

**PRODUCT** : OLED MODULE**MODEL NO.** : OEL-TG2P0238ZPOY-W-E**SUPPLIER** : TRULY SEMICONDUCTORS LTD.**DATE** : July 22, 2008CERT. No. QAC0946535  
(ISO9001)CERT. No. HKG002005  
(ISO14001)

# SPECIFICATION

Revision: 1.1

## OEL-TG2P0238ZPOY-W-E

This module uses ROHS material

If there is no special request from customer, TRULY SEMICONDUCTORS Co., Ltd will not reserve the tooling of the product under the following conditions:

1. There is no response from customer in two years after TRULY SEMICONDUCTORS Co., Ltd submit the samples;
2. There is no order in two years after the latest mass production.

And correlated data (include quality record) will be reserved one year more after tooling was discarded.

**TRULY SEMICONDUCTORS LTD:****CUSTOMER:**
 Quality Assurance Department: \_\_\_\_\_  
 Approved by:  
 Technical Department: \_\_\_\_\_

Approved by:



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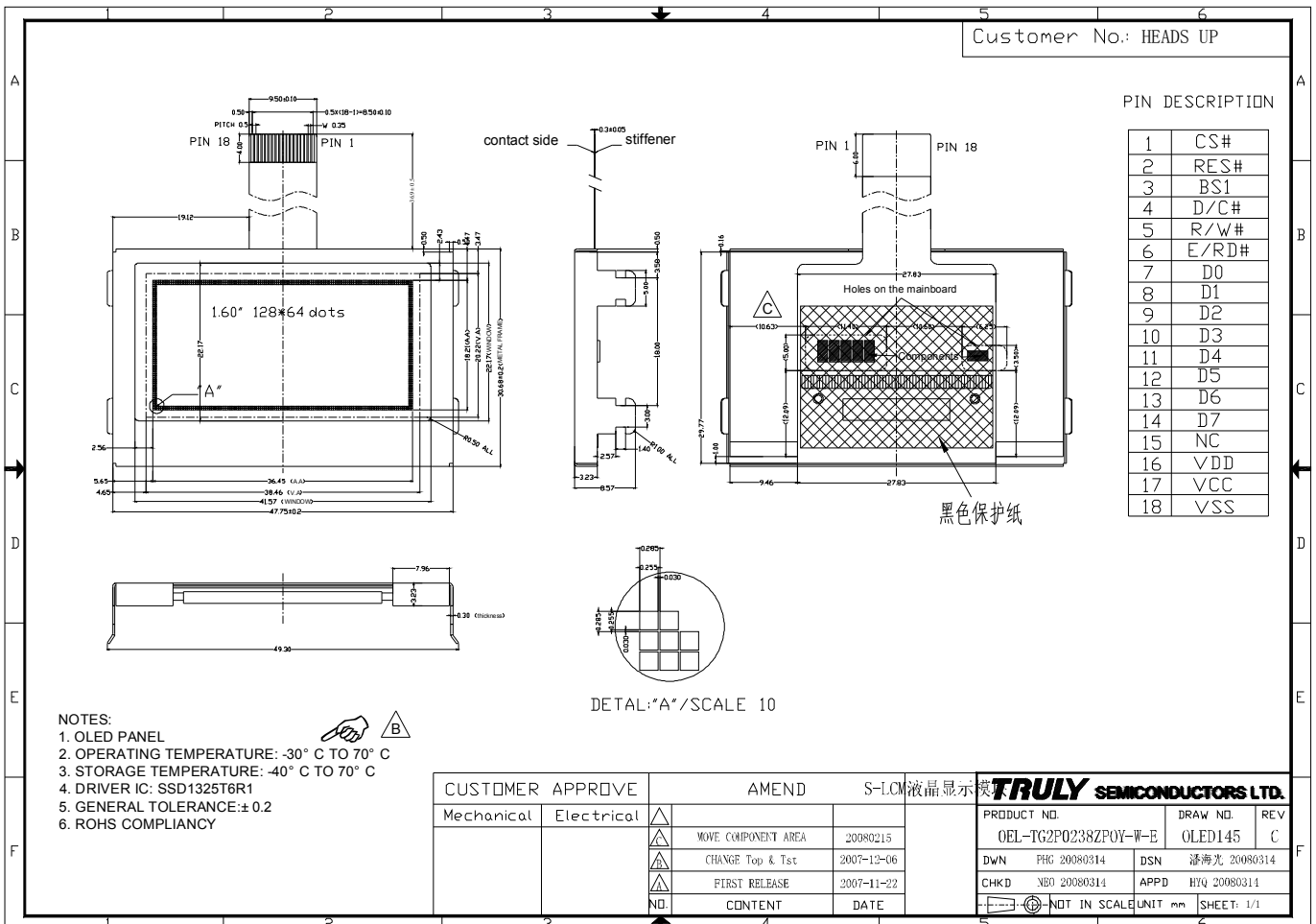
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<b>WRITTEN BY</b>	<b>CHECKED BY</b>	<b>APPROVED BY</b>
XT LIU	PENG JUN TING	QJMING

