NAN YA PLASTICS CORPORATION

SPECIFICATION OF
LCD MODULE
PRODUCT NO.: LTBGCTB91G1KS

SPEC. NO.: LMB91-1H-△0

CUSTOMER
APPROVED BY
DATE:

LCD DEPARTMENT
ELECTRONIC MATERIALS DIVISION
NAN YA PLASTICS CORPORATION
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EDITED ON : Mar. 23. 2007

Q.C. DEPT.	DESIGN MANAGER	DESIGN CHECK	DESIGNER
			W.R.HSU

RECORDS OF REVISION

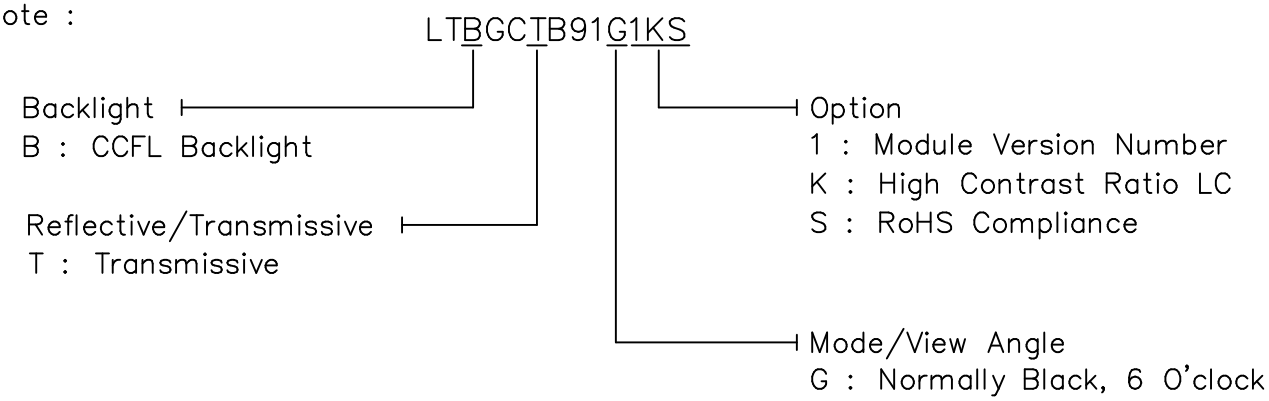
SPEC. NO.: LMB91-1H

DATE	REVISED NO.	REF. PAGE	SUMMARY	DESIGN	CHECK
03.23.07'	0	1~24/24	First Issue	W.R.HSU	

1. MECHANICAL DATA

NO	ITEM	CONTENTS	UNIT
1	Product No.	LTBGCTB91G1KS	–
2	Module Size	167.7 (W) x 116.8 (H) x 5.3 (D)	mm
3	Dot Size	0.17 (W) x 0.17 (H)	mm
4	Dot Pitch	0.19 (W) x 0.19 (H)	mm
5	Number of Dots	640 (W) x 480 (H)	Dot
6	Duty	1/240	–
7	LCD Display Mode	FSTN, Normally Black / Negative Image	–
8	Rear Polarizer	Transmissive Type	–
9	Viewing Direction	6	O'clock
10	Backlight	CCFL	–
11	Controller	Excluded	–
12	DC/DC Converter	Excluded	–
13	Touch Panel	Excluded	–
14	Weight	150 (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	5.5	V	
Input Voltage	VI	−0.3	VDD	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	
Ambient Temperature	−		49m/s² (5G)	

Note 2 Ta ≦ 70°C : 75%RH max

Note 3 Please refer to item of reliability test

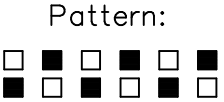
Note 4 Background color will change slightly depending on ambient temperature. That phenomenon is reversible.

Note 5

Frequency (Hz)	10~55~10/1 min
Vibration Width	1.5 m/m
Vibration Direction	X/Y/Z
Vibration Time	15 min/cycle X 3 directions

3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS OF LCM

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic	VDD-VSS	-		3.0	3.3	5.5	V
Input Voltage	VIH	H level		0.8VDD	-	VDD	V
	VIL	L level		0	-	0.2VDD	
Recommended LC Driving Voltage	VEE-VSS (Vop)	Duty= 1/240	-20°C	21.9	22.3	22.7	V
			0°C	21.0	21.4	21.8	
			25°C	20.1	20.5	20.9	
			50°C	18.6	19.0	19.4	
			70°C	17.3	17.7	18.1	
Power Supply Current	IDD	VDD-VSS=3.3V VEE-VSS=20.5V Ta=25°C Pattern: 		-	2	4	mA
	IEE			-	10	15	
Surface Luminance of LCM	L	IL = 5.0 mA Ta=25°C Pattern: Dots All ON		70	100	-	cd/m²
		IL = 5.0 mA Ta=25°C Pattern: Dots All OFF		-	15	-	

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used Lamp Rating Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Lamp Voltage	V_L	–	290	–	Vrms	–
Lamp current	I_L	–	5	–	mArms	–
Lamp power consumption	P_L	–	1.45	–	W	(*1)
Starting voltage	V_S	–	–	600	Vrms	Ta=25°C
Lamp life time	L_L	20000	–	–	hrs	at I_L = 5mArms Ta=25°C (*2)

(*1) Power consumption excluded inverter loss .

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

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

3-3-1 GENERAL SPECIFICATIONS

OPERATION TEMPERATURE : -10°C~60°C
STORAGE TEMPERATURE : -20°C~85°C
DIMENSION : 44.0(L)mm x 21.0(W)mm x MAX 18.0(H)mm

3-3-2 PIN ASSIGNMENTS

INPUT (CN1) CONNECTOR :

NO.	FUNCTION
1	VIN
2	GND

OUTPUT (CN2) CONNECTOR :

NO.	FUNCTION
3	OUT1
4	OUT2
5	OUT GND

3-3-3 RELATIONSHIP BETWEEN VIN & TUBE CURRENT

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Input Voltage	VIN	-	10.1	-	V	
Tube Current	IL	-	5	-	mA	

4. OPTICAL CHARACTERISTICS

WIDE TEMPERATURE MODE

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.
T	G	3.5	5	11	15	15	20	7	10	3.5	5	−	F: 35 R: 25	−	L: 30 R: 30
NOTE		NOTE 3,6										NOTE 3,5			

NOTE :

T : Transmissive

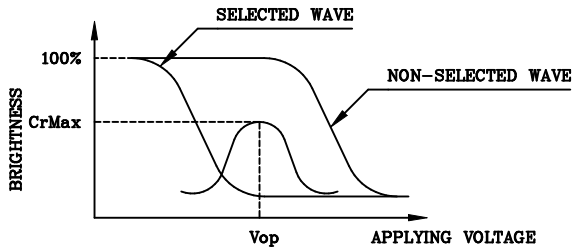
G : Normally Black, 6 O'clock

AT $\phi=0°$ $\theta=0°$

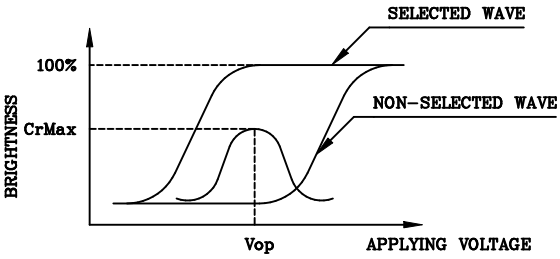
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	−20℃	600	900	1400	ms	NOTE 2,3
		0℃	240	350	530		
		25℃	200	250	370		
		50℃	60	90	150		
		70℃	50	80	120		
Response Time (fall)	Tf	−20℃	1100	1700	2600	ms	NOTE 2,3
		0℃	230	370	560		
		25℃	100	150	230		
		50℃	50	80	120		
		70℃	45	70	110		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



