

**MODEL NO. : TM022HDH26****ISSUED DATE: 2011-02-21****VERSION : Ver 1.0**

- ☒ 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

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Table of Contents

Coversheet.....	1
Table of Contents	2
Record of Revision.....	3
1 General Specifications	4
2 Input/Output Terminals	5
3 Absolute Maximum Ratings	6
4 Electrical Characteristics.....	7
5 Timing Chart.....	9
6 Optical Characteristics	15
7 Environmental / Reliability Test	19
8 Mechanical And FPCA Drawing	20
9 Packing Drawing	21
10 Precautions For Use of LCD Modules.....	23

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1 General Specifications

Feature		Spec
Display Spec.	Size	2.2 inch
	Resolution	240(RGB) x 320
	Interface	4-Wire SPI
	Color Depth	262K/65K
	Technology Type	a-Si
	Pixel Pitch (mm)	0.141X0.141
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Clear Type(3H)
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	40.10x55.20x2.35
	Active Area(mm)	33.84x45.12
	With/Without TSP	Without TSP
	Weight (g)	TBD
	LED Numbers	4 LEDs
Electronic	Driver IC	ILI9341

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



2 Input/Output Terminals

2.1 TFT LCD Panel

No	Symbol	I/O	Description	Comment
1	GND	P	Power Ground	
2	RESET	I	Reset Signal	
3	SCL	I	Serial interface clock in 4-wire 8-bit serial data interface	
4	D/CX	I	Command or parameter select in 4-wire 8-bit serial data interface	
5	CS	I	Chip select signal	
6	SDI	I	Serial input signal	
7	SDO	O	Serial output signal	
8	GND	P	Power Ground	
9	VCC	P	Power Supply of Analog/Logic Circuit	
10	LEDA	P	LED anode	
11	LEDK1	P	LED cathode	
12	LEDK2	P	LED cathode	
13	LEDK3	P	LED cathode	
14	LEDK4	P	LED cathode	

Note1: I/O definition:

I----Input O---Output P----Power/Ground NC--- Not connected



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	VCC	-0.3	4.6	V	
Input voltage	CS/D/CX/SCL/SDI /RESET	-0.3	IOVCC+0.5	V	
Back Light Forward Current	I _F	-	25	mA	ONE LED
Operating Temperature	Top	-20	70	°C	
Storage Temperature	Tst	-30	80	°C	



4 Electrical Characteristics

4.1 Driving TFT LCD Panel

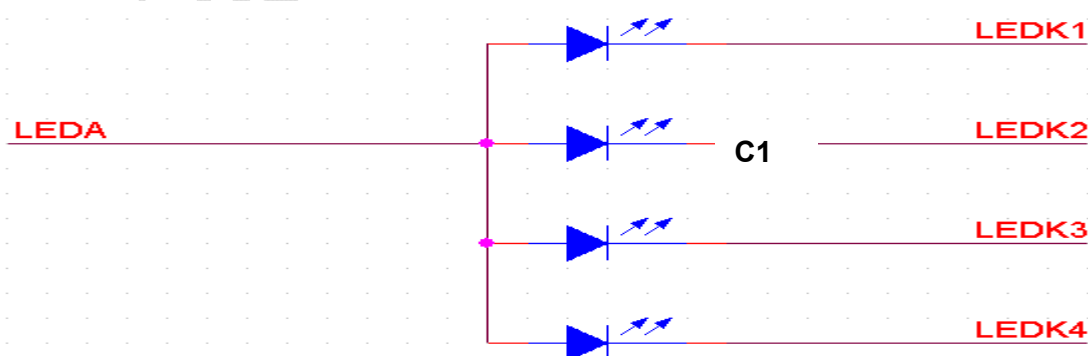
GND=0V, Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage	VCC	1.65	2.8	3.3	V	
Analog Supply Voltage	VCC	2.3	2.8	3.3	V	
Input Signal Voltage	High Level	VIH	0.7 VCC	-	VCC	V
	Low Level	VIL	-	-	0.3 VCC	V
Output Signal Voltage	High Level	VOH	0.8 VCC	-	-	V
	Low Level	VOL	-	-	0.2 VCC	V
(Panel+LSI) Power Consumption	Black Mode	-	18.10	-	m W	
	8 color Mode	-	8.16	-	m W	
	Sleeping Mode	-	0.035	-	m W	

4.2 Driving Backlight Ta=25°C

Item	Symbol	Min	Typ	Max	Unit	Remark
Forward Current	I _F	--	15	25	mA	For each LED
Forward Voltage	V _F	(2.9)	3.2	(3.4)	V	4 LEDs (in parallel)
Power Consumption	W _{BL}	--	192	--	mW	

Note1: Figure below shows the connection of backlight LED.

