NAN YA PLASTICS CORP. ELEC. MATERIALS DIV. LCD DEPARTMENT	SPECIFICATION	SPEC. NO. : LM134-0 DATE : SEP. 13, 1997 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
320x240 LCD MODULE
PRODUCT NO.: LTBHB_134_K

SPEC. NO.: LM134-0

APPROVED BY

EDITED ON : SEP. 13, 1997

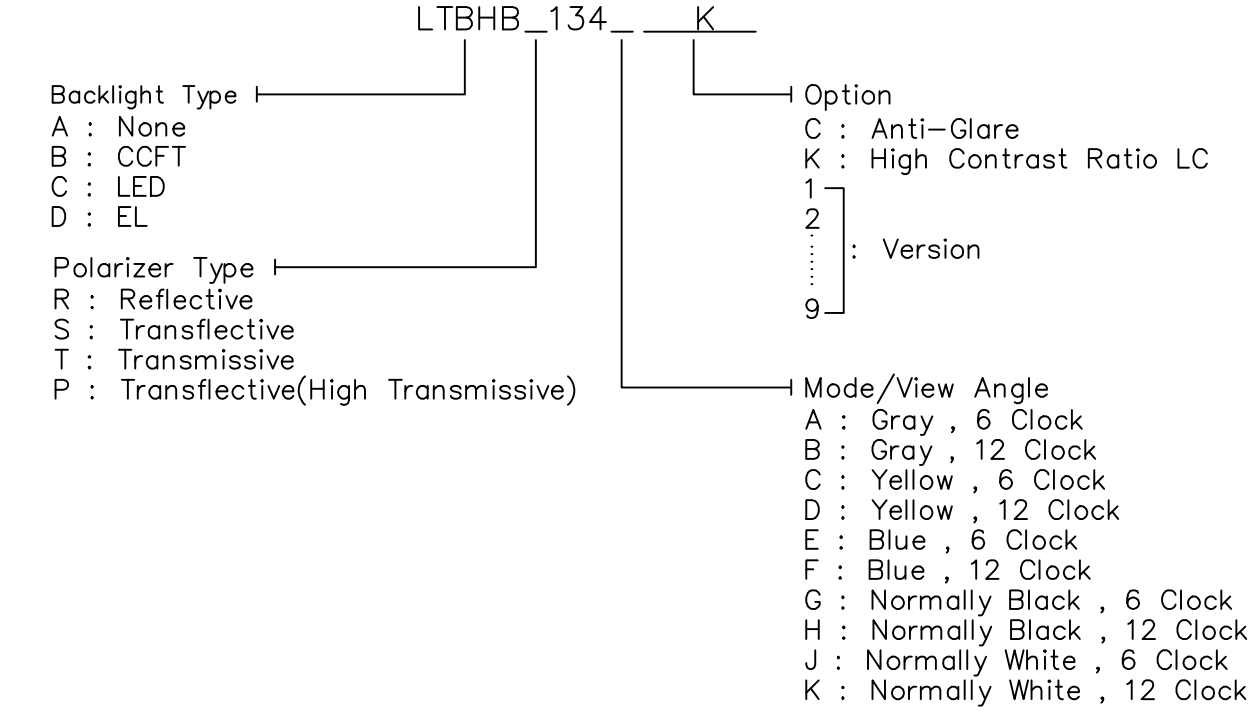
TECHNICAL MANAGER	DESIGN MANAGER	PERSON IN CHARGE

REV/DATE	R0/ 09.13.97'					APP	CHK	BY

1. MECHANICAL DATA

(1) Product No.		LTBHB_134_K
(2) Module Size		178.0(W)mm X 110.0(H)mm X MAX8.0(D)mm (CCFL B/L) (Excluded the mounting portions and connectors)
(3) Dot Size		0.33 (W)mm x 0.33 (H)mm
(4) Dot Pitch		0.36 (W)mm x 0.36 (H)mm
(5) Number of Dots		320 (W) x 240 (H)Dots
(6) Duty		1/240
(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		CCFL B/L
(10) Weight		220g(approx.)
(11) Controller		Without
(12) DC/DC Converter		Without

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	
Power Supply for LCD Drive	VDD−VO	0	26.0	V	
Input Voltage	VI	−0.3	VDD	V	
LED Applied Voltage	VLED	−	27.0	V	
Static Electricity	−	−	−	−	Note 1

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	−20	70	−30	80
Humidity(Without Condensation)	Note 1,3		Note 2,3	

Note 1 Ta ≦ 70°C : 75%RH max
Ta > 70°C : Absolute humidity must be lower than the humidity of 75%RH at 70°C

Note 2 Ta at −30°C will be < 48hrs, at 80°C will be < 120hrs

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

3. ELECTRICAL CHARACTERISTICS

(VDD = 5V±5%)

