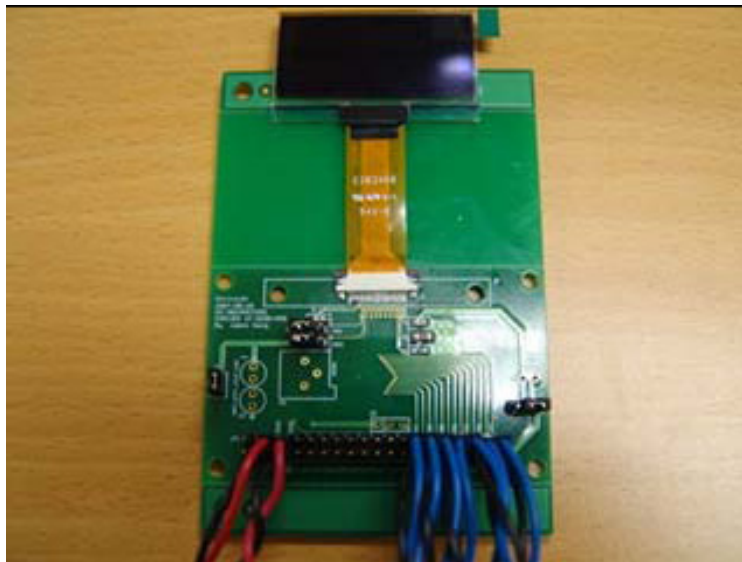


# OLED DISPLAY MODULE

## Application Notes

<b>PRODUCT NUMBER</b>	<b>DD-12864YO-3A with EVK board</b>
---------------------------	-------------------------------------



## TABLE OF CONTENTS

<b>1</b>	<b>EVK SCHEMATIC</b> .....	<b>4</b>
<b>2</b>	<b>SYMBOL DEFINITION</b> .....	<b>5</b>
<b>3</b>	<b>TIMING CHARACTERISTICS</b> .....	<b>6</b>
3.1	80 SERIES MPU PARALLEL INTERFACE .....	6
3.2	6800 SERIES MPU PARALLEL INTERFACE .....	8
3.3	SPI INTERFACE .....	9
<b>4</b>	<b>CONNECTION BETWEEN OLED AND EVK</b> .....	<b>10</b>
<b>5</b>	<b>POWER DOWN AND POWER UP SEQUENCE</b> .....	<b>12</b>
<b>6</b>	<b>HOW TO USE THE DD-12864YO-3A</b> .....	<b>13</b>
6.1	RECOMMENDED INITIAL CODE .....	14

