

**SPECIFICATION
FOR
LCD MODULE**

MODULE NO.: TLM101014-BE45-A1-61B

DOC.REVISION 01

Customer Approval:

CUSTOMER
APPROVED BY
DATE:

PREPARED BY (RD ENGINEER)	PREPARED BY (QA ENGINEER)	CHECKED BY	APPROVED BY
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深圳市加德满科技有限公司

SHENZHEN JDM TECHNOLOGY CO., LTD

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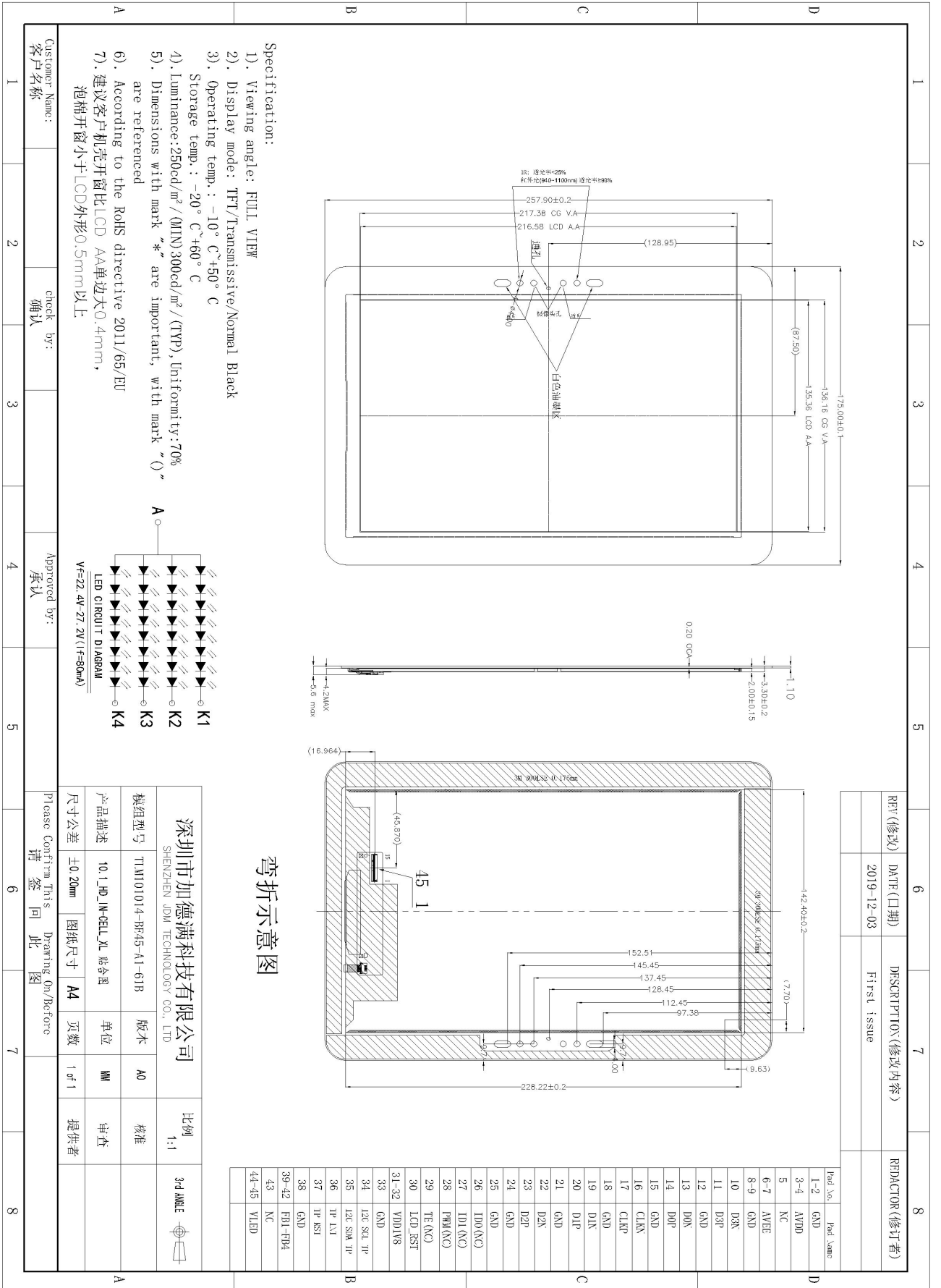
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1. Features & Mechanical Specifications

