

LCD Module Description

□正式规格 Official specifications

by customer:

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一、基本特征 General Feature:

项目 Item	标准值 Standard Value			单位 Unit
TFT 显示尺寸 TFT Display Size	3.0_a-Si TFT_VA			英寸 Inch
TFT 分辨率 TFT Number of Pixels	240 (H) (H) x 400 (V)			像素 Pixel
TFT 显示有效区域 TFT Display Active Area	38.88 (H) x 64.80 (V)			毫米 mm
液晶模组外形尺寸 LCD Module Dimensions	43.44 (H) x 75.30 (V) x 1.80 (D) <TFT>			毫米 mm
液晶模组观看方向角度 Viewing direction of LCD module	U85° D85° R85° L85° (Typ.)			度数 Deg.
液晶模组接口 LCD Module Interfaces	TFT	■ 4-wire SPI ■ MCU 8080 8-bits ■ MCU 8080 16-bits <Default>		—
	CTP	— — —		
液晶模组芯片 LCD Module Driver IC	TFT	ST7365P<TaiWan, China>		—
	CTP	— — —		
触摸屏 Touch Panel	☒ 不带触摸屏 No TP	☐ 带玻璃盖板 Have Glass Cover	☐ 带电阻触摸屏 Have RTP	—
TFT 模组重量 TFT Module Weight	不带触摸屏 Without TP	T. B. D ±5%		克 g
	带电容触摸屏 With CTP	T. B. D ±5%		
	带电阻触摸屏 With RTP	T. B. D ±5%		

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	TE	-Tearing效应信号用于同步MCU对帧存储器的写入。 -Tearing effect signal is used to synchronize MCU to frame memory writing. -如果不使用, 不连接这个引脚 -If not used, do not connect this pin
2~6	NC	不连接 Disconnected
7~8	VCI	电源 Power supply
9	SPI-SDA	- 串行接口数据输入/输出引脚。数据在SCL信号的上升沿被锁住。 Serial interface data input/output pins. The data is latched on the rising edge of the SCL signal. -如果不使用, 连接这个引脚到 "GND" If not used, connect this pin to "GND"
10	CSX	芯片选择引脚, 低电平使能。 Chip selection pin. Low enable.
11	RSX	显示数据(或参数)/命令(或寄存器索引)选择引脚 Display data (or parameter)/command (or register index)
12	WRX	-在MCU并行接口中的写操作启用。 Write enable in MCU parallel interface. -在SPI模式下, 该引脚被用作串行时钟 In SPI mode, this pin is used as the serial clock -如果不使用, 连接这个引脚到 "GND" If not used, connect this pin to "GND"
13	RDX	-8080单片机并行接口中的读取功能, 低电平有效。 Read enable in 8080 MCU parallel interface, Low-active. -如果不使用, 连接这个引脚到 "GND" If not used, connect this pin to "GND"
- 下一页 - - Next Page -		

引脚编号 Pin NO.	标号Symbol	详细描述 Description
14~29	DB[0~15]	-在MCU 8080并行接口中，DB[0~15]被用作数据总线。 In MCU 8080 parallel interface, DB[0~15] are used as data bus. -如果不使用，连接这个引脚到“GND” If not used, connect this pin to "GND"
30	RESX	重置信号。信号为低电平有效 Reset signal. Signal is active low
31~32	NC	不连接 Disconnected
33	GND	电源地 Power supply ground
34~37	LEDK	LED阴极 LED cathode
38	LEDA	LED阳极 LED anode
39	NC	不连接 Disconnected
40	GND	电源地 Power supply ground
- 下一页 - - Next Page -		

温馨提示 1：显示屏默认接口为 MCU-16 Bit，需要 MCU-8 Bit 或 4L-SPI 接口时请参照下面示意图变更 FPC 上电阻

Kind reminder1: The default interface of the display is MCU-16 Bit, if you need MCU-8 Bit or 4L-SPI interface, please refer to the following schematic to change the resistor on the FPC



温馨提示 2: 为了与我司更多的显示屏兼容, 建议将“Pin2-6”作为以下定义使用

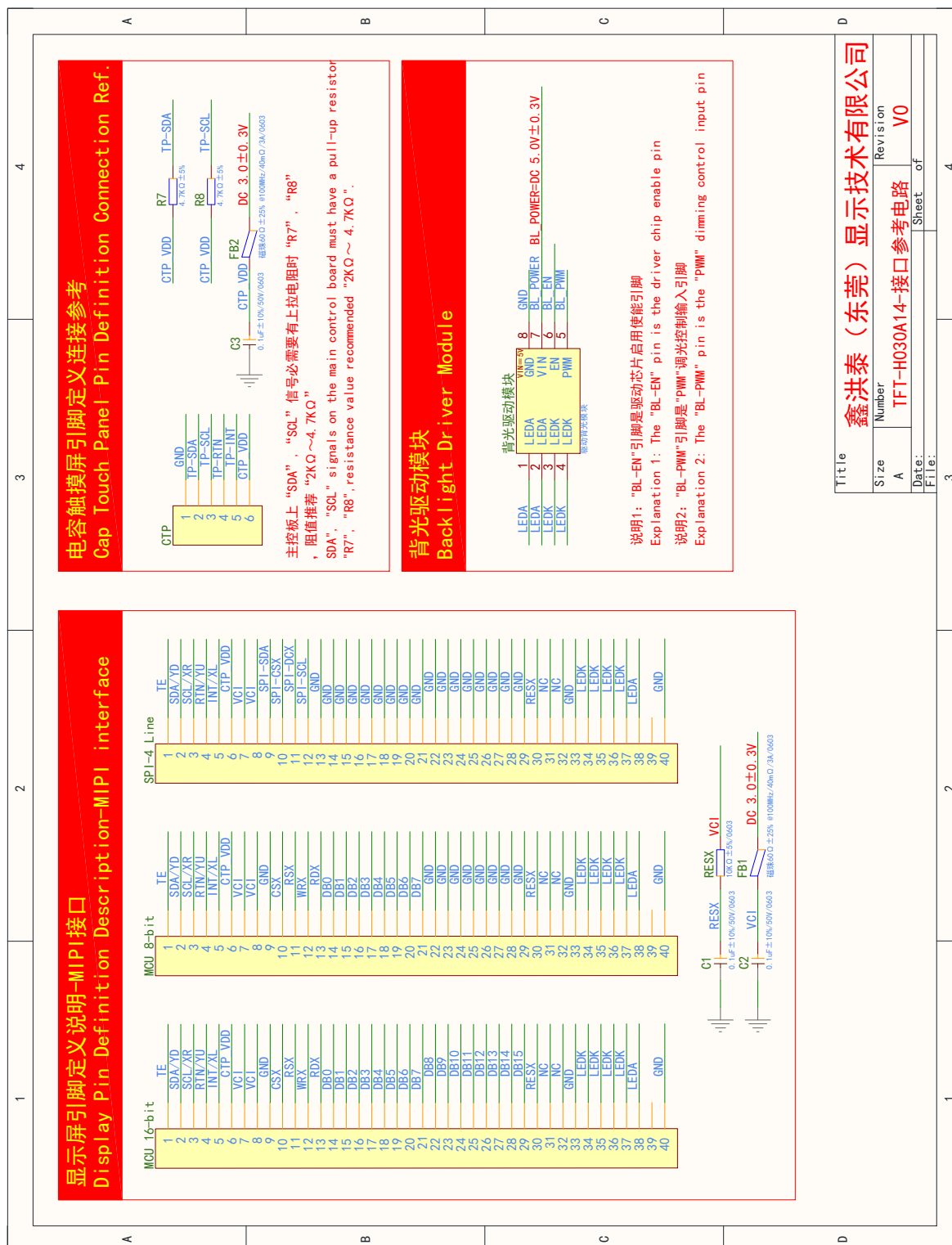
Kind reminder2: In order to be compatible with more display screens in our company, it is recommended to use "Pin2-6" as the following definition

引脚编号 Pin NO.	标号Symbol	详细描述 Description
2	SDA/YD	-电容触摸 I2C 数据信号 CTP I2C data signals -电阻触摸“YD”位置输入 Resistive touch "YD" Position Input
3	SCL/XR	-电容触摸 I2C 时钟信号 CTP I2C clock signal -电阻触摸“XR”位置输入 Resistive touch "XR" Position Input
4	RTN/YU	-电容触摸重置复位引脚 CTP Reset pin -电阻触摸“YU”位置输入 Resistive touch "YU" Position Input
5	INT/XL	-电容触摸中断信号 CTP interrupt signal -电阻触摸“XL”位置输入 Resistive touch "XL" Position Input
6	CTP_VDD	电容触摸电源 CTP Power supply
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3.2 电容触摸引脚说明 CTP Pin Description

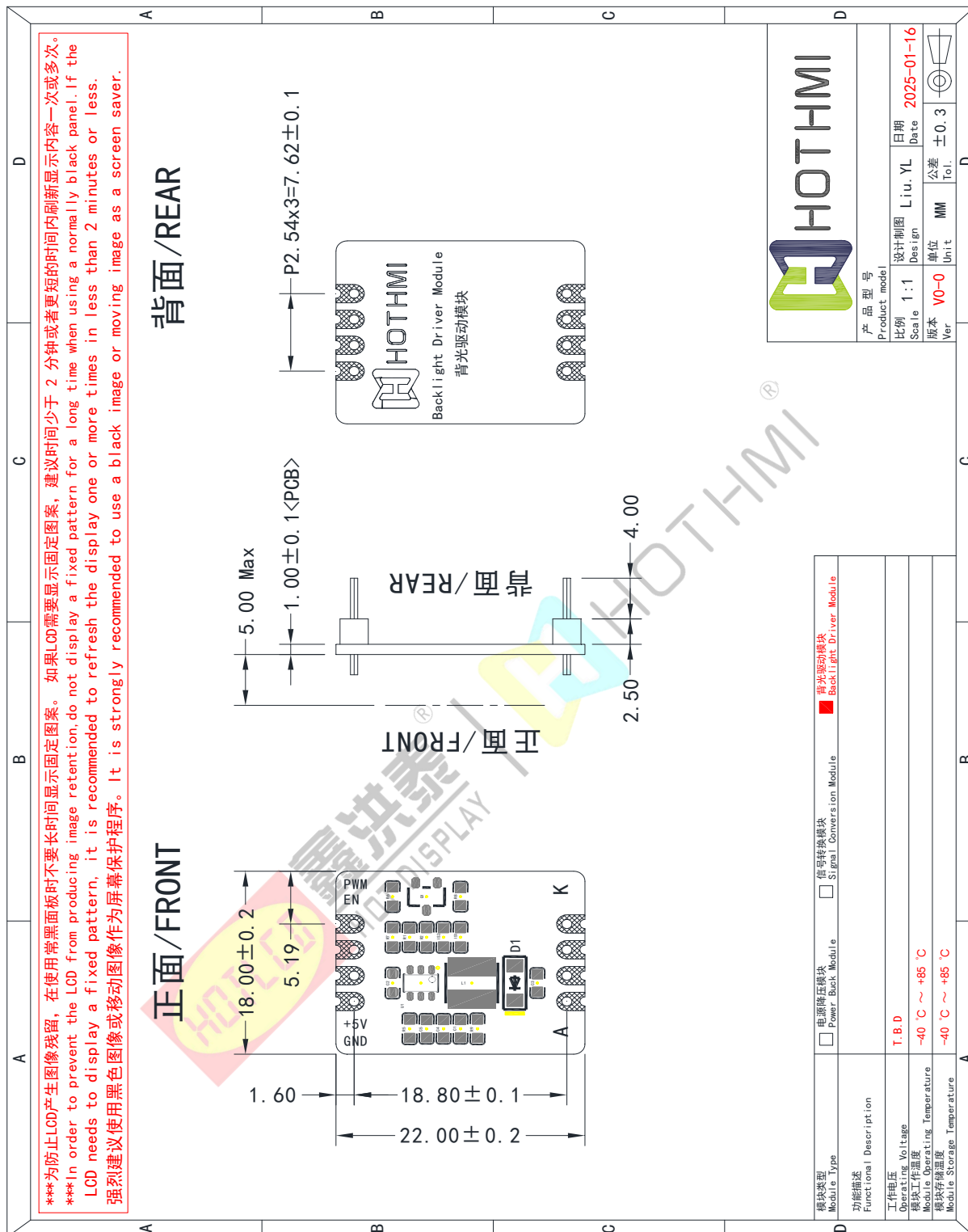
引脚编号 Pin NO.	标号 Symbol	详细描述 Description
1	—	未定义 Undefined
2	—	未定义 Undefined
3	—	未定义 Undefined
4	—	未定义 Undefined
5	—	未定义 Undefined
6	—	未定义 Undefined
— 结束 — — END —		

3.3 接口参考电路图 Interface Reference Circuit Diagram



温馨提示：我司能够提供配套的背光驱动模块和“AVDD”升压模块

Kind reminder: Our company can provide supporting backlight driver modules and "AVDD" boost modules

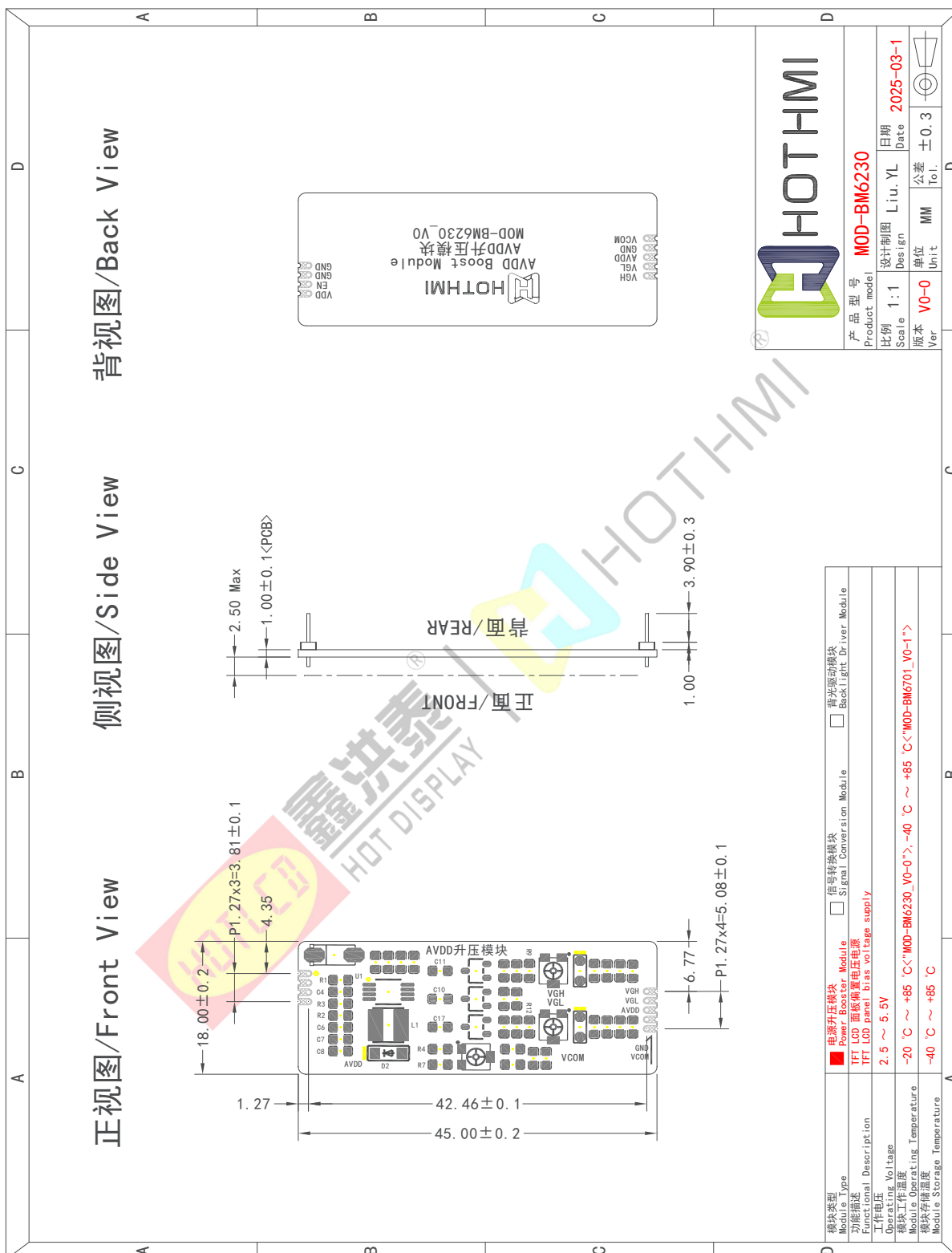


背光模块尺寸

Backlight Module Dimensions

温馨提示: 我司所有背光模块长, 宽尺寸相同, 引脚定义相同。使用的模块以实物为准。

Kind reminder: All of our backlight modules have the same length and width dimensions and the same pin definition. Modules used are subject to physical.



