深圳市一众显示科技有限公司

SHEN ZHEN TEAM SOURCE DISPLAY TECH. CO, TD.

TFT-LCD Module Specification

Module NO.：TST035HVHI-48

Version： V1.0

☐ **APPROVAL FOR SPECIFICATION** ☐ **APPROVAL FOR SAMPLE**

For Customer's Acceptance：	
Approved by	**Comment**

Team Source Display：		
Presented by	**Reviewed by**	**Organized by**

Version No.	Date	Content	Remark
V1.0	2018-09-25	Initial Release	

Document Revision History

Version	Date	Page	Description	Changed By
V1.0	2018.09.25		First issue	

Index

Contents **Page**

1. LCM Specification

1.1 Description

        TST035HVHI-48   is a transmissive type color active matrix liquid crystal display(LCD) which uses amorphous thin film transistor(TFT) as switching devices. This product is composed of a TFT LCD panel, a drive IC, a FPC and a LED-backlight unit. The active display area is 3.5 inches diagonally measured and the native resolution is 320*RGB*480.Features of this product are listed in the following table.

1.2 Functions & Features

Table 1.1 Module Functions & Features

Parameter	Value	Unit
LCD Mode	TFT/Transmissive	-
Color Depth	16.7M	-
Display Resolution	320RGB*480	pixels
Module Size	53.76(W)*84.18(H)*3.30(T)(Exclude FPC)	mm
Active Area (A.A)	48.96(W)*73.44(H)	mm
Pixel Arrangement	RGB-stripe	-
Viewing Direction	Wide View	
Display Mode	Normally Black	
LCD Controller/Driver	ILI9488	-
IC Package Type	COG	-
Interface	RGB 18-bit	-
Power Supply Voltage	2.8~3.3	V
Back-light	White LED*6	PCS
Liuminance	350(typ)	cd/m2

2. Mechanical Specification

GENERAL TOLERANCE:±0.2

Item	Specification
LCD Type	3.5"TFT,Transmissive, Normally white,TN
Resolution	320(RGB)*480
View Direction	All O'CLOCK
Driver IC	ILI9488
Color Depth	262K
Interface Types	SPI3+RGB18-bit
Operating voltage	VCC=2.8~3.3V,1.8V≤IOVCC≤VCC
TP/Lens	Without
Backlight LEDs	6 LEDs, 120mA,3.2V
Surface luminance	350 cd/m²
Operating temperature	-20 ℃~70 ℃
Storage Temperature	-30 ℃~80 ℃
Storage Humidiiy	60℃ 90% max

"☞" Need to pay attention to the key size with ∗

变更记录(Change History)

版本(Version)	日期(Date)
版本(Version)	
V1	
V2	

LED CIRCUIT DIAGRAM
(默认6颗灯，背光可兼容8个灯)

LED_A
LED_K

View Direction:All
3.5 IPS
320x480

弯折贴合FPC后出货

18-Bit RGB 接口

Pin	Assigment
1	GND
2	RESET
3	CS
4	SCLK
5	NC
6	SDI
7	SDO
8	NC
9	DB0
10	DB1
11	DB2
12	DB3
13	DB4
14	DB5
15	DB6
16	DB7
17	DB8
18	DB9
19	DB10
20	DB11
21	DB12
22	DB13
23	DB14
24	DB15
25	DB16
26	DB17
27	GND
28	VS
29	HS
30	DOTCLK
31	ENABLE
32	GND
33	IOVC
34	VCC
35	NC
36	NC
37	NC
38	LED_A
39	LED_K
40	NC

东莞市一众显示科技有限公司
DONG GUAN TEAM SOURCE DISPLAY TECH. CO, LTD.

视 角 (View):		设 计 (DESIGN)	审 核 (AUDITING)	批 准 (APPROVED)
单 位 (Unit): MM		Aron		
比 例 (Proportion): 1 : 1				
页 面 (Page): 1 / 1				
产品型号 (Product Type)TST035HVHI-48		2018.9.25		
版本(Version) V1				

