

NAN YA PLASTICS CORP.  
ELEC. MATERIALS DIV.  
LCD DEPARTMENT

# SPECIFICATION

SPEC. NO. : LM168-0  
DATE : JAN. 20, 1998  
SHEET NO. : 1/17

U.S. MARKETING ARM:

MARK PRODUCTS CORPORATION  
800 N. EDGEWOOD AVENUE  
WOOD DALE, IL 60191  
TEL: 630-787-9089  
FAX: 630-787-9015

SPECIFICATION OF  
640x480 LCD MODULE  
PRODUCT NO.: LT\_LD\_168\_\_\_\_\_

SPEC. NO.: LM168-0

APPROVED BY

EDITED ON : JAN. 20, 1998

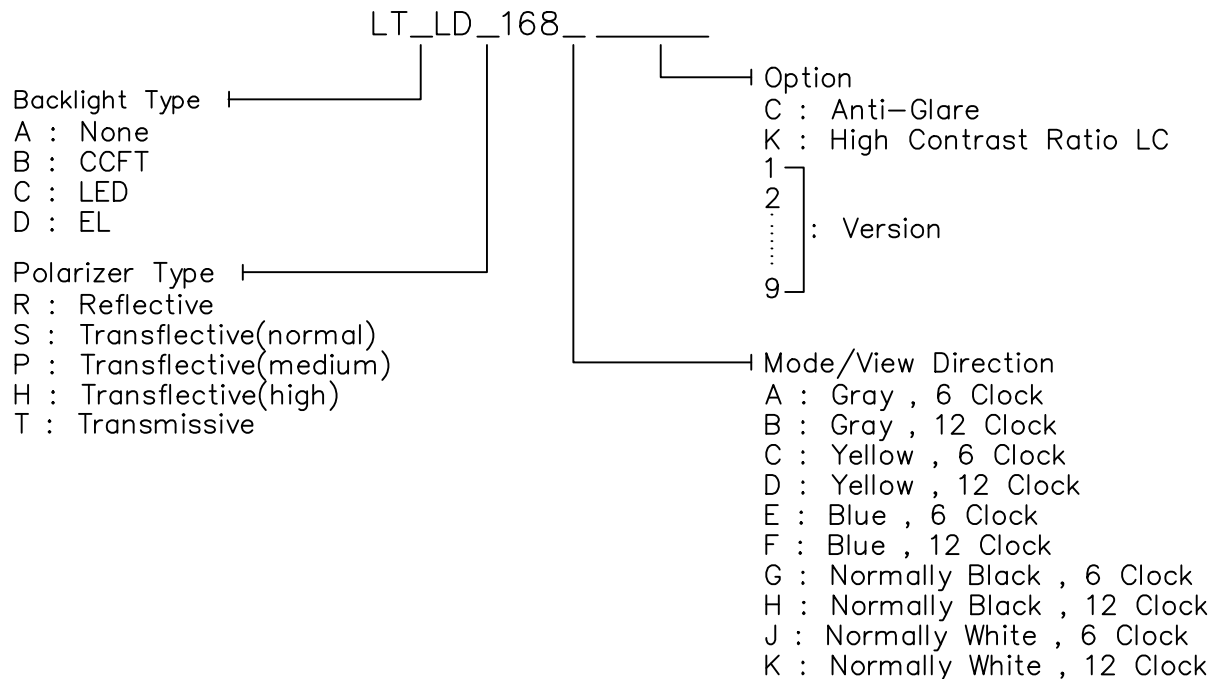
SALES MANAGER	DESIGN MANAGER	PERSON IN CHARGE

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# 1. MECHANICAL DATA

- (1) Product No. LT\_LD\_168\_---
- (2) Module Size 205.5 (W)mm x 141.0 (H)mm x 9.2 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 STN:  Gray Mode  Yellow Mode  Blue Mode  
 FSTN:  Black and White(Normally White/Positive Image)  
 Black and White(Normally Black/Negative Image)  
 Rear Polarizer:  Reflective  Transflective  Transmissive  
 Transflective(High Transmissive)
- (9) Viewing Direction  6 O'clock  12 O'clock  \_\_\_O'clock
- (10) Backlight  W/O  CCFL
- (11) Controller Without
- (12) DC/DC Converter Without
- (13) Weight W/O B/L : 250 g(approx.)  
 CCFL B/L : 310 g(approx.)

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	VDD-VEE	0	27	V	
Static Electricity	-	-	-	-	Note 1

Note 1 LCM should be grounded during handling LCM.

### (2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	NORMAL TEMP.				WIDE TEMP.			
	OPERATING		STORAGE		OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	-20	70	-20	70	-30	80
Humidity (Without Condensation)	Note 1,3		Note 2,3		Note 3,4		Note 3,5	

Note 1  $T_a \leq 50^\circ\text{C}$  : 85%RH max  
 $T_a > 50^\circ\text{C}$  : Absolute humidity must be lower  
 than the humidity of 85%RH at  $50^\circ\text{C}$

Note 2  $T_a$  at  $-20^\circ\text{C}$  will be < 48hrs, at  $70^\circ\text{C}$  will be < 120hrs

Note 3 Background color changes slightly depending on ambient temperature.  
 This phenomenon is reversible.

