Product Specification

Customer
Approved by Customer

1 Overview

this is a monochrome OLED display module with 128×32 dot matrix. The characteristics of this display module are high brightness, self-emission, high contrast ratio, slim/thin outline, wide viewing angle, wide temperature range, and low power consumption.etc.

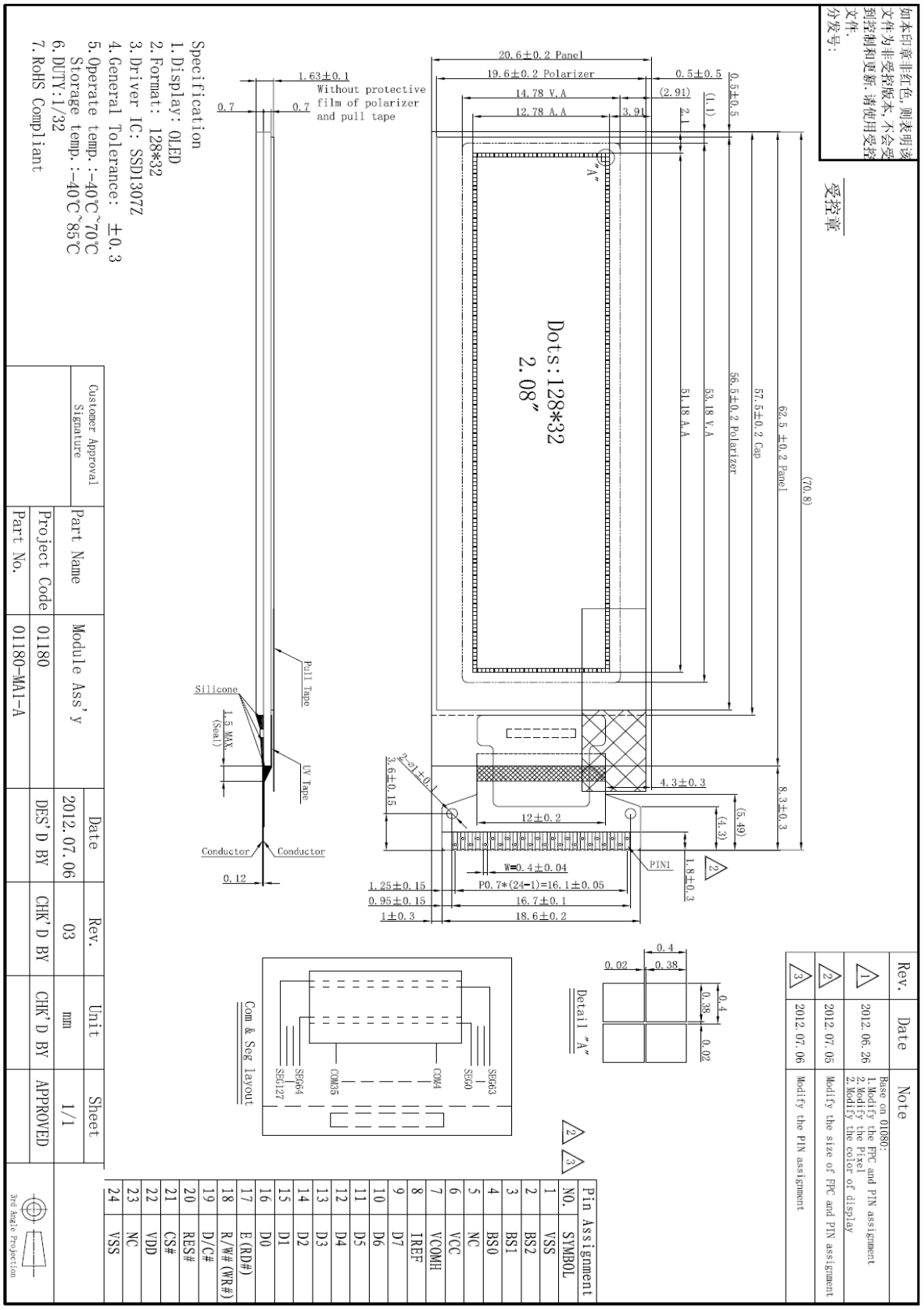
2 Features

- Display Color: White
- Dot Matrix:128×32
- Driver IC: SSD1307
- Interface: 8-bit 8080/8-bit 6800/4-Wire SPI/3-Wire SPI/I^2C
- Wide range of operating temperature: -40℃ to 70℃

3 Mechanical Data

NO.	ITEM	SPECIFICATION	UNIT
1	Dot Matrix	128(W)×32(H)	-
2	Dot Size	0.38(W)×0.38 (H)	mm^2
3	Dot Pitch	0.40(W)×0.40(H)	mm^2
4	Aperture Rate	90	%
5	Active Area	51.18(W)×12.78(H)	mm^2
6	Panel Size	62.5(W)×20.6(H) ×1.4(T)	mm^3
7	Module Size	70.8(W)×20.6(H) ×1.63(T)	mm^3
8	Diagonal A/A Size	2.08	inch
9	Module Weight	4.1±10%	gram

4 Mechanical Drawing



Rev.	Date	Note
1	2012.06.26	Base on 01080: 1. Modify the FPC and PIN assigment 2. Modify the Pixel 3. Modify the color of display
2	2012.07.05	Modify the size of FPC and PIN assigment
3	2012.07.06	Modify the PIN assigment

Customer Approval Signature	Part Name	Module Ass'y	Date	Rev.	Unit	Sheet
	Project Code	01180	2012.07.06	03	mm	1/1
	Part No.	01180-MA1-A	DES'D BY	CHK'D BY	CHK'D BY	APPROVED

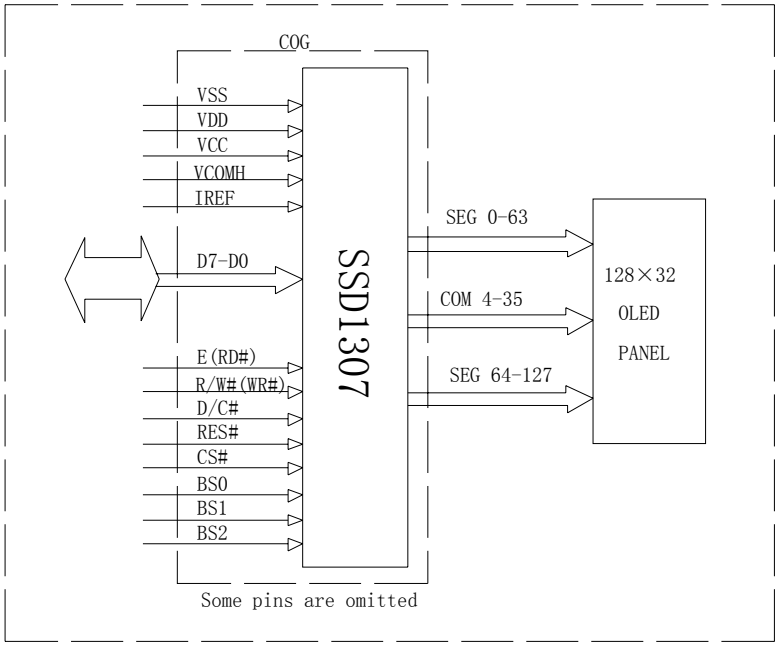
Pin Assignment	
NO.	SYMBOL
1	VSS
2	BS2
3	BS1
4	BS0
5	NC
6	VCC
7	VCOMH
8	IREF
9	D7
10	D6
11	D5
12	D4
13	D3
14	D2
15	D1
16	D0
17	E(RD#)
18	R/W#(WR#)
19	D/C#
20	RES#
21	CS#
22	VDD
23	NC
24	VSS

