1.0 cm(Type 0.39) Active Matrix Color OLED Panel Module

1. Overview/Application

B039FH8A0 is a 0.39 inch(1 cm) 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.)

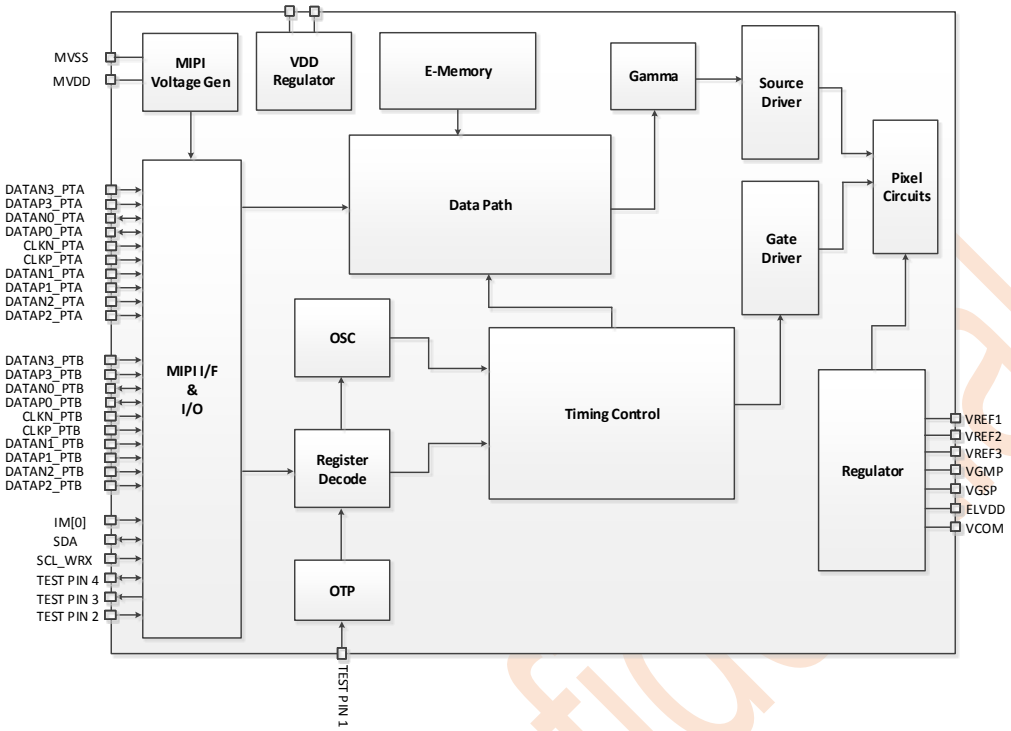
2. Features

- 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+I^2C

3. Module Structure

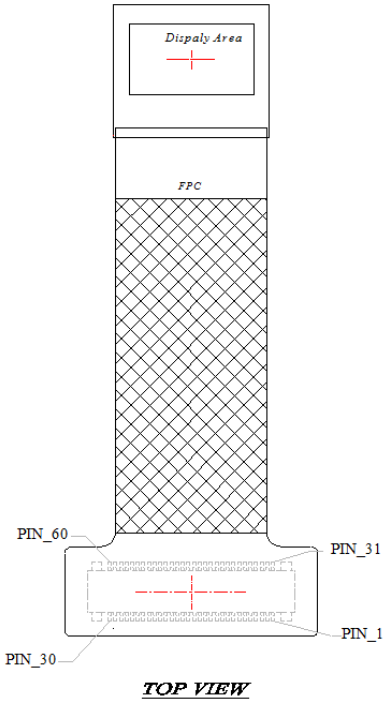
- Active matrix color OLED display with on-chip driver based on single crystal silicon transistors

4. System Block Diagram



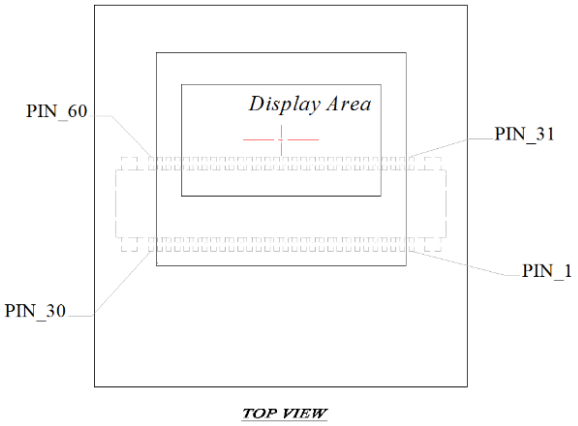
5. Pin Description

5.1 Pin Assignment



TOP VIEW

- **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. IM [0] / Command Execute / Image Write 0 / MIPI / MIPI 1 / I2C/MIPI / MIPI Note: MIPI 1port or 2port is selected by register setting
11	OTP_SEL	Input	MTP type selection. OTP_SEL, connect to GND : use internal OTP
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

