凯利光电（香港）有限公司

Kelly Photoelectric(HongKong)CO., LTD

☐ Tentative Specification
☐ Preliminary Specification
■ Approval Specification

MODEL NO :KL090MI424913

Customer:

APPROVED BY **SIGNATURE**

Name / Title _____ _____

Note

_____

Please return 1 copy for your confirmation with your signature and comments.

Approved By	Checked By	Prepared By

1. GENERAL DESCRIPTION

1.1 DESCRIPTION

KL090MI424913 is a transmissive type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching device. This model is composed of a TFT-LCD module (TFT-LCD panel, driver IC and FPC), a back-light unit and. The resolution of 1280*RGB*720 pixels and can display up to 16.7M colors.

1.2 GENERAL INFORMATION

Items	Specification	Unit	Note
Display mode	TFT Transmissive, Positive, NW，	-	-
LCM outline size	210.71(H) x 127.71.00(V) x 4.9(T)	mm	Note (1)(2)
Active area	198.912(H)X111.888(V)	mm	-
Number of pixels	1280*3RGB(H)X720(V)	pixels	-
Pixel arrangement	RGB stripe	-	-
Pixel size	0.1554(W)*RGB x 0.1554 (H)	mm	-
Display color	16.7M	color	-
Viewing direction	ALL	-	-
Controller / Driver	EK79002	-	-
Data interface	LVDS	-	
Backlight	6 White LEDs In Series 7 Parallels	-	
Weight	TBD	g	

Notes:

(1) Touch panel and back-light unit are included.

(2) FPC no included. (Refer to the module outline dimension for further information). Please see module specification drawing in Page14 for more details.

2. ELECTRICAL CHARACTERISTICS

2.1 LCM DC CHARACTERISTICS

(Ta=25±2°C)

Characteristics	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage 1	DVDD	3.0	3.3	3.6	V	
Power Supply Voltage 2	AVDD	-	-	-	V	
Power Supply Voltage 3	VGH	-	-	-	V	
Power Supply Voltage 4	VGL	-	-	-	V	
Power Supply Voltage 5	VCOM	-	-	-	V	
Current Consumption	I_{DD}	-	40	-	mA	Normal mode
	$I_{DD-SLEEP}$		2		mA	Sleep mode
Input voltage “L” Level	V_{IL}	GND	-	0.3VDD1	V	DVDD=3.0~3.6
Input voltage “H” Level	V_{IH}	0.7VDD1	-	VDD1	V	
Output voltage “L” Level	V_{oL}	0	-	0.2VDD1	V	I_{OL}=1mA
Output voltage “H” Level	V_{oH}	0.8VDD1	-	VDD1	V	I_{OH}=-1mA

2.2 BACK-LIGHT UNIT CHARACTERISTICS

The back-light system is an edge-lighting type with42 white LEDs. The characteristics of the back-light are shown in the following tables.

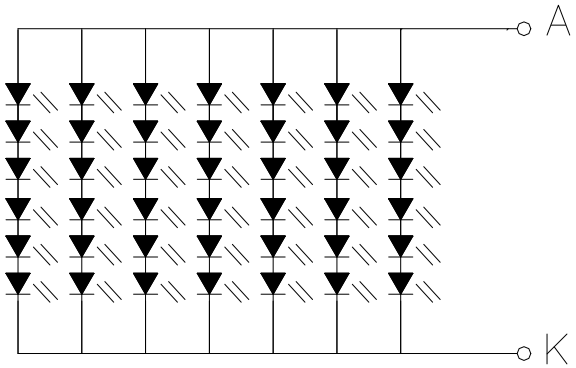
(Ta=25±2°C)

Characteristics	Symbol	Condition	Min.	Type	Max.	Unit	Notes
Forward Voltage	Vf	I_L=140mA	16.8	19.2	20.4	V	-
Forward current	I_L		--	140	-	mA	-
LED life time	-	I_L=140mA	20,000	30,000	--	Hr	Note 1

Note:

(1) The “LED life time” is defined as the module brightness decrease to 50% of original brightness at I_L=140mA. The LED life time could be decreased if operating I_L is larger than 140mA.

Backlight circuit diagram shown in below:



3. OPTICAL CHARACTERISTICS

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room.
Measuring equipment: BM-5AS, BM-7, EZ-Contrast.

(Ta=25±2°C)

