

PRODUCT 产品名称	: LCD MODULE 液晶显示模块
MODEL NO. 模块型号	: TFT1920720-26 (10.25)
样品编号	: -1
Revision 版本	: 0.3
SUPPLIER 供应商	: TRULY SEMICONDUCTORS LTD. 信利半导体有限公司
Customer 客户	: /
Customer No. 客户型号	: /



CERT. No. QAC0946535
(ISO9001)



CERT. No. HKG002005
(ISO14001)

SPECIFICATION

产品说明书

This module uses ROHS material
模块用环保材料

This specification may change without prior notice in order to improve performance or quality. Please contact TRULY R&D department for updated specification and product status before design for this product or release of this order.

为了提高产品性能和质量，此规格书及其内容均有可能在没有预先通告的情况下做出修改，请在产品设计或下单之前联系信利研发部门索要最新规格书。

Customers are requested to read the specifications of the TRULY semiconductor's LCD module carefully, if have any question, please tell us to modify in time ; When it's correct, please sign and seal the following form as the standard for the supply of both parties:

请客户认真阅读信利半导体 LCD 模组规格书，有问题及时提出给到我司给予修改，正确无误后请在以下表格签字盖章作为双方供货的准则：

Customer approval 客户核准	Accept 接受	<input type="checkbox"/>	Refuse 拒绝	<input type="checkbox"/>
	Suggestion: 意见:			
Sign 签字: _____				
Seal 盖章: _____				

REVISION RECORD

修改记录

REV NO. 版本号	REV DATE 修改日期	CONTENTS 内容	REMARKS 注释
0.1	2018-06-05	初始版本 0.1	/
0.2	2018-09-04	1. 修正参考应用电路图 1. 修正可靠性标准。 2. 更新模块操作规范	P13-16 页 P28 页 P33 页
0.3	2018-09-23	修正, 中英双版	/

WRITTEN BY 制作	CHECKED BY 检查	APPROVED BY 核准
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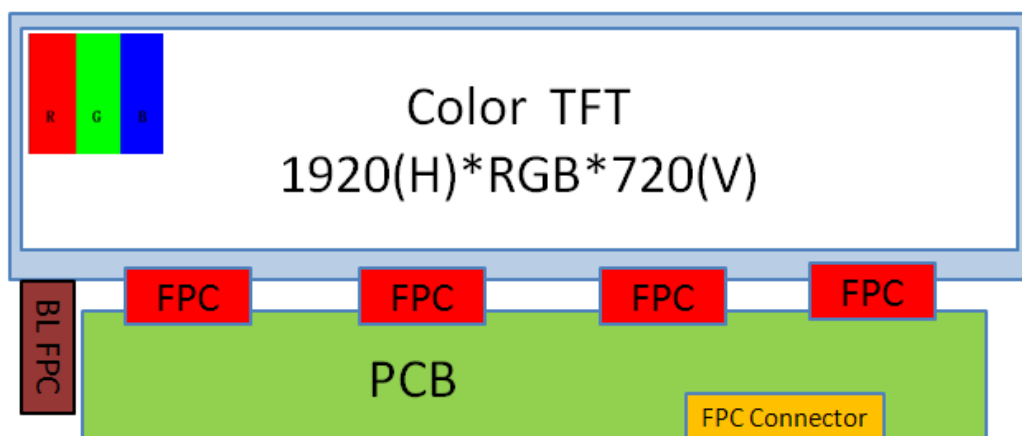
1) GENERAL INFORMATION

主要特征描述

Item 项目	Contents 内容	Unit 单位
LCD Type 液晶显示类型	10.25寸IPS TFT、全透	/
Display mode 显示模式	常黑(NB)	/
Recommended Viewing Direction 模块推荐使用方向	宽视角 (80/80/80/80 deg TYP (U/D/L/R @ C/R>10))	O' Clock
Module area (W×H×T) 模块外围尺寸 (宽 × 高×厚)	261.75×111.60×12.50	mm ³
Viewing area (W×H) 可视区域 (宽 × 高)	244.45×92.17	mm ²
Active area (W×H) 有效区域 (宽 × 高)	243.65×91.37	mm ²
Number of Dots 点阵	1920(H) ×RGB×720(V)	/
Pixel pitch (W × H) 像素间隙(宽 × 高)	0.1269×0.1269	mm ²
Surface Treatment 表面处理	AG	/
Inversion Mode 翻转方式	1 +2dot inversion	/
Backlight Type 背光类型	White LED	/
Module Power Consumption 模块功耗	11500.Typ	mW
Modules Weight 模块重量	425. Typ	g
LCD FPC connector 主屏FPC 连接器	FH28D-50S-0.5SH(05) HRS	/
Backlight FPC connector 背光 FPC连接器	FH52-12S-0.5SH	/
Interface Type 接口类型	2-port LVDS (VESA format) and 3SPI interface	/
Colors Depth 色彩深度	16.7M	Colors
Input voltage 输入电压	VDD=3.3.Typ	V

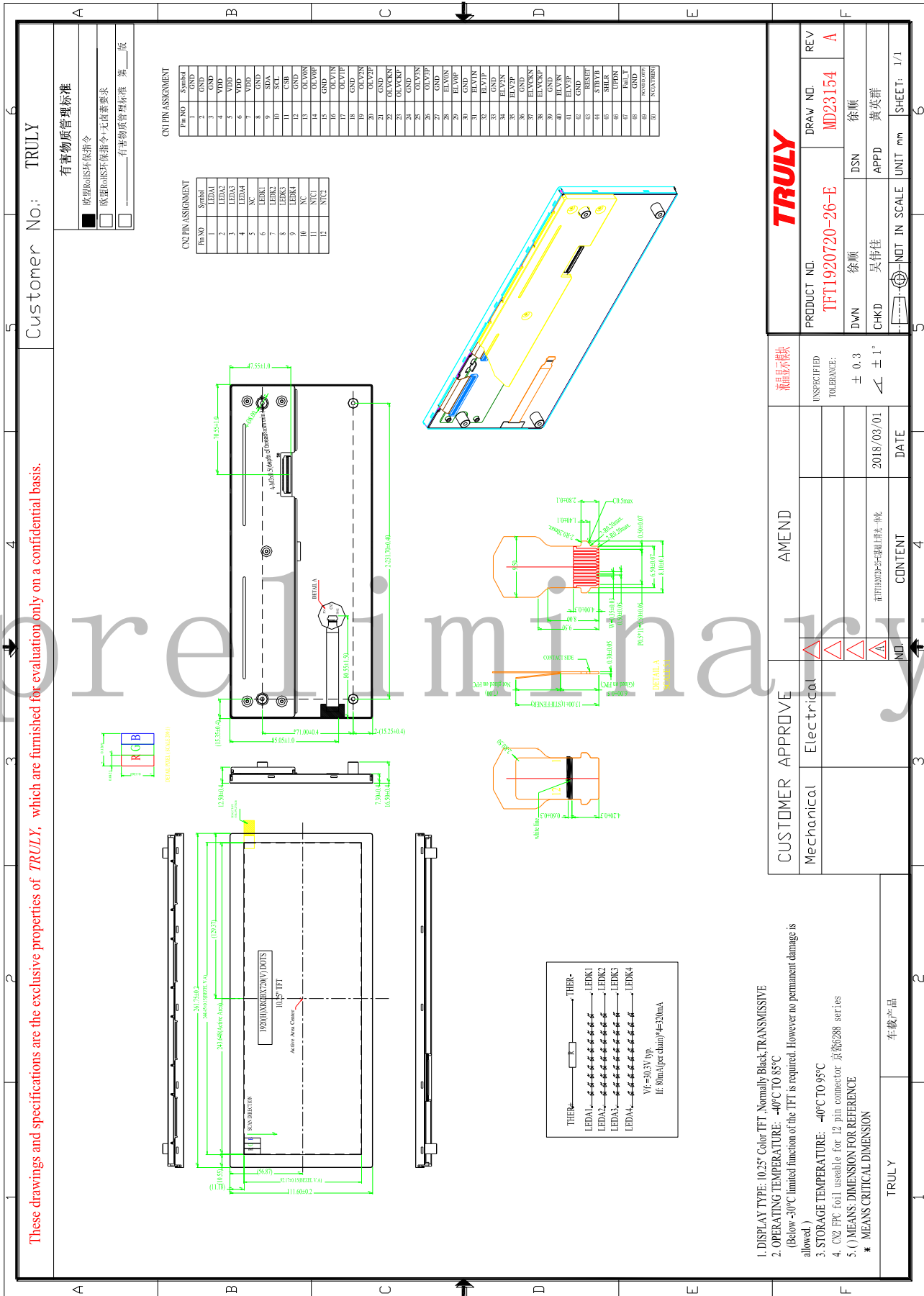
TBD: not sure 待定。Typ: typical value 典型值。

■Block Diagram 结构图



2) EXTERNAL DIMENSIONS

外形尺寸



3) ABSOLUTE MAXIMUM RATINGS

极限参数*Note1

Parameter 参数	Symbol 符号	Min 最小值	Max 最大值	Unit 单位
Input voltage 输入电压	VDD	-0.3	4	V
Digital Input voltage 数字输入电压	VIN	-0.3	VDD+0.3	V
Operating temperature 操作温度	-40	85	°C	-40
Storage temperature 储存温度	-40	90	°C	-40
Humidity 湿度	-	-	90%(Max60 °C)	RH

***Note1:** Absolute maximum ratings means the product can withstand short-term, NOT more than 120 hours. If the product is a long time to withstand these conditions, the life time would be shorter.

极限条件仅指产品能短暂承受的范围,不可超过 120 小时。如果产品长时间在极限条件,将有损产品的使用寿命。

***Note2:** Operating temperature between -40°C to -31°C does not specify the full optical performance of the LCD, but no damage of the display function will occur.

操作温度在-31°C至-40°C之间时, LCD 不会损坏, 但不保证光学特性。

4) ELECTRICAL CHARACTERISTICS

模块电气特性

DC CHARACTERISTICS

直流特性

Parameter	Symbol	Min	Typ	Max	Unit
Input voltage 输入电压	VDD	3.1	3.3	3.6	V
输入电流(VDD=3.3V) *Note1	IDD	-	370	450	mA
Sleep current 睡眠电流	Isleep	-	500	800	uA
Input voltage 'H' level 输入高电平	VIH	0.7VDD	-	VDD+0.3	V
Input voltage 'L' level 输入低电平	VIL	GND-0.3	-	0.3VDD	V
Output voltage 'H' level 输出高电平	VOH	VDD-0.4	-	VDD	V
Output voltage 'L' level 输出低电平	VOL	GND	-	GND +0.4	V
Operating frequency , per LVDS channel	F _{LVDS}	14	-	85	MHz
Differential input high Threshold voltage*Note2,3	V _{th}	0.1	-	-	V
Differential input low threshold voltage*Note2,3	V _{tl}	-	-	-0.1	V
Differential input common Mode voltage *Note3	V _{CM}	1	1.2	1.7- V _{id} /2	V
LVDS input voltage	V _{INLV}	0.7	-	1.7	V

Differential input voltage*Note3	Vid	0.2	-	0.6	V
Differential input leakage Current*Note3	VLEAK	-10	-	+10	uA

*Note1: IDD is test when VDD=3.3V.

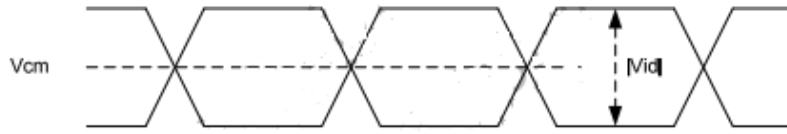
在VDD = 3.3V的条件下测试输入电流IDD.

*Note2: V_{CM} = 1.2V.

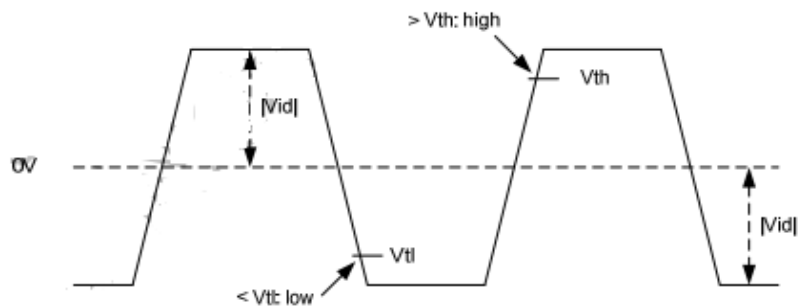
*Note3:

①.

Single-ended:
LVCLKP,
LVCLKN,
LVD[3:0]P,
LVD[3:0]N



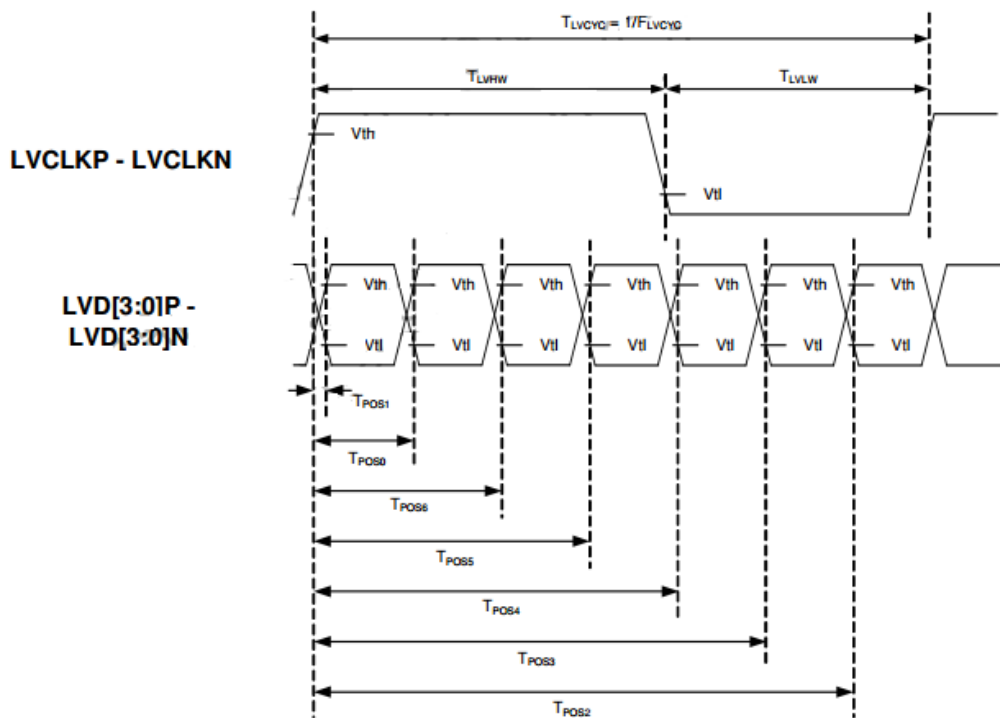
Differential:
LVCLKP-LVCLKN,
LVD[3:0]P-LVD[3:0]N



②. LVDS mode AC electrical characteristics

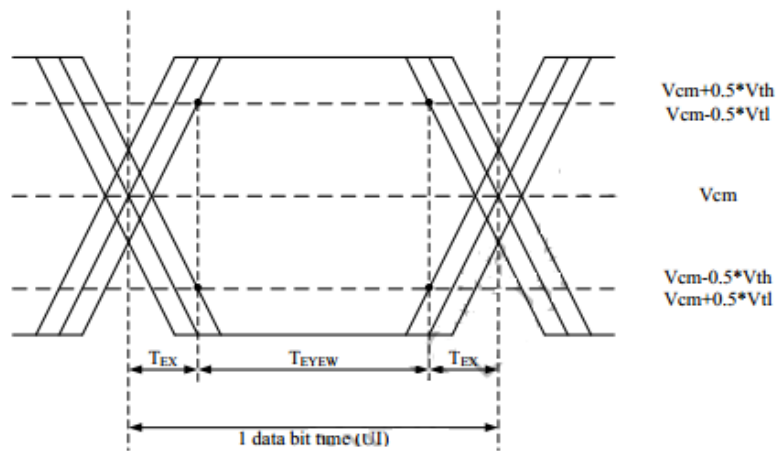
Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Clock frequency	F _{LVCYC}	14	-	85	MHz
Clock period	T _{LVCYC}	11.76	-	71.43	nsec
1 data bit time	UI	-	1/7	-	T _{LVCYC}
Clock high time	T _{LVCH}	3	4	4	UI
Clock low time	T _{LVCL}	3	3	4	UI
Position 1	T _{POS1}	-0.2	0	0.2	UI
Position 0	T _{POS0}	0.8	1	1.2	UI
Position 6	T _{POS6}	1.8	2	2.2	UI
Position 5	T _{POS5}	2.8	3	3.2	UI
Position 4	T _{POS4}	3.8	4	4.2	UI
Position 3	T _{POS3}	4.8	5	5.2	UI
Position 2	T _{POS2}	5.8	6	6.2	UI
Input eye width	T _{EYEW}	0.6	-	-	UI
Input eye border	T _{EX}	-	-	0.2	UI
LVDS wake up time	T _{ENLVDS}	-	-	150	μs

