

**OLED 96RGBx64 (0.95")
Display Module**

Product Specification

Part Name: OLED Display Module (**0.95"**)

Part ID: CY-3021

Doc No.: SCY-3021-F-XX-DV02

Customer:
Approved By:
Date:

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Record of Reversion

Rev	Issued Date	Description
V1.0	12/19/2008	New Create

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1. Features



- ◆ Display Type: OLED 0.95"
- ◆ High Contrast / High Brightness/ Wide View Angle
- ◆ Single Power / Built in DC to DC Converter for OEL Panel
- ◆ Plastic Cover for Assembly easily
- ◆ Support Parallel & Serial Interface

2. General Specification

2.1 Display Specifications

- ◆ Display Mode : Passive Matrix
- ◆ Display Color : 65,536 Colors (Maximum)
- ◆ Drive Duty: 1/64 Duty
- ◆ Number of Pixels : 96(RGB) x 64
- ◆ Pixel Pitch: 0.07 x 0.21 mm
- ◆ Pixel Size: 0.05 x 0.19 mm
- ◆ View Angle: >160 Degree

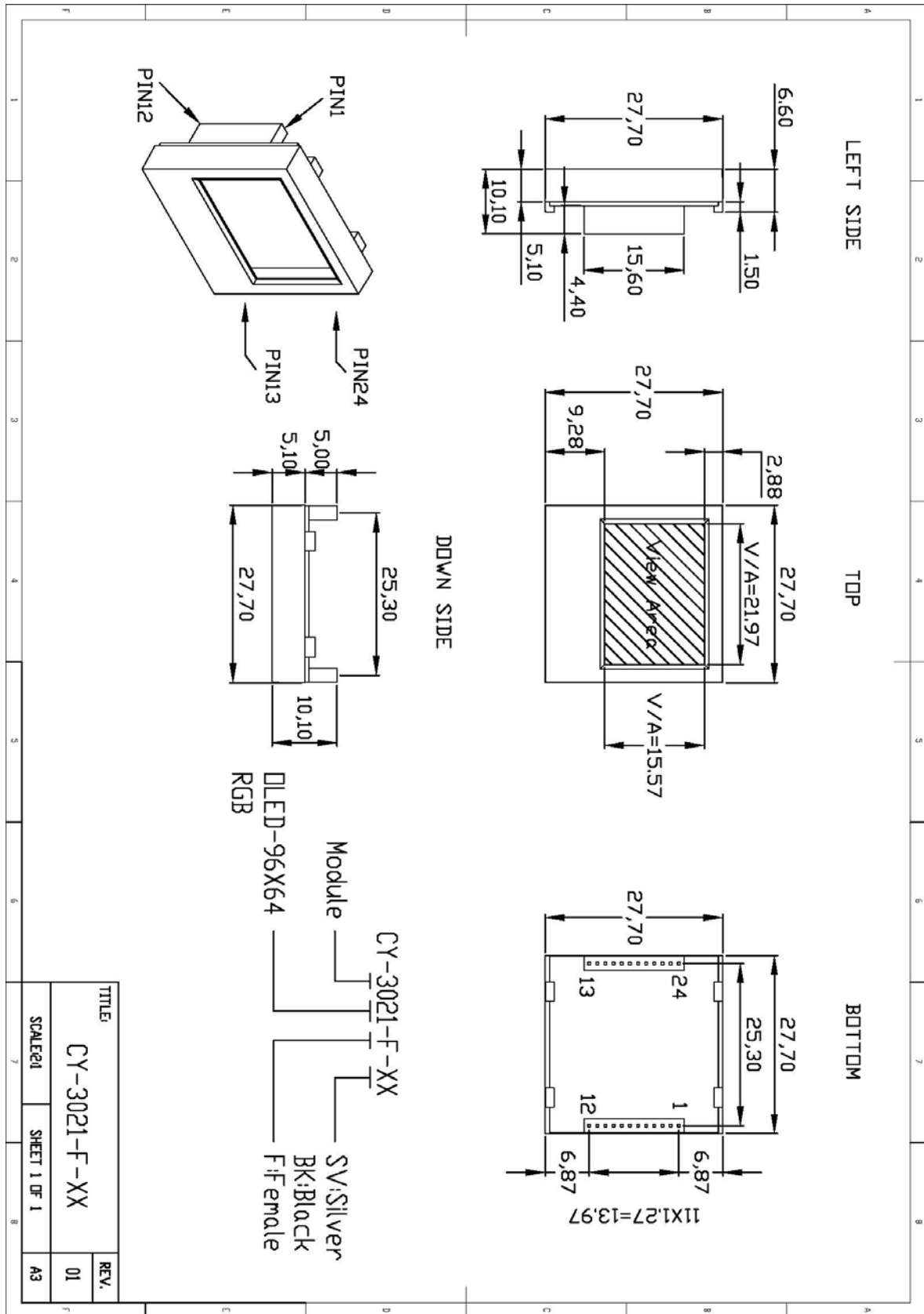
2.2 Mechanical Dimensions

- ◆ Dimensions : 27.70 x 27.70 x 10.10 mm
- ◆ Window Size : 21.97 x 15.57 mm
- ◆ Active Area: 20.14 x 13.42 mm
- ◆ Assembly: Pitch 1.27mm / 12 Pin Connector *2
- ◆ Assembly on PCB Easy & Removable & Flexible

2.3 Electrical Characteristic

- ◆ Supply Voltage: 2.4~3.5V
- ◆ Single Voltage Control Display Module
- ◆ Built-in DC to DC Power Supply to Drive OLED
- ◆ Driver IC: SSD1331Z
- ◆ Interface: Parallel/ Serial/ 68xx/ 80xx/ 4-wire SPI/ I²C

3. Mechanical Drawing



4. Pin Assignments

Pin Number	Symbol	Type	Function												
1	VDD	P	Power Supply for Core VDD This is a voltage supply pin. It must be connected to external source.												
2	VSS	G	Ground for System This is a ground pin. It must be connected to external source.												
3	NC	-	Reserved Pin												
4	NC	-	Reserved Pin												
5 6	BS1 BS2	I	Communication Protocol Select These pins are MCU interface selection input. See the following table: <table border="1"> <thead> <tr> <th></th> <th>68XX-parallel</th> <th>80XX-parallel</th> <th>Serial</th> </tr> </thead> <tbody> <tr> <td>BS1</td> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>BS2</td> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>		68XX-parallel	80XX-parallel	Serial	BS1	0	1	0	BS2	1	1	0
