

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

SPECIFICATION

SPEC. NO. : LM126-0
DATE : Sep. 24, 1998
SHEET NO. : 1/17

U.S. MARKETING ARM:

MARK PRODUCTS CORPORATION
800 N. EDGEWOOD AVENUE
WOOD DALE, IL 60191
TEL: 630-787-9089
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SPECIFICATION OF
128x32 LCD MODULE
PRODUCT NO.: LMCC4_126__M

SPEC. NO.: LM126-0

CUSTOMER
APPROVED BY
DATE:

EDITED ON : Sep.24.1998

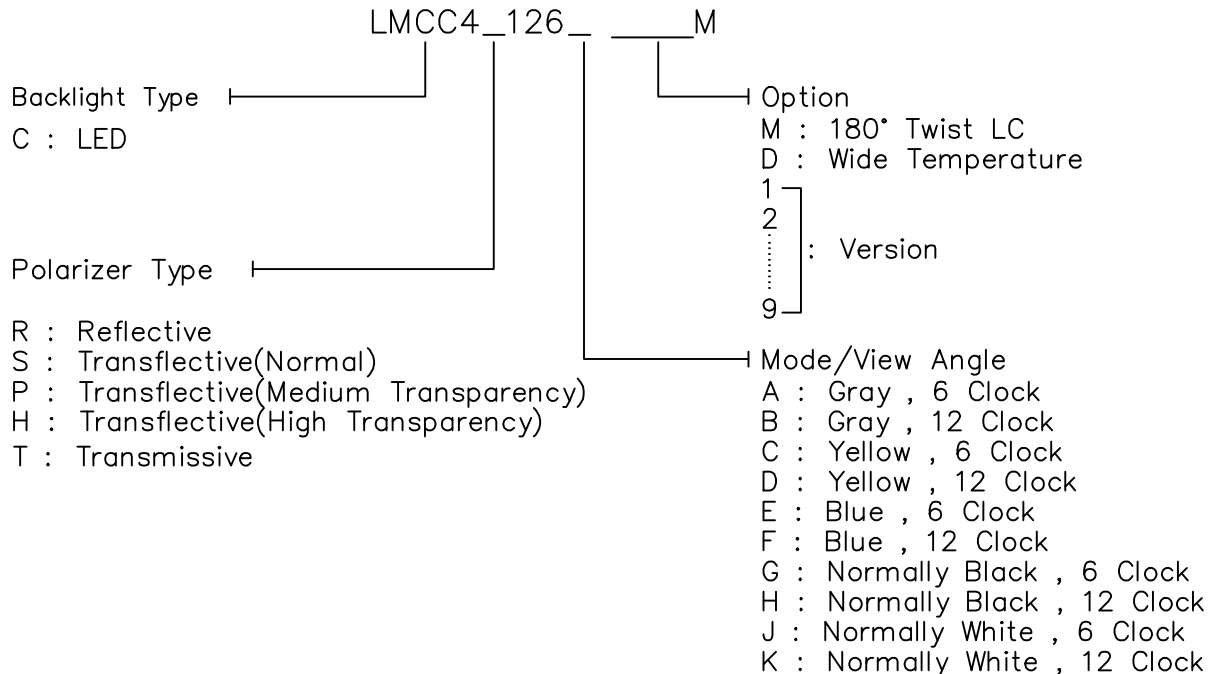
SALE MANAGER	TECHNICAL APPROVE	DESIGN MANAGER	DESIGN CHECK	DESIGNER

REV/DATE	RO/ 09.24.98'					APP	CHK	BY
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1. MECHANICAL DATA

- (1) Product No. LMCC4_126_M
 (2) Module Size 122.0 (W)mm x 44.0 (H)mm x MAX14.5 (D)mm
 (3) Dot Size 0.70 (W)mm x 0.60 (H)mm
 (4) Dot Pitch 0.74 (W)mm x 0.64 (H)mm
 (5) Number of Dots 128 (W) x 32 (H)Dots
 (6) Duty 1/32
 (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
 (8) Viewing Direction 6 O'clock 12 O'clock ___O'clock
 (9) Backlight LED (Color : Yellow-Green)
 (10) LCD Controller BUILT-IN LC7981 (SANYO)
 (11) Weight 78 g(approx.)
 (12) Negative Voltage BUILT-IN
 (13) Temp Comp. Circuit BUILT-IN

