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Custom Display

Production Custom designs Installation

Mechanical design



MODEL NO : ET024QV01-T

MODEL VERSION: 01

SPEC VERSION : 1.0

ISSUED DATE: 2022-12-29

☐ 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 240xRGBx320

As to basic specification of the driver IC, refer to the IC (Sitronix:ST7789V2) 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

240 dot-segment and 320 dot-common outputs;

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

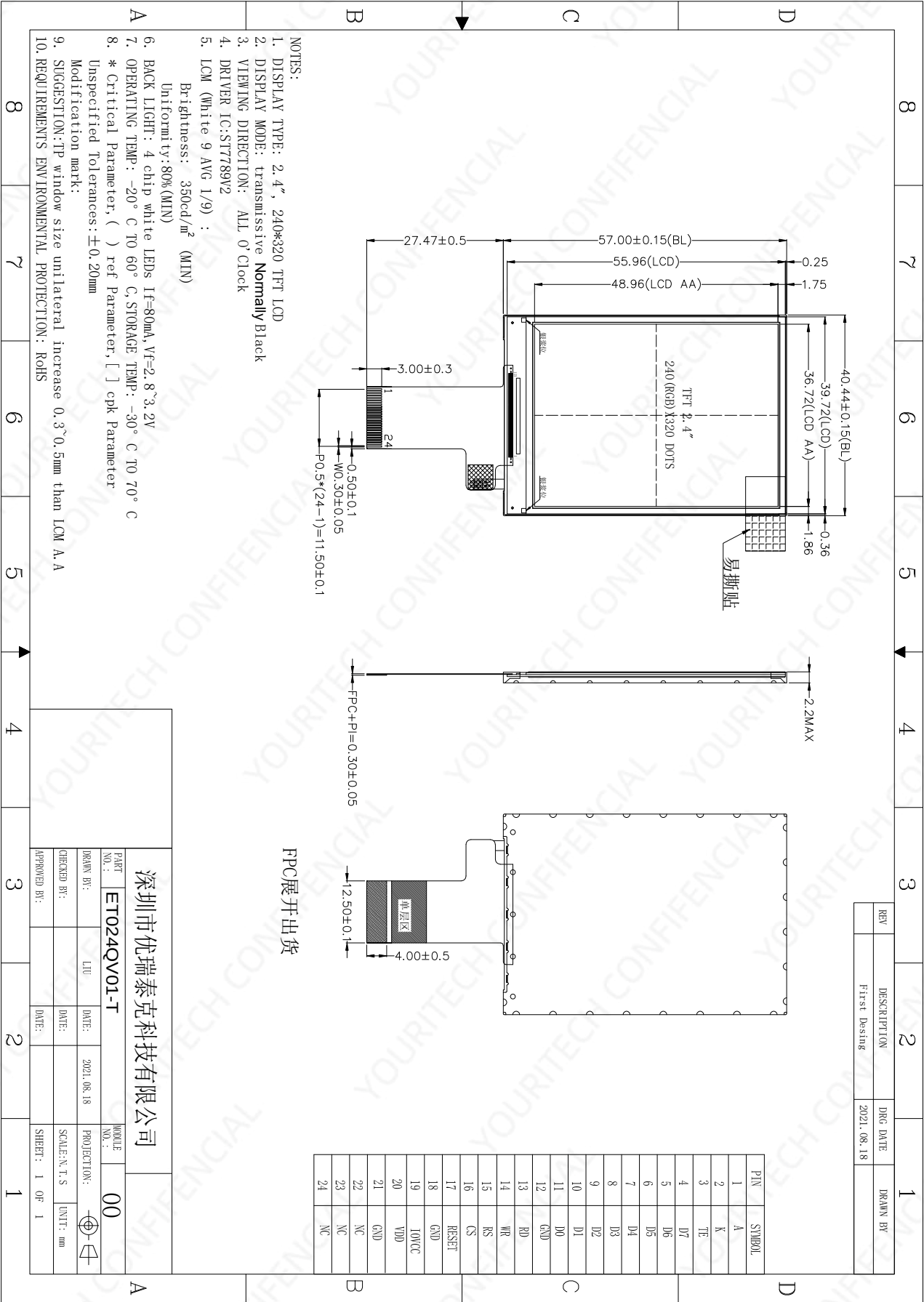
White LED back light;

8bit 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	240*3RGB(H)X320 (V)	Dots
Pixel arrangement	RGB stripe	--
Pixel Pitch (W*H)	0.153(H) x0.153 (V)	mm
Active area	36.72(H) x 48.96(V)	mm
Viewing direction	ALL O'CLOCK	--
TFT Driver IC	ST7789V2	--
TFT interface	8bit MCU interface	--
Approx. Weight	TBD	g
LCM Module Size(W*H*T)	40.44 (W)x57.00(H)x2.20(T)	mm
Touch structure	--	--
Touch Driver IC	--	--
Touch Interface	--	--



