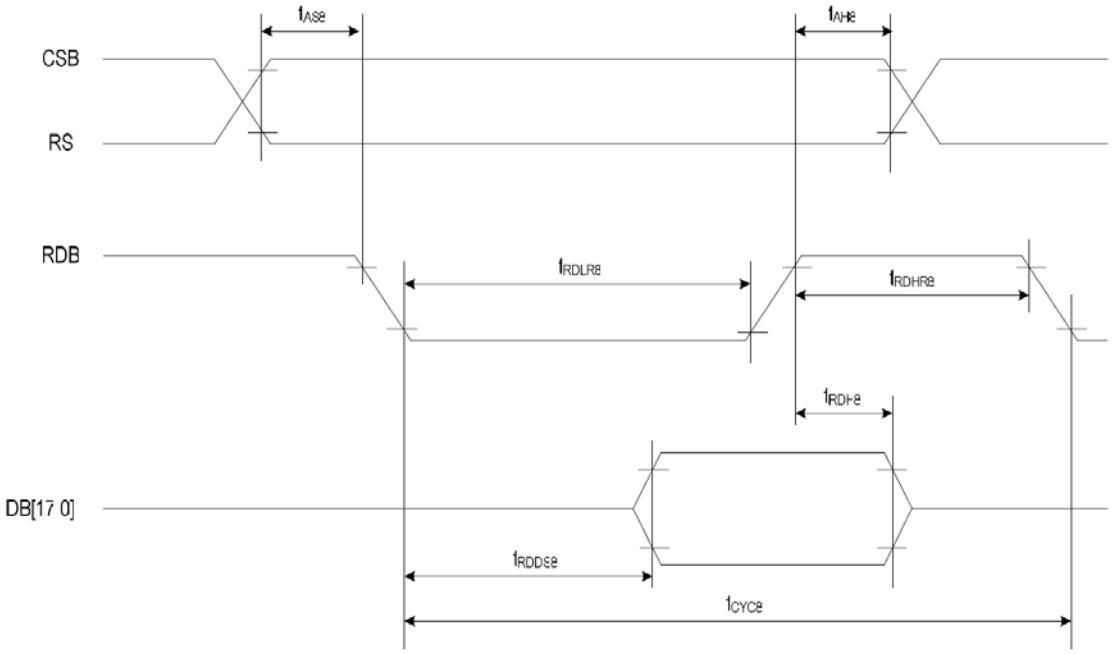
(***Write Timing***)

2. 68XX-Series MPU Parallel Interface Timing Characteristics:

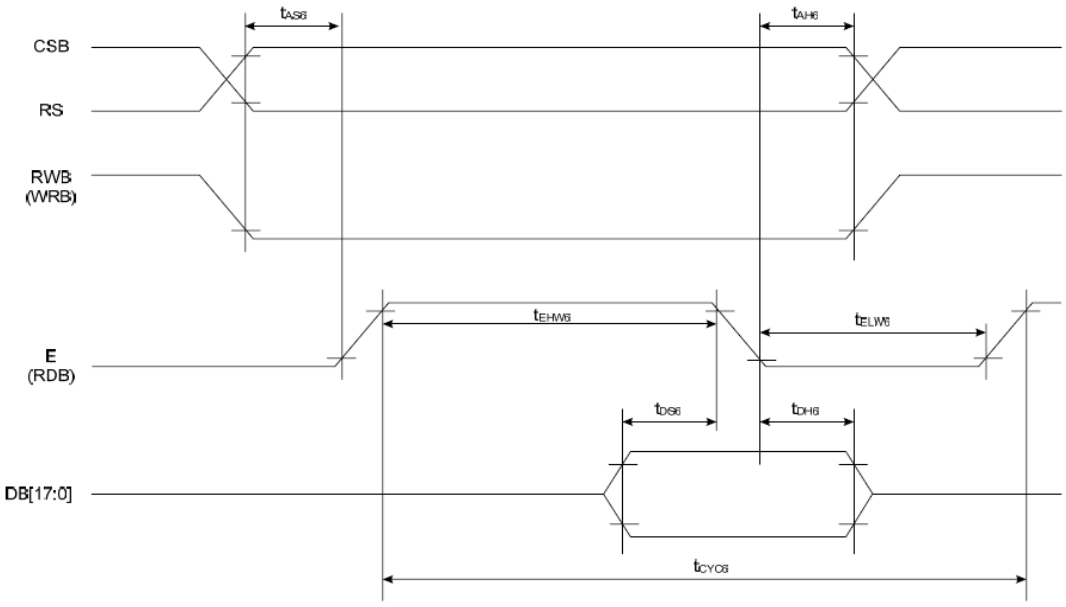
(V_{DD} = 2.8V, T_a = 25°C)

Symbol	Description		Min	Max	Unit	Port
t_{AH6}	Address Setup Timing	(Read)	10	-	ns	CSB RS
		(Write)	5	-	ns	
t_{AS6}	Address Hold Timing	(Read)	10	-	ns	
		(Write)	5	-	ns	
t_{CYC6}	System Cycle Timing	(Read)	200	-	ns	E
		(Write)	100			
t_{ELR6}	Read "L" Pulse Width		90	-	ns	
t_{EHR6}	Read "H" Pulse Width		90	-	ns	
t_{ELW6}	Write "L" Pulse Width		45	-	ns	
t_{EHW6}	Write "H" Pulse Width		45	-	ns	
t_{RDD6}	Read Data Output Delay Time	* CL = 15pF	0	70	ns	D[17:9]
t_{RDH6}	Data Hold Timing		0	70	ns	
t_{DS6}	Write Data Setup Timing		40	-	ns	
t_{DH6}	Write Data Hold Timing		10	-	ns	

* All the timing reference is 10% and 90% of V_{DDIO}.