## GENERAL INFORMATION

Item	Contents	Unit
LCD type	OLED panel	/
Module outline (W × H)	47.75 × 30.68	mm <sup>2</sup>
Viewing area (W×H)	38.46 × 20.22	mm <sup>2</sup>
Active area (W×H)	36.45 × 18.21	mm <sup>2</sup>
Number of Dots	128 × 64	/
Dot size (W × H)	0.255 × 0.255	mm <sup>2</sup>
Dot pitch (W × H)	0.285 × 0.285	mm <sup>2</sup>
Driver IC	SSD1325T6R1	/
Interface Type	System parallel interface, System Serial Interface	/
Diagonal Size	1.6	Inch
Display Color	Yellow	/
Grayscale	4	Bit
Thickness	8.57	mm

## EXTERNAL DIMENSIONS



**■ABSOLUTE MAXIMUM RATINGS**

Parameter		Symbol	Min	Max	Unit
Supply Voltage	Logic	V <sub>DD</sub>	-0.3	4.0	V
	Driving	V <sub>CC</sub>	-0.3	17	V
Operating temperature		T <sub>OP</sub>	-30	70	°C
Storage temperature		T <sub>ST</sub>	-40	70	°C
Humidity		RH		90%(Max60°C)	RH

**NOTE:**

Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded.

Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

**■ELECTRICAL CHARACTERISTICS**

## DC CHARACTERISTICS

( Ta = 25°C )

Parameter		Symbol	Min	Typ	Max	Unit
Supply Voltage	Logic	V <sub>DD</sub>	2.4	3.0	3.5	V
	Operating	V <sub>CC</sub>	8.0	12.0	16.0	V
Input voltage 'H' level		V <sub>IH</sub>	0.8V <sub>DD</sub>	-	V <sub>DD</sub>	V
Input voltage 'L' level		V <sub>IL</sub>	0	-	0.2V <sub>DD</sub>	V
Output voltage 'H' level		V <sub>OH</sub>	0.9V <sub>DD</sub>	-	V <sub>DD</sub>	V
Output voltage 'L' level		V <sub>OL</sub>	0	-	0.1V <sub>DD</sub>	V

AC CHARACTERISTICS

Conditions:

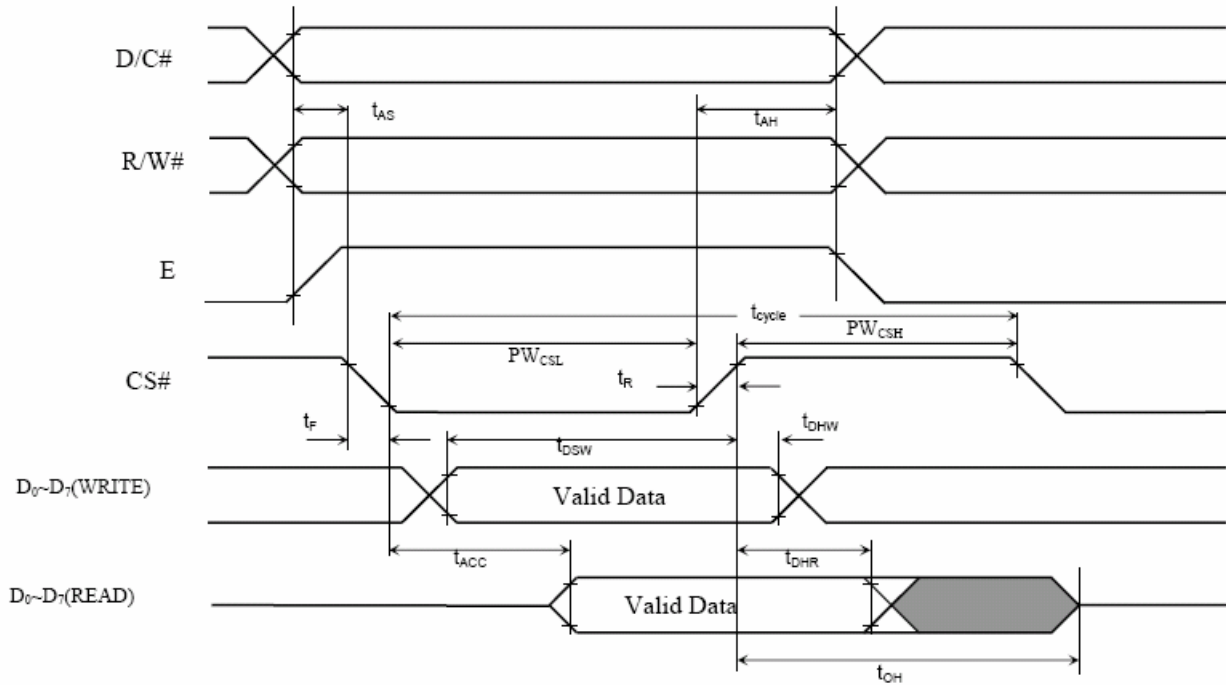
$V_{DD} - V_{SS} = 2.4 \text{ to } 3.5\text{V}$

