NAN YA PLASTICS CORPORATION

SPECIFICATION OF
LCD MODULE
PRODUCT NO.: LTD96S306QDGS_

SPEC. NO.: LM306-0D-△0

CUSTOMER
APPROVED BY
DATE:

EDITED ON : DEC.01.2005

LCD DEPARTMENT
ELECTRONIC MATERIALS DIVISION
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Q.C. DEPT.	DESIGN MANAGER	DESIGN CHECK	DESIGNER
			J.P Weng

RECORDS OF REVISION

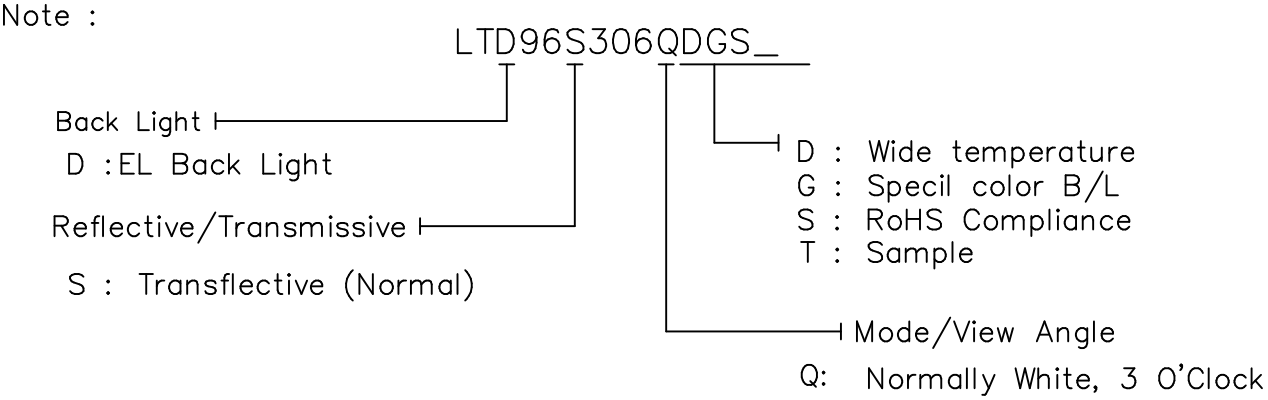
SPEC. : LM306-0D

DATE	REVISED NO.	REF. PAGE	SUMMARY	DESIGN	CHECK
12.01.2005'	0	1~24/24	First Issue	J.P Weng	

1. MECHANICAL DATA

NO	ITEM	CONTENTS	UNIT
1	Product No.	LTD96S306QDGS_	–
2	Module Size	101 (W) x 67 (H) x 5.3 MAX (D)	mm
3	Dot Size	0.31 (W) x 0.31 (H)	mm
4	Dot Pitch	0.32 (W) x 0.32 (H)	mm
5	Number of Dots	240 (W) x 160 (H)	Dot
6	Duty	1/160	–
7	LCD Display Mode	FSTN, Normally White / Positive Image	–
8	Rear Polarizer	Transflective Type	–
9	Viewing Direction	3	O'clock
10	Backlight	EL B/L(Indigo Blue)	–
11	Controller	Excluded	–
12	Weight	30 (Approx.)	g
13	Soldering	Lead Free	–

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=0 V Standard

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD−VSS	−0.3	6.5	V	
Input Voltage	VEE−VSS	0	27	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 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	25°C		3	3.3	3.6	V
Input Voltage		VIH	H level		0.8VDD	–	VDD	V
		VIO	L level		0	–	0.2VDD	V
Recommended LC Driving Voltage (Wide TEMP. LCM)		Vop= VEE-VSS	1/160 Duty 1/13 Bias	-20°C	21.4	21.8	22.2	V
				0°C	20.1	20.5	20.9	
				25°C	18.8	19.2	19.6	
				50°C	17.7	18.1	18.5	
				70°C	16.5	16.9	17.3	
Power Supply Current		IDD	VDD= 3.3V VSS= 0V VEE-VSS=19.2V FLM=70Hz		–	0.5	1	mA
		IEE			–	3	4.5	
Luminance	L	EL AC : 65V,250HZ	PATTERN (Dots ALL Off)		0.8	1	–	cd/m^2
			PATTERN (Dots ALL On)		–	0.4	0.6	

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used EL Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Maximum applied voltage	V_L	–	–	150	Vrms	–
Maximum applied frequcncy	F_L	–	–	1000	Hz	–
EL current	I_L	–	2.4	2.9	mArms	at 65Vrms 250Hz
EL power consumption	P_L	–	0.16	–	W	(*1)
EL life time	L_L	–	1000	–	hrs	at 65Vrms 250Hz (*2)

(*1) Power consumption excluded inverter loss .

(*2) EL 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°C		0°C		25°C		50°C		70°C		25°C		25°C	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
S	Q	8	10	9	11	10	12	6.5	8.5	3.5	5.0	−	36−36	−	46−32
NOTE		NOTE 6										NOTE 5			

NOTE : S: Transflective (Normal)

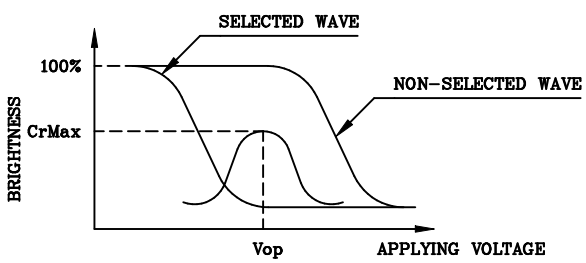
Q: Normally White, 3 O'Clock

AT $\phi=0°$ $\theta=0°$

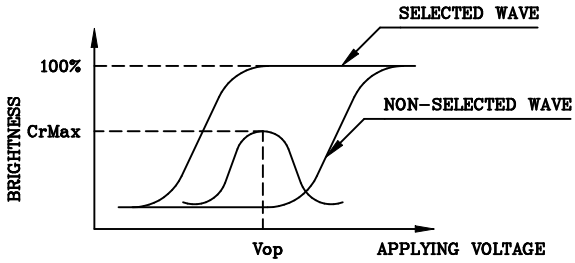
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	−20°C	2200	2700	3200	ms	NOTE 2
		0°C	480	580	680		
		25°C	80	100	120		
		50°C	70	90	110		
		70°C	40	50	60		
Response Time (fall)	Tf	−20°C	900	1100	1300	ms	NOTE 2
		0°C	180	230	280		
		25°C	65	80	95		
		50°C	30	40	50		
		70°C	20	25	30		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



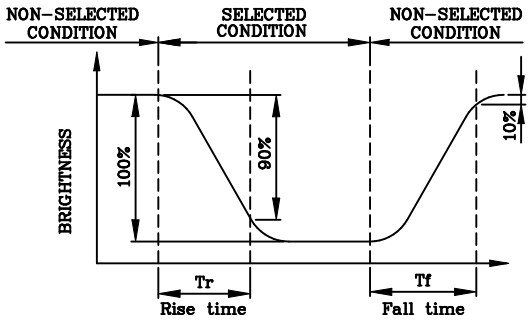
(negative type)