	68XX-parallel	80XX-parallel	Serial												
BS1	0	1	0												
BS2	1	1	0												
7	CS#	I	Chip Select This is the chip select input. The chip is enable for MCU communication only when CS# is pulled low.												
8	RES#	I	Power Reset for Controller and Drive This is reset signal input. When the pin is low , initialization of the chip is executed.												
9	D/C#	I	Data/ Command Control This pin is Data/Command control pin. When the pin is pulled high, the input at D0~D7 is treated as display data. When the pin is pulled low, the input at D0~D7 will be transferred to the command register.												
10	W/R# (R/W#)	I	Write or Read/Write Select When 80xx interface mode is selected, the pin will be the Write (WR#) input. When interfacing to a 68xx-series microprocessor, the pin will be used as Read/Write (R/W#) selection input. Pull this pin to “High” for read mode and pull it to “Low” for write mode.												
11	RD#(E)	I	Read or Read/Write Enable When 80xx interface mode is selected, the pin will be the Read (RD#) input. When interfacing to a 68xx-series microprocessor, the pin will be used as the Enable (E) signal. Read/Write operation is initiated when this pin is pulled high and the CS# is pulled low.												
12	NC	-	Reserved Pin												
13~20	D0~D7	I	Host Data Input /Output Bus These pins are 8-bit bi-directional data bus to be connected to the microprocessor’s data bus. When serial mode is selected, D1 will be the serial data input SDIN and the D0 will be the serial clock input SCLK.												
21	VSS	G	Ground for System This is a ground pin. It must be connected to external source.												
22	VCC-C TL	I	OLED Driver Power Supply ON/ OFF Control When this pin is pulled high, the panel power supply will be turned ON. When this pin is pulled low, the panel power supply will be turned OFF.												
23	NC	-	Reserved Pin												
24	VCC	P	Voltage Output High Level for COM Signal This pin is OLED driver power supply. When VCC-CTL is pulled high, the pin will be output about 14V voltage (Built in Panel Power Supply).												