ITEM		SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage for Logic		VDD−VSS	−	4.75	5.0	5.25	V
Supply Voltage for LCD		VEE−VSS	−	−25.2	−24.0	−22.8	V
Recommended Operating Voltage for LCD		VDD−VO	−20°C	−	25.0	25.4	V
			0°C	−	23.6	24	V
			25°C	−	22.9	23.3	V
			50°C	−	21.5	21.9	V
			70°C	−	20.9	21.3	V
Input Signal Voltage		VIH	H level	0.8VDD	−	VDD	V
		VIO	L level	0	−	0.2VDD	V
Supply Current for Logic		IDD	VDD=5.0 V VDD−VO=22.9 V PATTERN : 	−	6.5	−	mA
Supply Current for LCD		IEE		−	4.8	−	mA
CCFL LAMP	Supply Voltage	VFTL	FREQUENCY = 35 KHz	315	316.3	317	Vrms
	Supply Current	IFTL		4.9	5.0	5.1	Irms
	Brightness	B		34130	34360	34760	cd/m²
	Color Degree	X		0.3285	0.3293	0.3305	−
		Y		0.3316	0.3325	0.3340	

4. OPTICAL CHARACTERISTICS

AT V_{OP}

ITEM / MODE		Cr(Contrast Ratio)										θ(Viewing Angle)		φ(Viewing Angle)	
		-20℃		0℃		25℃		50℃		70℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
R	A	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	C	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	J	–	–	–	–	–	–	–	–	–	–	–	–	–	–
S	A	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	C	–	–	–	5.5	–	6.0	–	4.5	–	–	–	60	–	56
	J	–	–	–	5.5	–	6.5	–	5.0	–	–	–	32	–	77
T	E,F	–	–	–	–	–	6.0	–	–	–	–	–	65	–	±20
	G,H	–	–	–	8.0	–	8.0	–	6.5	–	–	–	76	–	±62
note		NOTE6										NOTE5			

note:

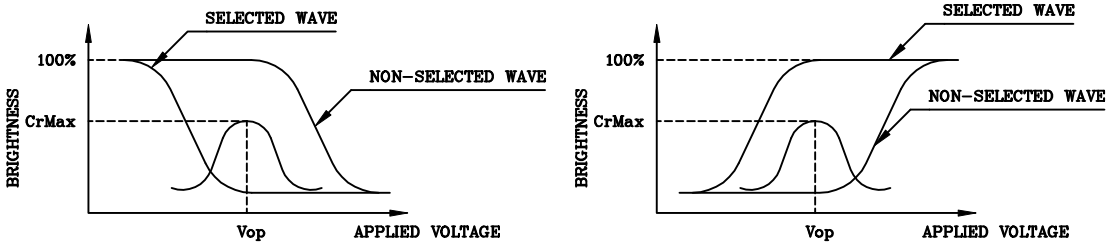
R: REFLECTIVE
S: TRANSFLECTIVE
T: TRANSMISSIVE
A: GRAY
C: YELLOW
E,F: BLUE
G,H: NORMALLY BLACK
J: NORMALLY WHITE

AT $\phi=0°$ $\theta=0°$

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	–	3700	5500	ms	NOTE 2
		0℃	–	660	900		
		25℃	–	160	240		
		50℃	–	110	165		
		70℃	–	75	110		
Response Time (fall)	Tf	-20℃	–	2600	3900	ms	NOTE 2
		0℃	–	560	840		
		25℃	–	90	140		
		50℃	–	75	110		
		70℃	–	50	70		

(NOTE 1)

Definition of Operation Voltage(Vop)



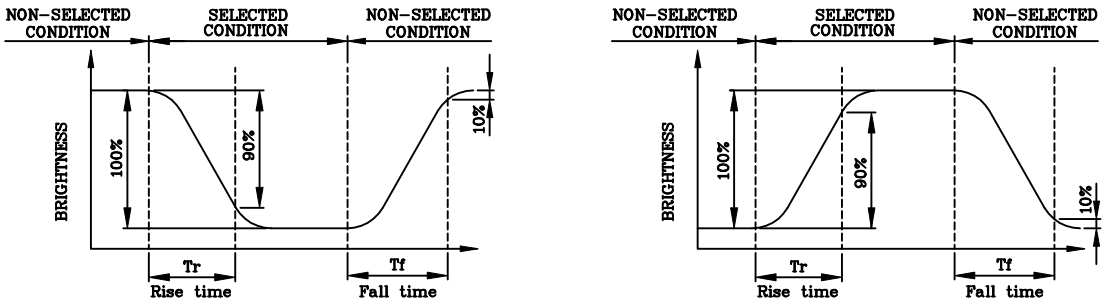
(positive type) (negative type)

*Conditions

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

(NOTE 2)

Definition of Response Time(Tr,Tf)



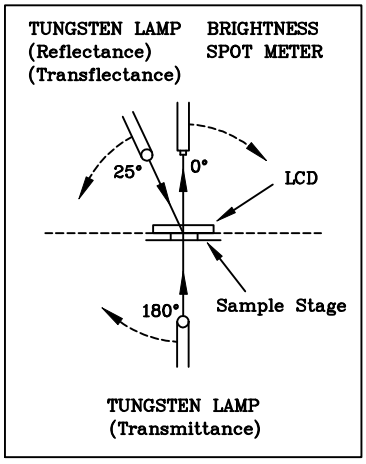
(positive type) (negative type)