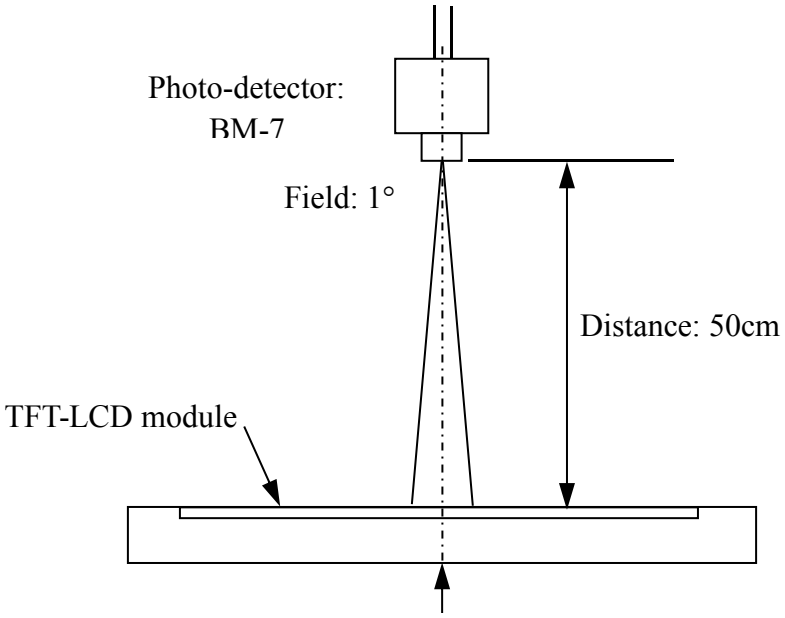
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center point)		C/R	-	-	-	800	-	BM-7 Note(2)
Luminance of white (Center point)		L_w	B/L on	-	400	-	cd/m^2	BM-7
Luminance uniformity		U_W	θ = 0. Normal viewing angle B/L On Note(1)	80	-	-	%	BM-7 Note(3)
Response Time		Tr + Tf		-	45	-	ms	BM-5AS Note(4)
Color Chromaticity (CIE 1931)	White	W_X		-0.05	0.280	+0.05	-	BM-7 Note(5)
		W_X		-0.05	0.314	+0.05		
	Red	R_X		-0.05	0.661	+0.05		
		R_Y		-0.05	0.321	+0.05		
	Green	G_X		-0.05	0.237	+0.05		
		G_y		-0.05	0.576	+0.05		
	Blue	B_X		-0.05	0.138	+0.05		
		B_Y		-0.05	0.108	+0.05		
Viewing Angle	Hor.	θ_L	C/R≥10	-	85	-	Deg	EZ Contrast Note(6)
		θ_R		-	85	-		
	Ver.	θ_u		-	85	-		
		θ_D		-	85	-		
Optima View Direction			ALL					Note(7)

* This condition will be changed by the evaluation circumstance. If product is exposed to high temperatures for extended time, there is a possibility of the polarizer film damage which could degrade the optical characteristics.

Notes:

(1) Test Equipment Setup: After stabilizing and leaving the panel alone at a given temperature for

30min, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room 30min after lighting the back-light. This should be measured in the center of screen.

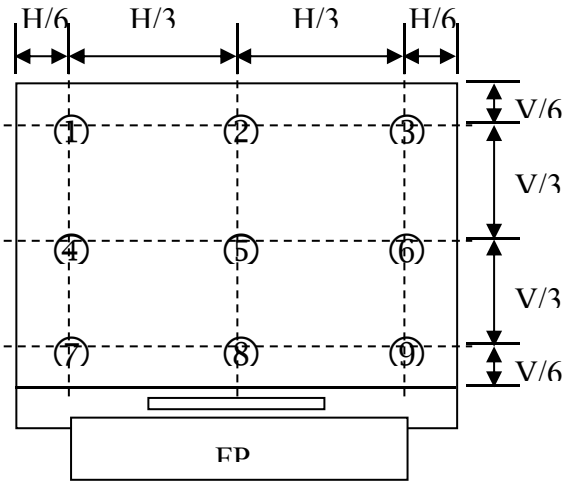


(2) Definition of Contrast Ratio (CR):

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance measured when LCD on the “white” state}}{\text{Luminance measured when LCD on the “black” state}}$$

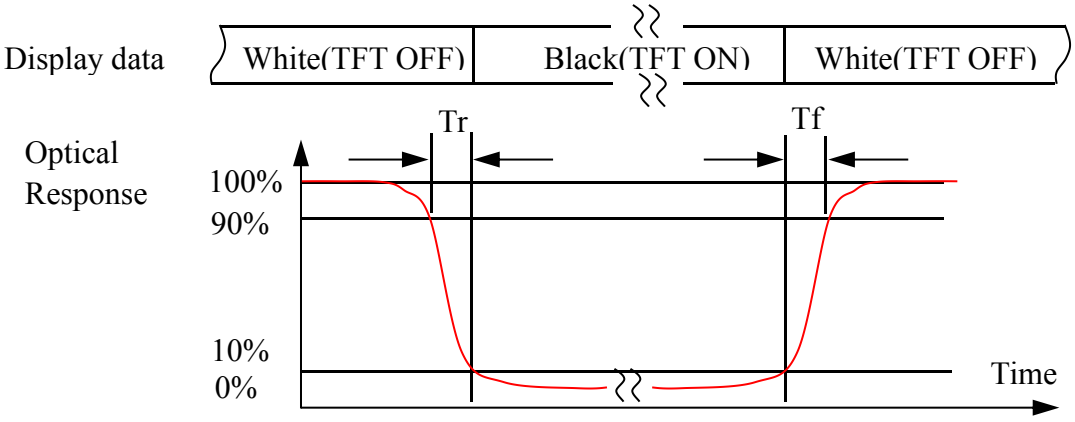
(3) Definition of Luminance Uniformity: Active area is divided into 9 measuring areas (Shown in below), every measuring point is placed at the center of each measuring area.

