

Product Specification

PART NUMBER # REV: FLC-121GML6200001#00

DESCRIPTION: TFT 12.1", 1024(H)*768(V), LVDS,
262K/16.2M colors, 1500CD with LED Driver

- () Preliminary Specification
(V) Approved Specification

Customer Name:	
Signature:	Date:

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Revision History

Version	Date	Page	Description	Note
V1.0	2022/05/09		1st initial	

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1. GENERAL DESCRIPTION

1.1 Description

12.1 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 1024 x 768 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	12.1"	Inch
2	Pixel Number	1024 (H) x 3(RGB)x 768 (V)	Pixels
3	Outline Dimension	260.5(W) x 204(H) x 10(D)(Max.)	mm
4	Active Area	245.76 (W) x 184.32 (H)	mm
5	Pixel Pitch	0.240 (H) x 0.240 (V)	mm
6	Display Colors	262K/16.2M	
7	Pixel Arrangement	RGB vertical stripe	--
8	Display Mode	Normally Black	--
9	Electrical Interface	LVDS	--
10	Surface Treatment	Anti-Glare	
11	Brightness	1500 (Typ.)	cd/m ²
12	Contrast Ratio	1000 (Typ.)	--
13	Power Consumption	VDD=1.22W (white pattern), BLU with Converter=15.84W (Typ.)	W

2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max		
Power Supply Voltage	Vcc	-0.3	-	4	V	(1)

2.2 Backlight Converter

Item	Symbol	Values			Unit	Note
		Min	Typ	Max		
Converter Voltage	V _i	-0.3	-	18	V	(1), (2)
Enable Voltage	EN	-	-	5.5	V	
Backlight Adjust	ADJ	-	-	5.5	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 input pin of LED light bar at $T_a = 25 \pm 2^\circ\text{C}$.

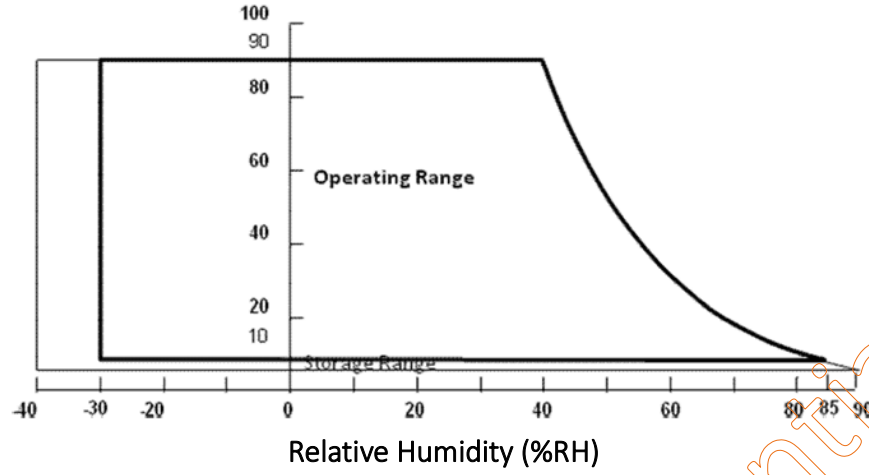
2.3 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	T _{op}	-30	-	+85	°C	
Storage Temperature	T _{stg}	-40	-	+90	°C	

TFT surface temperature

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 lamp.



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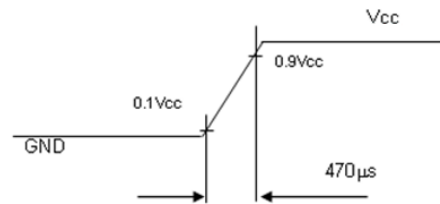
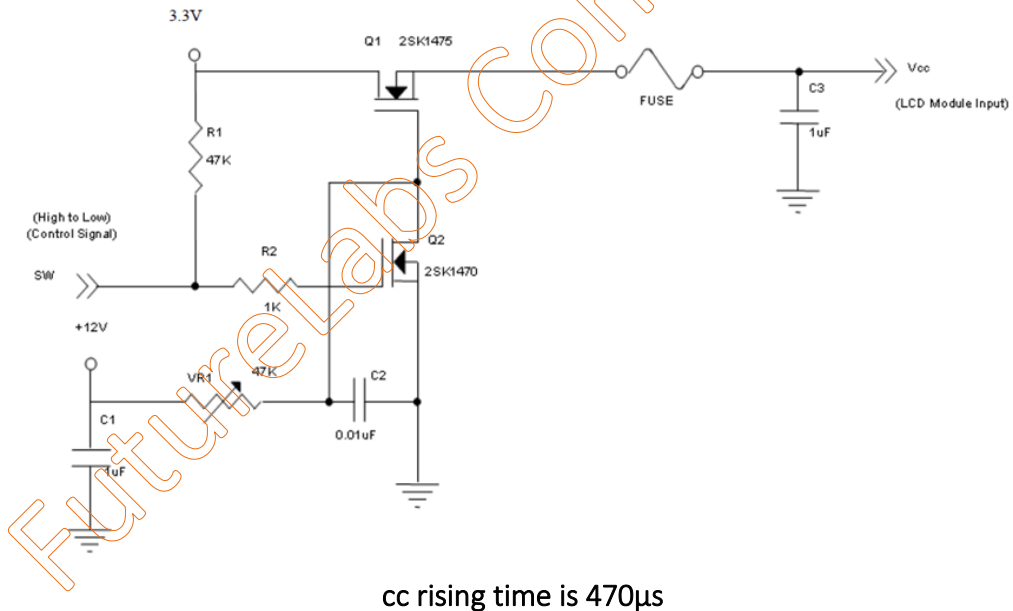
3. ELECTRICAL CHARACTERISTICS

