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MODEL NO : ET019QV02-T

MODEL VERSION: 01

SPEC VERSION : 1.0

ISSUED DATE: 2022-09-08

☐ Preliminary Specification

☒ Final Product Specification

Customer : _____

Approved by	Notes

Youri Confirmation

Prepared by	Reviewed by	Approved by
John	Johnny	Wang

1. Introduction

1.1 Scope of application

LCD specification: Dots 170xRGBx320.

As to basic specification of the driver IC, refer to the IC (ST7789V) 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;

IPS Type LCD

170dot-segment and 320 dot-common outputs;

65K/262K Color can be selected by software;

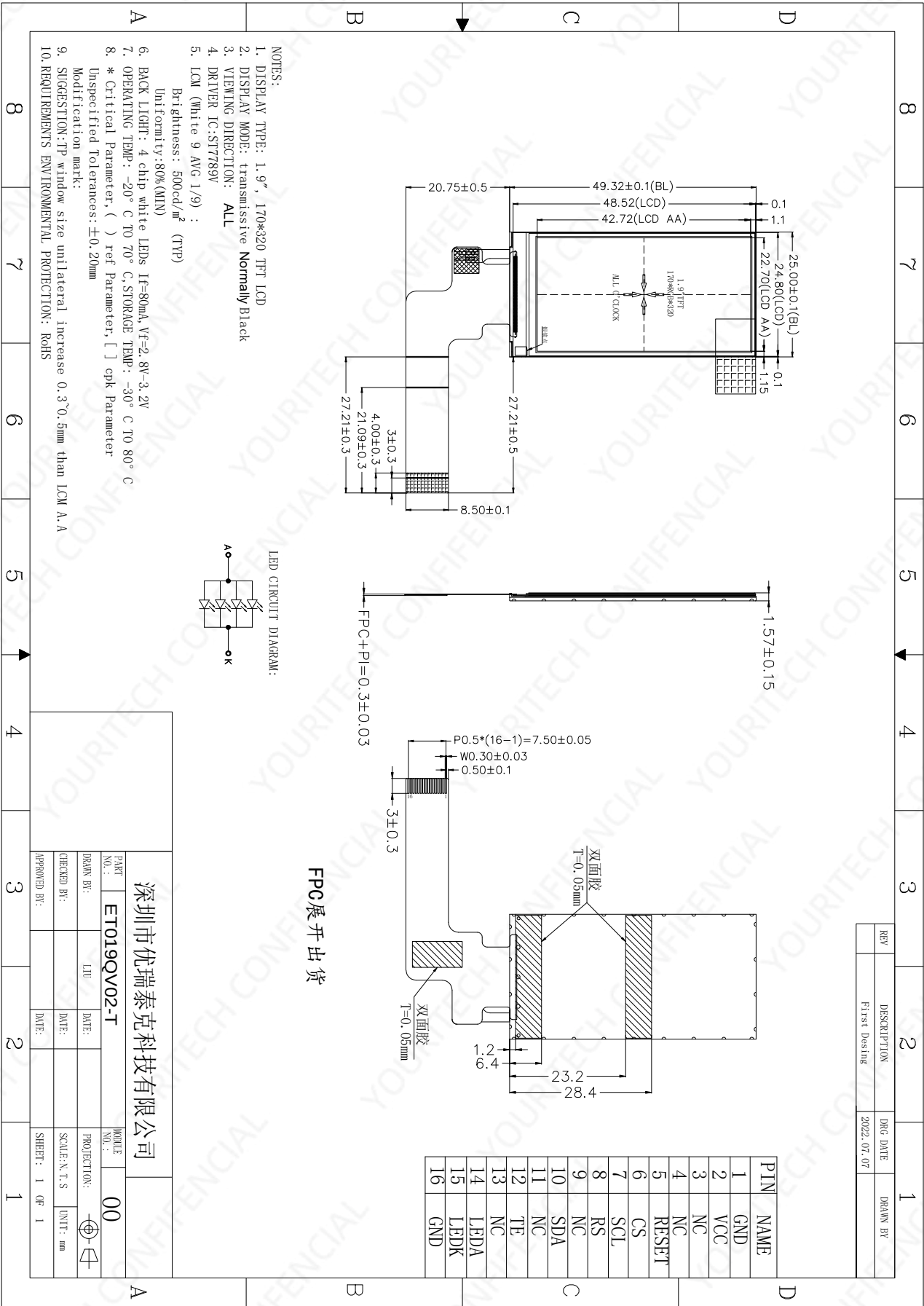
White LED back light;

