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CERT. No.: 282Q19070712006



CERT. No.: 282E19070712007

Product Specification

Model: TTX123BHT-01

12.3" TFT Display Module (1920*720)

This module uses RoHS material

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REVISION STATUS

Version	Revise Date	Page	Content	Modified by
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1. General Description

* DESCRIPTION

TTX123BHT-01 is a color active matrix TFT (Thin Film Transistor) LCD (liquid crystal display) that uses amorphous silicon TFT as a switching device. This model is composed of a Transmissive type TFT-LCD Panel, driver circuit, back-light unit. The resolution of a 12.3" TFT-LCD contains 1920*720 pixels, and can display up to 16.7M colors.

* Features

- Low Input Voltage: VDD: 3.3V
- Display Colors of TFT LCD: 16.7M colors
- CPU Interface: EDP

General Information Items	Specification	Unit	Note
	Main Panel		
Display area(AA)	292.03(H) *109.51(V) (12.3 inch)	mm	-
Driver element	a-Si TFT active matrix	-	-
Display colors	16.7M	colors	-
Number of pixels	1920(RGB) *720	dots	-
Pixel arrangement	RGB vertical stripe	-	-
Pixel pitch	0.1521(H) *0.1521(V)	mm	-
Viewing angle	ALL	o'clock	-
Drive IC	/	-	-
Display mode	Transmissive/ Normally White	-	-
Operating temperature	-20~+70	°C	-
Storage temperature	-30~+80	°C	-

Mechanical Information

Item		Min.	Typ.	Max.	Unit	Note
Module size	Horizontal(H)	-	301.17	-	mm	±0.3
	Vertical(V)	-	123.45	-	mm	±0.3
	Depth(D)	-	2.75	-	mm	±0.15
Weight		-	TBD	-	g	-

