MODEL NO. : TM070RDHG23

MODEL VERSION: 40

SPEC VERSION: 1.3

ISSUED DATE: 2016-11-19

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

Customer :

Approved by	Notes

TIANMA Confirmed :

Prepared by	Checked by	Approved by
Tiantian Zhao	Xiaoxing Ding	Kevin Kim

This technical specification is subjected to change without notice.

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Record of Revision

Rev	Issued Date	Description	Editor
1.0	2015-07-15	Preliminary Specification release	Yuntian GUAN
1.1	2016-01-19	Update spec model	Yuntian GUAN
1.2	2016-06-29	Update the power current	Tiantian Zhao
1.3	2016-11-19	Update spec format	Tiantian Zhao

1 General Specification

TM070RDHG23-40 is color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver IC with CABC function, FPC and a back light unit. This product accords with RoHS environmental criterion.

Item	Feature	Spec
Display spec	Size	7 inch
	Resolution	800(RGB) x 480
	Interface	RGB 24 bits
	Color Depth	16.7M
	Technology Type	a-Si
	Pixel Pitch	0.1926(H)x0.179(V)
	Pixel Configuration	R.G.B. Vertical Stripe
	Display Mode	TM with Normally White
	Surface Treatment(Up Polarizer)	Anti-Glare(3H)
	Viewing Direction (source IC at 6 o'clock)	12 o'clock
	Gray Scale Inversion Direction	6 o'clock
	LCM (W x H x D)	165x100x5.7
	Drive IC	TFT:HX8264+HX8664
Mechanical Characteristics	TFT Active Area	154.08x85.92
	Matching Connection Type	HIROSE FH12A-50S-0.5H
	LED Numbers	30 LEDs
	Weight	150.2g
Electrical Characteristics	Operation temperature	-20~70°
	Storage temperature	-30~80°

Note 1: Viewing direction for best image quality is different from Gray Scale Inversion Direction, there is a 180 degree shift.
Note 2: Requirements on Environmental Protection: RoHS

2. Input/output Terminals

Matched Connector: HIROSE FH12A-50S-0.5H

PIN	Symbol	I/O	Description	Remark
1	VLED+	P	Led anode	
2	VLED+	P	Led anode	
3	VLED-	P	Led cathode	
4	VLED-	P	Led cathode	
5	GND	P	Ground	
6	VCOM	P	Common voltage input	
7	VCC	P	Digital power supply	
8	MODE	I	DE/SYNC mode select. H:DE mode, L:SYNC mode	
9	DE	I	Data enable signal, active high to enable data,if not used,please pull low	
10	VSYNC	I	Vertical sync input, negative polarity,if not used,please pull High	
11	HSYNC	I	Horizontal sync input, negative polarity,if not used,please pull High	
12	B7	I	Blue data（MSB）	
13	B6	I	Blue data	
14	B5	I	Blue data	
15	B4	I	Blue data	
16	B3	I	Blue data	
17	B2	I	Blue data	
18	B1	I	Blue data	
19	B0	I	Blue data（LSB）	
20	G7	I	Green data（MSB）	
21	G6	I	Green data	
22	G5	I	Green data	
23	G4	I	Green data	
24	G3	I	Green data	
25	G2	I	Green data	
26	G1	I	Green data	
27	G0	I	Green data（LSB）	
28	R7	I	Red data（MSB）	
29	R6	I	Red data	
30	R5	I	Red data	
31	R4	I	Red data	
32	R3	I	Red data	
33	R2	I	Red data	
34	R1	I	Red data	
35	R0	I	Red data（LSB）	
36	GND	P	Ground	
37	DCLK	I	Clock for input data	
38	GND	P	Ground	
39	LR	I	Source left or right sequence control	

40	UD	I	Gate up or down scan control	
41	VGH	P	Positive power of TFT	
42	VGL	P	Negative power of TFT	
43	AVDD	P	Analog power supply	
44	RESET	I	Global reset pin	
45	NC	NC		
46	VCOM	P	Common voltage input	
47	DITHB	I	Dithering setting. H: 6bit resolution, L: 8bit resolution	
48	GND	P	Ground	
49	NC	NC		
50	NC	NC		

Note1: I/O definition.

