Product Specification

PART NUMBER # REV: FLC-070DML2000SA1#00

DESCRIPTION: TFT 7"W, 800(H)*480(V), LVDS, Full View 500CD

(   )   Preliminary Specification
(V)   Approved Specification

Customer Name:	
Signature:	**Date:**

PREPARED BY	REVIEWED BY
Ellen Chen	*David*

Revision History

Version	Date	Page	Description	Note
V1.0	2021/03/15		1st initial	

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 800 x 480 screen.

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"W	Inch
2	Pixel Number	800 (H) x 3(RGB)x 480 (V)	Pixels
3	Outline Dimension	170(W) x 110(H) x 9.51(D)	mm
4	Active Area	152.4 (W) x 91.44 (H)	mm
5	Pixel Pitch	0.1905 (H) x 0.1905 (V)	mm
6	Display Colors	16.7M / 262K	
7	Pixel Arrangement	RGB stripe	- -
8	Display Mode	Normally Black	- -
9	Electrical Interface	1ch-LVDS	- -
10	Surface Treatment	Anti-Glare	
11	Brightness	500 (Typ.)	cd/m2
12	Contrast Ratio	800 (Typ.)	--
13	Power Consumption	Total: 2.48 Backlight: 2.0	W

2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max		
Power Supply Voltage	V_{CC}	-0.3	-	3.6	V	(1)
Logic Supply Voltage	V_{IN}	-0.3	-	3.6	V	

2.2 Backlight Converter

Item	Symbol	Values			Unit	Note
		Min	Typ	Max		
Converter Voltage	LED_ V_{IN}	0	12.0	18.0	V	(1), (2)
Enable Voltage	LED_EN	0	3.3 / 5	7	V	Duty=100%
Backlight Adjust	LED_PWM	0	3.3 / 5	7	V	(1), (2) Pulse Width≤10msec. And Duty≤10%

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

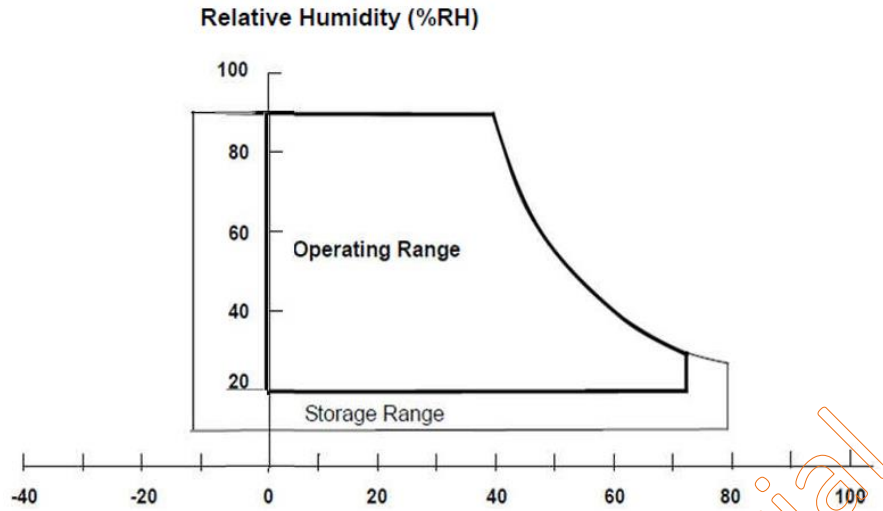Note (2) Specified values are for input pin of LED light bar at Ta=25±2°C。

2.3 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Top	-30	-	+85	°C	
Storage Temperature	Tstg	-40	-	+90	°C	

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

    (a) 90 %RH Max. (Ta $\leqq$ 40 ºC).

    (b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

    (c) No condensation.

Note 2 The absolute maximum rating values of this product are not allowed to be exceeded at any times. The module should not be used over the absolute maximum rating value. It will cause permanently unrecoverable function fail in such an condition.
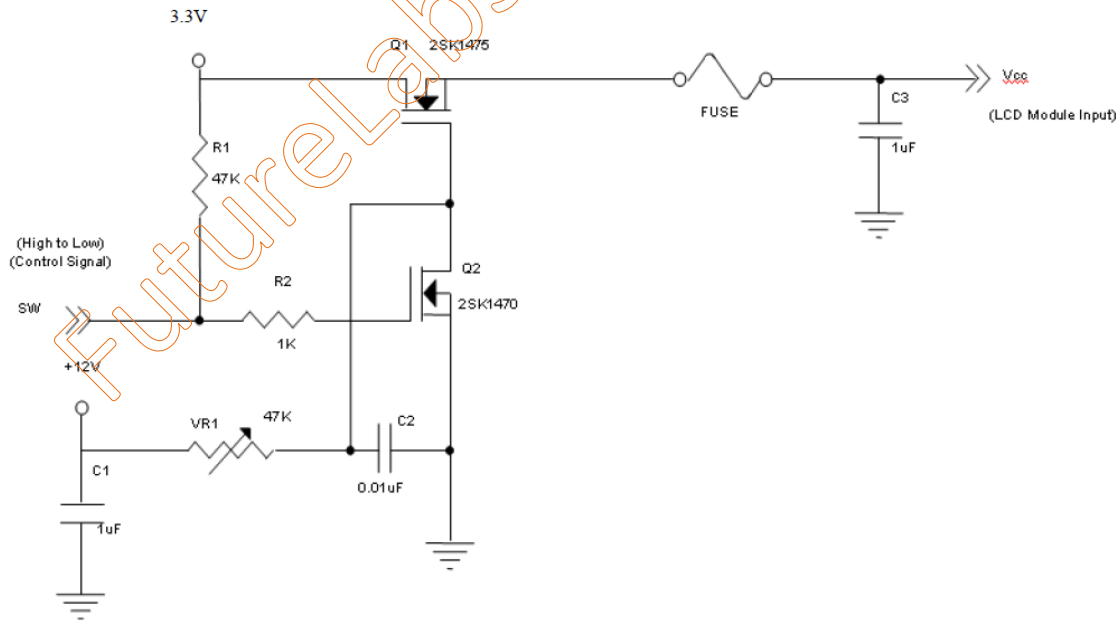
Relative Humidity (%RH)

