MODEL NO. : TM040WDHT1-00

ISSUED DATE: 2014-01-13

VERSION : Ver 2.0

□Preliminary Specification

■Final Product Specification

Customer :_____

Approved by	Notes

TIANMA Confirmed :

Prepared by	Checked by	Approved by
Longping.Deng		Jinquan.Liu

This technical specification is subjected to change without notice

Table of Contents

Record of Revision

Rev	Issued Date	Description	Editor
1.0	2011-12-02	Provisional Draft Release for reference	Longping.deng
2.0	2014-1-13	Final Product Specification,change Mchange echanical Drawing	Longping.deng

1 General Specifications

Feature		Spec
Display Spec.	Size	4.0 inch
	Resolution	360(RGB) * 600
	Technology Type	a-Si TFT
	Pixel Configuration	R.G.B. Stripe
	Pixel pitch(mm)	0.144*0.048
	Display Mode	ECB Transflective,NW
	Surface Treatment	HC
	Viewing Direction	6 o'clock
	Gray Scale Inversion Direction	12 o'clock
Mechanical Characteristics	LCM (W x H x D) (mm)	60.04*102.8*2.8
	Active Area(mm)	51.84*86.4
	With /Without TSP	Without TSP
	Matching Connection Type	PF030-O**B-C10-H
	LED Numbers	8 LEDs
	Weight (g)	33.2
Electrical Characteristics	Interface	RGB 24 bits
	Color Depth	16.7M
	Driver IC	HX8376-A

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: +/- 5%

2 Input/Output Terminals

2.1 CN1 of FPC

Connector:PF030-O**B-C10-H

No	Symbol	I/O	Description	Comment
1	LED-A	P	LED backlight anode	
2	LED-K1	P	LED backlight cathode	
3	LED-K2	P	LED backlignt cathode	
4	GND	P	ground	
5	DB0	I	data signal	
6	DB1	I	data signal	
7	DB2	I	data signal	
8	DB3	I	data signal	
9	DB4	I	data signal	
10	DB5	I	data signal	
11	DB6	I	data signal	
12	DB7	I	data signal	
13	DB8	I	data signal	
14	DB9	I	data signal	
15	DB10	I	data signal	
16	DB11	I	data signal	
17	DB12	I	data signal	
18	DB13	I	data signal	
19	DB14	I	data signal	
20	DB15	I	data signal	
21	DB16	I	data signal	
22	DB17	I	data signal	
23	DB18	I	data signal	
24	DB19	I	data signal	
25	DB20	I	data signal	
26	DB21	I	data signal	
27	DB22	I	data signal	
28	DB23	I	data signal	
29	GND	P	ground	
30	CSX	I	Chip select signal	
31	WRX_SCL	I	a write signal or Serial Clock	
32	RDX	I	read signal	
33	DCX	I	Data / Command Selection pin	
34	SDA	I	Serial data	
35	DE	I	data enable signal	

36	HSYNC	P	Line synchronizing signal	
37	VSYNC	I	VS signal	
38	PCLK	I	Dot clock signal	
39	TE	O	Tearing Effect pin	
40	RESX	I	Reset pin	
41	BC	O	PWM output pin of Backlight control	
42	BC_CTL	O	Enable signal of Backlight LED driver	
43	VDDC	P	A power supply for the I/O circuit and logic power	
44	VDD3	P	A power supply for the analog power	
45	GND	P	ground	
46	BS0	I	Select the MPU interface mode	
47	BS1	I	Select the MPU interface mode	
48	BS2	I	Select the MPU interface mode	
49	BS3	I	Select the MPU interface mode	
50	GND	P	ground	
51	GND	P	ground	
52	NC	-	NC	
53	NC	-	NC	
54	RIGHT	I	TP right pin	
55	BOTTOM	I	TP bottom pin	
56	LEFT	I	TP left pin	
57	TOP	I	TP top pin	

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

Table 2.1 terminal pin assignments

Notes:

3 Absolute Maximum Ratings

Ta = 25℃

Item	Symbol	MIN	MAX	Unit	Remark
I/0 circuit power	VDDC	-0.3	3.6	V	
Analog power	VCC	-0.3	5.5	V	
Input voltage	DB[0~23],VSYNC,HSYNC,DE,PCLK	-0.3	3.6	V	
Back Light Forward Current	I_{LED}		25	mA	For each LED
Operating Temperature	T_{OPR}	-20	70	℃	
Storage Temperature	T_{STG}	-30	80	℃	

Table 3.1 absolute maximum rating

4 Electrical Characteristics

4.1 Recommended Operating Condition

VCC=3.3V，GND=0V，Ta = 25℃

Item		Symbol	MIN	TYP	MAX	Unit	Remark
I/0 circuit power		VDDC	2.4	2.8	3.3	V	
Analog power		VCC	1.65	2.8	3.3		
Input Signal Voltage	Low Level	V_{IL}	-0.3	-	0.3* VDDC	V	
	High Level	V_{IH}	0.7* VDDC	-	VDDC	V	
Output Signal Voltage	Low Level	V_{OL}	-	-	0.2* VDD	V	
	High Level	V_{OH}	0.8*VDDC	-	-	V	
(Panel+LSI) Power Consumption		Black Mode (60Hz)		TBD		mW	
		Standby Mode		TBD		mW	

Table 4.1 LCD module electrical characteristics

Note 1: the value is for design stage only.