$T_A = 25^\circ\text{C}$

Table 25 : 6800-Series MPU Parallel Interface Timing Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$t_{cycle}$	Clock Cycle Time	300	-	-	ns
$t_{AS}$	Address Setup Time	0	-	-	ns
$t_{AH}$	Address Hold Time	0	-	-	ns
$t_{DSW}$	Write Data Setup Time	40	-	-	ns
$t_{DHW}$	Write Data Hold Time	15	-	-	ns
$t_{DHR}$	Read Data Hold Time	20	-	-	ns
$t_{OH}$	Output Disable Time	-	-	70	ns
$t_{ACC}$	Access Time	-	-	140	ns
$PW_{CSL}$	Chip Select Low Pulse Width (read)	120	-	-	ns
	Chip Select Low Pulse Width (write)	60	-	-	ns
$PW_{CSH}$	Chip Select High Pulse Width (read)	60	-	-	ns
	Chip Select High Pulse Width (write)	60	-	-	ns
$t_R$	Rise Time	-	-	15	ns
$t_F$	Fall Time	-	-	15	ns

Figure 36 : 6800-series MPU Parallel Interface Characteristics



**Conditions:**

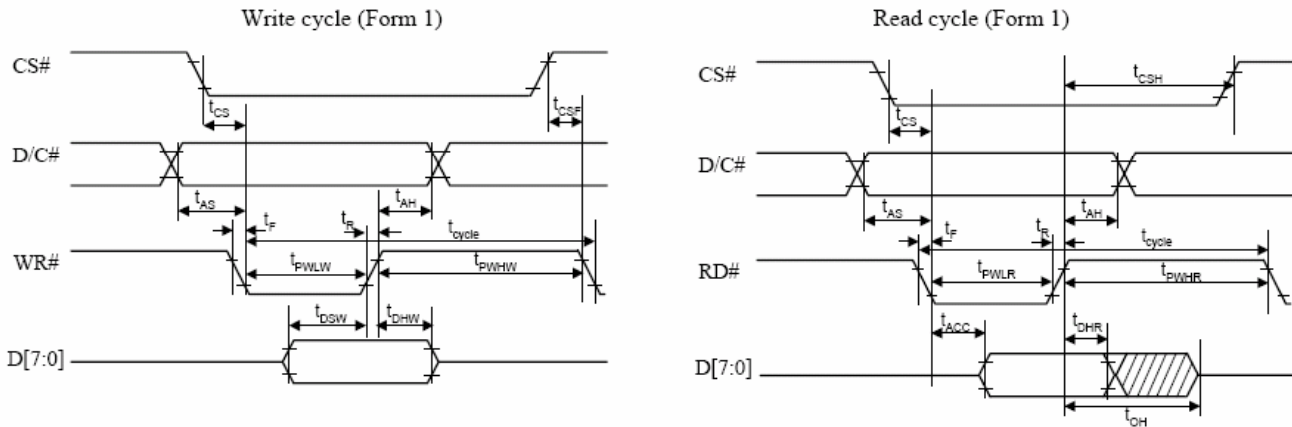
$V_{DD} - V_{SS} = 2.4 \text{ to } 3.5V$