*Conditions

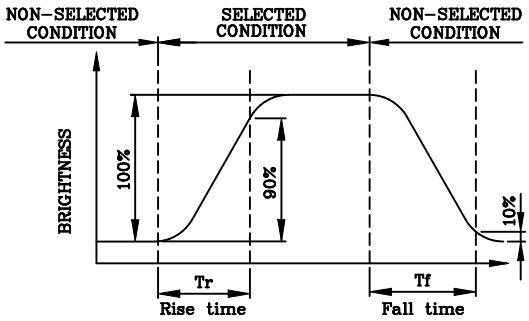
Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



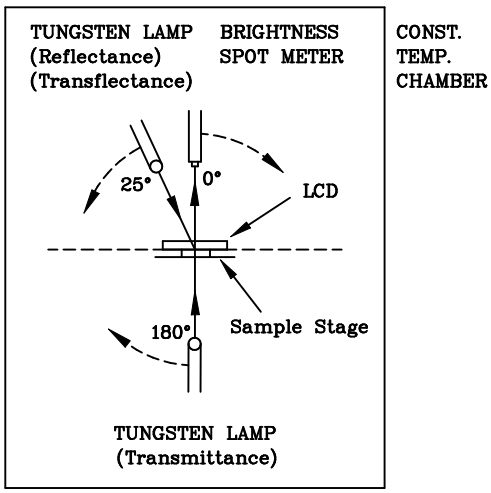
(negative type)

*Conditions

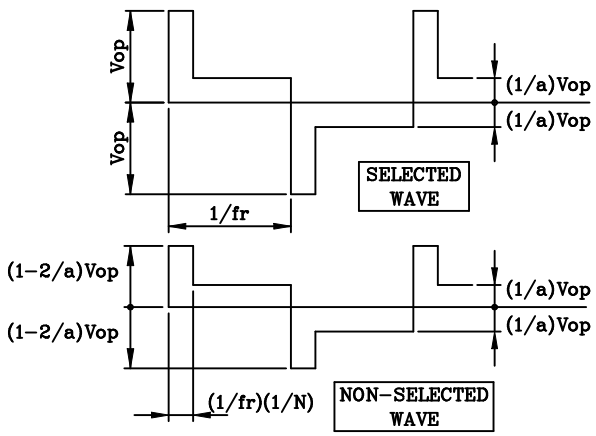
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

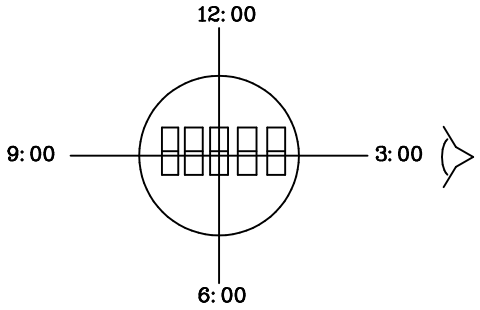


Multiplex Driving (1/N duty 1/a bias)



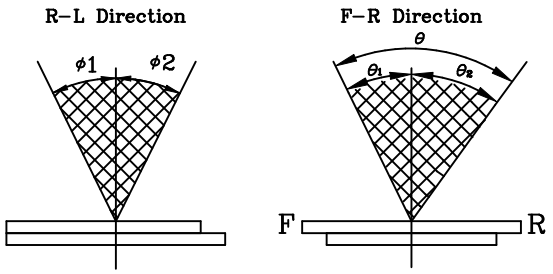
(NOTE 4)

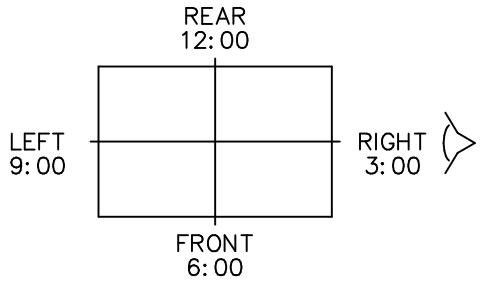
Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle





*For This Product

The Viewing Direction Is 3 O'clock

So $\phi 1 > \phi 2$

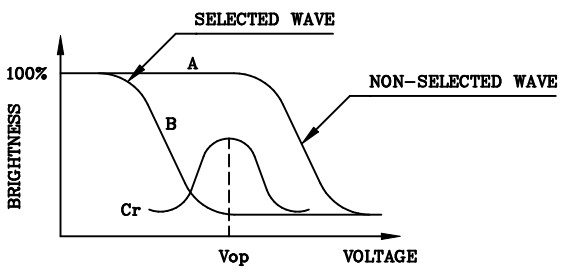
$$\theta = \theta_1 + \theta_2$$

*Conditions

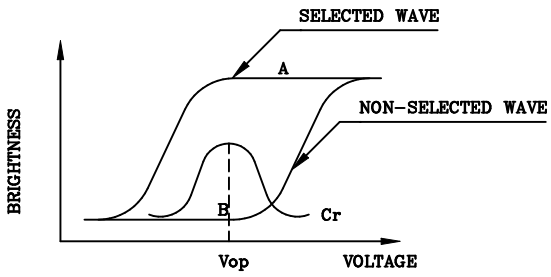
Operating Voltage : Vop
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



