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Cover glass

System solutions

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Custom Display

Production Custom designs Installation

Mechanical design



MODEL NO : ET096QE01-T

MODEL VERSION: 01

SPEC VERSION : 1.0

ISSUED DATE: 2020-08-24

☐ 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 80xRGBx160

As to basic specification of the driver IC, refer to the IC (Sitronix:ST7735S) 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

80 dot-segment and 160 dot-common outputs;

65/262K Color can be selected by software;

White LED back light;

4-line Seria interface

1.3 Applications:

2. LCM General specification

ITEM	Standard value	Unit
LCD Type	Normally Black	--
Drive element	TFT active matrix	--
Number of pixels	80*3RGB(H)X160 (V)	Dots
Pixel arrangement	RGB stripe	--
Pixel Pitch (H*V)	0.135(H) x0.1356 (V)	mm
Active area	10.8(H) x 21.696(V)	mm
Module Size(W*H*T)	14.04(W)x27.95(H)x1.38(T)	mm
Viewing direction	ALL O'CLOCK	
TFT Driver IC	ST7735S	-
TFT interface	4-line Serial Interface	-
Approx. Weight	TBD	g
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	--	--	--	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

4.2Back-Light Unit Characeristics

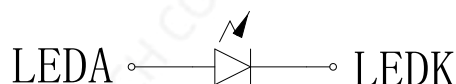
The back-light system is an edge-lighting type with 2 white LEDs. The characteristics of the back-light are shown in the following tables.

Characteristics	Symbol	Min.	Type	Max.	Unit	Notes
Forward Voltage	V _F	2.8	-	3.2	V	-
Forward current	I _F	--	20	-	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

5.1 LCM Pin Descriptions

1	NC	NC
2	NC	NC
3	SDA	input/output signal pin
4	SCL	Synchronous clock signal pin
5	RS	Display data/command selection pin
6	RESET	Reset signal input terminal. Active at 'L'.
7	CS	Chip select signal input pin
8	GND	Ground
9	NC	NC
10	VDD	PINPOWER SUPPLY (2.8-3.3V)
11	LEDK	Power supply for backlight cathode input terminal.
12	LEDA	Power supply for backlight anode input terminal.
13	GND	Ground

6. Timing Characteristics

Serial Interface Characteristics (4-line Serial)

