



# SPECIFICATION FOR TFT LCD MODULE

CUSTOMER : \_\_\_\_\_

CUSTOMER MODULE : \_\_\_\_\_

HL MODEL : HG070WV035T01

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





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## 1. GENERAL INFORMATION

### 1.1 features

- 1) Structure: TFT PANNEL+IC+FPC+BL+CTP
- 2) IPS Type LCD 800 dot-segment and 480 dot-common outputs
- 3) 16.7M Color can be selected by software
- 4) White LED back light
- 5) RGB interface
- 6) Operation Temperature : -20~60°C
- 7) Storage Temperature : -30~70°C
- 8) CTP cover lens : Asahi Glass 1.1mm
- 9) CTP structure : Glass+Glass
- 10) LED life time: -/

### 1.2 General specification

Item of	Contents	Unit
Panel Size	7.0	inch
LCD Type	a-si/TRANSMISSIVE	/
Display mode	Normally White	/
Pixel arrangement	800*3(RGB)*480	Dots
Pixel pitch (W*H)	64.2(H)*179 (V)	um
Active Area	154.08(H)*85.92(V)	Mm
Module area (W*H*T)	164.9 (H)*100(V)*7.85(T)	Mm
Recommended Viewing Direction	6	0' clock
Interface	RGB	/
Luminance for LCM	800	cd/m2
Weight	TBD	g





## 3. I/O CONNECTION & BLOCK DIAGRAM

### 3.1 I/O connection

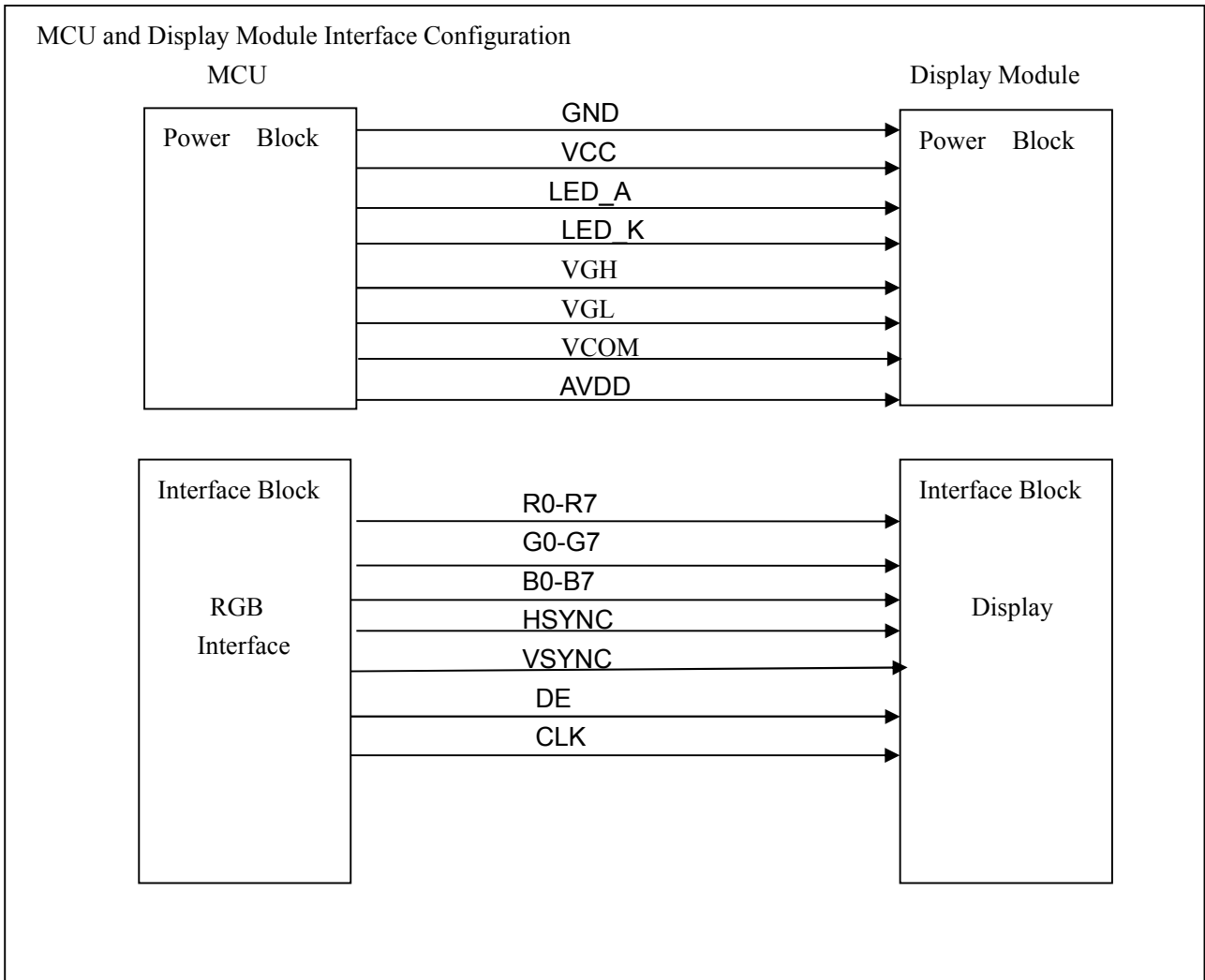
LCM Pin NO.	Symbol	I/O	Description
1-2	LEDA	P	LED Anode
3-4	LEDK	P	LED Cathode
5	GND	P	Ground
6	VCOM	P	Common voltage
7	DVDD	P	Power Voltage for digital circuit
8	MODE		DE/SYNC mode select
9	DE	I	DATA INPUT Enable
10	VSYNC	I	Vertical Synchronization
11	HSYNC	I	Horizontal Synchronization
12-19	B7~B0	I	Blue data
20-27	G7~G0	I	Green data
28-35	R7~R0	I	Red data
36	GND	P	Ground
37	DCLK	I	Parallel RGB clock input
38	GND	P	Ground
39	L/R	I	Left/Right selection
40	U/D	I	Up/Down selection
41	VGH	P	Gate ON Voltage
42	VGL	P	Gate OFF Voltage
43	AVDD	P	Power for Analog Circuit
44	RESET		Global reset pin
45	NC	-	
46	VCOM	P	Common voltage
47	DITHER	P	Dithering function
48	GND	P	Ground
49-50	NC	-	

