

Product Specification

PART NUMBER # REV: FLD-156MMLT2PU001#00

DESCRIPTION: TFT 15.6" w, 1920(H)*1080(V), LVDS,
16.7M Color, 500CD Assembled with Pcap

Customer Name:	
Signature:	Date:

PREPARED BY	REVIEWED BY
Jesse	David

Revision History

Version	Date	Page	Description	Note
V1.0	2025/03/27		1 st initial	

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1. GENERAL DESCRIPTION

1.1 Description

15.6 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 1920 x 1080 screen and 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	15.6" w	Inch
2	Pixel Number	1920 (H) x 3(RGB)x 1080 (V)	Pixels
3	Outline Dimension	382 (H) x 231.3 (V) x 15(D) Max.	mm
4	Active Area	344.16 (H) x 193.59 (V)	mm
5	Pixel Pitch	0.1792 (H) x 0.1792 (V)	mm
6	Display Colors	16.7M colors (8 bit)	
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 ²
12	Contrast Ratio	1500 (Typ.)	-
13	Power Supply Voltage	3.3V for LCD – 12V for Backlight	V

2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Power Supply Voltage	VDD	-0.3	-	4.0	V	TA=25°C

2.2 Environment Absolute Rating

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Operating Temperature	T _{OP}	-20	-	+70	°C	
Storage Temperature	T _{ST}	-30	-	+80	°C	

Note (1) The absolute maximum rating values of this product are not allowed to be exceeded at any times. Should a module be used with any of the absolute maximum ratings exceeded, the characteristics of the module may not be recovered, or in an extreme case, the module may be permanently destroyed.

Note (2) Before cosmetic and function test, the product must have enough recovery time, at least 24 hours at room temperature.

Note (3) In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.

3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD Module

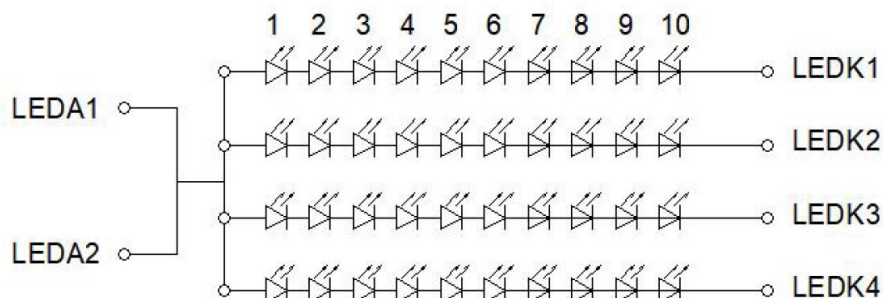
Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Power Voltage	VDD	3.0	3.3	3.6	V	
Power Current	IVDD	-	400	-	mA	
Input logic high voltage	V _{IH}	0.7VDD	-	VDD	V	
Input logic low voltage	V _{IL}	0	-	0.3VDD	V	

Note (1) The supply voltage is measured and specified at the interface connector of LCM.

3.2 Backlight Characteristics

Item		Symbol	Values			Unit	Note
			Min.	Typ.	Max.		
Input Voltage		VP_12V	11	12	13	V	
Input Current		IVCC_12V	-	823	-	mA	100%Brightness (VCC12V=12V)
Power Consumption		PLED	-	9.876	-	W	
Voltage for LED Backlight		VL	26	30	34	V	(1)
Current for LED Backlight		IL	-	280	-	mA	
PWM Control level	BL ON	PWM	2.5	3.3	5	V	
	BL Off		0	-	0.5	V	
EN Control level	BL ON	EN	2.5	3.3	5	V	
	BL Off		0	-	0.5	V	
PWM Dimming Frequency		-	0.1	-	20	KHz	
PWM Duty		-	5	-	100	%	
LED Life Time		-	30,000	-	-	Hours	(2)

Note (1) V_L=30V, I_L=280mA (Backlight circuit:10series connection,4parallel connection), the ambient temperature is 25°C.



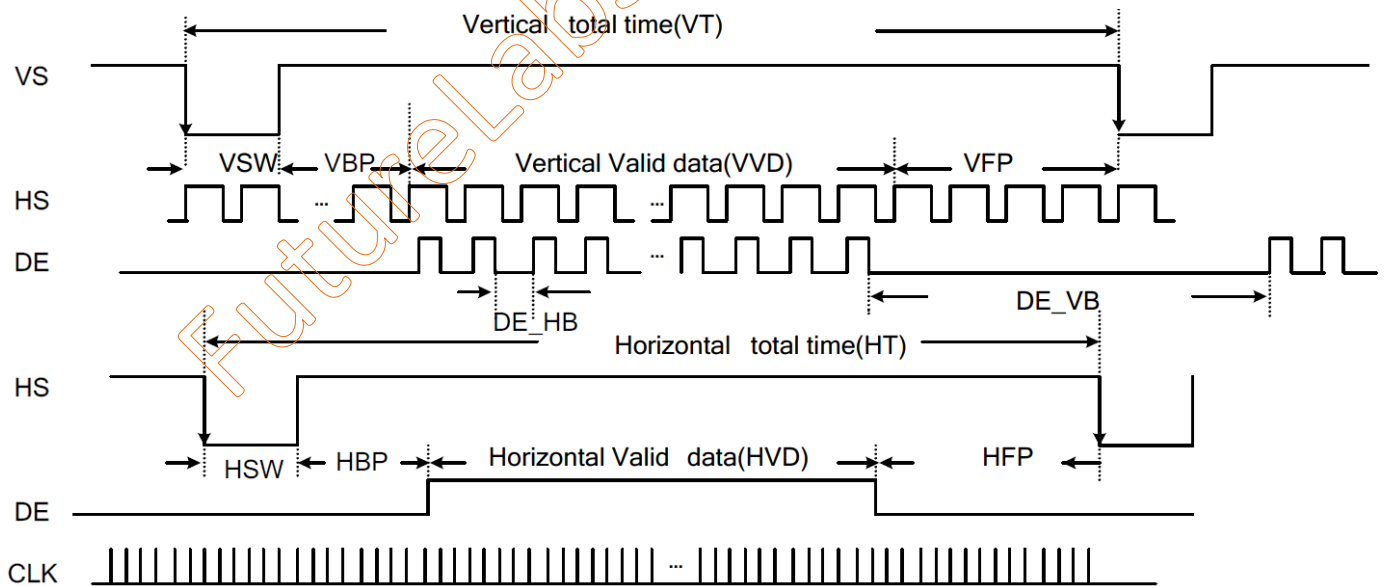
Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at $T_a=25^{\circ}\text{C}$ and 1/2 rated current . The LED lifetime could be decreased if operating I_L is larger than 280 mA.

