

TFT Product Specification

- ◇ PRELIMINARY SPECIFICATION
- ◆ APPROVED SPECIFICATION

Part Number: FLC-101HML0000SA2-V1

Description : TFT 10.1"W, 1280(H)*800(V), Full Viewing Angle , LVDS 8 bit, 1000CD

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Confidential

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Revision History

Version	Date	Page	Description	Note
V1.0	2019/05/11		1 st Release	
V2.0	2019/12/11		2 nd Release	



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1. GENERAL DESCRIPTION

1.1 Description

7 inch is a Color Active Matrix Liquid Crystal Display Module composed of a TFT LCD panel and LED backlight system. The screen format is intended to support the 1280(H) x800(V) screen and 16.7M colors.

1.2 Product Summary

The following items are summary on the table under Ta=25 °C condition:

No.	Item	Specification	Unit
1	Display Size	10.1" w	Inch
2	Pixel Number	1280(H) x (R,G,B) x 800(V)	Pixels
3	Outline Dimension	233(H) x 151.9(V) x9.06(D)	mm
4	Active Area	216.96 (H) x 135.6(V)	mm
5	Pixel Pitch	0.1695(H) x 0.1695(V)	mm
6	Display Colors	16.7M	--
7	Display Format	RGB Stripe	--
8	Display Mode	Normally Black	--
9	Electrical Interface	LVDS	
10	Surface Treatment	Anti-Glare	--
11	Brightness	1000 (central) (Typ)	cd/m ²
12	Contrast Ratio	1000 (Typ.)	--
13	Consumption of Power	LCM: 1.5 (Typ) Backlight: 6 (Typ)	W
14	Module Weight	325+/-10%	g

2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

Item	Symbol	Values		Unit	Remark
		Min	Max		
Supply Voltage	VDD	-0.5	5.0	V	
Supply Voltage for LED driver	LED_A	-0.3	24	V	
Supply Voltage for LED B/L PWM	VPWM	-	LED_A	V	

Note 1. VDD: Digital I/O Data

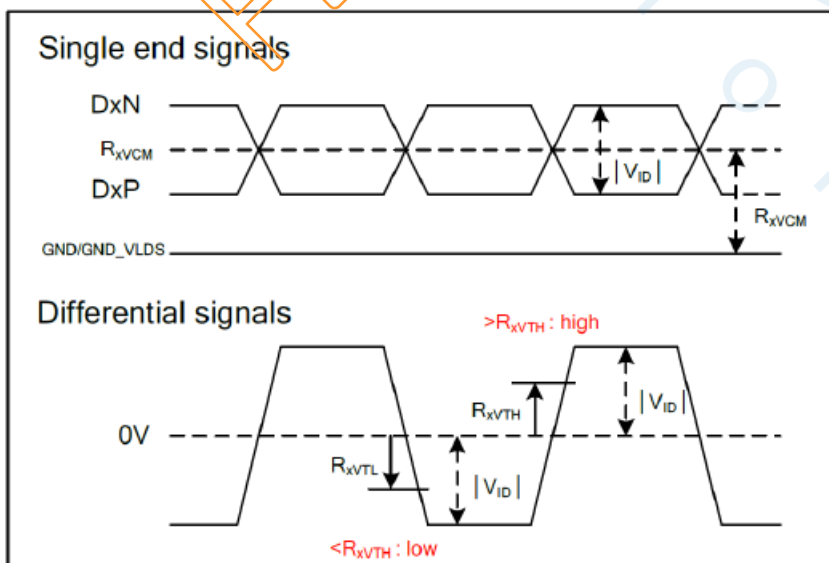
2.2 Environment Absolute Rating

Item	Symbol	Values		Unit	Remark
		Min	Max.		
Operating Temperature	Top	-30	80	°C	
Storage Temperature	Tstg	-30	80	°C	

