

AZ DISPLAYS,INC.

COMPLETE LCD SOLUTIONS

SPECIFICATIONS FOR LIQUID CRYSTAL DISPLAY

PART NUMBER: □□ □ □ AGM3224D-NC-FTH-T

DATE: □ □ □ □ □ □ MARCH 06, 2007

1. MECHANICAL DATA

NO	ITEM	CONTENTS	UNIT
1	Product No.	AGM3224D-NC-FTH-T	—
2	Module Size	167.1 (W) x 109.0 (H) x Max. 12.5 (D)	mm
3	Dot Size	0.33 (W) x 0.33 (H)	mm
4	Dot Pitch	0.36 (W) x 0.36 (H)	mm
5	Number of Dots	320 (W) x 240 (H)	Dot
6	Duty	1/240	—
7	LCD Display Mode	Black and White(Normally Black/Negative Image)	—
8	Rear Polarizer	Transmission	—
9	Viewing Direction	12	O'clock
10	Backlight	CCFL	—
11	Controller	Excluded	—
12	DC/DC Converter	Excluded	—
13	Touch Panel	Included	—
14	Weight	250 (Approx.)	g

2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	7.0	V	
Input Voltage	VI	-0.3	VDD+0.3	V	
Static Electricity	—	—	—	—	Note 1

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	WIDE TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-20	70	-40	80
Humidity (Without Condensation)	Note 2,4		Note 3,4	

Note 2 $T_a \leq 70^{\circ}\text{C}$: 75%RH max

Note 3 Please refer to item of reliability test

Note 4 Background color will change slightly depending on ambient temperature.
That phenomenon is reversible.

3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic	VDD-VSS	—		4.75	5.0	5.25	V
Input Voltage	VIH	H level		0.8VDD	—	VDD	V
	VIL	L level		0	—	0.2VDD	
Recommended LC Driving Voltage	VDD-V0	Duty=1/240	-20°C	24.7	25.2	25.7	V
			0°C	23.3	23.8	24.3	
			25°C	22.5	23.0	23.5	
			50°C	21.7	22.2	22.7	
			70°C	20.7	21.2	21.7	
Power Supply Current	IDD	FLM = 70 Hz VDD = 5.0 V VEE = -24.0 V VDD-V0 = 23.0 V PATTERN :		—	5	8	mA
	IEE	□ ■ □ ■ □ ■ ■ □ ■ □ ■ □		—	5	8	mA
Surface Luminance of LCM	L	(Lamp current : 5mA) (Dots All On)		65	80	—	cd/m ²
		(Lamp current : 5mA) (Dots All Off)		—	10	20	

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used Lamp Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp Voltage	V_L	—	250	—	Vrms	—
Lamp current	I_L	—	5	—	mA _{rms}	—
Lamp power consumption	P_L	—	1.3	—	W	(*1)
Starting voltage	V_S	—	405	445	Vrms	Ta=25°C
		—	465	510		Ta=0°C
Lamp life time	L_L	—	20000	—	hrs	at $I_L = 5 \text{ mA}_{rms}$ Ta=25°C (*2)

(*1) Power consumption excluded inverter loss .

(*2) Lamp life time is defined as follows : The final brightness is at 50% of original brightness .

3-3.ELECTRICAL CHARACTERISTICS OF RECOMMENDED INVERTER

TDK CXA-L10L

3-3-1 GENERAL SPECIFICATIONS

OPERATING TEMPERATURE : -10°C~60°C

STORAGE TEMPERATURE : -20°C~85°C

DIMENSION : 44.0(L)mm x 21.0(W)mm x MAX 18.0(H)mm

3-3-2 PIN ASSIGNMENTS

INPUT (CN1) CONNECTOR :

NO.	FUNCTION
1	VIN
2	GND

OUTPUT (CN2) CONNECTOR :

NO.	FUNCTION
3	OUT1
4	OUT2
5	OUT GND

3-3-3 RELATIONSHIP BETWEEN VIN & TUBE CURRENT

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Input Voltage	VIN	—	10.4	—	V	
Tube Current	IL	—	5	—	mA	

3-4.CHARACTERISTICS OF TOUCH PANEL

Used Touch Panel Rating

Temp.=25°C

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Applied Rating Voltage	V _R	—	—	—	7.0	V
Operating Temperature	T _{OPR}	20%~85% R.H. Max. Avoid Dew Condensation at Any Time	-5	—	60	°C
Storage Temperature	T _{STO}		-30	—	70	
Resistance of Terminal Electrodes	R _{ETD}	X Electrode	300	—	900	Ω
		Y Electrode	200	—	600	
Linearity	L	—	—	—	1.5	%
Insulation Resistance	R _{OFF}	V _{DC} =25V	10	—	—	MΩ
Transparency	T	According to JIS-K7015	—	80	—	%
Surface Hardness	S _H	According to JISK5600-5-4	3	—	—	H

Test condition : Touch panel is placed horizontally in a vessel and no power is supplied to T/P.

Normal state is temperature : 25±10°C, relative humidity : 60±25%

4. OPTICAL CHARACTERISTICS

AT Vop

ITEM MODE		Cr(Contrast Ratio)										θ (Viewing Angle)		ϕ (Viewing Angle)	
		-20℃		0℃		25℃		50℃		70℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	H	7.0	10.0	10.0	15.0	18.0	25.0	7.0	10.0	3.5	5.0	—	(F)30 (R)35	—	(L)30 (R)30
Note		NOTE 6										NOTE 5			

Note:

T : TRANSMISSIVE

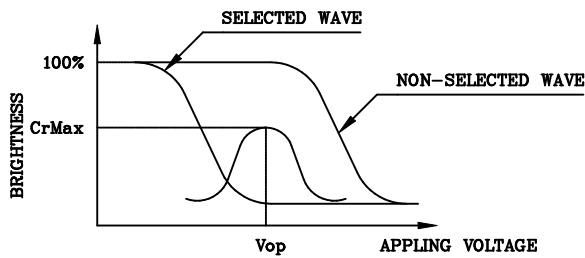
H : Normally Black , 12 O'clock

AT $\phi=0^\circ$ $\theta=0^\circ$

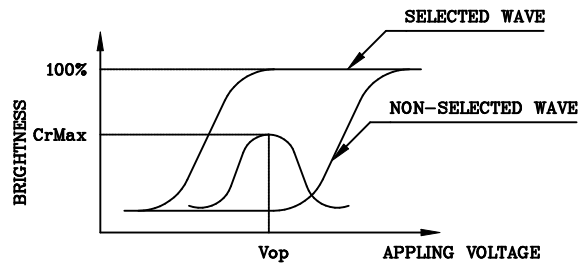
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	2500	3000	4500	ms	NOTE 2
		0℃	560	700	1100		
		25℃	240	300	450		
		50℃	120	150	230		
		70℃	65	80	120		
Response Time (fall)	Tf	-20℃	1600	2000	3000	ms	NOTE 2
		0℃	320	400	600		
		25℃	95	120	180		
		50℃	50	60	90		
		70℃	40	50	75		

(NOTE 1)

Definition of Operation Voltage(V_{op})



(positive type)



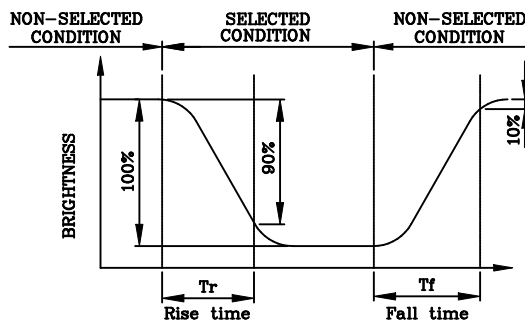
(negative type)

***Conditions**

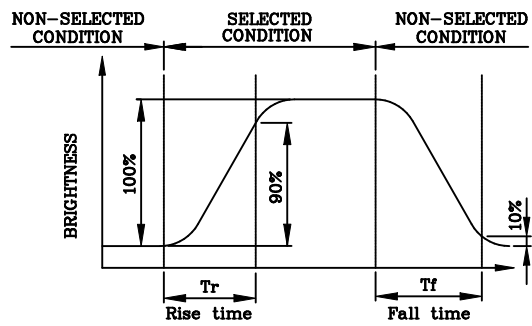
Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr, Tf)



(positive type)



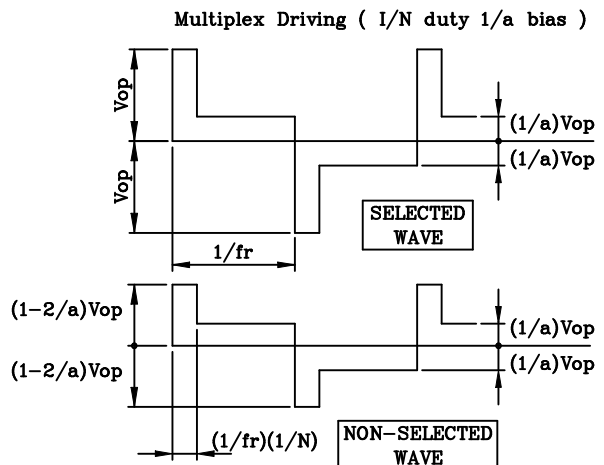
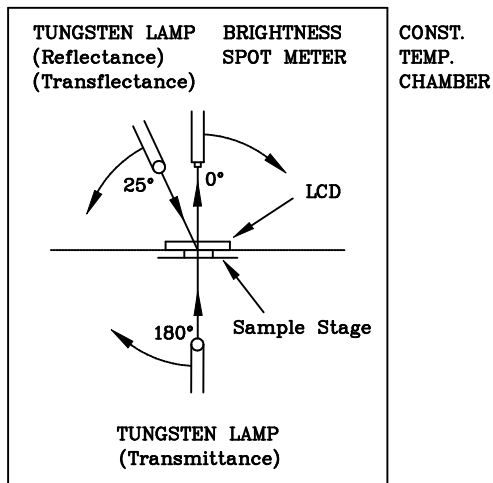
(negative type)

***Conditions**

Operating Voltage : V_{op}
Viewing Angle (θ, ϕ) : (0,0)
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

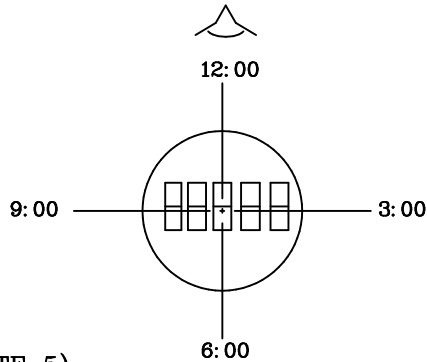
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



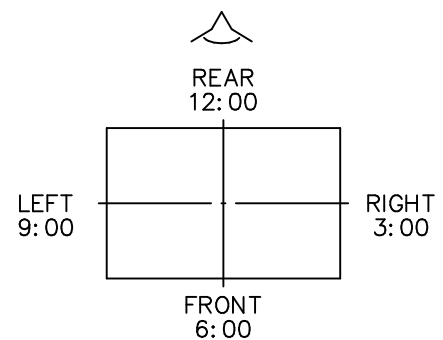
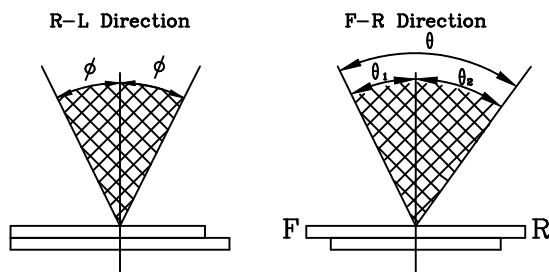
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



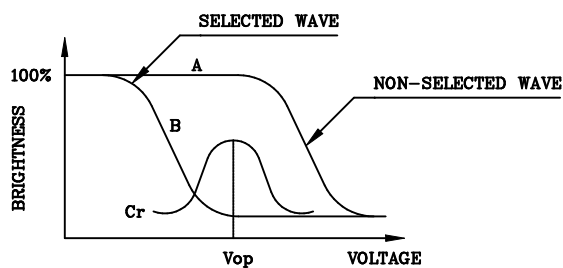
$$\theta = \theta_1 + \theta_2$$

***Conditions**

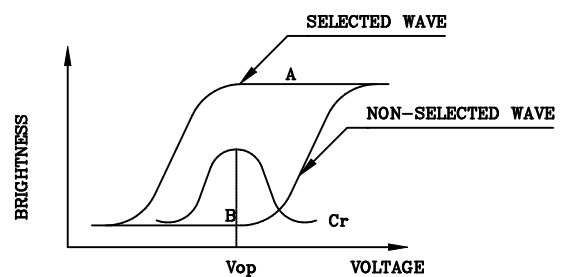
Operating Voltage : V_{op}
 Frame Frequency : 70Hz
 Applying Waveform : 1/N duty 1/a bias
 Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



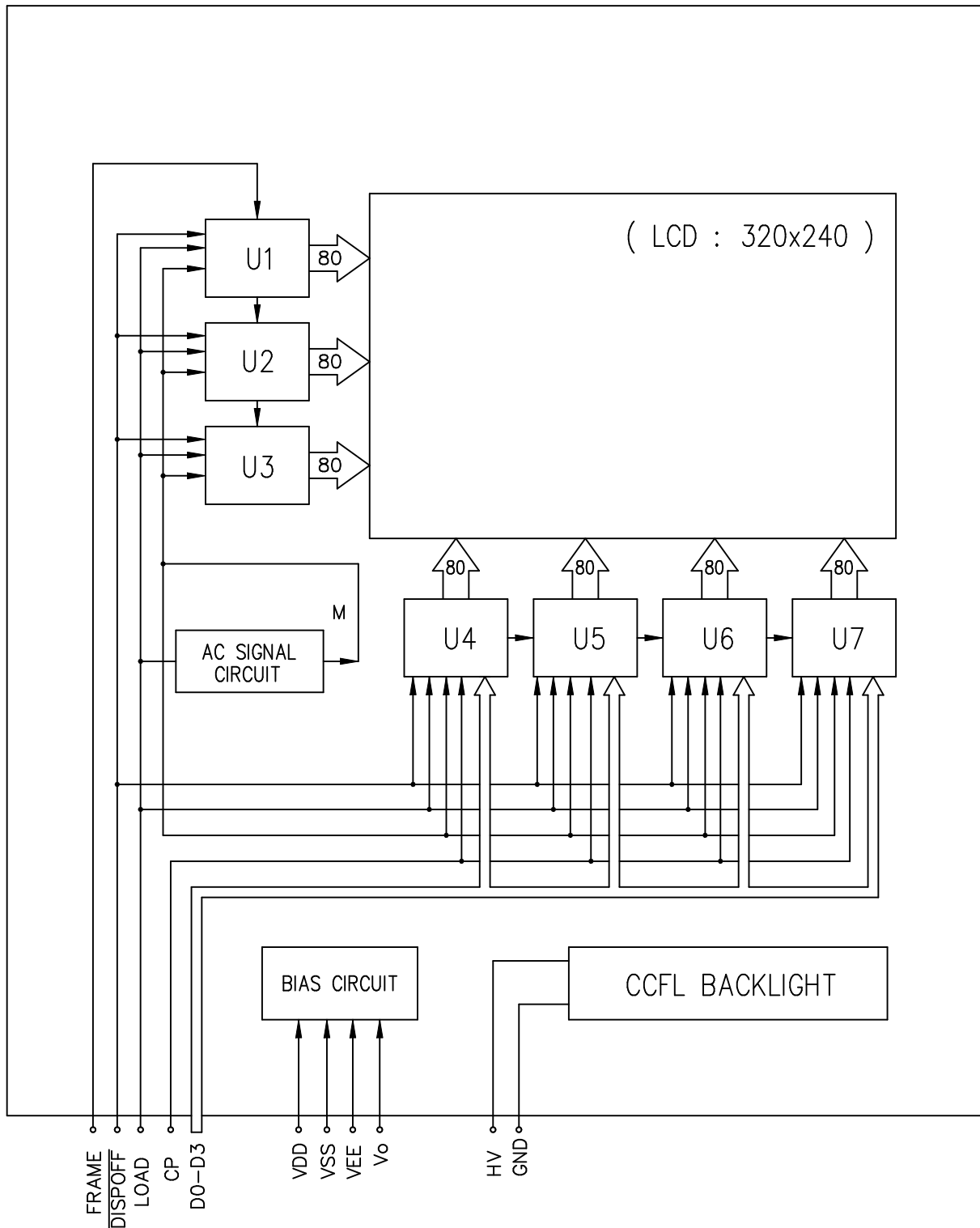
(negative type)

$$\text{Contrast Ratio : } Cr = A/B$$

***Conditions**

Viewing Angle : 0
 Frame Frequency : 70Hz
 Applying Waveform : 1/N duty 1/a bias

5. BLOCK DIAGRAM



6. DEFINITION OF INTERFACE

CN1: PITCH 1.25mm WIDTH 18.75mm

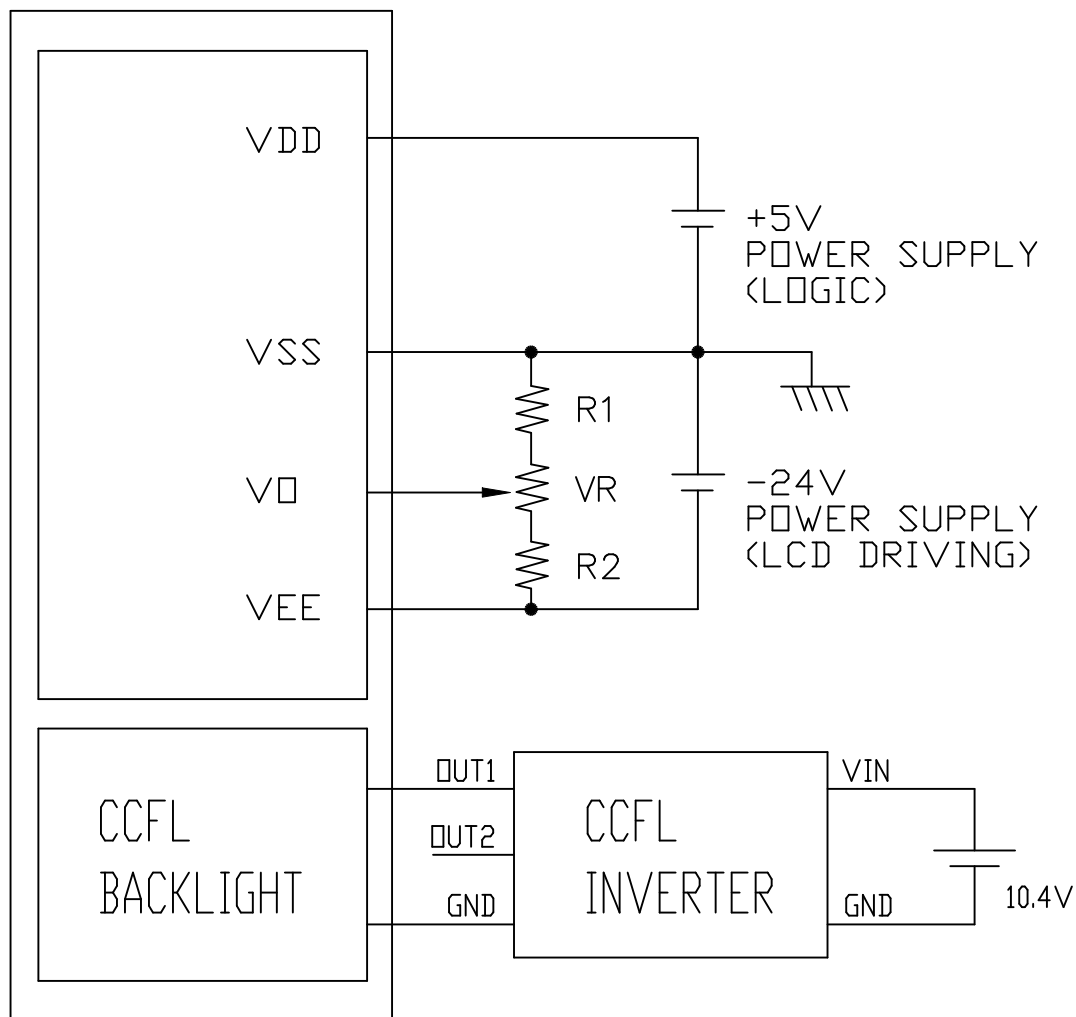
PIN NO.	SYMBOL	LEVEL	FUNCTION
1	D0	H/L	DISPLAY DATA SIGNAL
2	D1		
3	D2		
4	D3		
5	$\overline{\text{DISPOFF}}$	H/L	H: ON/L: OFF
6	FRAME	H	SCAN START-UP SIGNAL
7	NC	—	NO CONNECTION
8	LOAD	H→L	INPUT DATA LATCH SIGNAL
9	CP	H→L	DATA INPUT CLOCK SIGNAL
10	VDD	—	POWER SUPPLY FOR LOGIC(+5V)
11	VSS	—	SIGNAL GROUND(0V)
12	VEE	—	POWER SUPPLY FOR LCD
13	VO	—	LCD CONTRAST ADJUST VOLTAGE
14	FGND	—	FRONT PANNEL GROUND

CN2: J.A.E./IL-G-4S-S3C2

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	HV	—	POWER SUPPLY VOLTAGE FOR CCFL
2	NC	—	—
3	NC	—	—
4	GROUND	—	GROUND LINE(FROM INVERTER)

7. POWER SUPPLY

LCD MODULE



(NOTE)

1. $R1 + VR + R2 \approx 20K\Omega$

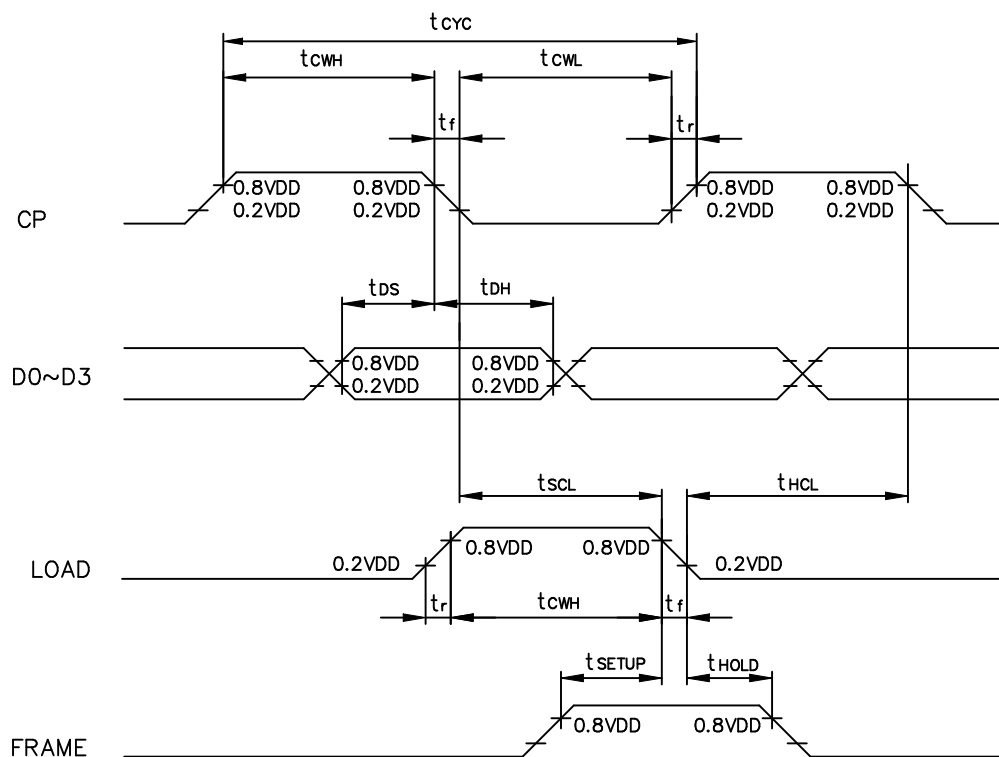
2. RECOMMENDED CCFT INVERTER : TDK CXA-L10L(TDK)
(OPERATING TEMP. $-10^{\circ}\sim 60^{\circ}\text{C}$)

8. TIMING CHARACTERISTICS

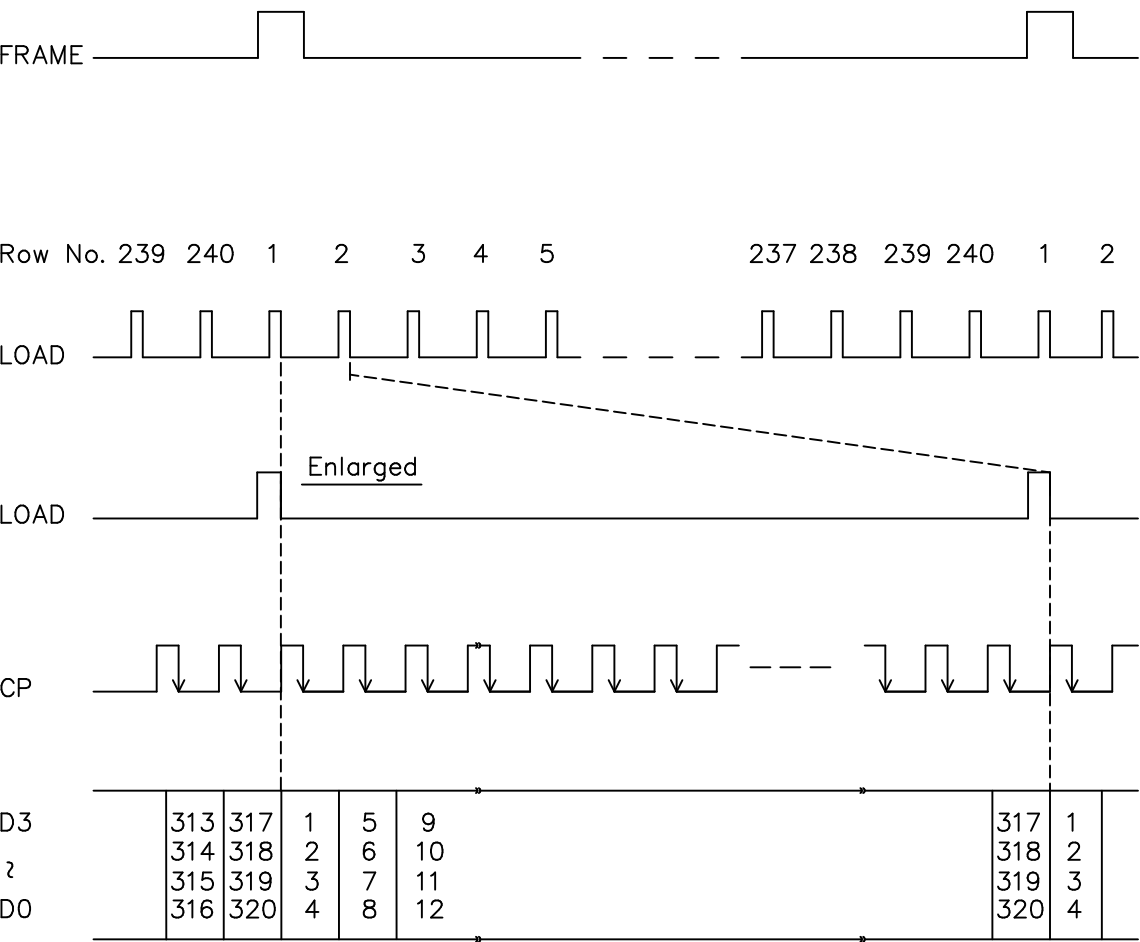
8-1.INPUT SIGNALS TIMING

VDD = 5V

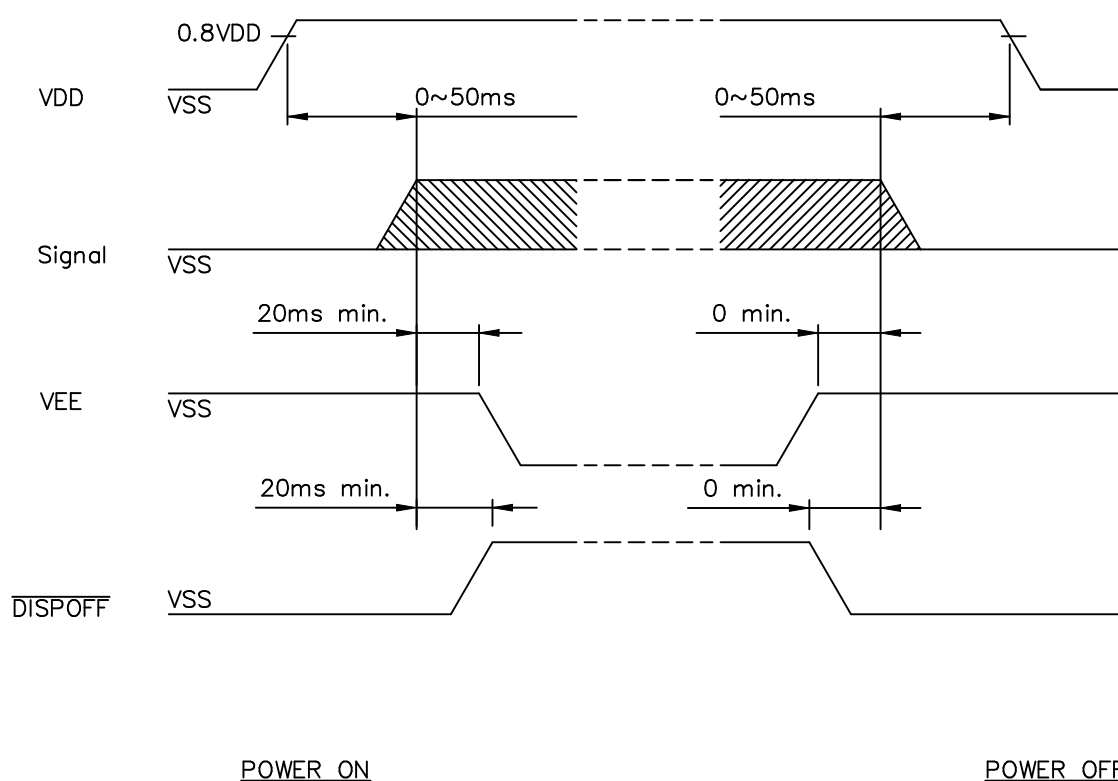
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CLOCK CYCLE TIME	t_{CYC}	250	—	—	ns
CLOCK HIGH LEVEL WIDTH	t_{CWH}	45	—	—	ns
CLOCK LOW LEVEL WIDTH	t_{CWL}	45	—	—	ns
CLOCK RISE TIME	t_r	—	—	50	ns
CLOCK FALL TIME	t_f	—	—	50	ns
DATA SETUP TIME	t_{DS}	30	—	—	ns
DATA HOLD TIME	t_{DH}	30	—	—	ns
CLOCK SETUP TIME	t_{SCL}	80	—	—	ns
CLOCK HOLD TIME	t_{HCL}	80	—	—	ns
FRAME SETUP TIME	t_{SETUP}	30	—	—	ns
FRAME HOLD TIME	t_{HOLD}	30	—	—	ns



8-2. TIMING CHART OF INPUT SIGNALS



8-3. POWER ON/OFF TIMING



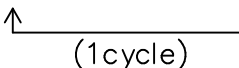
** The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

8-4. DISPLAY PATTERN

#001	D3	D2	D1	D0	D3					D0	D3	D2	D1	D0
#002	D3	D2	D1	D0	D3					D0	D3	D2	D1	D0
Data Input: Terminal : Dots (Row) on Display ----- D0 : dot 4, dot 8 dot 316, dot 320 D1 : dot 3, dot 7 dot 315, dot 319 D2 : dot 2, dot 6 dot 314, dot 318 D3 : dot 1, dot 5 dot 313, dot 317														
#239	D3	D2	D1	D0	D3					D0	D3	D2	D1	D0
#240	D3	D2	D1	D0	D3					D0	D3	D2	D1	D0
	d1	d2	d3	d4	d5					d316	d317	d318	d319	d320

9. RELIABILITY TEST

WIDE TEMPERATURE RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	80°C	120Hrs		Appearance without defect	
2	Low Temp. Storage	-40°C	120Hrs		Appearance without defect	
3	High Temp. & High Humi. Storage	60°C 90%RH	120Hrs		Appearance without defect	
4	High Temp. Operating Display	70°C	120Hrs		Appearance without defect	
5	Low Temp. Operating Display	-20°C	120Hrs		Appearance without defect	
6	Thermal Shock	-20°C, 30min → 70°C, 30min  (1cycle)			Appearance without defect	10 cycles

Inspection Provision

1.Purpose

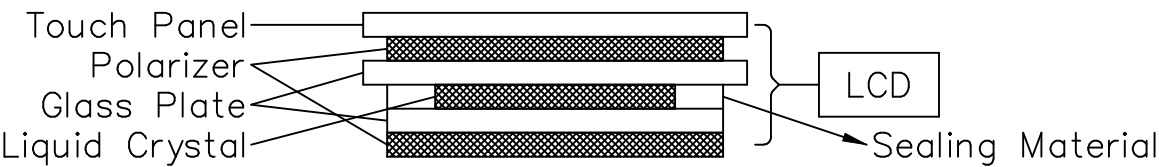
AZD inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of AZD LCD produces.

2.Applicable Scope

AZD inspection provision is applicable to the arrangement in regard to outgoing inspection and quality assurance after outgoing.

3.Technical Terms

3-1 AZD Technical Terms



4.Outgoing Inspection

4-1 Inspection Method

MIL-STD-105E Level II Regular inspection

4-2 Inspection Standard

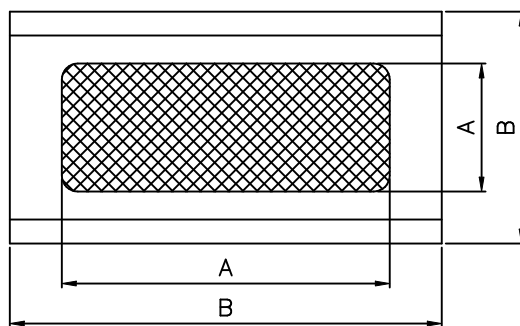
	Item		AQL(%)	Remarks
Major Defect	Dots	Opens	0.4	faults which substantially lower the practicality and the initial purpose difficult to achieve.
		Shorts		
		Erroneous operation		
	Solder appearance	Shorts		
		Loose		
	Cracks	Display surface cracks		
	Touch Panel contact resistance			
	Touch Panel input load			

	Touch Panel linearity		0.4	
	Dimensions	External from Dimensions	0.4	
Minor Defect	Inside the glass	Black spots	0.65	faults which appear to pose almost no obstacle to the practicality, effective use, and operation.
	Polarizing plate	Scratches, foreign Matter, air bubbles, and peeling		
	Dots	Pinhole, deformation		
	Color tone	Color unevenness		
	Solder appearance	Cold solder Solder projections		

4-3 Inspection Provisions

*Viewing Area Definition

Fig. 1



A : Zone Viewing Area
B : Zone Glass Plate Outline

*Inspection place to be 500 to 1000 lux illuminance uniformly without glaring.
The distance between luminous source(daylight fluorescent lamp and cool white fluorescent lamp) and sample to be 30cm to 50cm.

*Test and measurement are performed under the following conditions, unless otherwise specified.

Temperature	20± 15°C
Humidity	65± 20%R.H.
Pressure	860~1060hPa(mmbbar)

In case of doubtful judgment, it is performed under the following conditions.

Temperature	20± 2°C
Humidity	65± 5%R.H.
Pressure	860~1060hPa(mmbbar)

5.Specification for quality check

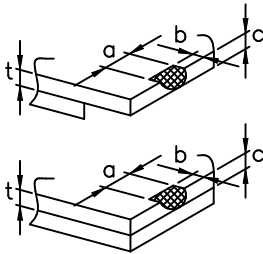
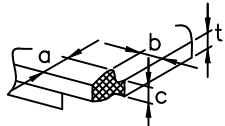
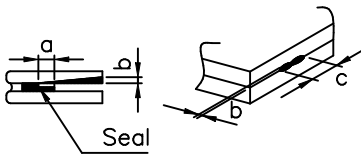
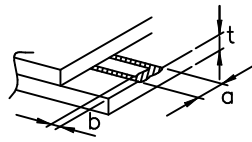
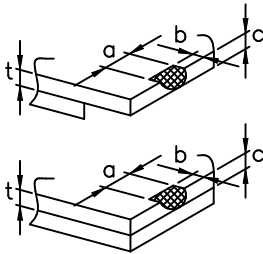
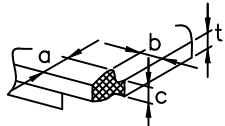
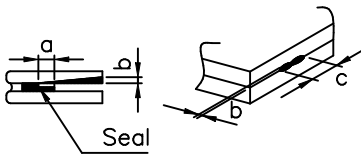
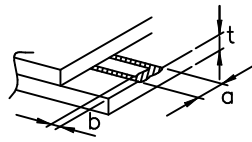
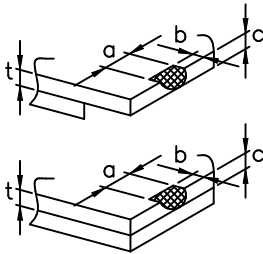
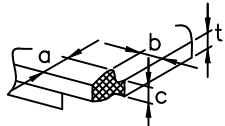
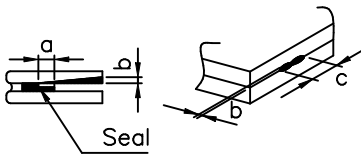
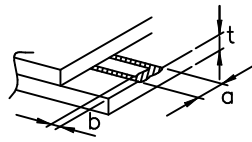
5-1 Electrical characteristics

NO.	Item	Criterion
1	Non operational	Fail
2	Miss operating	Fail
3	Missing dot	Fail
4	Contrast irregular	Fail
5	Response time	Within Specified value
6	Touch Panel contact resistance	Within Specified value
7	Touch Panel input load	Within Specified value
8	Touch Panel linearity	Within Specified value
9	Backlight turn on/off	Within Specified value

5-2 External Appearance Defect

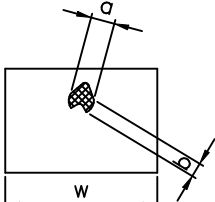
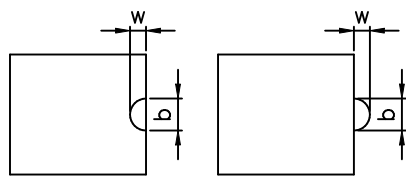
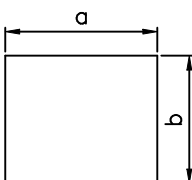
NO.	Item	Criterion																		
1	Black spots, foreign matter, and white spots (Including light leakage due to pinholes of polarizing plates, etc.)	(1)–1–Spots <table><tr><th>Average Diameter(mm):D</th><th>Number of pieces permitted</th></tr><tr><td>D≤0.1</td><td>Ignore</td></tr><tr><td>0.1<D≤0.2</td><td>5</td></tr><tr><td>0.2<D≤0.3</td><td>2</td></tr><tr><td>0.3<D</td><td>0</td></tr></table> Number of total pieces is set to within 5 pieces. Note that when there are 2 pieces or more, they are not to be concentrated. Set as: Average diameter = (Long diameter + Short diameter)/2 (1)–2–Blurred Spots(At lighting condition) <table><tr><th>Average Diameter(mm):D</th><th>Number of pieces permitted</th></tr><tr><td>D≤0.3</td><td>Ignore</td></tr><tr><td>0.3<D≤0.75</td><td>5</td></tr><tr><td>0.75<D</td><td>0</td></tr></table> Number of total pieces is set to within 5 pieces. Note that when there are 2 pieces or more, they are not to be concentrated. Set as: Average diameter = (Long diameter + Short diameter)/2	Average Diameter(mm):D	Number of pieces permitted	D≤0.1	Ignore	0.1<D≤0.2	5	0.2<D≤0.3	2	0.3<D	0	Average Diameter(mm):D	Number of pieces permitted	D≤0.3	Ignore	0.3<D≤0.75	5	0.75<D	0
Average Diameter(mm):D	Number of pieces permitted																			
D≤0.1	Ignore																			
0.1<D≤0.2	5																			
0.2<D≤0.3	2																			
0.3<D	0																			
Average Diameter(mm):D	Number of pieces permitted																			
D≤0.3	Ignore																			
0.3<D≤0.75	5																			
0.75<D	0																			

1	Line	(1)–1 Lines <table> <tr> <th>Width(mm): W</th><th>Length(mm): L</th><th>Number of pieces permitted</th></tr> <tr> <td>$W \leq 0.03$</td><td>Ignore</td><td>Ignore</td></tr> <tr> <td>$0.03 < W \leq 0.08$</td><td>$L \leq 4$</td><td>2</td></tr> <tr> <td>$0.08 < W \leq 0.1$</td><td>$L \leq 1$</td><td>1</td></tr> </table> Object exceeding 0.1mm follow the standards of the spots form. Note that when there are 2 pieces or more, they are not to be concentrated. (1)–2–Blurred Lines(At lighting condition) <table> <tr> <th>Width(mm): W</th><th>Length(mm): L</th><th>Number of pieces permitted</th></tr> <tr> <td>$W \leq 0.03$</td><td>Ignore</td><td>Ignore</td></tr> <tr> <td>$0.03 < W \leq 0.08$</td><td>$L \leq 3$</td><td>6</td></tr> <tr> <td>$0.08 < W$</td><td>$3 < L$</td><td>None</td></tr> </table> Object exceeding 0.1mm follow the standards of the spots form. Note that when there are 2 pieces or more, they are not to be concentrated.	Width(mm): W	Length(mm): L	Number of pieces permitted	$W \leq 0.03$	Ignore	Ignore	$0.03 < W \leq 0.08$	$L \leq 4$	2	$0.08 < W \leq 0.1$	$L \leq 1$	1	Width(mm): W	Length(mm): L	Number of pieces permitted	$W \leq 0.03$	Ignore	Ignore	$0.03 < W \leq 0.08$	$L \leq 3$	6	$0.08 < W$	$3 < L$	None
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$0.08 < W$	$3 < L$	None																								
2	Scratches(Glass, reflection plates, and polarizing plates)	In accordance with black spots. (At non lighting condition)																								
3	Color irregular	Not remarkable color irregular.																								

4	Air bubbles polarizing plates, and reflection plates	<table><tr><td>Average Diameter (mm): D</td><td>Number of pieces permitted</td><td rowspan="2">Average diameter = (Long diameter + Short diameter)/2</td></tr><tr><td>$D \leq 0.3$ $0.3 < D$</td><td>Ignore 0</td></tr></table> Note that when there are 4 pieces or more, they are not to be concentrated.	Average Diameter (mm): D	Number of pieces permitted	Average diameter = (Long diameter + Short diameter)/2	$D \leq 0.3$ $0.3 < D$	Ignore 0										
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5	Cracks	<table><tr><td>(1)General crack</td><td></td><td>$a \leq 5$ $b \leq 2$ $c \leq t$ Where, a and b are ignored when less than or equal to 0.5. The numbers of pieces are set at up to 5 pieces.</td></tr><tr><td>(2)Corner crack</td><td></td><td>$a \leq 2.5$ $b \leq 2.5$ $c \leq t$ $a + b \leq 4$</td></tr><tr><td>(3)Seal portion crack</td><td></td><td>$a \leq \text{The seal width} \times 1/3$ $b \leq t \times 2/3$ $c \leq 5$ The numbers of pieces are set at up to 5 pieces.</td></tr><tr><td>(4)ITO Pin crack</td><td></td><td>$a \leq 5$ $b \leq 1/3 \text{ pin length}$ $c \leq t$</td></tr><tr><td>(5)Progressive cracks</td><td></td><td>All taken to be unacceptable.</td></tr></table>	(1)General crack		$a \leq 5$ $b \leq 2$ $c \leq t$ Where, a and b are ignored when less than or equal to 0.5. The numbers of pieces are set at up to 5 pieces.	(2)Corner crack		$a \leq 2.5$ $b \leq 2.5$ $c \leq t$ $a + b \leq 4$	(3)Seal portion crack		$a \leq \text{The seal width} \times 1/3$ $b \leq t \times 2/3$ $c \leq 5$ The numbers of pieces are set at up to 5 pieces.	(4)ITO Pin crack		$a \leq 5$ $b \leq 1/3 \text{ pin length}$ $c \leq t$	(5)Progressive cracks		All taken to be unacceptable.
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(5)Progressive cracks		All taken to be unacceptable.															

6	Outer dimensions	Should be within the tolerance.
7	Newton ring(touch panel)	Orbicular of interference fringes is not allowed in the optimum contrast within the active area under viewing angle.
8	Soldering	Should be no defective soldering such as shorting, loose terminal cold solder, peeling of printed circuit board pattern, improper mounting position, etc.

5-3 Dot Appearance Defect

NO.	Item	Criteria
1	Pinhole	 Dot display a and b are each $\leq 0.2\text{mm}$ The overall total is taken be with in 10 units. Note that they are not to be concentrated.
2	Missing	 Dot display a and b are each $\leq 0.2\text{mm}$ The overall total is taken to be with in 10 units.
3	Thick and thin display	 Taken to be within $\pm 1.5\%$ of display character width(a) and height(b).

NOTICE:

- SAFETY

- 1.If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
- 2.If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- HANDLING

- 1.Avoid static electricity which can damage the CMOS LSI.
- 2.Do not remove the panel or frame from the module.
- 3.The polarizing plate of the display is very fragile. So, please handle it very carefully.
- 4.Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
- 5.Do not use ketonics solvent & Aromatic solvent. Use a soft cloth soaked with a cleaning naphtha solvent.

- STORAGE

- 1.Store the panel or module in a dark place where the temperature is $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$ and the humidity is below 65% RH.
- 2.Do not place the module near organics solvents or corrosive gases.
- 3.Do not crush, shake, or jolt the module.

- TERMS OF WARRANT

- 1.Acceptance inspection period
The period is within one month after the arrival of contracted commodity at the buyer's factory site.
- 2.Applicable warrant period
The period is within twelve months since the date of shipping out under normal using and storage conditions.