*Conditions

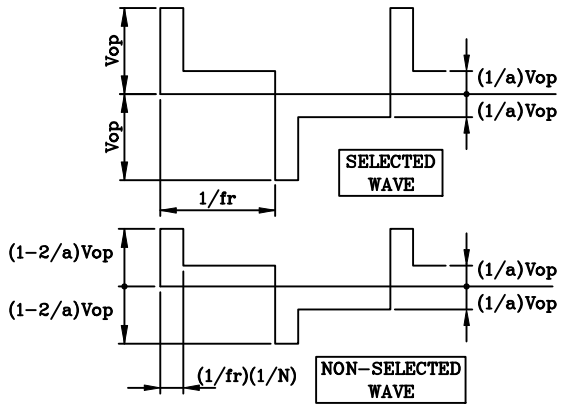
Operating Voltage : Vop
Viewing Angle (θ,ϕ) : (0,0)
Frame Frequency : 70Hz
Applied Waveform : 1/N duty, 1/a bias

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms

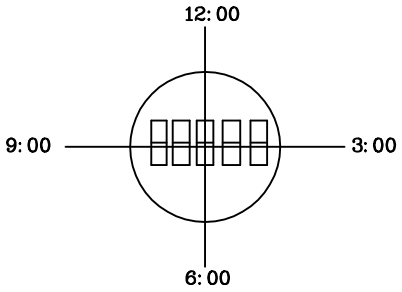


Multiplex Driving (1/N duty, 1/a bias)



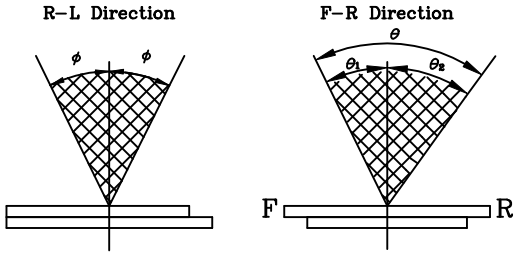
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



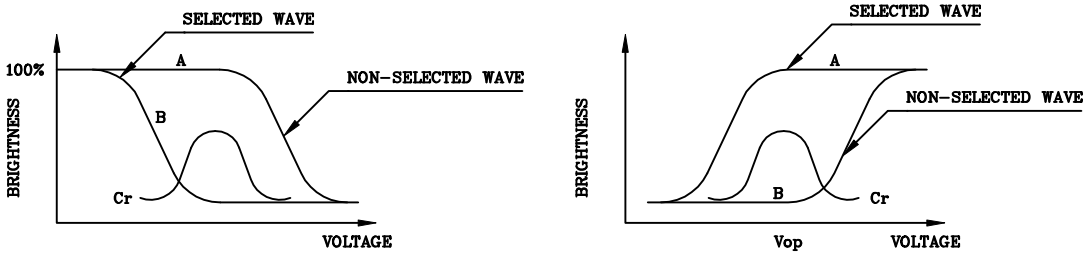
$\theta = \theta_1 + \theta_2$

*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)



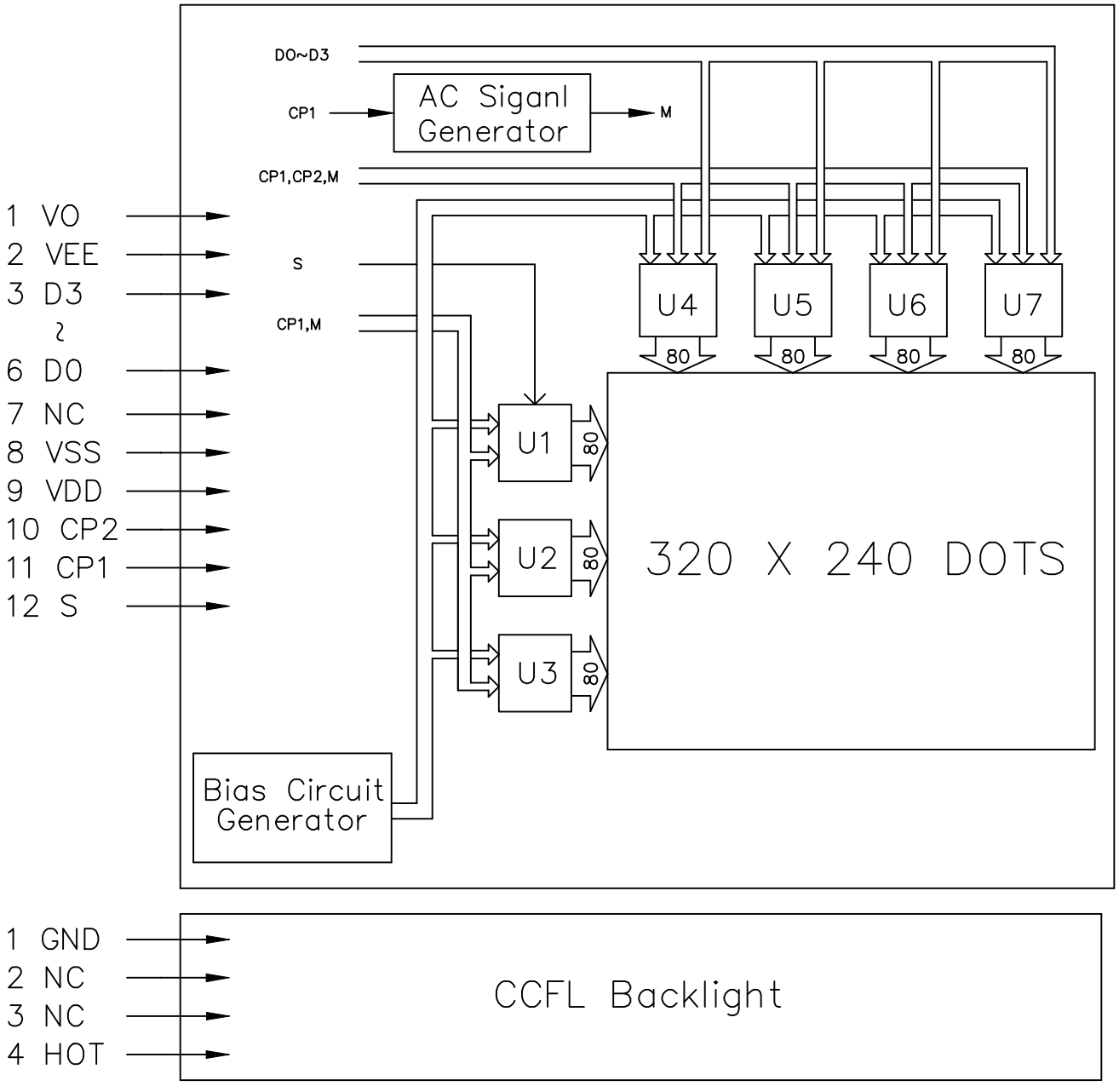
(positive type) (negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