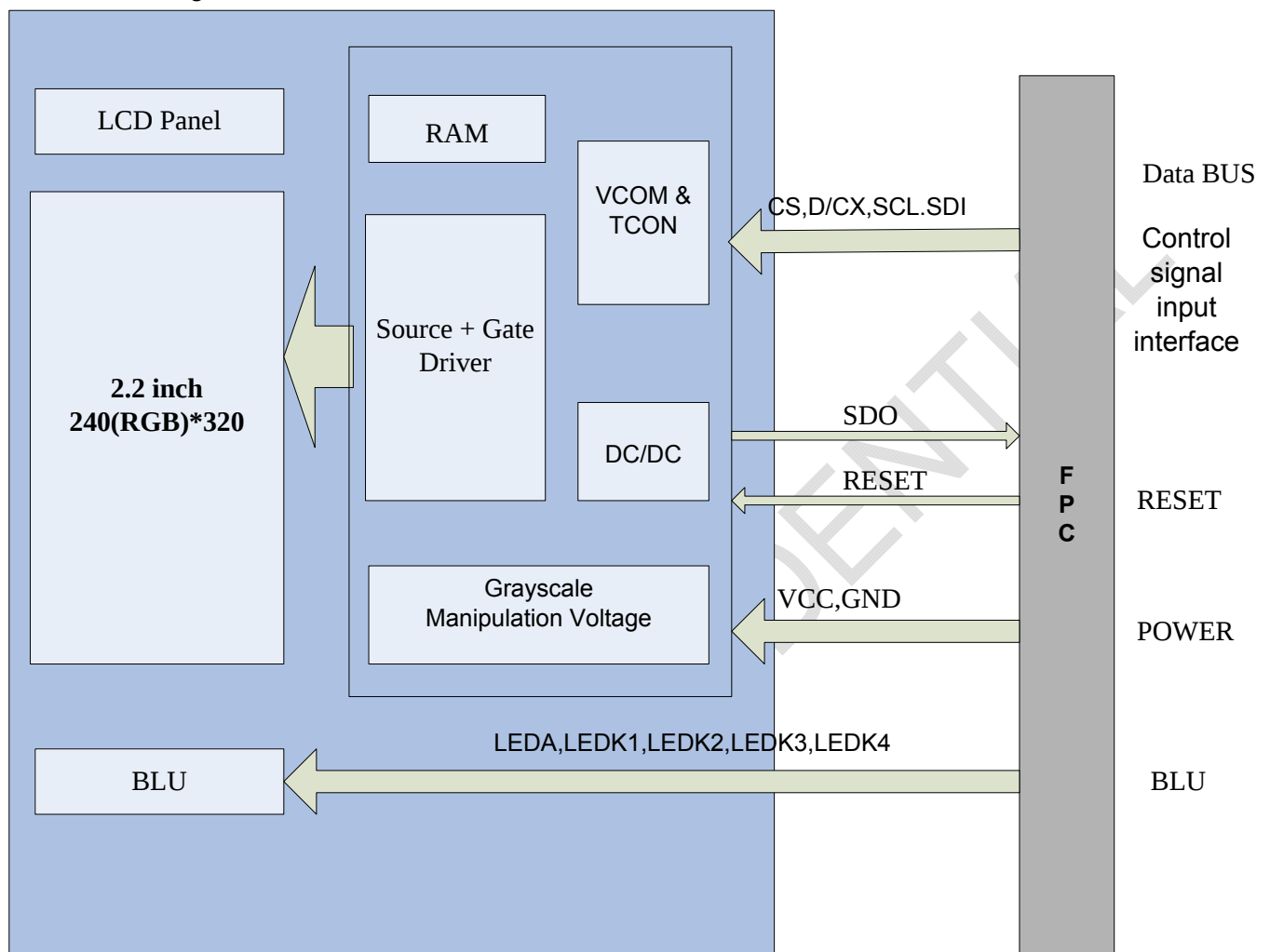


Note 2: One LED: I_F =15 mA, V_F =3.2V

Note 3: The Minimum Life of LED: 20,000 hours



4.3 Block Diagram





5 Timing Chart

5.1 Timing Parameter

Ta=25°C

Signal	Symbol	Parameter	min	max	Unit	Description
CS	tcss	Chip select time (Write)	40	-	ns	
	tcsh	Chip select hold time (Read)	40	-	ns	
SCL	twc	Serial clock cycle (Write)	100	-	ns	
	twrh	SCL "H" pulse width (Write)	40	-	ns	
	twrl	SCL "L" pulse width (Write)	40	-	ns	
	trc	Serial clock cycle (Read)	150	-	ns	
	trdh	SCL "H" pulse width (Read)	60	-	ns	
	trdl	SCL "L" pulse width (Read)	60	-	ns	
D/CX	tas	D/CX setup time	10	-		
	tah	D/CX hold time (Write / Read)	10	-		
SDA / SDI (Input)	tds	Data setup time (Write)	30	-	ns	
	tdh	Data hold time (Write)	30	-	ns	
SDA / SDO (Output)	tacc	Access time (Read)	10	-	ns	For maximum CL=30pF
	tod	Output disable time (Read)	10	50	ns	For minimum CL=8pF

