



DM-OLED039-694

0.39" Active Matrix Color OLED Panel Module - MIPI

1. Overview/Application

DM-OLED039-694 is a 0.39 inch diagonal, FHD resolution(1920 x1080), active matrix color OLED (Organic Light Emitting Display)panel module based on single crystal silicon backplane . The pixel circuits and driving IC are integrated on the silicon backplane to get the compact size and very low power consumption.

(Potential applications: Virtual Reality application (AR/VR) , Head mounted displays, Near-Eye Displays etc.)

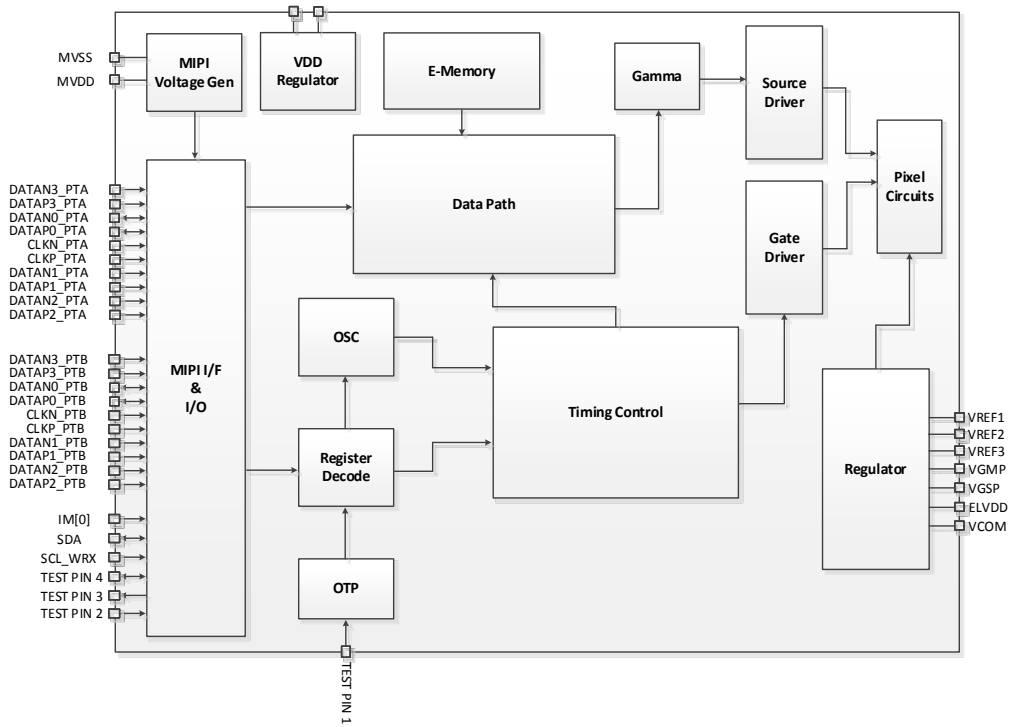
2. Features

- Small-size, high resolution 0.39 FHD Display PPI=5644
 - AP Operated Resolution (8*M, M=40~240) x RGB x (8*N, N=30~135)
 - Full color mode , 16.7M colors
 - Fast response
 - Thin and light in weight
 - Color enhancement, Sharpness enhancement
 - High contrast mode
 - High fluency mode
 - Power-saving (PS) mode
 - Scan direction selection, up or down
 - Interface , Support MIPI only or MIPI(data)+I²C(CMD)
-

3. Module Structure

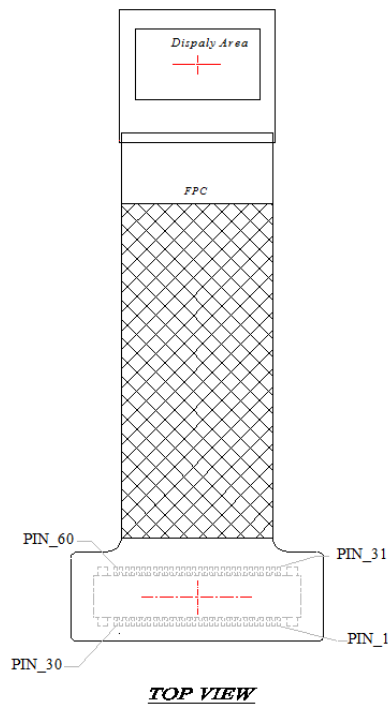
- Active matrix color OLED display with on-chip driver based on single crystal silicon transistors

System Block Diagram

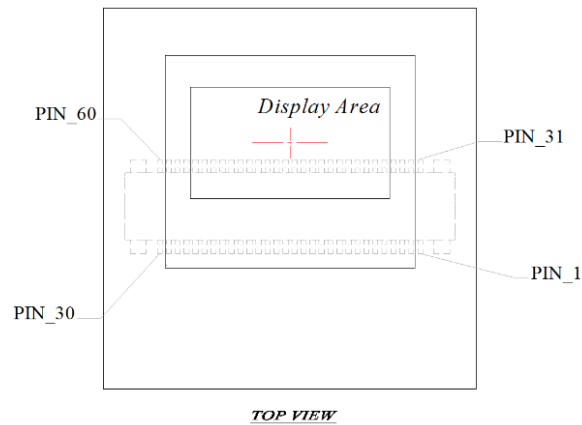


5. Pin Description

5.1 Pin Assignment



- **FPC module**



● **PCB module**

5.2 Pin description of FPC Module

PIN No. (FPC Side)	Symbol	Type	Description									
1	GND	Power Supply	Circuit ground									
2	GND	Power Supply	Circuit ground									
3	TEST PIN 1	Input	TEST pin (no connect , Floating)									
4	VREF2	Output	VREF voltage , Connect a capacitor for stabilization									
5	VREF3	Output	VREF voltage , Connect a capacitor for stabilization									
6	VGMP	Output	Gamma top voltage , Connect a capacitor for stabilization									
7	VGSP	Output	Gamma bottom voltage , Connect a capacitor for stabilization									
8	AVEE	Power Supply	Power supply for OLED cell , Connect a capacitor for stabilization									
9	VREF1	Output	VREF voltage , Connect a capacitor for stabilization									
10	IM [0]	Input	Use to select the Interface type. <table border="1" style="margin-left: 20px;"> <thead> <tr> <th>IM [0]</th> <th>Command Execute</th> <th>Image Write</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>MIPI</td> <td>MIPI</td> </tr> <tr> <td>1</td> <td>I2C</td> <td>MIPI</td> </tr> </tbody> </table> <p>Note: MIPI 1port or 2port is selected by register setting</p>	IM [0]	Command Execute	Image Write	0	MIPI	MIPI	1	I2C	MIPI
IM [0]	Command Execute	Image Write										
0	MIPI	MIPI										
1	I2C	MIPI										
11	OTP_SEL	Input	MTP type selection. OTP_SEL=0: use external MTP OTP_SEL=1: use internal MTP									
12	OCP_OUT	Output	Over current protect flag									
13	TEST PIN 2	Input	TEST pin , connect to GND									
14	SDA	Input/ Output	Bi-direction data PIN in I2C I/F If this pin is not used, please connect to VDDI									
15	SCL_WRX	Input	Synchronous clock signal in I2C I/F. If this pin is not used, please connect to VDDI									
16	TEST PIN 3	Output	TEST pin , (no connect , Floating)									
17	TEST PIN 4	Input/ Output	TEST pin , (no connect , Floating)									
18	RESX	Input	This signal will reset the device and must be applied to properly initialize the chip , Signal is active low									
19	MVDDL	Output	Internal system Power , Connect a capacitor for stabilization									
20	MVDDA	Output	Internal system Power , Connect a capacitor for stabilization									

