TFT Product Specification

- ◇ PRELIMINARY SPECIFICATION
- ◆ APPROVED SPECIFICATION

Part Number: FLC-150GML1000SA1

Description: TFT 15’’ 1024*768 Full View LVDS 1000CD with LED driver

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Approved by: David

Reviewed by	Natalie Lin
Date	2020/09/09

Revision History

Version	Date	Page	Description	Note
V1.0	2019/05/30		1st Edition	
V2.0	2019/06/04		Final Release	P1, P4, P5, P13, P14
V2.1	2020/09/09		Update drawing ME	

Table of Content

1. GENERAL DESCRIPTION

1.1 Description

15”W 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 FHD, 1024x768 screen and 16.2M/262K 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	15	Inch
2	Pixel Number	1024 (H) x RGB x 768 (V)	Pixels
3	Outline Dimension	326.5 (H) x 253.5(V) x 9.1(D)	mm
4	Active Area	304.1 (H) x 228.1 (V)	mm
5	Display Colors	262K/16.2M	- -
6	Pixel Arrangement	RGB vertical stripe	- -
7	Display Mode	Normally Black	- -
8	Electrical Interface	1 Ch LVDS	
9	Surface Treatment	Hard coating , Anti-Glare 3H	- -
10	Brightness	1,000 (Typ.)	cd/m2
11	Contrast Ratio	2,000 (Typ.)	- -
12	Total Power Consumption (Typ)	20.46	W

2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

TFT-LCD

Item	Symbol	Min	Max.	Unit	Note
Power Supply Voltage	VCC	-0.3	4	V	(1)

BACKLIGHT UNIT

Item	Symbol	Min	Max.	Unit	Note
LED Drive Voltage	Vi	10.8	13.2	V	(1/2)
Enable Voltage	EN		5.5	V	
Backlight Adjust	Dimming		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 lamp (Refer to 3.2 for further information).

2.2 Environment Absolute Rating

Item	Symbol	Min	Max	Unit	Note
Operating Temperature	Top	-20	70	°C	Ta=25℃
Storage Temperature	TST	-30	70	°C	

Note (1) Temperature and relative humidity range is shown in the figure below.
Note (2) 90 %RH Max. (Ta < 40℃).
Note (3) Wet-bulb temperature should be 39℃ Max.
Note (4): iF you LCD in close environment suitable venting on the system cover could be helpful for coling
Note (5): It is better to adapt Active cooling fan system especially for high luminance model

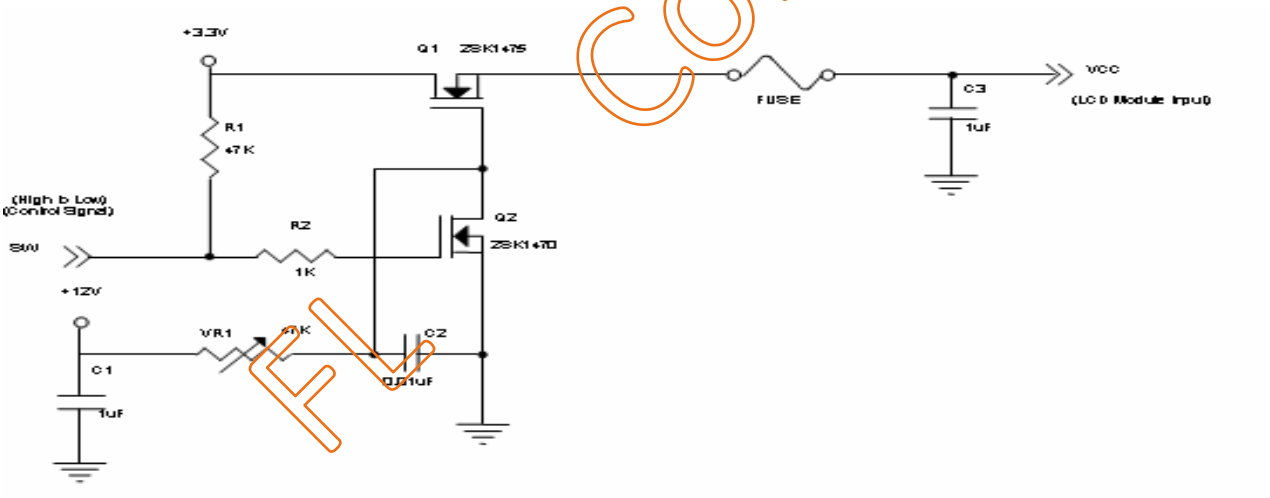
3. ELECTRICAL CHARACTERISTICS

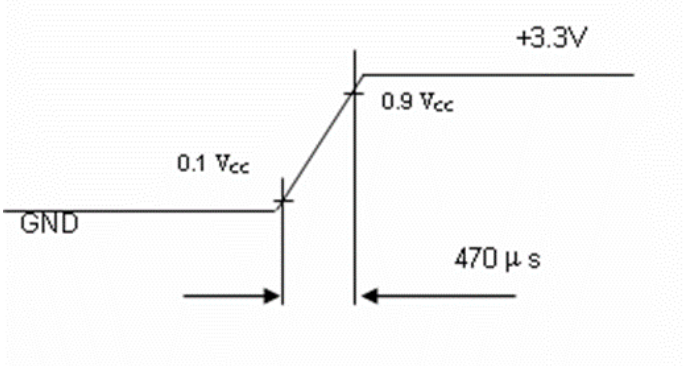
3.1 LCM Power Specification

Parameter	Symbol	Value			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			2.0	A	(2)
Power Supply Current White patten	ICC		800	960	mA	(3)a
Power Supply Current Black patten	ICC		670	800	mA	(3)b
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	VIH			100	mV	
Differential Input Voltage for LVDS Receiver Threshold "L" Level	VIL	-100			mV	
Teminating Resistor	RT		100		ohm	