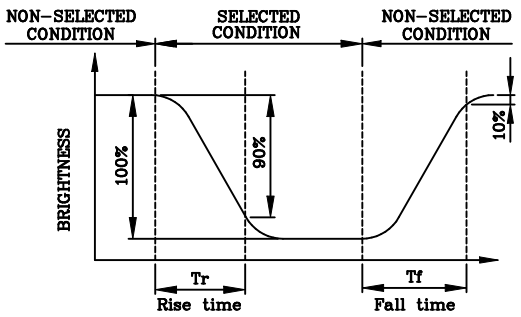
(negative type)

*Conditions

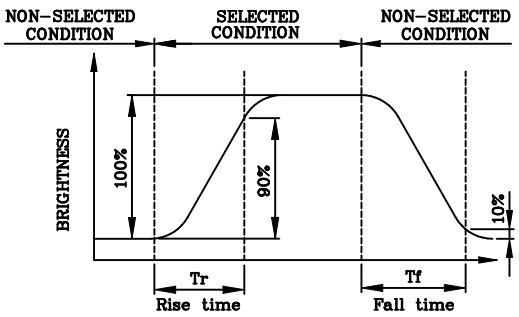
Viewing Angle : 0
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



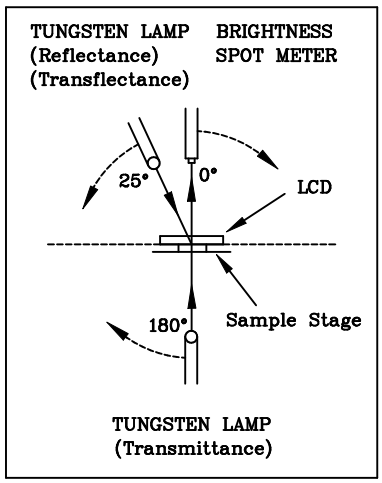
(negative type)

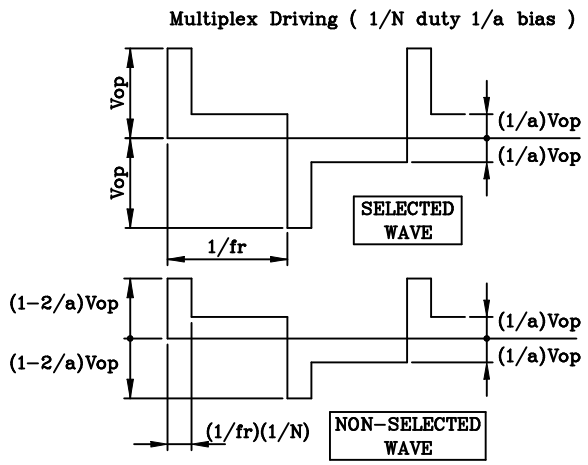
*Conditions

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

(NOTE 3)

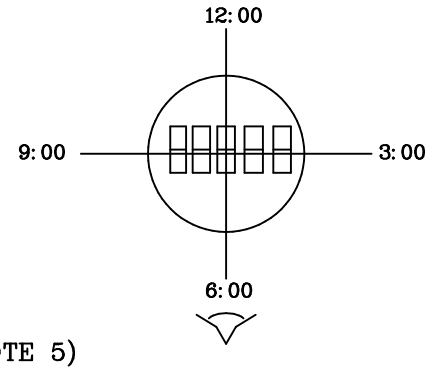
Description of Measuring Equipment and Driving Waveforms





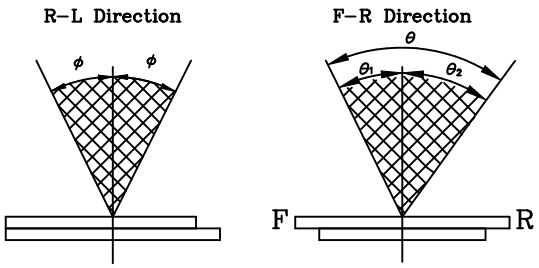
(NOTE 4)

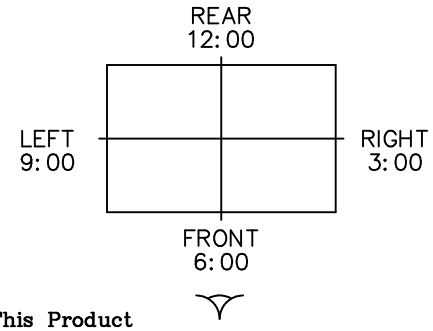
Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle





*For This Product

The Viewing Direction Is 6 O'clock

So $\theta_1 > \theta_2$

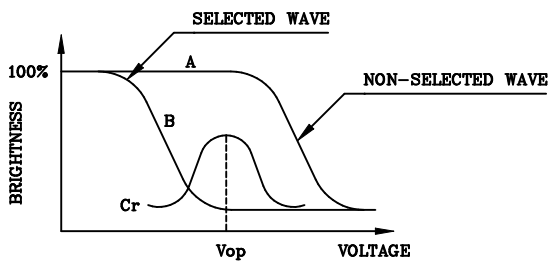
$\theta = \theta_1 + \theta_2$

*Conditions

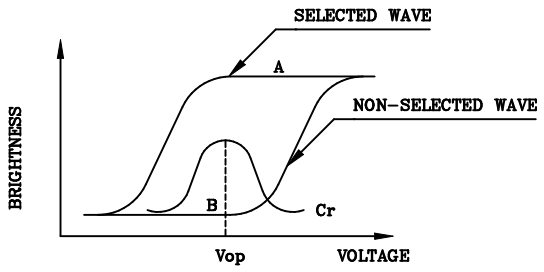
Operating Voltage : Vop
Frame Frequency : 70Hz
Applying Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