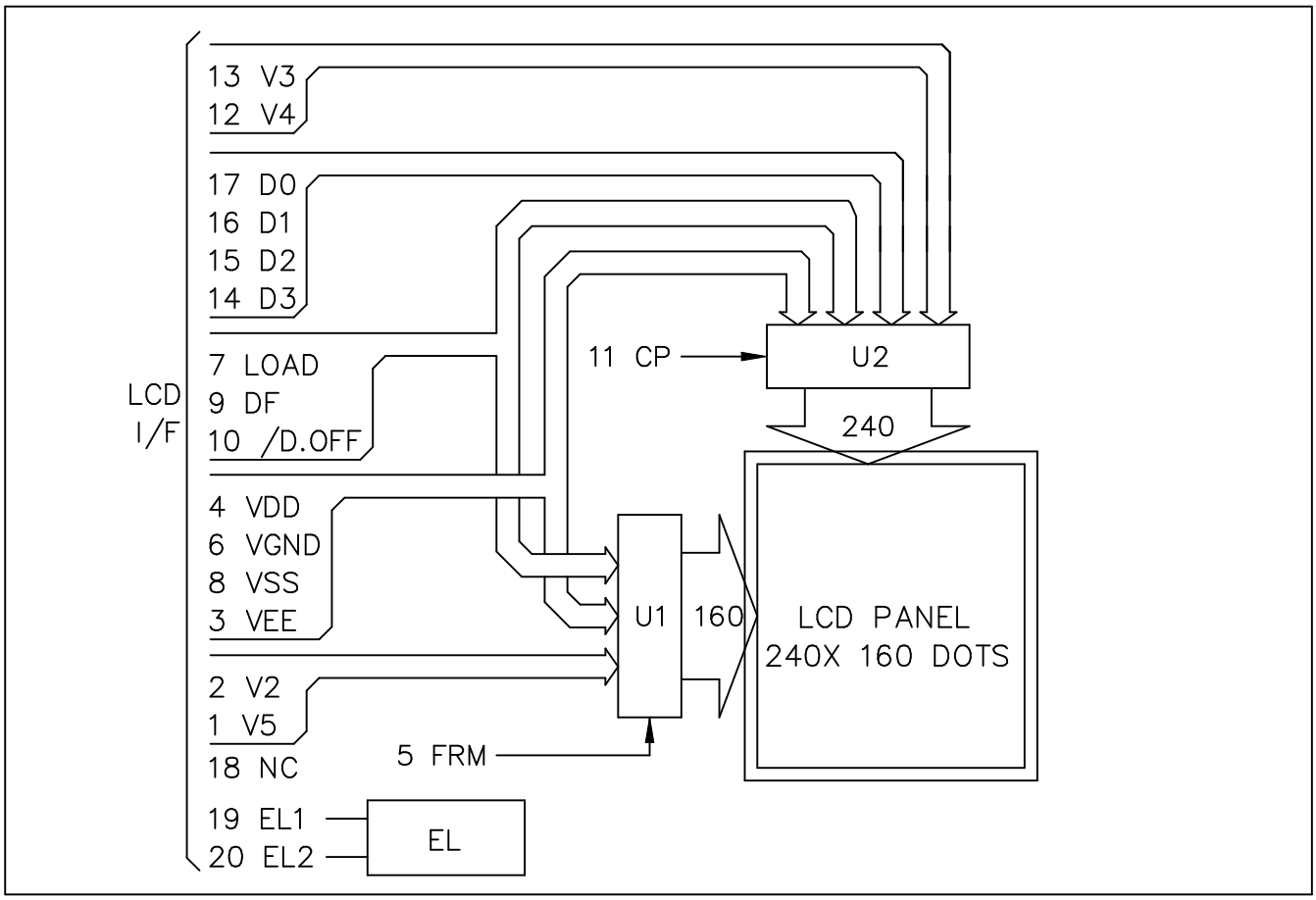
(negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

5. BLOCK DIAGRAM



Note1 :

1)Controller and bias voltage supply circuit are not included.

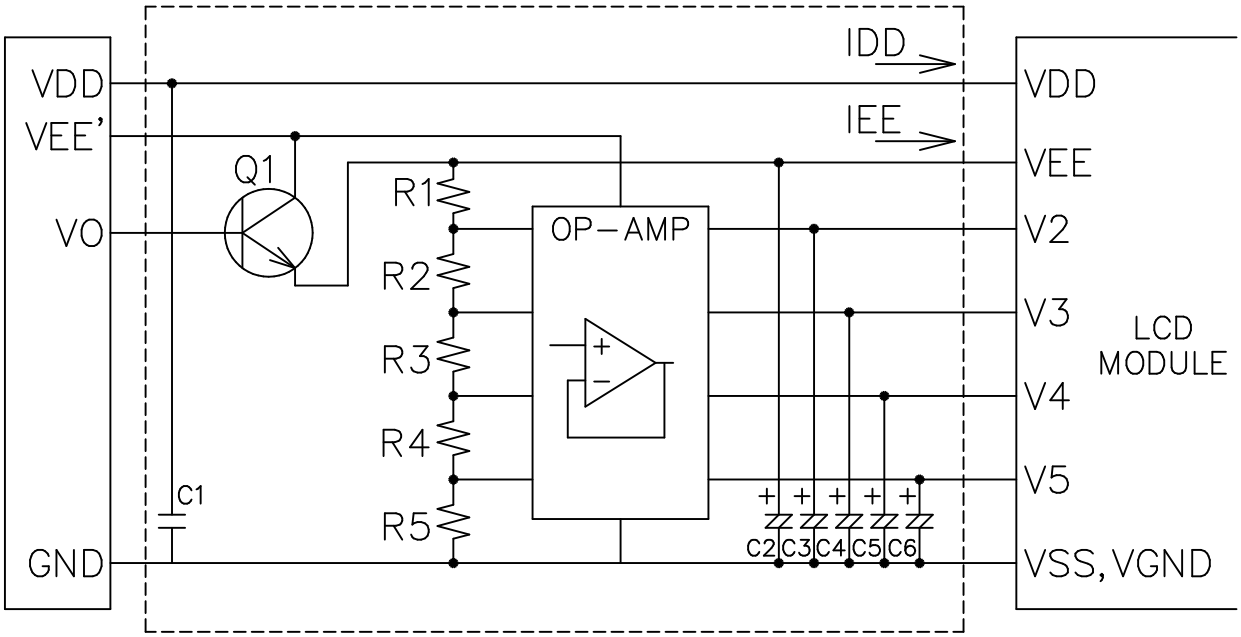
2)VEE,VGND,V2,V3,V4 and V5 are power supply voltage for LCD.
(VEE>V2>V3>V4>V5>VGND)

3)The bias is 1/13,VOP=VEE−VSS=19.2 V.

6. INTERNAL PIN CONNECTION

Pin No.	Symbol	Function
1	V5	Bias voltage for non-select (Common driver)
2	V2	Bias voltage for non-select (Common driver)
3	VEE	Power supply for LCD (+V)
4	VDD	Power supply for logic (+3.3V)
5	FRM	Frame start signal (Data signal of the shift register of the common driver)
6	VGND	GND,Power supply for LCD
7	LOAD	1)Latch pulse of display data 2)Shift clock for common driver
8	VSS	GND
9	DF	Switch signal to convert LCD drive waveform into AC
10	/D.OFF	H : Display ON, L : Display OFF
11	CP	Clock pulse for segment shift register
12	V4	Bias voltage for non-select (Segment driver)
13	V3	Bias voltage for non-select (Segment driver)
14	D3	Input data signal
15	D2	Input data signal
16	D1	Input data signal
17	D0	Input data signal
18	N.C.	No connectoin
19	EL1	Power supply for EL backlight
20	EL2	Power supply for EL backlight

7. POWER SUPPLY



Q1 : 2SC1815
OP-AMP : LP324
R1=R2=R4=R5=10KΩ, R3=9R1=91KΩ(1/13 Bias)
C1=0.1μF, C2~C6=3.3μF

Note 1 : These are general values.
In case to decrease LCD driving voltage with minimizing bias value, set these values with check display to avoid display's deterioration (response etc).

