SPECIFICATION
FOR
LCM MODULE

MODULE NO.: ABC020002A08-YIY-R
DOC.REVISION 00

Customer Approval:

	SIGNATURE	DATE
PREPARED BY (RD ENGINEER)		Nov-29-2007
PREPARED BY (QA ENGINEER)		
CHECKED BY		
APPROVED BY		

深圳秋田微电子有限公司
SHENZHEN AV-DISPLAY CO.,LTD.

DOCUMENT REVISION HISTORY

Version	DATE	DESCRIPTION	CHANGED BY
00	Nov-29-2007	First issue	Hu

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1. FUNCTIONS & FEATURES

1.1. Format	: 20x2 characters
1.2. LCD mode	: STN / Positive/Transmissive/YG
1.3. Viewing direction	: 6 O'clock
1.4. Driving scheme	: 1/16 Duty , 1/5 Bias
1.5. Power supply voltage (V_{DD})	: 5.0V
1.6. LCD driving voltage(Vop)	: 4.5V
1.7. Operation temp	: -20~70℃
1.8. Storage temp	: -30~80℃
1.9. Backlight color	: Bottom Y-G

2. MECHANICAL SPECIFICATIONS

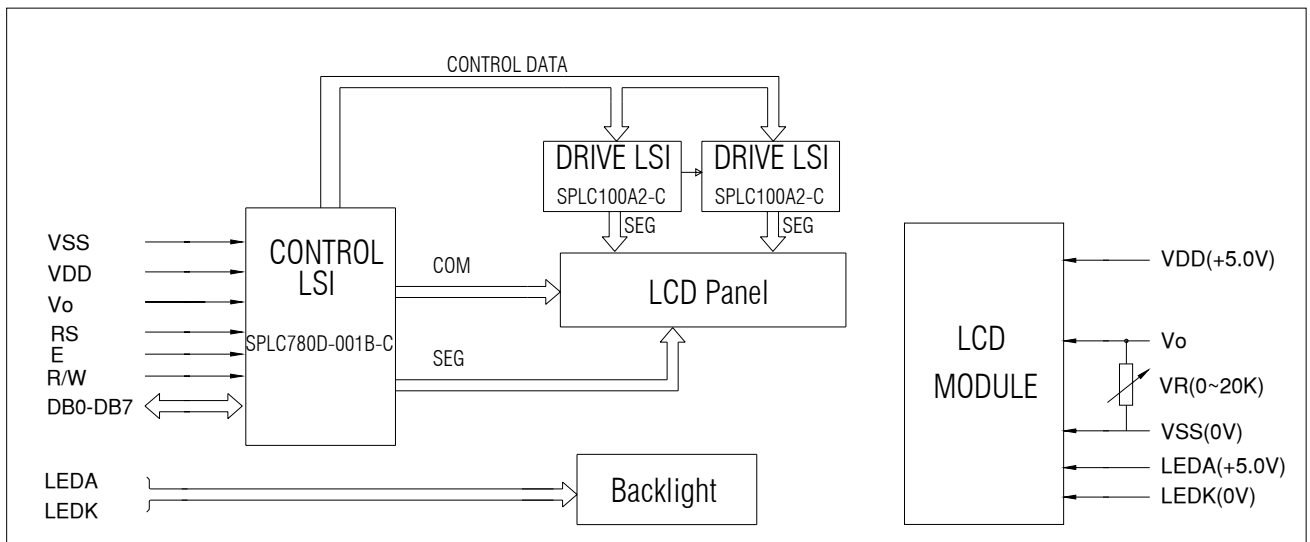|	
2.1. Module size	: 116.0mm(L)*37.0mm(W)*13.0 mm(H)max
2.2. Viewing area	: 85.0mm(L)*19.8mm(W)
2.3 Character pitch	: 3.70mm(L)*5.95mm(W)
2.4 Character size	: 3.20mm(L)*5.55mm(W)
2.5. Dot pitch	: 0.65mm(L)*0.70mm(W)
2.6. Dot size	: 0.60mm(L)*0.65mm(W)
2.7. Weight	: Approx.

