

## PRODUCT SPECIFICATION

PART NUMBER # REV: FLC-104GML6000SA3#00

DESCRIPTION: 10.4" TFT 1024x768 1000CD Full View LVDS interface

- ( ) Preliminary Specification
- (V) Approved Specification

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

<b>PREPARED BY</b>	<b>REVIEWED BY</b>
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## Revision History

Version	Date	Page	Description	Note
V1.0	2021/01/27		1 <sup>st</sup> initial	
V1.1	2021/03/23		Update Revision	

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# 1. GENERAL DESCRIPTION

## 1.1 Description

10.4" 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 XGA, 1024 x768 screen and 16.2M 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	10.4"	Inch
2	Pixel Number	1024 (H) x RGB x 768 (V)	Pixels
3	Outline Dimension	225.5(H) x 176.3 (V) x 8.72 (D)	mm
4	Active Area	210.4 (H) x 157.8 (V)	mm
5	Display Colors	16.2M/262K	--
6	Pixel Arrangement	RGB vertical stripe	--
7	Display Mode	Normally Black / Transmissive	--
8	Electrical Interface	LVDS	
9	Surface Treatment	Anti-Glare	--
10	Brightness	1,000 (Typ.)	cd/m2
11	Viewing Direction	All Direction	--
12	Contrast Ratio	1000 (Typ.)	--
13	Total Power Consumption (Typ)	TBD	--

# 2. ABSOLUTE MAXIMUM RATING

## 2.1 Electrical Absolute Rating

Item	Symbol	Values		Unit	Note
		Min	Max.		
Power supply voltage	V <sub>CC</sub>	-0.3	4	V	
Logic Input Voltage	V <sub>IN</sub>	-0.3	V <sub>CC</sub> +0.3	V	