$$\text{Luminance Uniformity} = \frac{\text{Min Luminance of white among 9-points}}{\text{Max Luminance of white among 9-points}} \times 100\%$$

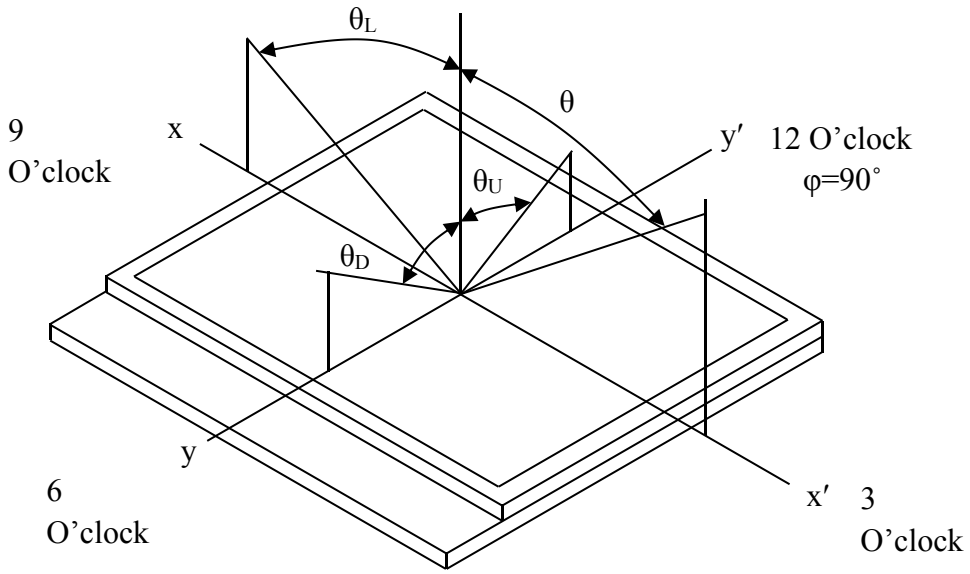


The spot locations for luminance measurement

(4) Definition of Response time: Sum of Tr and Tf.



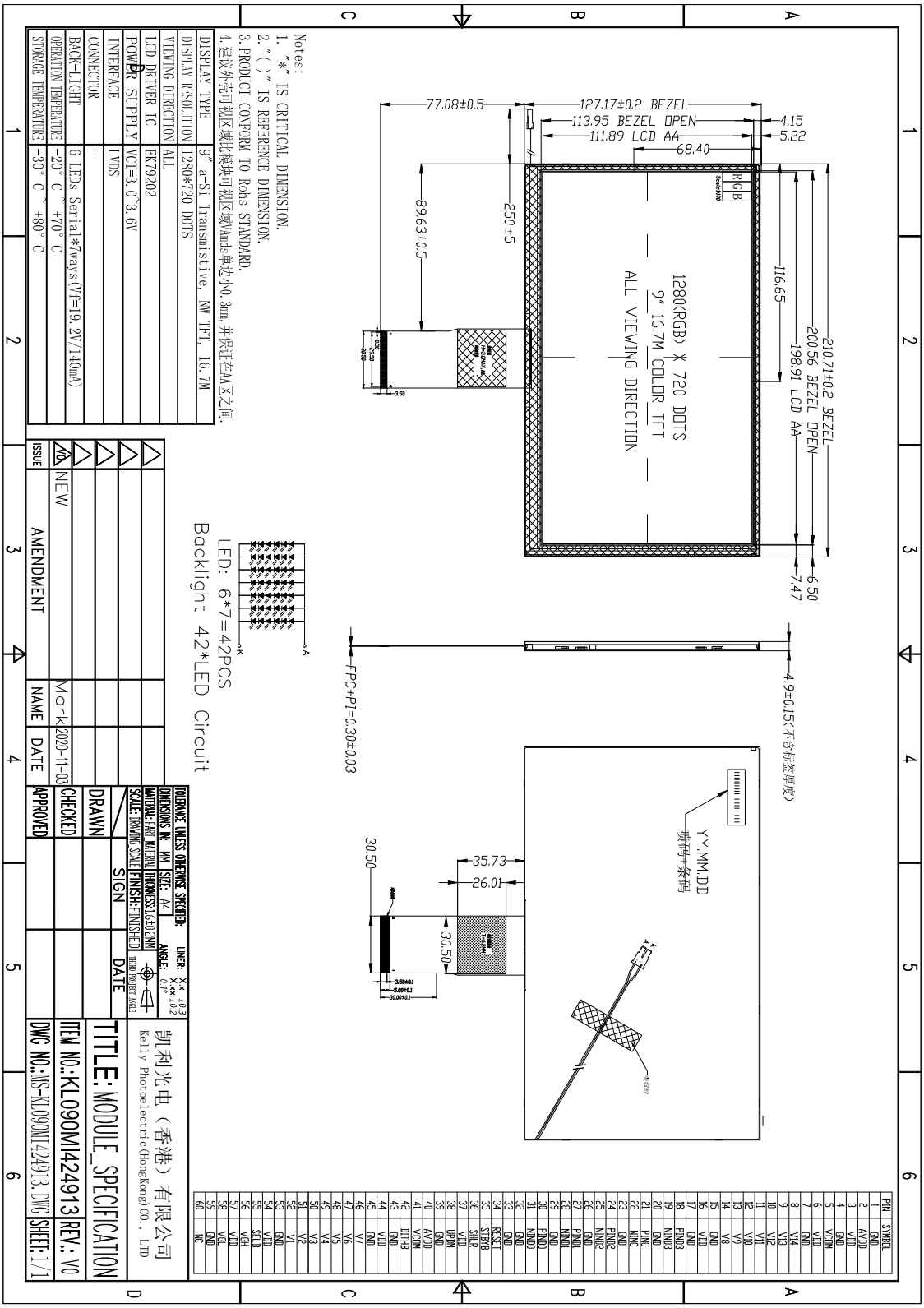
(5) Definition of Viewing Angle: The viewing angle range that the CR≥10.



