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MODEL NO : TM030LDHT16**MODEL VERSION: 00****SPEC VERSION : Ver 1.2****ISSUED DATE: 2023-10-18**

- ☐ Preliminary Specification
☒ Final Product Specification

Customer : _____

Approved by	Notes

TIANMA Confirmed :

Prepared by	Checked by	Approved by
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This technical specification is subjected to change without notice

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Record of Revision

[illegible]

1 General Specifications

Feature		Spec
Display Spec.	Size	3,0"
	Resolution	240(RGB)x400
	Technology Type	a-si TFT
	Pixel Configuration	RGB Vertical Stripe
	Pixel pitch(mm)	0.162x0.162
	Display Mode	ECB Mode, Transflective
	Surface Treatment	Top POL: HC Type($\frac{1}{4}$ λ haze63%) Bottom POL: clear
	Viewing Direction	5 o'clock
	Gray Scale Inversion Direction	11 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	76.40x47.28x2.40
	Active Area(mm)	38.88x64.8
	With /Without TSP	Without TP
	Matching Connection Type	FH19SC-45S-0.5SH(05) (HRS)
	LED Numbers	5 LEDs (serial)
	Weight (g)	17.6
Electrical Characteristics	Interface	CPU 16 bits
	Color Depth	65K
	Driver IC	ILI9327-ST20B

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: FH19SC-45S-0.5SH (05) (HRS)

Pin No.	Symbol	I/O	Function	Remark
1	GND	P	Ground	
2	LED-K	P	Power Supply for LED (V-)	
3	NC	-	Not connected	
4	LED-A	P	Power Supply for LED (V+)	
5	GND	P	Ground	
6	GND	P	Ground	
7	/RESET	I	RESET(Low active)	
8	GND	P	Ground	
9	DB15	I/O	CPU: Data bus serial(MSB)	
10	DB14	I/O	CPU: Data bus serial	
11	DB13	I/O	CPU: Data bus serial	
12	DB12	I/O	CPU: Data bus serial	
13	DB11	I/O	CPU: Data bus serial	
14	DB10	I/O	CPU: Data bus serial	
15	DB9	I/O	CPU: Data bus serial	
16	DB8	I/O	CPU: Data bus serial	
17	NC	-	Not connected	
18	DB7	I/O	CPU: Data bus serial	
19	DB6	I/O	CPU: Data bus serial	
20	DB5	I/O	CPU: Data bus serial	
21	DB4	I/O	CPU: Data bus serial	
22	DB3	I/O	CPU: Data bus serial	
23	DB2	I/O	CPU: Data bus serial	
24	DB1	I/O	CPU: Data bus serial	
25	DB0	I/O	CPU: Data bus serial	
26	NC	-	Not connected	
27	GND	P	CPU: Ground	
28	NC	-	Not connected	
29	/RD	I	CPU: read signal and read data.	
30	/WR	I	CPU: write signal and write data.	

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31	RS	I	CPU: Data / Command Selection pin.	
32	/CS	I	Chip select signal.	
33	GND	P	CPU: Ground	
34	GND	P	CPU: Ground	
35	GND	P	CPU: Ground	
36	GND	P	CPU: Ground	
37	NC	-	Not connected	
38	VCCIO	P	I/O Pad and Digital power supply	
39	VCC	P	Analog power supply	
40	IM0/ID	I/O	System interface select./ Identification	
41	IM1	I	System interface select.	
42	IM2	I	System interface select.	
43	GND	P	Ground	
44	GND	P	Ground	
45	GND	P	Ground	

Note : I---Input, O---Output, P--- Power/Ground

3 Absolute Maximum Ratings

GND=0V

Item	Symbol	MIN	MAX	Unit	Remark
Analog Supply Voltage	VCI	-0.3	4.6	V	Note1
Logic Supply Voltage	VDD	-0.3	4.6	V	
Input Voltage	VIN	-0.3	VDD+0.3	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 DB0~DB15, IM0~IM2,RD,WR,RS,CS,RESB.

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	VDD	3.1	3.2	3.3	V	
Analog Supply Voltage	VCI	2.9	3.0	3.1	V	
Input Signal Voltage	High Level	VIH	0.7 VDD	-	VDD	V
	Low Level	VIL	0	-	0.3 VDD	V
Output Signal Voltage	High Level	VOH	0.8 VDD	-	-	V
	Low Level	VOL	-	-	0.2 VDD	V

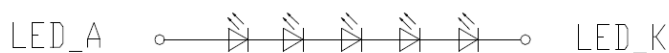
Table 4.1 LCD module electrical characteristics

4.2 Backlight Unit

Ta=25°C

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I _F	-	20	-	mA	One LED
Forward Voltage	V _F		2.85		V	One LED
Backlight Power Consumption	W _{BL}	-	285	-	mW	Typ.

