上海冠显光电科技有限公司
Shanghai Top Display Optoelectronics Co., LTD

LCD MODULE SPECIFICATION

Customer: _____

Module No.: TL040HDS30-B1620A

Date: 2023-09-22

Version: 0.1

■ **Pre-Specification for parameter checking**
□ **Final-Specification for sample approval**

For Customer's Acceptance:

Approved by	Comment

Approved by	Checked by	Prepared by
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Record of Revision

Rev.	Date	Description	Editor
0.1	2023-09-22	First release	Zaiping.Yang

1 General Specifications

No.	Item	Specification	Remark
1	LCD Size	4.0 inch (Diagonal)	
2	Driver Element	a-Si TFT active matrix	
3	Resolution	720 (RGB) ×720	
4	Display Mode	Normally Black	
5	Pixel Pitch(mm)	0.0999 (H) × 0.0999 (V)	
6	Display Colors	262K	
7	Surface Treatment	--	
8	Color Arrangement	RGB-Stripe	
9	Interface	3 line SPI+18B RGB	
10	Viewing Direction	ALL	
11	Gray Scale Inversion Direction	--	Note 1
12	Outline Dimension (mm)	74.83(W) × 78.98 (H) × 1.46 (T)	
13	Active Area (mm)	71.93 (W) × 71.93 (H)	
14	Touch Screen	Without CTP	
15	Display Driver IC	Y17B	
16	Touch Driver IC	--	

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180°shift.

Note 2: RoHS compliant.

2 Pin Assignment

2.1 LCD Pin assignment

Match connector: XF2M-4015-1A（OMRON）or equivalent.

PIN	Symbol	I/O	Description	Remark
1	LEDA	p	LED Anode	
2	LEDK1	p	LED Cathode1	
3	LEDK2	p	LED Cathode2	
4	GND	P	Power Ground	
5	VCI	P	Power Supply 2.8V	
6	RESET	I	Reset pin	
7	IM1(NC)	-	Not connection	
8	IM0(NC)	-	Not connection	
9	SDA	I	Serial interface DATA Input/Output.	
10	SCK	I	SPI interface clock input.	
11	CS	I	Chip selection signal	
12	PCLK	I	Pixel clock signal in RGB I/F mode.	
13	DE	I	Data enable signal in RGB I/F mode.	
14	VSYNC	I	Vertical synchronizing signal.	
15	HSYNC	I	Horizontal synchronizing signal .	
16~33	DB0~DB17	I	RGB data signal (DB0~DB5: B0~B5; DB6~DB11:G0~G5; DB12~DB17:R0~R5)	
34	GND	P	Power Ground	
35	TP_INT	O	Touch Interrupt,(2.8~3.3V H Level)	
36	TP_SDA	I/O	Touch IIC Data signal,(2.8~3.3V H Level)	
37	TP_SCL	I	Touch IIC Clock signal,(2.8~3.3V H Level)	
38	TP_RESET	I	Touch Reset Signal,,(2.8~3.3V H Level)	
39	TP_VCI	P	Touch Power supply	
40	GND	P	Power Ground	

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

3 Absolute Maximum Ratings

Ta = 25℃

Item	Symbol	Min.	Max.	Unit	Remark
Power Voltage	VCI	-0.50	4.2	V	
Operating Temperature	Top	-20.0	70.0	℃	
Storage Temperature	T_{st}	-30.0	80.0	℃	
Operating and Storage Humidity	H_{stg}	10%	90%	%(RH)	

4. Electrical Characteristics

4.1 Recommended Operating Condition

VCI=3.3V， GND=0V， Ta = 25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
LCM supply Voltage	VCI	2.8	3.0	3.3	V	
Input logic high voltage	VIH	0.7VCI	-	VCI	V	R0~R5, G0~G5,0~B5, DE, DCLK, HSYNC, VSYNC, MODE, RESET,
Input logic low voltage	VIL	0		0.3VCI	V	
Current of LCM supply Voltage	I_{VCI}	--	50	--	mA	VCI=3.3V, color bar pattern

4.2 Backlight Unit Driving Condition

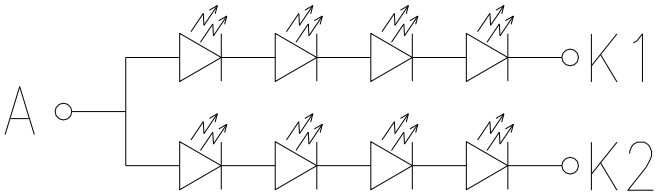
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Current	I_F	-	40	50	mA	8 LEDs (4 LED Serial, 2 LED Parallel)
Forward Current Voltage	V_F	-	12.8	14	V	
Backlight Power Consumption	W_{BL}	-	512	700	mW	
Operating Life Time	--	30000	--	--	hrs	Note 2, Note 3

Note1: The LED driving condition is defined for each module (4 LED Serial, 2 LED Parallel).

