TFT Product Specification

◇ PRELIMINARY SPECIFICATION

◆ APPROVED SPECIFICATION

Part Number: FLD-150GML20PUSA1

Description: 15” TFT LCD 300CD with LVDS interface, 1024x768 format assemble Pcap 3mm Black USB

Prepared by: Joy

Approved by	
Date	

Revision History

Version	Date	Page	Description	Note
V0.1	2018/03/16		First Edition	

Table of Content

A. LCD specification

1. GENERAL DESCRIPTION

1.1 Description

15” is a Color Active Matrix Liquid Crystal Display Module composed of a TFT LCD panel and LED backlight system. The module 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	15	Inch
2	Pixel Number	1024 (H) x RGB x 768 (V)	Pixels
3	Outline Dimension	326.5 (H) ×253.5 (V) ×9.1 (D)	mm
4	Active Area	304.1 (H) × 228.1 (V)	mm
5	Display Colors	16.2M	- -
6	Pixel Arrangement	RGB vertical stripe	- -
7	Display Mode	MVA / Normally Black / Transmissive	- -
8	Electrical Interface	LVDS	- -
9	Surface Treatment	Anti-Glare, 3H hard coating	- -
10	Brightness	300 (Typ.)	cd/m2
11	Contrast Ratio	2000 (Typ.)	- -
12	Total Power Consumption (Typ)	7.4	-W
13	Operating Temperature	-20 ~ 70	°C
14	Storage Temperature	-30 ~ 70	°C

2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

Item	Symbol	Values		Unit	Note
		Min	Max.		
Power supply voltage	VCC	-0.3	4	V	
Converter Voltage	Vi	-0.3	18	V	
Enable Voltage	EN	--	5.5	V	
Backlight Adjust	Dimming	--	5.5	V	

Note Permanent damage to the device may occur if max. values are exceeded. Function operation should be restricted to the conditions described under normal operating conditions.

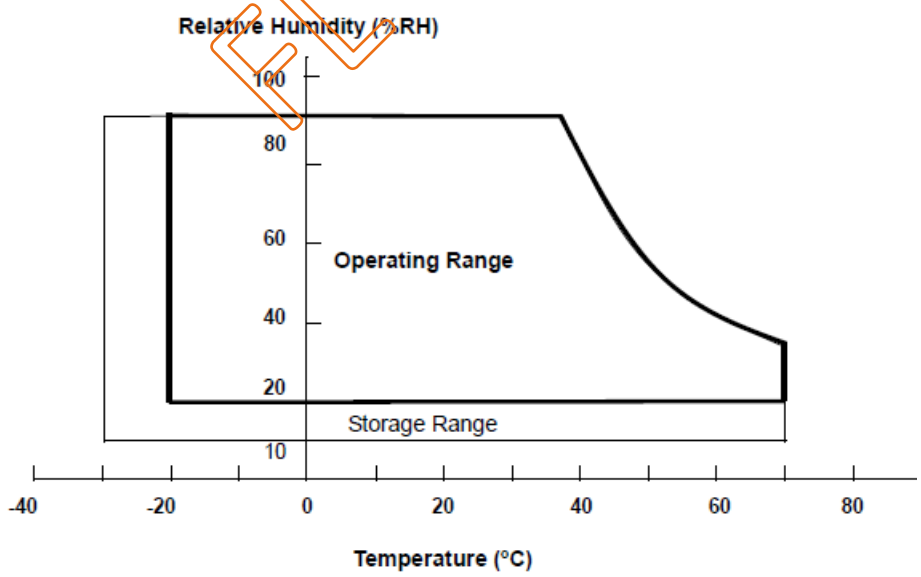
2.2 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min	Typ	Max.		
Operating Temperature	Top	-20		70	℃	Ta=25℃
Storage Temperature	Tstg	-30		70	℃	

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

Note (2) 90%RH M)ax. (Ta<40℃)

Note (3) Wet-bulb temperature should be 39℃ Max.