Table 5.0 timing parameter

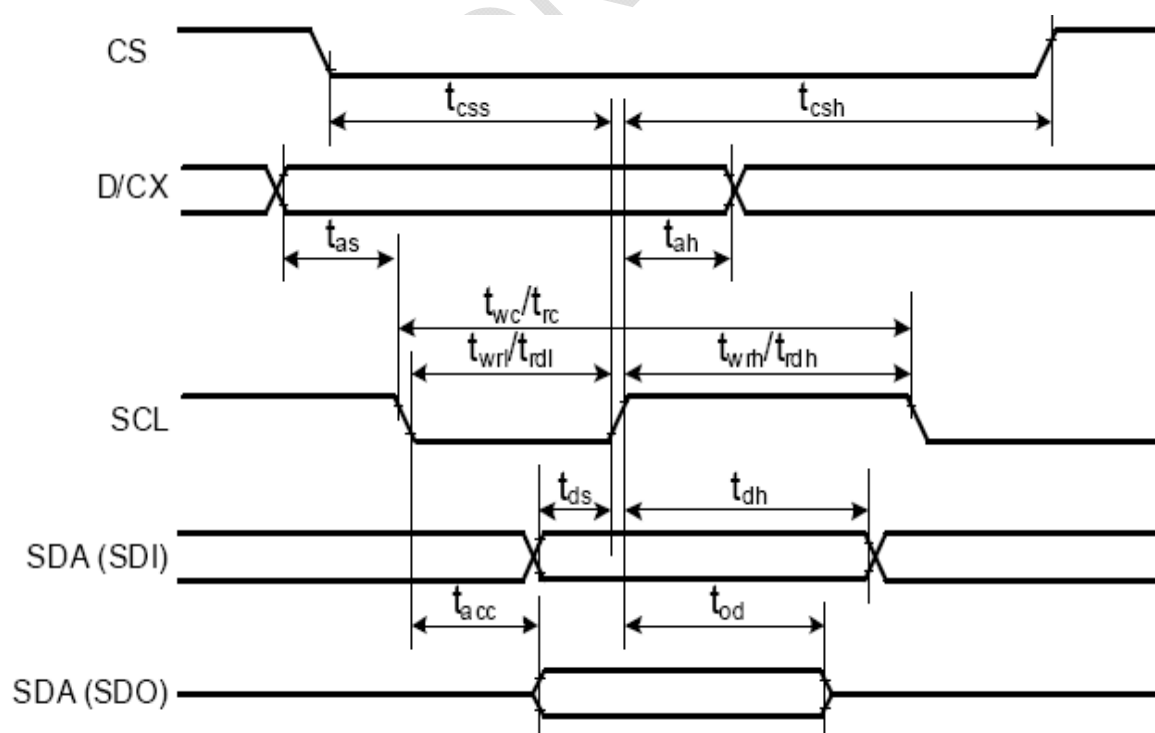


Figure 5.1 Serial interface characteristics



5.2 Register write/read timing

a. Write to register

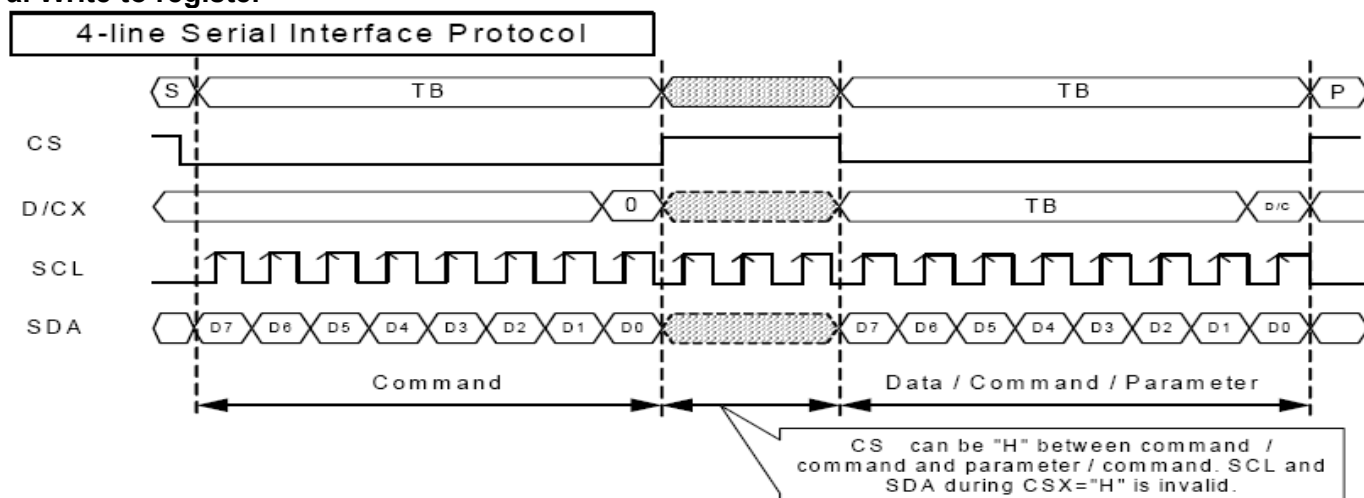


Figure 5.2 Register write timing in serial bus system interface

