MODEL NO. : TM028HDH01

ISSUED DATE: 2009-01-07

VERSION : Ver 1.1

□Preliminary Specification
■Final Product Specification

Customer :_____

Approved by	Notes

SHANGHAI TIANMA Confirmed :

prepared by	Checked by	Approved by
肖明 2009.1.9.	姚波辉 2009.1.9	徐明 09.1.9

This technical specification is subjected to change without notice

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2008-04-25	Rev 1.0 was issued	Xu Yun
1.1	2009-01-07	Modify the Module Name fromTS028HAACD01-00	Gao Ming

1 General Specifications

Feature		Spec
Display Spec.	Size	2.83 inch
	Resolution	240(RGB) X 320
	Interface	CPU 16 bits
	Color Depth	262K
	Technology Type	a-Si TFT
	Pixel Pitch (mm)	0.180x0.180
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Anti glare (3H)
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	50.00x69.20x2.65
	Active Area(mm)	43.2 x 57.6
	With /Without TSP	Without
	Weight (g)	18.64
	LED Numbers	4 LEDs
Electronic	Driver IC	ILI9325

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:LCM weight tolerance: ±5%

2 Input/Output Terminals

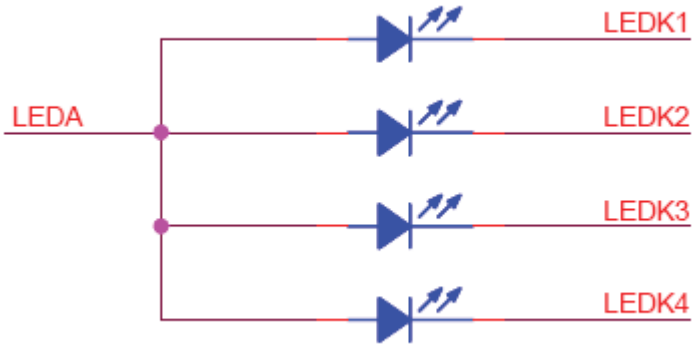
2.1 TFT LCD Panel

No	Symbol	I/O	Description	Remarks
1	DB0	I	Data input	
2	DB1	I	Data input	
3	DB2	I	Data input	
4	DB3	I	Data input	
5	GND	P	Power Ground	
6	VCC	P	Power Supply of Digital	
7	/CS	I	A chip select signal	
8	RS	I	A register select signal	
9	/WR	I	A write strobe signal and enables an operation to write data when the signal is low.	
10	/RD	I	A read strobe signal and enables an operation to read out data when the signal is low.	
11	NC			
12	X+	I	Touch Panel X(Right Side)	Not used
13	Y+	I	Touch Panel Y(6 Clock Side)	Not used
14	X-	I	Touch Panel X(Left Side)	Not used
15	Y-	I	Touch Panel Y(12 Clock Side)	Not used
16	LEDA	I	LED anode	
17	LEDK1	I	LED cathode	
18	LEDK2	I	LED cathode	
19	LEDK3	I	LED cathode	
20	LEDK4	I	LED cathode	
21	NC			
22	DB4	I	Data input	
23	DB8	I	Data input	
24	DB9	I	Data input	
25	DB10	I	Data input	
26	DB11	I	Data input	
27	DB12	I	Data input	
28	DB13	I	Data input	
29	DB14	I	Data input	
30	DB15	I	Data input	
31	/RESET	I	A RESET signal	
32	VCI	P	Power Supply of Analog	
33	VCC	P	Power Supply of Digital	
34	GND	P	Power Ground	
35	DB5	I/O	Data input	
36	DB6	I/O	Data input	
37	DB7	I/O	Data input	

Note2-1: I/O definition:

I-----Input O---Output P----Power

Note 2-2: The figure below shows the connection of backlight LED.



3 Absolute Maximum Ratings

3.1 Driving TFT LCD Panel

Ta = 25°C

Item	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	VCC	-0.3	4.6	V	
Analog Supply Voltage	VCI	-0.3	4.6	V	
Input Signal Voltage	DB0~DB15,/CS,RS,/WR, /RD,/RESET	-0.3	VCC +0.3	V	
Touch Panel Pin Voltage	V_{TP}	--	7	V	
Back Light Forward Current	I_{LED}	--	25	mA	For each LED
Operating Temperature	T_{OPR}	-20	60	℃	
Storage Temperature	T_{STG}	-30	70	℃	