<table>
<tr><th>PIN No.
(PCB Side)</th><th>Symbol</th><th>Type</th><th>Description</th></tr>
<tr><td>1</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>2</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>3</td><td>TEST PIN 1</td><td>Input</td><td>TEST pin (no connect，Floating)</td></tr>
<tr><td>4</td><td>IM [0]</td><td>Input</td><td>Use to select the Interface type.
<table><tr><th>IM [0]</th><th>Command Execute</th><th>Image Write</th></tr><tr><td>0</td><td>MIPI</td><td>MIPI</td></tr><tr><td>1</td><td>I2C/MIPI</td><td>MIPI</td></tr></table>Note: MIPI 1port or 2port is selected by register setting</td></tr>
<tr><td>5</td><td>OTP_SEL</td><td>Input</td><td>MTP type selection.
OTP_SEL, connect to GND : use internal OTP</td></tr>
<tr><td>6</td><td>OCP_OUT</td><td>Output</td><td>Over current protect flag</td></tr>
<tr><td>7</td><td>TEST PIN 2</td><td>Input</td><td>TEST pin，connect to GND</td></tr>
<tr><td>8</td><td>SDA</td><td>Input/ Output</td><td>Bi-direction data PIN in I2C I/F
If this pin is not used, please connect to VDDI</td></tr>
<tr><td>9</td><td>SCL_WRX</td><td>Input</td><td>Synchronous clock signal in I2C I/F.
If this pin is not used, please connect to VDDI</td></tr>
<tr><td>10</td><td>RESX</td><td>Input</td><td>This signal will reset the device and must be applied to properly initialize the chip，
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<tr><td>13</td><td>VIN</td><td>Power Supply</td><td>External power supply</td></tr>
<tr><td>14</td><td>VIN</td><td>Power Supply</td><td>External power supply</td></tr>
<tr><td>15</td><td>ENP</td><td>Input</td><td>Enable pin for Power IC (Connect to VIN)</td></tr>
<tr><td>16</td><td>ENN</td><td>Input</td><td>Enable pin for Power IC (Connect to VIN)</td></tr>
<tr><td>17</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>18</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>19</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>20</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
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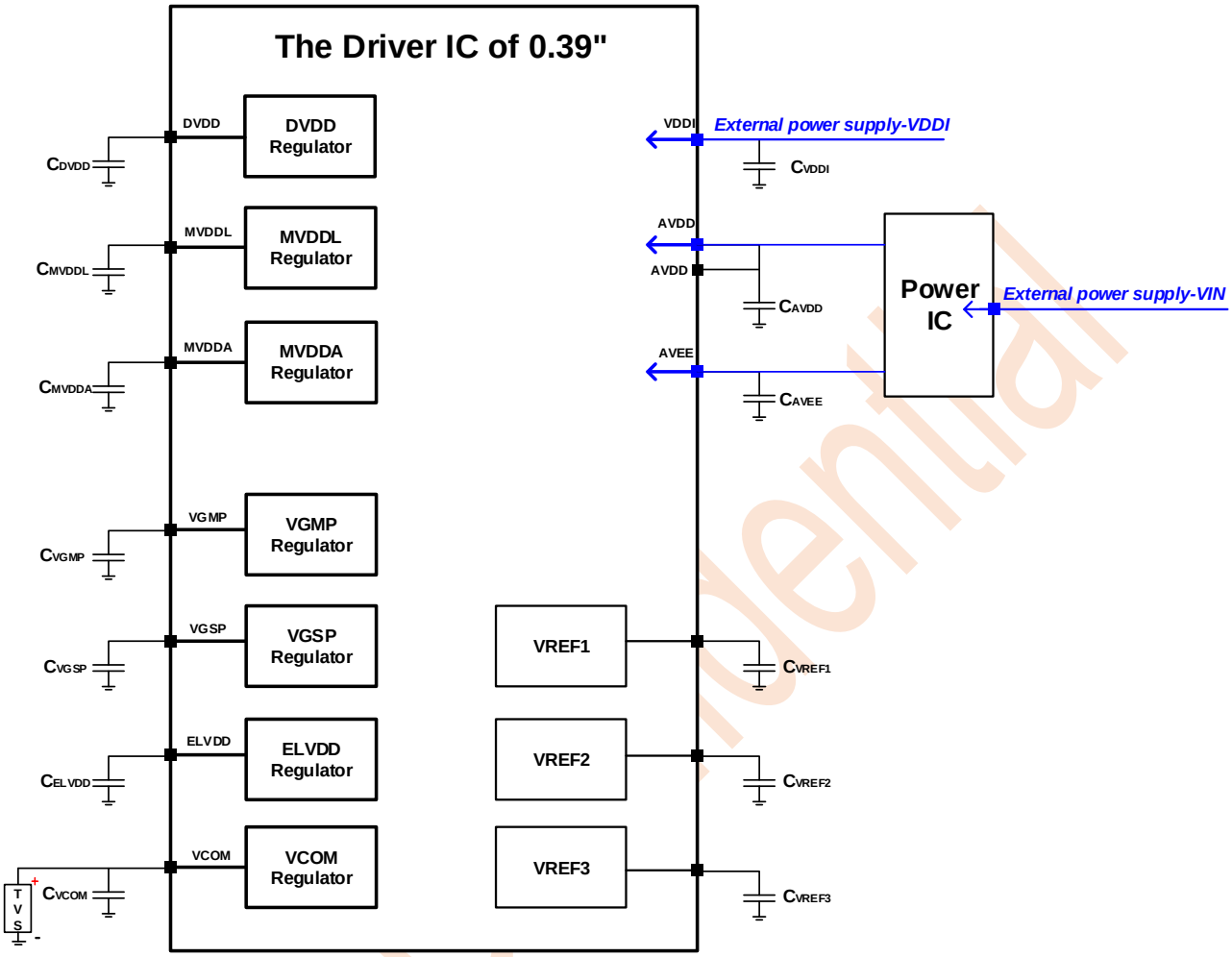
<tr><td>22</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>23</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>24</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>25</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>26</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>27</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>28</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>29</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>30</td><td>GND</td><td>Power Supply</td><td>Circuit ground</td></tr>
<tr><td>31</td><td>GND</td><td>Input</td><td>Circuit ground for MIPI</td></tr>
<tr><td>32</td><td>DATAP2_PTA</td><td>Input</td><td>Differential small amplitude signal of MIPI data input</td></tr>
<tr><td>33</td><td>DATAN2_PTA</td><td>Input</td><td>Differential small amplitude signal of MIPI data input</td></tr>
<tr><td>34</td><td>GND</td><td>Input</td><td>Circuit ground for MIPI</td></tr>
</table>