Item	Contents	Unit
	LCD	
LCD Type	TFT / Transmissive / Normally Black	--
Viewing direction	Full view	--
Backlight	White LED x 32	--
Interface	4 Lanes MIPI Interface	--
Outline Dimensio (LCM)	142.4(W) × 228.22(H) × 2.0(T)	mm
Glass area (W×H×T)	138.96× 225.176× 0.4	mm
Active area (W×H)	135.36× 216.576	mm
Number of Dots	800(RGB) ×1280	--
Dot pitch (W×H)	0.0564 × 0.1692	mm
Pixel pitch (W×H)	0.1692 × 0.1692	mm
T-IC	/	
Finger	/	
Channel Number	/	
Operating Temperature	-10~ +50	°C
Storage temperature	-20 ~ +60	°C
Polarizer	Top: IPS film	--
	Bottom: IPS film	

2. Dimensional Outline



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3. Pin Description

PIN No.	SYMBOL	Function
1~2	GND	Ground
3-4	AVDD	Power Supply 5.8V~6.0v 120mA
5	NC	No connection
6~7	AVEE	Power Supply -5.8v~-6.0v 120mA
8~9	GND	Ground
10	MIPI_D3-	MIPI differential data3 input(Negative)
11	MIPI_D3+	MIPI differential data3 input(Positive)
12	GND	Ground
13	MIPI_D0-	MIPI differential data0 input(Negative)
14	MIPI_D0+	MIPI differential data0 input(Positive)
15	GND	Ground
16	MIPI_CLK-	MIPI differential clock input(Negative)
17	MIPI_CLK+	MIPI differential clock input(Positive)
18	GND	Ground
19	MIPI_D1-	MIPI differential data1 input(Negative)
20	MIPI_D1+	MIPI differential data1 input(Positive)
21	GND	Ground
22	MIPI_D2-	MIPI differential data2input(Negative)
23	MIPI_D2+	MIPI differential data2 input(Positive)
24-25	GND	Ground
26	ID0(NC)	ID0(NC/GND) 1.8V NC
27	ID1(NC)	ID1(NC/GND) 1.8V NC
28	PWM(NC)	PWM Control Signal of LED Convert 1.8V NC
29	TE	NC
30	LCD_RST	Reset signal 1.8V
31-32	VDD1V8	Power Supply 1.8V
33	GND	Ground
34	I2C_SCL_TP	I2C CLK,TYP.1.8V
35	I2C_SDA_TP	I2C SDA,TYP.1.8V
36	TP_INT	Interrupt Pin 1.8V
37	TP_RST	TP Reset Pin 1.8V
38	GND	Ground
39-42	FB1-^FB4-	Cathode for light bar
42	NC	No connection
44-45	LED+	Anode for light bar

4. Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Digital Supply Voltage	IOVCC	-0.3 to +3.6	V
Operating Temperature range	Top	-10 to +50	°C
Storage Temperature range	Tst	-20 to +60	°C

5. Electrical Characteristics

DC Characteristics

Item	Symbol	Min.	Type.	Max.	Unit
Digital Power Supply Voltage	VDD1V8	1.65	1.8	1.95	V
	TP_3V3	/	/	/	V
	AVEE	-6.0	-5.8	-5.6	V
	AVDD	5.6	5.8	6.0	V

6. Backlight Characteristics

(White LED × 4 in series) × 7 in Parallel

(Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Forward Voltage	VF	IF=80mA	-	25.6	-	V	
Uniformity	ΔBp	-	70	75	-	%	
LCM Luminance	Lv	IF=80mA	250	300	-	cd/m ²	

7. Electro-Optical Characteristics

The relative measurement methods of optical characteristics are shown as below.