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

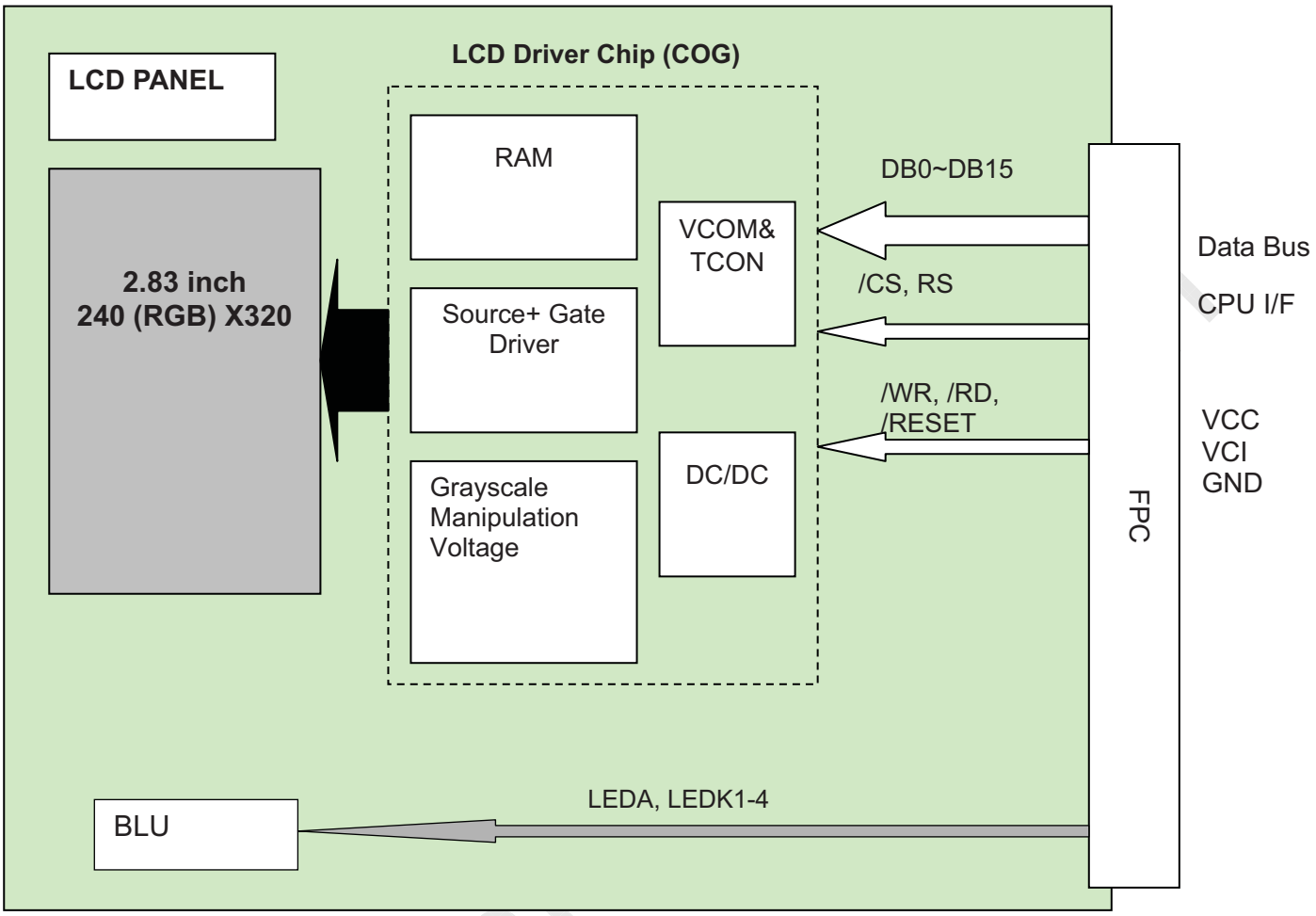
GND=0V, Ta=25℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage		VCC	2.5	2.8	3.3	V	
Analog Supply Voltage		VCI	2.5	2.8	3.3	V	
Input Signal Voltage	Low Level	V_{IL}	-0.3	--	0.2xVCC	V	DB0~DB15,/CS,RS,/WR, /RD,/RESET
	High Level	V_{IH}	0.8xVCC	--	VCC	V	
Output Signal Voltage	Low Level	V_{OL}	--	--	0.2xVCC	V	
	High Level	V_{OH}	0.8xVCC	--	--	V	
(Panel+ LSI) Power Consumption		Black Mode (60Hz)	--	15.4	--	mW	
		Standby Mode	--	70	--	μ W	
		Sleeping Mode	--	196	--	μ W	

4.2 Driving Backlight Ta=25℃

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

4.3 Block Diagram



5 Timing Chart

5.1 Timing Parameter

Item		Symbol	Unit	Min	Typ	Max
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_{WRr} / t_{WRf}	ns	-	-	25
Setup time	Write (RS to /CS, /WR)	t_{AS}	ns	10	-	-
	Read (RS to /CS, /RD)			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	-	-

