NAN YA PLASTICS CORPORATION

SPECIFICATION OF
LCD MODULE
PRODUCT NO.: LTBLDT168G6C

SPEC. NO.: LM168-6-△0

CUSTOMER
MAXON
APPROVED BY
DATE:

LCD DEPARTMENT
ELECTRONIC MATERIALS DIVISION
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EDITED ON : Oct. 13, 1999

SALE MANAGER	TECHNICAL APPROVE	DESIGN MANAGER	DESIGN CHECK	DESIGNER

RECORDS OF REVISION

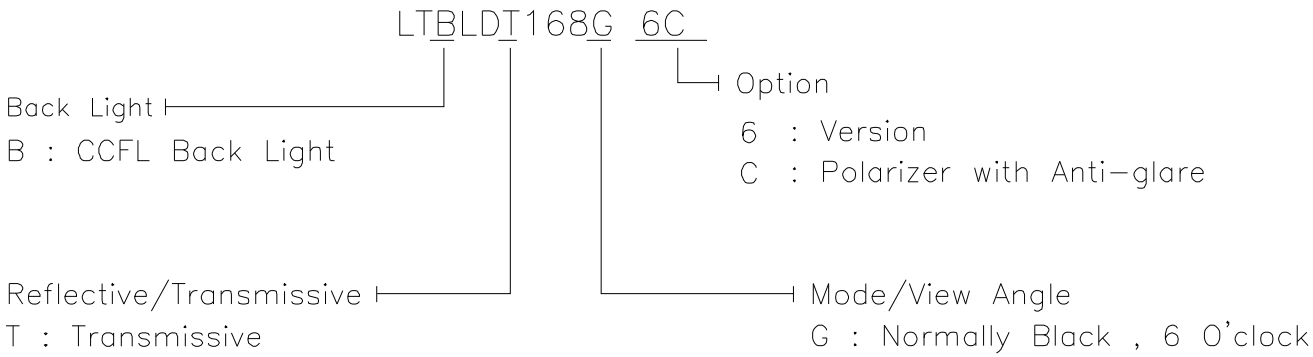
SPEC. NO. : LM168-6

DATE	REVISED NO.	REF. PAGE	SUMMARY	CHECK & APPROVAL
10.13.99'	0	23/23	First Issue (Positive Voltage For LCD Driver IC, M Signal Value Setting "06H")	

1. MECHANICAL DATA

(1) Product No.	LTBLDT168G6C
(2) Module Size	205.5 (W)mm x 141.0 (H)mm x 7.0 MAX (D)mm
(3) Dot Size	0.21 (W)mm x 0.21 (H)mm
(4) Dot Pitch	0.23 (W)mm x 0.23 (H)mm
(5) Number of Dots	640 (W) x 480 (H)Dots
(7) Duty	1/240
(8) LCD Display Mode	FSTN: Black and White(Normally Black/Negative Image) Rear Polarizer: Transmissive
(9) Viewing Direction	6 O'clock
(10) Backlight	CCFL
(11) Controller	Excluded
(12) DC/DC Converter	Excluded
(13) Weight	310 g(approx.)
(14) Used Driver IC (Voltage for LC drive)	Positive Voltage

Note :



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

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	-20	70
Humidity (Without Condensation)	Note 2,4		Note 3,4	
Vibration(Note 5)	-		49m/s² (5G)	

Note 1 LCM should be grounded during handling LCM.

Note 2 Ta ≦ 50°C : 85%RH max
Ta > 50°C : Absolute humidity must be lower than the humidity of 85%RH at 50°C

Note 3 Ta at -20°C will be < 48 hrs, at 70°C will be < 120 hrs

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 LCD

ITEM		SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic		VDD-VSS	-		3.0	3.3	3.6	V
					4.75	5.0	5.25	
Input Voltage		VIL	L level		VSS	0.2VDD	-	V
		VIH	H level		0.8VDD	VDD	-	V
LCM Recommand LCD Module Driving Voltage		VEE-VSS	VDD=5.0V Bias=1/13	0°C	23.0	23.4	23.8	V
				25°C	21.3	22.7	23.1	
				50°C	20.5	20.9	21.3	
Power Supply Current for LCM		IDD	VDD=5.0V VEE-VSS=22.7V FLM=70Hz PATTERN : ■ □ ■ □ □ ■ □ ■		-	2.0	4.0	mA
		IEE			-	6.8	13.0	
LCM	Surface Luminance	Ls	Vin=10.4V I_L=5mA @CXA-L10L (TDK)	PATTERN: (Dots All On) ■ ■ ■ ■ ■ ■ ■ ■	-	85.5	-	cd/m²
				PATTERN: (Dots All Off) □ □ □ □ □ □ □ □	-	13.3	-	
LCM	Surface Uniformity	U	Vin=10.4V I_L=5mA @CXA-L10L (TDK)	PATTERN: (Dots All On) ■ ■ ■ ■ ■ ■ ■ ■	80	85	-	%

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT

Used lamp : Rating Ta=25°C

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Open Voltage	V_{OPEN}	600	–	–	Vrms	–
Lamp Voltage	V_L	–	350	–	Vrms	–
Lamp current	I_L	4	5	6	mArms	(*1)
Lamp power consumption	P_L	–	1.75	–	W	(*2)
Lamp frequcncy	F_L	–	35	–	KHz	–
Lamp life time	L_L	10000	–	–	hrs	(*3)

(*1) It is recommended that I_L be not more than 6 mArms so that heat radiation of CCFT backlight may least affect the display quality .

(*2) Power consumption excluded inverter loss .

(*3) The life is defined by the time when the brightness gets down to 50% of the initial brightness.