4line SPI interface

1.3 Applications:

2. LCM General specification

ITEM	Standard value	Unit
LCD Type	Normally Black	--
Drive element	TFT active matrix	--
Number of pixels	170(H) RGB×320(V)	Dots
Pixel arrangement	RGB Vertical stripe	--
Pixel Pitch (W*H)	0.1335(H) ×0.1335 (V)	mm
Active area	22.7(W) ×42.72 (H)	mm
Viewing direction	ALL O'CLOCK	-
TFT Driver IC	ST7789V	
TFT interface	4line SPI interface	-
Approx. Weight	TBD	g
LCM Size(W*H*T)	25.00(W) ×49.32(H) ×1.57(T)	mm
Touch structure	--	
Touch Driver IC	--	-
Touch Interface	--	



3. Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit
LCM Operating Temperature	T _{OPR}	-20	+70	°C
LCM Storage Temperature	T _{STG}	-30	+80	°C
Humidity	RH	-	90	%

4. Electrical Characteristics

4.1 TFT DC Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage for I/O	I/O	--	--	--	V
Supply Voltage for(DC/DC)	VDD	2.5	2.8	3.6	V
Supply Voltage for(DC/DC)	AVDD				V
Supply Voltage for(DC/DC)	AVEE				V

4.2 Back-Light Unit Characteristics

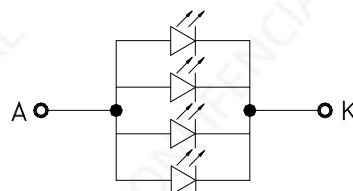
The back-light system is an edge-lighting type with 4 white LEDs. The characteristics of the back-light are shown in the following tables.

Characteristics	Symbol	Min.	Type	Max.	Unit	Notes
Forward Voltage	V _F	2.8	--	3.2	V	-
Forward current	I _F	--	80	-	mA	-
Luminance(With LCD)	L _v		500	--	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:

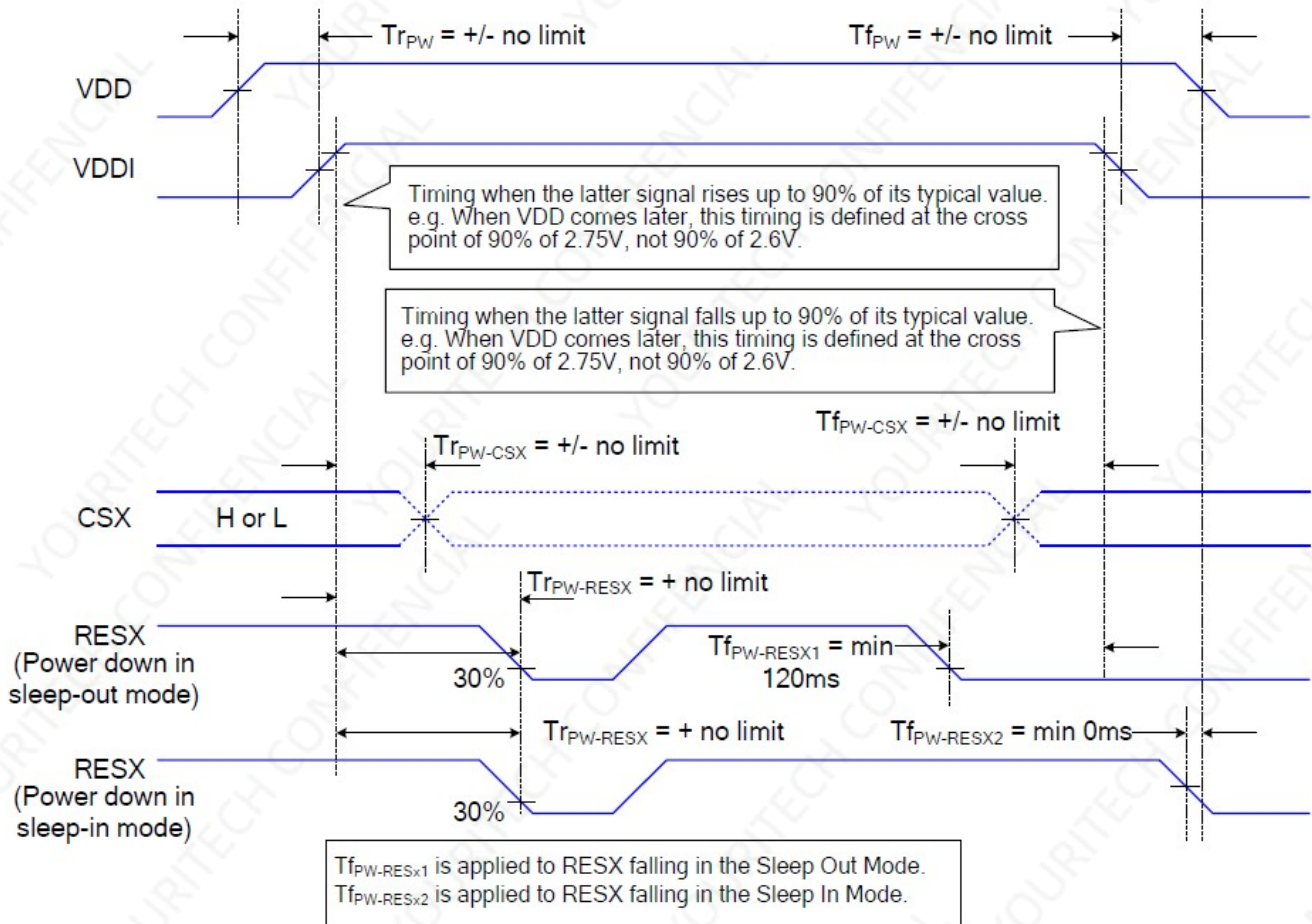


5. Module Function Description

Pin No.	Symbol	LCM Description
1	GND	Ground.
2	VCC	Power Supply For LCD.
3~4	NC	No Connection.
5	RESET	Reset Signal input pin.
6	CS	Chip selection signal.
7	SCL	Serial clock signal.
8	RS	Register selection signal.
9	NC	No Connection.
10	SDA	Serial data input/output pin.
11	NC	No Connection.
12	TE	Frame head pulse for tearing effect.
13	NC	No Connection.
14	LED_A	Power Supply For LED Backlight Anode Input.
15	LED_K	Power supply for backlight cathode input terminal.
16	GND	Ground.

6. Timing Characteristics

The power on/off sequence is illustrated below



Serial Interface Characteristics (4-line serial):

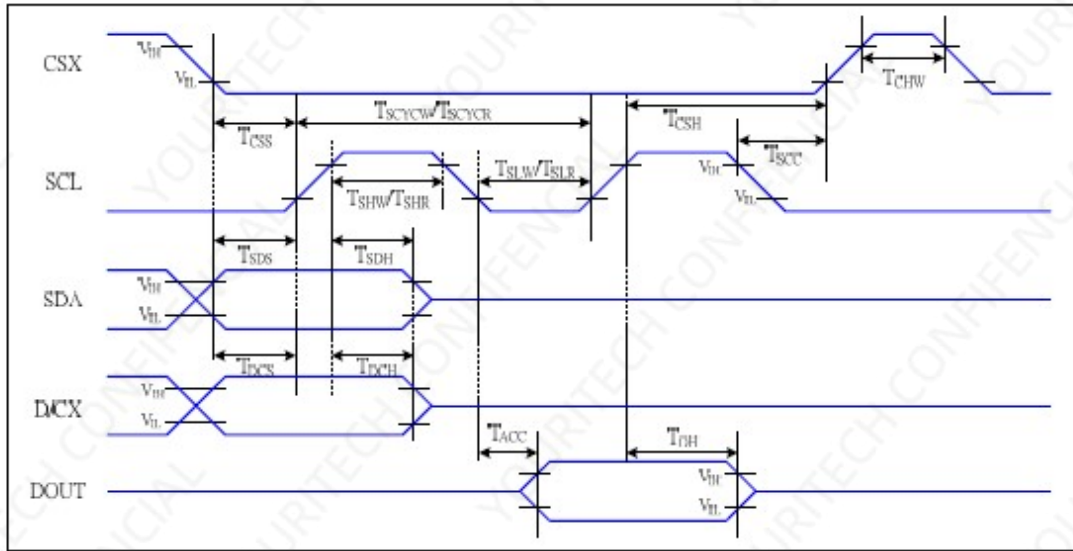


Figure 5 4-line serial Interface Timing Characteristics

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°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 & data ram
	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 & data ram
	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	
DOUT	T _{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T _{OH}	Output disable time	15	50	ns	For minimum CL=8pF

