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
150x32 LCD MODULE
PRODUCT NO.: LM_B4_031_M

SPEC. NO.: LM031-0

APPROVED BY

EDITED ON : MAR.02.1998

SALES MANAGER	DESIGN MANAGER	PERSON IN CHARGE

1. MECHANICAL DATA

(1) Product No.	LM_B4_031_
(2) Module Size	116.50 (W)mm x 42.0 (H)mm x MAX15.0 (D)mm (LED B.L.) 116.50 (W)mm x 42.0 (H)mm x MAX9.5 (D)mm (W/O B.L.)
(3) Dot Size	0.50 (W)mm x 0.55 (H)mm
(4) Dot Pitch	0.55 (W)mm x 0.60 (H)mm
(5) Duty	1/32
(6) 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
(7) Viewing Direction	☐ 6 O'clock ☐ 12 O'clock ☐____O'clock
(8) Backlight	☐ W/O ☐ LED ☐ EL
(9) Weight	LED B/L: 70.0 g W/O B/L: 54.5 g

Note :

LM_B4_031_____

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

Polarizer Type
R : Reflective
S : Transflective
P : Transflective(medium transparency)
H : Transflective(high transparency)
T : Transmission

Option
C : Anti-Glare
D : Wide Temperature
1
2
.
.
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

	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD−VSS	−0.3	6.5	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
Input Voltage	VIH	H level	0.8VDD	–	VDD	V
	VIO	L level	0	–	0.2VDD	V
Recommended LC Driving Voltage (NORMAL TEMP. LCM)	VDD–V0	0℃	–	7.5	8.0	V
		25℃	6.3	6.8	7.3	
		50℃	5.6	6.1	–	
Recommended LC Driving Voltage (WIDE TEMP. LCM)	VDD–V0	–20°C	–	8.5	8.9	V
		0°C	–	8.3	8.7	
		25°C	–	8.0	8.4	
		50°C	–	7.7	8.1	
		70°C	–	7.1	7.5	
Power Supply Current	IDD	VDD = 5.0V	–	–	5.0	mA
LED Power Supply Current	I_{LED}	V_{BL} = 5.0V_{DC} R_{LED} = 5.0Ω	–	170	–	mA

4.1 OPTICAL CHARACTERISTICS

(FOR NORMAL TEMPERATURE MODE LCM)

AT Vop

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	2.5	3.4	30	40	20	30
	C	4.0	8.0	40	60	25	40
	J						
S	A						
	C	4.0	7.0	40	60	25	35
	J						
T	E						
	C	3.0	6.0	40	50	20	35
NOTE		NOTE6		NOTE5			

AT ø=0° θ=0°

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0℃	–	470	940	ms	NOTE 2
		25℃	–	140	300		
		50℃	–	70	150		
Response Time (fall)	Tf	0℃	–	520	1000	ms	NOTE 2
		25℃	–	180	350		
		50℃	–	110	220		

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 NORMAL TEMPERATURE MODE LCM)

AT Vop

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						
	C						
	J						
S	A						
	C	–	6.5	–	60	–	90
	J						
T	E						
	C						
NOTE		NOTE6		NOTE5			

AT φ=0° θ=0°

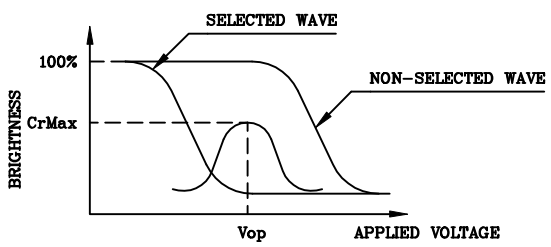
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	–	1800	2700	ms	NOTE 2
		0℃	–	400	600		
		25℃	–	150	230		
		50℃	–	70	110		
		70℃	–	70	110		
Response Time (fall)	Tf	-20℃	–	1060	1590	ms	NOTE 2
		0℃	–	250	380		
		25℃	–	105	160		
		50℃	–	65	100		
		70℃	–	60	90		

