LCD MODULE

SPECIFICATION

Model:	IE-D-1030CS04R18-CB-1
Version:	V1.0
Date:	20200717

REVISION HISTORY

Revision	Date	Contents of Revision Change	Remark
V1.0	2020.07.17	Preliminary release	

TABLE of CONTENTS

1. GENERAL INFORMATION

1.1 Features

1) Pixel Arrangement：RGB Vertical Stripe
2) Interface Mode： RGB 18bit
3) Driver IC： NV3052CGRB；Touch IC：FT6336U
4) Operation Temperature：-20~70℃
5) Storage Temperature：-30~80℃
6) Backlight Type：White LED
7) Display mode：Normally Black
8) Pixel Density：254 PPI
9) LED life time：30,000 Hours

1.2 Mechanical Specification

Item	Specification	Unit	Remark
Pixel Driving element	TFT	-	-
Screen Size	4.0	Inch	Diagonal
Resolution	720(W)*3(RGB)*720(H)	Dots	-
Interface	RGB	-	18bit
Module Power Consumption	0.7128	Watt	Typ.
Active Area	71.93(W)*71.93(H)	mm	-
Pixel pitch (W*H)	0.0999(W)*0.0999(H)	mm	-
CTP_Module Size (W*H*D)	84(W)*84(H)*3.19(D)	mm	Typ
Luminance	300	cd/m^2	Typ.
Viewing Direction	ALL	O'clock	
Display Color	262K	Colors	18bits

2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remark
Power supply1 voltage	VCI	-0.3	6.6	V	Note1
LED forward current	I_F	-0.001	20	mA	For each led,Note1
LED Reverse Voltage	V_R	-	5	V	For each led,Note1
Operating temperature	T_{op}	-20	70	°C	Note1,2
Storage temperature	T_{st}	-30	80	°C	Note1,2
Humidity	H_{st}	10	90	%RH	Note1,3

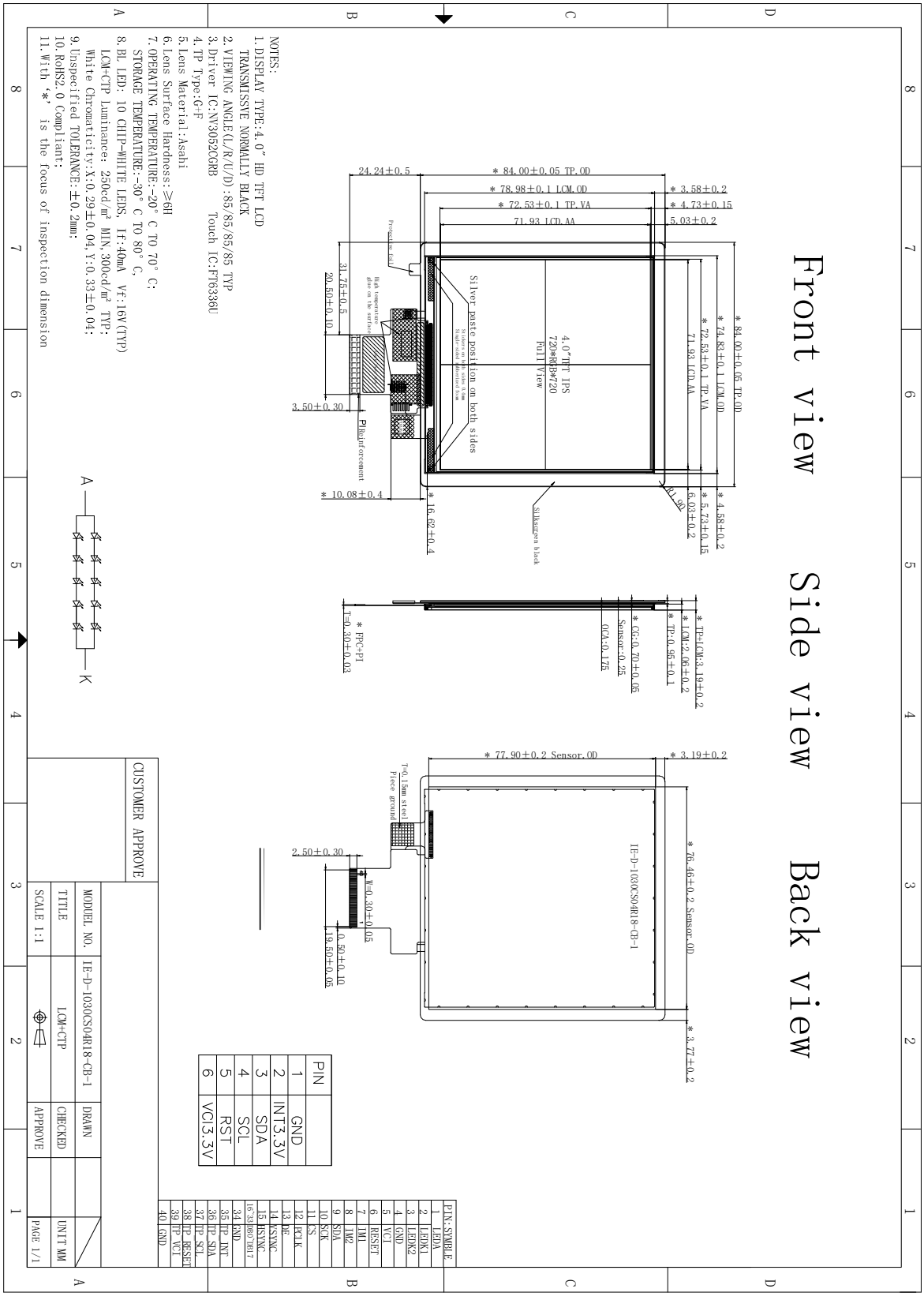
(Ta=+25°C,GND=0V)

Note1:If the module exceeds the absolute maximum ratings, it may be damaged permanently. Also if the module operates with the absolute maximum ratings for a long time, the reliability may drop.

