深圳市拓浦光电技术有限公司

TopView Product Specification

9.7” Color TFT-LCD Module

Model: TPV097HAH40PTL35

Note:1.Please contact TopView Optoelectronics before designing your product based on this module specification.
2.The information contained herein is presented merely to indicate the characteristics and performance of our products. No responsibility is assumed by TopView for any intellectual property claims or other problems

1. OVERVIEW

1.1 Introduction

The model TPV097HAH40PTL35 is a color active matrix thin film transistor (TFT) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. It is a Tran missive type display operating in the normally white mode. This TFT LCD has a 9.7 (4:3) inch diagonally measured active display area with WSVGA (1024 horizontal by 768 vertical pixel) resolution. Each pixel is divided into Red, Green, Blue dots which are arranged in vertical stripes

1.2 Features

- 9.7 (4:3 diagonal) inch configuration
- 16.7M color by 8 bit input
- RoHS Compliance
- Halogen Free

1.3 General information

Item	Specification	Unit
Screen Diagonal	9.7	Inch
Active area	196.608 x 147.456	mm
Pixels (HxV)	1024x3(RGB)X768	-
Pixel Pitch	0.192 (H) x 0.192 (V)	mm
Pixel Arrangement	R.G.B. Vertical Stripe	-
Display Mode	Normally White	-
Contrast Ratio	(500) (Typ.)	-
Response Time	(20) (Typ.)	ms
Input Voltage	3.7V	V
Interface	LVDS	
Module size	210.20x164.20x4.85mm	mm
Support Color	262,144	
Weight	TBD	g
Surface treatment	Hard Coating	

2. ABSOLUTE MAXIMUM RATINGS

The following are maximun values which, if exceeded, may cause faulty operation or damage to the unit.

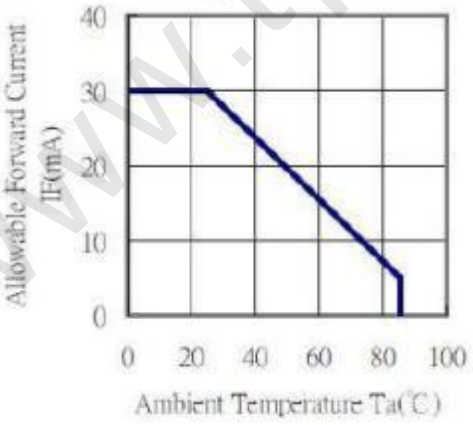
Item	Symbol	Min.	Max.	Unit	Note
Digital Supply Voltage	DVDD DVDD_LVDS	-0.3	7	V	
Analog Supply Voltage	AVDD	-0.5	14.85	V	
Gate On Voltage	VGH	-0.3	42	V	
Gate Off Voltage	VGL	-20	0.3	V	
Gate On-Gate Off Voltage	VGH-VGL	12	40	V	
Signal Input Voltage	NIND0 ~ NIND3 PIND0 ~ PIND3 NINC,PINC	-0.5	5	V	
Forward Current （per LED）	If	-	30	mA	
Reverse Voltage（per LED）	VR	-	5	V	
Pulse forward current（per LED）	Ifp	-	100	mA	1、2、3
Operating temperature	Topa	-20	70	℃	4
Storage temperature	Tstg	-30	80	℃	4

Note:

*1) If the product were used out of the operation and storage range, it will have quality issue.

*2) Ifp Conditions ： Pulse Width≤10msec，Duty≤1/10.

*3) Each one of LED operation must be follow diagram of Ambient Temperature and Allowable Forward Current.



*4)If users use the product out off the environmemtal operation range（temperature and humidity），it will have visual quality concerns.

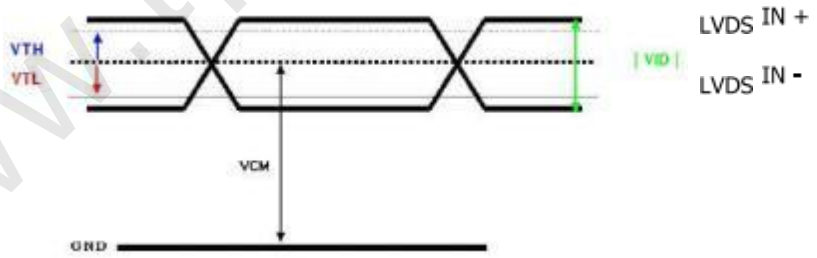
3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD

Ta=25℃

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Digital Power Supply Voltage For LCD	DVDD	2.3	3.3	3.6	V	
Logic Input Voltage (LVDS:IN+,IN-)	VCM	$\frac{VID}{2}$	-	$2.4 - \frac{VID}{2}$	V	Note1
	|VID|	200	-	600	mV	Note1
	VTH	-	-	100	mV	VCM=1.2V Note1
	VTL	-100	-	-	mV	
Analog Power Supply Voltage	AVDD	9.35	9.6	TBD	V	
Gate On Power Supply Voltage	VGH	17	19	20	V	
Gate Off Power Supply Voltage	VGL	-10.6	-10	-9.5	V	
Common Power Supply Voltage	VCOM	3.5	(3.75)		V	Note2
Logic Input Voltage	VIH	0.7*DVDD	-	DVDD	V	
	VIL	GND	-	0.3*DVDD	V	

【Note1】 LVDS signal



【Note2】 Please adjust VCOM to make the flicker level be minimum.