Table 4.2.1 backlight unit electrical characteristics



(V_F=14.25V(TYP), I_F=20mA)

Figure 4.2.1 LED backlight circuit

4.3 Block Diagram

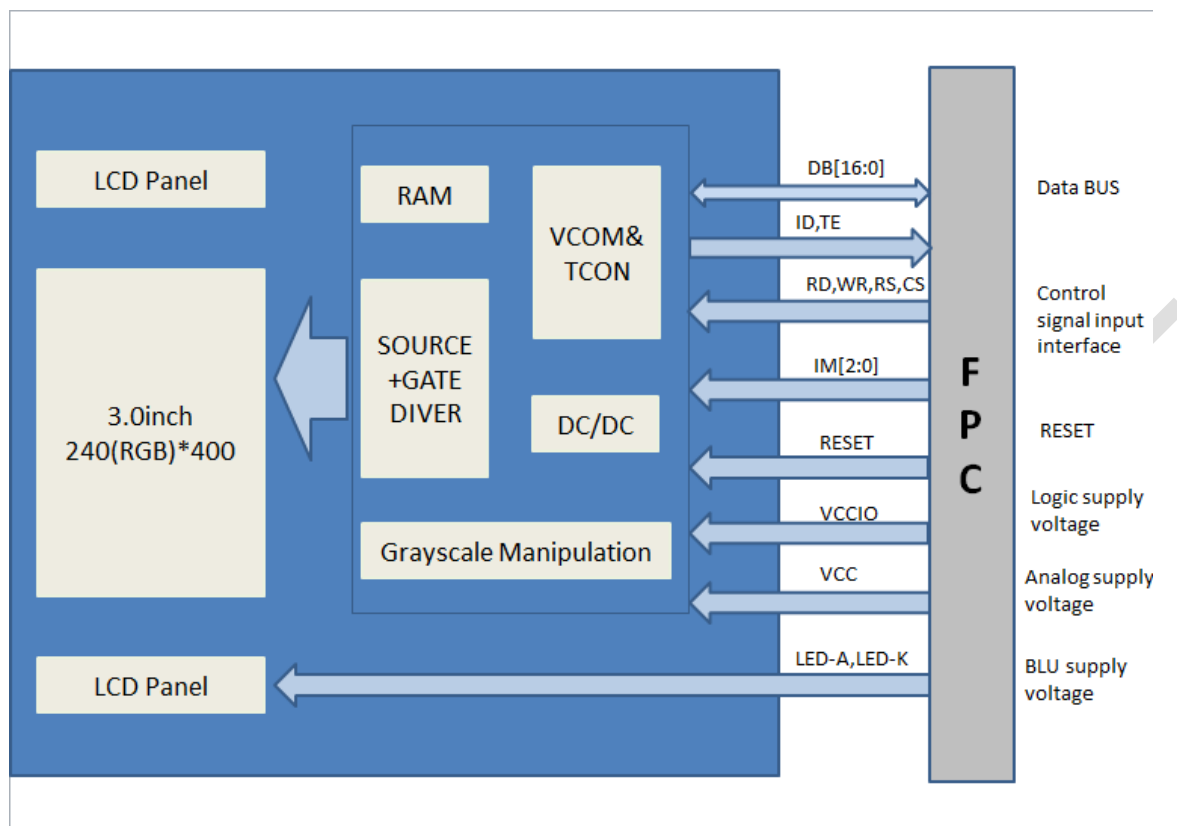


Figure 4.3 LCD module diagram

5 Timing Chart

5.1 AC Characteristics

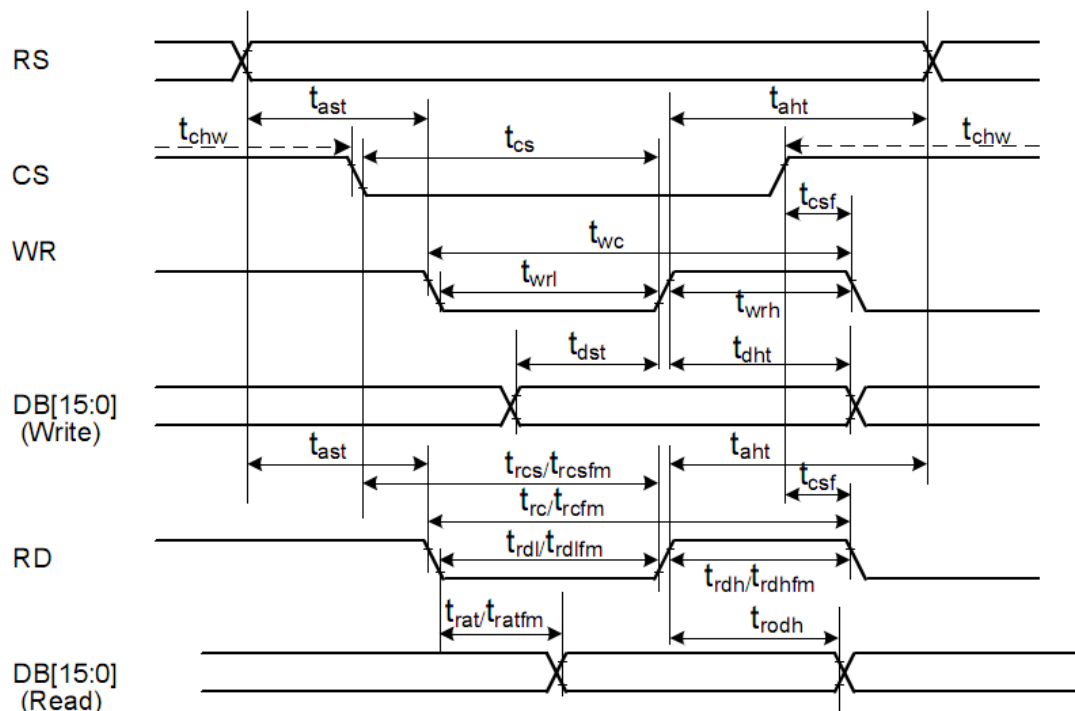


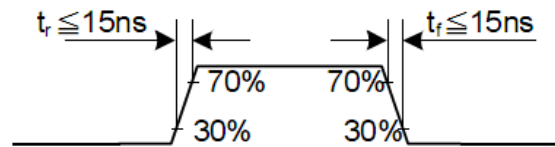
Table 5.1 AC Characteristics

5.2 CPU Interface Input Timing parameters

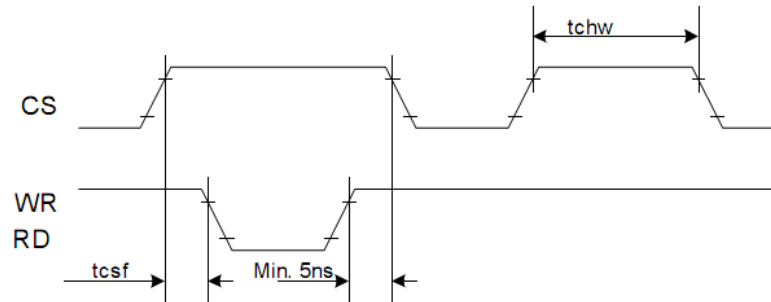
Signal	Symbol	Parameter	min	max	Unit	Description
RS	tast	Address setup time	0	-	ns	
	taht	Address hold time (Write/Read)	10	-	ns	
CS	tchwh	CSX "H" Pulse Width	0	-	ns	
	tcs	Chip Select setup time (Write)	20	-	ns	
	trcs	Chip Select setup time (Read ID)	45	-	ns	
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	
WR	tcsf	Chip Select Wait time (Write/Read)	10	-	ns	
	twc	Write cycle	80	-	ns	
	twrh	Write Control pulse H duration	25	-	ns	