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

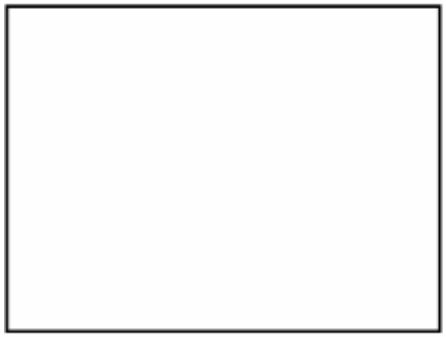
Note (2) Measurement Conditions





Note (3) The specified power supply current is under the conditions at V_{DD} =3.3V, Ta = 25 ± 2 ℃, DC Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

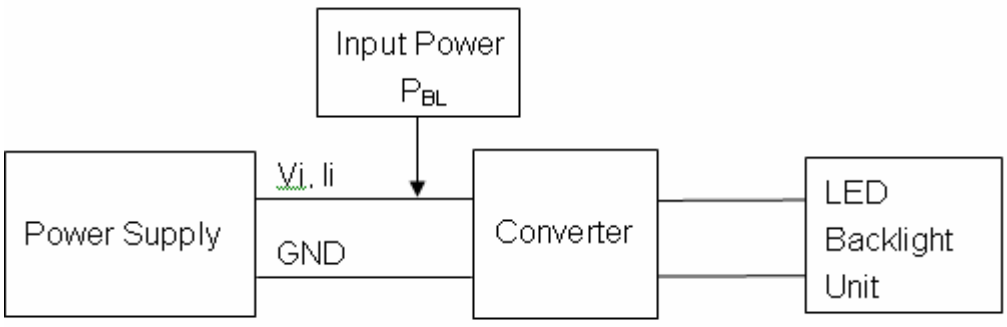
b. Black Pattern

Active Area

3.2 Backlight Unit

Parameter	Symbol	Min	Typ	Max	Units	Note
Converter Power Supply Voltage	Vi	10.8	12	13.2	V	
Converter Power Supply Current	Ii	-	1.834	-	A	@ Vi = 12V (Duty 100%)
Backlight Power Consumption	PBL	-	17.82	-	W	@ Vi = 12V (Duty 100%)
EN Control Level Backlight on	-	3.0	3.3	5.0	V	
EN Control Level Backlight off	-	0	-	0.8	V	
PWM Dimming Control Level PWM High Level	-	3.0	3.3	5.0	V	
PWM Dimming Control Level PWM Low Level	-	0		0.15	V	
PWM Dimming Control Duty Ratio	-	1	-	100	%	@100Hz
PWM Dimming Control Frequency	fPWM	100	200	20K	Hz	(2)
LED Life Time	LL	50,000	70,000		Hrs	(3)

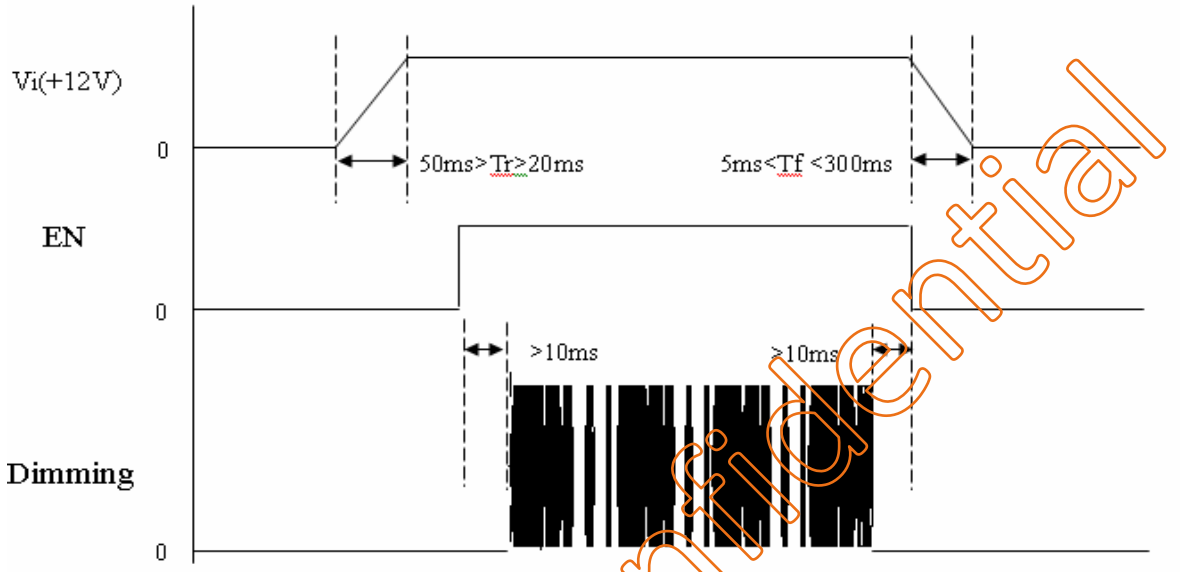
Note (1) LED current is measured by utilizing a high frequency current meter as shown below:



Note (2) At 20k Hz PWM control frequency，duty ratio range is restricted from 20% to 100%.

Note (3) 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.

