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
240x200 LCD MODULE
PRODUCT NO.: LM_88_201_

SPEC. NO.: LM201-0

CUSTOMER
APPROVED BY
DATE:

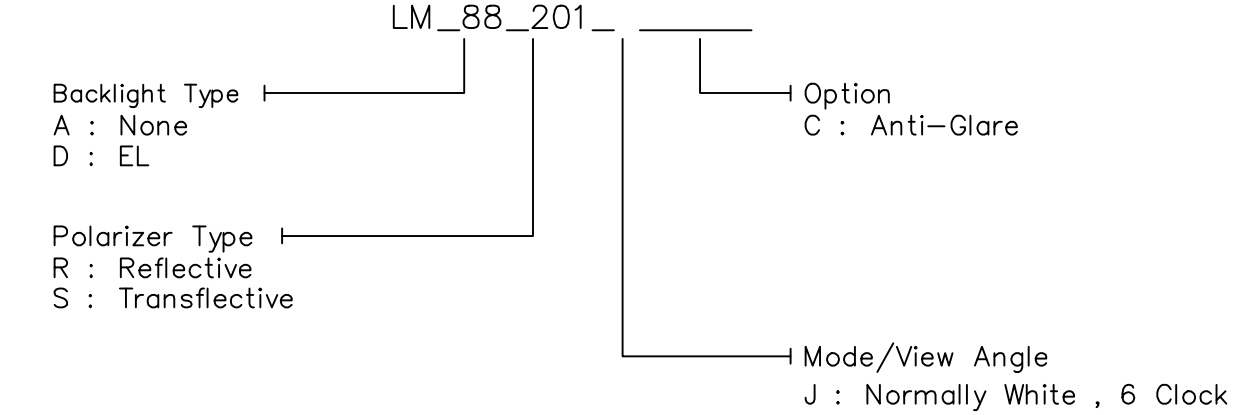
EDITED ON : AUGUST.20.1998

SALE MANAGER	TECHNICAL APPROVE	DESIGN MANAGER	DESIGN CHECK	DESIGNER

1. MECHANICAL DATA

(1) Product No.		LM_88_201_
(2) Module Size		88.0 (W)mm x 85.0 (H)mm x MAX 9.5 (D)mm (W/O,EL B/L)
(3) Dot Size		0.28 (W)mm x 0.28 (H)mm
(4) Dot Pitch		0.30 (W)mm x 0.30 (H)mm
(5) Number of Dots		240 (W) x 200 (H)Dots
(6) Duty		1/200
(7) LCD Display Mode	FSTN:	Black and White(Normal White/Positive Image)
	Rear Polarizer:	☐ Reflective ☐ Transflective
(8) Viewing Direction		☐ 6 O'clock
(9) Backlight		☐ W/O ☐ EL B/L
(10) Weight		W/O 77 g(approx.) EL B/L 83 g(approx.)
(11) Controller		Excluded
(12) DC/DC Converter		Built-in

Note :



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	
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.			
	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	−20	70
Humidity (Without Condensation)	Note 2,4		Note 3,4	

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 changes slightly depending on ambient temperature. This phenomenon is reversible.

3. ELECTRICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Logic Circuit Power Supply	VDD−VSS	−		−	3.0	3.3	V
Recommended LCD Driving Voltage (Normal Temp. LCM)	VDD−VO	Duty=1/200 Bias= 1/13	0°C	−	21.3	22.1	V
			25°C	19.2	20.2	20.7	
			50°C	18.6	19.1	−	
Input Voltage	VIH	H level		0.8VDD	−	VDD	V
	VIL	L level		0	−	0.2VDD	V
Supply Current for Logic	IDD	VDD = 3.0V VEE = −19.5V VDD−VO = 20.9V		−	30.0	35.0	mA
Supply Current for LCD	IO	PATTERN : UUUUUUUUUUUUU UUUUUUUUUUUUU UUUUUUUUUUUUU		−	6.0	10.0	μA
EL Power Supply Current	IEL	VEL=110V(AC) 400Hz		−	−	10.0	mA

4. OPTICAL CHARACTERISTICS

(For Normal Temperature Mode LCM)

AT V_{OP}

ITEM / MODE		Cr(Contrast Ratio) 25°C MIN.	Cr(Contrast Ratio) 25°C TYP.	θ(Viewing Angle) 25°C MIN.	θ(Viewing Angle) 25°C TYP.	φ(Viewing Angle) 25°C MIN.	φ(Viewing Angle) 25°C TYP.
R	J	4.5	10.0	40	61	25	70
S	J	4.5	6.0	40	62	25	68
note		FIG6		FIG5			

note:

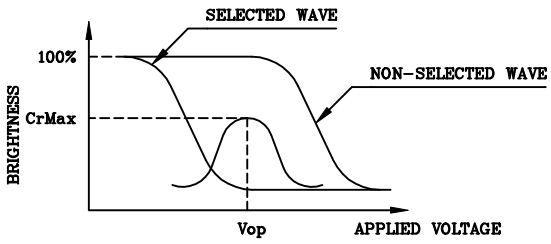
R: REFLECTIVE
S: TRANSFLECTIVE
J: NORMALLY WHITE

