MODEL NO. : TM030XDHG30

ISSUED DATE: 2014-10-28

VERSION : V1.3

■Preliminary Specification
□Final Product Specification

Customer :_____

Approved by	Notes

TIANMA Confirmed :

Prepared by	Checked by	Approved by

This technical specification is subjected to change without notice

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Record of Revision

Rev	Issued Date	Description	Editor
0.1	2014-5-14	Preliminary spec released	Jin Zhao
0.2	2014-5-22	Update electrical timing	Jin Zhao
1.0	2014-6-23	Update FPC pin out, RGB timing, mechanical drawing	Jin Zhao
1.1	2014-8-18	Update chromaticity and mechanical drawing	Jin Zhao
1.2	2014-8-21	Update size from 2.96” to 3”	Jin Zhao
1.3	2014-10-28	Update weight, power consumption and mechanical drawing	Jin Zhao

1 General Specifications

Feature		Spec
Display Spec.	Size	3”
	Resolution	480(RGB)x480
	Technology Type	a-si TFT
	Pixel Configuration	RGB Vertical Stripe
	Pixel pitch(mm)	0.111x0.111
	Display Mode	SFT
	Surface Treatment	HC
Mechanical Characteristics	LCM (W x H x D) (mm)	58.01×61.38×2.45
	Active Area(mm)	53.28 x 53.28
	Connection Type	FH26-41S-0.3SHW
	LED Numbers	4
	Weight (g)	16.9
Electrical Characteristics	Interface	RGB 24bit+SPI
	Color Depth	16.7M
	Driver IC	HX8369A

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+HF

Note 3: LCM weight tolerance: ± 5%

2 Input/Output Terminals

Recommended Connector: FH26-41S-0.3SHW

Pin	Symbol	I/O	Description	Remark
1	GND	P	Ground	
2	LED+	P	LED light anode	
3	LED-	P	LED light cathode	
4	VCC	P	Power supply for the analog power	
5	IOVCC	P	Power supply for the I/O circuit	
6	GND	P	Ground	
7	PCLK	I	Dot clock signal.	
8	DE	I	data enable	
9	HS	I	Line synchronizing signal.	
10	VS	I	VS signal	
11	SDO	I	Serial data .input	
12	SDI	I	Serial data output	
13	CSX	I	Chip select	
14	SCL	I	Serial Clock	
15	D0	I	Data bus	
16	D1	I	Data bus	
17	D2	I	Data bus	
18	D3	I	Data bus	
19	D4	I	Data bus	
20	D5	I	Data bus	
21	D6	I	Data bus	
22	D7	I	Data bus	
23	D8	I	Data bus	
24	D9	I	Data bus	
25	D10	I	Data bus	
26	D11	I	Data bus	
27	D12	I	Data bus	
28	D13	I	Data bus	

29	D14	I	Data bus	
30	D15	I	Data bus	
31	D16	I	Data bus	
32	D17	I	Data bus	
33	D18	I	Data bus	
34	D19	I	Data bus	
35	D20	I	Data bus	
36	D21	I	Data bus	
37	D22	I	Data bus	
38	D23	I	Data bus	
39	LCD_RESET	P	Reset	
40	ID(NC)	O	No Connection	
41	GND	P	Ground	

Table 2.1 Input terminal pin assignment

Note: 1. I---Input, O---Output, P--- Power/Ground
2. Interface mode setting BS[3:0]=1101

3 Absolute Maximum Ratings

Ta = 25℃

Item	Symbol	MIN	MAX	Unit	Remark
Logic Supply Voltage	IOVCC	-0.3	3.6	V	
Analog Supply Voltage	VCC	-0.3	5.5	V	
Input voltage	HS/VS/CLK/DE/DB[0:23]	-0.3	IOVCC+0.5	V	
Back Light Forward Current	I_F	-	25	mA	ONE LED
Operating Temperature	T_{op}	-20	70	℃	
Storage Temperature	T_{st}	-30	80	℃	

Table 3.1 Absolute maximum rating

4 Electrical Characteristics

4.1 LCD Module

GND=0V,Ta=25℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
Logic Supply Voltage		IOVCC	1.75	1.8/2.8	3.1	V	
Analog Supply Voltage		VCC	2.3	2.8	3.1	V	
Input Signal Voltage	High Level	VIH	0.7xIOVCC	-	IOVCC	V	
	Low Level	VIL	-	-	0.3xIOVCC	V	
Output Signal Voltage	High Level	VOH	0.8xIOVCC	-	-	V	
	Low Level	VOL	-	-	0.2xIOVCC	V	
(Panel+LSI) Power Consumption		White Mode	-	94	145	m W	VCC=2.8V IOVCC=1.8V
		Sleeping Mode	-	10	15	m W	

Table 4.1 LCD module electrical characteristics

4.2 Backlight Unit

Ta=25℃

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	-	20	-	mA	One LED
Forward Voltage	V_F	(2.9)	3.2	(3.4)	V	One LED
Backlight Power Consumption	W_{BL}	-	256	-	mW	4 LEDs

Table 4.2.1 backlight unit electrical characteristics

Figure 4.2 LED backlight circuit

Note: The LED lifetime 20000Hrs is defined as the module brightness decay 50% of original brightness at Ta=25 degree.
Environmental conditions such as sustained high operating temperatures, high humidity, operating conditions and other factors will effect on LED Lifetime.

