



SHENZHEN HANSHENG INDUSTRAIL CO.LTD.,

HS28B02A

DATASHEET

HS	PreparedBy	CheckedBy	ApprovedBy

VER: 1.0	2.8' TFT 240*320dots 4SPI/8BIT/16BIT
VER: 1.1	

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Revised History

[illegible]

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1.General Description

HS28B02A is a 240RGB*320 dots matrix TFT LCD module. It has a TFT panel composed of 720sources and 320gates. The LCM can be easily accessed by micro-controller.

2. Features

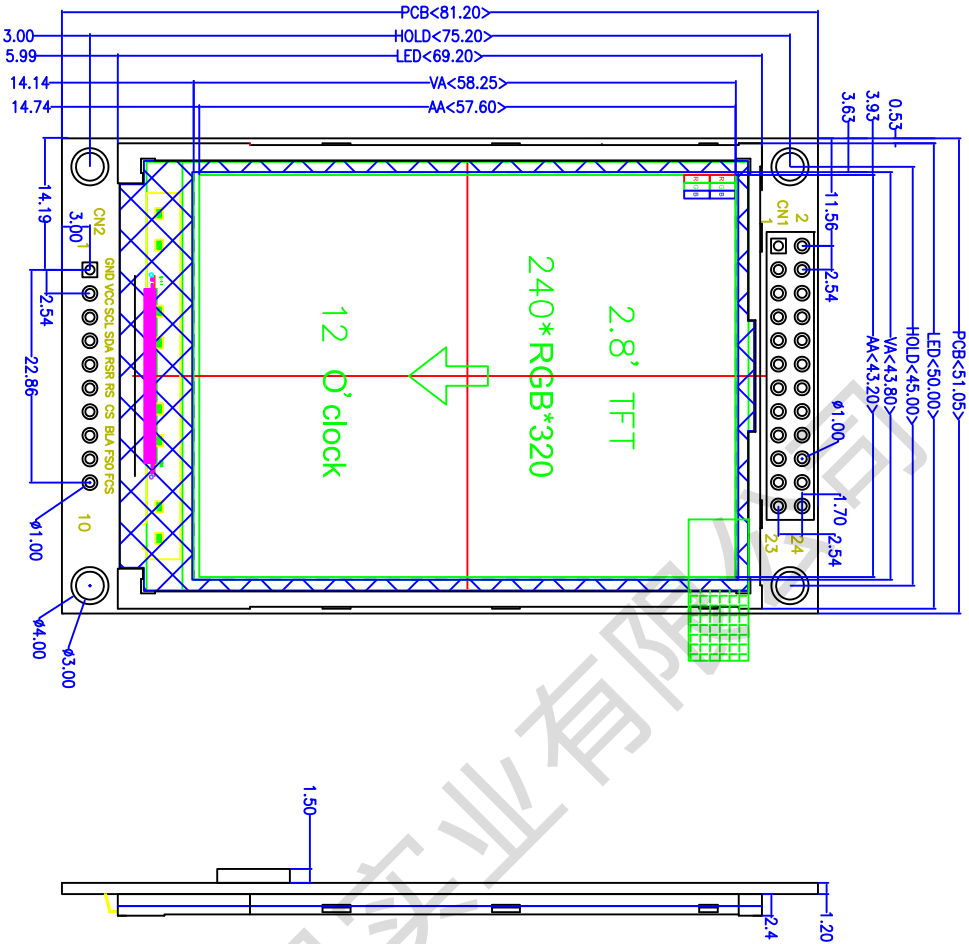
Display Mode	Transmissive
	a-TFT
Display Format	Graphic 240RGB*320 Dot-matrix
Input Data	16bits parallel interface
Viewing Direction	12 o'clock
Drive	ST7789

3. Mechanical Specification

Item	Specifications	Unit
Dimensional outline	51.00(W)*81.20(H)*3.75MAX	mm
Resolution	240RGB*320	dots
LCD Active area	43.20(W)*57.60(H)	mm
Pixel size	0.180(W)*0.180(H)	mm

