

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

SPECIFICATION

SPEC. NO. : LM154-0
DATE : DEC.03.1997
SHEET NO. : 1/20

U.S. MARKETING ARM:

MARK PRODUCTS CORPORATION
800 N. EDGEWOOD AVENUE
WOOD DALE, IL 60191
TEL: 630-787-9089
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SPECIFICATION OF
128x160 LCD MODULE
PRODUCT NO.: LM_68_154_

SPEC. NO.: LM154-0

APPROVED BY

EDITED ON : DEC.03.1997

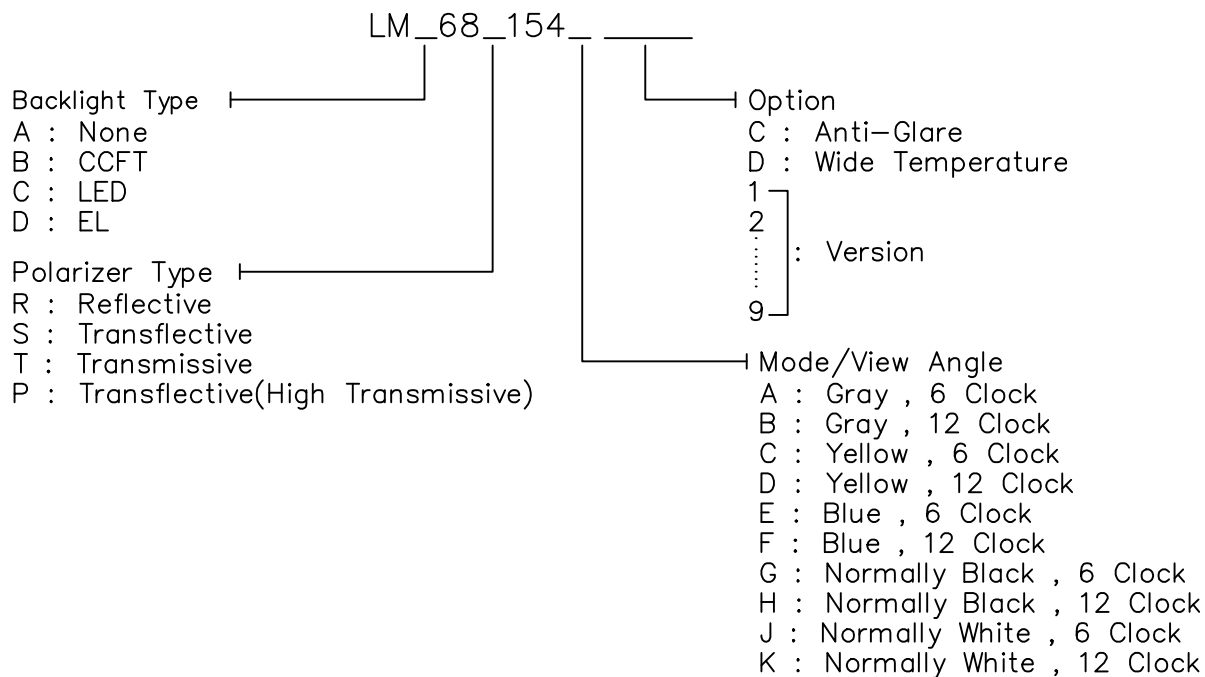
SALES MANAGER	DESIGN MANAGER	PERSON IN CHARGE

REV/DATE	R0/ 12.03.97'					APP	CHK	BY
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1. MECHANICAL DATA

- (1) Part Name LM_68_154__
- (2) Module Size 66.8 (W)mm x 86.8 (H)mm x MAX 5.0 (D)mm
(W/O, EL B.L.)
- (3) Dot Size 0.36 (W)mm x 0.36 (H)mm
- (4) Dot Pitch 0.395(W)mm x 0.395 (H)mm
- (5) Number of Dots 128 (W) x 160 (H)Dots
- (6) Duty 1/128
- (7) LCD DISPLAY MODE STN: GRAY YELLOW BLUE
FSTN: Black and White(Normal White/Positive Image)
 Black and White(Normal Black/Negative Image)
Rear Polarizer: Reflective Transflective Transmissive
- (8) Viewing direction 6 O'clock 12 O'clock ____O'clock
- (9) Backlight W/O EL LED
- (10) Weight W/O B.L. : 33.8 g

Note :



2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

V_{SS}=0 V Standard

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VCC-VSS	-0.3	7.0	V	
Input Voltage	VCC-V5	0	28.0	V	
Static Electricity	-	-	-	-	Note 1

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE		COMMENT
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	0	50	-20	70	Note 2 , 3
Humidity	Note 1		Note 1		Without condensation

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 < 120 hrs

Note 3 Background color changes slightly depending on ambient temperature.
This phenomenon is reversible.

