LCM Specification

PRODUCT TYPE:	TFT MODULE
PRODUCT P/N:	LH280QV010-40
VERSION:	V00

Customer（客户）		
INSPECTION RESULT 检测结果	TESTED BY 检测人	APPROVED BY 确认人

Supplier(屏厂)		
DESIGNED BY	CHECKED BY	APPROVED BY

Revision History

Date	Rev.	Reason
2017.04.15	V00	NEW ISSUE

CONTENTS

■ GENERAL DESCRIPTION

LH280QV010-40 is a TFT dot matrix LCD module. It is composed of a color-LCD panel, driver IC, FPC and a backlight unit. The module display area contains 240x320 pixels. This product accords with RoHS environmental criterion.

■ GENERAL FEATURES

Item	Contents	Unit
LCD Type	TFT TRANSMISSIVE	/
Viewing direction	12:00	O' Clock
Outside Dimensions	50.00(W)*69.20(H)*2.25(T)	mm
Active area (WxH)	43.20(W)*57.60(H)	mm
Number of Dots	240x320	/
Driver IC	ST7789V	/
Colors	65K/262K	/
Backlight Type	4LEDS / White	/
Interface Type	Mcu 8/9/16/18bit, SPI,RGB	/
Input voltage	2.8V/3.0V/3.3V	V

■ ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Min	Max	Unit
Power for Circuit Driving	VCC	-0.3	4.6	V
Power for Circuit Logic	IOVCC	-0.3	4.6	V
Input voltage	Vin	-0.3	VCC + 0.3	V
Operating temperature	Top	-20	70	℃
Storage temperature	Tst	-30	80	℃
Humidity	RH	/	90%(Max60℃)	RH

■ ELECTRICAL SPECIFICATIONS

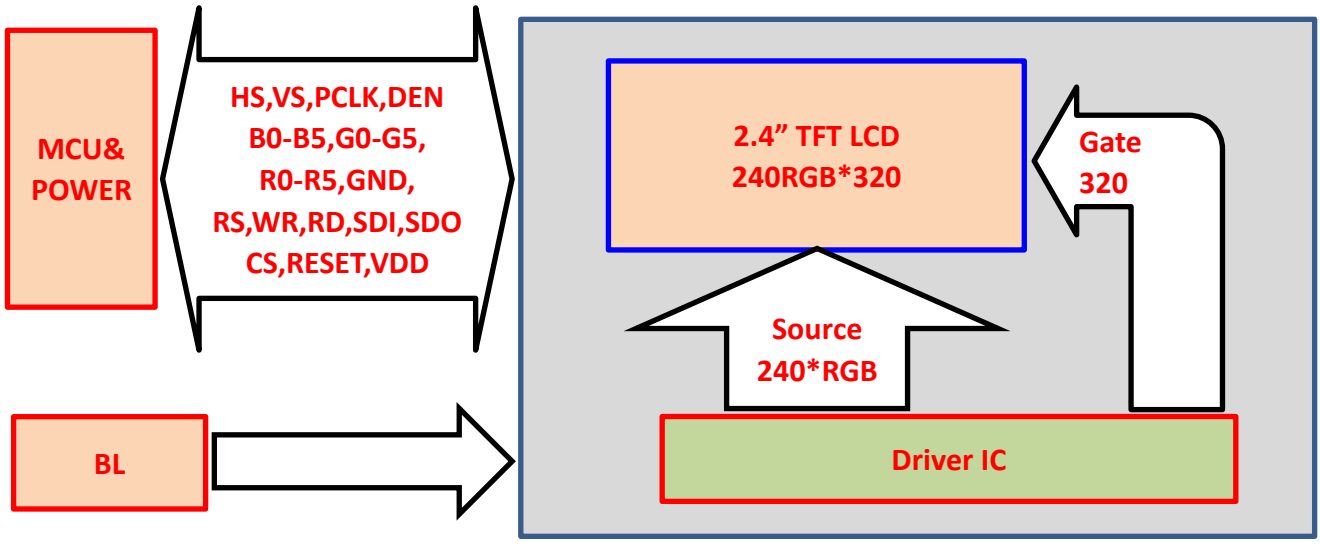
Parameter	Symbol	Min	Typ	Max	Unit
Power for analog/logic	Vcc -GND	2.6	2.8	3.3	V
I/O power supply	IOVCC	-	-	-	V
Input Current	Idd	TBD	TBD	TBD	V
Input voltage ' H ' level	Vih	0.7IOVCC	--	IOVCC	℃
Input voltage ' L ' level	Vil	GND	0	0.3IOVCC	
Output voltage ' H ' level	Voh	0.8IOVCC	--	IOVCC	℃
Output voltage ' L ' level	Vol	GND	0	0.2IOVCC	RH

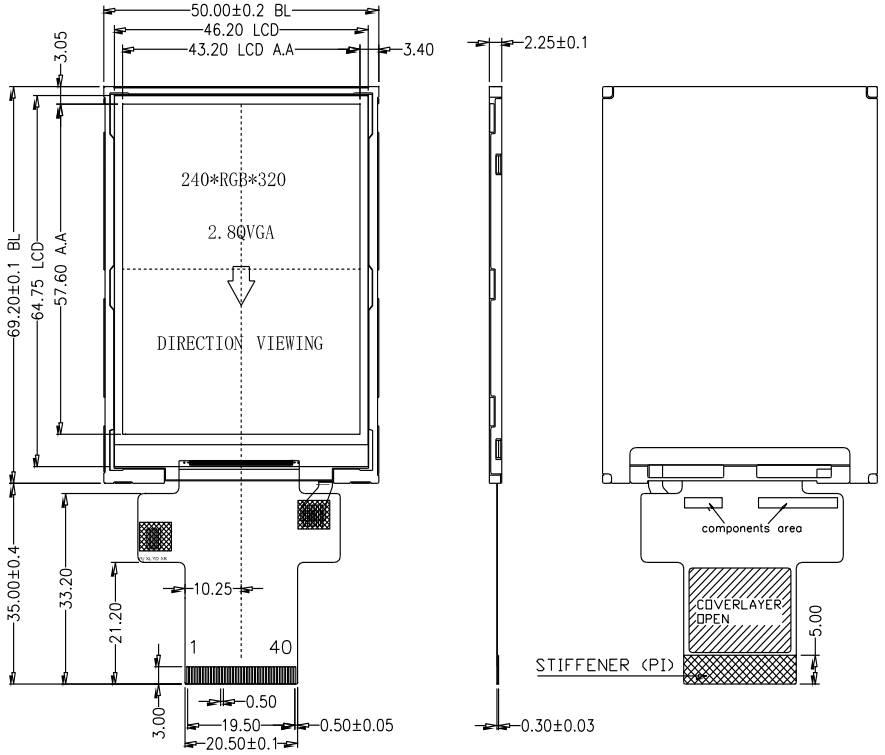
■ BACKLIGHT CHARACTERISTICS

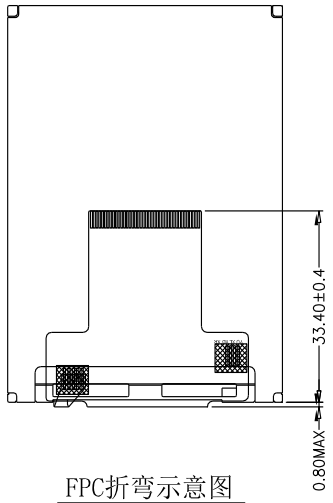
Using condition: constant current driving method If= 80mA(+/-10%)

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward voltage	Vf	3.0	3.2	3.4	V	If=80mA
Luminance with LCD	Lv	--	220	--	cd/m2	If=80mA
Number of LED	--	4			Pcs	--
Connection mode	S	Parallel			--	--

■ BLOCK DIAGRAM







FPC折弯示意图

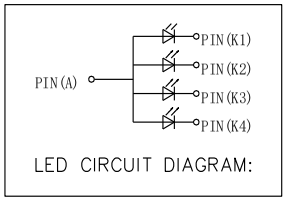
FPC展开出货

1	YU
2	XL
3	YD
4	XR
5	GND
6	VDD
7	SDO
8	DB17 / R5
9	DB16 / R4
10	DB15 / R3
11	DB14 / R2
12	DB13 / R1
13	DB12 / R0
14	DB11 / G5
15	DB10 / G4
16	DB9 / G3
17	DB8 / G2
18	DB7 / G1
19	DB6 / G0
20	DB5 / B5
21	DB4 / B4
22	DB3 / B3
23	DB2 / B2
24	DB1 / B1
25	DB0 / B0
26	SDI
27	PCLK
28	DEN
29	HSYNC
30	VSYNC
31	RD
32	WR / (SPI_RS)
33	RS / (SPI_SCK)
34	CS
35	RESET
36	IM0
37	IM1
38	IM2
39	LEDA
40	LEDK

