



Technology / FAQ

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Compatible Solution for SSD1309 and CH1116 IC

Since the COVID-19 pandemic began in 2020, COVID-19 has changed the supply chain balance, resulting in insufficient IC capacity in the display market. The supply of SSD1309 has become unstable, and lead times are getting longer. To guarantee on-time delivery to customers, we develop a new series using CH1116 to replace SSD1309.

In terms of modules, SSD1309 and CH1116 are compatible with each other. The following will explain the differences between the two from the hardware and software perspective and how to achieve compatibility.

Related Module Series	
Existing model (SSD1309 IC)	Recommend model (CH1116 IC)
WEO012864J	WEP012864AJ
WFO012864J	WFP012864AJ

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1. Hardware

Some pins of SSD1309 and CH1116 have different names but the same functions. For example, VDD, VCC, D/C, and BS0 of SSD1309 are equivalent to VDD1, VPP, A0, and IM0 of CH1116. Some pins have the same function but need to use different passive components, such as the resistance of pin IREF. The recommended circuit diagrams of the two ICs are shown in Figure 1 and Figure 2.

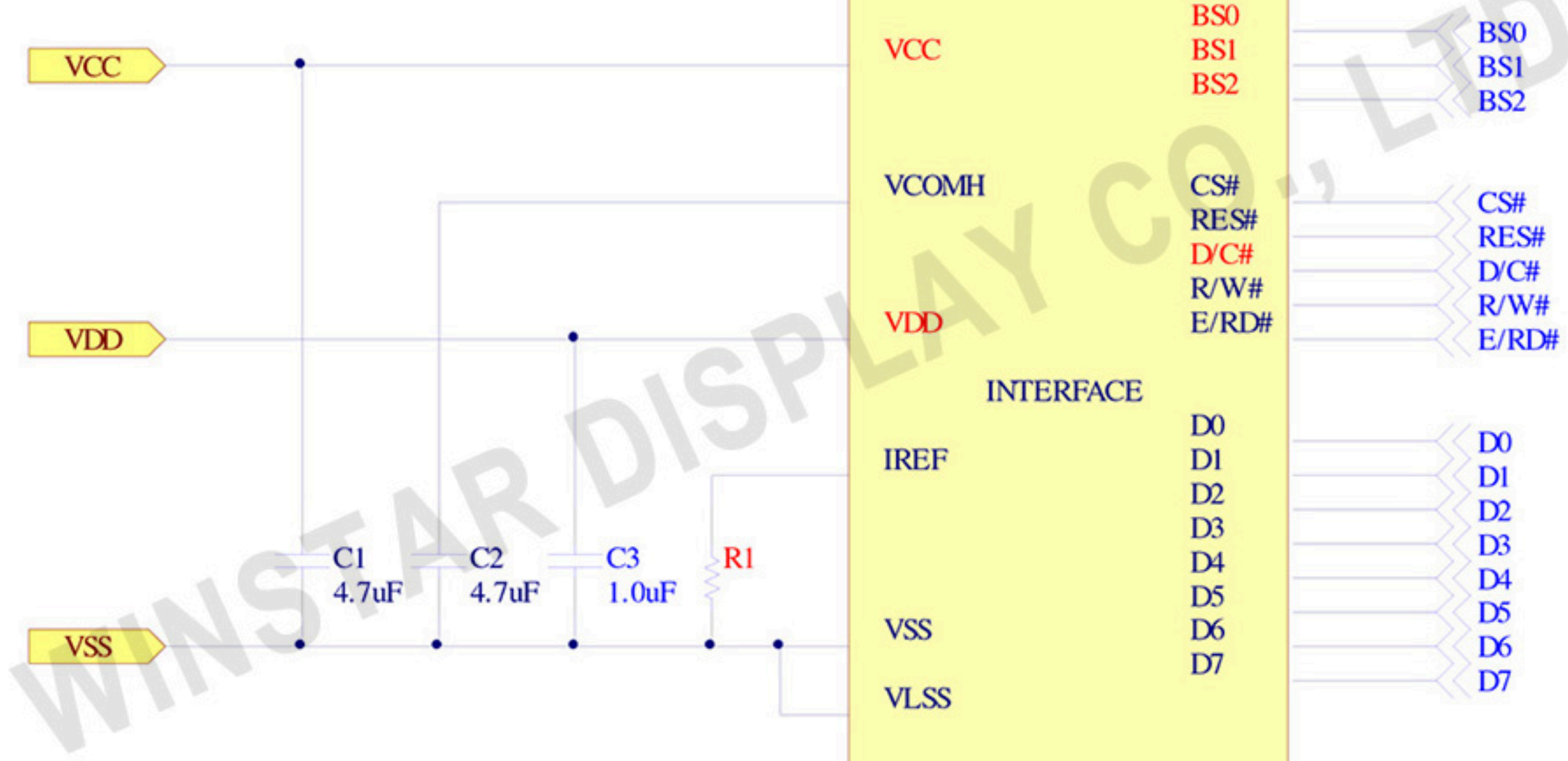


Figure 1. SSD1309 Application recommendations

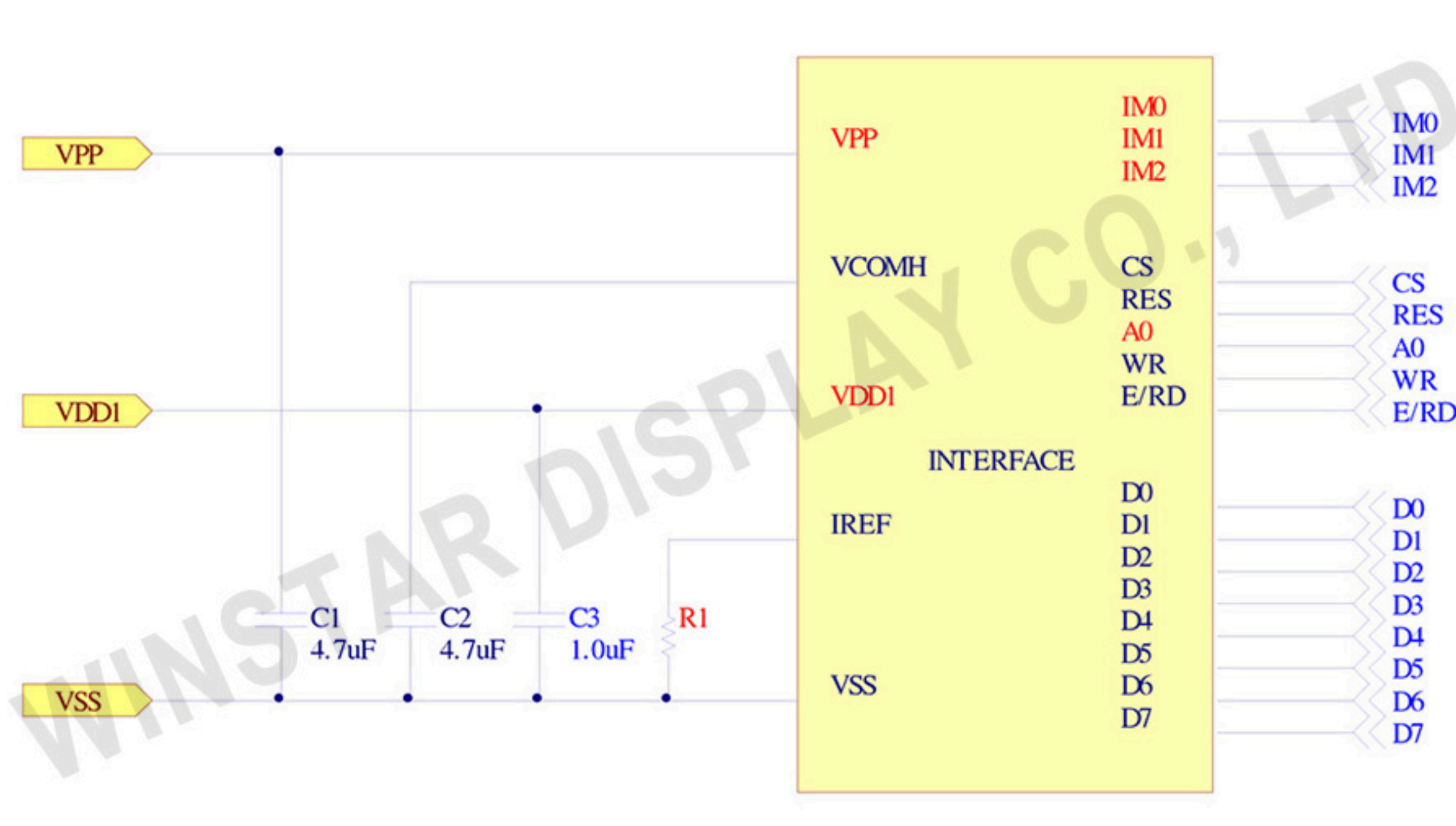


Figure 2. CH1116 Application recommendations

1.1. Pin IREF

Please pay attention to the resistance value of pin IREF, which can directly affect the brightness and current. When both ICs use the same VCC (VPP), the SSD1309 needs a larger resistance value. The formula for the resistance is below.