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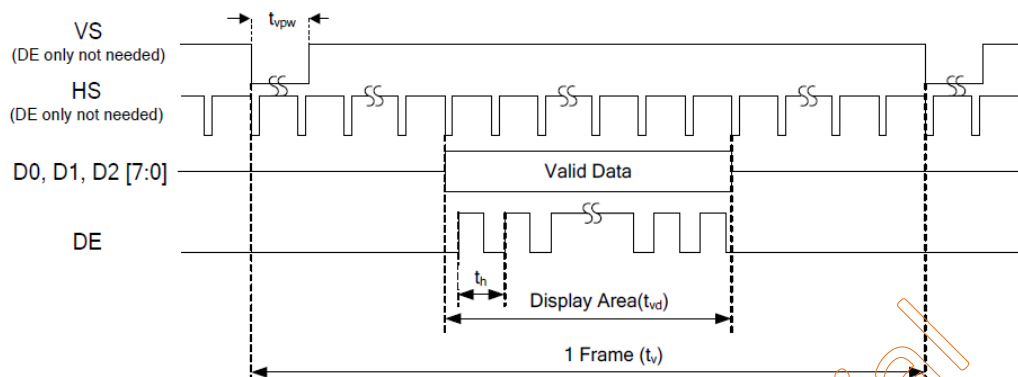
4. Signal Characteristic

4.1 Timing Characteristics

Item	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
DCLK frequency	fclk	-	148.5	-	MHz	Frame rate=60Hz
Horizontal valid data	thd	1920			DCLK	
Hsync pulse Width	thpw	-	44	-	DCLK	
Hsync back porch	thbp	-	232	-	DCLK	
Hsync front porch	thfp	-	48	-	DCLK	
H Blank	-	-	280	-	DCLK	
1 horizontal line	th	-	2200	-	DCLK	
Vertical valid data	tvd	1080			H	
Vsync pulse width	tvpw	-	5	-	H	
Vsync back porch	tvbp	-	42	-	H	
Vsync front porch	tvfp	-	3	-	H	
V Blank	-	-	45	-	H	
1 vertical field	tv	-	1125	-	H	