3. BLOCK DIAGRAM
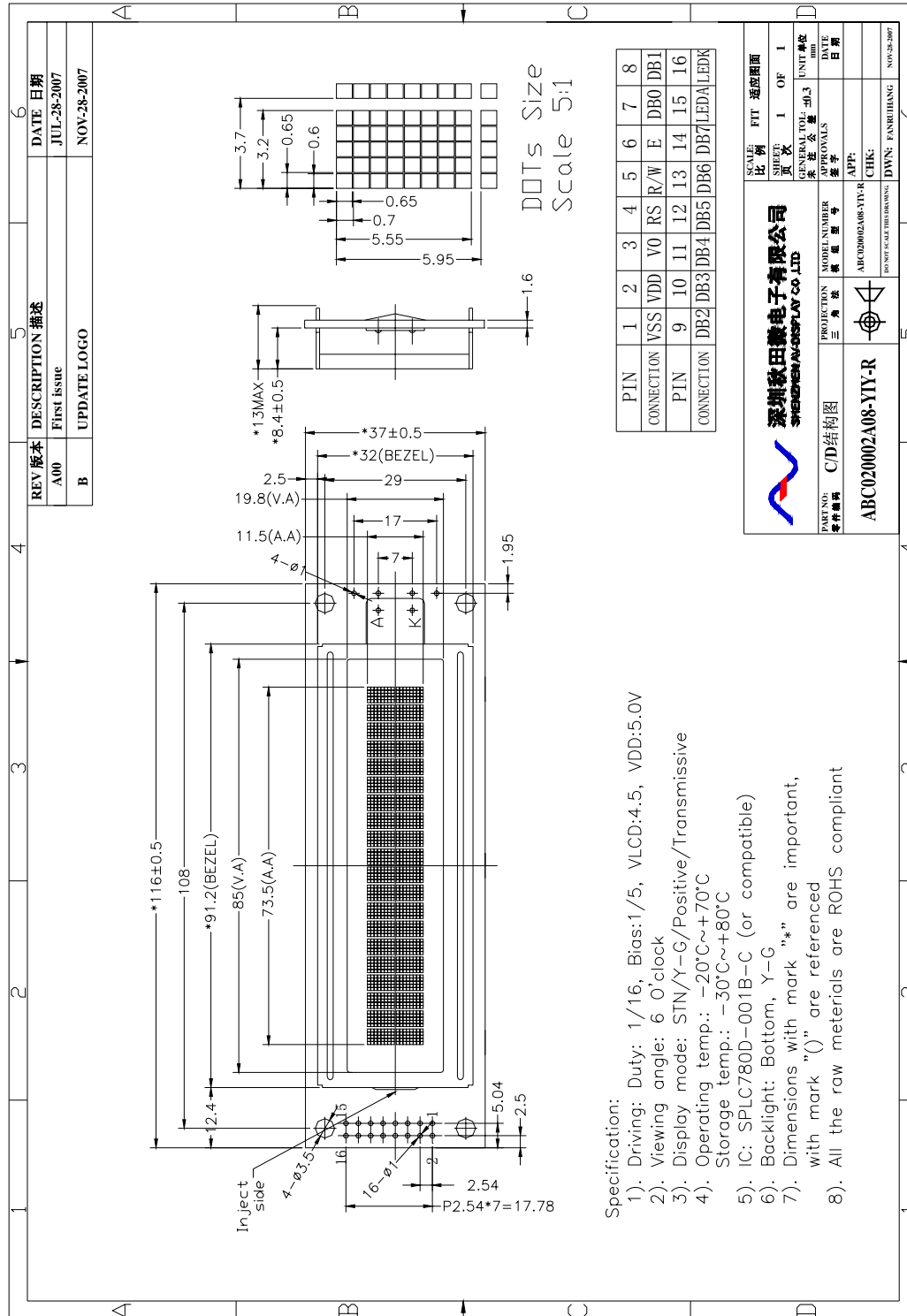

Figure 2. Block diagram

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4. DIMENSIONAL OUTLINE

REV 版本	DESCRIPTION 描述	DATE 日期
A00	First issue	JUL-28-2007
B	UPDATE LOGO	NOV-28-2007