AVDD 升压模块尺寸

AVDD Boost Module Dimensions

四、电气特性 Electrical Characteristics

4-1 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	-	Type -0.3	3.0	Type +0.3	伏 V
接口工作电压 IO Supply Voltage	IOVCC	-	Type -0.1	-	Type +0.1	伏 V
模拟电路电源 Power For Analog	AVDD	-	Type -0.3	-	Type +0.3	伏 V
TFT 栅极导通电压 TFT Gate ON Voltage	VGH	-	Type -1.0	-	Type +1.0	伏 V
TFT 栅极关断电压 TFT Gate OFF Voltage	VGL	-	Type -1.0	-	Type +1.0	伏 V
TFT 公共电极电压 TFT Common Electrode Voltage	VCOM	-	Type -0.5	-	Type +0.5	伏 V
工作电流 Operation Current	I _{oc}	VCI=3.3V	12	-	15	毫安 mA
		IOVCC	-	-	-	
待机电流 Standby Current	I _{sc}	STBYB=L	-	21	25	微安 uA
TFT 工作温度 TFT Operating Temp	TOPR	-	-20	+25	+70	摄氏度 ℃
TFT 储存温度 TFT Storage Temp	TSTG	-	-30	+25	+80	摄氏度 ℃

温馨提示

1. 电流数据采用 85C1 指针式电流表测量，仅供参考。
2. 必须调节 Vcom 以优化显示质量，如串扰和对比度等。
3. 我们只是建议将设定电压作为参考值。为了获得最佳的显示质量，应根据客户的开发情况改变设定电压。（显示质量可能会因客户的电压设置而改变。）。

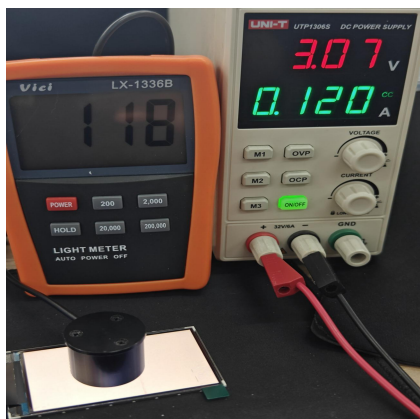
Kind reminder:

1. The current data is measured using an 85C1 pointer ammeter, for reference only.
2. Vcom must be adjusted to optimize display quality, as Crosstalk and Contrast Ratio etc.
3. We just kindly recommend the setting-voltages the reference value. In order to get the optimized display quality, the setting-voltage should be changed according to customer's developing condition. (The display quality could be changed by customer's setting - voltage.)

4-2 背光工作条件 LED back light specification

4-2-1: Backlight-1

项目 Item	标号 Symbol	条件 Condition	最小值 Min	典型值 Type	最大值 Max	单位 Unit
工作电压 Forward voltage	VF	恒流 constant current	Type -0.3	3.0	Type +3.0	伏特 V
工作电流 Forward current	IF		-	120	-	毫安 mA
亮度 (带 LCD) Luminance (With LCD)	Lv	不带触摸 Without TP	Type -15%	120	Type +15%	坎德拉/平方米 cd/m ²
		带电阻触摸 Have RTP		-		
		带电容触摸 Have CTP		-		
LED 寿命 LED life time	Hr	Ta=25±3 °C	20,000	30,000	-	小时 Hour

不带触摸
No TP带电阻触摸
Have RTP带电容触摸
Have CTP

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。

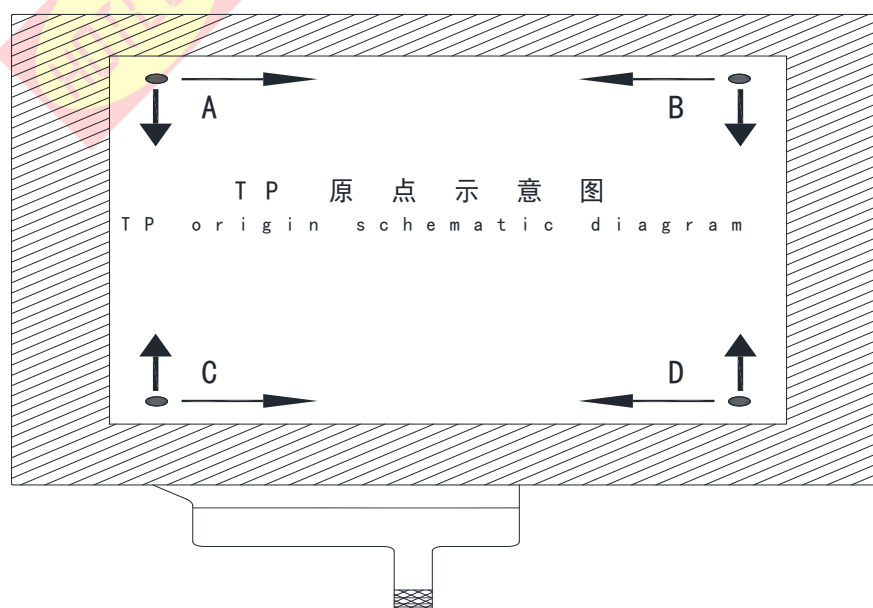
LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

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%.

4-3 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 Unit
表面硬度 Surface hardness	-	铅笔 Pencil	-	6H	-	硬度 Hard
最大点数 maximum point number	-	-	-	-	-	手指 Fingers
坐标原点 origin	-	-	-			位置 Position
X 分辨率 X resolution	-	-	-			-
Y 分辨率 Y resolution	-	-	-			-
透光率 Transmittance	-	-	80	-	-	百分比 %
USB 5V 输入电源 USB 5V input power	VDD5V	-	Type -0.3	-	Type +0.3	伏特 V
数字电源 Digital Power	VDD	-	Type -0.3	3.0	Type +0.3	伏特 V
I/O 电源 I/O Power	IOVDD	-	Type -0.3	-	Type +0.3	伏特 V
工作温度 Operation Temperature	-	20%-90%RH;	-20	+25	+70	摄氏度 ℃
储存温度 Storage Temperature	-		-30	+25	+80	摄氏度 ℃



五、液晶光学规格 TFT OPTICAL SPECIFICATION

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.

光学规格表

Optical Specifications Table

项目 Item		规格 SPEC	备注 Remark
透射 Transmittance (BLU ON)	对比度 Contrast ratio	Min 50:1; Typ 80:1	Test equipment: M3 , Note 5.2
	色域 Color Gamut	Min 21%; Typ 25%	Only CF, C Light, without OC, NTSC Note 5.5
	W(x, y)	(0.518, 0.307) $\pm$ 0.03	
	R(x, y)	(0.313, 0.481) $\pm$ 0.03	
	G(x, y)	(0.164, 0.166) $\pm$ 0.03	
	B(x, y)	(0.309, 0.322) $\pm$ 0.03	
	视角范围 Viewing Angle (12/6/9/3 点)	Typ 60/60/60/60 Min 45/45/45/45	Test equipment: M1 source pad down, CR>10 Note 5.1
	响应时间 Response Time	Max 30ms	Test equipment: M1 Tr+Tf, W90%/B10%. Note 5.4
反射 Reflection (BLU Off)	反射 Reflection	Min 4.5%; Typ 6.0%	Test equipment: M2 Note 5.3
	对比度 Contrast ratio	Min 14; Typ 18	Test equipment: M2 Note 5.2
	色域 Color Gamut	Min 14%; Typ 18%	NTSC Test equipment: M2 Note 5.3
	W(x, y)	(0.320, 0.317) $\pm$ 0.03	
	R(x, y)	(0.463, 0.332) $\pm$ 0.03	
	G(x, y)	(0.311, 0.484) $\pm$ 0.03	
	B(x, y)	(0.181, 0.233) $\pm$ 0.03	
	视角范围 Viewing Angle (12/6/9/3 点)	Typ 60/60/60/60 Min 50/50/50/50	Test equipment: M1 source pad down, CR>2 Note 5.1

测量条件 Measuring Condition:

透射模式（蓝光开启）、反射模式（蓝光关闭）；暗室（环境亮度 $\leq 1\text{lux}$ ）；环境温度： $25 \pm 2^\circ\text{C}$ 。

Transmittance Mode (Blu on), Reflection Mode (Blu off); Dark room (ambient luminance $\leq 1\text{lux}$); Ambient temperature: $25 \pm 2^\circ\text{C}$

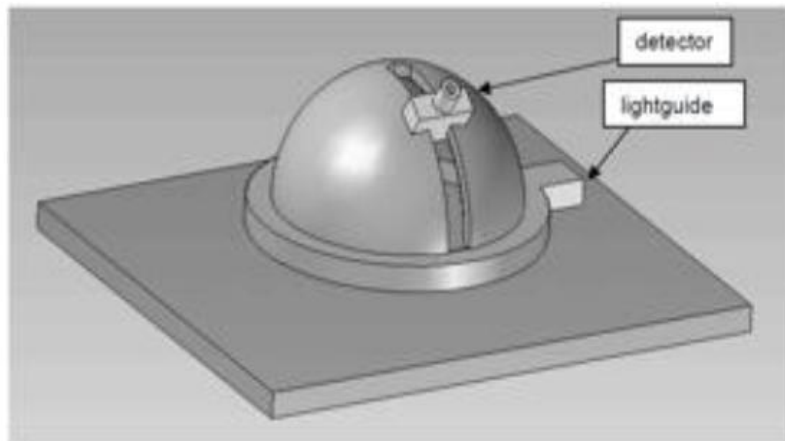
测量点：除非另有说明，否则活动区域的中心（一个点）

Measuring Point: Center of the Active area (one point) unless otherwise specified

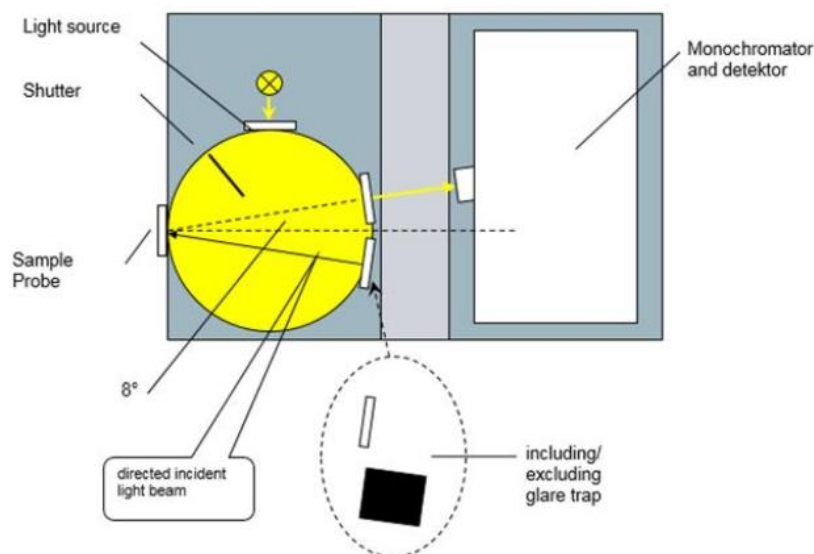
测量设备 Measuring Equipment:**1. 反射模式测量系统（背光关闭，测试点AA中心）**

Reflective Mode measurement system (Backlight is off, test point AA center)

M1: Measure equipment: DMS903



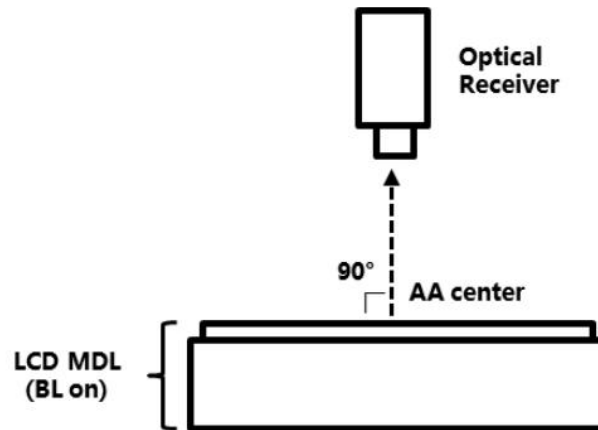
M2: Measure equipment: CM700D (8° , D65)



2. 透射模式测量系统（背光打开，测试点AA中心）

Transmissive mode measurement system (Backlight is on, test point AA center)

M3: Measure equipment: EYE2-400

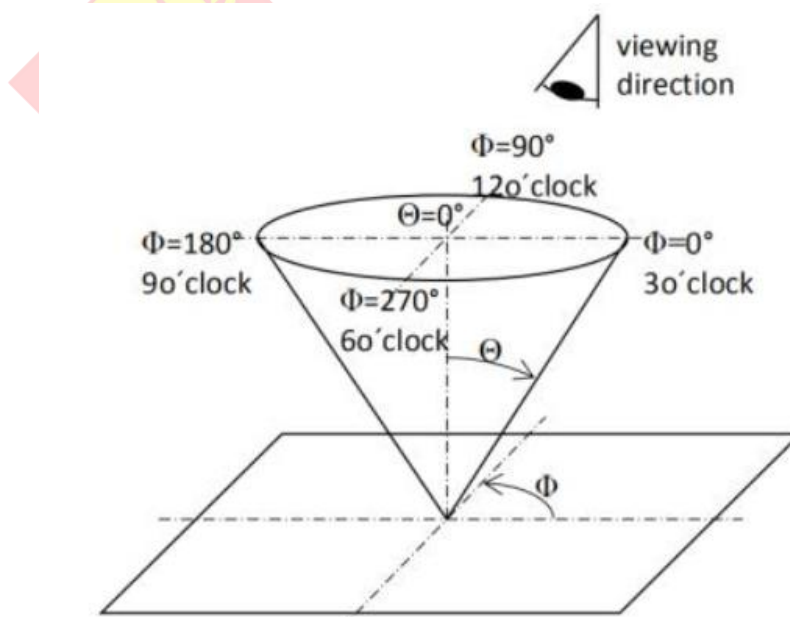


注释 Note:

4.1. 规格基于模块测试。透射/反射视角是对比度大于10/2的角度。相对于垂直于LCD表面的光轴，确定水平或3、9点钟方向和垂直或6、12点钟方向的观看。规范将根据测量值进行更新。在传输模式下，人的视角为8点（源板6点）。

4.1. Specifications are based on module testing. Transmittance/Reflection viewing angle is the angle at which the contrast ratio is greater than 10 / 2. The viewing 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. Spec. will be updated according to measured values. Human viewing angle is 8' clock in trans mode (source pad 6' clock).

