

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

SPECIFICATION

SPEC. NO. : LM028-2
DATE : NOV.18.1997
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
40x4 LCD MODULE
PRODUCT NO.: LM_K5_028_2__

SPEC. NO.: LM028-2

APPROVED BY

EDITED ON : NOV.18.1997

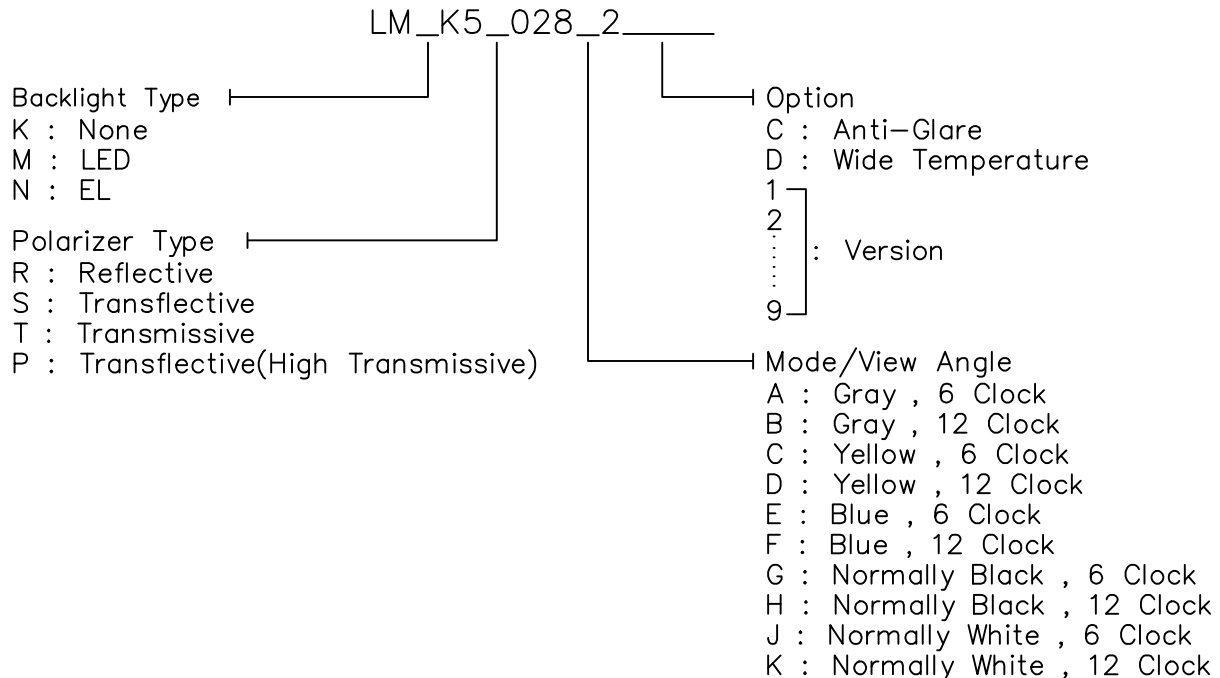
SALES MANAGER	DESIGN MANAGER	PERSON IN CHARGE

REV/DATE	R0/ 11.18.97'					APP	CHK	BY
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1. MECHANICAL DATA

- (1) Product No. LM_K5_028_2_____
- (2) Module Size 190.0 (W)mm x 54.0 (H)mm x MAX14.5 (D)mm (LED B.L.)
190.0 (W)mm x 54.0 (H)mm x MAX9.5 (D)mm (W/O,EL B.L.)
- (3) Dot Size 0.50 (W)mm x 0.55 (H)mm
- (4) Dot Pitch 0.57 (W)mm x 0.62 (H)mm
- (5) Number of Characters 40 (W) x 4 (H)Characters
- (6) Character Format 5 (W) x 8 (H)Dots
- (7) Duty 1/16
- (8) 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
- (9) Viewing Direction 6 O'clock 12 O'clock ____O'clock
- (10) Backlight W/O LED EL
- (11) Weight W/O B/L: 95.0 g
EL B/L: 101.0 g
LED B/L: 131.0 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	7.0	V	
Input Voltage	V _I	-0.3	VDD	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 Ta ≤ 50°C : 85%RH max