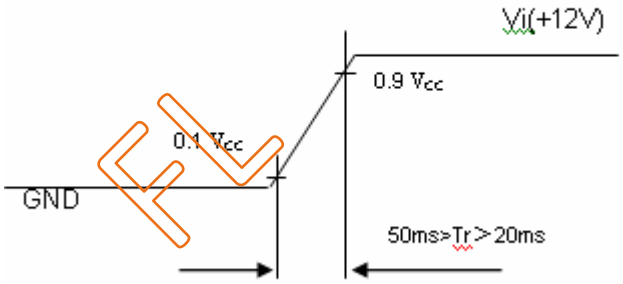
Power sequence and control signal timing are shown in the following figure



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

Turn ON sequence: Vi(+12V) → EN → Dimming Turn OFF sequence: Dimming → EN → Vi(+12V)

Note (4)



3.3 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(252)	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(252)	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(252)	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	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	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	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(252)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	Green(252)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	Green(252)	0	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	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
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	Blue(252)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

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

4. SIGNAL CHARACTERISTICS

4.1 Interface Timing

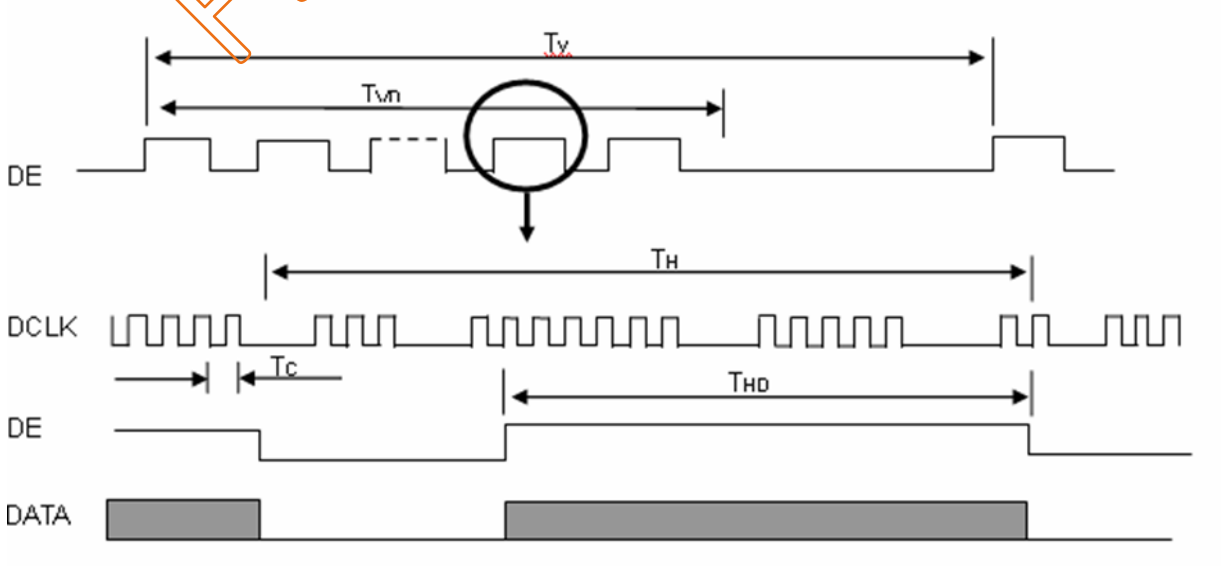
4.1.1 Timing Characteristics:

Parameter	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	53.35	65	80	MHz	
	Period	Tc	12.5	15.38	18.75	ns	
	Input cycle to cycle jitter	Trcl	--	--	200	ns	(a)
	Input Clock to data skew	TLVCCS	-0.02*Tc	-	0.02*Tc	ps	(b)
	Spread spectrum modulation range	Fclkin_mod	-	-	1.02*Fc	MHz	(c)
	Spread spectrum modulation frequency	Fssm			200	KHz	
Vertical Display Term	Frame Rate	Fr	55	60	70	Hz	Tv=Tvd+Tvb
	Total	Tv	780	806	840	Th	
	Active Display	Tvd	768	768	768	Th	
	Blanking	Tvb	Tv-Tvd	38	Tv-Tvd	Th	
Horizontal Display Term	Total	Th	1240	1344	1360	Tc	Th=Thd+Thb
	Active Display	Thd	1024	1024	1024	Tc	
	Blanking	Thb	Th-Thd	320	Th-Thd	Tc	