③. LVDS input timing:

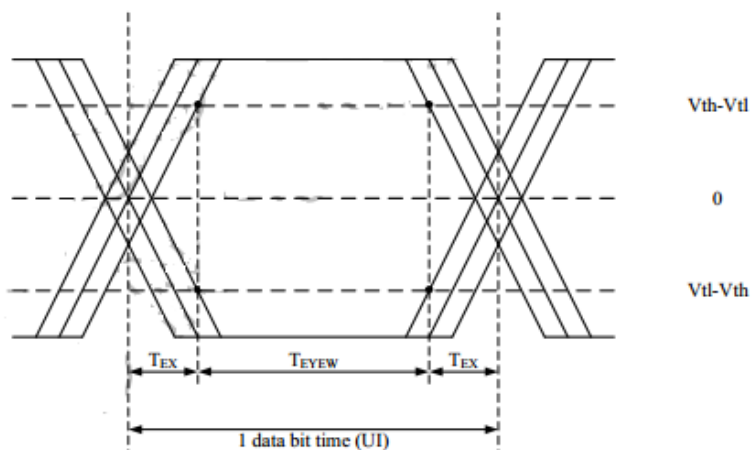


④. LVDS input eye diagram:

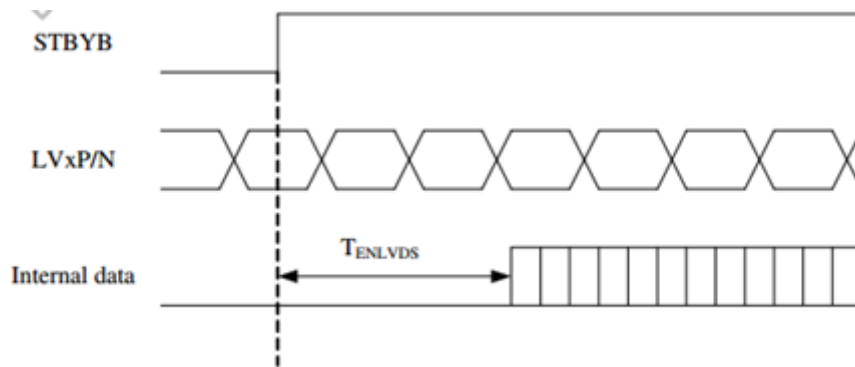
Single-ended:
LVD[3:0]P,
LVD[3:0]N



Differential:
LVD[3:0]P-LVD[3:0]N



⑤. LVDS wake up time



Paramete	Symbol	Condition	Spec.			Unit
			Min.	Typ.	Max.	
Modulation frequency	SSC _{MF}	-	23	-	200	KHz
Modulation rate	SSC _{MR}	LVDS clock = 85MHz center spread	-	-	±3	%

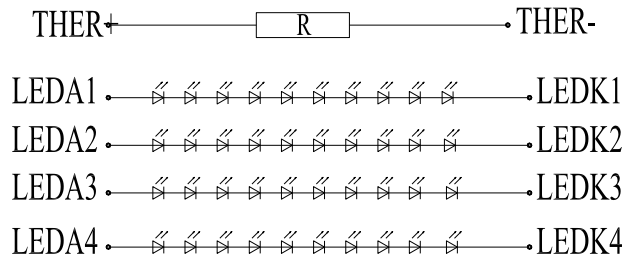
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5) BACKLIGHT CHARACTERISTICS

背光电气特性

5.1 Backlight circuit diagram

背光电路图



Driving conditions: Constant current 320mA

驱动条件: 恒流 80mA*4=320 mA

5.2 Backlit parameters

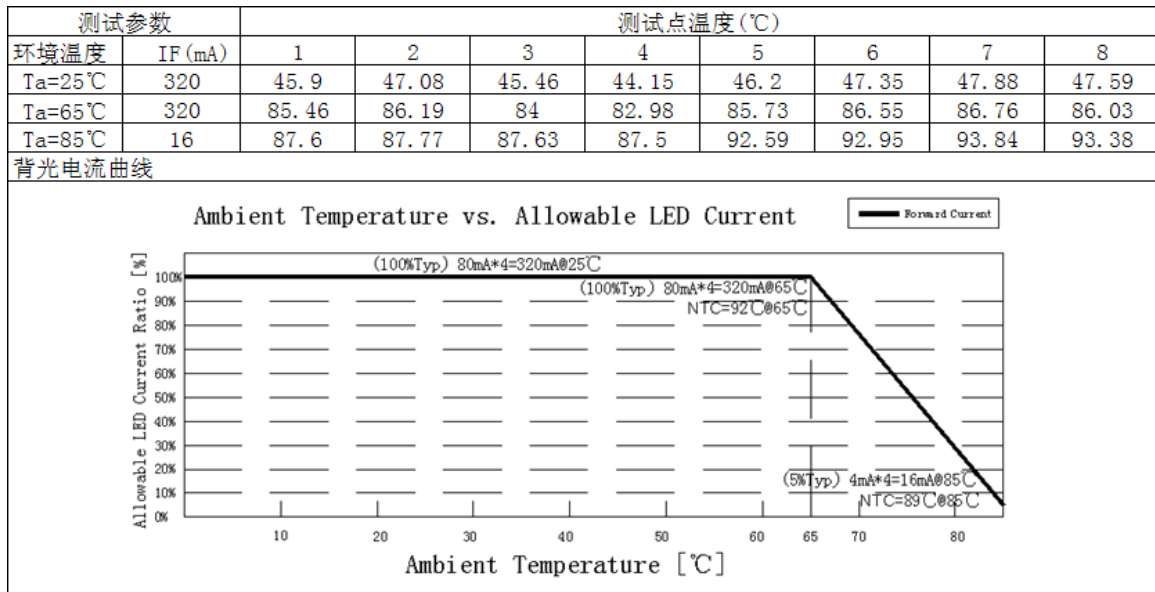
背光参数

TA=25℃

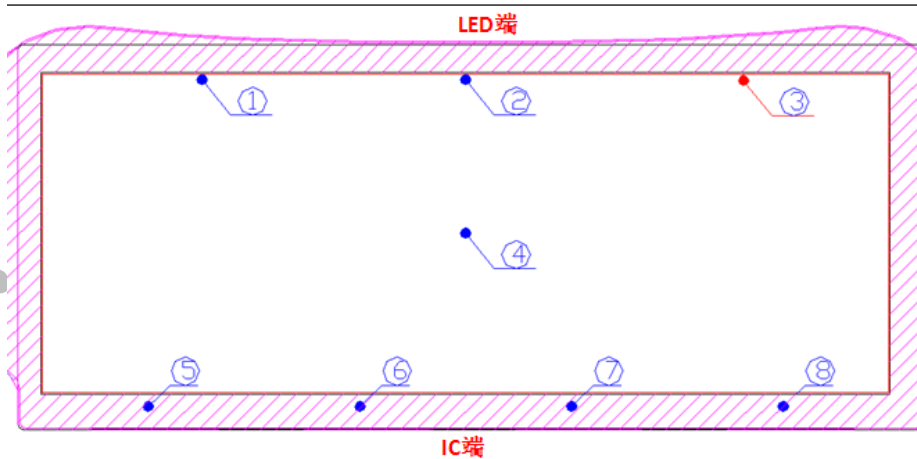
参数	驱动条件	简写	最小值	典型值	最大值	单位
背光在运行温度中电压范围	Ta=+85℃ If= 80mA*4	Vf	24.3	28.3	32.3	V
	Ta=+25℃ If= 80mA*4	Vf	26	30	34	V
	Ta=-40℃ If= 80mA*4	Vf	28.3	32.3	36.3	V
背光功耗	Ta=-40~+85℃ If= 80mA*4	P		10.35	11.53	W
背光电流使用范围	Ta=+25℃	I		80*4	84*4	mA
LED灯数量	-	-	40	-	-	片
LED连接方式	-	-	10串*4并	-	-	/
亮度衰减70% 背光寿命	30000					小时

***Note1:** Using condition: constant current driving method If=320 mA (+/-10%), current fluctuation have no damage for LCD module, but if the designed current is lower than the typical value, LCD module's optical performance will decrease. Recommended to design backlight drive strictly according to typical values.
 使用条件: 恒流驱动 320mA (精度: +/-10%), 电流波动对显示功能没有损害, 但需注意当电流低于典型值时, LCD 模组的光学性能会有所下降。建议严格按照典型值设计背光驱动。

***Note2:** Backlight LED derating curve: (when temperature ≥ 70℃, the backlight current of the LCD module needs to be reduced, In order to guarantee the LCD module working in safe temperature less than or equal to 90℃)
 背光 LED 灯降额曲线: (高温 70℃以上, LCD 模组的背光电流需要降低, 以保证 LCD 模组工作在安全温度以内 ≤ 90℃)



测试点示意图:



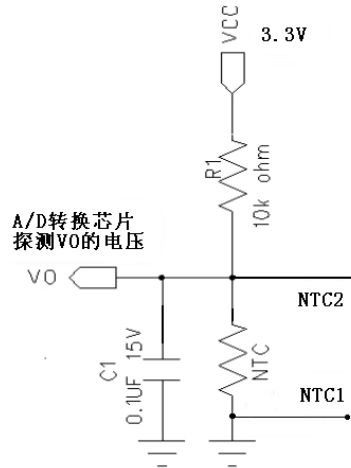
5.3 Thermal resistor (NCP18XH103F03RB)

热敏电阻(NCP18XH103F03RB)

NO.	Item	Specification	Condition
2.1	Resistance	10k ohm ± 1%	at 25°C, zero-power resistance
2.2	B-constant	3380 K± 1%	B-constant is calculated by zero-power resistance of Thermistor in 25°C and 50°C (*1)
2.3	Permissive Operating Current.	0.31 mA	at 25°C in still air (*2,*3)
2.4	Rated Electric Power	100 mW	at 25°C in still air (*2,*4)
2.5	Thermal Dissipation Constant	Approx. 1.0 mW/°C	at 25°C in still air (*2)
2.6	Operating temperature Range	-40~+125/°C	

Reference application circuit:

参考应用电路:



Calculation formula of Thermistor See below

热敏电阻计算公式见以下:

$$R_t = R * \text{EXP}(B * (1/T_1 - 1/T_2))$$

Formula interpretation:

公式解释:

1. R_t is Resistance of thermal resistor under the T_1 temperature;
 R_t 是热敏电阻在 T_1 温度下的阻值;
2. R is Resistance of thermal resistor under the $T_2(25^\circ\text{C})$ temperature ($10\text{K} \pm 1\%$);
 R 是热敏电阻在 $T_2(25^\circ\text{C})$ 的标称阻值($10\text{K} \pm 1\%$);
3. The B value is the B -constant of the thermal resistor;
 B 值是热敏电阻的重要参数;
4. EXP is e^n ;
 EXP 是 e 的 n 次方;
5. T_1 and T_2 are K degrees (Kelvin temperature), $\text{K degree} = 273.15(\text{absolute zero}) + \text{Celsius temperature}$. Such as: $T_2 = 273.15 + 25$.
 T_1 与 T_2 指的是 K 度即开尔文温度, $\text{K 度} = 273.15(\text{绝对温度}) + \text{摄氏温度}$ 。如: $T_2 = 273.15 + 25$

6) INTERFACE DESCRIPTION

接口定义

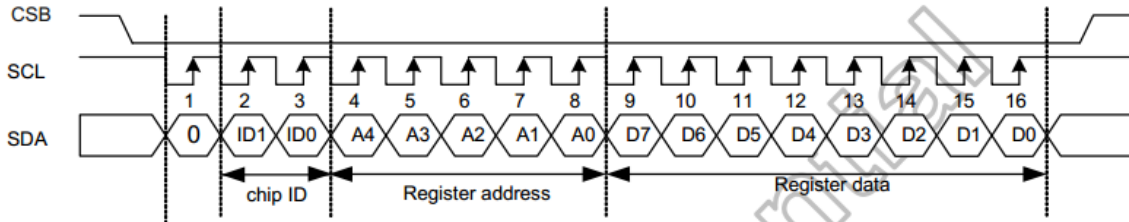
6.1 LCD Interface

LCD 接口定义

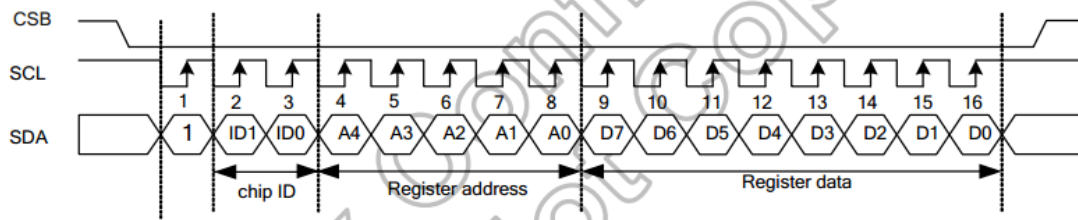
NO. 序号	Symbol 符号	I/O or connect to 输入/出 或连接到	Description 描述
1	GND	I Power	Power Ground(0V)
2	GND		
3	GND		
4	VDD	I Power	Power (3.3V)
5	VDD		
6	VDD		
7	VDD		
8	GND	I Power	Power Ground(0V)
9	SDA	I	SPI Data. *Note1:
10	SCL	I	SPI Clk. *Note1:
11	CSB	I	SPI Chip select. 0: chip select 1: no chip select *Note1:
12	GND	I Power	Power Ground(0V)
13	OLV0N	I	Odd LVDS data 0- (negative)
14	OLV0P	I	Odd LVDS data 0+ (positive)
15	GND	I	Power Ground(0V)
16	OLV1N	I	Odd LVDS data 1- (negative)
17	OLV1P	I	Odd LVDS data 1+ (positive)
18	GND	I Power	Power Ground(0V)
19	OLV2N	I	Odd LVDS data 2- (negative)
20	OLV2P	I	Odd LVDS data 2+ (positive)
21	GND	I Power	Power Ground(0V)
22	OLVCKN	I	Odd LVDS clock - (negative)
23	OLVCKP	I	Odd LVDS clock + (positive)
24	GND	I Power	Power Ground(0V)
25	OLV3N	I	Odd LVDS data 3- (negative)
26	OLV3P	I	Odd LVDS data 3+ (positive)
27	GND	I Power	Power Ground(0V)
28	ELV0N	I	Even LVDS data 0- (negative)
29	ELV0P	I	Even LVDS data 0+ (positive)
30	GND	I Power	Power Ground(0V)
31	ELV1N	I	Even LVDS data 1- (negative)
32	ELV1P	I	Even LVDS data 1+ (positive)
33	GND	I Power	Power Ground(0V)
34	ELV2N	I	Even LVDS data 2- (negative)
35	ELV2P	I	Even LVDS data 2+ (positive)
36	GND	I	Power Ground(0V)
37	ELVCKN	Power	Even LVDS clock - (negative)
38	ELVCKP	I	Even LVDS clock + (positive)
39	GND	I Power	Power Ground(0V)
40	ELV3N	Power	Even LVDS data 3- (negative)
41	ELV3P	I	Even LVDS data 3+ (positive)
42	GND	I Power	Power Ground(0V)
43	RESET	I	Reset PIN. 0: Reset Model 1: Normal Model
44	STBYB	I	Standby Model Control Pin. 0: Standby Model 1: Normal Model
45	SHLR	I	NC. Soft Control.
46	UPDN	I	NC. Soft Control.