Viewing Angle Range Is Defined As Follows



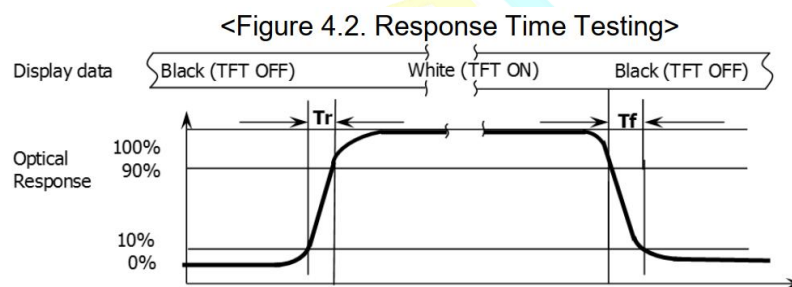
4.2. 规格基于模块测试。对比度测量应在以下视角进行 $= 0$ 并且位于LCD表面的中心。应首先将视野中的所有像素设置为白色，然后设置为暗（黑色）状态，以测量亮度。对比度（CR）是通过数学方法定义的。

4.2. Specifications are based on module testing. Contrast measurements shall be made at viewing angle of $= 0$ 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. Contrast Ratio (CR) is defined mathematically.

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

4.4. 规格基于模块测试。响应时间（黑色到白色）：Tr+Tf黑色（10%）到白色（90%）。如下图所示，透射率从10%变化到90%所需的时间是Tr，从90%变化到10%所需的是Tf。

4.4. Specifications are based on module testing. Response time (black to white): Tr+Tf Black(10%) to White(90%). As shown in figure below, the time needed for the transmittance to change from 10% to 90% is Tr, and 90% to 10% is Tf.



4.5. 表4中规定的透射率模式的色坐标和色域。应使用C光源在滤色器玻璃的中心进行测量。表4中指定的反射模式的颜色坐标。应在面板中心用D65灯测量。反射模式的色域应使用LCM进行测试，并通过RGB的x和y进行计算，如下所示：

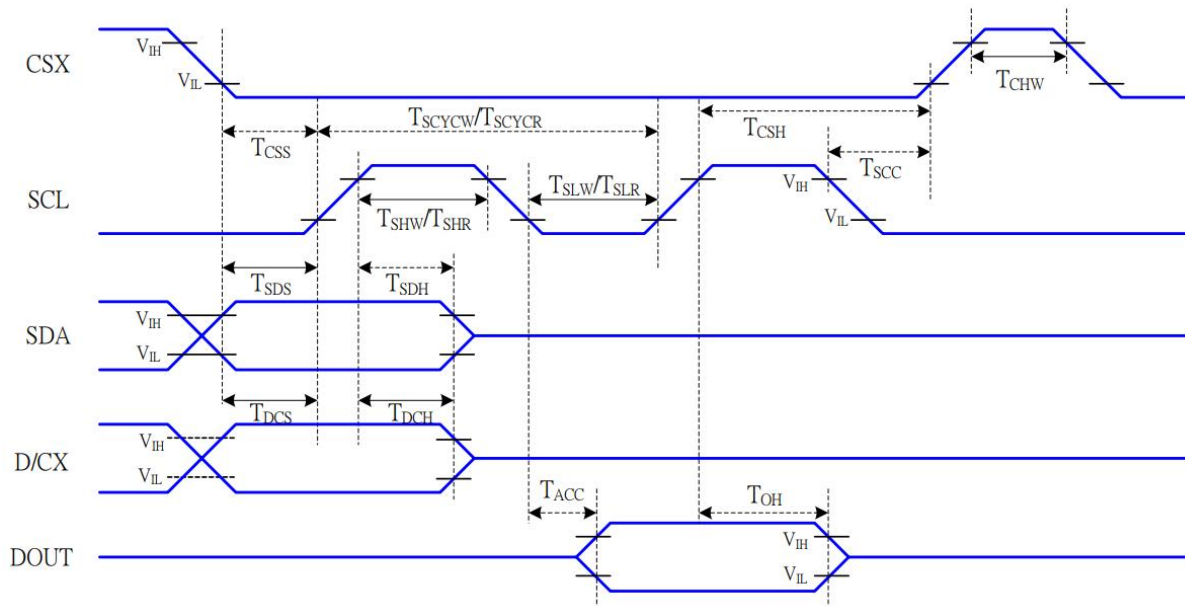
4.5. The color coordinates and Color Gamut of Transmittance mode specified in Table 4. shall be measured at the center of the color filter glass with C - light source. The color coordinates of Reflection mode specified in Table 4. shall be measured at the center of the panel with D65 light. Color Gamut of Reflection Mode should be tested with LCM and calculated by RGB' s x and y as below:

$$NTSC = \text{ABS} [R_x * (G_y - B_y) + G_x * (R_y - B_y) + B_x * (R_y - G_y) / 2 / 0.1582]$$

六、交流特性 AC characteristic

6.1. 4-SPI 串行数据传输接口特性

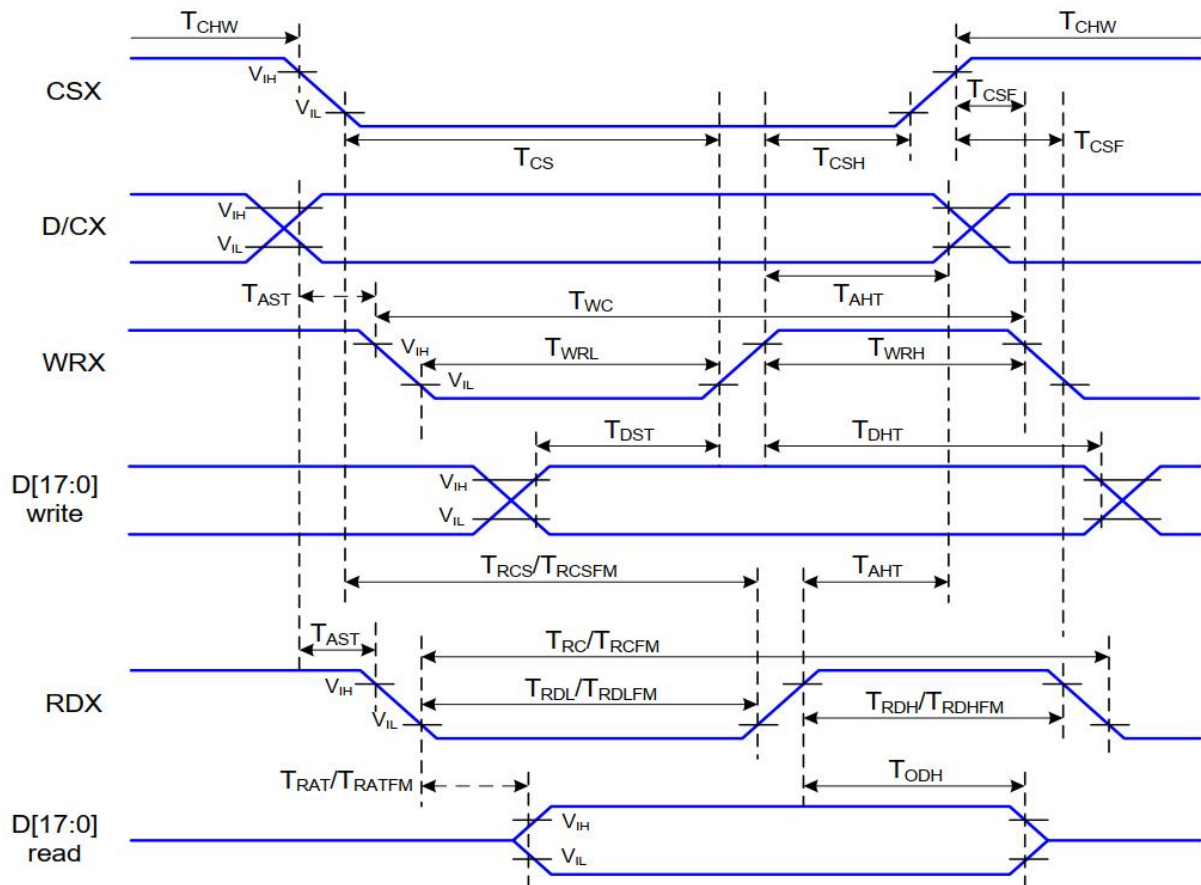
4-SPI Serial Data Transfer Interface Characteristics



4-SPI Interface Timing Characteristics

Signal	Symbol	Parameter	MIN	MAX	Unit	Description
CSX	T_{CSS}	Chip select setup time (write)	15		ns	
	T_{CSH}	Chip select hold time (write)	15		ns	
	T_{CSS}	Chip select setup time (read)	60		ns	
	T_{SCC}	Chip select hold time (read)	65		ns	
	T_{CHW}	Chip select "H" pulse width	40		ns	
SCL	T_{SCYCW}	Serial clock cycle (Write)	66		ns	-write command & data ram
	T_{SHW}	SCL "H" pulse width (Write)	15		ns	
	T_{SLW}	SCL "L" pulse width (Write)	15		ns	
	T_{SCYCR}	Serial clock cycle (Read)	150		ns	-read command & data ram
	T_{SHR}	SCL "H" pulse width (Read)	60		ns	
	T_{SLR}	SCL "L" pulse width (Read)	60		ns	
D/CX	T_{DCS}	D/CX setup time	10		ns	
	T_{DCH}	D/CX hold time	10		ns	
SDA (DIN)	T_{SDS}	Data setup time	10		ns	
	T_{SDH}	Data hold time	10		ns	
DOUT	T_{ACC}	Access time	10	50	ns	For maximum CL=30pF
	T_{OH}	Output disable time	15	50	ns	For minimum CL=8pF

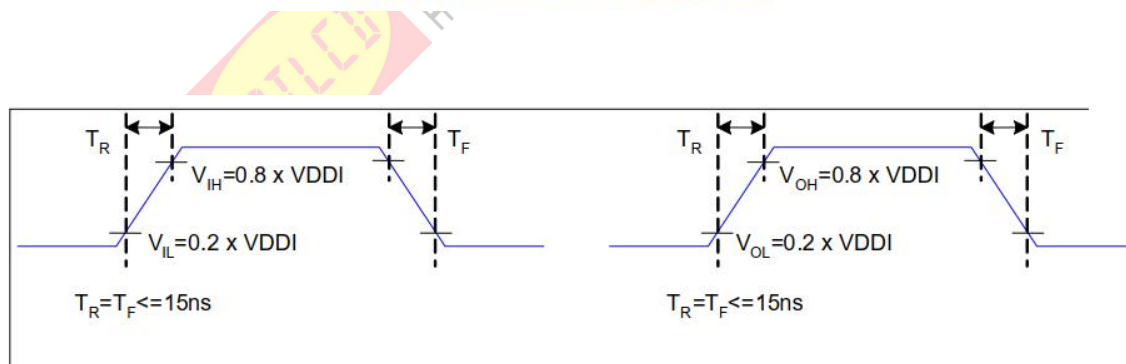
6.2. 并行 MCU 接口 Parallel MCU Interface



Parallel Interface Timing Characteristics (8080-Series MCU Interface)

Signal	Symbol	Parameter	Min	Max	Unit	Description
D/CX	T _{AST}	Address setup time	0		ns	-
	T _{AHT}	Address hold time (Write/Read)	10		ns	
CSX	T _{CHW}	Chip select "H" pulse width	0		ns	-
	T _{CS}	Chip select setup time (Write)	15		ns	
	T _{RCS}	Chip select setup time (Read ID)	45		ns	
	T _{RCSFM}	Chip select setup time (Read FM)	355		ns	
	T _{CSF}	Chip select wait time (Write/Read)	10		ns	
	T _{CSH}	Chip select hold time	10		ns	
WRX	T _{WC}	Write cycle	66		ns	
	T _{WRH}	Control pulse "H" duration	15		ns	
	T _{WRL}	Control pulse "L" duration	15		ns	
RDX (ID)	T _{RC}	Read cycle (ID)	160		ns	When read ID data
	T _{RDH}	Control pulse "H" duration (ID)	90		ns	
	T _{RDL}	Control pulse "L" duration (ID)	45		ns	
RDX (FM)	T _{RCFM}	Read cycle (FM)	450		ns	When read from frame memory
	T _{RDHFM}	Control pulse "H" duration (FM)	90		ns	
	T _{RDLFM}	Control pulse "L" duration (FM)	355		ns	
D[17:0]	T _{DST}	Data setup time	10		ns	For CL=30pF
	T _{DHT}	Data hold time	10		ns	
	T _{RAT}	Read access time (ID)	-	40	ns	
	T _{RATFM}	Read access time (FM)	-	340	ns	
	T _{ODH}	Output disable time	20	80	ns	

8080 Parallel Interface Characteristics



Rising and Falling Timing for I/O Signal

Note: The rising time and falling time (T_R , T_F) of input signal and fall time are specified at 15 ns or less. Logic high and low levels are specified as 20% and 80% of VDDI for Input signals.

6.3. 开机上电&关机下电顺序 Power-on/off sequence

VCI 可以以任何顺序应用。

VCI 可以按任何顺序断电。

断电期间，如果 LCD 处于睡眠模式，则 VCI 必须在释放 RESX 后至少 120 秒断电。

在断电期间，如果 LCD 处于睡眠模式，VCI 可以在释放 RESX 后至少 0 秒断电。

CSX 可以在任何时间应用，也可以永久接地。RESX 优先于 CSX

VCI can be applied in any order.

VCI can be power down in any order.

