MODEL NO. : <u>TS024HAACB01</u>

ISSUED DATE: <u>2007-10-16</u>

VERSION : <u>Ver 1.00</u>

■ **Preliminary Specification**
□ **Final Product Specification**

Customer : <u>   </u>

Approved by	Notes

SHANGHAI TIANMA Confirmed :

prepared by	Checked by	Approved by
吴逢治 2007-10-16		刘庆全 2007-10-25

This technical specification is subjected to change without notice

Table of Contents

Record of Revision

Rev	Issued Date	Description
0.10	2007-10-16	Preliminary release
1.00	2007-11-29	Add pacing information, add VCI voltage

GENERAL SPECIFICATIONS

Feature		Spec
Display Spec.	Size	2.4"
	Resolution	240(RGB) X 320
	Interface	CPU
	Color Depth	18bit
	Technology type	a-si TFT
	Pixel pitch (mm)	0.153x0.153
	Display colors	262k
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Plz)	AG
	Surface Treatment(touch panel)	Clear type (3H)
	Viewing Direction	6 o'clock
	Gray Scale Direction	12 o'clock
Mechanical Characteristics	DIM.	LCM (W x H x D) (mm)	42.72x60.26x3.4
	Active Area(mm)	36.72x48.96
	With /Without TSP	WITH TSP
	Weight (gram)	TBD.
	LED Numbers	4 LEDs
Electronic	Driver IC	NT39116

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

2 INPUT/OUTPUT TERMINALS
2.1 TFT LCD Panel

No	Symbol	I/O	Description	Comment
1	DB0	I	Data input	
2	DB1	I	Data input	
3	DB2	I	Data input	
4	DB3	I	Data input	
5	GND1	P	Power Ground	
6	VCC	P	Power Supply of Digital and Analog	
7	/CS	I	Chip select	
8	RS	I	Register select	
9	/WR	I	Write strobe	
10	/RD	I	Read strobe	
11	IM0	I	Mode select	
12	X+	O	Touch panel	
13	Y+	O	Touch panel	
14	X-	O	Touch panel	
15	Y-	O	Touch panel	
16	LED-A	P	LED anode	
17	LED-K1	P	LED cathode	
18	LED-K2	P	LED cathode	
19	LED-K3	P	LED cathode	
20	LED-K4	P	LED cathode	
21	IM3	I	Mode select	
22	DB4	I	Data input	
23	DB10	I	Data input	
24	DB11	I	Data input	
25	DB12	I	Data input	
26	DB13	I	Data input	
27	DB14	I	Data input	
28	DB15	I	Data input	
29	DB16	I	Data input	
30	DB17	I	Data input	
31	/Reset	I	Reset	
32	VCI	P	Power Supply of Digital and Analog	
33	VCC	P	Power Supply of Digital and Analog	
34	GND	P	Power Ground	
35	DB5	I	Data input	
36	DB6	I	Data input	
37	DB7	I	Data input	

Note 2-1: The figure below shows the connection of backlight LED.
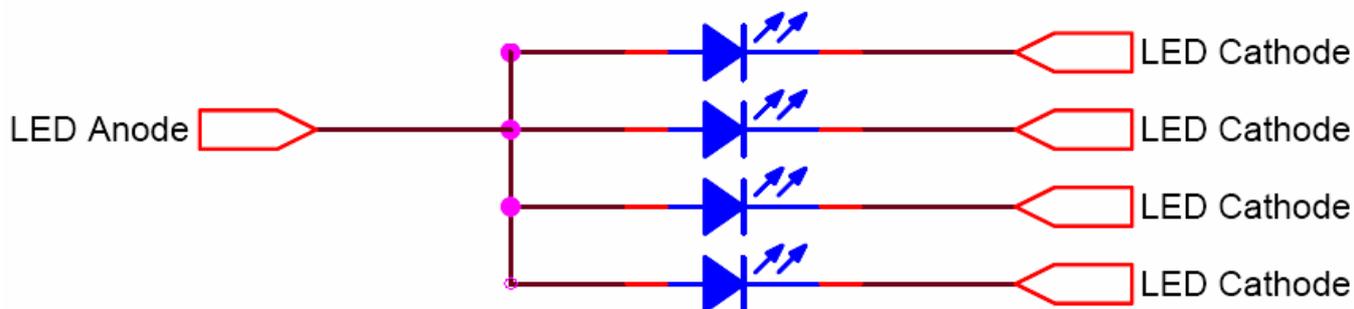
3 ABSOLUTE MAXIMUM RATINGS