I---Input, O---Output, P--- Power/Ground, N--- No connection

Note2:

Scan control input		Scanning direction
UD	LR	
GND	VCC	Up to down, left to right
VCC	GND	Down to up, right to left
GND	GND	Up to down, right to left
VCC	VCC	Down to up, left to right

3.Absolute Maximum Ratings

GND=0V

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VCC	-0.3	4.2	V	Note1
Input voltage	V_{IN}	-0.3	4.2	V	
Operating Temperature	Top	-20	70	℃	
Storage Temperature	Tst	-30	80	℃	
Relative Humidity Note2	RH	--	≤95	%	Ta≤40℃
		--	≤85	%	40℃＜Ta≤50℃
		--	≤55	%	50℃＜Ta≤60℃
		--	≤36	%	60℃＜Ta≤70℃
		--	≤24	%	70℃＜Ta≤80℃
Absolute Humidity	AH	--	≤70	g/m³	Ta＞70℃

Table 3 Absolute Maximum Ratings

Note1: Input voltage include R0~R7, G0~G7, B0~B7, 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 .1Driving TFT LCD Panel

Ta = 25℃

Item		Symbol	Min	Typ	Max	Unit	Remark
Voltage for logic circuit		VCC	3.00	3.30	3.60	V	
Analog Supply Voltage		AVDD	10.1	10.4	10.7	V	
Gate On Voltage		VGG	14.4	16	17.6	V	
Gate Off Voltage		VEE	-7.70	-7.00	-6.30	V	
Common Electrode Driving Signal		VCOM	3.85	3.95	4.05	V	
Input Signal Voltage	Low Level	VIL	0	-	0.3xVCC	V	
	High Level	VIH	0.7xVCC	-	VCC	V	

Table 4.1 LCD module electrical characteristics

Note1: For different LCM, the value may have a bit of difference.
Note2: To test the current dissipation, use “all Black Pattern”.

4.2 TFT Driving Backlight

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Forward Voltage	VLED	I_F=150mA	--	19.2	20.4	V	Note 1
Forward Current	I_F	-	-	150	--	mA	
Backlight Power Consumption	WBL	I_F=150mA	--	2880	--	mW	
Life Time	-	I_F=150mA	20000	40000	-	Hrs	Note 3

Table 4.2 LED backlight characteristics

Note 1: I_F is defined for five channels LED. There are total five LED channels in back light unit.Under LCM operating, the stable forward current should be inputted.
Note 2: Optical performance should be evaluated at Ta=25℃ only.
Note 3: If LED is driven by high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

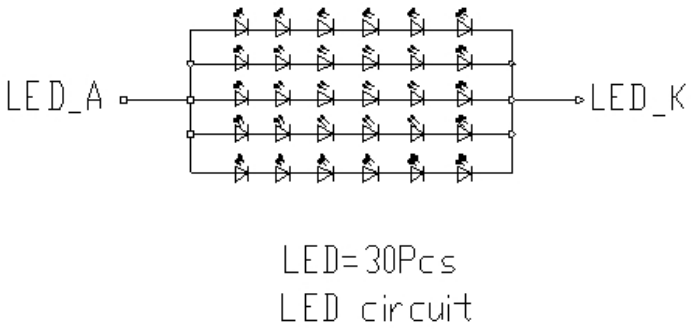
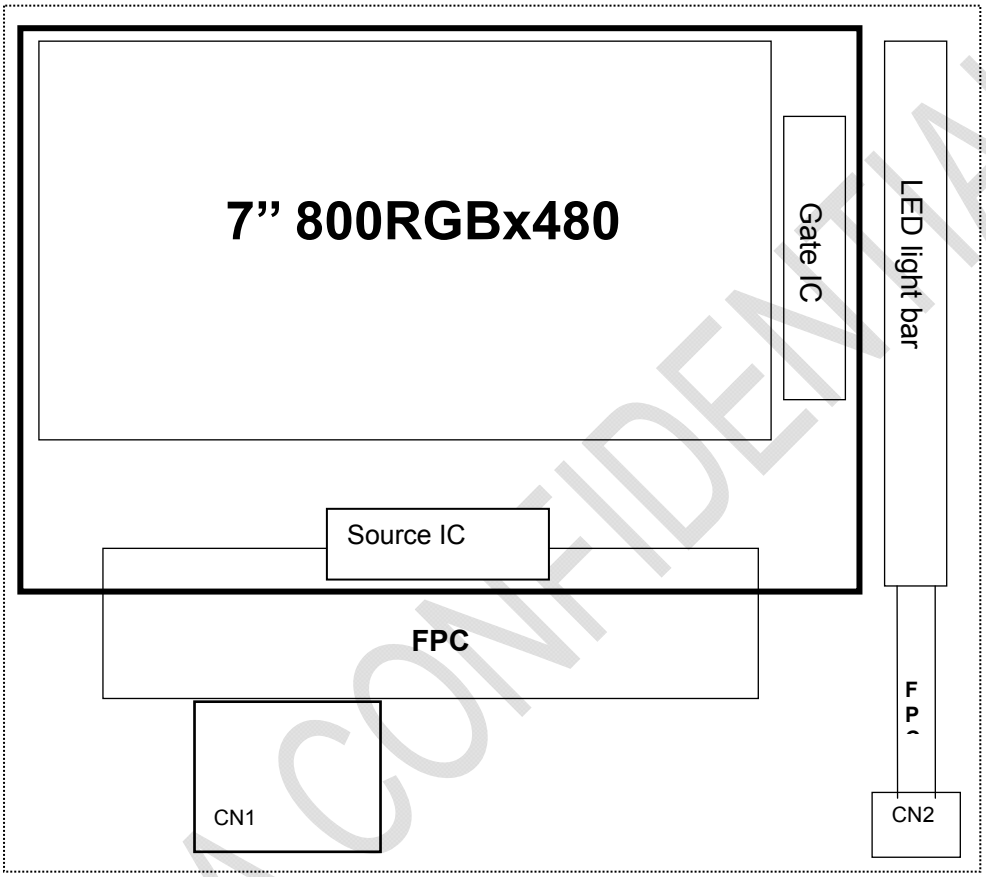