Table 6 4-line serial Interface Characteristics

Note : The rising time and falling time (Tr, Tf) of input signal are specified at 15 ns or less. Logic high and low levels are specified as 30% and 70% of VDDI for Input signals.

Reset Timing:

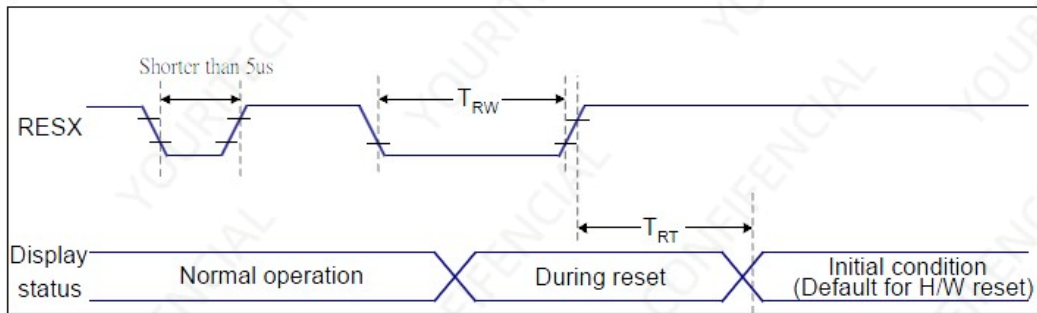


Figure 7 Reset Timing

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, Ta=25°C

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
				120 (Note 1, 6, 7)	ms

Table 9 Reset Timing

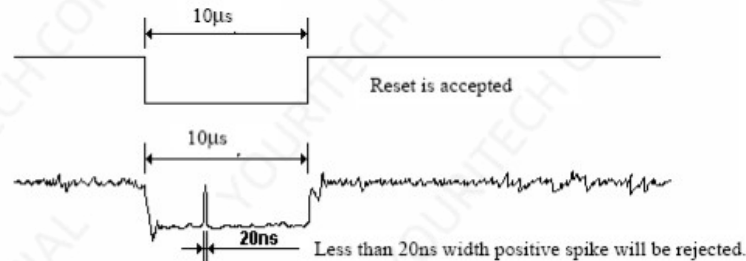
Notes:

1. The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

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

3. During the Resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out –mode. The display remains the blank state in Sleep In –mode.) and then return to Default condition for Hardware Reset.

4. Spike Rejection also applies during a valid reset pulse as shown below:



5. When Reset applied during Sleep In Mode.
6. When Reset applied during Sleep Out Mode.
7. It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

7. Optical Characteristics

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle	Horizontal	Θ3	CR>10	80			°	Note 1
		Θ9		80			°	
	Vertical	Θ12		80			°	
		Θ6		80			°	
Contrast Ratio		CR	Θ= 0°	700	900			Note 2
Transmittance		T(%)	Θ= 0°	3.9	4.3			Note 3
NTSC		%	Θ= 0°	60	65			
Reproduction Of color	Red	Rx	Θ= 0°	0.632	0.647	0.662		Note 4 *Color filter Glass W OC
		Ry		0.311	0.326	0.341		
	Green	Gx		0.276	0.291	0.306		
		Gy		0.571	0.586	0.601		
	Blue	Bx		0.124	0.139	0.154		
		By		0.100	0.115	0.13		
White		Wx	Θ= 0°	0.286	0.301	0.316		
		Wy		0.313	0.328	0.343		
Response Time		Tr+Tf	Θ= 0°		30	35	ms	Note 5

Note:

1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIG.2).
2. Contrast measurements shall be made at viewing angle of $\Theta = 0^\circ$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (See FIG. 2) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Transmittance is the value without APF Pol.
4. The color chromaticity coordinates specified in Table1 shall be calculated from The spectral data measured with all pixels first in red, green, blue and white.