The following items should be measured under the test conditions described in

7.1

Item	Symbol	Condition	Value			Unit	Note	
			Min	Typ	Max			
Uniformity	ΔBp		70	75		%	Note 4	
Viewing Angle	Left	θL	$Cr \geq 10$	75	80		deg	Note 1
	Right	θR		75	80			
	Top	ψT		75	80			
	Bottom	ψB		75	80			
Contrast Ratio	Cr	$\theta = 0$ $= 0$	800	1000			Note 2	
Response Time	Tr+Tf		--	30	--	ms		
	Tgray					ms		
Color Coordinate of CIE1931	Red	X	$\theta = 0$ $= 0$	0.575	0.605	0.635		Note 5
		y		0.321	0.351	0.381		
	Green	X		0.298	0.328	0.358		
		y		0.568	0.598	0.628		
	Blue	X		0.124	0.154	0.184		
		y		0.061	0.091	0.121		
	White	X		0.271	0.301	0.331		
		y		0.289	0.319	0.349		

Note :

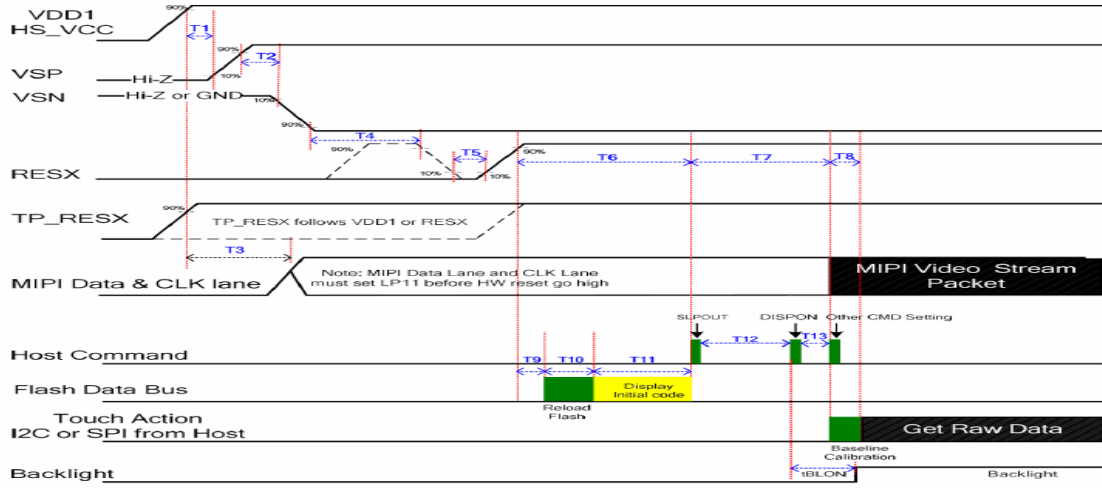
1. Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or 3, 9 o'clock direction and the vertical or 6, 12 o'clock direction with respect to the optical axis which is normal to the LCD surface (see FIGURE 1).
2. Contrast measurements 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 1) Luminance Contrast Ratio (CR) is defined mathematically.