3.0 ELECTRICAL CHARACTERISTICS

@VCC=5.0V±10%

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Logic Circuit Power Supply	VCC-VSS	-		4.5	5.0	5.5	V
LCD Driver Power Supply	VCC-V5	1/12Bias	0°C	-	19.0	20.0	v
			25°C	16.8	17.6	18.2	v
			50°C	15.7	16.1	-	v
Input Voltage	VIH	H level		0.8VCC	-	VCC	V
	VIL	L level		GND	-	0.2VCC	V
Supply Current for Logic	ICC	VCC = 5.0V		-	3.4	-	mA
Supply Current for LCD	ILCD	VCC -V5=18.2V		-	2.8	-	mA
Supply Current for EL	IEL	VBL=110VAC,400Hz (MAX)		-	-	-	mA

3.1 ELECTRICAL CHARACTERISTICS

@VCC=3.0V±10%

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Logic Circuit Power Supply	VCC-VSS	-		2.7	3.0	3.3	V
LCD Driver Power Supply	VCC-V5	1/12Bias	0°C	-	-	-	V
			25°C	-	-	-	V
			50°C	-	-	-	V
Input Voltage	VIH	H level		0.8VCC	-	VCC	V
	VIL	L level		GND	-	0.2VCC	V
Supply Current for Logic	ICC	VCC = 3.0V		-	3.2	-	mA
Supply Current for LCD	ILCD	VCC -V5=18.2V		-	2.9	-	mA
Supply Current for EL	IEL	VEL=110VAC,400Hz (MAX)		-	-	-	mA

4. OPTICAL CHARACTERISTICS

AT V_{OP}

MODE	ITEM	Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25 τ		25 τ		25 τ	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A	—	—	—	—	—	—
	C	—	—	—	—	—	—
	J	4	6	40	60	25	25
S	A	—	—	—	—	—	—
	C	—	—	—	—	—	—
	J	3.5	6	40	55	20	30
T	E	3	6	35	65	20	42
	G	6	15	45	90	30	50
note		NOTE6		NOTE5			

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

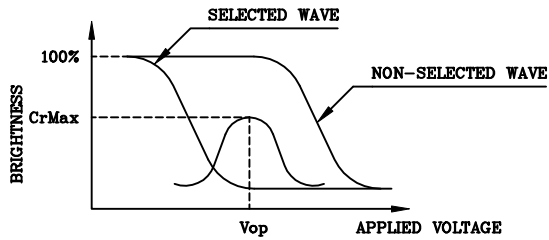
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0 τ	—	450	900	ms	NOTE 2
		25 τ	—	110	220		
		50 τ	—	65	130		
Response Time (fall)	Tf	0 τ	—	650	1100	ms	NOTE 2
		25 τ	—	135	250		
		50 τ	—	80	150		

note:

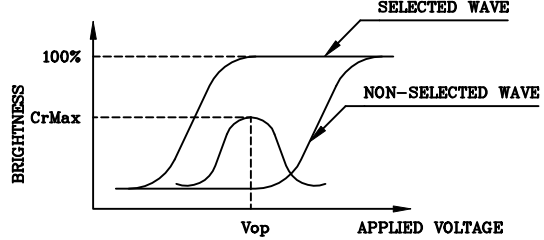
S: TRANSFLECTIVE
T: TRANSMISSIVE
A: GRAY
C: YELLOW
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



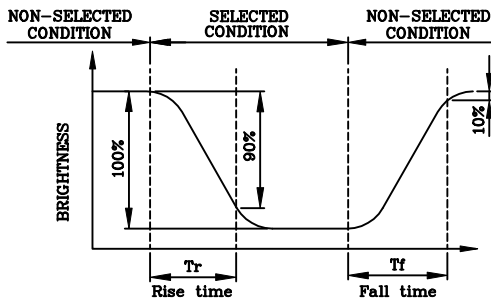
(negative type)

*Conditions

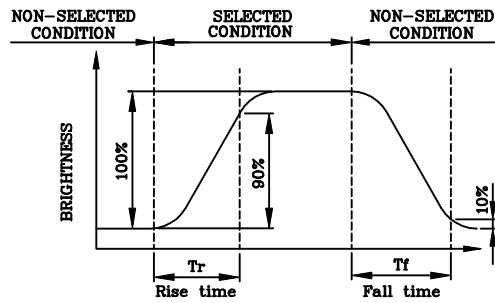
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



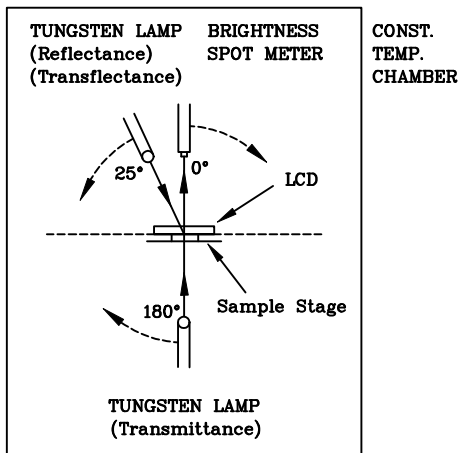
(negative type)