Ta = 25℃

Item	Symbol	MIN	MAX	Unit	Remark
Supply Voltage	VCC	-0.3	4.6	V	
Input Signal Voltage	CS,RS,WR,RD, RESET, D[0 :15]	-0.3	4.6	V	
Back Light Forward Current	I_{LED}		25	mA	One LED
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	

4 ELECTRICAL CHARACTERISTICS

4.1. Driving TFT LCD Panel

GND=0V, Ta=25℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Supply voltage		VCI	2.5	2.8	3.3		
supply voltage		VCC	1.65	2.8	3.3	V	
Input Signal Voltage	Low Level	V_{IL}	0		0.2*VCC	V	Input Signal Voltage
	High Level	V_{IH}	0.8*VCC		VCC	V	
Output Signal Voltage	Low Level	V_{IL}	0		0.2*VCC	V	output Signal Voltage
	High Level	V_{IH}	0.8*VCC		VCC	V	
(Panel+LSI) Power Consumption	Black Mode	TBD	TBD	TBD	mW	
	8 color Mode	TBD	TBD	TBD	mW	
	Standby Mode	TBD	TBD	TBD	mW	

4.2 Driving Backlight　　Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	--	20	--	mA	
Forward Voltage	V_F	(2.85)	3.2	(3.5)	V	
Power Consumption	W_{BL}	--	256	--	mW	

4.3. Block Diagram
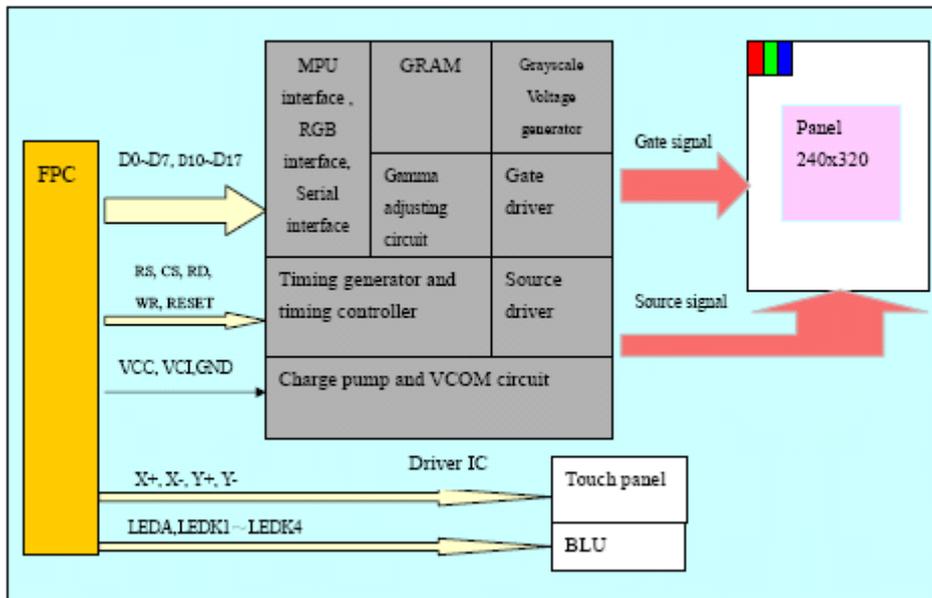
5   TIMING CHART

Item		Symbol	Unit	Min.	Typ.	Max.	Remark
Bus cycle time	Write	t_{CYCW}	ns	100	-	-	
	Read	t_{CYCR}	ns	300	-	-	
Write low-level pulse width		PW_{LW}	ns	50	-	500	
Write high-level pulse width		PW_{HW}	ns	50	-	-	
Read low-level pulse width		PW_{LR}	ns	150	-	-	
Read high-level pulse width		PW_{HR}	ns	150	-	-	
Write / Read rise / fall time		t_{WRf}/t_{WRf}	ns	-	-	25	
Setup time	Write (RS to nCS, E/nWR)	t_{AS}	ns	10	-	-	
	Read (RS to nCS, RW/nRD)			5	-	-	
Address hold time		t_{AH}	ns	5	-	-	
Write data set up time		t_{DSW}	ns	10	-	-	
Write data hold time		t_H	ns	15	-	-	
Read data delay time		t_{DDR}	ns	-	-	100	
Read data hold time		t_{DHR}	ns	5	-	-	