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

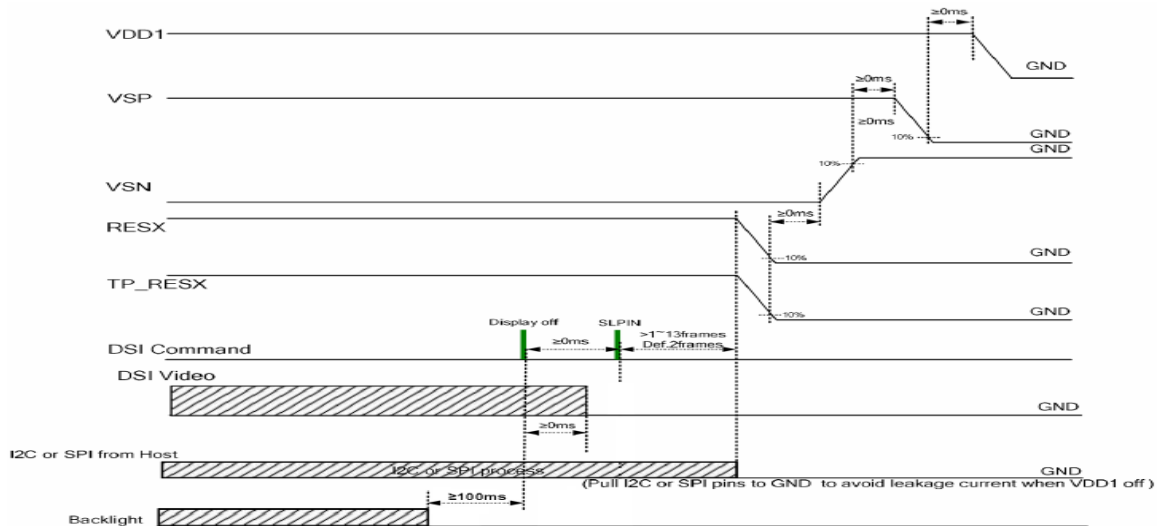
3. Transmittance is the Value with Polarizer
4. The color chromaticity coordinates specified in Table 5 shall be calculated from the spectral data measured with all pixels first in red, green, blue and white. Measurements shall be made at the center of the panel.
5. The electro-optical response time measurements shall be made as FIGURE 3 by switching the "data" input signal ON and OFF. The times needed for the luminance to change from 10% to 90% is Tr, and 90% to 10% is Td.

8. MIPI ELECTRICAL CHARACTERISTICS

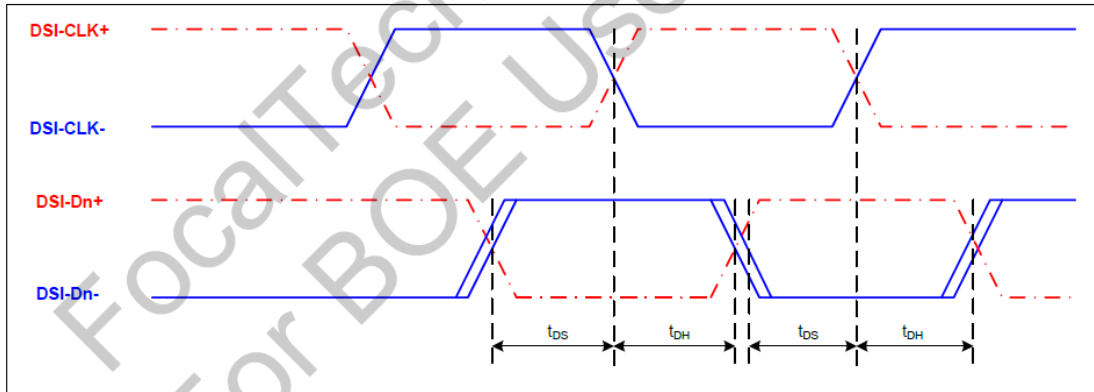
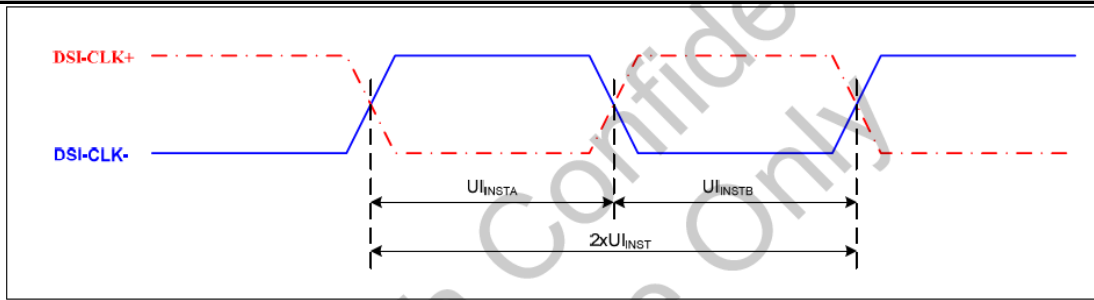
8.1. Power on/off Sequence



