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Custom Display

Mechanical design

Production Custom designs Installation



MODEL NO : ET020HV01-T

MODEL VERSION: 01

SPEC VERSION : 1.0

ISSUED DATE: 2020-09-01

☐ 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

This LCD module should be designed for mobile phone use.

LCD specification: Dots 240xRGBx320.

As to basic specification of the driver IC, refer to the IC (Orise: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;

ALL O'CLOCK Type LCD

240 dot-segment and 320 dot-common outputs;

262K Color can be selected by software;

White LED back light;

8 bit 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)	0.1275(W)x 0.1275(H)	mm
Active area	30.6(W) x40.80(H)	mm
Module Size(W*H*T)	34.60(W) x47.83(H) x1.95(T)	mm
Viewing direction	ALL O'CLOCK	
TFT Driver IC	TBD	-
TFT interface	8 bit MCU Interface	-
Approx. Weight	TBD	g



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	10	90	%

4.Electrical Characteristics

4.1 TFT DC Characteristics

(Ta=25±2°C)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage 1	VDDIO	1.65	1.8	3.3	V	
Power Supply Voltage 2	VDD	2.5	2.8	3.3	V	
Power Supply Voltage 3	VDD3	-	-	-	V	
Power Supply for MTP	VPP	-	-	-	V	

6.4 Back-Light Unit Characteristics

The back-light system is an edge-lighting type with 3 white LEDs. The characteristics of the back-light are shown in the following tables.

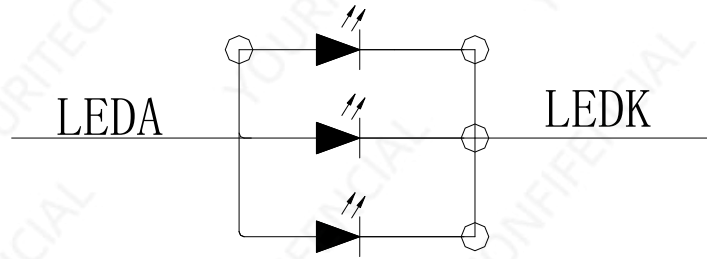
(Ta=25±2°C)

Characteristics	Symbol	Condition	Min.	Type	Max.	Unit	Notes
Forward Voltage	V _f	I _L =60mA	2.9	3.1	3.3	V	-
Forward current	I _L		--	60	-	mA	-
Luminance(With LCD)	L _v	I _L =60mA		500	--	cd/m ²	-
LED life time	-	I _L =60mA	----	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	A	Power supply for backlight anode input terminal.	
2	K	Power supply for backlight cathode input terminal.	
3	NC	NC	
4	NC	NC	
5	IOVCC	power supply for the I/O circuit(1.8V)	
6	VCC	power supply for DC/DC circuit(2.8V)	
7	D7	MCU parallel interface data bus	
8	D6	MCU parallel interface data bus	
9	D5	MCU parallel interface data bus	
10	D4	MCU parallel interface data bus	
11	D3	MCU parallel interface data bus	
12	D2	MCU parallel interface data bus	
13	D1	MCU parallel interface data bus	
14	D0	MCU parallel interface data bus	
15	RD	Read enable in 8080 MCU parallel interface	
16	WR	Write enable in MCU parallel interface	
17	RS	Display data/command selection pin in parallel interface	
18	CS	Chip select signal input pin	
19	TE	Tearing effect output pin to synchronize MPU to frame writing	
20	RESET	Reset signal input terminal. Active at 'L'.	
21	GND	Power Ground	
22	GND	Power Ground	