4. Product picture

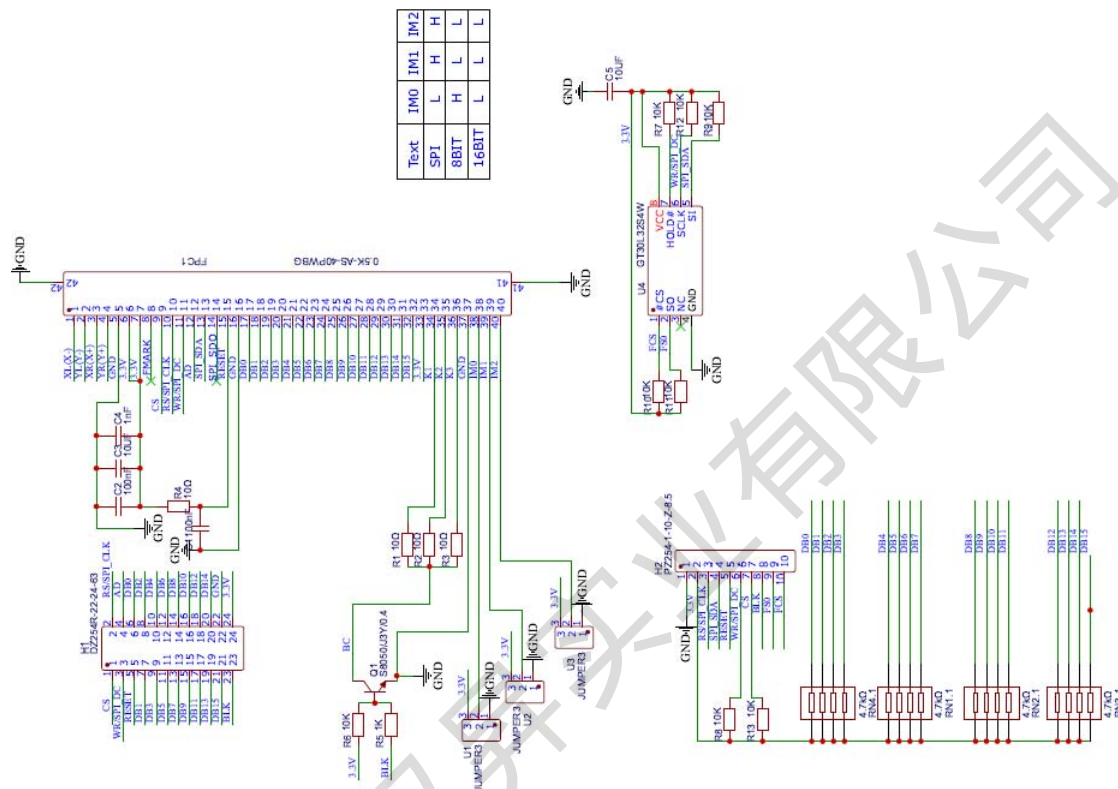
版次	描述	日期
#A0	初版	2019/4/10
#A1		
#A2		



CN1		CN1		CN2	
M0=L M1=L M2=L		M0=H M1=L M2=L		M0=L M1=H M2=H	
Parallel 16 BIT		Parallel 8 BIT		Serial 4spi	
1	CS	1	CS	1	GND
2	RS	2	RS	2	VCC
3	WR	3	WR	3	SCL
4	AD	4	AD	4	SDA
5	RST	5	RST	5	RSR
6	DO	6		6	RS
7	D1	7		7	CS
8	D2	8		8	BLA
9	D3	9		9	FSO
10	D4	10		10	FCS
11	D5	11			
12	D6	12			
13	D7	13			
14	D8	14	D8		
15	D9	15	D9		
16	D10	16	D10		
17	D11	17	D11		
18	D12	18	D12		
19	D13	19	D13		
20	D14	20	D14		
21	D15	21	D15		
22	GND	22	GND		
23	BLK	23	BLK		
24	VCC	24	VCC		

NOTE: 1. DISPLAY TYPE: Passive Matrix		6. OPERATING TEMP: -20°C ~ +70°C.		深圳市汉昇实业有限公司	
2. INTERFACE: 8BIT 16BIT 4SPI		7. STORAGE TEMP: -30°C ~ +80°C.			
3. DRIVE METHOD: 1/65DUTY		8. CONNECTOR: ST7789V			
4. OPERATING VOLTAGE: 3.3V		9. VIEWING DIRECTION: 12 O'CLOCK			
5. POLARIZER MODE: TRANSMISSIVE		10. ALL WITHOUT TOLERANCES. X±0.2			
		项目名称		LCM图	
		型号		HS28B02A	
		页序：		版本：#A1	
		制图：1/1		单位：mm	
		审核：		比例：1:1	
				日期：2019/10/15	

6. Schematic diagram



7. Maximum Ratings

Item	Symbol	Min	Max	Unit	Note
Supply voltage	VCC	3.0	3.3	V	
Operating temperature	T _{OPR}	-20	70	°C	
Storage temperature	T _{STR}	-30	80	°C	

8. Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{CC}		2.7	2.8	3.3	V
Input Voltage	H level	T_{IH}	$0.8 \cdot IOVCC$		$IOVCC$	V
	L level	T_{IL}	-0.3		$0.2 \cdot IOVCC$	
Storage temperature	I_{DD}	With internal voltage generation $V_{CC}=2.8V$; $T_{emp}=25^{\circ}C$			TBD	mA

9. Backlight Characteristic

Item	Symbol	Min	Typical	Max	Unit	Notes
LED module Forward voltage	V_{LED}	3.0	3.2	3.3	V	
LED module current	I_{LED}		90		mA	
L/G Surface Luminance ★1	L_s	3200			Cd/m^3	
LCM Surface brightness uniform ★2	L_D	80				%

★ 1Test condition is:

(a) Center point on active area.

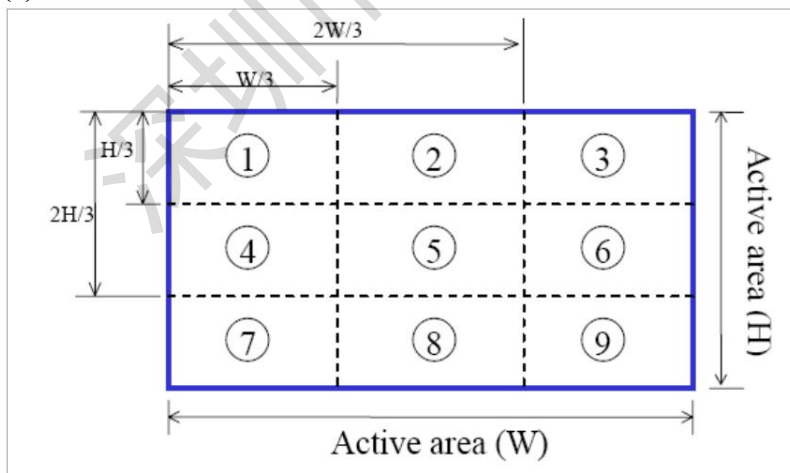
(b)Best Contrast.