(***Read Timing***)



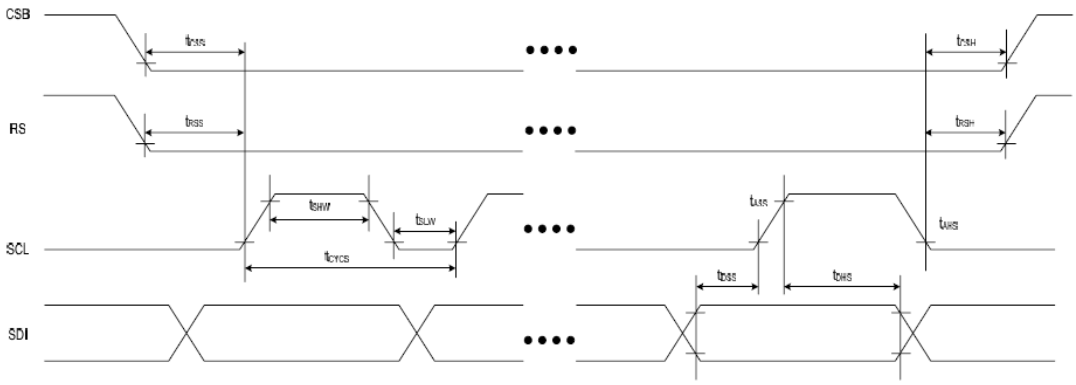
(***Write Timing***)

3. Serial Interface Timing Characteristics:

(V_{DD} 2.8V, T_a 25°C)

Symbol	Description	Min	Max	Unit	Port
t_{CYCS}	Serial Clock Cycle	100		ns	SCL
t_{SLW}	SCL "L" Pulse Width	45		ns	
t_{SHW}	SCL "H" Pulse Width	45		ns	
t_{DSS}	Data Setup Timing	5		ns	SDI
t_{DHS}	Data Hold Timing	5		ns	
t_{CSS}	CSB SCL Timing	5		ns	CSB
t_{CSH}	CSB Hold Timing	5		ns	
t_{RSS}	RS SCL Timing	5		ns	RS
t_{RSH}	RS Hold Timing	5		ns	

* All the timing reference is 10% and 90% of V_{DDIO}.

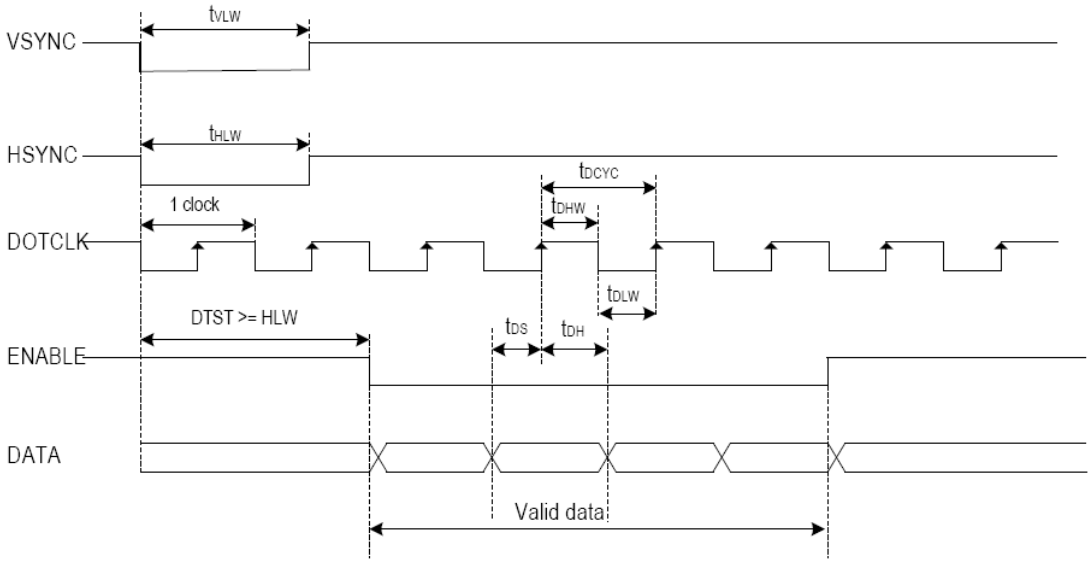


4. 4 RGB Interface Timing Characteristics:

(V_{DD} = 2.8V, T_a = 25°C)

Symbol	Description	Min	Max	Unit	Port
t_{DCYC}	Dot Clock Cycle	100	-	ns	DOTCLK
t_{DLW}	Dot "L" Pulse Width	50	-	ns	
t_{DHW}	Dot "H" Pulse Width	50	-	ns	
t_{DS}	Data Setup Timing	5	-	ns	D[17:12]
t_{DH}	Data Hold Timing	5	-	ns	
t_{VLW}	Vsync Pulse Width	1	-	DOTCLK	VSYNC
t_{HLW}	Hsync Pulse Width	1	-	DOTCLK	HSYNC

* All the timing reference is 10% and 90% of V_{DDIO}.



DTST: Setup Time for Data Transmission

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

■ TIMING OF POWER SUPPLY

1. Commands

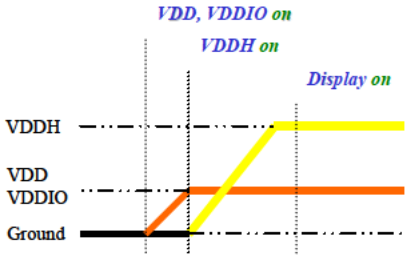
Refer to the Technical Manual for the SEPS525

2. Power down and Power up Sequence

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

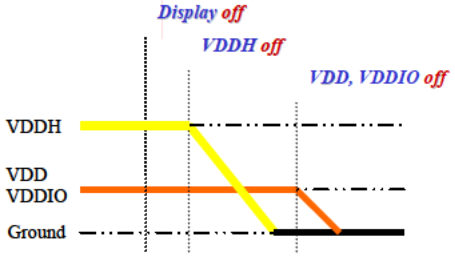
2.1 Power up Sequence:

1. Power up VDD, VDDIO
2. Send Display off command
3. Clear Screen
4. Power up VDDH
5. Delay 100ms
   (when VDD is stable)
6. Send Display on command



2.2 Power down Sequence:

1. Send Display off command
2. Power down VDDH
3. Delay 100ms
   (when VDDH is reach 0 and panel is completely discharges)
4. Power down VDD, VDDIO



