

液晶模组说明书

LCD Module Instructions

初定规格 Preliminary specification

正式规格 Official specifications

项目编号 Project No.	TFT-H070A22 Series
产品描述 Product Description	TFT LCD Module 1024 (RGB) x 600 Pixels 7.0 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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HotDisplay Technology Co., Ltd

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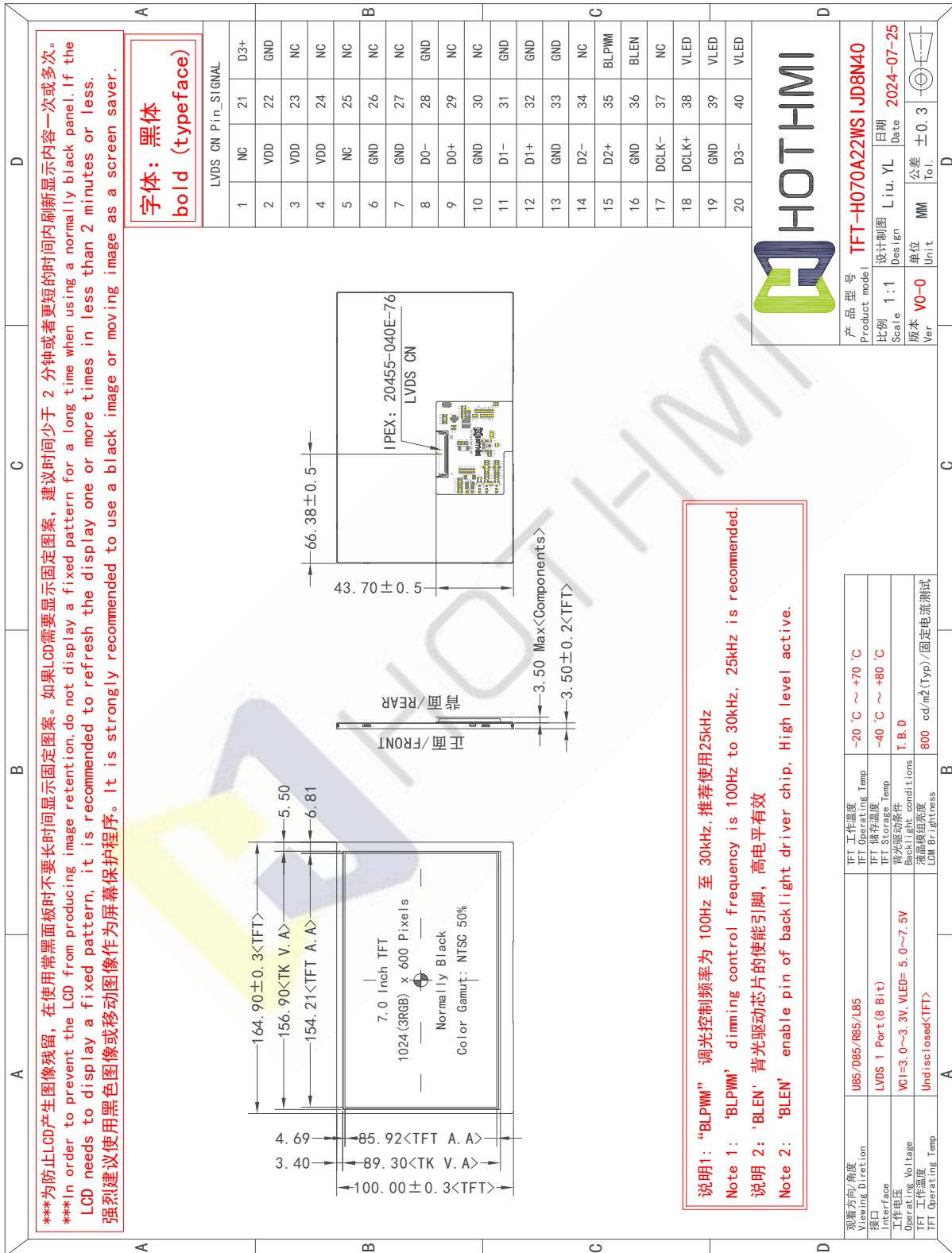
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一、基本特征 General Feature:

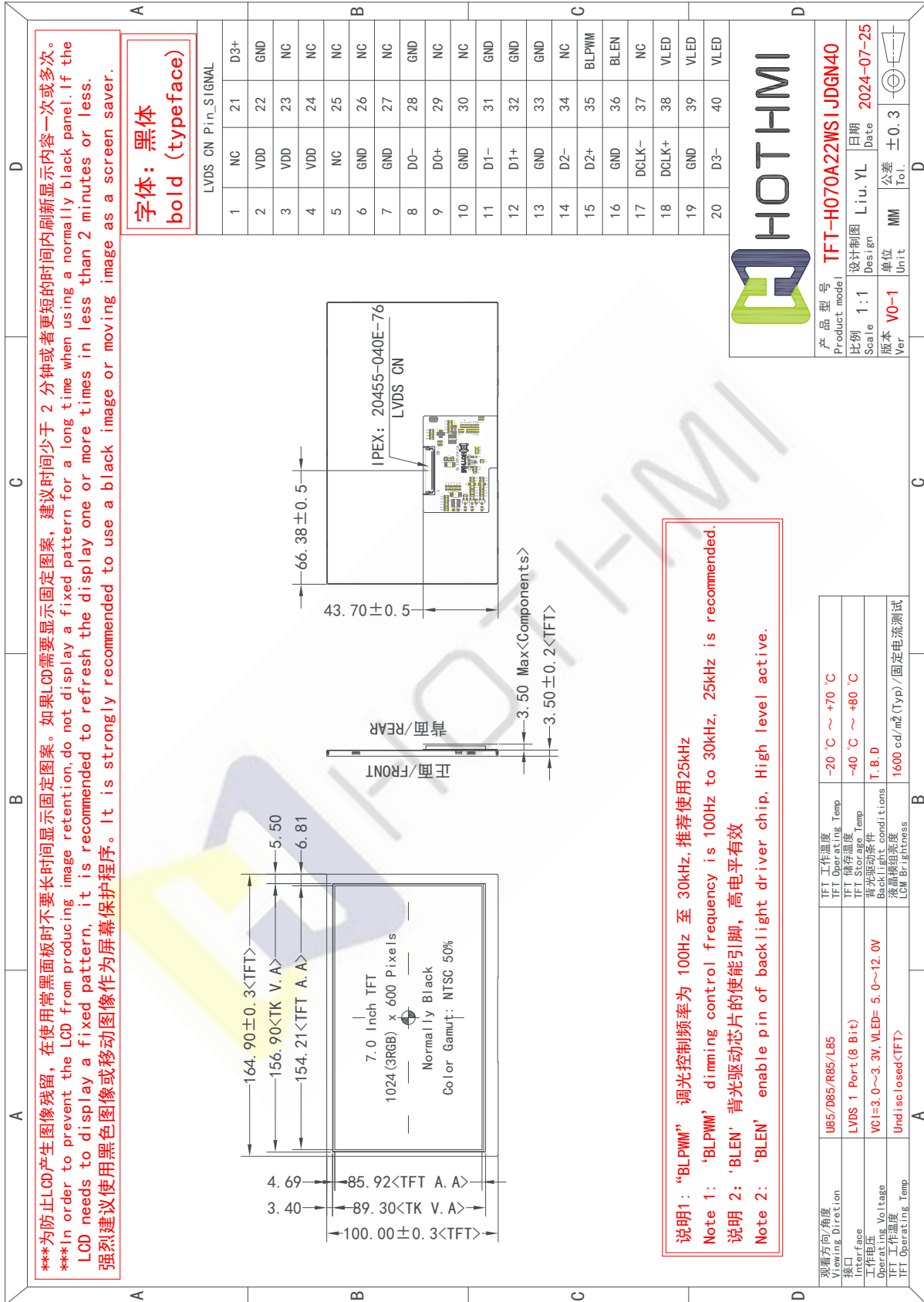
项目 Item	标准值 Standard Value			单位 Unit
TFT 显示尺寸 TFT Display Size	7.0			英寸 Inch
TFT 分辨率 TFT Number of Pixels	1024 (RGB) (H) x 600 (V)			像素 Pixel
TFT 显示有效区域 TFT Display Active Area	154.21 (H) x 85.92 (V)			毫米 mm
TFT 模组外形尺寸 TFT Module Dimensions	164.90 (H) x 100.00 (V) x 3.50 (D) <TFT>			毫米 mm
TFT 观看方向 TFT Viewing Direction	U85/D85/R85/L85			度数 Deg.
TFT 模组接口 TFT Module Interfaces	LVDS 1 Port (8 Bit/VESA) + MIPI-4 Lanes (DSI V1.02)			-
TFT 驱动芯片 TFT Driver IC	Undisclosed			-
电容触摸屏驱动芯片 CTP Driver IC	---			
触摸屏 Touch Panel	<input checked="" type="checkbox"/> 不带触摸屏 Whitout TP	<input type="checkbox"/> 带电阻触摸屏 With RTP	<input checked="" type="checkbox"/> 带电容触摸屏 With CTP	-
TFT 模组重量 TFT Module Weight	不带触摸屏 Without TP	107.20 ±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%		

说明 Description:

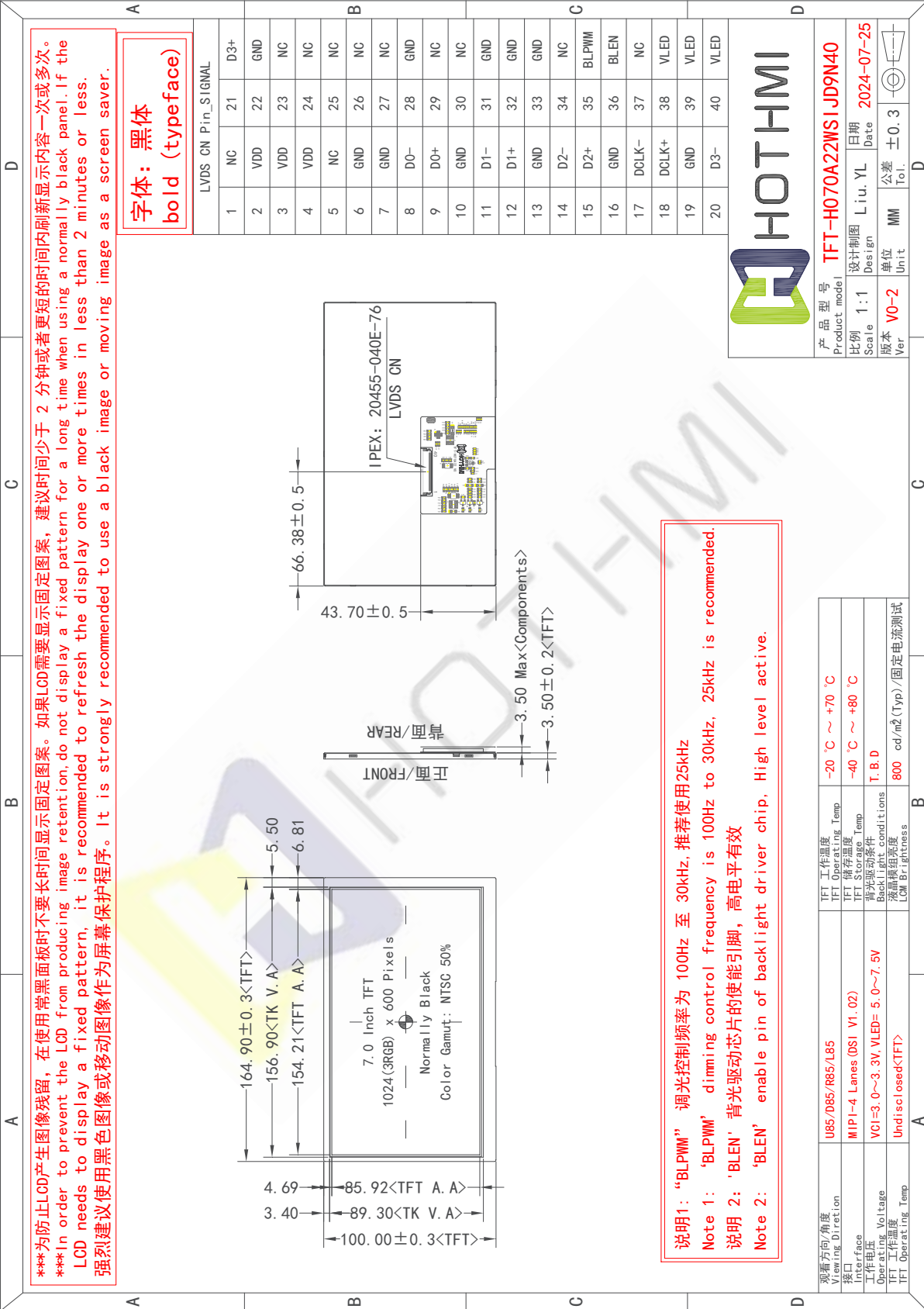
二、外形尺寸 Outline Dimensions



TFT-H070A22WS I JD8N40_V0-0 (LVDS)



TFT-H070A22WS1 JDGN40_V0-1 (LVDS)



TFT-H070A22WS1JD8N40_V0-2 (MIPI)

***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。
 ***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.
 强烈建议使用黑色图像或移动图像作为屏幕保护程序。It is strongly recommended to use a black image or moving image as a screen saver.

字体: 黑体
bold (typeface)

IPEX: 20455-040E-76
LVDS CN

背面/REAR 正面/FRONT

LVDS CN Pin_SIGNAL	
1	NC
2	D3+
3	GND
4	VDD
5	NC
6	NC
7	NC
8	NC
9	NC
10	NC
11	NC
12	NC
13	NC
14	NC
15	NC
16	NC
17	NC
18	NC
19	NC
20	NC
21	D3+
22	GND
23	NC
24	NC
25	NC
26	NC
27	NC
28	GND
29	NC
30	NC
31	GND
32	GND
33	GND
34	NC
35	BLPWM
36	BLN
37	NC
38	VLED
39	VLED
40	VLED

说明 1: "BLPWM" 调光控制频率为 100Hz 至 30kHz, 推荐使用25kHz
 Note 1: "BLPWM" dimming control frequency is 100Hz to 30kHz, 25kHz is recommended.
 说明 2: "BLN" 背光驱动芯片的使能引脚, 高电平有效
 Note 2: "BLN" enable pin of backlight driver chip, High level active.

观看方向/角度 Viewing Direction	U85/D85/R85/L85	工作温度 TFT Operat. Temp	-20 °C ~ +70 °C
接口 Interface	MIPI-4 Lanes (DSI V1.02)	TFT 储存温度 TFT Storage Temp	-40 °C ~ +80 °C
工作电压 Operat. Voltage	V0I=3.0~3.3V, VLED= 5.0~12.0V	背光驱动条件 Backlight Conditions	T.B.D
TFT 工作温度 TFT Operat. Temp	Undisclosed<TFT>	液晶亮度 LCD Brightness	1600 cd/m2(Typ)/固定电流测试

字体: 黑体
bold (typeface)

产品型号 Product model	TFT-H070A22WS1 JDGN40		
比例 Scale	1:1	设计制图 Design	日期 Date
版本 Ver	V0-3	单位 Unit	公差 Tol.
		MM	±0.3

TFT-H070A22WS1 JDGN40_V0-3 (MIPI)

三、引脚说明 Pin Description

3.1 模组引脚说明 TFT Pin Description

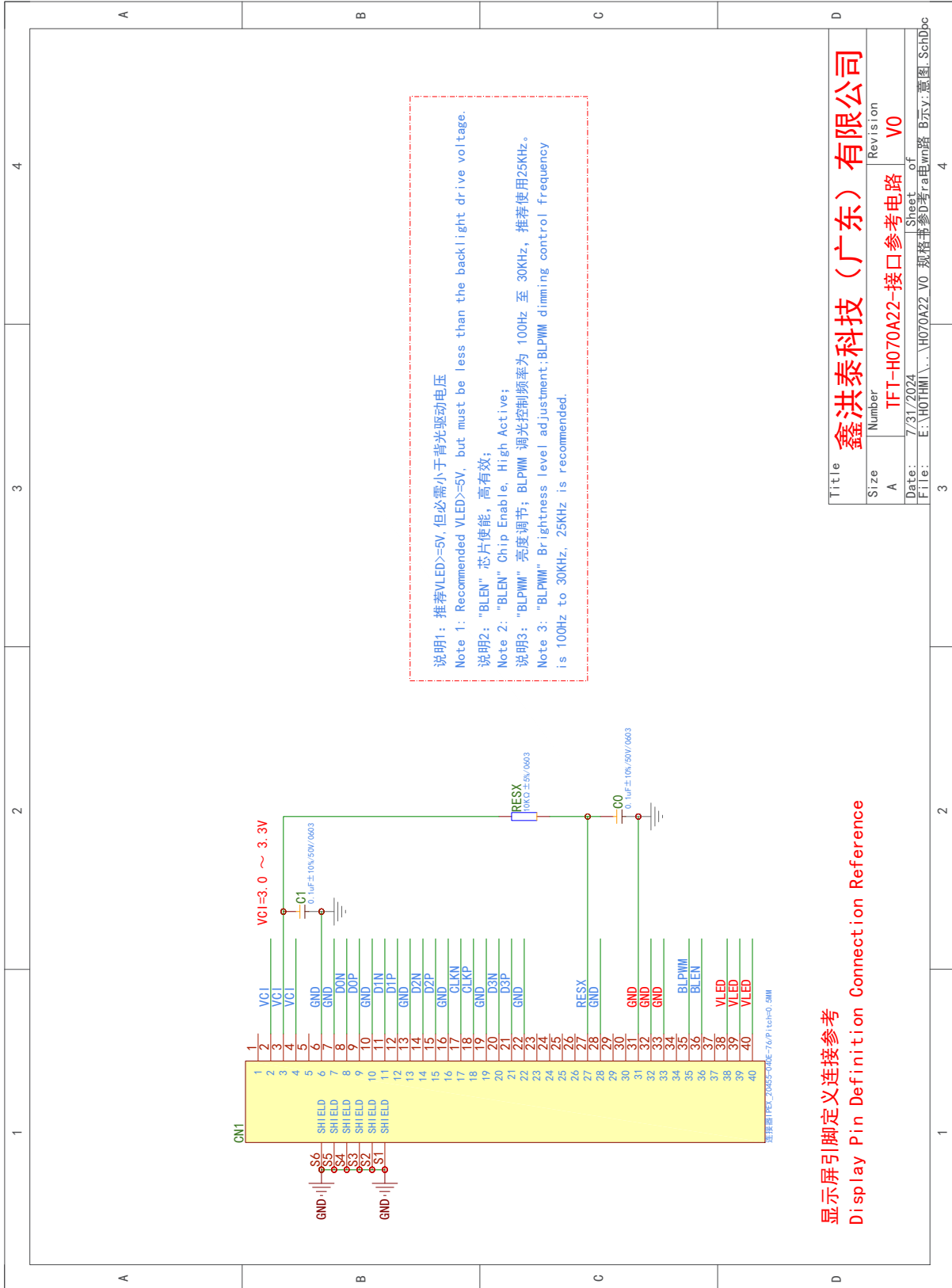
引脚编号 Pin NO.	标号 Symbol	详细描述 Description
1	NC	不连接 Not connected
2~4	VCI	电源 Power supply
5	NC	不连接 Not connected
6~7	GND	电源地 Power supply ground
8	D0N	LVDS 或 MIPI 数据通道 0 负端输入引脚 LVDS or MIPI data Lane 0 negative-end input pin
9	D0P	LVDS 或 MIPI 数据通道 0 正端输入引脚 LVDS or MIPI data Lane 0 positive-end input pin
10	GND	电源地 Power supply ground
11	D1N	LVDS 或 MIPI 数据通道 1 负端输入引脚 LVDS or MIPI data Lane 1 negative-end input pin
12	D1P	LVDS 或 MIPI 数据通道 1 正端输入引脚 LVDS or MIPI data Lane 1 positive-end input pin
13	GND	电源地 Power supply ground
14	D2N	LVDS 或 MIPI 数据通道 2 负端输入引脚 LVDS or MIPI data Lane 2 negative-end input pin
15	D2P	LVDS 或 MIPI 数据通道 2 正端输入引脚 LVDS or MIPI data Lane 2 positive-end input pin
16	GND	电源地 Power supply ground
17	DCKN	LVDS 或 MIPI 时钟线负端输入引脚 MIPI clock Lane negative-end input pin
18	DCKP	LVDS 或 MIPI 时钟线正端输入引脚 LVDS or MIPI clock Lane positive-end input pin
- 下一页 - - Next Page -		

