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## SPECIFICATIONS FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
ACMMI PART NO.	AMG12232C
DESCRIPTION	
APPROVED BY	
DATE	

PREPARED BY	CHECKED BY	APPROVED BY

## DOCUMENT REVISION HISTORY:

DATE	PAGE	DESCRIPTION
2000.8.	-	First release
2005.3.	-	Modify the full specification
2005.12.	4	Update the part number system

# **Contents**

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# 1. Module Classification Information

**A M C 1 6 0 2 A R - B - B 6 W T D W - S P**  
 1 2 3 4 5 6 7 8 9 10 11 12 13

1	Brand : Orient Display (N.A.) Ltd.
2	Display Type : C→ Character Type, G→ Graphic Type, NONE→ Custom-made
3	Display Font : Characters X Lines / Rows X Columns /Others
4	Model serials no.
5	RoHS compliant: R→YES NONE→ NO
6	IC Package Type: M→ SMT Type B→ COB Type T→ TAB Type G→ COG Type F→ COF Type S→ Special
7	LCD Mode: P→TN Positive N→TN Negative Y→ STN Positive, Yellow Green B→ STN Negative, Blue G→ STN Positive, Gray W→ FSTN Positive T→ FSTN Negative F→ FFSTN Negative S→ Special
8	Viewing direction 6→ 6:00,12→12:00, S→Special
9	Temperature range N → Normal Temperature W→ Wide Temperature S→ Special
10	LCD Polarizer Type R→ Reflective T→ Transmissive F→ Transflective S→ Special
11	Backlight Type N→ None D→ LED E→ EL F→ CCFL S→ Special
12	Backlight Color Y→ Yellow-green B→ Blue A→ Amber W→ White G→ Green R→ Red S→ Special
13	Internal Code

## **2. Precautions in use of LCD Modules**

- (1) Avoid applying excessive shocks to the module or making any alterations or modifications to it.
- (2) Don't make extra holes on the printed circuit board, modify its shape or change the components of LCD module.
- (3) Don't disassemble the LCM.
- (4) Don't operate it above the absolute maximum rating.
- (5) Don't drop, bend or twist LCM.
- (6) Soldering: only to the I/O terminals.
- (7) Storage: please storage in anti-static electricity container and clean environment.

## **3. General Specification**

<b>Item</b>	<b>Dimension</b>	<b>Unit</b>
Number of Dots	122 x 32	—
Module dimension(No Backlight )	98.0 x 60.0 x 13.0 (MAX)	mm
Module dimension(With LED Backlight )	98.0 x 60.0 x 13.0 (MAX)	mm
View area	76.0 x 25.2	mm
Active area	69.50 x 20.76	mm
Dot size	0.53 x 0.61	mm
Dot pitch	0.57 x 0.65	mm
LCD type	STN	
Duty	1/32	
View direction	6 o'clock or 12 o'clock	
Backlight Type	None, YELLOW-GREEN backlight	

## 4. Absolute Maximum Ratings

Item		Symbol	Min	Max	Unit
Input Voltage		$V_I$	-0.3	$V_{DD}+0.3$	V
Supply Voltage For Logic		$V_{DD}-V_{SS}$	-0.3	7.0	V
Supply Voltage For LCD		$V_{DD}-V_0$	$V_{dd}-13.5$	0	V
Standard Temperature LCM	Operating Temp.	Top	0	50	°C
	Storage Temp.	Tstr	-10	60	°C
Wide Temperature LCM	Operating Temp.	Top	-20	70	°C
	Storage Temp.	Tstr	-30	80	°C

## 5. Electrical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage For Logic	$V_{DD}-V_{SS}$	—	4.5	5.0	5.5	V
Supply Voltage For LCD	$V_{DD}-V_0$	$T_a=25^{\circ}\text{C}$	-	5.5	-	V
Input High Volt.	$V_{IH}$	—	$0.7 V_{DD}$	—	$V_{DD}$	V
Input Low Volt.	$V_{IL}$	—	$V_{SS}$	—	$0.3 V_{DD}$	V
Supply Current	$I_{DD}$	$V_{DD}=5\text{V}$	-	12.0	20.0	mA
Supply Voltage of Yellow-green backlight	$V_{LED}$	Forward current =240 mA  Number of LED die 2x24= 48	3.8	4.1	4.3	V

