



SPECIFICATION FOR TFT LCD MODULE

CUSTOMER : _____

CUSTOMER MODULE : _____

HL MODEL : HG101WU032T01

Preliminary Specification

Final Specification

Customer Confirmation column:

Approved by : _____ Dept. : _____ Date : _____

Please return one of the copies of the specification with your signature to us within two weeks after you receive this document. If it is not returned, we will assume that you agree to the entire contents of this specification document.

Designed by	Checked by	Approved by



Revision History

Version NO.	DATE	Description	Remak
V1.0	2021.02.28	FIRST ISSUE	



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1. GENERAL INFORMATION

1.1 features

- 1) Structure: TFT PANNEL+IC+FPC+BL
- 2) IPS Type LCD 1920 dot-segment and 1200 dot-common outputs
- 3) 16.7M Color can be selected by software
- 4) White LED back light
- 5) MIPI interface
- 6) Operation Temperature : -20~70°C
- 7) Storage Temperature : -30~80°C
- 8) CTP cover lens : Asahi
- 9) CTP structure : G+G
- 10) LED life time: -/

1.2 General specification

Item of	Contents	Unit
Panel Size	10.1	inch
LCD Type	a-si/TRANSMISSIVE	/
Display mode	Normally Black	/
Pixel arrangement	1920*3 (RGB)*1200	Dots
Pixel pitch (W*H)	37.64(H) × RGB × 112.92(V)	um
Active Area	216.8064(H)*135.504(V)	Mm
Module area (W*H*T)	249.96 (H)*168.6(V)*5.28(T)	Mm
Recommended Viewing Direction	ALL	0' clock
LCM IC	HX8290-B	/
TP IC	ILI2511	/
Interface	MIPI	/
Luminance for LCM+TP	360	cd/m2
NTSC	72	%
Weight	TBD	g



3. I/O CONNECTION

Connector : FH34SRJ-34S-0.5SH(50) (HRS) or equivalent

LCM Pin NO	Symbol	I/O	Description
1-3	VLEDINC	P	LED POWER SUPPLY
4	I2C_SDA	I	OTP_SDA
5	I2C_SCL	I	OTP_SCL
6	AGING	I	H,BIST; L NORMAL mode;
7	ID	I	ID Pin(1.8V 拉高或拉低)
8	ADDR	I	1.8V 拉高或拉低(预留)
9	GND	P	Power Ground
10	GND	P	Power Ground
11	GND	I	Power Ground
12	TDN3	I	DSI-D3- differential data signals for MIPI interface
13	TDP3	I	DSI-D3+ differential data signals for MIPI interface
14	GND	I	Power Ground
15	TDN0	I	DSI-D0- differential data signals for MIPI interface
16	TDP0	I	DSI-D0+ differential data signals for MIPI interface
17	GND	I	Power Ground
18	TCN	I	DSI-CLK- differential clock signals for MIPI interface
19	TCP	I	DSI-CLK+ differential clock signals for MIPI interface
20	GND	I	Power Ground
21	TDN1	I	DSI-D1- differential data signals for MIPI interface
22	TDP1	I	DSI-D1+ differential data signals for MIPI interface
23	GND	I	Power Ground
24	TDN2	I	DSI-D2- differential data signals for MIPI interface
25	TDP2	I	DSI-D2+ differential data signals for MIPI interface
26	GND	I	Power Ground
27	STBYB	I	Timing control
28	SCL	I	SCL for Bridge IC(1.8V)
29	SDA	I	SDA for Bridge IC(1.8V)
30	LED_PWM	I	Backlight LED PWM signal pin(1.8V)
31	Bridge_EN	I	Bridge_EN
32	VDD-OTP	P	OTP Power supply VDD OTP=8.6V
33-34	VDD	P	Power supply for digital circuits and IO pads(3.3V)

I: Input; O: Output; P: Power

TP NO.	Pin	Symbol	I/O	Description
1		GND	P	Power Ground
2		INT	O	Interrupt signals for TP
3		SDA	I/O	I2C data signals for TP
4		SCL	I	I2C clock signals for TP
5		RST	I	The signal will reset the TP, Signal is active low.
6		AVDD	P	TP-VCC Power Supply for TP



4. ABSOLUTE MAXIMUM RATINGS

(GND=AGND=0V)

Parameter of absolute maximum ratings 参数	Symbol 符号	Min 最小值	Max 最大值	Unit 单位
Power supply voltage1	VDD	VSS-0.3	3.6	V
Operating temperature	T _{op}	-20	70	°C
Storage temperature	T _{st}	-30	80	°C
Humidity	RH	10	90	RH

Note:

1. These range above is maximum value not the actual operating temperature . Actual Operating temperature is no more than 40°C and temperature refers to the LCM surface temperature ;
2. BOE is not responsible for product problems beyond the use conditions.

