

SPECIFICATION

PRODUCT NO. : TCXD020IBLON-2

VERSION : Ver 1.0

ISSUED DATE : 2021-03-02

This module uses ROHS material

FOR CUSTOMER: _____

APPROVAL FOR SPECIFICATION

APPROVAL FOR SAMPLE

DATE	APPROVED BY

Xinli Optoelectronics :

Presented by	Reviewed by	Organized by

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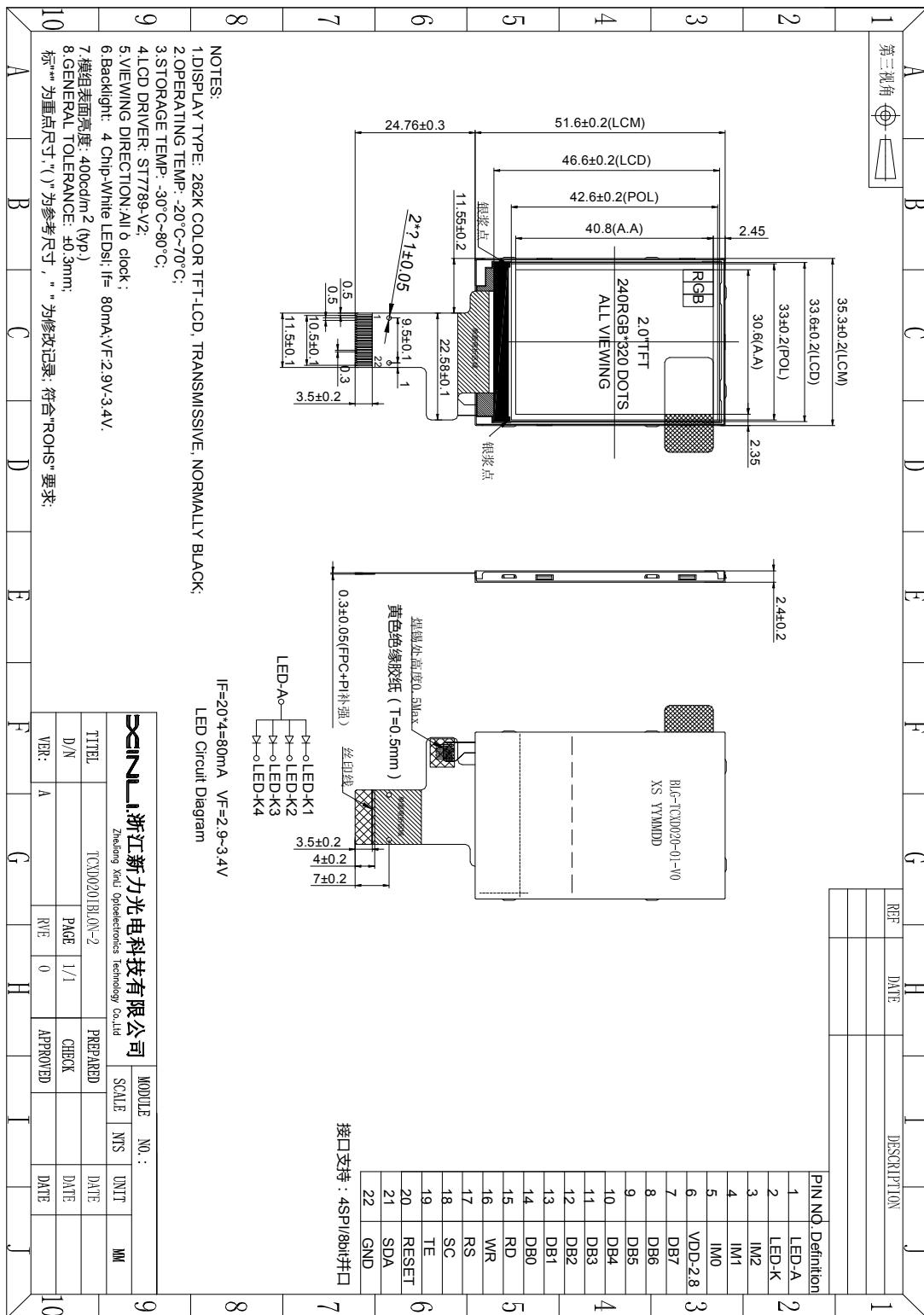
1. Revision Recode

2. General Description and Features

The 2.0 inch Module named TCXD020IBLON-2 is a-Si TFT-LCD module, which is the type of transmissive. It is consisted of TFT-LCD Panel, one Driver IC, one FPC and one Back-Light unit. Features of this product are listed in the following table.

NO	Item	Contents	Unit
(1)	Module Outsize	35.3*51.6*2.4	mm
(2)	LCD Active area	30.6*40.8	mm
(3)	Dot Number	240*3(RGB)*320	/
(4)	Dot size	0.1275(H)*0.1275(V)	mm
(5)	LCD type	TFT Transmissive	/
(6)	Display Color	65K	/
(7)	Viewing direction	ALL	O'clock
(8)	Backlight Type	4-chip LED, Parallel	/
(9)	Power Supply	2.8 (TYP)	V
(10)	Drive IC	ST7789V2	/
(11)	Interface	FPC0.5mm_Pitch 22pin	/
(12)	Interface type	8Bit MCU+4Line SPI	/
(13)	Module weight	TBD	g