47	Fail_T *Note2:	0	Error Detect Pin, connect to MCU I/O □. Read 1: abnormal, Read 0: normal.
48	GND	I Power	Power Ground(0V)
49	NC(VDD_OTP)	I	NC. Must Open.
50	NC(ATREN) *Note3:	Power	0: SPI model 1: OTP model

***Note1: Write(写): 地址位最高位为 0**



Read(读): 地址位最高位为 1



***Note2: FAIL_DET will detect following items:**

1. EEPROM reload dummy data and checksum error.
 2. IC enter self protection model (No HS/VIS/DE/CLK).
 3. GATE driver not feedback STV signal to TCON.
 4. Source driver internal signal not feedback to TCON.
 5. IC enter GAS model.
 6. LVDS un-lock at LVDS model.
- Any of them get error, then FAIL_T output pin is 1 (high).

***Note3: ATREN have internal Pull up high.**

6.2 Backlight Interface

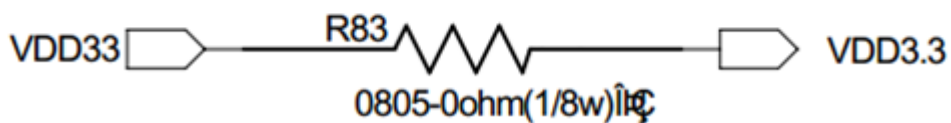
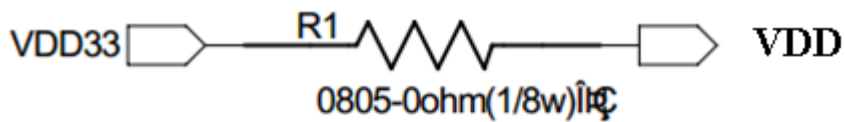
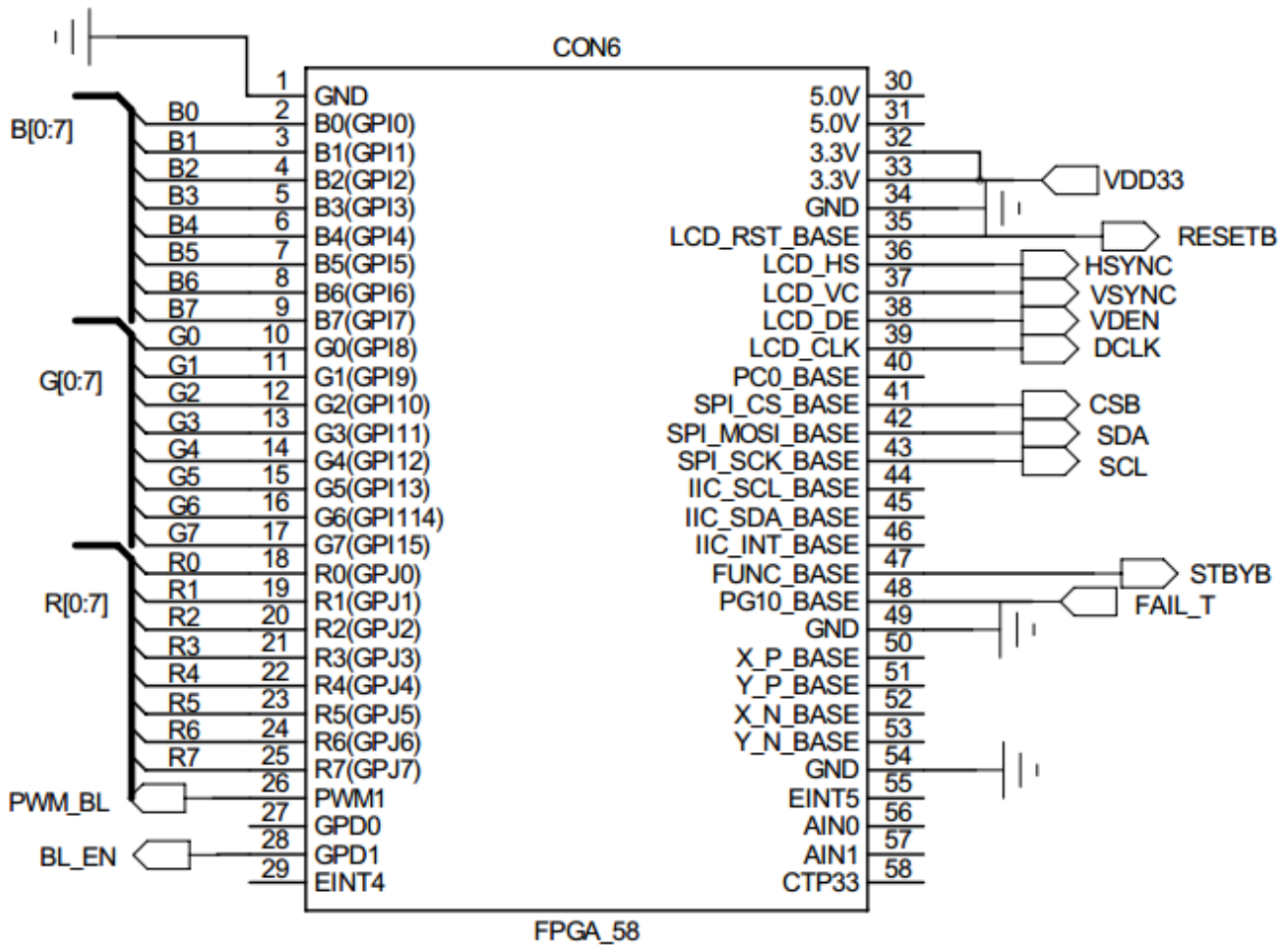
背光接口定义

NO. 序号	Symbol 符号	I/O or connect to 输入/出或连接到	Description 描述
1	LEDA1	Power	Backlight1+
2	LEDA2	Power	Backlight2+
3	LEDA3	Power	Backlight3+
4	LEDA4	Power	Backlight4+
5	NC	-	Open
6	LEDK1	Power	Backlight1-
7	LEDK2	Power	Backlight2-
8	LEDK3	Power	Backlight3-
9	LEDK4	Power	Backlight4-
10	NC	-	Open
11	NTC1	-	Thermistor pin 1
12	NTC2	-	Thermistor pin 2

7) REFERENCE APPLICATION CIRCUIT

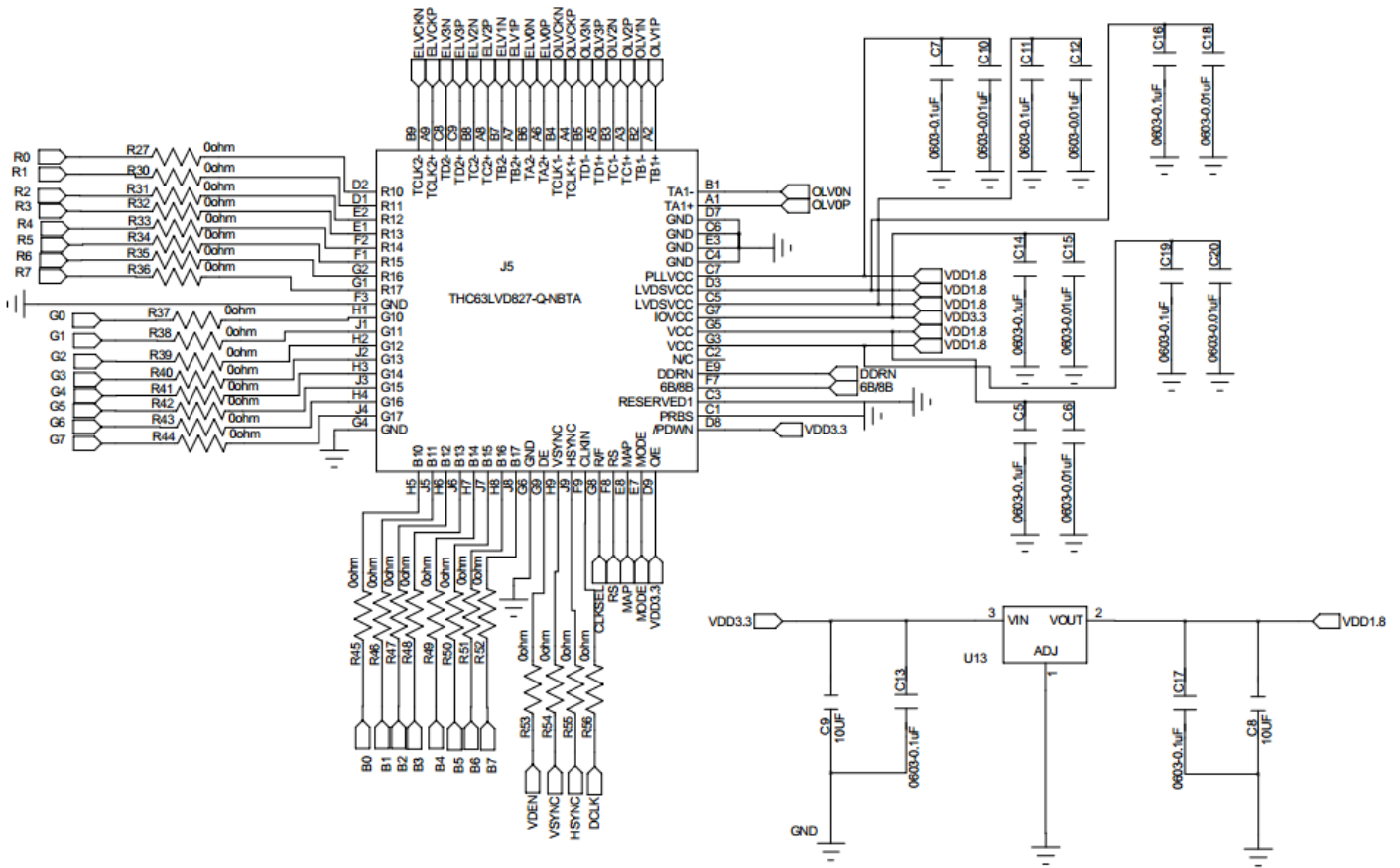
参考应用电路

MCU

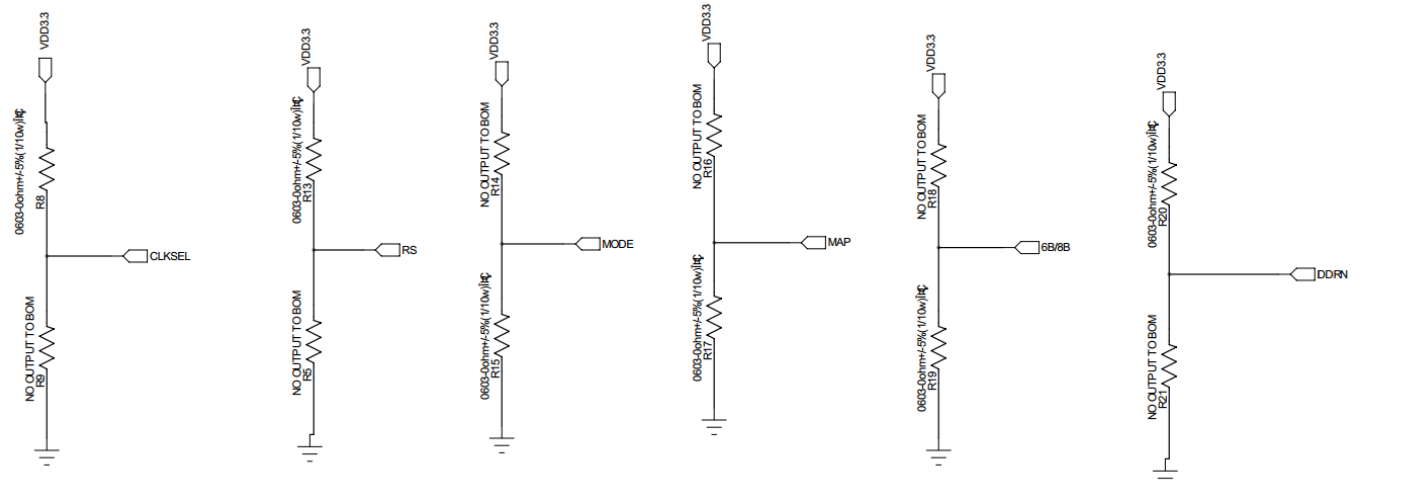


RGB TO LVDS CIRCUIT

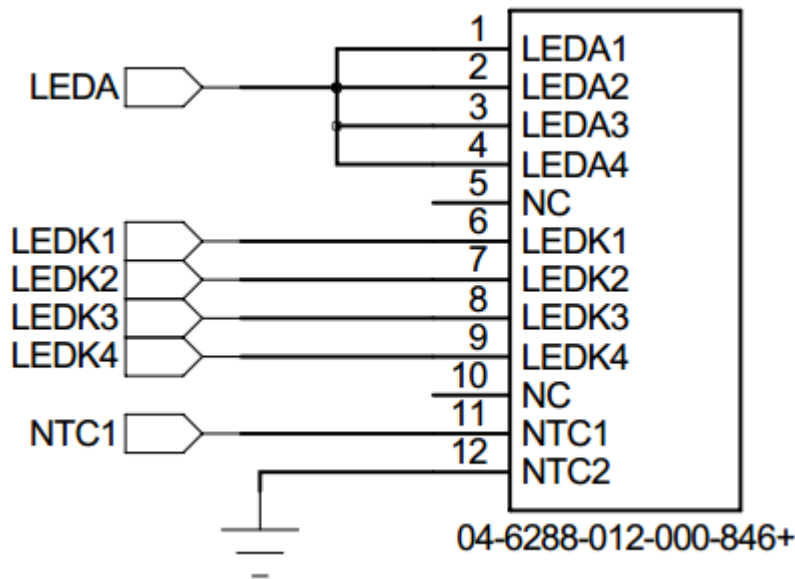
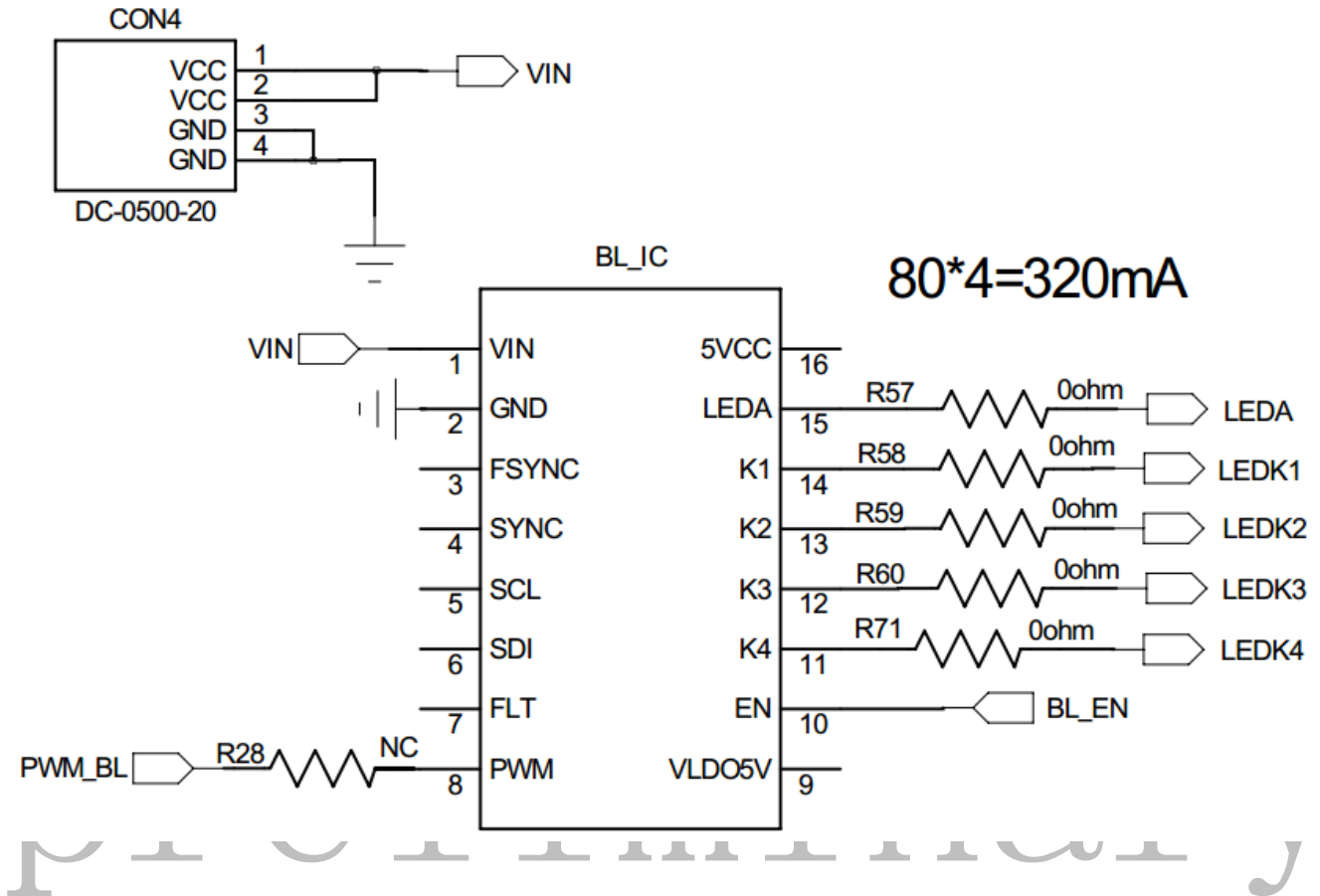
0.01UF closer to related PINs of IC