DOTs Size
Scale 5:1

3.7
3.2
0.65
0.6
0.65
0.7
5.55
5.95
1.6

*13MAX
*8.4±0.5
*37±0.5
*32(BEZEL)
2.5
29
19.8(V.A)
17
11.5(A.A)
7
4-Ø1
1.95

A K

*116±0.5
108
*91.2(BEZEL)
85(V.A)
73.5(A.A)
12.4
5.04
2.5
Inject side
4-Ø3.5
16
16-Ø1
2
2.54
P2.54*7=17.78

Specification:
1). Driving: Duty: 1/16, Bias:1/5, VLCD:4.5, VDD:5.0V
2). Viewing angle: 6 O'clock
3). Display mode: STN/Y-G/Positive/Transmissive
4). Operating temp.: -20°C~+70°C
   Storage temp.: -30°C~+80°C
5). IC: SPLC780D-001B-C (or compatible)
6). Backlight: Bottom, Y-G
7). Dimensions with mark "*" are important, with mark "()" are referenced
8). All the raw meterials are ROHS compliant

PIN	1	2	3	4	5	6	7	8
CONNECTION	VSS	VDD	V0	RS	R/W	E	DB0	DB1
PIN	9	10	11	12	13	14	15	16
CONNECTION	DB2	DB3	DB4	DB5	DB6	DB7	LEDA	LEDK

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PART NO. 零件编码: ABC020002A08-YIY-R

C/D结构图

MODEL NUMBER 板型型号: ABC020002A08-YIY-R

PROJECTION 三角法

SCALE 比例: FIT 适应图面
SHEET 页次: 1 OF 1
GENERAL TOL 未注公差: ±0.3
APPROVALS 签字
APP:
CHK:
DWN: FANRUHANG

UNIT 单位: mm
DATE 日期: NOV-28-2007

DO NOT SCALE THIS DRAWING

Figure 1. Dimensional outline

5. PIN DESCRIPTION

No.	Symbol	Function
1	VSS	Power ground (0V)
2	VDD	Power supply for Logic(+5V)
3	V0	Power supply for LCD drive
4	RS	Register selection (H: Data register , L :Instruction register)
5	RW	Read/write selection (H: Read , L: Write)
6	E	Enable signal.
7-14	DB0~DB7	Data Bus line
15	LEDA	Power supply for Backlight(+5V)
16	LEDK	Power supply for Backlight(0V)

6. MAXIMUM ABSOUTE LIMIT

Item	Symbol	MIN	MAX	Unit
Supply Voltage for Logic	V_{DD}	-0.3	7.0	V
Supply Voltage for LCD	V0	$V_{DD}-12.0$	$V_{DD}+0.3$	V
Input Voltage	Vin	-0.3	$V_{DD}+0.3$	V
Supply Current for Backlight	I_F(Ta = 25°C)	---	---	mA
Reverse Voltage for Backlight	V_R(Ta = 25°C)	---	3.0	V
Operating Temperature	Top	-20	70	℃
Storage Temperature	Tst	-30	80	℃

7. ELECTRICAL CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage for Logic	V_{DD}-V_{SS}	Ta = 25°C	4.8	5.0	5.2	V
Input High Voltage	V_{IH}	Ta = 25°C	$0.7V_{DD}$	---	V_{DD}	V
Input Low Voltage	V_{IL}	Ta = 25°C	-0.3	---	$0.2 V_{DD}$	V
Output High Voltage(TTL)	V_{OH}	Ta = 25°C	$0.75V_{DD}$	---	---	V
Output Low Voltage(TTL)	V_{OL}	Ta = 25°C	---	---	$0.2V_{DD}$	V
Supply Current	I_{DD}	Ta = 25°C	---	---	3.0	mA