引脚编号 Pin NO.	标号 Symbol	详细描述 Description
19	GND	电源地 Power supply ground
20	D3N	LVDS 或 MIPI 数据通道 3 负端输入引脚 LVDS or MIPI data Lane 3 negative-end input pin
21	D3P	LVDS 或 MIPI 数据通道 3 正端输入引脚 LVDS or MIPI data Lane 3 positive-end input pin
22	GND	电源地 Power supply ground
23~26	NC	不连接 Not connected
27	RESX	复位引脚，低有效。 Reset pin, active low.
28	GND	电源地 Power supply ground
29~30	NC	不连接 Not connected
31~33	GND	电源地 Power supply ground
34	NC	不连接 Not connected
35	BLPWM	背光亮度调节 Backlight Brightness Adjustment
36	BLEN	背光芯片使能，高有效 Backlight Chip Enable, High Active
37	NC	不连接 Not connected
38~40	VLED	背光电源 Backlight Power Supply
- 结束 - - END -		

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



Title		鑫洪泰科技 (广东) 有限公司	
Size	Number	Revision	
A	TFT-H070A22-接口参考电路	V0	
Date:	7/31/2024	Sheet	of
File:	E:\HOTHMI\...\H070A22_V0_规格书\参数\电路原理图	B:示V:	版图 SchDoc

显示屏引脚定义连接参考
Display Pin Definition Connection Reference

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	-	3.0	-	3.3	伏特 V
接口工作电压 IO Supply Voltage	IOVCC	-	-	-	-	伏特 V
待机电流 Standby Current	I _{sc}	No Load@ FR=60Hz	-	-	-	微安 uA
工作电流 Operation Current	I _{oc}		-	-	-	毫安 mA
TFT 工作温度 TFT Operating Temp	TOPR	-	-20	25	+70	摄氏度 ℃
TFT 储存温度 TFT Storage Temp	TSTG	-	-40	-	+80	摄氏度 ℃

4-2 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
透光率 Transmittance	-	-	80	-	-	百分比 %
数字电源 Digital Power	VDD	-	2.8	3.30	3.60	伏特 V
I/O 电源 I/O Power	IOVDD	-	2.8	3.30	3.60	伏特 V
工作温度 Operation Temperature	-	20%-90%RH;	-20	-	+70	摄氏度 ℃
储存温度 Storage Temperature	-		-30	-	+80	摄氏度 ℃

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

Backlighting 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	-	5.0	-	8.0	伏特 V
工作电流 Forward current	IF		600	-	-	毫安 mA
亮度 (带 LCD) Luminance (With LCD)	Lv	不带触摸 Without TP	-	800	-	坎德拉/平方米 cd/m ²
		带触摸 With TP	-	650	-	
LED 寿命 LED life time	Hr	Ta=25±3 °C	20,000	30,000	-	小时 Hour

Backlighting 2:

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	-	5.0	12.0	15.0	伏特 V
工作电流 Forward current	IF		1300	500	300	毫安 mA
亮度 (带 LCD) Luminance (With LCD)	Lv	不带触摸 Without TP	-	1600	-	坎德拉/平方米 cd/m ²
		带触摸 With TP	-	1400	-	
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%.

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 2°C）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 2°C) 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	GR>10	80	85	-	Deg.	Note 1
		⊙右/R		80	85	-	Deg.	
	垂直 Vertical	⊙上/U		80	85	-	Deg.	
		⊙下/D		80	85	-	Deg.	
对比度 Contrast ratio		CR	⊙ = 0°	-	1000	-	-	Note2
色域 Color Gamut		CG	CIE1931	-	50	-	%	
白色色度 White Chromaticity		Wx	⊙ = 0°	-0.03	0.305	+0.03	-	Note4 (Based on C Light)
		Wy			0.346		-	
色彩还原 Reproduction of color	红 Red	Rx			0.300		-	
		Ry			0.336		-	
	绿 Green	Gx			0.298		-	
		Gy			0.558		-	
	蓝 Blue	Bx			0.142		-	
		By			0.170		-	
响应时间（上升 + 下降） Response Time (Rising + Falling)		Tr+Tf	⊙ = 0° Ta= 25°C	-	30	40	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

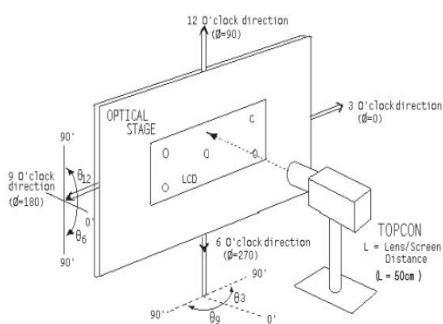


图 1

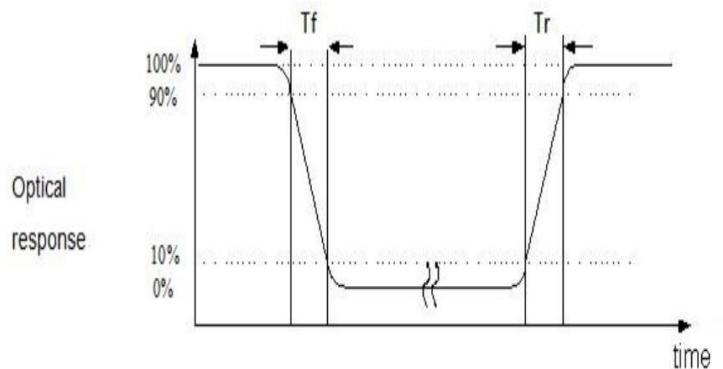


图 2

六、交流特性 AC characteristic

6.1. MIPI 直流特性 MIPI DC characteristic

Parameter	Symbol	Min.	Typ.	Max.	Unit
MIPI Characteristics for High Speed Receiver					
Single-ended input low voltage	V_{ILHS}	-40	-	-	mV
Single-ended input high voltage	V_{IHHS}	-	-	460	mV
Common-mode voltage	V_{CMRXDC}	70	-	330	mV
Differential input impedance	Z_{ID}	80	100	120	ohm
HS transmit differential voltage($V_{OD}=V_{DP}-V_{DN}$)	$ V_{OD} $	100	200	250	mV
MIPI Characteristics for Low Power Mode					
Pad signal voltage range	V_i	-50	-	1350	mV
Ground shift	V_{GNDSH}	-50	-	50	mV
Logic 0 input threshold	V_{IL}	0	-	550	mV
Logic 1 input threshold	V_{IH}	1000	-	1350	mV
Input hysteresis	V_{HYST}	25	-	-	mV
Output low level	V_{OL}	-50	-	50	mV
Output high level	V_{OH}	1.1	1.2	1.3	V
Output impedance of Low Power Transmitter	Z_{OLP}	110			ohm
Logic 0 contention threshold	$V_{ILCD,MAX}$	-	-	200	mV
Logic 1 contention threshold	$V_{IHCD,MIN}$	450	-	-	mV
MIPI Digital Operating Current	$I_{VDDMIPI}$	-	15	20	mA
MIPI Digital Stand-by Current	I_{STMPI}	-	-	250	uA

Note: MIPI Digital Operating and Stand-by Current is at RT 25°C condition.

