

液晶模组规格书

LCM Specification

☐初定规格 Preliminary specification

☒正式规格 Official specifications

项目编号 Project No.	TFT-H043A12SVILT5N40 TFT-H043A12SVILT4R40 TFT-H043A12SVILT4C40
产品描述 Product Description	TFT LCD Module 800 x 3RGB x 480 Dots 4.3 Inch TFT LCD

客 户 确 认 签 章:
Signature by customer:

☐小批量试产 Trial production ☐大批量生产 Mass production

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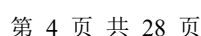
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1-0	2022-04-19	初次编制 First compilation.	Liu. YL



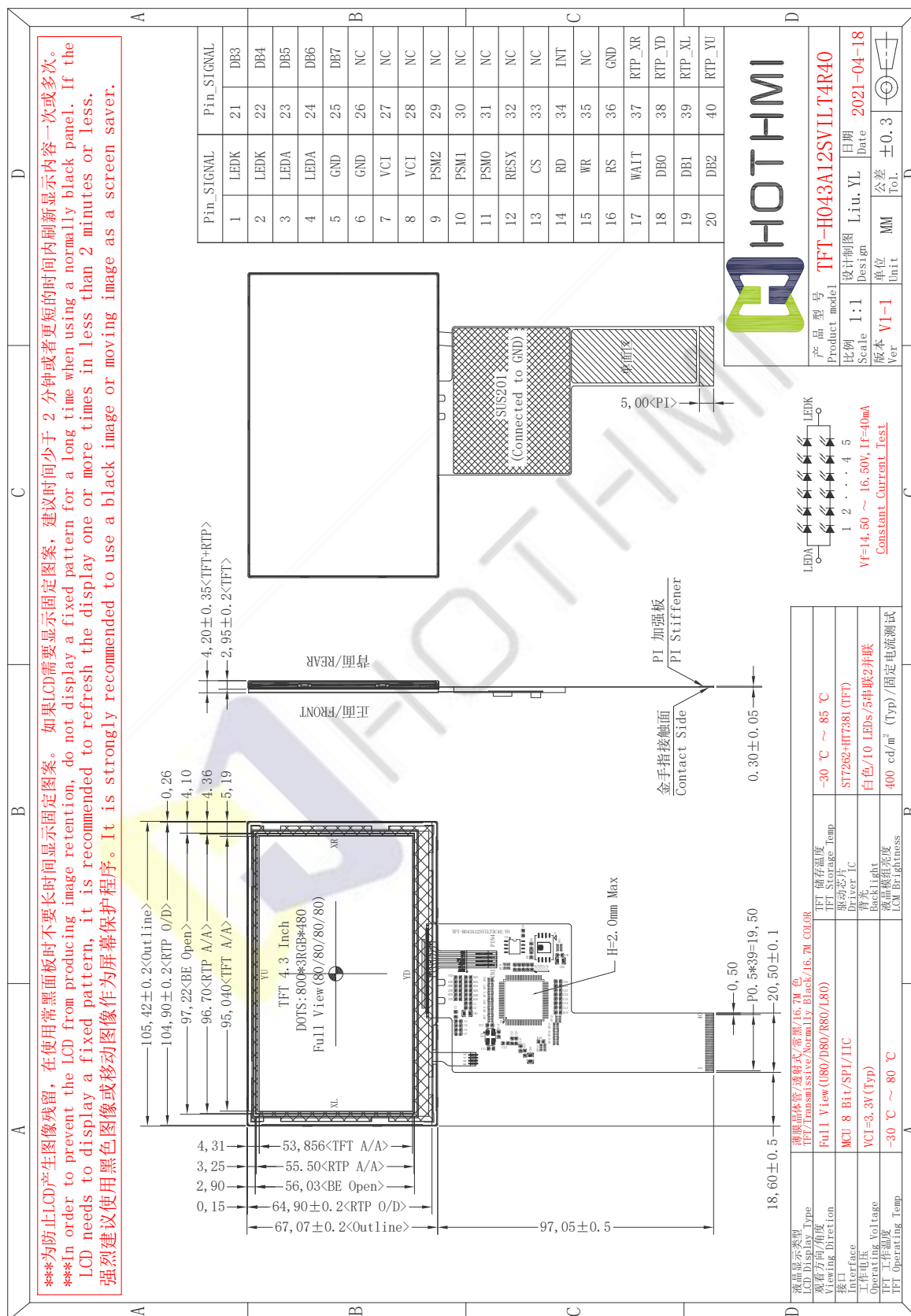
一、基本特征 General Feature:

项目 Item	标准值 Standard Value	单位 Unit
显示尺寸 Display Size	4.3	英寸 Inch
分辨率 Number of Pixels	800 (H) * 3 (RGB) * 480 (V)	点 dots
显示区域 Active Area	95.040 (H) * 53.856 (V)	毫米 mm
外形尺寸 Outline Dimension	105.42 (H) * 67.07 (V) * 2.95 (D) <TFT> 105.42 (H) * 67.07 (V) * 4.20 (D) <TFT+RTP> 105.42 (H) * 67.07 (V) * 4.70 (D) <TFT+CTP>	毫米 mm
观看方向 Viewing Direction	全 视角 Full 0'clock	-
TFT 接口 TFT Interface	MCU 8 bit/SPI/I2C	-
TFT 驱动芯片 TFT Driver IC	ST7262+HT7381	-
TFT 驱动电压 TFT Driver Condition	VCI=3.3V (Typ)	伏 V
背光-1 Backlight-1	白色 LED/10 颗/5 LEDs 并联 White LED/10 PCS/5 LEDs in series, 2 in parallel	-
触摸屏 Touch Panel	☒ 不带触摸屏 ☒ 带电阻触摸屏 ☒ 带电容触摸屏 Without TP With RTP With CTP	-
电容触摸屏驱动芯片 CTP Driver IC	GT911	-
电容触摸屏驱动电压 CTP Driver Condition	VDD=3.3V (Typ)	伏 V
TFT 液晶工作温度 Operation Temperature	-30 ~ 80	摄氏度 ℃
TFT 液晶储存温度 Storage Temperature	-30 ~ 85	摄氏度 ℃

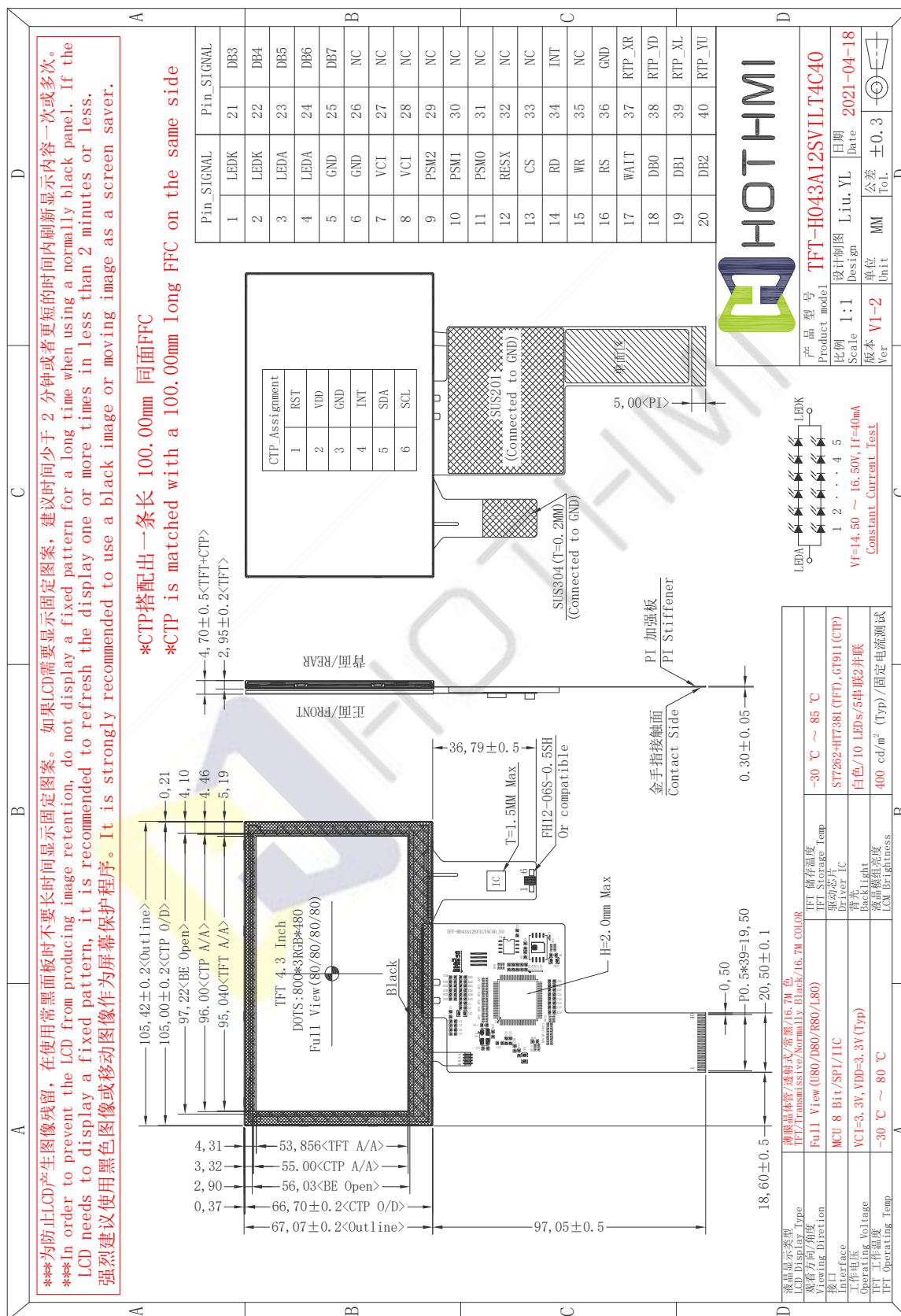
I、TFT-H043A12SVILT5N40 V1-0 (Without TP)