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

5.4 Peripheral Circuit

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



Notes:

No.	Signal Name	Typical Value	Maximum Rated Voltage	Note
1	VDDI	Cap, 2.2uF	6.3V	
2	AVDD	Cap, 1.0uF	10V	
3	ELVDD	Cap, 2.2uF	10V	
4	AVEE	Cap, 1.0uF	10V	
5	DVDD	Cap, 4.7uF	6.3V	
6	MVDDA	Cap, 1uF	6.3V	
7	MVDDL	Cap, 1uF	6.3V	
8	VGMP	Cap, 1uF	10V	
9	VGSP	Cap, 1uF	10V	
10	VREF1	Cap, 1uF	6.3V	
11	VREF2	Cap, 1uF	6.3V	
12	VREF3	Cap, 1uF	6.3V	
13	VCOM	Cap, 2.2uF TVS	10V	

(1) There are totally 13 capacitors and 1 Schottky diode.

(2) The Schottky diode is placed between VCOM and ground, and the anode connect to Vcom, the cathode connect to GND.

6. Absolute Maximum Ratings

The absolute maximum rating is listed on the below table. When the Driver IC of 0.39” is used beyond the absolute maximum ratings, it may be permanently damaged. It is strongly recommended use the driver IC within the following specified limits for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the driver IC will malfunction and cause poor reliability.

Item	Symbol	Value	Unit
Power Supply Voltage	VDDI	4	V
	AVDD-AVSS	7	V
	AVEE-AVSS	-7	V
MIPI Differential Input	CLKP_PTA/B, CLKN_PTA/B DATAP0_PTA/B, DATAN0_PTA/B DATAP1_PTA/B, DATAN1_PTA/B DATAP2_PTA/B, DATAN2_PTA/B DATAP3_PTA/B, DATAN3_PTA/B	1.32	V
Environment temperature	Topr	-40 ~ 85	°C
Storage temperature	Tstg	-45 ~ 90	°C

Note:

1. The environment temperature is not a reliable test temperature.

7. Electrical Characteristics

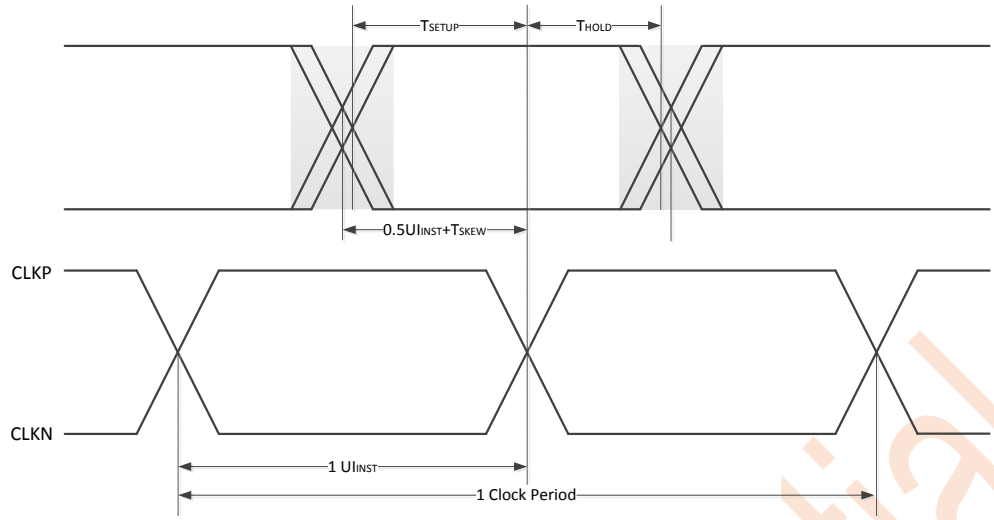
7.1 DC Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Power & Operation Voltage/Current						
AVDD Input Level	AVDD Voltage	-	5.4	-	6.0	V
	AVDD Loading Current	Driving current≥ Loading current	-	-	80	mA
AVEE Input Level	AVEE Voltage	-	-5.4		-6.0	V
	AVEE Loading Current	Driving current≥ Loading current	-	-	60	mA
VDDI Input Level	VDDI Voltage	-		1.8		V
	VDDI Loading Current	Driving current≥ Loading current	-	-	80	mA
MIPI I/O Power Supply	MVDD	-	-	1.2	-	V