Note 4  $T_a \leq 70^\circ\text{C}$  : 75%RH max  
 $T_a > 70^\circ\text{C}$  : Absolute humidity must be lower  
 than the humidity of 75%RH at  $70^\circ\text{C}$

Note 5  $T_a$  at  $-30^\circ\text{C}$  will be < 48hrs, at  $80^\circ\text{C}$  will be < 120hrs

### 3. ELECTRICAL CHARACTERISTICS

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Power Supply for Logic		VDD-VSS	-	4.75	5.0	5.25	V	
Input Voltage		VIL	L level	VSS	0.2VDD	-	V	
		VIH	H level	0.8VDD	VDD	-	V	
Recommended LCD Driving Voltage		VDD-VEE	VDD=5V Bias=1/13	0°C	23.2	23.7	24.2	V
				25°C	22.3	22.8	23.3	
				50°C	20.7	21.2	21.7	
Power Supply Current for LCM		IDD	VDD=5.0V VDD-VEE=22.0V FLM=70Hz	-	12.0	-	mA	
		IEE		-	5.0	-		
CCFL LAMP	Open Voltage	V <sub>OPEN</sub>	Lamp Current = 5 mArms Frequency = 55 KHz	-	440	-	V <sub>rms</sub>	
	Lamp Voltage	V <sub>L</sub>		-	330	-	V <sub>rms</sub>	
	Brightness	B		-	33600	-	cd/m <sup>2</sup>	
	Color Degree	X		-	0.311	-	-	
		Y		-	0.306	-		

## 4.OPTICAL CHARACTERISTICS

AT Vop

ITEM MODE		Cr(Contrast Ratio)		$\theta$ (Viewing Angle)		$\phi$ (Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	J	-	-	-	-	-	-
S	J	-	-	-	-	-	-
P	J	-	-	-	-	-	-
T	E	-	-	-	-	-	-
	G	4	7	40	65	25	35
NOTE		NOTE6		NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	-	330	510	ms	NOTE 2
		25℃	-	130	180		
		50℃	-	80	140		
Response Time (fall)	Tr	0℃	-	380	550	ms	NOTE 2
		25℃	-	150	260		
		50℃	-	80	160		

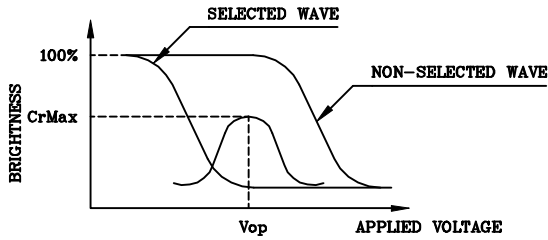
NOTE :

R: REFLECTIVE  
S: TRANSFLECTIVE  
P: TRANSFLECTIVE(HIGH TRANSMISSIVE)  
T: TRANSMISSIVE

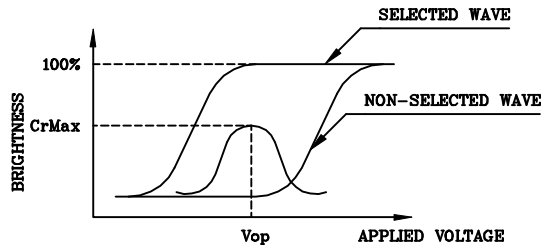
E: BLUE  
G: NORMALLY BLACK  
J: NORMALLY WHITE

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



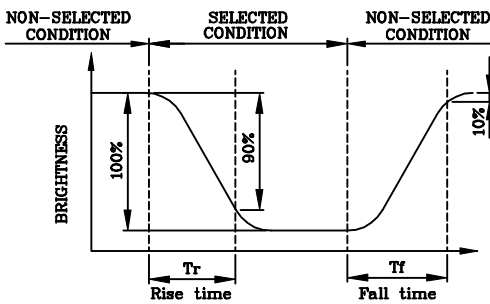
(negative type)

\*Conditions

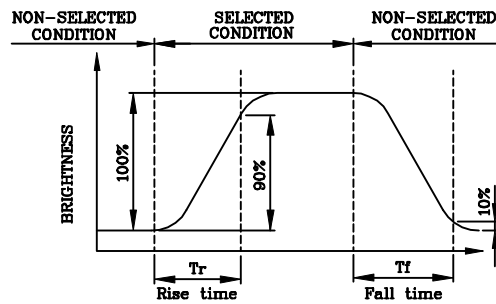
Viewing Angle : 0  
Frame Frequency : 70Hz  
Applied Waveform : I/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



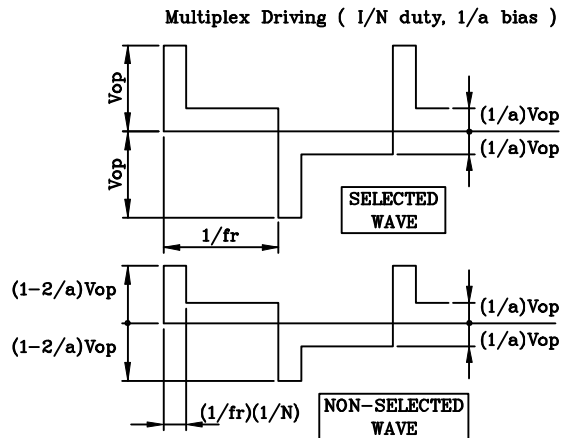
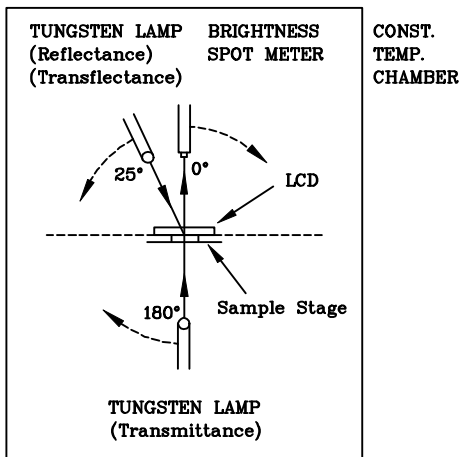
(negative type)

