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MODEL NO : ET096QE01-XMODEL VERSION: 01SPEC VERSION : 1.0ISSUED DATE: 2017-12-08☒ Preliminary Specification☐ Final Product Specification

Customer : _____

Approved by	Notes

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Record of Revision

[illegible]

1 General Specifications

Feature		Spec
Display Spec.	Size	0.96 inch
	Resolution	80xRGBx160
	Technology Type	a-Si
	Pixel Configuration	RGB Vertical Stripe
	Pixel pitch(mm)	0.135 (W) ×0.135 (H)
	Display Mode	Transmissive/Normally Black
	Viewing Direction	Free angle
Mechanical Characteristics	LCM (W x H x D) (mm)	13.3(H)*27.95(V)*1.78(D)
	Active Area(mm)	10.8*21.7
	With /Without TSP	Without TSP
	Driver IC	ST7735S
	Weight (g)	TBD
Electrical Characteristics	Interface	SPI
	Color Depth	262K

Note 1: Viewing direction for best image quality is different from TFT definition. There is a 180 degree shift.

Note 2: Requirements on Environmental Protection: Q/S0002

Note 3: LCM weight tolerance: ± 5%

2 Input/Output Terminals

Pin No.	Symbol	I/O	Function	Remark
1	TP0		TP interface	
2	TP1		TP interface	
3	SDA		Serial data input pin in serial interface operation	
4	SCL		Serial interface clock	
5	RS		Register select signal	
6	RESET		Chip reset signal	
7	CS		Chip select pin	
8	GND		Ground	
9	NC		No connection	
10	VCC(2.8V)		Analog Power Supply for LCM (2.8V)	
11	LED-		Backlight cathode	
12	LED+		Backlight anode	
13	GND		Ground	

3 Absolute Maximum Ratings

GND=0V

Item	Symbol	MIN	MAX	Unit	Remark
Power Voltage	VDD	-0.3	4.6	V	Note1
Operating Temperature	Top	-20	70	°C	
Storage Temperature	Tst	-30	80	°C	

Table 3 Absolute Maximum Ratings

Note 1: Temperature and relative humidity range are shown in the figure below.

4 Electrical Characteristics

4.1 Driving TFT LCD Panel

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Power Supply Voltage	VCC	2.7	2.8	2.9	V	
I/O Supply Voltage	VDDIO	1.65	1.8/2.8	3.3	V	
Input high level voltage	V _{IH}	0.8VDDIO		VDDIO	V	
Input low level voltage	V _{IL}	GND		0.2VDDIO	V	

4.2 Backlight Unit

The backlight system is an edge-lighting type with 1 LED. The characteristics of the LED are shown in the following tables.

Item	Symbol	MIN	TYP	MAX	Unit	Remark
Backlight forward voltage	V _F	-	3.2	-	V	1 LEDs
Backlight forward current	I _F	--	15	--	mA	
LED life time	--	20000	--	--	Hrs	

Note 1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 °C, typical IL value indicated in the above table and the fL=50k Hz until the brightness becomes less than 50%.



