

Product Specification

(Preliminary)

Product Name: LH12864L096A

Product Code: M00750

Customer
Approved by Customer
Approved Date:

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PRODUCT SPECIFICATION

REVISION RECORD

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PRODUCT SPECIFICATION

1 Overview

LH12864L096A is a monochrome OLED display module with 128×64 dot matrix. The characteristics of this display module are high brightness, self-emission, high contrast ratio, slim/thin outline, wide viewing angle, wide temperature range, and low power consumption.

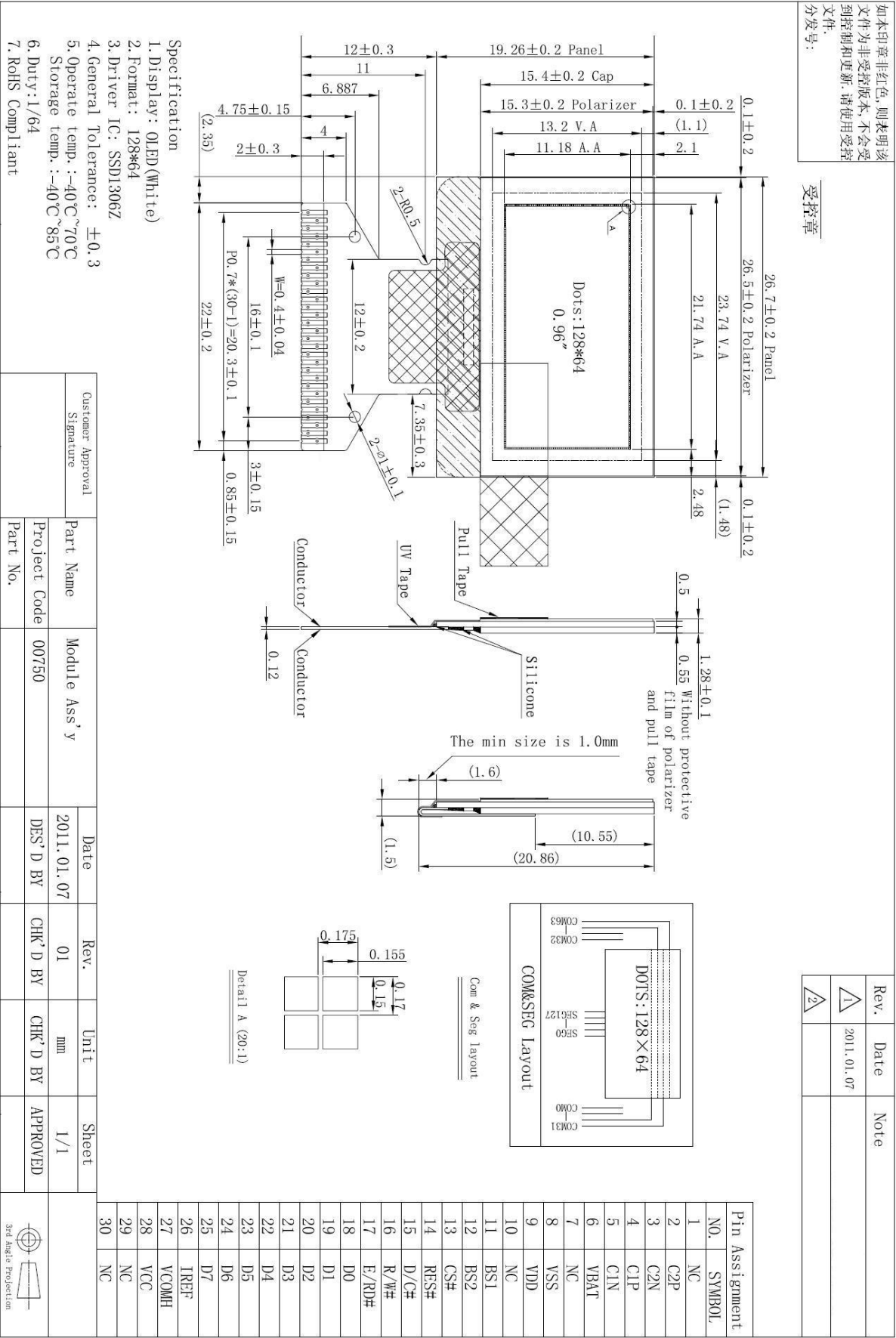
2 Features

- Display Color: White
- Dot Matrix: 128×64
- Driver IC: SSD1306Z
- Interface: 8-bit 6800、8-bit 8080、I²C 、4-Wire SPI
- Wide range of operating temperature: -40℃ to 70℃

3 Mechanical Data

NO.	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	128(W)×64(H)	-
2	Dot Size	0.15(W)×0.155 (H)	mm ²
3	Dot Pitch	0.17(W)×0.175 (H)	mm ²
4	Aperture Rate	78	%
5	Active Area	21.74(W)×11.18 (H)	mm ²
6	Panel Size	26.7(W)×19.26(H)×1.05(T)	mm ³
7	Module Size	26.7(W)×31.26(H)×1.28(T)	mm ³
8	Diagonal A/A Size	0.96	inch
9	Module Weight	1.28±10%	gram

4 Mechanical Drawing



5 Module Interface

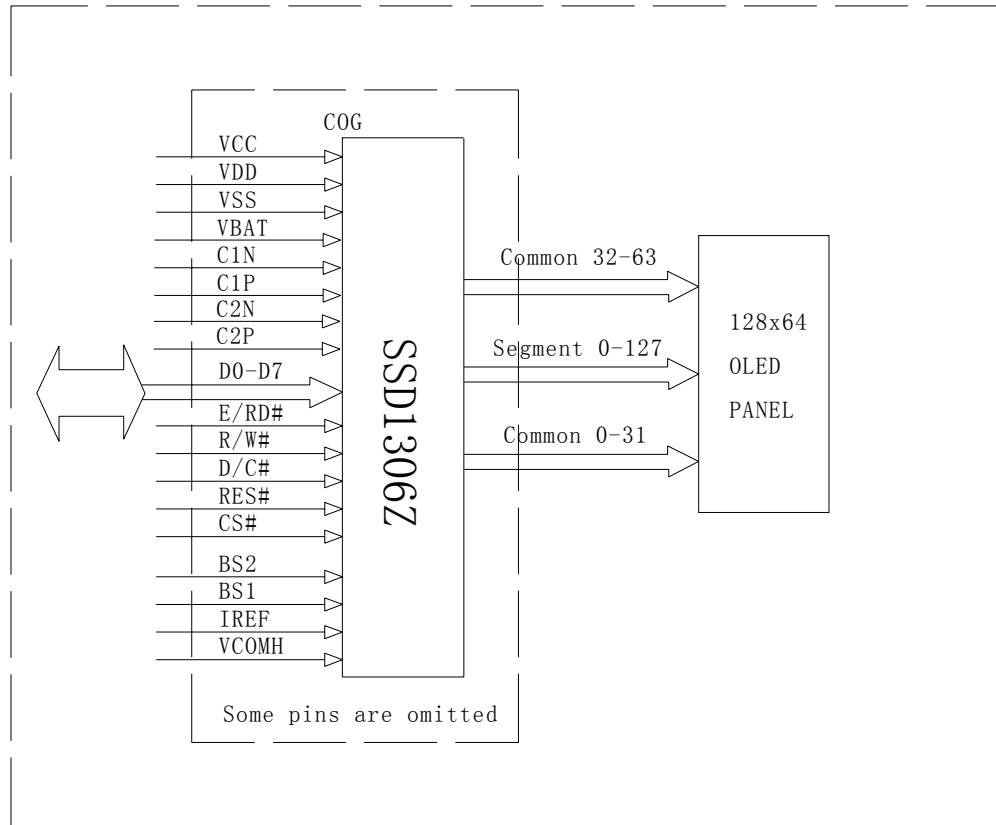
PIN NO.	PIN NAME	DESCRIPTION
1	NC	No Connection.
2	C2P	The Pin for charge pump capacitor; Connect to each other with a capacitor.
3	C2N	
4	C1P	
5	C1N	The Pin for charge pump capacitor; Connect to each other with a capacitor.
6	VBAT	Power supply for charge pump regulator circuit.
7	NC	No Connection.
8	VSS	Ground.
9	VDD	Power supply pin for core logic operation.
10	NC	No Connection.
11	BS1	Table 5-1
12	BS2	
13	CS#	Chip Select, active LOW.
14	RES#	This pin is reset signal input. When the pin is pulled LOW, initialization of the chip is executed. Keep this pin HIGH (i.e. connect to VDD) during normal operation.
15	D/C#	This is Data/Command control pin. When it is pulled HIGH (i.e. connect to VDD), the data at D[7:0] is treated as data. When it is pulled LOW, the data at D[7:0] will be transferred to the command register. In I ² C mode, this pin acts as SA0 for slave address selection.
16	R/W#	This is read / write control input pin connecting to the MCU interface. When interfacing to a 6800-series microprocessor, this pin will be used as Read/Write (R/W#) selection input. Read mode will be carried out when this pin is pulled HIGH (i.e. connect to VDD) and write mode when LOW. When 8080 interface mode is selected, this pin will be the Write (WR#) input. Data write operation is initiated when this pin is pulled LOW and the chip is selected. When serial or I ² C interface is selected, this pin must be connected to VSS.
17	E/RD#	When interfacing to a 6800-series microprocessor, this pin will be used as the Enable (E) signal. Read/write operation is initiated when this pin is pulled HIGH (i.e. connect to VDD) and the chip is selected. When connecting to an 8080-series microprocessor, this pin receives the Read (RD#) signal. Read operation is initiated when this pin is pulled LOW and the chip is selected. When serial or I ² C interface is selected, this pin must be connected to VSS.
18~25	D0~D7	These are 8-bit bi-directional data bus to be connected to the microprocessor's data bus. When serial interface mode is selected, D0 will be the serial clock input: SCLK; D1 will be the serial data input: SDIN and D2 should be kept NC. When I ² C mode is selected, D2, D1 should be tied together and serve as SDAout, SDAin in application and D0 is the serial clock input, SCL.
26	IREF	Segment output current reference pin
27	VCOMH	Common signal deselected voltage level. Connected a capacitor to VSS.
28	VCC	Power supply for panel driving voltage.
29~30	NC	No Connection.

