

LCM Specification

Preliminary specification

Final Specification

Project No. 项目编号	TFT-H035A5HVTST3N45		
Customer 客户名称			
Module No. 客户型号			
Product type 产品内容	TFT LCD Module 320 x 3RGB x 480 Dots 3.5" TFT LCD		
Signature by customer: 客户确认签章:			
<input type="checkbox"/> Trial production <input type="checkbox"/> Mass production			
编 制	电子审核	结构审核	批 准
Y. L			

深圳市鑫洪泰电子科技有限公司

Shenzhen Hot Display Technology Co., Ltd

1 Document revision history :

DOCUMENT REVISION	DATE	DESCRIPTION	PREPARED BY	APPROVED BY
0	2020-04-20	First Release.	Y.L	

1. General Feature:

Item	Standard Value	Unit
Display Size	3.5"	--
Number of Pixels	320(H)x3(RGB)*480(V)	--
Active Area	48.96(H) *73.44(V)	mm
LCM Outline Dimension	55.66(H) ×85.04(V)× 2.40(D)	mm
Viewing Direction	12 O'Clock	-
LCM Interface	MCU 8/16 Bit	-
LCM Driver IC	ST7796S	-
LCM Driver Voltage	VCI=2.8V	V
Backlight	White LED	-
Touch Panel	Without TP	-
CTP Driver IC	---	-
CTP Driver Voltage	VDD=2.8V	V
CTP I/O Digital Voltage	---	V
Operation Temperature	-20~70	°C
Storage Temperature	-30~80	°C

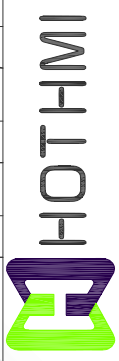
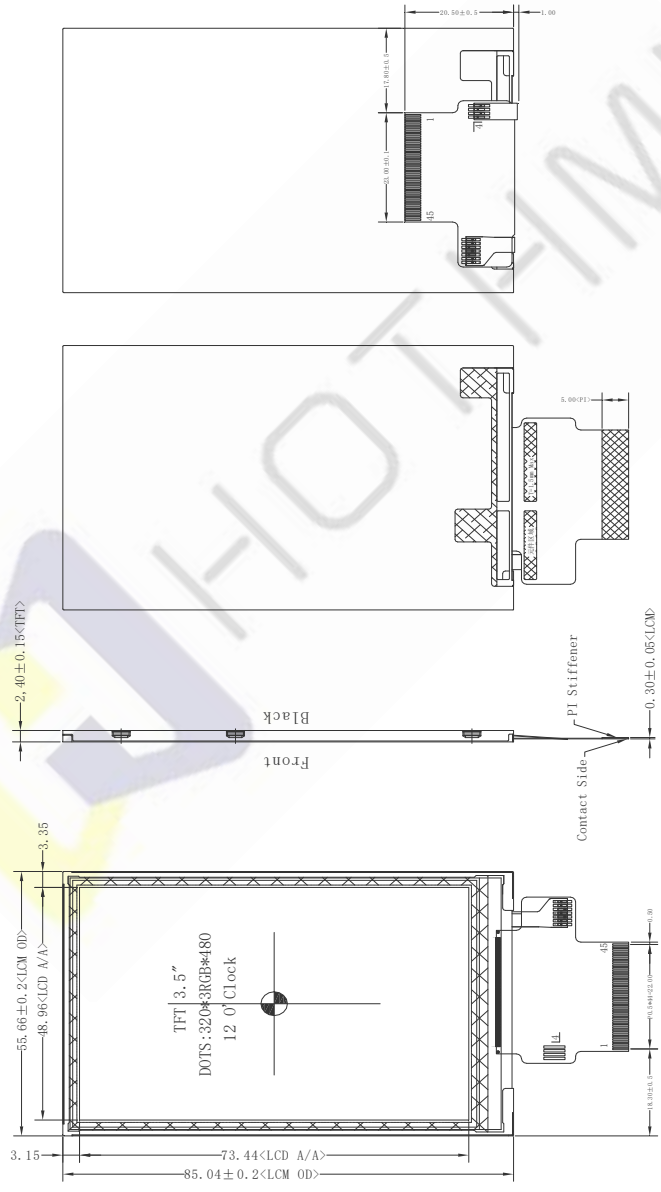
2.Outline Dimensions

*** Do not display the fixed pattern for a long time when using a normally black panel, as it may cause image sticking due to the LCM structure. If the screen is displayed in fixed mode, use a screen saver. It is recommended to display the fixed mode in less than 2 minutes or less.

