LCD MODULE

SPECIFICATION

Model:	IE-D-0907CS13R24-R0-1
Version:	V1.1
Date:	2018-06-08

■ **Preliminary Specification**

□ **Final Specification**

Customer Confirmation

Approved by	Notes

Please return one of the copies of the specification with your signature to us within two weeks after you receive this document. If it is not returned, we will assume that you agree to the entire contents of this specification document.

Prepared by	Reviewed by	Approved by

REVISION HISTORY

Revision	Date	Contents of Revision Change	Remark
V1.0	2018.5.30	Preliminary release	All
V1.1	2018.6.8	Change Operation Temperature	Page6

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1. GENERAL INFORMATION

1.1 Features

1) Pixel Arrangement：RGB Vertical Stripe
2) Interface Mode：54PIN　SPI_RGB 24bits
3) Driver IC：ST7272A
4) Operation Temperature：-20~70℃
5) Storage Temperature：-30~80℃
6) Backlight Type：White LED
7) Display mode：　Normally black,
8) Pixel Density：114 PPI
9) LED life time：30,000 Hours

1.2 Mechanical Specification

Item	Specification	Unit	Remark
Pixel Driving element	A-Si TFT	-	-
Screen Size	3.5	Inch	Diagonal
Resolution	320(W)*3(RGB)*240(H)	Dots	-
Interface	RGB 24bits	-	54PIN
Module Power Consumption	-	Watt	Typ.
Active Area	70.08(W)*52.56(H)	mm	-
Pixel pitch (W*H)	0.219(W)*0.219(H)	mm	-
Module Size (W*H*D)	76.84(W)*63.84(H)*3.32(D)	mm	Tolerance:±0.2
Luminance	800	cd/m^2	Typ.
Viewing Direction	All	O'clock	
Display Color	16.7M	Colors	24bits

2. ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Min.	Max.	Unit	Remark
Power supply1 voltage	VDD	-0.3	4	V	Note1
Power supply2 voltage	VCCIO	-0.3	4	V	Note1
LED forward current	I_F	-0.001	30	mA	For each led,Note1
LED Reverse Voltage	V_R	-	5	V	For each led,Note1
Operating temperature	T_{op}	-20	70	℃	Note1,2
Storage temperature	T_{st}	-30	80	℃	Note1,2
Humidity	H_{st}	10	90	%RH	Note1,3

(Ta=+25°C,DGND=AVSS=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.

DISPLAY TYPE:	3.5″ QVGA IPS TFT
	NORMALLY BLACK
	TRANSMISSIVE
RESOLUTION:	320(RGB)*240
Driver IC:	ST7272A
触控 IC:	
Viewing Angle(U/D/L/R)	80/80/80/80 (TYPE)
LCM+RTP BRIGHTNESS:	520cd/m2(MIN) 640cd/m2(TYPE)
Chromaticity(W TP):	
Contrast:	700 (TYPE)
NTSC:	
Uniformity	70% (MIN)
Tc:	
GAMMA	
CROSSTALK:	
BLICKLIGHT:	8pcs,8串20mA(20mA/LED)
Interface:	
OPERATING TEMP:	-20° C ~ 70° C
STORAGE TEMP:	-30° C ~ 80° C
电压：	IOVCC=3.3V(TYPE)
	VCC=3.3V(TYPE)
平面度：	0.35MM MAX
寄存器地址：	

LED A ○→|→|→|→|→|→|→|→|→○ LED K

BACKLIGHT CIRCUIT DIAGRAM 20mA/LED (8LED)

LED Vf:25.6V(TYP)

