

TFT Product Specification

- ◇ PRELIMINARY SPECIFICATION
- ◆ APPROVED SPECIFICATION

Part Number: FLC-070HMLB000SA1

Description : TFT 7", 1280(H)*800(V), IPS, LVDS, 16.7M color, 400CD

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Revision History

Version	Date	Page	Description	Note
V1.0	2021/7/09		Preliminary Edition	

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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) x 800(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	7.0	Inch
2	Pixel Number	1280(H) x (R,G,B) x 800(V)	Pixels
3	Outline Dimension	161 (H) x 107 (V) x 3.35 (D) (typ.)	mm
4	Active Area	149.76(H) x 93.6(V) (mm)	mm
5	Pixel Pitch	0.117(H) x 0.117(V) (mm)	mm
6	Display Colors	16.7M	--
7	Display Format	RGB vertical stripe	--
8	Display Mode	Normally Black	--
9	Electrical Interface	LVDS 40pin	

2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

Item	Symbol	Values		Unit	Remark
		Min	Max		
LCD Power Voltage	VDD	-0.5	5.0	V	
	AVDD	-0.5	14.85	V	
	VGH	-0.3	20	V	
	VGL	-20	0.3	V	
Backlight Forward Current	I _{LED}	-	25	mA	For each LED

2.2 Environment Absolute Rating

Item	Symbol	Values		Unit	Remark
		Min	Max.		
Operating Temperature	Top	-20	70	°C	Note 1.2.3.
Storage Temperature	Tstg	-30	80	°C	Note 1.2.3

Note 1. The relative temperature and humidity range are as below sketch, 90%RH Max. ($T_a \leq 40^\circ\text{C}$)

Note 2. The maximum wet bulb temperature $\leq 39^\circ\text{C}$ ($T_a > 40^\circ\text{C}$) and without dewing.

Note 3. If product in environment which over the definition of the relative temperature and humidity out of range too long, it will affect visual of LCD.

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Digital Power Supply Voltage	VDD	3	3.3	3.6	V	
Analog Supply Voltage	AVDD	10.5	11	11.5	V	
Gate On Voltage	VGH	17.5	18	18.5	V	
Gate Off Voltage	VGL	-7.1	-6.8	-6.5	V	
Common Electrode Driving Signal	VCOM	3.45	3.55	3.65	V	
Electrical characteristics current	Ivdd	42.4	53	63.6	mA	
	Iavdd	33.2	41.5	49.8	mA	
	Ivgh	0.326	0.408	0.490	mA	
	Ivgl	0.326	0.408	0.490	mA	
	Ivcom	0.004	0.005	0.006	mA	

Notes: test in the white picture.

3.2 TFT Driving Backlight

Item	Symbol	Condition	Min	Typ	Max	Unit	Remark
Forward Voltage	VLED	$I_F=140\text{mA}$	--	9.3	10.2	V	Note 1
Forward Current	I_F	-	-	140	-	mA	
Backlight Power Consumption	WBL	$I_F=140\text{mA}$	--	1302	1428	mW	
LifeTime	-	$I_F=140\text{mA}$	--	30,000-	-	Hrs	Note 2

Note 1: I_F is defined for one channel LED. There are total three LED channels in back light unit.

Under LCM operating, the stable forward current should be inputted.

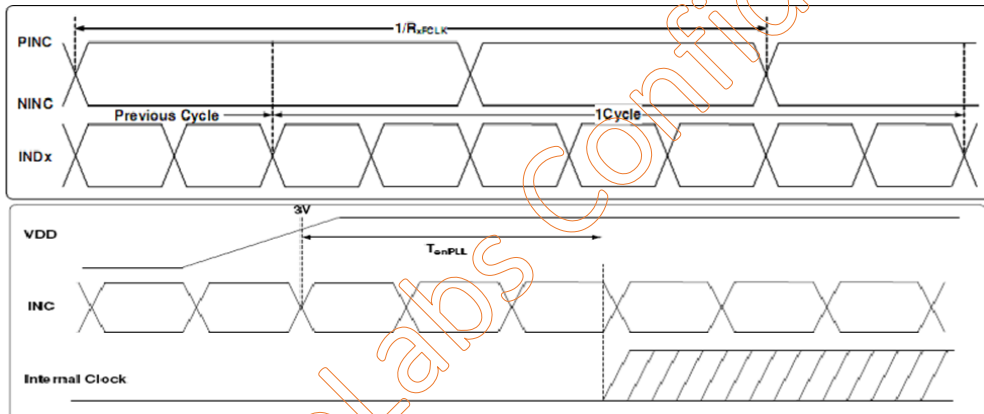
Note 2: If LED is driven by high current, high ambient temperature & humidity condition.

