

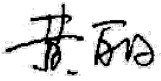
PRODUCT SPECIFICATION

CDTECH Model: **S021BWV01HN-FC01-AF**

CUSTOMER Model: **-**

Description: **2.1 " TFT-LCD Module with CTP**

Version: **2.0**

CDTECH	PREPARED BY	CHECKED BY	APPROVED BY
SIGNATURE			
DATE	2023.7.28	2023.7.28	2023.7.28

CUSTOMER APPROVAL	SIGNATURE	DATE

Record of Revisions

[illegible]



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1. General Specifications

1.1 LCM General Information

Item	Specification	Unit
LCD Size	2.1	inch
Number of Pixels	480 (H) RGB x 480 (V)	pixels
Display Mode	Normally Black	-
Viewing Direction	Free	o' clock
Interface	RGB	-
Display Colors	16.7M	colors
Outline Dimension	73.20 (H) x 73.20 (V) x 3.97 (D)	mm
Active Area	53.28 (H) x 53.28 (V)	mm
Pixel Pitch	0.111 (H) x 0.111 (V)	mm
Driver IC	ST7701SN-G5	-
Operation Temperature	-20~70	°C
Storage Temperature	-30~80	°C

1.2 Touch Panel Information

Item	Specification
Touch Structure	G+FF
Bonding Type with LCM	OCA Optical Bonding
Driver IC	CST328
Interface	I ² C
Touch Count Max	5 Points
Surface treatment	AF
Surface hardness	6H
I2C slave address	0x34
Origin of coordinate	Top Left Corner
Theoretical clicks	> 10000000

Note1: Requirements on environmental protection RoHS compliant.

2. Absolute Maximum Ratings

Item	Symbol	MIN.	MAX.	Unit	Note
Analog Supply voltage	VDD	-0.3	5.0	V	Note 1

Note 1: Permanent damage may occur to the LCD module if beyond this specification.

Functional operation should be restricted to the conditions described under normal operating conditions.

3. Electrical Characteristics

3.1 Recommended Operating Condition for TFT LCD

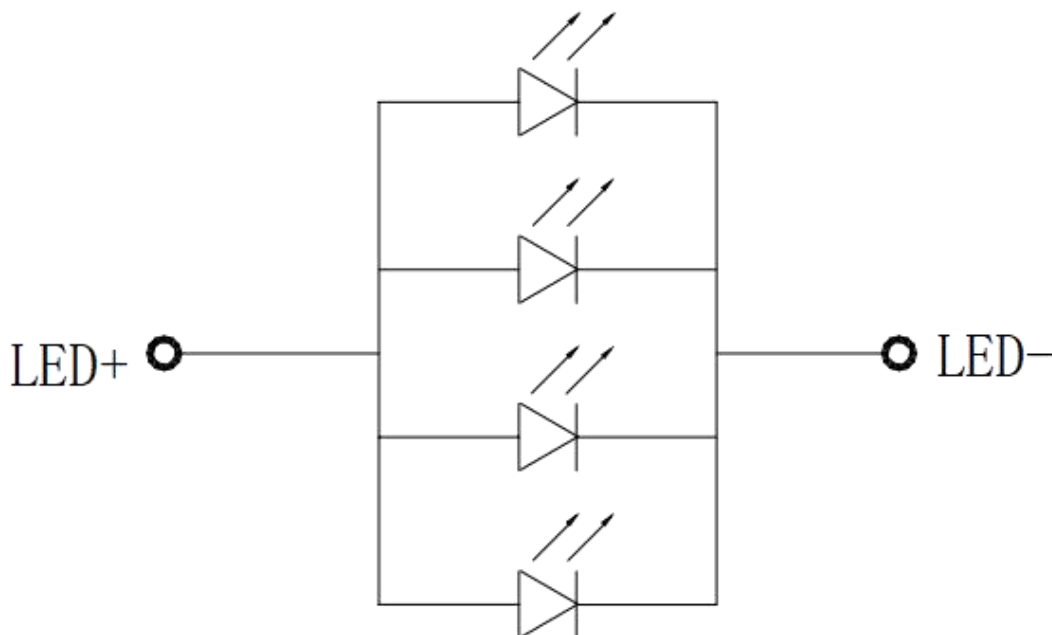
Item	Symbol	Min.	Typ.	Max.	Unit	Note
Analog Supply voltage	VCC	2.5	2.8	3.3	V	
Analog supply current	I _{VCC}	-	TBD	-	mA	VCC=2.8V
Logic input voltage	V _{IH}	0.7*VCC	-	VCC	V	
	V _{IL}	GND	-	0.3*VCC	V	

3.2 Recommended Driving Condition for Backlight

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Driving Current	I _F	-	80	-	mA	
Driving Voltage	V _F	2.7	-	3.4	V	
Power consumption	W _{BL}	0.216	-	0.272	W	
LED Life-Time	N/A	-	50,000	-	Hours	Ta=25℃ Note 1

Note 1: LED lifetime is defined as the module brightness decay 50% of original brightness at Ta=25 degree, typical current.