$$V_F=3.2V \quad I_F=15mA$$

5 Timing Chart

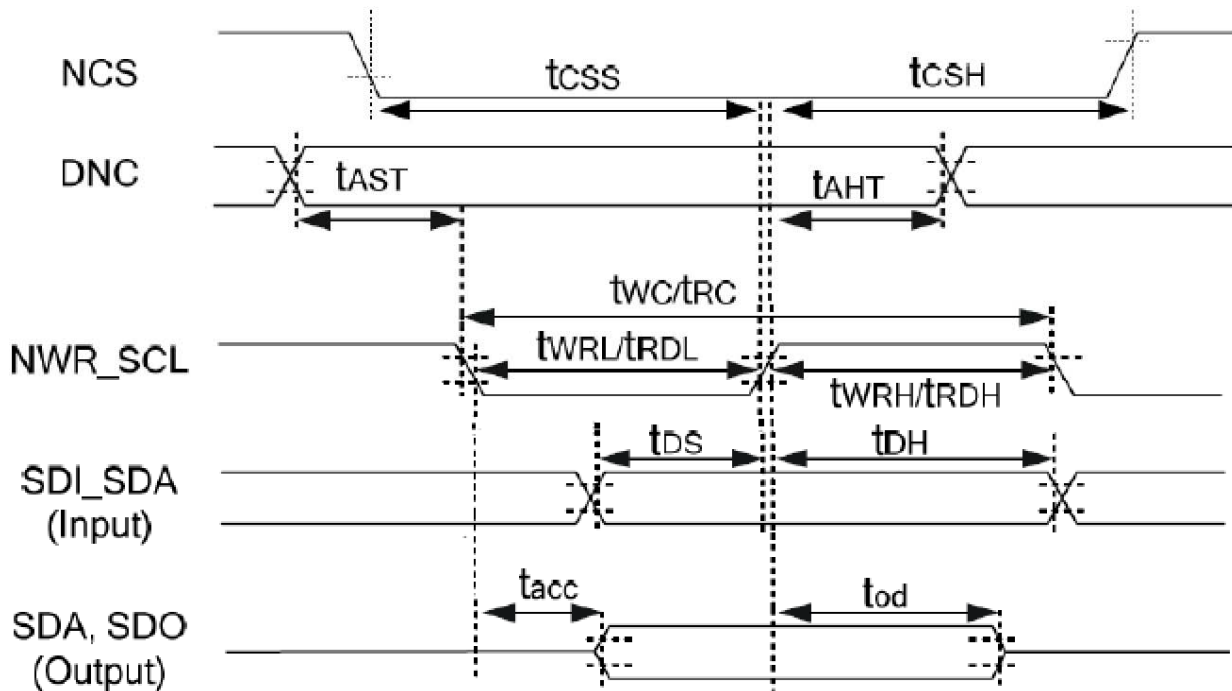


Figure 8-2: SPI 4-wire interface characteristics

(VSSA=0V, IOVCC=1.8V, VCI=2.8V, T_A = 25°C)

Signal	Symbol	Parameter	Min.	Max.	Unit	Description
NCS	t_{CSS}	Chip select setup time (Read)	60	-	ns	-
	t_{CSH}	Chip select hold time (Read)	65	-	ns	
DNC	t_{AST}	Address setup time	0	-	ns	-
	t_{AHT}	Address hold time (Write/Read)	10	-	ns	
NWR_SCL (Write)	t_{WC}	Write cycle	14	-	ns	-
	t_{WRH}	Control pulse "H" duration	6	-	ns	
	t_{WRL}	Control pulse "L" duration	6	-	ns	
NWR_SCL (Read)	t_{RC}	Read cycle	150	-	ns	-
	t_{RDH}	Control pulse "H" duration	60	-	ns	
	t_{RDL}	Control pulse "L" duration	60	-	ns	
SDI_SDA (Input)	t_{DS}	Data setup time	6	-	ns	For maximum CL=30pF
	t_{DH}	Data hold time	6	-	ns	
SDA, SDO (Output)	t_{ACC}	Read access time	10	50	ns	For minimum CL=8pF
	t_{OD}	Output disable time	15	50	ns	

6 Optical Characteristics

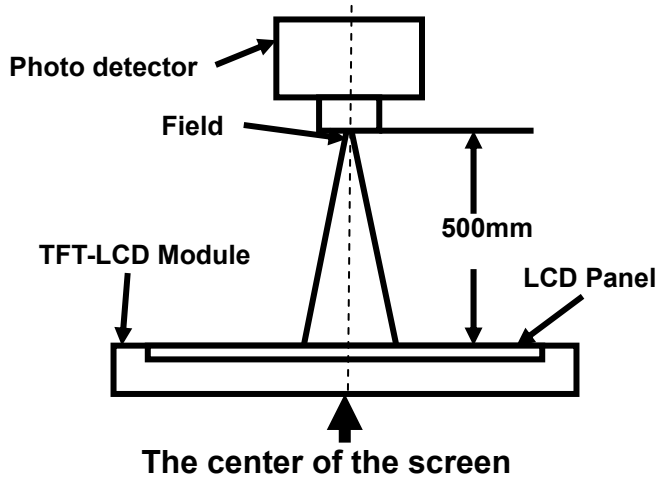
Item		Symbol	Condition	Min	Typ	Max	Unit	Remark
View Angles		θT	CR≧10	70	80	-	Degree	Note2,3
		θB		70	80	-		
		θL		70	80	-		
		θR		70	80	-		
Contrast Ratio		CR	θ=0°		600			Note 3
Response Time		T _{ON}	25℃	-	35	-	ms	Note 4
		T _{OFF}						
Chromaticity	White	x	Backlight is on	0.25	0.30	0.35		Note 1,5
		y		0.28	0.33	0.38		
	Red	x						Note 1,5
		y						
	Green	x						Note 1,5
		y						
	Blue	x						Note 1,5
		y						
Uniformity		U		80	85	--	%	Note 6
Luminance		L		-	120	-	cd/m ²	Note 7

Test Conditions:

1. $I_F = 15$ mA, and the ambient temperature is 25℃.
2. The test systems refer to Note 1 and Note 2.