$T_A = 25^\circ C$

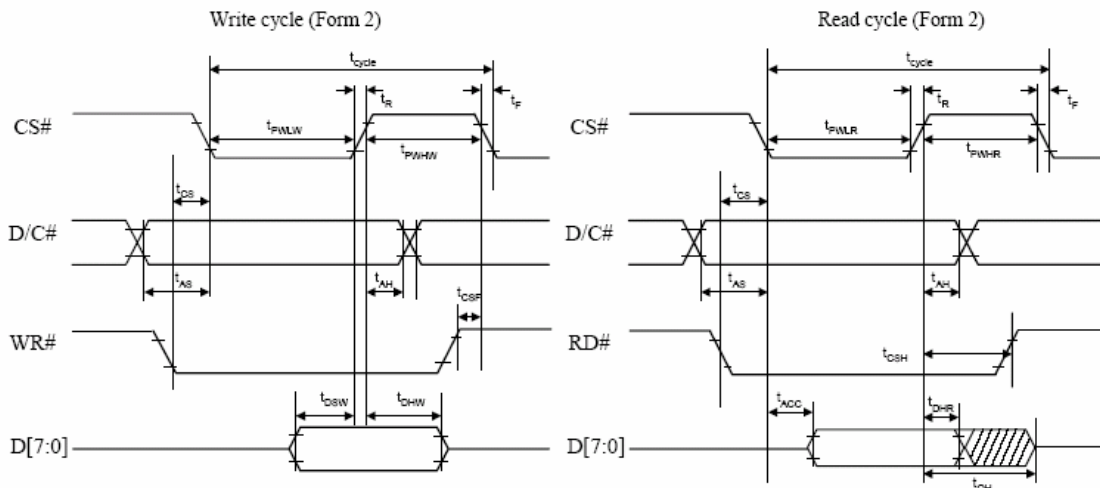
**Table 26 : 8080-Series MPU Parallel Interface Timing Characteristics**

Symbol	Parameter	Min	Typ	Max	Unit
$t_{cycle}$	Clock Cycle Time	300	-	-	ns
$t_{AS}$	Address Setup Time	10	-	-	ns
$t_{AH}$	Address Hold Time	0	-	-	ns
$t_{DSW}$	Write Data Setup Time	40	-	-	ns
$t_{DHW}$	Write Data Hold Time	15	-	-	ns
$t_{DHR}$	Read Data Hold Time	20	-	-	ns
$t_{OH}$	Output Disable Time	-	-	70	ns
$t_{ACC}$	Access Time	-	-	140	ns
$t_{PWLr}$	Read Low Time	120	-	-	ns
$t_{PWLw}$	Write Low Time	60	-	-	ns
$t_{PWHr}$	Read High Time	60	-	-	ns
$t_{PWHw}$	Write High Time	60	-	-	ns
$t_R$	Rise Time	-	-	15	ns
$t_F$	Fall Time	-	-	15	ns
$t_{CS}$	Chip select setup time	0	-	-	ns
$t_{CSH}$	Chip select hold time to read signal	0	-	-	ns
$t_{CSF}$	Chip select hold time	20	-	-	ns