8. TIMING CHARACTERISTICS

8-1 INTERFACE TIMING

@ VDD=3.3V±10%, Ta= 0~50 ℃

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
CP Cycle Time	tC	Fig.a	82	–	–	ns
CP Pulse Width	tSWH,tSWL	Fig.a	28	–	–	ns
CP Rise/Fall Time	tCR,tCF	Fig.a	–	–	50	ns
Data Set Up Time	tDSU	Fig.a , Fig.b	20	–	–	ns
Data Hold Time	tDHD	Fig.a , Fig.b	23	–	–	ns
LOAD Cycle Time	tL	Fig.b	250	–	–	ns
LOAD "H" Pulse Width	tLWH	Fig.a , Fig.b	30	–	–	ns
LOAD Rise/Fall Time	tLR,tLF	Fig.b	–	–	50	ns
CP To LOAD Delay Time	tCL	Fig.a	30	–	–	ns
LOAD To CP Delay Time	tLC	Fig.a	65	–	–	ns
FRM TO LOAD SETUP TIME	tFLS	Fig.b	30	–	–	ns
FRM TO LOAD HOLD TIME	tFLH	Fig.b	50	–	–	ns

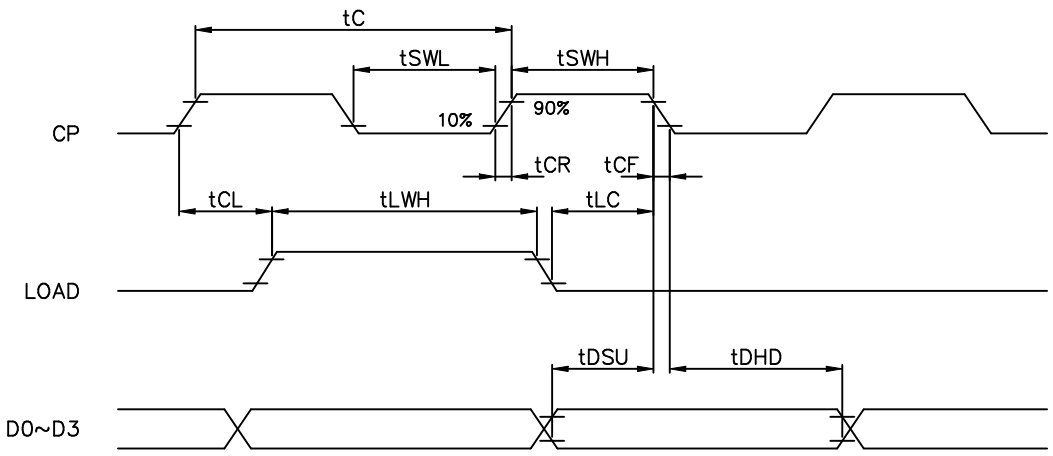


Fig . a Interface timing (SEGMENT)

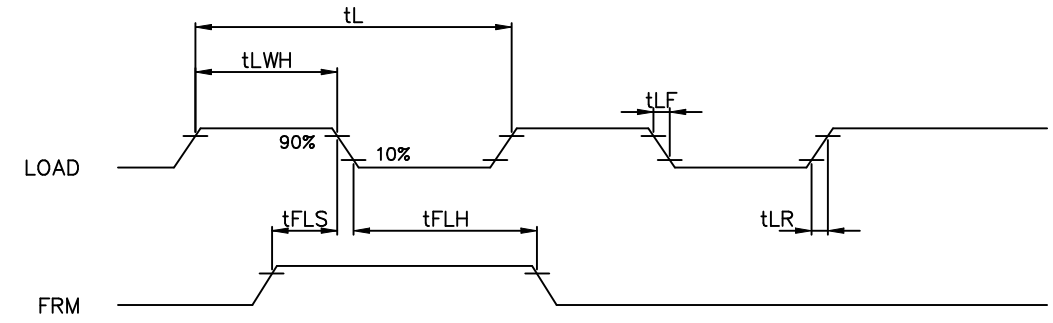
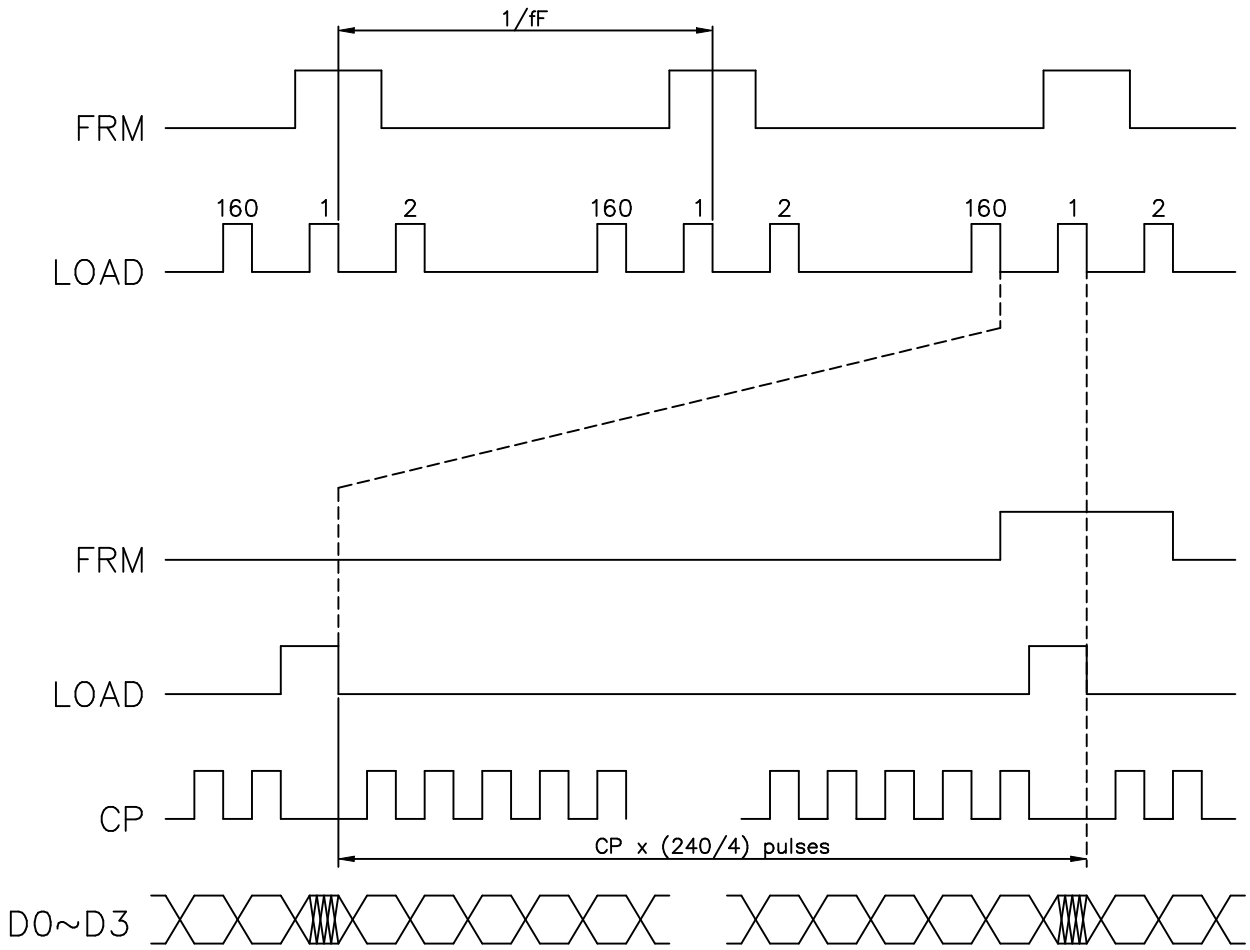
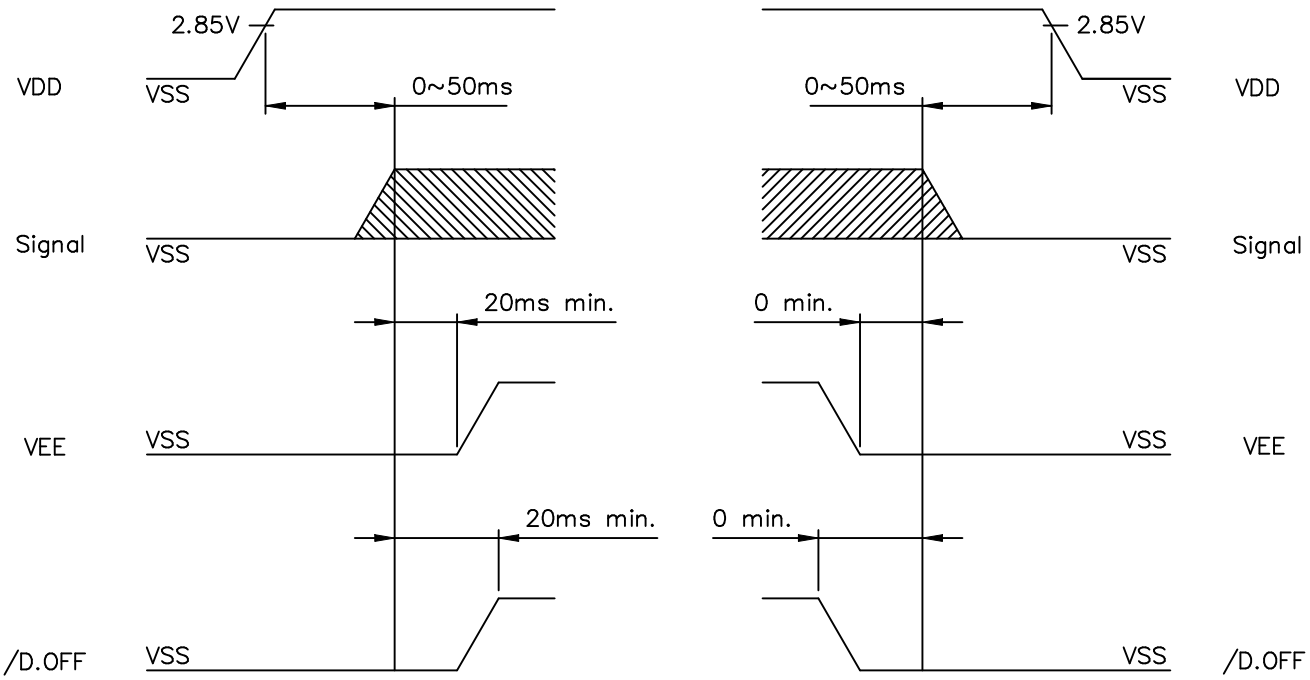


