

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

SPECIFICATION

SPEC. NO. : LM086-1
DATE : Mar. 6, 1998
SHEET NO. : 1/18

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
192x128 LCD MODULE
PRODUCT NO.: LM_98_086_3__

SPEC. NO.: LM086-1

APPROVED BY

EDITED ON : Mar. 6, 1998

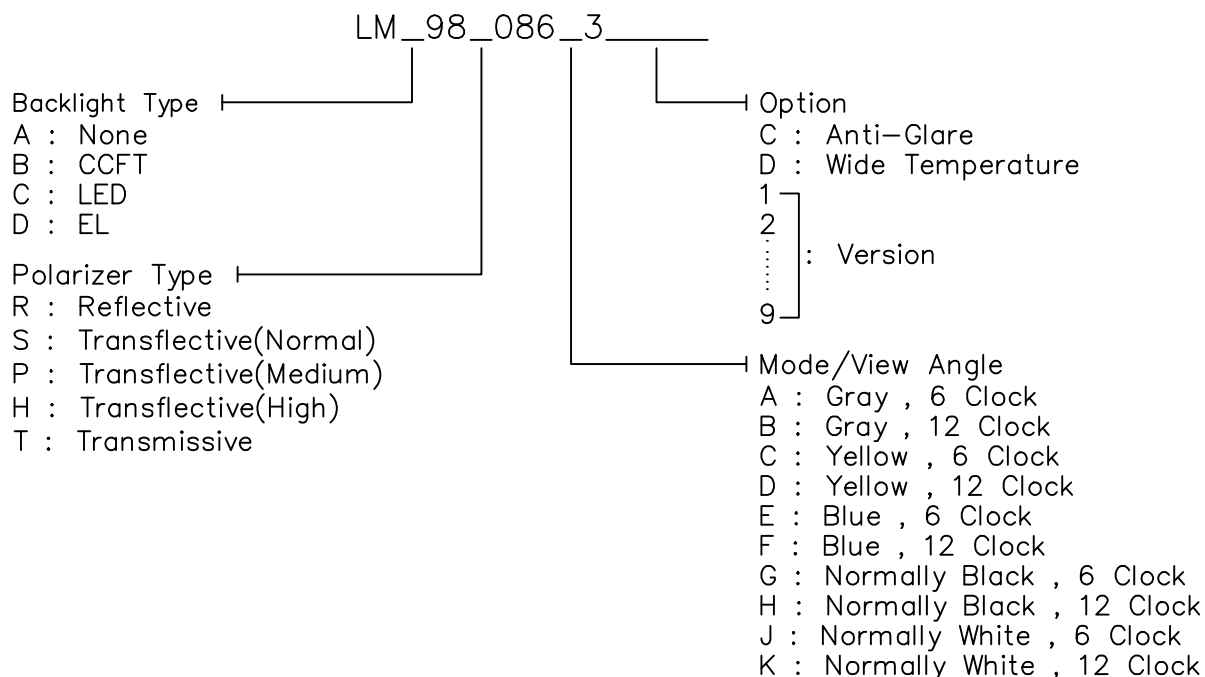
SALES MANAGER	DESIGN MANAGER	PERSON IN CHARGE

REV/DATE	RO/ 03.06.98'					APP	CHK	BY
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1. MECHANICAL DATA

- (1) Product No. LM_98_086_3_____
- (2) Module Size 98.0 (W)mm x 86.0 (H)mm x MAX13.4 (D)mm
(W/O, EL B/L)
- (3) Dot Size 0.33 (W)mm x 0.33 (H)mm
- (4) Dot Pitch 0.37 (W)mm x 0.37 (H)mm
- (5) Number of Dots 192 (W) x 128 (H)Dots
- (6) Duty 1/128
- (7) LCD Display Mode STN: Gray Mode Yellow Mode Blue Mode
FSTN: Black and White(Normally White/Positive Image)
 Black and White(Normally 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 B/L
- (10) Weight W/O : 87g(approx.)
 EL B/L : 95g(approx.)
- (11) Controller Without
- (12) DC/DC Converter Without

Note :



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2. ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V Standard

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD-VSS	-0.3	7.0	V	
Power Supply for LCM	VDD-VLC	0	20.0	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	55	-20	70
Humidity (Without Condensation)	Note 1,3		Note 2,3	

Note 1 $T_a \leq 55^\circ\text{C}$: 90%RH max.