4. OPTICAL CHARACTERISTICS

AT Vop

ITEM / MODE		Cr(Contrast Ratio)		θ(Viewing Angle)		ϕ(Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
T	G	–	8.0	–	80	–	±50
NOTE		NOTE 6		NOTE 5			

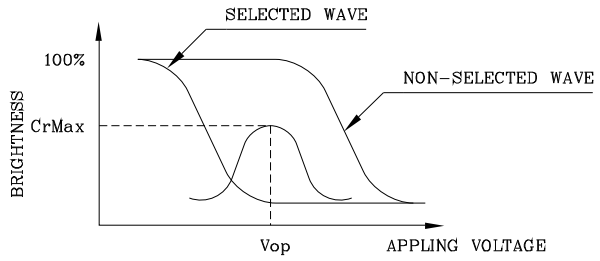
NOTE :
T: TRANSMISSIVE
G: NORMALLY BLACK, 6 O'clock

AT ø=0° θ=0°

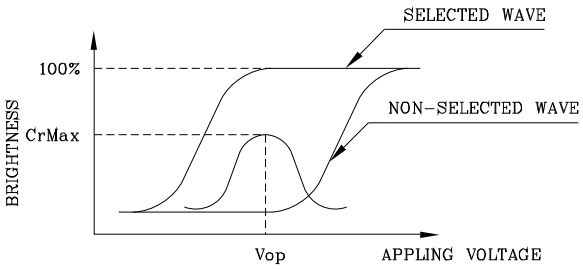
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	–	340	680	ms	NOTE 2
		25℃	–	120	240		
		50℃	–	90	180		
Response Time (fall)	Tr	0℃	–	370	710	ms	NOTE 2
		25℃	–	170	290		
		50℃	–	80	170		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



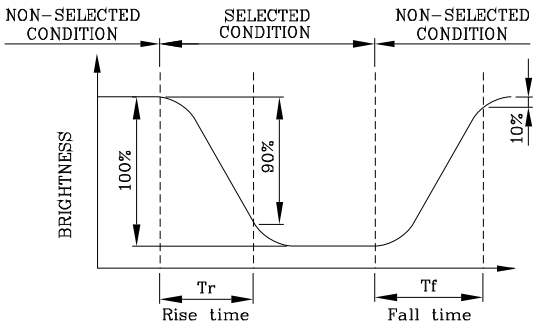
(negative type)

*Conditions

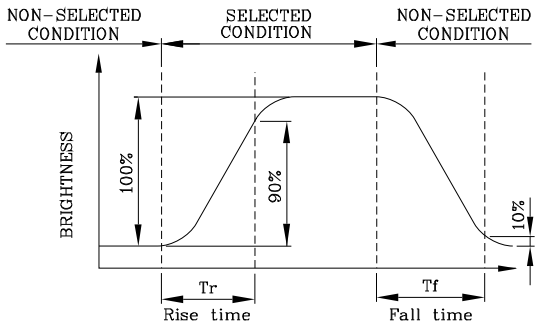
Viewing Angle : 0
Frame Frequency : 70Hz
Appling Waveform : I/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



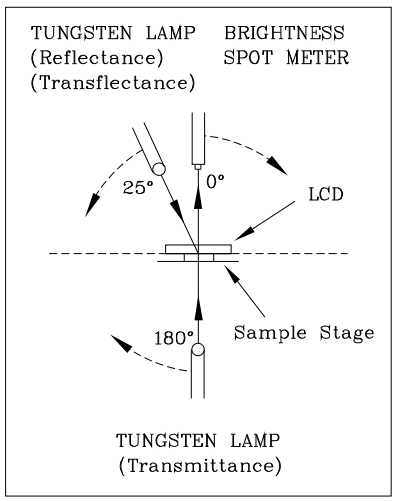
(negative type)

*Conditions

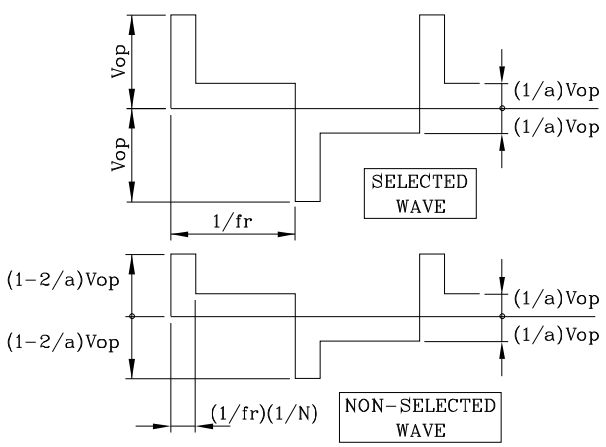
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Appling Waveform : I/N duty 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

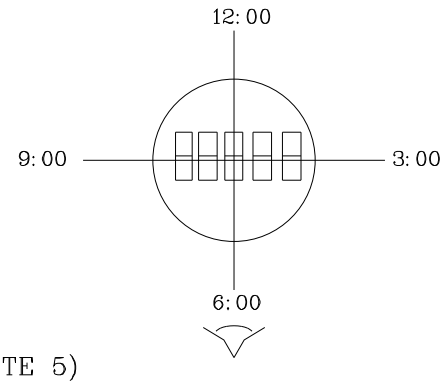


Multiplex Driving (I/N duty 1/a bias)



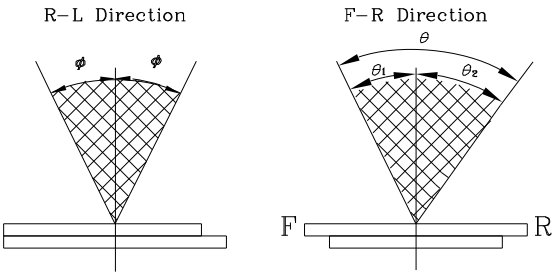
(NOTE 4)