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

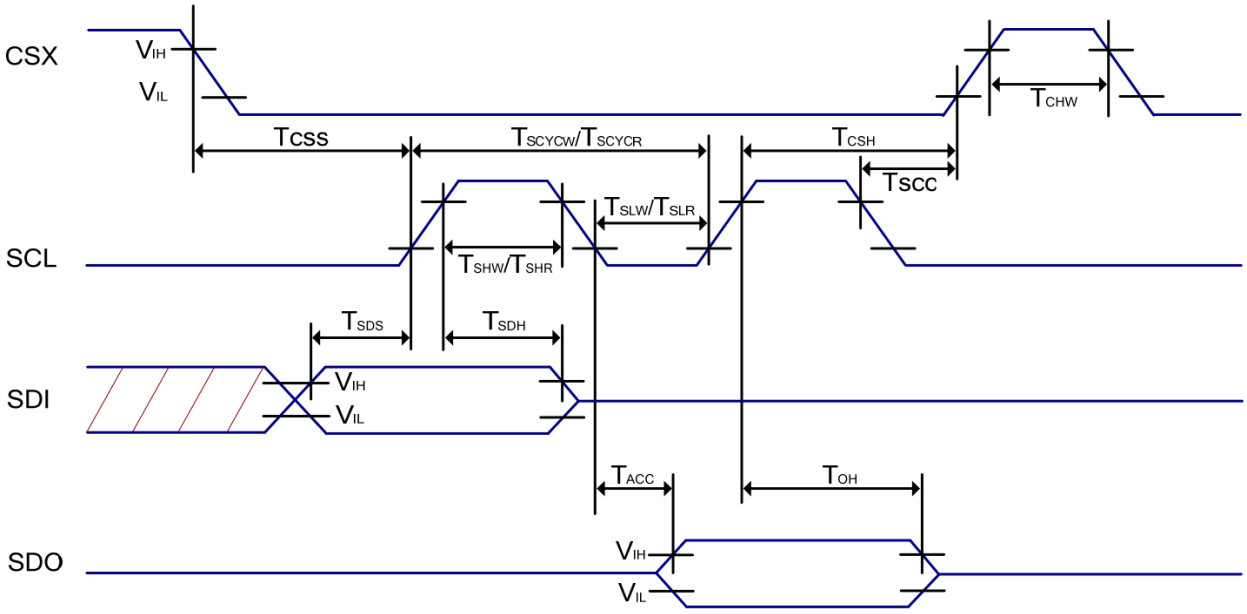
Note3: Optical performance should be evaluated at Ta=25℃ When LED is driven at high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

