

Shenzhen Leadtek Electronics Co.,Ltd

PRODUCT SPECIFICATION

TFT-LCD MODULE

Module No: LTK035P4046TX-V0

☒ Preliminary Specification

☐ Approval Specification

Designed by	Checked by	Approved by
<i>jona</i>	<i>tom</i>	<i>lan</i>

Final Approval by Customer

Approved by	Comment

※The specification of "TBD" should refer to the measured value of sample . If there is difference between the design specification and measured value, we naturally shall negotiate and agree to solution with customer.

Revision History

[illegible]

1. Introduction

1.1 Scope of application

This specification applies to the LCD module that is supplied by Leadtek Technology CO., LTD.

LCD specification: Dots 320xRGBx480

As to basic specification of the driver IC, refer to the IC (ILITEK:ILI9488) specification and data book.

All material & processing of the LCD module should be Lead Free.

1.2 TFT features:

Structure: TFT PANNEL+IC +FPC+BL;

ALL O'CLOCK Type LCD

320 dot-segment and 480 dot-common outputs;

262K Color can be selected by software;

White LED back light;

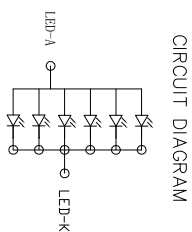
3/4line SPI or 8/16bit MCU Interface

1.3 Applications:

2. LCM General specification

ITEM	Standard value	Unit
LCD Type	Normally Black	--
Drive element	TFT active matrix	--
Number of pixels	320*3RGB(H)X480(V)	Dots
Pixel arrangement	RGB stripe	--
Pixel Pitch (W*H)	0.153(H) x 0.153(V)	mm
Active area	48.96(H) x 73.44(V)	mm
Viewing direction	ALL O'CLOCK	-
TFT Driver IC	ILI9488	
TFT interface	SPI/MCU Interface	-
LCM Size(W*H*T)	55.48(W) ×84.71(H) ×2.20(T)	mm
Approx. Weight	TBD	g
Touch structure	--	
Touch Driver IC		-
Touch Interface		

PIN ASSIGNMENT



NOTES:

1. DISPLAY TYPE: 3.5", 320*480 TFT LCD
2. DISPLAY MODE: Transmissive **Normally Black**
3. VIEWING DIRECTION: **ALL**
4. DRIVER IC: IL19488
5. LCM (White 9 AVG 1/9) :
Brightness: 400cd/m² (TYP)
Uniformity: 80% (MIN)
6. BACK LIGHT: 6 chip white LEDs If=120mA, Vf=2.8V~3.2V
7. OPERATING TEMP: -20° C to 60° C, STORAGE TEMP: -30° C to 70° C
8. * Critical Parameter, () ref Parameter, [] cpk Parameter
Unspecified Tolerances: ±0.20mm
9. Suggestion mark:
Modification mark:
10. REQUIREMENTS ENVIRONMENTAL PROTECTION: RoHS

3.Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit
LCM Operating Temperature	T _{OPR}	-20	+60	°C
LCM Storage Temperature	T _{STG}	-30	+70	°C
Humidity	RH	-	90	%

4.Electrical Characteristics

4.1 TFT DC Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage for I/O	VDDIO	1.65	1.8	3.3	V
Supply Voltage for(DC/DC)	VDD	2.7	2.8	3.3	V
Supply Voltage for(DC/DC)	AVDD				V
Supply Voltage for(DC/DC)	AVEE				V

4.2 Back-Light Unit Characeristics

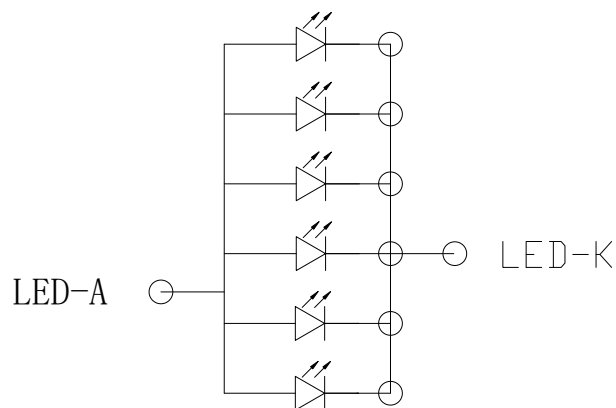
The back-light system is an edge-lighting type with 6 white LEDs. The characteristics of the back-light are shown in the following tables.

