


SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
MODEL	SCT050003-V03
CUSTOMER APPROVED	

APPROVED BY	CHECKED BY	ORGANIZED BY
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0158

RECORDS OF REVISIONS

Revision No	Revision Date	Description
Ver: A0	2019-01-14	First release

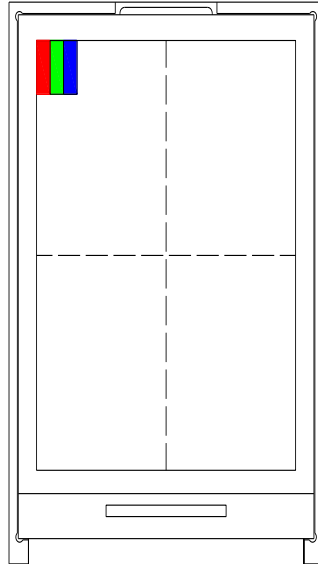
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- General Description
- Interface Timing
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1. General Description

This LCM **SCT050003-V03** is a TFT LCD module, **MIPI** Display Serial Interface, **720 (RGB) x 1280** dots graphic, and power supply circuit. The 16M color can be display.

This TFT-LCD has **4.96** inch diagonally measured active display area with **HD** resolution.



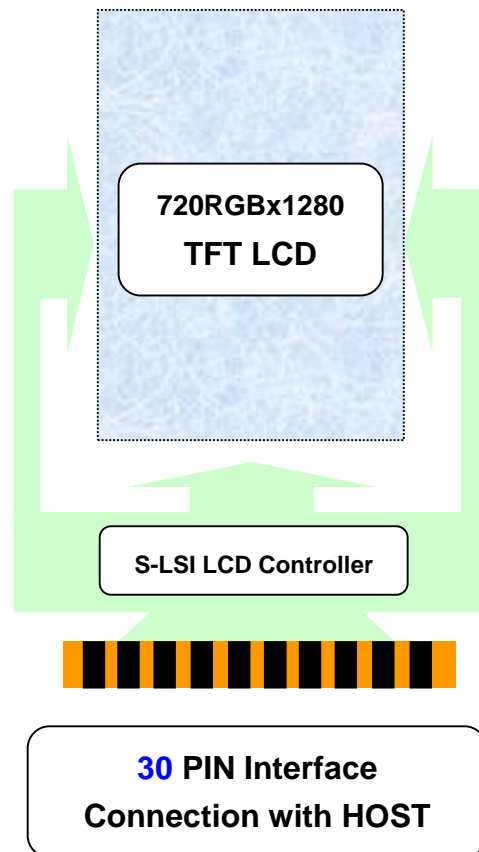
1.1 Mechanical Specifications

Item	Nominal Dimension	Unit
Dot Matrix	720 x RGB x 1280	Dots
Module Size (W×H×T)	64.30 x 118.30 x 1.55	mm.
Active Area (W×H)	61.78 x 109.82	mm.
Pixel arrangement	RGB Stripe	mm.
Dot Pitch (W×H)	0.0858 x 0.0858	mm.
Color depth	16M (MAX)	colors
Interface	MIPI DSI	-
Driving IC	ST7703	-

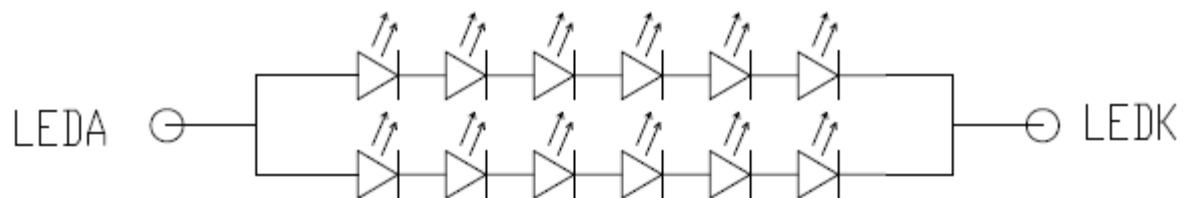
1.2 Display Specifications

Item	Nominal Dimension	Unit
Operating temperature	-20 ~70	°C
Storage temperature	-30~80	°C
LCD Type	a-Si TFT	-
LCD Mode	Normal BLACK	-
Backlight Type	LED x 12	PCS

