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Custom Display

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Custom designs
Installation

Mechanical design



SPECIFICATION FOR LCM Module

MODULE No:	ET098XX20-K
CUSTOMER:	

YOURITECH	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
APPROVED BY		



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* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 9.79" TFT-LCD contains 1280x320 pixels, and can display up to 16.7M colors.

* Features

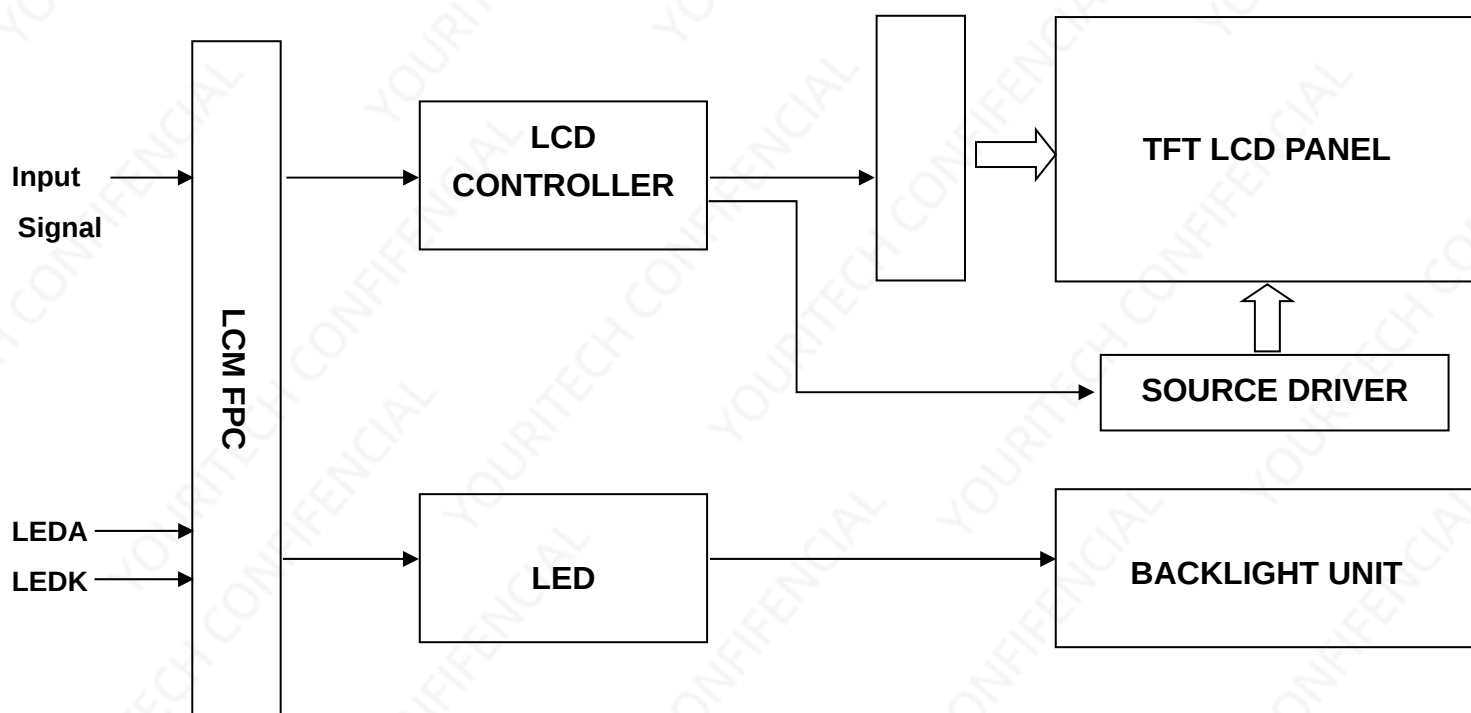
Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	241.152(H)*60.288(V) (9.79inch)	mm	
Driver element	TFT active matrix	-	
Display colors	16.7M	colors	
Number of pixels	1280(RGB)*320	dots	
Pixel arrangement	RGB Strip type	-	
Pixel pitch	0.1884(H)*0.1884(V)	mm	
Viewing angle	6 O'clock (12 O'clock Gray Scale Inversion)	o'clock	
LCM Interface	LVDS one portch (4data+1 clock)	-	
Display mode	Transmissive /Normally white	-	
Operating temperature	-30~+85	℃	
Storage temperature	-40~+90	℃	

* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	252.75	-	mm	
	Vertical(V)	-	73.17	-	mm	
	Depth(D)	-	7	11	mm	
Weight		-	TBD	-	g	



1. Block Diagram



3. Input terminal Pin Assignment

Backlight FPC connector : HIROSE, FH28-50S-0.5SH

NO.	SYMBOL	DISCRIPTION	I/O
1	GND	Ground.	P
2	GND	Ground.	P
3	GND	Ground.	P
4	GND	Ground.	P
5	GND	Ground.	P
6	GND	Ground.	P
7	GND	Ground.	P
8	VDD	Supply voltage (3.3V).	P
9	VDD	Supply voltage (3.3V).	P
10	VDD	Supply voltage (3.3V).	P
11	GND	Ground.	P
12	STBYB	Standby mode H: normal operation L: TCON, SD, power circuit and temp sensor will turn off	P
13	RESET	Reset pin H : normal operation L : reset state, suggest to connecting with an RC circuit for stability	I
14	GND	Red data input.	P
15	D3P	LVDS Differential Data Pair	I
16	D3N	LVDS Differential Data Pair	I
17	GND	Ground.	P
18	D2P	LVDS Differential Data Pair	I
19	D2N	LVDS Differential Data Pair	I
20	GND	Ground.	P
21	D1P	LVDS Differential Data Pair	I