I: Input; O: Output; P: Power

TP Pin NO.	Symbol	I/O	Description
1	AVDD	P	TP-VCC(3.3V) Power Supply for TP
2	RST	I	The signal will reset the TP, Signal is active low.
3	INT	O	Interrupt signals for TP
4	SCL	I	I2C clock signals for TP(3.3V)
5	SDA	I/O	I2C data signals for TP(3.3V)
6	GND	P	Power Ground



## 3.2 block diagram





## 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 voltage	VCC	-0.3	5	V
Backlight forward current	I <sub>LED</sub>	-0.001	30	mA(For each led)
Reverse Voltage	V <sub>R</sub>	-	10	V
Operating temperature	T <sub>op</sub>	-20	60	°C
Storage temperature	T <sub>st</sub>	-30	70	°C
Humidity	RH	-	90%(Max)/60°C	RH



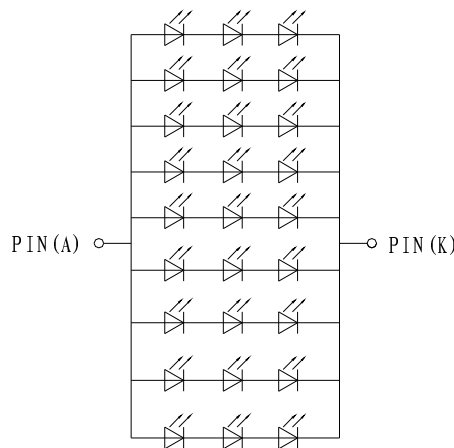


## 5. ELECTRICAL CHARACTERISTICS

### 5.1 Typical Operation Conditions

Item	Symbol 符号	Min 最小值	TYP 典型值	Max 最大值	Unit 单位
Power voltage	Dvdd	3	3.3	3.6	V
	AVDD	10.2	10.4	10.6	V
	VGH	15.3	16	16.7	V
	VGL	-7.7	-7	-6.3	V
Input signal voltage	VCOM	3.6	3.8	4	V
Input logic high voltage	V1H	0.7Dvdd	-	Dvdd	V
Input logic low voltage	V1L	0	-	0.3Dvdd	V
LED Forward voltage	Vf	8.4	9.6	10.2	V
Input backlight current	Iled	-	180	-	mA

