



# » APPLICATION NOTE (DOC No. HX8394-A-AN)

## » **HX8394-A**

800RGB x 1280 dot, 16.7M color,  
TFT Mobile Single Chip Driver  
*Temporary version 01 June, 2012*

# » HX8394-A

800RGB x 1280 dot, 16.7M color,  
TFT Mobile Single Chip Driver



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June, 2012

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**Temporary Version 01**

June, 2012

## 1. HX8394-A Layout Recommendation

### 1.1 Layout Recommendation

#### 1.1.1 Architecture 1 - with PFM circuit (Type A)

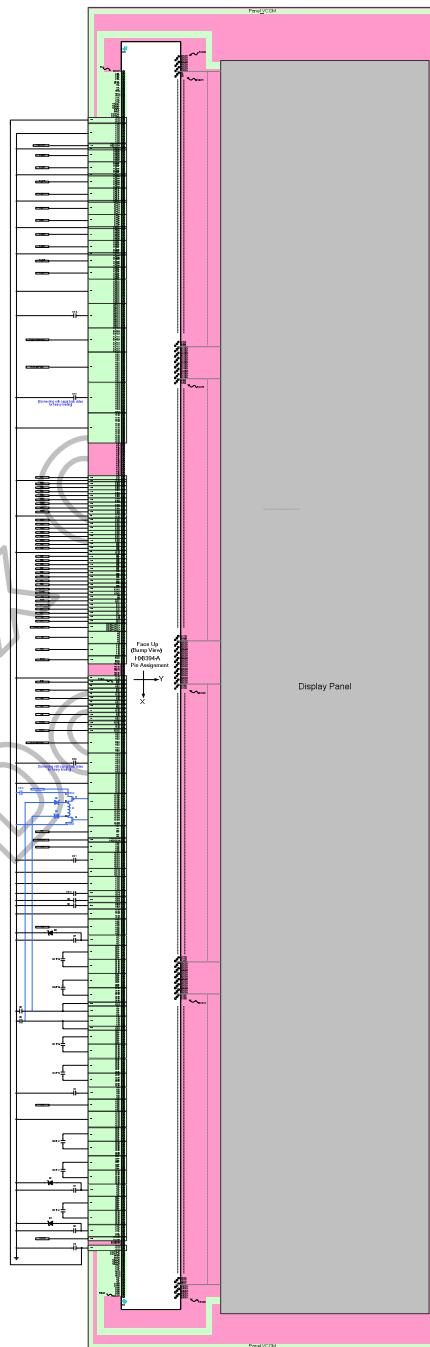


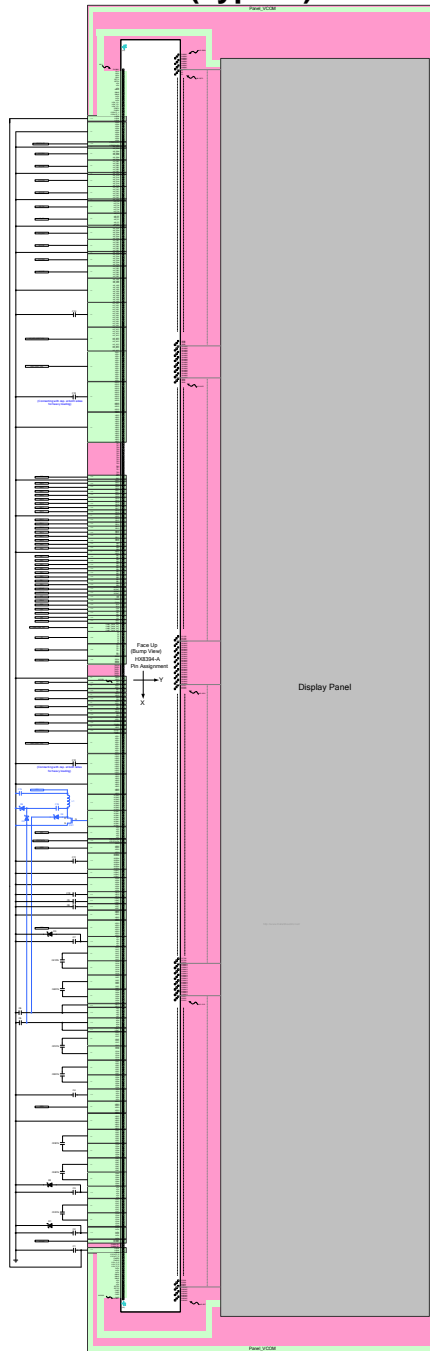
Figure 1.1: Power supply with PFM circuit (Type A)