★2Uniform measure condition:

(1)Measure 9 point. Measure location show below;

(2)Uniform=(Min. brightness /Max. brightness)*100%

(3)Best Contrast.



10. Module Function Description

10.1 Pin Descriptions

PIN No.	Symbol	Description
1	CS	LCD Chip selection pin; Low enable, high disable.
2	RS	Data/Command Control This pin is Data/Command control pin. When the pin is pulled high, the input at SDA is treated as display data. When the pin is pulled low, the input at SDA will be transferred to the command register.
3	WR	Serves as a write signal and MCU write data at the rising edge.
4	RD	Serves as a read signal and MCU read data at the rising edge.
5	RES	Power Reset for Controller and Driver This pin is reset signal input. When the pin is low, initialization of the chip is executed. Keep this pin pull high during normal operation
6-21	DB0-DB15	Data bus.
22	GND	Ground of Logic Circuit This is a ground pin. It acts as a reference for the logic pins. It must be connected to external ground
23	BLK	Backlight control pin When the pin is pulled high turn on backlight, When the pin is pulled low turn off backlight
24	VCC	Power Supply for Logic This is a voltage supply pin. It must be connected to external source

10.2 Timing characteristics.

7.4.1 8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus

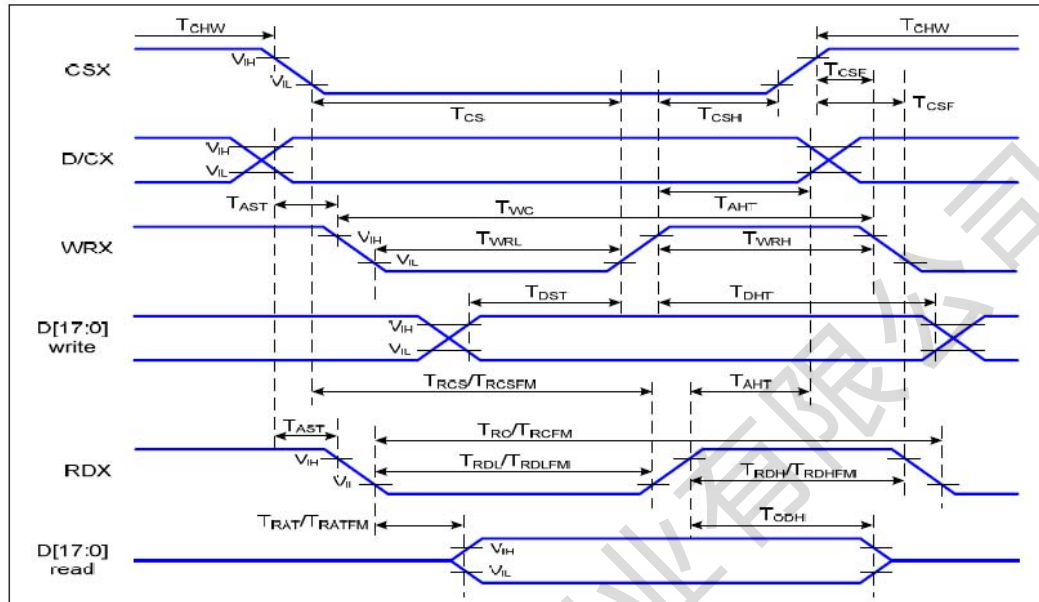


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

VDD=1.65 to 3.3V, VDD=2.4 to 3.3V, 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	
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

