

NAN YA PLASTICS CORPORATION

SPECIFICATION OF
LCD MODULE
PRODUCT NO.: LMBGANA32S51CK_

SPEC. NO.: LMA32-51- A

CUSTOMER
APPROVED BY
DATE:

LCD DEPARTMENT
ELECTRONIC MATERIALS DIVISION
NAN YA PLASTICS CORPORATION
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EDITED ON : SEP. 16, 2002

DESIGN MANAGER	DESIGN CHECK	DESIGNER
		C.F.SU

RECORDS OF REVISION

SPEC. NO. :
LMA32-51

[illegible]

3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS

(VDD = 5.0V±5%)

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic	VDD-GND	—		4.75	5.0	5.25	V
Input Voltage	VIH	H level		0.7VDD	—	VDD	V
	VIL	L level		0	—	0.3VDD	V
Recommended LC Driving Voltage	VDD-VO	Duty=1/240 Bias=1/13	-20°C	25.2	25.5	25.8	V
			0°C	23.6	23.9	24.2	
			25°C	22.8	23.1	23.4	
			50°C	21.3	21.6	21.9	
			70°C	20.3	20.6	21.9	
Power Supply Current	IDD	FLM = 70 Hz VDD = 5.0 V VEE = -24.0 V VDD-VO = 23.4 V		—	2.9	4.4	mA
	IEE	PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □		—	2.4	3.6	mA
Surface Luminance	L	(Dots All On)		—	170.0	—	cd/m ²
		(Dots All Off)		—	26.0	—	

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used CCFL Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp voltage	V _L	—	260	—	Vrms	—
Lamp current	I _L	4	5	6	mA _{rms}	—
Lamp power consumption	P _L	—	1.3	—	W	(*1)
Starting voltage	V _S	—	—	420	Vrms	—
Lamp frequency	F _L	—	35	—	KHz	—
Lamp life time	L _L	—	20000	—	hrs	IL = 5 mA _{rms} (*2)

(*1) Power consumption excluded inverter loss .

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

4.OPTICAL CHARACTERISTICS

AT V_{OP}

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.
N	S	2.5	4.0	3.5	5.0	4.0	5.5	3.0	4.5	2.0	3.0	—	67	—	±32
NOTE		NOTE 6										NOTE 5			

NOTE :

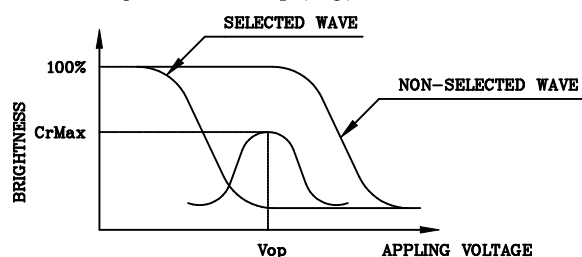
N : TRANSMISSION
S : BLUE

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

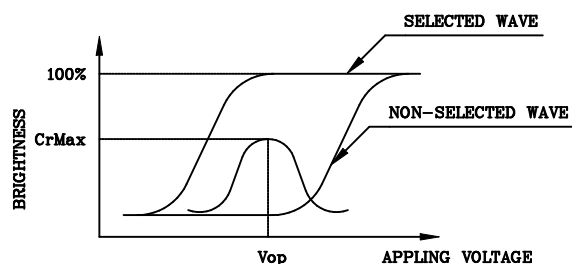
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	3200	4000	6000	ms	NOTE 2
		0℃	800	1000	1500		
		25℃	220	270	400		
		50℃	90	110	165		
		70℃	55	70	100		
Response Time (fall)	Tf	-20℃	2000	2200	3300	ms	NOTE 2
		0℃	360	420	630		
		25℃	150	180	270		
		50℃	45	60	90		
		70℃	40	50	75		

(FIG 1)

Definition of Operation Voltage(Vop)



(positive type)



(negative type)

*Conditions

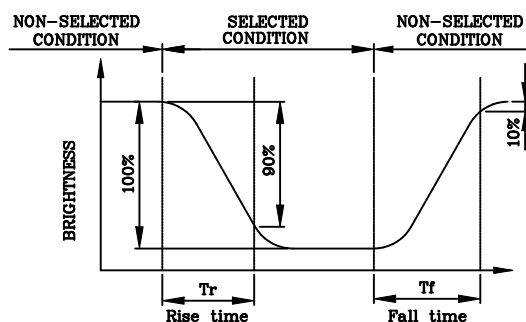
Viewing Angle : 0

Frame Frequency : 70Hz

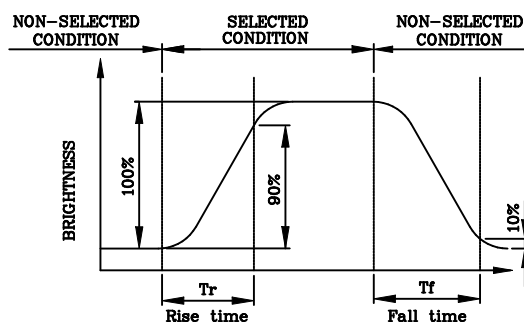
Applying Waveform : 1/N duty 1/a bias

(FIG 2)

Definition of Response Time(Tr,Tf)



(positive type)



(negative type)

*Conditions

Operating Voltage : V_{op}

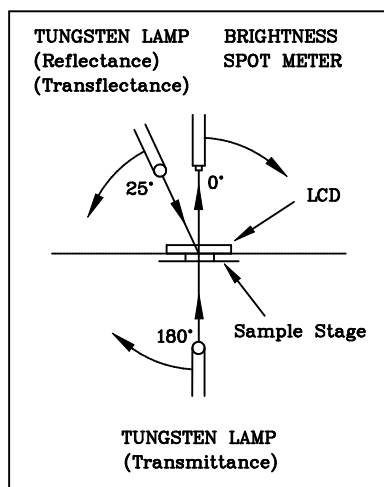
Viewing Angle (θ, ϕ) : (0,0)

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

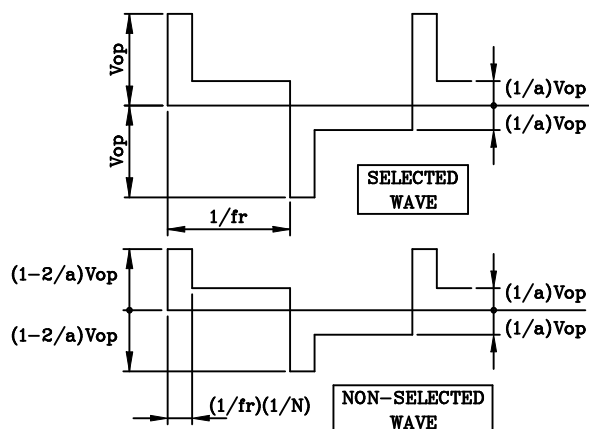
(FIG 3)

Description of Measuring Equipment and Driving Waveforms



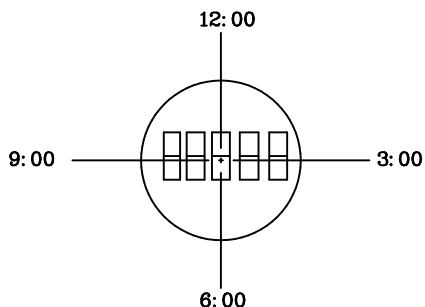
CONST.
TEMP.
CHAMBER

Multiplex Driving (1/N duty 1/a bias)



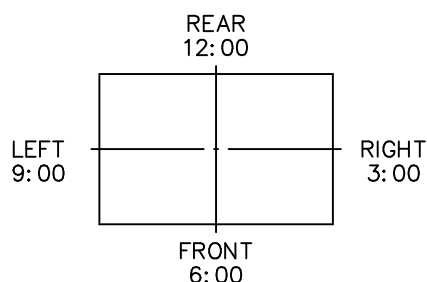
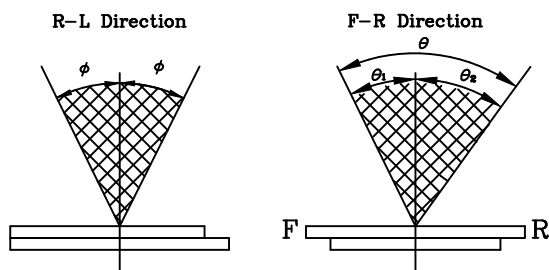
(FIG 4)

Definition of Viewing Direction



(FIG 5)

Definition of Viewing Angle



*For This Product

The Viewing Direction Is 6 O'clock
So $\theta_1 > \theta_2$

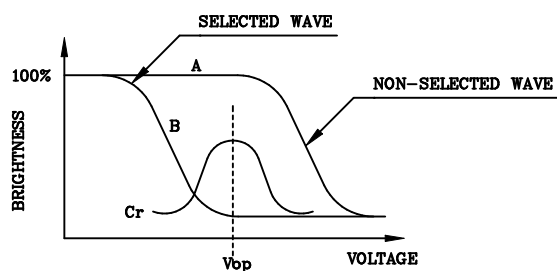
$$\theta = \theta_1 + \theta_2$$

*Conditions

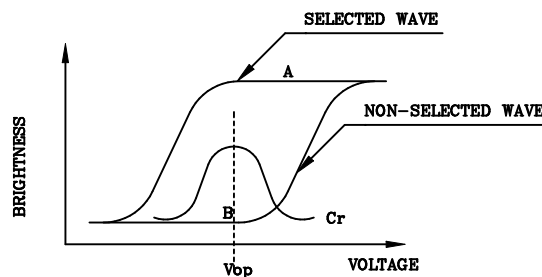
Operating Voltage : V_{op}
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(FIG 6)

Definition of Contrast Ratio (Cr)



(positive type)



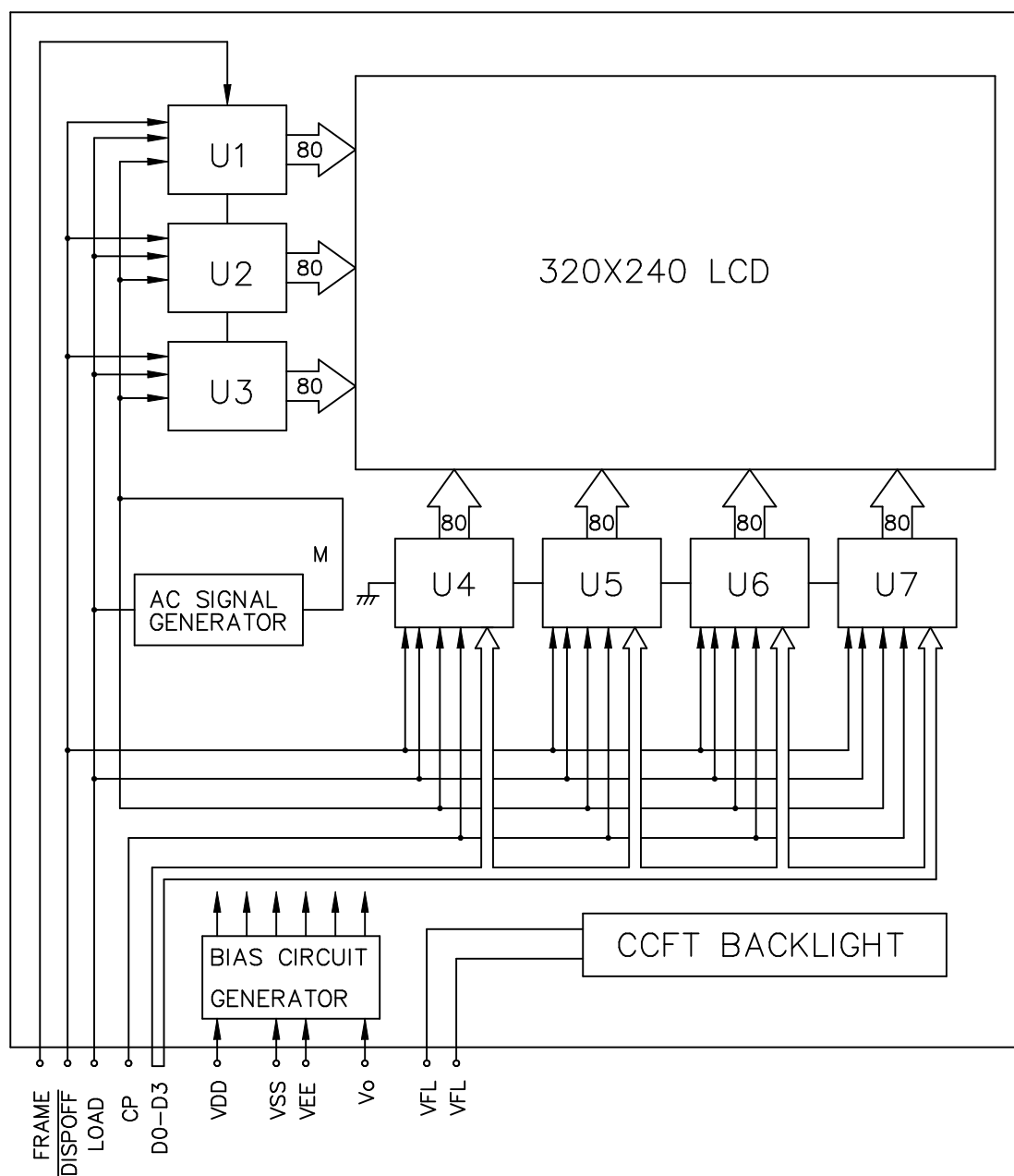
(negative type)

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

*Conditions

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

5. BLOCK DIAGRAM



* AC SIGNAL SETTING

J8	J7	J6	J5	J4	J3	J2	J1
L	L	H	L	H	H	L	H

6.INTERNAL PIN CONNECTION

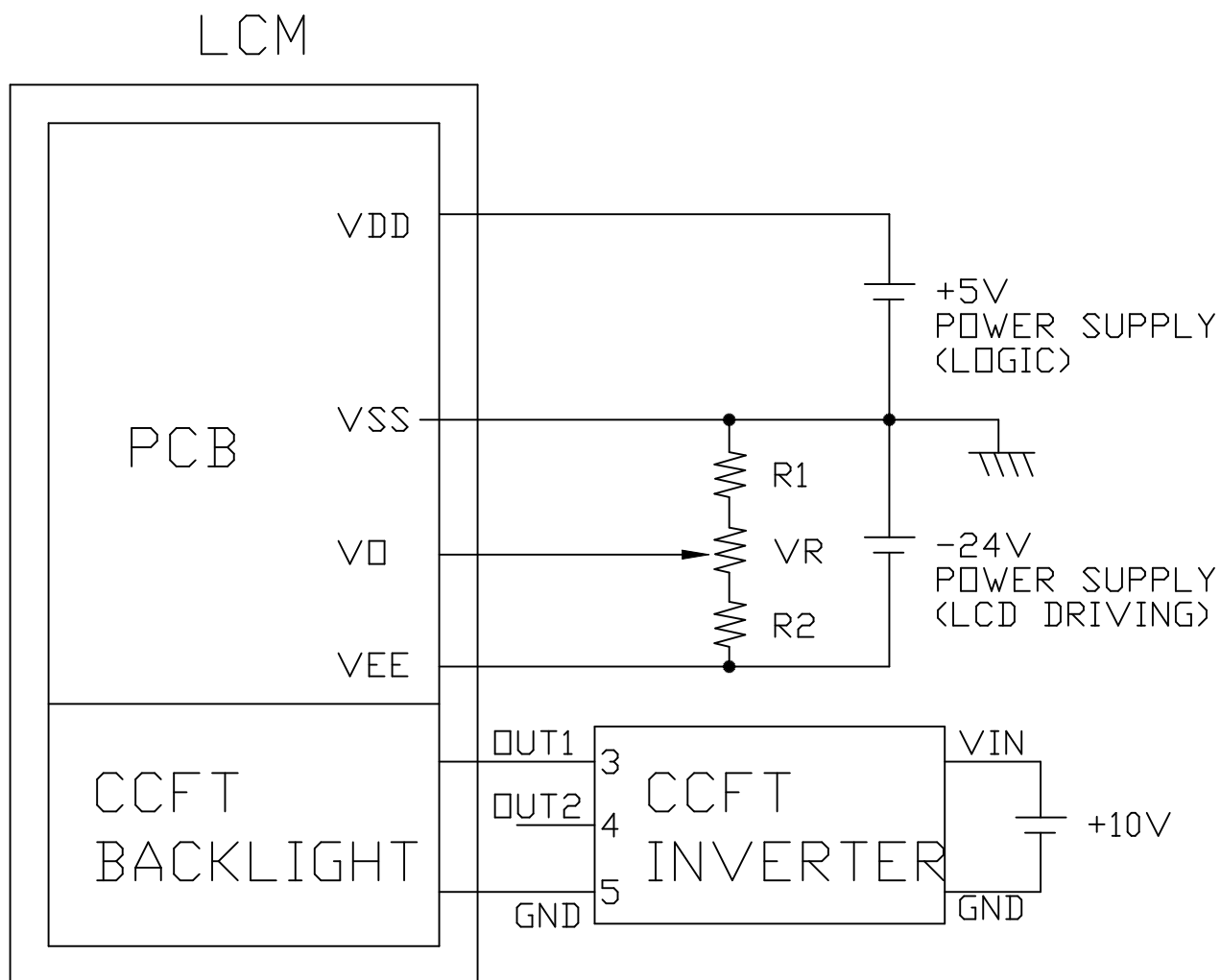
CN1: PITCH 1.25mm WIDTH 18.75mm

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 $\rightarrow$ L	INPUT DATA LATCH SIGNAL
9	CP	H $\rightarrow$ 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



1. $R1 + VR + R2 = 10K \sim 20K \Omega$

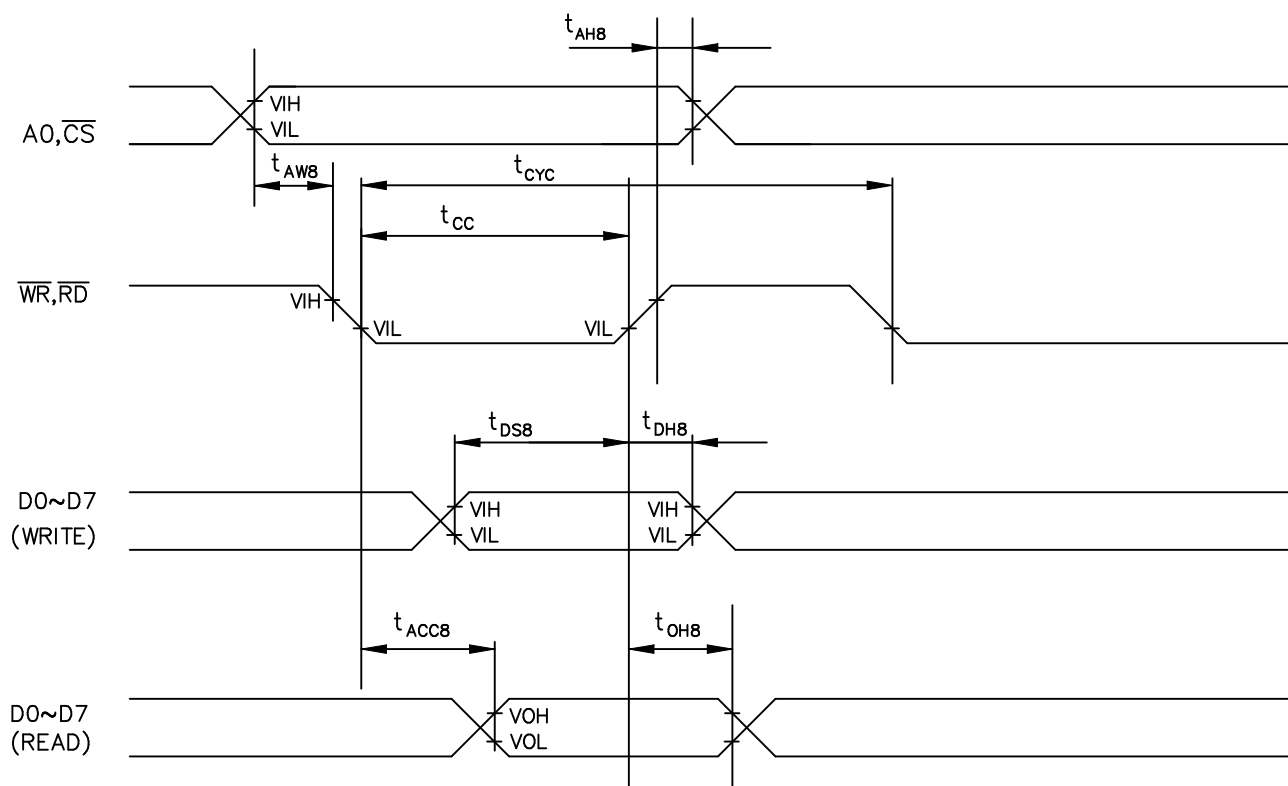
2. RECOMMENDED CCFT INVERTER : CXA-L10L(TDK)
(OPERATING TEMP. $-10^{\circ} \sim 60^{\circ}C$)

8. TIMING CHARACTERISTICS

8-1. READ/WRITE CHARACTERISTICS(8080 FAMILY MPU)

VDD=5.0V±5%

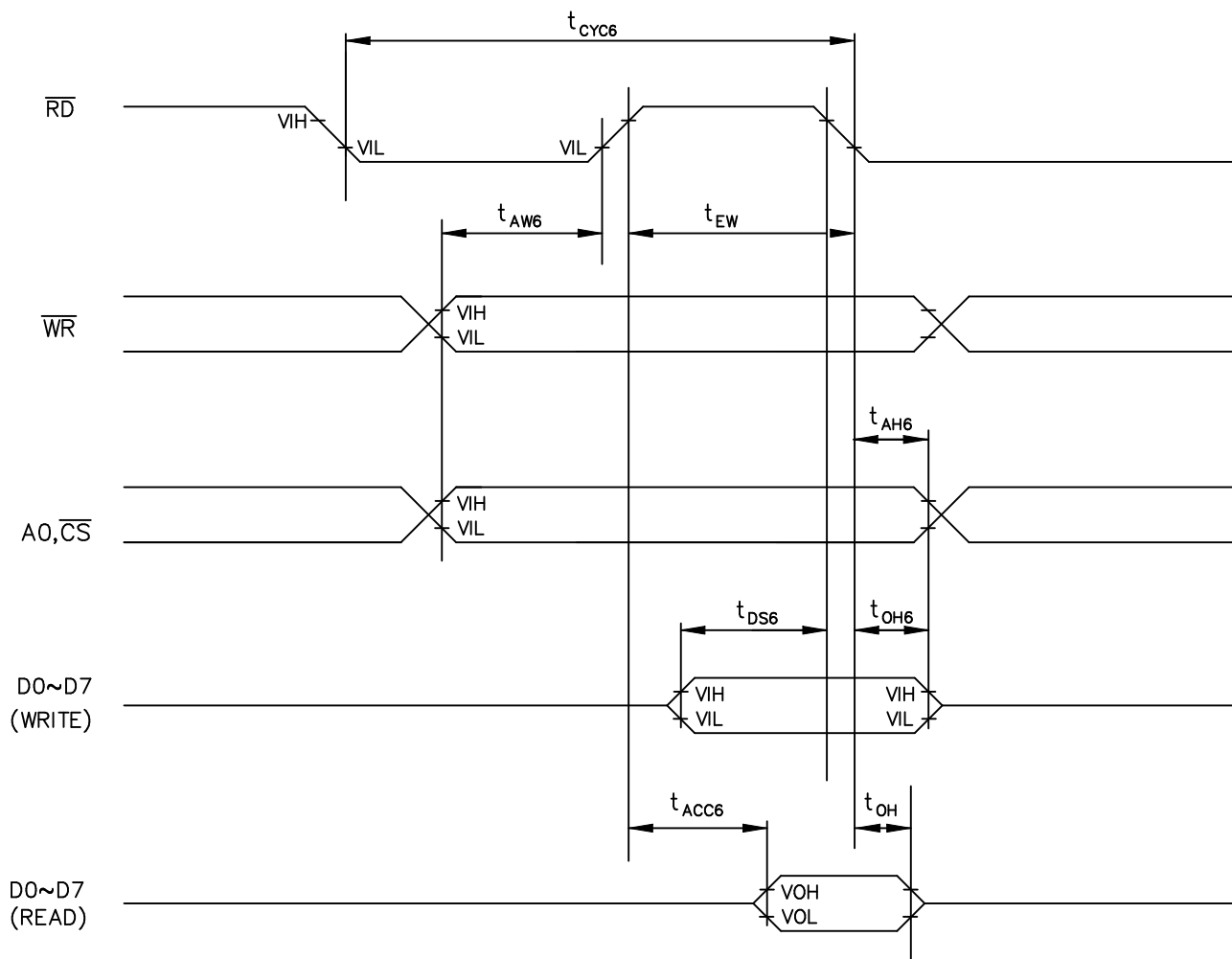
ITEM	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
A0, $\overline{CS}$	ADDRESS HOLD TIME	t_{AH8}	10	—	—	ns
	ADDRESS SETUP TIME	t_{AW8}	0	—	—	ns
$\overline{WR}, \overline{RD}$	SYSTEM CYCLE TIME	t_{CYC8}	1	—	—	ns
	STROBE PULSE WIDTH	t_{CC}	120	—	—	ns
D0 to D7	DATA HOLD TIME	t_{DH8}	5	—	—	ns
	DATA SETUP TIME	t_{DS8}	120	—	—	ns
	$\overline{RD}$ ACCESS TIME	t_{ACC8}	—	—	50	ns
	OUTPUT DISABLE TIME	t_{OH8}	10	—	50	ns



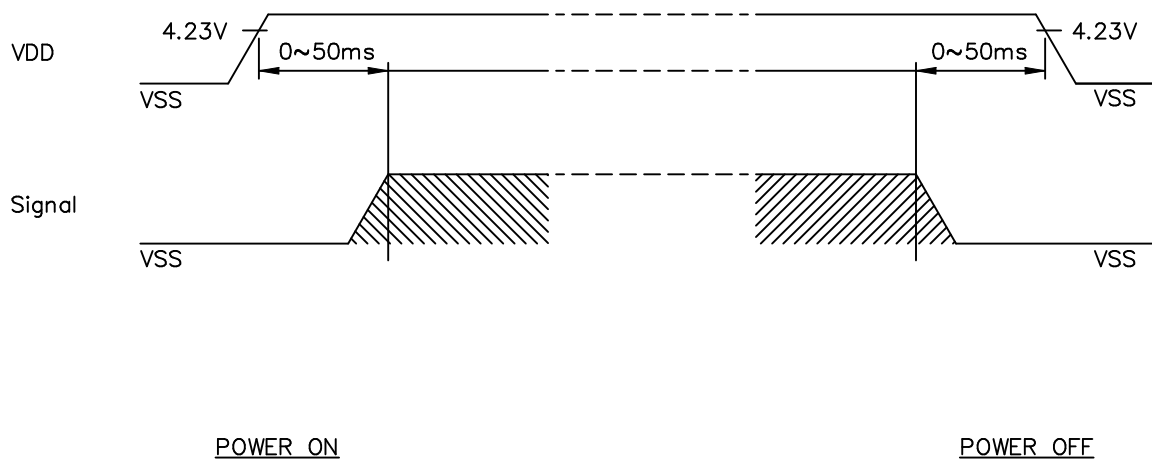
8-2.READ/WRITE CHARACTERISTICS(6800 FAMILY MPU)

VDD=5.0V±5%

ITEM	ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
A0, $\overline{CS}$, $\overline{WR}$	ADDRESS HOLD TIME	t_{AH6}	0	—	—	ns
	ADDRESS SETUP TIME	t_{AW6}	0	—	—	ns
	SYSTEM CYCLE TIME	t_{CYC6}	1	—	—	ns
D0 to D7	DATA HOLD TIME	t_{DH6}	0	—	—	ns
	DATA SETUP TIME	t_{DS6}	100	—	—	ns
	ACCESS TIME	t_{ACC6}	—	—	85	ns
	OUTPUT DISABLE TIME	t_{OH6}	10	—	50	ns
$\overline{RD}$	ENABLE PULSE WIDTH	t_{RDW}	120	—	50	ns



8-3.POWER ON/OFF TIMING



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

9. RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	70°C	120HR		Appearance without defect	
2	Low Temp. Storage	-20°C	120HR		Appearance without defect	
3	High Temp. & High Humi. Storage	40°C 90%RH	120HR		Appearance without defect	
4	Thermal Shock	-20°C, 30min → 25°C, 5min → 70°C, 30min → 25°C, 5min (1cycle)			Appearance without defect	5 cycles

NAN YA PLASTICS CORP. ELEC. MATERIALS DIV. LCD DEPARTMENT		SPECIFICATION		SPEC. NO. : LMA32-51 DATE : SEP. 16, 2002 SHEET NO. : 16 /24	
Inspection Provision					
1.Purpose					
The NAN YA inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of NAN YA LCD produces.					
2.Applicable Scope					
The NAN YA inspection provision is applicable to the arrangement in regard to outgoing inspection and quality assurance after outgoing.					
3.Technical Terms					
3-1 NAN YA Technical Terms					
Polarizer Glass Plate Liquid Crystal 					
4.Outgoing Inspection Provision					
Outgoing inspection is according to the product inspection manual. (Per 1-1, 1-2 & 1-3)					
4-1 Ispection Method					
MIL-STD-105D 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			
	Solder appearance	Erroneous operation			
		Shorts			
Cracks	Loose				
	Display surface cracks				
REV/DATE	R0/ 09.16.02'				BY C.F.SU

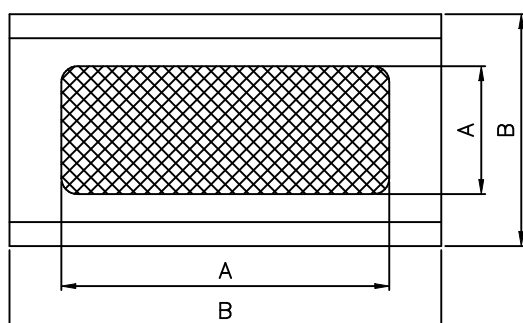
NAN YA PLASTICS CORP. ELEC. MATERIALS DIV. LCD DEPARTMENT	SPECIFICATION	SPEC. NO. : LMA32-51 DATE : SEP. 16, 2002 SHEET NO. : 17/24
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	Dimensions	External from Dimensions	0.4	
Minor Defect	Inside the glass	Black spots	0.65	faults which appear to pose 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 Out Line

*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 a sample to be 30cm to 50cm.

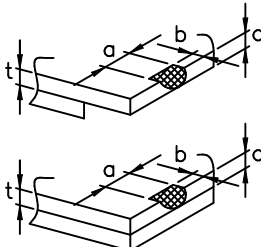
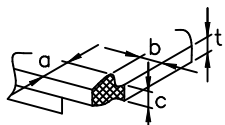
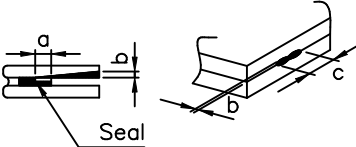
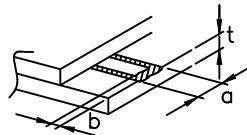
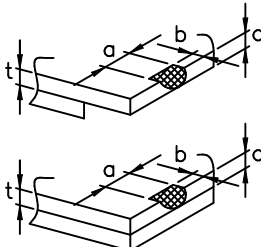
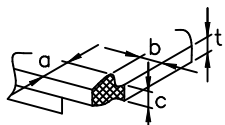
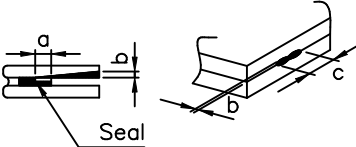
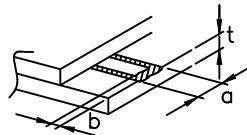
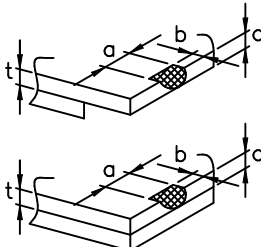
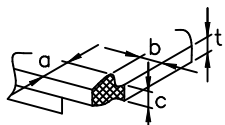
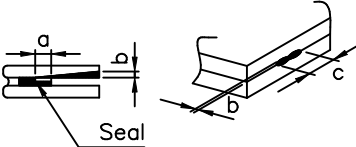
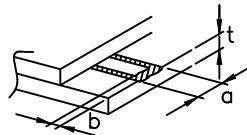
REV/DATE	R0/ 09.16.02'							BY C.F.SU
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NAN YA PLASTICS CORP. ELEC. MATERIALS DIV. LCD DEPARTMENT		SPECIFICATION			SPEC. NO. : LMA32-51 DATE : SEP. 16, 2002 SHEET NO. : 18/24																																		
*Test and measurement are performed under the following conditions, unless otherwise specified. <table> <tr> <td>Temperature</td> <td>20± 15℃</td> </tr> <tr> <td>Humidity</td> <td>65± 20%R.H..</td> </tr> <tr> <td>Pressure</td> <td>860~1060hPa(mmbars)</td> </tr> </table> In case of doubtful judgment, it is performed under the following conditions. <table> <tr> <td>Temperature</td> <td>20± 2℃</td> </tr> <tr> <td>Humidity</td> <td>65± 5%R.H..</td> </tr> <tr> <td>Pressure</td> <td>860~1060hPa(mmbars)</td> </tr> </table> 5.Specification for quality check 5-1 Electrical characteristics <table border="1"> <thead> <tr> <th>NO.</th> <th>Item</th> <th>Criterion</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Non operational</td> <td>Fail</td> </tr> <tr> <td>2.</td> <td>Miss operating</td> <td>Fail</td> </tr> <tr> <td>3.</td> <td>Missing dot</td> <td>Fail</td> </tr> <tr> <td>4.</td> <td>Contrast irregular</td> <td>Not allowable</td> </tr> <tr> <td>5.</td> <td>Response time</td> <td>Within Specified value</td> </tr> <tr> <td>6.</td> <td>CCFT backlight turn on/off</td> <td>Within Specified value</td> </tr> </tbody> </table>							Temperature	20± 15℃	Humidity	65± 20%R.H..	Pressure	860~1060hPa(mmbars)	Temperature	20± 2℃	Humidity	65± 5%R.H..	Pressure	860~1060hPa(mmbars)	NO.	Item	Criterion	1.	Non operational	Fail	2.	Miss operating	Fail	3.	Missing dot	Fail	4.	Contrast irregular	Not allowable	5.	Response time	Within Specified value	6.	CCFT backlight turn on/off	Within Specified value
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6.	CCFT backlight turn on/off	Within Specified value																																					
REV/DATE	R0/ 09.16.02'					BY C.F.SU																																	

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(At non lighting condition) <table><tr><th>Average Diameter(mm):D</th><th>Number of pieces permitted</th></tr><tr><td>$D\leq 0.1$</td><td>Ignore</td></tr><tr><td>$0.1 < D \leq 0.2$</td><td>5</td></tr><tr><td>$0.2 < D \leq 0.3$</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–Spots(At lighting condition) <table><tr><th>Average Diameter(mm):D</th><th>Number of pieces permitted</th></tr><tr><td>$D\leq 0.3$</td><td>Ignore</td></tr><tr><td>$0.3 < D \leq 0.75$</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	$D\leq 0.1$	Ignore	$0.1 < D \leq 0.2$	5	$0.2 < D \leq 0.3$	2	$0.3 < D$	0	Average Diameter(mm):D	Number of pieces permitted	$D\leq 0.3$	Ignore	$0.3 < D \leq 0.75$	5	$0.75 < D$	0
Average Diameter(mm):D	Number of pieces permitted																			
$D\leq 0.1$	Ignore																			
$0.1 < D \leq 0.2$	5																			
$0.2 < D \leq 0.3$	2																			
$0.3 < D$	0																			
Average Diameter(mm):D	Number of pieces permitted																			
$D\leq 0.3$	Ignore																			
$0.3 < D \leq 0.75$	5																			
$0.75 < D$	0																			

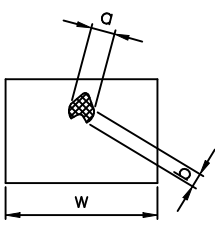
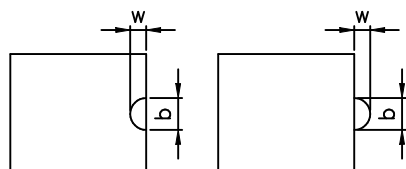
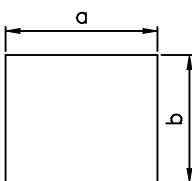
NAN YA PLASTICS CORP. ELEC. MATERIALS DIV. LCD DEPARTMENT		SPECIFICATION		SPEC. NO. : LMA32-51 DATE : SEP. 16, 2002 SHEET NO. : 20/24				
1.	Black spots, foreign matter, and white spots (Including light leakage due to pinholes of polarizing plates, etc.)	(1)-1 Spots(At non lighting condition)						
		Width(mm): W		Length(mm):L				
		W≤0.03		Ignore				
		0.03<W≤0.08		L≤4				
		0.08<W≤0.1		L≤1				
		Number of pieces permitted		Ignore				
		2		1				
		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 Spots(At lighting condition)						
Width(mm): W		Length(mm):L		Number of pieces permitted				
W≤0.03		Ignore		Ignore				
0.03<W≤0.08		L≤3		6				
0.08<W		3<L		None				
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.								
2.	Scratches(Glass, reflection plates, and polarizing plates)	In accordance with black spots. (At non lighting condition)						
3.	Color irregular	Not remarkable color irregular.						
REV/DATE	R0/ 09.16.02'							BY C.F.SU

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										
Average Diameter (mm): D	Number of pieces permitted	Average diameter = (Long diameter + Short diameter)/2															
$D \leq 0.3$ $0.3 < D$	Ignore 0																
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 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 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.
(1)General crack		$a \leq 5$ $b \leq 2$ $c \leq t$ Where, a and b are ignored when less than or equal 0.5. The numbers of pieces are set at up to 5 pieces.															
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(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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6.	Outer dimensions	Should be with in the tolerance.
7.	Newton ring	Orbicular of interference fringes. To be non. In case of doubtful judgenemt, agreement shall be reachment.
8.	Soldering	Should be no defective soldering such as shorting, loose terminal cold solder, peeling of printed circuit board pattern, improper mouting position, etc.

5-3 Dot Appearance Defect

NO.	Item	Criteria
1.	Plinhole	 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).

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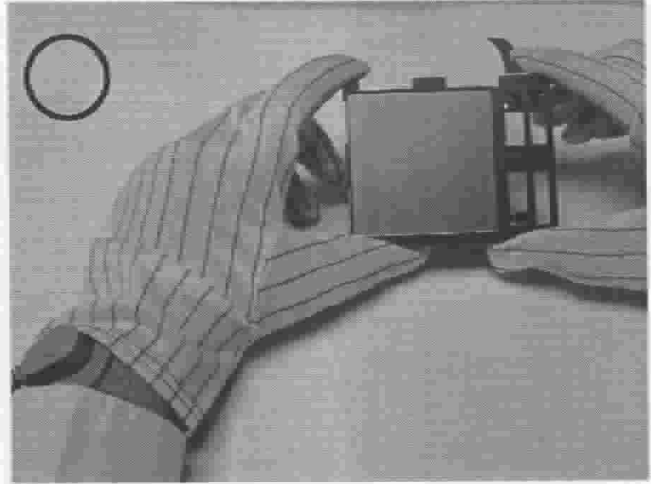
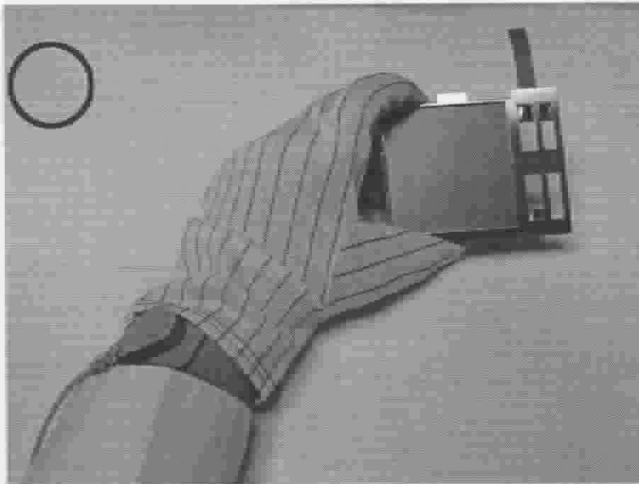
NAN YA PLASTICS CORP. ELEC. MATERIALS DIV. LCD DEPARTMENT		SPECIFICATION				SPEC. NO. : LMA32-51 DATE : SEP. 16, 2002 SHEET NO. : 23/24	
NOTE: • SAFETY 1.If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin. 2.If the liquid crystal touches your skin or clothes, please 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 with 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°C±5°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.							
REV/DATE	R0/ 09.16.02'						BY C.F.SU

THE NOTES OF LCM USING

LCM is easy to damage.

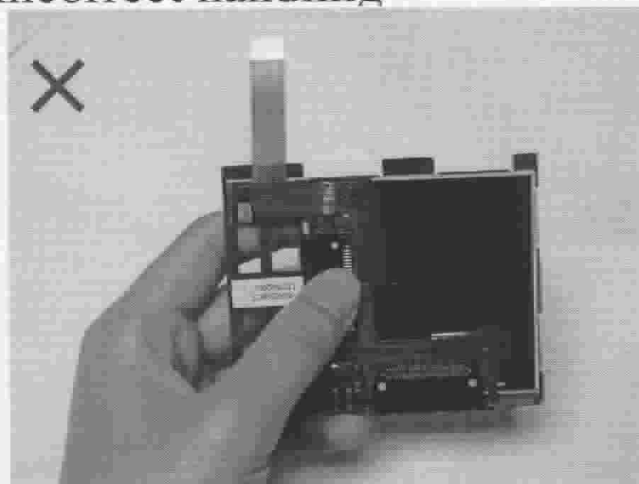
Please follow the notes as bellows, and be careful of handling!

Correct handling

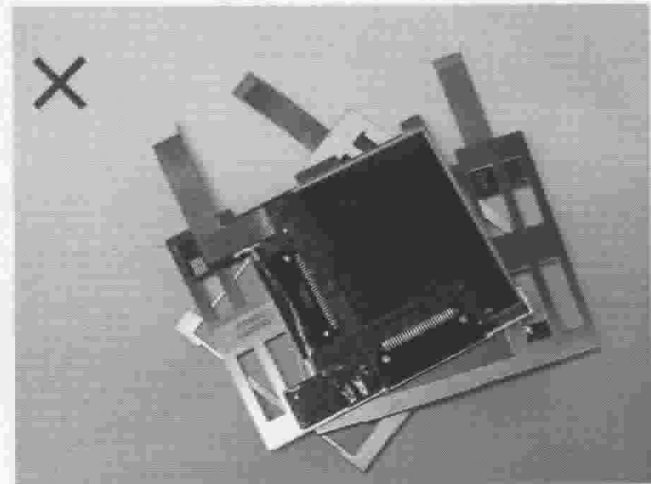


As above picture, please handle with glove by LCM edges and full EOS/ESD protection.

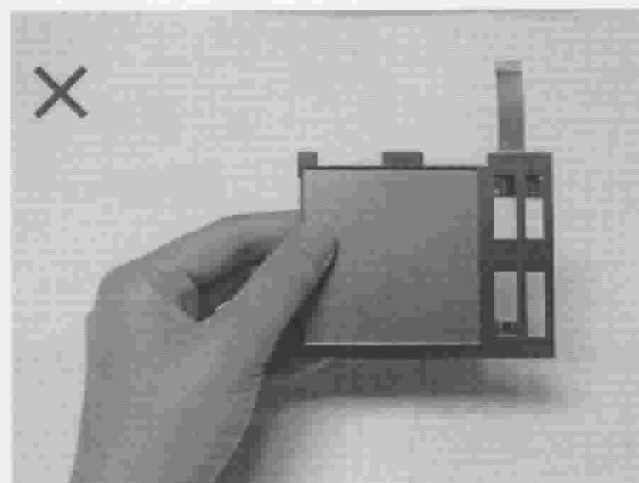
Incorrect handling



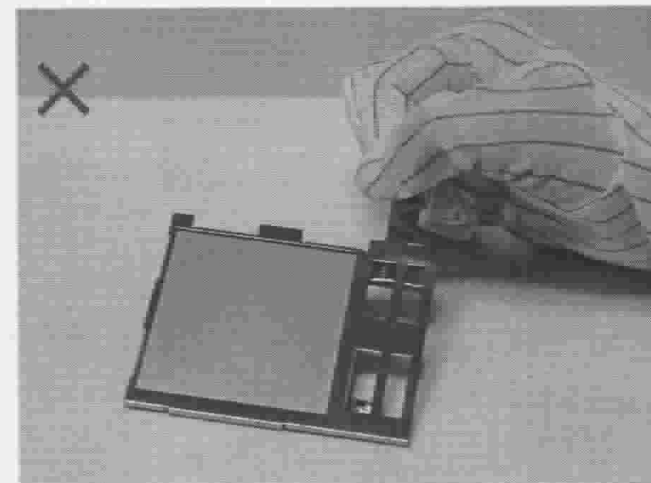
Please don't touch IC directly.



Please don't put one on another LCM.



Please don't hold the surface of LCM.



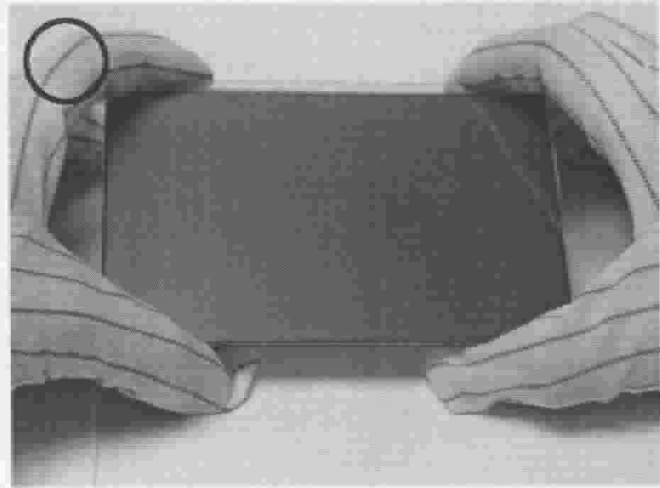
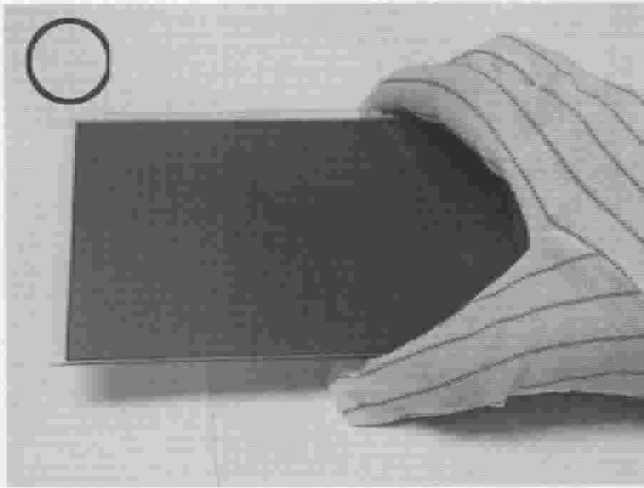
Please don't stretch interface of output.

THE NOTES OF LCD USING

LCD is easy damage.

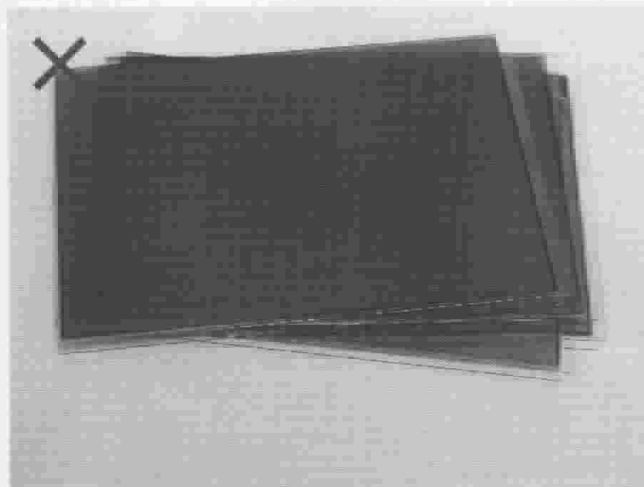
Please follow notes as bellows, and be careful of handling!

Correct handling

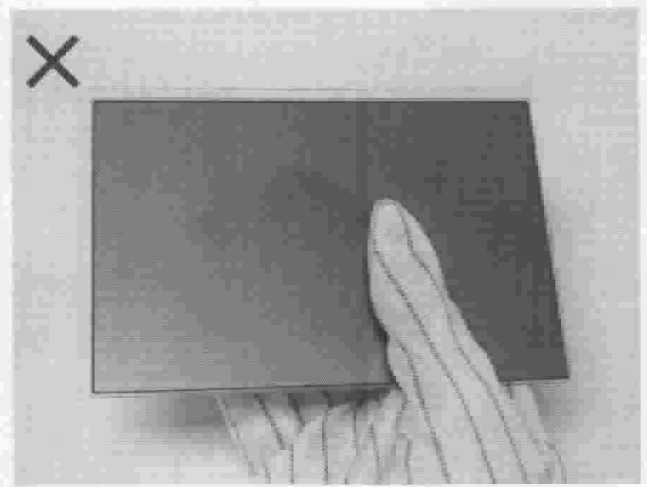


As above picture, please handle with glove by LCD edges and full EOS/ESD protection.

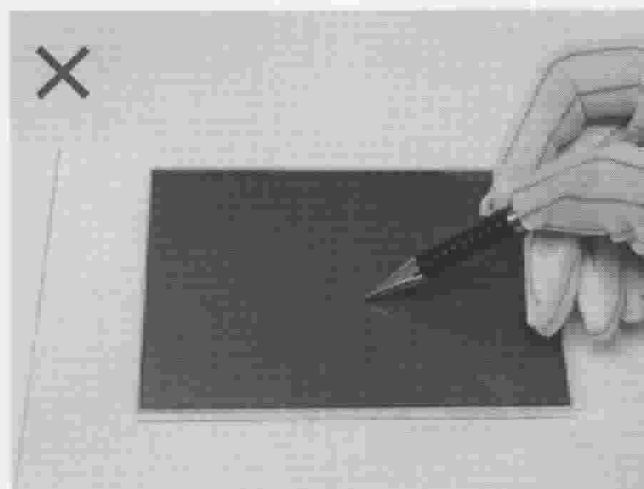
Incorrect handling



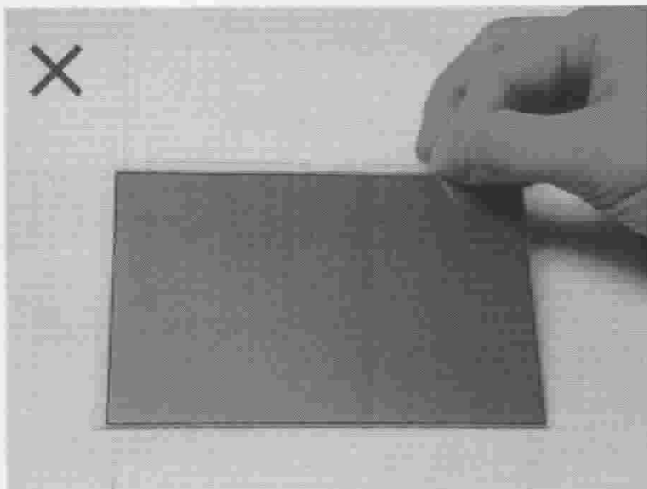
Please don't put one on another LCD.



Please don't hold the surface of LCD.



Please don't operate with sharp stick such as sharp pencil.



Please don't touch ITO glass without anti-static gloves.