Product No.	DD-12864YO-3A	REV. A

Page	2 / 15
------	--------

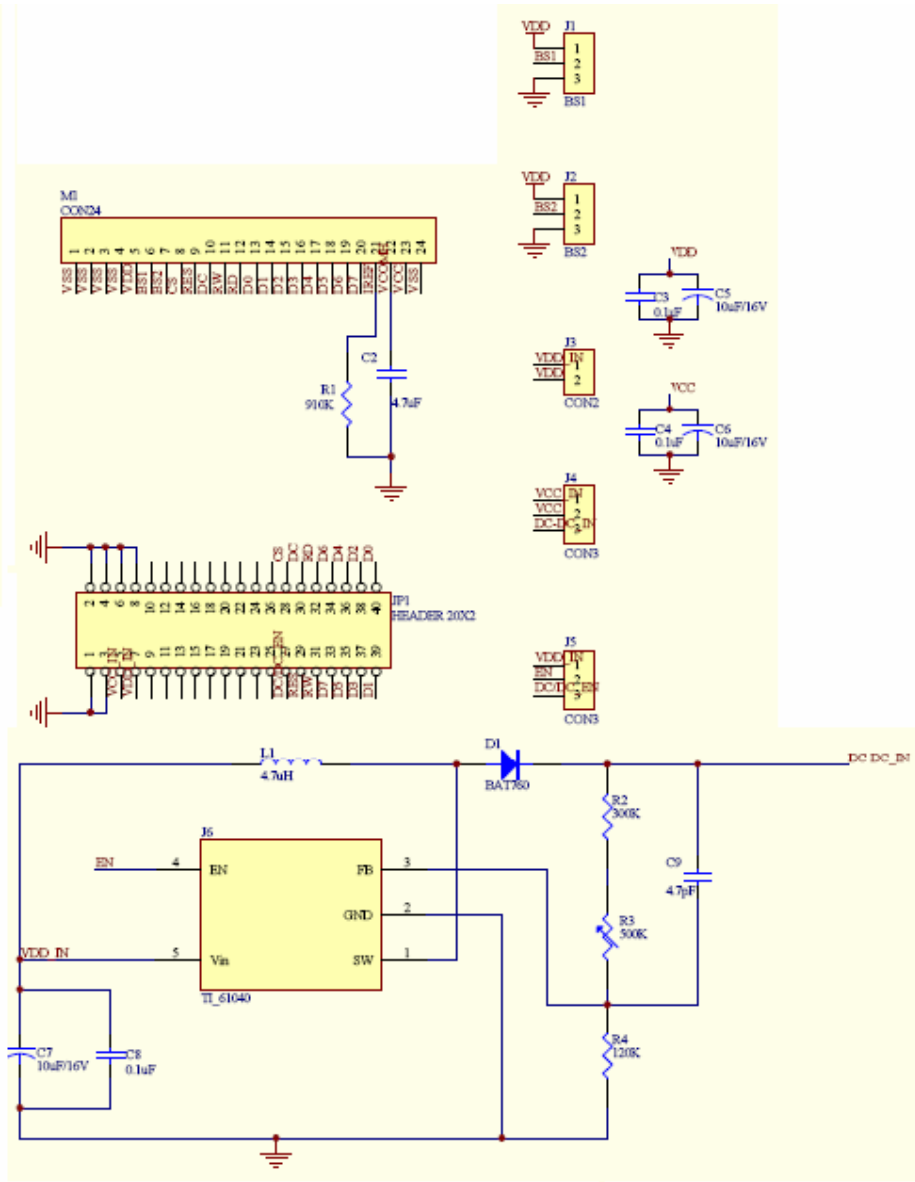
REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECR no.
A	16 <sup>th</sup> May 2008			First Issue	

Product No.	DD-12864YO-3A	REV. A

Page	3 / 15
------	--------

# 1 EVK Schematic



Product No.	DD-12864YO-3A	REV. A

Page	4 / 15
------	--------

## 2 Symbol Definition

**VCC:** Power supply for panel driving voltage.

**VSS:** This is ground pin.

**VDD:** Power supply for core logic operation.

**VDDIO:** Power supply for interface logic level.

**BS0~BS2:** MUC bus interface selection pin (BS0 pulled LOW in internal).

**CS:** This pin is chip select input (active LOW).

**RES:** This pin is reset signal input (active LOW).

**D/C:** This is DATA/COMMAND control pin. When it is Pulled HIGH, the data at D[0~7] is treated as data. When it is pulled LOW, the data at D[0~7] will be transferred to the command register. In I2C mode, this pin acts as SA0 for slave address select.

**R/W:** This is read/write control input pin connecting to the MCU interface. When interface to a 6800-series microprocessor, Read mode will be carried out when this pin is pulled HIGH and write mode when low. When interface to an 8080-microprocessor, this pin when be the data Write input. When serial interface is selected, this pin must be connected to Vss.

**E/RD:** When interface to a 6800-series microprocessor, this pin will be used as the Enable (E) signal. When interface to an 8080-microprocessor, this pin receives the Read (RD#)signal.

