

# OLED DISPLAY MODULE

## Product Specification

<b>CUSTOMER</b>	<b>Standard</b>	
<b>PRODUCT NUMBER</b>	<b>DD-160128FC-2B</b>	
<b>CUSTOMER APPROVAL</b>		<b>Date</b>

INTERNAL APPROVALS		
Product Mgr	Doc. Control	Electr. Eng
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Date: 15 Oct 10	Date: 15 Oct 10	Date: 15 Oct 10

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REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECR no.
A	22 Nov 06			First Issue	
B	26 Dec 10	4 5 7 8 18 6 11 17 19 29 4		1. Overall dimensions 2. Weight 3. Driver Supply Voltage 4. Operating current for VDDH 5. Optics Characteristics 6. Mechanical Drawing 7. Block Diagram 8. Add RGB interface 9. Power up sequence 10. Low Temperature Operation 11. Operating temperature	

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# 1 MAIN FEATURES

ITEM	CONTENTS
Display Format	160 (RGB) x 128 Dots
Overall Dimensions	Glass 39.9 x 34.0 x 1.6 mm
Colour	262,144 Colour
Active Area	33.575 x 26.864 mm
Viewing Area	35.575 x 28.864 mm
Display Mode	Passive Matrix (1.69")
Driving Method	1/128 duty
Driver IC	SEPS525
Operating temperature	-40 ~ +70
Storage temperature	-40 ~ +80

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## 2 MECHANICAL SPECIFICATION

### 2.1 MECHANICAL CHARACTERISTICS

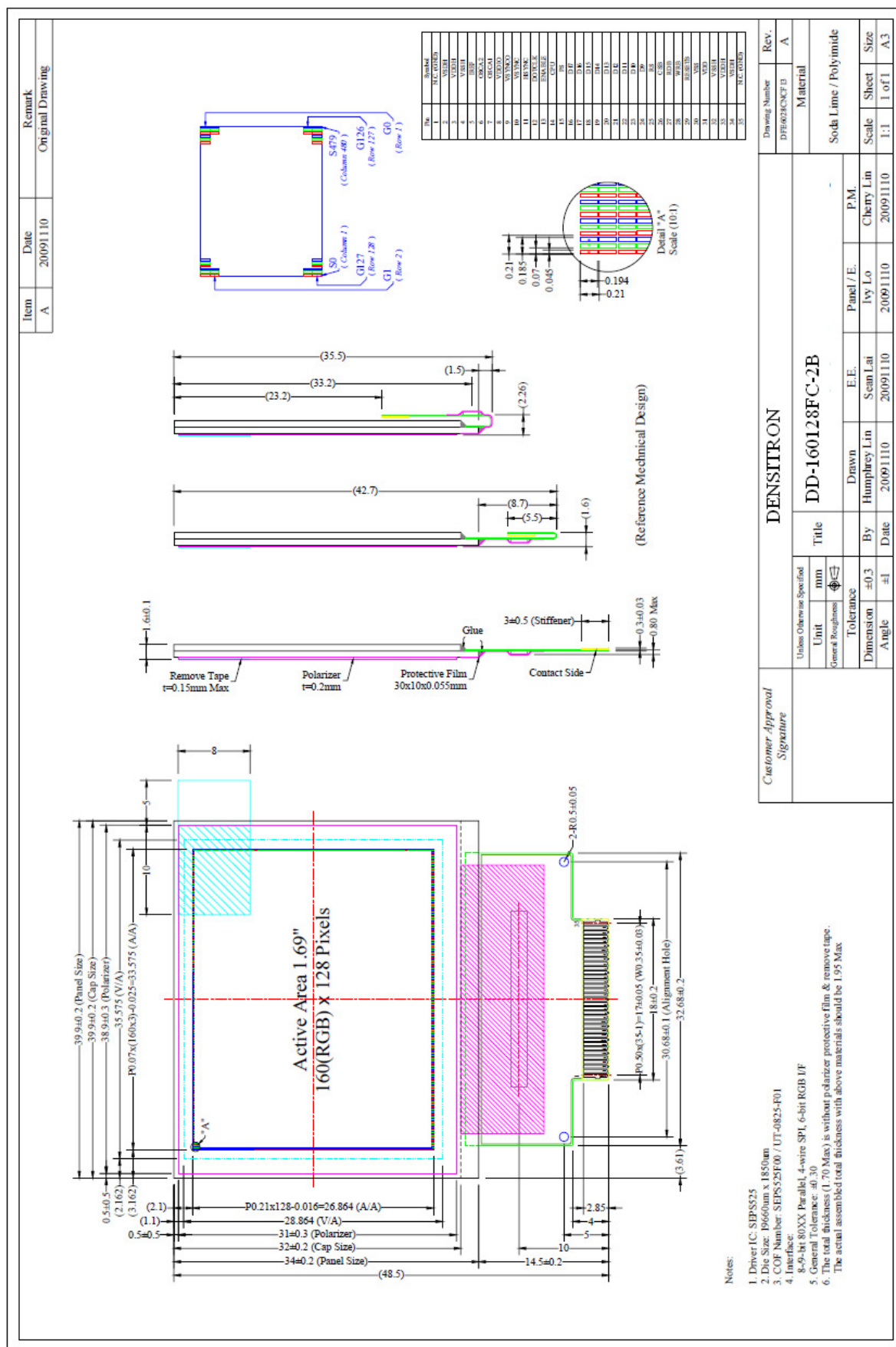
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ITEM	CHARACTERISTIC	UNIT
Display Format	160 (RGB) x 128	Dots
Overall Dimensions	Glass 39.9 x 34.0 x 1.6	mm
Viewing Area	35.575 x 28.864	mm
Active Area	33.575 x 26.864	mm
Dot Size	0.045 x RGB x 0.194	mm
Dot Pitch	0.07 x RGB x 0.21	mm
Weight	4.55	g
IC Controller/Driver	SEPS525F0A (COF)	

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## 2.2 MECHANICAL DRAWING



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### 3 ELECTRICAL SPECIFICATION

#### 3.1 ABSOLUTE MAXIMUM RATINGS

VSS = 0 V, Ta = 25 °C

Item	Symbol	Min	Max	Unit	Note
Supply Voltage	V <sub>DD</sub>	-0.3	4	V	Note 1, 2
Supply Voltage for I/O Pins	V <sub>DDIO</sub>	-0.3	4	V	
Driver Supply Voltage	V <sub>DDH</sub>	-0.3	16	V	
Operating Temperature	Top	-40	70	°C	
Storage Temperature	Tst	-40	80	°C	
Static Electricity	Be sure that you are grounded when handling displays.				

Note 1: All the above voltages are on the basis of “VSS=0V”.

Note 2: When this module is used beyond the above absolute maximum ratings, permanent damage to the module may occur. Also for normal operations it's desirable to use this module under the conditions according to Section 3.2 “Electrical Characteristics”. If this module is used beyond these conditions the module may malfunction and the reliability could deteriorate.