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

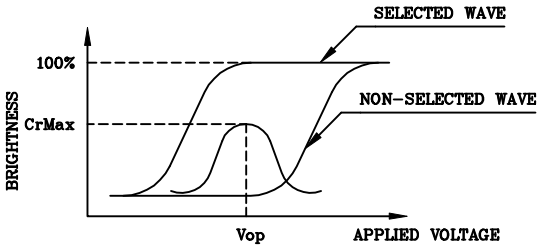
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0°C	—	390	780	ms	FIG2
		25°C	—	160	320		
		50°C	—	85	170		
Response Time (fall)	Tf	0°C	—	900	1800	ms	FIG2
		25°C	—	210	420		
		50°C	—	75	150		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



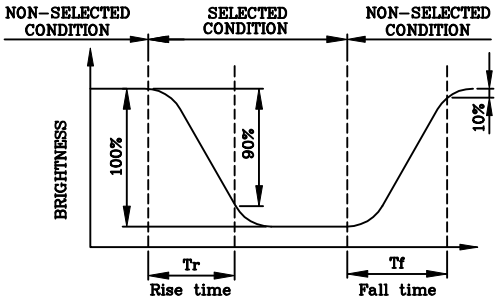
(negative type)

*Conditions

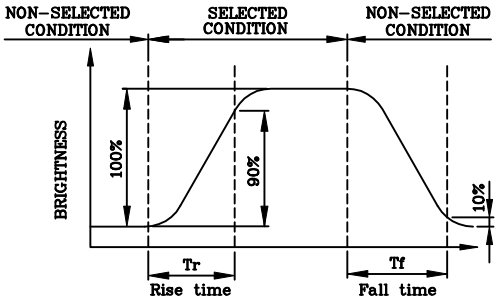
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



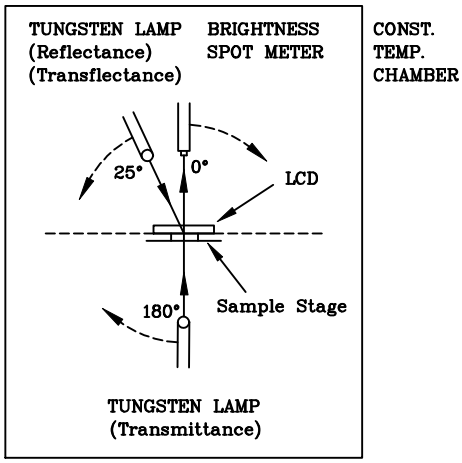
(negative type)

*Conditions

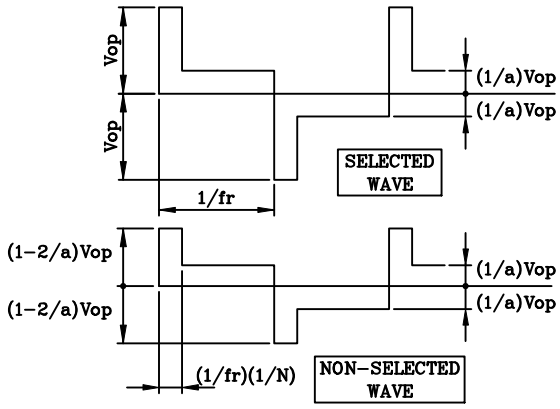
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

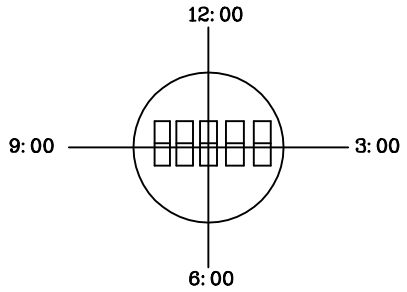


Multiplex Driving (1/N duty, 1/a bias)



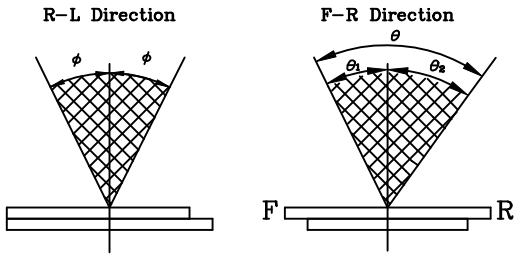
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



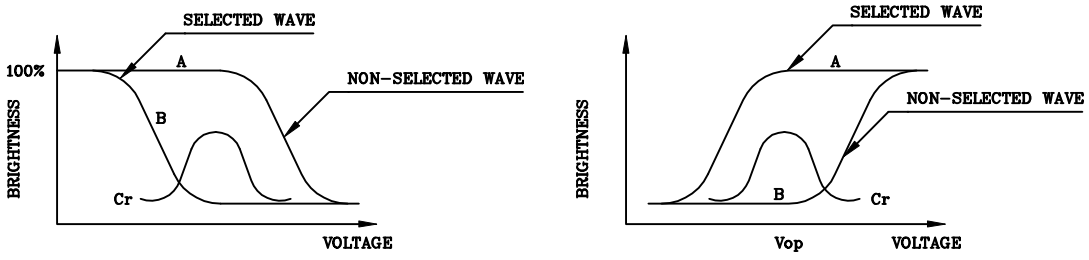
$\theta = \theta_1 + \theta_2$

*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)