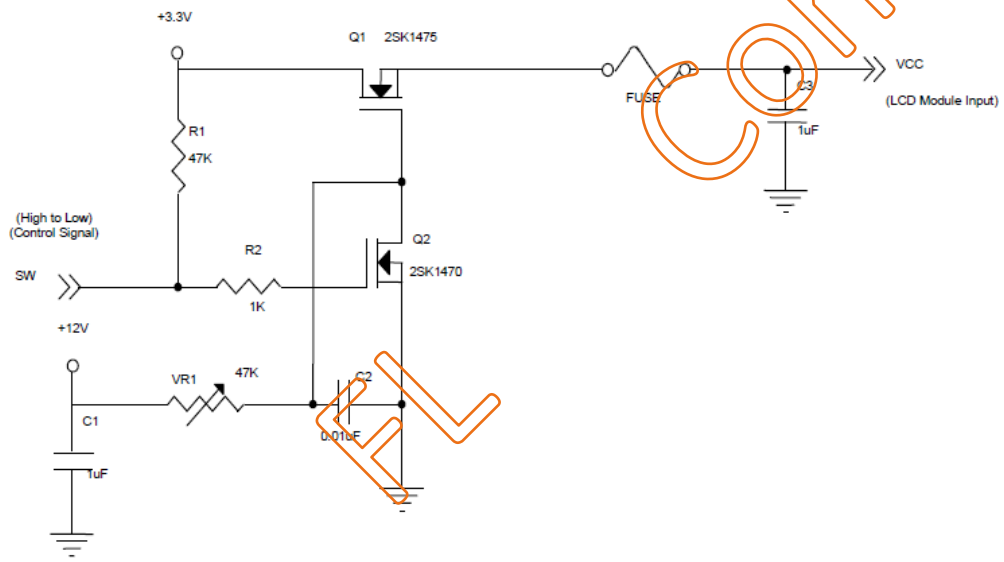
3. ELECTRICAL CHARACTERISTICS

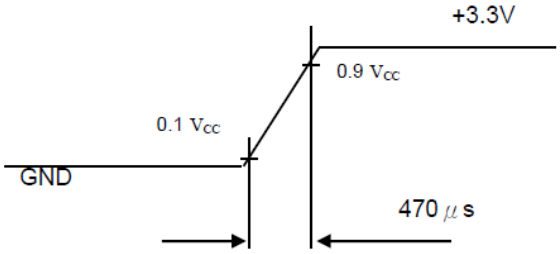
3.1 LCM

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	3.0	3.3	3.6	V	
Ripple Voltage		V_{RP}	--	--	100	mVp-p	
Rush Current		I_{RUSH}	-	-	2.0	A	(2)
Power Supply Current	White	-	--	800	960	mA	(3)
	Black		--	670	800	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		"H" Level	--	--	100	mV	
Differential Input Voltage for LVDS Receiver Threshold L level		"L" Level	-100	--	--	mV	
Terminating Resistor		R_T		100		Ohm	

Note (1) The assembly should be always operated within above ranges. Ta = 25 ± 2 ºC

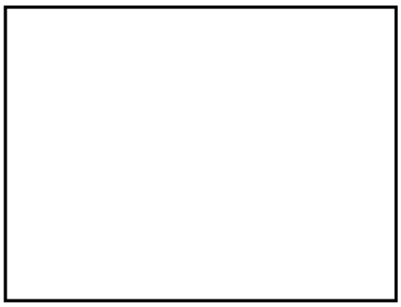
Note (2) Measurement Conditions:





Note (3) The specified power supply current is under the conditions at VDD=3.3V, Ta=25 ± 2 ºC, DC current and fv=60Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern



Active Area

b. Black Pattern

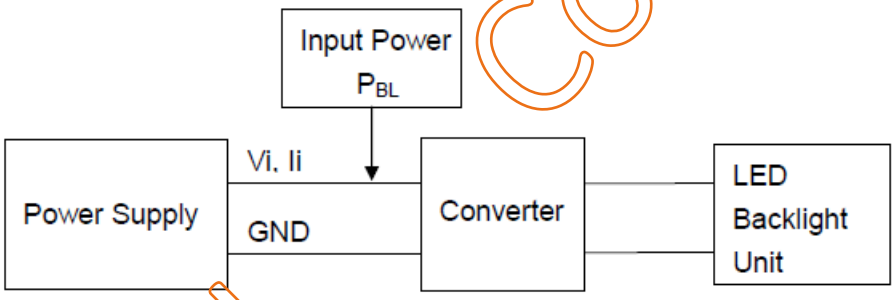
Active Area

3.2 Backlight Unit

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

Symbol	Parameter		Min.	Typ.	Max.	Unit	Note
Vi	Converter Power Supply Voltage		10.8	12.0	13.2	V	
Ii	Converter Power Supply Current		0.23	0.29	0.35	A	@Vi=12V (Duty 100%)
P_{BL}	BLU Power consumption		--	3.5	4.2	W	@Vi=12V (Duty 100%)
--	EN Control Level	Backlight on	2.0	3.3	5.0	V	
		Backlight off	0	--	0.8	V	
--	PWM Dimming Control Level	PWM High Level	2.0	3.3	5.0	V	
		PWM Low Level	0	--	0.15	V	
--	PWM Dimming Control Duty Ratio		1	--	100	%	@200Hz
f_{PWM}	PWM Dimming Control Frequency		190	200	20K	Hz	(2)
LL	LED life Time (Typical)		50,000	70,000	--	Hrs	(3)

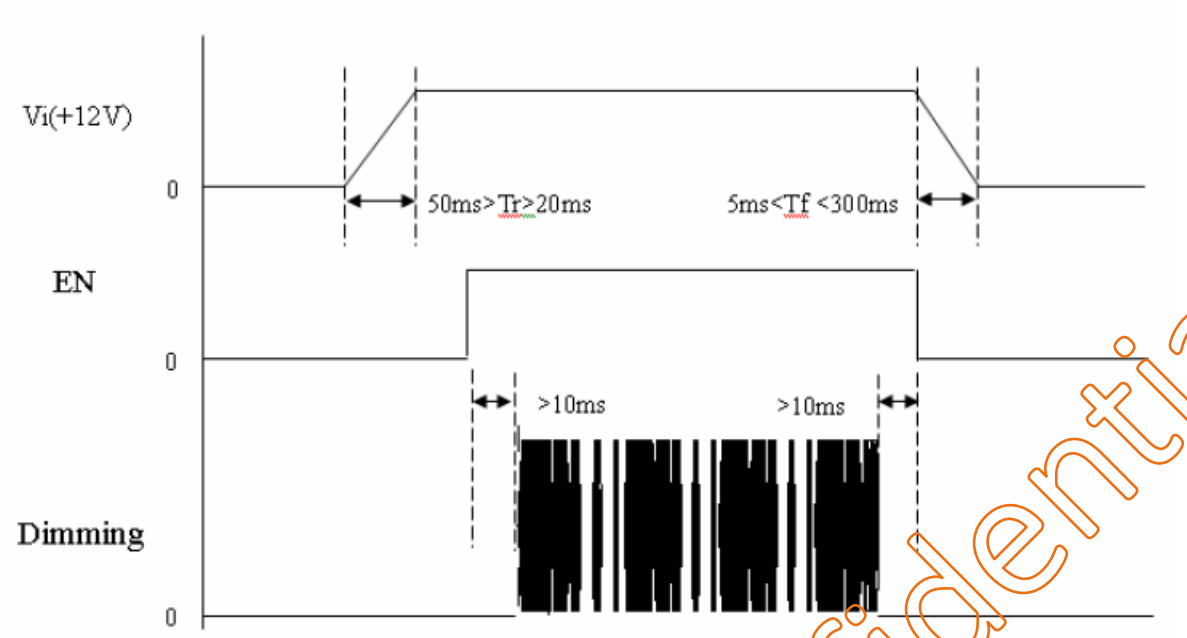
Note (1) LED current is measured by utilizing a high frequency current meter as shown below:



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

Note (3) The life time of LED is estimated data and defined as the time when it continues to operate under the conditions at Ta=25 ± 2 ºC 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

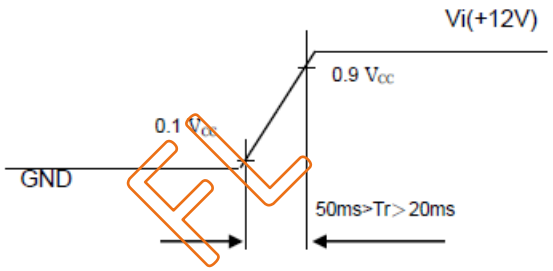


Note： While system is turned ON or OFF, the power sequences must follow as below descriptions

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

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

Note (4)



4. SIGNAL CHARACTERISTICS

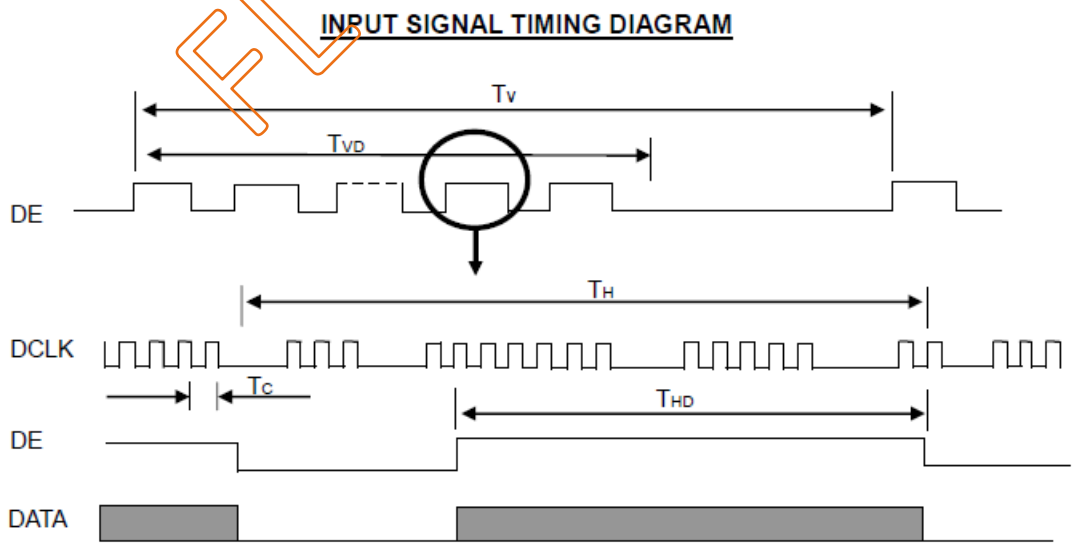
4.1 Interface Timing

4.1.1 Timing Characteristics:

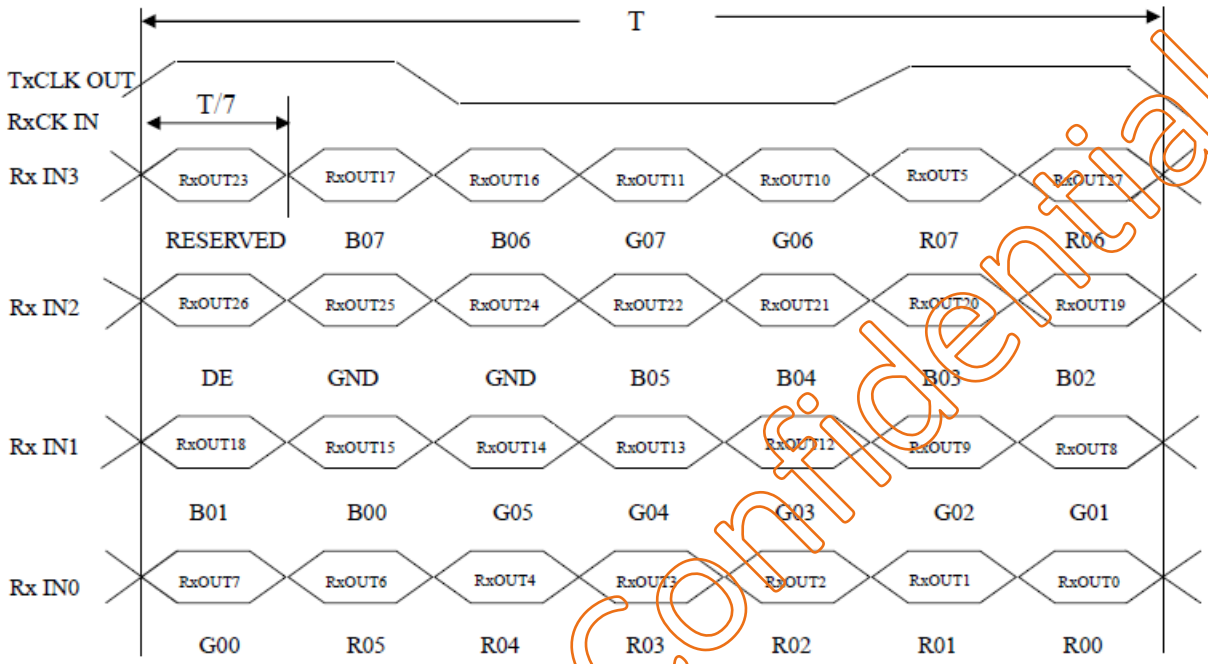
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	53.35	65	80	MHZ	
	Period	Tc	12.5	15.38	18.75	ns	
	Input cycle to cycle jitter	Trd	--	--	200	ns	(a)
	Input Clock to data skew	TLVCCS	-0.02*Tc	--	0.02*Tc	ps	(b)
	Spread spectrum modulation range	F_{clkin_mod}	--	--	1.02*Fc	MHz	(c)
	Spread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

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

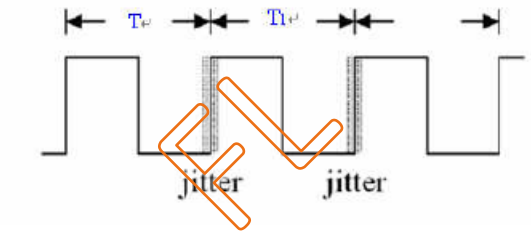
Note(2) The Tv(Tvd+Tvb) must be integer, otherwise, the module would operate abnormally.