7.2 AC Characteristics

7.2.1 MIPI High Speed Mode Characteristics

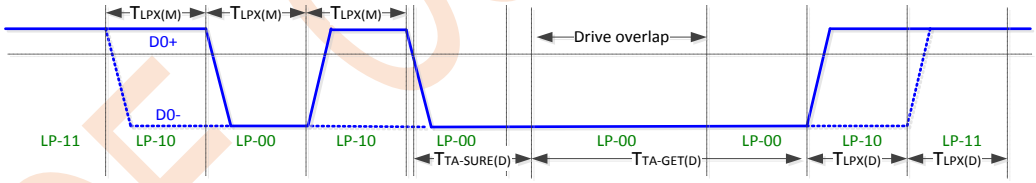
Parameter	Symbol	Min	Typ.	Max	Unit
UI instantaneous	UIINST	1	-	3	ns
T Data to Clock Skew	TSKEW	-0.15	-	0.15	UIHS
RX Data to Clock Setup Time Tolerance	TSETUP	0.15	-	-	UIHS
RX Data to Clock Hold Time Tolerance	THOLD	0.15	-	-	UIHS



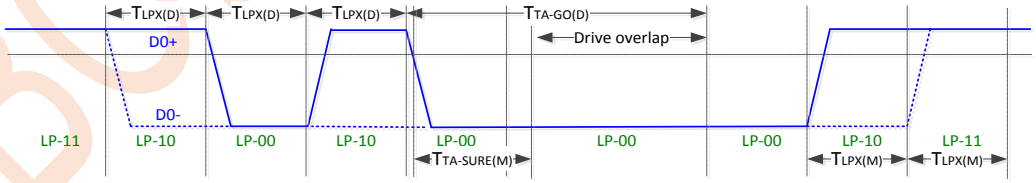
7.2.2 MIPI Low Power Mode Characteristics

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

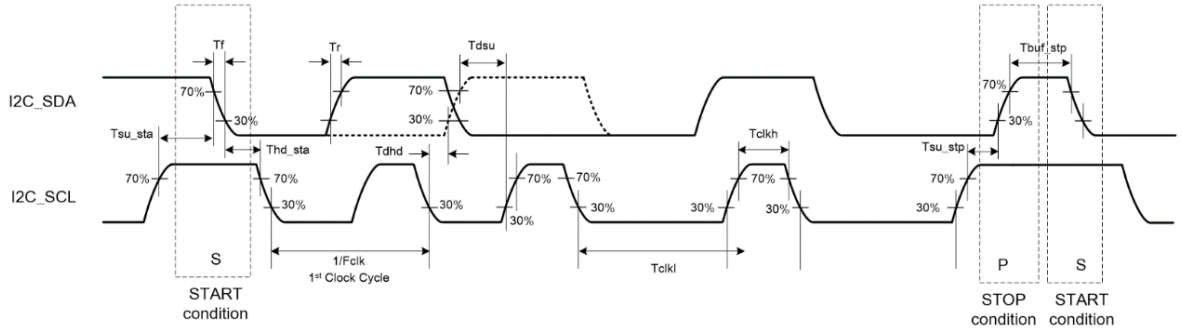


- Bus Turnaround from display module to MPU



7.2.3 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



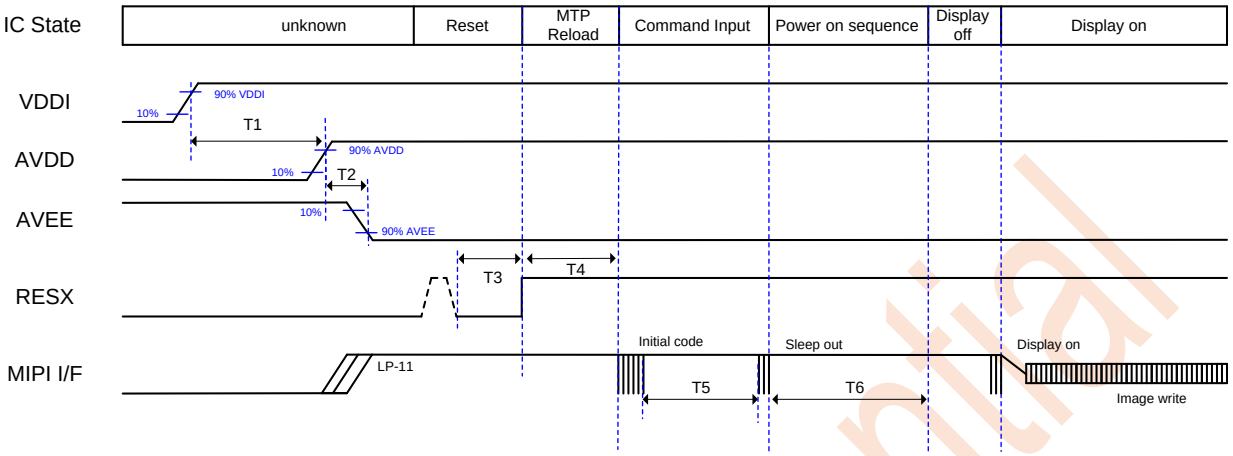
Notes:

No.	ITEM	Description	Note
1	Slave address	0x4C	
2	Pull-up resistor	4.7KΩ@100Kbps	
3	Read bit	Setting “1” for read	
4	Write bit	Setting “0” for write	
5	Start condition	SDA is setting from “1” to “0” when SCL is “1”	
6	Stop condition	SDA is setting from “0” to “1” when SCL is “1”	