## PFM Type A mode:

Pad Name	Symbol	Connection	Typical Component Value
VCOM	C1	Connect to Capacitor (Max 6V): VCOM ---(-)----   --- (+)---- VSSA	2.2 $\mu$ F
LVGL	C2	Connect to Capacitor (Max 16V): LVGL ---(+)--   --- (-)---- VSSA	4.7 $\mu$ F
	D1	Connect to Schottky Diode(VR $\geq$ 30V): VSSA ---(-)----  ◀--- (+)---- LVGL	VF < 0.4V / 20mA @ 25°C, VR $\geq$ 30V, (Recommended diode: RB521S-30)
VGL	D2	Connect to Schottky Diode(VR $\geq$ 30V): VSSA ---(-)----  ◀--- (+)---- VGL	
		C3	Connect to Capacitor (Max 16V): VGL ---(+)--   --- (-)---- VSSA
VGH	C4	Connect to Capacitor (Max 25V): VGH ---(+)--   --- (-)---- VSSA	4.7 $\mu$ F
C21P – C21N	C21PN	Connect to Capacitor (Max 16V): C11P ---(+)--   --- (-)----C11N	1.0 $\mu$ F
C22P – C22N	C22PN	Connect to Capacitor (Max 16V): C12P ---(+)--   --- (-)----C12N	1.0 $\mu$ F
C23P – C23N	C23PN	Connect to Capacitor (Max 16V): C13P ---(+)--   --- (-)----C13N	1.0 $\mu$ F
C24P – C24N	C24PN	Connect to Capacitor (Max 16V): C14P ---(+)--   --- (-)----C14N	1.0 $\mu$ F
C31P – C31N	C31PN	Connect to Capacitor (Max 16V): C31P ---(+)--   --- (-)----C31N	1.0 $\mu$ F
C41P – C41N	C41PN	Connect to Capacitor (Max 6V): C41P ---(+)--   --- (-)----C41N	1.0 $\mu$ F
C42P – C42N	C42PN	Connect to Capacitor (Max 6V): C42P ---(+)--   --- (-)----C42N	1.0 $\mu$ F
VSN	C5	Connect to Capacitor (Max 10V): VSN ---(+)--   --- (-)----VSSA	4.7 $\mu$ F
VSP	C6	Connect to Capacitor (Max 10V): VSP ---(+)--   --- (-)----VSSA	4.7 $\mu$ F
VCL	D3	Connect to Schottky Diode(VR $\geq$ 30V): VSSA ---(-)----  ◀--- (+)---- VCL	VF < 0.4V / 20mA @ 25°C, VR $\geq$ 30V, (Recommended diode: RB521S-30)
	C7	Connect to Capacitor (Max 6V): VCL ---(-)----   --- (+)---- VSSA	
VREF	C8	Connect to Capacitor (Max 6V): VREF ---(-)----   --- (+)---- VSSA	1.0 $\mu$ F
VSNR	C9	Connect to Capacitor (Max 10V): VSNR ---(+)--   --- (-)----VSSA	1.0 $\mu$ F
VSPR	C10	Connect to Capacitor (Max 10V): VSPR ---(+)--   --- (-)----VSSA	1.0 $\mu$ F
VDDDN	C11	Connect to Capacitor (Max 6V): VDDDN ---(+)--   --- (-)----VSSA	1.0 $\mu$ F
VDDD	C12	Connect to Capacitor (Max 6V): VDDD ---(+)--   --- (-)----VSSA	2.2 $\mu$ F
	C13	Connect to Capacitor (Max 6V): VDDD ---(+)--   --- (-)----VSSA	2.2 $\mu$ F
HS_LDO	C14	Connect to Capacitor (Max 6V): HS_LDO ---(+)--   --- (-)----HD_VSS	1.0 $\mu$ F
VDD3	C15	Connect to Capacitor (Max 10V): VDD3 ---(+)--   --- (-)----VSSA	1.0 $\mu$ F
PFM	D4	Connect to Schottky Diode(VR $\geq$ 30V): VSP ---(-)----  ◀--- (+)---- L1, SW1	VF < 0.4V / 20mA @ 25°C, VR $\geq$ 30V, (Recommended diode: RB521S-30)
PFM	D5	Connect to Schottky Diode(VR $\geq$ 30V): L1, SW2---(-)----  ◀--- (+)---- VSN	
PFM	SW1	Connect to Switcher: VCSW1, D4/L1 and VSSA	-
PFM	SW2	Connect to Switcher: VCSW2, D5/L1 and VDD3	-
PFM	L1	Connect to inductor: SW1/D4 and SW2/D5	22.0 $\mu$ H

