



OZDISAN ELECTRONIC A.S.

# 7” 16 bit TFT Digital Driver Board Specification

*TDDB-SSD-7.0-40P-16B-V2*

Doc.Version : 1.0



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## Product Pictures



TDDB-SSD-7.0-40P-16B-V2

34 Pins 16Bit User MPU interface, 40 pins TFT connection, 140mA Backlight Driver

## Main Parameters

|                           |               |
|---------------------------|---------------|
| Board supply voltage      | 3.3V          |
| Backlight supply voltage  | 2.7V ~ 5.5V   |
| Working current           | < 1mA         |
| Working temperature scope | -20°C ~ +60°C |
| Storage temperature scope | -40°C ~ +70°C |

## Controller Information

Built-in SSD1963

SSD1963 is a display controller of 1215K byte frame buffer to support up to 864x480x24bit graphics content. It also equips parallel MCU interfaces in a different bus width to receive graphics data and commands from MCU. Its display interface supports common RAM-less LCD driver of color depth up to 24 bit-per pixel.

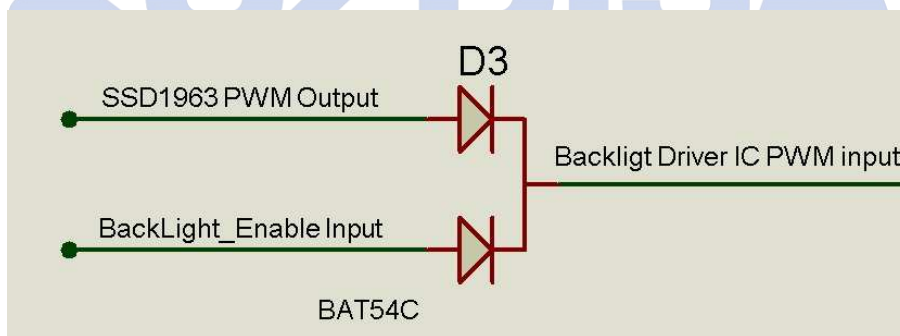


### Data Format

| Interface            | Cycle           | D[23] | D[22] | D[21] | D[20] | D[19] | D[18] | D[17] | D[16] | D[15] | D[14] | D[13] | D[12] | D[11] | D[10] | D[9] | D[8] | D[7] | D[6] | D[5] | D[4] | D[3] | D[2] | D[1] | D[0] |    |
|----------------------|-----------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|----|
| 24 bits              | 1 <sup>st</sup> | R7    | R6    | R5    | R4    | R3    | R2    | R1    | R0    | G7    | G6    | G5    | G4    | G3    | G2    | G1   | G0   | B7   | B6   | B5   | B4   | B3   | B2   | B1   | B0   |    |
| 18 bits              | 1 <sup>st</sup> |       |       |       |       |       |       | R5    | R4    | R3    | R2    | R1    | R0    | G5    | G4    | G3   | G2   | G1   | G0   | B5   | B4   | B3   | B2   | B1   | B0   |    |
| 16 bits (565 format) | 1 <sup>st</sup> |       |       |       |       |       |       |       |       | R5    | R4    | R3    | R2    | R1    | G5    | G4   | G3   | G2   | G1   | G0   | B5   | B4   | B3   | B2   | B1   |    |
| 16 bits              | 1 <sup>st</sup> |       |       |       |       |       |       |       |       | R7    | R6    | R5    | R4    | R3    | R2    | R1   | R0   | G7   | G6   | G5   | G4   | G3   | G2   | G1   | G0   |    |
|                      | 2 <sup>nd</sup> |       |       |       |       |       |       |       |       | B7    | B6    | B5    | B4    | B3    | B2    | B1   | B0   | R7   | R6   | R5   | R4   | R3   | R2   | R1   | R0   |    |
|                      | 3 <sup>rd</sup> |       |       |       |       |       |       |       |       | G7    | G6    | G5    | G4    | G3    | G2    | G1   | G0   | B7   | B6   | B5   | B4   | B3   | B2   | B1   | B0   |    |
| 12 bits              | 1 <sup>st</sup> |       |       |       |       |       |       |       |       |       |       |       |       |       | R7    | R6   | R5   | R4   | R3   | R2   | R1   | R0   | G7   | G6   | G5   | G4 |
|                      | 2 <sup>nd</sup> |       |       |       |       |       |       |       |       |       |       | G3    | G2    | G1    | G0    | B7   | B6   | B5   | B4   | B3   | B2   | B1   | B0   |      |      |    |
| 9 bits               | 1 <sup>st</sup> |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      | R5   | R4   | R3   | R2   | R1   | R0   | G5   | G4   | G3   |    |
|                      | 2 <sup>nd</sup> |       |       |       |       |       |       |       |       |       |       |       |       |       |       | G2   | G1   | G0   | B5   | B4   | B3   | B2   | B1   | B0   |      |    |
| 8 bits               | 1 <sup>st</sup> |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      | R7   | R6   | R5   | R4   | R3   | R2   | R1   | R0   |    |
|                      | 2 <sup>nd</sup> |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      | G7   | G6   | G5   | G4   | G3   | G2   | G1   | G0   |    |
|                      | 3 <sup>rd</sup> |       |       |       |       |       |       |       |       |       |       |       |       |       |       |      |      | B7   | B6   | B5   | B4   | B3   | B2   | B1   | B0   |    |