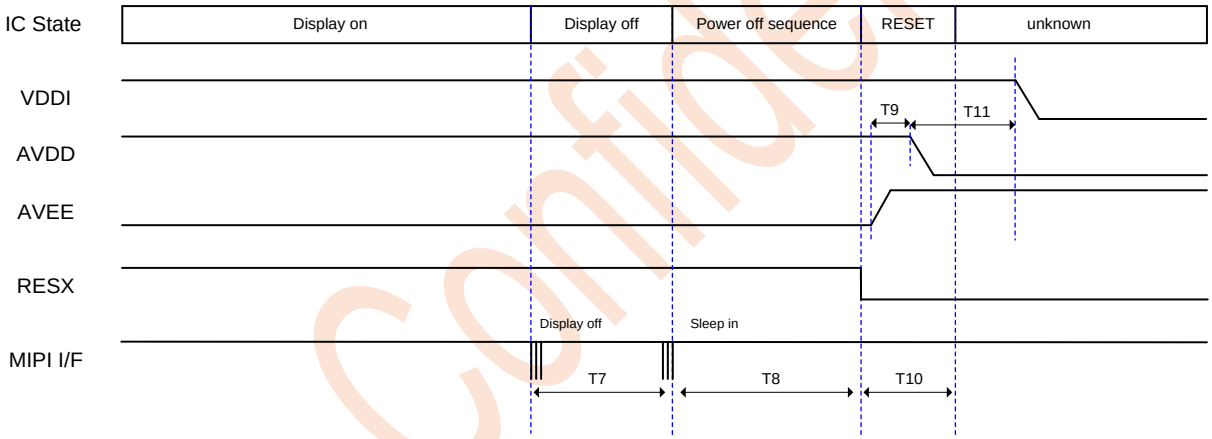
8. Power Supply Sequence

8.1 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

9. Description of Function

9.1 Display Mode

9.1.1 Power Mode

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

9.1.2 Idle Mode

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

9.1.3 BIST Mode

Register setting：

◆ BIST On/Off Control (C4h)

<table>
<tr><td rowspan="2">Instruction</td><td rowspan="2">R/W</td><td colspan="2">Address name</td><td colspan="9">Parameter</td></tr>
<tr><td>MIPI</td><td>Other</td><td>D15-D8</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
<tr><td rowspan="4">BISTONOFF</td><td rowspan="4">R/W</td><td rowspan="4">C4h</td><td>C400h</td><td>-</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>C401h</td><td>-</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>C402h</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>BION1</td></tr>
<tr><td>C403h</td><td>-</td><td>BION2</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Description</td><td colspan="12">This command is used to control BIST function (Free Run mode).
BIST function enable step:
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.
BIST function disable step:
1. Setting BION1=”0” and BION2=”0”,the driver IC will return to normal function.
2. Sending MIPI video data and enter Sleep-Out(11h) mode for normal display.</td></tr>
<tr><td>Restriction</td><td colspan="12">-</td></tr>
<tr><td>Default</td><td colspan="12"><table><tr><td>Status</td><td colspan="2">Default Value</td></tr><tr><td rowspan="4">Power On Sequence</td><td>C400h</td><td>AAh</td></tr><tr><td>C401h</td><td>55h</td></tr><tr><td>C402h</td><td>00h</td></tr><tr><td>C403h</td><td>00h</td></tr></table></td></tr>
</table>

◆ BIST CTRL (C5h)

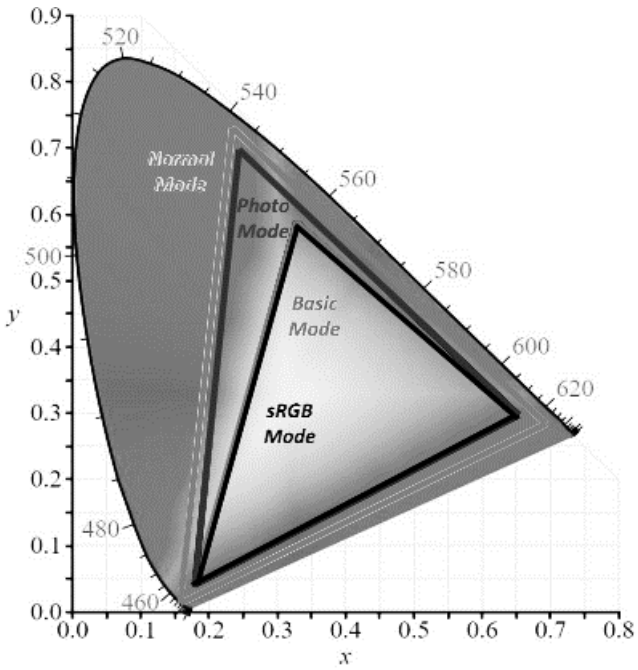
<table>
<tr><td rowspan="2">Instruction</td><td rowspan="2">R/W</td><td colspan="2">Address name</td><td colspan="9">Parameter</td></tr>
<tr><td>MIPI</td><td>I2C</td><td>D15-D8</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
<tr><td rowspan="3">BISTSET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