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



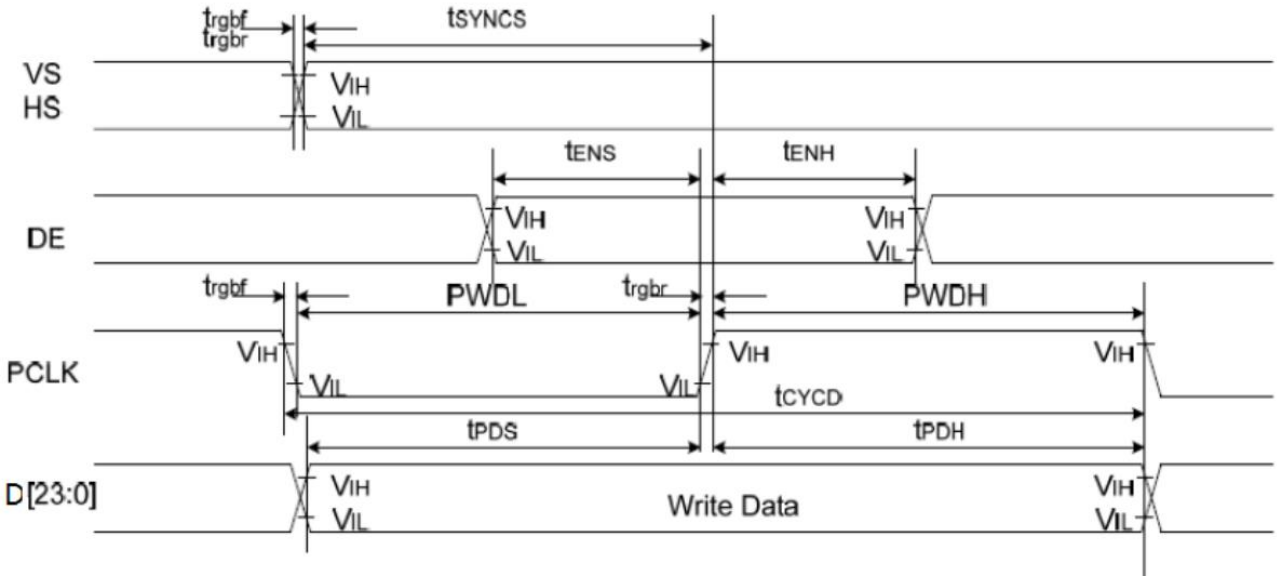
5 Timing Chart

5.1 Serial Interface Characteristics(3Line)



Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	Tcss	Chip select setup time	15	-	ns	-
	Tcsh	Chip select hold time	15	-	ns	
	Tscc	Chip select setup time	20	-	ns	
	Tchw	Chip “H” pulse width	40	-	ns	
SCL	Tscycw	Serial clock cycle (Write)	66	-	ns	-
	Tshw	SCL “H” pulse width (Write)	10	-	ns	
	Tslw	SCL “L” pulse width (Write)	10	-	ns	
	Tscycr	Serial clock cycle (Read)	150	-	ns	-
	Tshr	SCL“H” pulse width (Read)	60	-	ns	
	Tslr	SCL“L” pulse width (Read)	60	-	ns	
SDI	TSDS	Data setup time	10	-	ns	-
	Tsdh	Data hold time	10	-	ns	
	Tacc	Access time	10	50	ns	For maximum CL=30pF For minimum CL=8pF
	Toh	Output disable time	15	50	ns	

5.2 TFT-LCD RGB Input Timing



Signal	Symbol	Parameter	min	max	Unit	Description
VS/HS	t_{SYNCS}	VS/HS setup time	5	-	ns	24/18/16-bit bus RGB interface mode
	t_{SYNCH}	VS/HS hold time	5	-	ns	
DE	t_{ENS}	DE setup time	5	-	ns	
	t_{ENH}	DE hold time	5	-	ns	
D[23:0]	t_{POS}	Data setup time	5	-	ns	
	t_{PDH}	Data hold time	5	-	ns	
PCLK	PWDH	PCLK high-level period	13	-	ns	
	PWDL	PCLK low-level period	13	-	ns	
	t_{CYCD}	PCLK cycle time	28	-	ns	
	t_{rgbr},t_{rgbf}	PCLK,HS,VS rise/fall time	-	15	ns	

5.3 Recommended Timing Setting of TCON

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

VCI=3.3V, GND=0V, Ta=25℃

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK	Fclk	-	35	-	MHz	
	tclk	-	28	-	ns	
HSD	thd	-	720	-	tclk	
	thpw	-	2	-	tclk	
	thb	-	46	-	tclk	
	thfp	-	44	-	tclk	
VSD	tvd	-	720	-	th	
	tvpw	-	2	-	th	
	tvb	-	18	-	th	
	tvfp	-	16	-	th	

Note: For reference only, it needs to be adjusted according to the actual display effect.