Table 5-1: MCU Bus Interface Pin Selection

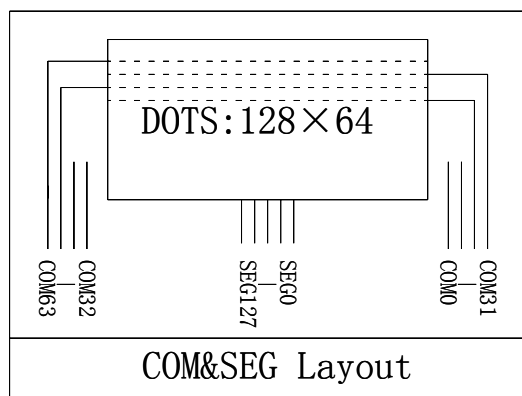
Pin Name	I ² C	6800	8080	4-SPI
BS1	1	0	1	0
BS2	0	1	1	0

6 Function Block Diagram

6.1 Function Block Diagram



6.2 Panel Layout Diagram



7 Absolute Maximum Ratings

ITEM	SYMBOL	MIN	MAX	UNIT	REMARK
Logic supply voltage	VDD	-0.3	4	V	IC maximum rating
Charge Pump Regulator Supply Voltage	VBAT	-0.3	5	V	IC maximum rating
OLED Operating voltage	VCC	0	16	V	IC maximum rating
Operating Temp.	Top	-40	70	°C	-
Storage Temp	Tstg	-40	85	°C	-

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

Note (2): Permanent breakage of module may occur if the module is used beyond the maximum rating. The module can be normal operated under the conditions according to Section 8 “Electrical Characteristics”. Malfunctioning of the module may occur and the reliability of the module may deteriorate if the module is used beyond the conditions.

8 Electrical Characteristics

8.1 DC Electrical Characteristics

ITEM	SYMBOL	TEST CONDITION	MIN	TYPE	MAX	UNIT
Logic Supply Voltage	VDD	22±3°C, 55±15%R.H	1.65	2.8	3.3	V
OLED Driver Supply Voltage (Supply Externally)	VCC	22±3°C, 55±15%R.H	7	7.2	7.5	V
OLED Driver Supply Voltage (Generated by Internal DC/DC)	VCC	22±3°C, 55±15%R.H	7	7.2	7.5	V
Charge Pump Regulator Supply Voltage	VBAT	22±3°C, 55±15%R.H	3.3	3.7	4.2	V
High-level Input Voltage	V _{IH}	-	0.8 × VDD	-	-	V
Low-level Input Voltage	V _{IL}	-	-	-	0.2 × VDD	V
High-level Output Voltage	V _{OH}	-	0.9 × VDD	-	-	V
Low-level Output Voltage	V _{OL}	-	-	-	0.1 × VDD	V

Note : The V_{CC} input must be kept in a stable value; ripple and noise are not allowed.

8.2 Electro-optical Characteristics

ITEM	SYMBOL	TEST CONDITION	MIN	TYPE	MAX	UNIT
Normal Mode Brightness	L _{br}	All pixels ON(1) (VCC generated by internal DC/DC)	60	80	-	cd/m ²
ICC,Sleep mode Current	ICC,SLEEP	VDD = 1.65V~3.3V, VCC = 7V~15V Display OFF, No panel attached	-	-	10	uA
IDD,Sleep mode Current	IDD,SLEEP	VDD = 1.65V~3.3V, VCC = 7V~15V Display OFF, No panel attached	-	-	10	uA
Normal Mode Power Consumption	Pt	All pixels ON(1)	-	80	100	mW
C.I.E(White)	(x)	x,y(CIE1931)	0.26	0.30	0.34	-
	(y)		0.28	0.32	0.36	-
Dark Room Contrast	CR	-	≥2000:1	-	-	-
Response Time	-	-	-	10	-	μ s
View Angle	-	-	≥160	-	-	Degree

Note(1): Normal Mode test conditions are as follows:

- Driving voltage : 7.2V(VCC Supplied Externally) or VBAT:3.7V(VCC Generated by Internal DC/DC).
- Contrast setting : 0xcf
- Frame rate : 105Hz
- Duty setting : 1/64

PRODUCT SPECIFICATION

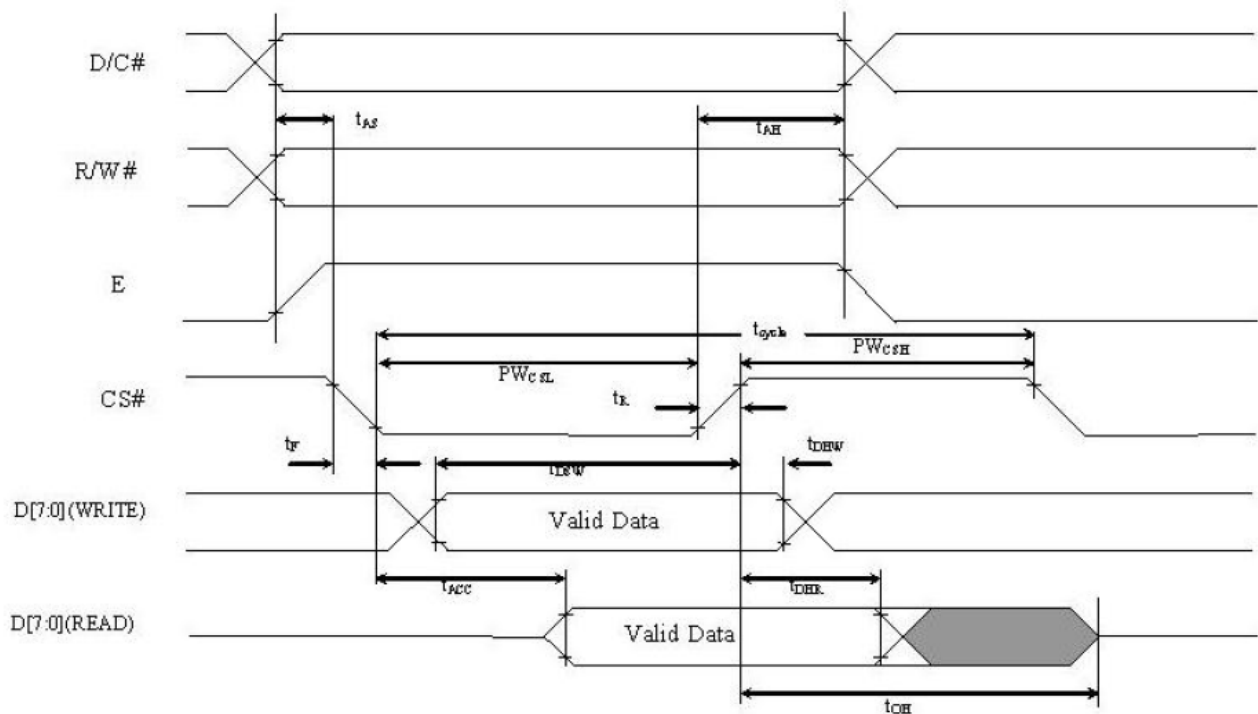
8.3 AC Electrical Characteristics

(1)6800-Series MPU Parallel Interface Timing Characteristics

(VDD - VSS = 1.65V to 3.3V, TA = 25°C)

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	7	-	-	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) Chip Select Low Pulse Width (write)	120 60	-	-	ns
PW_{CSH}	Chip Select High Pulse Width (read) Chip Select High Pulse Width (write)	60 60	-	-	ns
t_{R}	Rise Time	-	-	40	ns
t_{F}	Fall Time	-	-	40	ns

6800-series MCU parallel interface characteristics



PRODUCT SPECIFICATION

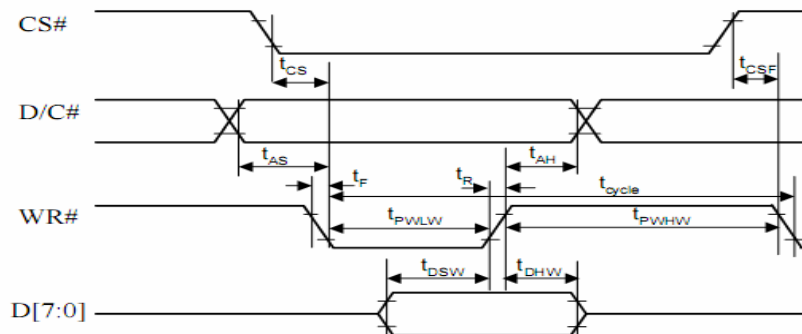
(2)8080-Series MPU Parallel Interface Timing Characteristics

(VDD - VSS = 1.65V to 3.3V, TA = 25°C)

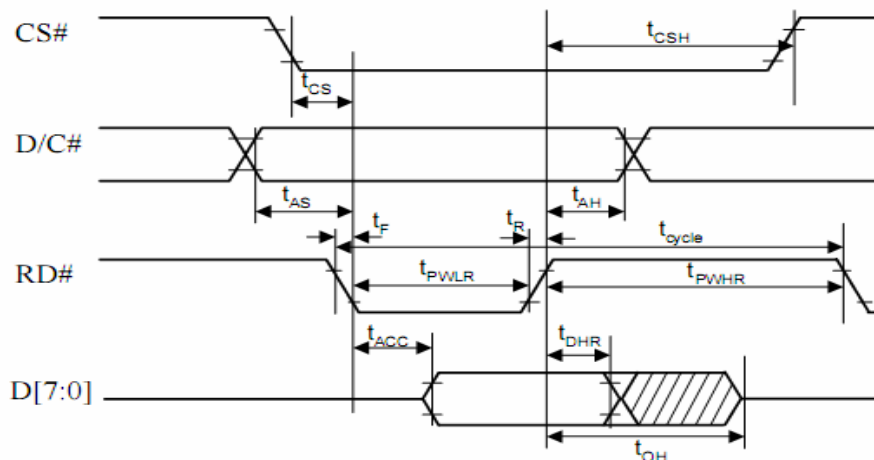
Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	10	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	7	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	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	-	-	40	ns
t_F	Fall Time	-	-	40	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