*Conditions

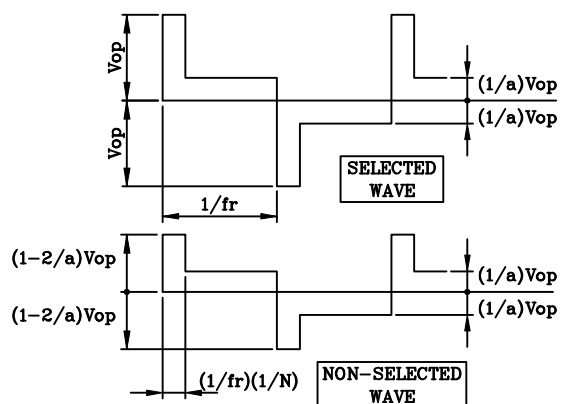
Operating Voltage : Vop
Viewing Angle (θ,φ) : (0,0)
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

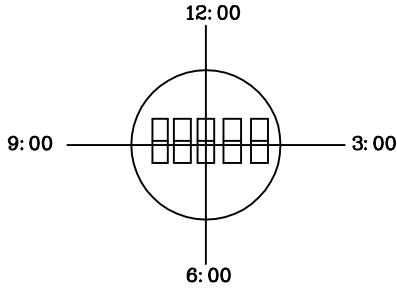


Multiplex Driving (1/N duty, 1/a bias)



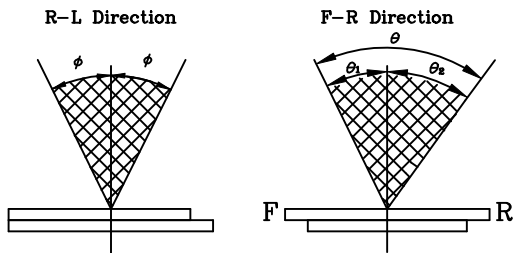
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



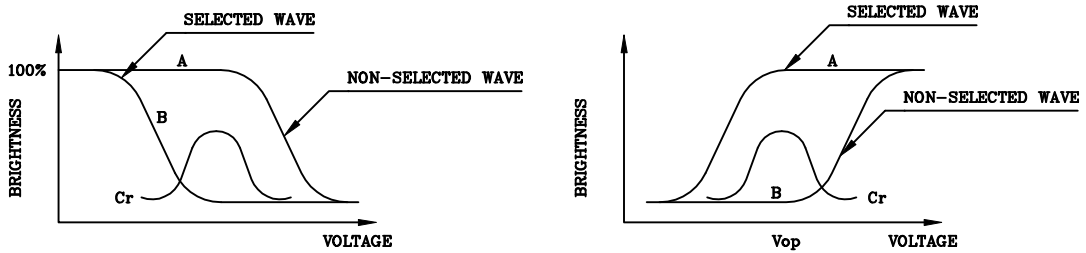
$\theta = \theta_1 + \theta_2$

*Conditions

Operating Voltage : 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)

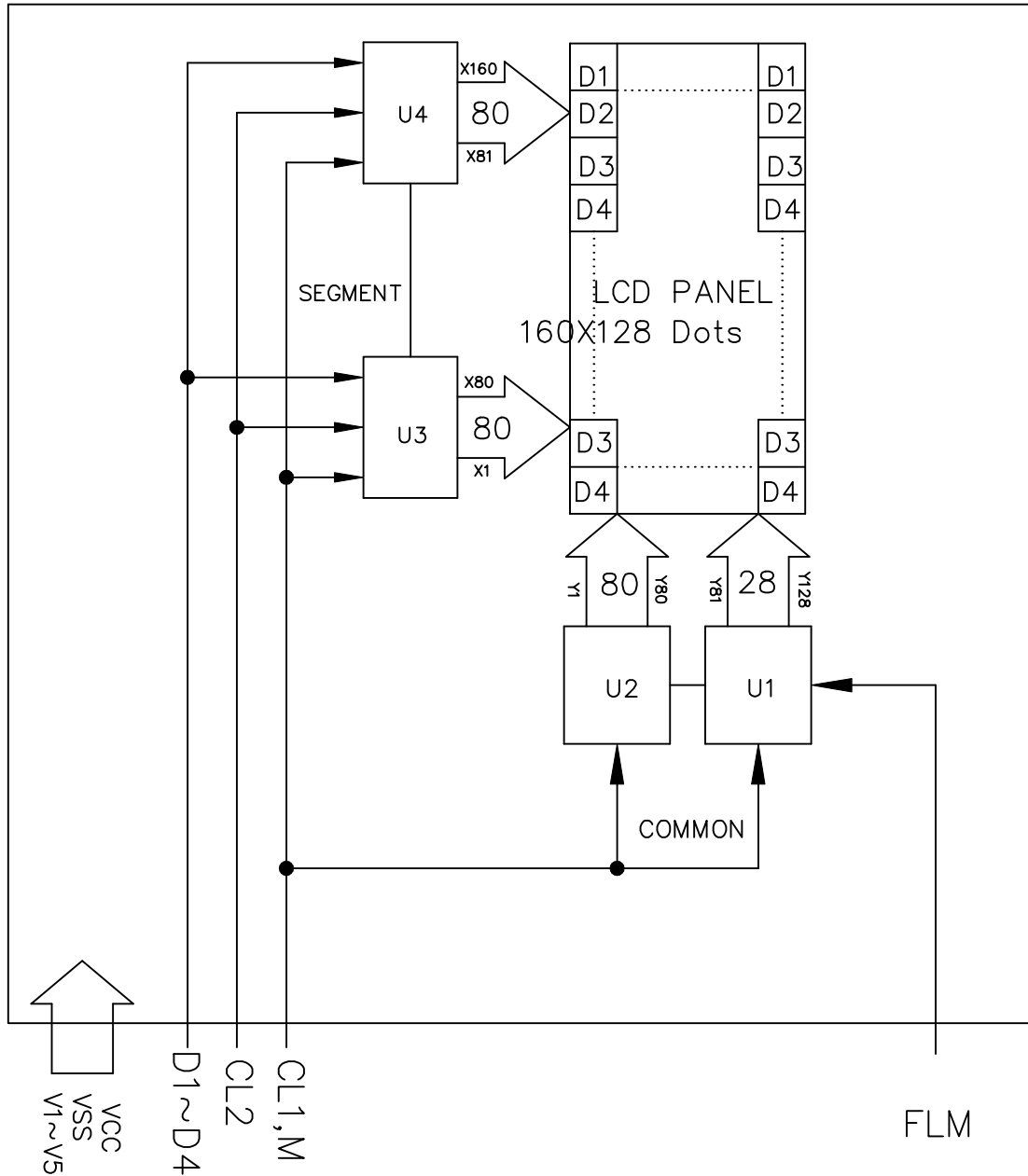
(negative type)

