MODEL NO. : ___TM047NDH01___

ISSUED DATE: ___2008-12-4___

VERSION : ___Ver 1.0___

■Preliminary Specification
□Final Product Specification

Customer : _____

Approved by	Notes

SHANGHAI TIANMA Confirmed :

Prepared by	Checked by	Approved by
2008-12-4		88'12/10

This technical specification is subjected to change without notice

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2008-12-4	Rev 1.0 was issued	Haijun He

1 General Specifications

Feature		Spec
Display Spec.	Size	4.7 inch
	Resolution	480(RGB) x 272
	Interface	RGB 24 bits
	Color Depth	16.7M dithering
	Technology type	a-Si
	Pixel pitch (mm)	0.216x0.216
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Clear type (3H)
	Viewing Direction	12 o'clock
	Gray Scale Inversion Direction	6 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	114.24x72.88x3.15
	Active Area(mm)	103.680 x 58.752
	With /Without TSP	Without TSP
	Weight(g)	57.6
	LED Numbers	11 LEDs

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: RoHS

Note 3: The weight tolerance ±5%.

2   Input/Output Terminals

2.1   TFT LCD Panel

Recommended connector: HIROSE FH23-45S-0.3SHW

No	Symbol	I/O	Description	Remark
1	VSS	P	Power Ground	
2	VSS	P	Power Ground	
3	VDD	P	Power Supply (+3.3V)	
4	VDD	P	Power Supply (+3.3V)	
5	R0	I	Red data	
6	R1	I	Red data	
7	R2	I	Red data	
8	R3	I	Red data	
9	R4	I	Red data	
10	R5	I	Red data	
11	R6	I	Red data	
12	R7	I	Red data	
13	G0	I	Green data	
14	G1	I	Green data	
15	G2	I	Green data	
16	G3	I	Green data	
17	G4	I	Green data	
18	G5	I	Green data	
19	G6	I	Green data	
20	G7	I	Green data	
21	B0	I	Blue data	
22	B1	I	Blue data	
23	B2	I	Blue data	
24	B3	I	Blue data	
25	B4	I	Blue data	
26	B5	I	Blue data	
27	B6	I	Blue data	
28	B7	I	Blue data	
29	VSS	P	Power Ground	
30	PCLK	I	Pixel clock	
31	DISP	I	Display on/off	
32	HSYNC	I	Horizontal sync signal	
33	VSYNC	I	Vertical sync signal	
34	DE	I	Date enable	
35	SCS	I	SPI chip select pin	Note2-1
36	SCL	I	SPI Serial Clock	
37	Y2	-	No connection	
38	X2	-	No connection	
39	Y1	-	No connection	
40	X1	-	No connection	
41	SDI	I	SPI Serial Data Input	
42	LED 1-	P	LED cathode (6 LEDs)	
43	LED 1+	P	LED anode (6 LEDs)	

| 44 | LED 2- | P | LED cathode (5 LEDs) | |
| 45 | LED 2+ | P | LED anode (5 LEDs) | |

Note2-1:   Pin 35 pull low with 1K resistor

Note2-2:   I/O definition：

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

3   Absolute Maximum Ratings

3.1   Driving TFT LCD Panel

Ta = 25°C

Item	Symbol	Min	Max	Unit	Remark
Power Supply Voltage	VDD	-0.3	4.0	V	
Input Signal Voltage	R0-R7,G0-G7,B0-B7,PCLK,DISP, HSYNC, VSYNC, DE, SCS, SCL, SDI	-0.3	VDD +0.3	V	
Back Light Forward Current	I_{LED}	--	25	mA	For each LED
Operating Temperature	T_{OPR}	-20	60	℃	
Storage Temperature	T_{STG}	-40	75	℃	

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

GND=0V, Ta=25℃

Item		Symbol	Min	Typ	Max	Unit	Remark
Power Supply Voltage		VDD	3.0	3.3	3.6	V	
Input Signal Voltage	Low Level	V_{IL}	0	--	0.2xVDD	V	R0-R7,G0-G7,B0-B7 PCLK,DISP, HSYNC, VSYNC, DE, SCS, SCL, SDI
	High Level	V_{IH}	0.8xVDD	--	VDD	V	
Output Signal Voltage	Low Level	V_{OL}	0	--	0.2xVDD	V	
	High Level	V_{OH}	0.8xVDD	--	VDD	V	
(Panel+ LSI) Power Consumption	Black Mode (60Hz)		--	85	90	mW	
	Standby Mode		--	0.8	1.0	mW	

4.2 Driving Backlight   Ta=25℃

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I_F	--	20		mA	One LED
Forward Voltage	V_F	--	3.2	--	V	One LED
Power Consumption	W_{BL}	--	704	--	mW	

Note 4-1: The figure below shows the connection of backlight LED.
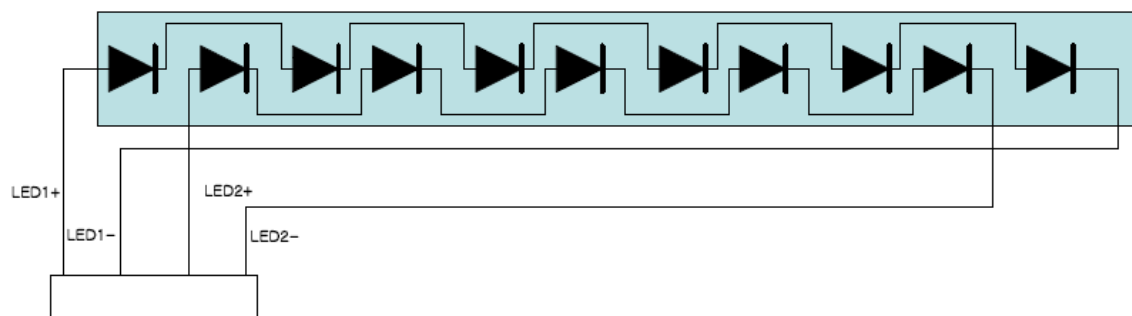
**4.3   Block Diagram**