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8. BACK LIGHT CHARACTERISTICS

LCD Module with Bottom YG LED Backlight
ELECTRICAL   RATINGS

Ta = 25°C

Item	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	VF	IF=210mA	3.9	4.1	4.3	V
Reverse Current	IR	VR=3.0V	---	---	10	uA
Luminous Intensity (Without LCD)	IV	IF=210mA	160	240	320	Cd/m^2
Wave length	λρ	IF=210mA	569	572	575	nm
Color		Yellow-Green				

9. ELECTRO-OPTICAL CHARACTERISTICS

(V_{OP} = 4.5V, Ta = 25°C)

Item	Symbol	Condition	Min	Typ	Max	Unit
Operating Voltage	Vop	Ta = -20°C	4.9	5.1	5.3	V
		Ta = 25°C	4.2	4.5	4.8	
		Ta = 70°C	3.7	3.9	4.0	
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

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

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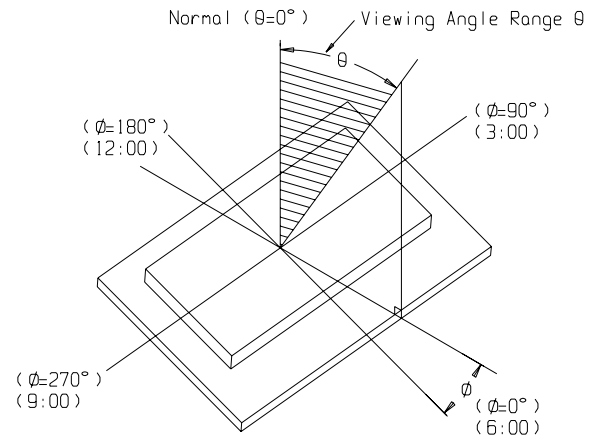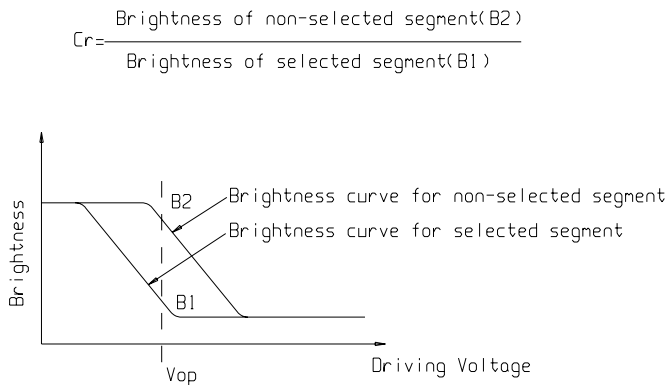
10. TIMING CHARACTERISTICS

Write mode(writing data from MPU to SPLC780D)

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	t_C	1000	-	-	ns	Pin E
E Pulse Width	t_{PW}	450	-	-	ns	Pin E
E Rise/Fall Time	t_R, t_F	-	-	25	ns	Pin E
Address Setup Time	t_{SP1}	60	-	-	ns	Pins: RS, R/W, E
Address Hold Time	t_{HD1}	20	-	-	ns	Pins: RS, R/W, E
Data Setup Time	t_{SP2}	195	-	-	ns	Pins: DB0 - DB7
Data Hold Time	t_{HD2}	10	-	-	ns	Pins: DB0 - DB7

Read mode(reading data from SPLC780D to MPU)

Characteristics	Symbol	Limit			Unit	Test Condition
		Min.	Typ.	Max.		
E Cycle Time	t_C	1000	-	-	ns	Pin E
E Pulse Width	t_W	450	-	-	ns	Pin E
E Rise/Fall Time	t_R, t_F	-	-	25	ns	Pin E
Address Setup Time	t_{SP1}	60	-	-	ns	Pins: RS, R/W, E
Address Hold Time	t_{HD1}	20	-	-	ns	Pins: RS, R/W, E
Data Output Delay Time	t_D	-	-	360	ns	Pins: DB0 - DB7
Data hold time	t_{HD2}	5.0	-	-	ns	Pin DB0 - DB7