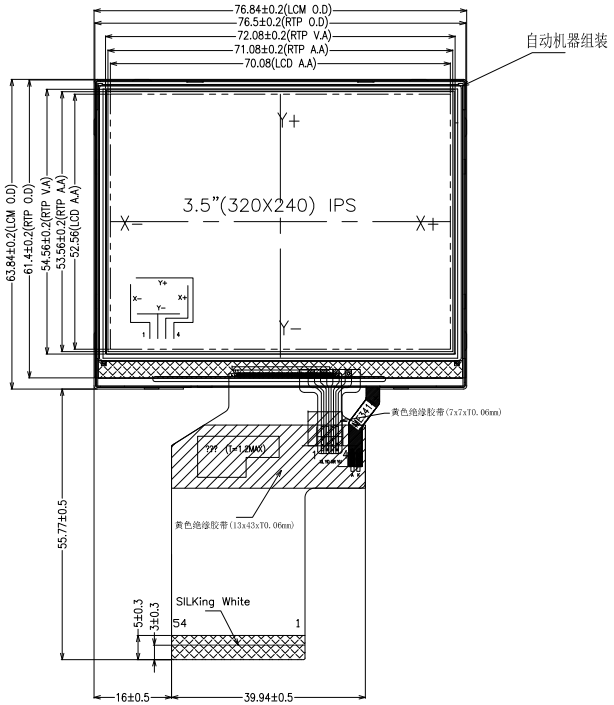
If:20mA

(CIRCUIT DIAGRAM)

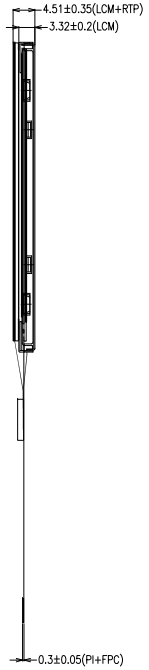
NOTE:

1. VIEWING DIRECTION: Free
2. 本产品符合RoHS要求
3. GENERAL TOLERANCE: ±0.2 ″( )″reference dimension
   *为重点尺寸
4. 客户终端使用连接器型号:
5. 产品要求SLEEP可以硬件无供电
6. 建议贴合的TP开窗尺寸比LCD AA左右宽度尺寸单边大0.4.
7. ESD(整机):接触+/-4Kv,空气+/-8Kv

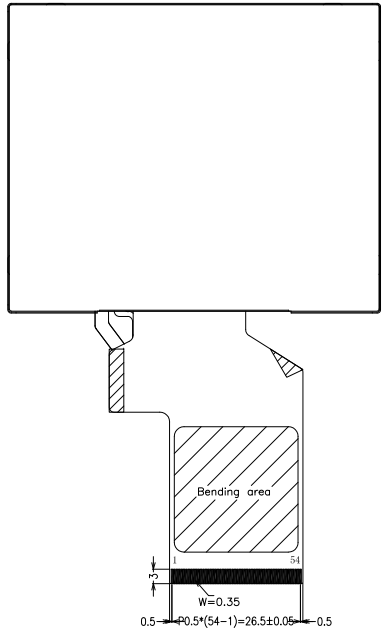
FRONT



SIDE



BACK



1	VLED-
2	VLED-
3	VLED+
4	VLED+
5	YU
6	XR
7	NC
8	/RESET
9	SPENA
10	SPCLK
11	SPDAT
12	B0
13	B1
14	B2
15	B3
16	B4
17	B5
18	B6
19	B7
20	G0
21	G1
22	G2
23	G3
24	G4
25	G5
26	G6
27	G7
28	R0
29	R1
30	R2
31	R3
32	R4
33	R5
34	R6
35	R7
36	HSYNC
37	VSYNC
38	DOTCLK
39	NC
40	NC
41	VCCIO(3.3V)
42	VDD(3.3V)
43	YD
44	XL
45	NC
46	NC
47	NC
48	NC
49	NC
50	NC
51	NC
52	ENB(DEN)
53	DGND
54	AVSS

RTP PIN	LOGIC
1	XL
2	YD
3	XR
4	YU

说明：

1. 结构：FILM+GLASS+tail 上线 FILM:雾面防牛（0.188mm）
   下线 GLASS:400Ω/□ 普通0.7mm tail:FPC (pitch=1.0mm)
2. 电路等级：DC5V 3. 绝缘阻抗：≥20MΩ(25V DC)
4. 线性：≤1.5% 5. 透光率：≥78% 6. 操作压力：50-120g
7. 笔划寿命：≥100,000次 8. 工作环境：-20℃～+70℃ 储存环境：-30℃～+80℃
9. X阻抗：300-1000Ω Y阻抗： 150-500Ω
10. 响应时间：<20ms
11. 未注尺寸公差按±0.20

VER.	SYMBOL	AMENDMENT	SIGN	DATE
01		First issue	邓瑞林	2018.05.29

DRAWN	
ME. CHECKED	
EE. CHECKED	
APPROVED	

TITLE

MODULE SPEC.