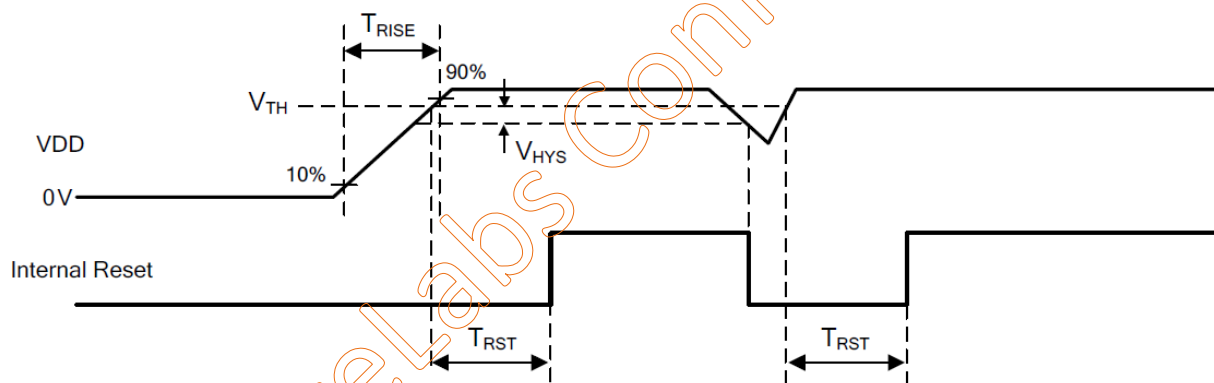
• Vertical



Vertical input timing at DE only mode

4.2 LVDS Signal Timing Characteristics

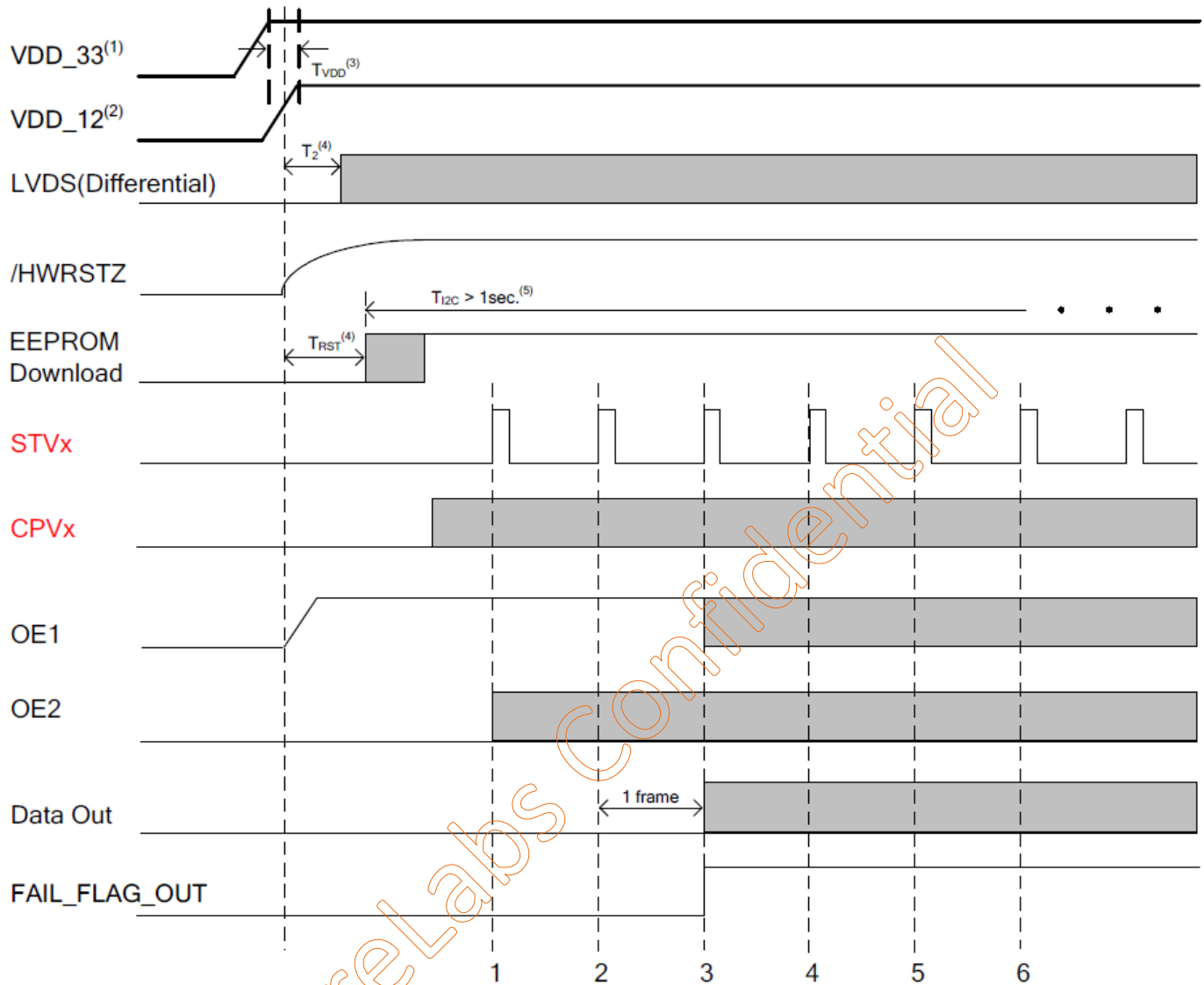
4.2.1 AC Electrical Characteristics



Power on reset

Parameter	Symbol	Values			Unit	Condition
		Min.	Typ.	Max.		
Reset threshold voltage	V_{TH}	0.7	0.8	0.9	V	For 1.25V power
		2.0	2.2	2.4	V	For 3.3V power
Hysteresis voltage	V_{HYS}	200	-	-	mV	For 3.3V power
Time constant of RC	T_{RST}	-	0.8RC	-	s	-
VDD rising time ⁽¹⁾	T_{RISE}	0.1	-	10	ms	For all power

Note (1) $T_{RISE} < T_{RST}$.



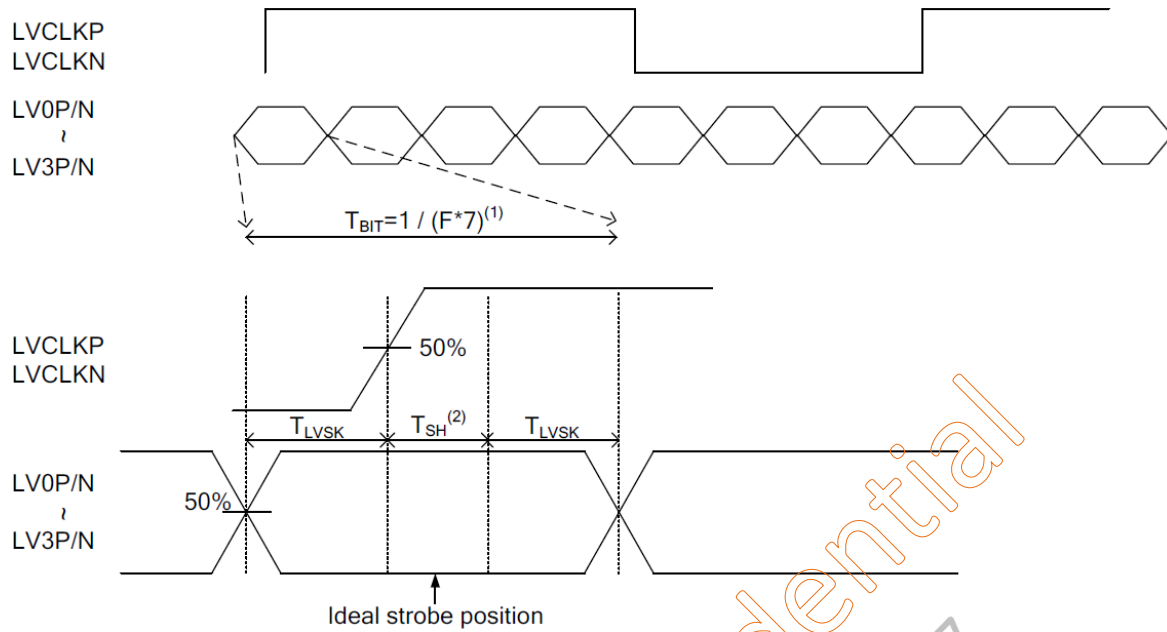
Note (1) VDD_33 means all 3.3V powers.

