

NAN YA PLASTICS CORP. ELEC. MATERIALS DIV. LCD DEPARTMENT	SPECIFICATION	SPEC. NO. : LM026-1 DATE : Nov. 04, 1996 SHEET NO. : 1/18
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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
 128x128 LCD MODULE
 PRODUCT NO.: LM_76_026_P_

SPEC. NO.: LM026-1

APPROVED BY

EDITED ON : Nov. 04, 1997

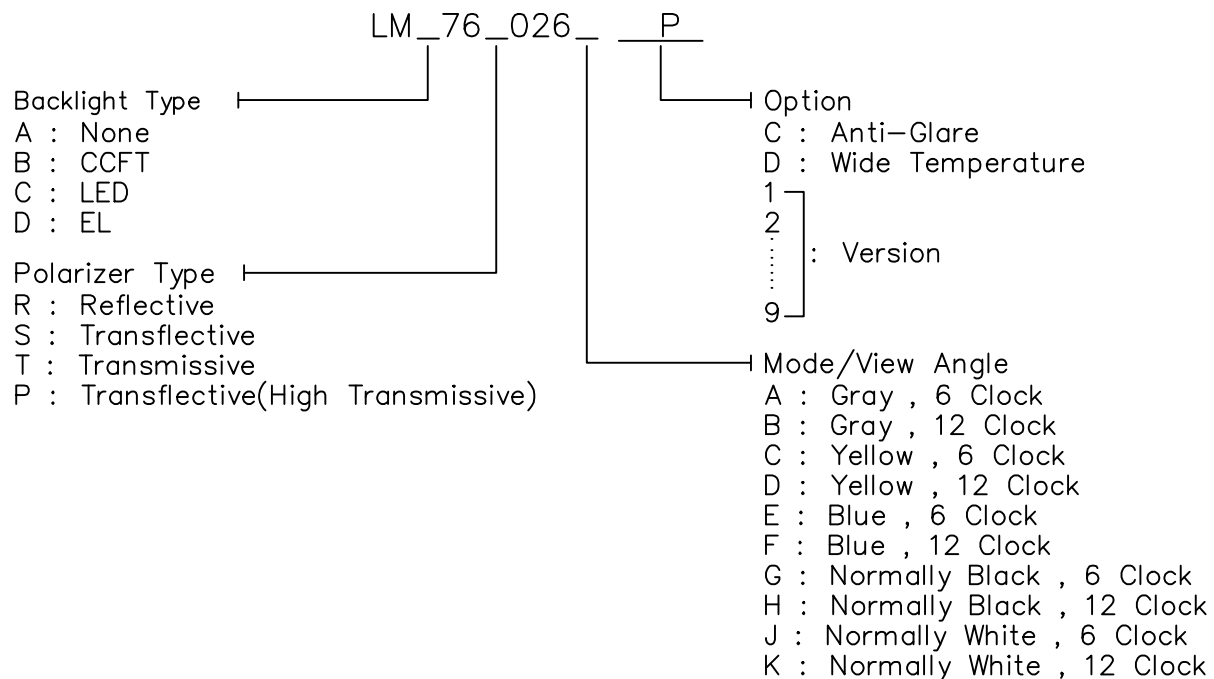
SALES MANAGER	DESIGN MANAGER	PERSON IN CHARGE

REV/DATE	R0/ 11.04.97'					APP	CHK	BY
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1. MECHANICAL DATA

- | | |
|-----------------------|--|
| (1) Product No. | LM_76_026_ _P_ |
| (2) Module Size | 72.4 (W)mm x 69.9 (H)mm x MAX13.5 (D)mm
(LED B.L.)
72.4 (W)mm x 69.9 (H)mm x MAX9.5 (D)mm
(W/O,EL B.L.) |
| (3) Dot Size | 0.32 (W)mm x 0.32 (H)mm |
| (4) Dot Pitch | 0.35 (W)mm x 0.35 (H)mm |
| (5) Number of Dots | 128 (W) x 128 (H)Dots |
| (6) Duty | 1/128 |
| (7) LCD Display Mode | STN: <input type="checkbox"/> Gray Mode <input type="checkbox"/> Yellow Mode <input type="checkbox"/> Blue Mode
FSTN: <input type="checkbox"/> Black and White(Normal White/Positive Image)
<input type="checkbox"/> Black and White(Normal Black/Negative Image)
Rear Polarizer: <input type="checkbox"/> Reflective <input type="checkbox"/> Transflective <input type="checkbox"/> Transmissive
<input type="checkbox"/> Transflective(High Transmissive) |
| (8) Viewing Direction | <input type="checkbox"/> 6 O'clock <input type="checkbox"/> 12 O'clock <input type="checkbox"/> ___O'clock |
| (9) Backlight | <input type="checkbox"/> W/O <input type="checkbox"/> EL <input type="checkbox"/> LED <input type="checkbox"/> CCFT |
| (10) LCD Controller | BUILT-IN LC7981 (SANYO) |
| (11) Weight | W/O B/L: about 53.9 g
EL B/L: about 56.8 g
LED B/L: about 68 g |