5. BLOCK DIAGRAM



* AC Signal Setting

J1	J2	J3	J4	J5	J6	J7	J8
L	L	L	H	L	H	H	H

6. INTERNAL PIN CONNECTION

CN1(LCD)

Pin No.	Symbol	Level	Function	
1	V0	—	LCD CONTRAST ADJUST VOLTAGE	
2	VEE	—	POWER SUPPLY FOR LCD DRIVE	
3	D3	H/L	DISPLAY DATA SIGNAL	
4	D2	H/L		
5	D1	H/L		
6	D0	H/L		
7	NC	—	NO CONNECTION	
8	VSS	—	0V	GROUND
9	VDD	—	5V	DC POWER SUPPLY
10	CP2	H/L	DATA INPUT CLOCK SIGNAL	
11	CP1	H/L	INPUT DATA LATCH SIGNAL	
12	S	H/L	SCAN START-UP SIGNAL	

CN2(CCFL)

Pin No.	Symbol	Level	Function
1	VFT1	—	POWER SUPPLY FOR CCFL(GND)
2	NC	—	NO CONNECTION
3	NC	—	NO CONNECTION
4	VFT2	—	POWER SUPPLY FOR CCFL(HOT)

Used connector :

CN1 : 12 PIN, FFC(PITCH 1.25mm)

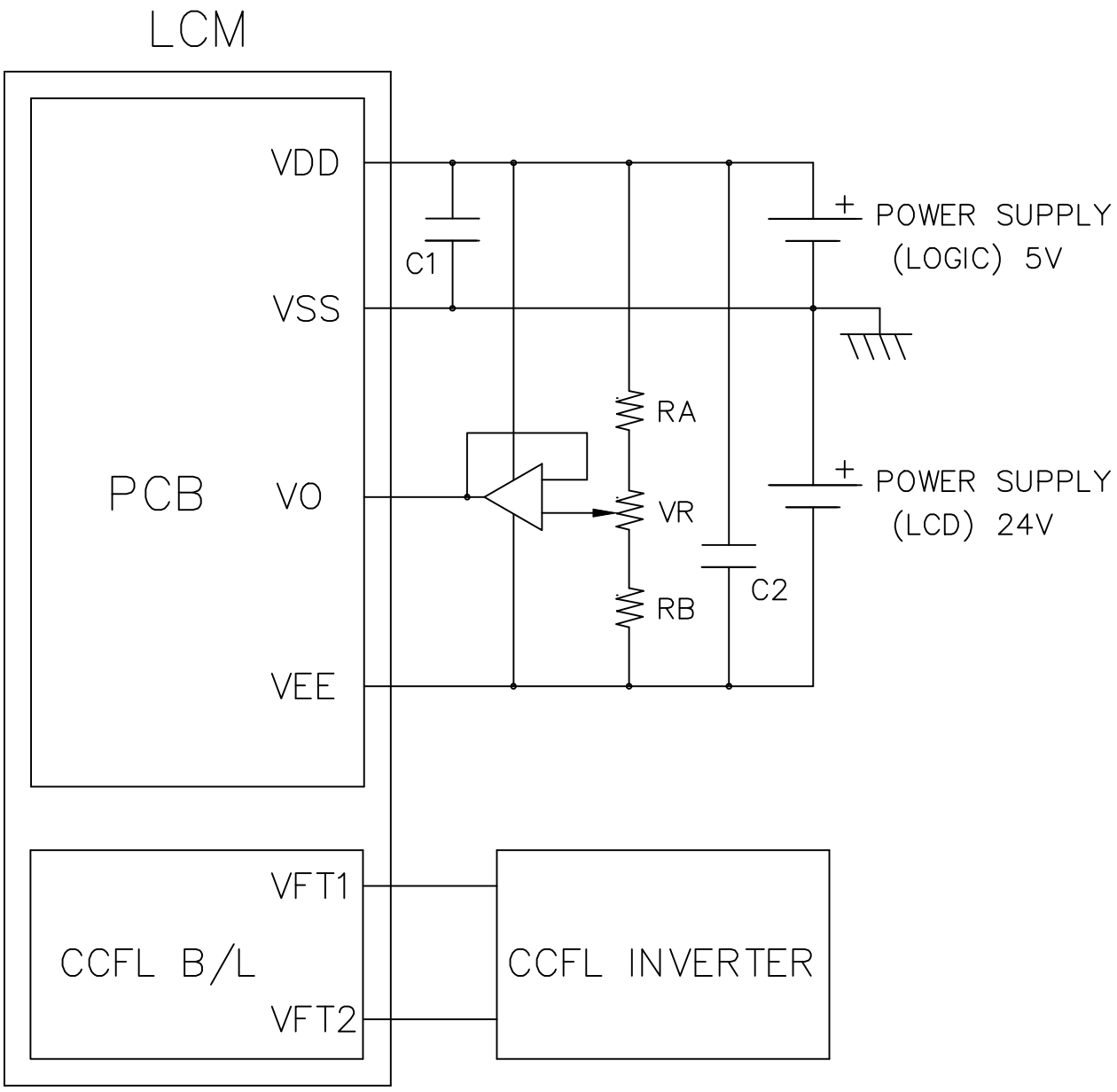
CN2 : M63M83-04 (MITSUMI)