$T_a > 55^\circ\text{C}$: Absolute humidity must be lower
than the humidity of 90%RH at 55°C

Note 2 T_a at -20°C will be $< 48\text{hrs}$, at 70°C will be $< 120\text{hrs}$

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

3. ELECTRICAL CHARACTERISTICS

(VDD= 5V ± 10%)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	
Input Voltage	VIH	H level	0.7VDD	-	VDD	V	
	VIO	L level	0	-	0.3VDD	V	
Recommended LC Driving Voltage	VDD-VLC	Duty= 1/128	0℃	15.5	16.1	16.7	V
		Bias= 1/12	25℃	15.5	16.1	16.7	
			55℃	15.0	15.6	16.1	
Power Supply Current	IDD	FLM=70 Hz VDD=5.0 V VLC=-11.2 V	1.4	1.9	-	mA	
	ILC	Pattern : □ ■ □ ■ □ ■ □ ■ □ ■	1.4	1.9	-	mA	
EL Power Supply Current	I EL	V _{EL} =115 Vrms f _{EL} =400 Hz	-	5.0	-	mA	

4. OPTICAL CHARACTERISTICS

AT Vop

ITEM MODE		Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25°C		25°C , Cr \geq 2		25°C , Cr \geq 2	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A	-	-	-	-	-	-
	C	-	-	-	-	-	-
	J	-	-	-	-	-	-
P	A	2.5	3.5	30	45	20	25
	C	-	-	-	-	-	-
	J	-	-	-	-	-	-
T	A	2.0	2.5	30	40	15	20
	E	-	-	-	-	-	-
	G	-	-	-	-	-	-
note		NOTE6		NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0°C	-	350	700	ms	NOTE 2
		25°C	-	120	240		
		55°C	-	50	100		
Response Time (fall)	Tf	0°C	-	650	1300	ms	NOTE 2
		25°C	-	180	360		
		55°C	-	80	160		

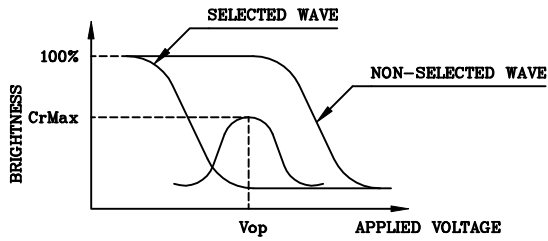
note: R: REFLECTIVE
S: TRANSFLECTIVE (NORMAL)
P: TRANSFLECTIVE (MEDIUM)
T: TRANSMISSIVE
A: GRAY
C: YELLOW
E: BLUE
G: NORMALLY BLACK
J: NORMALLY WHITE

* The display brightness non-uniformity will be < 20% in active display area.

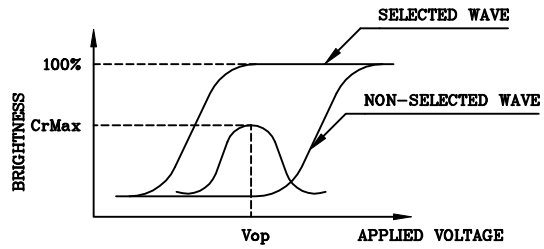
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(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



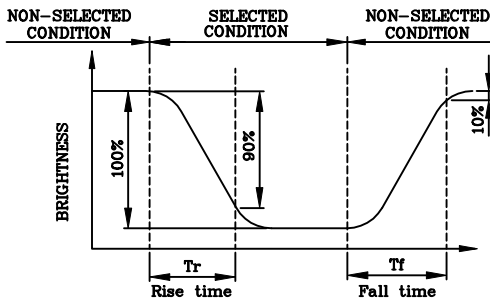
(negative type)

*Conditions

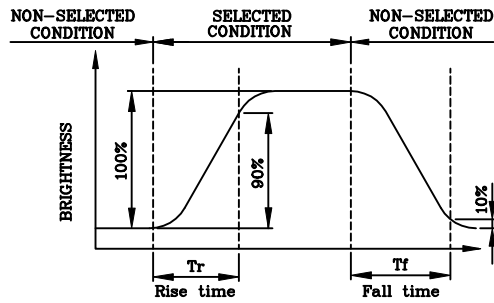
Viewing Angle : 0
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 2)

Definition of Response Time(Tr,Tf)



(positive type)