3.2 TFT-LCD Current Consumption

The following parameters are for reference only,With the actual debugging parameters as the standard

Item	Symbol	Condition	Min.	Typ.	Max.	Unit.	Note.
Gate on Current	IVGH	VGH =19V	-	0.5	1	mA	【Note1】
Gate off Current	IVGL	VGL= -10V	-	0.5	1	mA	【Note1】
Digital Current	IDVDD	DVDD = 3.7V	-	25	35	mA	【Note1】
Analog Current	IAVDD	AVDD = 9.6V	-	25	35	mA	【Note1】
Total Power Consumption	PC		-	336	478.5	mW	【Note1】

【Note1】 Typical: Under 256 gray pattern
Maximum: Under Black pattern

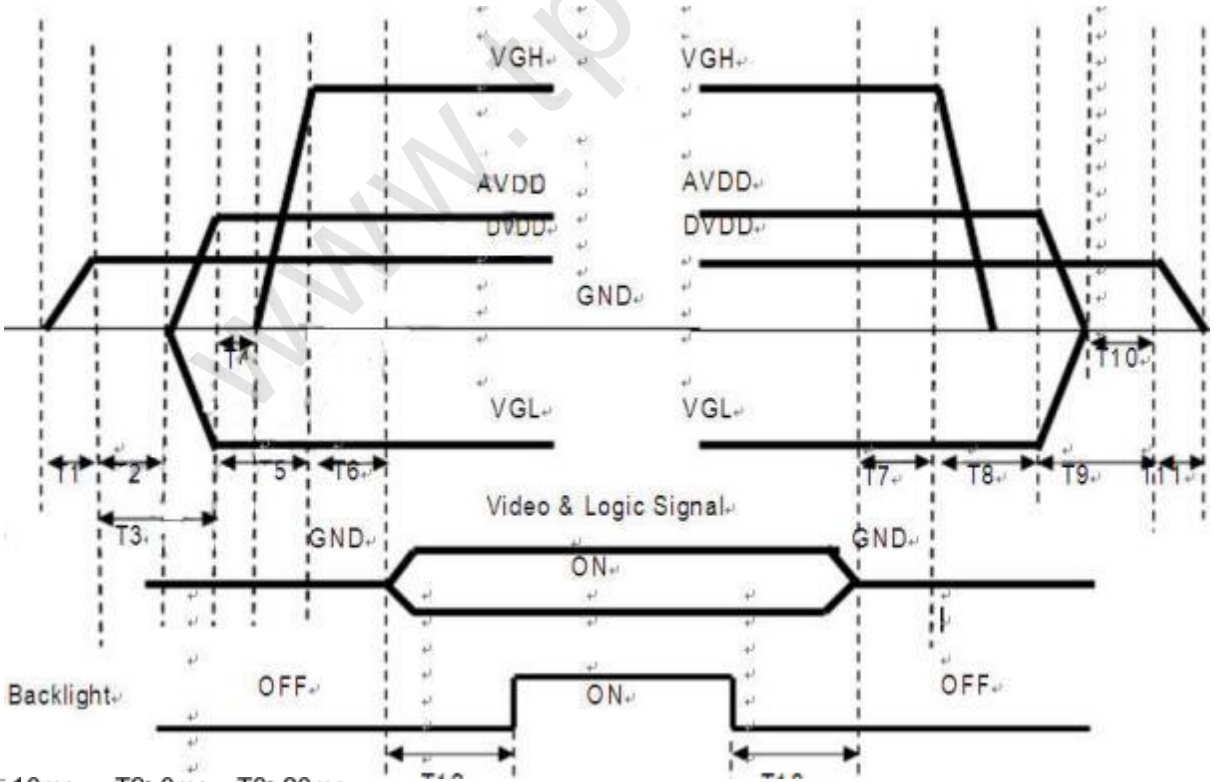
256 gray pattern

Black Pattern

3.3 Power and Signal sequence

Power On: DVDD→AVDD/VGL →VGH →Video &Logic Signal→Backlight

Power Off: Backlight→Video &Logic Signal→ VGH→AVDD/VGL→DVDD

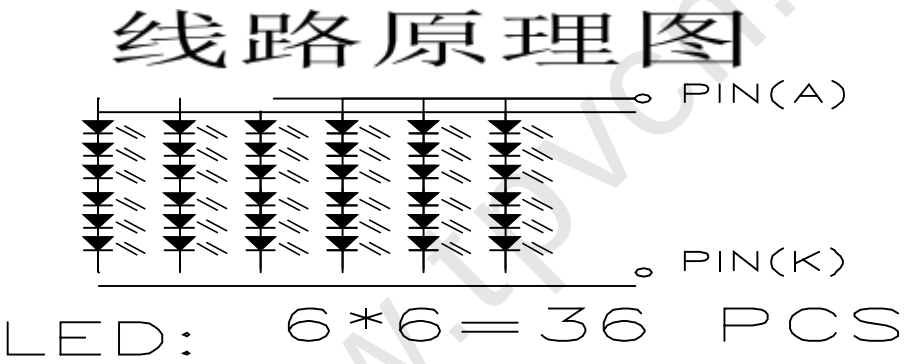


0<T1≦10ms T2>0ms T3>20ms T4>0ms T5>10ms 0<T6≦10ms T7>0ms
T8>0ms T9>0ms T10>0ms 0<T6≦10ms 0<T11≦10ms T12≧200ms T13≧200ms

3.4 Backlight

ITEM	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT	NOTE
LED current	IL	Ta=25℃ (20mA/serise)	–	150	–	mA	
LED voltage	VL	Ta=25℃ (20mA/serise)	16	18	19.8	V	
Power consumption	WL	Ta=25℃ (20mA/serise)	–	2.88	–	W	
LED Lifetime	-	Ta=25℃ F=20mA	30000			H	

Remarks:
*1)LED Circuit Diagram



*2) A: Anode(+), K: Cathode(−)
*3) Suggestion: Using the constant current control to avoid the leakage light and brightness quality issue.
*4) Definition of Led lifetime: Luminance < Initial luminance 50%.

