



# SPECIFICATION FOR TFT LCD MODULE

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

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

HL MODEL : ~~\_\_\_\_\_HG170SX006T01\_\_\_\_\_~~

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	2019.8.28	FIRST ISSUE	



## CONTENTS

No.	ITEM	PAGE
1.	GENERAL INFORMATION	4
2.	DIAGRAM FOR LCM	5
3.	I/O CONNECTION	6~7
4.	ELECTRICAL CHARACTERISTICS	7~13
5.	ELECTRO-OPTICAL CHARACTERISTICS	14~16
6.	RELIABILITY TEST CONDITIONS	17
7.	INSPECTION STANDARDS	18~19
8.	PACKAGE DRAWING	20



## 1. GENERAL INFORMATION

### 1.1 features

- 1) Structure: LCM+CTP
- 2) TN Type LCD 1280 dot-segment and 1024 dot-common outputs
- 3) 16.7M Color can be selected by software
- 4) White LED back light
- 5) Dual Channel LVDS interface
- 6) Operation Temperature : - 2 0 ~ 6 0 °C
- 7) CTP cover lens : 1 . 8 m m
- 8) CTP structure : G + G
- 9) LED life time: 8串4并

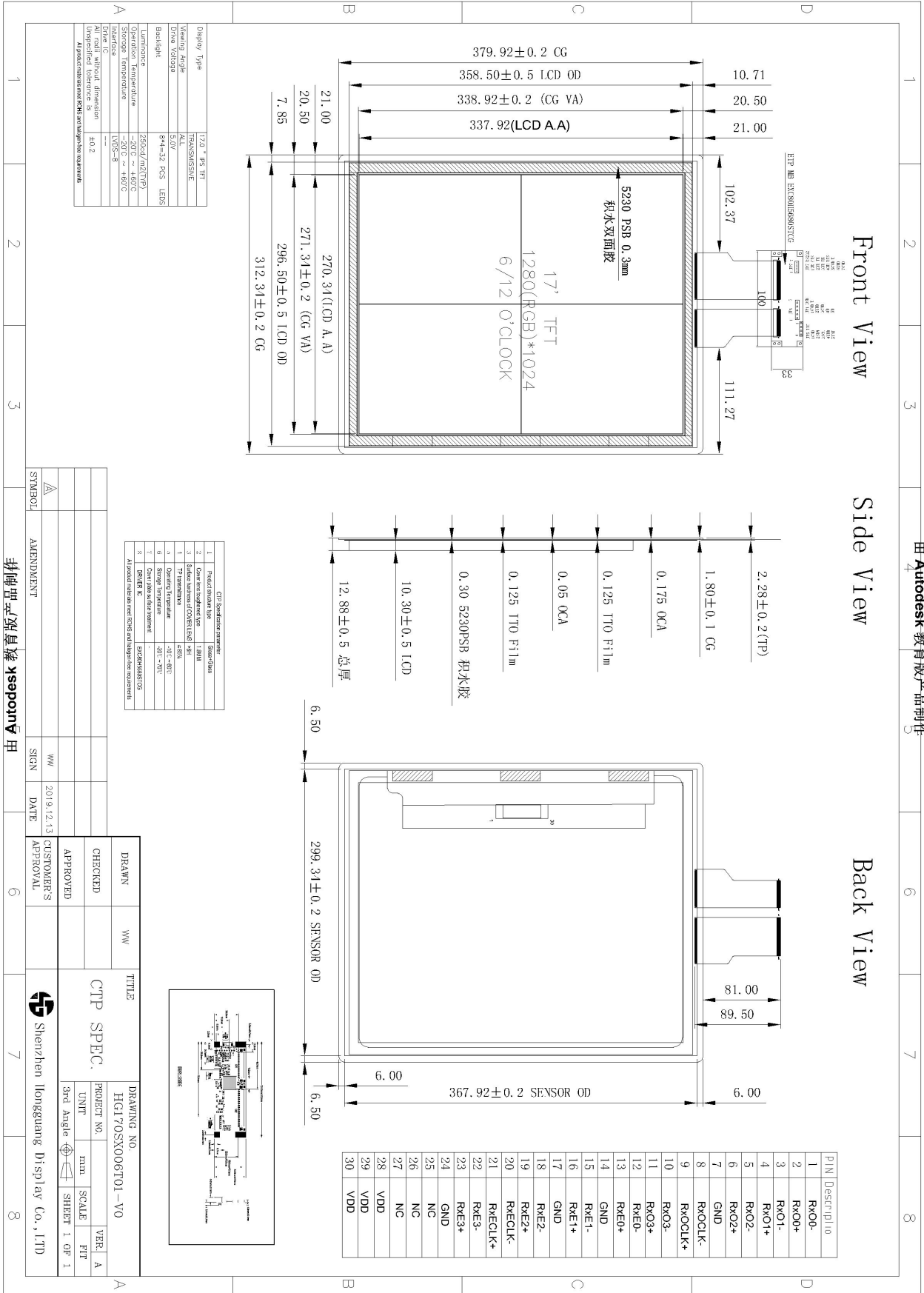
### 1.2 General specification

Item of	Contents	Unit
Panel Size	17	inch
LCD Type	a-si/TRANSMISSIVE	/
Display mode	Normally White	/
Pixel arrangement	1280 × 3(RGB) × 1024	Dots
Pixel pitch (W*H)	0.264(per one triad) × 0.264	um
Active Area	337.920(H) × 270.336(V)	Mm
Module area (W*H*T)	358.5(H) x 296.5(V) x 10.3(D)	Mm
Response Time	5 (Typ., on/off)	[msec]
Power Consumption (LCD Module + Backligh unit)	9.91 (Typ.) LCD module : PDD (Typ.)=3 @ Black pattern, Fv=60Hz Backlight unit : P BLU (Typ.) =6.91 @Is=60mA	[Watt]
Interface	Dual Channel LVDS	/
Luminance for LCM	250	cd/m2
NTSC	70	%
Weight	TBD	g



## 2. DIAGRAM FOR LCM

由 Autodesk 教育版产品制作



由 Autodesk 教育版产品制作



