

Product Specification

Product Name: VGM096096A0F02

Product Code: M00231

Customer
Approved by Customer
Approved Date:

Designed By	Checked By	Approved By	
		R&D	QA
曹 翔 平 2009.12.29	李 强 2009.12.29	王 强 2009.12.29	张 强 2009.12.29

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1 Overview

VGM096096A0F02 is an OLED full color 96(RGB)×96 dot matrix display module. 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.

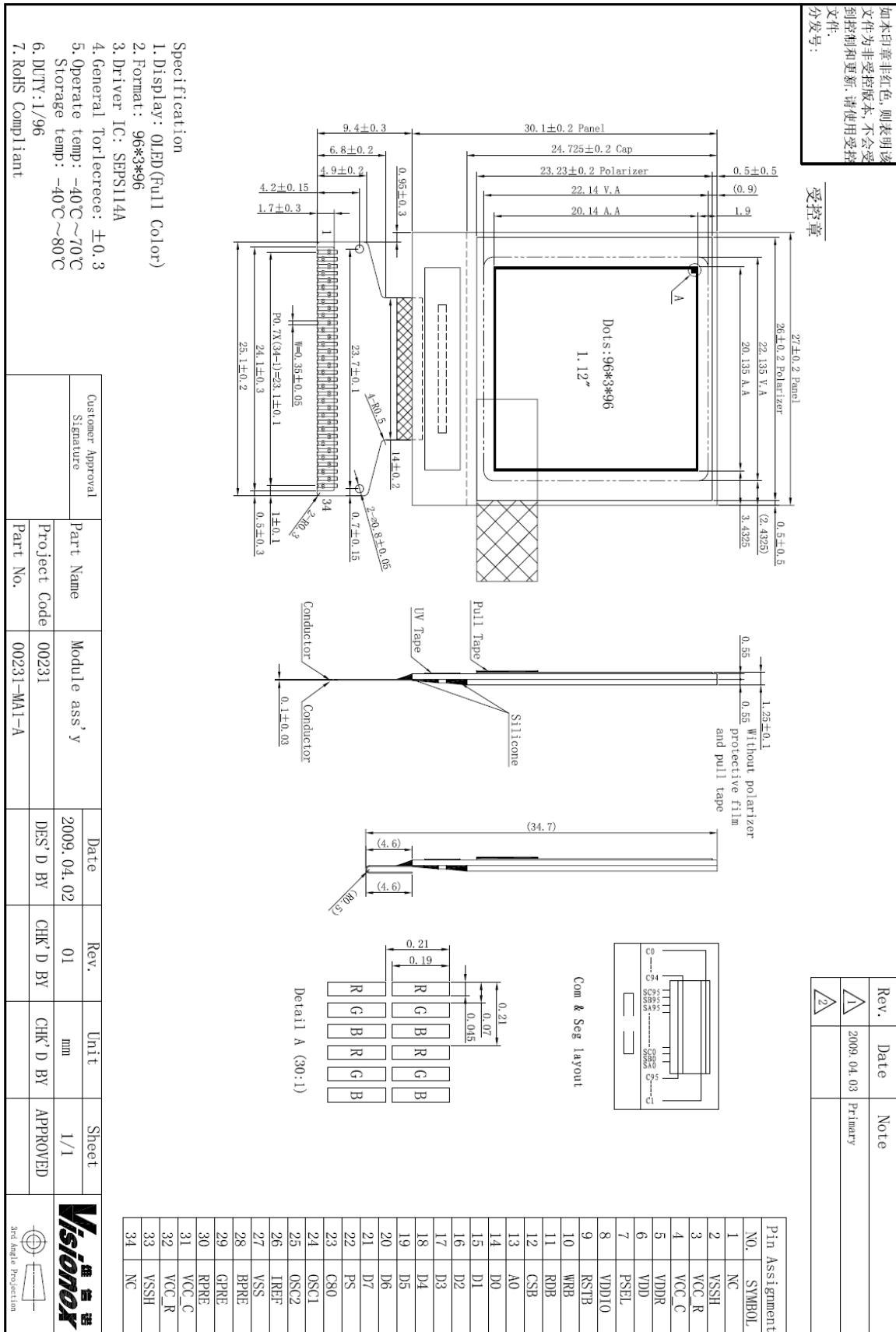
2 Features

- Display Color: 65k full colors
- Dot Matrix: 96(RGB)×96
- Driver IC: SEPS114A
- Interface: 8-bit 8080, 8-bit 6800, SPI
- Wide range of operating temperature: -40°C to 70°C

3 Mechanical Data

NO.	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	96(W)(RGB)×96(H)	-
2	Dot Size	0.045(W)×0.19(H)	mm ²
3	Dot Pitch	0.07(W)×0.21(H)	mm ²
4	Aperture Rate	58.2	%
5	Active Area	20.135(W)×20.14 (H)	mm ²
6	Panel Size	27(W)×30.1 (H)	mm ²
7	Module Size	According to the annexed mechanical drawing	mm ³
8	Diagonal A/A Size	1.12	inch
9	Module Weight	2.05 ± 10%	gram

