

SPECIFICATION FOR LCM MODULE

**MODULE NO.: ABG320240A00-BIC-R
DOC.REVISION 02**

Customer Approval:

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	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)		Nov-19-2007
PREPARED BY (QA ENGINEER)		
CHECKED BY		
APPROVED BY		

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	Aug-17-2006	First issue	
01	Nov-19-2007	Change drawing	
02	APR-1-2008	Modify Block diagram and PIN description	

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1. FUNCTIONS & FEATURES

1.1. Format	: 320x240dots
1.2. LCD mode	: STN / Negative transmissive mode / Blue
1.3. Viewing direction	: 6 o'clock
1.4. Driving scheme	: 1/240 Duty cycle, 1/12 Bias
1.5. Power supply voltage(V_{DD})	: 5.0V
1.6. LCD driving voltage	: 23.8V
1.7. Operation temp	: -20~70°C
1.8. Storage temp	: -30~80°C
1.9. Backlight color	: White

2. MECHANICAL SPECIFICATIONS

2.1. Module size	: 167.0mm(L)*109.0mm(W)*10.0max mm(H)
2.2. Viewing area	: 123.0mm(L)*92.0mm(W)
2.3. Dot pitch	: 0.36mm(L)*0.36mm(W)
2.4. Dot size	: 0.33mm(L)*0.33mm(W)
2.5. Weight	: Approx.

3. BLOCK DIAGRAM

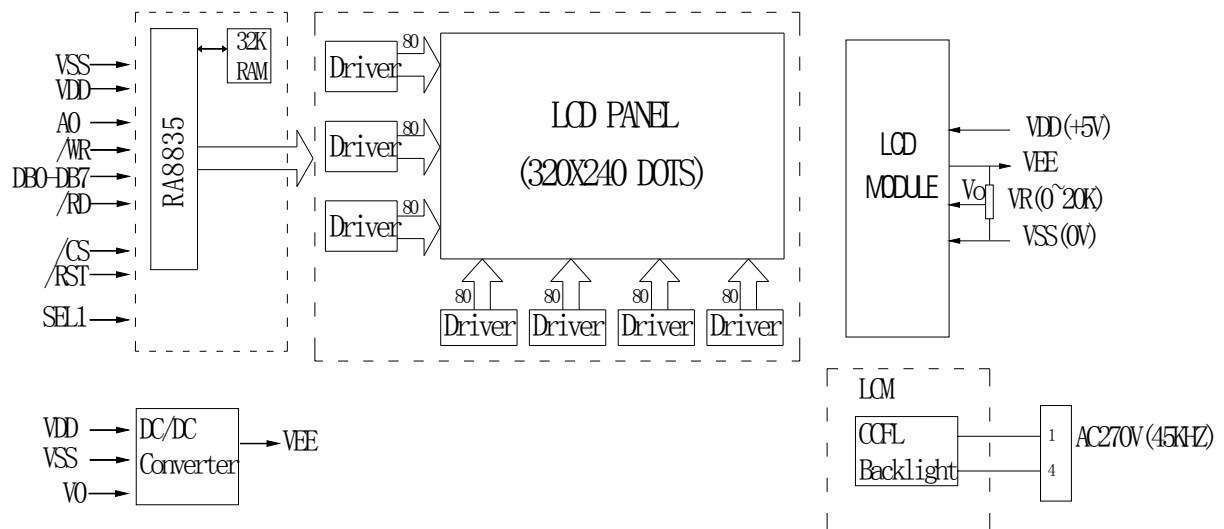


Figure 1. Block diagram

2



5. PIN DESCRIPTION

No.	Symbol	Function
1	VSS	GND(0V)
2	VDD	Power supply for the logic (+5V)
3	V0	Power supply for the LCD drive
4	A0	Register selection (H:Data register, L:Instruction register)
5	/WR	8080 family: Write signal 6800 family: R/W signal
6	/RD	8080 family: Read signal 6800 family: Enable clock (E)
7-14	DB0~DB7	Data bus line
15	/CS	Chip enable signal
16	/RST	Reset signal
17	VEE	Negative voltage output
18	SEL1	8080 or 6800 family interface select 0:8080,1:6800
19~22	NC	No connection