**D0~D7 :** These are 8-bit bi-directional data bus to be connected to the microprocessors data bus. When serial interface mode is selected, D0 (SCLK) will be the serial clock input, D1 (SDIN) will be the serial data input and D2 should be left opened. When I2C mode is selected, D1 (SDA<sub>in</sub>) AND D2 (SDA<sub>out</sub>) should be tied together, D0 (SCL) is the I2Cclock input

**IREF:** This is segment output current reference pin.

**VCOMH:** This pin for COM signal deselected level voltage.

Product No.	DD-12864YO-3A	REV. A

Page	5 / 15
------	--------

### 3 Timing characteristics

#### 3.1 80 Series MPU parallel interface

##### Write Characteristics

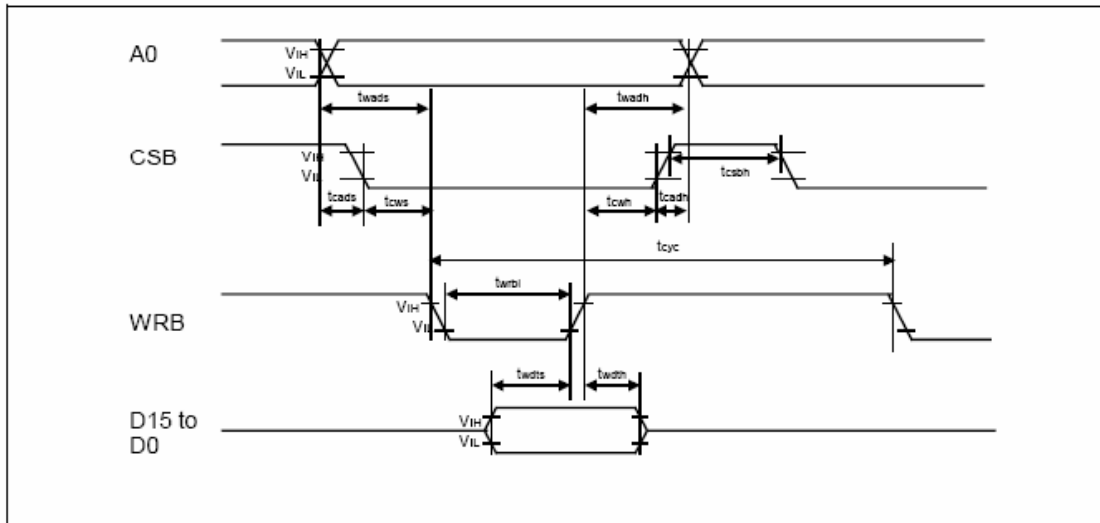


Figure 1: 80-series MPU parallel interface write timing characteristics

(V<sub>DD</sub> = 2.8V, T<sub>a</sub> = 25 °C)

Symbol	Parameter	Conditions	Related Pins	MIN	TYP	MAX	Unit
$t_{cyc}$	Write cycle time	-	WRB	100	-	-	ns
$t_{cads}$	Address and Select setup time	-	CSB, A0	0	-	-	ns
$t_{cwh}$	Address and Select hold time	-	CSB, A0	0	-	-	ns
$t_{wads}$	Address setup time	-	A0	50	-	-	ns
$t_{wadh}$	Address hold time	-	A0	20	-	-	ns
$t_{cws}$	Select setup time	-	CSB	10	-	-	ns
$t_{cwh}$	Select hold time	-	CSB	10	-	-	ns
$t_{wrhl}$	Write Low pulse width	-	WRB	30	-	-	ns
$t_{wrll}$	Write High pulse width	-	WRB	10	-	-	ns
$t_{wots}$	Data setup time	-	D15 to D0	10	-	-	ns
$t_{wth}$	Data hold time	-	D15 to D0	20	-	-	ns