Note2: In case of temperature below 0℃,the response time of liquid crystal (LC) becomes slower and the color of panel darker than normal one.

Note3: Temp. ≤ 60℃ , 90% RH MAX.
Temp. ＞60℃ , Absolute humidity shall be less than 90% RH at 60℃.

3. MECHANICAL DRAWING



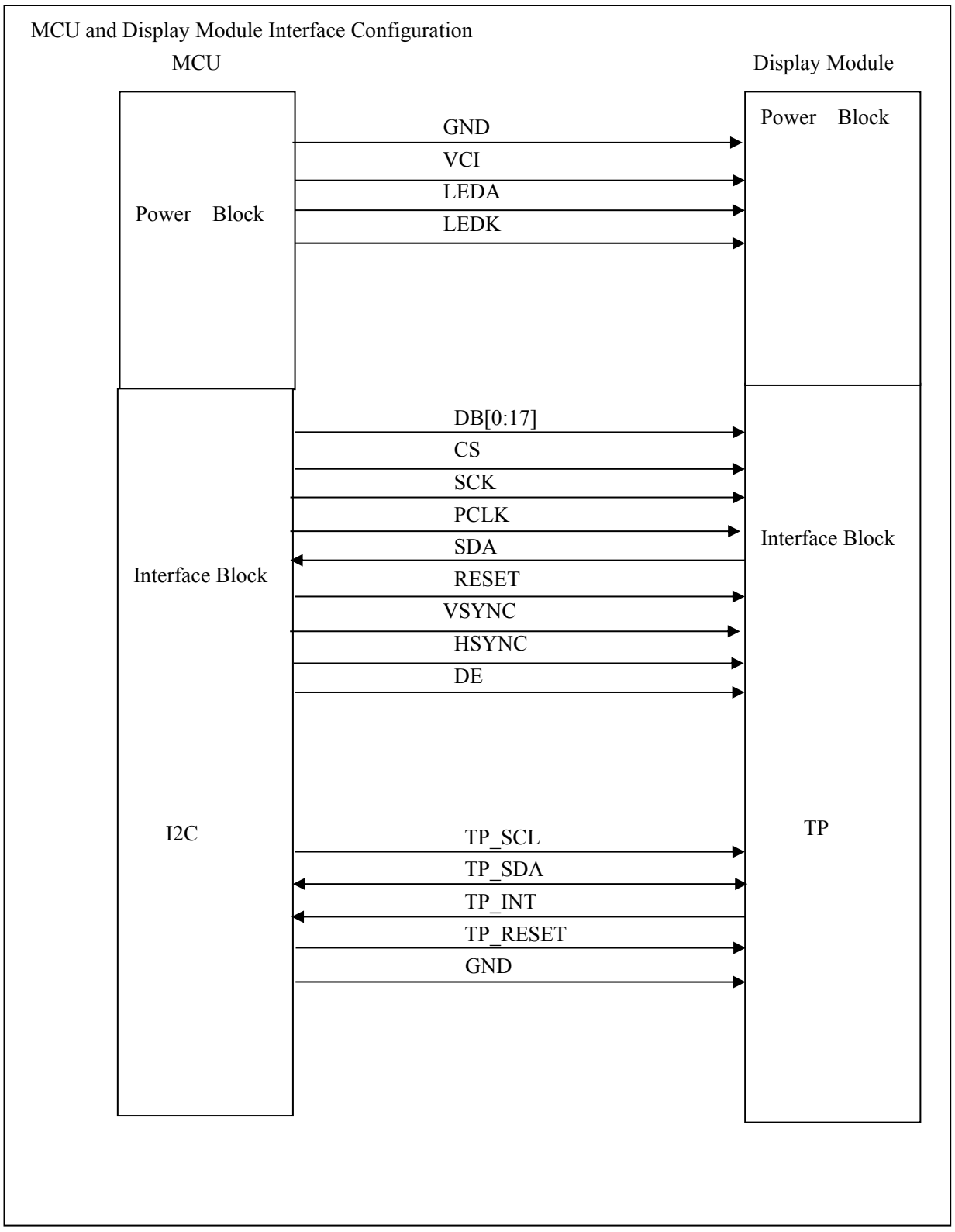
4. I/O CONNECTION & BLOCK DIAGRAM

4.1 I/O Connection

Pin No.	Symbol	I/O	Description
1	LEDA	P	Power supply for backlight anode
2	LEDK1	P	Power supply for backlight cathode
3	LEDK2	P	Power supply for backlight cathode
4	GND	P	Power Ground
5	**VCI**	P	Power supply for LCM
6	**RESET**	I	The signal will reset the LCM, Signal is active low.
7	**IM1**	-	NC
8	**IM2**	-	NC
9	**SDA**	I/O	Data input/output
10	**SCK**	I	Clock input
11	**CS**	I	Chip select pin for SPI interface
12	**PCLK**	I	Dot clock signal for RGB interface operation
13	**DE**	I	Data input enable. Display access is enabled when DE is "H"
14	**VSYNC**	I	Horizontal sync signal, Negative polarity
15	**HSYNC**	I	Horizontal sync signal, Negative polarity
16-33	**DB0-DB17**	I	Blue data input DB0-DB5(B0-B5) Green data input DB6-DB11(G0-G5) Red data input DB12-DB17(R0-R5)
34	**GND**	P	Power Ground
35	**TP_INT**	O	Interrupt signals for TP
36	**TP_SDA**	I/O	I2C data signal for TP
37	**TP_SCL**	I	I2C clock signals for TP
38	**TP_RESET**	I	The signal will reset the TP,Signal is active low
39	**TP_VCI**	P	Power supply for TP
40	**GND**	P	Power Ground

I：Input；O：Output；P：Power

4.2 Block Diagram



5. ELECTRICAL CHARACTERISTICS

5.1 TFT-LCD Panel Driving Section

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Power Supply1 Voltage	VCI	2.5	2.8	6.0	V	-
Power Supply Current	I_{VCI}	-	26	-	mA	Note1
Logic Input High Voltage	V_{IH}	0.7VCI	-	VCI	V	-
