MODEL NO. : TM025ZDZ01

ISSUED DATE: 2011-6-1

VERSION : Ver 1.4

■Preliminary Specification

□Final Product Specification

Customer :

Approved by	Notes

SHANGHAI TIANMA Confirmed :

Prepared by	Checked by	Approved by

This technical specification is subjected to change without notice

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2011-1-5	Preliminary specification release	Jin Zhao
1.1	2011-2-17	Update the packing and add the IIS.	Jin Zhao
1.2	2011-2-21	Add dimension inspection	Jin Zhao
1.3	2011-3-8	Modify the mechanical drawing	Jin Zhao
1.4	2011-6-1	Update power consumption, add initial code, add flicker spec, add backlight, bottom bezel and FPC drawing, update mechanical drawing	Jin Zhao

1 General Specifications

Feature		Spec
Display Spec.	Size	2.48”
	Resolution	320(RGB)x320
	Interface	3-Wire 9 bit SPI+24 bit RGB
	Driving IC	S6D05A1
	Technology type	a-si TFT
	Pixel pitch (mm)	0.1395x0.1395
	Display colors	16.7M
	Pixel Configuration	RGB Vertical Stripe
	Display Mode	TM,NW
	Surface Treatment	HC
	Viewing Direction	12 o’clock
	Gray Scale Inversion Direction	6 o’clock
Mechanical Characteristics	LCM (W x H x D) (mm)	50.44×56.34×2.6
	Active Area(mm)	44.64 x 44.64
	With /Without TSP	Without TP
	Weight (g)	15.18
	LED Numbers	4

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

Note 2: Requirements on Environmental Protection: Q/S0002

Note 3: LCM weight tolerance: ± 5%

2 INPUT TERMINALS PIN ASSIGNMENT

Recommended Connector: FH26-41S-0.3SHW

No	Symbol	I/O	Description	Comment
1	LEDA	P	LED anode	
2	LEDK	P	LED cathode	
3	RESET	I	Reset Signal	
4	VSYNC	I	Vertical Sync signal in RGB mode	
5	HSYNC	I	Horizontal Sync signal in RGB mode	
6	ENABLE	I	Data Enable signal in RGB mode	
7	DOTCLK	I	Pixel clock signal in RGB mode	
8	GND	P	Power Ground	
9	DB23	I	Data bus	
10	DB22	I	Data bus	
11	DB21	I	Data bus	
12	DB20	I	Data bus	
13	DB19	I	Data bus	
14	DB18	I	Data bus	
15	DB17	I	Data bus	
16	DB16	I	Data bus	
17	DB15	I	Data bus	
18	DB14	I	Data bus	
19	DB13	I	Data bus	
20	DB12	I	Data bus	
21	GND	P	Power Ground	
22	DB11	I	Data bus	
23	DB10	I	Data bus	
24	DB9	I	Data bus	
25	DB8	I	Data bus	
26	DB7	I	Data bus	
27	DB6	I	Data bus	
28	DB5	I	Data bus	
29	DB4	I	Data bus	
30	DB3	I	Data bus	
31	DB2	I	Data bus	
32	DB1	I	Data bus	
33	DB0	I	Data bus	
34	CS	I	Chip select signal	

35	SDI	I	Serial data bus	
36	SDO	O	Serial data output	
37	SCL	I	Serial interface clock in Serial Interface	
38	GND	P	Power Ground	
39	NC	-	Floating	
40	VCC	P	Power Supply of Analog Circuit	
41	IOVCC	P	Power Supply of Logic Circuit	

Table 2.1 Input terminal pin assignment

I---Input, O---Output, P--- Power/Ground

3 ABSOLUTE MAXIMUM RATINGS

Ta = 25℃

Item	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	IOVCC	-0.3	4.6	V	
Analog Supply Voltage	VCC	-0.3	4.6	V	
Input voltage	CS/SDI/SCL/HSYNC/VSYNC/DB[23:0]/DOTCLK/ENABLE/RESET	-0.3	IOVCC+0.5	V	
Back Light Forward Current	I_F	-	25	mA	ONE LED
Operating Temperature	T_{op}	-20	70	℃	
Storage Temperature	T_{st}	-30	80	℃	

Table 3.1 Absolute maximum rating

4 ELECTRICAL CHARACTERISTICS

4.1 LCD Module

GND=0V,Ta=25℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage		IOVCC	1.65	1.8/2.8	3.3	V	
Analog Supply Voltage		VCC	2.3	2.8	3.3	V	
Input Signal Voltage	High Level	VIH	0.7xIOVCC	-	IOVCC	V	
	Low Level	VIL	-	-	0.3xIOVCC	V	
Output Signal Voltage	High Level	VOH	0.8xIOVCC	-	-	V	
	Low Level	VOL	-	-	0.2xIOVCC	V	
(Panel+LSI) Power Consumption		Black Mode	-	2.25	-	m W	
		8 color Mode	-	1.11	-	m W	
		Sleeping Mode	-	0.039	-	m W	

Table 4.1 LCD module electrical characteristics

4.2 Backlight Unit

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	20	-	mA	One LED
Forward Voltage	V_F	(2.9)	3.2	(3.4)	V	One LED
Backlight Power Consumption	W_{BL}	-	256	-	mW	4 LEDs

Table 4.2.1 backlight unit electrical characteristics

Figure 4.2.1 LED backlight circuit

4.3 Block Diagram

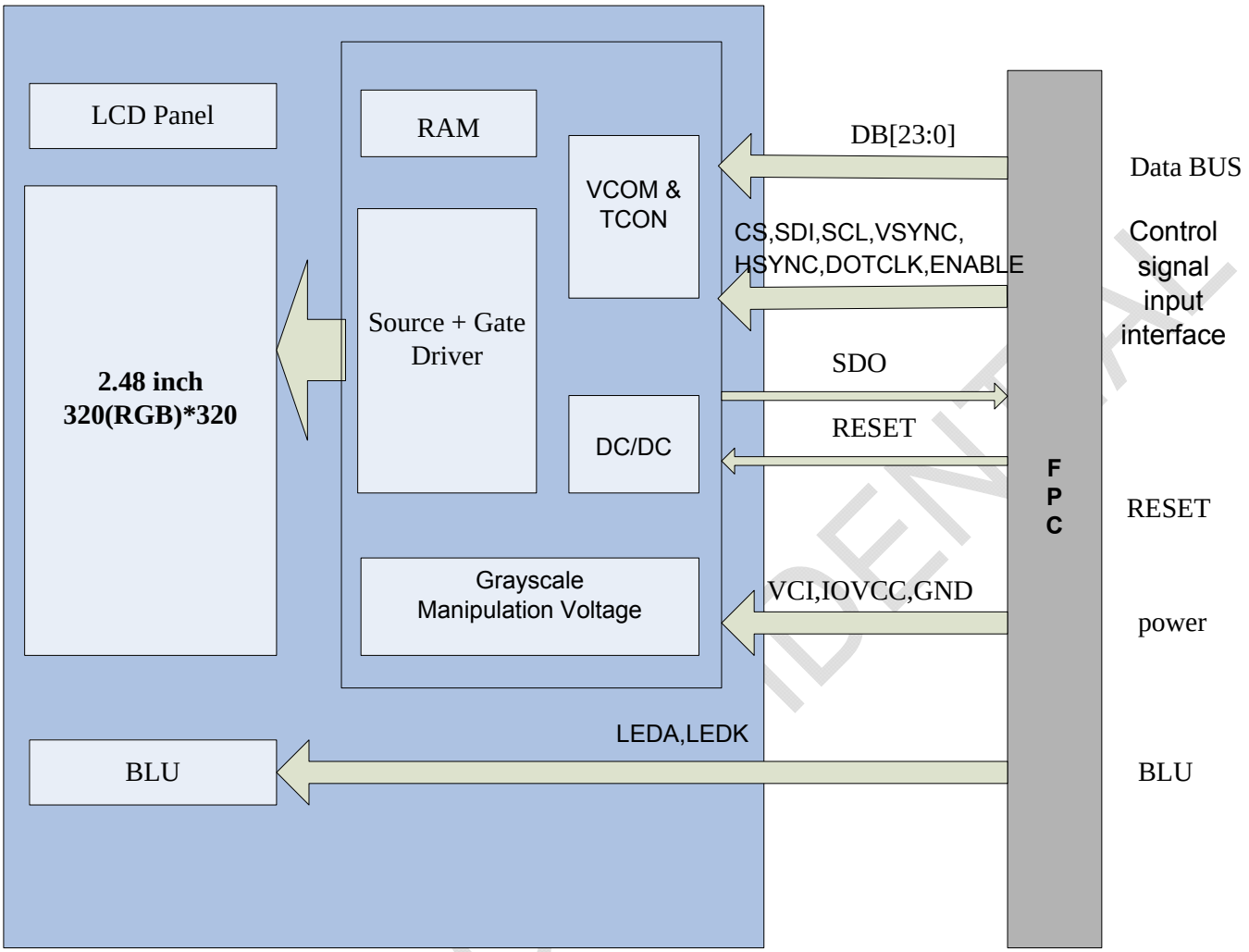


Figure 4.3 LCD module diagram

5 INTERFACE TIMING

5.1 Timing Parameter

5.1.1 For SPI Interface

Characteristic	Symbol	Specification		Unit
		Min.	Max.	
Serial clock write cycle time	tscycw	66	-	ns
Serial clock read cycle time	tscycr	150	-	ns
Serial clock rise / fall time	tR, tF	-	Note	ns
Pulse width high for write	tSCHW	15	-	ns
Pulse width high for read	tSCHR	60	-	ns
Pulse width low for write	tSCLW	15	-	ns
Pulse width low for read	tSCLR	60	-	ns
Chip Select setup time	tCSS	15	-	ns
Chip Select hold time	tCSH	15	-	ns
Serial input data setup time	tSIDS	15	-	ns
Serial input data hold time	tSIDH	15	-	ns
Serial output data delay time	tSODD	5	50	ns
Serial output data hold time	tSODH	15	75	ns