**Table 1.1: Adoptability of components (PFM Type A)**

**1.1.2 Architecture 2 - with PFM circuit (Type C)**



**Figure 1.2: Power supply with PFM circuit (Type C)**

### PFM Type C mode:

Pad Name	Symbol	Connection	Typical Component Value
VCOM	C1	Connect to Capacitor (Max 6V): VCOM ---(-)----   --- (+)----- VSSA	2.2 $\mu$ F
LVGL	C2	Connect to Capacitor (Max 16V): LVGL ---(+)- --- (-)----- VSSA	4.7 $\mu$ F
	D1	Connect to Schottky Diode(VR $\geq$ 30V): VSSA ---(-)----  ◀--- (+)---- LVGL	VF < 0.4V / 20mA @ 25°C, VR $\geq$ 30V, (Recommended diode: RB521S-30)
VGL	D2	Connect to Schottky Diode(VR $\geq$ 30V): VSSA ---(-)----  ◀--- (+)---- VGL	
		C3	Connect to Capacitor (Max 16V): VGL ---(+)- --- (-)----- VSSA
VGH	C4	Connect to Capacitor (Max 25V): VGH ---(+)- --- (-)----- VSSA	4.7 $\mu$ F
C21P – C21N	C21PN	Connect to Capacitor (Max 16V): C11P ---(+)- --- (-)-----C11N	1.0 $\mu$ F
C22P – C22N	C22PN	Connect to Capacitor (Max 16V): C12P ---(+)- --- (-)-----C12N	1.0 $\mu$ F
C23P – C23N	C23PN	Connect to Capacitor (Max 16V): C13P ---(+)- --- (-)-----C13N	1.0 $\mu$ F
C24P – C24N	C24PN	Connect to Capacitor (Max 16V): C14P ---(+)- --- (-)-----C14N	1.0 $\mu$ F
C31P – C31N	C31PN	Connect to Capacitor (Max 16V): C31P ---(+)- --- (-)-----C31N	1.0 $\mu$ F
C41P – C41N	C41PN	Connect to Capacitor (Max 6V): C41P ---(+)- --- (-)-----C41N	1.0 $\mu$ F
C42P – C42N	C42PN	Connect to Capacitor (Max 6V): C42P ---(+)- --- (-)-----C42N	1.0 $\mu$ F
VSN	C5	Connect to Capacitor (Max 10V): VSN ---(+)- --- (-)-----VSSA	4.7 $\mu$ F
VSP	C6	Connect to Capacitor (Max 10V): VSP ---(+)- --- (-)-----VSSA	4.7 $\mu$ F
VCL	D3	Connect to Schottky Diode(VR $\geq$ 30V): VSSA ---(-)----  ◀--- (+)---- VCL	VF < 0.4V / 20mA @ 25°C, VR $\geq$ 30V, (Recommended diode: RB521S-30)
	C7	Connect to Capacitor (Max 6V): VCL ---(-)----   --- (+)----- VSSA	
VREF	C8	Connect to Capacitor (Max 6V): VREF ---(-)----   --- (+)----- VSSA	1.0 $\mu$ F
VSNR	C9	Connect to Capacitor (Max 10V): VSNR ---(+)- --- (-)-----VSSA	1.0 $\mu$ F
VSPR	C10	Connect to Capacitor (Max 10V): VSPR ---(+)- --- (-)-----VSSA	1.0 $\mu$ F
VDDDN	C11	Connect to Capacitor (Max 6V): VDDDN ---(+)- --- (-)-----VSSA	1.0 $\mu$ F
VDDD	C12	Connect to Capacitor (Max 6V): VDDD ---(+)- --- (-)-----VSSA	2.2 $\mu$ F
	C13	Connect to Capacitor (Max 6V): VDDD ---(+)- --- (-)-----VSSA	2.2 $\mu$ F
HS_LDO	C14	Connect to Capacitor (Max 6V): HS_LDO ---(+)- --- (-)----HD_VSS	1.0 $\mu$ F
VDD3	C15	Connect to Capacitor (Max 10V): VDD3 ---(+)- --- (-)-----VSSA	1.0 $\mu$ F
PFM	C16	Connect to Capacitor (Max 10V): L1---(+)- --- (-)---D6	1.0 $\mu$ F
PFM	D4	Connect to Schottky Diode(VR $\geq$ 30V): VSP ---(-)----  ◀--- (+)--- L1, SW1, C6	VF < 0.4V / 20mA @ 25°C, VR $\geq$ 30V, (Recommended diode: RB521S-30)
PFM	D5	Connect to Schottky Diode(VR $\geq$ 30V): C16, D6---(-)----  ◀--- (+)--- VSN	
PFM	D6	Connect to Schottky Diode(VR $\geq$ 30V): VSSA ---(-)----  ◀--- (+)--- C16, D5	
PFM	SW1	Connect to Switcher: VCSW1, D4/L1 and VSSA	-
PFM	L1	Connect to inductor: VDD3/C15 and SW1/D4/C16	10.0 $\mu$ H