### 3.2 ELECTRICAL CHARACTERISTICS

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage	V <sub>DD</sub>		2.6	2.8	3.3	V
Supply Voltage x I/O pins	V <sub>DDIO</sub>		1.6	2.8	3.3	V
Driver Supply Voltage	V <sub>DDH</sub>		13.5	14	14.5	V
High Level Input	V <sub>IH</sub>		0.8xV <sub>DD</sub>	-	V <sub>DD</sub>	V
Low Level Input	V <sub>IL</sub>		0	-	0.4	V
High Level Output	V <sub>OH</sub>	I <sub>OH</sub> = -0.4mA	V <sub>DD</sub> -0.4	-	-	V
Low Level Output	V <sub>OL</sub>	I <sub>OL</sub> = -0.1mA	-	-	0.4	V
Operating current for VDD	I <sub>DD</sub>		-	2.5	3.5	mA
Operating current for VDDH	I <sub>DDH</sub>	Note 1	-	26.2	32.8	mA
		Note 2	-	14.9	18.6	

Note 1 VDD = 2.8V, VDDH = 14V, 100% Display Area Turn On

Note 2 VDD = 2.8V, VDDH = 14V, 500% Display Area Turn On

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### 3.3 INTERFACE PIN ASSIGNMENT

Mating Connector type: 35-pin, 0.5 mm pitch FFC/FPC. Type: AVX 04-6238-035-000-800

No.	Symbol	Function
1	N.C.	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
2	VSDH	Ground of OEL Panel These are the ground pins for analog circuits. It must be connected to external ground. VSDH: Data Driver Ground
3	VDDH	Power supply of OEL Panel This is the most positive voltage supply pin of the chip. It must be connected to external source.
4	VSSH	Ground of OEL Panel These are the ground pins for analog circuits. It must be connected to external ground. VSSH: Scan Driver Ground
5	IREF	Current reference for brightness Adjustment This pin is segment (data) current reference pin. A 68KΩ Resistor should be connected between this pin and VSS
6	OSCA2	Fine Adjustment for Oscillation The frequency is controlled by external 5.1 kΩ 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.
7	OSCA1	
8	VDDIO	Power supply for Interface logic level This is a voltage supply pin. It should be match with MCU interface voltage level. It must always be equal or lower than VDD
9	VSYNCO	RGB Mode functional Pins VSYNCO : Vertical Sync                      Output VSYNC:        Vertical Sync                      Input HSYNC :        Horizontal Sync                      Input DOTCLK :        Dot Clock                                      Input ENENABLE :        Video Enable                                      Input
10	VSYNC	
11	HSYNC	
12	DOTCLK	
13	ENABLE	
14	CPU	<i>Select CPU type</i> Low: 80-Series High: 68-Series
15	PS	<i>Select Parallel/Serial Interface</i> Low: Serial High: Parallel
16	D17	<i>Host Data Input/Output Bus.</i> These pins are 9-bit bi-directional data bus to be connected with MCU data bus.
17	D16	
18	D15	

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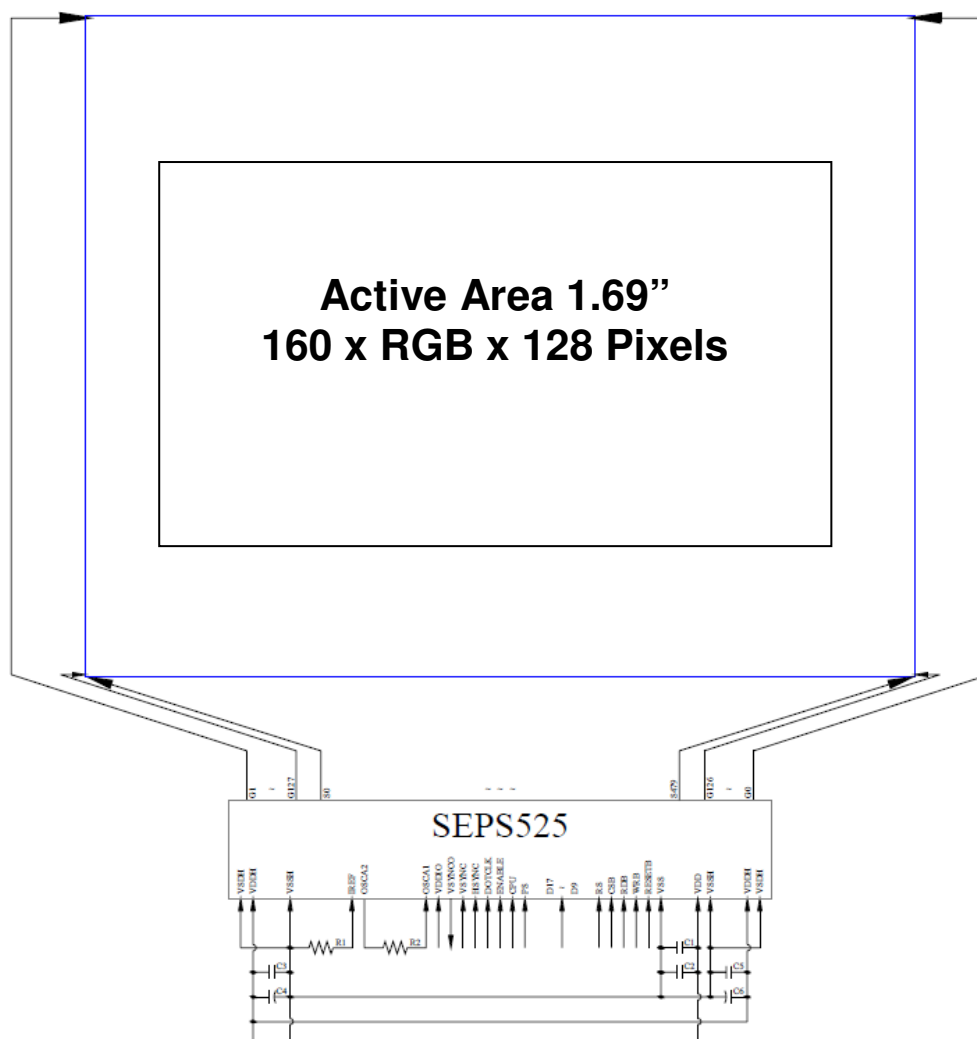
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19	D14	PS	Description
20	D13		
21	D12		
22	D11		
23	D10		
24	D9	1	8-bit Bus: D17 to D10 9-bit Bus: D17 to D9
		0	D[17] SCL: Synchronous Clock Input D[16] SDI: Serial Data Input D[15] SDO: Serial Data Output
25	RS	<i>Selects Data/Command</i> Low: Command High: Parameter/data	
26	CSB	<i>Chip Select</i> Low: SEPS525 is selected and can be accessed High: SEPS525 is not selected and cannot be accessed	
27	RDB	Read or Read/Write enable 80-system bus interface: read strobe signal (active low ) 68-system bus interface: bus enable strobe (active high) When serial mode, fix it to VDD or VSS level	
28	WRB	Write or Read/Write select 80-system bus interface: write strobe signal (active low) 68-system bus interface: read/write select Low: write, High: read When serial mode, fix it to VDD or VSS level	
29	RESETB	Power Reset for Controller and Driver This pin is reset signal input. When the pin is low, initialization of the chip is executed.	
30	VSS	Ground of Logic Circuit A reference for the logic pins. It must be connected to external ground	
31	VDD	Power supply for logic circuit This is a voltage supply pin. It must be connected to external source	
32	VSSH	Ground of OEL Panel These are the ground pins for analog circuits. It must be connected to external ground. VSSH: Scan Driver Ground	
33	VDDH	Power supply of OEL Panel This is the most positive voltage supply pin of the chip. It must be connected to external source.	
34	VSDH	Ground of OEL Panel These are the ground pins for analog circuits. It must be connected to external ground. VSDH: Data Driver Ground	
35	NC	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	