## 2.2 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Top	-30		85	°C	Ta=25°C
Storage Temperature	Tstg	-30		85	°C	

TFT surface temperature

## 3. ELECTRICAL CHARACTERISTICS

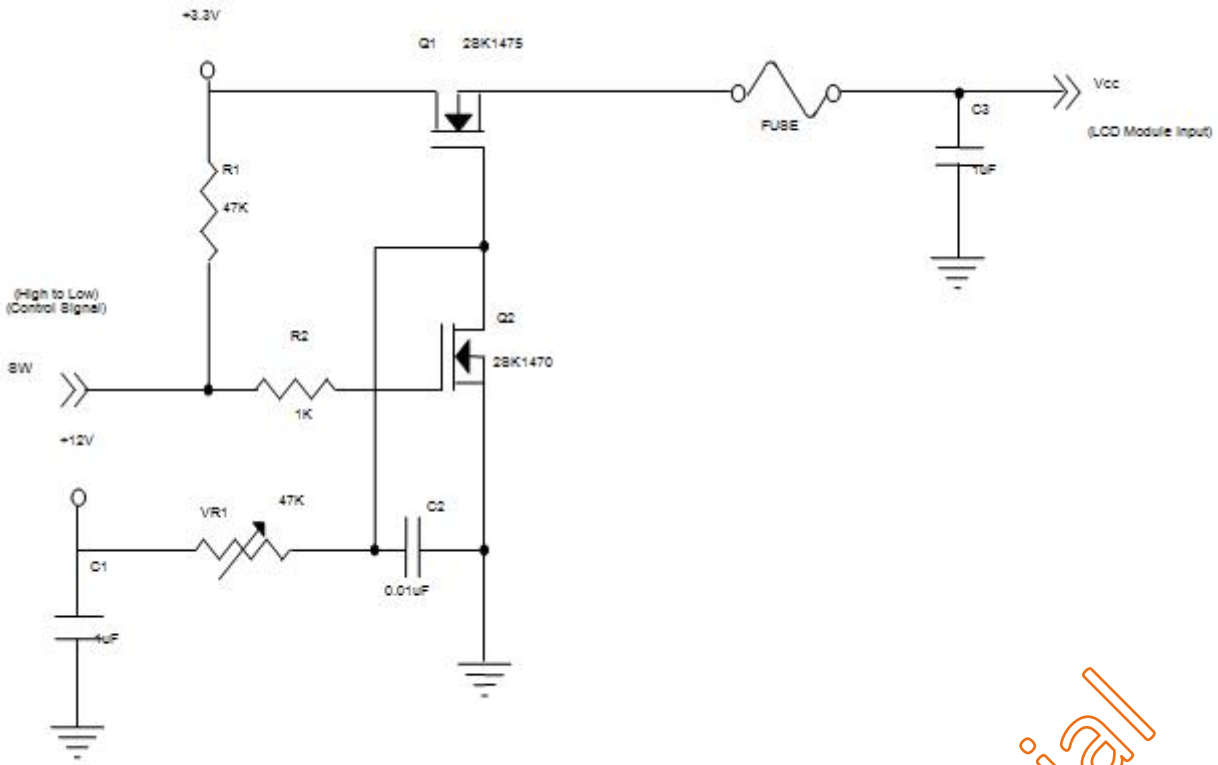
### 3.1 LCM

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	V <sub>CC</sub>	3.0	3.3	3.6	V	(1)
Power Supply Ripple Voltage	V <sub>RP</sub>	-	-	100	mV	
Rush Current	I <sub>RUSH</sub>	-	-	4.0	A	(2)
Power Supply Current	White		TBD	TBD	mA	(3)
	Black	-	TBD	TBD	mA	
Power Consumption	P <sub>L</sub>	---	TBD	TBD	W	
LVDS differential input voltage	V <sub>ID</sub>	100	-	600	mV	-
LVDS common input voltage	V <sub>IC</sub>	1.0	1.2	1.4	V	-
Logic High Input Voltage	V <sub>IH</sub>	2.3	-	V <sub>CC</sub>	V	
Logic Low Input Voltage	V <sub>IL</sub>	0	-	0.7	V	
LVDS terminating resistor	R <sub>T</sub>	-	100	-	ohm	

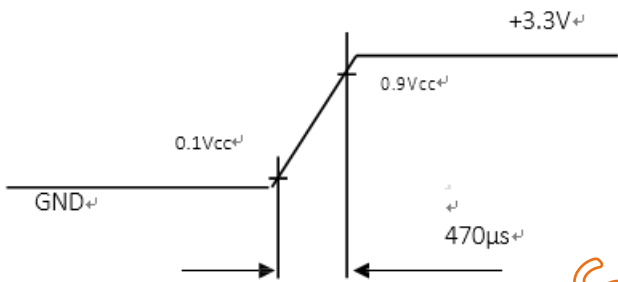
Note (1) The assembly should be always operated within above ranges.

Ta = 25 ± 2 °C

Note (2) Measurement Conditions:



**VCC rising time is 470us**



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

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a. White Pattern



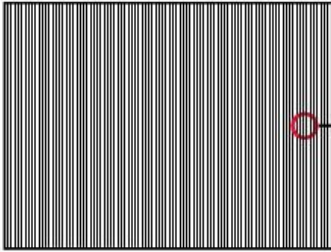
Active Area

b. Black Pattern

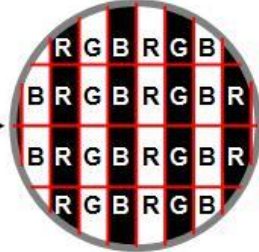


Active Area

c. Vertical Stripe Pattern



Active Area



### 3.2 Backlight Unit

#### LED Backlight Absolute Rating

Item	Symbol	Value			Note
		Min	Max.		
Forward Voltage	Fv	16	18	V	(1)
Forward Current	Fi	0.5	0.5	A	(2)

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 light bar Typ. =0.5A

**BLU Life Time** Min 70.000 Hrs, Typ 100.000

Note (3) Light Bar: 3pcs/s (3 x 6V) x 9 strings

Note (4) The lifetime of LED is estimated data and defined as the time when it continues to operate under the conditions at  $T_a = 25 \pm 2F \text{ } ^\circ\text{C}$  and Duty=100% until the brightness becomes  $\leq 50\%$  of its original value.

Operating LED under high temperature environment will reduce lifetime and lead to color shift.

LED light bar connector is connected to Back Light Unit with a cable.

Connector Name / Designation	Lamp Connector / Backlight lamp
Manufacturer	
Type Part Number	A20D/HD2-2P
Mating Type Part Number	S2B-PH-SM4-TB

Light bar cable=25cm

Connector No.	Pin No.	Input	Color	Function
	1	HV	Red	LED V+
	2	LV	Black	LED V-

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## 4. SIGNAL CHARACTERISTICS