II、TFT-H043A12SVILT4R40_V1-1(With RTP)



III、TFT-H043A12SVILT4C40 V1-2 (With CTP)



三、引脚说明 Pin Description

3.1. 模组引脚说明 TFT Pin Description

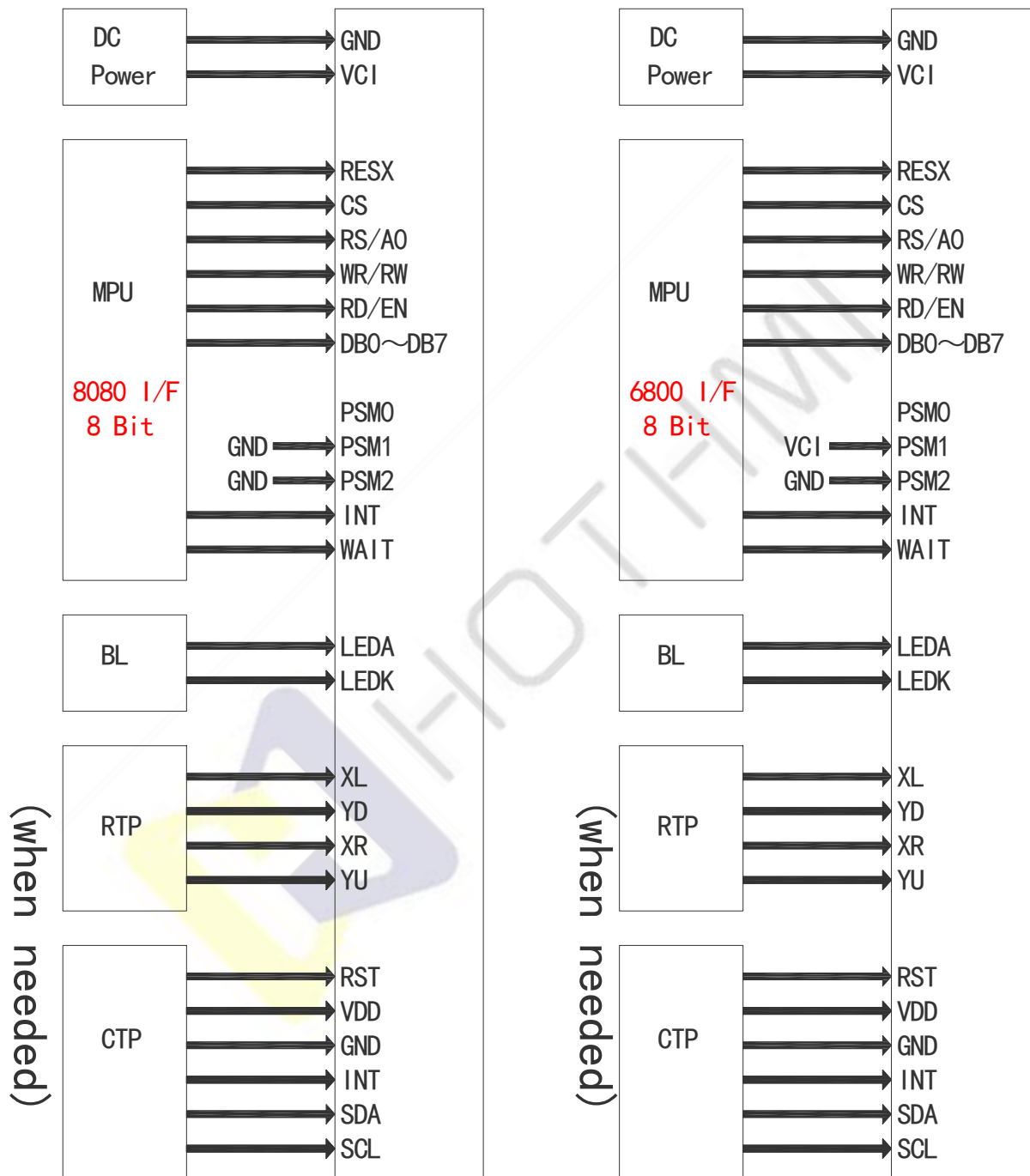
引脚编号 Pin NO.	标号 Symbol	详细描述 Description
1~2	LEDK	LED Cathode
3~4	LEDA	LED Anode
5~6	GND	Ground
7~8	VCI	Digital Power
9~11	PSM[2~0]	MCU interface settings.
12	RESX	Reset input signal When RESX = 0 and maintain the length of 256 clock cycles, chip will generate a reset action.
13	CS	Chip select signal. If the MCU interface is set to the serial mode, this pin can be set to GPIB [0], internal pull-up resistor.
14	RD	Read control signals. In parallel mode of 8080, this pin is RD# signal, RD#=0, which means MCU reads data or status read cycle to the chip. In the 6800 parallel mode, this pin is the EN signal, EN=1, indicating that the MCU's control of the chip is in the enable cycle. If the MCU interface is set to serial mode, this pin can be set to GPIB[1] with an internal pull-up resistor.
15	WR	write control signal In 8080 parallel port mode, this pin is the WR# signal, WR# = 0, representing the MCU A command write or data write cycle is performed on the chip. In 6800 parallel port mode, this pin is RW# signal, RW# = 1, representing MCU Data read or status read cycle is performed on the chip. RW# = 0, representing The MCU performs a command write or data write cycle to the chip. If the MCU interface is set to serial mode, this pin can be set to GPIB[2], There are internal pull-up resistors.
16	RS/A0	command or data select signal A0 = 0, which means that the MCU reads the status of the chip or the command write cycle. A0 = 1, which means the MCU reads or writes data to the chip.
- - - Next Page - - -		