5. ELECTRICAL CHARACTERISTICS

5.1 TFT LCD Module

LCD Module Electrical specifications

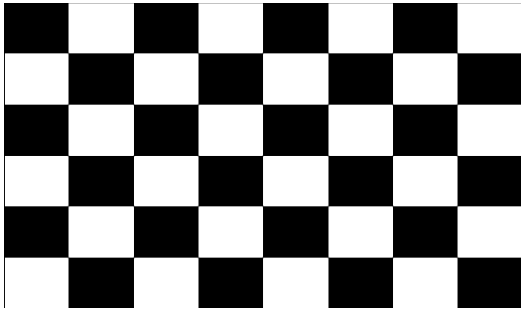
Parameter	Symbol	Values			Unit	Notes	
		Min.	Typ.	Max.			
Power Supply Voltage	VDD	3.0	3.3	3.6	V		
	VRP			300	mV	Ripple	
Power Supply Current	IDD	-	300	360	mA	Note 1	
Power Consumption	PLCD	-	1	1.2	W		
Rush current	IRUSH	-	-	3.0	A	Note 2	
CMOS Interface	Input Voltage	V _{IH}	2.7		3.3	V	
		V _{IL}	0		0.5	V	
	Output Voltage	V _{OH}	2.7		3.3	V	
		V _{OL}	0		0.5	V	

Notes : 1. The supply voltage is measured and specified at the interface connector of LCM.



The current draw and power consumption specified is for VDD=3.3V, Frame rate f V =60Hz and Clock frequency = 490MHz. Test Pattern of power supply current

a) Typ : Mosaic 8 x 6 Pattern(L0/L255)



b) Max : skip subPixel(L255)

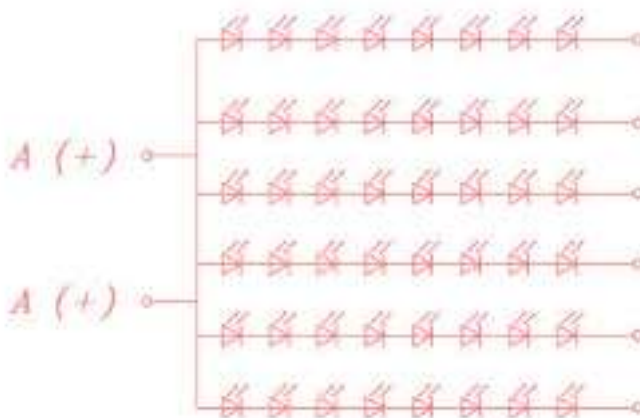


2. The duration of rush current is about 2ms and rising time of Power Input is 1ms(min)

5.2 Back-light Unit

LED Driving guideline specifications

Parameter		Values			Unit	Notes
		Min.	Typ.	Max.		
LED Forward Voltage	V_F	-	-	3.0	V	Note 1 (8pcs Serial 6pcs Parallel.)
LED Forward Current	I_F	-	22	-	mA	
Power Consumption	P_{LED}	-	3.73	-	W	
LED Quantity	-	-	48	-	EA	
LED Life Time	N/A	15000	-	-	Hrs	$I_F=22mA$ Note 2



Notes : 1. Power supply voltage 24V for LED Driver

Calculator Value for reference $I_F \times V_F \times 48 / 85\%(\text{efficiency}) = P_{LED}$