Contrast Ratio : $Cr=A/B$

*Conditions

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

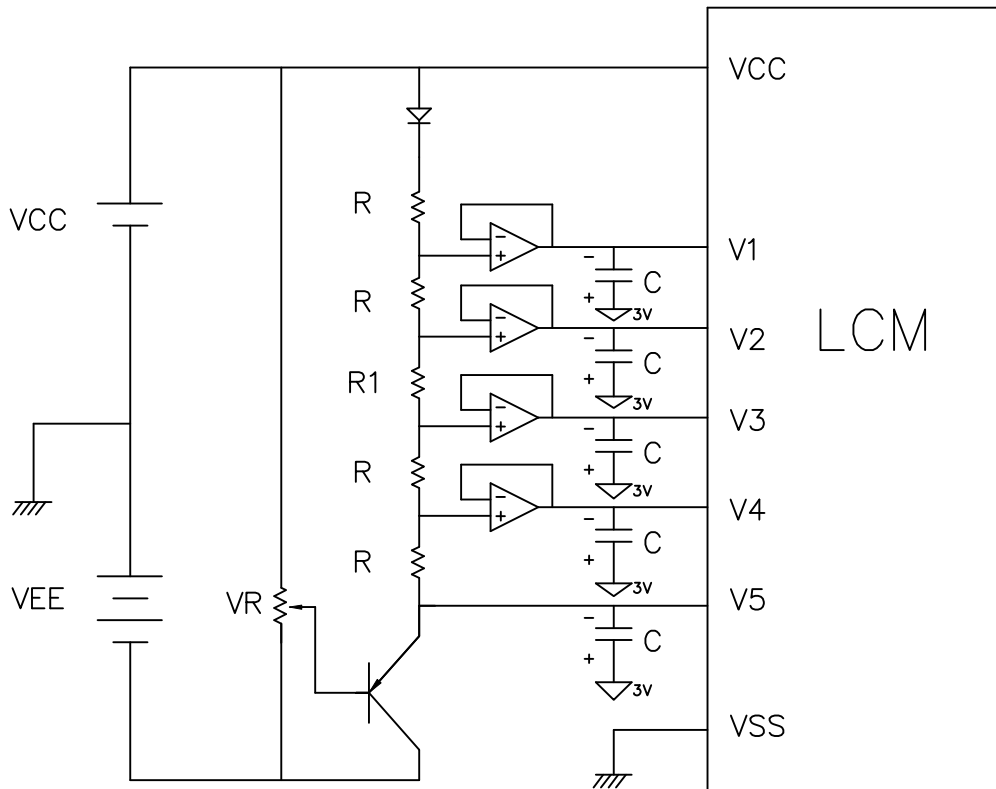
5. BLOCK DIAGRAM



6.INTERFACE PIN CONNECTION

Pin No.	Symbol	Function	Level
1	FLM	First line marker	H
2	CL1	Display data latch clock	H → L
3	CL2	Display data shift clock	H → L
4	M	Control signal for AC driving	H/L
5	D1	Display data	H/L
6	D2	Display data	H/L
7	D3	Display data	H/L
8	D4	Display data	H/L
9	V1	Power Supply for LCD(COM non-selected level)	
10	V2	Power Supply for LCD(SEG non-selected level)	
11	V3	Power Supply for LCD(SEG non-selected level)	
12	V4	Power Supply for LCD(COM non-selected level)	
13	V5	Power Supply for LCD(COM,SEG selected level)	
14	VCC	Power Supply for Logic (3V or 5V) Power Supply for LCD(COM,SEG selected level)	
15	VSS	Power Supply (GND)	
16	VEL	Power Supply for EL BACKLIGHT	
17	NC	-	
18	VEL	Power Supply for EL BACKLIGHT	