Reset Timing Characteristics

Ta=25℃

Item	Symbol	Unit	Min.	Typ.	Max.
Reset low-level width	tRES	ms	1	-	-
Reset rise time	trRES	μs	-	-	10
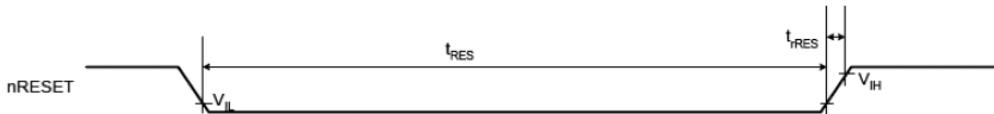
Register read/write timing:
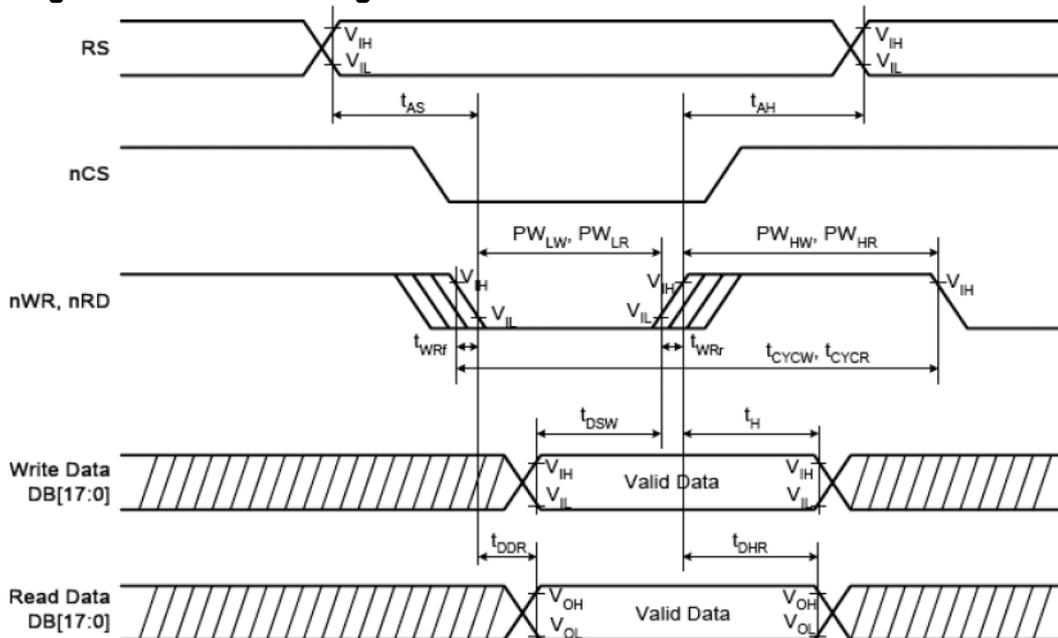
5.2 Power On/OFF Sequence

Refer to the ILI9325 datasheet for more details

Power ON Sequence

Step	Settings
Power Supply ON (V_{CI}, IOV_{CC}) $VCI \rightarrow IOV_{CC}$ or VCI, IOV_{CC} Simultaneously	
Power On Reset and Display OFF	**Display OFF Setting** DTE = 0 D[1:0] = 00 GON = 0 PON = 0
Registers setting before power supply startup	**Power supply initial setting** Set VC[2:0], VRH[3:0], VCM[5:0], VDV[5:0], PON=0
Registers setting for power supply startup (1)	**Power supply operation setting (1)** BT[2:0] = 000 Set DC1[2:0], DC0[2:0] PON = 1 Set AP[2:0]
Registers setting for power supply startup (2)	**Power supply operation setting (2)** Set BT[2:0]
Set the other registers	
Display ON Sequence	Set SAP=1
Display ON	DTE=1 D[1:0]=11 GON=1
Backlight ON	

- 1ms or more
- 10ms or more Oscillator Stabilizing time
- LCD Power Supply ON Sequence
- 40ms or more Step-up circuit stabilizing time
- Operational Amplifier stabilizing time

Power OFF Sequence

Step	Settings
Normal Display	**Display ON Setting** DTE=1 D[1:0]=11 GON=1
Backlight OFF	
Display OFF Sequence	
Display OFF	
Power Supply Halt Setting	SAP=0 AP[2:0] = 000 PON = 0
Power Supply OFF (V_{CI}, IOV_{CC}) $IOV_{CC} \rightarrow VCI$ Or IOV_{CC}, VCI Simultaneously	

