LCD MODULE SPECIFICATION

Customer: _____

Module No.: _____

Date: **2023-1-31**

Version: **1.0**

For Customer's Acceptance:

Approved by	Comment

Table of Contents

Record of Revision

Rev.	Date	Description	Editor
1.0	2023-1-31	First release	

1 General Specifications

No.	Item	Specification	Remark
1	LCD Size	4.3 inch (Diagonal)	
2	Driver Element	a-Si TFT active matrix	
3	Resolution	480 (RGB) ×272	
4	Display Mode	Normally Black, Transmissive	
5	Pixel Pitch(mm)	0.066 (H) × 0.198 (V)	
6	Display Colors	16.7M	
7	Surface Treatment	/	
8	Color Arrangement	RGB-Stripe	
9	Interface	RGB 24Bit,Digital (TTL)	
10	Viewing Direction	All	
11	Gray Scale Inversion Direction	/	Note 1
12	Outline Dimension (mm)	105.5(W) × 67.2 (H) × 4.75 (T)	
13	Active Area (mm)	95.04 (W) × 53.86 (H)	
14	Touch Screen	With CTP	
15	Display Driver IC	NV3047E	
16	Touch Driver IC	GT911	

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	LED-K	P	LED Cathode	
2	LED-A	P	LED Anode	
3	VSS	P	Power Ground	
4	VDD	P	Power Source	
5	R00	I	RED Data Signal (LSB)	
6	R01	I	RED Data Signal	
7	R02	I	RED Data Signal	
8	R03	I	RED Data Signal	
9	R04	I	RED Data Signal	
10	R05	I	RED Data Signal	
11	R06	I	RED Data Signal	
12	R07	I	RED Data Signal	
13	G00	I	GREEN Data Signal(LSB)	
14	G01	I	GREEN Data Signal	
15	G02	I	GREEN Data Signal	
16	G03	I	GREEN Data Signal	
17	G04	I	GREEN Data Signal	
18	G05	I	GREEN Data Signal	
19	G06	I	GREEN Data Signal	
20	G07	I	GREEN Data Signal	
21	B00	I	BLUE Data Signal(LSB)	
22	B01	I	BLUE Data Signal	
23	B02	I	BLUE Data Signal	
24	B03	I	BLUE Data Signal	
25	B04	I	BLUE Data Signal	
26	B05	I	BLUE Data Signal	
27	B06	I	BLUE Data Signal	
28	B07	I	BLUE Data Signal	
29	VSS	P	Power Ground	
30	DLCK	I	Clock Signal to Sample each date	
31	DISP	I	Display ON/OFF Signal	
32	HSYNC	I	Horizontal Synchronizing Signal	
33	VSYNC	I	Vertical Synchronizing Signal	
34	DE	I	Input Data enable control	
35	NC	-	Set Open	
36	VSS	P	Power Ground	
37	XR	-	Touch Panel PIN(No connection)	

38	YD	-	Touch Panel PIN(No connection)	
39	XL	-	Touch Panel PIN(No connection)	
40	YU	-	Touch Panel PIN(No connection)	

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

2.2 Touch panel pin assignment

Match connector: XF2M-1015-1A by OMRON or equivalent

No.	Symbol	Description
1	GND	Ground
2	VDD	TP 3.3V Power
3	SCL	I2C _SCL(2.8~3.3V), 4.7K~10K pull up resistor needed
4	NC	No connection
5	SDA	I2C_SDA (2.8~3.3V),4.7K~10K pull up resistor needed
6	NC	No connection
7	/RST	External reset(2.8~3.3V)
8	NC	No connection
9	INT	External interrupt (2.8~3.3V)
10	GND	Ground

3 Absolute Maximum Ratings

Ta = 25℃

Item	Symbol	Min.	Max.	Unit	Remark
Power Voltage	VDD	-0.50	4.0	V	
	TP_VDD	-0.50	3.6	V	
Backlight Forward Current(LED)	IF	0	60	mA	
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

VDD=3.3V，GND=0V，Ta = 25℃

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Analog/Digital supply Voltage	VDD	3.0	3.3	3.6	V	
TP supply Voltage	TP_VDD	2.8	3.0	3.3	V	
Input logic high voltage	VIH	0.7VDD	-	VDD	V	R0~R5, G0~G5,0~B5, DE, DCLK, HSYNC, VSYNC, MODE, RESET,
Input logic low voltage	VIL	0		0.3DD	V	
Analog/Digital supply Voltage	I_{VDD}	-	-	30	mA	VDD=3.3V, color bar pattern

4.2 Backlight Unit Driving Condition

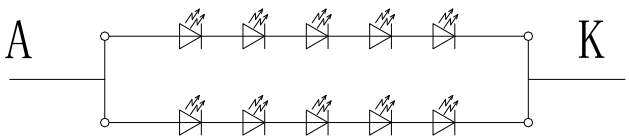
Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Current	I_F	-	40	50	mA	10 LEDs (5 LED Serial, 2 LED Parallel)
Forward Current Voltage	V_F	-	16	17.5	V	
Backlight Power Consumption	W_{BL}	-	640	875	mW	
Operating Life Time	--	30000	--	--	hrs	Note 2, Note 3

Note1: The LED driving condition is defined for each module (5LED Serial, 2 LED Parallel).