3. Pin Descriptions

Pin No.	Symbol	I/O	Functional	Remark
1	GND	P	System ground.	
2	RESET	I	RESX pin	
3	CS	I	Chip select input pin	
4	SCLK	I	Serial Clock	
5	IC-ID	-	N.C	
6	SDI	I	Serial data input bi-direction pin	
7	SDO	O	Serial data output	
8~25	DB0-DB17	I/O	18-Bit RGB interface data bus	
26	GND	P	System ground.	
27	VS	I	Frame synchronizing signal	
28	HS	I	Line synchronizing signal	
29	DOTCLK	I	Dot clock signal	
30	ENABLE		A data ENABLE input signal	
31	GND	P	System ground.	26
32	IOVCC	P	Power supply, 1.65~3.2V	
33	VCC	P	Power supply, 3.0~3.2V	
34	NC	-		
35	NC	-		
36	NC	-		
37	NC	-		
38	LEDA	P	LED Power supply +	
39	LEDK	P	LED Power supply -	
40	NC	-	-	

4. Electrical Units

4.1 Absolute Maximum Ratings

The absolute maximum ratings are list on Table 4.1. When used out of the absolute maximum ratings, the LCM may be permanently damaged. Using the LCM within the following electrical characteristics limit is strongly recommended for normal operation. If these electrical characteristic conditions are exceeded during normal operation, the LCM will malfunction and cause poor reliability.

Table 4.1   Module Absolute Maximum Ratings

Item	Symbol	Unit	Value	Note
Input power supply	Vdd	V	-0.3 to +3.6	
Analog power supply	Avdd	V	-0.3 to +3.6	
Operating Temperature	Top	°C	-20 to +70	
Storage Temperature	Tst	°C	-30 to +80	
Operating Humidity	Hop	%(RH)	80	

(VSS=0V)

4.2 Electrical characteristics

Table 4.2:DC Characteristic

Item		Symbol	Condition	Min.	Type.	Max.	Unit
Supply Voltage	Logic	IOVCC	---	1.65	1.8	3.2	V
Analog power supply	Logic	VCC	---	2.5	2.8	3.2	V
Input Voltage	H level	V_{IH}	---	0.7IOVdd	---	IOVdd	V
	L level	V_{IL}		DGND	---	0.3IOVdd	
Output Voltage	H level	V_{oH}	---	0.8IOVdd	---	IOvdd	V
	L level	V_{ol}	---	DGND	---	0.2IOVdd	

4.3 Back-light Specification

Table 4.3 Back-light Characteristics

Item	Symbol	Conditions	Min.	Type.	Max.	Unit
Supply Voltage	VF	Only Backlight	--	3.2	--	V
Supply Current	IF			120		mA
Average Brightness	IV	Backlight Current IF=120mA	4500	4800	-	Cd/m^2
CIE Color Coordinate (Without LCD)	X	Backlight Current IF=120mA	0.270	--	0.310	–
	Y		0.270	0.270	0.310	
Uniformity	B	Backlight Current IF=120mA	--	80%	–	%
Color	White					

Note: 6 LEDs in Parallel connection.

5. AC Characteristics

RGB 16 / 18-Bit interface Timing Characteristics:
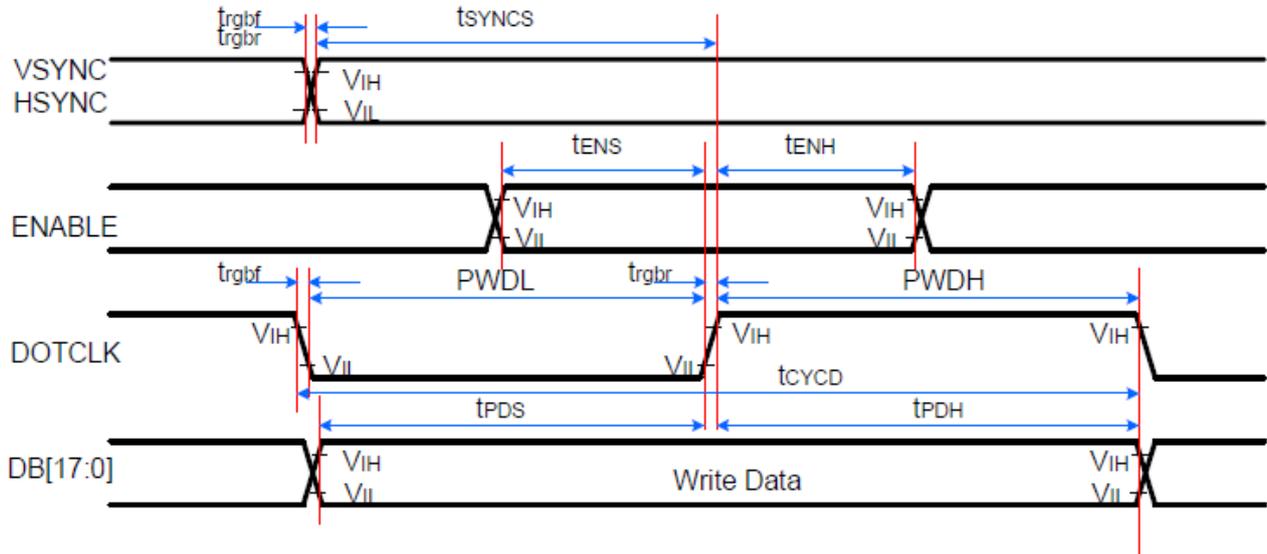
Signal	Symbol	Parameter	min	max	Unit	Description
VSYNC/ HSYNC	t_{SYNCS}	VSYNC/HSYNC setup time	15	-	ns	
	t_{SYNCH}	VSYNC/HSYNC hold time	15	-	ns	
ENABLE	t_{ENS}	ENABLE setup time	15	-	ns	
	t_{ENH}	ENABLE hold time	15	-	ns	
DB [23:0]	t_{PDS}	Data setup time	15	-	ns	16-/18-/24-bit bus RGB interface mode
	t_{PDH}	Data hold time	15	-	ns	
DOTCLK	PWDH	DOTCLK high-level period	20	-	ns	
	PWDL	DOTCLK low-level period	20	-	ns	
	t_{CYCD}	DOTCLK cycle time	50	-	ns	
	t_{rgbr}, t_{rgbf}	DOTCLK,HSYNC,VSYNC rise/fall time	-	15	ns	