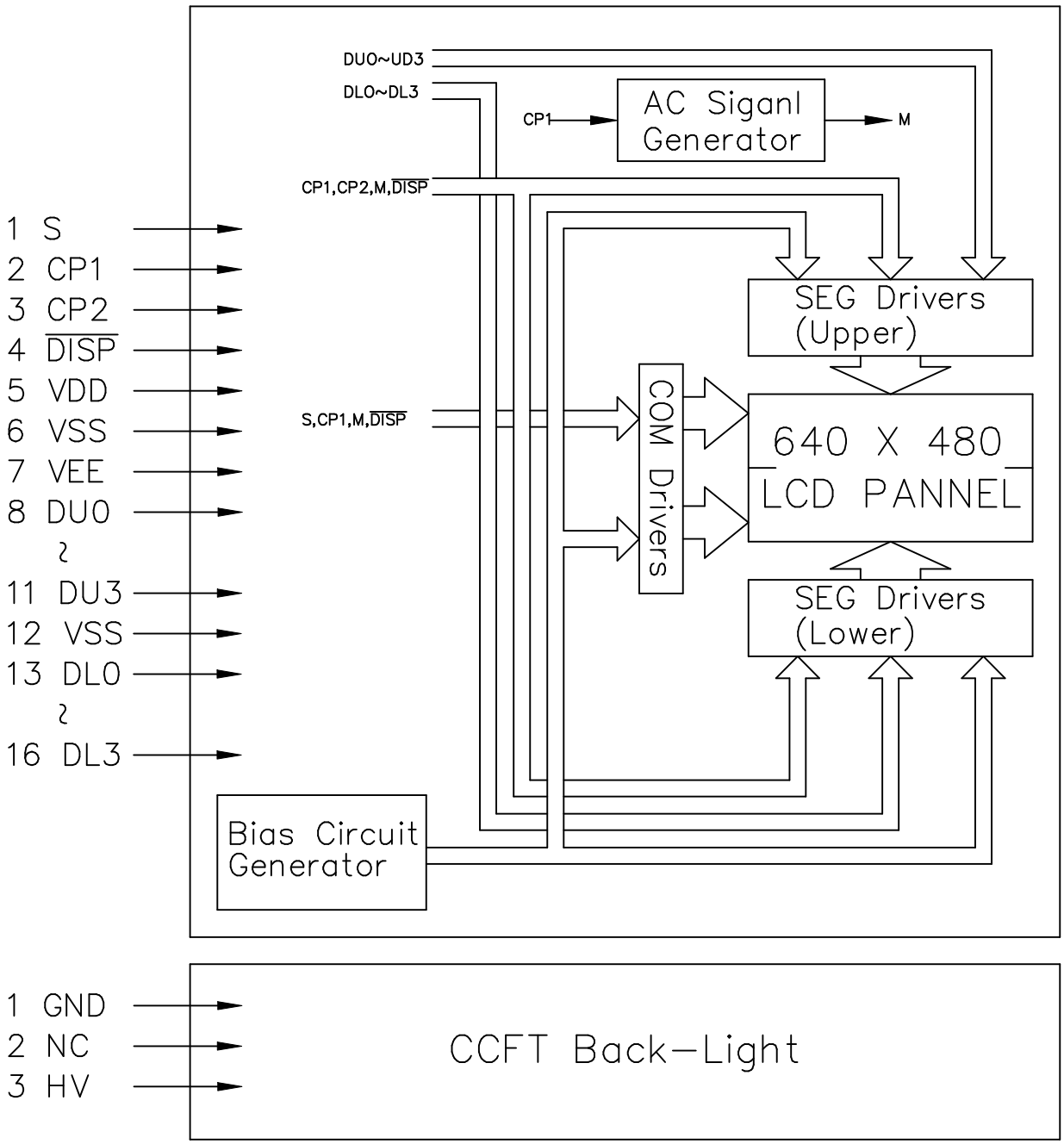
(negative type)

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

LCD

Pin No.	Symbol	Level	Function
1	S	H/L	SCAN START-UP SIGNAL
2	CP1	H→L	INPUT DATA LATCH SIGNAL
3	CP2	H→L	DATA INPUT CLOCK SIGNAL
4	$\overline{DISP}$	H/L	DISPLAY OFF ("H"=ON,"L"=OFF)
5	VDD	-	POWER SUPPLY FOR LOGIC (+)
6	VSS	-	SIGNAL GROUND (GND)
7	VEE	-	POWER SUPPLY FOR LCD (+)
8	DU0	H/L	DISPLAY DATA (UPPER HALF)
9	DU1		
10	DU2		
11	DU3		
12	VSS	-	SIGNAL GROUND (GND)
13	DL0	H/L	DISPLAY DATA (LOWER HALF)
14	DL1		
15	DL2		
16	DL3		

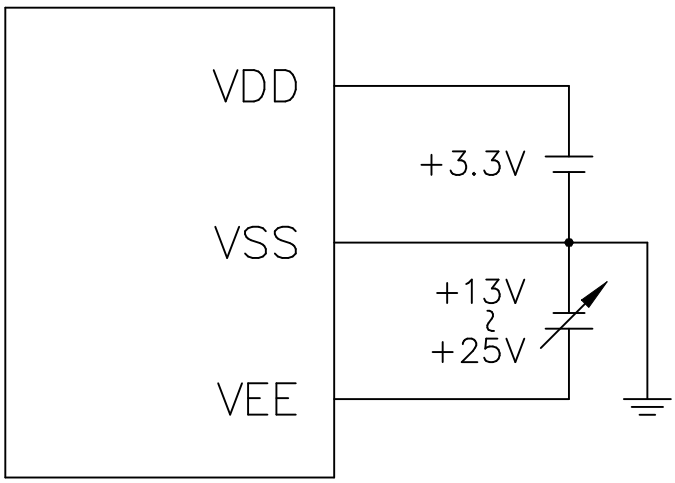
CCFT

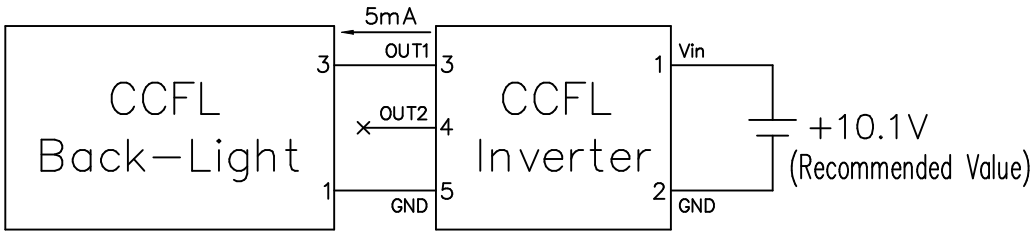
Pin No.	Symbol	Level	Function
1	GND	-	GROUND LINE (INVERTER)
2	NC	-	NO CONNECTION
3	HV	-	HIGH VOLTAGE LINE (INVERTER)

LCD
Used connector : FH12A-16S-0.5SH(55) (HIROSE)
Mating cable : FFC or FPC (Pitch 0.5mm,16 pins,Conact Partion Thickness 0.3mm)