\*Conditions

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

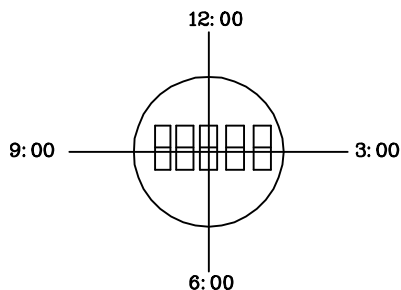
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



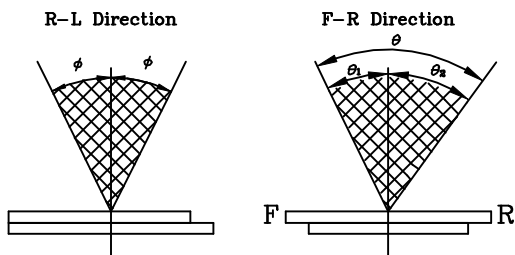
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle

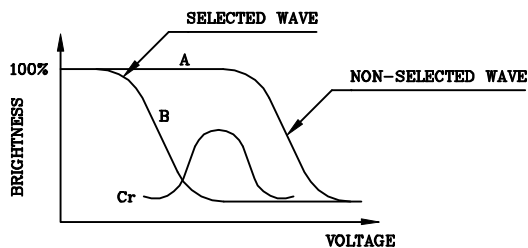


\*Conditions

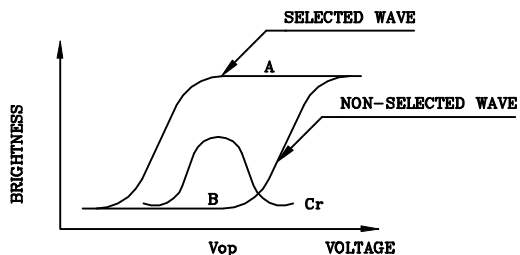
Operating Voltage :  $V_{op}$   
 Frame Frequency : 70Hz  
 Applied Waveform : 1/N duty, 1/a bias  
 Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

