SPECIFICATION
FOR
LCD Module
KD101FM-2-C001A

MODULE:	KD101FM-2-C001A
CUSTOMER:	

REV	DESCRIPTION	DATE
1.0	FIRST ISSUE	2016.10.07

STARTEK	INITIAL	DATE
PREPARED BY		
CHECKED BY		
APPROVED BY		

CUSTOMER	INITIAL	DATE
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Revision History

Date	Rev. No.	Page	Summary
2016.10.07	V1.0	ALL	FIRST ISSUE

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* Description

This is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 10.1'TFT-LCD contains 1280x800 pixels, and can display up to 16.7M colors.

* Features

-Low Input Voltage: 3.3V(TYP)

-Display Colors of TFT LCD: 16.7M colors

-TFT Interface: 1 Channel LVDS

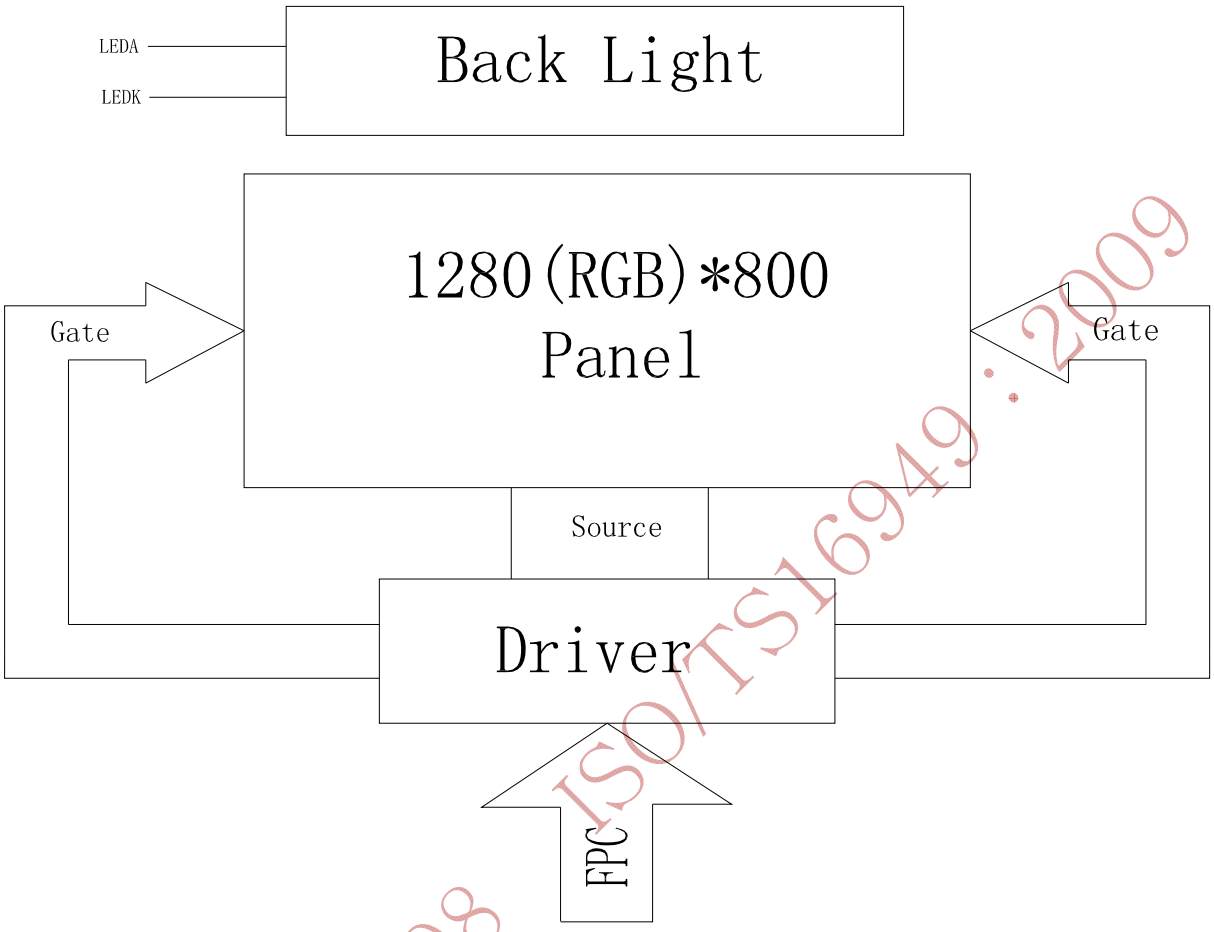
-CTP Interface: I2C/USB

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	216.96(H)*135.6(V) (10.1inch)	mm	-
CTP View area	217.96(H)*136.6(V)	mm	
Driver element	TFT active matrix	-	-
Display colors	65K/262K/16.7M	colors	-
Number of pixels	1280(RGB)*800	dots	-
TFT Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.1695(H)*0.1695(V)	mm	-
Viewing angle	ALL	o'clock	-
CTP Driver IC	FT5826QSL		
Display mode	Transmissive/Normally Black	-	-
Touch mode	10 point and Gestures		
Operating temperature	0～+50	℃	-
Storage temperature	-20～+60	℃	-

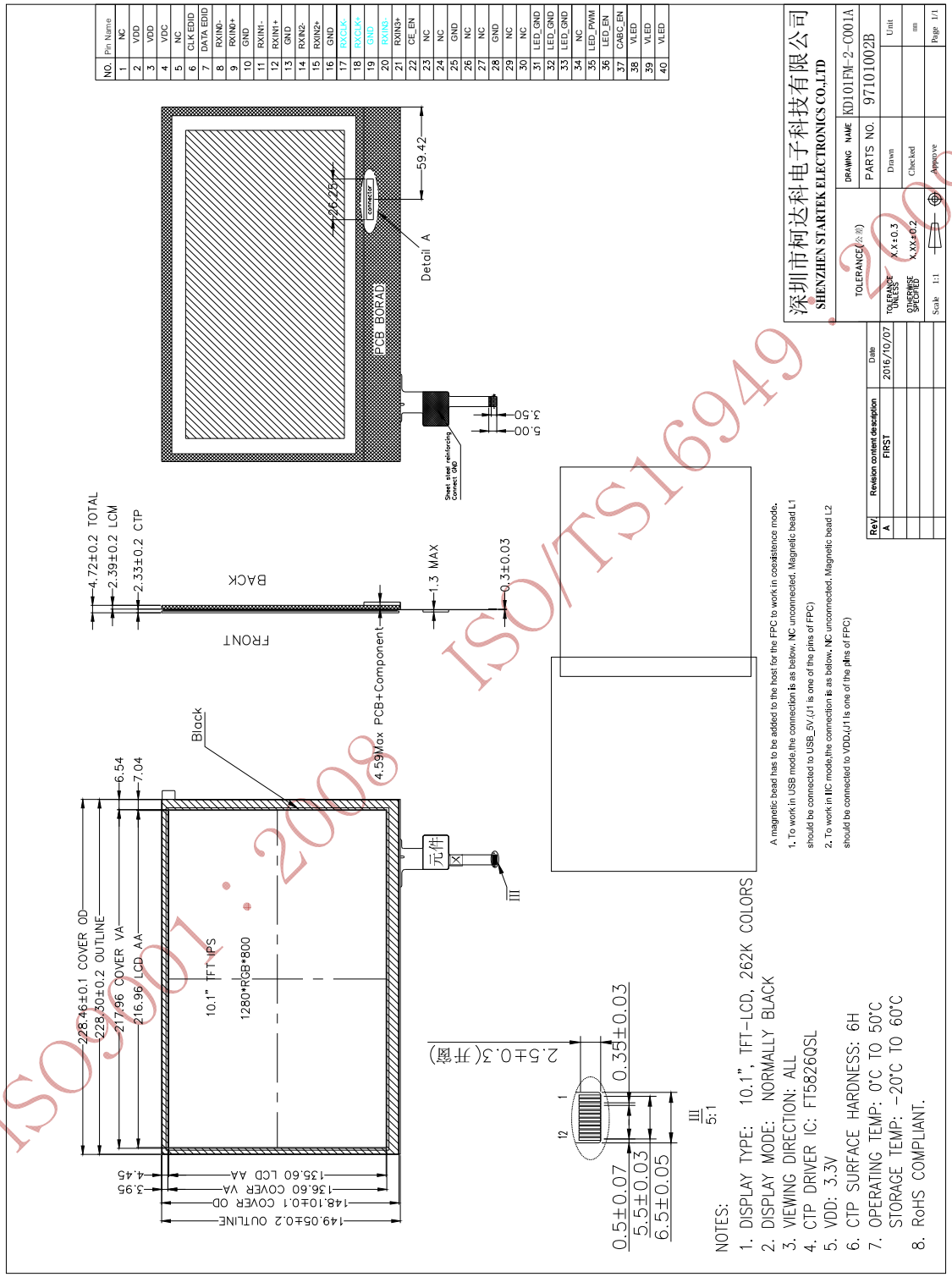
* Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)		228.46		mm	-
	Vertical(V)		149.5		mm	-
	Depth(D)		4.72		mm	-
Weight			TBD		g	-

1. Block Diagram



2. Outline dimension



3. Input terminal Pin Assignment

3.1 TFT

The electronics interface connector is 20455-040E-12.The connector interface pin assignments are listed in Table 6.