Mating connector :

CN1 : 5597-12APB.5597-12CPB(MOLEX)

CN2 : M60-04-30-134P (MITSUMI)

7. POWER SUPPLY



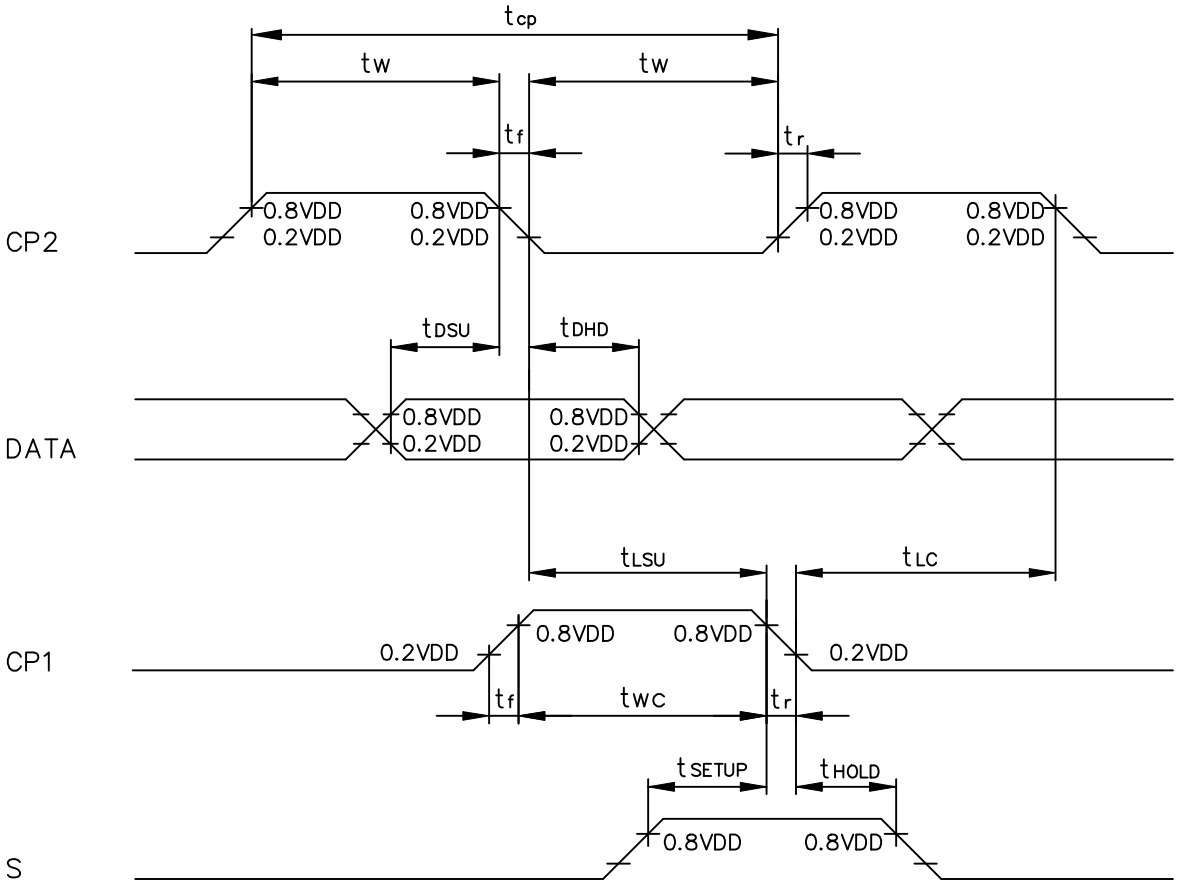
RA = 20 KΩ
RB = 0.1 KΩ
VR = 10 KΩ(VARIABLE)
C1,C2 = 10 μF