Symbol	Description	Min	Max	Unit	Note
T1	VDD1 to VSP	1	-	ms	
T2	VSP to VSN	1	-	ms	
T3	VDD1 to MIPI Lane	1	-	ms	
T4	Power Ready to Global Reset	1	-	ms	
T5	Global Reset Keep Low	15	-	us	TP Reset is the same
T6	Global Reset to Sleep Out	155	-	ms	
T7	Video Stream Start and Host TP Data Bus Active	140	-	ms	
T8	AP Start to Get Raw Data	30	-	ms	
T9	Reset to Flash Reload	-	5	ms	
T10	Flash Reload Time	-	50	ms	Default: 6MHz
T11	Display initial code by FW	-	100	ms	
T12	Sleep Out to Display On	120	-	ms	
T13	Display On to IC Ready	20	-	ms	
tBLON	Display On Command to BL On time	100	-	ms	



8.2. MIPI Interface Characteristics



Parameter	Symbol	Parameter	Specification			Unit
			MIN	TYP	MAX	
High speed Mode						
DSI-CLK +/-	$2xUI_{INST}$	Double UI instantaneous	2	-	25	ns
DSI-CLK +/-	UI_{INSTA}, UI_{INSTB}	UI instantaneous halves	1	-	12.5	ns
DSI-Dn +/-	t_{DS}	Data to clock setup time	0.15	-	-	UI
DSI-Dn +/-	t_{DH}	Data to clock hold time	0.15	-	-	UI
DSI-CLK +/-	t_{DRTCLK}	Differential rise time for clock	150	-	0.3UI	ps
DSI-Dn +/-	$t_{DRTDATA}$	Differential rise time for data	150	-	0.3UI	ps
DSI-CLK +/-	t_{DFTCLK}	Differential fall time for clock	150	-	0.3UI	ps
DSI-Dn +/-	$t_{DFTDATA}$	Differential rise time for data	150	-	0.3UI	ps

8.3. DC Characteristics Requirements

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(AVDD = 5.0V~6.5V, AVEE = -5.0V~-6.5V, VDDI = 1.65V~1.95V, Ta = -30°C ~ 70°C)

Parameter	Symbol	Conditions	Specification			Unit
			MIN	TYP	MAX	
Power supply voltage for MIPI Interface						
Power supply voltage for MIPI interface	VDDAM	-	1.65	1.8	1.95	V
	LVDSVDD	-	1.125	1.3	1.5	V
LPDT Input Characteristics						
Pad signal voltage range	VI	-	-50	-	1350	mV
Ground Shift	VGND SH	-	-50	-	50	mV
Logic 0 input threshold	VIL	-	0	-	550	mV
Logic 1 input threshold	VIH	-	880	-	LVDSVDD	mV
Input hysteresis	VHYST	-	25	-	-	mV
LPDT Output Characteristics						
Output low level	VOL	-	-50	-	50	mV
Output high level	VOH	-	1.1	1.2	1.3	V
Logic 1 contention threshold	VILCD,MIN	-	450	-	LVDSVDD	mV
Logic 0 contention threshold	VIHCD,MAX	-	0	-	200	mV
Output impedance of LPDT	ZOLP	-	80	100	125	ohm
Hi-speed Input/Output Characteristics						
Single-end input low voltage	VILHS	-	-40	-	-	mV
Single-end input high voltage	VIHHS	-	-	-	460	mV
Common mode voltage	VCMRXDC	-	70	-	330	mV
Hi-speed transmit voltage	VOD	-	140	200	250	mV
Differential input impedance	ZID	-	80	100	125	ohm

8.4. Power Consumption of TFT Panel

Power Supply: Frame Frequency: VBAT_SYS=3.8V, VD VDD_TP=1.8V F_{frame} >=60HZ @ 25degC

Display Mode	Item	Symbol	Value		Unit	Remark
			Typ	Max		
Display White	Current of VBAT_SYS	IVBAT_SYS	-	130	mA	
	Current of VD VDD_TP	ID VDD_TP	-	50	mA	

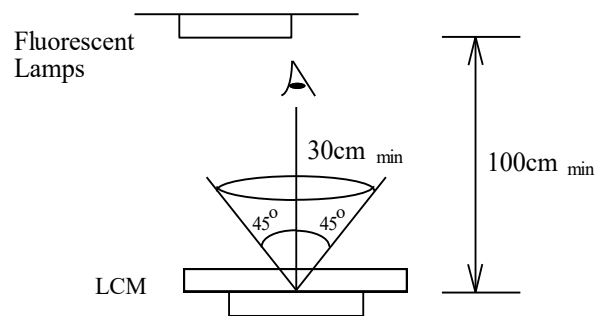
9. Quality Specifications

All The raw material are Rohs complicant.