4 Mechanical Drawing

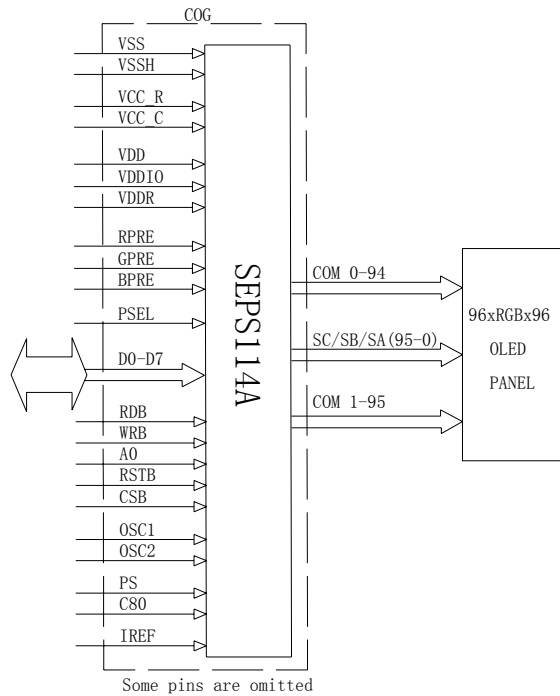


5 Module Interface

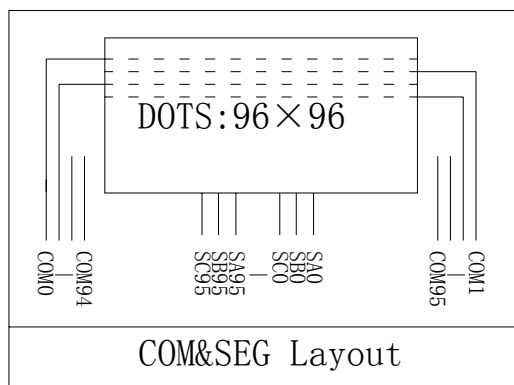
PIN NO.	PIN NAME	DESCRIPTION
1	NC	No connection.
2	VSSH	Ground for VCC_C/VCC_R.
3	VCC_R	Power supply for scan driver.
4	VCC_C	Data driver power supply(8V~18V).
5	VDDR	This pin is for supply voltage(1.7V) to the memory and digital of SEPS114A. This voltage is generated by internal regulator or supplied by an external voltage supplier.
6	VDD	Logic power supply(2.4V~3.3V).
7	PSEL	Regulator enable/disable for logic power supply2.
8	VDDIO	MPU I/F pad power supply(1.65V ~ 3.3V). VDDIO should be lower than VDD or the same as VDD.
9	RSTB	Reset pin, active low.
10	WRB	6800: Read or Write; 8080: Write(active low); SPI: connected to VDDIO or VSS.
11	RDB	6800: Enable(active high); 8080:Read(active low); SPI: connected to VDDIO or VSS..
12	CSB	Chip select pin, active low.
13	A0	Data / Command select pin. L: command; H: data
14~21	D0~D7	Data bus. When using SPI: DB[0] SCL : Serial clock input DB[1] SDI : Serial data input DB[2] SDO : Serial data output DB[3] R/W : Serial Read/Write , L: Write; H: Read
22	PS	Parallel/Serial interface type select pin. L: serial; H: parallel
23	C80	MPU type select pin. L: 80-series interface; H: 68-series interface
24	OSC1	Fine adjustment for oscillation. Tie a 27 kΩ resistor between OSC1 and OSC2. When the external clock mode is selected, OSC1 is used as external clock input.
25	OSC2	
26	IREF	Connected a resistor to VSS.
27	VSS	Ground for VDD/VDDR.
28	BPRE	Pre-charge voltage for Blue.
29	GPRES	Pre-charge voltage for Green.
30	RPRES	Pre-charge voltage for Red.
31	VCC_C	Data driver power supply(8V~18V).
32	VCC_R	Power supply for scan driver.
33	VSSH	Ground for VCC_C/VCC_R.
34	NC	No connection.

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	V _{DD}	-0.3	4	V	IC maximum rating
OLED Operating voltage	V _{CC_C}	8	18	V	IC maximum rating
Operating Temp.	Top	-40	70	°C	-
Storage Temp	Tstg	-40	80	°C	-

Note (1): All of the voltages are on the basis of “GND = 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
Supply voltage	V _{CC_C}	-	14.5	15	15.5	V
	V _{DD}	-	2.4	2.8	3.3	V
	V _{DDIO}	-	1.65	-	3.3	
	V _{DDR}	-	-	1.7	-	V
High-level Input Voltage	V _{IH}	-	$0.8 \times V_{DDL}$	-	V _{DDL}	V
Low-level Input Voltage	V _{IL}	-	0	-	0.4	V
High-level Output Voltage	V _{OH}	IOH= -0.1mA	V _{DDL} -0.4	-	-	V
Low-level Output Voltage	V _{OL}	IOL= -0.1mA	-	-	0.4	V
Input Leakage Current	ILI	VI=VSS or VDDL	-1	-	1	uA
Output Leakage Current	ILO	VI=VSS or VDDL	-1	-	1	uA
Oscillator Frequency By External Resistor	FOSCE	RF=27 kΩ	-	-	3	MHz

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)	TBD	80	-	cd/m ²
Standby Mode Brightness		Standby Mode 10% pixels ON(2)	-	TBD	-	cd/m ²
Normal Mode Power Consumption	Pt	All pixels ON(1)	-	221	270	mW
Standby Mode Power Consumption		Standby Mode 10% pixels ON(2)	-	TBD	-	mW
C.I.E(White)	(x)	x,y(CIE1931)	0.26	0.30	0.34	-
	(y)		0.28	0.32	0.36	-
C.I.E(Red)	(x)	x,y(CIE1931)	0.62	0.65	0.68	-
	(y)		0.31	0.34	0.37	-
C.I.E(Green)	(x)	x,y(CIE1931)	0.24	0.27	0.30	-
	(y)		0.54	0.57	0.60	-
C.I.E(Blue)	(x)	x,y(CIE1931)	0.11	0.14	0.17	-
	(y)		0.14	0.17	0.20	-
Dark Room Contrast	CR	-	≥2000:1	-	-	-
Response Time	-	-	-	10	-	μ s
View Angle	-	-	≥160	-	-	Degree