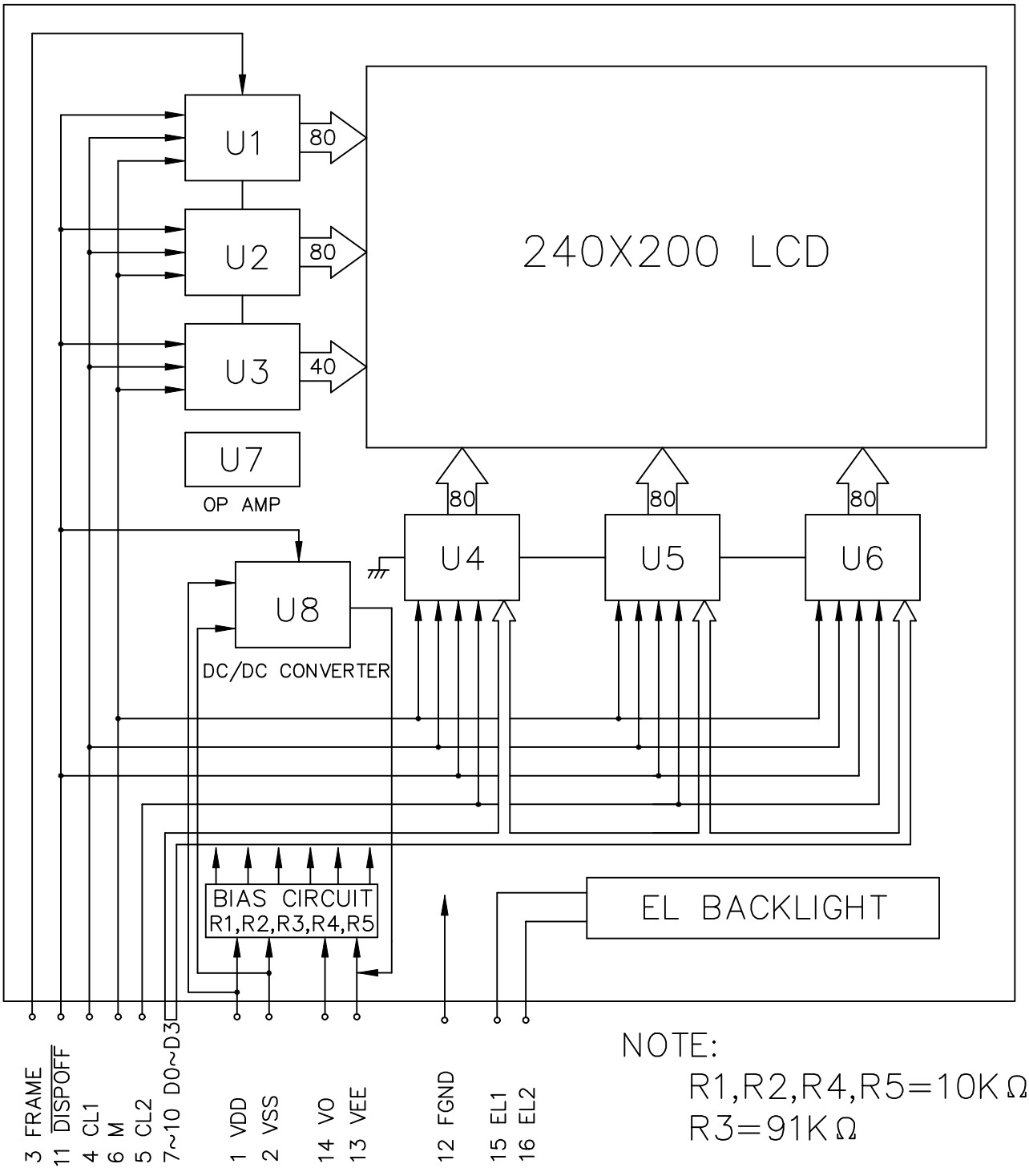
(positive type) (negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

5. BLOCK DIAGRAM



NOTE:

R1,R2,R4,R5=10KΩ

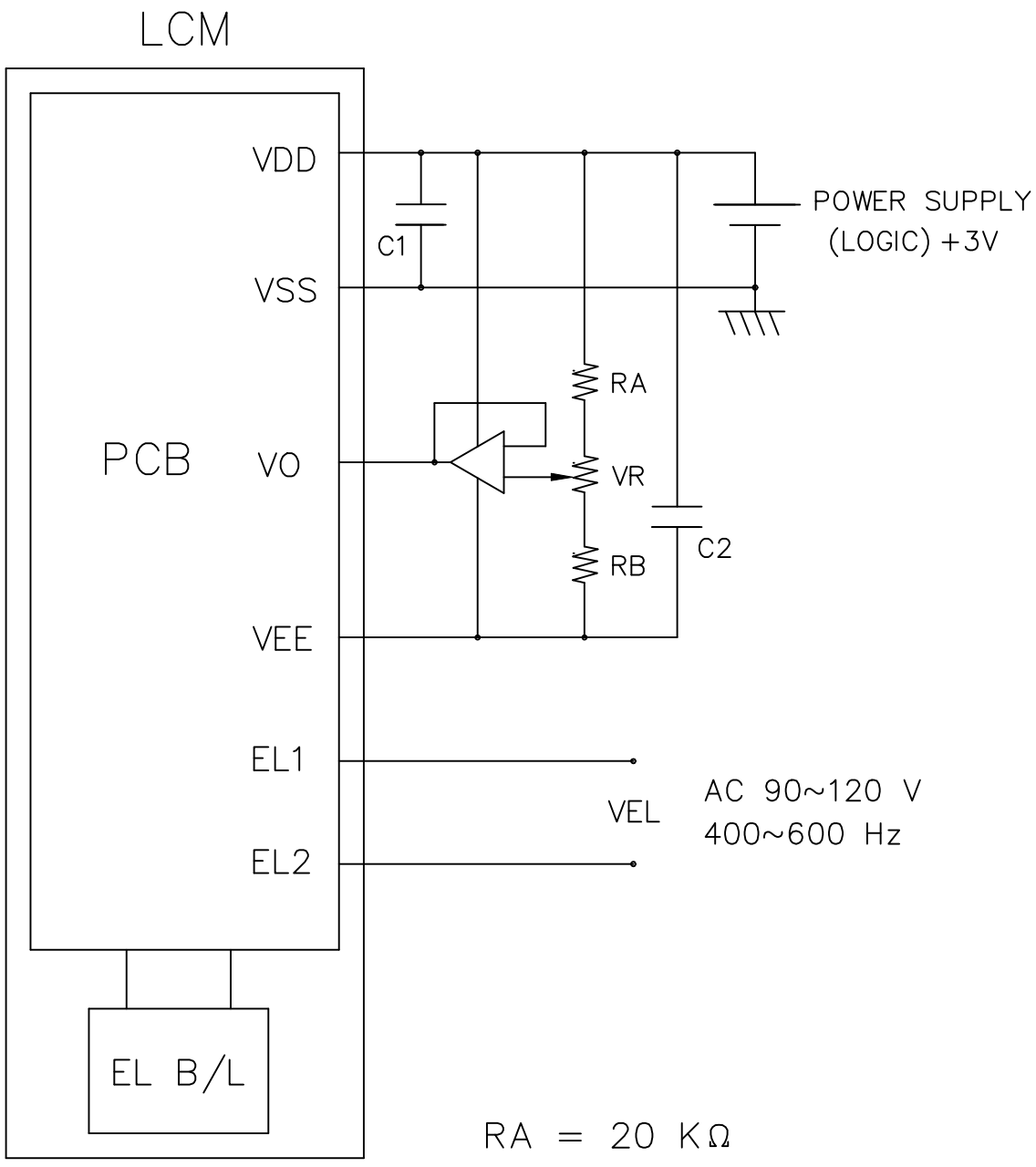
R3=91KΩ

REV/DATE	R0/ 08.20.98'					APP	CHK	BY

6. INTERNAL PIN CONNECTION

Pin No.	Symbol	Function	Level
1	VDD	Power Supply for Logic (+3V)	—
2	VSS	Signal GND(0V)	—
3	FRAME	Frame Signal	H
4	CL1	Display Data Latch Clock	H → L
5	CL2	Display Data Shift Clock	H → L
6	M	Control Signal for AC Driving	H/L
7	D0	Display Data	H/L
8	D1	Display Data	H/L
9	D2	Display Data	H/L
10	D3	Display Data	H/L
11	$\overline{\text{DISPOFF}}$	Display Off	L
12	FGND	Frame GND	—
13	VEE	Power Supply for LCD Driving	—
14	V0	Contrast Adjust for LCD Driving	—
15	EL1	Power Supply for EL B/L	—
16	EL2	Power Supply for EL B/L	—

7.POWER SUPPLY



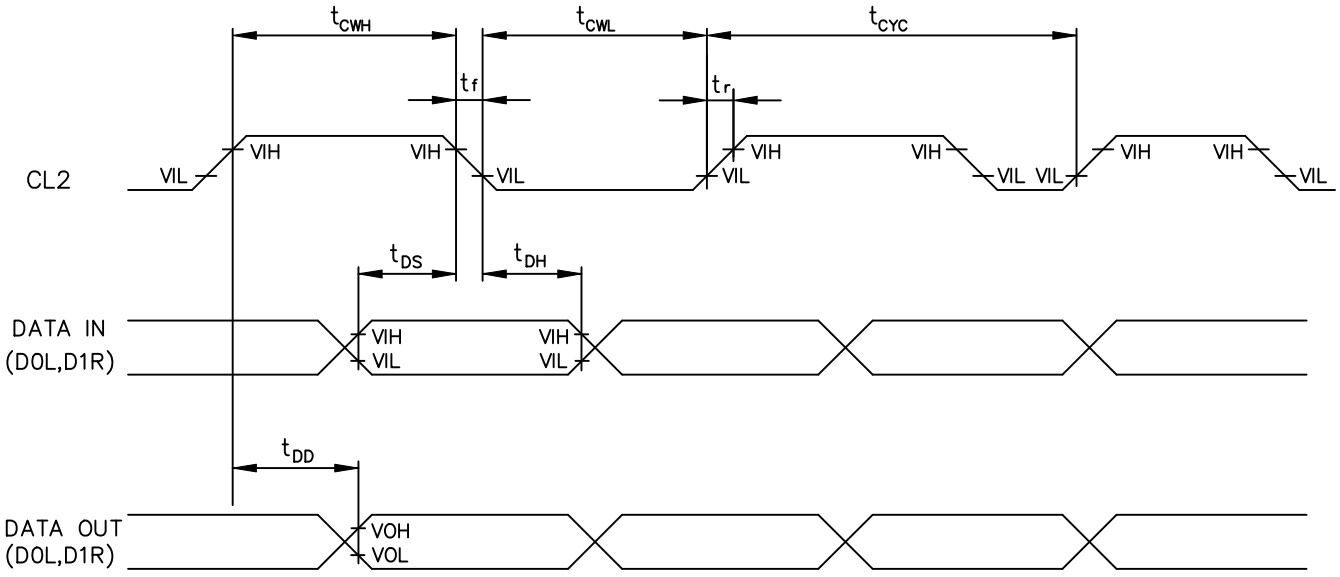
RA = 20 KΩ
RB = 0.1 KΩ
VR = 10 KΩ(VARIABLE)
C1,C2 = 10 μF