LCD module diagram
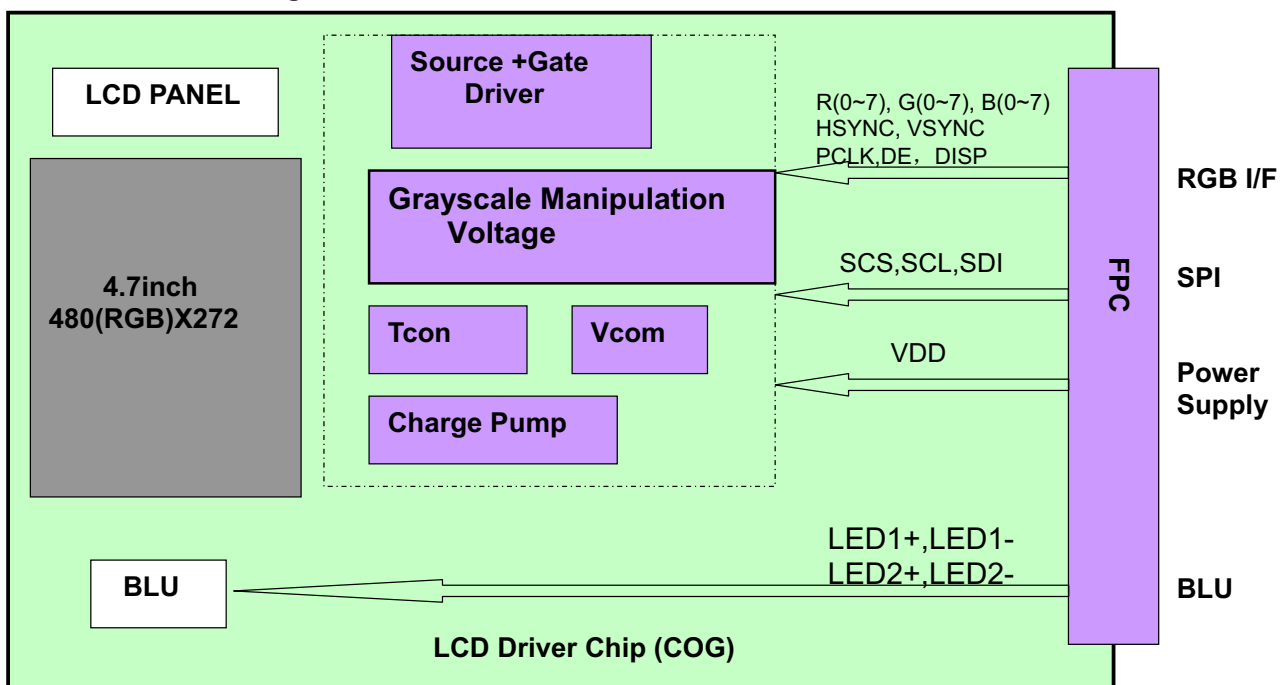
5 Timing Chart

5.1 RGB Timing Parameter

Item	Symbol	Values			Unit	Remark
		Min	Typ	Max		
Clock cycle	1/tc	-	9.00	15	MHz	
Hsync cycle	1/fH	-	17.14	-	KHz	
Vsync cycle	1/fV	-	59.94	-	Hz	
Horizontal signal	Th	525	525	605	CLK	
Horizontal display period	Thd	480	480	480-	CLK	
Horizontal Front porch	Thf	2	2	82	CLK	
Horizontal Pulse width	Thp	2	41	41	CLK	
Horizontal Back porch	Thb	2	2	41	CLK	
Vertical cycle	Tv	285-	286	511	H	
Vertical display period	Tvd	272	272	272	H	
Vertical Front porch	Tvf	1	2	227	H	
Vertical Pulse width	Tvp	1	10	11	H	
Vertical Back porch	Tvb	1	2	11	H	
DISP Setup Time	Tdiss	10	-	-	ns	
DISP Hold Time	Tdish	10	-	-	ns	
Clock Period	PW CLK	66.7	-	-	ns	
Clock Pulse High Period	PWH	26.7	-	-	ns	
Clock Pulse Low Period	PWL	26.7	-	-	ns	
Hsync Setup Time	Ths	10	-	-	ns	
Hsync Hold Time	Thh	10	-	-	ns	
Data Setup Time	Tds	10	-	-	ns	
Data Hold Time	Tdh	10	-	-	ns	
DE Setup Time	Tdes	10	-	-	ns	
DE Hold Time	Tdeh	10	-	-	ns	
Vsync Setup Time	Tvhs	10	-	-	ns	
Vsync Hold Time	Tvhh	10	-	-	ns	