**Table 1.2: Adoptability of components (PFM Type C)**



1.1.3 Architecture 3 - with HX5186-A

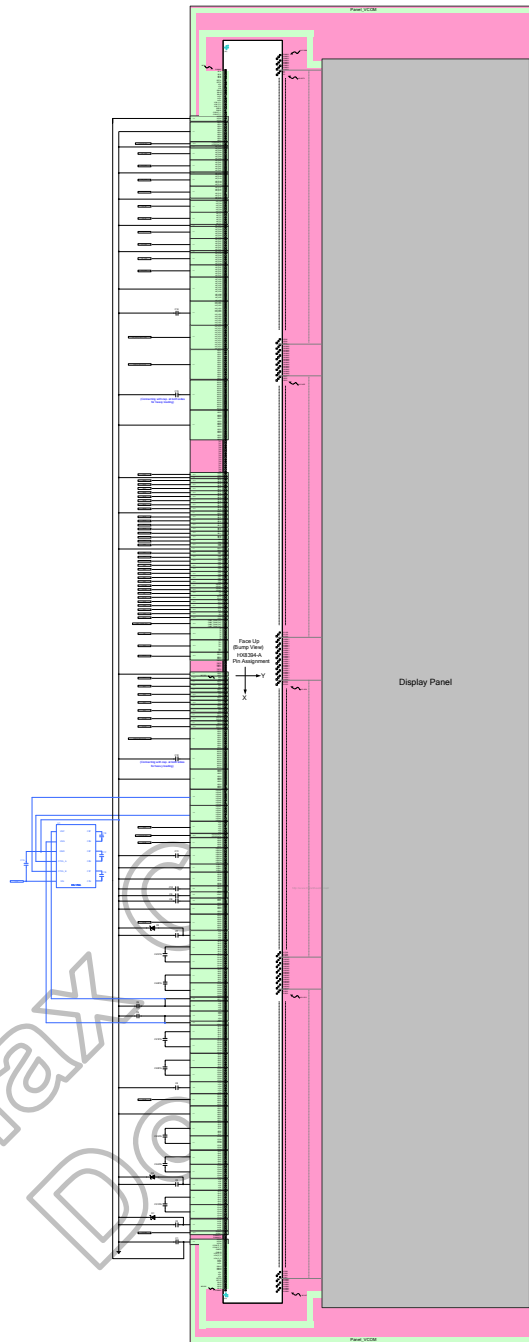


Figure 1.3: Power supply with HX5186-A

**HX5186-A mode:**

Pad Name	Symbol	Connection	Typical Component Value
VCOM	C1	Connect to Capacitor (Max 6V): VCOM ---(-)----   --- (+)---- VSSA	2.2 $\mu$ F
LVGL	C2	Connect to Capacitor (Max 16V): LVGL ---(+)--  --- (-)---- VSSA	4.7 $\mu$ F
	D1	Connect to Schottky Diode(VR $\geq$ 30V): VSSA ---(-)----  ◀--- (+)---- LVGL	VF < 0.4V / 20mA @ 25°C, VR $\geq$ 30V, (Recommended diode: RB521S-30)
VGL	D2	Connect to Schottky Diode(VR $\geq$ 30V): VSSA ---(-)----  ◀--- (+)---- VGL	
		C3	Connect to Capacitor (Max 16V): VGL ---(+)--  --- (-)---- VSSA
VGH	C4	Connect to Capacitor (Max 25V): VGH ---(+)--  --- (-)---- VSSA	4.7 $\mu$ F
C21P – C21N	C21PN	Connect to Capacitor (Max 16V): C11P ---(+)--  --- (-)----C11N	1.0 $\mu$ F
C22P – C22N	C22PN	Connect to Capacitor (Max 16V): C12P ---(+)--  --- (-)----C12N	1.0 $\mu$ F
C23P – C23N	C23PN	Connect to Capacitor (Max 16V): C13P ---(+)--  --- (-)----C13N	1.0 $\mu$ F
C24P – C24N	C24PN	Connect to Capacitor (Max 16V): C14P ---(+)--  --- (-)----C14N	1.0 $\mu$ F
C31P – C31N	C31PN	Connect to Capacitor (Max 16V): C31P ---(+)--  --- (-)----C31N	1.0 $\mu$ F
C41P – C41N	C41PN	Connect to Capacitor (Max 6V): C41P ---(+)--  --- (-)----C41N	1.0 $\mu$ F