5. Absolute Maximum Ratings

Parameter	Symbol	Min	Max	Unit	Notes
Supply Voltage	V _{DD}	-0.3	4	V	1,2
Driver Supply Voltage	V _{CC}	0	15	V	1,2
V _{CC} Supply Current	I _{CC}	-	25	mA	1,2
Operating Temperature	T _{OP}	-30	70	°C	-
Storage Temperature	T _{STG}	-40	80	°C	-

Note1 : All the above voltages are on the basis of “GND=0V”

Note2 : When this module is used beyond the above absolute maximum ratings, permanent breakage of the module may occur. Also for normal operations, it is desirable to use this module under the conditions according to Section 6. “Electrical Characteristics”. If this module is used beyond these conditions, malfunctioning of the module can occur and the reliability of the module may deteriorate.

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6. Electrical Characteristics

6.1 DC Characteristics

Characteristics	Symbol	Conditions	Min	TYP	Max	Unit
Supply Voltage	V _{DD}		2.4	2.8	3.5	V
Driver Supply Voltage	V _{CC}	Note 3	-	14.0	-	V
High Level Input	V _{IH}	I _{out} = 100μA, 3.3MHz	0.8×V _{DD}	-	V _{DD}	V
Low Level Input	V _{IL}	I _{out} = 100μA, 3.3MHz	0	-	0.2×V _{DD}	V
High Level output	V _{OH}	I _{out} = 100μA, 3.3MHz	0.9×V _{DD}	-	V _{DD}	V
Low Level output	V _{OL}	I _{out} = 100μA, 3.3MHz	0	-	0.1×V _{DD}	V
Operating Current for V _{DD}	I _{DD}	Note 4	-	0.2	0.6	mA
		Note 5		0.2	0.6	mA
Operating Current for V _{CC}	I _{CC}	Note 4	-	8	11	mA
		Note 5		13.5	18	mA
Sleep Mode Current for V _{DD}	I _{DD} , SLEEP		-	1	2	μA
Sleep Mode Current for V _{CC}	I _{CC} , SLEEP		-	<2	2	μA

Note 3: Brightness (L_{br}) and Driver Supply Voltage (V_{CC}) are subject to the change of the panel characteristics and the customer's request.

Note 4: V_{DD} = 2.8V, V_{CC} = 14V, 50% Display Area Turn on.

Note 5: V_{DD} = 2.8V, V_{CC} = 14V, 100% Display Area Turn on.

6.2 Optics Characteristics

Characteristics	Symbol	Conditions	Min	Typ	Max	Unit
Brightness (White)	L _{br}	With Polarizer (Note 3)	80	100	-	Cd/m ²
C.I.E. (White)	(x)	With Polarizer	0.26	0.30	0.34	
	(y)		0.30	0.33	0.36	
C.I.E. (Red)	(x)	With Polarizer	0.57	0.61	0.65	
	(y)		0.30	0.34	0.38	
C.I.E. (Green)	(x)	With Polarizer	0.26	0.30	0.34	
	(y)		0.58	0.62	0.66	
C.I.E. (Blue)	(x)	With Polarizer	0.10	0.14	0.18	
	(y)		0.14	0.18	0.22	
Dark Room Contrast	CR		-	>1000:1	-	
View Angle			>160	-	-	degree