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

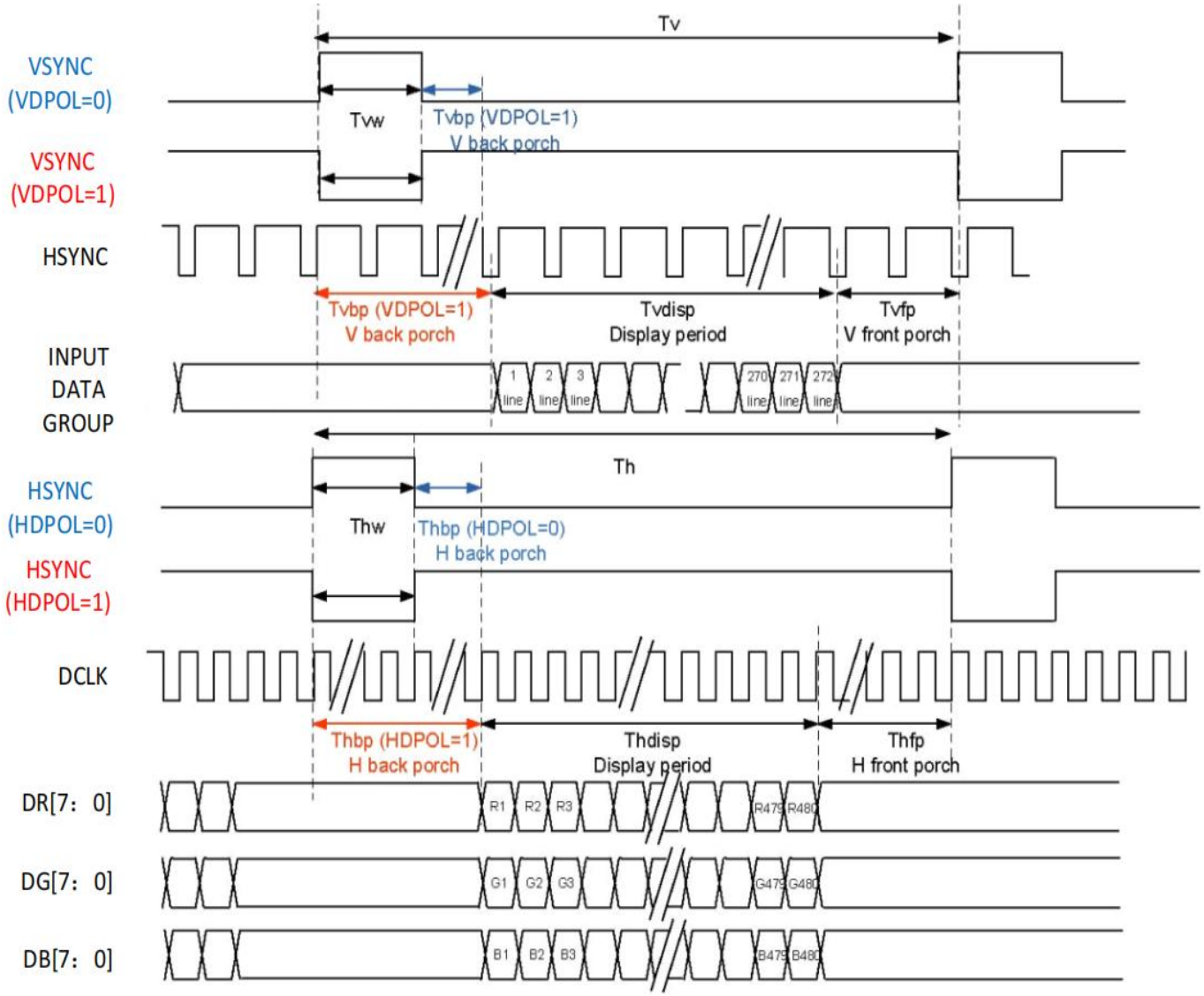
Note3: Optical performance should be evaluated at Ta=25℃ When LED is driven at high current, high ambient temperature & humidity condition. The life time of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating life time is estimated data.