8080-series parallel interface characteristics

Write Cycle



Read cycle



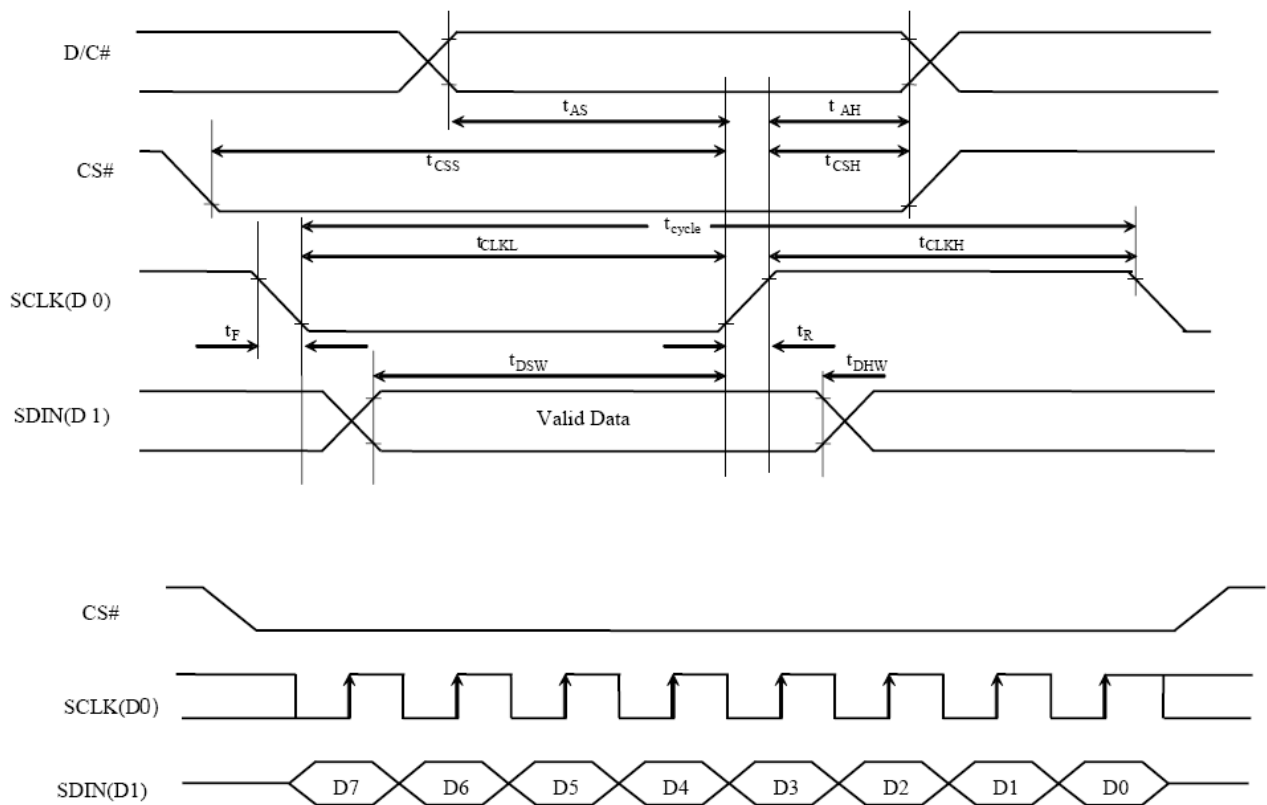
PRODUCT SPECIFICATION

(3)4-Wire Series Interface Timing Characteristics

(VDD - VSS = 1.65V to 3.3V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	100	-	-	ns
t_{AS}	Address Setup Time	15	-	-	ns
t_{AH}	Address Hold Time	15	-	-	ns
t_{CSS}	Chip Select Setup Time	20	-	-	ns
t_{CSH}	Chip Select Hold Time	10	-	-	ns
t_{DSW}	Write Data Setup Time	15	-	-	ns
t_{DHW}	Write Data Hold Time	15	-	-	ns
t_{CLKL}	Clock Low Time	20	-	-	ns
t_{CLKH}	Clock High Time	20	-	-	ns
t_{R}	Rise Time	-	-	40	ns
t_{F}	Fall Time	-	-	40	ns

4-wire Serial interface characteristics



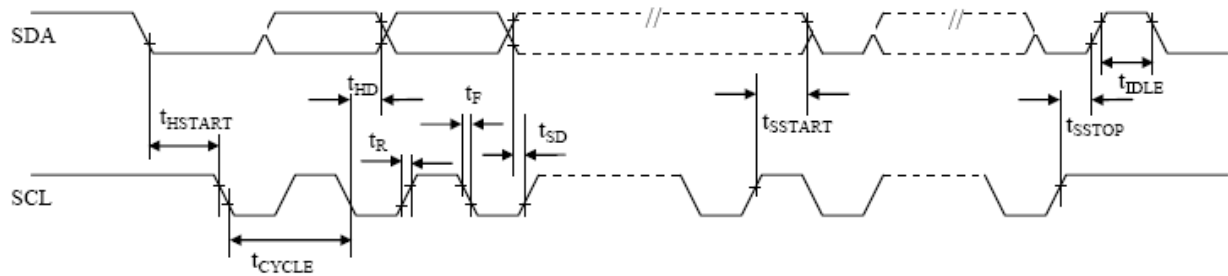
PRODUCT SPECIFICATION

(4) I²C Interface Timing Characteristics

(VDD - VSS = 1.65V to 3.3V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	2.5	-	-	us
t_{HSTART}	Start condition Hold Time	0.6	-	-	us
t_{HD}	Data Hold Time (for “SDA _{OUT} ” pin)	0	-	-	ns
	Data Hold Time (for “SDA _{IN} ” pin)	300	-	-	ns
t_{SD}	Data Setup Time	100	-	-	ns
t_{SSTART}	Start condition Setup Time (Only relevant for a repeated Start condition)	0.6	-	-	us
t_{SSTOP}	Stop condition Setup Time	0.6	-	-	us
t_{R}	Rise Time for data and clock pin	-	-	300	ns
t_{F}	Fall Time for data and clock pin	-	-	300	ns
t_{IDLE}	Idle Time before a new transmission can start	1.3	-	-	us

I²C Interface Timing Characteristics

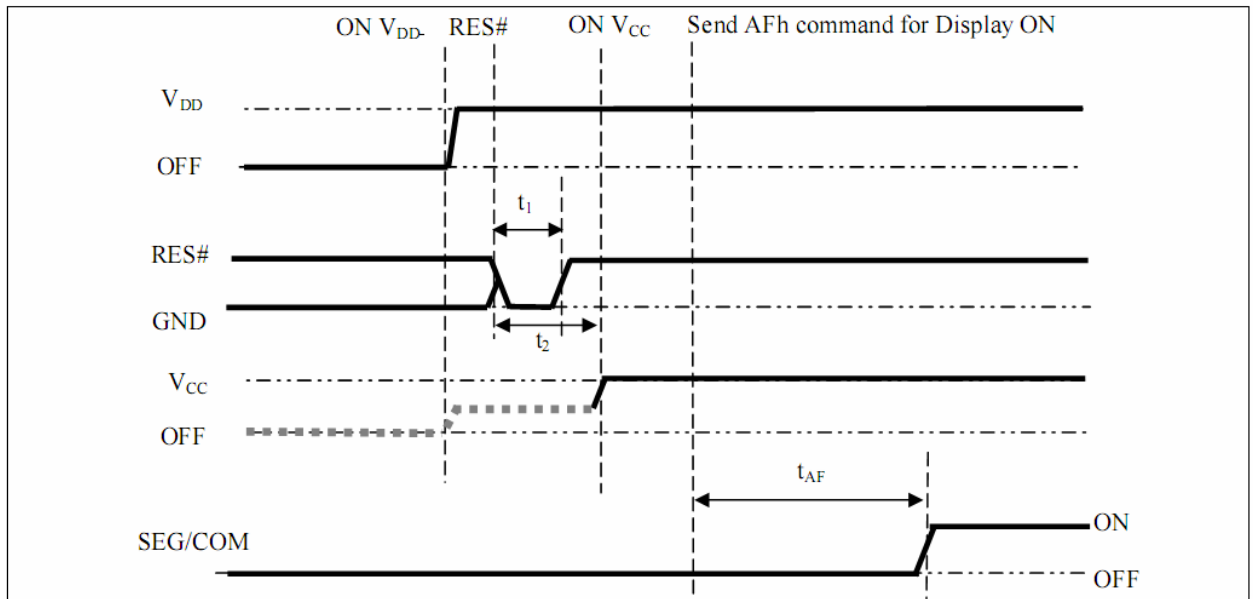


9 Functional Specification and Application Circuit

9.1 Power ON and Power OFF Sequence

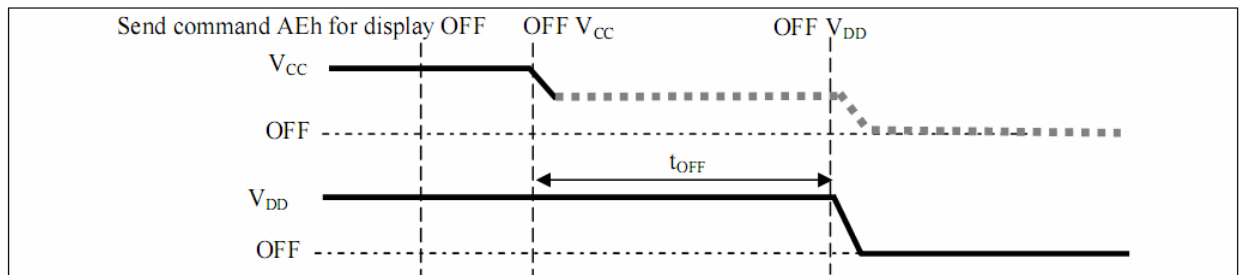
Power ON Sequence:

1. Power ON VDD
2. After VDD become stable, set RES# pin LOW (logic low) for at least 3us (t_1)⁽⁴⁾ and then HIGH (logic high).
3. After set RES# pin LOW (logic low), wait for at least 3us (t_2). Then Power ON VCC⁽¹⁾.
4. After VCC become stable, send command AFh for display ON. SEG/COM will be ON after 100ms(t_{AF}).