Fig . b Interface timing (COMMON)

8-2 TIMING CHART OF INPUT SIGNAL



8-3 POWER ON/OFF TIMING



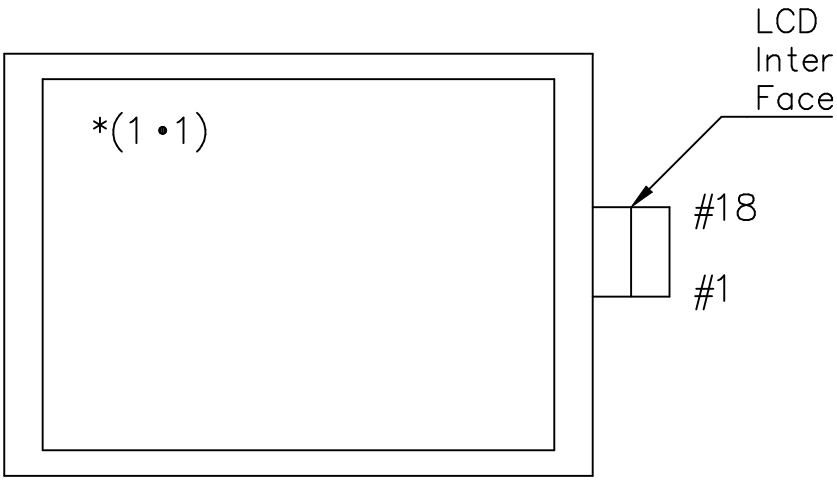
POWER ON

POWER OFF

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

8-4 DISPLAY PATTERN

	Column1	Column2	Column3	Column4	Column240
Row 1	1•1	1•2	1•3	1•4	1•240
Row 2	2•1	2•2	2•3		
Row 3	3•1	3•3			
	D0: (1•4)、(1•8) •••••(160•240)				
	D1: (1•3)、(1•7) •••••(160•239)				
	D2: (1•2)、(1•6) •••••(160•238)				
	D3: (1•1)、(1•5) •••••(160•237)				
Row 160	160•1				160•240



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

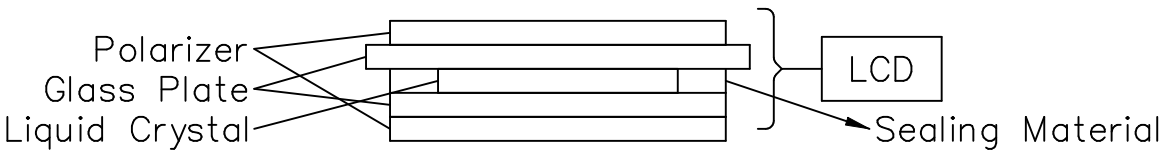
The NAN YA inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of NAN YA LCD produces.

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

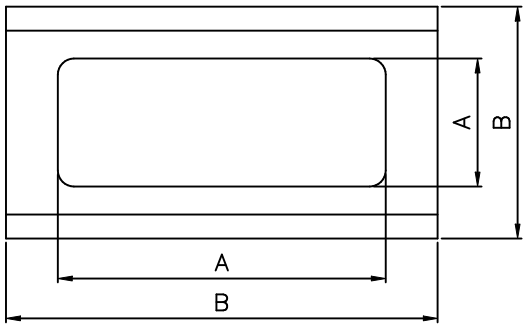
4-2 Inspection Standard

	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		

	Tablet lineality		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 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.	EL 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.