IM2	IM1	IM0	Interface Type	DB pin use
0	0	0	MCU 8080-16bit	DB[17:10], DB[8:1]
0	0	1	MCU 8080-8bit	DB[17:10]
0	1	0	MCU 8080-18bit	DB[17:0]
0	1	1	MCU 8080-9bit	DB[17:9]
1	0	1	3-wire 9bit data serial interface	SCK,CS, SDI: In, SDO:Out
1	1	1	4-wire 8bit data serial interface	SCK,CS,RS, SDI: In, SDO:Out

1.If not use pin,fix it to GND、IOVCC or NC.
2.If use RGB mode,PLS select serial interface

RGB mode	DB pin use
18bit RGB interface	B0~B5,G0~G5,R0~R5
16bit RGB interface	B1~B5,G0~G5,R1~R5



LED CIRCUIT DIAGRAM:

Specification:

1). Display mode:2.8" TFT,262K COLORS
2). Viewing angle: 12 O'clock
3). Operating temp.: −20°C~+70°C
Storage temp.: −30°C~+80°C
4). IC:ST7789V
5). Backlight:4 chip White LEDS,Parallel
6). General Tolerance:±0.2

Ver.	Description	Date:
V00	初版	170415

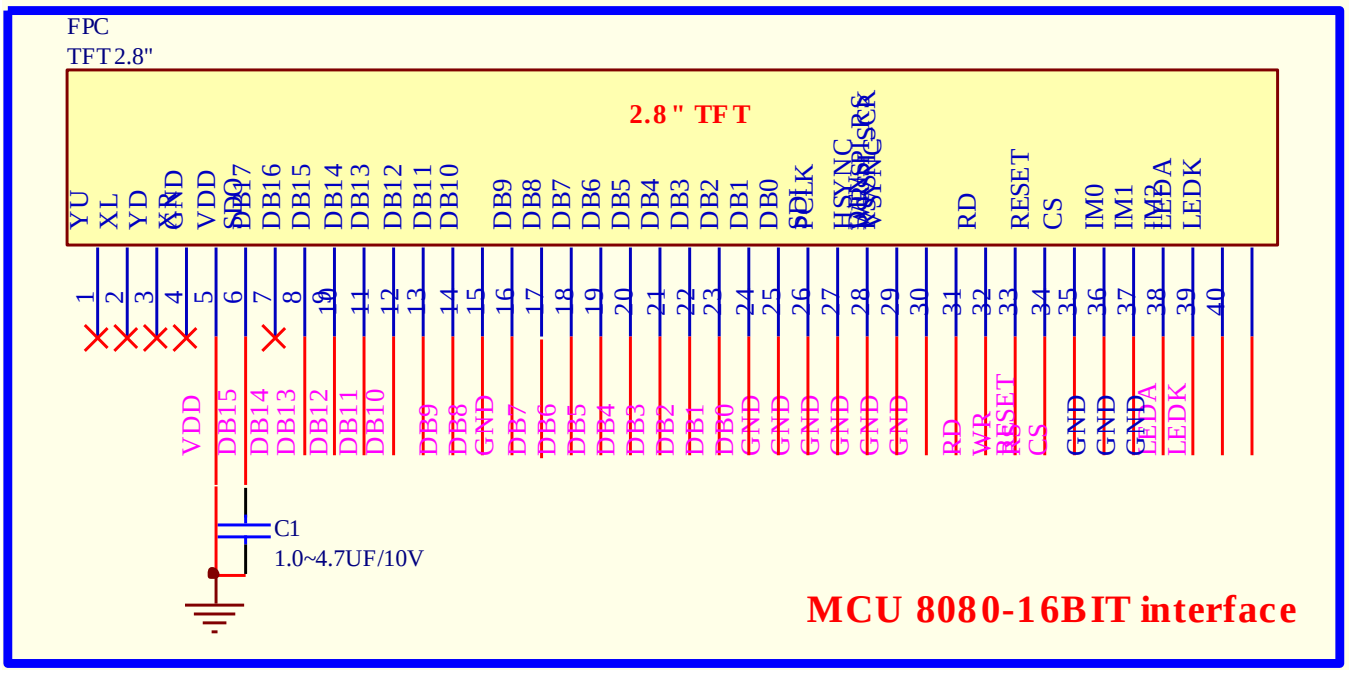
Drawn:
Checked:
Approved:

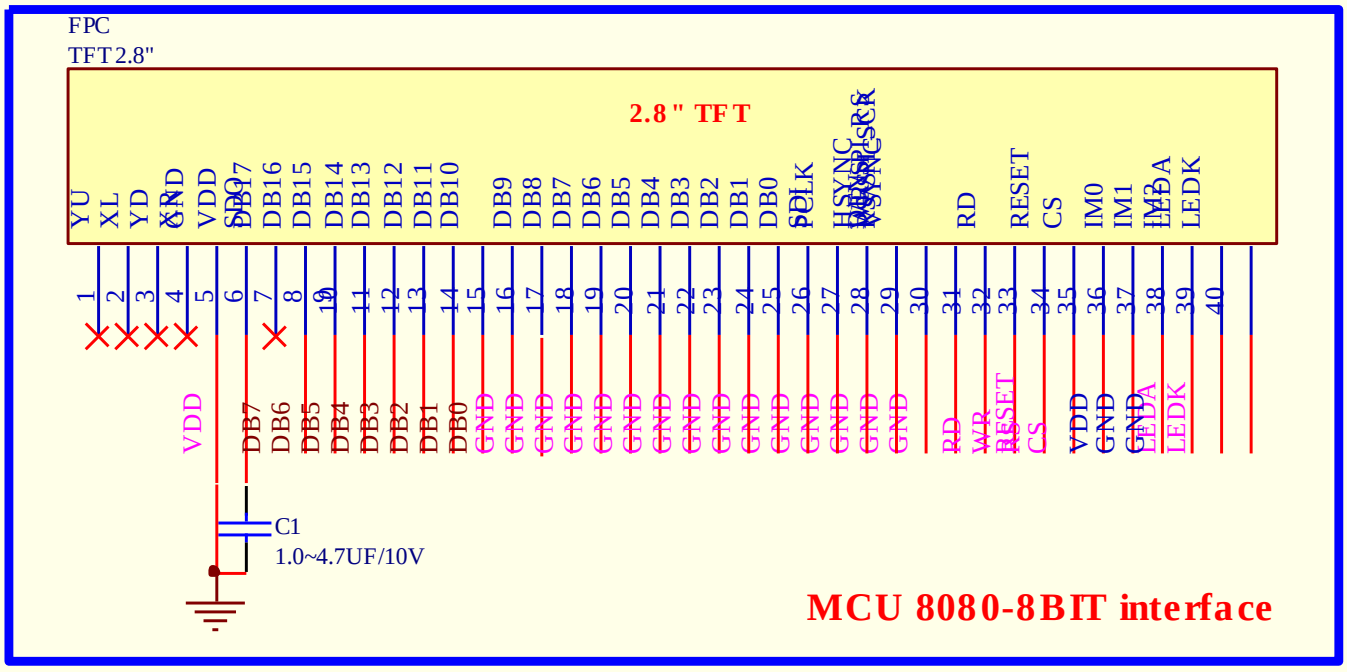
Title: TFT280QV4010
Purpuse: LCD MODULE
Scale: 1:1 | Unit:mm | Sheet NO:1 of 1