C42P – C42N	C42PN	Connect to Capacitor (Max 6V): C42P ---(+)--  --- (-)----C42N	1.0 $\mu$ F
VSN	C5	Connect to Capacitor (Max 10V): VSN ---(+)--  --- (-)----VSSA	4.7 $\mu$ F
VSP	C6	Connect to Capacitor (Max 10V): VSP ---(+)--  --- (-)----VSSA	4.7 $\mu$ F
VCL	D3	Connect to Schottky Diode(VR $\geq$ 30V): VSSA ---(-)----  ◀--- (+)---- VCL	VF < 0.4V / 20mA @ 25°C, VR $\geq$ 30V, (Recommended diode: RB521S-30)
	C7	Connect to Capacitor (Max 6V): VCL ---(-)----   --- (+)---- VSSA	
VREF	C8	Connect to Capacitor (Max 6V): VREF ---(-)----   --- (+)---- VSSA	1.0 $\mu$ F
VSNR	C9	Connect to Capacitor (Max 10V): VSNR ---(+)--  --- (-)----VSSA	1.0 $\mu$ F
VSPR	C10	Connect to Capacitor (Max 10V): VSPR ---(+)--  --- (-)----VSSA	1.0 $\mu$ F
VDDDN	C11	Connect to Capacitor (Max 6V): VDDDN ---(+)--  --- (-)----VSSA	1.0 $\mu$ F
VDDD	C12	Connect to Capacitor (Max 6V): VDDD ---(+)--  --- (-)----VSSA	2.2 $\mu$ F
	C13	Connect to Capacitor (Max 6V): VDDD ---(+)--  --- (-)----VSSA	2.2 $\mu$ F
HS_LDO	C14	Connect to Capacitor (Max 6V): HS_LDO ---(+)--  --- (-)----HD_VSS	1.0 $\mu$ F
VDD3	C15	Connect to Capacitor (Max 10V): VDD3 ---(+)--  --- (-)----VSSA	1.0 $\mu$ F
HX5186-A	U1	Please refer HX5186-A datasheet	-
HX5186-A	C16	Please refer HX5186-A datasheet	1.0 $\mu$ F
HX5186-A	C17	Please refer HX5186-A datasheet	1.0 $\mu$ F
HX5186-A	C18	Please refer HX5186-A datasheet	1.0 $\mu$ F