5 Module Interface

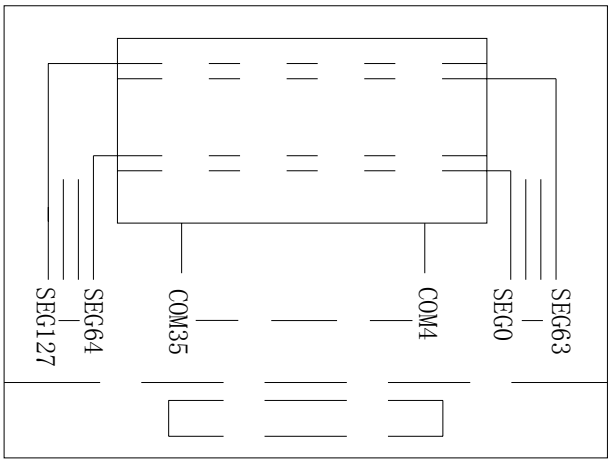
<table>
<tr><th>PIN NO.</th><th>PIN NAME</th><th>DESCRIPTION</th></tr>
<tr><td>1</td><td>VSS</td><td>This is a ground pin.</td></tr>
<tr><td>2</td><td rowspan="3">BS2
BS1
BS0</td><td rowspan="3">
<table>
<tr><td></td><td>I²C</td><td>6800-parallel</td><td>8080-parallel</td><td>4-wire SPI</td><td>3-wire SPI</td></tr>
<tr><td>BS0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>BS1</td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>BS2</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
</table>
</td></tr>
<tr><td>3</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>NC</td><td>No Connection.</td></tr>
<tr><td>6</td><td>VCC</td><td>Power supply for panel driving voltage. This is also the most positive power voltage supply pin.</td></tr>
<tr><td>7</td><td>VCOMH</td><td>The pin is for COM signal deselected voltage level.
A capacitor should be connected between this pin and VSS.</td></tr>
<tr><td>8</td><td>IREF</td><td>This is segment output current reference pin.
A resistor should be connected between this pin and VSS to maintain the IREF current at 10uA.</td></tr>
<tr><td>9~16</td><td>D7~D0</td><td>These are 8-bit bi-directional data bus to be connected to the microprocessor’s data bus.
When serial interface mode is selected, D0 will be the serial clock input: SCLK; D1 will be the serial data input: SDIN and D2 should be kept NC.
When I²C mode is selected, D2, D1 should be tied together and serve as SDAout, SDAin in application and D0 is the serial clock input, SCL.</td></tr>
<tr><td>17</td><td>E(RD#)</td><td>When interfacing to a 6800-series microprocessor, this pin will be used as the Enable (E)signal. Read/write operation is initiated when this pin is pulled HIGH (i.e. connect to VDD)and the chip is selected.
When connecting to an 8080-series microprocessor, this pin receives the Read (RD#)signal. Read operation is initiated when this pin is pulled LOW and the chip is selected.
When serial interface is selected, this pin must be connected to VSS.</td></tr>
<tr><td>18</td><td>R/W#(WR#)</td><td>This is read / write control input pin connecting to the MCU interface.
When interfacing to a 6800-series microprocessor, this pin will be used as Read/Write (R/W#) selection input. Read mode will be carried out when this pin is pulled HIGH (i.e.connect to VDD) and write mode when LOW.
When 8080 interface mode is selected, this pin will be the Write (WR#) input. Data write operation is initiated when this pin is pulled LOW and the chip is selected.
When serial or I²C interface is selected, this pin must be connected to VSS.</td></tr>
<tr><td>19</td><td>D/C#</td><td>This is Data/Command control pin. When it is pulled HIGH (i.e. connect to VDD), the data at D[7:0] is treated as data. When it is pulled LOW, the data at D[7:0] will be transferred to the command register.
In I²C mode, this pin acts as SA0 for slave address selection.
When 3-wire serial interface is selected, this pin must be connected to VSS.</td></tr>
<tr><td>20</td><td>RES#</td><td>This pin is reset signal input. When the pin is pulled LOW, initialization of the chip is executed. Keep this pin HIGH (i.e. connect to VDD) during normal operation.</td></tr>
<tr><td>21</td><td>CS#</td><td>This pin is the chip select input. (active LOW)</td></tr>
<tr><td>22</td><td>VDD</td><td>Power supply pin for core logic operation.</td></tr>
<tr><td>23</td><td>NC</td><td>No Connection.</td></tr>
<tr><td>24</td><td>VSS</td><td>This is a ground pin.</td></tr>
</table>

6 Function Block Diagram

6.1 Function Block Diagram



6.2 Panel Layout Diagram



Com & Seg layout

7 Absolute Maximum Ratings

ITEM	SYMBOL	MIN	MAX	UNIT	REMARK
Logic supply voltage	VDD	-0.3	4.0	V	IC maximum rating
OLED Operating voltage	VCC	0	16	V	IC maximum rating
Operating Temp.	Top	-40	70	℃	-
Storage Temp	Tstg	-40	85	℃	-

Note (1): All of the voltages are on the basis of "VSS = 0V".

Note (2): Permanent breakage of module may occur if the module is used beyond the maximum rating. The module can be normal operated under the conditions according to Section 8 "Electrical Characteristics". Malfunctioning of the module may occur and the reliability of the module may deteriorate if the module is used beyond the conditions.

8 Electrical Characteristics

8.1 DC Electrical Characteristics

ITEM	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Logic Supply Voltage	VDD	22±3°C, 55±15%R.H	1.65	3.0	3.3	V
OLED Driver Supply Voltage	VCC	22±3°C, 55±15%R.H	8.5	9	9.5	V
High-level Input Voltage	V_{IH}	-	0.8×VDD	-	-	V
Low-level Input Voltage	V_{IL}	-	-	-	0.2×VDD	V
High-level Output Voltage	V_{OH}	-	0.9×VDD	-	-	V
Low-level Output Voltage	V_{OL}	-	-	-	0.1×VDD	V

Note : The VCC input must be kept in a stable value; ripple and noise are not allowed.

