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SPECIFICATION
FOR
LCM MODULE

MODULE NO.: AMG19248AR-B-Y6NFDY
DOC. REVISION 02

Customer Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)		
PREPARED BY (QA ENGINEER)		
CHECKED BY		
APPROVED BY		

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	Sep-17-2007	First issue	
01	Sep-20-2007	Change 4/5/6	
02	Nov-13-2007	Change **4. Dimensional Outline**	

<u>CONTENTS</u>

1. FUNCTIONS & FEATURES

1.1. Format	: 192x48 dots
1.2. LCD mode	: STN /Positive Transflective Mode/Y-G
1.3. Viewing direction	: 6 o'clock
1.4. Driving scheme	: 1/48 Duty cycle, 1/8 Bias
1.5. Power supply voltage (V_{DD})	: 5.0V
1.6. LCD driving voltage	: 9.0V(Reference voltage)
1.7. Operation temp	: 0~+50℃
1.8. Storage temp	: -20~+70℃
1.9. Backlight color	: Yellow-Green
1.10 Control IC	: SBN0064G
1.11.RoHS standard	

2. MECHANICAL SPECIFICATIONS

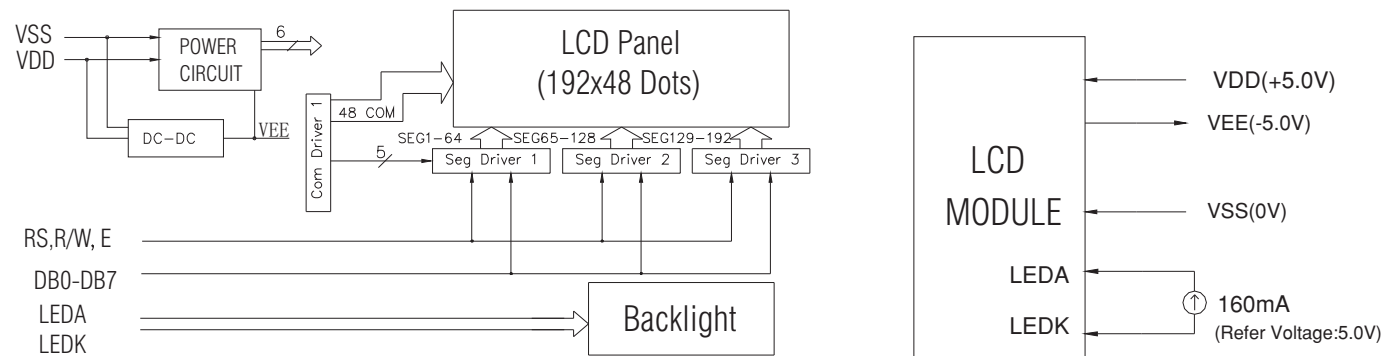|	
2.1. Module size	: 122.4mm(L)*52.7mm(W)*13.1max mm (H)
2.2. Viewing area	: 99.0mm(L)*24.0mm(W)
2.3. Dot pitch	: 0.49mm(L)*0.46mm(W)
2.4. Dot size	: 0.44mm(L)*0.41mm(W)
2.5. Weight	: Approx.

3. BLOCK DIAGRAM

Figure 1. Block diagram

1

4. DIMENSIONAL OUTLINE

Figure 1. Dimensional outline

5. PIN DESCRIPTION

No.	Symbol	Function
1	VSS	GND（0V）
2	VDD	Power supply for logic(+5.0V)
3	VEE	Output of supply negative voltage by the DC-DC converter on the module
4	RS	Register selection. (H: Data register L: Instruction register)
5	R/W	Read / write selection. (H: Read L: write)
6	E	Enable signal for chip
7~14	DB0~DB7	Data bus lines
15	LEDA	Power supply for backlight(+5.0V)
16	LEDK	Power supply for backlight(0V)
17	LED1	NO connection
18	LED2	
19	R/W	NO connection
20	E	

6. MAXIMUM ABSOUTE LIMIT

SYMBOL	PARAMETER	MIN.	MAX.	UNIT
V_{DD}	voltage on the V_{DD} pin(pad)	−0.3	+7.0	volt
V_{EE}	voltage on the V_{EE} pin(pad)	V_{DD} - 16		
V_{LCD} (note 2)	LCD bias voltage, V_{LCD}=V0-V5		13	
V_I	input voltage on any pin with respect to V_{SS}	−0.3	V_{DD} + 0.3	
P_D	power dissipation		200	mW
T_{stg}	storage temperature range	−55	+125	°C
T_{amb}	operating ambient temperature range	-30	+ 85	°C
Tsol (note 3)	soldering temperature/time at pin		260 °C, 10 Second	