Note 1: Thd=480CLK, Thf= 2CLK, Thp= 41CLK, Thb= 2CLK

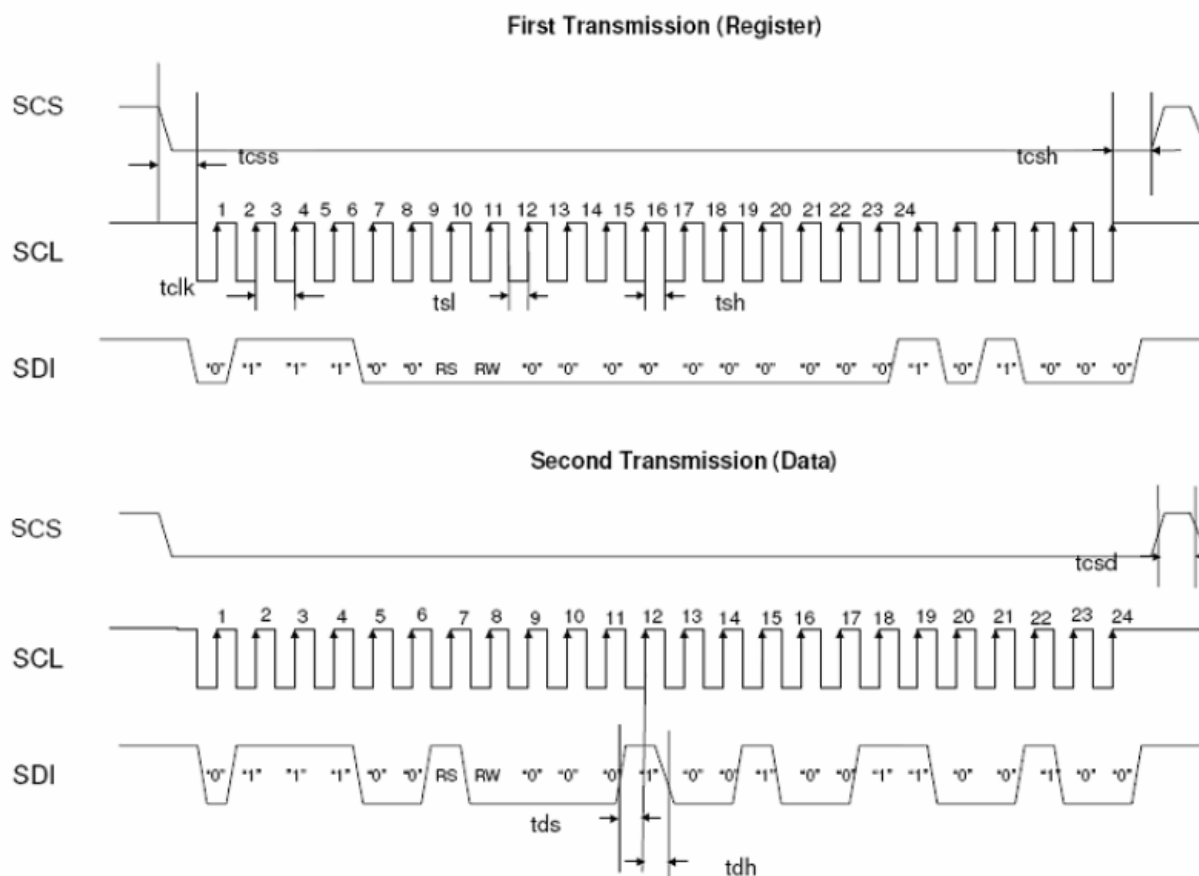   525CLK=480CLK + 2CLK + 41CLK + 2CLK

Note 2: Thf+ Thp+ Thb > 44 CLK
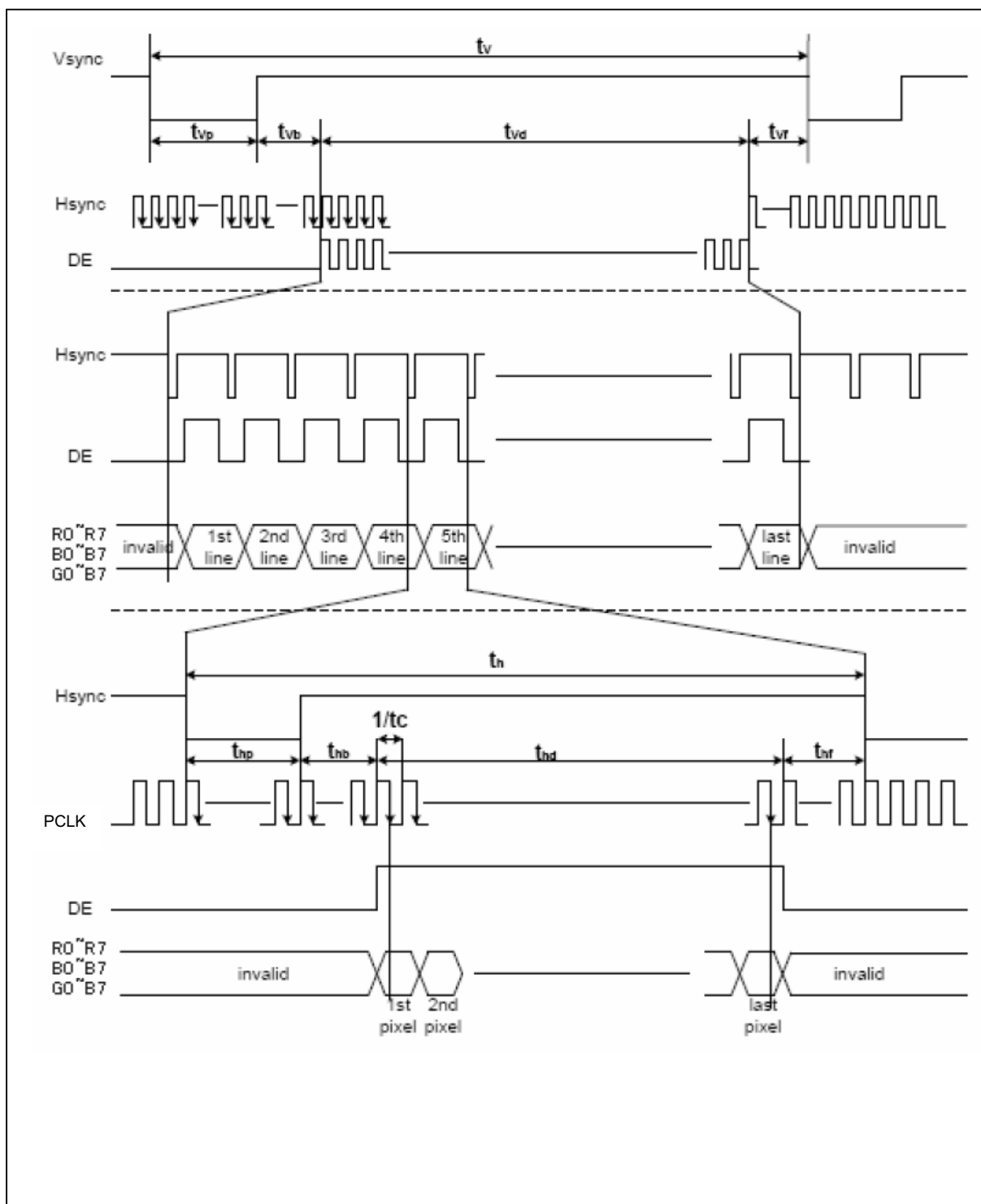