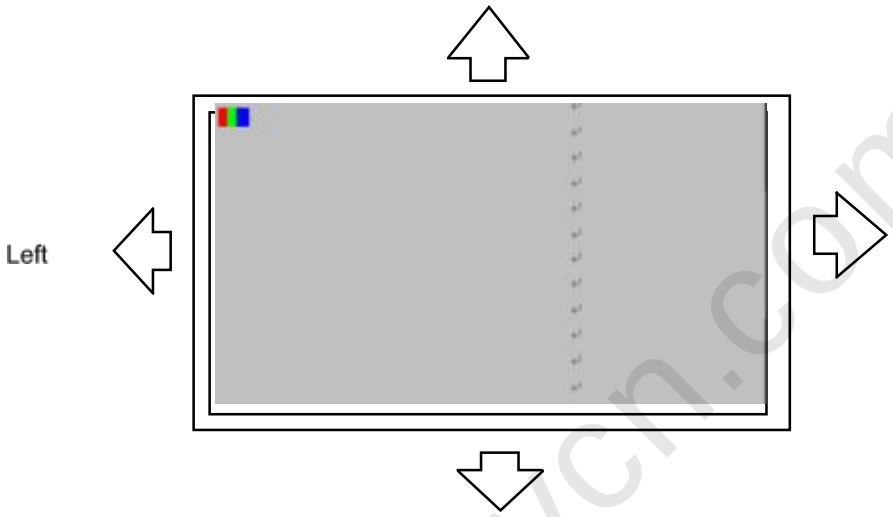
4. INTERFACE CONNECTION

4.1 CN1 (Input Signal)

Pin No.	SYMBOL	FUNCTION	Note
1	VCOM	Common voltage	
2	DVDD	Digital power	
3	DVDD	Digital power	
4	NC	Not connect	
5	RESET	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high. (R=10K ， C=1μF)	
6	UPDN	Vertical inversion	Note 1
7	SHLR	Horizontal inversion	Note 1
8	STBYB	Standby mode, normally pull high STBYB="1", normal operation STBYB="0",timing control, source driver will turn off, all output are high-Z	
9	GND	Ground	
10	NINC	Negative LVDS differential clock input	
11	PINC	Positive LVDS differential clock input	
12	GND	Ground	
13	NIND0	Negative LVDS differential data input	
14	PIND0	Positive LVDS differential data input	
15	GND	Ground	
16	NIND1	Negative LVDS differential data input	
17	PIND1	Positive LVDS differential data input	
18	GND	Ground	
19	NIND2	Negative LVDS differential data input	
20	PIND2	Positive LVDS differential data input	
21	GND	Ground	
22	NIND3	Negative LVDS differential data input	
23	PIND3	Positive LVDS differential data input	
24	GND	Ground	
25	SELB	6bit/8bit mode select if LVDS input data is 6bits,SELB set to High if LVDS input data is 8bits,SELB set to Low	
26	GND	Ground	
27	AVDD	Power for Analog Circuit	
28	GND	Ground	
29	VGH	Positive power for TFT	
30	NC	Not connect	
31	NC	Not connect	
32	VGL	Negative power for TFT	
33	GND	Ground	
34	NC	Not connect	
35	NC	Not connect	
36	NC	Not connect	
37	NC	Not connect	
38	NC	Not connect	
39	NC	Not connect	
40	NC	Not connect	

【Note1】UPDN and SHLR control function

SHLR	UPDN	Data shifting
DVDD	GND	Left→Right，Up→Down(default)
GND	GND	Right→Left，Up→Down
DVDD	DVDD	L ft→Right，Down→Up
GND	DVDD	R ght→Left，Dow →Up



5.0 LVDS mode DC elect rical characteristics

Parameter	Symbol	Spec. Min.	Spec. Typ.	Spec. Max.	Unit	Condition
Differential input high Threshold voltage	R_{XVTH}	-	-	+0.1	V	R_{XVCM}=1.2V
Differential input low threshold voltage	R_{XVTL}	-0.1	-	-	V	
Input voltage range (singled-end)	R_{XVIN}	0	-	VDD-1.2+ $\|V_{ID}\|/2$	V	-
Differential input common Mode voltage	R_{XVCM}	$\|V_{ID}\|/2$	-	VDD-1.2	V	-
Differential input voltage	$\|V_{ID}\|$	0.2	-	0.6	V	-
Differential input leakage Current	RV_{Xliz}	-10	-	+10	μA	-
LVDS Digital Operating Current	Iddlvds	-	15	30	mA	Fclk=65MHz, VDD=3.3V
LVDS Digital Stand-by Current	Istlvds	-	10	50	μA	Clock & all Functions are stopped