Note (2) VDD_12 means all 1.25V powers.

Note (3) $T_{VDD} < 200\mu s$.

Note (4) $0ms < T_2 < 50ms$, $T_2 \leq T_{RST}$.

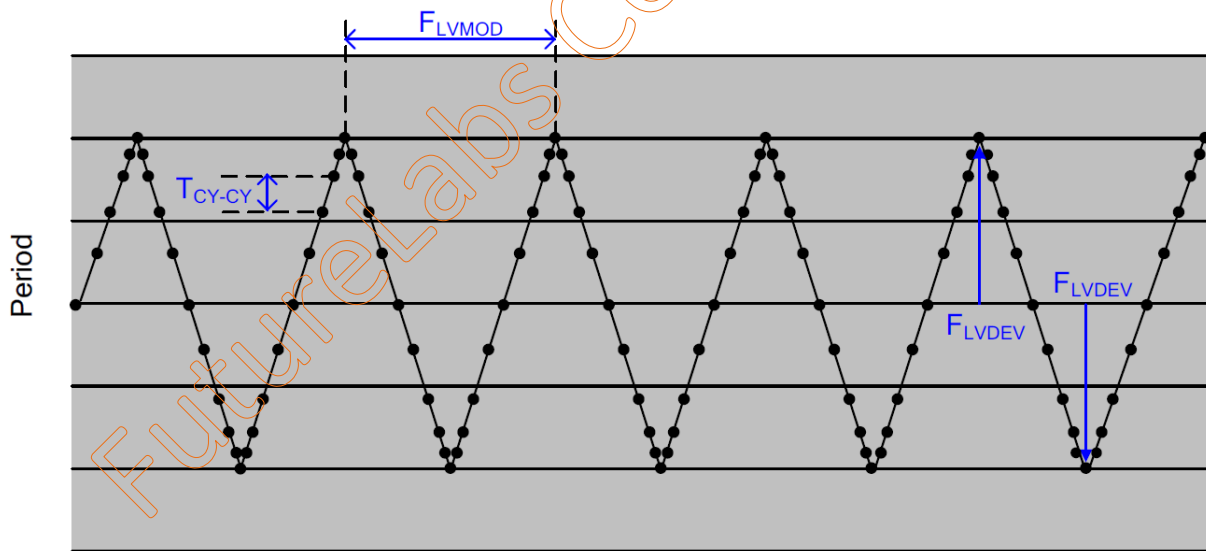
Note (5) $T_{I2C} > 1sec$. When $T_{I2C} < 1sec$, external I2C command is not allowed.



LVDS channel to channel skew

Note (1) T_{BIT} : Data period.

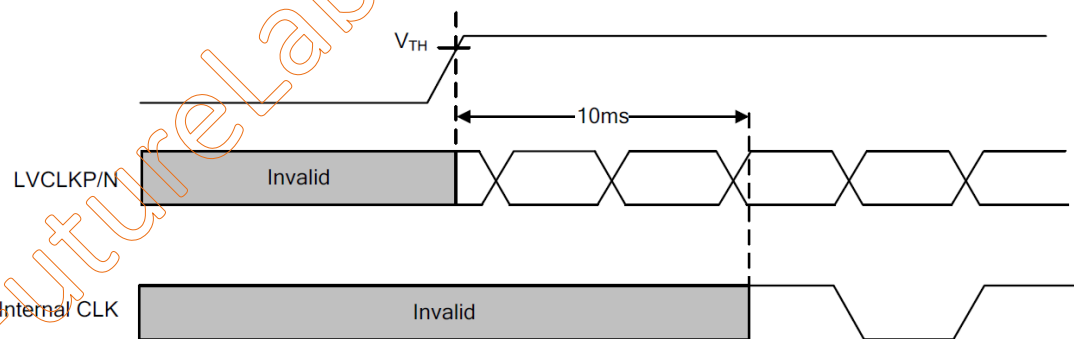
Note (2) T_{SH} : Internal clk sampling data window.



LVDS input SSC

Parameter	Symbol	Values			Unit	Condition
		Min.	Typ.	Max.		
LVDS input frequency	F	30	-	105	MHz	
LVDS channel to channel skew	T_{LVSK}	-600	-	+600	ps	F=30~65MHz $V_{IC}=1.2V$ $V_{ID}=\pm 200mV$
		-400	-	+400	ps	F=65~85MHz $V_{IC}=1.2V$ $V_{ID}=\pm 200mV$
		-300	-	+300	ps	F=85~95MHz $V_{IC}=1.2V$ $V_{ID}=\pm 200mV$
		-200	-	+200	ps	F=95~105MHz $V_{IC}=1.2V$ $V_{ID}=\pm 200mV$
Modulating frequency of input clock during SSC	F_{LVMOD}	10	-	200	KHz	F=105MHz $V_{IC}=1.2V$ $V_{ID}=\pm 200mV$
Maximum deviation of input clock frequency during SSC	F_{LVDEV}	-3	-	+3	%	
Cycle to cycle jitter	T_{CY-CY}	-	-	50	ps	