RD(ID)	twrl	Write Control pulse L duration	25	-	ns	
	trc	Read cycle (ID)	160	-	ns	
	trdh	Read Control pulse H duration (ID)	90	-	ns	
RD(FM)	trdl	Read Control pulse L duration (ID)	45	-	ns	
	trcfm	Read cycle (FM)	450	-	ns	
	trdhfm	Read Control pulse H duration (FM)	90	-	ns	
DB [15:0]	trdlfm	Read Control pulse L duration (FM)	355	-	ns	
	tdst	Data setup time	10	-	ns	
	tdht	Data hold time	10	-	ns	
	trat	Read access time (ID)	-	40	ns	For maximum CL = 30pF For minimum CL = 8pF
	tratfm	Read access time (FM)	-	340	ns	
	trodh	Output disable time	20	-	ns	

Table 5.2 CPU Input Timing Parameters

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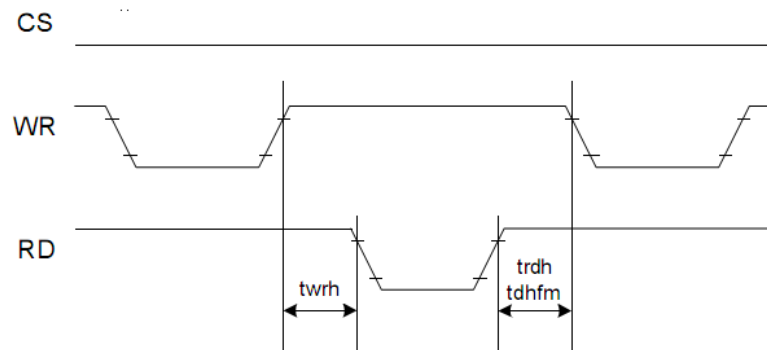


CS timings:



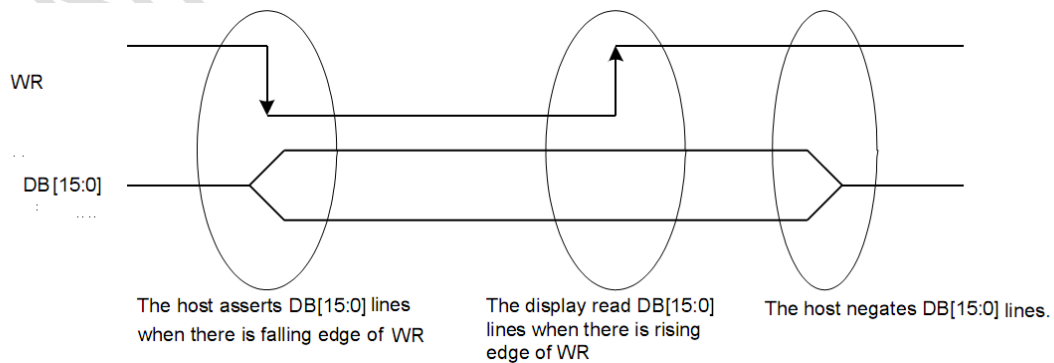
Note: Logic high and low levels are specified as 30% and 70% of VDD for Input signals.

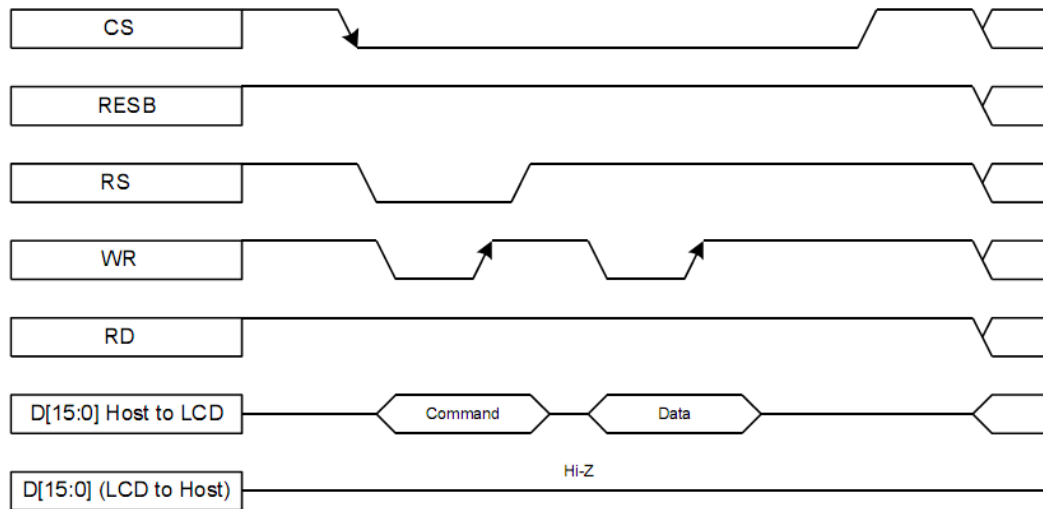
Write to read or read to write timings:



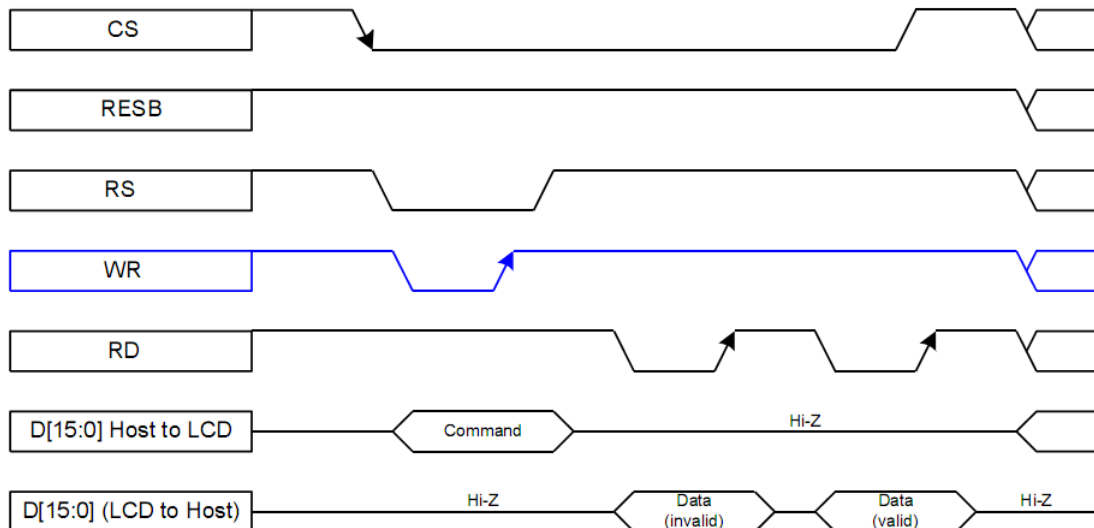
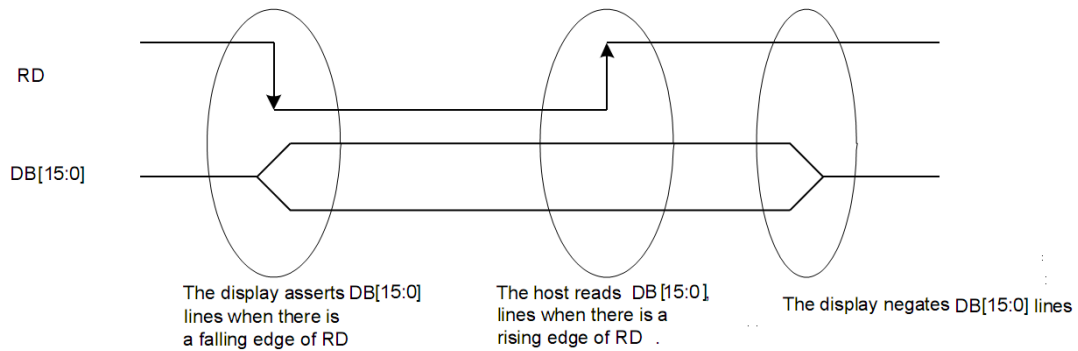
Note: Logic high and low levels are specified as 30% and 70% of VDD for Input signals.