Resistance	MPU I/F	Data bus
R8 L	8 Bit	DE[0:7]
R16	16 Bit	DE[0:15]

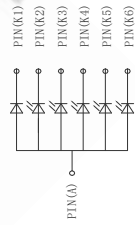
Connect to GND when not in use

Pin	SIGNAL	Pin	SIGNAL	Pin	SIGNAL
1	LED1	21	DB13	41	RFP_YD
2	LEDK1	22	DB12	42	RFP_XF
3	LEDK2	23	DB11	43	RFP_YU
4	LEDK3	24	DB10	44	GND
5	LEDK4	25	DB9	45	NC
6	LEDK5	26	DB8		
7	LEDK6	27	DB7		
8	GND	28	DB6		
9	NC	29	DB5		
10	VCI	30	DB4		
11	10VCC	31	DB3		
12	CS	32	DB2		
13	RR	33	DB1		
14	RS	34	DB0		
15	RD	35	NC		
16	RESX	36	NC		
17	NC	37	TE		
18	NC	38	NC		
19	DB15	39	GND		
20	DB14	40	RFP_XL		



TFT-H035A5HVTST3N45

Scale	1:1	Unit	MM	Tol.	±0.3	Date:	2020-04-20
Ver:	V0	Drawn:	Liu_YL				



BL CIRCUIT DIAGRAM:
VF=3.2V, IF=120mA

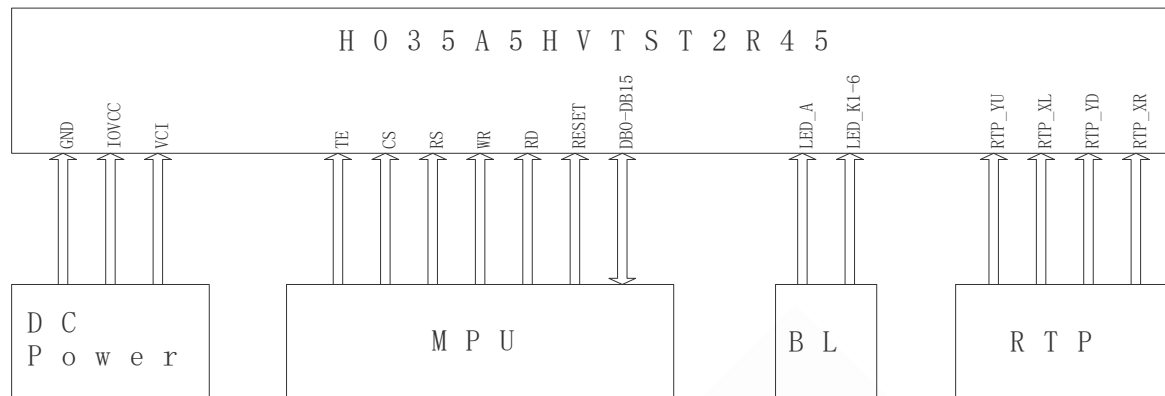
#1. LCD Display Type	TFT, Transmissive, Normally White	#6. Storage Temp	-30° C ~ 80° C
#2. Viewing Direction	12.0° Clock (060/060/L70/R70)	#7. Driver IC	ST7796S (TFT)
#3. Interface	MCU8/16	#8. Backlight	White VF=3.2 V, IF=120mA (Typ)
#4. Operating Voltage	VCI=3.3V, 10VCC=1.8V (Typ)	#9. LCM Brightness	350 cd/m ² (Typ)
#5. Operating Temp	-20° C ~ 70° C		