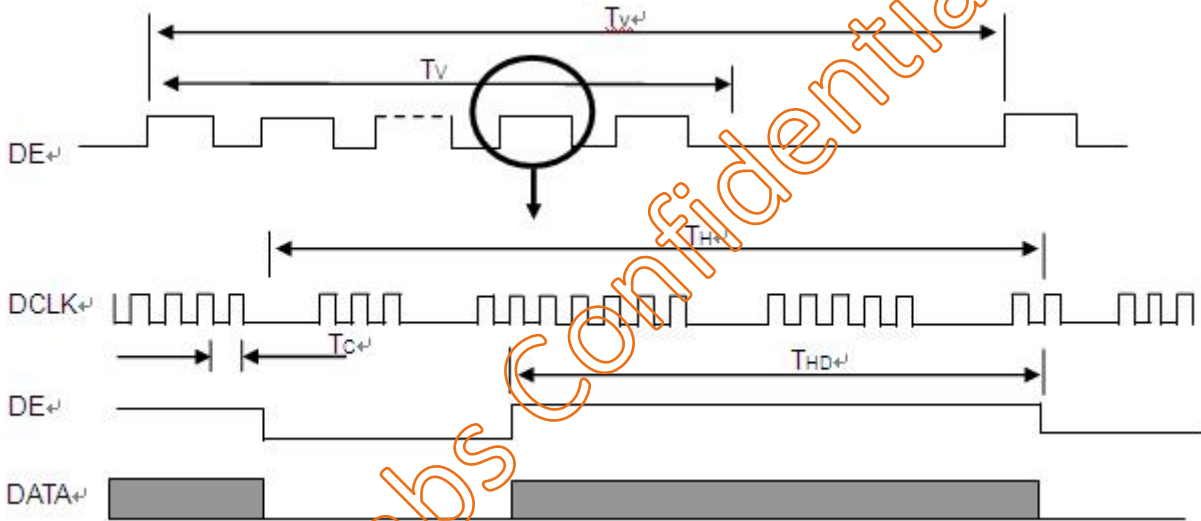
### 4.1 Interface Timing

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	F <sub>c</sub>	57.6	65	74.5	MHz	-
	Period	T <sub>c</sub>	13.4	15.4	17.4	ns	
	Input cycle to cycle jitter	T <sub>rcl</sub>	---	---	200	ns	(a)
	Input Clock to data skew	TLVCCS	-0.02*T <sub>c</sub>	---	0.02*T <sub>c</sub>	ps	(b)
	Spread spectrum modulation range	F <sub>clk<sub>in</sub>_mod</sub>	---	---	102*F <sub>c</sub>	MHz	(c)
	Spread spectrum modulation frequency	F <sub>SSM</sub>	---	---	200	KHz	
	High Time	T <sub>ch</sub>	---	4/7	---	T <sub>ch</sub>	
	Low Time	T <sub>cl</sub>	---	3/7	---	T <sub>ch</sub>	
Vertical Display Term	Frame Rate	F <sub>r</sub>	---	60	---	Hz	T <sub>v</sub> =T <sub>vd</sub> +T <sub>vb</sub>
	Total	T <sub>v</sub>	774	806	848	Th	-
	Active Display	T <sub>vd</sub>	768	768	768	Th	-
	Blank	T <sub>vb</sub>	6	38	80	Th	-
Horizontal Display Term	Total	T <sub>h</sub>	1240	1344	1464	T <sub>c</sub>	T <sub>h</sub> =T <sub>hd</sub> +T <sub>hb</sub>
	Active Display	T <sub>hd</sub>	1024	1024	1024	T <sub>c</sub>	-
	Blank	T <sub>hb</sub>	216	320	440	T <sub>c</sub>	-

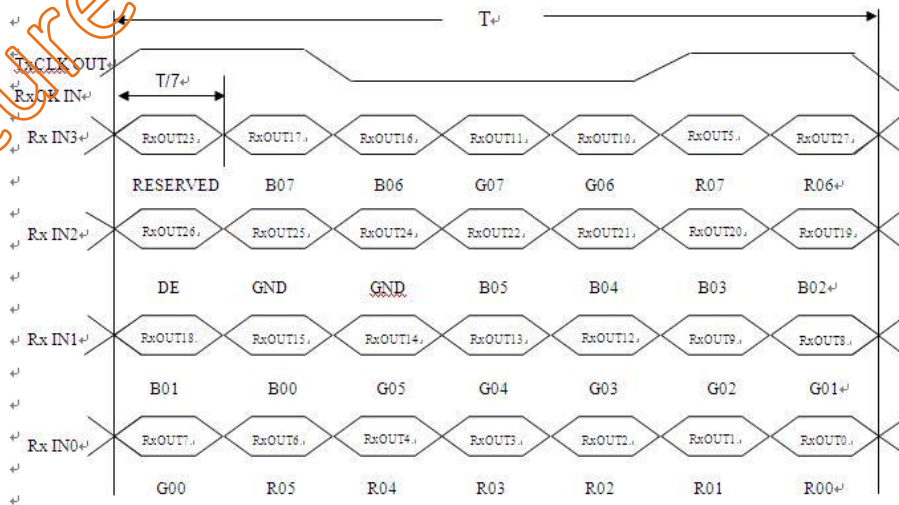
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

Note (2) The T<sub>v</sub>(T<sub>vd</sub>+T<sub>vb</sub>) must be integer, otherwise, the module would operate abnormally.