Table 5.3: LVDS mode DC electrical characteristics

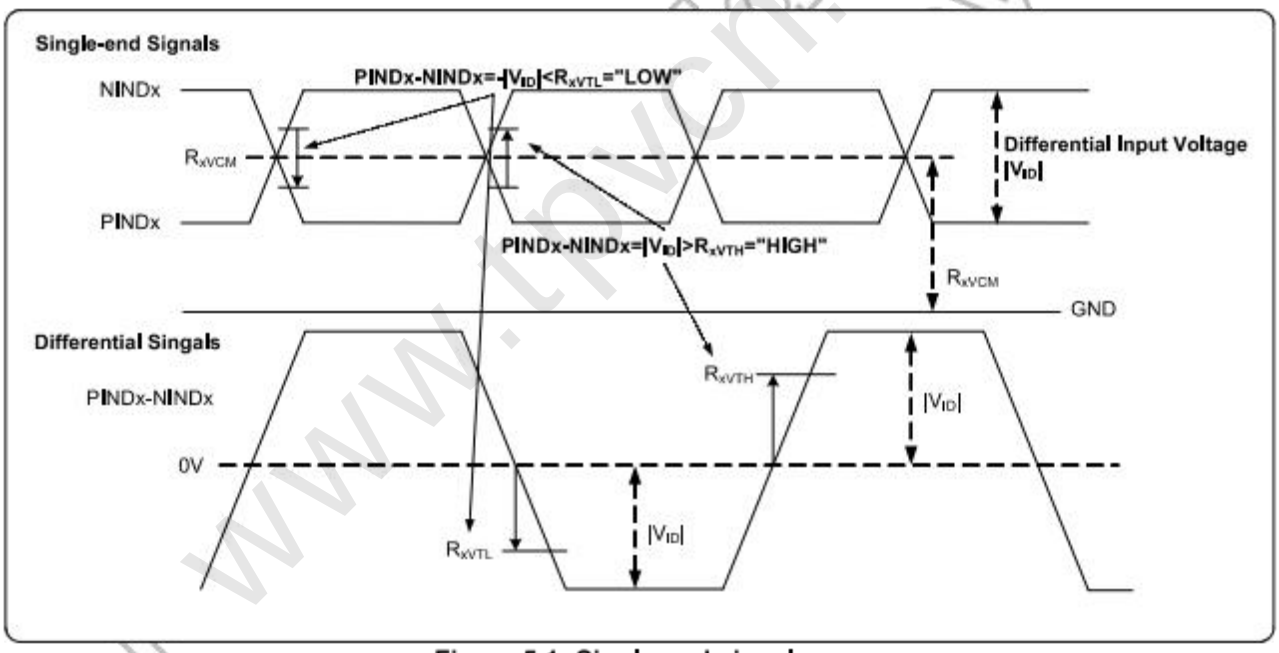
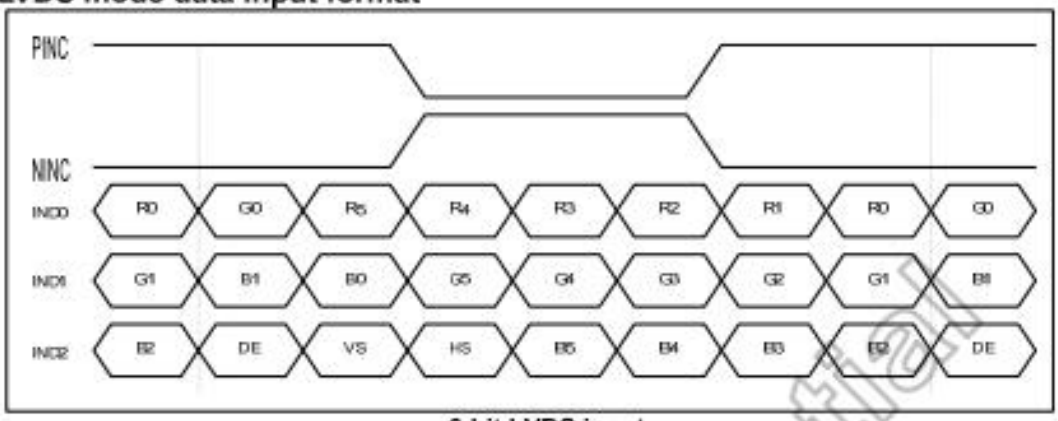
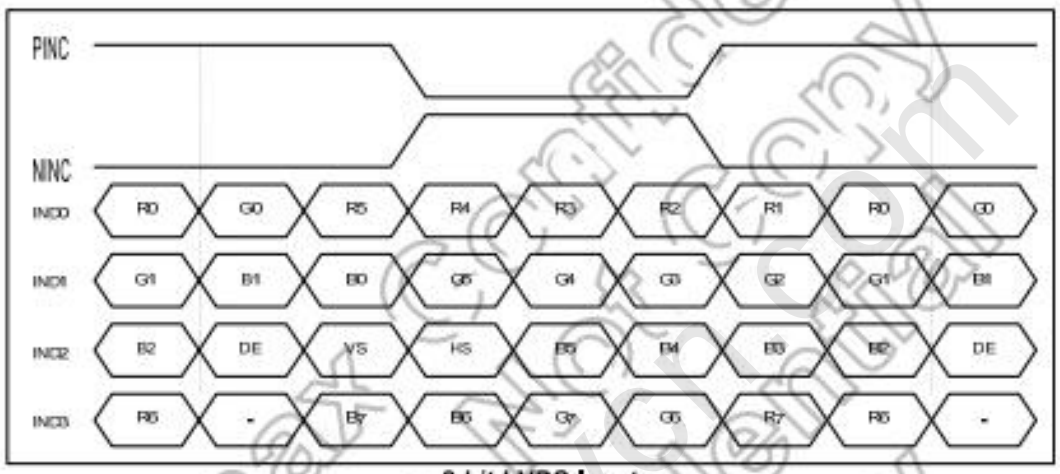