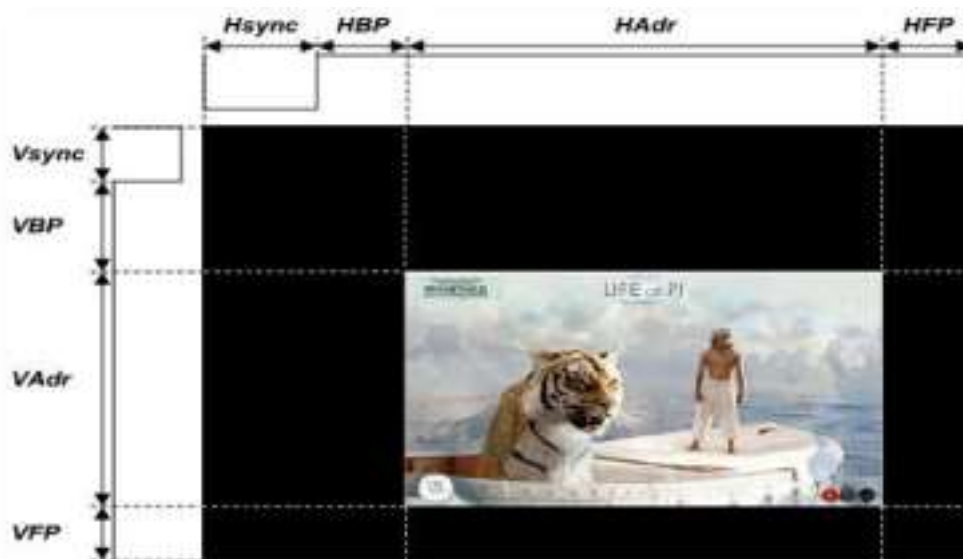
2. The LED Life-time define as the estimated time to 50% degradation of initial luminous.