10.3 Commands

Refer to the Technical Manual for the ILI9341

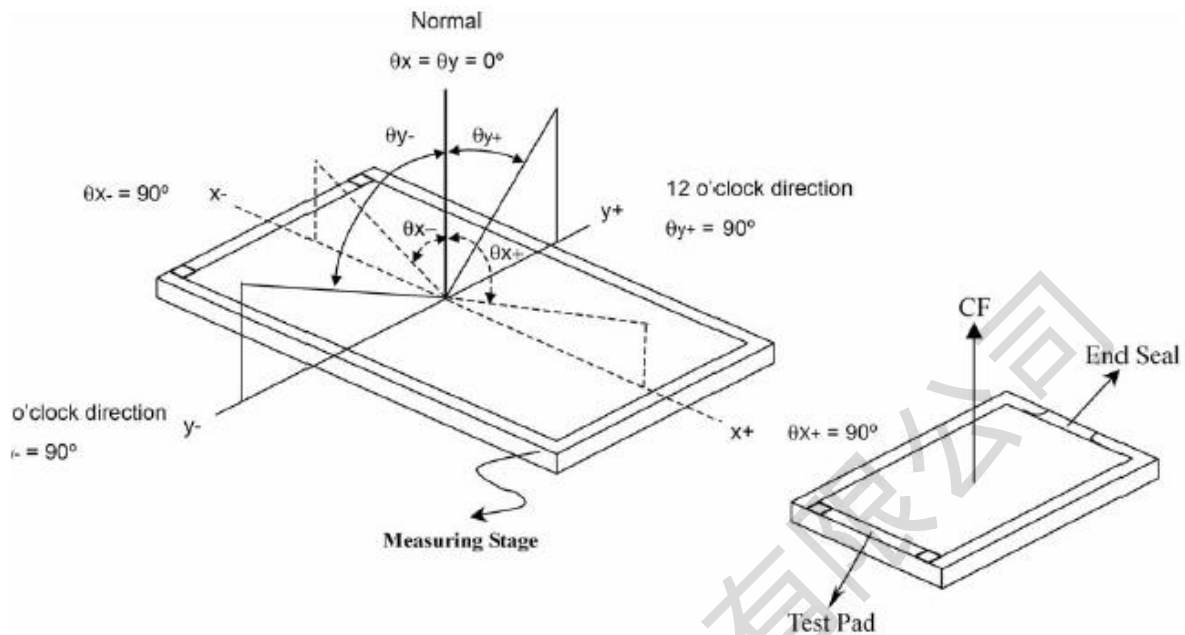
11. Electro-optical Characteristics

Item	Symbol	Conditions	Temp	Min.	Typ.	Max.	Unit	Note
Response Time	T_R	$\theta = \phi = 0$	25°C		TBD	TBD	msec	NOTE2
	T_F				TBD	TBD		
Viewing Angle Range	$\phi = 0^\circ (6'')$	$\phi = 90^\circ (3'')$		$\phi = 180^\circ (12'')$		$\phi = 270^\circ (9'')$		NOTE3
$\theta (25^\circ\text{C}) \text{ CR} \geq 10$	TBD	TBD		TBD		TBD		NOTE3

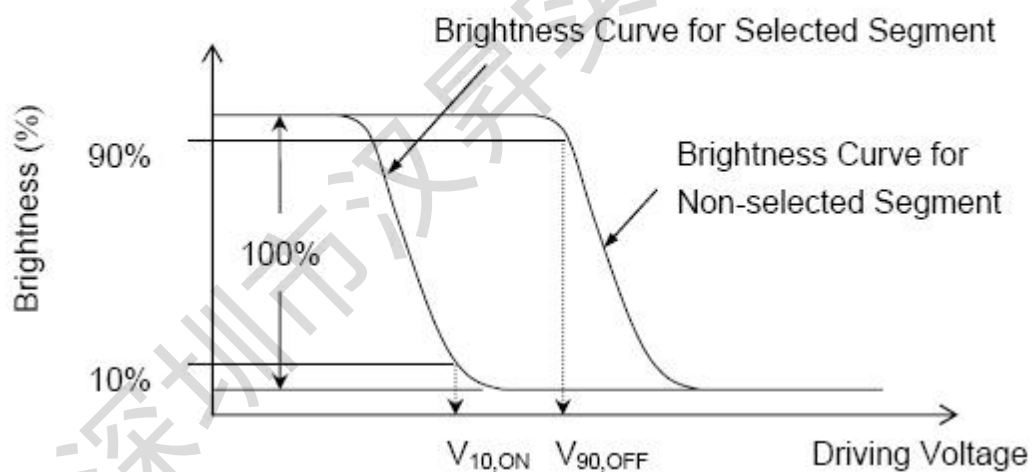
The above “viewing angle” is the measuring position with the largest contrast ratio. Not for good image quality. Viewing direction for good image quality is 12 O'clock.

● For panel only

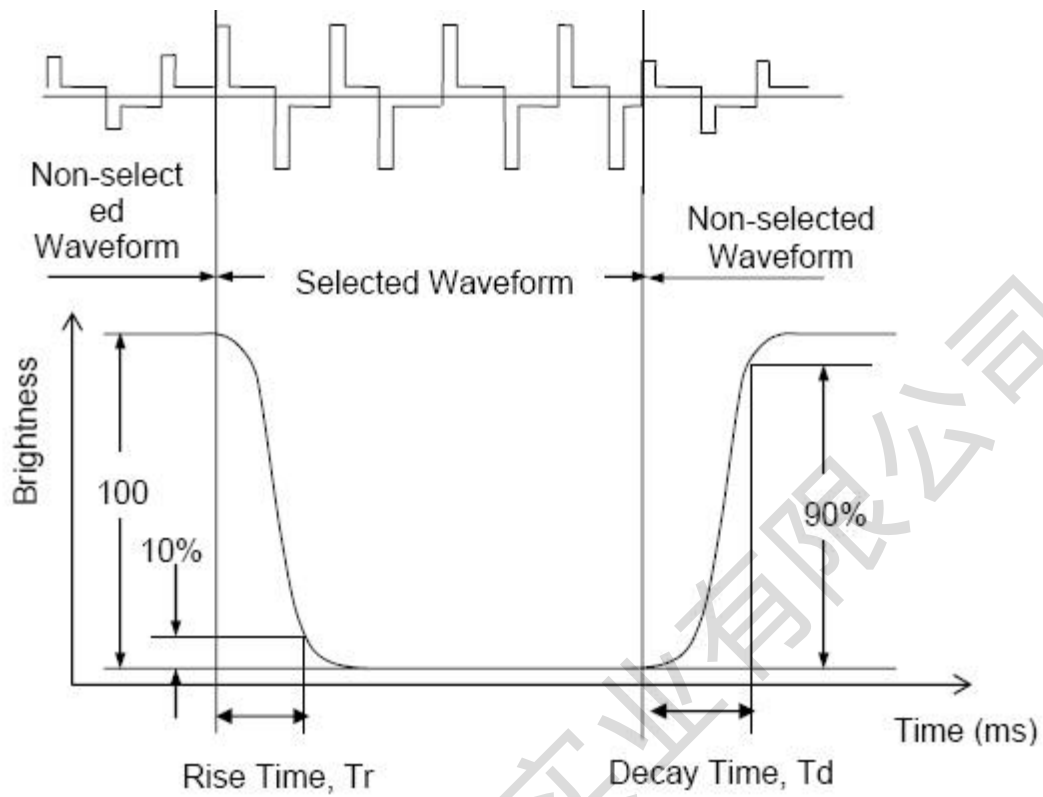
● Electro-Optical Characteristics Test Method