Figure 5.1: Single-end signals

5.2.2 LVDS mode data input format

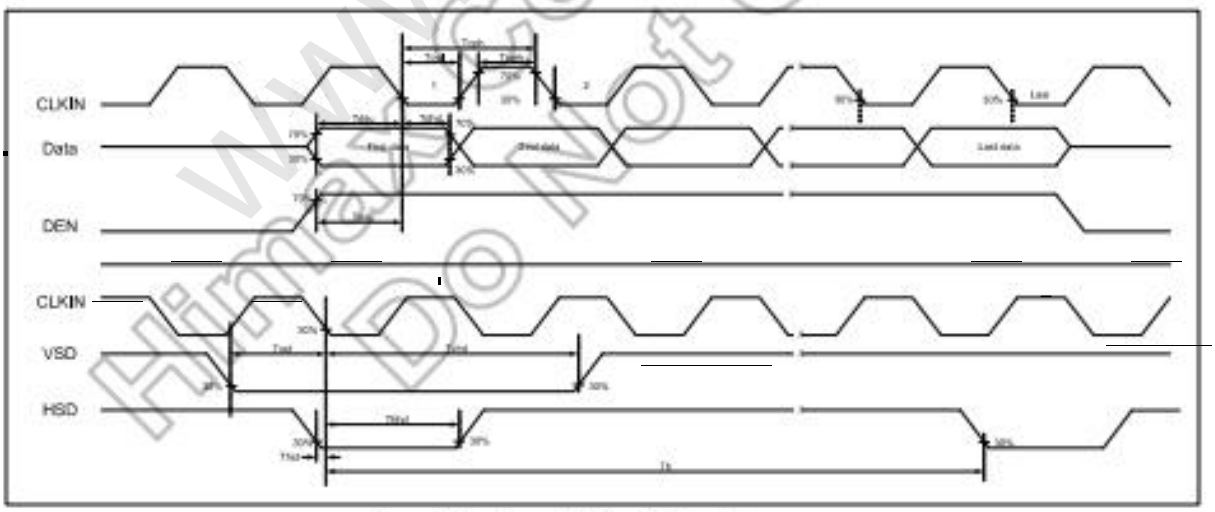


6-bit LVDS input



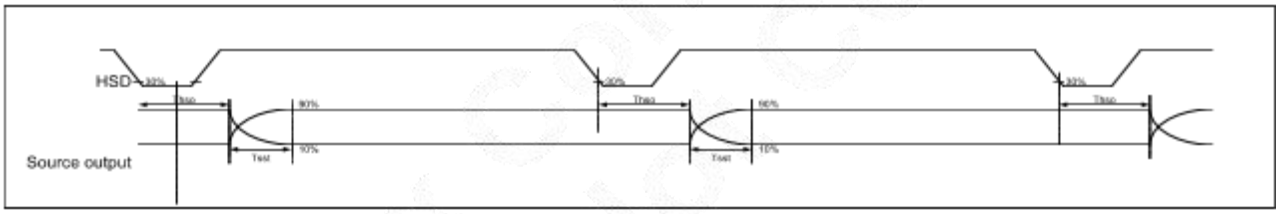
8-bit LVDS Input

5.2.3 Input clock and data timing diagram

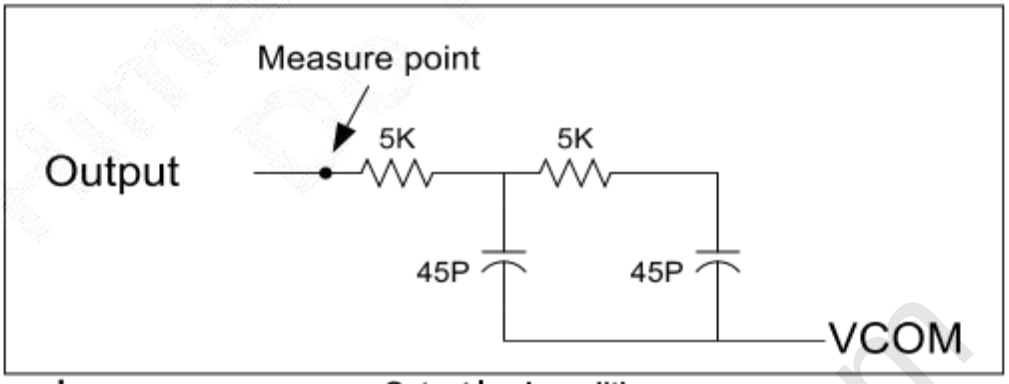


Input clock and data timing diagram

5.2.4 Source output timing diagram (Cascade)



Source output timing diagram



Output load condition

- **DE mode**

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	52	65	71	MHz
Horizontal Display Area	thd		1024		DCLK
HSD Period	th	1114	1344	1400	DCLK
HSD Blanking	thb+ thfp	90	320	376	DCLK
Vertical Display Area	tvd		768		T_H
VSD Period	tv	778	806	845	T_H
VSD Blanking	tvbp+ tvfp	10	38	77	T_H

DE mode (1024x768)

- **HV mode**

Horizontal timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
DCLK Frequency	fclk	57	65	70.5	MHz
Horizontal Display Area	thd		1024		DCLK
HSD Period	th	1200	1344	1400	DCLK
HSD Pulse Width	thpw	1	-	140	DCLK
HSD Back Porch	thbp		160		DCLK
HSD Front Porch	thfp	16	160	216	DCLK

HV mode horizontal timing (1024x768)

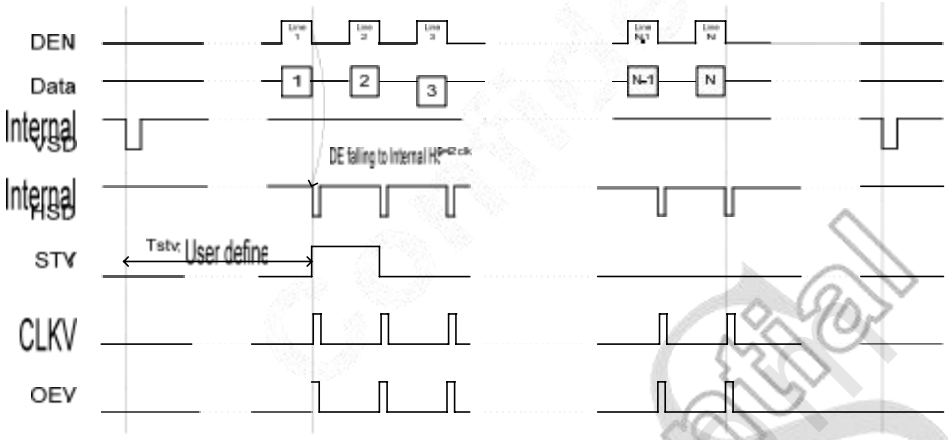
Vertical timing

Parameter	Symbol	Spec.			Unit
		Min.	Typ.	Max.	
Vertical Display Area	tvd		768		T_H
VSD Period	tv	792	806	840	T_H
VSD Pulse Width	tvpw	1	-	20	T_H
VSD Back Porch	tvbp		23		T_H
VSD Front Porch	tvfp	1	15	49	T_H

HV mode vertical timing (1024x768)