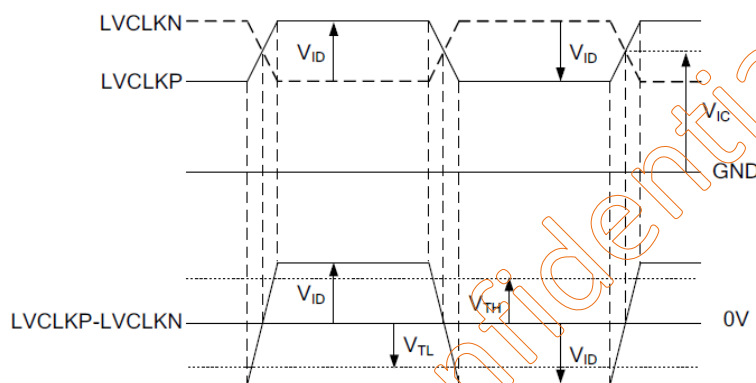
Phase Lock Loop wake-up time



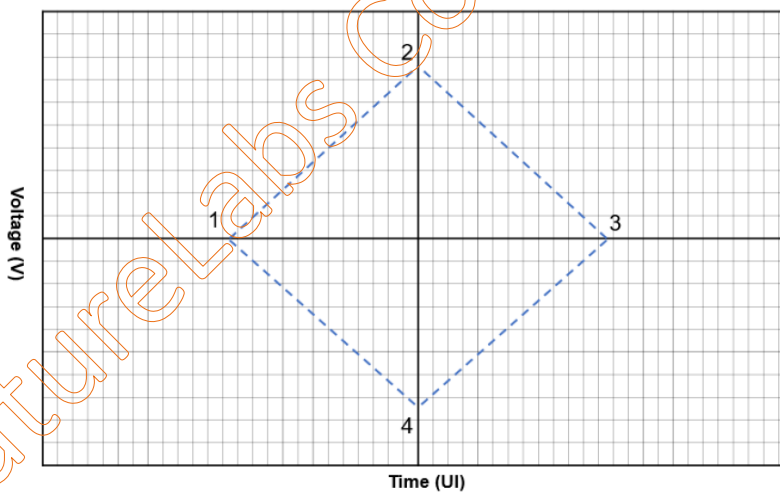
PLL wake up time

4.2.2 DC Electrical Characteristics

Parameter	Symbol	Values			Unit	Condition
		Min.	Typ.	Max.		
Differential input high threshold	V_{TH}	-	-	+100	mV	$V_{IC}=1.2V$
Differential input low threshold	V_{TL}	-100	-	-	mV	
LVDS common mode voltage	V_{IC}	0.7	-	1.6	V	
LVDS swing voltage	V_{ID}	± 100	-	± 600	mV	



LVDS V_{ID} and V_{IC} definition



Mask at TP3

Point	Time (UI)	Voltage (V)
High bit rate		
1	0.246	0.000
2	0.500	0.075
3	0.755	0.000
4	0.500	-0.075
Reduced bit rate		
1	0.375	0.000
2	0.500	0.023
3	0.625	0.000
4	0.500	-0.023

Sink eye vertices for TP3

5. INTERFACE PIN DESCRIPTION

5.1 LCM Connector PIN Assignment

The recommended model is MSBKT2407P30HB(STM) or 187034-3009(P-TWO) or Equivalent.

Pin No.	Symbol	I/O	Description	Note
1	RX00-	I	Odd pixel negative LVDS differential data input(O0-)	
2	RX00+	I	Odd pixel positive LVDS differential data input(O0+)	
3	RX01-	I	Odd pixel negative LVDS differential data input(O1-)	
4	RX01+	I	Odd pixel positive LVDS differential data input(O1+)	
5	RX02-	I	Odd pixel negative LVDS differential data input(O2-)	
6	RX02+	I	Odd pixel positive LVDS differential data input(O2+)	
7	GND	P	Ground	
8	RXCLK-	I	Odd pixel negative LVDS differential CLK input(OCLK-)	
9	RXCLK+	I	Odd pixel positive LVDS differential CLK input(OCLK+)	
10	RX03-	I	Odd pixel negative LVDS differential data input(O3-)	
11	RX03+	I	Odd pixel positive LVDS differential data input(O3+)	
12	RXE0-	I	Even pixel negative LVDS differential data input(E0-)	
13	RXE0+	I	Even pixel positive LVDS differential data input(E0+)	
14	GND	P	Ground	
15	RXE1-	I	Even pixel negative LVDS differential data input(E1-)	
16	RXE1+	I	Even pixel positive LVDS differential data input(E1+)	
17	GND	P	Ground	
18	RXE2-	I	Even pixel negative LVDS differential data input(E2-)	
19	RXE2+	I	Even pixel positive LVDS differential data input(E2+)	
20	RXECLK-	I	Even pixel negative LVDS differential CLK input(ECLK-)	
21	RXECLK+	I	Even pixel positive LVDS differential CLK input(ECLK+)	
22	RXE3-	I	Even pixel negative LVDS differential data input(E3-)	
23	RXE3+	I	Even pixel positive LVDS differential data input(E3+)	
24	GND	P	Ground	
25	NC	-	No Connection	
26	NC	-	No Connection	
27	NC	-	No Connection	
28	VDD	P	Power Supply	
29	VDD	P	Power Supply	
30	VDD	P	Power Supply	

Note (1) I: input; O: output; P: Power or Ground(0V).