DRAWING NO.

UNIT	mm	SCALE	FIT
3rd Angle		SHEET	1OF 1

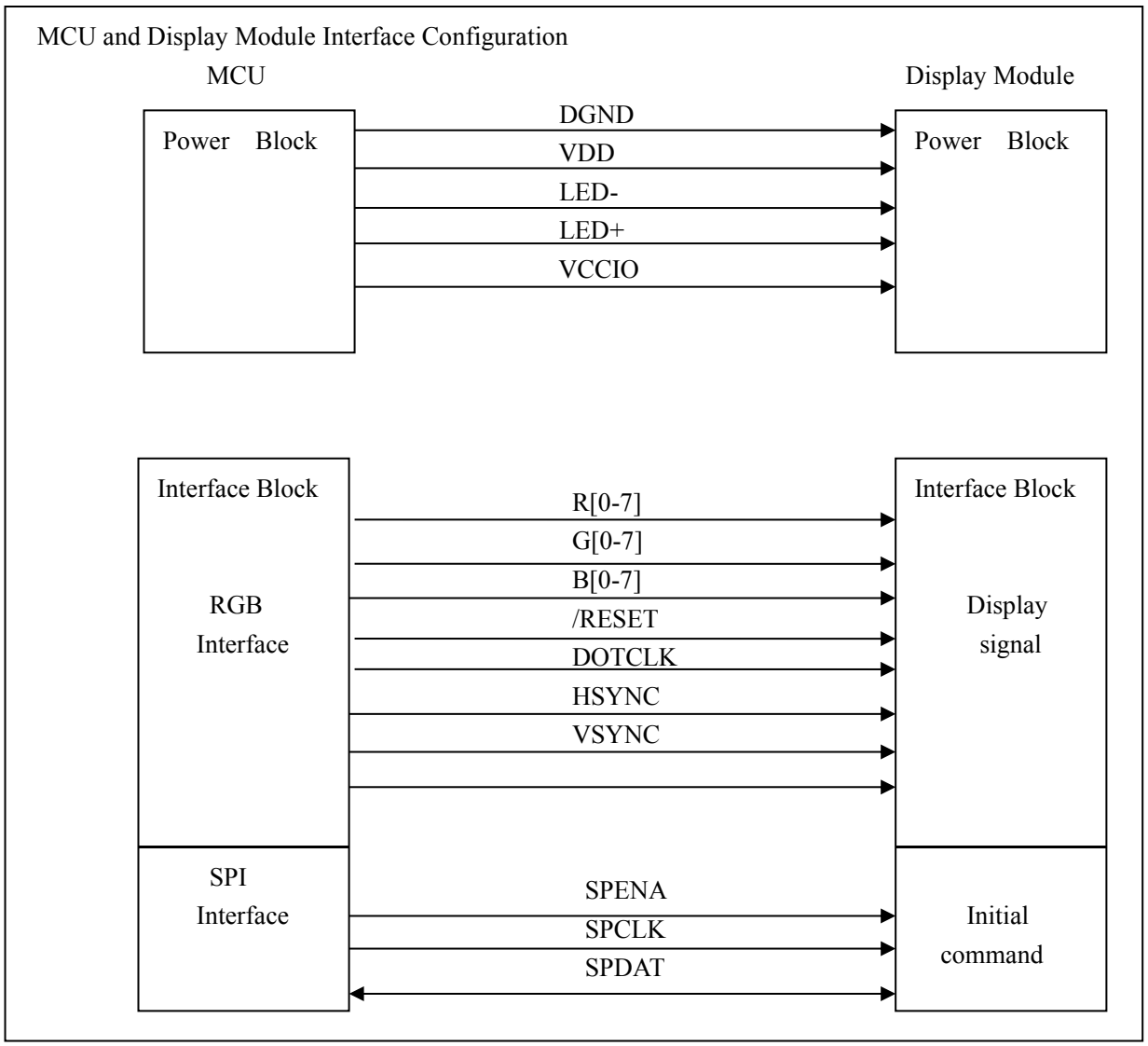
4. I/O CONNECTION & BLOCK DIAGRAM

4.1 I/O Connection

Pin No.	Symbol	I/O	Description
1-2	**LEDK**	P	Power supply for backlight cathode
3-4	**LEDA**	P	Power supply for backlight anode
5-7	**NC**	-	Dummy
8	**/RESET**	I	Global reset pin. When /RESET is “L”, internal initialization procedure is executed
9	**SPENA**	I	Serial communication chip selection
10	**SPCLK**	I	Serial communication clock input
11	**SPDAT**	I/O	Serial communication data input and output
12-19	**B0-B7**	I	Blue data input
20-27	**G0-G7**	I	Green data input
28-35	**R0-R7**	I	Red data input
36	**HSYNC**	I	Horizontal sync signal, default is negative polarity
37	**VSYNC**	I	Vertical sync signal, default is negative polarity
38	**DOTCLK**	I	Pixel clock input pin, default is positive polarity
39-40	**NC**	-	Dummy
41	**VCCIO**	P	Power supply for digital I/O pins.
42	**VDD**	P	Power supply for analog circuit.
43-51	**NC**	-	Dummy
52	**ENB**	I	Data input enable. Display access is enabled when DE is “H”
53	**DGND**	P	Power Ground
54	**AVSS**	P	Power Ground

I：Input；O：Output；P：Power

4.2 Block Diagram



5. ELECTRICAL CHARACTERISTICS

5.1 TFT-LCD Panel Driving Section