3. Mechanical Dimension

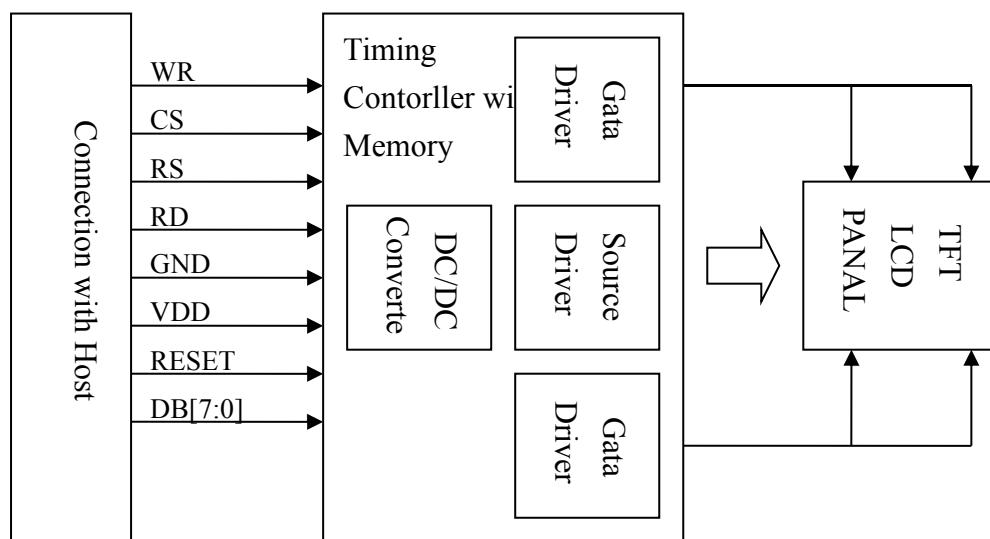


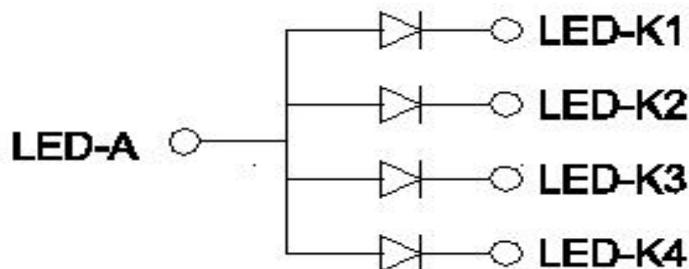
4. Interface Pin Connection

NO	Symbol	Level	Description								
1	LEDA	P	LED Anode								
2	LEDK	P	LED Cathode								
3	IM2	I	IM3	IM2	IM1	IMO	MPU Interface Mode		Data pin		
			0	0	0	0	80-8bit parallel I/F		DB[7:0]		
			0	0	0	1	80-16bit parallel I/F		DB[15:0]		
			0	0	1	0	80-9bit parallel I/F		DB[8:0]		
			0	0	1	1	80-18bit parallel I/F		DB[17:0],		
							3-line 9bit serial I/F		SDA: in/out		
4	IM1	I	0	1	0	1	2 data lane serial I/F		SDA: in/out WRX: in		
			0	1	1	0	4-line 8bit serial I/F		SDA: in/out		
			1	0	0	0	80-16bit parallel I/F II		DB[17:10], DB[8:1]		
			1	0	0	1	80-8bit parallel I/F II		DB[17:10]		
5	IMO	I	1	0	1	0	80-18bit parallel I/F II		DB[17:0],		
			1	0	1	1	80-9bit parallel I/F II		DB[17:9]		
			1	1	0	1	3-line 9bit serial I/F II		SDA: in/ SDO: out		
			1	1	1	0	4-line 8bit serial I/F II		SDA:in/ SDO: out		
6	VDD-2.8V	P	Power Supply for Analog, VDD-2.8=2.5V-3.3V								
7	DB7	I	MCU parallel interface data								
8	DB6	I	MCU parallel interface data								
9	DB5	I	MCU parallel interface data								
10	DB4	I	MCU parallel interface data								
11	DB3	I	MCU parallel interface data								
12	DB2	I	MCU parallel interface data								
13	DB1	I	MCU parallel interface data								
14	DB0	I	MCU parallel interface data								
15	RD	I	-Read enable in MCU parallel interface -If not used, please fix this pin at VDDI or DGND								
16	WR	I	-Write enable in MCU parallel interface. -Display data/command selection pin in 4-line serial interface. -Second Data lane in 2 data lane serial interface. -If not used, please fix this pin at VDDI or DGND.								

17	RS	I	-Display data/command selection pin in parallel interface. -This pin is used to be serial interface clock.
18	CS	I	-Chip selection pin Low enable. High disable.
19	TE	O	-Tearing effect signal is used to synchronize MCU to frame memory
20	RESET	I	-This signal will reset the device and it must be applied to properly initialize the chip. -Signal is active low.
21	SDA	I/O	-When IM3: Low, SPI interface input/output pin. -When IM3: High, SPI interface input pin. -The data is latched on the rising edge of the SCL signal. -If not used, please fix this pin at VDDI or DGND level.
22	GND	P	Power ground

5. Block Diagram





6. Maximum Rating

Item	Symbol	Rating	Unit
Operating temperature	Top	-20 to 70	°C
Storage temperature	Tst	-30 to 80	°C
Supply voltage	VDD	-0.3V ~ 4.6	V

NOTE:

If the module was used these absolute maximum ratings as above, it may be damaged permanently. Using the module within the following electrical characteristic conditions are also exceeded, the module will malfunction and cause poor reliability. VDD>GND must be maintained.

7. Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Analog power supply	VDD	-	2.4	2.8	3.3	V
Logic input signal Voltage	H level V _{ih}		0.7*VDD	-	VDD	V
	L level V _{il}		GND	-	0.3*VDD	V
Logic output signal Voltage	H level V _{oh}		0.8*VDD	-	VDD	V
	L level V _{ol}		GND	-	0.2*VDD	V

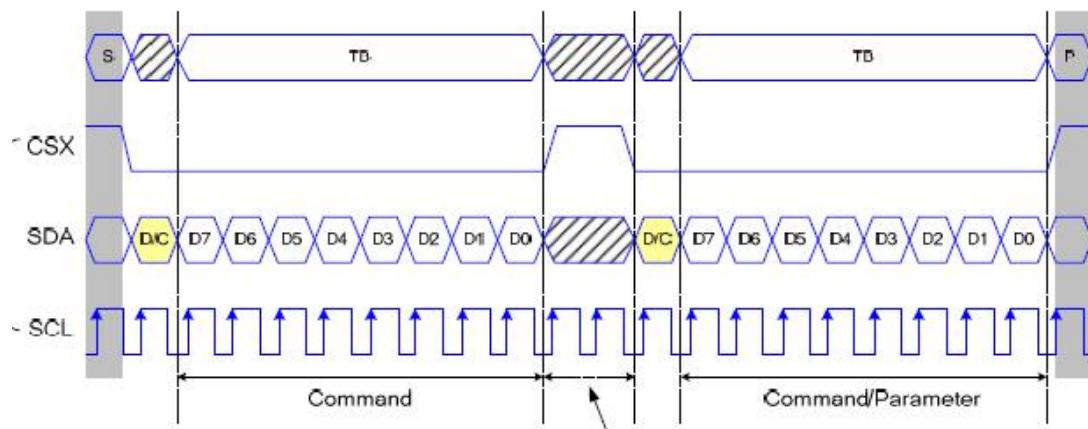
I_{VDD} ≈ 25mA。

8. Backlight Characteristics

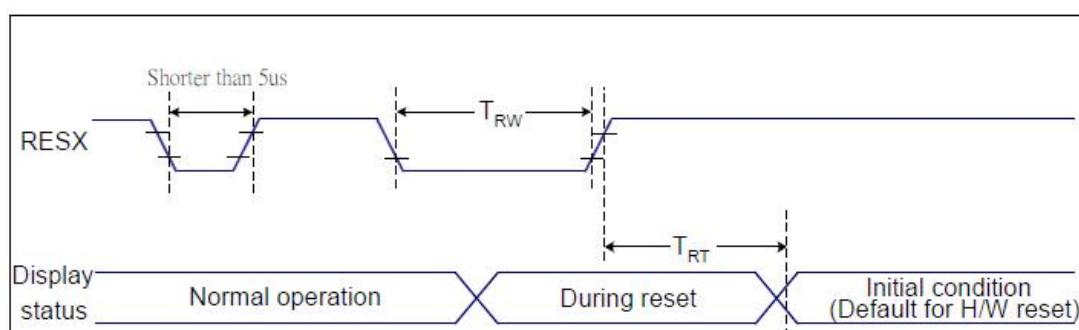
Item	syb	Min	Typ	Max	Unit	Condition
Voltage	Vf	2.8	3.2	3.4	V	IF=80mA
Number of LED	-		4		pcs	-
Power Consumption	PWF	-	256	-	mW	-
Connection mode	P		Parallel		-	-
LED life-span	-	-	(20000)	-	Hrs	-