Logic Input Low Voltage	V_{IL}	0	-	0.3VCI	V	-
Panel Power Consumption	P_{VDD}	-	0.7128	-	Watt	Note1
Module Power Consumption	P_{LCM}	-	0.0728	-	Watt	Note1,2

(Ta=+25°C,GND=0V)

Note1:Measurement Conditions (Video Mode): Full Screen Red Pattern,VDD=1.8V,60Hz Refresh.

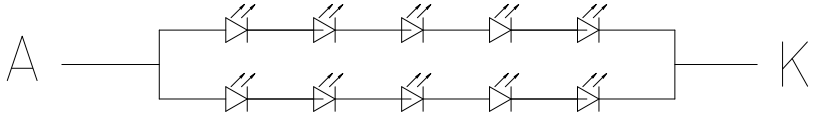
Note2: P_{LCM}= P_{VDD}+ P_{BL}， About P_{BL} information, inference to 5.2 Back Light Driving Section.

5.2 Back Light Driving Section

Item	Symbol	Min.	Typ.	Max.	Unit	Remark
Forward Voltage	V_F	-	16	-	V	Note1
Forward Current	I_F	-	40	-	mA	Note1
Backlight Power consumption	P_{BL}	-	0.64	-	Watt	Note1
LED life time	-	30000	-	-	Hours	Note2
LED Quantity			10		PCS	

(Ta=+25°C,GND=0V)

Note1:The “LED life time” is defined as the module brightness decrease to 50% of original brightness at I_{LED}=20mA(Per Led). The LED life time could be decreased if operating I_{LED} is larger than 20mA.



5.3 Power On/Off Sequence

5.3.1 Power On Timing of External Power IC

IOVCC and VCI can be applied in any order. IOVCC and VCI can be powered down in any order.

During power off, if LCD is in the Sleep Out mode, VCI and IOVCC must be powered down minimum 120msec after RESX has been released.

During power off, if LCD is in the Sleep In mode, IOVCC or VCI can be powered down minimum 0msec after RESX has been released.

CSX can be applied at any timing or can be permanently grounded. RESX has priority over CSX.

Note 1: There will be no damage to the display module if the power sequences are not met.

Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.

Note 3: There will be no abnormal visible effects on the display between end of Power On Sequence and before receiving Sleep Out command.