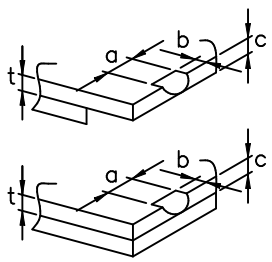
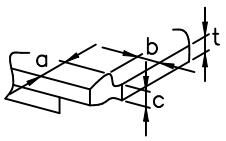
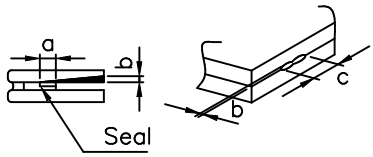
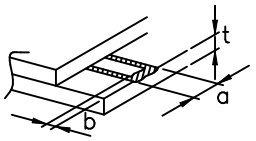
Note that when there are 2 pieces or more, they are not to be concentrated.
Set as: Average diameter = (Long diameter + Short diameter)/2

(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.

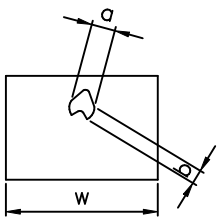
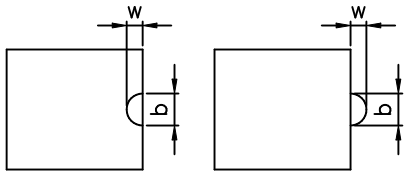
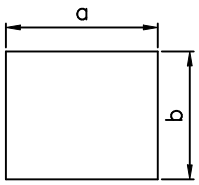
Note that when there are 2 pieces or more, they are not to be concentrated.
Set as: Average diameter = (Long diameter + Short diameter)/2</td></tr>
</table>

<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 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).

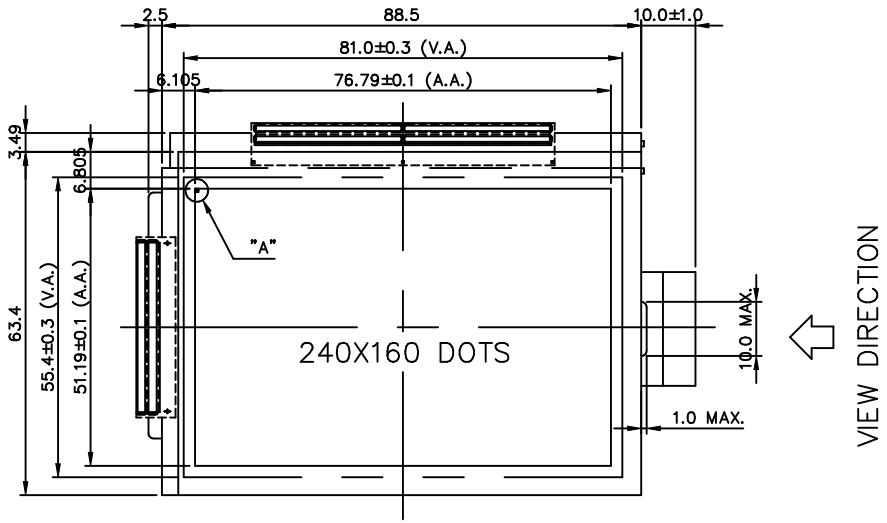
NOTICE:

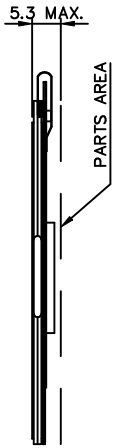
- SAFETY
  1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

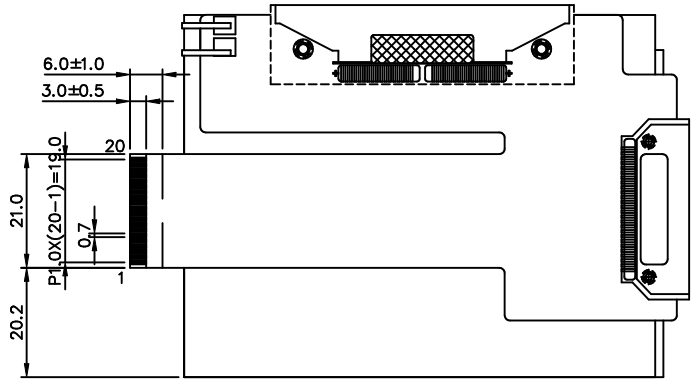
- HANDLING
  1. Avoid static electricity which can damage the CMOS LSI.
  2. Do not remove the panel or frame from the module.
  3. The polarizing plate of the display is very fragile. So, please handle it very carefully.
  4. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch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

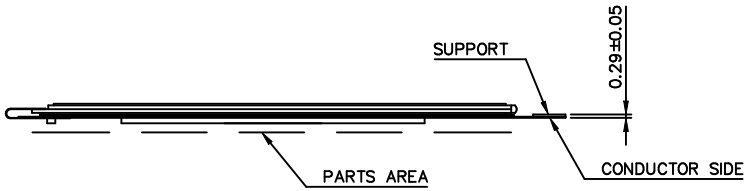
- STORAGE
  1. Store the panel or module in a dark place where the temperature is 25°C±5°C and the humidity is below 65% RH.
  2. Do not place the module near organics solvents or corrosive gases.
  3. Do not crush, shake, or jolt the module.

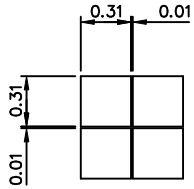
- TERMS OF WARRANT
  1. Acceptance inspection period
     The period is within one month after the arrival of contracted commodity at the buyer's factory site.
  2. Applicable warrant period
     The period is within twelve months since the date of shipping out under normal using and storage conditions.











DETAIL "A"
(S=30:1)

NOTES:
1. RESOLUTION: 240X160 DOTS
2. BACKLIGHT: EL (Indigo Blue)
3. PCB THICKNESS: 1.0±0.2mm

PIN NO.	SYMBOL	FUNCTION	PIN NO.	SYMBOL	FUNCTION
1	V5	Bias voltage for non-select (Common driver)	10	/D.OFF	H: Display ON, L: Display OFF
2	V2	Bias voltage for non-select (Common driver)	11	CP	Clock pulse for segment shift register
3	VEE	Power supply for LCD (+V)	12	V4	Bias voltage for non-select (Segment driver)
4	VDD	Power supply for logic (+3.3V)	13	V3	Bias voltage for non-select (Segment driver)
5	FRM	Frame start signal (Data signal of the shift register of the common driver)	14	D3	Input data signal
			15	D2	Input data signal
6	VGND	GND, Power supply for LCD	16	D1	Input data signal
7	LOAD	1) Latch pulse of display data 2) Shift clock for common driver	17	D0	Input data signal
			18	NC	No connection
8	VSS	GND	19	EL 1	Power supply for EL backlight
9	DF	Switch signal to convert LCD drive waveform into AC	20	EL 2	Power supply for EL backlight