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

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

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

注 1：如果不符合电源顺序，显示模块不会损坏。

注 2：在电源开/关序列期间，显示面板上不会出现异常的可见效果。

注 3：从开机序列结束到接收睡眠输出之前，显示器上不会出现异常可见效果命令。也在接收睡眠命令和电源关闭序列之间。

注 4：如果主机在以下顺序中定义的通电顺序期间没有保持 RESX 线路稳定，则有必要在主机开机序列完成后应用硬件重置（RESX）以确保正确操作。否则功能不放心。

注 5：将 VDD 和 VDDI 在 FPC 接在一起称为 VCI

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

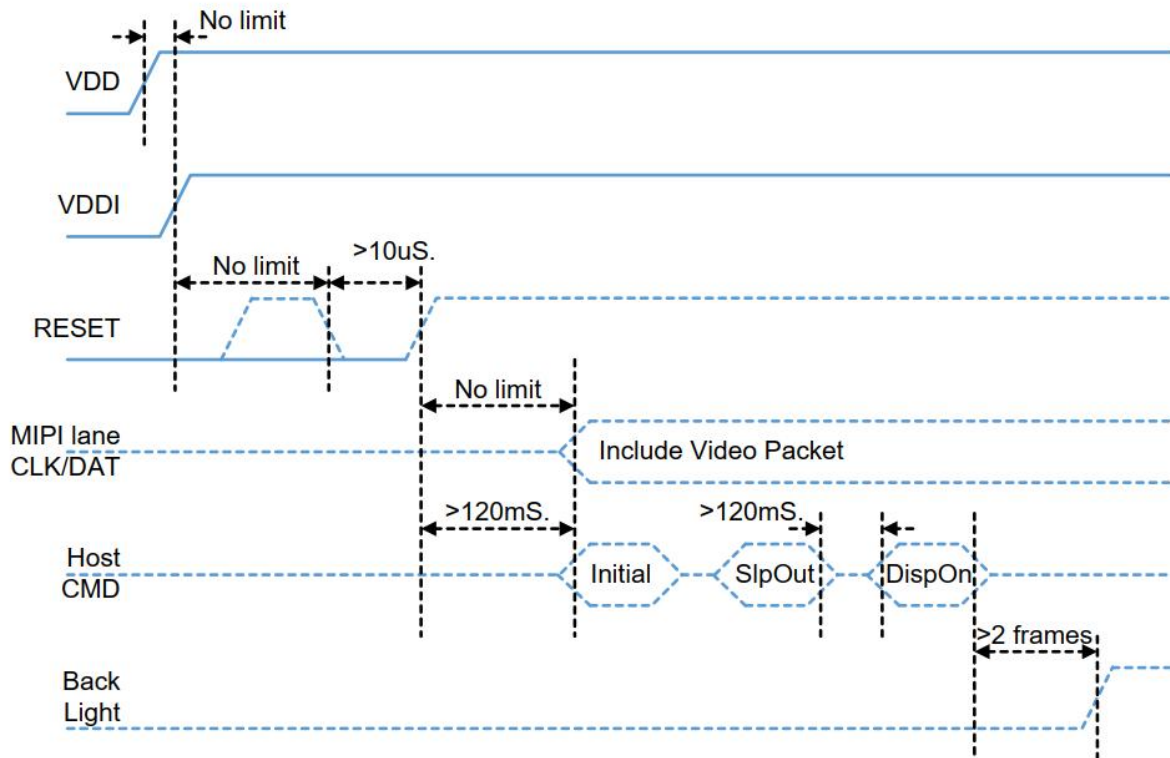
Note 2: There will be no abnormal visible effects on the display panel during the Power On/Off Sequences.

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

Note 4: If RESX line is not held stable by host during Power On Sequence as defined in the sequence below, then it will be necessary to apply a Hardware Reset (RESX) after Host Power On Sequence is complete to ensure correct operation. Otherwise function is not guaranteed.

Note 5: Connecting VDD and VDDI together on FPC is called VCI

The power on/off sequence is illustrated below



6.3.1. 不受控制的断电 Uncontrolled Power OFF

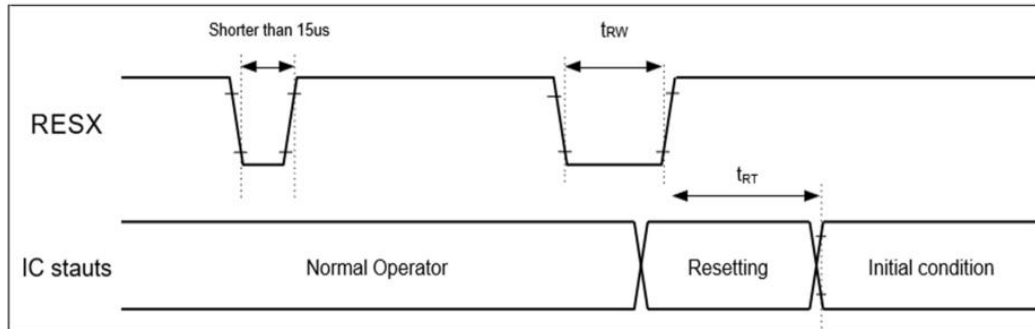
不受控断电是指在没有受控断电顺序的情况下取出电池的情况。它既不会损坏模块，也不会损坏主机接口。

如果发生不受控制的断电，显示器将变为空白，显示器上不会有任何可见的效果（空白显示），并保持空白，直到“通电顺序”通电。

The uncontrolled power-off means a situation which removed a battery without the controlled power off sequence. It will neither damage the module or the host interface.

If uncontrolled power-off happened, the display will go blank and there will not any visible effect on the display (blank display) and remains blank until "Power On Sequence" powers it up.

6.4. 重置输入定时 Reset input timings



Symbol	Parameter	Related pins	Min.	Max.	Unit
t_{RW}	Reset "L" pulse width ⁽²⁾	RESX	20	-	μs
t_{RT}	Reset complete time ⁽³⁾	-	-	5 ⁽⁵⁾	ms
		-	-	120 ⁽⁶⁾ (7) (8)	ms

Note:

1. The reset complete time also required time for loading ID bytes from OTP to registers. This loading is done every time when there is HW reset complete time (t_{RT}) within 5 ms after a rising edge of RESX.
2. Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 15 μs	Reset Rejected
Longer than 20 μs	Reset
Between 15 μs and 20 μs	Reset Start

3. During the resetting period, the display will be blanked (The display is entering blanking sequence, which maximum time is 120 ms, when Reset Starts in Sleep Out -mode. The display remains the blank state in Sleep In -mode) and then returns to Default condition for H/W reset.
4. Spike Rejection also applies during a valid reset pulse as shown below:

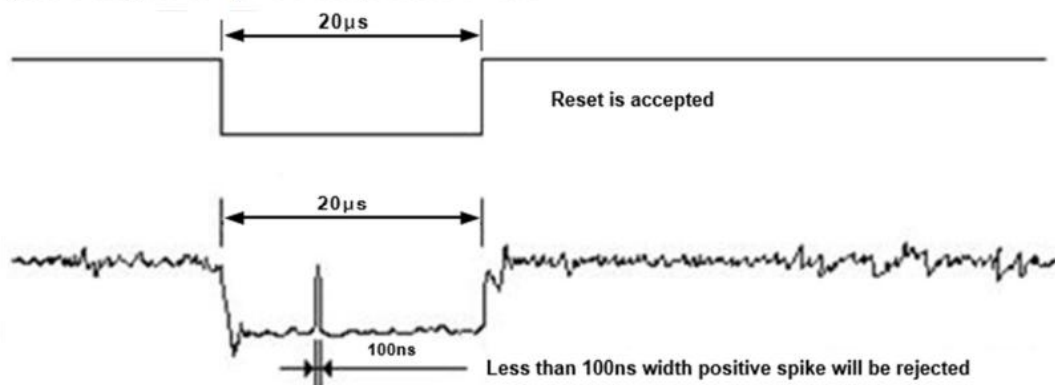


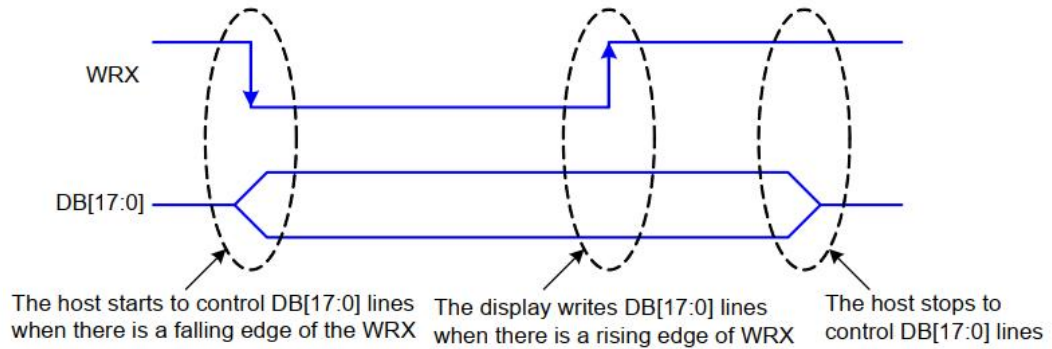
Table 10.4: Reset timings

1. When Reset is applied during Sleep In Mode.
2. When Reset is applied during Sleep Out Mode.
3. is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.
4. After Sleep Out command, it is necessary to wait 120msec then send RESX.

七、接口 Interface

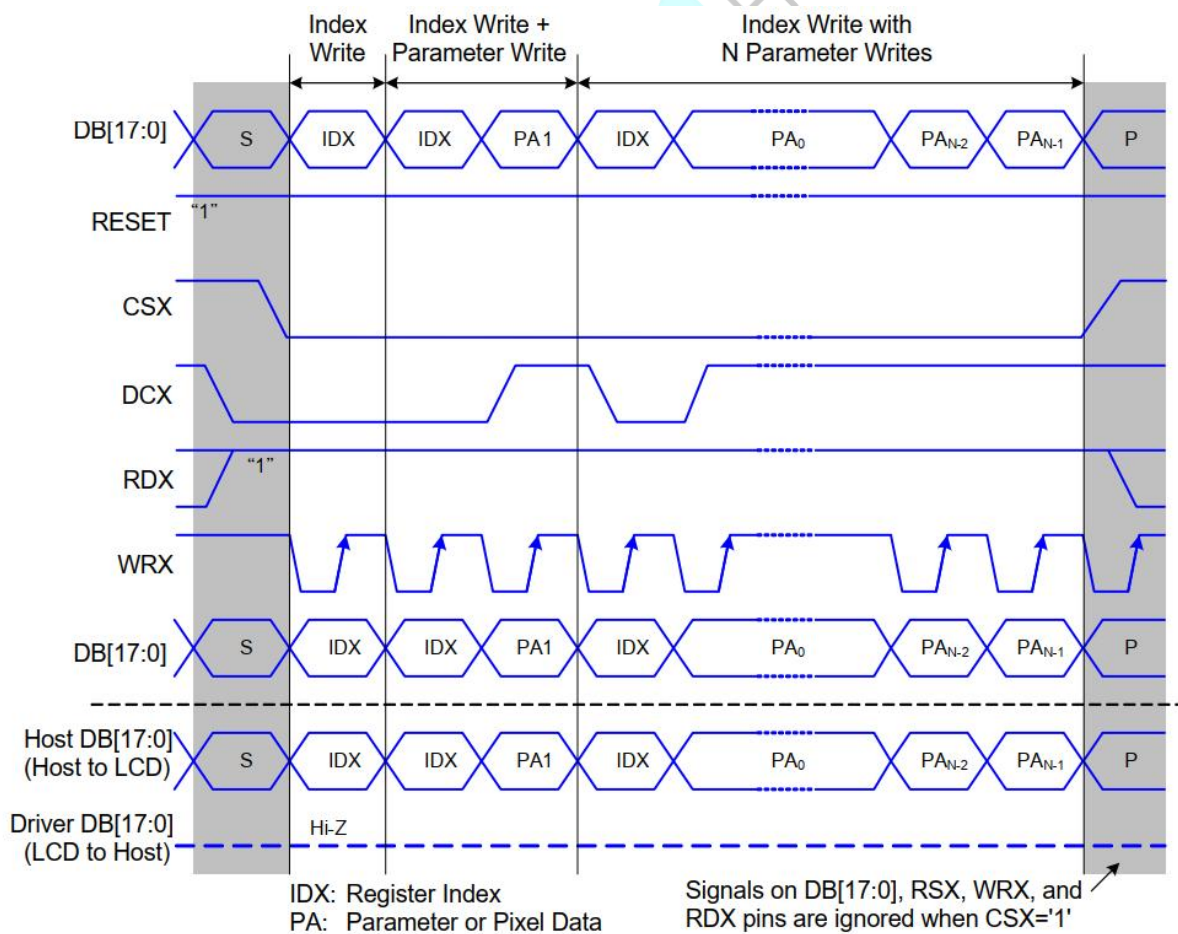
1. 8080 系列 MCU 接口 8080-Series MCU Interface

(1) 8080 系列 MCU 写入周期序列 8080-Series MCU Write Cycle Sequence



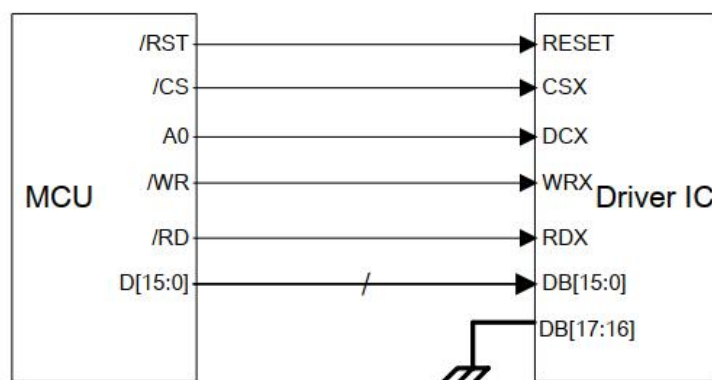
Note: WRX is an synchronized signal (It can be stopped).