21	GND	Power Supply	Circuit ground
22	VDDI	Power Supply	External power supply (1.8V for digital system power)
23	DVDD	Output	Internal system Power , Connect a capacitor for stabilization
24	DVDD	Output	Internal system Power , Connect a capacitor for stabilization
25	AVDD	Power Supply	Power supply for OLED cell , Connect a capacitor for stabilization
26	ELVDD	Output	Power supply for OLED cell , Connect a capacitor for stabilization
27	VCOM	Output	Power supply for OLED cell , Connect a capacitor for stabilization
28	VCOM	Output	Power supply for OLED cell , Connect a capacitor for stabilization
29	GND	Power Supply	Circuit ground
30	GND	Power Supply	Circuit ground
31	GND	Input	Circuit ground for MIPI
32	DATAP2_PTA	Input	Differential small amplitude signal of MIPI data input
33	DATAN2_PTA	Input	Differential small amplitude signal of MIPI data input
34	GND	Input	Circuit ground for MIPI
35	DATAP1_PTA	Input	Differential small amplitude signal of MIPI data input
36	DATAN1_PTA	Input	Differential small amplitude signal of MIPI data input
37	GND	Input	Circuit ground for MIPI
38	CLKP_PTA	Input	MIPI CLK
39	CLKN_PTA	Input	MIPI CLK
40	GND	Input	Circuit ground for MIPI
41	DATAP0_PTA	Input/ Output	Differential small amplitude signal of MIPI data input
42	DATAN0_PTA	Input/ Output	Differential small amplitude signal of MIPI data input
43	GND	Input	Circuit ground for MIPI
44	DATAP3_PTA	Input	Differential small amplitude signal of MIPI data input
45	DATAN3_PTA	Input	Differential small amplitude signal of MIPI data input
46	GND	Input	Circuit ground for MIPI
47	DATAP2_PTB	Input	Differential small amplitude signal of MIPI data input
48	DATAN2_PTB	Input	Differential small amplitude signal of MIPI data input
49	GND	Input	Circuit ground for MIPI
50	DATAP1_PTB	Input	Differential small amplitude signal of MIPI data input
51	DATAN1_PTB	Input	Differential small amplitude signal of MIPI data input
52	GND	Input	Circuit ground for MIPI
53	CLKP_PTB	Input	MIPI CLK
54	CLKN_PTB	Input	MIPI CLK
55	GND	Input	Circuit ground for MIPI
56	DATAP0_PTB	Input/ Output	Differential small amplitude signal of MIPI data input
57	DATAN0_PTB	Input/ Output	Differential small amplitude signal of MIPI data input
58	GND	Input	Circuit ground for MIPI
59	DATAP3_PTB	Input	Differential small amplitude signal of MIPI data input
60	DATAN3_PTB	Input	Differential small amplitude signal of MIPI data input