4.2 Backlight Unit Driving Condition

Ta=25℃

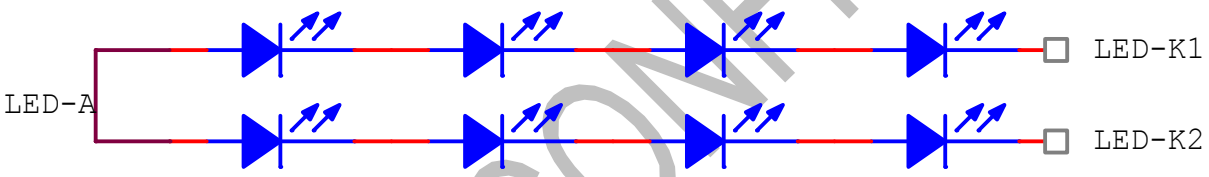
Item	Symbol	MIN	TYP	MAX	Unit	Remark
Forward Current	I_F	—	20	25	mA	For each LED
Forward Current Voltage	V_F	—	3.2	—	V	For each LED
Backlight Power Consumption	W_{BL}	—	TBD	—	mW	For total LEDs

Note1: The LED driving condition is defined for each LED module (2 LED Serial).

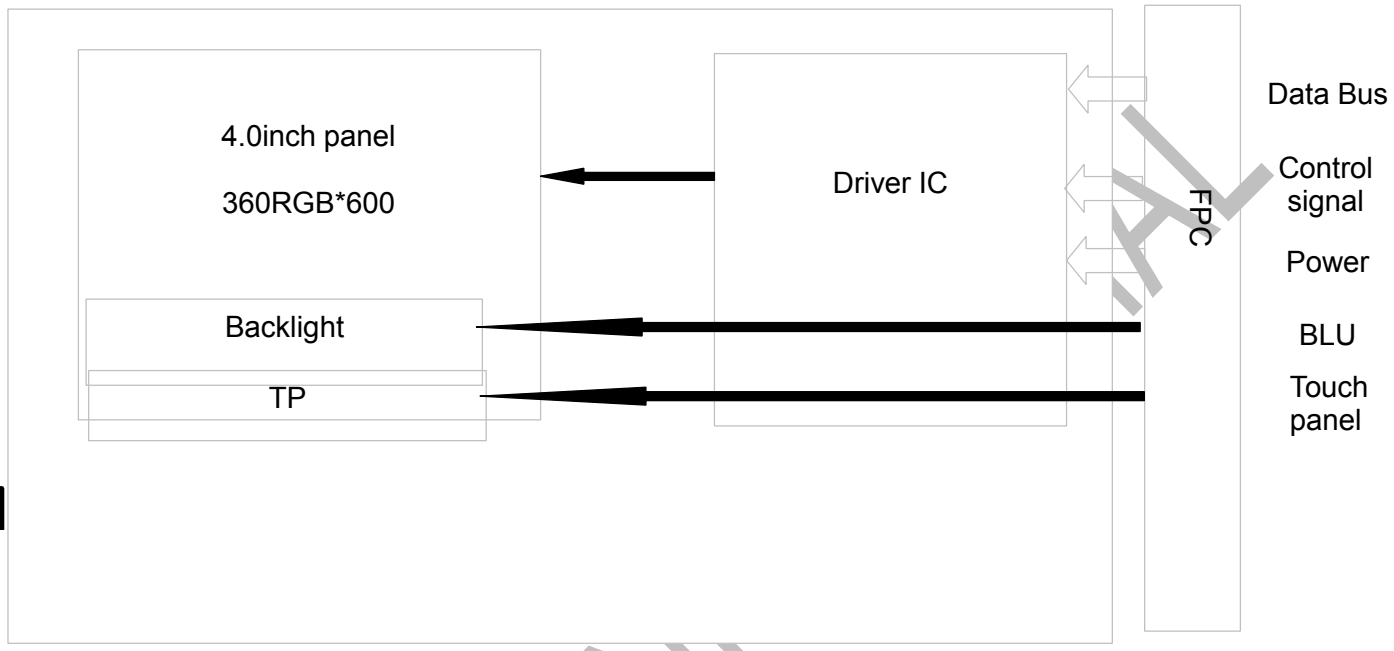
Note2: Under LCM operating, the stable forward current should be inputted. And forward voltage is for reference only.

Note3: Optical performance should be evaluated at Ta=25℃ only 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.