3. Reset Circuit

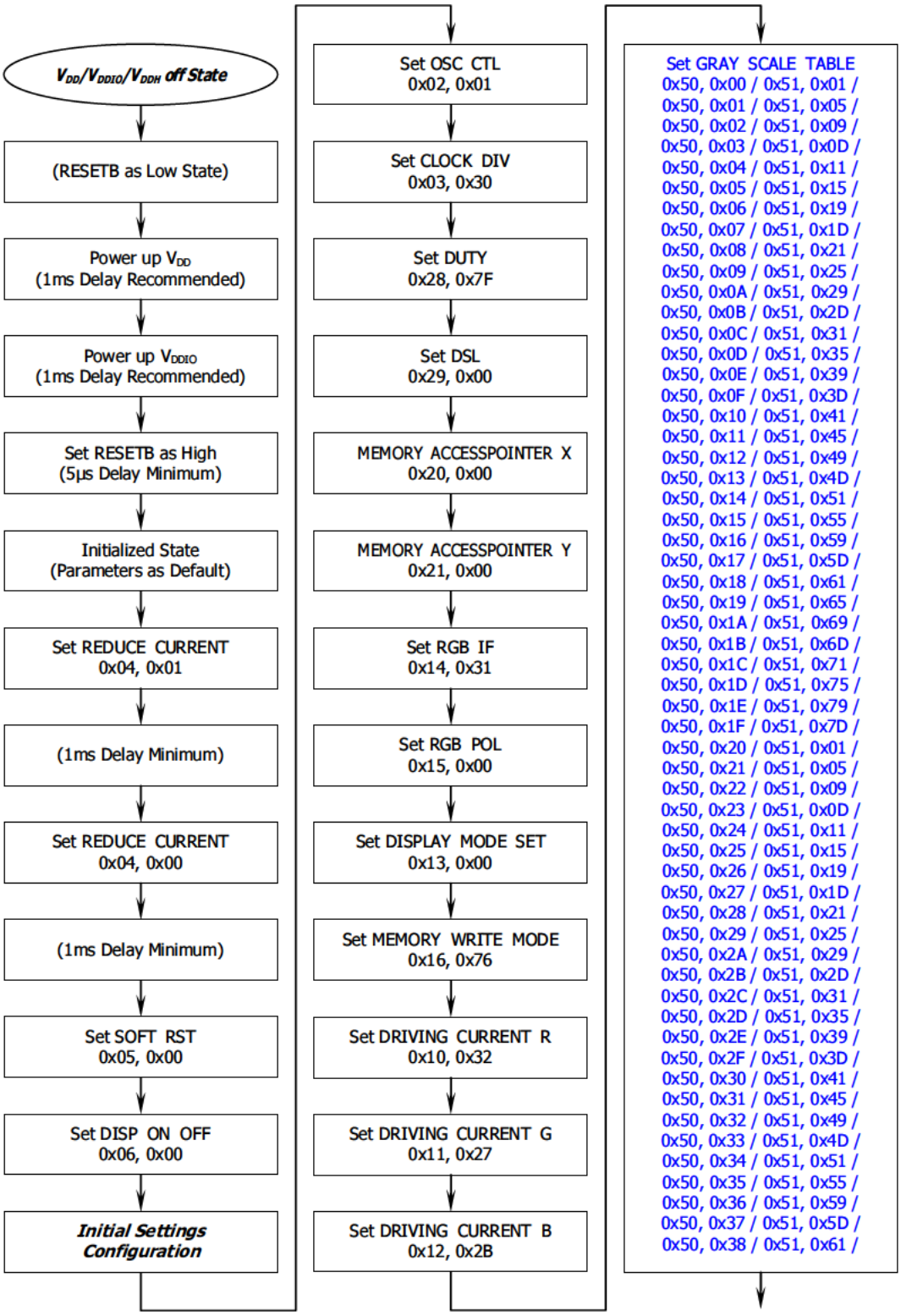
When RESETB input is low, the chip is initialized with the following status:

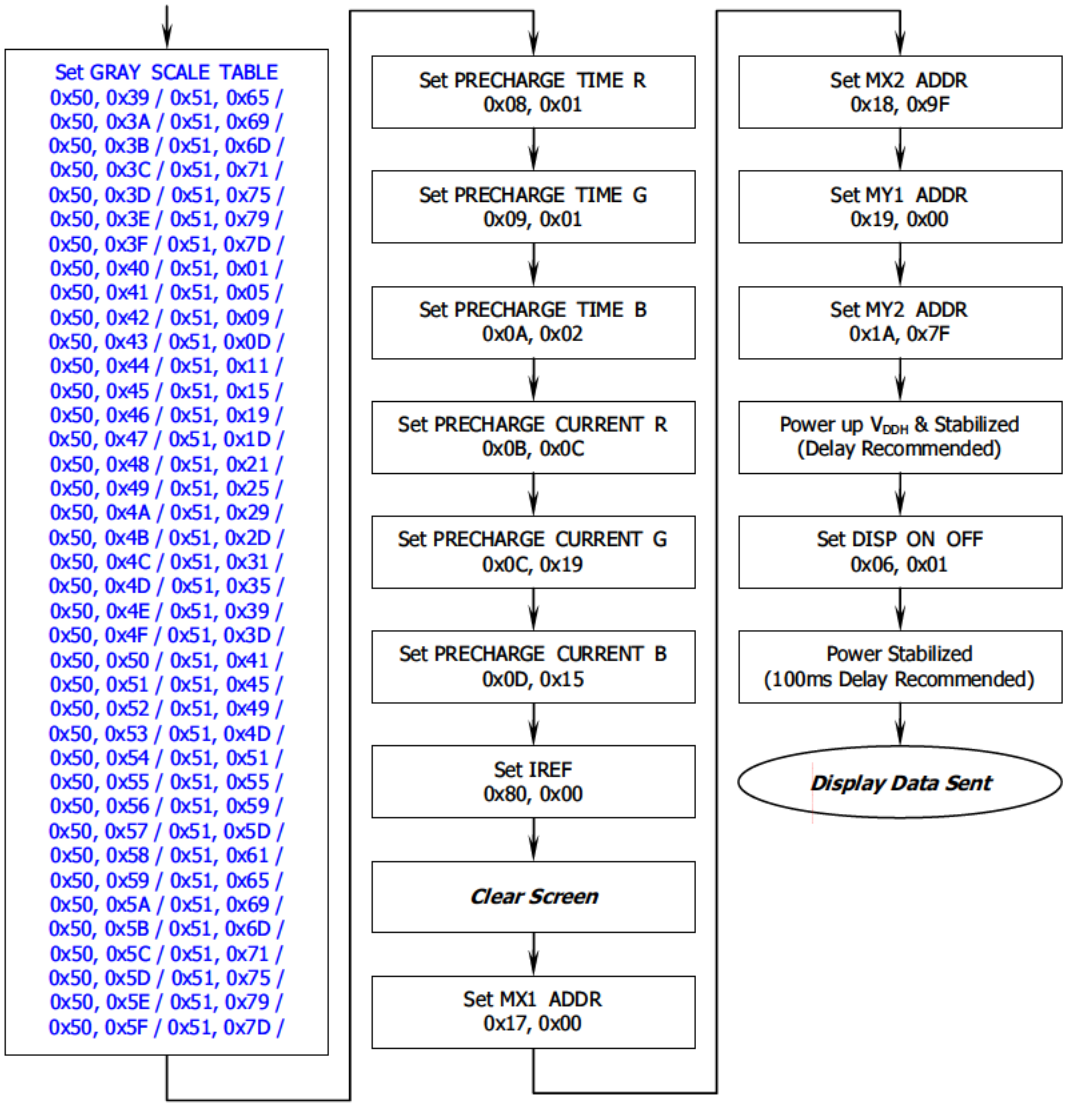
1. Frame frequency: 90Hz
2. OSC: internal OSC
3. Internal OSC: ON
4. DDRAM write horizontal address: MX1 = 00h, MX2 = 9Fh
5. DDRAM write vertical address: MY1 = 00h, MY2 = 7Fh
6. Display data RAM write: HC = 1, VC = 1, HV = 0
7. RGB data swap: OFF
8. Row scan shift direction: G0, G1, … , G126, G127
9.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