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

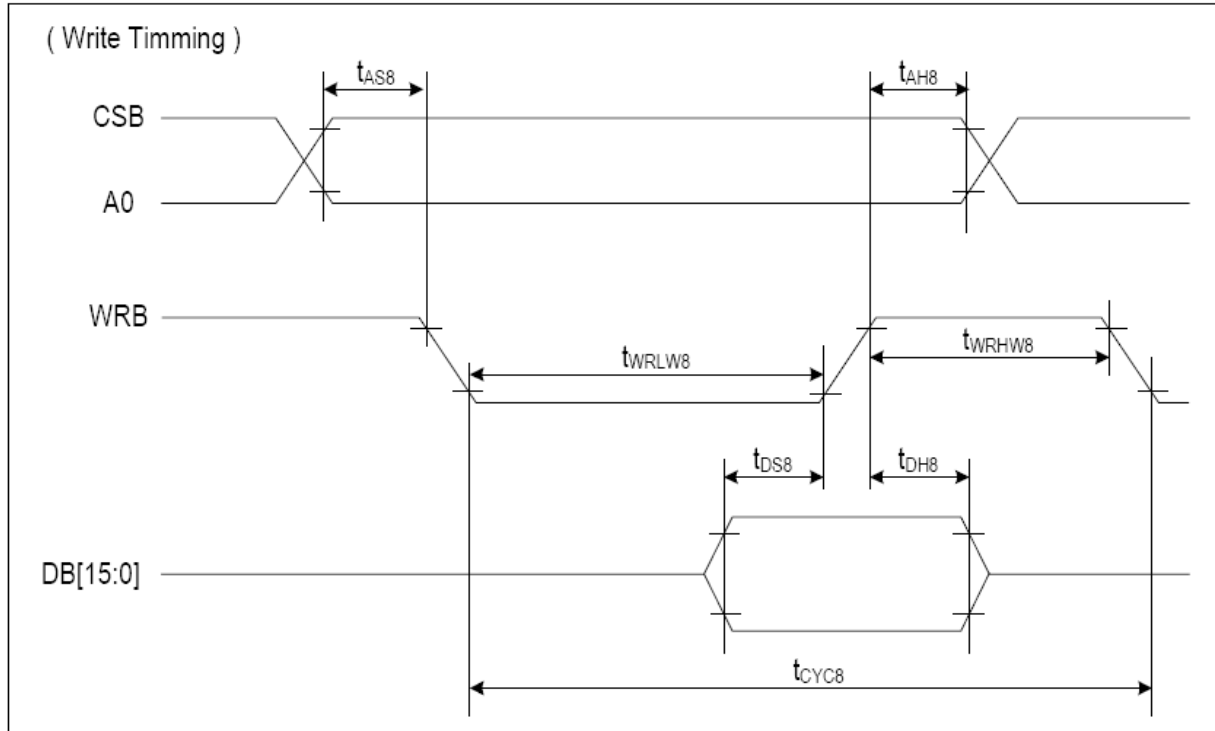
- Driving voltage : 15V
- Red contrast setting : TBD
- Green contrast setting : TBD
- Blue contrast setting : TBD
- Frame rate : TBD
- Duty setting : 1/96

Note(2): Standby Mode test conditions are as follows:

- Driving voltage : 15V
- Red contrast setting : TBD
- Green contrast setting : TBD
- Blue contrast setting : TBD
- Frame rate : TBD
- Duty setting : 1/96

8.3 AC Electrical Characteristics

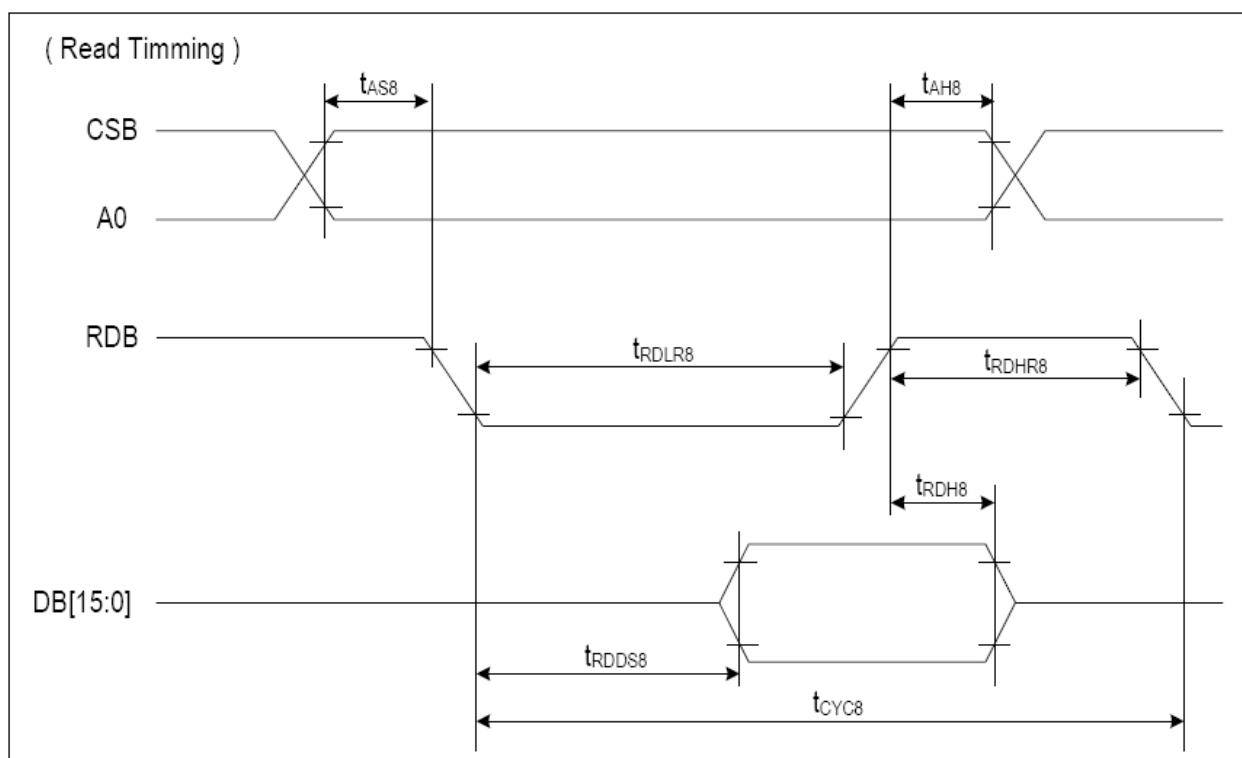
1) System Bus Read/Write Timing (8080 series CPU interface)