22	D1N	LVDS Differential Data Pair	I
23	GND	Ground.	P
24	D0P	LVDS Differential Data Pair	I
25	D0N	LVDS Differential Data Pair	I
26	GND	Ground.	P
27	CLKP	LVDS Differential CLK Pair	I
28	CLKN	LVDS Differential CLK Pair	I
29	GND	Ground.	P
30	GND	Ground.	P
31	BISTEN	Built-In Self Test function H : enable L : disable	I
32	GND	Ground.	P
33	NC	No connect	--
34	GND	Ground.	P
35	CS	Chip select signal H : chip not selected (inaccessible) L : chip selected (accessible)	I
36	SDA	Serial data input of SPI, I2C or EEPROM	I/O
37	SCL	Clock signal for SPI, I2C or EEPROM	I/O
38	GND	Ground.	P
39	MODE	TCON DE or SYNC mode selection H : DE mode L : SYNC mode	I
40	UD	GD vertical shift direction selection, actual shift direction depends on GD location (Left or right side on panel)	I
41	LR	SD horizontal shift direction selection H : SO[1] SO[2] ... SO[1284] L : SO[1284] SO[1283] ... SO[1]	I
42	NC	No connect	--



43	GND	Ground.	P
44	GND	Ground.	P
45	GND	Ground.	P
46	GND	Ground.	P
47	GND	Ground.	P
48	GND	Ground.	P
49	GND	Ground.	P
50	GND	Ground.	P



4. LCD Optical Characteristics

4.1 Optical specification

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	$\Theta=0$ Normal viewing angle	500	700	--		(1)(2)
Response time	Rising	T _R		--	400	--	msec	(1)(3)
	Falling	T _F		--	25	--		
Color Gamut		S(%)		--	50	--		
Uniformity		S(%)		75	80	--	%	
Color Filter Chromaticity	White	W _X		0.305	0.355	0.405		(1)(4) CA-310
		W _Y		0.315	0.365	0.415		
	Red	R _X		TBD	TBD	TBD		
		R _Y		TBD	TBD	TBD		
	Green	G _X		TBD	TBD	TBD		
		G _Y		TBD	TBD	TBD		
	Blue	B _X		TBD	TBD	TBD		
		B _Y		TBD	TBD	TBD		
Viewing angle	Hor.	Θ_L	CR>10	70	80	--		(1)(4)
		Θ_R		70	80	--		
	Ver.	Θ_U		60	70	--		
		Θ_D		60	70	--		
Option View Direction		6 O'clock (12 O'clock Gray Scale Inversion)						

*The data comes from the LCD specification.

Measuring Condition

Measuring surrounding : dark room

Ambient temperature : 25±2°C

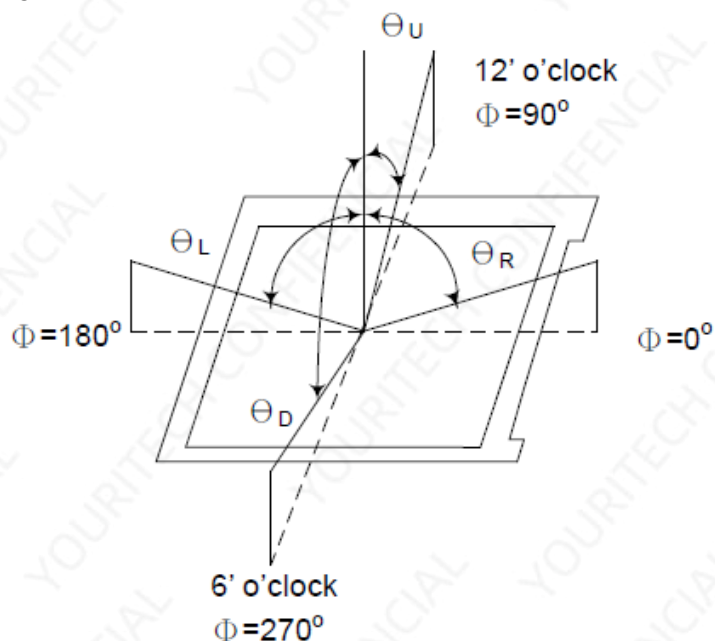
15min. warm-up time.

Measuring Equipment

FPM520 , which utilized SR-3 for Chromaticity and BM-5A for other optical characteristics.