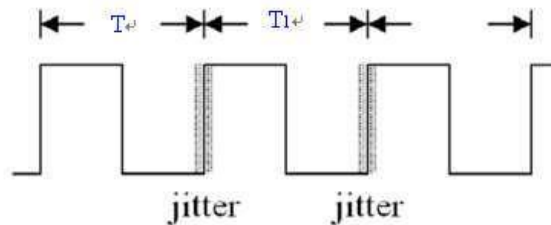
### INPUT SIGNAL TIMING DIAGRAM



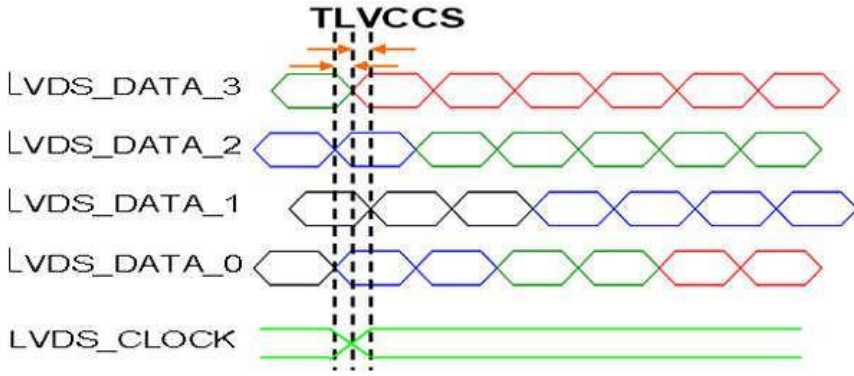
### TIMING DIAGRAM of LVDS



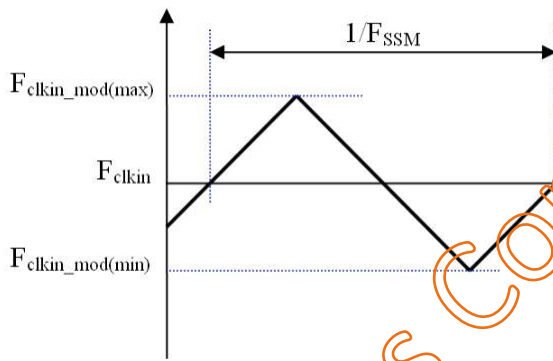
Note (a) The input clock cycle-to-cycle jitter is defined as below figures.  $Trcl = |T1 - Tl|$



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



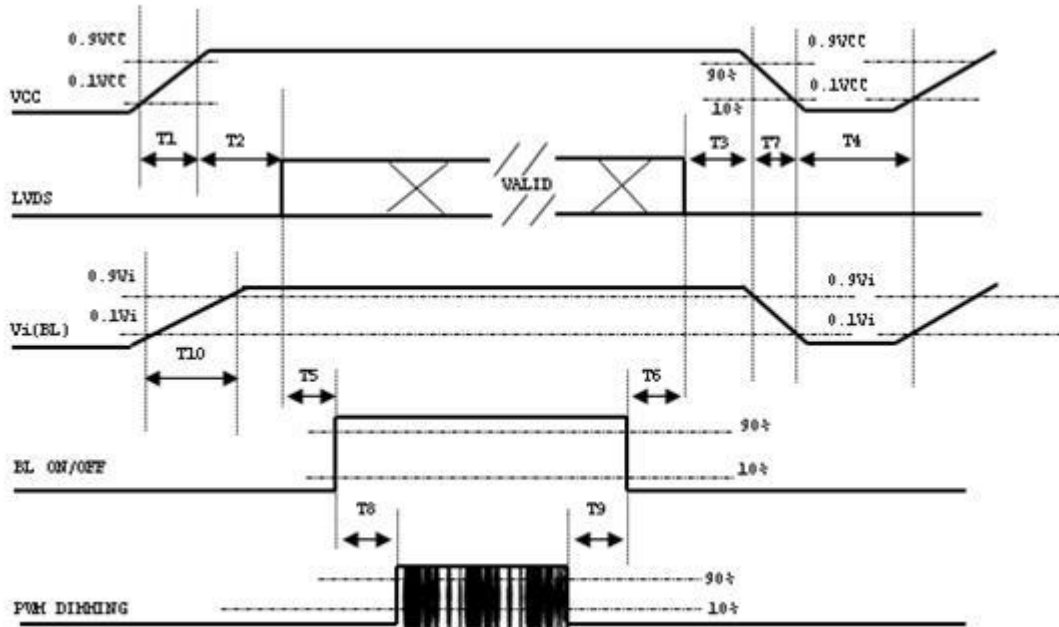
Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.



#### 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.

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

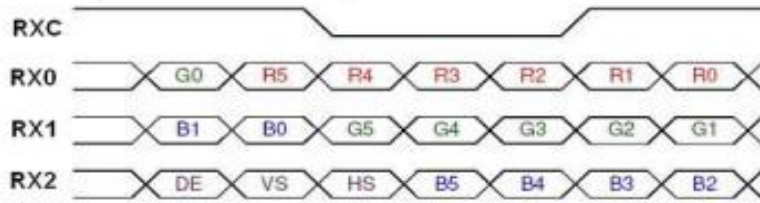
Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD VCC to 0V.

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.

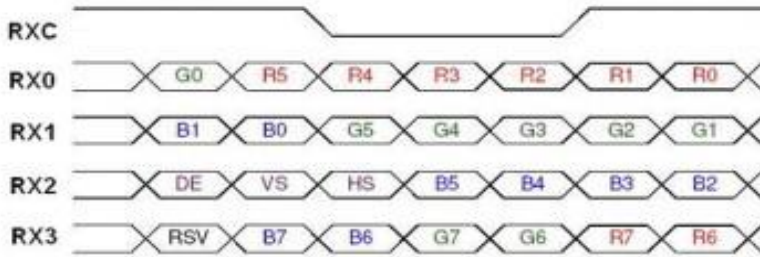
Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	---	10	ms
T2	0	---	50	ms
T3	0	---	50	ms
T4	500	---	---	ms
T5	450	---	---	ms
T6	200	---	---	ms
T7	10	---	100	ms
T8	10	---	---	ms
T9	10	---	---	ms
T10	20	---	50	ms