GRAY_LEVEL[7:0] : Set the gray level when BISTPATEN[4]=”1” in BIST function.
<table>
<tr><td>GRAY_LEVEL[7:0]</td><td>Description</td></tr>
<tr><td>0h</td><td>Gray Level : 00h</td></tr>
<tr><td>1h</td><td>Gray Level : 01h</td></tr>
<tr><td>2h</td><td>Gray Level : 02h</td></tr>
<tr><td>:</td><td>:</td></tr>
<tr><td>FDh</td><td>Gray Level : FDh</td></tr>
<tr><td>FEh</td><td>Gray Level : FEh</td></tr>
<tr><td>FFh</td><td>Gray Level : FFh</td></tr>
</table></td></tr>
<tr><td>Restriction</td><td colspan="11">-</td></tr>
<tr><td>Default</td><td colspan="11">
<table>
<tr><td>Status</td><td colspan="2">Default Value</td></tr>
<tr><td rowspan="3">Power On Sequence</td><td>C500h</td><td>01h</td></tr>
<tr><td>C501h</td><td>FFh</td></tr>
<tr><td>C502h</td><td>FFh</td></tr>
</table></td></tr>
</table>

9.2 Image Enhancement

9.2.1 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).

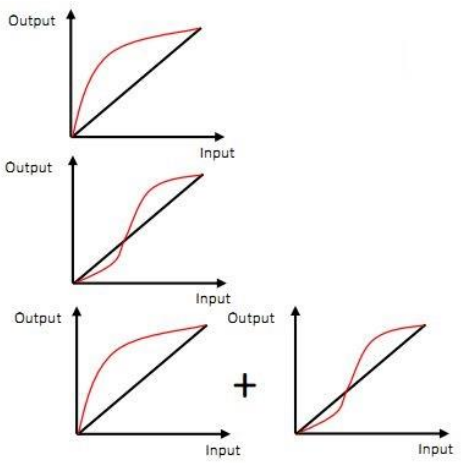
5700H	GAMUT											
Instruction	R/W	Address name		Parameter								
		MIPI	I2C	D15-D8	D7	D6	D5	D4	D3	D2	D1	D0
GAMUT	R/W	57h	5700h	-	-	-	-	-	-	-	GAMUT_SEL [1:0]	
Description	This command sets the control of gamut mapping. Bit: 2bit; Symbol: GAMUT_SEL[1:0]; Description: Gamut mapping control; Comment: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

9.2.2 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

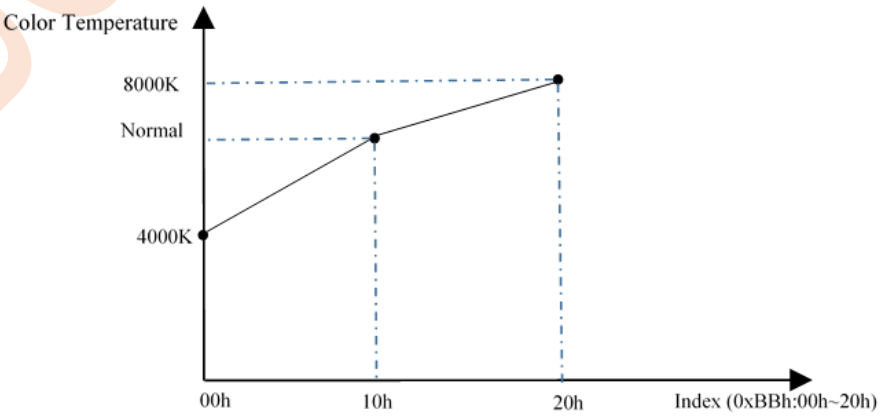
The 0.39”Micro OLED support a better display effect by the “2D Edge enhancement”, such as increasing the image sharpness, Jagger, Overshooting and Noise Depression.

9.2.3 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”.

9.3 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.