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

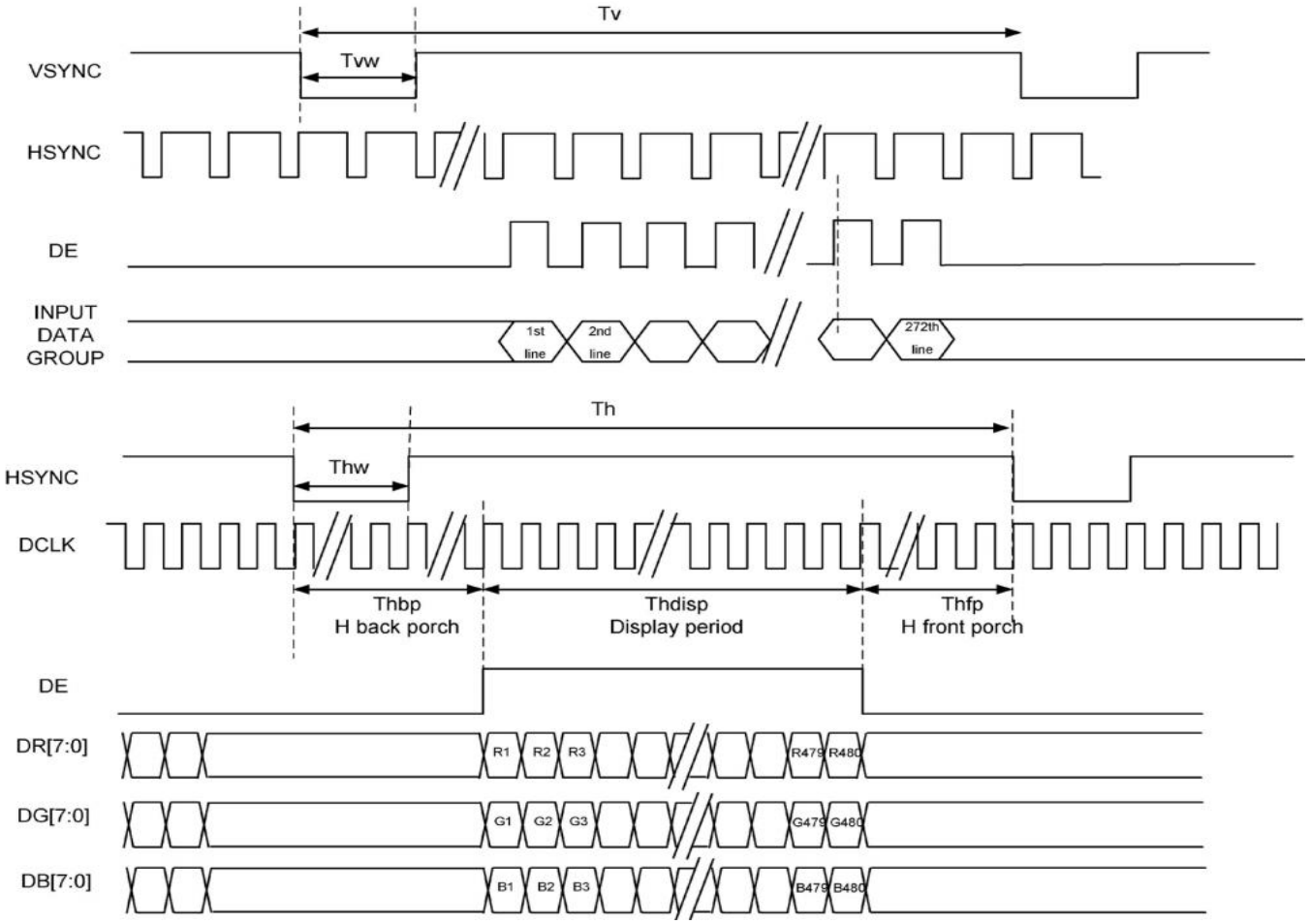


5 Timing Chart

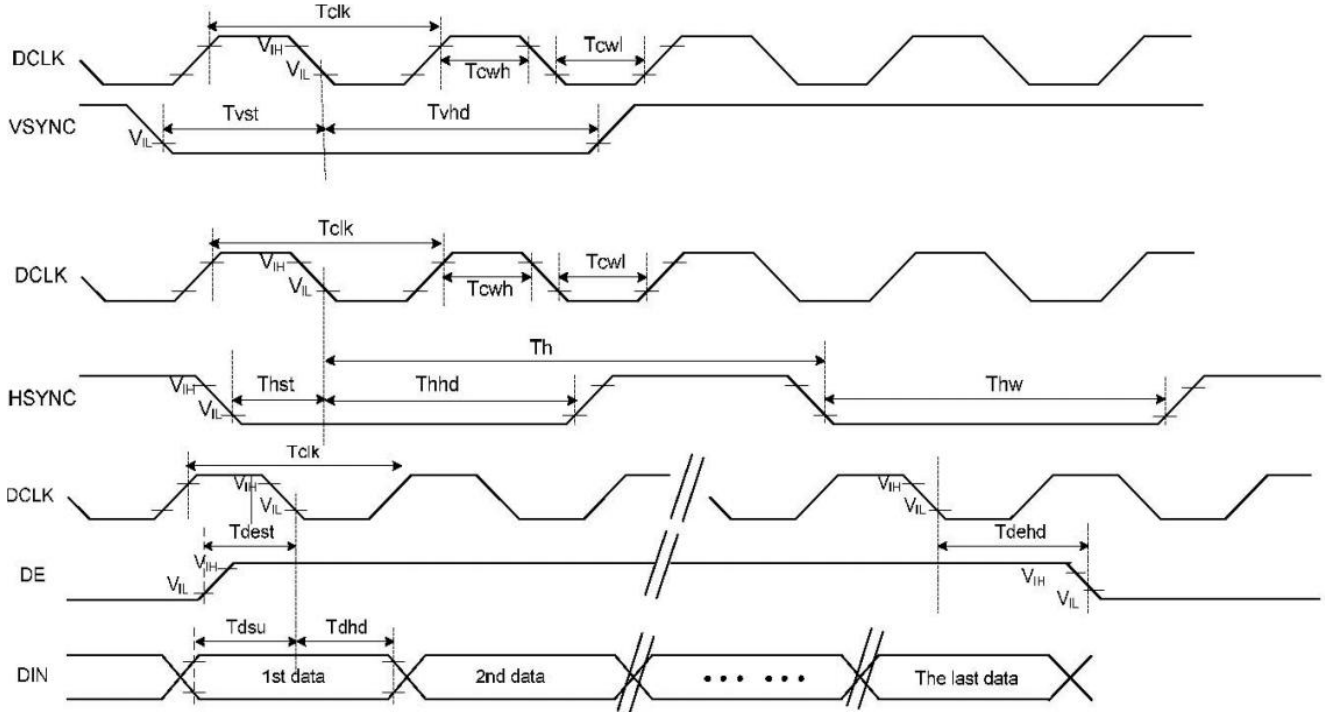
5.1 RGB SYNC Mode:



5.2 RGB SYNC-DE Mode:



5.3 Clock and Data Input Timing Diagram:



Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
System operation timing						
VDD power source slew time	TPOR			20	ms	From 0V to 99% VDD
GRB pulse width	tRSTW	10	50		us	R=10Kohm, C=1uF
Input/ Output timing						
CLK pulse duty	Tcw	40	50	60	%	
Hsync width	Thw	1			DCLK	
Hsync period	Th	55	60	65	us	
Vsync setup time	Tvst	12			ns	
Vsync hold time	Tvhd	12			ns	
Hsync setup time	Thst	12			ns	
Hsync hold time	Thhd	12			ns	
Data setup time	Tdsu	12			ns	
Data hold time	Tdhd	12			ns	
DE setup time	Tdest	12			ns	
DE setup time	Tdehd	12			ns	
SD output stable time	Tst			12	us	Output settled within +20Mv Loading =6.8k+28.2pF
GD output rise and fall time	Tgst			6	us	Output settled (5%~95%), Loading = 4.7k+29.8pF
3-wire serial communication						
Delay between CSB and Vsync	Tcv	1			us	
CS input setup time	Ts0	50			ns	
Serial data input setup time	Ts1	50			ns	
CS input hold time	Th0	50			ns	
Serial data input hold time	Th1	50			ns	
SCL pulse high width	Twh1	50			ns	
SCL pulse low width	Twl1	50			ns	
CS pulse high width	Tw2	400			ns	

5.4 Recommended Timing Setting of TCON

Parallel 24-bit RGB Input Timing (VDD=VDDI= 3.3V, AGND= 0V, TA=25℃)

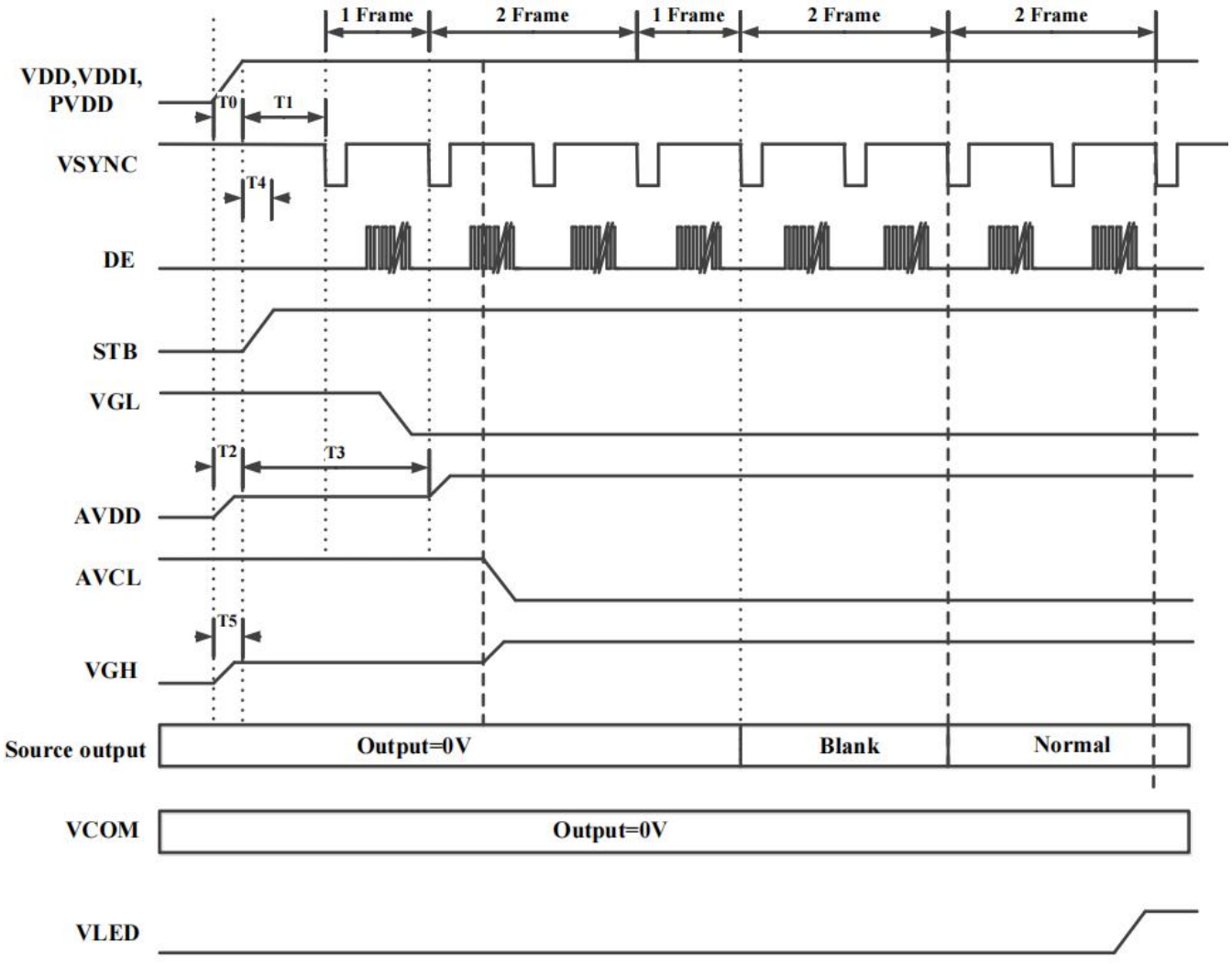
Item		Symbol	Min.	Typ.	Max.	Unit	Remark
DCLK Frequency		Fclk	8	9	12	MHz	
DCLK Period		Tclk	83	111	125	ns	
Frame Pate		FR			75	Hz	
Line Period		Tlp	24			us	
HSYNC	Period Time	Th		531		DCLK	
	Display Period	Thdisp		480		DCLK	
	Back Porch	Thbp		43		DCLK	By H_Blanking setting
	Front Porch	Thfp		8		DCLK	
	Pulse Width	Thw		4		DCLK	
VSYNC	Period Time	Tv		292		H	
	Display Period	Tvdisp		272		H	
	Back Porch	Tvbp		12		H	By V_Blanking setting
	Front Porch	Tvfp		8		H	
	Pulse Width	Tvw		4		H	