Power OFF Sequence:

1. Send command AEh for display OFF.
2. Power OFF VCC^{(1),(2),(3)}.
3. Power OFF VDD after t_{OFF} .⁽⁵⁾ (Typical t_{OFF} =100ms)



Note:

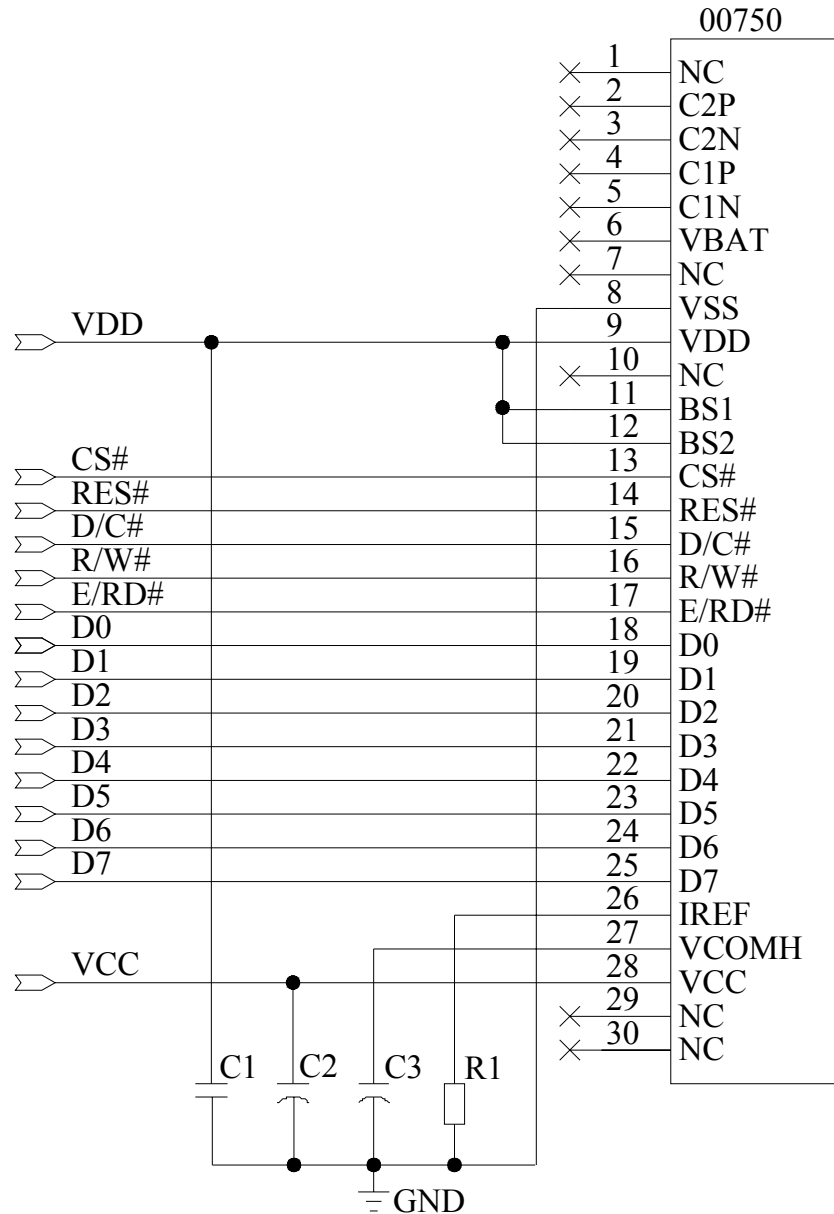
- (1) Since an ESD protection circuit is connected between VDD and VCC, VCC becomes lower than VDD whenever VDD is ON and VCC is OFF as shown in the dotted line of VCC in above figures.
- (2) VCC should be kept float (disable) when it is OFF.
- (3) Power Pins(VDD, VCC) can never be pulled to ground under any circumstance.
- (4) The register values are reset after t_1 .
- (5) VDD should not be Power OFF before VCC Power OFF

9.2 Application Circuit

9.2.1 Under external VCC Mode, the charge Pump Setting (8Dh) must be set as follow:

8Dh: Charge Pump Setting 10h: Disable Charge Pump

(1). The configuration for 8080-parallel interface mode, external VCC is shown in the following diagram



Pin connected to MCU interface: D[0:7], E/RD#, R/W#, D/C#, RES#, CS#

Recommended components

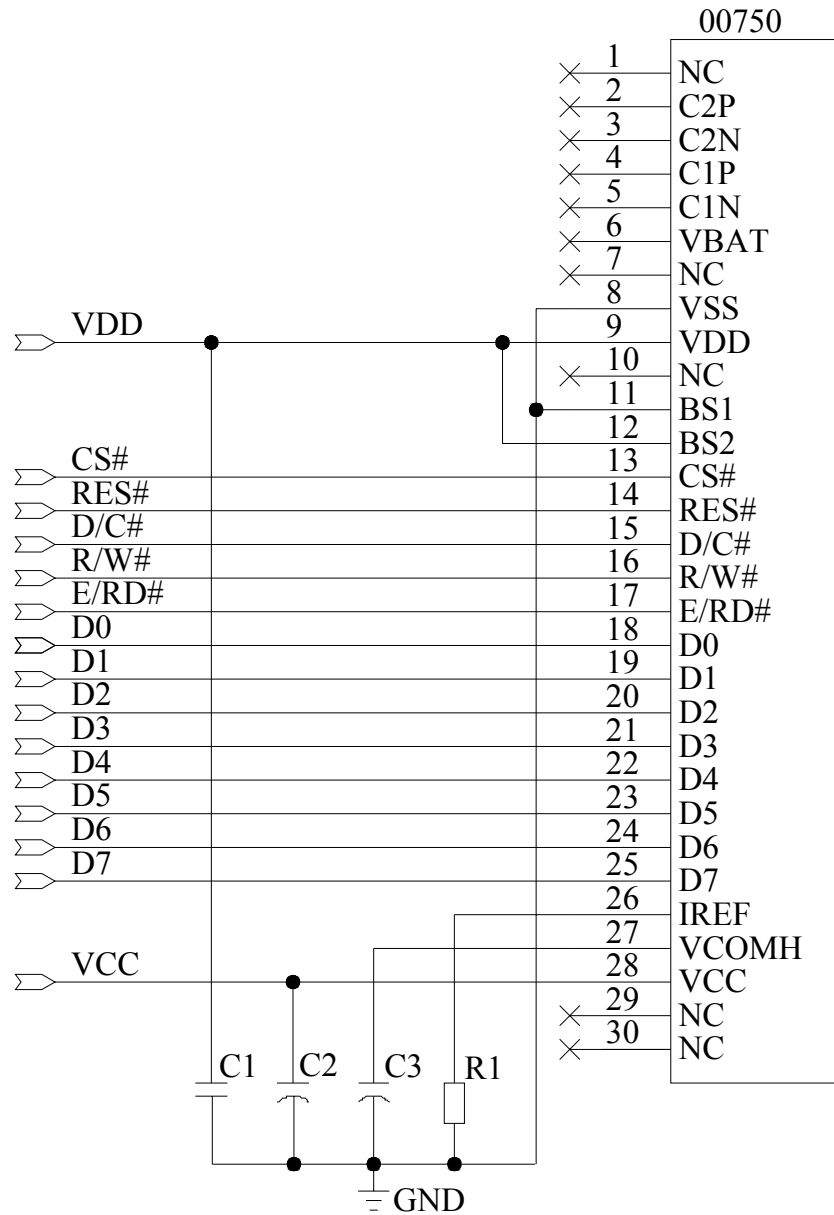
C1 : 0.1uF-0603-X7R±10%.ROHS

C2,C3 : 4.7μF/25V.ROHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 390K ohm.ROHS

PRODUCT SPECIFICATION

(2).The configuration for 6800-parallel interface mode, external VCC is shown in the following diagram