2. Mechanical Specification

<p>1. LCM 产品特征 (LCM Features):</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr><td>显示类型 (Display mode):</td><td>TFT/Normal BLACK</td></tr> <tr><td>驱动芯片 (Driver IC):</td><td>/</td></tr> <tr><td>人眼观察角 (Viewing Direction):</td><td>ALL</td></tr> <tr><td>接口类型 (Interface Types):</td><td>LWDS</td></tr> <tr><td>背光类型 (BackLight Types):</td><td>54pcs, 9#H6并120mA(20mA/LED), 电压为24.3-28.7V (TYP)</td></tr> <tr><td>LCM亮度 (LCDTP Brightness):</td><td>320 cd/m² Min, 400 cd/m² TYP</td></tr> <tr><td>颜色坐标 (Color Coordinate):</td><td>(X=0.31±0.05, Y=0.32±0.05)</td></tr> <tr><td>模组均匀度 (LCM Uniformity):</td><td>75% MIN</td></tr> <tr><td>操作温度 (Operating Temperature):</td><td>-20°C~70°C</td></tr> <tr><td>储存温度 (Storage Temperature):</td><td>-30°C~80°C</td></tr> <tr><td>平面翘曲度 (Plane Warpage Rate):</td><td><0.5MM</td></tr> <tr><td>连接器 (PC CONN):</td><td></td></tr> </table>	显示类型 (Display mode):	TFT/Normal BLACK	驱动芯片 (Driver IC):	/	人眼观察角 (Viewing Direction):	ALL	接口类型 (Interface Types):	LWDS	背光类型 (BackLight Types):	54pcs, 9#H6并120mA(20mA/LED), 电压为24.3-28.7V (TYP)	LCM亮度 (LCDTP Brightness):	320 cd/m ² Min, 400 cd/m ² TYP	颜色坐标 (Color Coordinate):	(X=0.31±0.05, Y=0.32±0.05)	模组均匀度 (LCM Uniformity):	75% MIN	操作温度 (Operating Temperature):	-20°C~70°C	储存温度 (Storage Temperature):	-30°C~80°C	平面翘曲度 (Plane Warpage Rate):	<0.5MM	连接器 (PC CONN):		<p>2. 一般公差: ±0.2mm. (GENERAL TOLERANCE: ±0.2) 3. 尺寸中带有“*”为重点管控尺寸. (*Dimensions of the key control and Control Dimensions.) 4. 图纸中带有“”特别说明及重点确认位置. (Special Note And Key Confirmation Position) 5. 产品所有物料符合 ROHS 规定要求. (All The Products Comply With The ROHS Requirements). 6. 可视区开窗设计要求: 建议外壳可视区域占比 模块VA单边小0.3mm以上. (Visual Area Window Design Requirements: The Proposed Shell Visual Area Than The Module VA Unilateral Small 0.3mm Above.).</p>	<p>二. 防静电PCB A设计建议及要求: (The Antistatic PCB A Design Suggestions And Requests) 1. 在RESET信号脚上接TVS管, 连接TVS管GND要 辅完整. (TVS Tube Feet, Then The RESET Signal, Connect The TVS Tube GND To Shop Complete). 2. 信号走线, 同时两侧包GND线. (Signal Go Line, While Both Sides Of The Package GND Line).</p>	<p>TP接口程式 (CNT3)</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr><td>1</td><td>VCC_TP</td></tr> <tr><td>2</td><td>VCC_TP</td></tr> <tr><td>3</td><td>GND</td></tr> <tr><td>4</td><td>LED_A</td></tr> <tr><td>5</td><td>GND</td></tr> <tr><td>6</td><td>LED_K1</td></tr> <tr><td>7</td><td>LED_K2</td></tr> <tr><td>8</td><td>LED_K3</td></tr> <tr><td>9</td><td>LED_K4</td></tr> <tr><td>10</td><td>LED_K5</td></tr> <tr><td>11</td><td>NCV1</td></tr> <tr><td>12</td><td>NCV2</td></tr> <tr><td>13</td><td>NCV3</td></tr> <tr><td>14</td><td>VDD</td></tr> <tr><td>15</td><td>VCC_TP</td></tr> <tr><td>16</td><td>NCV4</td></tr> <tr><td>17</td><td>TP_INT</td></tr> <tr><td>18</td><td>TP_EC_SCL</td></tr> <tr><td>19</td><td>TP_EC_SDA</td></tr> <tr><td>20</td><td>TP_RST</td></tr> <tr><td>21</td><td>GND</td></tr> <tr><td>22</td><td>STBY_V</td></tr> <tr><td>23</td><td>TP_A0</td></tr> <tr><td>24</td><td>ID</td></tr> <tr><td>25</td><td>RST1</td></tr> <tr><td>26</td><td>RST_LIN</td></tr> <tr><td>27</td><td>LR</td></tr> <tr><td>28</td><td>DSF_EC_SDA</td></tr> <tr><td>29</td><td>DSF_EC_SCL</td></tr> <tr><td>30</td><td>GND</td></tr> <tr><td>31</td><td>DA_N_P</td></tr> <tr><td>32</td><td>DA_P_P</td></tr> <tr><td>33</td><td>GND</td></tr> <tr><td>34</td><td>DR_N_P</td></tr> <tr><td>35</td><td>DR_P_P</td></tr> <tr><td>36</td><td>GND</td></tr> <tr><td>37</td><td>DC_N_P</td></tr> <tr><td>38</td><td>DC_P_P</td></tr> <tr><td>39</td><td>GND</td></tr> <tr><td>40</td><td>DC_N_P_E</td></tr> <tr><td>41</td><td>DC_P_P_E</td></tr> <tr><td>42</td><td>GND</td></tr> <tr><td>43</td><td>DD_N_P</td></tr> <tr><td>44</td><td>DD_P_P</td></tr> <tr><td>45</td><td>GND</td></tr> <tr><td>46</td><td>DA_N_P_O</td></tr> <tr><td>47</td><td>DA_P_P_O</td></tr> <tr><td>48</td><td>GND</td></tr> <tr><td>49</td><td>DD_N_P_O</td></tr> <tr><td>50</td><td>DD_P_P_O</td></tr> <tr><td>51</td><td>GND</td></tr> <tr><td>52</td><td>DC_N_P_O</td></tr> <tr><td>53</td><td>DC_P_P_O</td></tr> <tr><td>54</td><td>GND</td></tr> <tr><td>55</td><td>DC_N_P_O</td></tr> <tr><td>56</td><td>DC_P_P_O</td></tr> <tr><td>57</td><td>GND</td></tr> <tr><td>58</td><td>DD_N_P_O</td></tr> <tr><td>59</td><td>DD_P_P_O</td></tr> <tr><td>60</td><td>GND</td></tr> </table> <p>LCM 接口程式 (CNT1)</p> <table border="1" style="width:100%; 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LCM 接口程式 (CNT3)</p> <table border="1" style="width:100%; border-collapse: collapse;"> <tr><td>1</td><td>VCC_TP</td></tr> <tr><td>2</td><td>VCC_TP</td></tr> <tr><td>3</td><td>GND</td></tr> <tr><td>4</td><td>LEDAL</td></tr> <tr><td>5</td><td>GND</td></tr> <tr><td>6</td><td>LED_K1</td></tr> <tr><td>7</td><td>LED_K2</td></tr> <tr><td>8</td><td>LED_K3</td></tr> <tr><td>9</td><td>LED_K4</td></tr> <tr><td>10</td><td>LED_K5</td></tr> <tr><td>11</td><td>NCV1</td></tr> <tr><td>12</td><td>NCV2</td></tr> <tr><td>13</td><td>NCV3</td></tr> <tr><td>14</td><td>VDD</td></tr> <tr><td>15</td><td>VCC_TP</td></tr> <tr><td>16</td><td>NCV4</td></tr> <tr><td>17</td><td>TP_INT</td></tr> <tr><td>18</td><td>TP_EC_SCL</td></tr> <tr><td>19</td><td>TP_EC_SDA</td></tr> <tr><td>20</td><td>TP_RST</td></tr> <tr><td>21</td><td>GND</td></tr> <tr><td>22</td><td>STBY_V</td></tr> <tr><td>23</td><td>TP_A0</td></tr> <tr><td>24</td><td>ID</td></tr> <tr><td>25</td><td>RST1</td></tr> <tr><td>26</td><td>RST_LIN</td></tr> <tr><td>27</td><td>LR</td></tr> <tr><td>28</td><td>DSF_EC_SDA</td></tr> <tr><td>29</td><td>DSF_EC_SCL</td></tr> <tr><td>30</td><td>GND</td></tr> <tr><td>31</td><td>DA_N_P</td></tr> <tr><td>32</td><td>DA_P_P</td></tr> <tr><td>33</td><td>GND</td></tr> <tr><td>34</td><td>DR_N_P</td></tr> <tr><td>35</td><td>DR_P_P</td></tr> <tr><td>36</td><td>GND</td></tr> <tr><td>37</td><td>DC_N_P</td></tr> <tr><td>38</td><td>DC_P_P</td></tr> <tr><td>39</td><td>GND</td></tr> <tr><td>40</td><td>DC_N_P_E</td></tr> <tr><td>41</td><td>DC_P_P_E</td></tr> <tr><td>42</td><td>GND</td></tr> <tr><td>43</td><td>DD_N_P</td></tr> <tr><td>44</td><td>DD_P_P</td></tr> <tr><td>45</td><td>GND</td></tr> <tr><td>46</td><td>DA_N_P_O</td></tr> <tr><td>47</td><td>DA_P_P_O</td></tr> <tr><td>48</td><td>GND</td></tr> <tr><td>49</td><td>DD_N_P_O</td></tr> <tr><td>50</td><td>DD_P_P_O</td></tr> <tr><td>51</td><td>GND</td></tr> <tr><td>52</td><td>DC_N_P_O</td></tr> <tr><td>53</td><td>DC_P_P_O</td></tr> <tr><td>54</td><td>GND</td></tr> <tr><td>55</td><td>DC_N_P_O</td></tr> <tr><td>56</td><td>DC_P_P_O</td></tr> <tr><td>57</td><td>GND</td></tr> <tr><td>58</td><td>DD_N_P_O</td></tr> <tr><td>59</td><td>DD_P_P_O</td></tr> <tr><td>60</td><td>GND</td></tr> </table>	1	VCC_TP	2	VCC_TP	3	GND	4	LEDAL	5	GND	6	LED_K1	7	LED_K2	8	LED_K3	9	LED_K4	10	LED_K5	11	NCV1	12	NCV2	13	NCV3	14	VDD	15	VCC_TP	16	NCV4	17	TP_INT	18	TP_EC_SCL	19	TP_EC_SDA	20	TP_RST	21	GND	22	STBY_V	23	TP_A0	24	ID	25	RST1	26	RST_LIN	27	LR	28	DSF_EC_SDA	29	DSF_EC_SCL	30	GND	31	DA_N_P	32	DA_P_P	33	GND	34	DR_N_P	35	DR_P_P	36	GND	37	DC_N_P	38	DC_P_P	39	GND	40	DC_N_P_E	41	DC_P_P_E	42	GND	43	DD_N_P	44	DD_P_P	45	GND	46	DA_N_P_O	47	DA_P_P_O	48	GND	49	DD_N_P_O	50	DD_P_P_O	51	GND	52	DC_N_P_O	53	DC_P_P_O	54	GND	55	DC_N_P_O	56	DC_P_P_O	57	GND	58	DD_N_P_O	59	DD_P_P_O	60	GND	<p>4. 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显示类型 (Display mode):	TFT/Normal BLACK																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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背光类型 (BackLight Types):	54pcs, 9#H6并120mA(20mA/LED), 电压为24.3-28.7V (TYP)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
LCM亮度 (LCDTP Brightness):	320 cd/m ² Min, 400 cd/m ² TYP																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
颜色坐标 (Color Coordinate):	(X=0.31±0.05, Y=0.32±0.05)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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储存温度 (Storage Temperature):	-30°C~80°C																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
平面翘曲度 (Plane Warpage Rate):	<0.5MM																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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3. PIN DESCRIPTION