Operating Range

Storage Range

3. ELECTRICAL CHARACTERISTICS

3.1 LCD Electrical Specification

Parameter			Min.	Type	Max.	Unit.	Note
Power supply voltage		V_{CC}	3.0	3.3	3.6	V	
Ripple Voltage		V_{RP}	-	-	100	mVp-p	
Rush Current		I_{RUSH}	-	-	2	A	(2)
Power Supply Current	White	-	-	135	200	mA	(3)a
	Black		-	85	135	mA	(3)b
	Vertical Stripe		-	145	220	mA	(3)c
Power Consumption		PLCD	-	0.48	0.73	W	
LVDS differential input voltage		Vid	200	-	600	mV	
LVDS common input voltage		Vic	1.0	1.2	1.4	V	
LVDS terminating resistor		R_T	-	100	-	ohm	

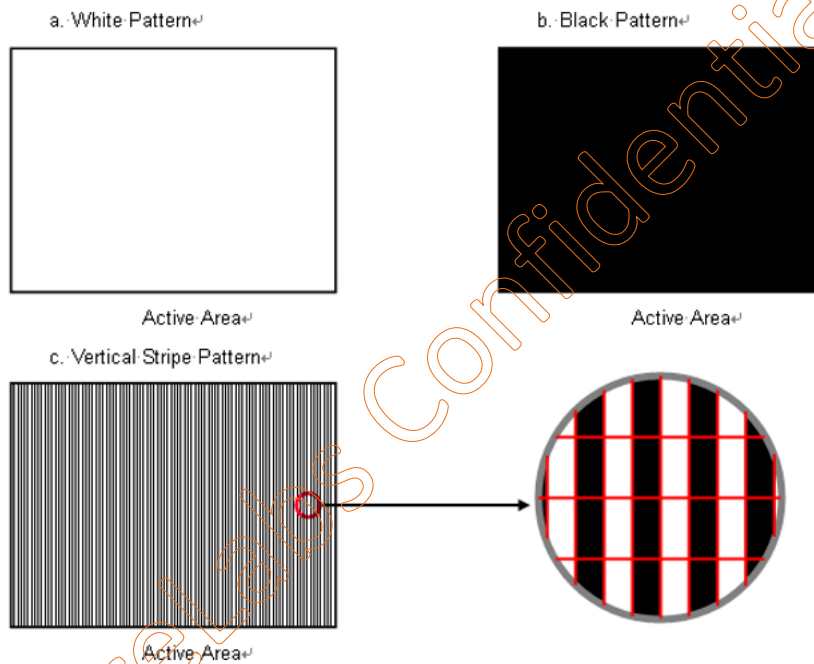Note (1) The ambient temperature is Ta = 25 $\pm$ 2 ℃.
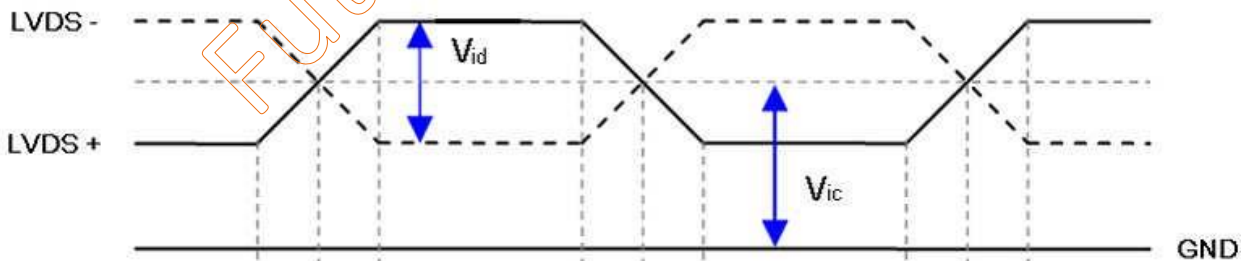Note (2) Measurement Conditions:

Vcc rising time is 470μs

Note (3) The specified power supply current is under the conditions at V_{CC}=3.3V, Ta=25±2°C, Fr=60Hz, whereas a power dissipation check pattern below is displayed.