Note :



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	
Power Supply for LC Drive	VDD-VEE	0	25.0	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
Logic Circuit Power Supply	VDD-VSS	-	4.75	5.0	5.25	V
Input Voltage	VIH	H level	0.8VDD	-	VDD	V
	VIL	L level	0	-	0.2VDD	V
Recommended LC Driving Voltage (Normal Temp. LCM)	VDD-VEE 1/12 Bias	0℃	-	19.0	20.0	V
		25℃	16.8	17.6	18.2	
		50℃	15.7	16.1	-	
Recommended LC Driving Voltage (Wide Temp. LCM)	VDD-VEE 1/12 Bias	-20℃	-	16.9	17.4	V
		-10℃	15.2	16.1	16.7	
		0℃	15.2	16.1	16.5	
		25℃	15.2	16.1	16.4	
		50℃	15.2	15.9	16.4	
		70℃	14.3	14.9	-	
Supply Current (LCD) (Normal Temp. LCM)	IDD	VDD = 5.0V	-	-	9	mA
	IEE	VEE = 12.6V	-	-	4	mA
LED Power Supply Current	I LED	V _{BL} = 5V _{dc} (R _{BL} = 3.3Ω)	-	240	400	mA
EL Power Supply Current	I EL	V _{EL} = 110V _{Ac} 400Hz	-	-	5	mA

4-1.OPTICAL CHARACTERISTICS

(For Normal Temperature Mode LCM)

AT V_{op}

ITEM MODE		Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A	3	4	40	60	25	30
	C	4	6	40	60	25	35
	J	4	6	40	60	25	35
S	A	3	4	40	60	20	30
	C	4	6	40	60	25	35
	J	3.5	6	40	55	20	30
T	E	3	4	35	65	20	40
	G	6	15	45	90	30	50
note		NOTE6		NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	-	450	900	ms	NOTE 2
		25℃	-	110	220		
		50℃	-	65	130		
Response Time (fall)	Tf	0℃	-	650	1100	ms	NOTE 2
		25℃	-	135	250		
		50℃	-	80	150		

note:

R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A: GRAY
C: YELLOW
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

4-2.OPTICAL CHARACTERISTICS

(For Wide Temperature Mode LCM)

AT V_{OP}

ITEM MODE		Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A	3.0	4.0	40	60	28	35
	C	-	-	-	-	-	-
	J	4.0	6.5	35	52	25	33
S	A	3.0	3.8	35	50	20	25
	C	-	-	-	-	-	-
	J	-	-	-	-	-	-
T	E	-	2.5	20	40	15	20
	G	5	10	50	86	35	50
note		NOTE6		NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	-	2200	4400	ms	NOTE 2
		-10℃	-	940	1880		
		0℃	-	440	880		
		25℃	-	120	240		
		50℃	-	60	120		
		70℃	-	50	100		
Response Time (fall)	Tf	-20℃	-	3800	6000	ms	NOTE 2
		-10℃	-	1260	2400		
		0℃	-	620	1200		
		25℃	-	180	350		
		50℃	-	80	150		
		70℃	-	70	130		

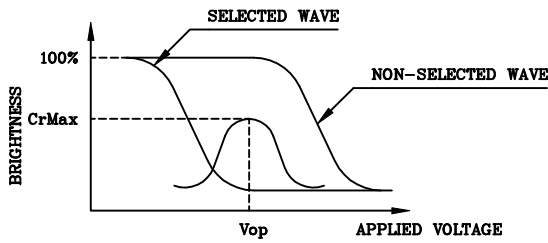
note:

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

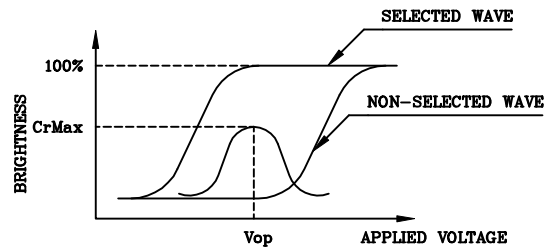
C: YELLOW
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