8. TIMING CHARACTERISTICS

8-1 COMMON DRIVER OPERATION TIMING

VDD=2.7~4.5V

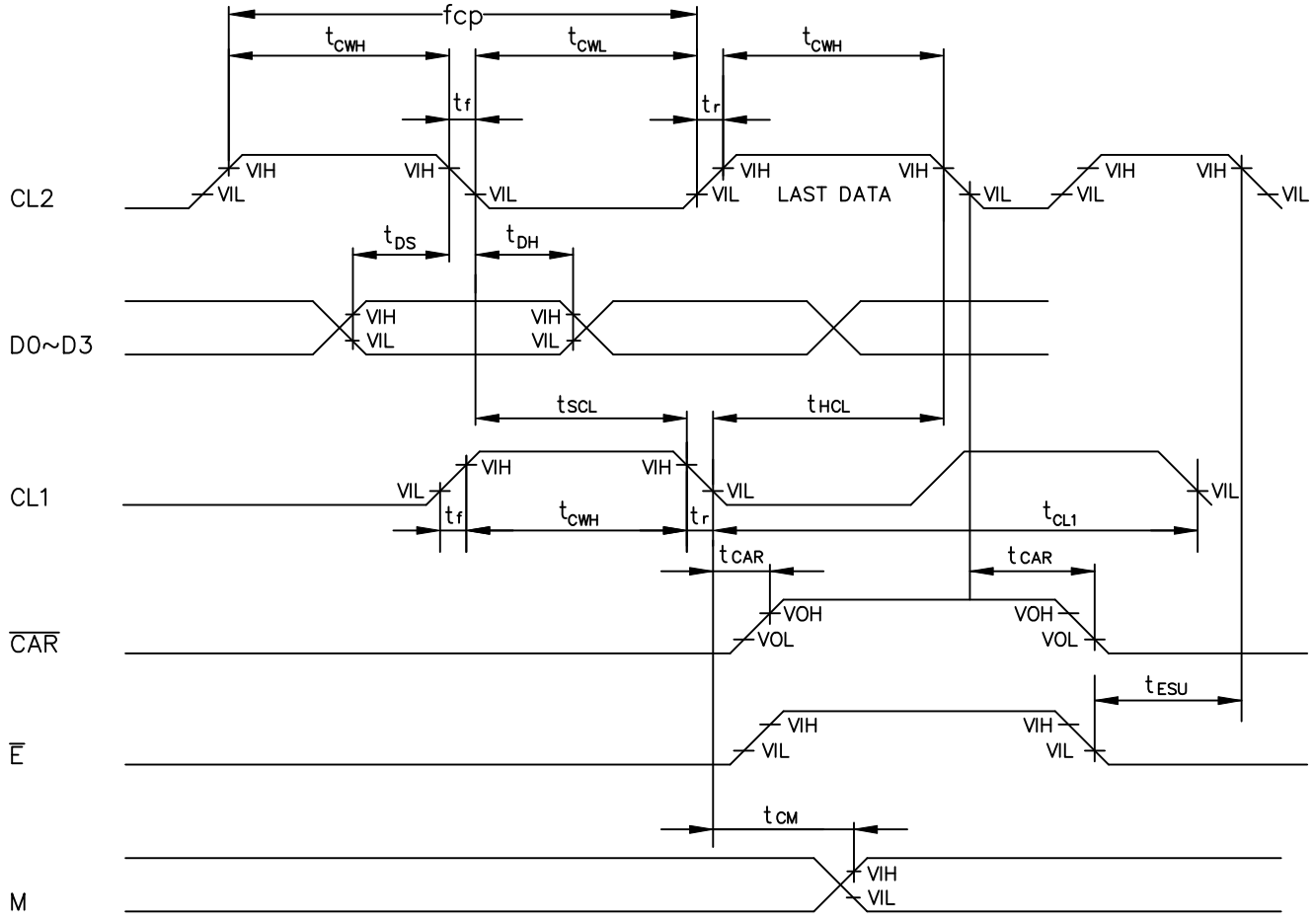
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CLOCK CYCLE TIME	t_{CYC}	10	–	–	μs
CLOCK HIGH LEVEL WIDTH	t_{CWH}	80	–	–	ns
CLOCK LOW LEVEL WIDTH	t_{CWL}	1.0	–	–	μs
CLOCK RISE/FALL TIME	t_r , t_f	–	–	30	ns
DATA SETUP TIME	t_{DS}	100	–	–	ns
DATA HOLD TIME	t_{DH}	100	–	–	ns
DATA OUTPUT DELAY TIME	t_{DD}	–	–	7.0	μs