4 Actual Application Example

Command usage and explanation of an actual example

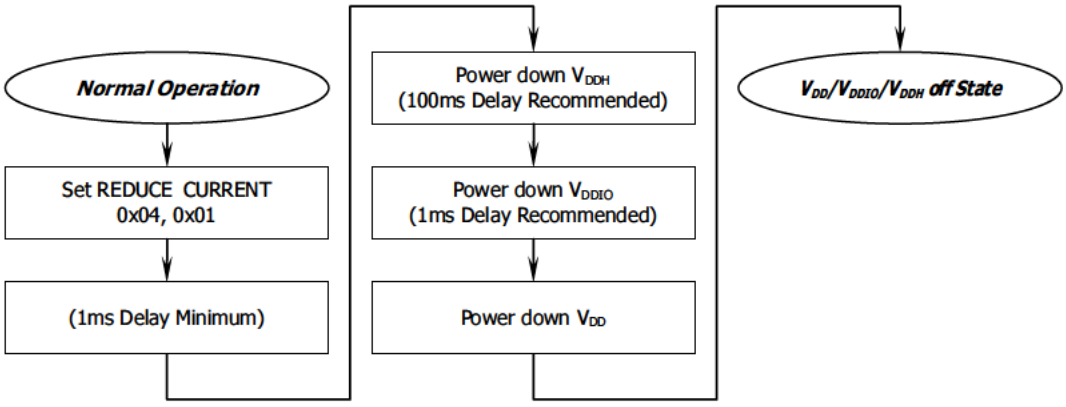
<Power up Sequence>



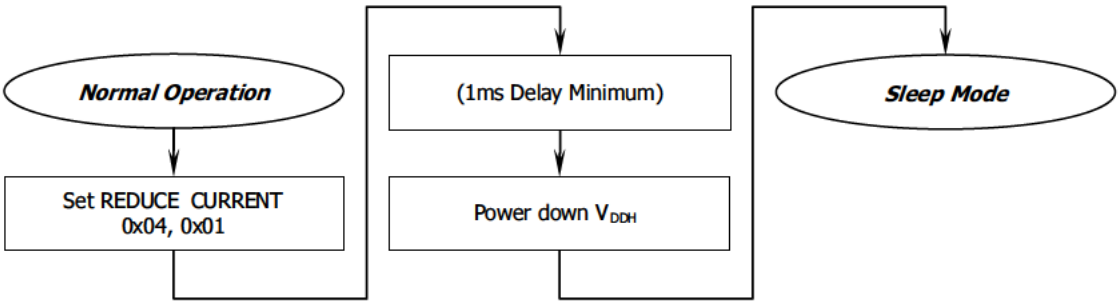


If the noise is accidentally occurred at the displaying window during the operation, please reset the display in order to recover the display function.

