

MODEL NO : TM024HDH49**MODEL VERSION: 01****SPEC VERSION : 2.9****ISSUED DATE: 2015-12-08**

- Preliminary Specification
- Final Product Specification

Customer : _____

App oved by	Notes

TIANMA Confirmed :

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This technical specification is subjected to change without notice

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Record of Revision

Rev	Issued Date	Description	Editor
1.0	2010-12-29	First release	Kelly hu
1.1	2011-1-12	Updated pin15 definition	Kelly hu
2.0	2011-9-30	Final spec release.	Jin Zhao
2.1	2012-1-14	Updated supply voltage and IC PN	Jin Zhao
2.2	2012-1-19	Updated drawing and package info	Jin Zhao
2.3	2012-3-22	Update mechanical drawing	Jin Zhao
2.4	2012-4-6	Update mechanical drawing and label info	Jin Zhao
2.5	2012-4-17	Update mechanical drawing and label info	Jin Zhao
2.6	2012-7-30	Update mechanical drawing and label info	Ada Fu
2.7	2012-11-7	Add FPC drawing and update the label info(change Fixed number from 004T to 005T).	Ada Fu
2.8	2015-7-8	Update patent LED and update PN	Jin Zhao
2.9	2015-12-8	Add relative humidity	Tiantian Zhao

1 General Specifications

	Feature	Spec
Display Spec.	Size	2.4"
	Resolution	240(RGB)x320
	Technology Type	a-si TFT
	Pixel Configuration	RGB Vertical Stripe
	Pixel pitch(mm)	0.153 x 0.153
	Display Mode	TM,NW
	Surface Treatment	Clear Type
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	42.72x60.26x2.55
	Active Area(mm)	36.720x48.960
	With /Without TSP	Without TP
	Matching Connection Type	FH12-24S-0.5SH
	LED Numbers	4
	Weight (g)	12
Electrical Characteristics	Interface	CPU 8 bits
	Color Depth	262K
	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

Note 3: LCM weight tolerance: $\pm 5\%$

2 Input/Output Terminals

Matched connector: FH12-24S-0.5SH

Pin No.	Symbol	I/O	Function	Remark
1	LEDK4	P	LED light cathode	
2	LEDK3	P	LED light cathode	
3	LEDK2	P	LED light cathode	
4	LEDK1	P	LED light cathode	
5	LEDA	P	LED light anode	
6	TE	O	Tearing effect output pin to synchronize MPU to frame writing, activated by S/W command	
7	DB7	I/O	Data Input	
8	DB6	I/O	Data Input	
9	DB5	I/O	Data input	
10	DB4	I/O	Data input	
11	DB3	I/O	Data Input	
12	DB2	I/O	Data Input	
13	DB1	I/O	Data Input	
14	DB0	I/O	Data Input	
15	GND	P	Power Ground	
16	RESET	I	Reset signal	
17	RD	I	Read enables signal	
18	WR	I	Write enables signal	
19	RS	I	Register select signal	
20	CS	I	Chip select signal	
21	GND	P	Power Ground	
22	IOVCC	P	Power Supply for Logic	
23	VCC	P	Power Supply for Analog	
24	GND	P	Power Ground	

Note1: Please add the FPC connector type and matched one if necessary .

3 Absolute Maximum Ratings

GND=0V

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VCC	-0.3	4.6	V	Note1
Input voltage	V _{IN}	-0.3	4.6	V	
Operating Temperature	Top	-20	70	°C	
Storage Temperature	Tst	-30	80	°C	
Relative Humidity Note2	RH	--	≤95	%	Ta ≤ 40°C
		--	≤85	%	40°C < Ta ≤ 50°C
		--	≤55	%	50°C < Ta ≤ 60°C
		--	≤36	%	60°C < Ta ≤ 70°C
		--	≤24	%	70°C < Ta ≤ 80°C
Absolute Humidity	AH	--	≤70	g/m ³	Ta > 70°C

Table 3 Absolute Maximum Ratings

Note1: Input voltage include R0~R5, G0~G5, B0~B5, Dotclk, Hsync, Vsync, Enable, R/L, U/D.

Note2: Ta means the ambient temperature.

It is necessary to limit the relative humidity to the specified temperature range.

Condensation on the module is not allowed.