5.3 Interface timing Parameter

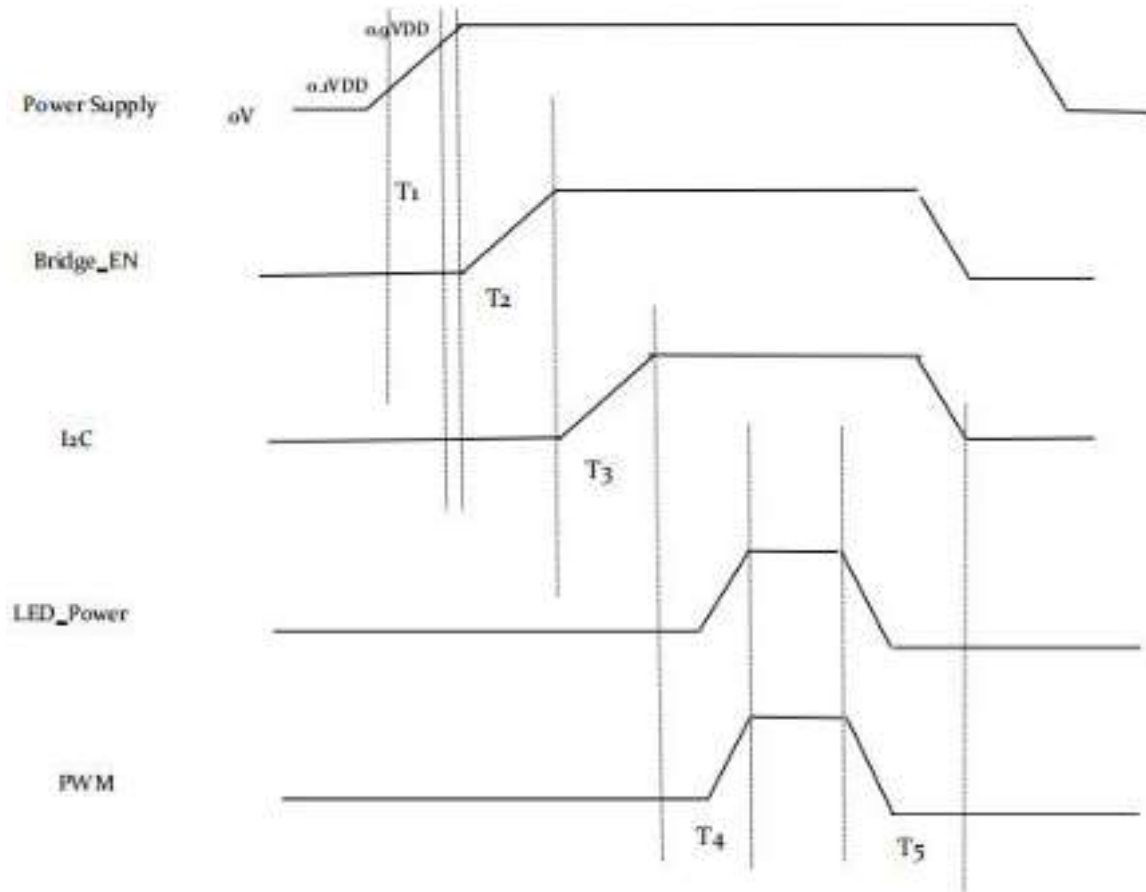


MIPI Timing Parameter

ITEM		SYMBOL	min	typ	max	UNIT	
LCD	Frame Rate	-	-	60	-	Hz	
	Pixels Rate	-	156.8	156.8	159.9	MHz	
Timing	Mipi CLK	Frequency	fCLK	490	498	MHz	
		Period	Tclk	2.01	2.04	ns	
	Horizontal	Horizontal total time	tHP	1343	1343	1366	tCLK
		Horizontal Active time	tHadr	1200			tCLK
		Horizontal Pulse Width	#Hsync	1	1	1	tCLK
		Horizontal Back Porch	tHBP	32	32	32	tCLK
		Horizontal Front Porch	tHFP	110	110	133	tCLK
	Vertical	Vertical total time	tp	1946	1946	1951	tH
		Vertical Active time	tVadr	1920			tH
		Vertical Pulse Width	tVsync	1	1	1	tH
		Vertical Back Porch	tVBP	14	14	14	tH
Vertical Front Porch		tVFP	11	11	16	tH	
Bit Rate		TX SPD (MBPS)	980	980	995	Mbps	
Lane			-	4	-	Lane	



5.4 Power Sequence



$0.5 \text{ ms} \leq T1 \leq 10 \text{ ms}$

T2:10ms

T3:10ms

$200\text{ms} \leq T4$

$200\text{ms} \leq T5$



5.5 Power Sequence

INITIALIZATION SEQUENCE NUMBER	INITIALIZATION SEQUENCE DESCRIPTION
Init seq 1	Power on
Init seq 2	After power is applied and stable, the DSI CLK lanes MUST be in HS state and the DSI data lanes MUST be driven to LP11 state
Init seq 3	Set EN pin to Low
Wait 10 ms ⁽¹⁾	
Init seq 4	Tie EN pin to High
Wait 10 ms ⁽¹⁾	
Init seq 5	Initialize all CSR registers to their appropriate values based on the implementation (The SN65DSI8x is not functional until the CSR registers are initialized)
Init seq 6	Set the PLL_EN bit (CSR 0x0D.0)
Wait 10 ms ⁽¹⁾	
Init seq 7	Set the SOFT_RESET bit (CSR 0x09.0)
Wait 10 ms ⁽¹⁾	
Init seq 8	Change DSI data lanes to HS state and start DSI video stream
Wait 5 ms ⁽¹⁾	
Init seq 9	Read back all registers and confirm they were correctly written
Init seq 10	Write 0xFF to CSR 0xE5 and CSR 0xE6 to clear the error registers
Wait 1 ms ⁽¹⁾	
Init seq 11	Read CSR 0xE5 and CSR 0xE6. If CSR 0xE5 and CSR 0xE6 != 0x00, then go back to step #2 and re-initialize

(1) Minimum recommended delay. It is fine to exceed these.