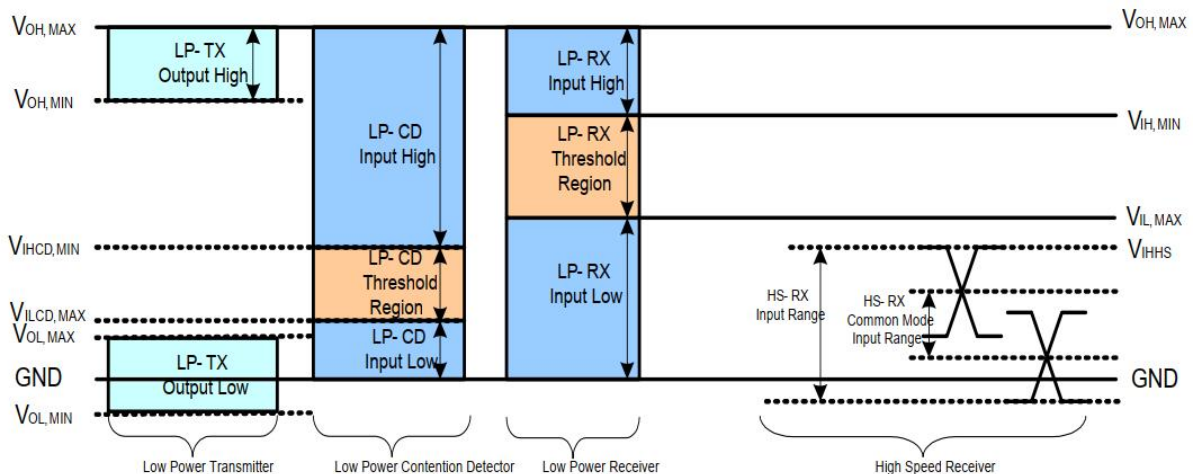


Figure: MIPI signaling and contention voltage levels

6.2. MIPI 交流特性 MIPI AC characteristic

1. MIPI 低功耗发射机交流规格 MIPI Low Power Transmitter AC Specification

Parameter	Symbol	Min	Typ	Max	Units	Notes
15%~85% rising time and falling time	T_{RLP} / T_{FLP}	-	-	25	ns	-
30%~85% rising time and falling time	T_{REOT}	-	-	35	ns	-
Pulse width of LP exclusive-OR clock	First LP EXOR clock pulse after STOP state or Last pulse before stop state	100	-	-	ns	-
	All other pulses	100	-	-	ns	-
Period of the LP EXOR clock(LP Speed)	$T_{LP-PER-TX}$	200	-	-	ns	-
Slew Rate @CLOAD =0pF	$\delta V / \delta t_{SR}$	20	-	500	mV/ns	-
Slew Rate @CLOAD =5pF		20	-	200	mV/ns	-
Slew Rate @CLOAD =20pF		20	-	150	mV/ns	-
Slew Rate @CLOAD =70pF		20	-	100	mV/ns	-
Load Capacitance	T_{RLP}	-	-	70	pF	-

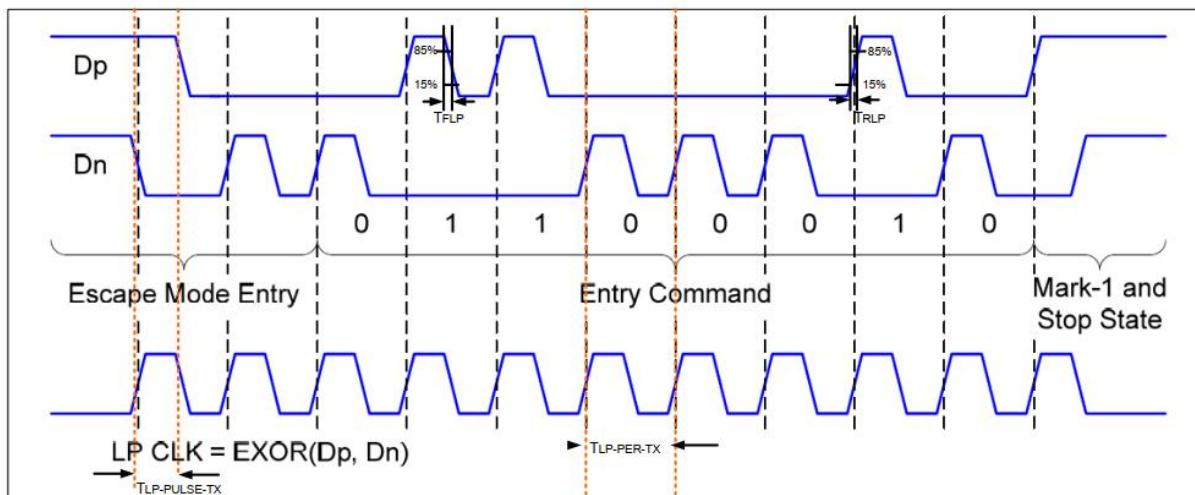


Figure : MIPI LP AC timing

2. MIPI 低功耗周转流程

MIPI Low Power Turnaround Procedure

Turnaround Procedure Operation Timing Parameters

Parameter	Symbol	Min	Typ	Max	Units
Length of any Low-Power state period	T_{LPX}	100	-	-	ns
Time-out before new TX side start driving	$T_{TA-Sure}$	T_{LPX}	-	$2T_{LPX}$	ns
Time to drive LP-00 by new TX	T_{TA-GET}	-	$5T_{LPX}$	-	ns
Time to drive LP-00 after Turnaround Request	T_{TA-GO}	-	$4T_{LPX}$	-	ns

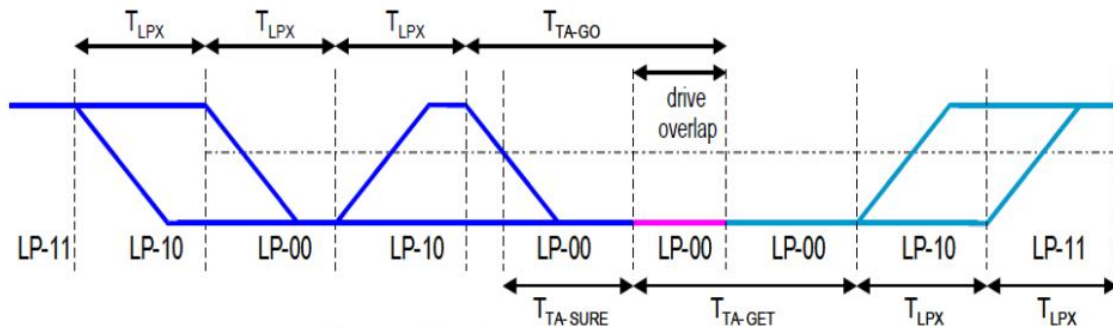


Figure : Turnaround Procedure

3. MIPI 高速交流特性

MIPI High Speed AC characteristics

Parameter	Descript	Spec.			Unit
		Min.	Typ.	Max.	
T_{REOT}	30%-85% rise time and fall time	-	-	35	ns
$T_{CLK-MISS}$	Timeout for receiver to detect absence of Clock transitions and disable the Clock Lane HS-RX.	-	-	60	ns
$T_{CLK-POST}^*1$	Time that the transmitter continues to send HS clock after the last associated Data Lane has transitioned to LP Mode. Interval is defined as the period from the end of $T_{HS-TRAIL}$ to the beginning of $T_{CLK-TRAIL}$.	$60\text{ ns} + 52 \cdot UI$	-		ns
$T_{CLK-PRE}$	Time that the HS clock shall be driven by the transmitter prior to any associated Data Lane beginning the transition from LP to HS mode.	8	-		UI
$T_{CLK-SETTLE}$	Time interval during which the HS receiver shall ignore any Clock Lane HS transitions, starting from the beginning of $T_{CLK-PRE}$.	95	-	300	ns
$T_{CLK-TERM-EN}$	Time for the Clock Lane receiver to enable the HS line termination, starting from the time point when D_n crosses $V_{IL,MAX}$.		-	38	ns
$T_{HS-SETTLE}$	Time interval during which the HS receiver shall ignore any Data Lane HS transitions, starting from the beginning of $T_{HSPREPRE}$.	$85\text{ ns} + 6 \cdot UI$	-	$145\text{ ns} + 10 \cdot UI$	ns
T_{EOT}	Time from start of $T_{HS-TRAIL}$ or $T_{CLK-TRAIL}$ period to start of LP-11 state	-	-	$105\text{ ns} + n \cdot 12 \cdot UI$	-
$T_{HS-EXI}^{(1)}$	time to drive LP-11 after HS burst	100	-	-	ns

$T_{HS-PREPARE}$	Time to drive LP-00 to prepare for HS transmission	$40ns + 4*UI$	-	$85ns+6*UI$	ns
$T_{HS-PREPARE} + T_{HS-ZERO}$	$T_{HS-PREPARE}$ + Time to drive HS-0 before the Sync sequence	$145ns + 10*UI$	-	-	ns
$T_{HS-SKIP}$	Time-out at RX to ignore transition period of EoT	40	-	$55ns+4*UI$	ns
$T_{HS-TRAIL}$	Time to drive flipped differential state after last payload data bit of a HS transmission burst	$60 + 4*UI$	-	-	ns
T_{LPX}	Length of any Low-Power state period	100	-	-	ns
Ratio T_{LPX}	Ratio of $T_{LPX(MASTER)}/T_{LPX(SLAVE)}$ between Master and Slave side	2/3	-	3/2	-
T_{TA-GET}	Time to drive LP-00 by new TX	$5*T_{LPX}$			ns
T_{TA-GO}	Time to drive LP-00 after Turnaround Request	$4*T_{LPX}$			ns
$T_{TA-SURE}$	Time-out before new TX side starts driving	T_{LPX}	-	$2*T_{LPX}$	ns

Note: (1) For $T_{CLK-POST}$ example:

$T_{CLK-POST}$ min value =164UI when MIPI max frequency per lane = 0.5Gbps.