4 Electrical Characteristics

4.1 LCD Module

GND=0V, Ta=25°C

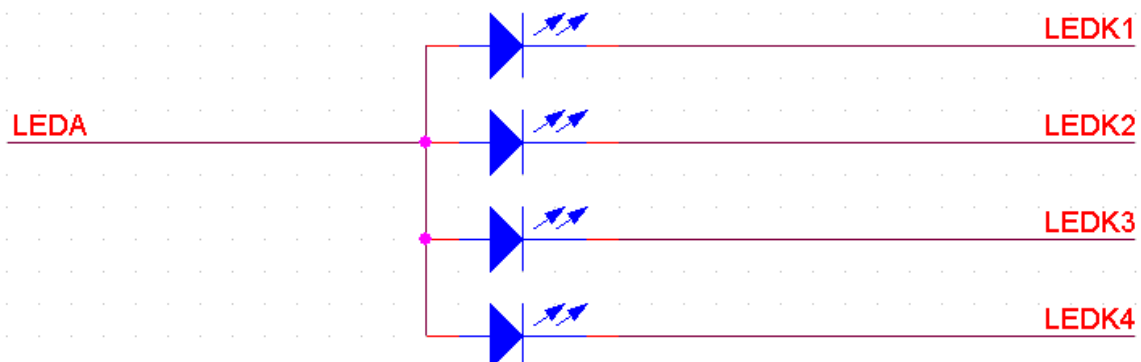
Item	Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage	IOVCC	2.5	2.8	3.3+/-10%	V	
Analog Supply Voltage	VCC	2.5	2.8	3.3+/-10%	V	
Input Signal Voltage	High Level	0.7 IOVCC	-	IOVCC	V	
	Low Level	-	-	0.3 IOVCC	V	
Output Signal Voltage	High Level	0.8 IOVCC	-	-	V	
	Low Level	-	-	0.2 IOVCC	V	
(Panel+LSI) Power Consumption	Black Mode	-	30	36	mW	
	Sleeping Mode	-	0.047	0.057	mW	

Table 4.1 LCD module electrical characteristics

4.2 Backlight Unit

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	15	-	mA	One LED
Forward Voltage	V_F	(2.9)	3.2	(3.4)	V	One LED
Backlight Power Consumption	W_{BL}	-	192	-	mW	4 LEDs
Lifetime	T	-	20000	-	Hr	One LED