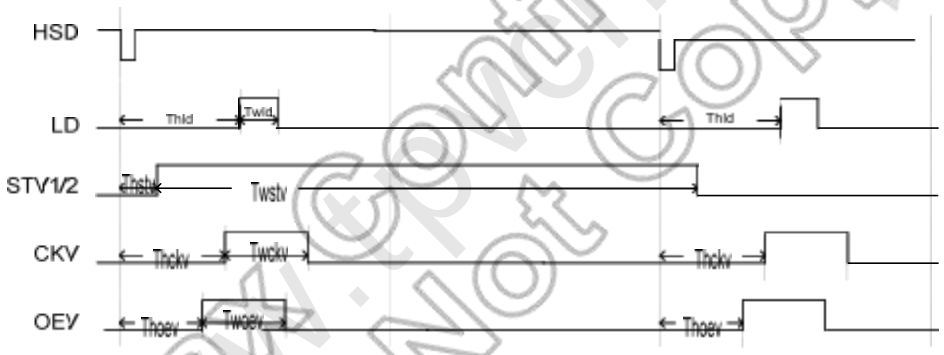
5.3 Output Timing

5.3.1 Vertical timing diagram DE (Cascade)



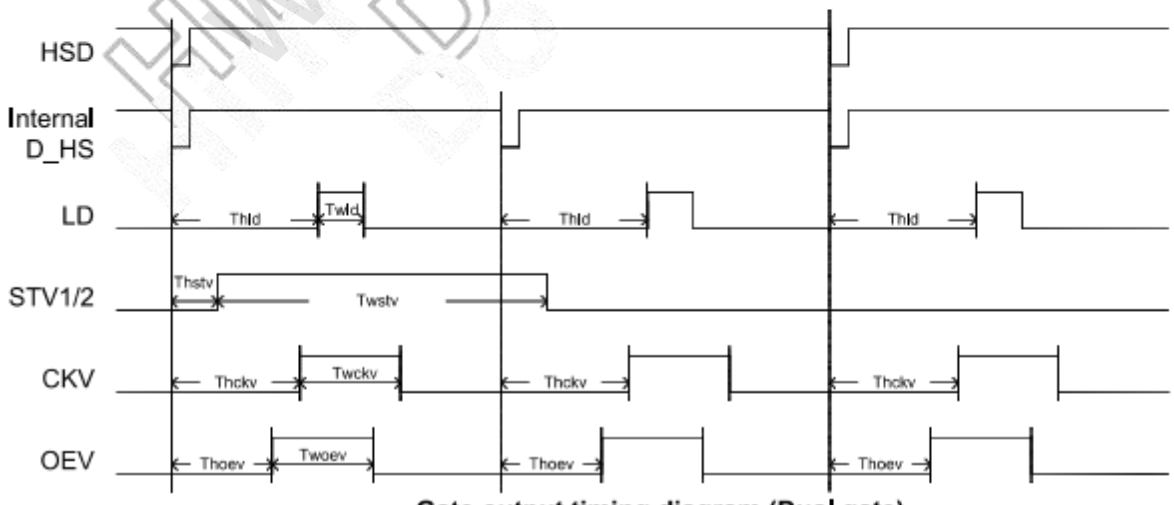
Vertical timing diagram DE (Cascade)

5.3.2 Gate output timing diagram (Cascade)



Gate output timing diagram (Cascade)

5.3.3 Gate output timing diagram (Dual gate)



Gate output timing diagram (Dual gate)

5.4 Color Data Reference

COLOR INPUT DATA		R DATA								G DATA								B DATA							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0
		MSB							LSB	MSB							LSB	MSB							LSB
BASIC COLOR	BLACK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	CYAN	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MAGENTA	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	YELLOW	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	WHITE	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
RED	RED(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(1)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED(255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	GREEN(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	GREEN(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
	GREEN(254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	GREEN(255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE(0)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	BLUE(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	BLUE(254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	BLUE(255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Note :

1) Gray level:
   Color(n)： n is level order; higher n means brighter level.
2) DATA:
   1: high，0: low

DIMENSION RANGE 尺寸范围							
TOLERANCE GRADE (±)	0 ~ 5	5 ~ 15	15 ~ 60	60 ~ 150	150 ~ 300	300 ~ 630	
A	0.05	0.10	0.15	0.20	0.25	0.30	
B	0.10	0.15	0.20	0.25	0.30	0.35	

UNLESS OTHERWISE SPECIFIED
公差以上表所示，除非另有指定

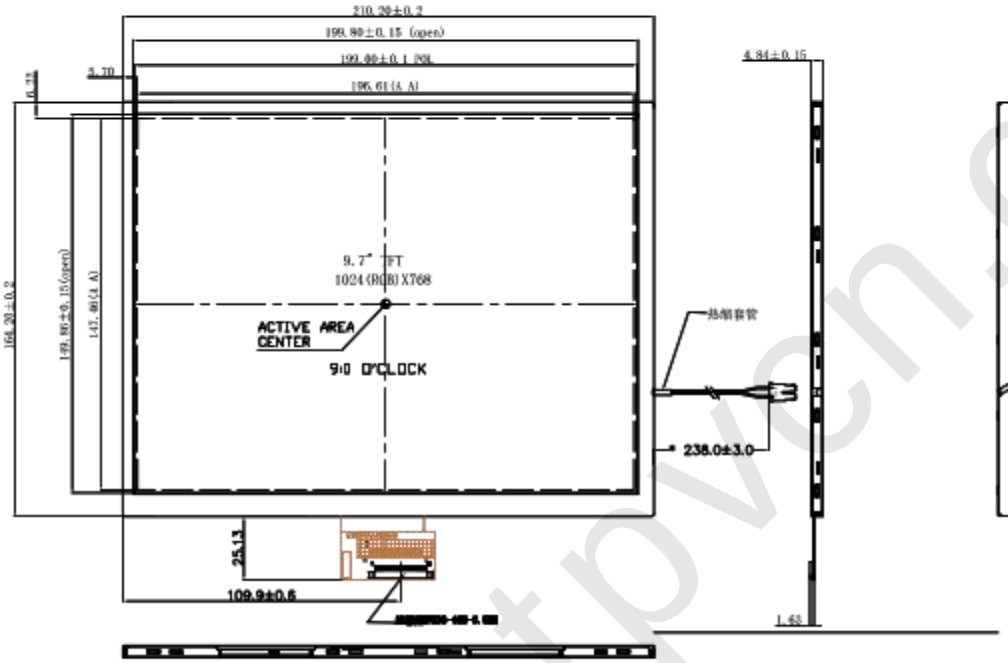
Customer Name: 客户名称	***	Approval Date: 承认日期	******	Approved by: 承认	******	Please Confirm This Drawing On/Before 请签回此图	