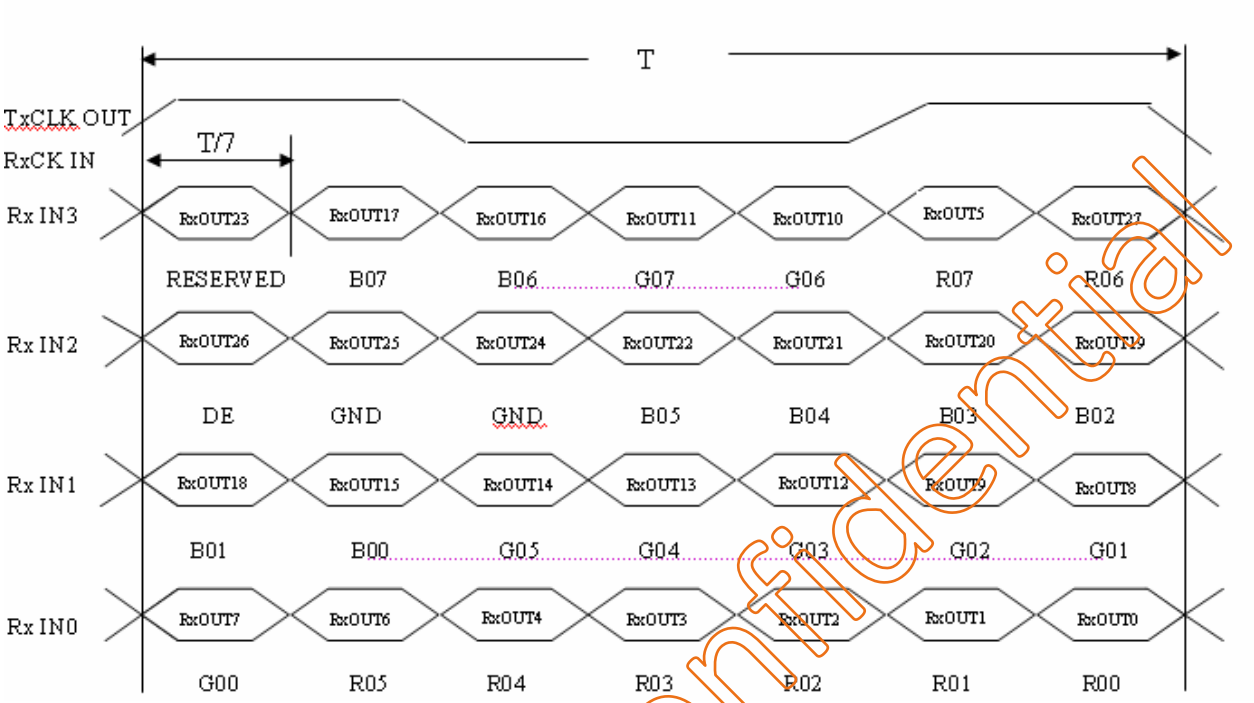
Note (1) DE Mode only, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

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

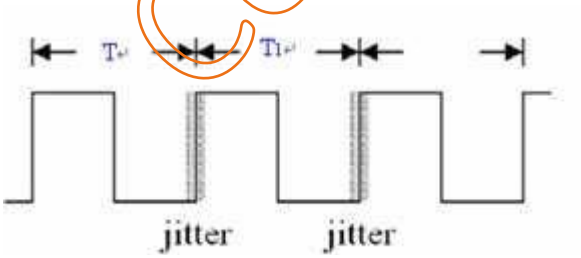
INPUT SIGNAL TIMING DIAGRAM



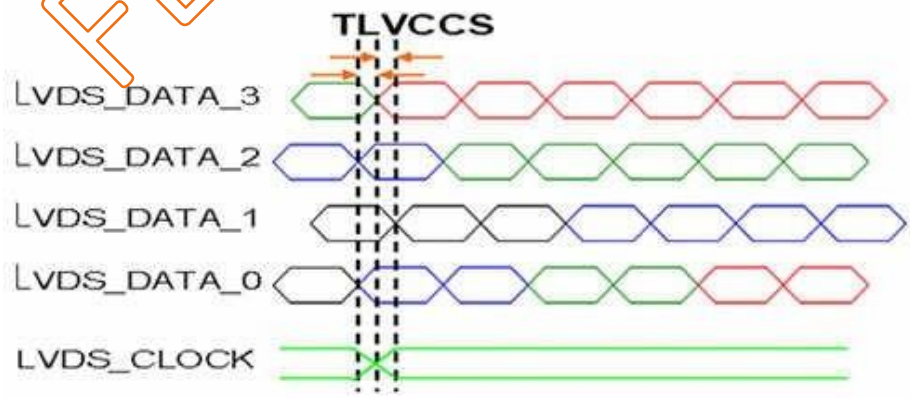
TIMING DIAGRAM of LVDS



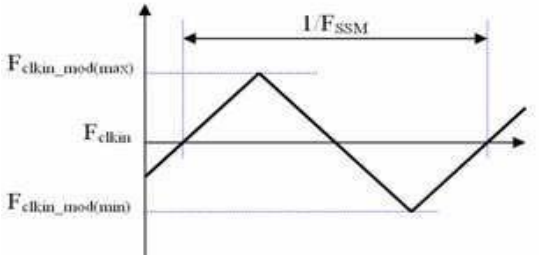
Note (a) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T1 – TI