CCFT
Used connector : BHR-03VS-1 (JST)
Mating connector : SM02(80)B-BHS-1

7. POWER SUPPLY





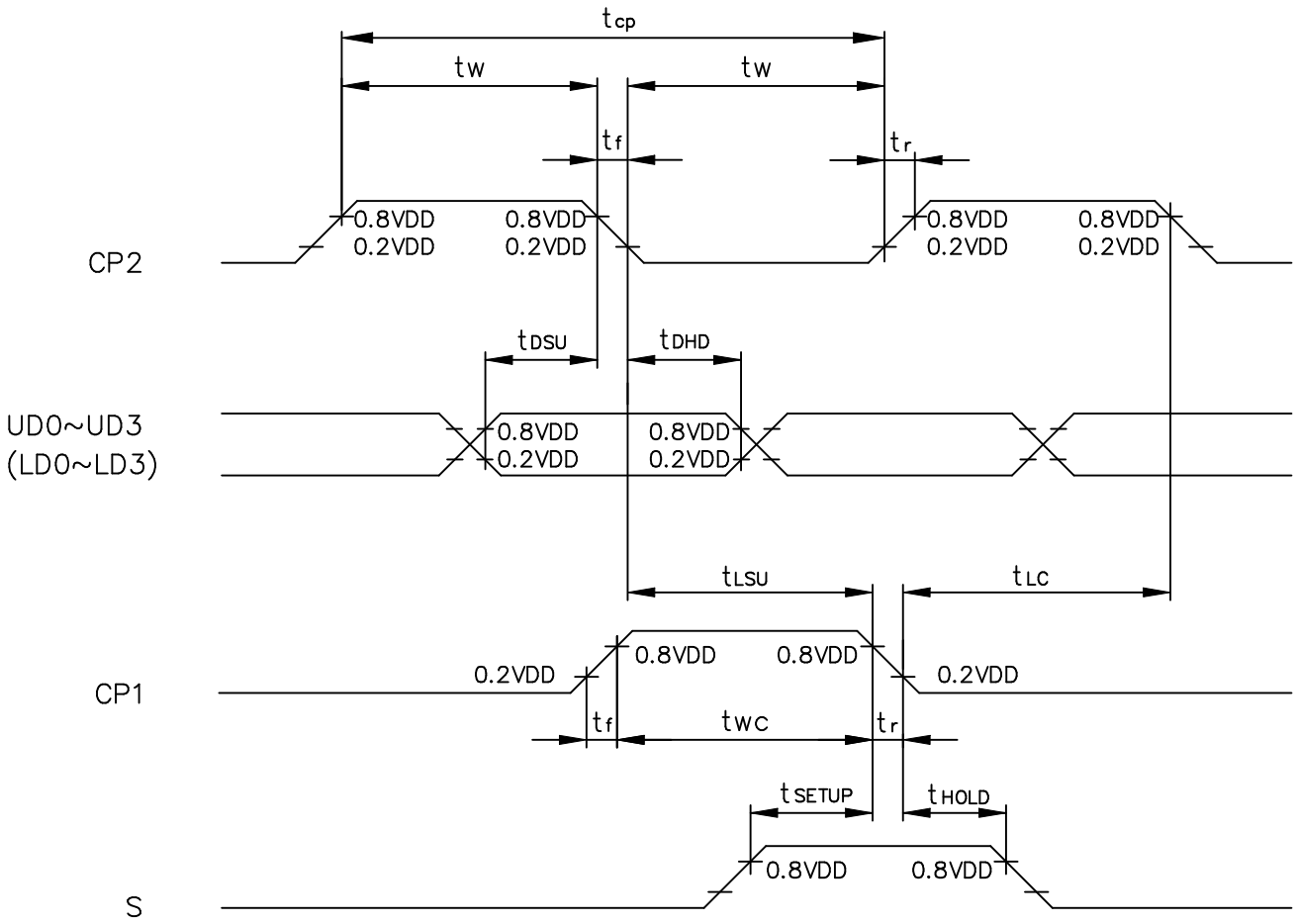
RECOMMENDED INVERTER : CXA-L10L (TDK)

8. TIMING CHARACTERISTICS

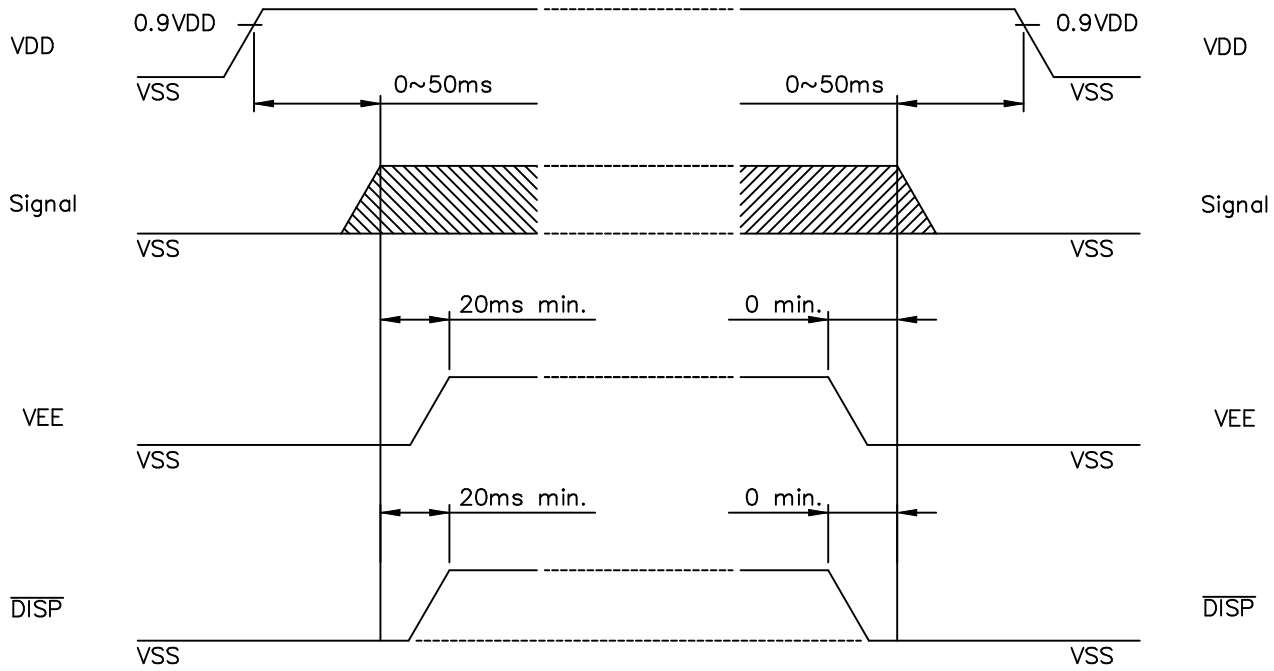
8-1. INTERFACE TIMING

@VDD=2.5~5.5V

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
Shift Clock Period	t_{cp}	125	–	–	ns
"CP2" PULSE WIDTH	t_W	51	–	–	ns
CLOCK RISE, FALL TIME	t_r , t_f	–	–	50	ns
DATA SETUP TIME	t_{DSU}	30	–	–	ns
DATA HOLD TIME	t_{DHD}	50	–	–	ns
"CP2"→ "CP1" FALL TIME	t_{LSU}	51	–	–	ns
"CP1"→ "CP2" FALL TIME	t_{LC}	51	–	–	ns
"S" SETUP TIME	t_{SETUP}	100	–	–	ns
"S" HOLD TIME	t_{HOLD}	100	–	–	ns
"CP1" PULSE WIDTH	t_{WC}	65	–	–	ns