Terminal	Symbol	Functions
Pin No.	Symbol	Description
1	GND	GROUND
2	NC	NC
3	LED_A1	LED Anode1
4	LED_A2	LED Anode2
5	NC	NC
6	LED_K1	LED Cathode 1
7	LED_K2	LED Cathode 2
8	LED_K3	LED Cathode 3
9	LED_K4	LED Cathode 4
10	NC(NTC1)	NC(NTC1)
11	NC(NTC2)	NC(NTC2)
12	NC	Reserved for BOE use only
13	VDD	LCD Power Supply, Min. 3.0V/Typ. 3.3V/Max. 3.6V
14	VDD	LCD Power Supply, Min. 3.0V/Typ. 3.3V/Max. 3.6V
15	VCC_TP	Power Supply For Touch
16	NC	NC
17	TP_INT	Interrupt Signal for Touch
18	TP_I2C_SCL	Touch I2C CLOCK
19	TP_I2C_SDA	Touch I2C DATA
20	TP_RST	TP External reset single
21	GND	GROUND
22	STBYB	Standby mode , Default H
23	Fail_det	Fail detect function output pin , Default H
24	UD	UP= H(Default), U2D sequence UP= L, D2U sequence
25	RESET	LCD reset , Default H
26	BIST_EN	Enable BIST function, GND for Normal , Default L
27	LR	LR= 0, shift left LR= 1(Default), shift right
28	DISP_I2C_SDA	Display I2C DATA
29	DISP_I2C_SCL	Display I2C CLOCK
30	GND	GROUND
31	DA_N_E	Negative Transmission data of Pixel 0 (EVEN)
32	DA_P_E	Positive Transmission data of Pixel 0 (EVEN)

33	GND	GROUND
34	DB_N_E	Negative Transmission data of Pixel 1 (EVEN)
35	DB_P_E	Positive Transmission data of Pixel 1 (EVEN)
36	GND	GROUND
37	DC_N_E	Negative Transmission data of Pixel 2 (EVEN)
38	DC_P_E	Positive Transmission data of Pixel 2 (EVEN)
39	GND	GROUND
40	DCLK_N_E	Negative Transmission Clock (EVEN)
41	DCLK_P_E	Positive Transmission Clock (EVEN)
42	GND	GROUND
43	DD_N_E	Negative Transmission data of Pixel 3 (EVEN)
44	DD_P_E	Positive Transmission data of Pixel 3 (EVEN)
45	GND	GROUND
46	DA_N_O	Negative Transmission data of Pixel 0 (ODD)
47	DA_P_O	Positive Transmission data of Pixel 0 (ODD)
48	GND	GROUND
49	DB_N_O	Negative Transmission data of Pixel 1 (ODD)
50	DB_P_O	Positive Transmission data of Pixel 1 (ODD)
51	GND	GROUND
52	DC_N_O	Negative Transmission data of Pixel 2 (ODD)
53	DC_P_O	Positive Transmission data of Pixel 2 (ODD)
54	GND	GROUND
55	DCLK_N_O	Negative Transmission Clock (ODD)
56	DCLK_P_O	Positive Transmission Clock (ODD)
57	GND	GROUND
58	DD_N_O	Negative Transmission data of Pixel 3 (ODD)
59	DD_P_O	Positive Transmission data of Pixel 3 (ODD)
60	GND	GROUND

4. ELECTRICAL CHARACTERISTICS

4.1 ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Values		Unit	Remark
		Min	Max.		
Supply Voltage for Logic circuit	VDD	3.0	3.6	V	
Supply Voltage for analog circuit	AVDD	-	-	V	

4.2 DC ELECTRICAL CHARACTERISTICS

4.2.1 OPERATING CONDITIONS

Typical Operating Conditions (Ta=25°C)

Item	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
Digital Supply Voltage	Vdd	3	3.3	3.6	V	
Analog Supply Voltage	AVDD	-	-	-	V	
Common Voltage	VCOM	-	-	-	V	
TFT Gate ON Voltage	VGH	-	-	-	V	
TFT Gate OFF Voltage	VGL	-	-	-	V	

4.2.2 BACKLIGHT UNIT (GND=0V)

Item	Symbol	Values			Unit	Remark
		Min	Typ	Max.		
Forward supply Voltage	V _f	24.3	-	29.7	V	
Forward supply Current	I _f	-	120	-	mA	
LCM Luminance	L _v	320	400	-	cd/m ²	I _B =120mA
Uniformity	/	75			%	-