Note4: The LED driving condition is defined for each LED module.



4.3 BLOCK DIAGRAM



1

5 Timing Chart

5.1 DPI interface characteristics-1

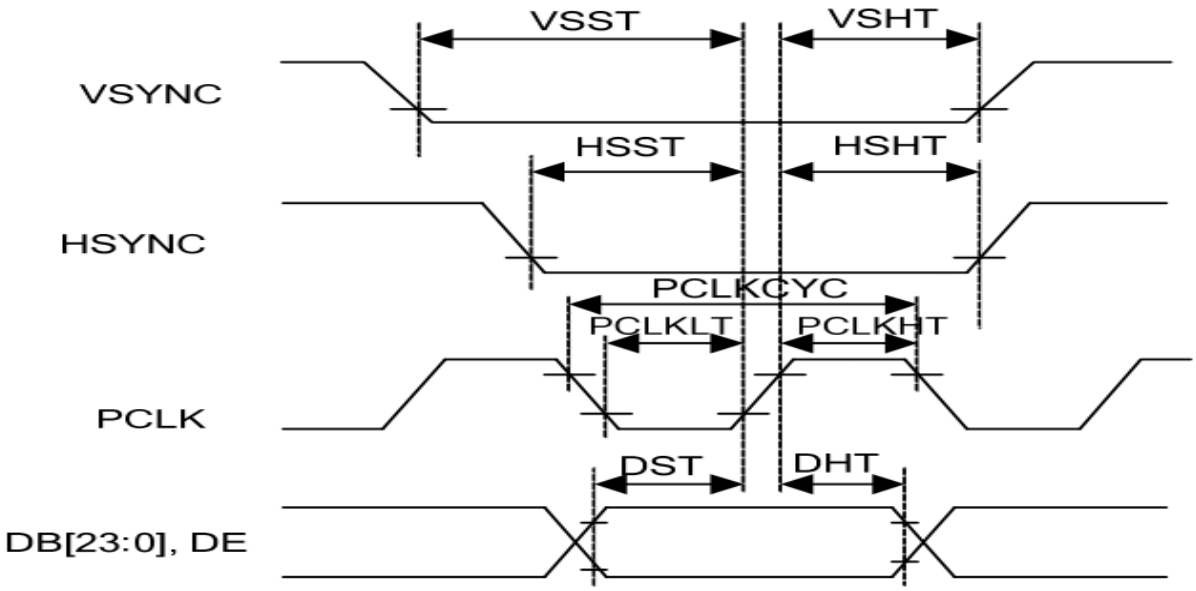


Figure 5.1.1 General timings for RGB I/F-1

5.2 General timings parameter setting for RGB I/F-1

(T_A=25°C, VDD1=1.65~1.95V, VDD3=2.3~3.3V, VSSA=0V)

Item	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Vertical sync. Setup Time	VSST	-	10	-	-	ns
Vertical sync. Hold Time	VSHT	-	10	-	-	ns
Horizontal sync. Setup Time	HSST	-	10	-	-	ns
Horizontal sync. Hold Time	HSHT	-	10	-	-	ns
Pixel Clock Cycle	PCLKCYC	24-/ 18-/ 16-bit	47	-	-	ns
Pixel Clock Setup Time	PLCKLT	-	10	-	-	ns
Pixel Clock High Time	PCLKHT	-	10	-	-	ns
Data Setup Time DB[17:0], Enable	DST	-	10	-	-	ns
Data Hold Time DB[17:0], Enable	DHT	-	10	-	-	ns

Note: (1) Signal rise and fall times are equal or less than 20ns.
(2) Measure of input signals are using 0.3xVDD1 for low state and 0.7xVDD1 for high state.