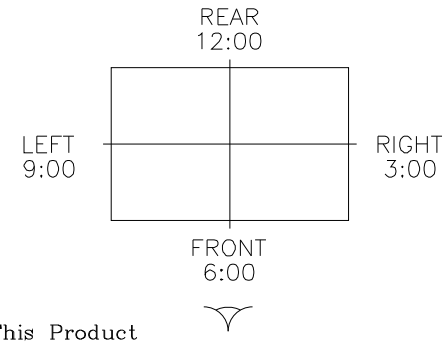
Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle





*For This Product

The Viewing Direction Is 6 O'clock

So θ1 > θ2

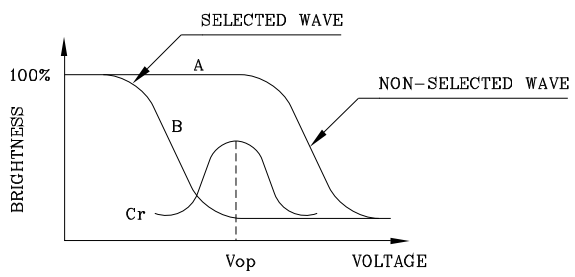
$\theta = \theta_1 + \theta_2$

*Conditions

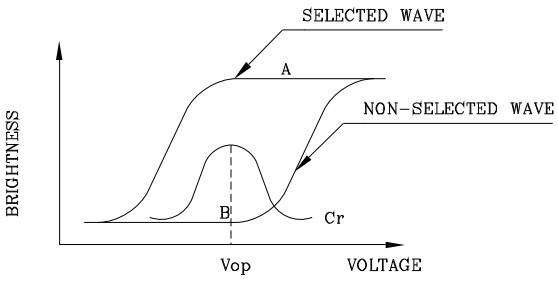
Operating Voltage : Vop
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



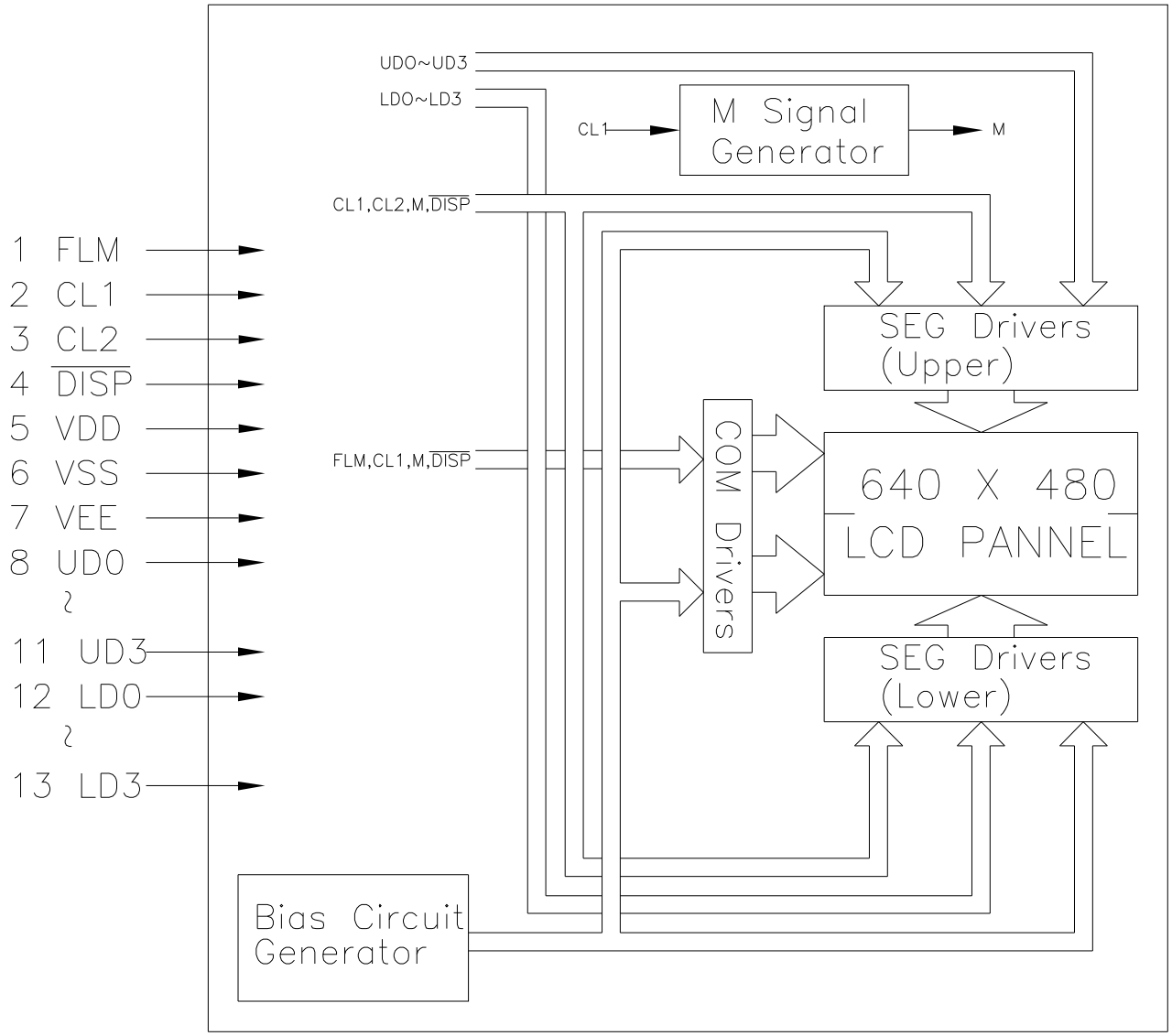
(negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