Pin connected to MCU interface: D[0:7], E/RD#, R/W#, D/C#, RES# , CS#

Recommended components

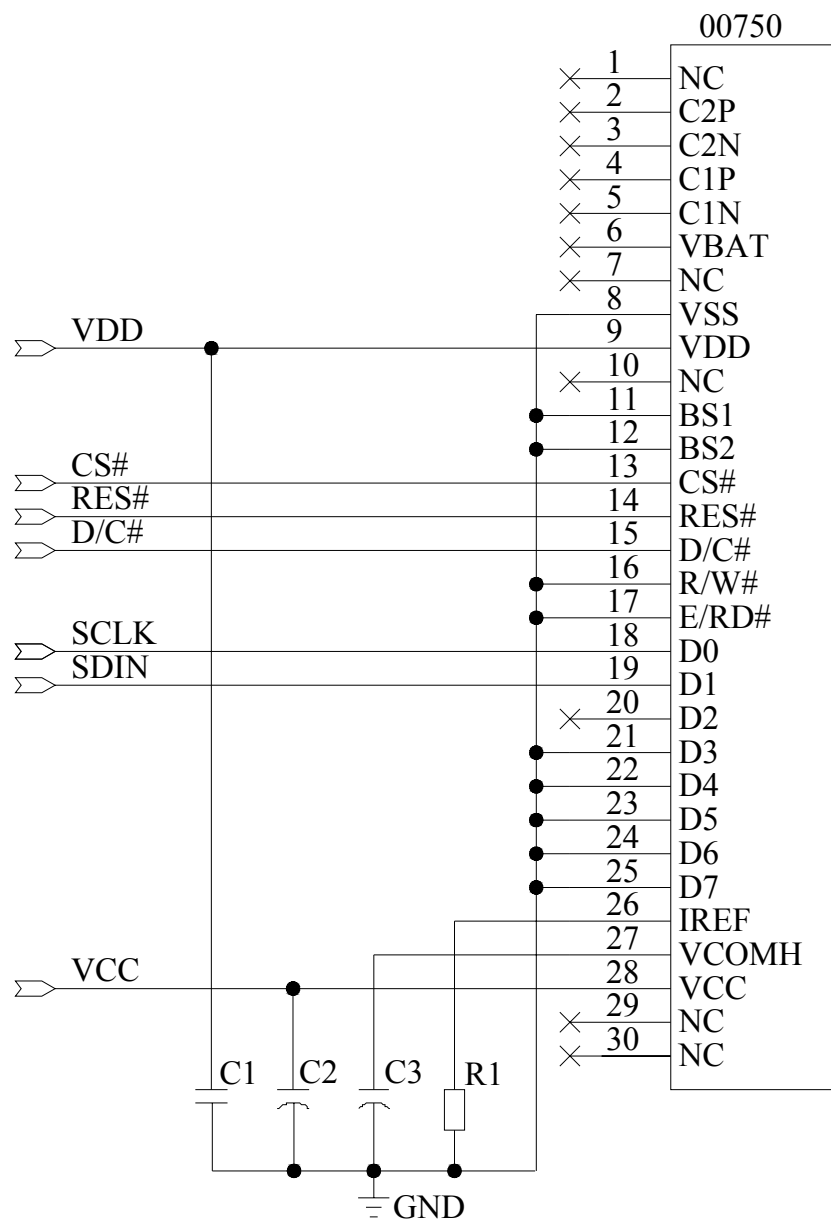
C1 : 0.1uF-0603-X7R±10%.ROHS

C2,C3 : 4.7μF/25V.ROHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 390K ohm.ROHS

PRODUCT SPECIFICATION

(3).The configuration for 4-wire-SPI interface mode, external VCC is shown in the following diagram



Pin connected to MCU interface: SDIN,SCLK, D/C#, RES# , CS#

Recommended components

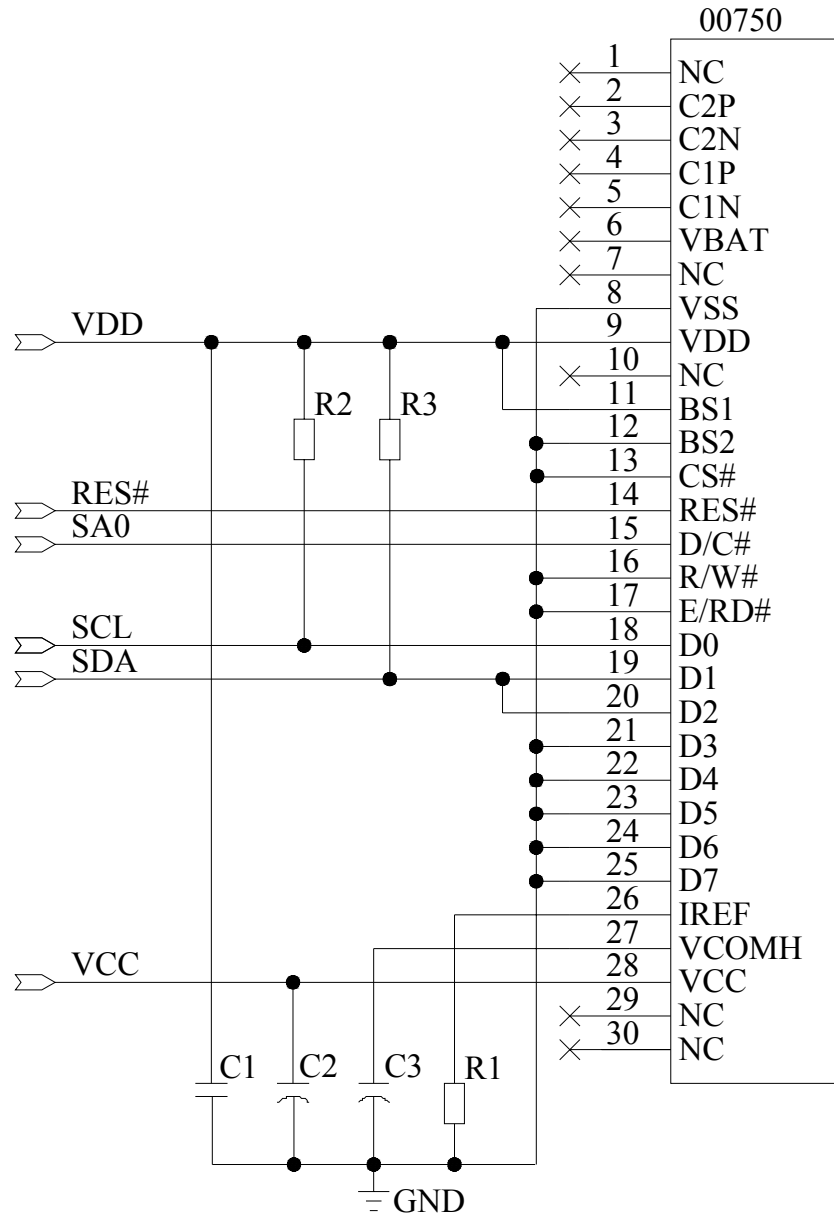
C1 : 0.1uF-0603-X7R±10%.ROHS

C2,C3 : 4.7μF/25V.ROHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 390K ohm.ROHS

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(4).The configuration for I²C interface mode, external VCC is shown in the following diagram



Pin connected to MCU interface: SCL,SDA,SA0, RES#

Recommended components

C1 : 0.1uF-0603-X7R±10%.ROHS

C2,C3 : 4.7µF/25V.ROHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 390K ohm.ROHS

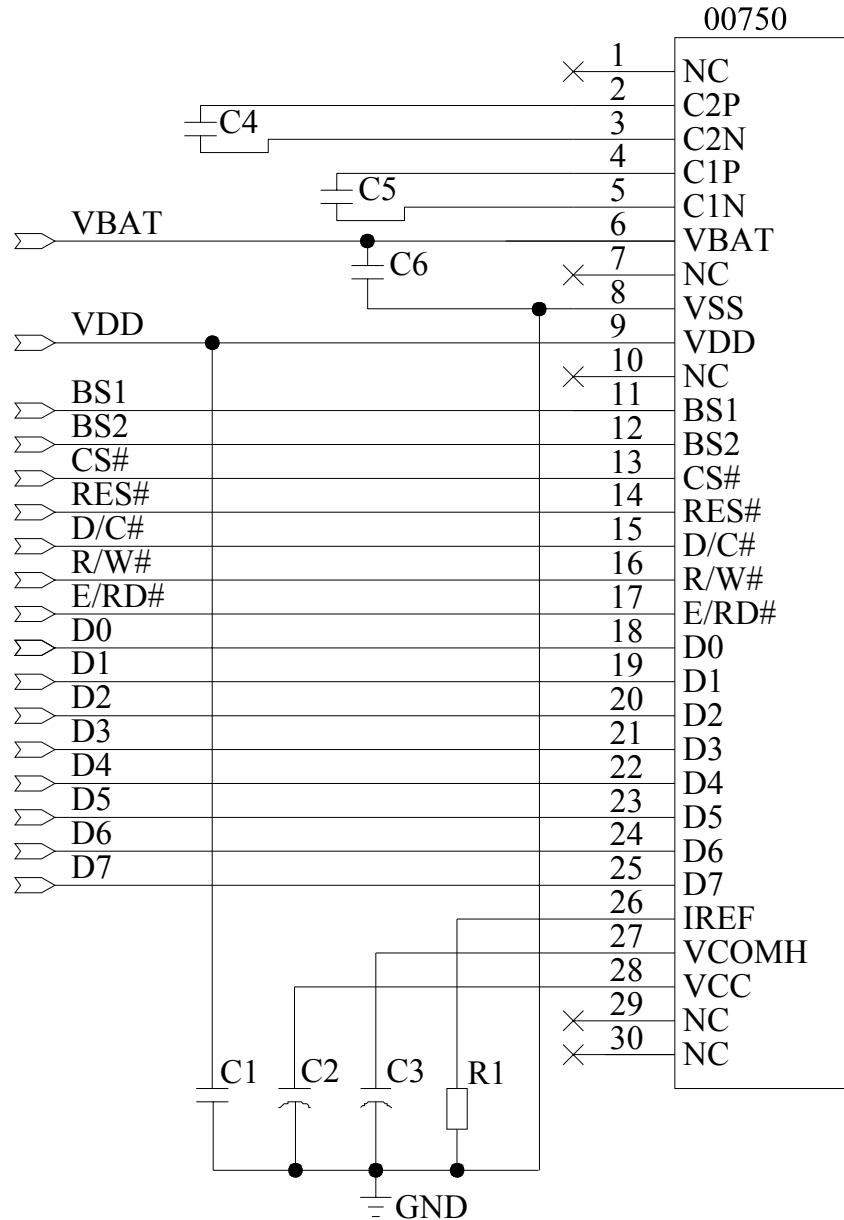
R2,R3: 0603 1/10W +/-5% 10K ohm.ROHS

PRODUCT SPECIFICATION

9.2.2 Under Internal DC/DC Mode, the charge Pump Setting (8Dh) must be set as follow:

8Dh: Charge Pump Setting 14h: Enable Charge Pump

The configuration for VCC Generated by Internal DC/DC Circuit is shown in the following diagram:



MCU interface Selection : BS1,BS2

Pin connected to MCU interface: D[0:7], E/RD#, R/W#, D/C#, RES# , CS#

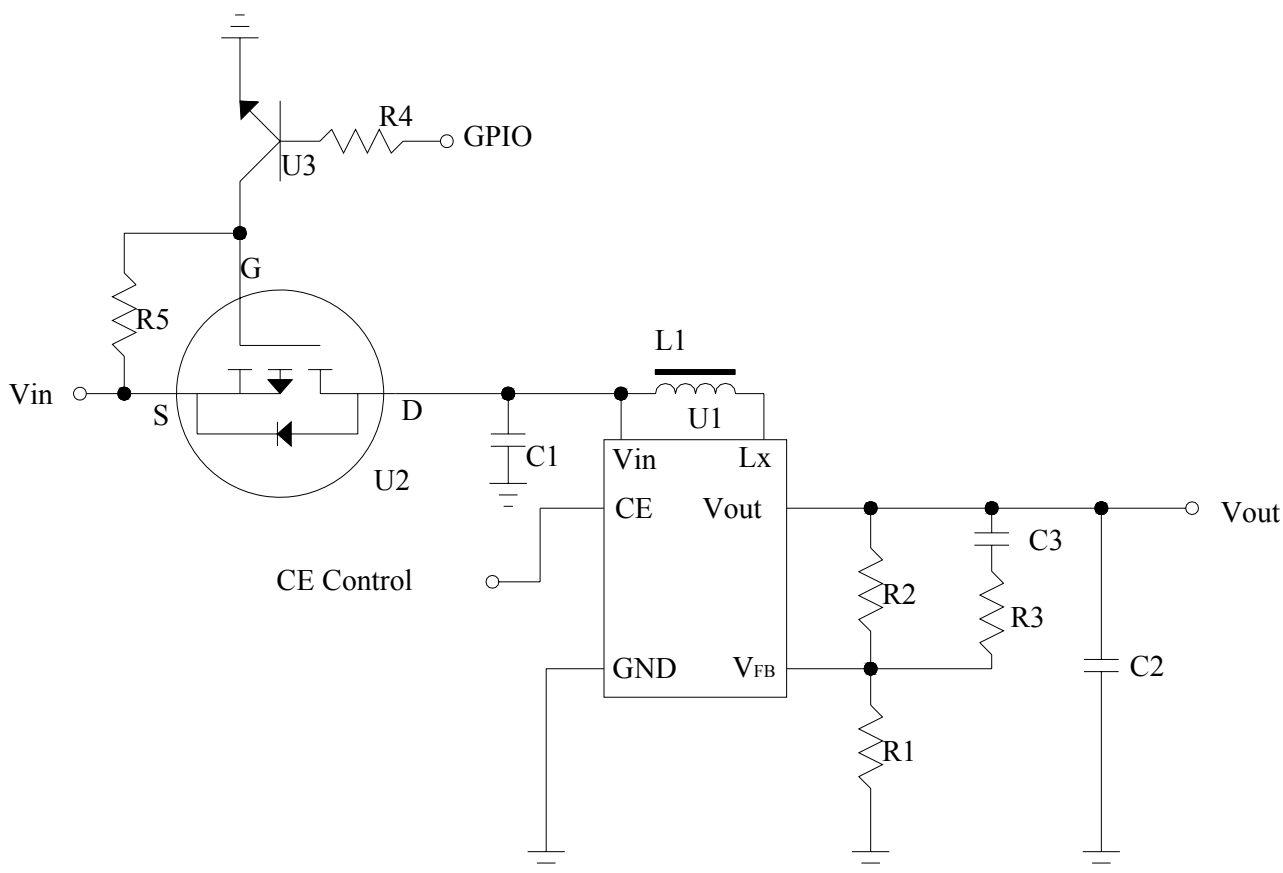
Recommended components

C1, C4, C5, C6: 1uF-0603-X7R±10%.ROHS

C2,C3 : 4.7µF/25V.ROHS (Tantalum Capacitors)

R1: 0603 1/10W +/-5% 390K ohm.ROHS

9.3 External DC-DC application circuit



Recommend component

The C1	: 1 uF-0603-X7R±10%.ROHS
The C2	: 1 uF-0603-X7R±10%.ROHS
The C3	: 220pF-0603-X7R±10%.ROHS
The R1	: 0603 1/10W +/-5% 10Kohm.ROHS
The R2	: 0603 1/10W +/-5% 62Kohm.ROHS
The R3	: 0603 1/10W +/-5% 2Kohm.ROHS
The R4	: 0603 1/10W +/-5% 1Kohm.ROHS
The R5	: 0603 1/10W +/-5% 10Kohm.ROHS
The L1	: 22uH
The U1	: R1200
The U2	: FDN338N
The U3	: 8050

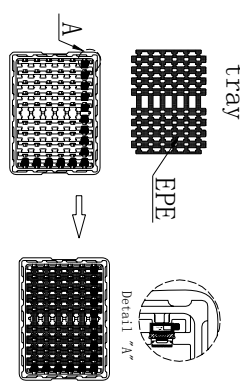
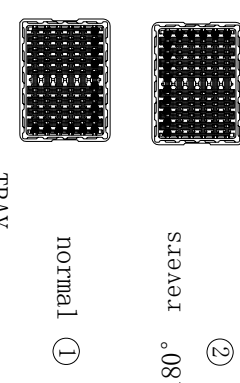
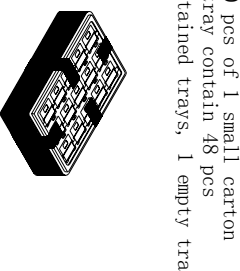
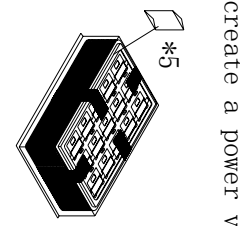
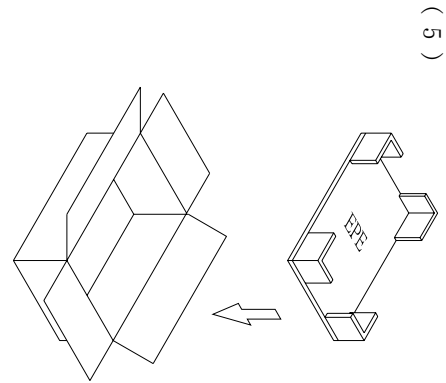
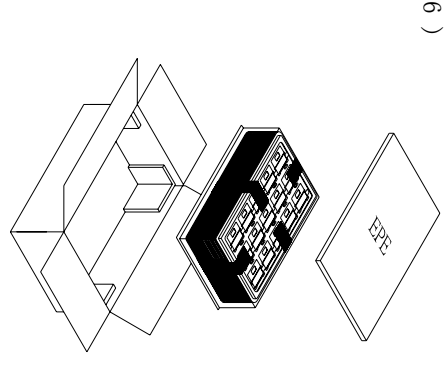
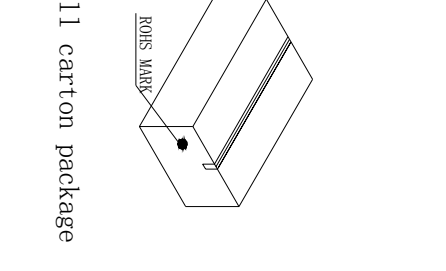
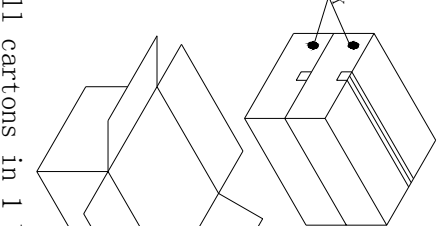
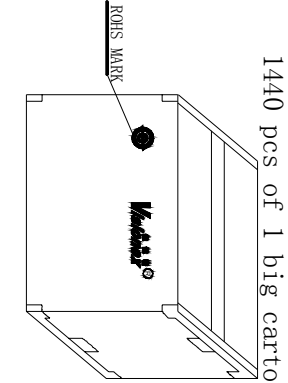
9.4 Display Control Instruction

Refer to SSD1306Z IC Specification.

9.5 Recommended Software Initialization

```
void Init_IC()
{
    Write_Command(0xAE);    //Set Display Off
    Write_Command(0xD5);    //display divide ratio/osc. freq. mode
    Write_Command(0x80);    //
    Write_Command(0xA8);    //multiplex ration mode:63
    Write_Command(0x3F);
    Write_Command(0xD3);    //Set Display Offset
    Write_Command(0x00);
    Write_Command(0x40);    //Set Display Start Line
    Write_Command(0x8D);    //Set Display Offset
    Write_Command(0x14);
    Write_Command(0xA1);    //Segment Remap
    Write_Command(0xC8);    //Sst COM Output Scan Direction
    Write_Command(0xDA);    //common pads hardware: alternative
    Write_Command(0x12);
    Write_Command(0x81);    //contrast control
    Write_Command(0xCF);
    Write_Command(0xD9);    //set pre-charge period
    Write_Command(0xF1);
    Write_Command(0xDB);    //VCOM deselect level mode
    Write_Command(0x40);    //Set Vvcomh=0.83*Vcc
    Write_Command(0xA4);    //Set Entire Display On/Off
    Write_Command(0xA6);    //Set Normal Display
    Write_Command(0xAF);    //Set Display On
}
```

10 Package Specification

Controlled Seal		Packing Process (1)~(9)					
(1) TRAY Type:00180-MT1-C Add EPE in every contained tray 		(2) 		(3) order①、②、①、② fix trays with tape 720 pcs of 1 small carton 1 tray contain 48 pcs 15 contained trays, 1 empty tray 		(4) package with plastic bags add five desiccants create a power vacuum *5 	
(5) 		(6) 		(7) 		(8) 	
(9) 30 contained trays, 2 empty trays, Package quantity products: 1440 pcs of 1 big carton  Package finished		NOTE:1、The inner carton and master carton must be sealed with adhesive tape. 2、Fill up the gap with EPE. 3、If the customer has special needs with the RoHS making, the inner carton and master carton need adhesive new RoHS marking at .					