Figure 5.1.2 General timings parameter setting for RGB I/F-1

5.2.1 DPI interface characteristics-2

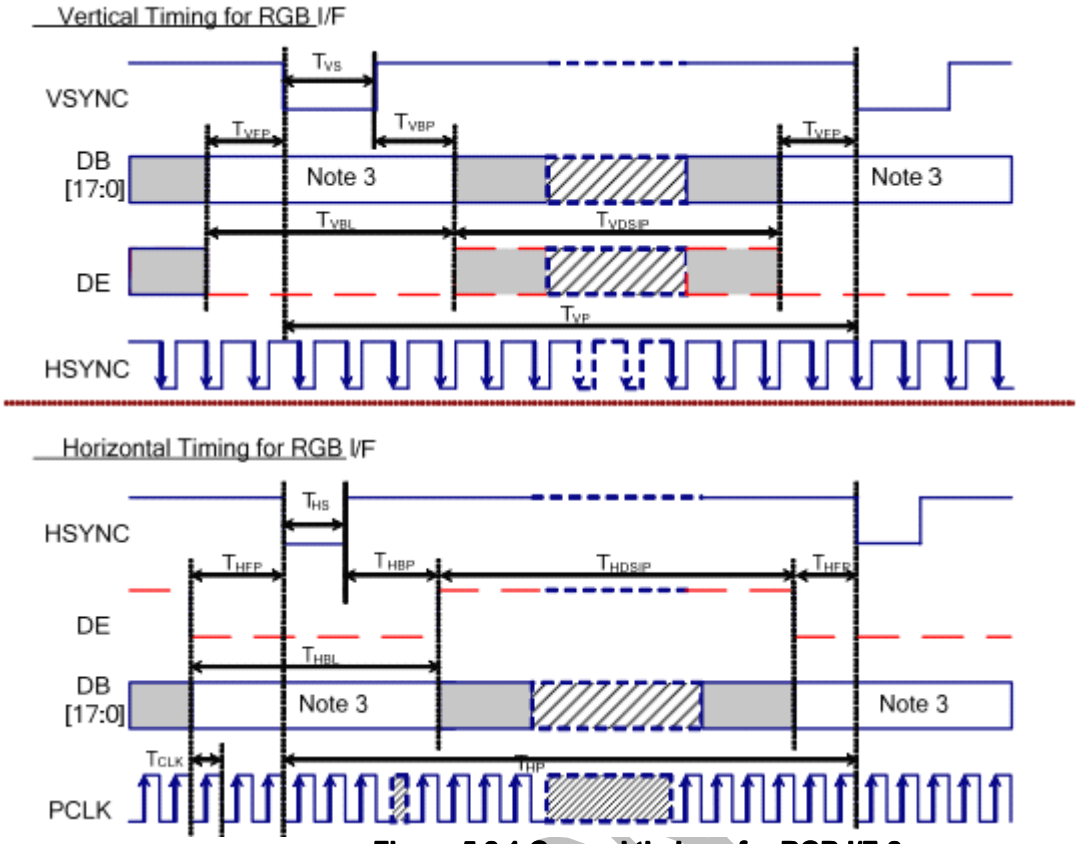


Figure 5.2.1 General timings for RGB I/F-2

5.2.2 General timings parameter setting for RGB I/F-2

Item	Symbol	Condition	Specification			Unit
			Min	Typ.	Max	
Vertical Timing						
Vertical cycle period	T_{VP}	-	646	-	-	HS
Vertical low pulse width	T_{VS}	-	2	-	-	HS
Vertical front porch	T_{VFP}	-	2	-	-	HS
Vertical back porch	T_{VBP}	-	2	-	-	HS
Vertical blanking period	T_{VBL}	$T_{VBP} + T_{VFP}$	6	-	-	HS
Vertical active area	T_{VDISP}	-	-	640	-	HS
			-		-	HS
					-	HS
Vertical refresh rate	T_{VRR}	Frame rate	50	60	70	Hz
Horizontal Timing						
Horizontal cycle period	T_{HP}	-	375	-	-	DOTCLK
Horizontal low pulse width	T_{HS}	-	5	-	-	DOTCLK
Horizontal front porch	T_{HFP}	-	5	-	-	DOTCLK
Horizontal back porch	T_{HBP}	-	5	-	-	DOTCLK
Horizontal blanking period	T_{HBL}	$T_{HBP} + T_{HFP}$	15	-	-	DOTCLK
Horizontal active area	T_{HDISP}	-	-	-	-	DOTCLK
Pixel clock cycle TVRR=60Hz	f_{CLKCYC}	-	14.1	-	-	MHz

Note: (1) VDD1=1.65 to 3.3V, VDD3=2.3 to 3.3V, VSSA=VSSD=0V, Ta=-30 to 70℃ (to +85℃ no damage)
(2) Data lines can be set to "High" or "Low" during blanking time – Don't care.
(3) HP is multiples of PCLK.