注：1) CSR registers, PLL_EN,SOFT_RESET 都是寄存器，上电时需要通过 I2C 配置。

Data 的状态由处理器进行控制。

2) Sequence 9,10,11，这些是 IC 监测到错误后重新启动时的初始化流程，如果需要可以不设置。

3) 背光 PWM 时序需与 LED_Power 同时上电。



6. ELECTRO-OPTICAL CHARACTERISTICS

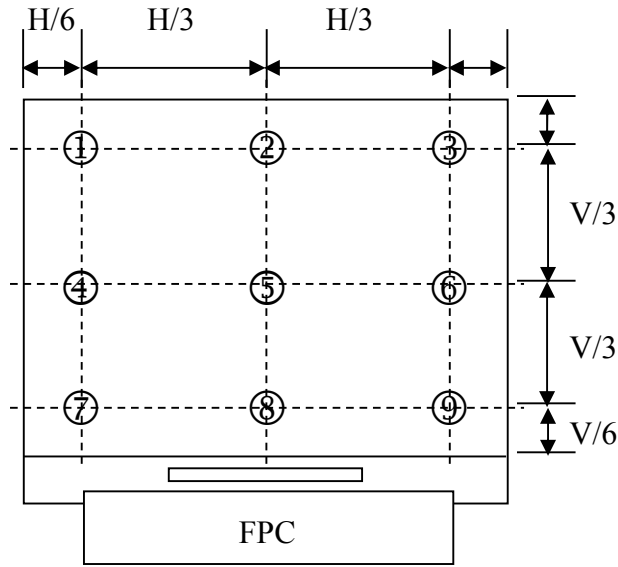
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio (Center point)		C/R	-	700	900	-	-	Note(1)	
Luminance uniformity		U _w	$\theta = 0$. Normal viewing angle B/L On Note(1)	75	80	-	%	Note(2)	
Response Time		Tr + Tf		-	30	35	ms	Note(3)	
Color Chromaticity (CIE 1931)	White	W _x			0.30			参考 值	Note(5)
		W _y			0.32				
	Red	R _x			0.644				
		R _y			0.344				
	Green	G _x		-0.02	0.315	+0.02			
		G _y			0.632				
	Blue	B _x			0.157				
		B _y			0.054				
Viewing Angle	Hor.	∅ 3R	C/R≥10	70	80	-	Deg	Note(4)	
		∅ 9L		70	80	-			
	Ver.	∅ 12U		70	80	-			
		∅ 6D		70	80	-			



Note1 Definition of Contrast Ratio (CR):

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note2: Definition of Luminance Uniformity: Active area is divided into 9 measuring areas (Shown in below), every measuring point is placed at the center of each measuring area.



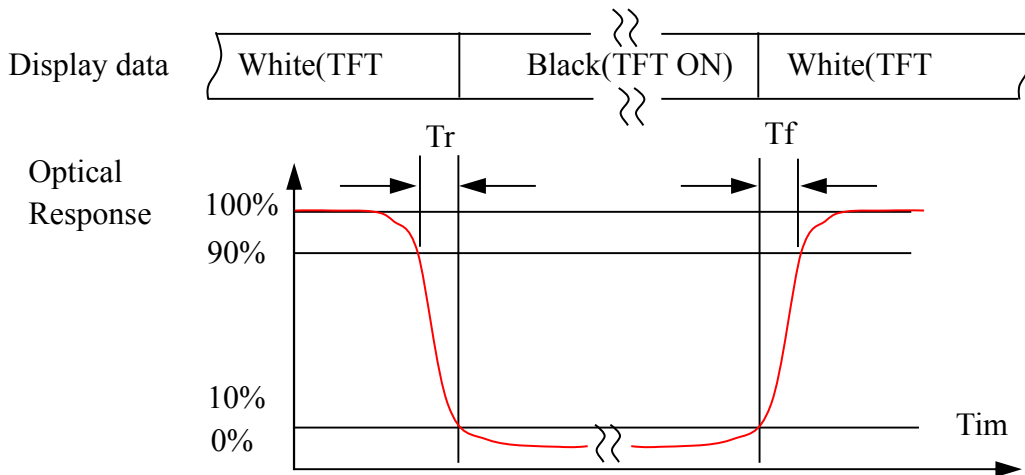
The spot locations for luminance measurement

$$\text{Luminance Uniformity} = \frac{B_{\min}}{B_{\max}} \times 100\%$$

B_{\max} : The measured maximum luminance of all measurement position.