Note (4) The power consumption is specified at the pattern with the maximum current.
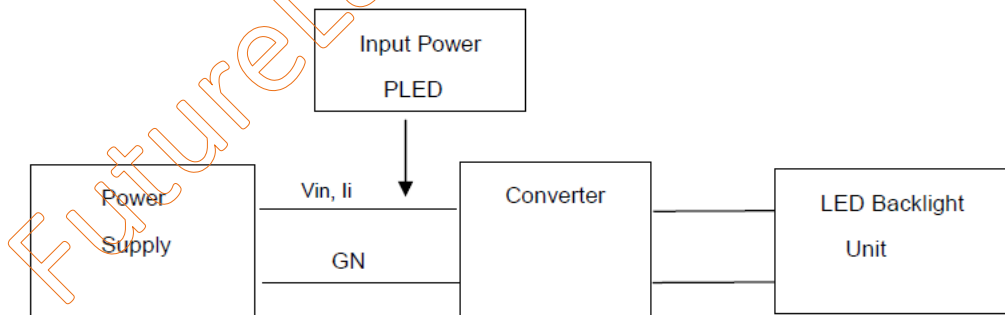
Note (5) VID waveform condition

3.2 Backlight Unit

Parameter guideline for LED driving is under stable conditions at 25°C (Room Temperature):

Parameter		Symbol	Min.	Type	Max.	Unit.	Note
Converter Power Supply Voltage		LED_Vin	10.8	12.0	13.2	V	
Converter Power Supply Current		Ii	0.1	0.17	2.0	A	@LED_Vin= 12V Duty=100%
Converter Input Rush Current		Iirsh		4.3		A	@LED_Vin rising = 1mS
Power Consumption		P_{LED}		2.0	2.3	W	@ LED_Vin = 12V Duty=100%
EN Control Level	Backlight on	LED_EN	2.0	3.3	5.0		
	Backlight off		0	-	0.15		
PWM Control Level	PWM High Level	LED_PWM	2.0	-	5.0		
	PWM Low Level		0	-	0.15		
PWM Control Duty Ratio			5	-	100	%	
PWM Control Frequency		f_{PWM}	190	200	300	Hz	
LED Life Time		L_L	50,000			Hrs	(2)

Note 1: LED light bar input voltage and current are measured by utilizing a true RMS multimeter.

Note 2: The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at Ta = 25±2℃ and Duty 100% until the brightness becomes ≦ 50% of its original value. Operating LED under high temperature environment will reduce life time and lead to color shift.
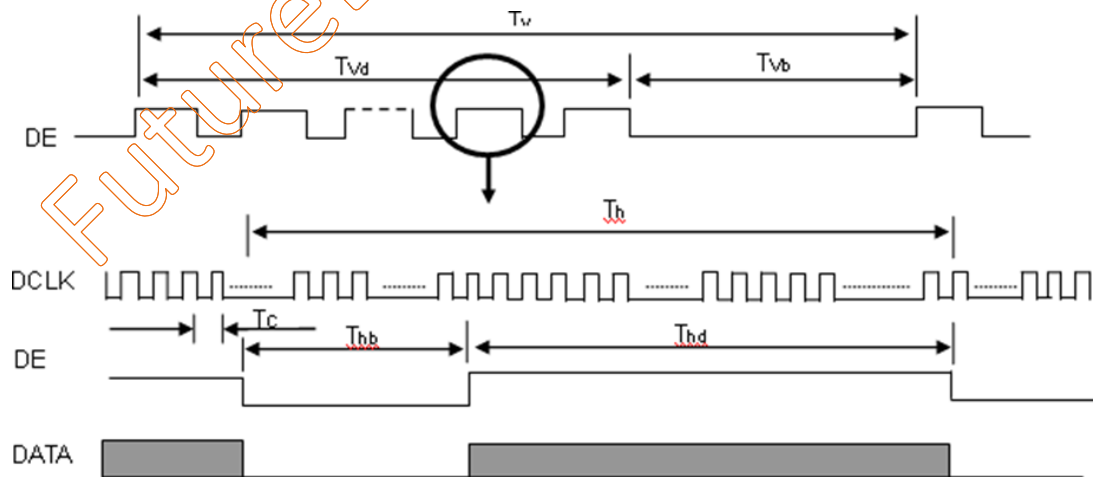
4.Timing Chart

4.1 Timing Table

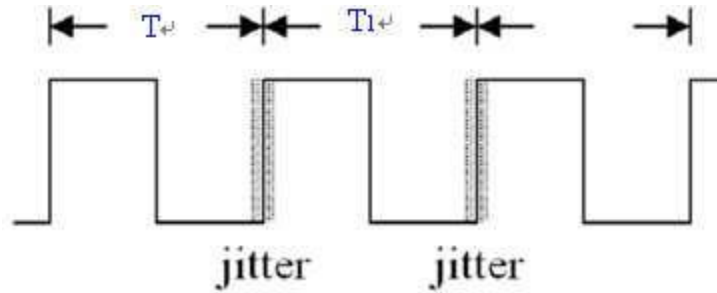| Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	25.2	25.4	35.7	MHz	-
	Period	Tc		39.37		ns	
	Input cycle to cycle jitter	T_{rcl}	-0.02*Tc	-	0.02*Tc	ns	(3)
	Input clock to data skew	TLVCCS	-0.02*Tc	-	0.02*Tc	ns	(4)
	Spread spectrum modulation range	Fclkin_mod	FC*98%	-	FC*102%	MHz	(5)
	Spread spectrum modulation frequency	F_{SSM}	23	-	93	KHz	
Vertical Display Term	Frame Rate	Fr	-	60	-	Hz	Tv=Tvd+Tvb
	Total	Tv	488	490	611	Th	-
	Active Display	Tvd		480		Th	-
	Blank	Tvb	8	10	131	Th	-
Horizontal Display Term	Total	Th	860	864	974	Tc	Th=Thd+Thb
	Active Display	Thd		800		Tc	-
	Blank	Thb	60	64	174	Tc	-

Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals are ignored.