Table 5.1 timing parameter

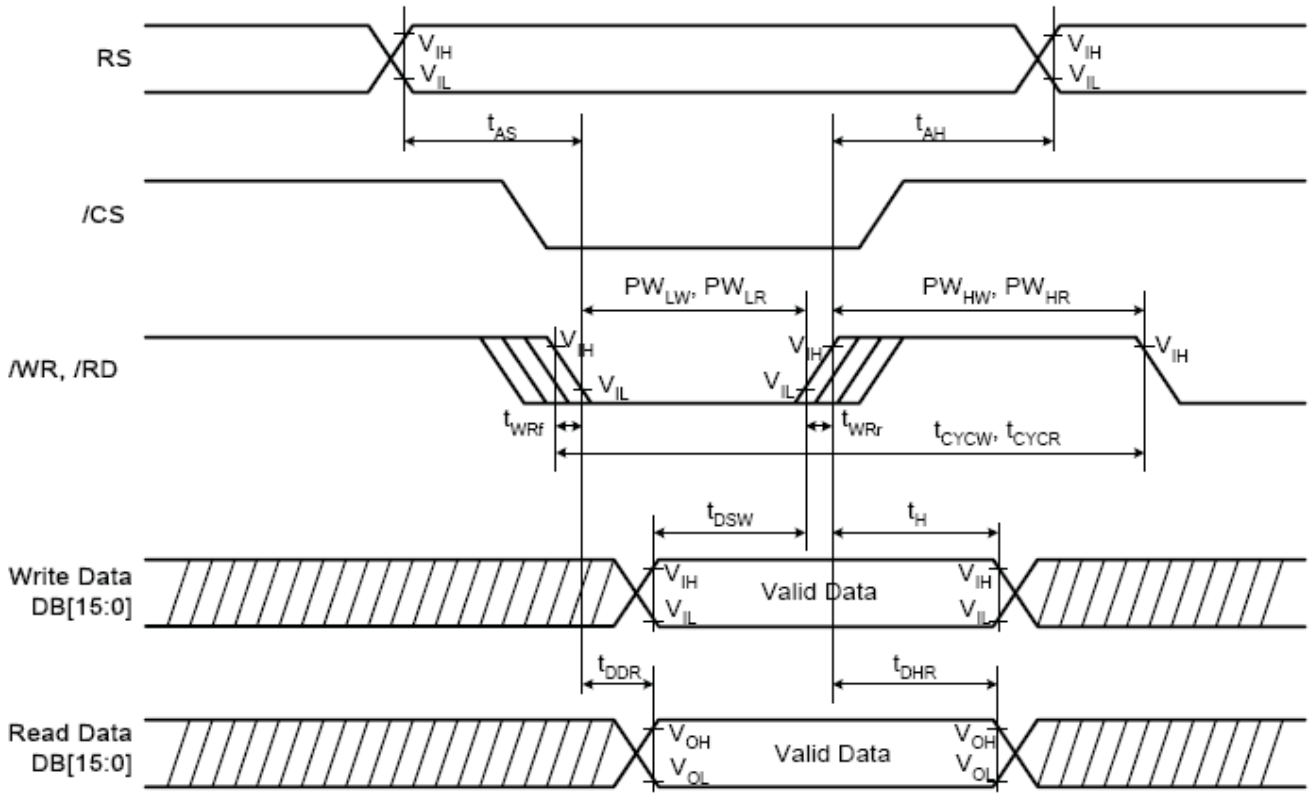


Figure 5.1 i80 System Bus Timing

5.2 Register write/read timing in I80 series system

a. Write to register

b. Read from register

Figure 5.2 i80 16-bit System Bus Interface Timing

5.3 GRAM write/read timing in I80 series system

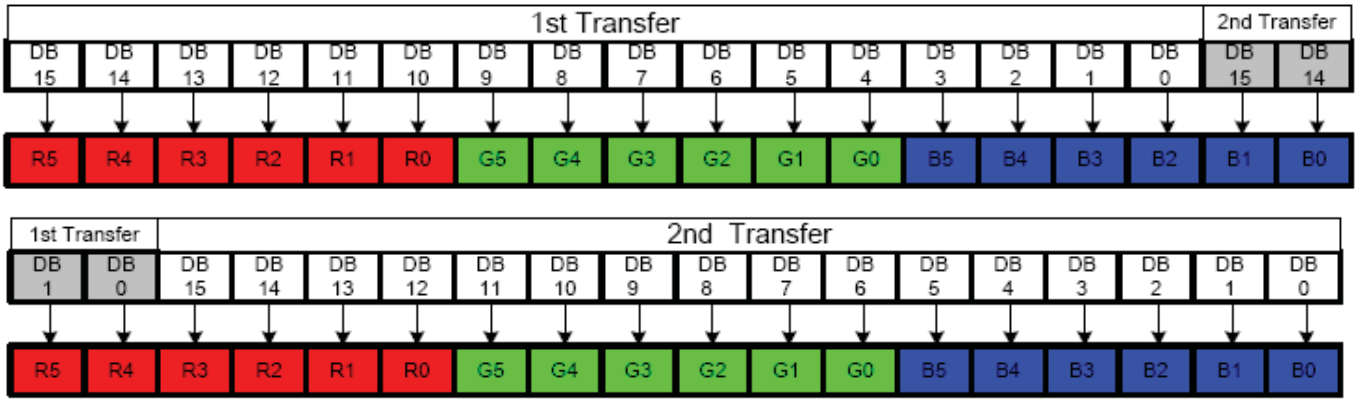
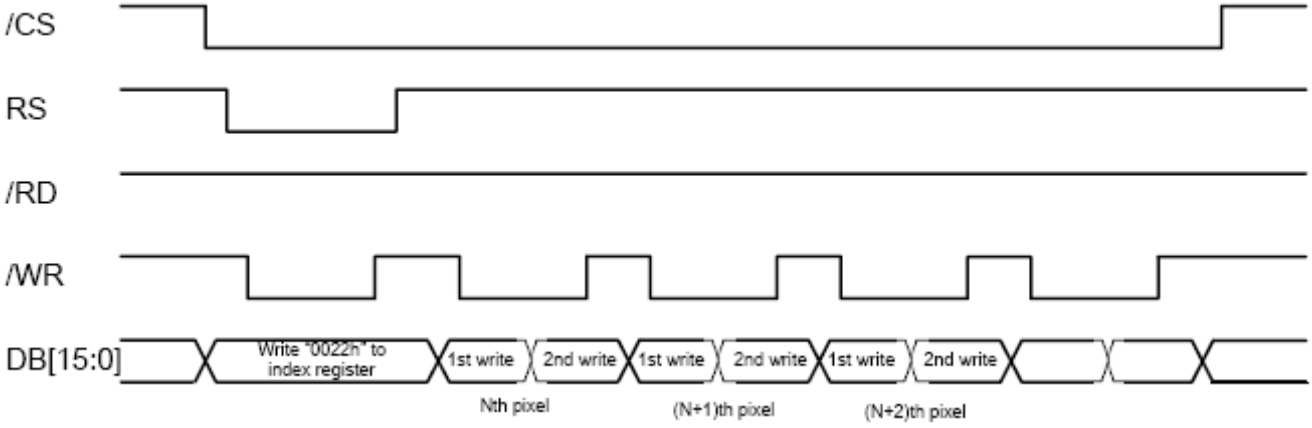