7. POWER SUPPLY



$$\frac{16.VEL}{18.VEL} = \frac{V_{EE} + R_1}{V_{EE} + R_1 + R}$$

VEL(MAX 110V 400Hz)

$R_1 = 8R \sim 10R$ (FOR 1/12 Bias $R_1 = 8R$)

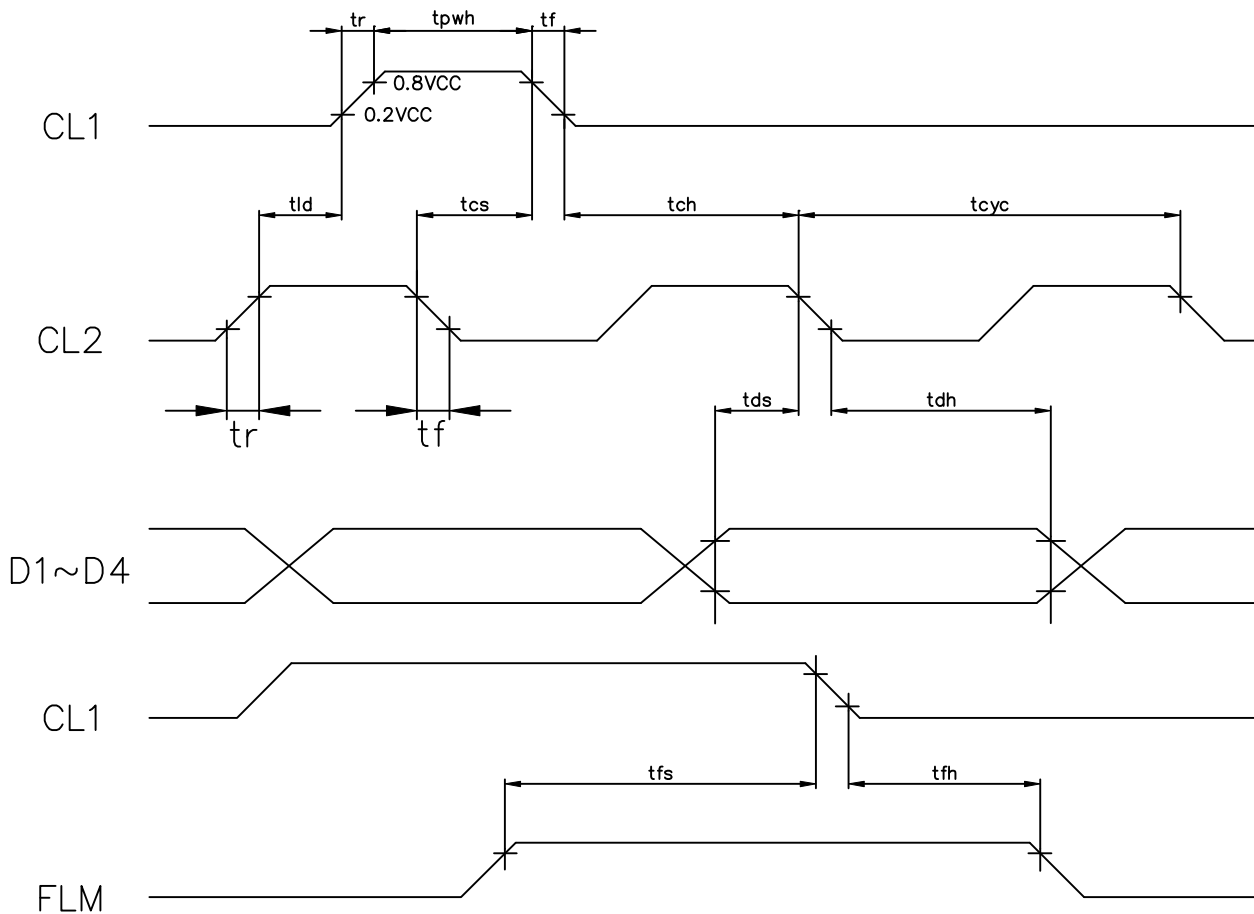
$C = 3.3\mu F$

$VR = 10K \sim 20K$

8.0. TIMING CHARACTERISTICS

$V_{cc}=5V\pm 10\%$

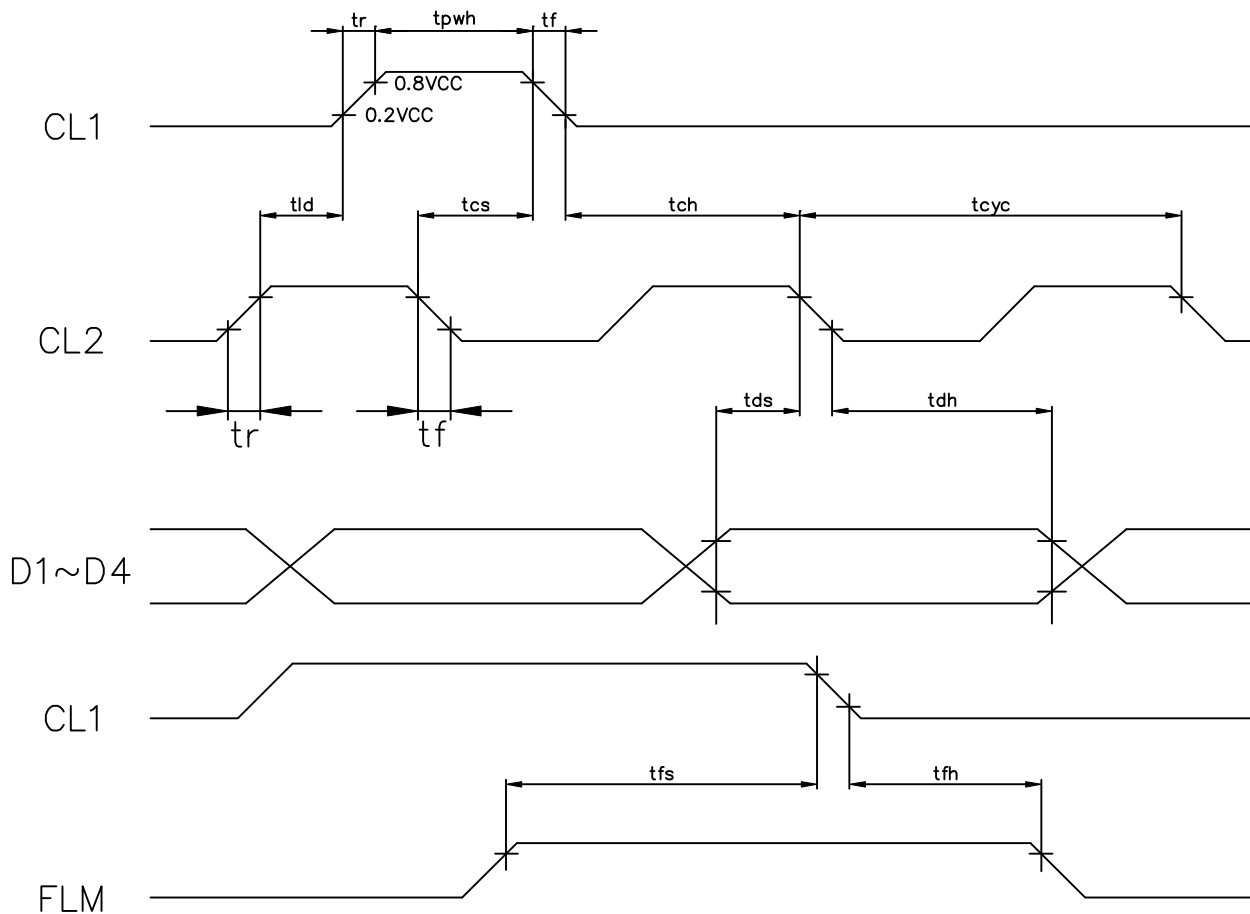
Item	Symbol	Min.	Typ.	Max.	Unit
Clock cycle time	tcyc	125	—	—	ns
High-level pulse width	tpwh	45	—	—	ns
Latch delay time	tld	80	—	—	ns
Clock setup time	tcs	80	—	—	ns
Clock hold time	tch	80	—	—	ns
Rise and fall time	tr,tf	—	—	—	ns
Data setup time	tds	20	—	—	ns
Data hold time	tdh	20	—	—	ns
FLM setup time	tfs	30	—	—	ns
FLM hold time	tfh	80	—	—	ns