5. BLOCK DIAGRAM



* M Signal Value Setting

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

6. INTERNAL PIN CONNECTION

LCD

Pin No.	Symbol	Level	Function
1	FLM	H/L	SCAN START-UP SIGNAL
2	CL1	H→L	DATA LATCH PULSE
3	CL2	H→L	DATA SHIFT PULSE
4	$\overline{DISP}$	H/L	DISPLAY OFF ("H"=ON,"L"=OFF)
5	VDD	–	POWER SUPPLY FOR LOGIC (+3.3V/+5V)
6	VSS	–	SIGNAL GROUND (GND)
7	VEE	–	POWER SUPPLY FOR LCD (+V)
8	UD0	H/L	DISPLAY DATA (UPPER HALF)
9	UD1		
10	UD2		
11	UD3		
12	LD0	H/L	DISPLAY DATA (LOWER HALF)
13	LD1		
14	LD2		
15	LD3		

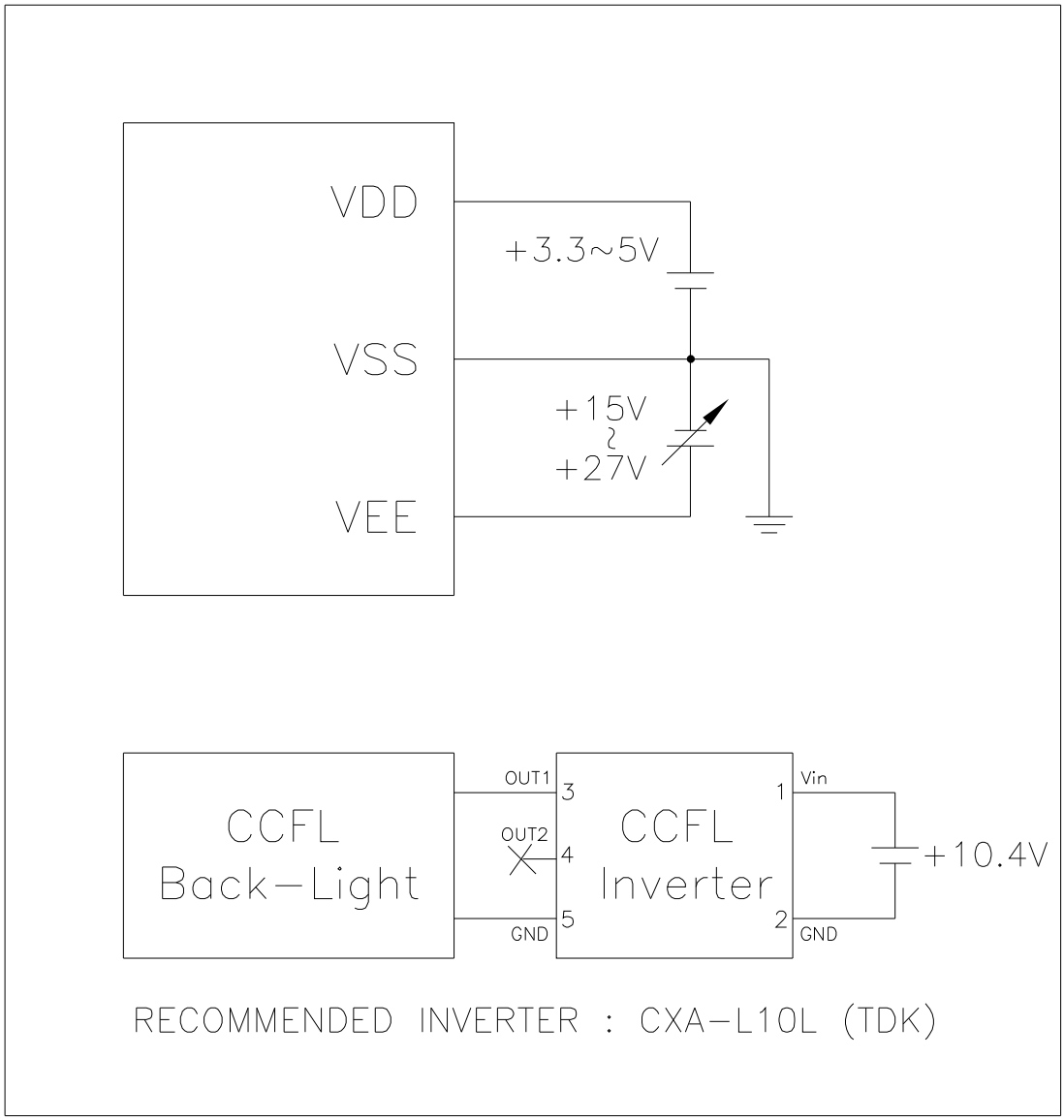
CCFL

Pin No.	Symbol	Level	Function
1	HV	–	HIGH VOLTAGE LINE (INVERTER)
2~3	NC	–	NON CONNECTION
4	GND	–	GROUND LINE (INVERTER)

LCD
Used connector : MOLEX 53261-1590
Mating connector : MOLEX 51021-1500(HOUSING) X 1 +
MOLEX 50058-8000(TERMINAL) X 15 or Compatible

CCFL
Used connector : M63M83-04 (MITSUMI)
Mating connector : M60-04-30-114P (MITSUMI)
M60-04-30-134P (MITSUMI)
M61M73-04 (MITSUMI)