Table 5.1.1 timing parameter

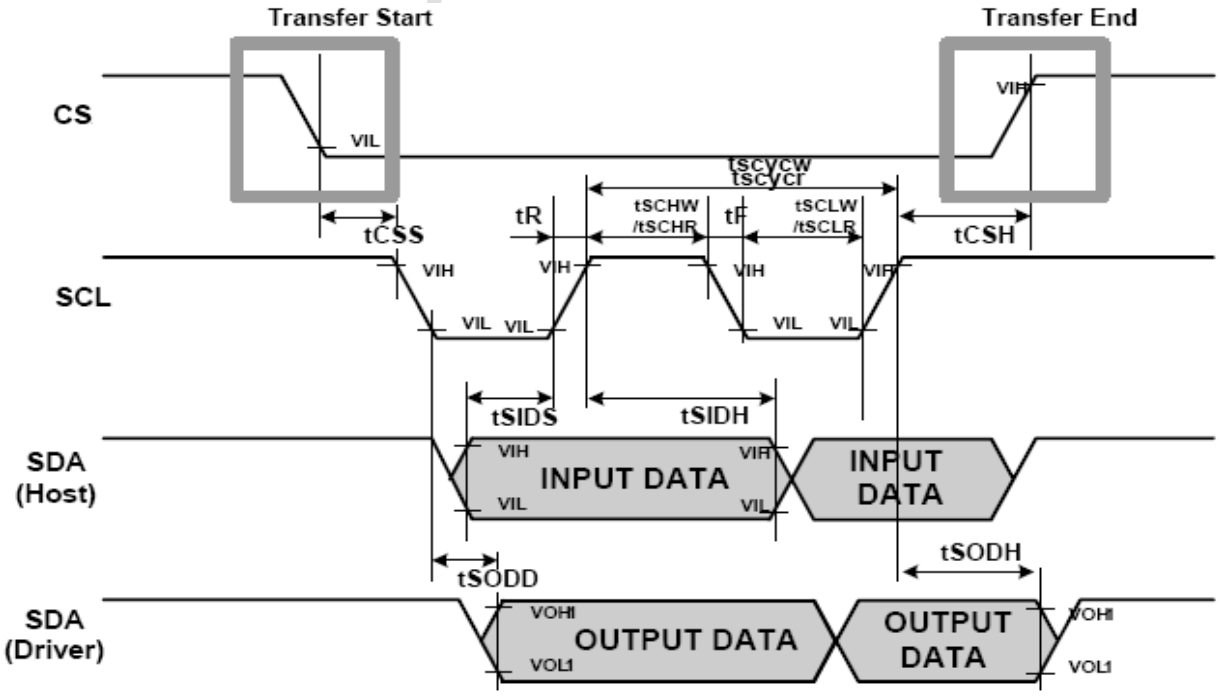


Figure 5.1.1 SPI interface characteristics

5.1.2 For RGB Interface

Parameter	Description	Min	Max	Unit
tDCYC	DOTCLK period	47	-	ns
tDWL	DOTCLK pulse width low	15	-	ns
tDWH	DOTCLK pulse width high	15	-	ns
tDR / tDF	DOTCLK rising / falling time		Note	ns
tSYNCS	VSYNC, HSYNC setup	13	-	ns
tENS	ENABLE setup	13	-	ns
tENH	ENABLE hold	13	-	ns
tDS	Input Data setup	13	-	ns
tDH	Input Data hold	13	-	ns