5.2 Backlight Connector PIN Assignment

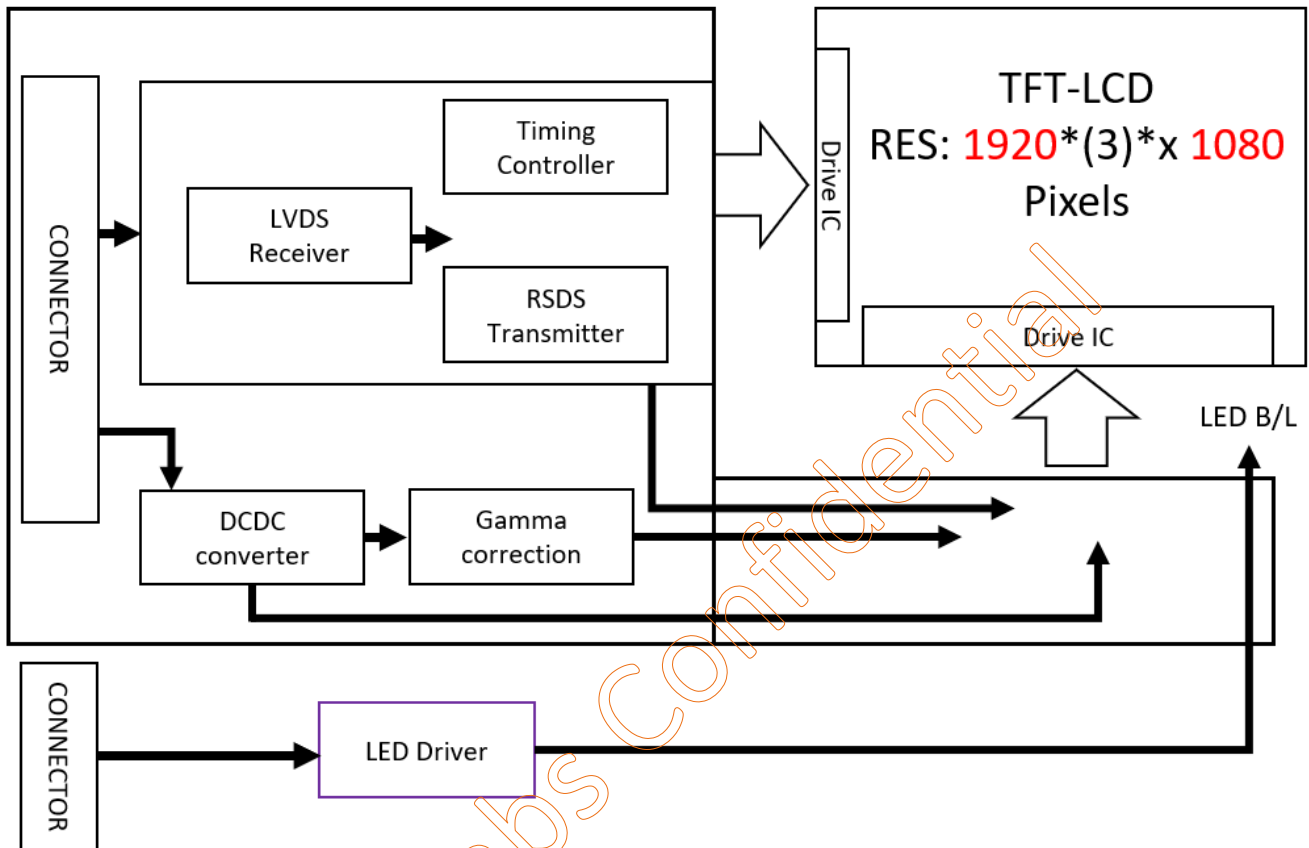
The recommended model is MSB24038P8D manufactured by STM.

Pin No.	Symbol	I/O	Description	Note
1	VLED 12V	P	BL Power supply 12V	
2	VLED 12V	P	BL Power supply 12V	
3	VLED 12V	P	BL Power supply 12V	
4	GND	P	Ground	
5	GND	P	Ground	
6	GND	P	Ground	
7	VLED_EN	I	Converter power IC Enable	
8	VPWM_EN	I	PWM Signal	

Note (1) I: input; O: output; P: Power or Ground(0V).

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 25 °C.

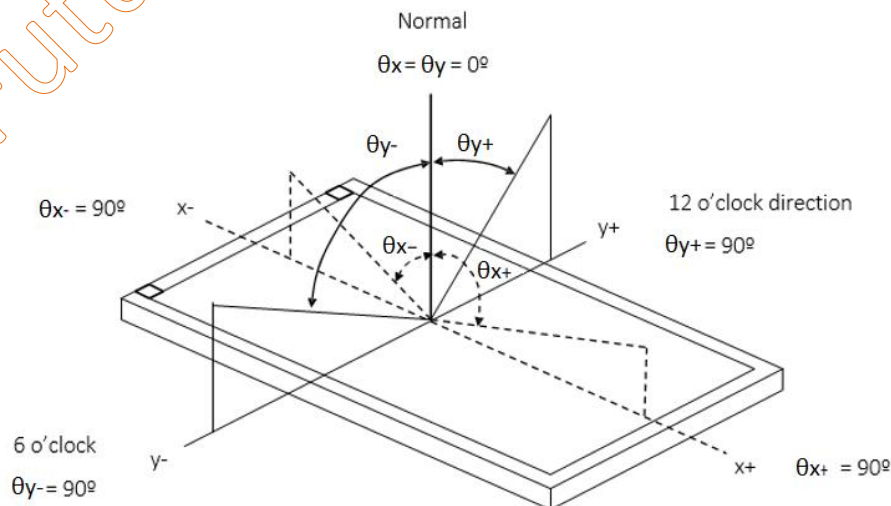
Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ$	1200	1500	-	-	(2)(5)
Response Time		T_R+T_F	25 °C	-	25	35	msec	(3)
Center Luminance of White		LC	$\theta_x=0^\circ, \theta_y=0^\circ$ Viewing angle at normal direction	400	500	-	cd/m ²	(4)(5)
Brightness uniformity				75	80		%	(5)(6)
Chromaticity	White	Wx		Typ. -0.05	0.310	Typ. +0.05	-	(1)(5)
		Wy			0.350		-	
Viewing Angle	Horizontal	θ_{x+}	CR $\geq$ 10	80	85	-	Deg.	(1)(5)
		θ_{x-}		80	85	-		
	Vertical	θ_{y+}		80	85	-		
		θ_{y-}		80	85	-		