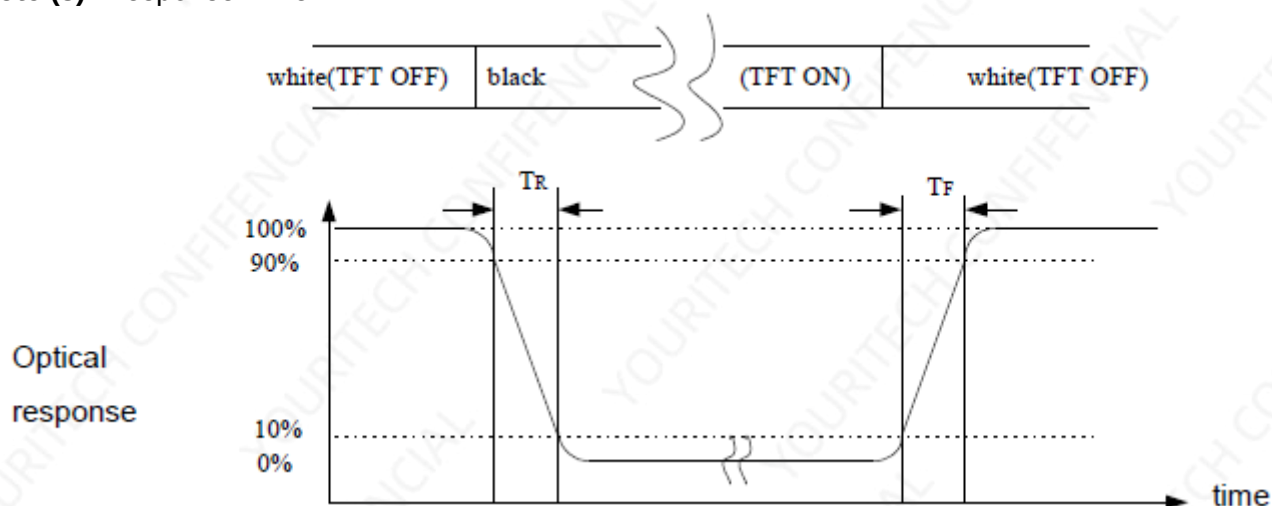
Note (1): Definition of Viewing Angle :



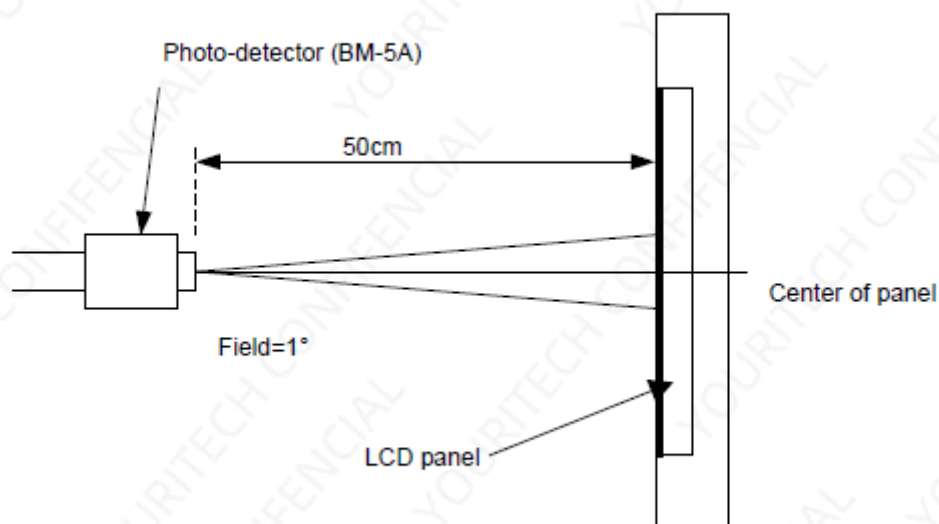
Note (2): Definition of Contrast Ratio(CR) :measured at the center point of panel

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

Note (3): Response Time



Note (4): Definition of optical measurement setup



5. Electrical Characteristics

5.1 Absolute Maximum Rating

Characteristics	Symbol	Min.	Max.	Unit	Note
Digital Supply Voltage	VDD	-0.5	5.0	V	Note1
Operating temperature	T _{OP}	-30	+85	°C	
Storage temperature	T _{ST}	-40	+90	°C	

NOTE1: If the absolute maximum rating of even is one of the above parameters is exceeded even momentarily, the quality of the product may be degraded. Absolute maximum ratings, therefore, specify the values exceeding which the product may be physically damaged. Be sure to use the product within the range of the absolute maximum ratings.

5.2 DC Electrical Characteristics

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Digital Supply Voltage	VDD	3.2	3.3	3.4	V	
Normal mode Current	IDD	--	160	320	mA	
Power Consumption (Without Backlight)	V _{FOG}	--	0.528	1.088	W	
Power Consumption (With Backlight)	V _{MDL}	--	4.068	5.984	W	
I/O Input voltage	H level	V _{IH}	0.7*VDD	--	VDD	V
	H level	V _{IL}	GND	--	0.3VDD	V



5.3 LED Backlight Characteristics

The back-light system is edge-lighting type with 24 chips LED

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Power Consumption	P_{LED}	--	3.54	4.896	W	
Forward Current	I_F	--	200	240	mA	
Forward Voltage	V_F	15	17.7	20.4	V	
LCM Luminance	LV	1000	1300	--	cd/m ²	Note3
LED life time	Hr	50000	--	--	Hour	Note1,2
Uniformity	Avg	75	80	--	%	Note3