3.1 LCD Electrical Specification

Parameter		Min.	Type	Max.	Unit.	Note
Power supply voltage	V _{CC}	3.0	3.3	3.6	V	(1) at V _{CC} =3.3V
Rush Current	I _{RUSH}	-	-	4	A	(2)
Power Supply Current	White	-	370	450	mA	(3)a, at V _{CC} =3.3V
	Black	-	300	380	mA	(3)b, at V _{CC} =3.3V
Power Consumption	P _L	-	1.22	1.49	W	
LVDS differential input voltage	V _{id}	100	-	600	mV	
LVDS common input voltage	V _{ic}	0.7	-	1.6	V	

Note (1) The assembly 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±2°C, Fr=60Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern



Active Area

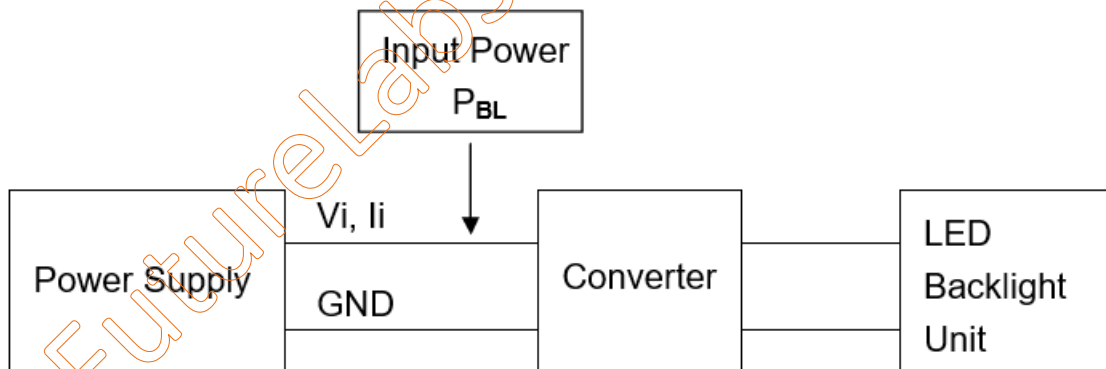
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3.2 Backlight Unit

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		V_i	10.8	12.0	13.2	V	
Converter Power Supply Ripple Voltage		V_{iRP}	-	-	500	mV	
Converter Power Supply Current		I_i	-	1.32	-	A	@ $V_i = 12V$ Duty=100%
Converter Inrush Current		I_{iRUSH}	-	-	3.0	A	@ V_i rising time = 10mS ($V_i=12V$)
Backlight Power Consumption		P_{BL}	-	15.84	-	W	@ $V_i = 12V$ Duty=100%
EN Control Level	Backlight on	BLON	2.5	3.3	5.0	V	
	Backlight off		0	-	0.3		
PWM Control Level	PWM High Level	E_PWM	2.5	3.3	5.0	V	
	PWM Low Level		0	-	0.15		
PWM Noise Range		V_{Noise}	-	-	0.1	V	
PWM Control Duty Ratio		-	1	-	100	%	@200Hz
PWM Control Frequency		f_{PWM}	80	100	20K	Hz	(3)
LED Life Time		L_L	50,000	-	-	Hrs	(2)