<Table 6. 1. Pin Assignments for the Interface Connector>

NO.	SYMBOL	DISCRIPTIONs
1	NC	No Connection
2	VDDIN	Power supply VDDIN=3.3V (Typ.)
3	VDDIN	
4	VDC	Power supply VDC=3.3V (Typ.)
5	NC	No Connection
6	CLK EDID	CLK for EDID function use
7	Data EDID	CLK for EDID function use
8	RIN0-	LVDS Negative data signal (-)
9	RIN0+	LVDS Positive data signal (+)
10	GND	GROUND
11	RIN1-	LVDS Negative data signal (-)
12	RIN1+	LVDS Positive data signal (+)
13	GND	GROUND
14	RIN2-	LVDS Negative data signal (-)
15	RIN2+	LVDS Positive data signal (+)
16	GND	GROUND
17	LVDS_CLK-	LVDS Negative CLK signal (-)
18	LVDS_CLK+	LVDS Positive CLK signal (+)
19	GND	GROUND
20	RIN3-	LVDS Negative data signal (-)
21	RIN3+	LVDS Positive data signal (+)
22	CE_EN	Color engine enable
23	NC	No Connection

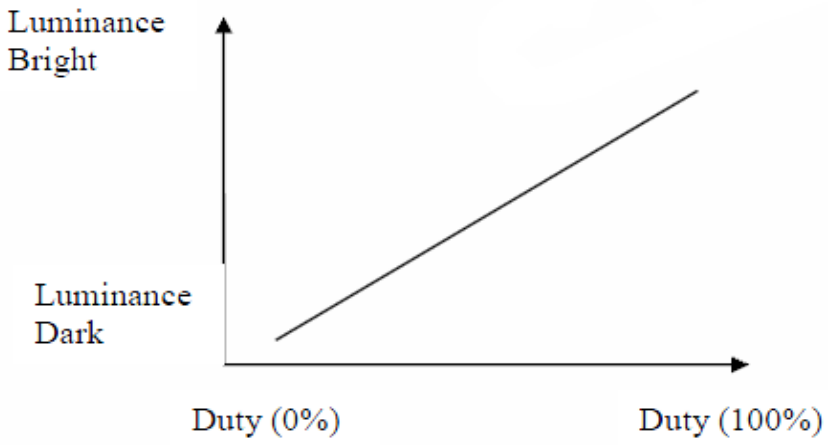
24	NC	No Connection
25	GND	GROUND
26	NC	No Connection
27	NC	No Connection
28	GND	GROUND
29	NC	No Connection
30	NC	No Connection
31	LED_GND	LED GROUND
32	LED_GND	
33	LED_GND	
34	NC	No Connection
35	LED_PWM	LED driver PWM duty
36	LED_EN	LED driver enable
37	CABC_EN	CABC function enable
38	VLED	Power supply VLED=3~18V (Typ.)
39	VLED	
40	VLED	

I: input, O: output, P: Power

Note1: The setting of CABC function are as follows.

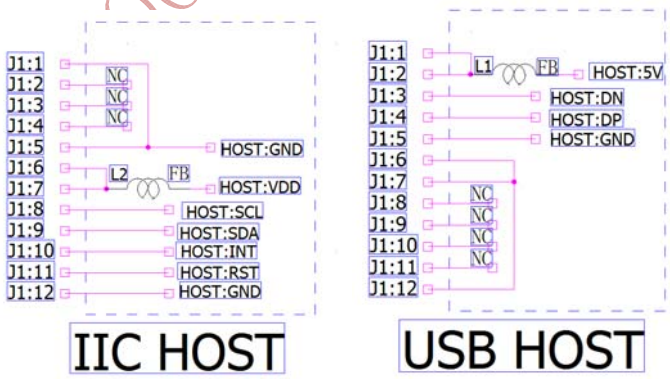
Pin	Enable	Disable
CABC_EN	High Voltage	Low Voltage or open

Note2: LED_PWM is used to adjust backlight brightness.



3.2 CTP

NO.	SYMBOL	DISCRIPTION	I/O
1	PSEL	Power Select pin. PSEL=0, powered by external voltage supply(2.8-3.6V); PSEL=5V(VBUS), powered by USB.	I
2	VBUS	VBUS sensor input, The pin should be connected to USB 4.5~5.5V power supply. This pin must be floating or connected to VDD3 when USB Power is not adopted. A 1μF ceramic capacitor to ground is required.	P
3	DN	USB D-	I/O
4	DP	USB D+	I/O
5	GND	Ground.	P
6	IOVCC	I/O power supply voltage.(I2C Interface select)	P
7	VDD	Supply voltage. (I2C Interface select)	P
8	SCL	I2C clock input. (I2C Interface select)	I
9	SDA	I2C data input and output(I2C Interface select)	I/O
10	INT	External interrupt to the host. (I2C Interface select)	I
11	RST	External Reset, Low is active. (I2C Interface select)	I
12	SS	Ground. (I2C Interface select)	P



NOTE: A magnetic bead has to be added to the host for the FPC to work in coexistence mode.

1. To work in USB mode,the connection is as below. NC unconnected. Magnetic bead L1 should be connected to USB_5V.(J1 is one of the pins of FPC)

2. To work in IIC mode,the connection is as below. NC unconnected. Magnetic bead L2 should be connected to VDD.(J1 is one of the pins of FPC)

4. LCD Optical Characteristics

4.1 Overview

The test of Optical specifications shall be measured in a dark room (ambient luminance ≤1lux andtemperature = 25±2℃) with the equipment of Luminance meter system (Goniometersystem and TOPCON BM-5) and test unit shall be located at an approximate distance50cm from the LCD surface at a viewing angle of Θand Φequal to 0°. While scanning Θand/or Ø, the center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement. VDD shall be 3.3+/-0.3V at 25°C.Optimum viewing angle direction is 6 'clock.

4.2 Optical Specifications

Item		Symbol	Condition	Min.	Typ.	Max.	Unit.	Note
Contrast Ratio		CR	Normal θ=Φ=0°	600	800			Note 2
Response time	Rising	$T_{R+}T_F$		--	25	--	msec	Note 6
	Falling							
Color Filter Chromacicity	White	W_X		Typ-0.03	0.313	Typ+0.03	--	Note 5
		W_Y		Typ-0.03	0.329	Typ+0.03		
Luminance	L			--	300	--	CD/m2	Note 3
Luminance uniformity	YU			--	80	--	%	Note 4
Viewing angle CR>10	Hor.	$Θ_L$	Φ=180°(9 o'clock)	70	80	--	degree	Note 1
		$Θ_R$	Φ=0°(3 o'clock)	70	80	--		
	Ver.	$Θ_U$	Φ=90°(12 o'clock)	70	80	--		
		$Θ_D$	Φ=270°(6 o'clock)	70	80	--		
Option View Direction		Free						

Notes : 1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).

2. Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state . (see FIGURE 1) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Center Luminance of white is defined as luminance values of 5point average across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display, the LED current is set at 20mA.

4. The White luminance uniformity on LCD surface is then expressed as : ΔY = Minimum Luminance of 5 (13)points / Maximum Luminance of 5(13) (points (see FIGURE 2).

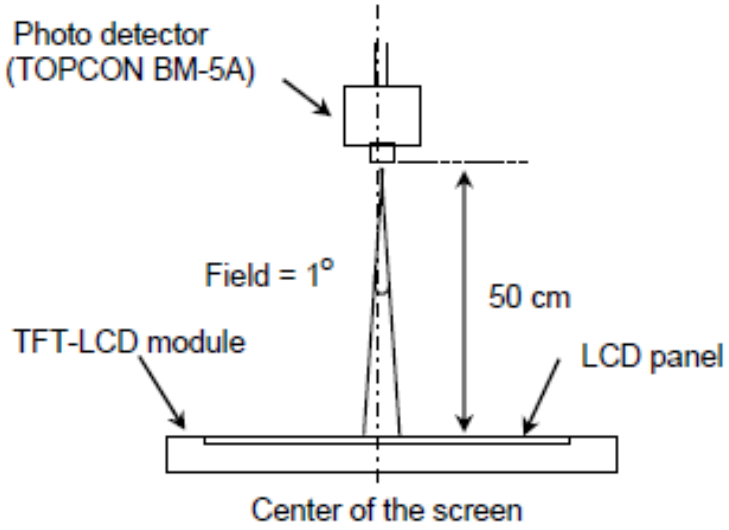
5. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.

6. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

7. Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark. (See FIGURE 4).

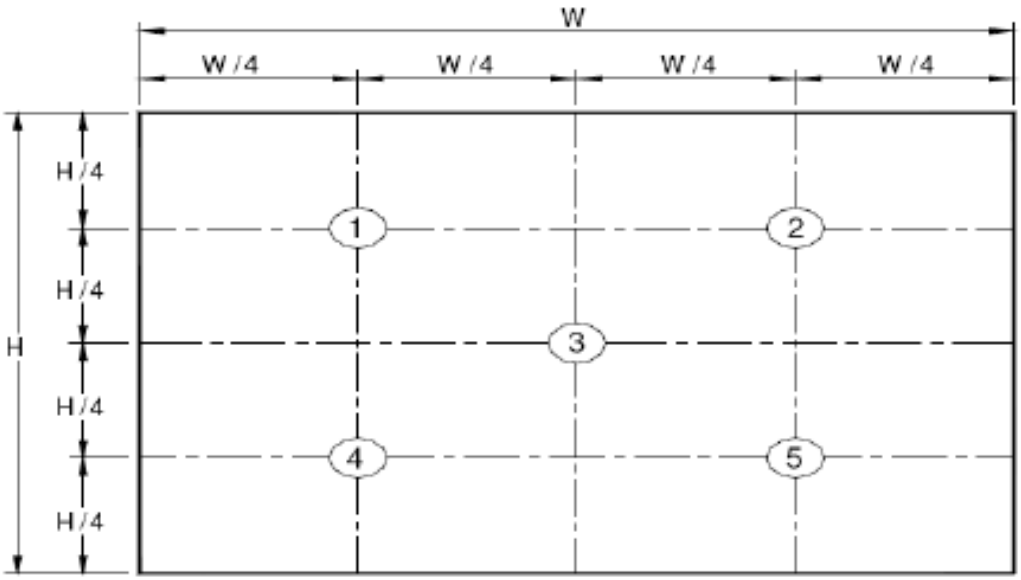
4.3 Optical measurements

Figure 1. Measurement Set Up



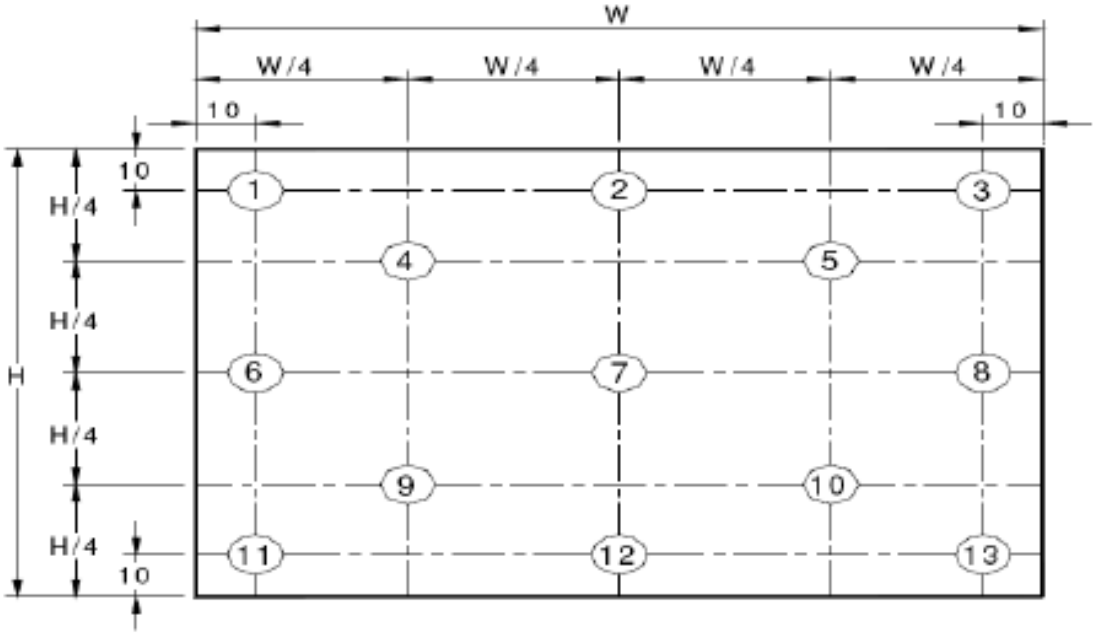
View angel range measurement setup

Figure 2. White Luminance and Uniformity Measurement Locations (5 points)