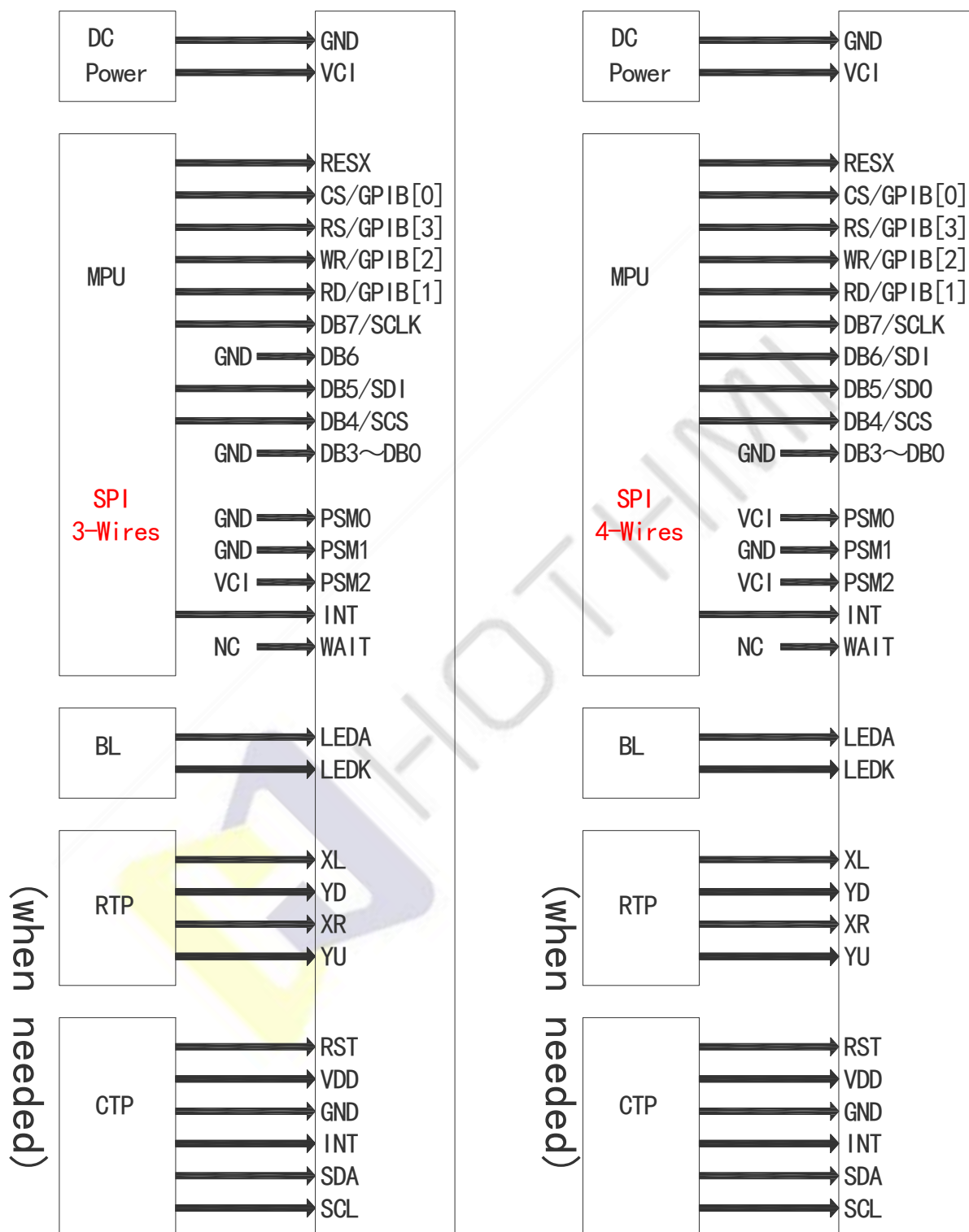
引脚编号 Pin NO.	标号 Symbol	详细描述 Description
17	WAIT	waiting for output signal When the MCU reads and writes the chip, if the chip is busy, it turns WAIT into a low level to notify the MCU to enter the waiting period.
18~25	DB[0~7]	♦ MCU data bus ♦ If set to serial port mode, these data buses will be used as serial port signals. Please refer to Table 3-2 "MCU serial port signal" description.
26~33	NC	Not Connect
34	INT	Interrupt output signal When the set interrupt condition occurs, this pin becomes a low level, which is used to generate an interrupt output to inform the MCU.
35	NC	Not Connect
36	GND	Ground
37	RTP_XR	Resistive TP function pin, If not used, let this pin open.
38	RTP_YD	Resistive TP function pin, If not used, let this pin open.
39	RTP_XL	Resistive TP function pin, If not used, let this pin open.
40	RTP_YU	Resistive TP function pin, If not used, let this pin open.
- - - END - - -		

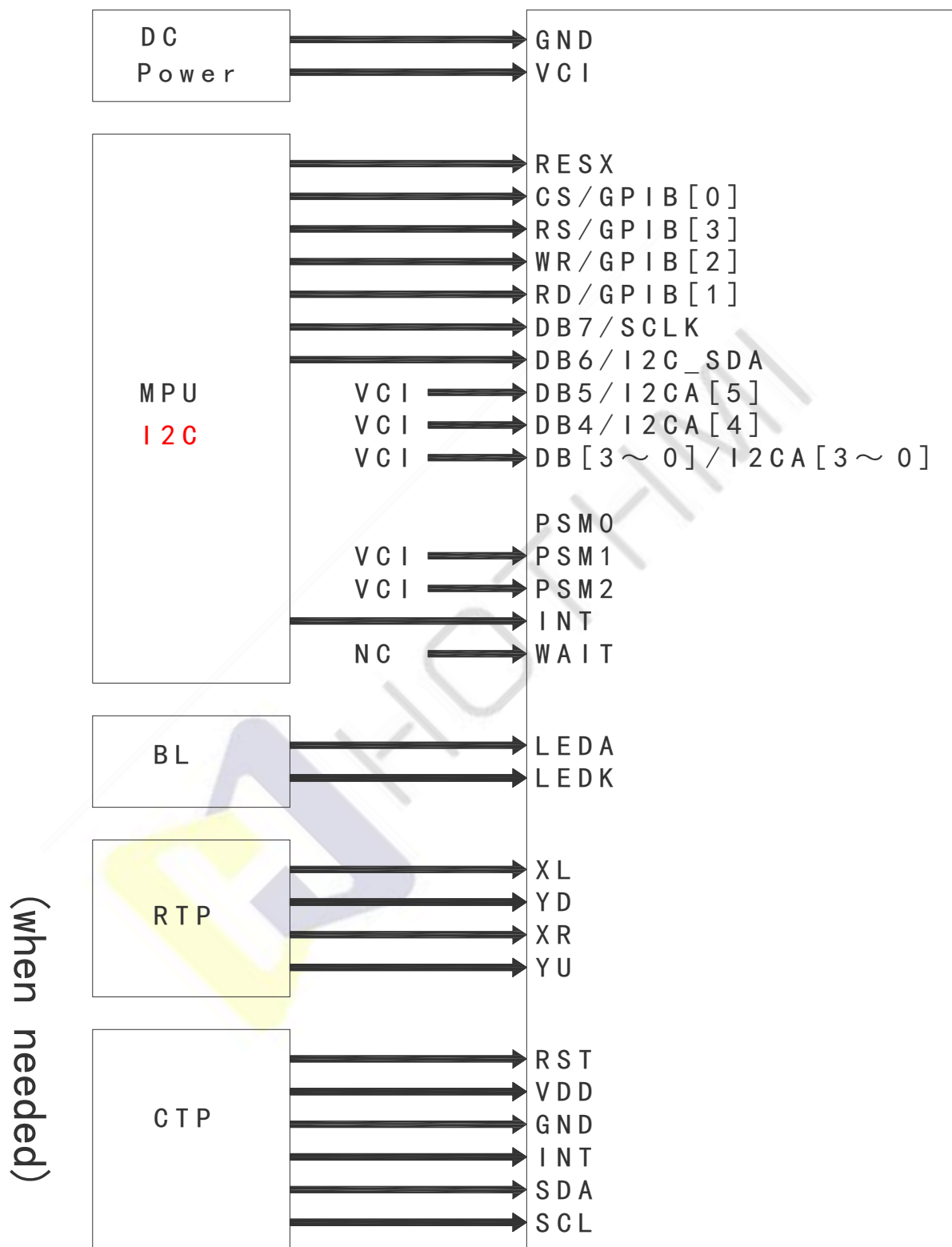
3.2. CTP 引脚说明 CTP Pin Description

引脚编号 Pin NO.	标号 Symbol	详细描述 Description
1	RTN	CTP Reset signal
2	VDD	CTP Power supply.
3	GND	Ground
4	INT	CTP interrupt read signal
5	SDA	CTP IIC data signal
6	SCL	CTP IIC clock signal
- - - END - - -		

3.3. 接线说明 Wiring instructions







四、电气特性 Electrical Characteristics

4.1. TFT 绝对最大额定值 TFT Absolute Maximum Ratings

项目 Item	标号 Symbol	条件 Condition	最小值 Min	典型值 Type	最大值 Max	单位 Unit
数字电源 Digital Power	VCI	-	-0.3	-	4.0	伏 V
IO 电源电压 IO Supply Voltage	IOVCC	-	-0.3	-	4.0	伏 V
输入电压范围 Input Voltage Range	VIN	-	-0.3	-	IOVCC +0.3	伏 V

注释 Note:

1. 超过上面列出的极限值可能会导致驱动 IC 永久损坏。 这些值仅用于测试。IC 应在芯片特性条件下正常运行。 如果不满足这些条件, IC 操作可能会出错, 可靠性可能会下降。That the exceeds the Limiting Value listed above it may cause the driver IC permanent damage. These values are for test only. IC should be operated under the Chip Characteristic conditions for normal operation. If these conditions are not met, IC operation may be error and the reliability may be deteriorated.
2. 参数在工作温度范围内有效, 除非另有说明。 除非另有说明, 所有电压均相对于 GND。Parameters are valid over operating temperature range unless otherwise specified. All voltages are with respect to GND unless otherwise noted.