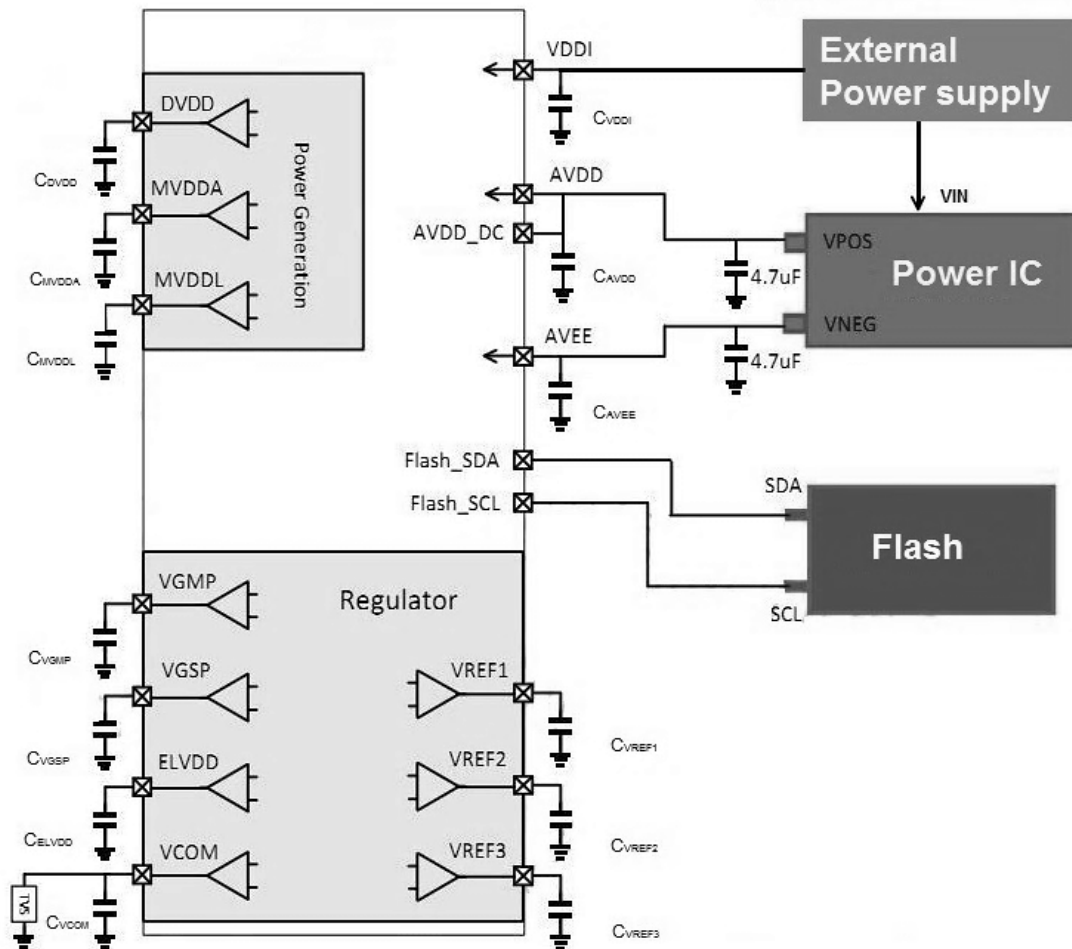
5.3 Pin description of PCB Module

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0	MIPI	MIPI										
1	I2C	MIPI										
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6	OCP_OUT	Output	Over current protect flag									
7	TEST PIN 2	Input	TEST pin , connect to GND									
8	SDA	Input/ Output	<p>Bi-direction data PIN in I2C I/F</p> <p>If this pin is not used, please connect to VDDI</p>									
9	SCL_WRX	Input	<p>Synchronous clock signal in I2C I/F.</p> <p>If this pin is not used, please connect to VDDI</p>									
10	RESX	Input	<p>This signal will reset the device and must be applied to properly initialize the chip ,</p> <p>Signal is active low</p>									
11	VDDI	Power Supply	External power supply (1.8V for digital system power)									
12	VDDI	Power Supply	External power supply (1.8V for digital system power)									
13	VIN	Power Supply	External power supply									
14	VIN	Power Supply	External power supply									
15	ENP	Input	Enable pin for Power IC (Connect to VIN)									
16	ENN	Input	Enable pin for Power IC (Connect to VIN)									
17	GND	Power Supply	Circuit ground									
18	GND	Power Supply	Circuit ground									
19	GND	Power Supply	Circuit ground									
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34	GND	Input	Circuit ground for MIPI
35	DATAP1_PTA	Input	Differential small amplitude signal of MIPI data input
36	DATAN1_PTA	Input	Differential small amplitude signal of MIPI data input
37	GND	Input	Circuit ground for MIPI
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39	CLKN_PTA	Input	MIPI CLK
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43	GND	Input	Circuit ground for MIPI
44	DATAP3_PTA	Input	Differential small amplitude signal of MIPI data input
45	DATAN3_PTA	Input	Differential small amplitude signal of MIPI data input
46	GND	Input	Circuit ground for MIPI
47	DATAP2_PTB	Input	Differential small amplitude signal of MIPI data input
48	DATAN2_PTB	Input	Differential small amplitude signal of MIPI data input
49	GND	Input	Circuit ground for MIPI
50	DATAP1_PTB	Input	Differential small amplitude signal of MIPI data input
51	DATAN1_PTB	Input	Differential small amplitude signal of MIPI data input
52	GND	Input	Circuit ground for MIPI
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54	CLKN_PTB	Input	MIPI CLK
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56	DATAP0_PTB	Input/ Output	Differential small amplitude signal of MIPI data input
57	DATAN0_PTB	Input/ Output	Differential small amplitude signal of MIPI data input
58	GND	Input	Circuit ground for MIPI
59	DATAP3_PTB	Input	Differential small amplitude signal of MIPI data input
60	DATAN3_PTB	Input	Differential small amplitude signal of MIPI data input

5.4 Peripheral Circuit

Mounting the capacitor for each power supply to ensure that the panel display normally.



Notes:

- (1) There are totally 13 capacitors and 1 Schottky diode.
- (2) The Schottky diode is placed between VCOM and ground.

6. Absolute Maximum Ratings

Item	Symbol	Min.	Maximum Ratings	Unit
External power supply	VDDI	1.65	1.95	V
	Vin (for PCB)	2.5	5.5	V
OLED Power Supply	AVDD	5.0	6.0	V
	AVEE	-5.0	-6.0	V
Logic input voltage	Vi	1.65	1.95	V
Operating temperature	Topr	-40	85	°C
Storage temperature	Tstg	-55	125	°C

7. Recommended Operating Conditions

Item	Symbol	Min.	Typ.	Max	Unit
External power supply	VDDI	1.65	1.8	1.95	V
	Vin (for PCB)	2.5	4.4	5.5	V
OLED Power Supply	AVDD	5.0	5.4	6.0	V
	AVEE	-5.0	-5.4	-6.0	V
Logic input voltage	Vi	1.65	1.8	1.95	V
Operating temperature	Topr	-10		80	°C

8. Electrical Characteristics

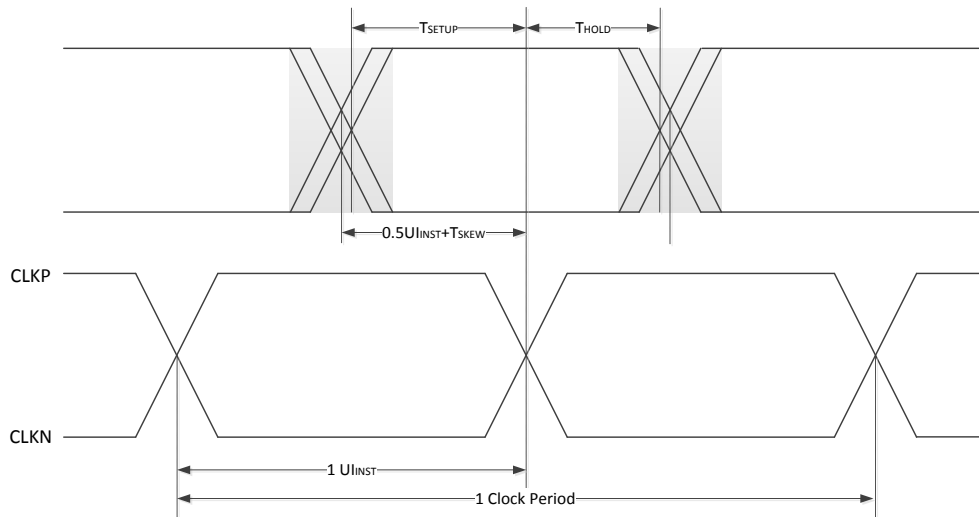
8.1 DC Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Power & Operation Voltage						
AVDD Input Level	AVDD	-	5.0		6.0	V
AVEE Input Level	AVEE	-	-5.0		-6.0	V
Digital I/O Power Supply	VDDI	-		1.8		V
Digital I/O Input Level @Logic High	VIH	VDDI=1.65V ~ 1.95V	0.7*VDDI	-	VDDI	V
Digital I/O Input Level @Logic Low	VIL	VDDI=1.65V ~ 1.95V	0	-	0.3*VDDI	V
Power IC Input Level	VIN (for PCB)	Vin = 2.5V~5.5V	2.5	4.4	5.5	V

