

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

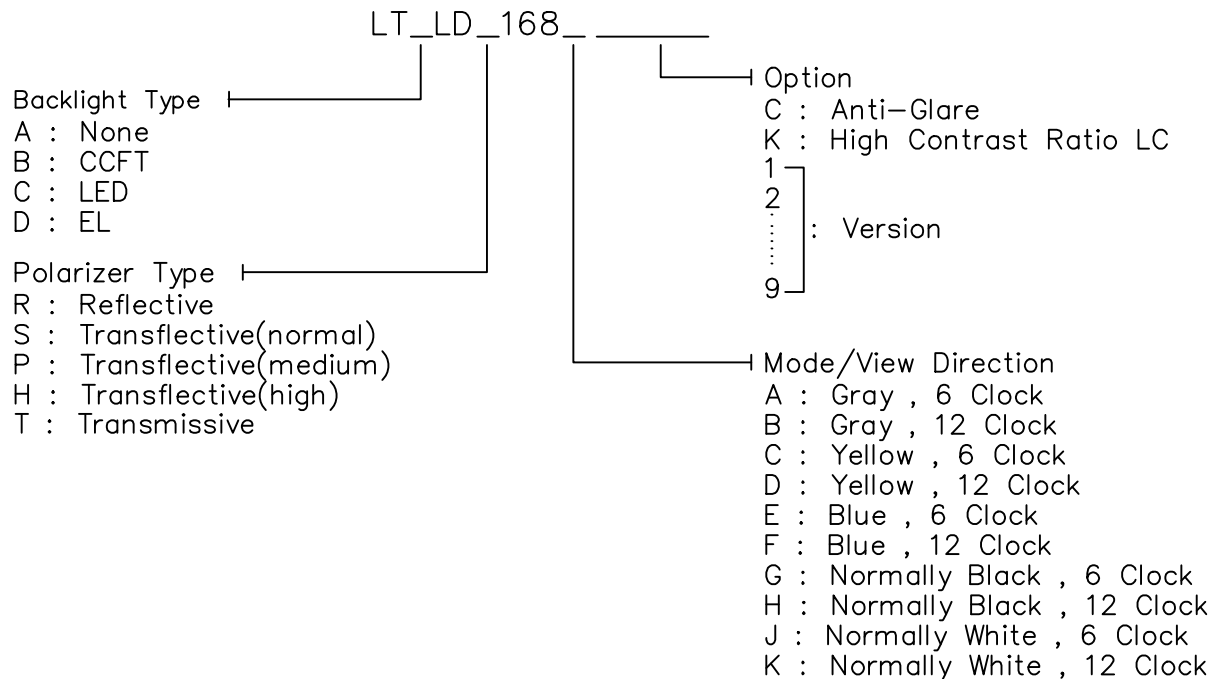
SALES MANAGER	DESIGN MANAGER	PERSON IN CHARGE

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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°C

Note 2 T_a at -20°C will be < 48hrs, at 70°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°C

Note 5 T_a at -30°C will be < 48hrs, at 80°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 _{OPEN}	Lamp Current = 5 mArms Frequency = 55 KHz	-	440	-	Vrms	
	Lamp Voltage	V _L		-	330	-	Vrms	
	Brightness	B		-	33600	-	cd/m ²	
	Color Degree	X		-	0.311	-	-	
		Y		-	0.306	-		

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.
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		

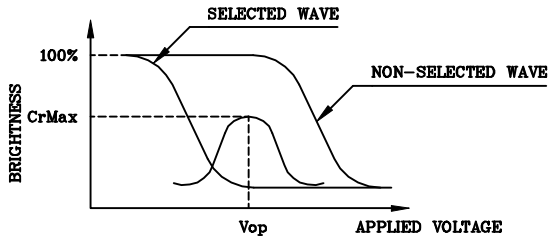
NOTE :