7. POWER SUPPLY



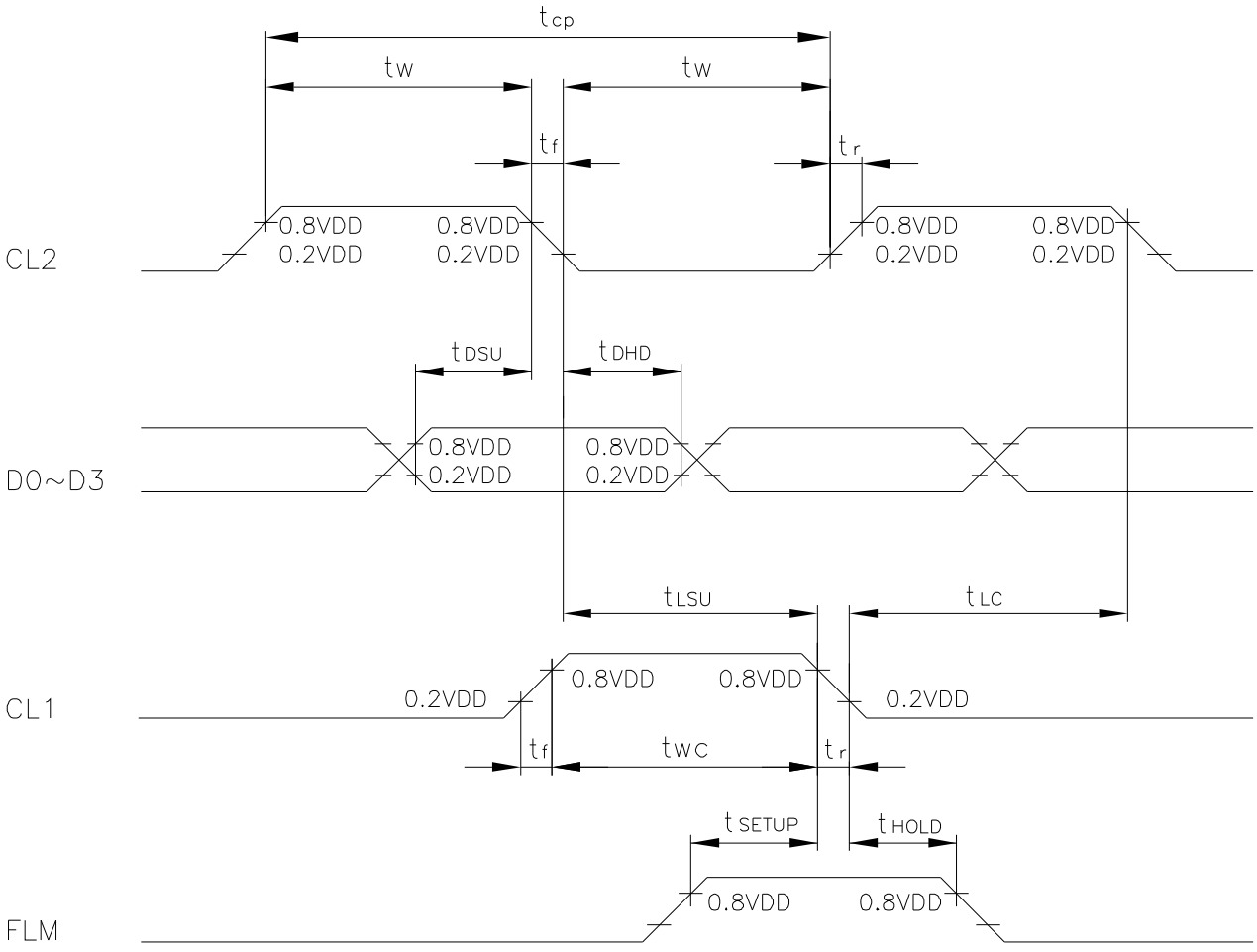
RECOMMENDED INVERTER : CXA-L10L (TDK)