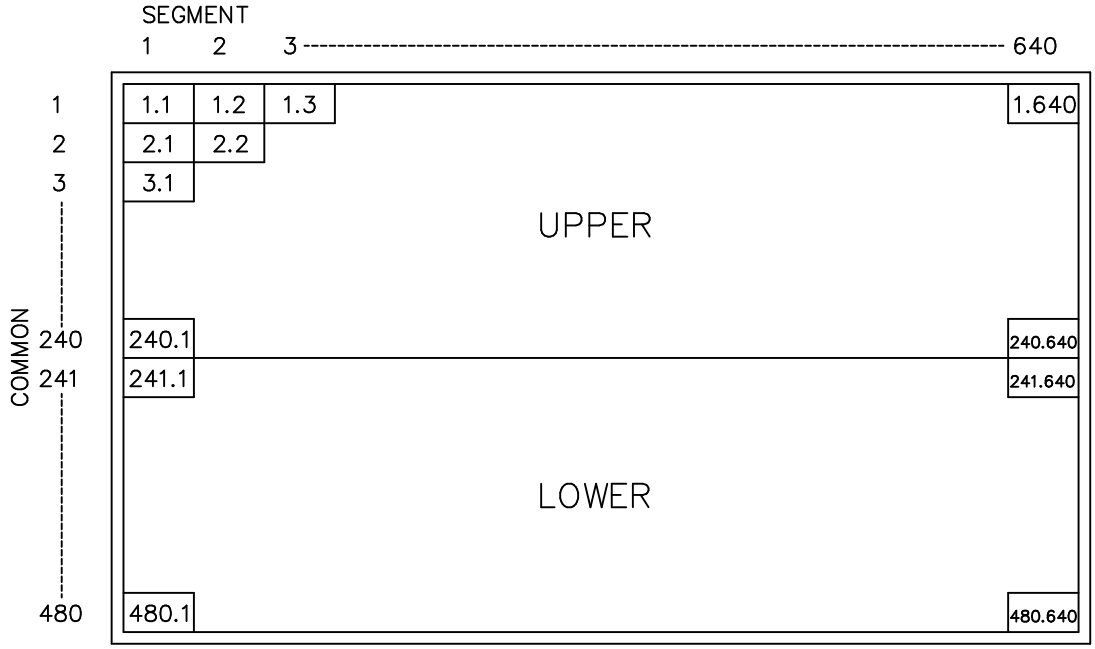
8-2.POWER ON/OFF TIMING



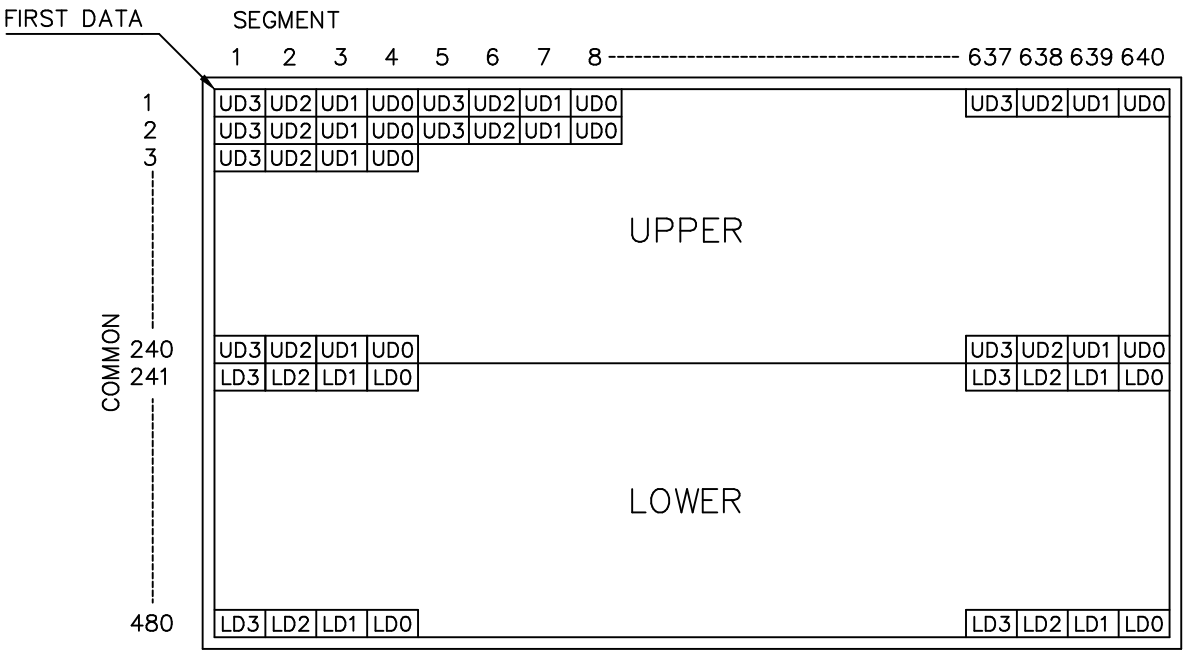
POWER ON　　POWER OFF

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

8-3.DISPLAY PATTERM



1.1 MEANS 1ST COMMON 1ST SEGMENT DOT



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

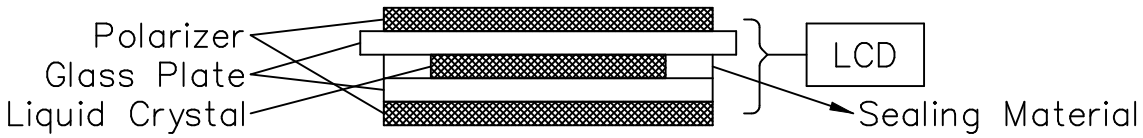
The NAN YA inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of NAN YA LCD produces.

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

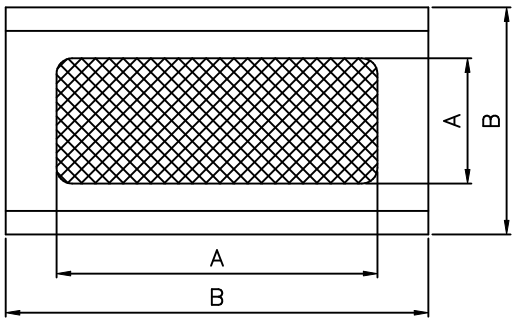
	Item		AQL(%)	Remarks
Major Defect	Dots	Opens Shorts Erroneous operation	0.4	faults which substantially lower the practicality and the initial purpose difficult to achieve.
	Solder appearance	Shorts Loose		
	Cracks	Display surface cracks		

	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 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

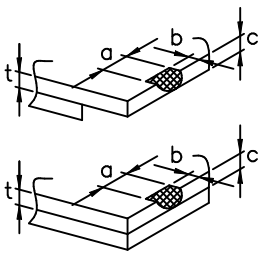
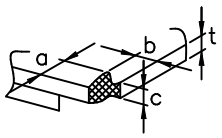
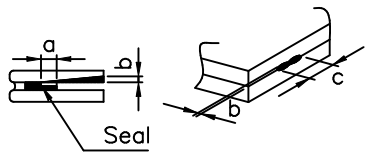
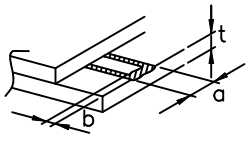
<table>
<tr><th>NO.</th><th>Item</th><th>Criterion</th></tr>
<tr><td>1</td><td>Black spots, foreign matter, and white spots (Including light leakage due to pinholes of polarizing plates, etc.)</td><td>
(1)-1-Spots
<table>
<tr><th>Average Diameter(mm): D</th><th>Number of pieces permitted</th></tr>
<tr><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.