9. Timing Characteristics

9.1 SPI Timing

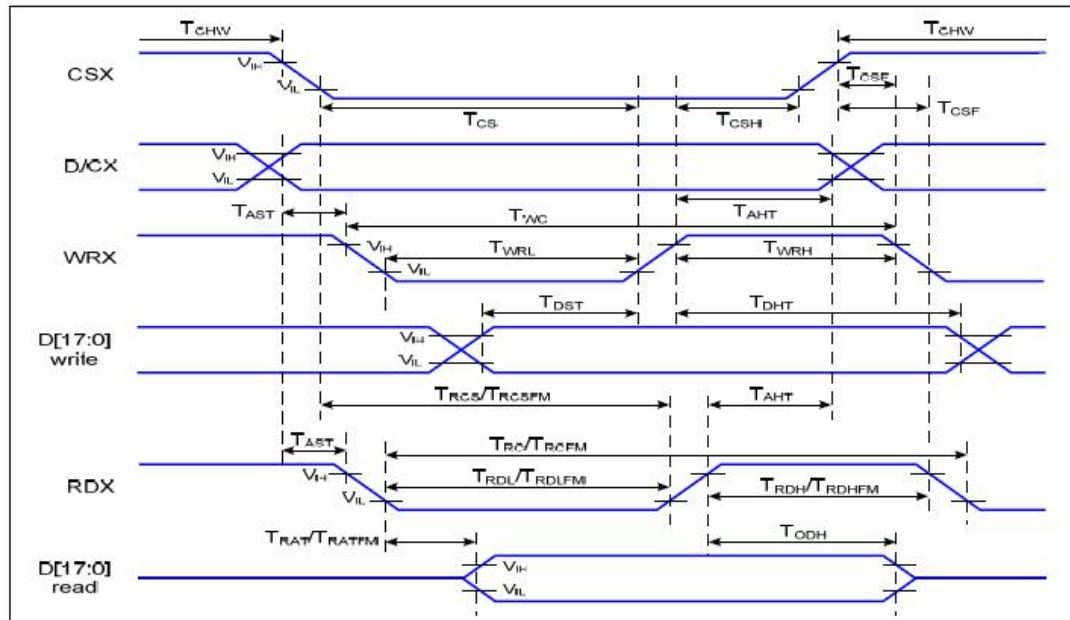


9.2 Reset Timing:



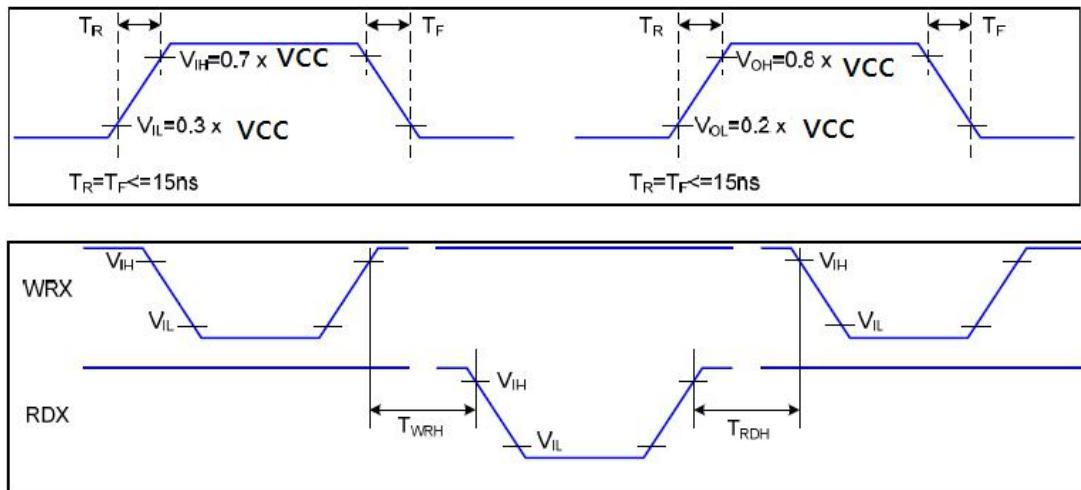
Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

9.3 MCU Timing



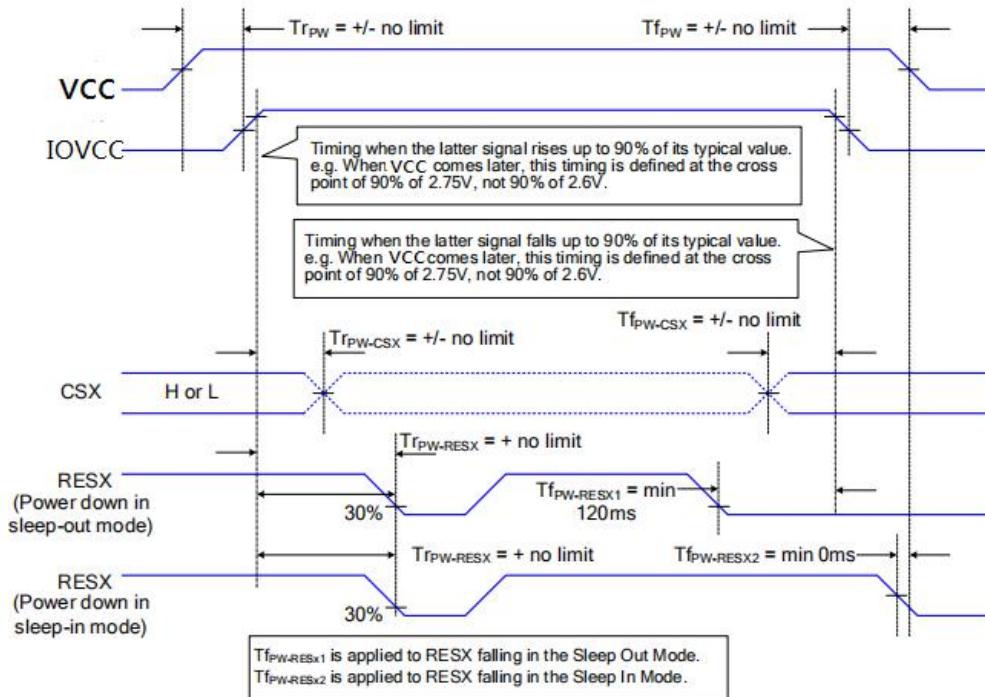
$VDD=1.65$ to $3.3V$, $VDD=2.4$ to $3.3V$, $AGND=DGND=0V$, $T_a = -30$ to $70^\circ C$

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	-
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	-
	T_{CS}	Chip select setup time (Write)	15		ns	
	T_{RCS}	Chip select setup time (Read ID)	45		ns	
	T_{RCFSM}	Chip select setup time (Read FM)	355		ns	
	T_{CSF}	Chip select wait time (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	-
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T_{RDHF}	Control pulse "H" duration (FM)	90		ns	
	T_{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T_{DST}	Data setup time	10		ns	For CL=30pF