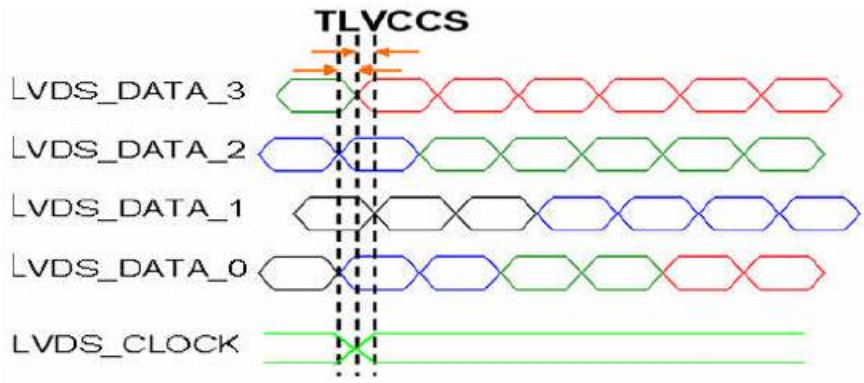
TIMING DIAGRAM of LVDS



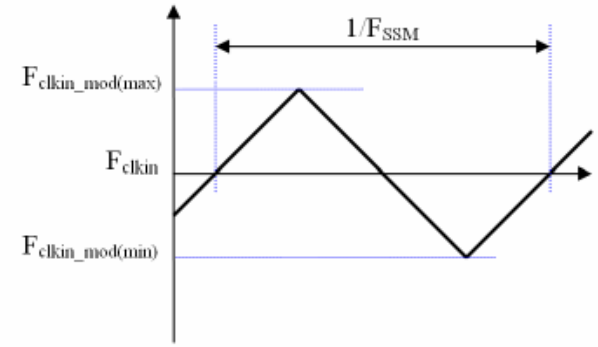
Note (a) The input clock cycle-to-cycle jitter is defined as below figures. Trcl = I T_1 – TI



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

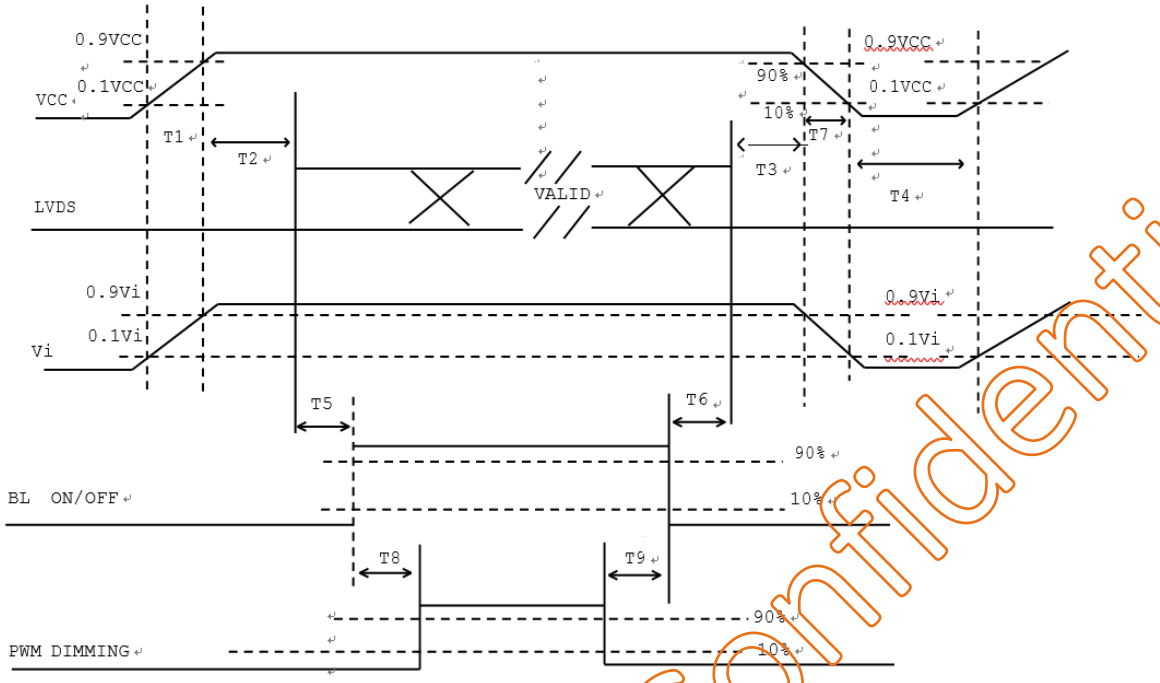


Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.