1.3 Block Diagram



1.4 Back-light Unit



1.5 Interface Pin

Pin No	Pin Symbol	Type	Description
1	LEDA	P	LED backlight anode
2	NC	-	No connection
3	LEDK	P	LED backlight cathode
4	NC	-	No connection
5	TE	O	Tear effect signal output
6	RESET	I	Hardware reset
7	LED_ID	O	LCD ID
8-12	NC	-	No connection
13	VDDI	P	Power supply for logic circuit.(1.65V-2.0V)
14	VDD	P	Power supply for analog circuit.(2.5V-5.0V)
15	NC	-	No connection
16	GND	P	Ground
17	D3P	I	High speed interface data differential signal input
18	D3N	I	High speed interface data differential signal input
19	GND	P	Ground
20	D2P	I	High speed interface data differential signal input
21	D2N	I	High speed interface data differential signal input
22	GND	P	Ground
23	D1P	I	High speed interface data differential signal input
24	D1N	I	High speed interface data differential signal input
25	GND	P	Ground
26	D0P	IO	High speed interface data differential signal input/output
27	D0N	IO	High speed interface data differential signal input/output
28	GND	P	Ground
29	D3P	I	High speed interface clock differential signal input
30	D3N	I	High speed interface clock differential signal input

2. Interface Timing

High Speed Mode

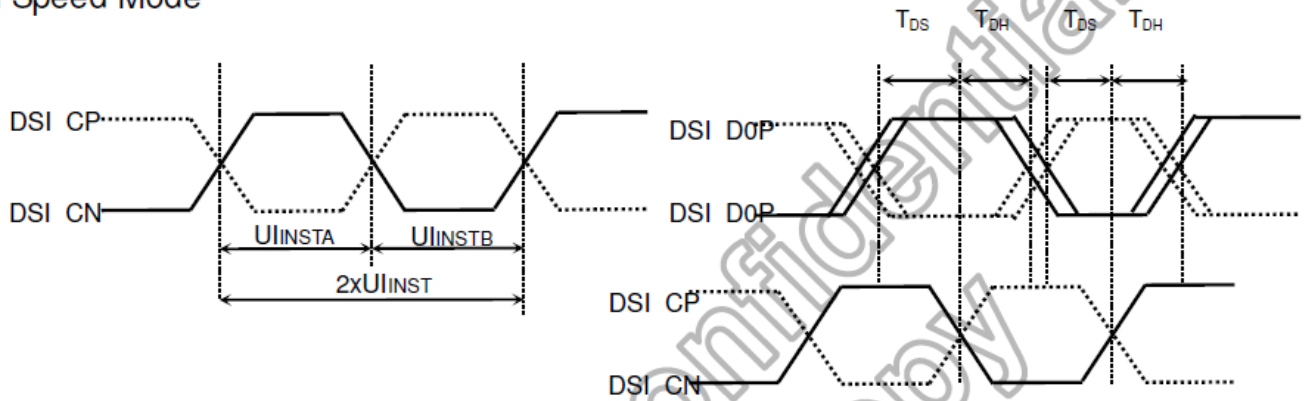


Figure 7.4: DSI clock timing Characteristics

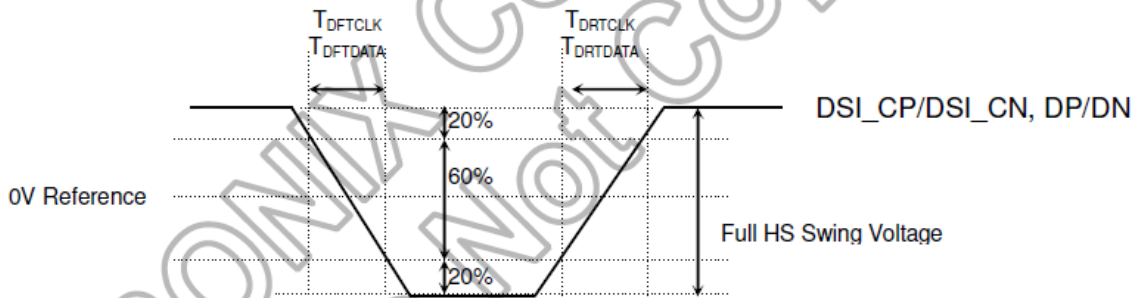


Figure 7.5: Rising and falling time on clock and data channel

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.5V to 3.3V, TA = -30 to 70°C)