Table 4.2.1 backlight unit electrical characteristics

Figure 4.2.1 LED backlight circuit

4.3 Block Diagram

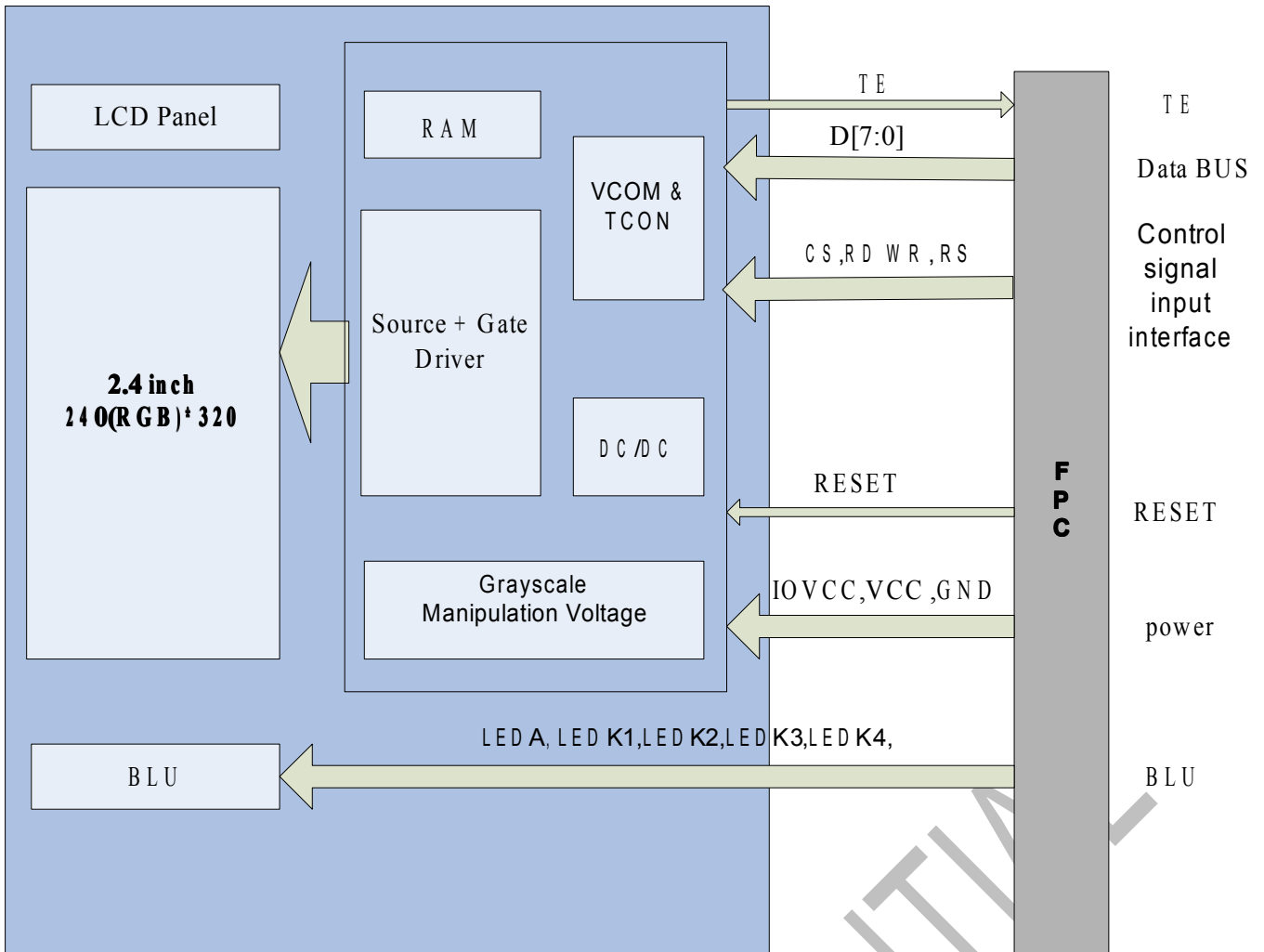


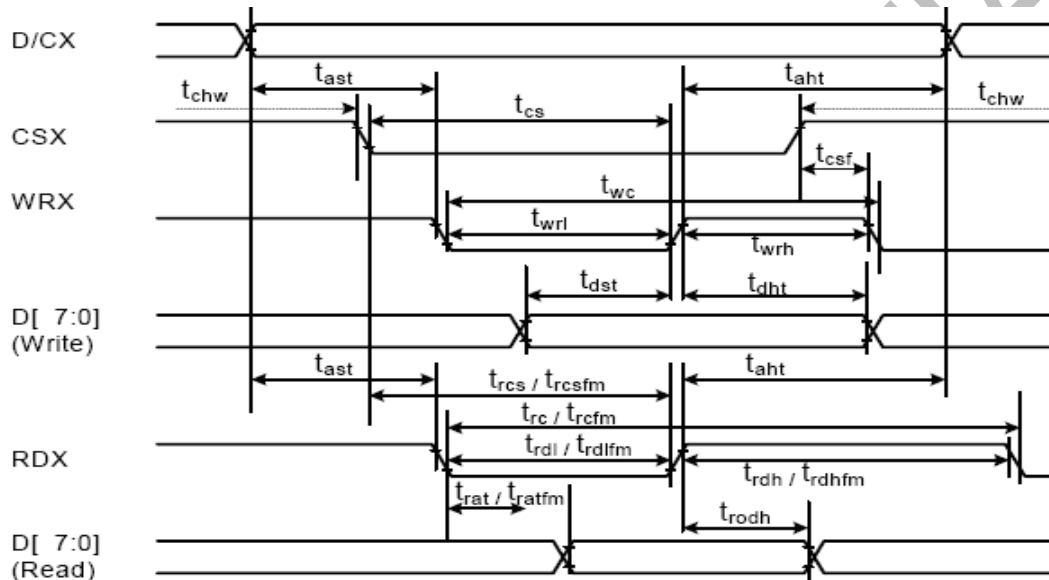
Figure 4.3 LCD module diagram

5 Timing Chart

5.1 Timing Parameter

Ta=25°C

Signal	Symbol	Parameter	min	max	Unit	Description
RS	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	10	-	ns	
CS	tchw	CSX "H" pulse width	0	-	ns	
	tcs	Chip Select setup time (Write)	15	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
WR	twc	Write cycle	66	-	ns	
	twrh	Write Control pulse H duration	15	-	ns	
	twrl	Write Control pulse L duration	15	-	ns	
RD (FM)	trcfm	Read Cycle (FM)	450	-	ns	
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RD (ID)	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
D[17:0], D[15:0], D[8:0], D[7:0]	tdst	Write data setup time	10	-	ns	For maximum CL=30pF For minimum CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

Table 5.1 timing parameter

Figure 5.1 Parallel interface characteristics

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5.2 Register write/read timing

a. Write to register

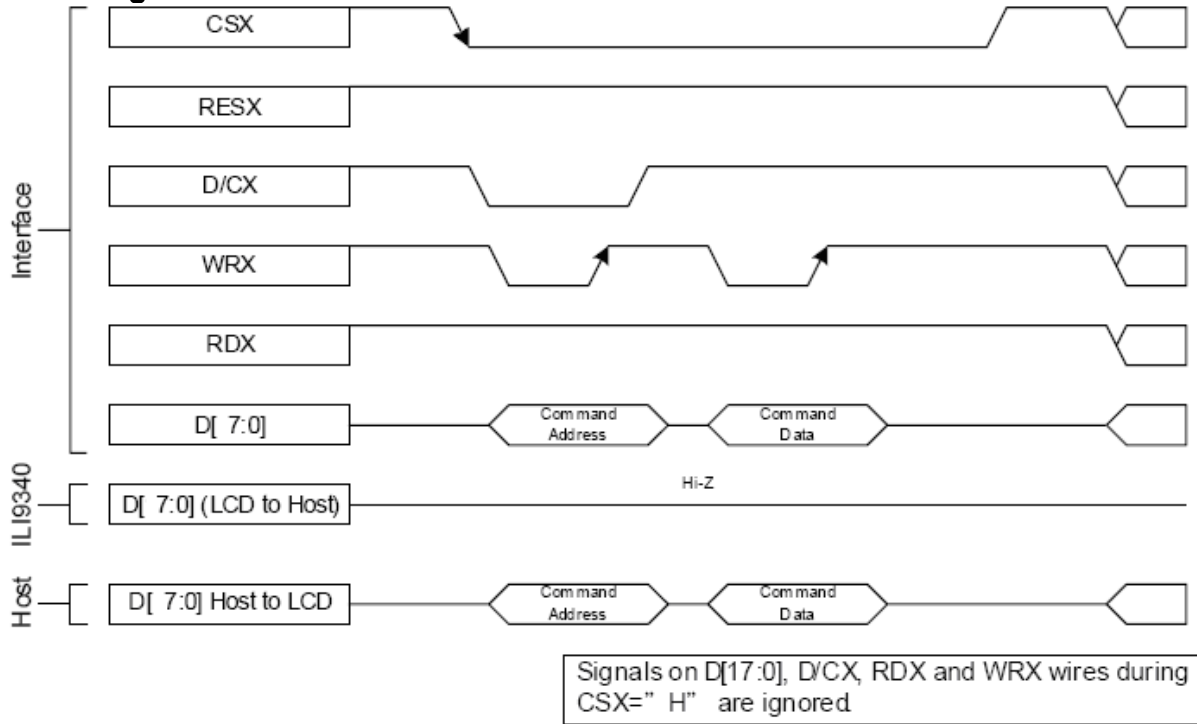


Figure 5.2.1 Register write timing in parallel bus system interface (for I80 series MPU)