5 Timing Chart

5.1 RGB interface characteristics

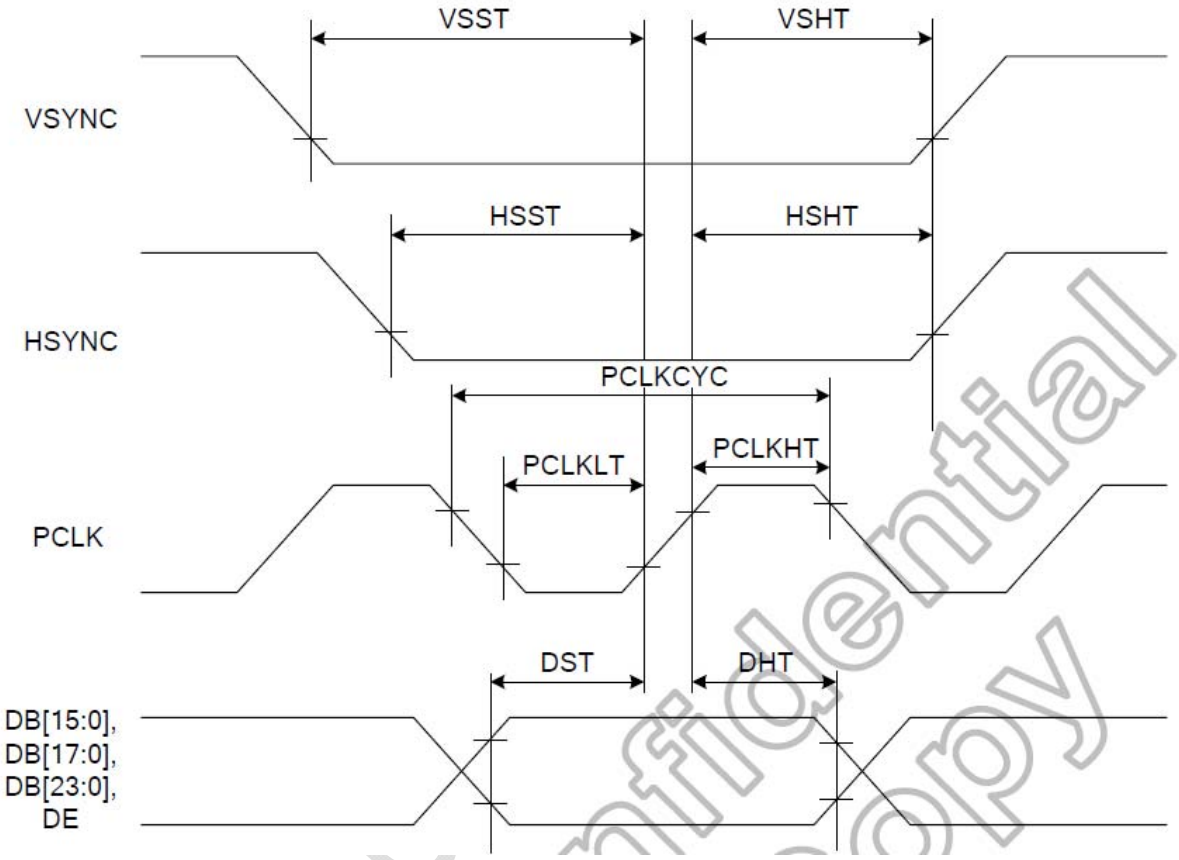


Figure 5.1: RGB interface characteristics

(VSSA=0V, VDD1=1.8V, VDD2=2.8V, VDD3=2.8V, T_A=25℃)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical sync. setup time	VSST	-	5	-	-	ns
Vertical sync. hold time	VSHT	-	5	-	-	ns
Horizontal sync. setup time	HSST	-	5	-	-	ns
Horizontal sync. hold time	HSHT	-	5	-	-	ns
Pixel clock cycle when RGB I/F is running	PCLKCYC (480x854)	VRR(3) = Min . 50 Hz Max. 70 Hz	21.6	-	34.3	MHz
			29.1	-	46.2	ns
	PCLKCYC (480x800)	VRR(3) = Min . 50 Hz Max. 70 Hz	20.3	-	32.2	MHz
			31	-	49.2	ns
	PCLKCYC (360x640)	VRR(3) = Min . 50 Hz Max. 70 Hz	12.4	-	20.3	MHz
			49.2		80.6	ns
Pixel clock low time	PCLKLT	-	5	-	-	ns
Pixel clock high time	PCLKHT	-	5	-	-	ns
Data setup time DB[23:0]	DST	-	5	-	-	ns
Data hold time DB[23:0]	DHT	-	5	-	-	ns

Note: (1) Signal rise and fall times are equal to or less than 20 ns.
(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.
(3) VRR : Vertical Refresh Rate, equal to VSYNC frequency.

