

NISIN

触摸显示模组产品规格承认书

Display Module Specifications for Approval

客户： 客户型号：			NS622HD3003AZ01		
批准 APPROVED	审核 CHECKED	拟制 DESIGNED	批准 APPROVED	审核 CHECKED	拟制 DESIGNED



修改记录

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2023-6-1	V00	初版发行	所有	李世龙

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1.产品规格 (Product Specifications)

面板类型 (Panel Type)	TFT LCD
面板尺寸 (Panel Size)	6.217 inch
显示类型 (Display Type)	Normal Black
分辨率 (Resolution)	720 (RGB) x 1520 (dot)
显示点间距 (Dot Pitch)	0.0313 (W) mm × 0.0939 (H) mm
显示色彩 (color)	16.7M
视角 (View Angle)	U/D/L/R: 80/80/80/80
显示驱动 IC (Display Driver IC)	FT8006S-AA
接口类型 (Interface Type)	MIPI 4 Lane
触摸类型 (TP Type)	IN CELL
触摸 IC (TP IC)	FT8006S-AA
外形尺寸 (Dimensions)	73 (H) X 159 (V) X 2.69 (T) (mm)
显示区尺寸 (Display area)	67.608 x 142.728 (mm)
模组亮度 (Module Brightness)	480Cd/m ² (TYP)
触摸点数 Touch points	10
触摸按键 Touch Key Number	0
触摸屏固件版本	Version: 0x01

3. 接口定义 (The Interface Definition)

PIN No.	PIN assignment	16	LED-
1	GND	17	LED+
2	D0N	18	VPOS_+5V
3	D0P	19	VENG_-5V
4	GND	20	LCM_RST
5	D1N	21	DSI_TE
6	D1P	22	NC
7	GND	23	LCD_ID
8	D2N	24	VO_1.8V
9	D2P	25	GND
10	GND	26	SCL0
11	D3N	27	SDA0
12	D3P	28	RST
13	GND	29	INT
14	TCN	≥30	NC
15	TCP		

4. 电性特性 (Electrical Characteristics)

4.1 ABSOLUTE MAXIMUM RATINGS

(AVDD = 4.5V ~ 6.5V, AVEE = -4.5V ~ -6.5V, VDDI = 1.65V ~ 1.95V, Ta = -30°C ~ 70°C)

Parameter	Symbol	Rating	Unit	Note
Power Supply Voltage 1	VDDI-VSS	-0.3 ~ +4.5	V	
Power Supply Voltage 2	VDDAM-VSS	-0.3 ~ +4.5	V	
Power Supply voltage 3	VDD_TP-VSS	-0.3 ~ +4.5	V	
Power Supply voltage 4	VDDI_TP-VSS	-0.3 ~ +4.5	V	
Power Supply Voltage 5	MTP_PWR-VSS	-0.3 ~ +8.8	V	
Power Supply Voltage 6	AVDD-VSS	-0.3 ~ +6.6	V	
Power Supply Voltage 7	VSS-AVEE	-0.3 ~ +6.6	V	
Power Supply Voltage 8	VGH-VGL	-0.3 ~ +32	V	
Input Voltage	Vt	-0.3 ~ VDDI+0.3	V	
Operating Temperature	Topr	-30 ~ +70	°C	
Storage Temperature	Tstg	-55 ~ +110	°C	

Note1. The maximum applicable voltage on any pin with respect to 0V.

Note2. Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

4.2 DC CHARACTERISTICS

4.2.1 Basic DC Characteristics

(AVDD = 4.5V~6.5V,AVEE = -4.5V~-6.5V,VDDI = 1.65V~1.95V, Ta = -30°C ~ 70°C)

Parameter	Symbol	Conditions	Specification			Unit	Notes
			MIN	TYP	MAX		
Power & Operation Voltage							
Analog Operating voltage	AVDD	Operating Voltage	4.5	5.5	6.5	V	
Analog Operating voltage	AVEE	Operating Voltage	-6.5	-5.5	-4.5	V	
Logic Operating voltage	VDDI	I/O supply voltage	1.65	1.8	1.95	V	
Digital Operating voltage	VDD	Digital supply voltage	1.125	1.3	1.5	V	
Hissi interface Operating voltage	VDDAM	MIPI supply voltage	1.65	1.8	1.95	V	
Touch Operating voltage	VDDI_TP	Touch supply voltage	1.65	1.8	1.95	V	
Input / Output							
Logic High level input voltage	VIH	-	0.7VDDI	-	VDDI	V	
Logic Low level input voltage	VIL	-	VSS	-	0.3VDDI	V	
Logic High level output voltage	VOH	IOH = -1.0mA	0.8VDDI	-	VDDI	V	
Logic Low level output voltage	VOL	IOL = +1.0mA	VSS	-	0.2VDDI	V	
Logic High level input current	IIH	Vin = VDDI or VDDAM	-	-	1	uA	
Logic Low level input current	IIL	Vin = VDDI or VDDAM	-1	-	-	uA	

VCOM Operation							
VCOMDC output voltage	VCOM	AVDD=AVEE=+/-5V	-2.3	-	0.3	V	
Source Driver							
Gamma positive reference voltage	VGMP	VGMP<AVDD-0.2V	3.5	-	6.0	V	
Gamma negative reference voltage	VGMN	VGMN>AVEE-0.2V	-6.0	-	-3.5	V	
Source output voltage	VSD	-	VGMN	-	VGMP	-	
Output deviation voltage (Source positive output channel)	V _{dev}	Sout >=+4.2V, Sout <=+0.8V	-	-	30	mV	
		+4.2V>Sout>+0.8V	-	-	15	mV	
Output deviation voltage (Source negative output channel)	V _{dev}	Sout <=-4.2V, Sout >=-0.8V	-	-	30	mV	
		-4.2V<Sout<-0.8V	-	-	15	mV	
Output offset voltage	V _{OFFSET}	-	-	-	100	mv	
Reference Voltage							
Internal reference voltage	V _{REF}	-	1.94	2.0	2.06	V	
Internal reference voltage	V _{REF_TP}	-	1.5	3.5	5	V	
Booster operation							
Pump output voltage	VGH	Range=(AVDD-AVEE) ~(3XAVDD-2 AVEE)	7.3	-	20.0	V	
Pump output voltage	VGL	Range=(VCL+AVEE) ~(2AVEE-AVDD)	-18.0	-	-5.3	V	
Regulator output voltage	VCL	-	-4.5	-2.75	-2.25	V	

Note1. The maximum applicable voltage on any pin with respect to 0V.