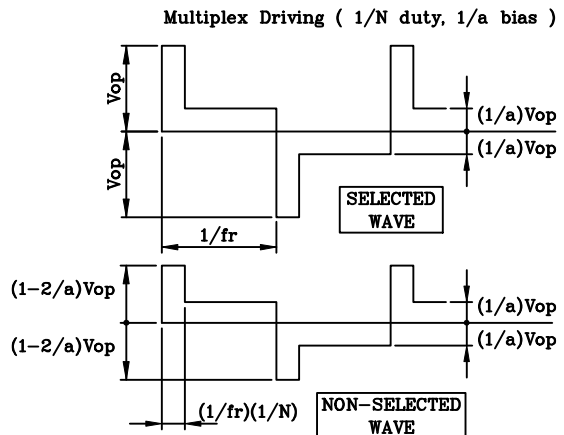
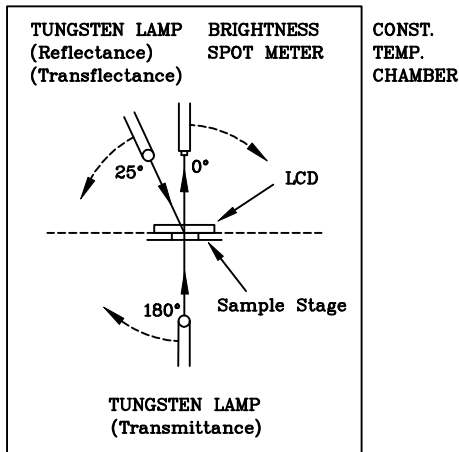
(negative type)

*Conditions

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

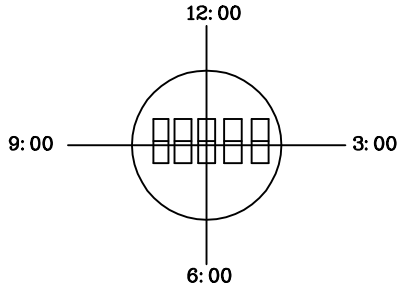
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



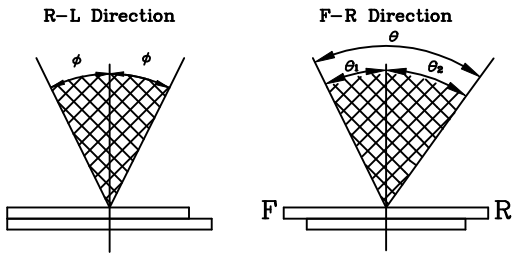
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



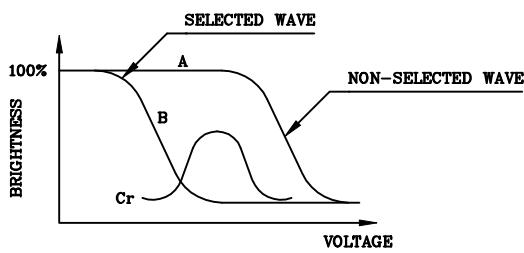
$$\theta = \theta_1 + \theta_2$$

*Conditions

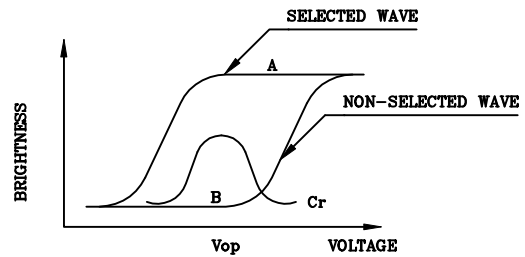
Operating Voltage : V_{op}
 Frame Frequency : 70Hz
 Applied Waveform : 1/N duty, 1/a bias
 Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