Characteristics	Symbol	Min.	Type	Max.	Unit	Notes
Forward Voltage	V _F	2.8	-	3.2	V	-
Forward current	I _F	--	120	-	mA	-
Luminance(With LCD)	L _v		400	--	cd/m ²	-
LED life time	N/A	----	30,000	--	Hr	Note 1

Note:

- (1) The “LED life time” is defined as the module brightness decrease to 50% of original brightness at I_L=20mA/LED. The LED life time could be decreased if operating I_L is larger than 25mA/LED.

Backlight circuit diagram shown in below:

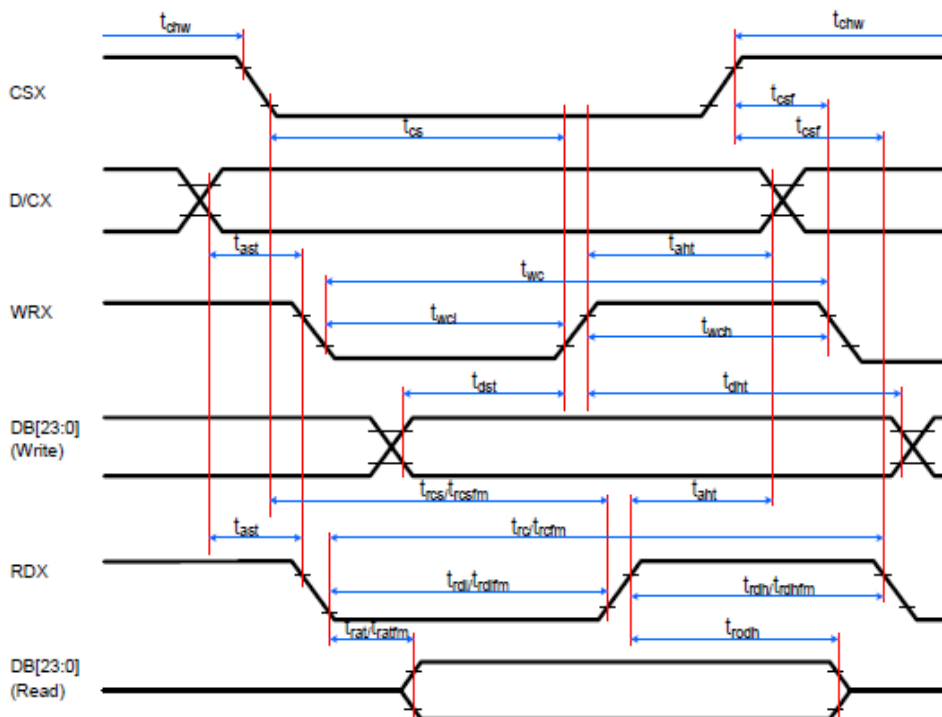


5. Module Function Description

Pin No.	Symbol	Functional	Notes																				
1	XL	Touch panel pin																					
2	YU	Touch panel pin																					
3	XR	Touch panel pin																					
4	YD	Touch panel pin																					
5	GND	Power Ground																					
6	IOVCC	I/O Voltage (IOVCC to DGND): 1.65V ~ 3.3V																					
7	VCI	Power supply : 2.7V ~ 3.3V																					
8	TE	Tearing effect output pin to synchronies MCU to frame rate.																					
9	CS	Chip select signal input pin																					
10	RS	Register select signal.																					
11	WR/SCL	Write strobe signal/ pin as Serial Clock when operates in the serial																					
12	RD	Read data at the rising edge.																					
13	SDA	serial data input/output bi-direction pin																					
14	SDO	Serial data output																					
15	RESET	Reset signal input terminal. Active at ‘L’.																					
16	GND	Power Ground																					
17-32	DB0~DB15	Data bus																					
33	LEDA	Power supply for backlight anode input terminal.																					
34~36	LEDK	Power supply for backlight cathode input terminal.																					
37	GND	Power Ground																					