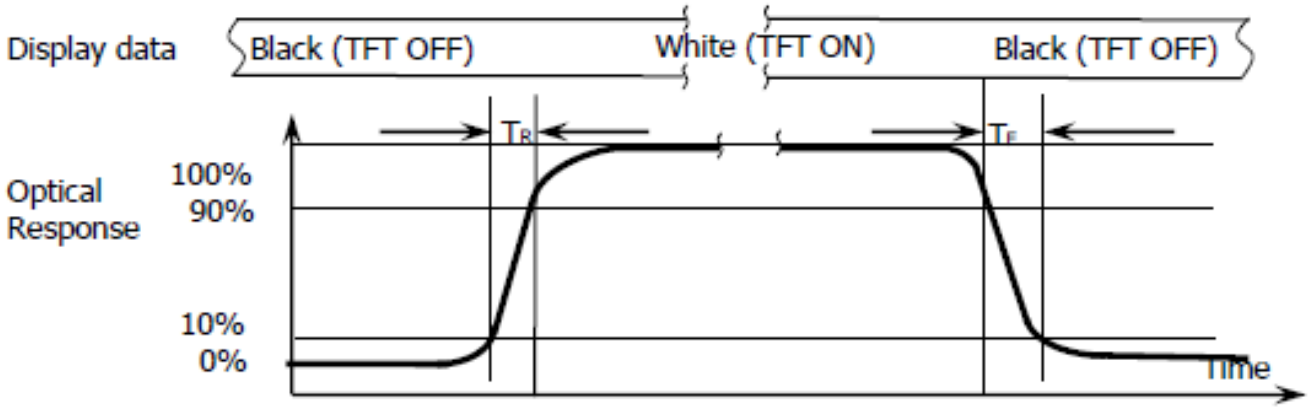
Center Luminance of white is defined as luminance values of center 5 points across the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in FIGURE 2 for a total of the measurements per display.
The White luminance uniformity on LCD surface is then expressed as : ΔY5 = Minimum Luminance of 5 points / Maximum Luminance of 5points (see FIGURE 2).

Figure 3. Uniformity Measurement Locations (13 points)



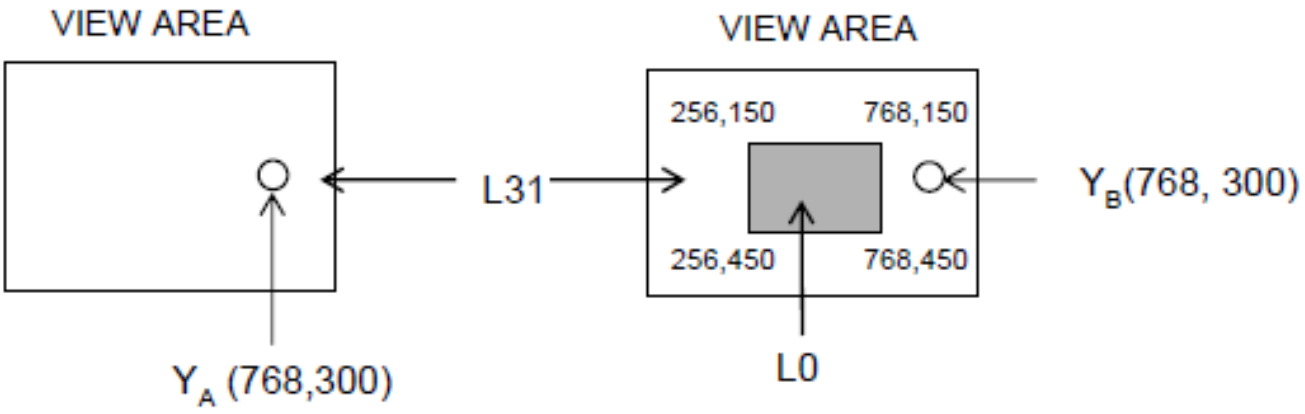
The White luminance uniformity on LCD surface is then expressed as : ΔY13 = Minimum Luminance of 13 points /Maximum Luminance of 13 points (see FIGURE 3).
The White luminance uniformity of 5 point is the same test method as 13 point using FIGURE 2.

Figure 4. Response Time Testing



The electro-optical response time measurements shall be made as shown in FIGURE 4 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr and 90% to 10% is Td.

Figure 5. Cross Modulation Test Description



$$\text{Cross-Talk (\%)} = \left| \frac{Y_B - Y_A}{Y_A} \right| \times 100$$

Where:

Y_A = Initial luminance of measured area (cd/m^2)
Y_B = Subsequent luminance of measured area (cd/m^2)

The location measured will be exactly the same in both patterns.

Cross-Talk of one area of the LCD surface by another shall be measured by comparing the luminance (YA) of a 25mm diameter area, with all display pixels set to a gray level, to the luminance (YB) of that same area when any adjacent area is driven dark (Refer to FIGURE 5).

5. Electrical Characteristics

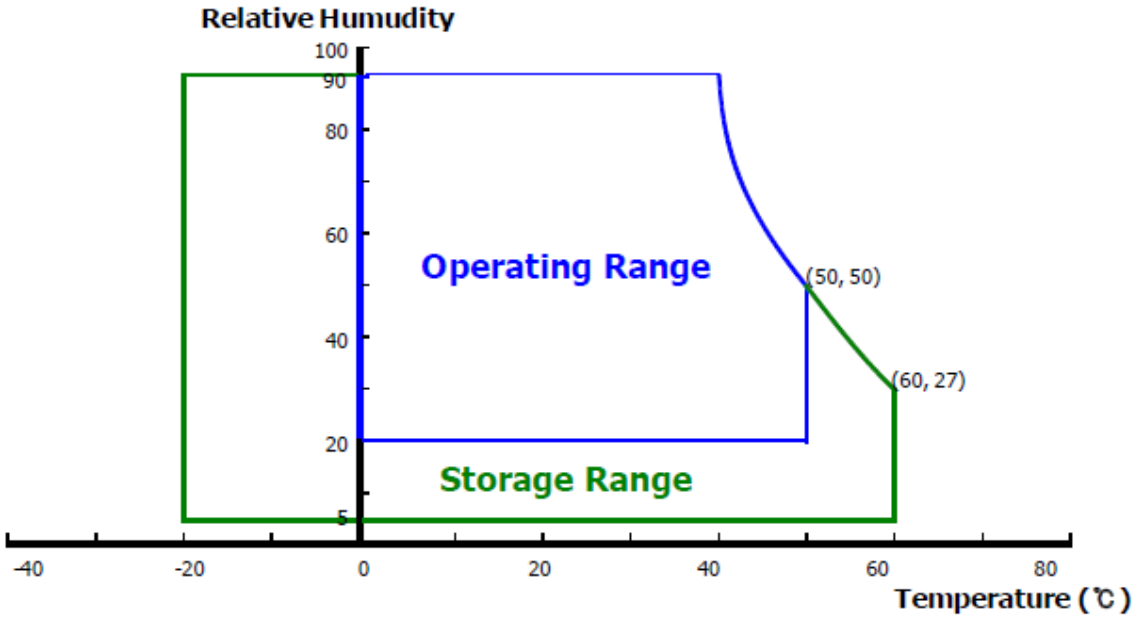
5.1 Absolute Maximum Ratings

The followings are maximum values which, if exceed, may cause faulty operation or damage to the unit. The operational and non-operational maximum voltage and current values are listed in Table 2.

< Table 2. LCD Module Electrical Specifications > [Ta =25±2 ℃]

Parameter	Symbol	Min.	Max.	Unit	Remarks
Power Supply Voltage (LCD Module)	V_{DD}	-0.3	4.2	V	
Back-light Power Supply Voltage	HV_{DDOUT}	-0.3	18	V	
Back-light LED Current	I_{HVDD}	-	96	mA	
Back-light LED Reverse Voltage	V_R	-	2	V	
Operating Temperature	T_{OP}	0	+50	℃	1)
Storage Temperature	T_{ST}	-20	+60	℃	

Note : 1) Temperature and relative humidity range are shown in the figure below.
Wet bulb temperature should be 39 ℃ max. and no condensation of water.