8-2 SEGMENT DRIVER OPERATION TIMING

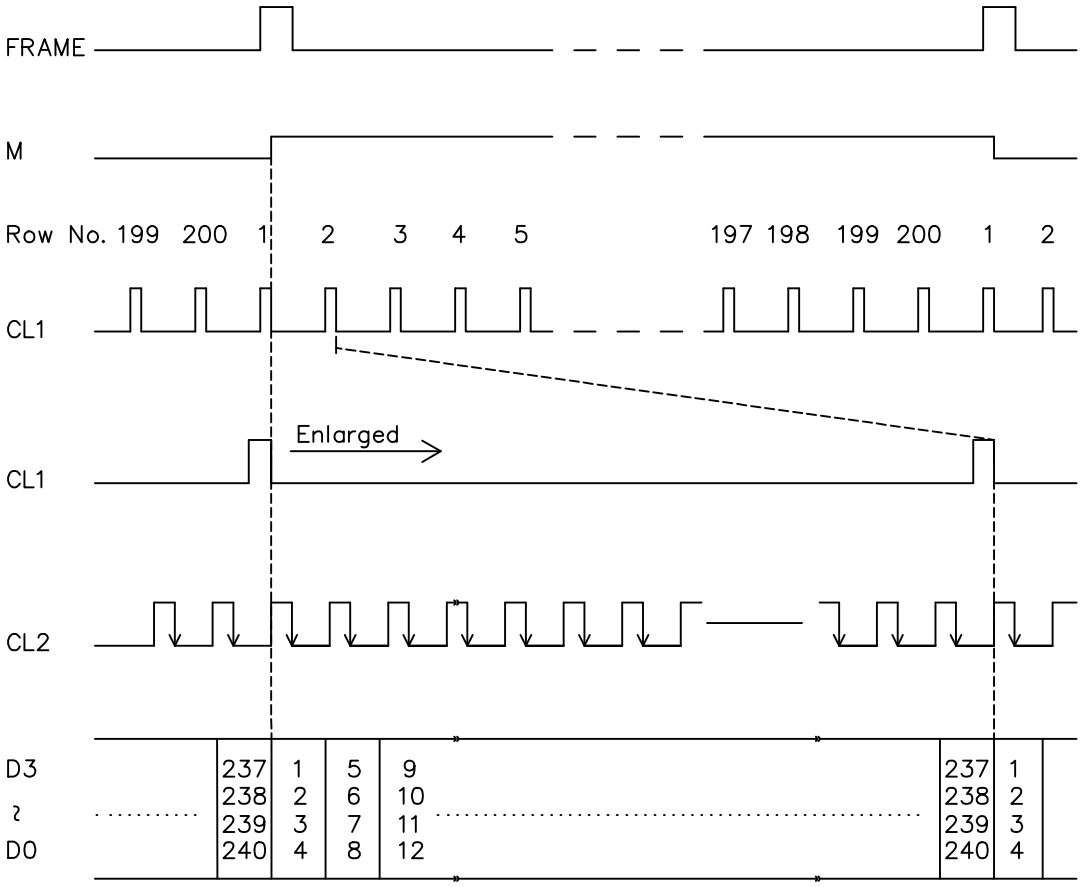
VDD=2.7~4.5V

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CLOCK FREQUENCY	f_{CL2}	–	–	6.5	MHZ
CLOCK CYCLE TIME	t_{CYC}	152	–	–	ns
CLOCK PULSE WIDTH	t_{CWH},t_{CWL}	65	–	–	ns
CLOCK RISE,FALL TIME	t_r , t_f	–	–	1	ns
CLOCK SETUP TIME	t_{SCL}	80	–	–	ns
CLOCK HOLD TIME	t_{HCL}	120	–	–	ns
DATA SETUP TIME	t_{DS}	50	–	–	ns
DATA HOLD TIME	t_{DH}	50	–	–	ns
ENABLE SETUP TIME	t_{ESU}	30	–	–	ns
CARRY OUTPUT DELAY TIME	t_{CAR}	–	–	100	ns
M PHASE DIFFERENCE	t_{CM}	–	–	300	ns
CL1 CYCLE TIME	t_{CL1}	t_{CYC}X50	–	–	ns