Note: Ta = -30 to 70 ℃, IOVCC = 1.65V to 3.3V, VCI = 2.5V to 3.3V, AGND = DGND = 0V
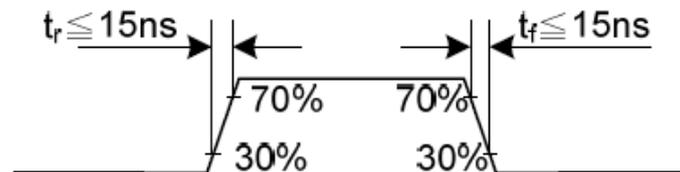
6. Power On/Off Sequence

6.1   Case 1 – NRESET line is held high or unstable by host at power on

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

Notes:

1. There will be no damage to the ILI9488 if the power sequences are not met.

2. There will be no abnormal visible effects on the display panel during the Power On/Off Sequence.

3. There will be no abnormal visible effects on the display between the end of the 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 11.1 and 11.2, 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.

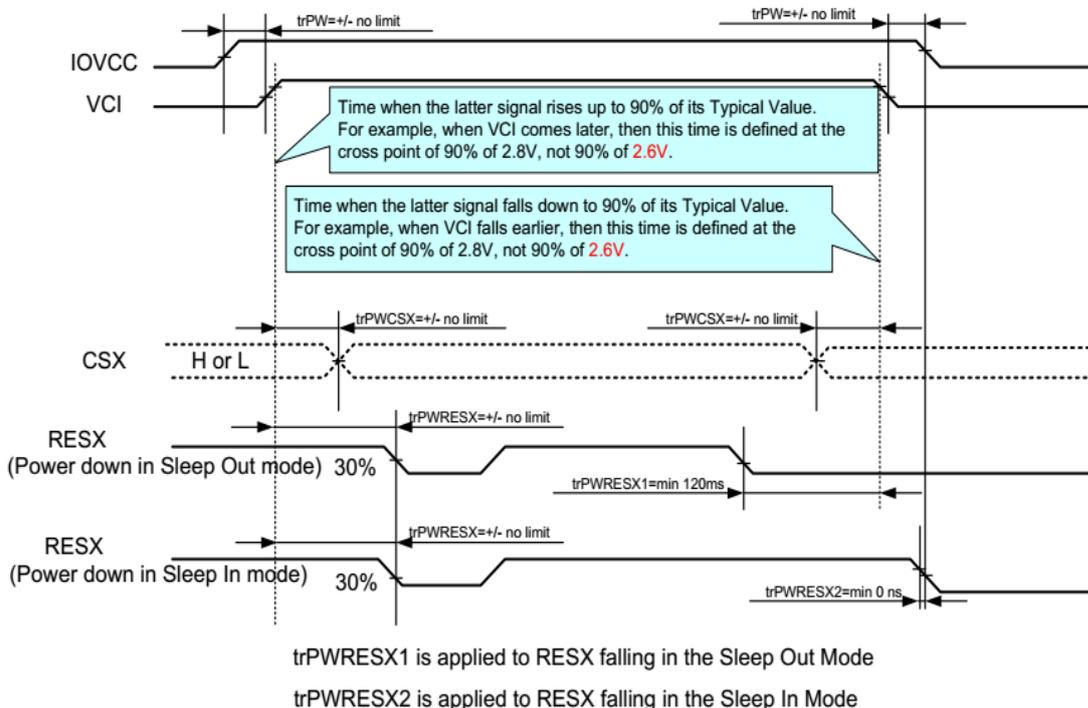5. When the power is turned on, the climb period timing(Trise) must be greater than 10us.
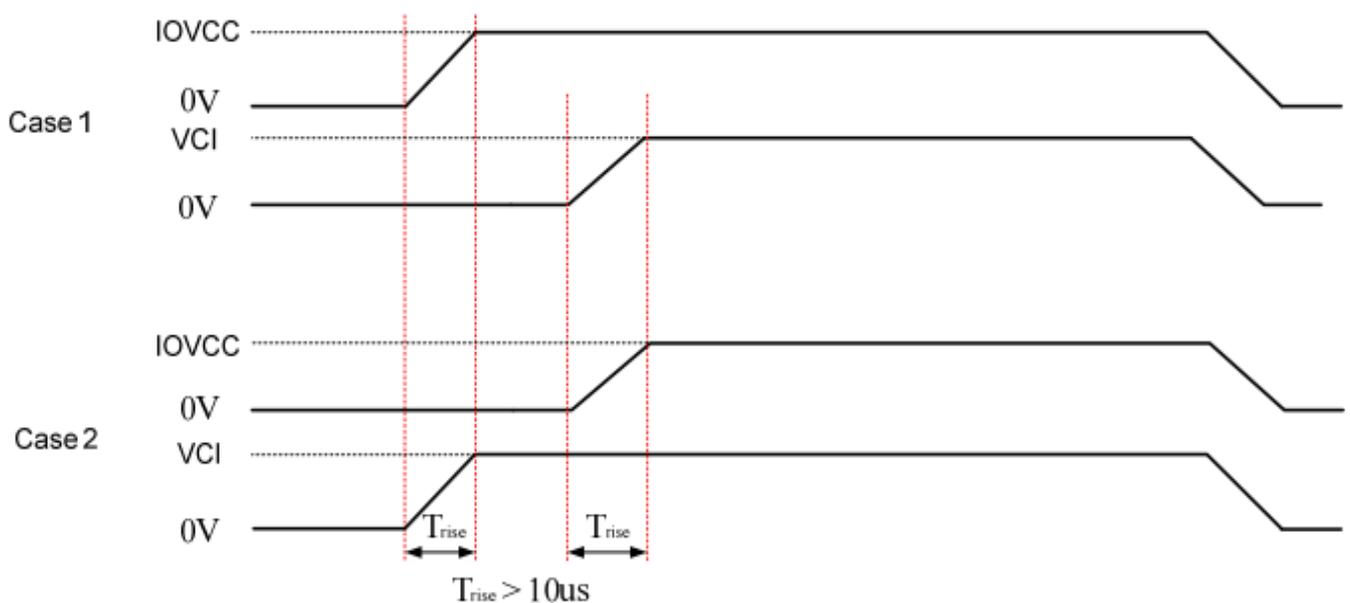
6.2 Case 2 – NRESET line is held low by host at power on

If the RESX line is held Low (and stable) by the host during Power On, then the RESX must be held low for a minimum of 10μsec after both VCI and IOVCC have been applied.