(VDD = 2.8V, Ta = 25°C)

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Address hold timing	t_{AH8}	-	5	-	ns	CSB
Address setup timing	t_{AS8}	-	5	-	ns	A0
System cycle timing	t_{CYC8}	-	100	-	ns	WRB
Write "L" pulse width	t_{WRLW8}	-	45	-	ns	WRB
Write "H" pulse width	t_{WRHW8}	-	45	-	ns	WRB
Data setup timing	t_{DS8}	-	30	-	ns	DB[15:0]
Data hold timing	t_{DH8}	-	10	-	ns	DB[15:0]

notice) All the timing reference is 10% and 90% of VDDIO.

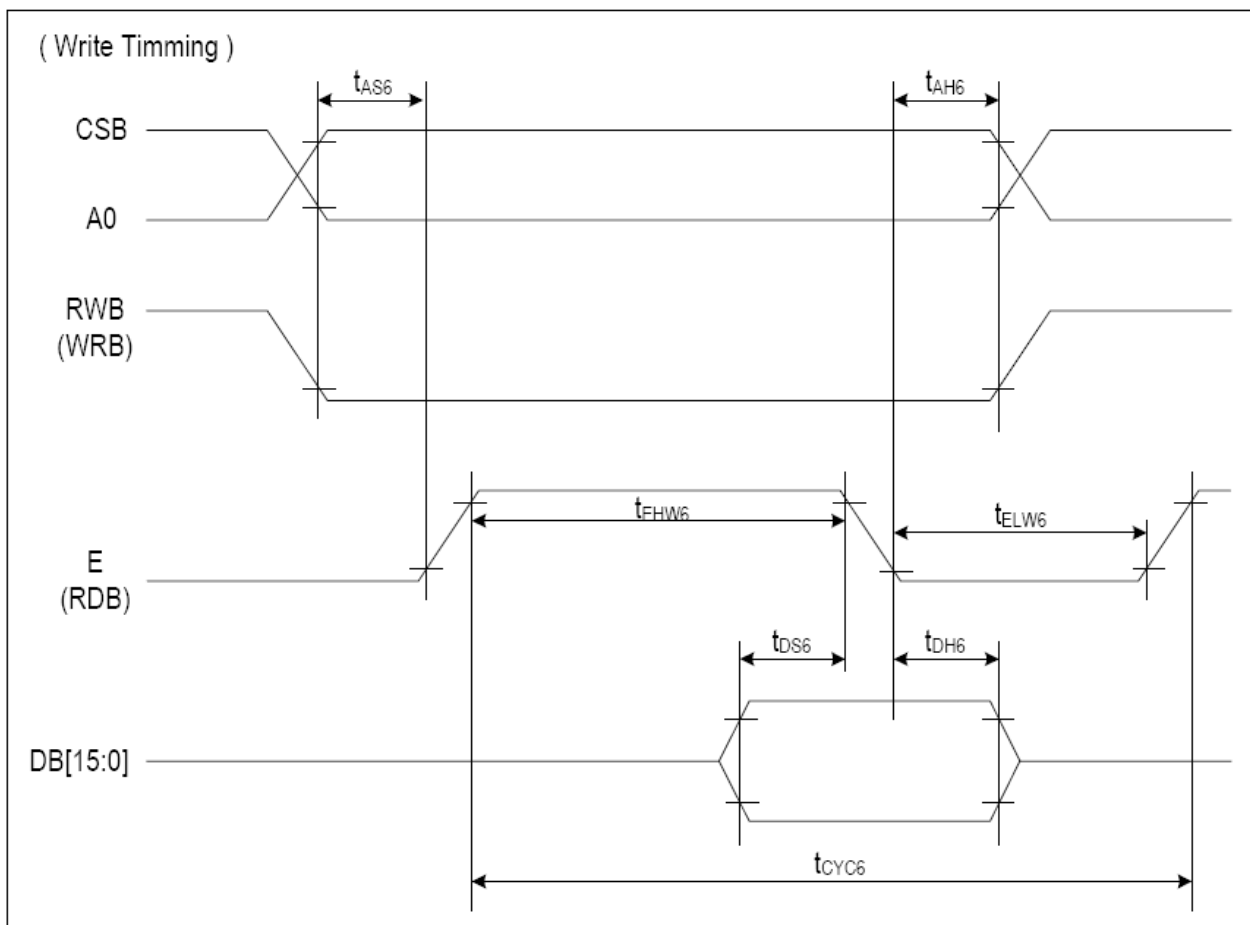


(VDD = 2.8V, Ta = 25°C)

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Address hold timing	t_{AH8}	-	5	-	ns	CSB
Address setup timing	t_{AS8}	-	5	-	ns	A0
System cycle timing	t_{CYC8}	-	200	-	ns	RDB
Read "L" pulse width	t_{RDLR8}	-	90	-	ns	RDB
Read "H" pulse width	t_{RDHR8}	-	90	-	ns	RDB
Read data output delay time	t_{RDDS8}	CL = 15 pF	-	60	ns	DB[15:0]
Data hold timing	t_{RDH8}	CL = 15 pF	0	-	ns	DB[15:0]

Notice) All the timing reference is 10% and 90% of VDDIO.