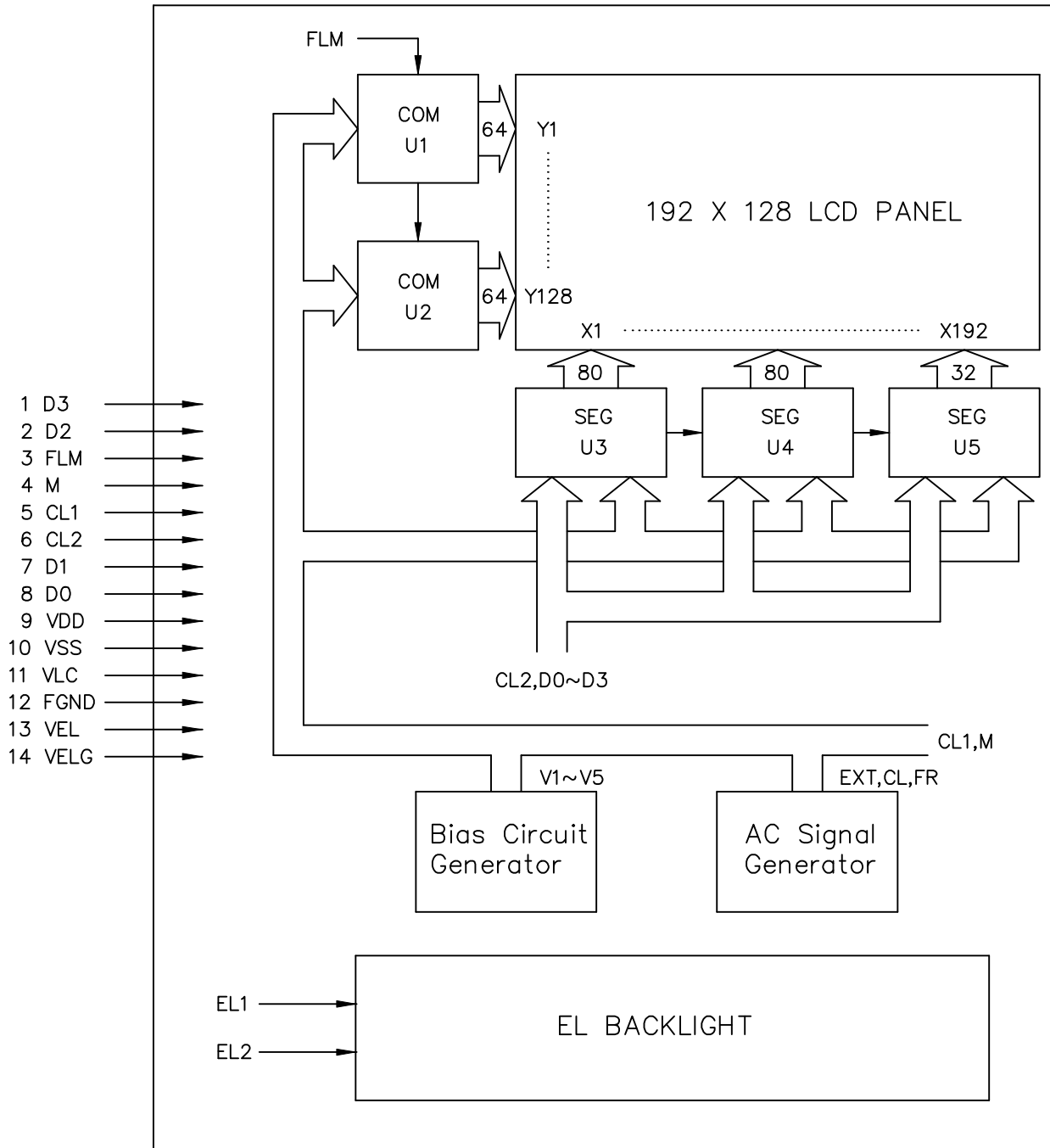
(negative type)

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

*Conditions

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

5. BLOCK DIAGRAM