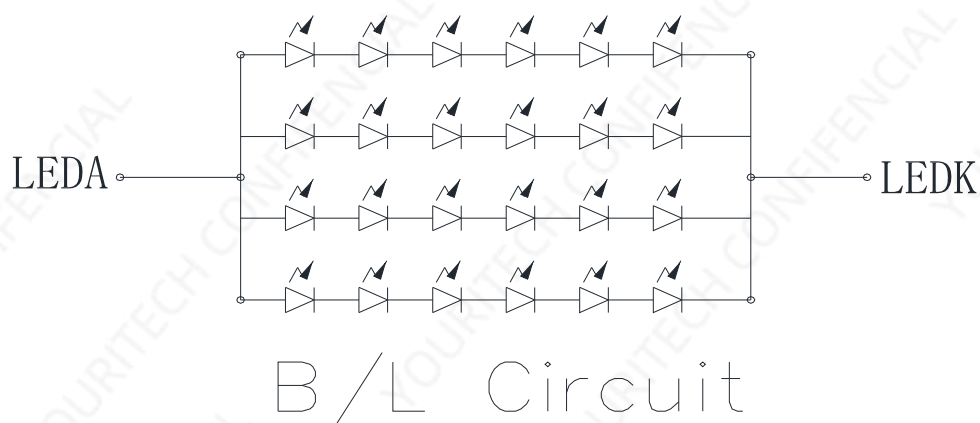
Note1: LED life time (Hr) can be defined as the time in which it continues to operate under the condition:

$T_a=25\pm3\text{ }^{\circ}\text{C}$, typical IL value indicated in the above table until the brightness becomes less than 50%.

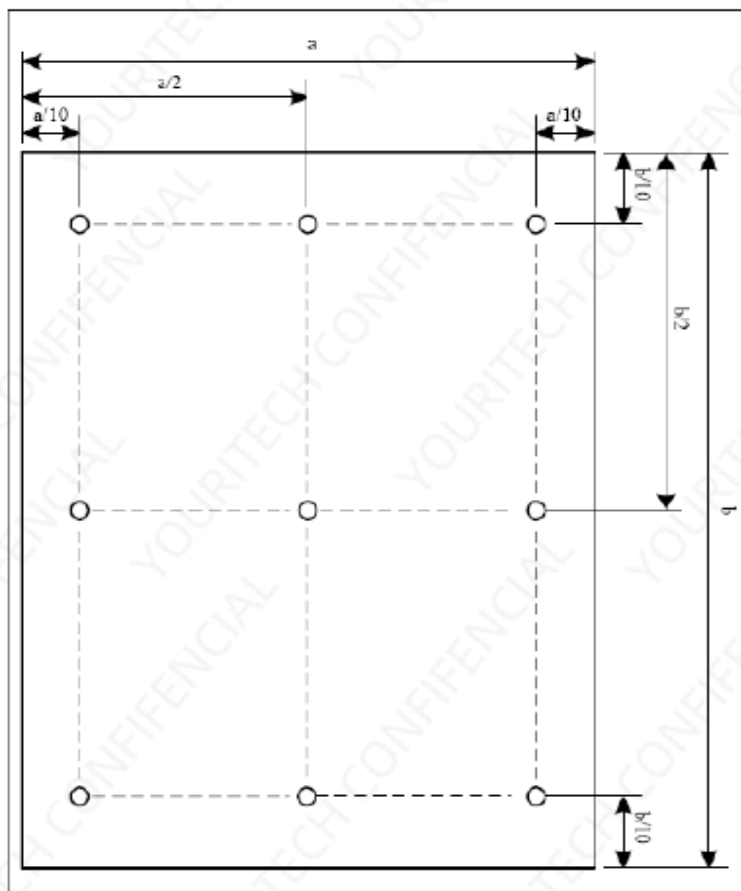
Note 2: The “LED life time” is defined as the module brightness decrease to 50% original brightness at

$T_a=25^{\circ}\text{C}$ and $I_L=200\text{ mA}$. The LED lifetime could be decreased if operating I_L is larger than 200mA.

The constant current driving method is suggested.



Note (3) Luminance Uniformity of these 9 points is defined as below:



$$\text{Uniformity} = \frac{\text{minimum luminance in 9 points (1-9)}}{\text{maximum luminance in 9 points (1-9)}}$$

$$\text{Luminance} = \frac{\text{Total Luminance of 9 points}}{9}$$



6. AC Characteristic

6.1. LVDS mode AC Electrical Characteristic

Timing Chart only for 1280X320 Sync mode / DE Mode Timing

Parameter	Symbol	Value			Unit
		Min.	Recommend	Max.	
CLK frequency	t _{CLK}	25.1	30.7	36.3	Mhz
Horizontal back porch	t _{HBP}		8		t _{CLK}
Horizontal display area	t _{HD}	1280	1280	1280	t _{CLK}
Horizontal front porch	t _{HFP}	15	74	159	t _{CLK}
Horizontal period	t _H	1295	1362	1439	t _{CLK}
Horizontal pulse width	t _{HPW}		2		t _{CLK}
Vertical back porch	t _{VBP}		40		t _H
Vertical display area	t _{VD}	320	320	320	t _H
Vertical front porch	t _{VFP}	3	16	100	t _H
Vertical period	t _V	323	376	420	t _H
Vertical pulse width	t _{VPW}		2		t _H