6. MAXIMUM ABSOLUTE LIMIT

(For IC)

Parameter	Symbol	Rating	Unit
Supply voltage range	V _{DD}	−0.3 to 7.0	V
Input voltage range	V _{IN}	−0.3 to V _{DD} + 0.3	V
Power dissipation	P _D	300	mW
Operating temperature range	T _{opr}	−20 to 75	°C
Storage temperature range	T _{stg}	−65 to 150	°C
Soldering temperature (10 seconds). See note 1.	T _{solder}	260	°C

Notes:

1. The humidity resistance of the flat package may be reduced if the package is immersed in solder. Use a soldering technique that does not heatstress the package.
2. If the power supply has a high impedance, a large voltage differential can occur between the input and supply voltages. Take appropriate care with the power supply and the layout of the supply lines. (See Section 2.3.)
3. All supply voltages are referenced to V_{SS} = 0V.

7. ELECTRICAL CHARACTERISTICS

$V_{DD} = 4.5$ to $5.5V$, $V_{SS} = 0V$, $T_a = -20$ to $75^{\circ}C$

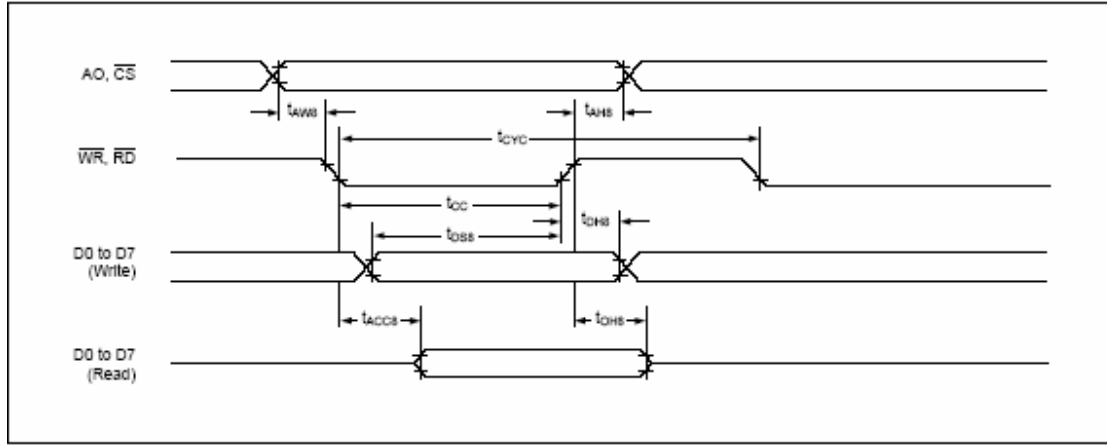
Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Supply voltage	VDD		4.5	5.0	5.5	V
Register data retention voltage	VOH		2.0	—	6.0	V
Input leakage current	ILI	VI = VDD. See note 6.	—	0.05	2.0	μA
Output leakage current	ILO	VI = VSS. See note 6.	—	0.10	5.0	μA
Operating supply current	Iopr	See note 4.	—	11	15	mA
Quiescent supply current	Iq	Sleep mode, VOSC1 = VCS = VRD = VDD	—	0.05	20.0	μA
Oscillator frequency	fOSC	Measured at crystal, 47.5% duty cycle. See note 7.	1.0	—	10.0	MHz
External clock frequency	fCL		1.0	—	10.0	MHz
Oscillator feedback resistance	Rf		0.5	1.0	3.0	MΩ
TTL						
HIGH-level input voltage	VIHT	See note 1.	0.5VDD	—	VDD	V
LOW-level input voltage	VILT	See note 1.	VSS	—	0.2VDD	V
HIGH-level output voltage	VOHT	IOH = −5.0 mA. See note 1.	2.4	—	—	V
LOW-level output voltage	VOLT	IOL = 5.0 mA. See note 1.	—	—	VSS + 0.4	V
CMOS						
HIGH-level input voltage	VIHC	See note 2.	0.8VDD	—	VDD	V
LOW-level input voltage	VILC	See note 2.	VSS	—	0.2VDD	V
HIGH-level output voltage	VOHC	IOH = −2.0 mA. See note 2.	VDD − 0.4	—	—	V
LOW-level output voltage	VOLC	IOH = 1.6 mA. See note 2.	—	—	VSS + 0.4	V
Open-drain						
LOW-level output voltage	VOLN	IOL = 6.0 mA. See note 5.	—	—	VSS + 0.4	V
Schmitt-trigger						
Rising-edge threshold voltage	VT+	See note 3.	0.5VDD	0.7VDD	0.8VDD	V
Falling-edge threshold voltage	VT−	See note 3.	0.2VDD	0.3VDD	0.5VDD	V