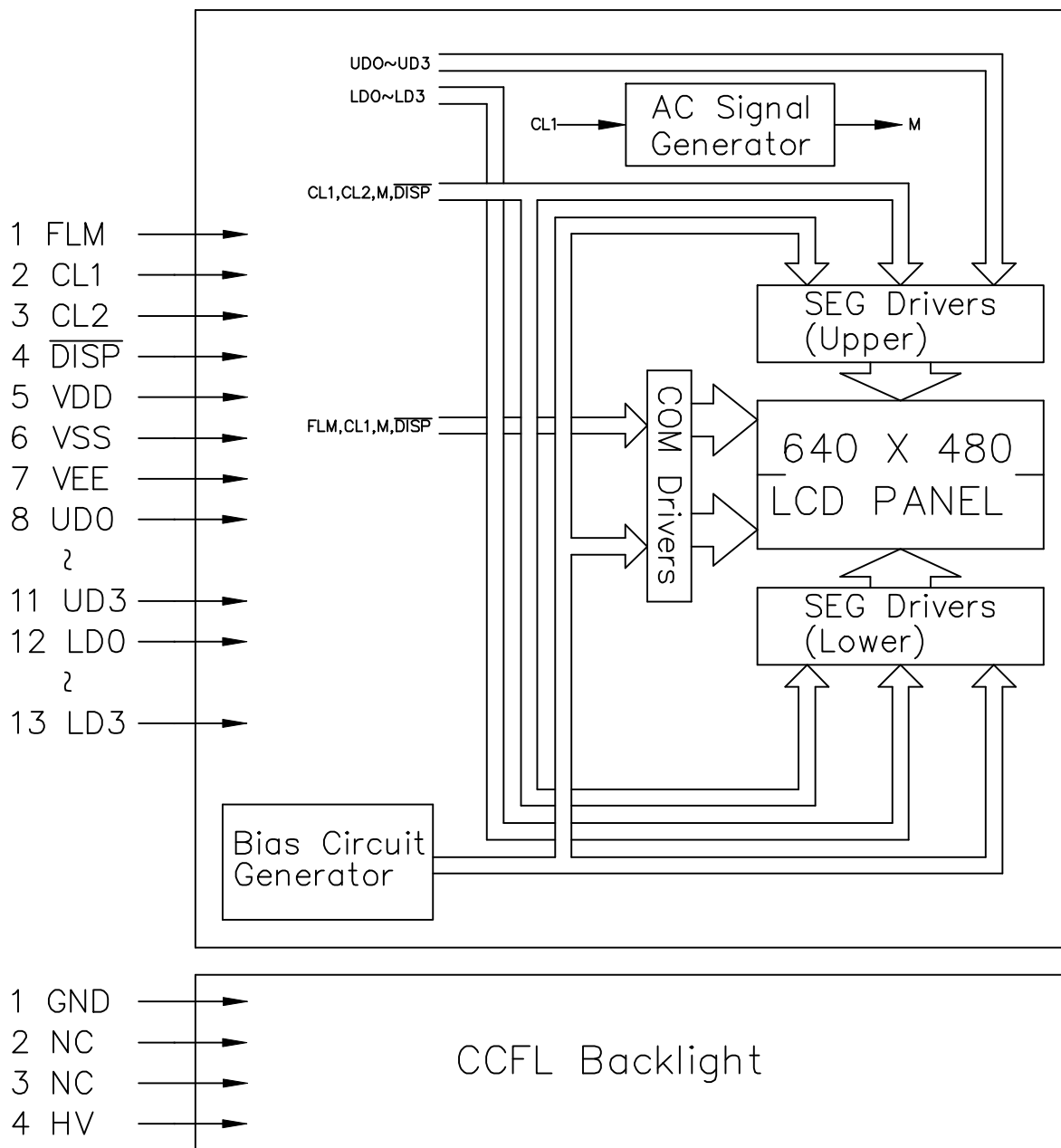
Contrast Ratio :  $Cr=A/B$

\*Conditions

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

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## 5. BLOCK DIAGRAM



\* AC Signal Setting

J1	J2	J3	J4	J5	J6	J7	J8
L	H	L	L	H	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	$\overline{\text{DISP}}$	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		
10	UD2		
11	UD3		
12	LD0	H/L	DISPLAY DATA (LOWER HALF)
13	LD1		
14	LD2		
15	LD3		

### CCFT

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

### LCD

Used connector : 53261-1590 (MOLEX)

### CCFT

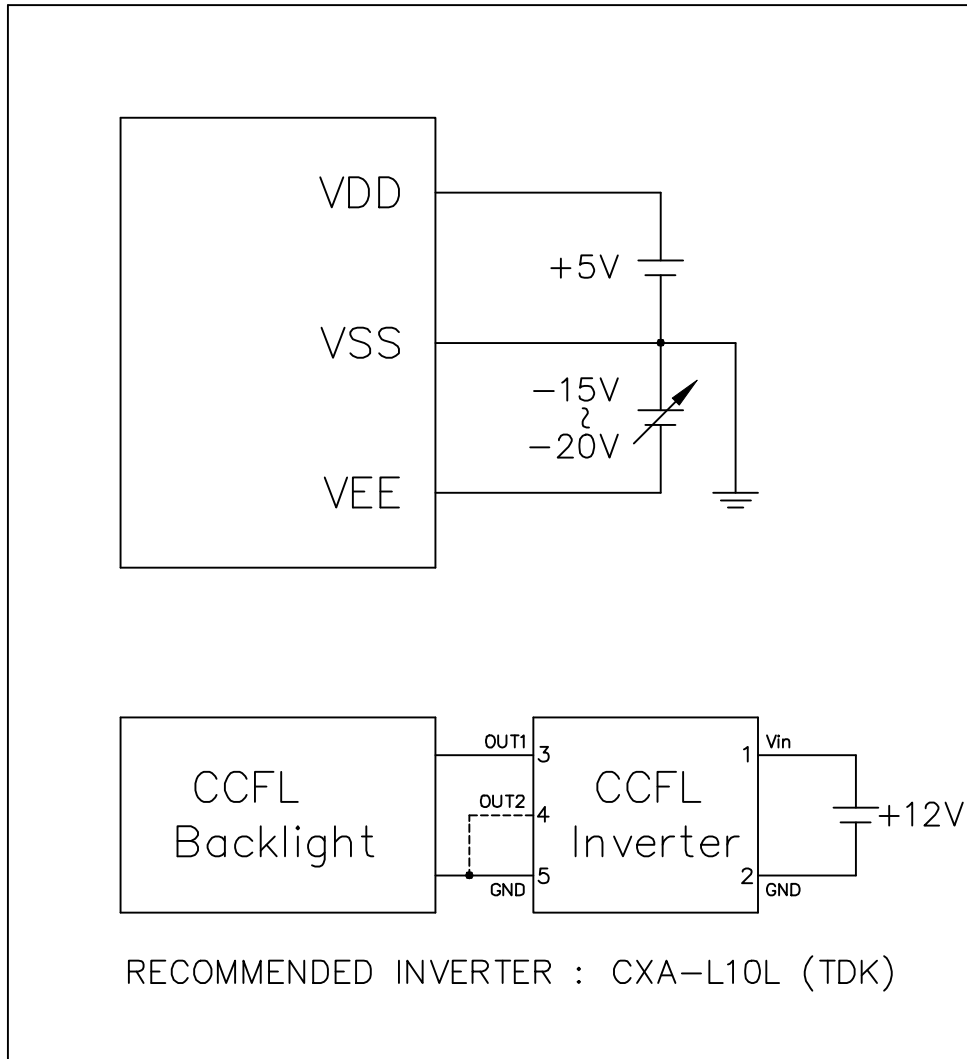
Used connector : M63M83-04 (MITSUMI)

Mating connector : M60-04-30-114P (MITSUMI)

M60-04-30-134P (MITSUMI)

M61M73-04 (MITSUMI)