NOTE :

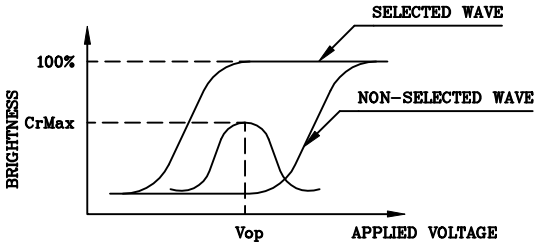
R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A: GRAY
C: YELLOW
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



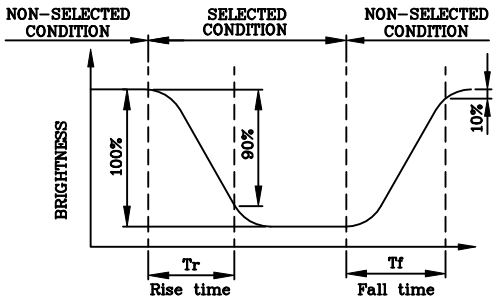
(negative type)

*Conditions

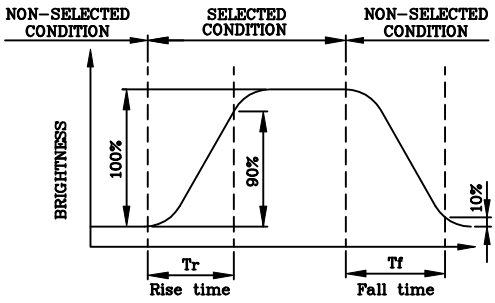
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



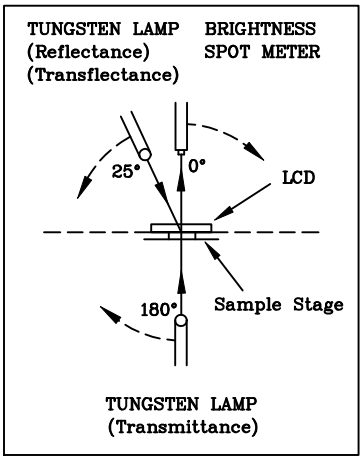
(negative type)

*Conditions

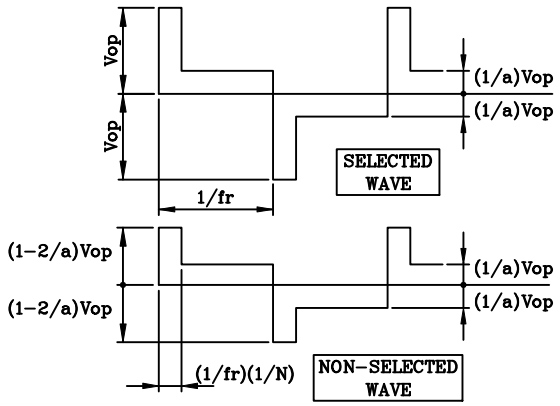
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

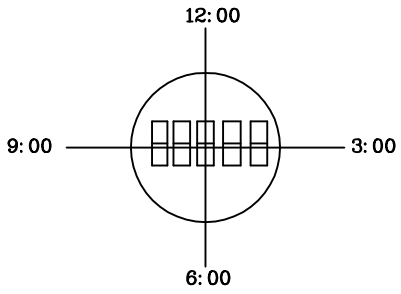


Multiplex Driving (1/N duty, 1/a bias)



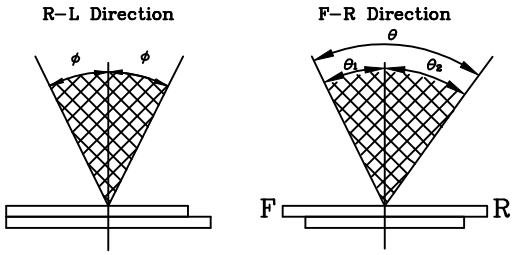
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