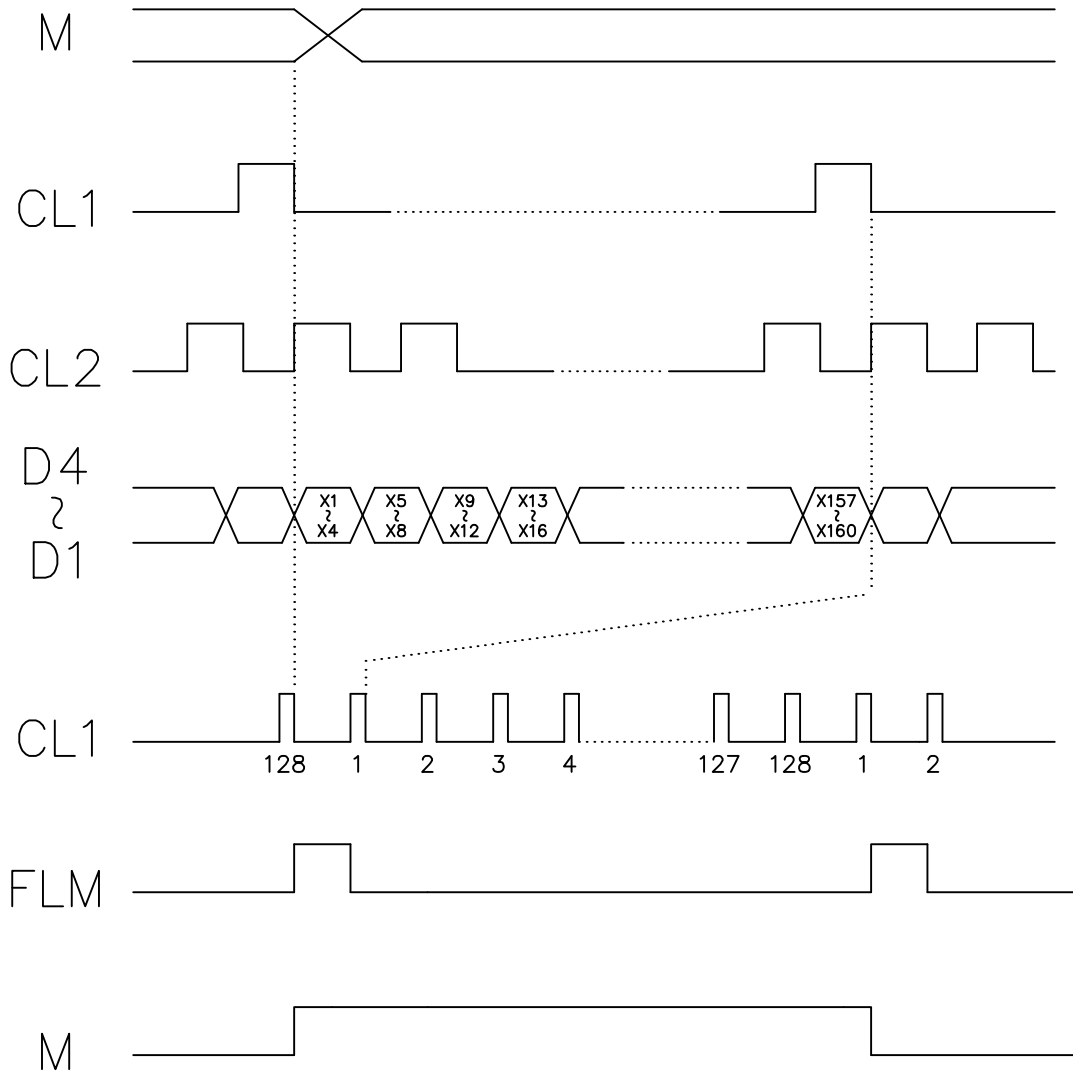
8.1. TIMING CHARACTERISTICS

$V_{CC}=3V\pm 10\%$

Item	Symbol	Min.	Typ.	Max.	Unit
Clock cycle time	tcyc	152	—	—	ns
High-level pulse width	tpwh	65	—	—	ns
Latch delay time	tld	80	—	—	ns
Clock setup time	tcs	80	—	—	ns
Clock hold time	tch	120	—	—	ns
Rise and fall time	tr,tf	—	—	30	ns
Data setup time	tds	50	—	—	ns
Data hold time	tdh	50	—	—	ns
FLM setup time	tfs	40	—	—	ns
FLM hold time	tfh	90	—	—	ns



8-1. INTERFACE TIMING CHART



Note:

1.Power On/Off Sequence:

The power On/Off sequence is important for LCM. We recommend you using the following power On/Off sequence:

Power On : Vcc,Vss → V1~V5
Power Off : V1~V5 → Vss,Vcc

If you don't follow the power on sequence that we recommend, the drivers of LCM may be damaged.

2.LCM connection:

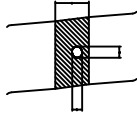
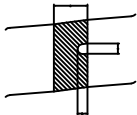
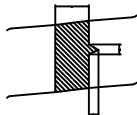
We strongly suggest you don't short Vss with V4~V5, if you do it, the drivers of LCM will be breakdown and destroyed.