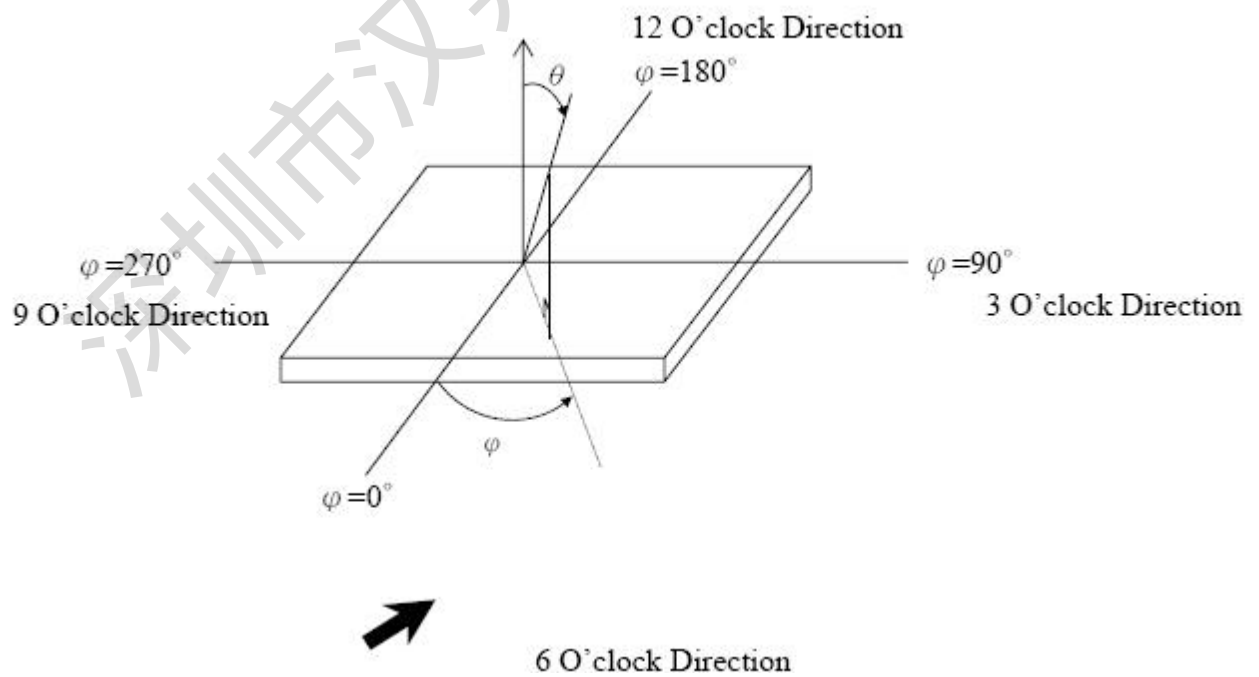
$$V_{op} = (V_{10, ON} + V_{90, OFF})/2$$



.Note2.Definition of Optical Response Time:

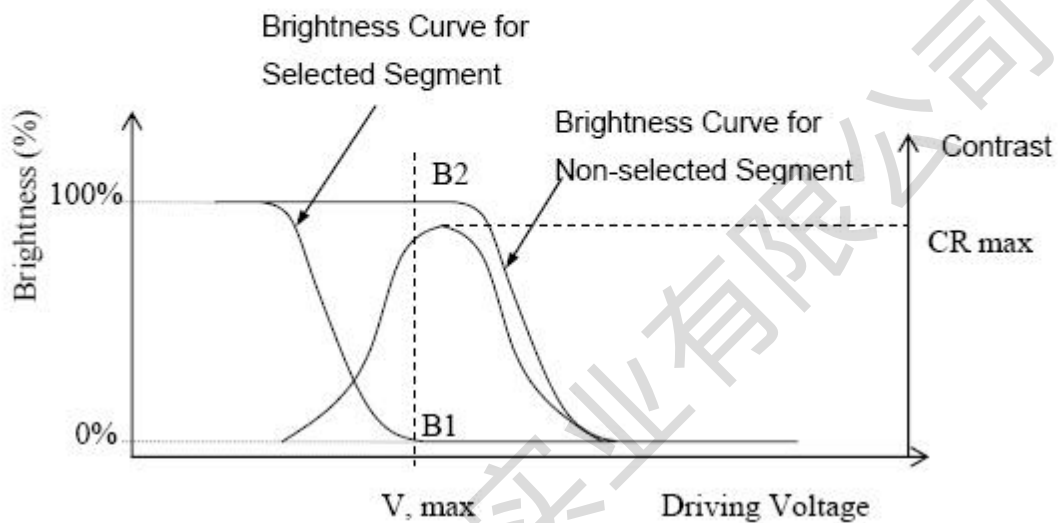


.Note3.Definition of Viewing Angle θ and ϕ :



Note4.Definition of Contrast ratio (CR):

$$CR = \frac{\text{Brightness of Non-selected Segment (B2)}}{\text{Brightness of Selected Segment (B1)}}$$



12. Reliability

12.1 Mtbf

The LCD module shall be designed to meet a minimum MTBF value of 50000 hours with normal