Note 2:LED circuit :



3.3 Touch Panel

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply voltage	VCC	-	3.3	-	V	
Analog supply current	I _{VCC}	-	TBD	-	mA	VCC=3.3V
Input high-level voltage	V _{IH}	0.7*VCC	-	VCC	V	
Input low -level voltage	V _{IL}	GND	-	0.3*VCC	V	

4. Interface Pin Assignment

4.1 LCM Pin Assignment

Recommended connector: TF31-40S-0.5SH manufactured by HIROSE

No.	Symbol	Description
1	LED_A	Power for LED backlight (Anode)
2	LED_ K1	Power for LED backlight (Cathode)
3	LED_ K2	Power for LED backlight (Cathode)
4	GND	Ground
5	VCC	Power supply
6	RESET	Global reset pin
7-8	NC	No connection
9	SDA	Serial input signal
10	SCK	Serial clock signal
11	CS	Chip select input signal
12	PCLK	Dot clock signal input. Latching input data at its rising edge
13	DE	Data enable input. Active high to enable the input data bus under “DE Mode”
14	VSYNC	Vertical sync input. Negative polarity
15	HSYNC	Horizontal sync input. Negative polarity
16	DB0	Data bus
17	DB1	Data bus
18	DB2	Data bus
19	DB3	Data bus
20	DB4	Data bus
21	DB5	Data bus
22	DG0	Data bus
23	DG1	Data bus
24	DG2	Data bus
25	DG3	Data bus
26	DG4	Data bus

27	DG5	Data bus
28	DR0	Data bus
29	DR1	Data bus
30	DR2	Data bus
31	DR3	Data bus
32	DR4	Data bus
33	DR5	Data bus
34	GND	Ground
35	TP_ INT	Interrupt signal for CTP (3.3V TYP)
36	TP_SDA	I2C data input and output for CTP (3.3V TYP)
37	TP_SCL	I2C clock input for CTP (3.3V TYP)
38	TP_RST	Reset Pin for CTP (3.3V TYP)
39	TP_VCC	Power supply for CTP (3.3V TYP)
40	GND	Ground

5. Interface Characteristics

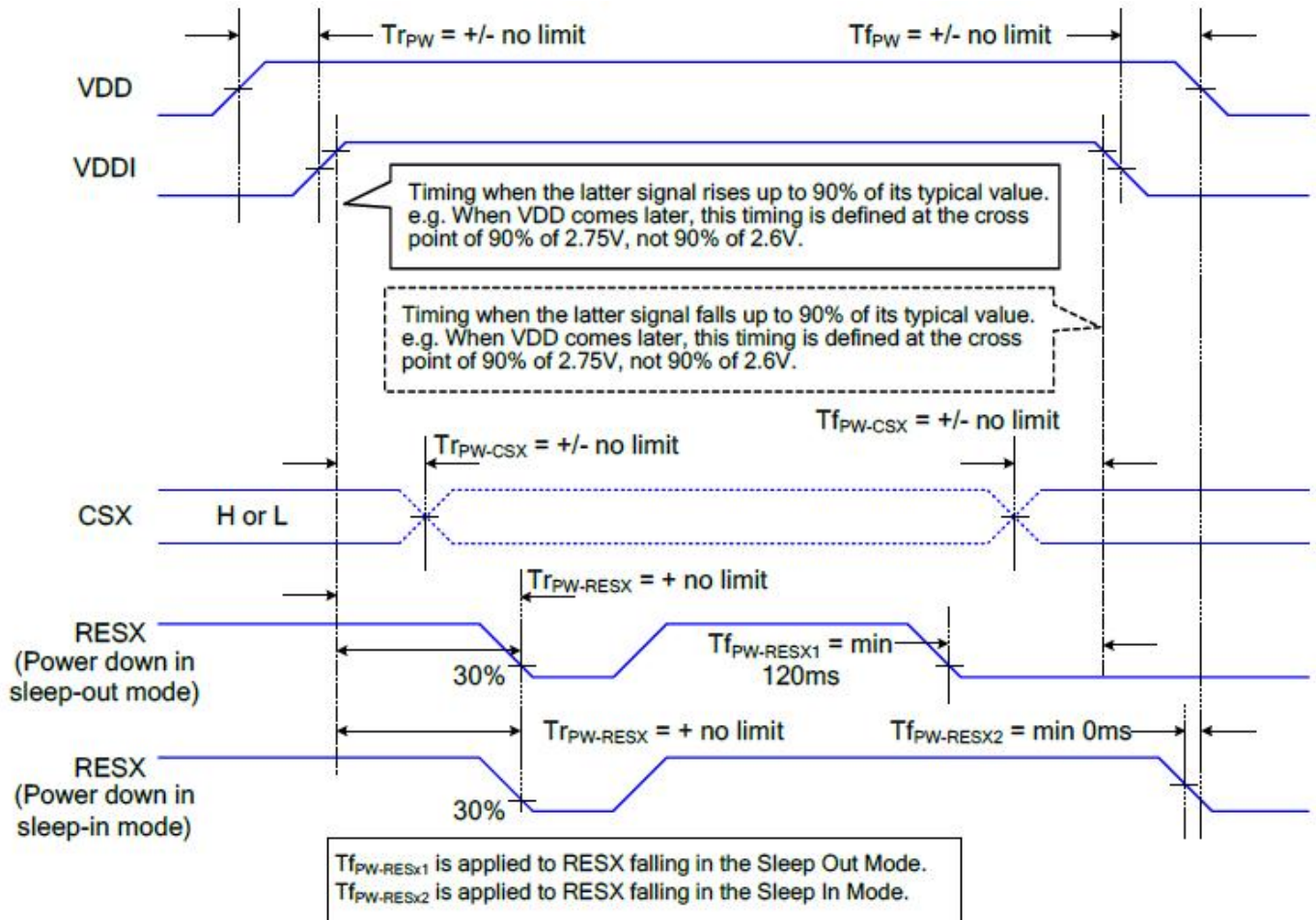
5.1 POWER ON/OFF SEQUENCE

VDDI and VDDA can be applied or powered down in any order. During the Power Off sequence, if the LCD is in the Sleep Out mode, VDDA and VDDI must be powered down with minimum 120msec. If the LCD is in the Sleep In mode, VDDA and VDDI can be powered down with minimum 0msec after the RESX is released. CSX can be applied at any timing or can be permanently grounded. RESX has high priority over CSX.