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

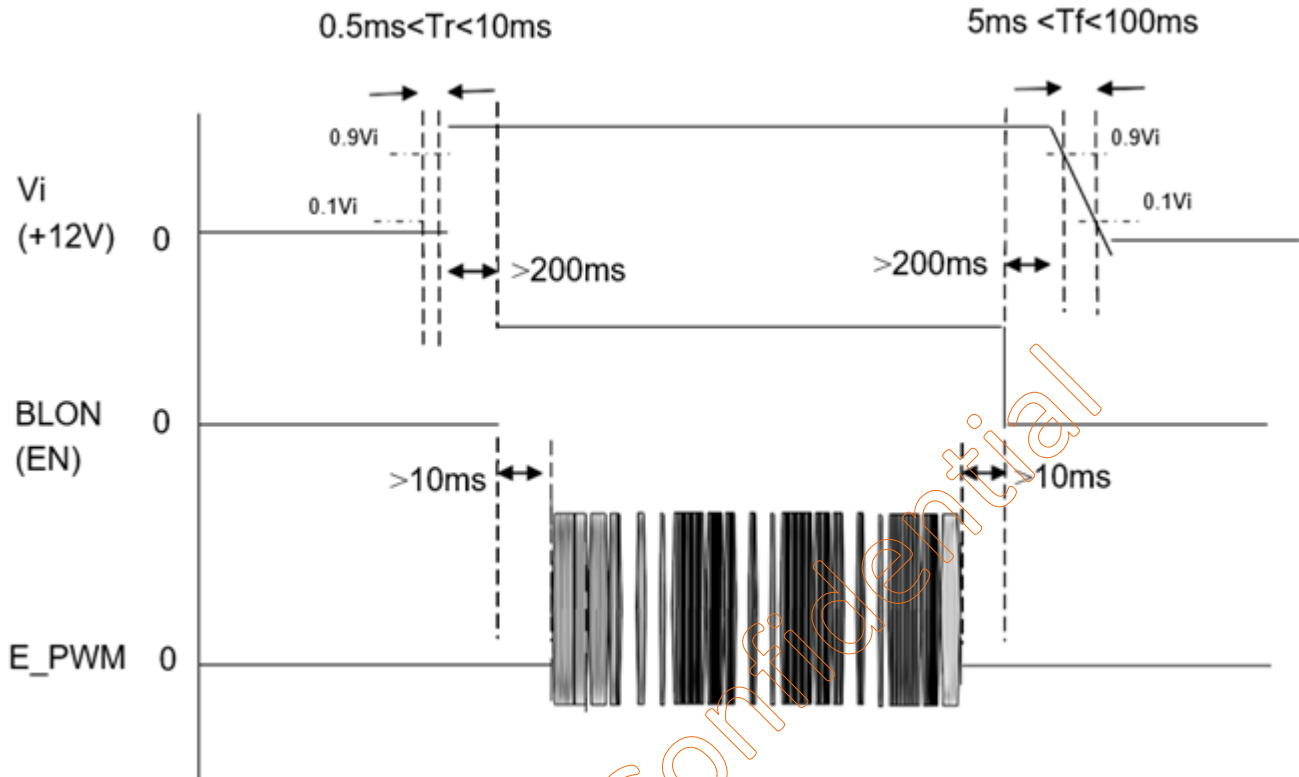


Note (2) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2 \text{ }^\circ\text{C}$ and Duty 100% until the brightness becomes $\leq 50\%$ of its original value. Operating LED at high temperature condition will reduce life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

Note (3) At 100Hz PWM control frequency , duty ratio range is restricted from 1% to 100%, When PWM control frequency is 20kHz, duty ratio range is restricted from 10% to 100%.

Note (4) Light Bar forward current / voltage: 0.8A/18V

Power sequence and control signal timing are shown in the following figure.



Note : #While system is turned ON or OFF, the power sequences must follow as below descriptions

Turn ON sequence: $V_i(+12V) \rightarrow \text{BLON} \rightarrow \text{E_PWM}$ signal