8.2 Electro-optical Characteristics

ITEM	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNIT
Normal Mode Brightness	L_{br}	All pixels ON(1)	60	80	-	cd/m^2
Sleep mode Current	IDD,SLEEP	VDD = 1.65V~3.3V, VCC = 7V~15V Display OFF, No panel attached	-	-	20	uA
Sleep mode Current	ICC,SLEEP	VDD = 1.65V~3.3V, VCC = 7V~15V Display OFF, No panel attached	-	-	20	uA
Normal Mode Power Consumption	Pt	All pixels ON(1)	-	94.5	117	mW
C.I.E(Green)	(x)	x,y(CIE1931)	0.26	0.30	0.34	-
	(y)		0.56	0.60	0.64	-
Dark Room Contrast	CR	-	≥2000:1	-	-	-
Response Time	-	-	---	10	-	μs
View Angle	-	-	≥160	-	-	Degree

Note(1): Normal Mode test conditions are as follows:

- Driving voltage : 9V
- Contrast setting : 0x40
- Frame rate : 105Hz
- Duty setting : 1/32

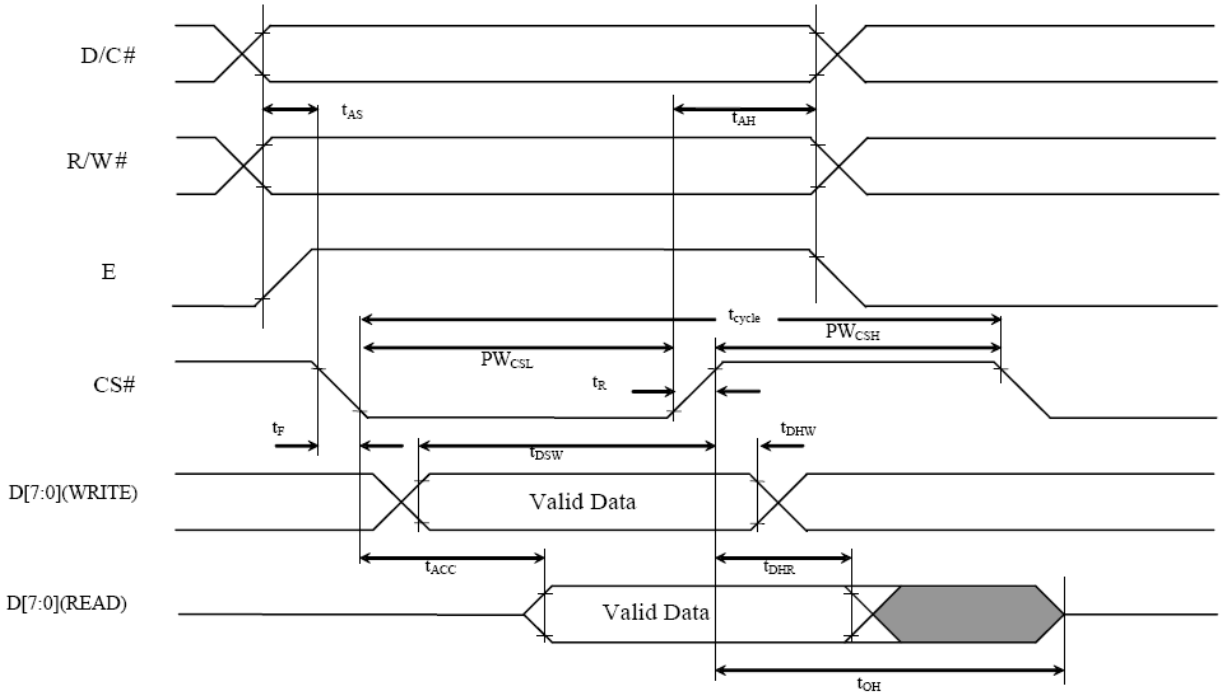
8.3 AC Electrical Characteristics

(1)6800-Series MPU Parallel Interface Timing Characteristics

(VDD - VSS = 1.65V to 3.3V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	0	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	7	-	-	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) Chip Select Low Pulse Width (write)	120 60	-	-	ns
PW_{CSH}	Chip Select High Pulse Width (read) Chip Select High Pulse Width (write)	60 60	-	-	ns
t_R	Rise Time	-	-	40	ns
t_F	Fall Time	-	-	40	ns

6800-series MCU parallel interface characteristics



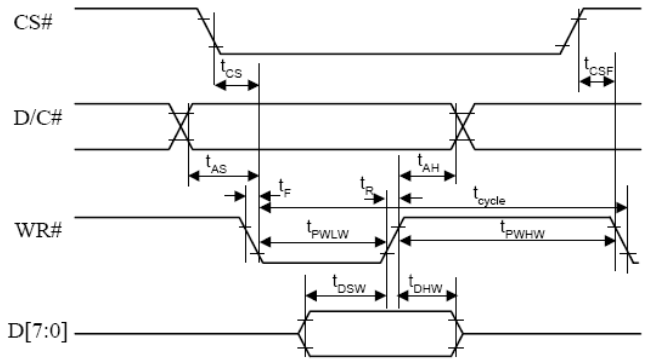
(2)8080-Series MPU Parallel Interface Timing Characteristics

(VDD - VSS = 1.65V to 3.3V, TA = 25°C)

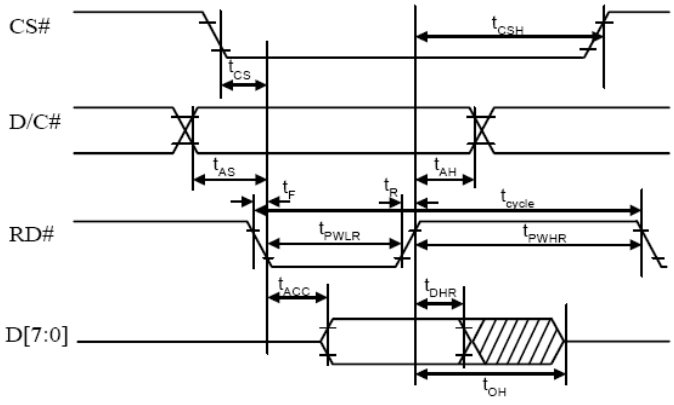
Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	300	-	-	ns
t_{AS}	Address Setup Time	10	-	-	ns
t_{AH}	Address Hold Time	0	-	-	ns
t_{DSW}	Write Data Setup Time	40	-	-	ns
t_{DHW}	Write Data Hold Time	7	-	-	ns
t_{DHR}	Read Data Hold Time	20	-	-	ns
t_{OH}	Output Disable Time	-	-	70	ns
t_{ACC}	Access Time	-	-	140	ns
t_{PWLR}	Read Low Time	120	-	-	ns
t_{PWLW}	Write Low Time	60	-	-	ns
t_{PWHR}	Read High Time	60	-	-	ns
t_{PWHW}	Write High Time	60	-	-	ns
t_R	Rise Time	-	-	40	ns
t_F	Fall Time	-	-	40	ns
t_{CS}	Chip select setup time	0	-	-	ns
t_{CSH}	Chip select hold time to read signal	0	-	-	ns
t_{CSF}	Chip select hold time	20	-	-	ns