(6) Definition of Color Chromaticity (CIE 1931)
Color coordinate of white & red, green, blue at center point.

(7) The different Rubbing Direction will cause the different optima view direction.

4. MODULE OUTLINE DIMENSION



5. MODULE INTERFACE DESCRIPTION

Terminal No.	Symbol	I/O	Function
1	AGND	-	Analog ground
2	AVDD	I	Not connect
3	VDD	I	Digital power
4	GND	-	Digital ground
5	VCOM	I	Not connect
6	VDD	I	Digital power
7	GND	-	Digital ground
8	V14	I	Not connect
9	V13	I	Not connect
10	V12	I	Not connect
11	V11	I	Not connect
12	V10	I	Not connect
13	V9	I	Not connect
14	V8	I	Not connect
15	GND	-	Digital ground
16	VDD_LVDS	I	LVDS power
17	GND	-	Digital ground
18	PIND3	I	Positive LVDS differential data inputs
19	NIND3	I	Negative LVDS differential data inputs
20	GND	-	Digital ground
21	PINC	I	Positive LVDS differential clock inputs
22	NINC	I	Negative LVDS differential clock inputs
23	GND	-	Digital ground
24	PIND2	I	Positive LVDS differential data inputs
25	NIND2	I	Negative LVDS differential data inputs
26	GND	-	Digital ground
27	PIND1	I	Positive LVDS differential data inputs
28	NIND1	I	Negative LVDS differential data inputs
29	GND	-	Digital ground
30	PIND0	I	Positive LVDS differential data inputs
31	NIND0	I	Negative LVDS differential data inputs
32	GND	-	Digital ground
33	GND_LVDS	-	LVDS fround
34	RGB	I	Global reset pin. Active low to enter reset state. Suggest to connecting with an RC reset circuit for stability. Normally pull high.(R=10kΩ C=0.1uF)
35	STBYB	I	Standby mode, normally pull high STBYB=”1”, normal operation STBYB=”0”, timing control, source driver will turn off, all output are high-Z
36	SHLR	I	Left or right display control
37	VDD	I	Digital power

38	UPDN	I	Up/Down display control
39	AGND	-	Analog ground
40	AVDD	I	Not connect
41	VCOM	I	Not connect
42	DITH	I	Dithering function enable control. Normally pull low DITHER="1", Enable inrtnal dithering function
43	GND	-	Digital ground
44	VDD	I	Digital power
45	GND	-	Digital ground
46	V7	I	Not connect
47	V6	I	Not connect
48	V5	I	Not connect
49	V4	I	Not connect
50	V3	I	Not connect
51	V2	I	Not connect
52	V1	I	Not connect
53	GND	-	Digital ground
54	VDD	I	Digital power
55	GND	-	Digital ground
56	VGH	I	Not connect
57	VDD	I	Digital power
58	VGL	I	Not connect
59	GND	-	Digital ground for Gate IC
60	NC	-	Not connect

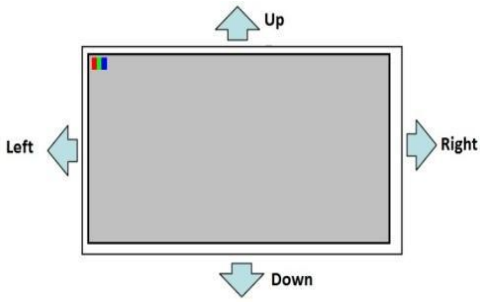
I/O: I: input, O: output, P: power

Remarks:

1) Mating Connector: 089K60-000100-G2-R (STARCONN)

2) UPDN and SHLR control function

UPDN	SHLR	FUNCTION
0	1	Normal Display
0	0	Inverse Left and Right
1	1	Inverse Up and Down
1	0	Inverse Left and Right / Inverse Up and Down