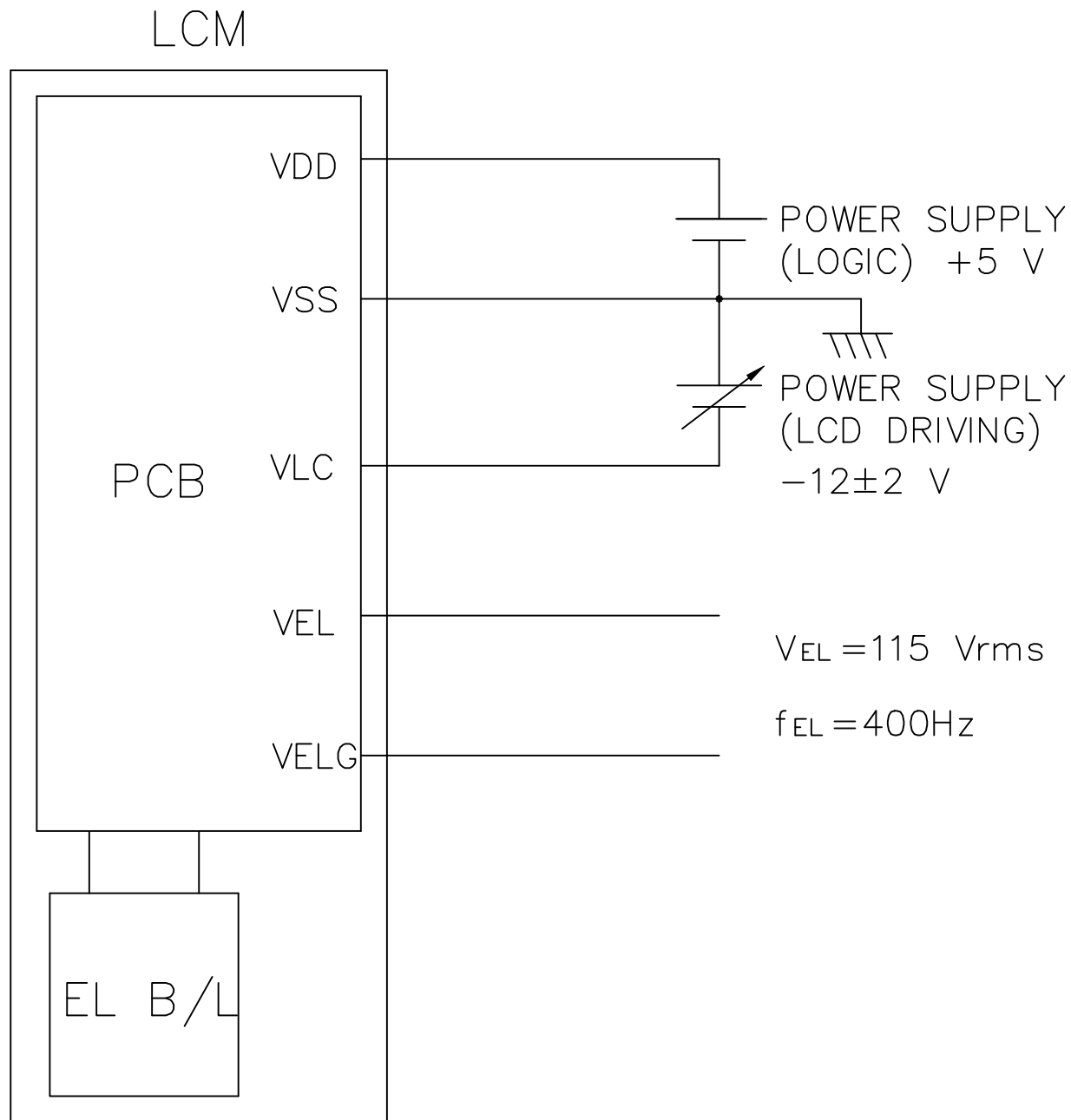
- * U1,U2 : common (row) drivers, HD66206 or compatible
- * U3~U5 : segment (column) drivers, HD66206 or compatible
- * Common and segment drivers can be driven by SED1335 controller