3. ELECTRICAL CHARACTERISTICS

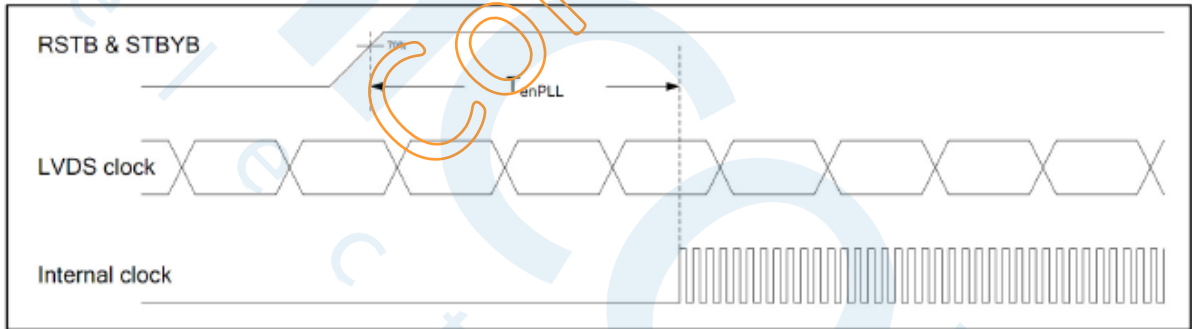
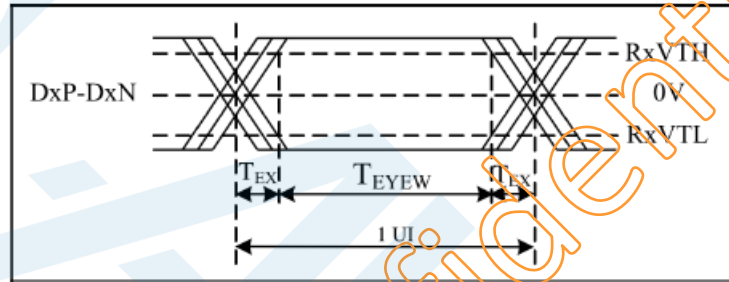
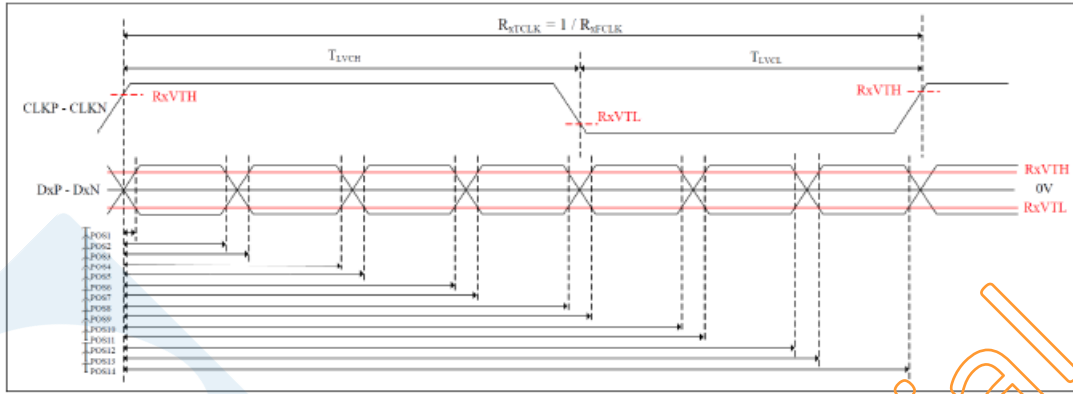
3.1 TFT LCD Characteristics

ITEM	Symbol	MIN	TYP	MAX	UNIT	NOTE
Supply Voltage	VDD	3.0	3.3	3.6	V	
Input signal voltage	VIH	0.7*VDD	-	VDD	V	
	VIL	GND	-	0.3*VDD	V	
Output Signal Voltage	VOH	VDD-0.4			V	
	VOL			VDD+0.4	V	
Current for Power Supply	IDD	--	450	840	mA	
Differential input high threshold voltage	RxVTH			0.1	V	
Differential input low threshold voltage	RxVTL	-0.1			V	
Input voltage range (singled-end)	RxVIN	0		VDD-1.0	V	
Differential input common mode voltage	RxVCM	0.6	1.2	2.4- VID /2	V	
Differential input voltage	VID	0.2	0.4	0.6	V	
Differential input leakage current	RVxliz	-10		10	uA	
LVDS Digital operation current	IVDD_LVDS	-	10	15	mA	FCLK=65MHz VDD_LVDS=3.3V Data pattern=55/H→ AA/H(loop)
LVDS Digital Stand-by Current	I STBD_LVDS	-	10	50	uA	RSTB=0 or STBYB=0 All functions are stopped CLKx & D0x connect to GND



3.2 LVDS AC Characteristics

Parameter	Symbol	MIN	TYP	MAX	UNIT	NOTE
Clock Frequency	RxFCLK	20		80	MHz	
Clock Period	RxTCLK	12.5		50	ns	
1 data bit time	UI	-	1/7	-	RxTCLK	
Clock high time	TLVCH		4		UI	
Clock low time	TLVCL		3		UI	
Position1	TPOS1	-0.25	0	0.25	UI	
Position2	TPOS2	0.75	-	1.25	UI	
Position3	TPOS3	0.75	1	1.25	UI	
Position4	TPOS4	1.75	-	2.25	UI	
Position5	TPOS5	1.75	2	2.25	UI	
Position6	TPOS6	2.75	-	3.25	UI	
Position7	TPOS7	2.75	3	3.25	UI	
Position8	TPOS8	3.75	-	4.25	UI	
Position9	TPOS9	3.75	4	4.25	UI	
Position10	TPOS10	4.75	-	5.25	UI	
Position11	TPOS11	4.75	5	5.25	UI	
Position12	TPOS12	5.75	-	6.25	UI	
Position13	TPOS13	5.75	6	6.25	UI	
Position14	TPOS14	6.75	-	7.25	UI	
Input eye width	TEXEW	0.5	-	-	UI	
Input eye border	TEX	-	-	0.25	UI	
PLL wake-up time	TenPLL			150	us	