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### 3.4 BLOCK DIAGRAM



MCU Interface Selection: CPU, PS  
 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

C1, C3, C5: 0.1μF  
 C2: 4.7μF  
 C4, C6: 4.7μF / 25V Tantalum Capacitor  
 R1: 68kΩ  
 R2: 5.1kΩ

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### 3.5 TIMING CHARACTERISTICS

#### 3.5.1 AC CHARACTERISTICS

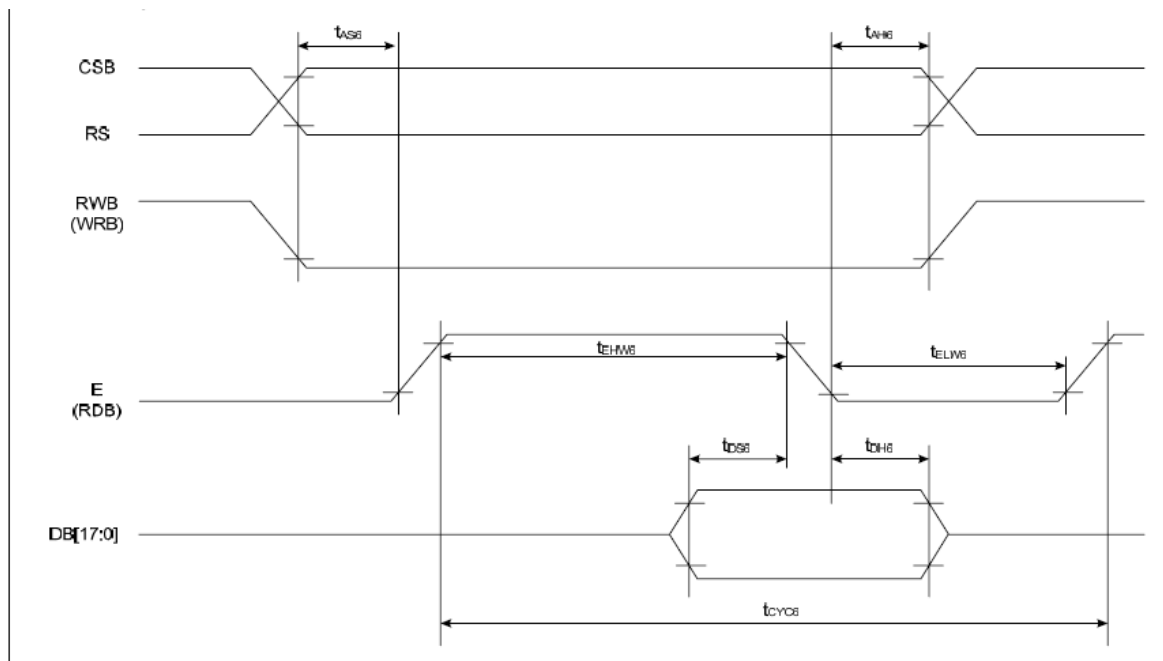
##### 3.5.1.1 6800-Series MPU Parallel Interface Timing Characteristics

VDD = 2.8V, Ta = 25°C

Characteristics	Symbol	Min	Max	Unit	Port
<b>Write Timing</b>					
Address hold timing	tAH6	5	-	nS	CSB
Address setup timing	tAS6	5	-	nS	RS
System cycle timing Write	tCYC6	100	-	nS	E
“L” pulse width Write	tELW6	45	-	nS	E
“H” pulse width	tEHW6	45	-	nS	E
Data setup timing	tDS6	40	-	nS	DB[17:0]
Data hold timing	tDH6	10	-	nS	DB[17:0]
<b>Read Timing</b>					
Address hold timing	tAH6	10	-	nS	CSB
Address setup timing	tAS6	10	-	nS	RS
System cycle timing Write	tCYC6	200	-	nS	E
“L” pulse width Write	tELW6	90	-	nS	E
“H” pulse width	tEHW6	90	-	nS	E
Data setup timing (CL= 15pF)	tDS6	0	70	nS	DB[17:0]
Data hold timing (CL= 15pF)	tDH6	0	70	nS	DB[17:0]

- All the timing should be based on 10% and 90% of V<sub>DD</sub>.