5.2 RGB Timing Chart
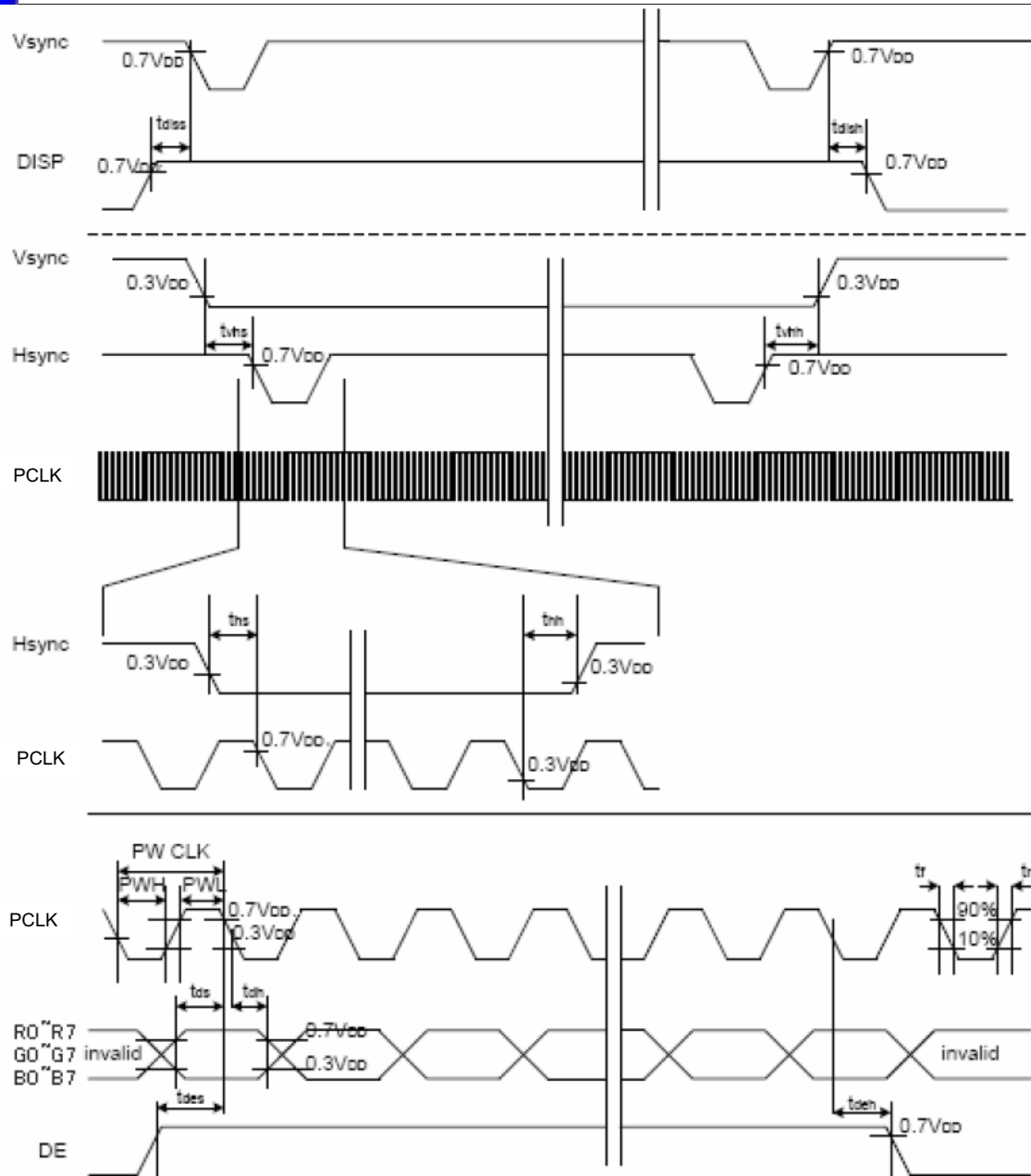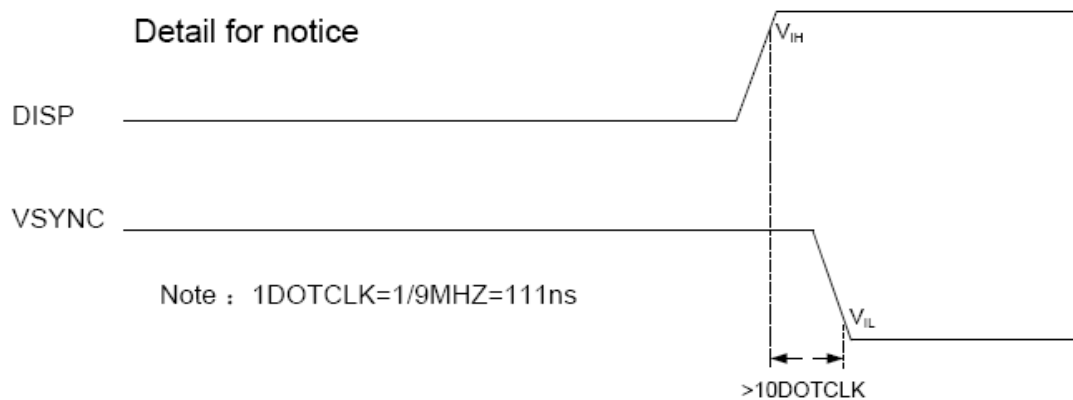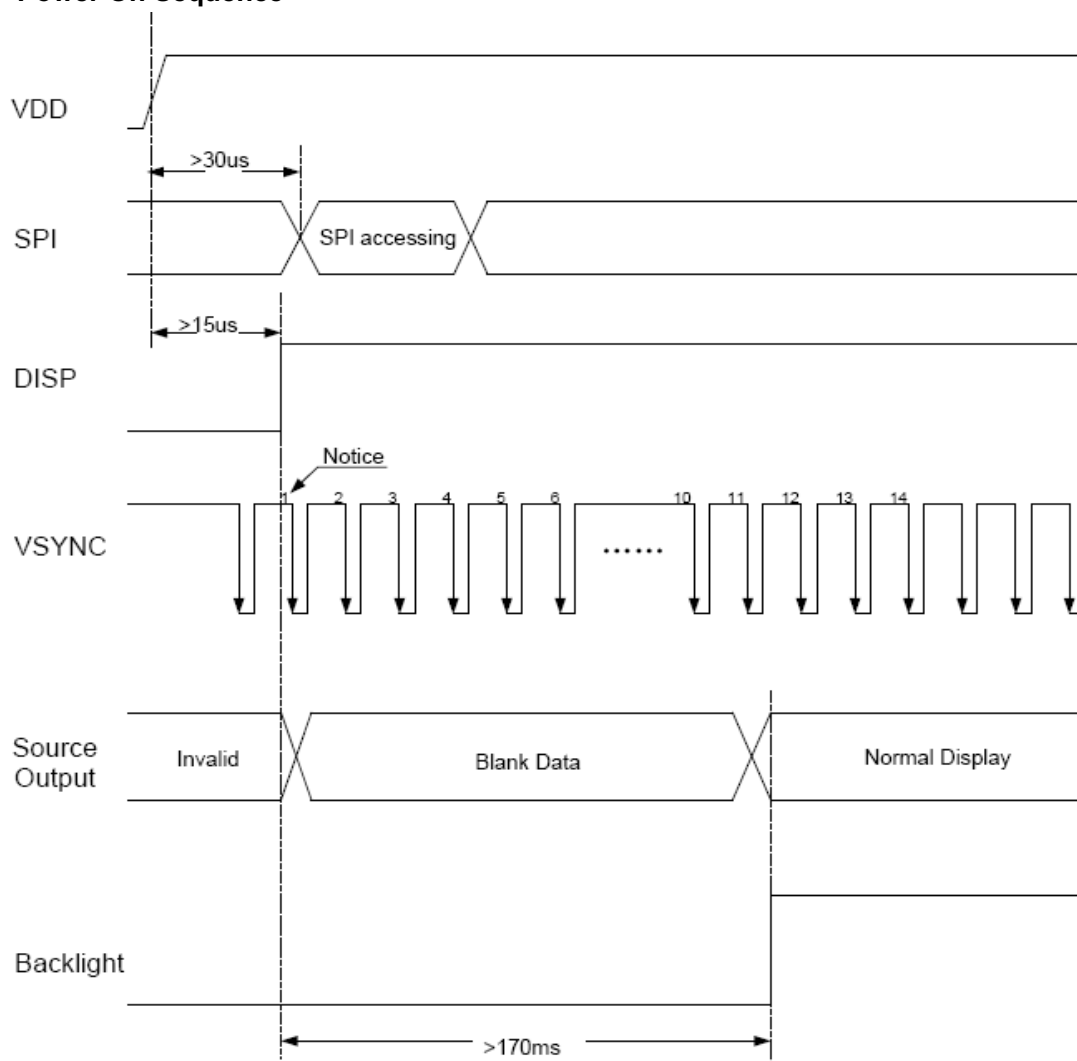
5.3   SPI Timing Chart