Table 1: 80-Series MPU Parallel Interface Write Timing Characteristics

Product No.	DD-12864YO-3A	REV. A
-------------	---------------	--------

Page	6 / 15
------	--------

READ CHARACTERISTICS

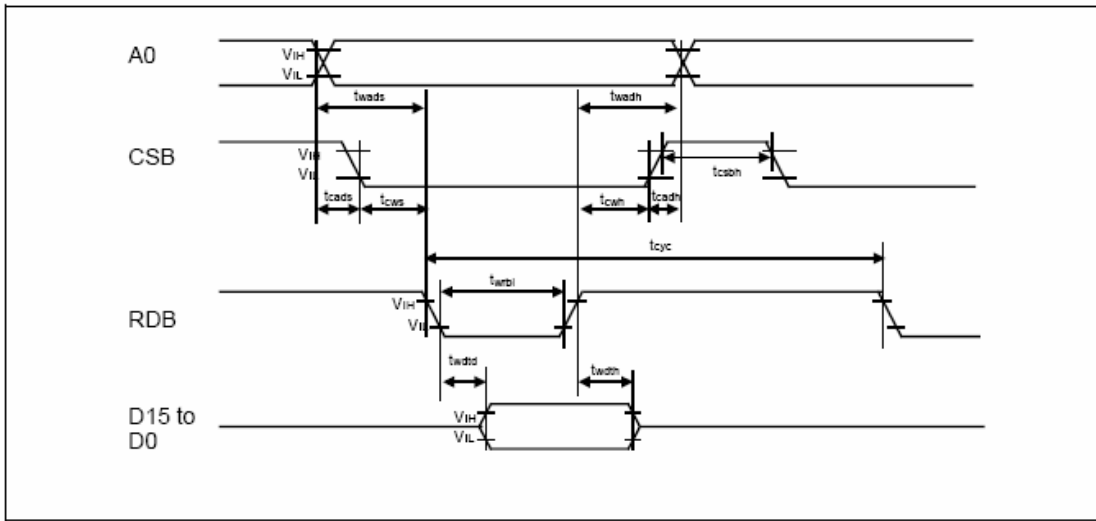


Figure 2: 80-series MPU parallel interface Read timing characteristics

Symbol	Parameter	Conditions	Related Pins	MIN	TYP	MAX	Unit
$t_{cyc}$	Read cycle time	-	RDB	500	-	-	ns
$t_{cads}$ $t_{cadh}$	Address and Select setup time Address and Select hold time	-	CSB,A0	0 0	- -	- -	ns
$t_{rads}$ $t_{radh}$	Address setup time Address hold time	-	A0	50 20	- -	- -	ns
$t_{csh}$ $t_{cshh}$	Select setup time Select hold time	-	CSB	10 10	- -	- -	ns
$t_{rdbi}$	Read Low pulse width	-	RDB	250	-	-	ns
$t_{cshh}$	Select High pulse width	-	CSB	10	-	-	ns
$t_{rtdi}$ $t_{rtdh}$	Data output delay time Data output hold time	CL = 100pF	D15 to D0	- 5	- -	200 -	ns