Turn OFF sequence: E_PWM signal $\rightarrow \text{BLON} \rightarrow V_i(+12V)$

4. Timing Chart

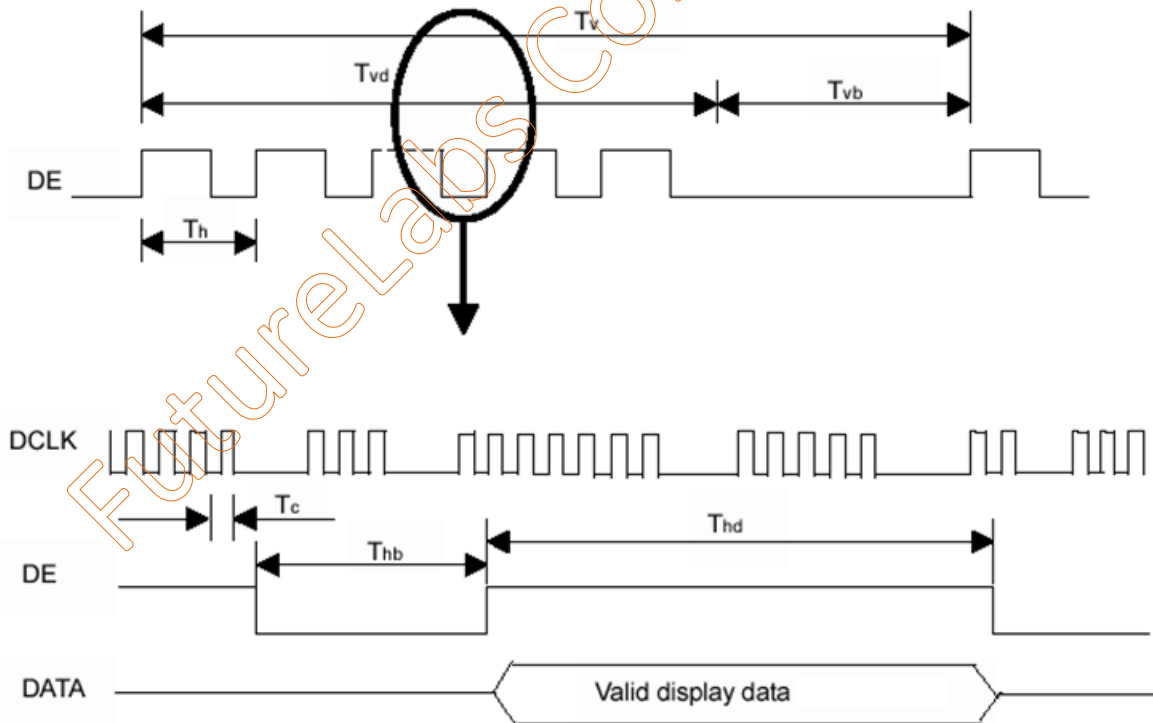
4.1 Timing Table

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	57.5	64.9	74.4	MHz	-
Vertical Active Display Term	Total	Tv	774	806	848	Th	Tv=Tvd+Tvb
	Display	Tvd	768			Th	-
	Blank	Tvb	6	38	80	Th	-
Horizontal Active Display Term	Total	Th	1240	1344	1464	Tc	Th=Thd+Thb
	Display	Thd	1024			Tc	-
	Blank	Thb	216	320	440	Tc	-

Note (1) Since this assembly is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this assembly would operate abnormally.

Note (2) Frame rate is 60Hz

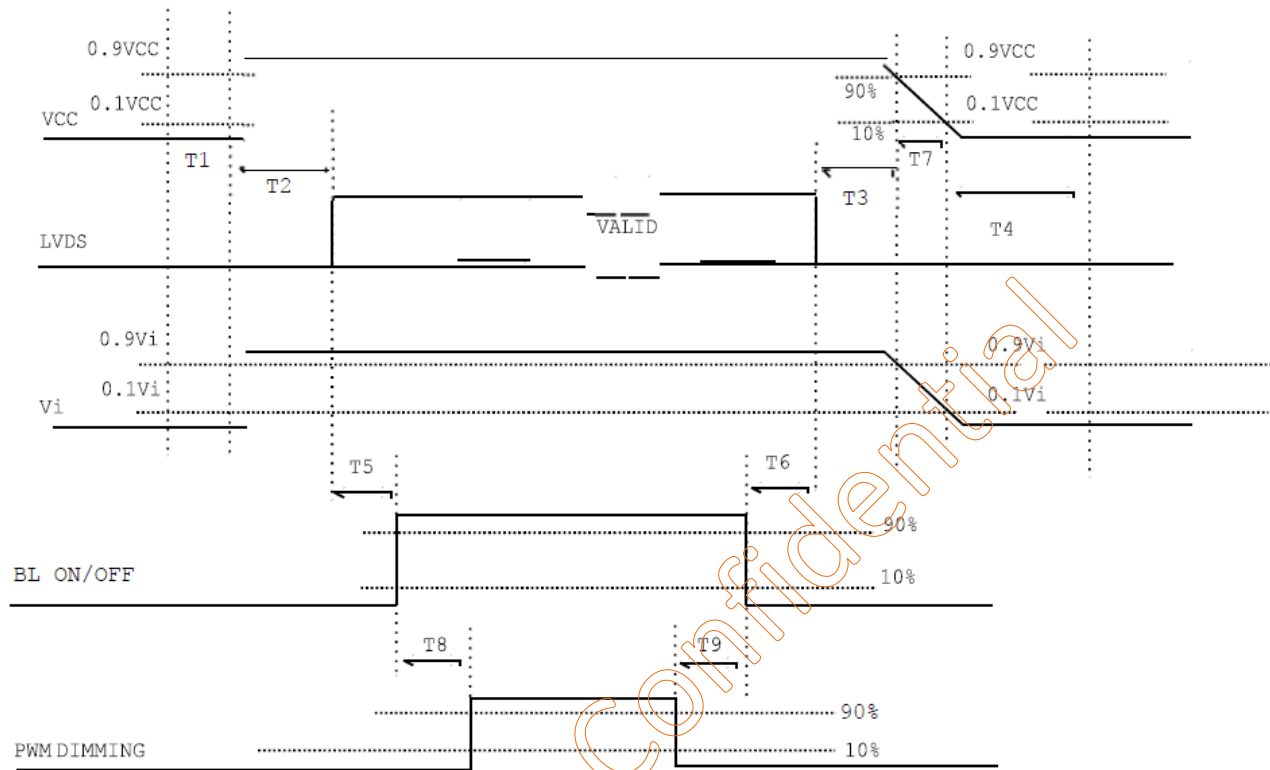
Note (3) The Tv(Tvd+Tvb) must be integer, otherwise, this module would operate abnormally.



INPUT SIGNAL TIMING DIAGRAM

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	200	-	-	ms
T6	200	-	-	ms
T7	5	-	300	ms
T8	10	-	-	ms
T9	10	-	-	ms

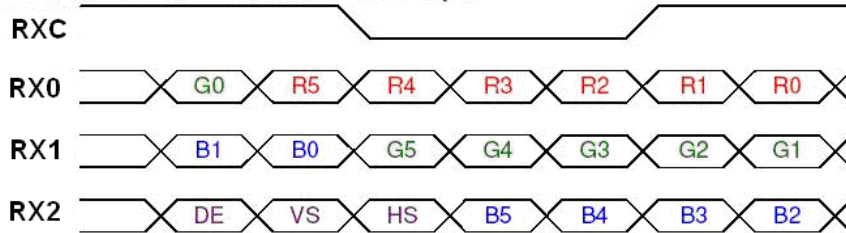
Note (1) Please avoid floating state of interface signal at invalid period.