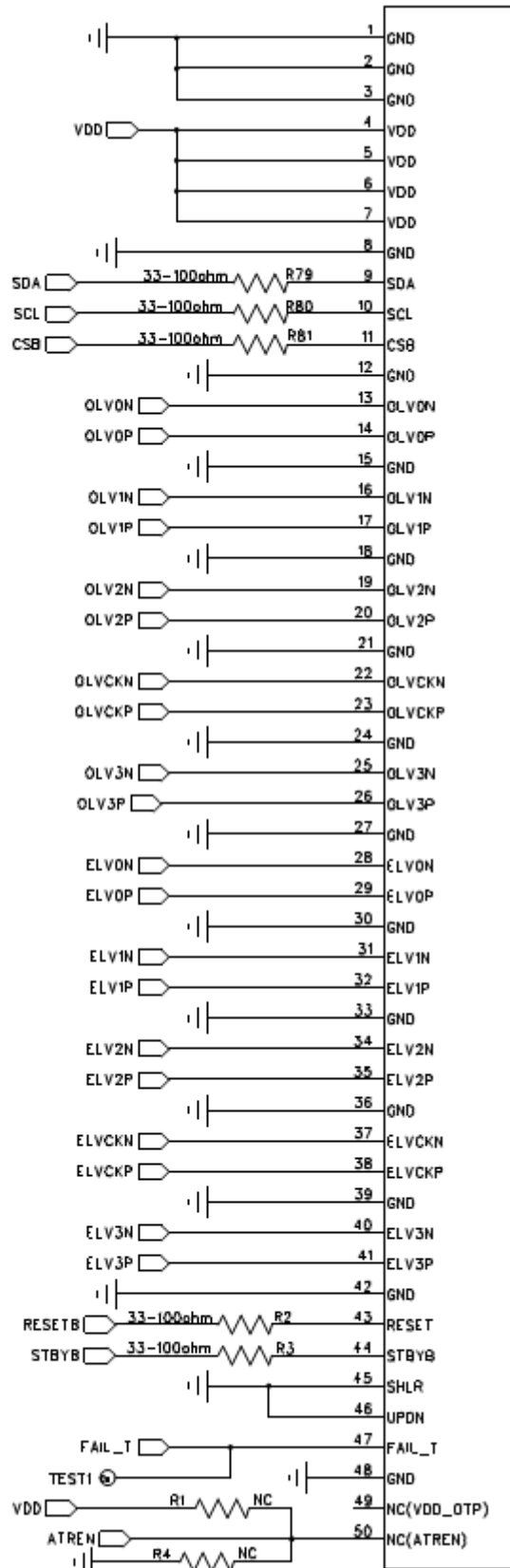
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backlight circuit



LCD Interface



pre

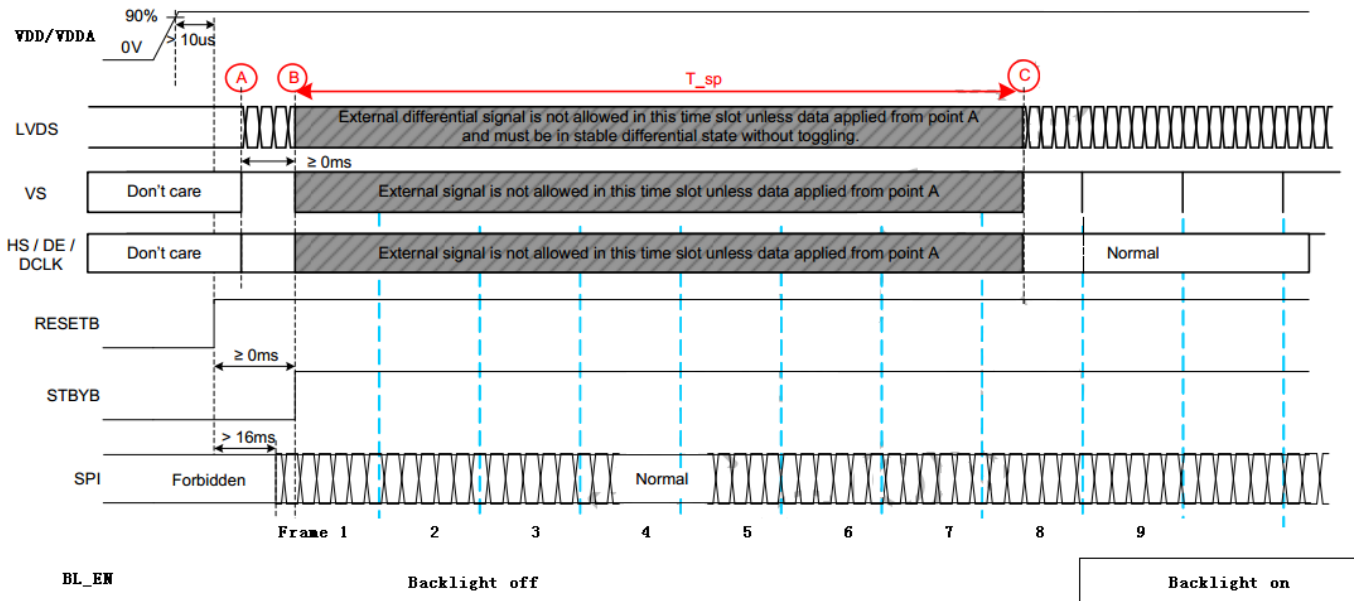
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8) TIMING CHARACTERISTICS

时序图

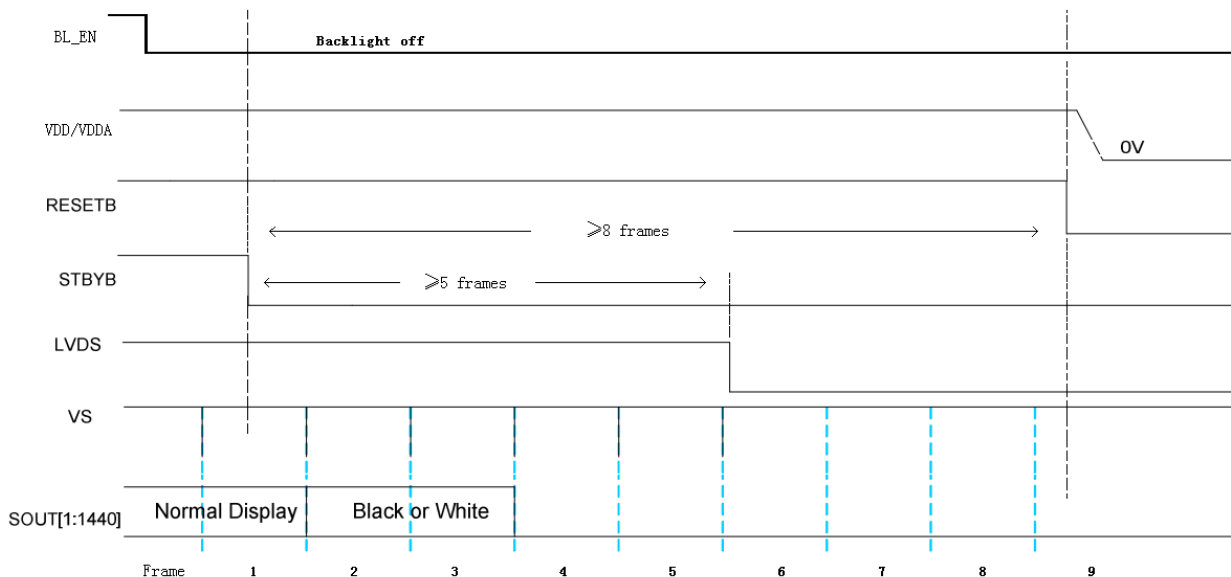
8.1 Power on/off sequence

Power on 上电:



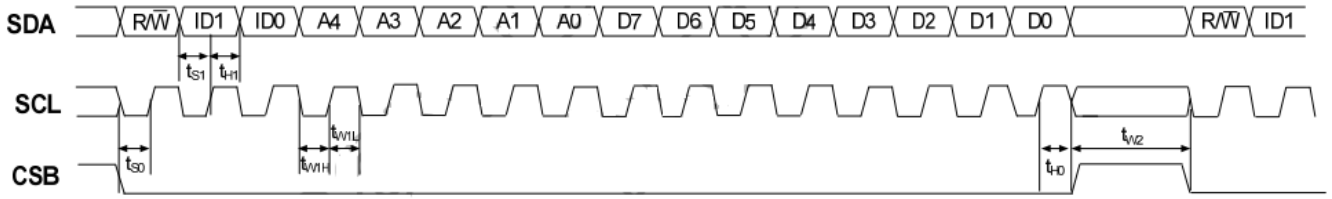
- *Note1: The system must start to continuously apply external display data from either point A or point C.
- *Note2: T_{sp} shown in the figure is 100 msec.
- *Note3: If the system starts to continuously apply external video data from point C, please keep stable differential state for each LVDS pair without toggling which leads to longer T_{sp}.
- *Note4: At least 16ms after RESET is high, SPI can be set to access registers.
- *Note5: We suggest set initial code registers before STBYB rising (must observe Note 4) or program in OTP/EEPROM.
- *Note6: One frame is 16.7ms when frame frequency is 60Hz.
- *Note7: We recommend turn on the backlight when LCD Display normal. There is ≥8 frames.

Power off 下电:



- *Note1: When power off, We recommend turn off backlight first.
- *Note2: At least 8 frames is needed in power off flow.

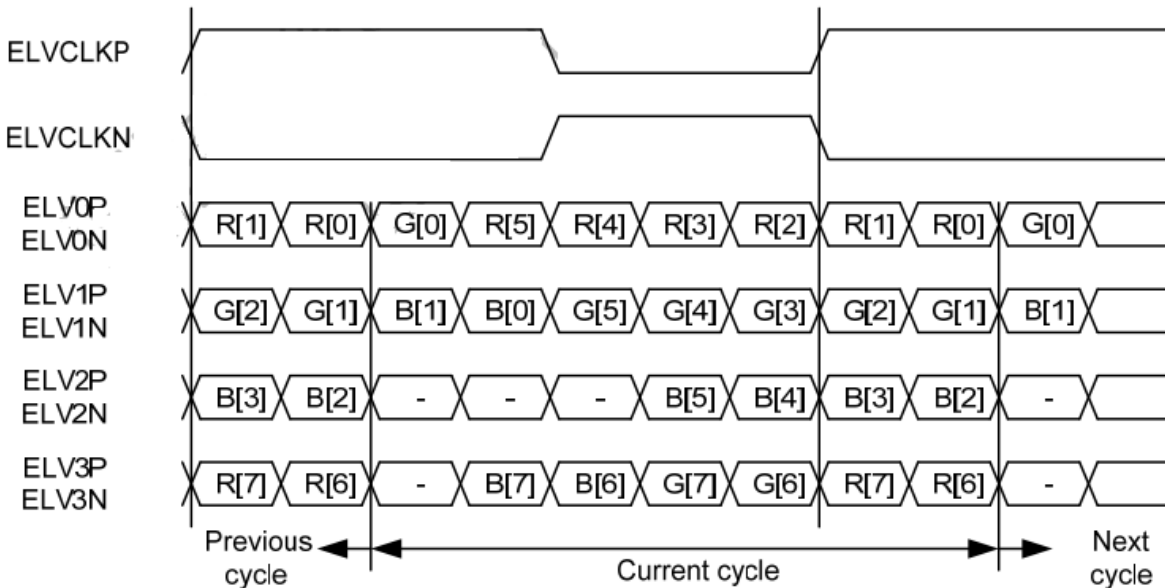
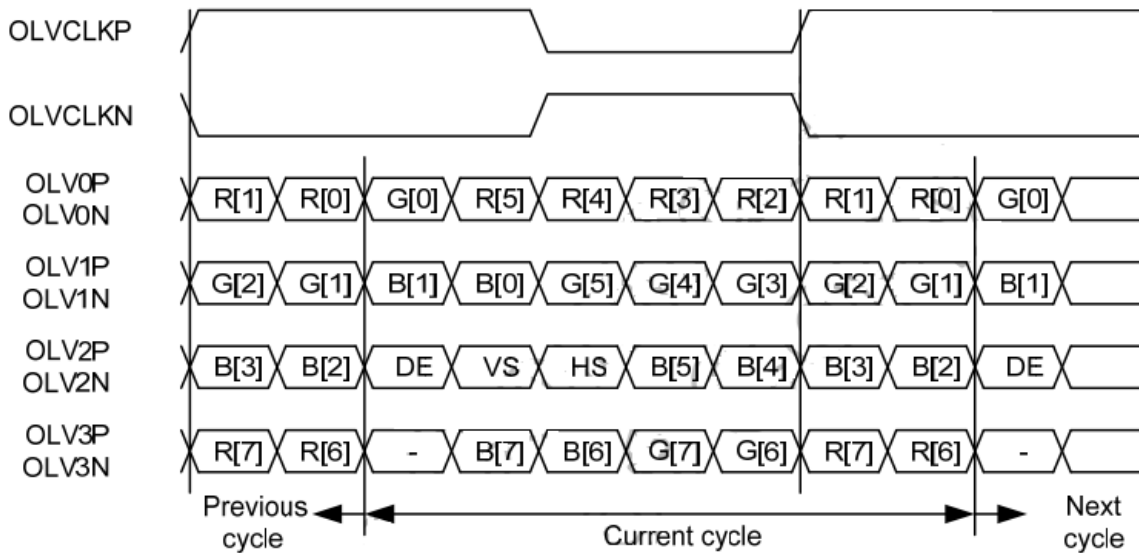
8.2 SPI Timing