Note:

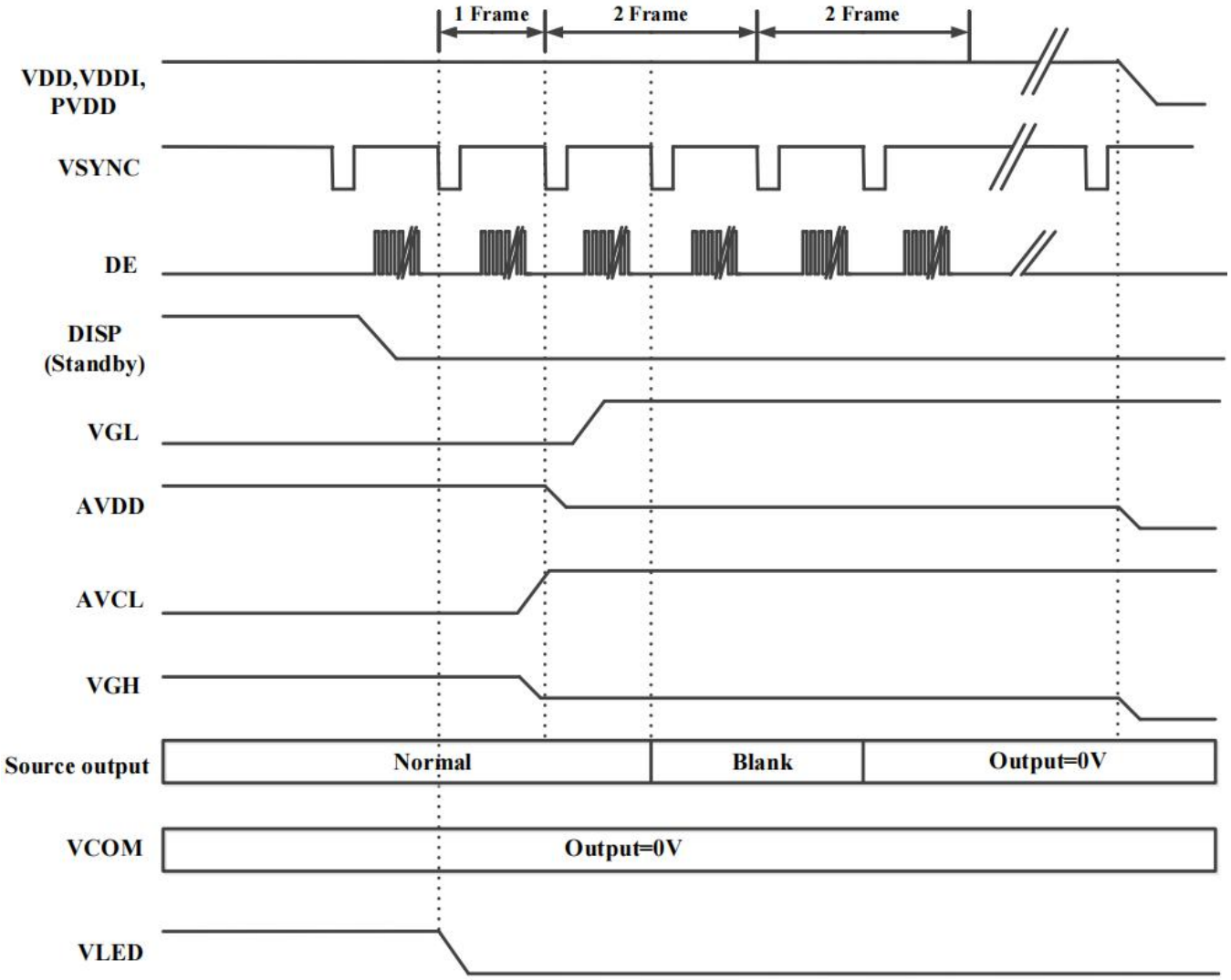
1. It is necessary to keep Tvbp =12, Tvfp = 8 , Tvw = 4 and Thbp = 43, Thfp = 8 Thw = 4 in sync mode.
2. The Max Value and Min Value of porch must satisfy the range of Frame Pate and Line Period
3. It is necessary to keep Thbp>10, Tvbp+Tvfp<128