Note: The "LED life time" is defined as the module brightness decrease to 50% of original brightness at  $I_L=20\text{mA}$  (for each led). The LED life time could be decreased if operating  $I_L$  is larger than 20mA





## 5.2 DC CHARACTERISTICS

Parameter	Symbol	Spec.			Unit	Condition
		Min.	Typ.	Max.		
Power supply voltage	VDD	2.7	3.3	3.6	V	-
Power supply voltage	AVDD	6.5	-	13.5	V	AVDD-V1 ≥ 0.5V
Low level input voltage	V <sub>IL</sub>	0	-	0.3VDD	V	For Digital Circuit
High level input voltage	V <sub>IH</sub>	0.7VDD	-	VDD	V	For Digital Circuit
Output low voltage	V <sub>OL</sub>	-	-	GND+0.4	V	I <sub>OL</sub> =400μA
Output high voltage	V <sub>OH</sub>	VDD-0.4	-	-	V	I <sub>OH</sub> =-400μA
Pull low/high resistance	R <sub>p</sub>	200K	250K	300K	Ohm	For the digital input pin @VDD=3.3V
Input leakage current	I <sub>i</sub>	-	-	+/- 1	μA	For Digital Circuit
Digital Operation current	I <sub>DD</sub>	-	5	10	mA	F <sub>clk</sub> =50MHz, F <sub>LD</sub> =48KHz, VDD=3.3V CABC function disable, No load
Digital stand-by current	I <sub>st1</sub>	-	10	50	μA	Clock & all functions are stopped
Analog Operating current	I <sub>DDA</sub>	-	5	10	mA	No load, F <sub>clk</sub> =50MHz, F <sub>LD</sub> = 48KHz @ AVDD = 10V, V1=8V, V14 = 0.4V
Analog Stand-by current	I <sub>st2</sub>	-	10	50	μA	No load, Clock & all functions are stopped
Input level of V1 - V7	V <sub>ref1</sub>	0.4*AVDD	-	AVDD-1	V	Gamma correction voltage input
Input level of V8 - V14	V <sub>ref2</sub>	0.1	-	0.6*AVDD	V	Gamma correction voltage input
Output Voltage deviation	V <sub>od1</sub>	-	+/-20	+/-35	mV	V <sub>O</sub> =AGND+0.1V ~ AGND+0.5V & V <sub>O</sub> =AVDD-0.5V ~ AVDD-0.1V
Output Voltage deviation	V <sub>od2</sub>	-	+/-15	+/-20	mV	V <sub>O</sub> =AGND+0.5V ~ AVDD-0.5V
Output Voltage Offset between Chips	V <sub>oc</sub>	-	-	+/- 20	mV	V <sub>O</sub> =AGND+0.5V ~ AVDD-0.5V
Dynamic Range of Output	V <sub>dr</sub>	0.1	-	AVDD-0.1	V	SO1 - SO1200
Sinking Current of Outputs	I <sub>OLy</sub>	80	-	-	μA	SO1-SO1200; V <sub>O</sub> = 0.1V vs. 1.0V, AVDD=13.5V
Driving Current of Outputs	I <sub>OHy</sub>	80	-	-	μA	SO1 - SO1200 ; V <sub>O</sub> = 0.1V vs. 12.5V , AVDD=13.5V
Resistance of Gamma Table	R <sub>g</sub>	0.7*R <sub>n</sub>	1.0*R <sub>n</sub>	1.3*R <sub>n</sub>	ohm	R <sub>n</sub> :Internal gamma resistor
Dcmp Buffer Output Voltage variation	V <sub>Dvar</sub>	-	-	-180	mV	AVDD=13.5V, C=1μF AVDD-0.5 ≤ GMI 1/2 ≤ AVDD-0.1 I <sub>sink</sub> = -3.5mA
		-	-	180	mV	AVDD=13.5V, C=1μF 0.1 ≤ GMI 1/2 ≤ 0.5 I <sub>source</sub> = 3.5mA , I <sub>sink</sub> = -3.5mA
		-	-	+/-90	mV	AVDD=13.5V, C=1μF 0.5 ≤ GMI 1/2 ≤ AVDD-0.5 I <sub>source</sub> = 3.5mA , I <sub>sink</sub> = -3.5mA