Table 5.3 GRAM Data and display data of 16- bit system interface

GRAM Read/Write Timing

a. Write to GRAM



b. Read from GRAM

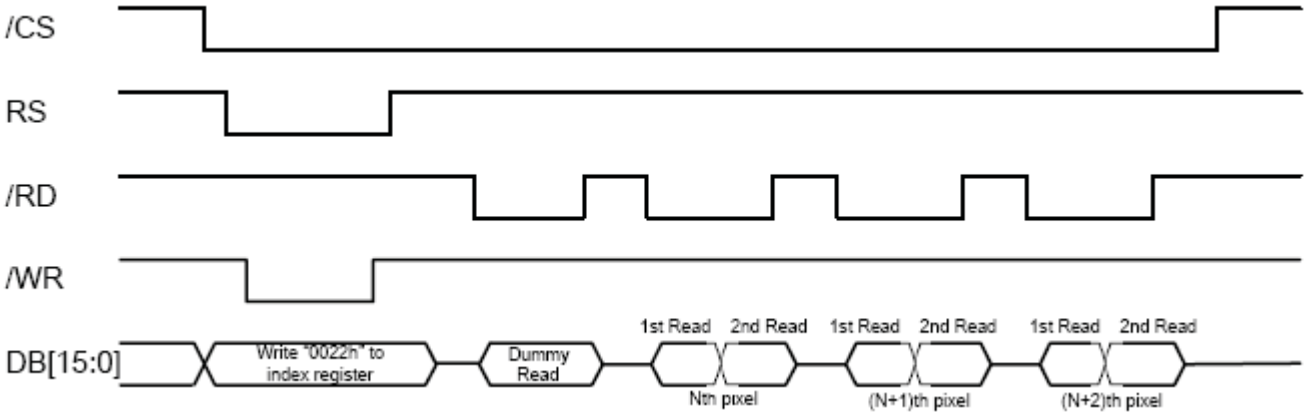
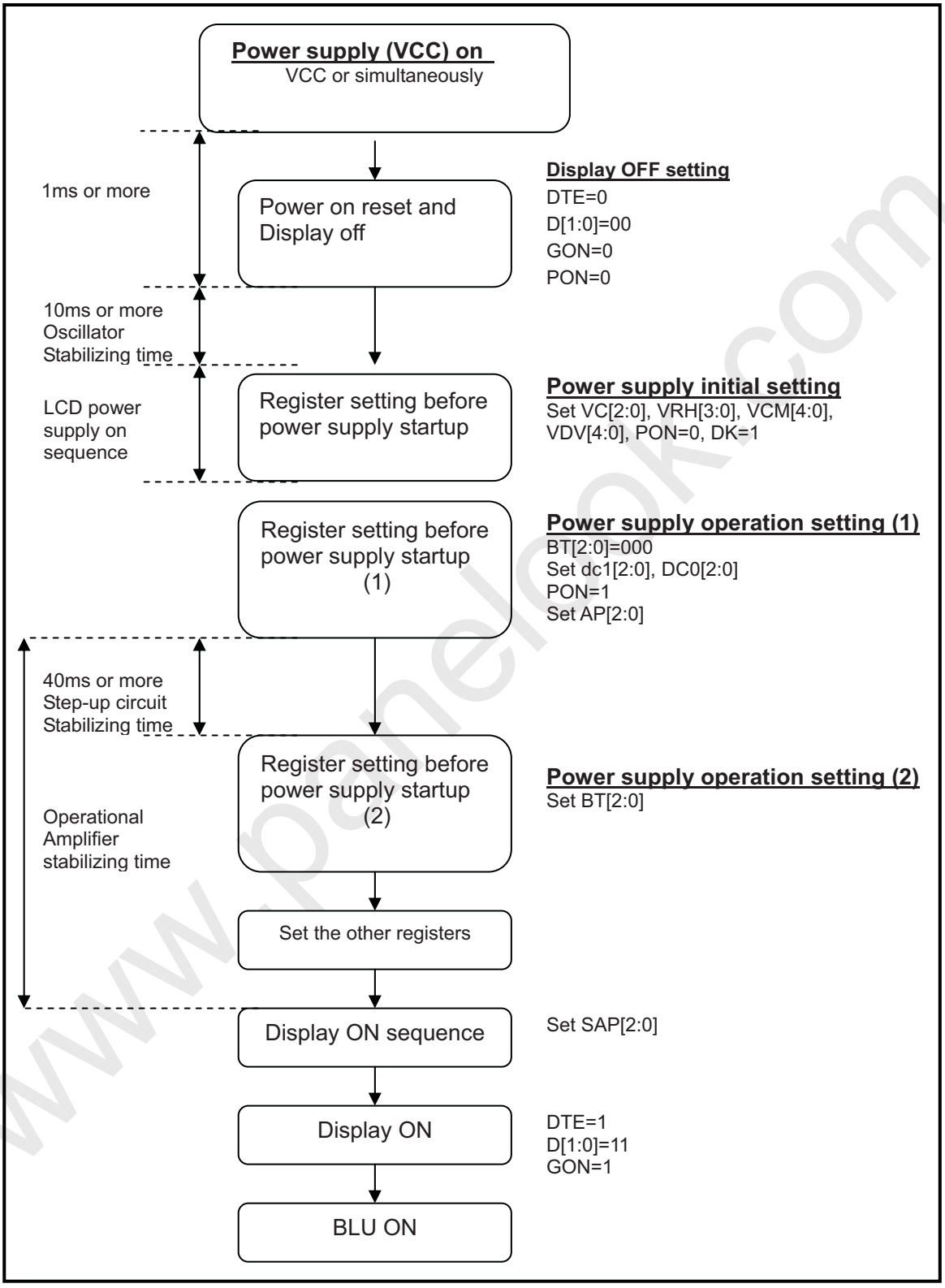