5.2 Backlight Driving Conditions

< Table 4. LED Driving guideline specifications > Ta=25+/-2°C

Parameter			Min.	Typ.	Max.	Unit	Remarks
LED Forward Voltage		V_F	-	2.8	3.0	V	-
LED Forward Current		I_F	-	20	21	mA	-
LED Power Consumption		P_{LED}	-	2	2.3	W	Note 1
LED Life-Time		N/A	15,000	-	-	Hour	IF = 20mA Note 2
Power supply voltage for Back light		V_{LED}	-	16.8	-	V	
Power supply Current for Back light		I_{LED}	-	120	-	mA	
EN Control Level	Backlight on	V_{ENH}	1.2	-	-	V	EN logic high voltage
	Backlight off	V_{ENL}	-	-	0.4	V	EN logic low voltage
PWM Control Level	PWM High Level	V_{PML}	1.2	-	-	V	
	PWM Low Level	V_{PML}	-	-	0.4	V	
PWM Control Frequency		F_{PWM}	5	-	20	KHz	
PWM duty Ratio			10%	-	-	%	

Notes : 1. Calculator Value for reference $I_{LED} \times V_{LED} = P_{LED}$

2. The LED Life-time define as the estimated time to 50% degradation of initial luminous.

5.3 TFT LCD Module

< Table 3. LCD Module Electrical Specifications > [Ta =25±2 ℃]

Parameter	Symbol	Values			Unit	Notes
		Min	Typ.	Max		
Power Supply Input Voltage	V_{DD}	3.0	3.3	3.6	V	Note 1
Power Supply Current	I_{DD}	-	303	-	mA	
LED Driver Power Supply Voltage	H_{VDD}	3	-	18	V	Note 2
LED Driver Power Supply Current	I_{HVDD}	-	568	-	mA	
LED Driver Efficiency	η	-	85	-	%	
Positive-going Input Threshold Voltage	V_{IT+}	-	-	+100	mV	Vcom = 1.2V typ.
Negative-going Input Threshold Voltage	V_{IT-}	-100	-	-	mV	
Differential input common mode voltage	V_{com}	-	1.2	-	V	V_{IH}=100mV, V_{IL}=-100mV
Power Consumption	P_D	-	1.0		W	
	P_{BL}	-	2.4		W	Have Driver
	P_{Total}	-	3.4		W	

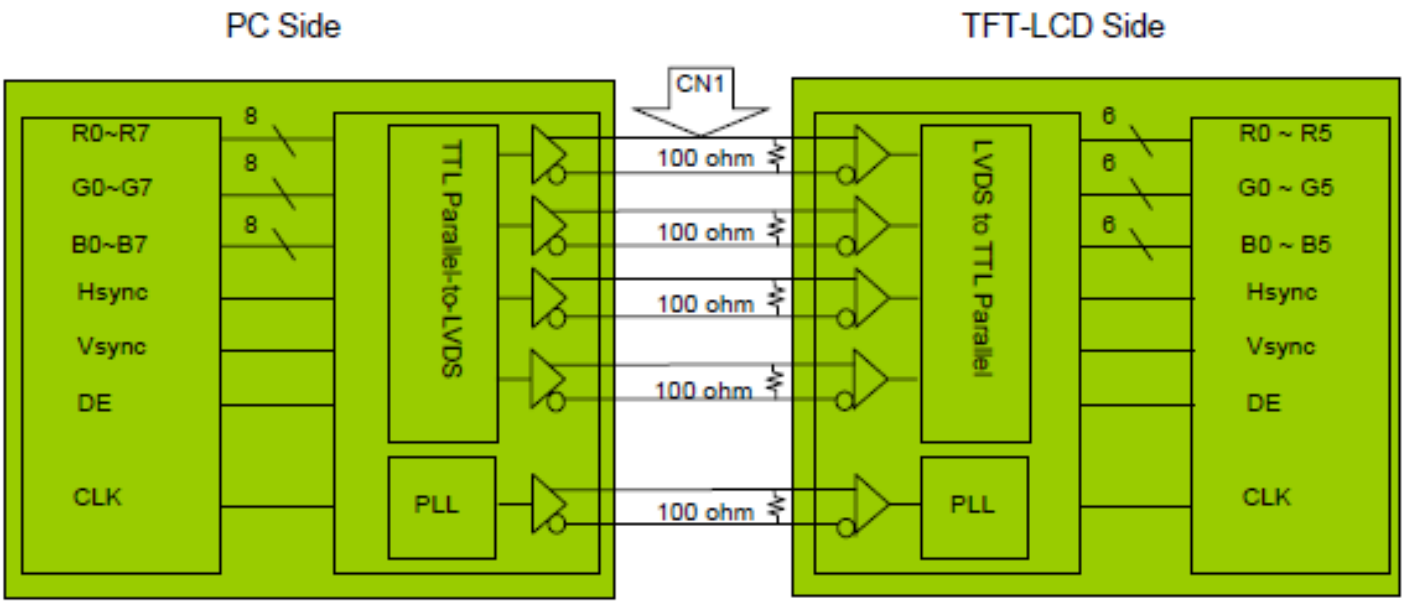
Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.
The current draw and power consumption specified is for 3.7V at 25 ℃
Max value at White Pattern

2. Calculated value for reference (VLED X ILED)

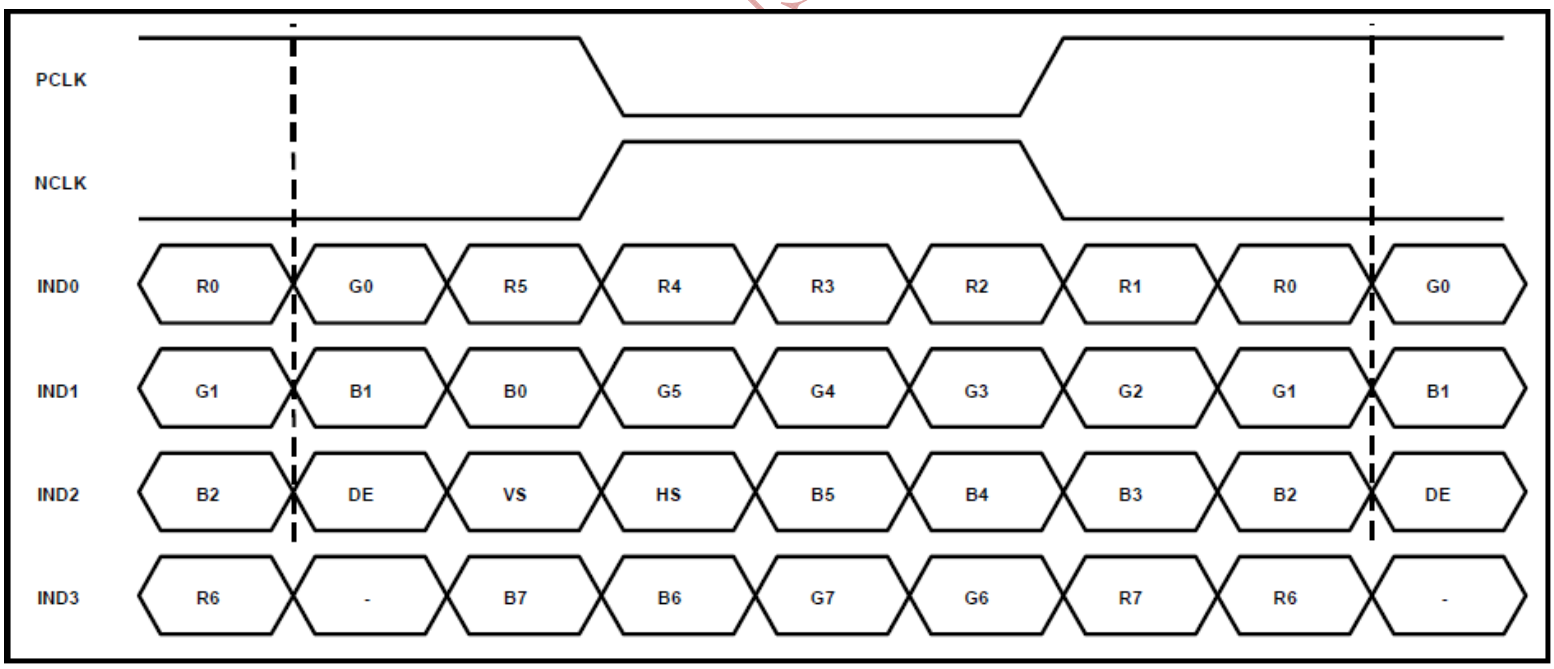
3. CTF of Power Supply Current: PD /PBL

6. LVDS Signal Timing Characteristics

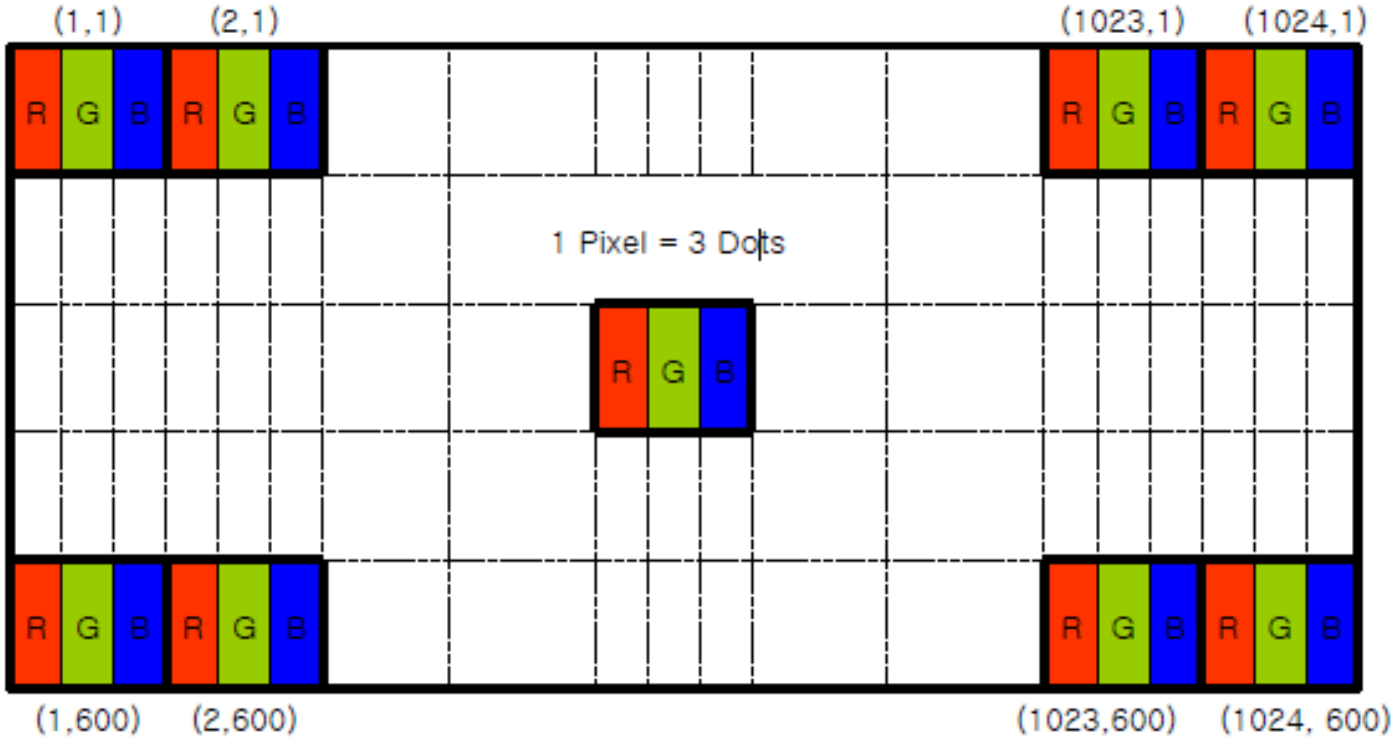
6.1 LVDS Interface



6.2 LVDS Input signal



6.3 LVDS Data Input Format



Display Position of Input Data (V-H)