b. Read from register

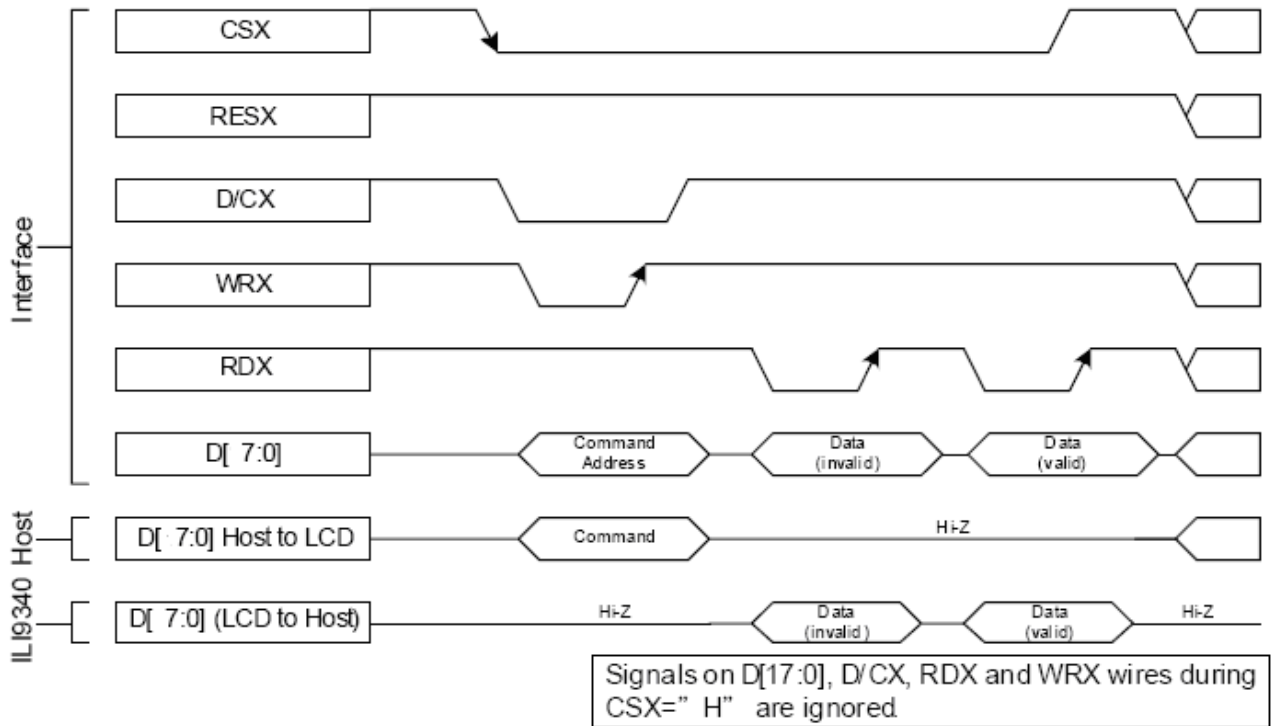


Figure 5.2.2 Register read timing in parallel bus system interface (for I80 series MPU)