The lifetime of LED will be reduced. Operating life means brightness goes down to 50% initial brightness. Typical operating lifetime is estimated data.

4 Timing Chart

4.1 AC Electrical Characteristics

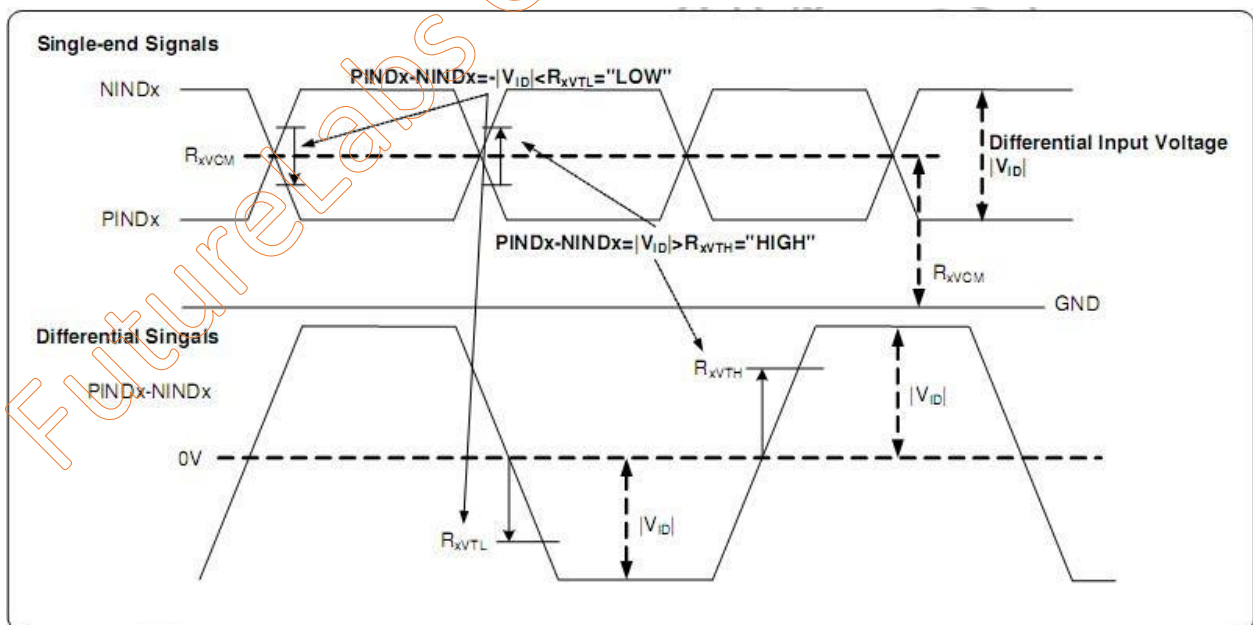
Parameter	Symbol	Min	Typ	Max	Unit	Conditions
Clock Frequency	R _x FCLK	20	-	80	MHz	
Input data skew margin	T _{RSKM}	500	-	-	ps	VID = 400mV, R _x VCM=1.2V R _x FCLK=80MHz
Clock high time	T _{LVCH}	-	4/7	-	R _x FCLK	
Clock low time	T _{LVCL}	-	3/7	-	R _x FCLK	
PLL wake-up time	T _{enPLL}	-	-	150	us	



4.2 DC Electrical Characteristics

VGH=18V, VGL=-6.8V, VDD=3.3V, GND=0V, Ta=25°C

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Differential input high Threshold voltage	R_{XVTH}	-	-	+0.1	V	
Differential input Low Threshold voltage	R_{XVTL}	-0.1	-	-	V	
Input voltage range	R_{XVIN}	0	-	VDD-1.0	V	
Differential input common Mode voltage	R_{XVCM}	$ V_{ID} /2$	-	$2.4 - V_{ID} /2$	V	
Differential input voltage	$ V_{ID} $	0.2	--	0.6	V	
Differential input leakage Current	$R_{V_{XlIz}}$	-10	--	+10	uA	
LVDS Digital Operating Current	Iddlvs	-	40	50	mA	Fclk=65MHz, VDD=3.3V
LVDS Digital Stand-by Current	Istlvs	--	10	50	uA	Clock & all functions are stopped