Item 项目	Symbol 符号	Min. 最小值	Typ. 典型值	Max. 最大值	Unit 单位	Remark 备注
Power Supply1 Voltage	VDD	3.0	3.3	3.6	V	-
Power Supply2 Voltage	VCCIO	3.0	3.3	3.6	V	-
Power Supply Current	I_{VDD}	-	30	-	mA	Note1
Logic Input High Voltage	V_{IH}	0.7VCCIO	-	VCCIO	V	-
Logic Input Low Voltage	V_{IL}	0	-	0.3VCCIO	V	-
Panel Power Consumption	P_{VDD}	-	0.099	-	Watt	Note1
Module Power Consumption	P_{LCM}	-	0.6	-	Watt	Note1,2

(Ta=+25°C, DGND=AVSS=0V)

Note1:Measurement Conditions (Video Mode): Full Screen Red Pattern,VDD=3.3V,60Hz Refresh.

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

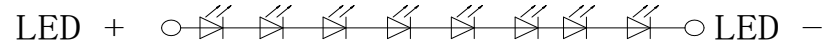
5.2 Back Light Driving Section

Item 项目	Symbol 符号	Min. 最小值	Typ. 典型值	Max. 最大值	Unit 单位	Remark 备注
Forward Voltage	V_F	-	25.6	-	V	Note1
Forward Current	I_F	-	20	-	mA	Note1
Backlight Power consumption	P_{BL}	-	0.51	-	Watt	Note1
LED life time	-	30000	-	-	Hrs	Note2
LED Quantity			8		PCS	

(Ta=+25°C, DGND=AVSS=0V)

Note1: The LED driving condition is defined for each LED module (8LED Serial, 1 LED Parallel)。
For each LED ： IF=20mA,VF=3.2V(Typ.)/3.4V(Max.),Ta=25℃。

Note2: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.



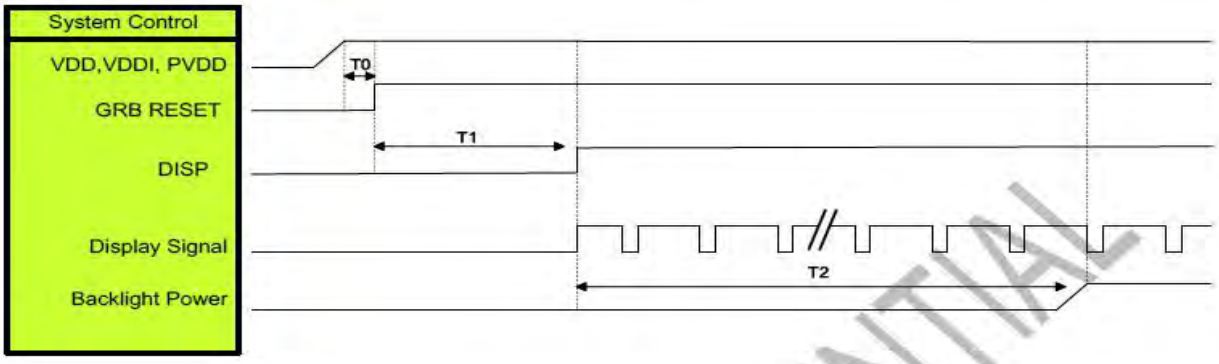
BACKLIGHT CIRCUIT DIAGRAM 20mA/LED (8LED)

LED Vf:25.6V(TYP)
If:20mA

(CIRCUIT DIAGRAM)

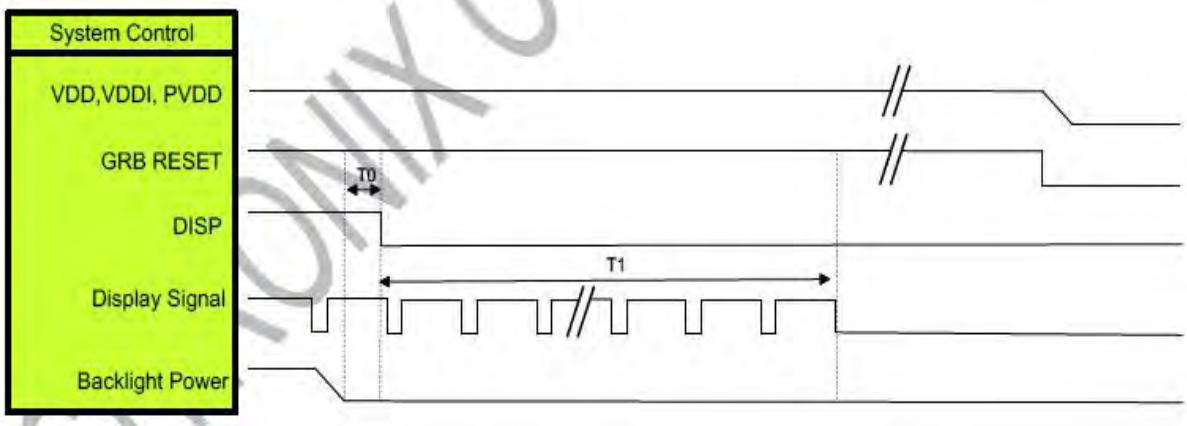
5.3 Power On/Off Sequence

5.3.1 Power on sequence



Symbol	Description	Min. Time	Unit
T0	System power stability to GRB RESET signal	0	ms
T1	GRB RESET= "High" to DISP="High"	10	ms
T2	Display Signal output to Backlight Power on	250	ms

Note: Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]



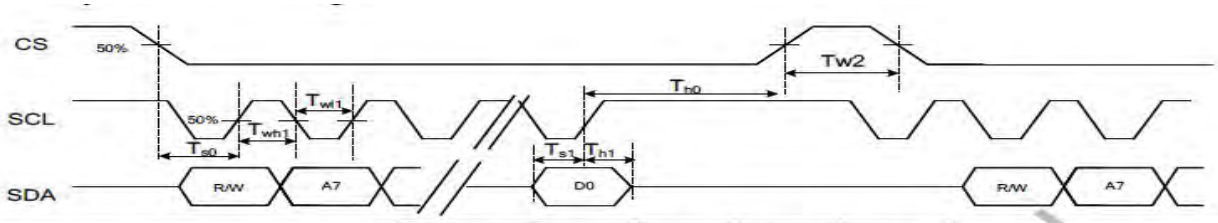
Symbol	Description	Min. Time	Unit
T0	Backlight Power off to DISP="Low"	5	ms
T1	DISP="Low" to IC internal voltage discharge complete	80	ms

Note: Display signal: DCLK; VSYNC; HSYNC; DE; DR[7:0]; DG[7:0]; DB[7:0]