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)	(1) ROUND TYPE																	
		<table border="1"> <thead> <tr> <th colspan="3">DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td></td> <td>a</td> <td>≦ 0.20</td> <td>NEGLECT</td> </tr> <tr> <td>0.20</td> <td>< a</td> <td>≦ 0.35</td> <td>5 MAX</td> </tr> <tr> <td>0.35</td> <td>< a</td> <td></td> <td>NONE</td> </tr> </tbody> </table>	DIAMETER mm (a*)			NO. OF DEFECT*		a	≦ 0.20	NEGLECT	0.20	< a	≦ 0.35	5 MAX	0.35	< a		NONE	
DIAMETER mm (a*)			NO. OF DEFECT*																
	a	≦ 0.20	NEGLECT																
0.20	< a	≦ 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 ≦ 0.03</td> <td>NEGLECT</td> </tr> <tr> <td>L ≦ 3</td> <td>0.03 < W ≦ 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 ≦ 0.03	NEGLECT	L ≦ 3	0.03 < W ≦ 0.08	6	3 < L	0.08 < W	NONE					
LENGTH mm(L)	WIDTH mm(W)	NO. OF DEFECT																	
N A	W ≦ 0.03	NEGLECT																	
L ≦ 3	0.03 < W ≦ 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 colspan="3">DIAMETER mm (a*)</th> <th>NO. OF DEFECT*</th> </tr> </thead> <tbody> <tr> <td></td> <td>a</td> <td>≦ 0.15</td> <td>NEGLECT</td> </tr> <tr> <td>0.15</td> <td>< a</td> <td>≦ 0.20</td> <td>2 MAX</td> </tr> <tr> <td>0.20</td> <td>< a</td> <td></td> <td>NONE</td> </tr> </tbody> </table>		DIAMETER mm (a*)			NO. OF DEFECT*		a	≦ 0.15	NEGLECT	0.15	< a	≦ 0.20	2 MAX	0.20	< a		NONE
DIAMETER mm (a*)			NO. OF DEFECT*																
	a	≦ 0.15	NEGLECT																
0.15	< a	≦ 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 ≦ 0.15 mm MAXIMUM NUMBER: IGNORED 0.15 < (a+b)/2 ≦ 0.20 MAXIMUM NUMBER: 10																	
6.	DOT DEFECT	(a+b)/2 ≦ 0.20 mm MAXIMUM NUMBER: IGNORED 0.20 < (a+b)/2 ≦ 0.30 MAXIMUM NUMBER: 5 x = WIDTH	 																
7.	CONTRAST IRREGULARITY (SPOT)	DIAMETER SPEC. a ≦ 0.50 mm 0.50 < a ≦ 0.75 0.75 < a ≦ 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. : LM154-0 DATE : DEC.03.1997 SHEET NO. : 19/20
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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.

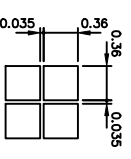
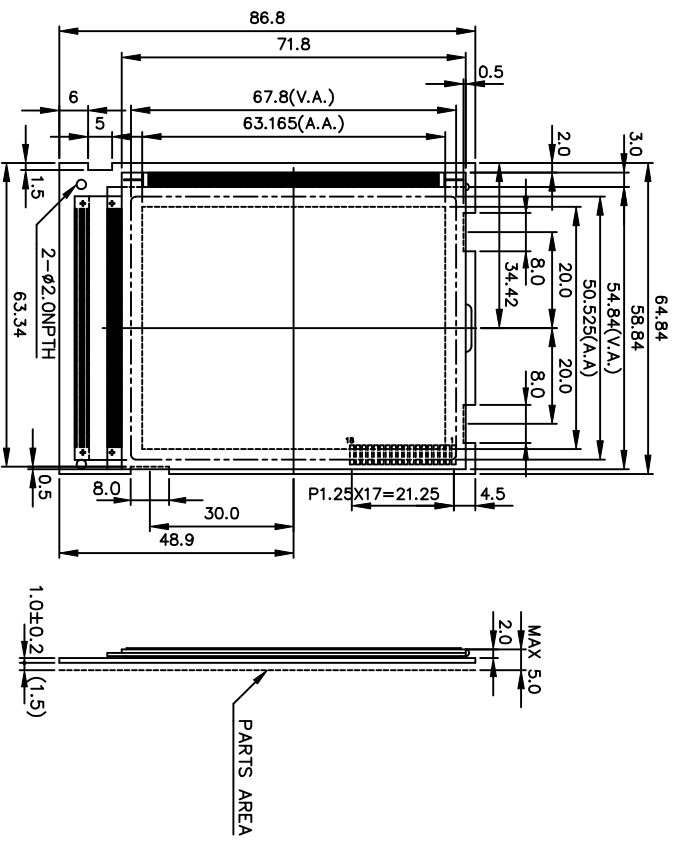
- HANDLING
 - 1.Prevent all contact with static electricity, which can damage the CMOS ICs. The module is packaged in a static-shielding bag to prevent damage during shipment, warehousing and removal from the shipping carton.
 - 2.Do not remove the panel or frame from the module.
 - 3.The polarizing 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/ 12.03.97'					APP	CHK	BY
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128 X 160 DOTS

NOTES :

1. RESOLUTION:160X128 Dots
2. GENERAL TOLERANCE : ±0.5mm
3. LOGIC VOLTAGE : 3V/5V
4. WITHOUT CONTROLLER IC
5. BACKLIGHT : NONE



PIN NO.	SYMBOL
1	FLM
2	CL1
3	CL2
4	M
5	D1
6	D2
7	D3
8	D4
9	V1
10	V2
11	V3
12	V4
13	V5
14	VOC
15	VSS
16	VEL
17	NC
18	VEL

產品編號		LMA68_154_		南亞塑膠工業股份有限公司	
NAME		DATE		NAN YA PLASTICS CORPORATION	
APPROVE		TITLE		製品圖	
CHECK		DWG-NO		MA-X154X Rev.A	
DESIGN		MAY PING		SCALE : 1/1	
DRAW		86:12:03		THIRD ANGLE PROJECT	