Ta > 50°C : Absolute humidity must be lower
than the humidity of 85%RH at 50°C

Note 2 Ta 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 Ta ≤ 70°C : 75%RH max

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

Note 5 Ta at -30°C will be < 48hrs, at 80°C will be < 120hrs

3. ELECTRICAL CHARACTERISTICS

(VDD= 5V ± 10%)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Input Voltage	VIH	H level	0.7VDD	—	VDD	V
	VIO	L level	0	—	0.3VDD	V
Recommended LC Driving Voltage (Normal Temp. LCM)	VDD-V0	0℃	—	4.8	5.4	V
		25℃	4.2	4.7	5.2	
		50℃	3.8	4.3	—	
Recommended LC Driving Voltage (Wide Temp. LCM)	VDD-V0	-20℃	5.9	6.4	7.2	V
		0℃	5.7	6.4	7.2	
		25℃	5.7	6.2	6.8	
		50℃	5.5	5.9	6.5	
		70℃	5.3	5.5	6.1	
Power Supply Current	IDD	VDD = 5.0V	—	4.7	6.0	mA
LED Power Supply Current	I _{LED}	V _{BL} = 5V _{Dc} (R _{BL} = 5Ω)	—	200	—	mA
EL Power Supply Current	I _{EL}	V _{BL} = 110V _{Ac} 400Hz	—	—	10.0	mA

4-1. OPTICAL CHARACTERISTICS

(FOR NORMAL TEMPERATURE MODE LCM)

AT Vop

MODE	ITEM	Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A/B	3.0	4.0	40	65	25	35
	C/D	5.0	8.0	50	70	28	38
	J/K						
S	A/B	3.0	4.0	35	60	20	32
	C/D	4.0	7.0	45	65	25	35
	J/K						
T	E/F	2.5	3.0	30	50	20	30
	C/D	2.5	5.0	30	50	20	30
NOTE		NOTE6		NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	-	460	900	ms	NOTE 2
		25℃	-	110	220		
		50℃	-	65	130		
Response Time (fall)	Tf	0℃	-	420	800	ms	NOTE 2
		25℃	-	140	250		
		50℃	-	90	155		

NOTE :

R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A/B: GRAY
C/D: YELLOW
E/F: BLUE
J/K: NORMALLY WHITE

4-2.OPTICAL CHARACTERISTICS

(FOR WIDE TEMPERATURE MODE LCM)

AT Vop

ITEM MODE		Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25 τ		25 τ		25 τ	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A/B	3.5	4.3	40	65	25	35
	C/D	5.5	9.0	50	70	28	38
	J/K						
S	A/B	3.2	4.1	35	60	20	32
	C/D	4.5	7.5	45	65	25	35
	J/K						
T	E/F	2.7	3.3	30	50	20	30
	C/D	3.0	5.5	30	50	20	30
NOTE		NOTE6		NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20 τ	-	1500	3000	ms	NOTE 2
		0 τ	-	270	540		
		25 τ	-	120	240		
		50 τ	-	70	140		
		70 τ	-	65	130		
Response Time (fall)	Tf	-20 τ	-	2000	3500	ms	NOTE 2
		0 τ	-	310	580		
		25 τ	-	100	220		
		50 τ	-	50	120		
		70 τ	-	40	105		

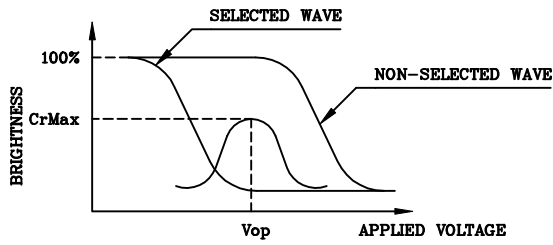
NOTE :