## 5.3 AC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
HS setup time	T <sub>hst</sub>	8	-	-	ns
HS hold time	T <sub>hhd</sub>	8	-	-	ns
VS setup time	T <sub>vst</sub>	8	-	-	ns
VS hold time	T <sub>vhd</sub>	8	-	-	ns
Data setup time	T <sub>dsu</sub>	8	-	-	ns
Data hold time	T <sub>dhd</sub>	8	-	-	ns
DE setup time	T <sub>esu</sub>	8	-	-	ns
DE hold time	T <sub>ehd</sub>	8	-	-	ns
VDD Power On Slew rate	TPOR	-	-	20	ms
RSTB pulse width	TRst	10	-	-	μs
CLKIN cycle time	T <sub>cph</sub>	20	-	-	ns
CLKIN pulse duty	T <sub>cwh</sub>	40	50	60	%
Output stable time	T <sub>sst</sub>	-	-	6	μs



### 5.4. Data input format

- Horizontal timing

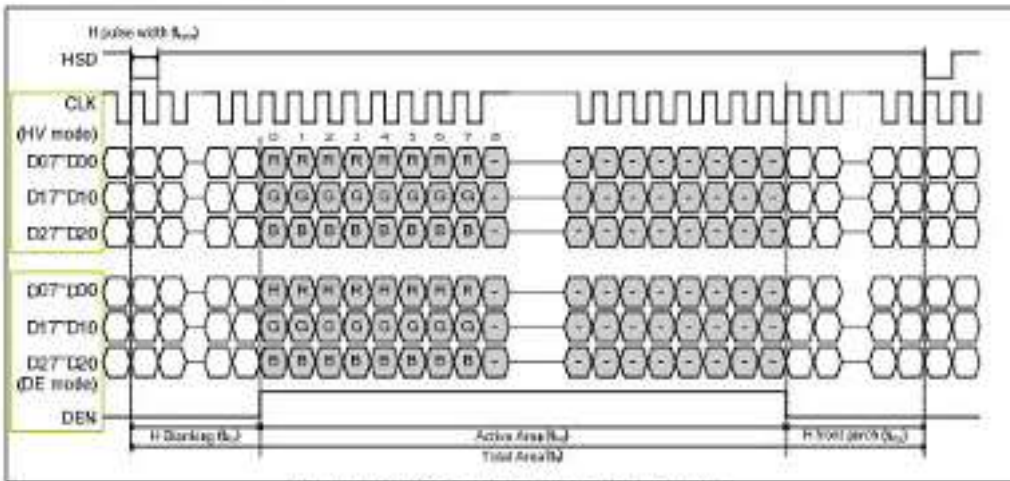


Figure 11.1 Horizontal input timing diagram

- Vertical Timing

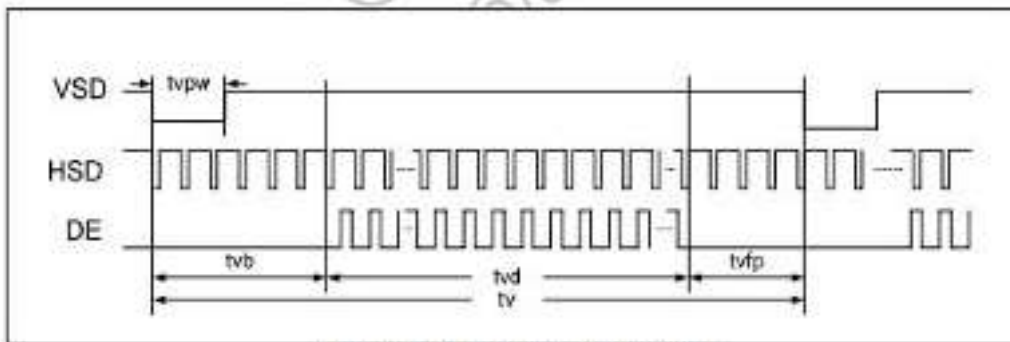


Figure 11.2: Vertical input timing diagram

- Horizontal Timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Horizontal Display Area	thd	-	800	-	DCLK
DCLK frequency	fclk	-	33.3	50	MHz
One Horizontal Line	th	862	1056	1200	DCLK
HS pulse width (Min.)	thpw	1			DCLK
HS pulse width (Typical.)	thpw	-			DCLK
HS pulse width (Max.)	thpw	40			DCLK
HS Back Porch (Blanking)	thb	46	46	46	DCLK
HS Front Porch	thfp	18	210	354	DCLK
DE mode Blanking	th-thd	45	256	400	DCLK

- Vertical Timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd	480			TH
VS period time	tv	510	525	650	TH
VS pulse width	tvpw	1	-	20	TH
VS Back Porch (Blanking)	tvb	23	23	23	TH
VS Front Porch	tvfp	7	22	147	TH
DE mode Blanking	tv-tvd	4	45	170	TH