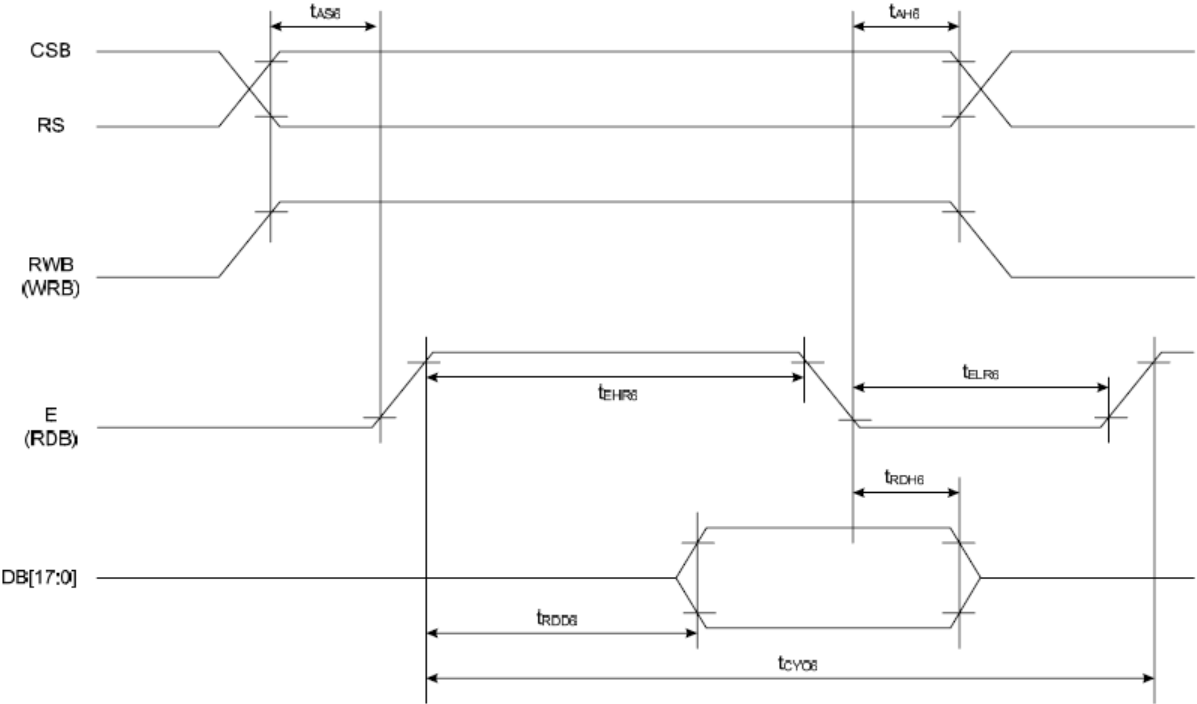
#### Write Timing



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**Read Timing**



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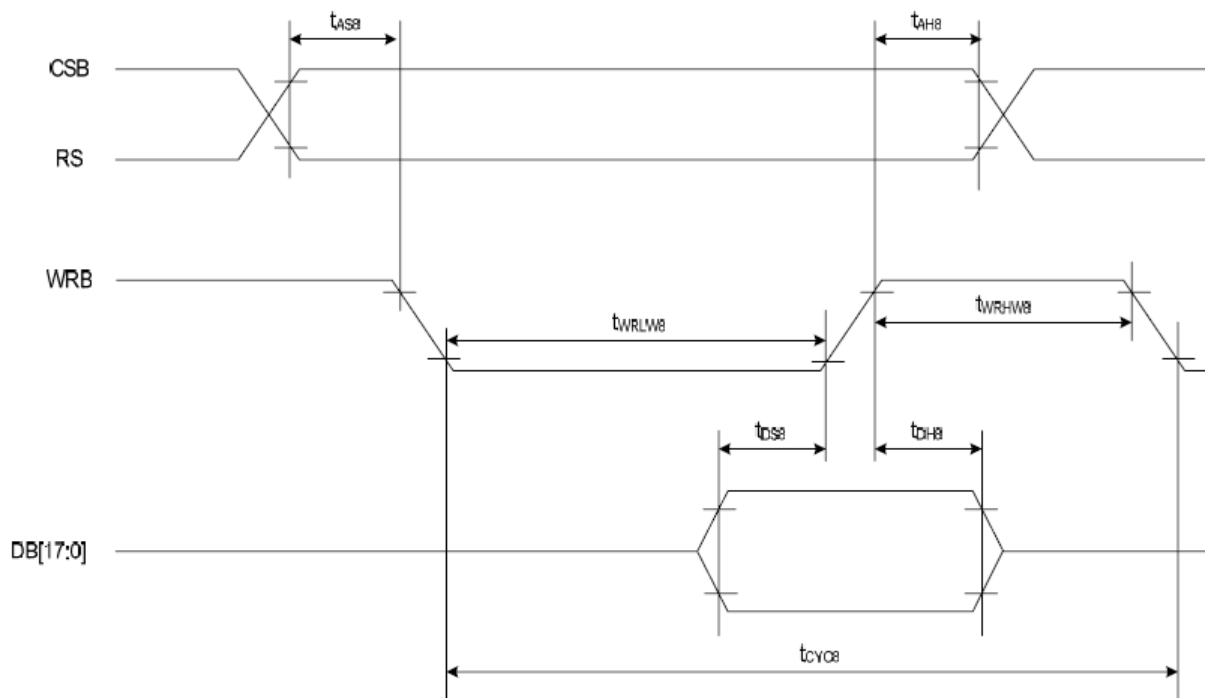
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### 3.5.1.2 8080-Series MPU Parallel Interface Timing Characteristics

Characteristics	Symbol	Min	Max	Unit	Port
<b>Write Timing</b>					
Address hold timing	tAH8	5	-	nS	CSB
Address setup timing	tAS8	5	-	nS	RS
System cycle timing Write	tCYC8	100	-	nS	WRB
“L” pulse width Write	tELW8	45	-	nS	
“H” pulse width	tEHW8	45	-	nS	
Data setup timing	tDS8	30	-	nS	DB[17:0]
Data hold timing	tDH8	10	-	nS	
<b>Read Timing</b>					
Address hold timing	tAH8	10	-	nS	CSB
Address setup timing	tAS8	10	-	nS	RS
System cycle timing Write	tCYC8	200	-	nS	RDB
“L” pulse width Write	tELW8	90	-	nS	
“H” pulse width	tEHW8	90	-	nS	
Data setup timing (CL= 15pF)	tDS8	0	60	nS	DB[17:0]
Data hold timing (CL= 15pF)	tDH8				