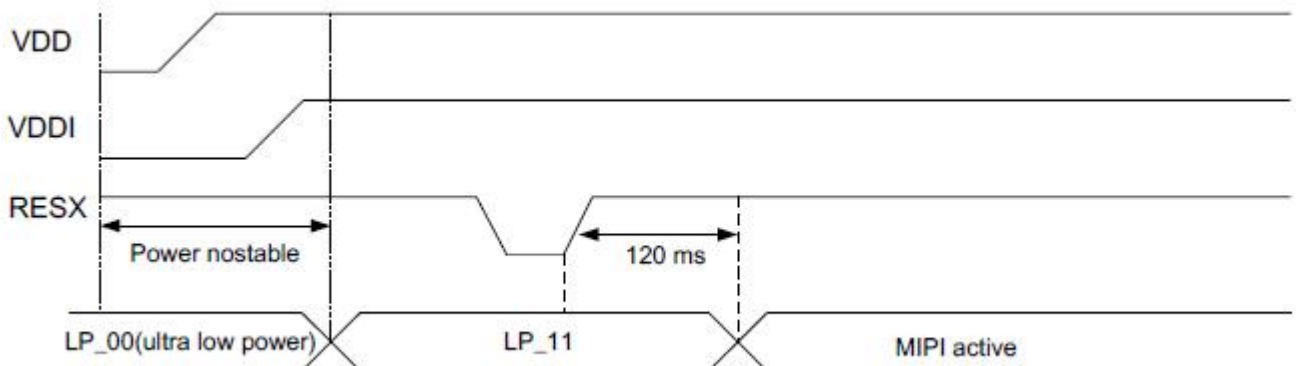
Notes:

1. There will be no damage to the ST7701SN if the power sequences are not met.
2. There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.
3. There will be no abnormal visible effects on the display between the end of Power On Sequence and before receiving the Sleep Out command, and also between receiving the Sleep In command and the Power Off Sequence.
4. If the RESX line is not steadily held by the host during the Power On Sequence as defined in Sections 9.1 , then it will be necessary to apply the Hardware Reset (RESX) after the completion of the Host Power On Sequence to ensure correct operations. Otherwise, all the functions are not guaranteed.
5. When VDDA is in power off State , the MIPI must set in Ultra Low Power Mode (GND Level).

The power on/off sequence is illustrated below:

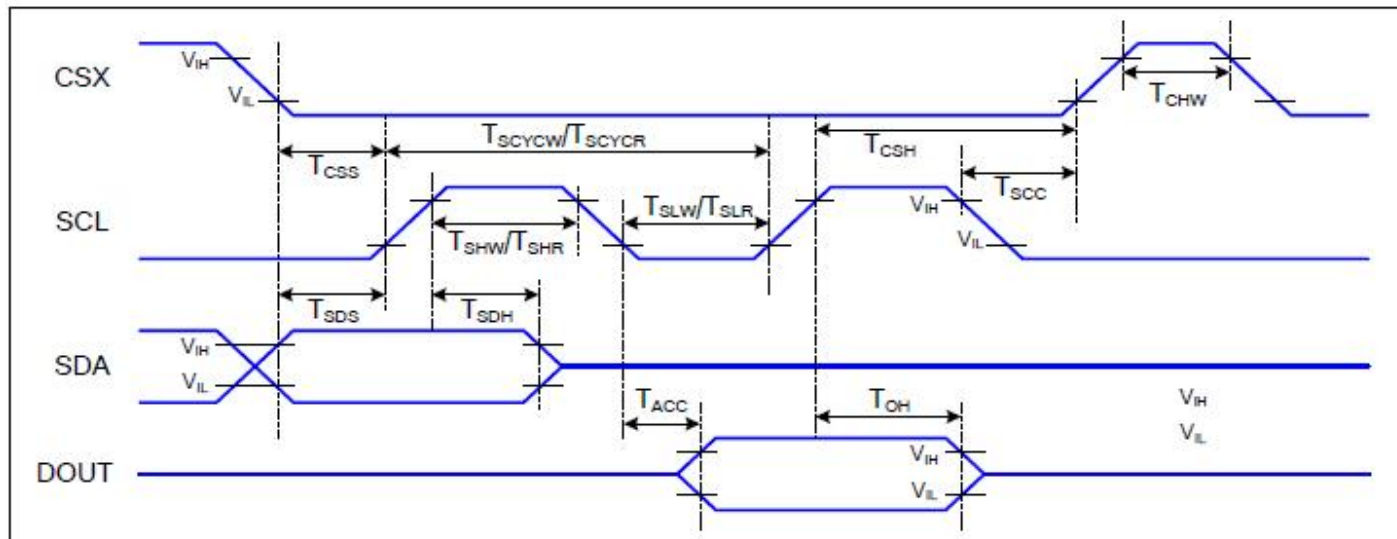


Note5:



5.2 AC Characteristics

5.2.1 Serial Interface Characteristics (3-line serial):

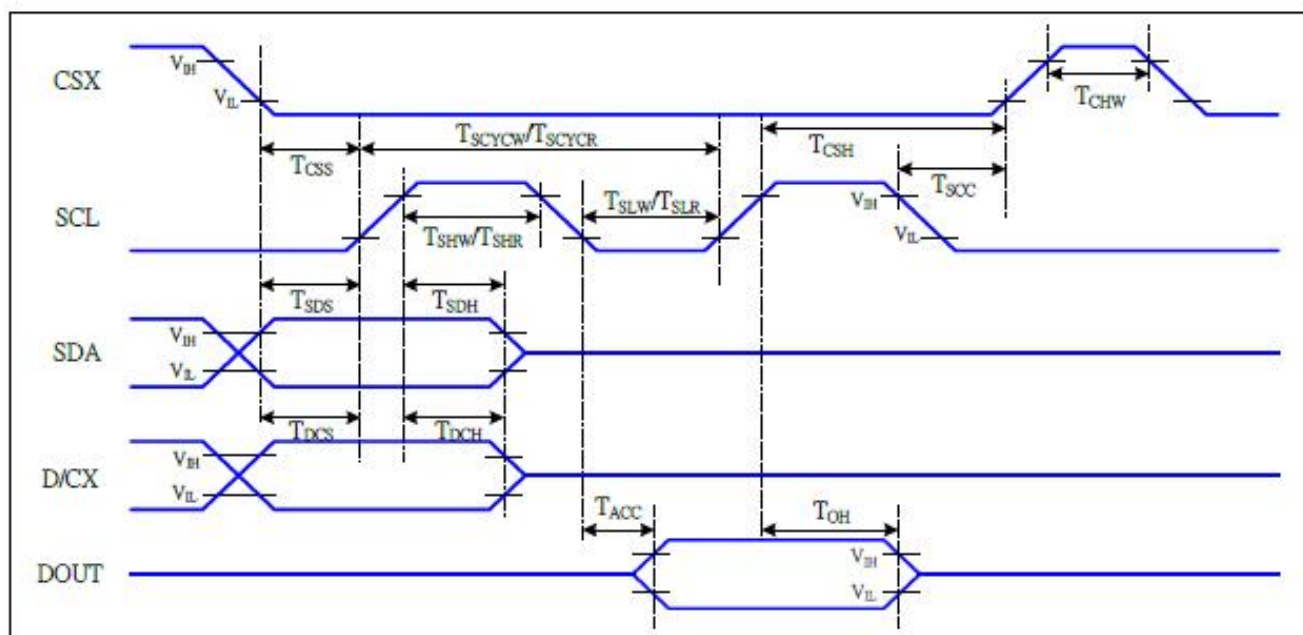


3-line serial Interface Timing Characteristics

Signal	Symbol	Parameter	Min	Max	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	60		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
SDO (DOUT)	T_{ACC}	Access time	20	50	ns	Max: CL=30pF
	T_{OH}	Output disable time	50	50	ns	Min: CL=8pF

3-line serial Interface Characteristics

5.2.2 Serial Interface Characteristics (4-line serial):



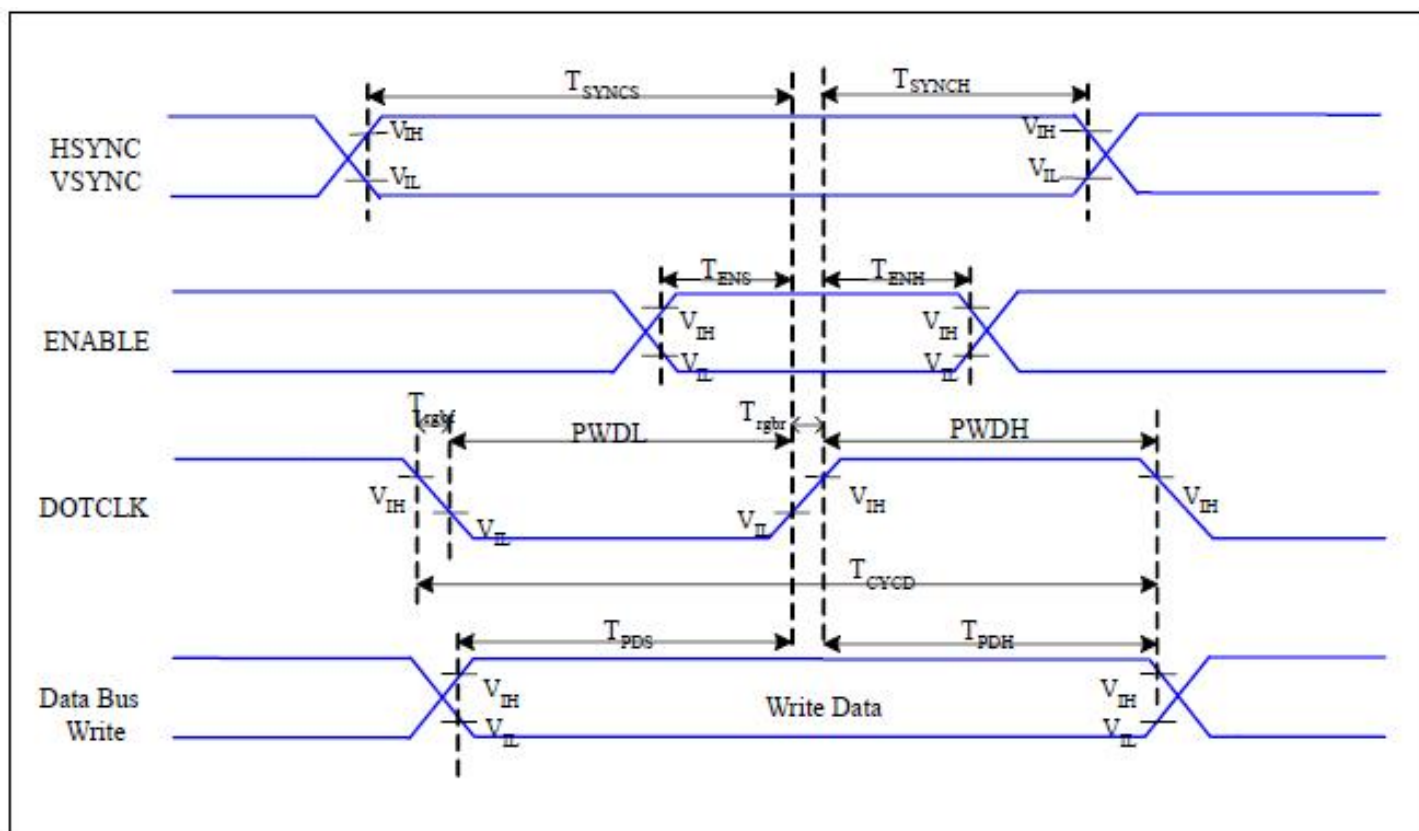
4-line serial Interface Timing Characteristics