4.2. TFT 面板工作条件 TFT Panel Operating Conditions

项目 Item	标号 Symbol	条件 Condition	最小值 Min	典型值 Type	最大值 Max	单位 Unit
数字电源 Digital Power	VCI	-	3.0	3.3	3.6	伏 V
IO 电源电压 IO Supply Voltage	IOVCC	-	3.0	3.3	3.6	
输入电压 Input Voltage	Vih		0.8* IOVCC	-	IOVCC	伏 V
	Vil		GND	-	0.3* IOVCC	
待机电流 Standby Current	Isc	No Load@ FR=60Hz	-	-	-	微安 uA
工作电流 Operation Current	Ioc		-	-	-	毫安 mA

4.3. 背光工作条件 LED back light specification

项目 Item	标号 Symbol	条件 Condition	最小值 Min	典型值 Type	最大值 Max	单位 Uint
工作电压 Forward voltage	VF	If=3.1V/20mA /1-chip	14.50	15.50	16.50	伏 V
工作电流 Forward current	IF		—	40	—	毫安 mA
亮度 (带 LCD) Luminance (With LCD)	Lv	Without TP	—	500	—	坎德拉/平方米 cd/m ²
		With TP	—	400	—	
LED 寿命 LED life time	Hr	Ta=25±3 °C	20,000	30,000	—	小时 Hour

注释 Note:

1. LED 寿命 (Hr) 定义为在 Ta=25±3 °C, 上表所示的典型电压电流值条件下持续工作直至亮度低于 50% 的时间。LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

2. 以上结果是按 MTBF 计算方式预估判定的 LED 失效时间, 实际测试 LED 在 Ta=25±3 °C 点亮 5000H, 亮度衰减 8%。The above results are estimated and judged by the MTBF calculation method of the LED failure time. The actual test LED is lit for 5000H at Ta=25±3 °C, and the brightness decays by 8%.

4.4. 电容触摸屏工作条件 CTP Operating Conditions

项目 Item	标号 Symbol	条件 Condition	最小值 Min	典型值 Type	最大值 Max	单位 Uint
数字电源 Digital Power	VDD	—	2.8	—	3.30	伏 V
I/O 数字电源 I/O Digital Power	IOVDD	—	2.8	—	3.30	伏 V
工作温度 Operation	—	≤90%RH	-20	—	70	摄氏度 °C
储存温度 Storage Temperature	—	≤90%RH	-30	—	-80	摄氏度 °C

五、液晶光学规格 TFT OPTICAL SPECIFICATION

5.1 概述 Overview

光学规格的测试应在暗室（环境亮度 1lux，温度=25℃）中使用亮度计系统（测角仪系统和TOPCON BM-5）设备进行测量，测试单元应位于大约在 θ 和 Φ 等于 0 的视角下，距 LCD 表面 50cm 的距离。显示面上测量点的中心应保持固定。测量前背光应工作 30 分钟。

The test of Optical specifications shall be measured in a dark room (ambient luminance 1lux and temperature = 25℃) with the equipment of Luminance meter system (Goniometer system and TOPCON BM-5) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0. The center of the measuring spot on the Display surface shall stay fixed. The backlight should be operating for 30 minutes prior to measurement.

5.2 光学规格 Optical Specifications

参数 Parameter		标号 Symbol	条件 Condition	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit	备注 Remark
视角范围 Viewing Angle Range	水平 Horizontal	⊙ 左/L	CR>10	—	80	—	Deg.	Note 1
		⊙ 右/R		—	80	—	Deg.	
	垂直 Vertical	⊙ 上/U		—	80	—	Deg.	
		⊙ 下/D		—	80	—	Deg.	
对比度 Contrast ratio		CR	⊙ = 0°	—	1200	—	—	Note2
色域 Color Gamut		CG	CIE1931	—	50	—	%	
白色色度 White Chromaticity		Wx	⊙ = 0°	-0.03	0.311	+0.03	—	
		Wy			0.338		—	
色彩还原 Reproduct ion of color	红 Red	Rx			—		—	Note4 (Based on C Light)
		Ry			—		—	
	绿 Green	Gx			—		—	
		Gy			—		—	
	蓝 Blue	Bx			—		—	
		By			—		—	
响应时间（上升 + 下降） Response Time (Rising + Falling)		Tr+Tf	⊙ = 0° Ta= 25℃	—	30	—	ms	Note5

注释 Note:

1. 视角是对比度大于10的角度。视角确定为相对于光轴的水平或3、9点钟方向和垂直或6、12点钟方向 垂直于 LCD 表面（见图 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. 对比度测量应在 $\theta = 0$ 的视角和 LCD 表面的中心进行。亮度测量时，视场中的所有像素首先设置为白色，然后设置为暗（黑色）状态。（参见图 1）亮度对比度（CR）是通过数学定义的。

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 FIGUR 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. 透射率是没有 APF 和没有 CG 的值。

Transmittance is the Value without APF and without CG.

4. 上表中规定的色度坐标应由所有像素首先测量的光谱数据计算为红色、绿色、蓝色和白色。测量应在面板的中心进行。

The color chromaticity coordinates specified in the above table 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.

5. 电光响应时间测量应如图 2 所示，通过打开和关闭“数据”输入信号来进行。亮度从 10%变化到90%所需的时间是 T_r ，90%到10%是 T_f 。

The electro-optical response time measurements shall be made as FIGURE 2 by switching the “data” input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_f .

Figure1 Measurement Set Up

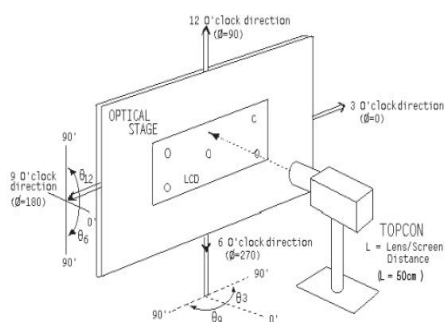


图 1

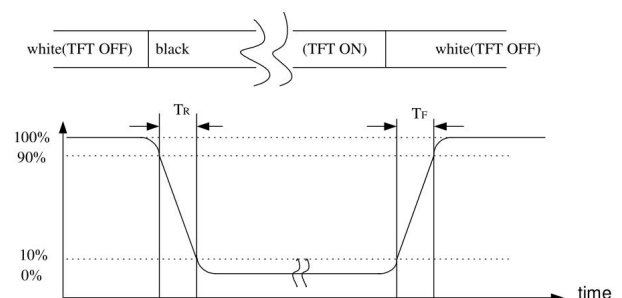
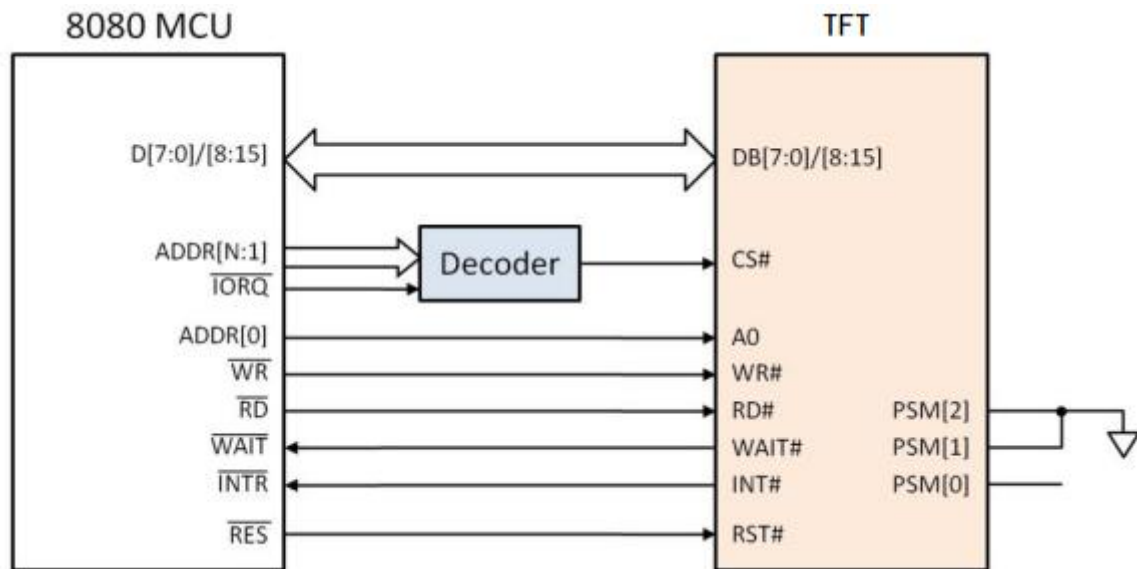