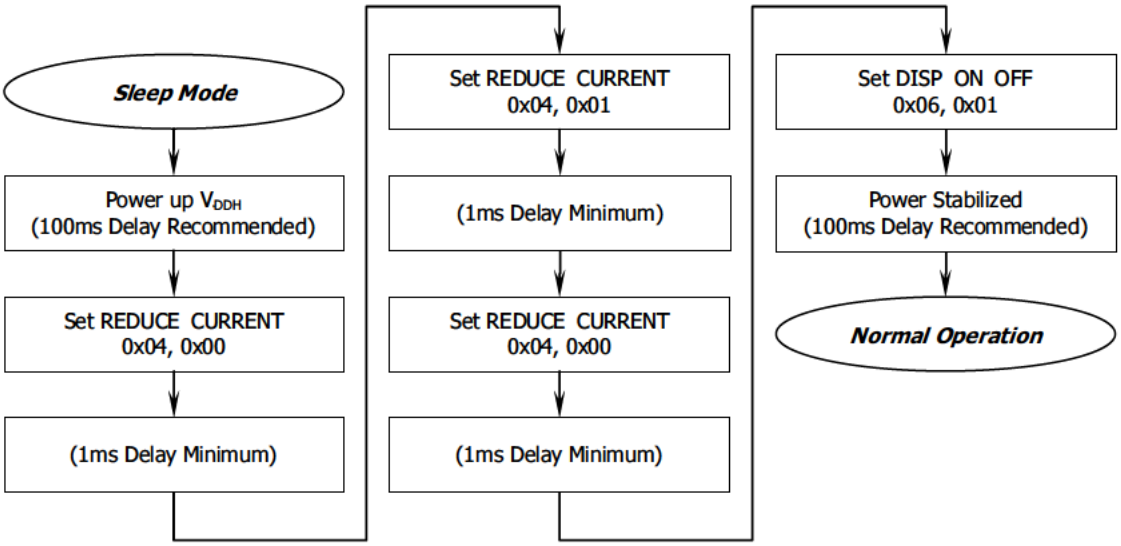
<Power down Sequence>



<Entering Sleep Mode>



<Exiting Sleep Mode>



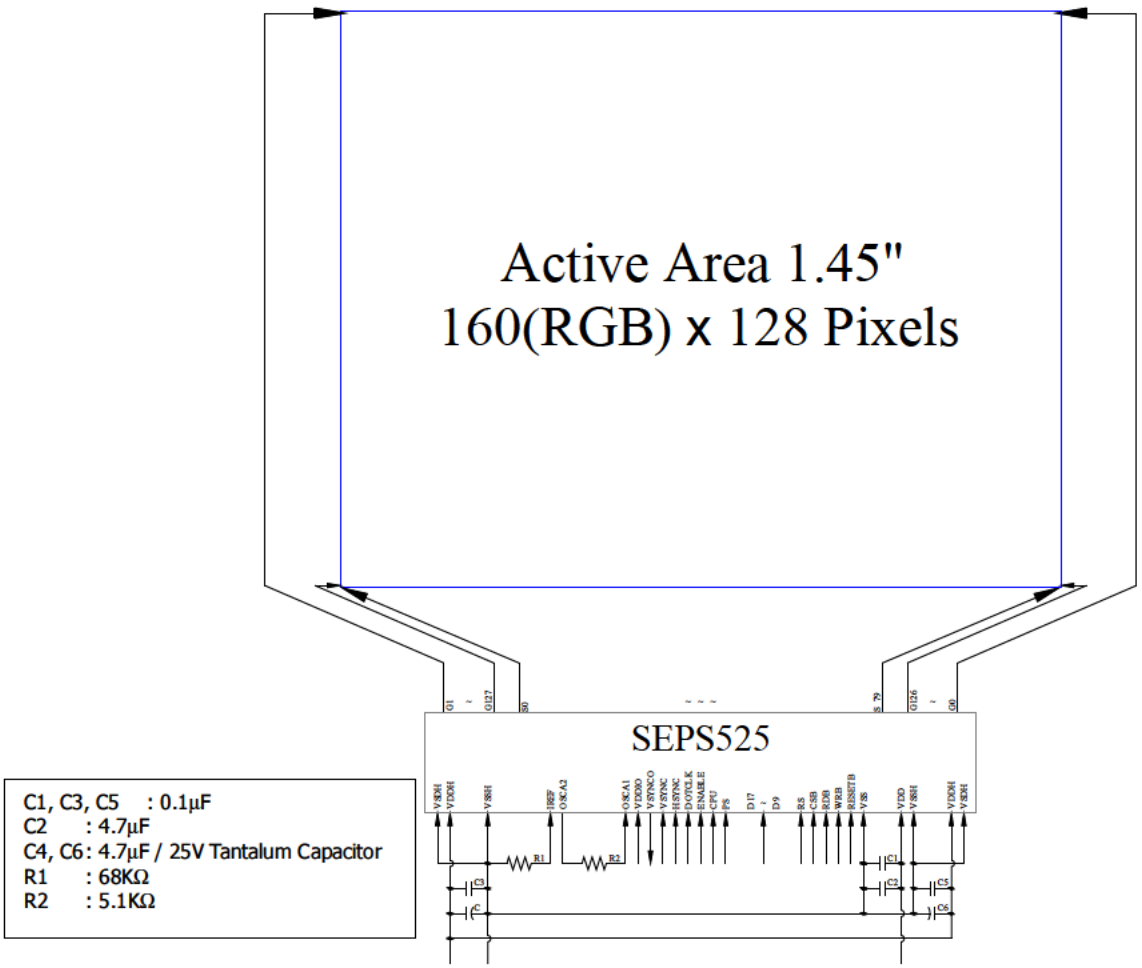
■ ELECTRO-OPTICAL CHARACTERISTICS (Ta=25℃)

Items		Symbol	Min.	Typ.	Max.	Unit	Remark
Operating Luminance		L	75	100	-	cd /m^2	White
Color Coordinate	White	CIE x	0.26	0.30	0.34	CIE1931	Darkroom
		CIE y	0.29	0.33	0.37		
Color Coordinate	Red	CIE x	0.60	0.64	0.68	CIE1931	Darkroom
		CIE y	0.30	0.34	0.38		
Color Coordinate	Green	CIE x	0.27	0.31	0.35	CIE1931	Darkroom
		CIE y	0.58	0.62	0.66		
Color Coordinate	Blue	CIE x	0.10	0.14	0.18	CIE1931	Darkroom
		CIE y	0.12	0.16	0.20		
Contrast Ratio		Cr	10000 :1	-	-		Darkroom
Viewing Angle Uniformity		△ θ	-	Free	-	Degree	-

Note : Brightness (L_{br}) is subject to the change of the panel characteristics and the customer s request.
Optical measurement taken at V_{DD} = 2.8V, V_{CC} = 13.0V.
Software configuration follows Actual Application Example .

■ INTERFACE PIN CONNECTIONS

1. Block Diagram



MCU Interface Selection : Base on CPU、PS connection and Register setting (14h &16h).
Pins connected to MCU interface : D17~D9, RS, CSB, RDB, WRB, and RESETB.
Pins connected to RGB interface : D17~D12, VSYNC, HSYNC, DOTCLK, and ENABLE.

EIM=1(default)

Interface mode	PS	CPU	DFM1	DFM0	D17	D16	D15	D14	D13	D12	D11	D10	D9	RS	CSB	RDB	WRB	RESETB
4-wire SPI	0	X	X	X	SCL	SDI	**NC**	**0**	**0**	**0**	**0**	**0**	**0**	RS	CSB	**0**	**0**	RESETB
80xx parallel 9 bit	1	0	1	0	D8	D7	D6	D5	D4	D3	D2	D1	D0	RS	CSB	RDB	WRB	RESETB
80xx parallel 8 bit	1	0	1	1	D7	D6	D5	D4	D3	D2	D1	D0	**0**	RS	CSB	RDB	WRB	RESETB
68xx parallel 9 bit	1	1	1	0	D8	D7	D6	D5	D4	D3	D2	D1	D0	RS	CSB	E	R/W	RESETB
68xx parallel 8 bit	1	1	1	1	D7	D6	D5	D4	D3	D2	D1	D0	**0**	RS	CSB	E	R/W	RESETB

EIM=0

Interface mode	RIM1	RIM0	D17	D16	D15	D14	D13	D12	D11	D10	D9	VSYNC	HSYNC	DOTCLK	ENABLE
6-bit RGB interface	1	0	D5	D4	D3	D2	D1	D0	**0**	**0**	**0**	VSYNC	HSYNC	DOTCLK	ENABLE

Note:
1. DFM1、DFM0 setting by Register 16h
2. EIM、RIM1、RIM0 setting by Register 14h
3. "X" : Don't care, "NC" : Non connection
   "1" : Connect to VDD or set to High level.
   "0" : Connect to GND or set to Low Level.