8. TIMING CHARACTERISTICS

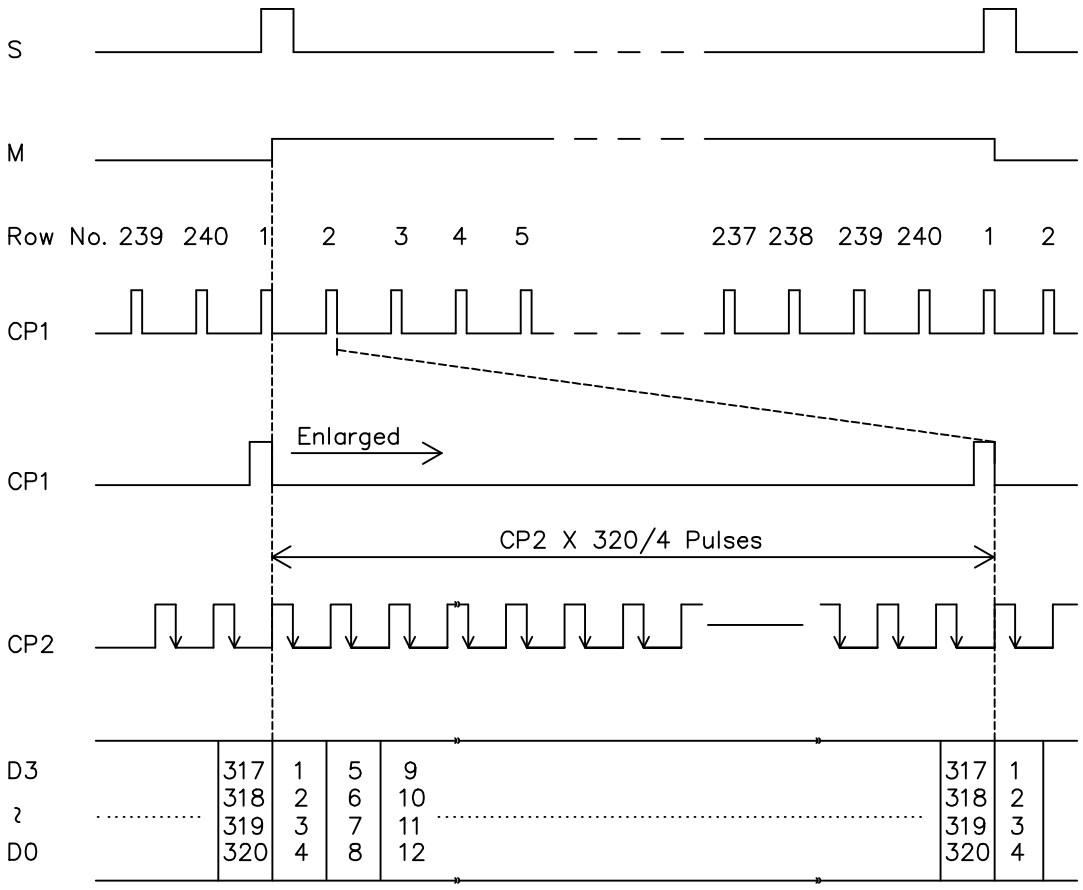
8-1 INTERFACE TIMING

@VDD=2.5~5.5V

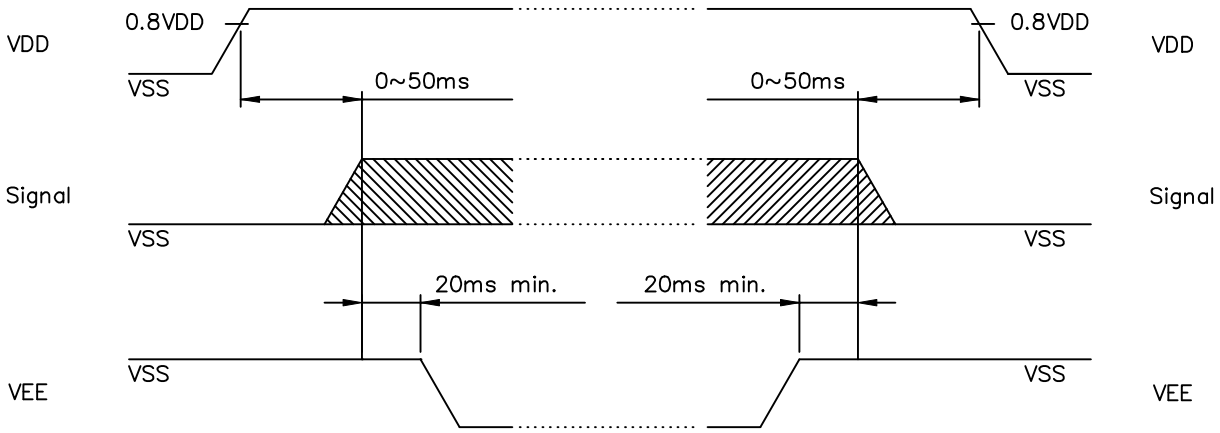
ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
"CP2" CLOCK CYCLE	t_{CP}	152	–	–	ns
"CP2" PULSE WIDTH	t_W	65	–	–	ns
CLOCK RISE, FALL TIME	t_r , t_f	–	–	50	ns
DATA SETUP TIME	t_{DSU}	50	–	–	ns
DATA HOLD TIME	t_{DHD}	40	–	–	ns
"CP2"→ "CP1" FALL TIME	t_{LSU}	65	–	–	ns
"CP1"→ "CP2" FALL TIME	t_{LC}	65	–	–	ns
"S" SETUP TIME	t_{SETUP}	100	–	–	ns
"S" HOLD TIME	t_{HOLD}	100	–	–	ns
"CP1" PULSE WIDTH	t_{WC}	65	–	–	ns