**Table 1.3: Adoptability of components (HX5186-A)**



### 1.2.2 HX8394-A DSI Video mode initial code for Ortus 4.8 inch panel

**/\*\*Please send initial code in LP mode.\*\*//**

Command 11h // Sleep Out  
Delay 200ms

Command B9h // Set Password  
Parameters FFh 83h 94h

Command BAh // Set MIPI  
Parameters 13h

**// User can change to HS mode to send other initial codes.**

**If HX5186-A**

Command B1h // Set Power  
Parameters 7Ch 00h 24h 06h 01h 10h 10h 34h 3Ch 2Ah 23h 57h **0Ah** 01h E6h

**else //HX5186-B**

Command B1h // Set Power  
Parameters 7Ch 00h 24h 06h 01h 10h 10h 34h 3Ch 2Ah 23h 57h **02h** 01h E6

Command B4h // Set CYC  
Parameters 00h 00h 00h 05h 08h 05h 4Ch 04h 05h 4Ch 23h 27h 19h 64h 6Ch 08h 05h 04h

Command D5h // Set GIP  
Parameters 00h 00h 00h 01h CDh 23h EFh 45h 67h 89h ABh CCh CCh DCh 10h FEh 32h BAh 98h 76h 54h CCh CCh C0h

Command E0h // Set Gamma  
Parameters 01h 0Ah 13h 0Eh 17h 33h 1Ch 28h 44h 4Ch 91h 56h 97h 16h 16h 0Eh 11h 01h 0Ah 14h 15h 1Fh 3Fh 1Eh 2Bh 44h 4Dh 91h 55h 98h 16h 16h 10h 11h

Command CCh // Set Panel  
Parameters 09h

Command 29h // Display On  
Parameters 09h

Delay 50ms

Video Stream :