8. TIMING CHARACTERISTICS

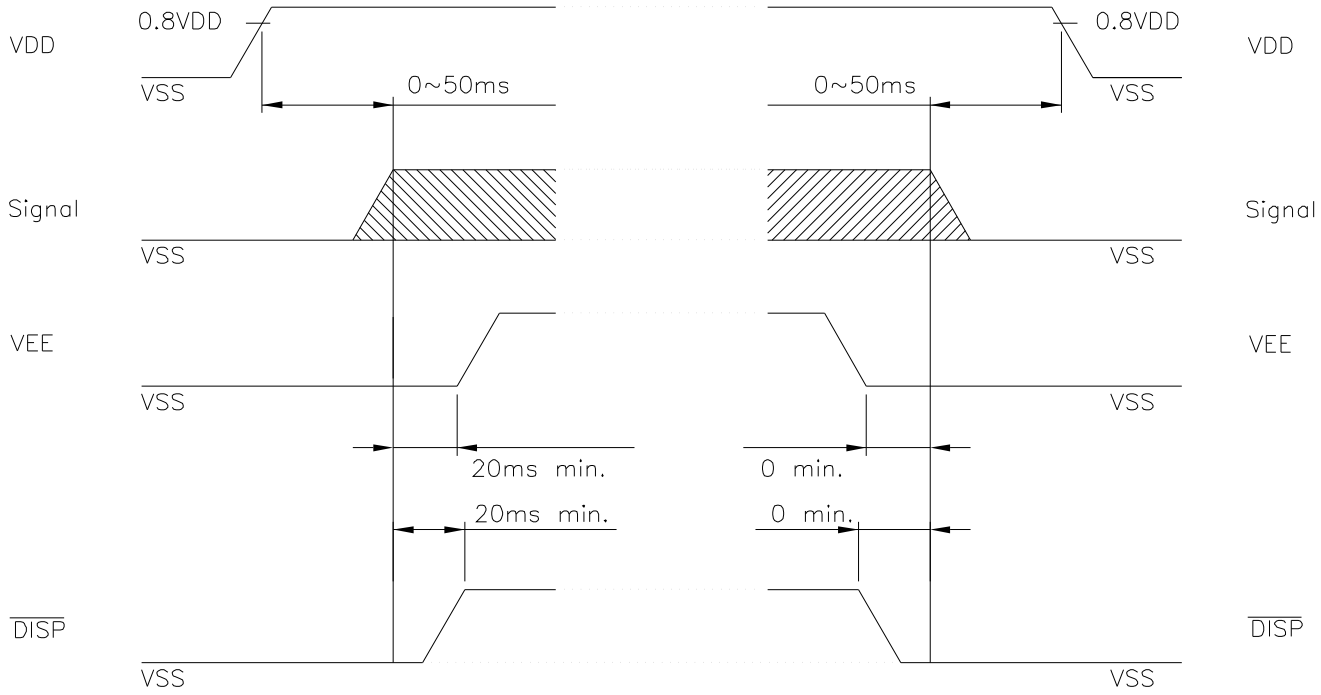
8-1. INTERFACE TIMING

@VDD=2.5~5.5V

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
Shift Clock Period	t_{cp}	152	–	–	ns
"CL2" PULSE WIDTH	t_w	65	–	–	ns
CLOCK RISE, FALL TIME	t_r , t_f	–	–	50	ns
DATA SETUP TIME	t_{DSU}	50	–	–	ns
DATA HOLD TIME	t_{DHD}	40	–	–	ns
"CL2"→ "CL1" FALL TIME	t_{LSU}	65	–	–	ns
"CL1"→ "CL2" FALL TIME	t_{LC}	65	–	–	ns
"FLM" SETUP TIME	t_{SETUP}	100	–	–	ns
"FLM" HOLD TIME	t_{HOLD}	100	–	–	ns
"CL1" PULSE WIDTH	t_{WC}	65	–	–	ns