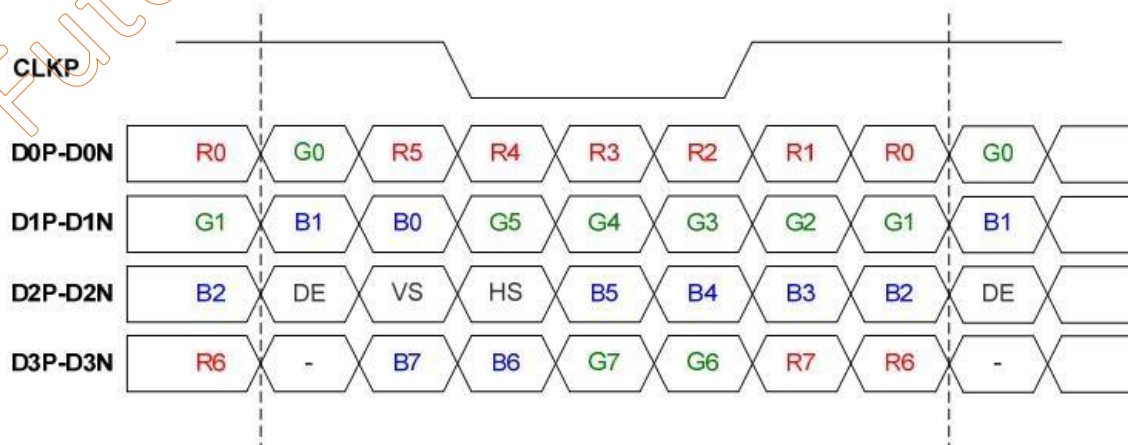


4.3 LCD Input Timing

Parameter	Symbol	Min.	Typ.	Max.	Unit	NOTE
Frequency	f _{CLK}	62.6	68.2	78.1	MHz	
Horizontal Blanking Time	t _{HBT}	20	69	164	t _{CLK}	
Horizontal back porch	t _{HBP}	5	5	164-t _{HFP}	t _{CLK}	
Horizontal display area	t _{HD}	1280	1280	1280	t _{CLK}	
Horizontal front porch	t _{HFF}	15	64	159	t _{CLK}	
Horizontal period	t _H	1300	1349	1444	t _{CLK}	
Horizontal pulse width	t _{HPW}	1	1	256	t _{CLK}	
Vertical Blanking Time	t _{VBT}	5	42	101	t _H	
Vertical back porch	t _{VBP}	2	2	101-t _{VFP}	t _H	
Vertical display area	t _{VD}	800	800	800	t _H	
Vertical front porch	t _{VFF}	3	40	99	t _H	
Vertical period	t _V	803	842	901	t _H	
Vertical pulse width	t _{VPW}	1	1	128	t _H	

4.4 Data Input Format

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

5. INTERFACE PIN DESCRIPTION

Pin No.	Symbol	I/O	function	Remarks
1	NC	--	No connection	
2	VDD	P	Power Voltage for digital circuit	
3	VDD	P	Power Voltage for digital circuit	
4	NC	--	No connection	
5	NC	--	No connection	
6	NC	--	No connection	
7	GND	P	Ground	
8	RXIN0-	I	- LVDS differential data input	
9	RXIN0+	I	+LVDS differential data input	
10	GND	P	Ground	
11	RXIN1-	I	-LVDS differential data input	
12	RXIN1+	I	+LVDS differential data input	
13	GND	P	Ground	
14	RXIN2-	I	-LVDS differential data input	
15	RXIN2+	I	+LVDS differential data input	
16	GND	P	Ground	
17	RXCLKIN-	I	-LVDS differential clock input	
18	RXCLKIN+	I	+LVDS differential clock input	
19	GND	P	Ground	
20	RXIN3-	I	-LVDS differential data input	
21	RXIN3+	I	+LVDS differential data input	
22	GND	P	Ground	
23	NC	--	No connection	
24	NC	--	No connection	
25	GND	P	Ground	
26	NC	--	No connection	
27	NC	--	No connection	
28	NC	--	No connection	
29	AVDD	P	Power for Analog Circuit	
30	GND	P	Ground	
31	LED-	P	LED Cathode	
32	LED-	P	LED Cathode	
33	NC	--	No connection	
34	NC	--	No connection	
35	VGL	P	Gate Off Voltage	

36	NC	--	No connection	
37	NC	--	No connection	
38	VGH	P	Gate On Voltage	
39	LED+	P	LED Anode	
40	LED+	P	LED Anode	

Note1: I/O definition.