(VIH=0.8*VDD, VIL=0.2*VDD)

Parameter	Symbol	MIN	TYP	MAX	Unit
Serial Clock Frequency	f_{CLK}	-	-	20	MHz
Serial Clock Cycle Time	t_{CLK}	50	-	-	ns
Clock Low Width	t_{SL}	25	-	-	ns
Clock High Width	t_{SH}	25	-	-	ns
Chip Select Setup Time	t_{CSS}	0	-	-	ns
Chip Select Hold Time	t_{CSh}	10	-	-	ns
Chip Select High Delay Time	t_{CSD}	20	-	-	ns
Data Setup Time	t_{dS}	5	-	-	ns
Data Hold Time	t_{dh}	10	-	-	ns

5.4   Power On Sequence

VDD

SPI

>30us

SPI accessing

DISP

>15us

VSYNC

Notice

1 2 3 4 5 6   ......   10 11 12 13 14

Source
Output

Invalid   Blank Data   Normal Display

Backlight

>170ms

Detail for notice

DISP

V_{IH}

VSYNC

V_{IL}

Note：1DOTCLK=1/9MHZ=111ns

>10DOTCLK

5.5　Power Off Sequence

VDD

DISP

VSYNC
1　2　3　4　5　6　　10　11
······

Source
Output
Valid　　　Blank Data

Backlight

>170ms
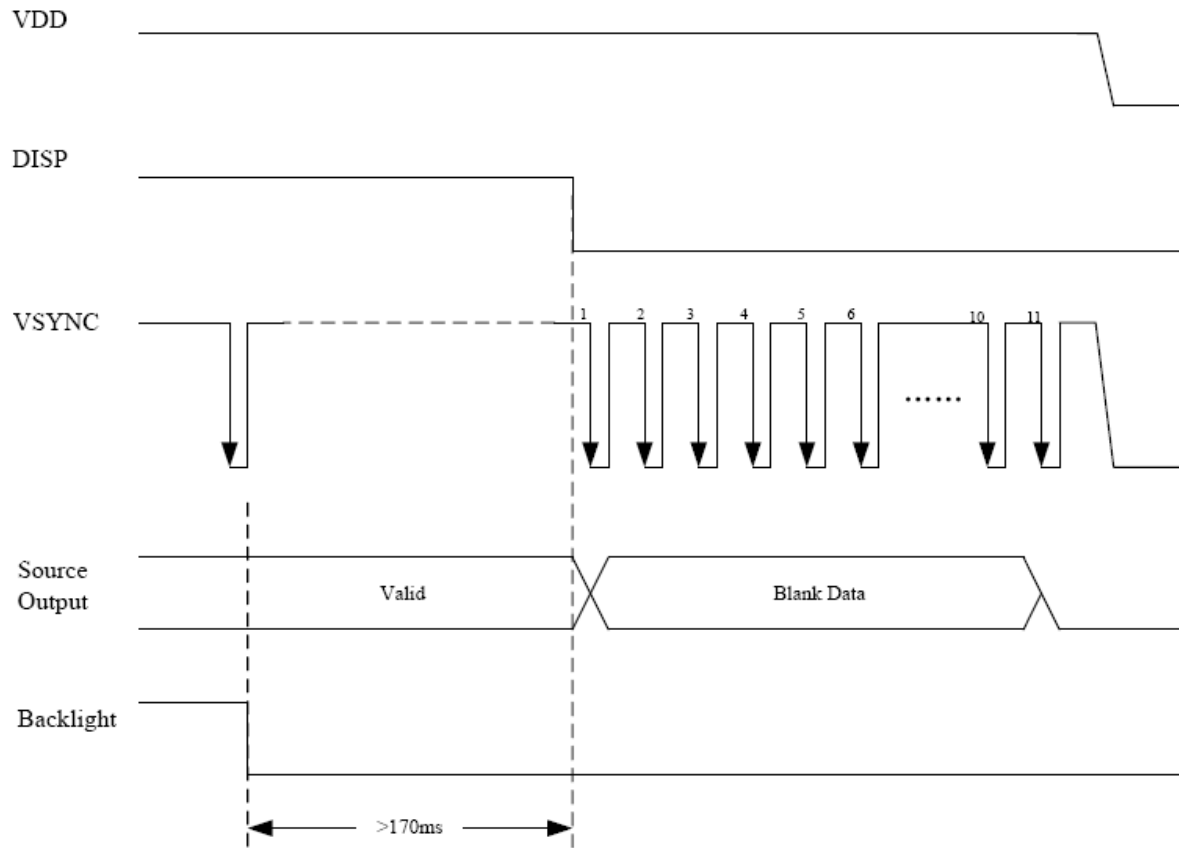
6 Optical Characteristics

6.1 Optical Specification

Ta=25℃

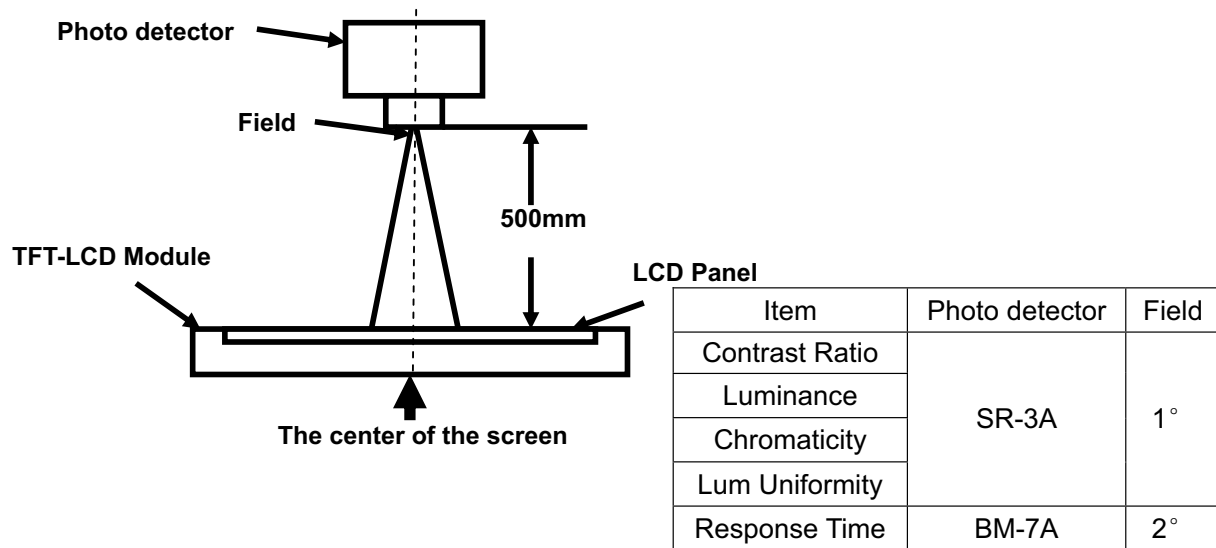| Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	45	50	-	Degree	Note 2
		θB		50	55	-		
		θL		60	65	-		
		θR		60	65	-		
Contrast Ratio		CR	θ=0°		400	-		Note1 Note3
Response Time		T_{ON}	25℃	-	30	45	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Blacklight is on	0.255	0.305	0.355		Note5, Note1
		y		0.265	0.315	0.365		
	Red	x		0.550	0.600	0.650		
		y		0.300	0.350	0.400		
	Green	x		0.290	0.340	0.390		
		y		0.510	0.560	0.610		
	Blue	x		0.095	0.145	0.195		
		y		0.040	0.090	0.140		
Uniformity		U		75	80	-	%	Note1 Note6
NTSC				-	50	-	%	Note 5
Luminance		L		320	400	-	cd/m^2	Note1 Note7

Test Conditions:

1. V_F=3.2V, I_L=20mA(LED 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.

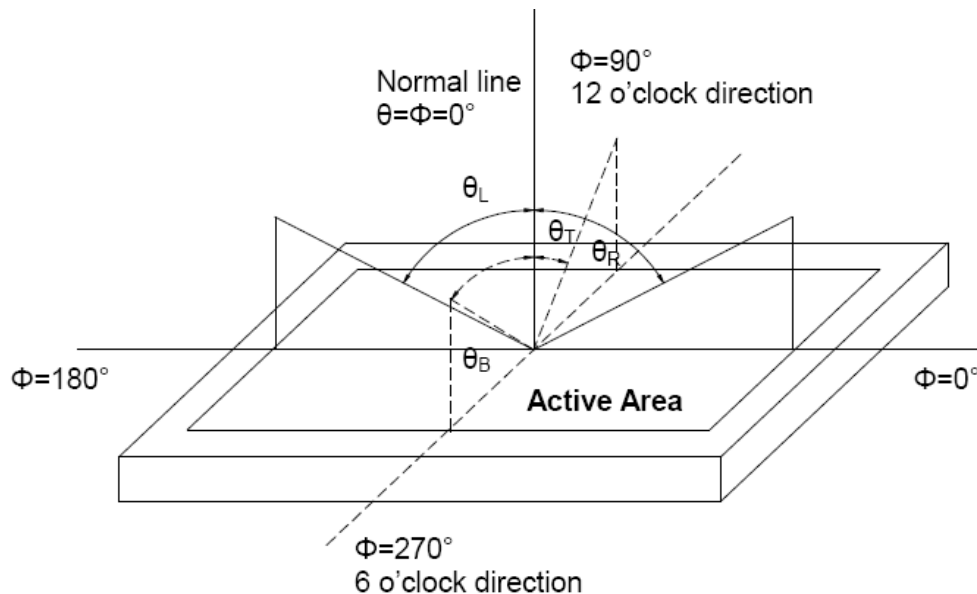viewing angle is measured at the center point of the LCD by CONOSCOPE(ergo-80)。

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 should driven by Vwhite.

