

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

SPECIFICATION

SPEC. NO. : LM078-2
DATE : Feb. 20, 1998
SHEET NO. : 1/18

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
320x240 LCD MODULE
PRODUCT NO.: LMCDB_078_K

SPEC. NO.: LM078-2

APPROVED BY

APPROVED BY

EDITED ON : Feb. 20, 1998

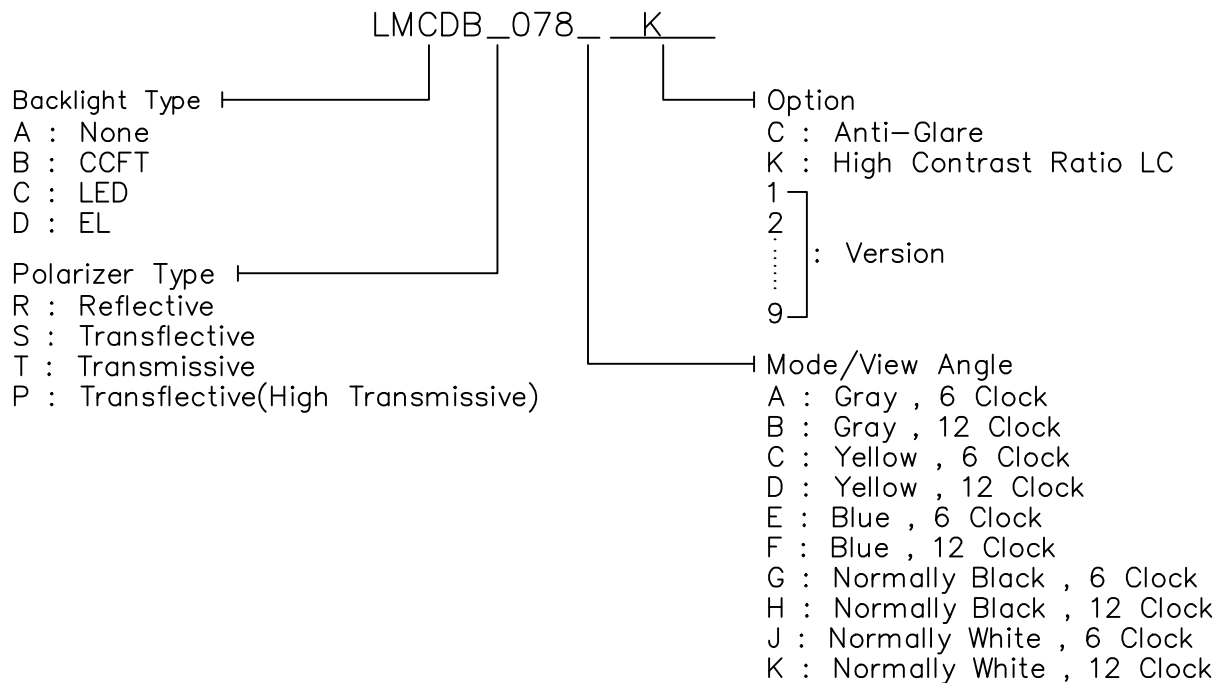
SALES MANAGER	DESIGN MANAGER	PERSON IN CHARGE

REV/DATE	RO/ 02.20.98'					APP	CHK	BY
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1. MECHANICAL DATA

- (1) Product No. LMADB_078_K
- (2) Module Size 134.5 (W)mm x 117.0 (H)mm x MAX 14.0 (D)mm
- (3) Dot Size 0.27 (W)mm x 0.27 (H)mm
- (4) Dot Pitch 0.30 (W)mm x 0.30 (H)mm
- (5) Number of Dots 320 (W) x 240 (H)Dots
- (6) Duty 1/240
- (7) LCD Display Mode STN: Gray Mode Yellow Mode Blue Mode
FSTN: Black and White(Normal White/Positive Image)
 Black and White(Normal Black/Negative Image)
Rear Polarizer: Transflective Transmissive
 Transflective (High Transmissive)
- (8) Viewing Direction 6 O'clock 12 O'clock ___O'clock
- (9) Backlight LED
- (10) Weight 190 g

Note :



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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	7.0	V	
Power Supply for LCD Drive	VDD-VO	0	26.0	V	
Input Voltage	VI	-0.3	VDD	V	
LED Applied Voltage	VLED	-	27.0	V	
Static Electricity	-	-	-	-	Note 1

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	-20	70	-30	80
Humidity(Without Condensation)	Note 1,3		Note 2,3	