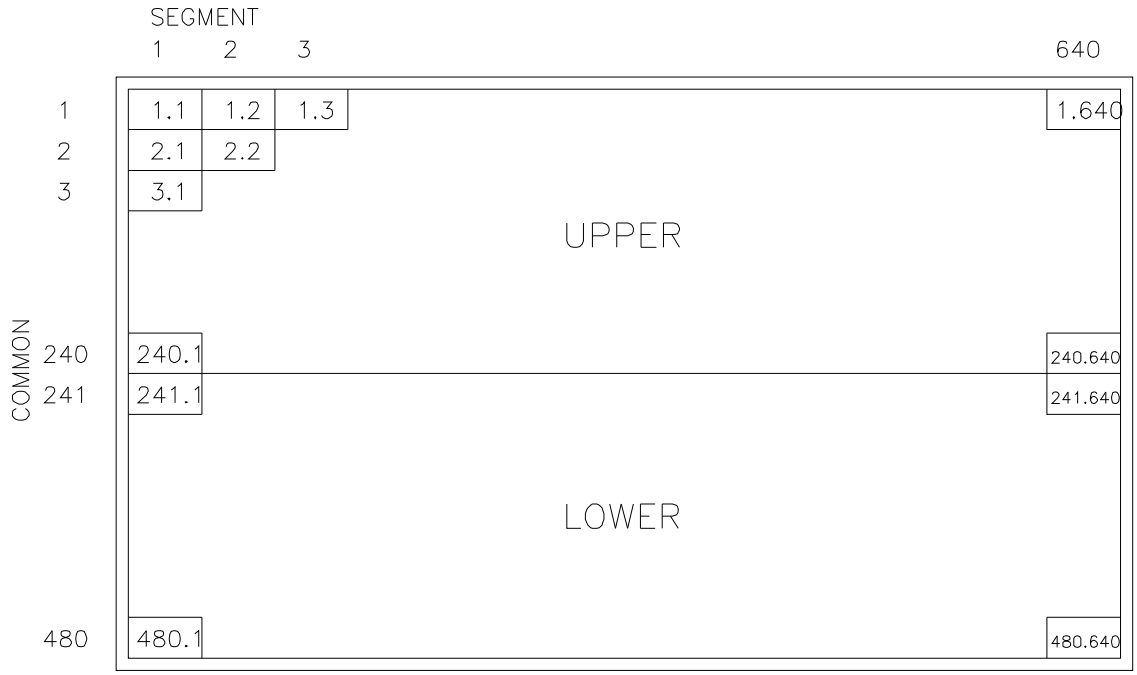


8-2. POWER ON/OFF TIMING

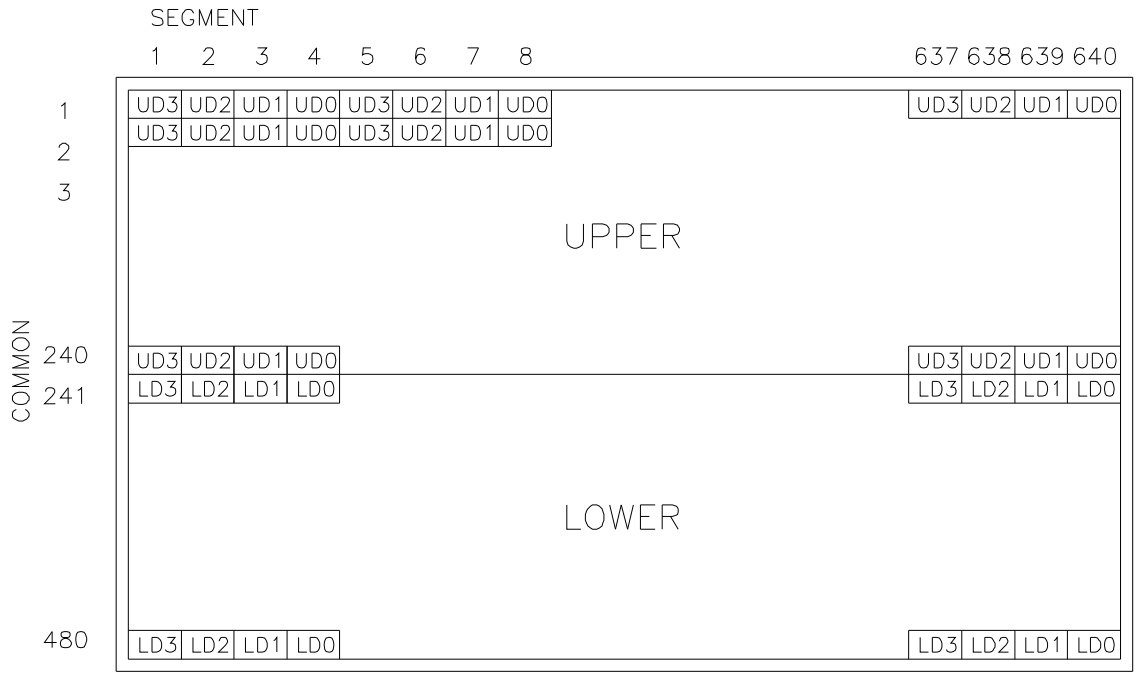


The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

8-3. DISPLAY PATTERM



NOTE : 1.1 MEANS 1ST COMMON 1ST SEGMENT DOT



9. RELIABILITY TEST

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

Inspection Provision

1.Purpose

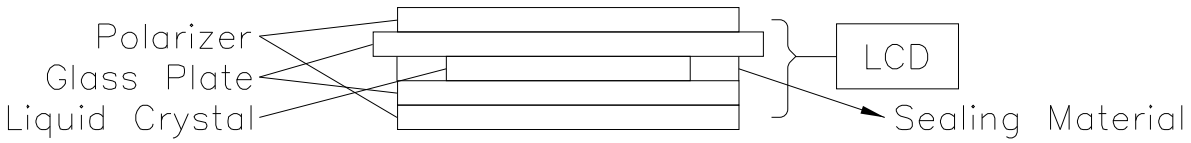
The NAN YA inspection provision provides outgoing inspection provision and its expected quality level based on our outgoing inspection of NAN YA LCD produces.

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 Provision

Outgoing inspection is according to the product inspection manual.

4-1 Ispection Method

MIL-STD-105D Level Ⅱ Regular inspection

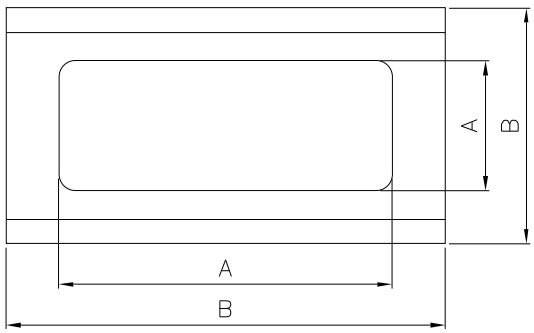
4-2 Inspection Standard

	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.

Otherwise specfied.

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

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

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

5.Specification for quality check

5-1 Electrical characteristics

NO.	Item	Criterion
1.	Non operational	NO-GO
2.	Miss operating	NO-GO
3.	Missing dot	NO-GO
4.	Contrast irregular	Non detectable
5.	Response time	Within Specified value
6.	EL backlight turn on/off	NO-GO

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.

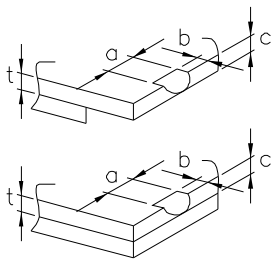
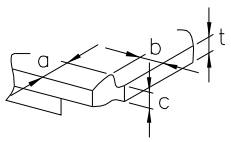
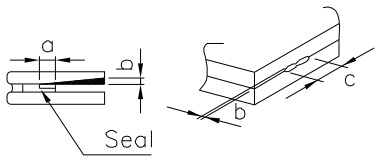
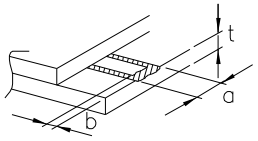
Note that when there are 2 pieces or more, they are not to be concentrated.
Set as: Average diameter = (Long diameter + Short diameter)/2
</td></tr>
</table>

<table>
<tr><td>1.</td><td>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>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.

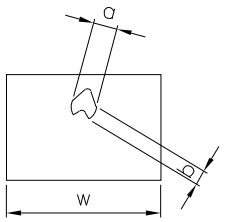
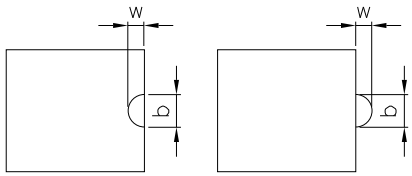
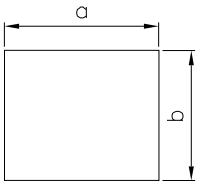
(1)−2 Spots(At lighting condition)

<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	Orbicular of interference fringes. To be non. In case of doubtful judgenemt, agreement shall be reachment.
8.	Soldering	Should be no defective soldering such as shorting, loose terminal cold solder, peeling of printed circuit board pattern, improper mouting position, etc.

5-3 Dot Appearance Defect

NO.	Item	Criteria
1.	Plinhole	 Dot display a and b are each ≦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).