R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A/B: GRAY

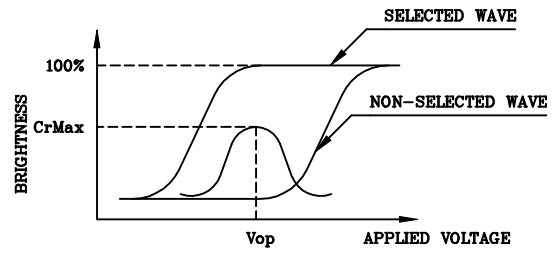
C/D: YELLOW
E/F: BLUE
J/K: NORMALLY WHITE

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



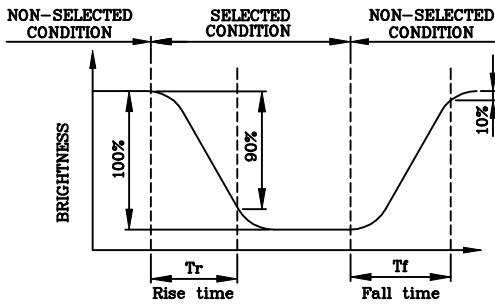
(negative type)

*Conditions

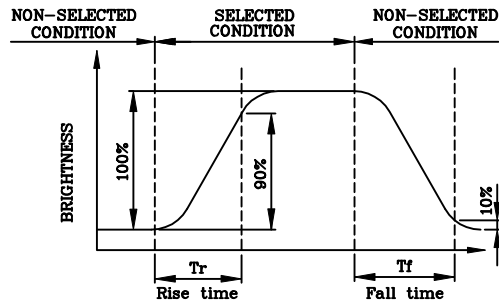
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



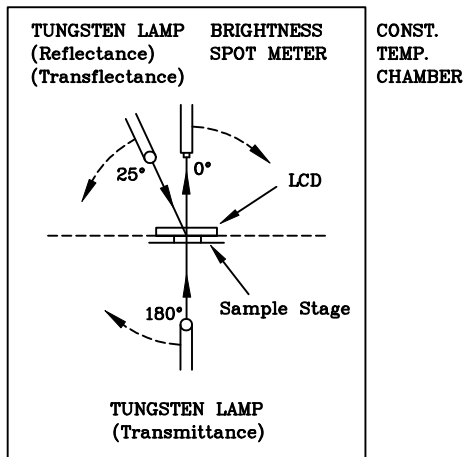
(negative type)

*Conditions

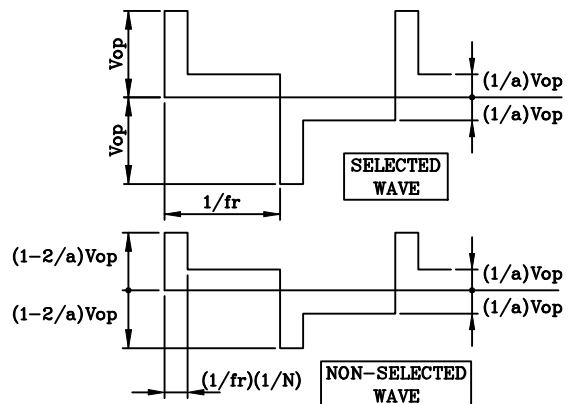
Operating Voltage : Vop
Viewing Angle (θ,φ) : (0,0)
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

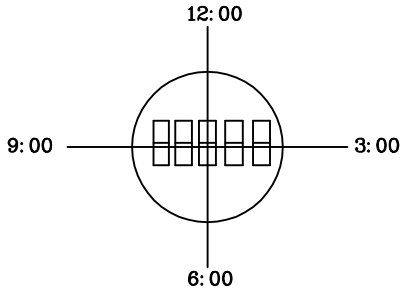


Multiplex Driving (1/N duty, 1/a bias)