Note 1 $T_a \leq 70^\circ\text{C}$: 75%RH max

$T_a > 70^\circ\text{C}$: Absolute humidity must be lower

than the humidity of 75%RH at 70°C

Note 2 T_a at -30°C will be < 48hrs, at 80°C will be < 120hrs

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

3. ELECTRICAL CHARACTERISTICS

(VDD = 5V±5%)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Power Supply for Logic	VDD-VSS	-	4.75	5.0	5.25	V	
Recommended Operating Voltage for LCD	VDD-VO'	Duty=1/240 Bias=1/13	-20°C	-	25	25.4	V
			0°C	-	23.6	24	V
			25°C	-	22.9	23.3	V
			50°C	-	21.5	21.9	V
			70°C	-	20.9	21.3	V
Input Voltage	VIH	H level	0.8VDD	-	VDD	V	
	VIL	L level	0	-	0.2VDD	V	
Power Supply Current	IDD	FLM = 70 Hz VDD = 5.0 V VEE = -27.0 V VDD-VO' = 22.9 V	-	8	-	mA	
	IEE	PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □	-	6	-	mA	
LED Power Supply Voltage	VLED	-	21	24	27	V	
LED Power Consumption	ILED	VLED = 24V	-	40	-	mA	

4. OPTICAL CHARACTERISTICS

AT Vop

ITEM MODE		Cr(Contrast Ratio)										ϕ (Viewing Angle)		θ (Viewing Angle)	
		-20℃		0℃		25℃		50℃		70℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
S	A														
	C														
	J		5.0		5.5		6.0		4.5		3.5		60		56
T	G		4.7		5.5		6.5		5.0		3.5		32		77
	C.D		6.5		10.0		10.0		6.5		2.5		76		62
note		NOTE6										NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	—	3700	5500	ms	NOTE 2
		0℃	—	660	900		
		25℃	—	160	240		
		50℃	—	110	165		
		70℃	—	75	120		
Response Time (fall)	Tf	-20℃	—	2600	3900	ms	NOTE 2
		0℃	—	560	840		
		25℃	—	90	140		
		50℃	—	75	110		
		70℃	—	50	70		

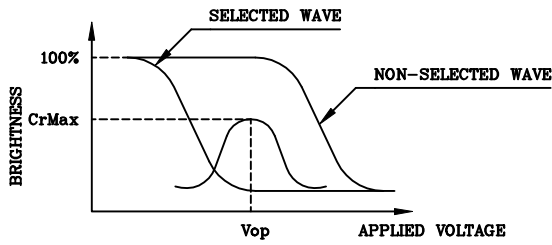
note:

S: TRANSFLECTIVE
T: TRANSMISSIVE
A: GRAY
C\D: YELLOW

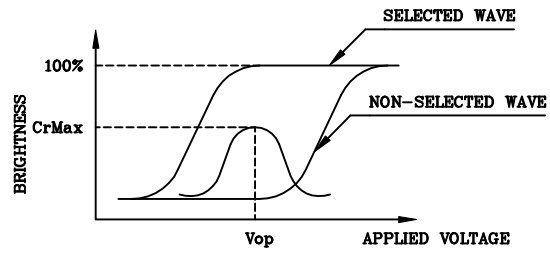
G: NORMALLY BLACK
J: NORMALLY WHITE

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



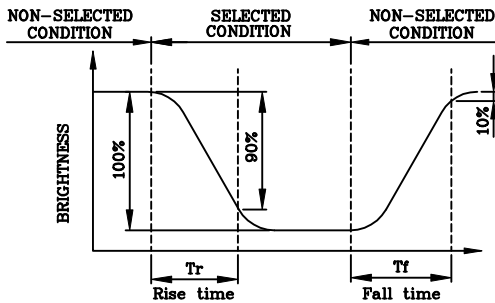
(negative type)

*Conditions

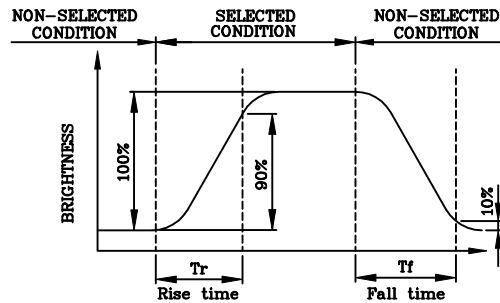
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



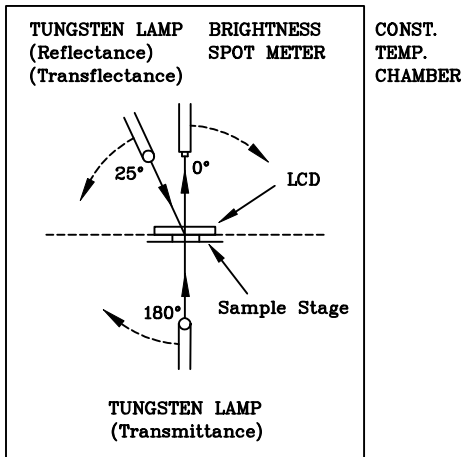
(negative type)