Table 5.1: RGB interface characteristics

5.2 Vertical Timings for RGB I/F

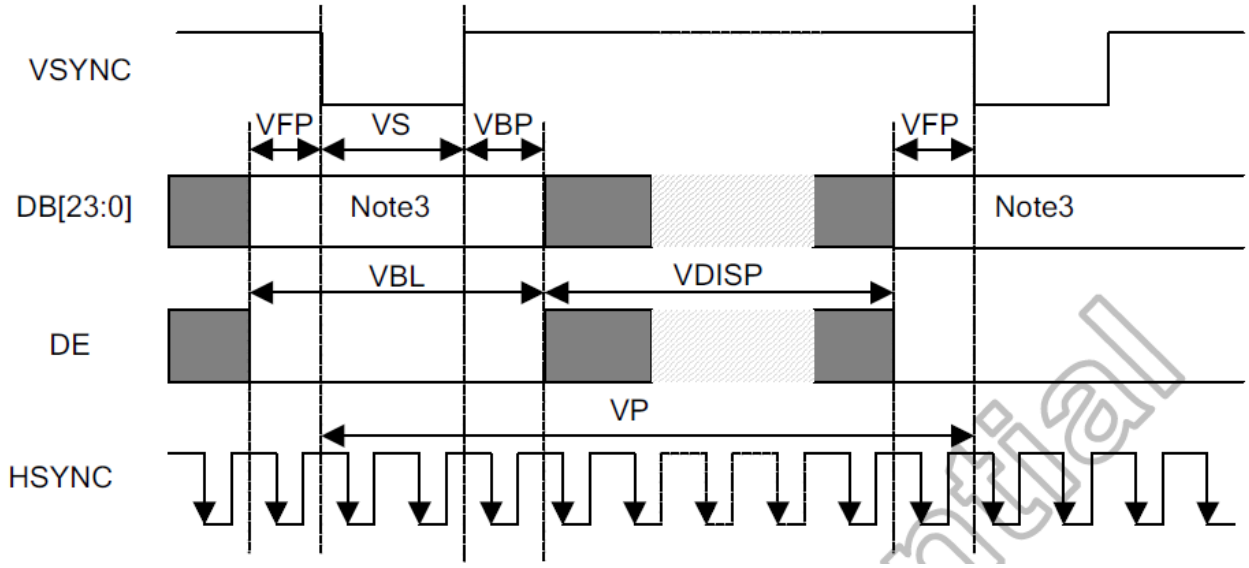


Figure 5.2: Vertical Timings for RGB I/F

(VSSA=0V, VDD1=1.8V, VDD2=2.8V, VDD3=2.8V, T_A=25℃)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Vertical cycle	VP	Resolution=480x854	860			Line
		Resolution=480x800	806	-	-	Line
		Resolution=360x640	646			Line
Vertical low pulse width	VS	-	2	-	Note(4)	Line
Vertical front porch	VFP	-	2	-	-	Line
Vertical back porch	VBP	-	2	-	Note(4)	Line
Vertical data start point	-	VS+VBP	4	-	Note(4)	Line
Vertical blanking period	VBL	VS+VBP+VFP	6	-	-	Line
Vertical active area	-	VDISP(480x854)	-	854	-	Line
		VDISP(480x800)	-	800		
		VDISP(360x640)	-	640		
Vertical Refresh rate	VRR	-	50	-	70	Hz

Note: (1) Signal rise and fall times are equal to or less than 20 ns.
(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for highstate.
(3) Data lines can be set to "High" or "Low" during blanking time – Don't care.
(4) The VS and VBP pulse width are related to ASG/GIP STV and CKV timing. The STV and CKV must be set at corresponding position for LCD normal display. Also refer to setion 6.2.66 SETGIP.