Notes:

1. $D0$ to $D7$, $A0$, \overline{CS} , \overline{RD} , \overline{WR} , $VD0$ to $VD7$, $VA0$ to $VA15$, V_{RD} , V_{WR} and V_{CE} are TTL-level inputs.
2. $SEL1$ and NT/PL are CMOS-level inputs. YD , $XD0$ to $XD3$, $XSCL$, $XECL$, LP , WF , $YSCL$, $YDIS$ and CLO are CMOS-level outputs.
3. \overline{RES} is a Schmitt-trigger input. The pulsewidth on \overline{RES} must be at least $200 \mu s$. Note that pulses of more than a few seconds will cause DC voltages to be applied to the LCD panel.
4. $f_{osc} = 10$ MHz, no load (no display memory), internal character generator, 256×200 pixel display. The operating supply current can be reduced by approximately 1 mA by setting both CLO and the display OFF.

8. TIMING CHARACTERISTICS

8080 family Interface Timing



8080 family interface timing

$T_a = -20 \text{ to } 75^\circ\text{C}$

Signal	Symbol	Parameter	$V_{DD} = 4.5 \text{ to } 5.5\text{V}$		$V_{DD} = 2.7 \text{ to } 4.5\text{V}$		Unit	Condition
			min	max	min	max		
$A0, \overline{CS}$	t_{AHS}	Address hold time	10	—	10	—	ns	CL = 100 pF
	t_{AWS}	Address setup time	0	—	0	—	ns	
$\overline{WR}, \overline{RD}$	t_{CYC}	System cycle time	See note	—	See note	—	ns	
	t_{OC}	Strobe pulsewidth	120	—	150	—	ns	
D0 to D7	t_{DS}	Data setup time	120	—	120	—	ns	
	t_{DH}	Data hold time	5	—	5	—	ns	
	t_{ACC}	\overline{RD} access time	—	50	—	80	ns	
	t_{OH}	Output disable time	10	50	10	55	ns	