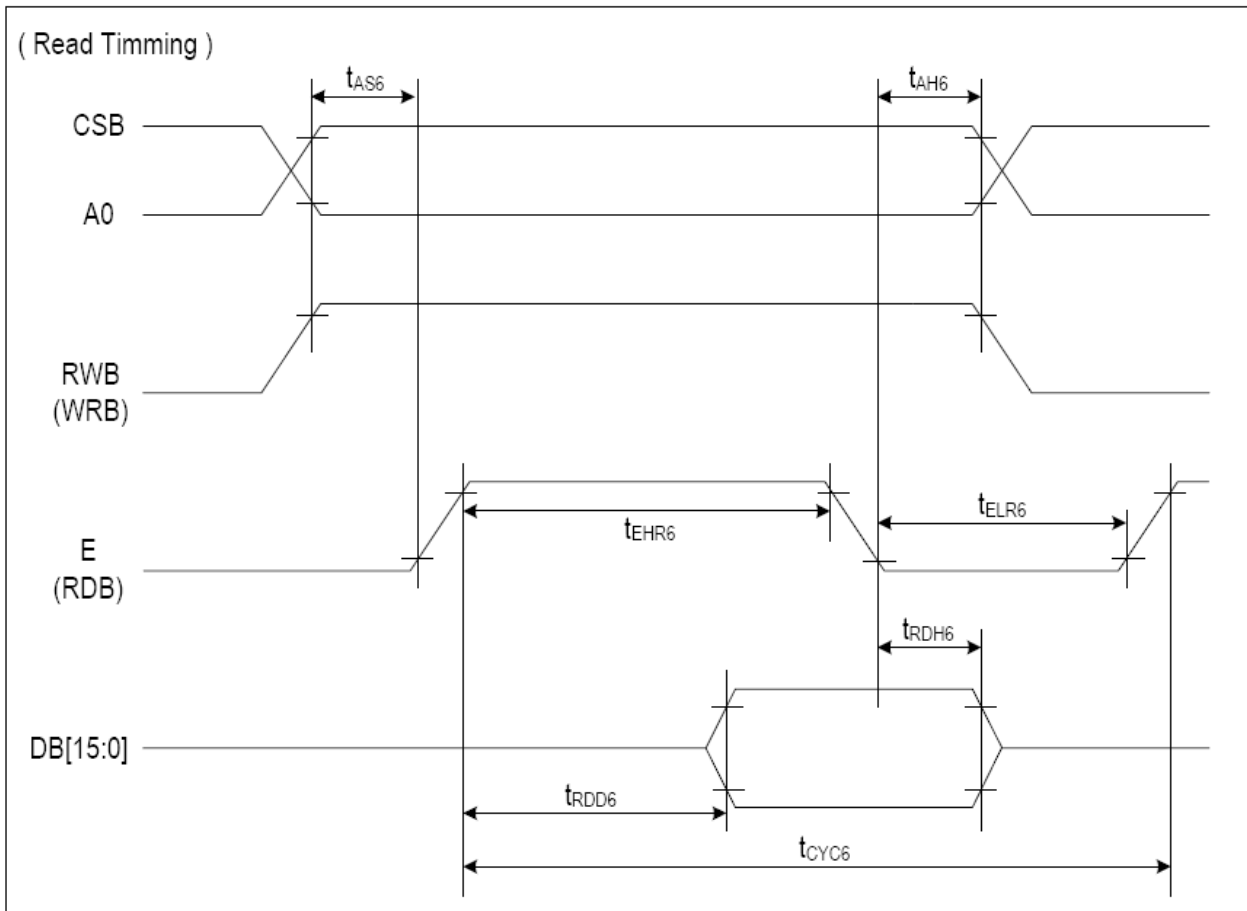
2) System Bus Read/Write Timing (6800 series CPU interface)



(VDD = 2.8V, Ta = 25℃)

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Address hold timing	t_{AH6}	-	5	-	ns	CSB
Address setup timing	t_{AS6}	-	5	-	ns	A0
System cycle timing	t_{CYC6}	-	100	-	ns	
Write "L" pulse width	t_{ELW6}	-	45	-	ns	E
Write "H" pulse width	t_{EHW6}	-	45	-	ns	
Data setup timing	t_{DS6}	-	40	-	ns	DB[15:0]
Data hold timing	t_{DH6}	-	10	-	ns	

Notice) All the timing reference is 10% and 90% of VDDIO.



(VDD = 2.8V, Ta = 25℃)

ITEM	SYMBOL	CONDITION	MIN	MAX	UNIT	PORT
Address hold timing	t_{AH6}	-	10	-	ns	CSB
Address setup timing	t_{AS6}	-	10	-	ns	A0
System cycle timing	t_{CYC6}	-	200	-	ns	E
Read "L" pulse width	t_{ELR6}	-	90	-	ns	E
Read "H" pulse width	t_{EHR6}	-	90	-	ns	E
Read data output delay time	t_{RDD6}	CL = 15 pF	0	70	ns	DB[15:0]
Data hold timing	t_{RDH6}	CL = 15 pF	0	70	ns	DB[15:0]

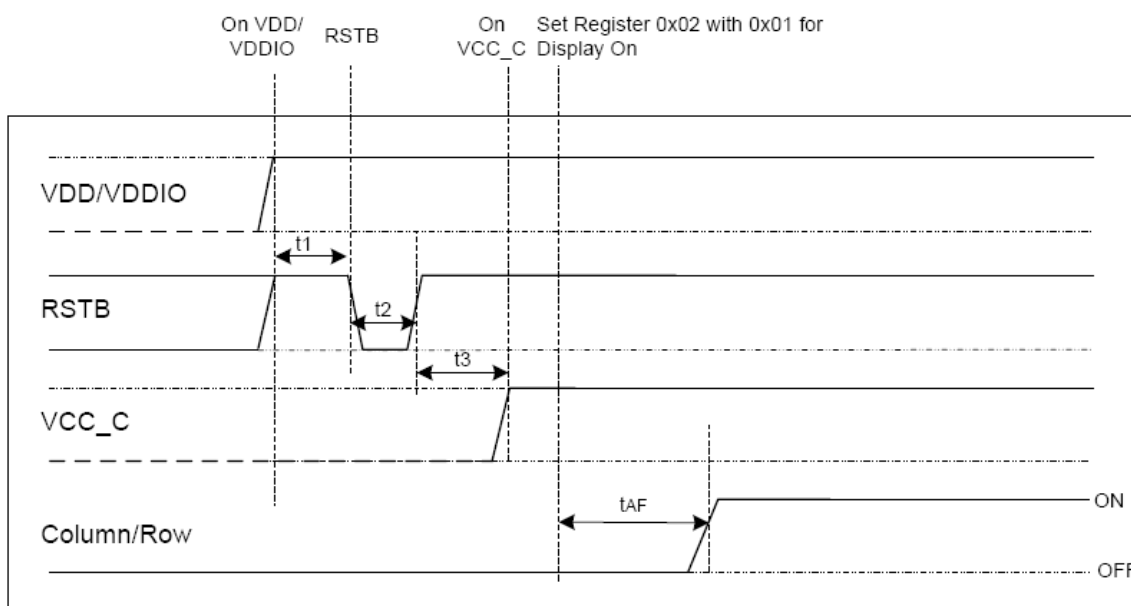
Notice) All the timing reference is 10% and 90% of VDDIO.