### 3. I/O connection

LCM Pin NO.	Symbol	Description
1	RxO0-	Negative LVDS differential data input(Odd data)
2	RxO0+	Positive LVDS differential data input(Odd data)
3	RxO1-	Negative LVDS differential data input(Odd data)
4	RxO1+	Positive LVDS differential data input(Odd data)
5	RxO2-	Negative LVDS differential data input(Odd data)
6	RxO2+	Positive LVDS differential data input(Odd data)
7	GND	Ground
8	RxOCLK-	Negative LVDS differential data input(Odd data)
9	RxOCLK+	Positive LVDS differential data input(Odd data)
10	RxO3-	Negative LVDS differential data input(Odd data)
11	RxO3+	Positive LVDS differential data input(Odd data)
12	RxE0-	Negative LVDS differential data input(Odd data)
13	RxE0+	Positive LVDS differential data input(Odd data)
14	GND	Ground
15	RxE1-	Negative LVDS differential data input(Odd data)
16	RxE1+	Positive LVDS differential data input(Odd data)
17	GND	Ground
18	RxE2-	Negative LVDS differential data input(Odd data)
19	RxE2+	Positive LVDS differential data input(Odd data)
20	RxECLK-	Negative LVDS differential data input(Odd data)
21	RxECLK+	Positive LVDS differential data input(Odd data)
22	RxE3-	Negative LVDS differential data input(Odd data)
23	RxE3+	Positive LVDS differential data input(Odd data)
24	GND	Ground
25	NC	NC
26	NC	NC
27	NC	NC
28	VDD	Power Supply Input Voltage
29	VDD	Power Supply Input Voltage
30	VDD	Power Supply Input Voltage



## 4. Electrical Characteristics

### 4.1 ABSOLUTE MAXIMUM RATINGS

(GND=AGND=0V)

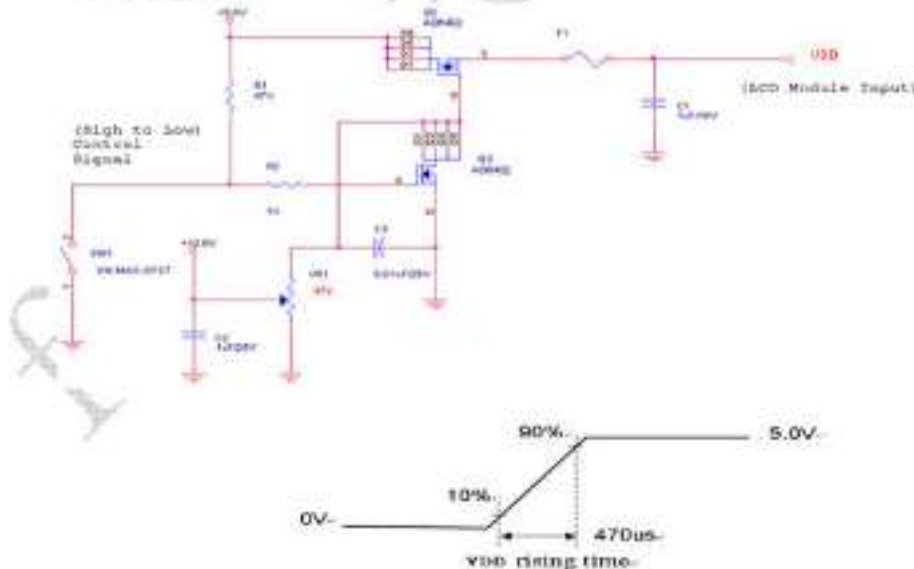
Parameter of absolute maximum ratings 参数	Symbol 符号	Min 最小值	Max 最大值	Unit 单位
Power supply voltage1	VDD	GND-0.3	6	V