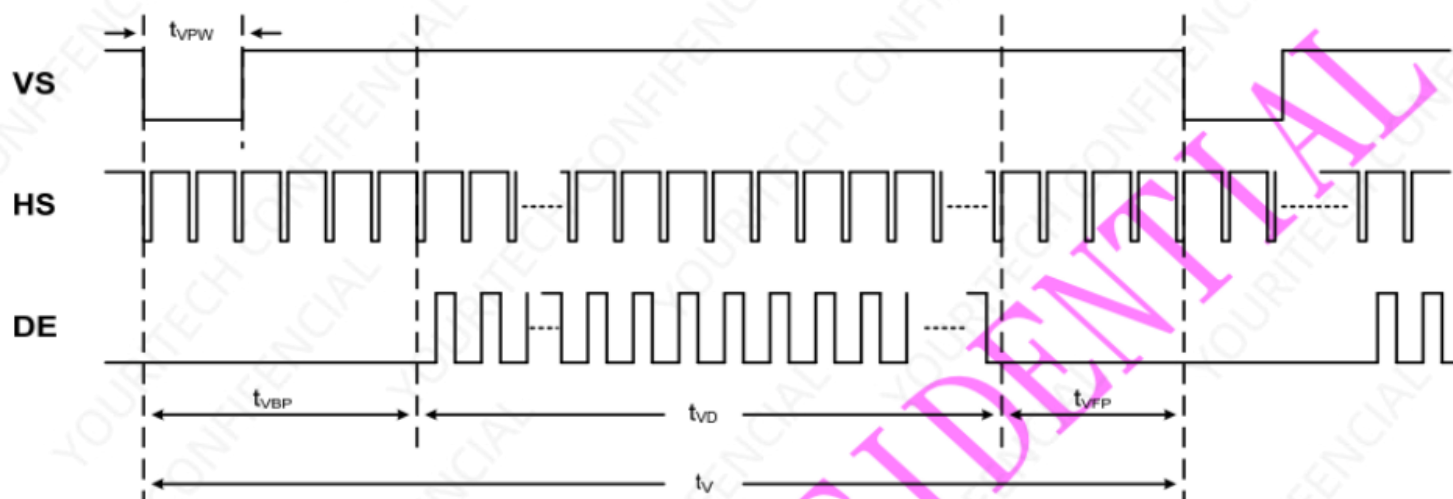
Notes: In Sync mode, it could support 1280X320 resolutions as full screen.
If users set DE mode, it could not supported 1280X320 resolutions as full screen.



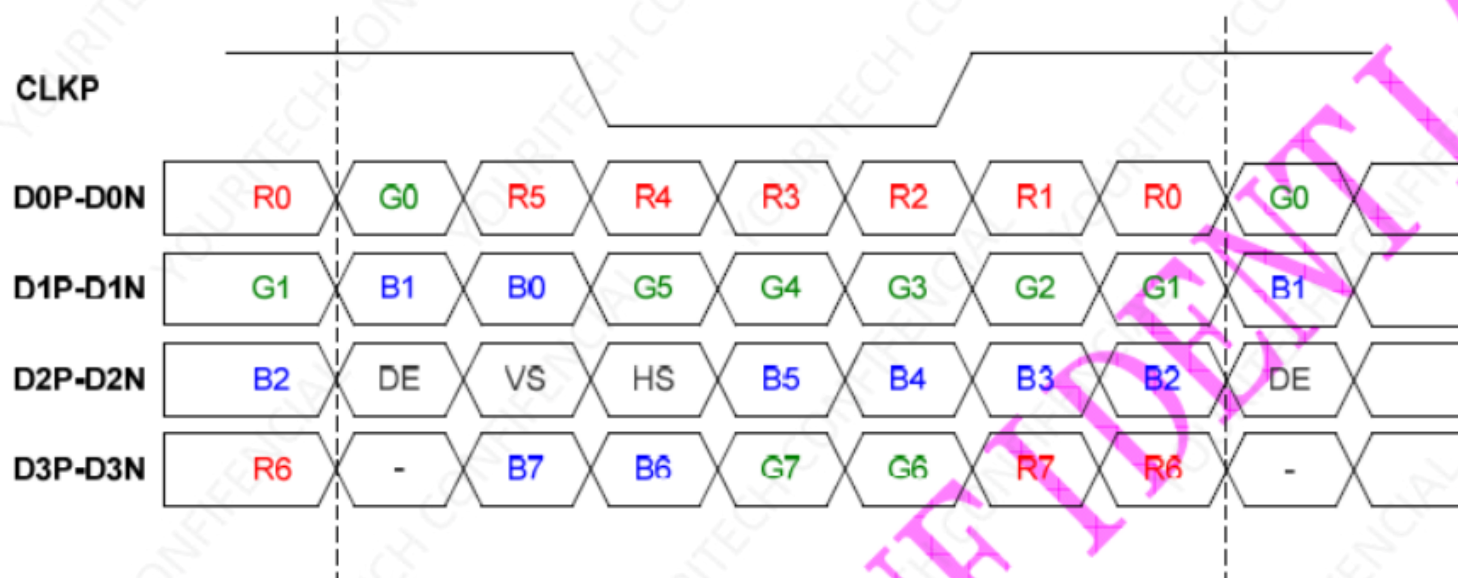
6.2. Data input format

TCON mode CMOS interface

Vertical input timing



VESA data mapping



Note 1 : for 6 bit mode, MSB are R/G/B[5] and R/G/B[0] are LSB
Note 2 : for 8 bit mode, MSB are R/G/B[7] and R/G/B[0] are LSB