图 2

六、输入信号的时序特性 Timing Characteristics of Input Signals

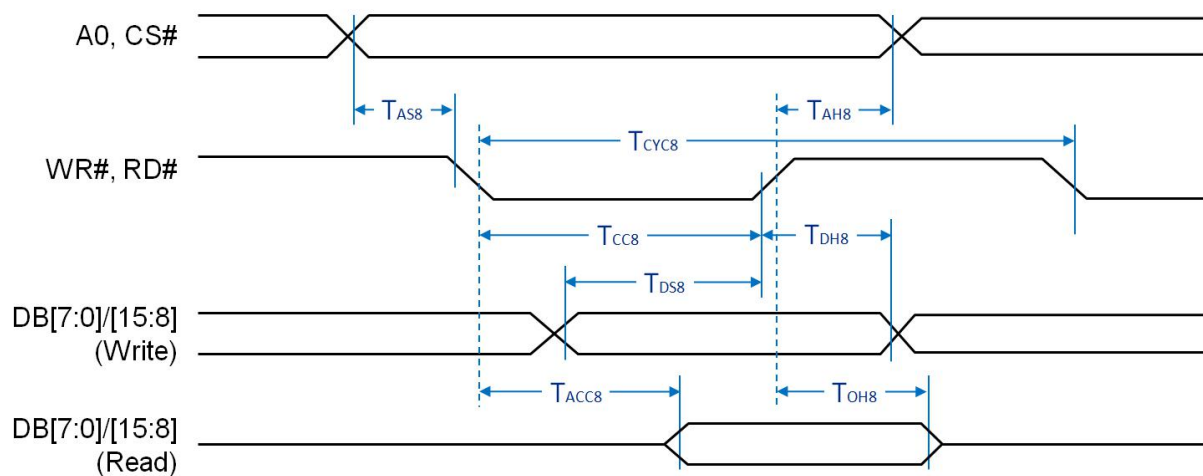
6.1. 8080 MCU 并行接口特性 8080 MCU Parallel Interface Characteristics



8080 MCU 并口电路图 8080 MCU parallel port circuit diagram

上图的应用电路如果没有使用 WAIT# 产生等待周期的话，则各周期之间的时间必须大于 5 个系统频率周期，以避免读取或写入的数据错误。复位信号 RST# 可以与 MCU 的复位信号（必须同样为 Low 动作）相接，或是通过 MCU 的 IO 信号来控制，也可以接一 RC 电路，当电源开启时产生一延时的复位信号，但是无论哪种方式都要确认复位信号有 256 个晶振频率（OSC）周期，同时在使用 TFT 时，MCU 应该要先确认状态寄存器的 bit1，得知 TFT 是否在标准操作状态。

If the application circuit above does not use WAIT# to generate wait cycles, the time between each cycle must be greater than 5 system frequency cycles to avoid read or write data errors. The reset signal RST# can be connected with the reset signal of the MCU (it must also be in Low action), or controlled by the IO signal of the MCU, or it can be connected to an RC circuit to generate a delayed reset signal when the power is turned on, but Either way, it is necessary to confirm that the reset signal has 256 crystal oscillator frequency (OSC) cycles. At the same time, when using TFT, the MCU should first confirm bit1 of the status register to know whether the TFT is in the standard operating state.

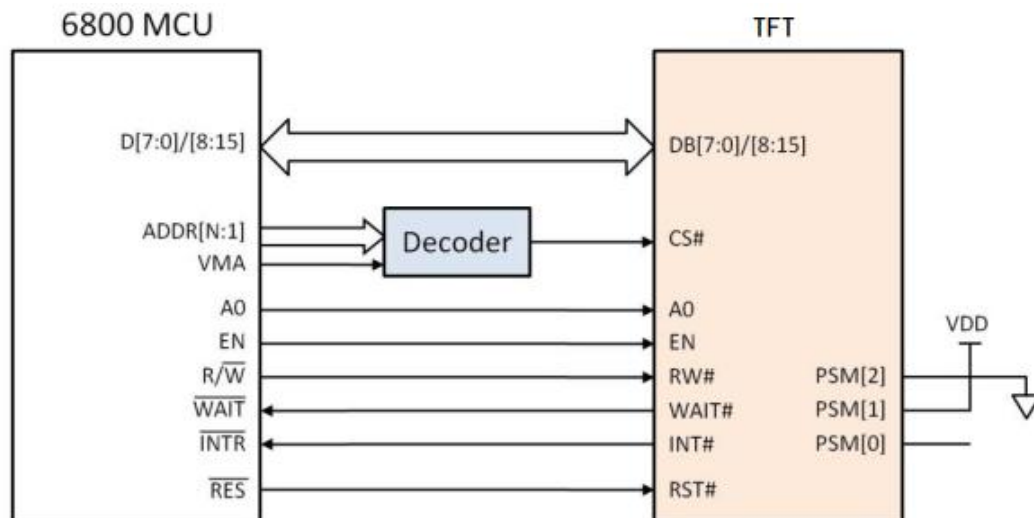


8080 MCU 并口时序图 8080 MCU parallel port timing diagram

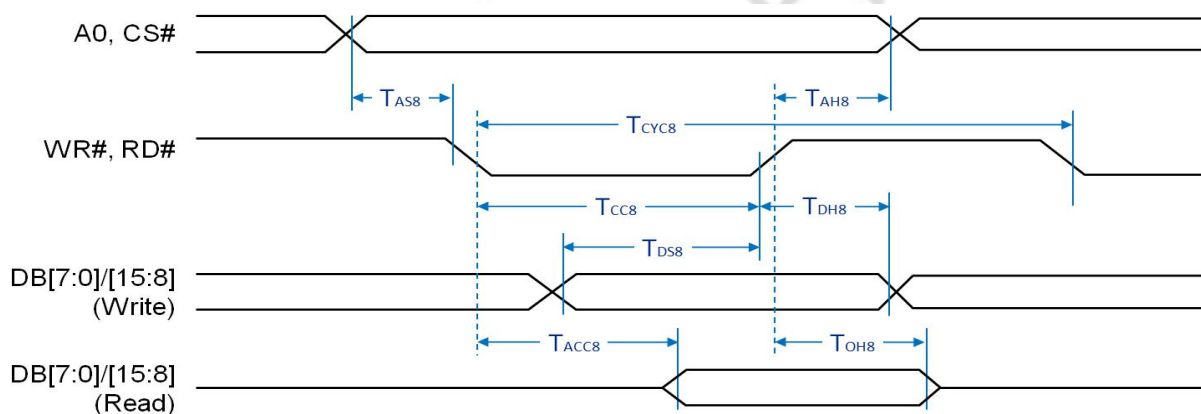
Symbol	Parameter	Rating		Unit	Note
		Min.	Max.		
T_{CYC8}	Cycle Time	50	--	ns	tc is one system clock period: tc = 1/SYS_CLK
T_{CC8}	Strobe Pulse Width	20	--	ns	
T_{AS8}	Address Setup Time	0	--	ns	
T_{AH8}	Address Hold Time	10	--	ns	
T_{DS8}	Data Setup Time	20	--	ns	
T_{DH8}	Data Hold Time	10	--	ns	
T_{ACC8}	Data Output Access Time	0	20	ns	
T_{OH8}	Data Output Hold Time	0	20	ns	

8080 并口时序参数 8080 parallel port timing parameters

6.2. 6800 MCU 并行接口特性 6800 MCU Parallel Interface Characteristics



6800 MCU 并口电路图 6800 MCU parallel port circuit diagram



6800 MCU 并口时序图 6800 MCU parallel port timing diagram

Symbol	Parameter	Rating		Unit	Note
		Min.	Max.		
T _{CYC8}	Cycle Time	50	--	ns	tc is one system clock period: tc = 1/SYS_CLK
T _{CC8}	Strobe Pulse Width	20	--	ns	
T _{AS8}	Address Setup Time	0	--	ns	
T _{AH8}	Address Hold Time	10	--	ns	
T _{DS8}	Data Setup Time	20	--	ns	
T _{DH8}	Data Hold Time	10	--	ns	
T _{ACC8}	Data Output Access Time	0	20	ns	
T _{OH8}	Data Output Hold Time	0	20	ns	

6800 并口时序参数 6800 parallel port timing parameters

MCU 控制 TFT 的方式就是通过硬件接口，然后对 TFT 进行寄存器的读写、及显示内存的数据写入，LT7381 有一个状态寄存器（Status Register）及 256 个指令寄存器，也就是 REG[00h] ~ REG[FF]，寄存器的读、写入步骤如下：

寄存器写入步骤：

1. Address Write: 写入该寄存器（REG）的地址，00h 代表 REG[00h]，01h 代表 REG[01h]，依此类推。

2. Data Write: 写入数据到该寄存器内。

寄存器读取步骤：

1. Address Write: 写入该寄存器的地址。

2. Data Write: 读取该寄存器的数据。

显示内存是存放 TFT 屏图像数据的地方，MCU 也是通过硬件接口，对 TFT 的显示内存进行数据写入，其步骤如下：

内存写入步骤：

1. 通过写入寄存器 → 先设定工作视窗。

2. 通过写入寄存器 → 设定图像的读码写入坐标（REG[5Fh] ~ REG[62h]）。

3. 通过写入寄存器 → 设定 Memory Data Port Register（REG[04h]）完成地址设定。

4. 对工作视窗写入数据，每个数据写入 Memory Data Port 都将会自动累加内存地址。

The way the MCU controls the TFT is through the hardware interface, and then reads and writes the registers to the TFT and writes the data to the display memory. The LT7381 has a Status Register and 256 instruction registers, that is, REG[00h] ~ REG [FF], the read and write steps of the register are as follows:

Register writing steps:

1. Address Write: Write the address of this register (REG), 00h represents REG[00h], 01h represents REG[01h], and so on.

2. Data Write: Write data to this register.

Register reading steps:

1. Address Write: Write the address of this register.

2. Data Write: Read the data of this register.

The display memory is where the image data of the TFT screen is stored. The MCU also writes data to the display memory of the TFT through the hardware interface. The steps are as follows:

Memory write steps:

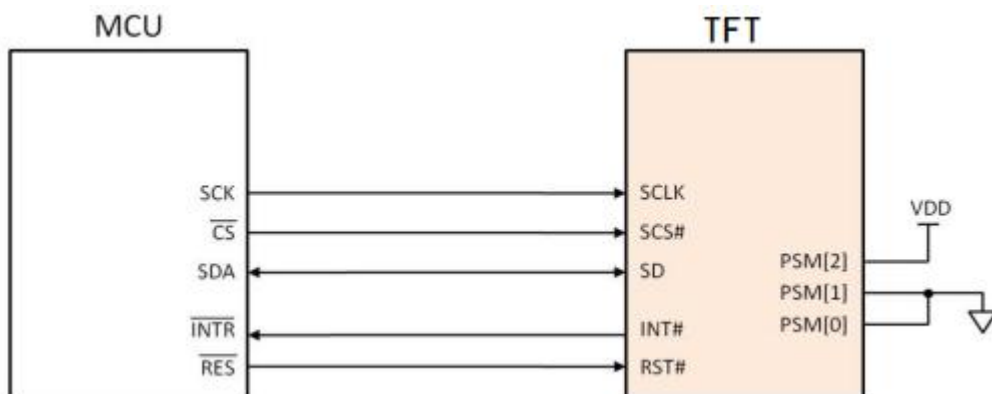
1. By writing to the register → first set the viewport.

2. By writing to the register → set the image read and write coordinates (REG[5Fh] ~ REG[62h]).

3. Complete the address setting by writing to the register → setting the Memory Data Port Register (REG[04h]). 4. Write data to the viewport, each data written to the Memory Data Port will automatically accumulate the memory address.

6.3. 串行接口特性 Serial Interface Characteristics

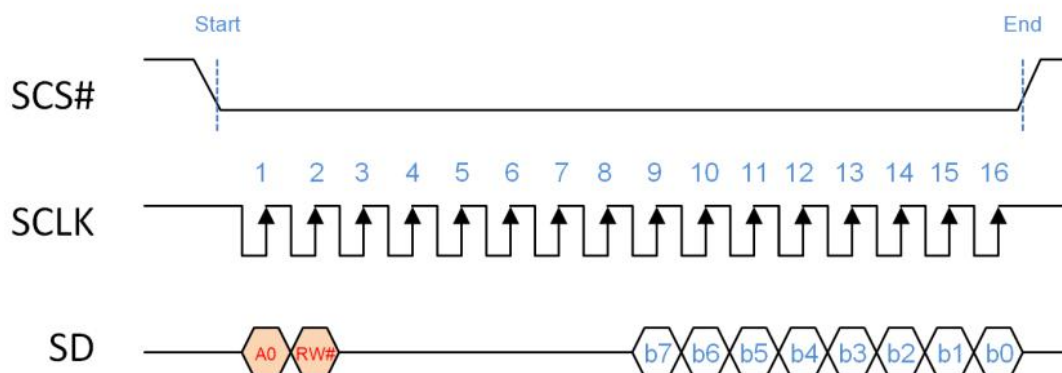
6-2-1: 3 线串行 3-line serial



MCU 3 线 SPI 串联接口电路图 MCU 3-wire SPI serial interface circuit diagram

MCU 可以通过 3 线的 SPI 串口与 TFT 连接, 上图为 3 线 SPI 串联接口电路图, 其基本时序如下图所示, SD 为双向传输的数据线。

The MCU can be connected to the TFT through the 3-wire SPI serial port. The above figure is the circuit diagram of the 3-wire SPI serial interface. The basic timing sequence is shown in the figure below. SD is the data line for bidirectional transmission.



MCU 3 线 SPI 串联界面时序图 MCU 3-Wire SPI Serial Interface Timing Diagram

状态寄存器读取:

1. MCU 发出 SCS# (Low) 及 SCLK (SPI 时钟信号)。
2. MCU 发出 A0 = 0, RW# = 1。
3. TFT 在 9 th ~ 16 th Clock 会送出 b7 ~ b0, MCU 就可以读到状态寄存器的数据。

指令寄存器地址写入:

1. MCU 发出 SCS# (Low) 及 SCLK (SPI 时钟信号)。
2. MCU 发出 A0 = 0, RW# = 0。
3. MCU 在 9 th ~ 16 th Clock 送出 b7 ~ b0 给 LT7381, b7 ~ b0 就是代表设定指令

寄存器的地址。

指令寄存器，或是内存数据写入：

1. MCU 发出 SCS# (Low) 及 SCLK (SPI 时钟信号)。

2. MCU 发出 $A0 = 1$, $RW\# = 0$ 。

3. MCU 在 9 th ~ 16 th Clock 送出 $b7 \sim b0$ 给 LT7381, $b7 \sim b0$ 就是代表写入到指令寄存器或是显示内存的数据。

指令寄存器数据读取：

1. MCU 发出 SCS# (Low) 及 SCLK (SPI 时钟信号)。

2. MCU 发出 $A0 = 1$, $RW\# = 1$ 。

3. TFT 在 9 th ~ 16 th Clock 会送出 $b7 \sim b0$ (指令寄存器的数据)，MCU 就可以读到指令寄存器的内容。

Status register read:

1. The MCU sends SCS# (Low) and SCLK (SPI clock signal).

2. The MCU issues $A0 = 0$, $RW\# = 1$.

3. The TFT will send $b7 \sim b0$ on the 9th ~ 16th Clock, and the MCU can read the data in the status register.

Instruction register address write:

1. The MCU sends SCS# (Low) and SCLK (SPI clock signal).

2. The MCU issues $A0 = 0$, $RW\# = 0$.

3. The MCU sends $b7 \sim b0$ to the LT7381 on the 9th ~ 16th Clock, and $b7 \sim b0$ is the address of the set instruction register.

Instruction register, or memory data write:

1. The MCU sends SCS# (Low) and SCLK (SPI clock signal).

2. MCU issues $A0 = 1$, $RW\# = 0$.

3. The MCU sends $b7 \sim b0$ to the LT7381 on the 9th ~ 16th Clock, and $b7 \sim b0$ represent the data written to the instruction register or display memory.

Instruction register data read:

1. The MCU sends SCS# (Low) and SCLK (SPI clock signal).

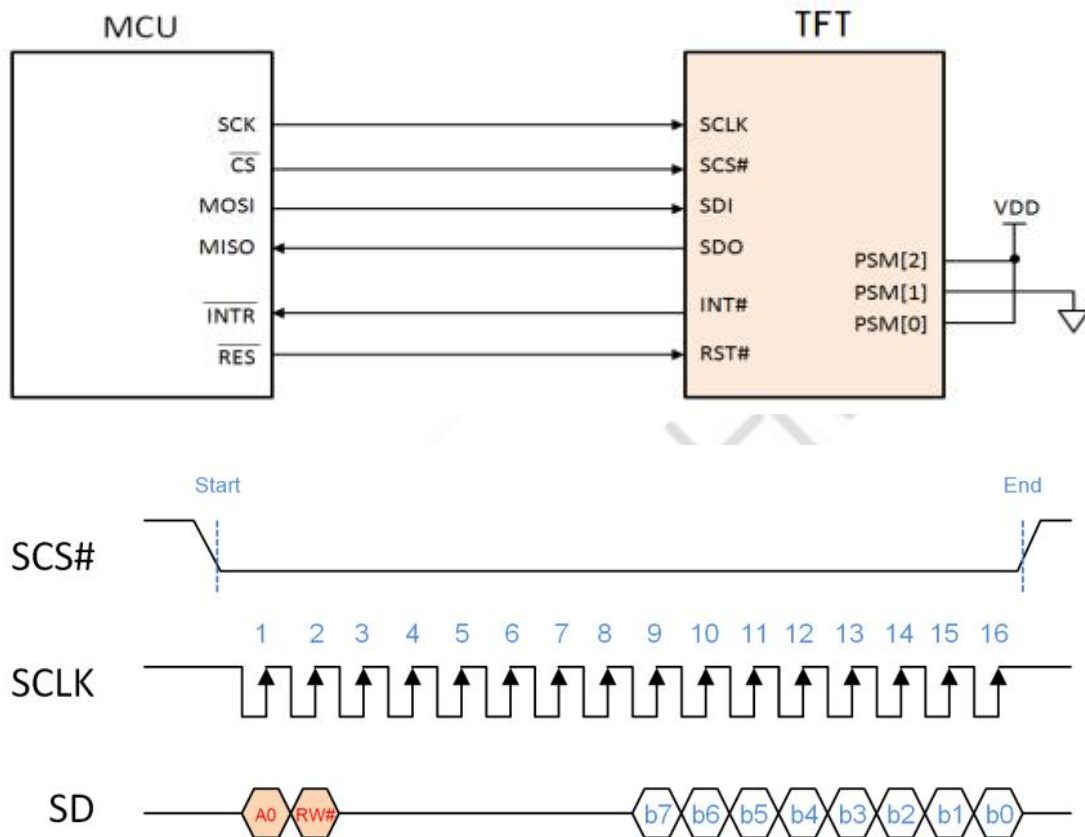
2. MCU issues $A0 = 1$, $RW\# = 1$.