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



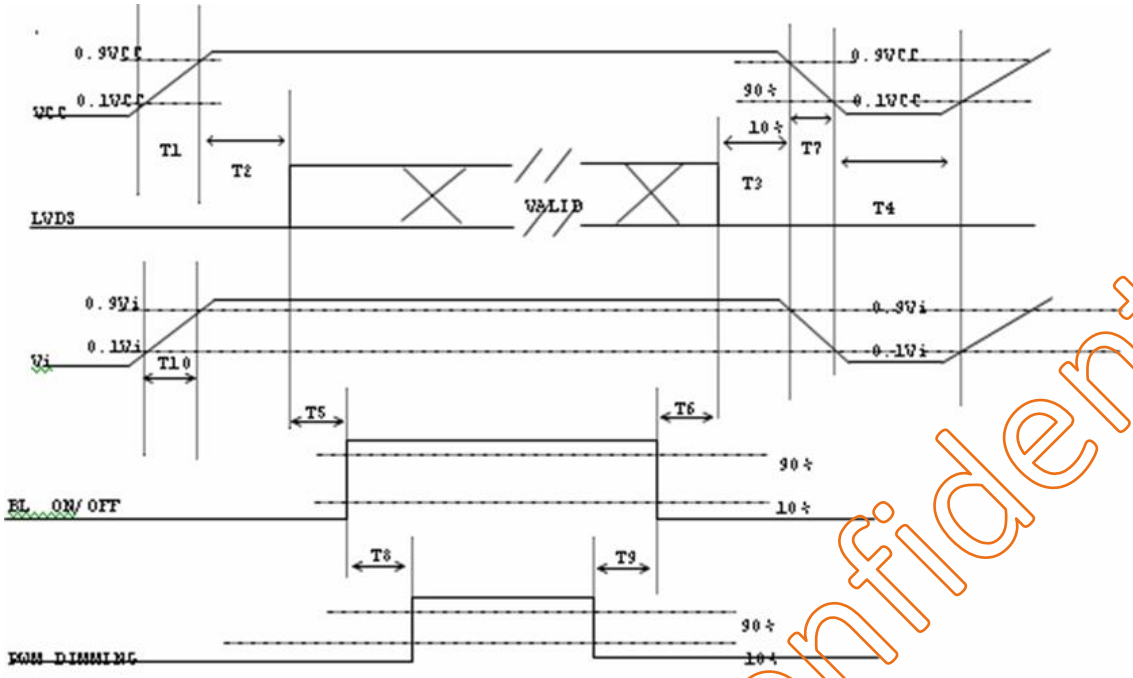
Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.



4.1.2 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.

Power ON/OFF sequence



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
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.

4.1.3 SCANNING DIRECTION

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

Fig.1 Normal Scan

Fig.2 Reverse Scan

Fig. 1 Normal scan (pin 4, LR/UD = High or NC)

Fig. 2 Reverse scan (pin 4, LR/UD = Low)

5. INTERFACE PIN DESCRIPTION

5.1 LCM Connector PIN Assignment

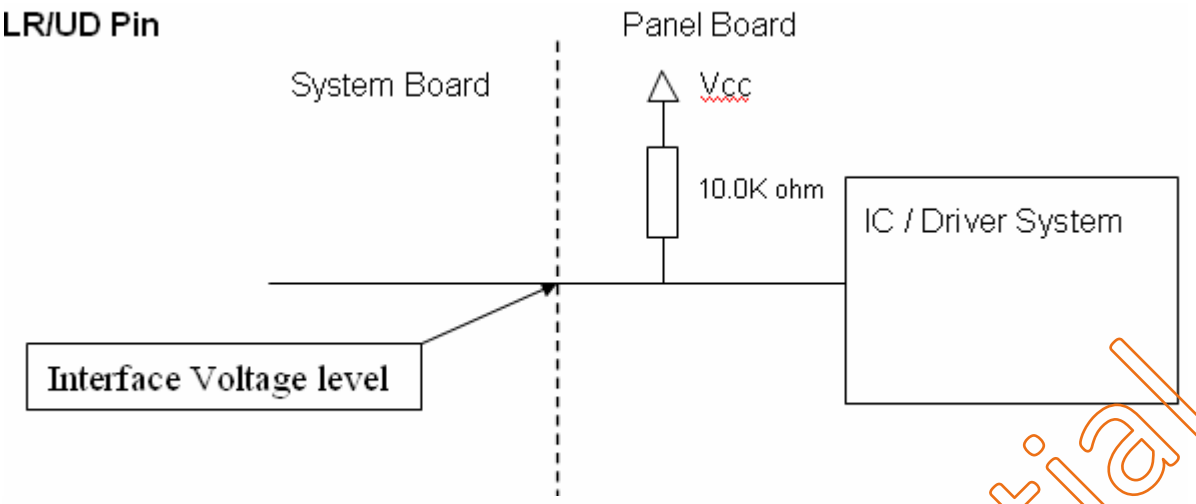
Pin No.	Symbol	Function	Polarity	Note
1	VCC	Power Supply +3.3V(typical)		
2	VCC	Power Supply +3.3V(typical)		
3	GND	Ground		
4	LR/UD	Reverse Scan Control H or NC = Normal Mode. L = Horizontal / Vertical Reverse Scan.		Note (3)
5	RX0-	LVDS Differential Data Input	Negative	
6	RX0+	LVDS Differential Data Input	Positive	
7	GND	Ground		
8	RX1-	LVDS Differential Data Input	Negative	
9	RX1+	LVDS Differential Data Input	Positive	
10	GND	Ground		
11	RX2-	LVDS Differential Data Input	Negative	
12	RX2+	LVDS Differential Data Input	Positive	
13	GND	Ground		
14	RXCLK-	LVDS Differential Clock Input	Negative	
15	RXCLK+	LVDS Differential Clock Input	Positive	
16	GND	Ground		
17	RX3-	LVDS Differential Data Input	Negative	
18	RX3+	LVDS Differential Data Input	Positive	
19	GND	Ground		
20	SEL68	LVDS 6/8 bits elect function control, High 6bit Input Mode Low or NC 8bit Input Mode		Note (3)

Note (1) Connector Part No.: Cvilux CID520D1HR0-NH or equivalent.