9.4 POWER ON/OFF

The power on/off sequence is illustrated below



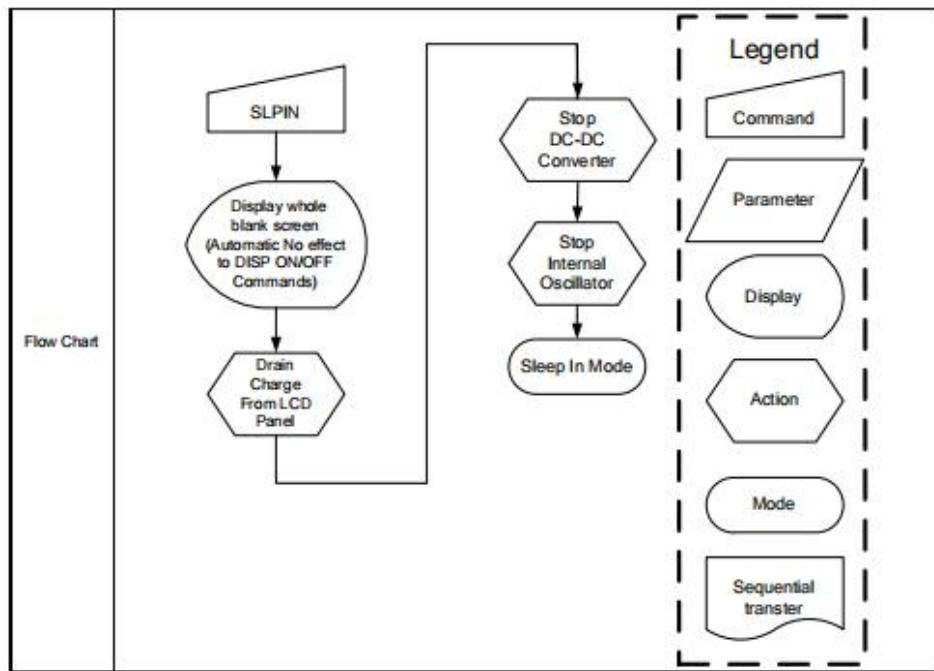
10. Application Circuit

Please consult our technical department for detail information.

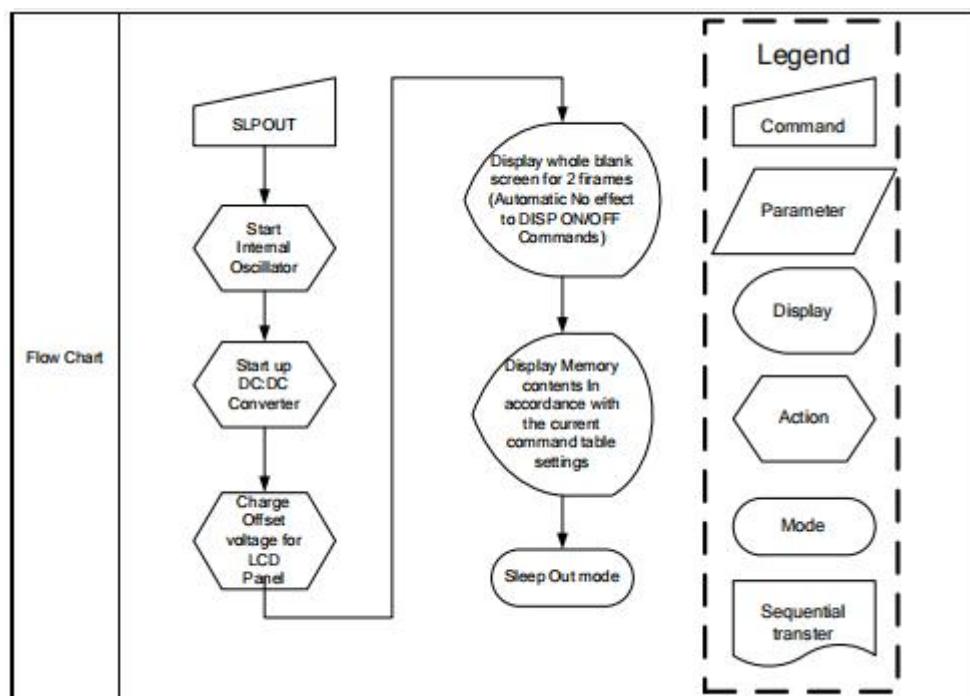
11. Initial Code

SLPIN (10h): Sleep in

SLPIN (Sleep In)																									
10H	D/CX	WRX	RDX	D17-B	D7	D6	D5	D4	D3	D2	D1	D0	HEX												
SLPIN	0	↑	1	-	0	0	0	1	0	0	0	0	(10h)												
parameter	No Parameter																								
Description	<ul style="list-style-type: none"> -This command causes the LCD module to enter the minimum power consumption mode. -In this mode the DC/DC converter is stopped, internal oscillator is stopped, and panel scanning is stopped. -MCU interface and memory are still working and the memory keeps its contents. "-" Don't care 																								
Restriction	<ul style="list-style-type: none"> -This command has no effect when module is already in sleep in mode. Sleep in mode can only be left by the sleep out command (11h). -It will be necessary to wait 5msec before sending any new commands to a display module following this command to allow time for the supply voltages and clock circuits to stabilize. -It will be necessary to wait 120msec after sending sleep out command (when in sleep in mode) before sending an sleep in command. 																								
Register availability	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Status</th> <th style="text-align: center;">Availability</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Normal Mode On, Idle Mode Off, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Normal Mode On, Idle Mode On, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Partial Mode On, Idle Mode Off, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Partial Mode On, Idle Mode On, Sleep Out</td> <td style="text-align: center;">Yes</td> </tr> <tr> <td style="text-align: center;">Sleep In</td> <td style="text-align: center;">Yes</td> </tr> </tbody> </table>													Status	Availability	Normal Mode On, Idle Mode Off, Sleep Out	Yes	Normal Mode On, Idle Mode On, Sleep Out	Yes	Partial Mode On, Idle Mode Off, Sleep Out	Yes	Partial Mode On, Idle Mode On, Sleep Out	Yes	Sleep In	Yes
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**SLPOUT (11h): Sleep Out**