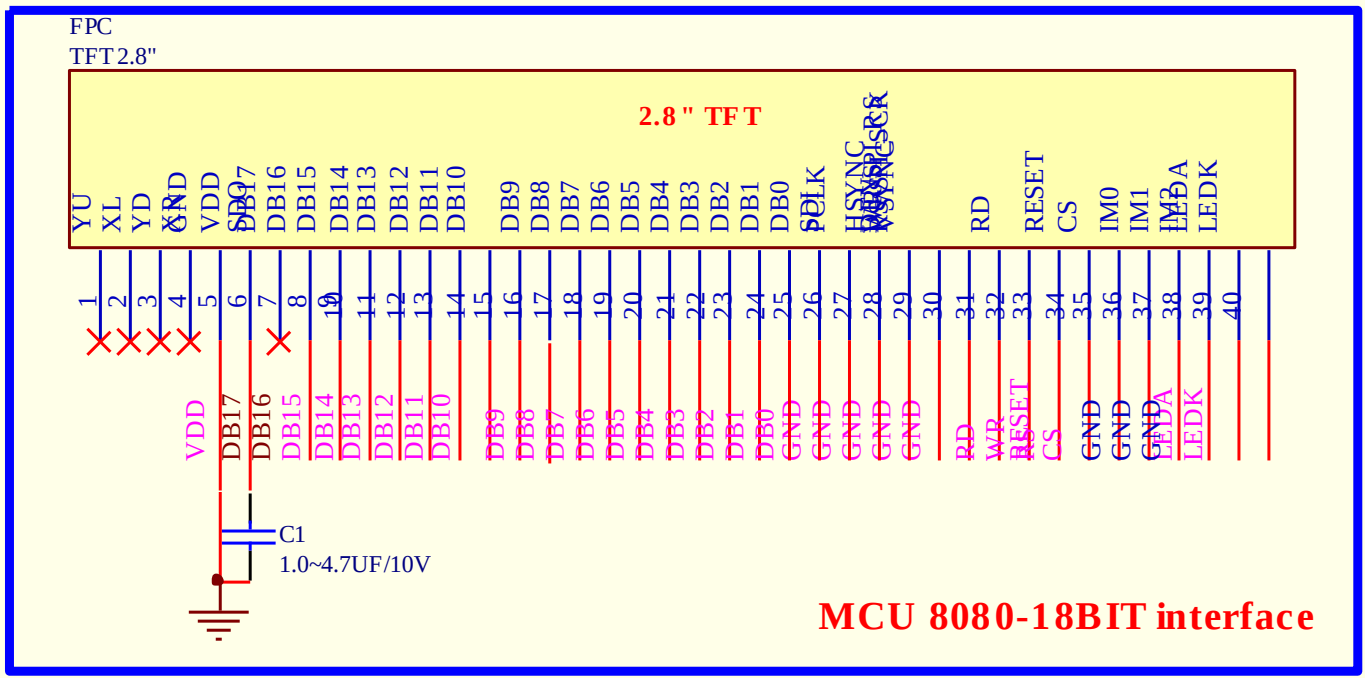
■ PIN DESCRIPTION

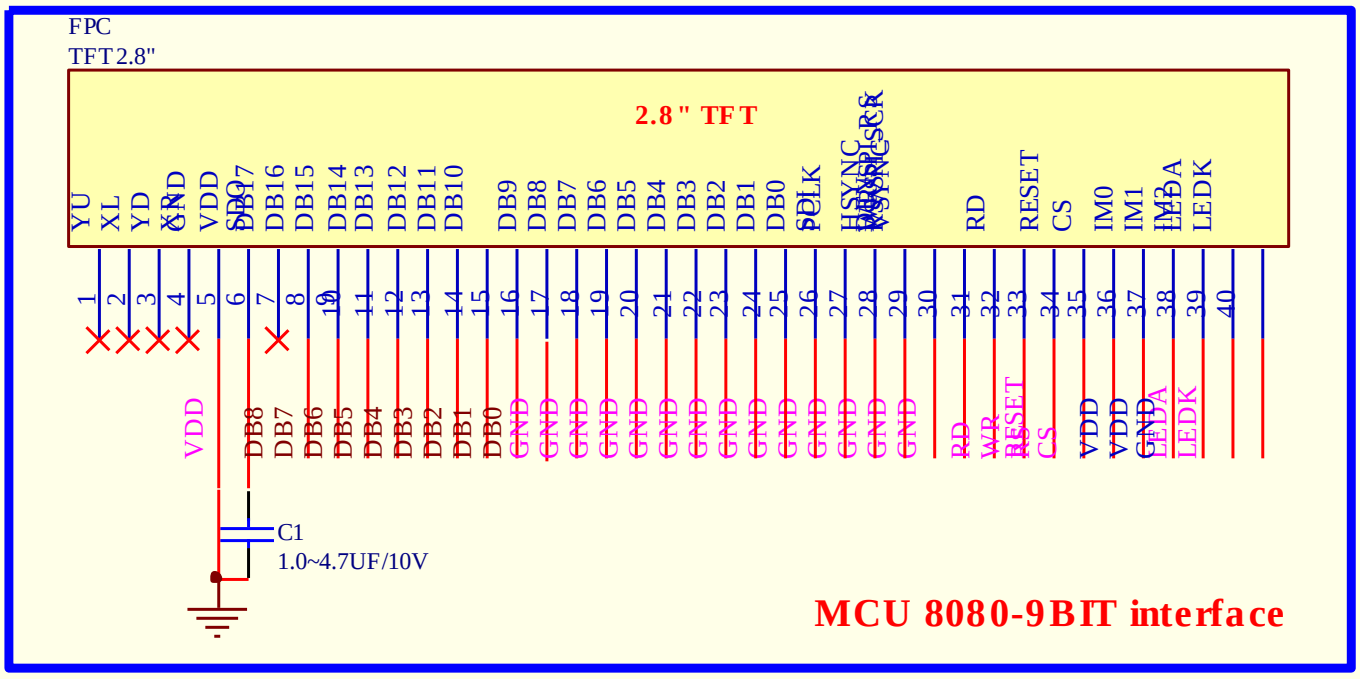
Pin.No	Symbol	DESCRIPTION
1	YU	TP Up, if not use,Please open it
2	XL	TP Left, if not use, Please open it
3	YD	TP Down, if not use, Please open it
4	XR	TP Right, if not use, Please open it
5	GND	Ground
6	VDD	Power Supply Voltage(2.8V/3.0V/3.3V),
7	SDO	serial interface output pin
8	DB17	Databus
9	DB16	
10	DB15	
11	DB14	
12	DB13	
13	DB12	
14	DB11	
15	DB10	
16	DB9	
17	DB8	
18	DB7	
19	DB6	
20	DB5	
21	DB4	
22	DB3	
23	DB2	
24	DB1	
25	DB0	
26	SDI	serial interface input pin
27	PCLK	Dot clock signal for RGB interface operation
28	DEN	Data enable signal for RGB interface
29	HSYNC	Horizontal synchronizing input signal for RGB interface
30	VSYNC	Vertical synchronizing input signal for RGB interface
31	RD	Read enable in 8080 MCU parallel interface
32	WR/SPI_RS	Write enable in MCU parallel interface. Display data/command selection pin in 4-line serial interface.
33	RS/ SPI_SCK	Display data/command selection pin in parallel interface. This pin is used to be serial interface clock.
34	CS	Chip select input pin. Enabled when CS is “L”.
35	RESET	A reset pin
36	IM0	The MCU interface mode select pin
37	IM1	The MCU interface mode select pin
38	IM2	The MCU interface mode select pin
39	LEDA	LED Anode
40	LEDK	LED Cathode

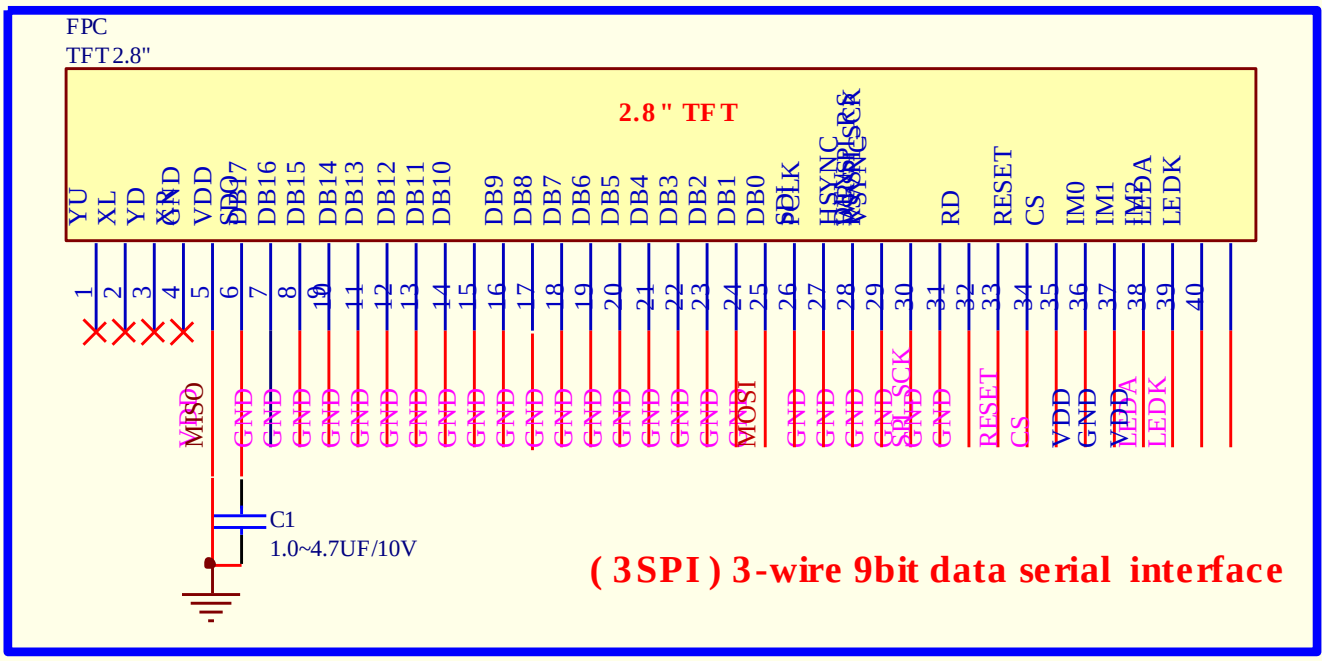
APPLICATION CIRCUIT:

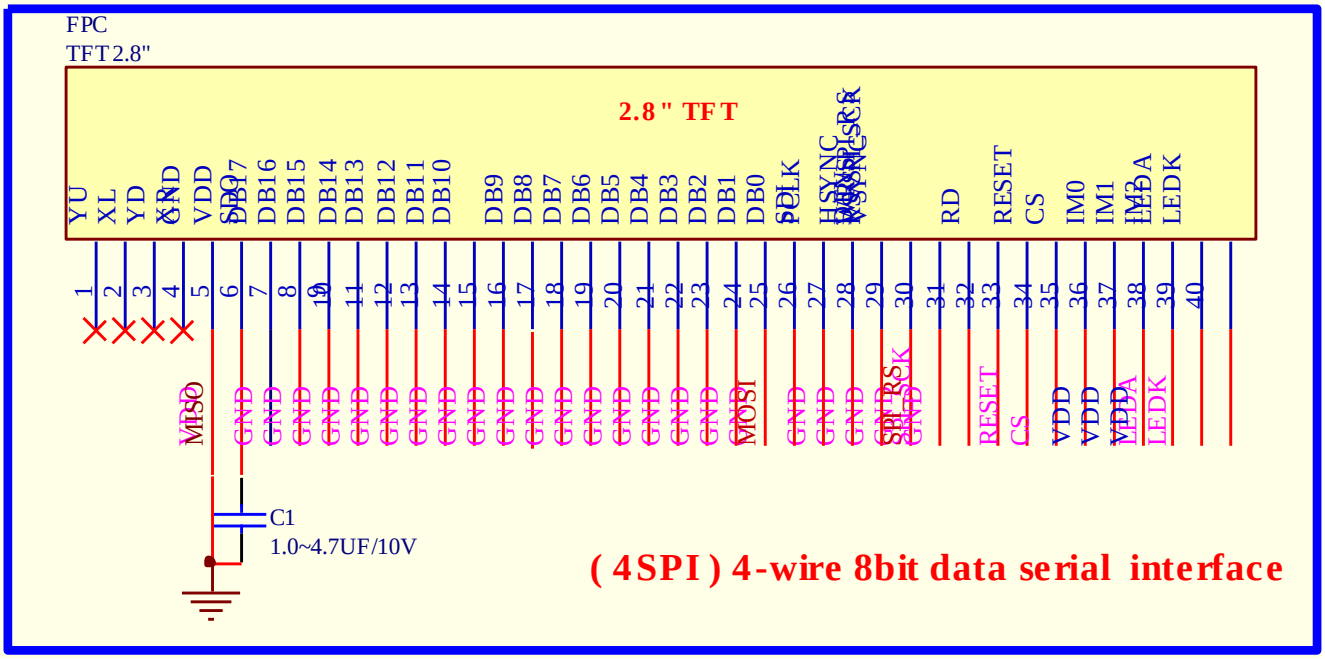


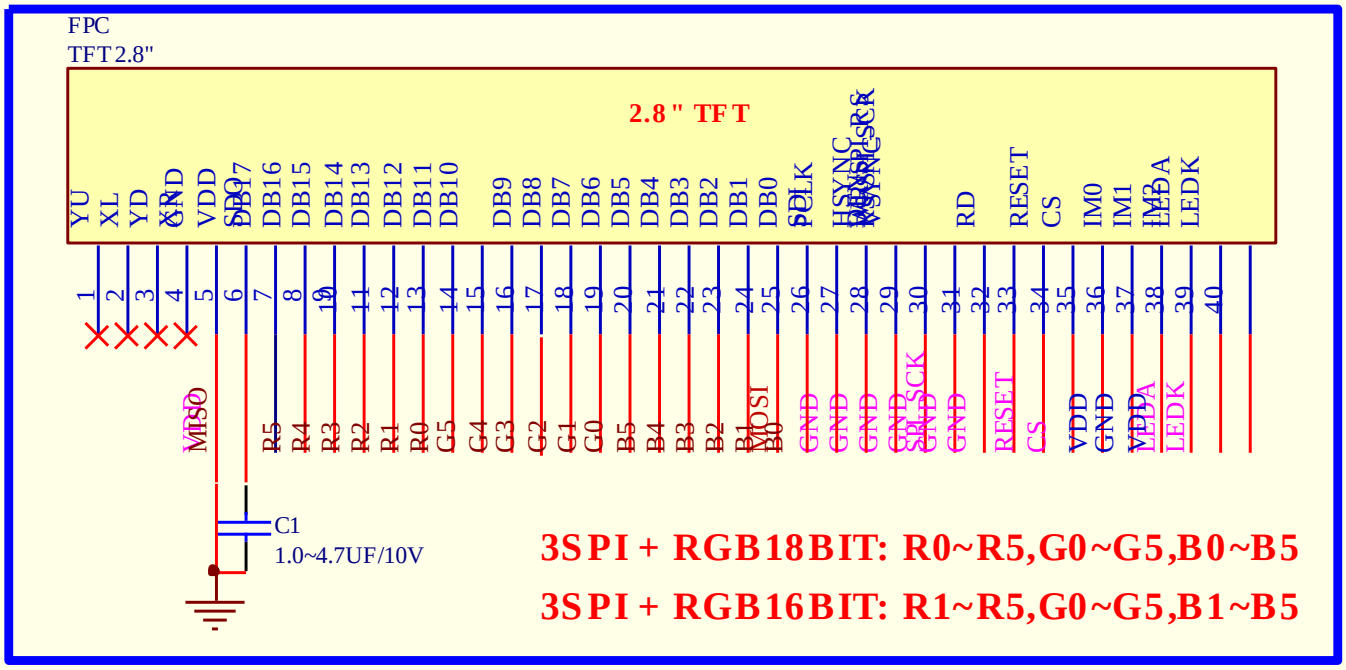



FPC
TFT2.8"
2.8" TFT
YU
XL
YD
XR
GND
VDD
DB17
DB16
DB15
DB14
DB13
DB12
DB11
DB10
DB9
DB8
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
RD
RESET
CS
IM0
IM1
LEDA
LEDK
C1
1.0~4.7UF/10V
MCU 8080-18BIT interface


FPC
TFT2.8"
2.8" TFT
YU
XL
YD
XR
GND
VDD
DB8
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
RD
RESET
CS
IM0
IM1
LEDA
LEDK
C1
1.0~4.7UF/10V
MCU 8080-9BIT interface