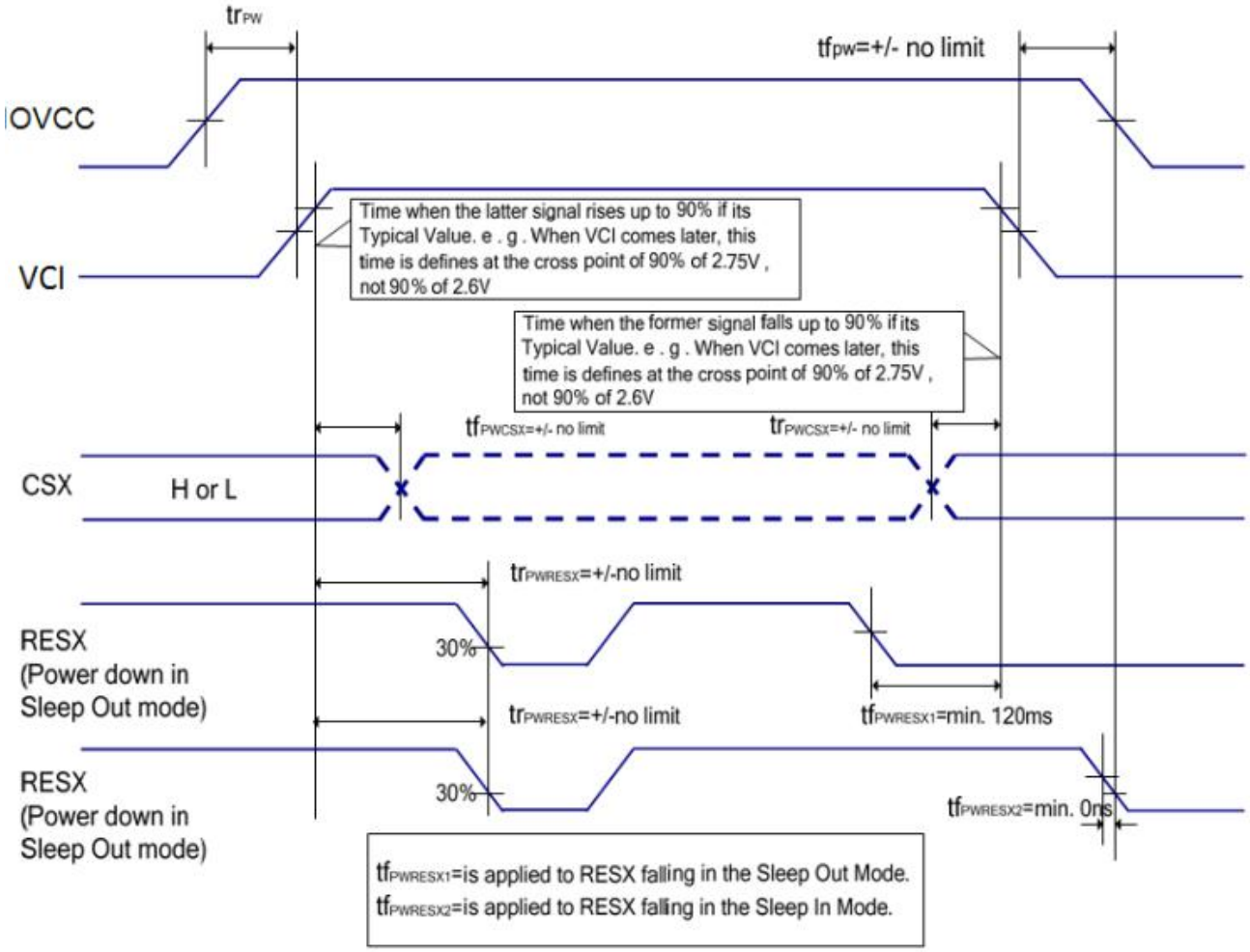
Also between receiving Sleep In command and Power Off Sequence.

If RESX line is not held stable by host during Power On Sequence, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.

The power on/off sequence is illustrated below:

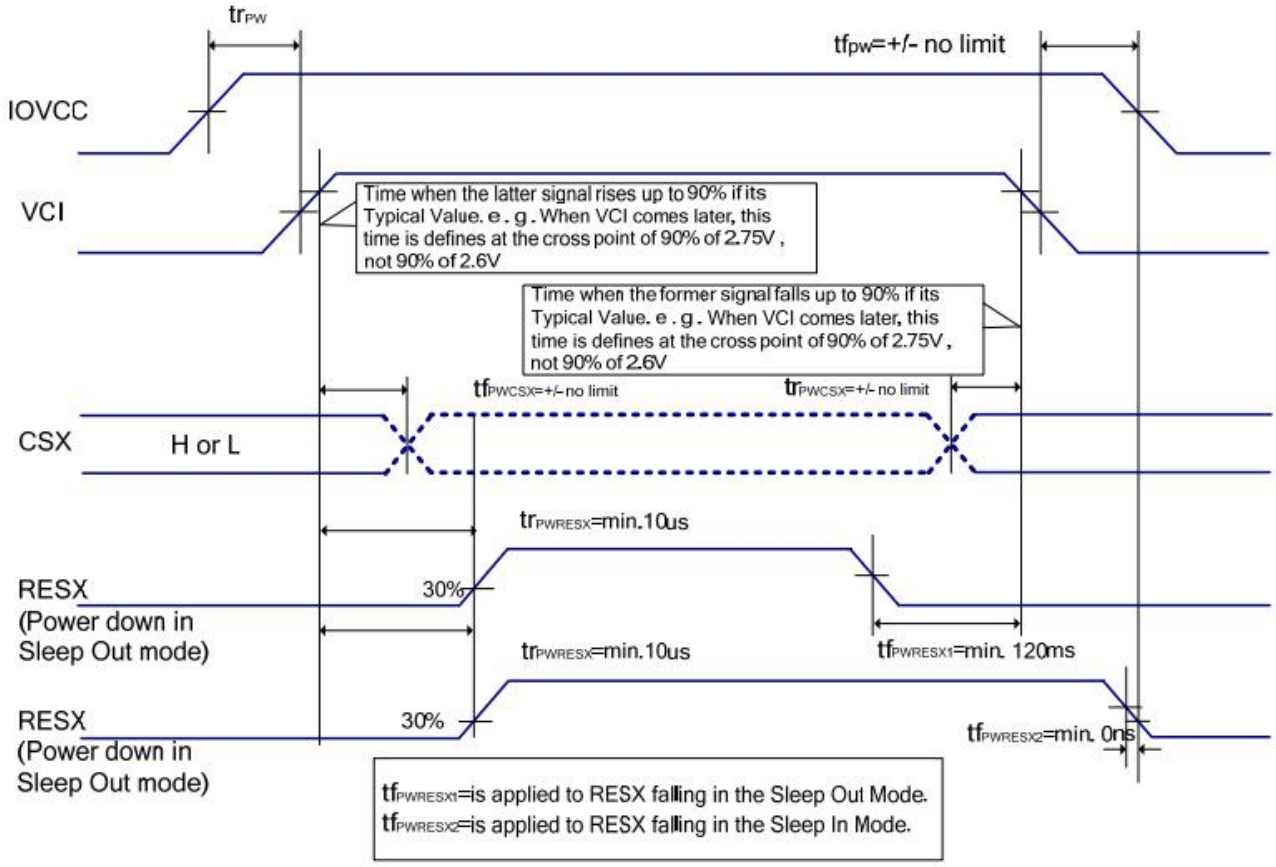
5.3.2 Case 1 -- RESX line is held high or unstable by host at power on