9 Functional Specification and Application Circuit

9.1 Power ON and Power OFF Sequence

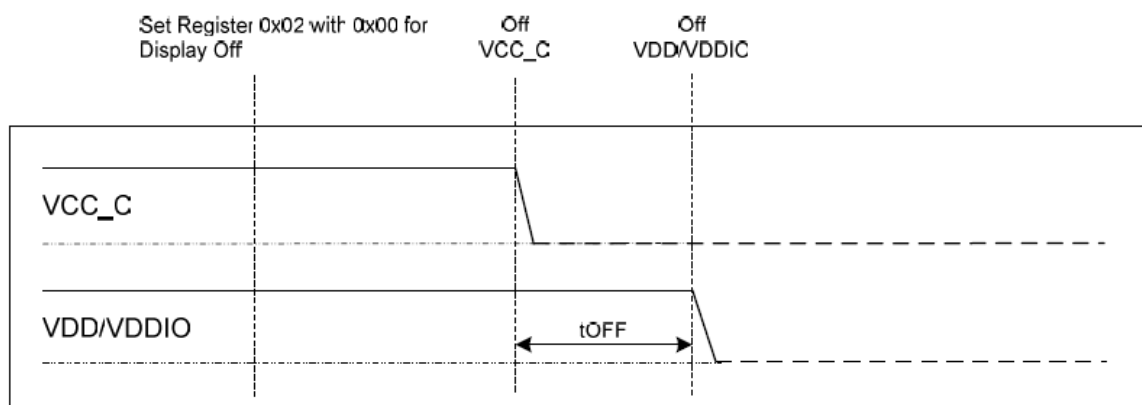
Power ON Sequence:

1. Power ON VDD, VDDIO.
2. After VDD, VDDIO become stable, and wait for 100ms (t_1), set RSTB pin LOW (logic low) for at least 1ms (t_2) and then HIGH (logic high).
3. After set RSTB pin HIGH (logic high), wait for at least 50ms (t_3). Then Power ON VCC_C.
4. After VCC_C become stable, set register 0x02 with value 0x01 for display ON. Data/Scan will be ON after 200ms (t_{AF}).



Power OFF Sequence:

1. Set register 0x02 with value 0x00 for display OFF.
2. Power OFF VCC_C.
3. Wait for t_{OFF} . Power OFF VDD, VDDIO. (where Minimum t_{OFF} = 0ms, Typical t_{OFF} = 100ms)

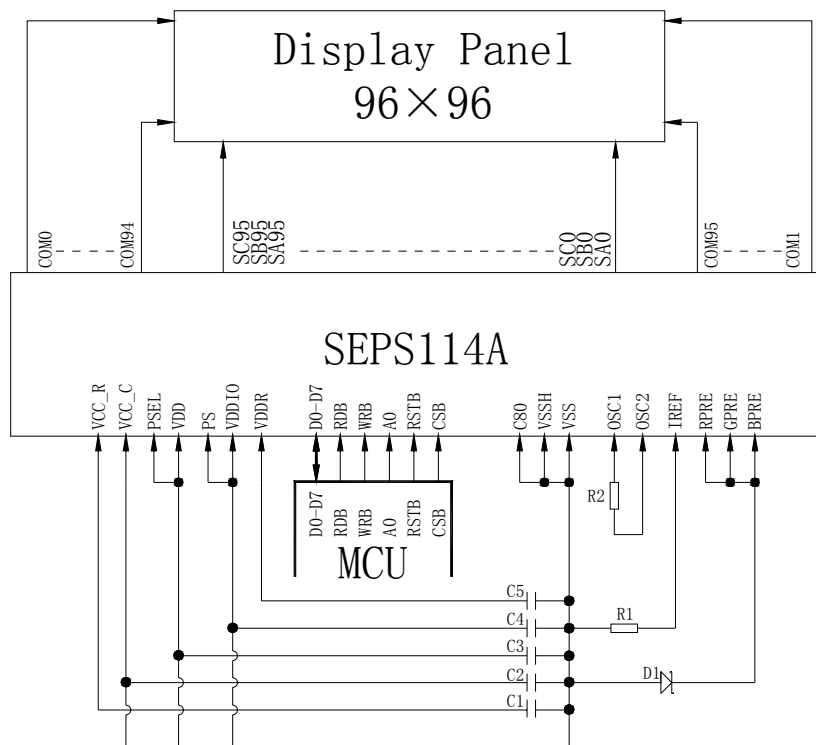


Note:

Since ESD protection circuit is connected between VDD, VDDIO and VCC_C, VCC_C becomes lower than VDD whenever VDD, VDDIO is ON and VCC_C is OFF. VCC_C should be kept disable when it is OFF.