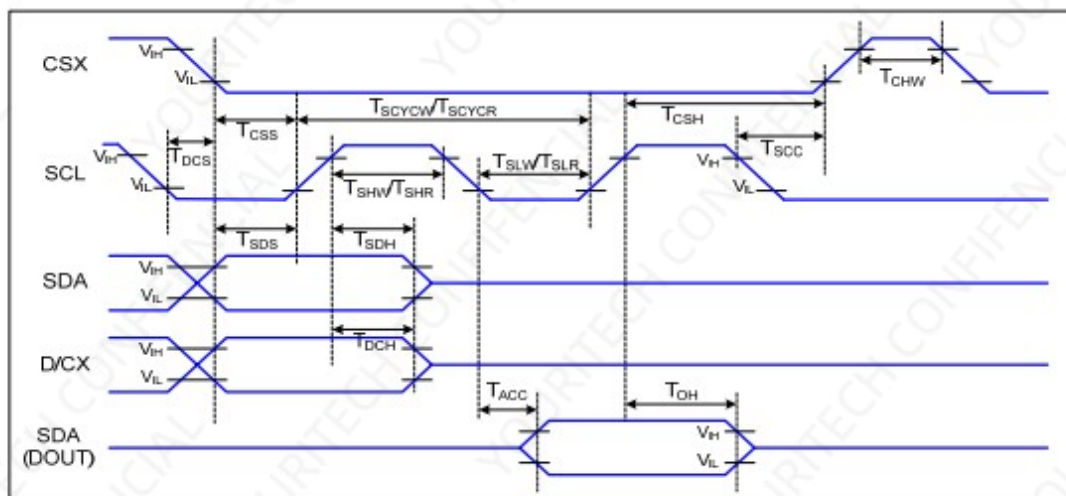


Figure 7 4-line Serial Interface Timing

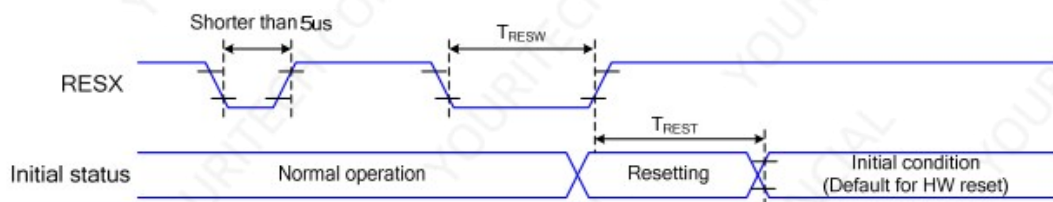
Ta=25 °C, VDDI=1.65~3.7V, VDD=2.5~4.8V

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	TCSS	Chip Select Setup Time (Write)	45		ns	
	TCSH	Chip Select Hold Time (Write)	45		ns	
	TCSS	Chip Select Setup Time (Read)	60		ns	
	TSCC	Chip Select Hold Time (Read)	65		ns	
	TCHW	Chip Select "H" Pulse Width	40		ns	
SCL	TSCYCW	Serial Clock Cycle (Write)	66		ns	-Write Command & Data Ram
	TSHW	SCL "H" Pulse Width (Write)	15		ns	
	TSLW	SCL "L" Pulse Width (Write)	15		ns	
	TSCYCR	Serial Clock Cycle (Read)	150		ns	-Read Command & Data Ram
	TSHR	SCL "H" Pulse Width (Read)	60		ns	
	TSLR	SCL "L" Pulse Width (Read)	60		ns	
D/CX	TDCS	D/CX Setup Time	10		ns	
	TDCH	D/CX Hold Time	10		ns	
SDA (DIN) (DOUT)	TSDS	Data Setup Time	10		ns	For Maximum CL=30pF For Minimum CL=8pF
	TSDH	Data Hold Time	10		ns	
	TACC	Access Time	10	50	ns	
	TOH	Output Disable Time	15	50	ns	

Table 7 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:



Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	tRESW	Reset Pulse Duration	10	-	us
	tREST	Reset Cancel	-	5	ms
				120	ms

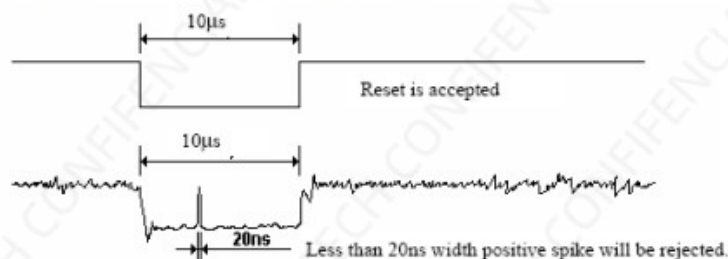
Table 14 Reset Timing

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

7.1 Optical Specification (HSD LC & Normal POL, Reference Only)

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (with Polarizer)		T(%)	—	—	(5.09)	—	%	w/o APCF
Transmittance (without Polarizer)		T(%)	—	—	(16.72)	—	%	
Contrast Ratio		CR	$\Theta=0$	—	(800)	—	—	(1)(2)
Response Time		$T_R + T_F$	Normal viewing angle	—	(30)	(40)	msec	(1)(3)
Color Gamut		S(%)			50	—	%	
Color Chromaticity (CIE1931)	White	W_x	-0.02		(0.306)	+0.02		(1)(4) CF glass
		W_y			(0.327)			
	Red	R_x			(0.610)			
		R_y			(0.333)			
	Green	G_x			(0.281)			
		G_y			(0.533)			
	Blue	B_x			(0.146)			
		B_y			(0.138)			
Viewing Angle	Hor.	Θ_L	CR>10	—	80	—		
		Θ_R		—	80	—		
	Ver.	Θ_U		—	80	—		
		Θ_D		—	80	—		
Optima View Direction		ALL						(5)