5.3 CPU Interface Register write/read timing





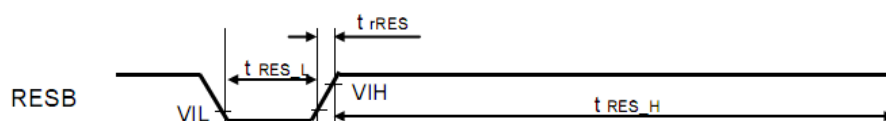
Register write timing



Register read timing

Figure 5.3 CPU Interface Register write/read timing

5.4 Reset timing Characteristics

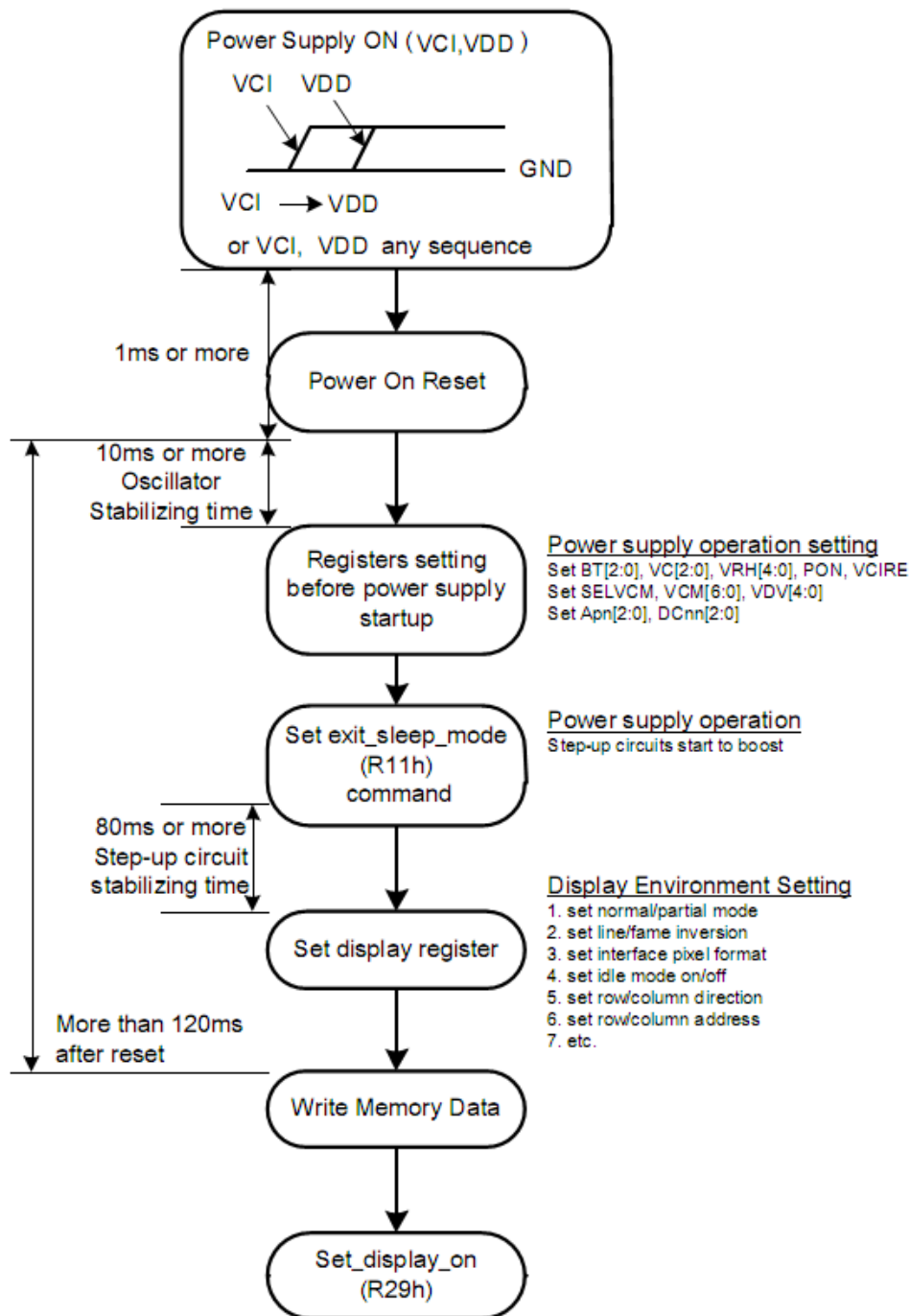


item	Symbol	Rating			Unit
		MIN	TYP	MAX	
Reset low-level width	t_{RES_L}	1	-	-	ms
Reset rise time	t_{rRES}	-	-	10	us
Reset high-level width	t_{RES_H}	120	-	-	ms