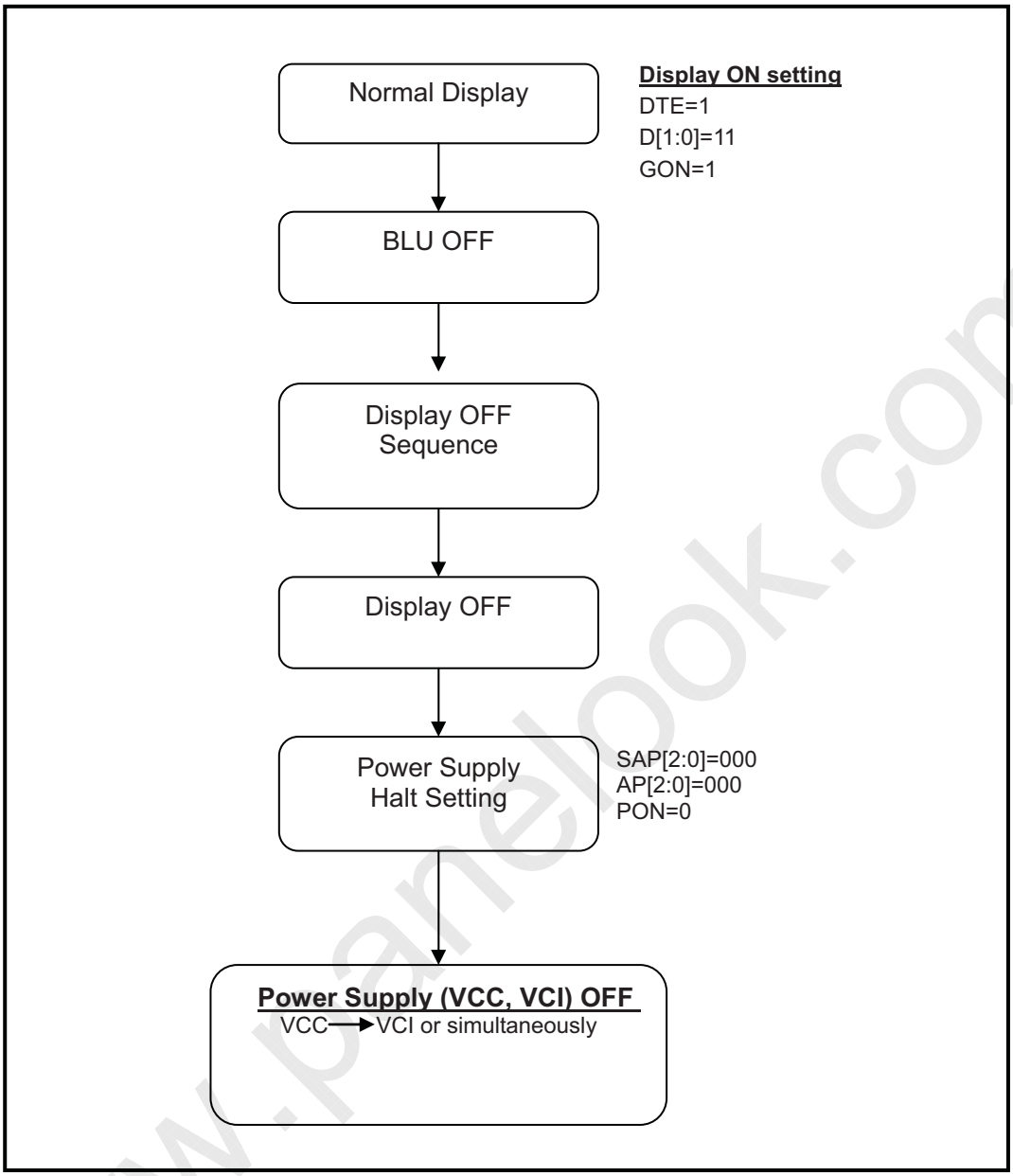
Figure 5.3 GRAM Read/Write Timing of i80 16-bit System Interface