### 4.3 The Input Data Format

#### SEL 6/8 = "High" for 6 bits LVDS Input



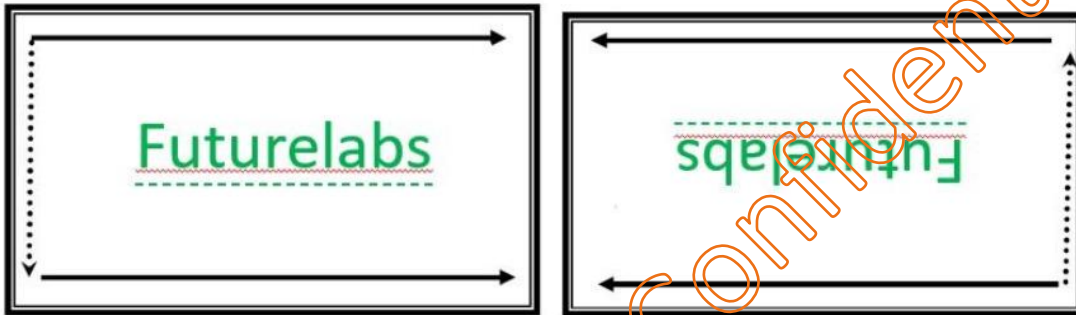
#### SEL 6/8 = "Low" or "NC" for 8 bits LVDS Input



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

Note (2) Please follow PSWG

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



## 5. INTERFACE PIN DESCRIPTION

### 5.1 LCM Connector PIN Assignment

LVDS

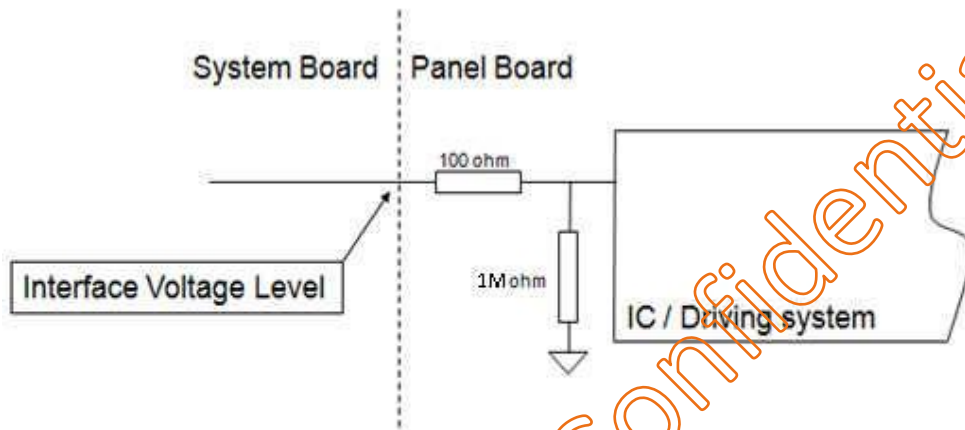
CN1 Connector Pin Assignment

Pin No.	Symbol	Description	Note
1	VCC	Power supply: +3.3V	-
2	VCC	Power supply: +3.3V	-
3	VCC	Power supply: +3.3V	-
4	GND	Ground	-
5	GND	Ground	-
6	GND	Ground	-
7	RPMI	Reverse Panel Function (Display Rotation)	( 2 )
8	NC	No Connection	( 2 )
9	NC	No Connection	( 2 )
10	NC	No Connection	( 2 )
11	SEL6/8	LVDS 6/8 bit select function control, Low or NC 8 bit Input Mode High 6bit Input Mode	( 2 )
12	GND	Ground	-
13	NC	No Connection	( 2 )
14	GND	Ground	-
15	RX0-	Negative transmission data of pixel 0	-
16	RX0+	Positive transmission data of pixel 0	-
17	GND	Ground	-
18	RX1-	Negative transmission data of pixel 1	-
19	RX1+	Positive transmission data of pixel 1	-
20	GND	Ground	-
21	RX2-	Negative transmission data of pixel 2	-
22	RX2+	Positive transmission data of pixel 2	-
23	GND	Ground	-
24	RXCLK-	Negative of clock	-
25	RXCLK+	Positive of clock	-
26	GND	Ground	-
27	RX3-	Negative transmission data of pixel 3	-
28	RX3+	Positive transmission data of pixel 3	-
29	GND	Ground	-
30	NC	No Connection	( 2 )

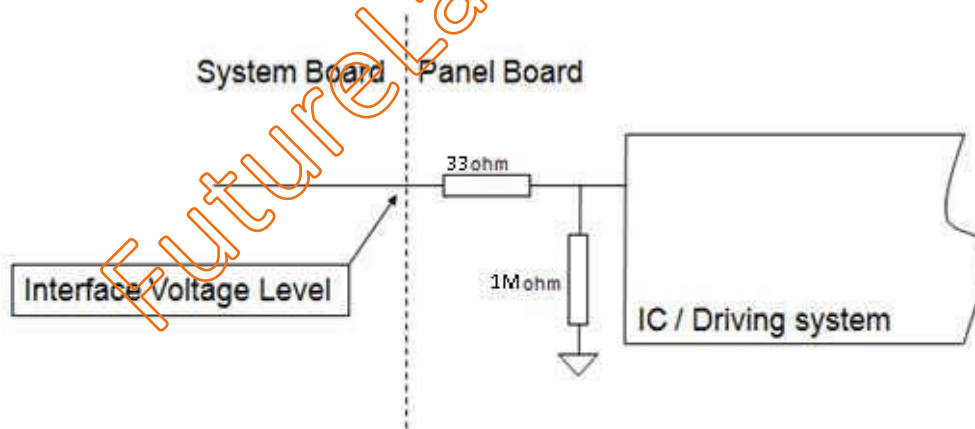
Note (1) Connector Part No.: STM, MSCK2407P30.D or compatible connector

Note (2) "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connected".