38	IM0	<table><tr><td>IM0</td><td>IM1</td><td>IM2</td><td>Interface</td></tr><tr><td>1</td><td>0</td><td>1</td><td>3 wire 9-bit date serialinterafce</td></tr><tr><td>1</td><td>1</td><td>1</td><td>4 wire 8-bit date serialinterafce</td></tr><tr><td>0</td><td>1</td><td>0</td><td>80 MCU 16-bit businterface</td></tr><tr><td>1</td><td>1</td><td>0</td><td>80 MCU 8-bit businterface</td></tr></table>	IM0	IM1	IM2	Interface	1	0	1	3 wire 9-bit date serialinterafce	1	1	1	4 wire 8-bit date serialinterafce	0	1	0	80 MCU 16-bit businterface	1	1	0	80 MCU 8-bit businterface	See ili9488 data sheet for details
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39	IM1																						
40	IM2																						

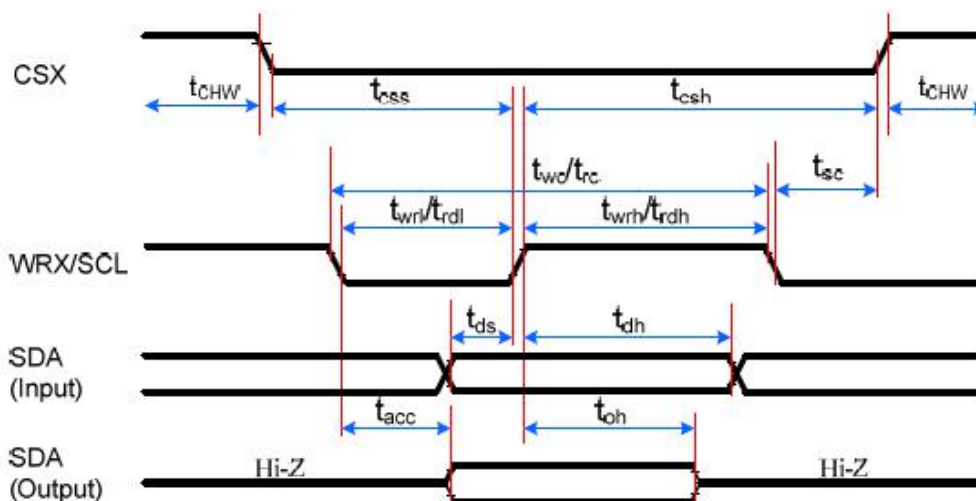
6. Timing Characteristics

DPI (Display Parallel 8-/9-16-/18-/24-bit interface) Timing Characteristics:



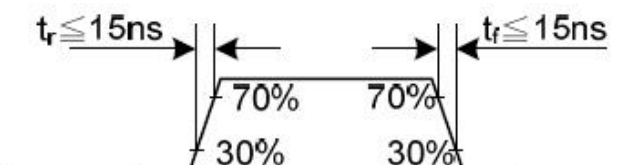
Signal	Symbol	Parameter	min	max	Unit	Description
DCX	tast	Address setup time	0	-	ns	-
	that	Address hold time (Write/Read)	0	-	ns	-
CSX	tchwh	CSX "H" pulse width	0	-	ns	-
	tcs	Chip Select setup time (Write)	15	-	ns	-
	trcs	Chip Select setup time (Read ID)	45	-	ns	-
	trcsfm	Chip Select setup time (Read FM)	355	-	ns	-
	tcsf	Chip Select Wait time (Write/Read)	0	-	ns	-
WRX	twc	Write cycle	40	-	ns	-
	twrh	Write Control pulse H duration	15	-	ns	-
	twrl	Write Control pulse L duration	15	-	ns	-
RDX (FM)	trcfm	Read Cycle (FM)	450	-	ns	When read from Frame Memory
	trdhfm	Read Control H duration (FM)	90	-	ns	
	trdlfm	Read Control L duration (FM)	355	-	ns	
RDX (ID)	trc	Read cycle (ID)	160	-	ns	When read ID data
	trdh	Read Control pulse H duration	90	-	ns	
	trdl	Read Control pulse L duration	45	-	ns	
DB [23:0], DB [17:0], DB [15:0], DB [8:0], DB [7:0]	tdst	Write data setup time	10	-	ns	For maximum, CL=30pF For minimum, CL=8pF
	tdht	Write data hold time	10	-	ns	
	trat	Read access time	-	40	ns	
	tratfm	Read access time	-	340	ns	
	trod	Read output disable time	20	80	ns	