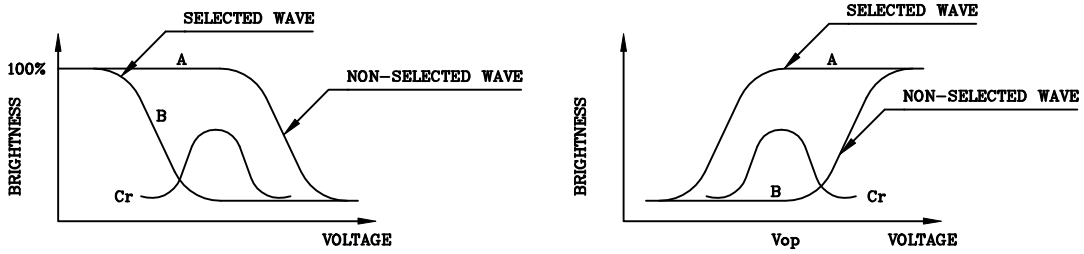
$\theta = \theta_1 + \theta_2$

*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)



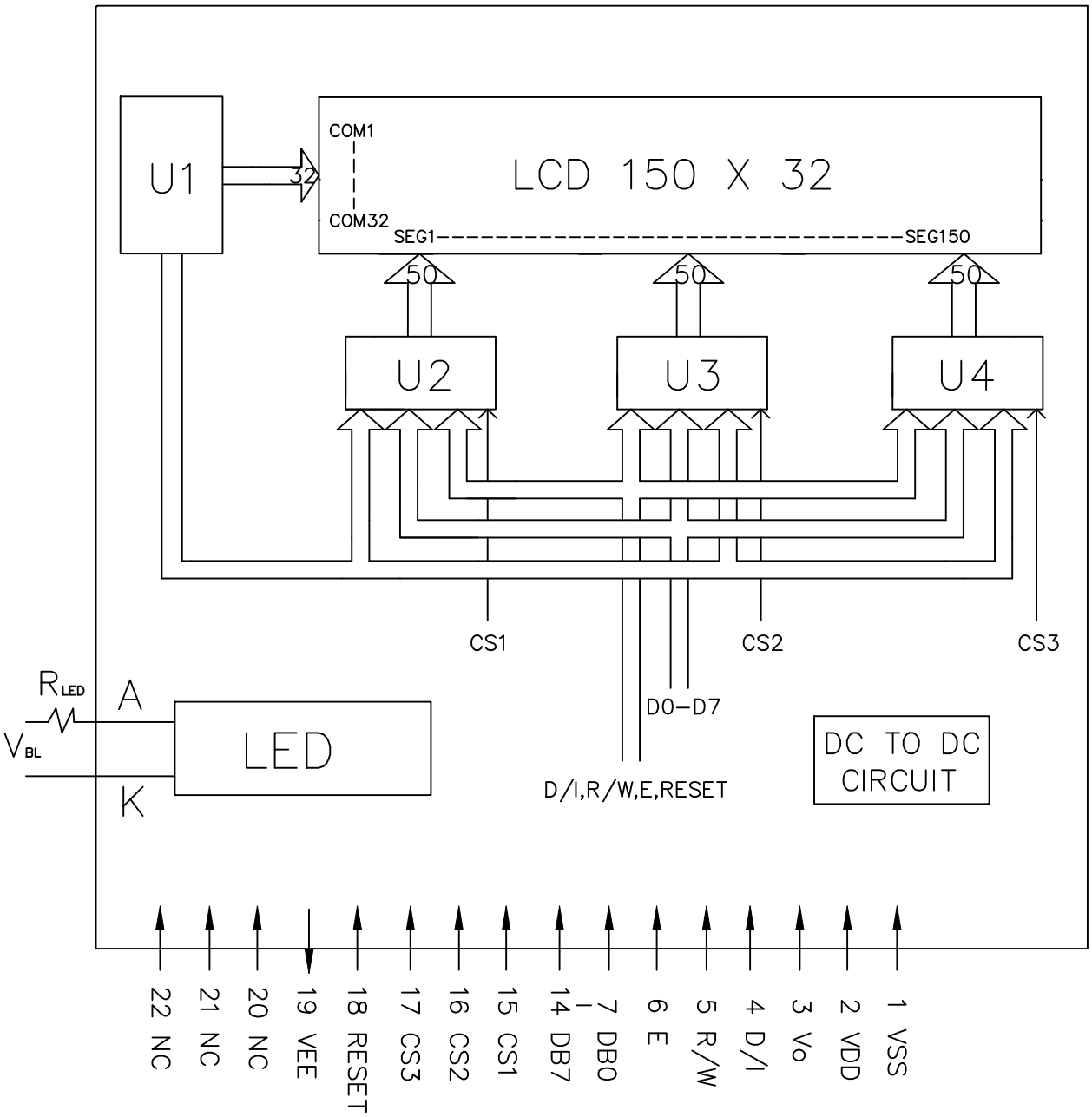
(positive type) (negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