**Figure 37 : 8080-series parallel interface characteristics (Form 1)**



**Figure 38 : 8080-series parallel interface characteristics (Form 2)**



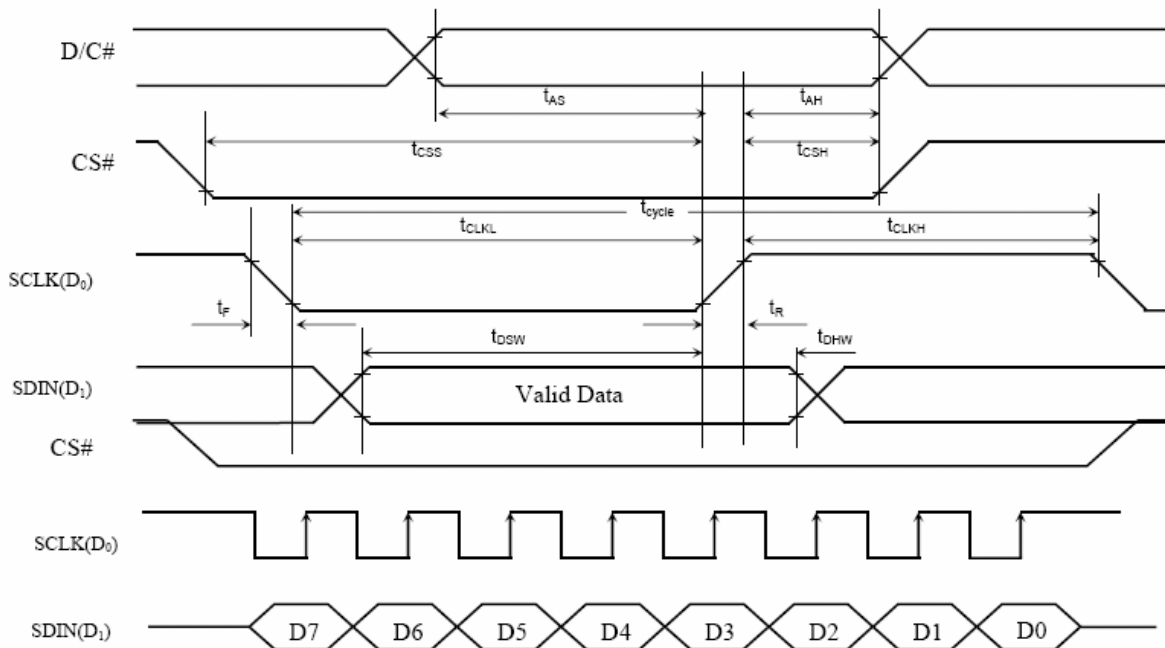
**Conditions:**

$V_{DD} - V_{SS} = 2.4 \text{ to } 3.5\text{V}$

$T_A = 25^\circ\text{C}$

**Table 27 : Serial Interface Timing Characteristics**

Symbol	Parameter	Min	Typ	Max	Unit
$t_{\text{cycle}}$	Clock Cycle Time	250	-	-	ns
$t_{\text{AS}}$	Address Setup Time	150	-	-	ns
$t_{\text{AH}}$	Address Hold Time	150	-	-	ns
$t_{\text{CSS}}$	Chip Select Setup Time	120	-	-	ns
$t_{\text{CSH}}$	Chip Select Hold Time	60	-	-	ns
$t_{\text{DSW}}$	Write Data Setup Time	100	-	-	ns
$t_{\text{DHW}}$	Write Data Hold Time	100	-	-	ns
$t_{\text{CLKL}}$	Clock Low Time	100	-	-	ns
$t_{\text{CLKH}}$	Clock High Time	100	-	-	ns
$t_{\text{R}}$	Rise Time	-	-	15	ns
$t_{\text{F}}$	Fall Time	-	-	15	ns

**Figure 39 : Serial Interface Characteristics**


## ■ TIMING OF POWER SUPPLY

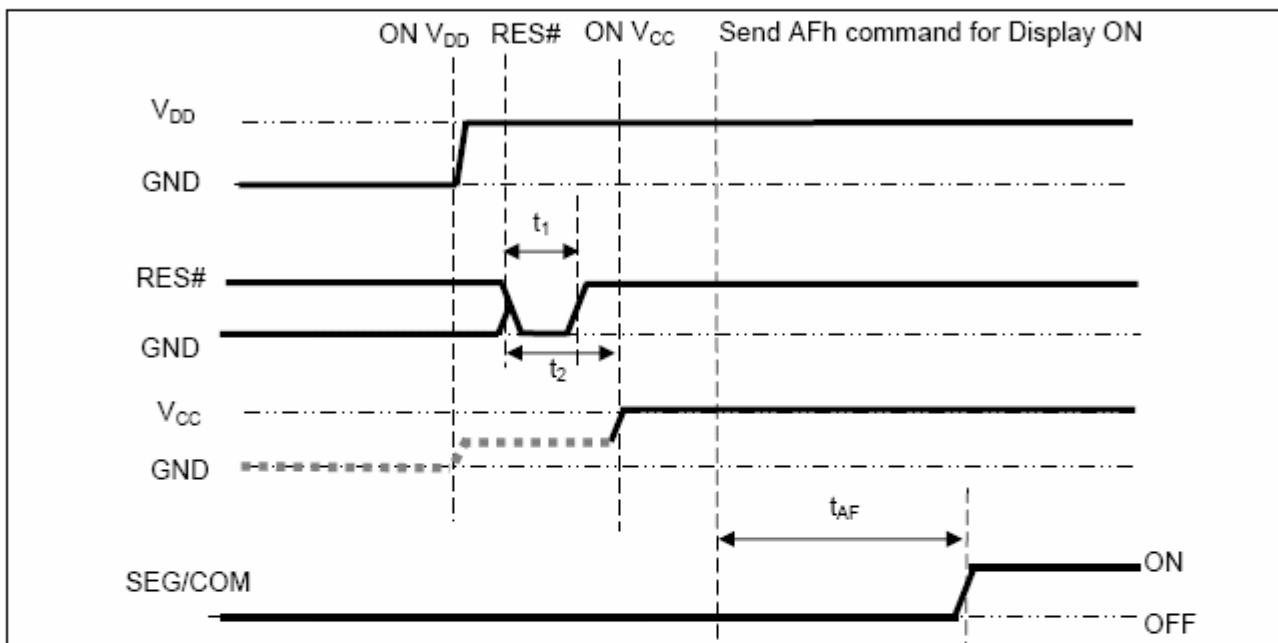
PLEASE REFER TO THE DRIVER IC SPECIFICATION.

The following figures illustrate the recommended power ON and power OFF sequence of SSD1325.

*Power ON sequence:*

1. Power ON  $V_{DD}$ .
2. After  $V_{DD}$  become stable, set RES# pin LOW (logic LOW) for at least 3 $\mu$ s ( $t_1$ ) and then HIGH (logic HIGH).
3. After set RES# pin LOW (logic LOW), wait for at least 3 $\mu$ s ( $t_2$ ). Then Power ON  $V_{CC}$ .<sup>(1)</sup>
4. After  $V_{CC}$  become stable, send command AFh for display ON. SEG/COM will be ON after 100ms ( $t_{AF}$ ).