Note2. Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above.

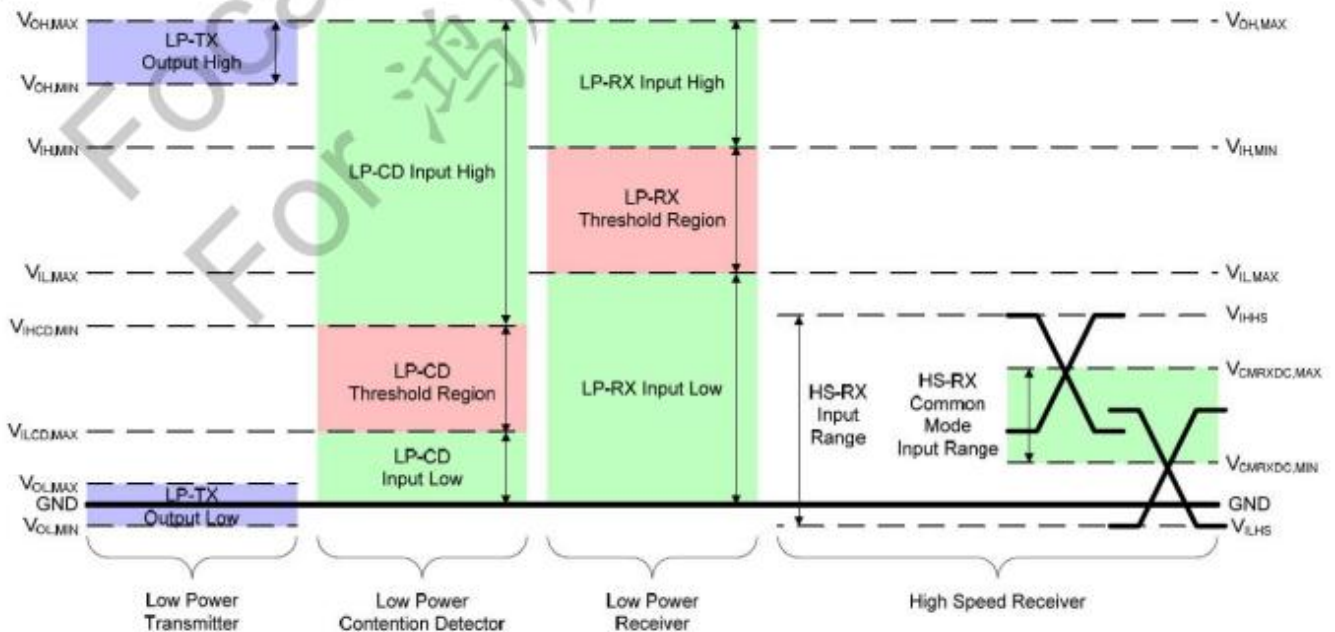
4.2.2 MIPI DC Characteristics

DC characteristics for MIPI-DSI

(AVDD = 5.0V~6.5V, AVEE = -5.0V~-6.5V, VDDI = 1.65V~1.95V, Ta = -30°C ~ 70°C)

Parameter	Symbol	Conditions	Specification			Unit
			MIN	TYP	MAX	
Power supply voltage for MIPI Interface						
Power supply voltage for MIPI interface	VDDAM	-	1.65	1.8	1.95	V
	LVDSVDD	-	1.125	1.3	1.5	V
LPDT Input Characteristics						
Pad signal voltage range	VI	-	-50	-	1350	mV
Ground Shift	VGND SH	-	-50	-	50	mV
Logic 0 input threshold	VIL	-	0	-	550	mV
Logic 1 input threshold	VIH	-	880	-	LVDSVDD	mV
Input hysteresis	VHYST	-	25	-	-	mV
LPDT Output Characteristics						
Output low level	VOL	-	-50	-	50	mV
Output high level	VOH	-	1.1	1.2	1.3	V
Logic 1 contention threshold	VIHCD, MIN	-	450	-	LVDSVDD	mV
Logic 0 contention threshold	VILCD, MAX	-	0	-	200	mV
Output impedance of LPDT	ZOLP	-	80	100	125	ohm