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

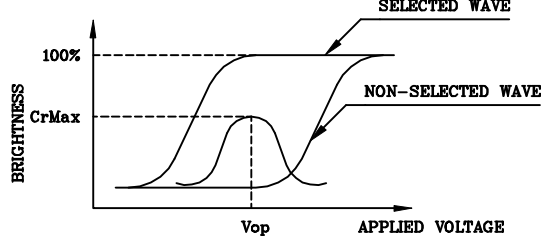
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



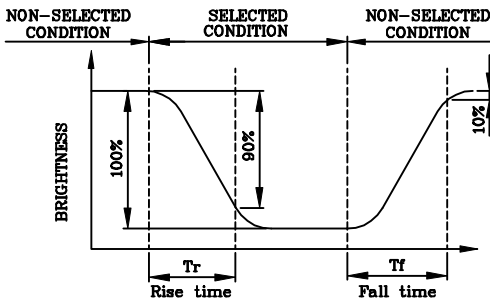
(negative type)

*Conditions

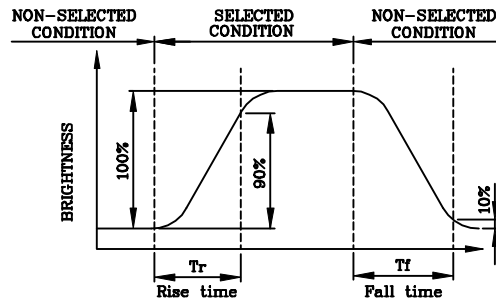
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : I/N duty 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



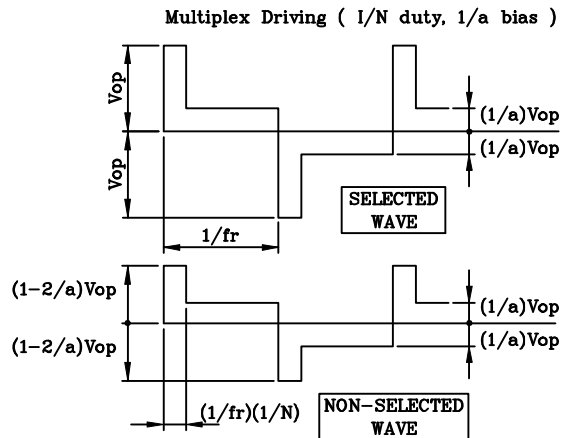
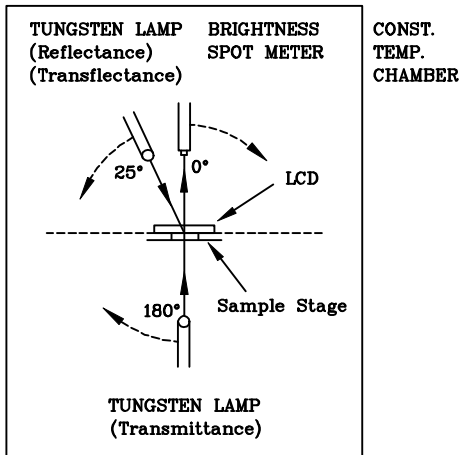
(negative type)

*Conditions

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

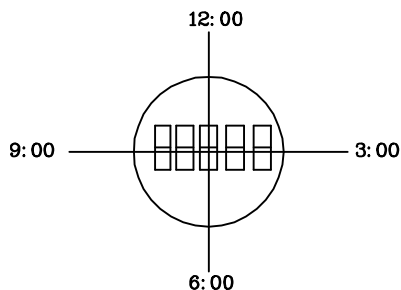
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



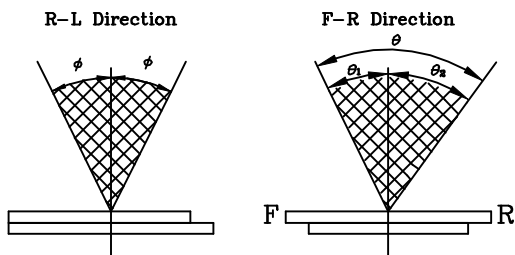
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