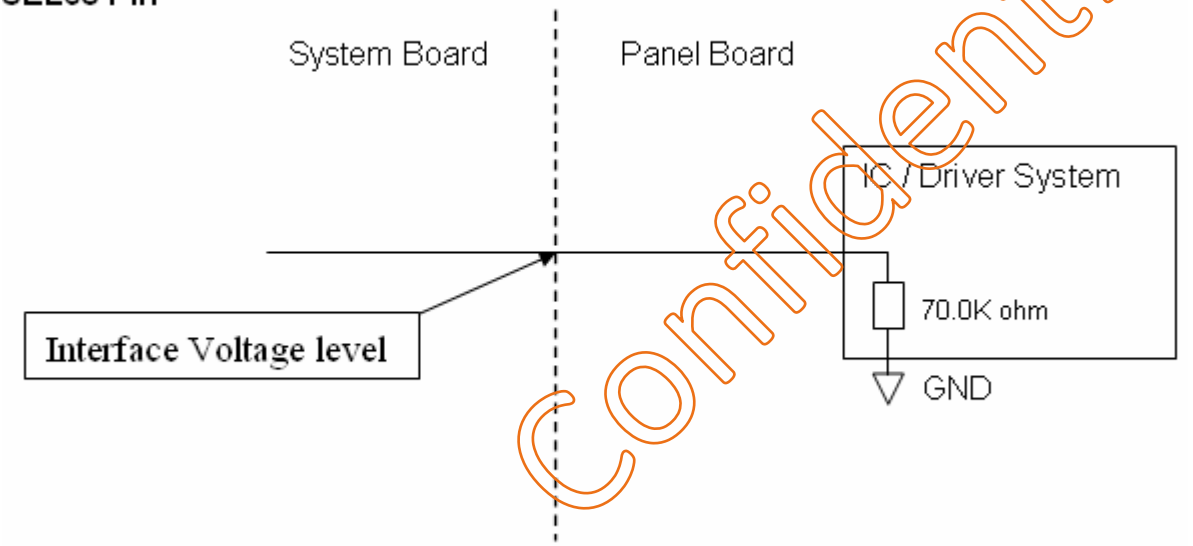
Note (2) User's connector Part No.: Hirose DF14-20S-1.25C or equivalent.

Note (3) "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connection".

LR/UD Pin



SEL68 Pin



5.2 Backlight and LED Driver Connector PIN Assignment

CN1 : MS24267R / 2.0mm pin pitch (STM)

Pin	Description
1	DC input
2	DC input
3	DC input
4	Ground
5	Brightness adjust
6	Ground
7	Backlight ON/OFF control

CN2 : MS24262R / 2.0mm pin pitch (STM)

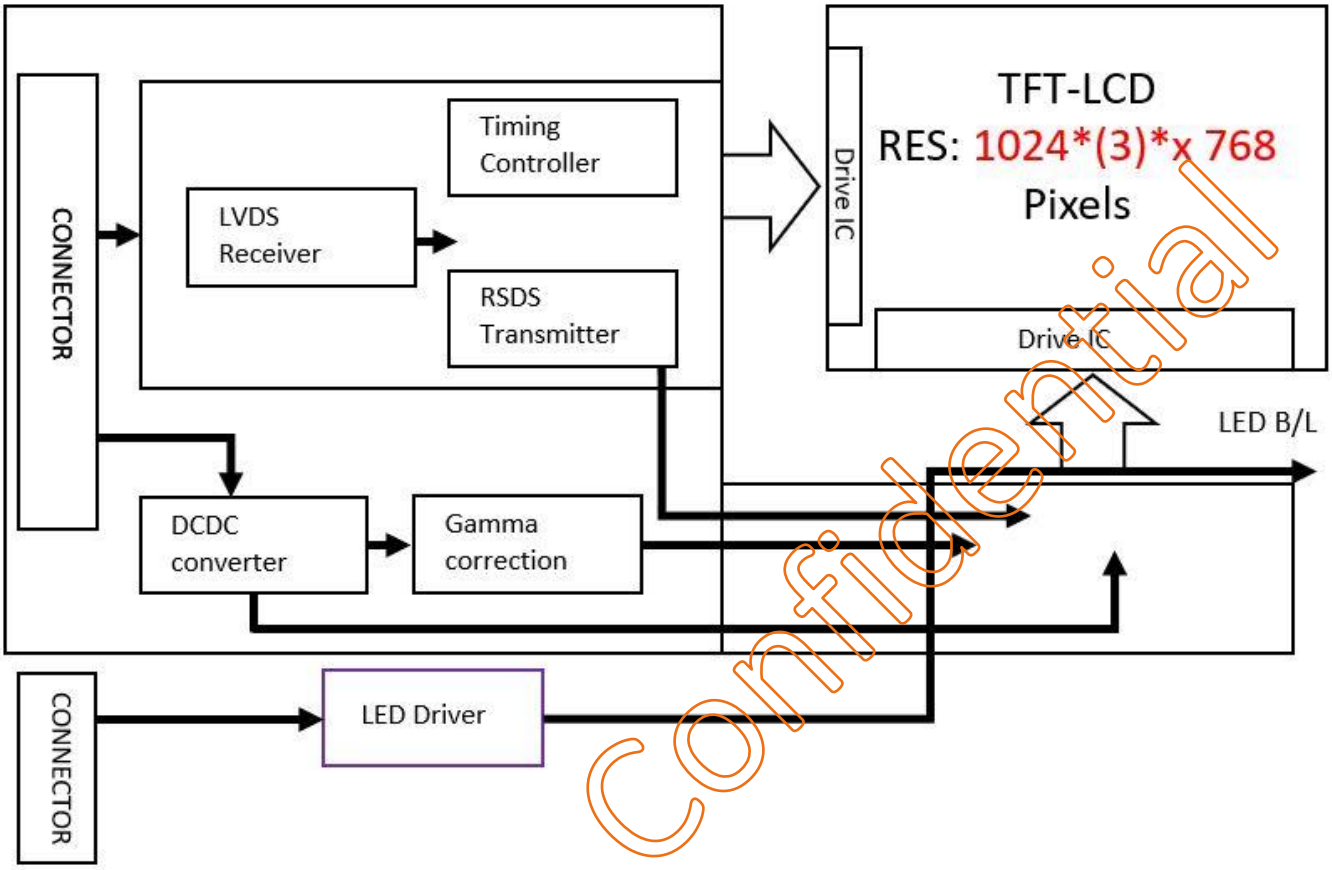
Pin	Description
1	LED V+ output
2	LED V- output

CN3 : MS24262R / 2.0mm pin pitch (STM)

Pin	Description
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.