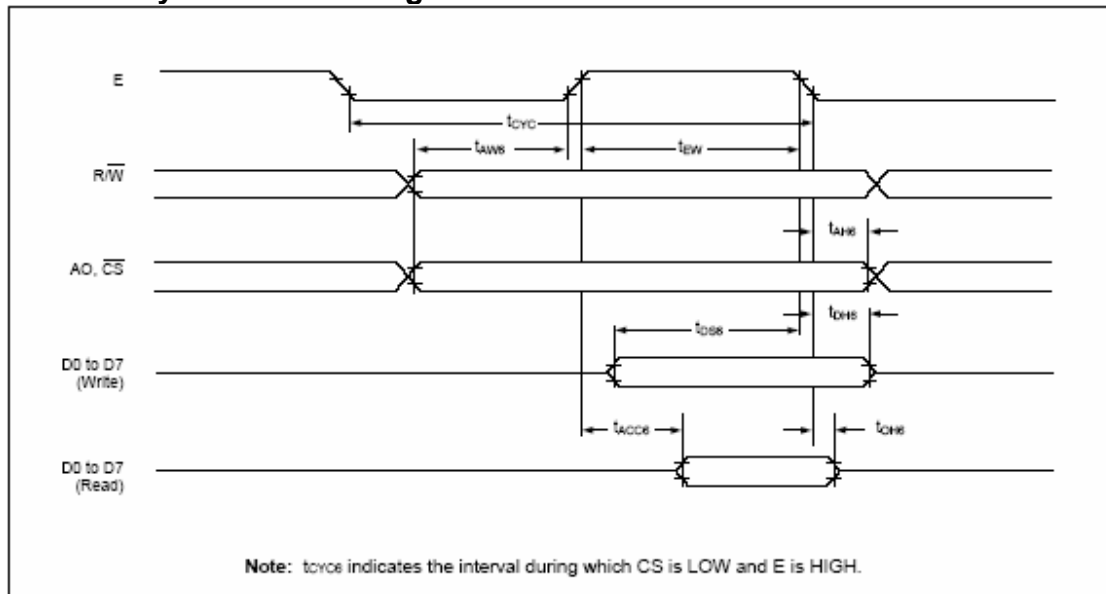
Note: For memory control and system control commands:

$$t_{CYC8} = 2t_c + t_{OC} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC8} = 4t_c + t_{OC} + 30$$

6800 family Interface Timing



6800 family interface timing

$T_a = -20$ to 75°C

Signal	Symbol	Parameter	$V_{DD} = 4.5$ to 5.5V		$V_{DD} = 2.7$ to 4.5V		Unit	Condition
			min	max	min	max		
A0, CS, R/W	t_{CYC6}	System cycle time	See note	—	See note	—	ns	CL = 100 pF
	t_{AWs}	Address setup time	0	—	10	—	ns	
	t_{AHs}	Address hold time	0	—	0	—	ns	
D0 to D7	t_{DSs}	Data setup time	100	—	120	—	ns	
	t_{DHS}	Data hold time	0	—	0	—	ns	
	t_{OHS}	Output disable time	10	50	10	75	ns	
	t_{ACCs}	Access time	—	85	—	130	ns	
E	t_{EW}	Enable pulsewidth	120	—	150	—	ns	

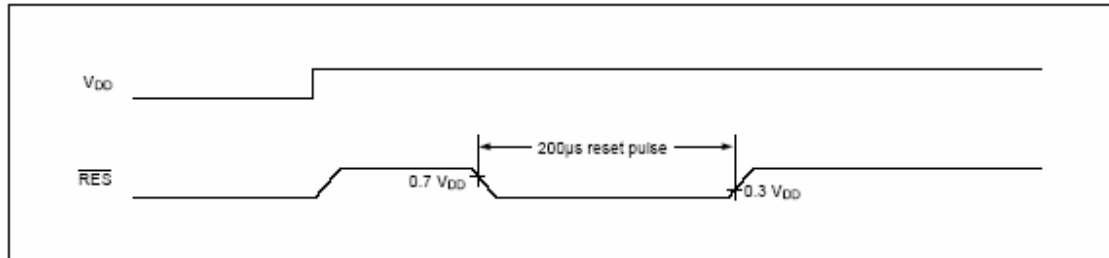
Note: For memory control and system control commands:

$$t_{CYC6} = 2t_c + t_{EW} + t_{CEA} + 75 > t_{ACV} + 245$$

For all other commands:

$$t_{CYC6} = 4t_c + t_{EW} + 30$$

9. The /RES (RESET) Terminal



10. CONTROL AND DISPLAY INSTRUCTION

Class	Command	Code												Hex	Command Description	Command Read Parameters	
		RD	WR	A0	D7	D6	D5	D4	D3	D2	D1	D0	No. of Bytes			Section	
System control	SYSTEM SET	1	0	1	0	1	0	0	0	0	0	0	40	Initialize device and display	8	4	
	SLEEP IN	1	0	1	0	1	0	1	0	0	1	1	53	Enter standby mode	0	4	
Display control	DISP ON/OFF	1	0	1	0	1	0	1	1	0	0	D	58, 59	Enable and disable display and display flashing	1	4	
	SCROLL	1	0	1	0	1	0	0	0	1	0	0	44	Set display start address and display regions	10	4	
	CSRFORM	1	0	1	0	1	0	1	1	1	0	1	5D	Set cursor type	2	4	
	CGRAM ADR	1	0	1	0	1	0	1	1	1	0	0	5C	Set start address of character generator RAM	2	4	
	CSRDIR	1	0	1	0	1	0	0	1	1	CD 1	CD 0	4C to 4F	Set direction of cursor movement	0	4	
	HDOT SCR	1	0	1	0	1	0	1	1	0	1	0	5A	Set horizontal scroll position	1	4	
	OVLAY	1	0	1	0	1	0	1	1	0	1	1	5B	Set display overlay format	1	4	
Drawing control	CSRW	1	0	1	0	1	0	0	0	1	1	0	46	Set cursor address	2	4	
	CSRR	1	0	1	0	1	0	0	0	1	1	1	47	Read cursor address	2	4	
Memory control	MWRITE	1	0	1	0	1	0	0	0	0	1	0	42	Write to display memory	—	4	
	MREAD	1	0	1	0	1	0	0	0	0	1	1	43	Read from display memory	—	4	

Notes:

- In general, the internal registers of the SED1330F/1335F/1336F are modified as each command parameter is input. However, the microprocessor does not have to set all the parameters of a command and may send a new command before all parameters have been input. The internal registers for the parameters that have been input will have been changed but the remaining parameter registers are unchanged.
 - 2-byte parameters (where two bytes are treated as one data item) are handled as follows:
 - CSRW, CSRR: Each byte is processed individually. The microprocessor may read or write just the low byte of the cursor address.
 - SYSTEM SET, SCROLL, CGRAM ADR: Both parameter bytes are processed together. If the command is changed after half of the parameter has been input, the single byte is ignored.
- APL and APH are 2-byte parameters, but are treated as two 1-byte parameters.

11. BACK LIGHT CHARACTERISTICS

LCD Module with CCF Backlight
ELECTRICAL RATINGS

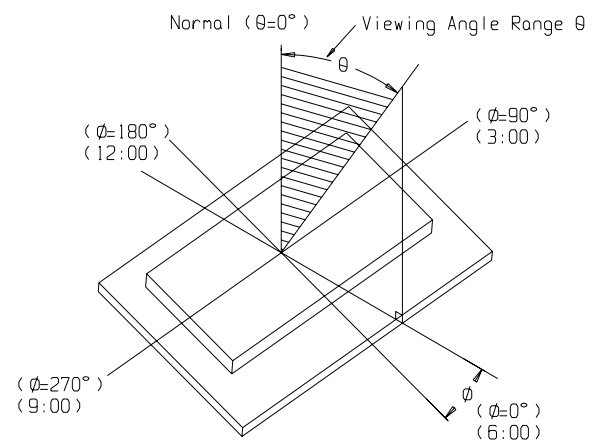
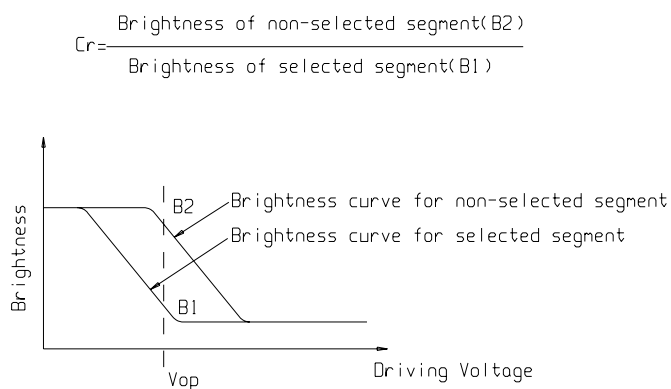
Ta = 25°C