$V_{DD1}=1.8, V_{DD}=2.8, AGND=DGND=0V, T_a=25\text{ }^{\circ}\text{C}$

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
SDO (DOUT)	T_{ACC}	Access time	20	50	ns	Max: CL=30pF Min: CL=8pF
	T_{OH}	Output disable time	50	50	ns	

4-line serial Interface Characteristics

5.2.3 RGB Interface Characteristics :



RGB Interface Timing Characteristics

$V_{DDI}=1.8, V_{DD}=2.8, AGND=DGND=0V, T_a=25\text{ }^{\circ}\text{C}$

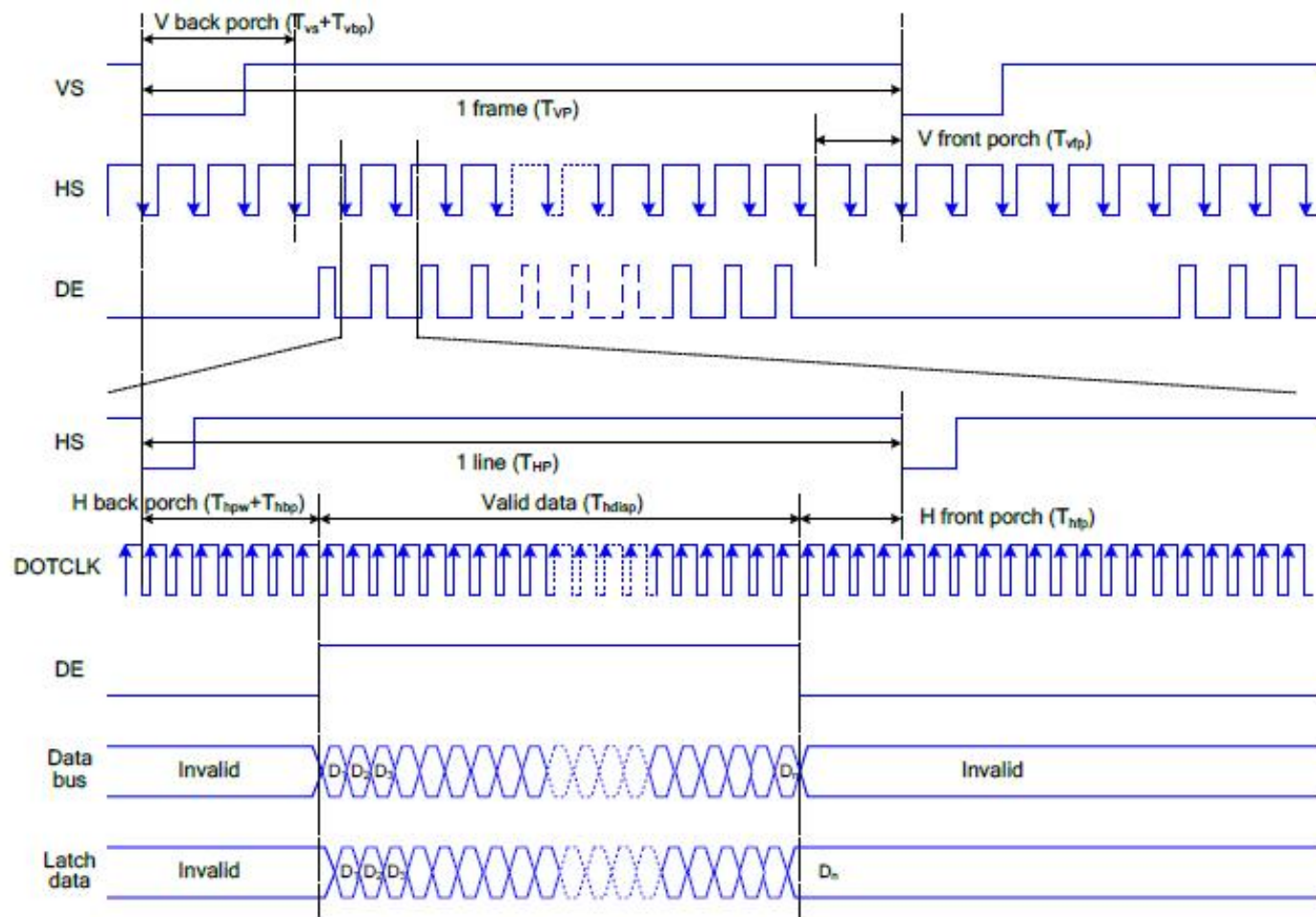
Signal	Symbol	Parameter	MIN	MAX	Unit	Description
HSYNC, VSYNC	T_{SYNCS}	VSYNC, HSYNC Setup Time	5	-	ns	
ENABLE	T_{ENS}	Enable Setup Time	5	-	ns	
	T_{ENH}	Enable Hold Time	5	-	ns	
DOTCLK	PWDH	DOTCLK High-level Pulse Width	15	-	ns	
	PWDL	DOTCLK Low-level Pulse Width	15	-	ns	
	T_{CYCD}	DOTCLK Cycle Time	33	-	ns	
	Trghr, Trghf	DOTCLK Rise/Fall time	-	15	ns	
DB	T_{PDS}	PD Data Setup Time	5	-	ns	
	T_{PDH}	PD Data Hold Time	5	-	ns	