5.4 Power On/Off sequence

5.4.1 Power on Sequence



5.4.2 Power off Sequence



6 Optical Characteristics

6.1 Optical Specification

Ta=25℃

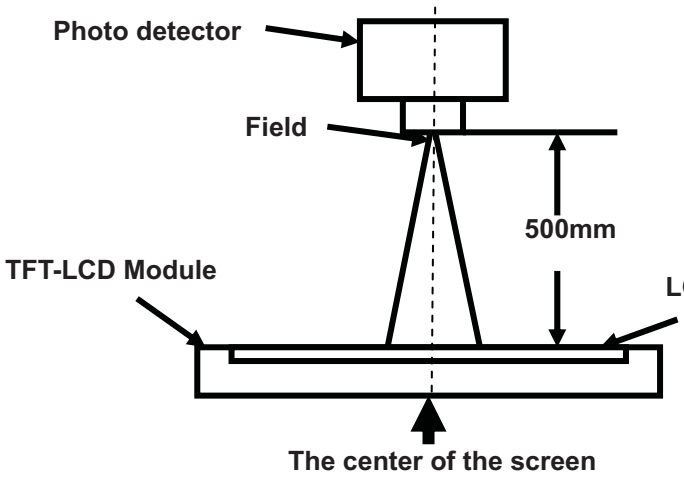
Item		Symbol	Condition	Min	Typ.	Max.	Unit	Remark
View Angles		θT	CR≧10	50	60	-	Degree	Note 2
		θB		30	40	-		
		θL		50	60	-		
		θR		50	60	-		
Contrast Ratio		CR	θ=0°	200	350	-		Note1 Note3
Response Time		Ton	25℃	-	25	40	ms	Note1 Note4
		Toff						
Chromaticity	White	x	Backlight is on	0.260	0.310	0.360		Note5, Note1
		y		0.280	0.330	0.380		
	RED	x		0.564	0.614	0.664		
		y		0.321	0.371	0.421		
	GREEN	x		0.284	0.334	0.384		
		y		0.547	0.597	0.647		
	BLUE	x		0.091	0.141	0.191		
		y		0.060	0.110	0.160		
Uniformity		U		75	80	-	%	Note1 Note6
NTSC				-	55	-	%	Note 5
Luminance		L		200	250	-	cd/m^2	Note1 Note7

Test Conditions:

1. VCI=2.8V, I_L=20mA(One 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)。

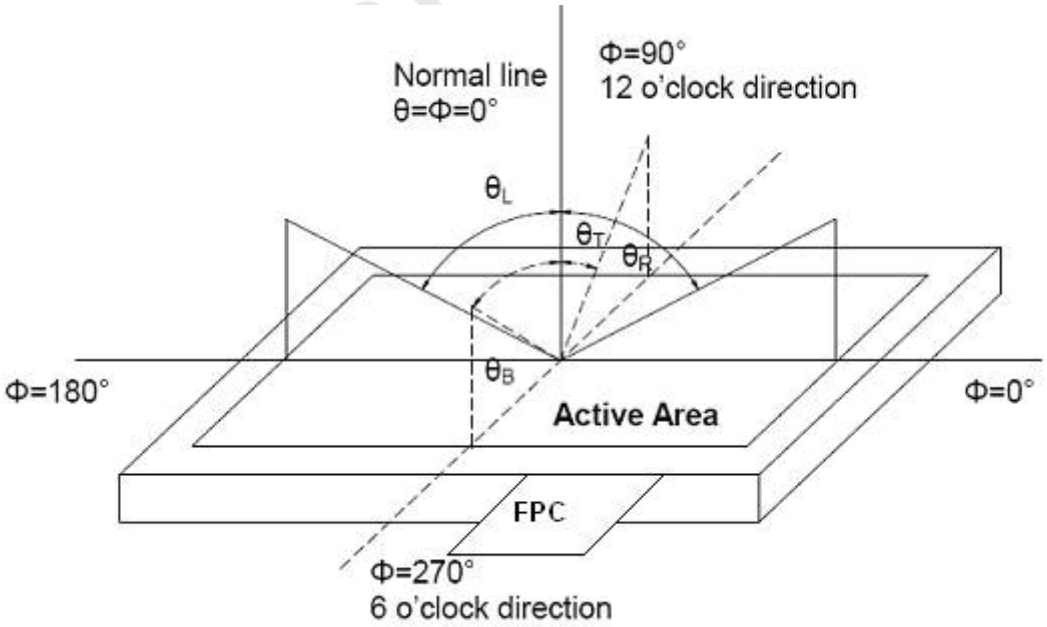


Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

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

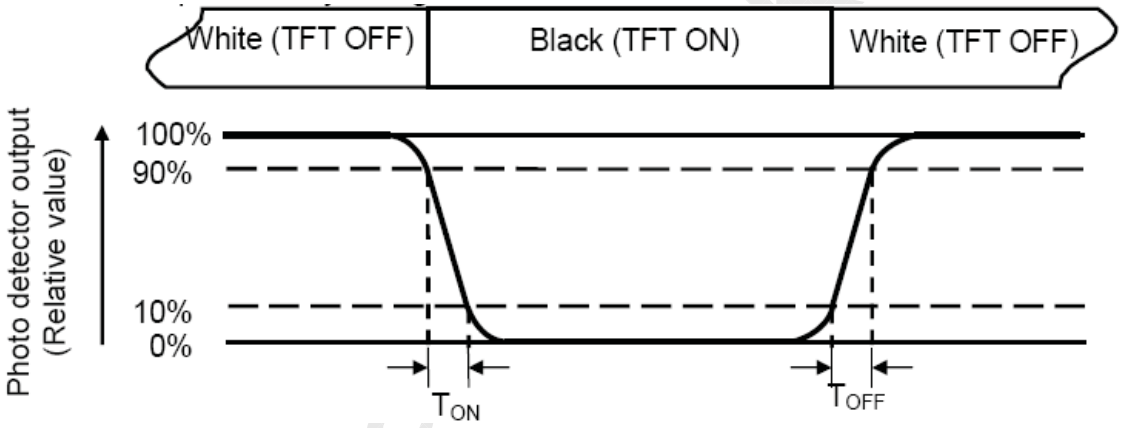
“White state “:The state is that the LCD should driven by Vwhite.