Item	Symbol	Condition	Min	Typ	Max	Unit
Tube Voltage	V	If= 5 mArms	---	270	---	V(AC)
Tube current	I		---	5	6	mArms
Power dissipation	Pd	If= 5 mArms	---	1.35	---	W
Lighting Frequency	Fosc	If= 5 mArms	---	45	---	KHZ
Luminance	Lv	If= 5 mArms		400		cd/m2

12. ELECTRO-OPTICAL CHARACTERISTICS

(VDD =5.0V, Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Operating Voltage	Vop	Ta = -20°C	23.9	24.3	24.7	V
		Ta = 25°C	23.4	23.8	24.2	
		Ta = 70°C	22.9	23.3	23.7	
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

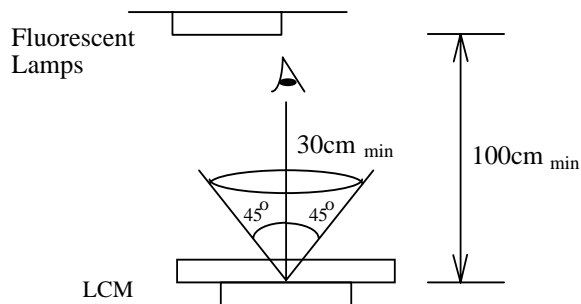


13.QUALITY SPECIFICATIONS

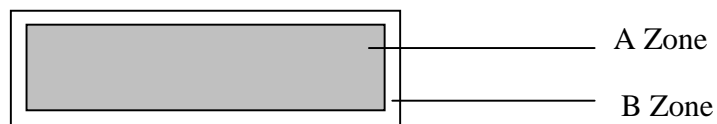
13.1 Standard of the product appearance test

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: Active display area (minimum viewing area).

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

13.2 Specification of quality assurance

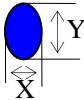
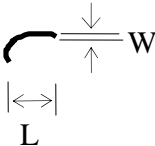
AQL inspection standard

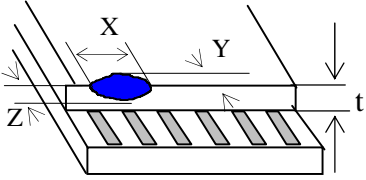
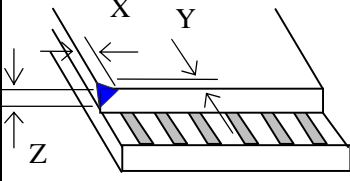
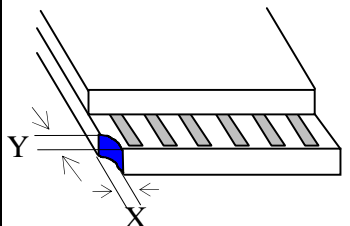
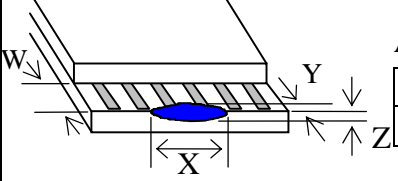
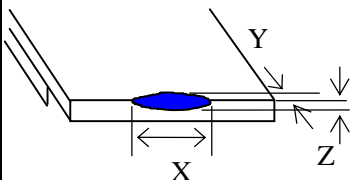
Sampling method: MIL-STD-105E, Level II, single sampling