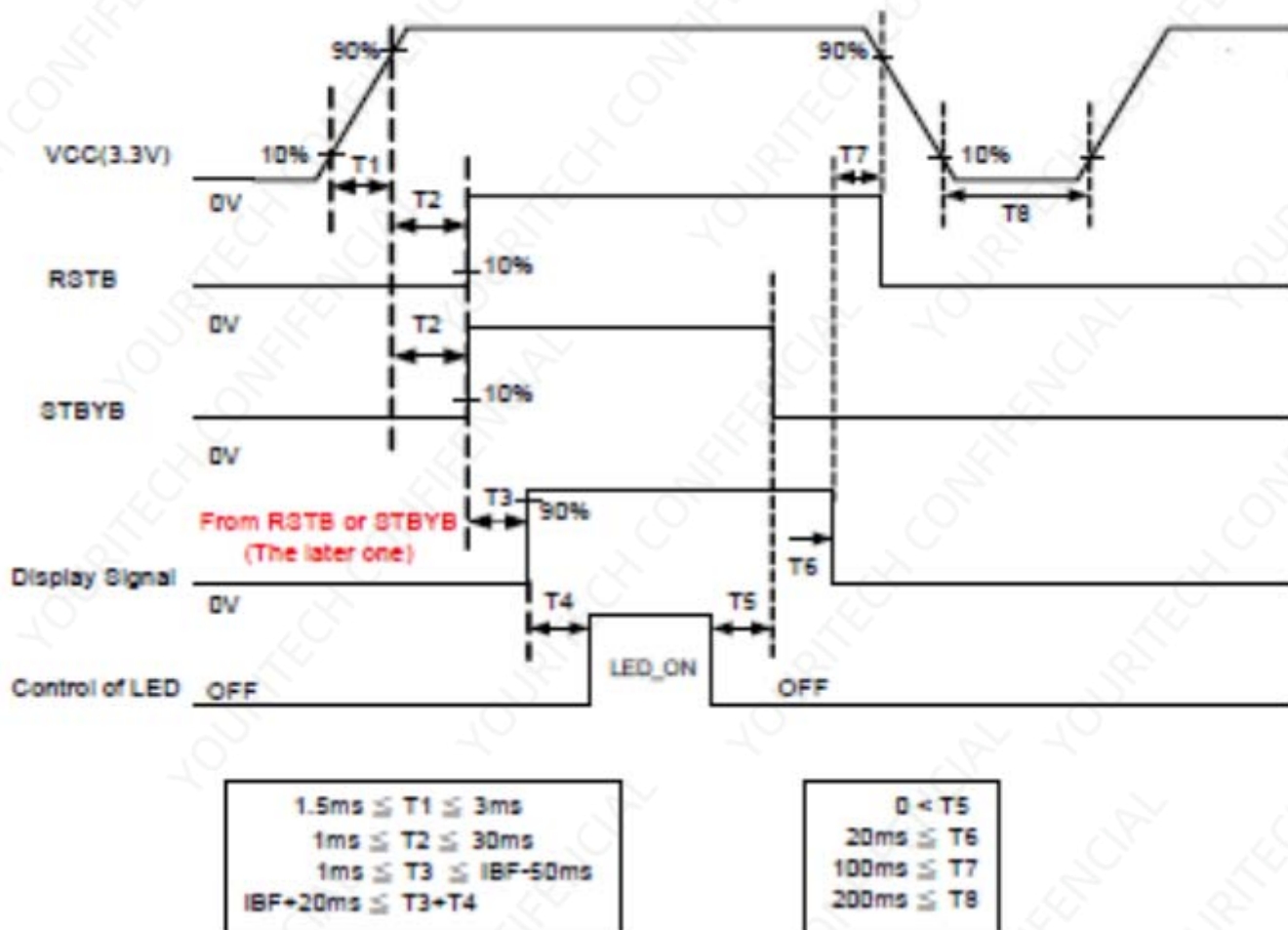


6.3. Power on /off sequence

Power on/off sequence with internal DC-DC

When ST8522 set as TCON mode or customers want to enable ST8522 internal power circuit to generate all voltages, In order to prevent IC damage from abnormal power on or off sequence, please follow below timings.

Power on/off Sequence



Note:

1. IBF: Initial BLACK or WHITE frames setting by IBF (2:0)
2. IBF (2:0) and frames:

IBF (2:0) Options for initial BLACK or WHITE frames

000:10 (default)