12.2 Test condition

NO.	ITEM	CONDITION	CRITERION
1	High Temperature Non-Operating Test	80°C*240Hrs	◦ No Defect Of Operational Function In Room Temperature Are Allowable ◦ IDD of LCM in Pre-and Post-Test Should Follow Specification
2	Low Temperature Non-Operating Test	-30°C*240Hrs	
3	High Temperature/Humidity Non Operating Test	60°C*90%RH*240Hrs	
4	High Temperature Operating Test	70°C*240Hrs	
5	Low Temperature Operating Test	-20°C*240Hrs	
6	Thermal Shock Test	-20°C (30Min) ↔ 70°C (30Min) *10CYCLES	

Notes:

1. Judgments should be made after exposure in room temperature for two hours.
2. The distill water is used for the high temperature/humidity test.
3. The sample above is individually for every reliability tests condition.

13. Inspection standards

1. AQL (Acceptable Quality Level)

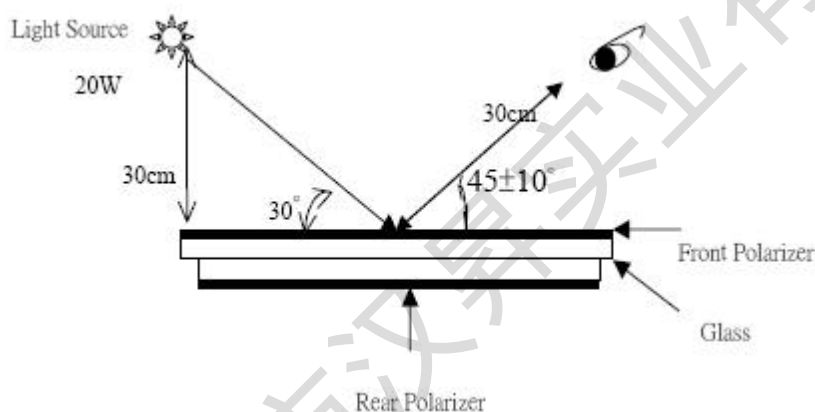
AQL of major and minor defect.

	MAJOR DEFECT	MINOR DEFECT
AQL	0.65	1.5

2. Basic conditions for inspection

The LCM face to us, in normal environment, the lux is 1000 ± 200 . (Darkroom's lux: 100 ± 50), About an angle of incidence 30° , a distance of 30 cm with an angle of 45° to check the products without uncovering the film!

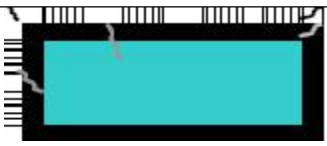
(As shown below)

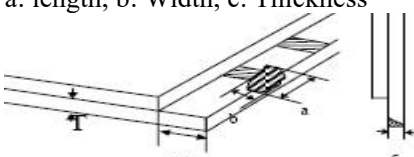
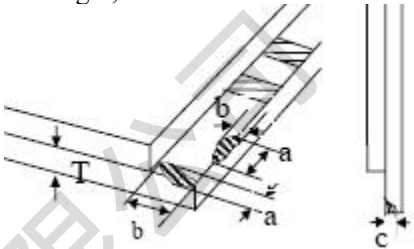
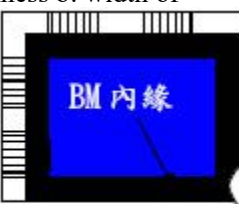


3. Inspection item and criteria

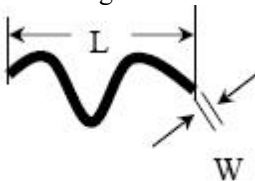
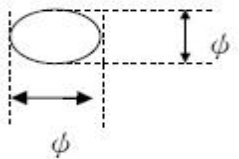
3.1 Visual inspection criterion in immobility

3.1.1 Glass defect

NO	Defect item	Criteria	Remark
1	Dimension Unconformity (Major defect)	By Engineering Drawing	
2	Cracks (Major defect)	1. Linear cracks panel 2. Nonlinear crack contrast by limited sample 【Reject】	
3	Glass extrude the conductive area (minor defect)	a: disregards and no influence assemblage. 1) $b \leq 1/3$ Pin width (non bonding area) 2) bonding area ≤ 0.5 mm 【Accept】	A: Length, b: Width

		【Accept】	
4	Pin-side ,conductive area damaged (minor defect)	(a c: disregards) $b \leq 1/3$ of effective length for bonding electrode 【Accept】	a: length, b: Width, c: Thickness 
5	Pin-side,non-conductive area damaged (minor defect)	1)Damage area don't touch the ITO (Including contraposition mark, except scribing mark) 【Accept】 2) $C < T$ $b \leq BM/3$ of width 【Accept】 3) $c = T$ b not touch the seal glue 【Accept】 4)a disregards	a: Length, b: Width c: Thickness 
6	Non-pin-side damage (minor defect)	$c < T$ 1)b exceeds $1/3 B_m$ 【Reject】 $c = T$ b not touch the seal glue 【Reject】	c: Thickness b: width of  damage

3.1.2LCD appearance defect(View area)