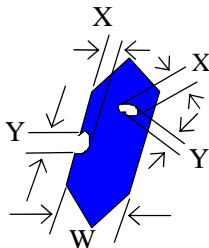
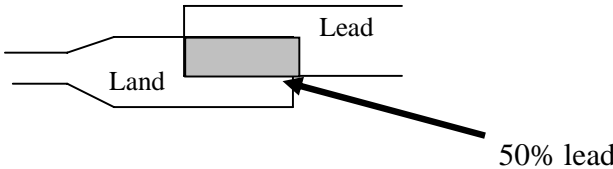
Defect classification (**Note: * is not including**)

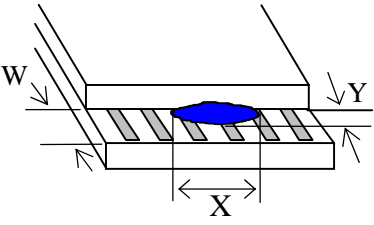
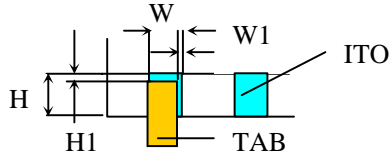
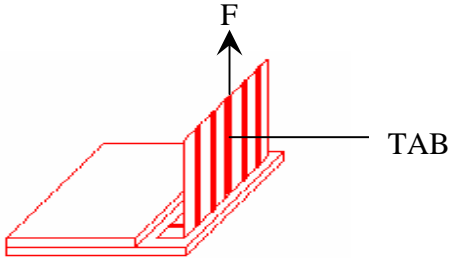
Classify	Item		Note	AQL
Major	Display state	Short or open circuit	1	0.65
		LC leakage		
		Flickering		
		No display		
		Wrong viewing direction		
		Contrast defect (dim, ghost)	2	
		Back-light	1,8	
	Non-display	Flat cable or pin reverse	10	
		Wrong or missing component	11	
Minor	Display state	Background color deviation	2	1.0
		Black spot and dust	3	
		Line defect, Scratch	4	
		Rainbow	5	
		Chip	6	
		Pin hole	7	
	Polarizer	Protruded	12	
		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																					
3	Point defect, Black spot, dust (including Polarizer) $\phi = (X+Y)/2$	<div></div> <table><tr><th>Point Size</th><th>Acceptable Qty.</th></tr><tr><td>$\phi \leq 0.10$</td><td>Disregard</td></tr><tr><td>$0.10 < \phi \leq 0.20$</td><td>3</td></tr><tr><td>$0.20 < \phi \leq 0.25$</td><td>2</td></tr><tr><td>$0.25 < \phi \leq 0.30$</td><td>1</td></tr><tr><td>$\phi > 0.30$</td><td>0</td></tr></table> <div>Unit: mm</div>	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								
Point Size	Acceptable Qty.																					
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$\phi > 0.30$	0																					
4	Line defect, Scratch	<div></div> <table><tr><th colspan="2">Line</th><th>Acceptable Qty.</th></tr><tr><th>L</th><th>W</th><th></th></tr><tr><td>---</td><td>$0.015 \geq W$</td><td>Disregard</td></tr><tr><td>$3.0 \geq L$</td><td>$0.03 \geq W$</td><td rowspan="2">2</td></tr><tr><td>$2.0 \geq L$</td><td>$0.05 \geq W$</td></tr><tr><td>$1.0 \geq L$</td><td>$0.1 > W$</td><td>1</td></tr><tr><td>---</td><td>$0.05 < W$</td><td>Applied as point defect</td></tr></table> <div>Unit: mm</div>	Line		Acceptable Qty.	L	W		---	$0.015 \geq W$	Disregard	$3.0 \geq L$	$0.03 \geq W$	2	$2.0 \geq L$	$0.05 \geq W$	$1.0 \geq L$	$0.1 > W$	1	---	$0.05 < W$	Applied as point defect
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$3.0 \geq L$	$0.03 \geq W$	2																				
$2.0 \geq L$	$0.05 \geq W$																					
$1.0 \geq L$	$0.1 > W$	1																				
---	$0.05 < W$	Applied as point defect																				
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	<div>  <p>Acceptable criterion</p> <table border="1"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>≤ 2</td><td>0.5mm</td><td>$\leq t/2$</td></tr> </tbody> </table> </div> <div>  <p>Acceptable criterion</p> <table border="1"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>≤ 2</td><td>0.5mm</td><td>$\leq t$</td></tr> </tbody> </table> </div> <div>  <p>Acceptable criterion</p> <table border="1"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>≤ 3</td><td>≤ 2</td><td>$\leq t$</td></tr> <tr> <td colspan="2">shall not reach to ITO</td><td></td></tr> </tbody> </table> </div> <div>  <p>Acceptable criterion</p> <table border="1"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>Disregard</td><td>≤ 0.2</td><td>$\leq t$</td></tr> </tbody> </table> </div> <div>  <p>Acceptable criterion</p> <table border="1"> <thead> <tr> <th>X</th><th>Y</th><th>Z</th></tr> </thead> <tbody> <tr> <td>≤ 5</td><td>≤ 2</td><td>$\leq t/3$</td></tr> </tbody> </table> </div>	X	Y	Z	≤ 2	0.5mm	$\leq t/2$	X	Y	Z	≤ 2	0.5mm	$\leq t$	X	Y	Z	≤ 3	≤ 2	$\leq t$	shall not reach to ITO			X	Y	Z	Disregard	≤ 0.2	$\leq t$	X	Y	Z	≤ 5	≤ 2	$\leq t/3$
X	Y	Z																																	
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shall not reach to ITO																																			
X	Y	Z																																	
Disregard	≤ 0.2	$\leq t$																																	
X	Y	Z																																	
≤ 5	≤ 2	$\leq t/3$																																	