PRODUCT SPECIFICATION

11 Reliability

11.1 Reliability Test

NO.	ITEM	CONDITION	QUANTITY
1	High Temperature (Non-operation)	85°C,240hrs	4
2	Low Temperature (Non-operation)	-40°C,240hrs	4
3	High Temperature (Operation)	70°C,240hrs	4
4	Low Temperature (Operation)	-40°C,240hrs	4
5	High Temperature / High Humidity (Operation)	60°C,90%RH,240hrs	4
6	Thermal shock (Non-operation)	-40°C~85°C(-40°C/30min;transit/3min;85°C/30min;transit/3min) 1cycle: 66min,30cycles	4
7	Vibration	Frequency: 5~50Hz,0.5G Scan rate: 1 oct/min Time: 2 hrs/axis Test axis: X,Y, Z	1 Carton
8	Drop	Height: 100 cm Sequence: 1 angle, 3 edges and 6 faces	1 Carton

Test and measurement conditions

1. All measurements shall not be started until the specimens attain to temperature stability, the stable time is at least 15 minutes.
2. The degradation of polarizer is ignored for item 5.
3. The tolerance of temperature is $\pm 3^{\circ}\text{C}$, and the tolerance of relative humidity is $\pm 5\%$.

Evaluation criteria

1. The function test is OK.
2. No observable defects.
3. Luminance: $\geq 50\%$ of initial value.
4. Current consumption: within $\pm 50\%$ of initial value.

11.2 Lifetime

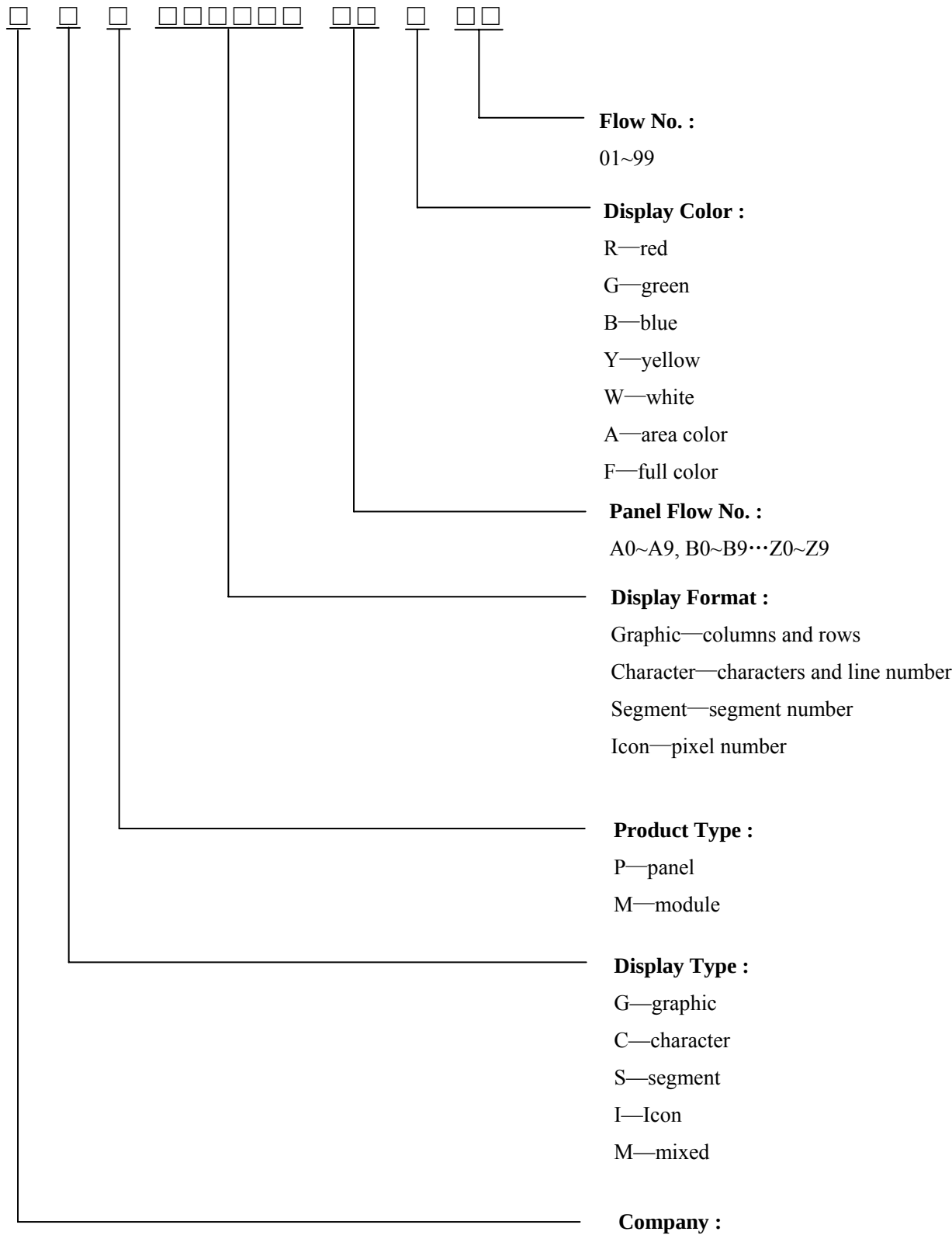
End of lifetime is specified as 50% of initial brightness and the test pattern at operating condition is 50% alternating checkerboard.

ITEM	MIN	MAX	UNIT	CONDITION
Operation Life Time	16,000	-	hrs	80cd/m ² ,50% Checkerboard

11.3 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 $22\pm 3^{\circ}\text{C}$; $55\pm 15\%$ RH.

12 Illustration of OLED Product Name



13 Outgoing Quality Control Specifications

13.1 Sampling Method

- (1) GB/T 2828.1-2003/ISO2859-1: 1999, inspection level II, normal inspection, single sample inspection
- (2) AQL: Major 0.65; Minor 1.0

13.2 Inspection Conditions

The environmental conditions for test and measurement are performed as follows.

Temperature: $22 \pm 3^{\circ}\text{C}$

Humidity: $55 \pm 15\% \text{R.H}$

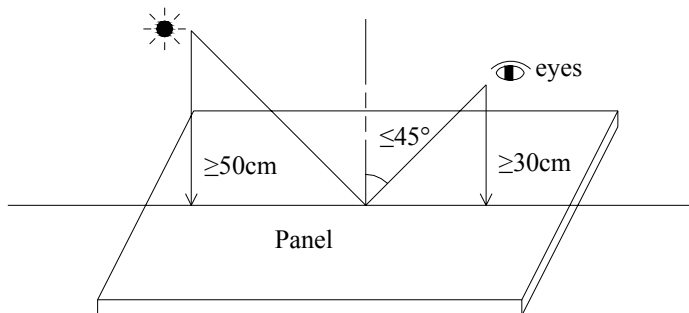
Fluorescent Lamp: 30W

Distance between the Panel & Lamp: $\geq 50\text{cm}$

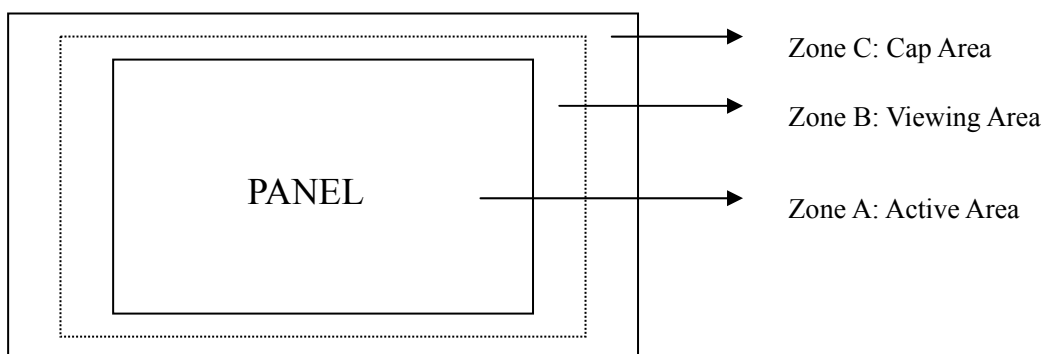
Distance between the Panel & Eyes: $\geq 30\text{cm}$

Viewing angle from the vertical in each direction: $\leq 45^{\circ}$

(See the sketch below)



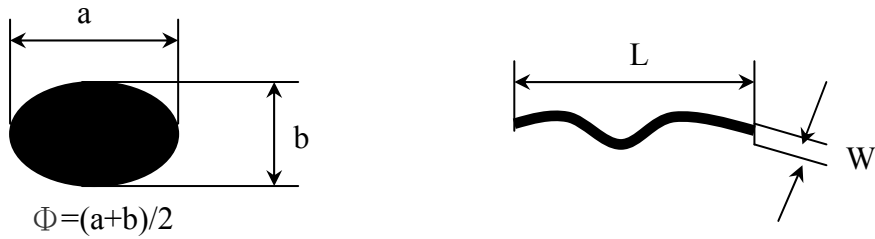
13.3 Quality Assurance Zones



PRODUCT SPECIFICATION

13.4 Inspection Standard

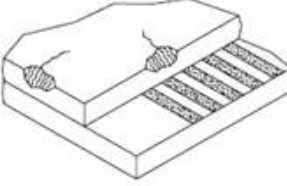
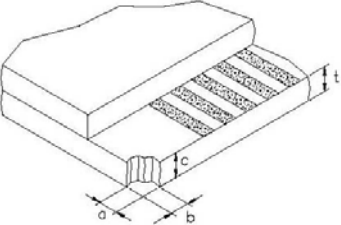
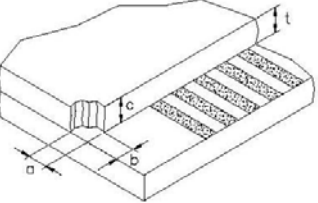
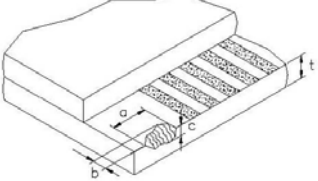
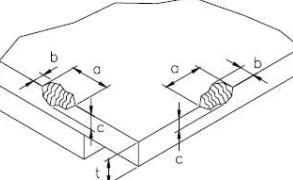
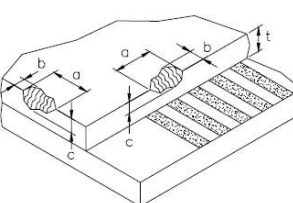
Definition of Φ & L & W (Unit: mm)