*Conditions

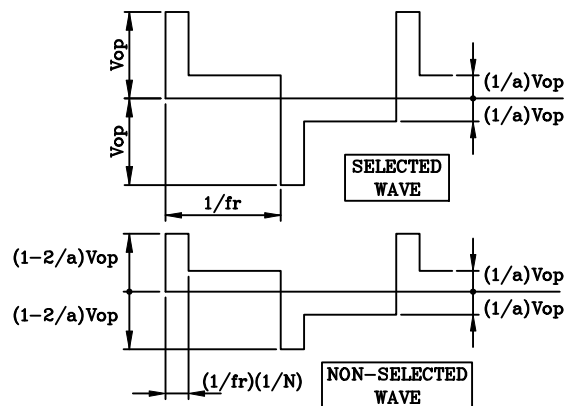
Operating Voltage : Vop
Viewing Angle (θ,φ) : (0,0)
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

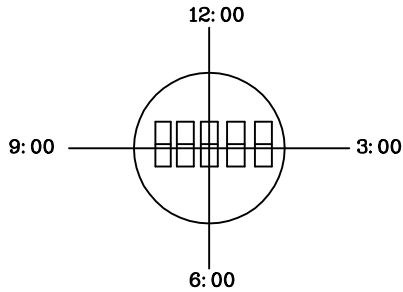


Multiplex Driving (1/N duty, 1/a bias)



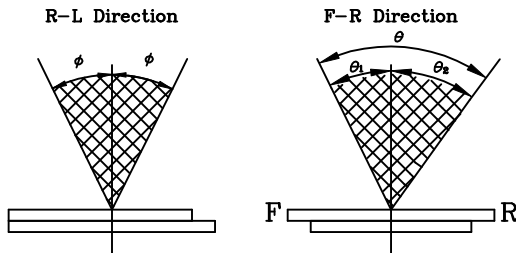
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



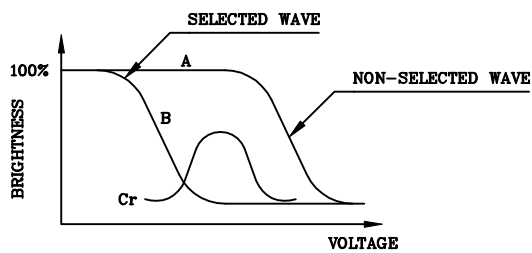
$$\theta = \theta_1 + \theta_2$$

*Conditions

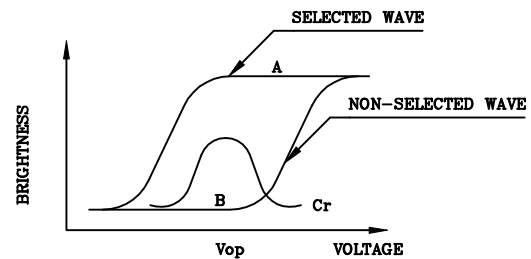
Operating Voltage : V_{op}
 Frame Frequency : 70Hz
 Applied Waveform : 1/N duty, 1/a bias
 Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