Note :



2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

V_{ss}=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VCC-VSS	-0.3	6.5	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 will change slightly depending on ambient temperature.
That 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

(at 25°C & $f_{FRAME} = 70HZ$)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Logic Circuit Power Supply	VCC-VSS	-	4.75	5.0	5.25	V
Input Voltage	VIH	H level	0.8VCC	VCC	-	V
	VIL	L level	-	VSS	0.2VCC	V
Supply Current for Logic	ICC	VCC = 5.0V	-	-	5	mA
LED Forward Voltage	V_F	$I_F = 160mA$	-	4.2	4.6	V
LED Luminous Intensity	L	$I_F = 160mA$	-	100	-	cd/m ²
LC Driving Voltage (180° Twist LC)	Vop	-20°C				V
		0°C				
		25°C	7.7	8.1	8.5	
		50°C				
		70°C				

4-1.OPTICAL CHARACTERISTICS

(For Normal Temperature Mode LCM)

AT Vop

ITEM MODE		Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
S	A,B	-	-	-	-	-	-
	C,D	-	7.0	-	65	-	100
	J,K	-	-	-	-	-	-
T	A,B	-	-	-	-	-	-
	C,D	-	-	-	-	-	-
	J,K	-	-	-	-	-	-
	E,F	-	-	-	-	-	-
	G,H	-	-	-	-	-	-
note		NOTE6		NOTE5			

note:

S: TRANSFLECTIVE

T: TRANSMISSIVE

A: GRAY,6 O'clock

C: YELLOW,6 O'clock

E: BLUE,6 O'clock

G: NORMALLY BLACK,6 O'clock

J: NORMALLY WHITE,6 O'clock

B: GRAY,12 O'clock

D: YELLOW,12 O'clock

F: BLUE,12 O'clock

H: NORMALLY BLACK,12 O'clock

K: NORMALLY WHITE,12 O'clock

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	-	-	-	ms	NOTE 2
		25℃	-	250	375		
		50℃	-	-	-		
Response Time (fall)	Tf	0℃	-	-	-	ms	NOTE 2
		25℃	-	150	225		
		50℃	-	-	-		

4-2.OPTICAL CHARACTERISTICS

(For Wide Temperature Mode LCM)

AT Vop

ITEM MODE		Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
S	A,B	-	-	-	-	-	-
	C,D	6	11	50	75	30	40
	J,K	-	-	-	-	-	-
T	A,B	-	-	-	-	-	-
	C,D	-	-	-	-	-	-
	J,K	-	-	-	-	-	-
	E,F	-	-	-	-	-	-
	G,H	-	-	-	-	-	-
note		NOTE6		NOTE5			

note:

S: TRANSFLECTIVE

T: TRANSMISSIVE

A: GRAY,6 O'clock

C: YELLOW,6 O'clock

E: BLUE,6 O'clock

G: NORMALLY BLACK,6 O'clock

J: NORMALLY WHITE,6 O'clock

B: GRAY,12 O'clock

D: YELLOW,12 O'clock

F: BLUE,12 O'clock

H: NORMALLY BLACK,12 O'clock

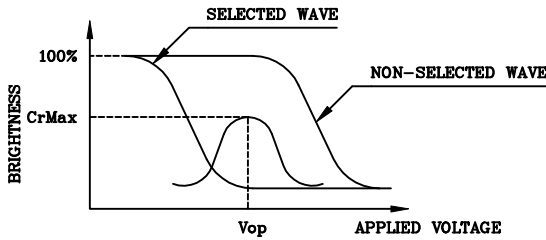
K: NORMALLY WHITE,12 O'clock

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

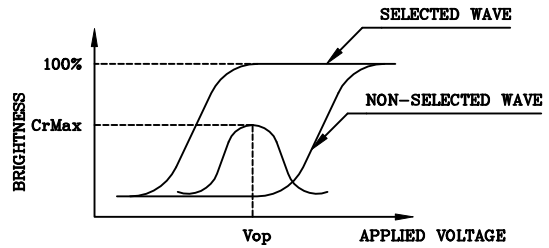
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	-	1100	2200	ms	NOTE 2
		25℃	-	80	160		
		70℃	-	40	80		
Response Time (fall)	Tf	-20℃	-	2400	4800	ms	NOTE 2
		25℃	-	125	250		
		70℃	-	60	120		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



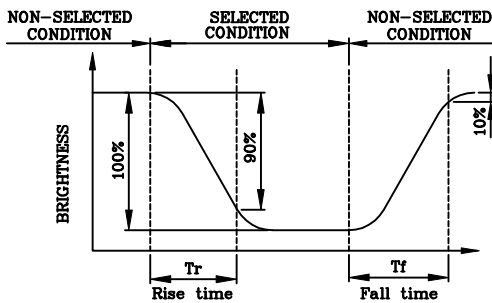
(negative type)

*Conditions

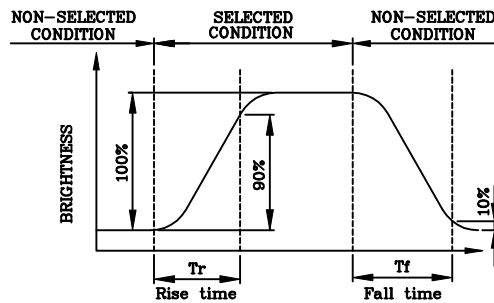
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



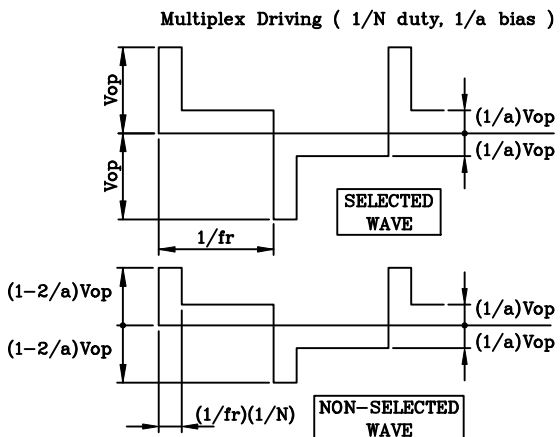
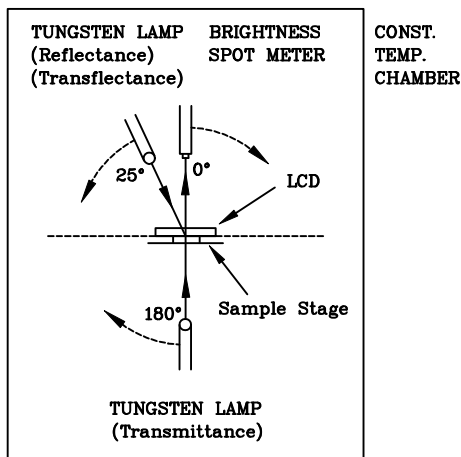
(negative type)

*Conditions

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

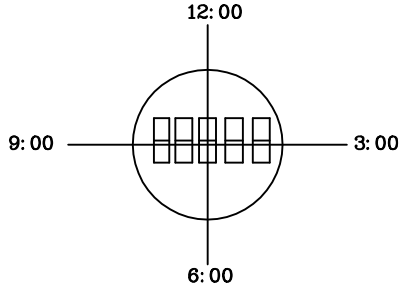
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



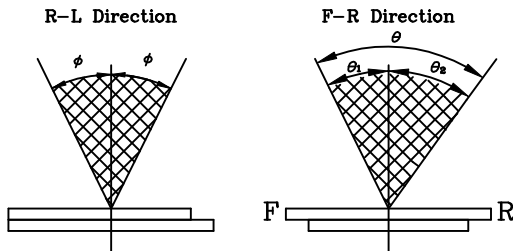
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