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Double UI instantaneous	2xUINST	TBD	-	25	ns
	UI instantaneous	UINSTA UINSTB	TBD	-	12.5	ns
DP/DN	Data to clock setup time	T _{DS}	0.15xUI	-	-	ps
	Data to clock hold time	T _{DH}	0.15xUI	-	-	ps
DSI_CP/ DSI_CN	Differential rise time for clock	T _{DRTCLK}	150	-	0.3UI	ps
	Differential fall time for clock	T _{DFTCLK}	150	-	0.3UI	ps
DP/DN	Differential rise time for data	T _{DRTDATA}	150	-	0.3UI	ps
	Differential fall time for data	T _{DFTDATA}	150	-	0.3UI	ps

Table 7.3: DSI High Speed Mode Characteristics

Low Power Mode

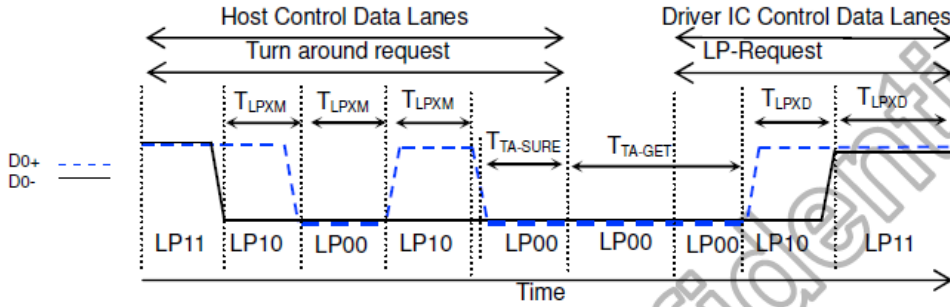


Figure 7.6: BTA from HOST to Display Module Timing

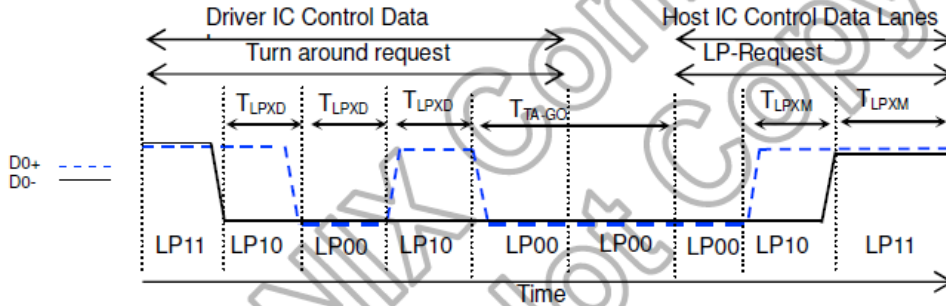


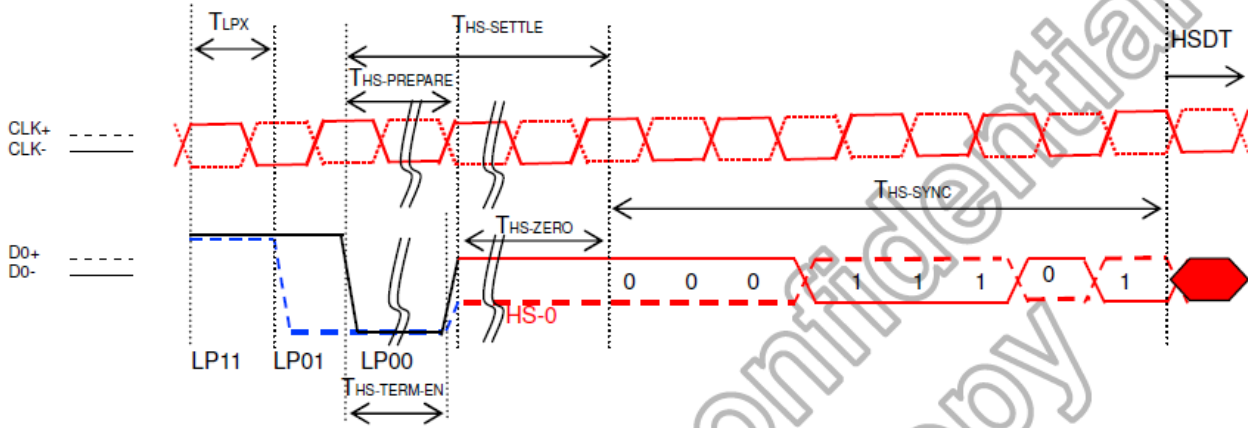
Figure 7.7: BTA from Display Module Timing to HOST