Table 5.1.2 timing parameter

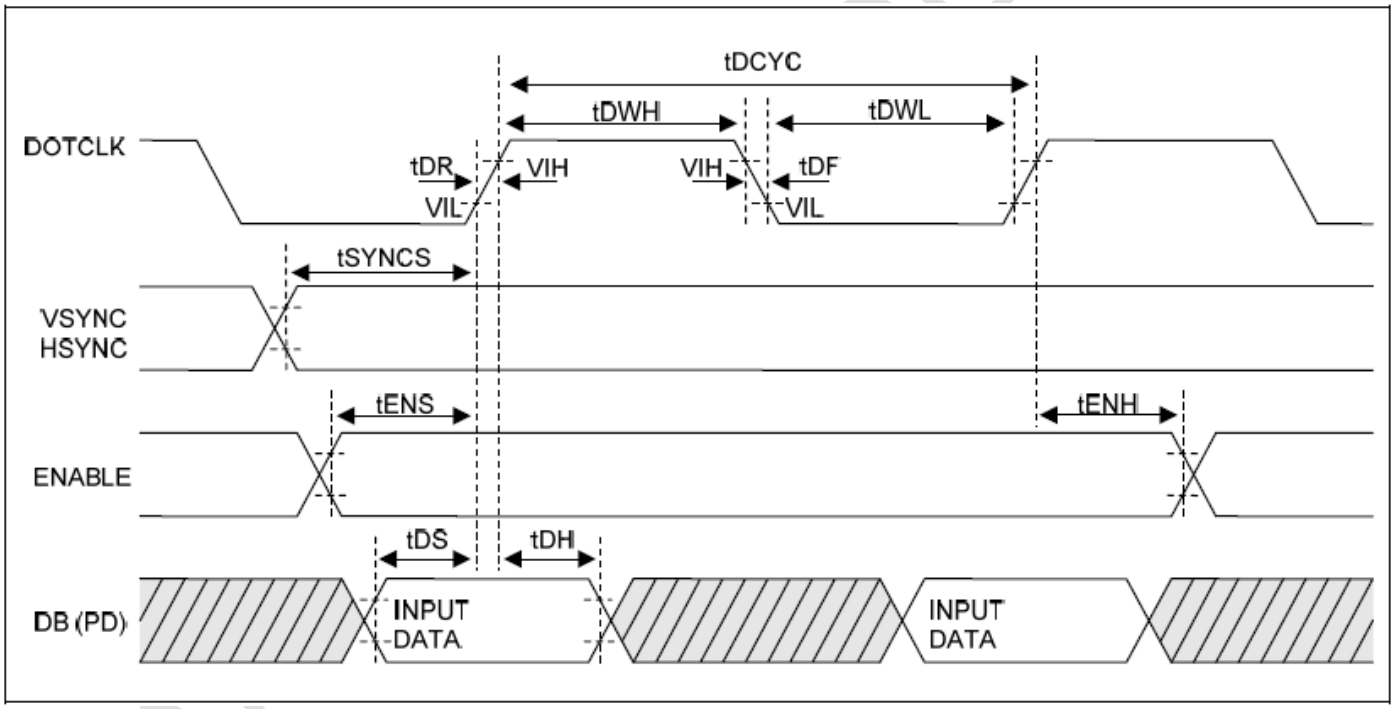


Figure 5.1.2 RGB interface characteristics

5.1.3 24-BIT RGB Interface

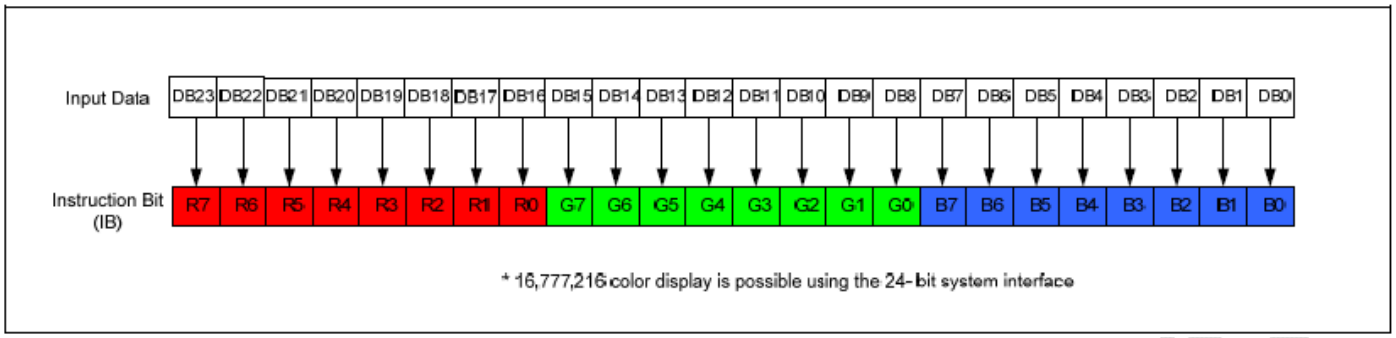


Table 5.1.3 Bit Assignment of GRAM Data on 24bit RGB Interface

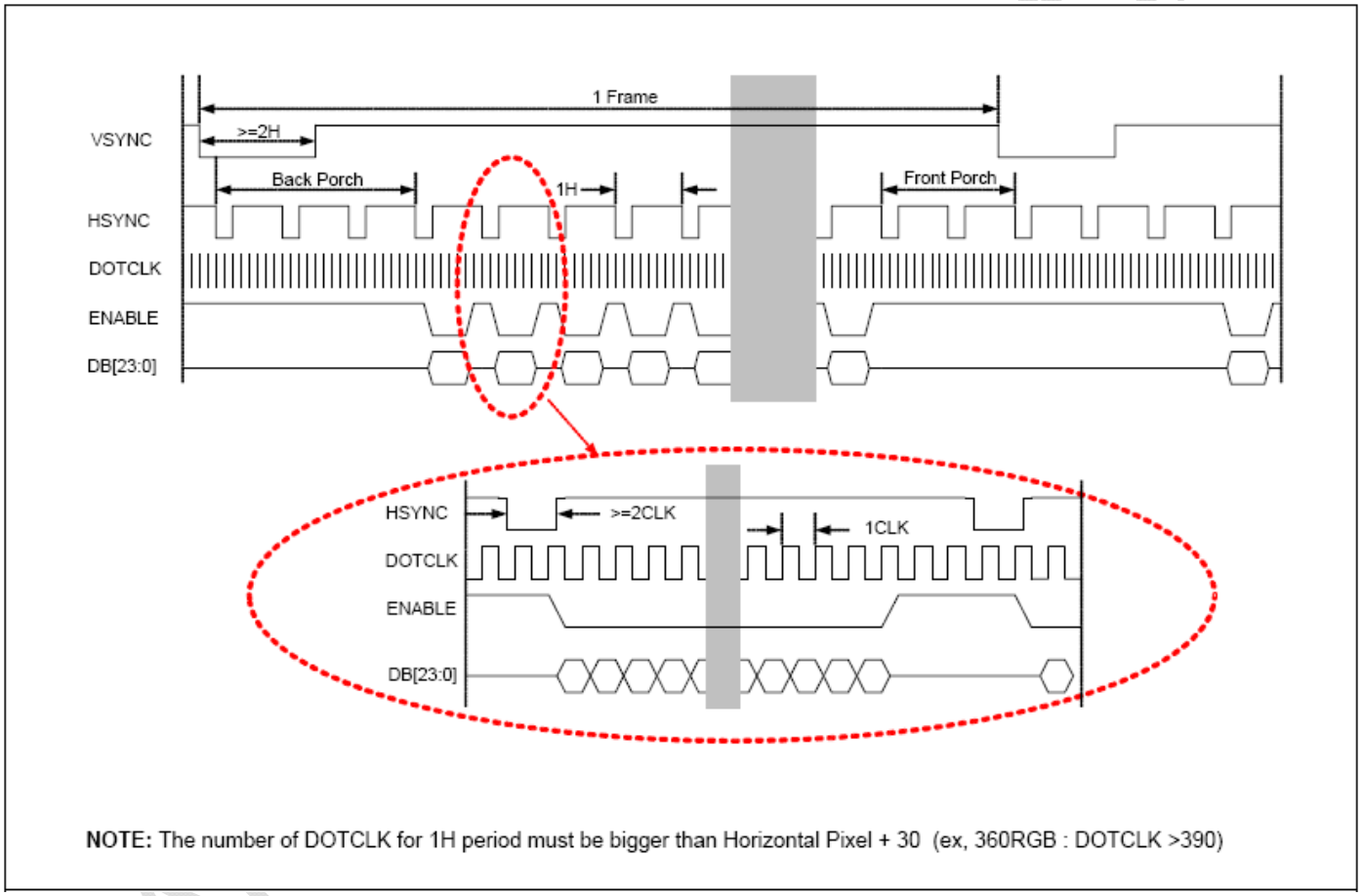


Figure 5.1.3 Timing Diagram of 24bit RGB Interface

5.2 Register write/read timing in SPI mode

a. Write to register

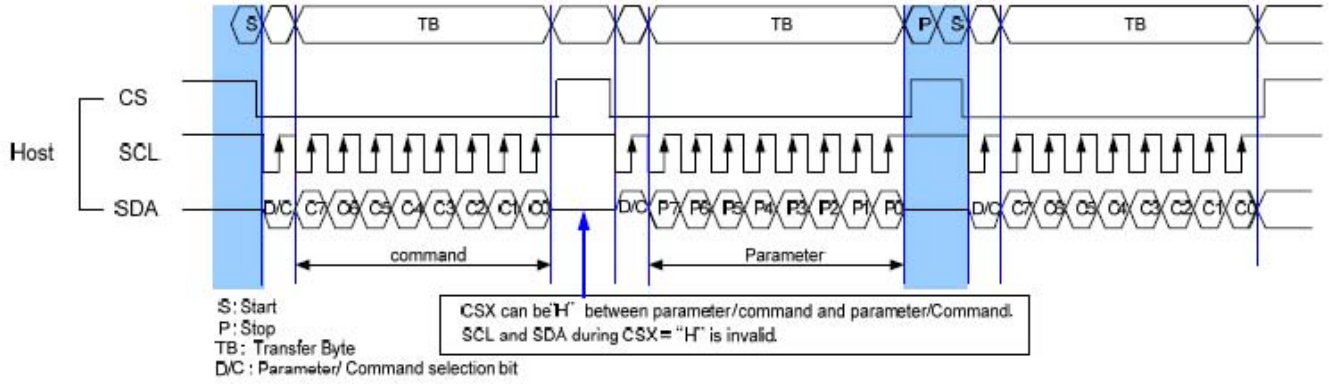
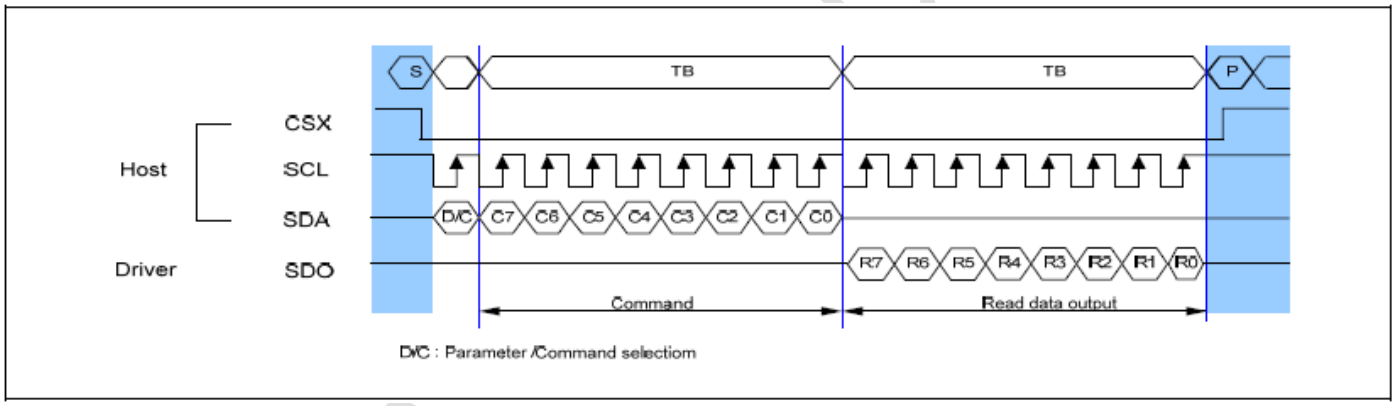


Figure 5.2 Register write timing in SPI interface

b. Read from register

b-1 Read 1-byte mode



b-2 Read multi-byte mode

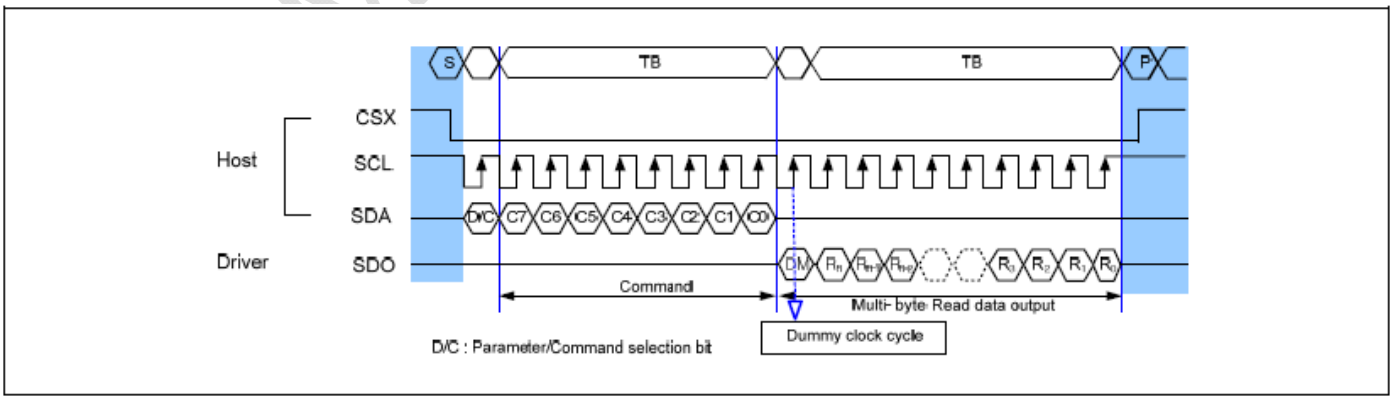


Figure 5.3 Register read timing of SPI interface

5.3 RESET TIMING

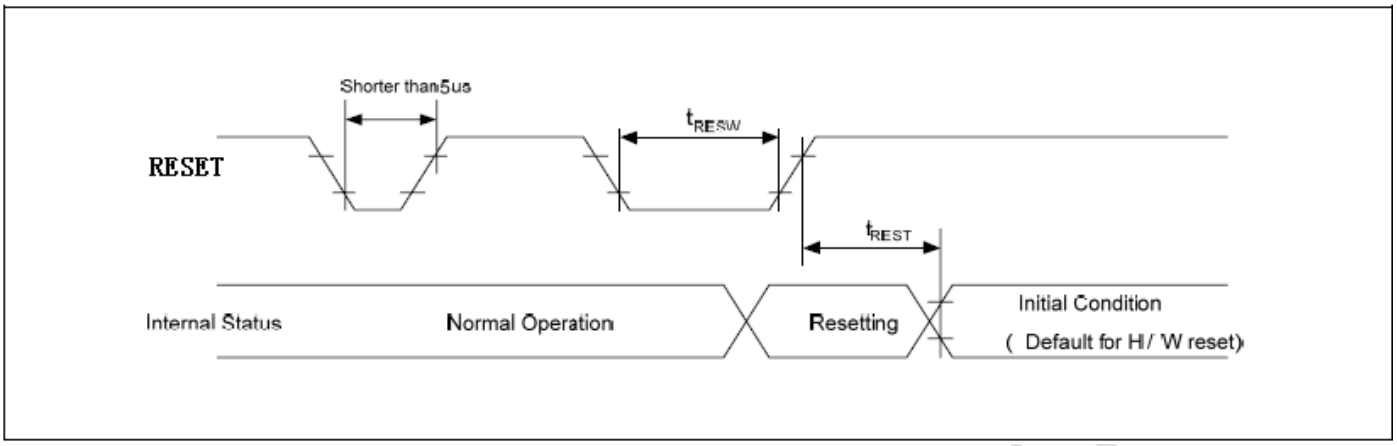


Figure 5.4 RESET Input timing

Symbol	Parameter	Pad	Min	Typ	Max	Unit	Note
tRESW	Reset low pulse width	RESX	10	-	-	µs	-
tREST	Reset completion time	RESX	-	-	5	ms	Reset during Sleep In mode
		RESX		-	120	ms	Reset during Sleep Out mode

Table 5.4-1 APON=0

Symbol	Parameter	Pad	Min	Typ	Max	Unit	Note
tRESW	Reset low pulse width	RESX	10	-	-	µs	-
tREST	Reset completion time	RESX	-	-	5	ms	Reset during Sleep In mode
		RESX		-	5	ms	Reset during Sleep Out mode

Table 5.4-2 APON=1

Symbol	Parameter	Pad	Min	Typ	Max	Unit	Note
tRESW	Reset low pulse width	RESX	50	-	-	µs	-
tREST	Reset completion time	RESX	-	-	5	ms	Reset during Deep standby mode

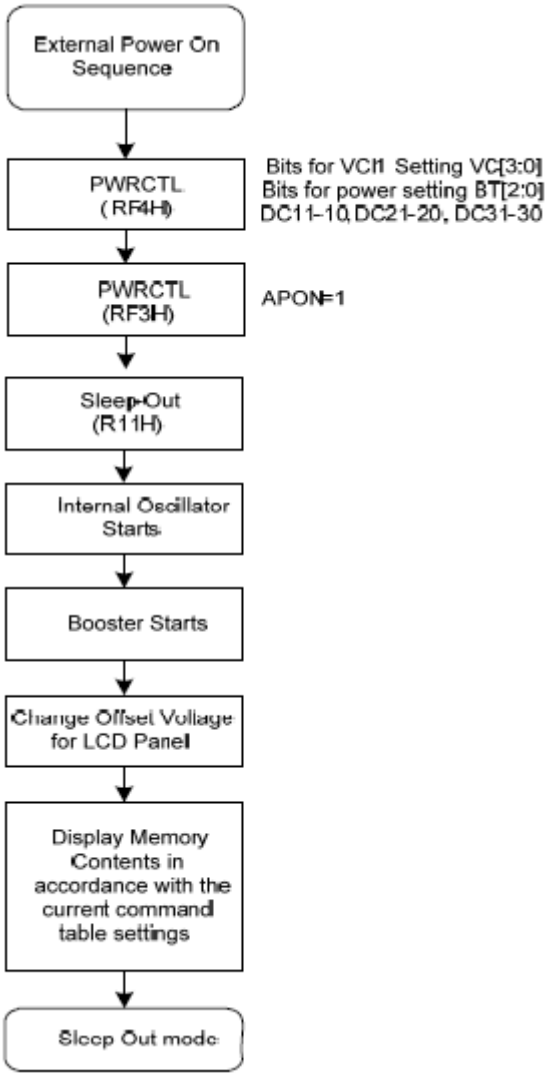
Table 5.4-3 Deep Standby

NOTE:

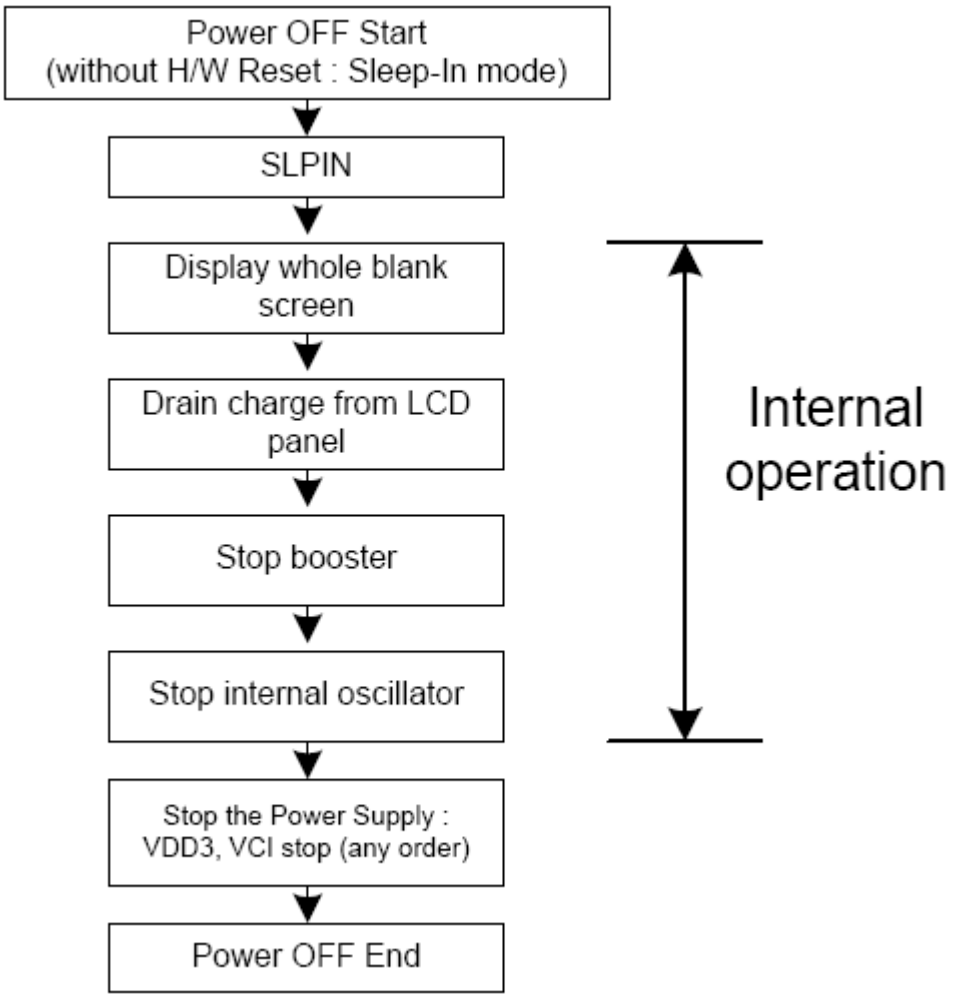
This is an automatic-boosting-operation-starting bit for the booster circuits. In case of APON=0, the automatic boosting sequence starter is halted and the booster circuits are operated independently by AVDD_EN, VGH_EN, VGL_EN and VCL_EN bits. In case of APON=1, booster circuits are operated automatically and sequentially.