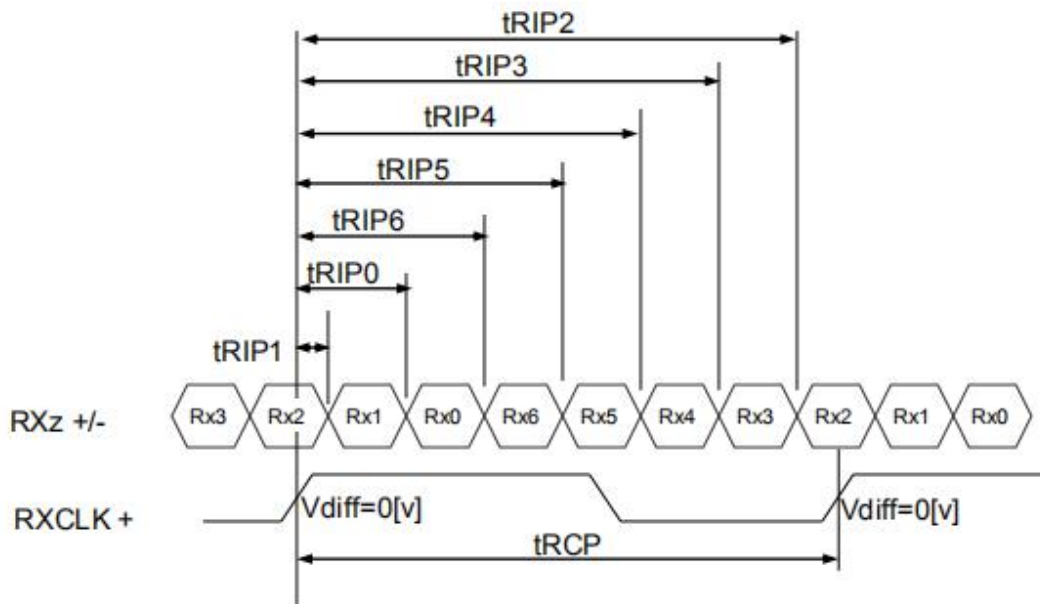
4.3 TIMING CHARACTERISTICS
LVDS INTERFACE AC CHARACTERISTICS

4.5 LVDS Rx Interface Timing Parameter

The specification of the LVDS Rx interface timing parameter is shown in Table 8.

<Table 8. LVDS Rx Interface Timing Specification>

Item	Symbol	Min	Typ	Max	Unit	Remark
CLKIN Period	tRCP	10	T	40	nsec	
Receiver Data Input Margin	tRMG	TBD	-	TBD	nsec	fCLKIN=MHz
		TBD	-	TBD	nsec	fCLKIN=MHz
Input Data 0	tRIP1	- tRMG	0.0	tRMG	Clock	
Input Data 1	tRIP0	T/7- tRMG	T/7	T/7+ tRMG	Clock	
Input Data 2	tRIP6	2 T/7- tRMG	2T/7	2T/7+ tRMG	Clock	
Input Data 3	tRIP5	3T/7- tRMG	3T/7	3T/7+ tRMG	Clock	
Input Data 4	tRIP4	4T/7- tRMG	4T/7	4T/7+ tRMG	Clock	
Input Data 5	tRIP3	5T/7- tRMG	5T/7	5T/7+ tRMG	Clock	
Input Data 6	tRIP2	6T/7- tRMG	6T/7	6T/7+ tRMG	Clock	



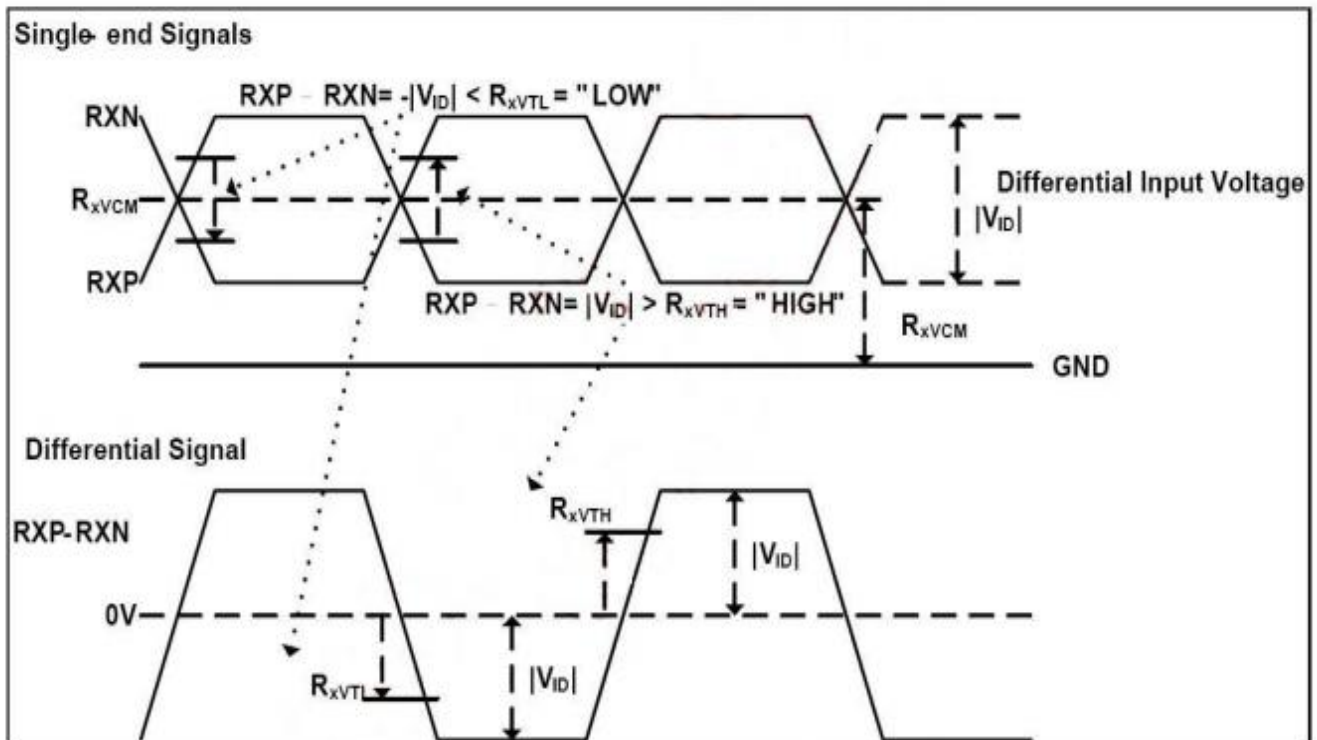
* Vdiff = (RXz+)-(RXz-),..... ,(RXCLK+)-(RXCLK-)

4.6 DC Specification

- LVDS Receiver Differential Input (DC Characteristics)