b. Read from register

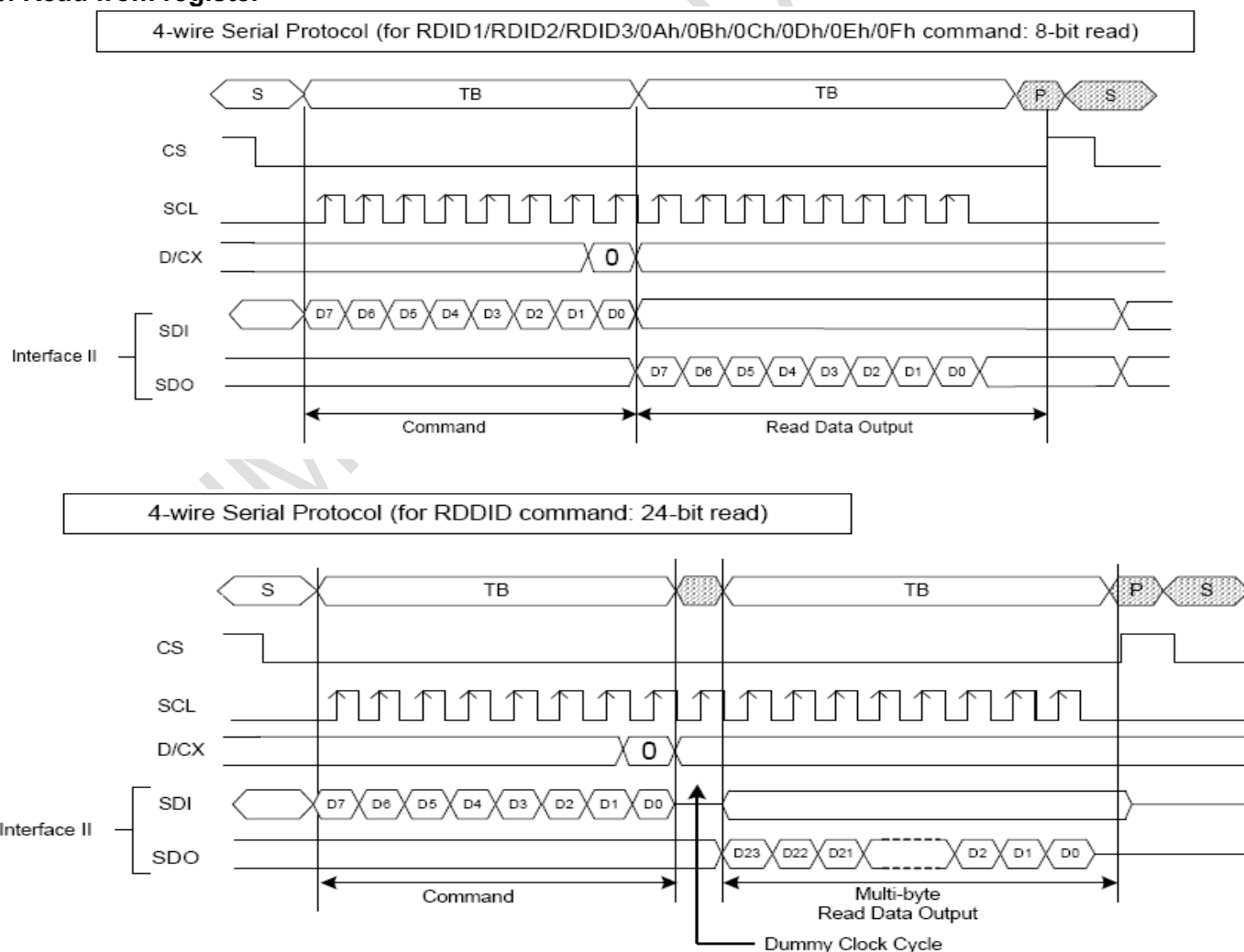


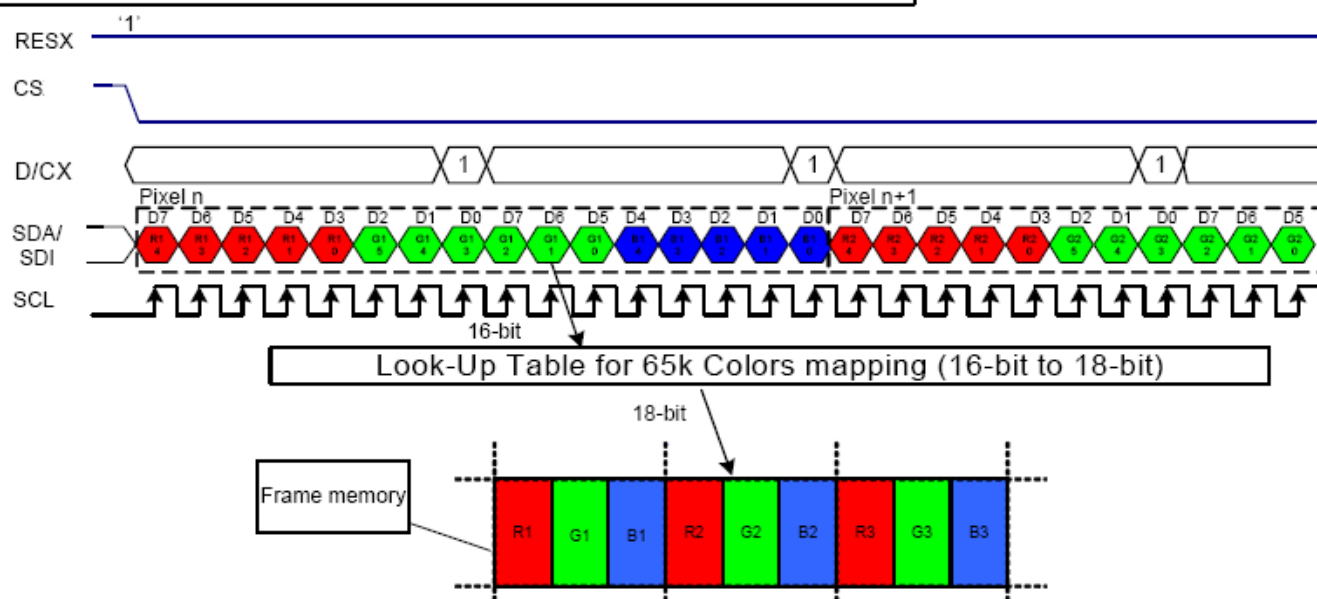
Figure 5.3 Register read timing in serial bus system interface

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5.3 GRAM Writing Characteristics (565 mode)