Default value is 1.

5.6 Power on Sequence when APON=1



5.7 Power off Sequence



5.8 Initial code

This version initial code is released on May 9.

```
void S6D05A1_init()
{
        RST_High;
        Delay(100); //1ms
        RST_Low;
        Delay(100);//10ms
        RST_High;
        Delay(120);//100ms

        WriteCommand(0x01);
        Delay(50);//100ms

        WriteCommand(0xF0);
          WriteData(0x5A);
          WriteData(0x5A);

    WriteCommand(0xF1);
          WriteData(0x5A);
          WriteData(0x5A);

    WriteCommand(0xF2);
          WriteData(0x27);//G1~G320    NL[5:0]
          WriteData(0x30);//NHW[6:0]
          WriteData(0x03);//PIINV IINV PINV NINV
          WriteData(0x08);//NVBP[7:0]
          WriteData(0x08);//NVFP[7:0]
          WriteData(0x08);//- - - - - - - - -
          WriteData(0x08);//- - - - - - - - -
          WriteData(0x00);//- - - - - - - - -
          WriteData(0x08);//- - - - - - - - -
          WriteData(0x08);//- - - - - - - - -
          WriteData(0x00);//- - - - - - - - -
          WriteData(0x01);//- - - - SM GS REV
          WriteData(0x00);//- - - - - - - -
          WriteData(0x00);//- - - - - - - -
          WriteData(0x54);//PIHW[6:0]
          WriteData(0x08);//PIVBP[7:0]
```

```
        WriteData(0x08);//PIVFP[7:0]
        WriteData(0x08);//RGB_NVBP[7:0]
        WriteData(0x08);//RGB_NVFP[7:0]

    WriteCommand(0xF4);
        WriteData(0x08);
        WriteData(0x00);
        WriteData(0x00);
        WriteData(0x00);
        WriteData(0x00);
        WriteData(0x00);
        WriteData(0x00);
        WriteData(0x00);
        WriteData(0x00);
        WriteData(0x00);
        WriteData(0x66);    //52 GVDD=4.5V/    AVDD=2VCI1
        WriteData(0x02);    //VGH=15V,VGL=-7.5V
        WriteData(0x00);
        WriteData(0x52);
        WriteData(0x02);

    WriteCommand(0xF5);
        WriteData(0x00);
        WriteData(0x5C);
        WriteData(0x5D);    // VCOM=5.4V       //51
        WriteData(0x00);
        WriteData(0x00);
        WriteData(0x04);
        WriteData(0x00);
        WriteData(0x00);
        WriteData(0x04);
        WriteData(0x00);
        WriteData(0x2A);
        WriteData(0x21);

    WriteCommand(0xF6);//SRCCTL (Source Control)
        WriteData(0x01);//- - - - - SVCIR[2] SVCIR[1] SVCIR[0]
        WriteData(0x00);//- - - SEL_360 - - - SG
        WriteData(0x08);//- - - - SAP[3] SAP[2] SAP[1] SAP[0]
        WriteData(0x03);//- - - - - - OCM[1] OCM[0]
```

```
WriteData(0x01);//- - - - NSDT[2] NSDT[1] NSDT[0]
WriteData(0x01);//- - - NSR_BLK[1]NSR_BLK[0]SR_ND
WriteData(0x01);//- - - PISDT[2] PISDT[1] PISDT[0]
WriteData(0x00);//- - - PISR_BLK[1] PISR_BLK[0]- -
WriteData(0x00);//- -

WriteCommand(0xF7);//IFCTL (Interface Control)
WriteData(0x48);//MY_EOR MX_EOR MV_EOR ML_EOR BGR_EOR - - -
WriteData(0x81);//IPM[2] IPM[1] IPM[0] MDT[1] MDT[0]SELF_REF DM[1] DM[0]
WriteData(0x30);//VPL HPL DPL EPL ENDIAN - TE_MON RIM
WriteData(0x02);//SPR_SEL - RGB_DIV[2] RGB_DIV[1] RGB_DIV[0]
WriteData(0x00);//- - - SDO_EN

WriteCommand(0xF8);//PANELCTL (Panel Control)
WriteData(0x11);
WriteData(0x00);

WriteCommand(0xF9);//GAMMASEL(Gamma Selection)
WriteData(0x17);

WriteCommand(0xFA);//Gamma positive 3
WriteData(0x00);//- - RFP5 RFP4 RFP5 RFP2 RFP1 RFP0
WriteData(0x02);//- - OSP5 OSP4 OSP3 OSP2 OSP1 OSP0
WriteData(0x00);//- - PKP05 PKP04 PKP03 PKP02 PKP01 PKP00
WriteData(0x21);//- - PKP15 PKP14 PKP13 PKP12 PKP11 PKP10
WriteData(0x2A);//- - PKP25 PKP24 PKP23 PKP22 PKP21 PKP20
WriteData(0x2D);//- - PKP35 PKP34 PKP33 PKP32 PKP31 PKP30
WriteData(0x2E);//- - PKP45 PKP44 PKP43 PKP42 PKP41 PKP40
WriteData(0x22);//- - PKP55 PKP54 PKP53 PKP52 PKP51 PKP50
WriteData(0x28);//- - PKP65 PKP64 PKP63 PKP62 PKP61 PKP60
WriteData(0x2F);//- - PKP75 PKP74 PKP73 PKP72 PKP71 PKP70
WriteData(0x3C);//- - PKP85 PKP84 PKP83 PKP82 PKP81 PKP80
WriteData(0x3F);//- - PKP95 PKP94 PKP93 PKP92 PKP91 PKP90
WriteData(0x34);//- - PKP105 PKP104 PKP103 PKP102 PKP101 PKP100
WriteData(0x00);//- - - - - - - -
WriteData(0x00);//- - - - - - - -
WriteData(0x00);//- - - - - GLP1 GLP0

WriteCommand(0xFB);//Gamma negative
```

```
        WriteData(0x00);//- - RFN5 RFN4 RFN3 RFN2 RFN1 RFN0
        WriteData(0x02);//- - OSN5 OSN4 OSN3 OSN2 OSN1 OSN0
        WriteData(0x34);//- - PKN05 PKN04 PKN03 PKN02 PKN01 PKN00
        WriteData(0x3F);//- - PKN15 PKN14 PKN13 PKN12 PKN11 PKN10
        WriteData(0x3C);//- - PKN25 PKN24 PKN23 PKN22 PKN21 PKN20
        WriteData(0x2F);//- - PKN35 PKN34 PKN33 PKN32 PKN31 PKN30
        WriteData(0x28);//- - PKN45 PKN44 PKN43 PKN42 PKN41 PKN40
        WriteData(0x22);//- - PKN55 PKN54 PKN53 PKN52 PKN51 PKN50
        WriteData(0x2E);//- - PKN65 PKN64 PKN63 PKN62 PKN61 PKN60
        WriteData(0x2D);//- - PKN75 PKN74 PKN73 PKN72 PKN71 PKN70
        WriteData(0x2A);//- - PKN85 PKN84 PKN83 PKN82 PKN81 PKN80
        WriteData(0x21);//- - PKN95 PKN94 PKN93 PKN92 PKN91 PKN90
        WriteData(0x00);//- - PKN105 PKN104 PKN103 PKN102 PKN101 PKN100
        WriteData(0x00);//- - - - - - - -
        WriteData(0x00);//- - - - - - - -
        WriteData(0x00);//- - - - - GLN1 GLN0

    WriteCommand(0x3A);
        WriteData(0x77);
    WriteCommand(0x11);
        Delay(120);//120ms

    WriteCommand(0x38);
    WriteCommand(0x29);

    /*WriteCommand(0x2A); //Set_clumn_address
      WriteData(0x00);//"SC15 SC14 SC13 SC12 SC11 SC10 SC9 SC8"
      WriteData(0x00);//"SC7 SC6 SC5 SC4 SC3 SC2 SC1 SC0"
      WriteData(0x01);//"EC15 EC14 EC13 EC12 EC11 EC10 EC9 EC8"
      WriteData(0x3F);//"EC7 EC6 EC5 EC4 EC3 EC2 EC1 EC0"

      WriteCommand(0x2B);//Set_page_address
      WriteData(0x00);//"SP15 SP14 SP13 SP12 SP11 SP10 SP9 SP8"
      WriteData(0x00);//"SP7 SP6 SP5 SP4 SP3 SP2 SP1 SP0"
      WriteData(0x01);//"EP15 EP14 EP13 EP12 EP11 EP10 EP9 EP8"
      WriteData(0x3F);//"EP7 EP6 EP5 EP4 EP3 EP2 EP1 EP0"

      WriteCommand(0x2C);//Write_memory_start*/        }
```

Need to program ID1= 0x68, ID2 = 0x45, ID3 = 0x00 in IC.