**\* All the timing should be based on 10% and 90% of  $V_{DD}$**

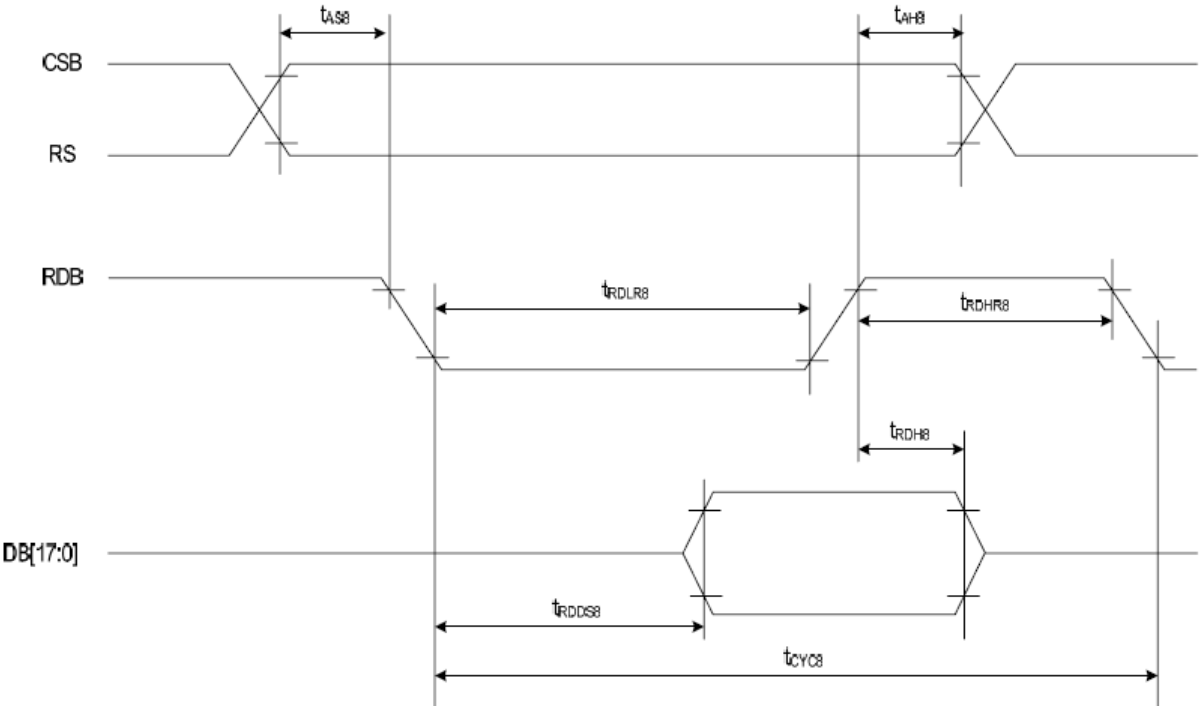
#### Write Timing



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Read timing



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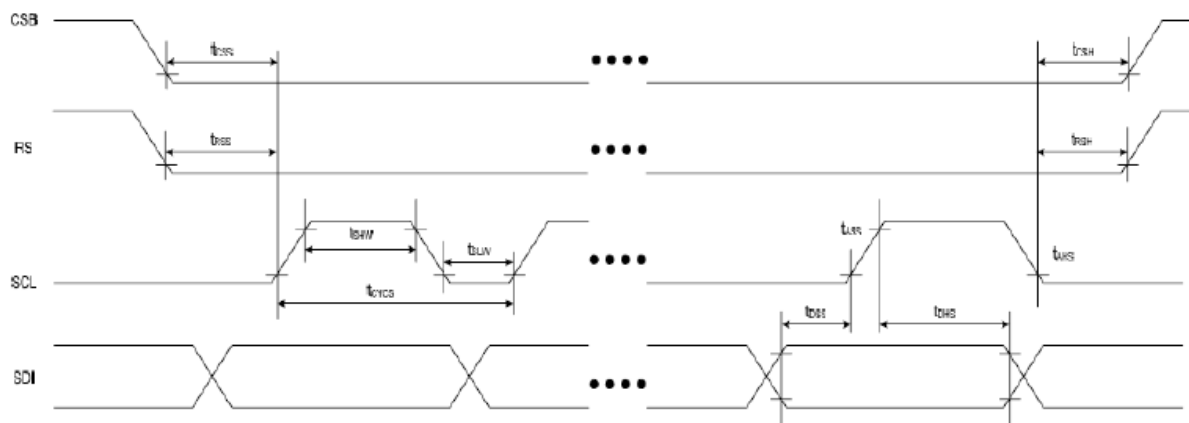
### 3.5.1.3 Serial Interface Timing Characteristics

VDD = 2.8V , Ta = 25°C

ITEM	SYMBOL	MIN	MAX	UNIT	PORT
Serial clock cycle SCL	tCYCS	60	-	nS	SCL
“H” pulse width SCL	tSHW	25			
“L” pulse width	tSLW	25			
Data setup timing Data	tDSS	25	-	nS	SDI
Hold timing	tDHS	25			
CSB-SCL timing	tCSS	25	-	nS	CSB
CSB-hold timing	tCSH	25			

*\* All the timing should be based on 10% and 90% of V<sub>DD</sub>*

#### Serial Interface Timing



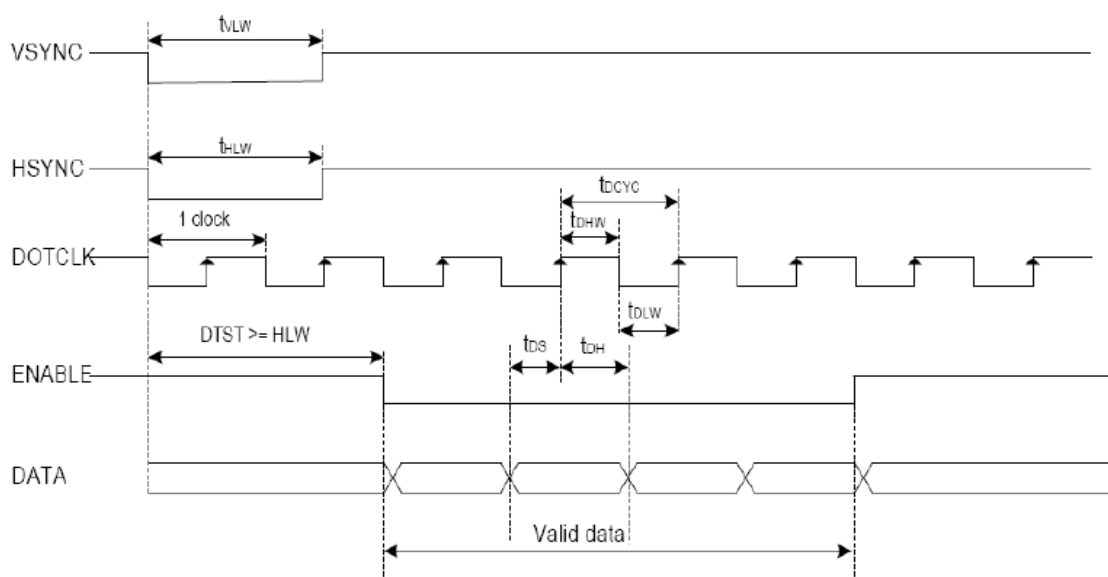


### 3.5.1.4 RGB Interface Timing Characteristics:

( $V_{DD} = 2.8V$ ,  $T_a = 25^{\circ}C$ )

Symbol	Item	Min	Max	Unit	Port
$t_{DCYC}$	Dot Clock Cycle	100	-	ns	
$t_{DLW}$	Dot "L" Pulse Width	50	-	ns	DOTCLK
$t_{DHW}$	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  $V_{DD}$ .



DTST: Setup Time for Data Transmission

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

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## 4 OPTICAL SPECIFICATION

### 4.1 OPTICAL CHARACTERISTICS

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Brightness(White)	L <sub>br</sub>	Note 1	60	75	-	cd/m <sup>2</sup>
C.I.E.(White)	(X)	C.I.E. 1931	0.26	0.30	0.34	-
	(Y)		0.29	0.33	0.37	
C.I.E.(Red)	(X)	C.I.E. 1931	0.60	0.64	0.68	-
	(Y)		0.30	0.34	0.38	
C.I.E.(Green)	(X)	C.I.E. 1931	0.27	0.31	0.35	-
	(Y)		0.58	0.62	0.66	
C.I.E.(Blue)	(X)	C.I.E. 1931	0.10	0.14	0.18	-
	(Y)		0.12	0.16	0.20	
Dark Room Contrast	CR		-	>2000:1	-	-
Viewing Angle			>160	-	-	degree

Note 1: Brightness (L<sub>br</sub>) and Supply Voltage for Display (VDDH) are subject to the change of the panel characteristics and the customer's request.

Optical measurement with polarizer is taken at VDD, VDDIO = 2.8V, VDDH = 14V and the software initial setting with section 5.4.1 Reference parameter table for normal operation mode.

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## 5 FUNCTIONAL SPECIFICATION

### 5.1 COMMANDS

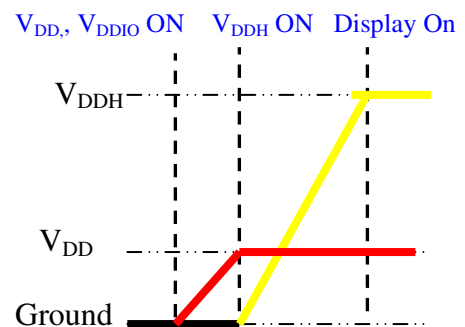
Please refer to the Technical Manual for the SEPS525