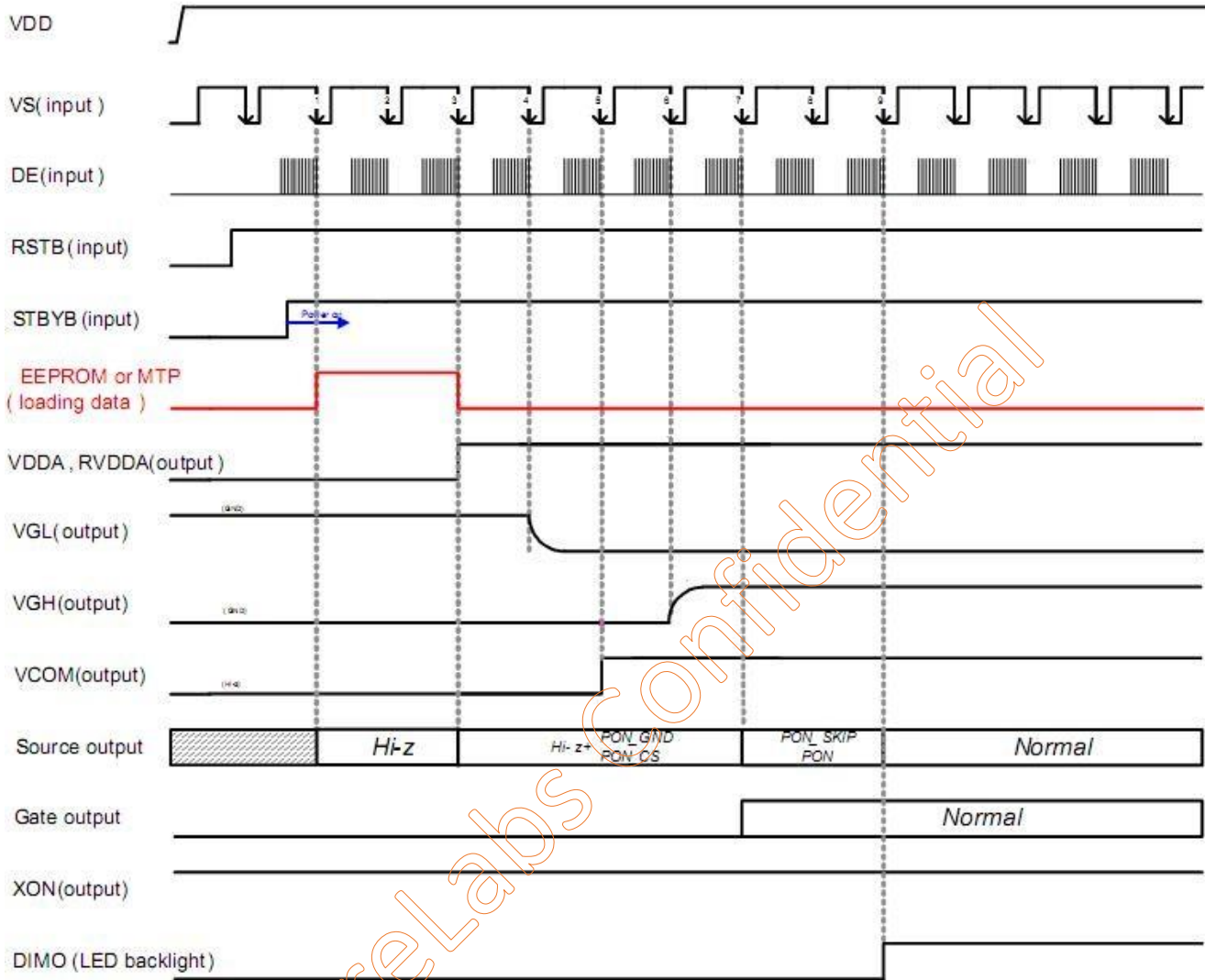
I---Input, O---Output, P--- Power/Ground, N--- No connection