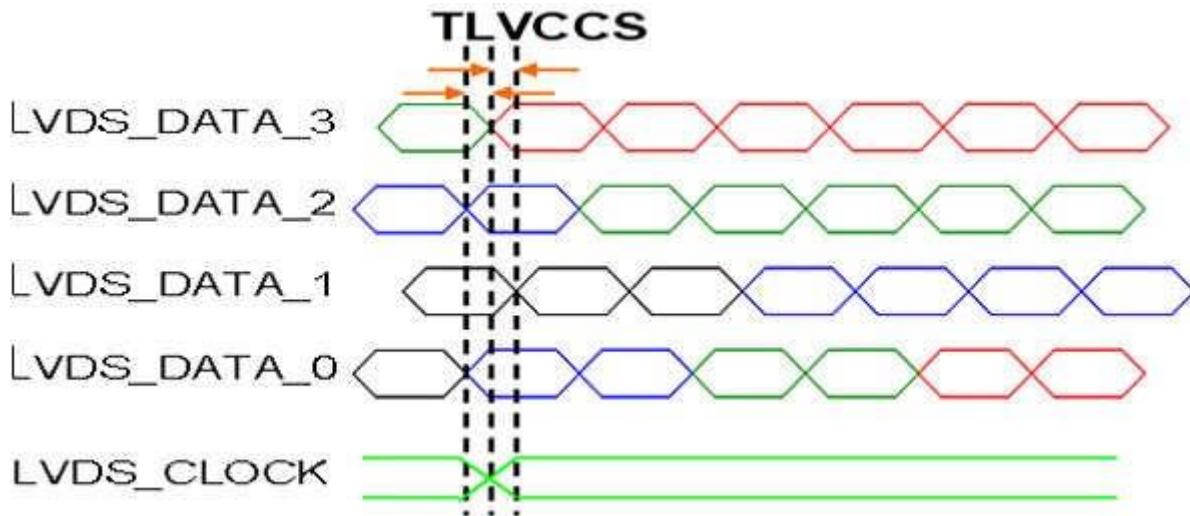Note (2) The Tv(Tvd+Tvb) must be integer, otherwise, this module would operate abnormally.

INPUT SIGNAL TIMING DIAGRAM

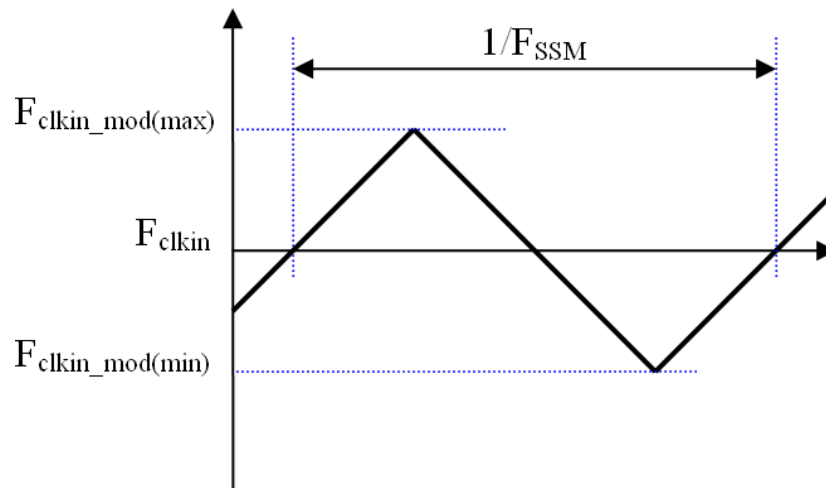Note (3) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T1 − TI