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6. INTERNAL PIN CONNECTION

PIN NO.	SYMBOL	FUNCTION
1	D3	DISPLAY DATA BUS LINE
2	D2	
3	FLM	ONE-FRAME TIMING SIGNAL
4	M	AC DRIVING CONTROL SIGNAL
5	CL1	DISPLAY DATA LATCH CLOCK
6	CL2	DISPLAY DATA SHIFT CLOCK
7	D1	DISPLAY DATA BUS LINE
8	D0	
9	VDD	POWER SUPPLY FOR LOGIC (+5V)
10	VSS	POWER SUPPLY (0V)
11	VLC	POWER SUPPLY FOR LCD (-V)
12	FGND	FRAME GROUND
13	VEL	EL DRIVING VOLTAGE
14	VELG	EL DRIVING VOLTAGE (GND)

7. POWER SUPPLY

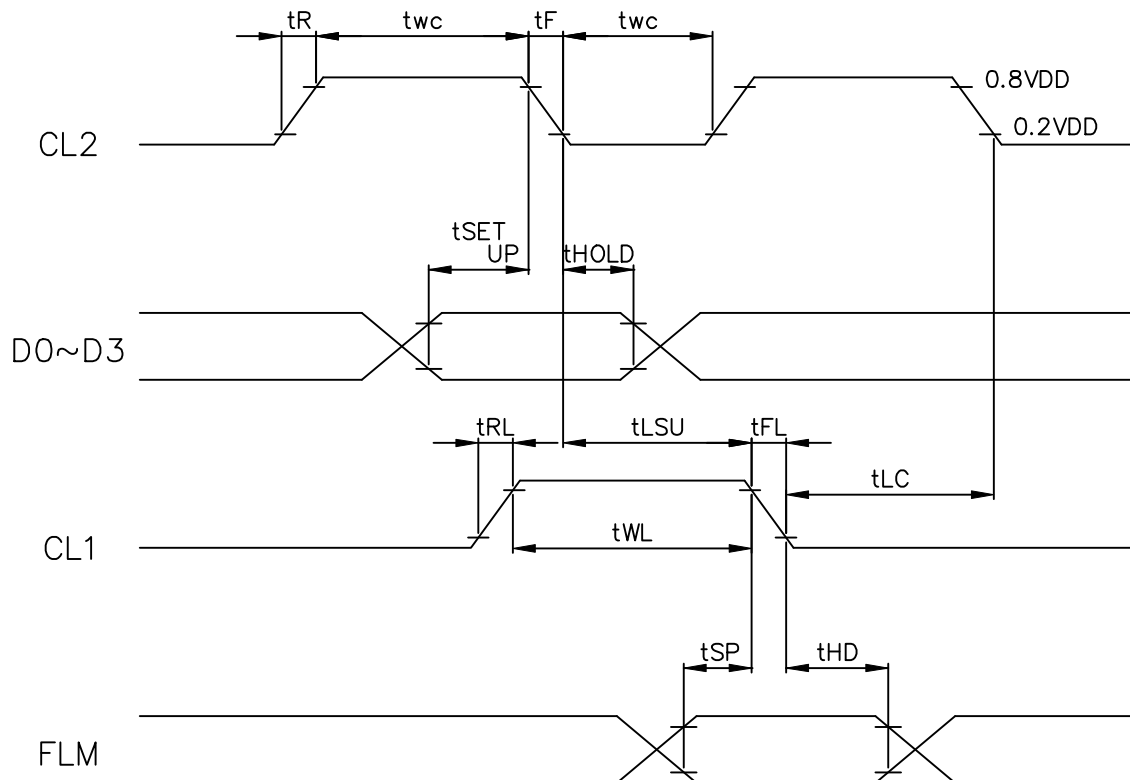


8. TIMING CHARACTERISTICS

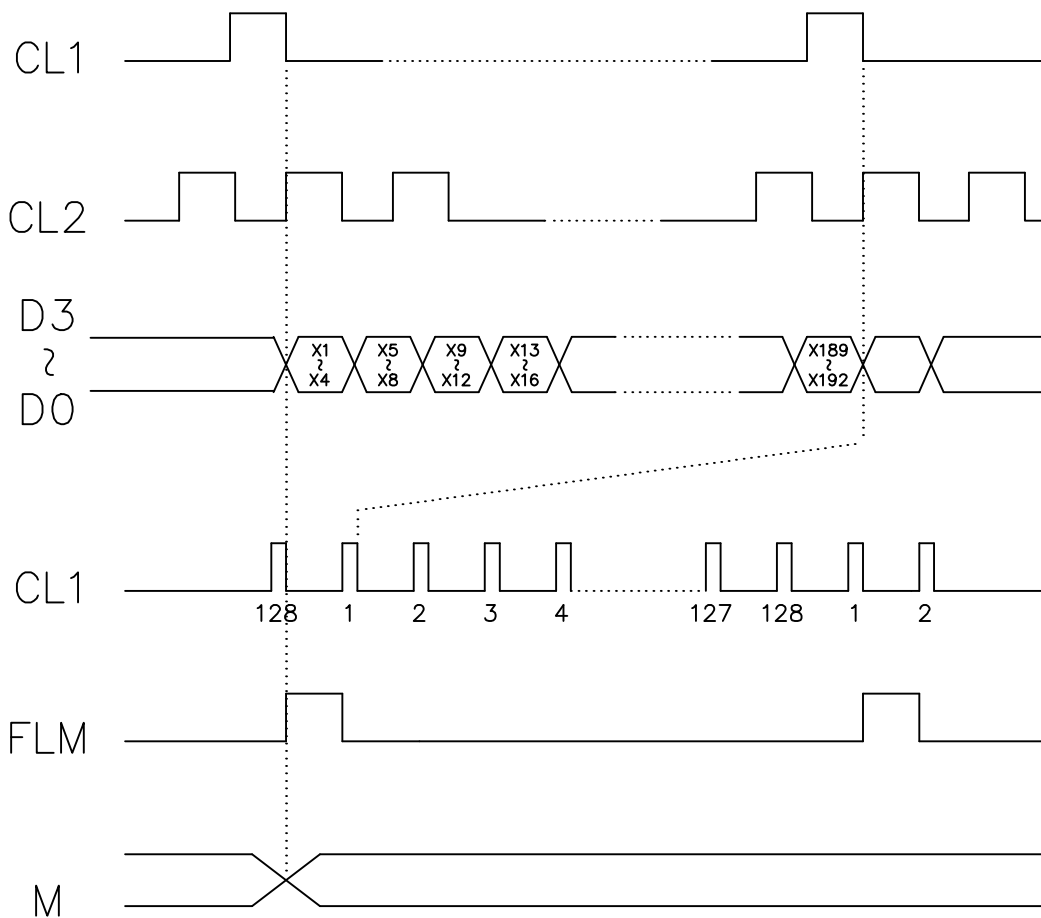
8-1. INTERFACE TIMING

@ VDD=5V±10%

Item	Symbol	Min.	Typ.	Max.	Unit
CL2 Pulse Width	tWC	100	-	-	ns
CL1 Pulse Width	tWL	100	-	-	ns
Data to CL2 Setup Time	tSETUP	80	-	-	ns
Data to CL2 Hold Time	tHOLD	80	-	-	ns
CL1 Setup Time	tLSU	90	-	-	ns
CL1 to CL2 Time	tLC	200	-	-	ns
CL2 Rise Time	tR	-	-	50	ns
CL2 Fall Time	tF	-	-	50	ns
CL1 Rise Time	tRL	-	-	50	ns
CL1 Fall Time	tFL	-	-	50	ns
FLM to CL1 Setup Time	tSP	100	-	-	ns
FLM to CL1 Hold Time	tHD	100	-	-	ns