(3-Line SPI System) Timing Characteristics:

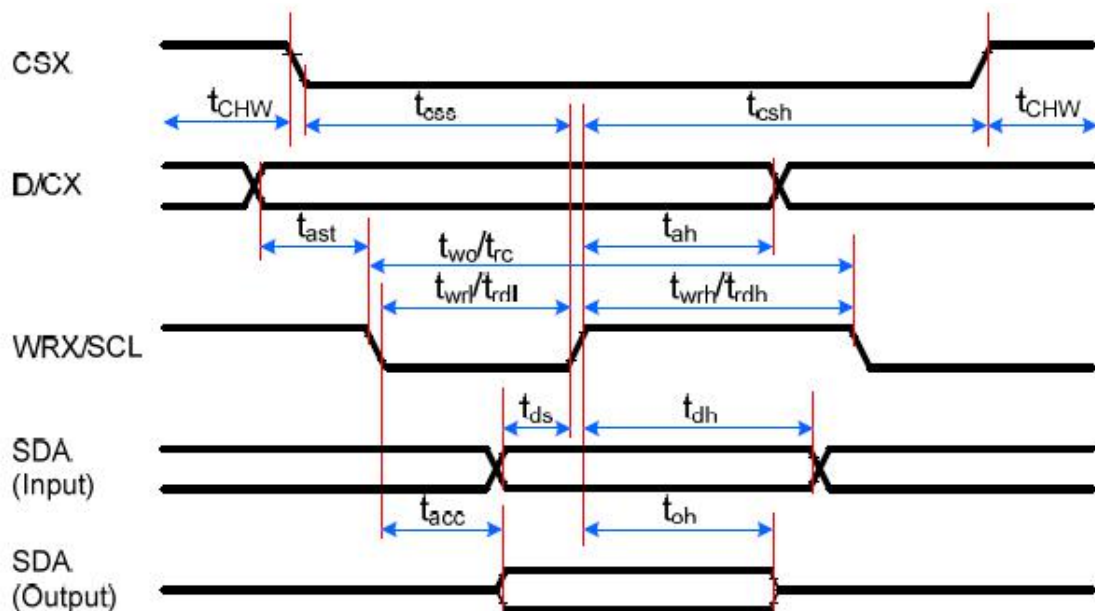


Signal	Symbol	Parameter	min	max	Unit	Description
CSX	tsc	SCL-CSX	15	-	ns	
	tchwr	CSX H Pulse Width	40	-	ns	
	tcss	Chip select time (Write)	60	-	ns	
	tcsh	Chip select hold time (Read)	65	-	ns	
SCL	twc	Serial Clock Cycle (Write)	66	-	ns	
	twrh	SCL H Pulse Width (Write)	15	-	ns	
	twrl	SCL L Pulse Width (Write)	15	-	ns	
	trc	Serial Clock Cycle (Read)	150	-	ns	
	trdh	SCL H Pulse Width (Read)	60	-	ns	
	trdl	SCL L Pulse Width (Read)	60	-	ns	
SDA/SDI (Input)	tds	Data setup time (Write)	10	-	ns	
	tdh	Data hold time (Write)	10	-	ns	
SDA/SDO (Output)	tacc	Access time (Read)	10	50	ns	For maximum CL=30pF
	toh	Output disable time (Read)	15	50	ns	For minimum CL=8pF

Note: Ta = -30 to 70 °C, IOVCC = 1.65V to 3.6V, VCI = 2.5V to 3.6V, AGND = DGND = 0V, T = 10+/-0.5ns