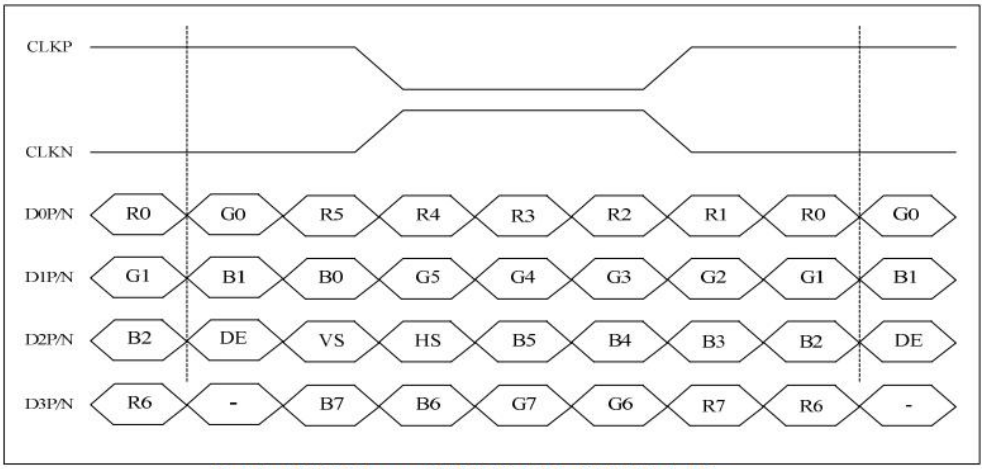
6. REFERENCE APPLICATION CIRCUIT

Please consult our technical department for detail information.

7. TIMINGS FOR LVDS Interface

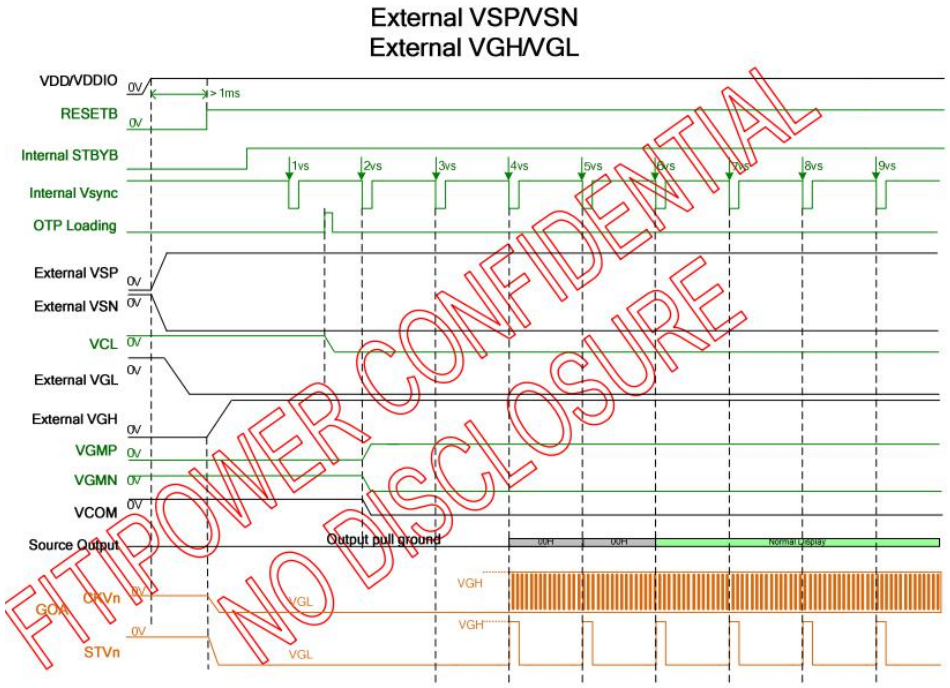
7.1 Timing Waveform

Parameter		Symbol	Value			Unit
			Min.	Typ.	Max.	
DCLK frequency @Frame rate=60Hz (LVDS)		F_{DCLK}	66.3	72.4	78.9	MHz
HSYNC period time		T_H	1380	1440	1500	DCLK
Horizontal display area		T_{HD}		1280		DCLK
HSYNC pulse width	Min.	T_{HPW}		1		
	Typ.			-		
	Max.			40		
HSYNC back porch(with pulse width)		T_{HBP}	88	88	88	DCLK
HSYNC front porch		T_{HFP}	12	72	132	DCLK
VSYNC period time		T_V	824	838	872	H
Vertical display area		T_{VD}		800		H
VSYNC pulse width	Min.	T_{VPW}		1		H
	Typ.			-		
	Max.			20		
VSYNC back porch(with pulse width)		T_{VBP}	23	23	23	H
VSYNC front porch		T_{VFP}	1	15	49	H