Measurements shall be made at the center of the C/F.

Measurement condition is C - light source & Halogen Lamp

5. The electro-optical response time measurements shall be made as FIG.3 by switching the "data" input signal ON and OFF.

The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_f .

Figure 1. Measurement Set Up

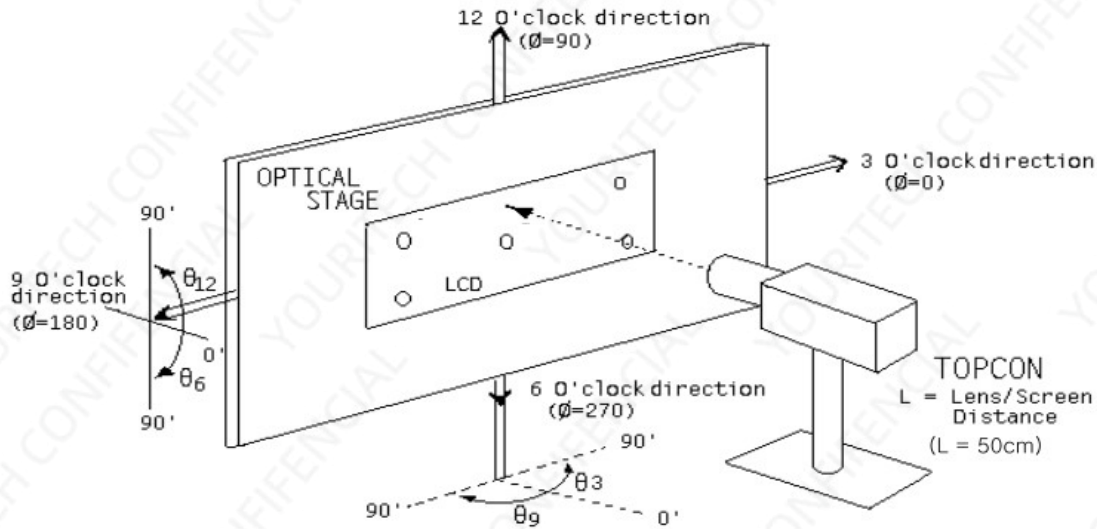
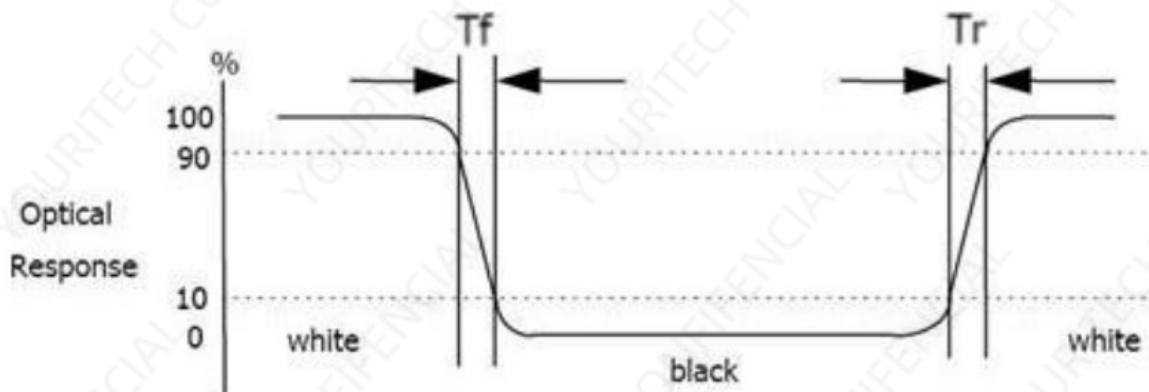


Figure 2. Response Time Testing



8. Reliability Test Item

No.	Test Item	Test Condition	Notes
1	High Temp. Storage	+80°C / 96H	1. Functional test isOK. Missing Segment,short, unclear segment non-display,display abnormally and liquid crystal leakare un-allowed. 2. No low temperature bubbles,end seal loose andfall, frame rainbow.
2	Low Temp. Storage	-30°C / 96H	
3	High Tempe. Operating	+70°C / 96H	
4	Low Tempe. 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

- END -