6 Optical Characteristics

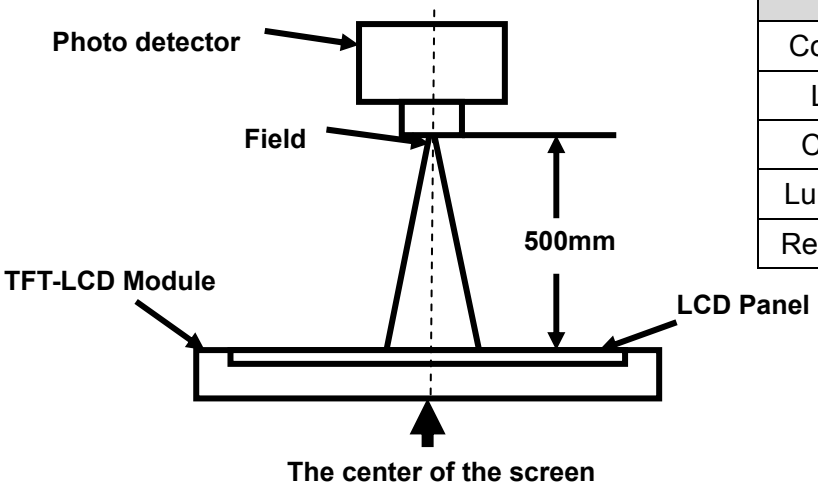
Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
View Angles		θT	CR≧10	55	60	-	Degree	Note 2
		θB		65	70	-		
		θL		65	70	-		
		θR		65	70	-		
Contrast Ratio		CR	θ=0°	400	500	-	-	Note1,3
Response Time		Ton	25℃	-	20	30	ms	Note1,4
		Toff						
Chromaticity	White	x	-	0.260	0.310	0.360	-	Note1,5
		y		0.290	0.340	0.390		
	RED	x		0.550	0.600	0.650		
		y		0.280	0.330	0.380		
	GREEN	x		0.290	0.340	0.390		
		y		0.535	0.585	0.635		
	BLUE	x		0.100	0.150	0.200		
		y		0.060	0.110	0.160		
Uniformity		U	-	70%	80%	-	%	Note1,6
NTSC		-	-	-	50%	-	%	Note 5
Luminance		L	-	350	400	-	cd/m2	Note1,7
Flicker		-	-	-	-	30	%	CA210 Contrast mode

Test Conditions:

1. VDD=2.8V, I_L =20mA(Backlight current), the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo Detector	Field
Contrast Ratio	SR-3A	1°
Luminance		
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	2°

Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。

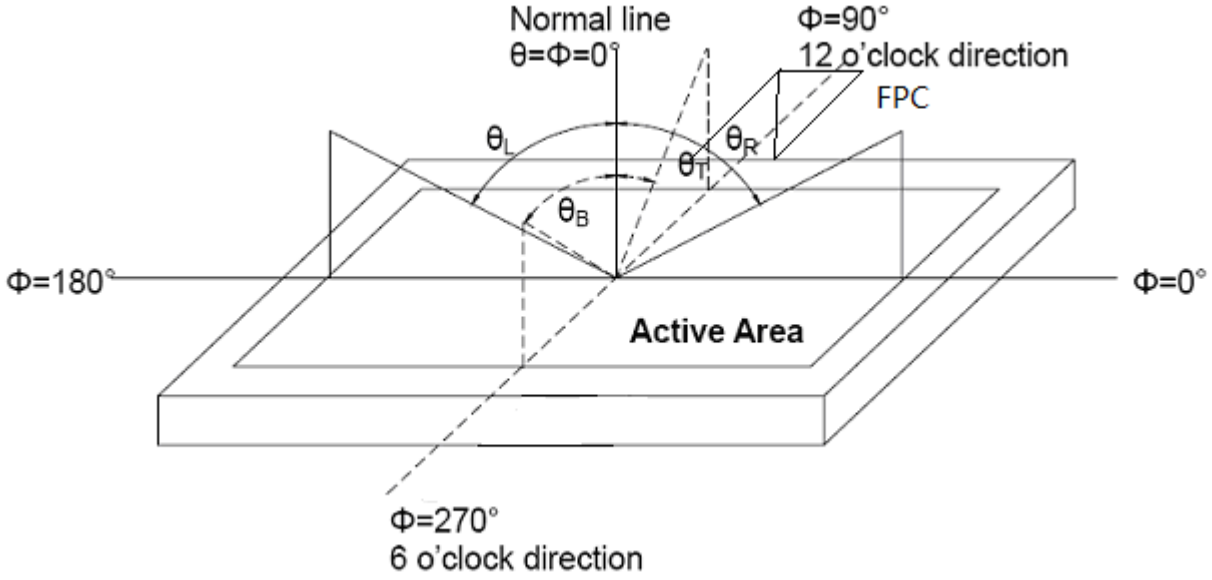


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

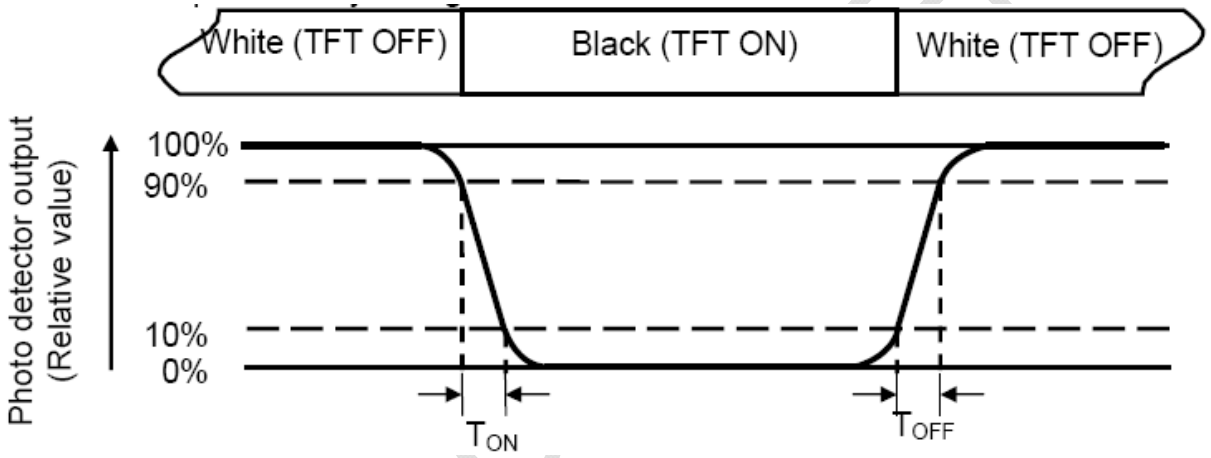
"White state ":The state is that the LCD is driven by $\mathbf{V}_{white}$.

"Black state": The state is that the LCD is driven by $\mathbf{V}_{black}$.

$\mathbf{V}_{white}$: To be determined $\mathbf{V}_{black}$: To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) is the time between photo detector output intensity changed from 10% to 90%.



Measure procedure

1. Setting panel display dynamic picture (alternating black image and white image)

2. Using BM-7 and signal generator test the rise time of white pattern converted to black pattern and the fail time of black pattern converted to white pattern (High reference level of signal generator set 90%,low set 10%)

3. Response time is the sum of rise time and fall time

Note 5: Definition of color chromaticity (CIE1931)

Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

Luminance Uniformity(U) = Lmin/ Lmax

L--------Active area length W----- Active area width

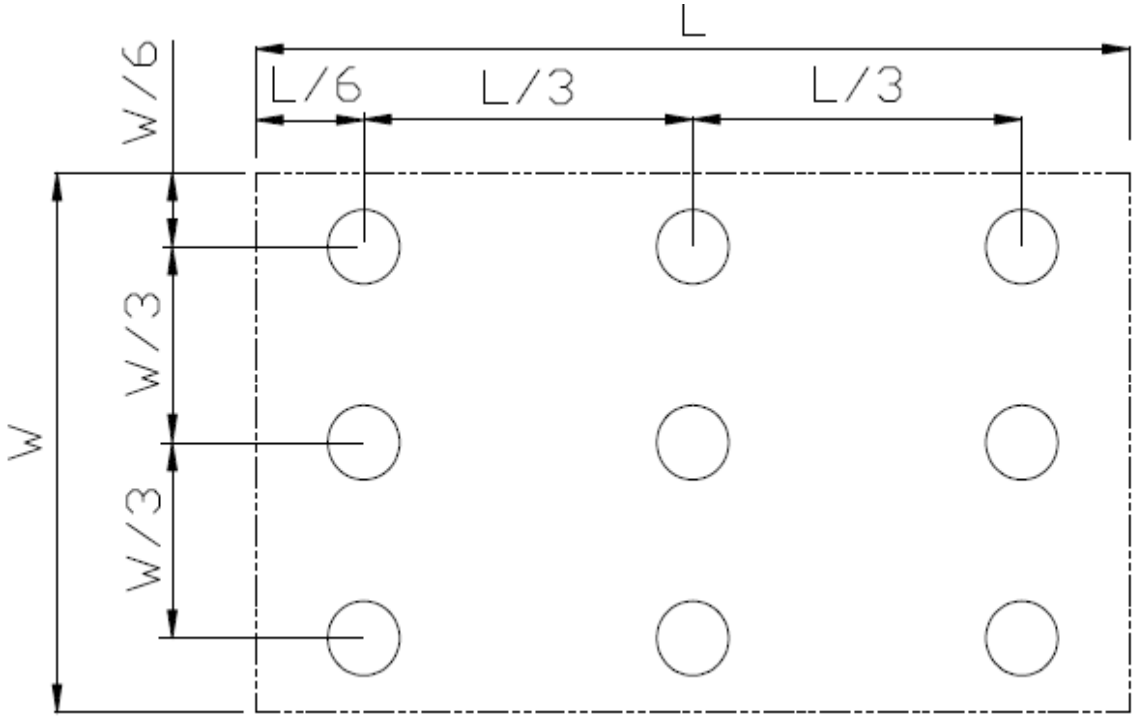


Fig. 2 Definition of uniformity

Lmax: The measured maximum luminance of all measurement position.

Lmin: The measured minimum luminance of all measurement position.

Note 7: Definition of Luminance :

Measure the luminance of white state at center point

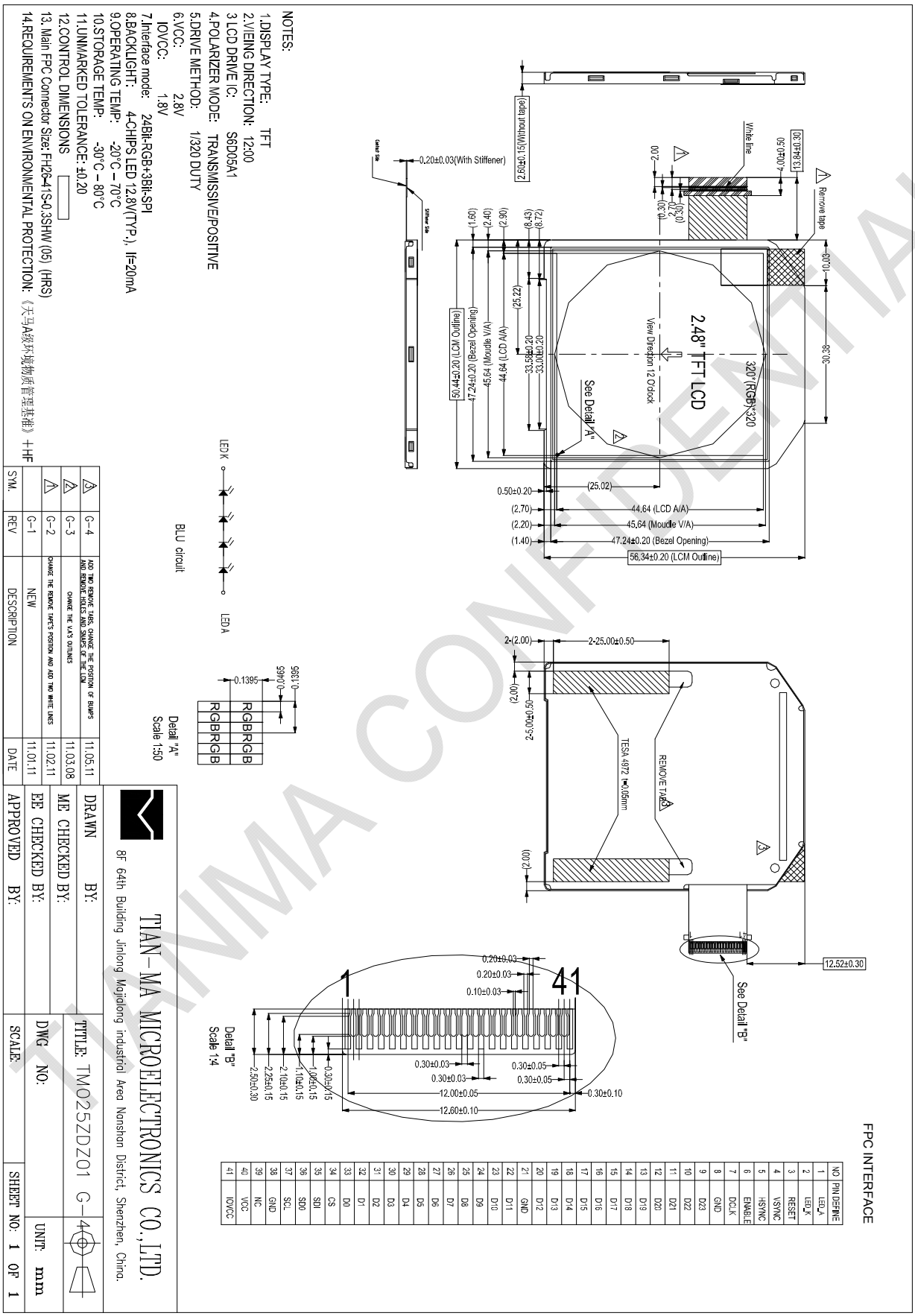
7 Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+70℃, 240hrs	Note1 IEC60068-2-1,GB2423.2
2	Low Temperature Operation	Ta=-20℃, 240hrs	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta=+80℃, 240hrs	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta=-30℃, 240hrs	IEC60068-2-1 GB2423.1
5	High Temperature & High Humidity Storage	Ta=+60℃, 90% RH 240 hours	Note2 IEC60068-2-78 GB/T2423.3
6	Thermal Shock (Non-operation)	-30℃ 30 min~+70℃ 30 min, Change time:5min, 20 Cycles	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22
7	Electro Static Discharge (Operation)	C=150pF, R=330Ω，5points/panel Air:±8KV, 5times; Contact:±4KV, 5 times; （Environment: 15℃～35℃, 30%～60%, 86Kpa～106Kpa）	IEC61000-4-2 GB/T17626.2
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total)(Package condition)	IEC60068-2-6 GB/T2423.10
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	IEC60068-2-27 GB/T2423.5
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8
11	Package Vibration Test	Random Vibration: 0.015GxG/Hz for 5-200Hz, -6dB/Octave from 200-500Hz 2 hours for each direction of X,Y,Z (6 hours for total)	IEC60068-2-34 GB/T2423.11