CS timings

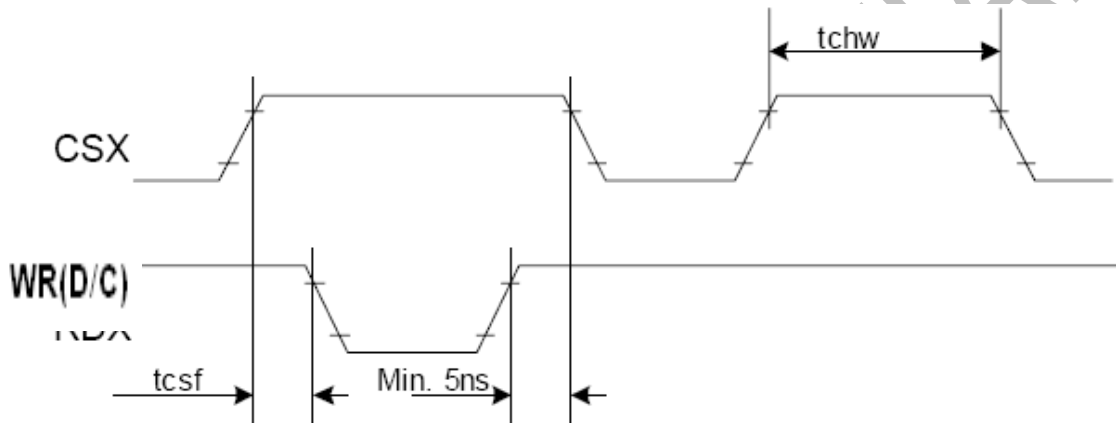


Figure 5.2.3 Chip selection timing

Write to read or read to write timings

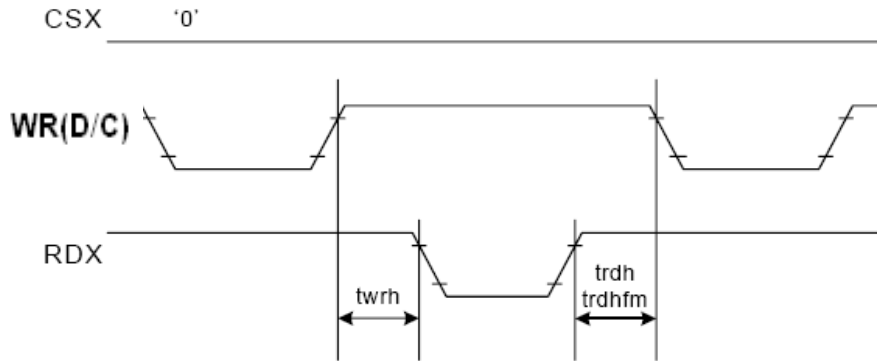
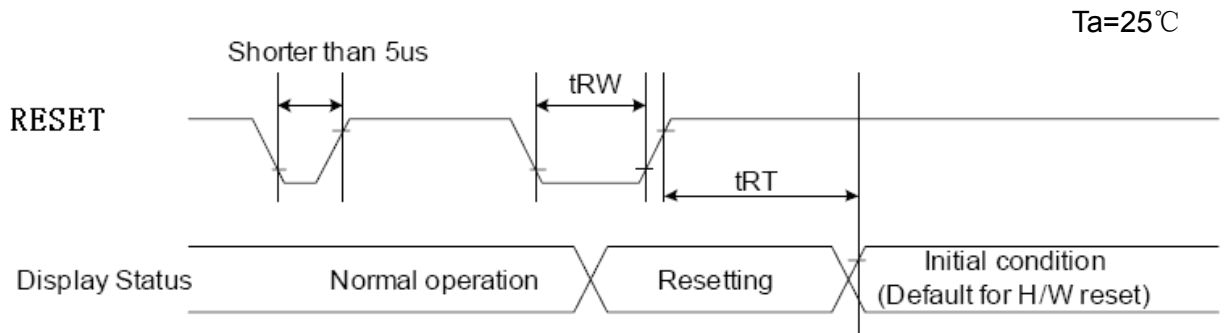


Figure 5.2.4 Write-to-read and read-to-write timing

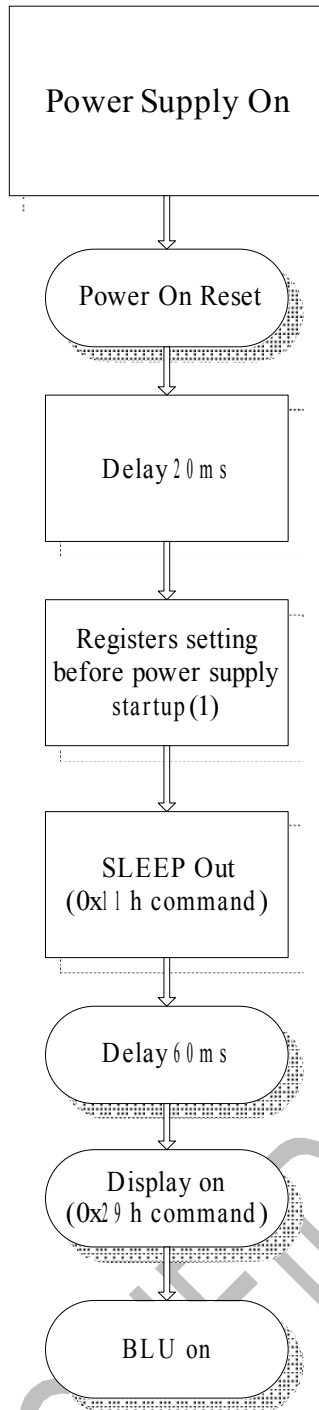
5.3 Reset Timing Characteristics



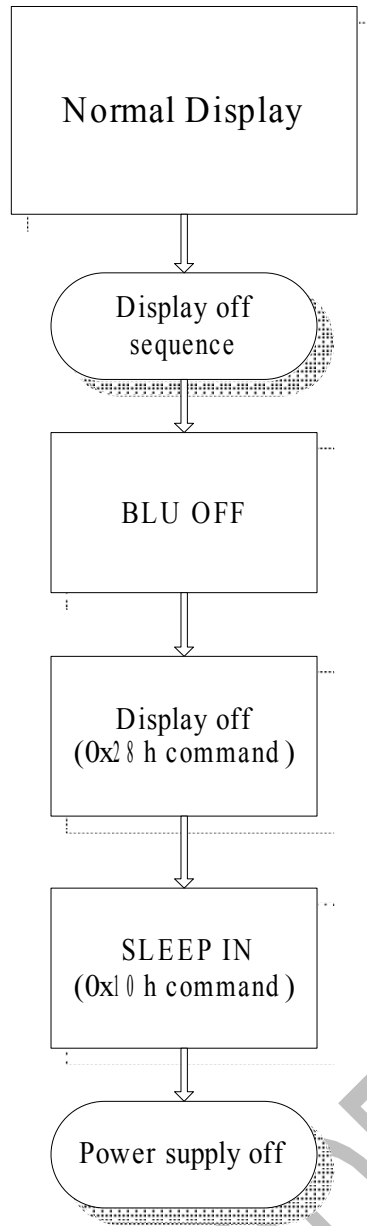
Signal	Symbol	Parameter	Min	Max	Unit
RESET	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5)	mS
				120 (note 1,6,7)	mS

