

## Product Specification

PART NUMBER # REV: FLC-070DML2200001#00

DESCRIPTION: TFT 7" w, 800(H)\*480(V), LVDS,  
262K/16.7M Color, 500CD

- ( ) Preliminary Specification  
( V ) Approved Specification

<b>Customer Name:</b>	
<b>Signature:</b>	<b>Date:</b>

PREPARED BY	REVIEWED BY
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## Revision History

Version	Date	Page	Description	Note
V1.0	2022/08/24		First 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 800 x 480 screen and 262K/16.7 M 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" w	Inch
2	Pixel Number	800 (H) x 3(RGB)x 480 (V)	Pixels
3	Outline Dimension	165(H)x104(V)x5.8(D) typ, 9,13 (D) PCB Zone	mm
4	Active Area	152.4 (H) x 91.44 (V)	mm
5	Pixel Pitch	0.1905(W) x 0.1905(H)	mm
6	Display Colors	16.7M / 262K	
7	Pixel Arrangement	RGB vertical stripe	-
8	Display Mode	Normally Black	-
9	Electrical Interface	LVDS	-
10	Surface Treatment	Anti-glare	-
11	Brightness	500 (Typ.)	cd/m <sup>2</sup>
12	Contrast Ratio	800 (Typ.)	-
13	Power Supply Voltage	3.3V for LCD – 12V for Backlight	
14	Power Consumption	Backlight System: 2.7W Total: 3.15W (Typ.)	W

## 2. ABSOLUTE MAXIMUM RATING

### 2.1 Electrical Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max		
Power Supply Voltage	V <sub>cc</sub>	-0.3	-	3.6	V	(1)
Logic Input Voltage	V <sub>IN</sub>	-0.3	-	3.6	V	

### 2.2 Backlight Converter

Item	Symbol	Values			Unit	Note
		Min	Typ	Max		
Converter Voltage	V <sub>i</sub>	0	-	18	V	(1), (2)
Enable Voltage	EN	-	-	7	V	
Backlight Adjust	ADJ	-	-	7	V	

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 LED converter.

### 2.3 Environment Absolute Rating

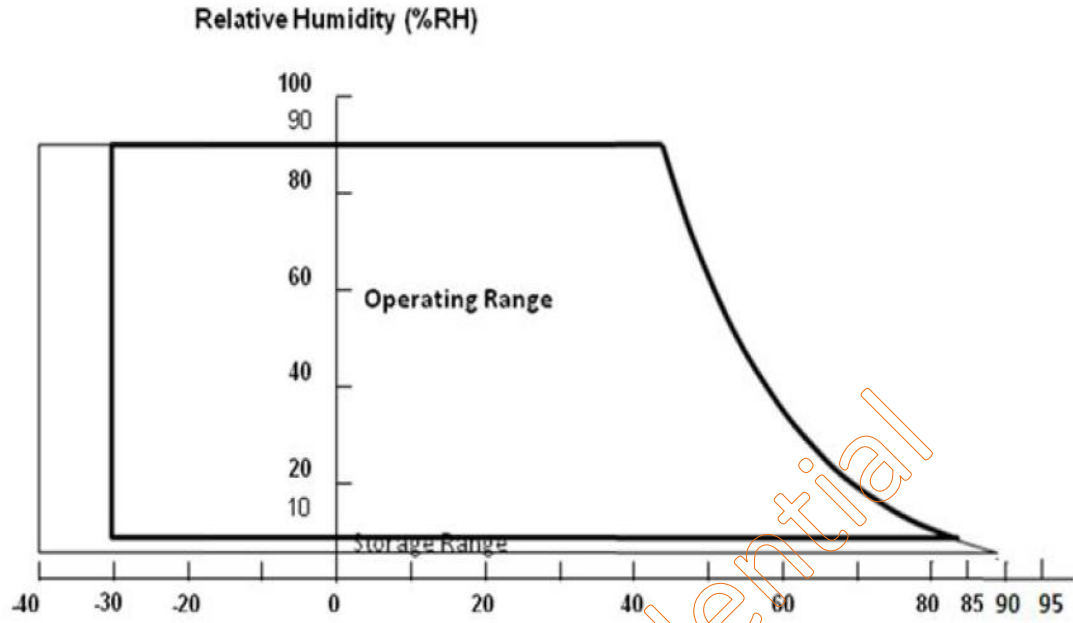
Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Top	-40	-	(85)	°C	
Storage Temperature	T <sub>stg</sub>	-30	-	(85)	°C	

Note (1) 90 %RH Max.

(2) Wet-bulb temperature should be 39 °C Max.

(3) No condensation.

(4) Panel surface temperature should be 0°C min. and 65°C max under V<sub>cc</sub>=5.0V, f<sub>r</sub>=60Hz, typical LED string current, 25°C ambient temperature, and no humidity control. Any condition of ambient operating temperature, the surface of active area should be keeping not higher than 65°C.