$T_{CLK-POST}$ min value =112UI when MIPI max frequency per lane = 1Gbps

(2) For T_{EOT} :

When $n = 1$ for Forward-direction HS mode and $n=4$ for Reverse-direction HS mode.

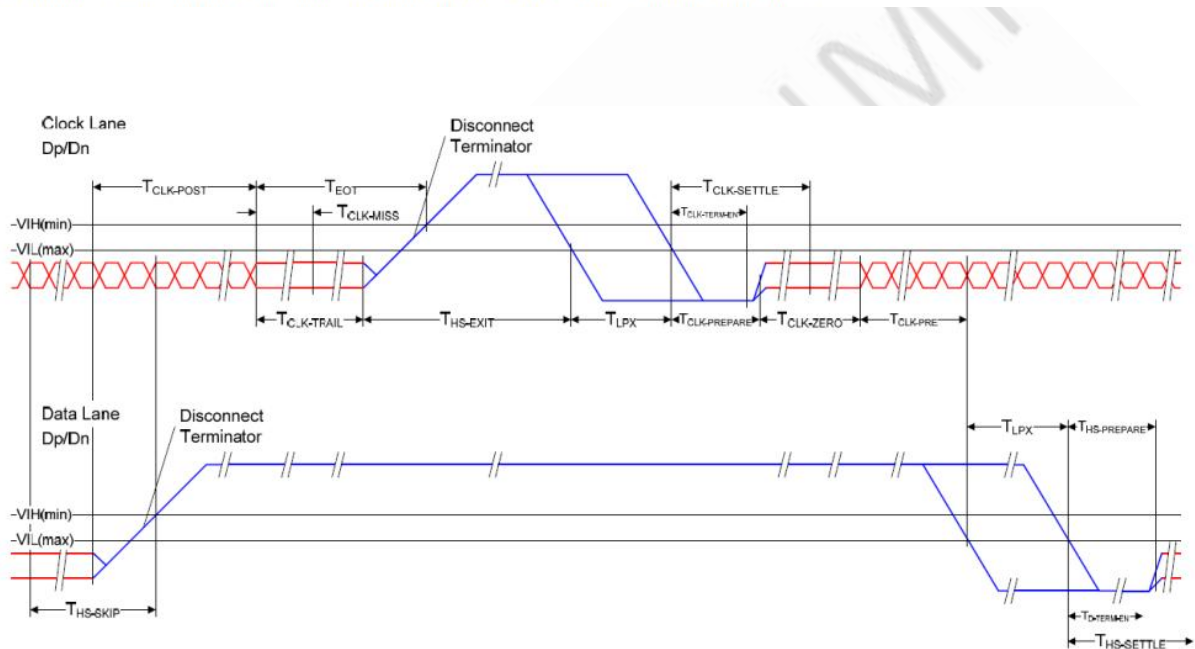


Figure : Switching the clock lane between clock transmission and low-power mode

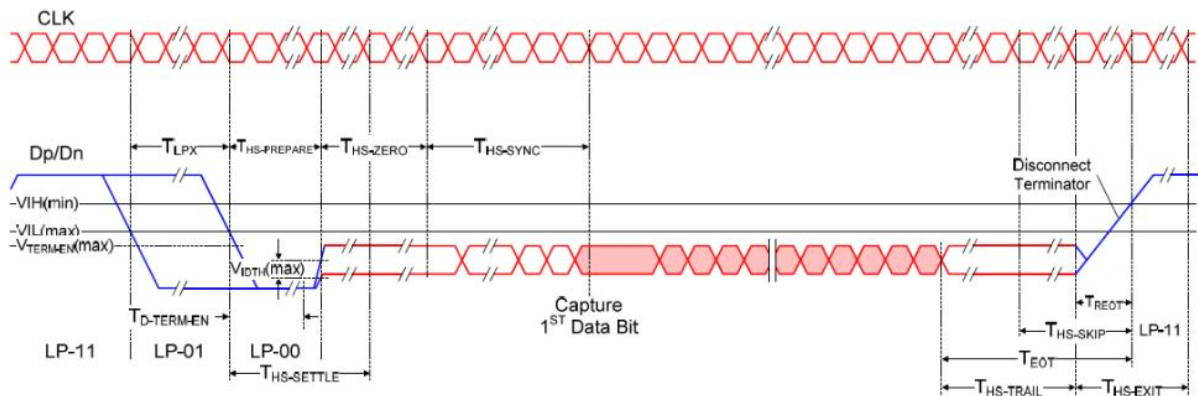


Figure : Timing of high-speed data transmission in bursts

4. MIPI 数据时钟时序规范 MIPI data-clock timing specification

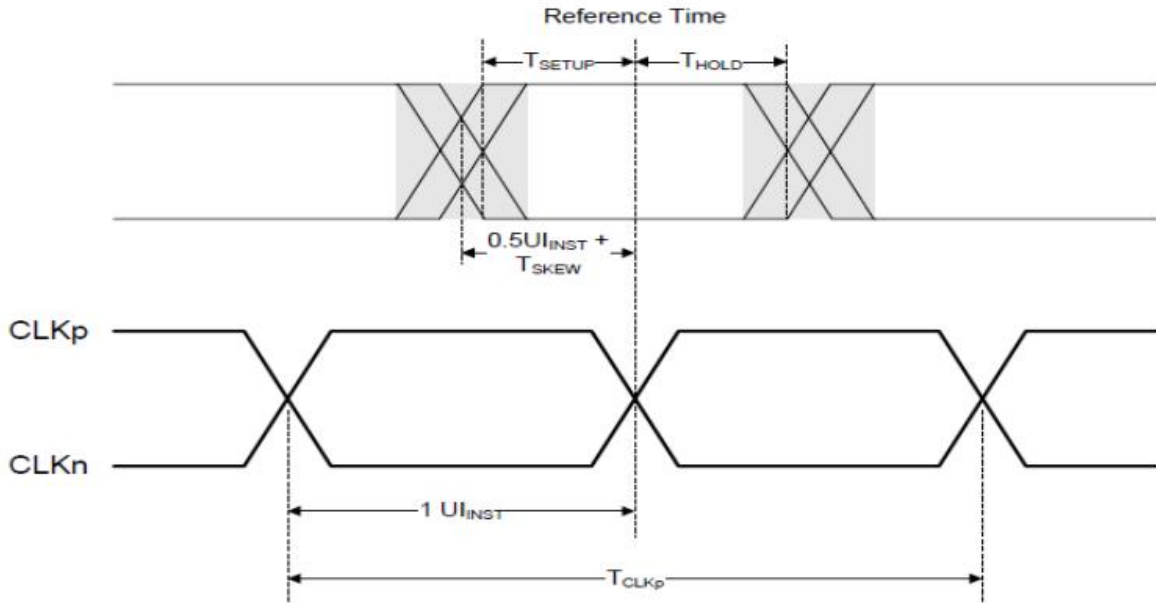


Figure : Data to clock timing

Parameter	Symbol	Min	Typ	Max	Units
Data to clock setup time	$T_{SETUP[RX]}$	0.15 ⁽¹⁾	-	-	UI_{INST}
Data to clock hold time	$T_{HOLD[RX]}$	0.15 ⁽¹⁾	-	-	UI_{INST}

Note: (1) Total setup and hold window for receiver of $0.3 * UI_{INST}$.