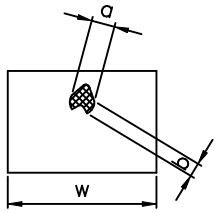
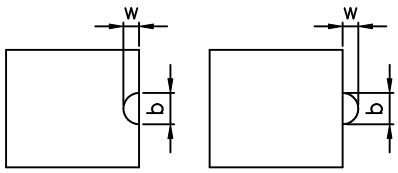
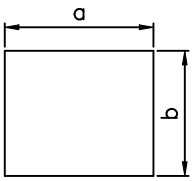
Note that when there are 2 pieces or more, they are not to be concentrated.
Set as: Average diameter = (Long diameter + Short diameter)/2
</td></tr>
</table>

<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 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).

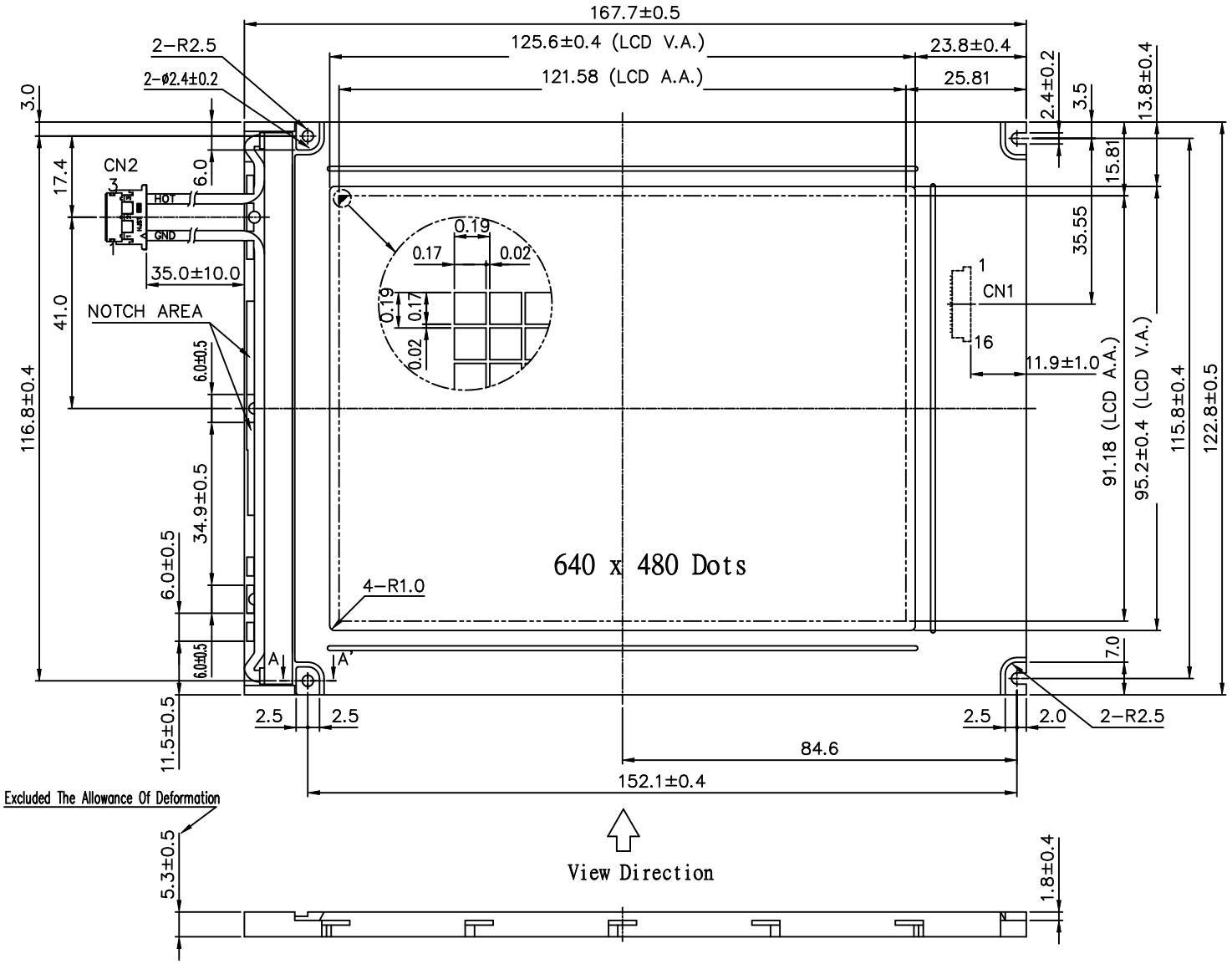
NOTICE:

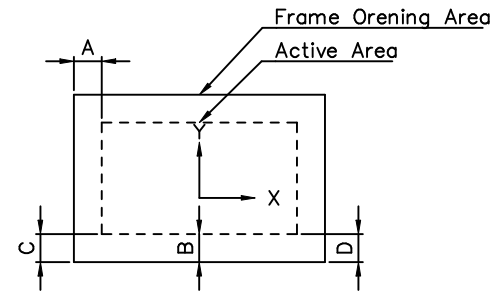
- SAFETY
  1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- 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.

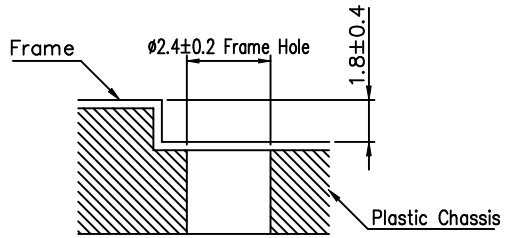
- TERMS OF WARRANT
  1. Acceptance inspection period
     The period is within one month after the arrival of contracted commodity at the buyer's factory site.
  2. Applicable warrant period
     The period is within twelve months since the date of shipping out under normal using and storage conditions.





1) Tolerance X-direction A : 2.01±0.8
2) Tolerance Y-direction B : 2.01±0.8
3) Obliquity of Display Area (C-D)<0.8

Frame/Display Postion



A-A' Section

Notes :

1. Resolution : 640 x 480 Dots
2. Backlight : CCFL (White)
3. Frame Material : SUS430
4. CCFL Connector : BHR-03VS-1 (JST)
5. Interface Connector : FH12A-16S-0.5SH(55) (Hirose)
6. Driver IC : NT7701H-TABF1
7. Tolerance No Specified : ± 0.5mm

CN1 Connector : FH12A-16S-0.5SH(55) (Hirose)

Pin NO	Symbol	Level	Function	Pin NO	Symbol	Level	Function
1	S	H/L	Scan Start-Up Signal	12	VSS		Signal Ground (GND)
2	CP1	H→L	Input Data Latch Signal	13	DL0	H/L	Display Data (Lower Half)
3	CP2	H→L	Data Input Clock Signal	14	DL1		
4	$\overline{DISPOFF}$	H/L	Display Off ("H"=ON,"L"=OFF)	15	DL2		
5	VDD	-	Power Supply For Logic (+)	16	DL3		
6	VSS	-	Signal Ground (GND)				
7	VEE	-	Power Supply For LCD (+)				
8	DU0	H/L	Display Data (Upper Half)				
9	DU1						
10	DU2						
11	DU3						

