NAN YA PLASTICS CORPORATION

SPECIFICATION OF
LCD MODULE
PRODUCT NO.: LMBFAT410GCDS

SPEC. NO.: LM410-0D-△0

CUSTOMER
APPROVED BY
DATE:

LCD DEPARTMENT
ELECTRONIC MATERIALS DIVISION
NAN YA PLASTICS CORPORATION
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EDITED ON : NOV.29.2006

Q.C DEPT.	DESIGN MANAGER	DESIGN CHECK	DESIGNER
			J.P. Weng

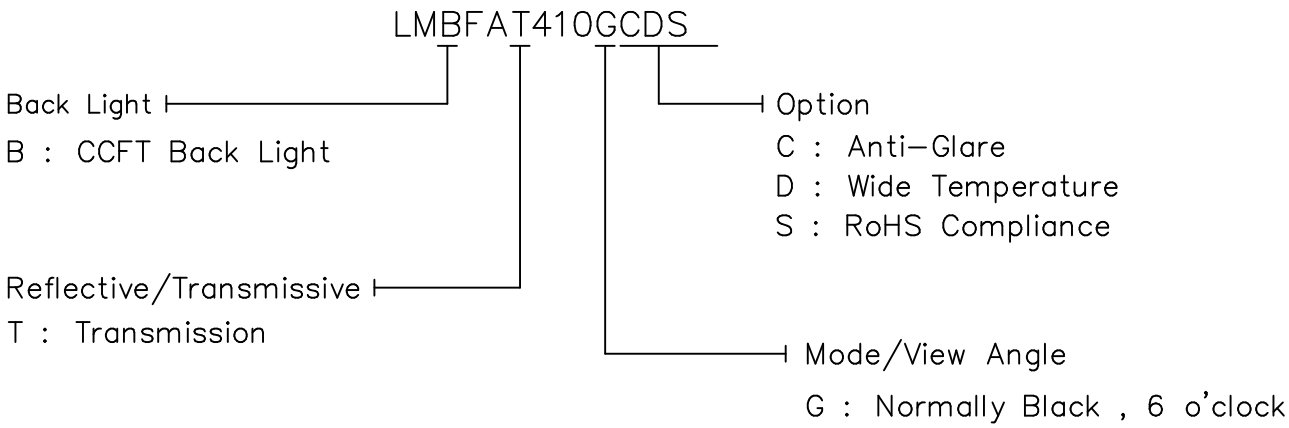
RECORDS OF REVISION

SPEC .: LM410-0D

DATE	REVISED NO.	REF. PAGE	SUMMARY	DESIGN	CHECK
11.29.06'	0	1~22/22	First Issue	J.P Weng	

1. MECHANICAL DATA

NO	ITEM	CONTENTS	UNIT
1	Product No.	LMBFAT410GCDS	–
2	Module Size	159.4(W) X 101.0(H) X MAX11.0(D)	mm
3	Dot Size	0.47 (W) x 0.47 (H)	mm
4	Dot Pitch	0.5 (W) x 0.5 (H)	mm
5	Number of Dots	240 (W) x 128 (H) Dots	Dot
6	Duty	1/128	–
7	LCD Display Mode	FSTN: Normally Black / Negative Image	–
8	Rear Polarizer	Transmission	–
9	Viewing Direction	6	O'clock
10	Backlight	CCFL	–
11	Controller	LC7981-E	–
12	DC/DC Converter	Excluded	–
13	Weight	169 (approx.)	g
14	Soldering	Lead Free	–



RoHS Compliance.

Nan Ya guarantees that this project doesn't include any materials (6 materials) or includes less than specified quantities which are regulated by RoHS Compliance.

2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V Standard

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD−VSS	0	6.5	V	
Power Supply for LC	VDD−VEE	0	22	V	
Input Voltage	VI	−0.3	VDD+0.3	V	
Static Electricity	−	−	−	−	Note 1

(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 Ta ≦ 70°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 OF LCM

ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic		VDD-VSS	Ta=25°C		4.5	5.0	5.5	V
Recommended LC Driving Voltage		VDD-VO	Duty=1/128	-20°C	19.2	19.5	19.8	V
				0°C	17.6	17.9	18.2	
				25°C	16.6	16.9	17.2	
				50°C	15.7	16.0	16.3	
				70°C	15.2	15.5	15.8	
Input Voltage		VIH	H level		0.8VDD	-	VDD	V
		VIL	L level		0	-	0.2VDD	V
Power Supply Current		IDD	VDD = 5.0 V VDD-VO = 16.9V Ta=25°C PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □		-	11	17	mA
		IEE			-	3	5	mA
LCM	Surface Luminance	L	Ta=25°C CXA-L10L Vin=10.5V IL=5mA	All On	250	320	-	cd/m²
				All Off	-	60	-	

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used CCFL Rating Temp.=25℃

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp voltage	V_L	–	337	–	Vrms	–
Lamp current	I_L	4.0	5.0	6.0	mArms	–
Lamp power consumption	P_L	–	1.93	–	W	(*1)
Starting voltage	Vs	–	–	940	Vrms	At 25℃ (*3)
		–	–	1230	Vrms	At 0℃ (*3)
Lamp life time	L_L	40000	–	–	hrs	IL = 5.0mArms(*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) Start-up Voltage means the lowest voltage (after output capacitor) at lighting on stable time under darkness environment (under 0.1 lux).

(*4) a. Please follow the table of Lamp Characteristics shown above if not to use the inverter recommended by Nan Ya .

b. If customers want to design inverter by themselves , please inform Nan Ya to offer the detail lamp specification .

3-3.ELECTRICAL CHARACTERISTICS OF RECOMMENDED INVERTER TDK CXA-L10L

3-3-1 GENERAL SPECIFICATIONS

OPERATION TEMPERATURE : -10℃~60℃

STORAGE TEMPERATURE : -20℃~85℃

DIMENSION : 56.0(L)mm x 29.0(W)mm x MAX 19.5(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	–	10.5	–	V	
Tube Current	IL	–	5	–	mA	

Note : Inverter must be used in the range of VIN Input Voltage. If it doesn't used in this range, the electrical characteristics of backlight would not be to guarantee.

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.
T	G	10	15	15	20	20	30	15	20	1.5	3.5	-	R: 40 F: 45	-	±40
Note		NOTE 6										NOTE 5			

Note:

T : TRANSMISSIVE

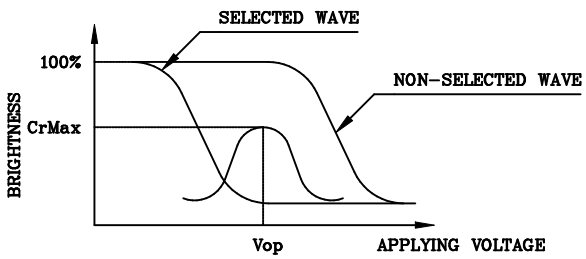
G : NORMALLY BLACK

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

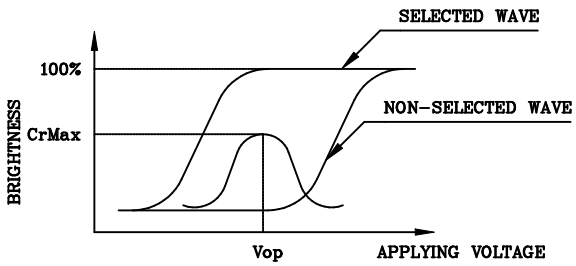
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	2500	3200	4800	ms	NOTE 2
		0℃	400	500	750		
		25℃	150	180	270		
		50℃	100	120	150		
		70℃	55	70	100		
Response Time (fall)	Tf	-20℃	2600	3600	5500	ms	NOTE 2
		0℃	550	700	1000		
		25℃	180	220	330		
		50℃	40	50	75		
		70℃	30	40	60		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



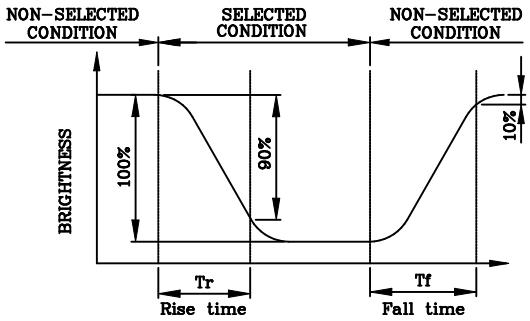
(negative type)

*Conditions

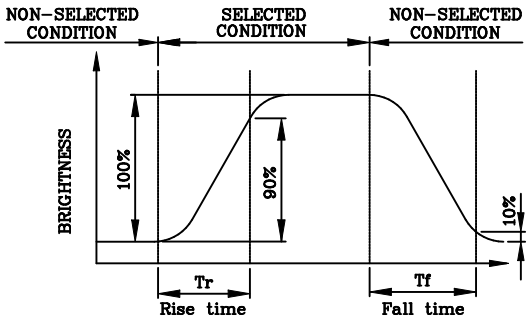
Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



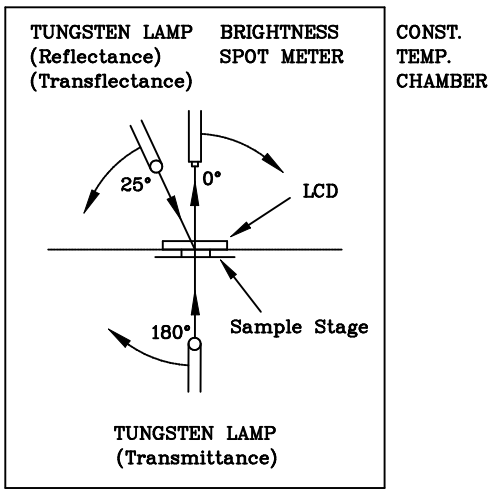
(negative type)

*Conditions

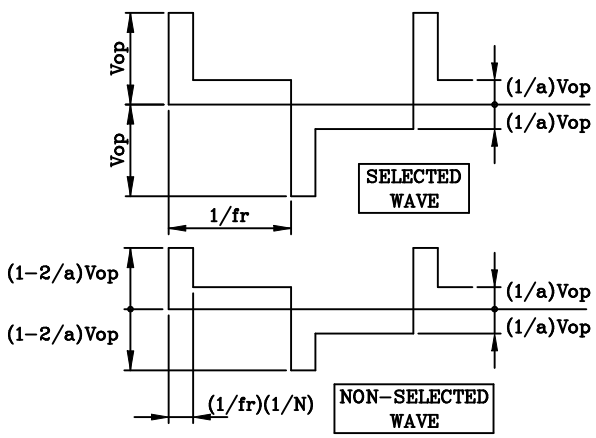
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

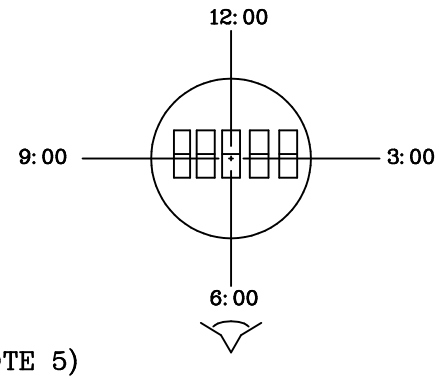


Multiplex Driving (1/N duty 1/a bias)



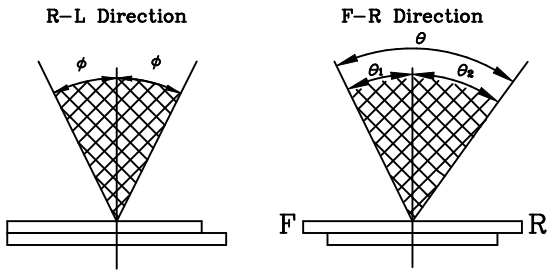
(NOTE 4)

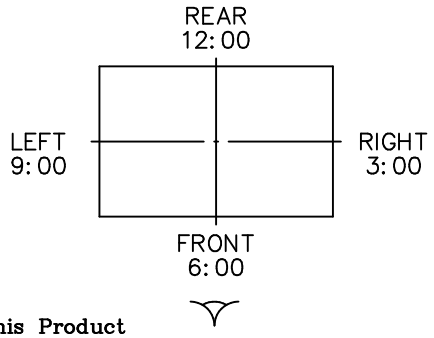
Definition of Viewing Direction



(NOTE 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 : Vop

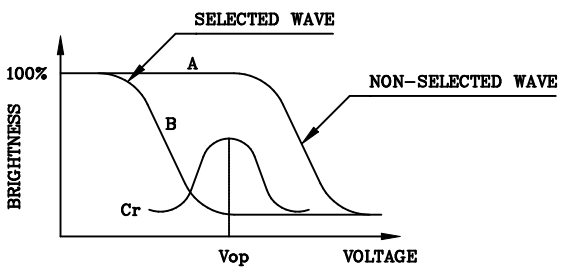
Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

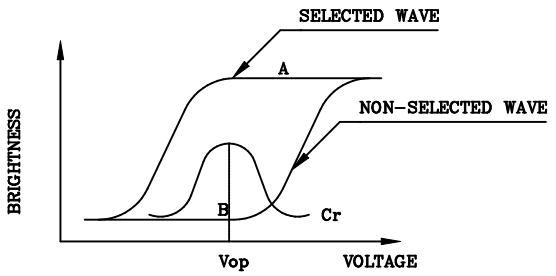
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

Contrast Ratio : Cr=A/B

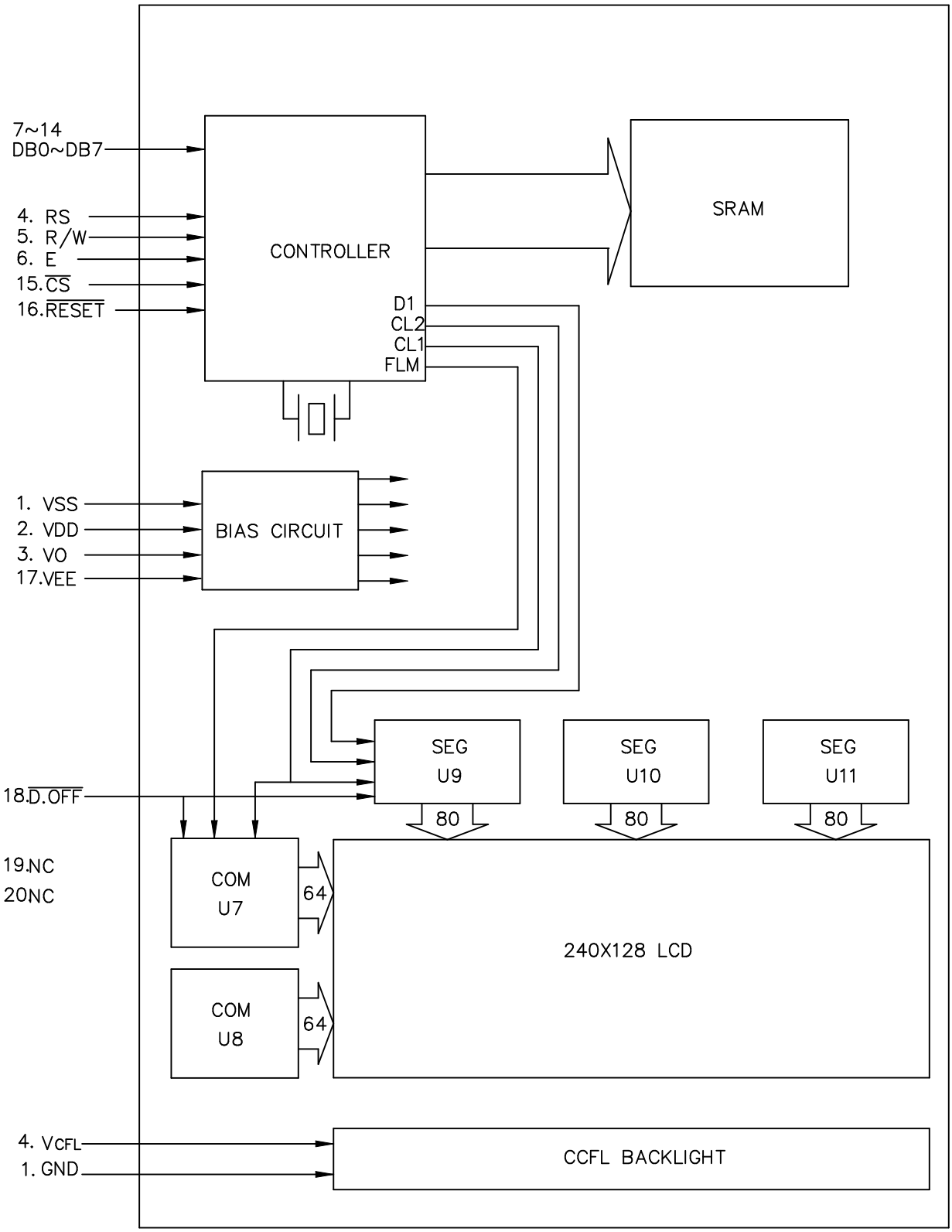
*Conditions

Viewing Angle : 0

Frame Frequency : 70Hz

Applying Waveform : 1/N duty 1/a bias

5. BLOCK DIAGRAM



6.INTERNAL PIN CONNECTION

CN1: Pitch 2.54mm x 20

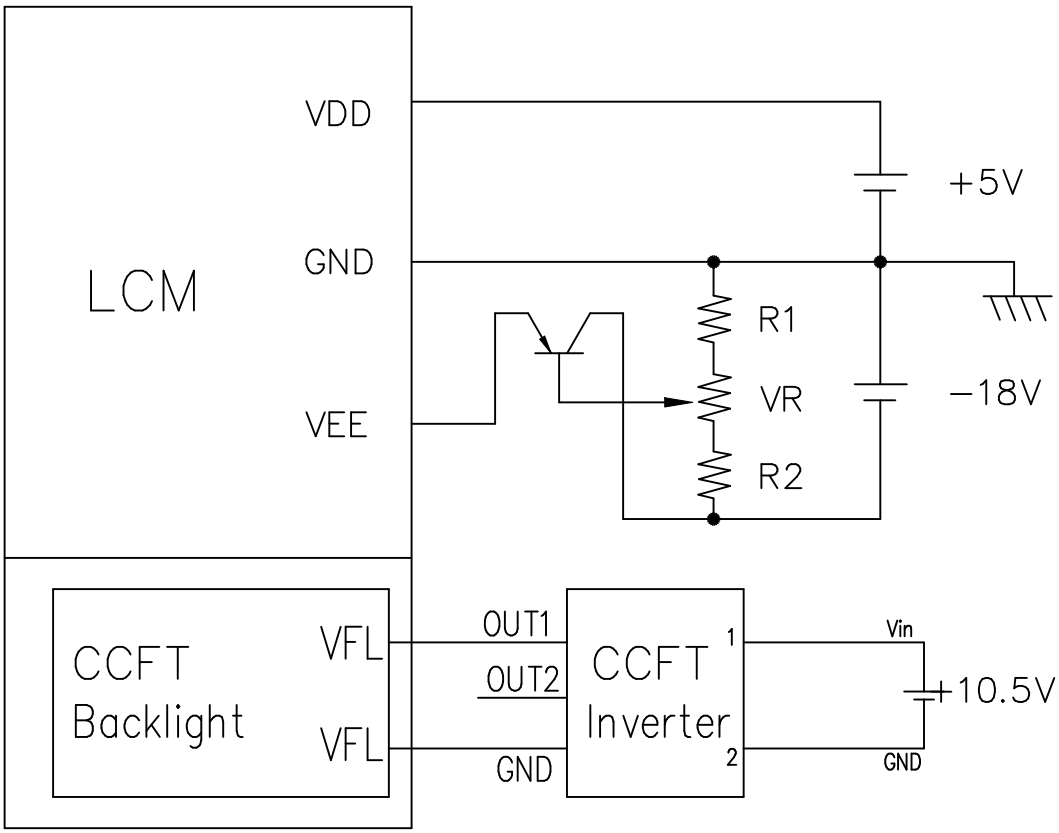
PinNo.	Symbol	Level	Function
1	VSS	—	GROUND(0V)
2	VDD	—	POWER SUPPLY FOR LOGIC CIRCUIT(+5V)
3	VO	—	POWER SUPPLY FOR LCD DRIVING
4	RS	H/L	REGISTER SELECT
5	R/W	H/L	READ/WRITE
6	E	H,H->L	ENABLE
7	DB0	H/L	DISPLAY DATA
8	DB1	H/L	
9	DB2	H/L	
10	DB3	H/L	
11	DB4	H/L	
12	DB5	H/L	
13	DB6	H/L	
14	DB7	H/L	
15	/CS	L	CHIP SELECT
16	/RST	L	RESET
17	VEE	—	POWER SUPPLY FOR LCD DRIVE
18	$\overline{\text{D.OFF}}$	—	NC FOR ON,GND FOR OFF
19	NC	—	NO CONNECTION
20	NC	—	NO CONNECTION

CN2 : M63M83-04(MITSUMI) OR COMPATIABLE

MATING CONNECTOR : MITSUMI M60-04-30-114P

PIN NO	SYNBOL	LEVEL	FUNCTION
1	GND	—	CFL GND
2	NC	—	NO CONNECTION
3	NC	—	NO CONNECTION
4	H.V	—	POWER SUPPLY FOR CFL

7.POWER SUPPLY



1. R1+VR+R2=10K~20K
2. Recommended CCFL Inverter : TDK CXA-L10L
   @ Vin=10.5V

8. TIMING CHARACTERISTICS

8-1. TIMING CHARACTERISTICS

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cyc}	Fig.a, Fig.b	1.0	-	-	us
Enable pulse width	PW_{EH}	Fig.a, Fig.b	450	-	-	ns
Enable rise/fall time	t_{Er} , t_{Ef}	Fig.a, Fig.b	-	-	25	ns
RS,R/W set up time	t_{AS}	Fig.a, Fig.b	140	-	-	ns
Data delay time	t_{DDR}	Fig.b	-	-	225	ns
Data set up time	t_{DSW}	Fig.a	225	-	-	ns
Hold time	t_H	Fig.a, Fig.b	20	-	-	ns

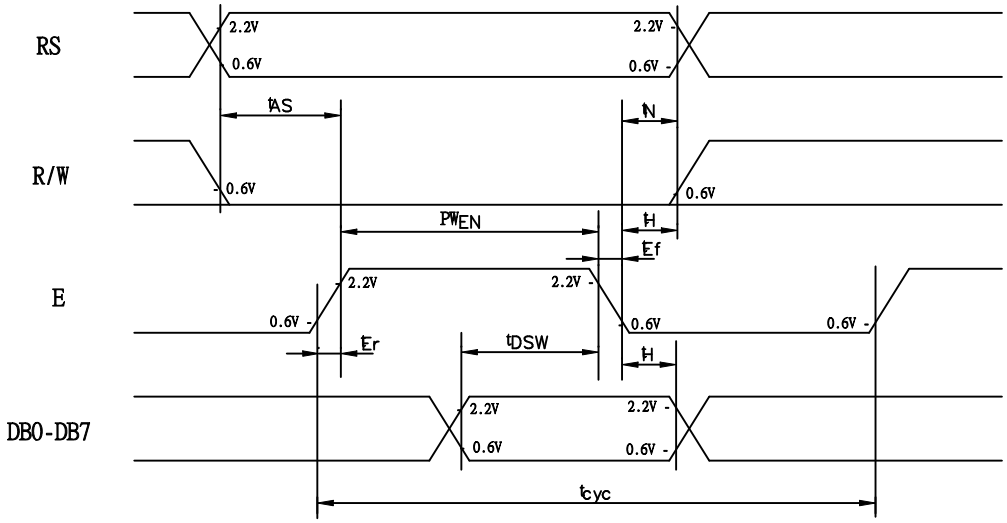
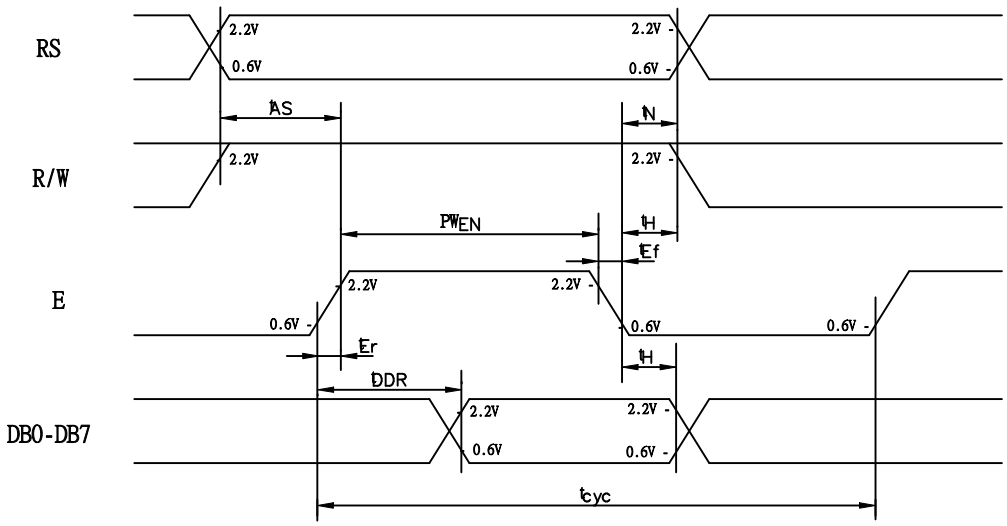
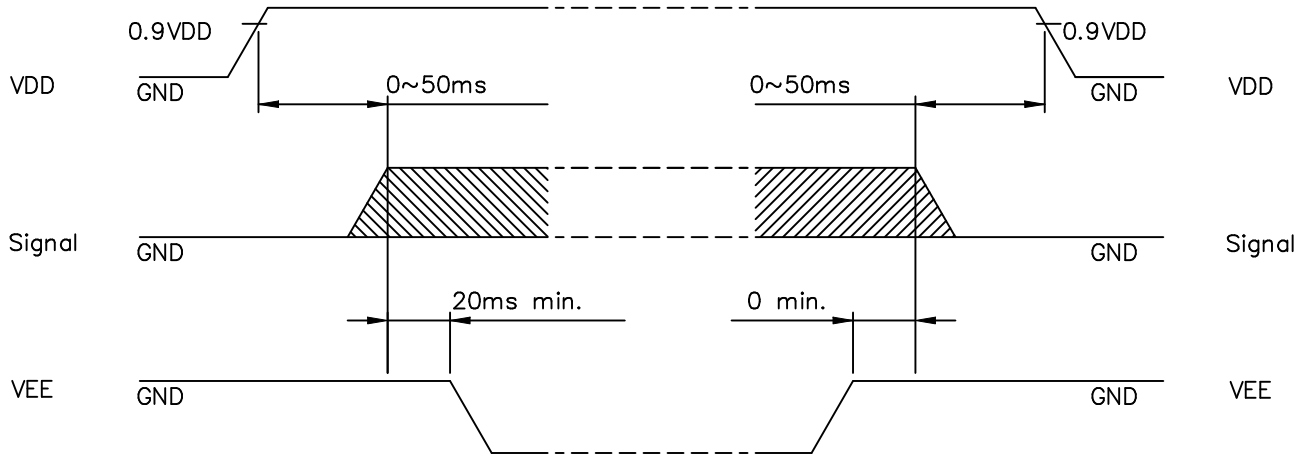


Fig. a Interface timing (data write)



Interface timing (data read)

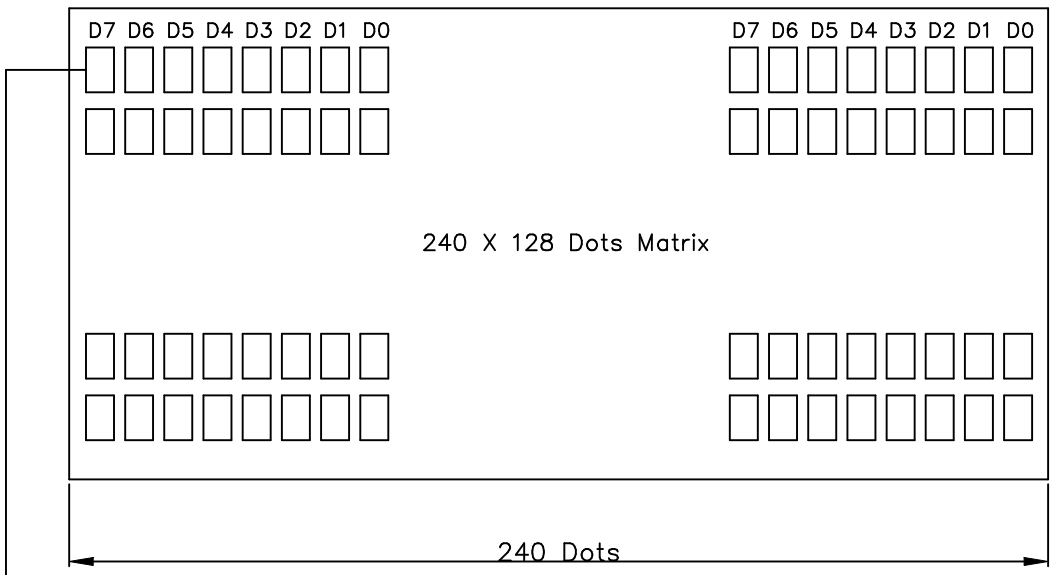
8-2.POWER ON/OFF TIMING



POWER ON POWER OFF

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

8-3 DISPLAY PATTERN



Startting dot for the startting address of display RAM.

D0~D7 are 8 bits transmitted data, where D0 is LSB and D7 is MSB.

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

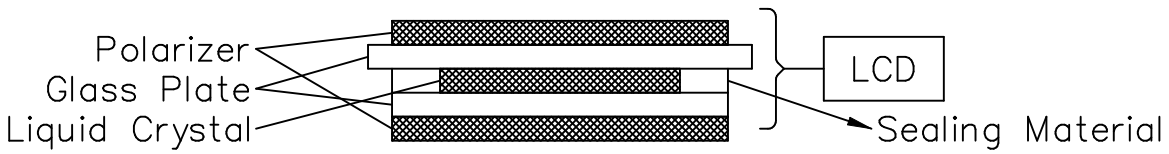
The NAN YA inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of NAN YA LCD produces.

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



4.Outgoing Inspection

4-1 Inspection Method

MIL-STD-105E Level Ⅱ Regular inspection

4-2 Inspection Standard

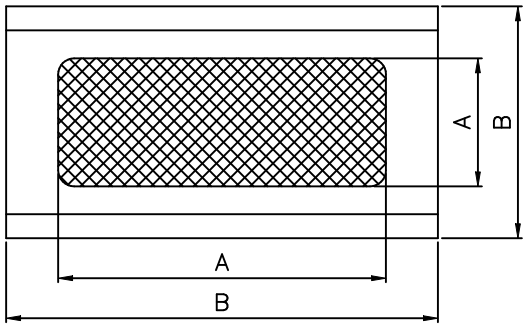
	Item		AQL(%)	Remarks
Major Defect	Dots	Opens Shorts Erroneous operation	0.4	faults which substantially lower the practicality and the initial purpose difficult to achieve.
	Solder appearance	Shorts Loose		
	Cracks	Display surface cracks		

	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.

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

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

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

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

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.	CCFL backlight turn on/off	Within Specified value

5-2 External Appearance Defect

<table>
<tr><th>NO.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>1.</td><td>Black spots, foreign matter, and white spots (Including light leakage due to pinholes of polarizing plates, etc.)</td><td>(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≦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.

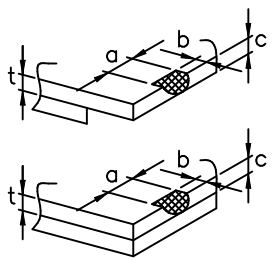
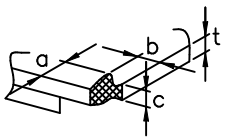
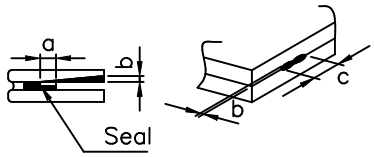
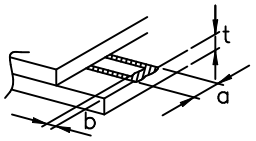
Note that when there are 2 pieces or more, they are not to be concentrated.
Set as: Average diameter = (Long diameter + Short diameter)/2</td></tr>
</table>

<table>
<tr><td>1.</td><td>Line</td><td>(1)-1-Lines(At non lighting condition)

<table><tr><th>Width(mm): W</th><th>Length(mm): L</th><th>Number of pieces permitted</th></tr><tr><td>W≦0.03</td><td>Ignore</td><td>Ignore</td></tr><tr><td>0.03<W≦0.08</td><td>L≦4</td><td>2</td></tr><tr><td>0.08<W≦0.1</td><td>L≦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.

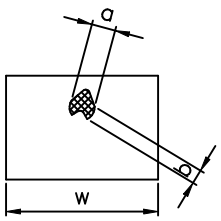
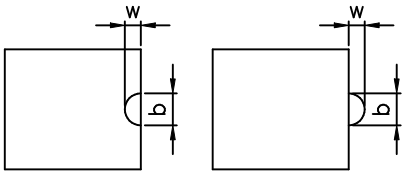
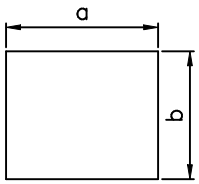
(1)-2-Blurred Lines(At lighting condition)

<table><tr><th>Width(mm): W</th><th>Length(mm): L</th><th>Number of pieces permitted</th></tr><tr><td>W≦0.03</td><td>Ignore</td><td>Ignore</td></tr><tr><td>0.03<W≦0.08</td><td>L≦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.</td></tr>
<tr><td>2.</td><td>Scratches(Glass, reflection plates, and polarizing plates)</td><td>In accordance with black spots.
(At non lighting condition)</td></tr>
<tr><td>3.</td><td>Color irregular</td><td>Not remarkable color irregular.</td></tr>
</table>

<table>
<tr><td>4.</td><td>Air bubbles polarizing plates, and reflection plates</td><td colspan="2">
<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</td><td>0</td></tr>
</table>
Average diameter = (Long diameter + Short diameter)/2
Note that when there are 4 pieces or more, they are not to be concentrated.
</td></tr>
<tr><td rowspan="5">5.</td><td rowspan="5">Cracks</td><td>(1)General crack
  </td><td>a≦5
b≦2
c≦t
Where, a and b are ignored when less that or equal 0.5. The numbers of pieces are set at up to 5 pieces.</td></tr>
<tr><td>(2)Corner crack
  </td><td>a≦2.5
b≦2.5
c≦t
a+b≦4</td></tr>
<tr><td>(3)Seal portion crack
  </td><td>a≦The seal widthx1/3
b≦tx2/3
c≦5
The numbers of pieces are set at up to 5 pieces.</td></tr>
<tr><td>(4)ITO Pin crack
  </td><td>a≦5
b≦1/3 pin length
c≦t</td></tr>
<tr><td>(5)Progressive cracks</td><td>All taken to be unacceptable.</td></tr>
</table>

6.	Outer dimensions	Should be with in 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 mouting position, etc.

5-3 Dot Appearance Defect

NO.	Item	Criteria
1.	Pinhole	 Dot display a and b are each ≦0.2mm 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 ≦0.2mm The overall total is taken to be with in 10 units.
3.	Thick and thin display	 Taken to be within±1.5% of display character width(a) and height(b).

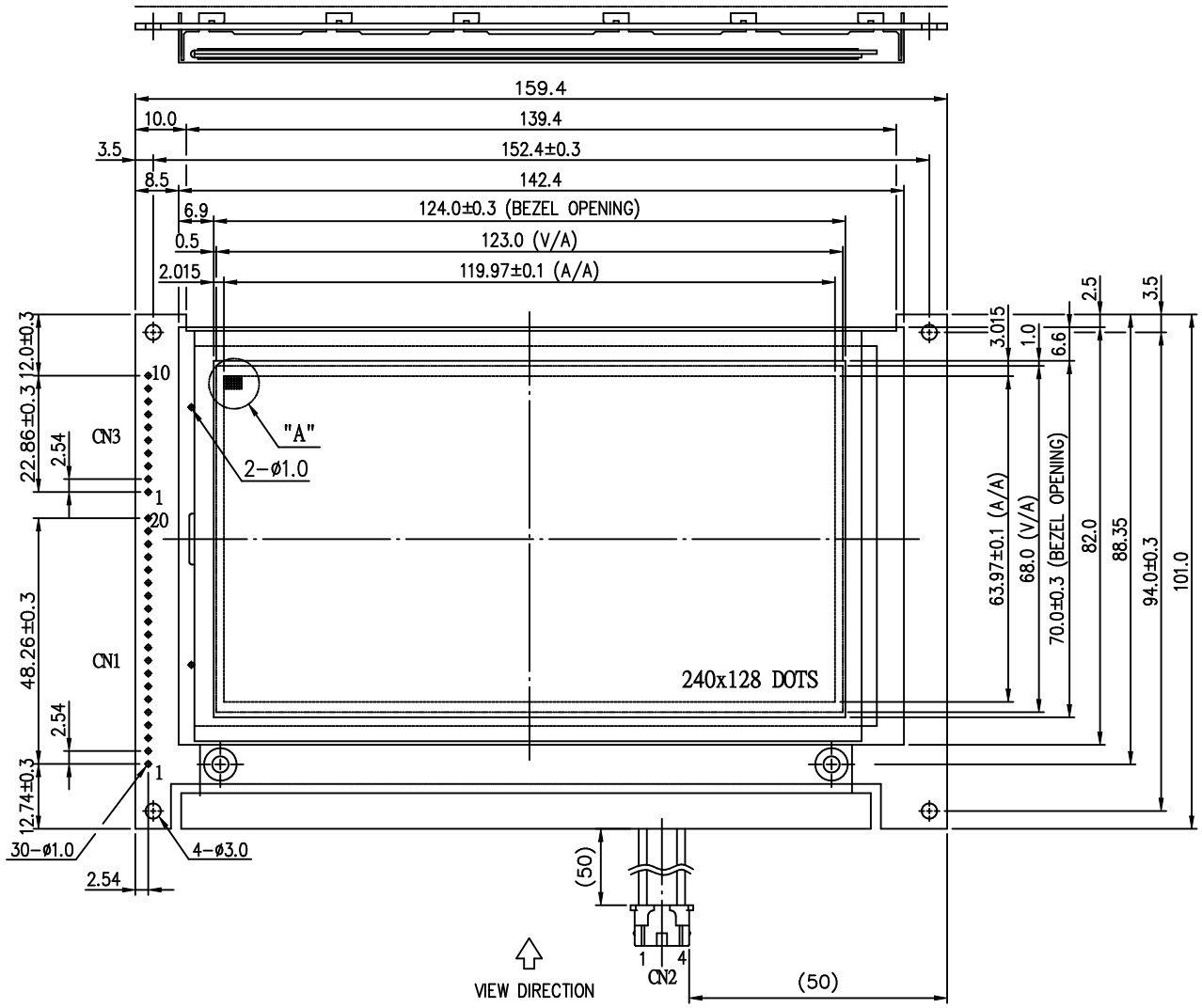
NOTICE:

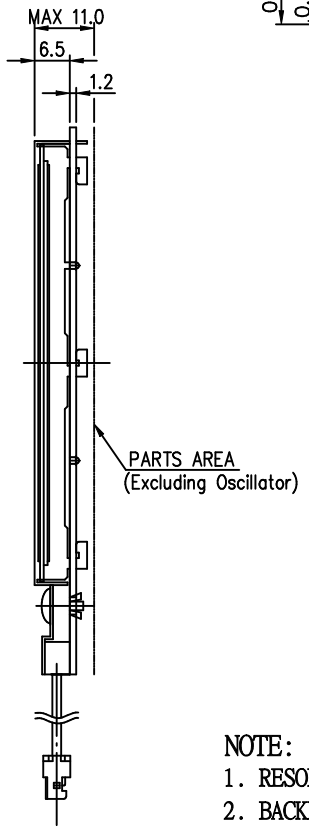
- SAFETY
  1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

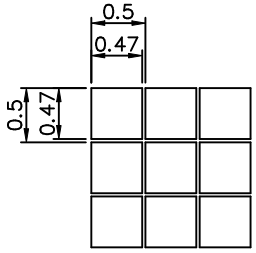
- HANDLING
  1. Avoid static electricity which can damage the CMOS LSI.
  2. Do not remove the panel or frame from the module.
  3. The polarizing plate of the display is very fragile. So, please handle it very carefully.
  4. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch 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°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.







"A" DETAIL
S = 20:1

NOTE:
1. RESOLUTION : 240x128 DOTS
2. BACKLIGHT : CCFL (WHITE)
3. GLASS THICKNESS : 0.7mm
4. FRAME MATERIAL : SECC (t=0.5)

CN1 : PITCH 2.54mm

Pin No	Symbol	Function
1	VSS	GROUND (0V)
2	VDD	POWER SUPPLY FOR LOGIC CIRCUIT (+5V)
3	V0	POWER SUPPLY FOR LCD DRIVE
4	RS	REGISTER SELECT
5	R/W	READ/WRITE
6	E	ENABLE
7	DB0	DISPLAY DATA
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	$\overline{CS}$	CHIP SELECT
16	$\overline{RES}$	RESET
17	VEE	POWER SUPPLY FOR LCD DRIVE
18	D.OFF	NC/DISPLAY GND/DISPLAY OFF
19	NC	NO CONNECTION
20	NC	NO CONNECTION

CN2 : M63M83-04 (MITSUMI)

Pin No	Symbol	Function
1	GND	CFL GND
2	N.C	—
3	N.C	—
4	H.V	POWER SUPPLY FOR CFL

GENERAL TOLERANCE LIST

DIMENSION	TOLERANCE
L ≦ 6	±0.25 (mm)
6 < L ≦ 18	±0.3 (mm)
18 < L ≦ 50	±0.4 (mm)
50 < L ≦ 125	±0.5 (mm)
125 < L	±0.6 (mm)

REV. NO.	DESCRIPTION	DATE	DESIGN	CHECK	APPROVE
5					
4					
3					
2					
1					

南亞塑膠工業股份有限公司
NAN YA PLASTICS CORPORATION

製品圖

LMBFAT410GCDS

	NAME	DATE	THIRD ANGLE P.
APPROVE			
CHECK			
DESIGN	CLOUDE	95.11.24	SCALE / UNIT
DRAWN	CLOUDE	95.11.24	1/1 / mm

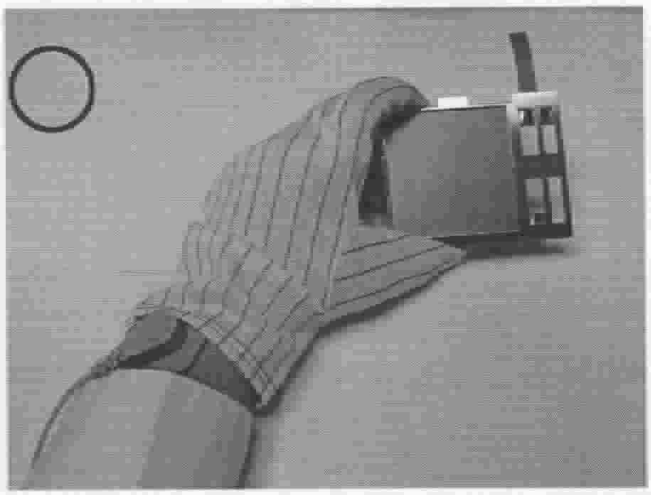
DWG NO. M410DD0A

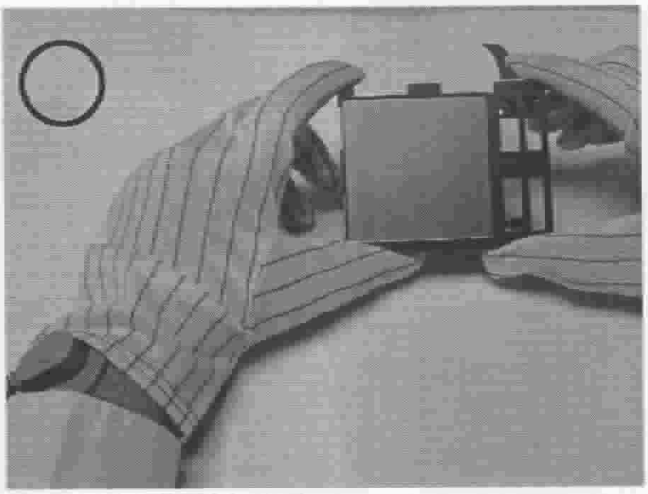
THE NOTES OF LCM USING

LCM is easy to damage.

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

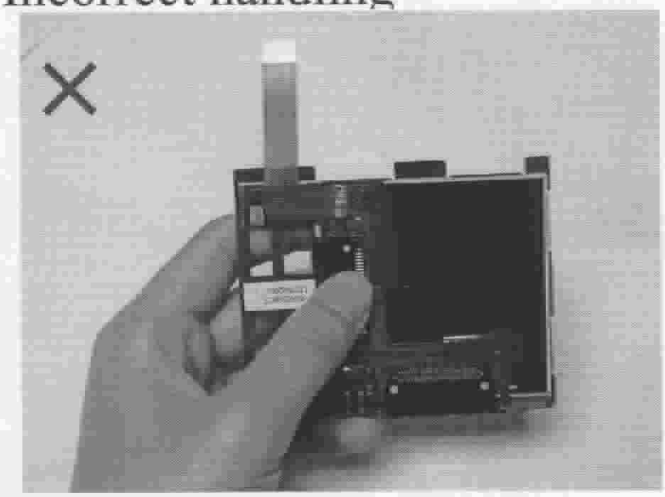
Correct handling



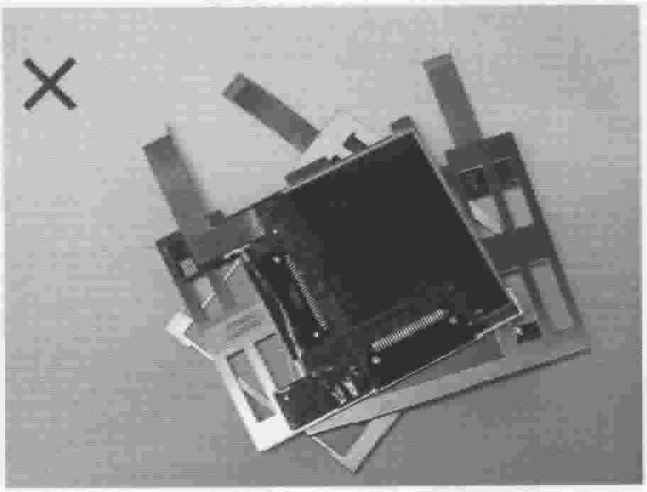


As above picture, please handle with glove by LCM edges and full EOS/ESD protection.

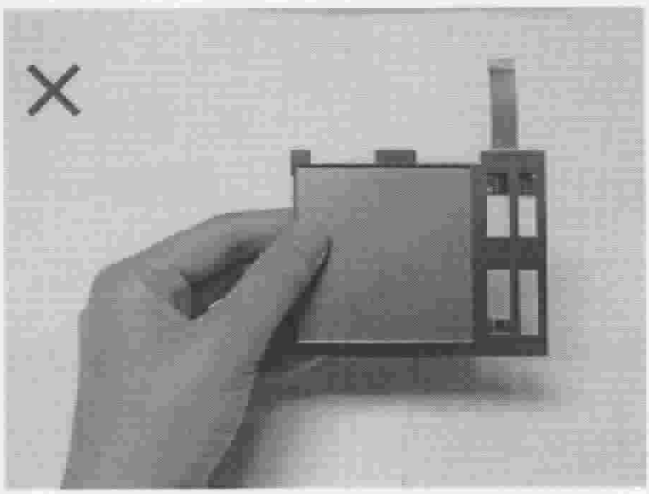
Incorrect handling



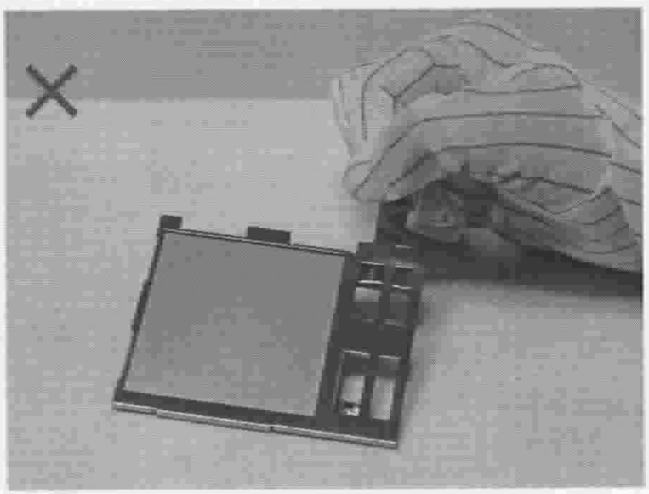
Please don't touch IC directly.



Please don't put one on another LCM.



Please don't hold the surface of LCM.

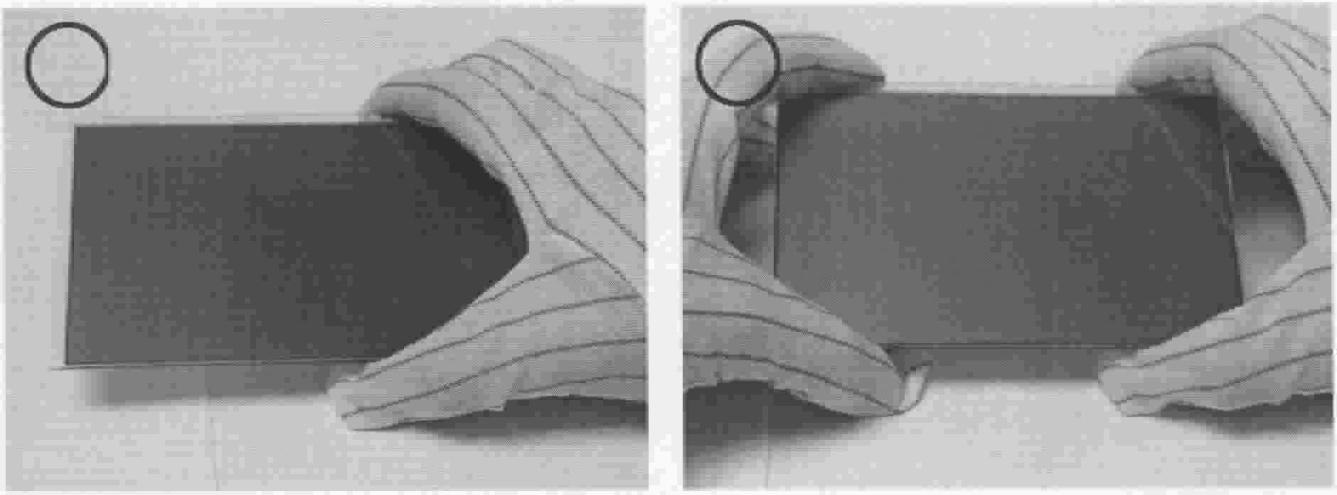


Please don't stretch interface of output.

THE NOTES OF LCD USING

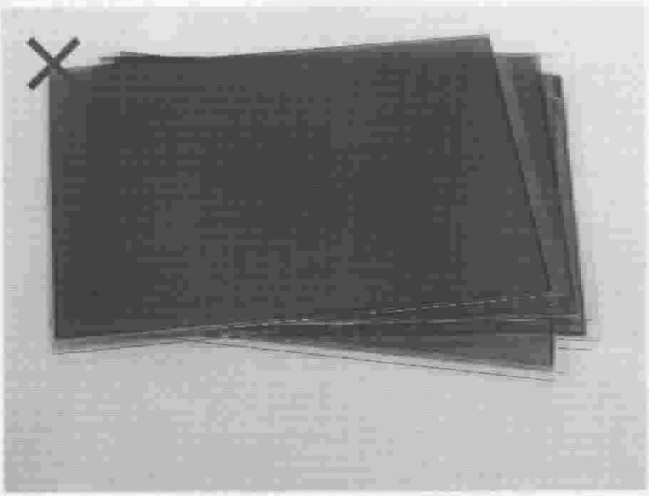
LCD is easy damage.
Please follow notes as bellows, and be careful of handling!

Correct handling

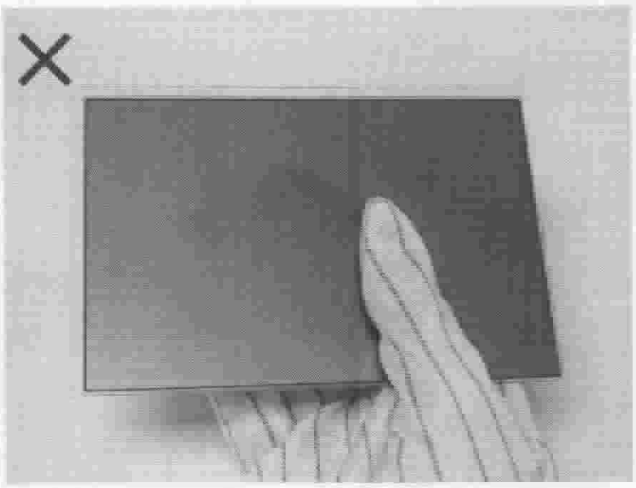


As above picture, please handle with glove by LCD edges and full EOS/ESD protection.

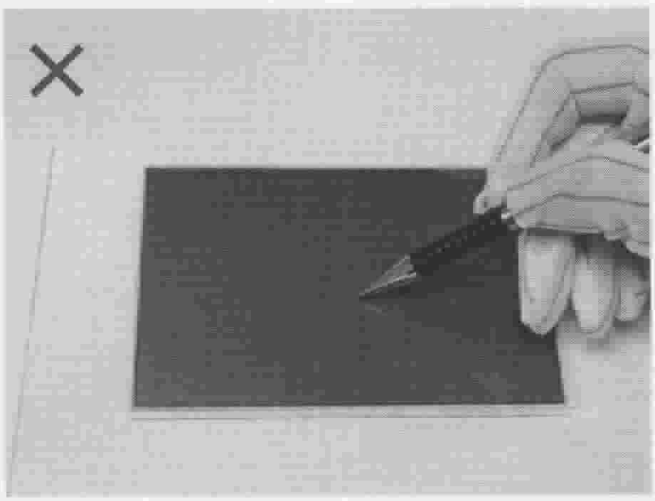
Incorrect handling



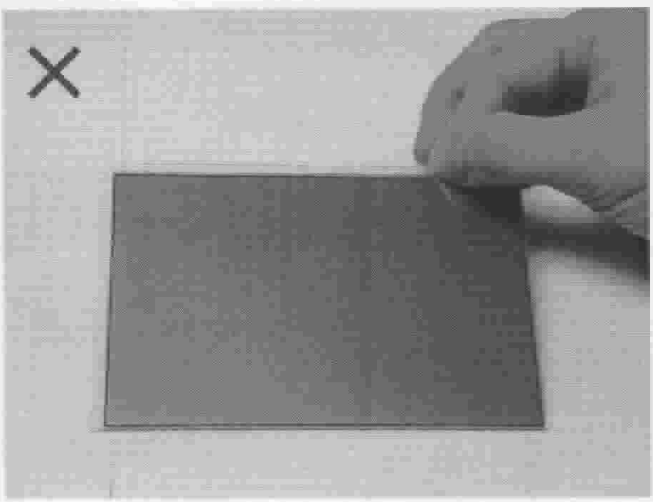
Please don't put one on another LCD.



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.