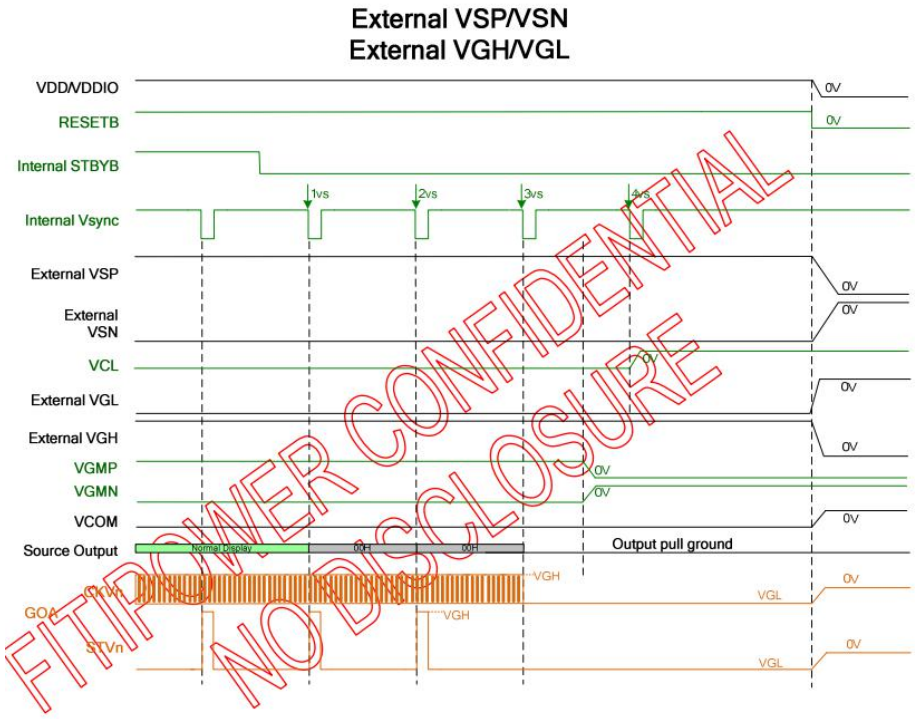


8-bit LVDS input(LVBIT=H, LVFMT=H)

7.2 Power on/off



Power on sequence with PMODE=H



Power off sequence with PMODE=H

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NO DISCLOSURE

8. RELIABILITY TEST CONDITIONS

No.	Test Item	Test Condition	Notes
1	High Temperature Storage	+70°C / 120H	Inspection after 2~4h storage at room temperature, the sample shall be free from defects: 1. Air bubble in the LCD; 2. Seal leak; 3. Non-display; 4. Missing segments; 5.Glass crack; 6. The surface shall be free from damage. 7. The electrical characteristics requirements shall be satisfied.
2	Low Temperature Storage	-20°C / 120H	
3	High Temperature Operating	+60°C / 120H	
4	Low Temperature Operating	-10°C / 120H	
5	Temperature Cycle	0±2°C⇆25°C⇆+50±2°C x 10cycles (30min) (5min) (30min)	
6	High Temperature /Humidity storage	50+5°C x 90%RH / 120H	
7	Vibration Test	Frequency: 10Hz~55Hz~10Hz Amplitude:1.5mm, 2 hours for each direction of X, Y, Z	
8	Packing Drop Test	Drop to the ground from 1m height, 1 corner, 3 edges, 6 surfaces.	
9	ESD test	Voltage:±8KV R: 330Ω C: 150pF Air discharge, 10time	
10	Image Sticking	25℃±2℃ Operation with test pattern sustained for 1 hrs(10x5). Change to gray pattern immediately. after 5 mins,the mura must be disappeared completely 。	

Remarks:

(1) The test samples should be applied to only one test item.