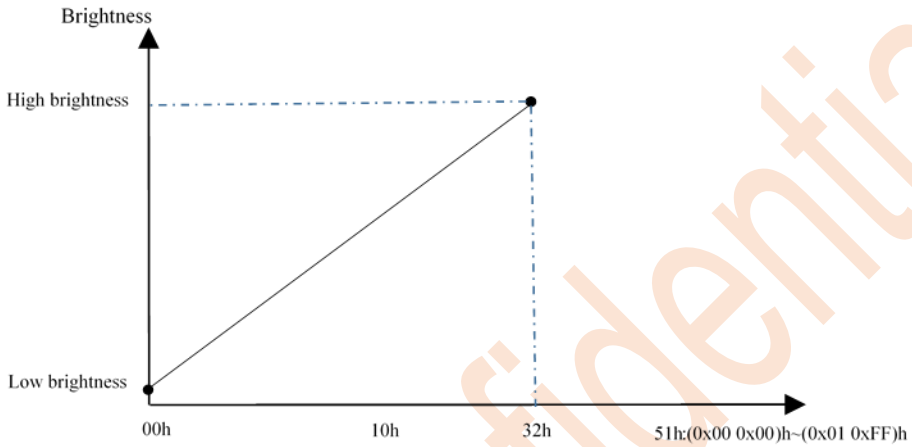


◆ Register setting

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

9.4 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				

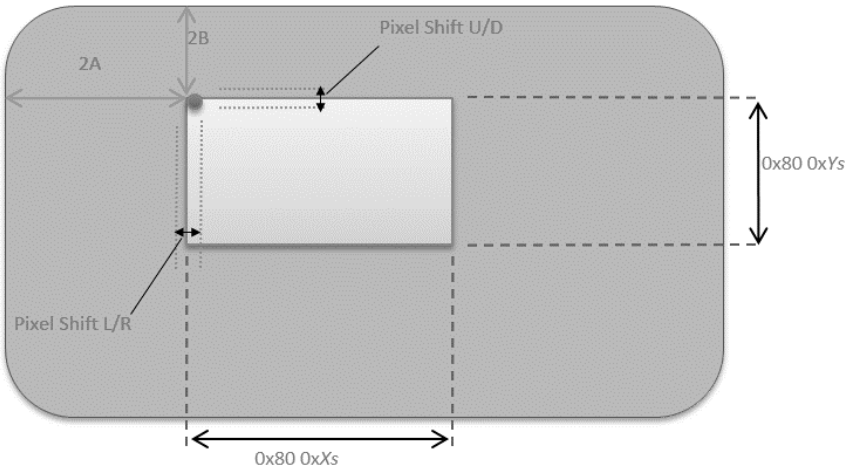
White CTRL Display (53h CMD1)

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

<table>
<tr><td>Description</td><td>This command is used to set brightness control and display diming control.
<table>
<tr><td>Bit</td><td>Symbol</td><td>Description</td><td>Comment</td></tr>
<tr><td>D5</td><td>BCTRL</td><td>Brightness control</td><td>1= Brightness control enable
0= Brightness control disable</td></tr>
<tr><td>D3</td><td>DD_BC</td><td>Display dimming control</td><td>1= Display dimming control enable
0= Display dimming control disable</td></tr>
<tr><td>D0</td><td>HBHC_SEL</td><td>Display mode control</td><td>0=High Brightness Low Contrast
1=Low Brightness High Contrast</td></tr>
</table></td></tr>
<tr><td>Restriction</td><td></td></tr>
<tr><td>Default</td><td>
<table>
<tr><th>Status</th><th colspan="2">Default Value</th></tr>
<tr><td>Power On Sequence</td><td>5300h</td><td>00h</td></tr>
</table></td></tr>
</table>

9.5 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： ±12pixel/step=4pixel	CMD2 Page0：0xB4



9.6 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									

10. Optical Characteristics

10.1 Optical Characteristics

Item			0.39 Micro OLED SPEC
White Brightness	Center		500 cd/m2
White Uniformity 9 Point	White(255)		>80%
View Angle (White)	Lum.Decay(50%)		-45°~45°
	Color Shift(Δu'v'<0.025)		-40°~40°
Contrast	CR		>10000:1
Color Coordinate	Red	CIE-x	0.63±0.03
		CIE-y	0.34±0.03
	Green	CIE-x	0.27±0.03
		CIE-y	0.61±0.03
	Blue	CIE-x	0.15±0.03
		CIE-y	0.09±0.03
	White	CIE-x	0.31±0.03
		CIE-y	0.33±0.03
Color Gamut(NTSC)			>60%
Color Temperature			>5000K

Notes:

1. The brightness of the product will be measured after 5 minutes of stabilization for the white screen at room temperature.

2. The formula of the brightness uniformity at 9 points of the white screen is Uniformity=1-(Max. -Min.)/(Ave.), and the Max., Min. and Ave. represent the maximum, minimum and average of the brightness of 9 points, respectively.

10.2 Measurement System · Measurement Method

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

Measurement temperature: Tpnl = 30℃

Measurement point: One point on the screen center

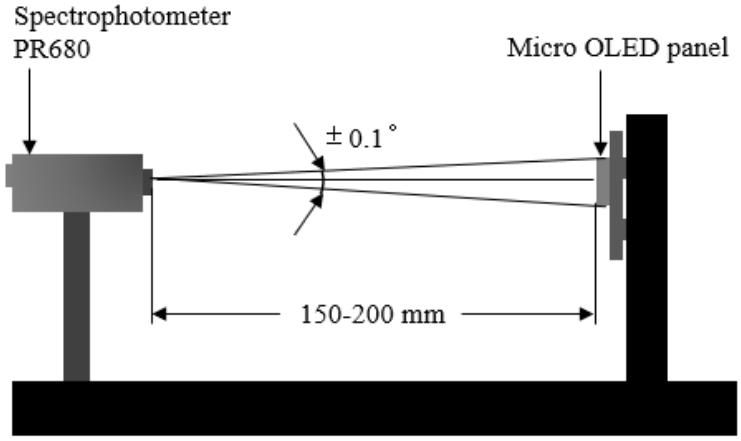
All white display: All RGB signal data is set to High.

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.

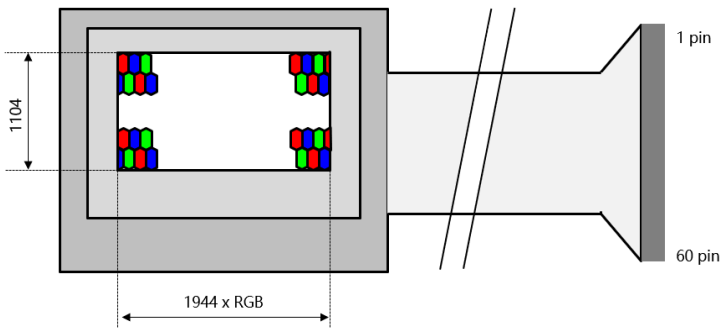
Contrast: Measure the luminance in all white display (@ : 500cd/m^2) and all black display in Measurement System A, and substitute them into the formula below.