### Backlight

The driver board has 140mA constant current Backlight Driver circuit with maximum 22V output. The backlight can be controlled from MCU Backlight Enable input or SSD1963 PWM output.



| Backlight Enable Input | SSD1963 PWM Output | Backlight          |
|------------------------|--------------------|--------------------|
| 0                      | Off                | Off                |
| 0                      | On                 | Brightness Dimming |
| 1                      | Off                | %100               |
| 1                      | On                 | %100               |



### Pin Description for CN1: 34Pin 16 bit input from User's

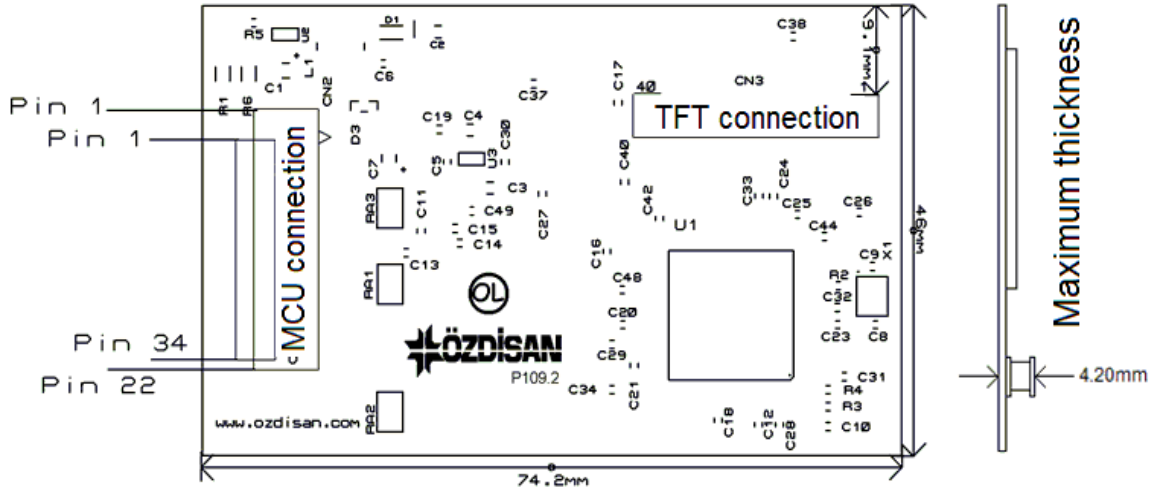
| Pin No. | Symbol | Function Description   |
|---------|--------|--|
| 1       | GND    | GND  |
| 2       | GND    | GND  |
| 3       | Vbl    | Backlight Supply 2.7V-5.5V                                       |
| 4       | Vbl    | Backlight Supply 2.7V-5.5V                                       |
| 5       | Vcc    | Board and TFT Supply 3.3V  |
| 6       | NC     |  |
| 7       | NC     |  |
| 8       | BLen   | Backlight Enable   |
| 9       | WR     | Write Signal-Active Low  |
| 10      | RD     | Read Signal-Active Low   |
| 11      | RS     | Register select (Data Or command)                                |
| 12      | CS     | Chip Select Signal- Active Low (Enables data or command sending) |
| 13      | TE     | Tear Effect  |
| 14      | RESET  | Reset Signal- Active Low   |
| 15-30   | D0-D15 | 16 Bit Bidirectional Data bus                                    |
| 31      | TP_R   | Touch Panel Right  |
| 32      | TP_B   | Touch Panel Bottom   |
| 33      | TP_L   | Touch Panel Left   |
| 34      | TP_T   | Touch Panel Top  |