Figure 5.4 Reset Input Timing

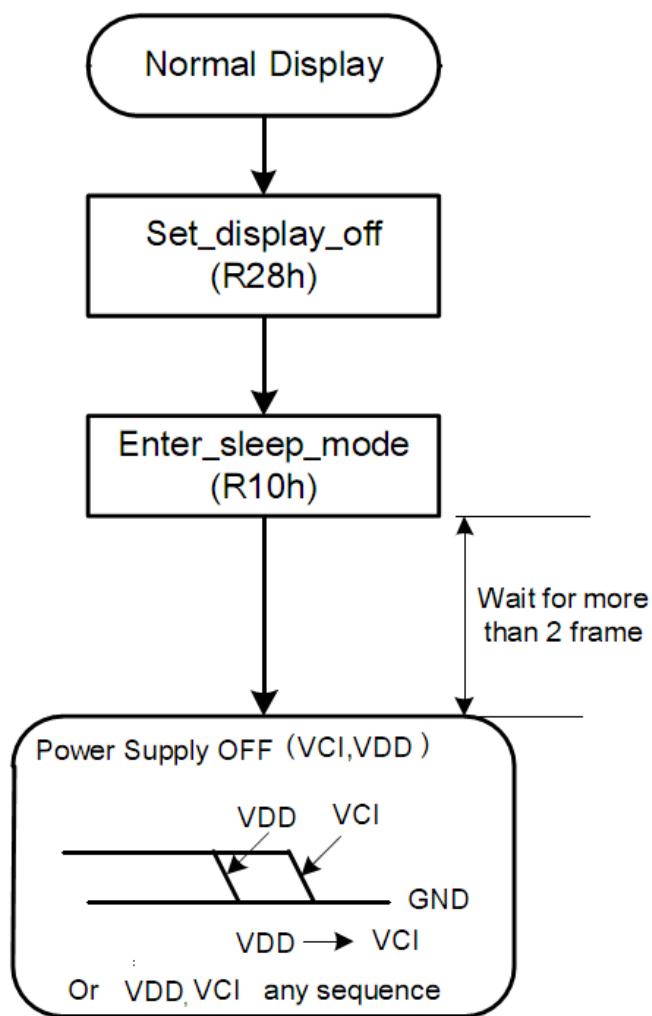
5.5 POWER ON/OFF SEQUENCE

5.5.1 Power on Sequence



Power ON Sequence

5.5.2 Power off Sequence



Power OFF Sequence

6 Optical Characteristics

6.1 Driving the backlight condition (Transmissive mode)

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥10	20	30	-	Degree	Note2,3
		θB		20	30	-		
		θL		25	35	-		
		θR		20	30	-		
Contrast Ratio		CR	θ=0°	50	80	-		Note 3
Response Time		T _{ON}	25℃	20	30	50	ms	Note 4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	0.259	0.289	0.319		Note 1,5
		y		0.284	0.314	0.344		
	Red	x		0.453	0.483	0.513		Note 1,5
		y		0.317	0.347	0.377		
	Green	x		0.268	0.298	0.328		Note 1,5
		y		0.486	0.516	0.546		
	Blue	x		0.128	0.158	0.188		Note 1,5
		y		0.089	0.119	0.149		
Uniformity		U		70	80		%	Note 6
NTSC				28	33		%	Note 5
Luminance		L		100	130		cd/m ²	Note 7

Test Conditions:

1. $I_F = 20\text{mA}$, and the ambient temperature is 25°C.
2. The test systems refer to Note 1 and Note 2.

6.2 Not Driving the backlight condition (Reflective mode)

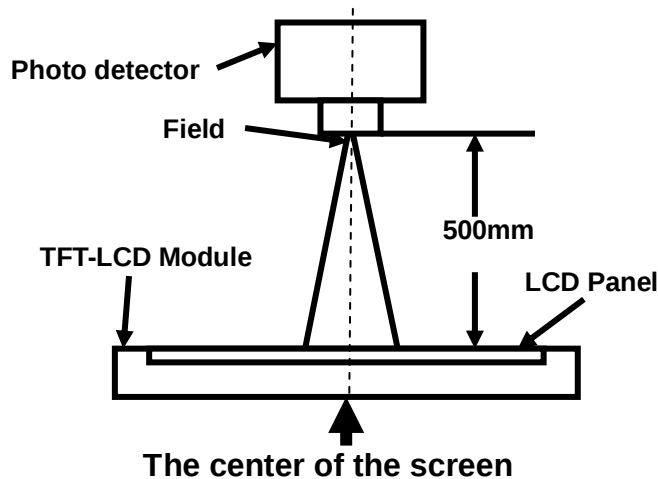
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥2	25	35	-	Degree	Note2,3
		θB		25	35	-		
		θL		20	30	-		
		θR		20	30	-		
Contrast Ratio		CR	θ=0°	5	7	-		Note 3
Response Time		T _{ON}	25℃	10	20	40	ms	Note 4
		T _{OFF}						
Chromaticity	White	x	Backlight is off	0.287	0.317	0.347		Note 1,5
		y		0.317	0.347	0.377		
Reflection ratio		U		4.5	5.2		%	

Test Conditions:

1. $I_F = 20$ mA, and the ambient temperature is $25^\circ C$.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

1. Transmissive mode: 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	LCD-5200	/

2. Reflective mode



D65 光源, 2° 视场角测试

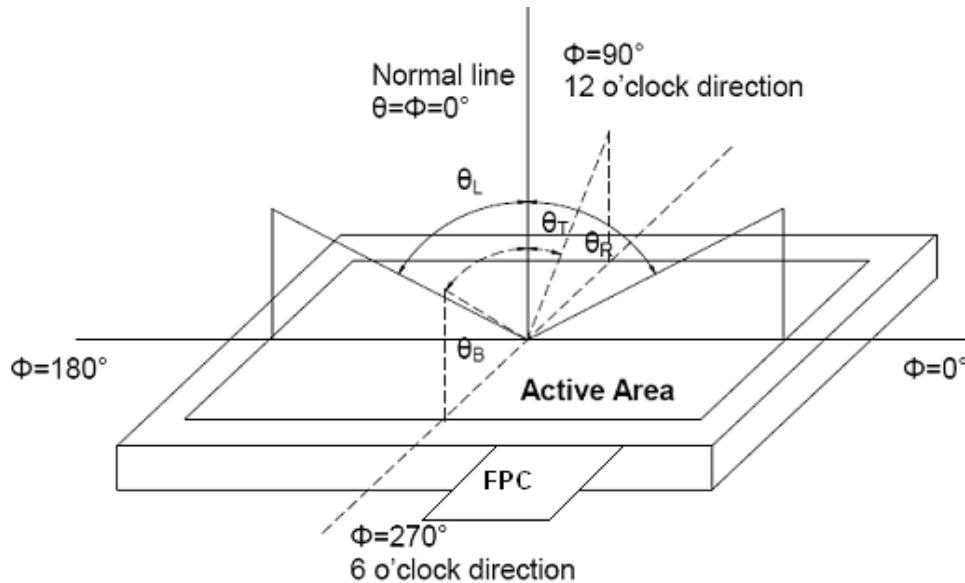
Item	Photo detector	Field
Chromaticity	700D	
Reflective Ratio		
Contrast Ratio		
Viewing angle	DMS	



Note 2: Definition of viewing angle range and measurement system.