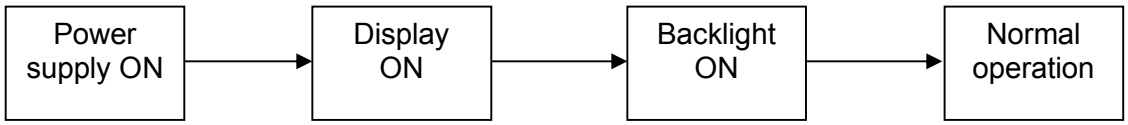
5.4 POWER ON SEQUENCE (VDDI=VDD)

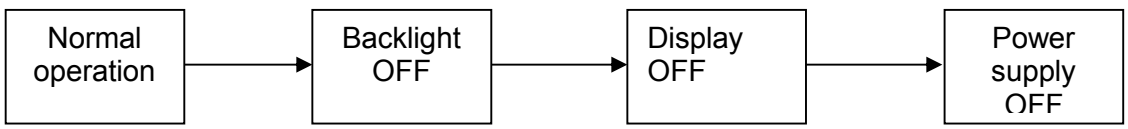
	Description	Min. Time
T0	Determined by the external power	
T1	Time from stable VDD, VDDI, PVDD set-up to the first VSYNC	T1=0
T2	Time from AVDD=0V to AVDD=3.3V	T2=T0
T3	Time from AVDD=3.3V to AVDD=6.0V	T3=T1+ (1*Frame)
T4	Time from stable VDD, VDDI, PVDD set-up to DISP asserted	T4=0
T5	Time from VGH=0V to VGH=3.3V	T5=T0



5.6 POWER OFF SEQUENCE (VDDI=VDD)







6 Optical Characteristics

Ta=25℃

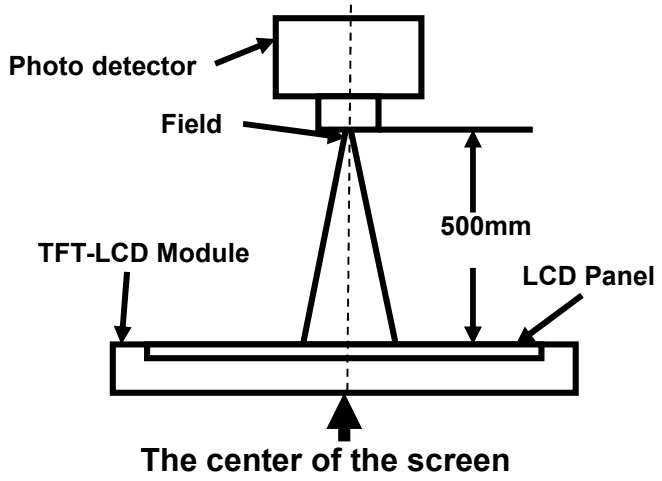
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
View Angles		θT	CR≧10	80	85	-	Degree	Note 2
		θB		80	85	-		
		θL		80	85	-		
		θR		80	85	-		
Contrast Ratio		CR	θ=0°	800	1000	-		Note1 Note3
Response Time		T_{ON}	25℃	--	30	35	ms	Note1 Note4
		T_{OFF}						
Chromaticity	White	x	Backlight is on	0.275	0.305	0.335		Note1 Note5
		y		0.306	0.336	0.366		
	Red	x		0.573	0.603	0.633		
		y		0.277	0.307	0.337		
	Green	x		0.384	0.314	0.344		
		y		0.527	0.557	0.687		
	Blue	x		0.115	0.145	0.175		
		y		0.120	0.150	0.180		
Uniformity		U		70	80	-	%	Note1 Note6
NTSC				-	50	-	%	Note 5
Luminance		L		-	460	-	cd/m^2	Note1 Note7

Test Conditions:

1. I_F= 40 mA, V_F=16V 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.

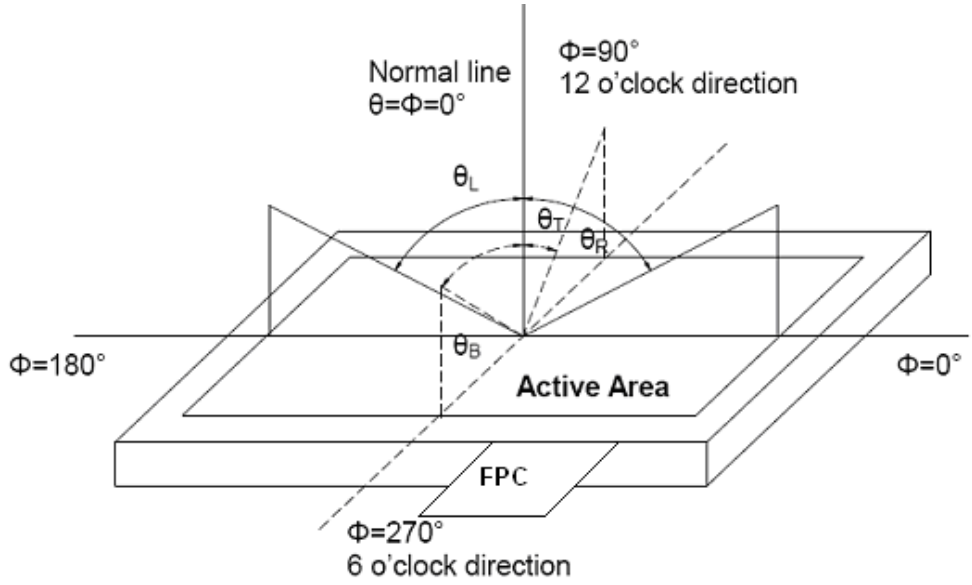
Properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Item	Photo detector	Field
Contrast Ratio	SR-3A	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

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

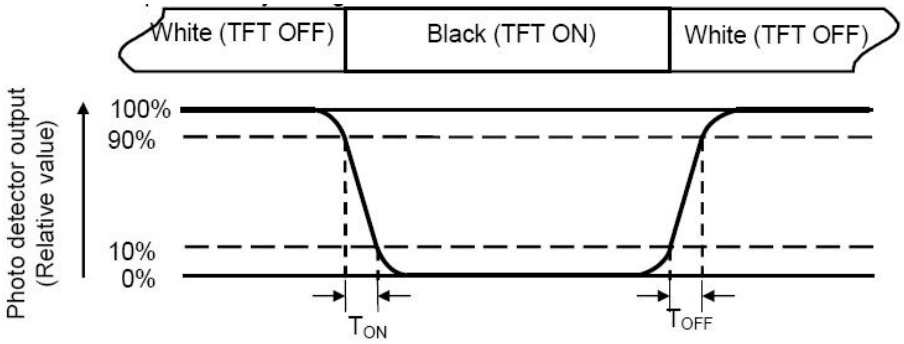
"White state ": The state is that the LCD should drive by Vwhite.

"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)

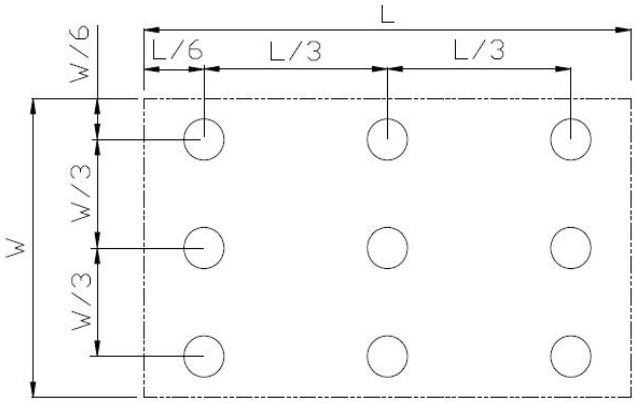
Color coordinates measured at center point of LCD.

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.