Notes

1. The following applies to the Absolute Maximum Rating:
   a) Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device.
   b) The SBN0064G includes circuitry specifically designed for the protection of its internal devices from the damaging effect of excessive static charge (ESD). However, it is suggested that conventional precautions be taken to avoid applying greater than the rated maxima.
   c) Parameters are valid over operating temperature range unless otherwise specified.
   d) All voltages are with respect to V_{SS}, unless otherwise noted.
2. The condition V_{DD}(V0)≥ V1 ≥ V2 ≥ V3 ≥ V4 ≥ V5 must always be met.
3. QFP-type packages are sensitive to moisture of the environment, please check the drypack indicator on the tray package before soldering. Exposure to moisture longer than the rated drypack level may lead to cracking of the plastic package or broken bonding wiring inside the chip.

7. ELECTRICAL CHARACTERISTICS

7.1. DC characteristics

V_{DD} = 5 V ±10%; V_{SS} = 0 V; all voltages with respect to V_{SS}, unless otherwise specified; T_{amb} = −20 to +75 °C.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{DD}	Supply voltage for logic		2.7	5.0	5.5	V
V_{NEG}	$V_{NEG}=V_{DD}-V_{EE}$				16	V
V_{LCD}	LCD bias voltage V_{LCD}= V0(V_{DD})-V5	Note 1.			13	V
V_{IL}	LOW level input voltage	For all inputs	0		0.8	V
V_{IH}	HIGH level input voltage	For all inputs	V_{DD}-2.2		V_{DD}	V
V_{OL}	LOW level output voltage of DB0~7 at I_{OL}=1.6 mA.		0.0		0.3	V
V_{OH}	HIGH level output voltage of DB0~7 at I_{OH}=-200µA.		V_{DD} − 0.3		V_{DD}	V
I_{LKG}	Leakage current of input pins	for all inputs			0.2	µA
I_{STBY}	Stand-by current at V_{DD}=5 volts	Note 2			3.0	µA
$I_{DD(1)}$	Operating current for display-only operation	Note 3			100	µA
$I_{DD(2)}$	Operating current for display and microcontroller access at t_{CYC}=1 MHz	Note 4			500	µA
C_{in}	Input capacitance of all input pins			5.0	8.0	pF
R_{ON}	LCD driver ON resistance	Note 5		5.0	7.5	KΩ

Notes:

1. LCD bias voltage V_{LCD} is V0 - V5. V0 should always be connected to VDD.

2. Conditions for the measurement: CLK1=CLK2=V_{DD}, measured at the V_{DD} pin.

3. This value is measured when the microcontroller does not perform any READ/WRITE operation to the chip and the chip is only performing display operation, with the following condition: 1/64 duty, $F_{CLK1,CLK2}$=250 KHz, frame frequency= 70Hz, and no loading for SEG0~63.

4. This values is measured when the microcontroller continuously performs READ/WRITE operation to the chip and the chip is also performing display operation with the following condition: 1/64 duty, $F_{CLK1,CLK2}$=250 KHz, frame frequency= 70Hz, and no loading for SEG0~63.

5. This measurement is for the transmission high-voltage PMOS or NMOS of SEG0~SEG63. Please refer to Section 16 for these driver circuit. The measurement is for the case when the voltage differential between the source and the drain of the high voltage PMOS or NMOS is 0.1 volts.