Spread Spectrum Clocking (SSC) tolerance of LVDS receiver

Parameter	Symbol	Min	Typ.	Max.	Unit	Conditions
Modulation frequency	SSC _{MF}			100	kHz	
Modulation rate	SSC _{MR}			+/-3	%	R _{SCLK} =70MHz

3.3 BACK LIGHT

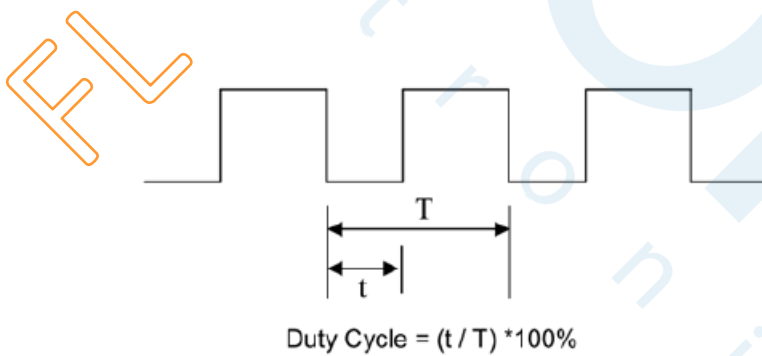
3.3.1 ELECTRICAL CHARACTERISTICS

Ta=25°C

ITEM	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
LED B/L Forward Voltage	V _F	Ta=25°C	15.5	-	22.5	V
LED B/L Forward Current	I _F			250	-	mA
LED Lifetime	L _f				50000	Hr
LED Driver Power Supply Voltage	LED_A		11.3	12	12.7	V
PWM High Threshold	VPWMH		1.8	-	-	V
PWM Low Threshold	VPWML		-	-	0.6	V
PWM Frequency	FPWM		100	-	20K	Hz
PWM Duty Cycle	TD		10	-	100	%
Current for LED Driver Power Supply	I _{LED_A}		-	500	1000	mA

Note (1) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25°C, 60+/-10% RH condition.

Note (2) PWM duty cycle active low.