RPFI pin:



SEL6/8 pin:



## 5.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-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.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
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
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	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
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	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
	Blue(1)	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	1	0
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

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

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.

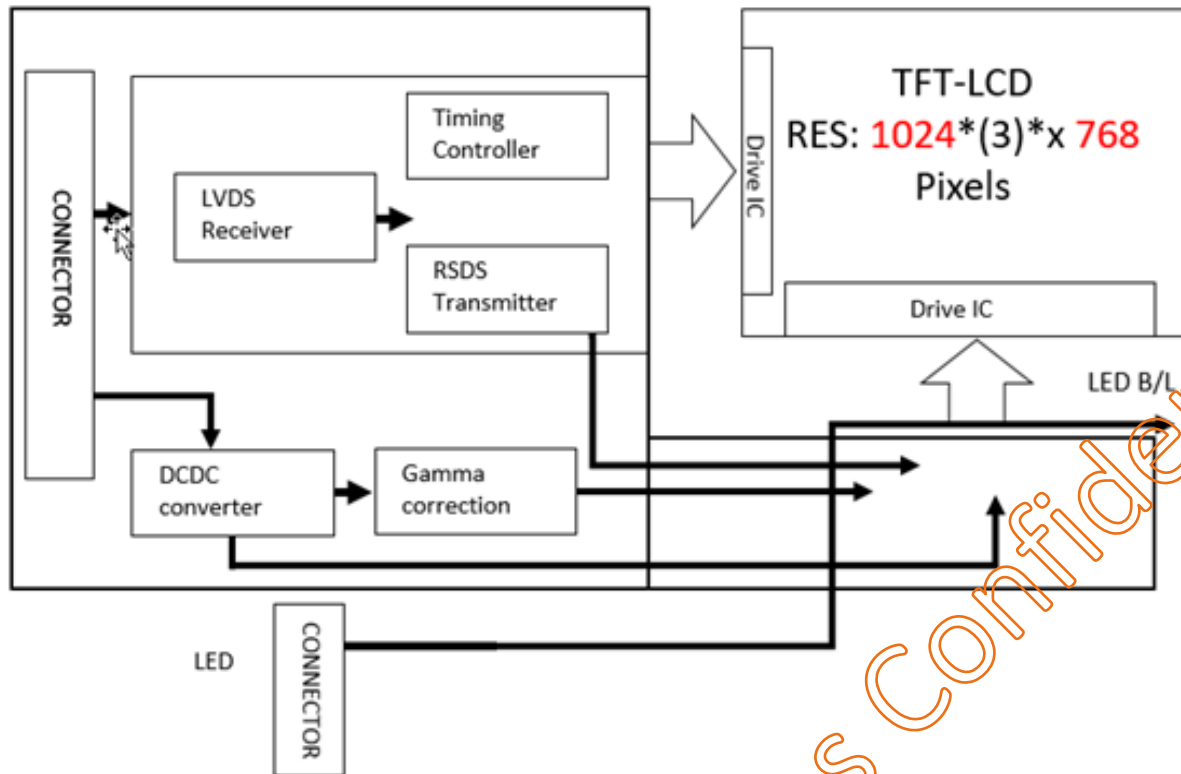


Color		Data Signal																							
		Red								Green								Blue							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	1	1	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	
	Red(1)	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	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	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	
	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	
	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	
	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	0	1	0	0	0	0	0	0	0	
Green(2)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	
⋮		⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
Green(253)		0	0	0	0	0	0	0	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	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	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	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	
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
	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	
	Blue(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	

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.