8080-Series WRX Protocol



8080-Series Parallel Bus Protocol, Write to Register or Display RAM

(2) 16 位 8080 系列接口写入格式 16-bit 8080-Series Interface Write Format



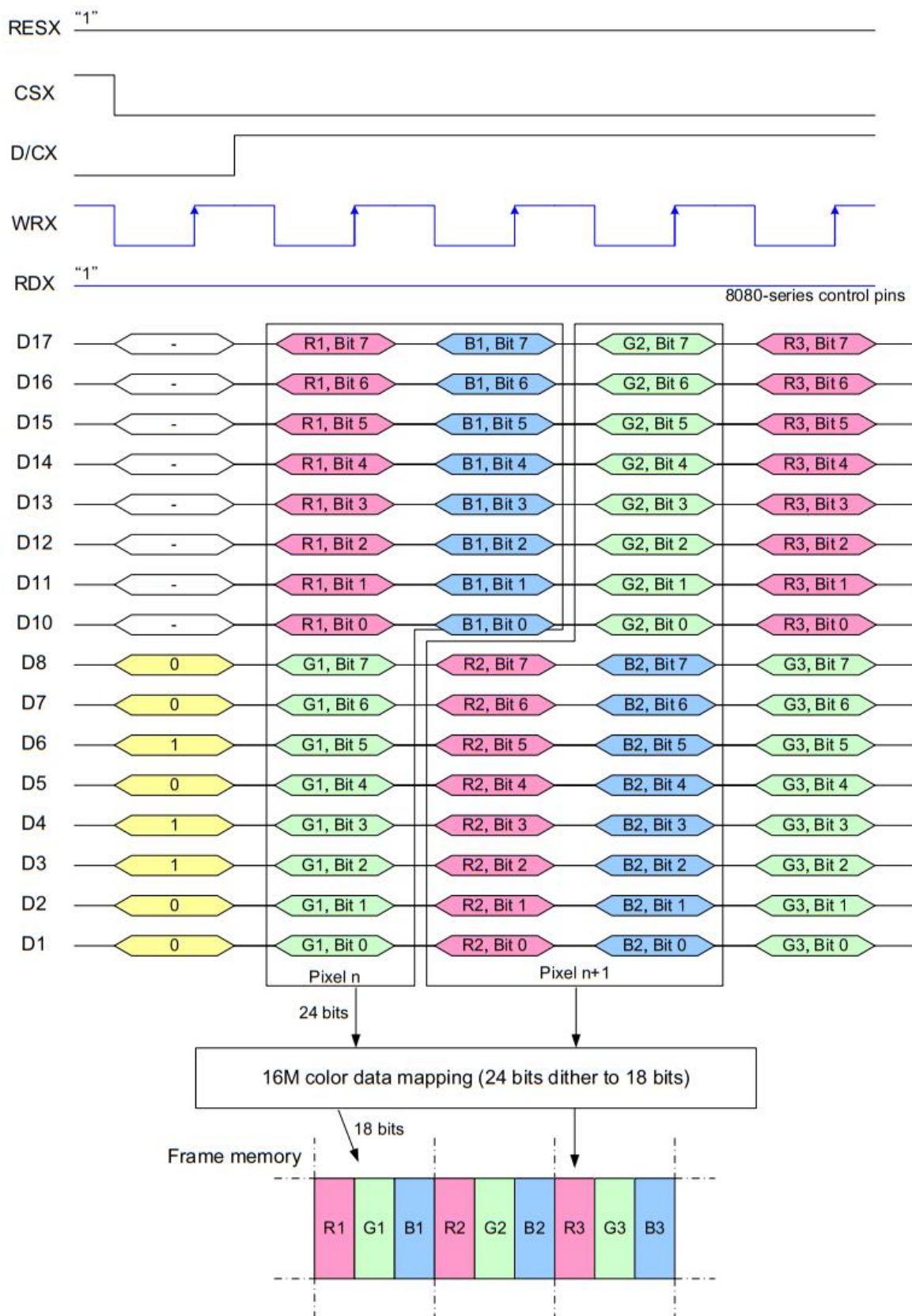
16-bit 8080-Series Interface Connection

当使用 262k 颜色格式时，每个像素需要两次传输。

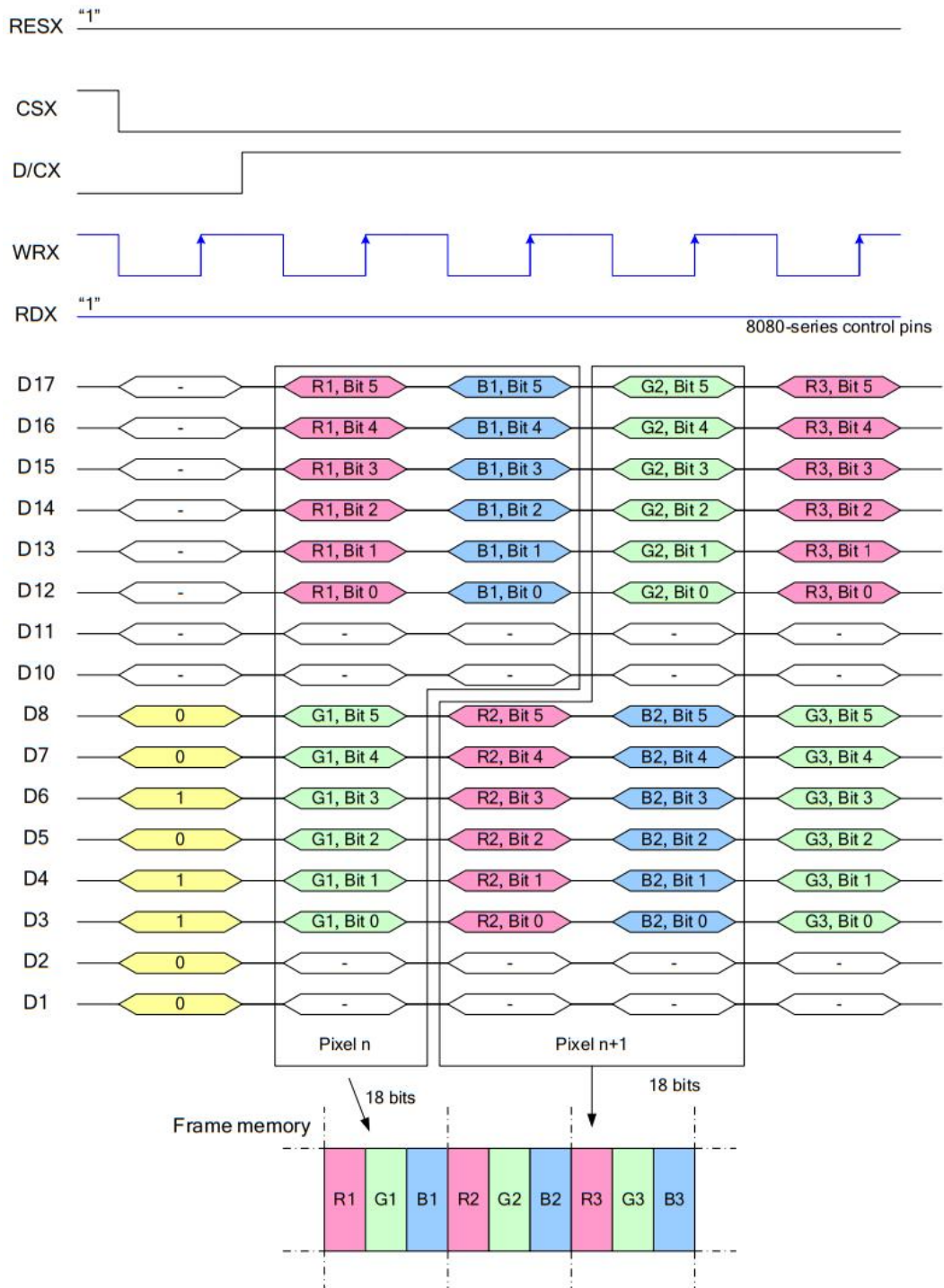
When the 262k-color format is used, two transfers for each pixel are required.

16-bit data bus for 24-bit/pixel (RGB-8-8-8-bit input), 16M-Colors, 3Ah=" 07h")

There are 2 pixels (6 sub-pixels) per 3 bytes



16-bit data bus for 18-bit/pixel (RGB-6-6-6-bit input), 262K-Colors, 3Ah=" 06h")
There are 2 pixels (6 sub-pixels) per 3 bytes

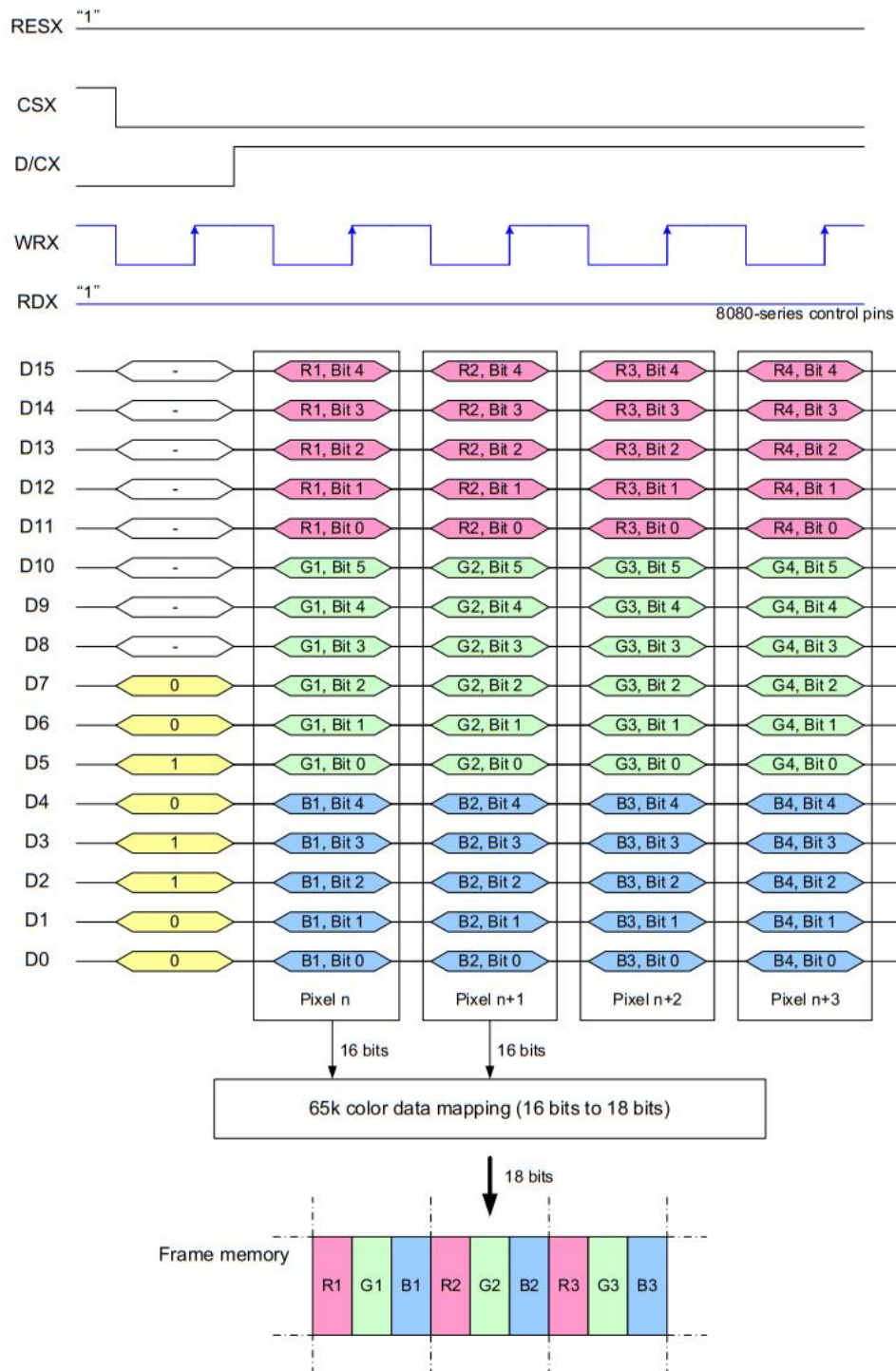


Note 1: The data order is as follows, MSB=D17, LSB=D1 and picture data is MSB=Bits 5, LSB=Bit 0 for Red, Green and Blue data.

Note 2: 3-times transfer is used to transmit 1 pixel data with the 18-bit color depth information.

Note 3: ' - ' = Don't care - Can be set to '0' or '1'

16-bit data bus for 16-bit/pixel (RGB-5-6-5-bit input), 65K-Colors, 3Ah=" 05h")

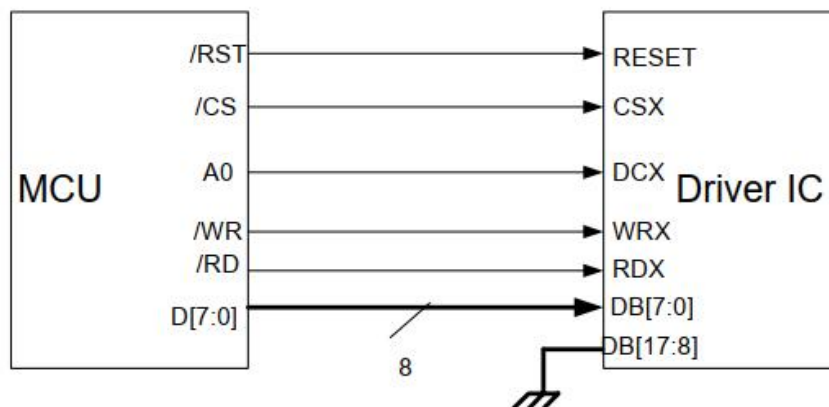


Note 1: The data order is as follows, MSB=D15, LSB=D0 and picture data is MSB=Bit 5, LSB=Bit 0 for Green, and MSB=Bit 4, LSB=Bit 0 for Red and Blue data.

Note 2: 1-times transfer (D15 to D0) is used to transmit 1 pixel data with the 16-bit color depth information.

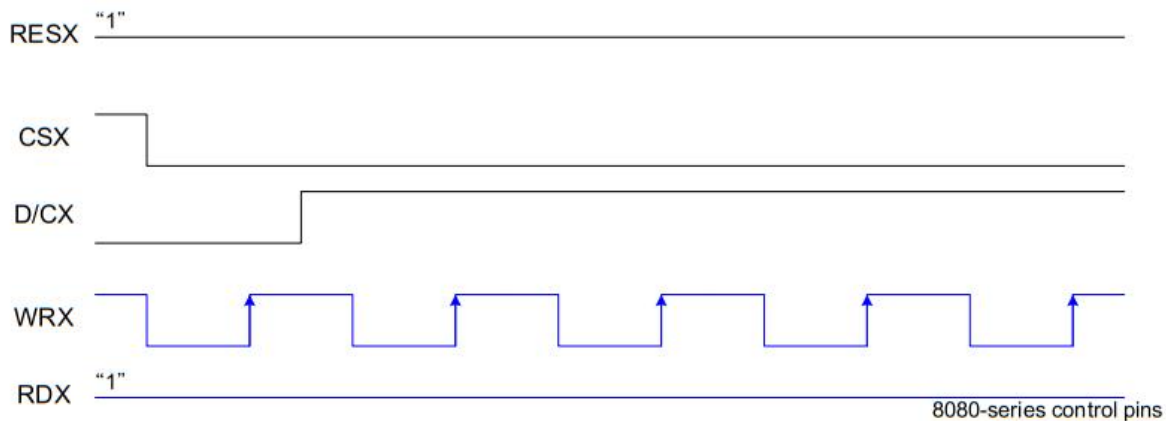
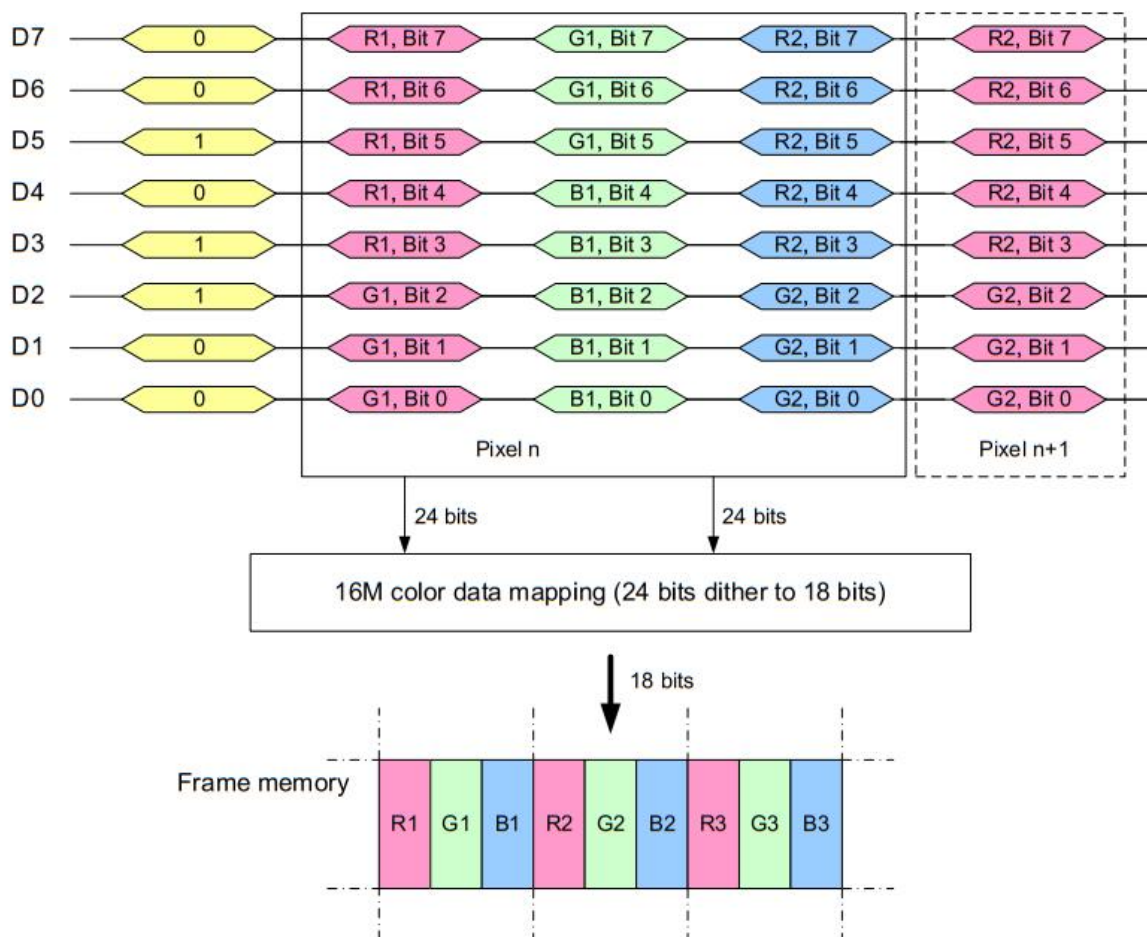
Note 3: '- ' = Don't care - Can be set to '0' or '1'