If RESX line is held High or unstable by the host during Power On, then a Hardware Reset must be applied after both VCI and IOVCC have been applied – otherwise correct functionality is not guaranteed. There is no timing restriction upon this hardware reset.



5.3.3 Case 2 -- RESX line is held high or unstable by host at power on

If RESX line is held Low (and stable) by the host during Power On, then the RESX must be held low for minimum 10sec after both VCI and IOVCC have been applied.

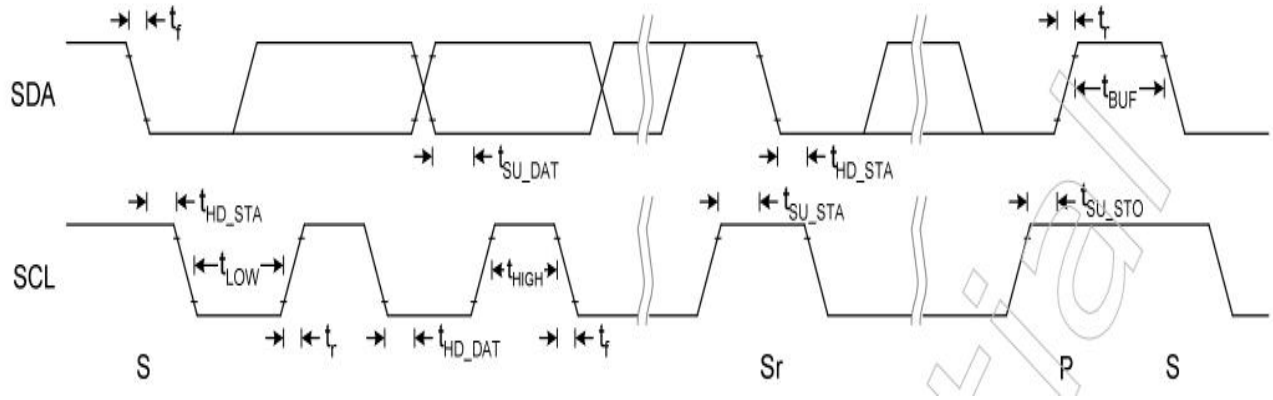


5.3.4 Case 2 -- RESX line is held high or unstable by host at power on

The uncontrolled power off means a situation when e.g. there is removed a battery without the controlled power off sequence. There will not be any damages for the display module or the display module will not cause any damages for the host or lines of the interface.

At an uncontrolled power off the display will go blank and there will not be any visible effects within (TBD) second on the display (blank display) and remains blank until "Power On Sequence" powers it up.