16 bit/pixel color order (R:5-bit, G:6-bit, B:5-bit), 65,536 colors



666 mode

18 bit/pixel color order (R:6-bit, G:6-bit, B:6-bit), 262,144 colors

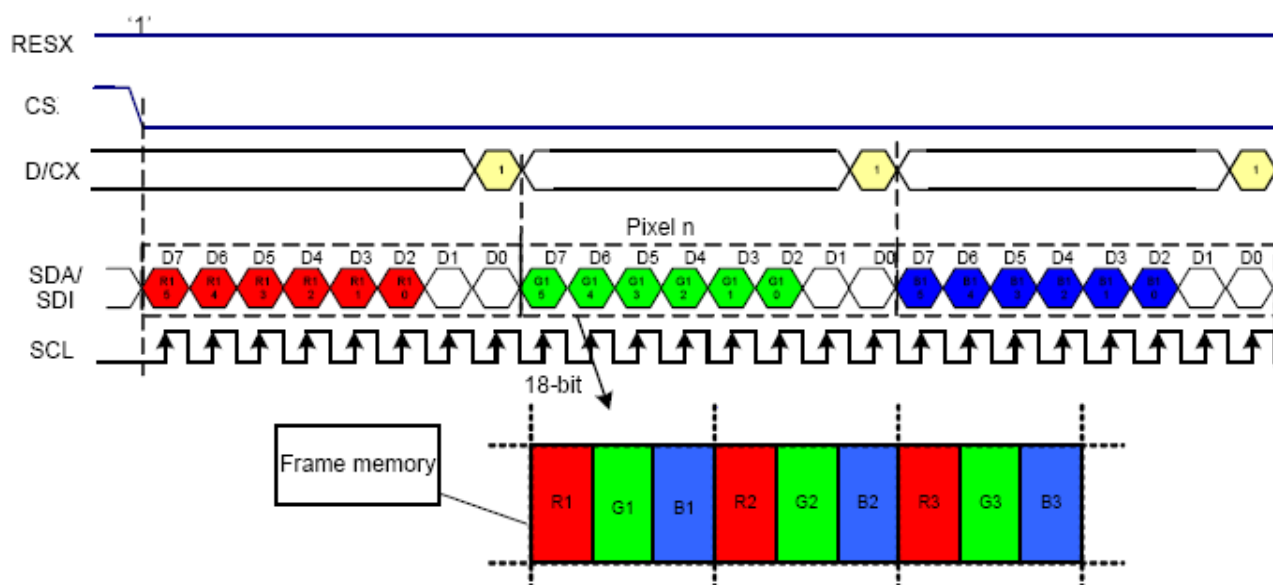
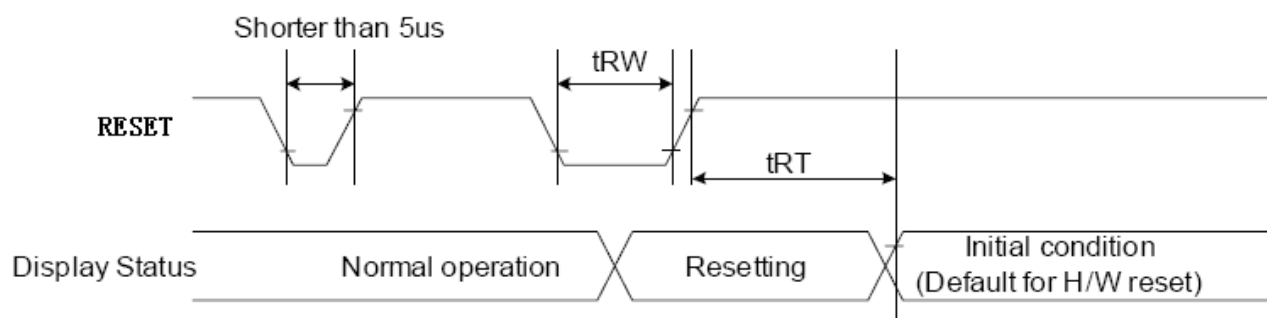


Figure 5.4 GRAM Writing Characteristics for 555/666 mode of 4-Wire SPI



5.4 Reset Timing Characteristics

Ta=25°C



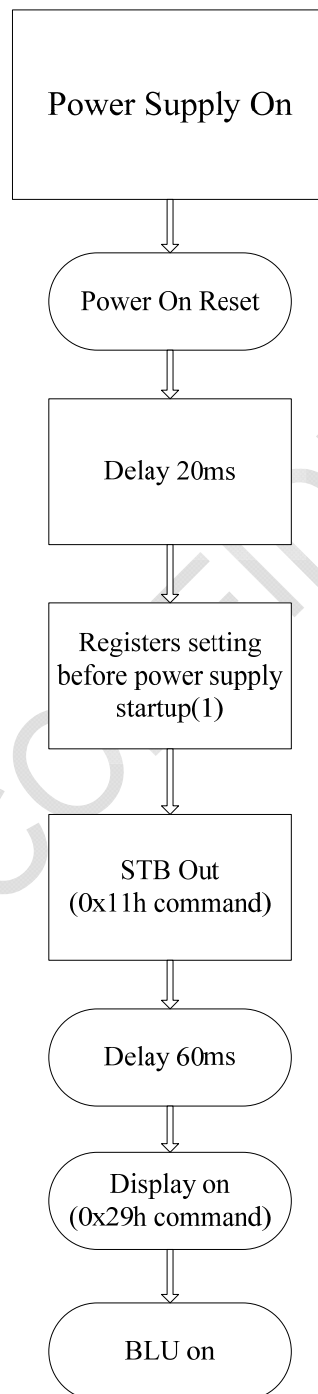
Signal	Symbol	Parameter	Min	Max	Unit
RESET	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