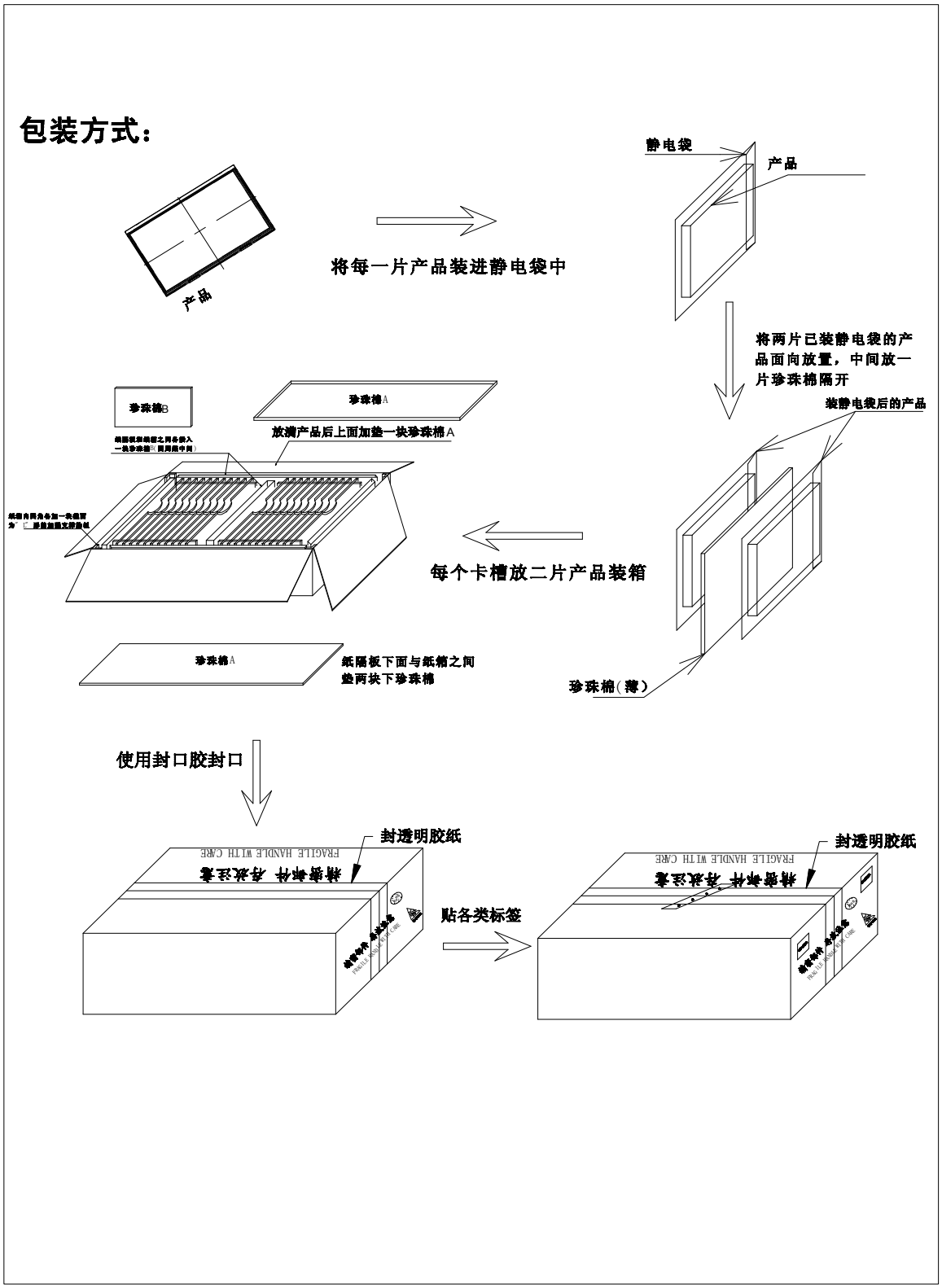
(2) Sample size for each test item is 5~10pcs.

(3) For High Temperature/Humidity storage test, pure water (resistance>10MΩ) should be used.

(4) In case of malfunction defect caused by ESD damage, if it would be recovered to normal state after resetting, it would be judge as a good part.

(5) Failure judgment criterion: basic specification, electrical characteristic, mechanical characteristic, optical characteristic.

9. PACKING SPECIFICATION



凯利光电 TFT 模组检验标准

1. 目的

A.明确模组的检验标准，防止不良品流入客户端。

B.便于与客户沟通。

2. 适用范围

适用于本公司所有TFT LCD 屏的模组。

3. 检验条件与环境

3.1 检验环境条件(Enplanation):

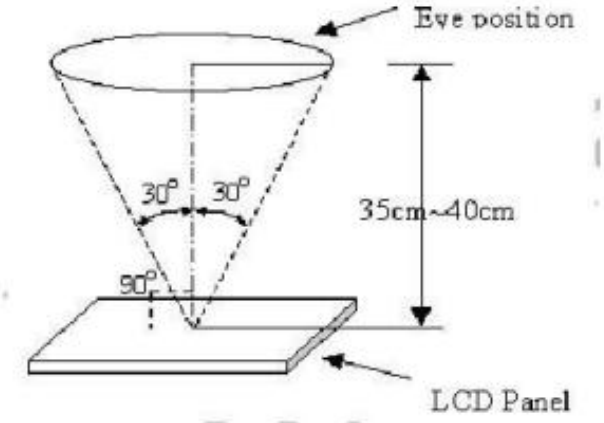
A.温度: 23±5 ℃；

B.湿度：55±10%RH.

C.外观检查光照：光照约300--500Lux;

D.点亮检查光照：光照约200--250Lux;

3.2 检测条件：



A.目视距离：35-40cm；

B.外观检验角度：±30°；

C.点亮检验角度：±30°。

3.3 抽样条件

A．批量：单次运送的单一机种之数量；

B．抽样计划:MIL-STD-105E 的一般检验水准II 级，正常检验、单次抽样。

AQL:主要缺点（Maj）0.65，次要缺点（Min）1.5；

(注：客户特殊要求除外)。

3.4 主要缺陷和次要缺陷的分类如下：

3.4.1 主要缺陷(Maj)：主要缺陷是指造成产品丧失使用性能的缺陷。如下：

A．显示异常: 产品不能正常显示；

B. 线缺陷；

C. 整个模组有严重的变形或者损坏；

D. 玻璃破片；

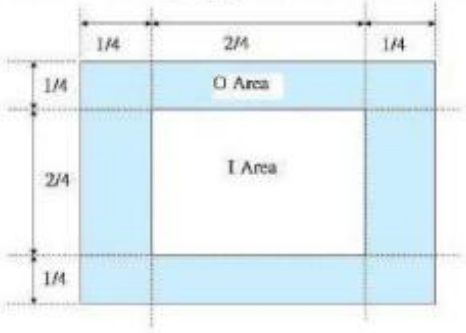
3.4.2 次要缺陷(Min): 次要缺陷是指不造成产品使用性能丧失的缺陷或难以发现的外观缺陷（不影响使用）。