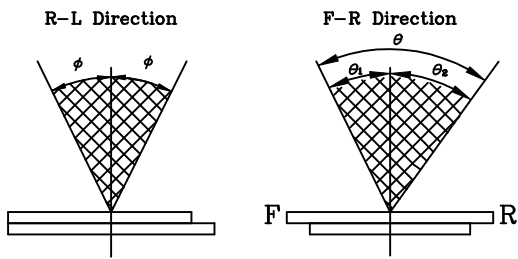
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle

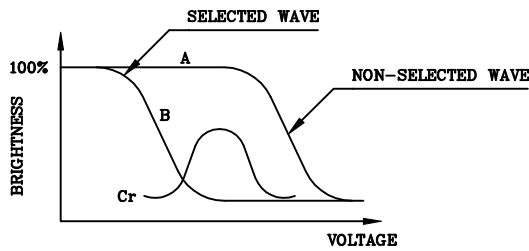


*Conditions

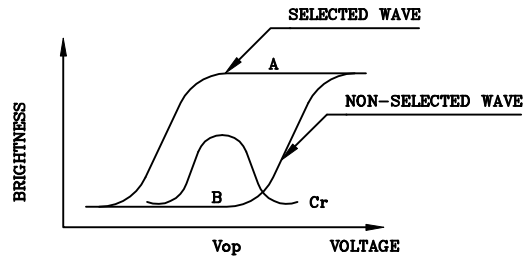
Operating Voltage : V_{op}
 Frame Frequency : 70Hz
 Applied Waveform : 1/N duty, 1/a bias
 Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



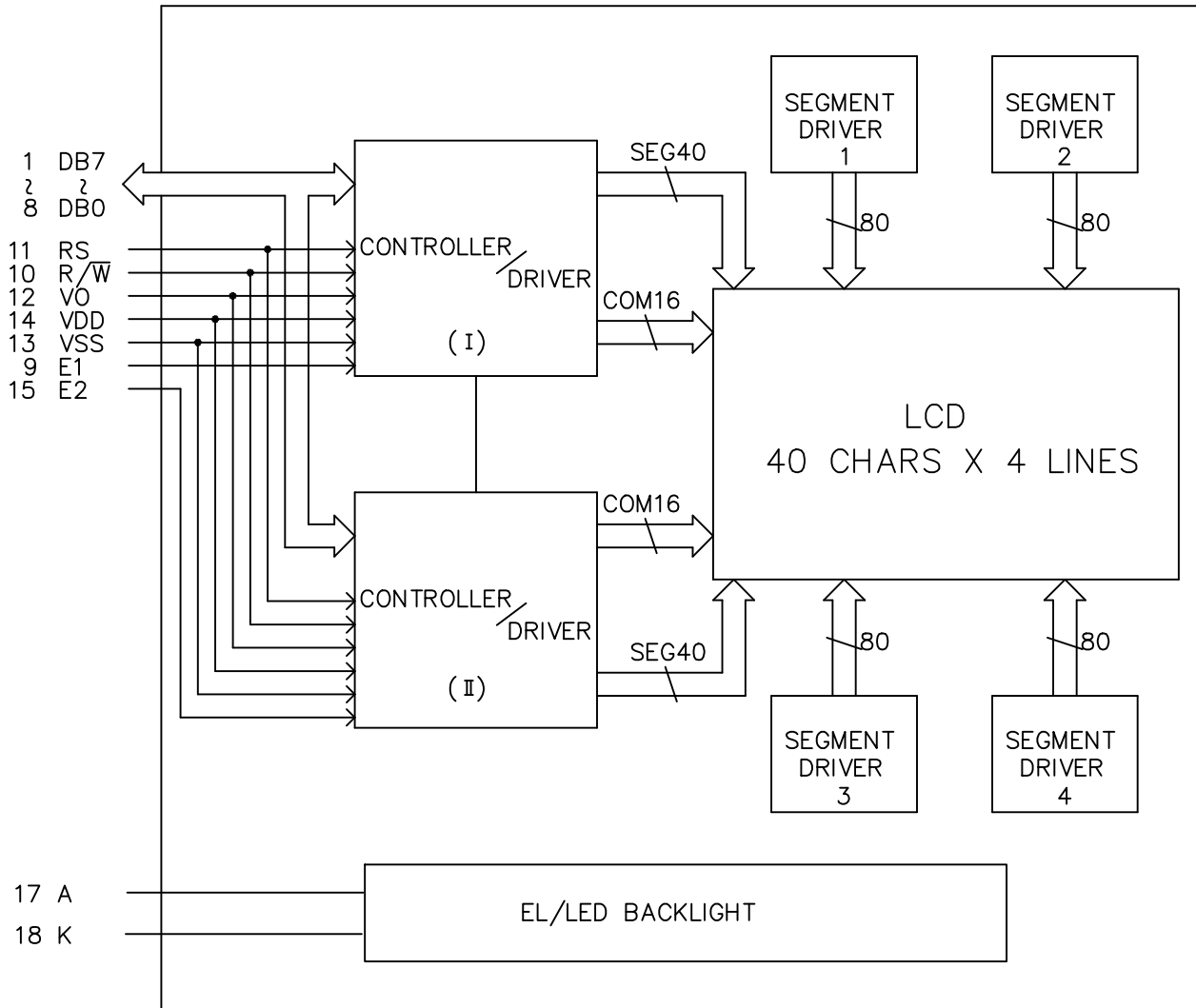
(negative type)