jitter   jitter

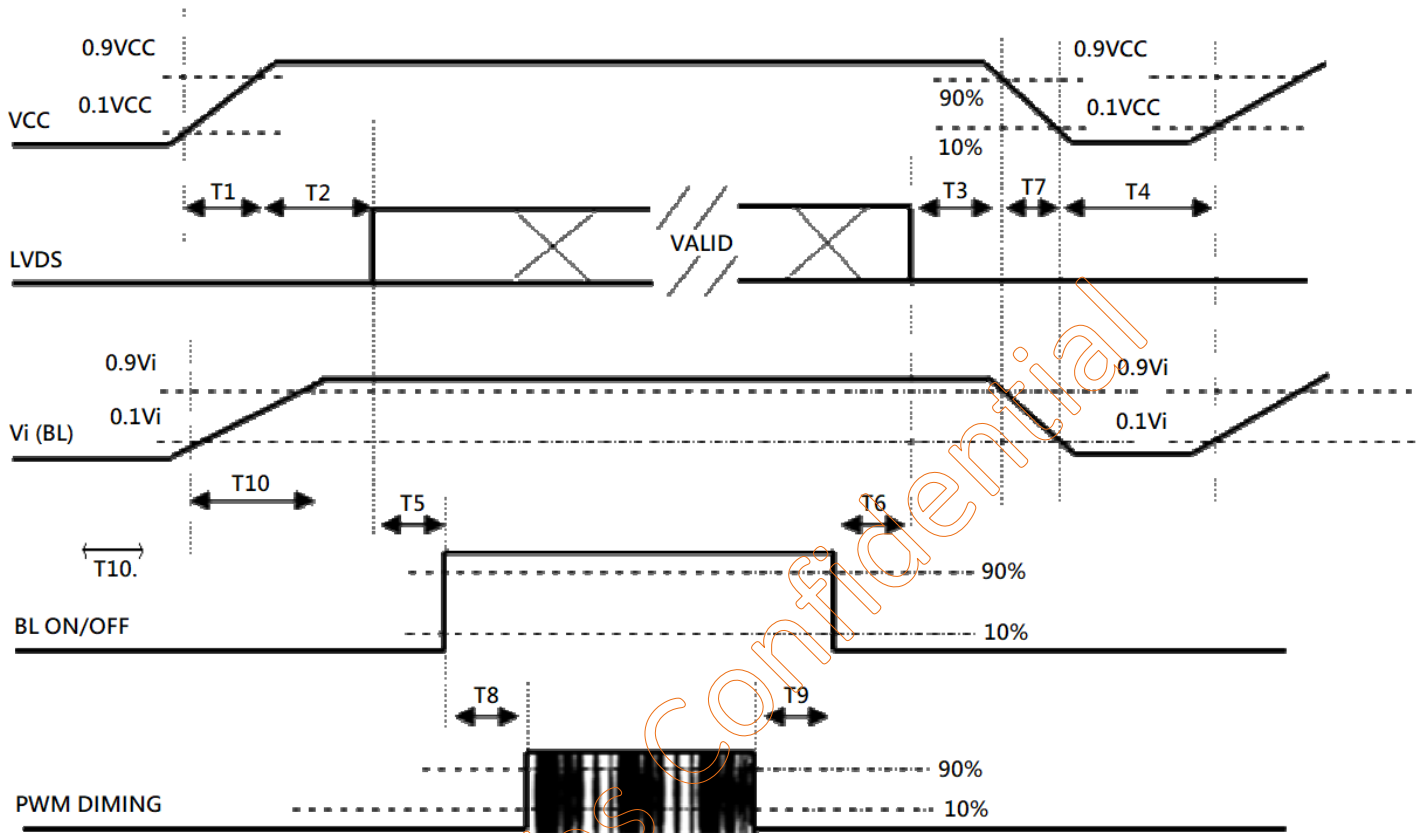Note (4) Input Clock to data skew is defined as below figures.

Note (5) The SSCG (Spread spectrum clock generator) is defined as below figures.

4.2 Power On/Off Sequence

The power sequence specifications are shown as the following table and diagram.

Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	450	-	-	ms
T6	200	-	-	ms
T7	10	-	100	ms
T8	10	-	-	ms
T9	10	-	-	ms
T10	20	-	50	ms

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

5. INTERFACE PIN DESCRIPTION

5.1 LCM Connector PIN Assignment

The electronics interface connector is Starconn 093G30-B0001A-G4 or equivalent.

Pin No.	Symbol	Functions	Note
1	12V	LED Power	
2	12V	LED Power	
3	12V	LED Power	
4	12V	LED Power	
5	ENLED	ENLED Enable pin	
6	Dimming	Backlight Adjust	
7	NC	No Connection	(2)
8	NC	No Connection	(2)
9	VCC	Power supply: +3.3V	
10	VCC	Power supply: +3.3V	
11	GND	Ground	
12	GND	Ground	
13	RX0-	Negative transmission data of pixel 0	
14	RX0+	Positive transmission data of pixel 0	
15	GND	Ground	
16	RX1-	Negative transmission data of pixel 1	
17	RX1+	Positive transmission data of pixel 1	
18	GND	Ground	
19	RX2-	Negative transmission data of pixel 2	
20	RX2+	Positive transmission data of pixel 2	
21	GND	Ground	
22	RXCLK-	Negative of clock	
23	RXCLK+	Positive of clock	
24	GND	Ground	
25	RX3-	Negative transmission data of pixel 3	
26	RX3+	Positive transmission data of pixel 3	
27	GND	Ground	