6. Timing Characteristics

MCU Interface Timing Characteristics of IC

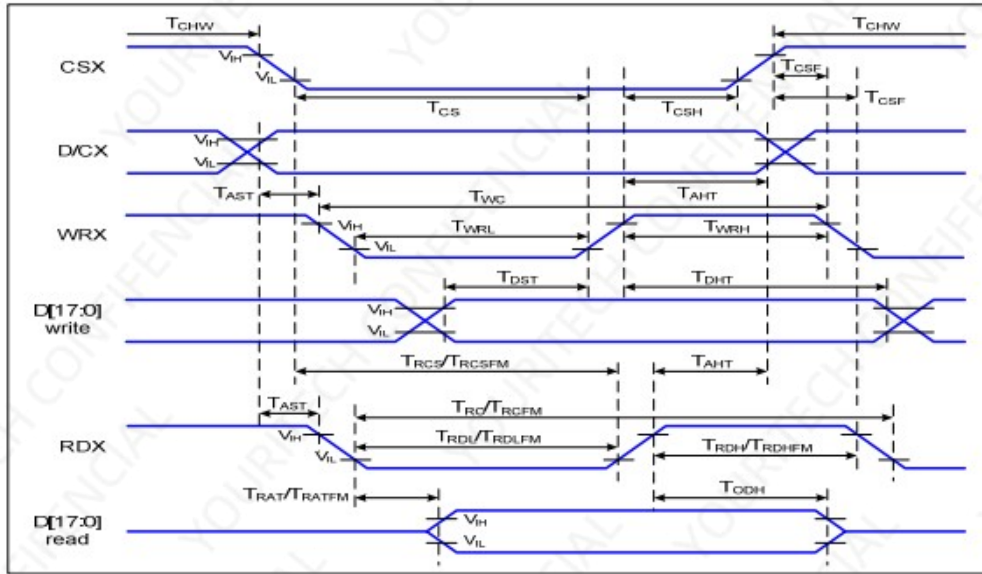


Figure 1 Parallel Interface Timing Characteristics (8080-Series MCU Interface)

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

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 _{RDH}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T _{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T _{RDHF}	Control pulse "H" duration (FM)	90		ns	
	T _{RDHF}	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

Table 4 8080 Parallel Interface Characteristics

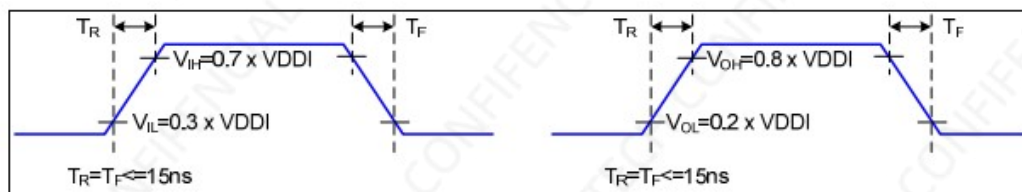


Figure 2 Rising and Falling Timing for I/O Signal

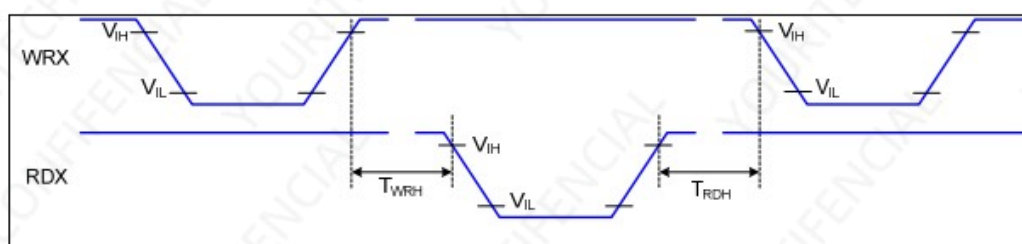


Figure 3 Write-to-Read and Read-to-Write Timing

Note: The rising time and falling time (T_r , T_f) of input signal and fall time 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:

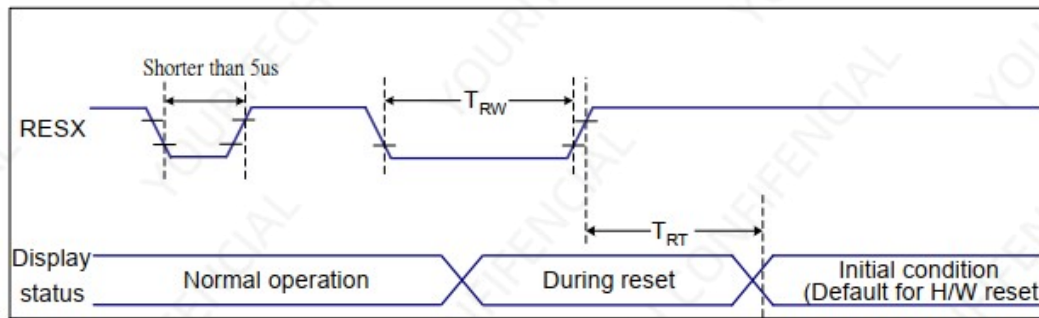


Figure 7 Reset Timing

VDDI=1.65 to 3.3V, VDD=2.4 to 3.3V, AGND=DGND=0V, $T_a=25^{\circ}\text{C}$

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

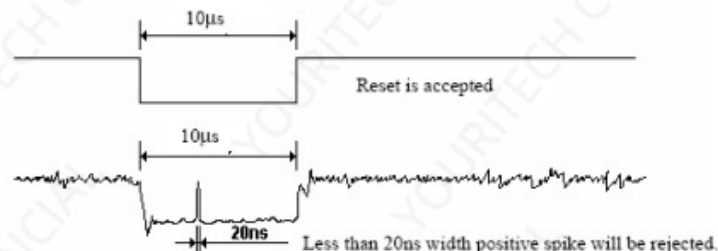
Notes:

- 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 (t_{RT}) within 5 ms after a rising edge of RESX.
- 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

- 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.