3. TFT will send $b7 \sim b0$ (the data of the instruction register) on the 9th ~ 16th Clock, and the MCU can read the contents of the instruction register.

6-2-2: 4 线串行 4-line serial

4 线 SPI 串型接口与 3 线类似，只是差别在它的数据线输入、输出是分开的，接口电路图如下：

The 4-wire SPI serial interface is similar to the 3-wire, except that its data line input and output are separated. The interface circuit diagram is as follows:



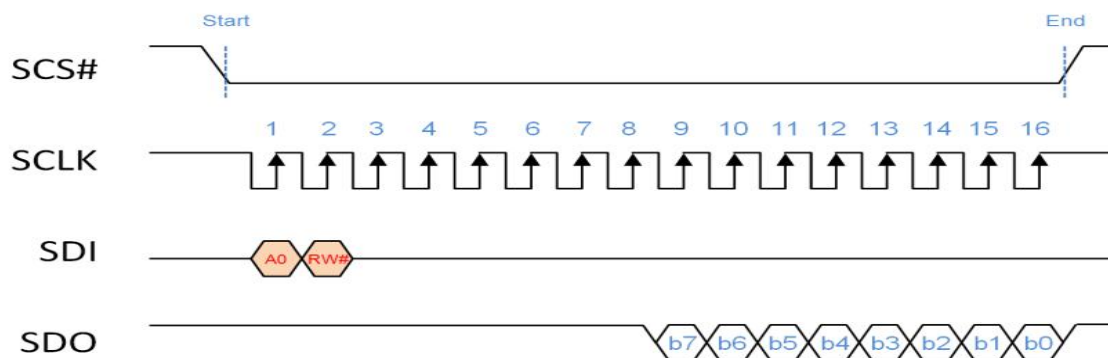
上图是 4 线 SPI 串联界面的写入时序，MCU 发出 $A0 = 0$ 、 $RW\# = 0$ ，代表 MCU 要写入指令寄存器地址，MCU 发出 $A0 = 1$ 、 $RW\# = 0$ ，代表 MCU 要写入数据到寄存器或是显示内存。

The above picture shows the write sequence of the 4-wire SPI serial interface. The MCU sends $A0 = 0$, $RW\# = 0$, which means the MCU wants to write the command register address, and the MCU sends $A0 = 1$, $RW\# = 0$, which means the MCU wants to write data to register or display memory.

下图是 4 线 SPI 串联接口的读取时序，MCU 发出 $A0 = 0$ 、 $RW\# = 1$ ，代表 MCU 要读取状态寄存器的数据，TFT 就会在 9 th ~ 16 th Clock 通过 SDO 送出 $b7 \sim b0$ （状态寄存器的数据），MCU 就可以读到状态寄存器的内容。同理，MCU 发出 $A0 = 1$ 、 $RW\# = 1$ ，代表 MCU 要读指令寄存器的数据，TFT 就会在 9 th ~ 16 th Clock 通过 SDO 送出 $b7 \sim b0$ （指令寄存器的数据），MCU 就可以读到指令寄存器的数据。

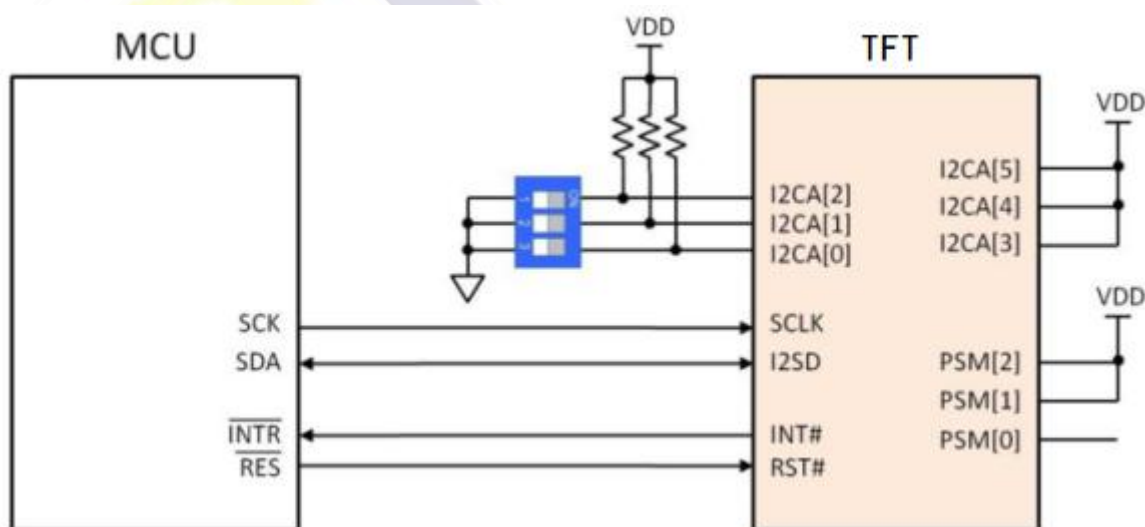
The following figure shows the read timing of the 4-wire SPI serial interface. The MCU sends $A0 = 0$, $RW\# = 1$, which means that the MCU wants to read the data of the status register,

and the TFT will send b7 ~ b0 through SDO at the 9th ~ 16th Clock. (data in the status register), the MCU can read the content of the status register. In the same way, the MCU sends A0 = 1, RW# = 1, which means that the MCU wants to read the data of the instruction register, and the TFT will send b7 ~ b0 (the data of the instruction register) through the SDO at the 9th ~ 16th Clock, and the MCU can Read the data in the instruction register.

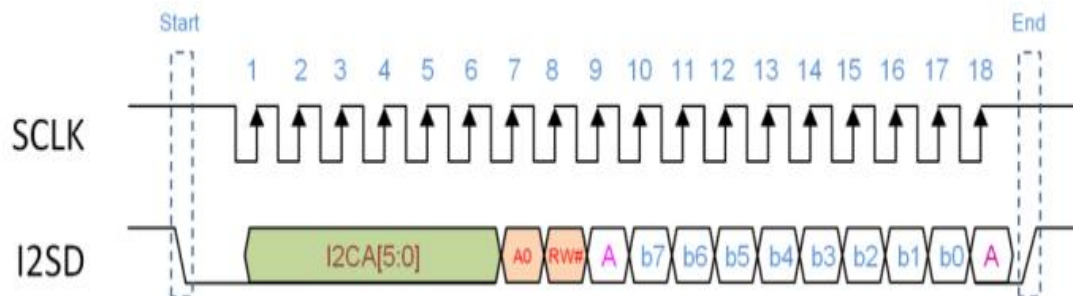


6-2-3: I2C 串型接口 I2C serial interface

I2C 串型接口模式也是与 3 线类似，差别在它的只有数据线 ISD 和时钟信号 SCLK 组成，TFT 的 I2C 串型接口兼容于标准的 I2C，下图为 I2C 串联接口电路图。I2CA[5:0] 是用来设定 Device ID，以避免不其他的 I2C 元件产生冲突，下图中的 I2CA[5:3] 接到 VDD，如果 DIP Switch 如果全部 ON，那么 Device ID 就等于 111000b = 38h。