SLPOUT (Sleep Out)																									
11H	DICX	WRX	RDX	D17-8	D7	D6	D5	D4	D3	D2	D1	D0	HEX												
SLPOUT	0	↑	1	-	0	0	0	1	0	0	0	1	(11h)												
parameter	No Parameter																								
Description	-This command turn off sleep mode. -In this mode the DC/DC converter is enable, internal display oscillator is started, and panel scanning is started.																								
Restriction	-This command has no effect when module is already in sleep out mode. Sleep out mode can only be left by the sleep in command (10h). -It will be necessary to wait 5msec before sending any new commands to a display module following this command to allow time for the supply voltages and clock circuits to stabilize. -It will be necessary to wait 120msec after sending sleep out command (when in sleep in mode) before sending an sleep in command. -The display module runs the self-diagnostic functions after this command is received.																								
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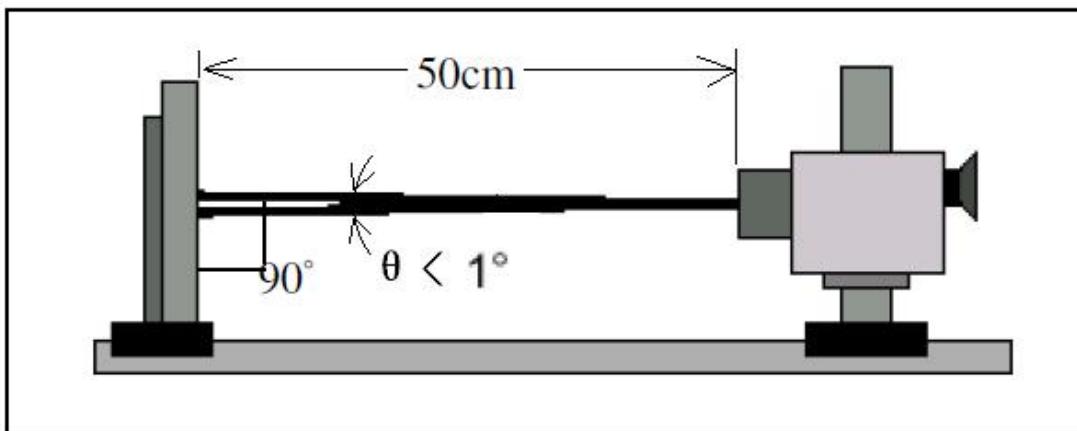
12. Electro-Optical Characteristics

Note 1: Ambient temperature=25°C±2°C

Note 2: To be measured in the dark room with backlight unit.

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Transmission (whit pol)	T		-	4.5	-	%	
Response time	Tr	$\theta = 0^\circ$	-	10	20	ms	4
	Tf	$\emptyset = 0^\circ$	-	20	30	ms	
Uniformity (Five point)	δ	$T_a = 25^\circ C$	70	80	-	%	7
Contrast ratio	WHITE		640	700	-	-	3,5
Surface Luminance	Lv		200	300	-	Cd/m ²	3,7
Viewing angle range	θ	$\emptyset = 90^\circ$		80	-	deg	6
		$\emptyset = 270^\circ$		80	-	deg	
		$\emptyset = 0^\circ$		80	-	deg	
		$\emptyset = 180^\circ$		80	-	deg	
Color filter chromaticity (x, y)	White	X	$\theta = \phi = 0^\circ$	TBD	TBD	TBD	7
		Y		TBD	TBD	TBD	
	Red	X	$\theta = \phi = 0^\circ$	TBD	TBD	TBD	
		Y		TBD	TBD	TBD	
	Green	X	$\theta = \phi = 0^\circ$	TBD	TBD	TBD	
		Y		TBD	TBD	TBD	
	Blue	X	$\theta = \phi = 0^\circ$	TBD	TBD	TBD	
		Y		TBD	TBD	TBD	

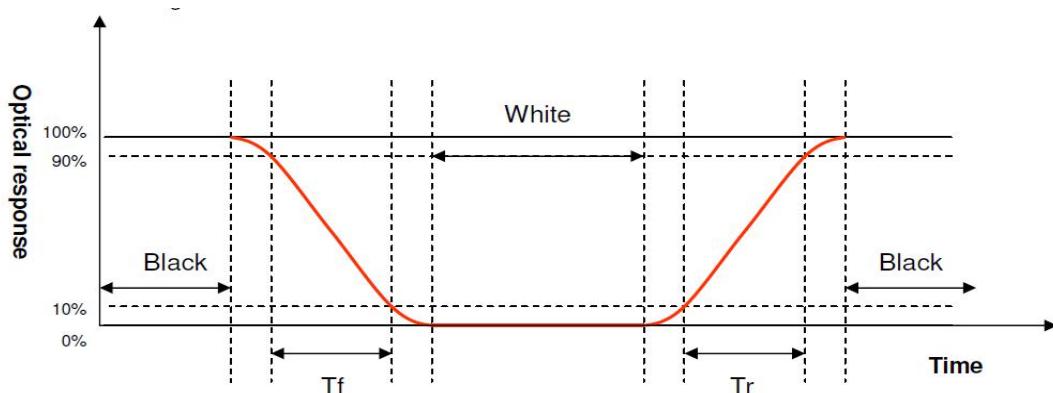
Note 3: To be measured at the center area of panel with a viewing cone of 1 by Topcon luminance meter BM-7A, after 10 minutes operation (module).