5

7.2. AC characteristics

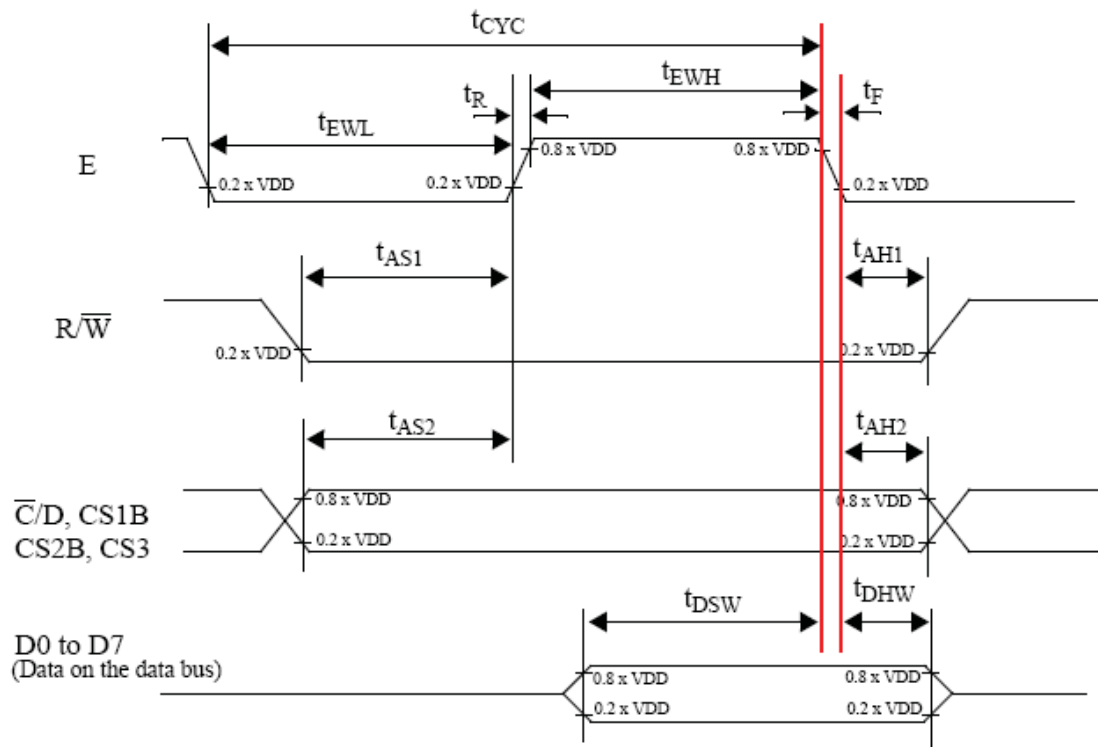### 7.2.1 writing timing

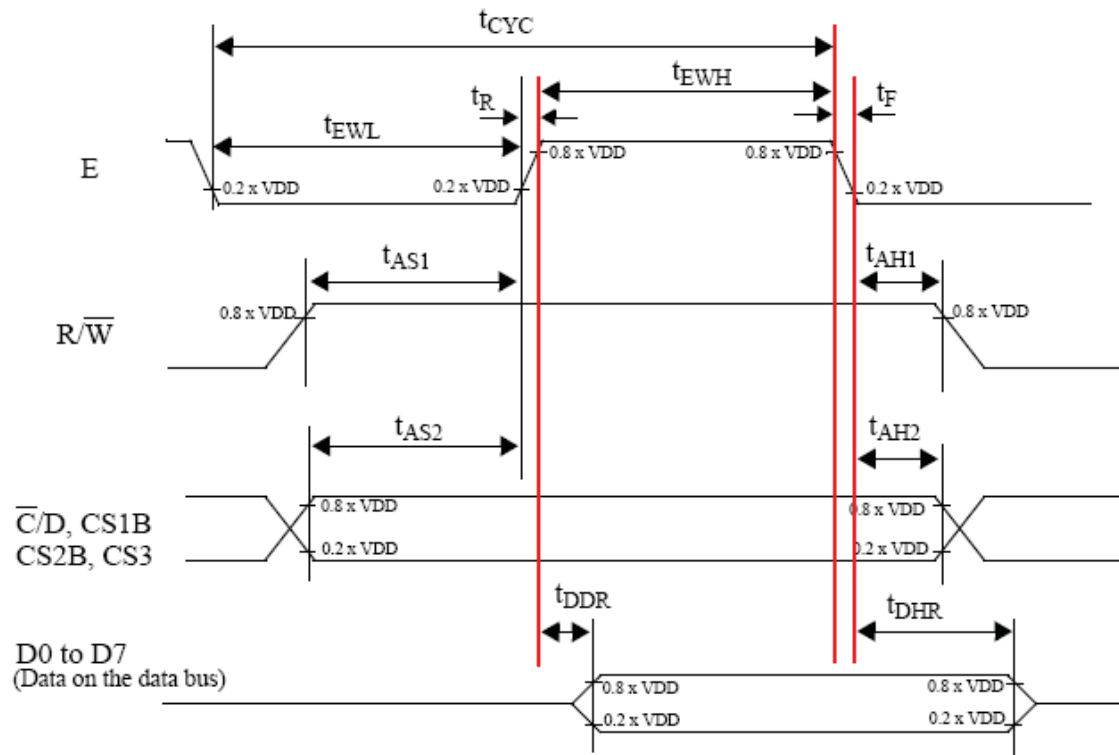Fig.16 AC timing for writing to the SBN0064G