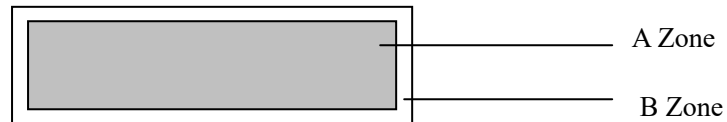
9.1. Standard of the product appearance test

Manner of appearance test: The inspection should be performed in using 20W x 2 fluorescent lamps. Distance between LCM and fluorescent lamps should be 100 cm or more. Distance between LCM and inspector eyes should be 30 cm or more.

Viewing direction for inspection is 45° from vertical against LCM.



Definition of zone:



A Zone: viewing area

B Zone: outside viewing area

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9.2. Specification of quality assurance

AQL inspection standard

Sampling method: MIL-STD-105E, Level II, single sampling

Defect classification (Note: * is not including)

NO.	项目	标准	备注																										
1	电测部分	无显示	主缺																										
		缺行、缺列	主缺																										
		显示异常（花屏、白屏、蓝屏、少画面、乱码）	主缺																										
		背光不亮	主缺																										
		亮暗点判定标准:																											
		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">屏幕规格（英寸）</th> <th style="width: 25%;">项目</th> <th style="width: 50%;">判定标准</th> </tr> </thead> <tbody> <tr> <td rowspan="3" style="text-align: center;">规格≤5</td> <td style="text-align: center;">亮点</td> <td style="text-align: center;">N≤1</td> </tr> <tr> <td style="text-align: center;">暗点</td> <td style="text-align: center;">N≤4</td> </tr> <tr> <td style="text-align: center;">总数</td> <td style="text-align: center;">N≤4</td> </tr> <tr> <td rowspan="3" style="text-align: center;">5 < 规格 ≤10.2</td> <td style="text-align: center;">亮点</td> <td style="text-align: center;">A 区: N=1 B 区: N≤2</td> </tr> <tr> <td style="text-align: center;">暗点</td> <td style="text-align: center;">A 区: N≤2 B 区: N≤4</td> </tr> <tr> <td style="text-align: center;">总数</td> <td style="text-align: center;">N≤5</td> </tr> <tr> <td rowspan="3" style="text-align: center;">规格>10.2</td> <td style="text-align: center;">亮点</td> <td style="text-align: center;">A 区: N=1 B 区: N≤2</td> </tr> <tr> <td style="text-align: center;">暗点</td> <td style="text-align: center;">A 区: N≤2 B 区: N≤4</td> </tr> <tr> <td style="text-align: center;">总数</td> <td style="text-align: center;">N≤6</td> </tr> </tbody> </table>			屏幕规格（英寸）	项目	判定标准	规格≤5	亮点	N≤1	暗点	N≤4	总数	N≤4	5 < 规格 ≤10.2	亮点	A 区: N=1 B 区: N≤2	暗点	A 区: N≤2 B 区: N≤4	总数	N≤5	规格>10.2	亮点	A 区: N=1 B 区: N≤2	暗点	A 区: N≤2 B 区: N≤4	总数	N≤6	
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			总数	N≤6																									
		备注:																											
		1, 缺陷大小>0.5dot 定义为点缺陷																											
		2, 缺陷大小≤0.5dot 不计																											
		3, 微弱亮点透过 6%ND Filter 仍可视计为点缺陷																											
		背光点状异物不良规格:																											
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			(D) mm: 平均直径= (长径+短径) / 2																										
			次缺																										