trPWRESX1 is applied to RESX falling in the Sleep Out Mode
trPWRESX2 is applied to RESX falling in the Sleep In Mode
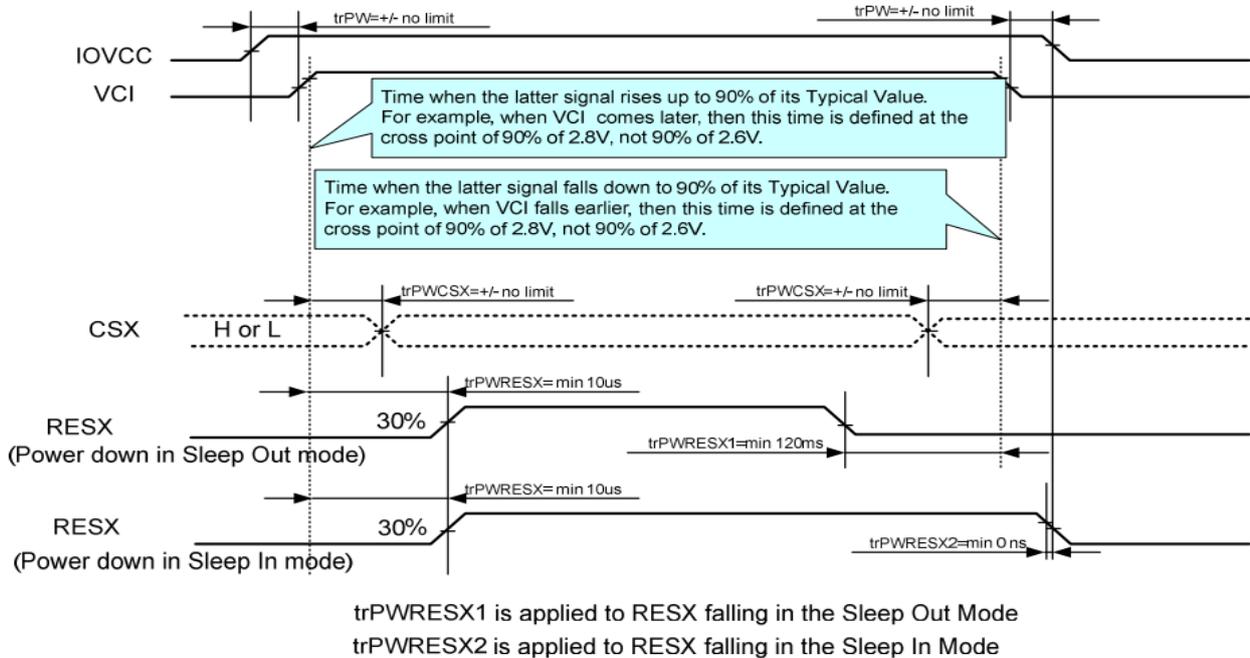
6.3 RESX Line is Held High or Unstable by Host at Power ON

If the RESX line is held High or unstable by the host during Power On, then Hardware Reset must be applied after both VCI and IOVCC have been applied. Otherwise, the correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.

trPWRESX1 is applied to RESX falling in the Sleep Out Mode

trPWRESX2 is applied to RESX falling in the Sleep In Mode

7. Optical Specification

7.1 Optical Specification

Light Source: C-light

(With UP Polarizer: APCFH4CVT, Down Polarizer: NPFCVT1764FCUARC9)   Ta=25℃

Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angle		θT	CR≧10	80	-	-	Degree	Note 2
		θB		80	-	-		
		θL		80	-	-		
		θR		80	-	-		
Contrast Ratio		CR	θ=0°	400	800	--		Note1 Note3
Response Time		T_ON	25℃	-	25	35	ms	Note1 Note4
		T_OFF	θ=0°					
Color Filter Chromaticity	White	x	θ=0°	0.27	0.31	0.35		
		y		0.28	0.32	0.36		
	Red	x		-	-	-		
		y		-	-	-		
	Green	x		-	-	-		
		y		-	-	-		
	Blue	x		-	-	-		
		y		-	-	-		
NTSC		-	θ=0°	-	72.8	-	%	Note 5
Transmittance		T	θ=0°	-	4.4	-	%	Note1 Note5

Test Conditions:

1. The ambient temperature is 25℃.

2. The test systems refer to Note 1 and Note 2.

3. The Transmittance and NTSC are the emulated values base on the panel with normal polarizer and C-Light, and when using LED back light they will be to decrease about 0.3%.

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.
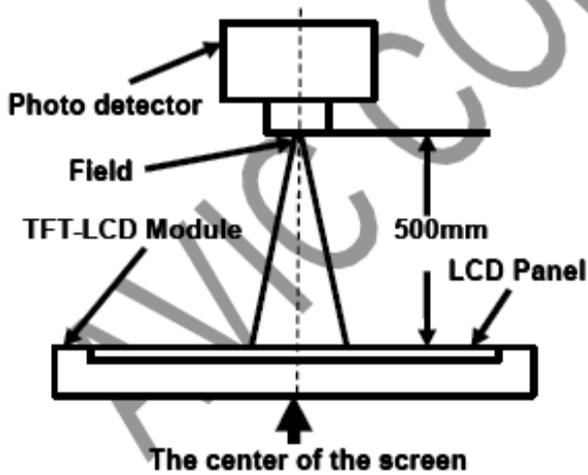
Item	Photo detector	Field
Contrast Ratio	SR-3A	1°
Chromaticity		
Response Time	BM-7A	2°

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).