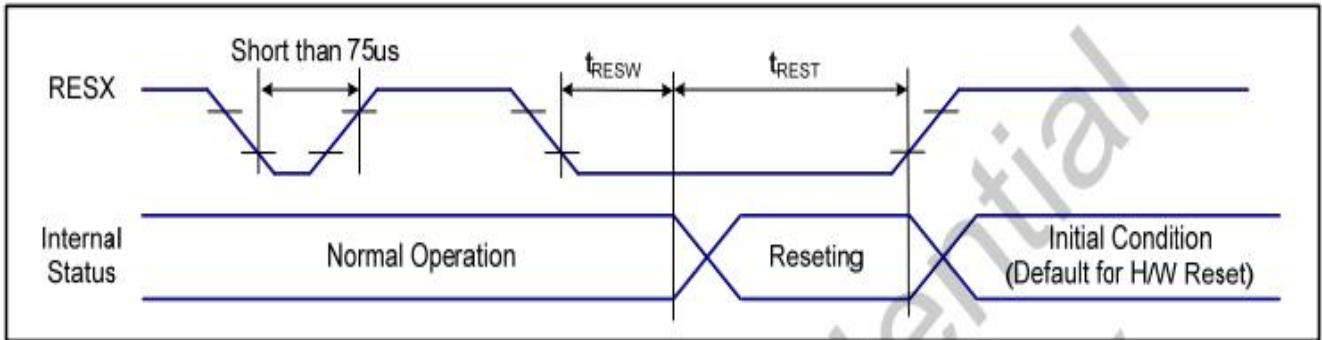
Hi-speed Input/Output Characteristics						
Single-end input low voltage	VILHS	-	-40	-	-	mV
Single-end input high voltage	VIHHS	-	-	-	460	mV
Single-end threshold for HS termination enable	VTERM-EN	-	-	-	450	mV
Differential input low threshold	VIDTL	-	-70	-	-	mV
Differential input high threshold	VIDTH	-	-	-	70	mV
Common mode voltage	VCMRXDC	-	70	-	330	mV
Differential input impedance	ZID	-	80	100	125	ohm



4.3 AC CHARACTERISTICS

4.3.1 Reset timing characteristics

t_{RESW} shorter than 75us, Reset will be rejected.



VSS=0V, VDDI=1.65V to 1.95V, Ta = -30°C to 70°C

Symbol	Parameter	MIN	TYP	MAX	Note	Unit
t_{RESW}	*1) Reset low pulse minimum width	150	-	-	Reset signal recognized	us
t_{REST}	*2) Reset complete time	5	-	-	Reset action complete	ms

Table: Reset input timing

Note 1. RESX low pulse that is too short does not cause irregular system reset according to the table below.

RESX Pulse	Action
Shorter than 75us	Reset Rejected
Longer than 150us	Reset Recognized
Between 75us and 150us	Reset sequence starts (It depends on voltage and temperature condition.)

Note 2. Once Reset low pulse is recognized, system requires RESX remaining low for another 5ms to complete H/W reset.

Note 3. During H/W Reset flow, ID1/ID2/ID3 and VCOM value in OTP will be latched to internal register during this period. This loading is done every time when H/W reset is complete ; The H/W reset sequence is complete when RESX is remaining low longer than $t_{RESW} + t_{REST}$.

Note 4. It is necessary to wait 15msec after releasing RESX before sending commands. Also Sleep Out command cannot be sent for 120 msec.

4.3.2 I²C interface characteristics

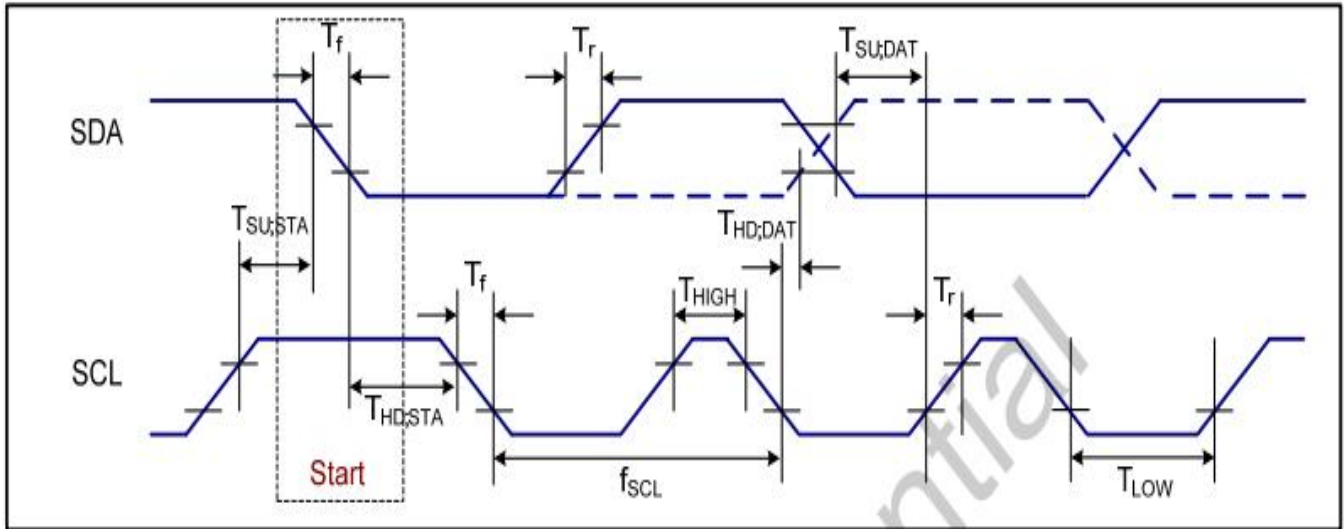


Table: I2C Interface Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
f_{SCLK}	SCL clock frequency	-	10	-	400	kHz
T_{LOW}	SCL clock LOW period	-	1.2	-	-	us
T_{HIGH}	SCL clock HIGH period	-	0.6	-	-	us
$T_{SU,DATA}$	data set-up time	-	250	-	-	ns
$T_{HD,DATA}$	data hold time	-	0	-	0.9	us
T_r	SCL and SDA rise time	Note 2	$20+0.1C_b$	-	300	ns
T_f	SCL and SDA fall time	Note 2	$20+0.1C_b$	-	300	ns
T_f	SDA fall time for read out	-	$20+0.1C_b$	-	1000	ns
C_b	Capacitive load represented by each bus line	-	-	-	400	pF
$T_{SU,STA}$	Setup time for a repeated START condition	-	0.6	-	-	us
$T_{HD,STA}$	START condition hold time	-	0.6	-	-	us
$T_{SU,STO}$	Setup time for STOP condition	-	0.6	-	-	us
T_{SW}	Tolerable spike width on bus	Note 1	-	-	50	ns
T_{BUF}	BUS free time between a STOP and START condition	-	4.7	-	-	us

Note1: The device inputs SDA and SCL are filtered and will reject spikes on the bus lines of width $<T_{SW(max)}$.