(3) 8 位 8080 系列接口写入格式 8-bit 8080-Series Interface Write Format

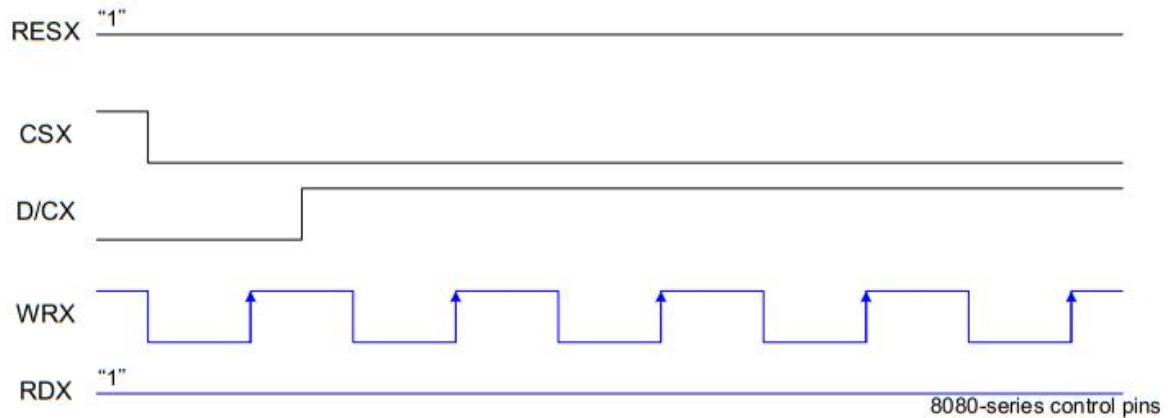
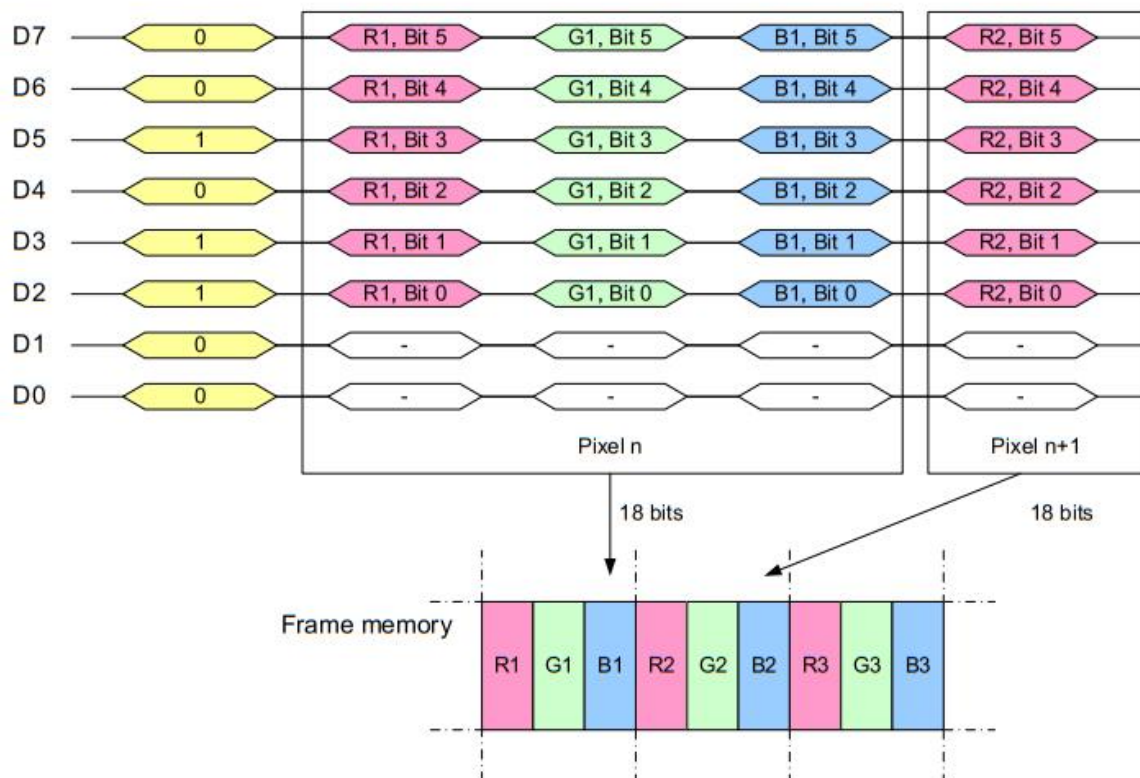


8-bit 8080-Series Interface Connection

8-bit data bus for 24-bit/pixel (RGB-8-8-8-bit input), 16M-Colors, 3Ah=" 07h")

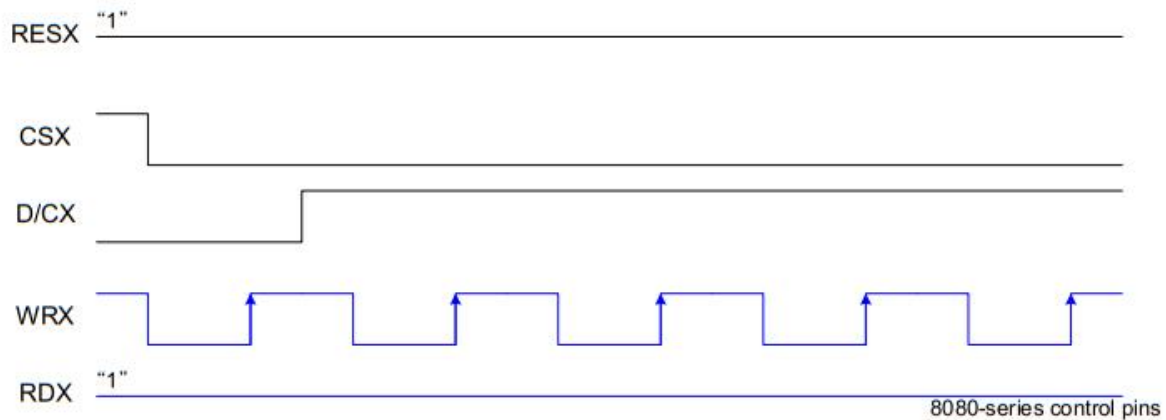
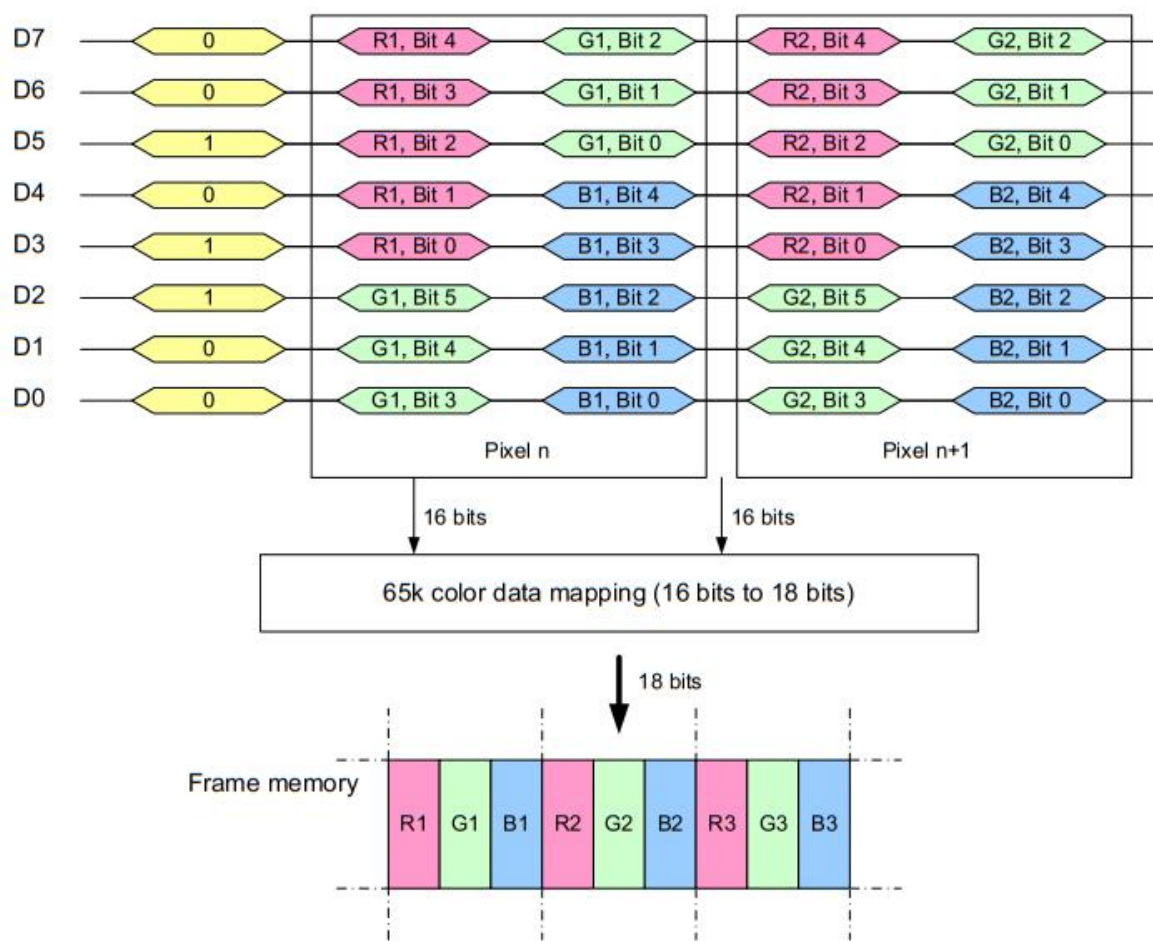


8-bit data bus for 18-bit/pixel (RGB-6-6-6-bit input), 262K-Colors, 3Ah=" 06h")



8-bit 8080-Series Interface Data Format (Index/Parameter/Pixel Data Write)

8-bit data bus for 16-bit/pixel (RGB-5-6-5-bit input), 65K-Colors, 3Ah=" 05h")

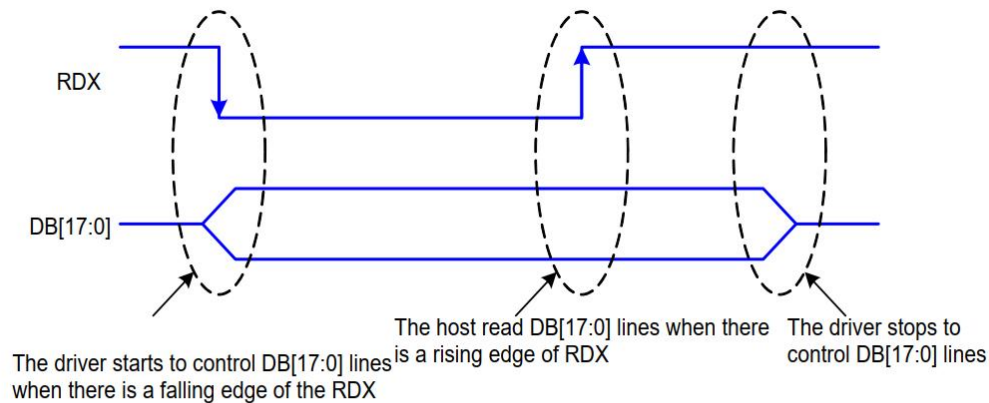


Note 1: The data order is as follows, MSB=D7, LSB=D0 and picture data is MSB=Bit 5, LSB=Bit 0 for Green, and MSB=Bit 4, LSB=Bit 0 for Red and Blue data.

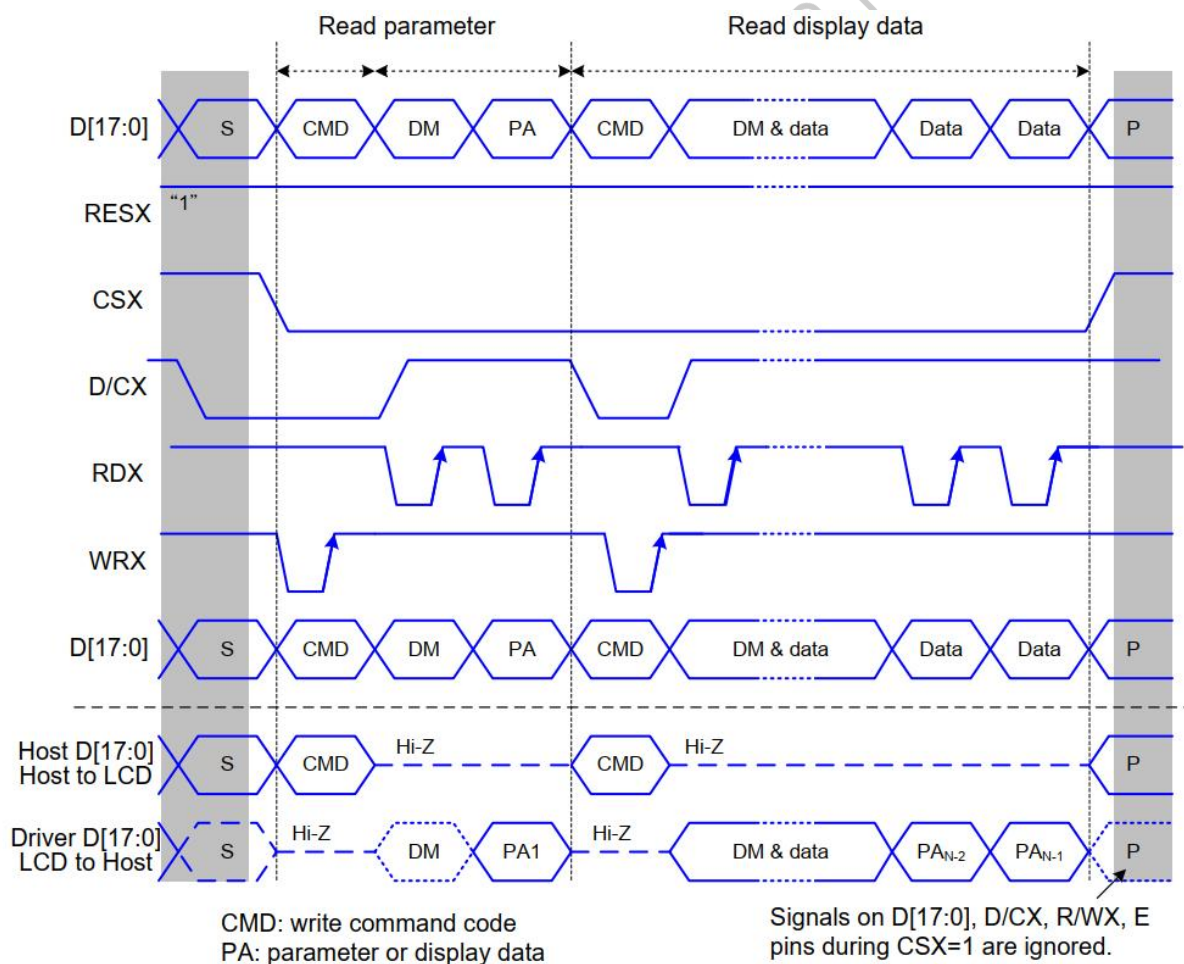
Note 2: 2-times transfer transmit 1 pixel data with the 16-bit color depth information.