Figure 4.2 LED connection of backlight

4.3 TFT Block Diagram



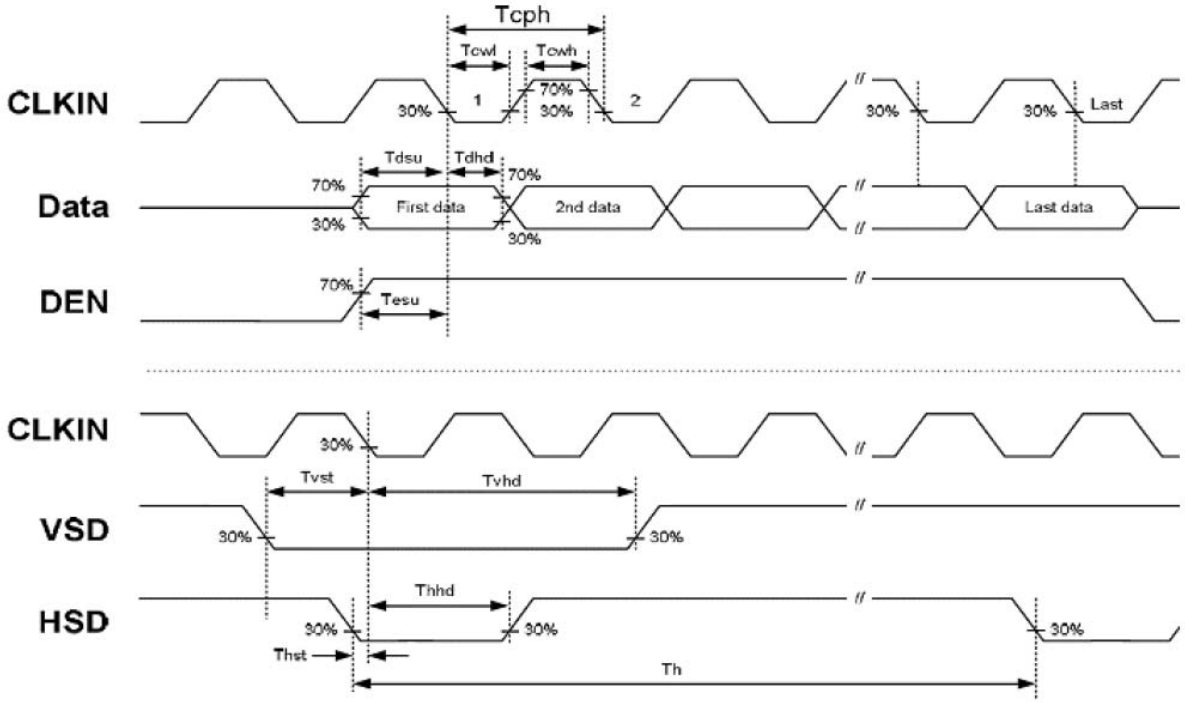
5.Timing Chart

5.1 TFT-LCD Input Timing

VCC=3.3V, GND=0V, Ta=25℃

Parameter	Symbol	Min	Typ	Max	Unit	Remark
DCLK frequency	F_{clk}	28	30.0	40.0	MHz	
DCLK cycle time	T_{cph}	25	33.3	36	ns	
DCLK pulse width	T_{cw}	40%	50%	60%	T_{cph}	
VS setup time	T_{vst}	8			ns	
VS hold time	T_{vhd}	8	-	-	ns	
HS setup time	T_{hst}	8			ns	
HS hold time	T_{hhd}	8	-	-	ns	
Data setup time	T_{dsu}	8			ns	Data to DCLK
Data hold time	T_{dhd}	8	-	-	ns	Data to DCLK
DE setup time	T_{esu}	8	-	-	ns	
DE hold time	T_{ehd}	8	-	-	ns	

Input Clock and Data timing Diagram:



5.2 Recommended Timing Setting Of TCON

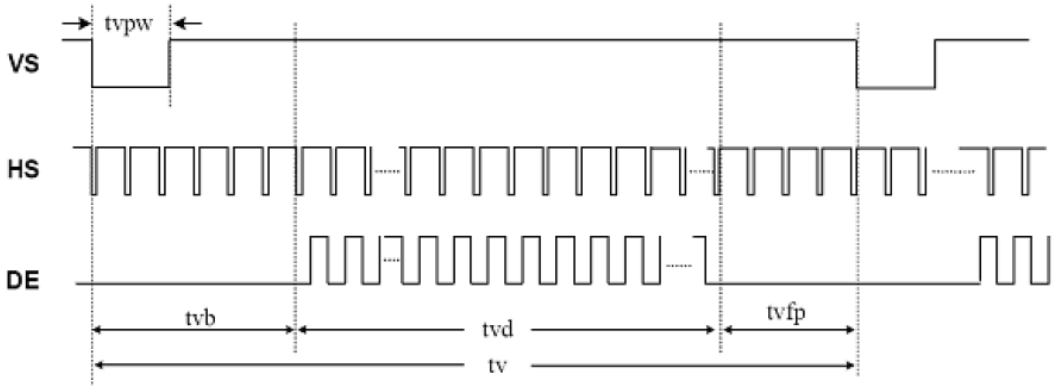
TCON (Embedded In Source IC) Input Timing (DCLK, HS, VS, DE)

VCC=3.3V, GND=0V, Ta=25℃

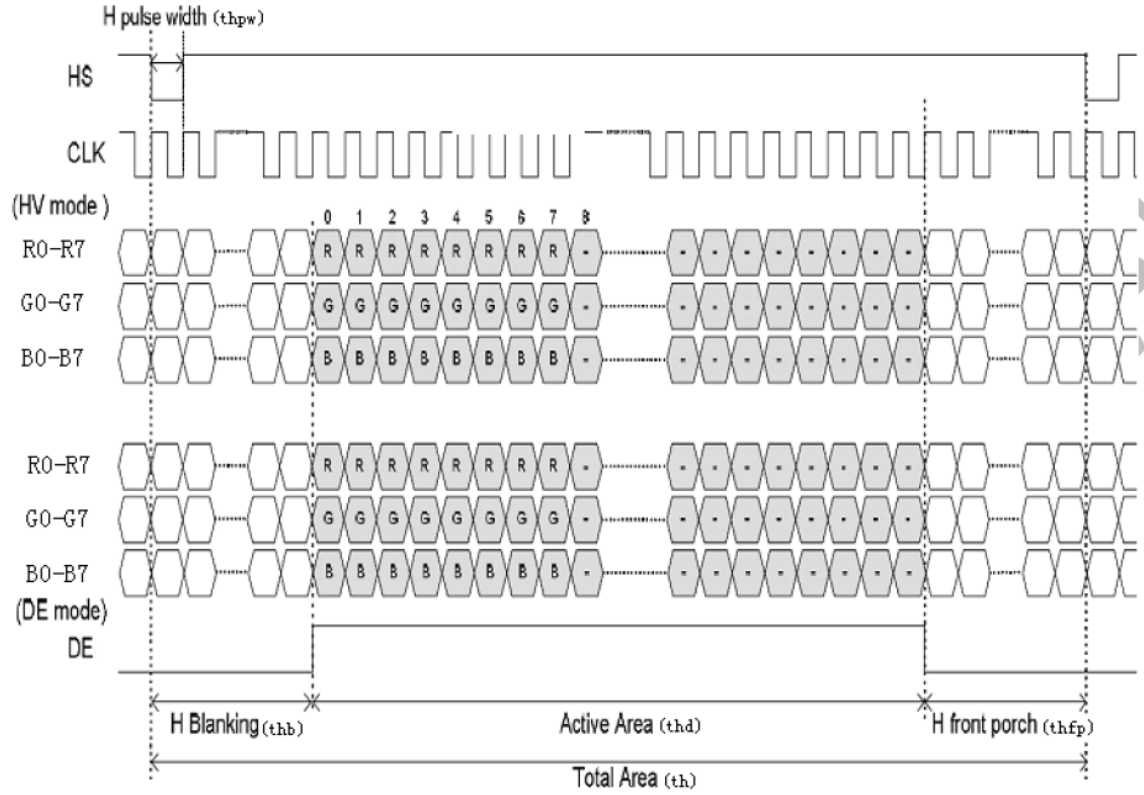
Parameter	Symbol	Min	Typ	Max	Unit	Remark
DCLK	F_{clk}	28	33.3	40	MHZ	
	t_{clk}	20	30	36	ns	
HSD	t_h	862	1056	1200	t_{clk}	
	t_{hd}	800	800	800	t_{clk}	
	t_{hpw}	1	-	40	t_{clk}	
	t_{hb}	46	46	46	t_{clk}	
	t_{hfp}	16	210	354	t_{clk}	
VSD	t_v	510	525	650	t_h	
	t_{vd}	480	480	480	t_h	
	t_{vpw}	1	3	20	t_h	
	t_{vb}	23	23	23	t_h	
	t_{vfp}	7	22	147	t_h	

Note 1: DE timing refer to HS, VS input timing.

