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SPECIFICATIONS
FOR LCD MODULE

CUSTOMER	
CUSTOMER PART NO.	
ACMMI PART NO.	AMG12232B
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
2005.10		Add white backlight
2005.12	4	Update the part number system

Contents

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

Item	Dimension	Unit
Number of Dots	122 x 32	—
Module dimension(No Backlight)	80.0 x 36.0 x 10.0（MAX）	mm
Module dimension(With LED Backlight)	80.0 x 36.0 x 14.0（MAX）	mm
Module dimension(White Backlight)	80.0 x 36.0 x 9.0（MAX）	mm
View area	60.5 x 18.5	mm
Active area	53.64 x 15.64	mm
Dot size	0.40 x 0.45	mm
Dot pitch	0.44 x 0.49	mm
LCD type	STN	
Duty	1/32	
View direction	6 o'clock or 12 o'clock	
Backlight Type	None, Yellow-green backlight, White backlight	

4. Absolute Maximum Ratings

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

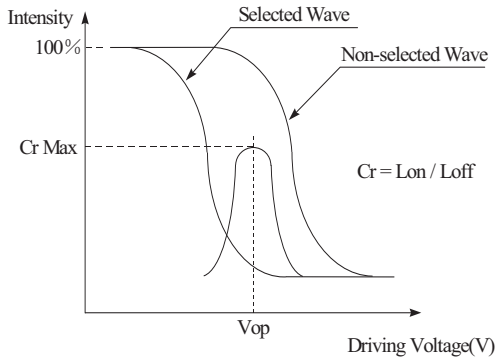
5. Electrical Characteristics

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	Ta=25℃	-	6.5	-	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}=5V	-	1.0	3.0	mA
Supply Voltage of Yellow-green backlight	V_{LED}	Forward current =190 mA Number of LED die 2x19= 38	3.8	4.2	4.3	V
Supply Voltage of White backlight	VLED	Forward current =20 mA Number of LED die 1	2.9	3.1	3.3	V

6. Optical Characteristics

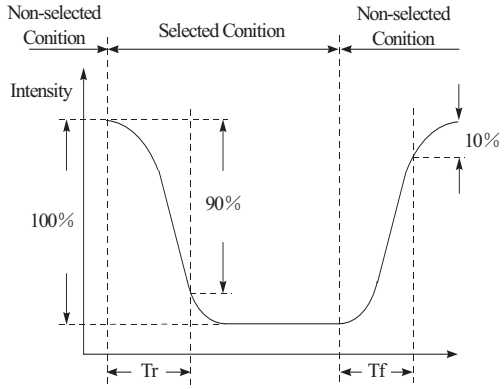
Item	Symbol	Condition	Min	Typ	Max	Unit
View Angle	(V)θ	CR≧2	-20	—	35	deg
	(H)φ	CR≧2	-30	—	30	deg
Contrast Ratio	CR	—	—	3	—	—
Response Time	T rise	—	—	—	250	ms
	T fall	—	—	—	250	ms

Definition of Operation Voltage (Vop)



[positive type]

Definition of Response Time (Tr , Tf)



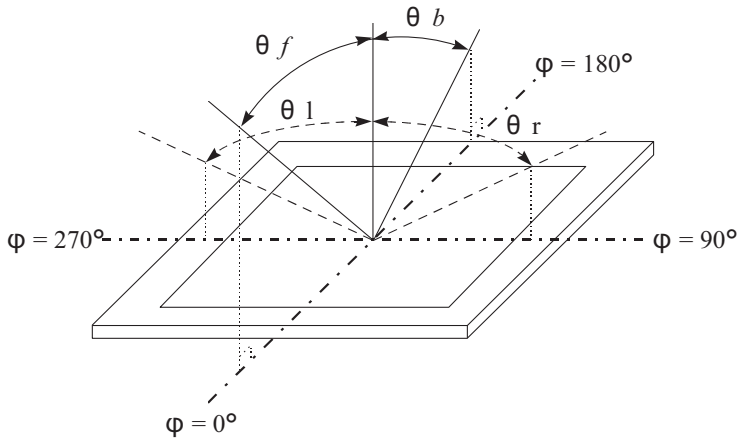
[positive type]

Conditions :

Operating Voltage : Vop Viewing Angle(θ , φ) : 0° , 0°

Frame Frequency : 64 HZ Driving Waveform : 1/N duty , 1/a bias

Definition of viewing angle(CR≧2)

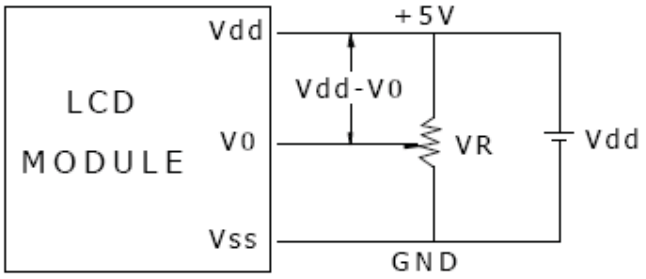


7. Interface Pin Function

Pin No.	Symbol	Level	Description
1	V_{SS}	0V	Ground
2	V_{DD}	5.0V	Supply Voltage for logic
3	V0		Operating voltage for LCD
4	A0	H/L	Register Select
5	CS1	H/L	Chip1 Select
6	CS2	H/L	Chip2 Select
7	CL	H/L	Clock
8	E	H/L	Enable
9	RW	H/L	Read/Write
10	DB0	H/L	Data bit 0
11	DB1	H/L	Data bit 1
12	DB2	H/L	Data bit 2
13	DB3	H/L	Data bit 3
14	DB4	H/L	Data bit 4
15	DB5	H/L	Data bit 5
16	DB6	H/L	Data bit 6
17	DB7	H/L	Data bit 7
18	RST	H/L	Reset Signal
19	LED(+)		Anode of LED Backlight
20	LED(-)		Cathode of LED Backlight

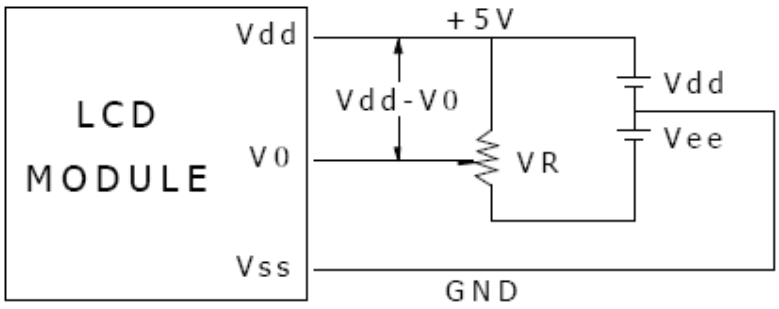
8. POWER SUPPLY

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



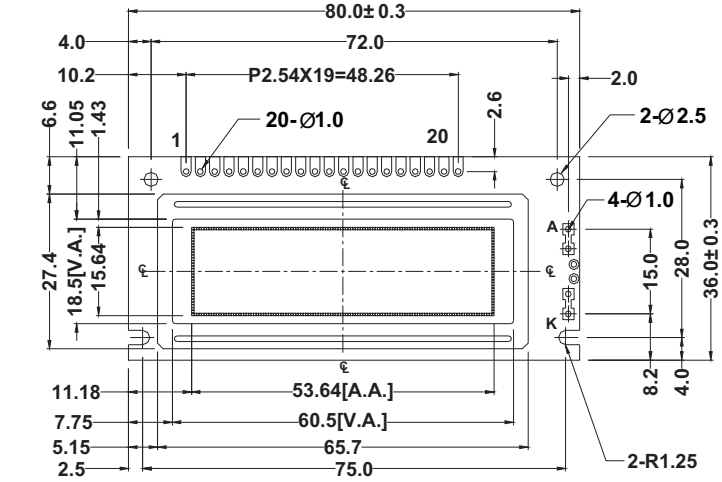
Vdd-V0: LCD Driving Voltage
VR: 10K - 20K

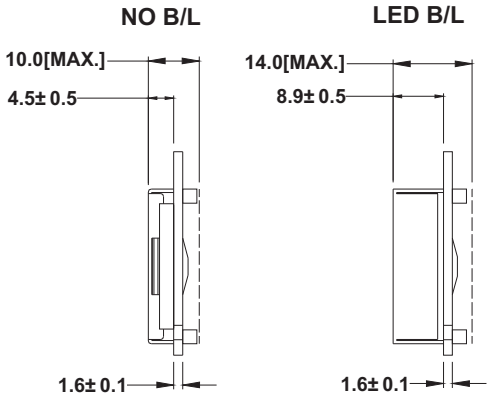
DUAL SUPPLY VOLTAGE TYPE (for LCM without Negative Power on PCB)

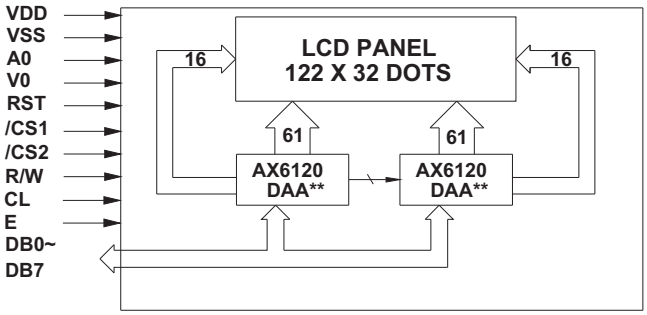


Vdd-V0: LCD Driving Voltage
VR: 10K - 20K

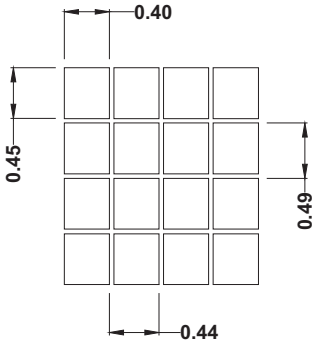
9. Contour Drawing &Block Diagram

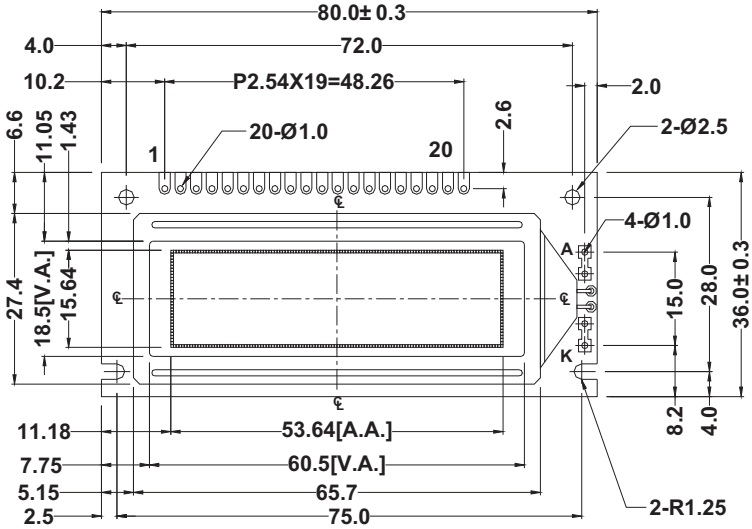


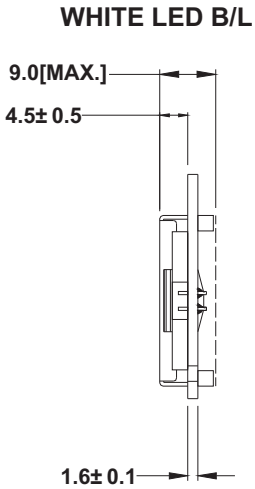




** OR EQUIVALENT



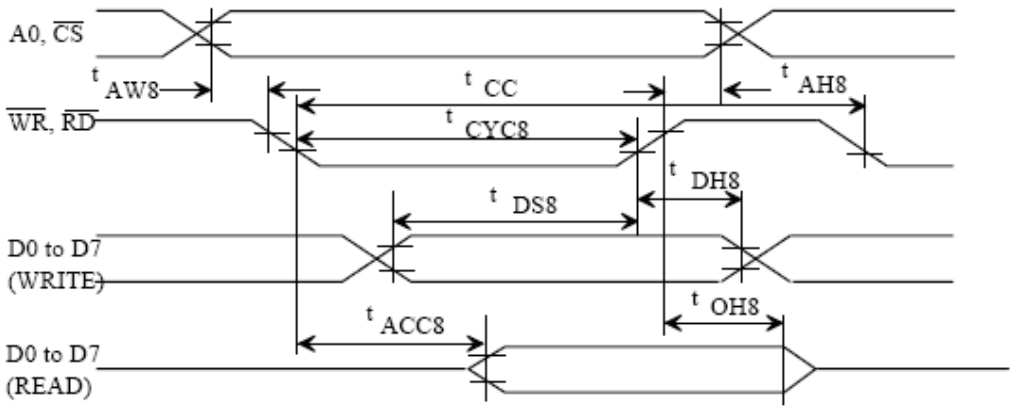




10.Timing Characteristics

AC Characteristics

• MPU Bus Read/Write I (80-family MPU)



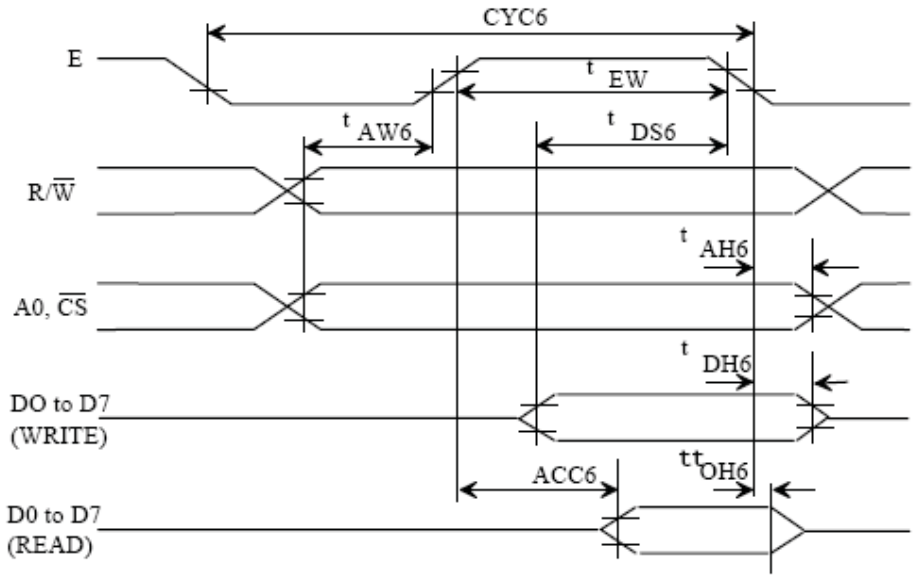
Ta= -20 to 75 deg. C, Vss= -5.0± 10% unless stated otherwise

Parameter	Symbol	Condition	Rating		Unit	Signal
			min	max		
Address hold time	tAH8		10	--	ns	A0, $\overline{CS}$
Address setup time	tAW8		20	--	ns	
System cycle time	tCYC8		1,000	--	ns	$\overline{WR}$, $\overline{RD}$
Control pulsewidth	tcc		200	--	ns	
Data setup time	tDS8		80	--	ns	DO to D7
Data hold time	tDH8		10	--	ns	
$\overline{RD}$ access time	tACC8	CL= 100pF	--	90	ns	
Output disable time	tCH8		10	60	ns	

Notes : 1. Increase parameter values by 200% when Vss= -3.0V.

2. All inputs must have a rise and fall time of less than 15 ns.

• **MPU Bus Read/Write II (68-family MPU)**

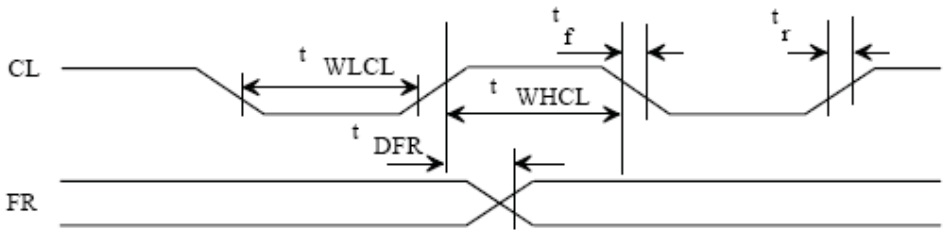


Ta= -20 to 75 deg. C. Vss= -5.0V ± 10% unless stated otherwise

Parameter		Symbol	Condition	Rating		Unit	Signal
				min	max		
System cycle time		tCYC6		1,000	--	ns	A0, CS, R/W
Address setup time		tAW6		20	--	ns	
Address hold time		tAH6		10	--	ns	
Data setup time		tDS6		80	--	ns	D0 to D7
Data hold time		tDH6		10	--	ns	
Output disable time		tOH6	CL= 100pF	10	60	ns	
Access time		tACC6		--	90	ns	
Enable pulsewidth	Read	tEW		100	--	ns	E
	Write			80	--	ns	

Notes : 1. tCYC6 is the cycle time of CS. E=H. not the cycle time of E.
2. Increase parameter values by 200% when Vss= -3.0V.
3. all inputs must have a rise and fall time of less than 15 ns.

• **Display Control Signal Timing**



Input

Ta= -20 to 75 deg. C, Vss= -5.0V ± 10% unless stated otherwise

Parameter	Symbol	Condition	Rating			Unit	Signal
			min	typ	max		
Low-level pulse width	tWLCL		35	--	--	μs	CL
High-level pulse width	tWHCL		35	--	--	μs	
Rise time	tr		--	30	150	μs	
Fall time	tf		--	30	150	μs	
FR delay time	tDFR		-2	0.2	2	μs	FR

Note : The listed input tDFR applies to the AX6120 and AX6121 in slave mode.

Output

Ta= -20 to 75 deg. C, Vss= -5.0V ± 10% unless stated otherwise

Parameter	Symbol	Condition	Rating			Unit	Signal
			min	typ	max		
FR delay time	tDFR	CL= 100pF	--	0.2	0.4	μs	FR

Notes : 1. The listed output tDFR applies to the AX6120 in master mode.

2. Increase parameter values by 200% when Vss= -3.0V.

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	A)Clear Size: d mm — Acceptable Qty in active area d ≦0.1 — Disregard 0.1<d≦0.2 — 6 0.2<d≦0.3 — 2 0.3<d — 0 Note: Including pin holes and defective dots which must be within one pixel size. B)Unclear Size: d mm — Acceptable Qty in active area d ≦0.2 — Disregard 0.2<d≦0.5 — 6 0.5<d≦0.7 — 2 0.7<d — 0	Minor
2	Bubbles in Polarizer	Size: d mm — Acceptable Qty in active area d≦0.3 — Disregard 0.3<d≦1.0 — 3 1.0<d≦1.5 — 1 1.5<d — 0	Minor
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℃ 96hrs	——
Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-10℃ 96hrs	——
High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	50℃ 96hrs	——
Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	0℃ 96hrs	——
High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	60℃,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℃,90%RH 96hrs	——
Temperature Cycle	Endurance test applying the low and high temperature cycle. -10℃ 25℃ 60℃ 30min 5min 30min 1 cycle	-10℃/60℃ 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 msedc 3 times of each direction	——

***Supply voltage for logic system=5V. Supply voltage for LCD system =Operating voltage at 25℃