### 4.2 Recommended Operating Condition

Symbol	Description	Min	Typ	Max	Unit	Remark
VDD	Power supply Input voltage	4.5	5.0	5.5	[Volt]	
IDD	Power supply Input Current (RMS)	-	0.6	0.72	[A]	VDD= 5.0V, Black Pattern, Fv=60Hz
		-	0.72	0.87	[A]	VDD= 5.0V, Black Pattern, Fv=75Hz
PDD	VDD Power Consumption	-	3	3.6	[Watt]	VDD= 5.0V, Black Pattern, Fv=60Hz
		-	3.6	4.32	[Watt]	VDD= 5.0V, Black Pattern, Fv=75Hz
IRush	Inrush Current	-	-	3.0	[A]	<b>Note 3-1</b>
VDDrp	Allowable VDD Ripple Voltage	-	-	500	[mV]	VDD= 5.0V, Black Pattern, Fv=75Hz

**Note 3-1:** Inrush Current measurement:

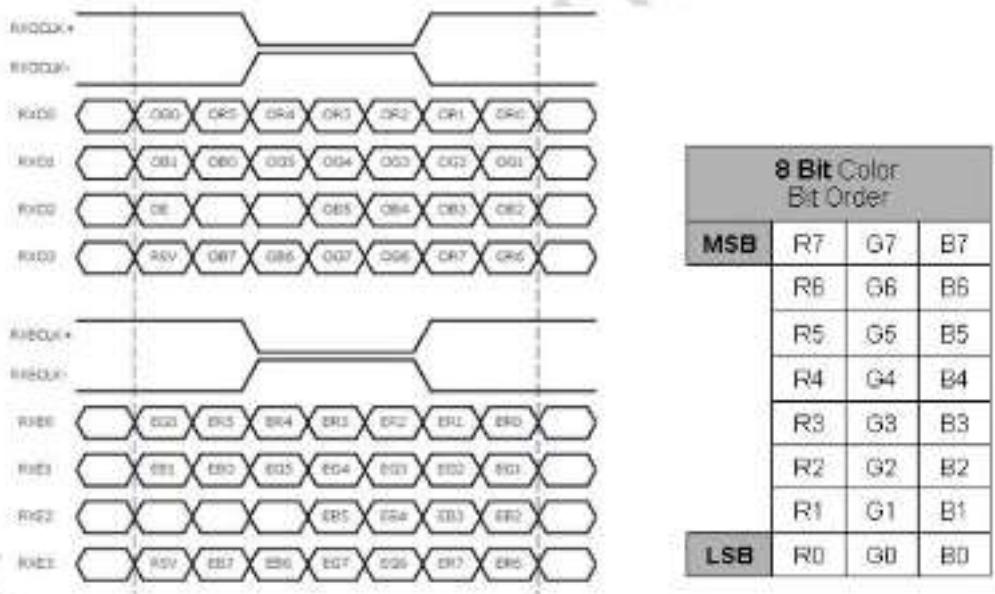
Test circuit:



The duration of VDD rising time: 470us.



## 4.3 LVDS Data Format



**Note 3-2:**

- a. O = "Odd Pixel Data" E = "Even Pixel Data"
- b. Refer to 3.4.1 LCD pixel format, the 1st data is 1 (Odd Pixel Data), the 2<sup>nd</sup> data is 2 (Even Pixel Data) and the last data is 1280 (Even Pixel Data).

## 4.4 Color versus Input Data

The following table is for color versus input data (8bit). The higher the gray level, the brighter the color.

Color	Gray Level	Color Input Data																				Remark			
		RED data (MSB:R7, LSB:R0)								GREEN data (MSB:G7, LSB:G0)								BLUE data (MSB:B7, LSB:B0)							
		R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4		B3	B2	B1
Black	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	
Gray 127	-	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	
Red	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	L255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Green	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	L255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	
Blue	L0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Black
	L255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	