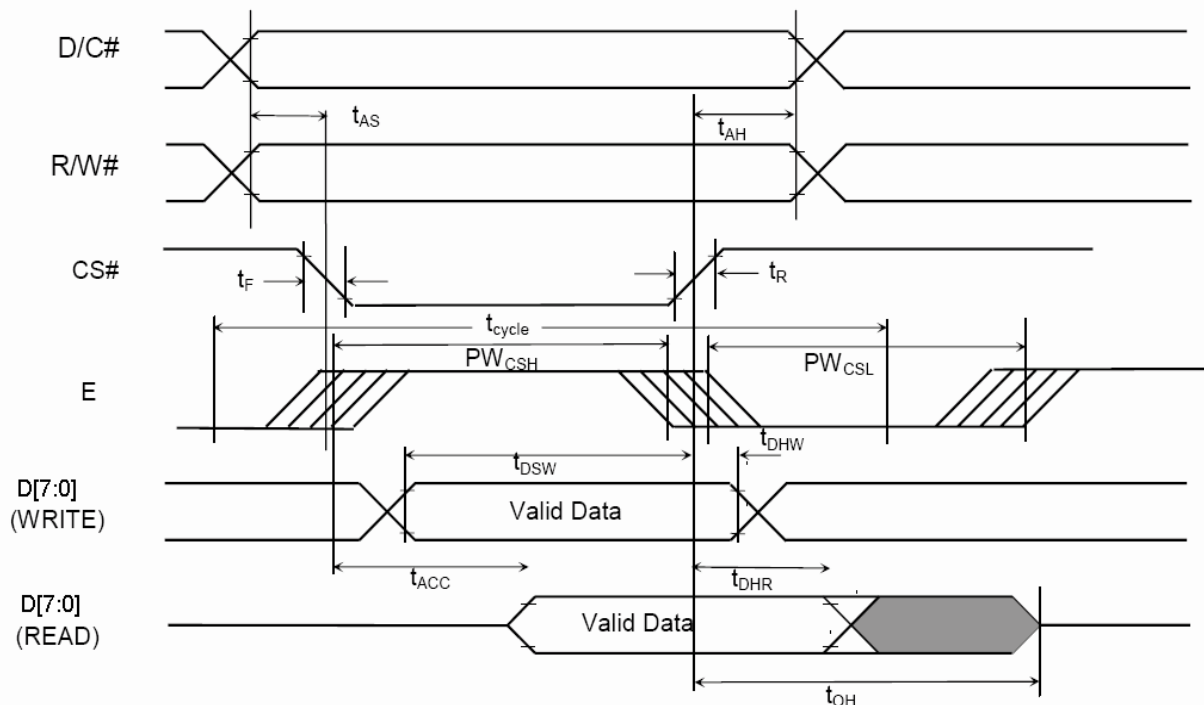
* Optical measurement taken at V_{DD} = 2.8V, V_{CC} = 14V.

7. Timing Chart

7.1 68XX-Series MPU Parallel Interface Timing Characteristics

Symbol	Description	Min	Max	Unit
t_{cycle}	Clock Cycle Time (write cycle)	130	-	ns
PW_{CSL}	Control Pulse Low Width (write cycle)	60	-	ns
PW_{CSH}	Control Pulse High Width (write cycle)	60	-	ns
t_{cycle}	Clock Cycle Time (read cycle)	200	-	ns
PW_{CSL}	Control Pulse Low Width (read cycle)	100	-	ns
PW_{CSH}	Control Pulse High Width (read cycle)	100	-	ns
t_{AS}	Address Setup Time	0	-	ns
t_{AH}	Address Hold Time	10	-	ns
t_{DSW}	Data Setup Time	40	-	ns
t_{DHW}	Data Hold Time	10	-	ns
t_{ACC}	Access Time	-	140	ns
t_{OH}	Output Disable Time	-	70	ns
t_R	Rise Time	-	15	ns
t_F	Fall Time	-	15	ns