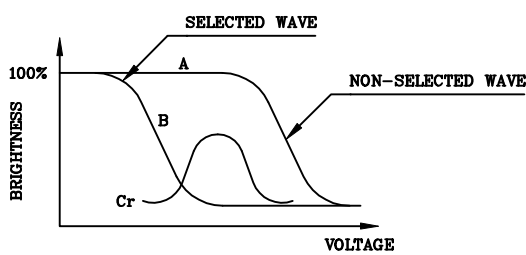
$\theta = \theta_1 + \theta_2$

*Conditions

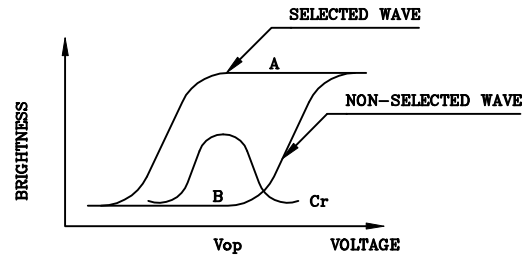
- Operating Voltage : V_{op}
- Frame Frequency : 70Hz
- Applied Waveform : 1/N duty, 1/a bias
- Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



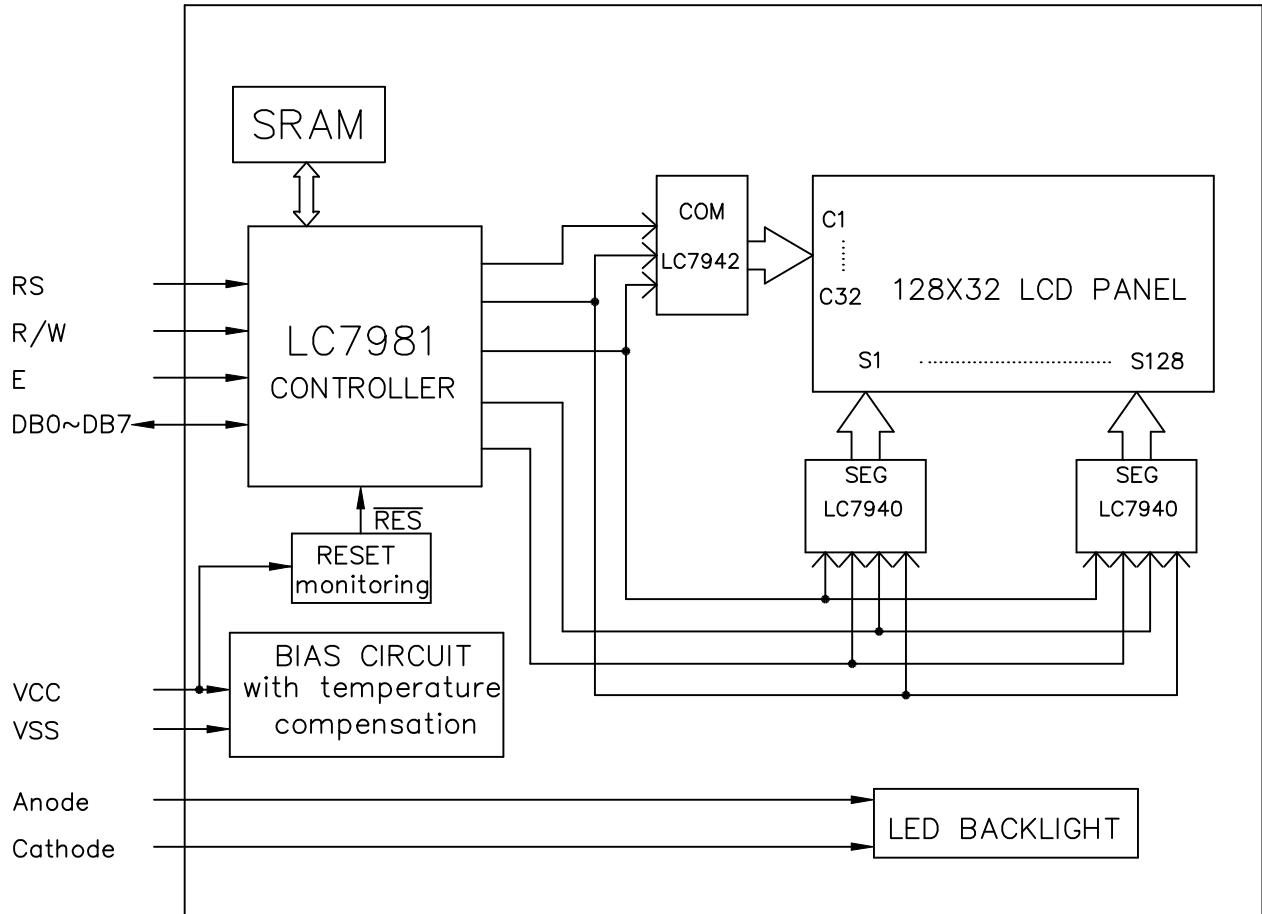
(negative type)

