

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

SPECIFICATION

SPEC. NO. : LM198-0
DATE : Sep.14,1998
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
240x160 LCD MODULE
PRODUCT NO.: LM_78_198_

SPEC. NO.: LM198-0

CUSTOMER
APPROVED BY
DATE:

EDITED ON : Sep.14,1998

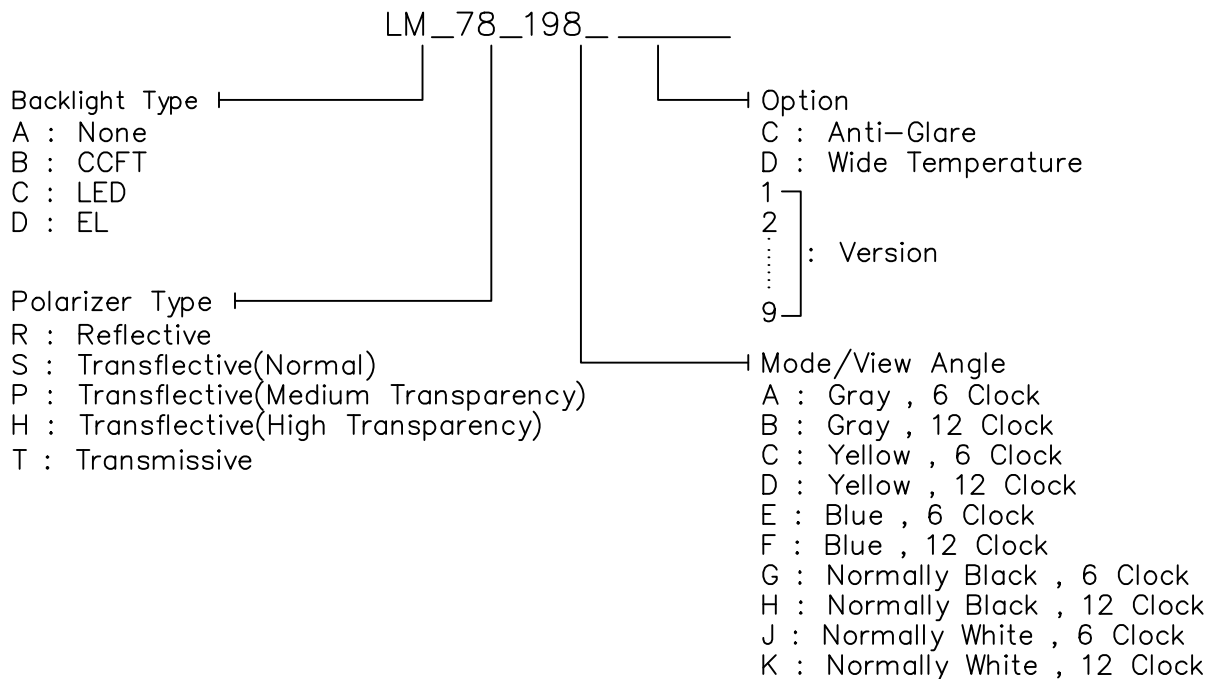
SALE MANAGER	TECHNICAL APPROVE	DESIGN MANAGER	DESIGN CHECK	DESIGNER

REV/DATE	RO/ 09.14.98'					APP	CHK	BY
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1. MECHANICAL DATA

- (1) Product No. LM_78_198_
- (2) Module Size 76.0 (W)mm x 80.0 (H)mm x MAX9.0 (D)mm
(W/O,EL B.L.)
- (3) Dot Size 0.17 (W)mm x 0.22 (H)mm
- (4) Dot Pitch 0.20 (W)mm x 0.25 (H)mm
- (5) Number of Dots 240 (W) x 160 (H)Dots
- (6) Duty 1/160
- (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: Reflective Transflective Transmissive
 Transflective(High Transmissive)
- (8) Viewing Direction 6 O'clock 12 O'clock ___O'clock
- (9) Backlight W/O EL LED CCFT
- (10) Weight W/O B/L: about 52 g
EL B/L: about 55 g

Note :



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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

V_{SS}=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	6.5	V	
Power Supply for LC Drive	VDD-VEE	0	28.0	V	
Input Voltage	V _I	-0.3	VDD+0.3	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 2,4		Note 3,4		Note 4,5		Note 4,6	

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 < 48hrs, at 70°C will be < 120hrs

Note 4 Background color changes slightly depending on ambient temperature.
This phenomenon is reversible.