CN2 CCFL Connector : BHR-03VS-1 (JST)

Pin NO	Symbol	Level	Function
1	GND	-	Ground Line (Inverter)
2	NC	-	No Connection
3	HV	-	High Voltage Line (Inverter)

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

LTBGCTB91G1KS

	NAME	DATE	THIRD ANGLE P.
APPROVE			
CHECK			
DESIGN	Campos Chen	96.03.21	SCALE / UNIT
DRAWN	Campos Chen	96.03.21	1/1 / mm

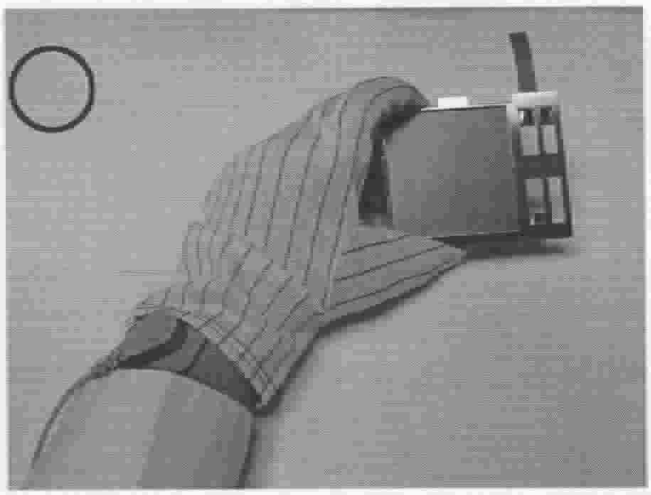
DWG NO. MB91HD1A 1 0

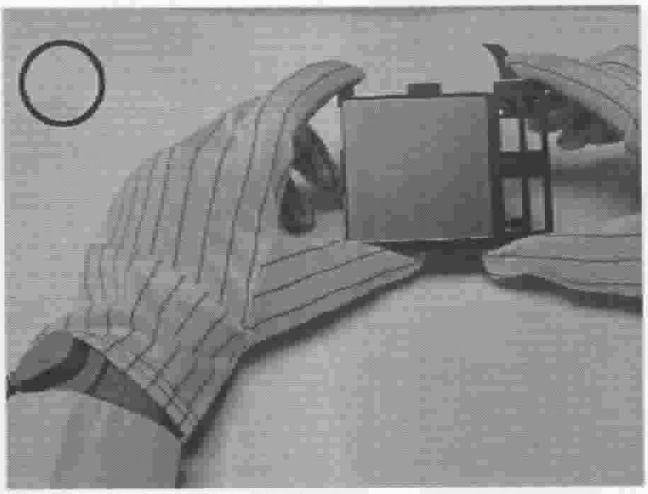
THE NOTES OF LCM USING

LCM is easy to damage.

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

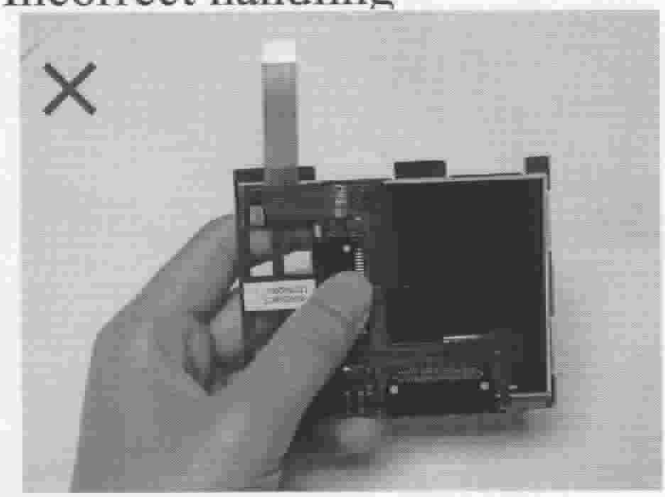
Correct handling



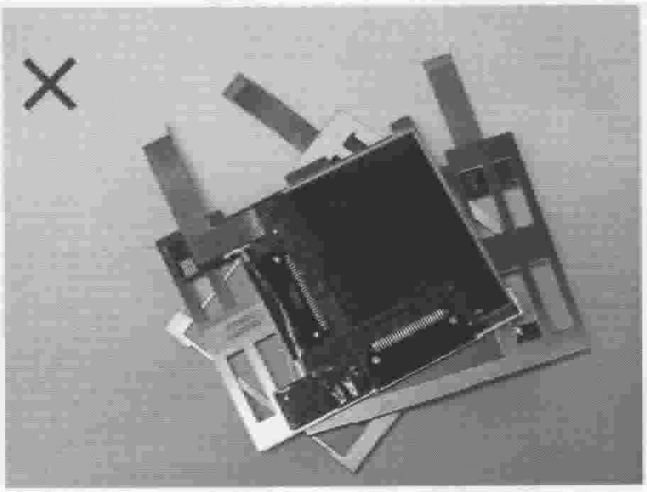


As above picture, please handle with glove by LCM edges and full EOS/ESD protection.

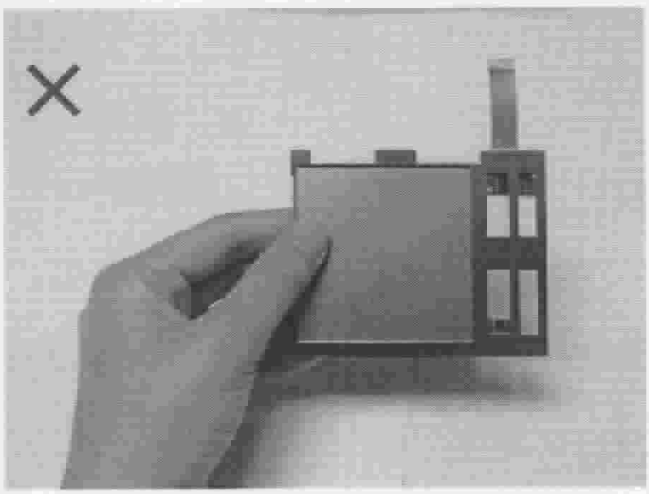
Incorrect handling



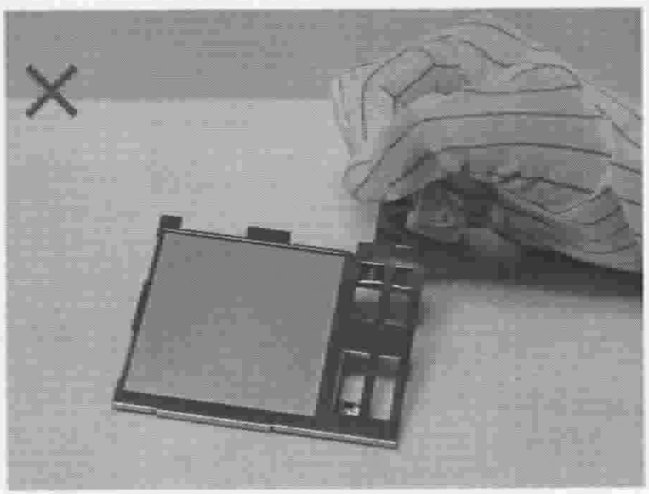
Please don't touch IC directly.