8.2 AC Characteristics

8.2.1 MIPI High Speed Mode Characteristics

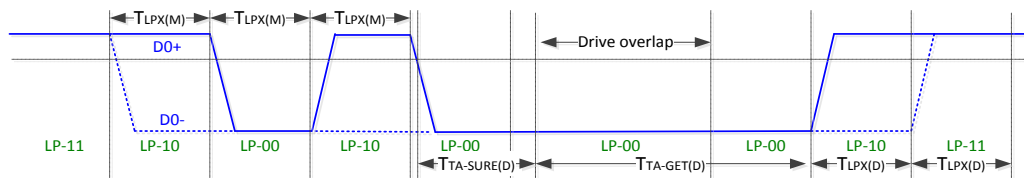
Parameter	Symbol	Min	Typ.	Max	Unit
UI instantaneous	UIINST	1	-	3	ns
T Data to Clock Skew	TSKEW	-0.15	-	0.15	UIHS
RX Data to Clock Setup Time Tolerance	TSETUP	0.15	-	-	UIHS
RX Data to Clock Hold Time Tolerance	THOLD	0.15	-	-	UIHS



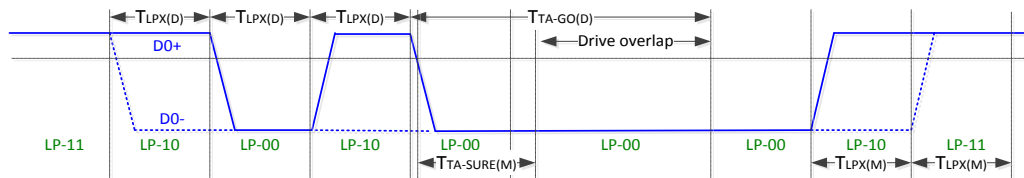
8.2.2 MIPI Low Power Mode Characteristics

Parameter	Description	Min	Typ.	Max	Unit
$T_{LPX(M)}$	Transmitted length of any Low-Power state period (MCU to display module)	50	-	-	ns
$T_{LPX(D)}$	Transmitted length of any Low-Power state period (display module to MCU)	50	-	-	ns
$T_{TA-SURE}$	Time that the new transmitter waits after the LP-10 state before transmitting the Bridge state(LP-00) during a Link Turnaround	T_{LPX}	-	$2 * T_{LPX}$	
T_{TA-GET}	Time that the new transmitter drives the Bridge state(LP-00) after accepting control during a Link Turnaround	$5 * T_{LPX}$			
T_{TA-GO}	Time that the transmitter drives the Bridge state(LP-00) before releasing control during a Link Turnaround	$4 * T_{LPX}$			

- Bus Turnaround from MPU to display module



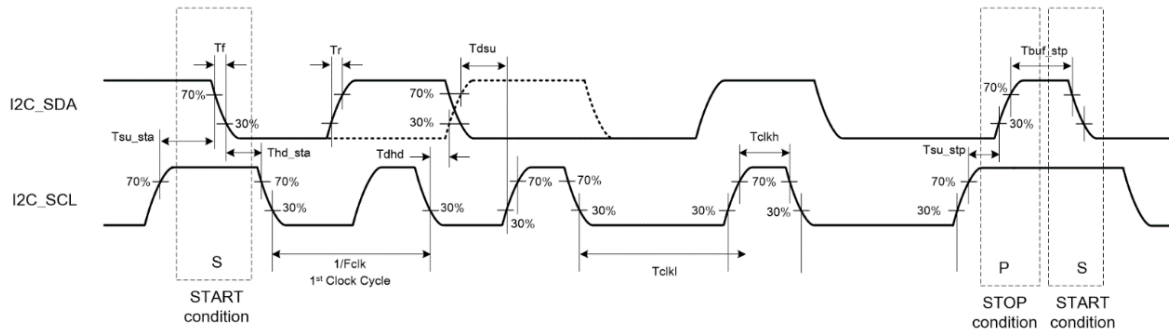
- Bus Turnaround from display module to MPU



8.2.3 I2C Interface Timing

Parameter	Symbol	Min.	Typ.	Max.	Unit
I2C Clock Frequency	Fclk	-	-	400	kHz
I2C Clock Low	TclkL	1300	-	-	ns
I2C Clock High	TclkH	600	-	-	ns
I2C Data Rising Time	Tdr	-	-	300	ns
I2C Data Falling Time	Tdf	-	-	300	ns

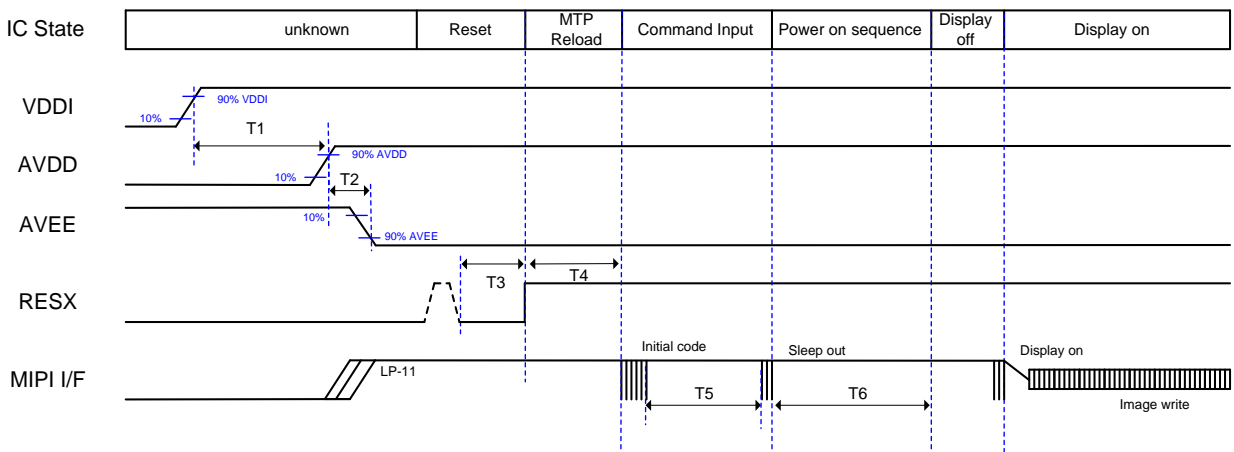
I2C Data Setup Time	Tdsu	100	-	-	ns
I2C Data Hold Time	Tdhd	-	-	TBD	ns
I2C Setup Time (Start Condition)	Tsu_sta	600	-	-	ns
I2C Hold Time (Start Condition)	Thd_sta	600	-	-	ns
I2C Setup Time (Stop Condition)	Tsu_stp	600	-	-	ns
I2C Bus Free Time (Stop Condition)	Tbuf_stp	1300	-	-	ns