MCU I2C 串联接口电路图 MCU I2C serial interface circuit diagram



MCU I2C 串联界面时序图 MCU I2C serial interface timing diagram

上图是 I2C 串联接口的时序, MCU 必须先知道在电路上所设的 Device ID, 然后在前 5 个 Clock 发出相同的 Device ID 数据, 以上面电路图为例就是发出 111000, A0 与 RW# 的定义与前面所说的 SPI 相同, MCU 发出 A0 = 1、RW# = 0, 代表 MCU 要在 10 th ~ 17 th Clock 写入数据 (b7 ~ b0) 到指令寄存器或是显示内存。当 MCU 发出 A0 = 1、RW# = 1, 代表 MCU 要读取指令寄存器的数据, TFT 就会在 10 th ~ 17 th Clock 通过 I2SD 送出 b7 ~ b0 (指令寄存器的数据), MCU 就可以读到指令寄存器的数据了。如果 MCU 发出 A0 = 0、RW# = 1, 代表 MCU 要读取状态寄存器的数据, TFT 就会在 10 th ~ 17 th Clock 送出 b7 ~ b0 (状态寄存器的数据), MCU 就可以读到状态寄存器的数据。

The above figure is the sequence of the I2C serial interface. The MCU must first know the Device ID set on the circuit, and then send the same Device ID data in the first 5 Clocks. Taking the above circuit diagram as an example, it sends out the definitions of 111000, A0 and RW# Same as the SPI mentioned above, the MCU sends A0 = 1, RW# = 0, which means that the MCU needs to write data (b7 ~ b0) to the instruction register or display memory at the 10th ~ 17th Clock. When the MCU sends A0 = 1, RW# = 1, it means that the MCU wants to read the data of the instruction register, the TFT will send b7 ~ b0 (the data of the instruction register) through I2SD at the 10th ~ 17th Clock, and the MCU can read the data in the instruction register. If the MCU sends A0 = 0, RW# = 1, it means that the MCU wants to read the data of the status register, the TFT will send b7 ~ b0 (the data of the status register) on the 10th ~ 17th Clock, and the MCU can read the status register The data.

七、可靠性测试 RELIABILITY TEST

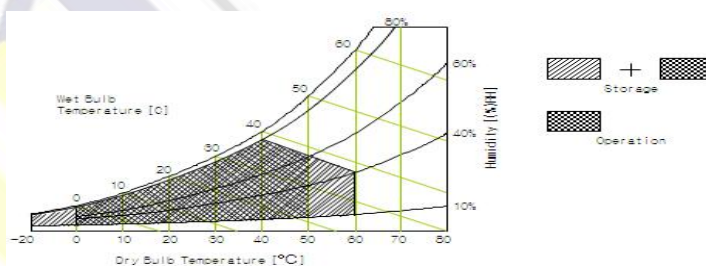
7-1 温度和湿度 Temperature and Humidity

测试项目 TEST ITEMS	条件 CONDITIONS	注释 NOTE
高温储存 High Temperature Storage	Ta=+85℃, 120hrs	
低温储存 Low Temperature Storage	Ta=-30 ℃, 120hrs	
高温运行试验 High Temperature Operation	Ta=+80 ℃, 120hrs	
低温运行试验 Low Temperature Operation	Ta=-30 ℃, 120hrs	
高温高湿（运行测试） High Temperature and High Humidity (Operating)	Ta=+60 ℃, 90%RH Max, 120hrs	

注释 Note:

1. 液晶驱动电压。由于液晶材料的特性, 该电压随环境温度而变化。Liquid Crystal driving voltage. Due to the characteristics of LC Material, this voltage varies with environmental temperature.

2. 温度和相对湿度范围如下图所示。湿球温度最高应为39℃。 并且没有冷凝水。
Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be 39 ℃ max. and no condensation of water.



3. 产品经可靠性测试后, 仅保证功能正常, 无任何致命缺陷（不显示、线路缺陷、显示异常等）。After the reliability test, the product only guarantee function normally without any fatal defect(non-display, line defect, abnormal display etc).

4. 所有显示判断均在面板温度恢复到室温两小时后进行 All display judgments are performed two hours after the panel temperature returns to room temperature

5. Ta: 环境温度 Ambient temperature

7-2 冲击和振动 Shock and Vibration

测试项目 TEST ITEMS	条件 CONDITIONS
包装冲击(非操作) Packing Shock (Non-Operation)	● Shock level:980m/s² ● Waveform:1/2 Sine wave,6msec ● ±X, ±Y ±Z, each axis 1 times
包装振动(非操作) Packing Vibration (Non-Operation)	● Frequency range:8-33.3HZ ● Stoke:1.0mm ● Sweep: 10Hz-50Hz ● x, y, z 2 hours for each direction

7-3 静电放电测试 Electrostatic Discharge

测试项目 TEST ITEMS	条件 CONDITIONS
ESD (Non-operation)	150pF, 330 Ω, Contact ±2KV, Air : ±4KV. Note 1 200pF, 0 Ω, ±200V Contact test. Note 2

测量点 Measure Point:

1. LCD玻璃和金属边框 LCD glass and metal bezel
2. 连接器引脚 IF connector pins

八、处理和注意事项 HANDDLING & CAUTIONS

8-1 操作注意事项 Caution For Operation

◆由于液晶模组是玻璃材质，请勿对其施加强烈的机械冲击或静载荷。请小心搬运，因为冲击、振动和粗心的搬运可能会严重影响产品。如果从高处坠落或受到强烈冲击，玻璃可能碎了。

Since the LCM is made of glass, do not apply strong mechanical impact or static load onto it. Handling with care since shock, vibration, and careless handling may seriously affect the product. If it falls from a high place or receives a strong shock, the glass maybe broken.

◆在规定的电压限制内驱动 LCM 是必不可少的，因为高于限制的电压会导致 LCM 的寿命缩短。由直流引起的电化学反应会导致 LCM 出现不良劣化，因此应避免使用直流驱动。

It is indispensable to drive the LCM within the specified voltage limit since the higher voltage than the limit causes LCM's life shorter. An electro-chemical reaction due to DC causes undesirable deterioration of the LCM so that the use of DC drive should avoid.

◆请勿在电源开启时将 LCM 连接到系统或从系统断开连接。

Do not connect or disconnect the LCM to or from the system when power is on.

◆切勿在高温高湿的异常条件下使用 LCM。

Never use the LCM under abnormal conditions of high temperature and high humidity.

◆当暴露于剧烈的温度波动（热到冷或冷到热）时，LCM 可能会受到影响；具体来说，从冷到热的剧烈温度波动会在 LCM 表面产生露水，这可能会影响 LCM 上偏振片的运行。

When expose to drastic fluctuation of temperature(hot to cold or cold to hot), the LCM may be affected; specifically, drastic temperature fluctuation from cold to hot, produces dew on the LCM's surface which may affect the operation of the polarizer on the LCM.

◆在低于工作温度范围的温度下，响应时间将极度延迟，另一方面，在高于其工作范围的温度下，LCM 可能会变黑。然而，这些现象并不意味着 LCM 出现故障或故障。一旦温度恢复到正常运行的推荐温度范围，LCM 将恢复正常运行。

Response time will be extremely delay at lower temperature than the operating temperature range and on the other hand LCM may turn black at temperature above its operational range. However those phenomenon do not mean malfunction or out of order with the LCM. The LCM will revert to normal operation once the temperature returns to the recommended temperature range for normal operation.

◆为防止LCD产生图像残留，在使用常黑面板时不要长时间显示固定图案。如果LCD需要显示固定图案，建议时间少于 2 分钟或者更短的时间内刷新显示内容一次或多次。强烈建议使用黑色图像或移动图像作为屏幕保护程序。

In order to prevent the LCD from producing image retention, do not display a fixed pattern for a long time when using a normally black panel. If the LCD needs to display a fixed pattern, it is recommended to refresh the display one or more times in less

than 2 minutes or less. It is strongly recommended to use a black image or moving image as a screen saver.

8-2 防静电措施 Caution Against Static Charge

◆LCM 使用 C-MOS LSI 驱动器，因此建议客户将任何未使用的输入端连接到 Vdd 或 Vss，上电前不要输入任何信号，并将您的身体、工作/装配区、装配设备接地 防止静电。

The LCM use C-MOS LSI drivers, so customers are recommended that any unused input terminal would be connected to Vdd or Vss, do not input any signals before power is turn on, and ground you body, work/assembly area, assembly equipments to protect against static electricity.

◆缓慢去除保护膜，保持去除方向与面板表面不垂直约 30 度，如有可能，在离子风机等 ESD 控制装置下，工作室湿度应保持在 50%RH 以上，以减少静电风险

Remove the protective film slowly, keeping the removing direction approximate 30-degree not vertical from panel surface, if possible, under ESD control device like ion blower, and the humidity of working room should be kept over 50%RH to reduce the risk of static charge.

◆避免使用合成纤维制成的工作服。我们推荐棉质衣服或其他经过导电处理的纤维。

Avoid the use work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

◆在处理 LCM 时，请戴上不带电材料的手套。对地导电手腕和对地导电鞋是必需的

In handling the LCM, wear non-charged material gloves. And the conducting wrist to the earth and the conducting shoes to the earth are necessary

--END--