< Table 9-1. LVDS Rx DC Characteristics >

Parameter	Symbol	Min	Typ	Max	Unit	Notes
Differential Input High Threshold Voltage	V_{TH}	-	-	+100	mV	VCM=1.2V
Differential Input Low Threshold Voltage	V_{TL}	-100	-	-	mV	
Differential Input Common Mode Voltage	VCM	0.7	1.2	1.6	V	
Differential Input Voltage	$ V_{ID} $	100	-	600	mV	

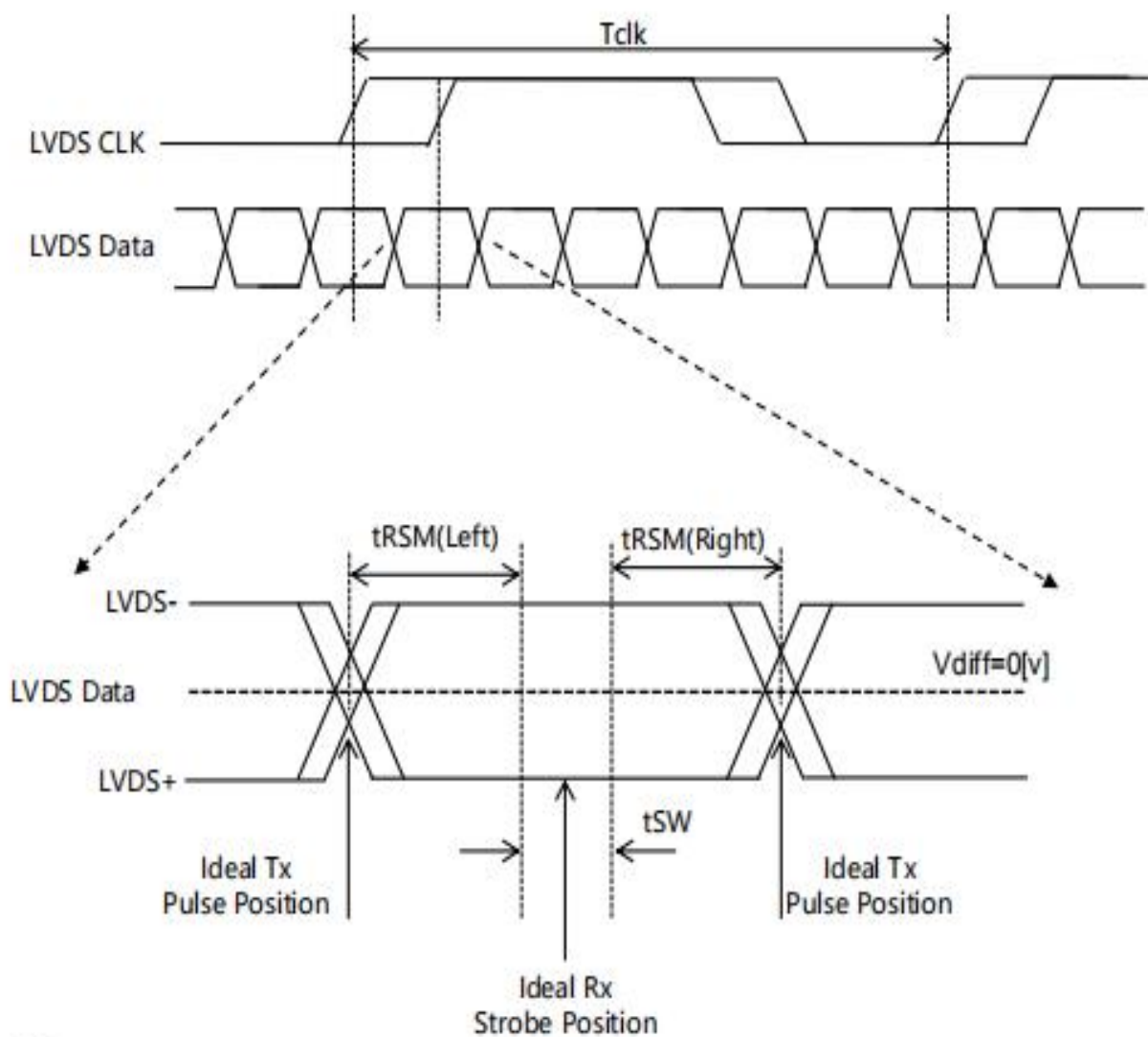


4.7 AC Specification

- LVDS Receiver Differential Input (AC Characteristics)

< Table 9-2. LVDS Rx AC Characteristics >

Parameter	Symbol	Min	Typ	Max	Unit	Notes
LVDS Strobe Width	t_{SW}	TBD	-	-	ps	V _{cm} =1.2V VID = 400mV @65MHz
LVDS Receiver Skew Margin	t_{RSM}	TBD	-	-	ps	



Note:

RSM: Receiver Skew Margin

SW: Strobe Width (Setup and Hold time; TCON Internal data sampling window)

5. OPTICAL CHARACTERISTICS (LCD MONOMER PARAMETERS)

7.1 Overview

The test of view angle range shall be measured in a dark room (ambient luminance ≤ 1 lux and temperature = $25 \pm 2^\circ\text{C}$) with the equipment of Luminance meter system (TOPCON CS2000/CA310) and test unit shall be located at an approximate distance 50cm from the LCD surface at a viewing angle of θ and Φ equal to 0° . We refer to $\theta=0$ ($=\theta_3$) as the 3 o'clock direction (the "right"), $\theta=90$ ($=\theta_{12}$) as the 12 o'clock direction ("upward"), $\theta=180$ ($=\theta_9$) as the 9 o'clock direction ("left") and $\theta=270$ ($=\theta_6$) as the 6 o'clock direction ("bottom"). While scanning θ and/or Φ , the center of the measuring spot on the Display surface shall stay fixed. The luminance, color and uniformity (etc) should be tested by CS2000/CA310. The backlight should be operating for 10 minutes prior to measurement. VDD shall be $3.3 \pm 0.3\text{V}$ at 25°C . Optimum viewing angle direction is 6 o'clock