2. Pin Definition

Pin Number	Symbol	I/O	Function
Power Supply			
31	VDD	P	**Power Supply for Operation** This is a voltage supply pin. It must be connected to external source & always be equal to or higher than V_{DDIO}.
8	VDDIO	P	**Power Supply for I/O Pin** This pin is a power supply pin of I/O buffer. It should be connected to V_{DD} or external source. All I/O signal should have V_{IH} reference to V_{DDIO}. When I/O signal pins (CPU, PS, D17~D9, control signals…) pull high, they should be connected to V_{DDIO}.
30	VSS	P	**Ground of Logic Circuit** This is a ground pin. It also acts as a reference for the logic pins. It must be connected to external ground.
3, 33	VDDH	P	**Power Supply for OEL Panel** These are the most positive voltage supply pins of the chip. They must be connected to external source.
2, 34 4, 32	VSDH VSSH	P	**Ground of OEL Panel** These are the ground pins for analog circuits. They must be connected to external ground. VSDH: Segment (Data Driver) VSSH: Common (Scan Driver)
Driver			
5	IREF	I/O	**Current Reference for Brightness Adjustment** This is the current reference pin to generate precharge and driving current. A 68KΩ resistor should be connected between this pin and V_{SS}.
Clock			
7 6	OSCA1 OSCA2	I O	**Fine Adjustment for Oscillation** The frequency is controlled by external 5.1kΩ resistor between OSCA1 and OSCA2. The oscillator signal is used for system clock generation. When the external clock mode is selected, OSCA1 is used external clock input.
RGB Interface			
9	VSYNCO	O	**Vertical Synchronization Triggering Signal** While using MCU interface, it must be floating.
10	VSYNC	I	**Vertical Synchronization Input** While using MCU interface, it must be connected to V_{DD}.
11	HSYNC	I	**Horizontal Synchronization Input** While using MCU interface, it must be connected to V_{DD}.
12	DOTCLK	I	**Dot Clock Input** While using MCU interface, it must be connected to V_{DD}.
13	ENABLE	I	**Video Enable Input** While using MCU interface, it must be connected to V_{DD}.
Interface			
14	CPU	I	**Select the CPU Type** Low: 80XX-Series MCU High: 68XX-Series MCU.
15	PS	I	**Select Parallel/Serial Interface Type** Low: Serial Interface High: Parallel Interface
29	RESETB	I	**Power Reset for Controller and Driver** This pin is reset signal input. When the pin is low, initialization of the chip is executed. Keep this pin pull high during normal operation.
26	CSB	I	**Chip Select** Low: SEPS525 is selected and can be accessed. High: SEPS525 is not selected and cannot be accessed.
25	RS	I	**Data/Command Control** Low: Command High: Parameter/Data

<table>
<tr><th>Pin Number</th><th>Symbol</th><th>I/O</th><th>Function</th></tr>
<tr><td colspan="4">Interface (Continued)</td></tr>
<tr><td>27</td><td>RDB</td><td>I</td><td>Read or Read/Write Enable
68XX Parallel Interface: Bus Enabled Strobe(Active High)
80XX Parallel Interface: Read Strobe Signal(Active Low)
While using serial interface, it must be connected to V_{DD} or V_{SS}.</td></tr>
<tr><td>28</td><td>WRB</td><td>I</td><td>Write or Read/Write Select
68XX Parallel Interface: Read (Low)/Write (High) Select
80XX Parallel Interface: Write Strobe Signal(Active Low)
While using serial interface, it must be connected to V_{DD} or V_{SS}.</td></tr>
<tr><td>16~24</td><td>D17~D9</td><td>I/O</td><td>Host Data Input/Output Bus
These pins are 9-bit bi-directional data bus to be connected to the microprocessor’s data bus.
<table>
<tr><th>PS</th><th>Description</th></tr>
<tr><td>0</td><td>D[17] SCL: Synchronous Clock Input
D[16] SDI: Serial Data Input
D[15] SDO: Serial Data Output</td></tr>
<tr><td>1</td><td>9-bit Bus: D[17:9]
8-bit Bus: D[17:10]</td></tr>
</table>
While using serial interface, the unused pins must be connected to V_{SS}.</td></tr>
<tr><td colspan="4">Reserve</td></tr>
<tr><td>1, 35</td><td>N.C. (GND)</td><td>-</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 as the ESD protection circuit.</td></tr>
</table>

■ RELIABILITY TESTS

<table>
<tr><th colspan="2">Item</th><th>Condition</th><th>Criterion</th></tr>
<tr><td colspan="2">High Temperature Storage (HTS)</td><td>85±2℃, 240 hours</td><td rowspan="7">1. After testing, the function test is ok.
2. After testing, no addition to the defect.
3. After testing, the change of luminance should be within +/- 50% of initial value.
4. After testing, the change for the mono and area color must be within (+/-0.02, +/- 0.02) and for the full color it must be within (+/-0.04, +/-0.04) of initial value based on 1931 CIE coordinates.
5. After testing, the change of total current consumption should be within +/- 50% of initial value.</td></tr>
<tr><td colspan="2">High Temperature Operating (HTO)</td><td>70±2℃, 240 hours</td></tr>
<tr><td colspan="2">Low Temperature Storage (LTS)</td><td>-40±2℃, 240 hours</td></tr>
<tr><td colspan="2">Low Temperature Operating (LTO)</td><td>-40±2℃, 240 hours</td></tr>
<tr><td colspan="2">High Temperature / High Humidity Storage (HTHHS)</td><td>60±3℃, 90%±3%RH, 120 hours</td></tr>
<tr><td colspan="2">Thermal Shock (Non-operation) (TS)</td><td>-40±2℃ ~ 25℃ ~ 85±2℃
(30min) (5min) (30min)
24cycles</td></tr>
<tr><td>Vibration (Packing)</td><td>10~55~10Hz,amplitude 1.5mm, 1 hour for each direction x, y, z</td><td colspan="2" rowspan="2">1. One box for each test.
2. No addition to the cosmetic and the electrical defects.</td></tr>
<tr><td>Drop (Packing)</td><td>Height : 1 m, each time for 6 sides, 3 edges, 1 angle</td></tr>
</table>

Note： 1) For each reliability test, the sample quantity is 3, and only for one test item.
2) The HTHHS test is requested the Pure Water(Resistance＞10MΩ).