No.	Item	Criterion								
7	Segment pattern W = Segment width $\phi = (X+Y)/2$	<p>(1) Pin hole</p> <p>$\phi < 0.10\text{mm}$ is acceptable.</p> <div><table border="1" data-bbox="908 566 1355 745"><thead><tr><th>Point Size</th><th>Acceptable Qty</th></tr></thead><tbody><tr><td>$\phi \leq 1/4W$</td><td>Disregard</td></tr><tr><td>$1/4W < \phi \leq 1/2W$</td><td>1</td></tr><tr><td>$\phi > 1/2W$</td><td>0</td></tr></tbody></table><p>Unit: mm</p></div>	Point Size	Acceptable Qty	$\phi \leq 1/4W$	Disregard	$1/4W < \phi \leq 1/2W$	1	$\phi > 1/2W$	0
Point Size	Acceptable Qty									
$\phi \leq 1/4W$	Disregard									
$1/4W < \phi \leq 1/2W$	1									
$\phi > 1/2W$	0									
8	Back-light	<p>(1) The color of backlight should correspond its specification.</p> <p>(2) Not allow flickering</p>								
9	Soldering	<p>(1) Not allow heavy dirty and solder ball on PCB. (The size of dirty refer to point and dust defect)</p> <p>(2) Over 50% of lead should be soldered on Land.</p> <div></div>								
10	Wire	<p>(1) Copper wire should not be rusted</p> <p>(2) Not allow crack on copper wire connection.</p> <p>(3) Not allow reversing the position of the flat cable.</p> <p>(4) Not allow exposed copper wire inside the flat cable.</p>								
11*	PCB	<p>(1) Not allow screw rust or damage.</p> <p>(2) Not allow missing or wrong putting of component.</p>								

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

13.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	No abnormalities in functions and appearance
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	
Low temp. Operating	-20°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 ($20 \pm 8^\circ\text{C}$), normal humidity (below $45 \pm 20\%$ 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).

13.4 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 AV.

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:

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 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

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

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