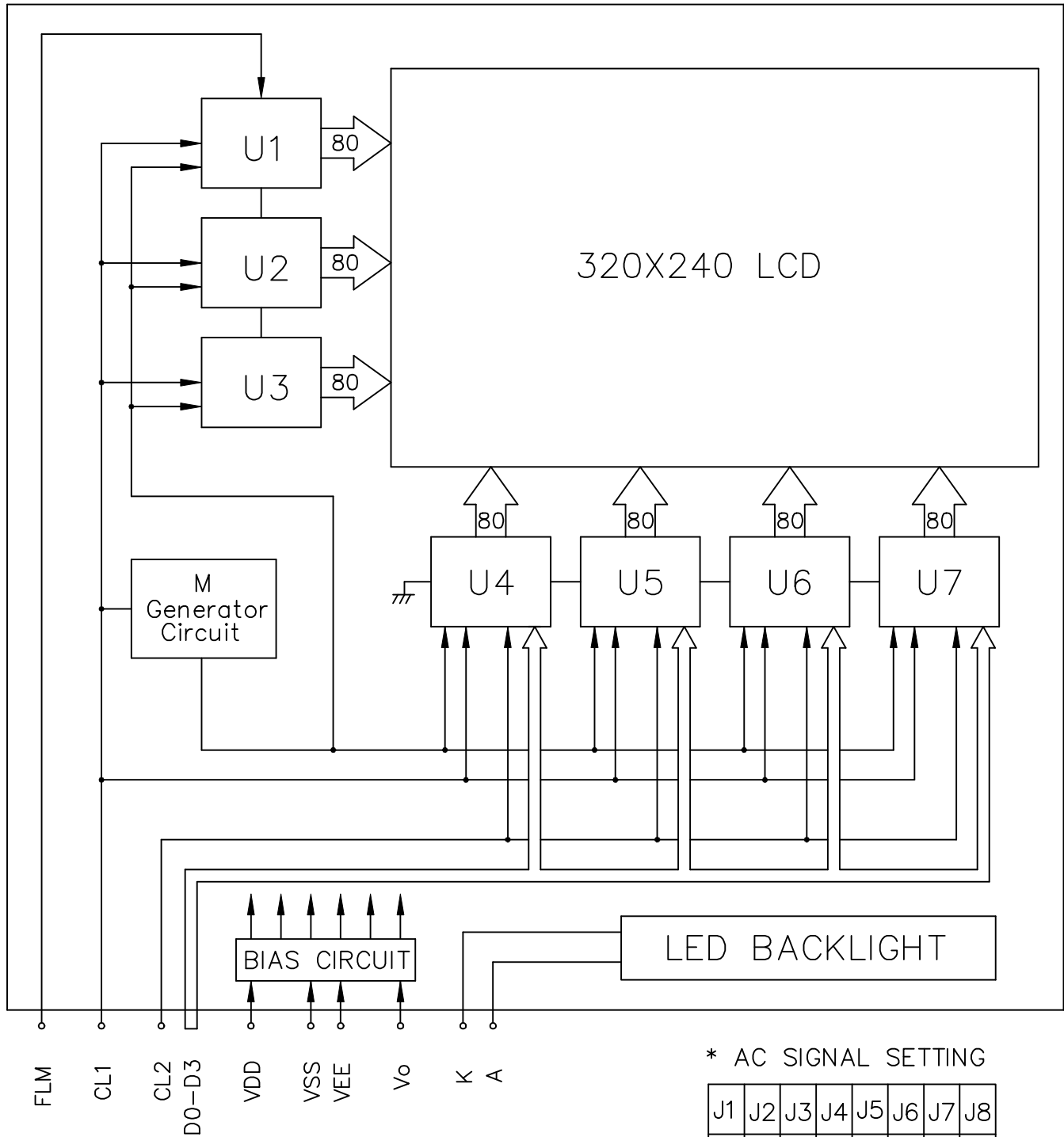
(negative type)