Figure 5.3 RESET Timing

5.4 Power on Sequence



5.5 Power off Sequence



6 Optical Characteristics

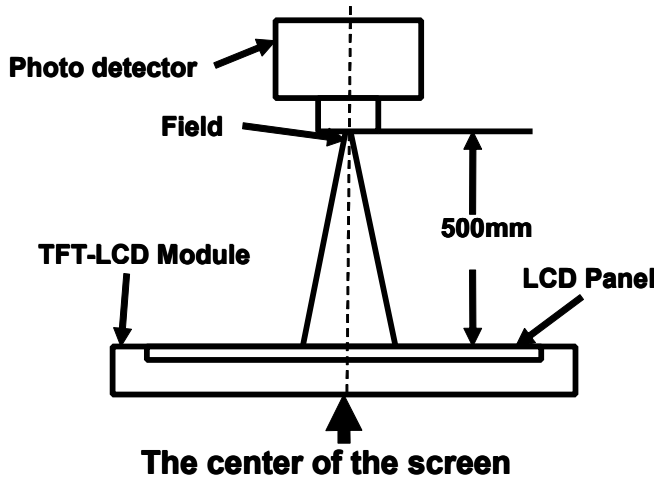
Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles	θT	CR \geq 10	60	70	60	Degree	Note2,3
	θB		50	60	50		
	θL		60	70	60		
	θR		60	70	60		
Contrast Ratio	CR	$\theta=0^\circ$	400	500	400		Note 3
Response Time	T _{ON}	25°C		20	30	ms	Note 4
	T _{OFF}						
Chromaticity	White	x	Backlight is on	0.236	0.286	0.336	Note 1,5
		y		0.261	0.311	0.361	
	Red	x		0.530	0.580	0.630	Note 1,5
		y		0.270	0.320	0.370	
	Green	x		0.288	0.338	0.388	Note 1,5
		y		0.531	0.581	0.631	
	Blue	x		0.101	0.151	0.201	Note 1,5
		y		0.048	0.098	0.148	
Uniformity	U		-	80%		%	Note 6
NTSC			-	50%		%	Note 5
Luminance	L		180	200		cd/m ²	Note 7

Test Conditions:

1. I_F= **60mA**, and the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

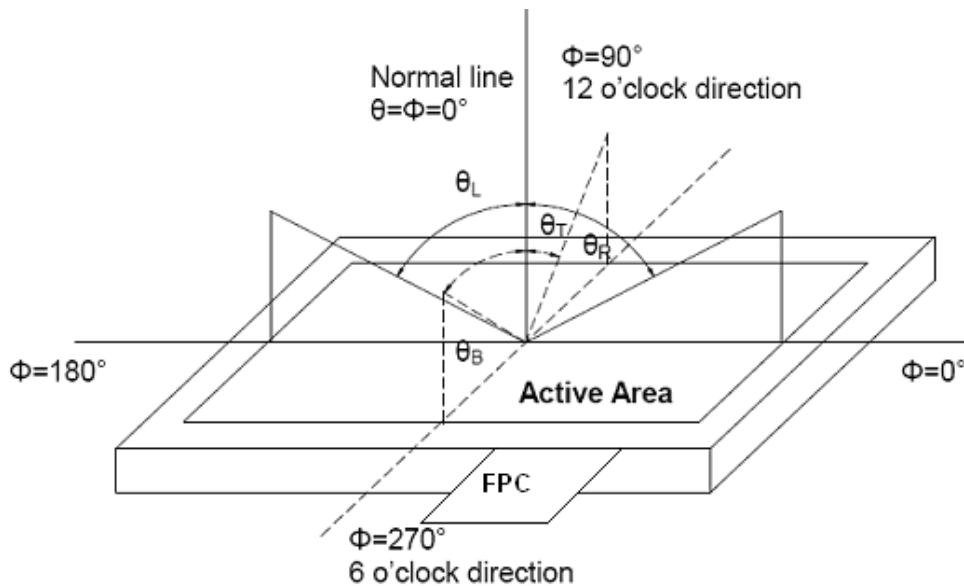
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



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).