<Table 9. Optical Specifications>

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing Angle range	Horizontal	θ_3	CR > 10	80	89	-	Deg.	Note 1
		θ_9		80	89	-	Deg.	
	Vertical	θ_{12}		80	89	-	Deg.	
		θ_6		80	89	-	Deg.	
Luminance Contrast ratio		CR	$\theta = 0^\circ$	900	1200	-		Note 2
Brightness Center		Lv	$\theta = 0^\circ$	320	400	-	cd/m ²	Note 3
White Luminance uniformity (9点)		ΔY		75	-	-	%	Note 4
Color Gamut	NTSC	CIE1931	$\theta = 0^\circ$	67	72	-	%	Note 7
Reproduction of color	White	Wx	$\theta = 0^\circ$ (center)	TYP. - 0.03	0.313	TYP. + 0.03		Note 5
		Wy			0.329			
	Red	Rx			0.641			
		Ry			0.342			
	Green	Gx			0.316			
		Gy			0.619			
	Blue	Bx			0.150			
		By			0.061			
Response Time		Tr+Td	Ta = 25° C $\theta = 0^\circ$	-	30	35	ms	Note 6
Gamma Scale				2.0	2.2	2.4		

- Notes :
1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see [FIGURE 1](#)).
 2. Contrast measurements shall be made at viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white, then to the dark (black) state. (see [FIGURE 2](#)) Luminance Contrast Ratio (CR) is defined mathematically.

$$CR = \frac{\text{Luminance when displaying a white raster}}{\text{Luminance when displaying a black raster}}$$

3. Luminance of white is defined as luminance values of center of the LCD surface. Luminance shall be measured with all pixels in the view field set first to white. This measurement shall be taken at the locations shown in [FIGURE 2](#) for a total of the measurements per display. The luminance is measured by CS2000/CA310 when the LED current is set at 60mA.
4. The White luminance uniformity on LCD surface is then expressed as : $\Delta Y = \text{Minimum Luminance of 9 points} / \text{Maximum Luminance of 9 points}$ (See [FIGURE 3](#)).
5. The color chromaticity coordinates specified in Table 5. shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
6. The electro-optical response time measurements shall be made as [FIGURE 4](#) by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is T_r , and 90% to 10% is T_d .

7. Definition of Color of CIE Coordinate and NTSC Ratio

8. Definition of gray inversion angle (see [FIGURE 5](#)).

7.2 Optical measurements

Figure 1: The definition of Viewing Angle

Refer to the graph below marked by θ and ϕ .

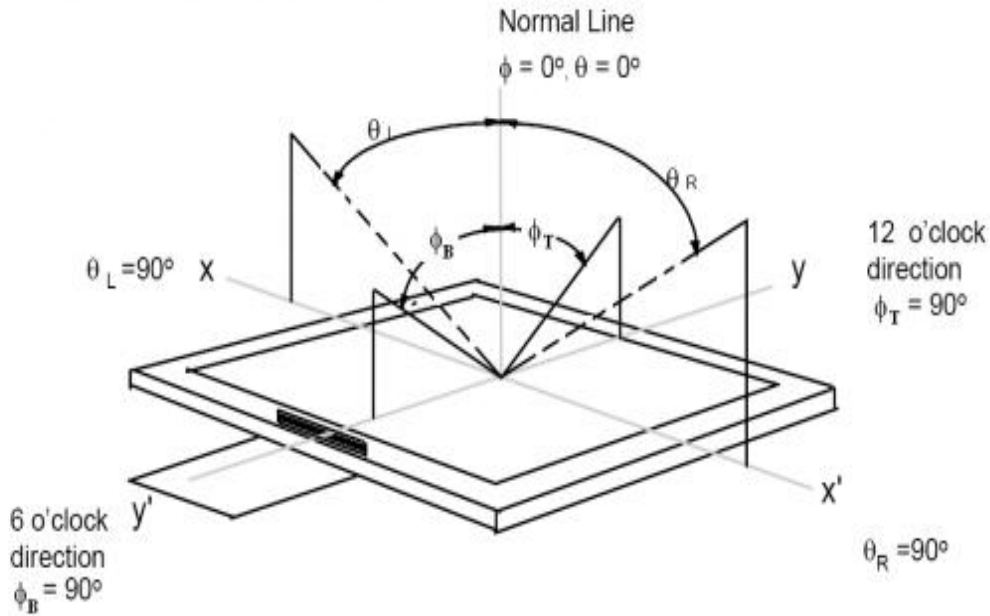
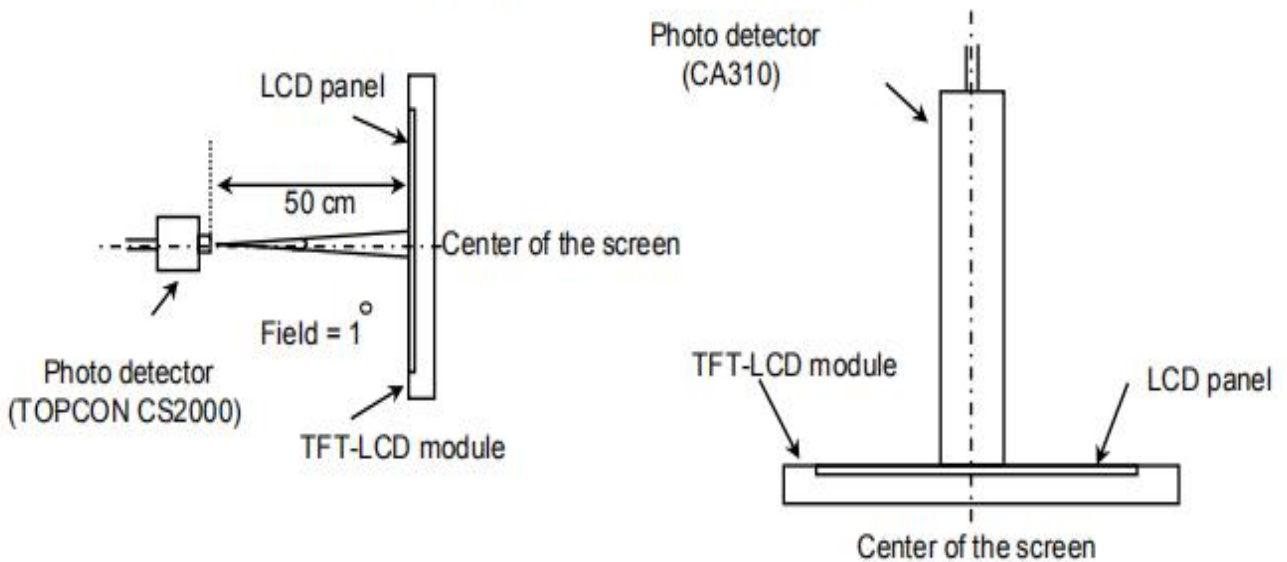