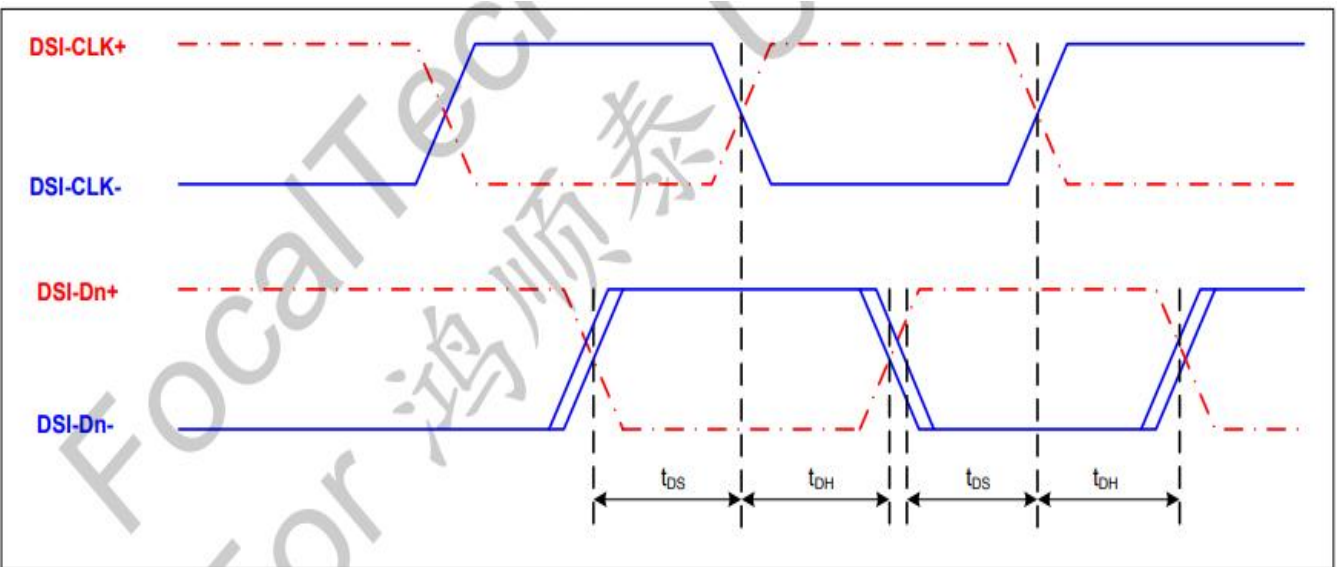
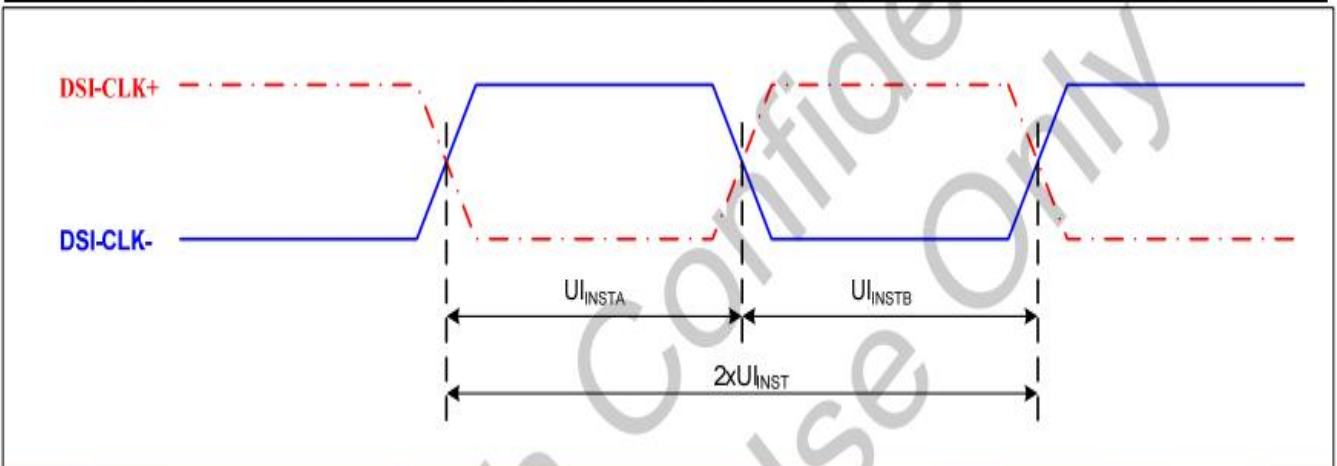
Note2: The rise and fall times specified here refer to the driver device and are part of the general fast I²C-bus specification. C_b = capacitive load per bus line.