Contrast Ratio : $Cr = A/B$

*Conditions

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

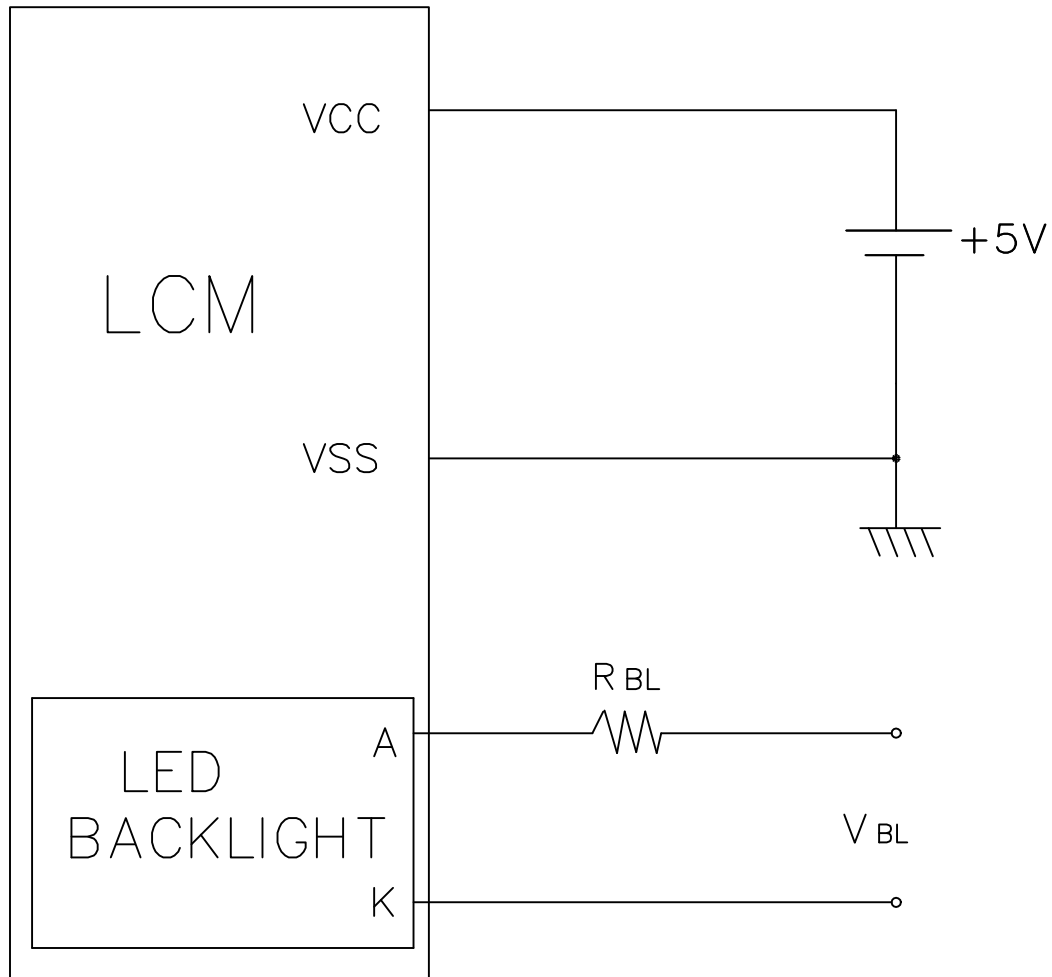
5. BLOCK DIAGRAM



6. INTERNAL PIN CONNECTION

PinNo.	Symbol	Level	Function
1	ANODE	—	ANODE FOR LED
2	CATHODE	—	CATHODE FOR LED
3	VSS	—	POWER SUPPLY
4	VCC	—	
5	—	—	NON CONNECTION
6	RS	H/L	H: INSTRUCTION CODE INPUT L: DATA INPUT
7	R/W	H/L	H: DATA READ (LCM TO MPU) L: DATA WRITE (MPU TO LCM)
8	E	H, H->L	ENABLE SIGNAL
9	DB0	H/L	DATA BUS LINE
10	DB1	H/L	
11	DB2	H/L	
12	DB3	H/L	
13	DB4	H/L	
14	DB5	H/L	
15	DB6	H/L	
16	DB7	H/L	

7. POWER SUPPLY