FPC
TFT2.8"
2.8" TFT
C1
1.0~4.7UF/10V
(3SPI) 3-wire 9bit data serial interface


FPC
TFT2.8"
2.8" TFT
C1
1.0~4.7UF/10V
(4SPI) 4-wire 8bit data serial interface


FPC
TFT2.8"
2.8" TFT
YU
XL
YD
XR
GND
VDD
SDO
DB17
DB16
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DB14
DB13
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DB6
DB5
DB4
DB3
DB2
DB1
DB0
SCL
HSYNC
VSYNC
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IM0
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IM2
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MISO
R5
R4
R3
R2
R1
R0
G5
G4
G3
G2
G1
G0
B5
B4
B3
B2
B1
B0
MOSI
GND
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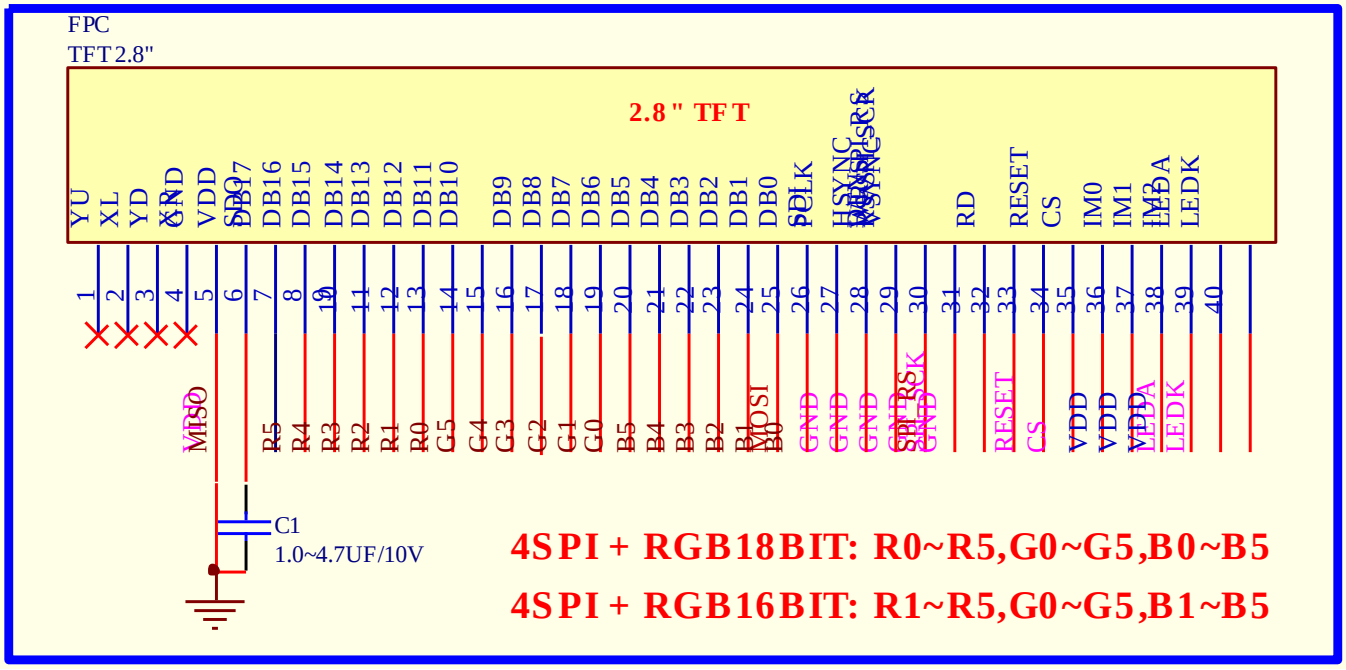
GND
SPI_RS
SPI_SCK
GND
GND
RESET
CS
VDD
GND
VDD
LEDA
LEDK
C1
1.0~4.7UF/10V
3SPI + RGB18BIT: R0~R5,G0~G5,B0~B5
3SPI + RGB16BIT: R1~R5,G0~G5,B1~B5


FPC
TFT2.8"
2.8" TFT
YU
XL
YD
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GND
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SDO
DB17
DB16
DB15
DB14
DB13
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DB11
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DB6
DB5
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DB2
DB1
DB0
SCL
HSYNC
VSYNC
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SCK
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MISO
R5
R4
R3
R2
R1
R0
G5
G4
G3
G2
G1
G0
B5
B4
B3
B2
B1
B0
MOSI
GND
GND
GND
SPI_RS
SPI_SCK
GND
GND
RESET
CS
VDD
VDD
VDD
LEDA
LEDK
C1
1.0~4.7UF/10V
4SPI + RGB18BIT: R0~R5,G0~G5,B0~B5
4SPI + RGB16BIT: R1~R5,G0~G5,B1~B5

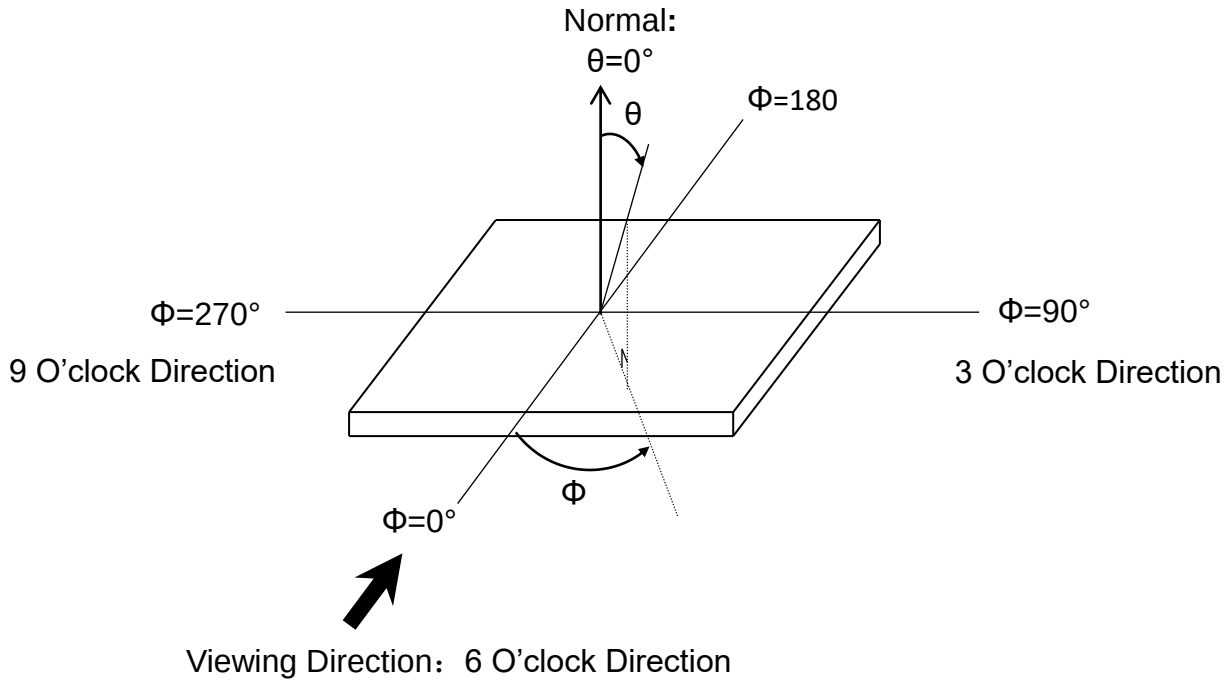
Initial Code:

```
//Initial Start 初始化开始
write_cmd(0x11);
delayms(150);
write_cmd(0xb2);
write_dat(0x0c);
write_dat(0x0c);
write_dat(0x00);
write_dat(0x33);
write_dat(0x33);
write_cmd(0xb7);
write_dat(0x35);
write_cmd(0xbb);
write_dat(0x19);
write_cmd(0xc0);
write_dat(0x2c);
write_cmd(0xc2);
write_dat(0x01);
write_cmd(0xc3);
write_dat(0x12);
write_cmd(0xc4);
write_dat(0x20);
write_cmd(0xc6);
write_dat(0x0f);
write_cmd(0xd0);
write_dat(0xa4);
write_dat(0xa1);

//----- gamma setting-----
write_cmd(0xe0);
write_dat(0xd0);
write_dat(0x04);
write_dat(0x0d);
write_dat(0x11);
write_dat(0x13);
write_dat(0x2b);
write_dat(0x3f);
write_dat(0x54);
write_dat(0x4c);
write_dat(0x18);
write_dat(0x0d);
write_dat(0x0b);
write_dat(0x1f);
write_dat(0x23);

write_cmd(0xe1);
write_dat(0xd0);
write_dat(0x04);
write_dat(0x0c);
write_dat(0x11);
write_dat(0x13);
write_dat(0x2c);
write_dat(0x3f);
write_dat(0x44);
write_dat(0x51);
write_dat(0x2f);
write_dat(0x1f);
write_dat(0x1f);
write_dat(0x20);
write_dat(0x23);

#ifdef  RGB_interface
write_cmd(0xB0);
write_dat(0x11);
write_dat(0xF0);
write_cmd(0xB1);
write_dat(0x40);
write_dat(0x09);
write_dat(0x14);
#endif

#if defined(RGB_interface)||defined(RGB666)
write_cmd(0x3a);
write_dat(0x66);
#else
write_cmd(0x3a);
write_dat(0x65);
#endif

write_cmd(0x36);
write_dat(0x00);
write_cmd(0x29);
//Initial Code END 初始化结束
//说明：
//RGB_interface: SPI+RGB接口
//RGB666：指MCU接口显示RGB666格式图片
//默认普通MCU与SPI接口显示RGB565格式图片
```

■ OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min	Typ	Max	Unit	Note
Response time		Tr+Tf	θ=0° Φ=0° Ta=25℃	-	30	40	ms	/
Contrast ratio		Cr		300	500	-	-	/
Luminance uniformity		δ WHITE		80	-	-	%	/
Viewing angle range		θ	Φ=90°	-	60	-	deg	/
			Φ=270°	-	60	-	deg	
			Φ=0°	-	60	-	deg	
			Φ=180°	-	45	-	deg	
CIE(x,y) chromaticity	Red	x	θ=0° Φ=0° Ta=25℃	0.590	0.610	0.630	/	/
		y		0.309	0.329	0.349		
	Green	x		0.279	0.299	0.319		
		y		0.547	0.567	0.687		
	Blue	x		0.123	0.143	0.163		
		y		0.091	0.111	0.131		
	White	x		0.288	0.308	0.328		
		y		0.307	0.327	0.347		

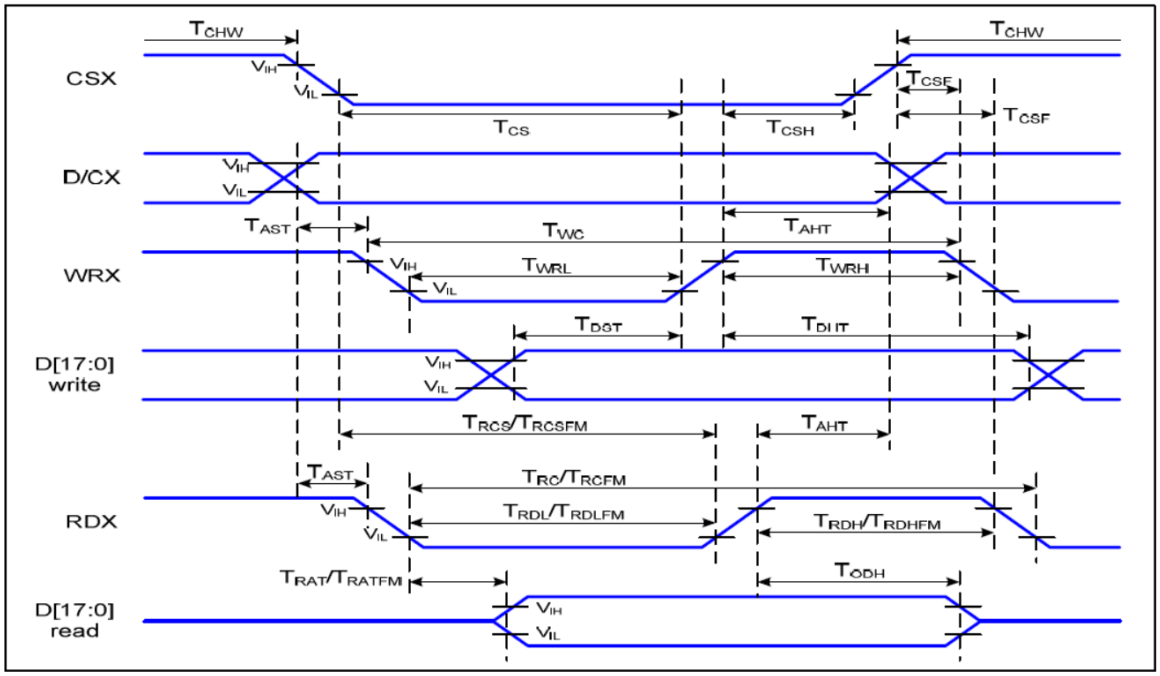
Definition of Viewing Angle θ and Φ



■ TIMING CHARACTERISTICS

Please refer to the datasheet of ST7789S for details。

8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus

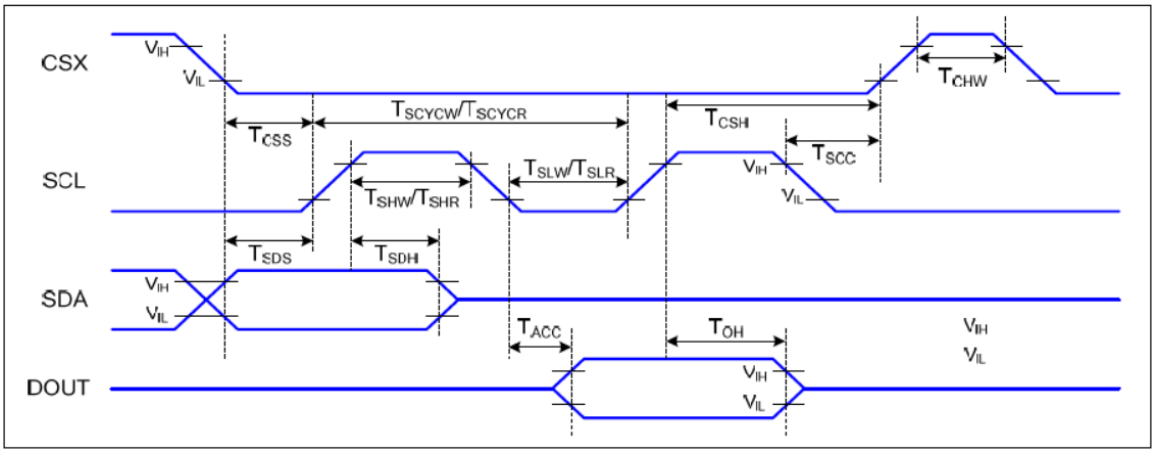


Note: Ta = -30 to 70 ° C, IOVCC=1.65V to 3.3V, VCC=2.5V to 3.3V, GND=0V

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	
WRX	T_{WC}	Write cycle	66		ns	
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		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	

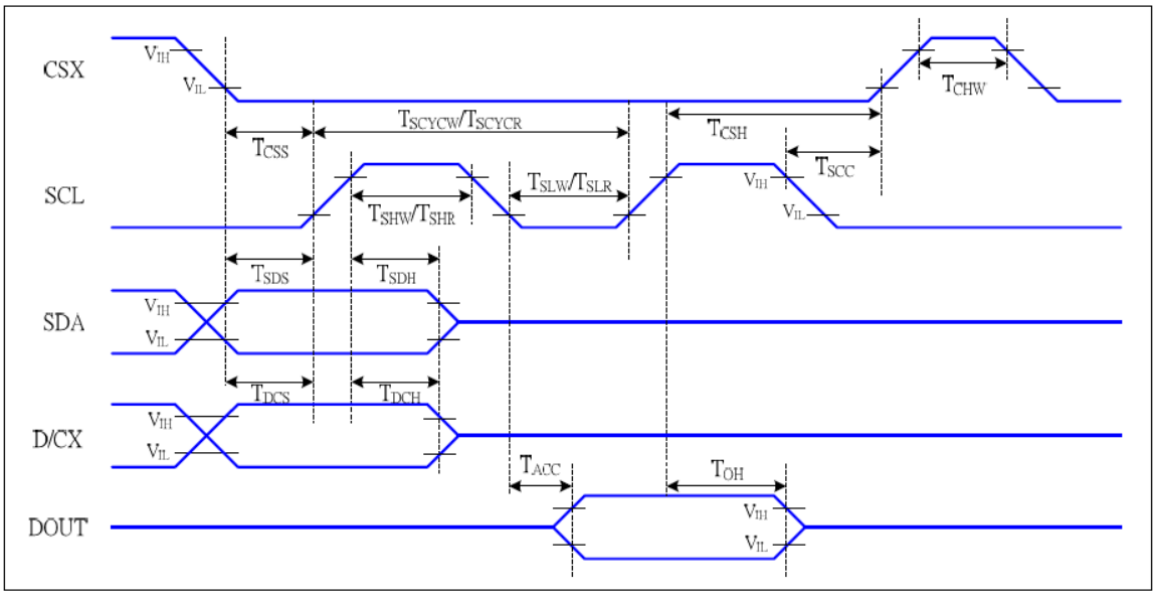
Serial Interface Characteristics (3-line serial):