Note3: All timing values are valid within the operating supply voltage and ambient temperature ranges and are referenced to V_{IL} and V_{IH} with an input voltage swing of V_{SS} to V_{DDI}

4.3.3 MIPI-DSI characteristics

High speed mode

Parameter	Symbol	Parameter	Specification			Unit
			MIN	TYP	MAX	
High Speed Mode						
DSI-CLK+/-	$2xU_{INST}$	Double UI instantaneous	2	-	25	ns
DSI-CLK+/-	U_{INSTA}, U_{INSTB}	UI instantaneous Halfs	1	-	12.5	ns
DSI-Dn+/-	t_{DS}	Data to clock setup time	0.15	-	-	UI
DSI-Dn+/-	t_{DH}	Data to clock hold time	0.15	-	-	UI
DSI-CLK+/-	t_{DRTCLK}	Differential rise time for clock	150	-	0.3UI	ps
DSI-Dn+/-	$t_{DRTDATA}$	Differential rise time for data	150	-	0.3UI	ps
DSI-CLK+/-	t_{DFTCLK}	Differential fall time for clock	150	-	0.3UI	ps
DSI-Dn+/-	$t_{DFTDATA}$	Differential fall time for data	150	-	0.3UI	ps



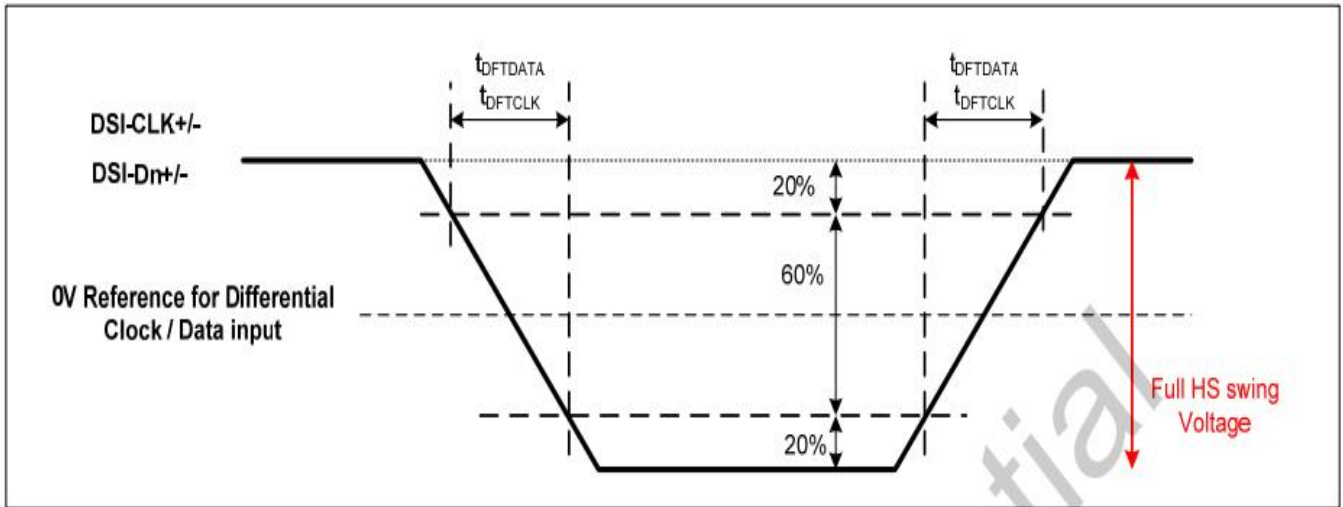


Figure: AC characteristics for MIPI-DSI High speed mode

Low power mode

Parameter	Symbol	Parameter	Specification			Unit
			MIN	TYP	MAX	
Low Power mode						
DSI-D0+/-	T_{LPXM}	Length of LP-00, LP-01, LP-10 or LP-11 periods MPU Display Module	50	-	-	ns
DSI-D0+/-	T_{LPXD}	Length of LP-00, LP-01, LP-10 or LP-11 periods Display Module MPU	58	-	-	ns
DSI-D0+/-	$T_{TA-SURED}$	Time-out before the MPU start driving	T_{LPXD}	-	$2T_{LPXD}$	ns
DSI-D0+/-	$T_{TA-GETD}$	Time to drive LP-00 by display module	$5T_{LPXD}$	-	-	ns
DSI-D0+/-	T_{TA-GOD}	Time to drive LP-00 after turnaround request - MPU	$4T_{LPXD}$	-	-	ns
DSI-D0+/-	Ratio T_{LPX}	Ratio of T_{LPXM} / T_{LPXD} between MCU and display module	2/3	-	3/2	-