7.2.2 reading timing

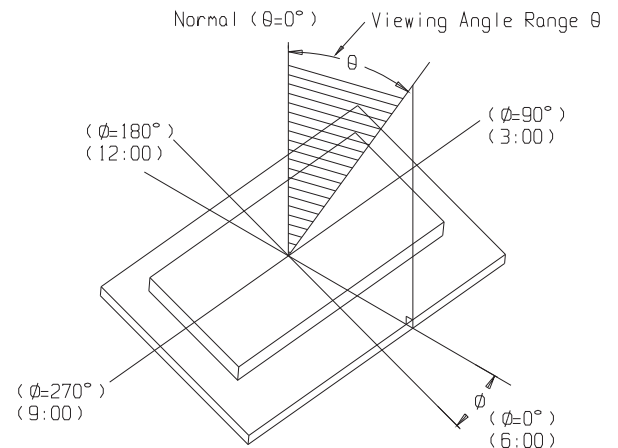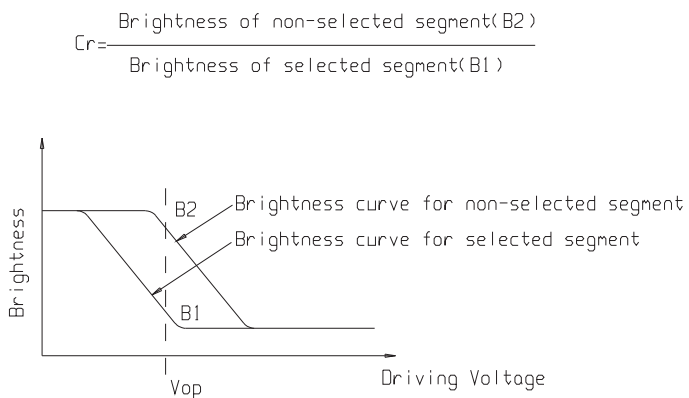Fig.17 AC timing for reading from the SBN0064G

8. BACKLIGHT CHARACTERISTICS

Ta = 25°C

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=160mA	---	4.2	---	V
Reverse Current	IR	VR=4.2 V	---	160	---	mA
Luminous Intensity (With LCD dots off)	IV		---	--	---	Cd/m^2
Wave length(Without LCD)	λρ	IF=160mA	570	---	575	nm
Color	Yellow-Green					

9. ELECTRO-OPTICAL CHARACTERISTICS

(VDD=5.0V, Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Operating Voltage	Vop	Ta = 25°C	8.7	9.0	9.3	V
Response time	Tr	Ta = 25°C	---	185	---	ms
	Tf		---	200	---	ms
Contrast	Cr	Ta = 25°C	---	4	---	---
Viewing angle range	θ	Cr≥2	-40	---	+40	deg
	Φ		-40	---	+40	deg

$$Cr = \frac{\text{Brightness of non-selected segment(B2)}}{\text{Brightness of selected segment(B1)}}$$

Brightness

B2 — Brightness curve for non-selected segment

Brightness curve for selected segment

B1

Vop — Driving Voltage

Normal (θ=0°)   Viewing Angle Range θ

(∅=180°) (12:00)

(∅=90°) (3:00)

(∅=270°) (9:00)

∅ (∅=0°) (6:00)

8

10.QUALITY SPECIFICATIONS

10.1 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.
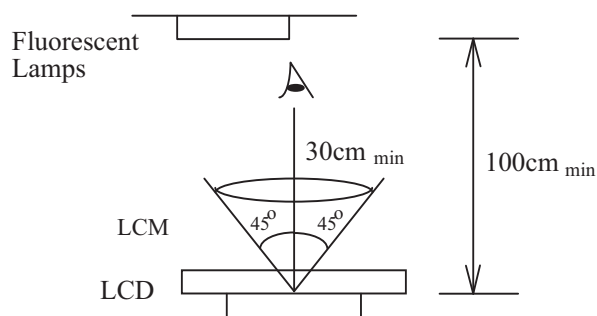
Definition of zone:
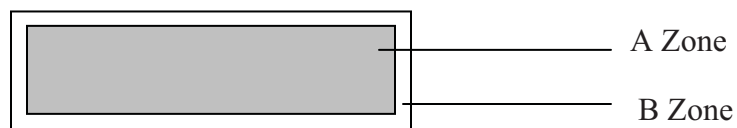
A Zone
B Zone

A Zone: Active display area (minimum viewing area).
B Zone: Non-active display area (outside viewing area).