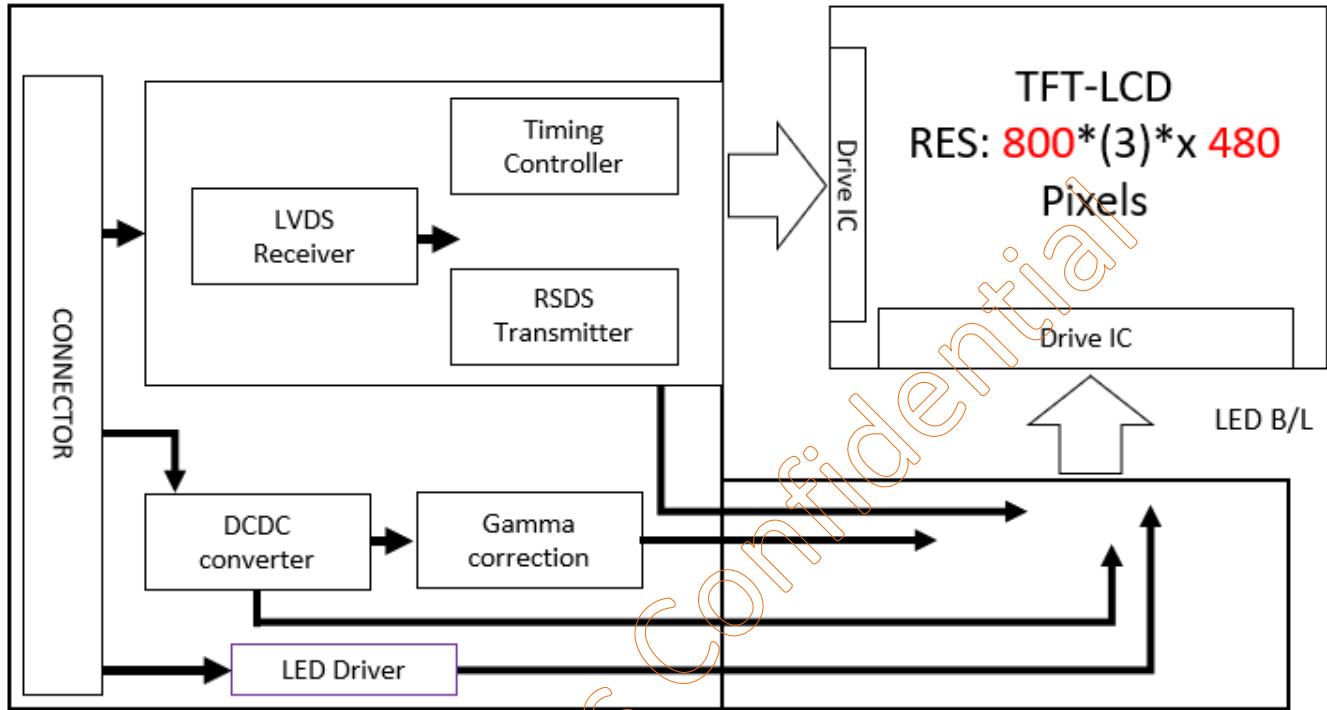| Pin No.	Symbol	Functions	Note
28	SEL6/8	LVDS 6/8 bit select function control.	(1)
		Low → 6 bit Input Mode	
		High or NC → 8bit Input Mode	
29	GND	Ground	
30	GND	Ground	

Note (1) "Low" stands for 0V. "High" stands for 3.3V

Note (2) Pin7, Pin8 input signals should be set to no connection or ground, this module would operate normally.

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.
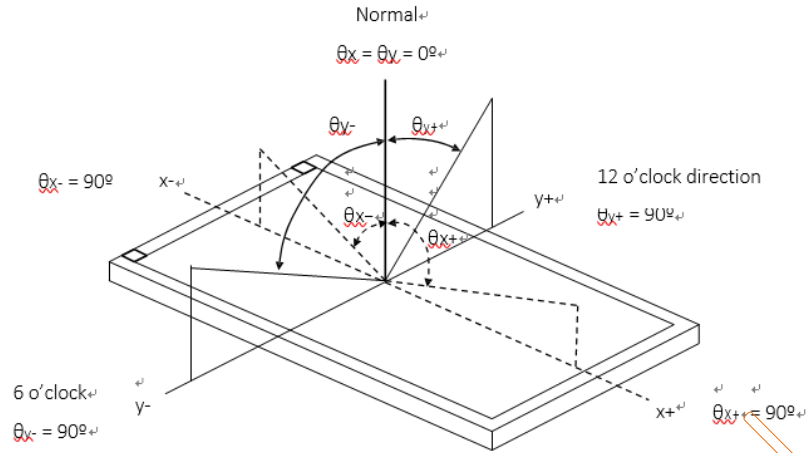
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_X=0°$	600	800	-	-	(2)(5)
Response Time		T_R	25°C	-	13	-	ms	(3)
		T_F			12			
Center Luminance of White		LC		360	500	750	cd/m2	(4)(5)
White Variation		W		70	-	-	%	
Chromaticity	Red	Rx	$\theta_X=0°$, $\theta_Y=0°$ Viewing angle at normal direction	Typ. -0.05	0.625	Typ. +0.05	-	(1) (5)
		Ry			0.303		-	
	Green	Gx			0.307		-	
		Gy			0.630		-	
	Blue	Bx			0.150		-	
		By			0.050		-	
	White	Wx			0.313		-	
		Wy			0.315		-	
Viewing Angle	Horizontal	θ_X+	CR=10	80	89	-	Deg.	(1)(5)
		θ_X-		80	89	-		
	Vertical	θ_Y+		80	89	-		
		θ_Y-		80	89	-		

The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance <2 lux, and at room temperature).

The room temperature is 25°C±2°C.