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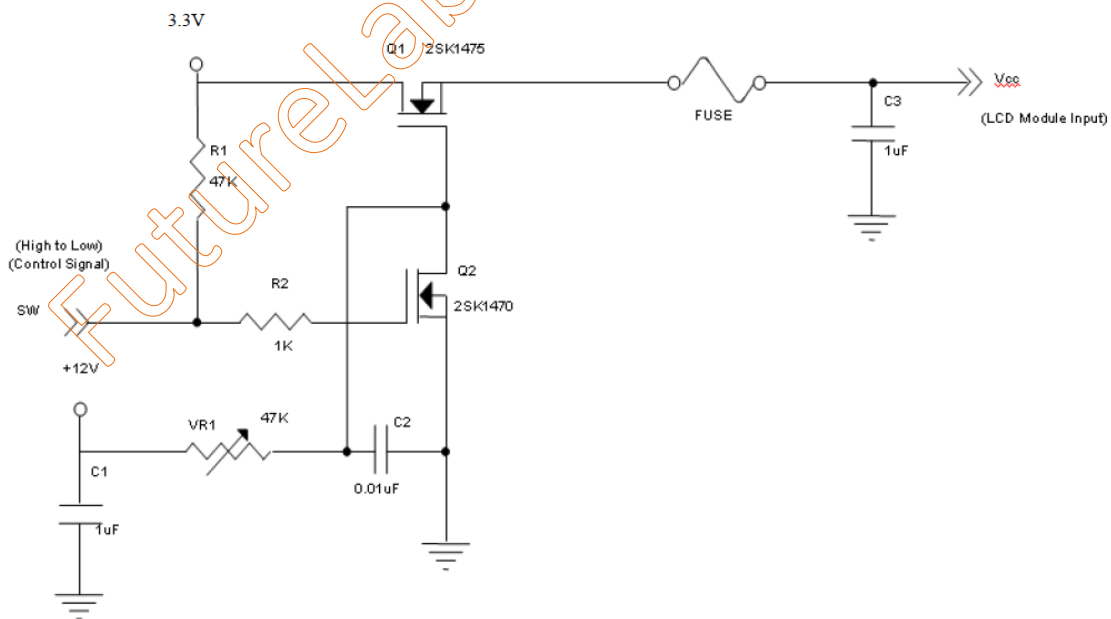
### 3. ELECTRICAL CHARACTERISTICS

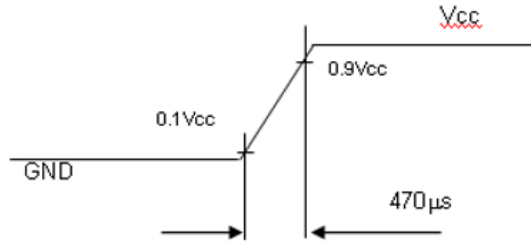
#### 3.1 TFT LCD Module

Item	Symbol	Values			Unit	Note
		Min	Typ	Max		
Power Supply Voltage	Vcc	3.0	3.3	3.6	V	-
Ripple Voltage	VRP	-	-	100	mVp-p	-
Rush Current	IRUSH	-	-	2	A	(2)
Power Supply Current	White	-	135	200	mA	(3)
	Black	-	85	135	mA	
LVDS Differential Input Voltage	Vid	200	-	600	mV	
LVDS Common Input Voltage	Vic	1.0	1.2	1.4	V	
Differential Input Voltage For LVDS Receiver Threshold	“H” Level	VTH	-	+100	mV	
	“L” Level	VTL	-100	-	mV	
Logic Input Voltage	“H” Level	VIH	2.6	Vcc	V	
	“L” Level	VIL	0	0.7	V	
Terminating Resistor	RT	-	100	-	ohm	

Note (1) The module should be always operated within above ranges.

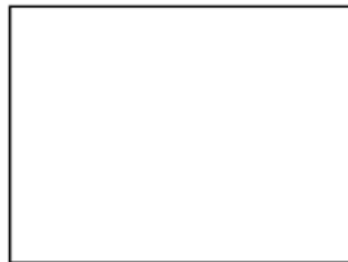
Note (2) Measurement Conditions:





Note (3) The specified power supply current is under the conditions at  $V_{CC} = 3.3V$ ,  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ , DC Current and  $f_v = 60 \text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