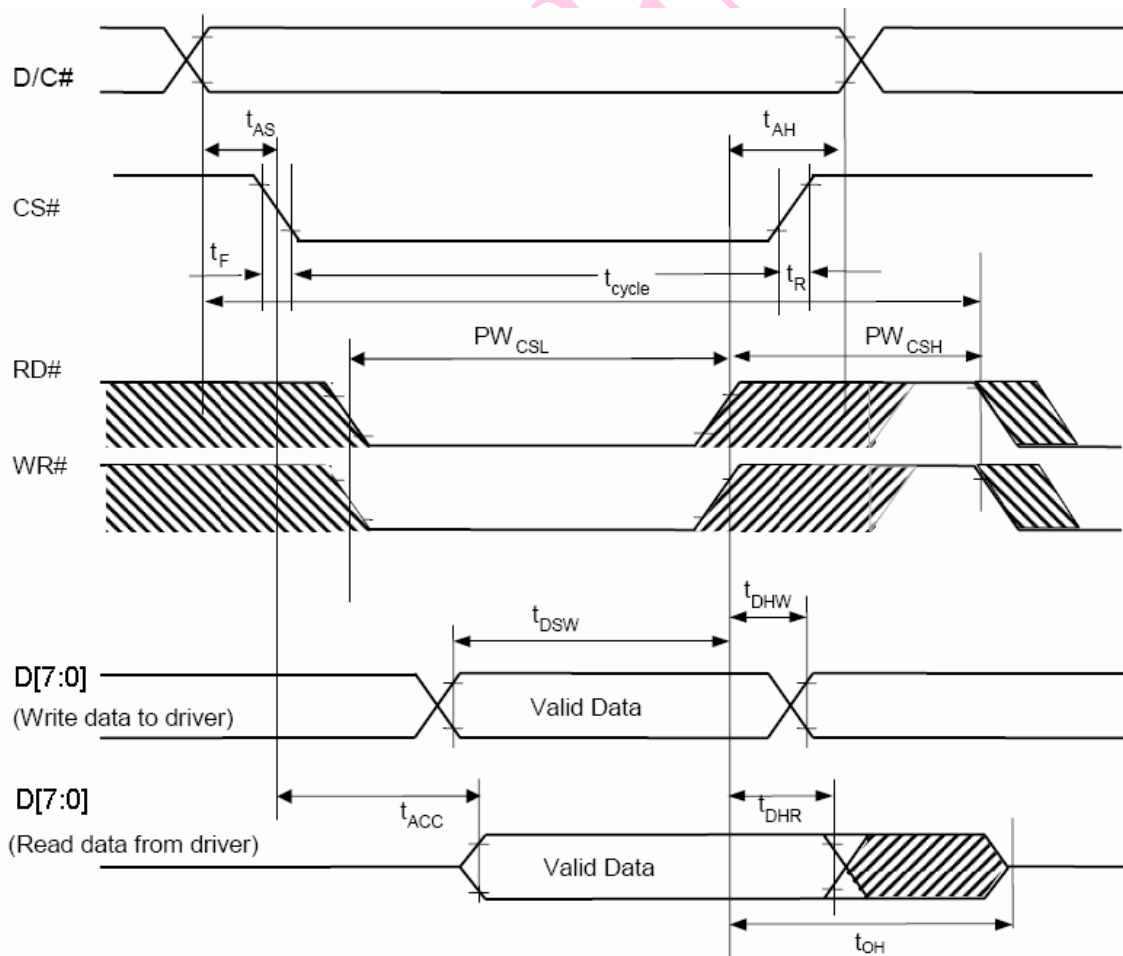
*($V_{DD} - V_{SS} = 2.4V$ to $3.5V$, $T_A = -40$ to $+85$ °C)



7.2 80XX-Series MPU Parallel Interface Timing Characteristics

Symbol	Description	Min	Max	Unit
t _{cycle}	Clock Cycle Time	130	-	ns
t _{AS}	Address Setup Time	0	-	ns
t _{AH}	Address Hold Time	10	-	ns
t _{DSW}	Write Data Setup Time	40	-	ns
t _{DHW}	Write Data Hold Time	10	-	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