7. SIGNAL TIMING SPECIFICATION

7.1 The KD101FM-2 is operated by the DE only.

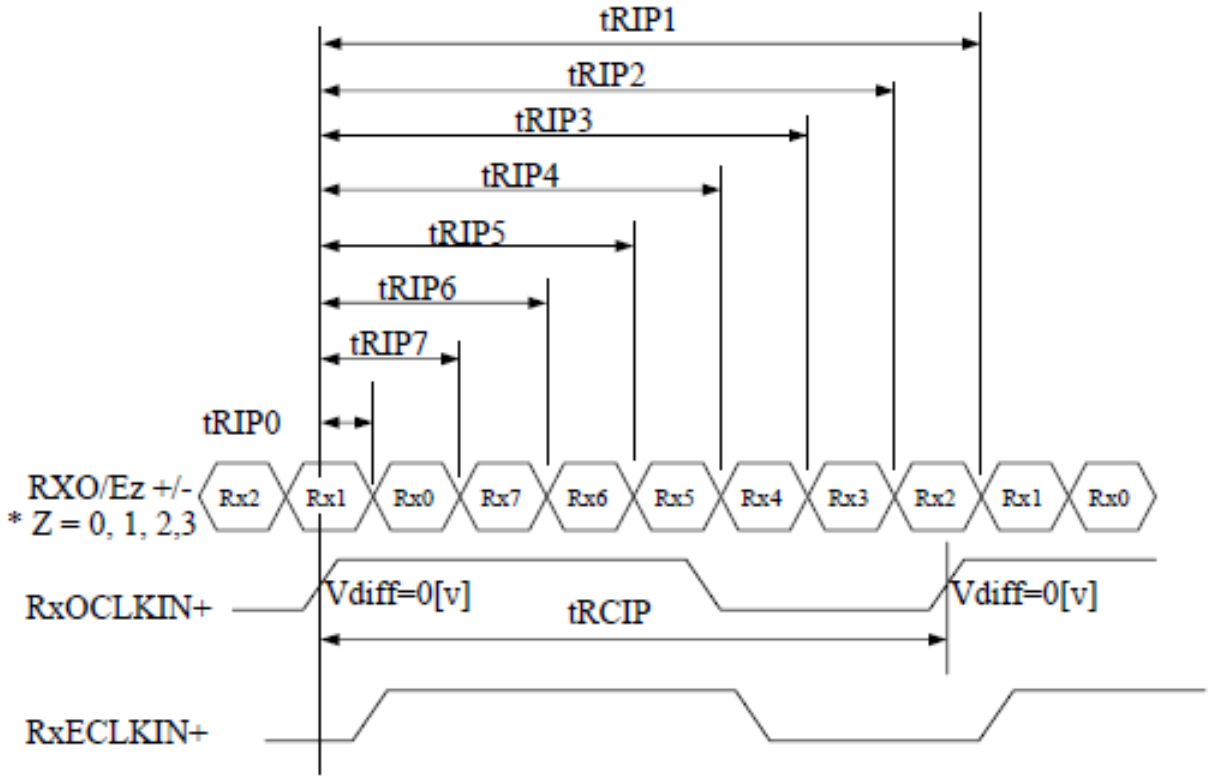
Parameter		Symbol	Min.	Typ.	Max.	Unit
Clock	Frequency	1/Tc	60	65	80	MHz
	Cycle	Tc	16.66	15.38	12.5	ns
Data Enable	Horizontal Period	THd	1280	1280	1280	Tc
	Horizontal Cycle	TH	1310	1330	1560	TC
		TH_time	19.5	20.46	21.83	ns
	Vertical Period	TVd	800	800	800	TC
	Vertical Cycle	TV		812		TC

7.2 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 8.

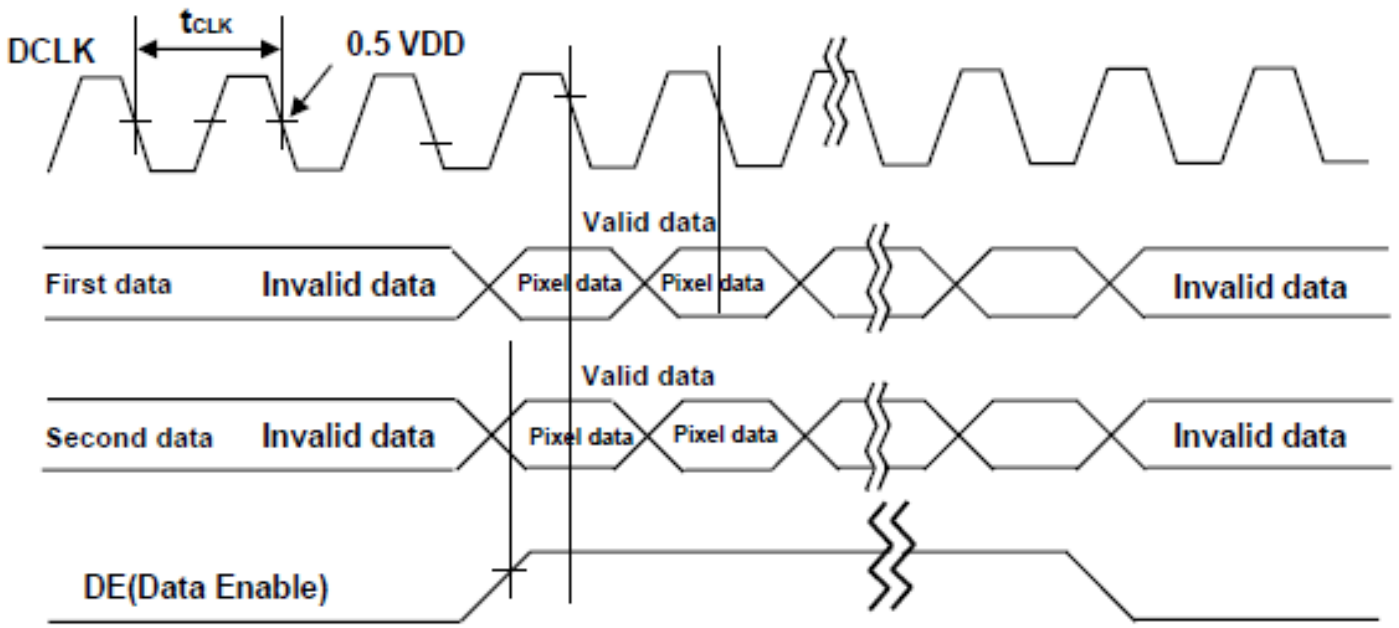
<Table 8. LVDS Rx Interface Timing Specification>

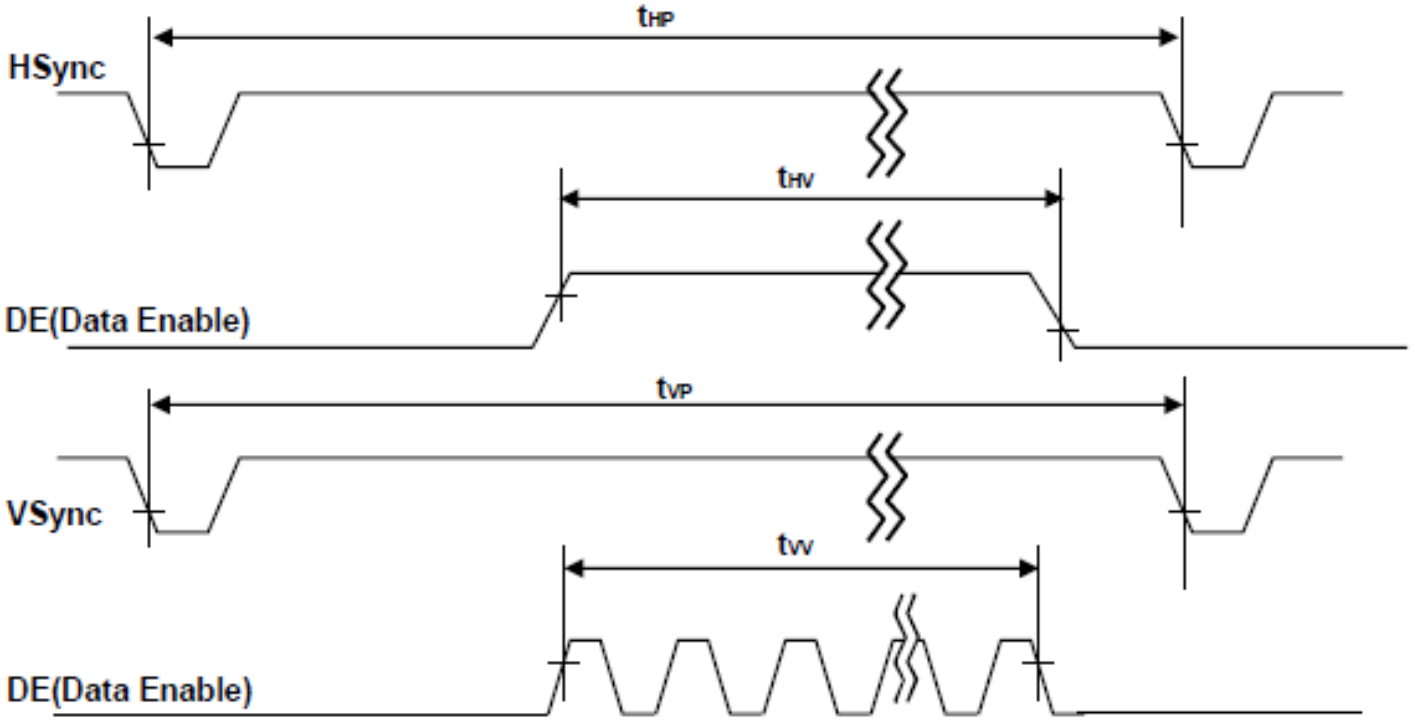
Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCIP	14.88	19.53	24.51	nsec	
Input Data 0	tRIP1	-0.4	0.0	+0.4	nsec	
Input Data 1	tRIP0	tRICP/7-0.4	tRICP/7	tRICP/7+0.4	nsec	
Input Data 2	tRIP7	2 ×tRICP/7-0.4	2 ×tRICP/7	2 ×tRICP/7+0.4	nsec	
Input Data 3	tRIP6	3 ×tRICP/7-0.4	3 ×tRICP/7	3 ×tRICP/7+0.4	nsec	
Input Data 4	tRIP5	4 ×tRICP/7-0.4	4 ×tRICP/7	4 ×tRICP/7+0.4	nsec	
Input Data 5	tRIP4	5 ×tRICP/7-0.4	5 ×tRICP/7	5 ×tRICP/7+0.4	nsec	
Input Data 6	tRIP3	6 ×tRICP/7-0.4	6 ×tRICP/7	6 ×tRICP/7+0.4	nsec	
Input Data 7	tRIP2	7 ×tRICP/7-0.4	7 ×tRICP/7	7 ×tRICP/7+0.4	nsec	