Viewing angle is measured With EWV Polarizer.
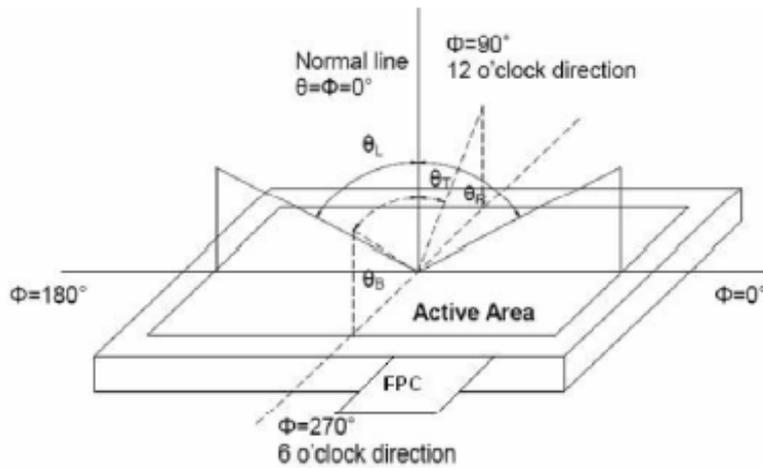
Fig. 1 Definition of viewing angle

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 driven by Vwhite.

"Black state": The state is that the LCD should driven 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%.
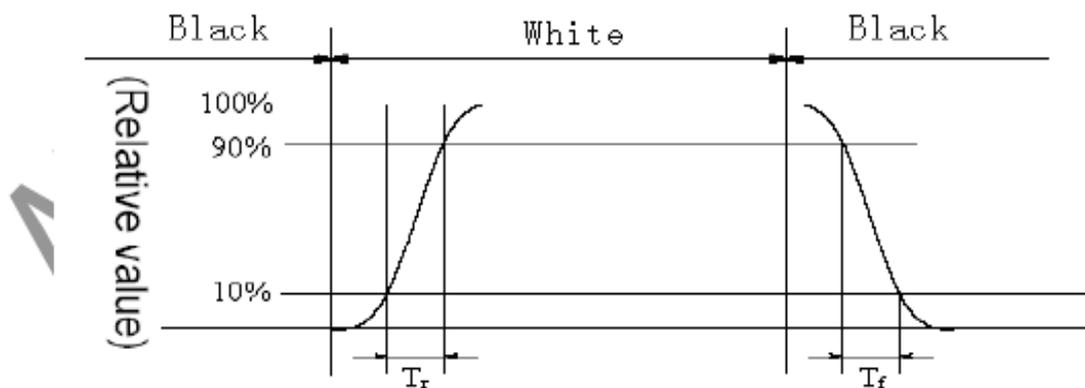
Note 5: Definition of color chromaticity (CIE1931)

8. Reliability Test Items

No.	Test Item	Test Condition	Remarks
1	High Temperature Operation	Ts = +70℃, 240 hours （Note1）	IEC60068-2-1:2007 GB2423.2-2008
2	ILow Temperature Operation	Ts = -20℃, 240 hours （Note1）	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	Ta = +80℃, 240 hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	Ta = -30℃, 240 hours	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at HighTemperature and Humidity	Ta = +50 ℃ , 90% RH max,240hours	IEC60068-2-78:2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃ 30 min~+80℃ 30 min, Change time:5min, 20 Cycle	Start with cold temperature, End with high temperature, IEC60068-2-14:1984, G B2423.22-2002
7	Package Vibration Test	Frequency range:10~55Hz Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 1 hour for each direction of X.Y.Z. (3 hours for total)	IEC60068-2-6:1982 GB/T2423.10—1995
8	Package Drop Test	Height:60cm, 1corner,3edges,6surfaces	IEC60068-2-32:1990 GB/T2423.8—1995

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

Note2: Ta is the ambient temperature of samples.

Note3: In the standard condition,there is not display function NG issue occurred.All the cosmetic specification is judged before the reliability stress.

9.Handling Precautions

9.1   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 If the display surface is contaminated, breathe on the surface and gently wipe it with a softdry 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

9.1.5   Do not attempt to disassemble the LCD.

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

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

9.1.7.1 Be sure to ground the body when handling the LCD.

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

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

9.2   Storage precautions

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

9.2.2   The LCD should be stored under the storage temperature range. If the LCD will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃ Relatively humidity: ≤80%

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

9.3   Transportation Precautions:

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