6 OPTICAL CHARACTERISTICS
6.1 Optical Specification

Ta=25℃

| Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
View Angles		ΘU	CR≧10	Tbd	40		Degree	Note 2
		ΘD		Tbd	20			
		ΘL		Tbd	45			
		θR		Tbd	45			
Contrast Ratio		CR	θ=0º		350			Note3
Response Time		Tr	25℃		25	40	ms	Note4
		Tf						
Chromaticity	**White**	x	Brightness is on		TBD			Note5, Note1
		y			TBD			
	RED	x			TBD			
		y			TBD			
	GREEN	x			TBD			
		y			TBD			
	BLUE	x			TBD			
		y			TBD			
Uniformity		U			80		%	Note6
NTSC					（60）		%	Note 5
Luminance		L			200		cd/m^2	Note7

Test Conditions:

1. Vcc=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.

Photo detector

Field

500mm

TFT-LCD Module

LCD Panel

The center of the screen
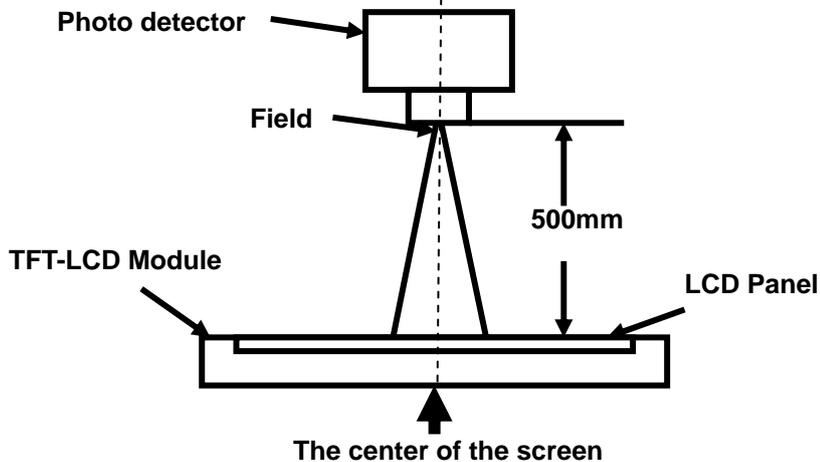
Item	Photo detector	Field
Contrast Ratio		
Luminance	SR-3A	1°
Chromaticity		
Lum Uniformity		
Response Time	BM-7A	