8080-series MCU parallel interface characteristics

Write cycle



Read Cycle

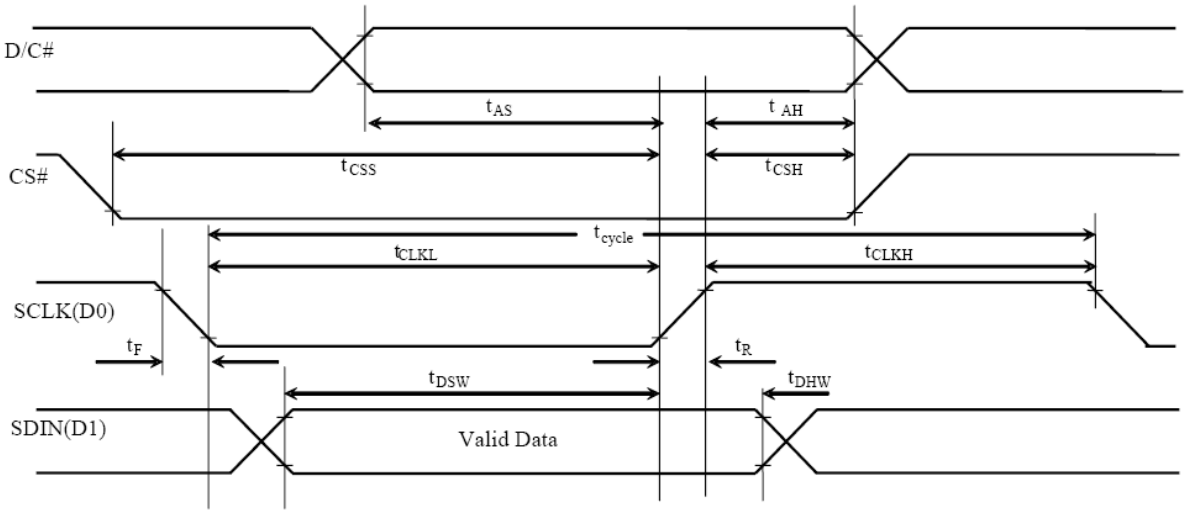


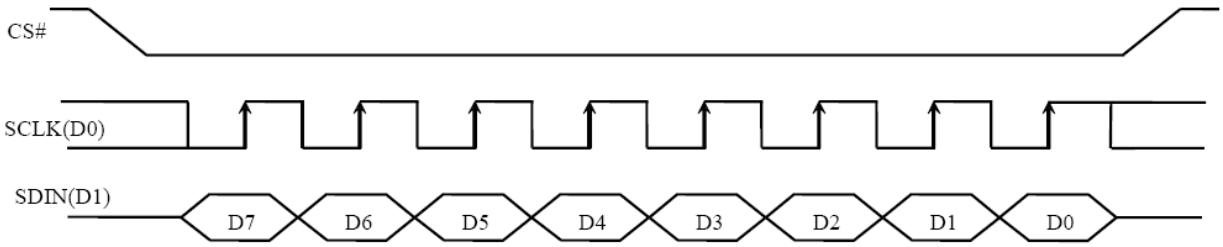
(3)4-wire Series MPU Parallel Interface Timing Characteristics

(VDD - VSS = 1.65V to 3.3V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	100	-	-	ns
t_{AS}	Address Setup Time	15	-	-	ns
t_{AH}	Address Hold Time	15	-	-	ns
t_{CSS}	Chip Select Setup Time	20	-	-	ns
t_{CSH}	Chip Select Hold Time	10	-	-	ns
t_{DSW}	Write Data Setup Time	15	-	-	ns
t_{DHW}	Write Data Hold Time	15	-	-	ns
t_{CLKL}	Clock Low Time	20	-	-	ns
t_{CLKH}	Clock High Time	20	-	-	ns
t_R	Rise Time	-	-	40	ns
t_F	Fall Time	-	-	40	ns

4-wire series MCU parallel interface characteristics



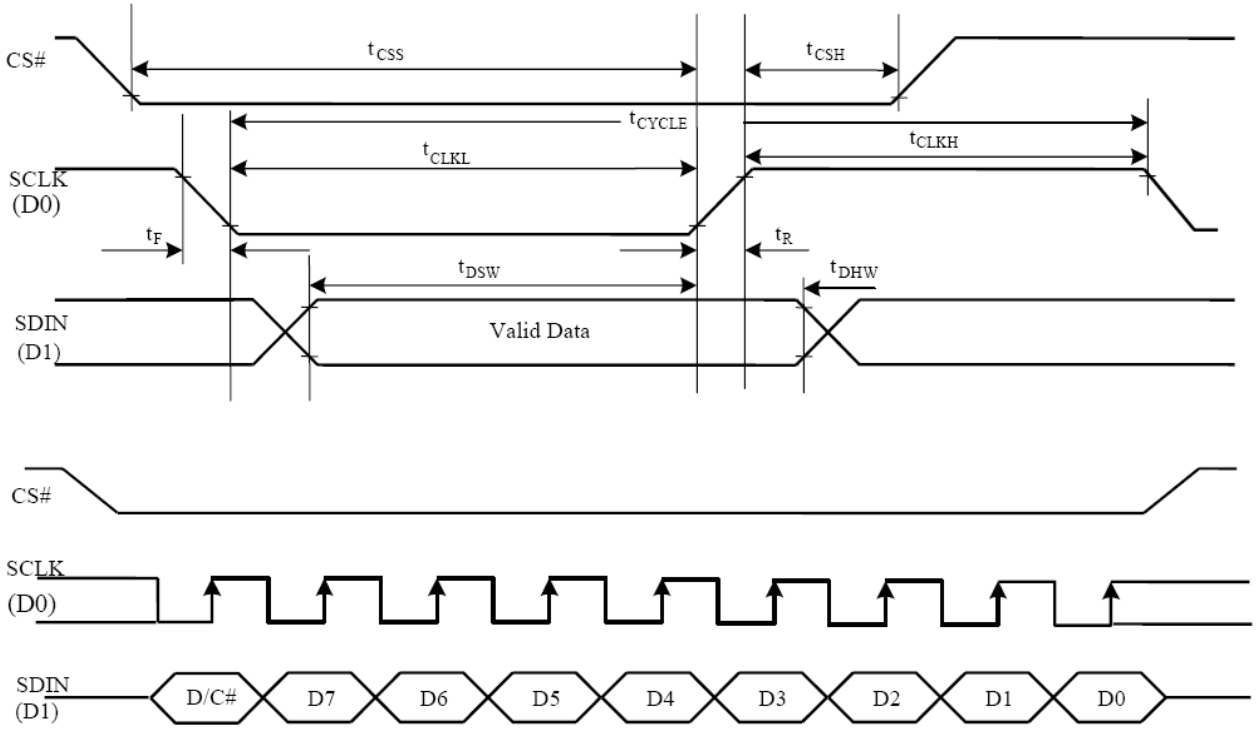


(4)3-wire Series MPU Parallel Interface Timing Characteristics

(VDD - VSS = 1.65V to 3.3V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	100	-	-	ns
t_{CSS}	Chip Select Setup Time	20	-	-	ns
t_{CSH}	Chip Select Hold Time	10	-	-	ns
t_{DSW}	Write Data Setup Time	15	-	-	ns
t_{DHW}	Write Data Hold Time	15	-	-	ns
t_{CLKL}	Clock Low Time	20	-	-	ns
t_{CLKH}	Clock High Time	20	-	-	ns
t_R	Rise Time	-	-	40	ns
t_F	Fall Time	-	-	40	ns