Note 3: Definition of contrast ratio

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

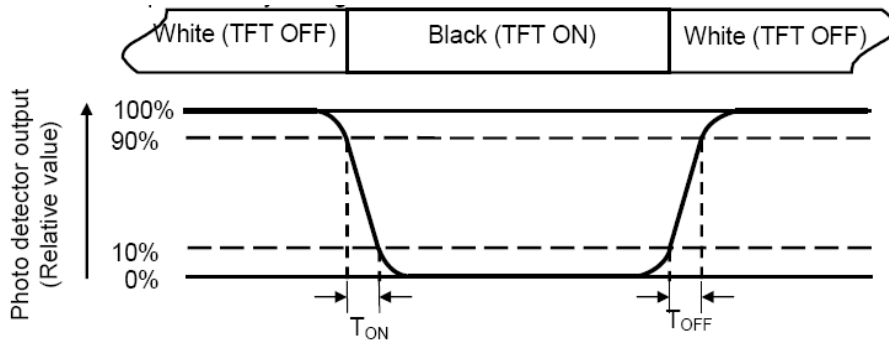
“White state “: The state is that the LCD should drive by Vwhite.

“Black state”: The state is that the LCD should drive by Vblack.

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)

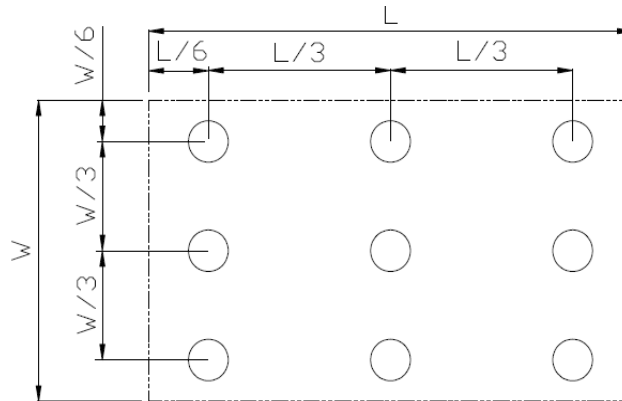
Color coordinates measured at center point of LCD.

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.

$$\text{Luminance Uniformity (U)} = L_{\min} / L_{\max}$$

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



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	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	Storage at High Temperature and Humidity	Ta=+60℃, 90% RH 240 hours	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,G B2423.22-2002
7	ESD	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 Test	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)	IEC60068-2-6:1982 GB/T2423.10—1995
9	Mechanical Shock (Non OP)	60G 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

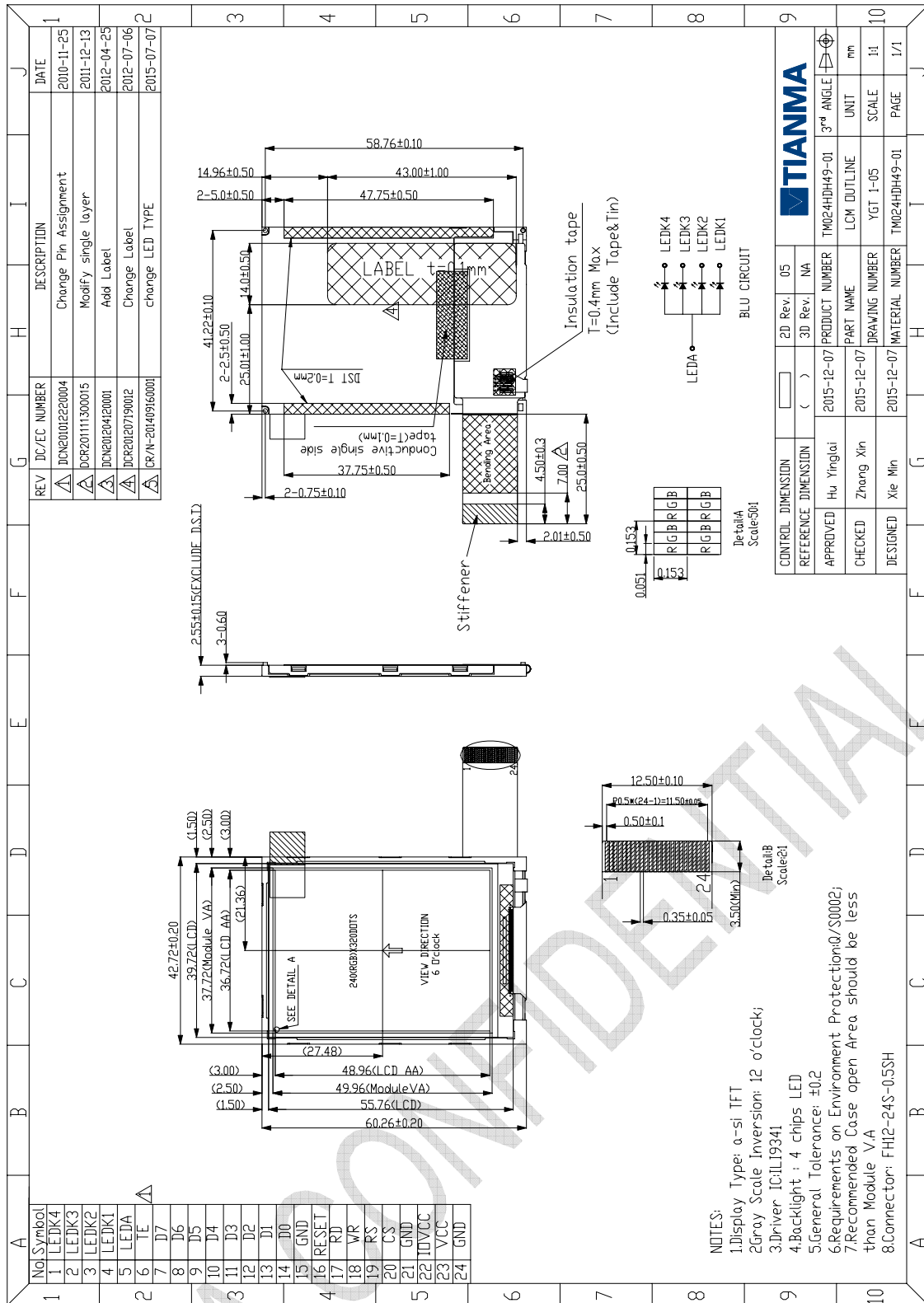
Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.

Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 4: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

8 Mechanical Drawing



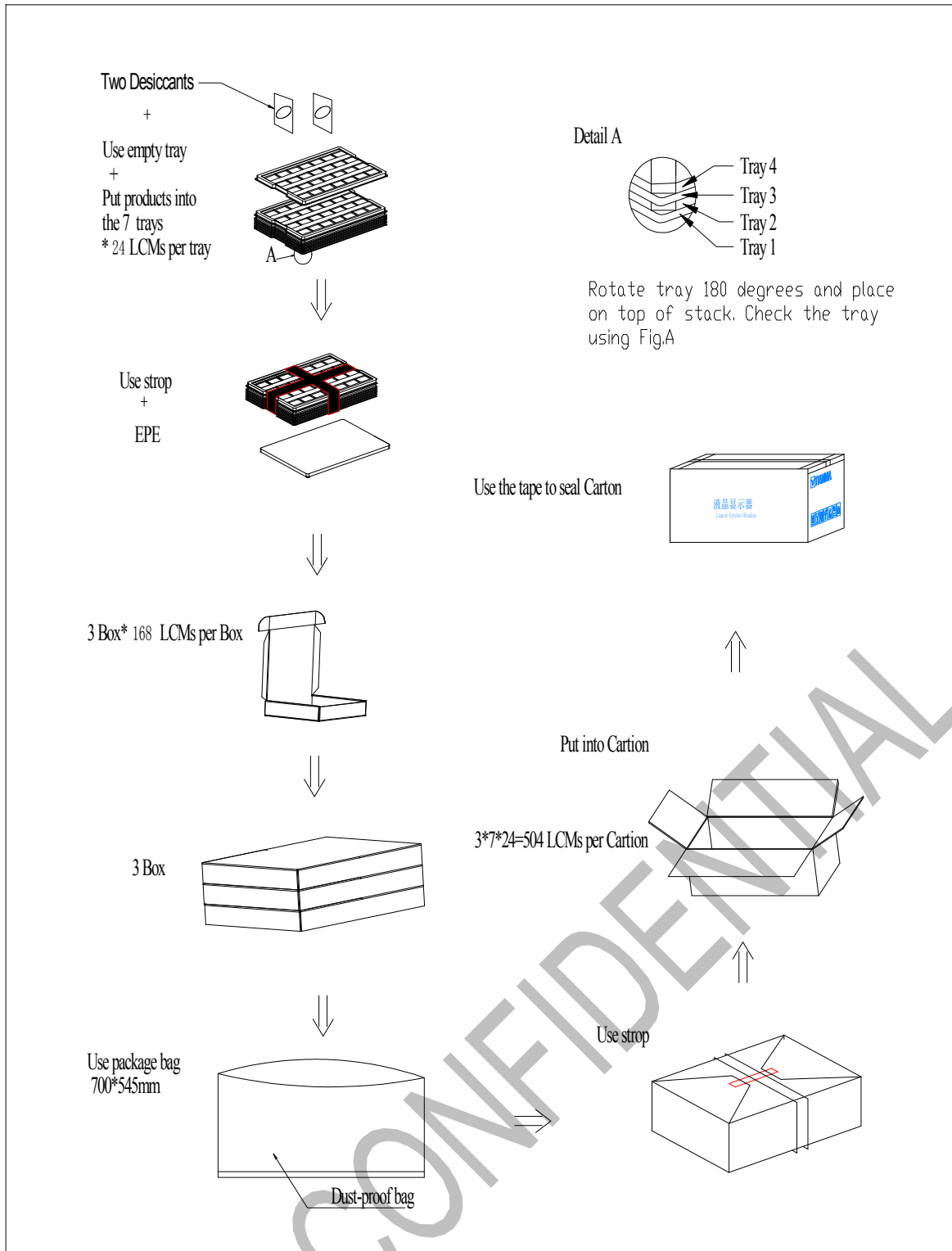
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9 Packing Drawing

9.1 Packaging flow

No	Item	Model (Material)	Dimensions(m m)	Unit Weight(Kg)	Quantit y	Remark
1	LCM module	TM024HDH49	42.72x60.26x2.5 5	0.012	504	
2	Tray	PET (Transmit)	485x330x13.8	0.17	24	Anti-static
3	Anti-static bag	PE	700x540	0.05	1	
4	BOX	Corrugated Paper	520x345x74	0.44	3	
5	Desiccant	Desiccant	45x50	0.0035	6	
6	Carton	Corrugated Paper	544x365x250	1.01	1	
7	EPE	EPE	485x330x5	0.0183	3	
8	Total weight (Kg)	12.6±5%kg				

9.2 Packaging flow



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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°C ~ 40°C 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

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