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

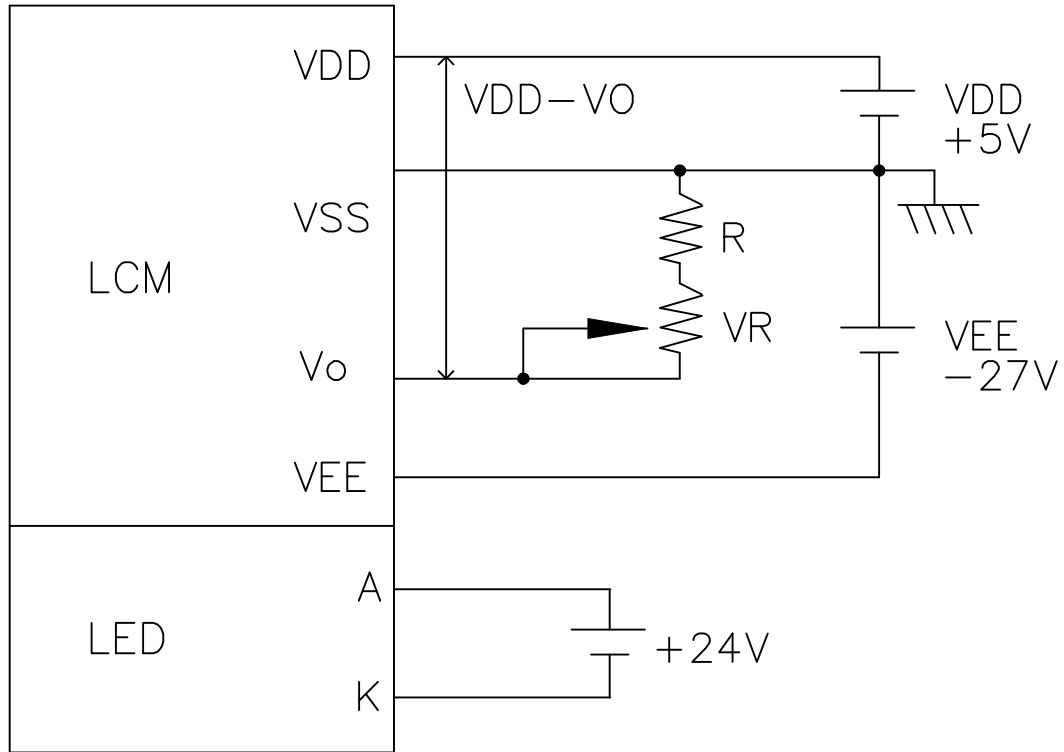
J1	J2	J3	J4	J5	J6	J7	J8
L	L	L	L	L	L	H	H

6. INTERNAL PIN CONNECTION

CN1

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	V0	-	OPERATING VOLTAGE FOR LCD
2	VEE	-	POWER SUPPLY FOR LCD
3	D3	H/L	DISPLAY DATA 3
4	D2	H/L	DISPLAY DATA 2
5	D1	H/L	DISPLAY DATA 1
6	D0	H/L	DISPLAY DATA 0
7	VSS	-	GND
8	VDD	-	POWER SUPPLY FOR LOGIC
9	CL2	H→L	DATA SHIFT
10	CL1	H→L	DATA LATCH
11	FLM	H/L	SCAN START PULSE
12	K	-	POWER SUPPLY FOR LED BACKLIGHT
13	A	-	POWER SUPPLY FOR LED BACKLIGHT
14	NC	-	NO CONNECTION