10.2 Specification of quality assurance
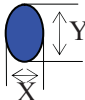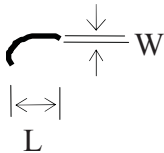
AQL inspection standard
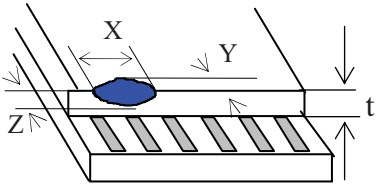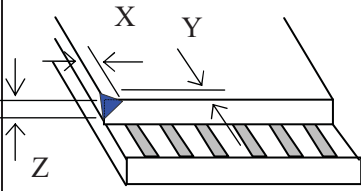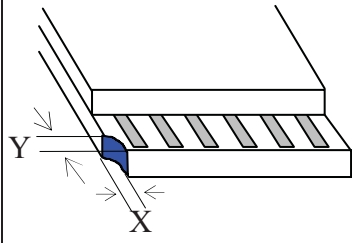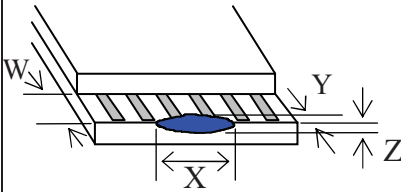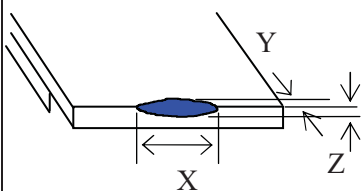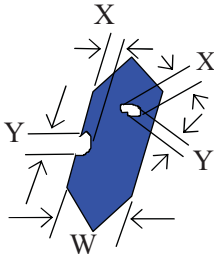
Sampling method: MIL-STD-105E, Level II, single sampling
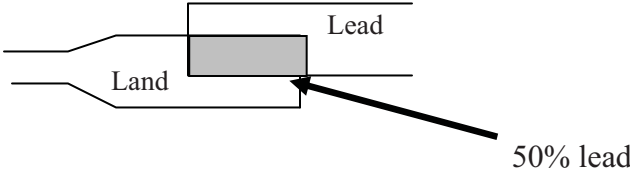
Defect classification **(Note: * is not including)**
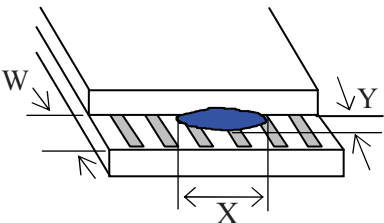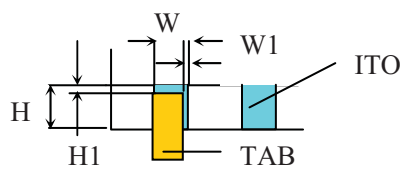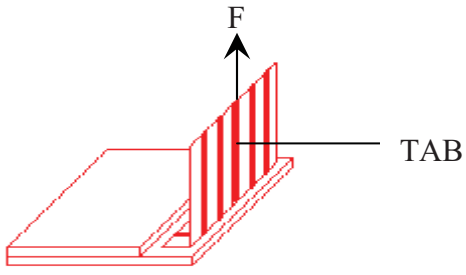
Classify		Item	Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
		Protruded	12	
	Polarizer	Bubble and foreign material	3	
	Soldering	Poor connection	9	
	Wire	Poor connection	10	
	TAB	Position, Bonding strength	13	

Note on defect classification

No.	Item	Criterion
1	Short or open circuit	Not allow
	LC leakage	
	Flickering	
	No display	
	Wrong viewing direction	
	Wrong Back-light	
2	Contrast defect	Refer to approval sample
	Background color deviation	