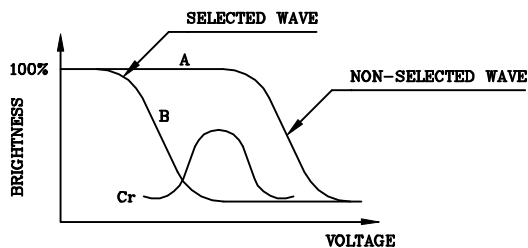
$\theta = \theta_1 + \theta_2$

*Conditions

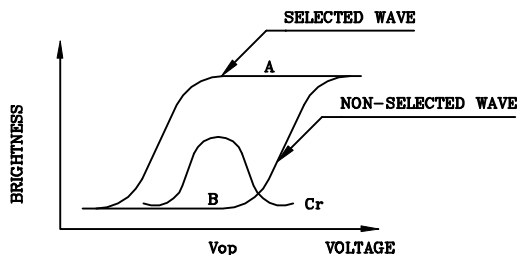
- Operating Voltage : V_{op}
- Frame Frequency : 70Hz
- Applied Waveform : 1/N duty, 1/a bias
- Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



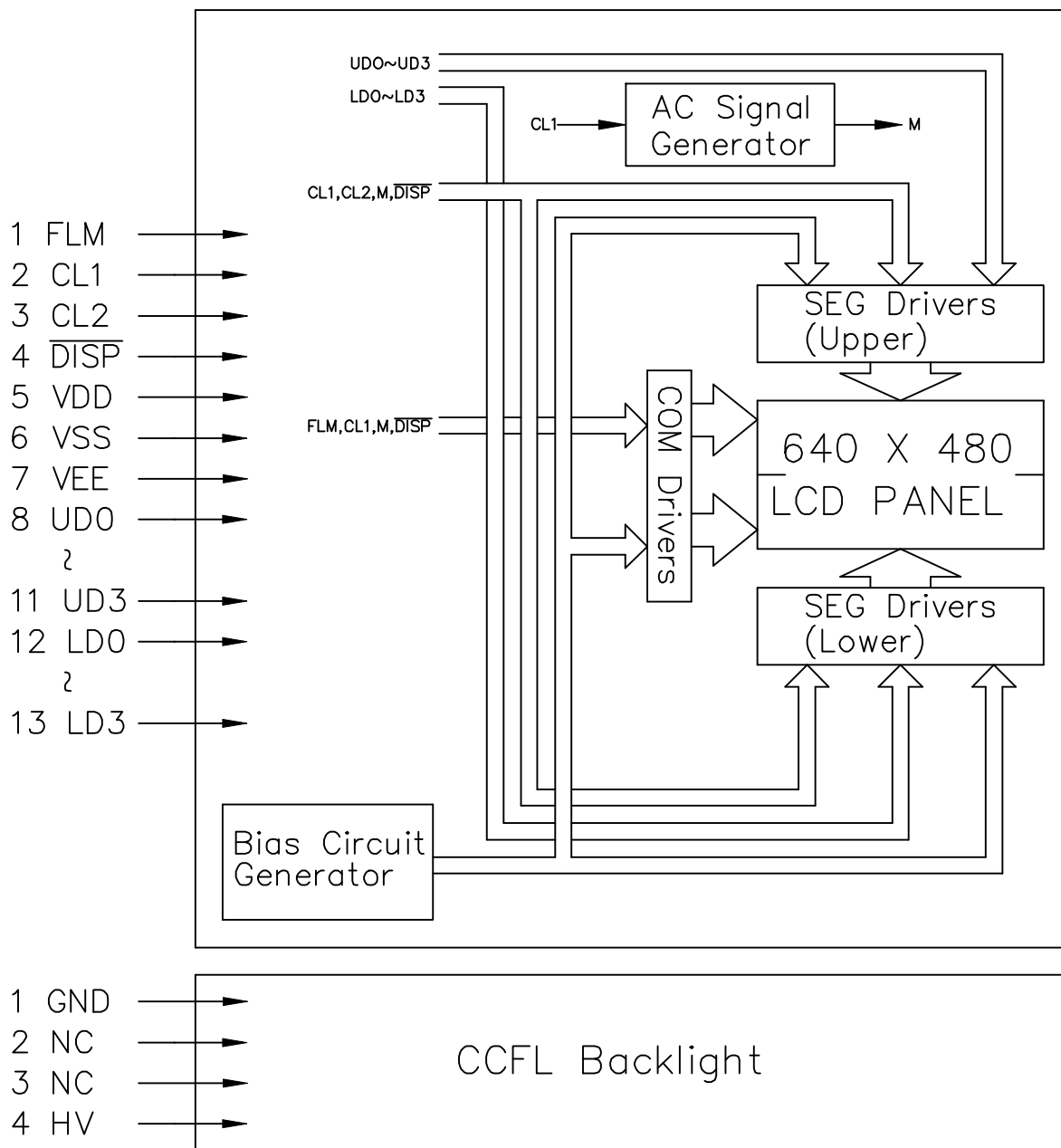
(negative type)