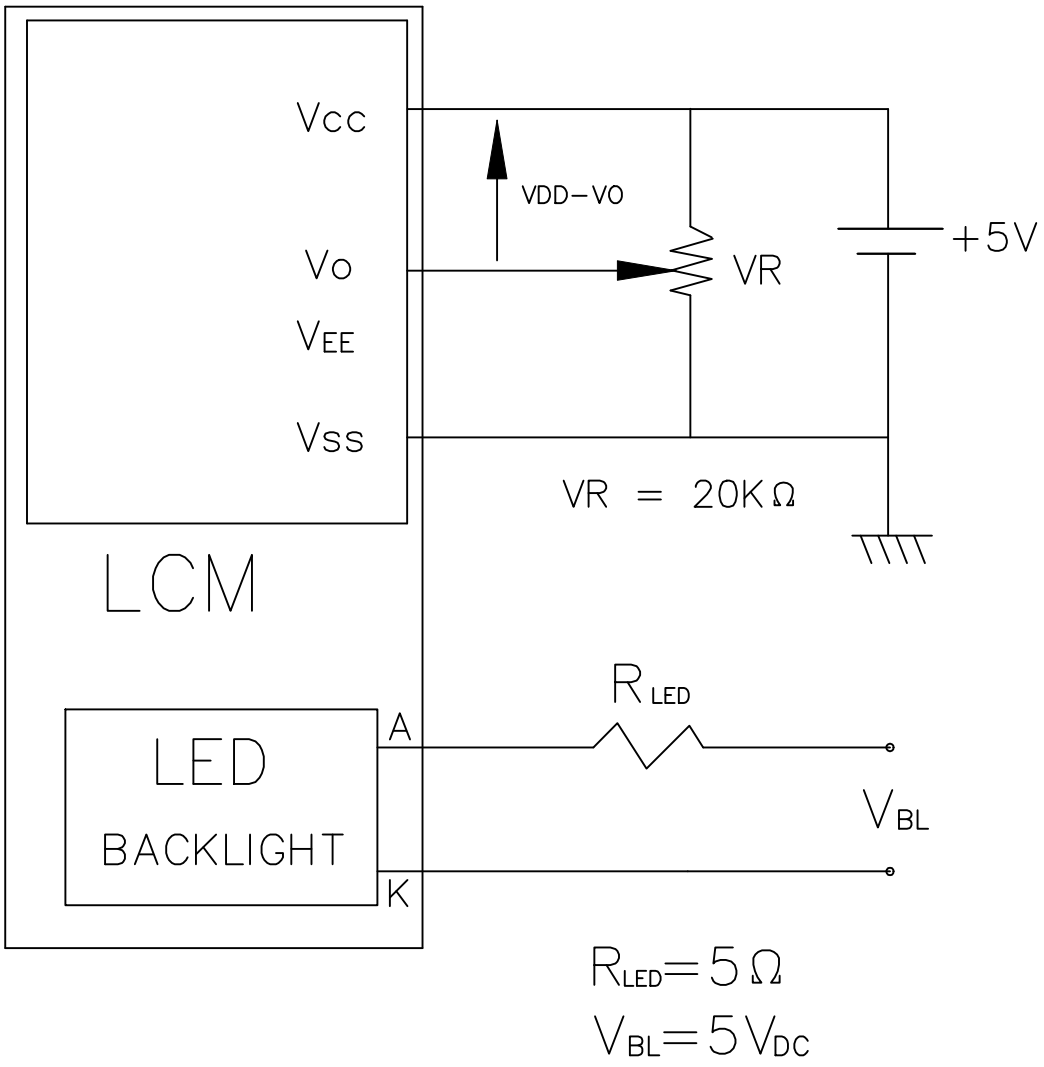
5. BLOCK DIAGRAM



6.INTERNAL PIN CONNECTION

Pin No.	Symbol	Level	Function	
1	Vss	—	0V	POWER SUPPLY
2	VDD	—	+5V	
3	Vo	—	OPERATING VOLTAGE FOR LCD DRIVING	
4	D/I	H/L	H:DATA INPUT L:INSTRUCTION CODE INPUT	
5	R/W	H/L	H:DATA READ (FROM LCM TO MPU) L:DATA WRITE (FROM MPU TO LCM)	
6	E	H,H->L	ENABLE SIGNAL	
7	DB0	H/L	DATA BUS LINE	
8	DB1	H/L		
9	DB2	H/L		
10	DB3	H/L		
11	DB4	H/L		
12	DB5	H/L		
13	DB6	H/L		
14	DB7	H/L		
15	CS1	H	CHIP SELECT FOR IC1	
16	CS2	H	CHIP SELECT FOR IC2	
17	CS3	H	CHIP SELECT FOR IC3	
18	RESET	L	" L " ACTIVE	
19	VEE	—	POWER SUPPLY FOR LCD DRIVING	
20	NC	—	NONE CONNECTION	
21	NC	—	NONE CONNECTION	
22	NC	—	NONE CONNECTION	