5.3.2 Power off sequence

5.4 Timing Characteristics

5.4.1 Timing for 3-Wire SPI Interface



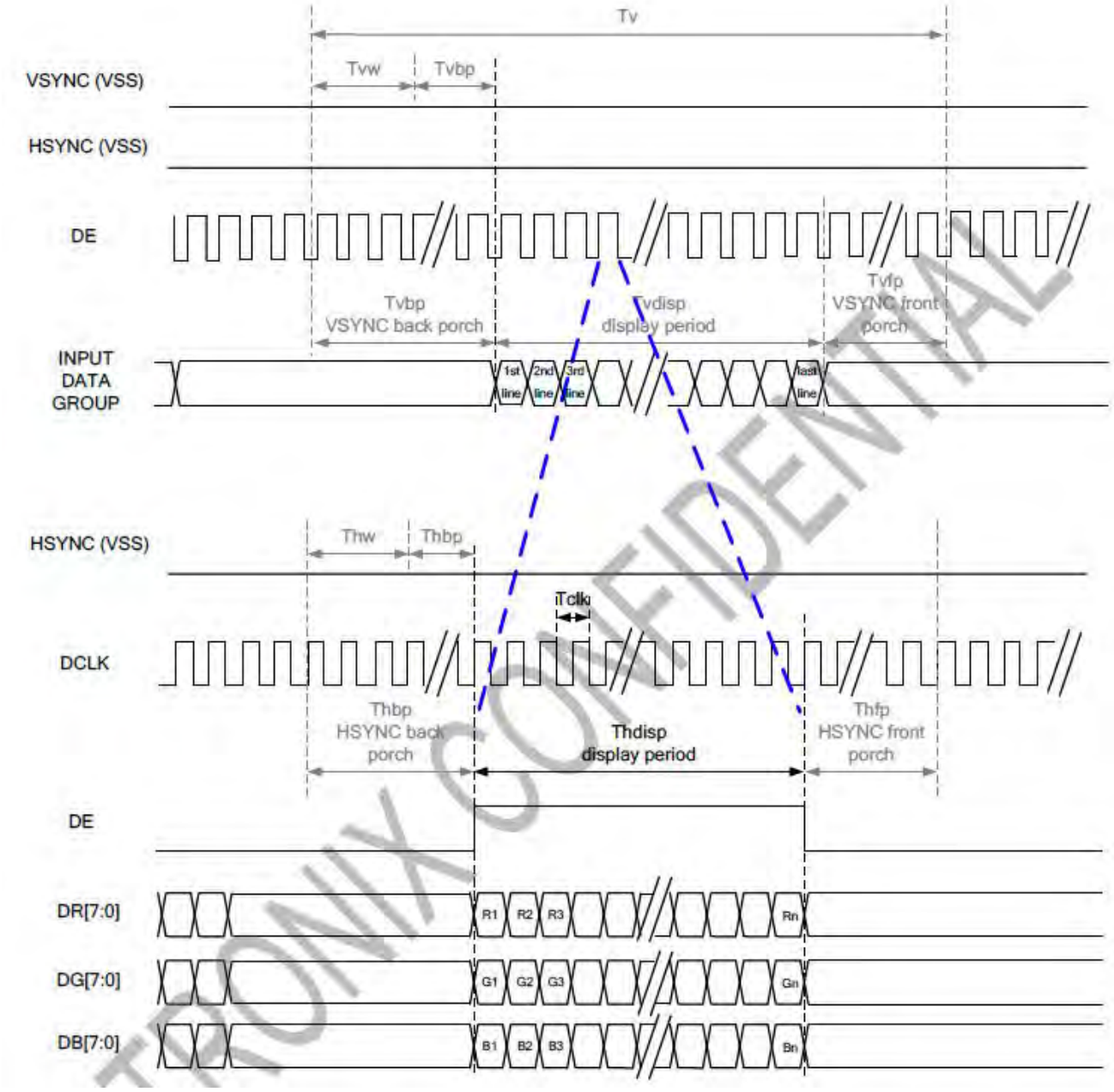
Item	Symbol	Min.	Typ.	Max.	Unit	Conditions
CS Input Setup Time	Ts0	50	-	-	ns	
Serial Data Input Setup Time	Ts1	50	-	-	ns	
CS Input Hold Time	Th0	50	-	-	ns	
Serial Data Input Hold Time	Th1	50	-	-	ns	
SCL Write Pulse High Width	Twh1	50	-	-	ns	
SCL Write Pulse Low Width	Twl1	50	-	-	ns	
SCL Read Pulse High Width	Trh1	300			ns	
SCL Read Pulse Low Width	Trl1	300			ns	
CS Pulse High Width	Tw2	400	-	-	ns	