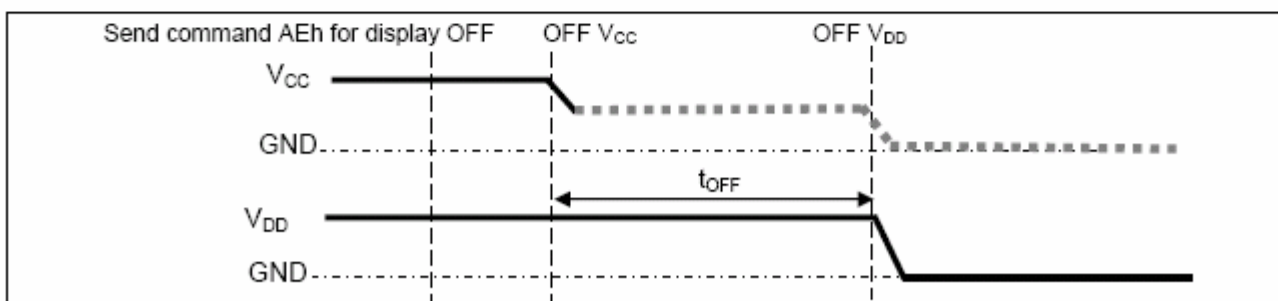
Figure 16 : The Power ON sequence



*Power OFF sequence:*

1. Send command AEh for display OFF.
2. Wait until panel discharges completely.
3. Power OFF  $V_{CC}$ .<sup>(1), (2)</sup>
4. Wait for  $t_{OFF}$ . Power OFF  $V_{DD}$ . (where Minimum  $t_{OFF}$ =0ms, Typical  $t_{OFF}$ =100ms)

Figure 17 : The Power OFF sequence



**Note:**

<sup>(1)</sup> Since an ESD protection circuit is connected between  $V_{DD}$  and  $V_{CC}$ ,  $V_{CC}$  becomes lower than  $V_{DD}$  whenever  $V_{DD}$  is ON and  $V_{CC}$  is OFF as shown in the dotted line of  $V_{CC}$  in Figure 16 and Figure 17.

<sup>(2)</sup>  $V_{CC}$  should be kept float when it is OFF.

## ■ ELECTRO-OPTICAL CHARACTERISTICS (Ta=25°C)

Items	Symbol	Min.	Typ.	Max.	Unit	Remark	
Operating Luminance	L	70	80*	-	cd /m <sup>2</sup>	Yellow	
Power Consumption	P	-	80	90	mW	30% pixels ON L=80cd/m <sup>2</sup>	
Frame Frequency	Fr	-	100	-	Hz		
Color Coordinate	YELLOW	CIE x	0.41	0.46	0.51	CIE1931	Darkroom
		CIE y	0.46	0.51	0.56		
Response Time	Rise	Tr	-	-	0.02	ms	-
	Decay	Td	-	-	0.02	ms	-
Contrast Ratio*	Cr	10000:1	-	-			Darkroom
Viewing Angle Uniformity	△θ	160	-	-	Degree		-
Operating Life Time*	Top	100,000	-	-	Hours		L=80cd/m <sup>2</sup>

Note:

1. **80cd/m<sup>2</sup>** is base on V<sub>DD</sub>=3.0V, V<sub>PP</sub>=12.0V, contrast command setting 0x40;
2. **Contrast ratio** is defined as follows:

$$\text{ratio} = \frac{\text{Contrast Photo - detector output with OLED being "white"}}{\text{Photo - detector output with OLED being "black"}}$$

3. **Life Time** is defined when the Luminance has decayed to less than 50% of the initial Luminance specification. ( 30% pixels scrolling display on)  
(The initial value should be closed to the typical value after adjusting.)

**■ INTERFACE DESCRIPTION**

Pin No.	Symbol	Level	Description
1	CS#	H/L	The chip select pin. Low is enabled
2	RES#	H/L	This pin is reset signal input .
3	BS1	H/L	It is the MPU interface switched pad(L:6800; H:8080)
4	D/C#	H/L	Data/Command data control pin
5	R/W#	H/L	MCU interface input pin
6	E/RD#	H/L	MCU interface input pin
7	D0	H/L	Data bus or as SCLK In SPI mode
8	D1	H/L	Data bus or as SDIN In SPI mode
9	D2	H/L	Data bus or left open In SPI mode
10	D3	H/L	Data bus or connected to Ground In SPI mode
11	D4	H/L	Data bus or connected to Ground In SPI mode
12	D5	H/L	Data bus or connected to Ground In SPI mode
13	D6	H/L	Data bus or connected to Ground In SPI mode
14	D7	H/L	Data bus or connected to Ground In SPI mode
15	NC	---	No connection
16	VDD	---	Logic voltage supply for IC
17	VCC	---	High voltage supply for OLED panel
18	VSS	0V	Ground

**■ APPLICATION CIRCUIT**

Please consult our technical department for detail information.