18/16 Bits RGB Interface Timing Characteristics

5.3 RGB Interface Timing

5.3.1 Timing Chart of Signals in RGB Interface DE Mode

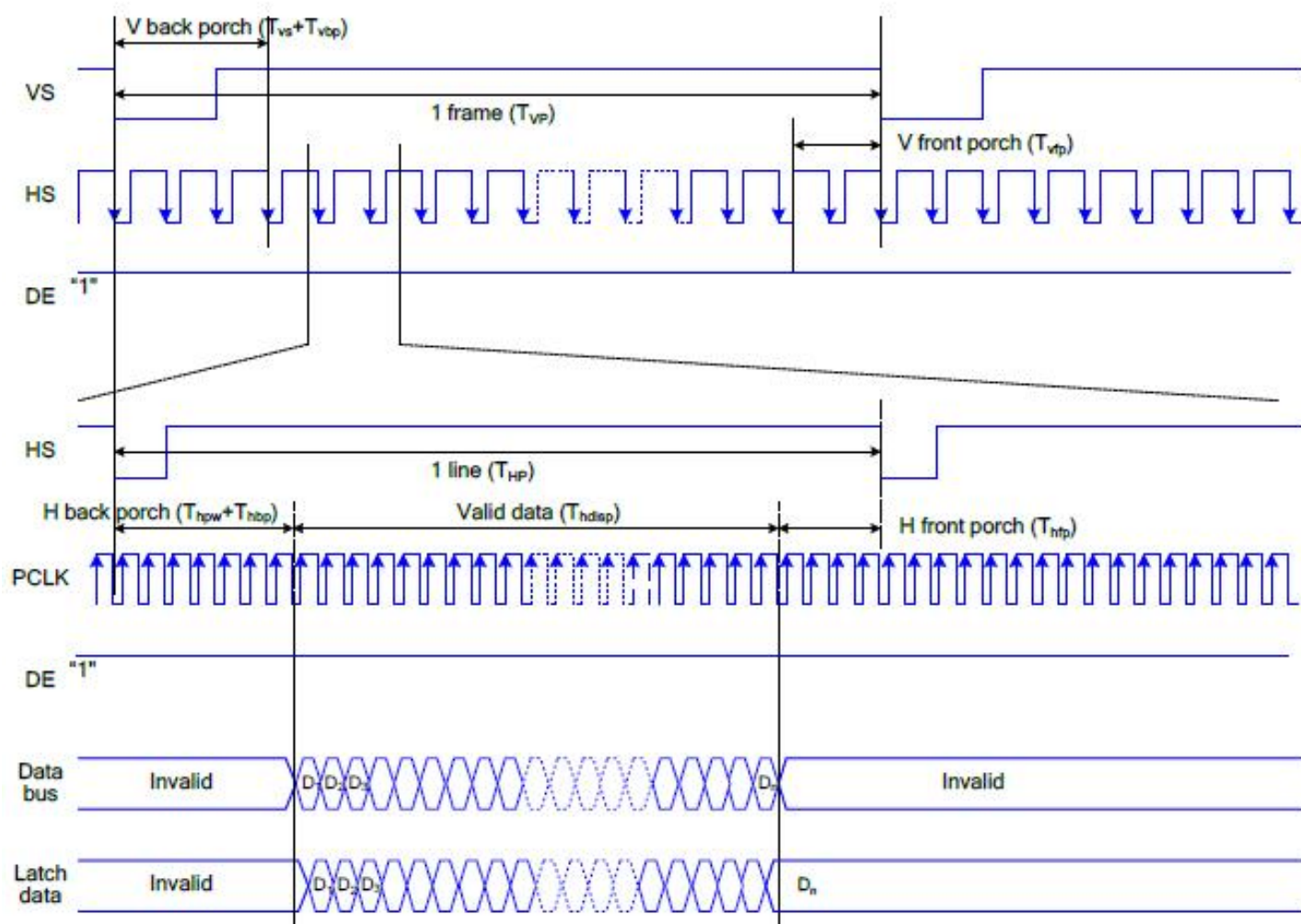
The timing chart of RGB interface DE mode is shown as follows.



Note: The setting of front porch and back porch in host must match that in IC as this mode.

5.3.2 Timing chart of RGB interface HV mode

The timing chart of RGB interface HV mode is shown as follows.