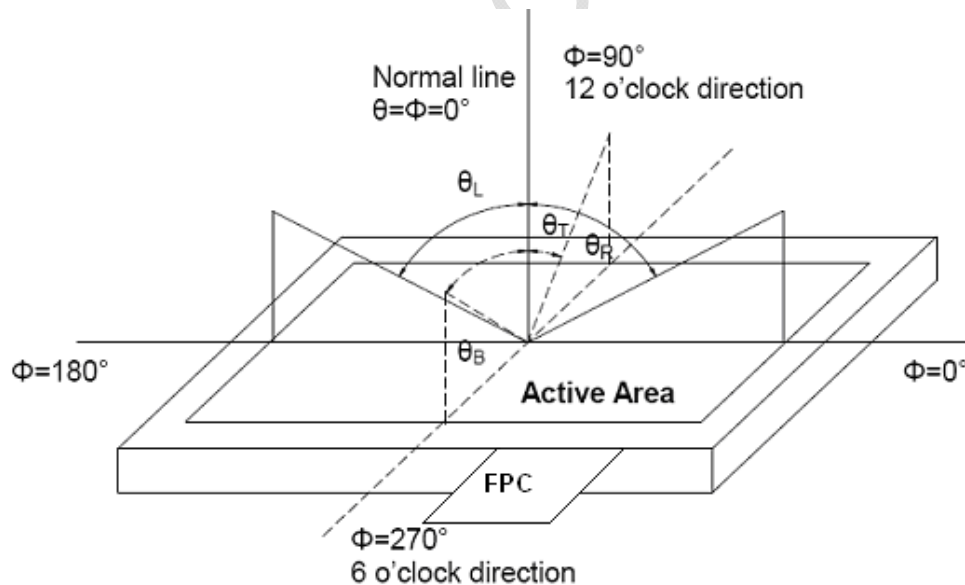
Note 1: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 Minutes operation, the optical properties are measured at the center point of the LCD screen. All input terminals LCD panel must be ground when measuring the center area of the panel.



Note 2: Definition of viewing angle range and measurement system.

viewing angle is measured at the center point of the LCD.



Note 3: Definition of contrast ratio

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD is on the "White" state}}{\text{Luminance measured when LCD is on the "Black" state}}$$

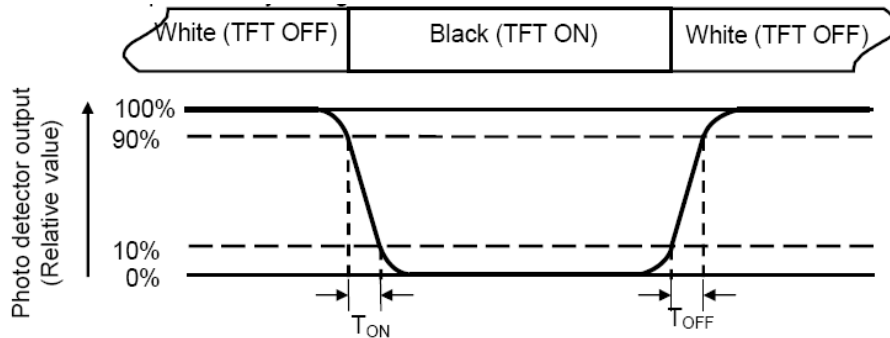
"White state ": The state is that the LCD should drive by V_{white} .

"Black state": The state is that the LCD should drive by V_{black} .

V_{white} : To be determined V_{black} : To be determined.

Note 4: Definition of Response time

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time (T_{ON}) is the time between photo detector output intensity changed from 90% to 10%. And fall time (T_{OFF}) is the time between photo detector output intensity changed from 10% to 90%.