## 1.3 Reference FPC Circuit and Initial Code for BOE 5.0 inch panel

### 1.3.1 HX8394-A FPC circuit for BOE 5.0 inch panel

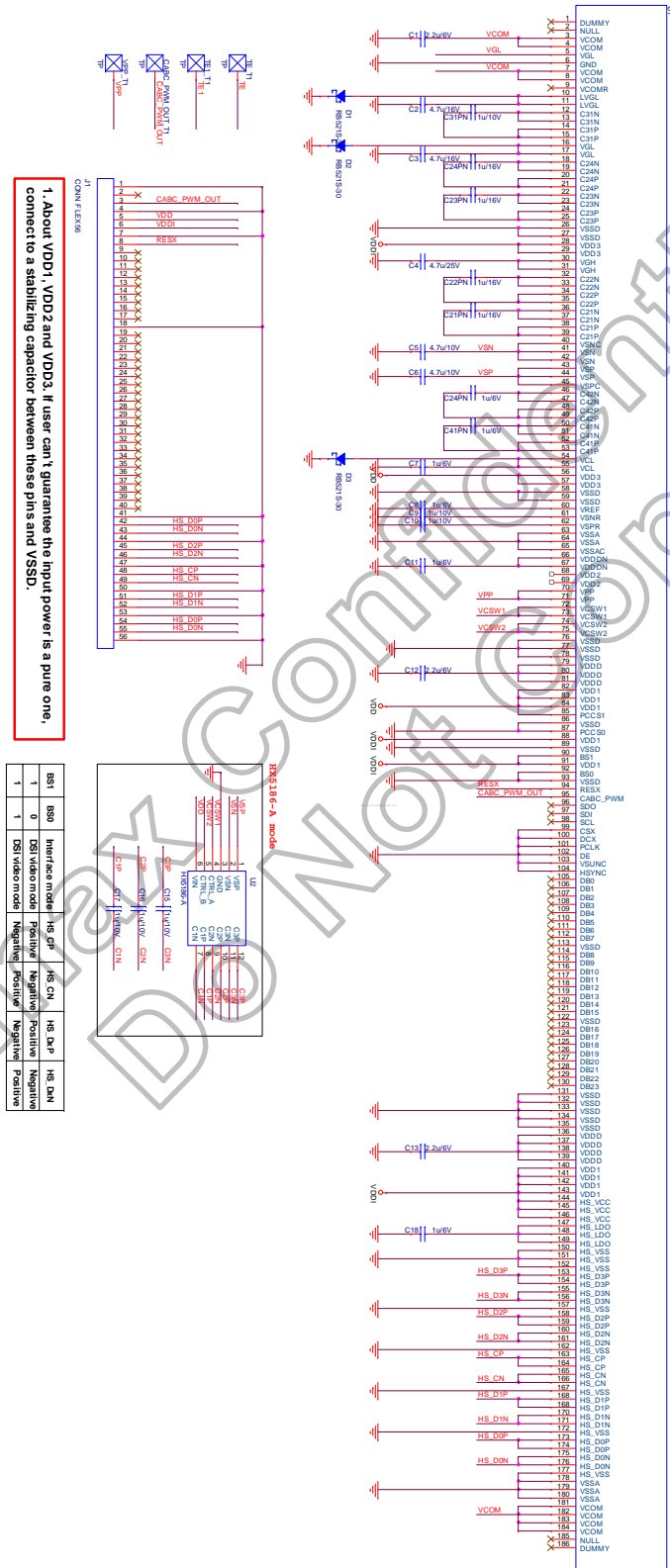


Figure 1.5: Reference FPC Circuit for BOE 5.0 inch panel

1.3.2 HX8394-A DSI Video mode initial code for BOE 5.0 inch panel

/\*\*Please send initial code in LP mode.\*\*/

Command 11h // Sleep Out  
Delay 200ms

Command B9h // Set Password  
Parameters FFh 83h 94h

Command BAh // Set MIPI  
Parameters 13h

// User can change to HS mode to send other initial codes.

If HX5186-A

Command B1h // Set Power  
Parameters 7Ch 00h 24h 09h 01h 11h 11h 36h 3Eh 26h 26h 57h 0Ah 01h E6h

else //HX5186-B

Command B1h // Set Power  
Parameters 7Ch 00h 24h 09h 01h 11h 11h 36h 3Eh 26h 26h 57h 02h 01h E6h

Command B4h // Set CYC  
Parameters 00h 00h 00h 05h 06h 41h 42h 02h 41h 42h 43h 47h 19h 58h 60h 08h 05h 10h

Command D5h // Set GIP  
Parameters 4Ch 01h 00h 01h CDh 23h EFh 45h 67h 89h ABh 11h 00h DCh 10h FEh 32h  
BAh 98h 76h 54h 00h 11h 40h