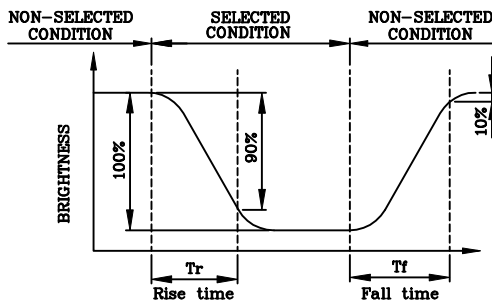
(negative type)

*Conditions

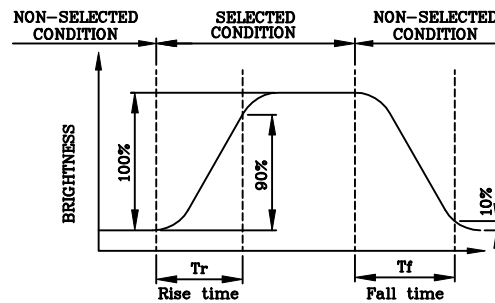
Viewing Angle : 0
 Frame Frequency : 70Hz
 Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



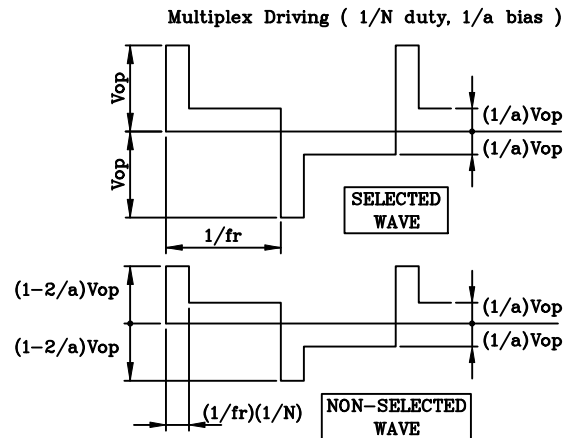
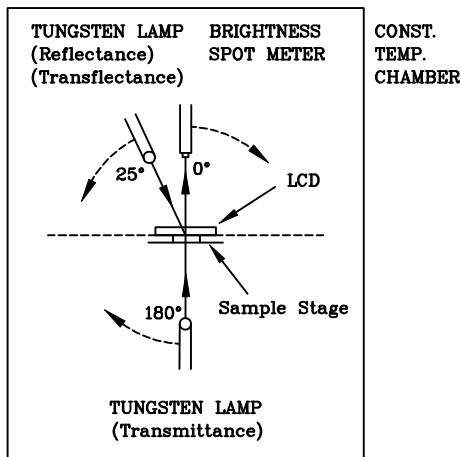
(negative type)

*Conditions

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

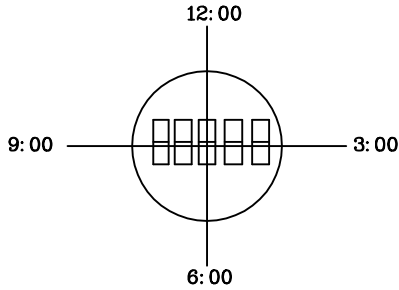
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



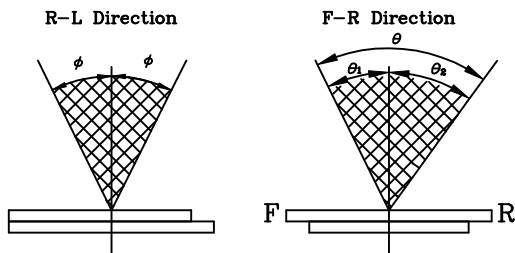
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



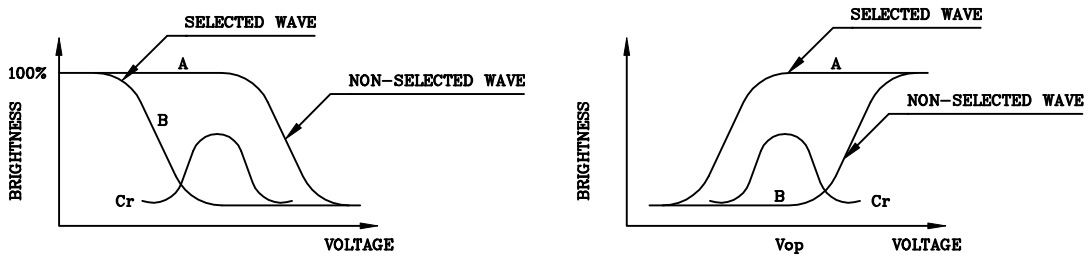
$$\theta = \theta_1 + \theta_2$$

*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)

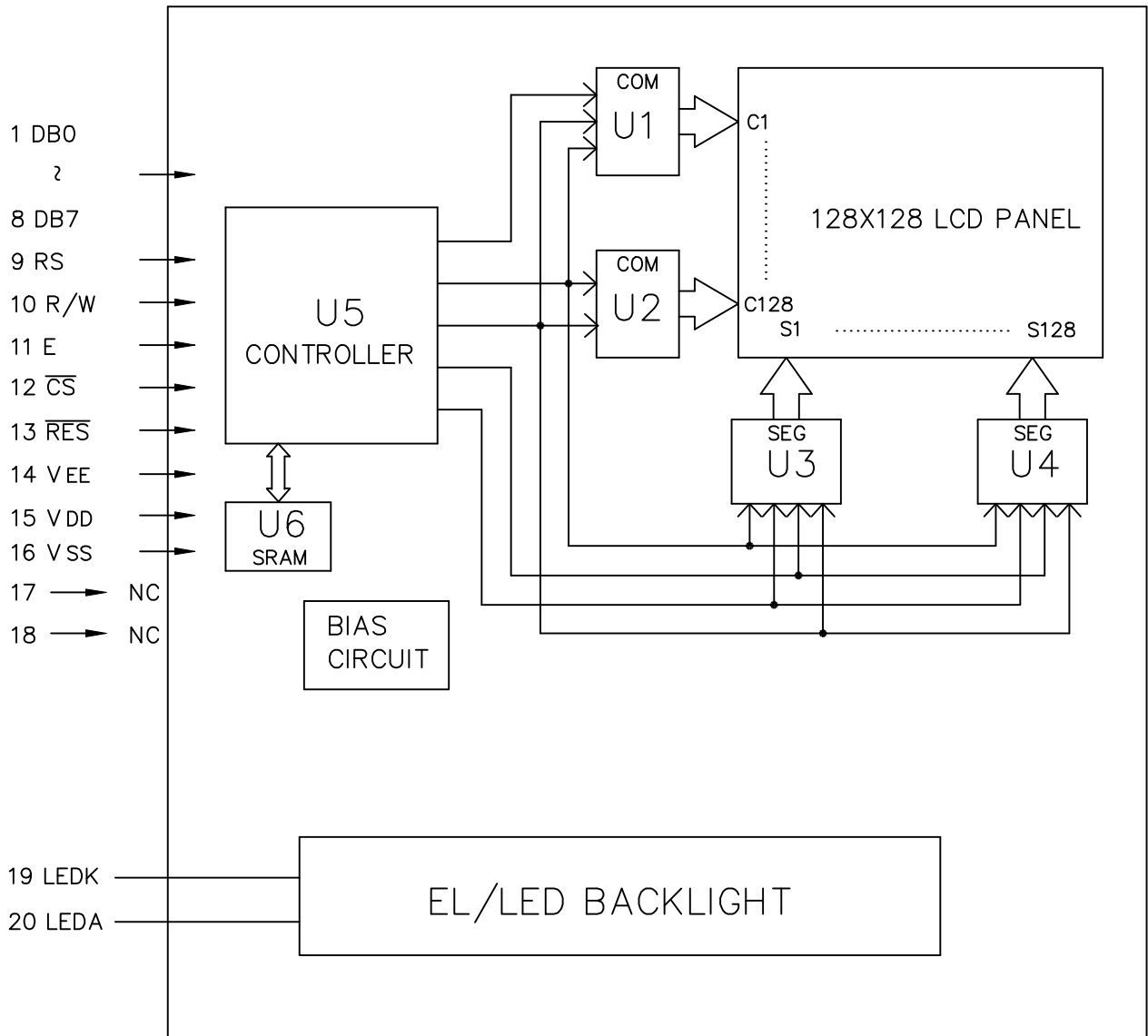
(negative type)

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

*Conditions

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

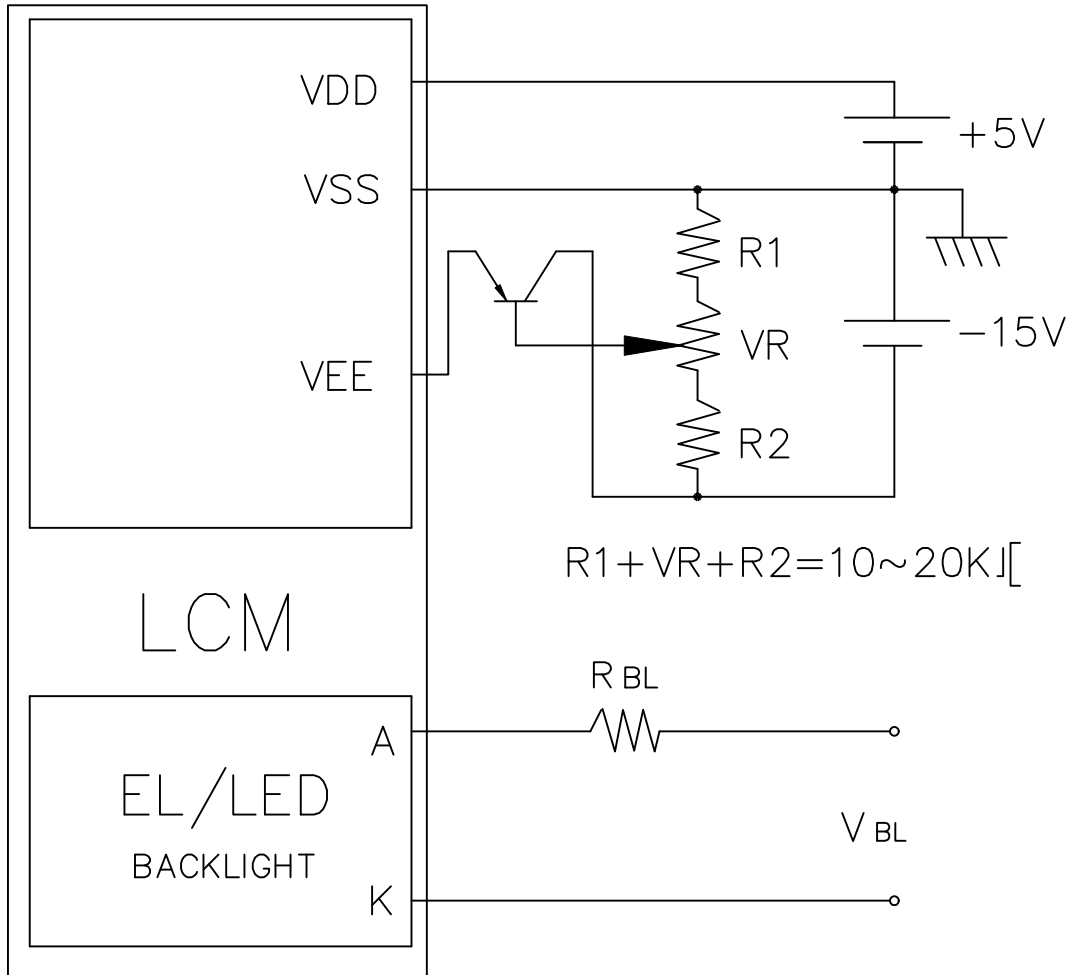
5. BLOCK DIAGRAM



6. INTERNAL PIN CONNECTION

PinNo.	Symbol	Level	Function
1	DB0	H/L	DATA BUS LINE
2	DB1	H/L	
3	DB2	H/L	
4	DB3	H/L	
5	DB4	H/L	
6	DB5	H/L	
7	DB6	H/L	
8	DB7	H/L	
9	RS	H/L	H: INSTRUCTION CODE INPUT L: DATA INPUT
10	R/W	H/L	H: DATA READ (LCM TO MPU) L: DATA WRITE (MPU TO LCM)
11	E	H, H->L	ENABLE SIGNAL
12	\overline{CS}	L	CHIP ENABLE ACTIVE "L"
13	\overline{RES}	L	RESET ACTIVE "L"
14	VEE	—	POWER SUPPLY FOR LCD CIRCUIT
15	VDD	—	POWER SUPPLY FOR LOGIC CIRCUIT
16	VSS	—	GROUND
17	N.C.	—	NO CONNECTION
18	N.C.	—	NO CONNECTION
19	LEDK	—	LED/EL BACKLIGHT
20	LEDA	—	LED/EL BACKLIGHT

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 PIN	3.3Ω	0Ω	5V _{DC}	110 V _{AC} 400Hz

8. TIMING CHARACTERISTICS

8-1 INTERFACE TIMING

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

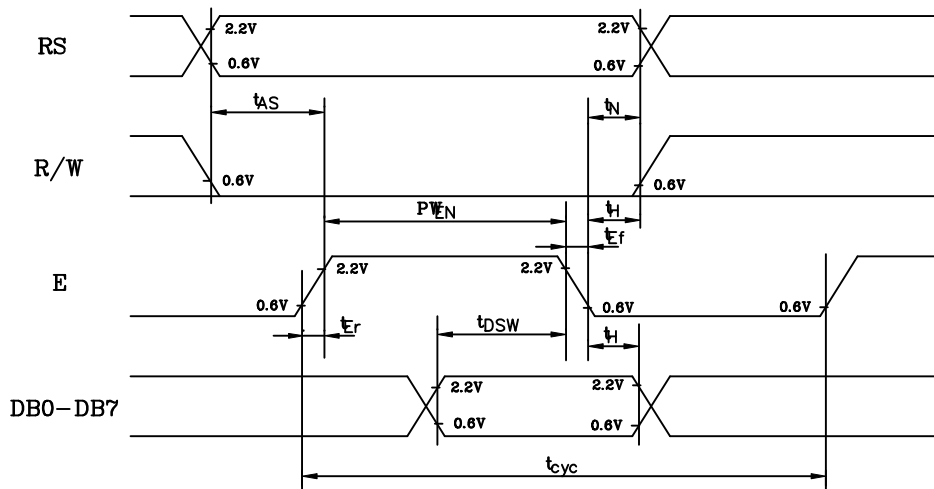


Fig. a Interface timing (data write)

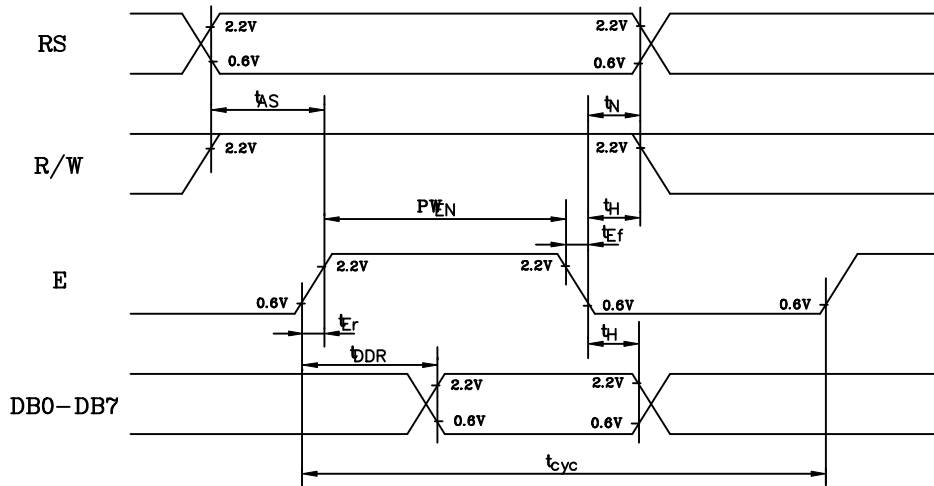
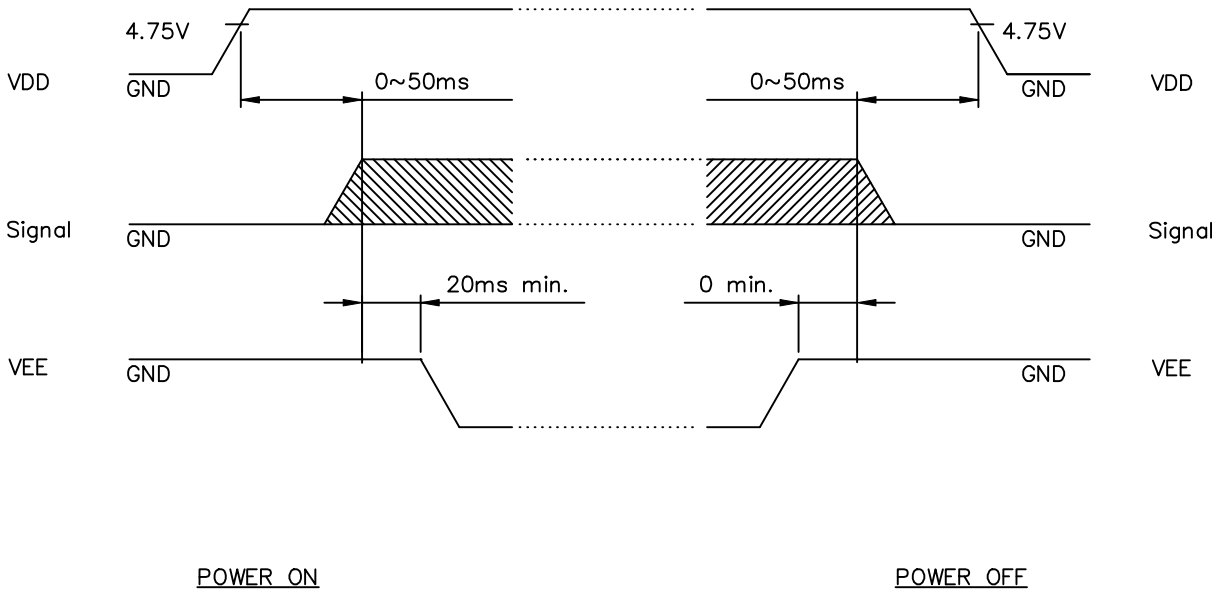


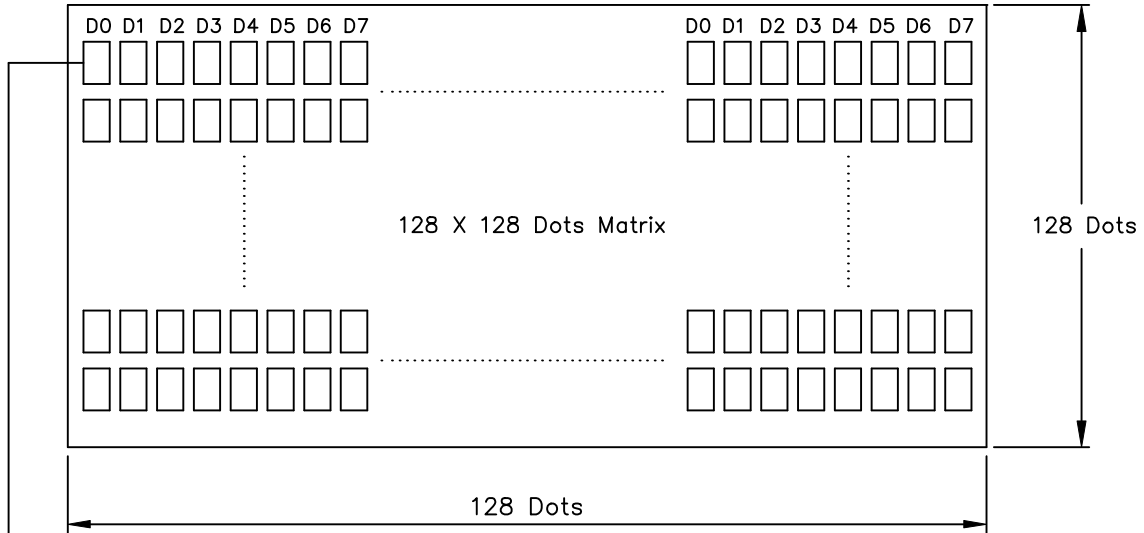
Fig. b Interface timing (data read)

8-2 POWER ON/OFF TIMING



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

9.DISPLAY PATTERN



Starting dot for the starting address of display RAM.

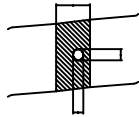
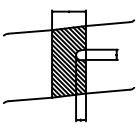
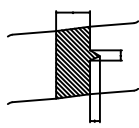
D0~D7 are 8 bits transmitted data ,where D0 is LSB and D7 is MSB.

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)	<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
DIAMETER mm (a*)	NO. OF DEFECT*																						
$a \leq 0.20$	NEGLECT																						
$0.20 < a \leq 0.35$	5 MAX																						
$0.35 < a$	NONE																						
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$L \leq 3$	$0.03 < W \leq 0.08$	6																					
$3 < L$	$0.08 < W$	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																					

NAN YA PLASTICS CORP. ELEC. MATERIALS DIV. LCD DEPARTMENT	SPECIFICATION	SPEC. NO. : LM026-1 DATE : Nov. 04, 1996 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.

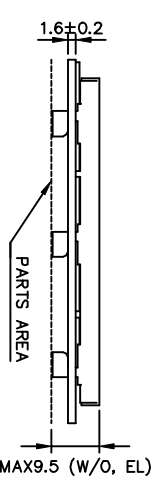
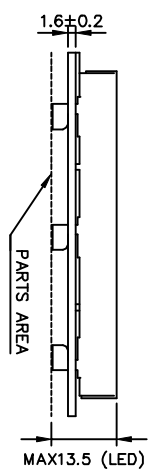
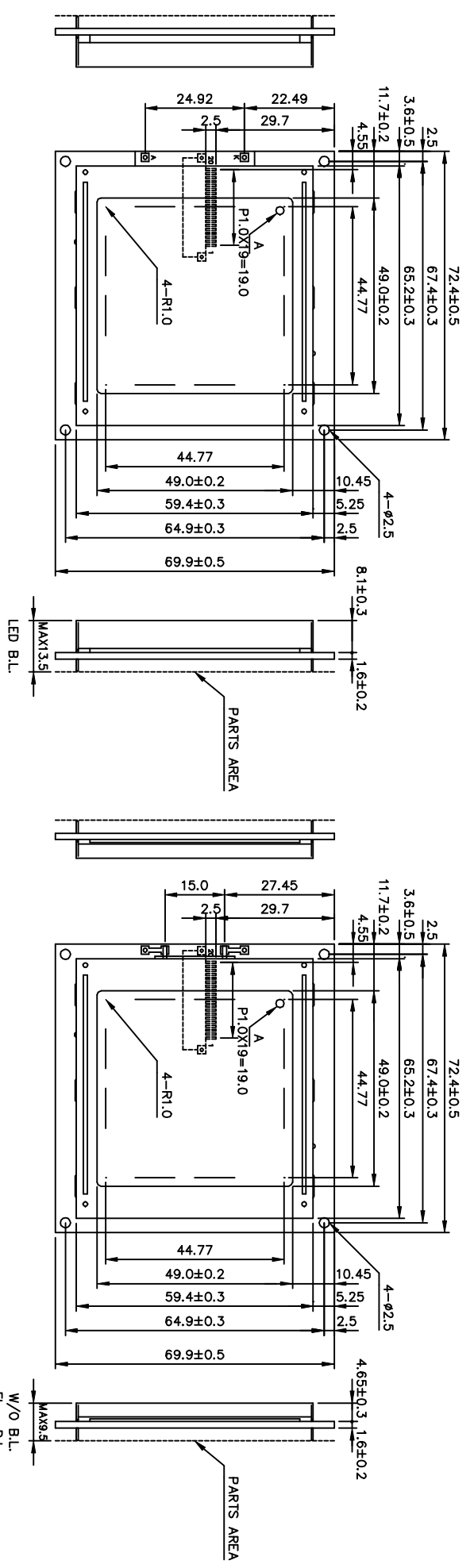
- TERMS OF WARRANTY

- 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

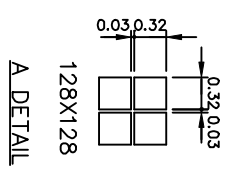
- LED : 50,000HR
 EL : 5,000HR
 CCFT : 10,000HR

REV/DATE	R0/ 11.04.97'					APP	CHK	BY
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NOTES:

1. RESOLUTION: 128X128 DOTS
2. CONTROLLER: LC7981(SANYO)
3. DC/DC: WITHOUT
4. BACKLIGHT: LED(YELLOW GREEN)
EL(WHITE)
EL(BLUE GREEN)
5. LMD76X026X1XP
CONNECTOR: 7P5 FPC2-T-020-20



Pin No.	Symbol	Level	Function
1-8	DB0-DB7	H/L	Data Bus Line
9	RS	H/L	H→Instruction L→Data
10	R/W	H/L	H:MPU→LC7981 L:MPU→LC7981
11	E	H/L	Enable
12	OS	L	Chip Enable Active "L"
13	RES	L	Reset Active "L"
14	VEE	-	Power Supply for LCD Circuit
15	VDD	-	Power Supply for Logic Circuit
16	VSS	-	Gound
17-18	NC		No Connection
19	LEDK		LED or EL Backlight
20	LEDA		LED or EL Backlight

產品編號		LM_76_026_P_	
NAME	DATE	南亞塑膠工業股份有限公司	
APPORVE		NAN YA PLASTICS CORPORATION	
CHECK		TITLE	製品圖
DESIGN		DWG-NO	MAXAX026XXPX
DRAW	MAY PING	Rev.A	Rev.A
	85.05.07	UNIT :	mm
		SCALE :	
		THIRD ANGLE PROJECT	