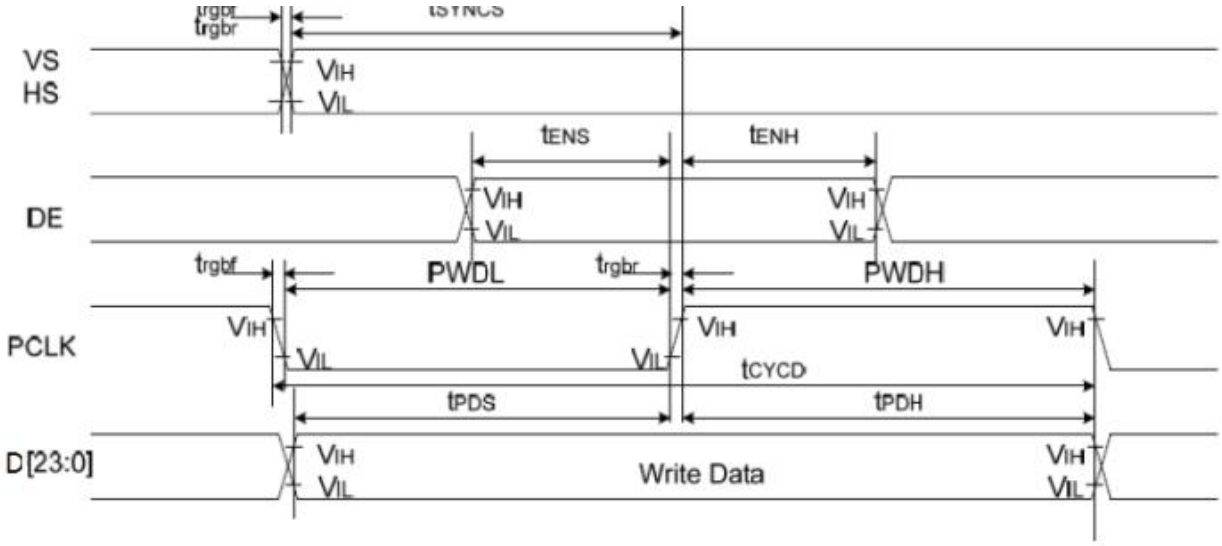
5.4.0 I2C interface timings



Parameter	Symbol	Min.	Max.	Unit
SCL low period	t_{lo}	1.3	-	us
SCL high period	t_{hi}	0.6	-	us
SCL setup time for START condition	t_{st1}	0.6	-	us
SCL setup time for STOP condition	t_{st3}	0.6	-	us
SCL hold time for START condition	t_{hd1}	0.6	-	us
SDA setup time	t_{st2}	0.1	-	us
SDA hold time	t_{hd2}	0	-	us

Note: 3.3V communication interface, 400Kbps communication speed, pull-up resistance 2K

5.4.1AC Characteristics



Signal	Symbol	Parameter	min	max	Unit	Description
VS/HS	tSYNCS	VS/HS setup time	5	-	ns	24/18/16-bit bus RGB interface mode
	tSYNCH	VS/HS hold time	5	-	ns	
DE	tENS	DE setup time	5	-	ns	
	tENH	DE hold time	5	-	ns	
D[23:0]	tPOS	Data setup time	5	-	ns	
	tPDH	Data hold time	5	-	ns	
PCLK	PWDH	PCLK high-level period	13	-	ns	
	PWDL	PCLK low-level period	13	-	ns	
	tCYCD	PCLK cycle time	28	-	ns	
	trgbr,trgbf	PCLK,HS,VS rise/fall time	-	15	ns	

5.5 Timing Diagram

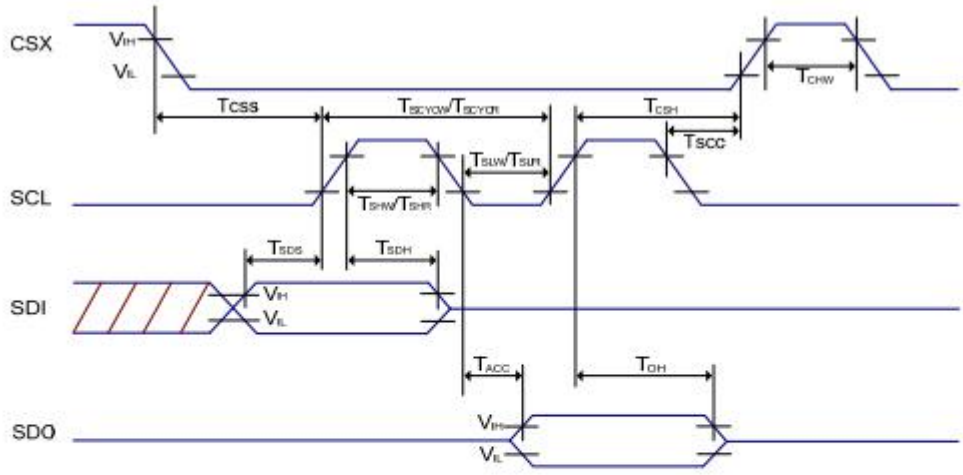
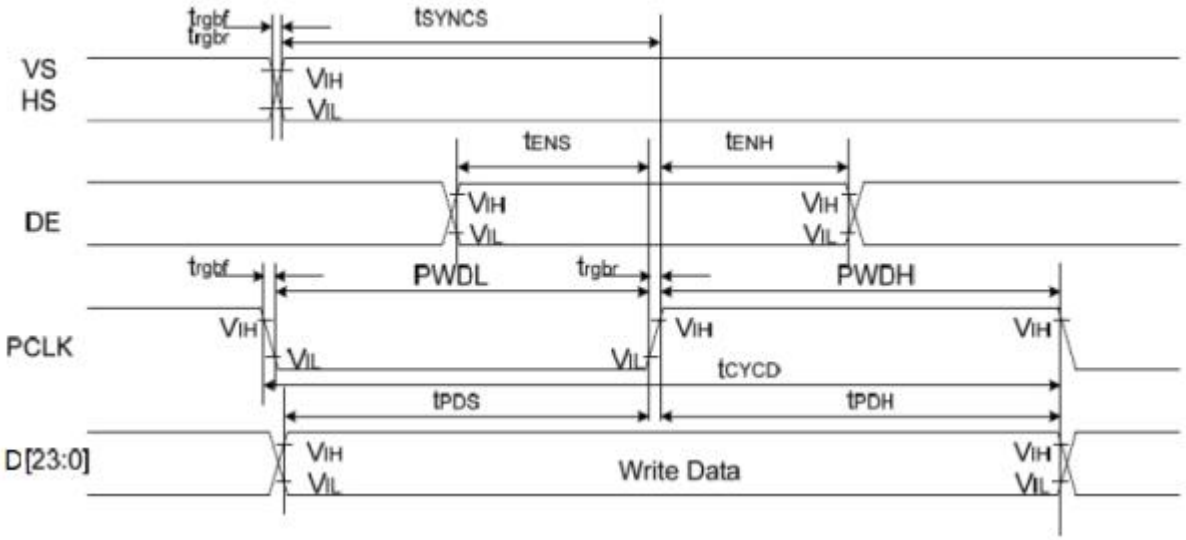