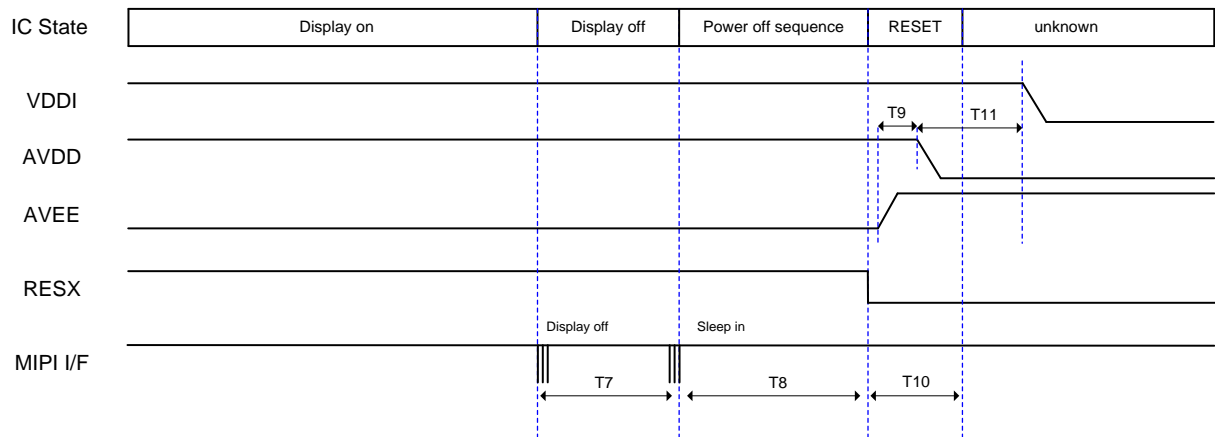
9. Power Supply Sequence

9.1 Power On/Off Sequence

Power on sequence



Power off sequence



Symbol	Min.	Typ.	Max.	Unit	Description
T1	1	-	-	ms	Power on time between AVDD and VDDI
T2	1	-	-	ms	Power on time between AVDD and AVEE
T3	1	-	-	ms	Effective hardware reset period
T4	20	-	-	ms	MTP reload time
T5	0	-	-	ms	The time is between initial code finished and sleep-out command
T6	2	-	8	VS	Power on sequence, the period can be modified
T7	1	-	-	VS	Blanking region
T8	-	1	-	VS	Power off sequence, the period can be modified
T9	1	-	-	ms	Power off time between AVEE and AVDD
T10	1	-	-	ms	Effective hardware reset period
T11	1	-	-	ms	Power off time between AVEE and VDDI

10. Description of Function

10.1 Display Mode

10.1.1 Power Mode

ITEM	Code value
Sleep In	0x10
Sleep Out	0x11
Display On	0x29
Display Off	0x28

10.1.2 Idle Mode

ITEM	Code value
Idle On	0x39(Default value)
Idle Off	0x38

10.1.3 BIST Mode

Register setting :

◆ BIST On/Off Control (C4h)

Instruction	R/W	Address name		Parameter									
		MIPI	Other	D15-D8	D7	D6	D5	D4	D3	D2	D1	D0	
BISTONOFF	R/W	C4h	C400h	-	1	0	1	0	0	1	0	1	
			C401h	-	0	1	0	1	0	1	0	1	
			C402h	-	-	-	-	-	-	-	-	-	BION1
			C403h	-	BION2	-	-	-	-	-	-	-	-
Description	<p>This command is used to control BIST function (Free Run mode).</p> <p>BIST function enable step:</p> <ol style="list-style-type: none"> 1. Enter Sleep-In(10h) mode. 2. Setting PATENICYC[1:0] and BISTPATEN[11:0] to control the display cycle time and pattern. 3. Setting BION1="1" and BION2="1", the driver IC will start to run the BIST function. <p>BIST function disable step:</p> <ol style="list-style-type: none"> 1. Setting BION1="0" and BION2="0", the driver IC will return to normal function. 2. Sending MIPI video data and enter Sleep-Out(1h) mode for normal display. 												
Restriction	-												
Default	Status		Default Value										
	Power On Sequence		C400h	AAh									
			C401h	55h									
			C402h	00h									
			C403h	00h									

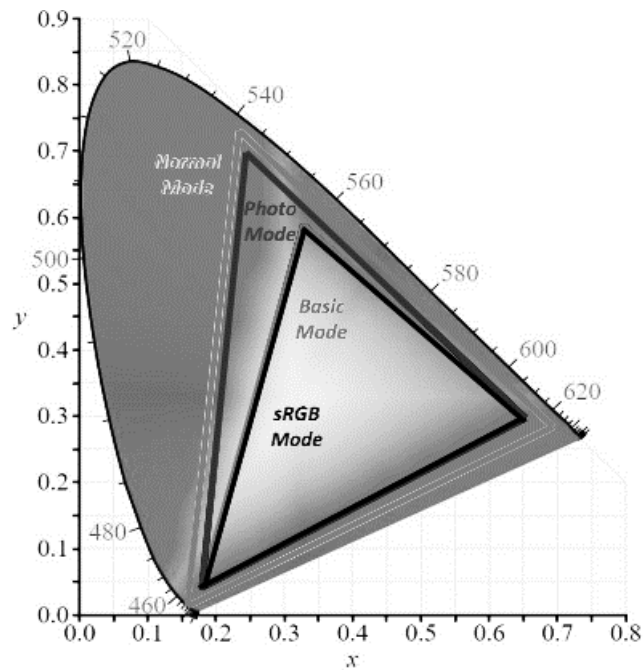
◆ BIST CTRL (C5h)