Contrast Ratio : $Cr=A/B$

*Conditions

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

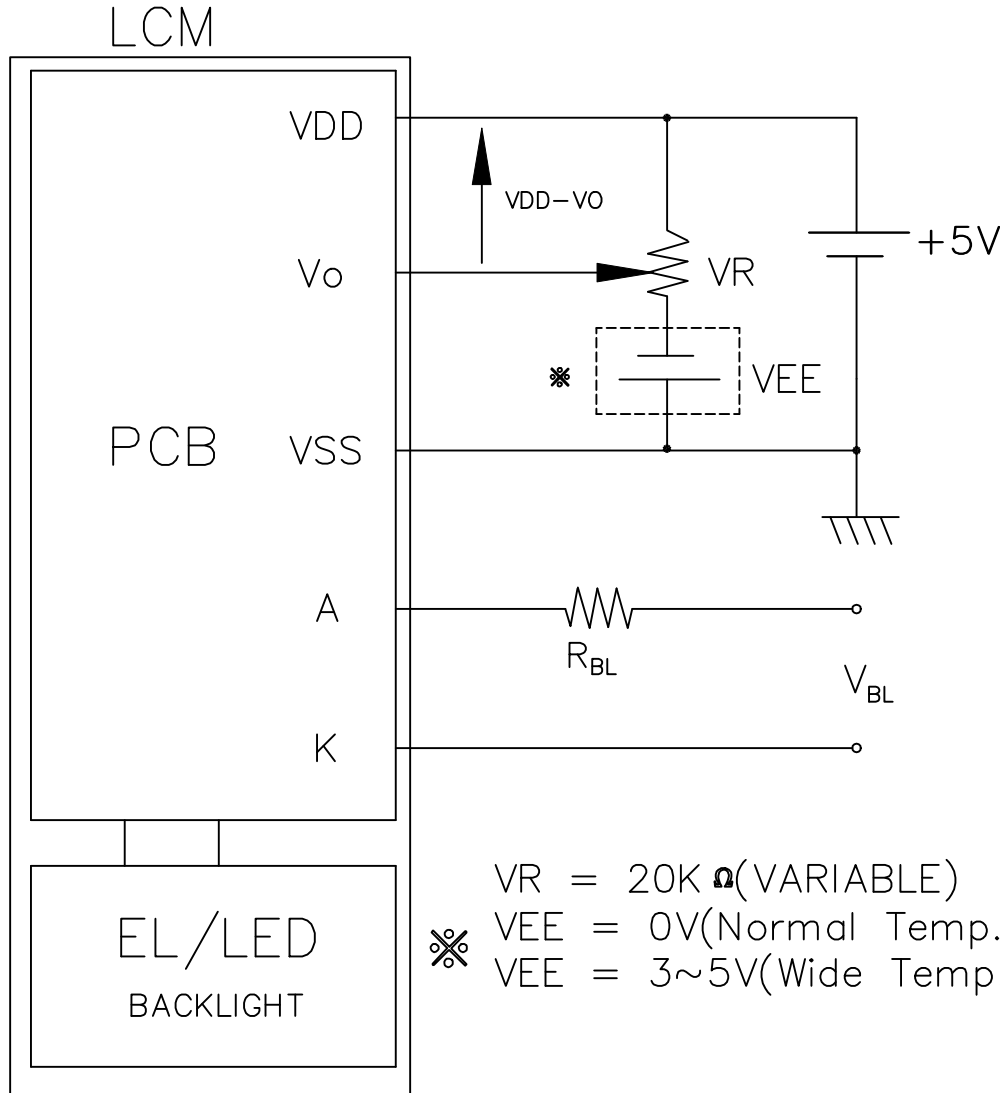
6. BLOCK DIAGRAM



6. INTERNAL PIN CONNECTION

PinNo.	Symbol	Function
1	DB7	Data Bus Line
2	DB6	
3	DB5	
4	DB4	
5	DB3	
6	DB2	
7	DB1	
8	DB0	
9	E1	Enable Signal (Lines 1 & 2)
10	R/ \bar{W}	H:Read L:Write
11	RS	H:Data L:Instruction
12	VO	Power Supply for LCD Driving
13	VSS	Power Supply (0V, GND)
14	VDD	Power Supply (+5V)
15	E2	Enable Signal (Lines 3 & 4)
16	NC	No Connection
(17)	A	Power Supply for EL/LED B/L
(18)	K	Power Supply for EL/LED B/L

7. POWER SUPPLY



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

ITEM Back Light Interface	R _{BL}		V _{BL}	
	LED	EL	LED	EL
A,K PAD	5 Ω	0 Ω	5V _{Dc}	110 V _{Ac} 400Hz

8-1. INTERFACE TIMING CHARACTERISTICS

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cyc}	Fig.a, Fig.b	500	-	-	ns
Enable pulse width	PW_{EH}	Fig.a, Fig.b	230	-	-	ns
Enable rise/fall time	t_{Er}, t_{Ef}	Fig.a, Fig.b	-	-	20	ns
RS, R/W set up time	t_{AS}	Fig.a, Fig.b	40	-	-	ns
RS, R/W hold time	t_{H1}	Fig.a, Fig.b	10	-	-	ns
Data set up time	t_{DSW}	Fig.a	60	-	-	ns
Data output delay time	t_{DDR}	Fig.b	-	-	120	ns
Data write hold time	t_{H2}	Fig.a	10	-	-	ns
Data read hold time	t_{H2}	Fig.b	5	-	-	ns