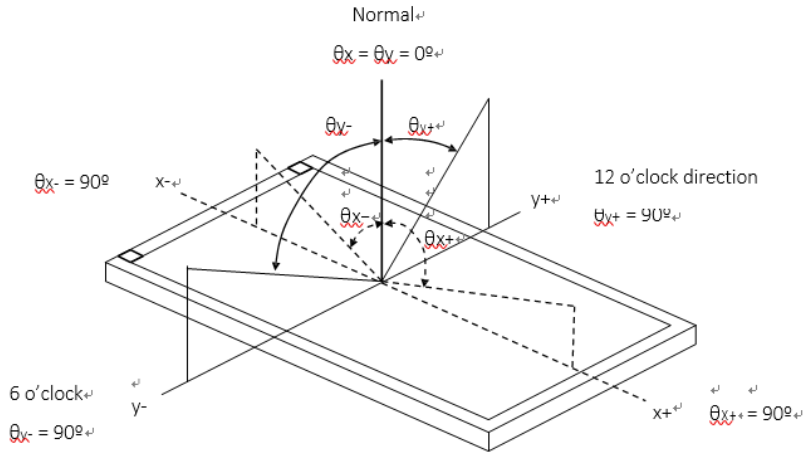
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θX=0°, θY =0° Viewing angle at normal direction	1300	2000		-	(2)
Response Time		TR+TF		-	21	35	ms	(3)
Uniformity		δW		75	80		%	(6)
Center Luminance of White		LC		900	1000	-	cd/m^2	(4)
White Variation		äW		-	1.25	1.33	-	(6)
Chromaticity	Red	Rx		-0.05	0.647	+0.05	-	(6)
		Ry			0.338		-	
	Green	Gx			0.321		-	
		Gy			0.606		-	
	Blue	Bx			0.157		-	
		By			0.039		-	
	White	Wx			0.313		-	
		Wy			0.329		-	
Viewing Angle	Horizontal	θX+	CR=10	80	88	-	Deg.	(1)
		θX-		80	88	-		
	Vertical	θY+		80	88	-		
		θY-		80	88	-		

The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance ≦1 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

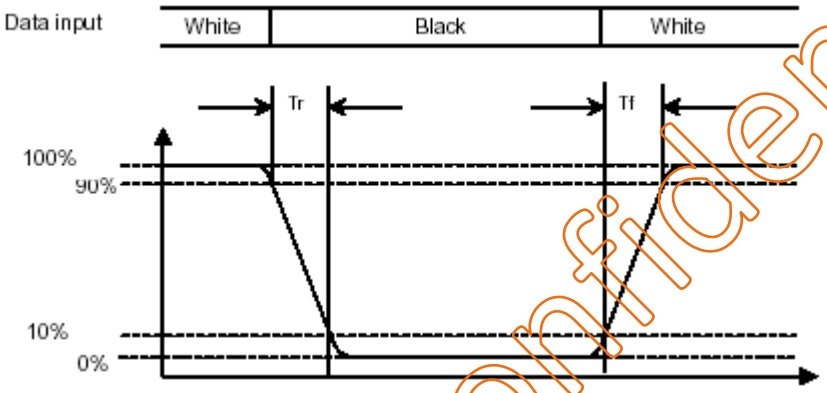


Note 2: Definition of Contrast Ratio (CR)

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. The response time interval is between 10% and 90% of amplitudes, please refer the figure to the followings:



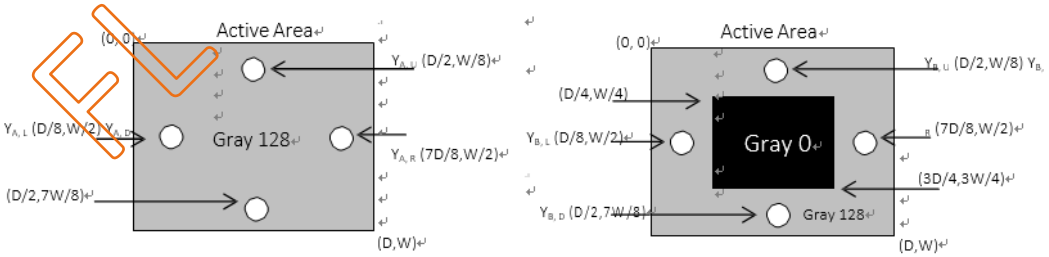
Note 4: Definition of Brightness (L)

Measure the center area of the panel and the viewing angle of the θx=θy =0°

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)

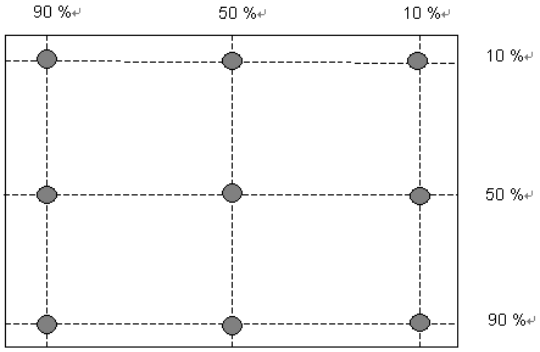
Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)