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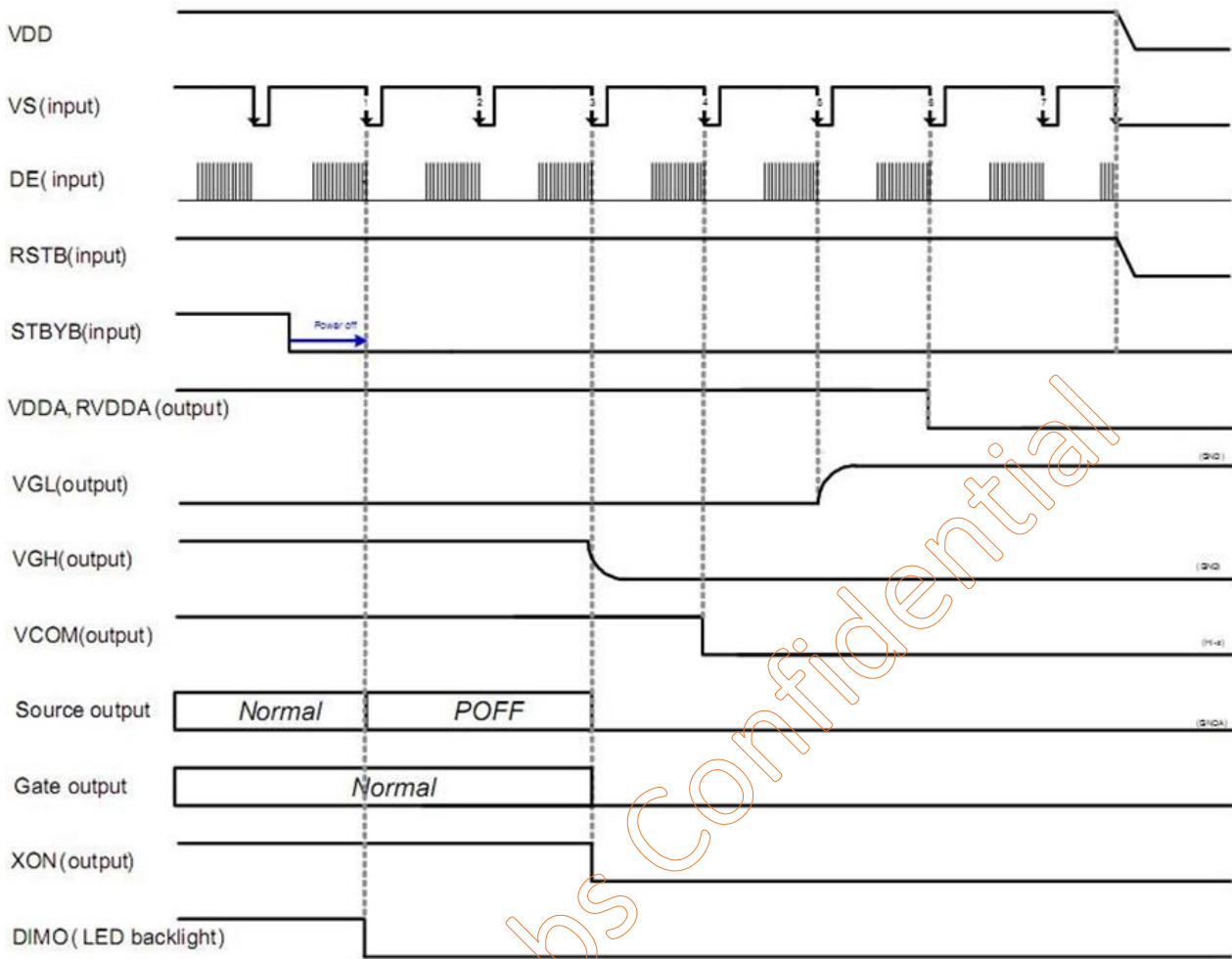
6. Power On/Off Timing

To prevent the device damage from latch up, the power on/off sequence shown below must be followed.