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 $\pm$ 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

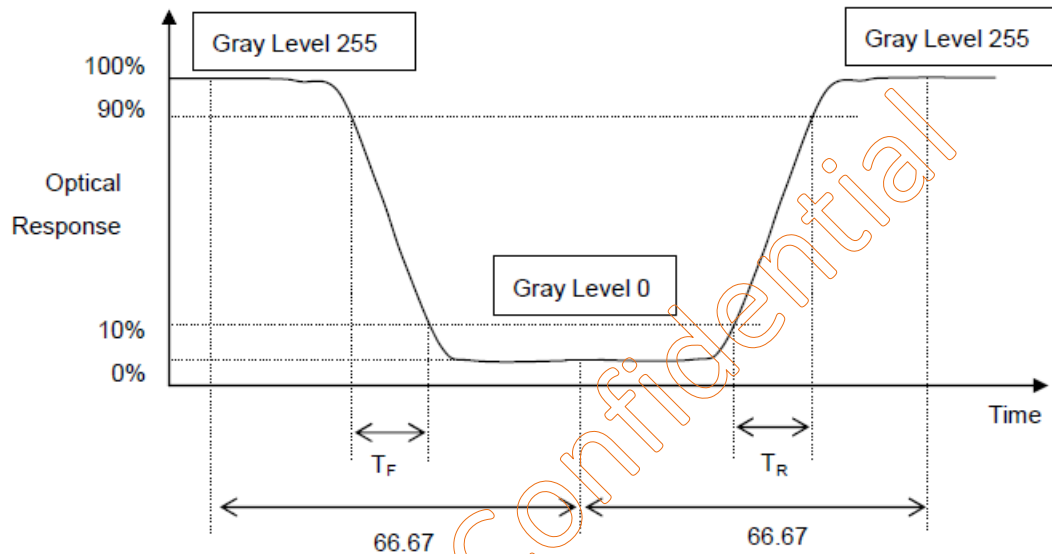


Note 2: Definition of Contrast Ratio (CR)

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:

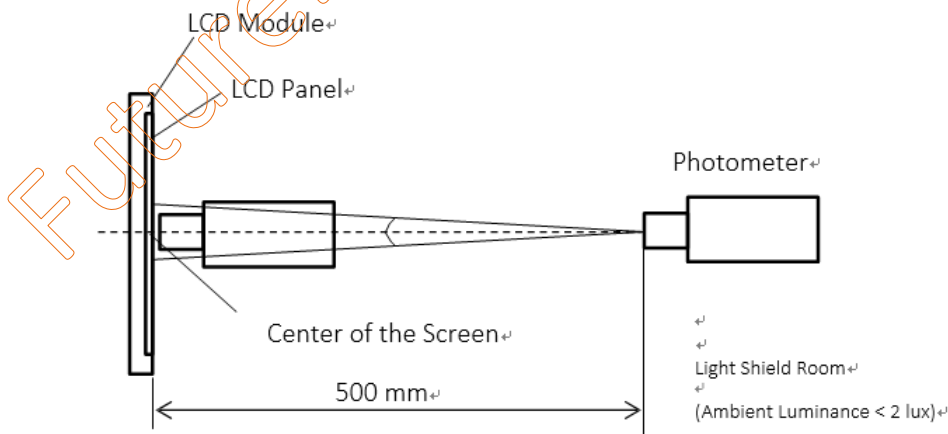
The response time is set initially by defining the “Rising Time (TR)” and the “Falling Time (TF)” respectively. Please refer the figure to the followings:



Note 4: Definition of Brightness (L)

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

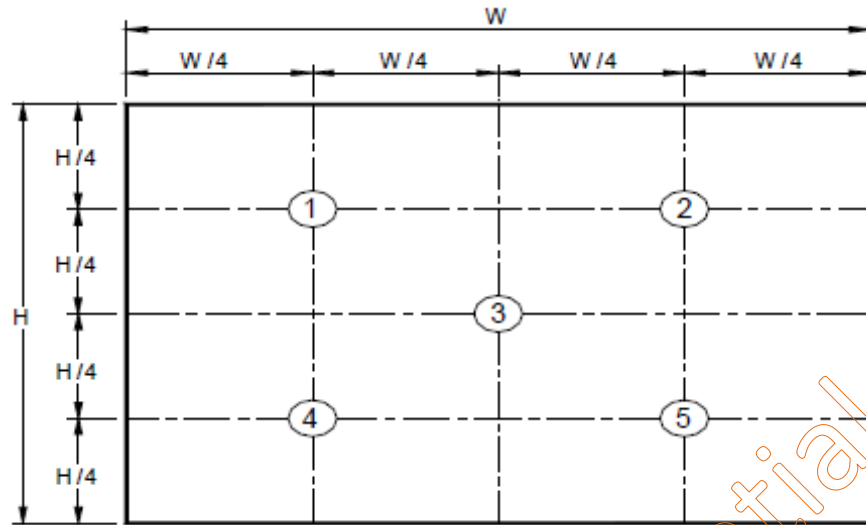
Note 5: The method of optical measurement:



Note 6: Definition of White Variation (δW):

Measure the luminance of gray level 255 at 5 points

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



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8. Touch Screen specification

8.1 Environmental Specification

Specification	Value
Operating Temperature	-30°C ~80°C
Storage Temperature	-40°C ~ 80°C
Operating Humidity	20% ~ 90%RH

8.2 Mechanical Specification

Specification	Value
Operating Life (Finger input)	10 ⁷ times
Light Transmittance	86% Min. (JIS K-7105) with glass
Surface hardness	7H
FPC Peeling Force	5N Max

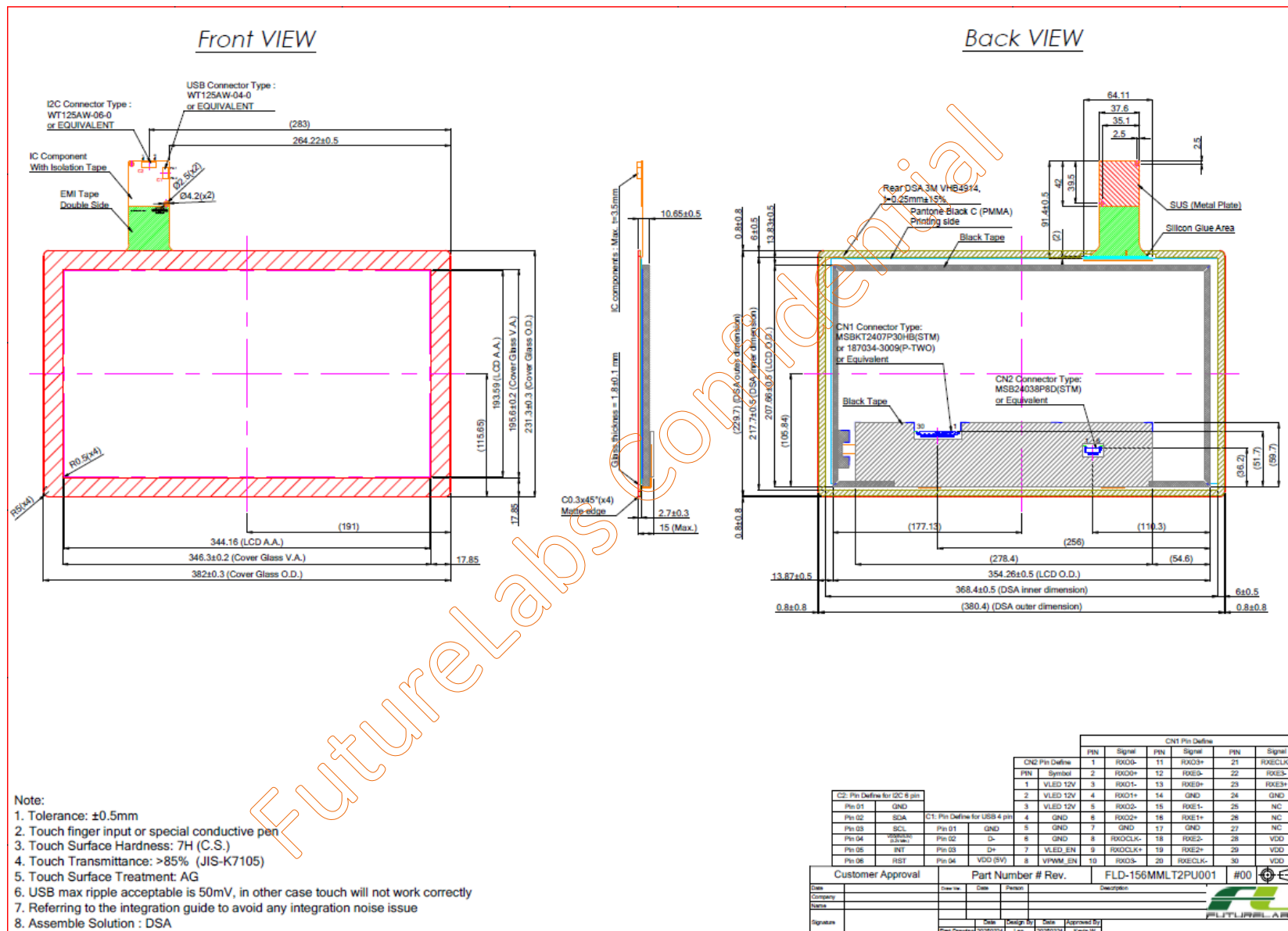
8.3 Electrical Specifications (USB Type Controller)

Parameters	Features
Circuit Board Dimension	Refer to drawings
Channels of Panel	Based on Sensor Design
Input Voltage	USB: 5VTyp.
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	16384×16384 resolution
Power consumption(mA)	Active Mode: <110mA
	Idle Mode : <55mA
	Sleep Mode :< 10mA
	(Operation Mode :Active Mode only)
Report rate(points/sec) Note(2)	> 100 Hz
Response time	Average < 25ms

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.

9. DIMENSION AND DRAWING



10. 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.
- For optical inspection please follow product IIS, for Integration follow Integration Guide
- 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.