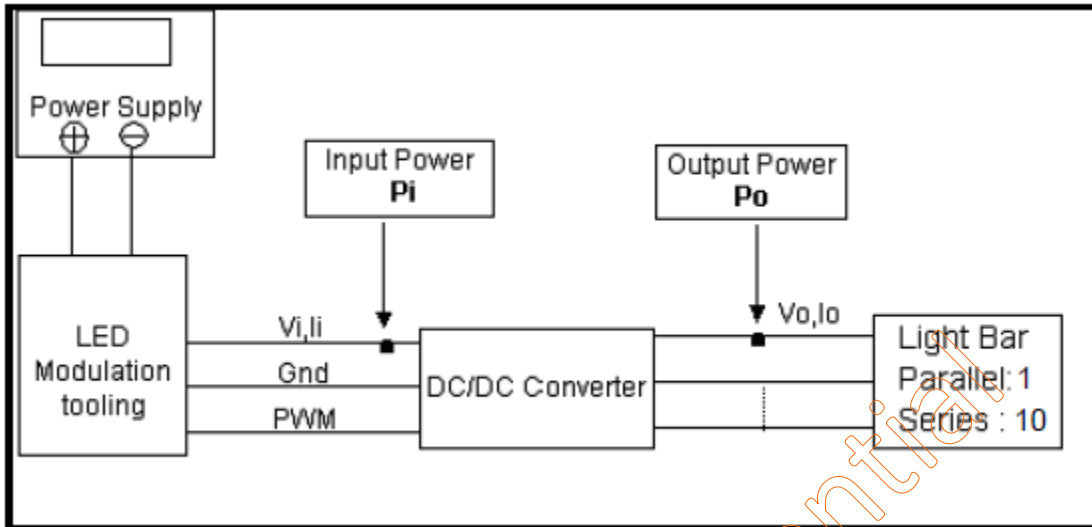
Active Area

### 3.2 Backlight Characteristics

Item	Symbol	Min.	Typ.	Max.	Unit	Remark	
Converter Power Supply Voltage	LED_Vin	10.8	12.0	13.2	V		
Converter Input Ripple Voltage	V <sub>iRP</sub>	-	-	500	mV		
Converter Power Supply Current	I <sub>i</sub>	0.18	0.22	0.3	A	@LED_Vin= 12V Duty=100%	
Converter Input Rush Current	I <sub>irsh</sub>			3	A	@LED_Vin rising = 1mS(Vi=12V)	
Input Power Consumption	P <sub>i</sub>	-	2.7	3.3	W	(1)	
EN Control Level	Backlight On	ENLED	2.0	3.3	5.0	V	EN Control Level
	Backlight Off	(BLON)	0	-	0.3	V	
PWM Control Level	PWM High Level	Dimming	2	--	5.0	V	PWM Control Level
	PWM Low Level	(E_PWM)	0	--	0.15	V	
PWM Noise Range	V <sub>Noise</sub>	-	-	0.1	V		
PWM Control Frequency	f <sub>PWM</sub>	190	200	20K	Hz	(3)	
PWM Dimming Control Duty Ratio	-	5	-	100	%	(3), @ 190Hz < f <sub>PWM</sub> < 1kHz	
		20	-	100	%	(3), @ 1kHz ≤ f <sub>PWM</sub> < 20kHz	
LED life time	LLED	50,000	-	-	Hrs	(2)	



Note (1) LED current is measured by utilizing a high frequency current meter as shown below:



Note (2) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at  $T_a = 25 \pm 2 \text{ }^\circ\text{C}$  and Duty 100% until the brightness becomes  $\leq 50\%$  of its original value. Operating LED at high temperature condition will reduce life time and lead to color shift.

Note (3) At 190 ~1kHz PWM control frequency, duty ratio range is restricted from 5% to 100%. 1K ~20kHz PWM control frequency, duty ratio range is restricted from 20% to 100%. If PWM control frequency is applied in the range from 1KHz to 20KHZ, The "non-linear" phenomenon on the Backlight Unit may be found. So It's a suggestion that PWM control frequency should be less than 1KHz.

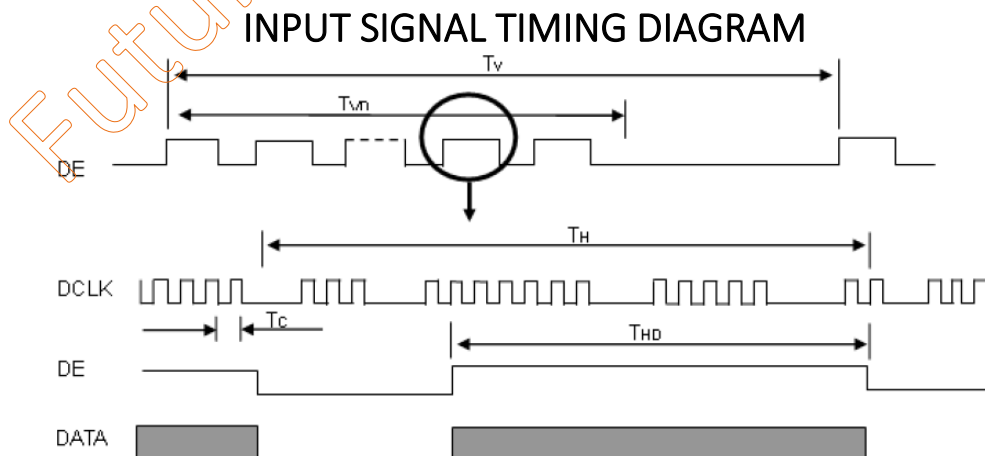
## 4. Signal Characteristic

### 4.1 Timing Chart

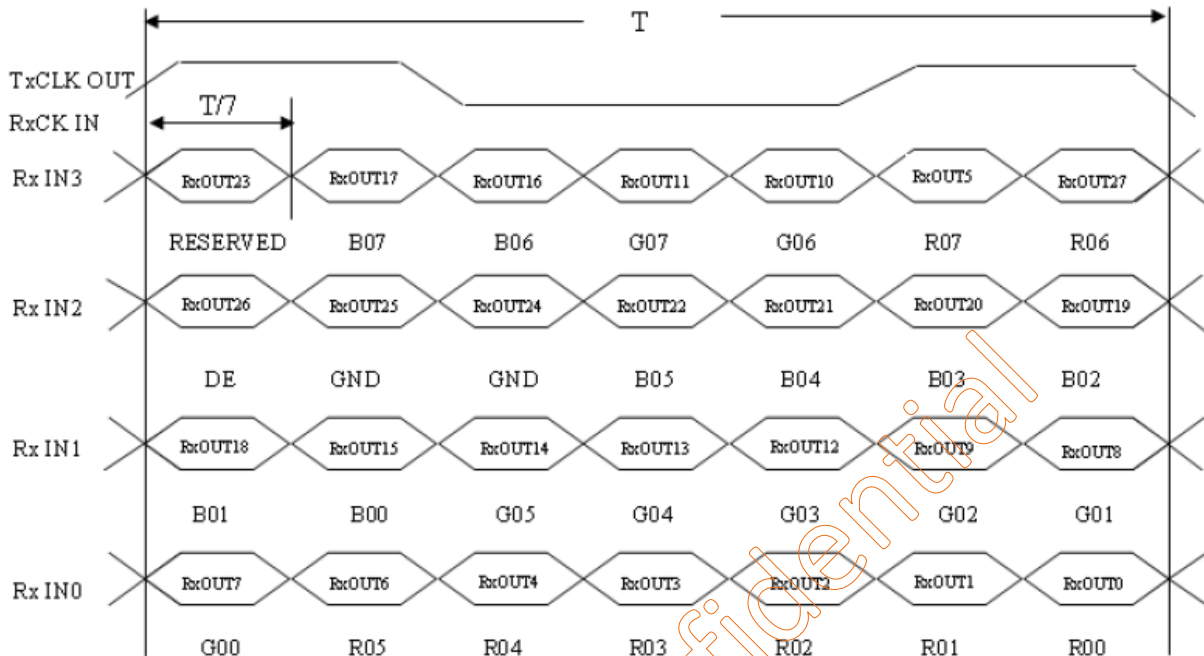
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	25.2	25.4	35.7	MHz	-
	Period	Tc		39.37		ns	
	Input cycle to cycle jitter	Trcl	-0.02*Tc	-	0.02*Tc	ns	(1)
	Input Clock to data skew	TLVCCS	-0.02*Tc	-	0.02*Tc	ps	(2)
	Spread spectrum modulation range	Fckin_mod	-	-	1.02*Fc	MHz	(3)
Vertical Display Term	Frame Rate	Fr	-	60	-	Hz	-
	Total	Tv	488	490	611	Th	Tv=Tvd+Tvb
	Active Display	Tvd	480	480	480	Th	-
Horizontal Display Term	Blank	Tvb	8	10	131	Th	-
	Total	Th	860	864	974	Tc	Th=Thd+Thb
	Active Display	Thd	800	800	800	Tc	-
Horizontal Display Term	Blank	Thb	60	64	174	Tc	-

Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

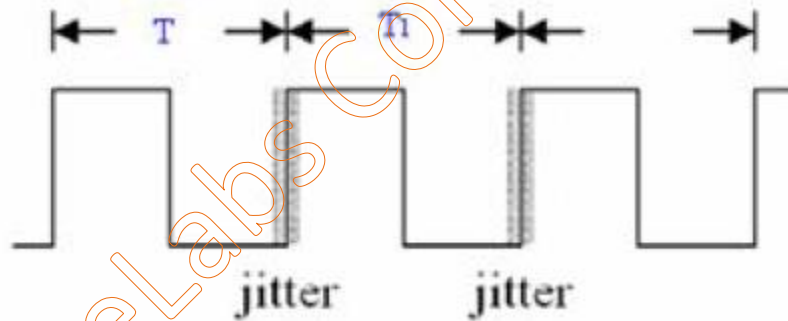
Note (2) The Tv(Tvd+Tvb) must be integer, otherwise, the module would operate abnormally.



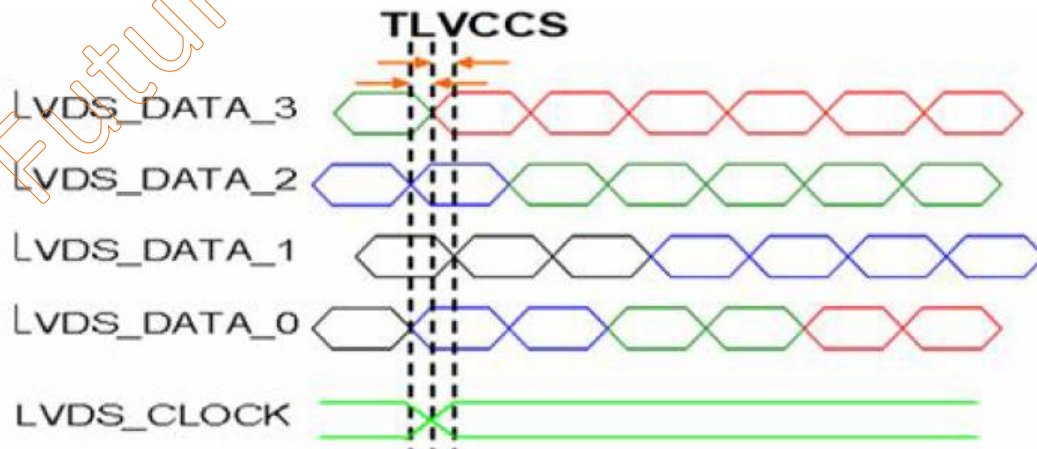
## TIMING DIAGRAM of LVDS



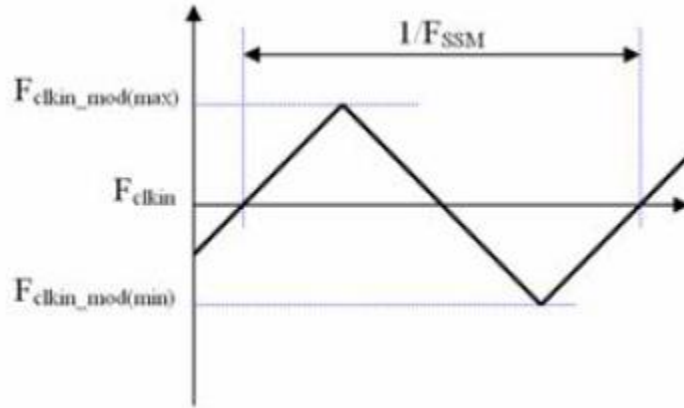
Note (1) The input clock cycle-to-cycle jitter is defined as below figures.  $Trcl = |T1 - T|$



Note (2) Input Clock to data skew is defined as below figures.

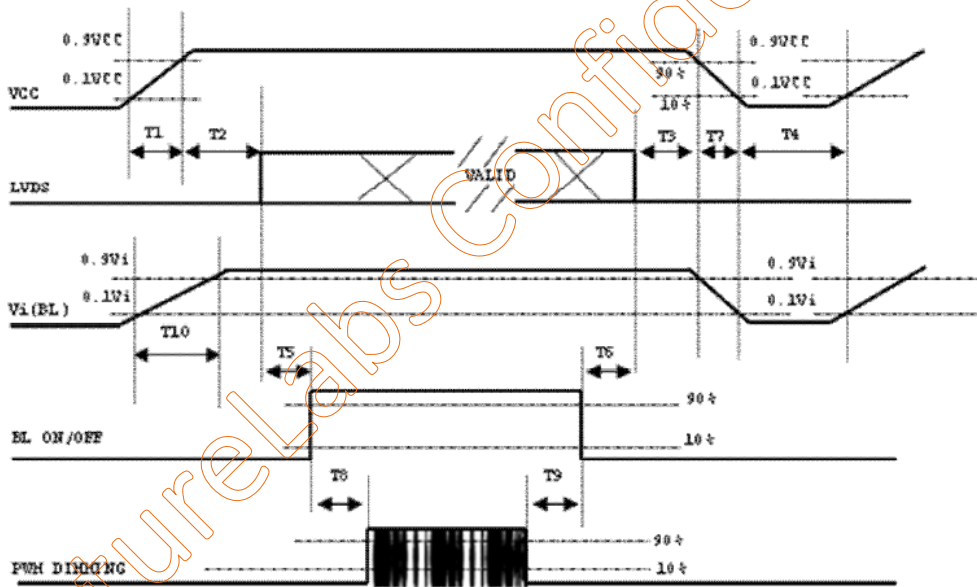


Note (3) The SSCG (Spread spectrum clock generator) is defined as below figures.