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



- When Reset applied during Sleep In Mode.
- When Reset applied during Sleep Out Mode.
- 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 Checification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Transmittance (with Polarizer)		T(%)	—	—	(4.50)	—	%	Normal POL
Transmittance (without Polarizer)		T(%)	—	—	(12.20)	—	%	
Contrast Ratio		CR	$\Theta=0$ Normal viewing angle	640	800	—	—	(1)(2)
Response Time		$T_R + T_F$		—	30	40	msec	(1)(3)
Color Gamut		S(%)		54	60	—	%	
Color Chromaticity (CIE1931)	White	W_x		± 0.02	(0.296)	± 0.02		(1)(4) CF glass
		W_y			(0.325)			
	Red	R_x			(0.647)			
		R_y			(0.329)			
	Green	G_x			(0.279)			
		G_y			(0.550)			
	Blue	B_x			(0.134)			
		B_y			(0.123)			
Viewing Angle	Hor.	Θ_L	CR>10	—	80	—		Viewing Angle base on using Normal Polarizer , Reference Only
		Θ_R		—	80	—		
	Ver.	Θ_U		—	80	—		
		Θ_D		—	80	—		
Optima View Direction		ALL						(5)

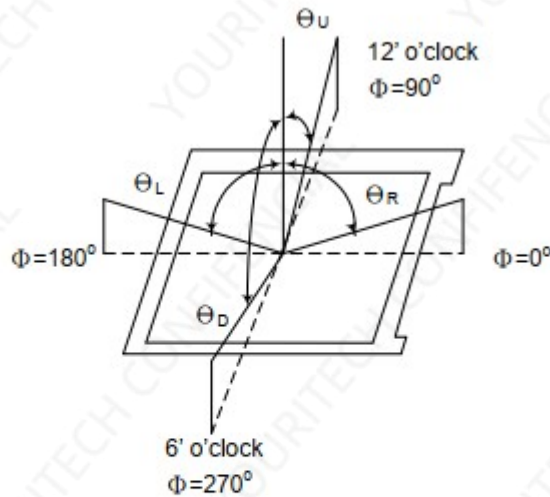
7.2 Measuring Condition

- 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.

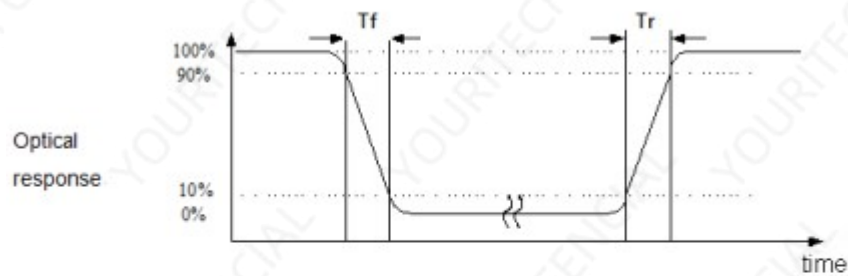
Note (1) Definition of Viewing Angle:



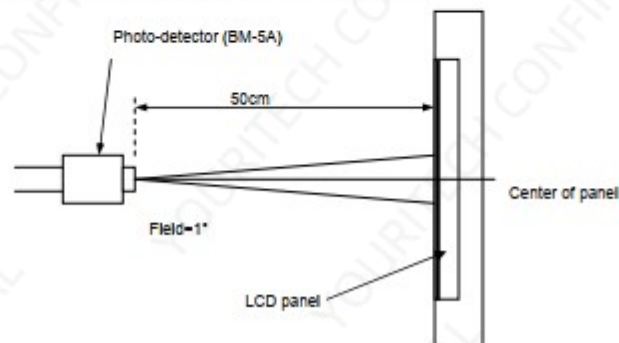
Note (2) Definition of Contrast Ratio (CR):
measured at the center point of panel

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

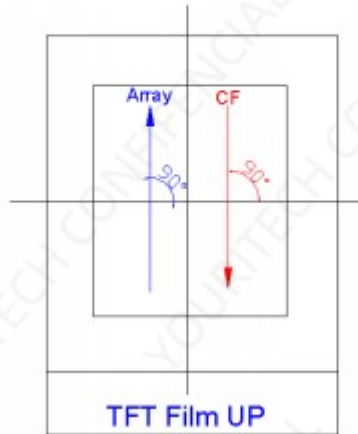
Note (3) Definition of Response Time: Sum of T_R and T_F



Note (4) Definition of optical measurement setup



Note (5) Rubbing Direction (The different Rubbing Direction will cause the different optima view direction.)



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

- END -