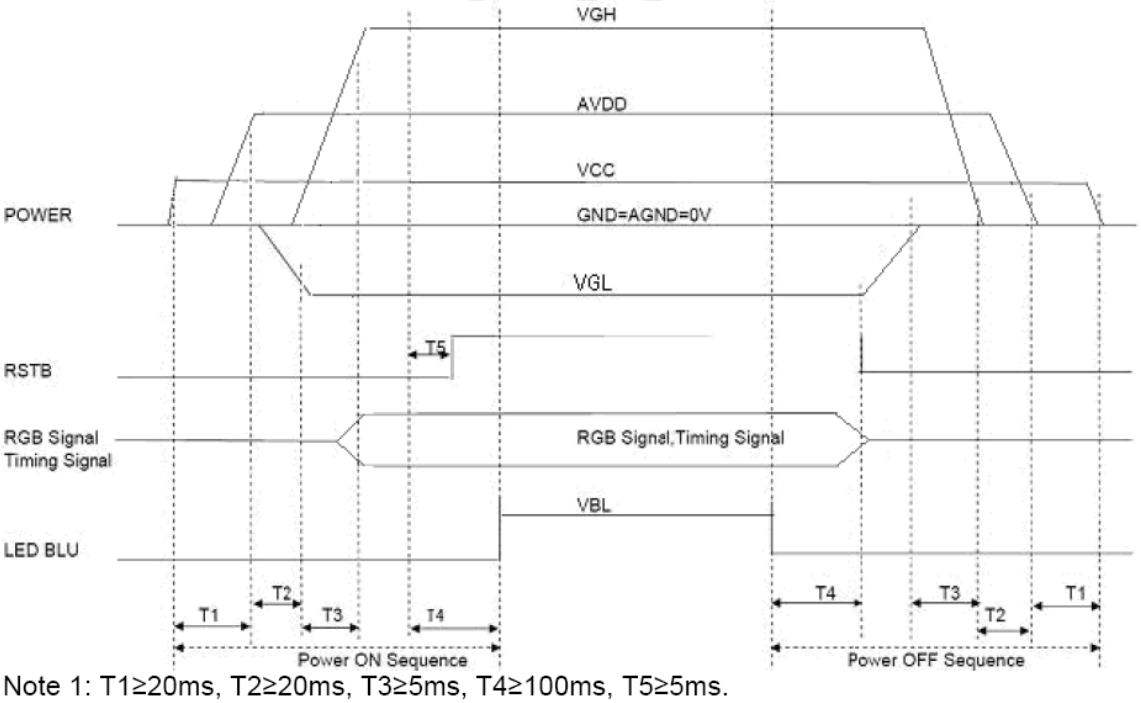
TCON Vertical Input Timing Diagram HV



TCON Horizontal Input Timing Diagram



5.3 POWER ON/OFF SEQUENCE



Note 1: T1≥20ms, T2≥20ms, T3≥5ms, T4≥100ms, T5≥5ms.

6. Optical Characteristics

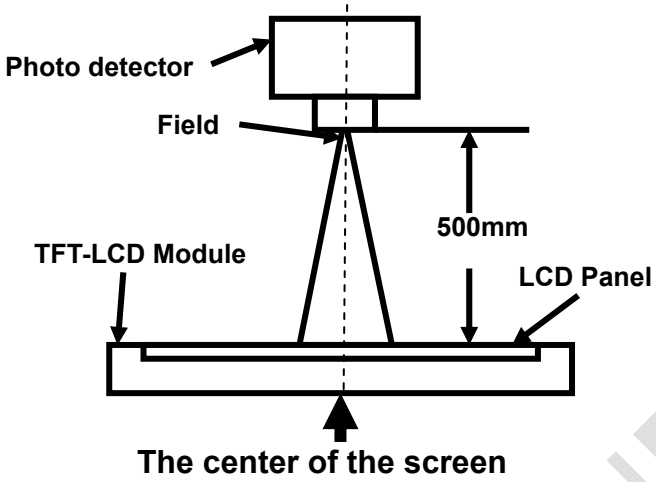
6.1 TFT Optical Characteristics

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	50	60	--	Degree	Note 2
		θB		60	80	--		
		θL		60	80	--		
		θR		60	80	--		
Contrast Ratio		CR	θ=0°	600	1000	--		Left/right 0° Top/bottom 5°
Response Time		T_{ON}	25℃	--	25	35	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	0.261	0.311	0.361		Note5 Note1
		y		0.278	0.328	0.378		
	Red	x		0.537	0.587	0.637		
		y		0.301	0.351	0.401		
	Green	x		0.291	0.341	0.391		
		y		0.534	0.584	0.634		
	Blue	x		0.099	0.149	0.199		
		y		0.047	0.097	0.147		
Uniformity		U		70	80	--	%	Note1、Note6
NTSC				40	50	--	%	
Luminance		L		1150	1400	--	cd/m^2	Note7