Note: Ta = -30 to 70 ° C, IOVCC=1.65V to 3.3V, VCC=2.5V to 3.3V, GND=0V

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select “H” pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	
	T_{SHW}	SCL “H” pulse width (Write)	15		ns	
	T_{SLW}	SCL “L” pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL “H” pulse width (Read)	60		ns	
	T_{SLR}	SCL “L” pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

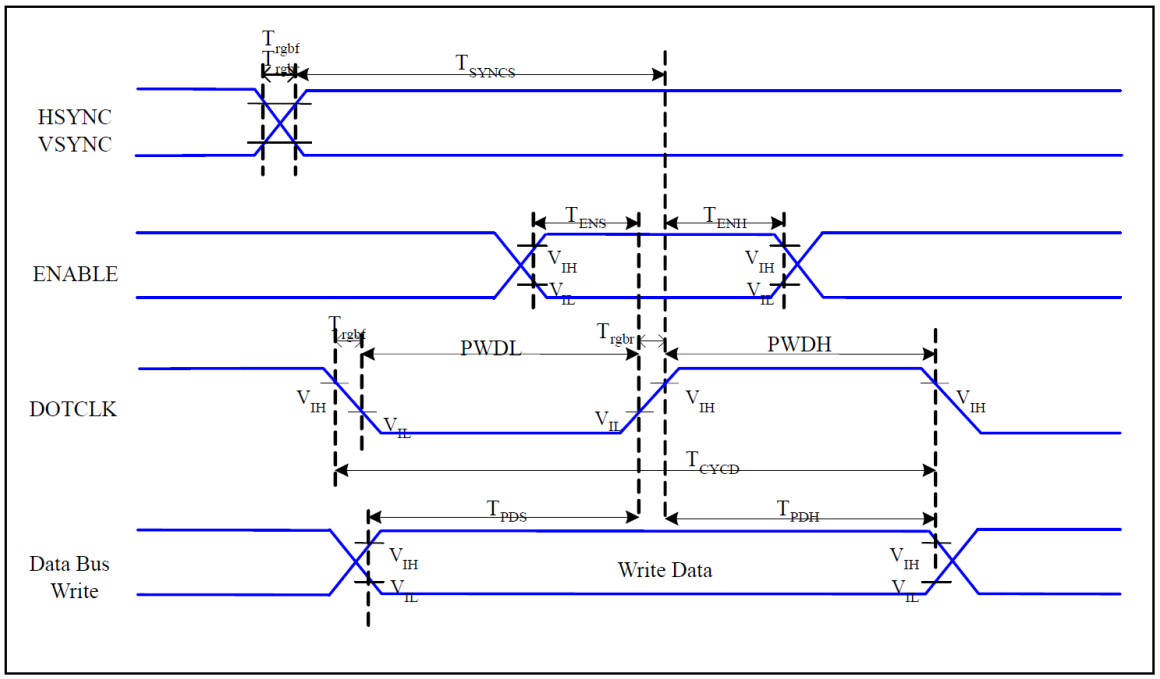
Serial Interface Characteristics (4-line serial):



Note: Ta = -30 to 70 ° C, IOVCC=1.65V to 3.3V, VCC=2.5V to 3.3V, GND=0V

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select “H” pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	T_{SHW}	SCL “H” pulse width (Write)	15		ns	
	T_{SLW}	SCL “L” pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL “H” pulse width (Read)	60		ns	
	T_{SLR}	SCL “L” pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

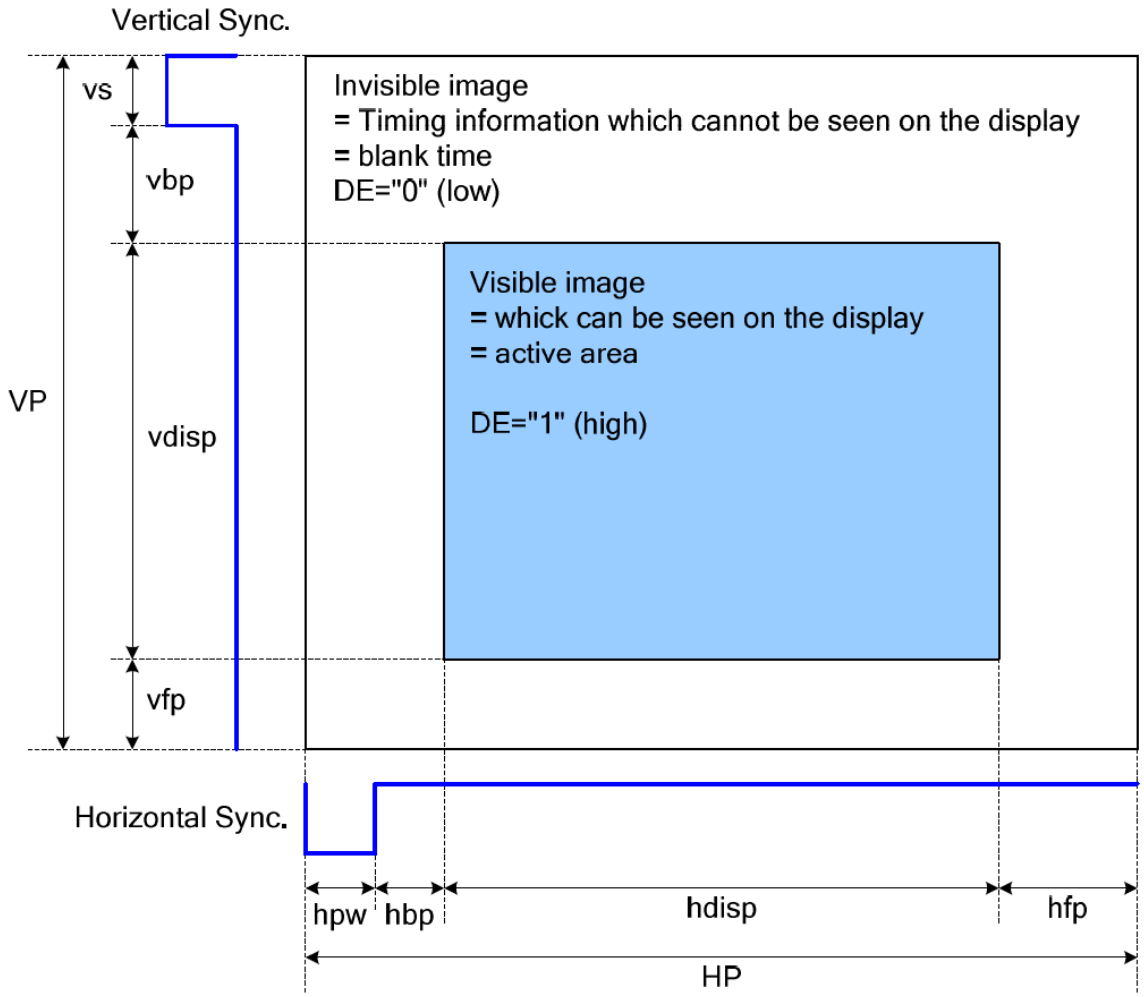
RGB Interface Characteristics:



Note: Ta = -30 to 70 ° C, IOVCC=1.65V to 3.3V, VCC=2.5V to 3.3V, GND=0V

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	30	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	25	-	ns	
	T_{ENH}	Enable Hold Time	25	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	60	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	60	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	120	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	20	ns	
DB	T_{PDS}	PD Data Setup Time	50	-	ns	
	T_{PDH}	PD Data Hold Time	50	-	ns	

DRAM Access Area by RGB Interface



Please refer to the following table for the setting limitation of RGB interface signals.

Parameter	Symbol	Min.	Typ.	Max.	Unit
Horizontal Sync. Width	hpw	2	10	hpw+hbp=31	Clock
Horizontal Sync. Back Porch	hbp	4	10		Clock
Horizontal Sync. Front Porch	hfp	2	38	-	Clock
Vertical Sync. Width	vs	1	4	vs+vbp=127	Line
Vertical Sync. Back Porch	vbp	1	4		Line
Vertical Sync. Front Porch	vfp	1	8	-	Line

Note:

1.Typical value are related to the setting of dot clock is 7MHz and frame rate is 70Hz..