(4-Line SPI System) Timing Characteristics:



Signal	Symbol	Parameter	min	max	Unit	Description
CSX	t_{css}	Chip select time (Write)	15	-	ns	
	t_{csh}	Chip select hold time (Read)	15	-	ns	
	t_{CHW}	CS H pulse width	40	-	ns	
SCL	t_{wc}	Serial clock cycle (Write)	50	-	ns	
	t_{wrh}	SCL H pulse width (Write)	10	-	ns	
	t_{wrl}	SCL L pulse width (Write)	10	-	ns	
	t_{rc}	Serial clock cycle (Read)	150	-	ns	
	t_{rdh}	SCL H pulse width (Read)	60	-	ns	
	t_{rdl}	SCL L pulse width (Read)	60	-	ns	
D/CX	t_{as}	D/CX setup time	10	-	ns	
	t_{ah}	D/CX hold time (Write/Read)	10	-	ns	
SDA/SDI (Input)	t_{ds}	Data setup time (Write)	10	-	ns	
	t_{dh}	Data hold time (Write)	10	-	ns	
SDA/SDO (Output)	t_{acc}	Access time (Read)	10	50	ns	For maximum $C_L=30pF$
	t_{od}	Output disable time (Read)	15	50	ns	For minimum $C_L=8pF$

Notes:

1. $T_a = -30$ to $70\text{ }^{\circ}\text{C}$, $IOVCC = 1.65\text{V}$ to 3.3V , $VCI = 2.5\text{V}$ to 3.3V , $AGND = DGND = 0\text{V}$, $T = 10\text{+/-}0.5\text{ns}$.
2. Does not include signal rising and falling times.

Reset Description:

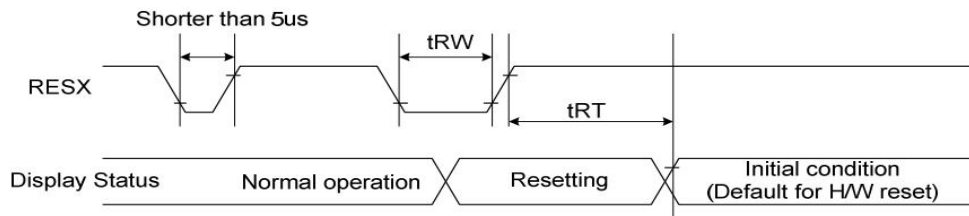


Table 39: Reset Timing

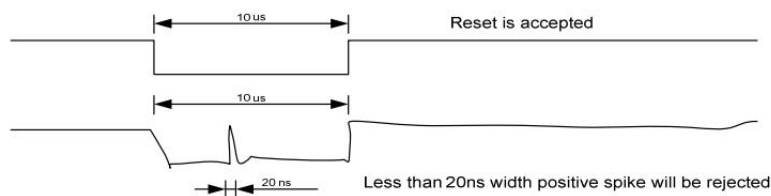
Signal	Symbol	Parameter	Min	Max	Unit
RESX	tRW	Reset pulse duration	10		uS
	tRT	Reset cancel		5 (note 1,5) 120 (note 1,6,7)	mS

Notes:

- The reset cancel also includes the required time for loading ID bytes, VCOM setting and other settings from the EEPROM to registers. After a rising edge of RESX, this loading is done within 5 ms after the H/W reset cancel (tRT).
- According to the Table 40, a spike due to an electrostatic discharge on the RESX line does not cause irregular system reset.

RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

- During the Reset period, the display will be blanked (When Reset starts in the Sleep Out mode, the display will enter the blanking sequence in at least 120 ms. The display remains the blank state in the Sleep In mode.) and then return to the default condition for the Hardware Reset.
- Spike Rejection can also be applied during a valid reset pulse, as shown below:



Positive Noise Pulse during Reset Low

- When Reset is applied during the Sleep In Mode.
- When Reset is applied during the Sleep Out Mode.
- It is necessary to wait 5msec after releasing RESX before sending commands. The Sleep Out command also cannot be sent in 120msec.