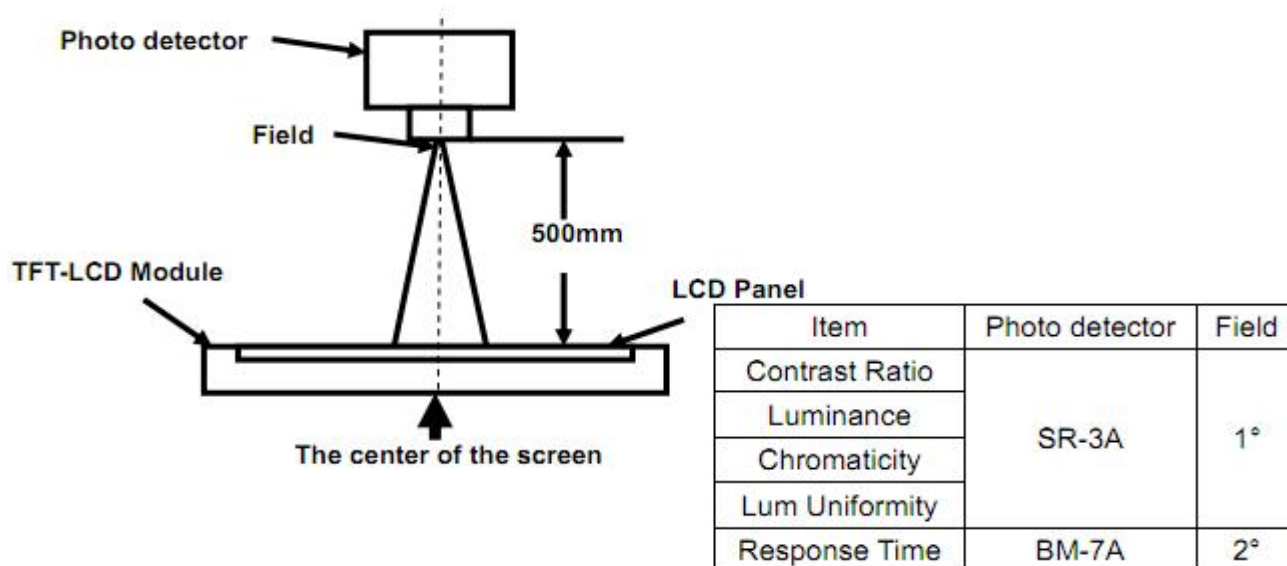


6. Optical Specifications

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Viewing Angle (CR≥10) B/L ON	θ_T	$\Phi=90^\circ$ (12 o'clock)	80	85	-	deg	Note2
	θ_B	$\Phi=270^\circ$ (6 o'clock)	80	85	-	deg	Note2
	θ_L	$\Phi=180^\circ$ (9 o'clock)	80	85	-	deg	Note2
	θ_R	$\Phi=0^\circ$ (3 o'clock)	80	85	-	deg	Note2
Response Time	T_{ON}	Normal $\theta=\Phi=0^\circ$	-	15	17	msec	Note4
	T_{OFF}		-	15	17	msec	Note4
Contrast Ratio	CR		800:1	1000:1	-	-	Note1 Note3
Color Chromaticity	W_X		0.250	0.300	0.350	-	Note1 Note5
	W_Y		0.276	0.326	0.376	-	Note1 Note5
	R_x		0.608	0.638	0.668	-	Note1 Note5
	R_y		0.300	0.330	0.360	-	Note1 Note5
	G_x		0.324	0.354	0.354	-	Note1 Note5
	G_y		0.557	0.587	0.617	-	Note1 Note5
	B_x		0.110	0.140	0.170	-	Note1 Note5
	B_y		0.042	0.072	0.102	-	Note1 Note5
Luminance	L		350	400	-	cd/m ²	Note1 Note7
Luminance Uniformity	YU		75	80	-	%	Note1 Note6
NTSC	-		64	69	-	%	-

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.



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).

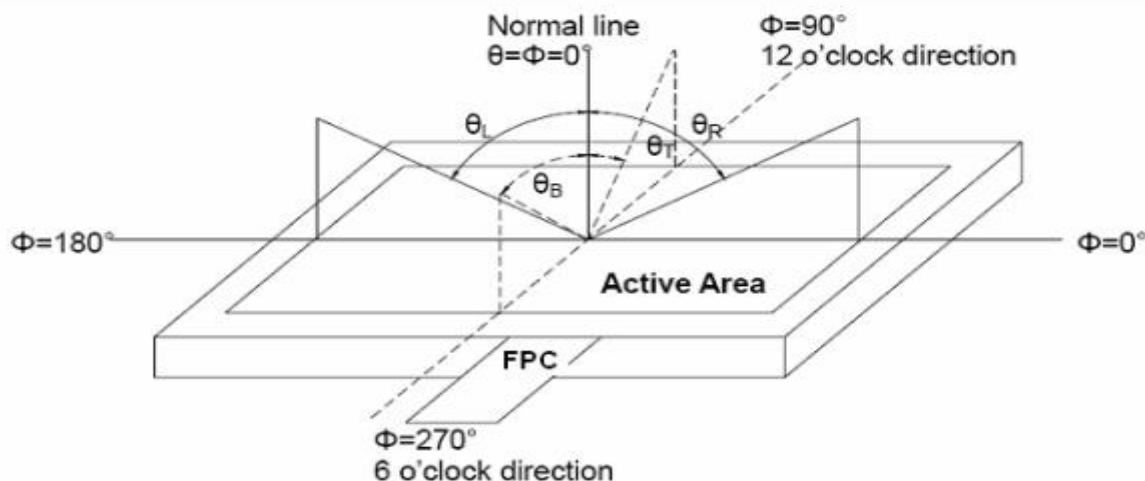


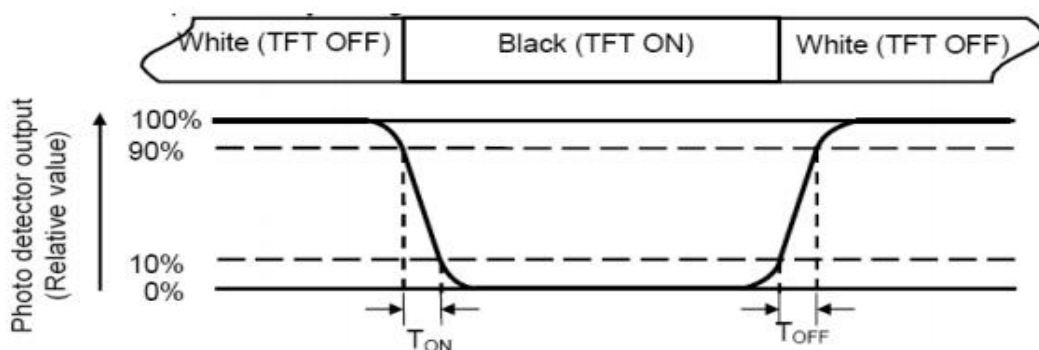
Fig. 1 Definition of viewing angle

Note 3: Definition of contrast ratio

$$CR = \frac{\text{Luminance with all pixels white}}{\text{Luminance with all pixels black}}$$

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 (TON) is the time between photo detector output intensity changed from 90% to 10%. And fall time (TOFF) 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

The luminance uniformity in surface luminance is determined by measuring luminance at each test position 1 through n, and then dividing the maximum luminance of n points luminance by minimum luminance of n points luminance. For more information see FIG.2.