I . Appearance Defects

NO.	ITEM	CRITERIA				CLASSIFICATION																
1	Polarizer Black or White spot, Dirty spot, Foreign matter, Dent on the polarizer	<table><tr><td rowspan="5">Average Diameter (mm)</td><td colspan="2">Acceptable Number</td></tr><tr><td>Zone A,B</td><td>Zone C</td></tr><tr><td>$\Phi \leq 0.15$</td><td>Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.15 < \Phi \leq 0.30$</td><td>3</td></tr><tr><td>$\Phi > 0.30$</td><td>0</td></tr></table>				Average Diameter (mm)	Acceptable Number		Zone A,B	Zone C	$\Phi \leq 0.15$	Ignore	Ignore	$0.15 < \Phi \leq 0.30$	3	$\Phi > 0.30$	0	Minor				
Average Diameter (mm)	Acceptable Number																					
	Zone A,B	Zone C																				
	$\Phi \leq 0.15$	Ignore	Ignore																			
	$0.15 < \Phi \leq 0.30$	3																				
	$\Phi > 0.30$	0																				
2	Scratch/line on the glass/Polarizer	<table><tr><td rowspan="2">Width (mm)</td><td rowspan="2">Length (mm)</td><td colspan="2">Acceptable Number</td></tr><tr><td>Zone A,B</td><td>Zone C</td></tr><tr><td>$W \leq 0.03$</td><td>---</td><td>Ignore</td><td rowspan="3">Ignore</td></tr><tr><td>$0.03 < W \leq 0.08$</td><td>$L \leq 5.0$</td><td>3</td></tr><tr><td>$W > 0.08$</td><td>---</td><td>0</td></tr></table>				Width (mm)	Length (mm)	Acceptable Number		Zone A,B	Zone C	$W \leq 0.03$	---	Ignore	Ignore	$0.03 < W \leq 0.08$	$L \leq 5.0$	3	$W > 0.08$	---	0	Minor
Width (mm)	Length (mm)	Acceptable Number																				
		Zone A,B	Zone C																			
$W \leq 0.03$	---	Ignore	Ignore																			
$0.03 < W \leq 0.08$	$L \leq 5.0$	3																				
$W > 0.08$	---	0																				
3	Polarizer Bubble	<table><tr><td rowspan="2">Average Diameter (mm)</td><td colspan="2">Acceptable Number</td></tr><tr><td>Zone A,B</td><td>Zone C</td></tr><tr><td>$\Phi > 0.5$</td><td>0</td><td rowspan="3">Ignore</td></tr><tr><td>$0.2 < \Phi \leq 0.5$</td><td>3</td></tr><tr><td>$\Phi \leq 0.2$</td><td>Ignore</td></tr></table>				Average Diameter (mm)	Acceptable Number		Zone A,B	Zone C	$\Phi > 0.5$	0	Ignore	$0.2 < \Phi \leq 0.5$	3	$\Phi \leq 0.2$	Ignore	Minor				
Average Diameter (mm)	Acceptable Number																					
	Zone A,B	Zone C																				
$\Phi > 0.5$	0	Ignore																				
$0.2 < \Phi \leq 0.5$	3																					
$\Phi \leq 0.2$	Ignore																					
4	Any Dirt & Scratch on Polarizer’s Protective Film	Ignore for not affect the polarizer.				Acceptable																
5	Any Dirt on Cap Glass	<table><tr><td>Average Diameter (mm)</td><td colspan="2">Acceptable Number</td></tr><tr><td>$\Phi \leq 0.5$</td><td colspan="2">Ignore</td></tr><tr><td>$0.5 < \Phi \leq 1.0$</td><td colspan="2">3</td></tr><tr><td>$\Phi > 1.0$</td><td colspan="2">0</td></tr></table>				Average Diameter (mm)	Acceptable Number		$\Phi \leq 0.5$	Ignore		$0.5 < \Phi \leq 1.0$	3		$\Phi > 1.0$	0		Minor				
Average Diameter (mm)	Acceptable Number																					
$\Phi \leq 0.5$	Ignore																					
$0.5 < \Phi \leq 1.0$	3																					
$\Phi > 1.0$	0																					

PRODUCT SPECIFICATION

5	Glass Crack	 Propagation crack is not acceptable.	Major
6	Corner Chip	 $t = \text{Glass thickness}$ Accept $a \leq 2.0\text{mm}$ or $b \leq 2.0\text{mm}$, $c \leq t$	Minor
7	Corner Chip on Cap Glass	 $t = \text{Glass thickness}$ Accept $a \leq 1.5\text{mm}$ or $b \leq 1.5\text{mm}$, $c \leq t$	Minor
8	Chip on Contact Pad	 $t = \text{Glass thickness}$ Accept $a \leq 3.0\text{mm}$ or $b \leq 0.8\text{mm}$, $c \leq t$ (on the contact pin) $a \leq 3.0\text{mm}$ or $b \leq 1.5\text{mm}$, $c \leq t$ (outside of the contact pin)	Minor
9	Chip on Face of Display	 $t = \text{Glass thickness}$ Accept $a \leq 1.5\text{mm}$ or $b \leq 1.5\text{mm}$, $c \leq t$	Minor
10	Chip on Cap Glass	 $t = \text{Glass thickness}$ Accept $a \leq 3.0\text{mm}$ or $b \leq 3.0\text{mm}$, $c \leq t/2$ $a \leq 1.5\text{mm}$ or $b \leq 1.5\text{mm}$, $t/2 \leq c \leq t$	Minor
11	Stain on Surface	Stain removable by soft cloth or air blow is acceptable.	Minor
12	TCP/FPC Damage	(1) Crack, deep scratch, deep hole and deep pressure mark on the TCP/FPC are not acceptable. (2) Terminal lead twisted or broken is not allowable. (3) Copper exposed is not allowed by naked eye inspection.	Minor
13	Dimension Unconformity	Checking by mechanical drawing.	Major

PRODUCT SPECIFICATION

II . Displaying Defects

NO.	ITEM	CRITERIA		CLASSIFICATION
1	Black/White spot Dirty spot Foreign matter	Average Diameter (mm)	Pieces Permitted	Minor
			Zone A,B Zone C	
		$\Phi \leq 0.10$	Ignore	
		$0.10 < \Phi \leq 0.20$	3	
		$\Phi > 0.20$	0	
2	No Display	Not allowable.		Major
3	Irregular Display	Not allowable.		Major
4	Missing Line (row or column)	Not allowable.		Major
5	Short	Not allowable.		Major
6	Flicker	Not allowable.		Major
7	Abnormal Color	Refer to the SPEC.		Major
8	Luminance NG	Refer to the SPEC.		Major
9	Over Current	Refer to the SPEC.		Major

14 Precautions for operation and Storage

14.1 Precautions for Operation

- (1) Since OLED panel is made of glass, do not apply any mechanical shock or impact or excessive force to it when installing the OLED module. Any strong mechanical impact due to falling dropping etc. may cause damage (breakage or cracking).
- (2) The polarizer on the OLED surface is made of soft material and is easily scratched. Please take most care when handing. When the surface of the polarizer of OLED Module is contaminated, please wipe it off gently by using moisten soft cloth with isopropyl alcohol, do not use water, ketone or aromatics. If there is saliva or water on the OLED surface, please wipe it off immediately.
- (3) When handling OLED module, please be sure that the body and the tools are properly grounded. And do not touch I/O pins with bare hands or contaminate I/O pins, it will cause disconnection or defective insulation of terminals.
- (4) Do not attempt to disassemble or process the OLED module.
- (5) OLED module should be used under recommended operating conditions shown in the specification. Since the higher voltage leads to the shorter lifetime, be sure to use the specified operating voltage.
- (6) Foggy dew, moisture condensation or water droplets deposited on surface and contact terminals will cause polarizer stain or damage, the deteriorated display quality and electrochemical reaction then leads to shorter life time and permanent damage to the module probably. Please pay attention to the environmental temperature and humidity.
- (7) An afterimage is created by the difference in brightness between unused dot and the fixed dot, according to the decrease of brightness of the emitting time. Therefore, to avoid having an afterimage, the full set should be thoroughly used instead of using a fixed dot. When the fixed dot emits, an afterimage can be created.
- (8) Flicker could be come out at full on display. And it disappears when frame frequency increase, but brightness decreases too.

14.2 Soldering

- (1) Soldering should be performed only on the I/O terminals.
- (2) Use soldering irons with proper grounding and no leakage.
- (3) Iron: no higher than 300°C and 3~4 sec during soldering.

14.3 Precautions for Storage

- (1) Please store OLED module in a dark place. Avoid exposure to sunlight, the light of fluorescent lamp or any ultraviolet ray.
- (2) Keep the environment temperature between 10°C and 35°C and the relative humidity less than 60%. Avoid high temperature and high humidity.
- (3) Keep the OLED modules stored in the container when shipped from supplier before using them is recommended.
- (4) Do not leave any article on the OLED module surface for an extended period of time.

14.4 Warranty period

LEE HON Company warrants for a period of 12 months from the shipping date when stored or used under normal condition.