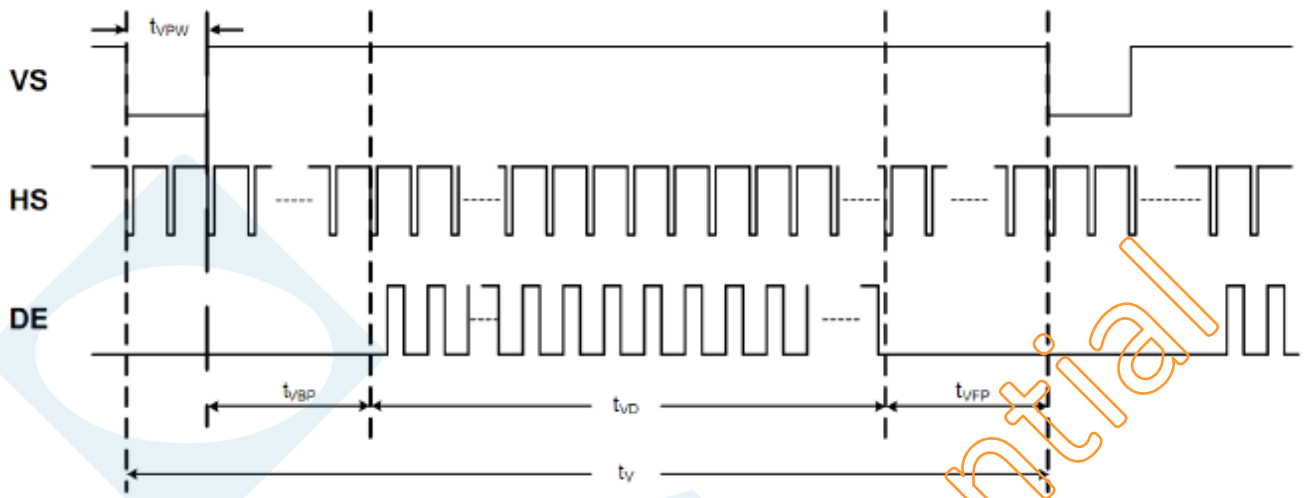


4. SIGNAL CHARACTERISTICS

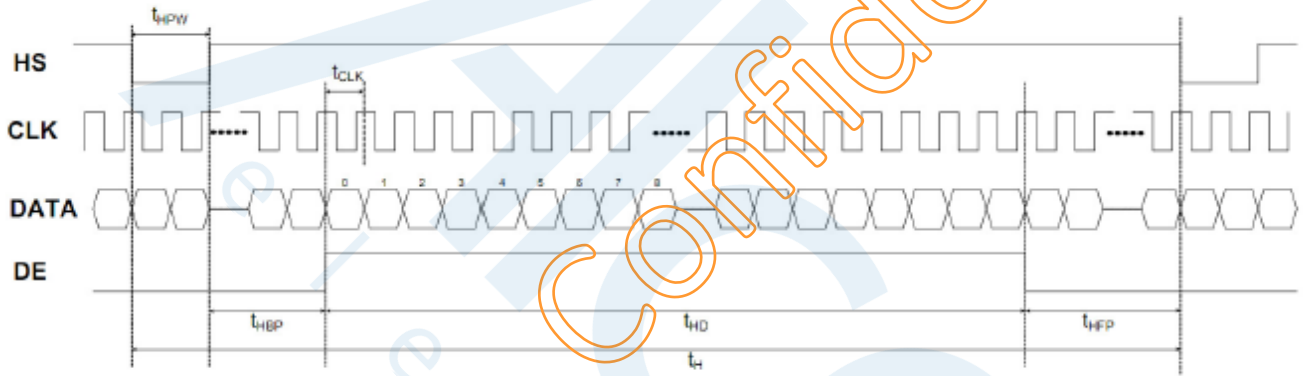
4.1 LCD Interface Timing

Item	Symbol	Min.	Typ.	Max.	Unit	Note
CLK frequency	1/tclk	68.4	71.9	78.1	MHz	
Horizontal blanking time	tHBT	136	144	164	tclk	Thbp+tHFP
Horizontal back porch	tHBP	5	5	164-tHFP	tclk	
Horizontal display area	tHD	-	1280	-	tclk	
Horizontal front porch	tHFP	131	139	159	tclk	
Horizontal period	tH	1416	1424	1444	tclk	
Horizontal pulse width	tHPW	1	1	256	tclk	
Vertical blanking time	tVBT	5	42	101	tH	tVBP+tVFP
Vertical back porch	tVBP	2	2	101-tVFP	tH	
Vertical display area	tVD	-	800	-	tH	
Vertical front porch	tVFP	3	40	99	tH	
Vertical period	tV	805	842	901	tH	
Vertical pulse width	tVPW	-	1	128	tH	
Frame Rate	F	-	60	-	Hz	