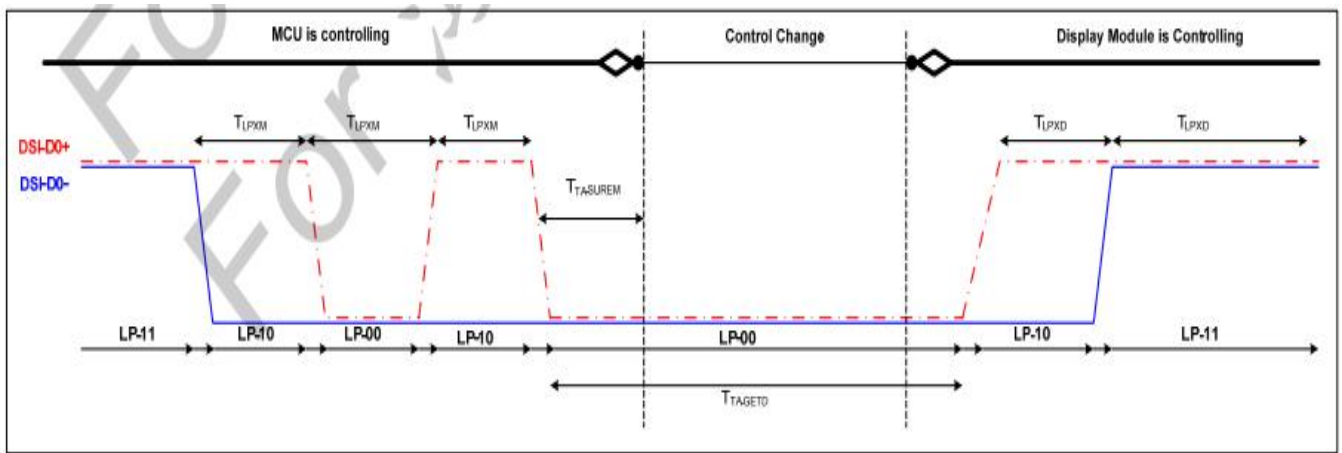


Figure: BTA from the MCU to the Display Module

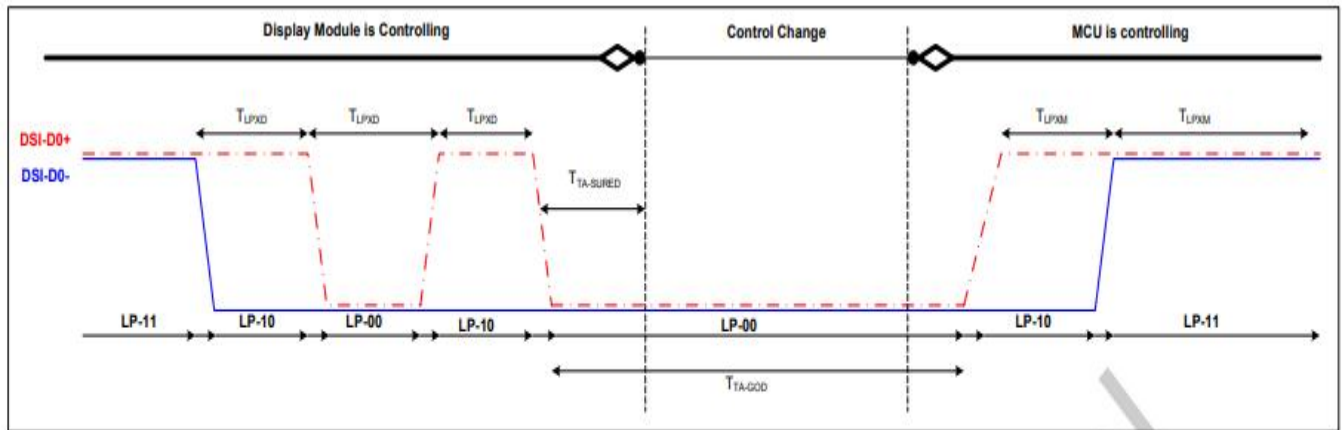


Figure: BTA from the Display Module to the MCU

5. 可靠性实验测试(Reliability Test Conditions And Methods)

序号	试验项目	试验条件及方法	试验设备	检验项目	检验工具
1	高温高湿(静、动态)试验	温度 $60^{\circ}\text{C} \pm 3^{\circ}\text{C}$, 湿度 $90\% \pm 3\%$, 要求选择时间分别为 96 小时, 静、动态(产品点亮)在室温下恢复 2 小时后进行外观, 显示功能检查。	恒温恒湿试验机	检验外观、功能、抗腐蚀性	目视/测试架/客户样机/显微镜
2	高、低温冲击试验	静态 -30°C (30 分钟) \sim 80°C (30 分钟) \sim -30°C (30 分钟), 24 个循环, 在室温下恢复 2 小时后进行外观, 显示功能检查。	冷热冲击试验机	检验外观、功能	

3	高温 存贮 试验	常温70℃+/-3℃、宽温80℃+/-3℃、96小时后在室温状态下恢复1小时在2小时内完成外观、显示功能检查。	烤箱	检验外观、功能	目视/测试架/客户样机													
4	低温 存贮 试验	常温-20℃+/-3℃、宽温-30℃+/-3℃、条件的试验箱内保存96小时后在室温状态下恢复1小时,在2小时完成外观、显示功能检查,特别注意检查是否有漏液、断线、腐蚀、偏光片不良现象。	低温冰箱	检验外观、功能														
5	低温 存贮 试验 (动态)	常温-20℃+/-3℃、宽温-30℃+/-3℃条件的试验箱内点亮刷屏,过程中每1小时观察一次,检查显示功能,如:异常,卡机,花屏等。特别注意检查是否有漏液、断线、腐蚀、偏光片不良现象。	低温冰箱	检验外观、功能	目视/测试架/客户样机													
6	包装 模组 跌落 试验	<p>1、跌落重量及自由落体高度:</p> <table border="1"> <thead> <tr> <th>总重量</th> <th>自由落体高度</th> </tr> </thead> <tbody> <tr> <td>0-9kg</td> <td>92cm</td> </tr> <tr> <td>9-25kg</td> <td>76cm</td> </tr> <tr> <td>25-45kg</td> <td>53cm</td> </tr> <tr> <td>45-68kg</td> <td>46cm</td> </tr> <tr> <td>大于 68kg</td> <td>41cm</td> </tr> </tbody> </table> <p>2、自由落体角度如下:</p> <ol style="list-style-type: none"> 一角: A角 三菱: A-B, A-D, A-C 六面: 面1, 面2, 面3, 面4, 面5, 面6; 	总重量	自由落体高度	0-9kg	92cm	9-25kg	76cm	25-45kg	53cm	45-68kg	46cm	大于 68kg	41cm	 <p>(图二)</p>	包装模组 跌落架	测试电性能无异常、外观检验无破损,无脱离现象	目视/测试架/客户样机
总重量	自由落体高度																	
0-9kg	92cm																	
9-25kg	76cm																	
25-45kg	53cm																	
45-68kg	46cm																	
大于 68kg	41cm																	
7	盐雾 试验	标准条件:中性盐雾试验(NSS试验):5%的氯化钠盐水溶液,溶液PH值中性(6.5~7.2),试验温度35±2℃,盐雾的沉降率在1~2ml/80cm ² .h之间,时间24h。2.其它特殊要求条件:醋酸盐雾试验(ASS试验):5%氯化钠溶液中配入冰醋酸,溶液PH值为3左右,试验温度35±2℃,盐雾的沉降率在1~2ml/80cm ² .h之间,时间24h。	盐雾试验 设备	检验外观、功能,盐雾试验结果的判定方法,腐蚀物出现判定法:定性判定,试验后功能测试应OK,外观观察产品无腐蚀现象产生。	目视/测试架/客户样机/显微镜													
8	ESD 抗静电 试验	测试架测试状态下试验:接触4KV,非接触(空气)8KV放电测试	防静电枪 (尖头接触放电, 圆头空气放电)	检验外观、功能	目视/测试架													