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

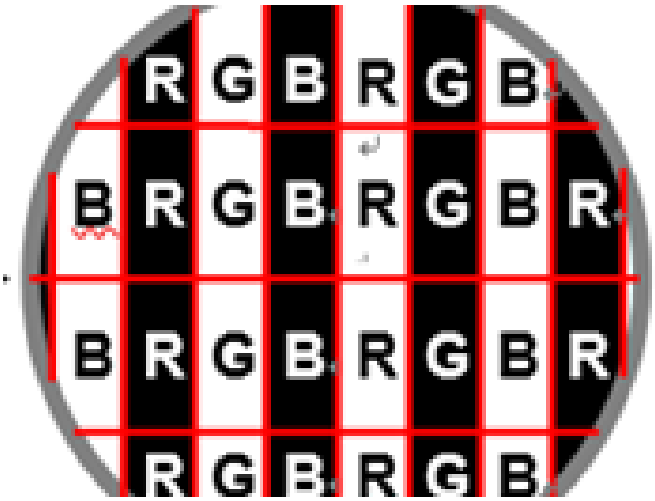
Note (1) Please avoid floating state of interface signal at invalid period.

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	Ty	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

4.2 Pixel Format Image



5. INTERFACE PIN DESCRIPTION

5.1 LCM Connector PIN Assignment

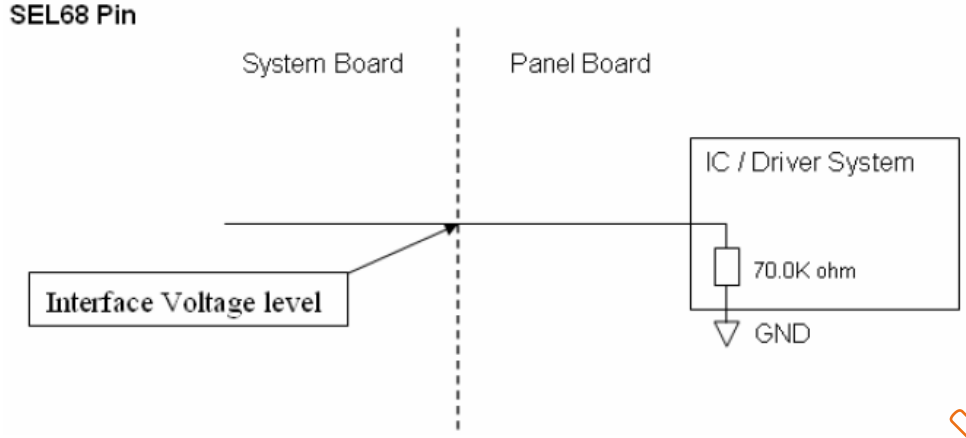
	Symbol	Description	Note
1	VCC	Power supply: +3.3V	-
2	VCC	Power supply: +3.3V	-
3	NC	No Connection	-
4	LR/UD	Reverser Scan Control H or NC= Normal Mode L= Horizontal/Vertical Reverse Scan	-
5	RX0-	LVDS Differential Data Input (Negative)	-
6	RX0+	LVDS Differential Data Input (Positive)	
7	GND	Ground	
8	RX1-	LVDS Differential Data Input (Negative)	
9	RX1+	LVDS Differential Data Input (Positive)	-
10	NC	No Connection	-
11	RX2-	LVDS Differential Data Input (Negative)	
12	RX2+	LVDS Differential Data Input (Positive)	-
13	GND	Ground	-
14	RXCLK-	LVDS Differential Clock (Negative)	-
15	RXCLK+	LVDS Differential Clock (Positive)	-
16	GND	Ground	-
17	RX3-	LVDS Differential Data Input (Negative)	-
18	RX3+	LVDS Differential Data Input (Positive)	-
19	NC	No Connection	-
20	SEL68	LVDS 6/8 bit select function control, High-> 6bit input mode Low or NC-> 8bit input mode	(3)

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

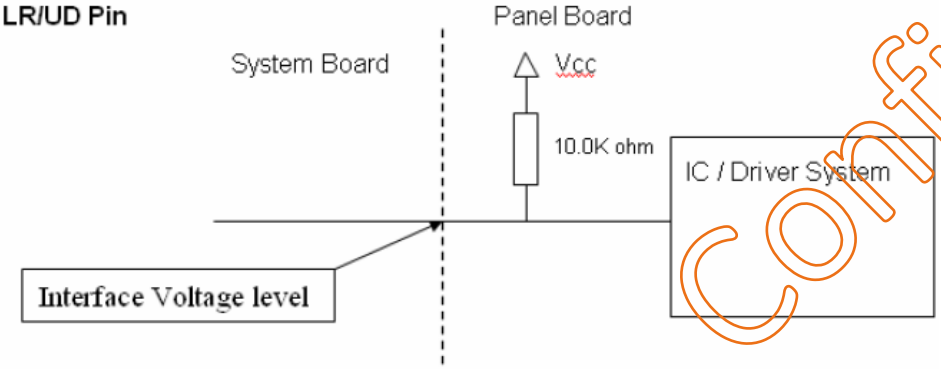
Note (2) User's connector Part No.: Hirose DF14-20S-1.25C or equivalent.

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

SEL68 Pin



LR/UD Pin



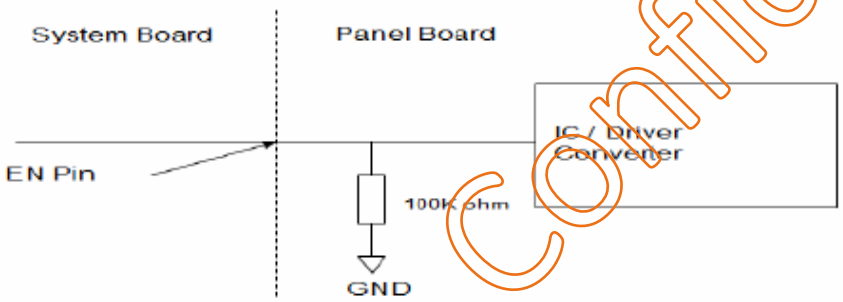
5.2 Backlight and LED Driver Connector PIN Assignment

Pin No	Symbol	Description	Remark
1	Vi	Converter input voltage	12V
2	V_{GND}	Converter ground	Ground
3	EN	Enable pin	3.3V
4	Dimming	Backlight Adjust	PWM Dimming (Hi: 3.3V_{DC}, Lo: 0V_{DC})
5	NC	Not Connect	