7.Optical Characteristics

Optical Specification

Item	Symbol	Condition	Specification			Unit	Remark
			Min.	Typ.	Max.		
Response time	Tr+Tf	$\theta = 0^\circ$	-	30	40	ms	Note 4
Contrast ratio	CR	$\theta = 0^\circ$		1000	-		Note 2,5
Viewing angle	Top	$CR \geq 10$	70	80	-	deg.	Note 2,5,6
	Bottom	$CR \geq 10$	70	80	-		
	Left	$CR \geq 10$	70	80	-		
	Right	$CR \geq 10$	70	80	-		
Color chromaticity (CF only, light source is C light, CIE 1931)	Rx	$\theta = 0^\circ$	-0.03	0.655	+0.03		Note 3
	Ry			0.317			
	Gx			0.260			
	Gy			0.571			
	Bx			0.144			
	By			0.074			
Color chromaticity (CF only, light source is C light, CIE 1931)	Wx	$\theta = 0^\circ$		0.304			Only for reference
	Wy	$\theta = 0^\circ$		0.327			
NTSC(CF only, light source is C light, CIE 1931)	%	CIE1931	60	70	-	%	Note 3
Transmittance (w/o APCF / w/i CTC Gal SK2 BL)	Trans		3.74	4.4		%	Note 9

Note 1: Ambient temperature = 25°C.

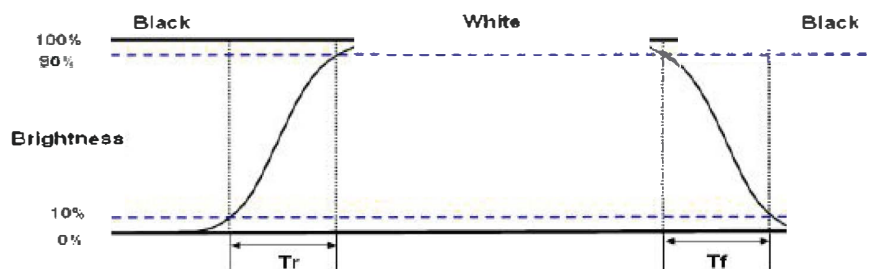
Note 2: To be measured with a viewing cone of 2°by Topcon luminance meter SR3.

Note 3: Definition of color chromaticity (CIE 1931) Color coordinates measured at center point of LCD.

Note 4: Transmittance of Specification is cell with CTC's polarizer and BL.

Note 5: Definition of response time:

The output signals of TRD-100 are measured when the input signals are changed to "White" (rising time) and from "White" to "Black" (falling time), respectively. The interval is between the 10% and 90% of amplitudes. Refer to figure as below.

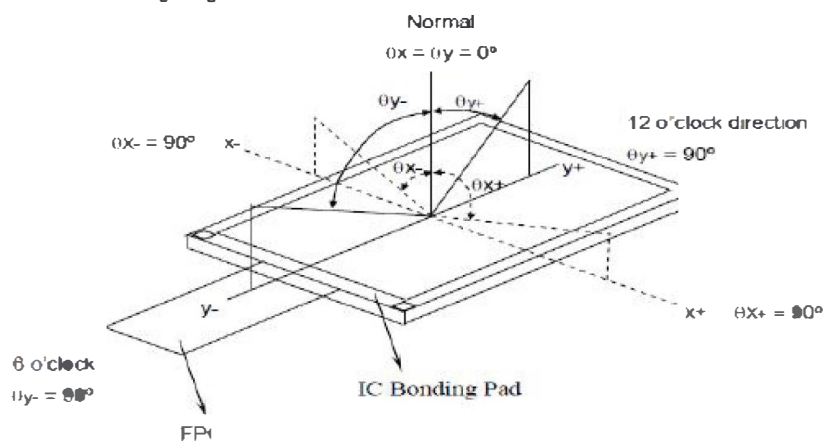


Note 6: Definition of contrast ratio:

Contrast ratio is calculated by the following formula.