## 4.2 Power ON/OFF Sequence

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.



Parameter	Values			Units Min
	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)The supply voltage of the external system for the module input should be the same as the definition of Vcc.
- (2)When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.
- (3)In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.
- (4)T4 should be measured after the module has been fully discharged between power off and on period.
- (5)Interface signal shall not be kept at high impedance when the power is on.
- (6)FL won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.

There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this symptom, we suggest "Vcc falling timing" to follow "T7 spec".

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## 5. INTERFACE PIN DESCRIPTION

### 5.1 LCM Connector PIN Assignment

Pin No.	Symbol	Function	Polarity	Note
1	12V	LED power		-
2	12V	LED power		-
3	12V	LED power		-
4	12V	LED power		-
5	ENLED	Enable pin		-
6	Dimming	Backlight Adjust		-
7	NC	No Connection		(4)
8	NC	No Connection		(4)
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	Negative	-
14	RX0+	Positive transmission data of pixel 0	Positive	-
15	GND	Ground		-
16	RX1-	Negative transmission data of pixel 1	Negative	-
17	RX1+	Positive transmission data of pixel 1	Positive	-
18	GND	Ground		-
19	RX2-	Negative transmission data of pixel 2	Negative	-
20	RX2+	Positive transmission data of pixel 2	Positive	-
21	GND	Ground		-
22	RXCLK-	Negative of clock	Negative	-
23	RXCLK+	Positive of clock	Positive	-
24	GND	Ground		-
25	RX3-	Negative transmission data of pixel 3	Negative	-
26	RX3+	Positive transmission data of pixel 3	Positive	-
27	UD	Gate Driver Up/Down scan control. When UD=H, reverse scan When UD=L, normal scan		(3)

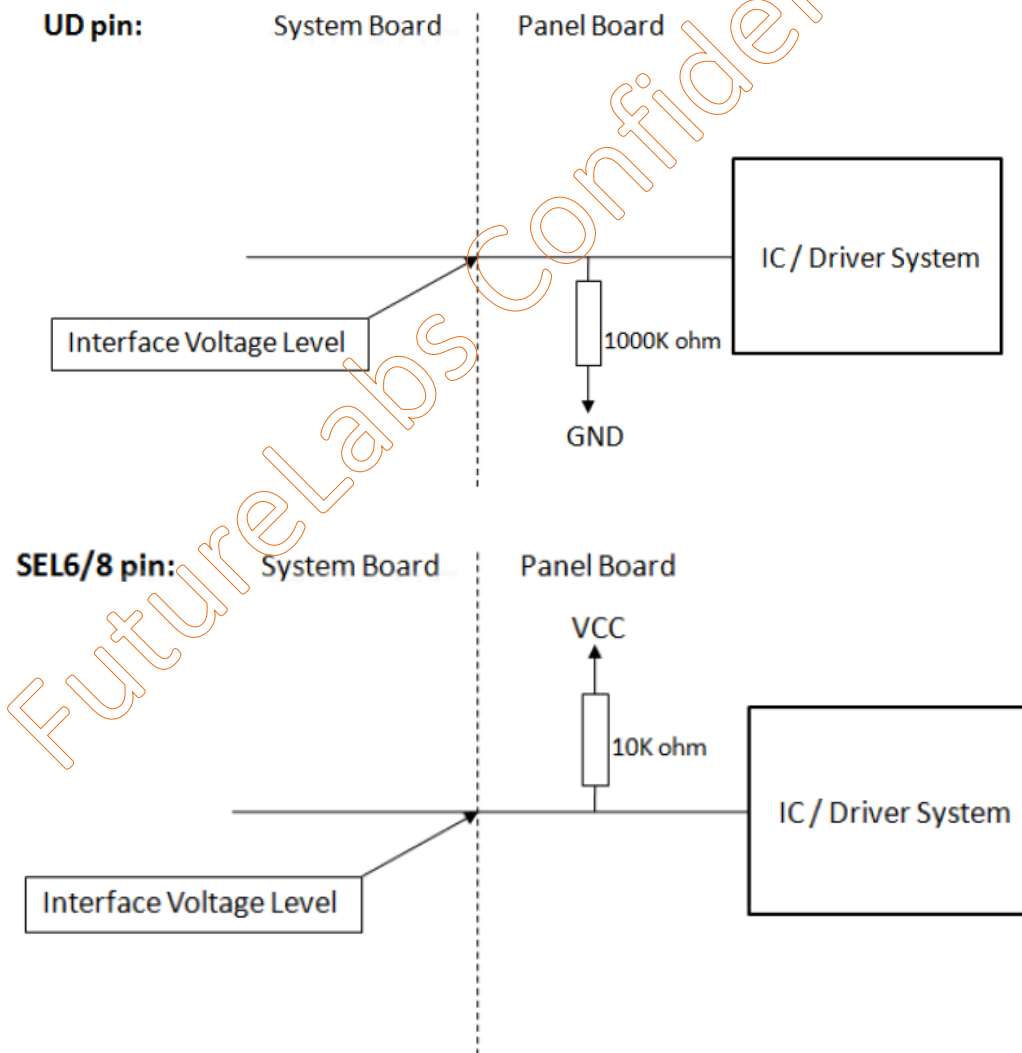
28	SEL6/8	LVDS 6/8 bit select function control, Low → 6 bit Input Mode High or NC → 8bit Input Mode	(3)
29	LR	Source Driver Right/ Left scan control. When LR=H, normal scan When LR=L, reverse scan	(3)
30	GND	Ground	