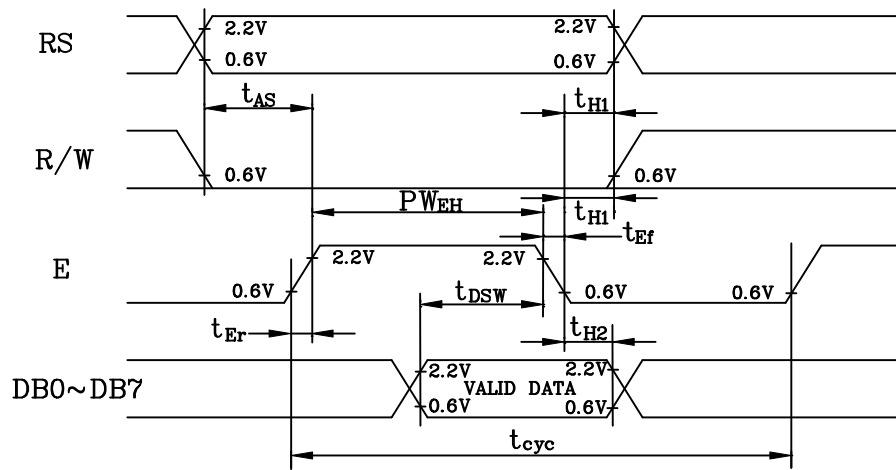


Fig.a Interface timing (data write)

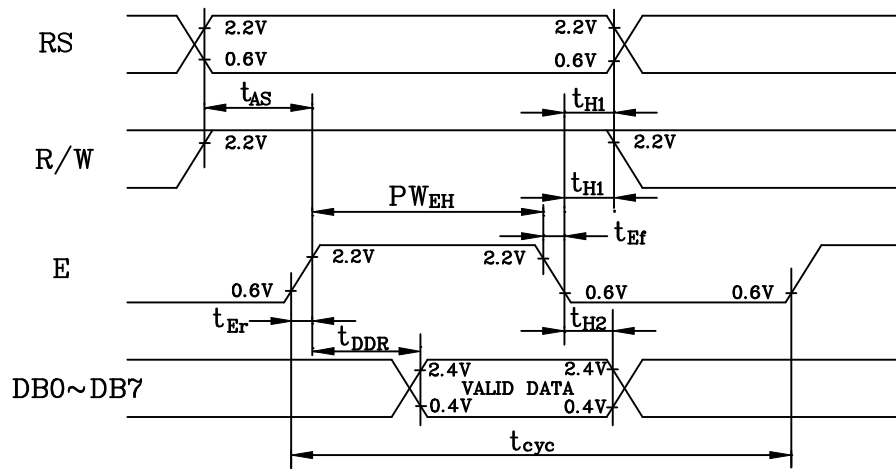


Fig.b Interface timing (data read)

8-2.DISPLAY PATTERN (40x4)

Display Data RAM Address
 Versus Character Position

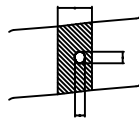
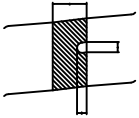
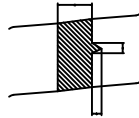
	1	2	.....	16	17	.....	32	33	.....	39	40
U1	00	01	.....	0F	10	.....	1F	20	.....	26	27
	40	41	.....	4F	50	.....	5F	60	.....	66	67
U2	00	01	.....	0F	10	.....	1F	20	.....	26	27
	40	41	.....	4F	50	.....	5F	60	.....	66	67

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>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. $a \leq 0.50$ 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													

(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.