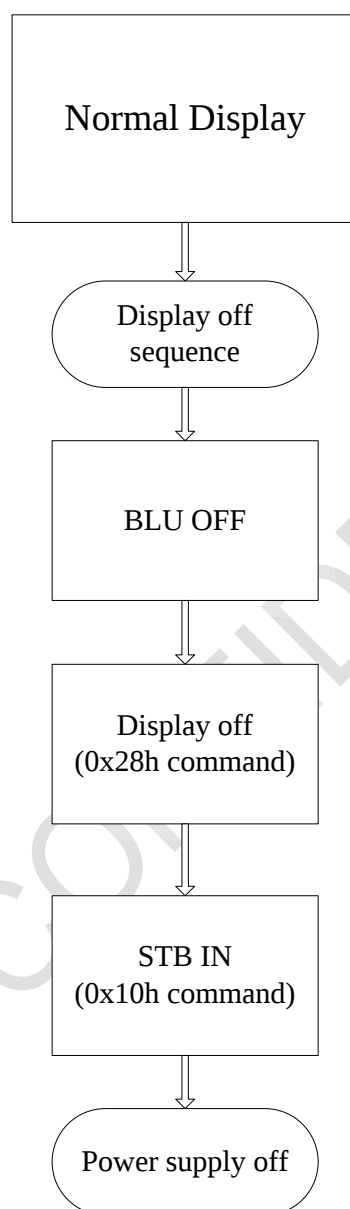
Figure 5.5 RESET Timing



5.5 Power On/Off sequence

5.5.1 Power on Sequence







6 Optical Characteristics

Ta=25°C

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	$CR \geq 10$	60	70	-	Degree	Note 2
		θB		50	60	-		
		θL		60	70	-		
		θR		60	70	-		
Contrast Ratio		CR	$\theta=0^{\circ}$	400	500	-		Note1 Note3
Response Time		T _{ON}	25℃	-	20	30	ms	Note1 Note4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	0.245	0.295	0.345		Note5 Note1
		y		0.274	0.324	0.374		
	Red	x		0.556	0.606	0.656		
		y		0.277	0.327	0.377		
	Green	x		0.294	0.344	0.394		
		y		0.484	0.534	0.584		
	Blue	x		0.096	0.146	0.196		
		y		0.056	0.106	0.156		
Uniformity		U		--	80	--	%	Note1 Note6
NTSC				--	50	--	%	Note 5
Luminance		L		200	240	--	cd/m ²	Note1 Note7

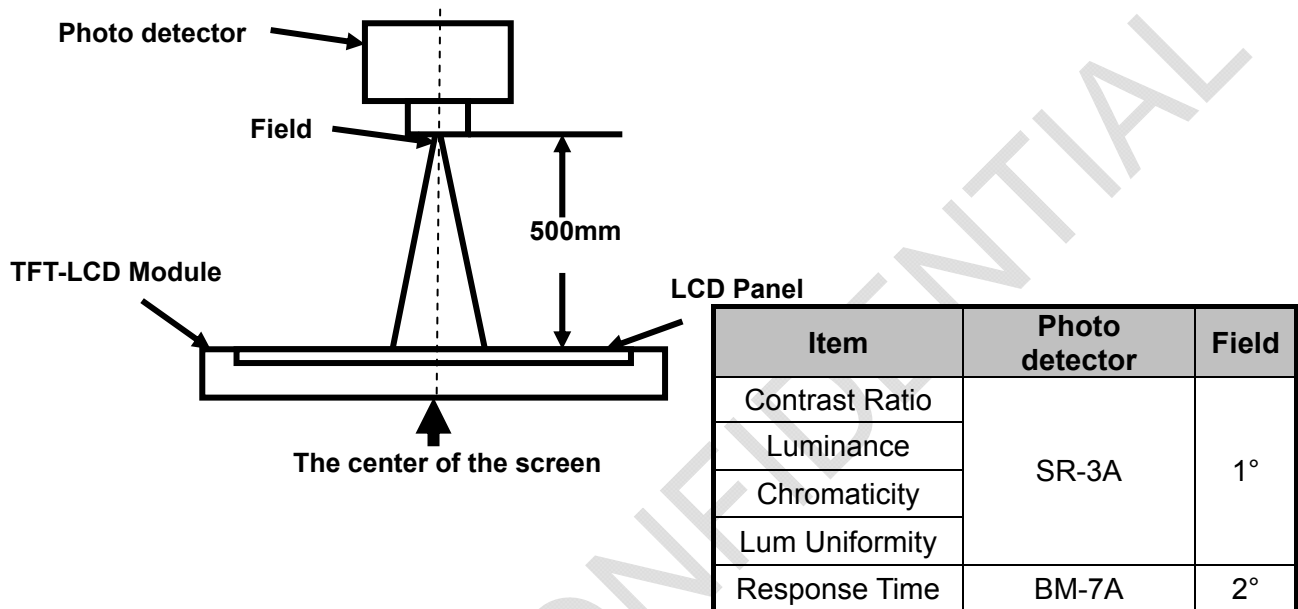
Test Conditions:

1. $V_F = 3.2V$, $I_L = 20mA$ (Backlight current), the ambient temperature is 25°C.
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.



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).