7. POWER SUPPLY



$R_{LED} = 5\,\Omega$

$V_{BL} = 5\,V_{DC}$

8. TIMING CHARACTERISTICS

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cyc}	Fig.a, Fig.b	500	–	–	ns
E high level width	P_{WEH}	Fig.a, Fig.b	220	–	–	ns
E low level width	P_{WEL}	Fig.a, Fig.b	220	–	–	ns
E rise/fall time	t_r, t_f	Fig.a, Fig.b	–	–	20	ns
Address set up time	t_{AS}	Fig.a, Fig.b	40	–	–	ns
Address hold time	t_{AH}	Fig.a, Fig.b	10	–	–	ns
Data delay time	t_{DDR}	Fig.b	–	–	140	ns
Data set up time	t_{DSW}	Fig.a	60	–	–	ns
Data hold time (WR)	t_{DHW}	Fig.a	10	–	–	ns
Data hold time (RD)	t_{DHR}	Fig.b	20	–	–	ns

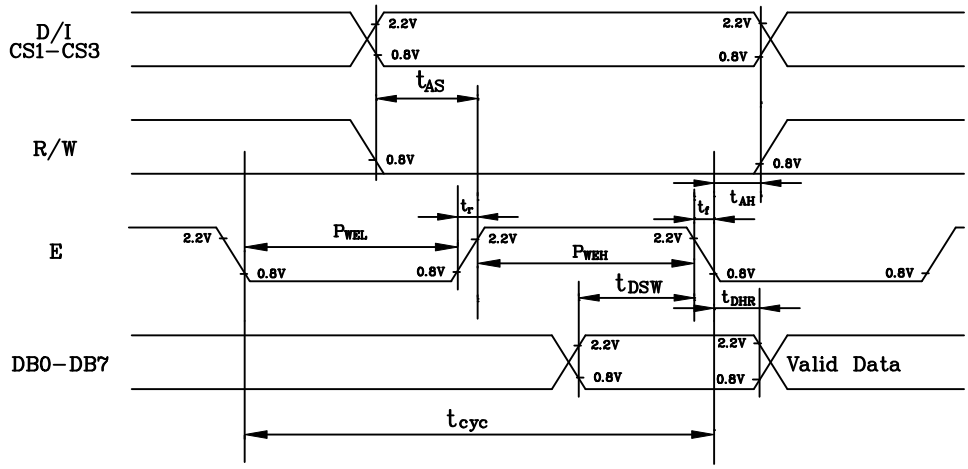


Fig. a Interface timing (data write)