# 7. POWER SUPPLY

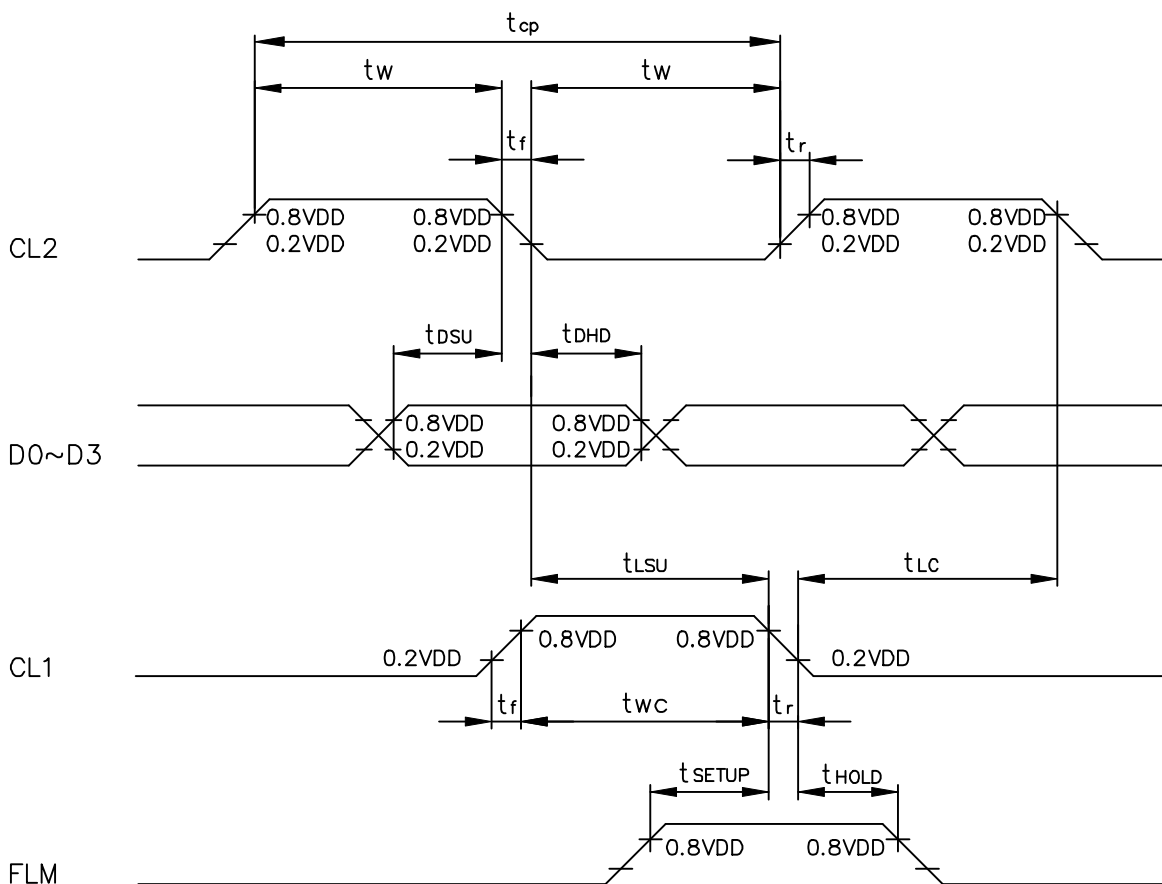


## 8. TIMING CHARACTERISTICS

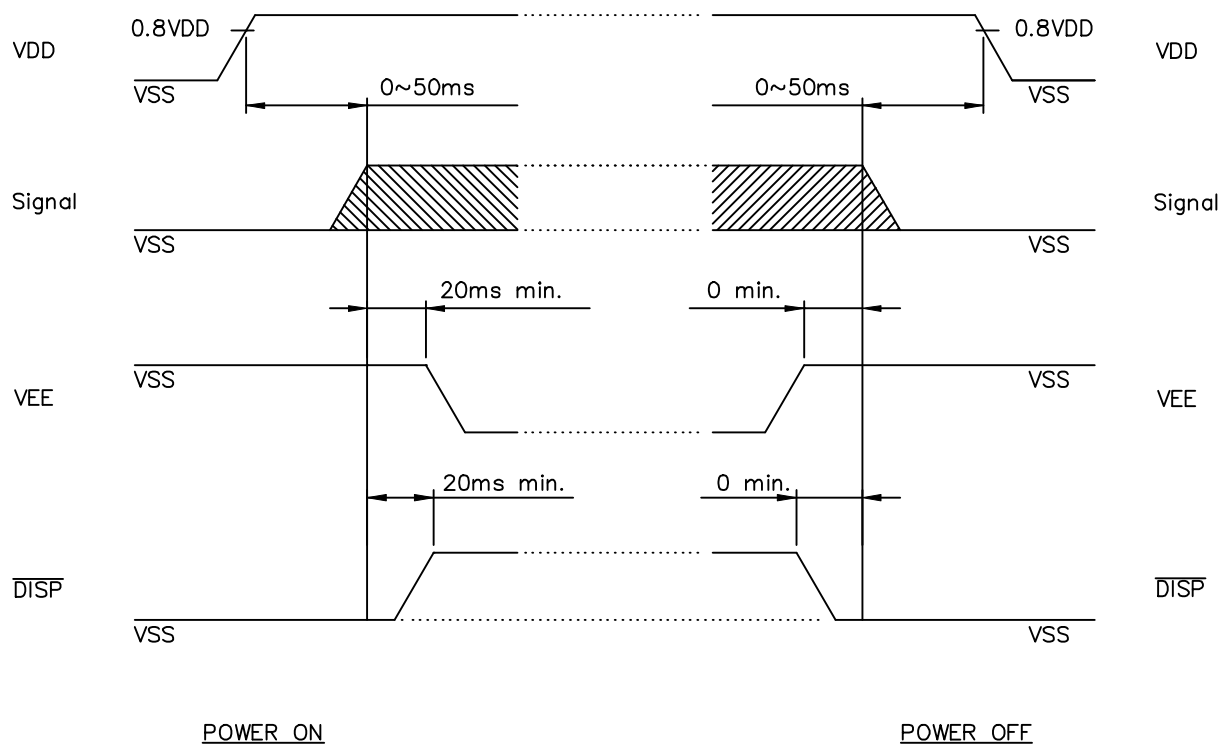
### 8-1. INTERFACE TIMING

@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
"FRAME" SETUP TIME	$t_{setup}$	100	—	—	ns
"FRAME" HOLD TIME	$t_{hold}$	100	—	—	ns
"CL1" PULSE WIDTH	$t_{wc}$	65	—	—	ns