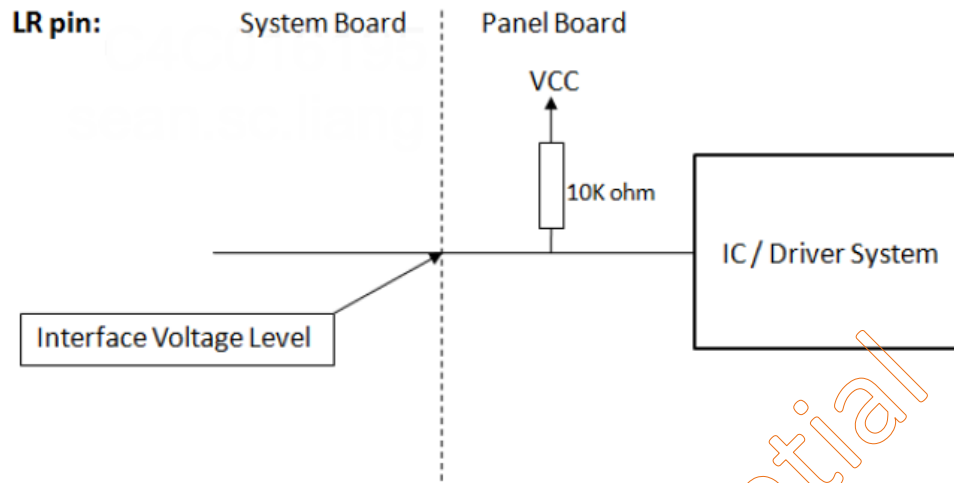
Note (1) Connector Part No.: Starconn 093G30-B0001A-G4.or P-TWO 187114-30091

Note (2) User’s connector Part No: Mating Wire Cable Connector Part No. :FI-X30H (JAE) or FI-X30HL (JAE)

Note (3) “Low” stands for 0V. “High” stands for 3.3V

Note (4) Pin7, Pin8 input signals should be set to no connection or ground, this module





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## 5.2 Color Data Input Assignment

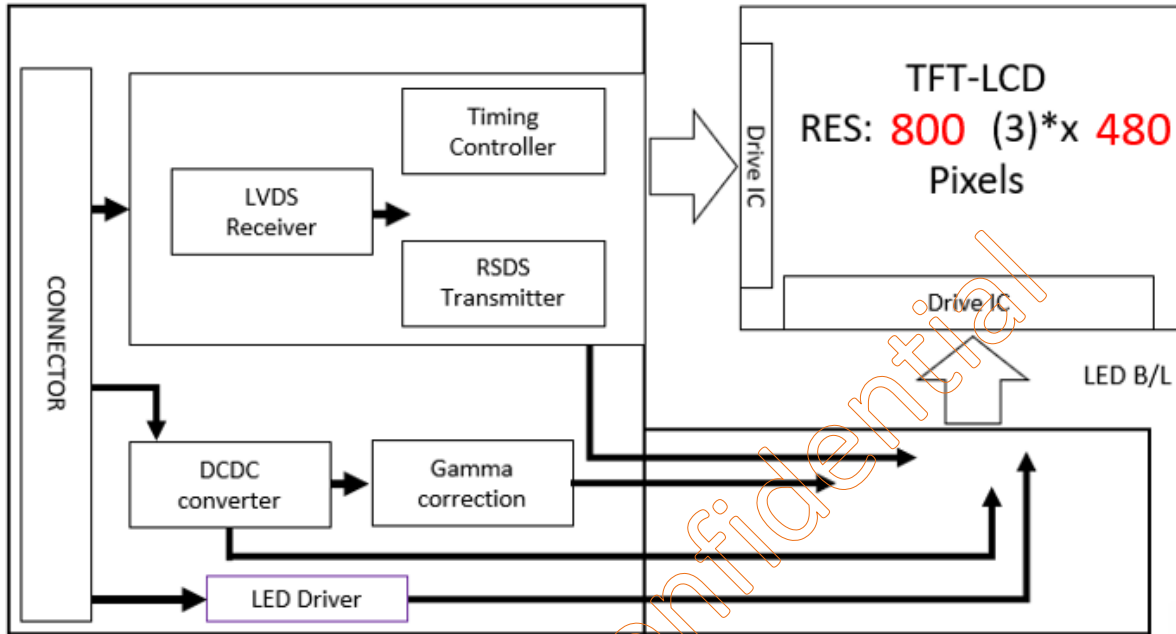
The brightness of each primary color (red, green and blue) is based on the 8-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Red(253)	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Green(1)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Green(2)		0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
...		...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Green(253)		0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
Green(254)		0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
Green(255)		0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale Of Blue		Blue(0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	1
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0
	Blue(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

## 6. BLOCK DIAGRAM

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



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## 7. OPTICAL CHARACTERISTIC

The optical characteristics are measured under stable conditions at room temperature 25 °C.