8-2 TIMING CHART OF INPUT SIGNALS



8-3 POWER ON/OFF TIMING

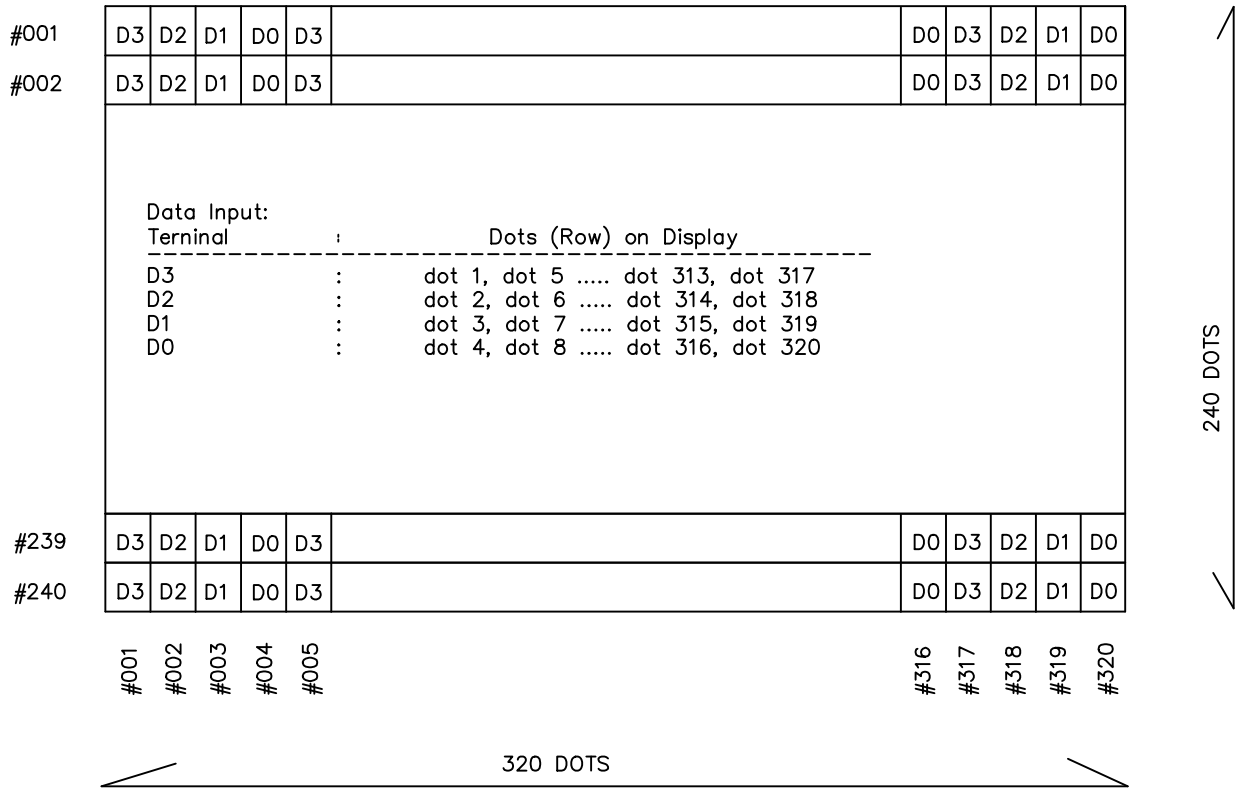


POWER ON

POWER OFF

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

8-4 DISPLAY PATTERN



Data Input:

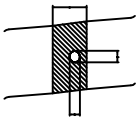
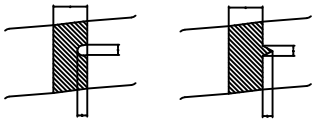
Terninal	:	Dots (Row) on Display
D3	:	dot 1, dot 5 ..... dot 313, dot 317
D2	:	dot 2, dot 6 ..... dot 314, dot 318
D1	:	dot 3, dot 7 ..... dot 315, dot 319
D0	:	dot 4, dot 8 ..... dot 316, dot 320

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:

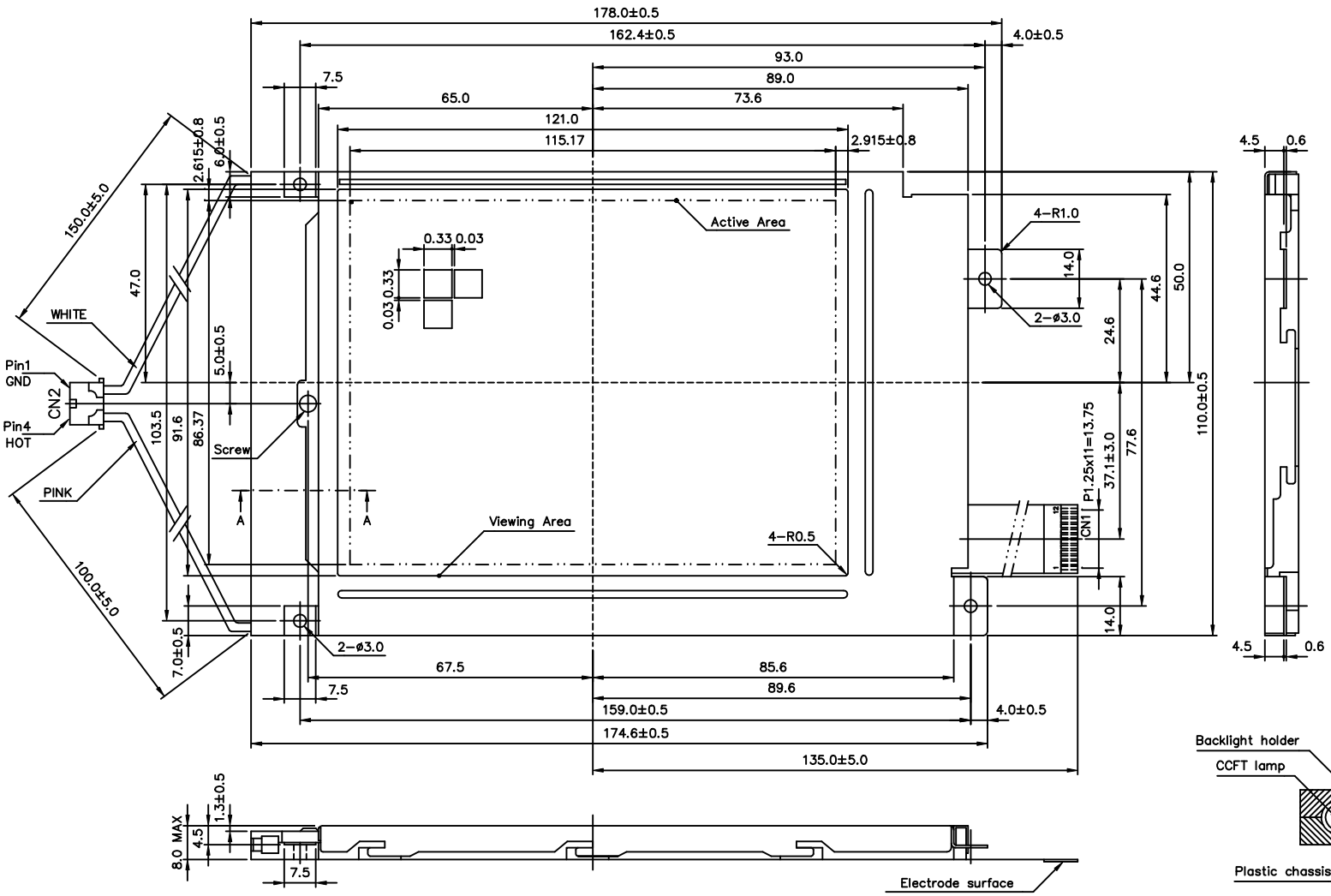
- SAFETY
  1. If the LCD panel breaks, be careful not to allow the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- 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



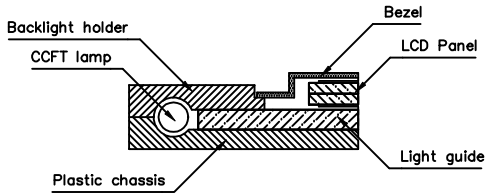
INTERFACE SYMBOL

CN1

Pin No.	SYMBOL	Pin No.	SYMBOL
1	Vo	7	NC
2	VEE	8	VSS
3	D3	9	VDD
4	D2	10	CP2
5	D1	11	CP1
6	D0	12	S

CN2

Pin No.	SYMBOL
1	GND(white)
2	NC
3	NC
4	HOT(pink)



A–A' Section(Scale : 2/1)

Note :

1. RESOLUTION : 320 X 240 DOTS
2. CONTROLLER : WITHOUT
3. DC/DC CONVERTER : WITHOUT

產品編號	LTBHB_134_K		南亞塑膠工業股份有限公司 NAN YA PLASTICS CORPORATION		
	NAME	DATE	TITLE	製品圖	
APPROVE					
CHECK			DWG-NO	TB–x134x	Rev.A
DESIGN			THIRD ANGLE PROJECT	UNIT : mm	
DRAW	MAY PING	86.09.13		SCALE : 1/1	