Note 5 Ta ≤ 70°C : 75%RH max

Ta > 70°C : Absolute humidity must be lower
than the humidity of 75%RH at 70°C

Note 6 Ta at -30°C will be < 48hrs, at 80°C will be < 120hrs

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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	
Input Voltage	VIH	H level	0.7VDD	-	VDD	V	
	VIL	L level	0	-	0.3VDD	V	
Recommended LC Driving Voltage (Normal Temp. LCM)	VDD-VO	Duty= 1/160 Bias= 1/13	0℃	22.0	22.4	22.8	V
			25℃	20.6	21.0	21.4	
			50℃	18.9	19.3	19.7	
Power Supply Current (LCD)	IDD	FRAME = 70 Hz VDD = 5.0 V VEE = -23.0 V VDD-VO = 21.0 V	-	2.7	4	mA	
	IEE	PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □	-	2.5	4	mA	
EL Power Supply Current	I EL	VEL = 110VAc 400Hz	-	2.53	5	mA	

4. OPTICAL CHARACTERISTICS

(For Normal Temperature Mode LCM)

AT V_{op}

MODE	ITEM	Cr(Contrast Ratio)						θ (Viewing Angle)		θ (Viewing Angle)	
		0 τ		25 τ		50 τ		25 τ		25 τ	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A										
	C										
	J		5.5		5.0		4.0		74		74
S	A										
	C										
	J		6.0		5.5		4.0		73		72
note		NOTE6						NOTE5			

note:

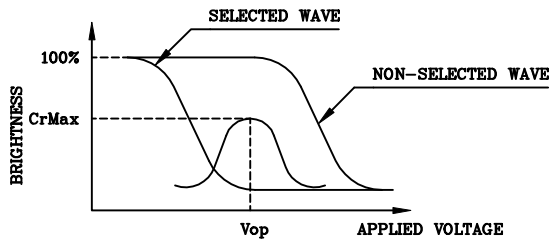
A: GRAY
C: YELLOW
J: NORMALLY WHITE
R: REFLECTIVE
S: TRANSFLECTIVE

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

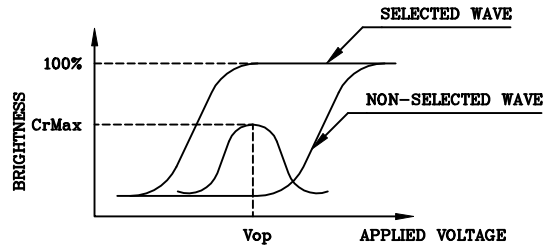
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0 τ	-	700	1050	ms	NOTE 2
		25 τ	-	200	300		
		50 τ	-	100	150		
Response Time (fall)	Tf	0 τ	-	550	850	ms	NOTE 2
		25 τ	-	150	230		
		50 τ	-	70	110		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



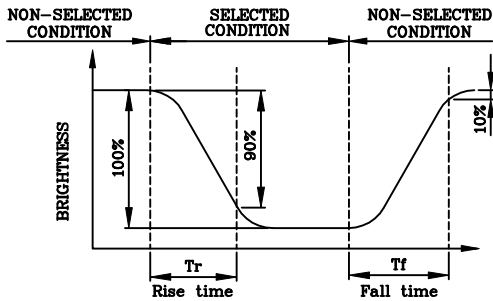
(negative type)

*Conditions

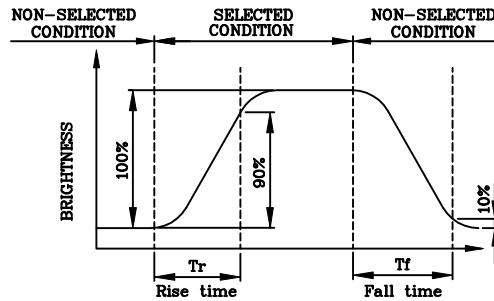
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



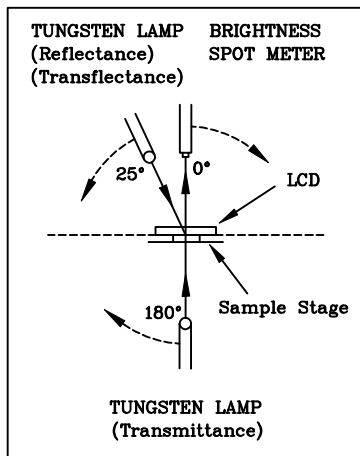
(negative type)