6. 光电参数 (Optical Characteristics)

6.1 光学规格 (Optical Specifications)

Item	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Transmittance (without DBEF)	T%	Viewing normal angle $\theta_x = \theta_y = 0^\circ$	2.74	3.33	--	%	All left side data are based on INX's following condition - 1. LC : AAS 2. BLU : INX's BLU 3. Polarizer w/o APCF 4. Machine : DMS-900 5. VLC : Vbright > 5.4V Vdark < 0.2V
Contrast Ratio	CR		1200	1500	--	--	
Response Time	$T_{on} + T_{off}$		--	30	35	ms	
Viewing Angle	Hor.	θ_{x+}		80	--	deg.	
		θ_{x-}		80	--		
	Ver.	θ_{y+}		80	--		
		θ_{y-}		80	--		
CF Only Color Chromaticity (CIE1931)	Red	X_R	0.636	0.656	0.676	--	Under C light simulation
		Y_R	0.301	0.321	0.341		
	Green	X_G	0.236	0.256	0.276		
		Y_G	0.540	0.560	0.580		
	Blue	X_B	0.119	0.139	0.159		
		Y_B	0.067	0.087	0.107		
	White	X_W	0.274	0.294	0.314		
		Y_W	0.295	0.315	0.335		
Color Gamut	CG	--	68.8%	--			

*Note (1) Definition of Contrast Ratio (CR) :

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255

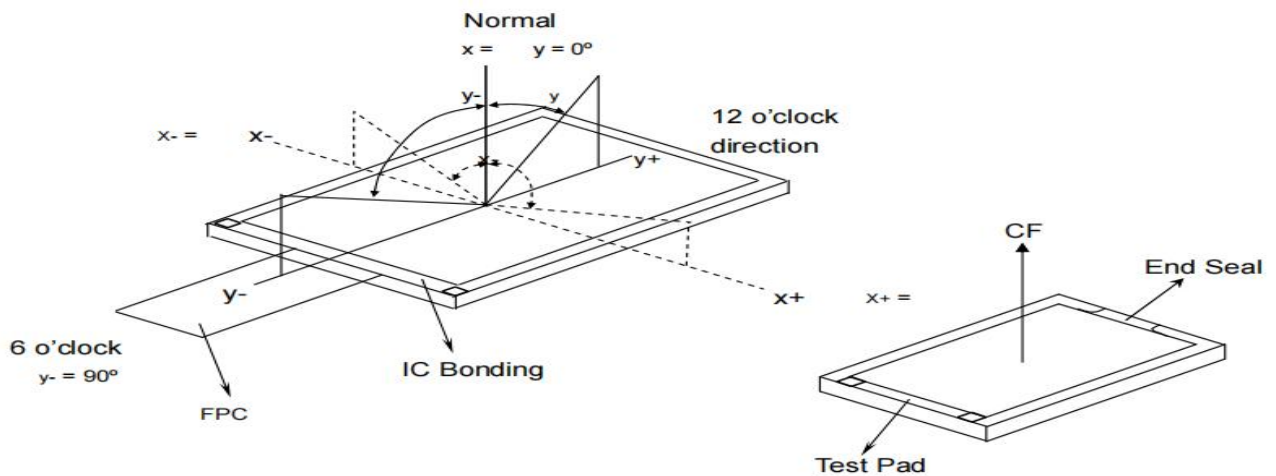
L 0: Luminance of gray level 0

$$CR = CR (X)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (5).

6.2 视角定义 (Description of View Angle)

Measurement Set Up



7. 检验标准 (Inspection standard)

9.1 Inspection conditions is as follows

- 1) Viewing angle is within $\pm 30^\circ$ from vertical direction, as fig 1
- 2) Viewing angle is the angle defined in the drawing
- 3) Ambient temperature is approximately $25 \pm 5^\circ \text{C}$
- 4) Ambient luminance is about 300~500 Lux.

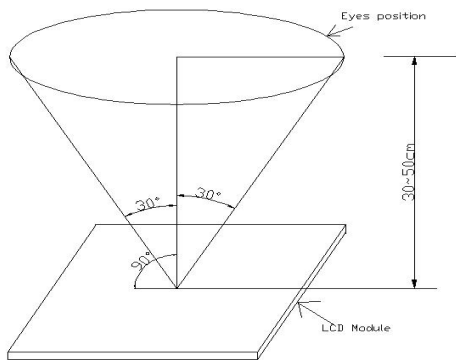
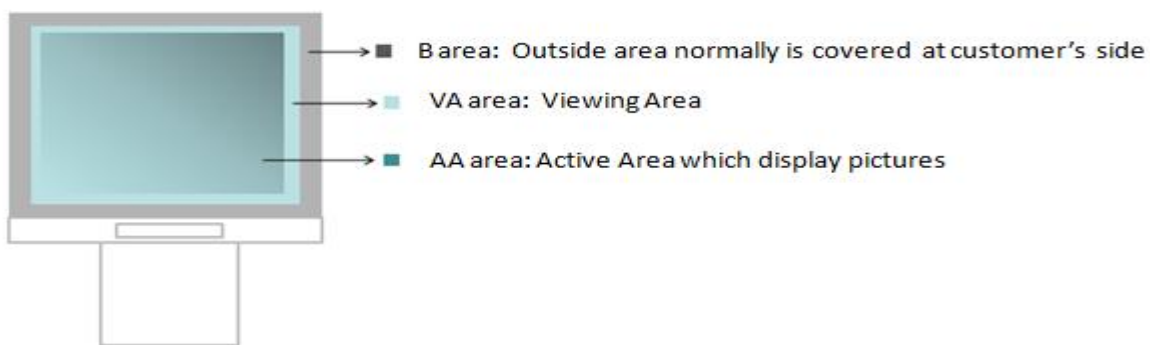