Recommended Value for R_{BL} and V_{BL}

ITEM Back Light Interface	R _{BL}	V _{BL}	R _{BL}	V _{BL}
		LED	LED	LED
A,K PIN	5 Ω	5V _{Dc}	49 Ω	12V _{Dc}

8. TIMING CHARACTERISTICS

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cyc}	Fig.a, Fig.b	1.0	-	-	us
Enable pulse width	PW_{EH}	Fig.a, Fig.b	450	-	-	ns
Enable rise/fall time	t_{Er}, t_{Ef}	Fig.a, Fig.b	-	-	25	ns
RS,R/W set up time	t_{AS}	Fig.a, Fig.b	140	-	-	ns
Data delay time	t_{DDR}	Fig.b	-	-	225	ns
Data set up time	t_{DSW}	Fig.a	225	-	-	ns
Hold time	t_H	Fig.a, Fig.b	20	-	-	ns

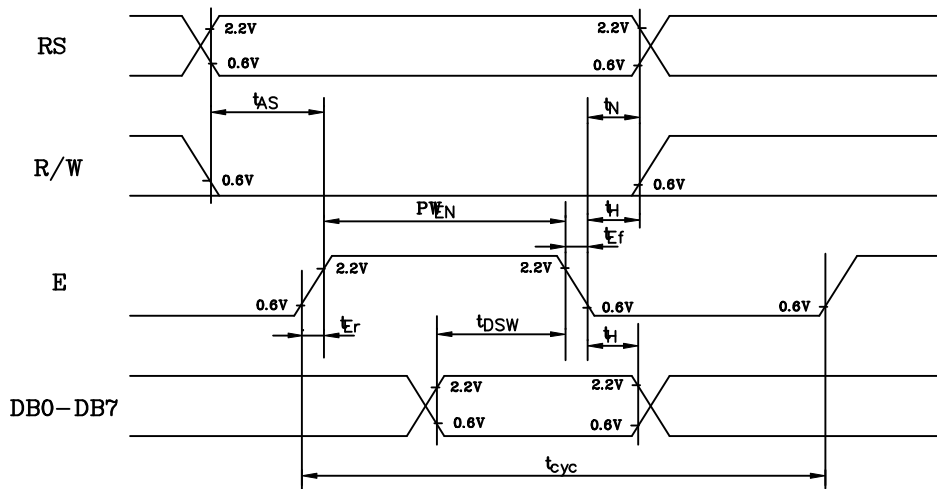


Fig. a Interface timing (data write)