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

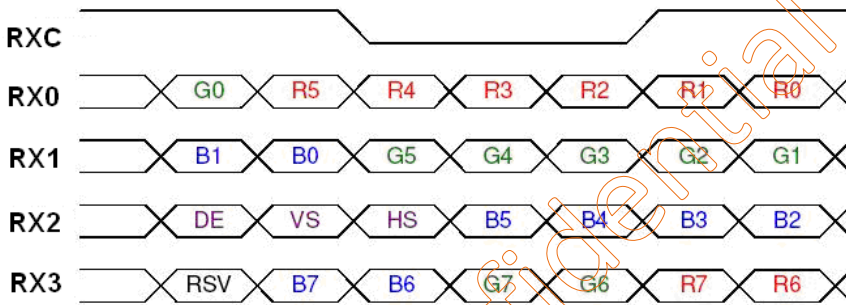
Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight converter power must be turned off before the power supply for the logic and the interface signal is invalid.

4.3 The Input Data Format

SEL68 = "Low" or "NC" for 6 bits LVDS Input



SEL68 = "High" for 8 bits LVDS Input



Note (1) R/G/B data 7: MSB, R/G/B data 0: LSB.

Note (2) Please follow PSWG.

Signal Name	Description	Remark
R7	Red Data 7 (MSB)	Red-pixel Data Each red pixel's brightness data consists of these 8 bits pixel data.
R6	Red Data 6	
R5	Red Data 5	
R4	Red Data 4	
R3	Red Data 3	
R2	Red Data 2	
R1	Red Data 1	
R0	Red Data 0 (LSB)	
G7	Green Data 7 (MSB)	Green-pixel Data Each green pixel's brightness data consists of these 8 bits pixel data.
G6	Green Data 6	
G5	Green Data 5	
G4	Green Data 4	
G3	Green Data 3	
G2	Green Data 2	
G1	Green Data 1	
G0	Green Data 0 (LSB)	
B7	Blue Data 7 (MSB)	Blue-pixel Data Each blue pixel's brightness data consists of these 8 bits pixel data.
B6	Blue Data 6	
B5	Blue Data 5	
B4	Blue Data 4	
B3	Blue Data 3	
B2	Blue Data 2	
B1	Blue Data 1	
B0	Blue Data 0 (LSB)	
RXCLKIN+	LVDS Clock Input	
RXCLKIN-		
DE	Display Enable	
VS	Vertical Sync	
HS	Horizontal Sync	

Note (3) Output signals from any system shall be low or Hi-Z state when VCC is off.

4.4 Scanning Direction

The following figures show the image see from the front view. The arrow indicates the direction of scan.



Fig. 1 Normal scan (pin 17, reLR = Low or NC, pin 18, reUD = Low or NC)

Fig. 2 Reverse scan (pin 17, reLR = High, pin 18, reUD = Low or NC)

Fig. 3 Reverse scan (pin 17, reLR = Low or NC, pin 18, reUD = High)

Fig. 4 Reverse scan (pin 17, reLR = High, pin 18, reUD = High)

5. INTERFACE PIN DESCRIPTION

5.1 LCM Connector PIN Assignment

The electronics interface connector is STARCONN 076B20-0048RA-G4 or equivalent.

Mating User's connector Part No.: JAE FI-SE20ME or equivalent.

Pin No.	Symbol	Functions	Note
1	RX3+	Differential Data Input, CH3 (Positive)	
2	RX3-	Differential Data Input, CH3 (Negative)	
3	NC	NC	
4	SEL68	LVDS 6/8 bit select function control, Low or NC → 6 bit Input Mode High → 8bit Input Mode	Note (1)
5	GND	Ground	
6	RXC+	Differential Clock Input (Positive)	
7	RXC-	Differential Clock Input (Negative)	
8	GND	Ground	
9	RX2+	Differential Data Input , CH2 (Positive)	
10	RX2-	Differential Data Input , CH2 (Negative)	
11	GND	Ground	
12	RX1+	Differential Data Input , CH1 (Positive)	
13	RX1-	Differential Data Input, CH1 (Negative)	
14	GND	Ground	
15	RX0+	Differential Data Input, CH0 (Positive)	
16	RX0-	Differential Data Input, CH0 (Negative)	
17	reLR	Horizontal Reverse Scan Control, Low or NC→Normal Mode. High→Horizontal Reverse Scan	Note (1)
18	reUD	Vertical Reverse Scan Control, Low or NC→Normal Mode, High→Vertical Reverse Scan	Note (1)
19	VCC	Power supply	
20	VCC	Power supply	

Note (1) "Low" stands for 0V. "High" stands for 3.3V, "NC" stands for "No Connected"

5.2 Backlight Interface PIN Assignment

CN1: The electronics interface connector is JST S7B-PH-SM4-TB or equivalent.

Pin No.	Functions	Note
1	DC Input +12V	
2	DC Input +12V	
3	DC Input +12V	
4	Ground	
5	PWM Brightness Adjust	
6	Ground	
7	Backlight On/Off Control	

CN2: The electronics interface connector is MS2426R or equivalent.