### Pin Description for CN3: Pin Connections to TFT Panel

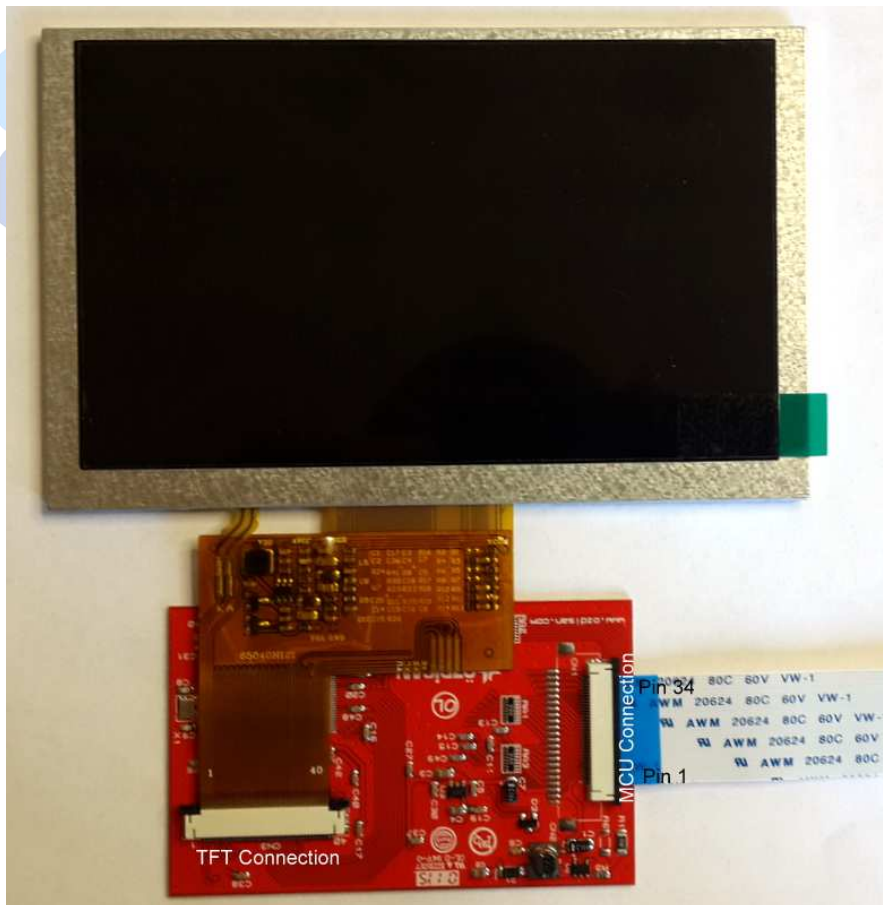
| Pin No. | Symbol | Function Description   |
|---------|--------|------------------------|
| 1       | LED-   | LED Cathode            |
| 2       | LED+   | LED Anode              |
| 3       | GND    | Power Ground           |
| 4       | VDD    | Power Voltage(3.3V)    |
| 5-12    | R0-R7  | Red Data 0-7           |
| 13-20   | G0-G7  | Green Data 0-7         |
| 21-28   | B0-B7  | Blue Data 0-7          |
| 29      | GND    | Power Ground           |
| 30      | DCLK   | Pixel clock            |
| 31      | DISP   | Display on/off         |
| 32      | HSYNC  | Horizontal sync signal |
| 33      | VSYNC  | Vertical sync signal   |
| 34      | DE     | Data enable            |
| 35      | NC     | No connection          |
| 36      | GND    | Power Ground           |
| 37      | X_R    | Right electrode        |
| 38      | Y_B    | Bottom electrode       |
| 39      | X_L    | Left electrode         |
| 40      | Y_T    | Top electrode          |