(VSSA=0V, IOVCC=1.65V to 3.3V, VCI=2.3V to 3.3V, T_A = -30 to 70°C)

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11 Host → Display module	T _{LPXM}	50	-	-	ns
	Length of LP-00/LP01/LP10/LP11 Display module → Host	T _{LPXD}	50	-	-	ns
	Time-out before the MPU start driver	T _{TA-SURE}	T _{LPXD}	-	2xT _{LPXD}	ns
	Time to drive LP-00 by display module	T _{TA-GET}	5xT _{LPXD}	-	-	ns
	Time to drive LP-00 after turnaround request Host	T _{TAGO}	4xT _{LPXD}	-	-	ns

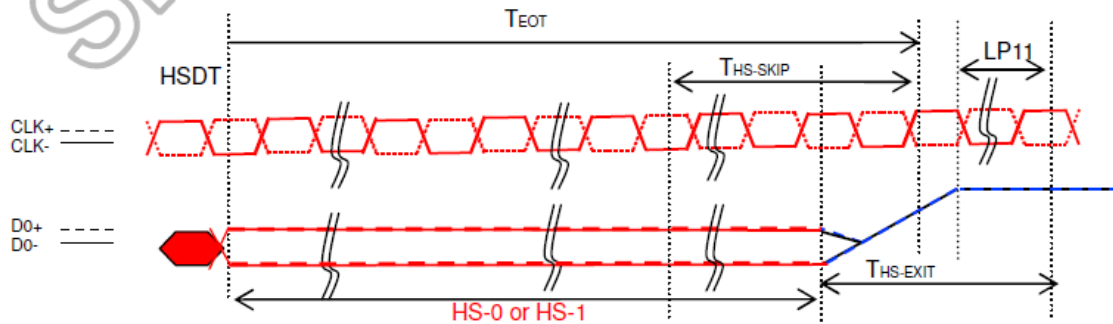
Table 7.4: DSI Low Power Mode Characteristics

DSI BURSTS



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Length of LP-00/LP01/LP10/LP11	TLPX	50	-	-	ns
	Time to Driver LP-00 to prepare for HS transmission	THS-PREPARE	40+4UI	-	85+6UI	ns
	Time to enable data receiver line termination	THS-TERM-EN	-	-	35+4xUI	ns
	Time to drive LP-00 by display module	T _{TA-GET}	5xTLPXD	-	-	ns
	Time to drive LP-00 after turnaround request Host	T _{TAGO}	4xTLPXD	-	-	ns

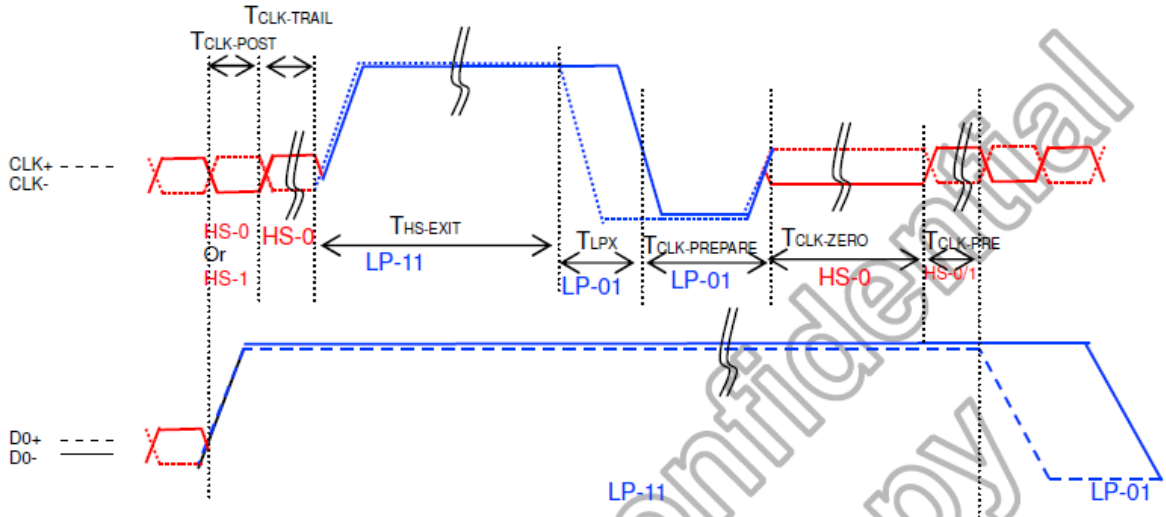
Table 7.5: DSI Low Power Mode to High Speed Mode Timing