2.If the setting of hpw is 10 dot clocks and hbp is 10 dot clocks, the setting of HBP in command B1h is 20 dot clocks

3.In with ram mode, hpw+hbp+hfp≧22 (default)

4.In without ram mode, hpw+hbp≧20

■ INSPECTION CRITERION

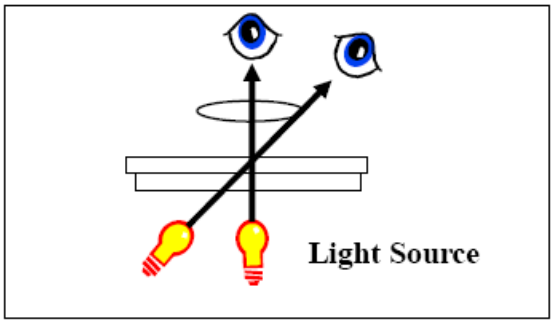
Sampling Method

Unless otherwise agreed upon in writing, the sampling inspection shall be applied to the Customer's incoming inspection.

1 Lot size: Quantity per shipment lot
2 Sampling type: Normal inspection , single sampling
3 Inspection level: Ⅱ
4 Sampling table: MIL-STD-105D
5 Acceptable Quality Level(AQL): Major=0.65 Minor=1.5

Inspection Method

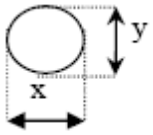
1) Ambient Condition:
   a. Temperature: Room temperature 25±5℃
   b. Illumination: Single fluorescent lamp non-directive(300 to 700 Lux)
2) Viewing distance
   The distance between the LCD and the inspector's eyes shall be at least 30-50cm.
3) Viewing Angle
   The inspection shall be conducted within normal viewing angle range.

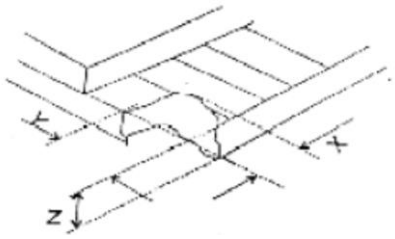
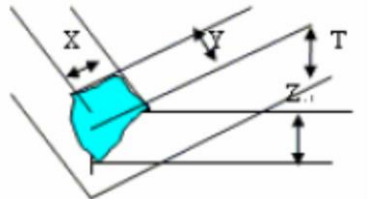
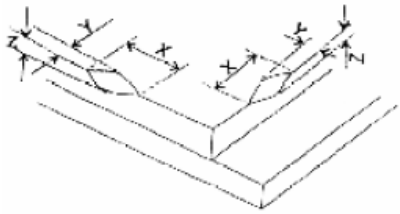
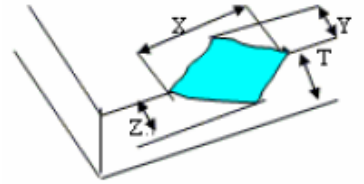
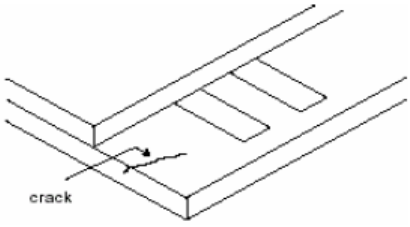


Major Defect

No	Items	Inspection Standard	Classification of defects
1	All functional defects	1.No display 2.Display abnormally 3.Missing vertical，horizontal segment 4.Short circuit 5. Back-light no lighting, flickering and abnormal lighting.	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed.	
4	linearity	No more than 1.5%	

Cosmetic Defect

<table>
<tr><th>No</th><th>Items</th><th colspan="2">Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="6">1</td><td rowspan="6">Clear Spot, Black Spot, white Spot, defect Pinhole, Foreign Particle, polarizer Dirt TP Dirt</td><td colspan="2">For dark/white spot, size Φ is defined as Φ=(x+y)/2  </td><td rowspan="6">Minor</td></tr>
<tr><td>Size(mm)</td><td>Acceptable Qty</td></tr>
<tr><td>Φ≤0.15</td><td>Ignore</td></tr>
<tr><td>0.15＜Φ≤0.20</td><td>2</td></tr>
<tr><td>0.20＜Φ≤0.30</td><td>1</td></tr>
<tr><td>Φ＞0.30</td><td>0</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">(line defect) Black and White line Polarizer scratch</td><td colspan="2">Define:  </td><td rowspan="6">Minor</td></tr>
<tr><td>Width(mm)</td><td>Length(mm);Acceptable Qty</td></tr>
<tr><td>W≤0.03</td><td>Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤3.0; N≤2</td></tr>
<tr><td>0.05<W≤0.1</td><td>L≤2.0; N≤2</td></tr>
<tr><td>0.1<W</td><td>Define as spot defect</td></tr>
<tr><td rowspan="6">3</td><td rowspan="6">Dim Spots Circle shaped and dim edged defects</td><td colspan="2">/</td><td rowspan="6">Minor</td></tr>
<tr><td>Size(mm)</td><td>Acceptable Qty</td></tr>
<tr><td>Φ≤0.2</td><td>Ignore</td></tr>
<tr><td>0.20＜Φ≤0.40</td><td>2</td></tr>
<tr><td>0.40＜Φ≤0.60</td><td>1</td></tr>
<tr><td>Φ＞0.60</td><td>0</td></tr>
</table>

<table>
<tr><th>No</th><th>Items</th><th>Inspection Standard</th><th>Classification of defects</th></tr>
<tr><td rowspan="5">4</td><td rowspan="5">Glass defect
TP defect</td><td>(1) Chips on corner（A:LCD Glass defect）
 
<table><tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr><tr><td>≤2.0</td><td>≤S</td><td>Disregard</td></tr></table>
Notes: S=contact pad length
Chips on the corner of terminal shall not be allowed to extend into the ITO pad or expose perimeter seal.</td><td rowspan="5">Minor</td></tr>
<tr><td>(2) Chips on corner （TP Glass defect）
 
<table><tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr><tr><td>≤3.0</td><td>≤3.0</td><td>Disregard</td></tr></table></td></tr>
<tr><td>(3)Usual surface cracks（LCD Glass defect）
 
<table><tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr><tr><td>≤3.0</td><td><Inner border line of the seal</td><td>Disregard</td></tr></table></td></tr>
<tr><td>(4)Usual surface cracks（TP Glass defect）
 
<table><tr><td>X(mm)</td><td>Y(mm)</td><td>Z(mm)</td></tr><tr><td>≤6.0</td><td>＜2.0</td><td>Disregard</td></tr></table></td></tr>
<tr><td>(5) Crack（Cracks tend to break are not allowed.）
 
</td></tr>
</table>

■ RELIABILITY

N0.	TEST ITEM	CONDITIONS
1	High Temperature Storage	80℃；96 hrs
2	Low Temperature Storage	-30℃；96 hrs
3	HighTemperature Operation	70℃；96 hrs
4	Low Temperature Operation	-20℃；96 hrs
5	High Temperature and High Humidity Operation	50℃, 90% RH；96 hrs
6	Thermal shock(Storage)	-20℃(0.5Hr)→70℃(0.5Hr) 100 Cycles

NOTE:

1. All judgement of display are performed after temperature of panel return to room temperature.
2. Display function should be no change under normal operating condition.
3. Under no condensation of dew.
4. WE only guarantee the above 6 test items, and without guarantee the others.

■ PRECAUTIONS

Handing Precautions

(1) The display panel is made of glass and polarizer. As glass is fragile, it tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.
(2) If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.
(3) Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).
(4) The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming is contacting with room temperature air.
(5) If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents
- Isopropyl alcohol
- Ethyl alcohol
Do not scrub hard to avoid damaging the display surface.
(6) Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.
- Water

- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contacting oil and fats.

(7) Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

(8) Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

(9) Do not attempt to disassemble or process the LCD module.

(10) NC terminal should be open. Do not connect anything.

(11) If the logic circuit power is off, do not apply the input signals.

(12) Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- Do not alter, modify or change the shape of the tab on the metal frame.
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- Do not damage or modify the pattern writing on the printed circuit board.
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- Do not drop, bend or twist LCM.

Storage Precautions

When storing the LCD modules, the following precaution is necessary.

(1) Store them in a sealed polyethylene bag. If properly sealed, there is no need for the dessicant.

(2) Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0° C and 35° C.

(3) The polarizer surface should not come in contact with any other objects. (We advise you to store them in the container in which they were shipped).

Others

Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

- Exposed area of the printed circuit board.
-Terminal electrode sections.