### Outline Dimensions



### Board Connections





## Other Tools used with the boards

DS1057-03-5A34W4L10E1B: Flat cable with 34 pins 10cm



FPC4AMR6-34TNBT-U: Connector with 34 pins

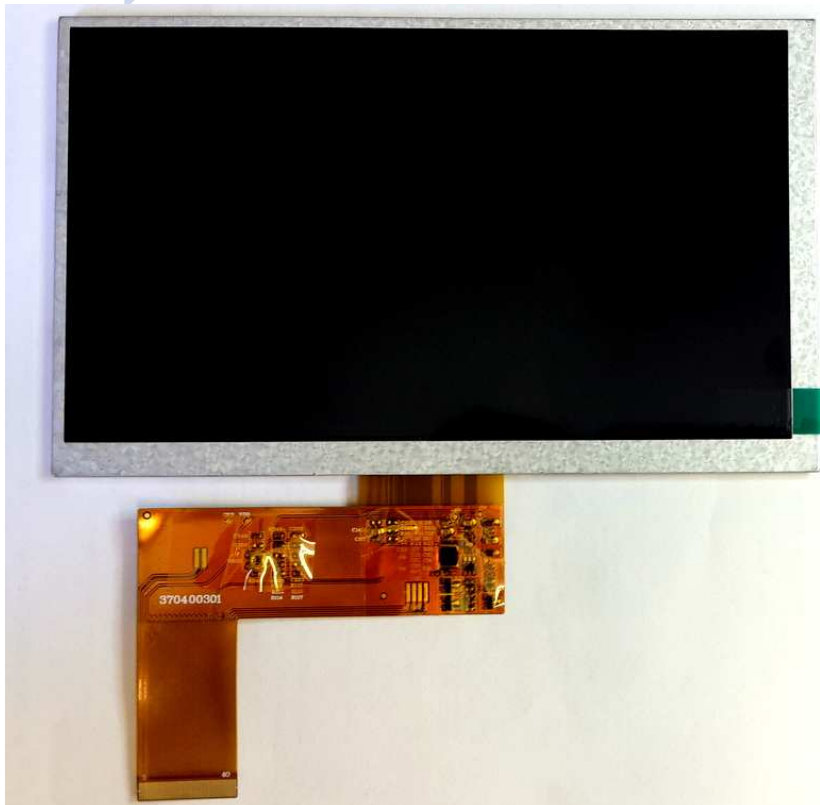


7" TFT panel

SAT070HS40D21Y0-351001

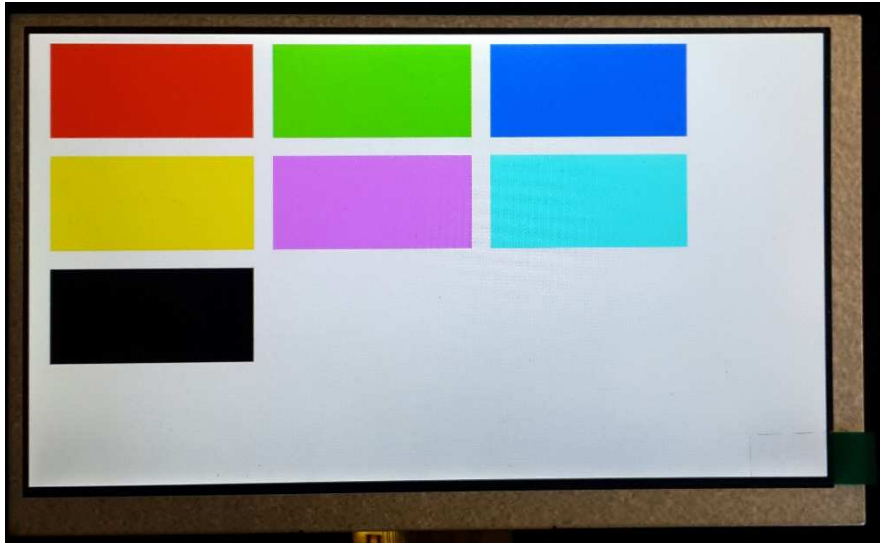
7" TFT panel with Touch Panel

SAT070HS40D21Y0351001TP





## Code Sample



*TFT screen which is working with this software*

```
//pin defines for STM32 in mikroC compiler
unsigned int TFT_DataPort at GPIOE_ODR;
sbit TFT_RST at GPIOB_ODR.B1;
sbit TFT_RS at GPIOC_ODR.B4;
sbit TFT_CS at GPIOC_ODR.B5;
sbit TFT_RD at GPIOA_ODR.B7;
sbit TFT_WR at GPIOA_ODR.B6;
sbit TFT_BLED at GPIOA_ODR.B5;

void Send_TFT_Command(char index)
{
    TFT_CS = 0;
    TFT_RS = 0;
    TFT_DataPort = index;
    TFT_WR = 0;
    asm nop;
    TFT_WR = 1;
    TFT_CS = 1;
}

void Send_TFT_Data_8(unsigned char index)
{
    TFT_CS = 0;
    TFT_RS = 1;
```