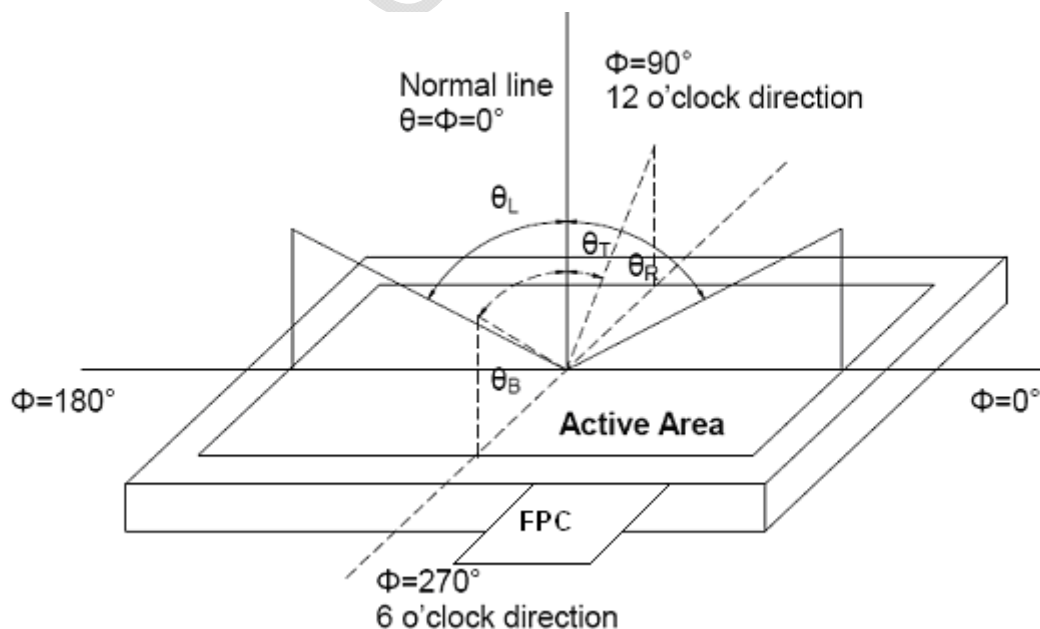


Fig. 1 Definition of viewing angle



Note 3: Definition of contrast ratio

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

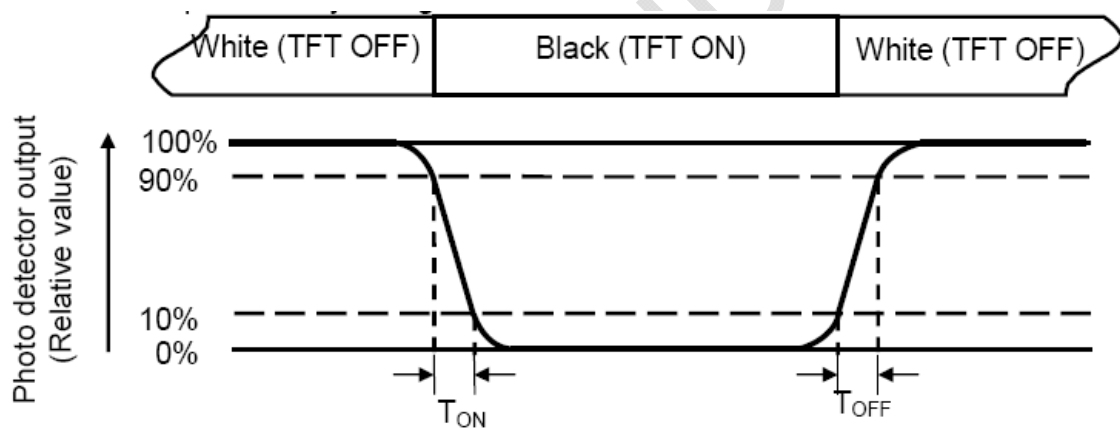
"White state": The state is that the LCD should be driven by V_{white} .

"Black state": The state is that the LCD should be driven by V_{black} .

V_{white} : 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 (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) 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

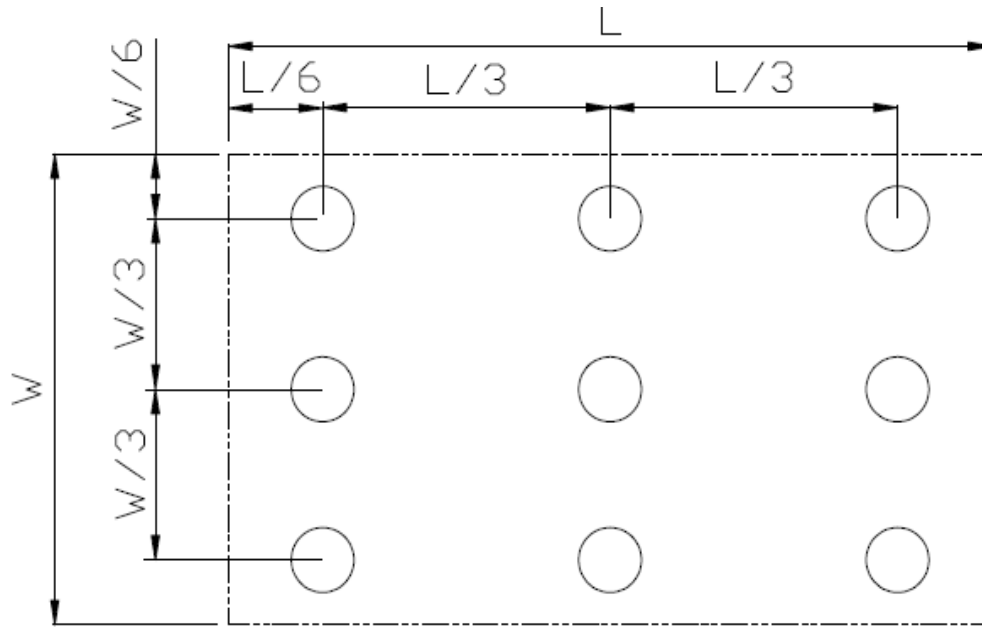


Fig. 2 Definition of uniformity

L_{max} : The measured maximum luminance of all measurement position.