“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

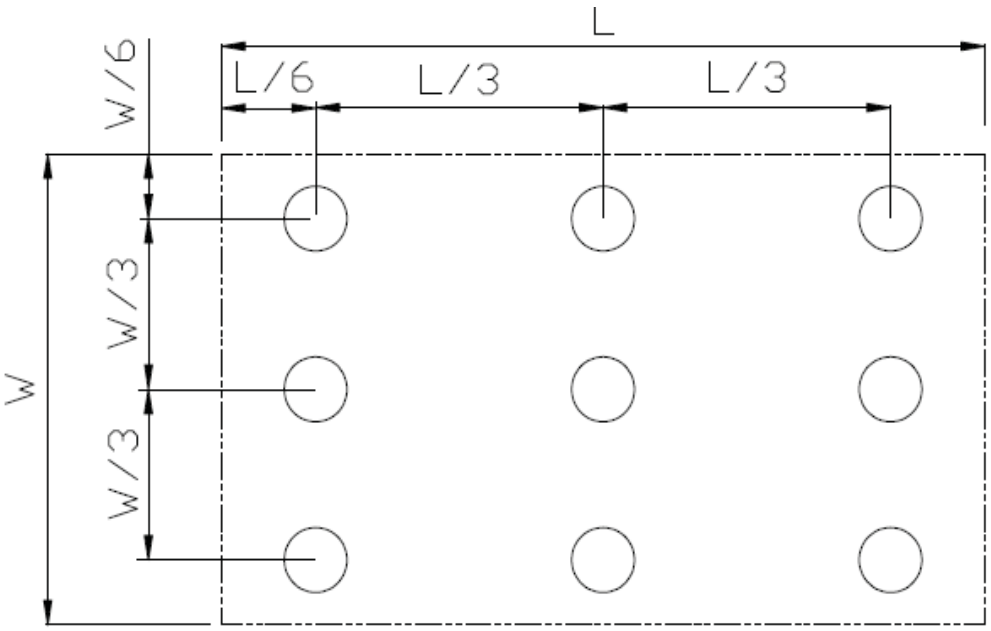


Fig. 2 Definition of uniformity

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.

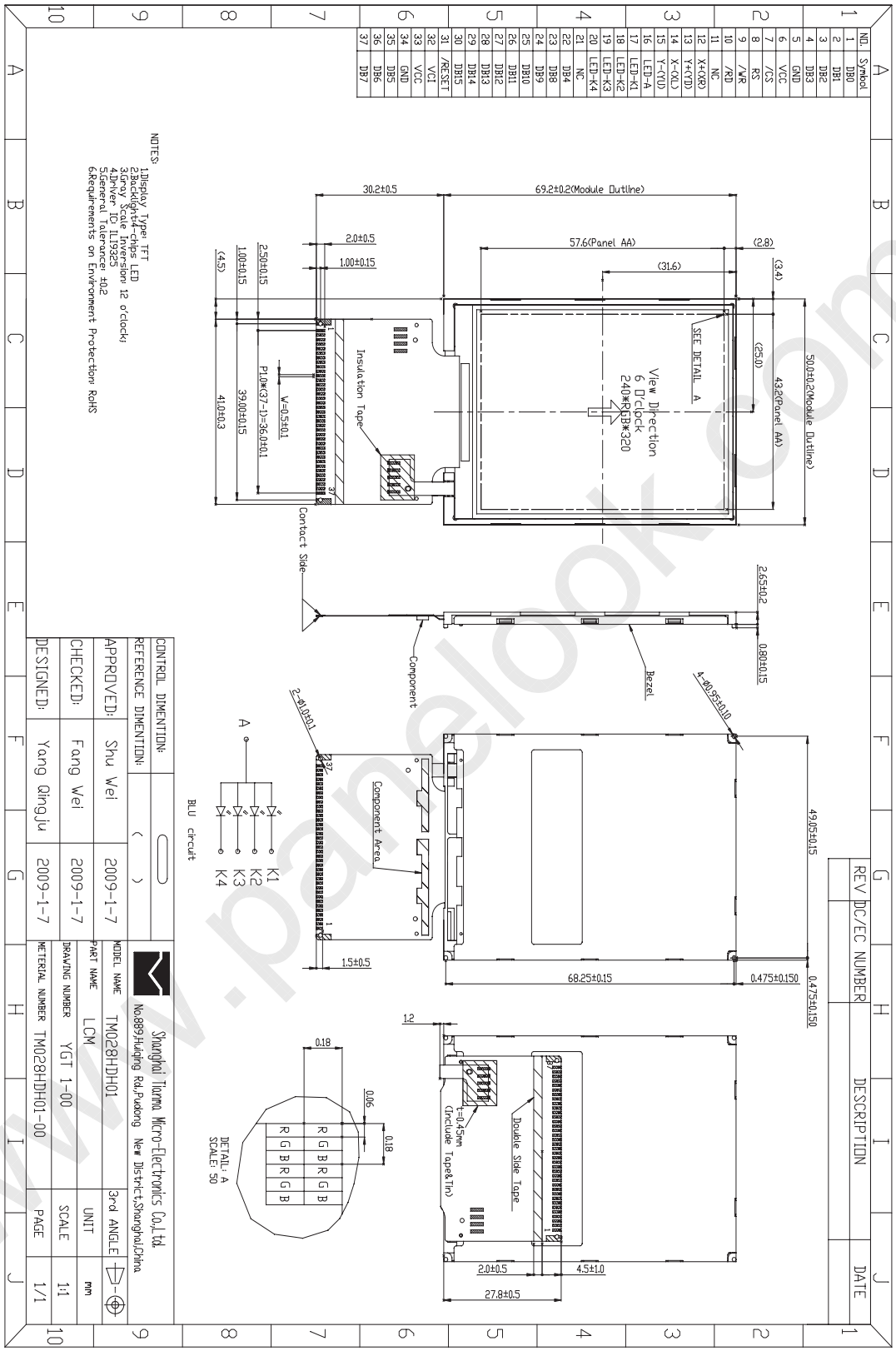
7 Environmental / Reliability Tests

No	Test Item	Condition	Remarks
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

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

Note2: Ta is the ambient temperature of sample.