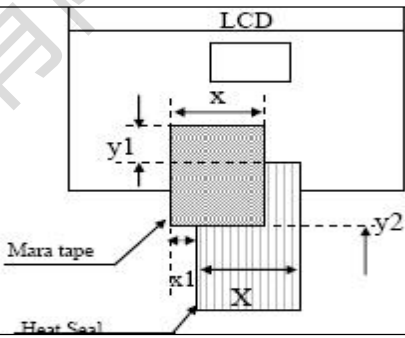
NO	Defect item	Criteria		Remark
1	Fiber、glass cratch、polarizer scratch/folded (minor defect)	Specification	Allowable	note1:L: Length, W: Width note2: disregard if out of AA 
		$W \leq 0.03\text{mm}$	disregard	
		$0.03\text{mm} < W \leq 0.05\text{mm};$ $L \leq 3.0\text{mm}$	2	
		$0.05\text{mm} < W \leq 0.1\text{mm};$ $L \leq 3.0\text{mm}$	1	
		$W > 0.1\text{mm}; L > 3.0\text{mm}$	0	
2	Polarizer bubble、concave and convex (minor defect)	$\phi \leq 0.2\text{mm}$	disregard	note1: $\phi = (L+W)/2$, L:Length, W :Width note2:disregard if out of AA
		$0.2\text{mm} < \phi \leq 0.3\text{mm}$	2	
		$0.3\text{mm} < \phi \leq 0.5\text{mm}$	1	
		$0.5\text{mm} < \phi$	0	
3	Black dots、dirty dots、impurities、eye winker (minor defect)	$\phi \leq 0.15\text{mm}$	disregard	note2:disregard if out of AA 
		$0.15\text{mm} < \phi \leq 0.25\text{mm}$	2	
		$0.25\text{mm} < \phi \leq 0.3\text{mm}$	1	
		$0.3\text{mm} < \phi$	0	
4	Polarizer prick	$\phi \leq 0.1\text{mm}$	disregard	note1: $\phi = (L+W)/2$, L=Length,

	(minor defect)	$0.1\text{mm} < \phi \leq 0.25\text{mm}$	3	W=Width note2:the distance between two dots>5mm
		$\phi > 0.25\text{mm}$	0	

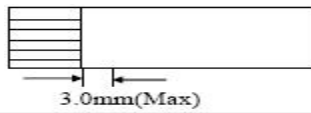
3.1.3FPC

NO	Defect item	Criteria		Remark
1	Copper screen peel (minor defect)	Copper screen peel 【Reject】		
2	No release tape or peel	No release tape or peel 【Reject】		
3	Dirty dot and impurity of FPC for customer using side (minor defect)	Specification	Allowable	Note1: Cannot have stride ITO impurities
		$\phi \leq 0.25\text{mm}$	2	
		$\phi > 0.25$	0	

3.1.4Black tape & Mara tape

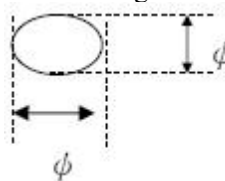
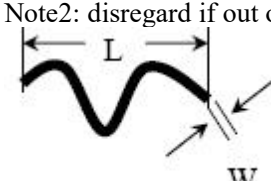
NO	Defect item	Criteria	Remark
1	FPC or H/S black tape (minor defect)	1. shift spec: 1) glue to the polarize 【Reject】 2) IC bare 【Reject】 2. left-and-right spec: 1) exceed of FPC edge or H-S edge 【Reject】 2) IC bare 【Reject】	
2	No black tape (major defect)	No black tape 【Reject】	
3	Tape position mistake (minor defect)	Not by engineering drawing	
4	Mara tape defect (minor defect)	Peel before pulling the protecting film 【Reject】	

3.1.5Silicon and Taffy glue

NO	Defect item	Criteria	Remark
1	Quantity of silicon (major defect)	Uncover the ITO and circuit area 【Reject】	note: compared by engineering
2	Taffy glue (major defect)	1.Uncover the reveal copper area【Reject】 2.Cover layer 0.3mm(Min)~3.0mm(Max) 【Reject】	note: if customer has special requirement, refer to the technical document 
3	Depth of glue covering (major defect)	Depth of glue covering overtop front Polarizer 【Reject】	Except of the special requirement

3.2Electrical criteria

NO	Defect item	Criteria	Remark
----	-------------	----------	--------

1	No display (major defect)	No display 【Reject】		
2	Missing line (major defect)	Missing line 【Reject】		
3	Seg-com light and dark (major defect)	Seg-com light and dark 【Reject】	ND filter 2% test	
4	No display in immobility (major defect)	No display in immobility 【Reject】		
5	Flicker of Pattern (major defect)	Flicker of Pattern 【Reject】		
6	Mura (major defect)	ND filter 2%test		
7	Over current (major defect)	Over current 【Reject】		
8	Voltage out of specification (major defect)	Voltage out of specification 【Reject】		
9	Pattern blur, error code (major defect)	Pattern blur, error code 【Reject】		
10	Dark light, Flicker (major defect)	Dark light, Flicker 【Reject】		
11	Black/white dots、 Dirty dots、 eye winker (major defect)	Specification	Allowable	Note1:disregard if out of AA 
		$\phi \leq 0.15\text{mm}$	disregard	
		$0.15\text{mm} < \phi \leq 0.25\text{mm}$	2	
		$0.25\text{mm} < \phi \leq 0.3\text{mm}$	1	
		$0.3\text{mm} < \phi$	0	
12	Fiber、glass crutch、Polarizer scratch/folded (major defect)	$W \leq 0.03\text{mm}$	disregard	Note1:L: Length, W: Width Note2: disregard if out of AA 
		$0.03\text{mm} < W \leq 0.05\text{mm}$ $L \leq 3.0\text{mm}$	2	
		$0.05\text{mm} < W \leq 0.1\text{mm}$ $L \leq 3.0\text{mm}$	1	
		$W > 0.1\text{mm}; L > 3.0\text{mm}$	0	

14.Precautions for using LCD modules.