*Conditions

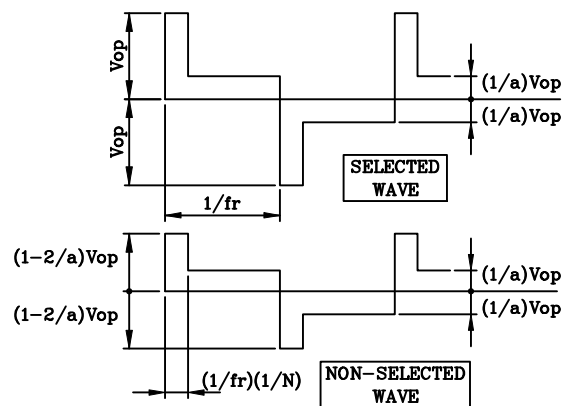
Operating Voltage : Vop
Viewing Angle (θ,φ) : (0,0)
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

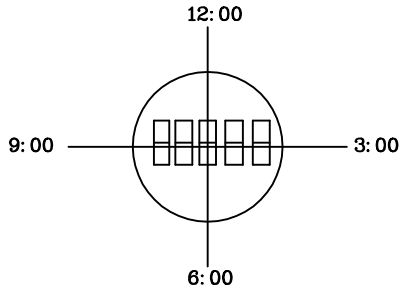


Multiplex Driving (1/N duty, 1/a bias)



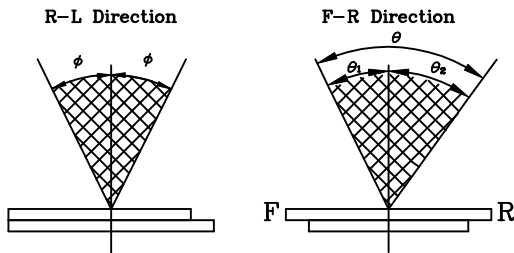
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



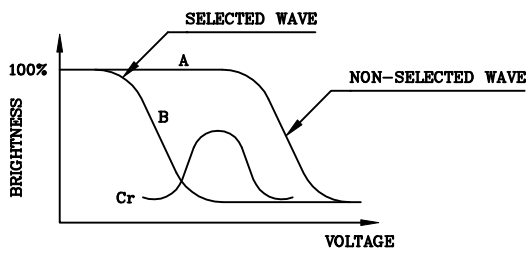
$$\theta = \theta_1 + \theta_2$$

*Conditions

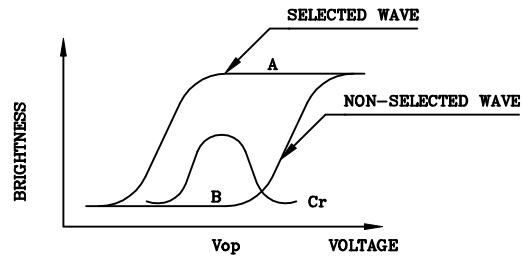
Operating Voltage : V_{op}
 Frame Frequency : 70Hz
 Applied Waveform : 1/N duty, 1/a bias
 Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



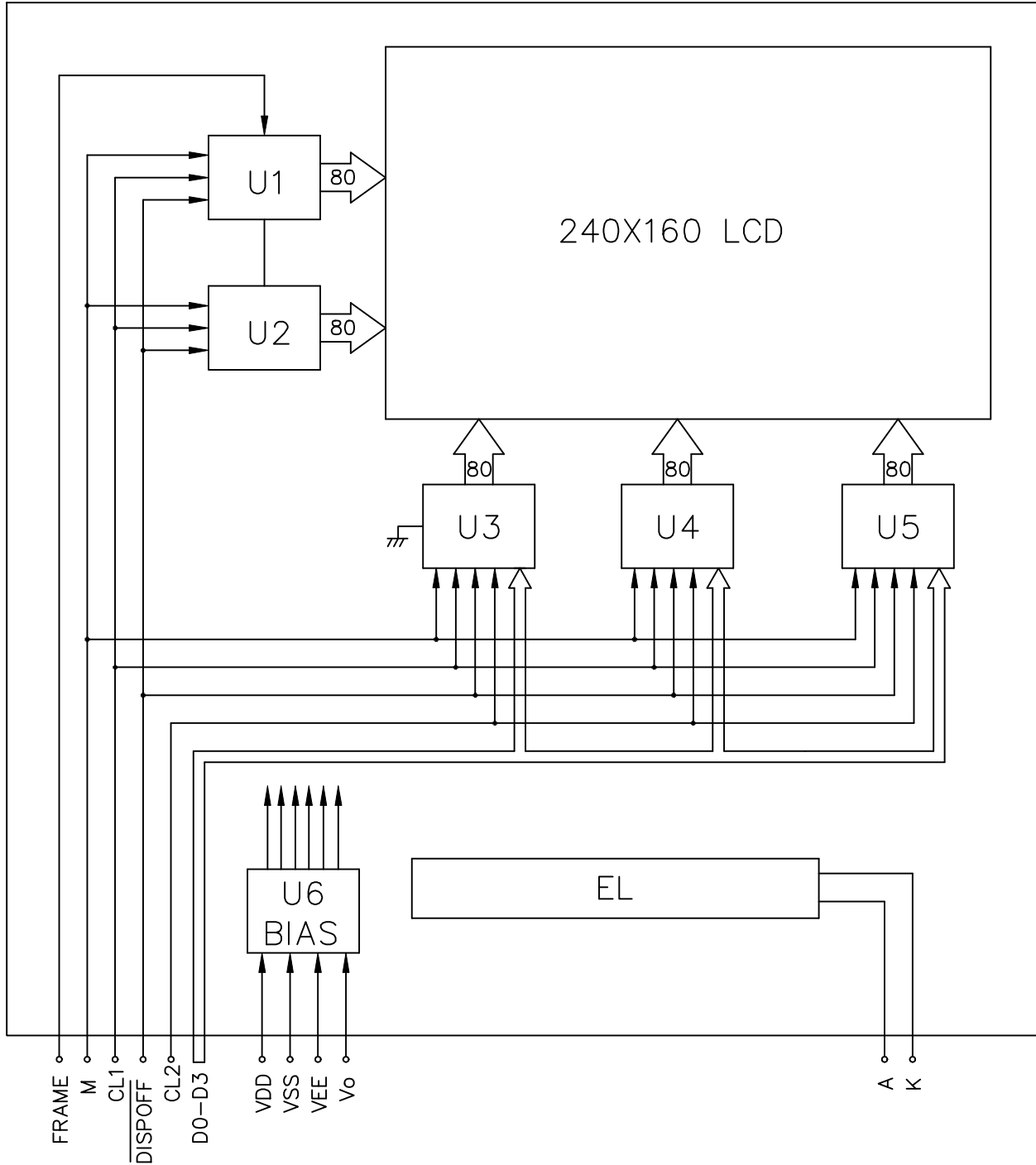
(negative type)