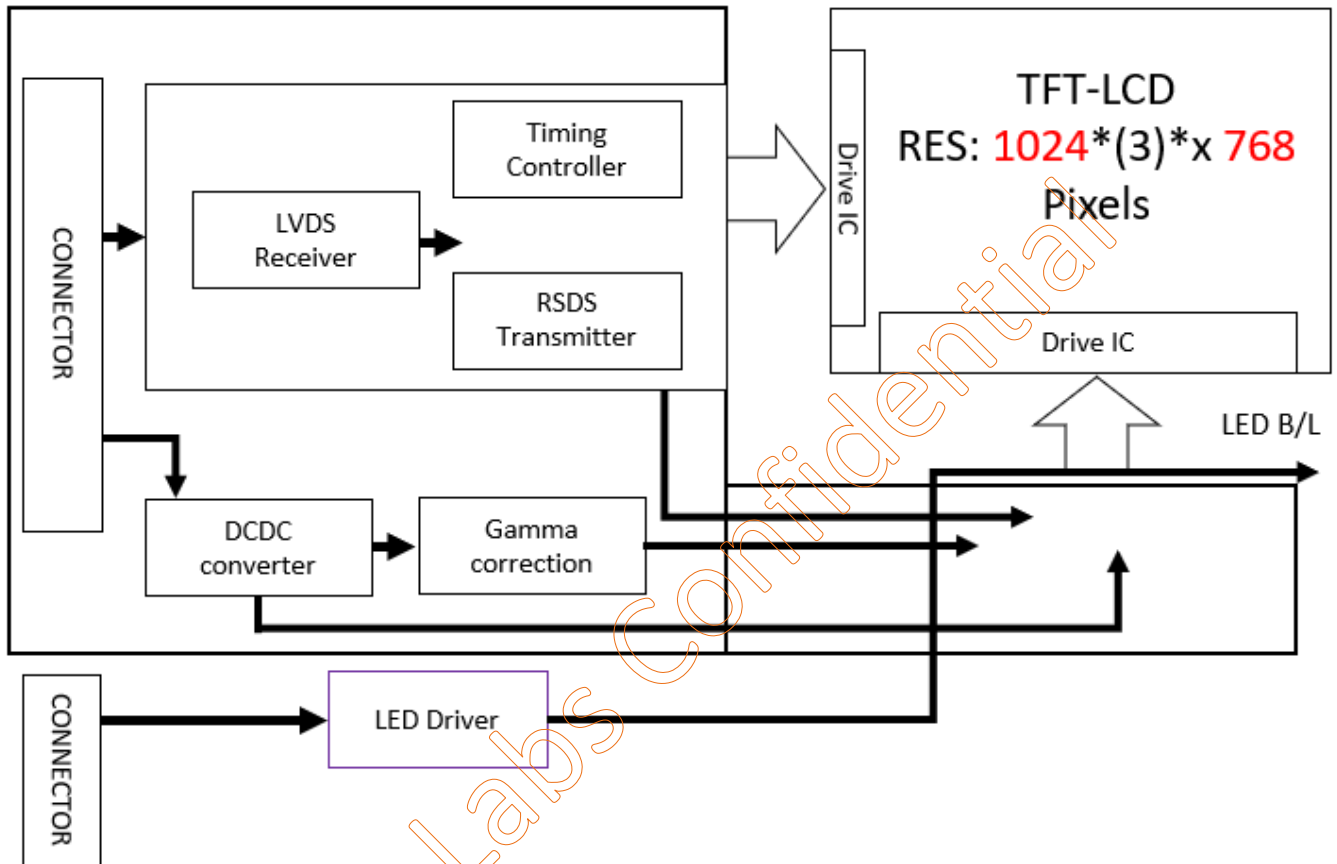
Pin No.	Functions	Note
1	LED V+ Output	
2	LED V- Output	

CN3: The electronics interface connector is MS2426R or equivalent.

Pin No.	Functions	Note
1	LED V+ Output	
2	LED V- Output	

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.