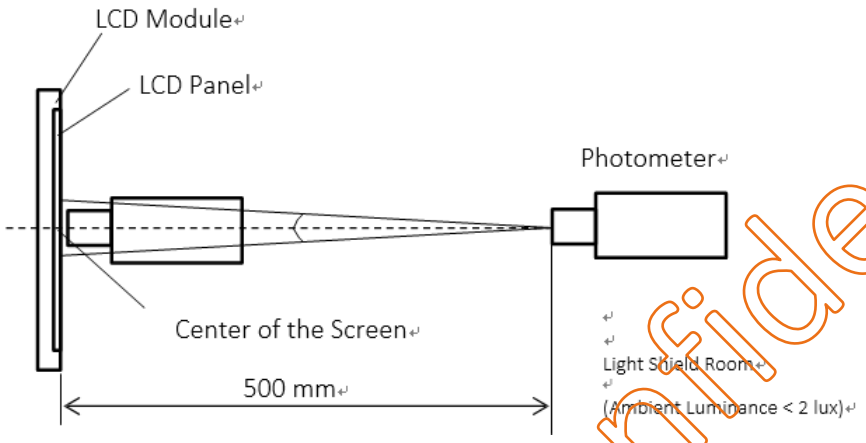
Note 6: Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

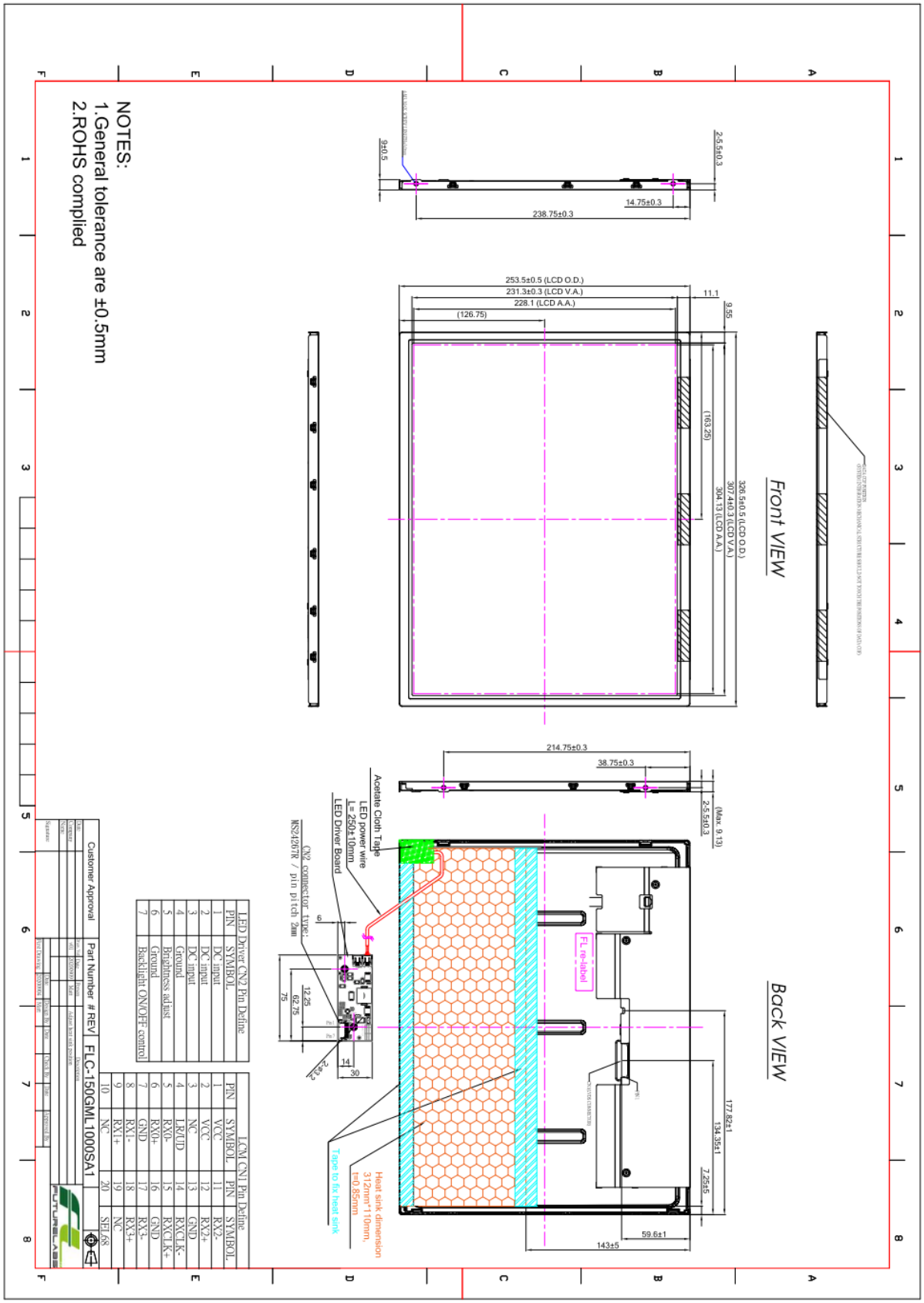
δW = Maximum [L (1), L (2),~ , L (8),L (9)] / Minimum [L (1), L (2) ~ , L (8),L (9)]



Note 7: The method of optical measurement:



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 ttern 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.