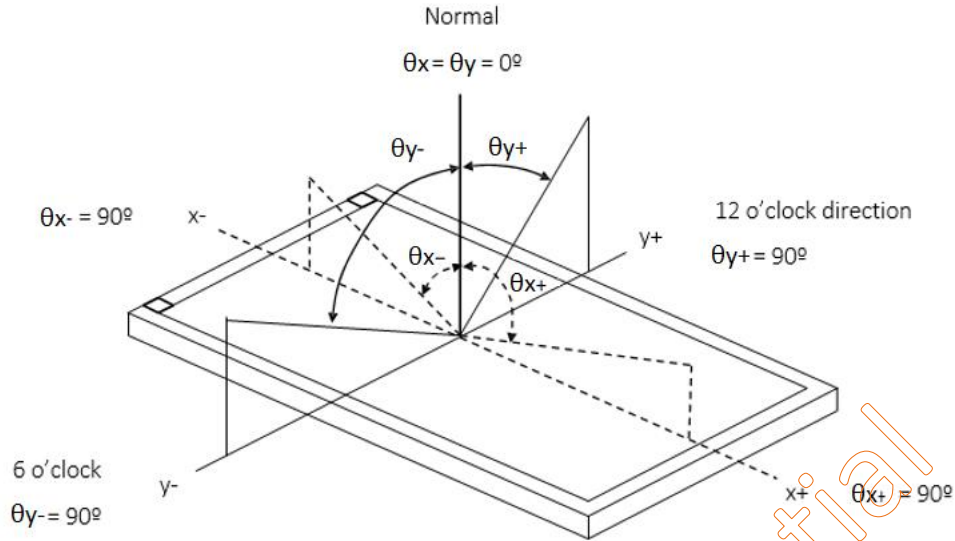
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ$	600	800	-	-	(2)(5)
Response Time		TR	$\theta_x=0^\circ, \theta_y=0^\circ$	-	13	-	ms	(3)
		TF		-	12	-		
Center Luminance of White		LC	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction	400	500	-	cd/m <sup>2</sup>	(4)(5)
Chromaticity	Red	Rx		Typ. -0.05	Typ. +0.05	(0.580)	-	(1) (5)
		Ry				(0.330)	-	
	Green	Gx				(0.334)	-	
		Gy				(0.600)	-	
	Blue	Bx				(0.150)	-	
		By				(0.054)	-	
	White	Wx				0.313	-	
		Wy				0.329	-	
Viewing Angle	Horizontal	$\theta_{x+}$		CR $\geq$ 10	80	89	-	Deg.
		$\theta_{x-}$	80		89	-		
	Vertical	$\theta_{y+}$	80		89	-		
		$\theta_{y-}$	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

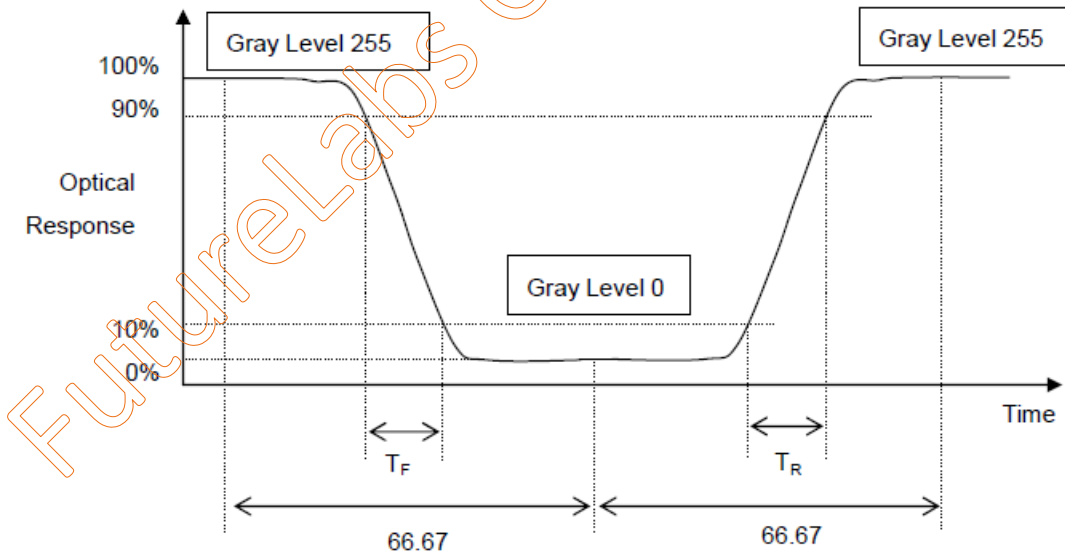


Note 2: Definition of Contrast Ratio (CR)

Measure the viewing angle of  $\Theta = 0$  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 Response Time:

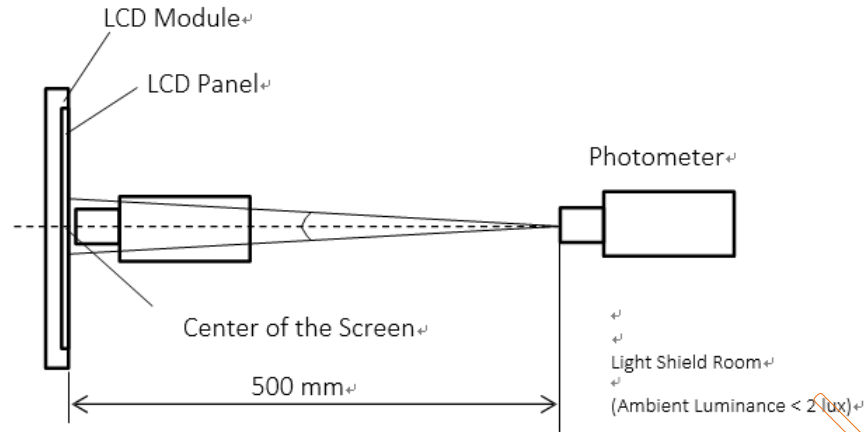
The response time is set initially by defining the "Rising Time (TR)" and the "Falling Time (TF)" respectively. Please refer the figure to the followings:



Note 4: Definition of Brightness (L)