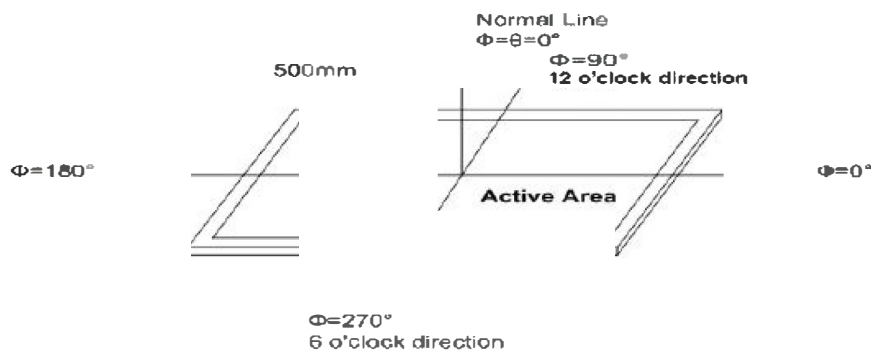
$$\text{Contrast ratio (CR)} = \frac{\text{Brightness on the "white" state}}{\text{Brightness on the "black" state}}$$

Note 7: Definition of viewing angle

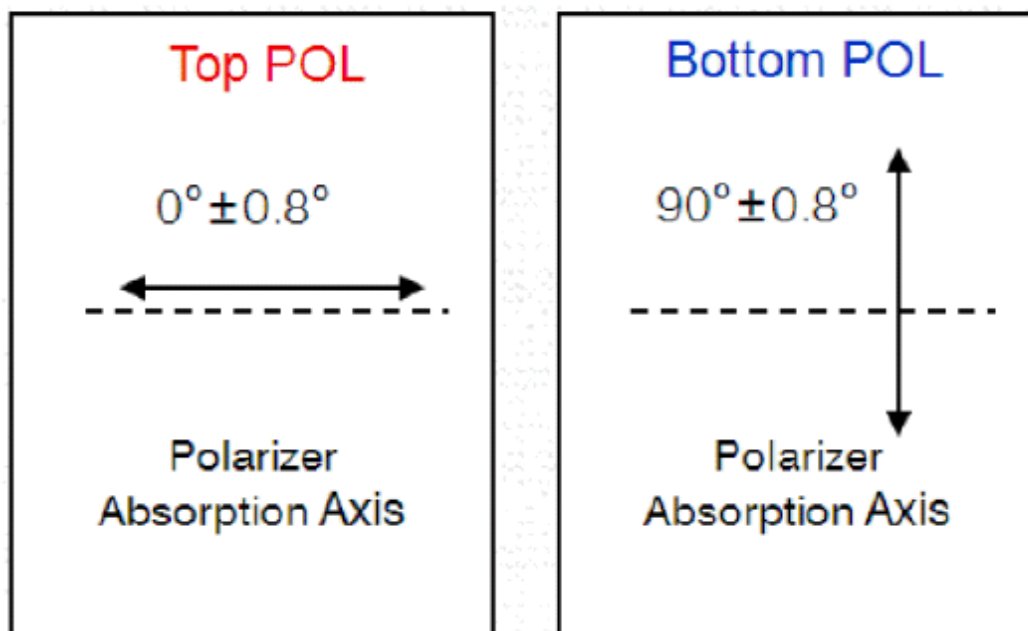


Note 8: Definition of optical measurement system. The optical characteristics should be measured in dark room. The optical properties are measured at the center point of the LCD screen, (Response time is measured by Photo detector TRD_100, other items are measured by SR3.

Spectrometer



Note 9: The absorption axis direction of polarizer refer to figure as bellow :



8. Reliability Test Item

No.	Test Item	Test Condition	Notes
1	High Temp. Storage	+70°C / 96H	1. Functional test is OK. Missing Segment, short, unclear segment non-display, display abnormally and liquid crystal leakage un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temp. Storage	-30°C / 96H	
3	High Temp. Operating	+60°C / 96H	
4	Low Temp. Operating	-20°C / 96H	
5	High Temperature / Humidity storage	50°C x 90%RH / 96H	
6	Thermal and cold shock	Static state, -20°C (30min) ~60°C (30min), 50 cycles	

9. Packing Method----TBD