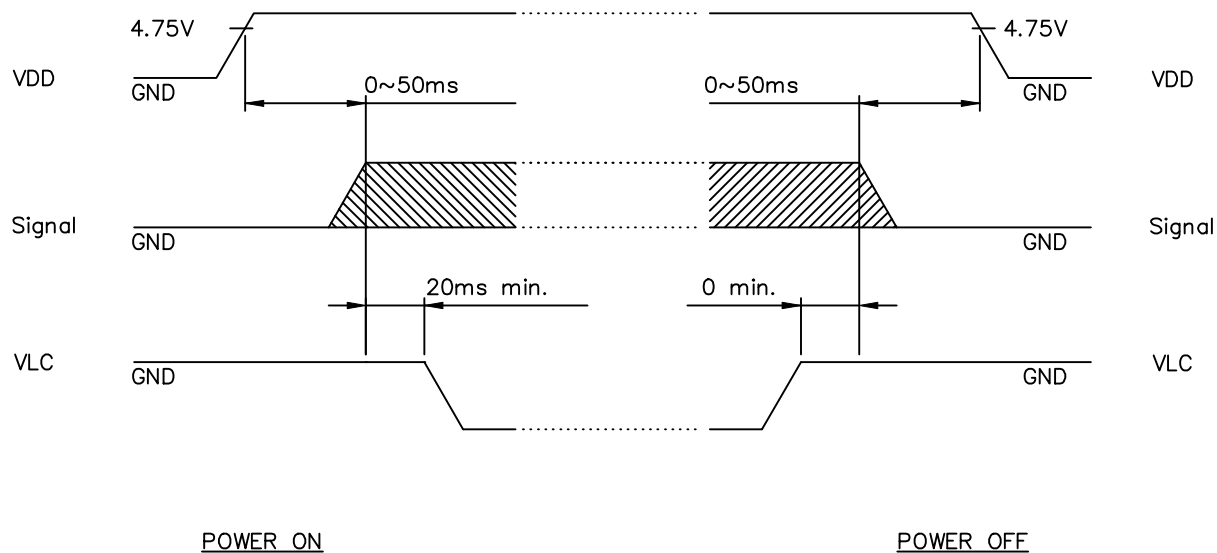


8-2. TIMING CHART



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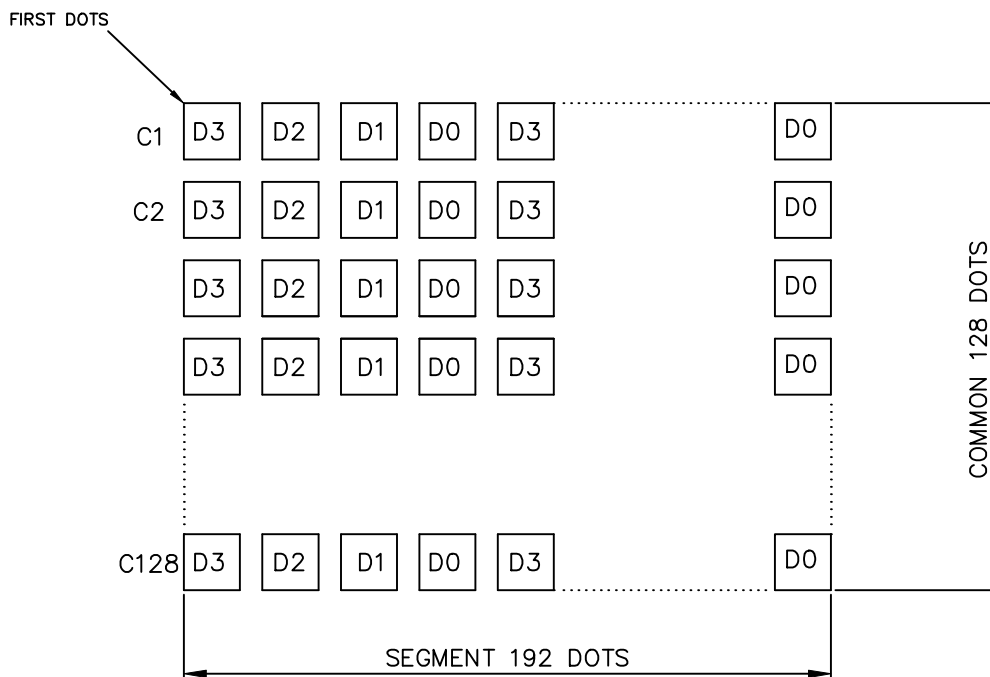
8-3. POWER ON/OFF TIMING



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

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8-4.DISPLAY PATTERN

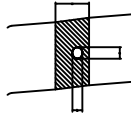
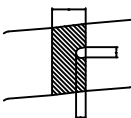
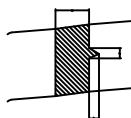


9. RELIABILITY TEST

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

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																						
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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																					

(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.