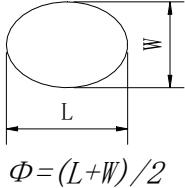
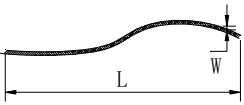
fig1

9.2 Panel area definition



9.3 Routine inspection standards

项目	不良定义	不良现象	判定标准	检验方法	
9.3.1	外观尺寸	与图纸尺寸不相符	NG	卡尺	
9.3.2	功能	显示少线	NG	目视	
		无显示	NG	目视	
		显示异常	NG	目视	主
		TP 功能不良, 无触摸	NG	目视/用手触摸	主

9.3.3	点亮产品可见 及在 LCD 或 T/P 上有擦拭 不掉的点状物	偏光片刺伤、脏点、 圆形物、黑点  $\Phi = (L+W)/2$	$\Phi \leq 0.10mm$		1、距产品 30mm 目视 不见忽略。 2、5mm 间 距内只允 许 3 个点。 3、显示区 只允许 10 个点,超过 以上第 2 第 3 项则 NG。	目 视 (用菲淋 卡比对)	次	
			$0.10mm < \Phi \leq 0.15mm$		1			
			$\Phi > 0.15mm$		NG			
			0.15mm < Φ \leq 0.2mm 按照 A-品入库					
			$\Phi \leq 0.10mm$		1、10mm 间距 内只允许 3 个 2、显示区只 允许 10 个 点,超过以 上任意一项 则 NG	目 视 (用菲淋 卡比对)		
			$0.1mm < \Phi \leq 0.15mm$		4 (TP、屏各 允许 2 个)			
$0.15mm < \Phi \leq 0.2mm$		2 (TP、屏各 允许 1 个)						
$\Phi > 0.2mm$		NG						
9.3.4	点亮产品可见 及在 LCD 或 T/P 上有擦拭 不掉的线状物 /刮伤				允许个数	目视(用 菲琳卡 比对)	次	
			长(L)	宽(W)				
			$\leq 1mm$	$\leq 0.03mm$	2			
			$\leq 2mm$	$0.03 < W \leq 0.05mm$	1			
			$> 2mm$	$> 0.05mm$	NG			
两条线毛之间必须距离 10mm 以上 (3.1 寸—6.0 寸).								

9.3.5	偏光片气泡	$\Phi = (X+Y) / 2$ 	尺寸	允许个数	在日光台灯下撕起保护膜, 距待测物 30cm 目视	次
			1、 $\Phi \leq 0.1\text{mm}$ 2、不超过边框 1/3	不计 (密集不可)		
			$0.10 < \Phi \leq 0.2\text{mm}$	1		
			$\Phi > 0.2\text{mm}$	NG		
			$0.2 < \Phi \leq 1.5\text{mm}$, (边框以外) >2.4寸-6.0寸气泡间距大于10mm以上	3		
9.3.6	T/P 及偏光片凹凸点	T/P: LCD 偏光片上有凹凸点	可视区有水纹(擦拭不掉)拒收 未进入可视区允收, 客户装机后不见允收	在同一视角下用样品比对	次	
9.3.7	<u>Mura</u>	边框四周或任一侧的色差、较画面深、区域云状不均、固定位置之图形凹陷状、封口部分较画面深的半圆形、一圈圈均匀的色差、线状 mura、黑画面可见因 spacer 聚集产生的 mura、均匀的实斜线、区域性斜线、Driver IC 与 TFT 匹配问题等原因的 mura	1.判定画面为 128 灰阶画面, 用 ND filter 盖住 mura 位置进行判定。 2、ND1.3 (ND5%可遮盖不见) 3、双方若有签 限度样品, 优先 限度样品。	ND filter, 128 灰阶画面	次	

8.模组使用注意事项 (Precautions for Use of LCD Modules)

8.1 如果接口定义内有定义 IM0, 请根据规格书 (4.接口定义) 内的定义做正确选择以匹配数据线的位数。

8.2 客户在做结构设计时, 请保证机壳开窗尺寸比触摸屏 V.A 单边少 0.3mm。泡棉开窗尺寸比触摸屏 V.A 单边大 0.2mm。

8.3 模组的主要部件 LCD 和 TP 都是由玻璃组成, 在测试、使用、移动过程中, 请轻拿轻放。当产品不带触摸屏时, 靠近 FPC 的屏幕两端绝对不能受力, 否则会导致玻璃破损和显示不良的发生。

8.4 粘合偏光片、背光、触摸屏的胶材是有机物质, 在接触到甲苯、乙醇、丙酮时, 会破坏粘

性。在使用中，请防止这些物质接触到产品。

8.5 如果显示表面掉落有灰尘、异物，切忌用手直接擦拭。请用棉签轻轻挑擦。

8.6 如果 LCD 破损导致液晶泄露，请不要让皮肤或衣服沾到液晶。如果不小心碰到，请立即用肥皂和清水清洗。

8.7 用手直接触摸显示区域会造成偏光片的损坏，同时容易引起静电问题。

8.8 当模组运行时，在显示区域施加压力会导致显示不正常。撤去外力，重新开机，可以恢复。

8.9 潮湿的环境可能引起玻璃 ITO 的腐蚀，在使用中，在保证规格书要求的最高温度条件下请确保湿度在 60%以下。