3-wire series MCU parallel interface characteristics

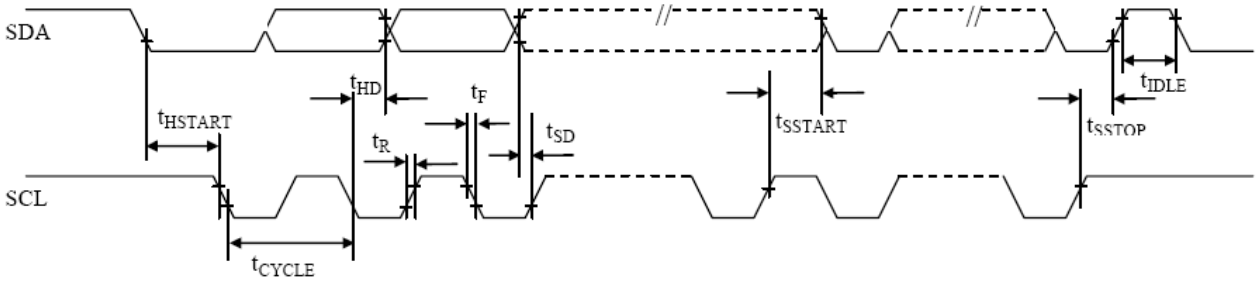


(5)I²C MPU Parallel Interface Timing Characteristics

(VDD - VSS = 1.65V to 3.3V, TA = 25°C)

Symbol	Parameter	Min	Typ	Max	Unit
t_{cycle}	Clock Cycle Time	2.5	-	-	us
t_{HSTART}	Start condition Hold Time	0.6	-	-	us
t_{HD}	Data Hold Time (for "SDA_{OUT}" pin)	0	-	-	ns
	Data Hold Time (for "SDA_{IN}" pin)	300	-	-	ns
t_{SD}	Data Setup Time	100	-	-	ns
t_{SSTART}	Start condition Setup Time (Only relevant for a repeated Start condition)	0.6	-	-	us
t_{SSTOP}	Stop condition Setup Time	0.6	-	-	us
t_R	Rise Time for data and clock pin	-	-	300	ns
t_F	Fall Time for data and clock pin	-	-	300	ns
t_{IDLE}	Idle Time before a new transmission can start	1.3	-	-	us

I²C series MCU parallel interface characteristics

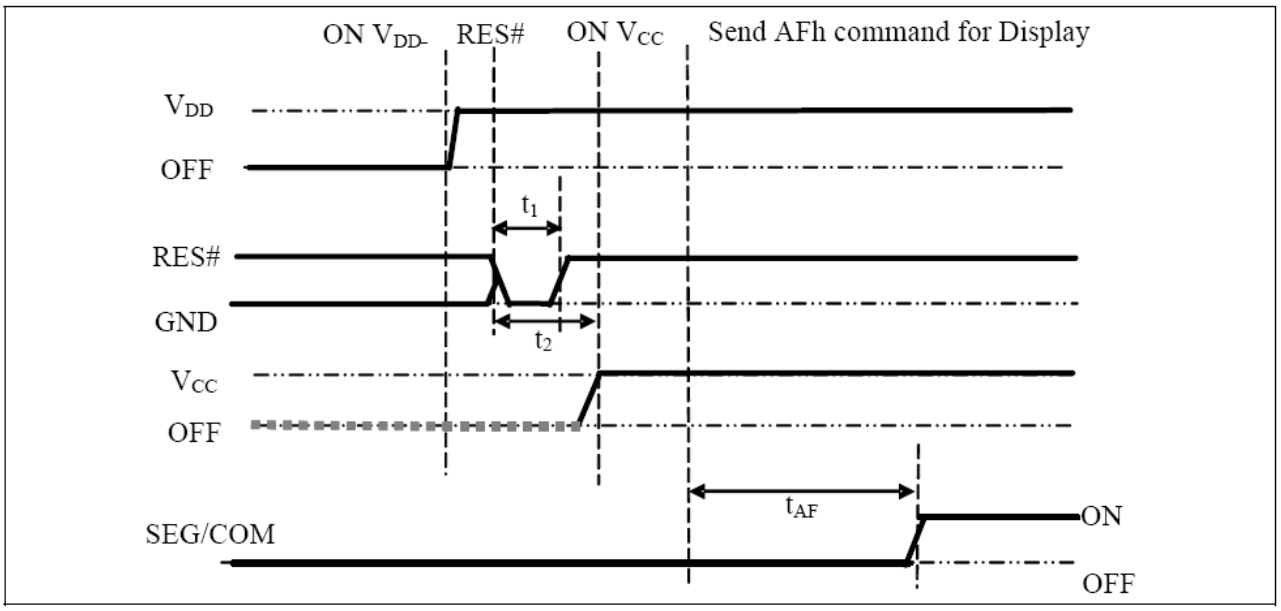


9 Functional Specification and Application Circuit

9.1 Power ON and Power OFF Sequence

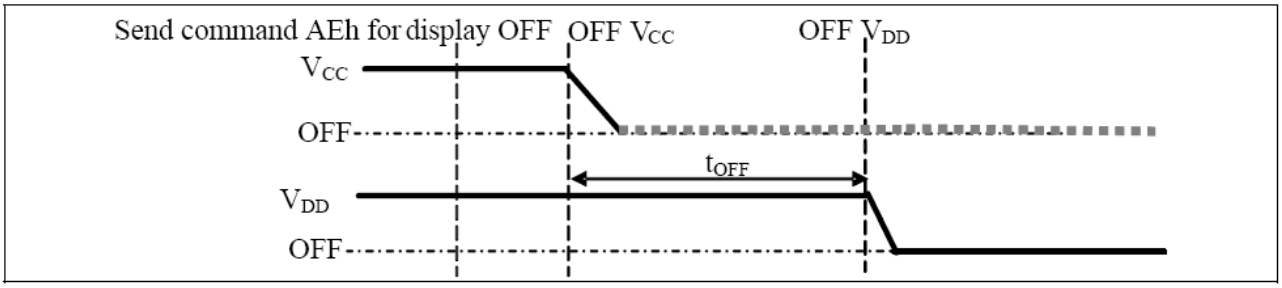
Power ON Sequence:

1. Power ON VDD.
2. After VDD become stable, set RES# pin LOW (logic low) for at least 3us (t_1)[3] and then HIGH (logic high).
3. After set RES# pin LOW (logic low), wait for at least 3us (t_2). Then Power ON VCC. [1]
4. After VCC become stable, send command AFh for display ON. SEG/COM will be ON after 100ms(t_{AF}).