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	2.5	2.8	3.3	V
Supply Voltage for(DC/DC)	AVDD	--	--	--	V
Supply Voltage for(DC/DC)	AVEE	--	--	--	V

4.2 Back-Light Unit Characteristics

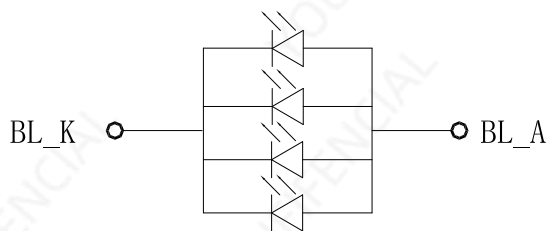
The back-light system is an edge-lighting type with 4 white LEDs. The characteristics of the back-light are shown in the following tables.

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+CTP)	L _v	--	350	--	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:



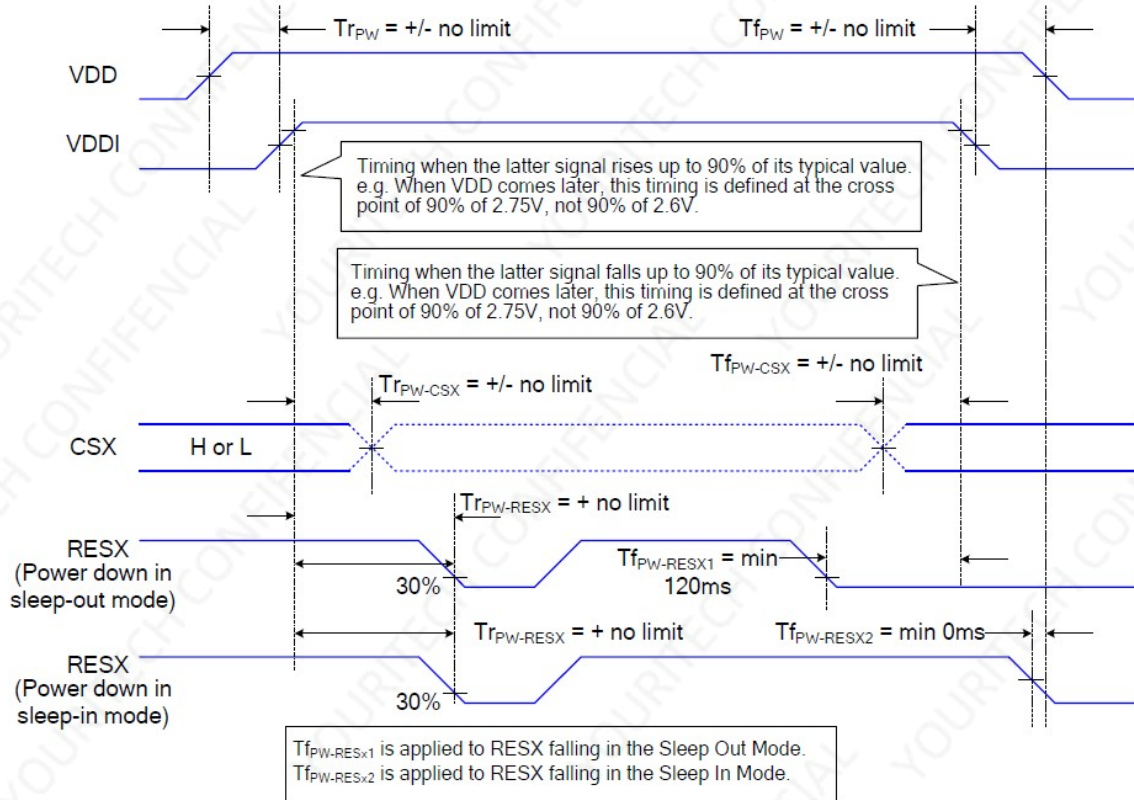
5. Module Function Description

Pin No.	Symbol	Functional	Notes
1	LEDA	Power supply for backlight anode input terminal.	
2	LEDK	Power supply for backlight cathode input terminal.	
3	TE	Frame head pulse for tearing effect.	
4-11	DB7~DB0	MCU parallel interface data bus.	
12	GND	Power Ground	
13	RD	Read data at the rising edge.	
14	WR	Write enable in MCU parallel interface.	
15	RS	Display data/command selection pin in parallel interface.	
16	CS	Chip select signal input pin	
17	RESET	Reset signal input terminal. Active at 'L'.	
18	GND	Power Ground	
19	IOVCC	Power Supply For I/O.	
20	VDD	Power supply : 2.5V ~ 3.3V	
21	GND	Power Ground	
22-24	NC	NC	