Note 3: ' - ' = Don't care - Can be set to '0' or '1'

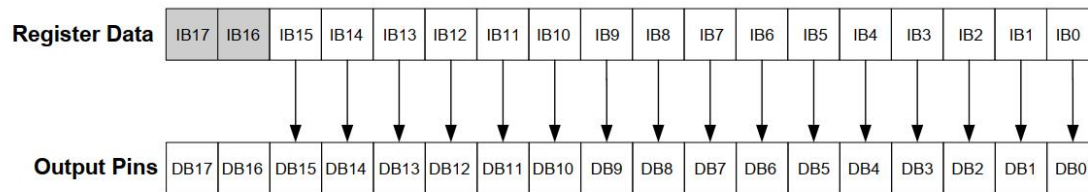
(4) 8080 系列 MCU 读取周期序列 8080-series MCU Read Cycle Sequence



8080-Series RDX Protocol



(5) 16 位 8080 系列接口读取格式 16-bit 8080-Series Interface Read Format



16-bit data bus for 18-bit/pixel, 262K-Colors, 3Ah="06h"

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	BUS width
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Dummy Read
R5	R4	R3	R2	R1	R0	X	X	G5	G4	G3	G2	G1	G0	X	X	3 Transfer 2 Pixel
B5	B4	B3	B2	B1	B0	X	X	R5	R4	R3	R2	R1	R0	X	X	
G5	G4	G3	G2	G1	G0	X	X	B5	B4	B3	B2	B1	B0	X	X	

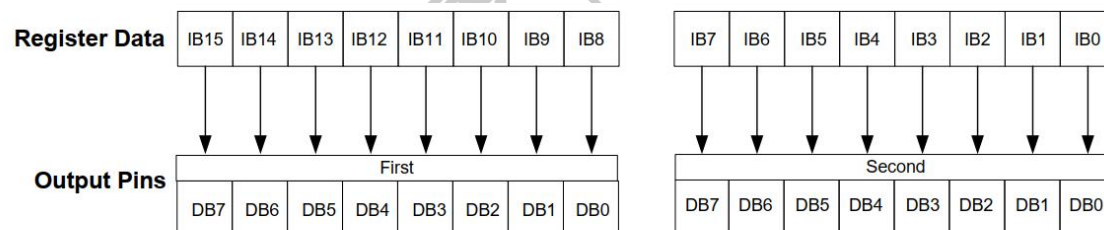
16-bit 8080-Series Interface Data Format 262K (Register/Pixel Data Read)

16-bit data bus for 16-bit/pixel, 65K-Colors, 3Ah="05h"

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	BUS width
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Dummy Read
R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B4	B3	B2	B1	B0	1 Transfer 1 Pixel

16-bit 8080-Series Interface Data Format 65K (Register/Pixel Data Read)

(6) 8 位 8080 系列接口读取格式 8-bit 8080-Series Interface Read Format



8-bit data bus for 18-bit/pixel, 262K-Colors, 3Ah="06h"

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	BUS width
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Dummy Read
X	X	X	X	X	X	X	X	R5	R4	R3	R2	R1	R0	X	X	3 Transfer 1 Pixel
X	X	X	X	X	X	X	X	G5	G4	G3	G2	G1	G0	X	X	
X	X	X	X	X	X	X	X	B5	B4	B3	B2	B1	B0	X	X	

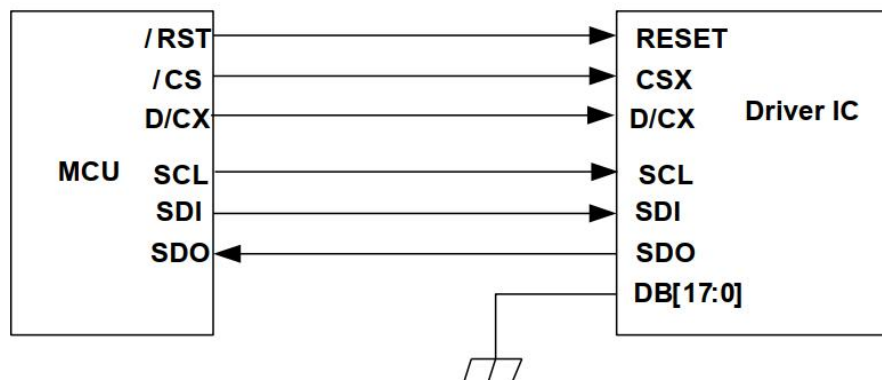
8-bit 8080-Series Interface Data Format (Register/Pixel Data Read)

8-bit data bus for 16-bit/pixel, 65K-Colors, 3Ah="05h"

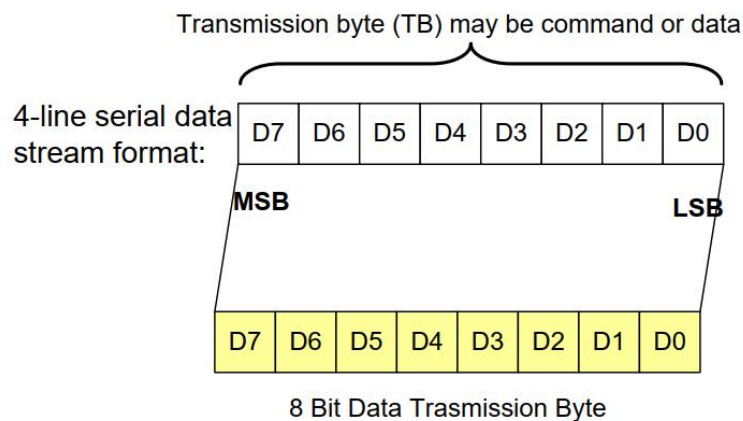
D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0	BUS width
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Dummy Read
X	X	X	X	X	X	X	X	R4	R3	R2	R1	R0	G5	G4	G3	2 Transfer 1 Pixel
X	X	X	X	X	X	X	X	G2	G1	G0	B4	B3	B2	B1	B0	

2. 串行接口 Serial Peripheral Interface (SPI)

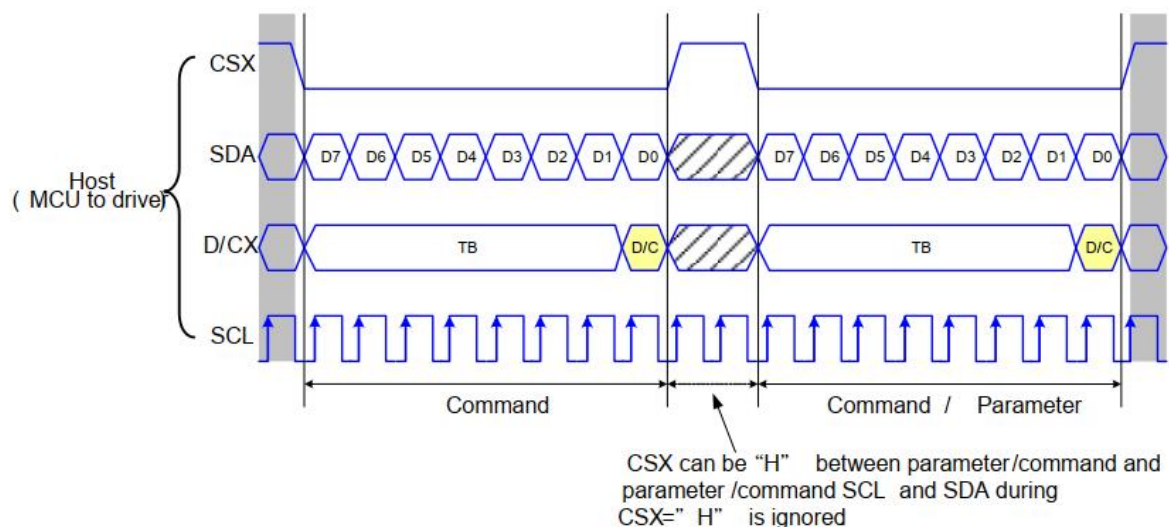
(1) 4 线接口 4-Line Interface



① 写入序列 Write Sequence

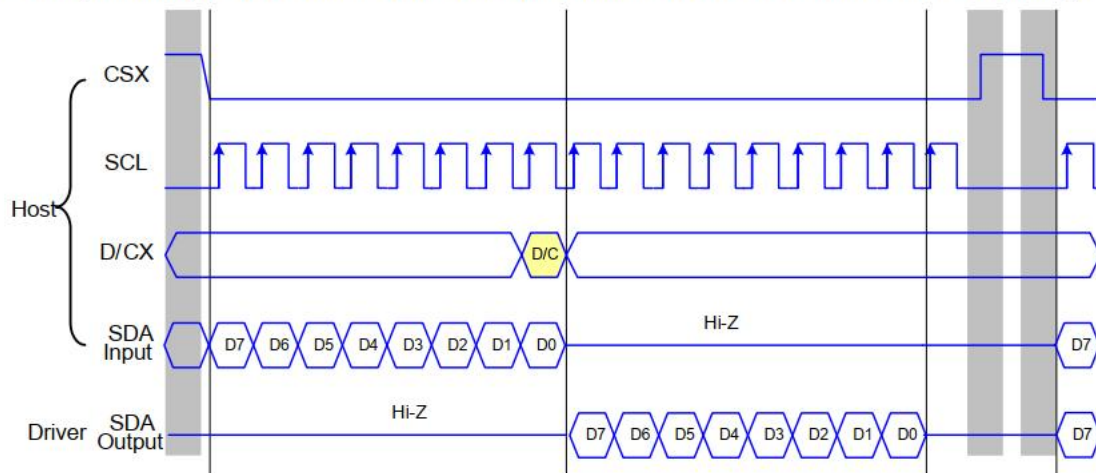


The 4-line serial interface writes sequence described in the Figure as below

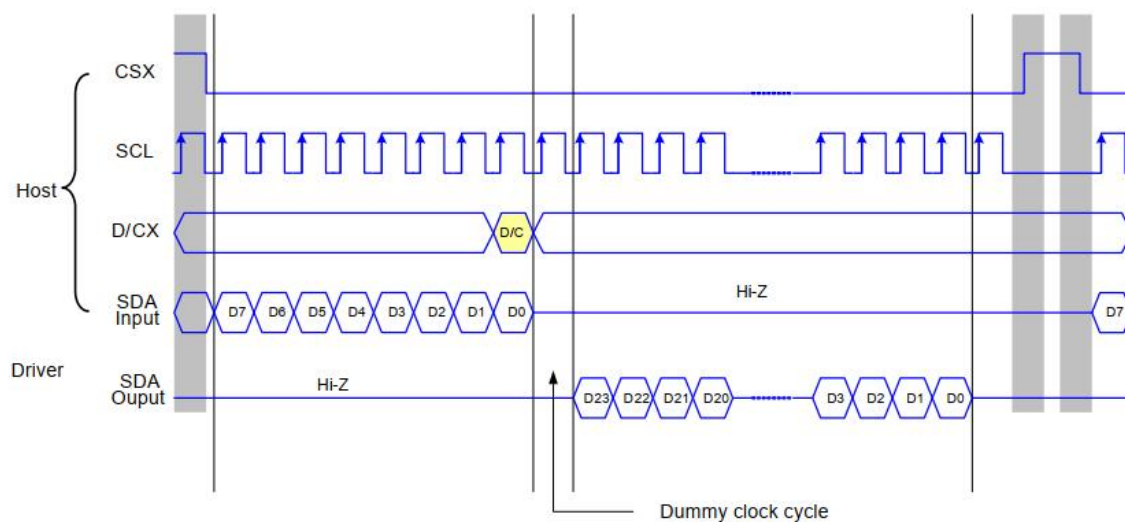


② 读取序列 Read Sequence

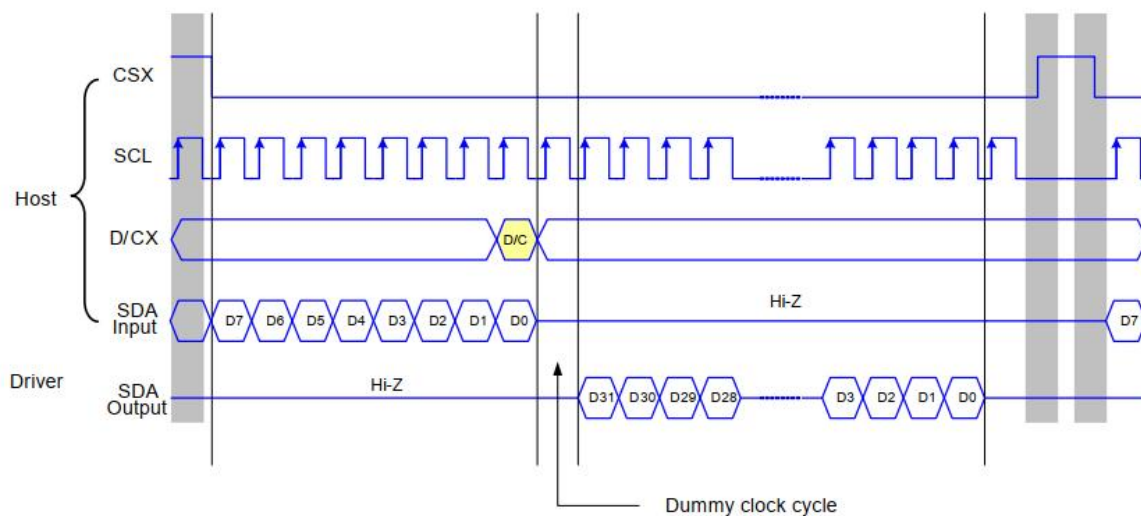
4-line serial protocol (for RDID1/RDID2/RDID3/0Ah/0Bh/0Ch/0Dh/0Eh/0Fh command: 8-bit read):



4-line serial protocol (for RDDID command: 24-bit read)



4-line serial protocol (for RDDST command: 32-bit read)