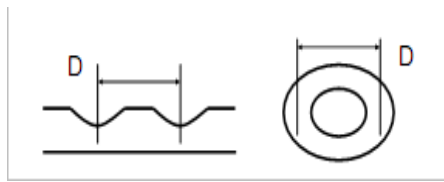
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		偏光片凹、凸点不良规格:			
		大小 (D) mm	允许数量		
		$D \leq 0.3$	不计 (密集不可)		
		$0.3 \leq D \leq 0.5$	4		
		$0.5 \leq D \leq 0.7$	2		
		$D > 0.7$	0		
		MURA 规格:			
		不允许任何透过 6%ND Filter 可视之 MURA			

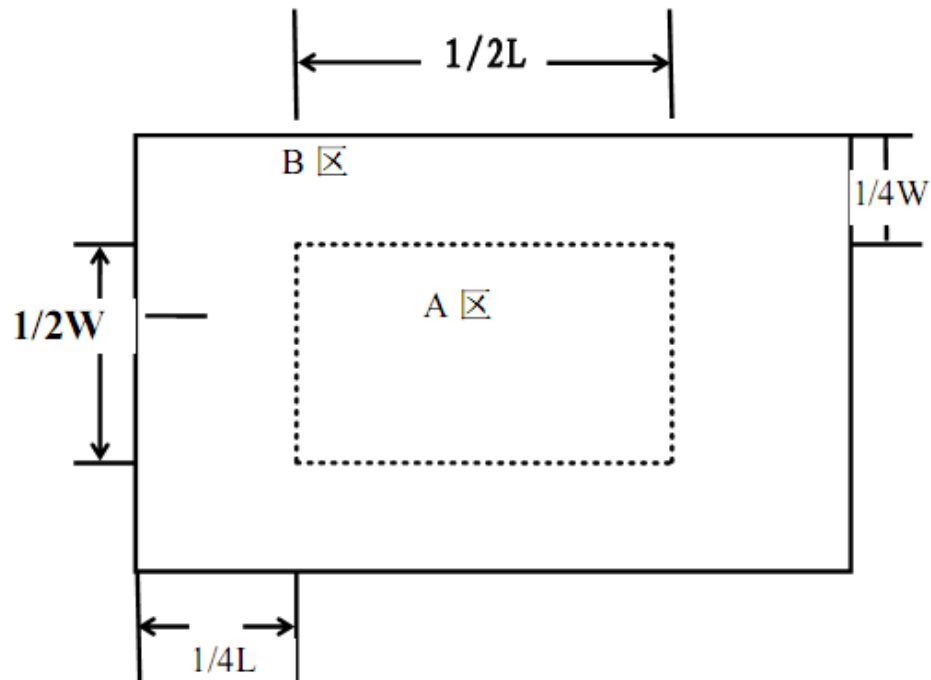
2	外观部分	偏光片裂痕	次缺	目视	
		A. B区域内不论大小不可存在			
		点状不良 (如: 凹、凸点等)	次缺		同电性规格
		线状不良 (如: 脏污、毛线等)	次缺		同电性规格
		偏光片偏移超出要求 (依客户要求而定)	次缺		
		贴反	次缺		
	无保护膜、保护膜上无易撕贴	次缺			
	面板缺角	在不影响外观、线路性能的情况下视为OK品	次缺		

3	FPC	不可“V”字形折痕, 折痕处发白	次缺	目视、显微镜
		引角断	次缺	
		断路/短路	次缺	
		产品上有分层	次缺	
		引脚/线路; 凹、凸偏斜超过30%	次缺	
		双面胶掉、歪斜且影响使用	次缺	
		引脚非导电异物不可跨越两条线, 导电依凹/凸判定	次缺	
		PAD翘起、变形、脱落	次缺	
		刮伤, 以不露铜为OK	次缺	
		气泡不能横跨2条线路, 且不可超过2个	次缺	

4	Film上的鱼眼、凹痕、气泡		$D \leq 0.3\text{mm}$	不计 (密集不可)
			$0.3\text{mm} < D \leq 0.5\text{mm}$	$N \leq 3$ (距离在5mm以上)
			$0.5 \leq D \leq 0.7$	2
			$D > 0.7$	0

5	牛顿环	满屏的六分之一以内	$N \leq 3$
		超过满屏的六分之一	NG

A、B 区域图表说明



判定

允许水准 AQL, 严重缺点 CR=0、主要缺点 MA=0.4、次要缺点 MI=1.0

9.3. Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	60°C	48	No abnormalities in functions and appearance
High temp. Operating	50°C	48	
Low temp. Storage	-20°C	48	
Low temp. Operating	-10°C	48	
Humidity	60°C/ 90%RH	48	
Temp. Cycle	-20°C ← 25°C → 60°C (60 min ← 5 min → 60min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (20±8°C), normal humidity (below 65% RH), and in the area not exposed to direct sun light.

9.4. Precaution for using LCD/LCM

LCD/LCM is assembled and adjusted with a high degree of precision. Do not attempt to make any alteration or modification. The followings should be noted.

General Precautions:

1. LCD panel is made of glass. Avoid excessive mechanical shock or applying strong pressure onto the surface of display area.
2. The polarizer used on the display surface is easily scratched and damaged. Extreme care should be taken when handling. To clean dust or dirt off the display surface, wipe gently with cotton, or other soft material soaked with isopropyl alcohol, ethyl alcohol or trichlorotrifluoroethane, do not use water, ketone or aromatics and never scrub hard.
3. Do not tamper in any way with the tabs on the metal frame.
4. Do not make any modification on the PCB without consulting JDM.
5. When mounting a LCM, make sure that the PCB is not under any stress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
6. Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels and also cause rainbow on the display.
7. Be careful not to touch or swallow liquid crystal that might leak from a damaged cell. Any liquid crystal adheres to skin or clothes, wash it off immediately with soap and water.

Static Electricity Precautions:

1. CMOS-LSI is used for the module circuit; therefore operators should be grounded whenever he/she comes into contact with the module.
2. Do not touch any of the conductive parts such as the LSI pads; the copper leads on the PCB and the interface terminals with any parts of the human body.
3. Do not touch the connection terminals of the display with bare hand; it will cause disconnection or defective insulation of terminals.
4. The modules should be kept in anti-static bags or other containers resistant to static for storage.
5. Only properly grounded soldering irons should be used.
6. If an electric screwdriver is used, it should be grounded and shielded to prevent sparks.
7. The normal static prevention measures should be observed for work clothes and working benches.
8. Since dry air is inductive to static, a relative humidity of 50-60% is recommended.

Soldering Precautions:

1. Soldering should be performed only on the I/O terminals.
2. Use soldering irons with proper grounding and no leakage.
3. Soldering temperature: $280^{\circ}\text{C}\pm 10^{\circ}\text{C}$
4. Soldering time: 3 to 4 second.
5. Use eutectic solder with resin flux filling.
6. If flux is used, the LCD surface should be protected to avoid spattering flux.
7. Flux residue should be removed.

Operation Precautions:

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1. The viewing angle can be adjusted by varying the LCD driving voltage V_o .
 2. Since applied DC voltage causes electro-chemical reactions, which deteriorate the display, the applied pulse waveform should be a symmetric waveform such that no DC component remains. Be sure to use the specified operating voltage.
 3. Driving voltage should be kept within specified range; excess voltage will shorten display life.
 4. Response time increases with decrease in temperature.
 5. Display color may be affected at temperatures above its operational range.
 6. Keep the temperature within the specified range usage and storage. Excessive temperature
 7. and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.
 8. For long-term storage over 40°C is required, the relative humidity should be kept below 60%,
 9. and avoid direct sunlight.

Limited Warranty

JDM LCDs and modules are not consumer products, but may be incorporated by JDM's customers into consumer products or components thereof, JDM does not warrant that its LCDs and components are fit for any such particular purpose.

1. The liability of JDM is limited to repair or replacement on the terms set forth below. JDM will not be responsible for any subsequent or consequential events or injury or damage to any personnel or user including third party personnel and/or user. Unless otherwise agreed in writing between JDM and the customer, JDM will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with JDM general LCD inspection standard. (Copies available on request)
2. No warranty can be granted if any of the precautions state in handling liquid crystal display above has been disregarded. Broken glass, scratches on polarizer mechanical damages as well as defects that are caused accelerated environment tests are excluded from warranty.
3. In returning the LCD/LCM, they must be properly packaged; there should be detailed description of the failures or defect.