6. Timing Characteristics

Power ON/OFF Sequence

The power on/off sequence is illustrated below



8080 Series MCU Parallel Interface Characteristics: 18/16/9/8-bit Bus

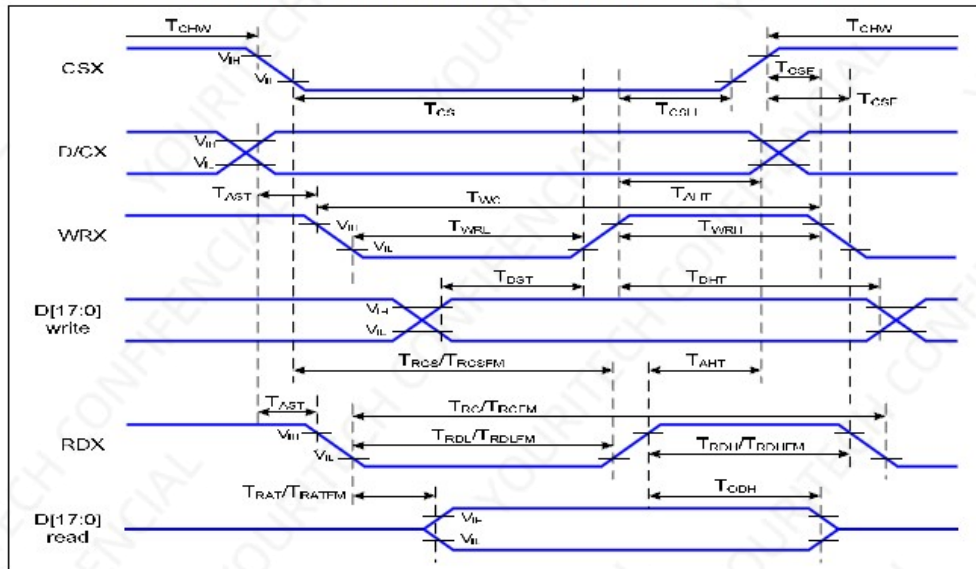


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T_{AST}	Address setup time	0		ns	-
	T_{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T_{CHW}	Chip select "H" pulse width	0		ns	-
	T_{CS}	Chip select setup time (Write)	15		ns	
	T_{RCS}	Chip select setup time (Read ID)	45		ns	
	T_{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T_{CSF}	Chip select wait time (Write/Read)	10		ns	
	T_{CSH}	Chip select hold time	10		ns	
WRX	T_{WC}	Write cycle	66		ns	-
	T_{WRH}	Control pulse "H" duration	15		ns	
	T_{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T_{RC}	Read cycle (ID)	160		ns	When read ID data
	T_{RDH}	Control pulse "H" duration (ID)	90		ns	
	T_{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T_{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T_{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T_{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T_{DST}	Data setup time	10		ns	For CL=30pF
	T_{DHT}	Data hold time	10		ns	
	T_{RAT}	Read access time (ID)		40	ns	
	T_{RATFM}	Read access time (FM)		340	ns	
	T_{ODH}	Output disable time	20	80	ns	

Reset Timing:

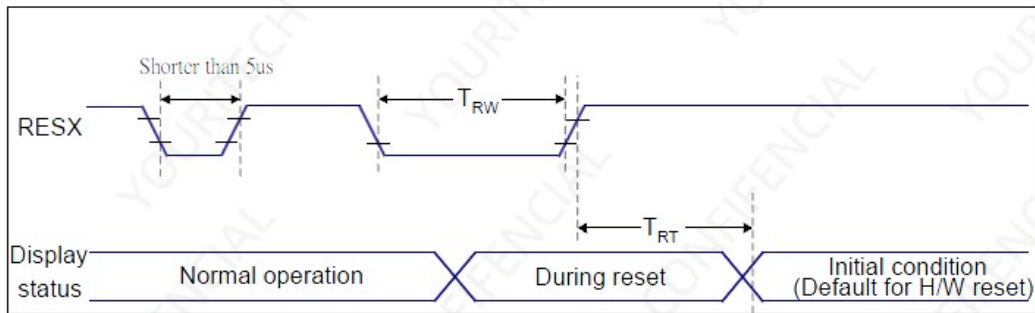


Figure 7 Reset Timing

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

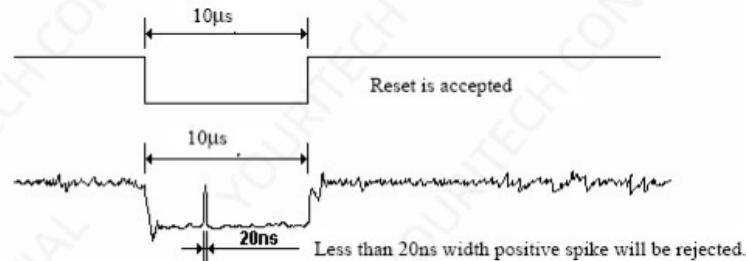
Notes:

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 Range	Horizontal	Θ3	CR> 10	70	80	-	Deg.	Note1
		Θ9		70	80	-	Deg.	
	Vertical	Θ12		70	80	-	Deg.	
		Θ6		70	80	-	Deg.	
Contrast ratio		CR	Θ = 0°	1000	1500	-		Note2
Transmittance		Tr		4.0	4.65		%	Note3
Color Gamut		CG		65	70		%	
Reproduction of color	Red	Rx	Θ = 0°	0.632	0.652	0.672		Note4 (Based on C Light)
		Ry		0.302	0.322	0.342		
	Green	Gx		0.256	0.276	0.296		
		Gy		0.562	0.582	0.602		
	Blue	Bx		0.121	0.141	0.161		
		By		0.071	0.091	0.111		

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
White Chromaticity		Wx	Θ = 0°	0.287	0.307	0.327		
		Wy		0.314	0.334	0.354		
Response Time (Rising + Falling)		T _r + T _f	Ta= 25° C Θ = 0°		35	45	ms	Note 5

Note:

- 1.Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles 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 FIGURE 1).
- 2.Contrast measurements shall be made at viewing angle of $\Theta = 0$ 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 FIGUR 1)
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 and without CG.
4. The color chromaticity coordinates specified in the above table 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 panel.
5. The electro-optical response time measurements shall be made as FIGURE 2 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 .

Figure1 Measurement Set Up

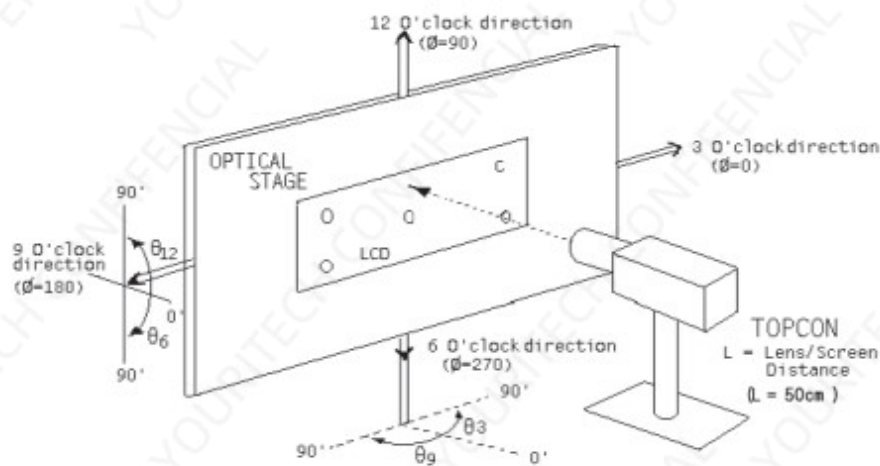
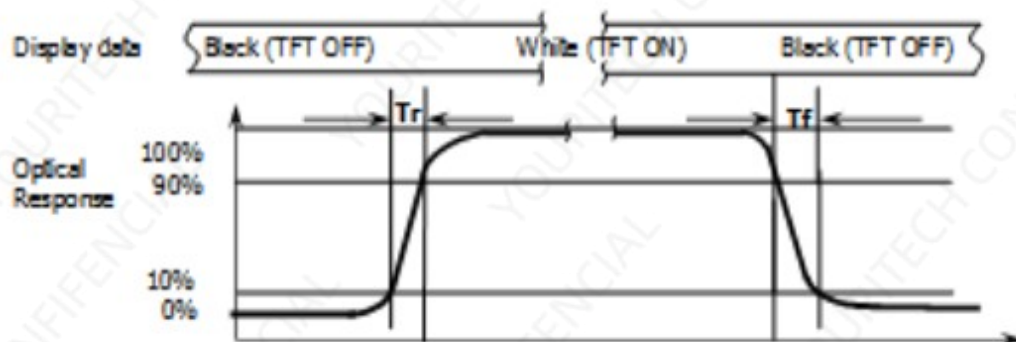


Figure2 Response Time Testing



8. Reliability Test Item

No.	Test Item	Test Condition	Notes
1	High Temp. Storage	+70°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	+60°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 -