Table 2: 80-Series MPU Parallel Interface Read Timing Characteristics

Product No.	DD-12864YO-3A	REV. A

Page	7 / 15
------	--------

### 3.2 6800 Series MPU parallel interface

#### PARALLEL INTERFACE CHARACTERISTICS (6800-SERIES MPU)

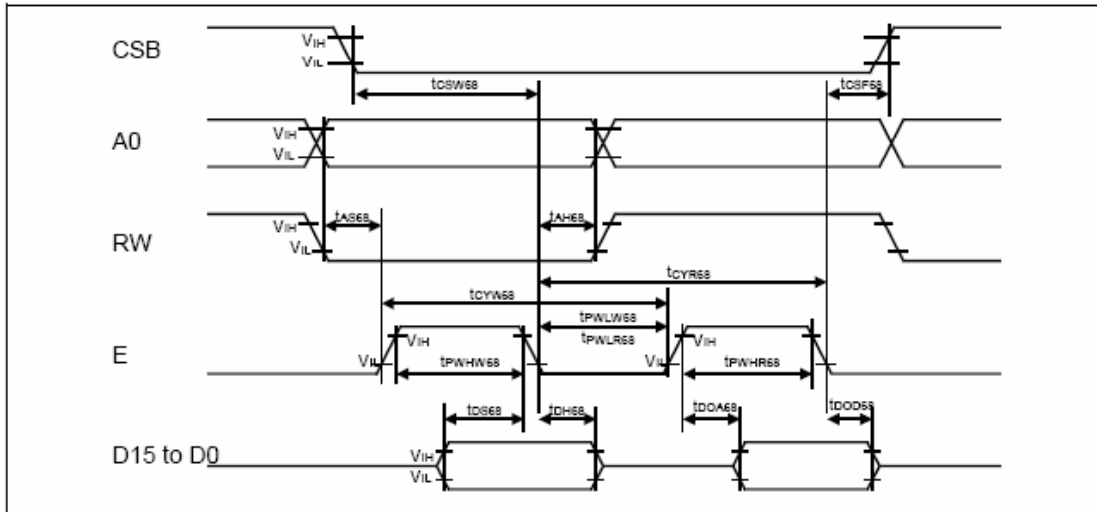


Figure 3: 6800-Series MPU Parallel Interface Write Timing Characteristics

(V<sub>SS</sub>=0V, V<sub>DD</sub>=2.8V, T<sub>a</sub> = 25°C)

Symbol	Parameter	Conditions	Related Pins	MIN	TYP	MAX	Unit
t <sub>CSW68</sub> t <sub>CSF68</sub>	Chip select setup time Chip select hold time	-	CSB	10 10	- -	- -	ns
t <sub>AS68</sub> t <sub>AH68</sub>	Address setup time Address hold time	-	A0 RW	50 20	- -	- -	ns
t <sub>CYW68</sub> t <sub>PWHW68</sub> t <sub>PWLW68</sub>	Write cycle time Write High Time Write Low Time	-	E	160 40 90	- - -	- - -	ns
t <sub>CYR68</sub> t <sub>PWHR68</sub> t <sub>PWLR68</sub>	Read cycle time (Parameter read) Read High (Parameter read) Read Low (Parameter read)	-	E	160 40 90	- - -	- - -	ns
t <sub>CYR68</sub> t <sub>PWHR68</sub> t <sub>PWLR68</sub>	Read cycle time (Data read) Read High (Data read) Read Low (Data read)	-	E	450 355 90	- - -	- - -	ns
t <sub>DS68</sub> t <sub>DH68</sub>	Data setup time Data hold time	-	D15 to D0	10 20	- -	- -	ns
t <sub>DOA68</sub> t <sub>DOD68</sub>	Data output access time Data output disable time	CL = 30pF		- 40	- -	40 80	ns

Table 3: 6800-Series MPU Parallel Interface Write Timing Characteristics

Product No.	DD-12864YO-3A	REV. A
-------------	---------------	--------

Page	8 / 15
------	--------



### 3.3 SPI INTERFACE

#### SERIAL INTERFACE CHARACTERISTICS

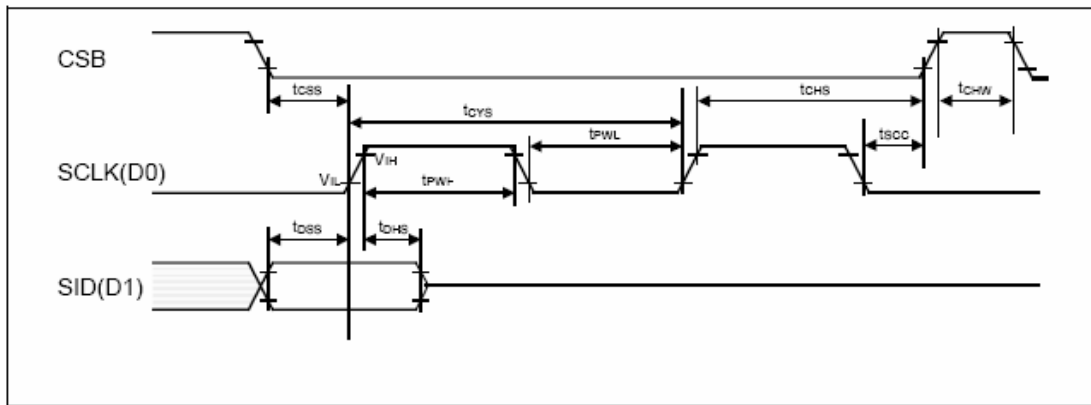


Figure 4: Serial Peripheral Interface Timing Characteristics

( $V_{SS}=0V$ ,  $V_{DD}=2.8V$ ,  $T_a = 25^{\circ}C$ )