14.1 Safety

- (1)Do not swallow any liquid crystal ,even if there is no proof that liquid crystal is poisonous.
- (2)If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
- (3)If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

14.2 Srorang Conditions

- (4)Store the panel or module in a dark place where the temperature is $23 \pm 5^{\circ}\text{C}$ and the humidity is below $45 \pm 20\% \text{RH}$.
- (5)Store in anti-static electricity container.
- (6)Store in clean environment, free from dust, active gas, and solvent.
- (7)Do not place the module near organics solvents or corrosive gases.
- (8))Do not crush, shake, or jolt the module.

14.3 Handling Precautions

- (9)Avoid static electricity, which can damage the CMOS LSI.
- (10)The polarizing plate of the display is very fragile, please handle if very carefully.
- (11)Do not give external shock.
- (12)DO not apply excessive force on the surface.
- (13)Bo not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- (14)Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (15)Do not operate it above the absolute maximum rating.
- (16)Do not remove the panel or frame from the module.

14.4Warranty

The period is within twelve months since the date of shipping out under normal using and storage conditions.

15.Revision history

16. The appendix

```
void LCD_Init(void)
{
    LCD_RES_Clr(); //复位
    delay_ms(100);
    LCD_RES_Set();
    delay_ms(100);

    LCD_BLK_Set(); //打开背光
    delay_ms(100);
    //***** Start Initial Sequence *****//
    LCD_WR_REG(0x11); //Sleep out
    delay_ms(120); //Delay 120ms
    //***** Start Initial Sequence *****//
    LCD_WR_REG(0xCF);
    LCD_WR_DATA8(0x00);
    LCD_WR_DATA8(0xD9);
    LCD_WR_DATA8(0X30);

    LCD_WR_REG(0xED);
    LCD_WR_DATA8(0x64);
    LCD_WR_DATA8(0x03);
    LCD_WR_DATA8(0X12);
    LCD_WR_DATA8(0X81);

    LCD_WR_REG(0xE8);
    LCD_WR_DATA8(0x85);
    LCD_WR_DATA8(0x10);
    LCD_WR_DATA8(0x78);

    LCD_WR_REG(0xCB);
    LCD_WR_DATA8(0x39);
    LCD_WR_DATA8(0x2C);
    LCD_WR_DATA8(0x00);
    LCD_WR_DATA8(0x34);
    LCD_WR_DATA8(0x02);

    LCD_WR_REG(0xF7);
    LCD_WR_DATA8(0x20);

    LCD_WR_REG(0xEA);
    LCD_WR_DATA8(0x00);
```

```

LCD_WR_DATA8(0x00);

LCD_WR_REG(0xC0);    //Power control
LCD_WR_DATA8(0x21);  //VRH[5:0]

LCD_WR_REG(0xC1);    //Power control
LCD_WR_DATA8(0x12);  //SAP[2:0];BT[3:0]

LCD_WR_REG(0xC5);    //VCM control
LCD_WR_DATA8(0x32);
LCD_WR_DATA8(0x3C);

LCD_WR_REG(0xC7);    //VCM control2
LCD_WR_DATA8(0xC1);

LCD_WR_REG(0x36);    // Memory Access Control
LCD_WR_DATA8(0x08);

LCD_WR_REG(0x3A);
LCD_WR_DATA8(0x55);

LCD_WR_REG(0xB1);
LCD_WR_DATA8(0x00);
LCD_WR_DATA8(0x18);

LCD_WR_REG(0xB6);    // Display Function Control
LCD_WR_DATA8(0x0A);
LCD_WR_DATA8(0xA2);

LCD_WR_REG(0xF2);    // 3Gamma Function Disable
LCD_WR_DATA8(0x00);

LCD_WR_REG(0x26);    //Gamma curve selected
LCD_WR_DATA8(0x01);

LCD_WR_REG(0xE0);    //Set Gamma
LCD_WR_DATA8(0x0F);
LCD_WR_DATA8(0x20);
LCD_WR_DATA8(0x1E);
LCD_WR_DATA8(0x09);
LCD_WR_DATA8(0x12);
LCD_WR_DATA8(0x0B);
LCD_WR_DATA8(0x50);

```

```
LCD_WR_DATA8(0xBA);
LCD_WR_DATA8(0x44);
LCD_WR_DATA8(0x09);
LCD_WR_DATA8(0x14);
LCD_WR_DATA8(0x05);
LCD_WR_DATA8(0x23);
LCD_WR_DATA8(0x21);
LCD_WR_DATA8(0x00);

LCD_WR_REG(0xE1);    //Set Gamma
LCD_WR_DATA8(0x00);
LCD_WR_DATA8(0x19);
LCD_WR_DATA8(0x19);
LCD_WR_DATA8(0x00);
LCD_WR_DATA8(0x12);
LCD_WR_DATA8(0x07);
LCD_WR_DATA8(0x2D);
LCD_WR_DATA8(0x28);
LCD_WR_DATA8(0x3F);
LCD_WR_DATA8(0x02);
LCD_WR_DATA8(0x0A);
LCD_WR_DATA8(0x08);
LCD_WR_DATA8(0x25);
LCD_WR_DATA8(0x2D);
LCD_WR_DATA8(0x0F);
LCD_WR_REG(0x29);    //Display on
}
```