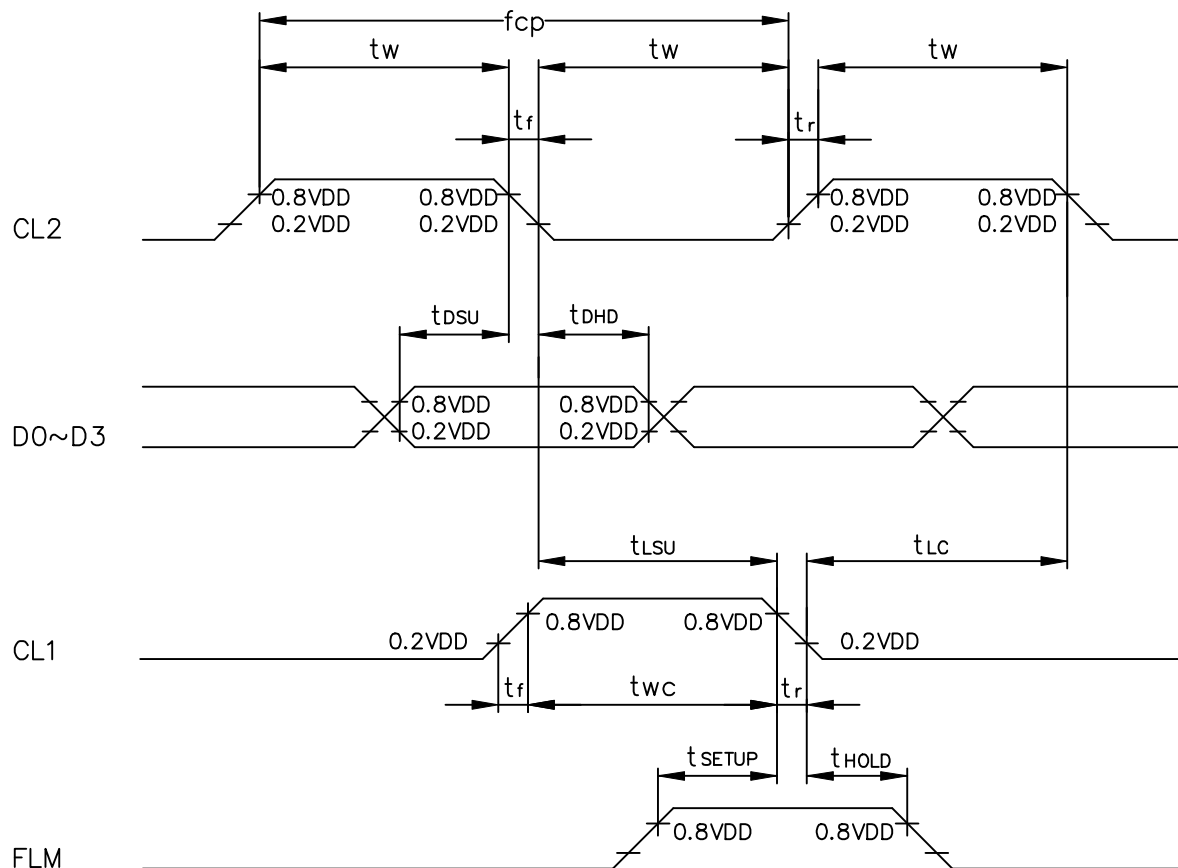
7. POWER SUPPLY



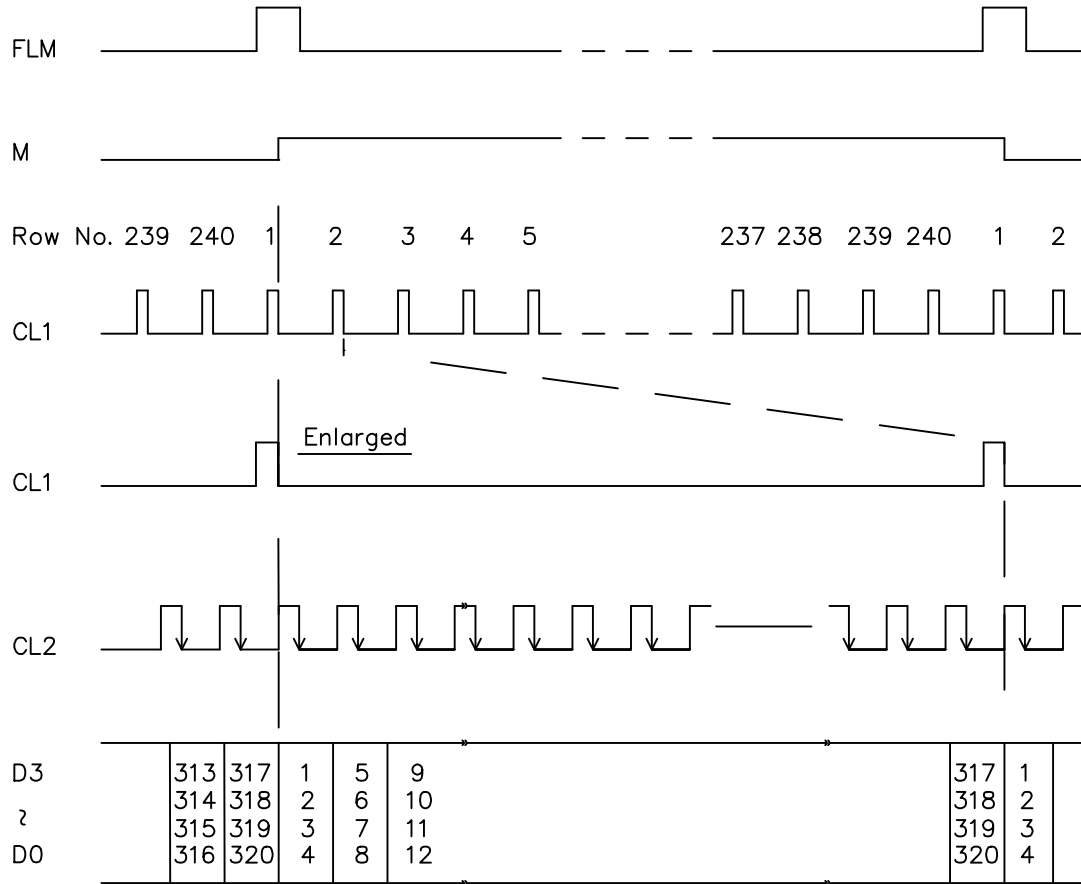
RECOMMENDED VR : 30K~50K Ω
 R : 4.3K Ω

8.1 TIMING CHARACTERISTICS

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CLOCK FREQUENCY	f_{cp}	-	-	6.5	MHZ
CLOCK PULSE WIDTH	t_w	63	-	-	ns
CLOCK RISE,FALL TIME	t_r, t_f	-	-	20	ns
DATA SET UP TIME	t_{dsu}	50	-	-	ns
DATA HOLD TIME	t_{dhd}	50	-	-	ns
CL1 SET UP TIME	t_{lsu}	80	-	-	ns
CL1 CL LOCK TIME	t_{lc}	80	-	-	ns
"FLM" SET UP TIME	t_{setup}	100	-	-	ns
"FLM" HOLD TIME	t_{hold}	100	-	-	ns
"CL1" PULSE WIDTH	t_{wc}	125	-	-	ns