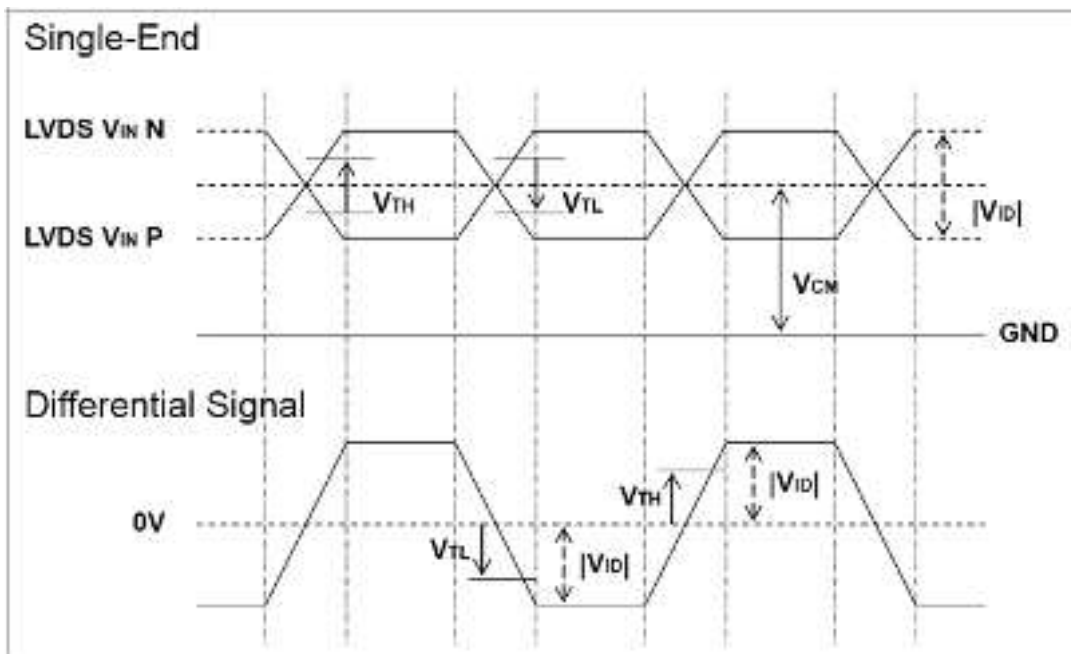
## 4.5 LVDS Specification

### 4.5.1 DC Characteristics:

Symbol	Description	Min	Typ	Max	Units	Condition
$V_{TH}$	LVDS Differential Input High Threshold	-	-	+100	[mV]	$V_{CM} = 1.2V$
$V_{TL}$	LVDS Differential Input Low Threshold	-100	-	-	[mV]	$V_{CM} = 1.2V$
$ V_{ID} $	LVDS Differential Input Voltage	100	-	600	[mV]	
$V_{CM}$	LVDS Common Mode Voltage	+1.0	+1.2	+1.5	[V]	$V_{TH}-V_{TL} = 200mV$

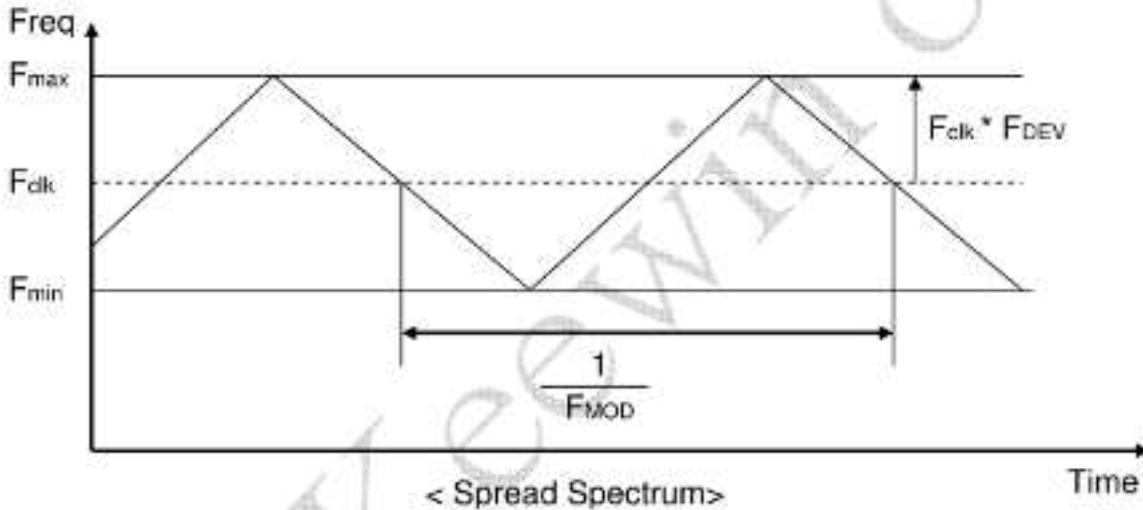
### LVDS Signal Waveform:

Use RxOCLK- & RxOCLK+ as example.



### 4.5.2 AC Characteristics:

Symbol	Description	Min	Max	Unit	Remark
$F_{DEV}$	Maximum deviation of input clock frequency during Spread Spectrum	-	$\pm 3$	%	
$F_{MDD}$	Maximum modulation frequency of input clock during Spread Spectrum	-	200	KHz	



Fclk: LVDS Clock Frequency

## 4.6 Input Timing Specification

It only support DE mode, and the input timing are shown as the following table.

Symbol	Description		Min.	Typ.	Max.	Unit	Remark
Tv	Vertical Section	Period	1036	1066	1873	Th	
Tdisp (v)		Active	1024	1024	1024	Th	
Tblk (v)		Blanking	12	42	849	Th	
Fv		Frequency	50	60	76	Hz	
Th	Horizontal Section	Period	730	844	1320	Tclk	
Tdisp (h)		Active	640	640	640	Tclk	
Tblk (h)		Blanking	90	204	680	Tclk	
Fh		Frequency	37.8	54	68.4	KHz	<b>Note 3-3</b>
Tclk	LVDS Clock	Period	50	60	76	ns	1/Fclk
Fclk		Frequency	51.8	64	93.7	MHz	<b>Note 3-4</b>