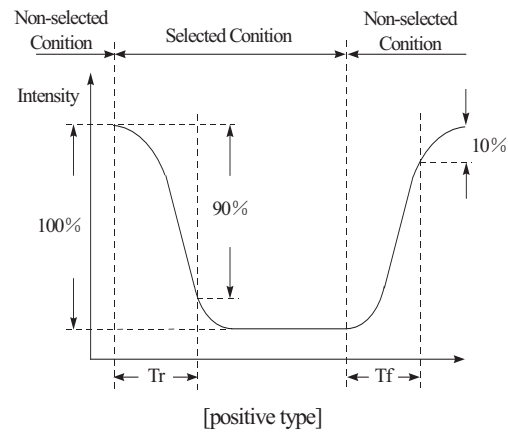
## 6. Optical Characteristics

Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V) $\theta$	$CR \geq 2$	-20	—	35	deg
	(H) $\phi$	$CR \geq 2$	-30	—	30	deg
Contrast Ratio	CR	—	—	3	—	—
Response Time	T rise	—	—	—	250	ms
	T fall	—	—	—	250	ms

### Definition of Operation Voltage (Vop)



### Definition of Response Time (Tr, Tf)



### Conditions :

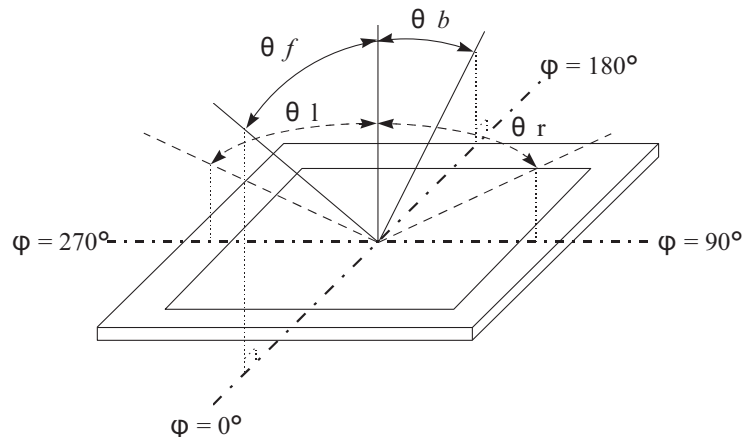
Operating Voltage : Vop

Viewing Angle( $\theta$ ,  $\phi$ ) :  $0^\circ$ ,  $0^\circ$

Frame Frequency : 64 HZ

Driving Waveform : 1/N duty, 1/a bias

### Definition of viewing angle( $CR \geq 2$ )



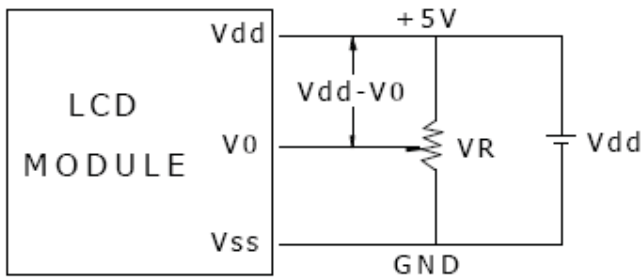
## **7. Interface Pin Function**

<b>Pin No.</b>	<b>Symbol</b>	<b>Level</b>	<b>Description</b>
1	V <sub>SS</sub>	0V	Ground
2	V <sub>DD</sub>	5.0V	Supply Voltage for logic
3	V <sub>0</sub>		Operating voltage for LCD
4	A0	H/L	Register Select
5	E1	H/L	Enable For Chip1, Active High, Left Part
6	E2	H/L	Enable For Chip2, Active High, Left Part
7	DB0	H/L	Data bit 0
8	DB1	H/L	Data bit 1
9	DB2	H/L	Data bit 2
10	DB3	H/L	Data bit 3
11	DB4	H/L	Data bit 4
12	DB5	H/L	Data bit 5
13	DB6	H/L	Data bit 6
14	DB7	H/L	Data bit 7
15	LED(+)		Anode of LED Backlight
16	LED(-)		Cathode of LED Backlight
17	RW	H/L	Read/Write
18	RST	H/L	Reset Signal