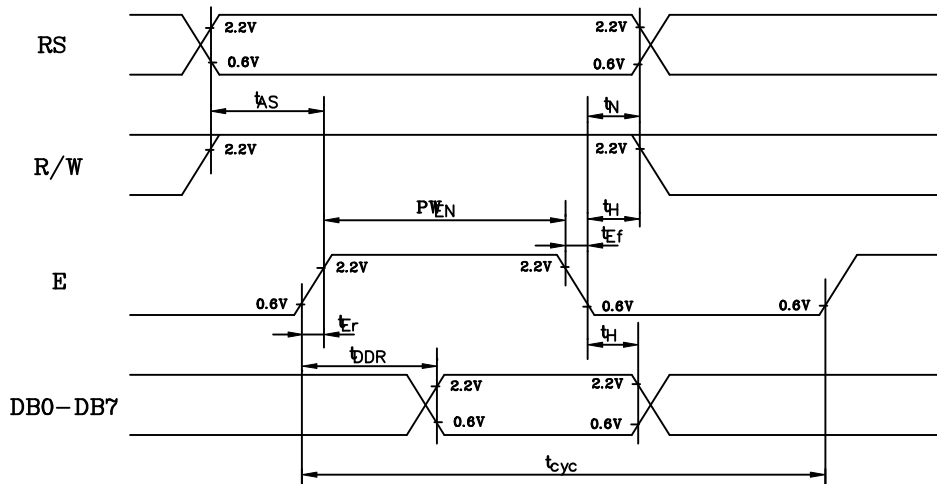
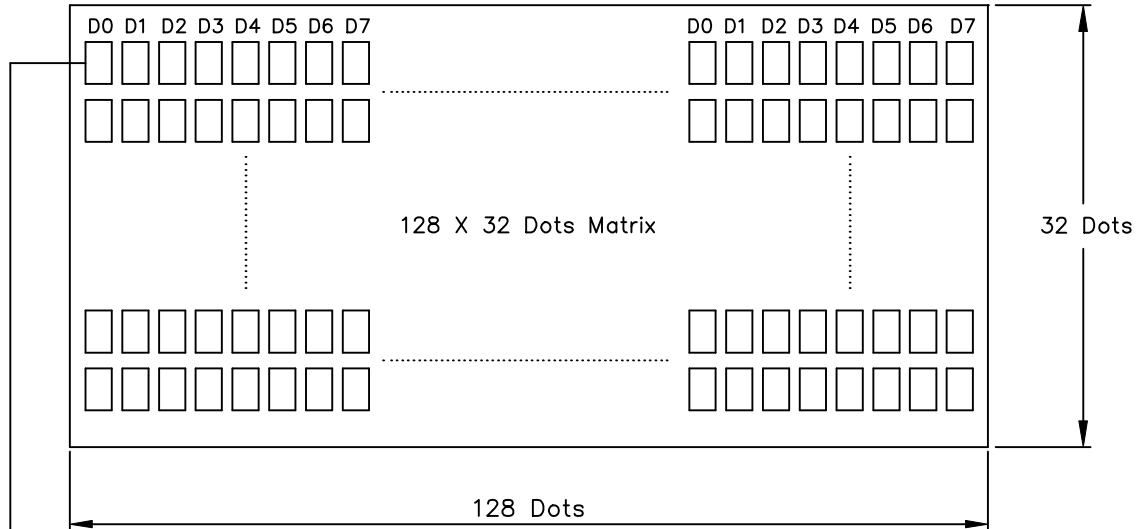


Fig. b Interface timing (data read)

9.DISPLAY PATTERN



Starting dot for the starting address of display RAM.

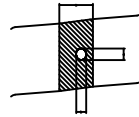
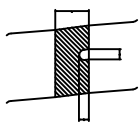
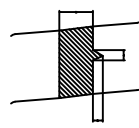
D0~D7 are 8 bits transmitted data ,where D0 is LSB and D7 is MSB.