"Black state": The state is that the LCD should driven by Vblack.

Vwhite: To be determined   Vblack: 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%.
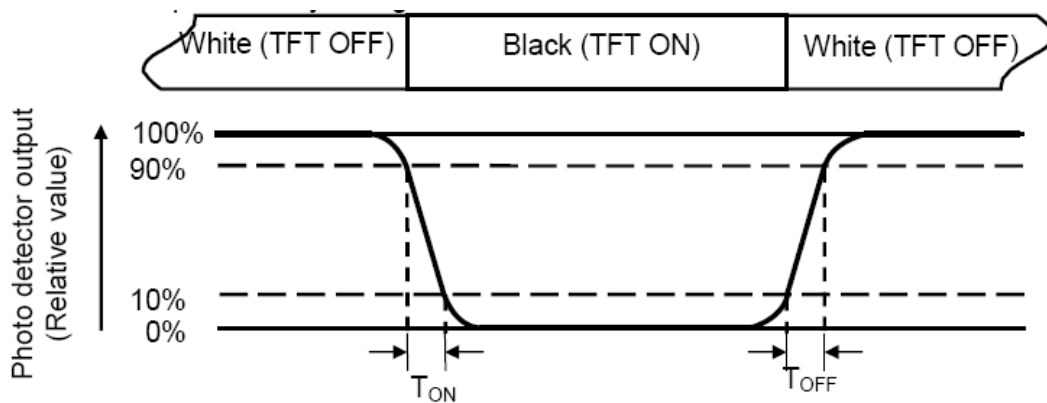
Note 5: Definition of color chromaticity (CIE1931)

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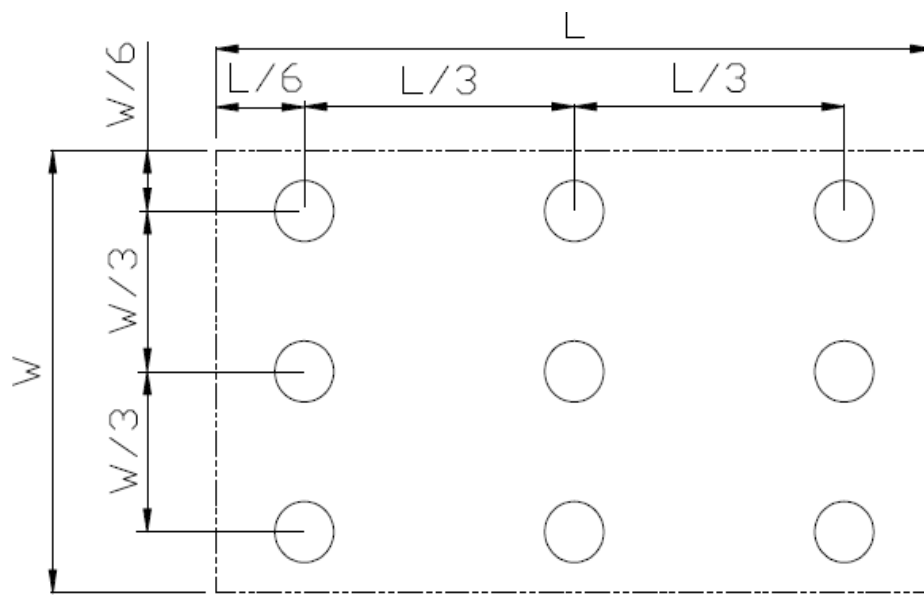
L-------Active area length W----- Active area width

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 Test

7.1 Module reliability

| No	Test Item	Condition	Remark
1	High Temperature Operation	Ts=+60℃, 240hrs	Note1 IEC60068-2-2,GB2423.2—89
2	Low Temperature Operation	Ta=-20℃, 240hrs	IEC60068-2-1 GB2423.1—89
3	High Temperature Storage	Ta=+70℃, 240hrs	IEC60068-2-2, GB2423.2—89
4	Low Temperature Storage	Ta=-30℃, 240hrs	IEC60068-2-1 GB2423.1—89
5	High Temperature & High Humidity Storage	Ta=+60℃, 90% RH 240 hours	Note2 IEC60068-2-3, GB/T2423.3—2006
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—87
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—1998
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—1995
9	Shock (Non-operation)	60G 6ms, ±X,±Y,±Z 3times, for each direction	IEC60068-2-27 GB/T2423.5—1995
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32 GB/T2423.8—1995
11	Baseline Function Test	Room Temp 72Hr	Note 3
12	Operating Temp & Humidity Test	Temp -20℃ － +60℃, Humi 0 – 90% RH, 102 Hr	Note 3
13	Storage Test	Temp -40℃ － +75℃, Humi 0 – 90% RH, 86 Hr	Note 3
14	Thermal shock Test	-20℃ － +60℃, 10 cycle -40℃ － +75℃, 10 cycle	Note 3
15	Image Sticking	Room Temp, 24 Hr	Note 4

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

Note2: Ta is the ambient temperature of sample.

Note3: The conditions is requested by MITAC

Note4: Image Sticking Burn In Pattern is the following Cross pattern. And check patterns are Full Screen White, Red, Blue, Green and Black Pattern.
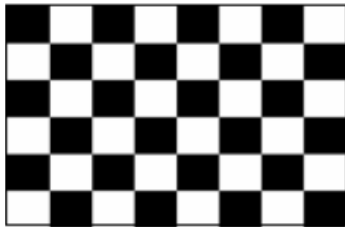
Cross Pattern

Judgment:
 Main LCD should work under the normal condition.
 After the temperature and humidity test, the luminance and CR(Contrast Ratio) should not be changed over 50% compared with those before the test.

8 Register Setting

write address<=16'h0001;   write DATA<=16'h7946;

write address<=16'h0002;   write DATA<=16'h2037;

write address<=16'h0003;   write DATA<=16'hDB30;

write address<=16'h0004;   write DATA<=16'h00aF;

write address<=16'h0005;   write DATA<=16'h1FCC;

write address<=16'h0006;   write DATA<=16'h372e;

write address<=16'h0007;   write DATA<=16'h000c;

write address<=16'h0008;   write DATA<=16'h002b;

write address<=16'h0009;   write DATA<=16'h4008;

write address<=16'h000f;   write DATA<=16'h0140;

write address<=16'h0010;   write DATA<=16'h0301;

write address<=16'h0011;   write DATA<=16'h0201;

write address<=16'h0012;   write DATA<=16'h0005;

write address<=16'h0013;   write DATA<=16'h0101;

write address<=16'h0014;   write DATA<=16'h0207;

write address<=16'h0015;   write DATA<=16'h0300;

write address<=16'h0016;   write DATA<=16'h0201;

write address<=16'h0017;   write DATA<=16'h0306;

write address<=16'h0018;   write DATA<=16'h0c02;

write address<=16'h0019;   write DATA<=16'h0905;