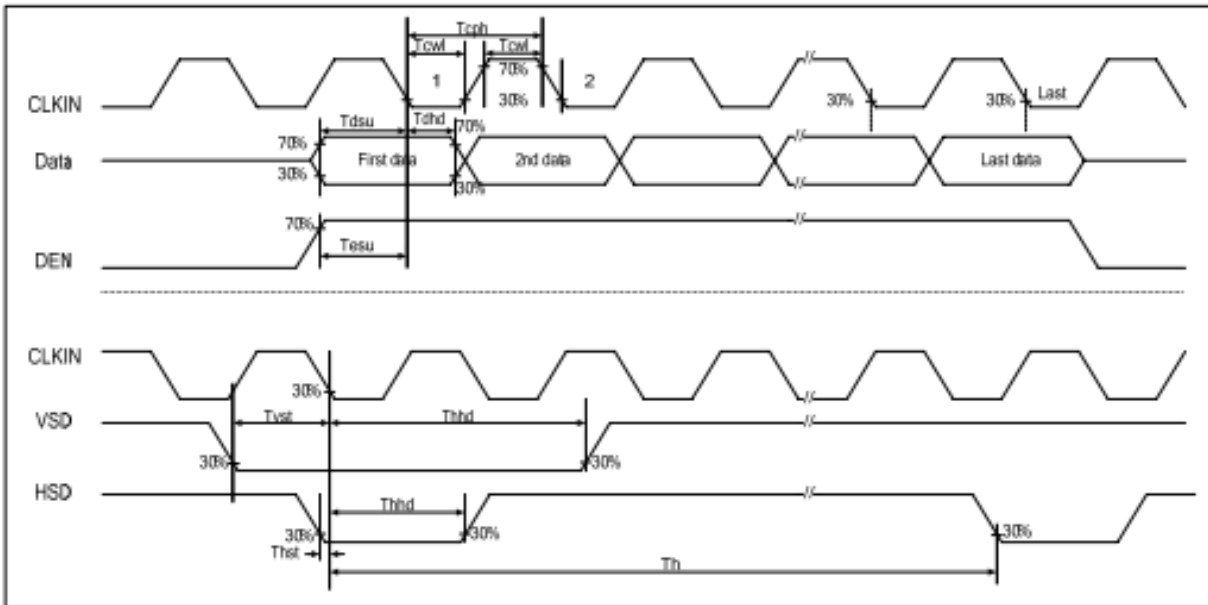
## 5.5. Waveform

### 5.5.1 Parallel 24-bit RGB mode

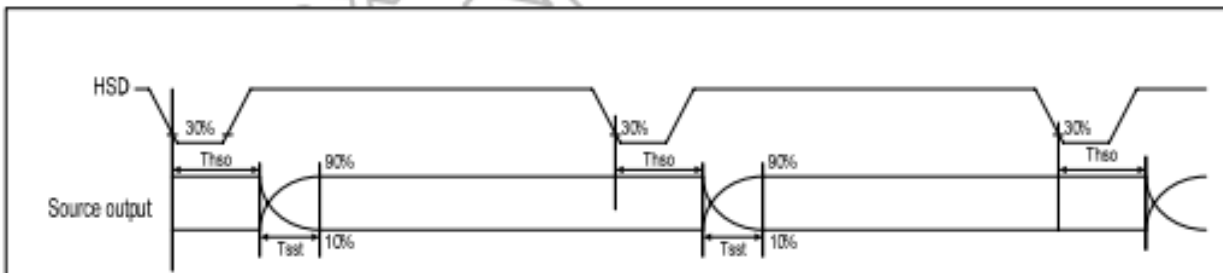
Parameter	Symbol	Spec.			Unit	Conditions
		Min.	Typ.	Max.		
CLKIN Frequency	Fdk	-	40	50	MHz	VDD = 3.0V ~ 3.6V
CLKIN Cycle Time	Tclk	20	25	-	ns	-
CLKIN Pulse Duty	Tcwh	40	50	60	%	Tclk
Time from HSD to Source Output	Thso	-	20	-	CLKIN	-
Time from HSD to LD	Thld	-	20	-	CLKIN	-
Time from HSD to STV	Thstv	-	2	-	CLKIN	-
Time from HSD to CKV	Thckv	-	20	-	CLKIN	-
Time from HSD to OEV	Thoev	-	4	-	CLKIN	-
LD Pulse Width	Twid	-	10	-	CLKIN	-
CKV Pulse Width	Twckv	-	66	-	CLKIN	-
OEV Pulse Width	Twoev	-	74	-	CLKIN	-

### 5.5.2 Timing diagram

Input clock and data timing waveform



Source output timing waveform