Command E0h // Set Gamma  
Parameters 24h 33h 36h 3Fh 3Fh 3Fh 3Ch 56h 05h 0Ch 0Eh 11h 13h 12h 14h 12h 1Eh  
24h 33h 36h 3Fh 3Fh 3Fh 3Ch 56h 05h 0Ch 0Eh 11h 13h 12h 14h 12h 1Eh

Command C7h // Himax internal use, not open.  
Parameters 00h 20h

Command CCh // Set Panel  
Parameters 09h

Command 29h // Display On  
Parameters 09h

Delay 50ms

Video Stream :

## 2.Code For Reference

### 2.1 Sleep in (10h)

```
void Sleep_in_function(void)
{
    //Sleep In
    SET_CMD(0x10);
    DelayX1ms(120);
}
```

### 2.2 Sleep out (11h)

```
void Sleep_out_function(void)
{
    //Sleep Out
    SET_CMD(0x11);
    DelayX1ms(200);
}
```

### 2.3 Display off (28h)

```
void Display_off_function(void)
{
    //Display Off
    SET_CMD(0x28);
}
```

### 2.4 Display on (29h)

```
void Display_on_function(void)
{
    //Display On
    SET_CMD(0x29);
}
```

## 2.5 CABC on

### 2.5.1 UI mode

**void CABC\_UI\_mode\_function(void)**

```
{
    //After Normally Light On
    //CABC UI Mode Setting
    SET_CMD(0x51);    //DBV[7:0]=0xFF
    SET_PAs(0xFF);

    SET_CMD(0x53);    //BCTRL=1, BL=1
    SET_PAs (0x24);

    SET_CMD(0x55);    //SCABC UI Mode
    SET_PAs (0x01);
    DelayX1ms(5);
}
```

### 2.5.2 Still mode

**void CABC\_Still\_mode\_function(void)**

```
{
    //After Normally Light On
    //CABC UI Mode Setting
    SET_CMD(0x51);    //DBV[7:0]=0xFF
    SET_PAs(0xFF);

    SET_CMD(0x53);    //BCTRL=1, BL=1
    SET_PAs (0x24);

    SET_CMD(0x55);    //SCABC Still Mode
    SET_PAs (0x02);
    DelayX1ms(5);
}
```

### 2.5.3 Moving mode

**void CABC\_Moving\_mode\_function(void)**

```
{
    //After Normally Light On
    //CABC UI Mode Setting
    SET_CMD(0x51);    //DBV[7:0]=0xFF
    SET_PAs(0xFF);

    SET_CMD(0x53);    //BCTRL=1, BL=1
    SET_PAs (0x24);

    SET_CMD(0x55);    //SCABC Moving Mode
    SET_PAs (0x03);
    DelayX1ms(5);
}
```



}

## 2.6 CABC off

**void CABC\_off\_function(void)**

```
{  
    //CABC Mode off Setting  
    SET_CMD(0x55);    //SCABC Mode off  
    SET_PAs (0x00);  
}
```

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### 3.Revision History

Version	Date	Description of Changes
01	2011/11/01	New setup
	2011/11/29	1. Updated pad information of figure 1.1~1.3. (P4~6)
01.01	2012/01/05	1. Updated Figure 1.3: Power supply with HX5186-A. (P6)
01.02	2012/02/10	1. Added reference initial code for Ortus 4.8 inch panel. (P7)
01.03	2012/02/15	1. Added components table for each mode. (P6, P8, P10) 2. Added reference FPC circuit for Ortus 4.8 inch panel. (P11)
01.04	2012/02/24	1. Updated PFM Type A L1 inductor value from 10uH to 22uH. (P6)
01.05	2012/04/13	1. Updated initial settings for HX5186-B. (P12)
01.06	2012/06/01	1. Modified VSP, VSN, VGH, VGL and LVGL capacitor values to 4.7uF. (P6~11) 2. Added reference FPC circuit for BOE 5.0 inch panel. (P13, P14)

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