Figure: 3-pin Serial Interface Characteristics

Table: SPI Interface Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	Tcss	Chip select setup time	15	-	ns	-
	Tcsh	Chip select hold time	15	-	ns	
	Tscc	Chip select setup time	20	-	ns	
	Tchw	Chip "H" pulse width	40	-	ns	
SCL	Tscycw	Serial clock cycle (Write)	66	-	ns	-
	Tshw	SCL "H" pulse width (Write)	10	-	ns	
	Tslw	SCL "L" pulse width (Write)	10	-	ns	
	Tscycr	Serial clock cycle (Read)	150	-	ns	-
	Tshr	SCL"H" pulse width (Read)	60	-	ns	
	Tslr	SCL"L" pulse width (Read)	60	-	ns	
SDI	TSDS	Data setup time	10	-	ns	-
	Tsdh	Data hold time	10	-	ns	
	Tacc	Access time	10	50	ns	For maximum CL=30pF For minimum CL=8pF
	Toh	Output disable time	15	50	ns	

5.5.1 Timing Parameters



Signal	Symbol	Parameter	min	max	Unit	Description
VS/HS	tSYNCS	VS/HS setup time	5	-	ns	24/18/16-bit bus RGB interface mode
	tSYNCH	VS/HS hold time	5	-	ns	
DE	tENS	DE setup time	5	-	ns	
	tENH	DE hold time	5	-	ns	
D[23:0]	tPDS	Data setup time	5	-	ns	
	tPDH	Data hold time	5	-	ns	
PCLK	PWDH	PCLK high-level period	13	-	ns	
	PWDL	PCLK low-level period	13	-	ns	
	tCYCD	PCLK cycle time	28	-	ns	
	trgbr,trgbf	PCLK,HS,VS rise/fall time	-	15	ns	

Note 1: IOVCC=1.65 to 3.6V, VCI=2.5 to 6V, VSSA=VSS=0V, Ta=-30 to 70℃

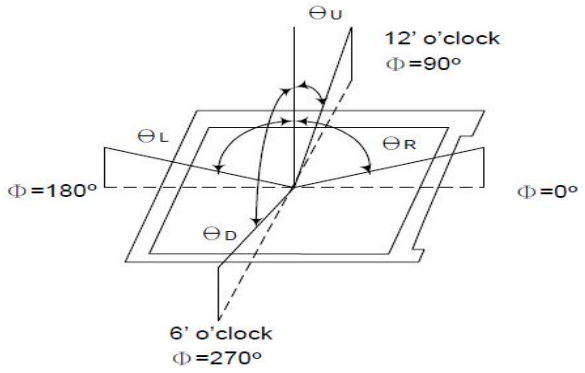
6. OPTICAL CHARACTERISTICS

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Contrast Ratio	C/R	θ = 0°	800	1000	-	-	Note(4)
NTSC Ratio	S	θ =0°	63	68		%	Note(7)
Luminance	L	θ =0°	-	300	-	cd/m2	Note(5)
Luminance uniformity	U_W	θ =0°	75	80	-	%	Note(3)
Response Time	T_R+ T_F	25 °C	-	35	-	ms	Note(2)
Color Coordination	W_X	θ = 0° (Center) Normal viewing angle B/L On	-+0.03	0.2891	+0.03	NTSC (x,y)	Note(6)
	W_Y			0.3328			
	R_X			0.650			
	R_Y			0.318			
	G_X			0.263			
	G_y			0.565			
	B_X			0.140			
	B_Y			0.086			
Viewing Angle	θ_L	C/R>10	-	85	-	Degree	Note(1)
	θ_R		-	85	-		
	θ_U		-	85	-		
	θ_D		-	85	-		

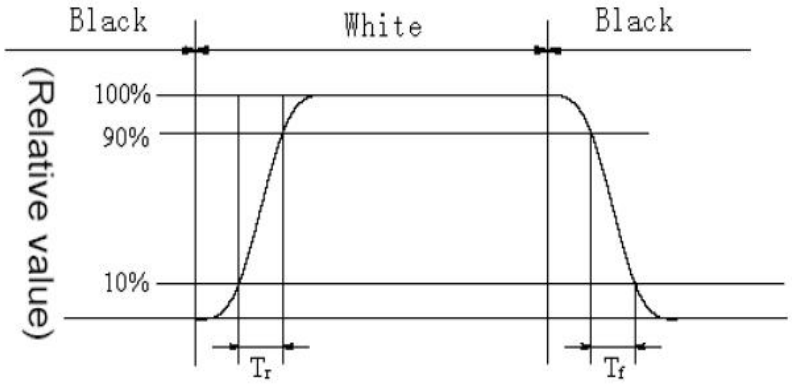
Test Conditions:

1. the ambient temperature is+25℃.
2. The test systems refer to Note 8.