SSD1309 :

$$R1 = \frac{\text{Voltage at IREF} - \text{VSS}}{\text{IREF}} \geq \frac{(\text{VCC} - 3) \text{V}}{10\mu\text{A}}$$

CH1116 :

$$(R1 + 150\text{K}\Omega) = \frac{\text{Voltage at IREF} - \text{VSS}}{\text{IREF}}$$

$$R1 = \left[\frac{\text{Voltage at IREF} - \text{VSS}}{\text{IREF}} \right] - 150\text{K}\Omega \geq \left[\frac{(\text{VPP} - 3.5) \text{V}}{18.75\mu\text{A}} \right] - 150\text{K}\Omega$$

2. Software

Most of the commands of SSD1309 and CH1116 are compatible, but some are still different. For example, two ICs each have exclusive functions, so the IC can only use some commands. In addition, some commands have the same function, but the parameters are incompatible, as shown in Table 1.

Table 1. Command difference between SSD1309 and CH1116

	SSD1309	CH1116
Set Memory Addressing Mode 20H	Set the way of memory addressing into one of the below three modes. 00H : Horizontal Addressing Mode 01H : Vertical Addressing Mode 02H : Page Addressing Mode	N/A
Set Column Address 21H	Setup column start and end address	N/A
Set Page Address 22H	Setup page start and end address	N/A
Set Breathing Light 23H	N/A	Set Breathing Light ON/OFF, Brightness Adjust and Time Interval.
Additional Horizontal Scroll Setup Mode Set 24H	N/A	Set up the horizontal scroll parameters. It determined the scrolling start column position and end column position.
Continuous Horizontal Scroll Setup 26H / 27H	Set up the horizontal scroll parameters. It determined the scrolling start page, end page, scrolling speed, start column and end column.	Set up the horizontal scroll parameters. It determined the direction of horizontal scroll, scrolling start page, time interval and end page.
Continuous Vertical and Horizontal Scroll Setup 29H / 2AH	Set up the continuous vertical scroll parameters. It determined the scrolling start page, end page, scrolling speed and vertical scrolling offset.	N/A
Content Scroll Setup 2CH / 2DH	RAM contents are scrolled horizontally and updates by one column. It determined the scrolling start page, end page, start column and end column.	N/A
Set Scroll Mode 2CH / 2DH	N/A	Control continuous or single screen scroll.
Set Pump voltage value 30H-33H	N/A	Specifies output voltage (VPP) of the internal charger pump. 30H: 10V ; 31H: 7.4V ; 32H: 8V ; 33H: 9V
IREF Resistor Set 82H	N/A	IREF can be controlled by external resistor or internal resistor. Note: When internal resistor is selected, external resistor should be open. External and internal resistances are connected in parallel.
Set Segment Remap A0H / A1H	A0H : column address 0 is mapped to SEG0 A1H : column address 127 is mapped to SEG0	A0H : column address 0 is mapped to SEG0 A1H : column address 131 is mapped to SEG0
Set Vertical Scroll Area A3H	This command consists of 3 consecutive bytes to set up the vertical scroll area.	N/A
Set DC-DC OFF/ON ADH	N/A	This command is to control the DC-DC voltage converter.
Set Display Clock Divide Ratio/Oscillator Frequency D5H	Dicde Ratio : 3 · 4 · 8 · 16	Dicde Ratio : 1~16
Set Adaptive Power Save D6H / D7H	N/A	D6H: Normal D7H: Adaptive Power Save(POR)
Set Pre-charge Period D9H	A[3:0] : Dis-charge A[7:4] : Pre-charge	A[3:0] : Pre-charge A[7:4] : Dis-charge
Set COM Pins Hardware Configuration DAH	02H : Sequential Mode; Disable COM Left/Right remap 12H : Alternative Mode; Disable COM Left/Right remap 22H : Sequential Mode; Enable COM Left/Right remap 32H : Alternative Mode; Enable COM Left/Right remap	02H : Sequential Mode 12H : Alternative Mode
Set VCOMH Deselect Level DBH	00H : 0.64 x VCC 34H : 0.78 x VCC 3CH : 0.84 x VCC	00H : 0.430 x VCC 3FH : 0.834 x VCC
Set GPIO DCH	This double byte commands is used to set the state of GPIO pin.	N/A
Set row non-overlap/SEG Hiz Period DCH	N/A	This command is used to set the duration of the row non-overlap /SEG Hiz Period period.
Set Command Lock FDH	Set Command Lock	N/A

3. Compatibility

In order to make the ICs compatible to each other, the hardware and software of the module need to be modified.

The pins of the two ICs are roughly the same in terms of hardware. The resistance value of IREF must conform to the respective calculation formulas at the same time. If the resistance value is too small, there is a risk of burning out the IC. In addition, VCC (VPP) must follow the specifications of SSD1309 and CH1116 simultaneously; the former is 7V~16V, and the latter is 6.4V~14V.