L_{min} : 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

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts=+70℃, 240hrs	Note1 IEC60068-2-1:2007,GB2423.2-2008
2	Low Temperature Operation	Ta=-20℃, 240hrs	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta=+80℃, 240hrs	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta=-30℃, 240hrs	IEC60068-2-1:2007 GB2423.1-2008
5	High Temperature & High Humidity Storage	Ta=+60℃, 90% RH 240 hours	Note2 IEC60068-2-78 :2001 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, IEC60068-2-14:1984,GB2423.22-2002
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)	IEC61000-4-2:2001 GB/T17626.2-2006
8	Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz hours for each direction of X.Y.Z. (6 hours for total) (Package condition)	2 IEC60068-2-6:1982 GB/T2423.10—1995
9	Shock (Non-operation)	100G 6ms, ±X,±Y,±Z 3times, for each direction	IEC60068-2-27:1987 GB/T2423.5—1995
10	Package Drop Test	Height:80 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

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

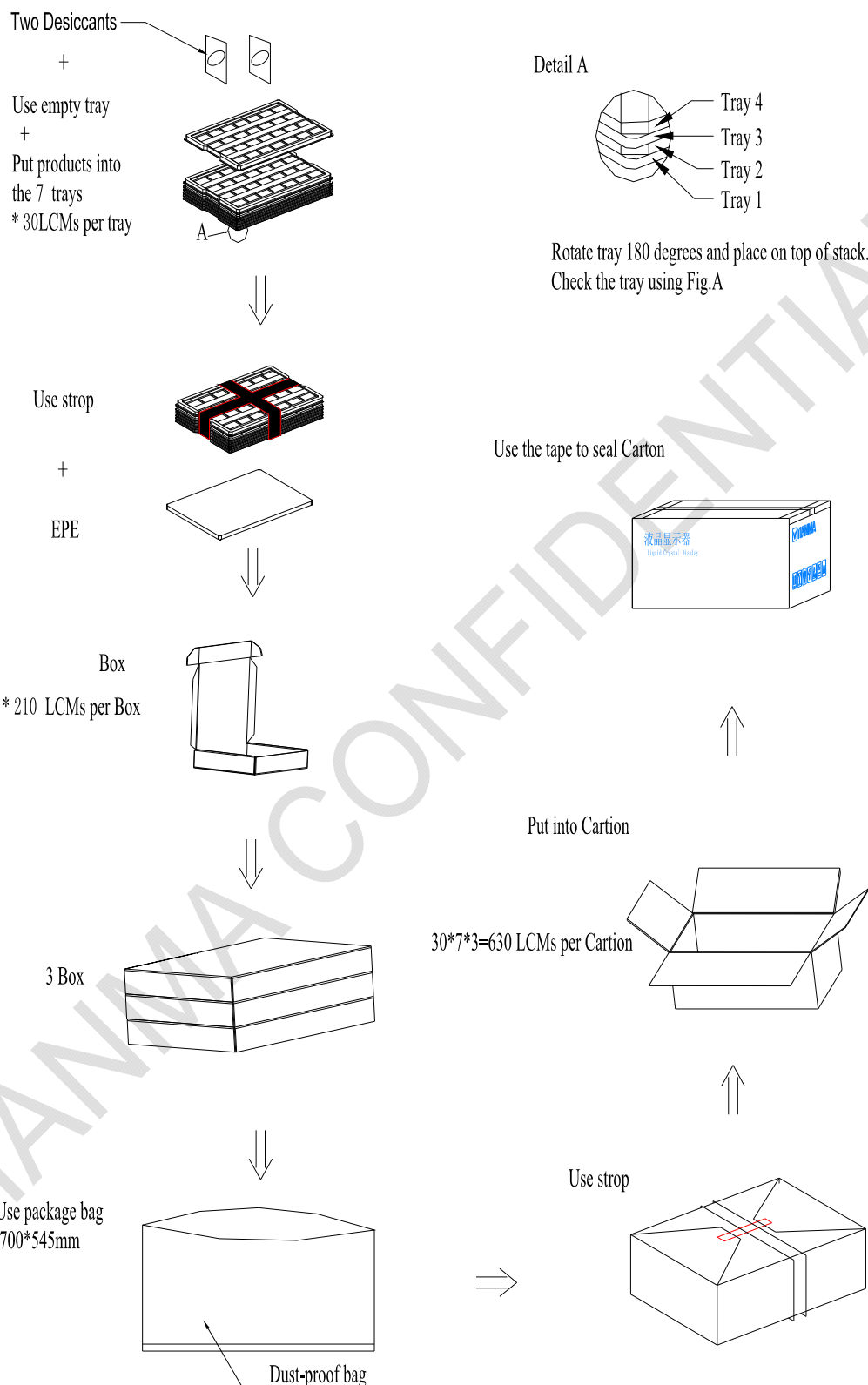
Note2: Ta is the ambient temperature of sample.





9 Packing Drawing

No	Item	Model (Material)	Dimensions(m m)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM022HDH26-00	40.1×55.2×2.35	TBD	630	
2	Tray	PET (Transmit)	485×330×11.8	0.172	24	Anti-static
3	EPE	EPE	485×330×5	0.0183	3	
4	Anti-static bag	PE	700×545	0.046	1	
5	BOX	CORRUGATED PAPER	520×345×74	0.3879	3	
6	Desiccant	Desiccant	45×50	0.002	6	
7	Carton	CORRUGATED PAPER	544×365×250	1.01	1	
8	Total weight	TBDKg				





10 Precautions For Use of LCD Modules

10.5 Handling Precautions.

- 10.5.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- 10.5.2 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.
- 10.5.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- 10.5.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- 10.5.5 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 alcoholSolvents other than those mentioned above may damage the polarizer. Especially, do not use the following:
 - Water
 - Ketone
 - Aromatic solvents
- 10.5.6 Do not attempt to disassemble the LCD Module.
- 10.5.7 If the logic circuit power is off, do not apply the input signals.
- 10.5.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
 - 10.5.8.1 Be sure to ground the body when handling the LCD Modules.
 - 10.5.8.2 Tools required for assembly, such as soldering irons, must be properly ground.
 - 10.5.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
 - 10.5.8.4 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.

10.6 Storage precautions

- 10.6.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.
- 10.6.2 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%
- 10.6.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.7 Transportation Precautions:

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