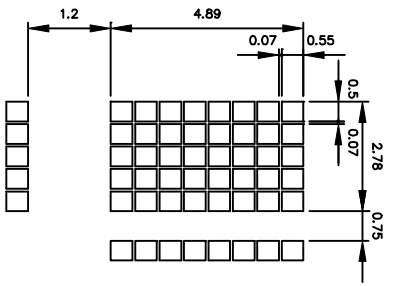
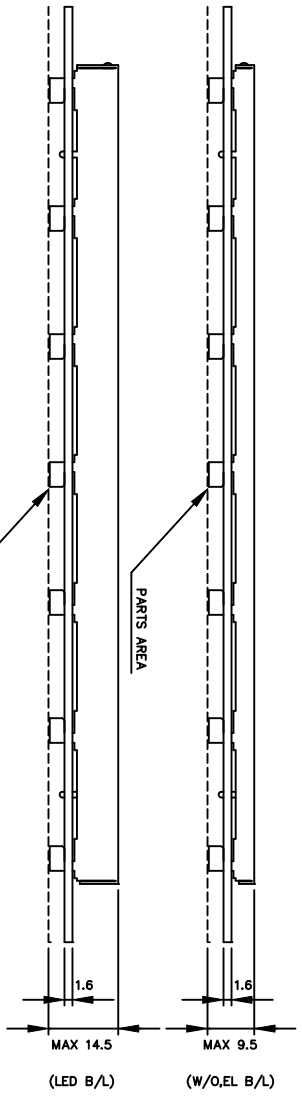
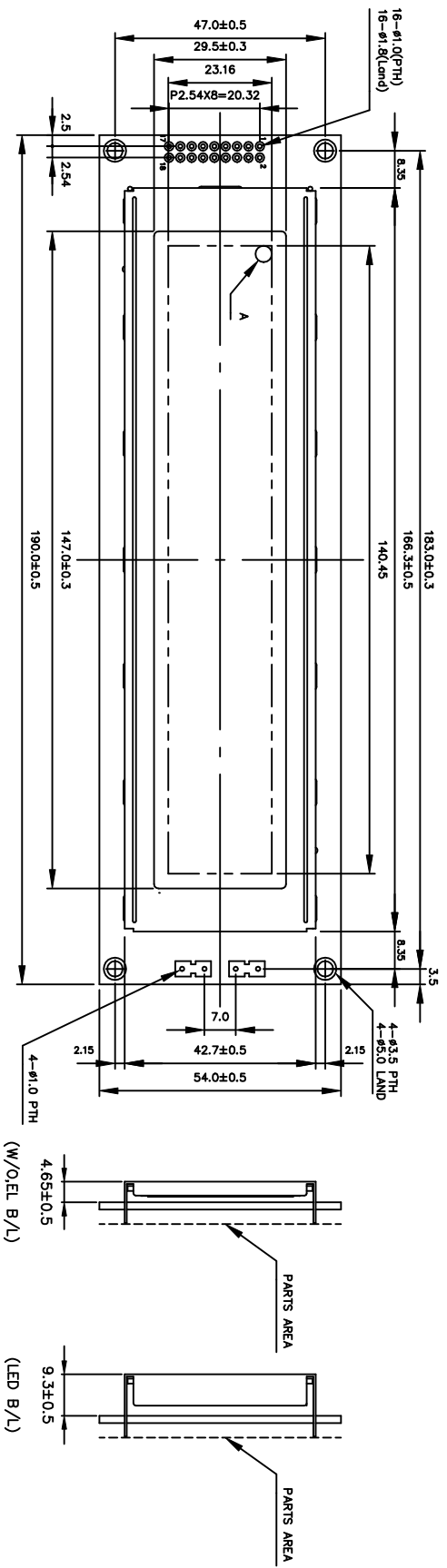
• TERMS OF WARRANTY

- 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/ 11.18.97'					APP	CHK	BY
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PinNo.	Symbol	Function
1	DB7	Data Bus Line
2	DB6	
3	DB5	
4	DB4	
5	DB3	
6	DB2	
7	DB1	
8	DB0	
9	EU	Enable Signal (Up panel)
10	R/W	Hi/Read L/Write
11	RS	Hi/Data L/Instruction
12	VO	Power Supply for LCD Driving
13	VSS	Power Supply (OV, GND)
14	VDD	Power Supply (+5V)
15	ED	Enable Signal (Down panel)
16	NC	No Connection
17	A	Power Supply for EL/LED B/L
18	K	Power Supply for EL/LED B/L

NOTES :
1. RESOLUTION: 40 CHARACTERS X 4 LINES

產品編號	LM_K5_028_2	南亞塑膠工業股份有限公司
NAME		NAN YA PLASTICS CORPORATION
DATE		
TITLE	外觀尺寸圖	
DWG-NO	MXCX028X2	Rev.A
DESIGN		
DRAW	MAY PING	86.11.18
THIRD ANGLE PROJECT	UNIT : mm	SCALE : 1/1