001:40

010:70

011:90



100:120

101:200

110:200

111:250

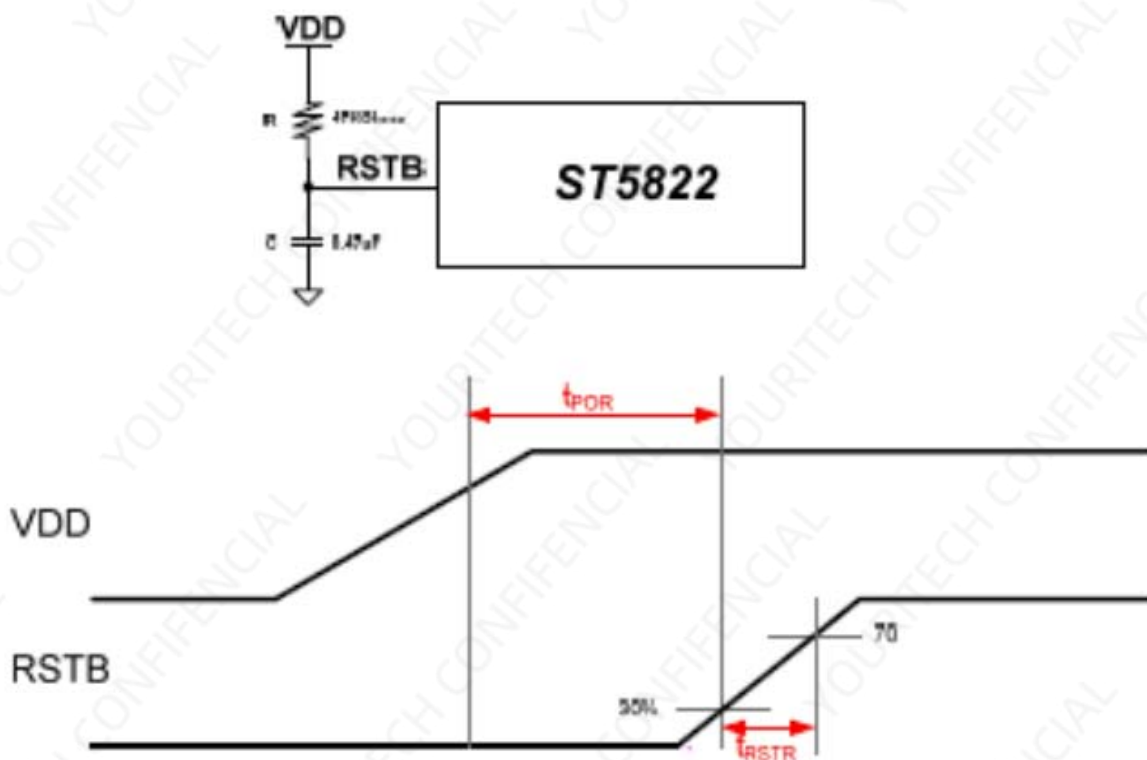
3.AI Internal powers (VDDA/VCOM/VGH/VGL) also should be tuned off under power off period to meet T8 spec.

Recommend power on reset timing

We recommend connecting an external RC circuit with RSTB pin for digital circuit initial state stability.

Recommend : $47k\Omega + 0.47\mu F$ or external MCU control, $t_{POR} > 1ms$

t_{RSTR} max. timing spec.: $< 1\mu S$ (external MCU control)



7. LCD Module Out-Going Quality Level

7.1 VISUAL & FUNCTION INSPECTION STANDARD

7.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

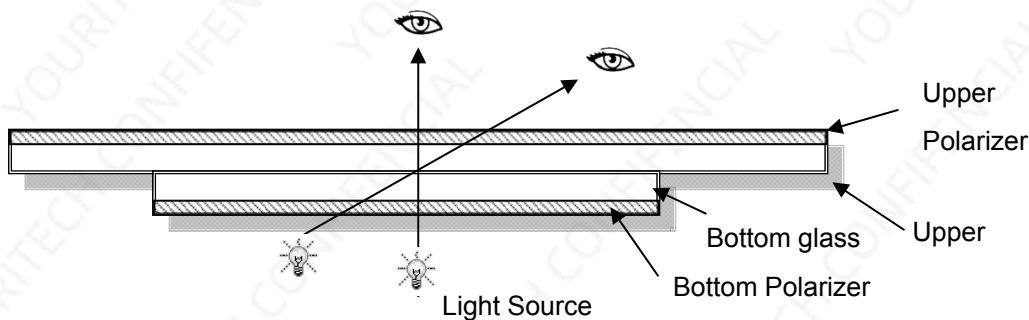
Temperature : $25 \pm 5^{\circ}\text{C}$

Humidity : $65\% \pm 10\% \text{RH}$

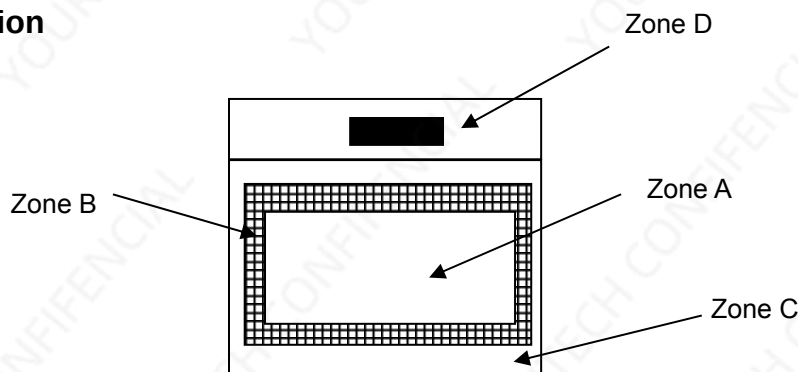
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance: 30-50cm



7.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Zone D : IC Bonding Area

Note:As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer



7.1.3 Sampling Plan

According to GB/T 2828.1-2003 ; , normal inspection, Class II

AQL:

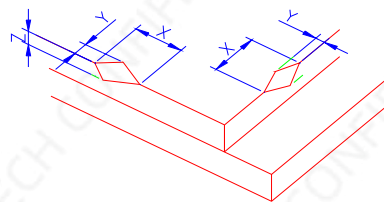
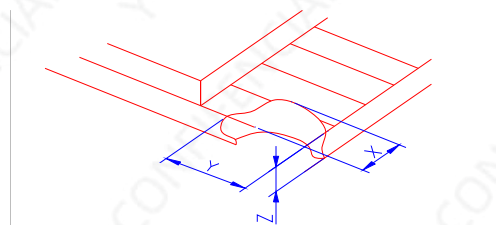
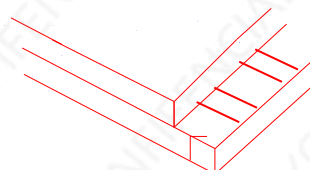
Major defect	Minor defect
0.65	1.5

LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Spot Line defect	Light dot, Dim spot, Polarizer Bubble ; Polarizer accidented spot.	
6	Soldering appearance	Good soldering , Peeling off is not allowed.	
7	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	



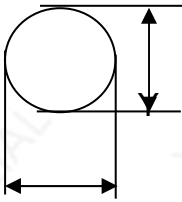
7.1.4 Criteria (Visual)

Number	Items	Criteria(mm)						
1.0 LCD Crack/Broken NOTE: X: Length Y: Width Z: Height L: Length of ITO, T: Height of LCD	(1) The edge of LCD broken	 <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	<Inner border line of the seal	≤T
	X	Y	Z					
	≤3.0mm	<Inner border line of the seal	≤T					
(2)LCD corner broken	 <table><tr><td>X</td><td>Y</td><td>Z</td></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table>	X	Y	Z	≤3.0mm	≤L	≤T	
X	Y	Z						
≤3.0mm	≤L	≤T						
(3) LCD crack	 Crack Not allowed							



2.0

Spot defect



X

$$\Phi = (X + Y) / 2$$

① light dot (LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.10$	Ignore		
$0.10 < \Phi \leq 0.25$	4(distance $\geq 10\text{mm}$)		
$0.25 < \Phi \leq 0.35$	3		
$\Phi > 0.4$	0		

② Dim spot (LCD/TP/Polarizer dim dot, light leakage、dark spot)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.1$	Ignore		
$0.10 < \Phi \leq 0.25$	4(distance $\geq 10\text{mm}$)		
$0.25 < \Phi \leq 0.35$	3		
$\Phi > 0.4$	0		

③ Polarizer accidented spot

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.3 < \Phi \leq 0.5$	3(distance $\geq 10\text{mm}$)		
$\Phi > 0.5$	0		

④ Pixel bad points (light dot, Dim dot, color dot)

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.15$	Ignore		
$0.2 < \Phi \leq 0.3$	2(distance $\geq 10\text{mm}$)		
$\Phi > 0.4$	0		

⑤ Polarizer Bubble

Zone Size (mm)	Acceptable Qty		
	A	B	C
$\Phi \leq 0.2$	Ignore		
$0.3 < \Phi \leq 0.4$	4(distance $\geq 10\text{mm}$)		
$0.4 < \Phi \leq 0.5$	3		
$\Phi > 0.5$	0		



3.0	Line defect (LCD/TP /Polarizer backlight black/white line, scratch, stain)	Width(mm)	Length(m m)	Acceptable Qty		
				A	B	C
		$\Phi\leq0.05$	Ignore	Ignore		Ignore
		$0.05<W\leq0.06$	$L\leq5.0$	$N\leq3$		
		$0.07<W\leq0.08$	$L\leq4.0$	$N\leq2$		
		$0.08<W$	Define as spot defect			

4.0	Electronic Comp onents SMT	Not allow missing parts, solderless connection, cold solder joint, mismatch, The positive and negative polarity opposite
5.0	Display color& B rightness	1. Color: Measuring the color coordinates, The measurement standard according to the datasheet or samples. 2. Brightness: Measuring the brightness of White screen, The measurement standard according to the datasheet or Samples.
6.0	LCD Mura	By 5% ND filter invisible.

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed



8. Reliability Test Result

Item	Condition	Inspection after test
High Temperature Operating	85°C,500Hrs	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Non-display; 3.Missing segments/line; 4.Glass crack; 5.Current IDD is twice higher than initial value.
Low Temperature Operating	-30°C, 500Hrs	
High Temperature Storage	90°C, 500Hrs	
Low Temperature Storage	-40°C, 500Hrs	
High Temperature & High Humidity Operating	+60°C, 90% RH ,500 hours.	
Thermal Shock (Non-operation)	-40°C,30 min ↔ +85°C,30 min, Change time:5min 20CYC.	
ESD test	C=150pF, R=330,5points/panel Air:±8KV, 5times; Contact:±2KV, 5 times; (Environment: 15°C~35°C, 30%~60%).	
Vibration (Non-operation)	Frequency range:10~55Hz, Stroke:1.5mm Sweep:10Hz~55Hz~10Hz 2 hours for each direction of X.Y.Z. (6 hours for total) (Package condition).	
Box Drop Test	1 Corner 3 Edges 6 faces,80 _{cm} (MEDIUM BOX)	

Remark:

- 1.The test samples should be applied to only one test item.
- 2.Sample size for each test item is 5~10pcs.
- 3.For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.
- 4.In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.
- 5.Failure Judgment Criterion: Basic Specification, Electrical Characteristic, Mechanical Characteristic, Optical Characteristic.
6. The color fading mura of polarizing filter should not care.



9. Cautions and Handling Precautions

9.1 Handling and Operating the Module

- (1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
- (2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
- (3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
- (4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
- (5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static; it may cause damage to the CMOS ICs.
- (9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (10) Do not disassemble the module.
- (11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (12) Pins of I/F connector shall not be touched directly with bare hands.
- (13) Do not connect, disconnect the module in the "Power ON" condition.

9.2 Storage and Transportation.

- (1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 °C and relative humidity of less than 70%
- (2) Do not store the TFT-LCD module in direct sunlight.
- (3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
- (4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
- (5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.