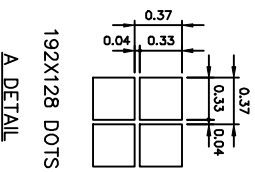
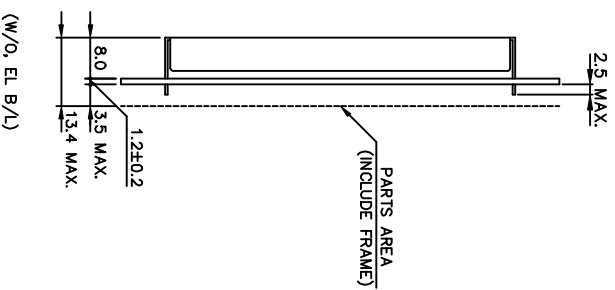
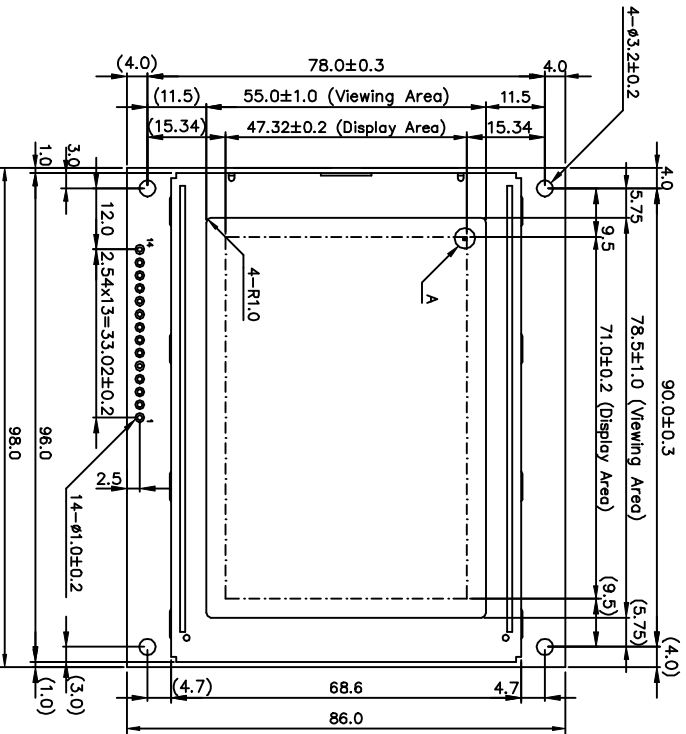
• TERMS OF WARRANTY

- 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.

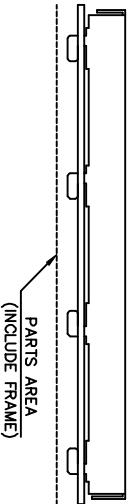
• TYPICAL OPERATING LIFETIME OF BACKLIGHT

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

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Pin No.	Symbol	Function
1	D3	Display Data Input
2	D2	One-Frame Timing Signal
3	FLM	AC Driving Control Signal
4	M	Display Data Latch Clock
5	CL1	Display Data Shift Clock
6	CL2	Display Data Input
7	D1	Power Supply for Logic (+5V)
8	D0	Power Supply (0V)
9	VDD	Power Supply for LCD (-V)
10	VSS	Frame Ground
11	VLC	EL Driving Voltage
12	FGND	EL Driving Voltage (GND)
13	VEL	
14	VELG	



- NOTE :
1. RESOLUTION : 192 X 128 Dots
 2. CONTROLLER : Without
 3. DC/DC : Without
 4. TOLERANCE NO SPECIFIED : $\pm 0.5 \text{mm}$

產品編號	LM_98_086_3	南亞塑膠工業股份有限公司
NAME		NAN YA PLASTICS CORPORATION
DATE		
APPROVE		製圖
CHECK		DWG-NO MXXCX086X3X Rev.A
DESIGN		UNIT : mm
DRAW	MAY PING 87.03.06	SCALE : 2/3