Power OFF Sequence:

1. Send command AEh for display OFF.
2. Power OFF VCC.[1], [2]
3. Power OFF VDD after tOFF. [4] (typical t_{OFF}=100ms)



Note:

(1) VCC should be kept float (i.e. disable) when it is OFF.

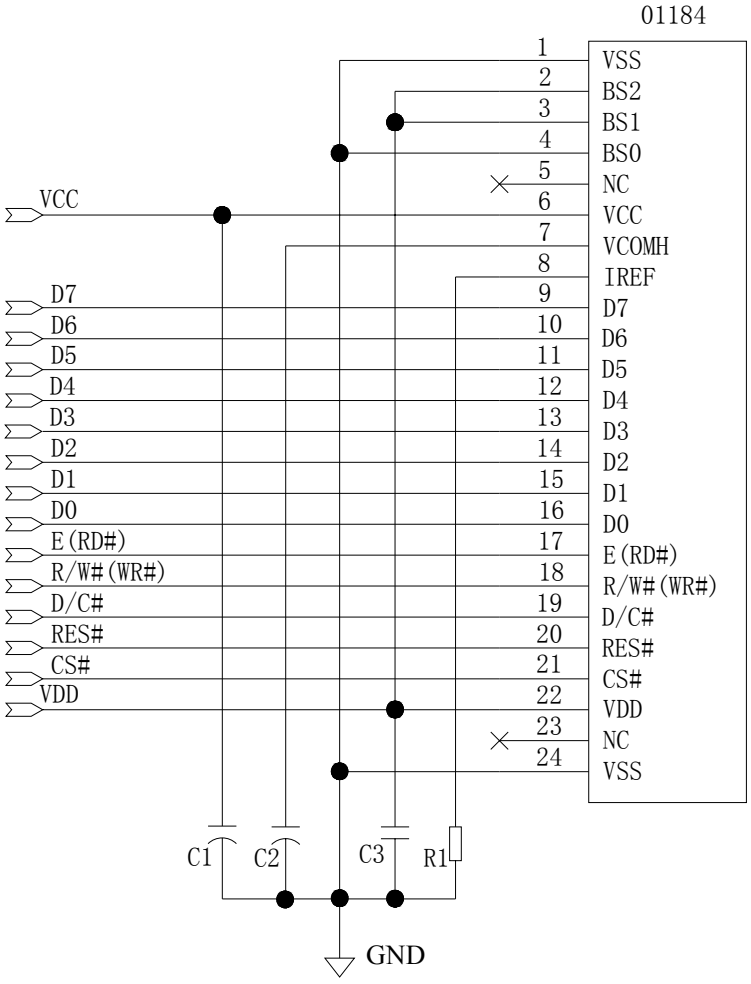
(2) Power Pins (VDD, VCC) can never be pulled to ground under any circumstance.

(3) The register values are reset after t_1.

(4) VDD should not be Power OFF before VCC Power OFF.

9.2 Application Circuit

(1) The configuration for 8-bit 8080 mode, external VCC is shown in the following diagram:



Pin connected to MCU interface: D[7:0], E(RD#), R/W#(WR#), D/C#, RES# ,CS#

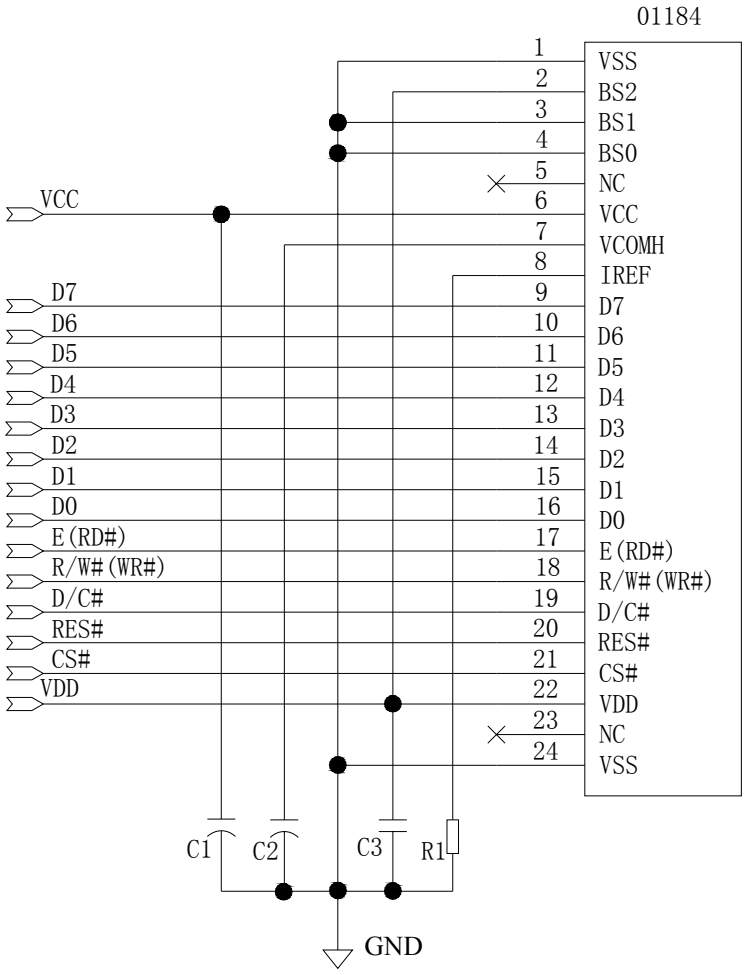
Recommended components

C1,C2: 4.7μF/25V.ROHS (Tantalum Capacitors)

C3: 0.1uF-0603-X7R±10%.ROHS

R1: 0603 1/10W +/-5% 620Kohm.ROHS

(2) The configuration for 8-bit 6800 mode, external VCC is shown in the following diagram:



Pin connected to MCU interface: D[7:0], E(RD#), R/W#(WR#), D/C#, RES# ,CS#

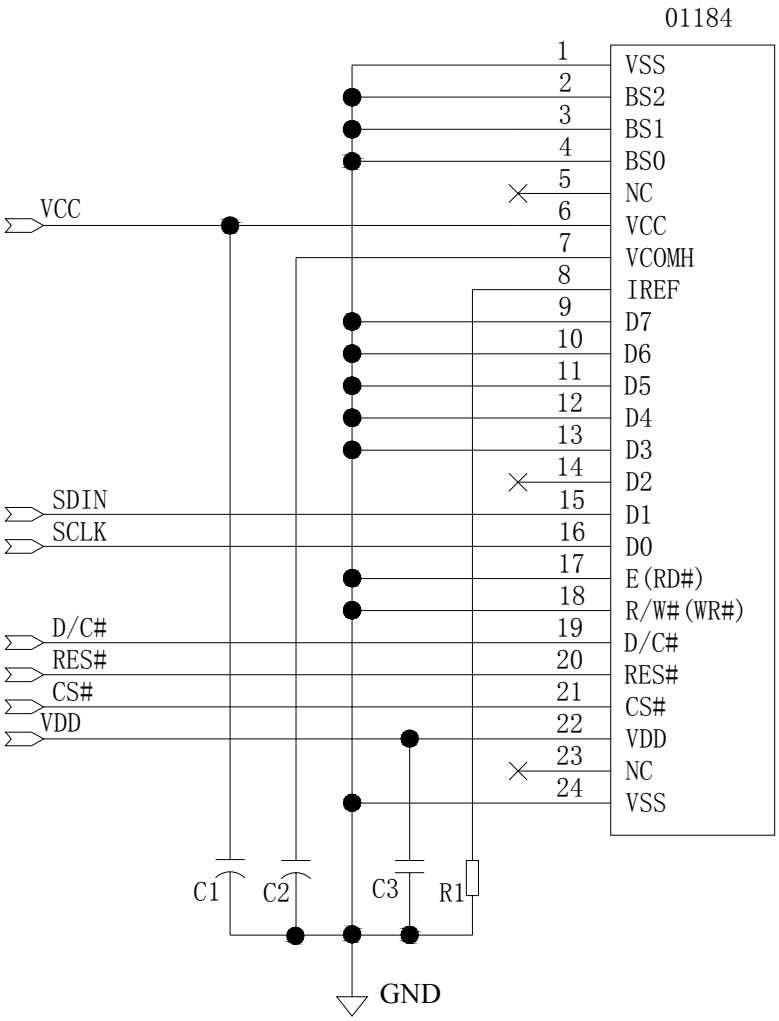
Recommended components

C1,C2: 4.7μF/25V.ROHS (Tantalum Capacitors)

C3: 0.1uF-0603-X7R±10%.ROHS

R1: 0603 1/10W +/-5% 620Kohm.ROHS

(3) The configuration for 4-wire SPI mode, external VCC is shown in the following diagram:



Pin connected to MCU interface: SCLK, SDIN, D/C#, RES# ,CS#

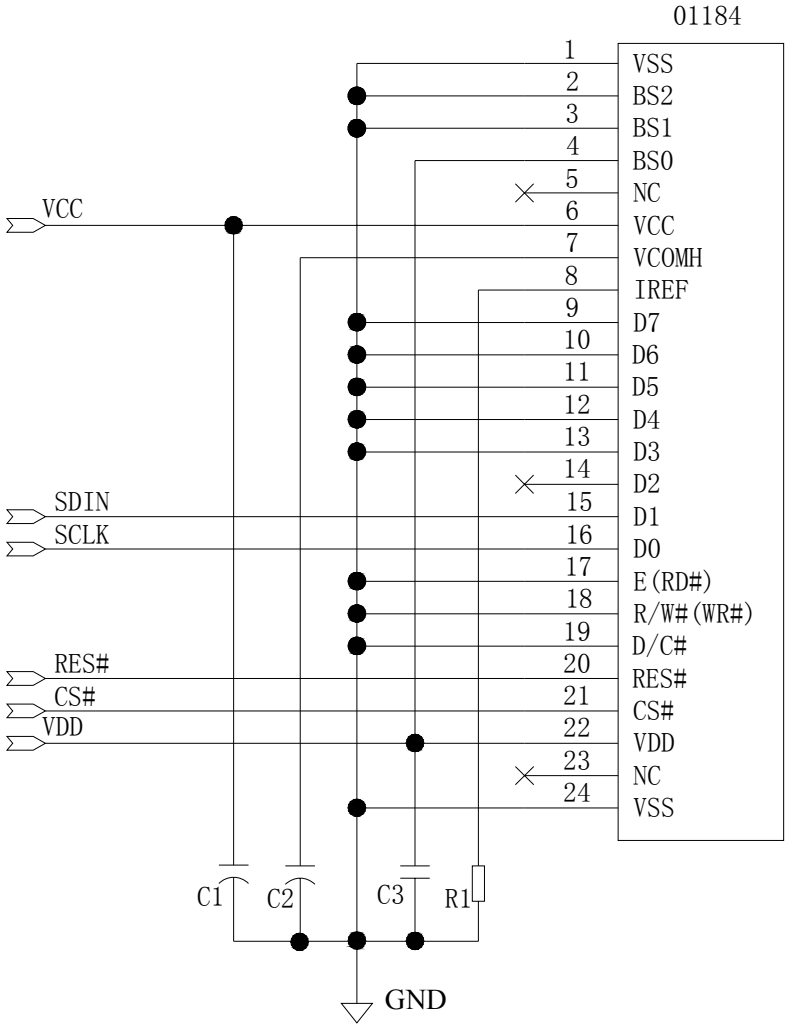
Recommended components

C1,C2: 4.7μF/25V.ROHS (Tantalum Capacitors)

C3: 0.1uF-0603-X7R±10%.ROHS

R1: 0603 1/10W +/-5% 620Kohm.ROHS

(4) The configuration for 3-wire SPI mode, external VCC is shown in the following diagram:



Pin connected to MCU interface: SCLK, SDIN, RES# ,CS#

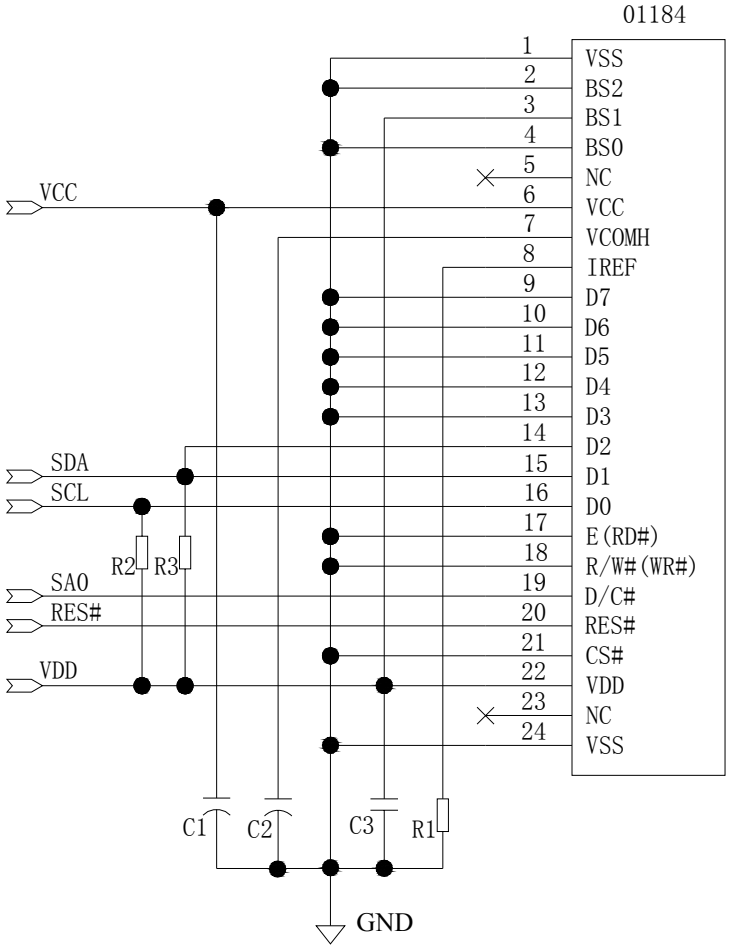
Recommended components

C1,C2: 4.7μF/25V.ROHS (Tantalum Capacitors)