**Note 3-3:** The equation is listed as following. Please don't exceed the above recommended value.

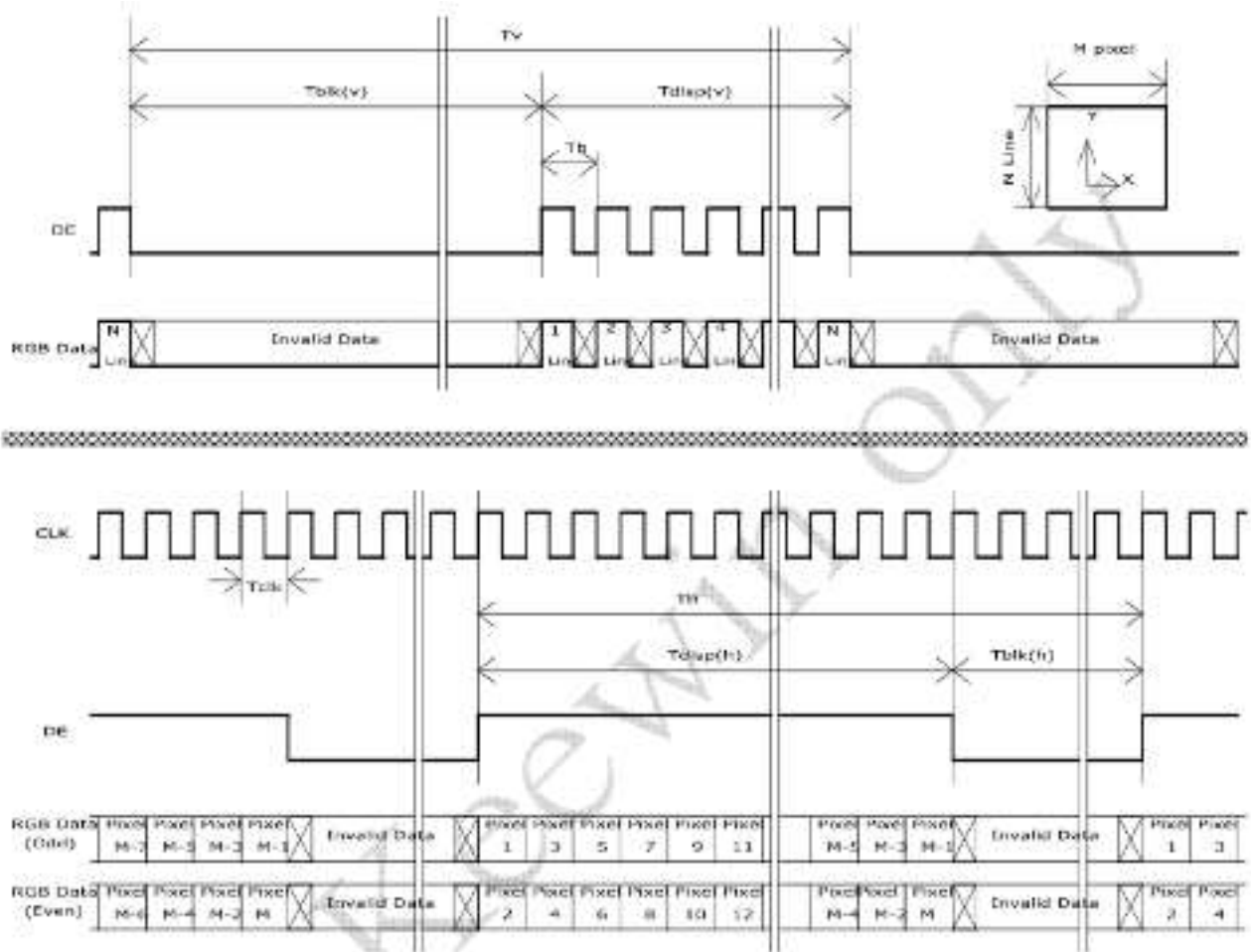
$$\begin{aligned} F_h (\text{Min.}) &= F_{\text{clk}} (\text{Min.}) / T_h (\text{Min.}); \\ F_h (\text{Typ.}) &= F_{\text{clk}} (\text{Typ.}) / T_h (\text{Typ.}); \\ F_h (\text{Max.}) &= F_{\text{clk}} (\text{Max.}) / T_h (\text{Min.}); \end{aligned}$$

**Note 3-4:** The equation is listed as following. Please don't exceed the above recommended value.

$$\begin{aligned} F_{\text{clk}} (\text{Min.}) &= F_v (\text{Min.}) \times T_h (\text{Min.}) \times T_v (\text{Min.}); \\ F_{\text{clk}} (\text{Typ.}) &= F_v (\text{Typ.}) \times T_h (\text{Typ.}) \times T_v (\text{Typ.}); \\ F_{\text{clk}} (\text{Max.}) &= F_v (\text{Max.}) \times T_h (\text{Typ.}) \times T_v (\text{Typ.}); \end{aligned}$$