3. Pin Description

3.1 Pin Description

Pin NO.	Symbol	Description
1	LED_A	LED Anode
2-7	LED_K1-K6	LED Cathode
8	GND	Ground
9	NC	No Connect
10	VCI	Power supply for analog and booster circuits.
11	IOVCC	Power supply for I/O system.
12	CS	Chip selection pin. Low-active.
13	WR	Write enable in MCU parallel interface
14	RS	Display data/command selection (RS) pin in MCU interface
15	RD	Read enable in 8080 MCU parallel IF. Low-active.
16	RESET	LCM Reset Pin.
17, 18	NC	No Connect
19-34	DB15-DB0	Data Bus. If not used, please fix this pin at GND.
35, 36	NC	No Connect
37	TE	Tearing effect output. If not used, leave this pin open
38	NC	No Connect
39	GND	Ground
40	RTP_XL	Resistive touch screen control pins
41	RTP_YD	Resistive touch screen control pins
42	RTP_XR	Resistive touch screen control pins
43	RTP_YU	Resistive touch screen control pins
44	GND	Ground
45	NC	No Connect
-- END --		

3.2 Wiring Diagram



Resistance	MPU I / F	Data bus
R8_L	8 Bit	DB [0 : 7]
R16	16 Bit	DB [0 : 15]
Connect to GND when not in use		

4. Electrical Characteristics

4-1 TFT LCD Module Operating Conditions

Item	Symbol	Condition	Min	Type	Max	Unit
Interface logic circuits	IOVCC	-	1.65	1.80	3.30	V
Analog Power supply	VCI	-	2.50	2.80	3.30	V
TFT Gate on voltage	VGH	-	10.0	-	16.0	V
TFT Gate off voltage	VGL	-	-16.0	-	-10.0	V

4-2 LED back light specification (pera chip)

Item	Symbol	Condition	Min	Type	Max	Unit
Forward voltage	Vt	If=20mA	-	3.2	-	V
Forward current	Ipn	/1-chip	-	120	-	mA
Luminance(With LCD)	Lv	If=120mA	-	350	-	cd/m ²
Luminous color	White					

4. OPTICAL SPECIFICATION

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance 1lux and temperature = 25 ± 2°C) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0°. The center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement.

4.2 Optical Specifications

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle Range	Horizontal	Θ L	CR>10	-	70	-	Deg.	Note 1
		Θ R		-	70	-	Deg.	
	Vertical	Θ U		-	60	-	Deg.	
		Θ D		-	60	-	Deg.	
Contrast ratio		CR	$\Theta = 0^\circ$	-	500	-		Note2
Color Gamut		CG		-	60	-	%	
White Chromaticity		Wx		-	0.307	-		
		Wy		-	0.327	-		
Reproduction of color	Red	Rx	$\Theta = 0^\circ$	-	0.624	-		Note4 (Based on C Light)
		Ry		-	0.331	-		
	Green	Gx		-	0.296	-		
		Gy		-	0.577	-		
	Blue	Bx		-	0.143	-		
		By		-	0.109	-		
Response Time (Rising + Falling)		Tr+Tf	$\Theta = 0^\circ$ Ta= 25°C	-	20	-	ms	Note5
Transmittance		Tr		-	-	-	%	Note3

Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o' clock direction and the vertical or 6, 12 o' clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black)

state . (see FIGUR 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Transmittance is the Value without APF and without CG.

4. The color chromaticity coordinates specified in the above table shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

5. The electro-optical response time measurements shall be made as FIGURE 2 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_f .