Table 5.2: Vertical Timings for RGB I/F

5.3 Horizontal Timings for RGB I/F

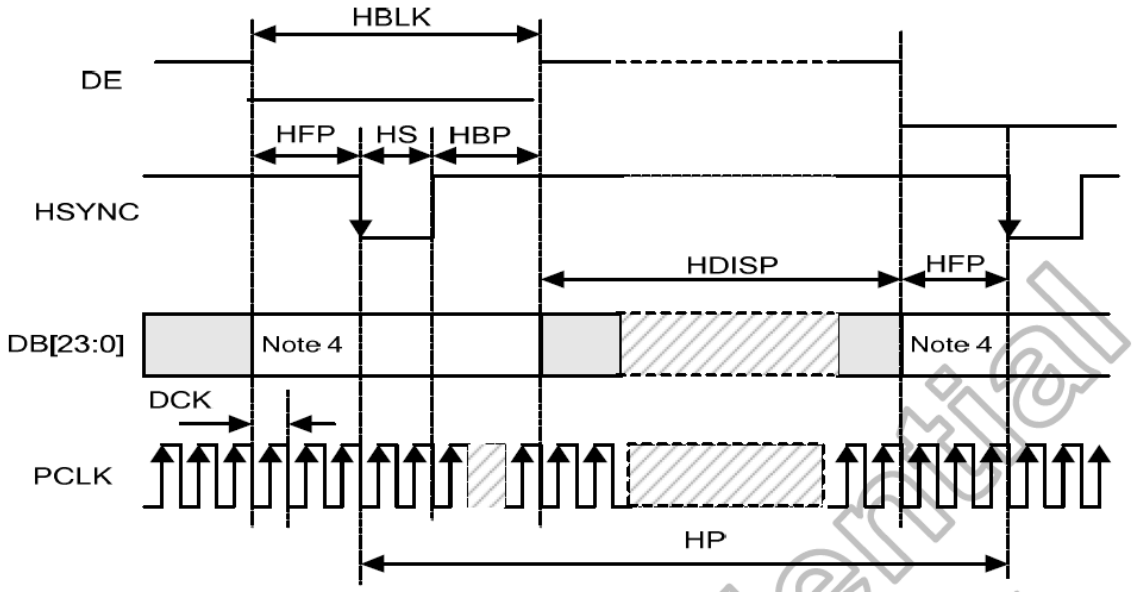


Figure 5.3 Horizontal Timings for RGBI/F

(VSSA=0V, VDD1=1.8V, VDD2=2.8V, VDD3=2.8V, T_A=25℃)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
HS cycle	HP	Resolution=480x854	504	-	568	DCK
		Resolution=480x800	504	-	568	DCK
		Resolution=360x640	384	-	448	DCK
HS low pulse width	HS	-	5	-	78	DCK
Horizontal back porch	HBP	-	5	-	78	DCK
Horizontal front porch	HFP	-	5	-	78	DCK
Horizontal data start point	-	HS+HBP	19	-	83	DCK
			700	-	-	ns
Horizontal blanking period	HBLK	HS+HBP+HFP	24	-	88	DCK
Horizontal active area	HDISP	Resolution=480x854	-	480	-	DCK
		Resolution=480x800	-	480	-	DCK
		Resolution=360x640	-	360	-	DCK
Pixel clock frequency When RGB I/F is running	DCK (480x854)	VRR = Min. 50 Hz – Max. 70 Hz	21.6	-	34.3	MHz
			29.1	-	46.2	ns
	DCK (480x800)	VRR = Min. 50 Hz – Max. 70 Hz	20.3	-	32.2	MHz
			31	-	49.2	ns
	DCK (360x640)	VRR = Min. 50 Hz – Max. 70 Hz	12.4	-	20.3	MHz
			49.2		80.6	ns

Note:(1) Signal rise and fall times are equal to or less than 20 ns.
(2) Input signals are measured by 0.30 x VDD1 for low state and 0.70 x VDD1 for high state.
(3) HP is multiples of eight DCK.
(4)Data lines can be set to "High" or "Low" during blanking time – Don't care.