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



Note 3: Definition of contrast ratio

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

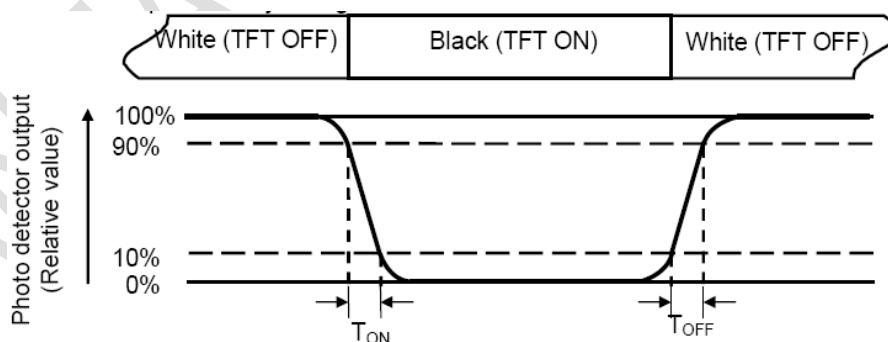
"White state ": The state is that the LCD should drive by V_{white}.

"Black state": The state is that the LCD should drive 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)

- (1) Color coordinates measured at center point of LCD.
- (2) For reflective mode color chromaticity we need to test at least 3 different batches to make sure the stability of panel and it accepts reasonable change after we get the stability data.

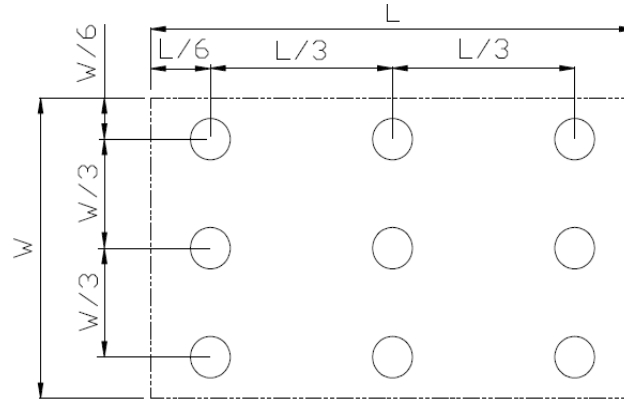
Note 6: Definition of Luminance Uniformity

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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



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

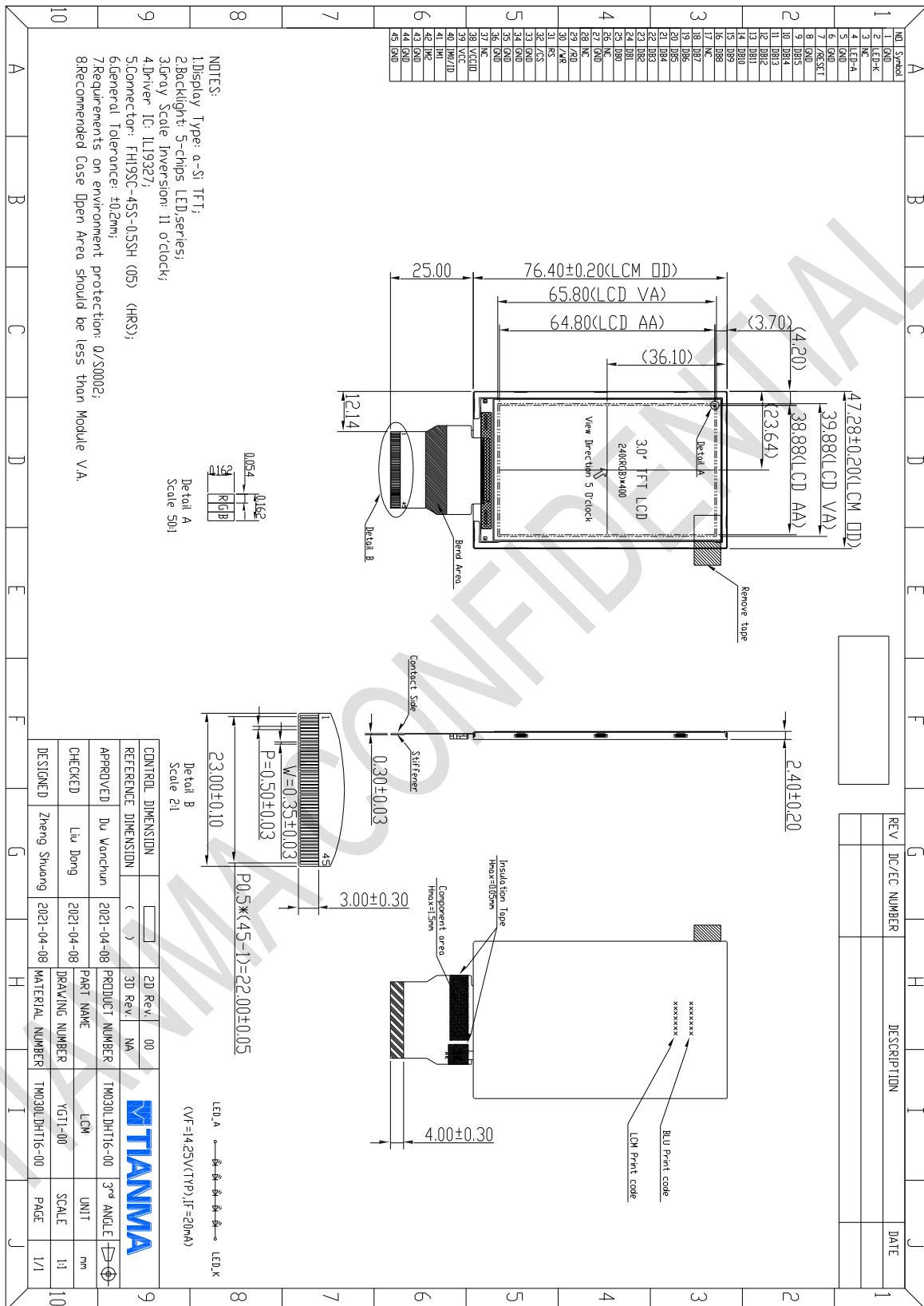
No	Test Item	Condition	Remarks
1	High Temperature Operation	Ta=+70℃, 240hrs	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	Ta=-20℃, 240hrs	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta=+80℃, 240hrs	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta=-30℃, 240hrs	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. (for total)	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	Drop 1 corner, 3 edges, 6 surfaces from height of 80cm (Weight≤10kg); of 60 cm (Weight>10kg)	IEC60068-2-32:1990 GB/T2423.8—1995

Note1: Ta is the ambient temperature of sample.