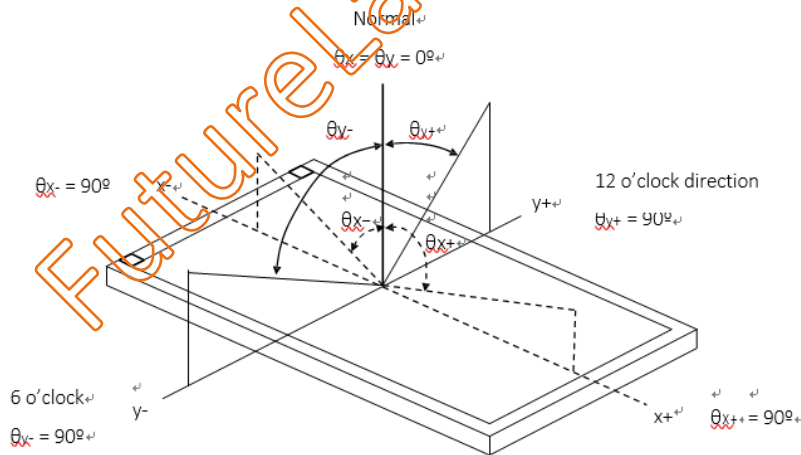
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio	CR	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction	700	1000		-	(2)	
Response Time	TR		-	14	19	ms	(3)	
	TF		-	11	16	ms		
Center Luminance of White	LC		900	1000	-	cd/m <sup>2</sup>	(4)	
White Variation	$\delta W$		-	1.25	1.4	-	(7)	
Chromaticity	Red		Rx	Typ.	0.652	Typ.	-	(6)
			Ry		0.338		-	
	Green	Gx	0.326		-			
		Gy	0.608		-			
	Blue	Bx	0.150		-			
		By	0.053		+0.05		-	
	White	Wx	0.313		-			
Wy		0.329	-					
Viewing Angle	Horizontal	$\theta_{x+}$	80	88	-	Deg.	(1)	
		$\theta_{x-}$	80	88	-			
	Vertical	$\theta_{y+}$	80	88	-			
		$\theta_{y-}$	80	88	-			

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.

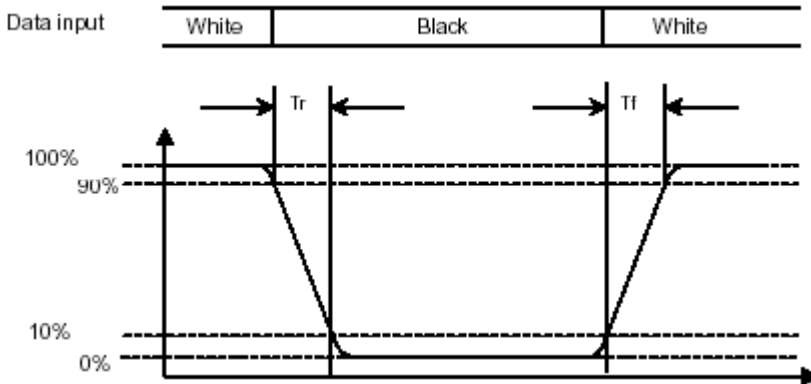


### Note 2: Definition of Contrast Ratio (CR)

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 ( $T_r$ )” 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:



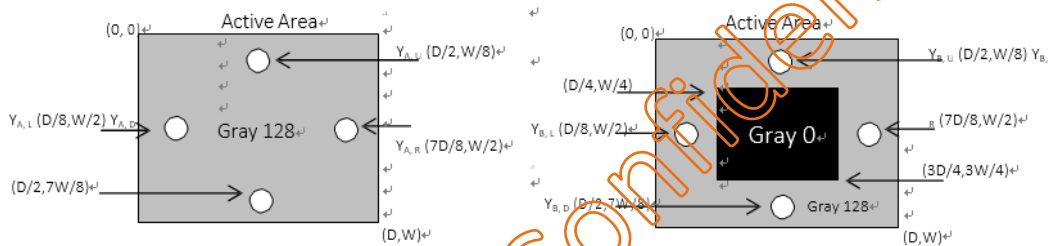
Note 4: Definition of Brightness (L)

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

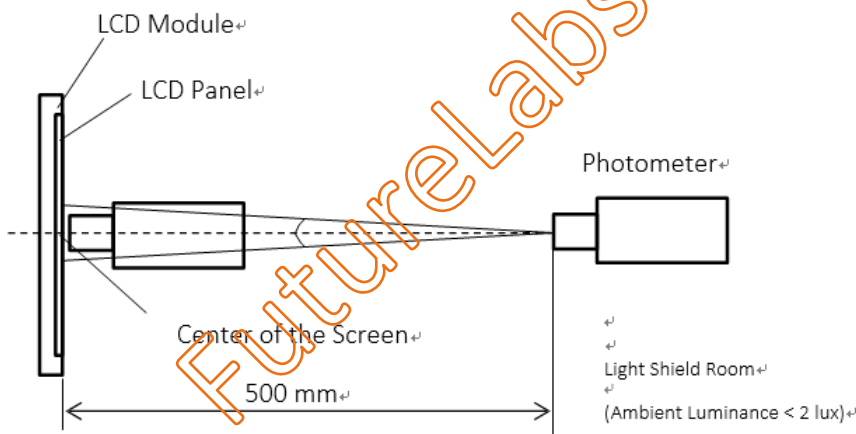
Note 5: Definition of Cross Talk  $CT = |Y_B - Y_A| / Y_A \times 100$  (%) Where:

$Y_A$  = Luminance of measured location without gray level 0 pattern ( $cd/m^2$ )

$Y_B$  = Luminance of measured location with gray level 0 pattern ( $cd/m^2$ )