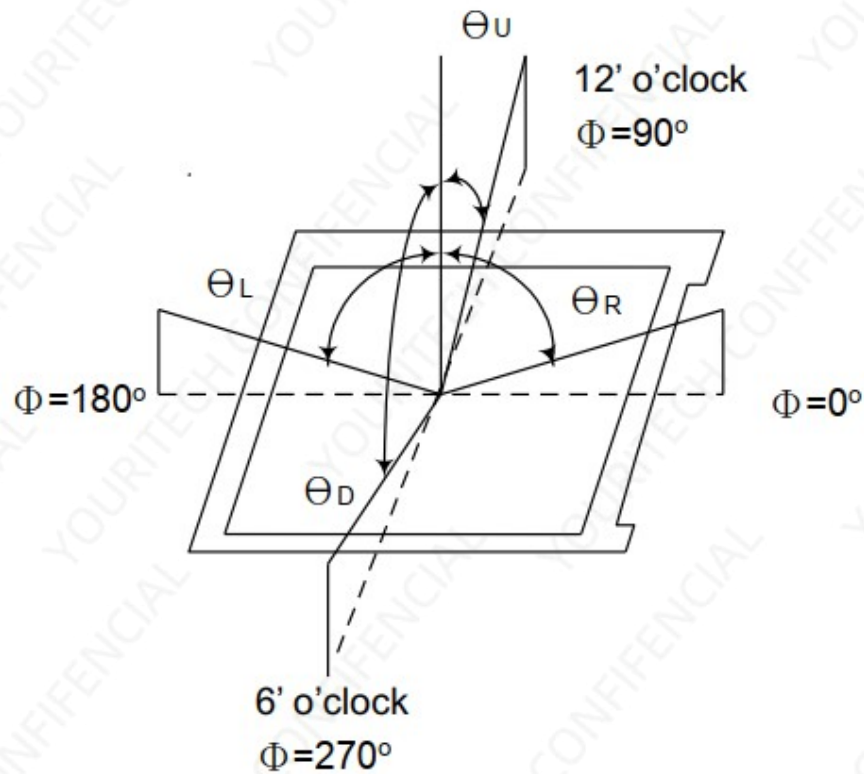
7.2 Measuring Condition

- Measuring surrounding : dark room
- Ambient temperature : $25 \pm 2^\circ\text{C}$
- 15min. warm-up time.

7.3 Measuring Equipment

FPM520 of Westar Display technologies, INC., which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.

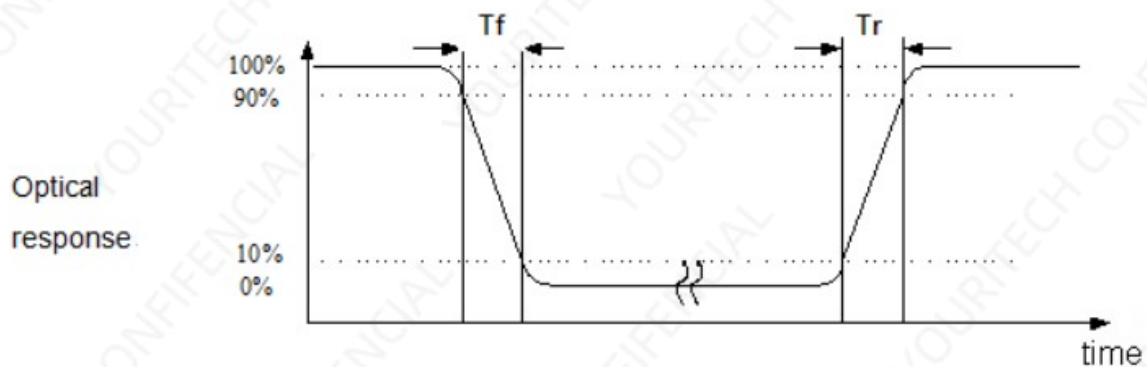
Note (1) Definition of Viewing Angle:



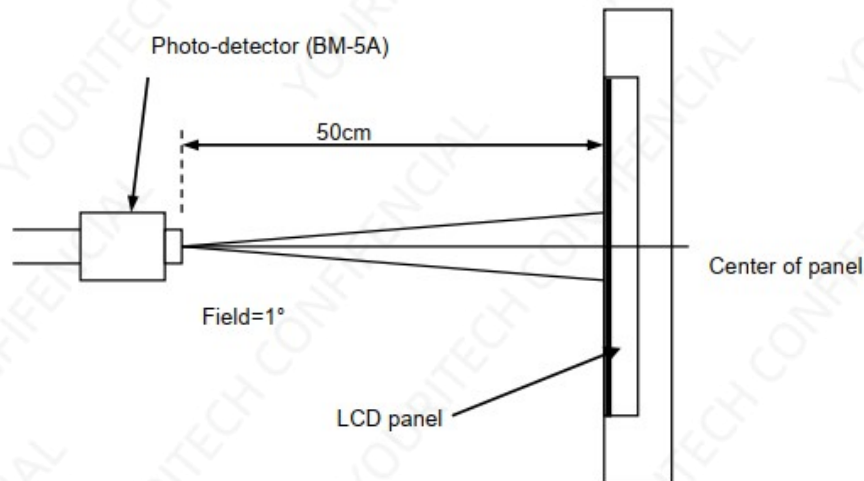
Note (2) Definition of Contrast Ratio (CR):
measured at the center point of panel

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

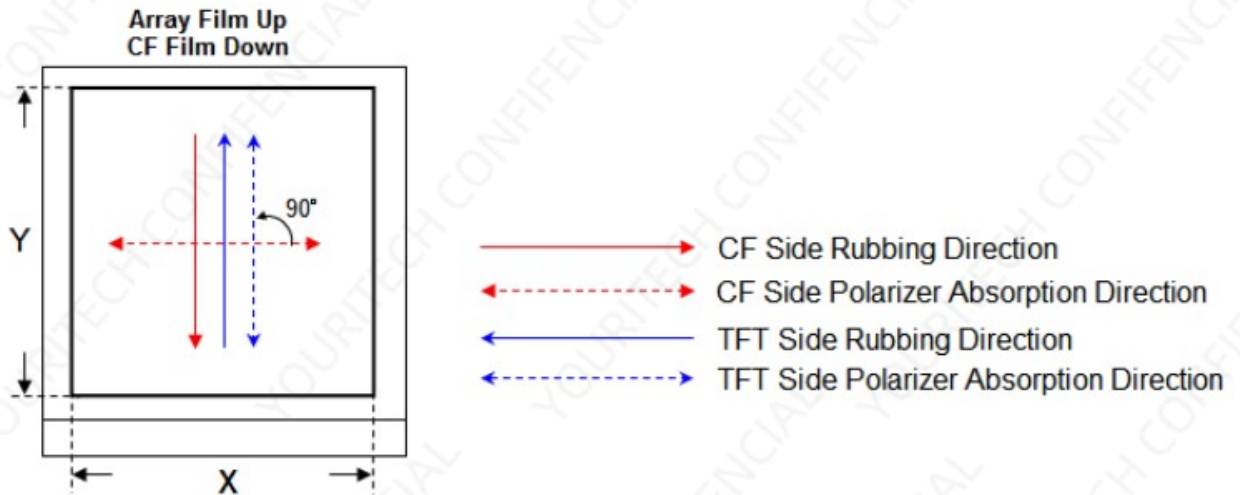
Note (3) Definition of Response Time: Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Rubbing Direction & Polarizer Absorption Direction



Item	Specifications	Unit	Note
Rubbing Direction	90° (TFT) / -90° (CF)	degree	2-domain IPS-pro
Absorption axis of Polarizer	90° (TFT) / 0° (CF)	degree	Array Film Up CF Film Down

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) ~70°C (30min), 50 cycles	

9. Packing Method----TBD

- END -