Figure1 Measurement Set Up

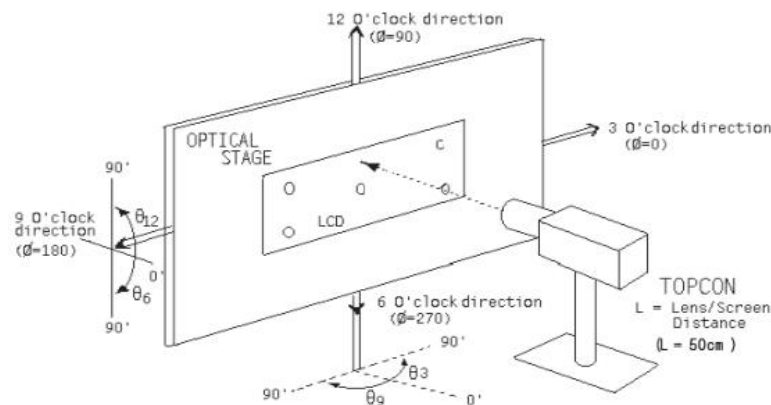
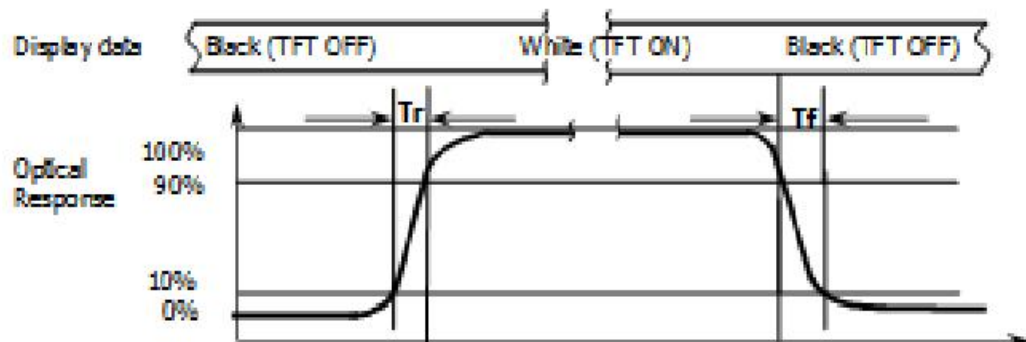
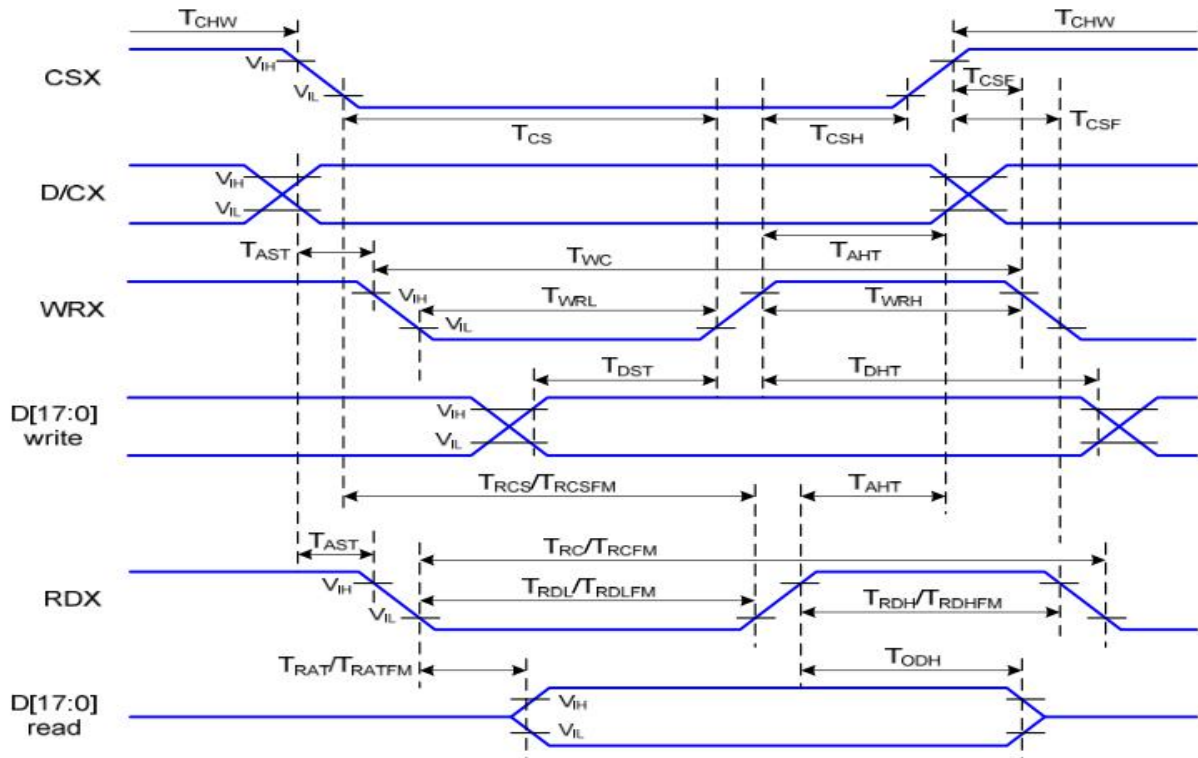


Figure2 Response Time Testing



6. Timing Characteristics of Input Signals

6-1 TFT 8080 Series MCU Parallel Interface Characteristics: 8/16-bit Bus



VDDI=1.8V, VDDA=2.8V, AGND=DGND=0V, Ta=25 °C

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T _{AST}	Address setup time	0		ns	
	T _{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T _{CHW}	Chip select "H" pulse width	0		ns	
	T _{CS}	Chip select setup time (Write)	15		ns	
	T _{RCS}	Chip select setup time (Read ID)	45		ns	
	T _{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T _{CSF}	Chip select wait time (Write/Read)	10		ns	
	T _{CSH}	Chip select hold time	10		ns	
	T _{WRH}	Control pulse "H" duration	15		ns	
RDX (ID)	T _{WRL}	Control pulse "L" duration	15		ns	When read ID data
	T _{RC}	Read cycle (ID)	160		ns	
	T _{RDH}	Control pulse "H" duration (ID)	90		ns	
RDX (FM)	T _{RDH}	Control pulse "H" duration (ID)	90		ns	When read from frame memory
	T _{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T _{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T _{DST}	Data setup time	10		ns	For CL=30pF
	T _{DHT}	Data hold time	10		ns	
	T _{RAT}	Read access time (ID)	-	40	ns	
	T _{RATFM}	Read access time (FM)	-	340	ns	
	T _{ODH}	Output disable time	20	80	ns	

7. RELIABILITY TEST

7-1 Temperature and Humidity

Test Item	Test Condition	Check Time
High Temp Storage	Ta= 80°C	240 hrs
Low Temp Storage	Ta= -30°C	240 hrs
High Temp Operation	Ta= 70°C	240 hrs
Low Temp Operation	Ta= -20°C	240 hrs
High Temp & High Humidity Operation	Ta=60°C H=90%RH	240 hrs

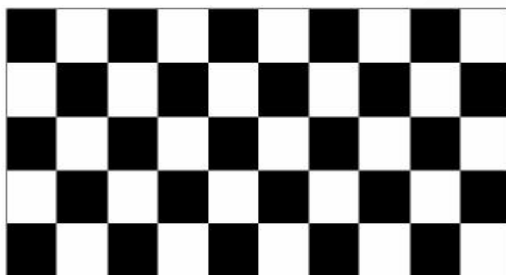
Note: (1) Ta : Ambient temperature

(2) All judgments of display are performed after temp of panel returns to room temperature

(3) Display function should be no change under normal operating condition.

(4) Under no condensation of dew

(5)*INX only guarantee the above 5 test items. INX wouldn't guarantee the others not shown as the above ones..



(a) Test Pattern (chess board Pattern)



(b) Gray Pattern

7-2 Shock and Vibration

ITEMS	CONDITIONS
Packing Shock (Non-Operation)	<ul style="list-style-type: none"> ● Shock level:980m/s² ● Waveform:1/2 Sine wave,6msec ● ±X, ±Y ±Z,each axis 1 times
Packing Vibration (Non-Operation)	<ul style="list-style-type: none"> ● Frequency range:8-33.3HZ ● Stoke:1.0mm ● Sweep: 10Hz-50Hz ● x,y,z 2 hours for each direction

7-3 Electrostatic Discharge

TEST ITEM	CONDITIONS
ESD (Non-operation)	150pF,330Ω , Contact±4KV,Air :±8KV.Note 1
	200pF,0Ω , ±200V Contact test.Note 2

Note:Measure Point:

1.LCD glass and metal bezel

2.IF connector pins

8.HANDDLING & CAUTIONS

8-1 Caution For Operation

◆Since the LCM is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass maybe broken.