10. 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

11. 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 ≦ 0.03</td> <td>NEGLECT</td> </tr> <tr> <td>L ≦ 3</td> <td>0.03 < W ≦ 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 ≦ 0.03	NEGLECT	L ≦ 3	0.03 < W ≦ 0.08	6	3 < L	0.08 < W	NONE	
LENGTH mm(L)	WIDTH mm(W)	NO. OF DEFECT													
N A	W ≦ 0.03	NEGLECT													
L ≦ 3	0.03 < W ≦ 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. a ≦ 0.50 mm 0.50 < a ≦ 0.75 0.75 < a ≦ 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													

(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

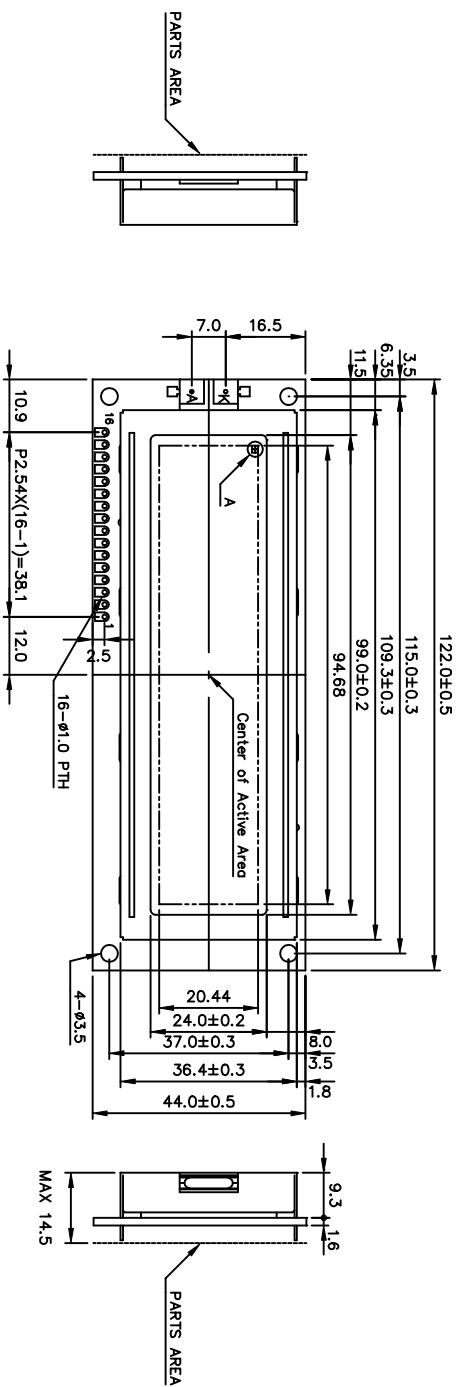
- 1.Acceptance inspection period
The inspection period is within one month after the arrival of the contracted goods at the buyer's factory site.
- 2.Applicable warranty period
The warranty period is within twelve months from the date of invoice under normal usage and storage conditions.

• TYPICAL OPERATING LIFETIME OF BACKLIGHT

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

REV/DATE	RO/ 09.24.98'					APP	CHK	BY
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Pin No.	Symbol	Description
1	Anode	Anode for LED
2	Cathode	Cathode for LED
3	Vss	Power Supply (GND)
4	Vcc	Power Supply (+5V)
5	-	Non Connection
6	RS	Register Selection
7	R/W	Hi:Read/L:Write
8	E	Enable Signal
9	DB0	Data Bus Line
10	DB1	
11	DB2	
12	DB3	
13	DB4	
14	DB5	
15	DB6	
16	DB7	



128 X 32
A DETAIL

產品編號	LMCC4_126_M	南亞塑膠工業股份有限公司
NAME		NAN YA PLASTICS CORPORATION
DATE		製器圖
APPROVE		DWG-NO
CHECK		MC-X126XXXM
DESIGN		Rev.A
DRAW	MAY PING	87.08.20
		UNIT : mm
		SCALE :