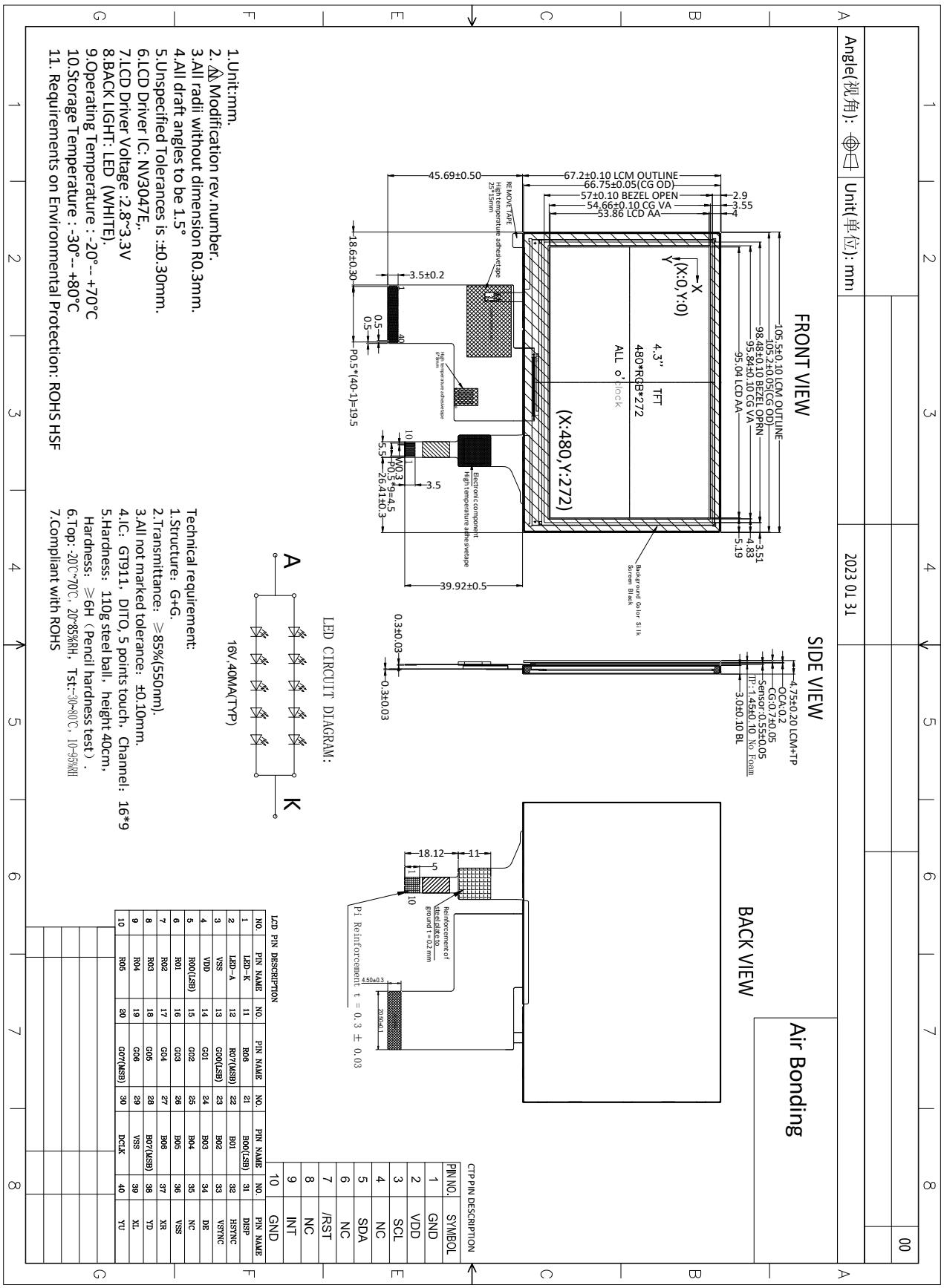
7 Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	Ts = +70℃, 120 hours	IEC60068-2-1 GB2423.2
2	Low Temperature Operation	Ta = -20℃, 120 hours	IEC60068-2-1 GB2423.1
3	High Temperature Storage	Ta = +80℃, 120 hours	IEC60068-2-1 GB2423.2
4	Low Temperature Storage	Ta = -30℃, 120 hours	IEC60068-2-1 GB2423.1
5	Storage at High Temperature and Humidity	Ta = +60℃, 90% RH max,120hours	IEC60068-2-78 GB/T2423.3
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, 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

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

Note2: Ta is the ambient temperature of samples.

8 Mechanical Drawing



1.Unit:mm.
2.⚠ Modification rev.number.
3.All radii without dimension R0.3mm.
4.All draft angles to be 1.5°
5.Unspecified Tolerances is :±0.30mm.
6.LCD Driver IC: NV3047E,.
7.LCD Driver Voltage :2.8~3.3V
8.BACK LIGHT: LED (WHITE).
9.Operating Temperature : -20°-- +70°C
10.Storage Temperature : -30°-- +80°C
11. Requirements on Environmental Protection: ROHS HSF

Technical requirement:
1.Structure: G+G.
2.Transmittance: ⩾85%(550nm).
3.All not marked tolerance: ±0.10mm.
4.IC: GT911. DITO, 5 points touch. Channel: 16*9
5.Hardness: 110g steel ball. height 40cm.
Hardness: ⩾6H (Pencil hardness test).
6.Top: -20℃~70℃, 20~85%RH, Tst:-30~80℃, 10~95%RH
7.Compliant with ROHS

LCD PIN DESCRIPTION

NO.	PIN NAME	NO.	PIN NAME	NO.	PIN NAME	NO.	PIN NAME
1	LED-K	11	R06	21	B00(LSB)	31	DISP
2	LED-A	12	R07(MSB)	22	B01	32	HSYNC
3	VSS	13	G00(LSB)	23	B02	33	VSYNC
4	VDD	14	G01	24	B03	34	DE
5	R00(LSB)	15	G02	25	B04	35	NC
6	R01	16	G03	26	B05	36	VSS
7	R02	17	G04	27	B06	37	XR
8	R03	18	G05	28	B07(MSB)	38	YD
9	R04	19	G06	29	VSS	39	XL
10	R05	20	G07(MSB)	30	DCLK	40	YU

CTP PIN DESCRIPTION

PIN NO.	SYMBOL	PIN NAME
1	GND	GND
2	VDD	VDD
3	SCL	SCL
4	NC	NC
5	SDA	SDA
6	NC	NC
7	/RST	NC
8	NC	INT
9	INT	GND
10	GND	

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.