Please don't put one on another LCM.



Please don't hold the surface of LCM.

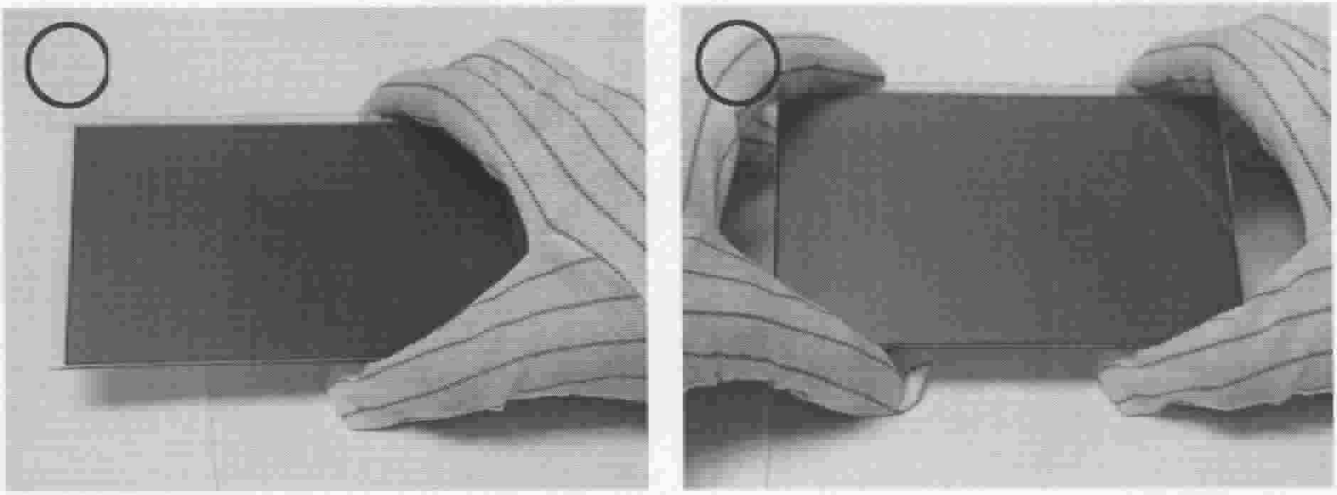


Please don't stretch interface of output.

THE NOTES OF LCD USING

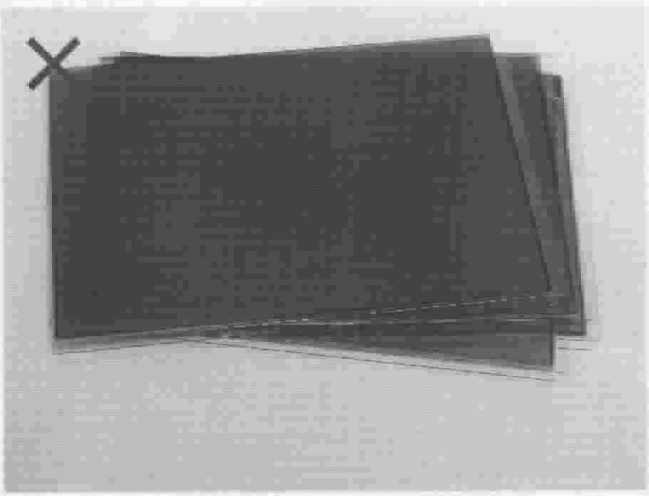
LCD is easy damage.
Please follow notes as bellows, and be careful of handling!

Correct handling

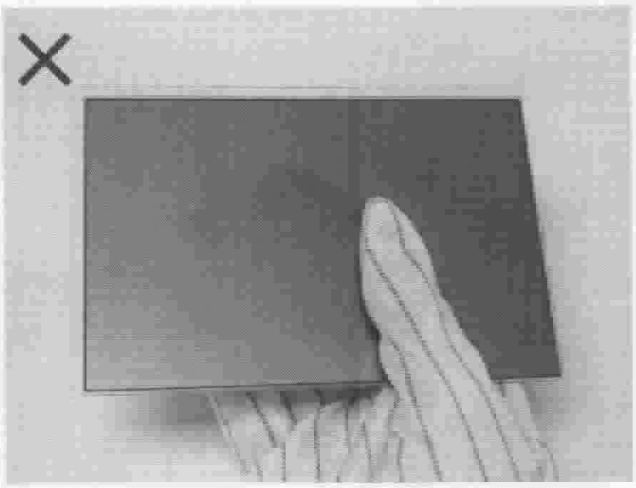


As above picture, please handle with glove by LCD edges and full EOS/ESD protection.

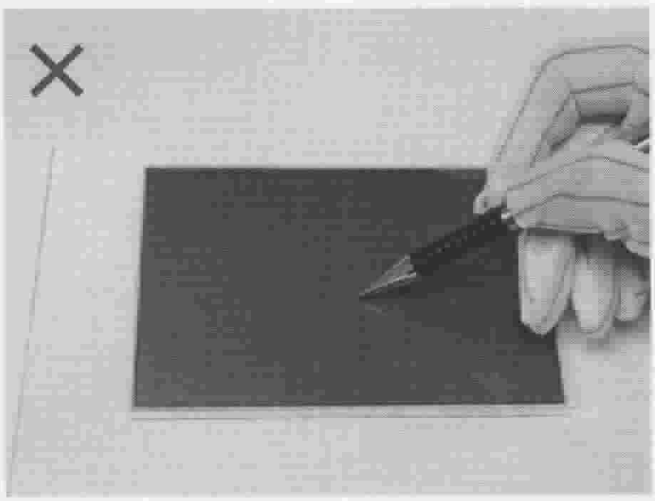
Incorrect handling



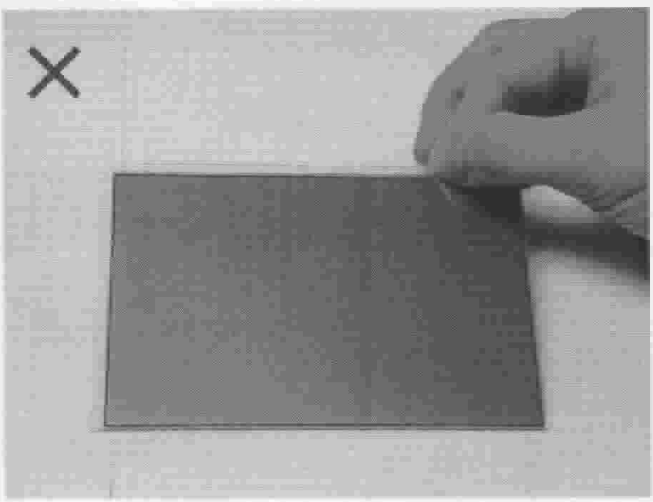
Please don't put one on another LCD.



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.