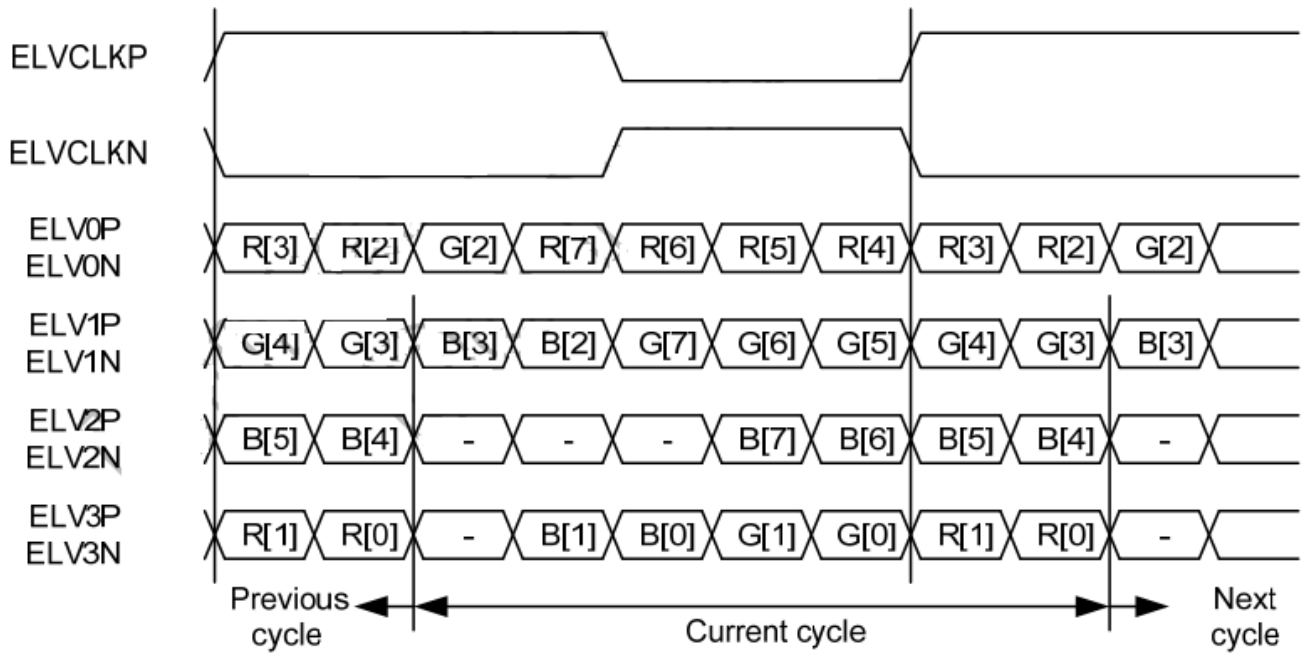
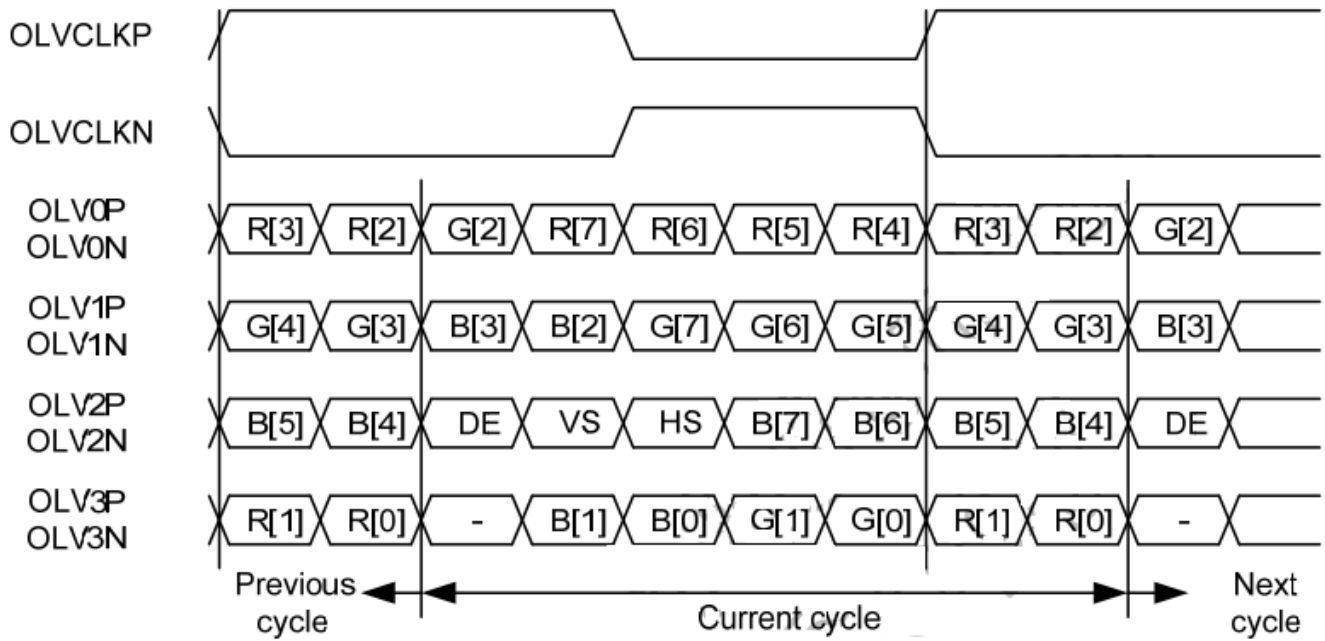
Parameter	Symbol	Conditions	Spec.			Unit
			Min.	Typ.	Max.	
SDA setup time	t_{S0}	CSB to SCL	60	-	-	ns
	t_{S1}	SDA to SCL	60	-	-	ns
SDA hold time	t_{H0}	CSB to SCL	60	-	-	ns
	t_{H1}	SDA to SCL	60	-	-	ns
Pulse width	t_{W1L}	SCL pulse width	75	-	-	ns
	t_{W1H}	SCL pulse width	75	-	-	ns
	t_{W2}	CSB pulse width	1	-	-	μ s
Clock duty	-	-	40	50	60	%

8.3 LVDS Timing

① 2-port LVDS signals, VESA format(8-bit)



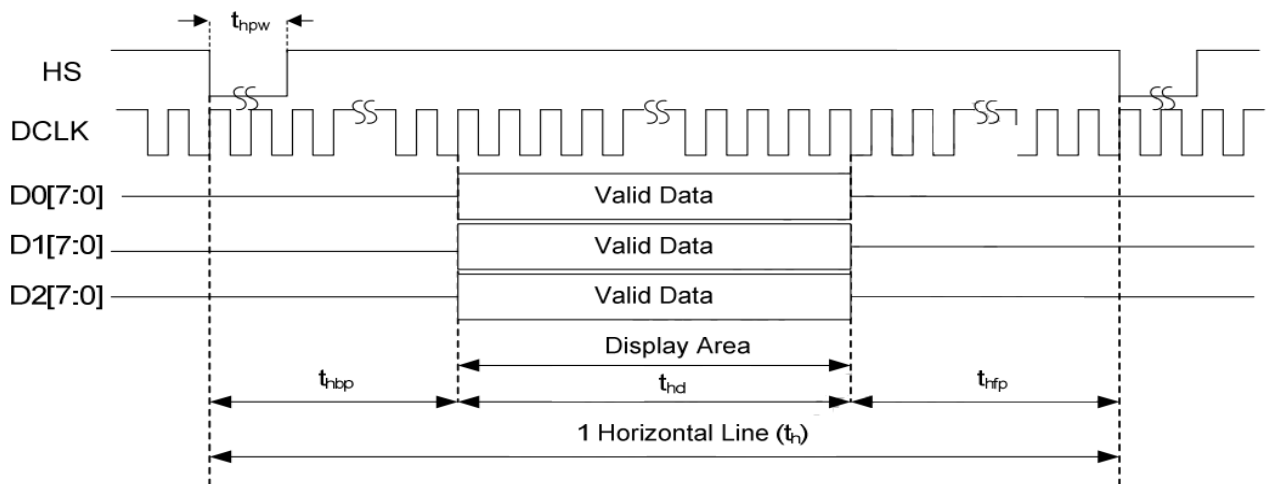
② 2-port LVDS signals, JEIDA format(8-bit)



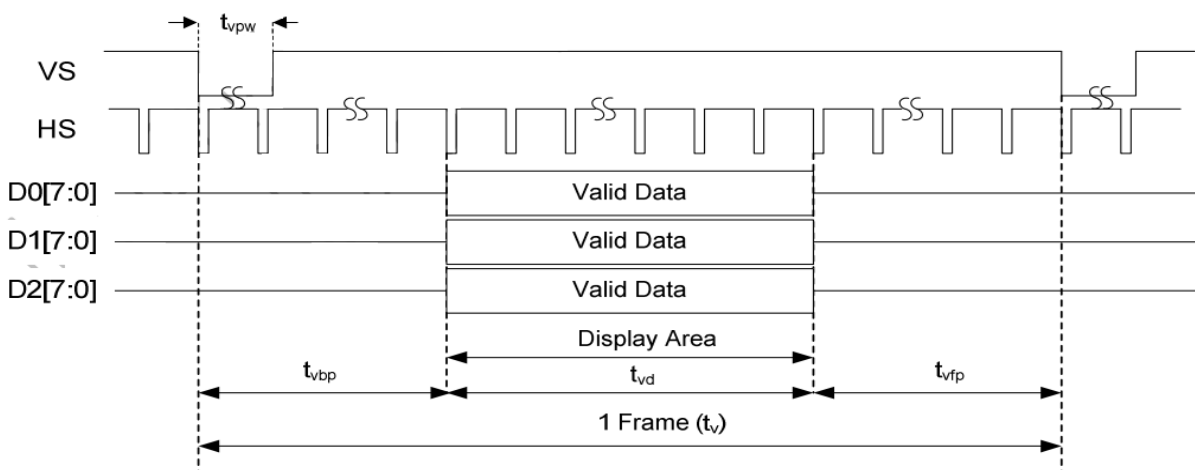
If use RGB to LVDS driving IC。RGB timing are set as follow: (HS+VS model)

如果使用 RGB 转 LVDS 芯片。RGB 按照以下配置: (HS+VS model)

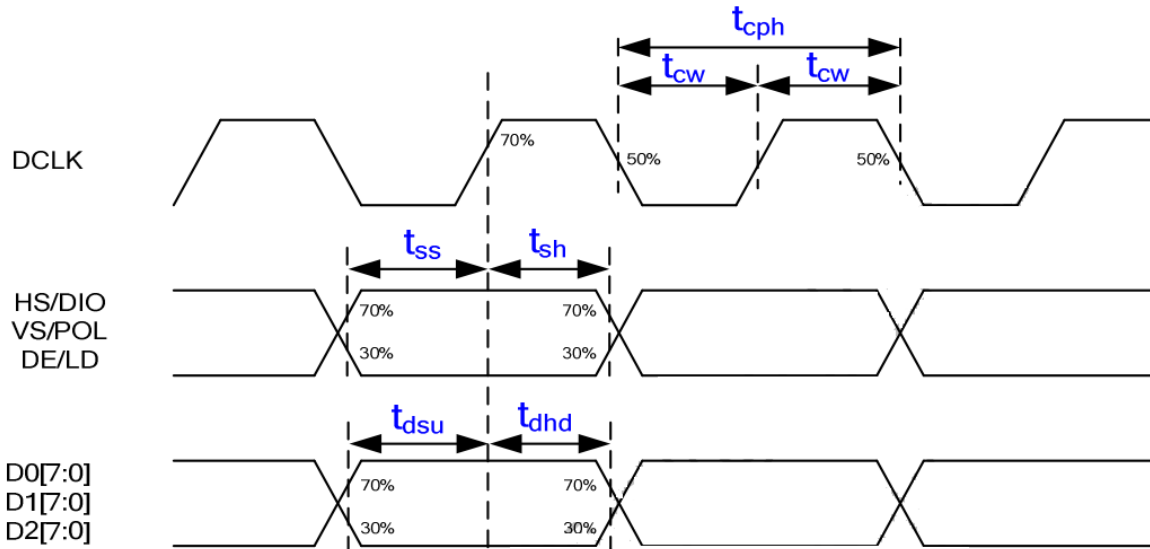
• Horizontal



• Vertical



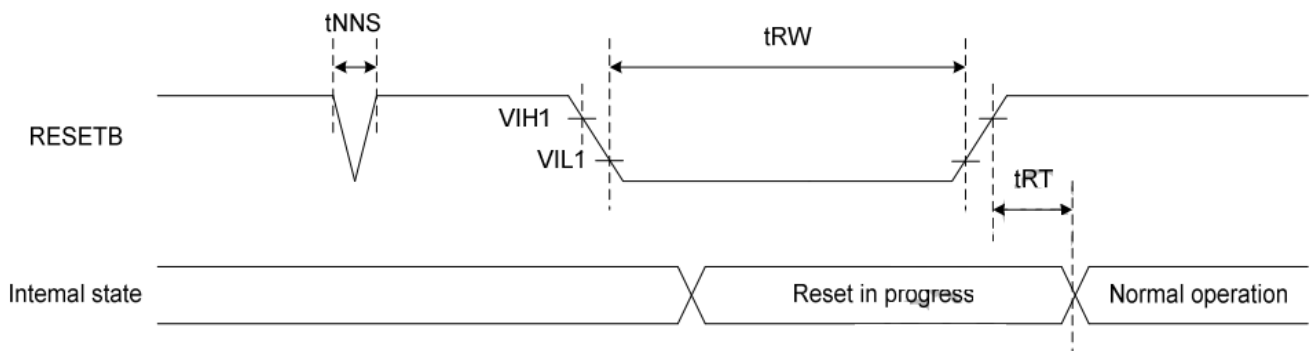
Parameter	Symbol	Panel Resolution 1920xRGBx720 (Two Port) (RS[3:0]=0x1h)			Unit
		Min.	Typ.	Max.	
		DCLK frequency	F_{DCLK}	-	
Horizontal valid data	t_{hd}	960			DCLK
Hsync pulse Width (default)	t_{hpw}	3	8	254	DCLK
Hsync pulse Width (ESD_PROT_ENB=0, enable)	t_{hpw}	10	12	254	DCLK
Hsync back porch	t_{hbp}	8	16	255	DCLK
Hsync front porch	t_{hfp}	16	16	40	DCLK
1 horizontal line	t_h	984	992	1104	DCLK
Vertical valid data	t_{vd}	720			
Vsync pulse width	t_{vpw}	1	2	24	H
Vsync back porch	t_{vbp}	2	5	25	H
Vsync front porch	t_{vfp}	8	31	31	H
1 vertical field	t_v	730	756	792	H
Frame rate	FR	-	60	-	Hz



Input data/Sync. Parameters

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK period	T_{cph}	16.67	-	-	ns
DCLK duty ratio	T_{cw}	40	50	60	%
Data setup time	T_{dsu}	5	-	-	ns
Data hold time	T_{dhd}	5	-	-	ns
VS setup time	T_{ss}	5	-	-	ns
VS hold time	T_{sh}	5	-	-	ns
HS setup time	T_{ss}	5	-	-	ns
HS hold time	T_{sh}	5	-	-	ns
DE setup time	T_{ss}	5	-	-	ns
DE hold time	T_{sh}	5	-	-	ns

8.4 RESET Timing



(VDD1=VDD2=2.7 to 3.6V, GND=0V, T_A =-40 to +105 °C)

Signal	Parameter	Symbol	Spec.			Unit
			Min.	Typ.	Max.	
RESETB	Reset pulse width	t_{RW}	10	-	-	μs
	Reset complete time	t_{RT}	-	-	5	μs
	Negative spike noise width	t_{NNS}	-	-	100	μs

9) Software Settings

软件设置

RGB to 2-port LVDS

9.1 RGB Timing

RGB 时序

```
#define LCD_WIDTH      24
#define LCD_XSIZE     1920
#define LCD_YSIZE     720
#define VBPD          3
#define VFPD          8
#define VSPW          2
#define HBPD          18
#define HFPD          16
#define HSPW          12
```

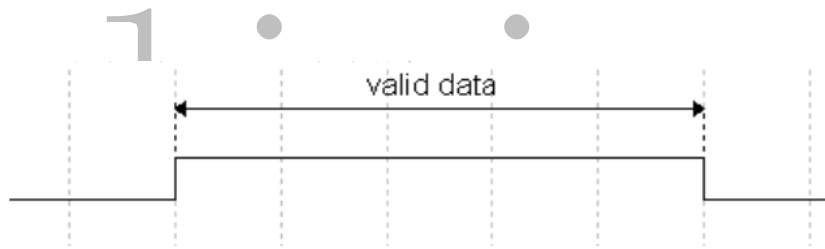
$DOTCLK = \text{Frame} * (\text{LCDWIDE} + \text{HBPD} + \text{HFPD} + \text{HSPW}) * (\text{LCDHIGH} + \text{VBPD} + \text{VFPD} + \text{VSPW}) / 1000000$

Parameter	Symbol	Min	Typ	Max
frame frequency	Frame	58	60 Hz	70Hz
CLK	DOTCLK	83.6MHz	86.45MHz	100.9MHz

9.2 RGB Timing Polarity

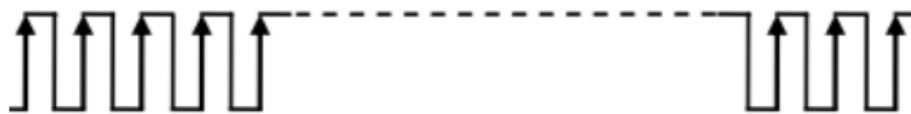
RGB 时序极性

DEN:



DOTCLK:

输入数据锁存在 DOTCLK 的上升沿上。



9.3 Initialize program

初始化程序

9.3.1 LCD initialize program (Rev 0.1)

LCD 初始化程序(Rev 0.1)

TBD

9.3.2 SPI_Write

SPI 写函数

```
void LCDSPI_Write(unsigned char address, unsigned char datas )
```

```
{  
    unsigned char i=0 , j=0;  
    U8 MB=0;  
    SET_SPI_SDA_OUTPUT(); //MCU SPI口设为输出  
    SET_SPI_SCL_OUTPUT(); //MCU SPI口设为输出  
    SET_SPI_CS_OUTPUT(); //MCU SPI口设为输出  
  
    MB=address;  
    SPI_SCL(1); //SPI 时钟信号  
    SPI_CS(1); //SPI 片选信号  
    Delayus(5);  
  
    SPI_CS(0);  
    Delayus(5);  
  
    for(i=0;i<8;i++)  
    {  
        SPI_SCL(0);  
        if(MB&0x80)  
            SPI_SDA_OUT(1); //SPI 数据线  
        else  
            SPI_SDA_OUT(0);  
        Delayus(1);  
        SPI_SCL(1);  
        Delayus(1);  
        MB<<=1;  
    }  
    MB=datas;  
    for(i=0;i<8;i++)  
    {  
        SPI_SCL(0);  
        if(MB&0x80)  
            SPI_SDA_OUT(1);  
        else  
            SPI_SDA_OUT(0);  
        Delayus(1);  
        SPI_SCL(1);  
        Delayus(1);  
        MB<<=1;  
    }  
    SPI_SCL(1);  
    SPI_CS(1);  
    Delayus(1);  
}
```

preliminary

9.3.3 Power on code

上电代码

```

void power_on()
{
    power_down_vcc(1); //打开系统电源3.3V
    Backlight(0);      //背光默认关闭
    //CSB上电必须默认为高，SCL SDA 上电默认为低。复位拉高稳定后才能动作
    STBYB(0);          //睡眠上电必须默认为低
    RESET(0);          //复位上电必须默认为低，执行复位
    Delayms(50);       //必须≥1ms

    RESET(1);          //复位控制拉高,结束复位
    Delayms(20);       //必须≥20ms，等待复位稳定

    LCD_INIT();        //IC 初始化
    Enable_LVDS(1);    //enable LVDON/P~LVD3N/P & LVCLKN/P, LVDS信号配置
    //including RGB controlling signal HSYNC, VSYNC, DATA
    //ENABLE, CLK, data

    STBYB(1);          //睡眠控制拉高，开显示
    Delayms(150);      //Better≥150ms 8frame

    Backlight(1);      //打开背光
}
    
```

9.3.4 Power off code

下电代码

```

void poweroff()
{
    Backlight(0);      //背光先关闭
    Delayms(300);      //请根据背光完全关断（电流为0）的时间调整

    STBYB(0);          //睡眠控制拉低使能，关闭显示
    Delayms(100);      //100ms 等待>=5 帧

    Enable_LVDS(0);    //关闭 LVDS 信号
    Delayms(50);        //150ms 等待>=3 帧

    RESET(0);          //复位控制拉低，执行芯片复位
    Delayms(5);

    power_down_vcc(0); //关闭系统电源 3.3V
}
    
```

10) ELECTRO-OPTICAL CHARACTERISTICS

光电参数

Item 项目	Symbol 符号	Condition 条件		Min 最小值	Typ 典型值	Max 最大值	Unit 单位	Remark 注释	Note 备注
Response time 响应时间	Tr+ Tf	$\theta=0^\circ$ $\varnothing=0^\circ$	25°C	/	25	30	ms	FIG 1.	4
			-20°C	/	200	250			
			-30°C	/	350	600			
Contrast ratio 对比度	$\theta=0^\circ$ $\varnothing=0^\circ$	$\theta=0^\circ$ $\varnothing=0^\circ$	25°C	700	1000	/	/	FIG 2	1
Luminance uniformity 均匀度	δ WHITE	$\theta=0^\circ$ $\varnothing=0^\circ$	白色	80	85	/	%	FIG 2.	3
			黑色	70	75	/			
Surface Luminance 表面亮度	Lv	$\theta=0^\circ$ $\varnothing=0^\circ$ Ta=25°C	/	700	1000	/	cd/ m ²	FIG 2.	2
Viewing angle range 视角范围	θ		$\varnothing = 90^\circ$	80	85	/	deg	FIG 3.	6
			$\varnothing = 270^\circ$	80	85	/	deg	FIG 3	
			$\varnothing = 0^\circ$	80	85	/	deg	FIG 3	
			$\varnothing = 180^\circ$	80	85	/	deg	FIG 3	
NTSC ratio 色彩饱和度	-	/	65	70	-	%	-	-	
CIE (x, y) chromaticity CIE 色度坐标	Red x	$\theta=0^\circ$ $\varnothing=0^\circ$ Ta=25°C	0.615	0.655	0.695	-	FIG 2.	5	
	Red y		0.295	0.335	0.375	-			
	Green x		0.260	0.300	0.340	-			
	Green y		0.570	0.610	0.650	-			
	Blue x		0.105	0.145	0.185	-			
	Blue y		0.025	0.065	0.105	-			
	White x		0.260	0.300	0.340	-			
	White y		0.285	0.325	0.365	-			
闪屏	FLK	$\theta=0^\circ$ $\varnothing=0^\circ$	-	-	-25	dB	FIG 5	7	
Gamma	γ	Ta=25°C	-	2.2	-	-	FIG 4	8	

***Note 1.** Contrast Ratio(Cr) is defined mathematically by the following formula. For more information see FIG 2.

对比度是由以下公式计算所得。详见FIG 2。

$$\text{Contrast Rao 对比度} = \frac{\text{Average Surface Luminance with all white pixels (P 1,P2,)} \\ \text{显示白色画面时平均表面亮度(P 1,P2,)}}{\text{Average Surface Luminance with all black pixels (P 1,P2,)} \\ \text{显示黑色画面时平均表面亮度(P 1,P2,)}}}$$

***Note 2.** Surface luminance is the LCD surface luminance with all white pixels. For more information see FIG 2.

表面亮度是在显示白色画面时，测试的平均亮度值，详见FIG 2。

$$Lv = \text{Average Surface Luminance with all white pixels (P 1,P2,)} \\ \text{平均的表面亮度(P 1,P2,)}$$

***Note 3.** The luminance uniformity is determined by measuring luminance at each test position 1 through 9, and then dividing the maximum luminance of 9 points luminance by minimum luminance of 9 points luminance. For more information see FIG 2.

均匀度是在显示白色画面时,测试P1点到P9点的亮度,再用9个点亮度的最小值除以最大值详见FIG 2。

$$\delta \text{ WHITE} = \frac{\text{Minimum Surface Luminance with all white pixels (P1, P2,)} \\ \text{白色画面下表面亮度最小值 (P1, P2,)}}{\text{Average Surface Luminance with all white pixels (P 1,P2,)}}}$$

均匀度 = Maximum Surface Luminance with all white pixels (P1, P2,)
白色画面下表面高度最大值 (P1, P2,)

- *Note 4.** Response time is the time required for the display to transition from White to black(Rise Time, Tr) and from black to white(Decay Time, Tf). For additional information see FIG 1. The test equipment is DMS-803
响应时间是 Tr (上升时间) 与Tf(下降时间)的和; Tr 指显示白色画面转为显示黑色画面需要的时间, Tf 指显示黑色画面转为显示白色画面需要的时间。详见FIG 1。测试设备: DMS-803。
- *Note 5.** CIE (x, y) chromaticity, The x,y value is determined by measuring luminance at each test position 1 through9,and then make average value. For more information see FIG 2. The test equipment is CS2000.
色度坐标。x,y的值是通过每一个点测试9次亮度取平均值确定的。详见FIG 2。测试设备: CS2000。
- *Note 6.** Viewing angle is the angle at which the contrast ratio is greater than 100. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD surface.For more information see FIG 3. Test equipment is ConoScope or DMS-803.
视角指对比度大于等于一个特定值2时的可视范围, 对TFT屏, 对比度特定值为10。视角由横轴 (x轴), 竖轴(y轴)同Z轴(垂直于LCD表面)之间的夹角来定义。详见 FIG3。测试设备: ConoScope or DMS-803。
- *Note 7.** Flicker test standard: First using customer's standard, IF no, using the TRULY's internal standards. For more information see FIG 5. Test equipment is MSE or CA210.
闪屏测试条件和标准: 优先按客户条件和标准测试。无客户条件的则按信利内部标准进行测试。详见 FIG5。测试设备: MSE or CA210。
- *Note 8.** Gamma test standard: First using customer's standard, IF no, using TRULY Internal Standard: (2.2±0.4), white and gray scale screen(not show RGB).For more information see FIG4 . Test equipment is MSE or CA210.
Gamma测试标准: 优先按客户标准, 客户无要求则按信利内部标准 (2.2±0.4), 白色灰阶画面(不区分RGB)。详见FIG4。测试设备: MSE or CA210。

FIG 1. The definition of Response Time 响应时间定义

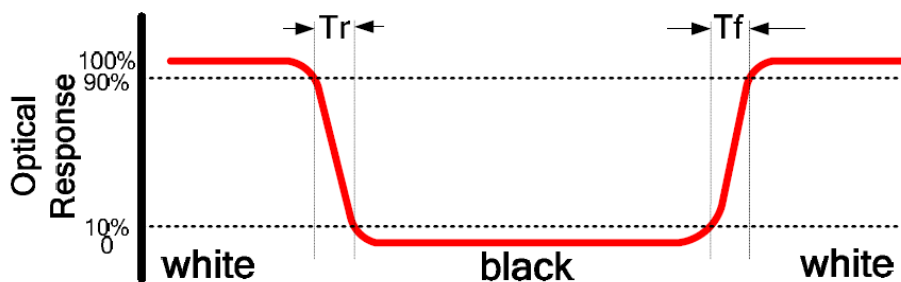


FIG 2. Measuring method for Contrast ratio, surface luminance, Luminance uniformity,CIE (x, y) chromaticity

对比度, 表面亮度, 均匀度, CIE坐标测试方法

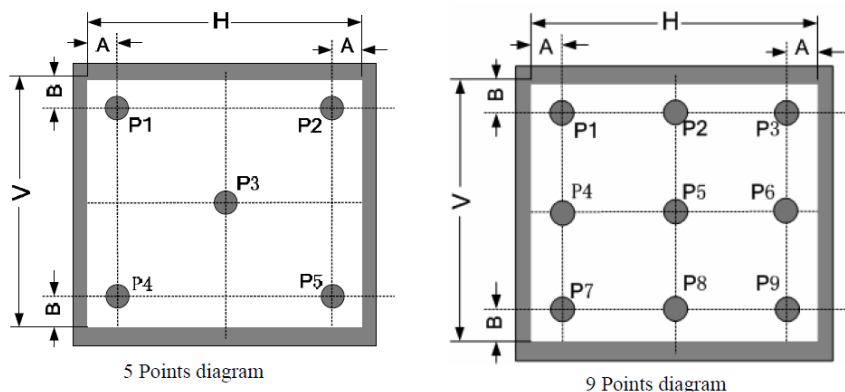


FIG 3. The definition of viewing angle
视角定义

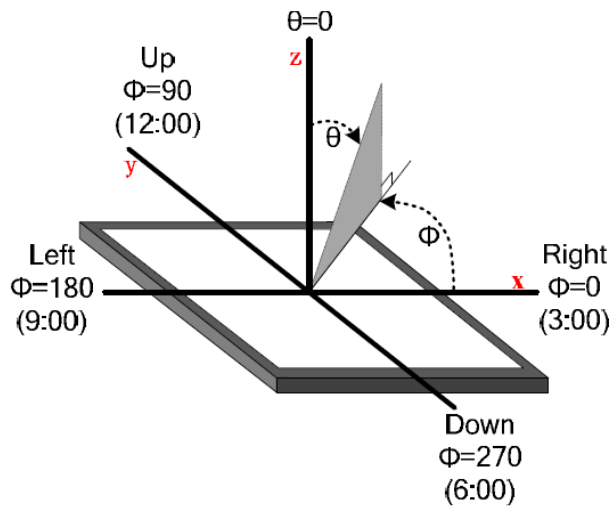


FIG 4. The definition of Gamma curve.
Gamma曲线定义

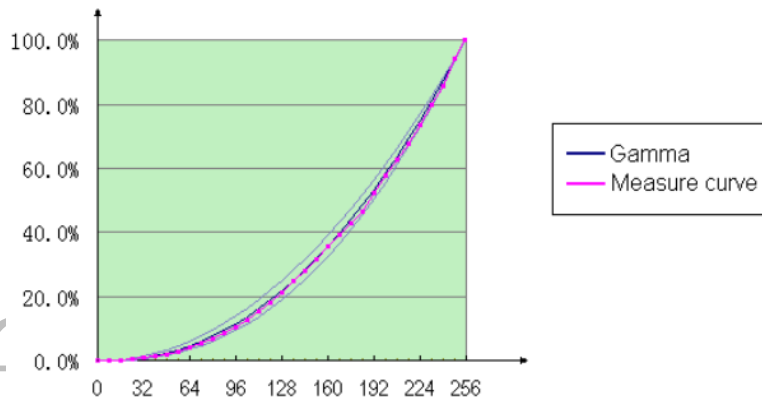


FIG 5 .闪屏测试

Test Picture: According to the model driver IC supports to choose picture such as line inversion 、dot inversion 、frame inversion and sub-pixel inversion.

测试画面: 根据driver IC 支持的模式, 分别选择行翻转、点翻转、帧翻转、子像素翻转画面。

Measurement method: Testing the flicker value under specific flip model by comparison、JEITA and VESA measurements method. General choice JEITA method test the center point and record the flicker DB value under the Corresponding frequency (HZ).

测量方法: 采用对比法/ JEITA/VESA测量特定翻转方式下的flicker值。一般选择JEITA法, 测试中心点并记录对应频率(HZ)下的flicker DB值。

测试设备: MSE、CA210

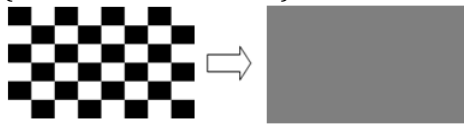
Measurement instrument: MSE、CA210



11) RELIABILITY TEST CONDITIONS

可靠性试验条件

No.	Test Item	Test Condition	Inspection after test	
1	High Temperature Storage 高温存储	90°C*500hrs, Non-Operation	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 1.Air bubble in the LCD; 2.Sealleak; 3.Non-display; 4.missing segments; 5.Glass crack; 6.Current Idd is twice higher than original value. 7.Reduction of the original contrast ratio of more than 50% 8 reducing of the minimum brightness from more than 50% *Note: After Damp Proof Test operating, the display function of test samples should be checked after 24hours storage at room temperature. 试验结束后,已测试的LCD 样品必须在室内正常温湿度环境下放置2~4个小时以上才能进行功能和外观检查,样品不允许有以下缺陷: 1.模块中有气泡。 2.封口松脱。 3.不显示。 4.漏笔。 5.玻璃破碎。 6.电流Idd大于初时值的2倍。 7.对比度低于初始值的一半。 8.亮度减小不超过初值的一半。 注意: 防潮试验操作后,测试样品的显示功能应24小时室温贮藏后进行检查。	
2	Low Temperature Storage 低温存储	-40°C*500hrs, Non-Operation		
3	High Temperature Operating 高温运行	+85°C*500hrs, Operation		
4	Low Temperature Operating 低温运行	-30°C*500hrs, Operation		
5	Temperature Cycle storage 温度循环	-30°C(30mins) ~ +85°C (30mins) 200cycle Non-Operation		
6	Damp Proof Test operating 高温高湿	+60°C*90%rH*500hrs, Operation		
7	UV exposure resistance UV 光照	Xenon arc lamp, Light intensity: 1120W/m2. Chamber temperature: +40 °C Total 72hrs. According to IEC 68-2-5 Sa-A		
9	ESD Test 静电测试	Air discharge: C=150pF±10%,R=330Ω±10%, 5point/panel Air: +/-15KV, 5times Contact discharge: C=150pF±10%, R=330Ω±10%, 5 point/panel Contact: +/-8KV, 5times		GB/T17626 (IEC61000) / ISO10605

10	Ghosting Test 残影测试	① 25℃; 2 hours ② 65℃(Oven real temperature) Times: fixed 1 hours Chessboard image (total Number: 25~100) 	Immediately switch to 50% gray scale and take out in the normal temperature environment observe: Ghosting disappear in 10 minute or no Ghosting. 立即切换到50%灰阶并取出放置在常温环境观察: 10分钟内残影消失或无残影(各视角方向)
11	Vibration Test 振动测试	10Hz~55Hz~10Hz amplitude 1.5mm. 2hours for each X,Y,Z direction (Packing condition)	1.功能测试正常, 无致命缺陷, 如不显示。
12	Dropping test 冲击试验	Drop to the ground from 1m height , one time , every side of carton (packing condition)	2.没有玻璃破碎、崩缺、封口松脱、环氧框裂口等缺陷。 3.无结构松动脱落。

***Note1.** The test samples should be applied to only one test item.

每个被测试的模块只能用于其中的一个测试项目。

***Note2.** Sample size for each test item is 2~10pcs.

每个测试项目的样品数量为 2~10 片。

***Note3.** For Damp Proof Test, Pure water(Resistance > 10MΩ) should be used.

对于高温高湿试验, 试验箱的用水必须是电阻大于10M欧姆的纯水。

***Note4.** After tests been done, visual inspection will be implemented after 2~4hours storage at room temperature. Test samples at low temperature test conditions should be visual inspected immediately and judge there is bubble or not.