(Ta=+25°C, DGND=AVSS=0V)

5.4.2 Parallel 24-bit RGB Input Timing Table

Parallel 24-bit RGB Input Timing Table							
Item		Symbol	Min.	Typ.	Max.	Unit	Note
DCLK Frequency		Fclk	5	6	8	MHz	
DCLK Period		Tclk	125	167	200	ns	
HSYNC	Period Time	Th	325	371	438	DCLK	
	Display Period	Thdisp		320		DCLK	
	Back Porch	Thbp	3	43	43	DCLK	SYNC mode back porch control by H_BLANKING[7:0] setting Thbp= H_BLANKING[7:0]
	Front Porch	Thfp	2	8	75	DCLK	
	Pulse Width	Thw	2	4	43	DCLK	
VSYNC	Period Time	Tv	244	260	289	HSYNC	
	Display Period	Tvdisp		240		HSYNC	
	Back Porch	Tvbp	2	12	12	HSYNC	SYNC mode back porch control by V_BLANKING[7:0] setting Tvbp= V_BLANKING[7:0]
	Front Porch	Tvfp	2	8	37	HSYNC	
	Pulse Width	Tvw	2	4	12	HSYNC	

5.5 Timing Diagram



6. OPTICAL CHARACTERISTICS

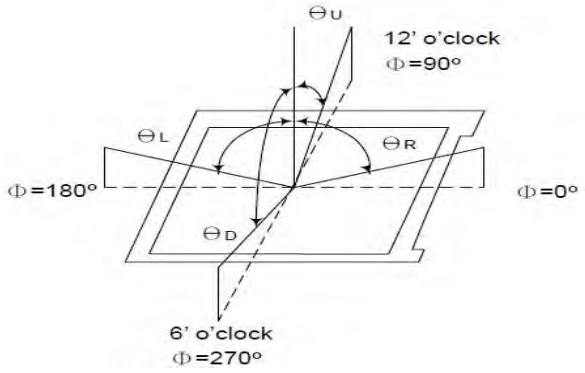
Parameter 参数	Symbol 符号	Condition 条件	Min. 最小值	Typ. 典型值	Max. 最大值	Unit 单位	Remark 备注
Contrast Ratio	C/R	θ = 0°	640	800	-	-	Note(4)
NTSC Ratio	S	θ =0°	55	60	-	%	Note(7)
Luminance	L	θ =0°	-	800	-	cd/m2	Note(5)
Luminance uniformity	U_W	θ =0°	70	80	-	%	Note(3)
Response Time	T_R+ T_F	25 °C	-	30	40	ms	Note(2)
Color Coordination	W_X	θ = 0° (Center) Normal viewing angle B/L On	-0.03	0.317	+0.03	NTSC (x,y)	Note(6)
	W_Y			0.339			
	R_X			TBD			
	R_Y			TBD			
	G_X			TBD			
	G_y			TBD			
	B_X			TBD			
	B_Y			TBD			
Viewing Angle	θ_L	C/R>10	70	80	-	Degree	Note(1)
	θ_R		70	80	-		
	θ_U		70	80	-		
	θ_D		70	80	-		

Test Conditions:

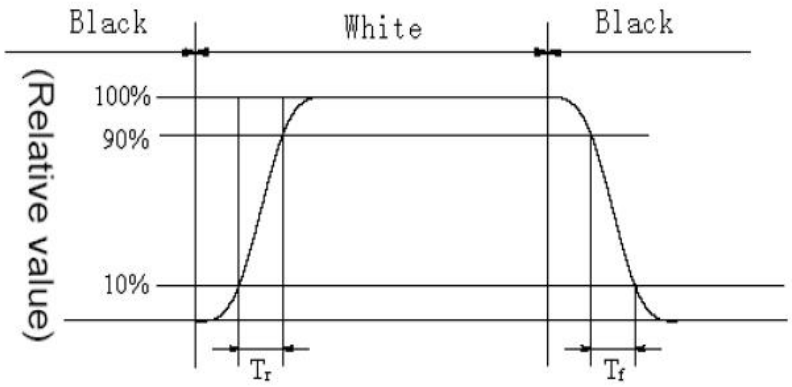
1. VDD=3.3V, I_F=20mA (Backlight current), the ambient temperature is+25℃.