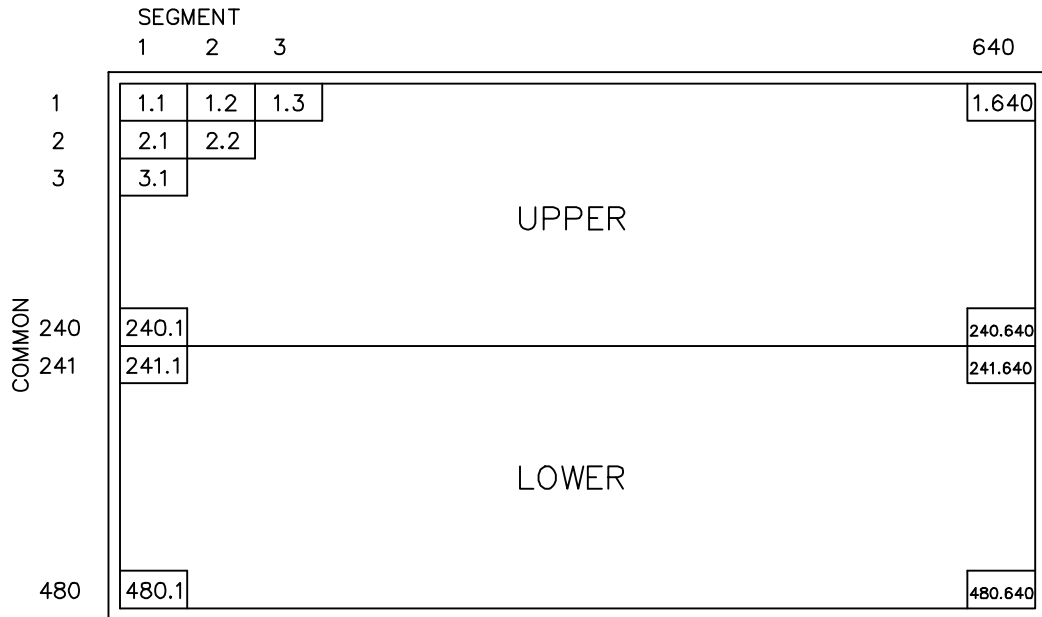


## 8-2. POWER ON/OFF TIMING

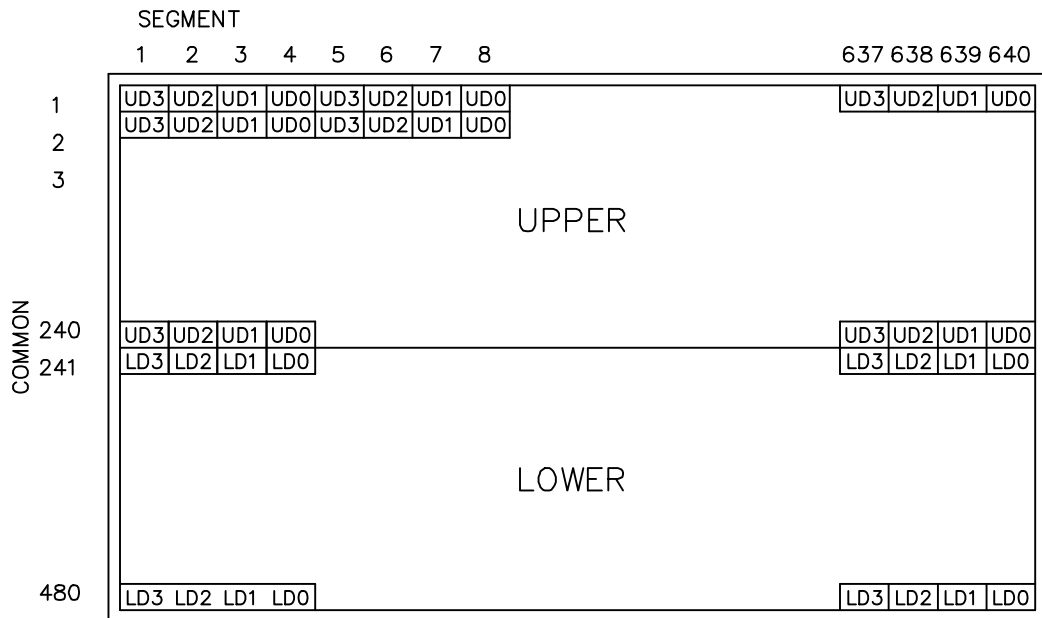


The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

### 8-3.DISPLAY PATTERN



NOTE : 1.1 MEANS 1st COMMON / 1st SEGMENT DOT

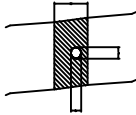
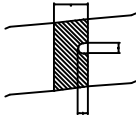
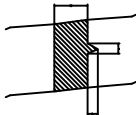