9 Mechanical Drawing
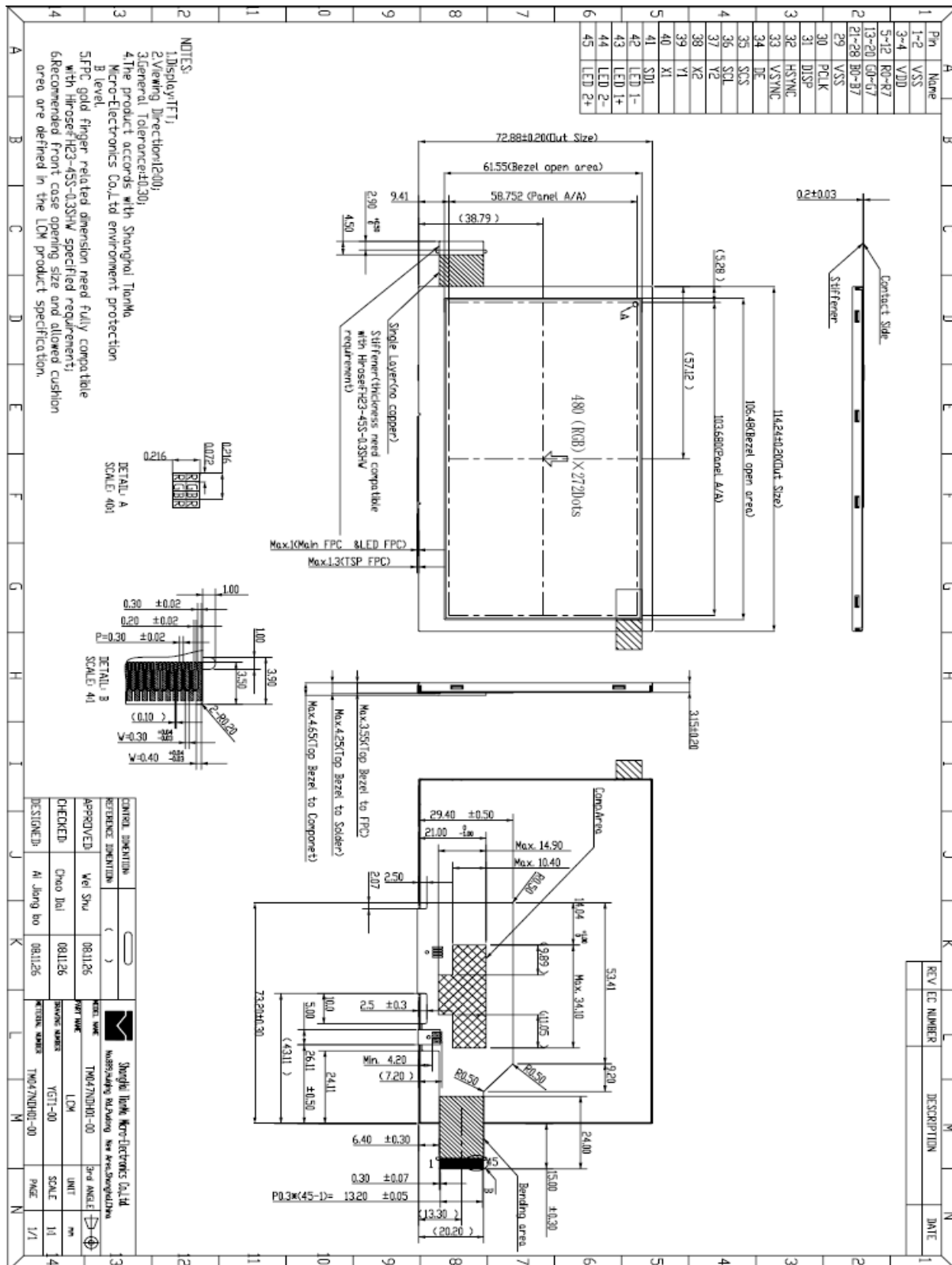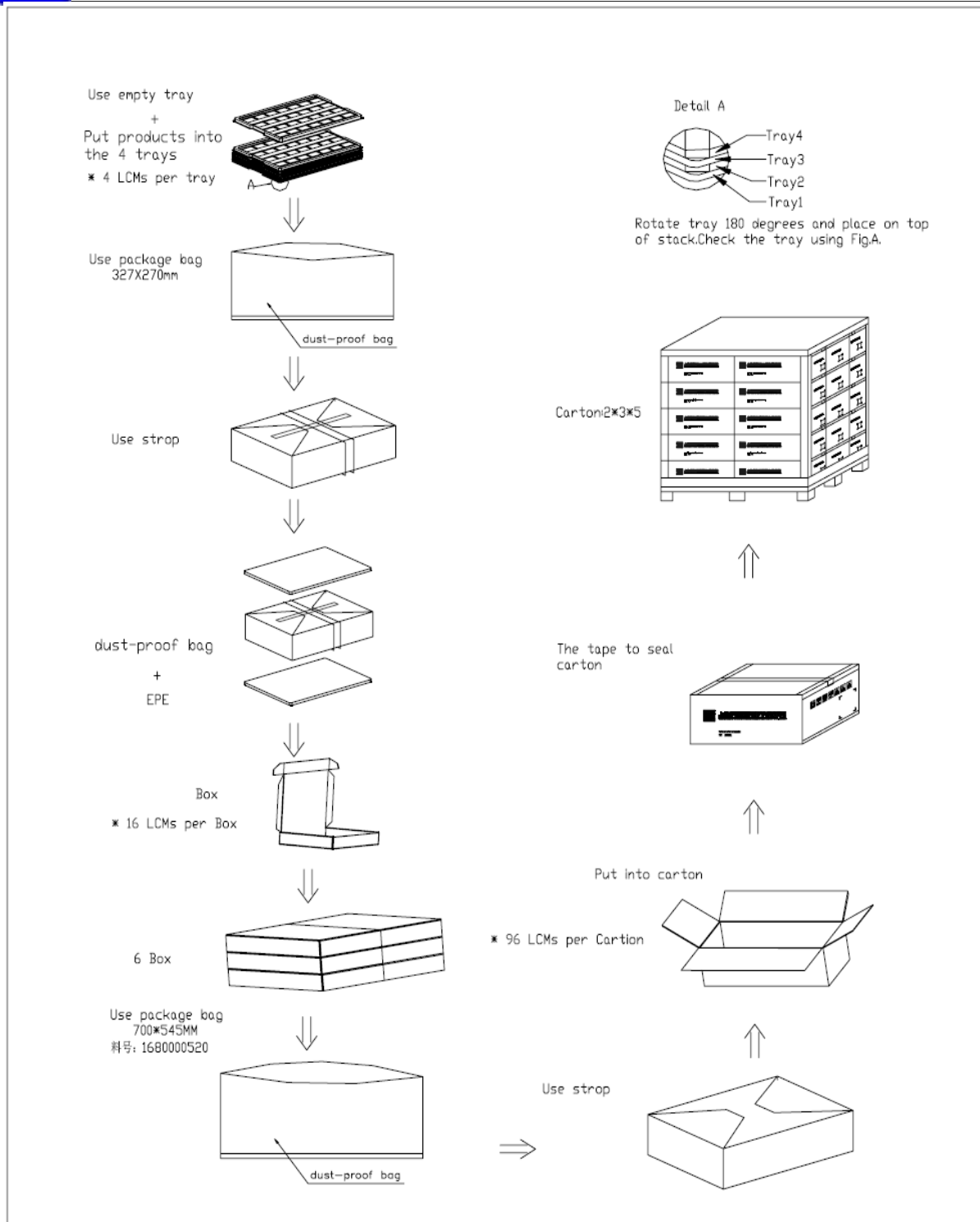
10 Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Weight(Kg)	Quantity	Remark
1	LCM module	TM047NDH01	114.24×72.88×3.15	0.058	96	
2	Tray	PET（Transmit）	315×247×13	0.082	30	Anti-static
3	EPE	EPE	315×247×5	0.080	12	
4	DUST-PROOF BAG	PE	700×545	0.050	1	
5	BOX	CORRUGATED PAPER	260×345×70	0.440	6	
6	DUST-PROOF BAG	PE	327×440	0.025	6	
7	Carton	CORRUGATED PAPER	544×365×250	1.010	1	
8	Total weight(kg)	11.486±5%				