Instruction	R/W	Address name		Parameter									
		MIPI	I2C	D15-D8	D7	D6	D5	D4	D3	D2	D1	D0	
BISTSET	R/W	C5h	C500h	-	0	0	PATENICYC[1:0]		BISTPATEN[11:8]				
			C501h	-	BISTPATEN[7:0]								
			C502h	-	GRAY_LEVEL[7:0]								
description	This command is used to set the display pattern in BIST function.												
	PATENICYC[1:0] : Cycle time between each display pattern.												
	PATENICYC[1:0]			Pattern cycle time									
	0h			256 Frame									
	1h			512 Frame									
	2h			1024 Frame									
	3h			2048 Frame									
	BISTPATEN[11:0] : Select the display pattern in BIST function.												
	BISTPATEN[9:0]			Description									
	BISTPATEN[0]			Red pattern.									
	BISTPATEN[1]			Green pattern.									
	BISTPATEN[2]			Blue pattern.									
	BISTPATEN[3]			Black pattern.									
	BISTPATEN[4]			Gray Level pattern. (Set by BIST_GRAY_LEVEL[7:0])									
	BISTPATEN[5]			Vertical Gradation pattern.									
BISTPATEN[6]			Horizontal Gradation pattern.										
BISTPATEN[7]			Color Bar pattern.										
BISTPATEN[8]			Crosstalk with boundary pattern.										
BISTPATEN[9]			Source CP Pattern										
BISTPATEN[10]			Gamma CP Pattern										
BISTPATEN[11]			Reserved										
<i>Note1: the patterns which the bit number of BISTPATEN[9:0] is set to "1" will display and change automatically.</i> <i>Note2: When BISTPATEN[11:0]=12'h000, display pattern will be black pattern.</i>													
GRAY_LEVEL[7:0] : Set the gray level when BISTPATEN[4]="1" in BIST function.													
GRAY_LEVEL[7:0]			Description										
0h			Gray Level : 00h										
1h			Gray Level : 01h										
2h			Gray Level : 02h										
:			:										
FDh			Gray Level : FDh										
FEh			Gray Level : FEh										
FFh			Gray Level : FFh										
Restriction	-												
Default	Status			Default Value									
	Power On Sequence			C500h			01h						
				C501h			FFh						
C502h				FFh									

10.2 Image Enhancement

10.2.1 Gamut Mapping—Selectable Color Mode with Different Gamut

- ◆ 0.39" Micro OLED support Normal Mode/Photo Mode/ Basic Mode (sRGB Mode).



- ◆ Register Setting

Gamut mapping (57 CMD1).

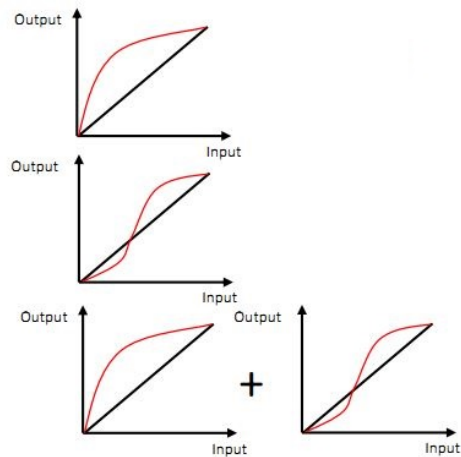
5700H		GAMUT										
Instruction	R/W	Address name			Parameter							
		MIPI	I2C	D15-D8	D7	D6	D5	D4	D3	D2	D1	D0
GAMUT	R/W	57h	5700h	-	-	-	-	-	-	-	-	GAMUT_SEL [1:0]
Description	This command sets the control of gamut mapping.											
	Bit	Symbol	Description		Comment							
2bit	GAMUT_SEL[1:0]	Gamut mapping control		0h= Gamut mapping 0 —Normal Mode 1h= Gamut mapping 1—Photo Mode 2h= Gamut mapping 2—Basic Mode								
Restriction	-											
Default	Status			Default Value								
	Power On Sequence			5700h					00h			

10.2.2 Contrast/Edge Enhancement

Contrast Enhancement :

- ◆ Adaptive curve for indoor and outdoor environment

In order to increase the readable, we need trade-off between brightness and contrast ratio.



Adaptive curve of contrast

- ◆ 2D Edge enhancement

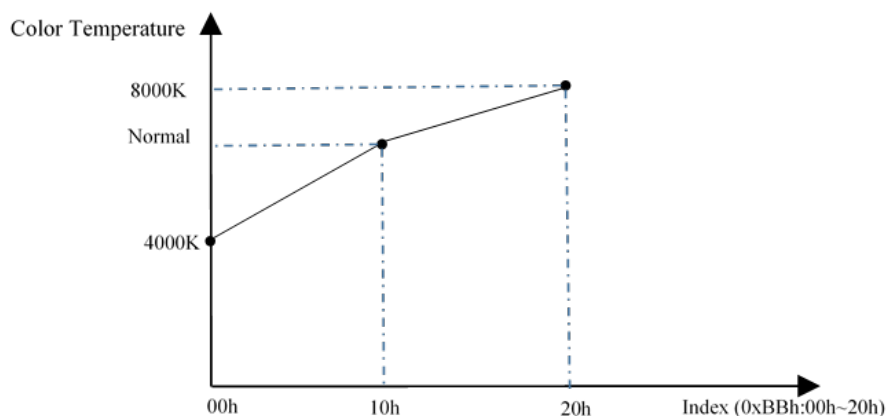
The 0.39"Micro OLED support a better display effect by the "2D Edge enhancement", such as increasing the image sharpness, Jagger, Overshooting and Noise Depression.

10.2.3 High Brightness or High Contrast Mode

High Brightness for AR Application, High Contrast for VR Application. This function adjusts the display mode according to the register "53h".

10.3 Color Temperature Function (Auto White Balance Control)

This function adjusts the R/G/B gamma parameter according to the register BBh setting to adjust the White balance and change the color temperature at the same time.

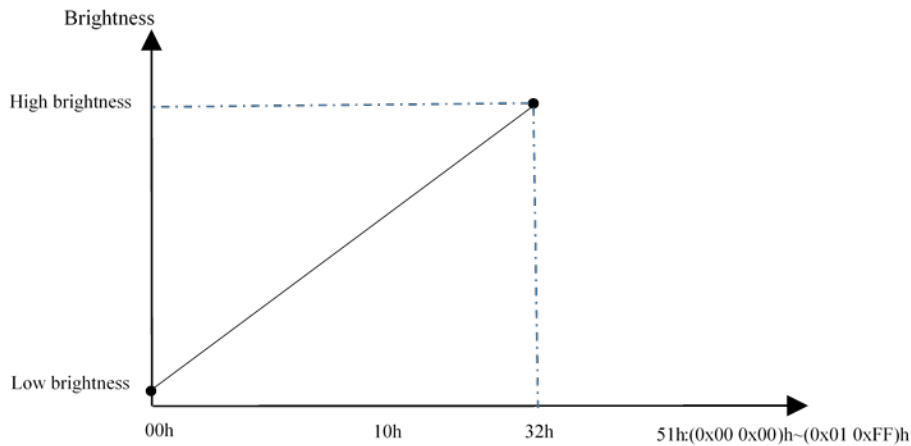


◆ Register setting

ITEM	Address name	Code value	Default value
Color Temperature	0xBBh CMD Page1	00h~20h	10h

10.4 Brightness Control(BC) Functions

This function adjusts the gamma parameter according to the register 51h and 53h setting to adjust the luminance.