In terms of software, there are three points to note:

- There are many Memory Addressing Modes for SSD1309 to choose from, but CH1116 only has Page Addressing Mode. Therefore, we recommend using Page Addressing Mode.
- The resolution of the SSD1309 supports 128x64, and CH1116 is 132x64. When setting Segment Remap (A0h/A1h), we recommend using A0h to avoid offsetting the display pattern.
- We can choose whether to turn on the DC-DC Voltage Converter (Adh) of CH1116, but SSD1309 does not have this function. We recommend turning off the DC-DC converter of CH1116 and using external VCC/VPP.

In addition, by setting the Command Lock (Fdh) of SSD1309, the respective commands of the two ICs can be written in the same initial code, as shown in Figure 3, Figure 4, and Figure 5. The commands circled by red boxes are the differences between the two initial codes. In Figure 5, after using Fdh to lock the IC, SSD1309 does not accept any commands except Fdh, but CH1116 is not affected. Therefore, we can issue commands to the two ICs separately.

```

0xAE //Display Off
0xA8 //Select Multiplex Ratio
0x3F //0x3F(1/64 Duty)
0x03 //Setting Display Offset
0x00 //00H Reset
0x20 //Set Memory Addressing Mode
0x02 //Page Addressing Mode
0x00 //Set Column Address LSB
0x10 //Set Column Address MSB
0x40 //Set Display Start Line
0x0B //Set Deselect Vcom Level
0x34
0x81 //Set Contrast Control
0x7F
0xD5 //SET DISPLAY CLOCK
0x70
0xA0 //Set Segment Re-Map
//column address 0 is mapped to SEG0
0xC0 //Set COM Output Scan Direction
0x0A //Set COM Hardware Configuration
0x12 //Alternative COM Pin
0x09 //Set Pre-Charge period
0x22
0xA4 //Set Entire Display ON
0xA6 //Set Normal Display
0xAF // Display ON
    
```

Figure 3: Initial code for SSD1309

```

0xAE //Display Off
0xA8 //Select Multiplex Ratio
0x3F //0x3F(1/64 Duty)
0x03 //Setting Display Offset
0x00 //00H Reset
0x8A //Master Configuration
0x8A //IREF external VCC supply
0x82 //IREF Resistor Set
0x80 //External resistor
0x08 //Set Column Address LSB
0x10 //Set Column Address MSB
0x40 //Set Display Start Line
0x0B //Set Deselect Vcom Level
0x34
0x81 //Set Contrast Control
0x7F
0xD5 //SET DISPLAY CLOCK
0x50
0xA0 //Set Segment Re-Map
//column address 0 is mapped to SEG0
0xC0 //Set COM Output Scan Direction
0x0A //Set COM Hardware Configuration
0x12 //Alternative COM Pin
0x09 //Set Pre-Charge period
0x22
0xA4 //Set Entire Display ON
0xA6 //Set Normal Display
0xAF // Display ON
    
```

Figure 4: Initial code for CH1116

```

0xAE //Display Off
0xA8 //Select Multiplex Ratio
0x3F //0x3F(1/64 Duty)
0x03 //Setting Display Offset
0x00 //00H Reset
0x20 //Set Memory Addressing Mode
0x02 //Page Addressing Mode
0x00 //Set Column Address LSB
0x10 //Set Column Address MSB
0x40 //Set Display Start Line
0x0B //Set Deselect Vcom Level
0x34
0x81 //Set Contrast Control
0x7F
0xD5 //SET DISPLAY CLOCK
0x70
0xA0 //Set Segment Re-Map
//column address 0 is mapped to SEG0
0xC0 //Set COM Output Scan Direction
0x0A //Set COM Hardware Configuration
0x12 //Alternative COM Pin
0x09 //Set Pre-Charge period
0x22
0xF0 //Set Command Lock
0x16 //Lock SSD1309
0xA4 //Master Configuration
0x8A //Select external VCC supply
0x82 //IREF Resistor Set
0x80 //External resistor
0x81 //Set Contrast Control
0xFF
0xD5 //SET DISPLAY CLOCK
0x50
0xF0 //Set Command Lock
0x12 //Unlock SSD1309
0xA4 //Set Entire Display ON
0xA6 //Set Normal Display
0xAF // Display ON
    
```

Figure 5: Initial code for SSD1309 and CH1116

4. Conclusion

These two ICs, SSD1309 and CH1116 are compatible with each other. We can have the same display image and brightness by using the same hardware and software. As long as the components such as resistors and capacitors are adjusted, and the initial code is modified, SSD1309 can be replaced with CH1116. According to the situation, we can modify the software slightly without changing the hardware to make the two ICs achieve the same display effect.

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