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)。

$\Phi=90°$
12 o'clock direction

Normal line
$\theta=\Phi=0°$

θ_L

θ_T

θ_R

θ_B

$\Phi=180°$

Active Area

$\Phi=0°$

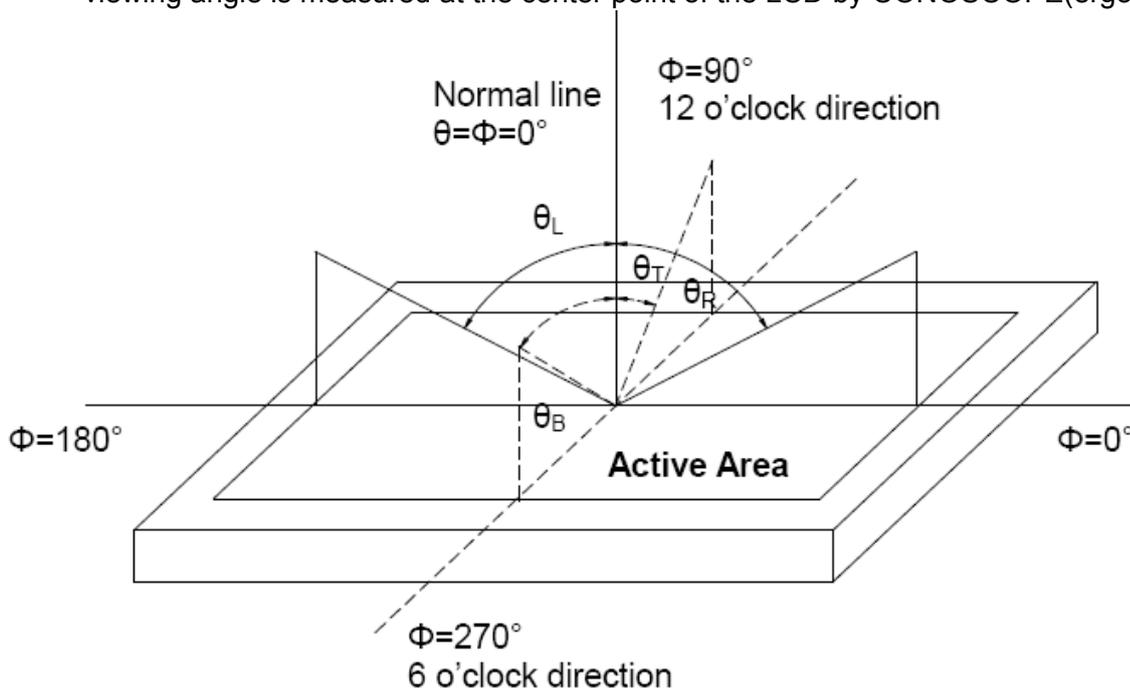$\Phi=270°$
6 o'clock direction

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 which the LCD is driven by **V**white.
"Black state": The state is which the LCD is driven by **V**black.
Vwhite: To be determined   **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%.
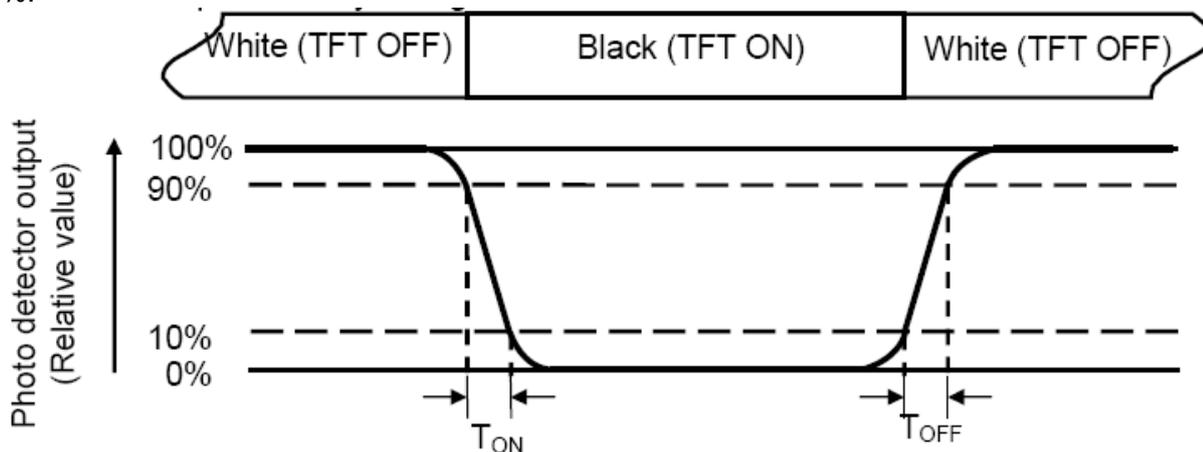
Note 5: Definition of color chromaticity (CIE1931)
Color coordinates measured at center point of LCD.

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) = L$_{min}$/ L$_{max}$
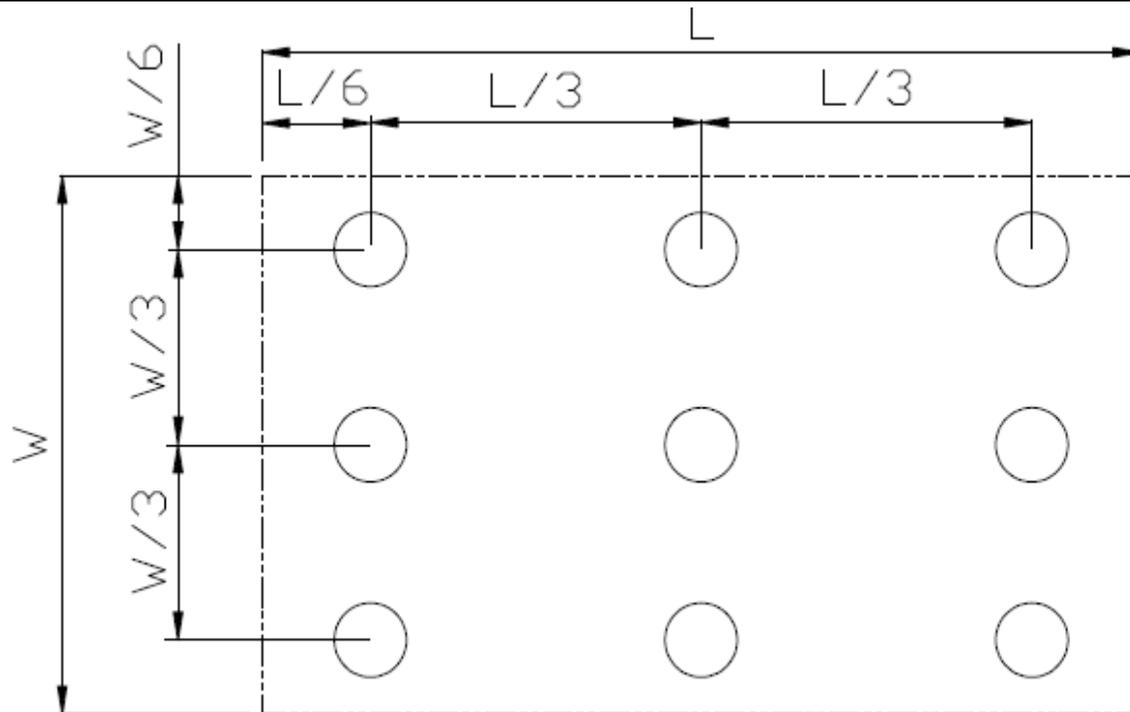L-------Active area length W----- Active area width