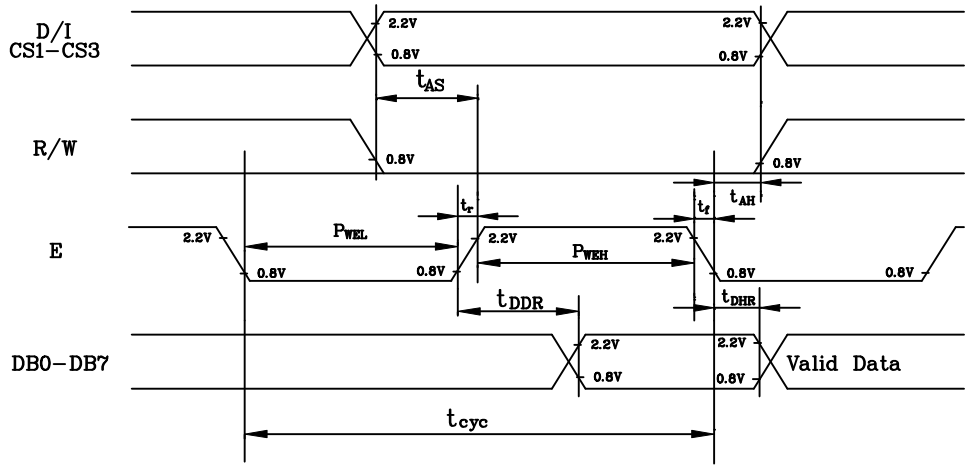


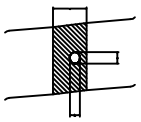
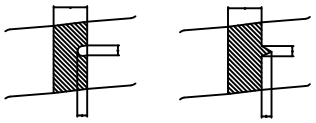
Fig. b Interface timing (data read)

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

<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:

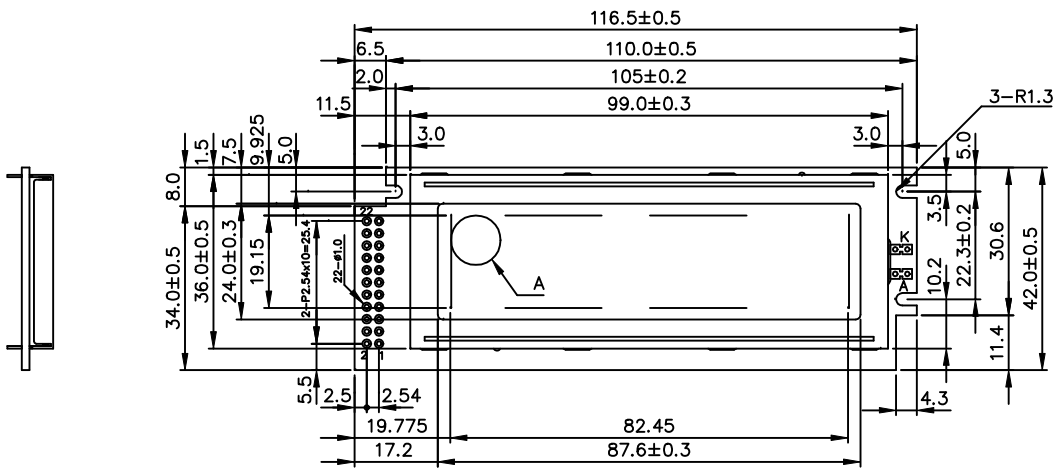
- SAFETY
  1. If the LCD panel breaks, be careful not to allow the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