■OUTGOING QUALITY CONTROL SPECIFICATION

◆Standard

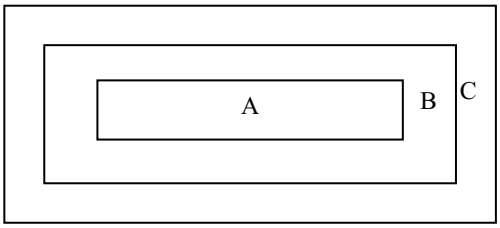
According to GB/T2828.1-2003/ISO 2859-1：1999 and ANSI/ASQC Z1.4-1993, General Inspection Level II.

◆Definition

1 Major defect : The defect that greatly affect the usability of product.

2 Minor defect : The other defects, such as cosmetic defects, etc.

3 Definition of inspection zone:



Zone A: Active Area

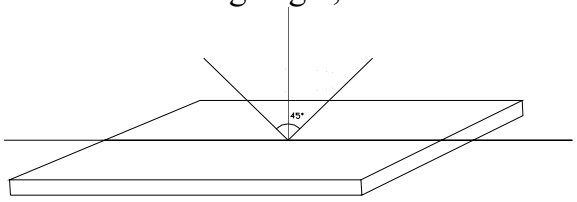
Zone B: Viewing Area except Zone A

Zone C: Outside Viewing Area

Note: As a general rule, visual defects in Zone C are permissible, when it is no trouble of quality and assembly to customer`s product.

◆Inspection Methods

1 The general inspection : under 20W x 2 or 40W fluorescent light, about 30cm viewing distance, within 45º viewing angle, under 25±5℃.



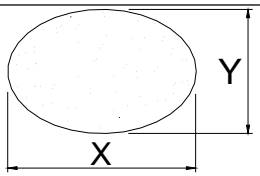
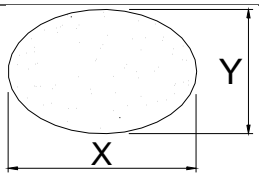
2 The luminance and color coordinate inspection : By PR705 or BM-7 or the equal equipments, in the dark room, under 25±5℃.

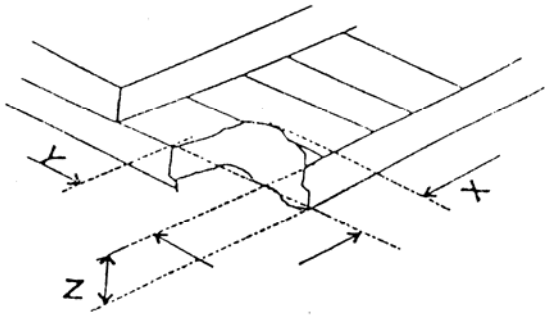
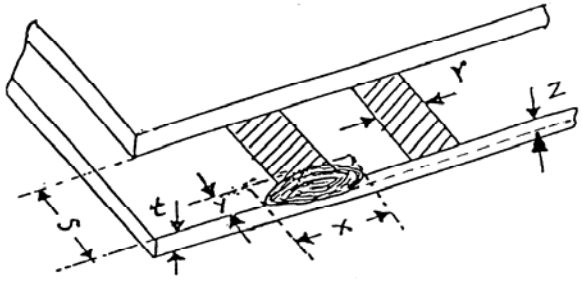
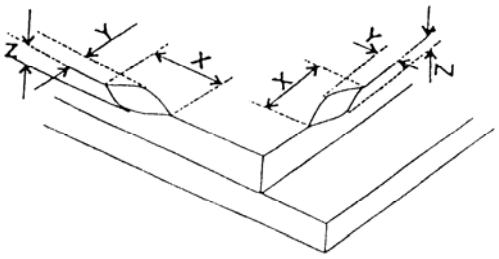
◆Inspection Criteria

1 Major defect : AQL= 0.65

Item	Criterion
Function Defect	1. No display or abnormal display is not accepted
	2. Open or short is not accepted.
	3. Power consumption exceeding the spec is not accepted.
Outline Dimension	Outline dimension exceeding the spec is not accepted.
Glass Crack	Glass crack tends to enlarge is not accepted.

2 Minor Defect : AQL= 1.5

<table>
<tr><td>Item</td><td colspan="4">Criterion</td></tr>
<tr><td rowspan="6">Spot Defect (dimming and lighting spot)</td><td colspan="2">Size (mm)</td><td colspan="2">Accepted Qty</td></tr>
<tr><td colspan="2"></td><td>Area A + Area B</td><td>Area C</td></tr>
<tr><td rowspan="4">  </td><td>Φ≦0.10</td><td colspan="2">Ignored</td></tr>
<tr><td>0.10＜Φ≦0.15</td><td>3</td><td rowspan="3">Ignored</td></tr>
<tr><td>0.15＜Φ≦0. 20</td><td>1</td></tr>
<tr><td>0.20＜Φ</td><td>0</td></tr>
<tr><td colspan="4">Note : Φ= (x + y) / 2</td></tr>
<tr><td rowspan="5">Line Defect (dimming and lighting line)</td><td>L (Length) : mm</td><td>W (Width) : mm</td><td>Area A + Area B</td><td>Area C</td></tr>
<tr><td>/</td><td>W≦0.03</td><td colspan="2">Ignored</td></tr>
<tr><td>L≦3.0</td><td>0.03＜W≦0.05</td><td>2</td><td rowspan="3">Ignored</td></tr>
<tr><td>L≦2.0</td><td>0.05＜W≦0.08</td><td>1</td></tr>
<tr><td>/</td><td>0.08＜W</td><td>As spot defect</td></tr>
<tr><td colspan="5">Remarks: The total of spot defect and line defect shall not exceed 4 pcs.</td></tr>
<tr><td>Polarizer Stain</td><td colspan="4">Stain which can be wiped off lightly with a soft cloth or similar cleaning is accepted, otherwise, according to the Spot Defect and the Line Defect.</td></tr>
<tr><td rowspan="7">Polarizer Scratch</td><td colspan="4">1. If scratch can be seen during operation, according to the criterions of the Spot Defect and the Line Defect.</td></tr>
<tr><td colspan="4">2. If scratch can be seen only under non-operation or some special angle, the criterion is as below :</td></tr>
<tr><td>L (Length) : mm</td><td>W (Width) : mm</td><td>Area A + Area B</td><td>Area C</td></tr>
<tr><td>/</td><td>W≦0.03</td><td colspan="2">Ignore</td></tr>
<tr><td>5.0＜L≦10.0</td><td>0.03＜W≦0.05</td><td>2</td><td rowspan="3">Ignore</td></tr>
<tr><td>L≦5.0</td><td>0.05＜W≦0.08</td><td>1</td></tr>
<tr><td>/</td><td>0.08＜W</td><td>0</td></tr>
<tr><td rowspan="5">Polarizer Air Bubble</td><td colspan="2">Size</td><td>Area A + Area B</td><td>Area C</td></tr>
<tr><td rowspan="4">  </td><td>Φ≦0.20</td><td colspan="2">Ignored</td></tr>
<tr><td>0.20＜Φ≦0.50</td><td>2</td><td rowspan="3">Ignored</td></tr>
<tr><td>0.50＜Φ≦0.80</td><td>1</td></tr>
<tr><td>0.80＜Φ</td><td>0</td></tr>
</table>