Table 5.3 Horizontal Timings for RGB I/F

5.4 Serial data write and read

5.4.1 Serial data write mode

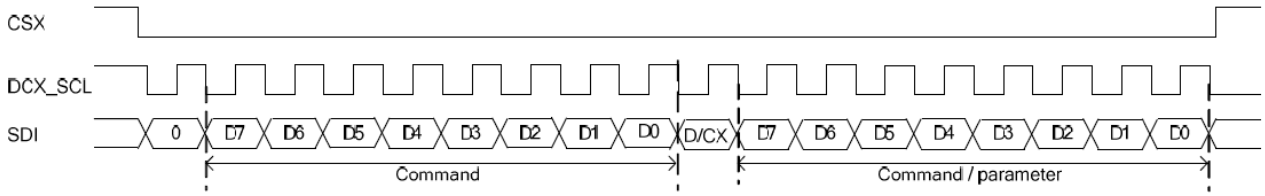


Figure 5.4.1: Serial data write mode

5.4.2 Serial data read mode

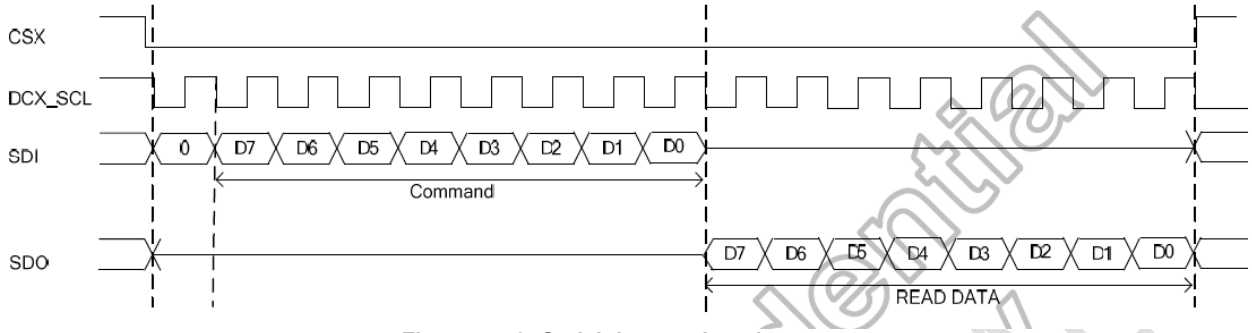


Figure 5.4.2: Serial data read mode

5.5 Reset Input Timing

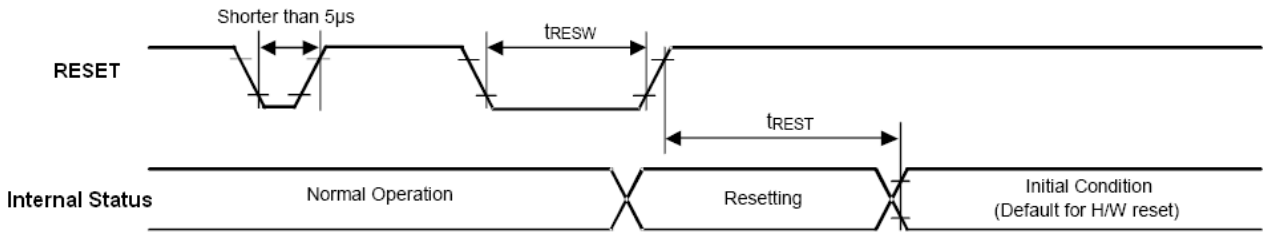


Figure 5.4: Reset input timing

GND=0V, Ta = 25℃

Symbol	Parameter	Related pins	Min.	Typ.	Max.	Note	Unit
t_{RESW}	Reset low pulse width	Reset	10	-	-	-	us
t_{REST}	Reset complete time	-	5	-	-	When reset is applied during Sleep In mode	ms
		-	120	-	-	When reset is applied during Sleep Out mode	ms

Table 5.4 Reset input timing

Note: (1) Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 5 µ	Reset Rejected
Longer than 10 µs	Reset
Between 5 µs and 10 µs	Reset Start

(2) Spike Rejection also applies during a valid reset pulse as shown below:
(3) It is necessary to wait 5msec after releasing NRESET before sending commands. Also Sleep Out command cannot be sent for 120msec.

5.6 Power ON/OFF Timing

5.6.1 Power On Sequence

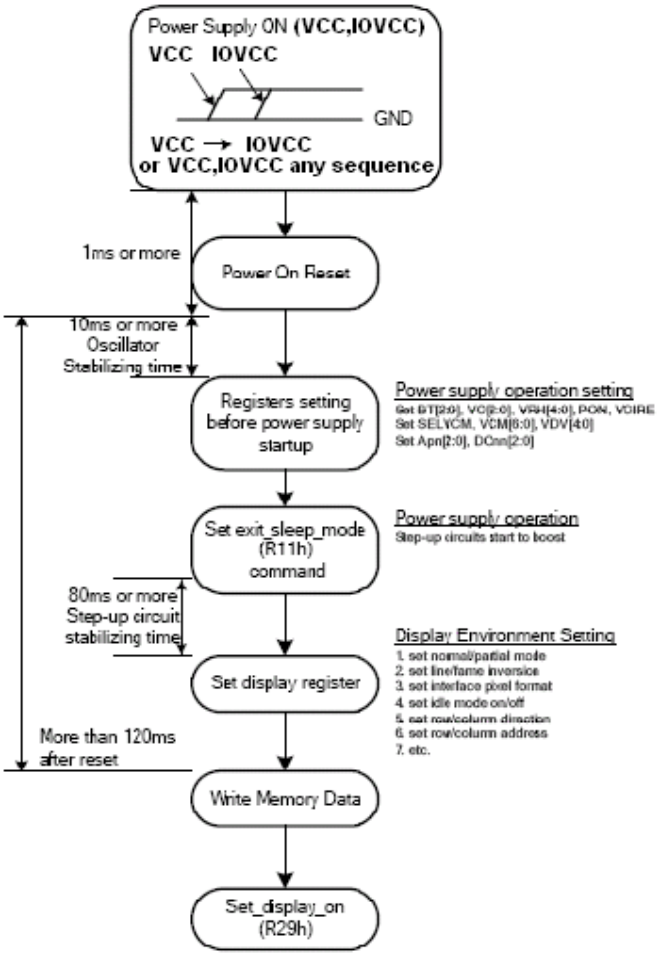


Figure 5.5: Power on sequence

5.6.2 Power Off Sequence

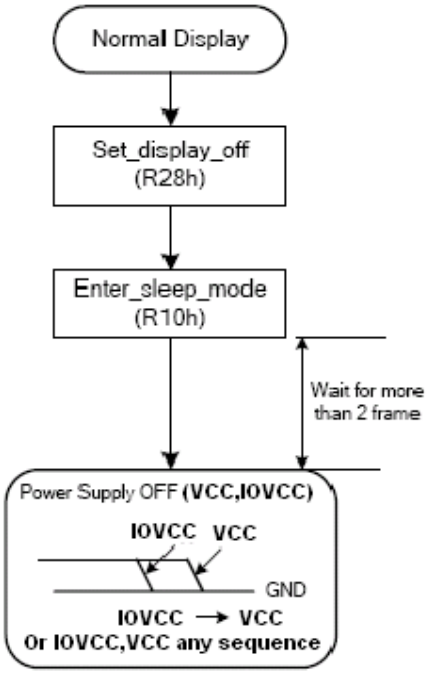


Figure 5.6: Power off sequence

5.7 OTP IC ID

OTO IC ID at register C3h.