试验完成后, 在常温条件下恢复至少2小时后检查试验样品。低温试验条件的试验样品需立即目视检查有无低温气泡。

***Note5.** For ESD test, 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.

如果由静电引起产品故障, 当放置一段时间后能够恢复正常, 则不视为产品缺陷。

***Note6.** Since there's no EMC lab in Truly, EMC test is recommended to implement by customer based on a complete component (like instrument cluster, CID, audio) level, if any problem related to display module, Truly will work together with customer for improvement. Truly will have to send to external lab for test if a EMC test report is required by customer, but needing customer pay the charge.

因为信利没有EMC实验室, 电磁兼容测试建议客户基于一个完整的零件(如仪表、CID、音频)去测试。如果出现和模块相关的问题, 信利将与客户一起改进。如果客户需要一个电磁兼容测试报告, 信利必须向外部实验室发送测试报告, 但需要客户支付费用。

12) INSPECTION CRITERION

检查标准

1.0 Purpose 目的:

This specification is made to be used as the standard acceptance / rejection criteria for TFT product.

这份规格书用来作为 TFT-LCD 产品接收/拒绝的标准。

2.0 Inspection method 检查方法:

Ambient temperature & humidity : 20~25 °C , 55~70%RH

检测温湿度 : 20~25 °C , 55~70%RH

Visual inspection illumination: 800lux~2000lux

外观检测环境 : 800lux~2000lux

Function checking illuminance : <30 lux

功能检测环境: <30 lux

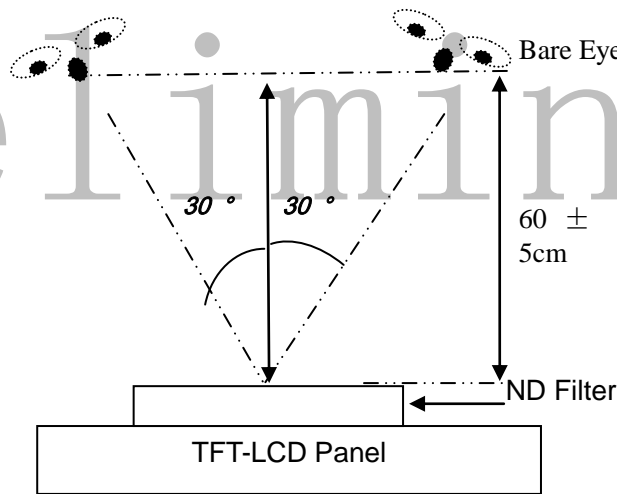
Viewing angle : U/D/L/R 30 degree

检测角度 : U/D/L/R 30 degree

Viewing distance : 35±5 cm

检测距离 : 35±5 cm

ND Filter: 5%



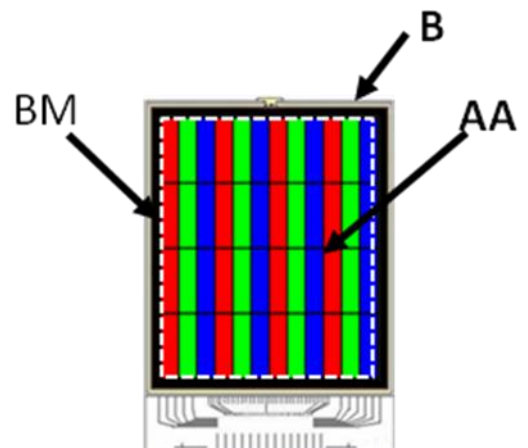
3.0 Definition 定义:

A area: Viewing area after assembly.
(Reference V.A of the drawing/AA+BM)

A 区: 装配后的可视区域.
(参照图纸 V.A 区/ AA+BM)

B area: Invisible area after assembly.
(reference other area except the V.A of the drawing)

B 区: 装配后看不到的区域.
(参照图纸除 V.A 的其它区域)



4.0 Inspection specification 检查规格

NO.	Inspection content 检查内容	Inspection specification 检查标准	
4.1	Display function 功能缺陷	TFT not display is not allowed. TFT 不显示不允许.	
		TFT Display abnormally is not allowed. TFT 显示异常不允许.	
		Missing segment is not allowed. 缺划不允许.	
4.2	Liquid crystal nonconformance 液晶缺陷	Liquid crystal not fulfilled is not allowed. 液晶灌不满不允许.	
		Liquid crystal leak is not allowed. 液晶漏墨不允许.	
4.3	Spot nonconformance (Such as black spot、white spot、foreign matters) 点缺陷(如黑点、白点、异物点)	A Area	Acceptable QTY 可接受数量
		Size(mm)	Ignore 忽略不计
		$\Phi \leq 0.20$	5
		$0.20 < \Phi \leq 0.50$	0
		$\Phi > 0.50$	0
		Remark: Definition of spot size Φ : $\Phi = (X+Y)/2$	
4.4	Electrical nonconformance 像素点	A Area	Acceptable QTY 可接受数量
		Symptom Bright(RGB) Sub- pixel 亮子像素点	0
		Dark Sub- pixel 暗子像素点	5
		Distance between Sub- pixel to Sub- pixel 相邻的子像素点距离	$\geq 5mm$
<p>Note1. One pixel consists of 3 sub-pixels, including R,G and B dot(Sub-pixel=Dot) 一个像素由3个子像素组成, 包含R, G, B 点(子像素=点)</p> <p>Note2. Bright dot: in the black screen , one of R or G or B is bright ; bright area is more than 1/2 one dot 黑色界面下, 红绿蓝任意一个像素被点亮, 都统称DOT亮点。白色界面下, 有红或绿或蓝任意一个像素未点亮, 都统称DOT暗点。面积超过1/2DOT 点即为不良, 面积小于1/2DOT 的点为OK。</p> <p>Note3. Dark dot : in the white screen , one of R or G or B is not bright, dark area is more than 1/2 one dot 用 5% ND filter 遮盖测试不可见可接受, 具体参见 2.0。</p> <p>Note4. Bright dot is defined through 5% transmission ND filter as 2.0: 黑色界面下, 在视区范围之外的点不良, 不计入不良统计。</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div data-bbox="167 1825 686 2049">  </div> <div data-bbox="710 1825 933 2049">  <p style="text-align: center;">Bright Dot</p> </div> <div data-bbox="949 1825 1204 2049">  <p style="text-align: center;">Dark Dot</p> </div> <div data-bbox="1236 1803 1516 2094">  <p style="text-align: center;">$< 5mm$ NG</p> </div> </div>			

4.5	Line nonconformance (such as black line、white line、foreign matters、polarizer scratch、glass scratch) 线缺陷 (如黑线、白线、异物、偏光片划伤、玻璃划伤)	Size (mm) 尺寸 (mm)		A Area A 区
		L(length) L(长度)	W(width) W(宽度)	Acceptable QTY 可接受数量
		≤3	≤0.05	3
		≤2	0.05 < W ≤ 0.1	2
		/	> 0.1	0



4.6	Polarizer position and size 偏光片位置和尺寸	Shifting in position exceed the engineering drawing is not allowed 移动的位置不允许超过玻璃的外围尺寸；
		Incomplete covering smaller than the engineering drawing is not allowed. 由于偏光片位置移动导致可视区域不能完全可视，则不接收。

4.7	Foreign on polarizer protect film 偏光片保护膜异物	Foreign on polarizer protect film easier to clean is allowed. 偏光片保护膜可擦拭异物可以接受
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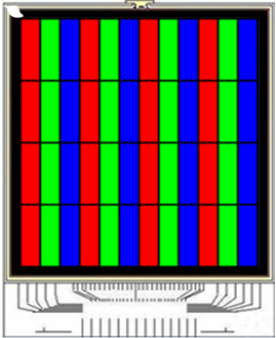
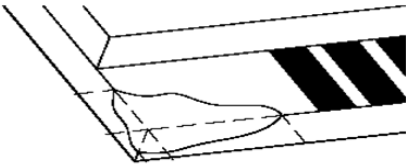
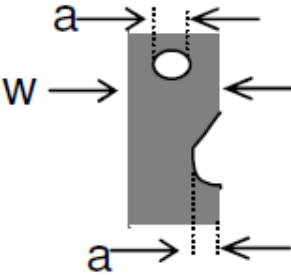
4.8	Polarizer dent and bubble 偏光片凹痕和气泡 (偏光片下)	A Area	Acceptable QTY 可接受数量
		Size(mm)	Ignore 忽略不计
		Φ ≤ 0.25	5
		0.25 < Φ ≤ 0.50	3
		0.50 < Φ ≤ 1.0	0

Note1. All kinds of above nonconformance on B area are acceptable but where into A area must meet above inspection specification.
所有的以上缺陷在 LCD 的 B 区是可以接受的，但是 A 区必须满足以上标准。

Note2. The distance between spots must exceed or equal 10mm.
点与点之间的距离必须大于 8mm。

4.9	TFT glass nonconformance (Unit: mm) TFT 玻璃缺陷 (单位: mm)	4.9.1 TFT cosmetic dimension is bigger or smaller than the engineering drawing limit size is not allowed TFT 外观尺寸比图纸尺寸大或小都是不允许的。
		4.9.2 Glass crack on any glass position is not allowed. 在玻璃的任何位置存在裂缝都是不允许的。



		<p>4.9.3 Glass chipped into epoxy frame is not allowed. 玻璃边崩不允许进入环氧筐。</p>  <p>4.9.4 Glass corner chipped on the contact pad: Glass chipped reach to the electro pad is not allowed 玻璃引线区域边崩：边崩进入引线脚不允许。</p> 
5.0	MURA	<p>Visible by ND5% filter, refer to limit samples. 使用 ND5%不可见,极限样品。(终端客户应用画面不可见为 OK)</p>
5.1	Soldering 焊接	<p>Follow IPC-A-610G standard, Class 2 Acceptance. 根据 IPC-A-610G 二级</p>
5.2	<p>FPC defect</p> 	<p>1. Dent, pinhole width $a < w/3$. 凹痕、针孔 的宽度 $a < w/3$. (w: circuitry width.) (w: 线路宽度.)</p> <p>2. Open circuit is unacceptable. 不允许开路.</p> <p>3. No oxidation, contamination and distortion. 不允许氧化, 脏污 及 扭曲.</p>
5.3	Bezel 铁框	<p>1 No rust, distortion on the Bezel. 不能生锈, 铁框不能变型。</p> <p>2 No visible fingerprints, stains or other contamination 不能有明显手指印、污点 或其它脏污。</p>

13) PRECAUTIONS FOR USING LCD MODULES

使用注意事项

1. Handling Precaution

处理注意事项

- 1.0 The display panel is made of glass and polarizer. As glass is fragile. It tends to become or chipped during handling especially on the edges. Please avoid dropping or jarring. Do not subject it to a mechanical shock by dropping it or impact.

显示屏由玻璃和偏光片组成。由于玻璃是脆的，使用过程中要特别注意边缘区。请防止跌落或振动。不能机械碰撞。

- 1.1 If the display panel is damaged and the liquid crystal substance leaks out, be sure not to get any in your mouth. If the substance contacts your skin or clothes, wash it off using soap and water.

如果显示屏损坏且液晶物质泄漏，切勿入口。如果液晶物质与皮肤或衣服接触，请使用肥皂和水冲洗。

- 1.2 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary. Do not touch the display with bare hands. This will stain the display area and degraded insulation between terminals (some cosmetics are determined to the polarizer).

请勿施加过大的压力于显示屏或连接部位，否则会引起色调变化。不要用手接触显示屏，这将弄脏显示区和降低端子之间的绝缘能力（一些外观是由偏光片决定的）。

- 1.3 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully. Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.). Do not put or attach anything on the display area to avoid leaving marks on it. Condensation on the surface and contact with terminals due to cold will damage, stain or dirty the polarizer. After products are tested at low temperature they must be warmed up in a container before coming in to contact with room temperature air.

覆盖液晶显示模块显示平面的偏光片是软性且易被擦伤，请小心轻拿。请勿用任何硬度大于 HB 铅笔芯的物品（玻璃，镊子等）接触、撞压或摩擦裸露偏光片。不要放置或粘附物体在显示区域上以免留下痕迹。冷凝在表面和端子将会损坏或弄脏偏光片。产品在低温下测试之后，与室温空气接触之前必须在容器内升温。

- 1.4 If the display surface becomes contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If it is heavily contaminated, moisten cloth with one of the following solvents

- Isopropyl alcohol
- Ethyl alcohol

Do not scrub hard to avoid damaging the display surface.

如果显示平面受污，可对平面吹热气且轻轻地用软性干布擦除。如果受污严重，用含下列一种溶剂的湿布擦除：

- 甘油
- 酒精

请勿用力擦拭以免损坏显示平面。

- 1.5 Solvents other than those above-mentioned may damage the polarizer. Especially, do not use the following.

- Water
- Ketone
- Aromatic solvents

Wipe off saliva or water drops immediately, contact with water over a long period of time may cause deformation or color fading. Avoid contact with oil and fats.

除以上提到的溶剂外，其他溶剂可能会损坏偏光片，特别要避免使用以下溶剂：

- 水
- 酮
- 芳烃溶剂

立即擦掉唾液或水滴，长时间与水接触会引起变形或褪色。避免接触油和油脂。

- 1.6 Exercise care to minimize corrosion of the electrode. Corrosion of the electrodes is accelerated by water droplets, moisture condensation or a current flow in a high-humidity environment.

特别注意最小限度地减少电极腐蚀，电极腐蚀会因水滴、湿度冷凝或在高湿环境下通电而加速。

- 1.7 Install the LCD Module by using the mounting holes. When mounting the LCD module make sure it is free of twisting, warping and distortion. In particular, do not forcibly pull or bend the I/O cable or the backlight cable.

使用安装孔装配液晶显示模块，安装时一定要不要弯曲、扭曲和变形。要特别注意不要用力拔，弯曲传输线或背光线。

- 1.8 Do not attempt to disassemble or process the LCD module.

请勿拆卸液晶显示模块。

- 1.9 NC terminal should be open. Do not connect anything.

悬空端应断开，不要连接任何器件。

- 1.10 If the logic circuit power is off, do not apply the input signals.

如果逻辑电路电源是断开的，不要施加输入信号。

- 1.11 Electro-Static Discharge Control, Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC. To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

由于液晶显示模块使用 CMOS 集成，要特别注意静电放电问题。对 CMOS 器件，要特别注意静电。为防止静电损坏，注意保持合宜的工作环境。

- Before removing LCM from its packing case or incorporating it into a set, be sure the module and your body have the same electric potential. Be sure to ground the body when handling the LCD modules.

-液晶显示模块移出包装盒和安装之前，要保证模块和人体具有相同的电位。处理模块时，可靠接地。

- Tools required for assembling, such as soldering irons, must be properly grounded. Make certain the AC power source for the soldering iron does not leak. When using an electric screwdriver to attach LCM, the screwdriver should be of ground potentiality to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.