Figure 2. Measurement Set Up



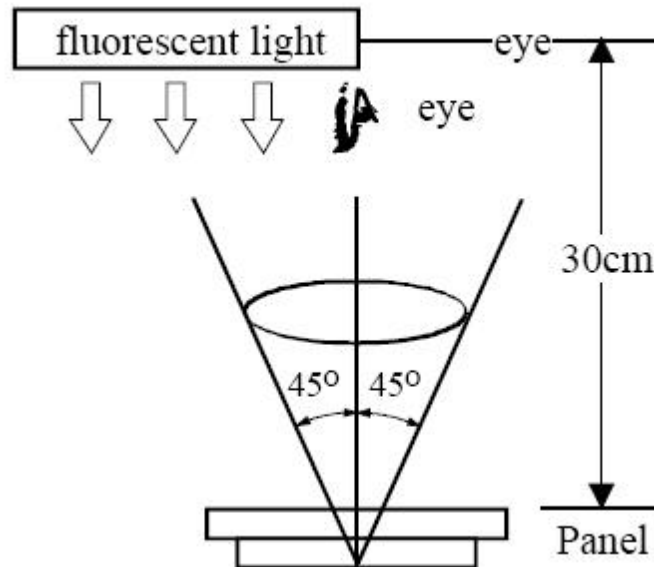
View angel range, uniformity, etc. measurement setup

Flicker, measurement setup

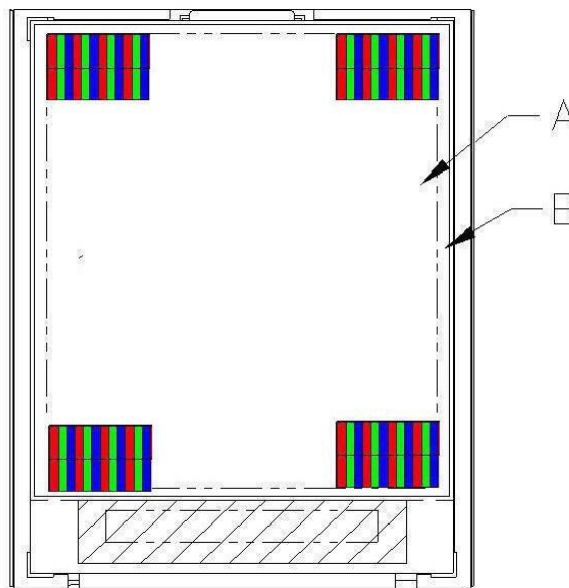
6. QUALITY SPECIFICATIONS

6.1 INSPECTION CONDITION

- (1) Inspect under 800-1200Lux fluorescent light, leaving 30~35cm between panels and eyes, and between panels and lights.
- (2) Inspection condition is $23\pm 5^{\circ}\text{C}$, $50\pm 20\%\text{RH}$ maximum.



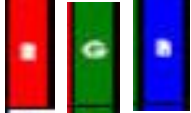

6.2 DEFINITION OF AREA


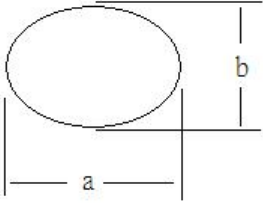


A Area : Viewing area.

B Area : Out of viewing. (outside viewing area)

6.3 INSPECTION SPECIFICATION

NO	Item	Acceptable specification	Judgment Criterion
1	Electrical Testing	<p>1-1 sub pixel classification</p> <ul style="list-style-type: none"> ● Sub Pixel: Number of sub pixel doesn't exceed two dot. <div style="text-align: center;">  <p>Sub Pixel (Dot)</p> </div> <p>a> Dark dot ----two Allowed b> Bright dot ---- two Allowed</p> <ul style="list-style-type: none"> ● Pixel : Three dots link together doesn't exceed twos <div style="text-align: center;">  <p>Pixel</p> </div> <p>1-2 Leakage to light</p> <ul style="list-style-type: none"> ● Leakage to light be not allowed. <p>1-3 Picture to shake</p> <ul style="list-style-type: none"> ● Picture had shake, twinkle and noise etc. instable of defect that be not allowed. <p>1-4 Function</p> <ul style="list-style-type: none"> ● No display or No function. ● Source Line, Gate Line. ● Contrast Ratio ● Current consumption exceeds product specifications. ● Display malfunction. 	<p>$N \leq 2$</p> <p>$N \leq 2$</p> <p>$N=0$</p> <p>$N=0$</p> <p>$N=0$</p>
2	Mechanical Dimension	<p>2-1 Mechanical Dimension exceeds product specifications. 2-2 Out of frame and boss of plastic changed shape that be not allowed.</p>	<p>$N=0$</p>