## 9. RELIABILITY TEST

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 Humidity Storage	40°C 90%RH	120HR		Appearance without defect	
4	Thermal Shock	-20°C/30min → 25°C/5min → 60°C/30min → 25°C/5min (= 1cycle)			Appearance without defect	5 cycles

# 10.LCD PRODUCT QUALITY STANDARD

## (1) DISPLAY APPEARANCE

NO	ITEM	C R I T E R I A																					
1.	INCLUSIONS (BLACK SPOT , WHITE SPOT , DUST)	<p>(1) ROUND TYPE</p> <table border="1"> <thead> <tr> <th>DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td><math>a \leq 0.20</math></td> <td>NEGLECT</td> </tr> <tr> <td><math>0.20 &lt; a \leq 0.35</math></td> <td>5 MAX</td> </tr> <tr> <td><math>0.35 &lt; a</math></td> <td>NONE</td> </tr> </tbody> </table> <p>(2) LINEAR TYPE</p> <table border="1"> <thead> <tr> <th>LENGTH mm(L)</th> <th>WIDTH mm(W)</th> <th>NO. OF DEFECT</th> </tr> </thead> <tbody> <tr> <td>N A</td> <td><math>W \leq 0.03</math></td> <td>NEGLECT</td> </tr> <tr> <td><math>L \leq 3</math></td> <td><math>0.03 &lt; W \leq 0.08</math></td> <td>6</td> </tr> <tr> <td><math>3 &lt; L</math></td> <td><math>0.08 &lt; W</math></td> <td>NONE</td> </tr> </tbody> </table>		DIAMETER mm (a*)	NO. OF DEFECT*	$a \leq 0.20$	NEGLECT	$0.20 < a \leq 0.35$	5 MAX	$0.35 < a$	NONE	LENGTH mm(L)	WIDTH mm(W)	NO. OF DEFECT	N A	$W \leq 0.03$	NEGLECT	$L \leq 3$	$0.03 < W \leq 0.08$	6	$3 < L$	$0.08 < W$	NONE
DIAMETER mm (a*)	NO. OF DEFECT*																						
$a \leq 0.20$	NEGLECT																						
$0.20 < a \leq 0.35$	5 MAX																						
$0.35 < a$	NONE																						
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$L \leq 3$	$0.03 < W \leq 0.08$	6																					
$3 < L$	$0.08 < W$	NONE																					
2.	SCRATCH	<p>1.SCRATCH ON PROTECTIVE FILM IS PERMITTED . 2.SCRATCH ON POLARIZER SHALL BE AS FOLLOW: (1) ROUND TYPE</p> <table border="1"> <thead> <tr> <th>DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td><math>a \leq 0.15</math></td> <td>NEGLECT</td> </tr> <tr> <td><math>0.15 &lt; a \leq 0.20</math></td> <td>2 MAX</td> </tr> <tr> <td><math>0.20 &lt; a</math></td> <td>NONE</td> </tr> </tbody> </table> <p>(2) LINEAR TYPE BE JUDGED BY 1.-(2) LINEAR TYPE</p>		DIAMETER mm (a*)	NO. OF DEFECT*	$a \leq 0.15$	NEGLECT	$0.15 < a \leq 0.20$	2 MAX	$0.20 < a$	NONE												
DIAMETER mm (a*)	NO. OF DEFECT*																						
$a \leq 0.15$	NEGLECT																						
$0.15 < a \leq 0.20$	2 MAX																						
$0.20 < a$	NONE																						
3.	DENT	DIAMETER < 1.5mm																					
4.	BUBBLE	NOT EXCEEDING 0.5mm AVERAGE DIAMETER IS ACCEPTABLE BETWEEN GLASS AND POLARIZING FILM.																					
5.	PIN HOLE	$(a+b)/2 \leq 0.15$ mm MAXIMUM NUMBER: IGNORED $0.15 < (a+b)/2 \leq 0.20$ MAXIMUM NUMBER: 10																					
6.	DOT DEFECT	$(a+b)/2 \leq 0.20$ mm MAXIMUM NUMBER: IGNORED $0.20 < (a+b)/2 \leq 0.30$ MAXIMUM NUMBER: 5 x = WIDTH	 																				
7.	CONTRAST IRREGULARITY (SPOT)	DIAMETER SPEC. $a \leq 0.50$ mm $0.50 < a \leq 0.75$ $0.75 < a \leq 1.00$ $1.00 < a$	NO. OF DEFECT* NEGLECT 5 3 NONE																				
8.	DOT WIDTH	DESIGN WIDTH ±15%																					
9.	COLOR TONE AND UNIFORMITY	OBVIOUS UNEVEN COLOR IS NOT PERMITTED																					

REV/DATE

R0/  
01.20.98'

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(2) NOTE:

• SAFETY

- 1.If the LCD panel breaks, be careful not to allow 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.Prevent all contact with static electricity, which can damage the CMOS ICs. The module is packaged in a static-shielding bag to prevent damage during shipment, warehousing and removal from the shipping carton.
- 2.Do not remove the panel or frame from the module.
- 3.The polarizing plate on the front surface of the display is very fragile and easily scratched. The module is shipped with a protective liner which must be removed from the polarizing plate prior to assembly.
- 4.Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of polarizing plate.
- 5.Do not use ketonics solvent or aromatic solvent on the polarizing plate. Use a soft cloth soaked with plastic-lens cleaning solution.