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

LTD96S306QDS_

	NAME	DATE	THIRD ANGLE P.
APPROVE			
CHECK			
DESIGN	C. B. LAN	94.11.08	SCALE / UNIT
DRAWN	C. B. LAN	94.11.08	1/1 / mm

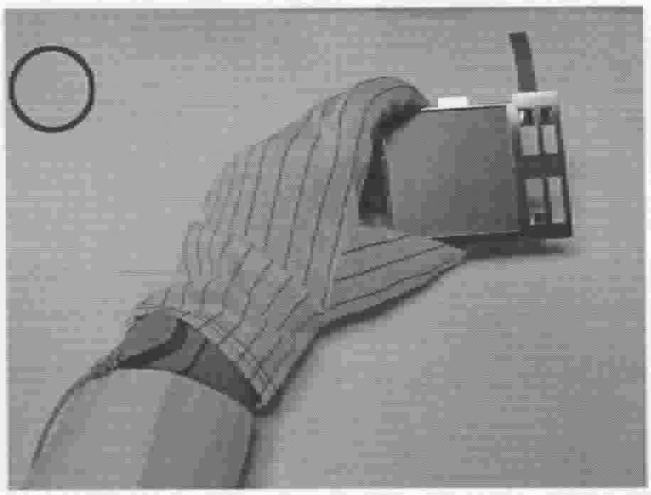
DWG NO. M306DD0A 1/1 0

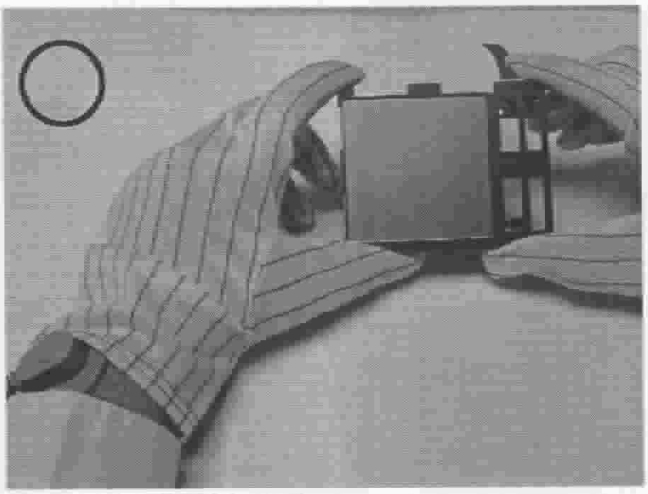
THE NOTES OF LCM USING

LCM is easy to damage.

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

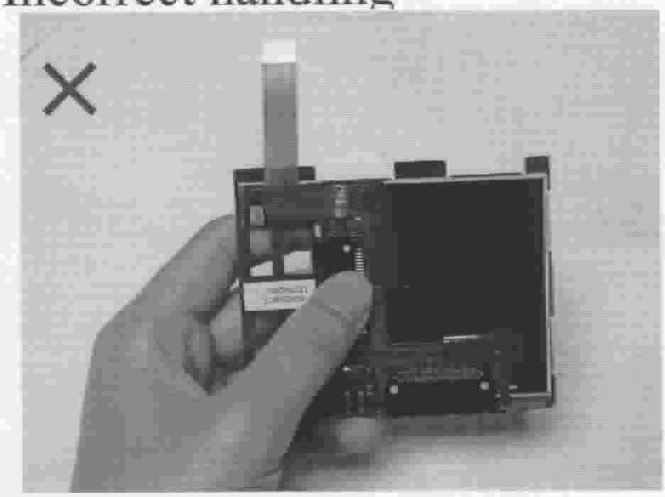
Correct handling



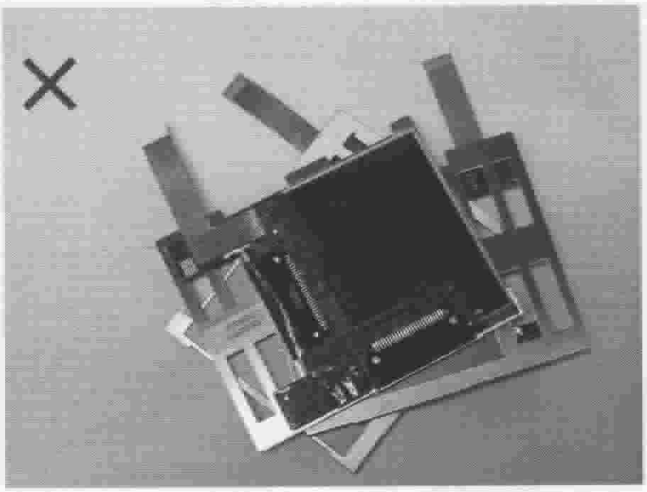


As above picture, please handle with glove by LCM edges and full EOS/ESD protection.

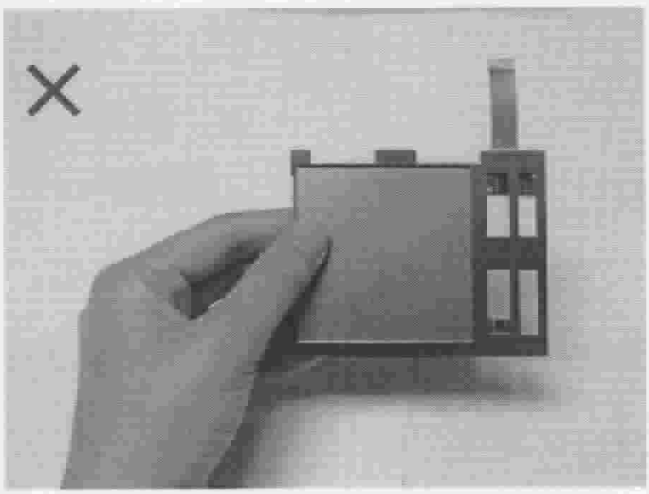
Incorrect handling



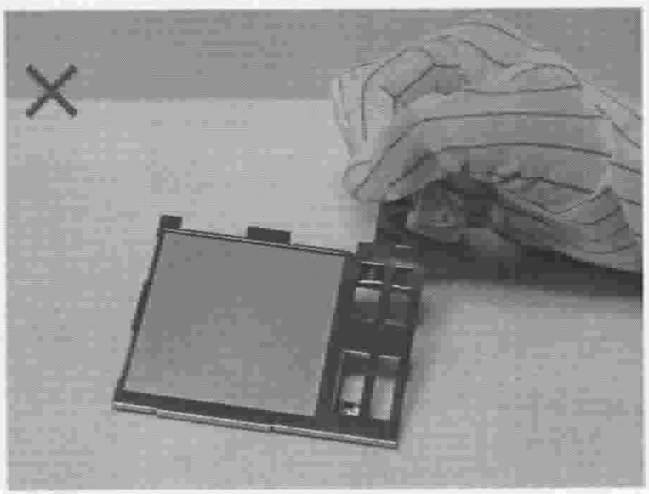
Please don't touch IC directly.