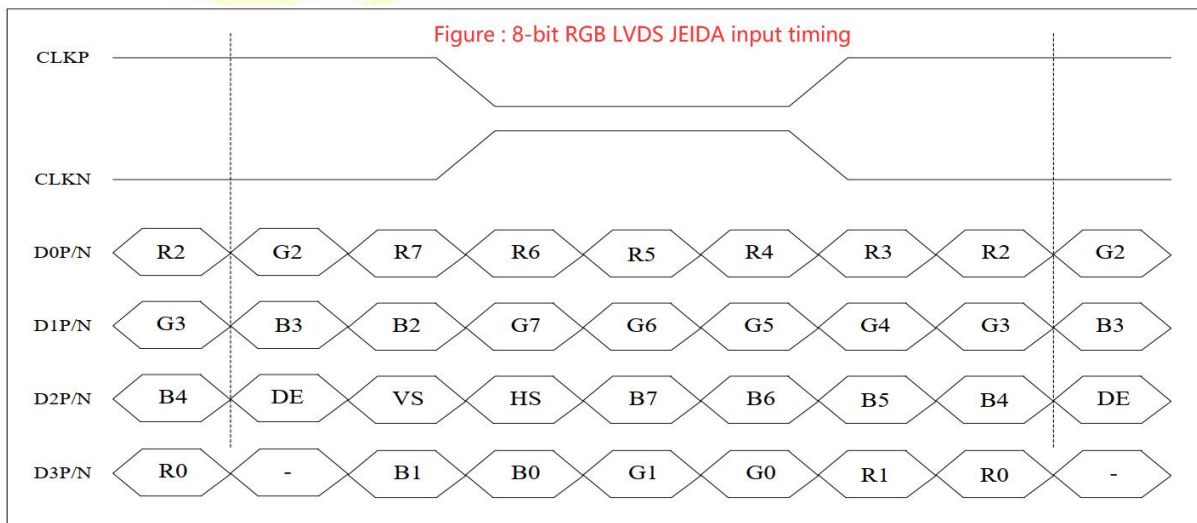
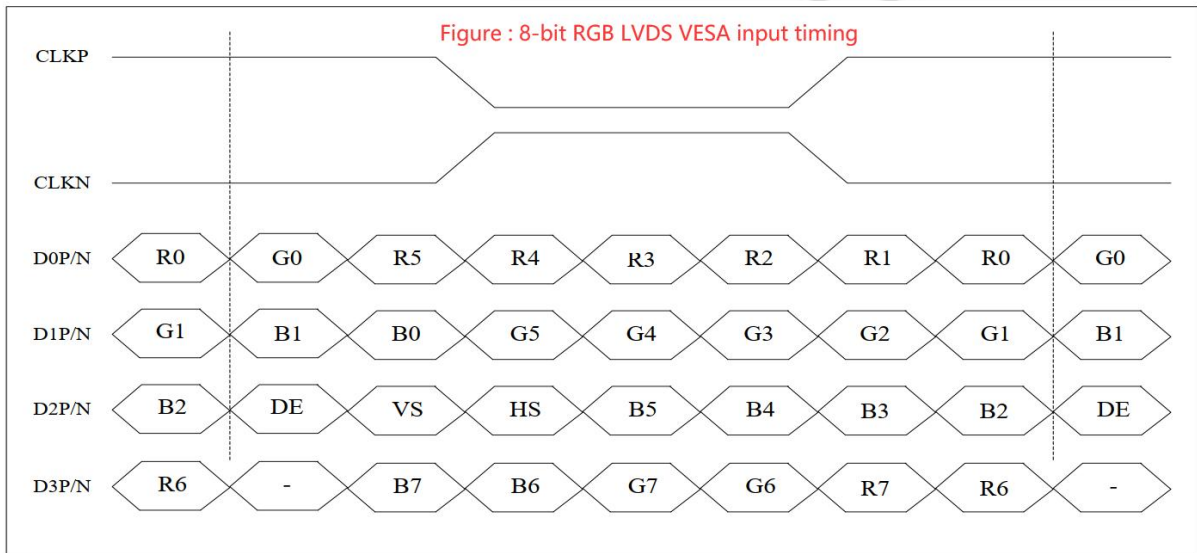
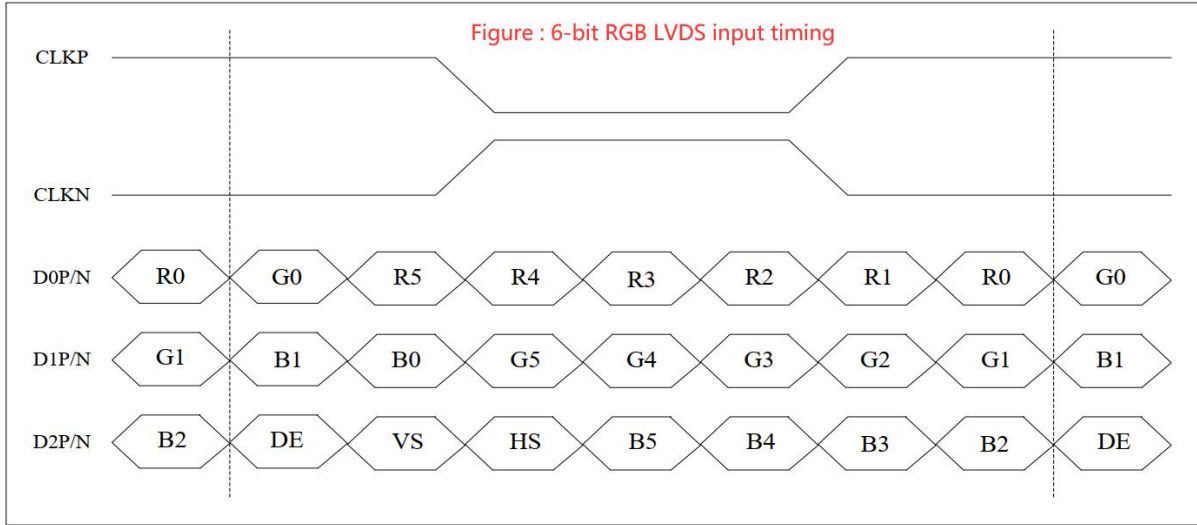
Table : Data to Clock Timing Specifications

5. MIPI 数据时钟时序规范 MIPI data-clock timing specification

MIPI Input Timing	Symbol	1024RGBx768			1024RGBx600			800RGBx600			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
MIPI 24-bit RGB@ 2 lane Operating Frequency	-	500	-	750	400	616	750	330	476	750	Mbps
MIPI 24-bit RGB@ 4 lane Operating Frequency	-	250	390	500	200	308	500	165	238	500	Mbps
Frame Rate@ 2 lane	-	47	-	-	48	60	-	49	60	-	Hz
Frame Rate@ 4 lane	-	47	60	-	48	60	-	49	60	-	Hz
Horizontal Total	tht	1114	1344	1400	1114	1344	1400	890	1000	1300	DCLK
Hsync Pulse width	ths	1	24	HBP-1	1	24	HBP-1	1	24	HBP-1	DCLK
Horizontal Back Porch	thb	60	160	160	60	160	160	60	160	250	DCLK
Horizontal Valid Data	thd	1024			1024			800			DCLK
Horizontal Front Porch	thfp	30	160	216	30	160	216	30	40	250	DCLK
Vertical Total	tv	788	806	845	620	635	800	620	660	800	THT
Vsync Pulse Width	tv	1	2	VBP-1	1	2	VBP-1	1	2	VBP-1	THT
Vertical Back Porch	tvb	8	23	33	8	23	100	8	39	100	THT
Vertical Valid Data	tv	768			600			600			THT
Vertical Front Porch	tvfp	12	15	44	12	12	100	12	21	100	THT

6.3. LVDS 输入时序 LVDS INPUT TIMING

1. LVDS 数据输入格式 LVDS data input format



2. LVDS 时序特性 LVDS timing characteristic

LVDS Input Timing	Symbol	1024RGBx768			1024RGBx600			800RGBx600			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
DCLK Frequency	-	52.7	65	71	41.4	51.2	67.2	33.1	39.6	62.4	MHZ
Horizontal Total	tht	1114	1344	1400	1114	1344	1400	890	1000	1300	DCLK
Hsync Pulse width	ths	1	24	HBP-1	1	24	HBP-1	1	24	HBP-1	DCLK
Horizontal Back Porch	thb	60	160	160	60	160	160	60	160	250	DCLK
Horizontal Valid Data	thd	1024			1024			800			DCLK
Horizontal Front Porch	thfp	30	160	216	30	160	216	30	40	250	DCLK
Vertical Total	vt	788	806	845	620	635	800	620	660	800	THT
Vsync Pulse Width	tv	1	2	VBP-1	1	2	VBP-1	1	2	VBP-1	THT
Vertical Back Porch	tvb	8	23	33	8	23	100	8	23	100	THT
Vertical Valid Data	tvd	768			600			600			THT
Vertical Front Porch	tvfp	12	15	44	12	12	100	12	37	100	THT

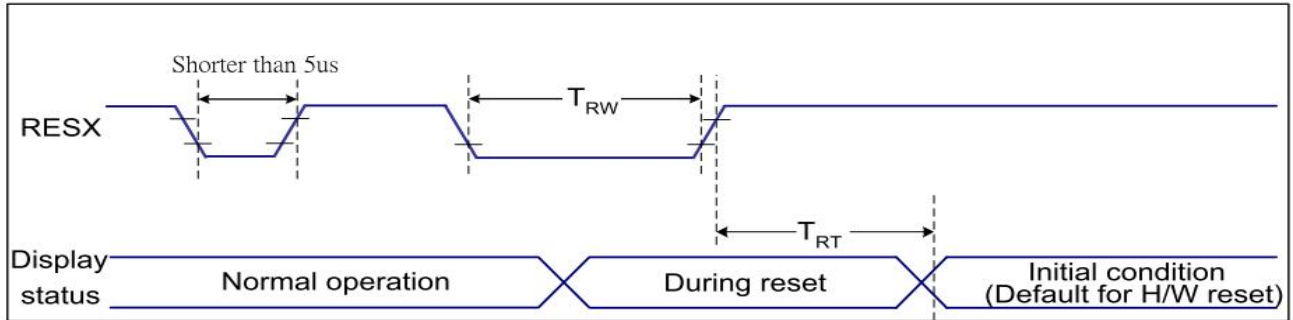
3. LVDS 直流电气特性 LVDS DC electrical characteristic

Parameter	Symbol	Min.	Typ.	Max.	Unit	Condition
Differential input high threshold voltage	R _{XVTH}			+37	mV	1. R _{XVCM} +1/2 V _{ID} <=1650mV. 2. R _{XVCM} -1/2 V _{ID} >=400mV.
Differential input low threshold voltage	R _{XVTL}	-37			mV	
Input voltage range (singled-end)	R _{XVIN}	400	-	1650	mV	
Differential input common mode voltage	R _{XVCM}	600	1200	1375	mV	
Differential input voltage	V _{ID}	100	-	400	mV	
Differential input impedance	Z _{ID}	80	100	120	ohm	
Differential input leakage current	I _{LCLVDS}	-10	-	+10	uA	

4. LVDS 交流电气特性 LVDS AC electrical characteristic

Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Clock frequency	R _{XFCLK}	20	-	71	MHz	Refer to input timing table for each display resolution
Input data skew margin	T _{RSKM}	-0.2	-	0.2	UI	V _{ID} = 200mV R _{XVCM} = 1.2V 1UI=1/(R _{XFCLK} x7)
Clock high time	T _{LVCH}	-	4/(7* R _{XFCLK})	-	ns	
Clock low time	T _{LVCL}	-	3/(7* R _{XFCLK})	-	ns	
PLL wake-up time	T _{enPLL}	-	-	150	us	

6.4. 复位时序 Reset Timing



VDDI=1.8, VDD=2.8, AGND=DGND=0V, Ta=25 °C

Related Pins	Symbol	Parameter	MIN	MAX	Unit
RESX	TRW	Reset pulse duration	10	-	us
	TRT	Reset cancel	-	5 (Note 1, 5)	ms
			120 (Note 1, 6, 7)	ms	

注释 Notes:

1. 复位取消还包括将 ID 字节、VCOM 设置和其他设置从 NVM（或类似设备）加载到寄存器所需的时间。每次在 RESX 上升沿后 5 ms 内有硬件复位取消时间（tRT）时，都会执行此加载。

The reset cancel includes also required time for loading ID bytes, VCOM setting and other settings from NVM (or similar device) to registers. This loading is done every time when there is HW reset cancel time (tRT) within 5 ms after a rising edge of RESX.