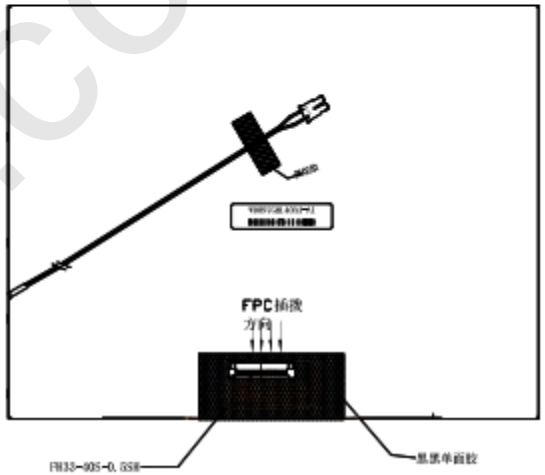
ROHS

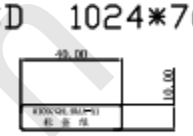
模组图

HSD 1024*768

PIN	SYMBOL	PIN	SYMBOL
1	VCOM	31	NC
2	DVDD	32	VGL
3	DVDD	33	GND
4	NC	34	NC
5	RESET	35	NC
6	UPDN	36	NC
7	SHLR	37	NC
8	STBYB	38	NC
9	GND	39	NC
10	NINC	40	NC
11	PINC	41	
12	GND	42	
13	NIND0	43	
14	PIND0	44	
15	GND	45	
16	NIND1	46	
17	PIND1	47	
18	GND	48	
19	NIND2	49	
20	PIND2	50	
21	GND	51	
22	NIND3	52	
23	PIND3	53	
24	GND	54	
25	SELB	55	
26	GND	56	
27	AVDD	57	
28	GND	58	
29	VGH	59	
30	NC	60	





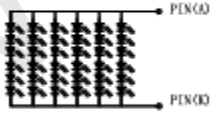


Notes:
1. RoHS must be complied.
2. ⚠ Modification rev. number
3. Draft angle 1.5° :
4. ( ) reference dimension, :critical dimension ±0.1
5. All radii without dimension R0.3, Unspecified Tolerances is:

Electrical-Optical Characteristics(Ta=25° C):

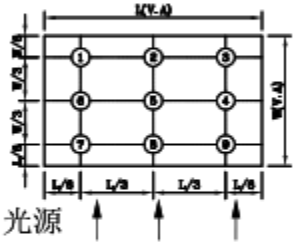
项目 Item		符号 Symbol	最小值 Min	典型值 Typ	最大值 Max	单位 Unit	测试条件 Condition
模组亮度	Average Lumious Itesity	Lv	—	300	—	cd/m²	If=150 mA
背光亮度	Average Lumious Itesity	Lv	—	—	—	cd/m²	
均匀性	Uiformity	Avg	80	—	—	%	
色坐标	Colour coordiate	X	0.26	—	0.33		
		y	0.27	—	0.34		
功率	Power Disipatio	Pd	—	—	—	mW	
正向电压	Forward Voltage	Vf	—	18.5	—	V	
反向电流	Reverse Curret	Ir	—	—	—	uA	
反向电压	ReverseVoltage	Vr	—	—	—	V	
工作温度	Operatig Temperature Rnge	Topr	-20	—	70	℃	
贮存温度	Storage Temperature Rnge	Tstg	-30	—	80	℃	

线路原理图



LED: 6*6=36 PCS

测试点位置图



主要材料表			
10	FOG	1	HK
9	Bezel	1	
8	Reflector film	1	
7	Prism film (upper)	1	
6	Prism film (lower)	1	
5	Diffuser film	1	
4	SMT LED (white)	36	
3	FPC	1	
2	Light guide	1	
1	Plastic housing	1	
NO.	TITLE(名称)	Q'TY	MATERIAL(材质)

NO. 序号	REV 修订	DATE 修订日期	DESCRIPTION 修订内容	REVISER 修订者

成品图

REV 版本	A0
SCALE 比例	1:1
PART No. 料号	TPV097HAH40PTL36
Material 客户料号	********
MATERIAL 规格	210.2*164.2*4.85
COLOR 颜色	
UNIT 单位	mm
DATE 日期	2017-08-12

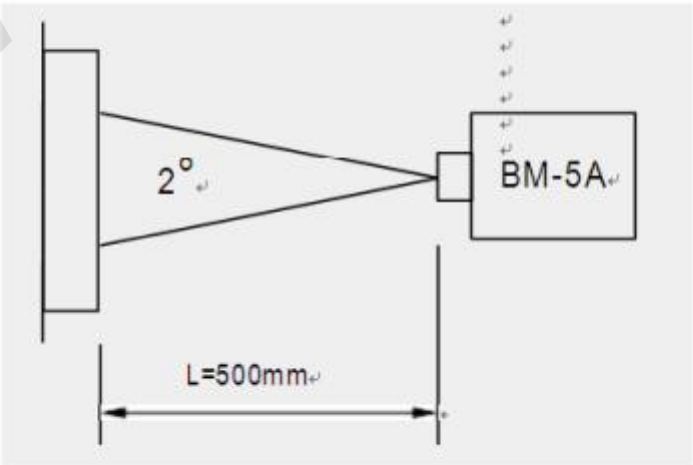
APPROVED BY 核准	CHECKED BY 審核	DRAWN BY 繪圖
		LX

7. OPTICAL CHARACTERISTICS

Ta = 25°C, Vcc=3.3V

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Luminance(CEN)		Lw		320	350	—	cd/m^2	
Contrast		CR	Θ=0 Normal viewing angle	400	500	—		(1)(2)
Response time		Tr		—	6	12	msec	(1)(3)
		Tf		—	14	20		
Color gamut		S		45	50	—	%	C light
Color chromaticity (CIE1931)	Red	R_x		-0.02	0.620	+0.02		(1)(4) CF Glass C light
		R_Y			0.332			
	Green	G_x			0.281			
		G_Y			0.534			
	Blue	B_x			0.146			
		B_Y			0.131			
	White	W_x			0.301			
		W_y			0.326			
Viewing angle (With EWV PZ)	Hor.	Θ_L	CR>10	80	85	—		(1)(4)
		Θ_R		65	75	—		
	Ver.	Θ_U		75	85	—		
		Θ_D		75	85	—		
Optima View Direction		9 o'clock						(5)

【Note1】Measure condition：25℃±2℃，60±10%RH，under10 Lux in the dark room.BM-5A (TOPCON)，viewing angle2°，IL=260mA（Backlight current），measurement after lighting on 10 mins.