Note 4: Definition of response time:

The output signals of photo detector are measured when the input signals are changed from “black” to “white” (rising time) and from “white” to “black” (falling time), respectively. The response time is defined as the time interval between the 10% and 90% of amplitudes.

Refer to figure as below.



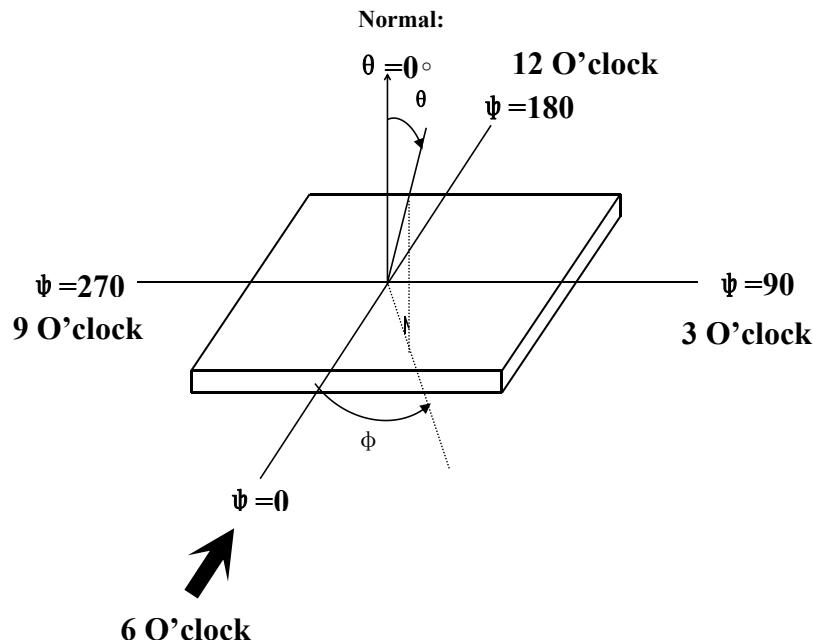
Note 5. Definition of contrast ratio:

Contrast ratio is calculated with the following formula:

$$\text{Contrast ratio (CR)} = \frac{\text{Photo detector output when LCD is at "White" state}}{\text{Photo detector output when LCD is at "Black" state}}$$

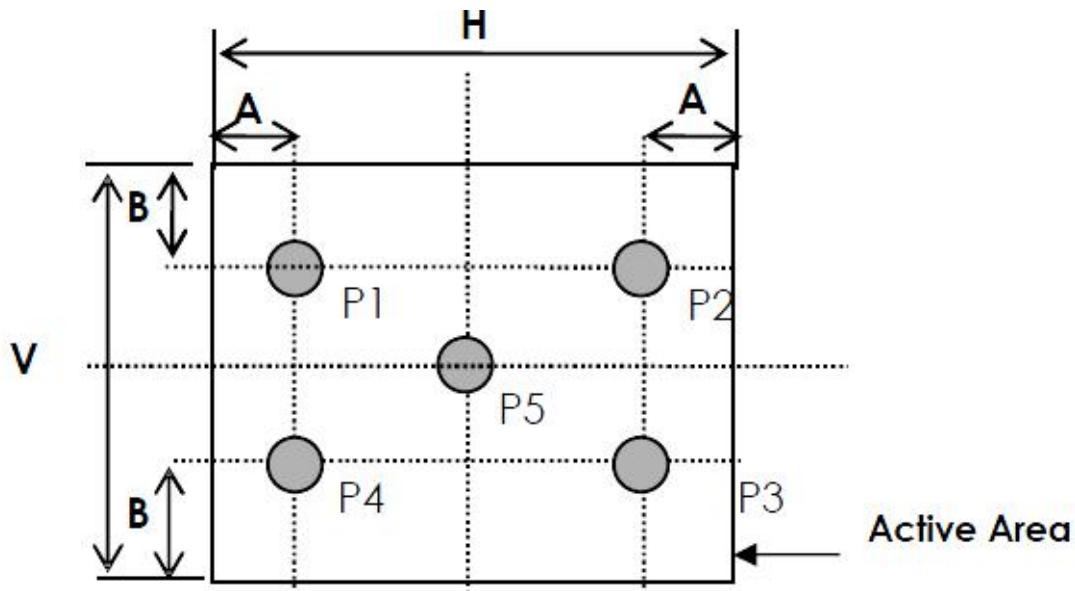
Note 6. Definition of viewing angle

Viewing angle is the angle at which the contrast ratio is greater than 2, for TFT module the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.



Note 7. Surface luminance is the LCD surface from the surface with all pixels displaying white. Refer to figure as below.