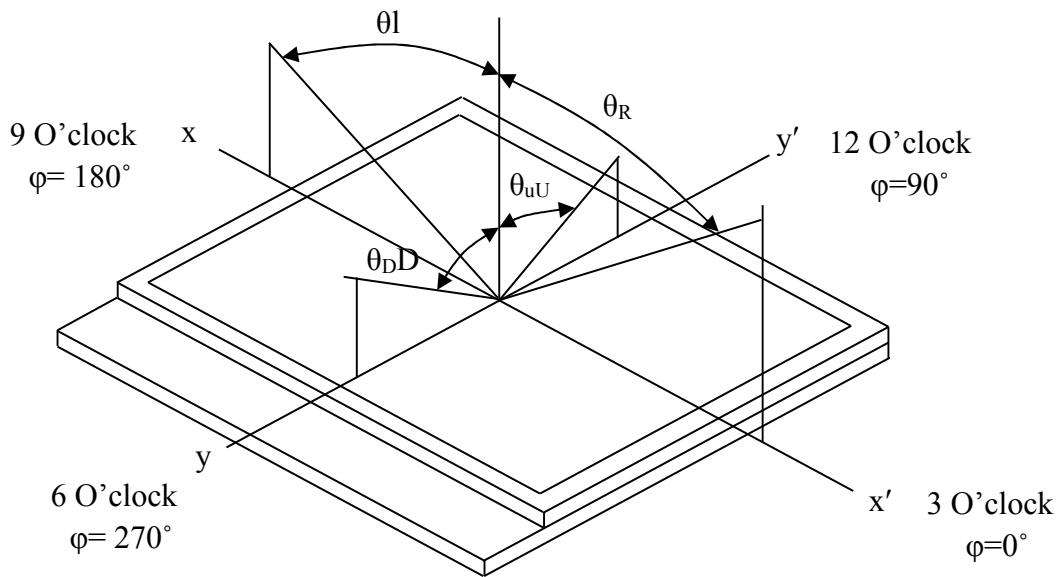
B_{\min} : The measured minimum luminance of all measurement position.

Note 3: Definition of Response time: Sum of T_r and T_f





Note4.Definition of Viewing Angle: The viewing angle range that the $CR \geq 10$



Note 5: Definition of Color Chromaticity (CIE 1931)

Color coordinate of white & red, green, blue at center point.



7. RELIABILITY TEST CONDITIONS

No	Test Item	Test Condition	STANDARD
1	High Temperature Storage	+80°C / 96Hours	1. Functional test is OK. Missing Segment, short, unclear segment, on-display, display abnormally and liquid crystal leak are un-allowed. 2. No low temperature bubbles, end seal loose and fall, frame rainbow.
2	Low Temperature Storage	-30°C / 96Hours	
3	High Temperature Operating	+70°C / 96Hours	
4	Low Temperature Operating	-20°C / 96Hours	
5	Thermal and cold shock	0°C↔+50°C x 10cycles (30min) (5min) (30min)	
6	Operate at High Temperature and Humidity	60°C x 90%RH / 24H	
7	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude:1.5mm, 2 hours for each direction of X, Y, Z	1. Function test is OK. 2. No glass crack, chipped glass, end seal loose and fall, epoxy frame crack and so on. 3. No structure loose and fall.
8	Dropping test	Drop to the ground from 1m height, 1 corner, 3 edges, 6 surfaces.	
9	ESD test	Contact: ±4KV Air: ±8KV 150PF/330Ω,5Points/pa nel,5times	The test results shall be subject to the whole machine test.

NOTE:

1. The reliability items will be fully performed in new sample qualification,
2. The reliability status will be tested as monitor during mass production. Individual reliability test shall be performed by lot, Moreover, the individual reliability item shall be decided according to reliability plan.
3. All samples are inspected after keeping in the room with normal temperature and humidity for 2 hours or above.
4. Vibration test: It is not necessary to test for those products without assembly frame, backlight, PCB and so on.
5. Dropping test: It is necessary for affirming new package.
6. For the high temperature and high humidity test, pure water of over 10 MΩ.cm should be used.
7. Each test item applies for test LCM only once. Then tested LCM cannot be used again in any other test item.
8. The quantity of LCM examination for each test item is 5pcs to 10pcs.



8. INSPECTION STANDARDS

8.1 AQL Sampling inspection standard

使用 GB/T 2828-2003 一般 II 水平, 采用正常检查一次抽样方式; 具体抽检方式参照《成品检验管理程序》、《抽样管理规范》

缺陷区分	AQL 允收水准
严重缺陷	0 收 1 退
重缺	0.4
轻缺	1.0

8.2 Inspect the condition

8.2.1 在 20—40W 日光灯的照明条件下, 样品离检查者眼睛约 30cm 处进行检查。检验方向以垂直线前后左右 45° (以时钟 3 点、6 点、9 点、12 点)