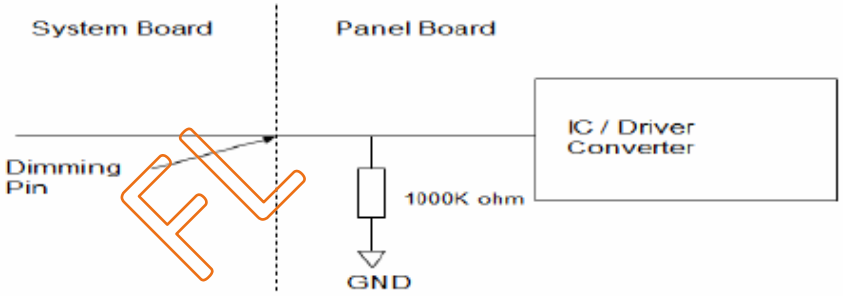
Note (1) Connector Part No.: CI4205M2HRP-NH(Cvilux) or equivalent.

Note (2) User's connector Part No.: Molex 51146-0500 or equivalent.

EN Pin

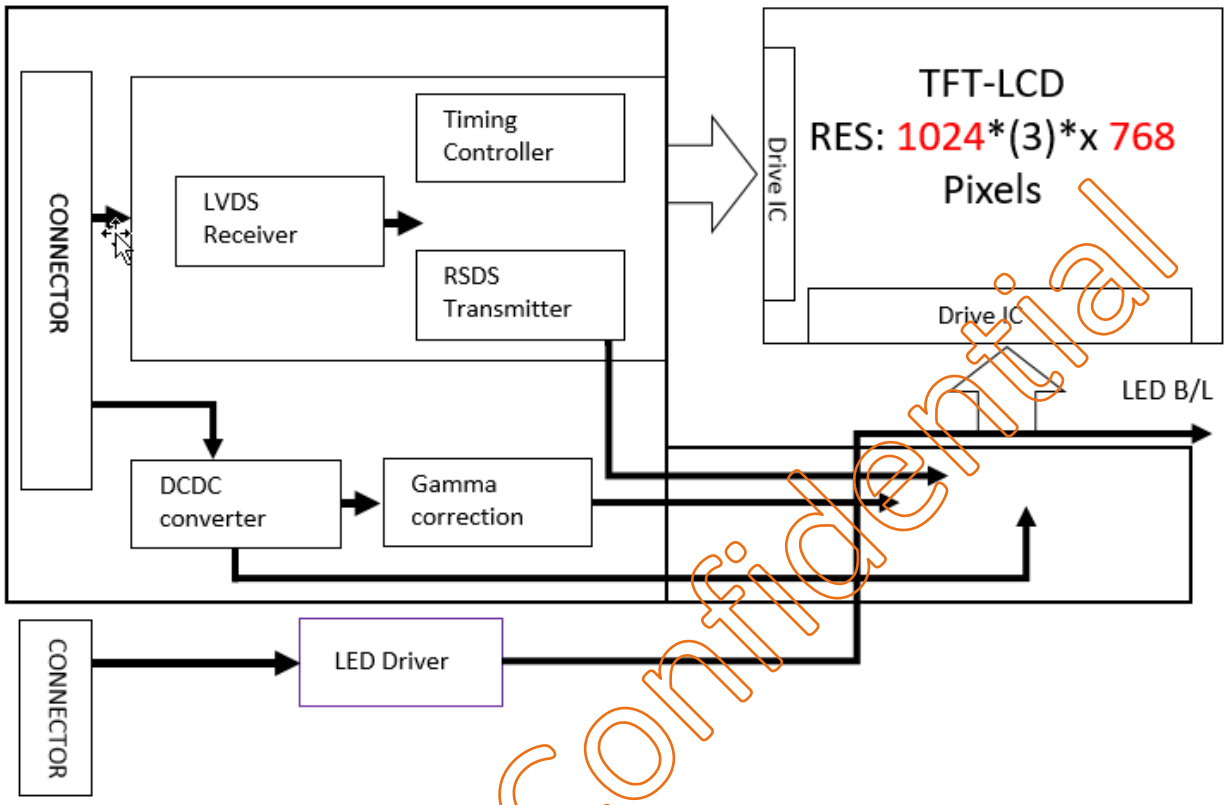


Dimming Pin



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.

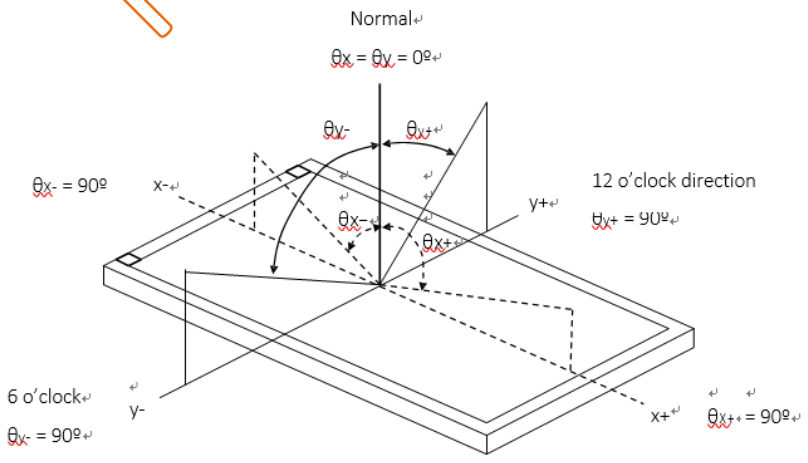
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	θ_X=0°, θ_Y =0° Viewing angle at normal direction	1300	2000		-	(2)(5)
Response Time		T_R		-	16	21	ms	(3)
		T_F		-	7	14	ms	
Center Luminance of White		L_C		240	300	-	cd/m2	(4)(5)
White Variation		δW		-	1.25	1.33	-	(5)(6)
Chromaticity	Red	Rx		Typ. -0.05	0.647	Typ. +0.05	-	(1) (5)
		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	θ_X+	CR≥10	80	88	-	Deg.	(1)(5)
		θ_X-		80	88	-		
	Vertical	θ_Y+		80	88	-		
		θ_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