$$\text{Contrast Ratio : } Cr = A/B$$

*Conditions

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

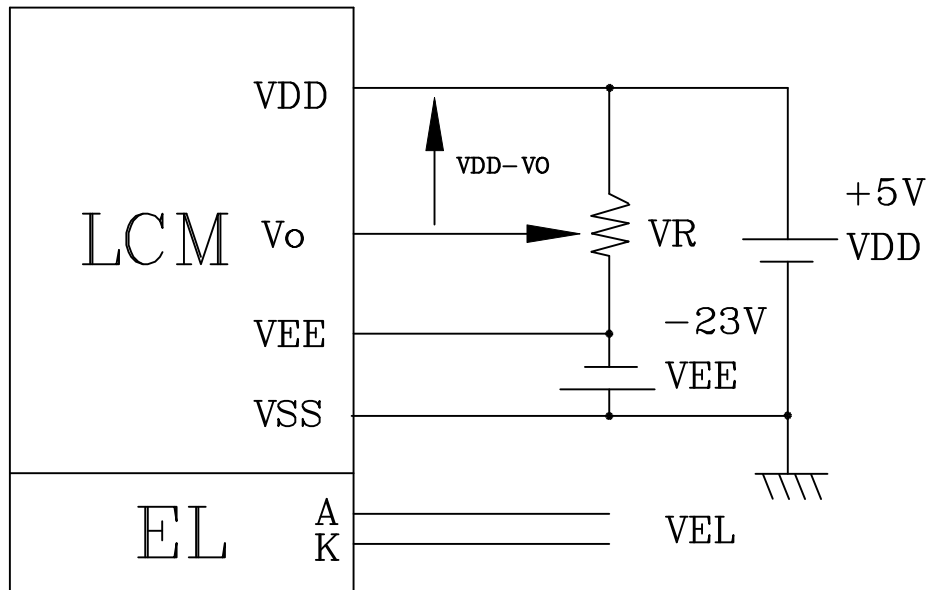
5. BLOCK DIAGRAM



6. INTERFACE PIN CONNECTION

Pin No.	Symbol	Function
1	FRAME	Frame Signal
2	CL1	Display Data Latch Signal
3	M	LCD Drive Signal (AC Signal)
4	$\overline{\text{DISPOFF}}$	Display off
5	CL2	Display Data Shift Clock
6~9	D0~D3	Display Data
10	NC	None Connection
11	VDD	Power Supply Voltage: +5V
12	VSS	Signal GND: 0V
13	VEE	Power Supply Voltage for LCD
14	V0	Power Supply Voltage for LCD
15	A	Power Supply Voltage for EL
16	K	Power Supply Voltage for EL