NOTE:
If the last bit is HS-0, the transmitter changes from HS-0 to HS-1
If the last bit is HS-1, the transmitter changes from HS-1 to HS-0

Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_D0P/ DSI_D0P	Time-Out at Display Module to Ignore Transition Period of EoT	T _{HS-SKIP}	40	-	55+4xUI	ns
	Time to Driver LP-11 after HS Burst	T _{HS-EXIT}	100	-	-	ns

Table 7.6: DSI Low Power Mode to High Speed Mode Timing



Signal	Item	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
DSI_CP/ DSI_CN	Time that the MCU shall continue sending HS clock after the last associated Data Lane has transitioned to LP mode	$T_{CLK-POST}$	60+52xUI	-	-	ns
	Time to drive HS differential state after last payload clock bit of a HS transmission burst	$T_{CLK-TRAIL}$	60	-	-	ns
	Time to drive LP-11 after HS burst	$T_{HS-EXIT}$	100	-	-	ns
	Time to drive LP-00 to prepare for HS transmission	$T_{CLK-PREPARE}$	38	-	95	ns
	Time-out at Clock Lane Display Module to enable HS Termination	$T_{CLK-TERM-EN}$	-	-	38	ns
	Minimum lead HS-0 drive period before starting Clock	$T_{CLK-PREPARE} + T_{CLK-ZERO}$	300	-	-	ns
	Time that the HS clock shall be driven prior to any associated data Lane beginning the transition from LP to HS mode	$T_{CLK-PRE}$	8xUI			

Table 7.7: Clock Lanes High Speed Mode to/from Low Power Mode Timing

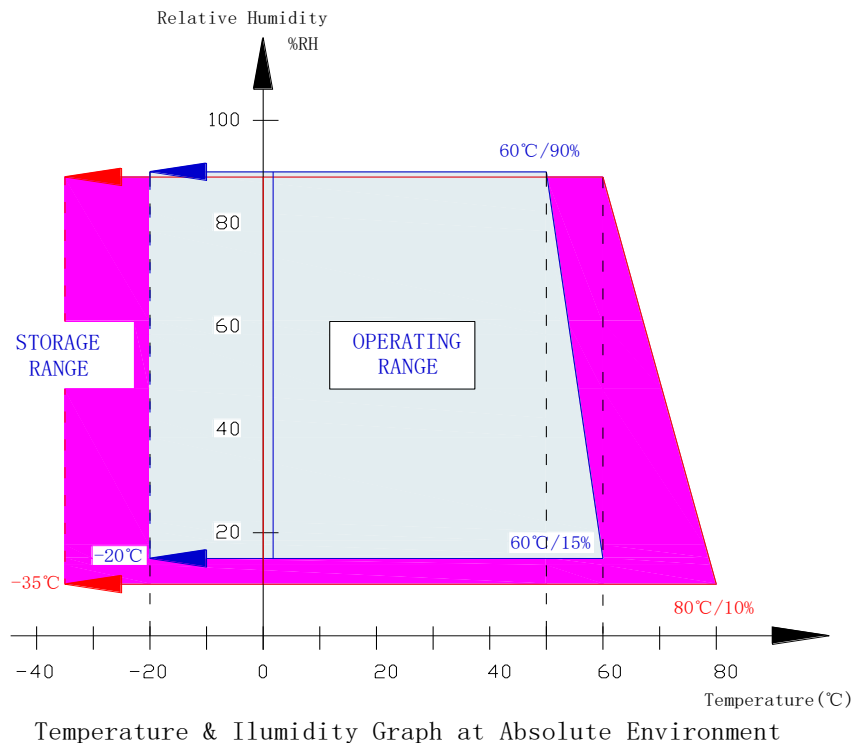
3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Item	Symbol	Min	Max	Unit
Power supply for logic	VDDI	-0.3	+5.5	V
Power supply for analog	VDD	-0.3	+6.6	V
Operate temperature range	TOP	-20	70	°C
Storage temperature range	TST	-30	80	°C

Note:

- (1) 90%RH maximum humidity, 60°C maximum wet-bulb temperature When operated at a temperature lower than 0°C, the LCD worked slowly and the screen appeared low-contrast images due to the characteristics of LC(Liquid Crystal).
- (2) If any fixed pattern is displayed on LCD for minutes, image-sticking phenomenon may occur.
- (3) Degradation could occur to pixels' TFT when DC BIOS is input into its gate-signal under POWER OFF WAITING STAND-BY & SLEEP MODE. Therefore, LCD should be turn off then.
- (4) Please operate a LCD module on the basis of the recommended S/W(Register)



DATA). If you want to change any part of the S/W, you must take driver's confirmation.

3.2 DC Characteristics

T_a= 25°C

Item	Symbol	Min.	Typ.	Max.	Unit	Condition
Power supply for logic	VDDI	1.65	1.8	2.0	V	
Power supply for analog	VDD	3.0	2.8	5.0	V	
Input high level voltage	V _{IH}	0.7VDDI	--	VDDI	V	
Input low level voltage	V _{IL}	0	--	0.3VDDI	V	
Power supply current	I _{DD}	--	TBD	--	mA	
Backlight forward voltage	V _F	16.6	--	21	V	
Backlight forward current	I _F	--	40	40	mA	

4. Optical characteristics

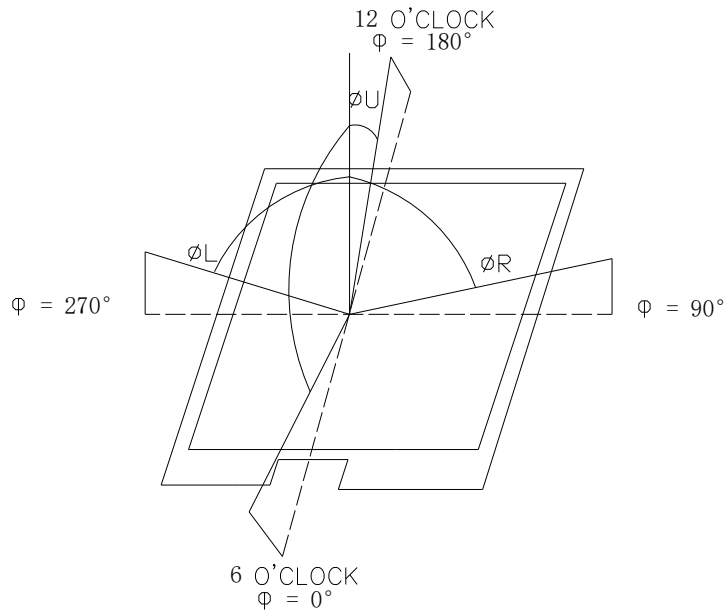
Parameter		Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing angle		Left	CR _≥ 10		85		Degree	(2)
		Right			85		Degree	
		Up			85		Degree	
		Down			85		Degree	
Color Chromaticity	Red	R _x	θ=0 Normal viewing angle	-0.05	0.657	+0.05	-	Color Chromaticity
		R _y			0.316		-	
	Green	G _x			0.257		-	
		G _y			0.581		-	
	Blue	B _x			0.145		-	
		B _y			0.075		-	
	White	W _x			0.300		-	
		W _y			0.324		-	
Contrast ratio		CR	optimal	800	1000		-	(1)
Response time		Tr+Tf			25	40	ms	(3)
Luminance on surface		L _v	Normally θ _x = θ _y = 0	350	400	-	cd/m ²	