8.2 TIMING CHART OF INPUT SIGNALS



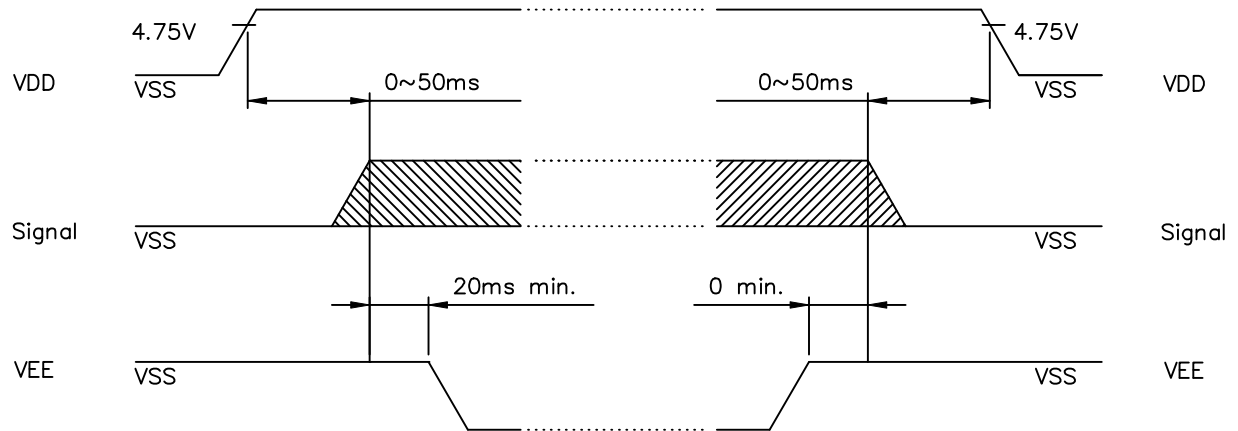
8.3DISPLAY PATTERN

#001	D3	D2	D1	D0	D3		D0	D3	D2	D1	D0
#002	D3	D2	D1	D0	D3		D0	D3	D2	D1	D0
<p>Data Input: Terninal : Dots (Row) on Display</p> <p>D0 : dot 4, dot 8 dot 316, dot 320 D1 : dot 3, dot 7 dot 315, dot 319 D2 : dot 2, dot 6 dot 314, dot 318 D3 : dot 1, dot 5 dot 313, dot 317</p>											
#239	D3	D2	D1	D0	D3		D0	D3	D2	D1	D0
#240	D3	D2	D1	D0	D3		D0	D3	D2	D1	D0
	d1	d2	d3	d4	d5		d316	d317	d318	d319	d320

240 dots

320 dots

8.4 POWER ON/OFF TIMING



POWER ON

POWER OFF

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

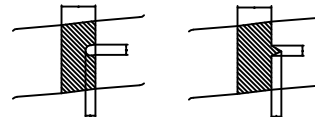
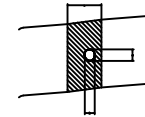
9. RELIABILITY TEST

NO	ITEM	CONDITION			STANDARD	NOTE
1	High Temp. Storage	70°C	120HR		Appearance without defect	
2	Low Temp. Storage	-20°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 (= 1 cycle)			Appearance without defect	5 cycles

13.LCD PRODUCT QUALITY STANDARD

(1) DISPLAY APPEARANCE

NO	ITEM	C R I T E R I A													
1.	INCLUSIONS (BLACK SPOT, WHITE SPOT, DUST)	(1) ROUND TYPE													
		<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>	DIAMETER mm (a*)	NO. OF DEFECT*	$a \leq 0.20$	NEGLECT	$0.20 < a \leq 0.35$	5 MAX	$0.35 < a$	NONE					
DIAMETER mm (a*)	NO. OF DEFECT*														
$a \leq 0.20$	NEGLECT														
$0.20 < a \leq 0.35$	5 MAX														
$0.35 < a$	NONE														
		(2) LINEAR TYPE													
		<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>	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	
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													
2.	SCRATCH	1.SCRATCH ON PROTECTIVE FILM IS PERMITTED . 2.SCRATCH ON POLARIZER SHALL BE AS FOLLOW:													
		(1) ROUND TYPE													
		<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>	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														
		(2) LINEAR TYPE BE JUDGED BY 1.-(2) LINEAR TYPE													
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.													
		<table border="1"> <thead> <tr> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td>$a \leq 0.50$ mm</td> <td>NEGLECT</td> </tr> <tr> <td>$0.50 < a \leq 0.75$</td> <td>5</td> </tr> <tr> <td>$0.75 < a \leq 1.00$</td> <td>3</td> </tr> <tr> <td>$1.00 < a$</td> <td>NONE</td> </tr> </tbody> </table>	NO. OF DEFECT*	$a \leq 0.50$ mm	NEGLECT	$0.50 < a \leq 0.75$	5	$0.75 < a \leq 1.00$	3	$1.00 < a$	NONE				
NO. OF DEFECT*															
$a \leq 0.50$ mm	NEGLECT														
$0.50 < a \leq 0.75$	5														
$0.75 < a \leq 1.00$	3														
$1.00 < a$	NONE														
8.	DOT WIDTH	DESIGN WIDTH±15%													
9.	COLOR TONE AND UNIFORMITY	OBVIOUS UNEVEN COLOR IS NOT PERMITTED													



NAN YA PLASTICS CORP. ELEC. MATERIALS DIV. LCD DEPARTMENT	SPECIFICATION	SPEC. NO. : LM078-2 DATE : Feb. 20, 1998 SHEET NO. : 17/18
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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.