7. POWER SUPPLY



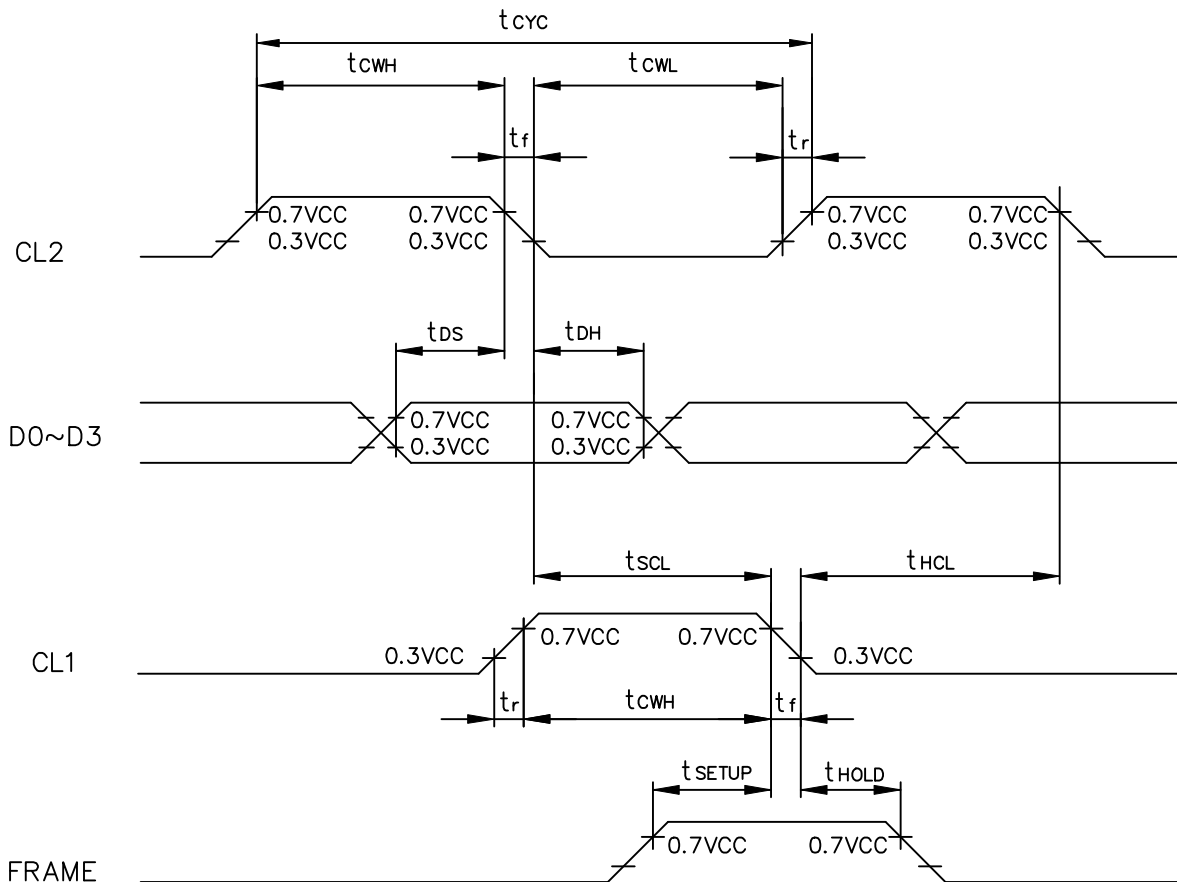
RECOMMENDED:

$$VR = 10K \sim 20K \Omega$$

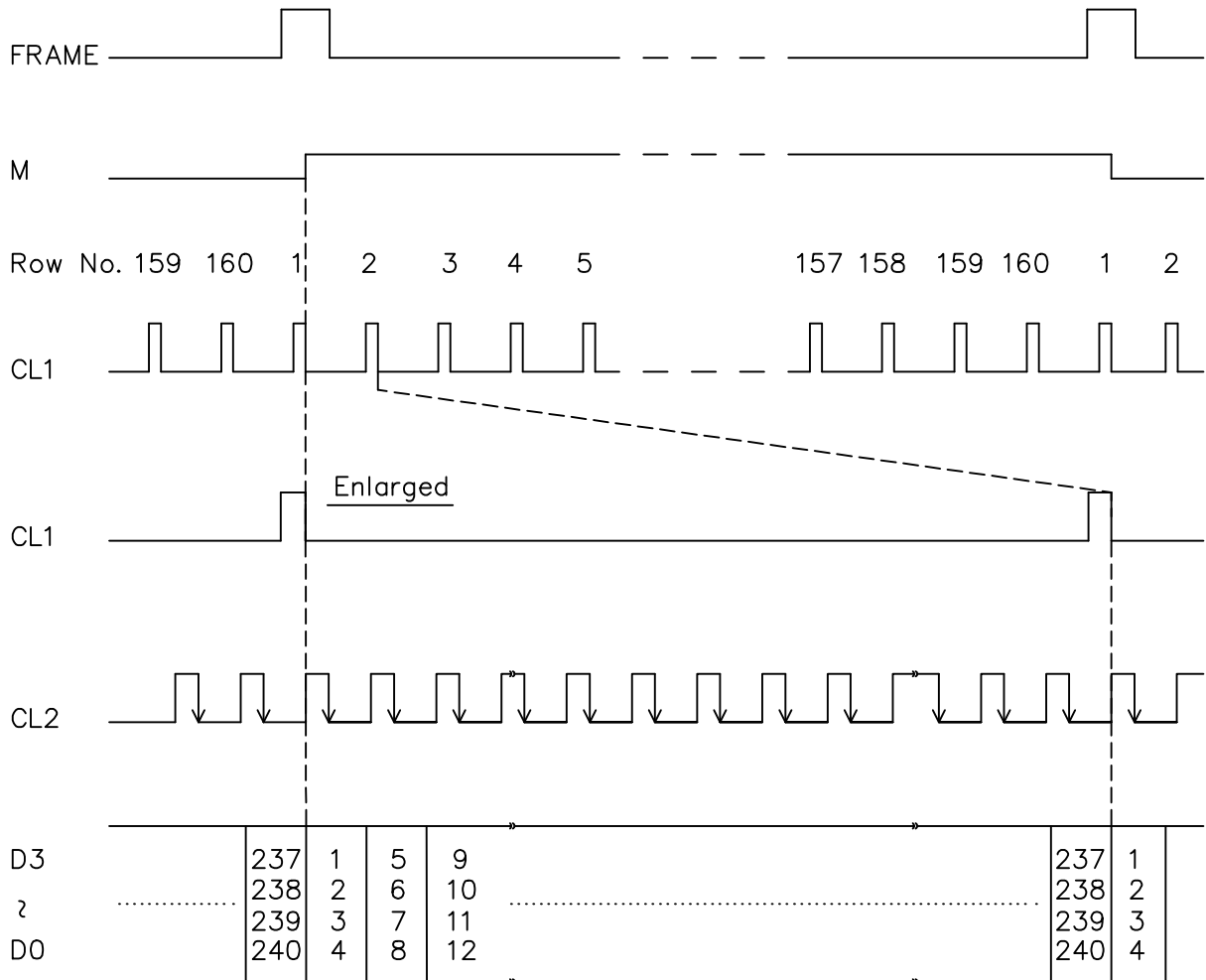
VEL : AC 110 V
 400 Hz

8.1. TIMING CHARACTERISTICS

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CLOCK CYCLE TIME	t_{cyc}	125	-	-	ns
CLOCK HIGH LEVEL WIDTH	t_{cWH}	40	-	-	ns
CLOCK LOW LEVEL WIDTH	t_{cWL}	40	-	-	ns
CLOCK RISE TIME	t_r	-	-	30	ns
CLOCK FALL TIME	t_f	-	-	30	ns
DATA SETUP TIME	t_{DS}	20	-	-	ns
DATA HOLD TIME	t_{DH}	20	-	-	ns
CLOCK SETUP TIME	t_{SCL}	80	-	-	ns
CLOCK HOLD TIME	t_{HCL}	80	-	-	ns
FRAME SETUP TIME	t_{SETUP}	100	-	-	ns
FRAME HOLD TIME	t_{HOLD}	100	-	-	ns