### 5.2 POWER UP/DOWN SEQUENCE

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

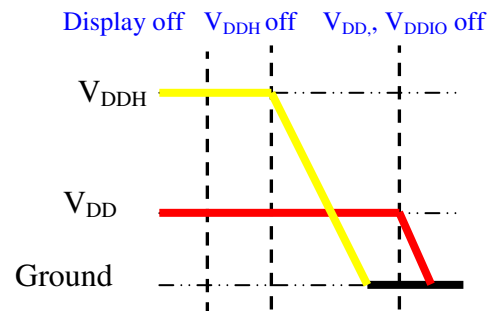
#### 5.2.1 POWER UP SEQUENCE

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



#### 5.2.2 POWER DOWN SEQUENCE

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



### 5.3 RESET CIRCUIT

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

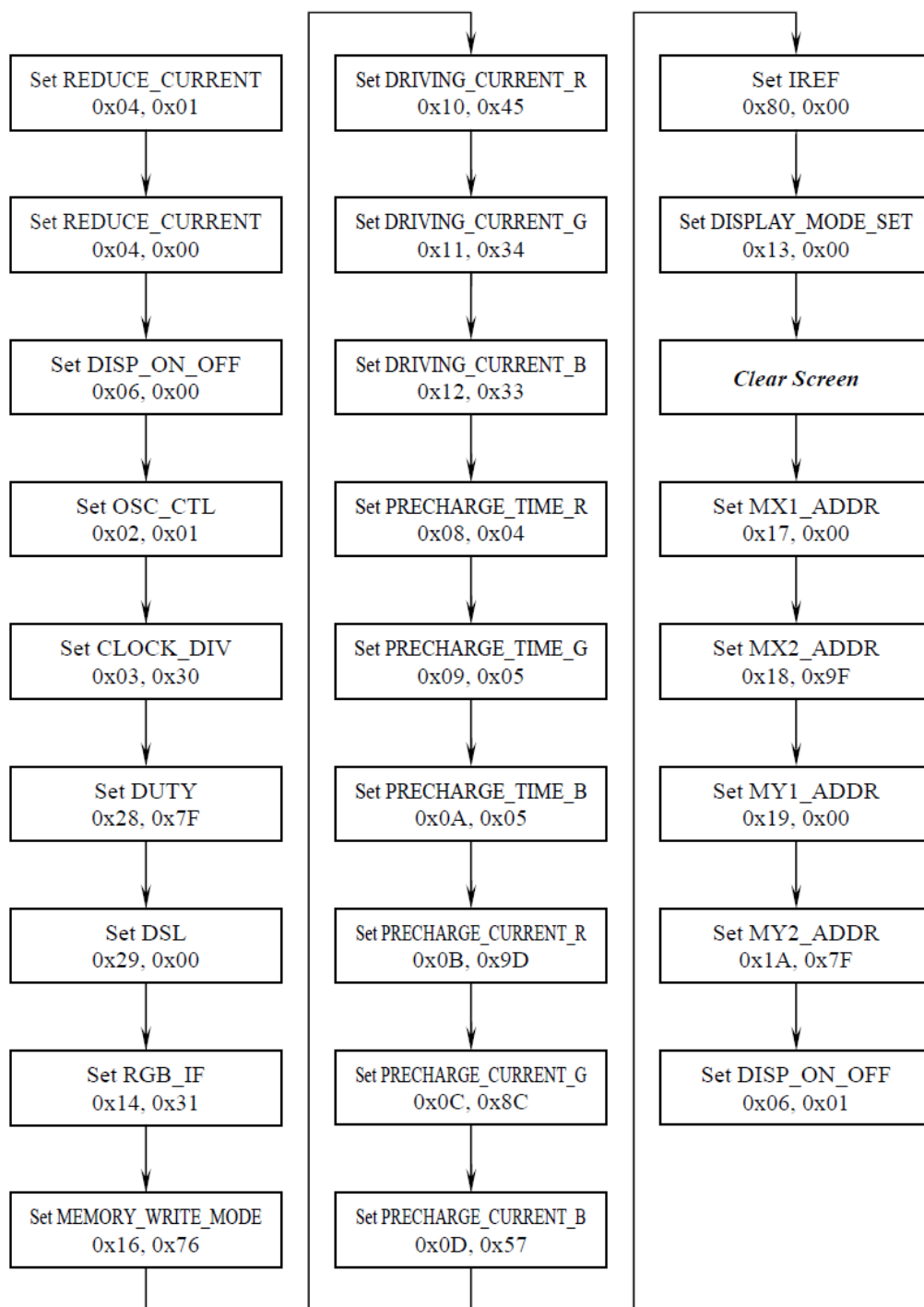
1. Frame frequency: 90Hz
2. OSC: internal OSC
3. Internal OSC: ON
4. DDRAM write horizontal address: MX1 = 00h, MX2 = 9Fh
5. DDRAM write vertical address: MY1 = 00h, MY2 = 7Fh
6. Display data RAM write: HC = 1, VC = 1, HV = 0
7. RGB data swap: OFF
8. Row scan shift direction: G0, G1, ..., G126, G127
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. Pre-charge time(R/G/B): 0 clock
14. Pre-charge current(R/G/B): 0 uA 15. Driving current(R/G/B): 0 uA

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## 5.4 ACTUAL APPLICATION EXAMPLE

<Initialization>



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

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### 5.4.1 Reference Parameters Table

(VDD = 2.8V, Ta = 25°C)

Command Parameter	Normal operation mode	Power saving mode
Set Display On_Off	0x06, 0x00	
Set SOFT_RST	0x05, 0x00	
Set REDUCE_CURRENT	0x04, 0x01 wait 1ms 0x04,0x00	
Set OSC_CTL	0x02, 0x01	
Set CLOCK_DIV	0x03, 0x09	
Set PRECHARGE_TIME_R	0x08, 0x03	0x08, 0x00
Set PRECHARGE_TIME_G	0x09, 0x05	0x09, 0x00
Set PRECHARGE_TIME_B	0x0A, 0x05	0x0A, 0x00
Set PRECHARGE_CURRENT_R	0x0B, 0x56	0x0B, 0x00
Set PRECHARGE_CURRENT_G	0x0C, 0x4D	0x0C, 0x00
Set PRECHARGE_CURRENT_B	0x0D, 0x46	0x0D, 0x00
Set DRIVING_CURRENT_R	0x10, 0x0A	0x10, 0x0D
Set DRIVING_CURRENT_G	0x11, 0x0A	0x11, 0x0C
Set DRIVING_CURRENT_B	0x12, 0x0A	0x12, 0x0B
Set DISPLAY_MODE_SET	0x13, 0x00	
Set RGB_IF	0x14, 0x01	
Set RGB_POL	0x15, 0x00	
Set MEMORY_WRITE_MODE	0x16, 0x76	
Set MX1_ADDR	0x17, 0x00	
Set MX2_ADDR	0x18, 0x9F	
Set MY1_ADDR	0x19, 0x00	
Set MY2_ADDR	0x1A, 0x7F	
Set MEMORY_ACCESS_POINTER X	0x20, 0x00	
Set MEMORY_ACCESS_POINTER Y	0x21, 0x00	
Set DUTY	0x28, 0x7F	
Set DSL	0x29, 0x00	
Set D1_DDRAM_FAC	0x2E, 0x00	
Set D1_DDRAM_FAR	0x2F, 0x00	