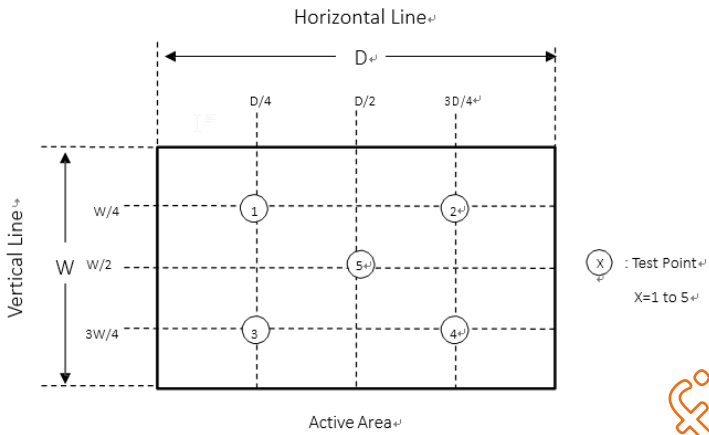
Note 6: The method of optical measurement:



Note 7: Definition of White Variation ( $\delta W$ ):

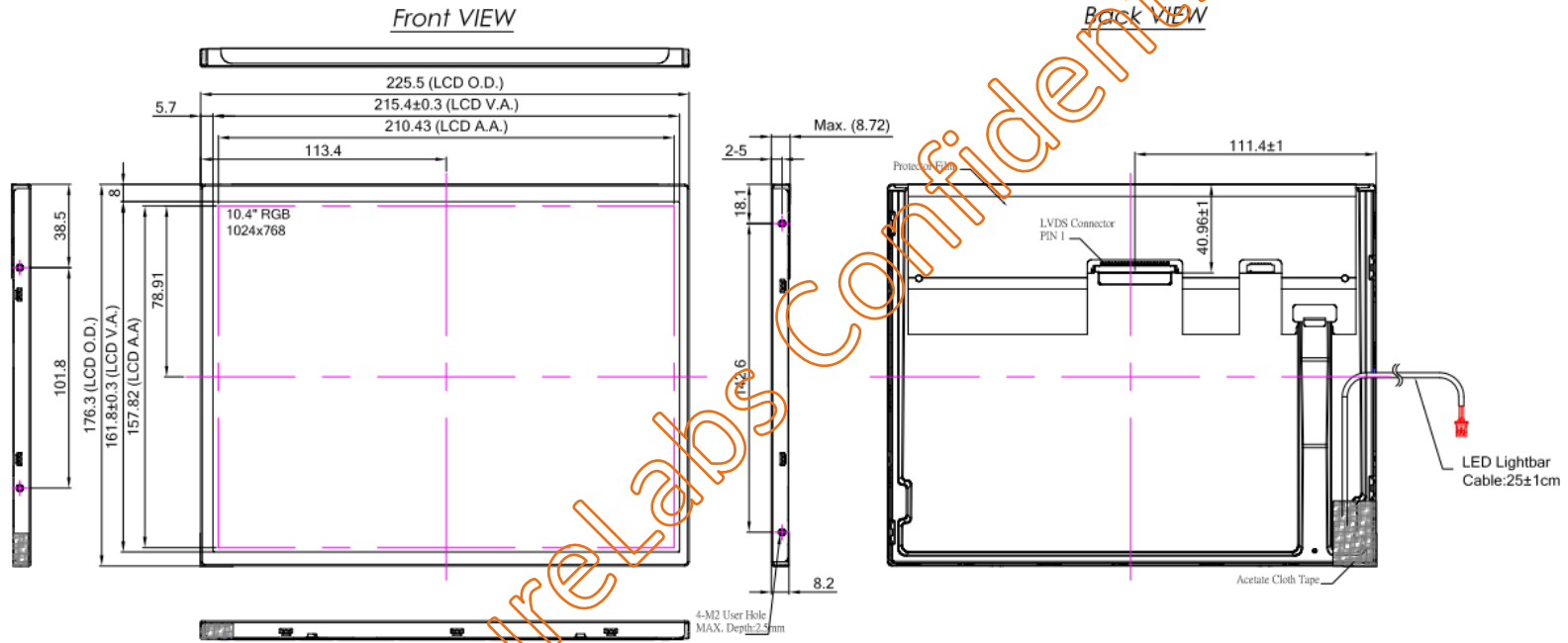
Measure the luminance of gray level 255 at 5 points

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



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## 8. DIMENSION AND DRAWING



**NOTES:**

- 1.General tolerance are  $\pm 0.5\text{mm}$
- 2.ROHS must be complied

CN1 Pin Define					
PIN	SYMBOL	PIN	SYMBOL	PIN	SYMBOL
1	VCC	11	SEL6/8	21	RX2-
2	VCC	12	GND	22	RX2+
3	VCC	13	NC	23	GND
4	GND	14	GND	24	RXCLK-
5	GND	15	RX0-	25	RXCLK+
6	GND	16	RX0+	26	GND
7	RPFI	17	GND	27	RX3-
8	NC	18	RX1-	28	RX3+
9	NC	19	RX1+	29	GND
10	NC	20	GND	30	NC

Customer Approval	Part Number # REV	FLC-104GML6000SA3	#00
Date	Rev. No.	Issue	Revision
Design			
Draw			
Signature	Date	Drawn By	Date
		Check By	Date
		Approved By	

## 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.