* Vdiff = (RXO/Ez+)-(RXO/Ez-),.... ,(RXO/ECLK+)-(RXO/ECLK-)

7.3 SIGNAL TIMING WAVEFORMS OF INTERFACE SIGNAL





7.4 INPUT SIGNALS, BASIC DISPLAY COLORS & GRAY SCALE OF COLORS

Color & Gray Scale		Input Data Signal																							
		Red Data								Green Data								Blue Data							
		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
	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
	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
	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
	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
	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	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
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	▽	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	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	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
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0
	▽	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	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	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
	△	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	0	1
	▽	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Gray Scale of White	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
	△	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
	Darker	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
	△	↑								↑								↑							
	▽	↓								↓								↓							
	Brighter	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1
	▽	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	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

8. CTP Specification

8.1 Electrical Characteristics

8.1.1 Absolute Maximum Rating

Item	Symbol	Min.	Max.	Unit	Note
Power Supply Voltage	VDD	-0.3	3.6	V	1,2
I/O Digital Voltage	IOVCC	1.8	3.6	V	1
Operating temperature	T_{OP}	0	50	℃	1
Storage temperature	T_{ST}	-20	60	℃	1

NOTES:

1.If used beyond the absolute maximum ratings, FT5X26 may be permanently damaged. It is strongly recommended that the device be used within the electrical characteristics in normal operations. If exposed to the condition not within the electrical characteristics, it may affect the reliability of the device.

2.Make sure VDDA(high)≥VSSA (low)

3.Make sure VDD (high)≥VSS (low).

8.1.2 DC Electrical Characteristics

Table 3-2 DC Characteristics (VDDA=VDD3=2.8~3.3V, Ta=-40~85℃)

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit	Note
Input high-level voltage	VIH		0.7 x IOVCC	--	IOVCC	V	
Input low -level voltage	VIL		-0.3	--	0.3 x IOVCC	V	
Output high -level voltage	VOH	IOH=-0.1mA	0.7 x IOVCC	--	--	V	
Output low -level voltage	VOL	IOH=0.1mA	--	--	0.3 x IOVCC	V	
I/O leakage current	ILI	Vin=0~VDDA	-1	--	1	μA	
Current consumption (Normal operation mode)	Iopr	VDDA=VDD3 = 2.8V Ta=25℃ MCLK=24MHz	--	Table3-3	--	mA	
Current consumption (Monitor mode)	Imon	VDDA=VDD3 = 2.8V Ta=25℃ MCLK=24MHz	--	Table3-3	--	mA	
Current consumption (Sleep mode)	Islp	VDDA=VDD3 = 2.8V Ta=25℃ MCLK=24MHz	--	Table3-3	--	μA	
Step-up output voltage	VDD5	VDDA=VDD3= 2.8V	4.5	5.0	5.2	V	
Power Supply voltage	VDDA VDD3		2.8		3.6	V	

8.1.3 Power Consumption

Table 3-3 Power Consumption

IC	Interface	Active (mA)	Monitor(mA)	Sleep(uA)
FT5C26	I2C	19.16	9.88	35.4
	I2C-HID	19.02	9.66	188.5
	USB-HID	20.73	10.27	187.5
FT5B26	I2C	17.20	8.63	35.4
	I2C-HID	17.21	8.67	188.5
	USB-HID	18.77	9.48	187.5
FT5926	I2C	15.12	7.77	35.4
	I2C-HID	15.01	7.58	188.5
	USB-HID	16.68	8.56	187.5
FT5826	I2C	12.97	6.85	35.4
	I2C-HID	12.91	6.78	188.5
	USB-HID	14.55	7.44	187.5

8.1.4 AC Characteristics

Table 3-4 AC Characteristics of Oscillators

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit	Note
OSC clock 1	fosc1	VDD3 = 2.8V Ta=25℃	47	48	49	MHz	

Table 3-5 AC Characteristics of TX & RX

Item	Symbol	Test Condition	Min	Typ	Max	Unit	Note
TX acceptable clock	ftx		100	150	270	KHz	
TX output rise time	Ttxr		--	20	--	nS	
TX output fall time	Ttxf		--	20	--	nS	
RX input voltage	Trxi		1.2	--	1.6	V	

8.1.5 I/O Ports Circuits

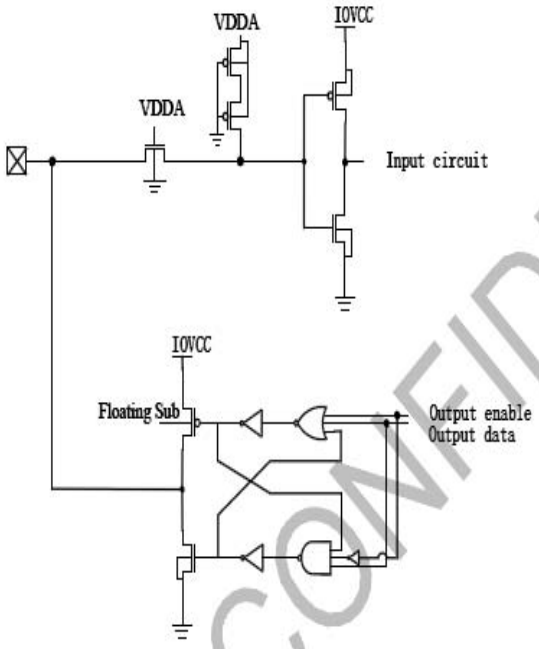


Figure 3-1 Digital In/Out Port Circuit

The input/output property can be configured via firmware setting. The firmware can also control its output behavior as push-pull or as open-drain that SDA of I2C interface is required.

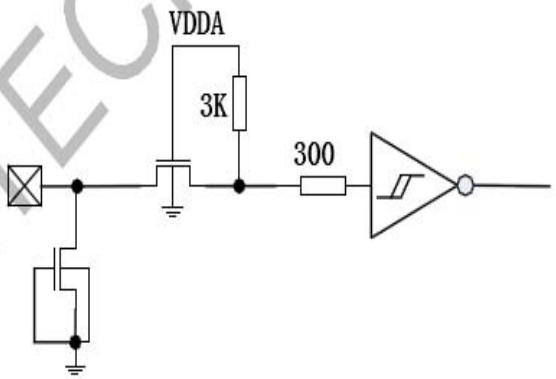


Figure 3-2 Reset Input Port Circuits

8.1.6 POWER ON/Reset Sequence

Reset should be pulled down to be low before powering on and powering down. I2C/SPI shouldn't be used by other devices during Reset time after IOVCC powering on (Tprt). INT signal will be sent to the host after initializing all parameters and then start to report points to the host. If Power is down, the voltage of supply must be below 0.3V and Tpdt is more than 5ms.

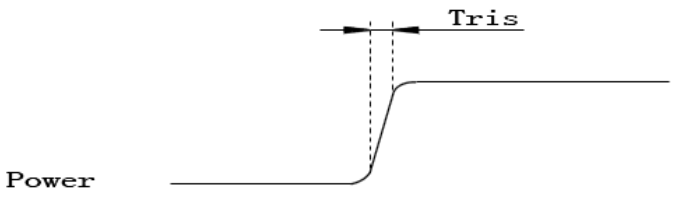


Figure 3-7 Power on time

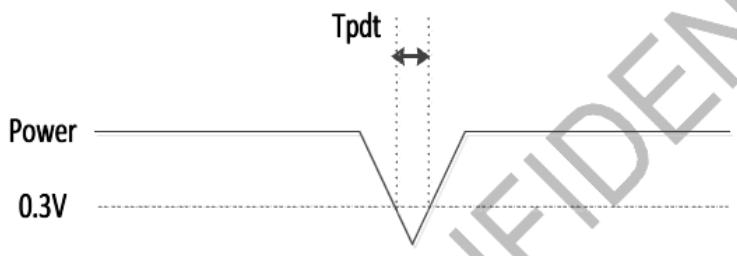


Figure 3-8 Power Cycle requirement

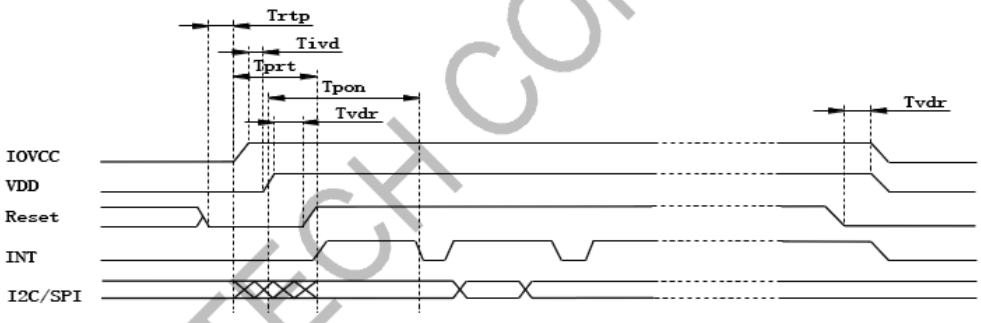


Figure 3-9 Power on / down Sequence

Reset time must be enough to guarantee reliable reset, The time of starting to report point after resetting approach to the time of starting to report point after powering on.