Please don't put one on another LCM.



Please don't hold the surface of LCM.

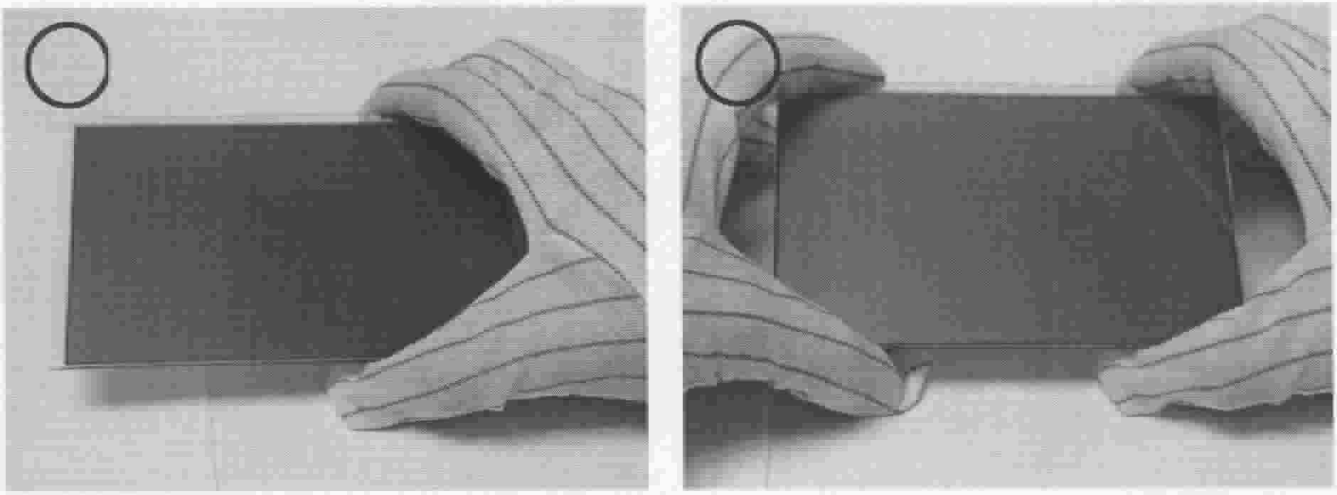


Please don't stretch interface of output.

THE NOTES OF LCD USING

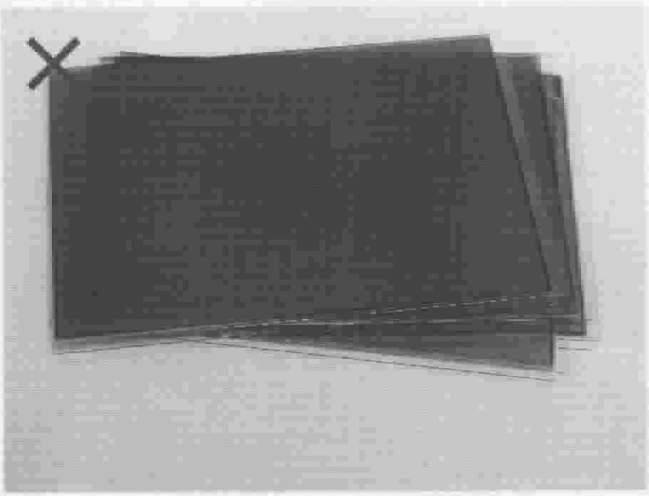
LCD is easy damage.
Please follow notes as bellows, and be careful of handling!

Correct handling

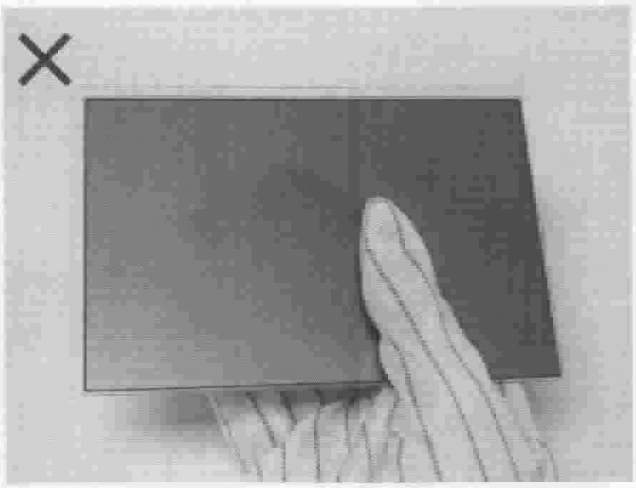


As above picture, please handle with glove by LCD edges and full EOS/ESD protection.

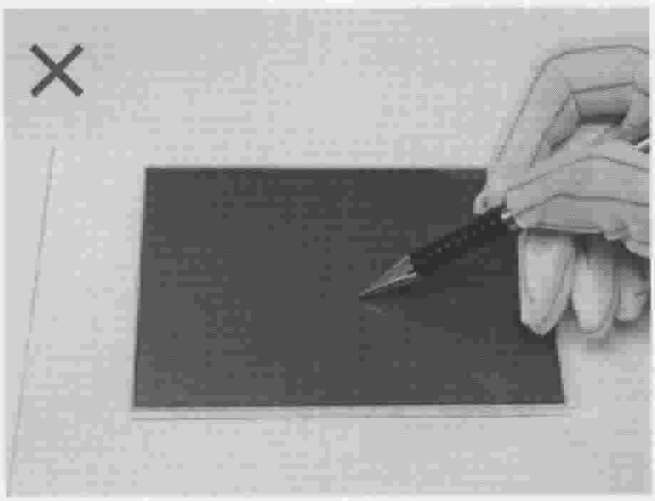
Incorrect handling



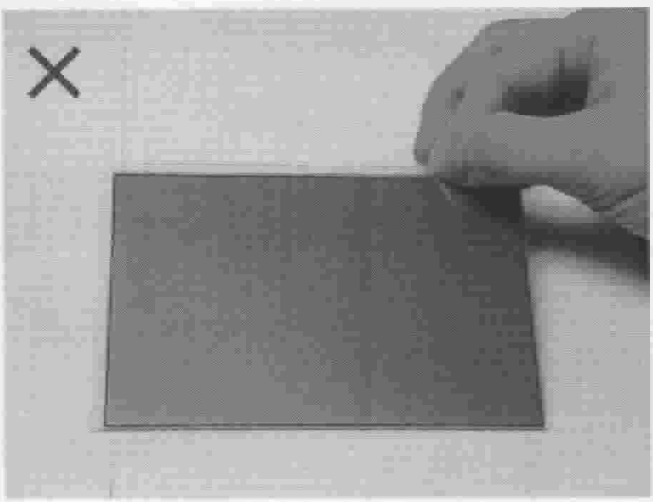
Please don't put one on another LCD.



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.