**■ INITIAL CODE**

Please consult our technical department for detail information.

**■ RELIABILITY**

Item		Condition	Criterion
High Temperature Storage (HTS)		70±2°C, 200 hours	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.
High Temperature Operating (HTO)		70±2°C, 96 hours	
Low Temperature Storage (LTS)		-40±2°C, 200 hours	
Low Temperature Operating (LTO)		-30±2°C, 96 hours	
High Temperature / High Humidity Storage (HTHHS)		50±3°C, 90%±3%RH, 120 hours	
Thermal Shock (Non-operation)  (TS)		-30±2°C ~ 25°C ~ 70±2°C  (30min) (5min) (30min)  10cycles	
Vibration (Packing)	10~55~10Hz, amplitude 1.5mm, 1 hour for each direction x, y, z	1. One box for each test. 2. No addition to the cosmetic and the electrical defects.	
Drop (Packing)	Height : 1 m, each time for 6 sides, 3 edges, 1 angle		
ESD (finished product housing)	±4kV (R: 330Ω C: 150pF, 10times, air discharge)	1. After testing, cosmetic and electrical defects should not happen. 2. In case of malfunction or defect caused by ESD damage, it would be judged as a good part if it would be recovered to normal state after resetting.	

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).

3) The test should be done after 2 hours of recovery time in normal environment.

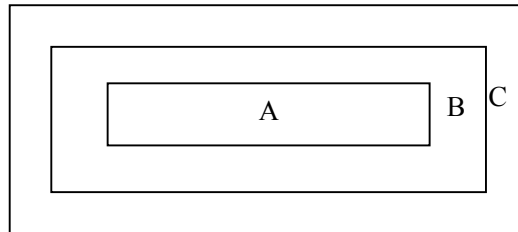
## ■ OUTGOING QUALITY CONTROL SPECIFICATION

### ◆ 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

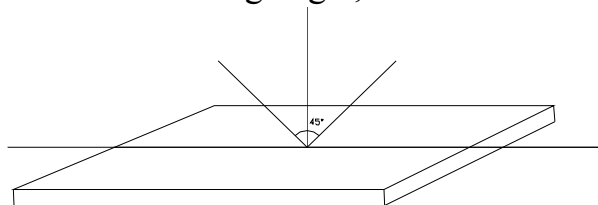
Zone C: Outside Viewing Area

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 45° viewing angle, under 25±5°C.



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

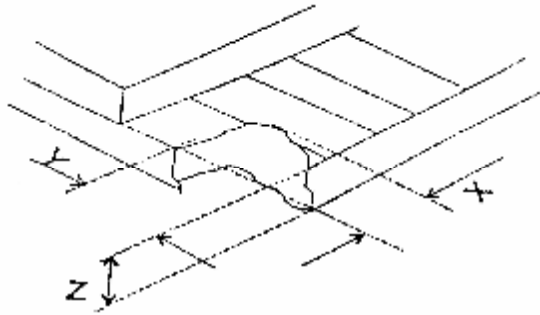
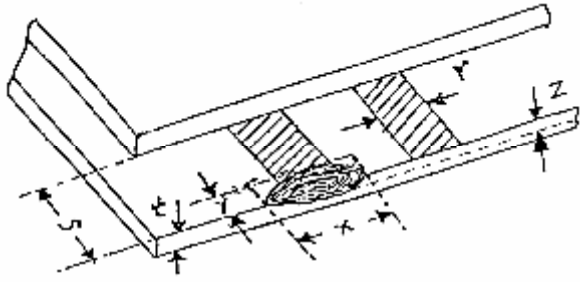
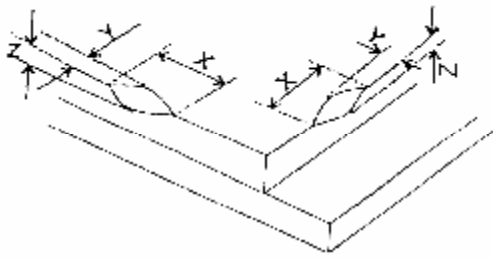
### ◆ Inspection Criteria