Use empty tray
+
Put products into
the 4 trays
* 4 LCMs per tray

Detail A

Tray4
Tray3
Tray2
Tray1

Rotate tray 180 degrees and place on top
of stack.Check the tray using Fig.A.

Use package bag
327X270mm

dust-proof bag

Use strop

Carton:2*3*5

dust-proof bag
+
EPE

The tape to seal
carton

Box

* 16 LCMs per Box

Put into carton

6 Box

* 96 LCMs per Cartion

Use package bag
700*545MM
料号: 1680000520

Use strop

dust-proof bag

11 Precautions for Use of LCD Modules

11.1 Handling Precautions

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

11.1.2 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.

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

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

11.1.5 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

11.1.6 Do not attempt to disassemble the LCD Module.

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

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

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

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

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

11.1.8.4 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.

11.2 Storage precautions

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

11.2.2 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%

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

11.3 Transportation Precautions:

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

---

12 Product Naming Rule

TFT Module Code		Active Area(size)	Resolution	Deliver Type	Producing Area	Serial Num	
T	M	XXX	X	X	X	X	X

(1) TM : Tianma

(2) Active Area(size): 047= 4.7 inch diagonal

(3)Resolution :

480x240(Delta) A	240x400(Stripe) L
640x240(Delta) B	400x240(Stripe) M
960x240(Delta) C	480x272(Stripe) N
96x64 (Stripe) D	480x234(Stripe) U
128x128(Stripe) E	320x480(Stripe) P
128x160(Stripe) F	480x640(Stripe) Q
176x220(Stripe) G	800x480(Stripe) R
240x320(Stripe) H	800x600(Stripe) S
240x240(Stripe) V	1024x768(Stripe) T
320x320(Stripe) J	others X
320x240(Stripe) K	

(4)Deliver Type

TSP+BL(CCFL)+FPC+M4	A
TSP+BL(LED)+FPC+M4	B
BL(CCFL)+FPC+M4	C
BL(LED)+FPC+M4	D
BL(LED)+FPC+M4.Dual Display	E
FPC+M4	F
M4	G
M3	H
M2	Y
M1	J
BL(CCFL)+FPC+M4+PCB	K
BL(LED)+FPC+M4+PCB	L
TSP+BL(CCFL)+FPC+M4+PCB	M
TSP+BL(LED)+FPC+M4+PCB	N
Others	X

Remark

M1:Panel(array+CF)
M2:Panel(array+CF+LC)
M3:Panel(array+CF+LC+PLZ)
M4:Panel(array+CF+LC+PLZ+Driver)

(5) Producing Area

Shenzhen	Z
Shanghai	H
Chengdu	C
Wuhan	W

13 Cosmetic Spec

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

13.2　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.

13.3　Inspection Sampling Method
 13.3.1. Lot size : Quantity per shipment lot per model
 13.3.2. Sampling type: Normal inspection, Single sampling
 13.3.3. Inspection level: II
 13.3.4. Sampling table : MIL-STD-105D
 13.3.5. Acceptable quality level　（AQL）
     Major defect : AQL=0.4
     Minor defect: AQL=0.65

13.4　Inspection Conditions
 13.4.1 Ambient conditions:
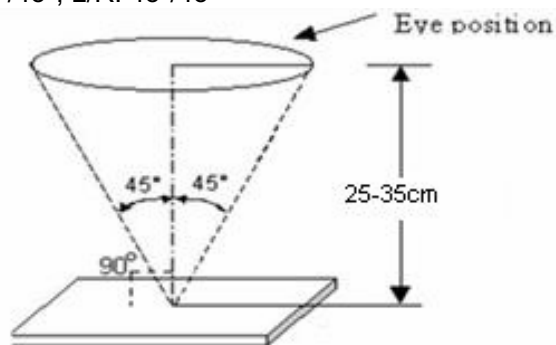   a. Temperature: Room temperature 25±5℃
    b. Humidity: (60±10)％RH
    c. Illumination: Single fluorescent lamp non-directive (1000 to 1200 Lux)
 13.4.2 Viewing distance
    The distance between the LCD and the inspector's eyes shall be at least 30±5cm
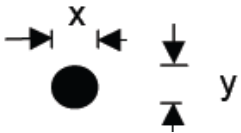 13.4.3 Viewing Angle
     U/D: 45º/45º, L/R: 45º/45º

13.5   Inspection Criteria

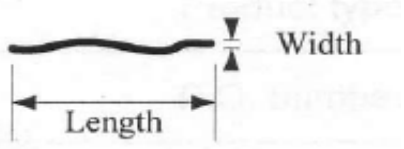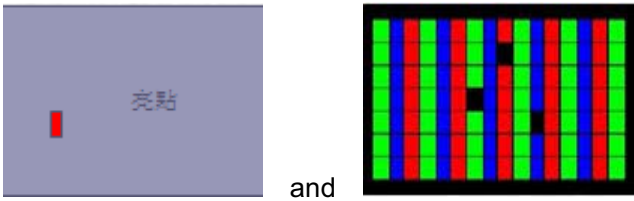Defects are classified as major defects and minor defects according to the degree of defectiveness defined herein.

13.5.1 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

13.5.2   Minor defect

Item No	Items to be inspected	Inspection standard	
5.2.1	Spot Defect Including Black spot White spot Foreign particle	For dark/white spot is defined $\varphi = (x+y) / 2$	
		Size φ(mm)	Acceptable Quantity
		φ≤0.10	Ignore
		0.10 < φ≤0.20	3
		0.20 < φ	Not allowed

5.2.2	Line Defect Including Black line White line Scratch	Define:	
		Width(mm) Length(mm)	Acceptable Quantity
		W≤0.03	Ignore
		0.03< W≤0.1 L≤2.0	2
		0.1< W	Not allowed
5.2.3	Polarizer Dent/Bubble	Sizeφ(mm)	Acceptable Quantity
		φ≤0.1	Ignore
		0.1< φ≤0.3	2
		0.3< φ	Not allowed
5.2.4	Electrical Dot Defect	Bright and Black dot define: and	
		Inspection pattern: Full white、Full black、Red、green and blue screens	
		Item	Acceptable Quantity
		Black dot defect	2
		Bright dot defect	0
		Total Dot	2

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.

13.6   Mechanics specification

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