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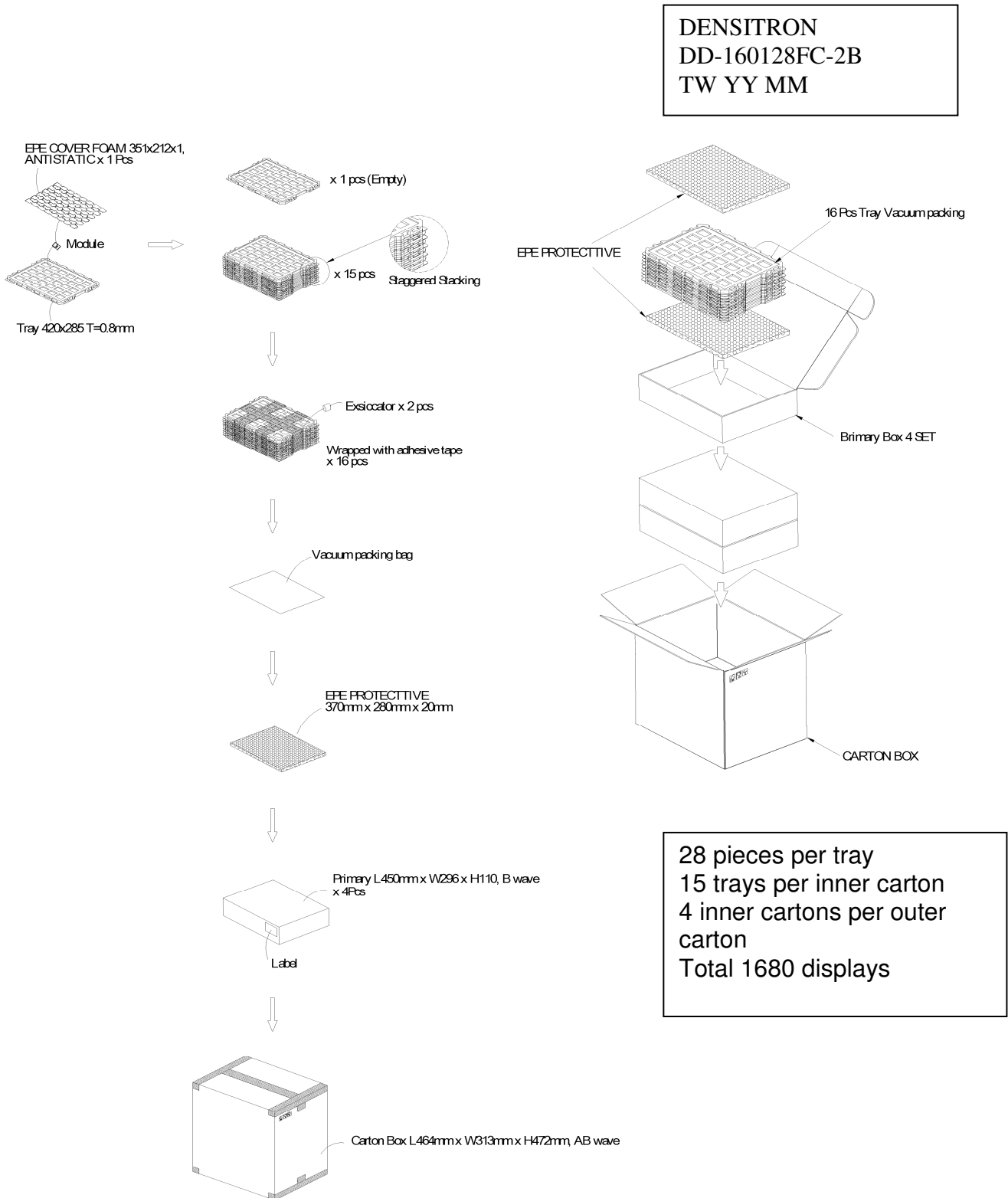
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Set D1_DDRAM_SAC	0x31, 0x00
Set D1_DDRAM_SAR	0x32, 0x00
Set SCR1_FX1	0x33, 0x00
Set SCR1_FX2	0x34, 0x9F
Set SCR1_FY1	0x35, 0x00
Set SCR1_FY2	0x36, 0x7F
Set IREF	0x80, 0x00
Set DISP_ON_OFF	0x06, 0x01

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## 6 PACKAGING AND LABELLING SPECIFICATION



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## 7 QUALITY ASSURANCE SPECIFICATION

### 7.1 CONFORMITY

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

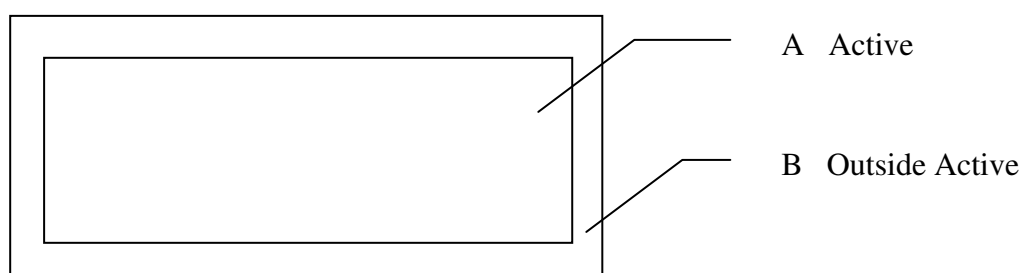
### 7.2 DELIVERY ASSURANCE

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#### 7.2.1 DELIVERY INSPECTION STANDARDS

IPC-AA610, class 2 electronic assemblies standard

#### 7.2.2 Zone definition



#### 7.2.3 Visual inspection

Test and measurement to be conducted under following conditions :

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

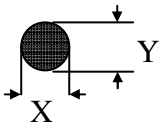
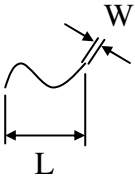
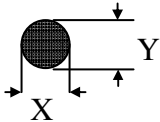
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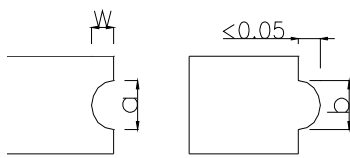
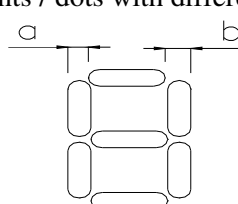
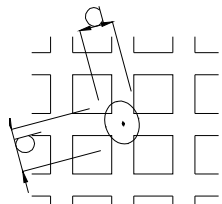
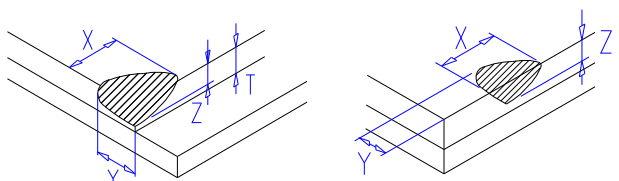
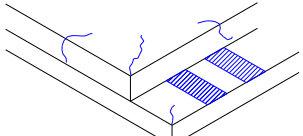
### 7.2.4 Standard of appearance inspection