Write mode timing diagram(Writing data from MPU to SPLC780D)
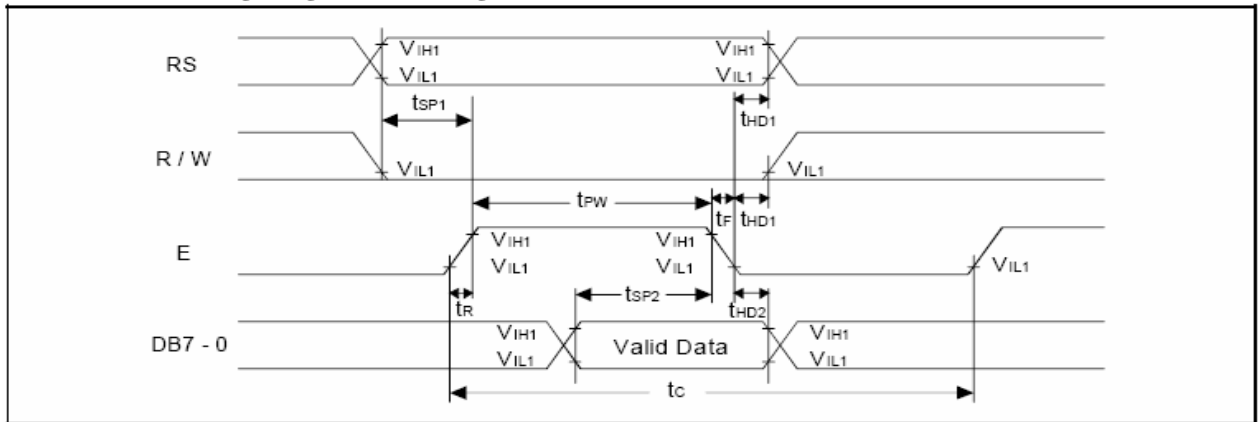
Read mode timing diagram(Reading data from SPLC780D to MPU)
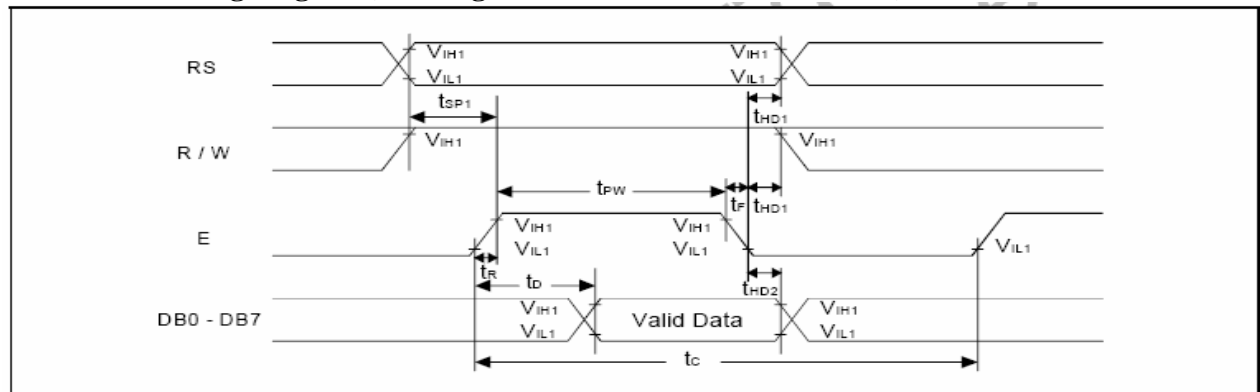
11. CONTROL AND DISPLAY COMMAND

Instruction	Instruction Code										Description	Execution time (Temp = 25℃)		
	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		Fosc= 190KHz	Fosc= 270KHz	Fosc= 350KHz
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC	2.16ms	1.52ms	1.18ms
Return Home	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	2.16ms	1.52ms	1.18ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	S	Assign cursor moving direction and enable the shift of entire display	53μs	38μs	29μs
Display ON/ OFF Control	0	0	0	0	0	0	1	D	C	B	Set display (D), cursor(C), and blinking of cursor(B) on/off control bit.	53μs	38μs	29μs
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	-	-	Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data.	53μs	38μs	29μs
Function Set	0	0	0	0	1	DL	N	F	-	-	Set interface data length (DL: 8-bit/4-bit), numbers of display line (N: 2-line/1-line) and, display font type (F:5x10 dots/5x8 dots)	53μs	38μs	29μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	53μs	38μs	29μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter	53μs	38μs	29μs
Read Busy Flag and Address Counter	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.			
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	53μs	38μs	29μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	53μs	38μs	29μs

Note1: "--": don't care

Note2: In the operation condition under -20℃ ~ 75℃, the maximum execution time for majority of instruction sets is 100us, except two instructions, "Clear Display" and "Return Home", in which maximum execution time can take up to 4.1ms.

12. Font Characteristic
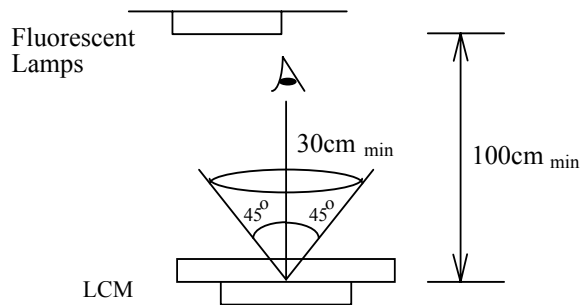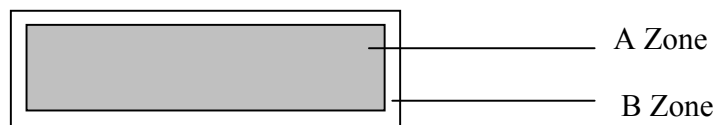
13.QUALITY SPECIFICATIONS

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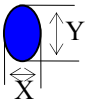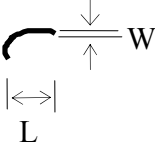
Defect classification (**Note: * is not including**)
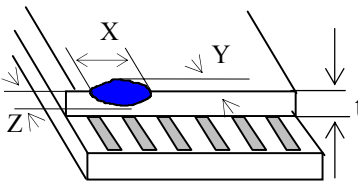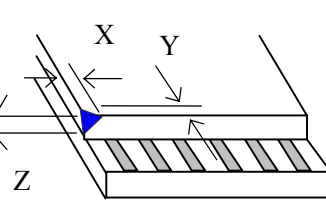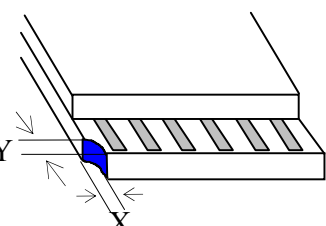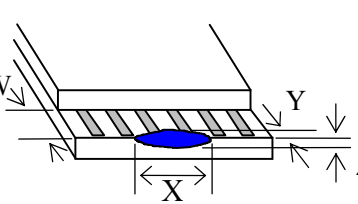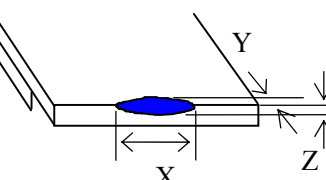
Classify		Item		Note	AQL
Major	Display state	Short or open circuit		1	0.65
		LC leakage			
		Flickering			
		No display			
		Wrong viewing direction			
		Contrast defect (dim, ghost)		2	
		Back-light		1,8	
	Non-display	Flat cable or pin reverse		10	
		Wrong or missing component		11	
Minor	Display state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

9
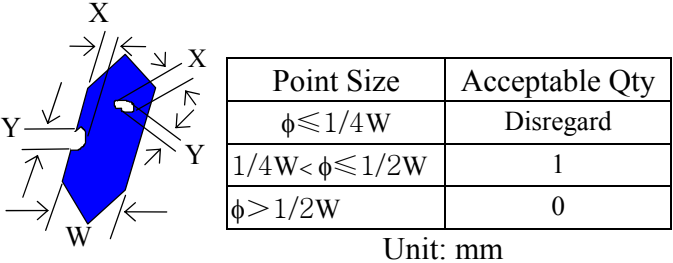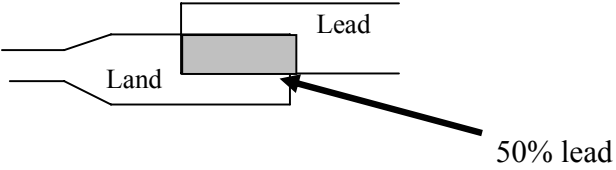
Note on defect classification

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) $\phi = (X+Y)/2$	
4	Line defect, Scratch	
5	Rainbow	Not more than two color changes across the viewing area.

For item 3, the criterion table:

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

For item 4, the criterion table:

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

Unit: mm

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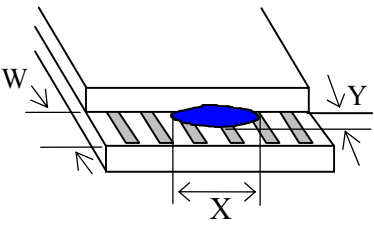| No	Item	Criterion			

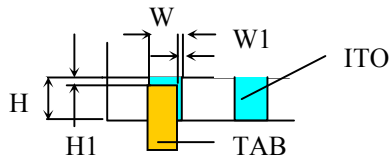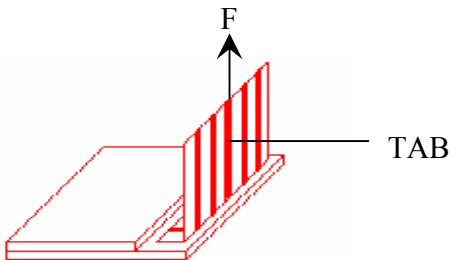| No	Item	Criterion
6	Chip Remark: X: Length direction Y: Short direction Z: Thickness direction t: Glass thickness W: Terminal Width	**Acceptable criterion** | X	Y	Z
≤2	0.5mm	≤t/2 | **Acceptable criterion** | X	Y	Z
≤2	0.5mm	≤t | **Acceptable criterion** | X	Y	Z
≤3	≤2	≤t
shall not reach to ITO		| **Acceptable 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. <table><tr><td>Point Size</td><td>Acceptable Qty</td></tr><tr><td>$\phi \leqslant 1/4W$</td><td>Disregard</td></tr><tr><td>$1/4W< \phi \leqslant 1/2W$</td><td>1</td></tr><tr><td>$\phi > 1/2W$</td><td>0</td></tr></table>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. Lead Land 50% lead
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.

No	Item	Criterion
12	Protruded W: Terminal Width	W, Y, X labeled diagram Acceptable criteria: $Y \leq 0.4$
13	TAB	1. Position W, W1, ITO, H, H1, TAB labeled diagram $W1 \leq 1/3W$ $H1 \leq 1/3H$ 2 TAB bonding strength test F, TAB labeled diagram P (=F/TAB bonding width) ≥ 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.

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13.3 Reliability of LCM

Reliability test condition:

Item	Condition	Time (hrs)	Assessment
High temp. Storage	80°C	48	
High temp. Operating	70°C	48	
Low temp. Storage	-30°C	48	No abnormalities
Low temp. Operating	-20°C	48	in functions
Humidity	40°C/ 90%RH	48	and appearance
Temp. Cycle	-20°C ← 25°C →70°C (30 min ← 5 min → 30min)	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.

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 isoproly 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 made 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°C±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.

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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.