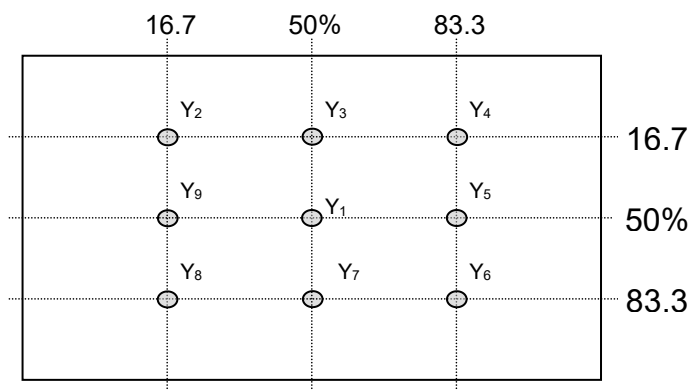


Fig. 2 Definition of points

Note 7: Definition of Luminance (Refer Fig. 2)

Surface luminance is the luminance with all pixels displaying white.

L_v = Average Surface Luminance with all white pixels($P_1, P_2, P_3, \dots, P_n$).

7. Reliability Test Items

Test Item	Test Conditions
High Temperature Storage	Ta= +80℃ 96hrs
Low Temperature Storage	Ta= -30℃ 96hrs
High Temperature Operation	Ta= +70℃ 96hrs
Low Temperature Operation	Ta= -20℃ 96hrs
High Temperature and Humidity Storage	Ta= +60℃, 90% RH 96hrs
Thermal Shock (Non-operation)	-30℃/30 min ~ +80℃/30 min for 20 cycles Start with cold temperature end with high temperature
Electro Static Discharge	Contact = ± 4 kV, class B Air = ± 8 kV, class B R=330Ω,C=150pF
Vibration	Sweep: 10Hz~55Hz~10Hz Stroke: 1.5mm 2 hrs for each direction of X .Y. Z.
Mechanical Shock	60G 6ms,±X,±Y,±Z 3 times for each direction
Package Drop Test	Height: 60 cm 1 corner, 3 edges, 6 surfaces

Notes: The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample will not be accepted if appear these defects:

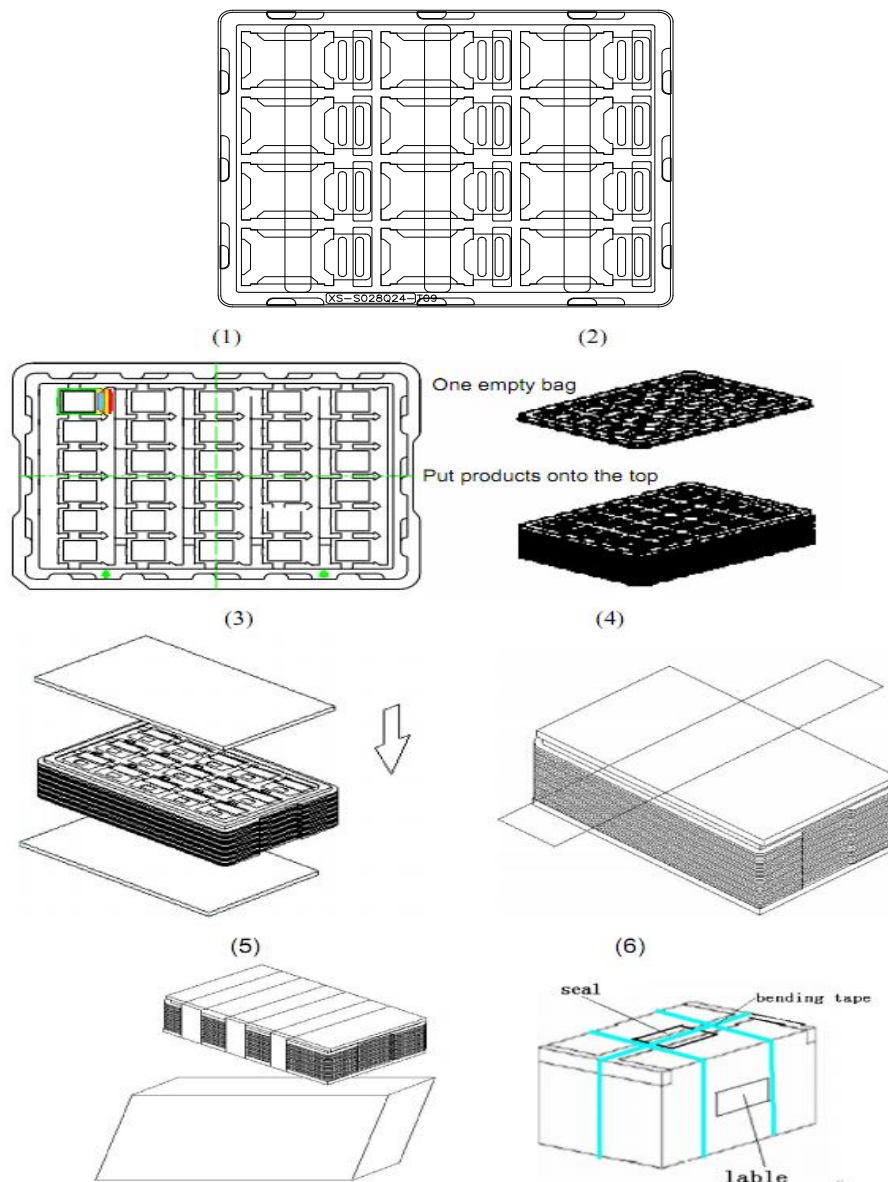
- 1). Air bubble in the LCD
- 2). Seal leak or Glass crack
- 3). Non display or abnormal display
- 4). Brightness reduction >50%

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9. Packing

Packing Method



Steps:

1. Put module into tray cavity
2. Tray stacking
3. Put 1 cardboard under the tray stack and 1 cardboard above
4. Fix the cardboard to the tray stack with adhesive tape
5. Put the tray stack into carton
6. Carton sealing with adhesive tape

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
- Ketene
- 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

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