C3H	SETID (Set ID)												
	DNC	NRD	NWR	D15-D8	D7	D6	D5	D4	D3	D2	D1	D0	HEX
Command	0	1	↑	-	1	1	0	0	0	0	1	1	C3
1st parameter	1	1	↑	-	ID1[7:0]								-
2nd parameter	1	1	↑	-	0	ID2[6:0]							-
3rd parameter	1	1	↑	-	ID3[7:0]								-
Description	This command is used to set ID (RDAh, RDBh, RDCh) value.												

6 Optical Characteristics

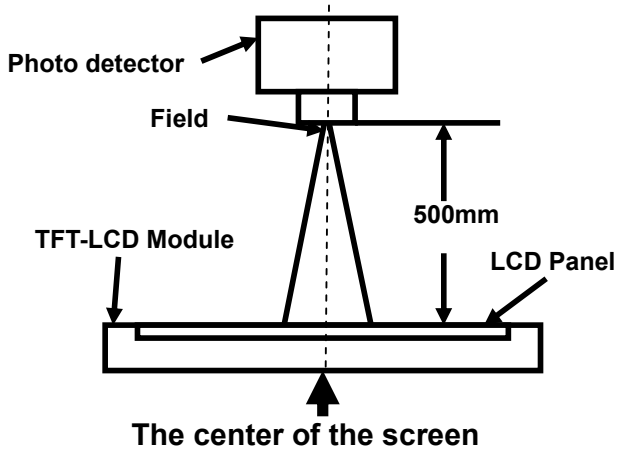
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≥10	70	80		Degree	Note2,3
		θB		70	80			
		θL		70	80			
		θR		70	80			
Contrast Ratio		CR	θ=0°	600	800			Note 3
Response Time		T_{ON}	25℃		25	35	ms	Note 4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	0.270	0.310	0.350		Note 1,5
		y		0.290	0.330	0.370		
	Red	x		0.550	0.590	0.630		Note 1,5
		y		0.276	0.316	0.356		
	Green	x		0.266	0.306	0.346		Note 1,5
		y		0.539	0.571	0.639		
	Blue	x		0.114	0.154	0.194		Note 1,5
		y		0.081	0.121	0.161		
Uniformity		U		75%	80%		%	Note 6
NTSC					50%		%	Note 5
Luminance		L		400	450		cd/m^2	Note 7

Test Conditions:

1. I_F= 20 mA, and the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

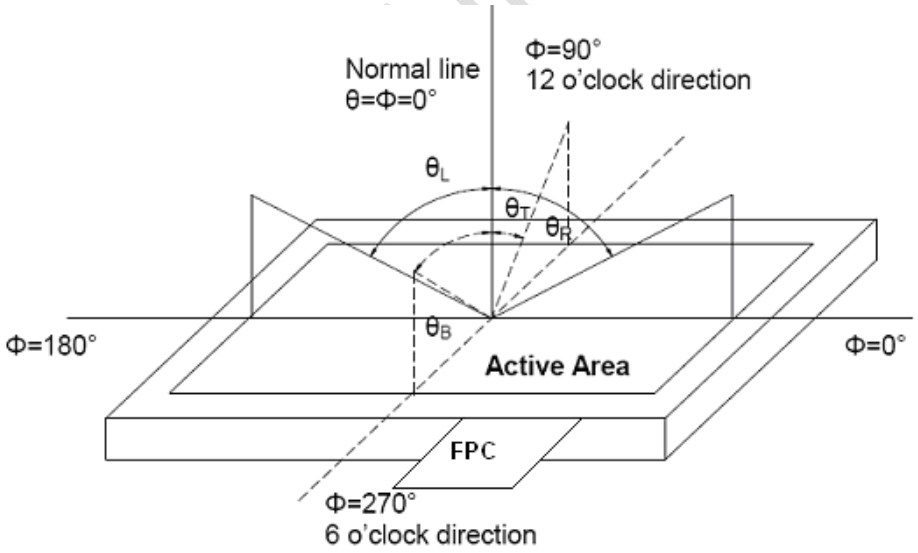
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



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)。



Note 3: Definition of contrast ratio

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

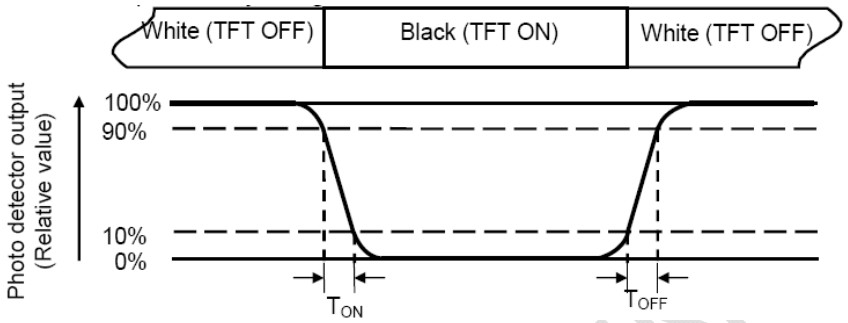
"White state ": The state is that the LCD should drive by Vwhite.