4.2 Timing Chart



Vertical input timing

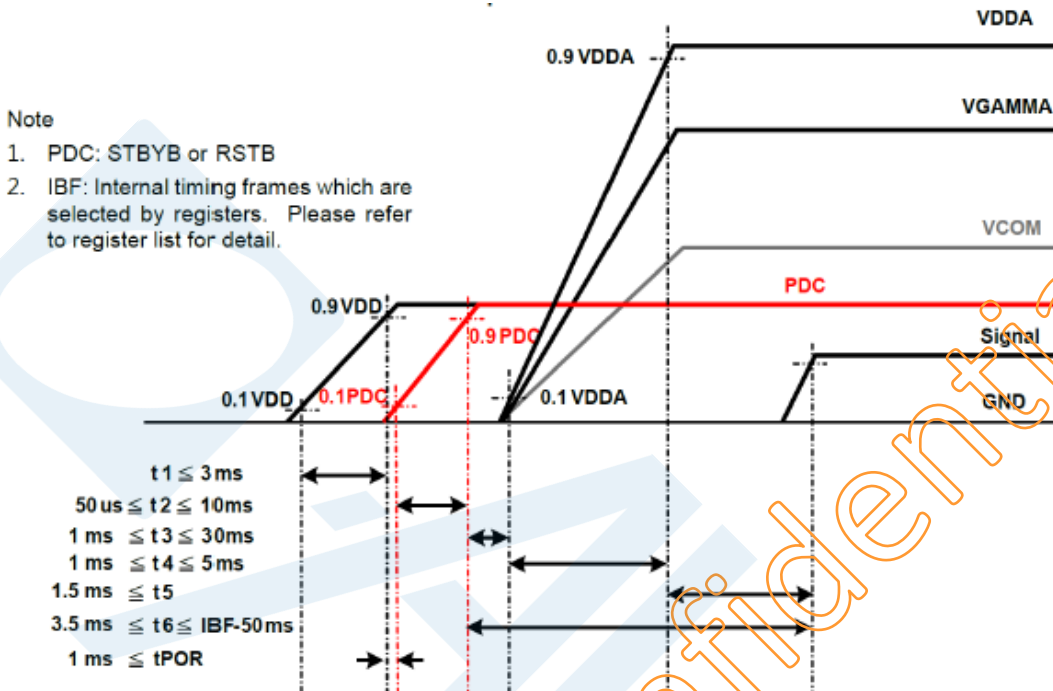


Horizontal input timing

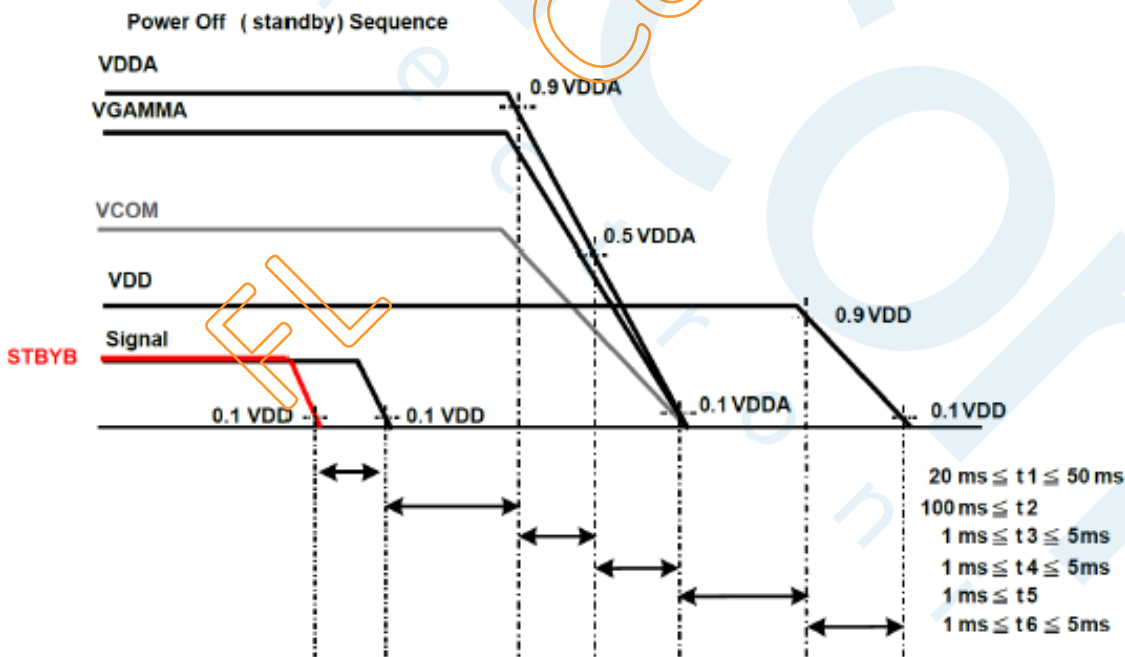


4.3 Power Sequence

Power On Sequence



Power Off Sequence



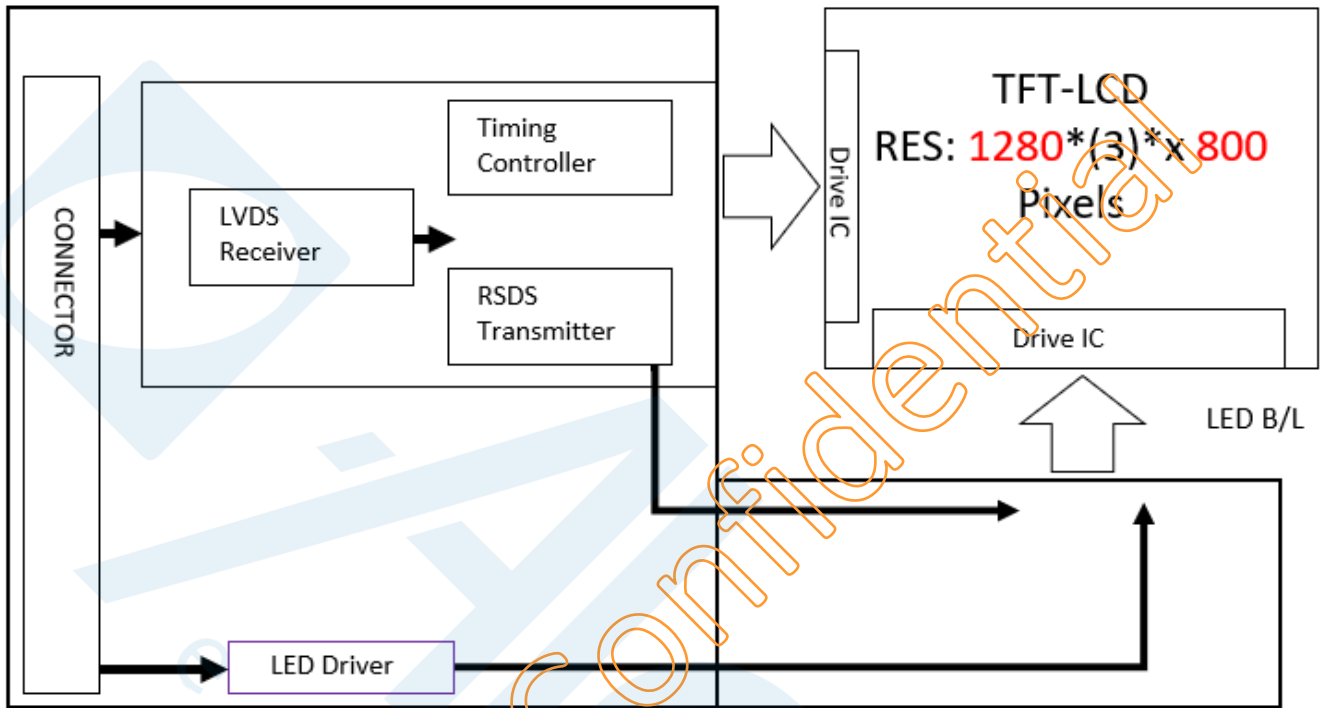
5. INTERFACE PIN DESCRIPTION

Connector: STM MSAK24025P40B or equivalent

PIN no.	Symbol	Description
1	NC	No Connection
2	VDD	Power Supply for logic circuit
3	VDD	Power Supply for logic circuit
4	NC	No Connection
5	NC	No Connection
6	NC	No Connection
7	NC	No Connection
8	RXin0-	-LVDS Differential Data Input
9	RXin0+	+LVDS Differential Data Input
10	GND	Ground
11	RXin1-	-LVDS differential Data Input
12	RXin1+	+LVDS differential Data Input
13	GND	Ground
14	RXin2-	-LVDS Differential Data Input
15	RXin2+	+LVDS Differential Data Input
16	GND	Ground
17	RXCLK-	-LVDS differential Clock Input
18	RXCLK+	+LVDS differential Clock Input
19	GND	Ground
20	RXin3-	-LVDS Differential Data Input
21	RXin3+	+LVDS Differential Data Input
22	GND	Ground
23	NC	No Connection
24	NC	No Connection
25	GND	Ground
26	NC	No Connection
27	NC	No Connection
28	GND	Ground
29	NC	No Connection
30	NC	No Connection
31	LED_K	Power ground for LED driver
32	LED_K	Power ground for LED driver
33	LED_K	Power ground for LED driver