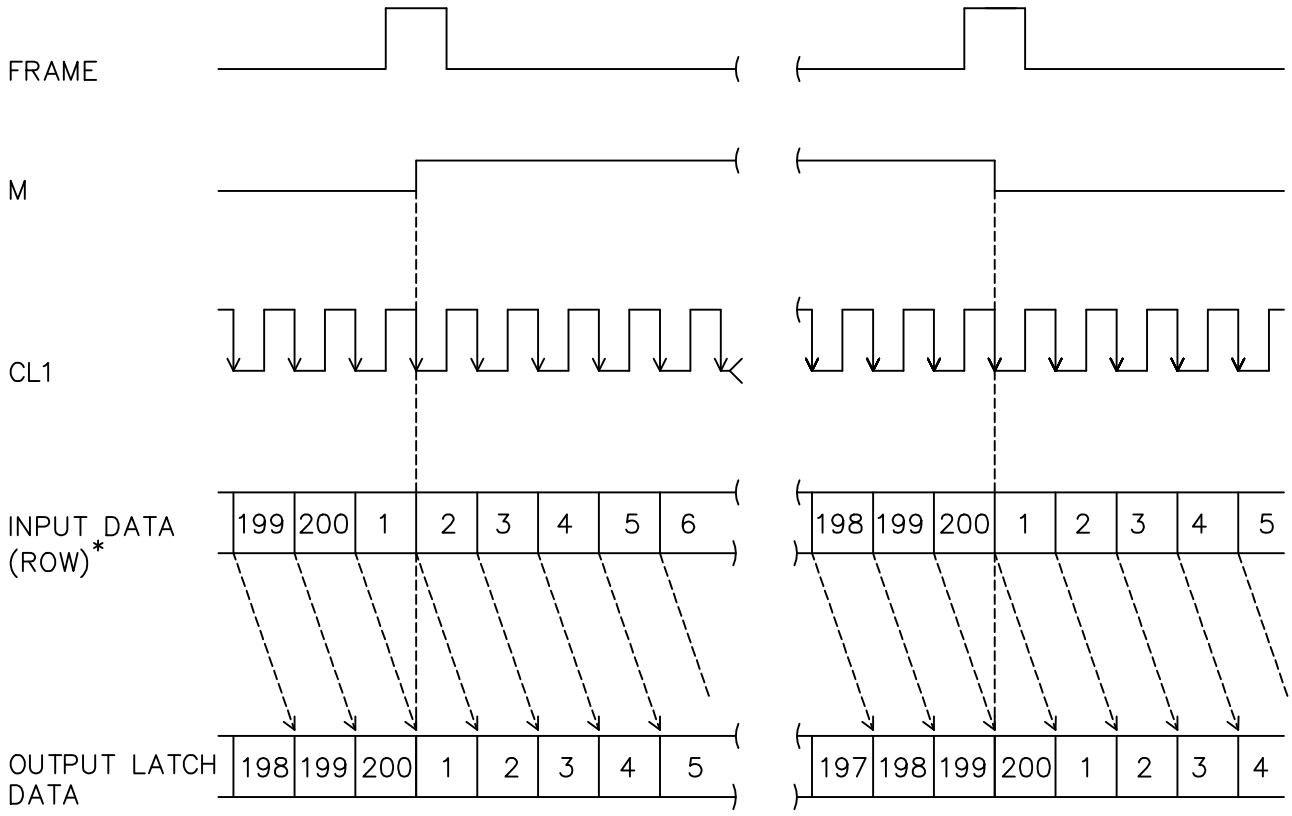


REV/DATE	R0/ 08.20.98'					APP	CHK	BY

8-3 TIMING CHART OF INPUT SIGNALS

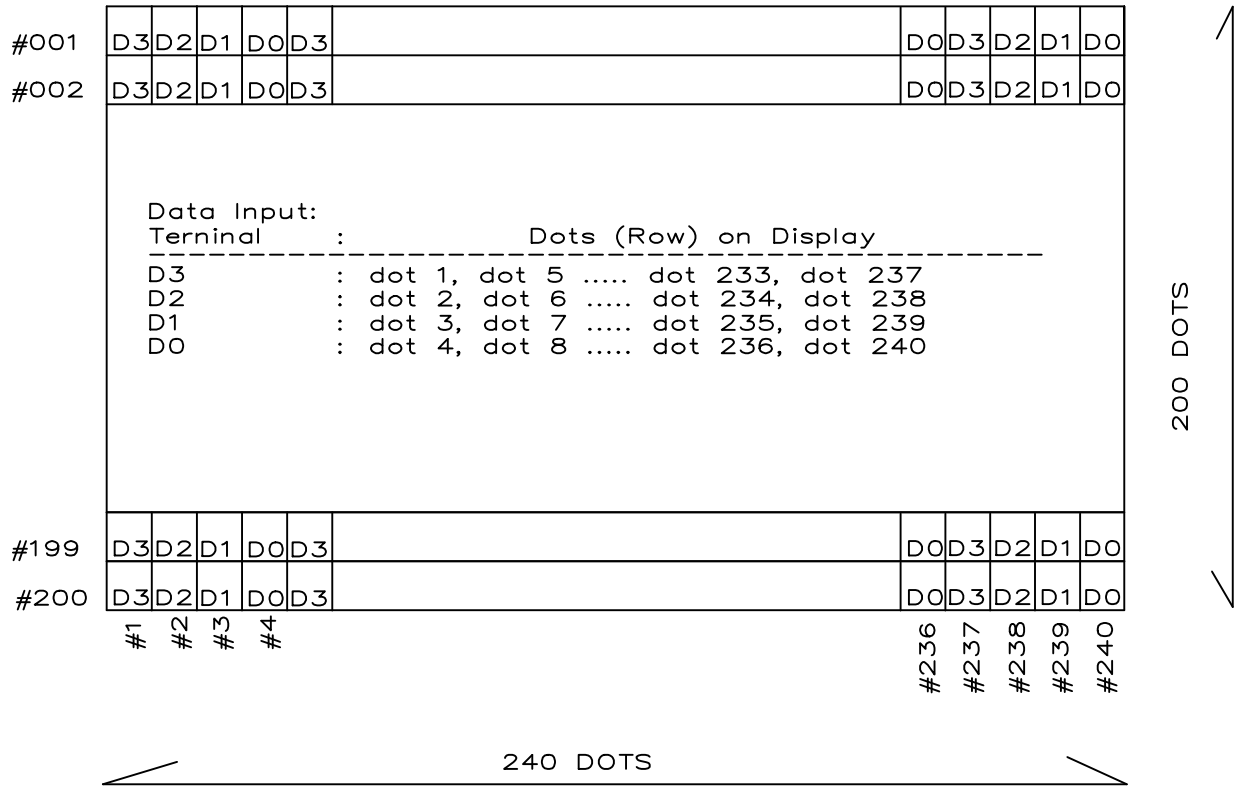


8-4 RELATION OF INPUT DATA AND OUTPUT LATCH DATA



*. ONE ROW DATA INCLUDE 80 COLUMNS DATA,
ONE COLUMN DATA INCLUDE 4 BITS DATA

8-5 DISPLAY PATTERN

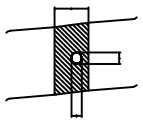
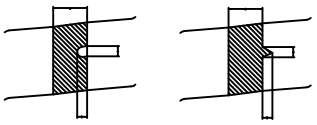


9. RELIABILITY TEST

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:

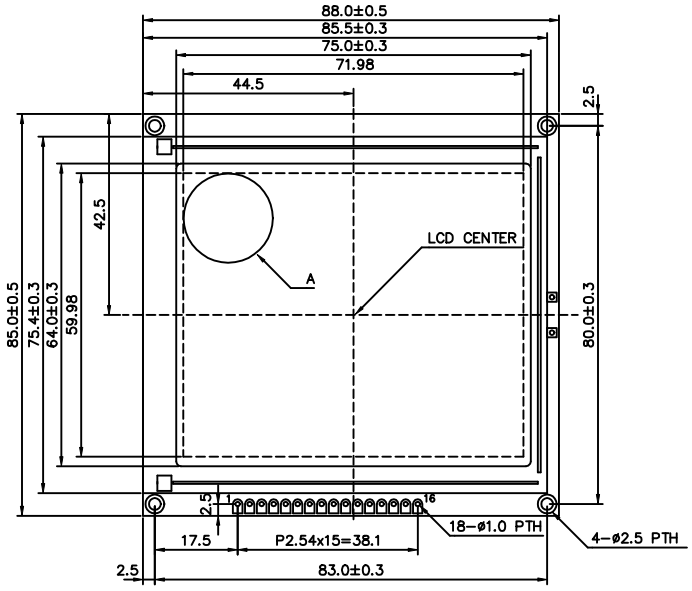
- SAFETY
  1. If the LCD panel breaks, be careful not to allow the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

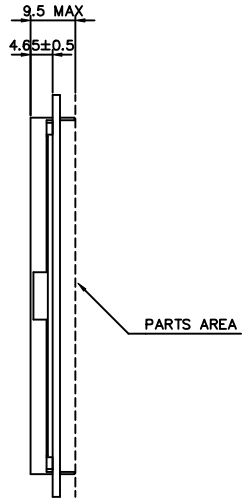
- HANDLING
  1. Prevent all contact with static electricity, which can damage the CMOS ICs. The module is packaged in a static-shielding bag to prevent damage during shipment, warehousing and removal from the shipping carton.
  2. Do not remove the panel or frame from the module.
  3. The polarizing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