Figure 5.2.2 General timings parameter setting for RGB I/F-2

5.3 POWER ON SEQUENCE

5.3.1 RESX line is held high or unstable by host at power on

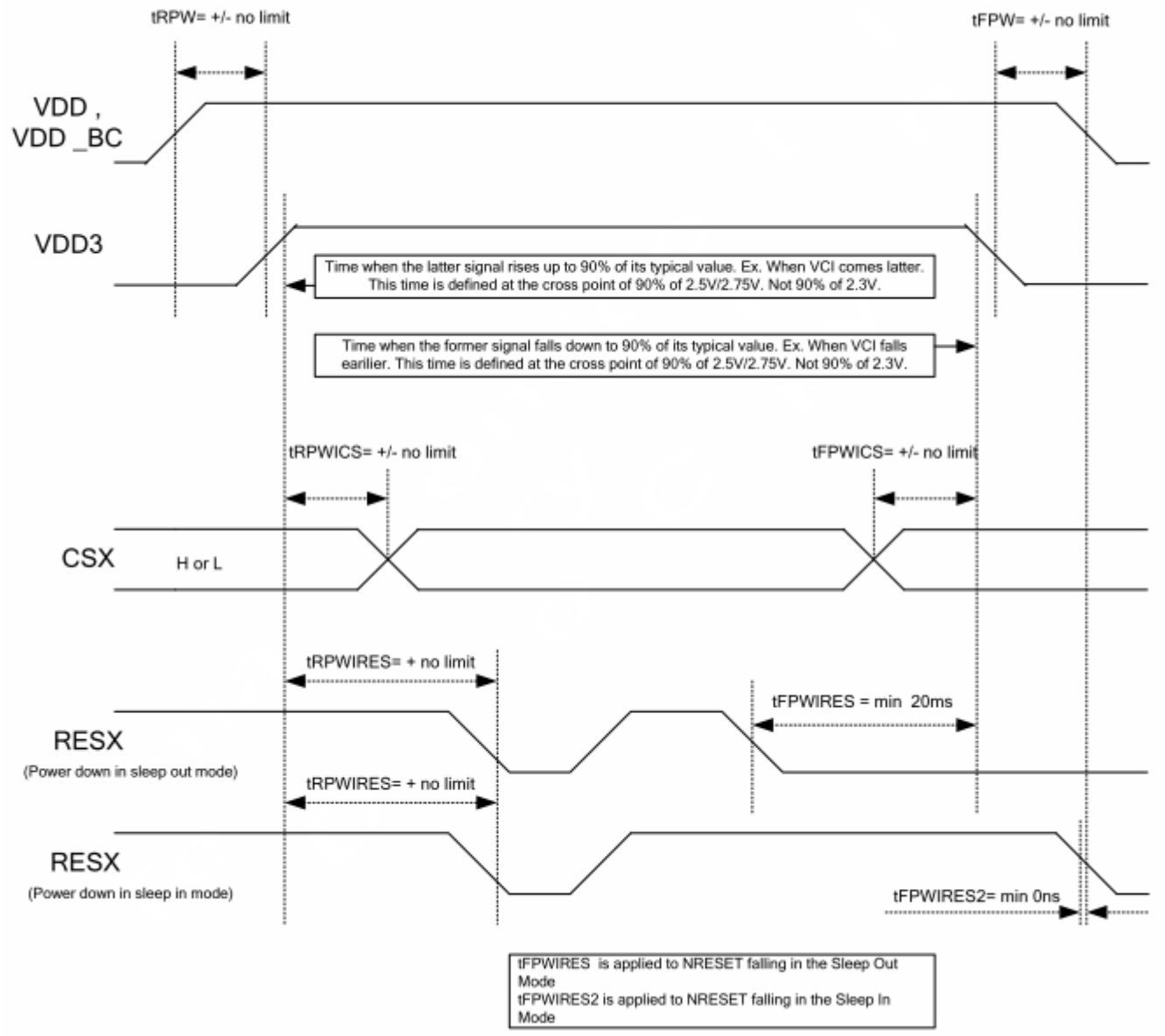


Figure 5.3.1 RESX line is held high or unstable by host at power on

5.3.2 RESX line is held low by host at power on

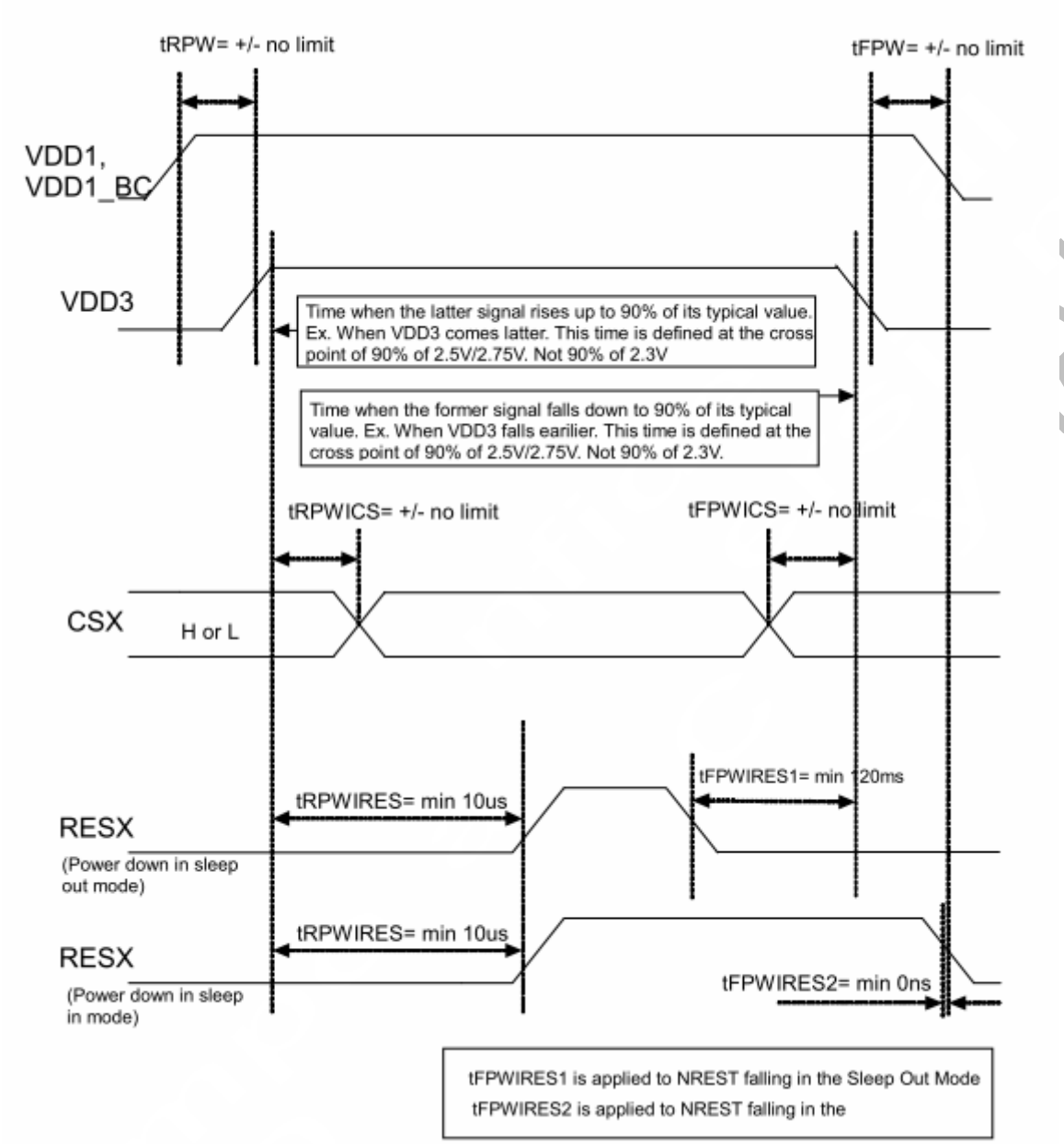


Figure 5.3..2 RESX line is held low by host at power on

6 Optical Characteristics

Ta=25℃

Transmissive mode

Item			Min	TYP	MAX
Transmittance (%)			1.6	1.8	---
Gamma Curve			---	2.2	---
Luminance (cd/m2)			160	200	---
Contrast ratio			80	100	---
Viewing angle CR≧10		Top	45	55	---
		Bottom	30	40	---
		Left	30	40	---
		Right	35	45	---
Response time Tr +Tf (ms) (25℃)			35	40	50
Chromaticity	White	Wx	0.25	0.3	0.35