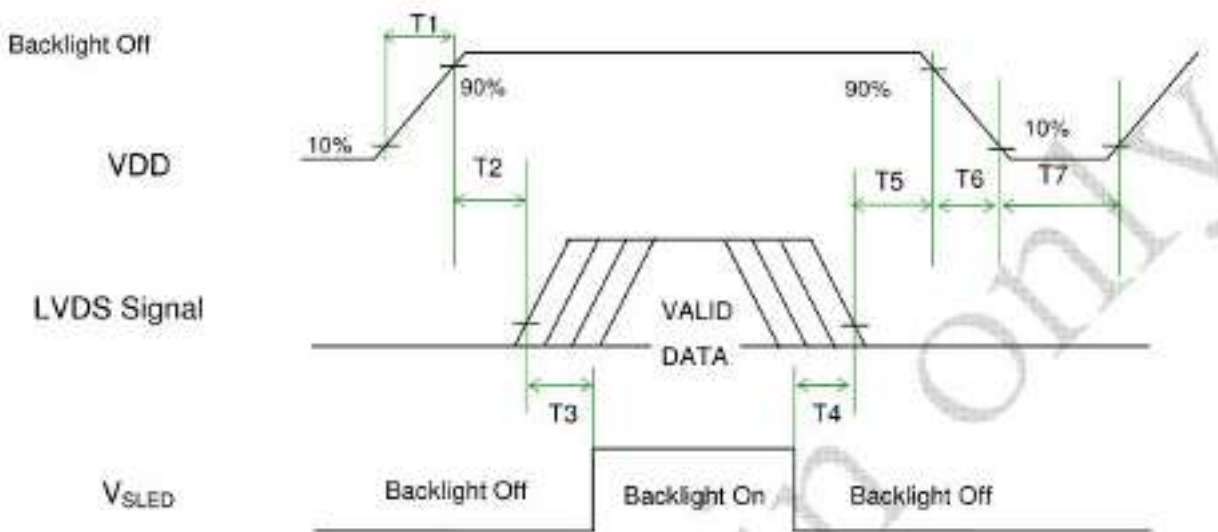


## 4.7 Input Timing Diagram



## 4.8 Power ON/OFF Sequence

VDD power, LVDS signal and backlight on/off sequence are as following. LVDS signals from any system shall be Hi-Z state when VDD is off.





## Power Sequence Timing

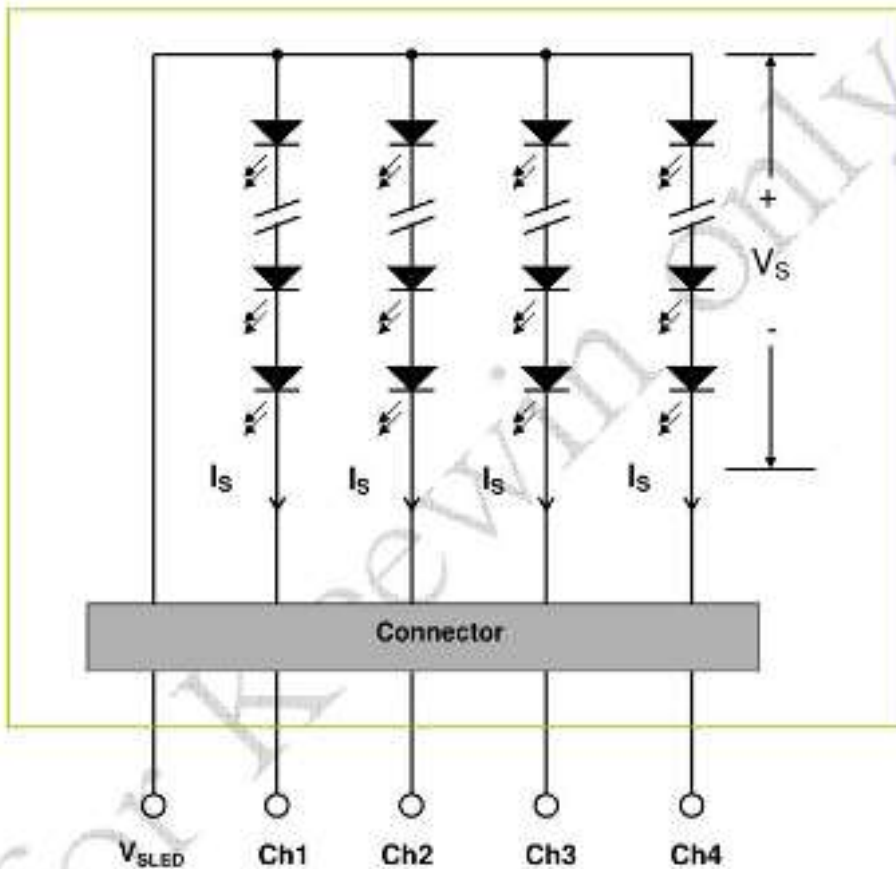
Symbol	Value			Unit	Remark
	Min.	Typ.	Max.		
T1	0.5	-	10	[ms]	
T2	0	-	50	[ms]	
T3	500	-	-	[ms]	
T4	100	-	-	[ms]	
T5	0	-	50	[ms]	<i>Note 3-5</i> <i>Note 3-6</i>
T6	0	-	150	[ms]	<i>Note 3-6</i>
T7	1000	-	-	[ms]	

**Note 3-5 :** Recommend setting T5 = 0ms to avoid electronic noise when VDD is off.

**Note 3-6 :** During T5 and T6 period , please keep the level of input LVDS signals with Hi-Z state.

## 4.9 Backlight Unit

The following shows the block diagram of the 17 inch Backlight Unit. And it includes 36 pcs LED in the LED light bar. (4 strings and 9 pcs LED of one string).