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
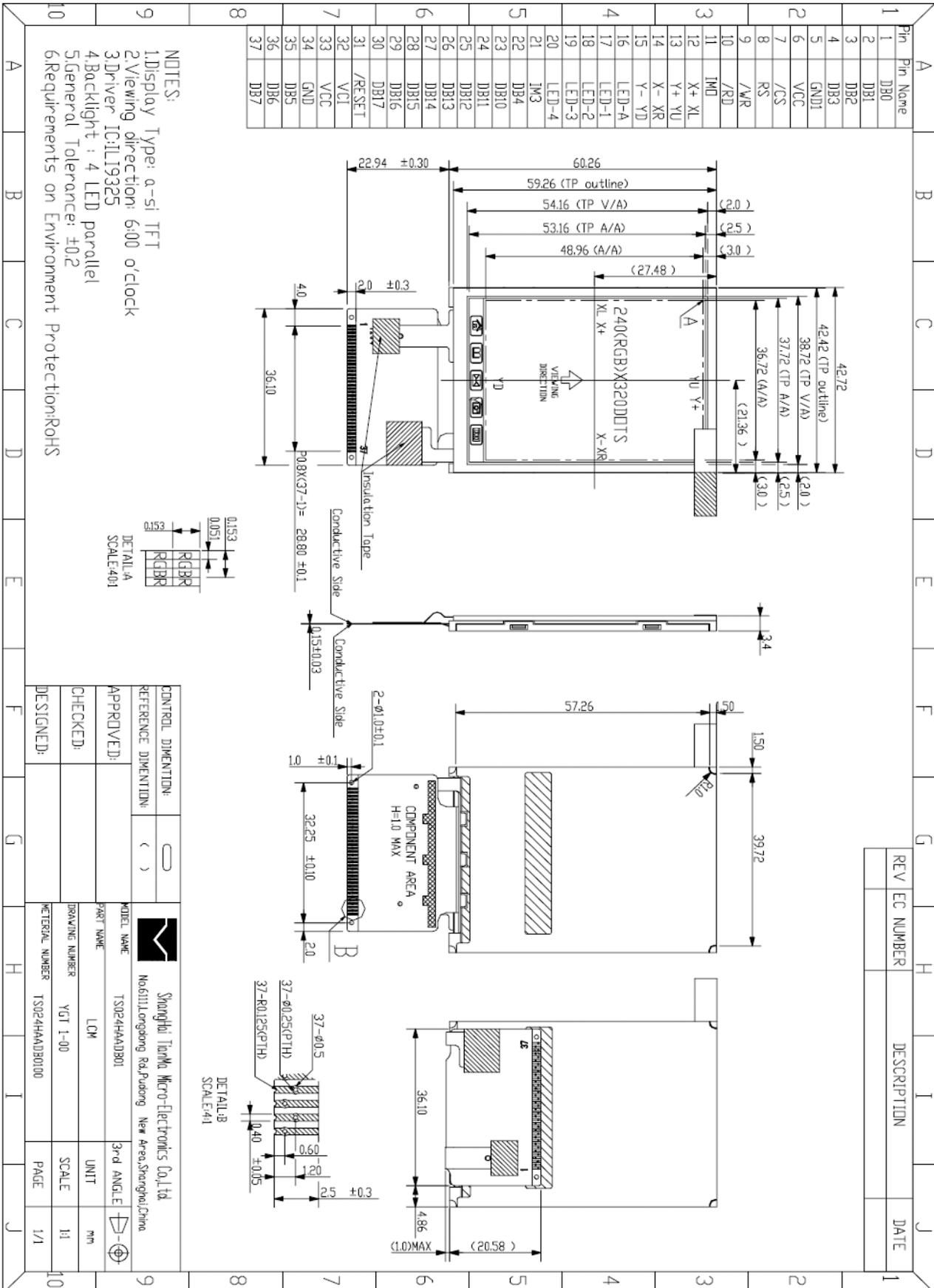
7 Environmental / Reliability Tests