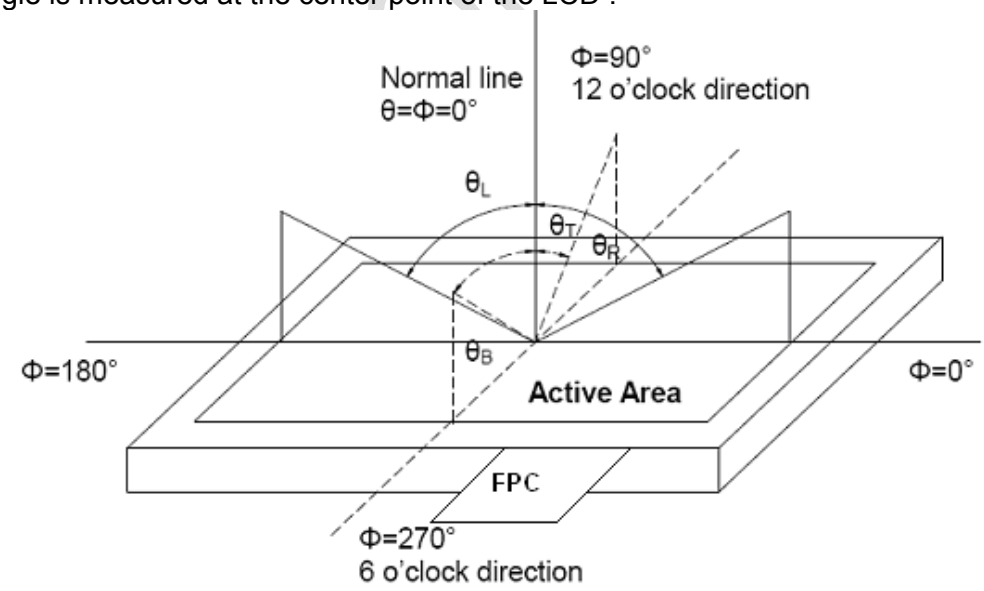
Test Conditions:

1. I_F= 30mA(one channel), 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 10 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.



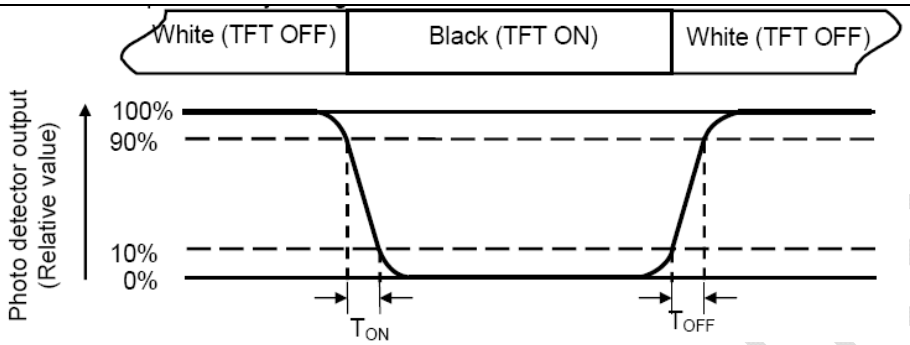
Note 2: Definition of viewing angle range and measurement system.
viewing angle is measured at the center point of the LCD .



Note 3: Definition of contrast ratio

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

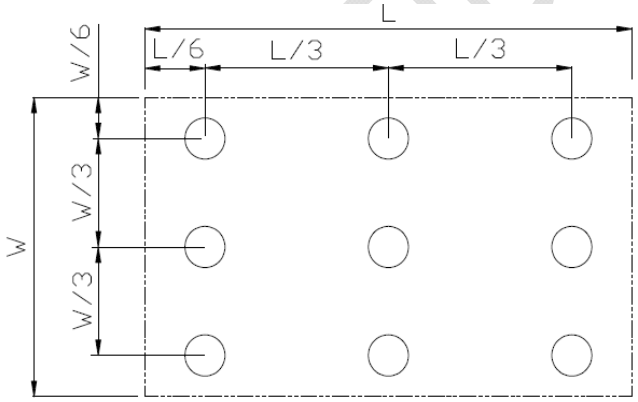
"White state ": The state is that the LCD should drive by Vwhite.
"Black state": The state is that the LCD should drive by Vblack.
Vwhite: To be determined Vblack: To be determined.
Note 4: Definition of Response time
The response time is defined as the LCD optical switching time interval between "White" state and "Black" state. Rise time (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) = Lmin/ Lmax

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



Lmax: The measured Maximum luminance of all measurement position.