Symbol	Parameter	Conditions	Related Pins	MIN	TYP	MAX	Unit
$t_{CYS}$ $t_{WHs}$ $t_{WLs}$	Serial clock cycle High pulse width Low pulse width	-	SCLK	160 60 60	- - -	- - -	ns
$t_{DSS}$ $t_{DHE}$	Data setup time Data hold time	-	SID (D1)	60 60	- -	- -	ns
$t_{CSS}$ $t_{CHS}$ $t_{CHW}$	Chip select setup time Chip select hold time Chip select high pulse width	-	CSB	60 65 45	- - -	- - -	ns
$t_{SCC}$	SCLK to Chip select	-	SCLK, CSB	20	-	-	ns

Table 4: Serial Peripheral Interface Timing Characteristics

Product No.	DD-12864YO-3A	REV. A
-------------	---------------	--------

Page	9 / 15
------	--------

**4 Connection Between OLED and EVK**



**Figure 5 EVK PCB and DD-12864YO-3A Module**

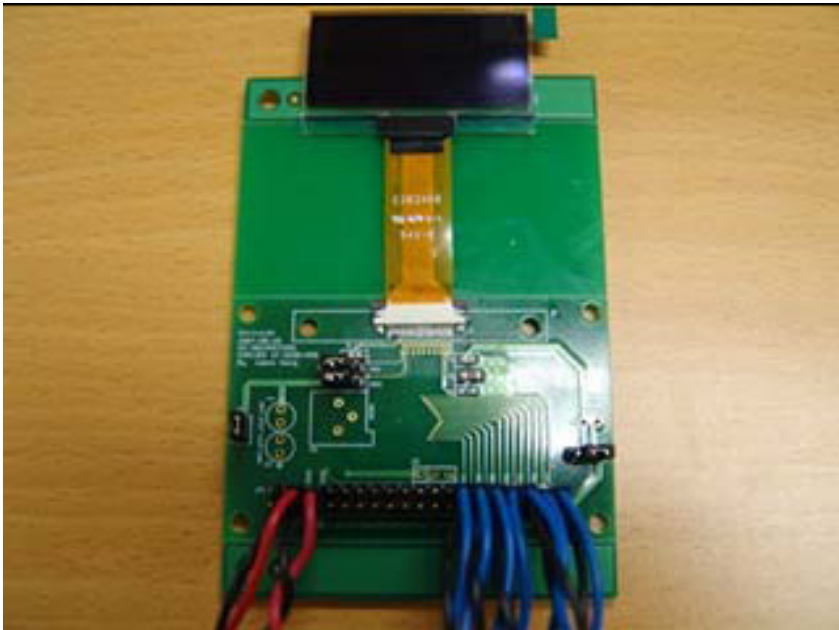
The DD-12864YO-3A is COG type module; please refer to figure 1 & 2. User can use leading wire to connect EVK with customers systems. The example shown in Fig



**Figure 6 combination of the module**

Product No.	DD-12864YO-3A	REV. A

Page	10 / 15
------	---------



**Figure 7 EVK with test platform**

- Note 1: It is OLED high voltage supply
- Note 2: It is logic voltage supply
- Note 3: Those are leading wire connect to control board. Those are data pin (D0~D7)
- Note 4: Those are leading wore connect to control board. Those are control pin. (DC, CS, RD, WR, RES)

Product No.	DD-12864YO-3A	REV. A

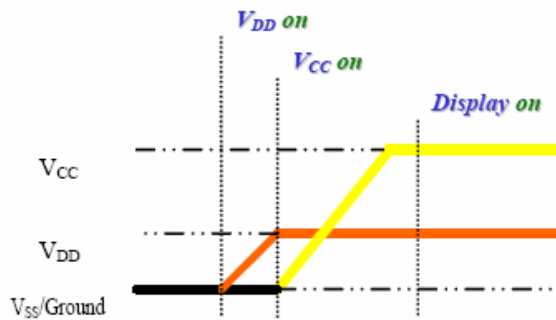
Page	11 / 15
------	---------

## 5 Power down and Power Up sequence

To protect the OLED panel and extend the panel life time the driver IC power up/down routine should include a delay period between high voltage and low voltage power sources during turn on/off. So that the panel has enough time to charge up or discharge before/ after operation.