9.2 Application Circuit

The configuration for 8080-parallel interface mode, external V_{CC} is shown in the following diagram:



Recommended components

C1: 4.7 uF

C2: 1uF

C3, C4: 0.1uF

C5: 2.2uF

R1: 39 kΩ

R2: 27 kΩ

D1: UDZSTE-172.7B(zener diode)

9.3 Display Control Instruction

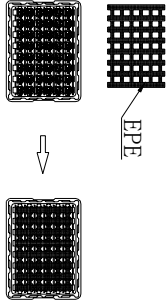
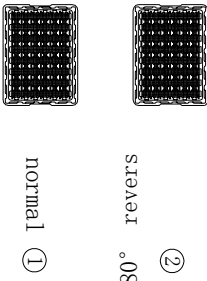
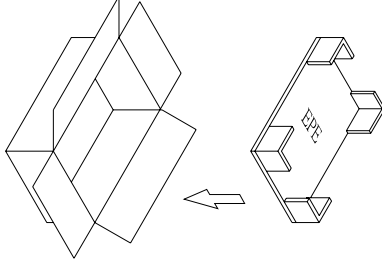
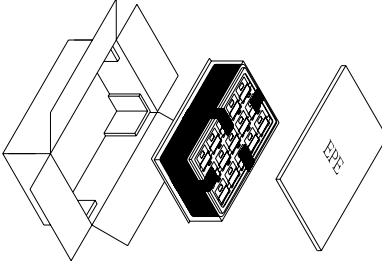
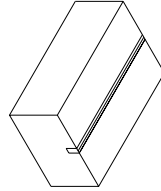
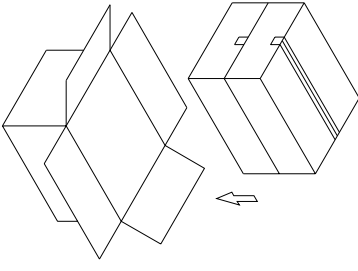
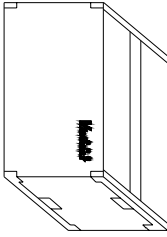
Refer to SEPS114A IC Specification.

9.4 Recommended Software Initialization

TBD

10 Package Specification

Package order (1)~(9)

(1) Tray: 370*273 t=0.8mm Add EPE in every contained tray 	(2)  normal ① server ②	(3) order ①、②、①、② fix trays with tape Package quantity products: 540 pcs of 1 small carton 1 tray contain 36 pcs 15 contained trays, 1 empty tray 	(4) package with plastic bags add five desiccants create a power vacuum  *5
(5) 	(6) 	(7)  small carton package L425*W330*L175 mm	(8)  2 small cartons in 1 big carton
(9) 30 contained trays, 2 empty trays, Package quantity products: 1080 pcs of 1 big carton  Package finished L450*W350*L360 mm	NOTE: Tape on the small carton & big carton		

11 Reliability

11.1 Reliability Test

NO.	ITEM	CONDITION	QUANTITY
1	High Temperature (Non-operation)	80°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~80°C (-40°C/30min;transit/3min;80°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.

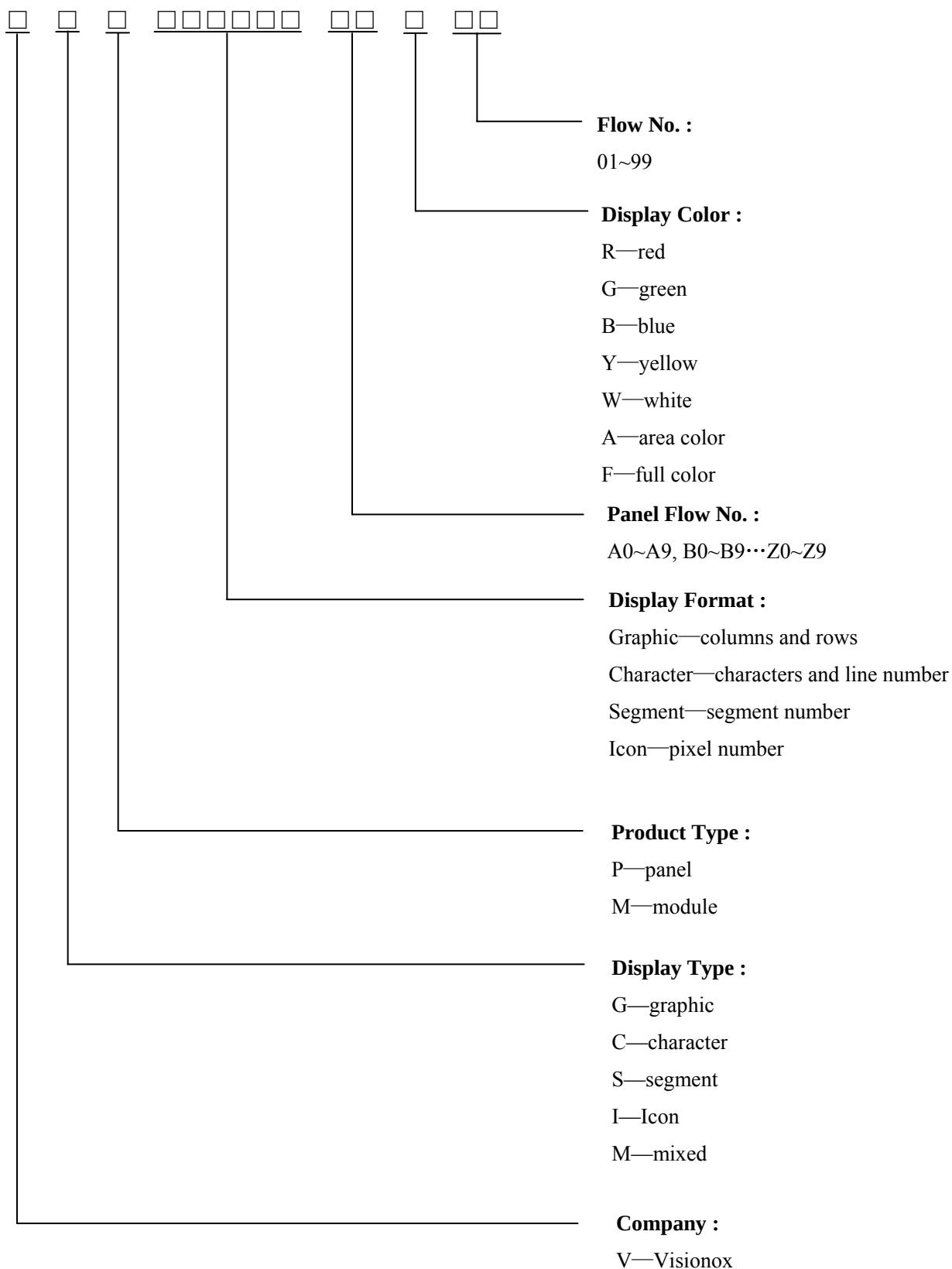
ITEM	MIN	MAX	UNIT	CONDITION
Operation Life Time	TBD	-	hrs	80cd/m ² ,50% Checkerboard