Measure the center area of the panel and the viewing angle of the  $\theta_x = \theta_y = 0^\circ$

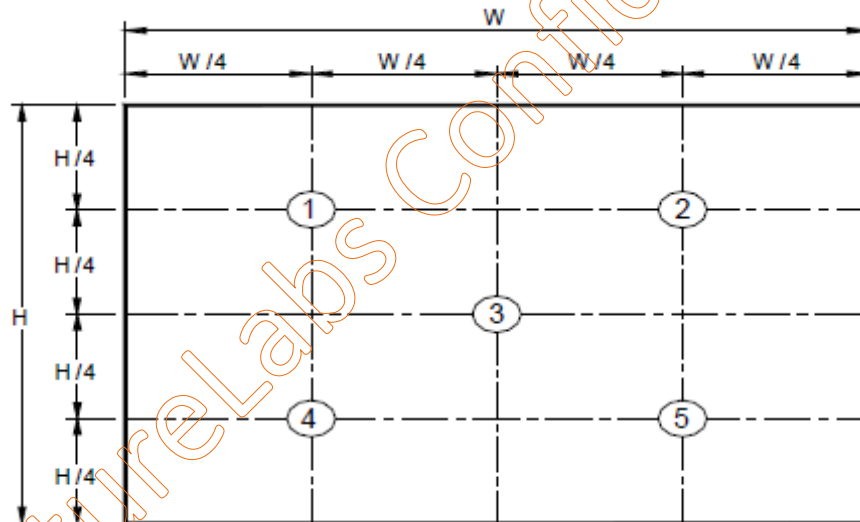
Note 5: The method of optical measurement:



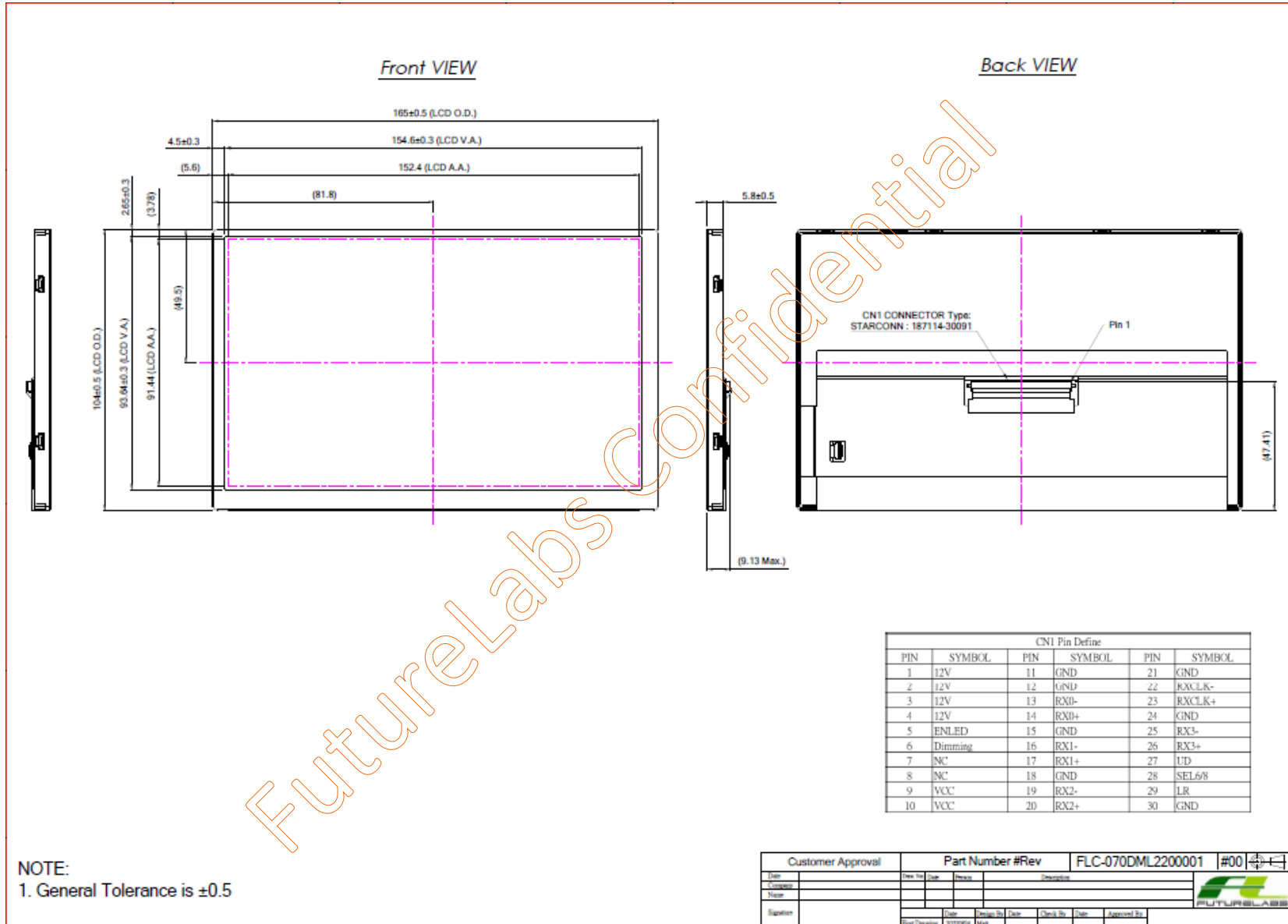
Note 6: Definition of White Variation ( $\delta W$ ):

Measure the luminance of gray level 255 at 5 points

$$\delta W = (\text{Maximum } [L(1), L(2), L(3), L(4) \sim L(5)] / \text{Minimum } [L(1), L(2), L(3), L(4) \sim L(5)]) \times 100\%$$



# 8 DIMENSION AND DRAWING



## 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.