Lmin: The measured Minimum luminance of all measurement position.

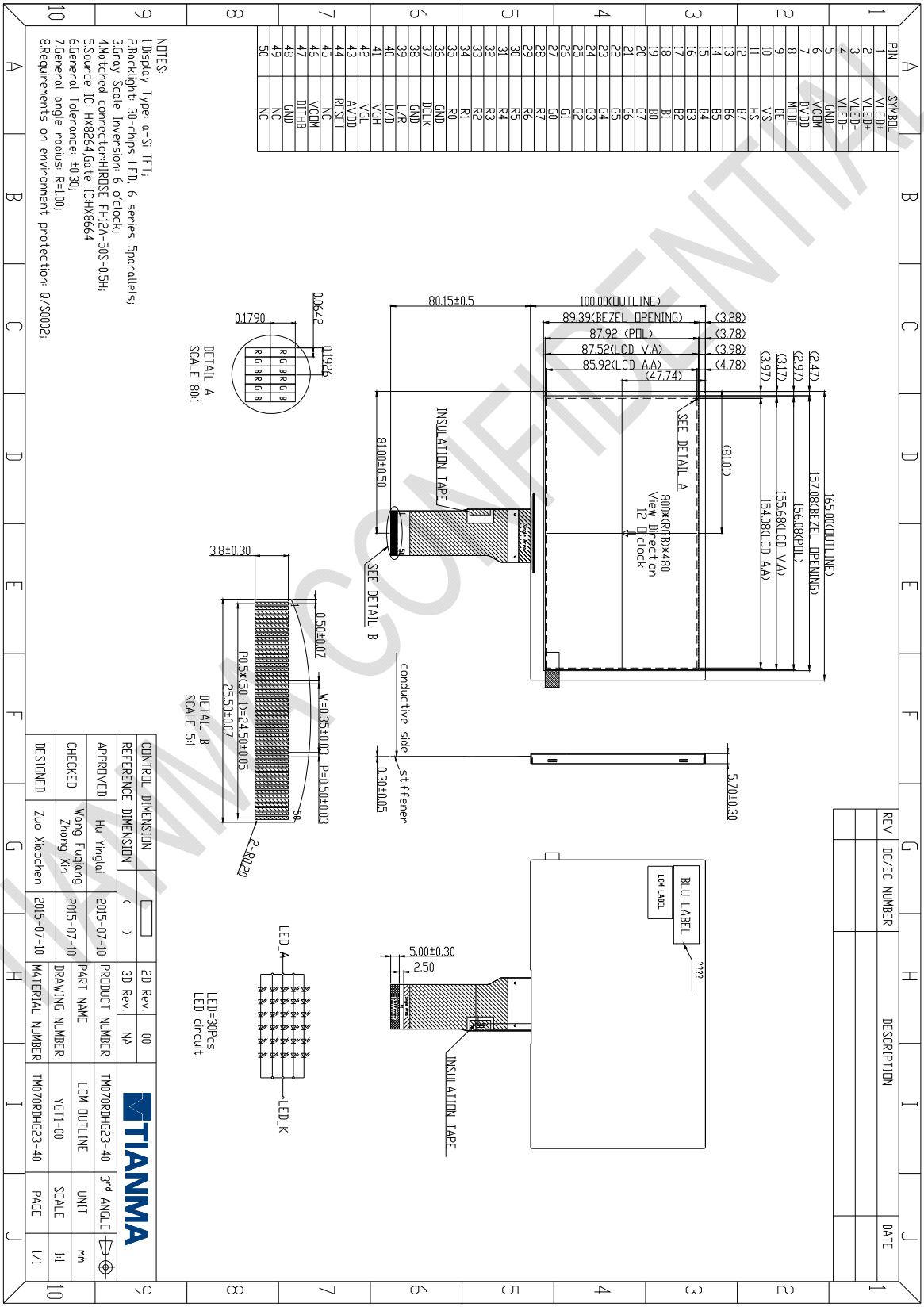
Note 7: Definition of Luminance:
Measure the luminance of white state at center point.

7.Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ta = +70℃, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	Ta = -20℃, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta = +80℃, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta = -30℃, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
5	High Temperature & Humidity Storage	Ta=+60℃、RH=90%, 240 hours	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃（30min）-80℃（30min）,Change Time:5min,100cycle	Start with cold temperature End with high temperature, IEC60068-2-14,GB2423.22
7	ESD	C=150pF、R=330Ω Air: ±8KV Contact:±4KV 5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,GB2423.22-2002
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)	IEC61000-4-2:2001 GB/T17626.2-2006
9	Shock Test	Half Sine Wave 100G ,6ms,±X,±Y,±Z 3times for each direction	IEC60068-2-6:1982 GB/T2423.10—1995
10	Drop Test(package state)	Height:60cm, 1corner,3edges,6surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