"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)

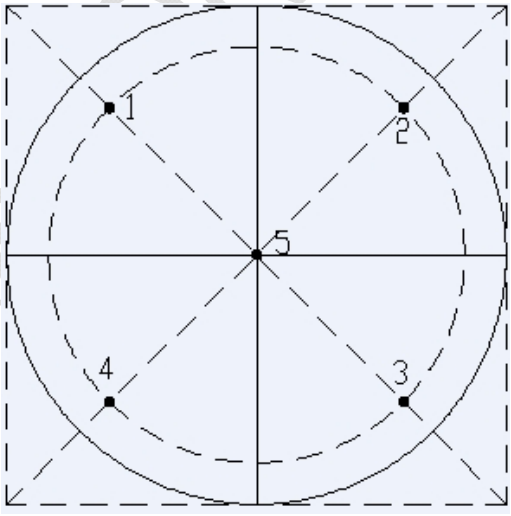
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 5 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 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,GB2423.22-2002
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	Package Drop Test	Height:60 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

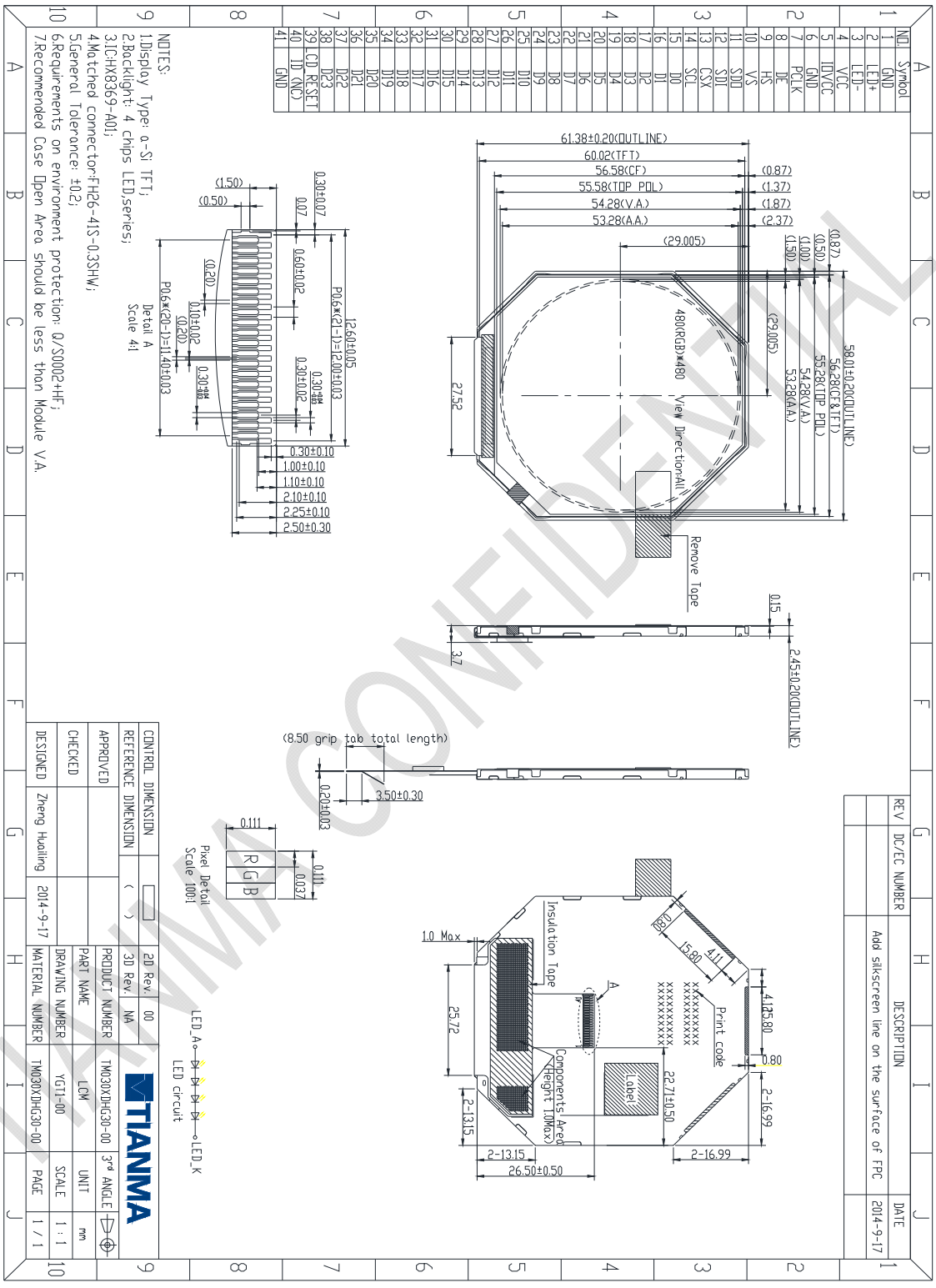
Note1: Ts is the temperature of panel's surface.