8.2. TIMING CHART OF INPUT SIGNALS



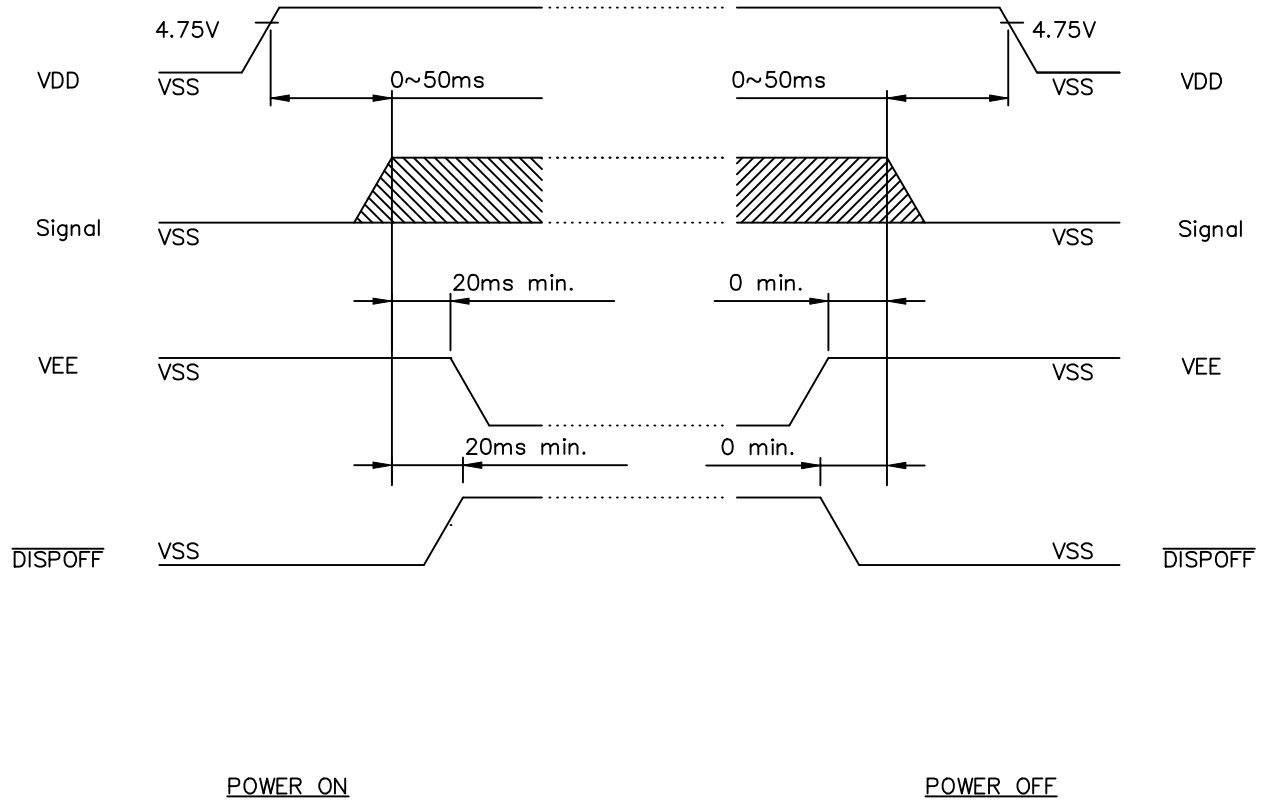
8.3.DISPLAY PATTERN

#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> <hr/> <p>D3 : dot 1, dot 5 dot 233, dot 237 D2 : dot 2, dot 6 dot 234, dot 238 D1 : dot 3, dot 7 dot 235, dot 239 D0 : dot 4, dot 8 dot 236, dot 240</p>												
#159	D3	D2	D1	D0	D3			D0	D3	D2	D1	D0
#160	D3	D2	D1	D0	D3			D0	D3	D2	D1	D0
	#1	#2	#3	#4				#236	#237	#238	#239	#240

160 DOTS

240 DOTS

8.4. POWER ON/OFF TIMING



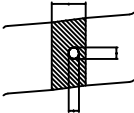
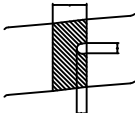
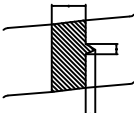
The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

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

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)	(1) ROUND TYPE													
		<table border="1"> <thead> <tr> <th colspan="2">DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>≤ 0.20</td> <td>NEGLECT</td> </tr> <tr> <td>$0.20 < a$</td> <td>≤ 0.35</td> <td>5 MAX</td> </tr> <tr> <td>$0.35 < a$</td> <td></td> <td>NONE</td> </tr> </tbody> </table>	DIAMETER mm (a*)		NO. OF DEFECT*	a	≤ 0.20	NEGLECT	$0.20 < a$	≤ 0.35	5 MAX	$0.35 < a$		NONE	
DIAMETER mm (a*)		NO. OF DEFECT*													
a	≤ 0.20	NEGLECT													
$0.20 < a$	≤ 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 colspan="2">DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td>a</td> <td>≤ 0.15</td> <td>NEGLECT</td> </tr> <tr> <td>$0.15 < a$</td> <td>≤ 0.20</td> <td>2 MAX</td> </tr> <tr> <td>$0.20 < a$</td> <td></td> <td>NONE</td> </tr> </tbody> </table>	DIAMETER mm (a*)		NO. OF DEFECT*	a	≤ 0.15	NEGLECT	$0.15 < a$	≤ 0.20	2 MAX	$0.20 < a$		NONE	
DIAMETER mm (a*)		NO. OF DEFECT*													
a	≤ 0.15	NEGLECT													
$0.15 < a$	≤ 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.													
		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 \pm 15%													
9.	COLOR TONE AND UNIFORMITY	OBVIOUS UNEVEN COLOR IS NOT PERMITTED													

(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.