【Note2】Definition of contrast ratio：
Contrast Ratio (CR)= (White) Luminance of ON ÷ (Black) Luminance of OFF

【N t 3】 Definition of luminance： Measure white luminance on the point 5 as figure.7 1
Definition of Luminance Uniformity: Measure white luminance on the point1~9 as figure.7-1
o e △L = [L(MIN)/L(MAX)]×100

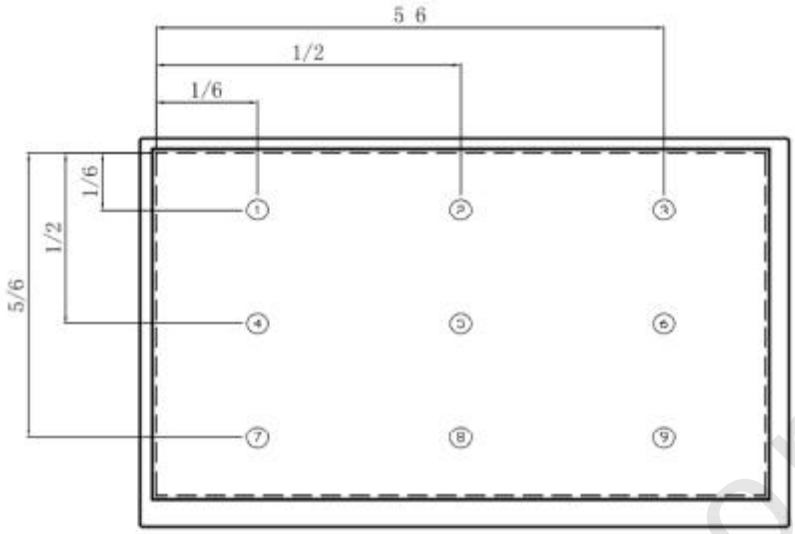
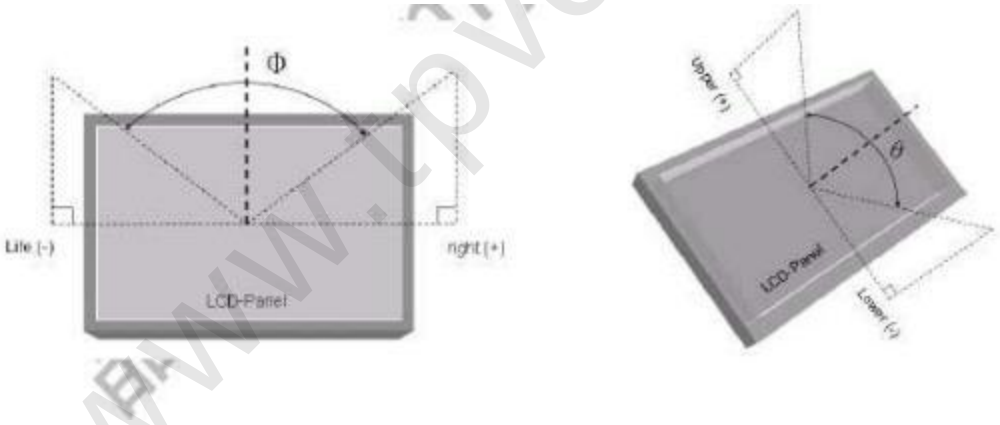


Fig.7-1 Measuring point

【Note4】 Definition of Viewing Angle(θ,ψ),refer to Fig.7-2as below：



【Note5】 Definition of Response Time.(White-Black)

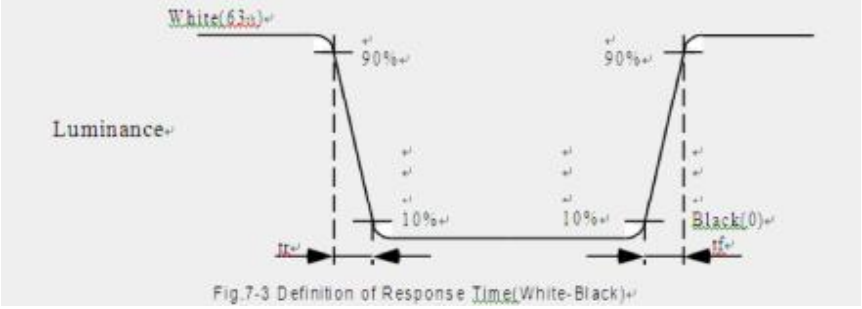


Fig.7-3 Definition of Response Time(White-Black)

8. RELIABILITY TEST

8.1. Temperature and humidity

No.	Item	Conditions	Remark
1	High Temperature Storage	Ta= +70°C, 240hrs	
2	Low Temperature Storage	Ta= -30°C, 240hrs	
3	High Temperature Operation	Ta= +70°C, 240hrs	
4	Low Temperature Operation	Ta= -20°C, 240hrs	
5	Thermal Cycling Test (non operation)	-30°C(30min)→+70°	

【N t 1】:

Condition of Image Sticking test：25 ℃± 2 ℃

Operation with test pattern sustained for 4 hrs, then change to gray pattern immediately.

o eAfter 5 mins, the mura must be disappeared completely .

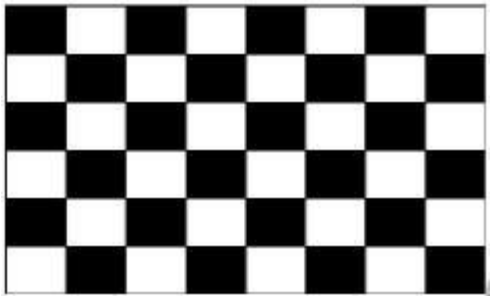


Image Sticking pattern

Mid-Gray pattern

8.2. Shock and Vibration

TEST ITEMS	CONDITIONS
Shock (Non-operation)	Shock level: 980m/s^2 (equal to 100G). Waveform: half sinusoidal wave,6ms. Number of shocks: +X,+Y,+Z axes for a total of nine shock inputs.
Vibration (Non-operation)	Frequency range:8~33.3Hz Stoke：1.3 mm Vibration: sinusoidal wave, perpendicular axis(both x, z axis: 2hrs ,y axis: 4hrs). Sweep: 2.9G,33.3 Hz -400 Hz Cycle time: 15 min

8.3 Electrostatic Discharge

TEST ITEM	CONDITIONS	Note
ESD	150pF，330 ，±8kV&±15kV air& contact test	1
	200pF，0 ，±200V contact test	2

【Note】 Measure

1: LCD glass and metal bezel

2: IF connector pins