- 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

Item	Criterion			
	Size (mm)		Accepted Qty	
Spot Defect (dimming and lighting spot)		$\Phi \leq 0.10$	Ignored	
		$0.10 < \Phi \leq 0.15$	3	Ignored
		$0.15 < \Phi \leq 0.20$	1	
		$0.20 < \Phi$	0	
	Note : $\Phi = (x + y) / 2$			
Line Defect (dimming and lighting line)	L ( Length ) : mm	W ( Width ) : mm	Area A + Area B	Area C
	/	$W \leq 0.03$	Ignored	
	$L \leq 3.0$	$0.03 < W \leq 0.05$	2	Ignored
	$L \leq 2.0$	$0.05 < W \leq 0.08$	1	
	/	$0.08 < W$	As spot defect	
Remarks: The total of spot defect and line defect shall not exceed 4 pcs.				
Polarizer Stain	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.			
Polarizer Scratch	1. If scratch can be seen during operation, according to the criterions of the Spot Defect and the Line Defect.			
	2. If scratch can be seen only under non-operation or some special angle, the criterion is as below :			
	L ( Length ) : mm	W ( Width ) : mm	Area A + Area B	Area C
	/	$W \leq 0.03$	Ignore	
	$5.0 < L \leq 10.0$	$0.03 < W \leq 0.05$	2	Ignore
	$L \leq 5.0$	$0.05 < W \leq 0.08$	1	
/	$0.08 < W$	0		
Polarizer Air Bubble	Size		Area A + Area B	Area C
		$\Phi \leq 0.20$	Ignored	
		$0.20 < \Phi \leq 0.50$	2	Ignored
		$0.50 < \Phi \leq 0.80$	1	
		$0.80 < \Phi$	0	

Glass Defect (Glass Chipped )	<p>1. On the corner</p>  <table border="1" data-bbox="1061 309 1425 474"> <tr> <td>x</td> <td><math>\leq 2.0</math></td> </tr> <tr> <td>y</td> <td><math>\leq S</math></td> </tr> <tr> <td>z</td> <td><math>\leq t</math></td> </tr> </table>	x	$\leq 2.0$	y	$\leq S$	z	$\leq t$
	x	$\leq 2.0$					
	y	$\leq S$					
z	$\leq t$						
<p>2. On the bonding edge</p>  <table border="1" data-bbox="1061 810 1425 976"> <tr> <td>x</td> <td><math>\leq a / 2</math></td> </tr> <tr> <td>y</td> <td><math>\leq s / 3</math></td> </tr> <tr> <td>z</td> <td><math>\leq t</math></td> </tr> </table>	x	$\leq a / 2$	y	$\leq s / 3$	z	$\leq t$	
x	$\leq a / 2$						
y	$\leq s / 3$						
z	$\leq t$						
<p>3. On the other edges</p>  <table border="1" data-bbox="1061 1281 1425 1447"> <tr> <td>x</td> <td><math>\leq a / 5</math></td> </tr> <tr> <td>y</td> <td><math>\leq 1.0</math></td> </tr> <tr> <td>z</td> <td><math>\leq t</math></td> </tr> </table>	x	$\leq a / 5$	y	$\leq 1.0$	z	$\leq t$	
x	$\leq a / 5$						
y	$\leq 1.0$						
z	$\leq t$						
<p>Note: t: glass thickness ; s: pad width ; a: the length of the edge</p>							
TCP Defect	Crack, deep fold and deep pressure mark on the TCP are not accepted						
Pixel Size	The tolerance of display pixel dimension should be within $\pm 20\%$ of the spec						
Luminance	Refer to the spec or the reference sample						
Color	Refer to the spec or the reference sample						

## ■ 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 corrode 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:  $V_{DD} \rightarrow V_{CC}$ , and power off sequence:  $V_{CC} \rightarrow V_{DD}$ .
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 :  $260^{\circ}\text{C} \pm 10^{\circ}\text{C}$ .
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) TRULY will replace or repair any of its OLED modules which are found to be functional defect when inspected in accordance with TRULY OLED acceptance standards (copies available upon request). Cosmetic/visual defects must be returned to TRULY within 90 days of shipment. Confirmation of such date should be based on freight documents. The warranty liability of TRULY is limited to repair and/or replacement on the terms above. TRULY 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.

**■ PRIOR CONSULT MATTER**

- 1.①For Truly standard products, we keep the right to change material, process ... for improving the product property without notice on our customer.  
②For OEM products, if any change needed which may affect the product property, we will consult with our customer in advance.
- 2.If you have special requirement about reliability condition, please let us know before you start the test on our samples.

**■ FACTORY**

**FACTORY NAME:** TRULY SEMICONDUCTORS LTD.

**FACTORY ADDRESS:** Truly Industrial Area, ShanWei City,GuangDong,China

**P.C:** 516600 **URL:** <http://www.truly.com.hk> <http://www.trulysemi.com>