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+70℃, 240hrs	Note1 IEC60068-2-2,GB2423.2—89
2	High Temperature & High Humidity Operation	Ta = +60℃, 90% RH max,240 hours	Note2 IEC60068-2-3, GB/T2423.3—2006
3	Low Temperature Operation	Ta=-20℃, 240hrs	IEC60068-2-1 GB2423.1—89
4	High Temperature Storage (non-operation)	Ta=+80℃, 240hrs	IEC60068-2-2, GB2423.2—89
5	Low Temperature Storage (non-operation)	Ta=-30℃, 240hrs	IEC60068-2-1 GB2423.1—89
6	Thermal Shock (non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, 30 Cycle	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:±15KV，5times;Contact:±8KV，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)	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/2423.8—1995

Note1: Ts is the temperature of panel's surface.
Note2: Ta is the ambient temperature of samples.

8 MECHANICAL DRAWING

NOTES:
1. Display Type: a-si TFT
2. Viewing direction: 6:00 o'clock
3. Driver IC:ILI9325
4. Backlight : 4 LED parallel
5. General Tolerance: ±0.2
6. Requirements on Environment Protection:RoHS

Pin / Pin Name table:

Pin	Pin Name		Pin	Pin Name
1	DB0		20	LED-4
2	DB1		21	IM3
3	DB2		22	DB4
4	DB3		23	DB10
5	GND1		24	DB11
6	VCC		25	DB12
7	/CS		26	DB13
8	RS		27	DB14
9	/WR		28	DB15
10	/RD		29	DB16
11	IM0		30	DB17
12	X+ XL		31	/RESET
13	Y+ YU		32	VCI
14	X- XR		33	VCC
15	Y- YD		34	GND
16	LED-A		35	DB5
17	LED-1		36	DB6
18	LED-2		37	DB7
19	LED-3			

Dimensions:
- 22.94 ±0.30
- 60.26
- 59.26 (TP outline)
- 54.16 (TP V/A) (2.0)
- 53.16 (TP A/A) (2.5)
- 48.96 (A/A) (3.0)
- (27.48)
- 42.72
- 38.72 (TP outline)
- 37.72 (TP V/A)
- 36.72 (A/A)
- (21.36)
- 40 2.0 ±0.3
- 36.10
- P0.8X(37-1)= 28.80 ±0.1
- 240(RGB)X320DOTS
- XL X+ / XU Y+ / X- XR
- VIEWING DIRECTION
- Insulation Tape
- Conductive Side
- 0.15±0.03 Conductive Side
- 3.4

DETAIL:A SCALE:40:1
- 0.153
- 0.153
- 0.051
- RGBR / RGBR

- 57.26
- 1.50
- 1.50
- R0.3
- 39.72
- 2-ø1.0±0.1
- 1.0 ±0.1
- 32.25 ±0.10
- COMPONENT AREA H=1.0 MAX
- 2.0

DETAIL:B SCALE:4:1
- 37-ø0.25(PTH)
- 37-R0.125(PTH)
- 37-ø0.5
- 37-ø0.25(PTH)
- 36.10
- 0.40
- 0.60
- 1.20
- 2.5 ±0.3
- 4.86
- (1.0)MAX
- (20.58)

Title block:

Shanghai TianMa Micro-Electronics Co.,Ltd
No.6111,Longdong Rd.,Pudong New Area,Shanghai,China

CONTROL DIMENTION:	
REFERENCE DIMENTION:	( )
APPROVED:	MODEL NAME: TS024HAADB01
CHECKED:	PART NAME: LCM
DESIGNED:	DRAWING NUMBER: YGT 1-00
	METERIAL NUMBER: TS024HAADB0100