C3: 0.1uF-0603-X7R±10%.ROHS

R1: 0603 1/10W +/-5% 620Kohm.ROHS

(5) The configuration for I^2C mode, external VCC is shown in the following diagram:



Pin connected to MCU interface: SCL, SDA, RES# ,SA0

SA0	I^2C Address
0	0x78
1	0x7a

Recommended components

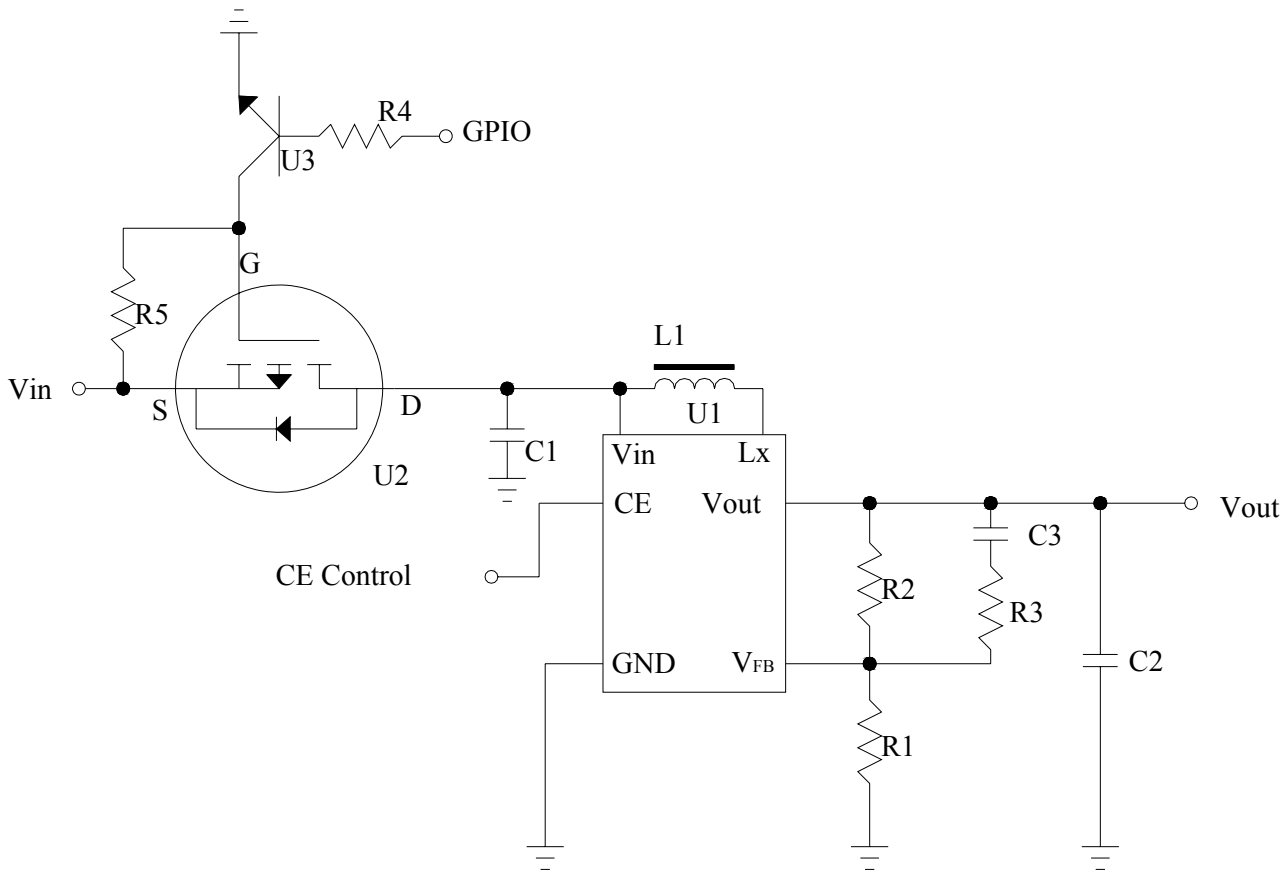
C1,C2: 4.7μF/25V.ROHS (Tantalum Capacitors)

C3: 0.1uF-0603-X7R±10%.ROHS

R1: 0603 1/10W +/-5% 620Kohm.ROHS

R2,R3: 0603 1/10W +/-5% 10Kohm.ROHS

9.3 External DC-DC application circuit



Recommend component

The C1	: 1 uF-0603-X7R±10%.ROHS
The C2	: 1 uF-0603-X7R±10%.ROHS
The C3	: 220pF-0603-X7R±10%.ROHS
The R1	: 0603 1/10W +/-5% 10Kohm.ROHS
The R2	: 0603 1/10W +/-1% 110Kohm.ROHS
The R3	: 0603 1/10W +/-5% 2Kohm.ROHS
The R4	: 0603 1/10W +/-5% 1Kohm.ROHS
The R5	: 0603 1/10W +/-5% 10Kohm.ROHS
The L1	: 22uH
The U1	: R1200
The U2	: FDN338P
The U3	: 8050

9.4 Display Control Instruction

Refer to SSD1307 IC Specification.

9.5 Recommended Software Initialization

```
void Init_IC()
{
    Write_Command(0xAE);        //Set Display Off
    Write_Command(0xD5);        //Display divide ratio/osc. freq. mode
    Write_Command(0xA1);
    Write_Command(0xA8);
    Write_Command(0x1F);
    Write_Command(0xD3);        //Set Display Offset
    Write_Command(0x23);
    Write_Command(0x40);        //Set Display Start Line
    Write_Command(0xA1);        //Segment Remap
    Write_Command(0xC8);        //Set COM Output Scan Direction
    Write_Command(0xDA);        //Set SEG Pins Hardware Configuration
    Write_Command(0x12);
    Write_Command(0x81);         //Contrast control
    Write_Command(0x40);
    Write_Command(0xD9);         //Set pre-charge period
    Write_Command(0x51);
    Write_Command(0xDB);        //Set VCOMH
    Write_Command(0x20);
    Write_Command(0xA4);
    Write_Command(0xA6);        //Set Normal Display
    Write_Command(0xAF);        //Set Display On
}
```