5.4 Reset timing

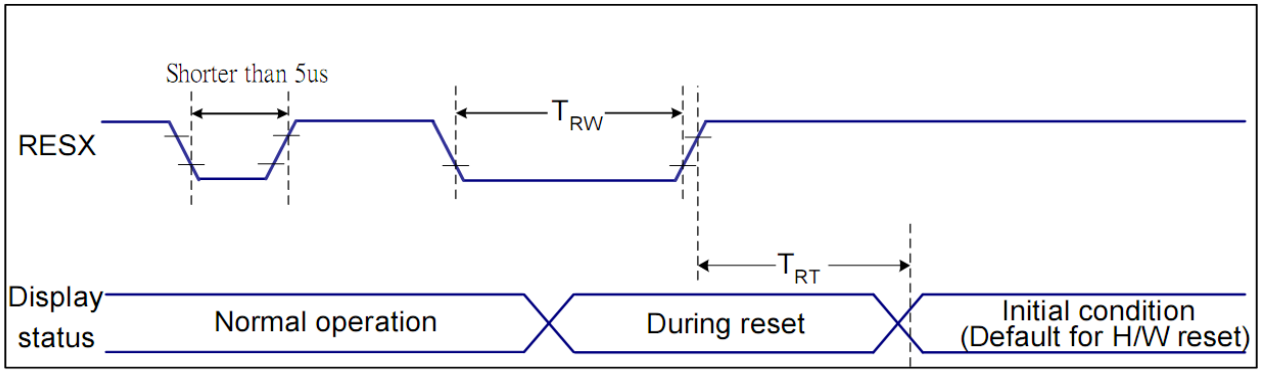


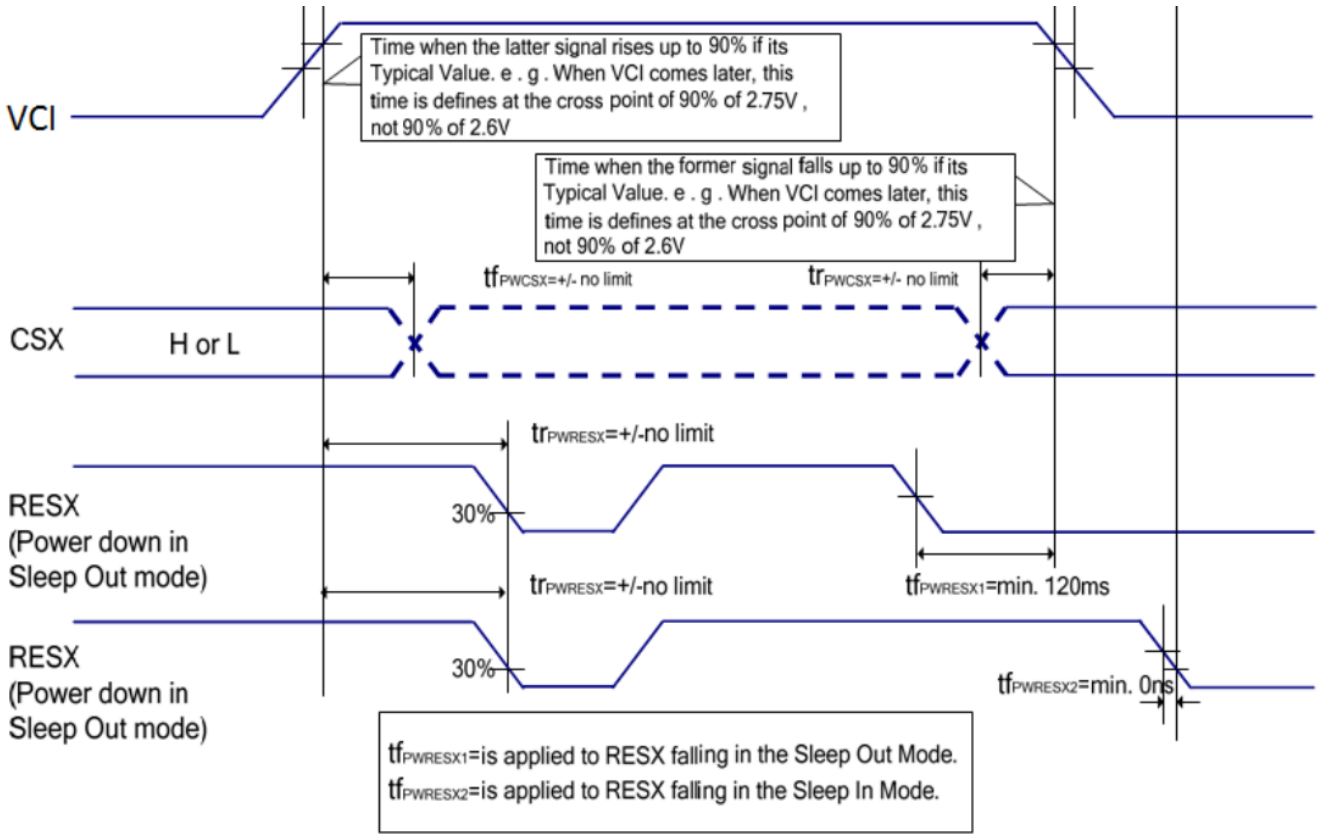
Figure Reset Timing

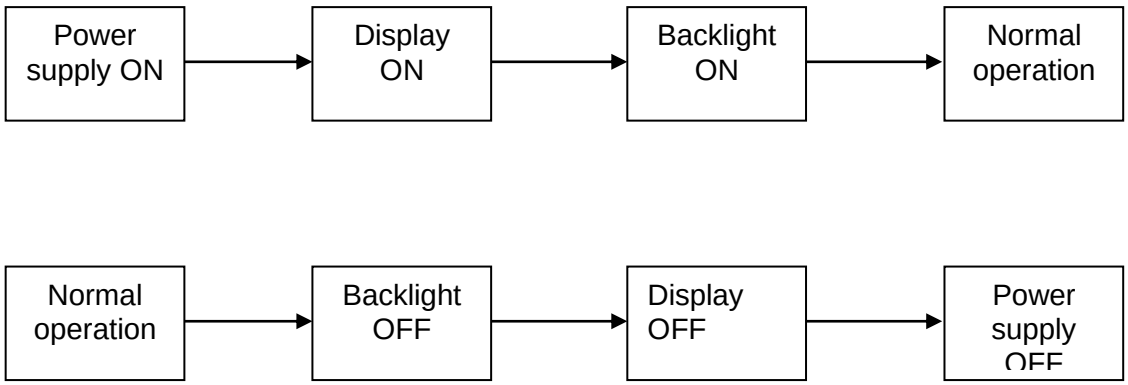
IOVCC=1.65 to 3.3V, VCI=2.6 to 3.3V, AGND=DGND=0V, Ta=25℃

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel		5	ms
				120	ms

Table Reset Timing

5.5 POWER ON/OFF SEQUENCE :





6 Optical Characteristics

Ta=25℃

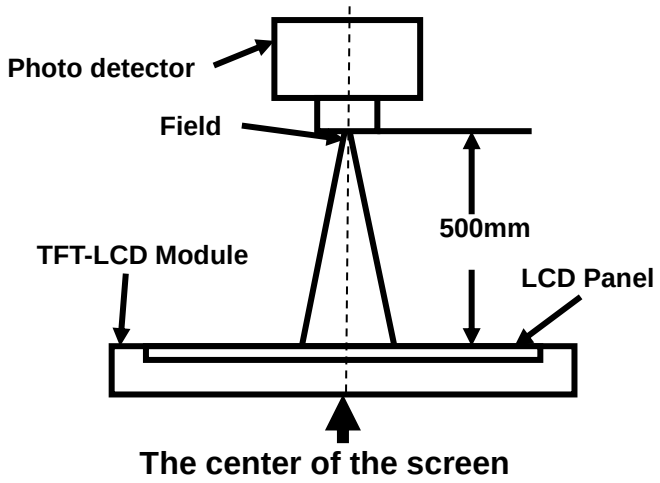
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
View Angles		θT	CR≧10	80	85	-	Degree	Note 2
		θB		80	85	-		
		θL		80	85	-		
		θR		80	85	-		
Contrast Ratio		CR	θ=0°	800	1000	-		Note1 Note3
Response Time		T_{ON}	25℃	25	35	-	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	0.274	0.304	0.344		Note1 Note5
		y		0.283	0.313	0.343		
	Red	x		0.597	0.627	0.657		
		y		0.308	0.338	0.368		
	Green	x		0.290	0.320	0.350		
		y		0.553	0.583	0.553		
	Blue	x		0.121	0.151	0.181		
		y		0.026	0.056	0.086		
Uniformity		U		80	85	--	%	Note1 Note6
NTSC				63	68	--	%	Note 5
Luminance		L		--	380	--	cd/m^2	Note1 Note7

Test Conditions:

1. I_F= 40 mA, V_F=12.8 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.

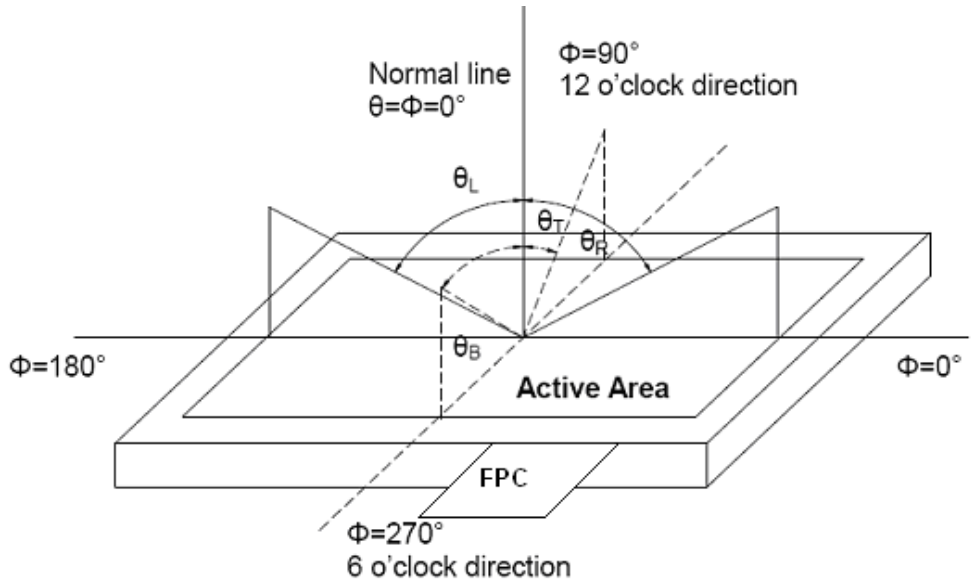
Properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A or similar equipment	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

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

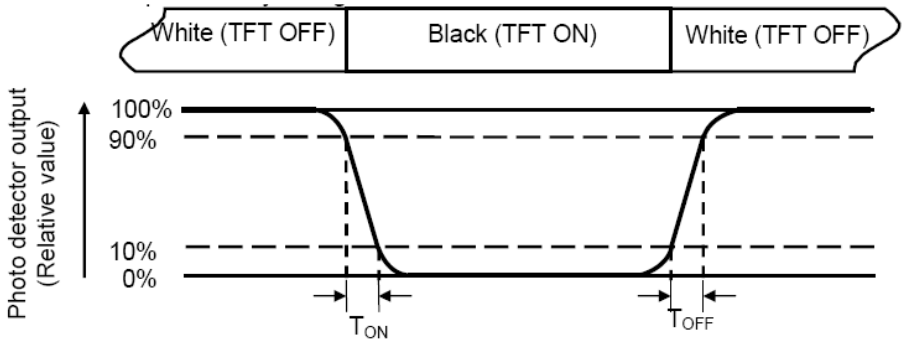
"White state ": The state is that the LCD should drive by Vwhite.

"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)

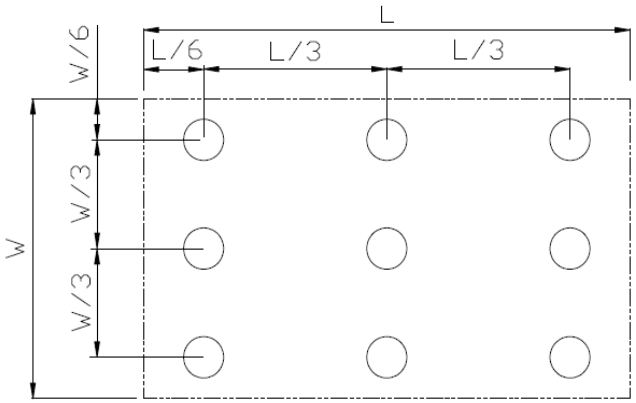
Color coordinates measured at center point of LCD.

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.