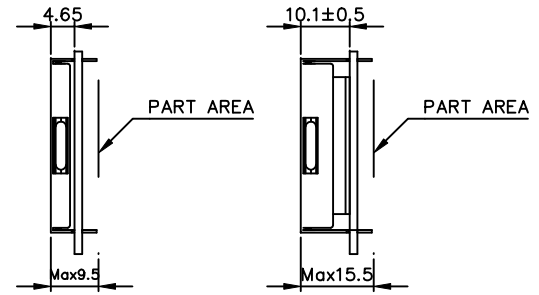
- HANDLING
  1. Prevent all contact with static electricity, which can damage the CMOS ICs. The module is packaged in a static-shielding bag to prevent damage during shipment, warehousing and removal from the shipping carton.
  2. Do not remove the panel or frame from the module.
  3. The polarizing 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.

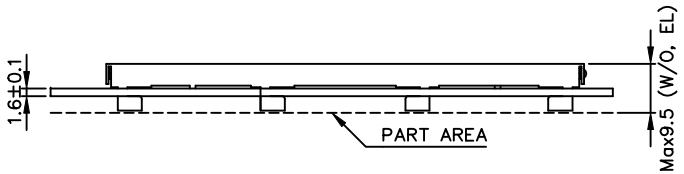
- STORAGE
  1. Store the panel or module in a dark place where the temperature is 25°C±5°C and the humidity is below 65% RH.
  2. Do not place the module near organics solvents or corrosive gases.
  3. Do not crush, shake, or jolt the module.

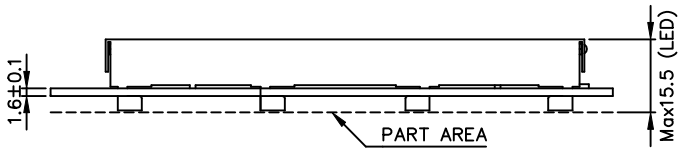
- TERMS OF WARRANTY
  1. Acceptance inspection period
     The inspection period is within one month after the arrival of the contracted goods at the buyer's factory site.
  2. Applicable warranty period
     The warranty period is within twelve months from the date of invoice under normal usage and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

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



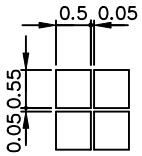






INTERNAL PIN CONNECTION

PinNo.	Symbol	Level	Function	
1	V_{SS}	—	0V	Power supply
2	V_{DD}	—	+5V	
3	V_O	—	OPERATING VOLTAGE FOR LCD DRIVING	
4	D/I	H/L	H:DATA INPUT L:INSTRUCTION CODE INPUT	
5	R/W	H/L	H:DATA READ (FROM LCM TO MPU) L:DATA WRITE (FROM MPU TO LCM)	
6	E	H,H->L	ENABLE SIGNAL	
7	DB0	H/L	DATA BUS LINE	
8	DB1	H/L		
9	DB2	H/L		
10	DB3	H/L		
11	DB4	H/L		
12	DB5	H/L		
13	DB6	H/L		
14	DB7	H/L		
15	CS1	H	CHIP SELECT FOR IC1	
16	CS2	H	CHIP SELECT FOR IC2	
17	CS3	H	CHIP SELECT FOR IC3	
18	RES	L	RESET	
19	VEE	—	POWER SUPPLY FOR LCD DRIVING	
20	NC	—	NO CONNECTION	
21	NC	—	NONE CONNECTION	
22	NC	—	NONE CONNECTION	



150x32 DOTS
A DETAIL

Note :
1.Resolution : 150X32 Dots
2.General Tolerance : ±0.5mm

產品編號	LM_B4_031_		南亞塑膠工業股份有限公司 NAN YA PLASTICS CORPORATION
	NAME	DATE	
APPROVE			TITLE: 製品圖
CHECK			DWG-NO: MXBX031X Rev.A
DESIGN			UNIT : mm
DRAW	MAY PING	87..03.02	SCALE : 2/3

THIRD ANGLE PROJECT