◆It is indispensable to drive the LCM within the specified voltage limit since the higher voltage than the limit causes LCM's life shorter. An electro-chemical reaction due to DC causes undesirable deterioration of the LCM so that the use of DC drive should avoid.

◆Do not connect or disconnect the LCM to or from the system when power is on.

◆Never use the LCM under abnormal conditions of high temperature and high humidity.

◆When expose to drastic fluctuation of temperature(hot to cold or cold to hot), the LCM may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCM's surface which may affect the operation of the polarizer on the LCM.

◆Response time will be extremely delay at lower temperature than the operating temperature range and on the other hand LCM may turn black at temperature above its operational range. However those phenomenon do not mean malfunction or out of order with the LCM. The LCM will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.

◆Do not display the fixed pattern for a long time when using a normally black panel, as it may cause image sticking due to the LCM structure. If the screen is displayed in fixed mode, use a screen saver. It is recommended to display the fixed mode in less than 2 minutes or less.

◆Do not disassemble and/or re-assemble LCM module

7-2 Caution Against Static Charge

◆The LCM use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.

◆Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.

◆Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

◆In handling the LCM, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary

9.LCD display initialization code

```
Void ST7796Spanelinitialcode(void)
```

```
{  
    RST=1;  
    Delay(200);  
  
    RST=0;  
    Delay(800);  
  
    RST=1;  
    Delay(800);  
  
    Delay(120); // Delay 120ms  
    WriteComm(0x11); // Sleep Out  
    Delay(120); // Delay 120ms  
    WriteComm(0xf0) ;  
    WriteData(0xc3) ;  
  
    WriteComm(0xf0) ;  
    WriteData(0x96) ;  
  
    WriteComm(0x36);  
    WriteData(0x48);  
  
    WriteComm(0x3A);  
    WriteData(0x55);  
  
    WriteComm(0xB4);  
    WriteData(0x01);  
  
    WriteComm(0xB7) ;  
    WriteData(0xC6) ;  
  
    WriteComm(0xe8);  
    WriteData(0x40);  
    WriteData(0x8a);  
    WriteData(0x00);  
    WriteData(0x00);  
    WriteData(0x29);
```

```
WriteData(0x19);  
WriteData(0xa5);  
WriteData(0x33);
```

```
WriteComm(0xc2);  
WriteData(0xa7);
```

```
WriteComm(0xc5);  
WriteData(0x19);
```

```
WriteComm(0xe0); //Positive Voltage Gamma Control
```

```
WriteData(0xf0);  
WriteData(0x00);  
WriteData(0x08);  
WriteData(0x0e);  
WriteData(0x0d);  
WriteData(0x1a);  
WriteData(0x37);  
WriteData(0x54);  
WriteData(0x47);  
WriteData(0x2b);  
WriteData(0x16);  
WriteData(0x15);  
WriteData(0x1a);  
WriteData(0x1d);
```

```
WriteComm(0xe1); //Negative Voltage Gamma Control
```

```
WriteData(0xf0);  
WriteData(0x02);  
WriteData(0x06);  
WriteData(0x0c);  
WriteData(0x0e);  
WriteData(0x29);  
WriteData(0x34);  
WriteData(0x44);  
WriteData(0x47);  
WriteData(0x2b);  
WriteData(0x17);  
WriteData(0x16);  
WriteData(0x19);
```

```
WriteData(0x1d);  
WriteComm(0xf0);  
WriteData(0x3c);  
WriteComm(0xf0);  
WriteData(0x69);
```

```
WriteComm(0x21); //Display Inversion On
```

```
Delay(120); //Delay 120ms  
WriteComm(0x29); //Display ON  
Delay(120); }
```

```
Void ST7796SPanelSleepInMode (void)
```

```
{  
Write command 0x10;  
Delays (120);  
}
```

```
Void ST7796SPanelSleepOutMode (void)
```

```
{  
Write command 0x11;  
Delays (120);  
}
```

--- END ---