Power ON:

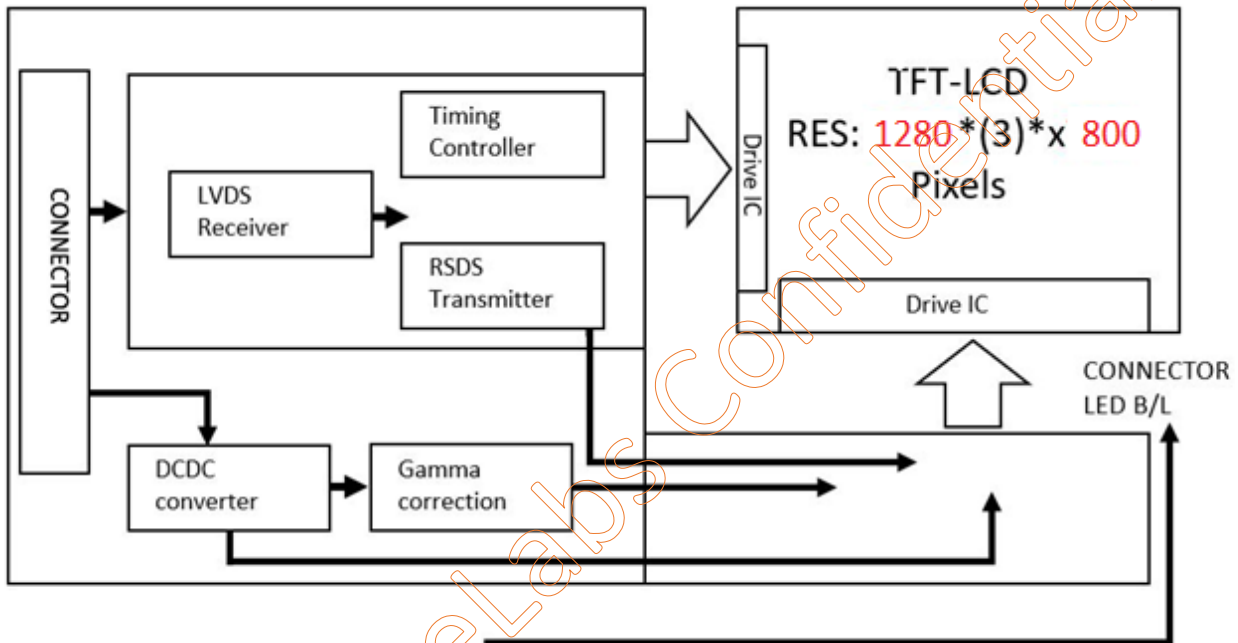


Power Off:



7. BLOCK DIAGRAM

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



7. OPTICAL CHARACTERISTIC

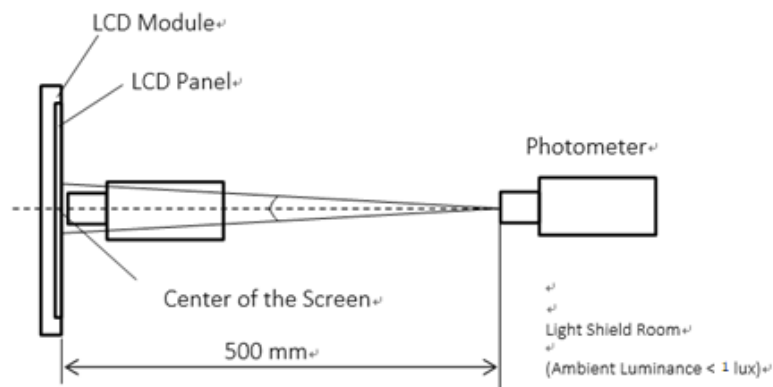
The optical characteristics are measured under stable conditions at room temperature.