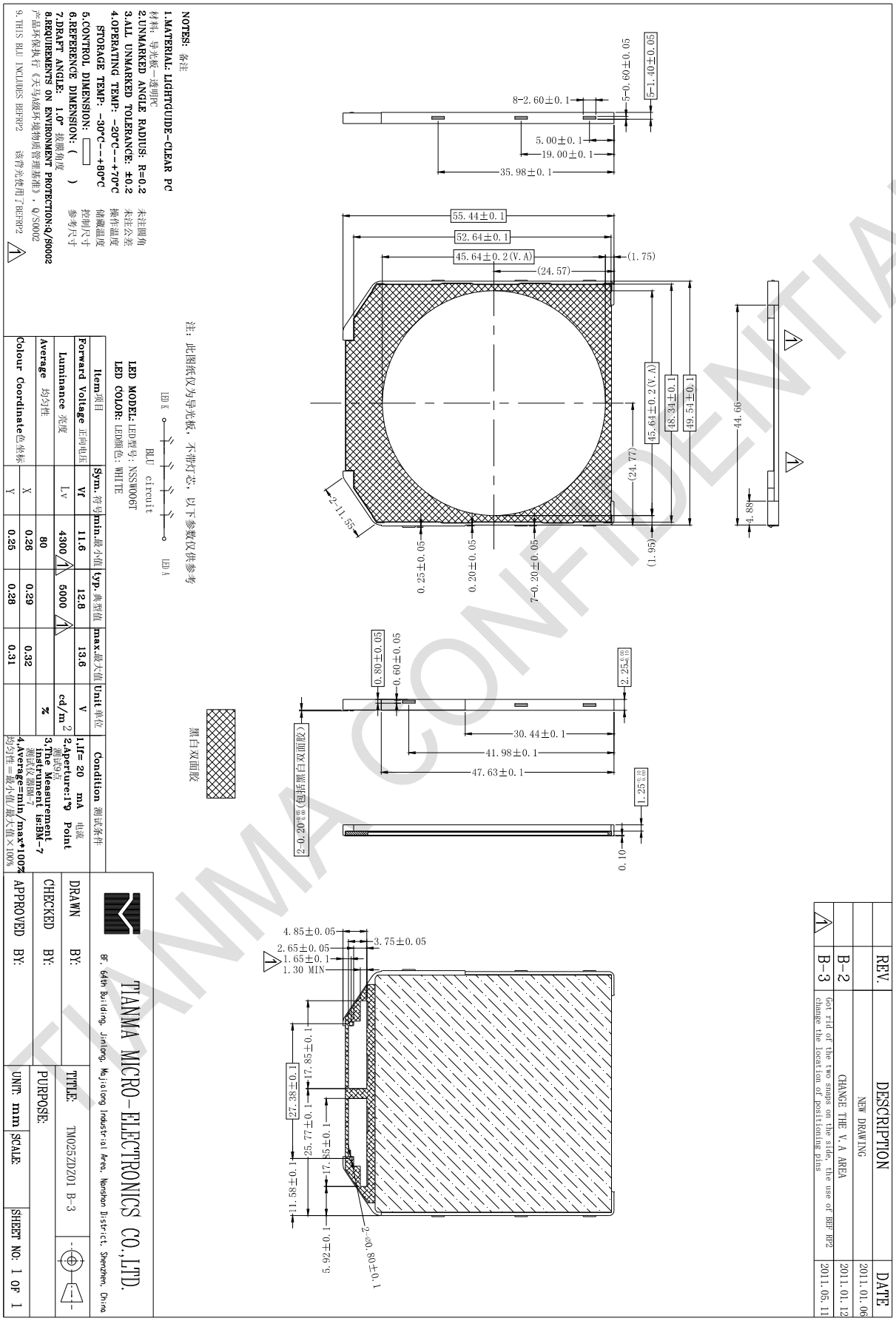
Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.