34	NC	No Connection
35	PWM	Adjust LED BL brightness
36	NC	No Connection
37	NC	No Connection
38	LED_A	Power supply for LED driver
39	LED_A	Power supply for LED driver
40	LED_A	Power supply for LED driver

6. BLOCK DIAGRAM

The following diagram shows the functional block of the TFT module:



7. OPTICAL CHARACTERISTIC

The optical characteristics are measured under stable conditions at room temperature.

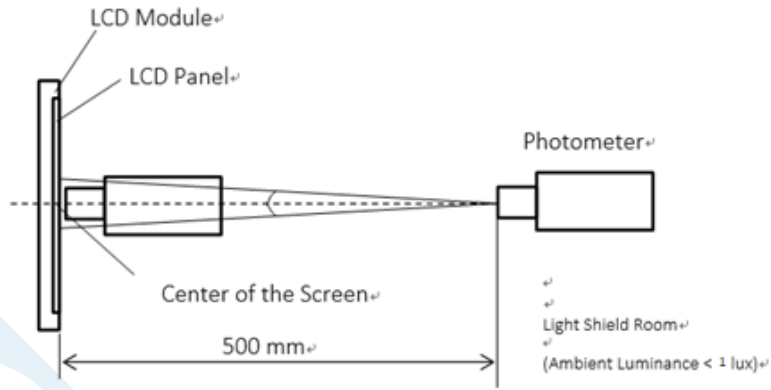
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Viewing Angle	Horizontal	θ_{x+}	Center $CR \geq 10$	75	85	--	Deg.	
		θ_{x-}		75	85	--		
	Vertical	θ_{y+}		75	85	--		
		θ_{y-}		75	85	--		
Contrast Ratio		CR	$\theta_x = \theta_y = 0^\circ$	800	1000	--		Note 1,2
Response time		Rising +Falling	Center $\theta_x = \theta_y = 0^\circ$	--	25	40	ms	Note 5
Uniformity (9P)		YU	$\theta_x = \theta_y = 0^\circ$	80	85	--	%	Note 1,3
Brightness		L	$\theta_x = \theta_y = 0^\circ$	900	1000	--	cd/m ²	Note 1
Chromaticity	Wx	Center $\theta_x = \theta_y = 0^\circ$	-0.05	+0.05	0.301			Note 1,2
	Wy				0.351			
	Rx				0.594			
	Ry				0.318			
	Gx				0.336			
	Gy				0.606			
	Bx				0.147			
	By				0.126			

The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance ≤ 1 lux, and at room temperature).