③ 4-SPI 颜色格式 4-SPI Color format

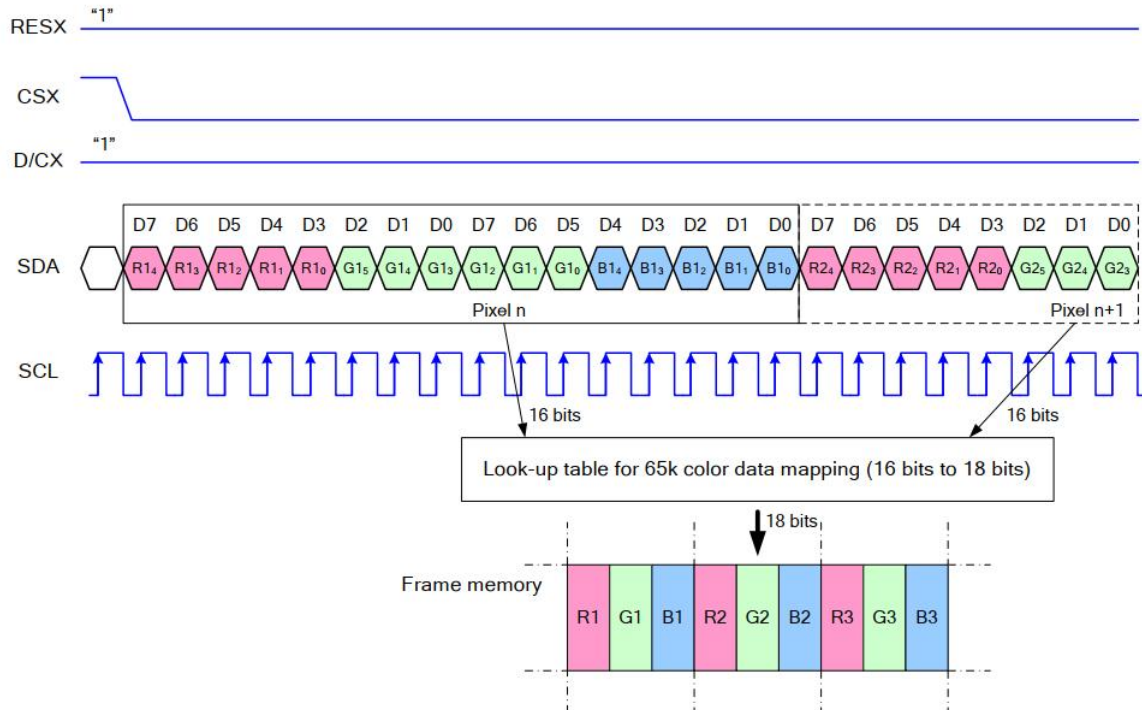
不同的显示数据格式可用于下面列出的 LCM 支持的两种颜色深度。

Different display data formats are available for two colors depth supported by the LCM listed below.

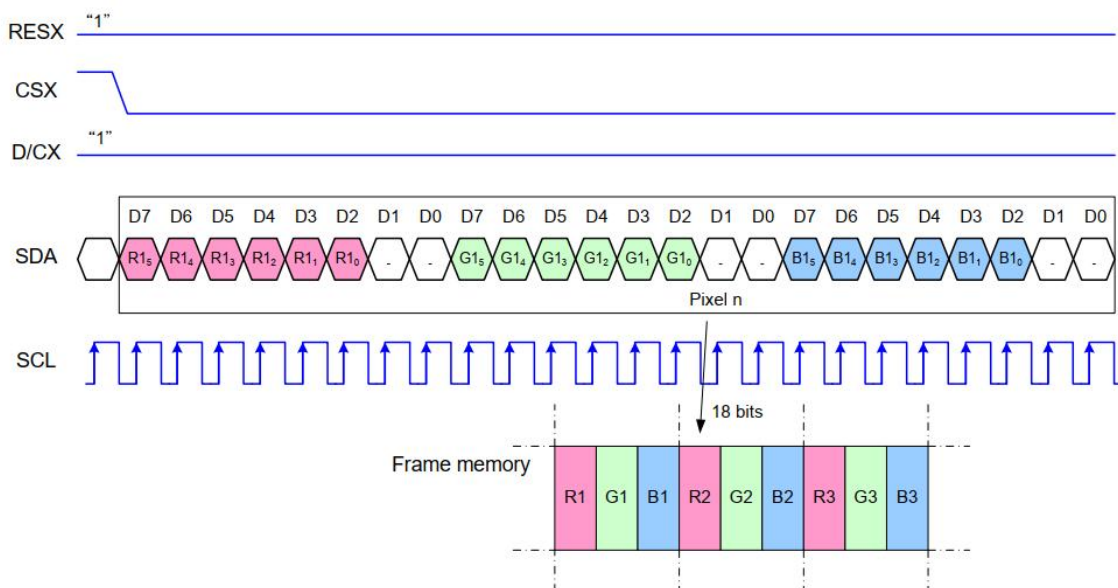
65k colors, RGB 5-6-5-bit input

262k colors, RGB 6-6-6-bit input

Write data for 16-bit/pixel (RGB-5-6-5-bit input), 65K-Colors, 3Ah="05h"



Write data for 18-bit/pixel (RGB-6-6-6-bit input), 262K-Colors, 3Ah="06h"



八、可靠性测试 RELIABILITY TEST

8-1 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=+80 °C, 120hrs	
低温储存 Low Temperature Storage	Ta=-30 °C, 120hrs	
高温运行试验 High Temperature Operation	Ta=+70°C, 120hrs	
低温运行试验 Low Temperature Operation	Ta=-20 °C, 120hrs	
高温高湿（运行测试） High Temperature and High Humidity (Operating)	Ta=+60 °C, 90%RH, 120hrs	

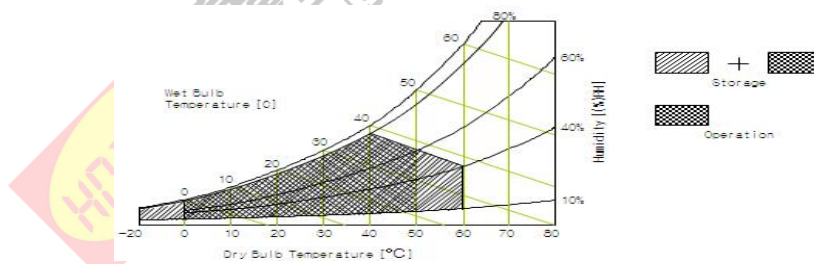
注释 Note:

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°C。并且没有冷凝水。

Temperature and relative humidity range are shown in the figure below. Wet bulb temperature should be 39 °C 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2小时后进行

All display judgments are made after the panel temperature returns to room temperature for 2 hours

5. Ta: 环境温度

Ta: Ambient temperature

8-2 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)	<ul style="list-style-type: none"> ● 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)	<ul style="list-style-type: none"> ● Frequency range:8-33.3HZ ● Stoke:1.0mm ● Sweep: 10Hz-50Hz ● x, y, z 2 hours for each direction

8-3 静电放电测试 Electrostatic Discharge

测试项目 TEST ITEMS	条件 CONDITIONS
ESD (Non-operation)	150pF, 330 Ω , Contact ±4KV, Air : ±8KV. 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

九、处理和注意事项 HANDDLING & CAUTIONS

9-1 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.

◆强烈的光照会导致 LCD 偏光片和彩色滤光片退化。 不准在强光或高温高湿下长期存放或直接运行。

Strong sunlight can cause LCD polarizers and color filters to degrade. Long-term storage or direct operation under strong light or high temperature and humidity is not allowed.

9-2 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.

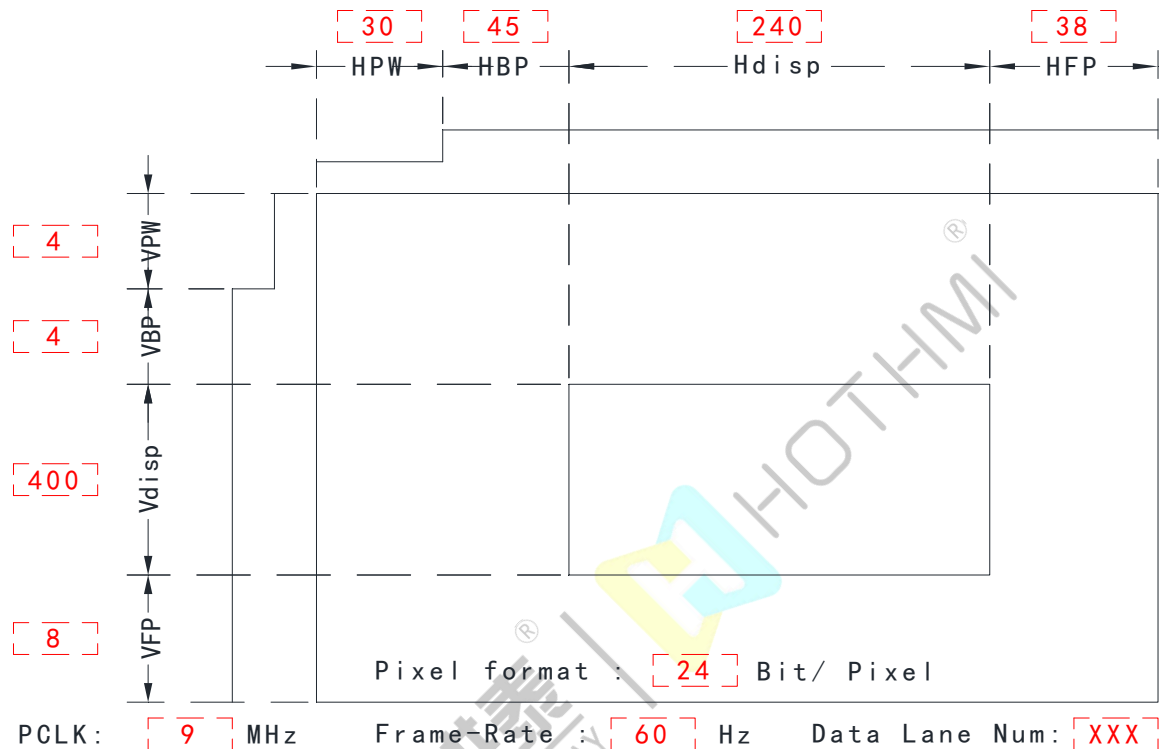
◆在处理 LCM 时，请戴上不带电材料的手套。 对地导电手腕和对地导电鞋是必需的

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

十、初始化代码 Initialization code

说明：这些参数值仅供参考，可能并不完全适用于所有软件平台，
请根据您使用的平台优化参数。

Description : These parameter values are for reference only and
may not be fully applicable to all software platforms, please
optimise the parameters according to the platform you are using.



Void Panel_Initial_code(void)

```
{  
//=====上电操作顺序 Power on operation sequence=====//  
Set_STBYB(0); // GPIO2 SET STBYB low  
Set_POWER(1, 0, 0, 0); // 1.8V ON, 2.8V OFF, 5V OFF, BL OFF  
Delay(150);  
Set_POWER(1, 1, 1, 0); // 1.8V ON, 2.8V ON, 5V ON, BL OFF  
Delay(150);  
Set_RESET(1); // MIPI RESET 1, LCD RESET 1  
Delay(200);  
Set_RESET(0); // MIPI RESET 0, LCD RESET 0  
Delay(100);  
Set_RESET(1); // MIPI RESET 1, LCD RESET 1  
Delay(100);  
//=====初始化代码 initialization code=====//
```

//SPI, MCU 接口初始化代码共用 SPI, MCU interface initialisation code share

//-----Start Initial Code -----//

WriteComm(0x11);

Delay(500); //ms

WriteComm(0xf0);

WriteData(0xc3);

WriteComm(0xf0);

WriteData(0x96);

WriteComm(0x36);

WriteData(0x48);

WriteComm(0x3A);

WriteData(0x55);

WriteComm(0xB0);

WriteData(0x00);

WriteComm(0xB6);

WriteData(0x20);

WriteData(0x02);

WriteData(0x3B);

//WriteComm(0xF0);

//WriteData(0xC3);

//WriteComm(0xF0);

//WriteData(0x96);

WriteComm(0xB4);

WriteData(0x01);

WriteComm(0xb5);

WriteData(0x02); //vfp[7:0]

WriteData(0x02); //vbp[7:0]

WriteData(0x00);

WriteData(0x04); //hbp[7:0]

```
WriteComm(0xB7);  
WriteData(0xC6);  
  
WriteComm(0xC0);  
WriteData(0xF0);  
WriteData(0x35);  
  
WriteComm(0xC1);  
WriteData(0x28); //0x15  
  
WriteComm(0xC2);  
WriteData(0xAF);  
  
WriteComm(0xC5); //VCOM  
WriteData(0x06);  
  
WriteComm(0xE8);  
WriteData(0x40);  
WriteData(0x8A);  
WriteData(0x00);  
WriteData(0x00);  
WriteData(0x29);  
WriteData(0x19);  
WriteData(0xA5);  
WriteData(0x33);  
  
WriteComm(0xE0);  
WriteData(0x70);  
WriteData(0x04);  
WriteData(0x0A);  
WriteData(0x0B);  
WriteData(0x0A);  
WriteData(0x27);  
WriteData(0x31);  
WriteData(0x55);  
WriteData(0x47);  
WriteData(0x29);  
WriteData(0x13);  
WriteData(0x13);
```

WriteData (0x29) ;

WriteData (0x2D) ;

WriteComm (0xE1) ;

WriteData (0x70) ;

WriteData (0x08) ;

WriteData (0x0E) ;

WriteData (0x09) ;

WriteData (0x08) ;

WriteData (0x04) ;

WriteData (0x33) ;

WriteData (0x32) ;

WriteData (0x49) ;

WriteData (0x36) ;

WriteData (0x14) ;

WriteData (0x14) ;

WriteData (0x2A) ;

WriteData (0x2F) ;

WriteComm (0x2a) ;

WriteData (0x00) ;

WriteData (0x28) ;

WriteData (0x01) ;

WriteData (0x17) ;

WriteComm (0x2b) ;

WriteData (0x00) ;

WriteData (0x00) ;

WriteData (0x01) ;

WriteData (0x8f) ;

WriteComm (0x21) ;

WriteComm (0xF0) ;

WriteData (0x3C) ;

WriteComm (0xF0) ;

WriteData (0x69) ;

Delay (600) ;

WriteComm (0x29) ;

Delay (600) ;

Delay (150) ;

Set_STBYB (1) ; // GPIO2 SET STBYB High

Set_POWER (1, 1, 1, 1) ; // 1.8V ON, 2.8V ON, 5V ON, BL ON

Delay (150) ;

}

MIPI 代码格式说明 Code Format Description

SSD_SEND (0x01, 0xCC, 0x15, 0x04, 0x35) ;

参数 1 (Parameter 1) : 0x00 DCS_Short_Write
 0x01 DCS_Long_Write
 0x10 Generic_Short_Write
 0x11 Generic_Long_Write

参数 2 (Parameter 2) : 寄存器地址 (Register Address)

参数 3 ~ N (Parameter 3 ~ N) : 寄存器数据 (Register Data)

DCS_Short_Write_NP (0x11) ;

参数 1 (Parameter 1) : 寄存器地址, 无数据 (Register Address, no data)

文档修订记录

Document revision history :

版本 Version	日期 DATE	修改说明 Modify description	编辑 Editorial
0-0	2026-10-29	初次编制 First compilation.	R. L

— — 结束 — —

— — END — —