◆ Register setting

White Display Brightness(51h CMD1).

5100H		WRDISBV											
Instruction	R/W	Address		Parameter									
		MIPI	Other	D15-D8	D7	D6	D5	D4	D3	D2	D1	D0	
WRDISBV	W	51h	5100h	-	DBV[7:0]							-	-
			5101h	-	-	-	-	-	-	-	-	-	DBV [8]
Description	This command is used to adjust brightness.												
Restriction	-												
Default	Status			Default Value									
	Power On Sequence			5100h				00h					
				5101h				00h					

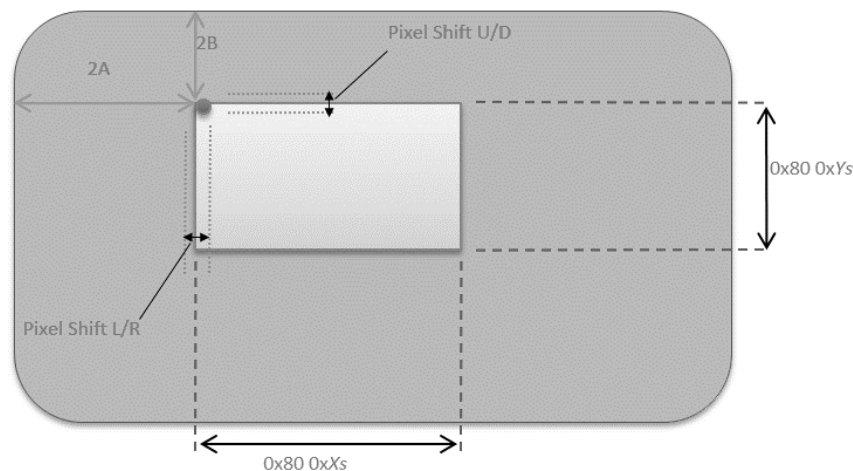
White CTRL Display (53h CMD1)

5300H		WRCTRLD										
Instruction	R/W	Address		Parameter								
		MIPI	I2C	D15-D8	D7	D6	D5	D4	D3	D2	D1	D0
WRCTRLD	W	53h	5300h	-	-	-	BCTRL	-	DD_BC	-	-	HBHC_SEL

Description	This command is used to set brightness control and display diming control.			
	Bit	Symbol	Description	Comment
	D5	BCTRL	Brightness control	1= Brightness control enable 0= Brightness control disable
	D3	DD_BC	Display dimming control	1= Display dimming control enable 0= Display dimming control disable
D0	HBHC_SEL	Display mode control	0=High Brightness Low Contrast 1=Low Brightness High Contrast	
Restriction				
Default	Status		Default Value	
	Power On Sequence		5300h	00h

10.5 Display Active-Area(AA) Control

ITEM	Description	Code 值
Resolution	X-direction: Support 8N, N=40~240 Y-direction: support 8M, M=30~135	CMD1: 0x80(NC[7:0] NL[7:0])
Active-Area(AA) control	Display start pointer	Xs: CMD1: 0x2A Ys: CMD1: 0x2B
	Pixel shift: $\pm 12\text{pixel}/\text{step}=4\text{pixel}$	CMD2 Page0: 0xB4



10.6 Auto Temperature Compensation Function

Brightness and white point of OLED depends on display panel temperature as show in below. This module integrates Brightness and white point compensation function against panel temperature variation. This function allows to sustain relatively constant luminance and white point even if panel temperature changing as shown in below.

◆ Register Settings

2300H		ALLPON											
Instruction	R/W	Address name		Parameter									
		MIPI	Other	D15-D8	D7	D6	D5	D4	D3	D2	D1	D0	
ALLPON	R/W	25h	2500h	-	-	-	-	-	-	-	-	-	TC_ENABLE
Description	This command is used to turn on temperature sensor.												
Restriction	-												
Default	Status			Default Value									
	Power On Sequence			2500h					00h				

11. Optical Characteristics

11.1 Optical Characteristics

Item		0.39 Micro OLED SPEC	
White Brightness	Center	1500 cd/m ²	
White Uniformity 9 point	White (255)	>90%	
	White (128)	>90%	
	White (64)	>90%	
View Angle (White)	Lum. Decay (50%)	-55°~55°	
	Color Shift ($\Delta u'v' < 0.025$)	-45°~45°	
Contrast	CR	>10000:1	
Color Coordinate	Red	CIE-x	0.64±0.03
		CIE-y	0.33±0.03
	Green	CIE-x	0.26±0.03
		CIE-y	0.67±0.03
	Blue	CIE-x	0.15±0.03
		CIE-y	0.07±0.03
White	CIE-x	0.31±0.03	
	CIE-y	0.31±0.03	
Color Gamut (NTSC)		>80%	
Color Temperature		>6000K	

11.2 Measurement System • Measurement Method

The luminance and chromaticity are measured in Measurement System A shown below.

Measurement temperature: T_{pnl} = 30°C

Measurement point: One point on the screen center

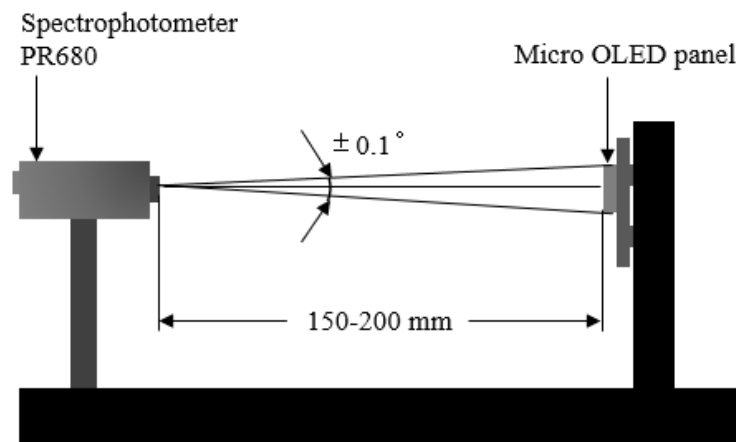
All white display: All RGB signal data is set to High.

All black display: All RGB signal data is set to Low.

Luminance and chromaticity: Measure the luminance and chromaticity in all white display in Measurement System A.