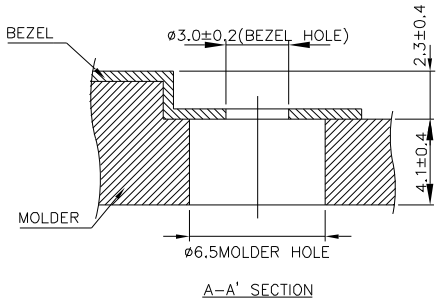
- SAFETY
  1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

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

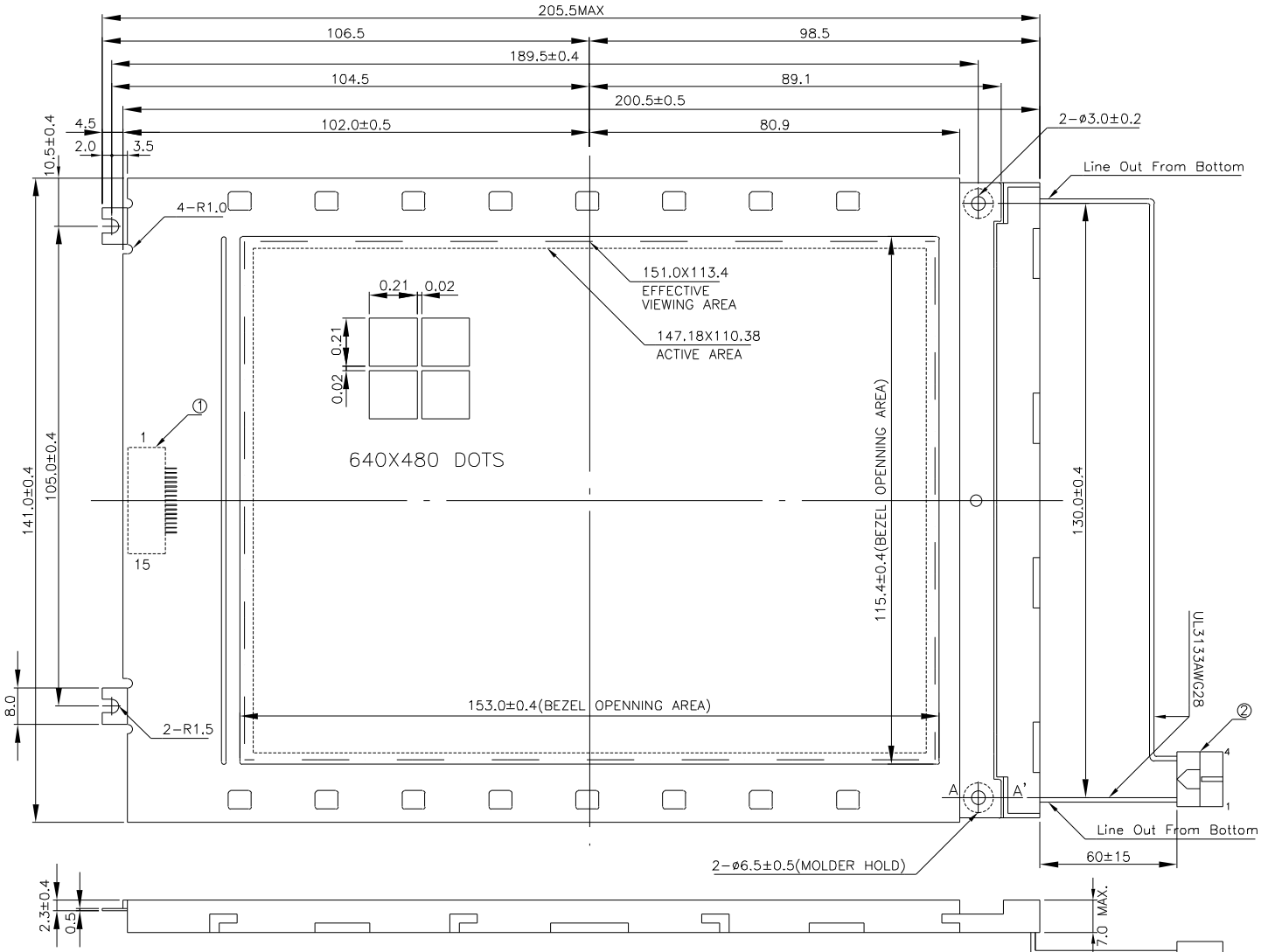
- STORAGE
  1. Store the panel or module in a dark place where the temperature is 25°C±5°C and the humidity is below 65% RH.
  2. Do not place the module near organics solvents or corrosive gases.
  3. Do not crush, shake, or jolt the module.

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

- THE OPERATING LIFE TIME OF BACK LIGHT
  CCFT : 10,000HR



A–A' SECTION



Note :

① used LCD connector : MOLEX, 53261–1590

② used CCFT connector : M63M83–04 (MITSUMI)
correspondable CCFT connector : M60–04–30–114P (MITSUMI)
M60–04–30–134P (MITSUMI)
M61M73–04 (MITSUMI)

③ TOLERANCE NO SPECIFIED:±0.5 mm

I/O connection

Pin No.	Symbol	Signal Level	Function
1	FLM	H	Scan Start-up Signal
2	CL1	H→L	Data Latch Pulse
3	CL2	H→L	Data Shift Pulse
4	$\overline{DISP}$	H/L	Display Off ("H"=ON,"L"=OFF)
5	VDD	–	Power Supply for Logic (+5V)
6	VSS	–	Signal Ground (GND)
7	VEE	–	Power Supply for LCD (+V)
8	UD0	H/L	Display Data (Upper Half)
9	UD1	H/L	
10	UD2	H/L	
11	UD3	H/L	
12	LD0	H/L	Display Data (Lower Half)
13	LD1	H/L	
14	LD2	H/L	
15	LD3	H/L	

CCFT

Pin No.	Symbol	Signal Level	Function
1	HV	–	High Voltage Line (Inverter)
2~3	NC	–	Non Connection
4	GND	–	Ground 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

LTBLDx168x6x

	NAME	DATE	THIRD ANGLE P.	
APPROVE				
CHECK				
DESIGN	Louis Lee	88.10.13	SCALE	UNIT
DRAWN	MAY PING	88.10.13	2/3	mm

DWG NO. M168-D6A ① A