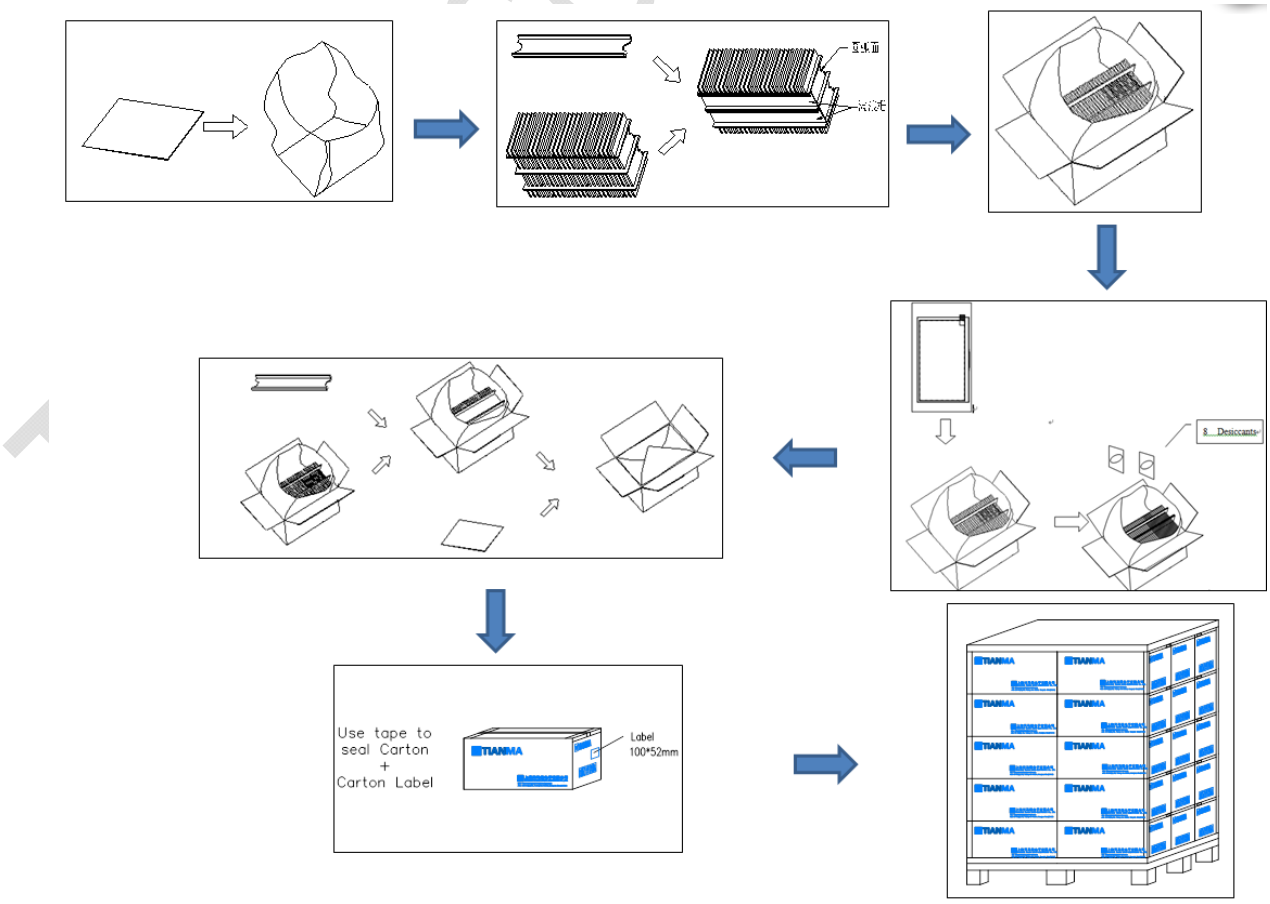
Note1: Ts is the temperature of panel's surface.
Note2: Ta is the ambient temperature of sample.
Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.
Note 4: In the standard condition, there shall be no practical problem that may 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



9.Packaging Material

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity
1	LCM module	TM070RDHG23-40	165*100.00*5.70	0.15	50
2	Partition_1	Corrugated Paper	513*333*215	2.0	1
3.	Anti-Static Bag	PE	200*185*0.05	0.01	50
4	Dust-Proof Bag	PE	700*545	0.0600	1
5	Partition_2	Corrugated Paper	505*332	0.1	2
6	Corrugated Bar	Corrugated Paper	513*148	0.06	4
7	Crepe Paper Tape		30*10	TBD	50
8	Dessicant	Dessicant	45*35	0.002	8
9	Carton	Corrugated Paper	530*350*250	1.1000	1
10	LABEL		100*52mm 2000PCS/卷	0.01	1
11	Total weight	7.5±5%			



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

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.