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```

TFT_DataPort = index;
TFT_WR = 0;
asm nop;
TFT_WR = 1;
TFT_CS = 1;
}
void Send_TFT_Data_16(int index)
{
TFT_CS = 0;
TFT_RS = 1;
TFT_DataPort = index;
/*
if data port has 8 bit output
TFT_DataH = index>>8;
TFT_DataL = index&0x00FF;
*/
TFT_WR = 0;
asm nop;
TFT_WR = 1;
TFT_CS = 1;
}
void init_SSD1963(void)
{
TFT_RST = 0; // Hold in reset
TFT_RS = 1; // Enable data access
TFT_CS = 1; // Disable LCD
TFT_RD = 1;
TFT_WR = 1;
// Release from reset
Delay_ms(100);
TFT_RST = 1;
Delay_ms(100);
Send_TFT_Command(0x01); //Software Reset
Send_TFT_Command(0x01); //Software Reset
Send_TFT_Command(0x01); //Software Reset
Delay_ms(100);
Send_TFT_Command(0xE2); //SET PLL freq=110MHz
Send_TFT_Data_8(0x21); //N=33, 33X10=330Mhz
Send_TFT_Data_8(0x02); //M=3 330/3=110Mhz

```







```

Send_TFT_Data_8(0x54);
Delay_ms(100);
Send_TFT_Command(0xE0);//PLL settings
Send_TFT_Data_8(0x01);//START PLL
delay_ms(1);// Wait to let the PLL stable
Send_TFT_Command(0xE0);//PLL settings
Send_TFT_Data_8(0x03); //LOCK PLL
delay_ms(1);
Send_TFT_Command(0xB0); //LCD MODE Settings
Send_TFT_Data_8(0x20); //TFT panel data width 24bit, FRC, dithering disable
Send_TFT_Data_8(0x00); //hsync+Vsync+DEN
Send_TFT_Data_8(0x03); //horizontal panel size(horizontal lines) HightByte
Send_TFT_Data_8(0x1F); //LowByte
Send_TFT_Data_8(0x01); //vertical panel size(vertical lines) HightByte
Send_TFT_Data_8(0xDF); //SET vertical size LowByte
Send_TFT_Data_8(0x00); //avaible if serial RGB mode is selected.
delay_ms(1);

Send_TFT_Command(0xF0);
Send_TFT_Data_8(0x03);//SSD1963 data input format data 16 bit
delay_ms(1);
Send_TFT_Command(0x3A);//Pixel format
Send_TFT_Data_8(0x60);
delay_ms(1);
Send_TFT_Command(0xE6);//SET PCLK freq=33MHz = 110MHz * LCDC_FPR / 2^20
Send_TFT_Data_8(0x04);
Send_TFT_Data_8(0xD7);
Send_TFT_Data_8(0xF9);
delay_ms(1);
Send_TFT_Command(0xB4);
Send_TFT_Data_8(0x04); //horizontal total period (display + non-display)-1 highbyte
Send_TFT_Data_8(0x1F); //low byte
Send_TFT_Data_8(0x00); //Horizontal Pulse Width + Horizontal Back Porch highbyte
Send_TFT_Data_8(0x58); //low byte
Send_TFT_Data_8(0x27); //Horizontal Sync Pulse Width
Send_TFT_Data_8(0x00); //Hsync pulse start position
Send_TFT_Data_8(0x00); //lowbyte
Send_TFT_Data_8(0x00); //for serial RGB mode
delay_ms(1);

```



```

Send_TFT_Command(0xB6);
Send_TFT_Data_8(0x02); //vertical total period (display + non-display)-1 highbyte
Send_TFT_Data_8(0x0C); //low byte
Send_TFT_Data_8(0x00); //vertical Pulse Width + vertical Back Porch highbyte
Send_TFT_Data_8(0x20); //low byte
Send_TFT_Data_8(0x00); //vertical Sync Pulse Width
Send_TFT_Data_8(0x00); //Vsync pulse start position
Send_TFT_Data_8(0x00); //lowbyte
delay_ms(1);
Send_TFT_Command(0x36); // Address Mode
Send_TFT_Data_8(0x00);
delay_ms(1);
Send_TFT_Command(0x29); //SET display on
//backlight PWM setting.
Send_TFT_Command(0xBE);
Send_TFT_Data_8(0x01); //PLL clock / (256 * (PWMF[7:0] + 1)) / 256
Send_TFT_Data_8(0x64); //PWM duty cycle
Send_TFT_Data_8(0x01); //PWM, DBC enable/disable setting.
Send_TFT_Data_8(0x00); //DBC manual brightness
Send_TFT_Data_8(0x00); //DBC minimum brightness
Send_TFT_Data_8(0x00); //Brightness prescaler
}

```