Note (1) Definition of contrast ratio

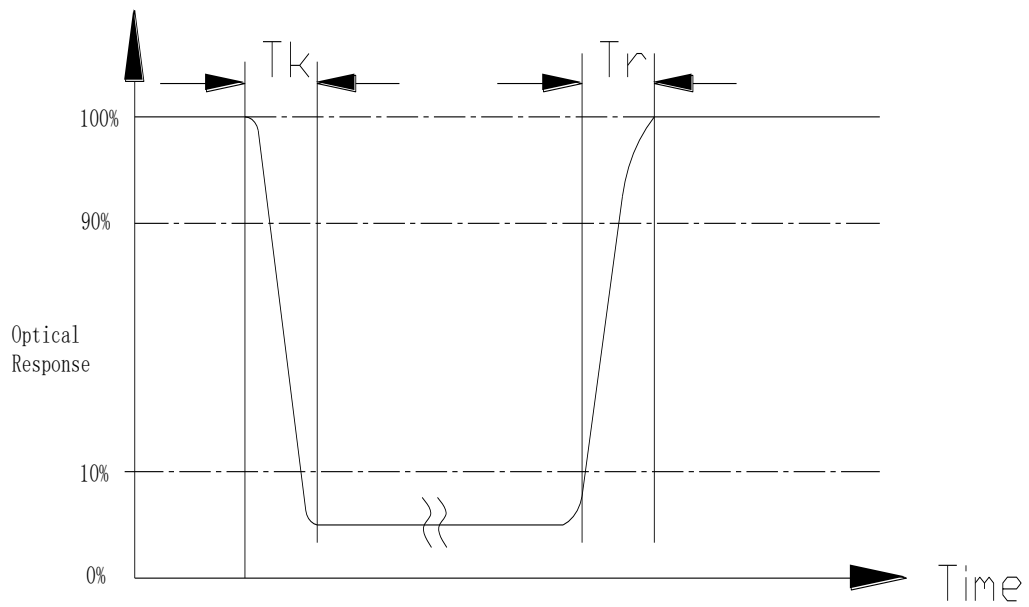
Measured at the center point of panel

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

Note (2) Definition of viewing angle



Note (3) Definition of response time: T_r+T_f



5. Reliability

5.1 Reliability Condition

*One single product test for only one item.

Item No	Item	Condition	Remark
1	High temperature Operating	60°C, 120Hours	Finish product (With polarizer)
2	Low temperature Operating	-10°C, 120 Hours	Finish product (With polarizer)
3	High temperature Storage	70°C, 200 Hours	Finish product (With polarizer)
4	Low temperature Storage	-20°C, 200 Hours	Finish product (With polarizer)
5	High temperature & humidity Storage	50°C, 90%RH, 120 Hours	Finish product (With polarizer)
6	Thermal Shock Storage (No operation)	-10°C , 30min.<=> 60°C , 30min. 10 Cycles	Finish product (With polarizer)
7	ESD test	Voltage:±8KV R:330 ohm,C:150pF Air discharge,10 times	Finish product (With polarizer)
8	Vibration test	10 => 55 =>10 => 55 => 10 Hz, within 1 minute;Amplitude:1.5mm. 15 minutes for each Direction (X,Y,Z)	Finish product (With polarizer)
9	Drop test	Packed, 100CM free fall 6 sides, 1 corner, 3edges	Finish product (With polarizer)

* Judgment after test: keep in room temperature for more than 2 hours.

- Current consumption < 2 times of initial value
- Contrast > 1/2 initial value
- Function: work normally

5.2 Inspection plan

Class	Item	Judgment	Class
Packing & Indicate	1.Outside and inside package	"Model no." , "lot no." and "quantity" Should indicate on the package.	Minor
	2.Model mixed and quantity	Other model mixed.....rejected. Quantity short or over....rejected.	Critical
	3.Product indication	"Model no." should indicate on the product	Major
Assembly	4.Dimension,LCD glass scratch And scribe defect	According to specification or drawing	Major
Appearance	5.Viewing area	Polarizer edge or LCD's sealing line is visible in the viewing arearejected	Minor
	6.Blemish、 black spot、 White spot in the LCD And LCD glass cracks	According to standard of visual inspection (inside viewing area)	Minor
	7. Blemish、 black spot White spot and scratch on the polarizer	According to standard of visual inspection (inside viewing area)	Minor
	8.Bubble in polarizer	According to standard of visual inspection (inside viewing area)	Minor
	9.LCD's rainbow color	Strong deviation color (or Newton ring) of LCDrejected. Or according to limited sample (if needed, and inside viewing area)	Minor
	10.FPC	Burned area or wrong part number is on FPC. The symbol, character, and mark of FPC are unidentifiable. The stripped solder mask, A>1.0mm 0.3mm < stripped solder mask or visible circuit, A<1.0mm,and the number is ≧4 pieces. Particle between circuits in solder mask.. Circuit is peeled off or cracked. Any circuit risen or exposed. 0.2mm< Area of solder ball, A is ≧0.4mm,the number of solder ball is ≧3 pieces. The magnitude of solder ball, A is>0.4mm.	Minor