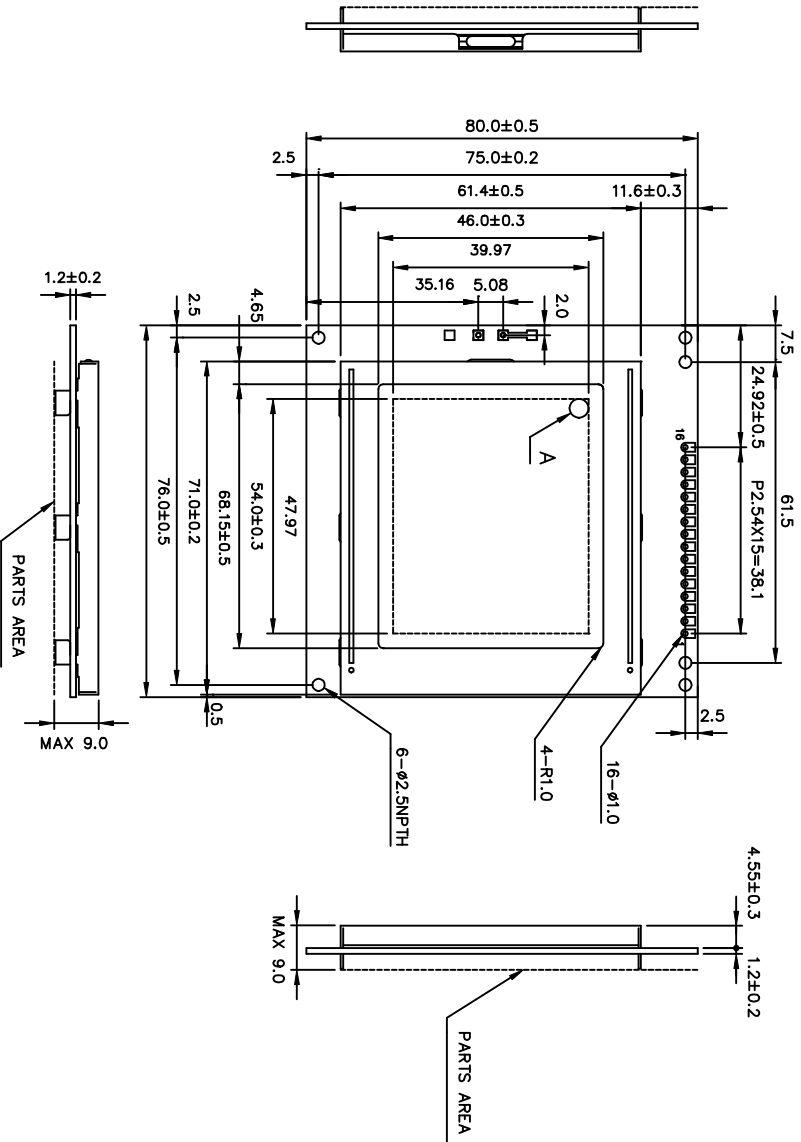
• TERMS OF WARRANTY

- 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.

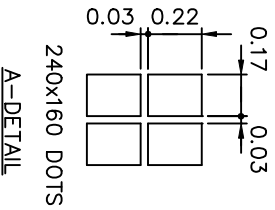
• TYPICAL OPERATING LIFETIME OF BACKLIGHT

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

REV/DATE	RO/ 09.14.98'					APP	CHK	BY
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Pin No.	Symbol	Function
1	FRAME	Frame Signal
2	CL1	Display Data Latch Signal
3	M	LCD Drive Signal (AC Signal)
4	DISPOFF	Display off
5	CL2	Display Data Shift Clock
6~9	D0~D3	Display Data
10	NC	None Connection
11	VDD	Power Supply Voltage: +5V
12	VSS	Signal GND: 0V
13	VFE	Power Supply Voltage for LCD
14	V0	Power Supply Voltage for LCD
15	NC	NO CONNECTION
16	NC	NO CONNECTION



- NOTES:
1. RESOLUTION : 240X160 DOTS
 2. CONTROLLER : WITHOUT
 3. DC/DC : WITHOUT
 4. BACKLIGHT : WITHOUT
 5. GENERAL TOLERANCE : ± 0.2 mm

產品編號	LMA78_198_	南亞塑膠工業股份有限公司
NAME		NAN YA PLASTICS CORPORATION
DATE		
TITLE		裝配圖
APPROVE		
CHECK		
DESIGN		
DRAW	MAY PING	87.07.06
DWG-NO		LMAX198XT
UNIT		mm
SCALE		0.68/1