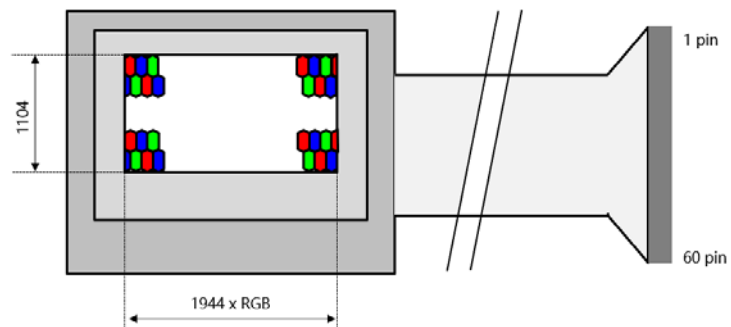
Contrast: Measure the luminance in all white display (@ : 500cd/m²) and all black display in Measurement System A, and substitute them into the formula below.

Contrast = Luminance in all white display/Luminance in all black display



Measurement System

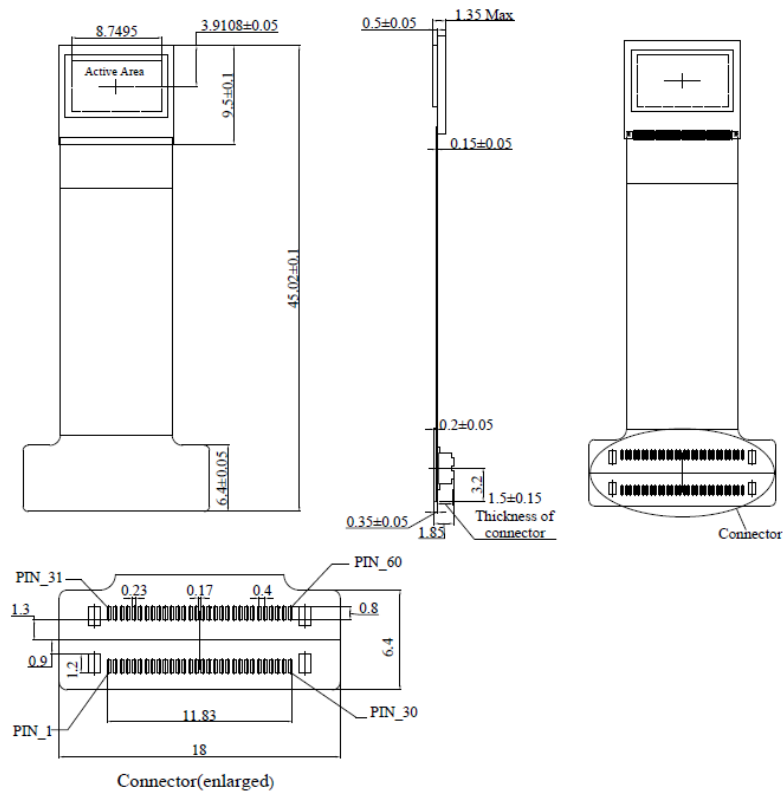
12. Pixel Alignment



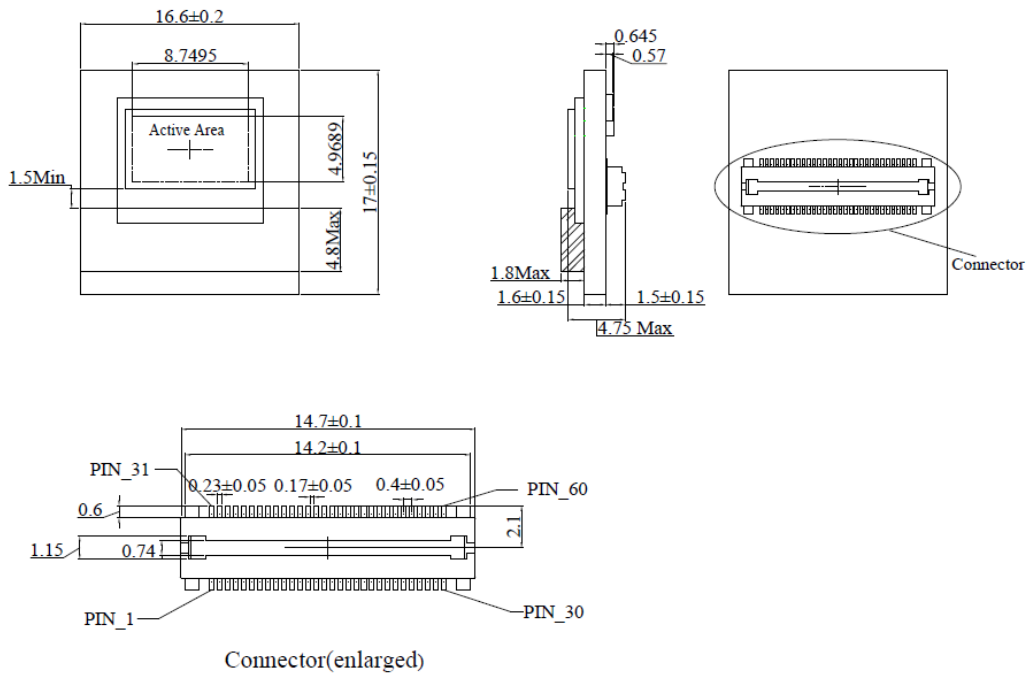
※Including orbit margin

13. Package Outline

13.1 FPC Module(Unit : mm)



13.2 PCB Module(Unit : mm)



14. Notes on Handling

14.1 Static charge prevention

Be sure to take the following protective measures. Organic EL panels are easily damaged by static charges.

- (1) Use non-chargeable gloves or handle with bare hands.
- (2) Use a wrist strap connecting ground when handling.
- (3) Do not touch any electrodes on the panel.
- (4) Wear non-chargeable clothes and conductive shoes.
- (5) Install grounded conductive mats on the working floor and working table.
- (6) Keep the panel away from any charged materials.

14.2 Protection from dust and dirt

- (7) Operate in a clean environment.
- (8) Do not touch the panel surface. The surface is easily scratched.

When cleaning on panel surface, use a clean-room wiper with isopropyl alcohol. Be careful not to leave stains on the surface.

- (9) Use ionized air to blow dust off the panel surface.

14.3 Others

- (10) Not hold FPC (Flexible Printed Circuit) , not twist the FPC, not bend FPC because connection area between the FPC and panel is easily broken by mechanical stress.
- (11) The minimum fold radius of the FPC is 1.0 mm, So, do not fold the FPC less than 1.0mm radius.
- (12) Do not drop the module.
- (13) Do not twist or bend the module .
- (14) Keep the module away from heat sources.
- (15) Not be close the module to water or other solvents.
- (16) Do not store or use the module at high temperatures or high humidity circumstance, as the circumstance may affect module specifications.
- (17) When disposing of this, regard it as industrial waste and please comply with related regulations.
- (18) Do not store or use the panel in reactive chemical substance (including alcohol) environments, as these may affect the specifications.