(Ta=25°C)

Symbol	Description	Min.	Typ.	Max.	Unit	Remark
Is	LED String Current		60	66	[mA]	100% duty ratio of LED chip
Vs	LED String Voltage	25.2	28.8	32.4	[Volt]	Is=60mA @ 100% duty ratio; <b>Note 4-1</b>
ΔVs	Maximum Vs Voltage Deviation of light bar	-	-	1.8	[Volt]	Is=60mA @ 100% duty ratio; <b>Note 4-2</b>
P <sub>BLU</sub>	LED Light Bar Power Consumption	-	6.91	8.55	[Watt]	<b>Note 4-3</b>
LT <sub>LED</sub>	LED Life Time	30,000	-	-	[Hour]	<b>Note 4-4</b>

**Note 4-1:** Vs (Typ.) = V F (Typ.) X LED No. (one string);

a. V F : LED chip forward voltage, V F (Min.)=2.8V, V F (Typ.)=3.2V, V F (Max.)=3.6V

b. The same equation to calculate Vs(Min.) & Vs (Max.) for respective V F (Min.) & V F (Max.);

**Note 4-2:** ΔVs (Max.) = ΔV F X LED No. (one string);

a. ΔV F: LED chip forward voltage deviation; (0.2 V , each Bin of LED V F )

**Note 4-3:** P BLU (Typ.) = Vs (Typ.) X Is (Typ.) X 4 ; ( 4 is total String No. of LED Light bar)

P BLU (Max.) = Vs (Max.) X Is (Max.) X 4 ;

**Note 4-4:** Definition of life time:

a. Brightness of LED becomes to 50% of its original value

b. Test condition: Is = 60mA and 25°C (Room Temperature)



## 5. ELECTRO-OPTICAL CHARACTERISTICS

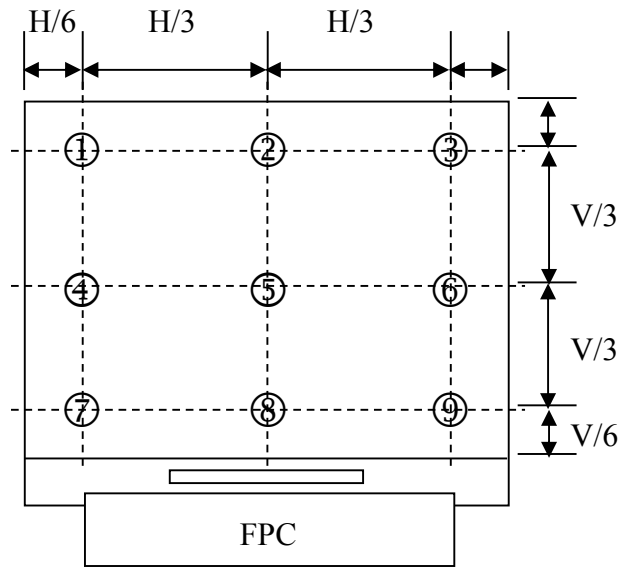
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio (Center point)		C/R	-	600	1000	-	-	Note(1)
Luminance uniformity		U <sub>w</sub>		75	80	-	%	Note(2)
Response Time		Tr		-	3.8	5.5	ms	Note(3)
		Tf		-	1.2	2.5		
		Tr+Tf		-	5	8		
Color Chromaticity (CIE 1931)	White	W <sub>x</sub>	θ = 0. Normal viewing angle B/L On  Note(1)		0.313		参考 值	Note(5)
		W <sub>y</sub>			0.329			
	Red	R <sub>x</sub>			0.645			
		R <sub>y</sub>			0.333			
	Green	G <sub>x</sub>		-0.02	0.320	+0.02		
		G <sub>y</sub>			0.626			
	Blue	B <sub>x</sub>			0.153			
		B <sub>y</sub>			0.057			
Viewing Angle	Hor.	∅ 3R	C/R≥10	75	85	-	Deg	Note(4)
		∅ 9L		75	85	-		
	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.