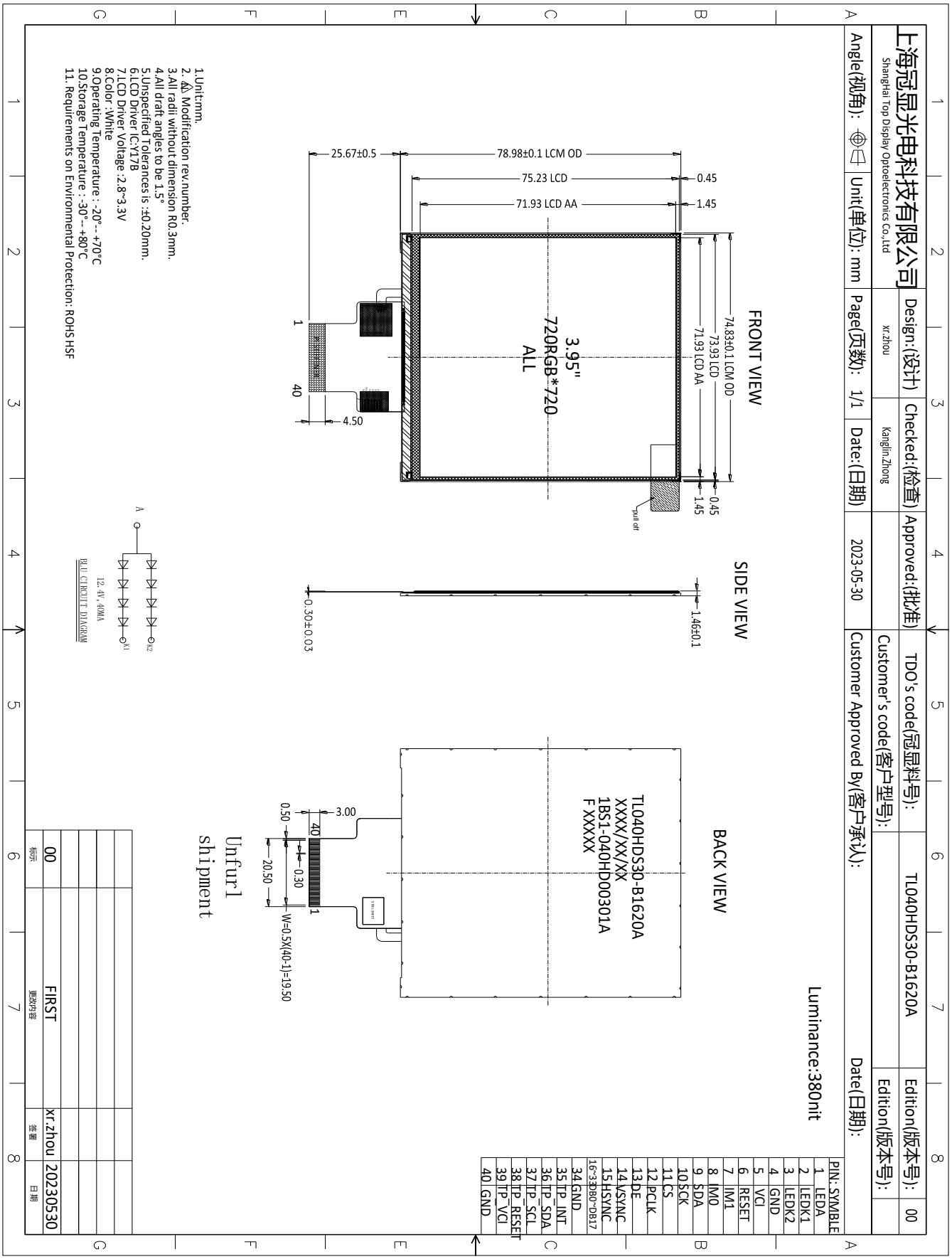
7 Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts = +70℃, 240 hours	No abnormalities in functions
2	Low Temperature Operation	Ta = -20℃, 240 hours	No abnormalities in functions
3	High Temperature Storage	Ta = +80℃, 240 hours	No abnormalities in functions
4	Low Temperature Storage	Ta = -30℃, 240 hours	No abnormalities in functions
5	Storage at High Temperature and Humidity	Ta = +60℃, 90% RH max,240hours	No abnormalities in functions
6	Thermal Shock (non-operating)	-30℃ 30 min~ +70℃ 30 min, Change time: 0.5 hour ← 5 min → 0.5 hour.10 Cycle	Start with cold temperature, End with high temperature,
7	ESD	C=150pF, R=330Ω,5point/panel Air: ±8Kv, 5times; Contact:±4Kv,5times (Environment:15℃~35℃, 30%~60%.86Kpa~106Kpa)	No abnormalities in functions

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

Note2: Ta is the ambient temperature of samples.

8 Mechanical Drawing



9 Precautions for Use of LCD Modules

Handling Precautions

9.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

9.1.2 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.

9.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

9.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

9.1.5 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

9.1.6 Do not attempt to disassemble the LCD Module.

9.1.7 If the logic circuit power is off, do not apply the input signals.

9.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

9.1.8.1 Be sure to ground the body when handling the LCD Modules.

9.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

9.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

9.1.8.4 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.

Storage Precautions

9.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

9.2.2 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%

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

Transportation Precautions

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