• STORAGE

- 1.Store the panel or module in a dark place where the temperature is  $25^{\circ}\text{C}\pm 5^{\circ}\text{C}$  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 WARRANTY

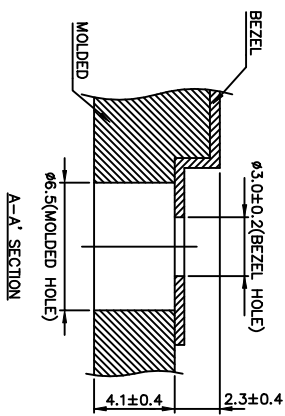
- 1.Acceptance inspection period  
The inspection period is within one month after the arrival of the contracted goods at the buyer's factory site.
- 2.Applicable warranty period  
The warranty period is within twelve months from the date of invoice under normal usage and storage conditions.

• TYPICAL OPERATING LIFETIME OF BACKLIGHT

- LED : 50,000HR  
EL : 5,000HR  
CCFT : 10,000HR

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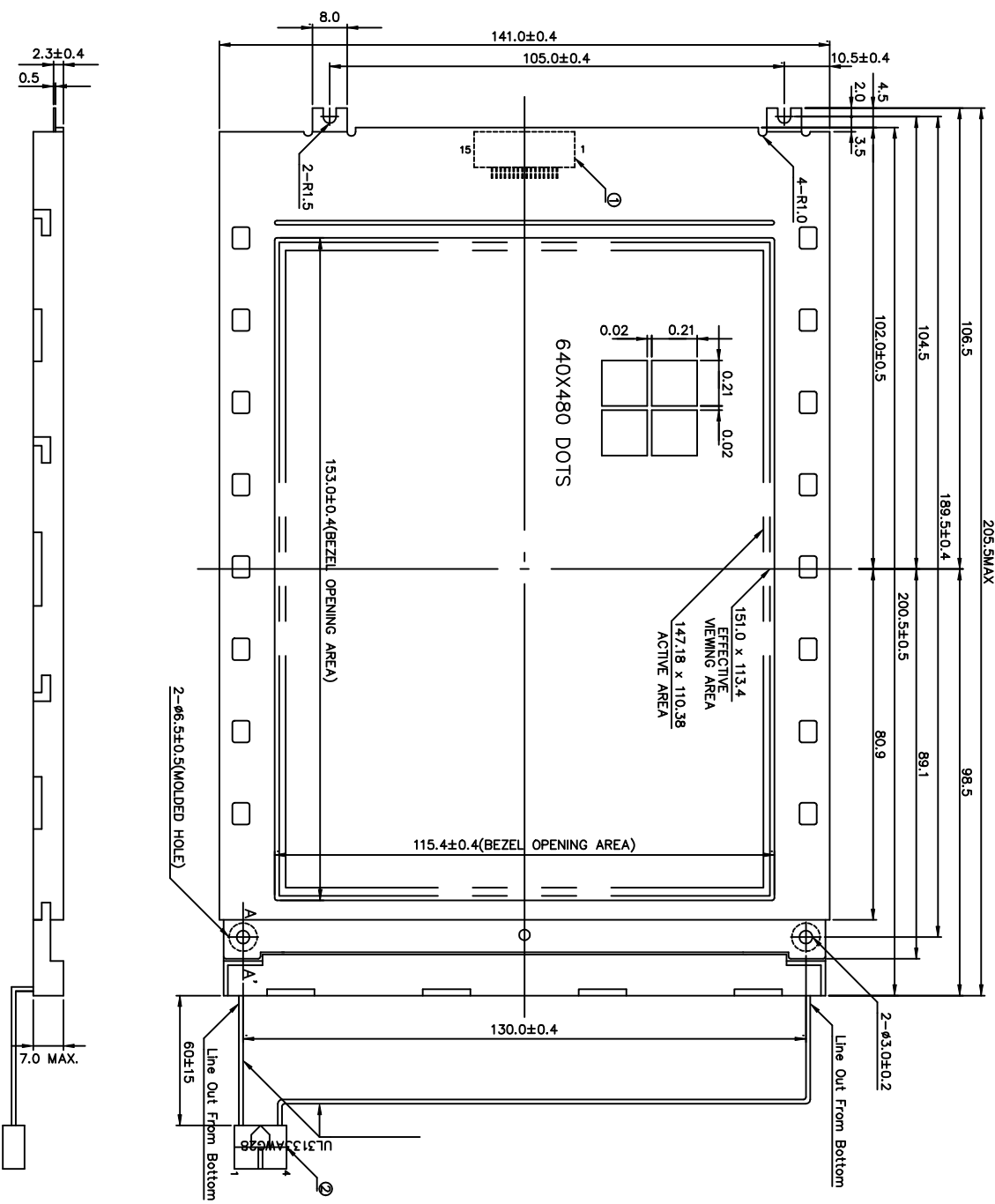
Note :  
 ① used LCD connector : 53261-1590 (MOLEX)  
 ② used COFT connector : M63M83-04 (MITSUMI)  
 mating COFT connector : M60-04-30-114P (MITSUMI)  
 M60-04-30-134P (MITSUMI)  
 M61M73-04 (MITSUMI)

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	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	Display Data (Lower Half)
12	LD0	H/L	
13	LD1	H/L	
14	LD2	H/L	
15	LD3	H/L	

COFT

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



產品編號	LT_LD_168_	南亞塑膠工業股份有限公司
NAME		NAN YA PLASTICS CORPORATION
DATE		
APPROVE		製品圖
CHECK		DWG-NO
DESIGN		Tx-x168x
DRAWN		Rev.A
MAY PING	87.01.20	UNIT : mm
		SCALE : 2/3