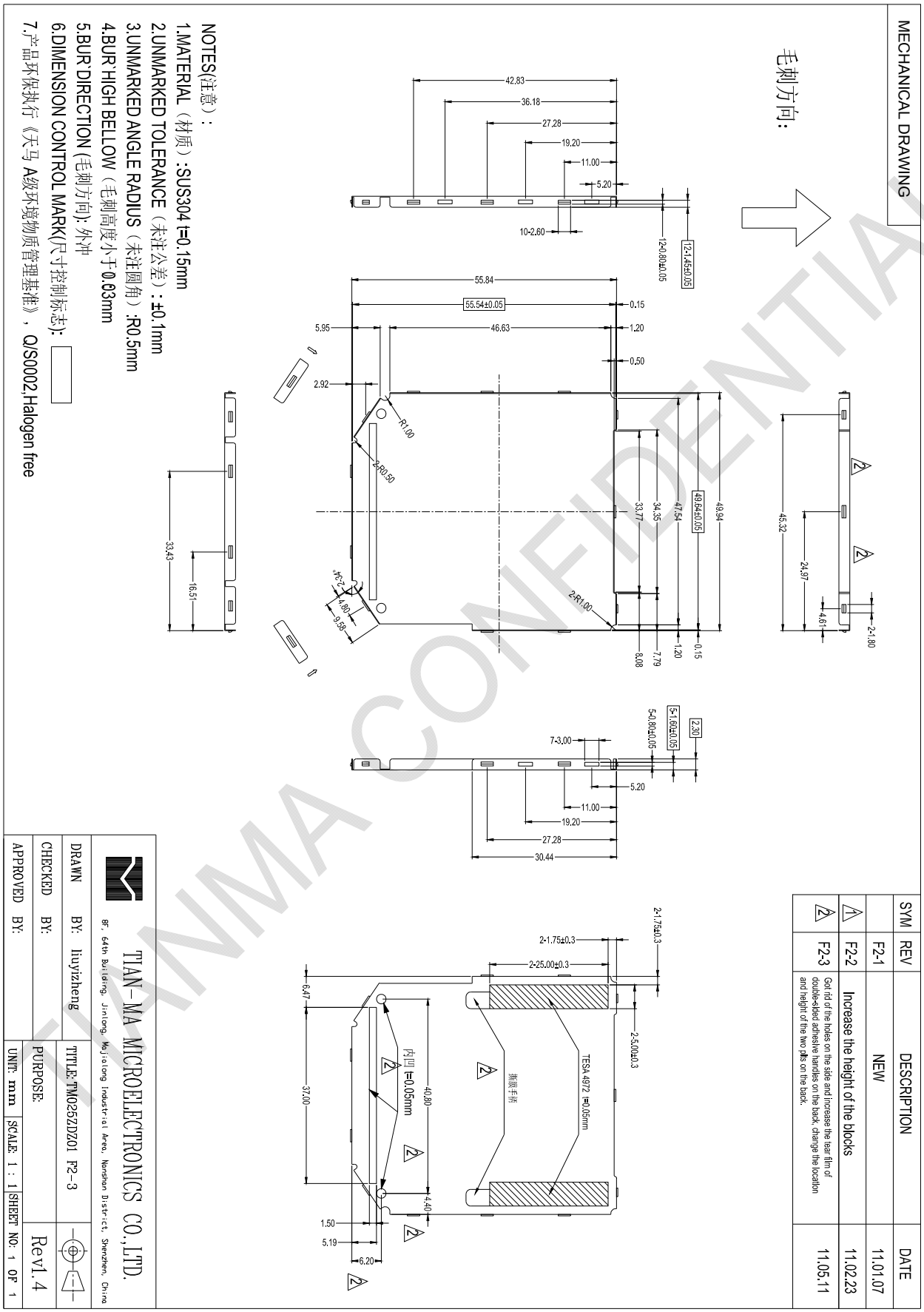
8 Mechanical Drawing



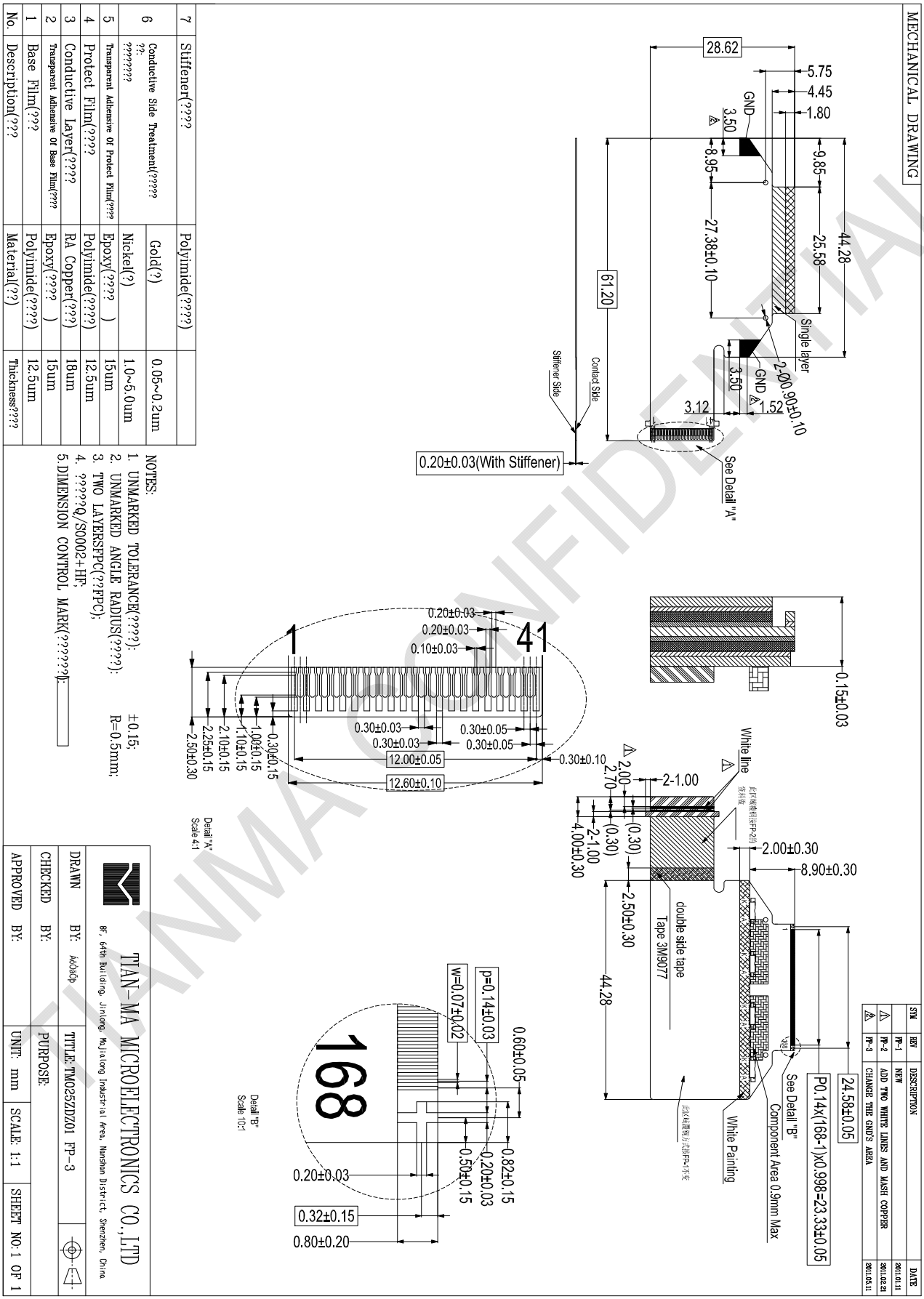
Backlight Drawing



Bottom Bezel Drawing



FPC Drawing

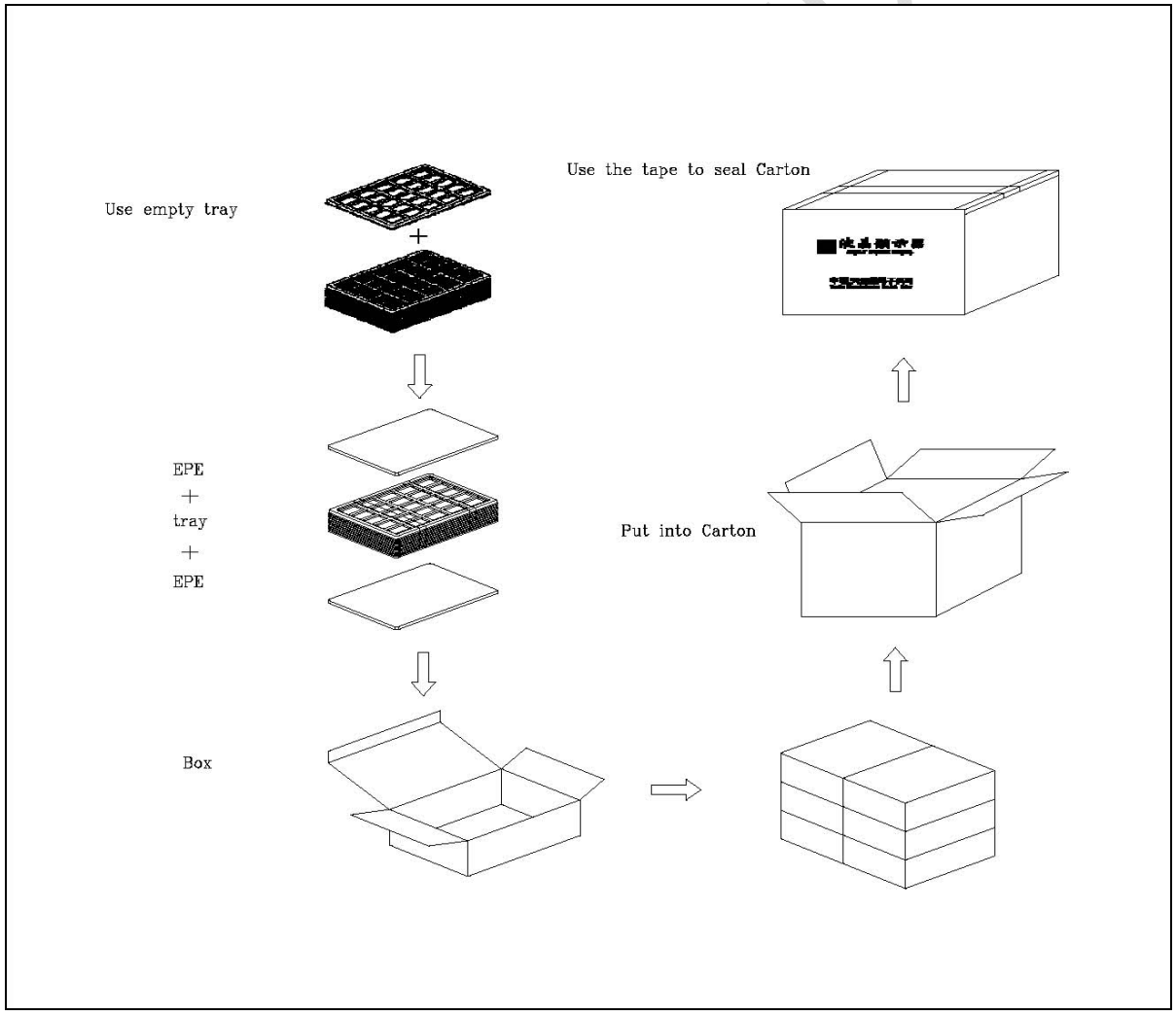


No.	Description(???	Material(??)	Thickness????
7	Stiffener(????	Polyimide(????)	
6	Conductive Side Treatment(????? ??: ???????	Gold(?)	0.05~0.2um
		Nickel(?)	1.0~5.0um
5	Transparent Adhesive Of Protect Film(????	Epoxy(????)	15um
4	Protect Film(????	Polyimide(????)	12.5um
3	Conductive Layer(????	RA Copper(???)	18um
2	Transparent Adhesive Or Base Film(????	Epoxy(????)	15um
1	Base Film(???	Polyimide(????)	12.5um

NOTES:
1. UNMARKED TOLERANCE(????): ±0.15;
2. UNMARKED ANGLE RADIUS(????): R=0.5mm;
3. TWO LAYERSFPC(??FPC);
4. ?????Q/S0002+HF;
5.DIMENSION CONTROL MARK(???????)

9 Packaging Drawing

NO	Item	Model（Material）	Dimensions(mm)	Unit Weight(Kg)	Quantity
1	LCM module	TM025ZDZ01	50.44*56.34*2.6	0.01518	924
2	Tray	PS	356.0*256.0*12.0	0.07	72
3	EPE	EPE	320.0*220.0*3.0	0.00528	12
4	BOX	CORRUGATED PAPER	363.0×263.0×95.0	0.285	6
5	Carton	CORRUGATED PAPER	550.0×385.0×320.0	1.057	1
6	Total weight(Kg)	21.89668			



10 Precautions for Use of LCD Modules

10.1 Handling Precautions

10.1.1. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes,promptly wash it off using soap and water.

10.1.3. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

— Isopropyl alcohol

— Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:— Water, Ketone, Aromatic solvents

10.1.6. Do not attempt to disassemble the LCD Module.

10.1.7. If the logic circuit power is off, do not apply the input signals.

10.1.8. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

a. Be sure to ground the body when handling the LCD Modules.

b. Tools required for assembly, such as soldering irons, must be properly ground.

c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

10.2.1. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃ Relatively humidity: ≤80%

10.2.3. The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 Transportation Precautions

The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

上海天馬微電子有限公司
SHANGHAI TIANMA MICROELECTRONICS CO., LTD.

Shanghai Tianma Micro-Electronics Corporation

TFT-LCD Module Incoming Inspection Standard

Customer	Nest Labs/Pegatron
Description	Module IIS
Model Name	TM025ZDZ01
Date	2011-1-28
Version	1.0

Customer Approval		
Customer Name	Checked & Approved by	Date

Prepared By	Checked by	Approved By

HISTORY OF REVISION

REV NO.	REV DATE	CONTENTS	REMARKS
1.0	2011.01.28		

Shanghai Tianma Micro-Electronics CO.,LTD

1. Scope:

The incoming inspection standards shall be applied to TFT-LCD Modules (hereinafter called "Modules") that supplied by Shanghai Tianma Micro-Electronics Corporation.

2. Incoming Inspection

The customer shall inspect the modules within twenty calendar days of the delivery date （the “inspection period）at its own cost. The result of the inspection（acceptance or rejection）shall be recorded in writing, and a copy of this writing will be promptly sent to the seller, If the results of the inspecting from buyer does not send to the seller within twenty calendar days of the delivery date. The modules shall be regards as acceptance.

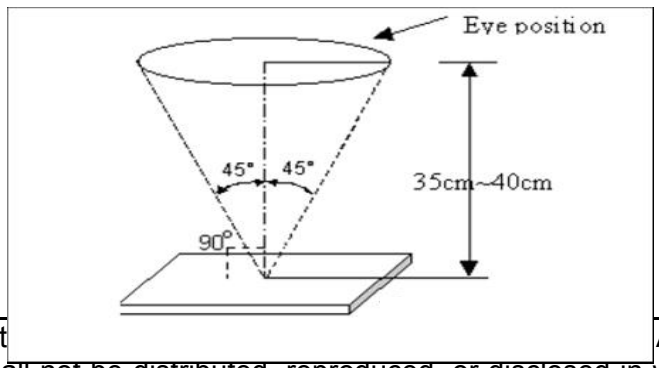
Should the customer fail to notify the seller within the inspection period, the buyers right to reject the modules. Shall be lapsed and the modules shall be deemed to have been accepted by the buyer.