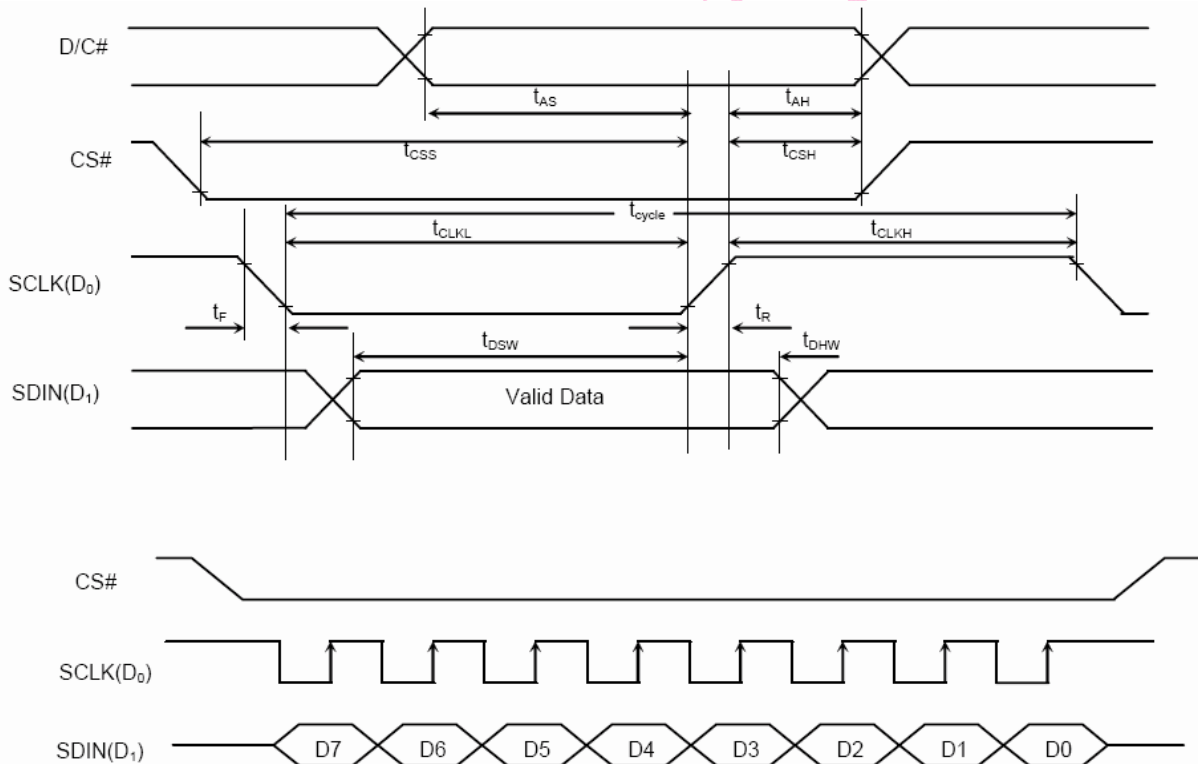
*(VDD - VSS = 2.4V to 3.5V, TA = -40 to +85 °C)



7.3 Series Interface Timing Characteristics

Symbol	Description	Min	Max	Unit
t _{cycle}	Clock Cycle Time	150	-	ns
t _{AS}	Address Setup Time	40	-	ns
t _{AH}	Address Hold Time	40	-	ns
t _{CSS}	Chip Select Setup Time	75	-	ns
t _{CSH}	Chip Select Hold Time	60	-	ns
t _{DSW}	Write Data Setup Tim	40	-	ns
t _{DHW}	Write Data Hold Tim	40	-	ns
t _{CLKL}	Clock Low Time	75	-	ns
t _{CLKH}	Clock High Time	75	-	ns
t _R	Rise Time		15	ns
t _F	Fall Time		15	ns

*(V_{DD} - V_{SS} = 2.4V to 3.5V , T_A = -40 to +85 °C)