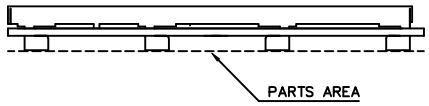
- TERMS OF WARRANTY
  1. Acceptance inspection period
     The inspection period is within one month after the arrival of the contracted goods at the buyer's factory site.
  2. Applicable warranty period
     The warranty period is within twelve months from the date of invoice under normal usage and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

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





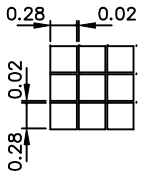
(W/O,EL B/L)



(W/O,EL B/L)

INTERNAL PIN CONNECTION

Pin No.	Symbol	Pin No.	Symbol
1	V_{DD}	9	D2
2	V_{SS}	10	D3
3	FRAME	11	$\overline{DISPOFF}$
4	CL1	12	FGND
5	CL2	13	VEE
6	M	14	VO
7	D0	15	EL1
8	D1	16	EL2



A DETAIL(240 X 200)

NOTE :

1. RESOLUTIONS : 240 x 200 DOTS
2. CONTROLLER : EXCLUDED
3. DC/DC CONVERTER : BUILT-IN
4. TOLERANCE NO SPECIFIED : ±0.5mm

產品編號	LM_88_201_		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	Mx-x201X REV.A
DESIGN			THIRD ANGLE PROJECT	UNIT : mm
DRAW	MAY PING	87.08.20		SCALE :