A. 玻璃带点；

B. 玻璃刮伤、凹痕、周边色差、漏光；

C．背光异物；
D. 铁框折痕、划伤、生锈、缝隙≥0.6mm；
E．玻璃保护膜刮伤、脏污、汽泡；
F 漏贴 PASS、产品标签。
3.5 作业注意事项：
3.5.1 检验前先戴好手指套及静电手环；
3.5.2 检验作业时不可有配戴戒指、手表等手饰，物料要小心轻放,以免造成破损、脏污等；
3.5.3 开包装后注意密封包装防潮防湿保存.
3.6 检测画面及区域定义：
A. 检测画面: 全白,全黑, 全红, 全绿, 全蓝画面.
B. 内部区域(I)与外部区域(O)的定义:
I: Inner display area 中心區域
O: Outer display area 非中心區域

Note-1：I/O 區定義/ I/O Area Definition



4.检验标准
4.1 外观检

项目	判定标准	分类
玻璃破裂	不允许	Maj
玻璃漏液	不允许	Maj
玻璃破角	影响线路、性能不可有	Maj
FPC	破损、折伤、短路、金手指偏位等影响性能不可有	Maj

铁框缝隙＞0.65mm	不可有	Min
漏贴PASS、产品标签	≤1/10000	Min
成品尺寸与产品规格书不符	不允许	Maj

4.2 点亮（电性）检查

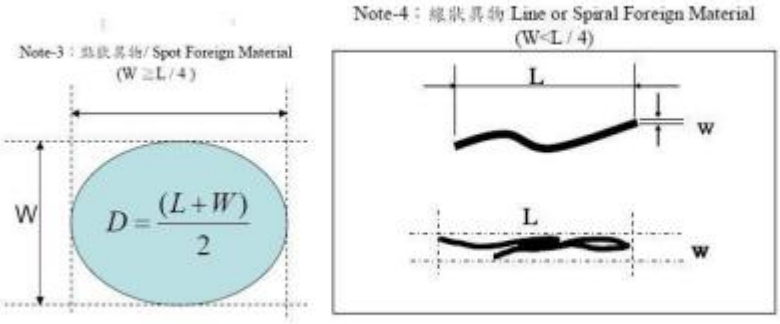
项目	判定标准		分类	
屏的规格	I 区	O 区	总数	Min
亮点	N≤0	N≤2	N≤2	Min
暗点	N≤0	N≤2	N≤2	Min
异物	N≤0	N≤2	N≤2	Min
两连点	N≤0	N≤1	N≤1	Min
总数	N≤0	N≤2	N≤2	Min
亮点带点比例	95:5			
三连点、并列点	不允许			Min
亮线	不允许			Maj

FOG 玻璃点	D≤0.2mm	忽略不计	Min
	0.2mm<D≤0.3mm	N≤2	
	D≥0.3mm	不允许	

FOG 偏异（线状）	0.05mm<W≤0.1mm，L≤5mm	N≤2	Min
	W>0.1mm 或L >5mm	不允许	
FOG 偏异（点状）	D≤0.2mm	忽略不计	Min
	0.2mm<D≤0.3mm	N≤2	
	D>0.3mm	不允许	
FOG 压痕（气泡）	D≤0.2mm	忽略不计	Min
	0.2mm<D≤0.3mm	N≤2	
	D>0.3mm	不允许	

接上页的点亮（电性）检查：

	判定标准		分类
Mura	6%ND 不可見(但若有 LIMUT SAMPLE,參照SAMPLE) 判定基準以灰階畫面50%.		Min
B/L 不良(異物黑點白點)	D≤0.2mm	忽略不计	Min
	0.2mm<D≤0.3mm	N≤2	Min
	D>0.3mm	不允许	Min
B/L 不良(異物黑點白點)	W<0.05 mm	不计	Min
	0.05 mm≦W≦0.1 mm L≦5 mm	N≤2	Min
	W>0.1或 L>5mm	不允许	Min
微小亮点透过 ND 过滤6%仍可视计为点缺陷（全黑画面和50%灰阶检查）。			
忽略不计点请分散插箱，不可集中放在一起			



（如下图 1）

1.3 连续点的定义

两点连续	三点连续	两点连续	三点连续	两点连续	两点连续
■ ■	■ ■ ■	■■	■■■	□■ ■□	■□ □■

5.包装及标识

包装方式与相关标识依客人要求，在客人没作明确要求时，依我司标准确定。

(注：本公司产品保固期为一年，模组ID上有相关信息，如HSD101D042-20160808A03226表示2016年8月8日出产)