## 6. ELECTRO-OPTICAL CHARACTERISTICS

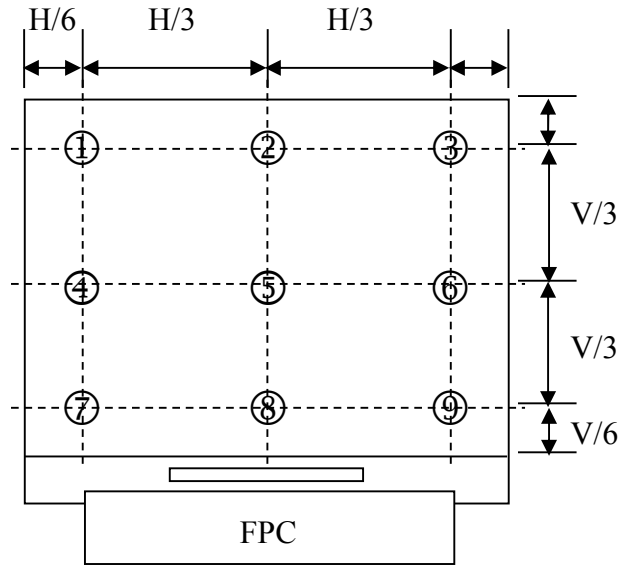
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Note	
Contrast Ratio (Center point)		C/R	-	400	500	-	-	Note(1)	
Luminance uniformity		U <sub>w</sub>	θ = 0. Normal viewing angle B/L On  Note(1)	80	85	-	%	Note(2)	
Response Time		Tr + Tf		-	25	50	ms	Note(3)	
Color Chromaticity (CIE 1931)	White	W <sub>x</sub>			0.30			参考 值	Note(5)
		W <sub>y</sub>			0.32				
	Red	R <sub>x</sub>		0.571					
		R <sub>y</sub>		0.352					
	Green	G <sub>x</sub>	-0.02	0.345	+0.02				
		G <sub>y</sub>		0.557					
	Blue	B <sub>x</sub>		0.148					
		B <sub>y</sub>		0.128					
Viewing Angle	Hor.	∅ 3R	C/R≥10	60	70	-	Deg	Note(4)	
		∅ 9L		60	70	-			
	Ver.	∅ 12U		40	50	-			
		∅ 6D		60	70	-			



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.



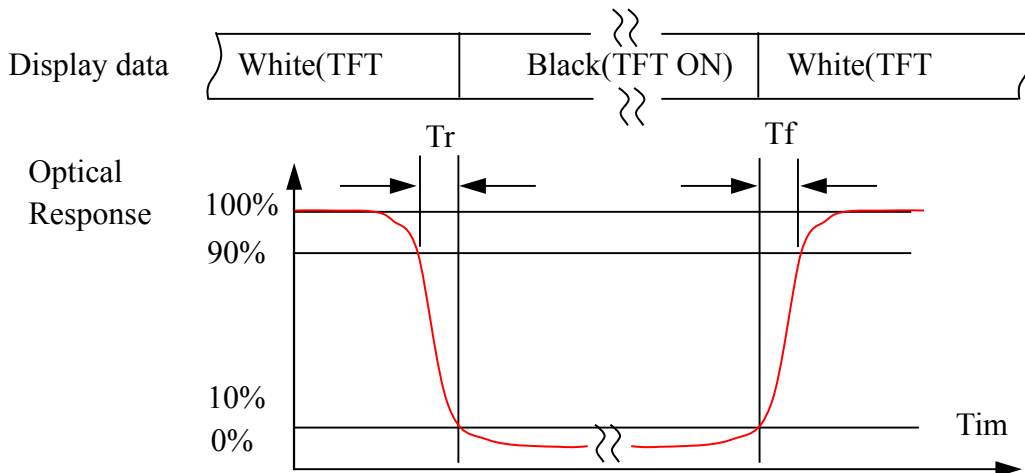
The spot locations for luminance measurement

$$\text{Luminance Uniformity} = \frac{H/6 \cdot B_{\min}}{V/6 \cdot B_{\max}} \times 100\%$$

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

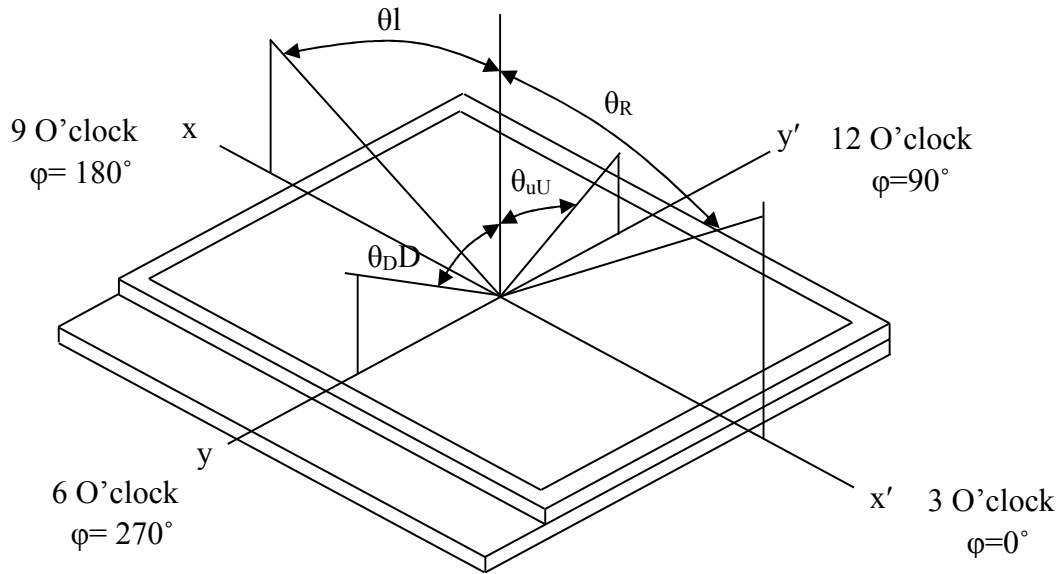
$B_{\min}$ : The measured minimum luminance of all measurement position.

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	+70°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	+60°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: ±6KV Air: ±10KV 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