3rd ANGLE	PAGE 1/1	SCALE 1:1	UNIT mm

REV	EC NUMBER	DESCRIPTION	DATE

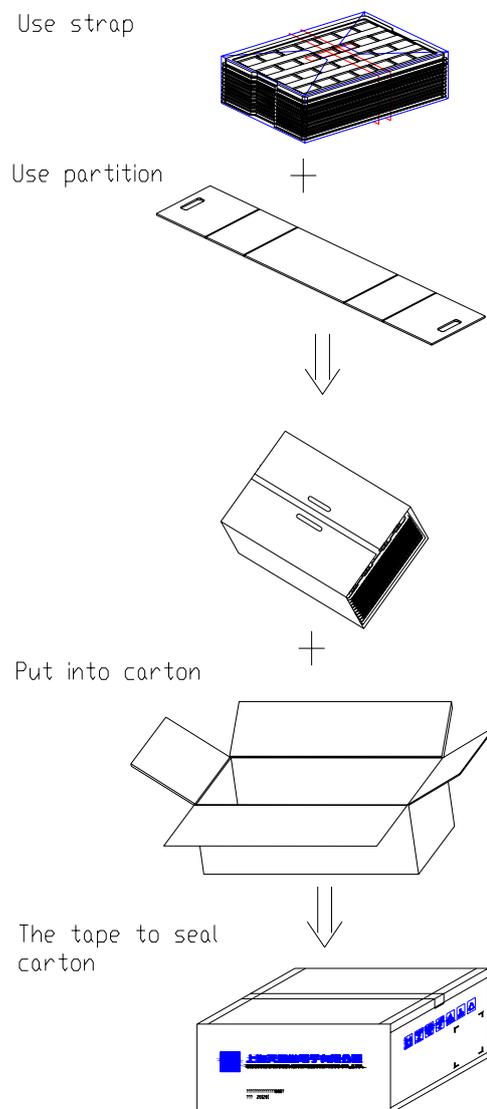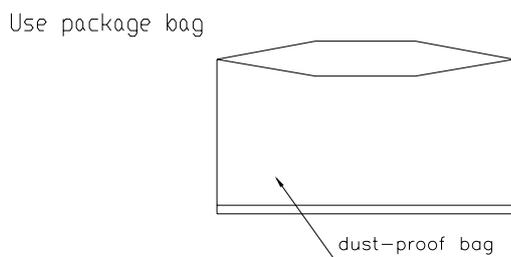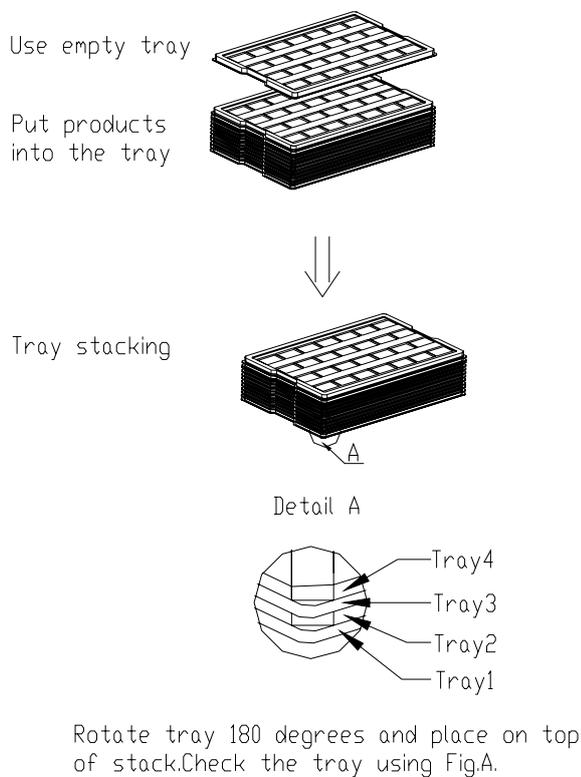## 9   Packing

Package Quantity:
  One Tray Include: 28 Pcs Module
  One package: 22Pcs Tray(21Tray+1Empty Tray)
  One Carton Include: 28X21=588 Pcs Module

Use empty tray

Put products
into the tray

Use strap

Use partition

Tray stacking

Detail A

Tray4
Tray3
Tray2
Tray1

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

Put into carton

Use package bag

The tape to seal
carton

dust-proof bag

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.