Measuring method for Contrast ratio, surface luminance, Luminance uniformity, CIE (x, y) chromaticity



A : 5 mm B : 5 mm H,V : Active Area

Light spot size $\Delta E=7\text{mm}$, 500mm distance from the LCD surface to detector lens
measurement instrument is TOPCON's luminance meter BM-7A

Uniformity definition= [min of 5point/max of 5points]x100%

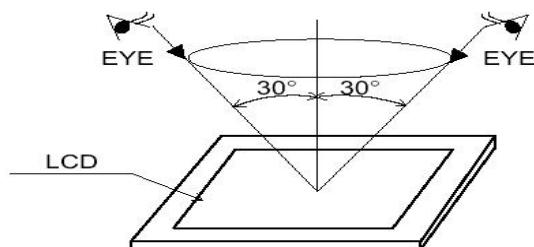
Lv = Average Surface Luminance with all white pixels (P₁, P₂, P₃, P₄, P₅)

13. Quality Assurance

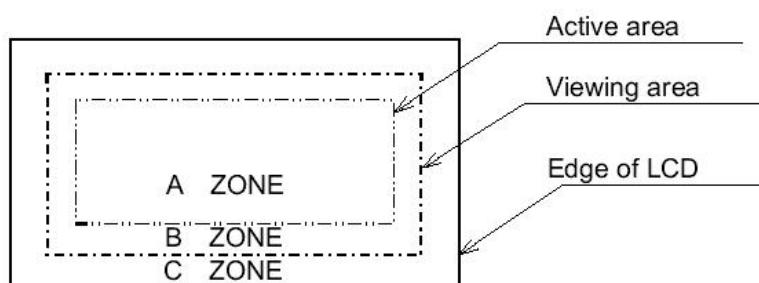
The customer should check and accept the products of XINLI within one month after reception. This standard for Quality Assurance should affirm the quality of LCD products to supply to purchaser by XINLI Company Limited.

1. Appearance Inspection

- (1) Ambient illumination condition need 750lux for visual cosmetic inspection (300lux for Electrical characteristic functional inspection.)
- (2) The distance from eyes to LCD must be 30cm.
- (3) Viewing direction must be within 30 degrees to vertical line of LCD center.



2. Definition of A zone, B zone and C zone



3. Appearance Criterion

TBD

14. Reliability Test

This standard reliability test is done only for the first lot of MP products. Customer and supplier must hold a discussion if other reliability test is requested by customer.

NO.	Test Item	Test Condition	Remarks
1	High temperature storage	80°C, 240 H	Note1 IEC60068-2-1:2007, GB2423.2-2008
2	Low temperature storage	-30°C, 240H	IEC60068-2-1:2007 GB2423.1-2008
3	High temperature operation	70°C, 240H	IEC60068-2-1:2007 GB2423.2-2008
4	Low temperature operation	-20°C, 240H	IEC60068-2-1:2007 GB2423.1-2008
5	High temperature /humidity storage	60°C, 90% RH, 240H	Note2 IEC60068-2-78 :2001 GB/T2423.3—2006
6	Temperature Cycle (Non operation)	-30°C/80°C, 10 cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984, GB2423.22-2002
7	Drop Test (package)	Height:100 cm, 1 corner, 3 edges, 6 surfaces	IEC60068-2-32:1990 GB/T2423.8—1995
8	Electro Static Discharge (Operation)	C=150pF, R=330Ω, 5points/panel Air:± 4KV, 5times; Contact:± 2KV, 5 times; (Environment: 15°C~35°C, 30%~60%, 86Kpa~ 106Kpa)	IEC61000-4-2:2001 GB/T17626.2-2006

15. Precautions for Operation and Storage

1. Precautions for Operation

- (1)Since LCD panel made of glass,in order to prevent from glass broken or color tone change,please do not apply any mechanical shock or impact or excessive force to it when installing the LCD module.
- (2)If LCD panel is broken and liquid crystal substance leaks out and contact your skin or clothes,please immediately wash it off by using soap and water.
- (3)The polarizer on the LCD surface is soft and easily scratched.Please be careful when handling.
- (4)If LCD surface becomes contaminated,please wipe it off gently by using moisten soft cloth with normal hexane,do not use acetone,ketone,ethanol, alcohol or water.If there is saliva or water on the LCD surface,please wipe it off immediately.
- (5)When handing LCD module,please be sure that the body and the tools are properly grounded.And do not touch I/F pins with bare hands or contaminate I/F pins.
- (6)Do not attempt to disassemble or process the LCD module.
- (7)LCD module should be used under recommended operating conditions shown in chapter 6 and 7.
- (8)Response time will be extremely slower at lower temperature than at specified temperature and LCD will show different color when at higher temperature.The phenomenon will disappear when returning to specified condition.
- (9)Foggy dew,moisture condensation or water droplets deposited on surface and contact terminals will cause polarizer stain or damage,the deteriorated display quality and electrochemical reaction then leads to the shorter life time and permanent damage to the module probably.Please pay attention to the environmental temperature and humidity.

2. Precautions for Storage

- (1)Please store LCD module in a dark place,avoid exposure to sunlight,the light of fluorescent lamp or any ultraviolet ray.
- (2)Keep the environment temperature at between 10°C and 35 °C and at normal humidity.Avoid high temperature,high humidity or temperature below 0°C.
- (3)That keeps the LCD modules stored in the container shipped from supplier before using them is recommended.

(4)Do not leave any article on the LCD module surface for an extended period of time.

3. Warranty period

Warrants for a period of 12 Months from the shipping date when stored or used under normal condition.

16. Product tracking

TBD

17. Package Specification

TBD