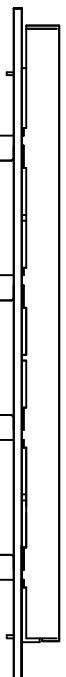
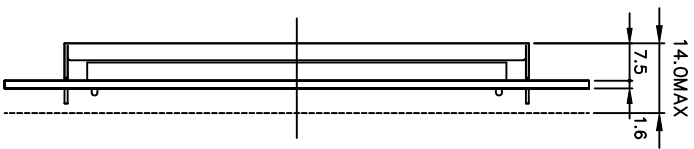
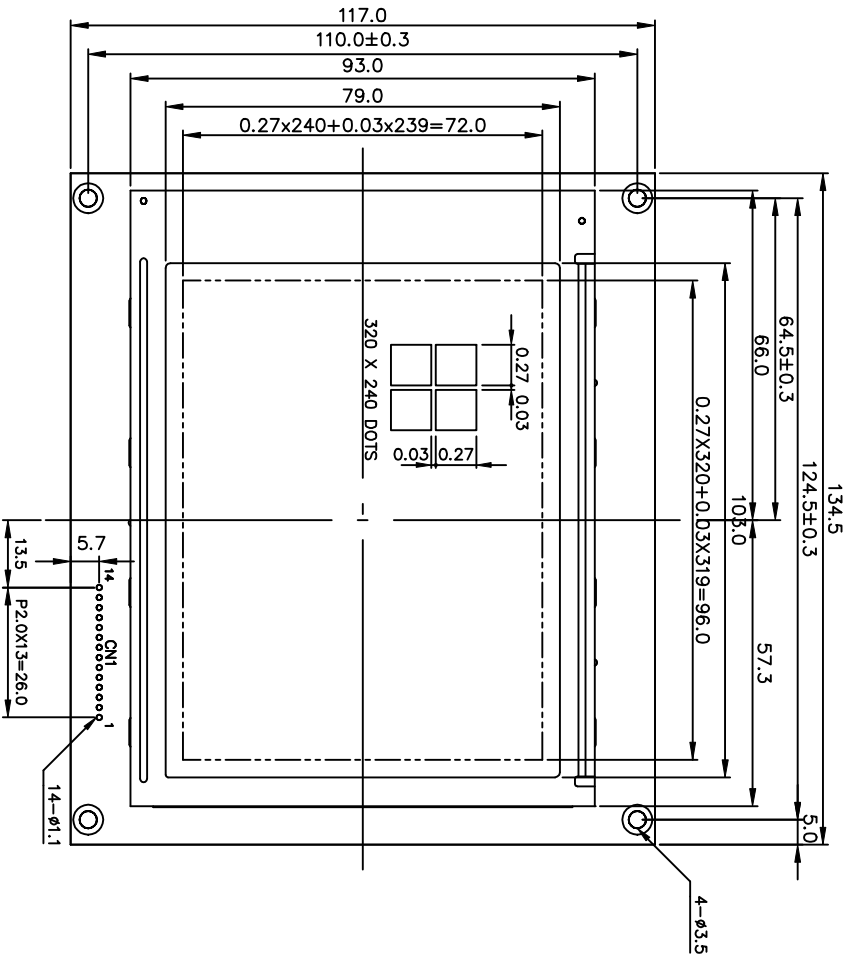
- HANDLING
 - 1.Prevent all contact with static electricity, which can damage the CMOS ICs. The module is packaged in a static-shielding bag to prevent damage during shipment, warehousing and removal from the shipping carton.
 - 2.Do not remove the panel or frame from the module.
 - 3.The polarizing 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

REV/DATE	R0/ 02.20.98'					APP	CHK	BY
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INTERFACE PIN CONNECTION

PinNo.	Symbol	Level	Function
1	V0	—	Operating voltage for LCD driving
2	VEE	—	Power supply for LCD driving
3	D3	H/L	Display data 3
4	D2	H/L	Display data 2
5	D1	H/L	Display data 1
6	DO	H/L	Display data 0
7	VSS	—	0V for logic(V)
8	VDD	—	Power supply for logic(V)
9	CL2	H- \bar{L}	Display data latch pulse
10	CL1	H- \bar{L}	Display data latch pulse
11	FLM	H/L	Spot start pulse
12	K	—	Power supply for LED backlight(V)
13	A	—	Power supply for LED backlight(V)
14	NC	—	—

產品編號	LMCDB_078_K	南亞塑膠工業股份有限公司
NAME		NAN YA PLASTICS CORPORATION
DATE		
APPROVE		外觀尺寸圖
CHECK		DWG-NO MC-X078XX
DESIGN		Rev.B
DRAW	MAY PING 85.11.28	UNIT : mm
		SCALE :