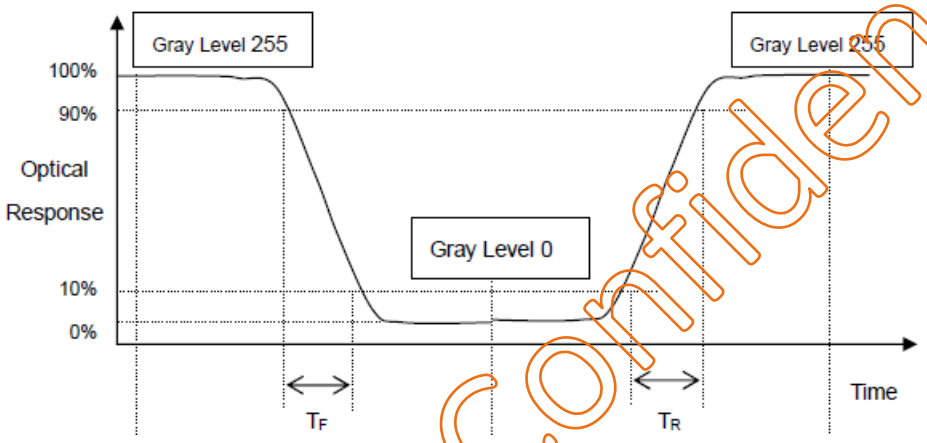


Note 2: Definition of Contrast Ratio (CR)

Measure the viewing angle of 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:

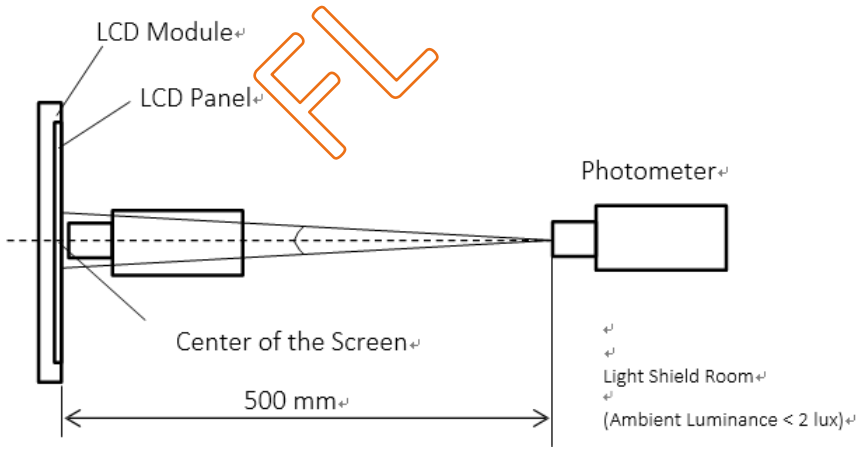
The response time is set initially by defining the "Rising Time (Tr)" and the "Falling Time (Tf)" respectively. The response time interval is between 10% and 90% of amplitudes, please refer the figure to the followings:



Note 4: Definition of Brightness (Lc)

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

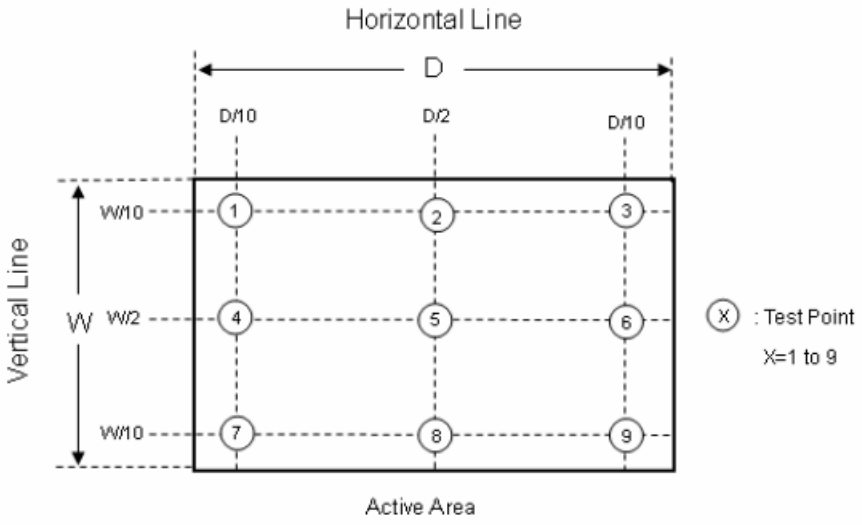
Note 5: The method of optical measurement:



Note 6: Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

δW = Maximum [L (1), L (2), L (3)…L (8), L (9)] / Minimum [L (1), L (2), L (3)… L (4), L (5)]



B. Touch Screen specification

1. Enviromental Specification

Specification	Value	Remarks
Operating Temperature	-20ºC ~ 70ºC	
Storage Temperature	-40ºC ~ 80ºC	
Operating Humidity	20% ~ 90%RH	
Storage Humidity	10% ~ 90%RH	

2. Mechanical Specification

Specification	Value
Operating Life (Finger input)	10^7 times
Light Transmittance	>85% Min. (JIS K-7105) with glass
Surface hardness	6H
FPC Peeling Force	5N Max