3. Inspection Sampling Method

3.1. Lot size: Quantity per shipment lot per model
3.2. Sampling type: Normal inspection, Single sampling
3.3. Inspection level: II
3.4. Sampling table: MIL-STD-105D
3.5. Acceptable quality level （AQL）
Major defect: AQL=0.4
Minor defect: AQL=1.00

4. Inspection Conditions

4.1 Ambient conditions:
a. Temperature: Room temperature 25±5℃
b. Humidity: (60±10) ％RH
c. Illumination: Single fluorescent lamp non-directive (300 to 700 Lux)
4.2 Viewing distance
The distance between the LCD and the inspector’s eyes shall be at least 35±5 ㎝.
4.3 Viewing Angle
U/D: 45º/45º, L/R: 45º/45º



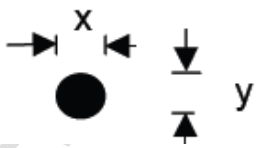
5. Inspection Criteria

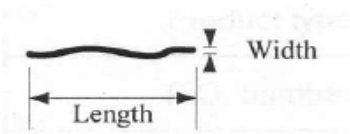
Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

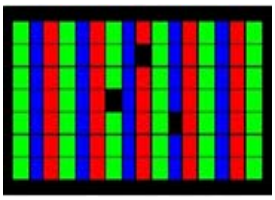
5.1 Major defect

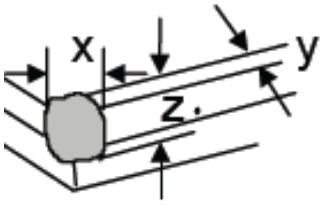
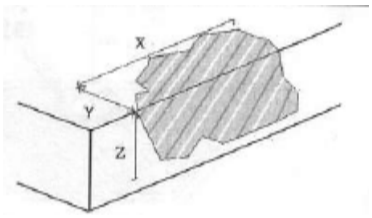
Item No	Items to be inspected	Inspection Standard
5.1.1	All functional defects	1) No display 2) Display abnormally 3) Short circuit 4) line defect
5.1.2	missing	Missing function component
5.1.3	Crack	Glass Crack

5.2 Minor defect

<table>
<tr><th>Item No</th><th>Items to be inspected</th><th colspan="2">Inspection standard</th></tr>
<tr><td rowspan="5">5.2.1</td><td rowspan="5">Spot Defect
Including
Black spot
White spot
Pinhole
Foreign particle
Polarizer dirt</td><td colspan="2">For dark/white spot is defined
$\varphi=(x+y)/2$
 
</td></tr>
<tr><td>Size φ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>φ≤0.10</td><td>Ignore</td></tr>
<tr><td>0.10＜ φ≤0.20</td><td>3</td></tr>
<tr><td>0.20＜ φ</td><td>Not allowed</td></tr>
</table>

<table>
<tr><td rowspan="6">5.2.2</td><td rowspan="6">Line Defect In-cluding
Black line
White line
Scratch</td><td colspan="2">Define:
 
</td></tr>
<tr><td>Width(mm)
Length(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>W≤0.03</td><td>Ignore</td></tr>
<tr><td>0.03＜ W≤0.05
L≤2.0</td><td>2</td></tr>
<tr><td>0.05＜ W≤0.1 L≤2.0</td><td>1</td></tr>
<tr><td>0.1＜ W</td><td>Not allowed</td></tr>
<tr><td rowspan="6">5.2.3</td><td rowspan="6">Polarizer Dent/Bubble</td><td>Size φ(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>φ≤0.2</td><td>Ignore</td></tr>
<tr><td>0.2＜ φ≤0.3</td><td>2</td></tr>
<tr><td>0.3＜ φ≤0.4</td><td>1</td></tr>
<tr><td>0.4＜ φ</td><td>Not allowed</td></tr>
<tr><td>Total QTY</td><td>3</td></tr>
<tr><td rowspan="5">5.2.4</td><td rowspan="5">Electrical Dot Defect</td><td colspan="2">Bright and Black dot define:
 

and
 </td></tr>
<tr><td colspan="2">Inspection pattern: Full white、Full black、Red、green and blue screens</td></tr>
<tr><td>Item</td><td>Acceptable Quantity</td></tr>
<tr><td>Black dot defect</td><td>2</td></tr>
<tr><td>Bright dot defect</td><td>0</td></tr>
</table>

<table>
<tr><td></td><td></td><td>Total Dot</td><td>2</td></tr>
<tr><td rowspan="6">5.2.5</td><td rowspan="6">Glass defect</td><td colspan="2">1.Corner Fragment:  </td></tr>
<tr><td>Size(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>X≤2mm
Y≤2mm
Z≤T</td><td>Ignore
T：Glass thickness
X: Length
Y: Width
Z: thickness</td></tr>
<tr><td>X >2 mm ,
Y>2 mm,
Z>Thickness,</td><td>Not allowed</td></tr>
<tr><td colspan="2">2. Side Fragment:  </td></tr>
<tr><td>Size(mm)</td><td>Acceptable Quantity</td></tr>
<tr><td>X≤5.0mm
Y ≤1mm
Z≤T</td><td>Ignore
T：Glass thickness
X: Length
Y: Width
Z: thickness</td></tr>
</table>

Note: 1. Dot defect is defined as the defective area of the dot area is larger than 50% of the dot area.

2. The distance between two bright dot defects (red, green, blue, and white) should be larger than 15mm.

3. The distance between black dot defects or black and bright dot defects should be more than 5mm apart.

4. Polarizer bubble is defined as the bubble appears on active display area. The defect of polarizer bubble shall be ignored if the polarizer bubble appears on the outside of active display area.

6. Mechanics specification

As for the outside dimension, weight of the modules, please refer to product specification for more details

7. Precaution

Please pay attention to the following items when you use the LCD Modules:

7-1 Do not twist or bend the module and prevent the unsuitable external force for display module during assembly.

7-2 Adopt measures for good heat radiation. Be sure to use the module with in the specified temperature.

7-3 Avoid dust or oil mist during assembly.

7-4 Following the correct power sequence while operating. Do not apply the invalid signal, otherwise, it will cause improper shut down and damage the module.

7-5 Less EMI: it will be more safety and less noise.

7-6 Please operate module in suitable temperature. The response time & brightness will drift by different temperature.

7-7 Avoid to display the fixed pattern (exclude the white pattern) in a long period, otherwise, it will cause image stains.

7-8 Be sure to turn off the power when connection of disconnecting the circuit.

7-9 Polarizer scratches easily, please handle it carefully.

7-10 Display surface never likes dirt of stains.

7-11 A dew drop may lead to destruction. Please wipe off and moisture before using module.

7-12 Sudden temperature changes cause condensation, and it will cause polarizer damaged.

7-13 High temperature and humidity may degrade performance. Please do not expose the module to the direct sunlight and so on.

7-14 Acetic acid or chlorine compounds are not friends with TFT display module.

7-15 Static electricity will damage the module, please do not touch the module without any

grounded device.

7-16 Do not disassemble and reassemble the module by self.

7-17 Be careful do not touch the rear side directly.

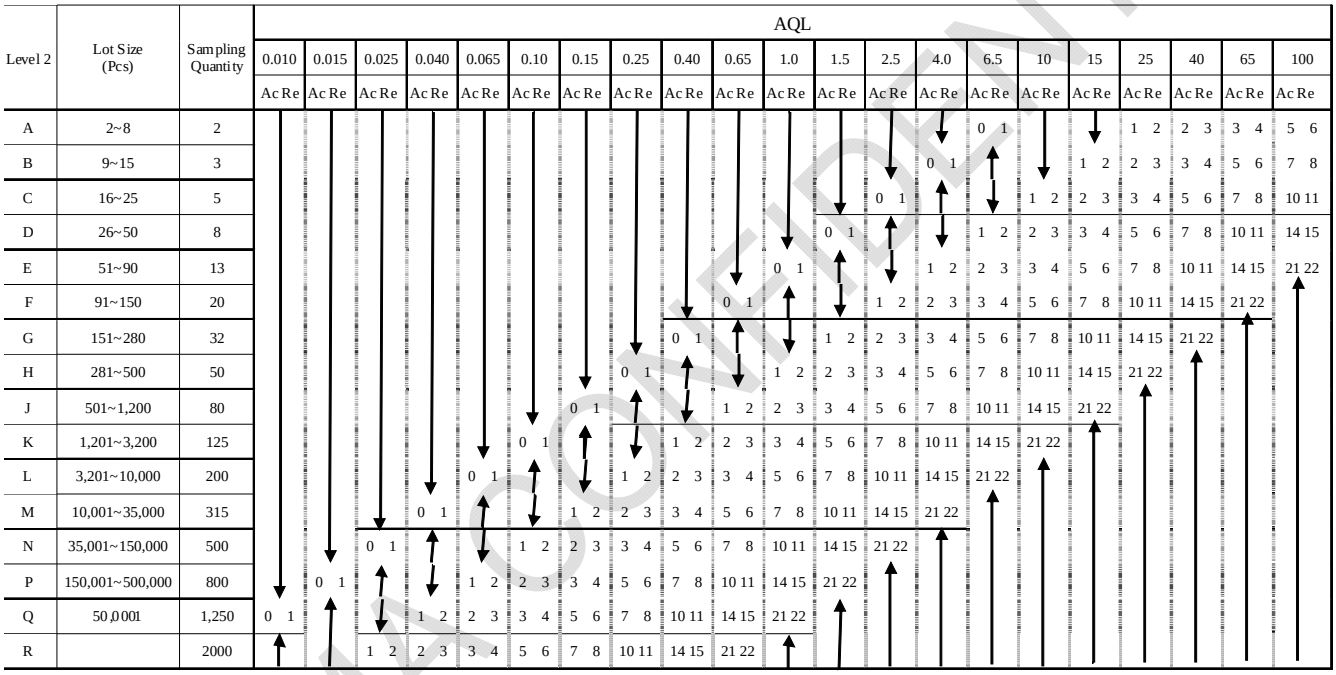
7-18 Not strong vibration or shock. It will cause module broken.

7-19 Storage the modules in suitable environment with regular packing.

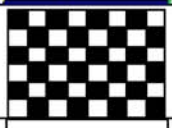
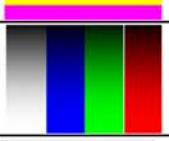
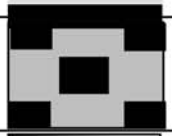
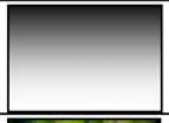
7-20 Be careful or injury from a broken display module.

7-21 Please avoid the pressure adding to the surface (front or rear side) of modules, because it will cause the display non-uniformity of other function issue.

8. Appendix



Level 2	Lot Size (Pcs)	Sampling Quantity	AQL																					
			0.010	0.015	0.025	0.040	0.065	0.10	0.15	0.25	0.40	0.65	1.0	1.5	2.5	4.0	6.5	10	15	25	40	65	100
			Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re	Ac Re
A	2~8	2															0 1			1 2	2 3	3 4	5 6
B	9~15	3														0 1			1 2	2 3	3 4	5 6	7 8
C	16~25	5													0 1			1 2	2 3	3 4	5 6	7 8	10 11
D	26~50	8												0 1			1 2	2 3	3 4	5 6	7 8	10 11	14 15
E	51~90	13											0 1			1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22
F	91~150	20										0 1			1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22	
G	151~280	32									0 1		1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22			
H	281~500	50								0 1		1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22				
J	501~1,200	80							0 1		1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22					
K	1,201~3,200	125						0 1		1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22						
L	3,201~10,000	200					0 1		1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22							
M	10,001~35,000	315				0 1		1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22								
N	35,001~150,000	500			0 1		1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22									
P	150,001~500,000	800		0 1		1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22										
Q	50,0001	1,250	0 1		1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22											
R		2000		1 2	2 3	3 4	5 6	7 8	10 11	14 15	21 22												

No	Pattern Name	Condition	Level(0~255)RGBW / Color
1	Fonts/Frame Line		L0 / L255word / 1 pixel frame line RGBY color
2	6"X8" Chessboard		L255 / L0 block
3	Frame W 255		L255 / White
4	Frame W 128		L128 /White
5	Frame R 255		L255 / Red
6	Frame G 255		L255 / Green
7	Frame B 255		L255 / Blue
8	Frame W 0		L0 / Black
9	V 8 Color Bar		L255 BBRGWCYM
10	H 4 Color Bar		L0~L255 RGBW
11	Pixel ON OFF		L255 / L0 Pixel ON OFF
12	Five Block		L0 five bock/ L128
13	H Gray Level		L0~L255
14	V Gray Level		L0~L255
15	Logo / Vesrion / Real picture / numeral		Logo

9. Dimension Inspection