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Viewing Angle	Horizontal	θ_{x+}	Center $CR \geq 10$	80	88	--	Deg.	Note 4
		θ_{x-}		80	88	--		
	Vertical	θ_{Y+}		80	88	--		
		θ_{Y-}		80	88	--		
Contrast Ratio		CR	$\theta_x = \theta_y = 0^\circ$	600	800	--		Note 1,2
Response time		Rising +Falling	Center $\theta_x = \theta_y = 0^\circ$	--	35	40	ms	Note 5
Uniformity (9P)		YU	$\theta_x = \theta_y = 0^\circ$	70	75	--	%	Note 1,3
Brightness		L	$\theta_x = \theta_y = 0^\circ$	320	400	--	cd/m ²	Note 1
Chromaticity		xW	Center $\theta_x = \theta_y = 0^\circ$	0.256	0.306	0.356		
		yW		0.279	0.329	0.379		
		xR		0.520	0.570	0.620		
		y R		0.280	0.330	0.380		
		xG		0.300	0.350	0.400		
		y G		0.542	0.592	0.642		
		xB		0.105	0.155	0.205		
		y B		0.051	0.101	0.151		
NTSC				40	50	--	%	

1. $I_F = 20\text{mA}$ (one channel), the ambient temperature is 25°C .
2. The test systems refer to Note 1 and Note 2.

Note 1: The method of optical measurement

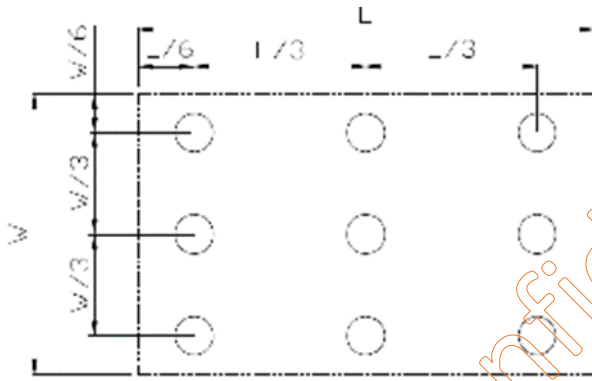
The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 20 minutes and in a dark room.



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

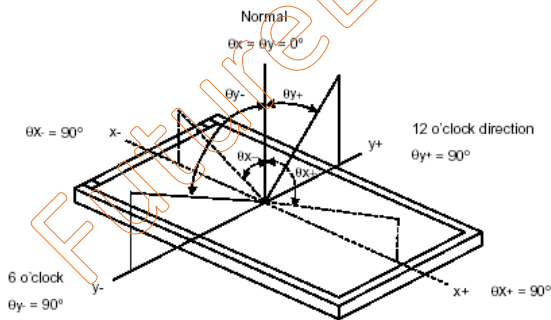
Note 3: Definition of Luminance and Luminance uniformity



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

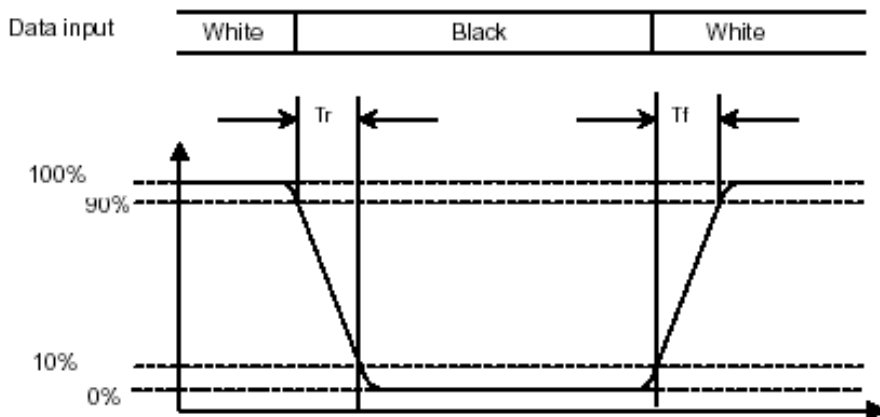
Note 4. Definition of view angle

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.