Note 1:   Definition of Viewing 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
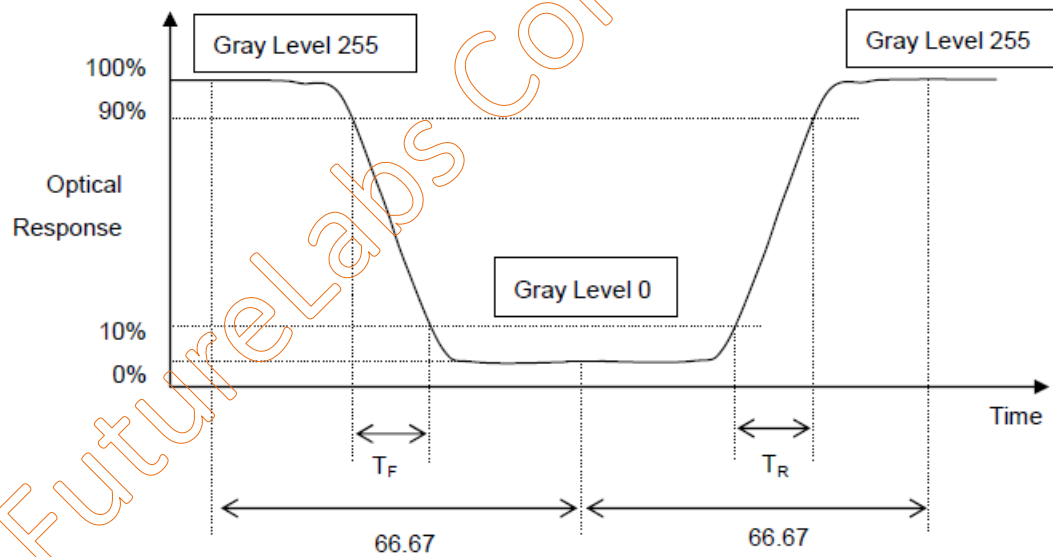
Note 2: Definition of Contrast Ratio (CR)

Measure the viewing angle of Θ= 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
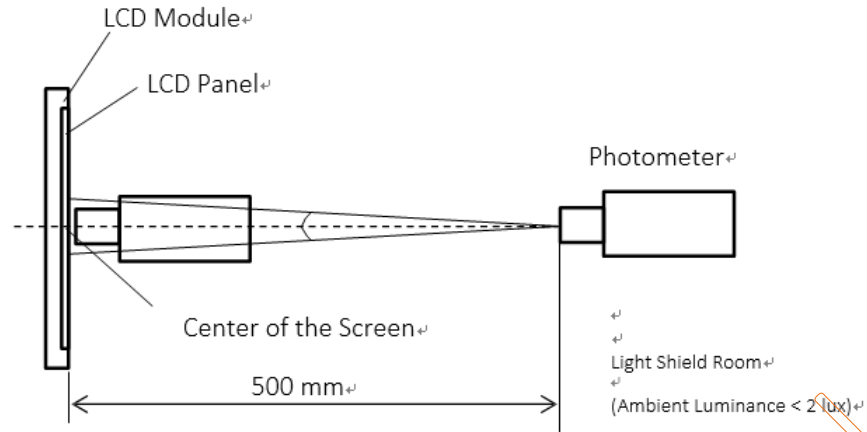
Note 3: Definition of Response Time:

The response time is set initially by defining the "Rising Time (TR)" and the "Falling Time (TF)" respectively. Please refer the figure to the followings:

Note 4: Definition of Brightness (L)