Contrast Ratio : $Cr = A/B$

*Conditions

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

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

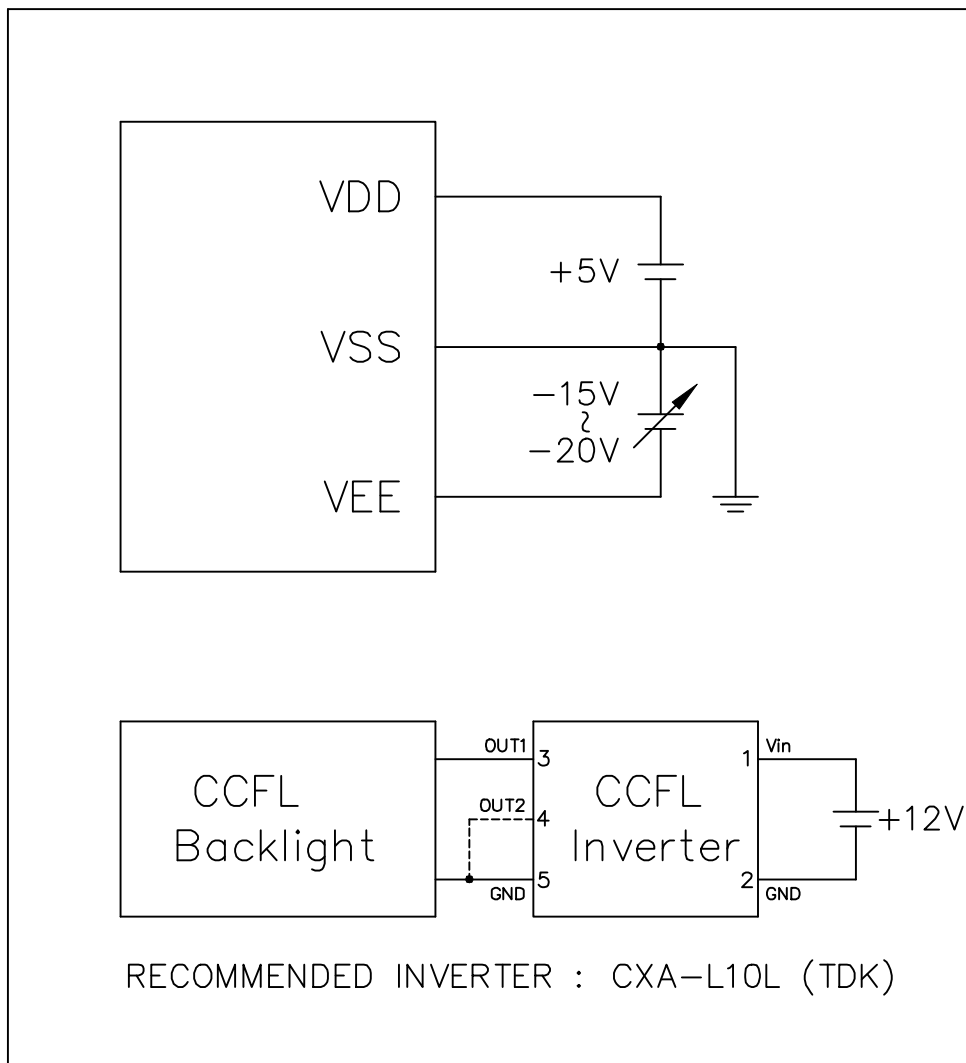
Used connector : M63M83-04 (MITSUMI)