- 使用工具如电烙铁，要可靠接地，并确保烙铁使用交流电，不要漏电。用电批固定模块时，电批应接地，尽可能降低电动换向器火花产生的电磁波。

- To reduce the amount of static electricity generated, do not conduct assembling and other work under dry conditions. To reduce the generation of static electricity be careful that the air in the work is not too dry. A relative humidity of 50%-60% is recommended. As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.

- 为减少静电产生，不在干燥组装或其它操作。为降低静电，工作场地一定不要干燥。建议相对湿度为 50%-60%。尽可能使你的工作服和工作台接地。

- The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

- 液晶显示模块表面有一个保护膜。需要小心操作以减少撕保护膜时静电的产

生。

- 1.12 Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

由于液晶显示模块由高精度装配和调节制成，应避免对模块过大的冲击或做任何更改。

- Do not alter, modify or change the shape of the tab on the metal frame.
- 不要改动金属架上的翼片形状。
- Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- 不要在印制电路板上钻额外的孔，修改形状或更改印制线路板上元件的位置。
- Do not damage or modify the pattern writing on the printed circuit board.
- 不要更改或损坏印制线路板上的图案。
- Absolutely do not modify the zebra rubber strip (conductive rubber) or heat seal connector.
- 绝对不要更改斑马条（导电胶条）或导电纸连接器。
- Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- 除焊接接口外，不要用烙铁做任何更改。
- Do not drop, bend or twist the LCM.
- 不要扔、弯和扭模块。

preliminary

2. Handling precaution for LCM

模块操作规范

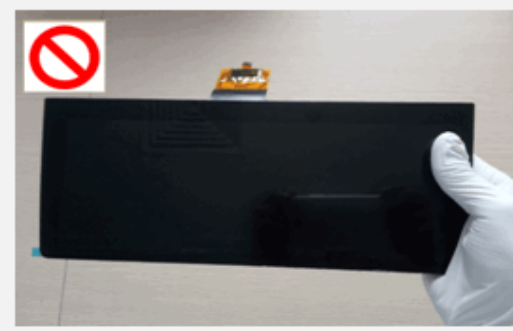
2.0 LCM is easy to be damaged. Please note below and be careful for handling.

液晶显示模块很容易被损坏. 请注意以下并小心操作

2.1 Correct handling: 正确操作:



2.2 Incorrect handling: 错误操作:



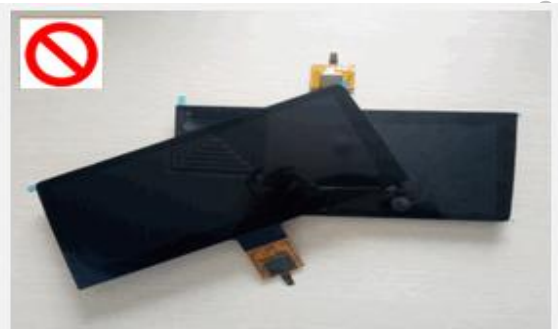
拿取模块的一端，模块重心不稳，容易掉落



仅指头拿取模块两端，容易掉落



手掌覆盖模块拿取，容易掉落



模块堆叠，表面划伤



用尖锐物刻画模块表面，易划伤

3. Storage Precautions

储存注意事项

3.1 When storing the LCD modules, the following precaution are necessary.

液晶显示模块的存储依照以下几点:

3.1.1 Store them in a sealed polyethylene bag. If properly sealed, there is no need for the desiccant.

使用聚乙烯袋密封, 如果密封得当, 不需要干燥剂。

3.1.2 Store them in a dark place. Do not expose to sunlight or fluorescent light, keep the temperature between 0°C and 35°C, and keep the relative humidity between 40%RH and 60%RH.

避光保存, 避免直接暴露在太阳光或黄光灯下, 保持温度在0~35摄氏度之间, 保持相对湿度在40%RH 和 60%RH之间。

3.1.3 The polarizer surface should not come in contact with any other objects (We advise you to store them in the anti-static electricity container in which they were shipped).

偏光片表面避免接触其他物质 (建议存放在货运防静电包装中)。

3.2 Transportation Precautions 运输注意事项

3.2.1 During shipment, please handle with care. The packaging bag can not be broken, step on trap. Packaging Carton layer height can not be over two meters. 装运过程要轻拿轻放. 不能出现包装袋破损, 蹒陷. 卡通箱叠层高度不能超过2米.

3.2.2 The transportation process should pay attention to the waterproof and moisture-proof measures. Product can not be watering. Ethylene sealed bags can not be unsealed. 运输过程要注意有防水和防潮措施. 产品不能淋水. 产品乙烯密封袋不可开封.

3.3 Others 其它

3.3.1 Liquid crystals solidify under low temperature (below the storage temperature range) leading to defective orientation or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subject to a low temperature.

液晶在低温会凝固 (低于储存温度范围以下), 会导致缺陷或产生气泡 (黑或白)。如果模块处于低温下, 也会产生气泡。

3.3.2 If the LCD modules have been operating for a long time showing the same display patterns, the display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. A normal operating status can be regained by suspending use for some time. It should be noted that this phenomenon does not adversely affect performance reliability.

如果液晶显示模块长时间工作于同一个显示图案, 换屏时会出现鬼影, 也会出现轻微的对比度不均。停止使用一段时间后可恢复到正常状态。此现象不会严重影响性能可靠性。

3.3.3 To minimize the performance degradation of the LCD modules resulting from destruction caused by static electricity etc., exercise care to avoid holding the following sections when handling the modules.

工作为最小限度地降低由静电等导致液晶显示模块性能降低, 使用模块时慎重使用下列区域:

3.3.3.1 - Exposed area of the printed circuit board.

- 印制电路板裸露区域。

3.3.3.2 - Terminal electrode sections.

- 印制电路板引出端子区域。

4. USING LCD MODULES

使用液晶显示模块

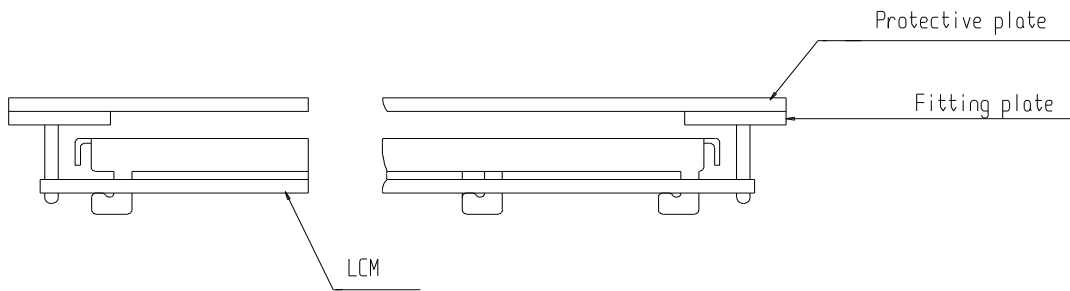
4.1 Installing LCD Modules 安装液晶显示模块

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

印制线路板上的孔用来固定液晶显示屏，如下图所示。安装液晶显示模块时，注意以下事项：

4.1.1 Cover the surface with a transparent protective plate to protect the polarizer and LC cell.

贴一层透明保护膜来保护偏光片和液晶盒。



4.1.2 When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface, refer to the individual specifications for measurements. The measurement tolerance should be $\pm 0.1\text{mm}$.

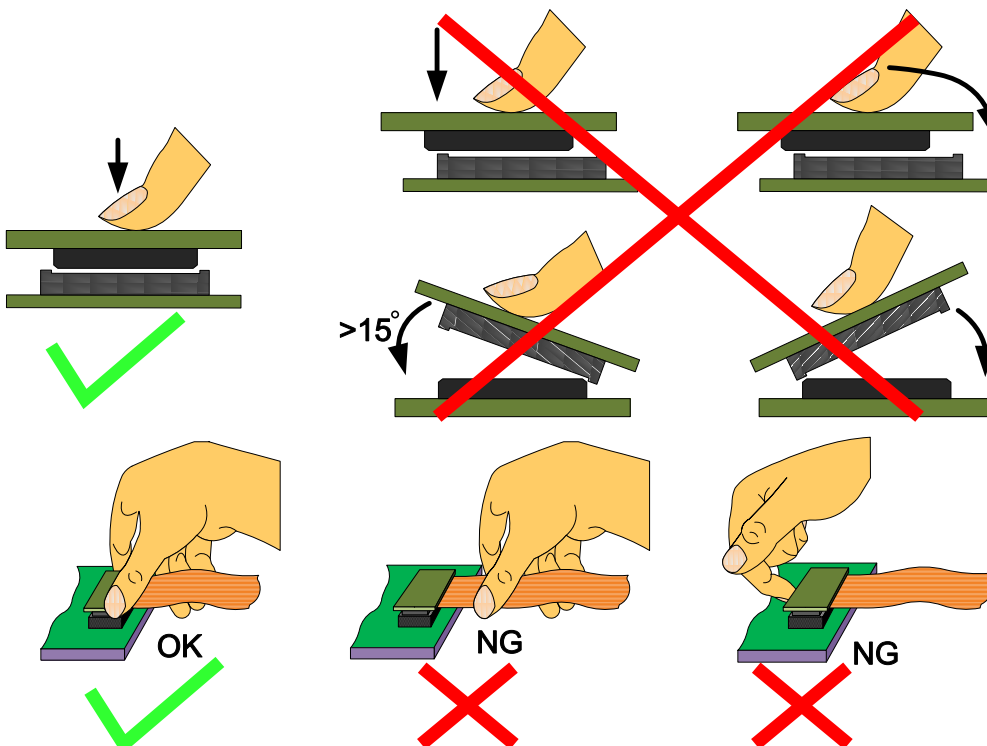
将模块安装进入其它设备时，模块和安装板之间间隔应有足够的高度以避免模块表面受压。参照专业度量技术标准。量度公差应是 ± 0.1 毫米。

4.2 Precaution for assemble the module with BTB connector:

用板对板连接器安装液晶显示模块注意事项：

Please note the position of the male and female connector position, don't assemble or assemble like the method which the following picture shows

请注意连接器的公母及连接位置，请勿出现下图所示的连接方式。



4.3 Precaution for soldering the LCM 焊接模块注意事项

	Manual soldering 手工焊接	Machine drag soldering 机器拖焊	Machine press soldering 机器压焊
No RoHS Product 非环保产品	290°C ~350°C. Time : 3-5S.	330°C ~350°C. Speed : 4-8 mm/s.	300°C ~330°C. Time : 3-6S. Press: 0.8~1.2Mpa
RoHS Product 环保产品	340°C ~370°C. Time : 3-5S.	350°C ~370°C. Time : 4-8 mm/s.	330°C ~360°C. Time : 3-6S. Press: 0.8~1.2Mpa

4.3.1 If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation (This does not apply in the case of a non-halogen type of flux). It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

如果使用助焊剂，完成焊接后一定要清除剩余的助焊剂（除非卤化物助焊剂）。建议焊接时用盖子保护显示屏面以避免因焊剂油溅出造成的任何损坏。

4.3.2 When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.

焊接背光源和线路板时，不应装卸多于三次。尽管焊接温度会有变化，但不应超过上面提到的焊接温度和时间最大值。

4.3.3 When remove the electroluminescent panel from the PC board, be sure the solder has completely melted, the soldered pad on the PC board could be damaged.

从线路板上移除背光源时，要保证焊锡已完全熔化，不要损坏线路板上的焊接位。

4.4 Precautions for Operation 工作运行注意事项:

4.4.1 Viewing angle varies with the change of liquid crystal driving voltage (VLCD). Adjust VLCD to show the best contrast.

视角应随液晶驱动电压(VLCD)变化而变化.调整VLCD 可显示最好的对比度。

4.4.2 It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage then the limit cause the shorter LCD life. An electrochemical reaction due to direct current causes LCD's undesirable deterioration, so that the use of direct current drive should be avoided.

在液晶驱动电压内来操作模块是必要的。超过限定电压会缩短液晶寿命。直流电会引起液晶的电化学反应，导致液晶老化，因此要避免直流电驱动液晶。

4.4.3 Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them. However those phenomena do not mean malfunction or out of order with LCD's, which will come back in the specified operating temperature.

液晶响应时间在低温时比常温要慢，高温时，液晶底色会深。然而,这并不是指液晶显示屏工作异常，显示屏在温度恢复时，效果会恢复正常。

4.4.4 If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.

如果在运行过程中显示区受到挤压,显示将会异常.然而挤压中断,将恢复正常。

4.4.5 A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit. Usage under the maximum operating temperature, 50%RH or less is required.

接线端冷凝会引起电化学反应而断路。因此必须在最大的操作温度之内，湿度小于50% 的条件下使用液晶显示模块。

4.4.6 Input logic voltage before apply analog high voltage such as LCD driving voltage when power on. Remove analog high voltage before logic voltage when power off the module. Input each signal after the positive/negative voltage becomes stable.

开机时，先让逻辑电压，再接通模拟高压，如显示屏驱动电压。关机时，先断开模拟高压，再关逻辑电压。正负电源都稳定后再送控制信号。

4.4.7 Please keep the temperature within the specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.

模块在操作和存储规格范围内使用。高温高湿可能会引起偏振退化，起泡，偏光片脱落等问题。

4.5 Safety 安全

4.5.1 It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.

建议将损坏的液晶显示屏压成碎片，用溶剂诸如丙酮、乙醇冲洗掉，迟后烧掉。

4.5.2 If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

如果任何液体从液晶盒泄漏出且与手接触，要用肥皂和水彻底清洗。

4.6 Limited Warranty 有限责任

Unless agreed between TRULY and the customer, TRULY will replace or repair any of its LCD modules which are found to be functionally defective when inspected in accordance with TRULY LCD acceptance standards (copies available upon request) for a period of one year from date of production. Cosmetic/visual defects must be returned to TRULY within 90 days of shipment. Confirmation of such date shall be based on data code on product. The warranty liability of TRULY limited to repair and/or replace on the terms set forth above. TRULY will not be responsible for any subsequent or consequential events.

除信利和客户之间另有协议外，自生产之日起一年内，根据信利的液晶显示屏品质标准，信利将对有功能缺陷的液晶显示模块换货或返工。

外观/视觉缺陷产品，必须在出货后90天内归还信利。以产品上标识日期为准。信利保修责任仅限于对符合上述规定的货品进行返工和/或换货。对此后发生的任何情况，信利均不承担任何责任。

4.7 Return LCM under warranty 模块保修

4.7.1 No warranty can be granted if the precautions stated above have been disregarded. The typical examples of violations are :

保修是以上述注意事项未被忽视为先决条件的。典型的违反例子如下：

4.7.1.1 - Broken LCD glass.

-断裂的液晶显示屏玻璃。

4.7.1.2 - PCB eyelet is damaged or modified.

-印制线路板孔修改或损坏。

4.7.1.3 - PCB conductors damaged.

-线路板导体损坏。

4.7.1.4 - Circuit modified in any way, including addition of components.

-线路随意变更，包括元件变化。

4.7.1.5 - PCB tampered with by grinding, engraving or painting varnish.

-印制电路板已修改，如研磨，雕刻，绘涂等。

4.7.1.6 - Soldering to or modifying the bezel in any manner.

-焊接或变动模块

4.7.2 Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned with sufficient description of the failures or defects. Any connectors or cable installed by the customer must be removed completely without damaging the PCB eyelet, conductors and terminals.

模块维修清单将按双方协议送呈客户。模块详细缺陷描述须模块一并退回。顾客安装的连接器和电缆必须在不破坏线路板孔，线路和引线端条件下全部移去。

14) PACKING SPECIFICATION

包装规格书

TBD

15) FACTORY CONTACT INFORMATION

工厂联系信息

■ PRIOR CONSULT MATTER

提前商议事项

1.0 For Truly standard products, we keep the right to change material, process ... for improving the product property without prior notice to our customer.

对于信利的标准产品，我们保留在不通知客户的情况下，为提高产品性能而改变原材料及加工方法等的权利。

2.0 For OEM products, if any changes are needed which may affect the product property, we will consult with our customer in advance.

对于 OEM 产品，如果需要做任何会影响到产品性能的改变，我们会提前和客户商议。

3.0 If you have special requirement about reliability condition, please let us know before you start the test on our samples.

如对可靠性条件有特殊要求，请在模块测试前通知我们。

FACTORY NAME: TRULY SEMICONDUCTORS LTD.

工厂名称:信利半导体有限公司

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