		Wy	0.28	0.33	0.38
	Red	Rx	0.52	0.57	0.62
		Ry	0.28	0.33	0.38
	Green	Gx	0.28	0.33	0.38
		Gy	0.44	0.49	0.54
	Blue	Bx	0.11	0.16	0.21
		By	0.11	0.16	0.21
NTSC (%)			---	35	---

Reflective mode

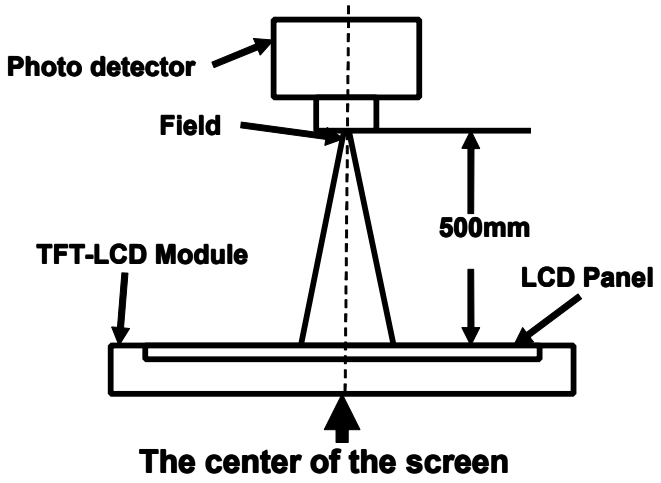
Item			Min	Typ	MAX
Reflectance			5.4%	6%	---
Contrast ratio			5	8	---
Viewing angle CR≧10		Top	50	60	---
		Bottom	50	60	---
		Left	45	55	---
		Right	50	60	---
Chromaticity	White	Wx	0.27	0.32	0.37
		Wy	0.29	0.34	0.39
	Red	Rx	0.34	0.39	0.44
		Ry	0.28	0.33	0.38
	Green	Gx	0.28	0.33	0.38
		Gy	0.34	0.39	0.44
	Blue	Bx	0.17	0.22	0.27
		By	0.18	0.23	0.28
NTSC			---	5	---

Test Conditions:

1. I_F= 20 mA, V_F=6.4 V and the ambient temperature is 25±2℃.humidity is 65±7%
2. The test systems refer to Note 1 and Note 2.