An average operating lifetime of more than 10,000 hrs (50% checkerboard) at room temperature is approached by 240 hrs @ 80°C operating.

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

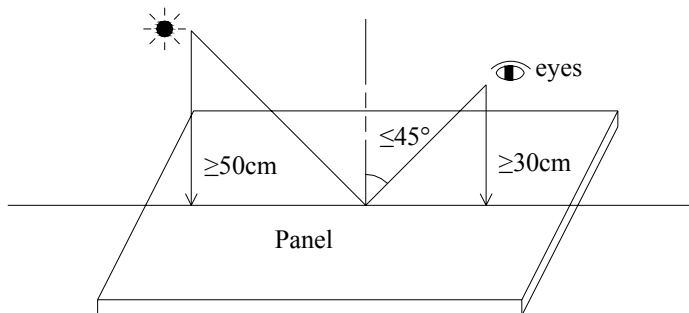
Fluorescent Lamp: 30W

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

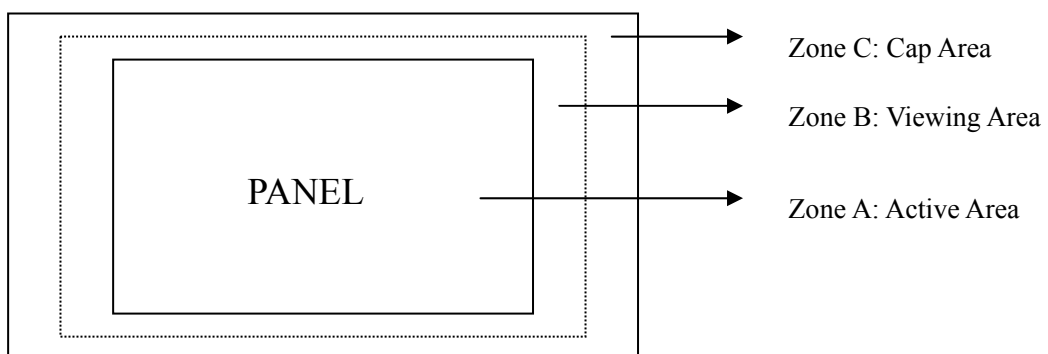
Distance between the Panel & Eyes: $\geq 30\text{cm}$

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

(See the sketch below)

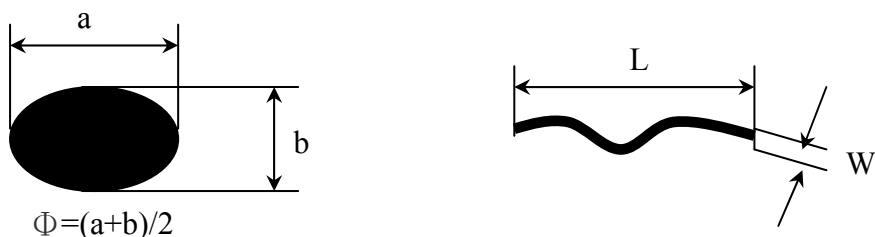


13.3 Quality Assurance Zones

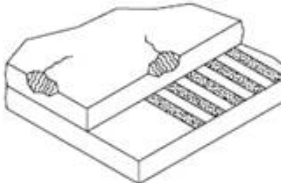


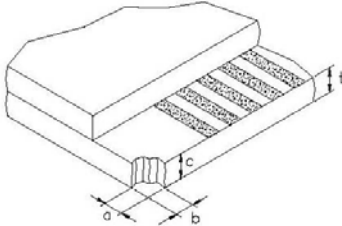
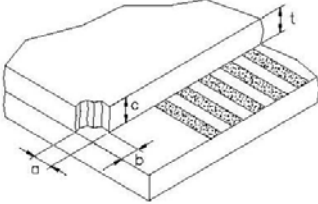
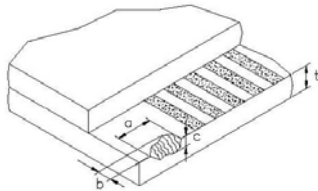
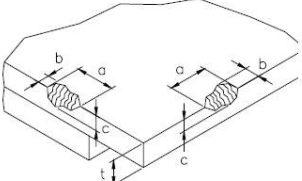
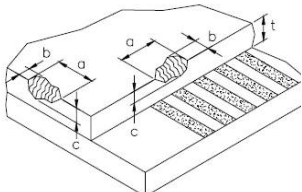
13.4 Inspection Standard

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><th rowspan="2">Average Diameter (mm)</th><th colspan="2">Acceptable Number</th></tr><tr><th>Zone A,B</th><th>Zone C</th></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><th rowspan="2">Width (mm)</th><th rowspan="2">Length (mm)</th><th colspan="2">Acceptable Number</th></tr><tr><th>Zone A,B</th><th>Zone C</th></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><th rowspan="2">Average Diameter (mm)</th><th colspan="2">Acceptable Number</th></tr><tr><th>Zone A,B</th><th>Zone C</th></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	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

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	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

Visionox Display Co., Ltd. warrants for a period of 12 months from the shipping date when stored or used under normal condition.