Note1: Definition of Viewing Angle: The viewing angle range that the CR>10

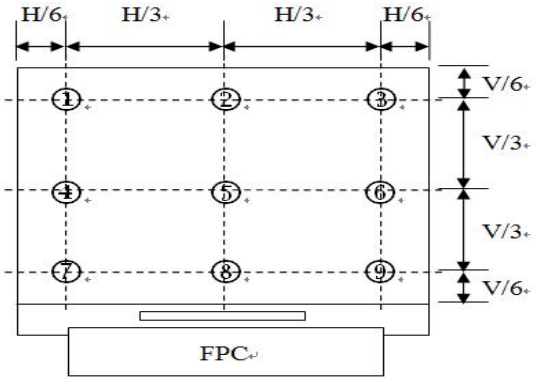


Note2: Definition of Response time: Sum of T_R and T_F



Note 3: Definition of Luminance Uniformity: Active area is divided into 9 measuring areas, every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity} = \frac{\text{Min Luminance of white among 9-points}}{\text{Max Luminance of white among 9-points}} \times 100\%$$

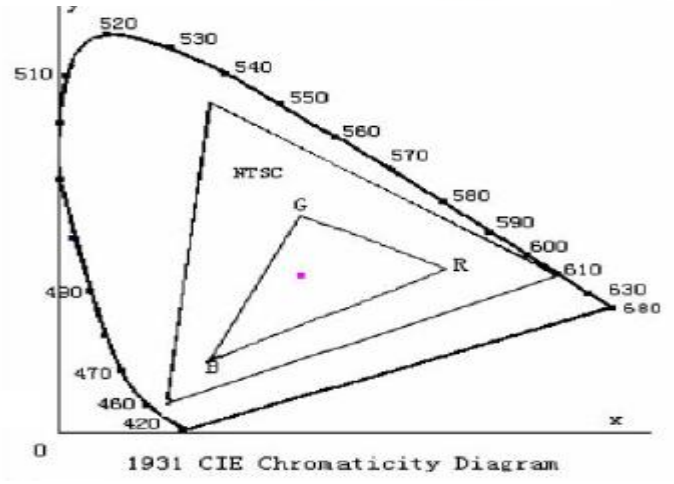


Note4: Definition of Contrast Ratio (CR): measured at the center point of panel

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

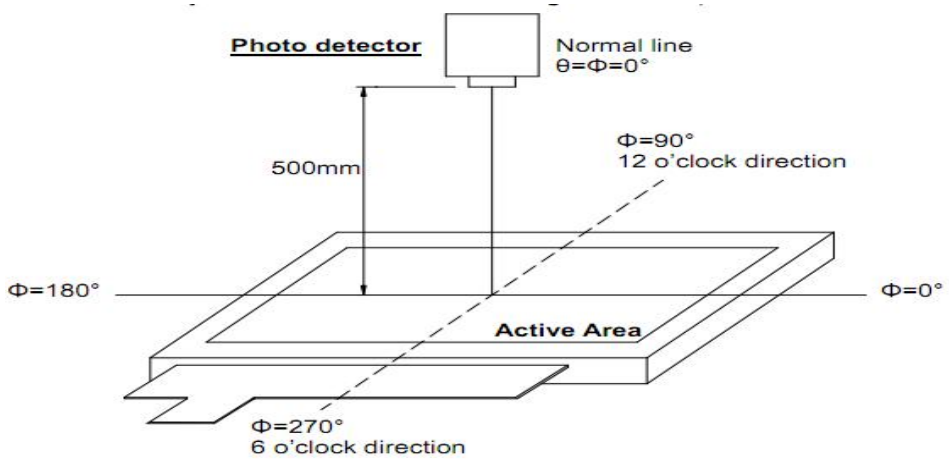
Note 5: Definition of Luminance: Center Luminance of white is defined as luminance values of 1point average across the LCD surface.
Note 6: Definition of Color Chromaticity (CIE 1931)
Color coordinates of white & red, green, blue measured at center point of LCD.
Note 7: Definition of NTSC ratio:

$$\text{NTSC ratio} = \frac{\text{Area of RGB triangle}}{\text{Area of NTSC triangle}}$$



Note 8: Definition of optical measurement system.

The optical characteristics should be measured in dark room. After 5 minutes operation, the optical properties are measured at the center point of the LCD screen.(Response time is measured by Photo detector TOPCON BM-7, Field of view: 1°/Height: 500mm.)



7. RELIABILITY

Item	Test Condition	Remark
High Temperature Storage	Ta =+80°C / 96Hours	Note1,2,3
Low Temperature Storage	Ta =-30°C / 96Hours	Note1,2,3
High Temperature Operating	Ta =+70°C / 96Hours	Note1,2,3
Low Temperature Operating	Ta =-20°C / 96Hours	Note1,2,3
Temperature Cycle storage Test	-30°C/30min ⇆+80°C /30min for 30cycles,Transfer time less than 5min	Note2,3
Thermal humidity storage Test	60°C x 90%RH / 96Hours	Note2,3
Package Vibration Test	Frequency: 10Hz~55Hz,Amplitude:1.5mm, 1 hrs for each direction of X, Y, Z	Note2
Packing shock test	Drop to the ground from 1m height, 1 corner, 3 edges, 6 surfaces.	Note2

Inspection after Test:

Note1:Ta is the ambient temperature of samples.

Note 2: In the standard condition, there shall be no practical problem that may affect the display function. After the reliability test, the product only guarantees operation, but doesn't guarantee all the cosmetic specification.

Note 3: Before cosmetic and function tests , the product must have enough recovery time, at least 2 hours at room temperature.

8. PACKAGE DRAWING