8.2.2 检验者视力需达到标准视力 1.0 以上。

8.2.3 检验者需戴静电手环、两手八个手指套。

8.2.4 外观检验者以目视检查或以菲林对比卡比对。

8.2.5 电性测试使用电测测架, 主板, 电源线及单片机。

8.2.6 若标准与规格书不符时, 以产品发行之规格书特殊检验规格、工程变更为准

8.2.7 辉色度检测请参照样品, 检测方法依照辉色度检验标准。

8.2.8 电测检验环境: 照度为 200LUX 以下, 外观检验环境: 照度为 600LUX-1000LUX, 检验时间: 1 秒-3 秒。

8.2.9 检验工具: 电测测架, 主板, 电源线及单片机, 菲林对比卡, 游标卡尺, 放大镜, 实体显微镜 (必要时) 等等。

8.3 Judgment criterion

小尺寸点、线判定标准: (6.2 寸以内)

1	点状缺陷 (磨伤、异物、针孔、凹痕、缺膜、气泡、白点、彩点、脏点)		判定 (A/B/C 区)	$D \leq 0.10$, 忽略不计, 但密集型不允许	MI	OK
				$0.1 < D \leq 0.15$, $ds \geq 10$		$N \leq 2$
				$0.15 < D \leq 0.2$, $ds \geq 10$		$N \leq 1$
				LCD 亮点: $0.15 < D$		$N \leq 1$
				$D > 0.2$		NG
			判定 (D 区)	同背面丝印油墨区杂质判定标准		
			注: 1) D 区的点状缺陷需在不影响 CTP 功能、客户组装及整机的外观的情况下, 判定 OK		MI	
2	线状缺陷 (磨伤、无感划伤、毛屑、纤维等)		判定 (A/B/C 区)	$W \leq 0.03mm$, $L \leq 3mm$, $ds \geq 10$	MI	$N \leq 2$
				$0.03mm < W \leq 0.05mm$, $L \leq 3mm$, $ds \geq 10$		$N \leq 1$
				$W > 0.05mm$ 或 $L > 3mm$		NG



中尺寸点、线判定标准：（6.2 8寸以内）

1	点状缺陷 (磨伤、异物、针孔、凹痕、缺膜、气泡、白点、彩点、脏点)		判定(A/B/C区)	$D \leq 0.10$, 忽略不计, 但密集型不允许 $0.15 < D \leq 0.25$, $ds \geq 10$ $0.25 < D \leq 3$, $ds \geq 10$ LCD亮点: $0.2 < D$ $D > 0.3$	MI	OK
			判定(D区)	同背面丝印油墨区杂质判定标准		N \leq 2 N \leq 1 N \leq 1 NG
			注: 1) D区的点状缺陷需在不影响CTP功能、客户组装及整机的外观的情况下, 判定OK		MI	
2	线状缺陷 (磨伤、无感划伤、毛屑、纤维等)		判定(A/B/C区)	$W \leq 0.03mm$, $L \leq 3mm$, $ds \geq 10$ $0.03mm < W \leq 0.05mm$, $L \leq 3mm$, $ds \geq 10$	MI	N \leq 2
				$W > 0.05mm$ 或 $L > 3mm$		N \leq 1
						NG

大尺寸点、线判定标准：（8.1~13.3寸以内）

1	点状缺陷 (磨伤、异物、针孔、凹痕、缺膜、气泡、白点、彩点、脏点)		判定(A/B/C区)	$D \leq 0.1$, 忽略不计, 但密集型不允许 $0.15 < D \leq 0.3$, $ds \geq 10$ $0.3 < D \leq 0.35$, $ds \geq 10$ LCD亮点: $0.25 < D$ $D > 0.35$	MI	OK
			判定(D区)	同背面丝印油墨区杂质判定标准		N \leq 2 N \leq 1 N \leq 1 NG
			注: 1) D区的点状缺陷需在不影响CTP功能、客户组装及整机的外观的情况下, 判定OK		MI	
2	线状缺陷 (磨伤、无感划伤、毛屑、纤维等)		判定(A/B/C区)	$W \leq 0.05mm$, $L \leq 5mm$, $ds \geq 10$ $0.05mm < W \leq 0.07mm$, $L \leq 5mm$, $ds \geq 10$	MI	N \leq 2
				$W > 0.07mm$ 或 $L > 5mm$		N \leq 1
						NG



9. PACKAGE DRAWING