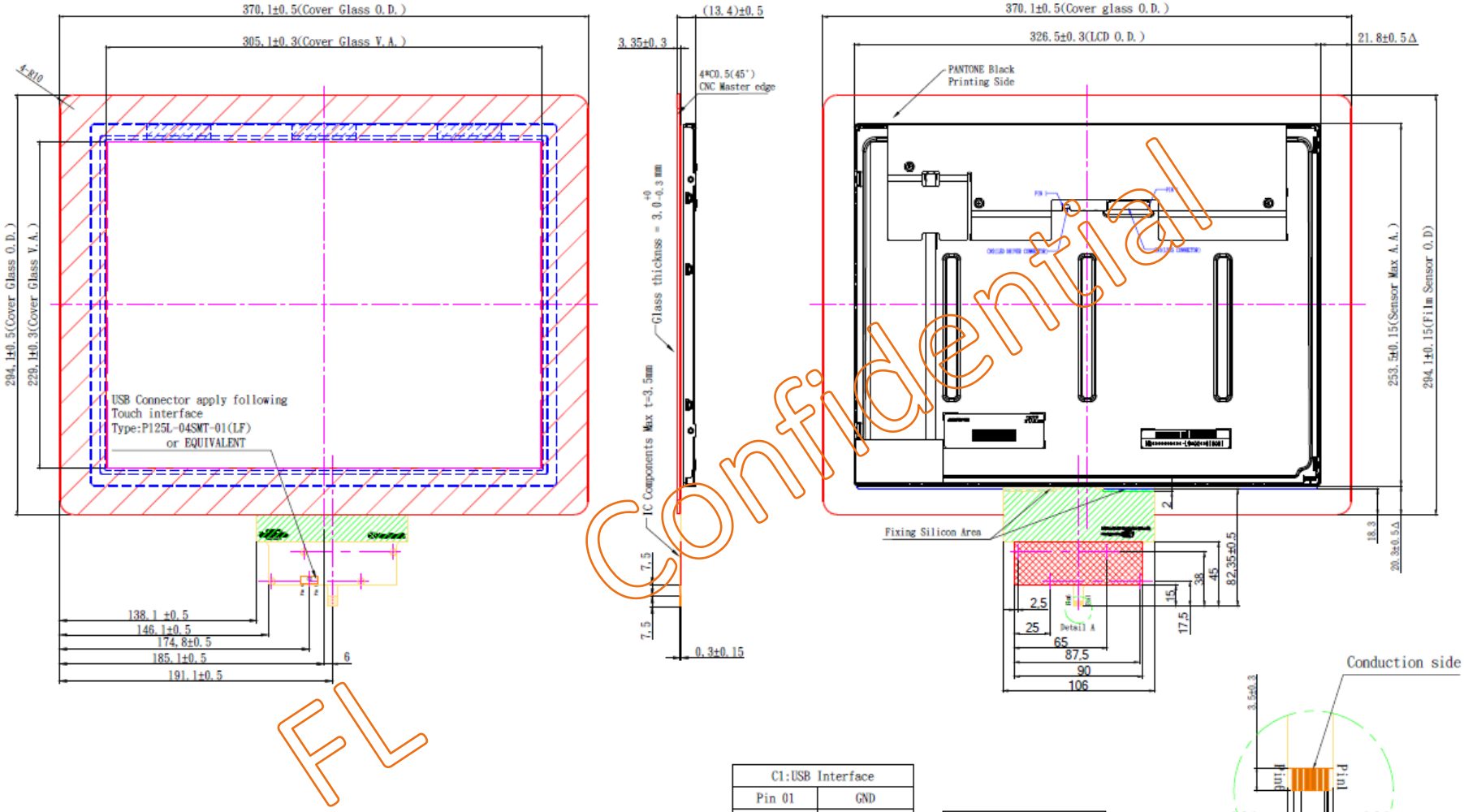
3. USB Type Controller

Parameters	Features
Circuit Board Dimension	Refer to drawings
Channels of Panel	Based on Sensor Design
Input Voltage	5V for USB
Linearity(Note 1)	Single Line drawing accuracy : Up to 1pt +/- 1mm offset /10mm
	Single Touch (point) accuracy : Up to 1pt +/- 1mm
Interface	USB: 2.0(Below) Full Speed
Resolution	4096×4096 resolution
Power consumption(mA)	Active Mode: <70mA
	Idle Mode : <55mA
	Sleep Mode :< 15mA
	(Operation Mode :Active Mode only)
Report rate(points/sec) Note(2)	＞100 Hz
Response time	Average < 25 ms

Note (1): Depending by Sensor design and other parameters, Refer to Windows 8 Logo regulation if need to follow min spec

Note (2): Report rate will vary by channel number, cover thickness, number of fingers and other parameters

C. DIMENSION AND DRAWING



C1:USB Interface	
Pin 01	GND
Pin 02	D-
Pin 03	D+
Pin 04	VDD
Pin 05	NC
Pin 06	RST

C2:Pin Define for USB 4 pin	
Pin 01	GND
Pin 02	D-
Pin 03	D+
Pin 04	VDD

Note:
1. Tolerance: ±0.5mm
2. Touch finger input or special conductive pen
3. Touch Surface Hardness: 6H (Semi-Tempered Glass)
4. Touch Transmittance: >85% (JIS-K7105)
5. Touch Surface Treatment: None
6. Distance between LCD and touch panel need to be minimum 1.0mm otherwise touch maybe will not work correctly
7. If customer put a front cover all around need use at least 2mm thick gasket between touch and metal frame
8. USB max ripple acceptable is 50mV, in other case touch will not work correctly
9. Referring to the integration guide to avoid any integration noise issue
10. LCD model : FLC-150GML2000SA1
11. Touch model : RTPC150-H30BP1-U
12. Assembly Solution : DSA

Customer Approval		Part Number	FLD-150GML20PUSA1
Date		Rev.	Date	Person	Description
Company					
Name					
Signature		Date	Design By	Date	Check By	Date	Approved By

D. PRECAUTION AND PRODUCT HANDLING

- Do not apply the external force such as bending or twisting to the module 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 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.
- 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.