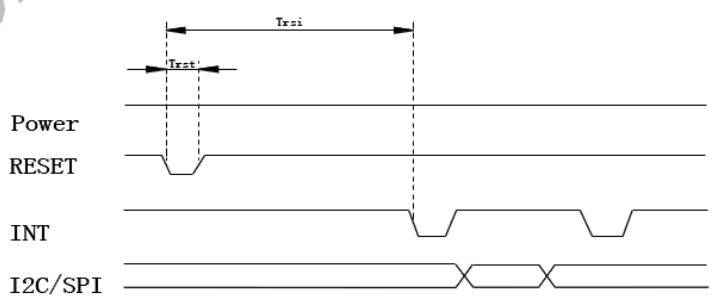


Figure 3-10 Reset Sequence

Table 3-6 Power on/Reset Sequence Parameters

Parameter	Description	Min	Max	Units
Tris	Rise time from 0.1VDD to 0.9VDD	--	5	ms
Tpdt	Time of the voltage of supply being below 0.3V	5	--	ms
Trtp	Time of resetting to be low before powering on	100	--	μs
Tivd	Delay time of VDD powering on after IOVCC powering on	10	--	μs
Tprt	Reset time after IOVCC powering on	2Tris+Tivd+Tvdr	--	ms
Tpon	Time of starting to report point after powering on	400	--	ms
Tvdr	Reset time after VDD powering on	1	--	ms
Trsi	Time of starting to report point after resetting	400	--	ms
Trst	Reset time	1	--	ms

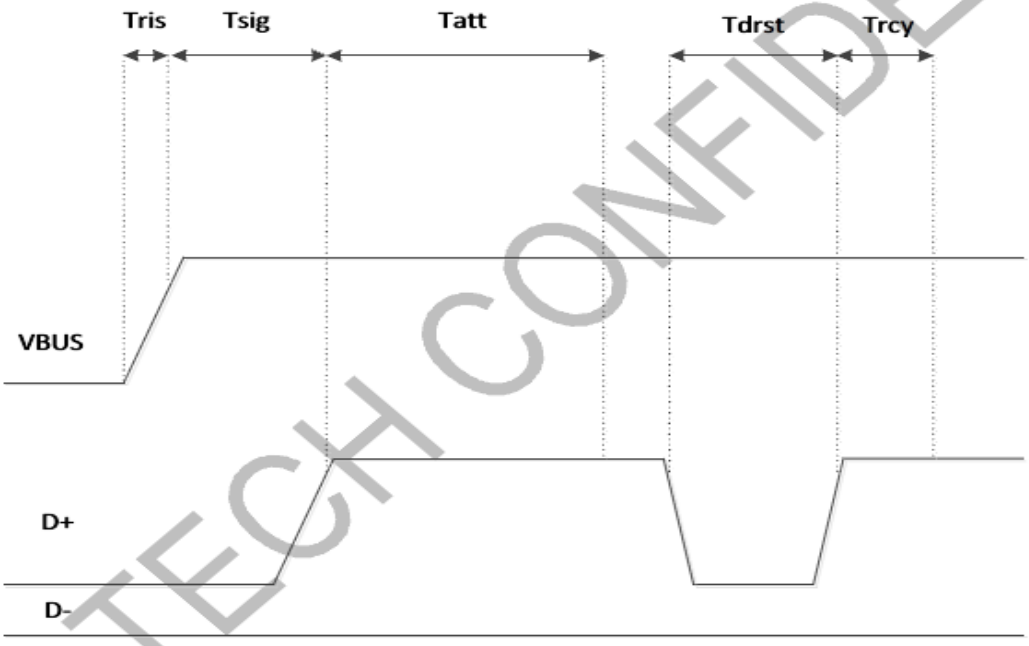


Figure 3-11 Power on / down Sequence

Table 3-7 USB Power on/Reset Sequence Parameters

Parameter	Description	Min	Max	Units
Tris	Rise time from 0.1VDD to 0.9VDD	--	5	ms
Tsig	Time required for the device internal power rail to stablilize and for D+ or D- to reach VIH (min)	100	--	ms
Tatt	Time ensures that the electrical and mechanical connection is stable before software attempts to reset the attached device	100	--	ms
Tdrst	Time hubs drive reset to a device	10	--	ms
Trcy	The USB System Software guarantees a minimum of 10 ms for reset recovery	10	--	ms

8.2 Serial Interface

FT5X26 supports the I2C OR USB interfaces, which can be used by a host processor or other devices.

8.2.1 I2C

The I2C is always configured in the Slave mode. The data transfer format is shown in Figure 2-4.

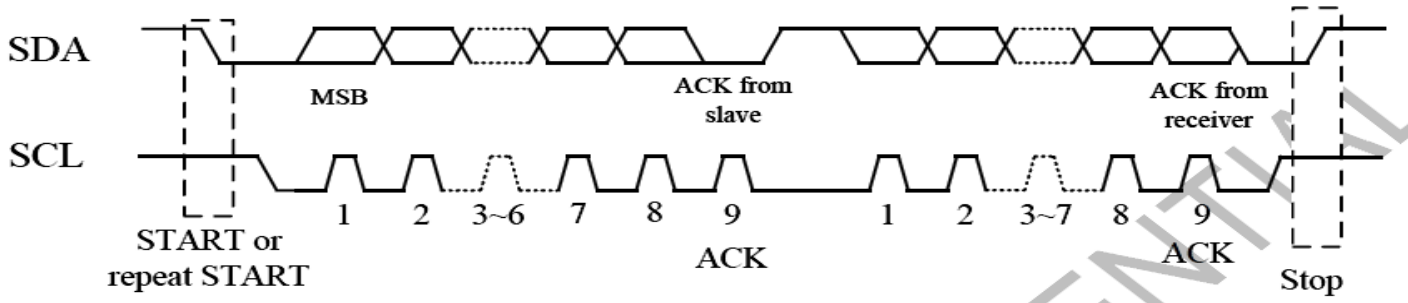


Figure 2-4 I2C Serial Data Transfer Format

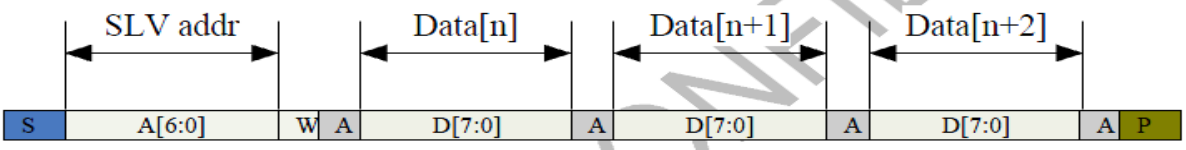


Figure 2-5 I2C master write, slave read

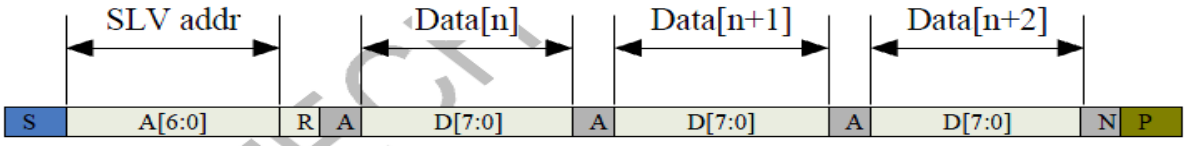


Figure 2-6 I2C master read, slave write

Table 2-1 lists the meanings of the symbols used in the above figures.

Table 2-1 Mnemonics Description

Mnemonics	Description
S	I2C Start or I2C Restart
A[6:0]	Slave address
R/W	READ/WRITE bit, '1' for read, '0' for write
A(N)	ACK(NACK) bit
P	STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

I2C Interface Timing Characteristics is shown in Table 2-2.

Table 2-2 I2C Timing Characteristics

Parameter	Min	Max	Unit

SCL frequency	10	400	KHz
Bus free time between a STOP and START condition	4.7	\	us
Hold time (repeated) START condition	4.0	\	us
Data setup time	250	\	ns
Setup time for a repeated START condition	4.7	\	us
Setup Time for STOP condition	4.0	\	us

8.2.2 USB

USB is configured in device mode, and a Full speed USB function is supported. The USB function controller is as follows.

USB 2.01-compliant composite device , full speed (12Mbps) ;

Require external crystal (12MHz) ;

Support USB LPM L1;

integrated transceiver;

Support USB-HID protocol for Win8.

Vendor ID: 0x2808

9. LCD Module Out-Going Quality Level

9.1 VISUAL & FUNCTION INSPECTION STANDARD

9.1.1 Inspection conditions

Inspection performed under the following conditions is recommended.

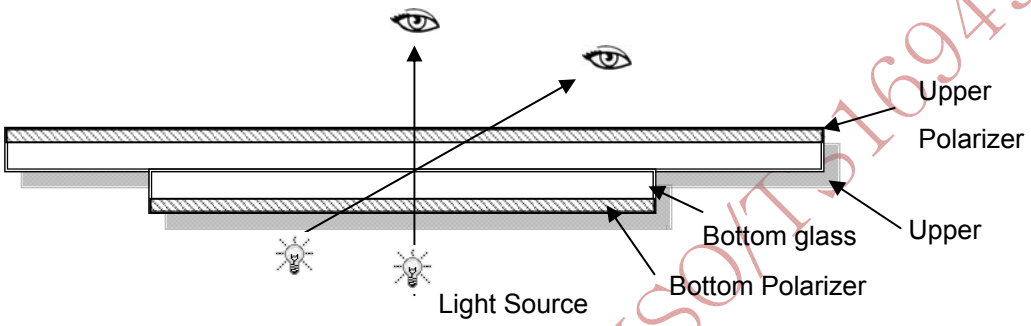
Temperature : 25±5℃

Humidity : 65%±10%RH

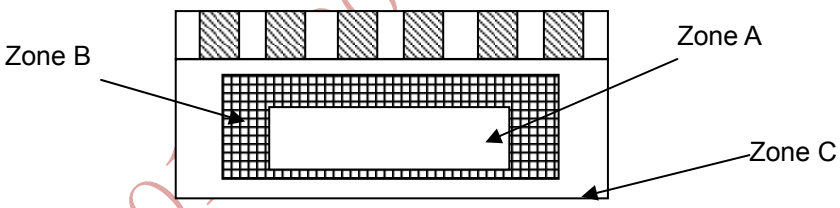
Viewing Angle : Normal viewing Angle.

Illumination: Single fluorescent lamp (300 to 700Lux)

Viewing distance:30-50cm



9.1.2 Definition



Zone A : Effective Viewing Area(Character or Digit can be seen)

Zone B : Viewing Area except Zone A

Zone C : Outside (Zone A+Zone B) which can not be seen after assembly by customer .)