No.	Item	Criterion
3	Point defect, Black spot, dust (including Polarizer) $\phi = (X+Y)/2$	

Point Size	Acceptable Qty.
$\phi \leq 0.10$	Disregard
$0.10 < \phi \leq 0.20$	3
$0.20 < \phi \leq 0.25$	2
$0.25 < \phi \leq 0.30$	1
$\phi > 0.30$	0

Unit：mm

No.	Item	Criterion
4	Line defect, Scratch	

Line		Acceptable Qty.
L	W	
---	$0.015 \geqslant W$	Disregard
$5.0 \geqslant L$	$0.03 \geqslant W$	2
$5.0 \geqslant L$	$0.05 \geqslant W$	
$5.0 \geqslant L$	$0.1 > W$	1
---	$0.05 < W$	Applied as point defect

Unit: mm

No.	Item	Criterion
5	Rainbow	Not more than two color changes across the viewing area.

No	Item	Criterion

6 — Chip

Remark:
- X: Length direction
- Y: Short direction
- Z: Thickness direction
- t: Glass thickness
- W: Terminal Width

Acceptable criterion

X	Y	Z
≤2	0.5mm	≤t/2

Acceptable criterion

X	Y	Z
≤3	0.5mm	≤t

Acceptable criterion

X	Y	Z
≤3	≤2	≤t
shall not reach to ITO		

Acceptable criterion

X	Y	Z
Disregard	≤0.2	≤t

Acceptable criterion

X	Y	Z
≤5	≤2	≤t/3

No.	Item	Criterion
7	Segment pattern W = Segment width $\phi = (X+Y)/2$	(1) Pin hole $\phi < 0.10mm$ is acceptable. Unit: mm
8	Back-light	(1) The color of backlight should correspond its specification. (2) Not allow flickering
9	Soldering	(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect) (2) Over 50% of lead should be soldered on Land.
10	Wire	(1) Copper wire should not be rusted (2) Not allow crack on copper wire connection. (3) Not allow reversing the position of the flat cable. (4) Not allow exposed copper wire inside the flat cable.
11*	PCB	(1) Not allow screw rust or damage. (2) Not allow missing or wrong putting of component.

For item 7, the point size table:

Point Size	Acceptable Qty
$\phi \leqslant 1/4W$	Disregard
$1/4W < \phi \leqslant 1/2W$	1
$\phi > 1/2W$	0

No	Item	Criterion
12	Protruded W: Terminal Width	 Acceptable criteria: $Y \leq 0.4$
13	TAB	1. Position $W1 \leqslant 1/3W$ $H1 \leqslant 1/3H$ 2 TAB bonding strength test P (=F/TAB bonding width) $\geqslant$650gf/cm ,(speed rate: 1mm/min) 5pcs per SOA (shipment)
14	Total no. of acceptable Defect	A. Zone Maximum 2 minor non-conformities per one unit. Defect distance: each point to be separated over 10mm B. Zone It is acceptable when it is no trouble for quality and assembly in customer's end product.

14

10.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	70°C	48	No abnormalities in functions and appearance
High temp. Operating	50°C	48	
Low temp. Storage	-20°C	48	
Low temp. Operating	0°C	48	
Humidity	40°C/ 90%RH	48	
Temp. Cycle	0°C ← 25°C →50°C (30 min ← 5 min → 30min)	10cycles	

Recovery time should be 24 hours minimum. Moreover, functions, performance and appearance ,etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature ($20\pm8°C$), normal humidity (below $45\pm20\%$ RH), and in the area not exposed to direct sun light. The life time is not content the life time of the LED (for the life time of LED which decay only 50%,in the industry the experience value is 50000 hours, but there are not any experimentation data to support this).

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10.4 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 isoproply alcohol, ethyl alcohol or trichlorotriflorothane, 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 Orient Display.

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: $280°C \pm 10°C$
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:

1. The viewing angle can be adjusted by varying the LCD driving voltage Vo.
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 and humidity could cause polarization degradation, polarizer peel-off or generate bubbles.

7. For long-term storage over 40°C is required, the relative humidity should be kept below 60%, and avoid direct sunlight.

Limited Warranty

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

1. The liability of Orient Display is limited to repair or replacement on the terms set forth below. Orient Display 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 Orient Display and the customer, Orient Display will only replace or repair any of its LCD which is found defective electrically or visually when inspected in accordance with Orient Display 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.