8. Function Specification

8.1 Commands

Refer to the Technical Manual for the SSD1331

8.2 Power Down and Power up Sequence

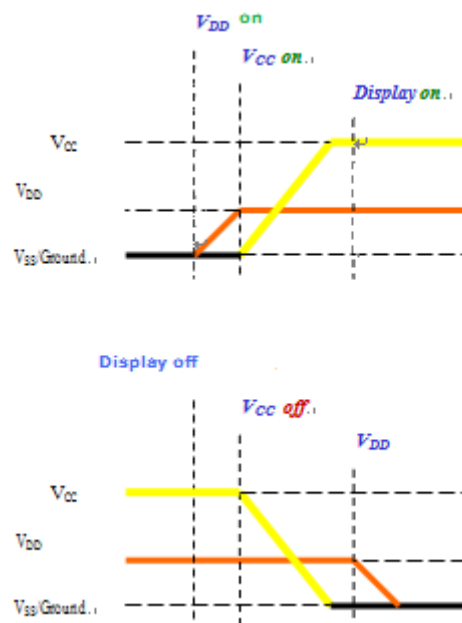
To protect OEL panel and extend the panel life time, the driver IC power up/down routine should include a delay period between high voltage and low voltage power sources during turn on/off. It gives the OEL panel enough time to complete the action of charge and discharge before/after the operation.

8.2.1 Power up Sequence

1. Power up V_{DD}
2. Send Display off Command
3. Driver IC initial setting
4. Clear Screen
5. Power up V_{CC}
6. Delay 100ms (When V_{DD} is stable)
7. Send Display on Command

8.2.2 Power down Sequence

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



8.3 Reset Circuit

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

1. Display is OFF
2. 64 MUX Display Mode
3. Display start line is set at display RAM address 0
4. Display offset set to 0
5. Normal segment and display data column and row address mapping (SEG0 mapped to address 00H and COM0 mapped to address 00H)
6. Column address counter is set at 0
7. Master contrast control register is set at 0FH
8. Individual contrast control registers of color A,B, and C are set at 80H
9. Shift register data clear in serial interface
10. Normal display mode (Equivalent to A4 command)

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9. Command Application Example

Command usage and explanation of an actual example

<Initialization>

```

OLED_VCC_CTL=0;           //Off power up Panel Vcc
OLED_RESET=0;            //Reset driver IC for 100ms
Delay_100ms (1);
OLED_RESET=1;
Set_Display_Off (0xAE);
Set_Re-map & Data Format (0xA0, 0x74);
Set_Display_Start Line (0xA1, 0x00);
Set_Display_Offset (0xA2, 0x00);
Set_Display_Mode (0xA4);
Set_MUX_Ratio (0xA8, 0x3F);
Set_Master_Configuration (0xAD, 0x8E);
Set_Power_Saving_Mode (0xB0, 0x0B);
Set_Reset (Phase 1) / Pre-charge (Phase 2) period (0xB1,0x31);
Set_Oscillator_Frequency / Clock Divider (0xB3,0xF0);
Set_Second Pre-charge Speed of Color A (0x8A, 0x64);
Set_Second Pre-charge Speed of Color B (0x8B, 0x78);
Set_Second Pre-charge Speed of Color C (0x8C, 0x64);
Set_Pre-charge Level (0xBB, 0x3A);
Set_VCOMH (0xBE, 0x3E);
Set_Master_Current (0x87, 0x06);
Set_Contrast for Color A (0x81, 0x91);
Set_Contrast for Color B (0x82, 0x50);
Set_Contrast for Color C (0x83, 0x7D);
Set_Display On (0xAF);
OLED_VCC=1;              //Power up Vcc
Delay_100ms(1);         //Dealy 100ms
Set_Display_On(0xAF);    // Display On (0x00/0x01)

```

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

10. Reliability

10.1 Contents of Reliability Test

Item	Conditions	Criteria
High Temperature Operation	70°C , 240hrs	The operational functions work.
Low Temperature Operation	-30°C , 240hrs	
High Temperature Storage	80°C , 240hrs	
Low Temperature Storage	-40°C , 240hrs	
High Temperature/ Humidity Operation	60°C , 90% RH, 120hrs	
Thermal Shock	-40°C <=> 85°C , 24 cycles 1hr dwell	

*The samples used for the above test do not include polarizer.

*No moisture condensation is observed during tests.

10.2 Lifetime

End of lifetime is specified as 50% of initial brightness

Parameter	Min	Max	Unit	Condition	Notes
Operating Life Time	10,000	-	Hrs	80 cd/m ² , 50% checkerboard	*
Storage Life Time	20,000	-	Hrs	Ta=25°C, 50%RH	

*The average operating lifetime at room temperature is estimated by the accelerated operation at high temperature conditions.

10.3 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 23±5°C ; 55±15%RH