Note 1: Definition of optical measurement system.

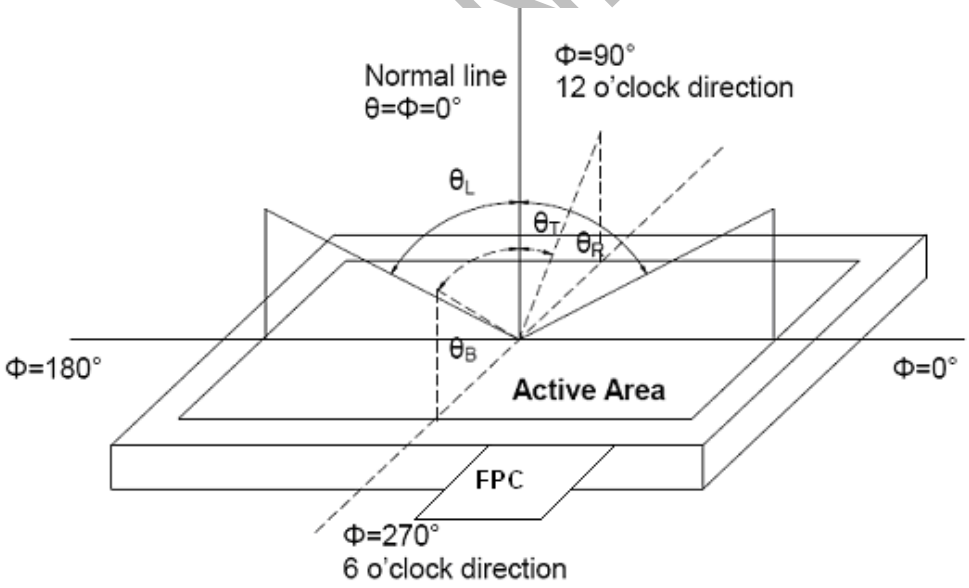
The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



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

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

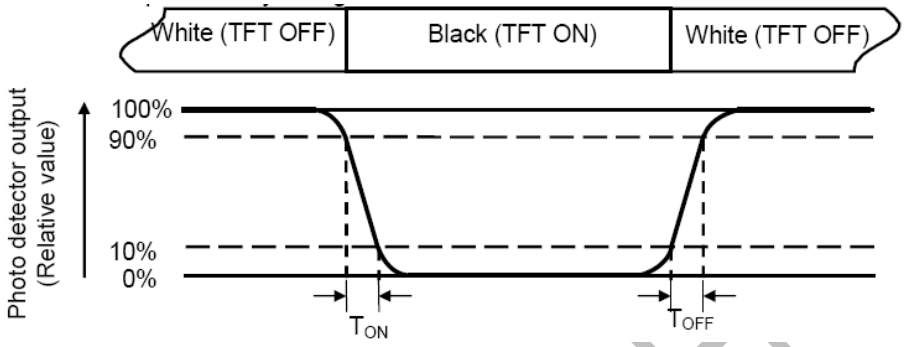
“White state “: The state is that the LCD should drive by Vwhite.

“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)

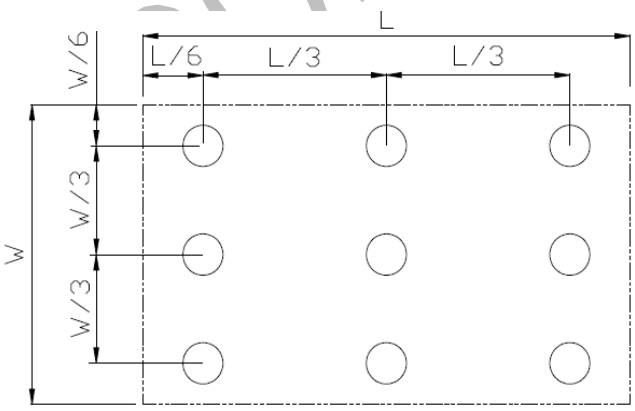
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 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.