<table>
<tr><td rowspan="4">Glass Defect (Glass Chiped)</td><td>1. On the corner
 
(mm)
<table><tr><td>x</td><td>≤ 2.0</td></tr><tr><td>y</td><td>≤ S</td></tr><tr><td>z</td><td>≤ t</td></tr></table></td></tr>
<tr><td>2. On the bonding edge
 
(mm)
<table><tr><td>x</td><td>≤ a / 2</td></tr><tr><td>y</td><td>≤ s / 3</td></tr><tr><td>z</td><td>≤ t</td></tr></table></td></tr>
<tr><td>3. On the other edges
 
(mm)
<table><tr><td>x</td><td>≤ a / 5</td></tr><tr><td>y</td><td>≤ 1.0</td></tr><tr><td>z</td><td>≤ t</td></tr></table></td></tr>
<tr><td>Note: t: glass thickness ; s: pad width ; a: the length of the edge</td></tr>
<tr><td>TCP Defect</td><td>Crack, deep fold and deep pressure mark on the TCP are not accepted</td></tr>
<tr><td>Pixel Size</td><td>The tolerance of display pixel dimension should be within ±20% of the spec</td></tr>
<tr><td>Luminance</td><td>Refer to the spec or the reference sample</td></tr>
<tr><td>Color</td><td>Refer to the spec or the reference sample</td></tr>
</table>

■ CAUTIONS IN USING OLED MODULE

◆Precautions For Handling OLED Module:

1. OLED module consists of glass and polarizer. Pay attention to the following items when handling:
   i. Avoid drop from high, avoid excessive impact and pressure.
   ii. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead.
   iii. If the surface becomes dirty, breathe on the surface and gently wipe it off with a soft dry cloth. If it is terrible dirty, moisten the soft cloth with Isopropyl alcohol or Ethyl alcohol. Other solvents may damage the polarizer. Especially water, Ketone and Aromatic solvents.
   iv. Wipe off saliva or water drops immediately, contact the polarizer with water over a long period of time may cause deformation.
   v. Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peeling-off may occur with high temperature and high humidity.
   vi. Condensation on the surface and the terminals due to cold or anything will damage, stain or dirty the polarizer, so make it clean as the way of iii.
2. Do not attempt to disassemble or process the OLED Module.
3. Make sure the TCP or the FPC of the Module is free of twisting, warping and distortion, do not pull or bend them forcefully, especially the soldering pins. On the other side, the SLIT part of the TCP is made to bend in the necessary case.
4. When assembling the module into other equipment, give the glass enough space to avoid excessive pressure on the glass, especially the glass cover which is much more fragile.
5. Be sure to keep the air pressure under 120 kPa, otherwise the glass cover is to be cracked.
6. Be careful to prevent damage by static electricity:
   i. Be sure to ground the body when handling the OLED Modules.
   ii. All machines and tools required for assembling, such as soldering irons, must be properly grounded.
   iii. Do not assemble and do no other work under dry conditions to reduce the amount of static electricity generated. A relative humidity of 50%-60% is recommended.
   iv. Peel off the protective film slowly to avoid the amount of static electricity generated.
   v. Avoid to touch the circuit, the soldering pins and the IC on the Module by the body.
   vi. Be sure to use anti-static package.
7. Contamination on terminals can cause an electrochemical reaction and corrade the terminal circuit, so make it clean anytime.
8. All terminals should be open, do not attach any conductor or semiconductor on the terminals.
9. When the logic circuit power is off, do not apply the input signals.
10. Power on sequence: $V_{DD} \rightarrow V_{PP}$, and power off sequence: $V_{PP} \rightarrow V_{DD}$.
11. Be sure to keep temperature, humidity and voltage within the ranges of the spec, otherwise shorten Module’ s life time, even make it damaged.
12. Be sure to drive the OLED Module following the Specification and Datasheet of IC controller, otherwise something wrong may be seen.

13. When displaying images, keep them rolling, and avoid one fixed image displaying more than 30 seconds, otherwise the residue image is to be seen. This is the speciality of OLED.

◆Precautions For Soldering OLED Module:

1. Soldering temperature : 260°C ± 10°C.
2. Soldering time : 3-4 sec.
3. Repeating time : no more than 3 times.
4. If soldering flux is used, be sure to remove any remaining flux after finishing soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended to protect the surface with a cover during soldering to prevent any damage due to flux spatters.

◆ Precautions For Storing OLED Module:

1. Be sure to store the OLED Module in the vacuum bag with dessicant.
2. If the Module can not be used up in 1 month after the bag being opened, make sure to seal the Module in the vacuum bag with dessicant again.
3. Store the Module in a dark place, do not expose to sunlight or fluorescent light.
4. The polarizer surface should not touch any other objects. It is recommended to store the Module in the shipping container.
5. It is recommended to keep the temperature between 0°C and 30°C , the relative humidity not over 60%.

◆ Limited Warranty

Unless relevant quality agreements signed with customer and law enforcement, for a period of 12 months from date of production, all products (except automotive products) All Shore will replace or repair any of its OLED modules which are found to be functional defect when inspected in accordance with All Shore OLED acceptance standards (copies available upon request). Cosmetic/visual defects must be returned to All Shore within 90 days of shipment. Confirmation of such date should be based on freight documents. The warranty liability of All Shore is limited to repair and/or replacement on the terms above. All Shore will not be responsible for any subsequent or consequential events.

◆Return OLED Module Under Warranty:

1. No warranty in the case that the precautions are disregarded.
2. Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects.