NAN YA PLASTICS CORPORATION

SPECIFICATION OF
LCD MODULE
PRODUCT NO.: LMC97H436J54GLS_

SPEC. NO.: LM436-54- △0

CUSTOMER
APPROVED BY
DATE:

LCD DEPARTMENT
ELECTRONIC MATERIALS DIVISION
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EDITED ON : JANUARY.24.2007

Q.C. DEPT.	DESIGN MANAGER	DESIGN CHECK	DESIGNER
			C.Y.CHAN

RECORDS OF REVISION

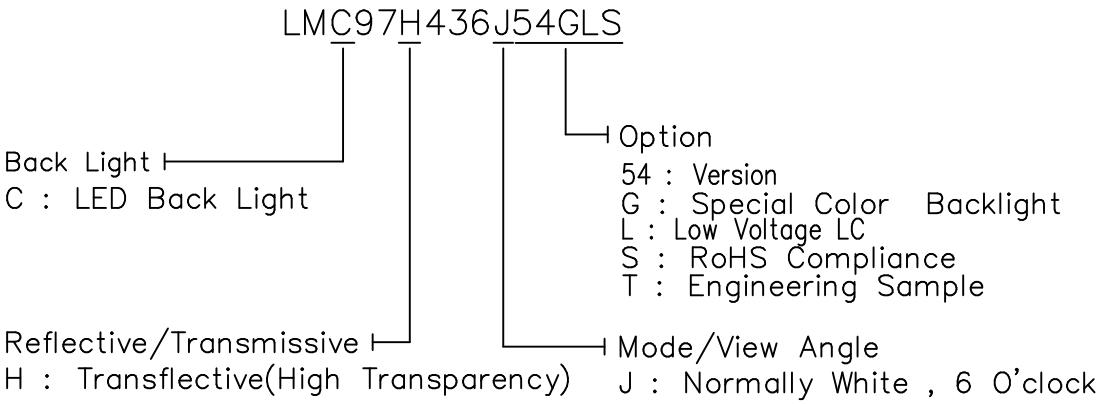
SPEC. NO. : LM436-54

DATE	REVISED NO.	REF. PAGE	SUMMARY	DESIGN	CHECK
01.24.2007	0	1/23~23/23	First Issue	C.Y.CHAN	

1. MECHANICAL DATA

NO	ITEM	CONTENTS	UNIT
1	Product No.	LMC97H436J54GLS_	–
2	Module Size	93.0 (W) x 70.0 (H) x Max.12.5 (D)	mm
3	Dot Size	0.48 (W) x 0.48 (H)	mm
4	Dot Pitch	0.52 (W) x 0.52 (H)	mm
5	Number of Dots	128 (W) x 64 (H)	Dot
6	Duty	1/64	–
7	LCD Display Mode	Black and White(Normal White/Positive Image)	–
8	Rear Polarizer	Transflective(High Transparency)	–
9	Viewing Direction	6	O'clock
10	Backlight	LED	–
11	Controller	NT7107 / NT7108 OR COMPATIBLE	–
12	DC/DC Converter	Included	–
13	Touch Panel	Excluded	–
14	Weight	75.0 (Approx.)	g

Note :



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

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

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	WIDE TEMP.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	-20	70
Humidity (Without Condensation)	Note 2,4		Note 3,4	

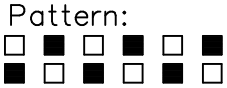
Note 1. LCM should be grounded during handling LCM.

Note 2 Ta ≦ 50°C : 80%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

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic	VDD-VSS	–		4.5	5.0	5.5	V
Input Voltage	VIH	H level		0.8VDD	–	VDD	V
	VIL	L level		0	–	0.2VDD	
Recommended LC Driving Voltage	VDD-V0	Duty =1/64	0°C	9.1	9.5	9.9	V
			25°C	8.8	9.2	9.6	
			50°C	8.7	9.1	9.5	
Power Supply Current	IDD	VDD = 5.0V VDD-V0=9.2 V Ta=25°C		–	2	3	mA
	IEE	Pattern: 		–	1.5	3	
Surface Luminance of LCM	L	Ta=25°C V_{AK} = 5 V Pattern: Dots All ON		–	15	–	cd/m²
		Ta=25°C V_{AK} = 5 V Pattern: Dots All OFF		30	40	–	

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used LED Rating (Constant Voltage Driving) Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Peak forward current	I_P	–	–	120	mA	–
Maximum reverse voltage	V_R	–	–	5	V	–
Applied forward voltage	V_{AK}	–	5	–	V	–
Applied forward current	I_{AK}	–	–	80	mA	–
LED power consumption	P_F	–	–	0.4	W	–
LED life time	L_L	–	40000	–	hrs	at V_{AK} = 5V (*1)

(*1) LED 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)		ø(Viewing Angle)	
		0°C		25°C		50°C		25°C		25°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
H	J	4.5	6.0	4.5	6.0	3.5	5.0	–	36-26	–	±31
Note		NOTE 6						NOTE 5			

NOTE :

H: Transflective(High Transparency)

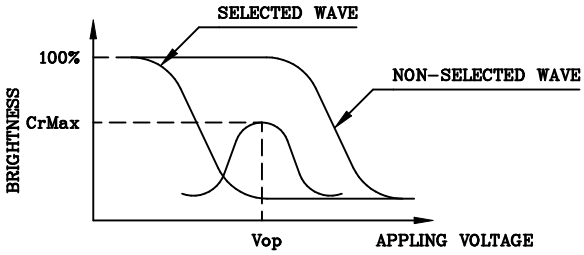
J: Normally White , 6 O'clock

AT ø=0° θ=0°

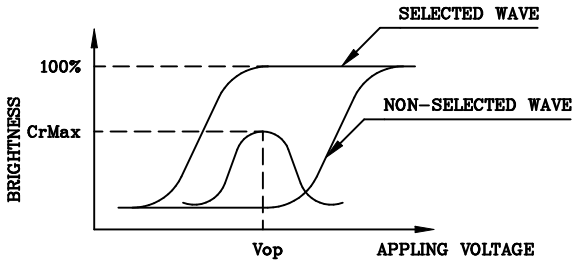
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0°C	680	850	1270	ms	NOTE 2
		25°C	160	200	300		
		50°C	95	120	180		
Response Time (fall)	Tf	0°C	400	500	600	ms	NOTE 2
		25°C	95	120	180		
		50°C	40	50	75		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



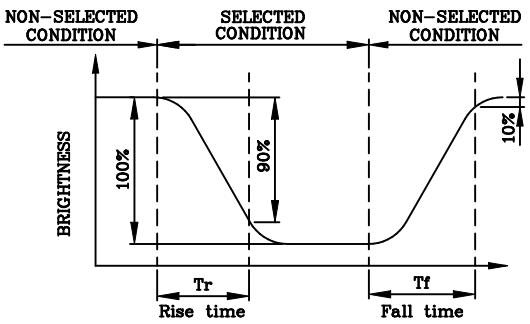
(negative type)

*Conditions

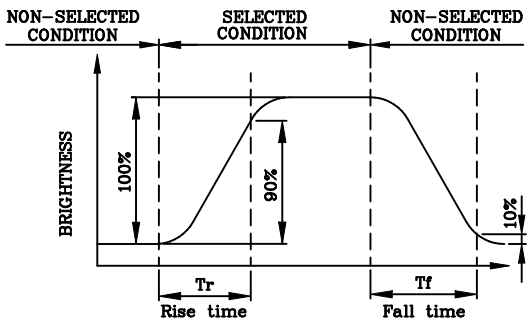
Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



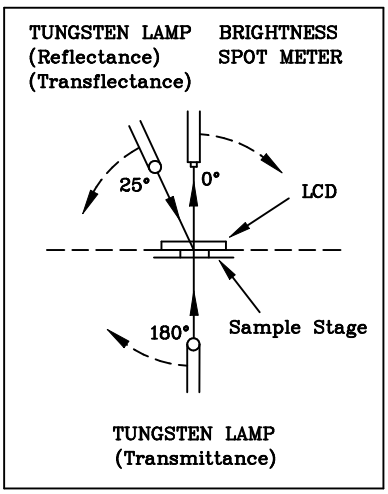
(negative type)

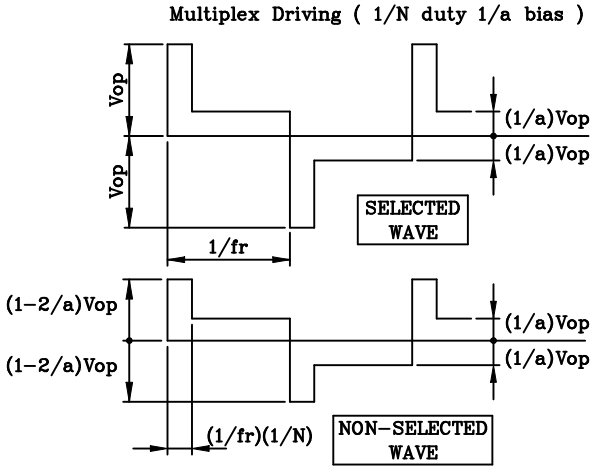
*Conditions

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

(NOTE 3)

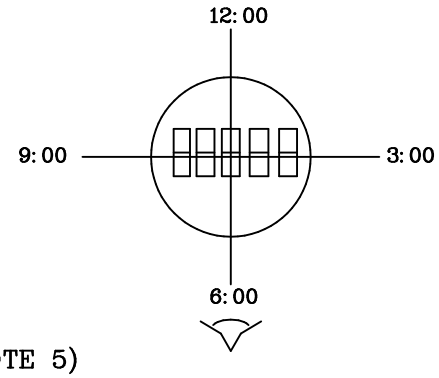
Description of Measuring Equipment and Driving Waveforms





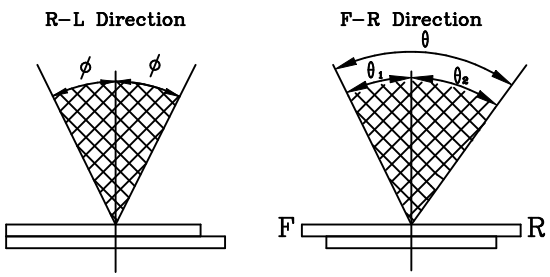
(NOTE 4)

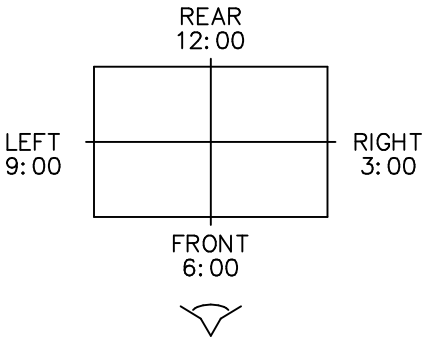
Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle





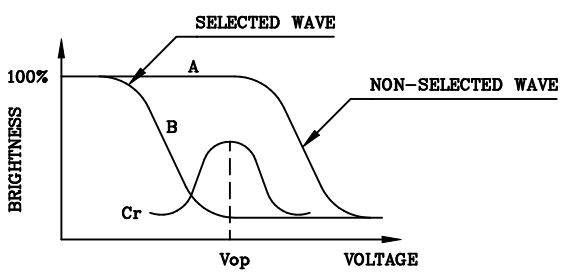
$\theta = \theta_1 + \theta_2$

*Conditions

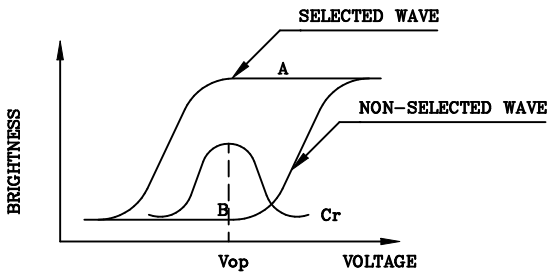
Operating Voltage : Vop
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



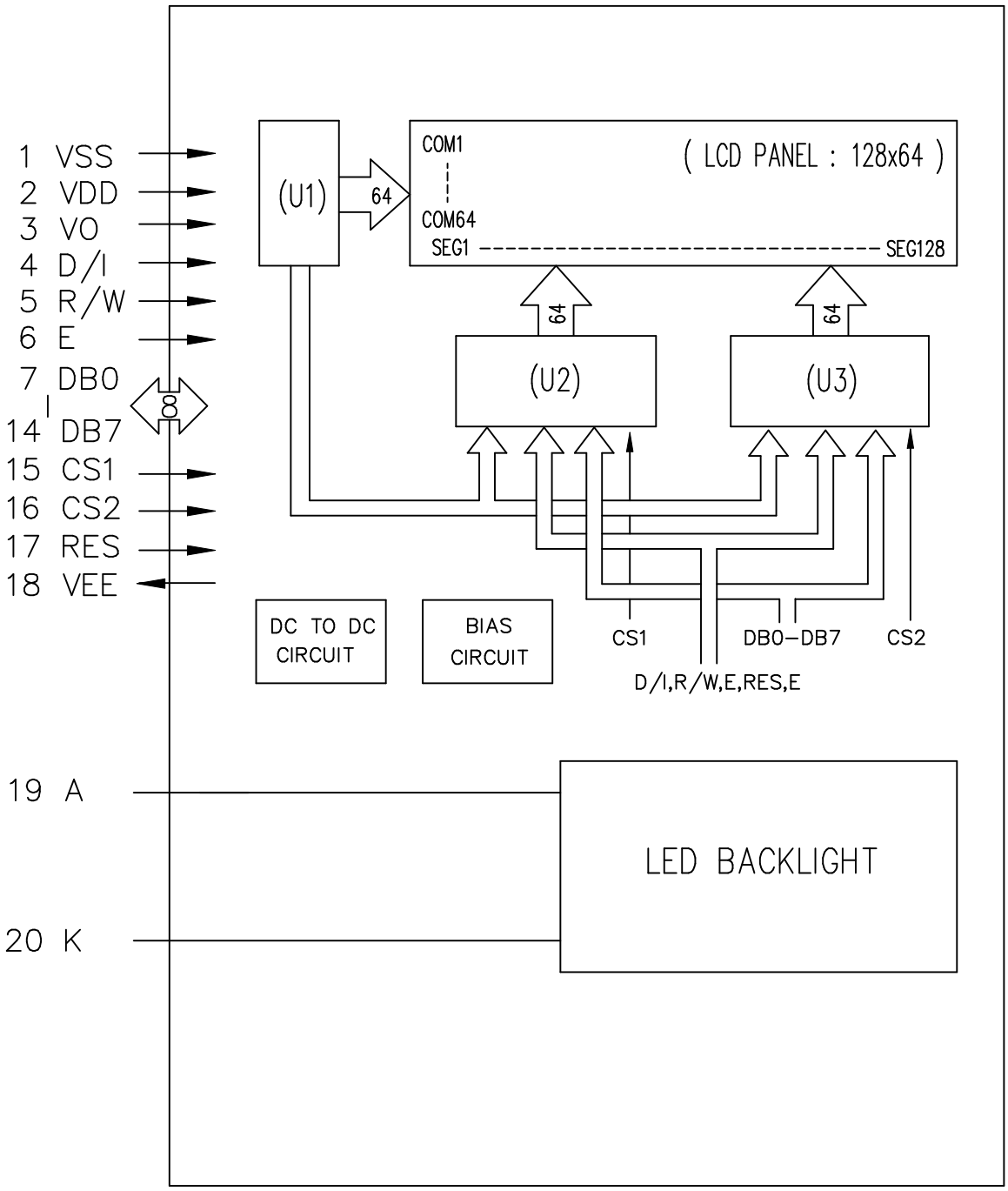
(negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

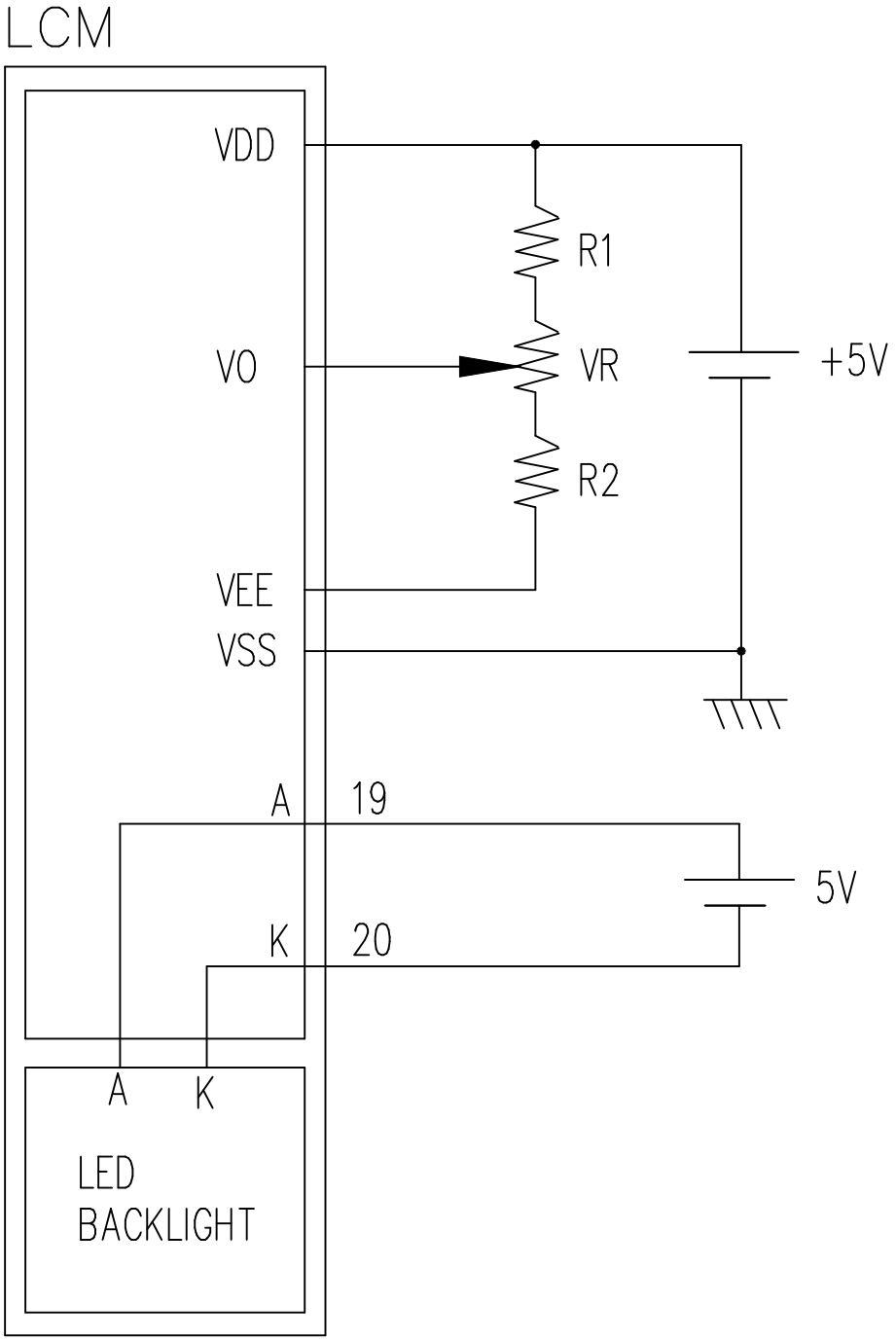
5. BLOCK DIAGRAM



6. DEFINITION OF INTERFACE

Pin No.	Symbol	Level	Function	
1	VSS	–	0V	Power Supply
2	VDD	–	+5V	
3	V0	–	Operating Voltage for LCD Driving	
4	D/I	H/L	H : Data Input L : Instruction Code Input	
5	R/W	H/L	H : Data Read (LCM to MPU) L : Data Write (MPU to LCM)	
6	E	H,H→L	Enable Signal	
7	DB0	H/L	Data Bus Line	
8	DB1			
9	DB2			
10	DB3	H/L	Data Bus Line	
11	DB4			
12	DB5			
13	DB6			
14	DB7			
15	CS1	H	Chip Select for IC1	
16	CS2	H	Chip Select for IC2	
17	RES	L	Reset Active "L"	
18	VEE	–	Negative Voltage Output	
19	K	–	Cathode for EL/LED Backlight	
20	A	–	Anode for EL/LED Backlight	

7. POWER SUPPLY



Note:

R1+VR+R2 ≒ 20KΩ

8-1.INTERFACE TIMING CHARACTERISTICS

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Enable cycle time	tcyc	Fig.a , Fig.b	1000	–	–	ns
E high level width	PWEH	Fig.a , Fig.b	450	–	–	ns
E low level width	PWEL	Fig.a , Fig.b	450	–	–	ns
E rise/fall time	tr , tf	Fig.a , Fig.b	–	–	25	ns
Address set up time	tAS	Fig.a , Fig.b	140	–	–	ns
Address hold time	tAH	Fig.a , Fig.b	10	–	–	ns
Data delay time	tDDR	Fig.b	–	–	320	ns
Data set up time	tDSW	Fig.a	200	–	–	ns
Data hold time (WR)	tDHW	Fig.a	10	–	–	ns
Data hold time (RD)	tDHR	Fig.b	20	–	–	ns

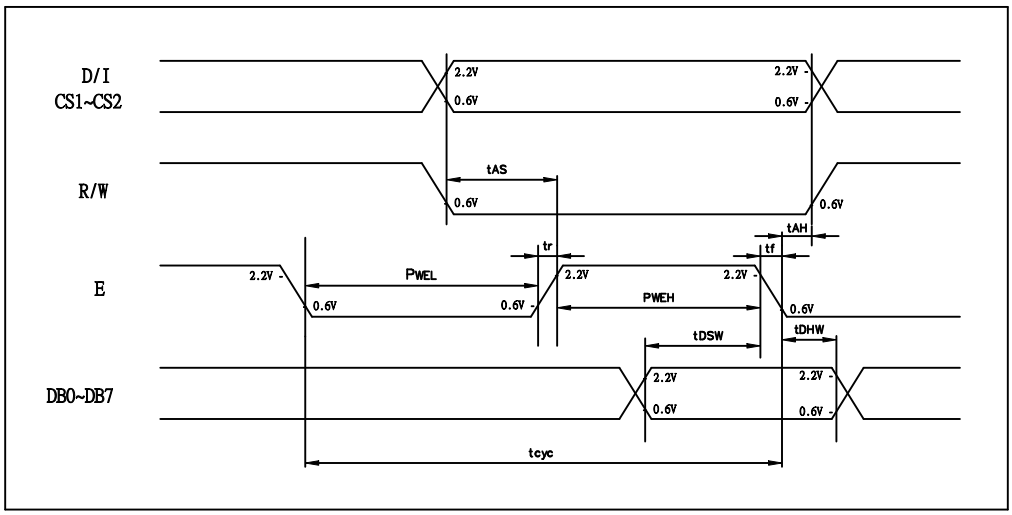


Fig.(a) Interface timing (data write)

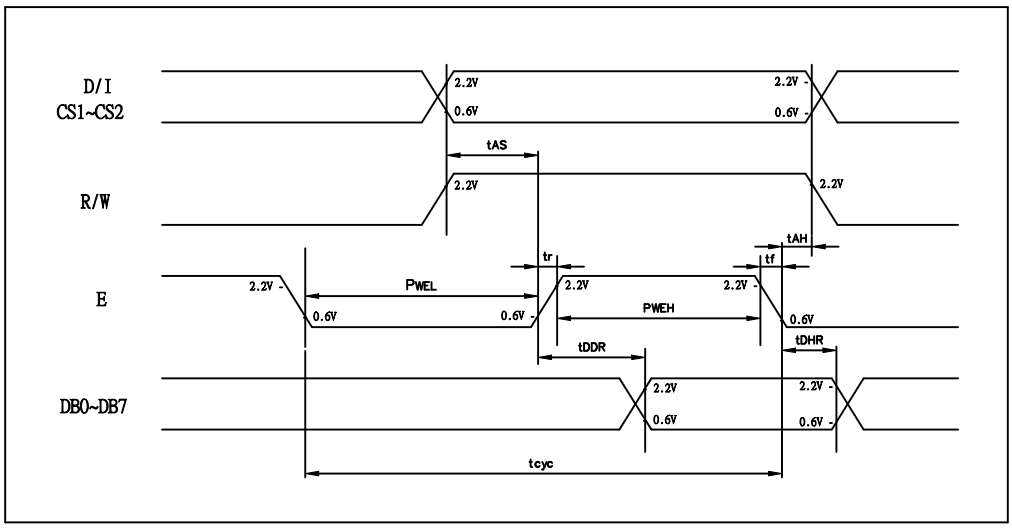
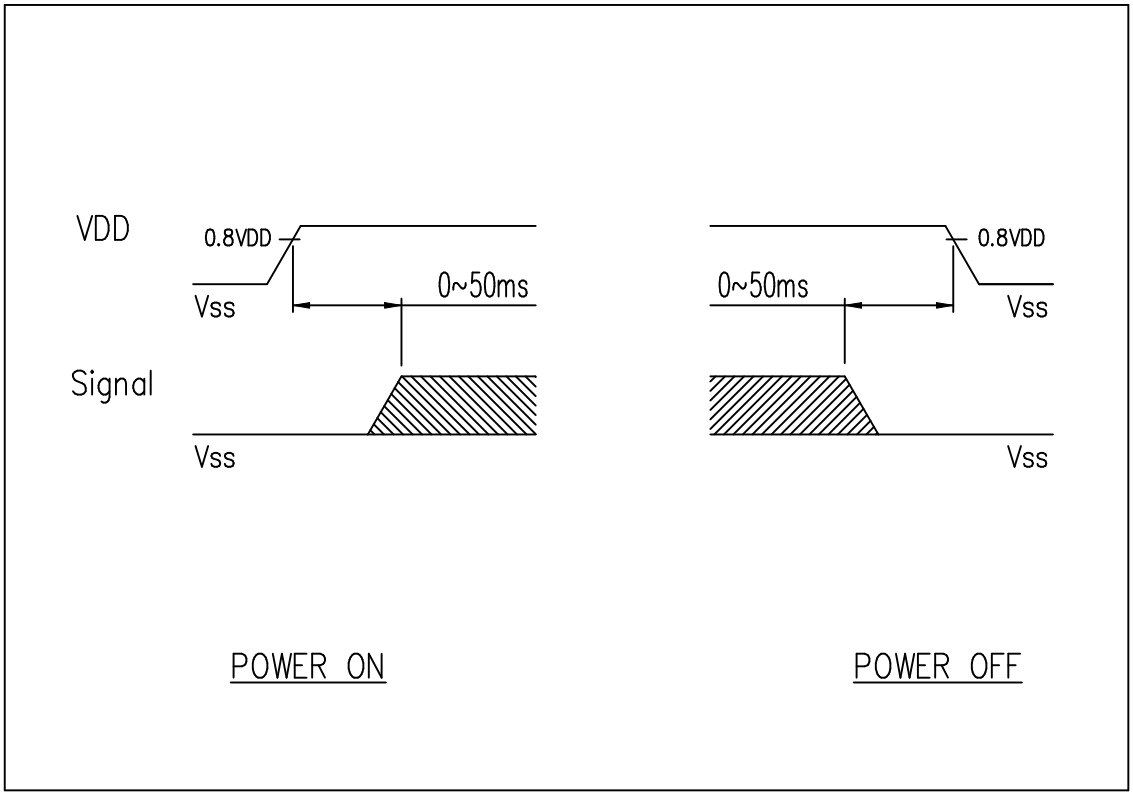


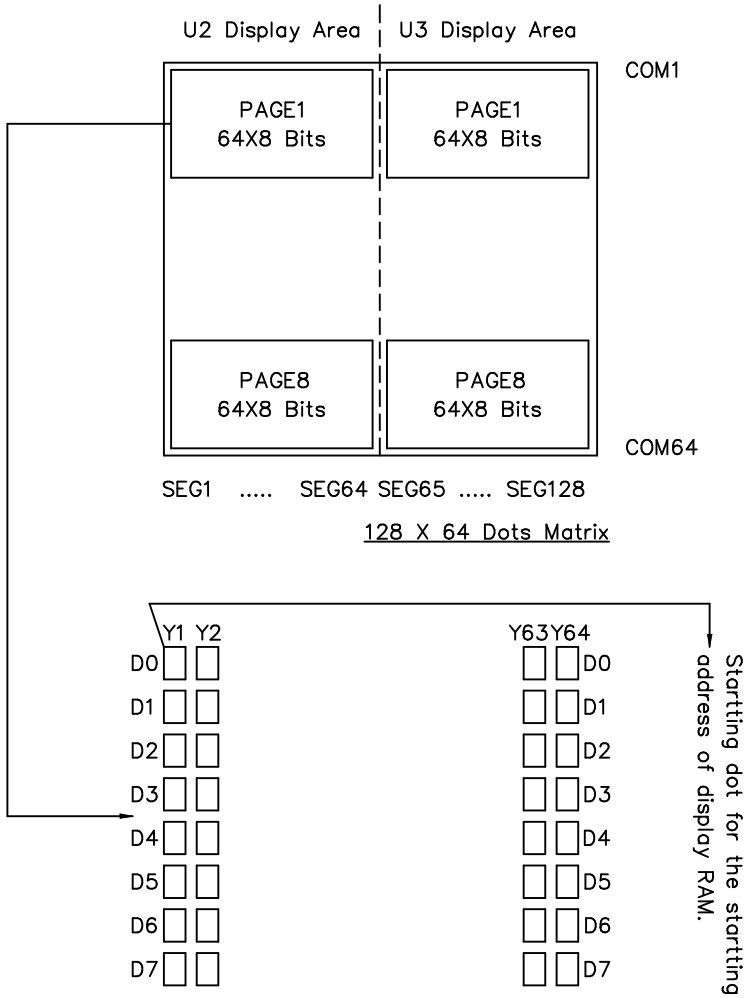
Fig.(b) Interface timing (data read)

8-2.POWER ON/OFF TIMING CHARACTERISTICS

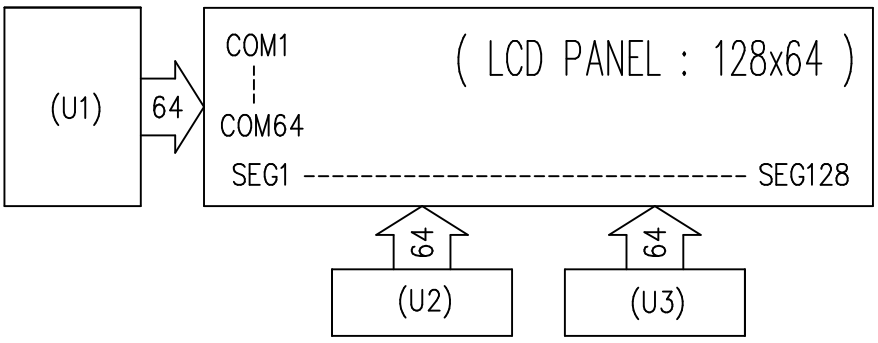


** The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

8-3. DISPLAY PATTERN



** Each segment driver has 8 pages RAM , and each page has 64 x 8 bits RAM .
D0~D7 are 8 bits transmitted data , where D0 is LSB and D7 is MSB .



9. RELIABILITY TEST

NORMAL TEMPERATURE RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	70°C	120Hrs		Appearance without defect	
2	Low Temp. Storage	−20°C	120Hrs		Appearance without defect	
3	High Temp. & High Humi. Storage	50°C 90%RH	120Hrs		Appearance without defect	
4	High Temp. Operating Display	50°C	120Hrs		Appearance without defect	
5	Low Temp. Operating Display	0°C	120Hrs		Appearance without defect	
6	Thermal Shock	−20°C,30min → 70°C,30min ↑ (1cycle)			Appearance without defect	10 cycles

Inspection Provision

1.Purpose

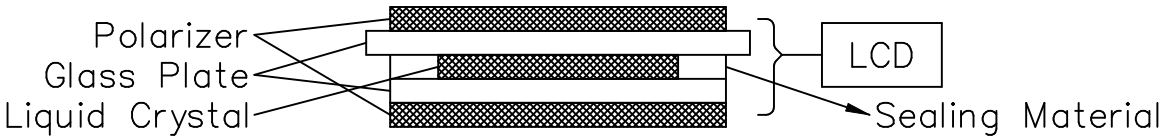
The NAN YA inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of NAN YA LCD produces.

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

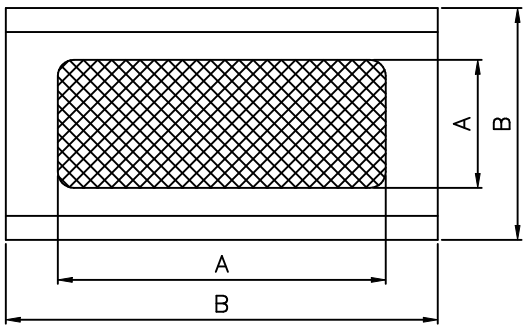
4-2 Inspection Standard

	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 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(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

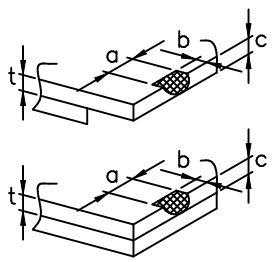
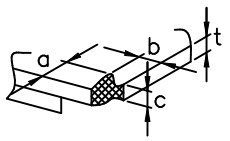
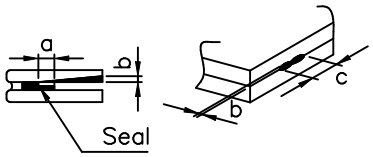
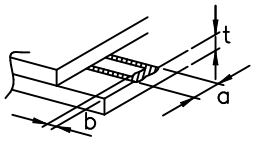
5-1 Electrical characteristics

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	Backlight turn on/off	Within Specified value

5-2 External Appearance Defect

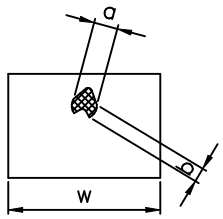
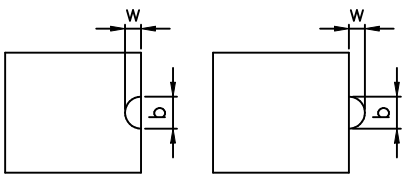
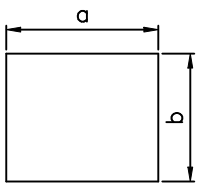
<table>
<tr><th>NO.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>1</td><td>Black spots, foreign matter, and white spots (Including light leakage due to pinholes of polarizing plates, etc.)</td><td>(1)-1-Spots
<table><tr><th>Average Diameter(mm): D</th><th>Number of pieces permitted</th></tr><tr><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
<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 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>a≦2.5
b≦2.5
c≦t
a+b≦4</td></tr>
<tr><td>(3)Seal portion crack
 
</td><td>a≦The seal width x1/3
b≦t x2/3
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 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 ≦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).

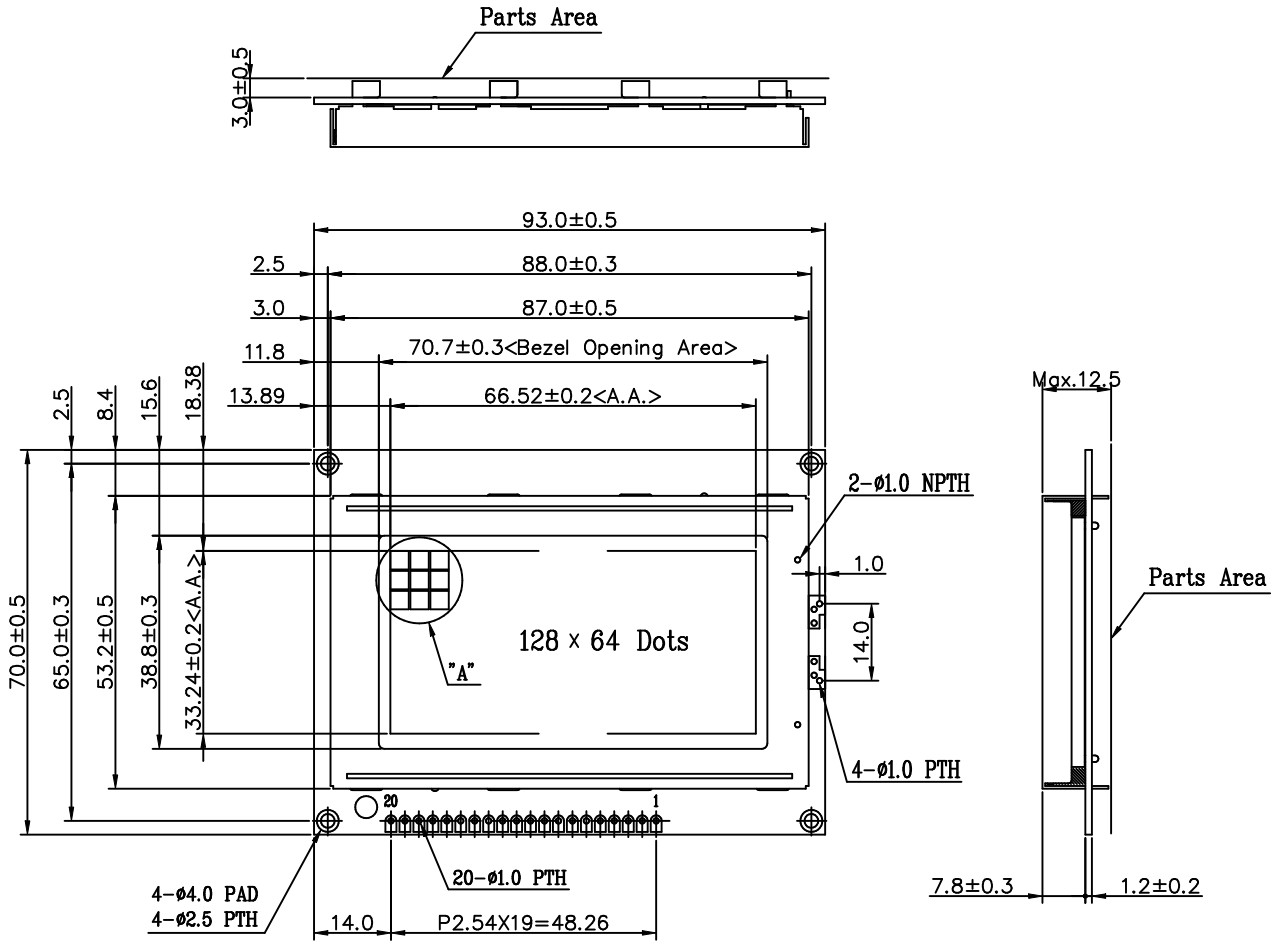
NOTICE:

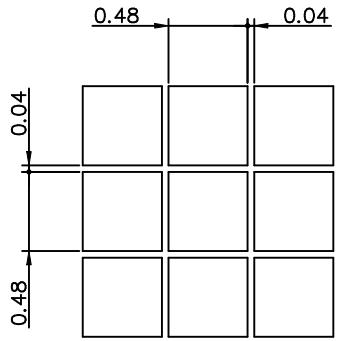
- SAFETY
  1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- 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.





Detail "A"
(Scale 30:1)

View Direction

Notes :

1. Resolution : 128 x 64 Dots
2. Frame : SPCC (0.5 t)
3. Backlight : LED (White)
4. DC/DC Coverter : Built-In

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	VSS	Power Supply (0V)	10	DB3	Data Bus Line
2	VDD	Power Supply (+5V)	11	DB4	
3	V0	Operating Voltage for LCD Driving	12	DB5	
4	D/I	H : Data Input L : Instruction Code Input	13	DB6	
			14	DB7	
5	R/W	H: Data Read (LCM to MPU) L: Data Write (MPU to LCM)	15	CS1	Chip Select for IC1
			16	CS2	Chip Select for IC2
6	E	Enable Signal	17	RES	Reset Active "L"
7	DB0	Data Bus Line	18	VEE	Negative Voltage Output
8	DB1		19	A	Power Supply for LED Backlight
9	DB2		20	K	

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)
ANGLE	±1° (DEG)

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

LMC97H436J54GLS_

	NAME	DATE	THIRD ANGLE P.
APPROVE	TONY CHOU	96.01.15	
CHECK	Y. C. Liu	96.01.09	
DESIGN	Campos Chen	96.01.05	SCALE: 1/1
DRAWN	Campos Chen	96.01.05	UNIT: mm

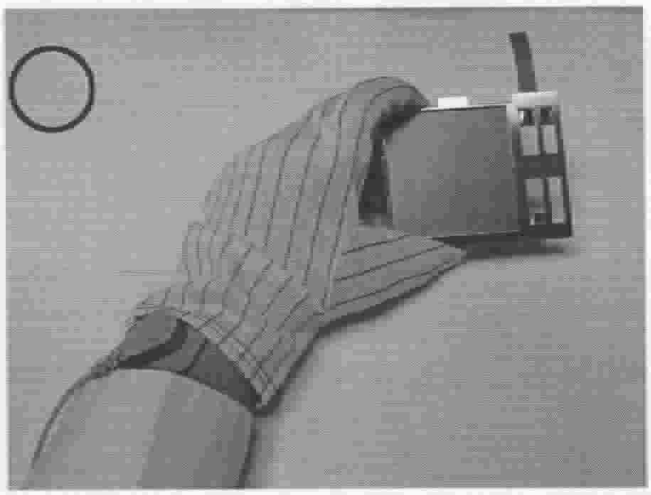
DWG NO. M436-D54A

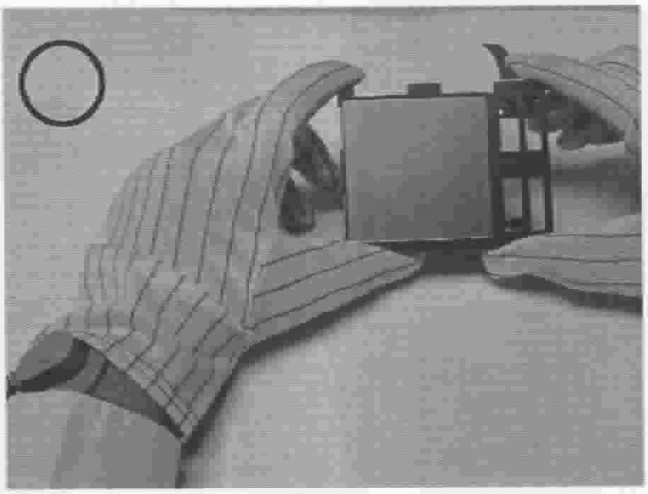
THE NOTES OF LCM USING

LCM is easy to damage.

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

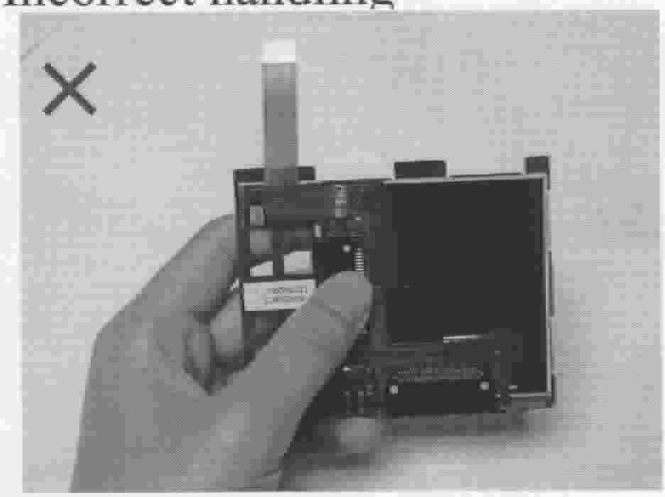
Correct handling



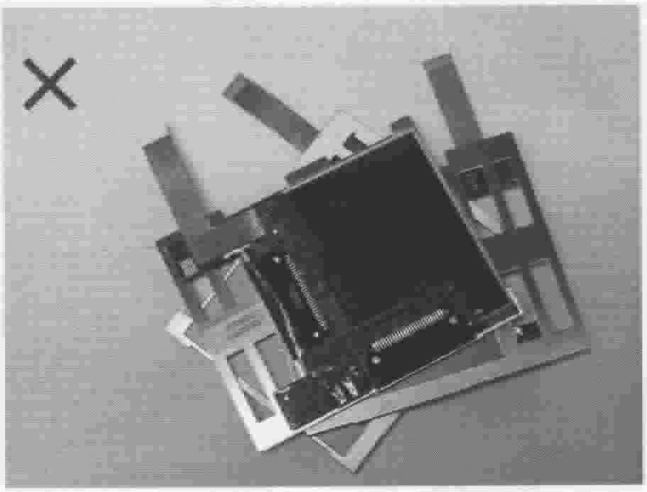


As above picture, please handle with glove by LCM edges and full EOS/ESD protection.

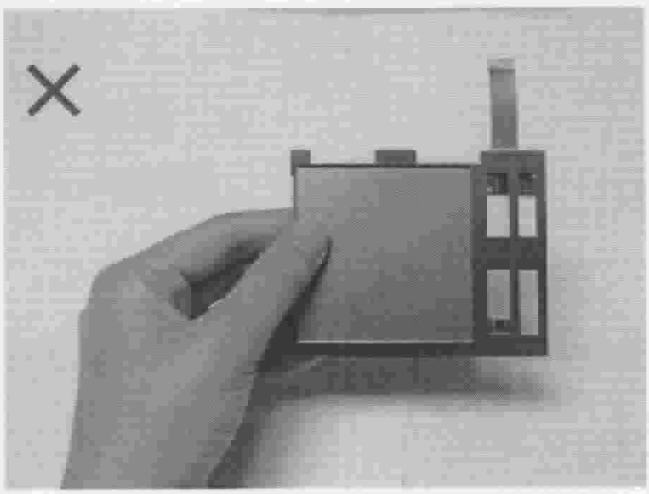
Incorrect handling



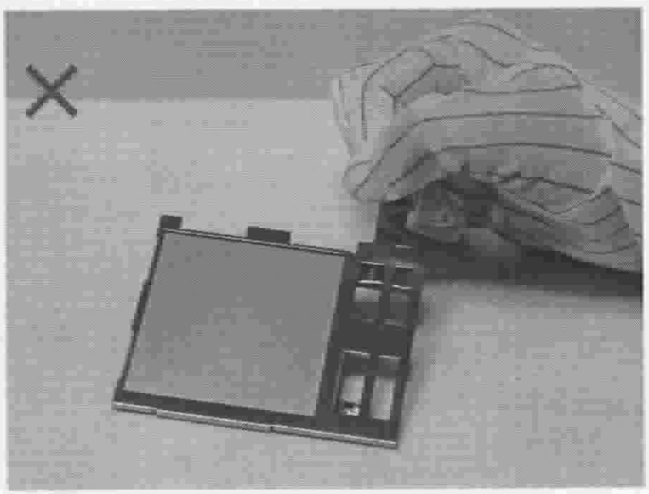
Please don't touch IC directly.



Please don't put one on another LCM.



Please don't hold the surface of LCM.

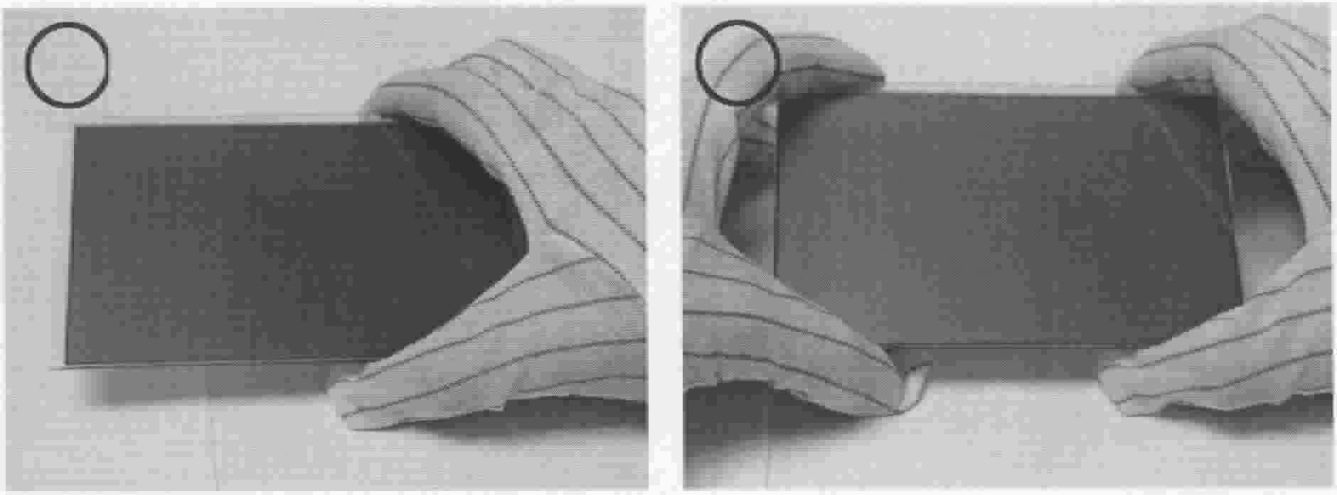


Please don't stretch interface of output.

THE NOTES OF LCD USING

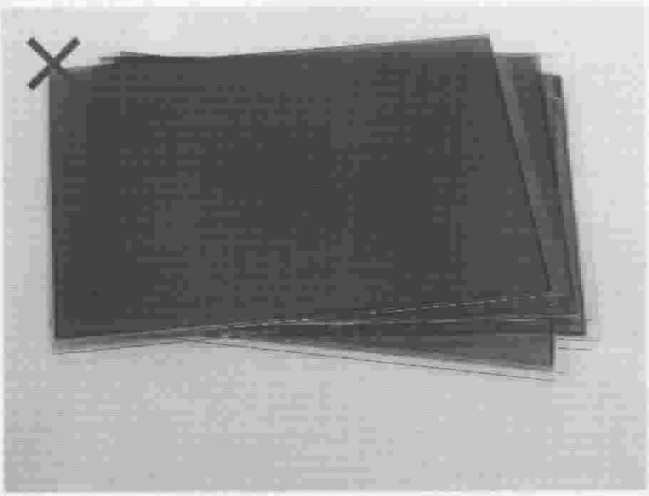
LCD is easy damage.
Please follow notes as bellows, and be careful of handling!

Correct handling

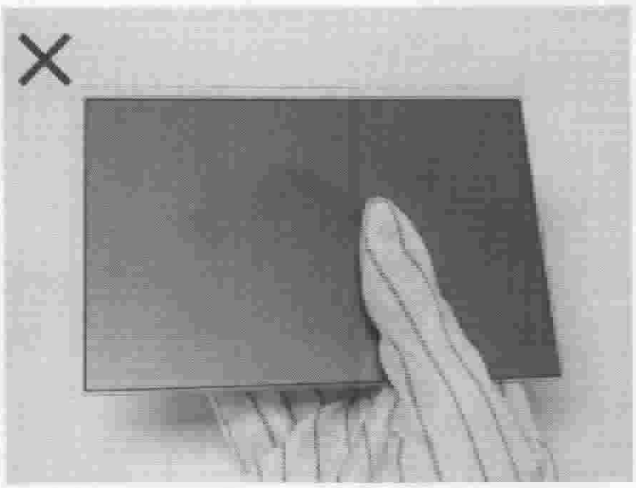


As above picture, please handle with glove by LCD edges and full EOS/ESD protection.

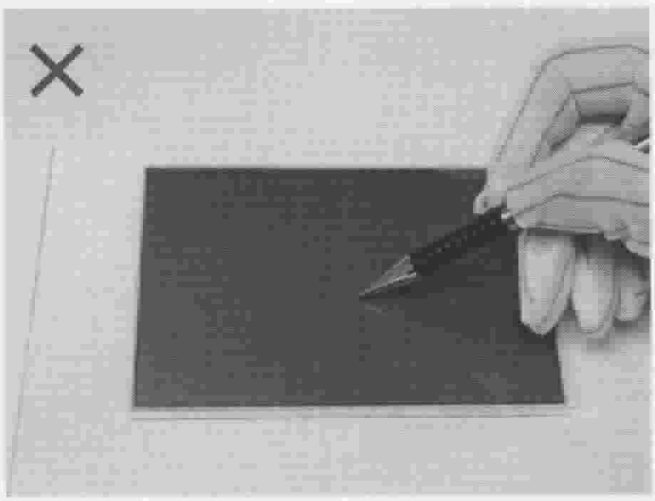
Incorrect handling



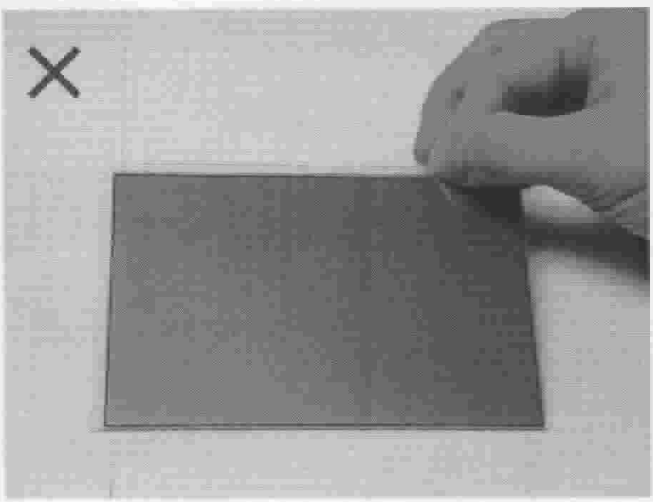
Please don't put one on another LCD.



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.