```

void draw_rectangle(unsigned int X1,unsigned int X2,unsigned int Y1,unsigned int Y2,unsigned int red,unsigned int green,unsigned int blue)
{
    unsigned char X_point_1_1;
    unsigned char X_point_1_2;
    unsigned char X_point_2_1;
    unsigned char X_point_2_2;
    unsigned char Y_point_1_1;
    unsigned char Y_point_1_2;
    unsigned char Y_point_2_1;
    unsigned char Y_point_2_2;

    unsigned long temp1;
    unsigned long temp2;
    unsigned long frame_pixel;

```



```

unsigned long pixel_CNT;
unsigned int color;

red=red<<11;
green=green<<5;
color=blue|green|red;

temp1= X2-X1+1;
temp2= Y2-Y1+1;
frame_pixel=temp1*temp2;

X_point_1_1=X1>>8;
X_point_1_2=X1&0x00FF;
X_point_2_1=X2>>8;
X_point_2_2=X2&0x00FF;

Y_point_1_1=Y1>>8;
Y_point_1_2=Y1&0x00FF;
Y_point_2_1=Y2>>8;
Y_point_2_2=Y2&0x00FF;

```

```
Send_TFT_Command(0x2A);//Setup the frame buffer vertical addressing range
```

```
Send_TFT_Data_8(X_point_1_1);
```

```
Send_TFT_Data_8(X_point_1_2);
```

```
Send_TFT_Data_8(X_point_2_1);
```

```
Send_TFT_Data_8(X_point_2_2);
```

```
Send_TFT_Command(0x2B);// Setup the frame buffer horizontal address range
```

```
Send_TFT_Data_8(Y_point_1_1);
```

```
Send_TFT_Data_8(Y_point_1_2);
```

```
Send_TFT_Data_8(Y_point_2_1);
```

```
Send_TFT_Data_8(Y_point_2_2);
```

```
Send_TFT_Command(0x2C);
```

```
pixel_CNT=0;
```

```
while(pixel_CNT<=frame_pixel)
```

```
{
```

```
    Send_TFT_Data_16(color);
```

```
    pixel_CNT++;
```

```
}
```

```
}
```

```
void main()
```

```
{
```

```
    //pin configurations for STM32 in Mikroc compiler
```



```

GPIO_Digital_Output(&GPIOA_BASE, _GPIO_PINMASK_ALL); // Set PORTB as digital output
GPIO_Digital_Output(&GPIOB_BASE, _GPIO_PINMASK_ALL); // Set PORTB as digital output
GPIO_Digital_Output(&GPIOC_BASE, _GPIO_PINMASK_ALL); // Set PORTB as digital output
GPIO_Digital_Output(&GPIOD_BASE, _GPIO_PINMASK_ALL); // Set PORTB as digital output
GPIO_Digital_Output(&GPIOE_BASE, _GPIO_PINMASK_ALL); // Set PORTB as digital output

GPIOA_ODR = 0;

GPIOB_ODR = 0;

GPIOC_ODR = 0;

GPIOD_ODR = 0;

GPIOE_ODR = 0;

GPIOA_OSPEEDR=0xFFFFFFFF;
GPIOB_OSPEEDR=0xFFFFFFFF;
GPIOC_OSPEEDR=0xFFFFFFFF;
GPIOD_OSPEEDR=0xFFFFFFFF;
GPIOE_OSPEEDR=0xFFFFFFFF;

TFT_BLED=1;

/*
TFT_BLED=1 -> backlight % 100
TFT_BLED=0 and SSD1963 PWM on-> backlight=PWM
TFT_BLED=0 and SSD1963 PWM off-> backlight=off
*/
init_SSD1963();

//color depth in 16 bit mode

//red 0-31

//green 0-63

//blue 0-31

draw_rectagle(0,799,0,479,31,63,31);

while(1)
{
    draw_rectagle(20,220,10,110,31,0,0);
    draw_rectagle(240,440,10,110,0,63,0);
    draw_rectagle(460,660,10,110,0,0,31);
    draw_rectagle(20,220,130,230,31,63,0);
    draw_rectagle(240,440,130,230,31,0,31);
    draw_rectagle(460,660,130,230,0,63,31);
    draw_rectagle(20,220,250,350,0,0,0);
}
}

```