2. The test systems refer to Note 8.

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

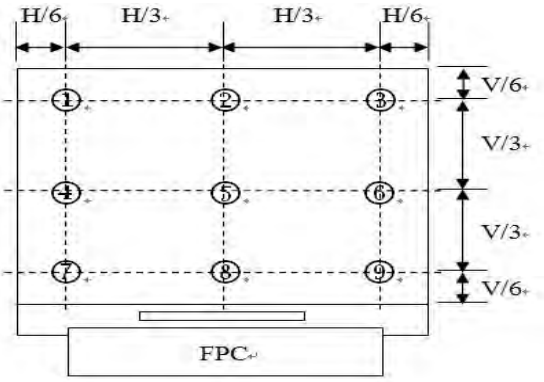


Note2: Definition of Response time: Sum of T_R and T_F



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

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

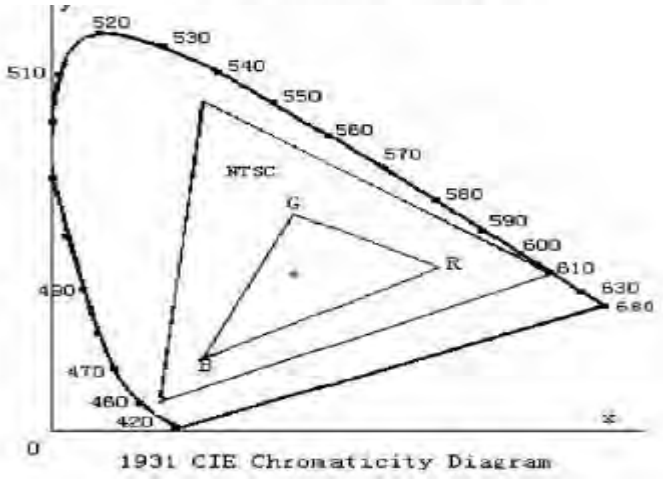
Note 5: Definition of Luminance: Center Luminance of white is defined as luminance values of 1point average across the LCD surface.

Note 6: Definition of Color Chromaticity (CIE 1931)

Color coordinates of white & red, green, blue measured at center point of LCD.

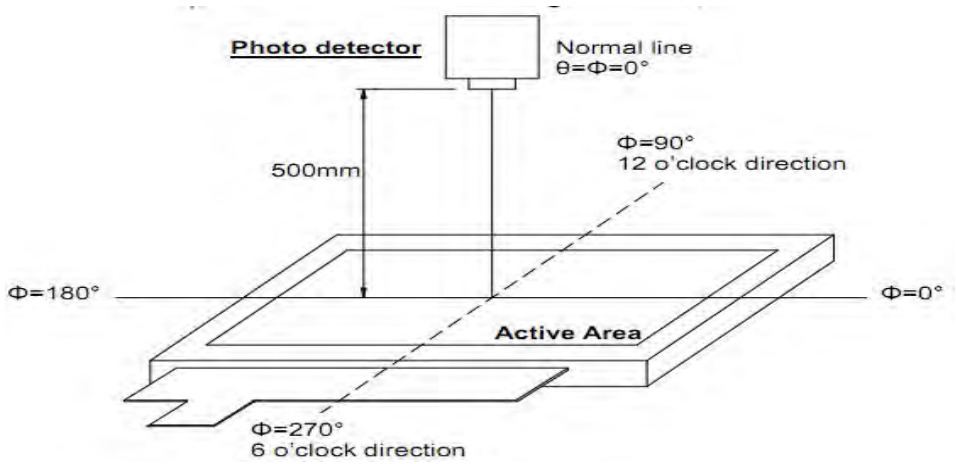
Note 7: Definition of NTSC ratio:

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



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 Δ+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
ESD	C=150PF,R=330 Ohm Air:±8kv,5times(Center) Contact: ±4kv,5times(Center)	Note4

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.

Note 4: In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judged as a good part.

8. PACKAGE DRAWING