8 Mechanical Drawing

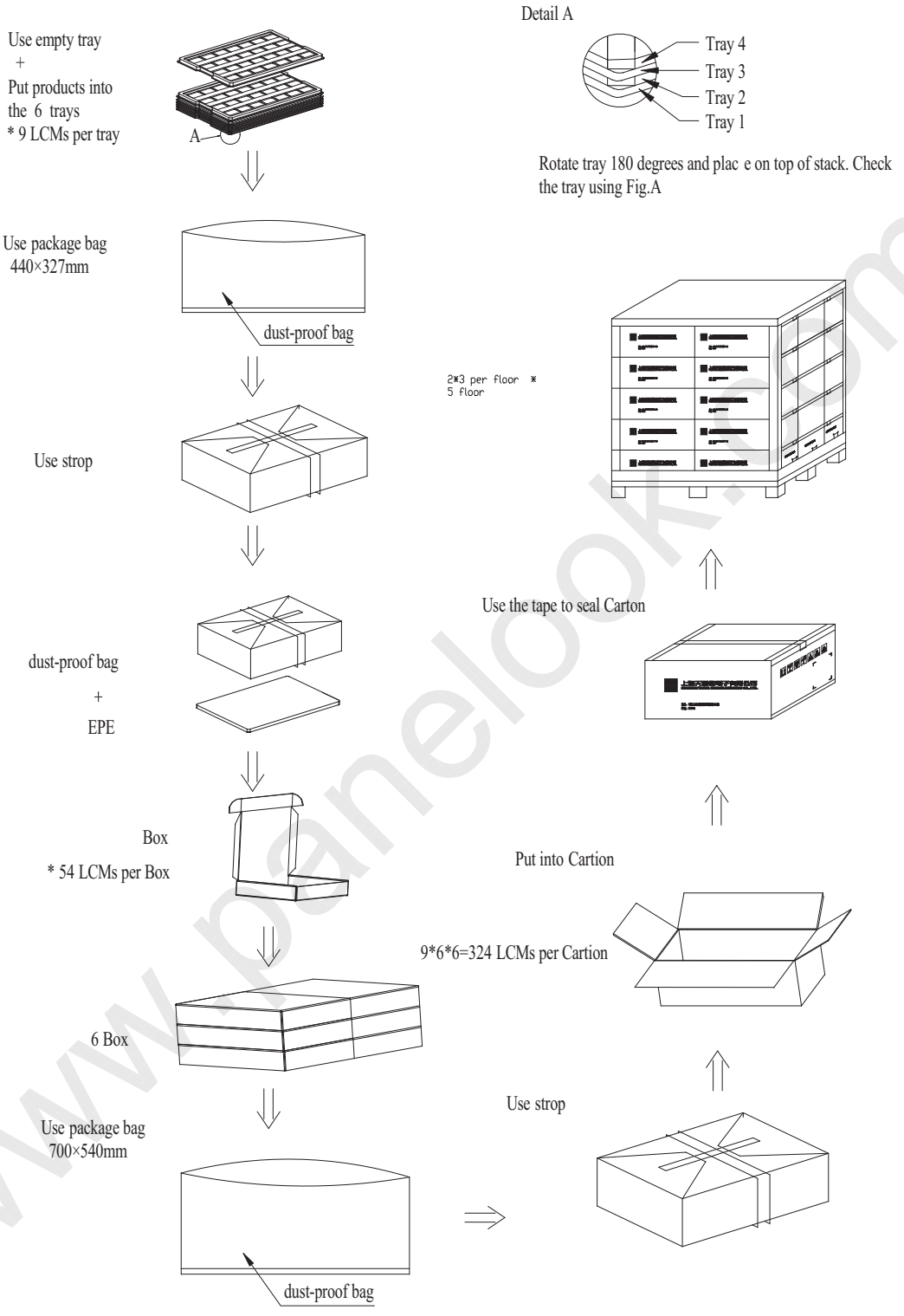


9 Packing Drawing

9.1 Packaging Material Table

No	Item	Model(Material)	Dimensions (mm)	Unit Weigt (Kg)	Quantity	Remark
1	LCM	TM028HDH01	50.0x69.2x2.65	0.0186	324	
2	Tray	PET(Transmit)	315.0x247.0x11.6	0.079	42	Anti-static
3	EPE	EPE	315.0X247.0X5.0	0.009	6	
4	Dust-Proof Bag	PE	700.0x545.0	0.046	1	
5	Anti-static bag	PE	327.0x440.0	0.021	6	
6	Box	Corrugated Paper	345.0x260.0x70.0	0.227	6	
7	Carton	Corrugated Paper	544.0x365.0x250.0	1.010	1	
8	Total Weight (Kg)	11.9424±5%				

9.2 Packaging Drawing



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.

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

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

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

10.1.8.4 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.

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.