5.3 Standard of visual inspection

Class	Item	Judgment	Class
Electrical	11.Electrical and optical characteristics (contrast、VOP、chromaticity...etc)	According to specification or drawing. (inside viewing area)	Critical
	12.Missing pattern	Missing dot、 line、 character.....rejected	Critical
	13.Short circuit、 wrong pattern display	Non display、 wrong pattern display、 current consumption out of specification.....rejected	Critical
	14.Pin hole、 pattern deformity	According to standard of visual inspection	Minor
	15.Black spot、 white spot、 black line、 white line、 slant line、 background uneven、 color uneven	Strong deviation color.....rejected Or according to limited sample full off screen (all black) ...disregards	Minor
	16.Stick image (retention image)	Fixed test picture within two hours...rejected	Minor

Class	Item	Judgment														
Minor	. Blemish、 black spot、 white spot in the LCD.	(A) Round type: unit: mm <table border="1"> <thead> <tr> <th>Diameter (mm.)</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>0.2<A</td> <td>0</td> </tr> </tbody> </table> <p>Note: A= (Length +Width) / 2</p>	Diameter (mm.)	Acceptable Q'ty	0.2<A	0										
	Diameter (mm.)	Acceptable Q'ty														
0.2<A	0															
. Blemish、 black spot、 white spot and scratch on th polarizer	(B) Liner type: unit: mm <table border="1"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>---</td> <td>$W \leq 0.03$</td> <td>Disregard</td> </tr> <tr> <td>$L \leq 5$</td> <td>$0.03 < W \leq 0.05$</td> <td>3</td> </tr> <tr> <td>$L \leq 5$</td> <td>$0.05 < W \leq 0.07$</td> <td>1</td> </tr> <tr> <td>---</td> <td>$0.07 < W$</td> <td>Follow round type</td> </tr> </tbody> </table>	Length	Width	Acceptable Q'ty	---	$W \leq 0.03$	Disregard	$L \leq 5$	$0.03 < W \leq 0.05$	3	$L \leq 5$	$0.05 < W \leq 0.07$	1	---	$0.07 < W$	Follow round type
Length	Width	Acceptable Q'ty														
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$L \leq 5$	$0.05 < W \leq 0.07$	1														
---	$0.07 < W$	Follow round type														
Minor	Bubble in polarizer	unit: mm <table border="1"> <thead> <tr> <th>Diameter</th> <th>Acceptable Q'ty</th> </tr> </thead> <tbody> <tr> <td>$A \leq 0.3$</td> <td>Disregard</td> </tr> <tr> <td>$0.3 < A \leq 0.5$</td> <td>1</td> </tr> <tr> <td>$0.5 < A$</td> <td>0</td> </tr> </tbody> </table>	Diameter	Acceptable Q'ty	$A \leq 0.3$	Disregard	$0.3 < A \leq 0.5$	1	$0.5 < A$	0						
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$A \leq 0.3$	Disregard															
$0.3 < A \leq 0.5$	1															
$0.5 < A$	0															
Minor	Pin hole、 Pattern deformity	unit: dot size <table border="1"> <thead> <tr> <th>Diameter</th> <th>Acc. Q'ty</th> </tr> </thead> <tbody> <tr> <td>$0.4 < \Phi$</td> <td>0</td> </tr> </tbody> </table>	Diameter	Acc. Q'ty	$0.4 < \Phi$	0										
Diameter	Acc. Q'ty															
$0.4 < \Phi$	0															

6. Precaution

6.1 Handling

- (1) Protect the panel from static, it may cause damage to the CMOS Gate Array IC.
- (2) Use fingerstalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (3) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (4) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Don't use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (5) Pins of I/F connector shall not be touched directly with bare hands.
- (6) Refrain from strong mechanical shock and / or any force to the panel. In addition to damage, this may cause improper operation or damage to the panel.
- (7) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a B pencil lead.
- (8) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
- (9) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.

6.2 Storage

- (1) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the panel with temperature from 0 to 35°C and relative humidity of less than 70%.
- (2) The panel shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

6.3 Operation

- (1) The LCD shall be operated within the limits specified. Operation at values outside of these limits may shorten life, and/or harm display images.
- (2) Do not exceed the absolute maximum rating value. (the supply voltage variation, Input voltage variation in part contents and environmental temperature and so on). Otherwise the panel may be damaged.
- (3) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image "Sticks" to the screen.

8. Packing method

8.1 Packing Quantity (TBD)

8.2 Flowing chart (TBD)