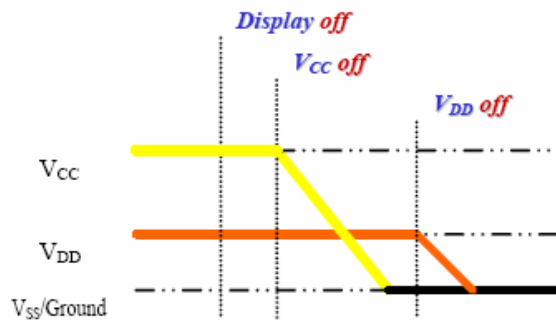
### Power up Sequence:

1. Power up  $V_{DD}$
2. Send Display off command
3. Driver IC Initial Setting
4. Clear Screen
5. Power up  $V_{DDH}$
6. Delay 100ms  
(when  $V_{DD}$  is stable)
7. Send Display on command



### Power down Sequence:

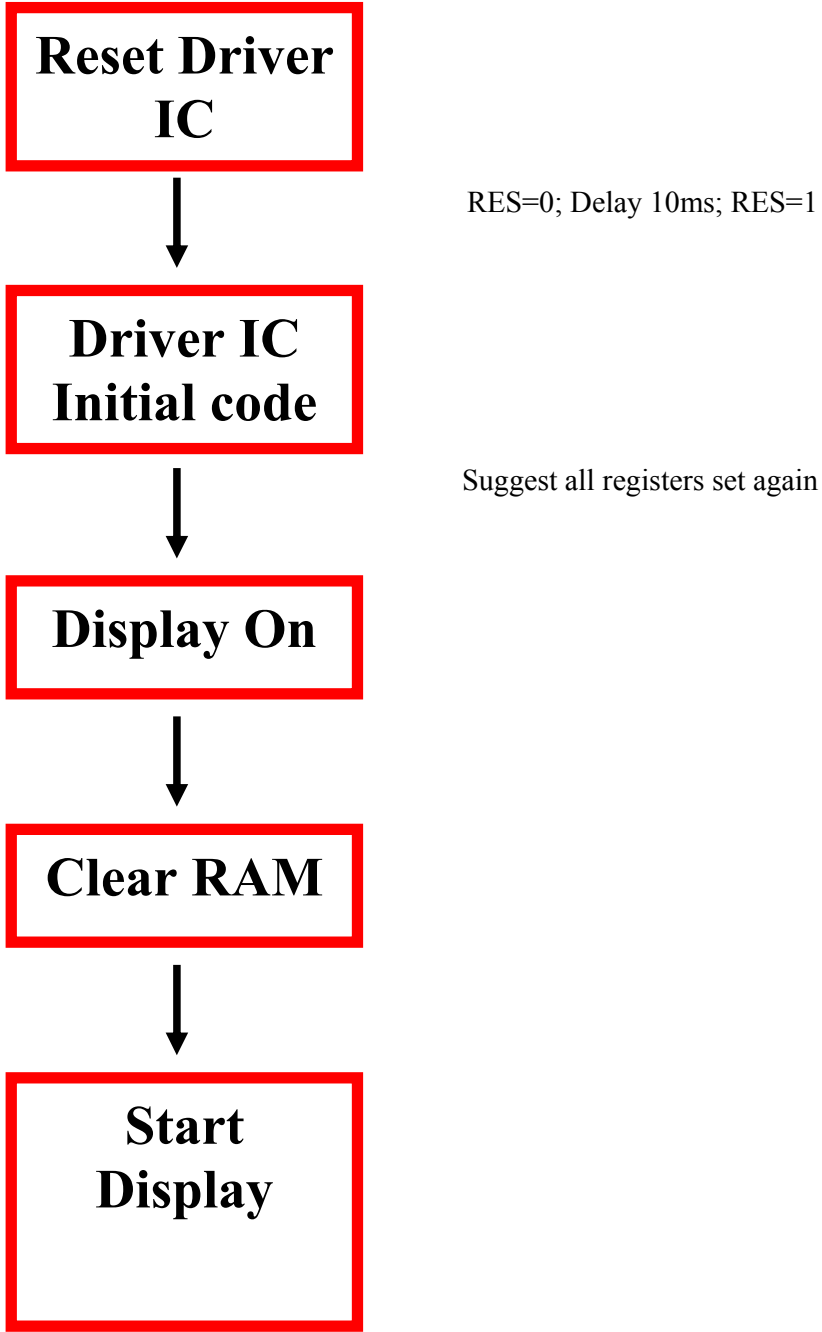
1. Send Display off command
2. Power down  $V_{DDH}$
3. Delay 100ms  
(when  $V_{DDH}$  is reach 0 and  
panel is completely  
discharges)
4. Power down  $V_{DD}$