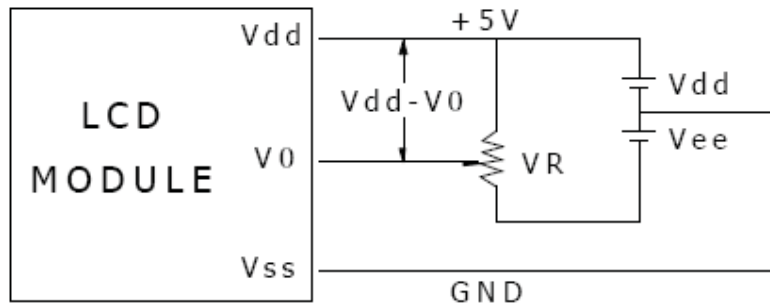
## 8. POWER SUPPLY

### SINGLE SUPPLY VOLTAGE TYPE (for LCM with Negative Power on PCB)



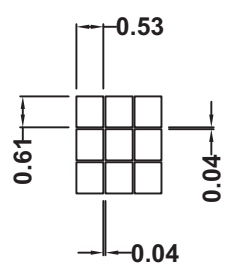
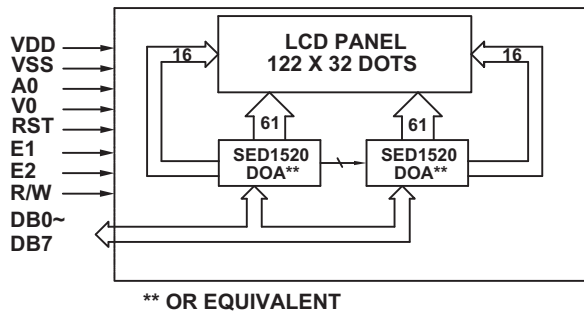
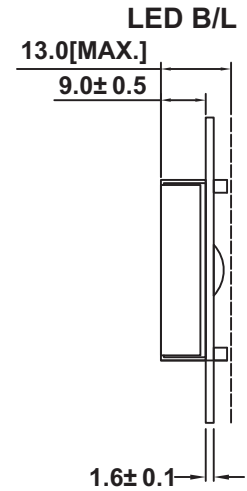
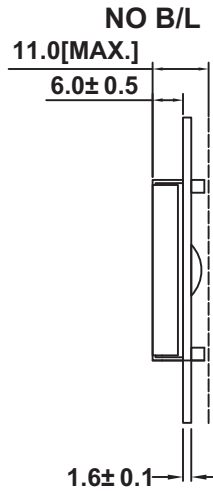
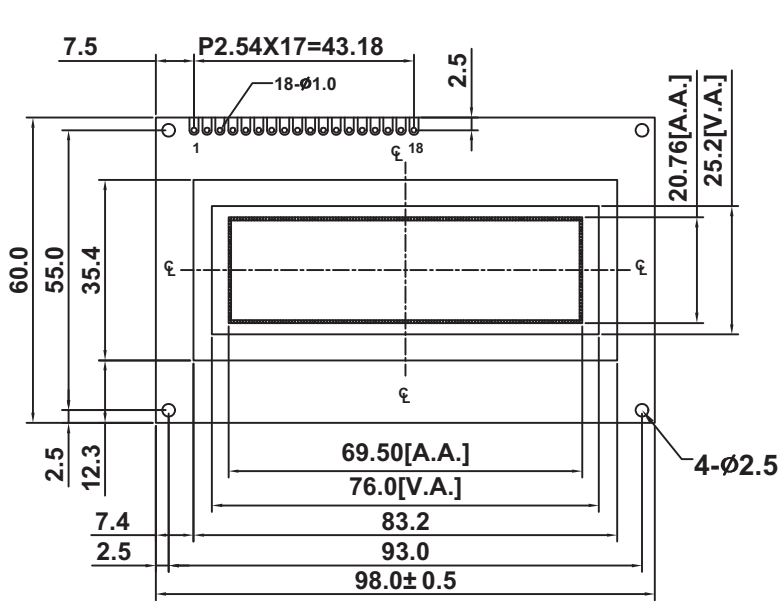
Vdd-V0: LCD Driving Voltage  
VR: 10K - 20K

### DUAL SUPPLY VOLTAGE TYPE (for LCM without Negative Power on PCB)



Vdd-V0: LCD Driving Voltage  
VR: 10K - 20K

# 9. Contour Drawing & Block Diagram



# 10. Timing Characteristics

- AC Characteristics

- Read/Write timing for the 80-port MPU

( $T_a = -20$  to  $75^\circ\text{C}$ ,  $V_{SS} = -5.0\text{V} \pm 10\%$ )

Parameter	Signal	Symbol	Condition	Rating			Unit	
				Min	Typ	Max		
Address hold time	A0, $\overline{\text{CS}}$	$t_{AHB}$		10	—	—	ns	
Address set-up time		$t_{AWB}$		20	—	—	ns	
System cycle time	$\overline{\text{WR}}$ , $\overline{\text{RD}}$	$t_{CYC8}$		1000	—	—	ns	
Control pulse width		$t_{CC}$		200	—	—	ns	
Data set-up time	D0 ~ D7	$t_{DS8}$		80	—	—	ns	
Data hold time		$t_{DH8}$		10	—	—	ns	
$\overline{\text{RD}}$ access time		$t_{ACC8}$	$C_L = 100\text{pF}$		—	—	90	ns
Output disable time		$t_{OH8}$			10	—	60	ns

\*2. The ratings when  $V_{SS} = -3.0\text{V}$  are approximately 100% higher than when  $V_{SS} = -5.0\text{V}$ .

- Read/Write timing for the 68-port MPU

( $T_a = -20$  to  $75^\circ\text{C}$ ,  $V_{SS} = -5.0\text{V} \pm 10\%$ )

Parameter	Signal	Symbol	Condition	Rating			Unit	
				Min	Typ	Max		
System cycle time	A0, $\overline{\text{CS}}$ R/ $\overline{\text{W}}$	$t_{CYC6} * 3$		1000	—	—	ns	
Address set-up time		$t_{AW6}$		20	—	—	ns	
Address hold time		$t_{AH6}$		10	—	—	ns	
Data set-up time	D0 ~ D7	$t_{DS6}$		80	—	—	ns	
Data hold time		$t_{DH6}$		10	—	—	ns	
Output disable time		$t_{OH6}$	$C_L = 100\text{pF}$		10	—	60	ns
Access time		$t_{ACC6}$			—	—	90	ns
Enable pulse width	READ	E	$t_{EW}$	100	—	—	ns	
	WRITE			80	—	—	ns	

\*3.  $t_{CYC6}$  indicates the cycle during which  $\overline{\text{CS}}/\overline{\text{E}}$  are HIGH; it does not indicate the cycle of the E signal.

\*4. The ratings when  $V_{SS} = -3.0\text{V}$  are approximately 100% higher than when  $V_{SS} = -5.0\text{V}$ .

- Control timing for 80-port/68-port display

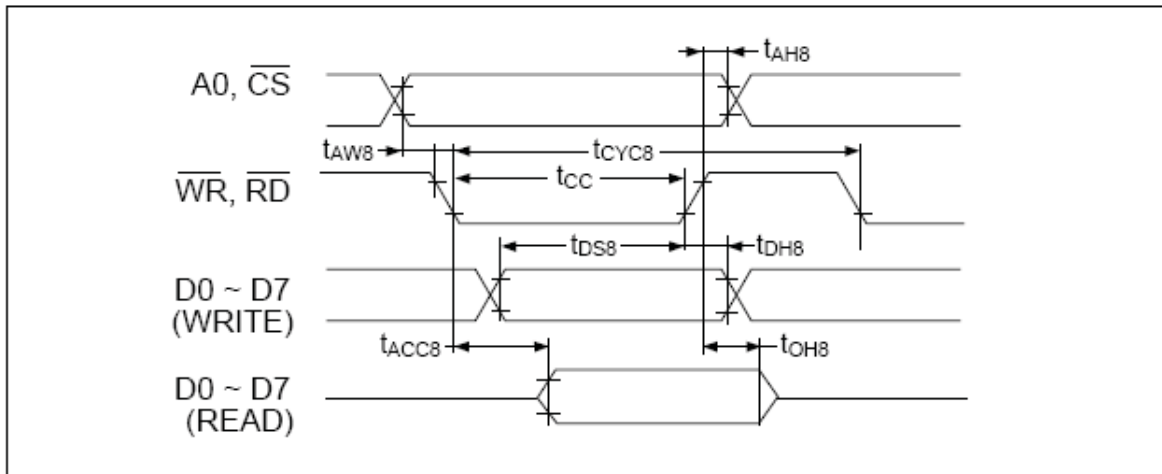
( $T_a = -20$  to  $75^\circ\text{C}$ ,  $V_{SS} = -5.0\text{V} \pm 10\%$ )

Parameter	Signal	Symbol	Condition	Rating			Unit
				Min	Typ	Max	
LOW pulse width	CL	$t_{WLCL}$		35	—	—	$\mu\text{s}$
HIGH pulse width		$t_{WHCL}$		35	—	—	$\mu\text{s}$
Rising time		$t_r$		—	30	150	ns
Falling time		$t_f$		—	30	150	ns
FR delay time	FR	$t_{DFR}$	(Input timing)	-2.0	0.2	2.0	$\mu\text{s}$
			(Output timing), $C_L = 100\text{pF}$	—	0.2	0.4	

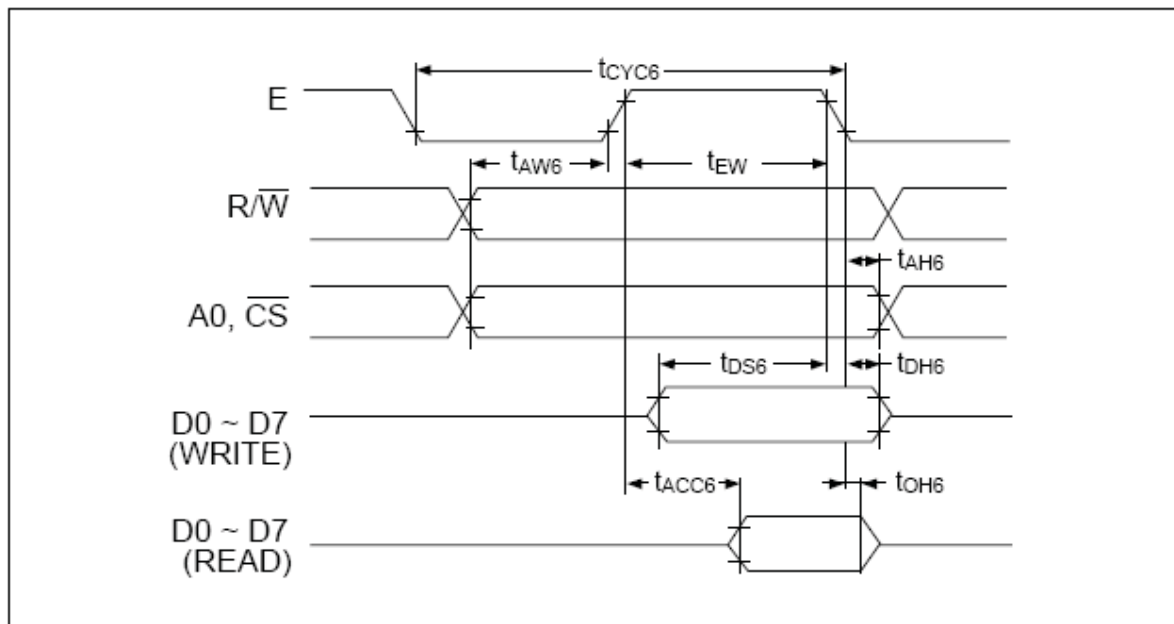
\*5. The ratings when  $V_{SS} = -3.0\text{V}$  are approximately 100% higher than when  $V_{SS} = -5.0\text{V}$ .

\*6. The input timing of the FR delay time is determined by the SED1520 (Slave).  
The output timing of the FR delay time is determined by the SED1520 (Master).

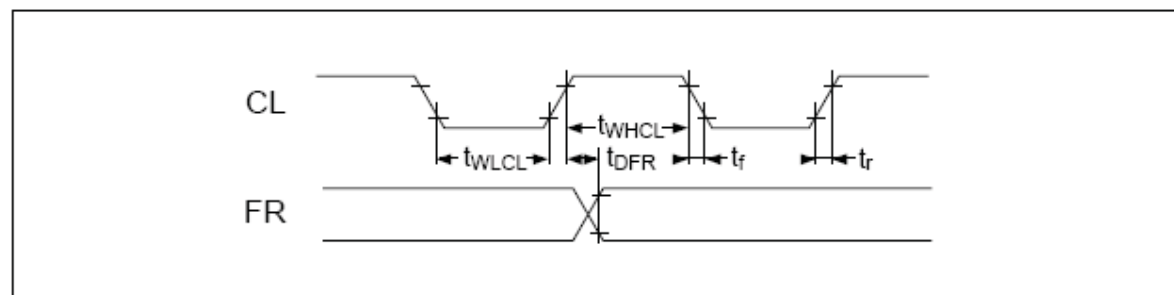
- Timing Chart
- Read/Write timing for the 80-port MPU



- Read/Write timing for the 68-port MPU



- Control timing for 80-port/68-port display



# 11. Instruction Table

## ■ DISPLAY COMMANDS

(Based on the 80-port MPU; the  $\overline{RD}$  and  $\overline{WR}$  commands differ for the 68-port MPU.)

Command	$\overline{RD}$ $\overline{WR}$ A0	D7 D6 D5 D4 D3 D2 D1 D0	Function
1 Display ON/OFF	1 0 0	1 0 1 0 1 1 1 0/1	Switches the entire display ON or OFF, regardless of the Display RAM's data or the internal status. *7
2 Display START Line	1 0 0	1 1 0	Display START address (0~31) Determines the line of RAM data to be displayed at the display's top line (COM0).
3 Page Address Set	1 0 0	1 0 1 1 1 0	Page (0~3) Sets the page of the Display RAM in the page address register.
4 Column (Segment) Address Set	1 0 0	0	Column address (0~79) Sets the column address of the Display RAM in the column address register.
5 Status Read	0 1 0	BUSY ACC ON/OFF RESET 0 0 0 0	Reads the status. BUSY 1: Busy (internal processing) 0: READY status ADC 1: Rightward (forward) output 0: Leftward (reverse) output ON/OFF 1: Display OFF 0: Display ON RESET 1: Resetting 0: Normal
6 Write Display Data	1 0 1	Write Data	Writes the data on the data bus to RAM
7 Read Display Data	0 1 1	Read Data	Reads data from the Display RAM onto the data bus.
These commands access a previously-specified address of the Display RAM, after which the column address is incremented by one.			
8 ADC Select	1 0 0	1 0 1 0 0 0 0 0/1	Used to reverse the correspondence between the Display RAM's column addresses and segment driver output ports 0: Rightward (forward) output 1: Leftward (reverse) output
9 Static Drive ON/OFF	1 0 0	1 0 1 0 0 1 0 0/1	Selects normal display operation or static all-lit drive display operation. 1: Static drive (Power Save) *7 0: Normal display operation
10 Duty Select	1 0 0	1 0 1 0 1 0 0 0/1	Selects the duty factor for driving LCD cells. 1: 1/32 duty 0: 1/16 duty
11 Read Modify Write	1 0 0	1 1 1 0 0 0 0 0	Increments the column address counter by one only when display data is written but not when it is read.
12 End	1 0 0	1 1 1 0 1 1 1 0	Cancels the Ready Modify Write mode.
13 Reset	1 0 0	1 1 1 0 0 0 1 0	Resets the Display START line to the 1st line in the register. Resets the column address counter to 0 and page address register to 3.

\*7. Power Save mode is entered by selecting static drive in Display OFF status.

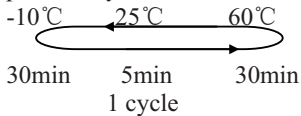
# 12.Quality Assurance

## Screen Cosmetic Criteria

Item	Defect	Judgment Criterion	Partition																				
1	Spots	<p>A)Clear</p> <table border="0"> <tr> <td><u>Size: d mm</u></td> <td><u>Acceptable Qty in active area</u></td> </tr> <tr> <td><math>d \leq 0.1</math></td> <td>Disregard</td> </tr> <tr> <td><math>0.1 &lt; d \leq 0.2</math></td> <td>6</td> </tr> <tr> <td><math>0.2 &lt; d \leq 0.3</math></td> <td>2</td> </tr> <tr> <td><math>0.3 &lt; d</math></td> <td>0</td> </tr> </table> <p>Note: Including pin holes and defective dots which must be within one pixel size.</p> <p>B)Unclear</p> <table border="0"> <tr> <td><u>Size: d mm</u></td> <td><u>Acceptable Qty in active area</u></td> </tr> <tr> <td><math>d \leq 0.2</math></td> <td>Disregard</td> </tr> <tr> <td><math>0.2 &lt; d \leq 0.5</math></td> <td>6</td> </tr> <tr> <td><math>0.5 &lt; d \leq 0.7</math></td> <td>2</td> </tr> <tr> <td><math>0.7 &lt; d</math></td> <td>0</td> </tr> </table>	<u>Size: d mm</u>	<u>Acceptable Qty in active area</u>	$d \leq 0.1$	Disregard	$0.1 < d \leq 0.2$	6	$0.2 < d \leq 0.3$	2	$0.3 < d$	0	<u>Size: d mm</u>	<u>Acceptable Qty in active area</u>	$d \leq 0.2$	Disregard	$0.2 < d \leq 0.5$	6	$0.5 < d \leq 0.7$	2	$0.7 < d$	0	Minor
<u>Size: d mm</u>	<u>Acceptable Qty in active area</u>																						
$d \leq 0.1$	Disregard																						
$0.1 < d \leq 0.2$	6																						
$0.2 < d \leq 0.3$	2																						
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<u>Size: d mm</u>	<u>Acceptable Qty in active area</u>																						
$d \leq 0.2$	Disregard																						
$0.2 < d \leq 0.5$	6																						
$0.5 < d \leq 0.7$	2																						
$0.7 < d$	0																						
2	Bubbles in Polarizer	<table border="0"> <tr> <td><u>Size: d mm</u></td> <td><u>Acceptable Qty in active area</u></td> </tr> <tr> <td><math>d \leq 0.3</math></td> <td>Disregard</td> </tr> <tr> <td><math>0.3 &lt; d \leq 1.0</math></td> <td>3</td> </tr> <tr> <td><math>1.0 &lt; d \leq 1.5</math></td> <td>1</td> </tr> <tr> <td><math>1.5 &lt; d</math></td> <td>0</td> </tr> </table>	<u>Size: d mm</u>	<u>Acceptable Qty in active area</u>	$d \leq 0.3$	Disregard	$0.3 < d \leq 1.0$	3	$1.0 < d \leq 1.5$	1	$1.5 < d$	0	Minor										
<u>Size: d mm</u>	<u>Acceptable Qty in active area</u>																						
$d \leq 0.3$	Disregard																						
$0.3 < d \leq 1.0$	3																						
$1.0 < d \leq 1.5$	1																						
$1.5 < d$	0																						
3	Scratch	In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor																				
4	Allowable Density	Above defects should be separated more than 30mm each other.	Minor																				
5	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-light type should be judged with back-light on state only.	Minor																				

# 13. Reliability

## Content of Reliability Test

Environmental Test			
Test Item	Content of Test	Test Condition	Applicable Standard
High Temperature storage	Endurance test applying the high storage temperature for a long time.	60°C 96hrs	—
Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-10°C 96hrs	—
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	50°C 96hrs	—
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	0°C 96hrs	—
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60°C, 90%RH 96hrs	—
High Temperature/ Humidity Operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	50°C, 90%RH 96hrs	—
Temperature Cycle	Endurance test applying the low and high temperature cycle. 	-10°C/60°C 10 cycles	—
Mechanical Test			
Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs	—
Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G Half sign wave 11 msdc 3 times of each direction	—

\*\*\*Supply voltage for logic system=5V. Supply voltage for LCD system =Operating voltage at 25°C