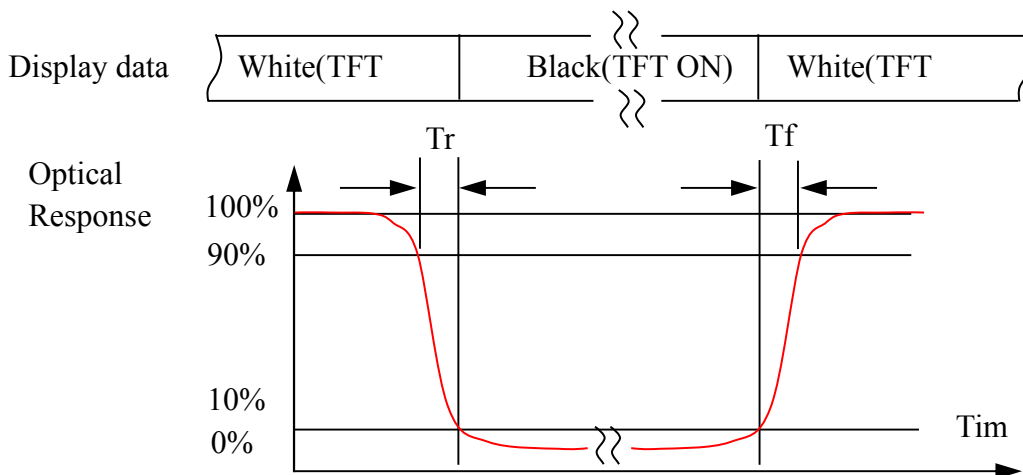
The spot locations for luminance measurement

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

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

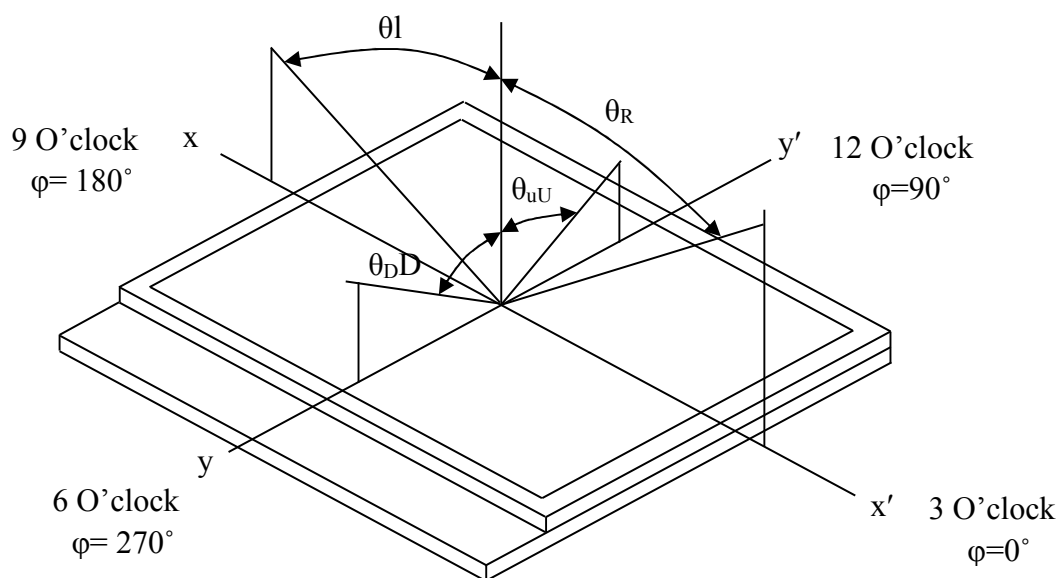
$B_{\min}$ : The measured minimum luminance of all measurement position.

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.





## 6. RELIABILITY TEST CONDITIONS

No	Test Item	Test Condition	STANDARD
1	High Temperature Storage	+60°C / 48Hours	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	-20°C / 48Hours	
3	High Temperature Operating	+60°C / 48Hours	
4	Low Temperature Operating	-20°C / 48Hours	
5	Thermal and cold shock	0°C↔+50°C x 10cycles (30min) (5min) (30min)	
6	Operate at High Temperature and Humidity	50°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 0.6m 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.



## 7. INSPECTION STANDARDS

### 7.1 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

### 7.2 Inspect the condition

7.2.1 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)

7.2.2 检验者视力需达到标准视力 1.0 以上。

7.2.3 检验者需戴静电手环、两手八个手指套。

7.2.4 外观检验者以目视检查或以菲林对比卡比对。

7.2.5 电性测试使用电测测架, 主板, 电源线及单片机。

7.2.6 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

7.2.7 辉色度检测请参照样品, 检测方法依照辉色度检验标准。

7.2.8 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。

7.2.9 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。

### 7.3 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	MI	OK
				$0.15 < D \leq 0.25$ , $ds \geq 10$		$N \leq 2$
				$0.25 < D \leq 3$ , $ds \geq 10$		$N \leq 1$
				LCD亮点: $0.2 < D$		$N \leq 1$
				$D > 0.3$		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

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	MI	OK
				$0.15 < D \leq 0.3$ , $ds \geq 10$		$N \leq 2$
				$0.3 < D \leq 0.35$ , $ds \geq 10$		$N \leq 1$
				LCD亮点: $0.25 < D$		$N \leq 1$
				$D > 0.35$		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)	$W \leq 0.05mm$ , $L \leq 5mm$ , $ds \geq 10$	MI	$N \leq 2$
				$0.05mm < W \leq 0.07mm$ , $L \leq 5mm$ , $ds \geq 10$		$N \leq 1$
				$W > 0.07mm$ 或 $L > 5mm$		NG



## 8. PACKAGE DRAWING

### LCM产品(刀卡类)包装流程图

1.0 包装材料清单:

见受控BOM

2.0 包装方法说明:

