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____

SPEC. NO.: LM026-0

APPROVED BY

EDITED ON : Nov. 04, 1997

SALES MANAGER	DESIGN MANAGER	PERSON IN CHARGE

1. MECHANICAL DATA

(1) Product No.	LM_76_026_
(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: ☐ 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) LCD Controller	BUILT-IN T6963C (TOSHIBA)
(11) Weight	W/O B/L: about 51.4 g EL B/L: about 54.3 g LED B/L: about 63 g

Note :

LM_76_026_____

Backlight Type
- A : None
- B : CCFT
- C : LED
- D : EL

Polarizer Type
- R : Reflective
- S : Transflective
- T : Transmissive
- P : Transflective(High Transmissive)

Option
- C : Anti-Glare
- D : Wide Temperature
- 1 ~ 9 : Version

Mode/View Angle
- A : Gray , 6 Clock
- B : Gray , 12 Clock
- C : Yellow , 6 Clock
- D : Yellow , 12 Clock
- E : Blue , 6 Clock
- F : Blue , 12 Clock
- G : Normally Black , 6 Clock
- H : Normally Black , 12 Clock
- J : Normally White , 6 Clock
- K : Normally White , 12 Clock

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 LC Drive	VDD−VEE	0	25.0	V	
Input Voltage	VI	−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
LED Average Brightness	B(LED)		−	32.1	−	cd/m²
EL Power Supply Current	I EL	V_{EL} = 110V_{AC} 400Hz	−	−	5	mA
EL Average Brightness	B(EL)		−	20.18	−	cd/m²

4-1.OPTICAL CHARACTERISTICS

(For Normal Temperature Mode LCM)

AT V_{OP}

ITEM / MODE		Cr(Contrast Ratio) 25℃ MIN.	Cr(Contrast Ratio) 25℃ TYP.	θ(Viewing Angle) 25℃ MIN.	θ(Viewing Angle) 25℃ TYP.	φ(Viewing Angle) 25℃ MIN.	φ(Viewing Angle) 25℃ 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 $\phi=0°$ $\theta=0°$

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) 25℃ MIN.	Cr(Contrast Ratio) 25℃ TYP.	θ(Viewing Angle) 25℃ MIN.	θ(Viewing Angle) 25℃ TYP.	φ(Viewing Angle) 25℃ MIN.	φ(Viewing Angle) 25℃ 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	A	–	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		

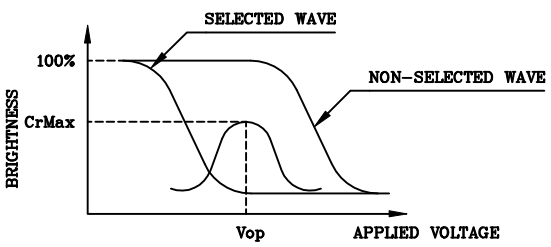
note:

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

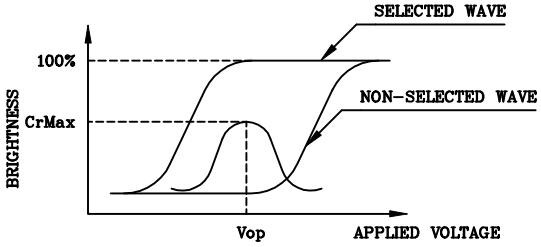
C: YELLOW
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



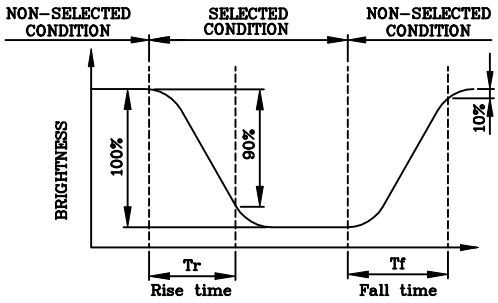
(negative type)

*Conditions

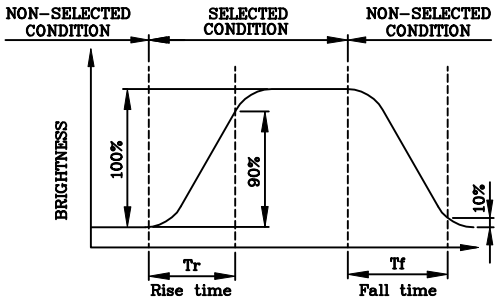
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



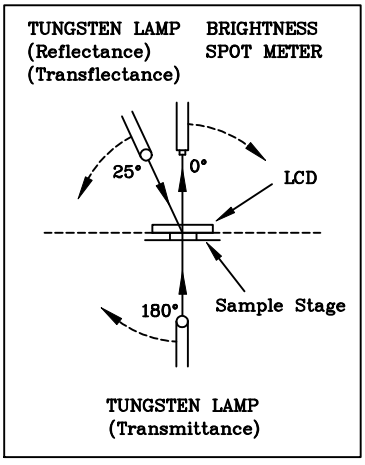
(negative type)

*Conditions

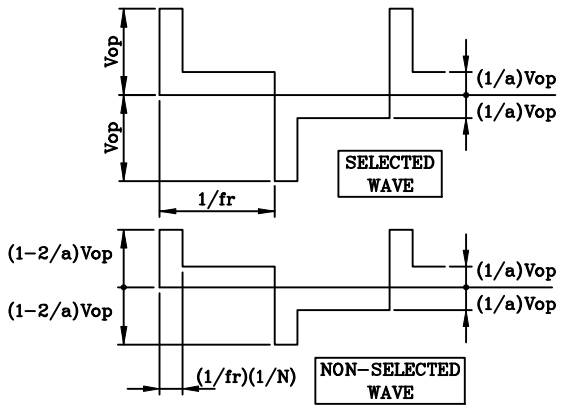
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

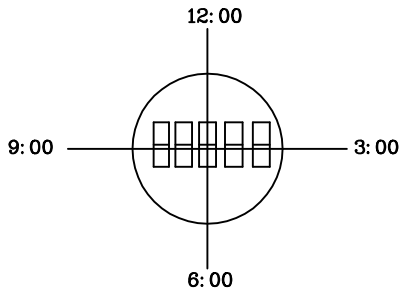


Multiplex Driving (1/N duty, 1/a bias)



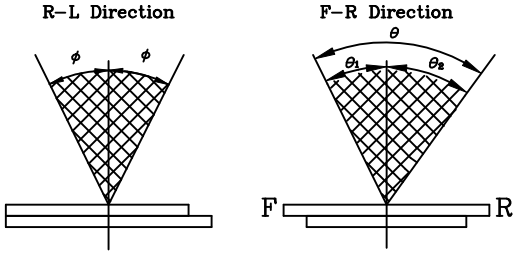
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



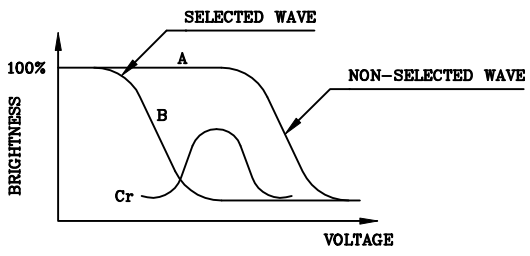
$\theta = \theta_1 + \theta_2$

*Conditions

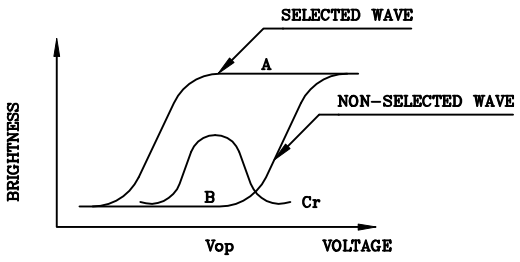
Operating Voltage : Vop
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



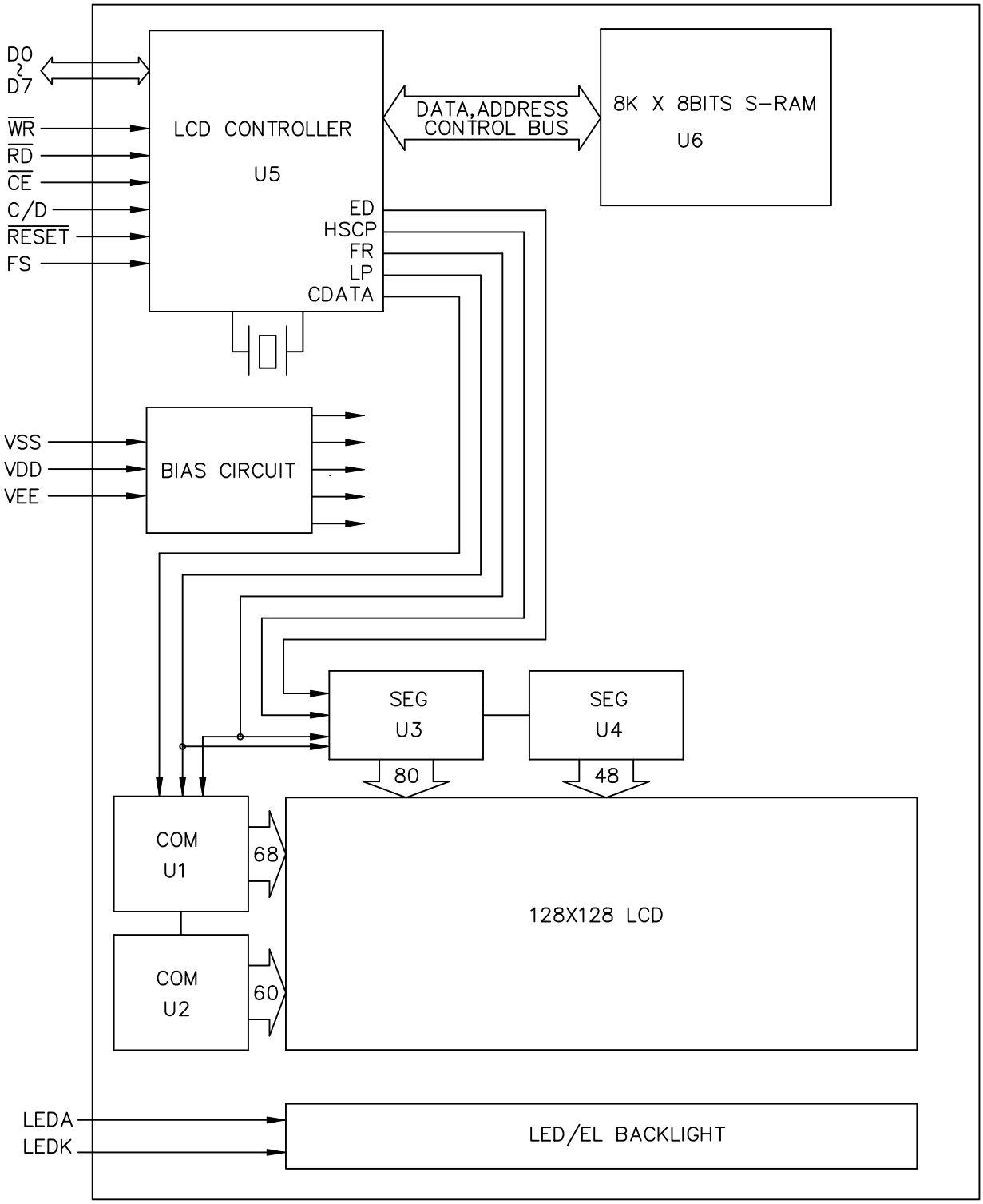
(negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

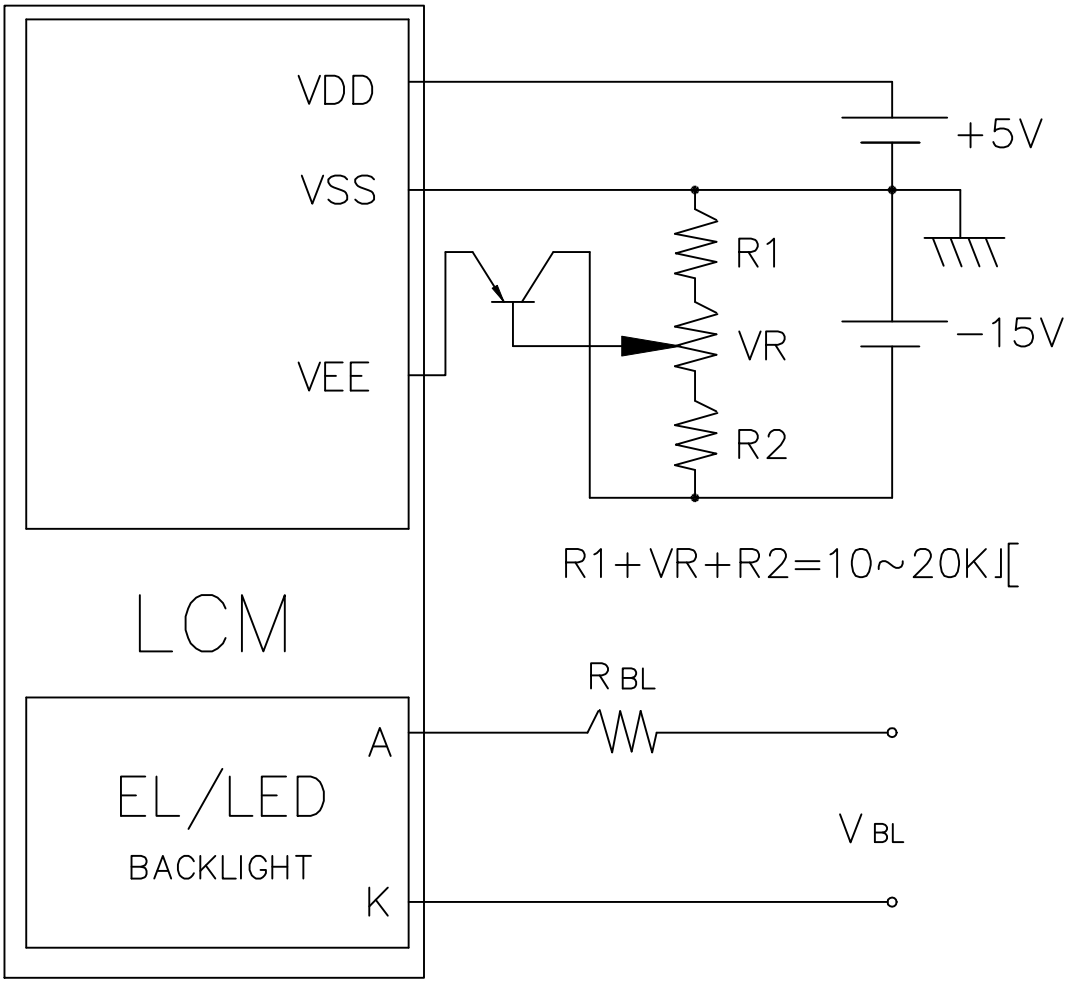
5. BLOCK DIAGRAM



6. INTERNAL PIN CONNECTION

PIN NO.	SYMBOL	FUNCTION
1	VSS	GROUND
2	VDD	POWER SUPPLY FOR LOGIC CIRCUIT
3	VEE	POWER SUPPLY FOR LCD CIRCUIT
4	$\overline{WR}$	DATA WRITE
5	$\overline{RD}$	DATA READ
6	$\overline{CE}$	CHIP ENABLE
7	C/D	$\overline{WR}$="L",C/D="H" :COMMAND WRITE $\overline{WR}$="L",C/D="L" :DATA WRITE $\overline{RD}$="L",C/D="H" :STATUS READ $\overline{RD}$="L".C/D="L" :DATA READ
8	$\overline{RESET}$	CONTROLLER RESET
9	D0	DATA INPUT/OUTPUT
10	D1	DATA INPUT/OUTPUT
11	D2	DATA INPUT/OUTPUT
12	D3	DATA INPUT/OUTPUT
13	D4	DATA INPUT/OUTPUT
14	D5	DATA INPUT/OUTPUT
15	D6	DATA INPUT/OUTPUT
16	D7	DATA INPUT/OUTPUT
17	FS	FONT SELECT CONNECT TO VDD :6X8 PIXELS/CHARACTER CONNECT TO VSS :8X8 PIXELS/CHARACTER
18	NC	NO CONNECTION
19	LEDK	LED or EL BACKLIGHT
20	LEDA	LED or 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	3.3J[	0J[	$5V_{DC}$	110 V_{AC} 400Hz

8. TIMING CHARACTERISTICS

8-1. INTERFACE TIMING

ITEM	ITEM	CONDITION	MIN.	MAX.	UNIT
C/D SET UP TIME	t_{CDS}	Fig.	100	–	ns
C/D HOLD TIME	t_{CDH}	Fig.	10	–	ns
$\overline{CE}$,$\overline{RD}$,$\overline{WR}$ CLOCK WIDTH	t_{CP},t_{RP},t_{WP}	Fig.	80	–	ns
DATA SET UP TIME	t_{DS}	Fig.	80	–	ns
DATA HOLD TIME	t_{DH}	Fig.	40	–	ns
ACCESS TIME	t_{ACC}	Fig.	–	150	ns
DATA OUTPUT HOLD TIME	t_{OH}	Fig.	10	50	ns

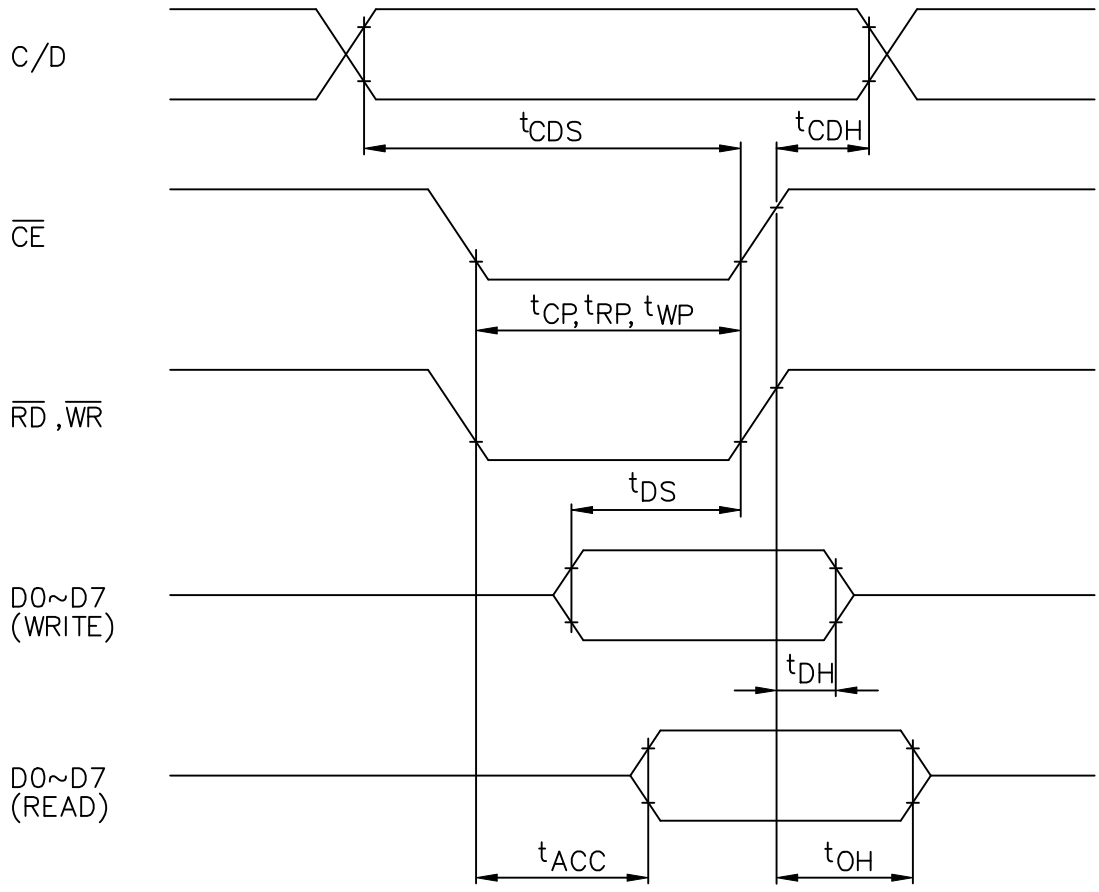
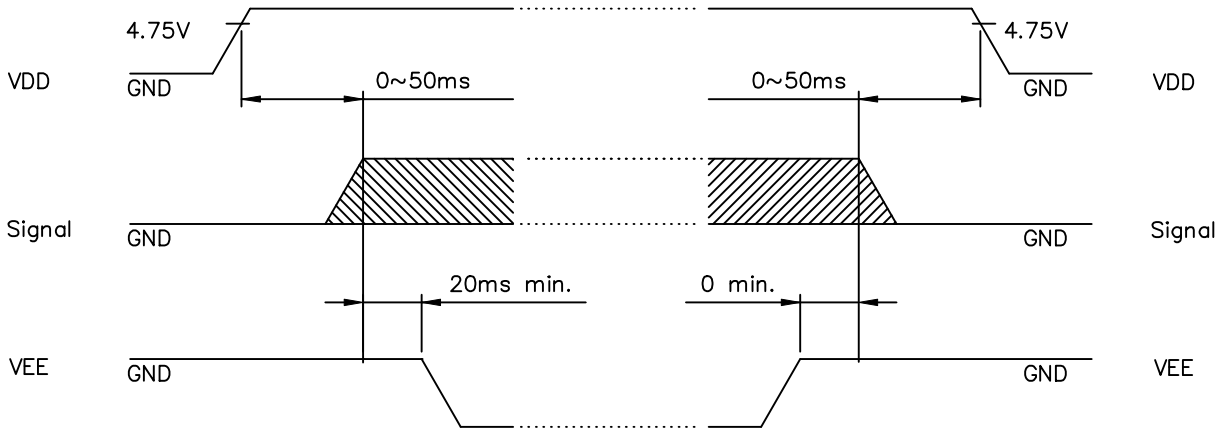


Fig. INTERFACE TIMING CHART

8-2.POWER ON/OFF TIMING

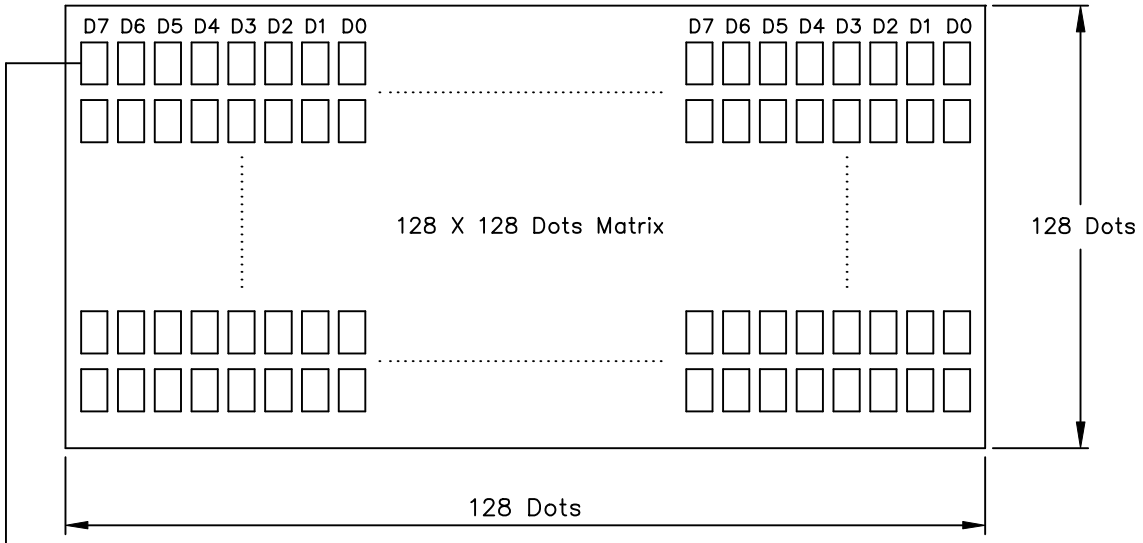


POWER ON

POWER OFF

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

9. DISPLAY PATTERN



Startting dot for the startting address of display RAM.

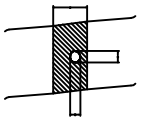
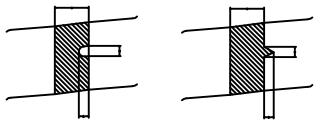
D0~D7 are 8 bits transmitted data ,where D0 is LSB and D7 is MSB.

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

<table>
<tr><th>NO</th><th>ITEM</th><th>C R I T E R I A</th></tr>
<tr><td>1.</td><td>INCLUSI-ONS (BLACK SPOT , WHITE SPOT , DUST)</td><td>(1) ROUND TYPE
<table>
<tr><th>DIAMETER mm (a*)</th><th>NO. OF DEFECT*</th></tr>
<tr><td>a ≦ 0.20
0.20 < a ≦ 0.35
0.35 < a</td><td>NEGLECT
5 MAX
NONE</td></tr>
</table>
(2) LINEAR TYPE
<table>
<tr><th>LENGTH mm(L)</th><th>WIDTH mm(W)</th><th>NO. OF DEFECT</th></tr>
<tr><td>N A
L ≦ 3
3 < L</td><td>W ≦ 0.03
0.03 < W ≦ 0.08
0.08 < W</td><td>NEGLECT
6
NONE</td></tr>
</table></td></tr>
<tr><td>2.</td><td>SCRATCH</td><td>1.SCRATCH ON PROTECTIVE FILM IS PERMITTED .
2.SCRATCH ON POLARIZER SHALL BE AS FOLLOW:
(1) ROUND TYPE
<table>
<tr><th>DIAMETER mm (a*)</th><th>NO. OF DEFECT*</th></tr>
<tr><td>a ≦ 0.15
0.15 < a ≦ 0.20
0.20 < a</td><td>NEGLECT
2 MAX
NONE</td></tr>
</table>
(2) LINEAR TYPE
BE JUDGED BY 1.-(2) LINEAR TYPE</td></tr>
<tr><td>3.</td><td>DENT</td><td>DIAMETER < 1.5mm</td></tr>
<tr><td>4.</td><td>BUBBLE</td><td>NOT EXCEEDING 0.5mm AVERAGE DIAMETER IS ACCEPTABLE BETWEEN GLASS AND POLARIZING FILM.</td></tr>
<tr><td>5.</td><td>PIN HOLE</td><td>(a+b)/2 ≦ 0.15 mm
MAXIMUM NUMBER: IGNORED
0.15 < (a+b)/2 ≦ 0.20
MAXIMUM NUMBER: 10
  </td></tr>
<tr><td>6.</td><td>DOT DEFECT</td><td>(a+b)/2 ≦ 0.20 mm
MAXIMUM NUMBER: IGNORED
0.20 < (a+b)/2 ≦ 0.30
MAXIMUM NUMBER: 5
x = WIDTH
  </td></tr>
<tr><td>7.</td><td>CONTRAST IRREGUL-ARITY (SPOT)</td><td>DIAMETER SPEC. — NO. OF DEFECT*
a ≦ 0.50 mm — NEGLECT
0.50 < a ≦ 0.75 — 5
0.75 < a ≦ 1.00 — 3
1.00 < a — NONE</td></tr>
<tr><td>8.</td><td>DOT WIDTH</td><td>DESIGN WIDTH±15%</td></tr>
<tr><td>9.</td><td>COLOR TONE AND UNIFOR-MITY</td><td>OBVIOUS UNEVEN COLOR IS NOT PERMITTED</td></tr>
</table>

(2) NOTE:

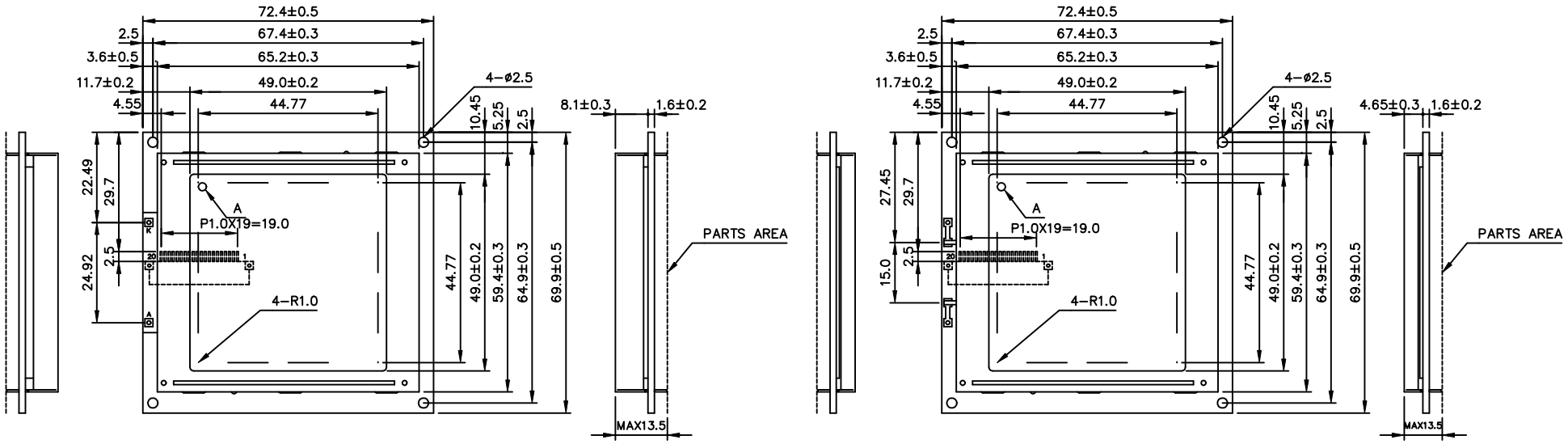
- SAFETY
  1. If the LCD panel breaks, be careful not to allow the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- 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°C±5°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.

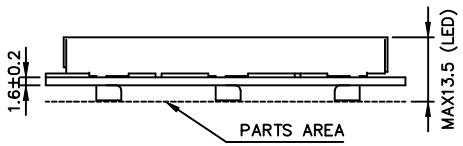
- TERMS OF WARRANTY
  1. Acceptance inspection period
     The inspection period is within one month after the arrival of the contracted goods at the buyer's factory site.
  2. Applicable warranty period
     The warranty period is within twelve months from the date of invoice under normal usage and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

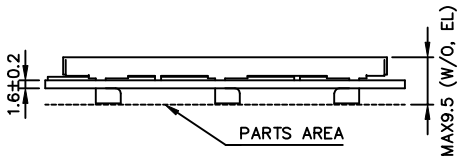
- TYPICAL OPERATING LIFETIME OF BACKLIGHT
  LED : 50,000HR
  EL : 5,000HR
  CCFT : 10,000HR



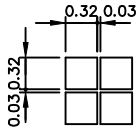
LED B.L.

W/O B.L.
EL B.L.





Pin No.	Symbol	Function
1	VSS	Ground
2	VDD	Power Supply for Logic Circuit
3	VEE	Power Supply for LCD Circuit
4	$\overline{WR}$	Data Write
5	$\overline{RD}$	Data Read
6	$\overline{CE}$	Chip Enable
7	C/D	$\overline{WR}$="L",C/D="H" : Command Write $\overline{WR}$="L",C/D="L" : Data Write $\overline{RD}$="L",C/D="H" : Status Read $\overline{RD}$="L",C/D="L" : Data Read
8	$\overline{RESET}$	Controller Reset
9-16	D0-D7	Data Bus Line
17	FS	Font Select Connect to VDD : 6x8 Pixels/Character Connect to VSS : 8x8 Pixels/Character
18	NC	No Connection
19	LEDK	LED or EL Backlight
20	LEDA	LED or EL Backlight



A DETAIL

NOTES:

1.RESOLUTION: 128X128 DOTS
2.CONTROLLER: T6963C(TOSHIBA)
3.DC/DC: WITHOUT
4.BACKLIGHT: LED(YELLOW GREEN)
EL(WHITE)

產品編號	LM_76_026_		南亞塑膠工業股份有限公司 NAN YA PLASTICS CORPORATION	
	NAME	DATE	TITLE	製品圖
APPROVE			DWG-NO	MX-X026X Rev.A
CHECK				
DESIGN			UNIT : mm	
DRAW	MAY PING	85.05.07	SCALE : 2/3	

THIRD ANGLE PROJECT