Note 5: Definition of color chromaticity (CIE1931)

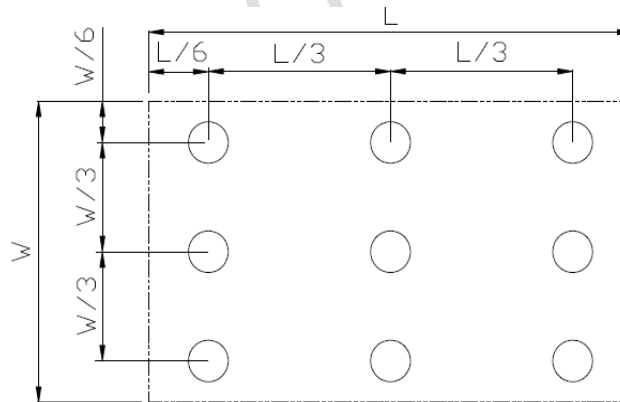
Color coordinates measured at center point of LCD.

Note 6: Definition of Luminance Uniformity

Active area is divided into 9 measuring areas (Refer Fig. 2). Every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity (U)} = L_{\min} / L_{\max}$$

L-----Active area length W----- Active area width



$L_{\max}$: The measured Maximum luminance of all measurement position.

$L_{\min}$: The measured Minimum luminance of all measurement position.

Note 7: Definition of Luminance:

Measure the luminance of white state at center point.

7 Environmental / Reliability Test

No	Test Item	Condition	Remarks
1	High Temperature Operation	70℃, 96Hours	IEC60068-2-1:2007 GB2423.2-2008
2	Low Temperature Operation	-20℃, 96 Hours	IEC60068-2-1:2007 GB2423.1-2008
3	High Temperature Storage	80℃, 96Hours	IEC60068-2-1:2007 GB2423.2-2008
4	Low Temperature Storage	-30℃, 96 Hours	IEC60068-2-1:2007 GB2423.1-2008
5	Storage at High Temperature and Humidity	60℃, 90%RH, 96 Hours	IEC60068-2-78 :2001 GB/T2423.3—2006
6	Thermal Shock (non-operation)	-30℃/0.5h~+80℃/0.5h for a total 24 cycles	Start with cold temperature, End with high temperature, IEC60068-2-14:1984,G B2423.22-2002
7	ESD	±2KV, Human Body Mode, 150pF/330Ω ; ±8KV, Air Mode, 150pF/330Ω ;	IEC61000-4-2:2001 GB/T17626.2-2006
8	Vibration Test	10 => 55 =>10 => 55 => 10 Hz, within 1 minute;Amplitude:1.5mm. 15 minutes for each Direction (X,Y,Z)	IEC60068-2-6:1982 GB/T2423.10—1995
10	Package Drop Test	Packed, 66CM free fall 6 sides, 1 corner, 3edges	IEC60068-2-32:1990 GB/T2423.8—1995

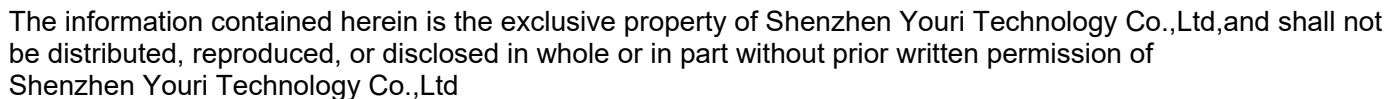
Note1: Ts is the temperature of panel's surface.

Note2: Ta is the ambient temperature of sample.

Note3: Before cosmetic and function test, the product must have enough recovery time, at least 2 hours at room temperature.

Note 4: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but don't guarantee all of the cosmetic specification.

8. Outline Dimension



9 Packing Drawing

TBD

10 Precautions for Use of LCD Modules

a) Handling Precautions

- i. The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- ii. If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.
- iii. Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- iv. The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.
- v. If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:
 - Isopropyl alcohol
 - Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

- Water
 - Ketone
 - Aromatic solvents
- vi. Do not attempt to disassemble the LCD Module.
 - vii. If the logic circuit power is off, do not apply the input signals.
 - viii. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

10.1.8.1 Be sure to ground the body when handling the LCD Modules.

10.1.8.2 Tools required for assembly, such as soldering irons, must be properly ground.

10.1.8.3 To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.

10.1.8.4 The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

b) Storage precautions

- i. When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

- ii. The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ~ 40℃ Relatively humidity: ≤80%

- iii. The LCD modules should be stored in the room without acid, alkali and harmful gas.

c) Transportation Precautions

- i. The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.