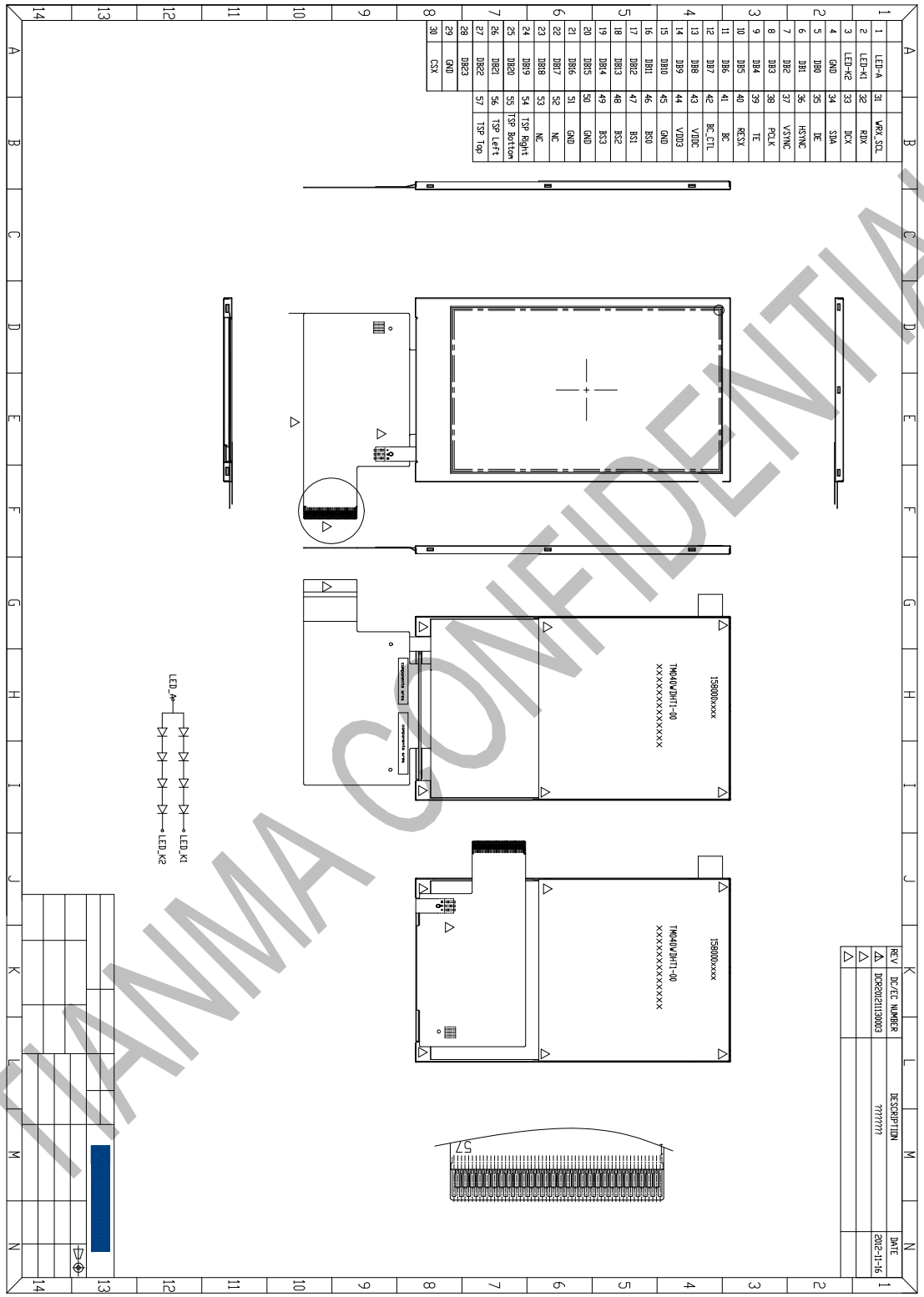
7 Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts = +70℃, 240 hours	IEC60068-2-1 GB2423.2
2	Low Temperature Operation	Ta = -20℃, 240 hours	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta = +80℃, 240 hours	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta = -30℃, 240 hours	IEC60068-2-1 GB2423.1
5	Storage at High Temperature and Humidity	Ta = +60℃, 90% RH max,240hours	IEC60068-2-78 GB/T2423.3
6	Thermal Shock (non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, 100 Cycle	Start with cold temperature, End with high temperature, IEC60068-2-14,GB2423.22
7	ESD	C=150pF,R=330Ω,5point/panel Air:±8Kv,5times; Contact:±4Kv,5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	IEC61000-4-2 GB/T17626.2
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)	IEC60068-2-6 GB/T2423.10
9	Mechanical Shock (Non Op)	Half Sine Wave 60G 6ms, ±X,±Y,±Z 3times for each direction	IEC60068-2-27 GB/T2423.5
10	Package Drop Test	Height:80cm, 1corner,3edges,6surfaces	IEC60068-2-32 GB/T2423.8

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

Note2: Ta is the ambient temperature of samples.

8 Mechanical Drawing



9 Packing drawing

No	Item	Model (Material)	Dimensions(mm)	Unit Weight(Kg)	Quantity	Remark
1	LCM module	TM040WDHT1	74.92x42.74x2.6	0. 0332	210	
2	Tray	PET（Transmit）	485×330×13.8	0. 161	24	
3.	Anti-Static Bag	PE	700×545	0.05	1	
4	BOX	Corrugated Paper	520×345×74	0.44	3	
5	Desiccant	Desiccant	45×50	0.0035	6	
6	EPE	EPE	485×335×5	0.019	3	
7	Carton	Corrugated Paper	544×365×250	0. 76	1	
8	Total weight	13.05±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.