Note:

As a general rule ,visual defects in Zone C can be ignored when it doesn't effect product function or appearance after assembly by customer.

9.1.3 Sampling Plan

According to GB/T 2828-2003 ; , normal inspection, Class Ⅱ

AQL:

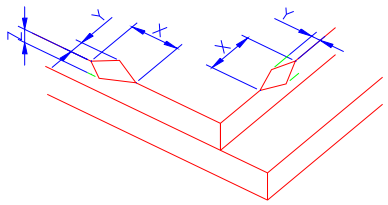
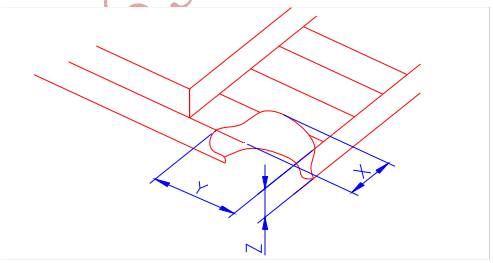
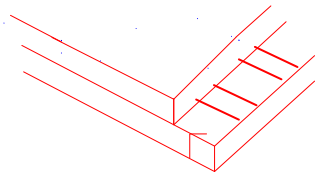
Major defect	Minor defect
0.65	1.5

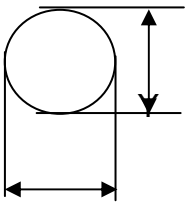
LCD: Liquid Crystal Display , TP: Touch Panel , LCM: Liquid Crystal Module

No	Items to be inspected	Criteria	Classification of defects
1	Functional defects	1) No display, Open or miss line 2) Display abnormally, Short 3) Backlight no lighting, abnormal lighting. 4) TP no function	Major
2	Missing	Missing component	
3	Outline dimension	Overall outline dimension beyond the drawing is not allowed	
4	Color tone	Color unevenness, refer to limited sample	Minor
5	Soldering appearance	Good soldering , Peeling off is not allowed.	
6	LCD/Polarizer/TP	Black/White spot/line, scratch, crack, etc.	

9.1.4 Criteria (Visual)

<table>
<tr><th>Number</th><th>Items</th><th>Criteria(mm)</th></tr>
<tr><td rowspan="3">1.0 LCD Crack/Broken

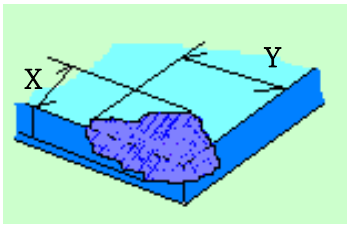
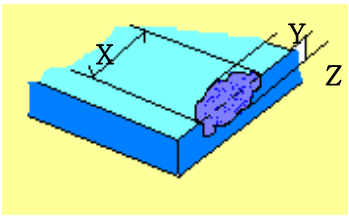
NOTE:
X: Length
Y: Width
Z: Height
L: Length of ITO,
T: Height of LCD</td><td>(1) The edge of LCD broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td><Inner border line of the seal</td><td>≤T</td></tr></table></td></tr>
<tr><td>(2)LCD corner broken</td><td> 
<table><tr><th>X</th><th>Y</th><th>Z</th></tr><tr><td>≤3.0mm</td><td>≤L</td><td>≤T</td></tr></table></td></tr>
<tr><td>(3) LCD crack</td><td> 
Crack
Not allowed</td></tr>
</table>

<table>
<tr><th>Number</th><th>Items</th><th>Criteria (mm)</th></tr>
<tr><td>2.0</td><td>Spot defect
 
X
Φ=(X+Y)/2</td><td>① light dot（LCD/TP/Polarizer black/white spot , light dot, pinhole, dent, stain）
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Accep able Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.10</td><td colspan="2">Ignore</td><td rowspan="4">Ignor</td></tr>
<tr><td>0.10<Φ≤0.20</td><td colspan="2">3(distance≧10mm)</td></tr>
<tr><td>0.20<Φ≤0.25</td><td colspan="2">2</td></tr>
<tr><td>Φ＞0.25</td><td colspan="2">0</td></tr>
</table>
②Dim spot（LCD/TP/Polarizer dim dot, light leakage、dark spot）
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.10<Φ≤0.20</td><td colspan="2">3(distance≧10mm)</td></tr>
<tr><td>0.20<Φ≤0.30</td><td colspan="2">2</td></tr>
<tr><td>Φ＞0.30</td><td colspan="2">0</td></tr>
</table>
③ Polarizer accidented spot
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.3<Φ≤0.5</td><td colspan="2">2(distance≧10mm)</td></tr>
<tr><td>Φ>0.5</td><td colspan="2">0</td></tr>
</table></td></tr>
<tr><td></td><td>Line defect (LCD/TP /Polarizer black/white line, scratch, stain)</td><td>
<table>
<tr><th rowspan="2">Width(mm)</th><th rowspan="2">Length(mm</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.03</td><td>Igno e</td><td colspan="2">Ignore</td><td rowspan="3">Ignore</td></tr>
<tr><td>0.03<W≤0.05</td><td>L≤3.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.05<W≤0.08</td><td>L≤2.0</td><td colspan="2">N≤2</td></tr>
<tr><td>0.08<W</td><td colspan="4">Define as spot defect</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>3.0</td><td>Polarizer Bubble</td><td>
<table>
<tr><th rowspan="2">Zone
Size (mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.2</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.2<Φ≤0.4</td><td colspan="2">3(distance≧10 m)</td></tr>
<tr><td>0.4<Φ≤0.6</td><td colspan="2">2</td></tr>
<tr><td>0.6<Φ</td><td colspan="2">0</td></tr>
</table>
</td></tr>
<tr><td>4.0</td><td>SMT</td><td>According to IPC-A-610C class Ⅱ standard . Function defect and missing part are major defect ,the others are minor defect.</td></tr>
</table>

<table>
<tr><td rowspan="2"></td><td rowspan="2"></td><td>TP bubble/ accidented spot</td><td>
<table>
<tr><th rowspan="2">Size Φ(mm)</th><th colspan="3">Acceptable Qty</th></tr>
<tr><th>A</th><th>B</th><th>C</th></tr>
<tr><td>Φ≤0.1</td><td colspan="2">Ignore</td><td rowspan="4">Ignore</td></tr>
<tr><td>0.1<Φ≤0.25</td><td colspan="2">3 (distance≧</td></tr>
<tr><td>0.25<Φ≤0.3</td><td colspan="2">2</td></tr>
<tr><td>0.3<Φ</td><td colspan="2">0</td></tr>
</table>
</td></tr>
<tr><td>Assembly deflection</td><td>beyond the edge of backlight ≤0.15mm</td></tr>
</table>

<table>
<tr>
<td>5.0</td>
<td>TP
Related</td>
<td>Newton
Ring</td>
<td>Newton Ring area>1/3 TP area
NG

Newton Ring area≤1/3 TP area
OK</td>
<td> 
</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TP corner
broken
X：length
Y：width
Z：height</td>
<td>
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>X≤3.0mm</td><td>Y≤3.0mm</td><td>Z<LCD
thicknes</td></tr>
</table>
*
Circuitry broken is not allowed.
</td>
<td> 
</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TP edge
broken
X：length
Y：width
Z：height</td>
<td>
<table>
<tr><th>X</th><th>Y</th><th>Z</th></tr>
<tr><td>X≤6.0mm</td><td>Y≤2.0mm</td><td>Z<LCD
thicknes</td></tr>
</table>
* Circuitry broken is not allowed.
</td>
<td> 
</td>
</tr>
</table>

Criteria (functional items)

Number	Items	Criteria (mm)
1	No display	Not allowed
2	Missing segment	Not allowed
3	Short	Not allowed
4	Backlight no lighting	Not allowed
5	TP no function	Not allowed

10. Reliability Test Result

10.1 Condition

Item	Condition	Sample Size	Test Result	Note
Low Temperature Operating Life test	0℃, 96HR	3ea	pass	-
Thermal Humidity Operating Life test	50℃90%RH, 96HR	3ea	pass	-
Temperature Cycle ON/OFF test	0℃ ↔ 50℃, ON/OFF, 20CYC	3ea	pass	(1)
High Temperature Storage test	60℃, 96HR	3ea	pass	-
Low Temperature Storage test	-20℃, 96HR	3ea	pass	-
ESD test	150pF, 330Ω , ±6KV(Contact)/± 8KV(Air), 5 points/panel, 10 times/point	3ea	pass	
Thermal Shock Resistance	The sample should be allowed to stand the following 5 cycles of operation: TSTL for 30 minutes -> normal temperature for 5 minutes -> TSTH for 30 minutes -> normal temperature for 5 minutes, as one cycle, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours	3ea	pass	
Box Drop Test	1 Corner 3 Edges 6 faces, 66㎝(MEDIUM BOX)	1box	pass	-

Note (1) ON Time over 10 seconds, OFF Time under 10 seconds

11. Cautions and Handling Precautions

11.1 Handling and Operating the Module

(1) When the module is assembled, it should be attached to the system firmly.
Do not warp or twist the module during assembly work.
(2) Protect the module from physical shock or any force. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
(3) Note that polarizer is very fragile and could be easily damaged. Do not press or scratch the surface.
(4) Do not allow drops of water or chemicals to remain on the display surface.
If you have the droplets for a long time, staining and discoloration may occur.
(5) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
(6) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane.
Do not use ketene type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs, or clothes, it must be washed away thoroughly with soap.
(8) Protect the module from static; it may cause damage to the CMOS ICs.
(9) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
(10) Do not disassemble the module.
(11) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
(12) Pins of I/F connector shall not be touched directly with bare hands.
(13) Do not connect, disconnect the module in the “Power ON” condition.
(14) Power supply should always be turned on/off by the item 6.1 Power On Sequence &6.2 Power Off Sequence

11.2 Storage and Transportation.

(1) Do not leave the panel in high temperature, and high humidity for a long time.
It is highly recommended to store the module with temperature from 0 to 35 ℃ and relative humidity of less than 70%
(2) Do not store the TFT-LCD module in direct sunlight.
(3) The module shall be stored in a dark place. When storing the modules for a long time, be sure to adopt effective measures for protecting the modules from strong ultraviolet radiation, sunlight, or fluorescent light.
(4) It is recommended that the modules should be stored under a condition where no condensation is allowed. Formation of dewdrops may cause an abnormal operation or a failure of the module.
In particular, the greatest possible care should be taken to prevent any module from being operated where condensation has occurred inside.
(5) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.

12. Packing

----TBD----------