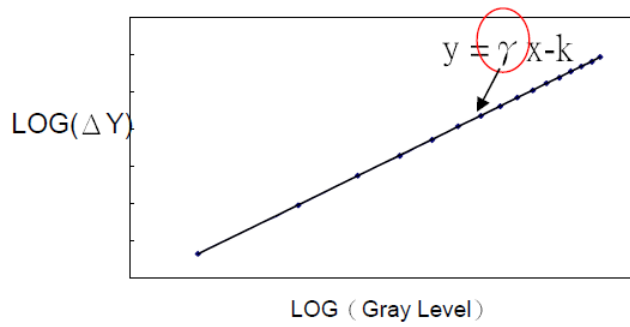
Note 5. Definition of Response time

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



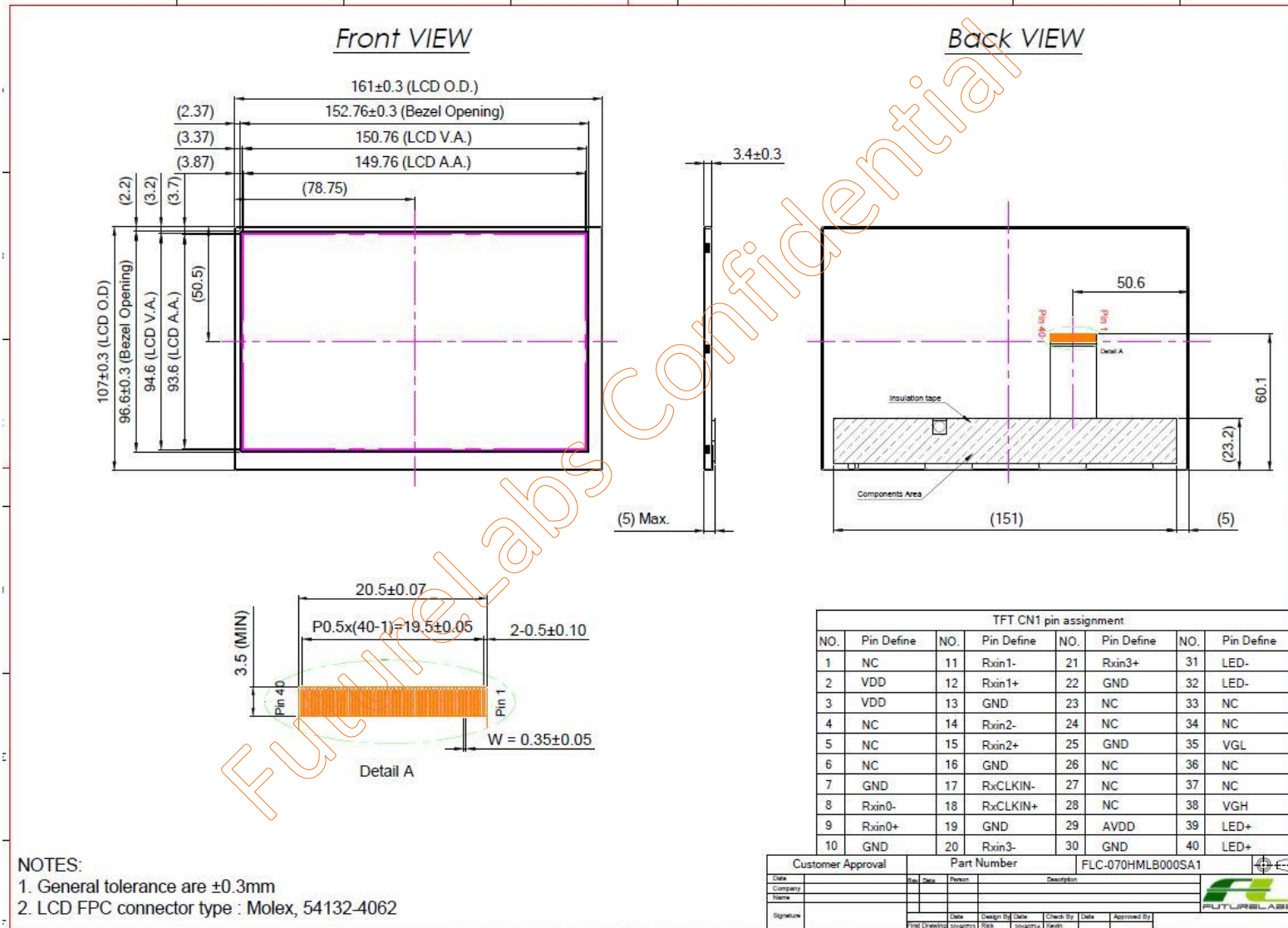
Note 6. Definition of Gamma (VESA)

Based on Customer Sample, take the average value as a standard center value and the variation range of gamma value caused by loop voltage error should be between +/- 0.2. the bellow figure shows how to obtain the gamma curve and γ (from gray level: 0、15、31-----239、255)



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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.