NO	Item	Acceptable specification	Judgment Criterion																																												
3	Cosmetic Inspection	<p>3-1 Blemish: Line shapes of defect</p> <table border="1" data-bbox="363 324 1313 678"> <thead> <tr> <th>Length</th> <th>Width</th> <th>Acceptable number</th> <th>Mini. space</th> </tr> </thead> <tbody> <tr> <td>---</td> <td>$W \leq 0.08$</td> <td>Ignore</td> <td rowspan="3">10MM</td> </tr> <tr> <td>$L \leq 10MM$</td> <td>$0.08 < W \leq 0.10$</td> <td>3</td> </tr> <tr> <td>$L \leq 10MM$</td> <td>$0.10 < W \leq 0.20$</td> <td>1</td> </tr> <tr> <td>--</td> <td>$W > 0.20$</td> <td>Not allowed</td> <td>---</td> </tr> </tbody> </table> <p>L: length(mm) W: width(mm)</p>  <p>3-2 Blemish: dot shapes of defect.</p> <table border="1" data-bbox="435 936 1281 1171"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Mini. Space</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.20$</td> <td>Ignore</td> <td>---</td> </tr> <tr> <td>$0.20 < \Phi \leq 0.25$</td> <td>3</td> <td rowspan="2">5 m m</td> </tr> <tr> <td>$0.25 < \Phi \leq 0.35$</td> <td>2</td> </tr> <tr> <td>$\Phi > 0.35$</td> <td>0</td> <td>---</td> </tr> </tbody> </table> <p>3-3 Polarizer Bubble</p> <table border="1" data-bbox="435 1245 1281 1413"> <thead> <tr> <th>Dimension</th> <th>Acceptable number</th> <th>Mini. Space</th> </tr> </thead> <tbody> <tr> <td>$\Phi \leq 0.30$</td> <td>Ignore</td> <td>---</td> </tr> <tr> <td>$0.30 < \Phi \leq 0.40$</td> <td>4</td> <td>15 m m</td> </tr> <tr> <td>$\Phi > 0.40$</td> <td>0</td> <td>---</td> </tr> </tbody> </table> <p>Foreign Substances</p>  <p>$\Phi = (a+b)/2$</p>	Length	Width	Acceptable number	Mini. space	---	$W \leq 0.08$	Ignore	10MM	$L \leq 10MM$	$0.08 < W \leq 0.10$	3	$L \leq 10MM$	$0.10 < W \leq 0.20$	1	--	$W > 0.20$	Not allowed	---	Dimension	Acceptable number	Mini. Space	$\Phi \leq 0.20$	Ignore	---	$0.20 < \Phi \leq 0.25$	3	5 m m	$0.25 < \Phi \leq 0.35$	2	$\Phi > 0.35$	0	---	Dimension	Acceptable number	Mini. Space	$\Phi \leq 0.30$	Ignore	---	$0.30 < \Phi \leq 0.40$	4	15 m m	$\Phi > 0.40$	0	---	
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NO	Item	Acceptable specification	Judgment Criterion			
3	Cosmetic Inspection	3-4 Scratch <ul style="list-style-type: none"> ● Sensate scratch not allowed. ● Impassive scratch as below. <p style="text-align: right; color: red;">Unit:mm</p>				
		Length		Width	Acceptable number	Mini. space
		-----		$W \leq 0.08$	Ignore	10 m m
		$L \leq 10$		$0.08 < W \leq 0.10$	5	
		$L \leq 10$		$0.10 < W \leq 0.18$	4	---
		----		$0.18 < W$	Not allowed	
		$L > 3.5$		----	Not allowed	
		4		Package	4-1 Mixed product types 4-2 Shipping q'ty should be the same as "shipping notice form" q'ty. 4-3 Outer box can't broken.	N=0
5	LCD Mura	LCD Mura according to ND 5% keep out to determine, if keep out distance at 30cm be seen by eyes is NG, otherwise will be ok if invisible.				

7. RELIABILITY

High Temperature Operation	70°C for 96 hours	Inspection after 2~4hours storage at room temperature, the sample shall be free from defects: 试验结束后, 已测试的 LCD 样品必须在室内正常温湿度环境下放置 2~4 个小时以上才能进行功能和外观检查, 样品不允许有以下缺陷: 1. 无功能不良, 例: 缺划, 显异, 严重爆灯等 2. 外观无偏光片气泡, OCA 气泡等不良: 2. The test samples should be applied to only one test item. 每个被测试的模块只能用于其中的一个测试项目。
Low Temperature Operation	-20°C for 96 hours	
High Temperature Storage	80°C for 96 hours	
Low Temperature Storage	-30°C for 96 hours	
High Temperature Operation Humidity Operation	60°C, 90%RH for 72 hours	
Thermal Shock	-10°C (30min) ~+25°C (5min)~ +60°C (30min) for 10 cycles	
Vibration Test (No Operation)	Frequency: 10~55Hz Amplitude:1.0mm Sweep Time: 11min Test Period: 6 Cycles for each direction of X, Y, Z	
Static electricity test	Touch ±4KV, air touch ±8KV	

8. HANDLING PRECAUTION

8.1 SAFETY

- (1) Do not swallow any liquid crystal, even if there is no proof that liquid crystal is poisonous.
- (2) If the LCD panel breaks, be careful not to get liquid crystal to touch your skin.
- (3) If skin is exposed to liquid crystal, wash the area thoroughly with alcohol or soap.

8.2 STORAGE CONDITIONS

- (1) Store the panel or module in a dark place where the temperature is $23\pm 5^{\circ}\text{C}$ and the humidity is below $50\pm 20\% \text{RH}$.
- (2) Store in anti-static electricity container.
- (3) Store in clean environment, free from dust, active gas, and solvent.
- (4) Do not place the module near organics solvents or corrosive gases.
- (5) Do not crush, shake, or jolt the module.

8.3 HANDLING PRECAUTIONS

- (1) Avoid static electricity which can damage the CMOS LSI.
- (2) The polarizing plate of the display is very fragile. So, please handle it very carefully.
- (3) Do not give external shock.
- (4) Do not apply excessive force on the surface.
- (5) Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- (6) Do not use ketonic solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.
- (7) Do not operate it above the absolute maximum rating.
- (8) Do not remove the panel or frame from the module.

8.4 WARRANTY

- 1) Under normal use and storage conditions, it is within 12 months from the date of delivery. 在正常使用和储存条件下，自交货之日起12个月内。
- 2) According to Techstar TFT LCD quality standard, Techstar will rework or exchange for functional defect goods since within one year. 依据Techstar TFT LCD质量标准，Techstar将在一年内保修或置换功能缺陷产品。
- 3) strictly prohibit the display in the whole machine for a long time point a fixed screen (display by the LCD residual shadow determination criteria); suggest that the entire machine more than 2 minutes without the use of LCM automatically into hibernation, more than 30 minutes without the use of the system to force LCM into hibernation. 严禁显示屏在整机长期点一个固定画面（显示屏依LCD残影判定标准）；建议整机超过2分钟不使用LCM自动进入休眠，超过30分钟不使用系统强制LCM进入休眠状态。
- 3) Display is strictly prohibited to work continuously for more than 8 hours on the whole machine. 严禁显示屏在整机连续工作8小时以上。

- 4) Please take the module under static protection.请在有静电防护情况下，拿取模组。
- 5) LCM in special scenarios (such as high concentration of chemicals, strong magnetic field, extreme cold, and other use scenarios) use in advance to contact us to confirm.LCM在特殊场景（比如高浓度化学品，强磁场，极寒等使用场景）使用时提前联系我们确认。

9. PACKAGE DRAWING

TBD