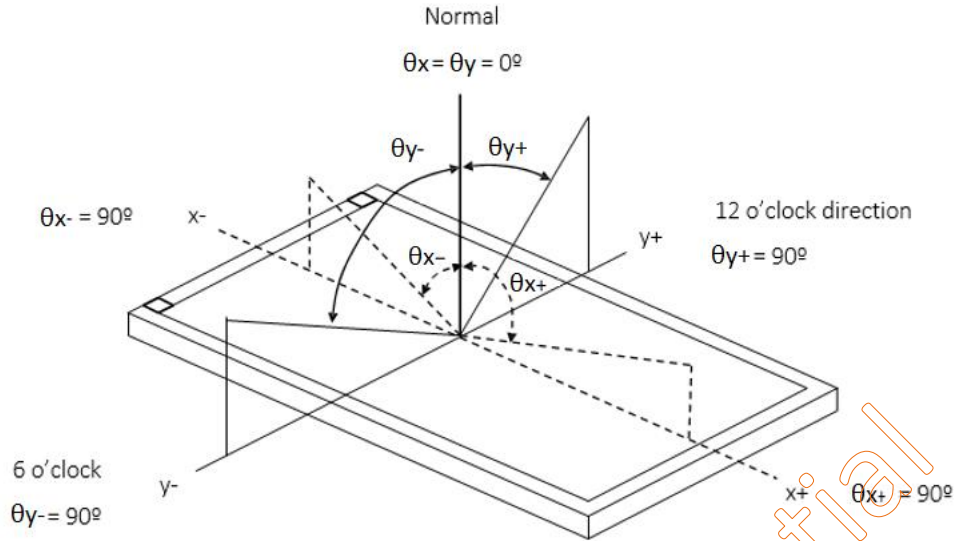
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ$	700	1000	-	-	(2)(5)
Response Time		T _R	25°C	-	13	18	ms	(3)
		T _F			12	17		
Center Luminance of White		LC	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction	1350	1500	-	cd/m ²	(4)(5)
White Variation		W		-	1.25	1.4		
Chromaticity	Red	R _x		$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction	Typ. -0.05	0.625	Typ. +0.05	-
		R _y	0.338			-		
	Green	G _x	0.324			-		
		G _y	0.607			-		
	Blue	B _x	0.153			-		
		B _y	0.048			-		
	White	W _x	0.313			-		
		W _y	0.329			-		
Viewing Angle	Horizontal	θ_{x+}	CR=10	85	89	-	Deg.	(1)(5)
		θ_{x-}		85	89	-		
	Vertical	θ_{y+}		85	89	-		
		θ_{y-}		85	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

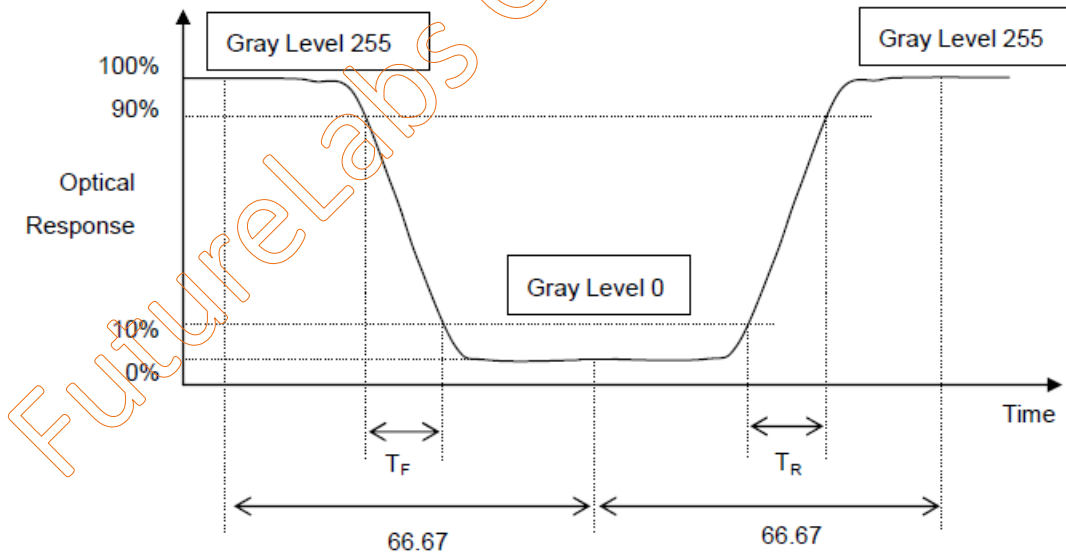


Note 2: Definition of Contrast Ratio (CR)

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:

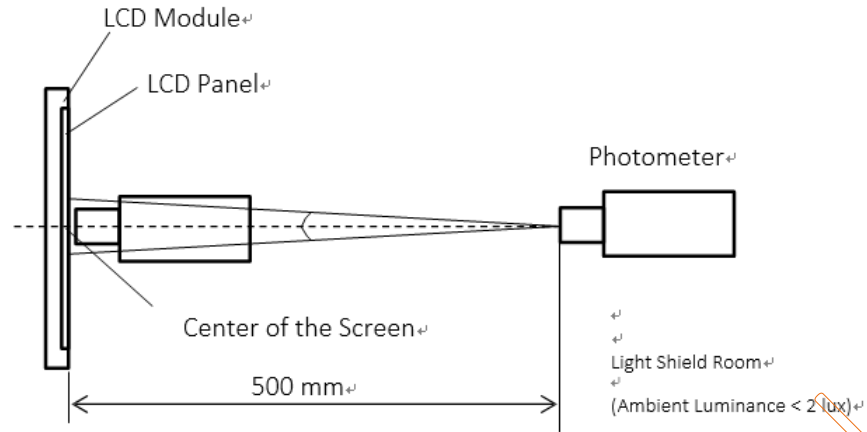
The response time is set initially by defining the "Rising Time (TR)" and the "Falling Time (TF)" respectively. Please refer the figure to the followings:



Note 4: Definition of Brightness (L)