The operation temperature is $25^\circ\text{C} \pm 2^\circ\text{C}$

Note 1: The method of optical measurement

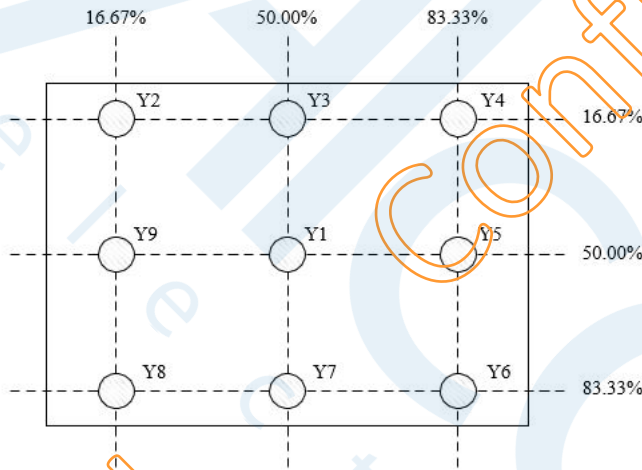
The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 20 minutes and in a dark room.



Note 2: Definition of Contrast Ratio

Measure the viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance with all pixels in white state divide by Luminance with all pixels in Black state

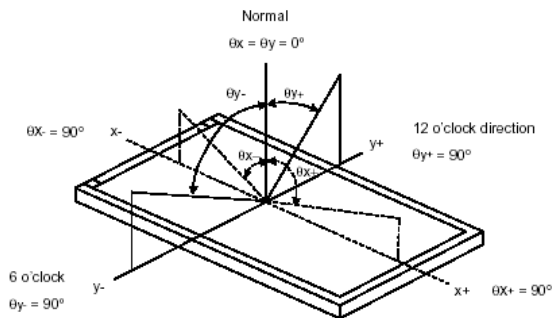
Note 3: Definition of Luminance and Luminance uniformity



Minimum luminance values of 9 points divide by Maximum luminance of 9 points.

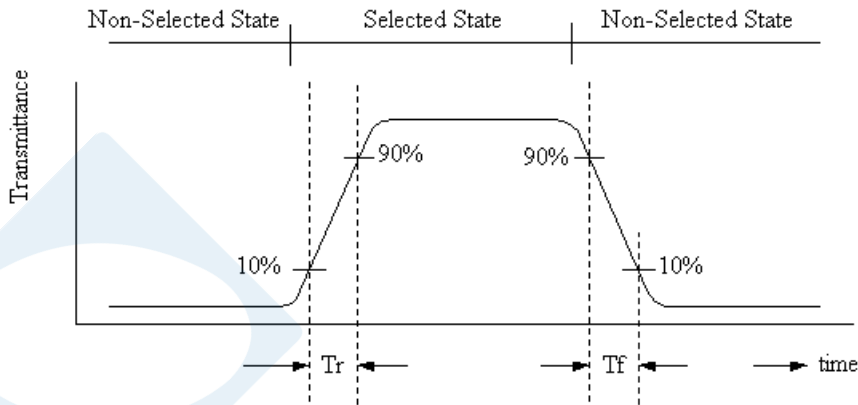
Note 4. Definition of view angle

Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or the vertical clock direction with respect to the optical axis which is normal to the LCD surface.



Note 5. Definition of Response time

The response time is set initially by defining the “Rising Time (Tr)” and the “Falling Time (Tf)” respectively. The response time interval is between 10% and 90% of amplitudes, please refer the figure to the followings:



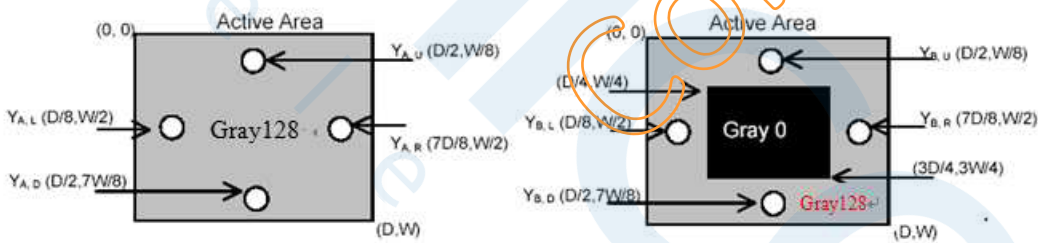
Note 6: Crosstalk Modulation Ratio

$$CT = (Y_B - Y_A) / Y_A \times 100\%$$

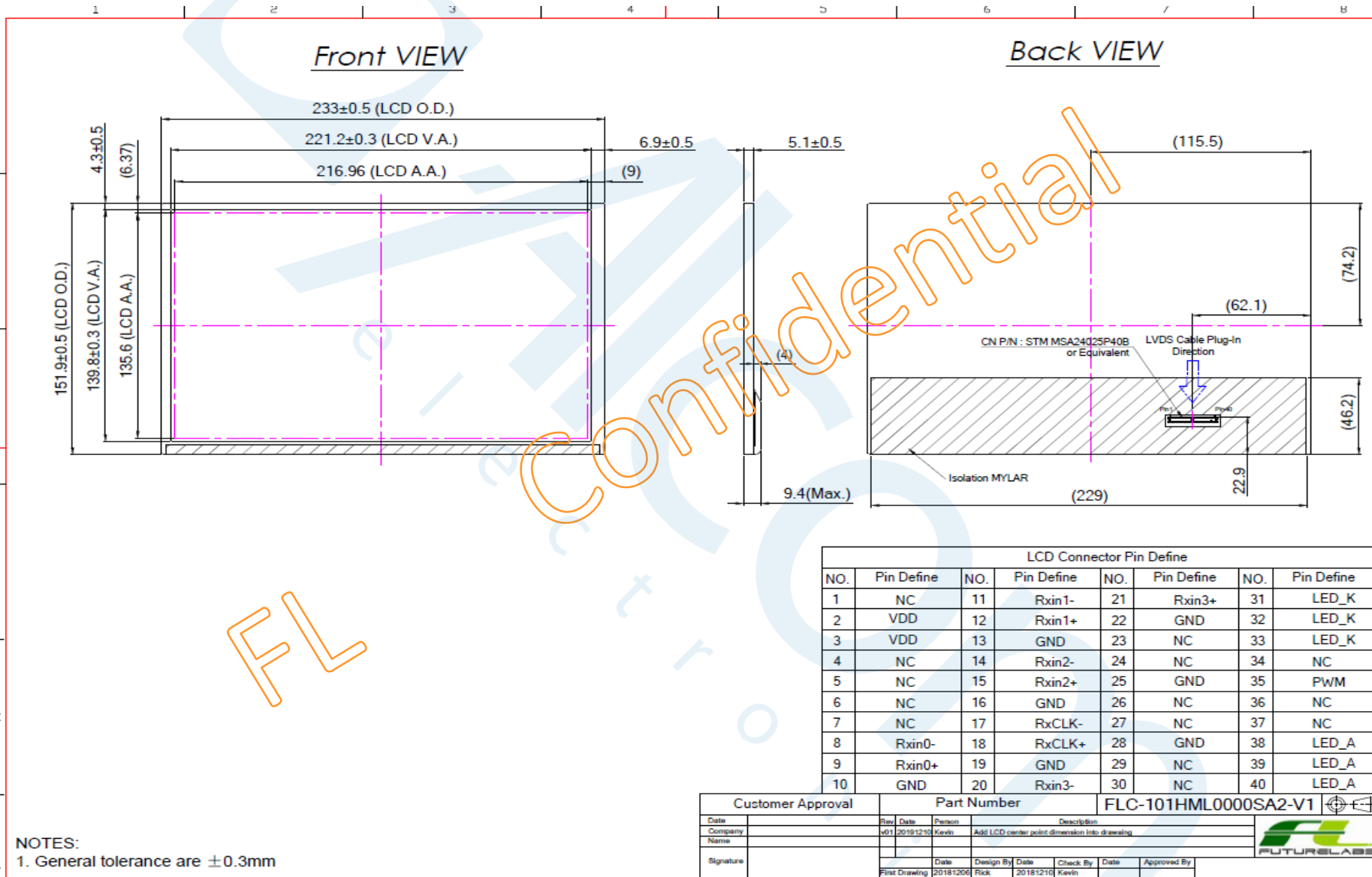
YA、YB measure position and definition

YA means luminance at gray level 128(exclude gray level 0 pattern)

YB means luminance at gray level 128(include gray level 0 pattern)



8. Outline dimension



9. PRECAUTION AND PRODUCT HANDLING

- Do not apply the external force such as bending or twisting to the LCD panel and backlight during assembly.
- Do not insert and plug out the input connector while the LCD panel is operating.
- Do not take apart the panel or frame from LCD module assembly or insert anything into the backlight unit.
- Do not keep the same pattern in a long period of time, it may cause image sticking on LCD panel. Can use shuffle content periodically if fixed pattern is displayed on the screen.
- Do not touch the display area with bare hands, this will stain the display area.
- Pay attention to handle lead wire of backlight, that is not tugged in connect with LED driver.
- Do not change variable resistance settings in LCD panel, it may cause not satisfy of LCD characteristics specification.
- The surface of LCD panel's polarizer is very soft and easily scratched, please use a very soft dry cloth without chemicals for cleaning.
- To avoid the static electricity to damage the CMOS LSI, the operator should be grounded when in contact with the LCD panel, and also to all electrical equipment.
- Need to follow the correct power frequency when LCD panel is connecting and operating, this can avoid damage to CMOS LSI during latch-up.
- Need to store the LCD panel indoor without the exposure of sunlight where the temperature is $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and the humidity is below 60% RH.