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	OLED Display	Missing lines, short circuits or wrong patterns on OLED display are not allowed																																	
Minor	Black spot, white spot, dust	<p>Round type: as per following drawing  <math>\varnothing = (X+Y)/2</math></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><math>\varnothing &lt; 0.1</math></td> <td>Any number</td> <td rowspan="4">Any number</td> </tr> <tr> <td><math>0.1 &lt; \varnothing &lt; 0.2</math></td> <td>3</td> </tr> <tr> <td><math>0.2 &lt; \varnothing &lt; 0.25</math></td> <td>1</td> </tr> <tr> <td><math>0.25 &lt; \varnothing</math></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><math>W \leq 0.05</math></td> <td>Any number</td> <td rowspan="3">Any number</td> </tr> <tr> <td><math>L &lt; 2.0</math></td> <td><math>W \leq 0.1</math></td> <td>3</td> </tr> <tr> <td><math>L &gt; 2.0</math></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	$L < 2.0$	$W \leq 0.1$	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																																		
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$0.25 < \varnothing$	0																																		
Acceptable quantity																																			
Length	Width	Zone A	Zone B																																
--	$W \leq 0.05$	Any number	Any number																																
$L < 2.0$	$W \leq 0.1$	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><math>\varnothing = (X+Y)/2</math></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><math>\varnothing &lt; 0.5</math></td> <td>Any number</td> <td rowspan="2">Any number</td> </tr> <tr> <td><math>\varnothing &gt; 0.5</math></td> <td>0</td> </tr> </tbody> </table>	Acceptable quantity			Size	Zone A	Zone B	$\varnothing < 0.5$	Any number	Any number	$\varnothing > 0.5$	0																						
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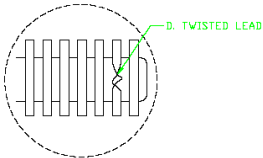
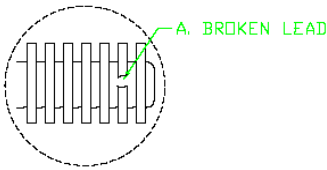
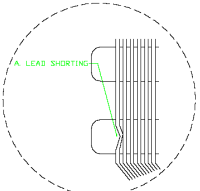
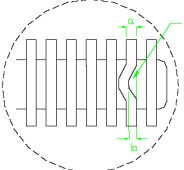
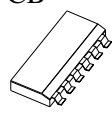
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Class	Item	Criteria																												
Minor	Segment deformation	<p>1b. Pin hole on dot matrix display</p>  <table border="1" data-bbox="1005 380 1404 560"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th></th> </tr> </thead> <tbody> <tr> <td><math>a, b &lt; 0.1</math></td> <td>Any number</td> </tr> <tr> <td><math>(a+b)/2 \le 0.1</math></td> <td>Any number</td> </tr> <tr> <td><math>0.5 &lt; \varnothing &lt; 1.0</math></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="1005 761 1404 873"> <thead> <tr> <th colspan="2">Acceptable</th> </tr> </thead> <tbody> <tr> <td><math>a \geq b</math></td> <td><math>a/b \leq 4/3</math></td> </tr> <tr> <td><math>a &lt; b</math></td> <td><math>a/b &gt; 4/3</math></td> </tr> </tbody> </table> <p>3. Alignment layer defect <math>\varnothing = (a+b)/2</math></p>  <table border="1" data-bbox="1005 940 1404 1164"> <thead> <tr> <th colspan="2">Acceptable quantity</th> </tr> <tr> <th>Size</th> <th></th> </tr> </thead> <tbody> <tr> <td><math>\varnothing \leq 0.4</math></td> <td>Any number</td> </tr> <tr> <td><math>0.4 &lt; \varnothing \leq 1.0</math></td> <td>5</td> </tr> <tr> <td><math>1.0 &lt; \varnothing \leq 1.5</math></td> <td>3</td> </tr> <tr> <td><math>1.5 &lt; \varnothing \leq 2.0</math></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																													
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$1.0 < \varnothing \leq 1.5$	3																													
$1.5 < \varnothing \leq 2.0$	2																													
Minor	Panel Chipping	<p><math>X \leq 1/6</math> Panel length <math>Y \leq 1</math> <math>Z \leq T</math></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 affect electrical function																												

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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><math>\varnothing &lt; 0.2</math></td> <td>Any number</td> </tr> <tr> <td><math>\varnothing &gt; 0.25</math></td> <td>4</td> </tr> <tr> <td rowspan="2">On display</td> <td><math>\varnothing \geq 0.25</math></td> <td>2</td> </tr> <tr> <td><math>L = 3</math></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													

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## **7.3 DEALING WITH CUSTOMER COMPLAINTS**

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### **7.3.1 Non-conforming analysis**

Purchaser should supply Densitron with detailed data of non-conforming sample.  
 After accepting it, Densitron should complete the analysis in two weeks from receiving the sample.  
 If the analysis cannot be completed on time, Densitron must inform the purchaser.

### **7.3.2 Handling of non-conforming displays**

If any non-conforming displays are found during customer acceptance inspection which Densitron is clearly responsible for, return them to Densitron.  
 Both Densitron and customer should analyse the reason and discuss the handling of non-conforming displays when the reason is not clear.  
 Equally, both sides should discuss and come to agreement for issues pertaining to modification of Densitron quality assurance standard.

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## 8 RELIABILITY SPECIFICATION

### 8.1 RELIABILITY TESTS

Test Item	Test Condition	Evaluation and assessment
High Temperature Operation	70°C±2, 240 hours	No abnormalities in function and appearance
Low Temperature Operation	-40°C±2, 240 hours	No abnormalities in function and appearance
High Temperature Storage	80°C±2, 240 hours	No abnormalities in function and appearance
Low Temperature Storage	-40°C±2, 240 hours	No abnormalities in function and appearance
High Temperature & High Humidity Storage(Operation)	60°C±2, 90%RH, 120 hours	No abnormalities in function and appearance
Thermal Shock	24 cycle of -40°C 1 Hour, 85°C 1 Hour	No abnormalities in function and appearance

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

#### 8.1.1 FAILURE CHECK STANDARD

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

### 8.2 LIFE TIME

Item	Description
1	Function, performance, appearance, etc. shall be free from remarkable deterioration more than 10,000 hours under 75 cd/m <sup>2</sup> brightness 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.

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## 9 HANDLING PRECAUTIONS

### *Safety*

If the panel breaks, be careful not to get the organic substance in your mouth or in your eyes.

If the organic substance touches your skin or clothes, wash it off immediately using soap and plenty of water.

### *Mounting and Design*

Place a transparent plate (e.g. acrylic, polycarbonate or glass) on the display surface to protect the display from external pressure. Leave a small gap between the transparent plate and the display surface.

Design the system so that no input signal is given unless the power supply voltage is applied.

### *Caution during OLED cleaning*

Lightly wipe the display surface with a soft cloth soaked with Isopropyl alcohol, Ethyl alcohol or Trichlorotrifluoroethane.

Do not wipe the display surface with dry or hard materials that will damage the polariser surface.

Do not use aromatic solvents (toluene and xylene), or ketonic solvents (ketone and acetone).

### *Caution against static charge*

As the display uses C-MOS LSI drivers, connect any unused input terminal to  $V_{DD}$  or  $V_{SS}$ . Do not input any signals before power is turned on.

Also, ground your body, work/assembly table and assembly equipment to protect against static electricity.

### *Packaging*

Displays use OLED elements, and must be treated as such. Avoid strong shock and drop from a height.

To prevent displays from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

### *Caution during operation*

It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life.

### *Other Precautions*

When a display module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur.

Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored.

Also, there will be no problem in the reliability of the module.

### *Storage*

Store the display in a dark place where the temperature is  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$  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).

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