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

M60-04-30-134P (MITSUMI)

M61M73-04 (MITSUMI)

7. POWER SUPPLY

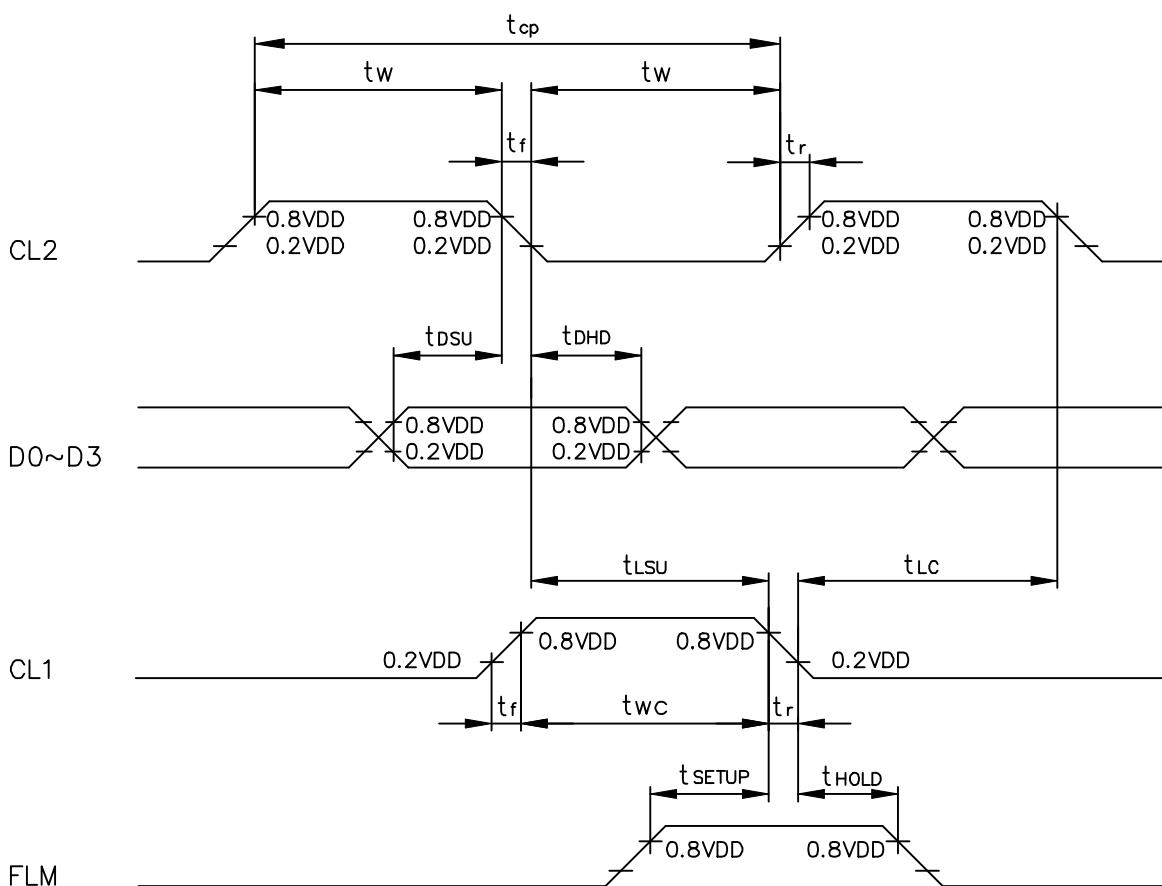


8. TIMING CHARACTERISTICS

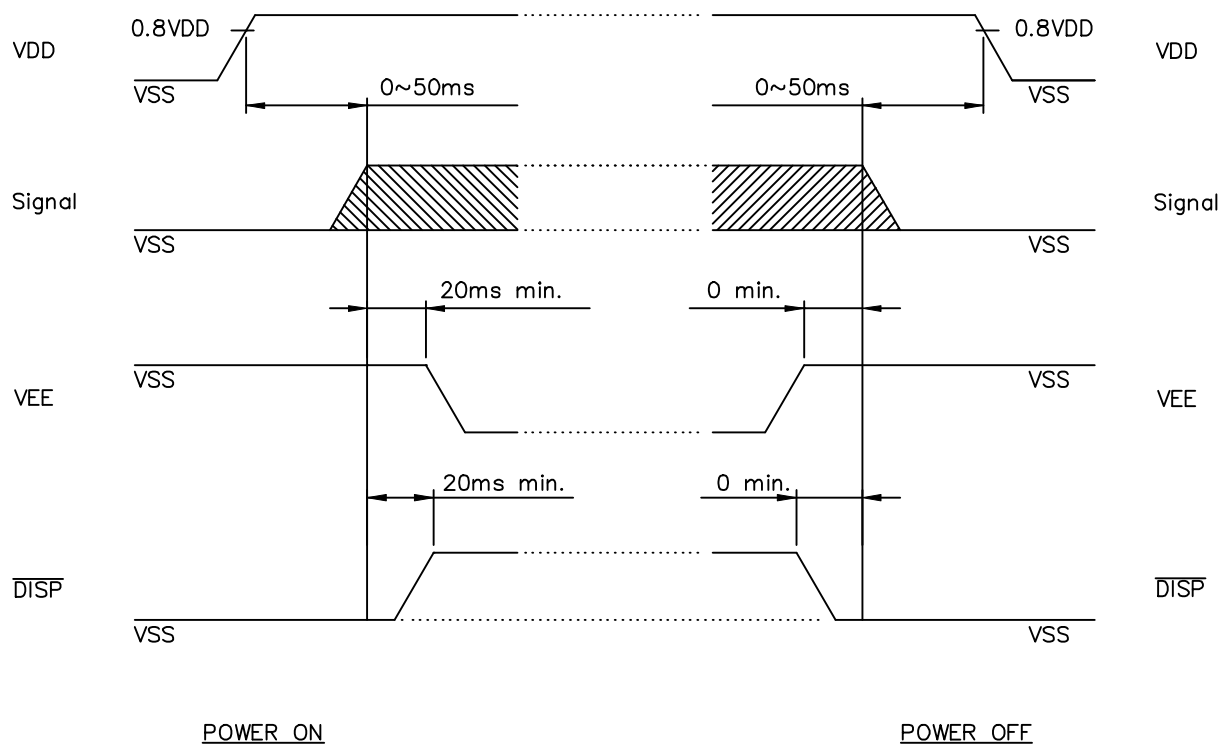
8-1. INTERFACE TIMING

@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

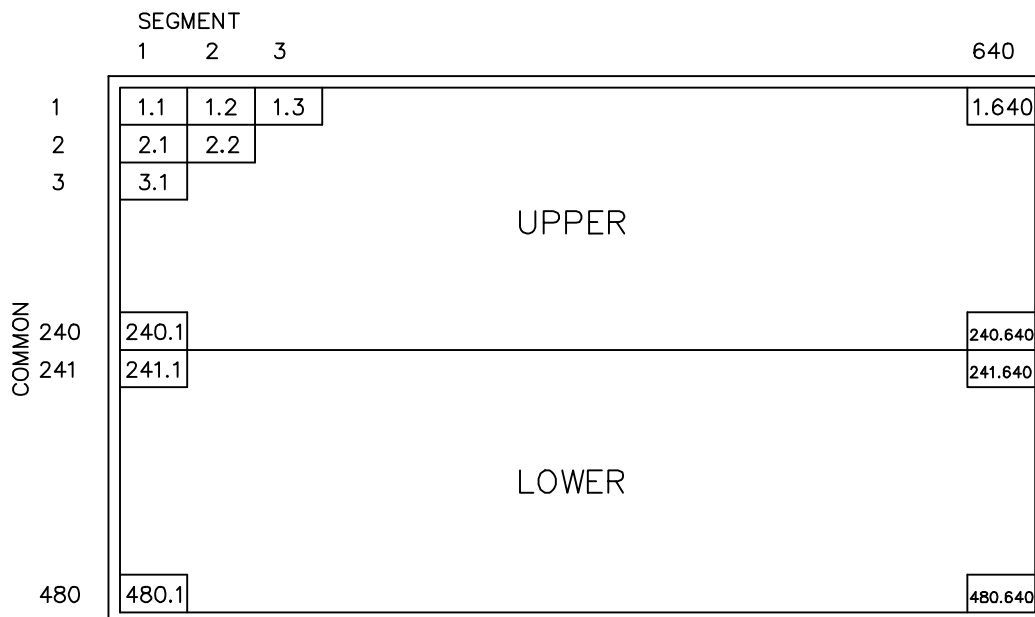


8-2. POWER ON/OFF TIMING

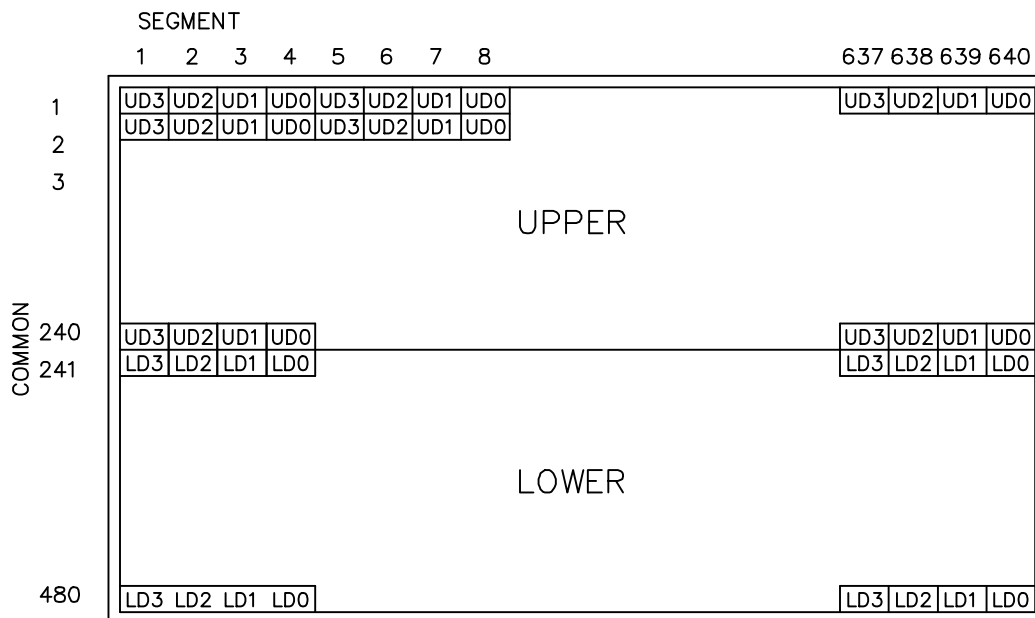


The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

8-3.DISPLAY PATTERN



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

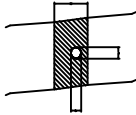
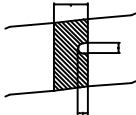
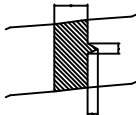


9. RELIABILITY TEST

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>$a \leq 0.20$</td> <td>NEGLECT</td> </tr> <tr> <td>$0.20 < a \leq 0.35$</td> <td>5 MAX</td> </tr> <tr> <td>$0.35 < a$</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>$W \leq 0.03$</td> <td>NEGLECT</td> </tr> <tr> <td>$L \leq 3$</td> <td>$0.03 < W \leq 0.08$</td> <td>6</td> </tr> <tr> <td>$3 < L$</td> <td>$0.08 < W$</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
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$3 < L$	$0.08 < W$	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>$a \leq 0.15$</td> <td>NEGLECT</td> </tr> <tr> <td>$0.15 < a \leq 0.20$</td> <td>2 MAX</td> </tr> <tr> <td>$0.20 < a$</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

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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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