2. 根据下表，由于 RESX 线路上的静电放电引起的尖峰不会导致不规则的系统复位

Spike due to an electrostatic discharge on RESX line does not cause irregular system reset according to the table below:

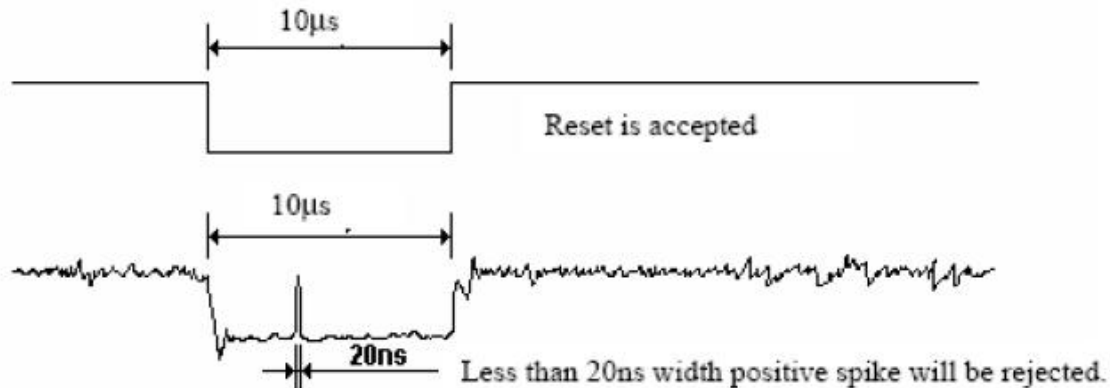
RESX Pulse	Action
Shorter than 5us	Reset Rejected
Longer than 9us	Reset
Between 5us and 9us	Reset starts

3. 在复位期间，显示屏将被消隐（显示屏进入消隐序列，最长持续时间为 120 毫秒，此时 Reset Starts in Sleep Out - mode。显示屏在 Sleep In - mode 中保持消隐状态。）然后返回硬件复位的默认条件。

4. 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 return to Default condition for Hardware Reset.

4. 尖峰抑制也适用于有效复位脉冲期间，如下所示：

Spike Rejection also applies during a valid reset pulse as shown below:



5. 在进入睡眠期间应用复位时

When Reset applied during Sleep In Mode.

6. 在退出睡眠期间应用复位时

When Reset applied during Sleep Out Mode.

7. 释放 RESX 后需要等待 5 毫秒以上才能发送命令。也不能在 120 毫秒内发送睡眠退出命令。

It is necessary to wait 5msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120msec.

6.5. 开机上电顺序 Power-on sequence

IOVCC 和 VCI 可以按任何顺序应用或断电。在关机序列期间，如果 LCD 处于休眠模式，则 VCI 和 IOVCC 必须在至少 120 毫秒内断电。如果 LCD 处于休眠模式，VCI 和 IOVCC 可以在 RESX 释放后至少 0 毫秒内断电。CSX 可以在任何时间应用，也可以永久接地。RESX 的优先级高于 CSX。

IOVCC and VCI can be applied or powered down in any order. During the Power Off sequence, if the LCD is in the Sleep Out mode, VCI and IOVCC must be powered down with minimum 120msec. If the LCD is in the Sleep In mode, VCI and IOVCC can be powered down with minimum 0msec after the RESX is released. CSX can be applied at any timing or can be permanently grounded. RESX has high priority over CSX.

备注 Notes:

1. 如果不满足电源顺序，TFT 不会损坏。

TFT will not be damaged if the power sequence is not met.

2. 在电源开/关序列期间，显示面板上不会有异常的可见效果。

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

3. 在 Power On Sequence 结束和收到 Sleep Out 命令之前，以及在收到 Sleep In 命令和 Power Off Sequence 之间，显示屏上不会出现异常可见的效果。

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

4. 如果在第 6.4.1 节中定义的开机序列期间主机没有稳定地保持 RESX 线，则有必要在主机开机序列完成后应用硬件复位 (RESX) 以确保正确的操作。否则，无法保证所有功能。

If the RESX line is not steadily held by the host during the Power On Sequence as defined in Sections 6.4.1, then it will be necessary to apply the Hardware Reset (RESX) after the completion of the Host Power On Sequence to ensure correct operations. Otherwise, all the functions are not guaranteed.

6.5.1. 不受控制的断电 Uncontrolled Power Off

非受控断电是指在没有受控断电序列的情况下取出电池的情况。它不会损坏模块或主机接口。

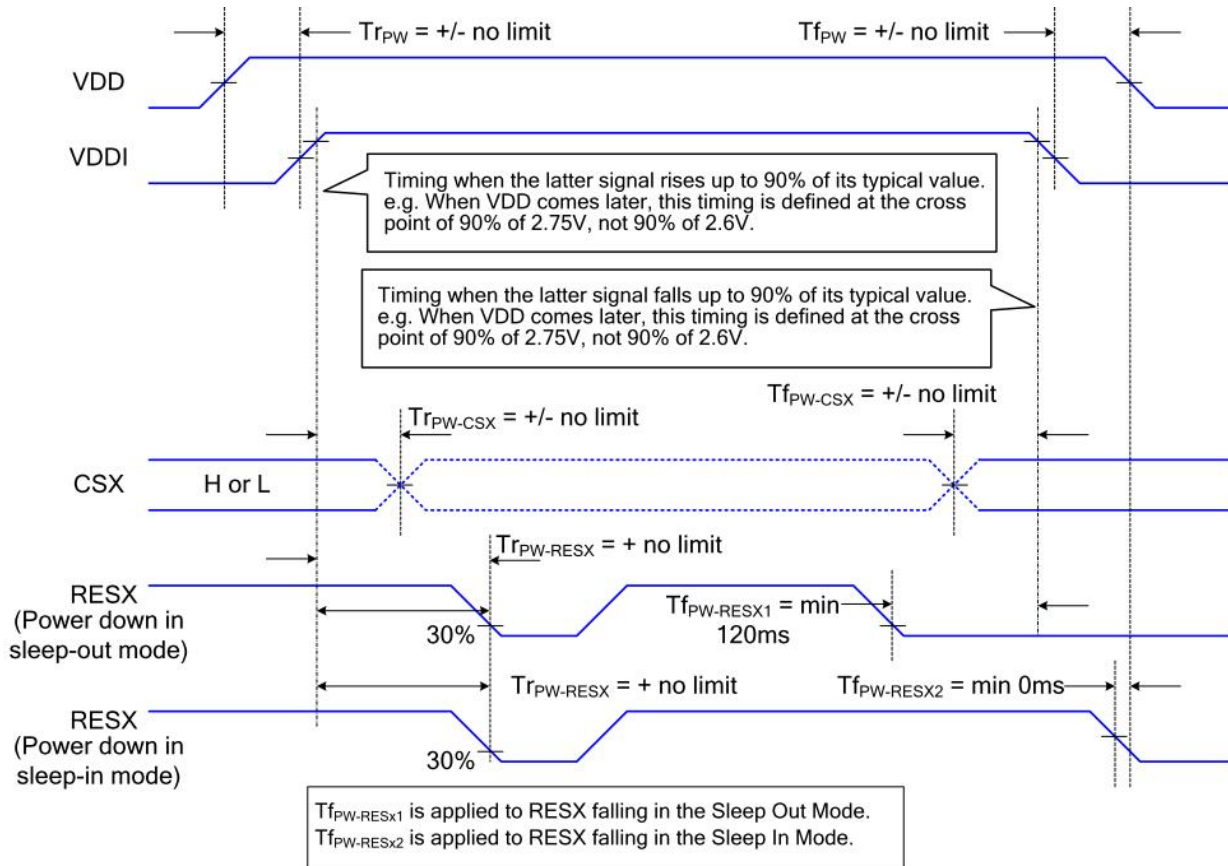
The uncontrolled power-off means a situation which removed a battery without the controlled power off sequence. It will neither damage the module or the host interface.

如果发生不受控制的断电，显示屏将变为空白，显示屏上不会有任何可见效果（空白显示）并保持空白，直到“Power On Sequence”启动它。

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.

电源开/关顺序如下图所示

The power on/off sequence is illustrated below



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=+80 °C, 120hrs	
低温储存 Low Temperature Storage	Ta=-40 °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	

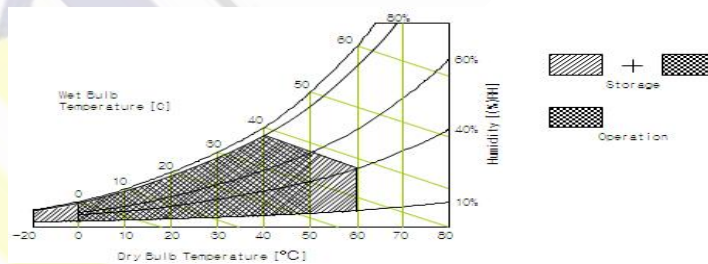
注释 Note:

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

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)	<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

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 ±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

八、处理和注意事项 HANDLING & 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.