Note2: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 3: 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.

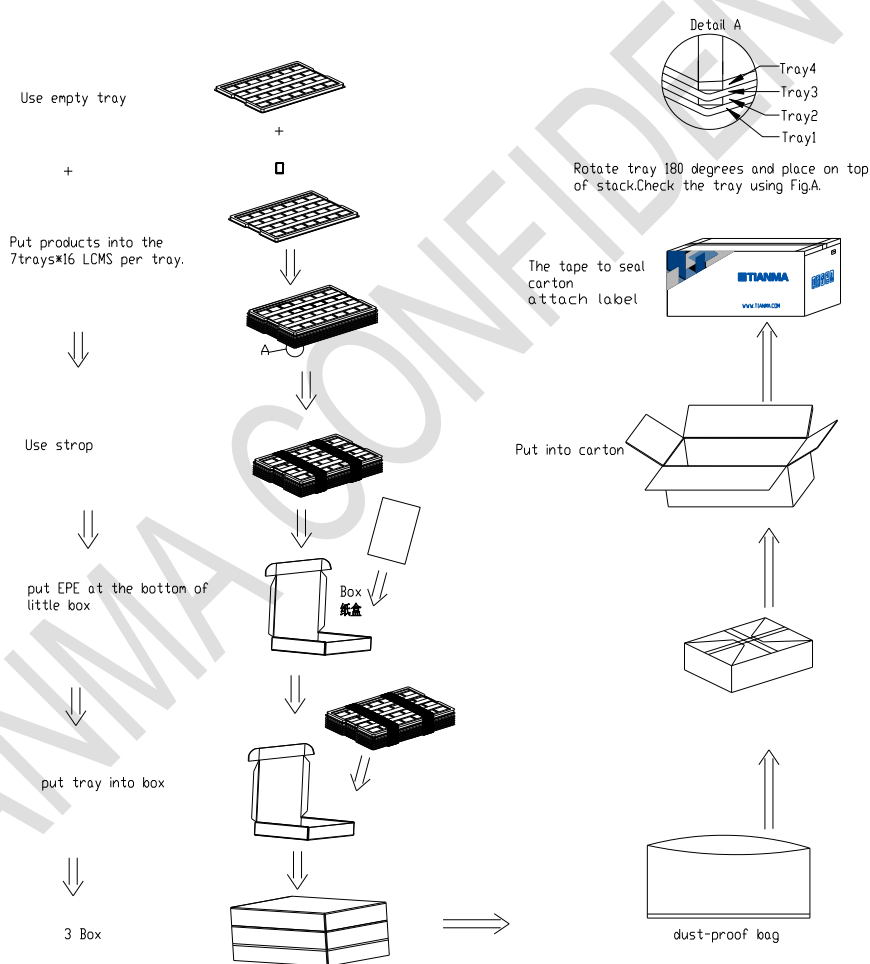
8 Mechanical Drawing



9 Packing Drawing

9.1 Packaging flow

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM030LDHT16-00	47.28×76.4×2.4	0.0176	336	5.9136
2	Tray	PET	485×330×14	0.210	24	5.04
3	Dust-proof Bag	PE	700×545×0.05	0.046	1	0.021
4	Carton	Corrugated Paper	544×365×250	1.01	1	1.01
5	BOX	Corrugated Paper	520×345×74	0.38	3	1.32
6	EPE	EPE	485×330×5	0.016	3	0.048
7	Label		100×52	0.001	1	0.001
8	Total weight	13.35±10%				



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: Room temperature $23 \pm 4^{\circ}\text{C}$.

Humidity: $(50 \pm 30) \% \text{RH}$.

The display warranty period is 12 months.

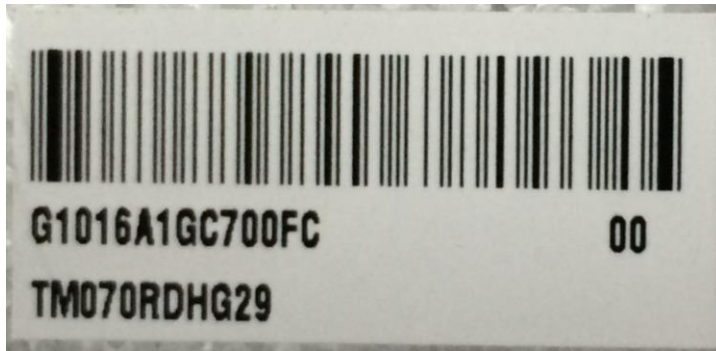
10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 Transportation Precautions

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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.

10.4 Bar Code definition on module



Note: Bar Code definition

Definition label is Panel ID, and it is unique and includes manufacture relevant information, for instance TM070RDHG29. G1016A1GC700FC Label definition as below:

G1016: Produce No.

A1: Produce line

G: 2014 year (A: 2008, B: 2009, C: 2010...);

C: December (1-9:Jan-Sep, A-C: Oct- Dec.)

7: Date 7 (date1-31,from 1-9,A-X,not including I,O)

00FC: Serial No(start from 0001).