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

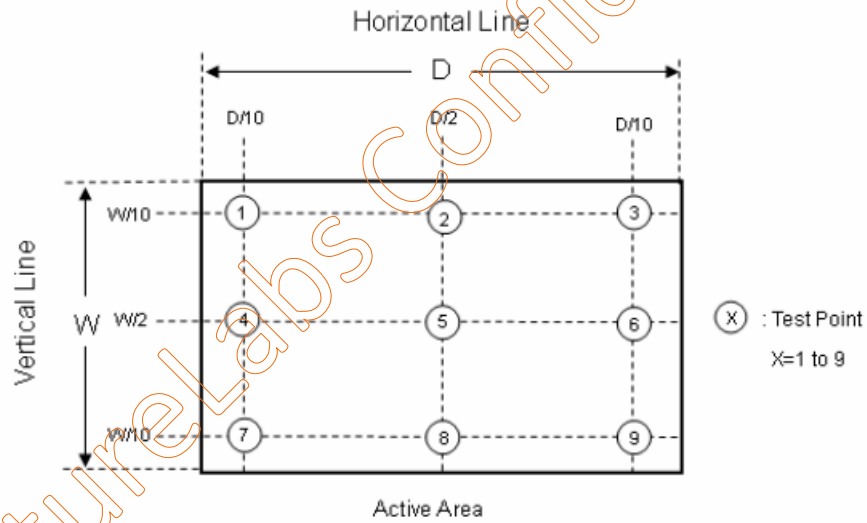
Note 5: The method of optical measurement:



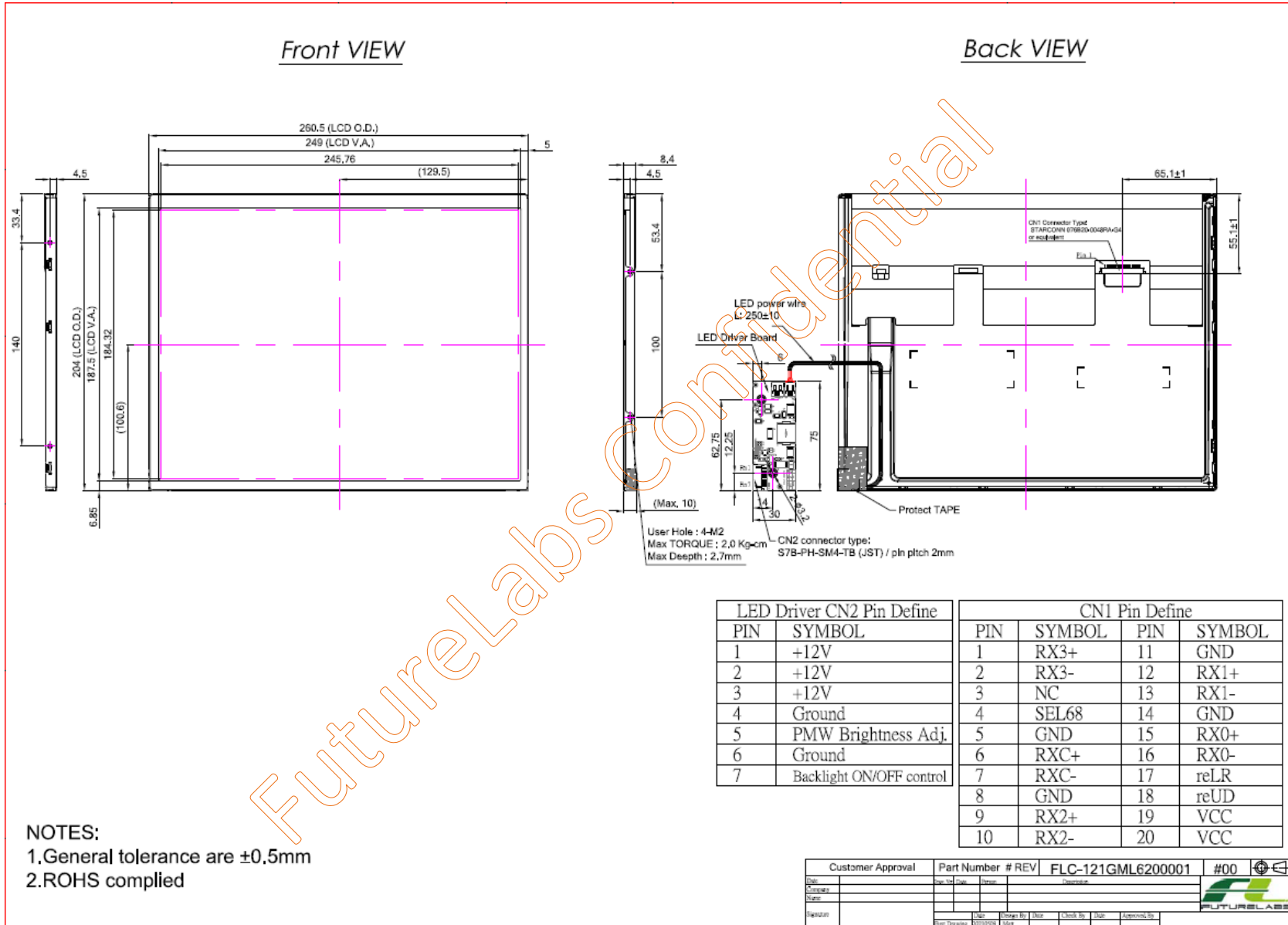
Note 6: Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4) \sim L(9)] / \text{Minimum} [L(1), L(2), L(3), L(4) \sim L(9)]$$



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.