◆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.

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.

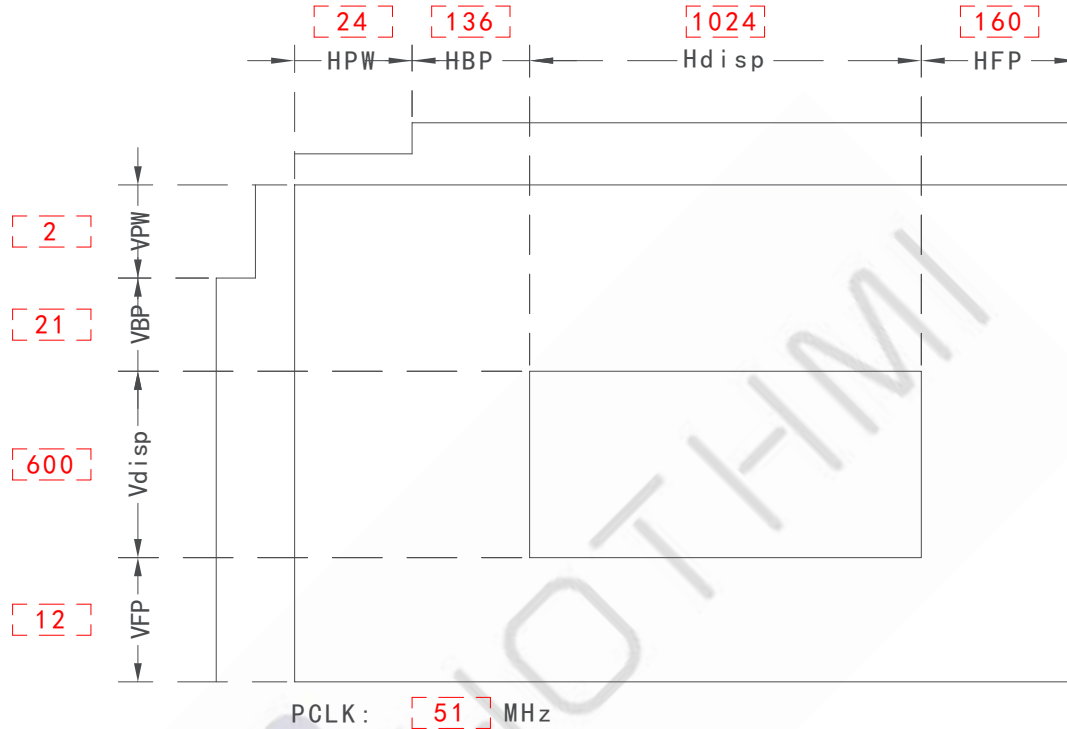
◆在处理 LCM 时，请戴上不带电材料的手套。对地导电手腕和对地导电鞋是必需的

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

九、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)
```

```
{
```

```
//=====上电复位操作=====//
```

```
LCD_RESET=1;
```

```
Delays(1); //Delay 1ms
```

```
LCD_RESET=0;
```

```
Delays(10); //Delay 10ms
```

```
LCD_RESET=1;
```

```
Delays(120); //Delay 120ms
```

```
//=====//
```

```
//LVDS 接口无需初始化代码 No initialisation code required for LVDS interface
```

```
//MIPI 接口初始化代码 MIPI InterFace initialisation code
```

```
DSI_CMD(0x30);
```

```
DSI_PA(0x00);
```

```
DSI_CMD(0xF7);
```

```
DSI_PA(0x49);
```

```
DSI_PA(0x61);
DSI_PA(0x02);
DSI_PA(0x00);
DSI_CMD(0x30);
DSI_PA(0x01);
DSI_CMD(0x04);
DSI_PA(0x0C);
DSI_CMD(0x05);
DSI_PA(0x00);
DSI_CMD(0x06);
DSI_PA(0x00);
DSI_CMD(0x0B);
DSI_PA(0x13); //0x13=4lanes, 0x12=3lanes, 0x11=2lanes, 0x10=1 lanes
DSI_CMD(0x17);
DSI_PA(0x00);

DSI_CMD(0x1F);
DSI_PA(0x05); //add hs_settle time
DSI_CMD(0x23);
DSI_PA(0x00); //add //close gas
DSI_CMD(0x25);
DSI_PA(0x19);
DSI_CMD(0x28);
DSI_PA(0x18);
DSI_CMD(0x29);
DSI_PA(0xFC); //revcom
DSI_CMD(0x2A);
DSI_PA(0x00); //revcom
DSI_CMD(0x2B);
DSI_PA(0xFC); //vcom
DSI_CMD(0x2C);
DSI_PA(0x00); //vcom
DSI_CMD(0x30);
DSI_PA(0x02);
DSI_CMD(0x01);
DSI_PA(0x22);
DSI_CMD(0x03);
DSI_PA(0x12);
DSI_CMD(0x04);
DSI_PA(0x00);
```


DSI_CMD (0x05) ;
DSI_PA (0x64) ;
DSI_CMD (0x0A) ;
DSI_PA (0x08) ;
DSI_CMD (0x0B) ;
DSI_PA (0x0A) ;
DSI_PA (0x1A) ;
DSI_PA (0x0B) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x11) ;
DSI_PA (0x10) ;
DSI_PA (0x06) ;
DSI_PA (0x08) ;
DSI_PA (0x1F) ;
DSI_PA (0x1D) ;
DSI_CMD (0x0C) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
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DSI_PA (0x0D) ;
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DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x16) ;
DSI_PA (0x1B) ;
DSI_PA (0x0B) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x11) ;
DSI_PA (0x10) ;
DSI_PA (0x07) ;
DSI_PA (0x09) ;
DSI_PA (0x1E) ;
DSI_PA (0x1C) ;

DSI_CMD (0x0E) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_CMD (0x0F) ;
DSI_PA (0x16) ;
DSI_PA (0x1B) ;
DSI_PA (0x0D) ;
DSI_PA (0x0B) ;
DSI_PA (0x0D) ;
DSI_PA (0x11) ;
DSI_PA (0x10) ;
DSI_PA (0x1C) ;
DSI_PA (0x1E) ;
DSI_PA (0x09) ;
DSI_PA (0x07) ;
DSI_CMD (0x10) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
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DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_CMD (0x11) ;
DSI_PA (0x0A) ;
DSI_PA (0x1A) ;
DSI_PA (0x0D) ;

DSI_PA (0x0B) ;
DSI_PA (0x0D) ;
DSI_PA (0x11) ;
DSI_PA (0x10) ;
DSI_PA (0x1D) ;
DSI_PA (0x1F) ;
DSI_PA (0x08) ;
DSI_PA (0x06) ;
DSI_CMD (0x12) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_PA (0x0D) ;
DSI_CMD (0x14) ;
DSI_PA (0x00) ;
DSI_PA (0x00) ;
DSI_PA (0x00) ;
DSI_PA (0x00) ; //CKV_OFF
DSI_CMD (0x18) ;
DSI_PA (0x99) ;
DSI_CMD (0x30) ;
DSI_PA (0x06) ;
DSI_CMD (0x12) ;
DSI_PA (0x36) ;
DSI_PA (0x2B) ;
DSI_PA (0x2C) ;
DSI_PA (0x3A) ;
DSI_PA (0x33) ;
DSI_PA (0x30) ;
DSI_PA (0x30) ;
DSI_PA (0x2E) ;
DSI_PA (0x2B) ;
DSI_PA (0x1B) ;

DSI_PA (0x2A) ;
DSI_PA (0x20) ;
DSI_PA (0x16) ;
DSI_PA (0x29) ;
DSI_CMD (0x13) ;
DSI_PA (0x36) ;
DSI_PA (0x2B) ;
DSI_PA (0x2C) ;
DSI_PA (0x3A) ;
DSI_PA (0x33) ;
DSI_PA (0x30) ;
DSI_PA (0x30) ;
DSI_PA (0x2E) ;
DSI_PA (0x2B) ;
DSI_PA (0x1B) ;
DSI_PA (0x2A) ;
DSI_PA (0x20) ;
DSI_PA (0x16) ;
DSI_PA (0x29) ;

DSI_CMD (0x30) ;
DSI_PA (0x0A) ;
DSI_CMD (0x02) ;
DSI_PA (0x4F) ;
DSI_CMD (0x0B) ;
DSI_PA (0x40) ;
DSI_CMD (0x12) ;
DSI_PA (0x3E) ;
DSI_CMD (0x13) ;
DSI_PA (0x78) ;
DSI_CMD (0x30) ;
DSI_PA (0x0D) ;
DSI_CMD (0x0D) ;
DSI_PA (0x04) ;
DSI_CMD (0x10) ;
DSI_PA (0x0C) ;
DSI_CMD (0x11) ;
DSI_PA (0x0C) ;
DSI_CMD (0x12) ;
DSI_PA (0x0C) ;

```

DSI_CMD (0x13) ;
DSI_PA (0x0C) ;

DSI_CMD (0x30) ;
DSI_PA (0x00) ;
//DSI_CMD (0x36) ;
//DSI_PA (0x03) ;

DSI_CMD (0x11) ;
DelayX1ms (200) ;
DSI_CMD (0x29) ;
DelayX1ms (200) ;

}
    
```

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	2024-07-31	初次编制 First compilation.	YL

-- 结束 --
-- END --