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.

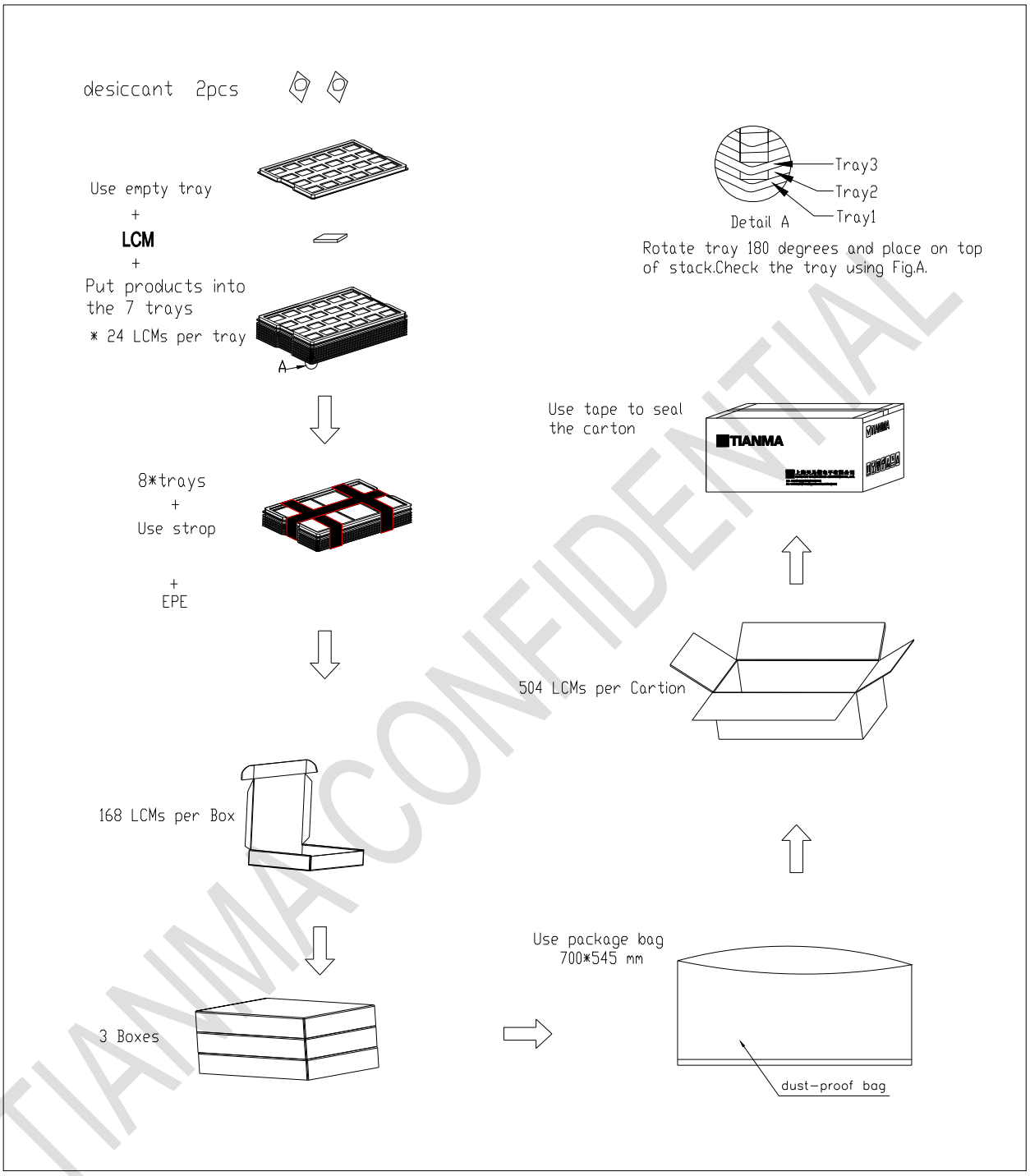
Note 4: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

8 Mechanical Drawing



9 Packing Drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCD	TM030XDHG30-00	58.01×61.38×2.45	0.0169	504	
2	Carton	Corrugated paper	544×365×250	0.76	1	
3	Dust-Proof Bag	PE	700×545	0.046	1	
6	Tray	PET	485.0×330.0×13.8	0.162	24	
7	DESICCANT		45×35mm	0.002	6	
8	BOX	Corrugated paper	520×345×74	0.3879	3	
9	Total weight	14.4Kg±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.