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



Measurement System

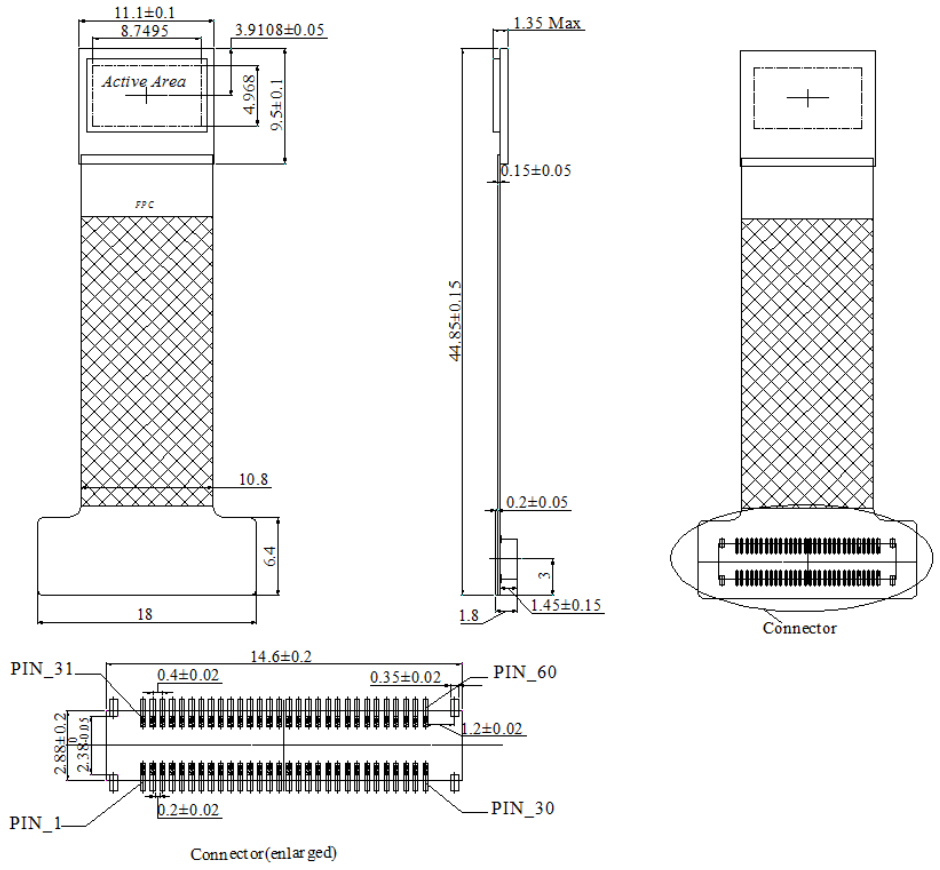
11. Pixel Alignment



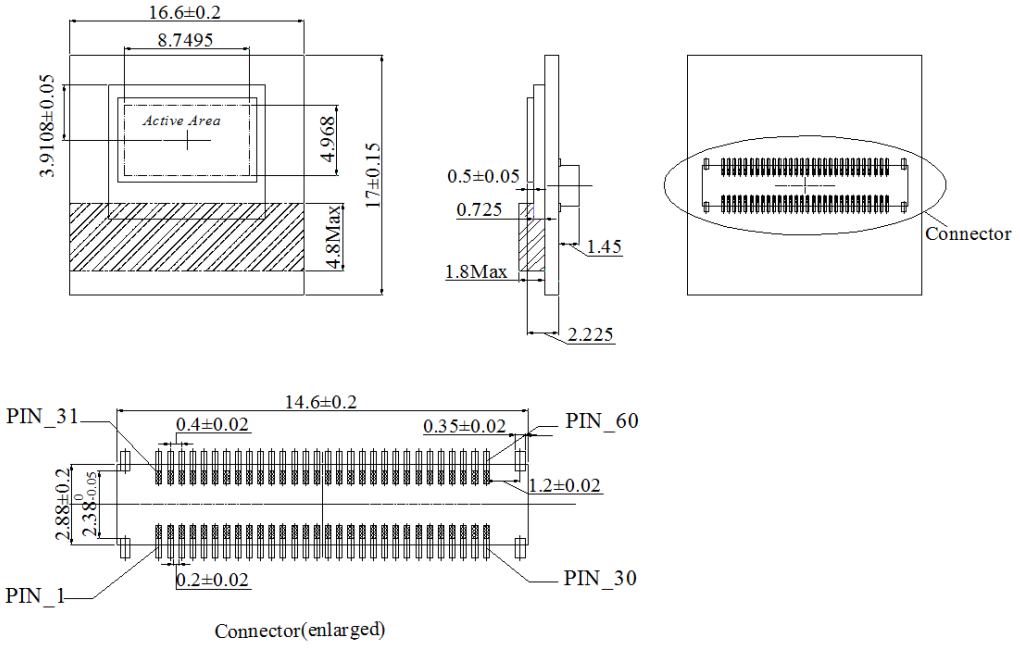
※Including orbit margin

12. Package Outline

12.1 FPC Module(Unit：mm)



12.2 PCB Module(Unit：mm)



Note:

1. The connector models of the FPC module and PCB module are DF40B-60DS-0.4V (51), and the corresponding connector model is DF40B-60DP-0.4V (51).

13. Notes on Handling

13.1 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.

13.2 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.

13.3 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.