Product No.	DD-12864YO-3A	REV. A

Page	12 / 15
------	---------

## 6 How to use the DD-12864YO-3A



Product No.	DD-12864YO-3A	REV. A
-------------	---------------	--------

Page	13 / 15
------	---------

## 6.1 Recommended Initial code

---

```

void initial()
{
write_command(0xae);           //(display on)
write_command(0x00);           //set low column address
write_command(0x10);           //set high column address
write_command(0x40);           //(display start set)
write_command(0x2e);           //(stop horizontal scroll)
write_command(0xb0);           //(page address)
write_command(0x81);           //(set contrast control register)
write_command(0x7f);
write_command(0xa1);           //(set segment re-map)
write_command(0xa4);           //(normal display mode)
write_command(0xa6);           //(set normal/inverse display)
write_command(0xa8);           //(set multiplex ratio)
write_command(0x3f);
write_command(0xd3);           //(set display offset)
write_command(0x00);
write_command(0xad);           //(set dc-dc on/off)
write_command(0x8e);           //
write_command(0xc8);           //(set com output scan direction)
write_command(0xd5);           //(set display clock divide ratio/oscillator/frequency)
write_command(0xf0);           //
write_command(0xd8);           //(set area color mode on/off & low power display mode )
write_command(0x05);           //
write_command(0xd9);           //(set pre-charge period)
write_command(0xc2);
write_command(0xda);           //(set com pins hardware configuration)
write_command(0x12);
write_command(0xdb);           //(set vcom deselect level)
write_command(0x08);
write_command(0xaf);           //(display on)
}

```

Product No.	DD-12864YO-3A	REV. A

Page	14 / 15
------	---------

## WRITE DATA & COMMAND SUB FUNCTION

```

void write_command(unsigned char aa)
{
IOCLR = 0x000000ff;
IOSET = RD_IN;      //RD=1
IOCLR = DC_IN;      //DC=0
IOCLR = CS_IN;      //CS=0
IOCLR = WR_IN;      //WR=0
IOSET = aa;         //-----input command
IOSET = WR_IN;      //WR=1
IOSET = CS_IN;      //CS=1
IOCLR = RD_IN;
}
void write_data(unsigned char bb)
{
IOCLR = 0x000000ff;
IOSET = RD_IN;      //RD=1
IOSET = DC_IN;      //DC=1
IOCLR = CS_IN;      //CS=0
IOCLR = WR_IN;      //WR=0
IOSET = bb;         //-----input data
IOSET = WR_IN;      //WR=1
IOSET = CS_IN;      //CS=1
}

```

**Note: RD recommends Initial code and sub function for 8080 series CPU interface.**

Product No.	DD-12864YO-3A	REV. A

Page	15 / 15
------	---------