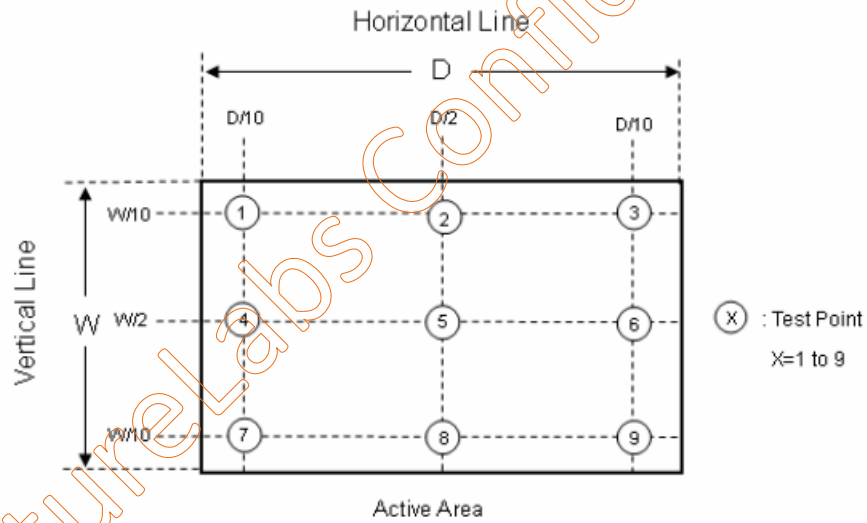Measure the center area of the panel and the viewing angle of the $\theta x = \theta y = 0°$
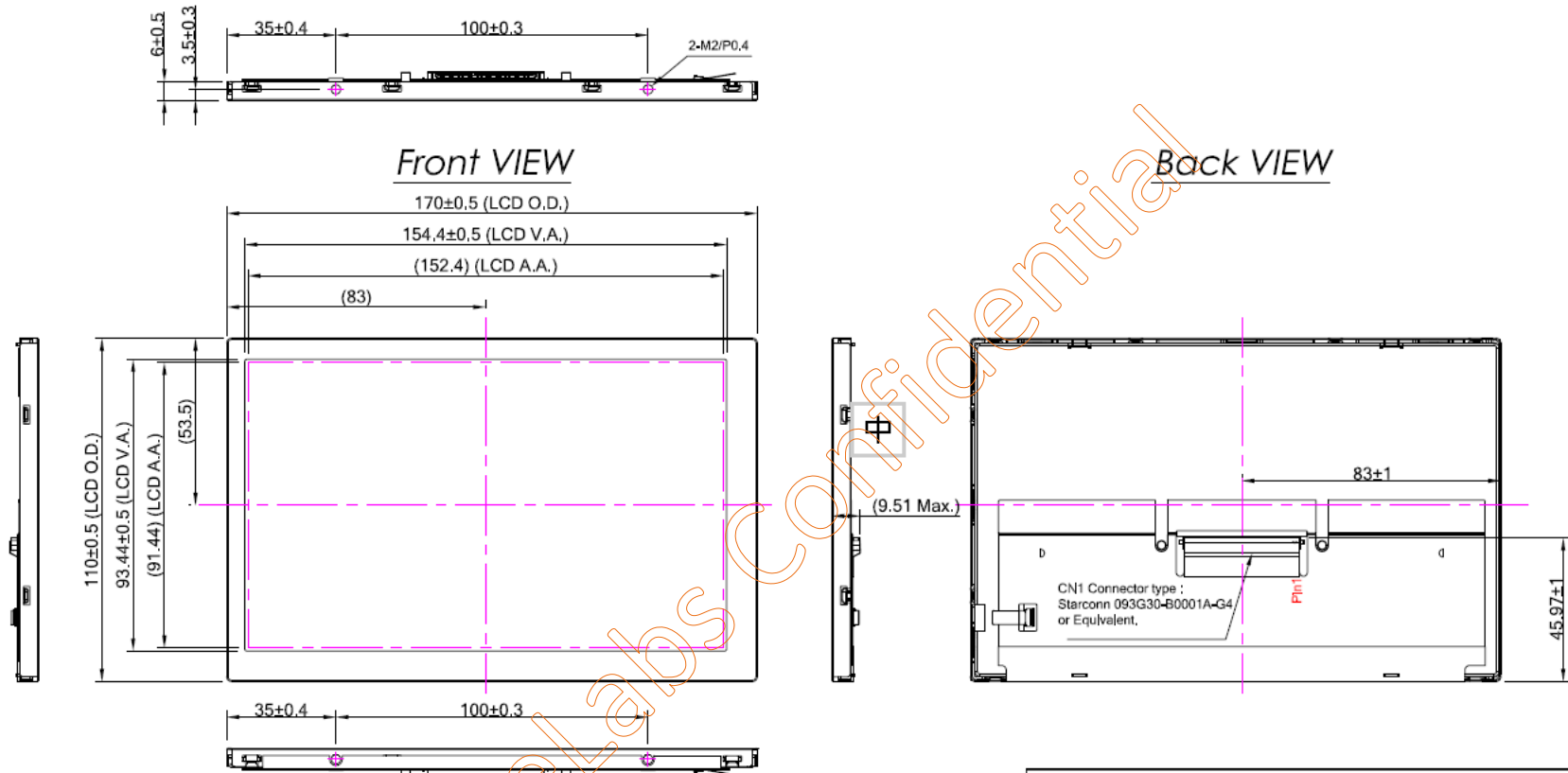
Note 5: The method of optical measurement:

Note 6:   Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

δW = Maximum [L (1), L (2), L (3), L (4)~ L (9)] / Minimum [L (1), L (2), L (3), L (4)~ L (9)]

8. DIMENSION AND DRAWING

Front VIEW

170±0,5 (LCD O,D,)
154,4±0,5 (LCD V,A,)
(152.4) (LCD A.A.)
(83)

35±0.4   100±0.3

6±0.5   3.5±0.3   2-M2/P0.4

110±0.5 (LCD O.D.)
93.44±0.5 (LCD V.A.)
(91.44) (LCD A.A.)
(53.5)

Back VIEW

83±1

(9.51 Max.)

45.97±1

CN1 Connector type :
Starconn 093G30-B0001A-G4
or Equivalent,

Pin1

CN1 Pin Define

PIN	SYMBOL	PIN	SYMBOL	PIN	SYMBOL
1	12V	11	GND	21	GND
2	12V	12	GND	22	RXCLK-
3	12V	13	RX0-	23	RXCLK+
4	12V	14	RX0+	24	GND
5	ENLED	15	GND	25	RX3-
6	Dimming	16	RX1-	26	RX3+
7	NC	17	RX1+	27	GND
8	NC	18	GND	28	SEL6/8
9	VCC	19	RX2-	29	GND
10	VCC	20	RX2+	30	GND

NOTE:
General Tolerance is ±0.5

Customer Approval		Part Number #Rev		FLC-070DML2000SA1	#00	
Date		Draw. Ver. Data	Person	Description		
Company						
Name						
Signature						
		Date	Design By	Date	Check By	Date	Approved By
		First Drawing	20210311	Max			

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°C ± 5°C and the humidity is below 60% RH.