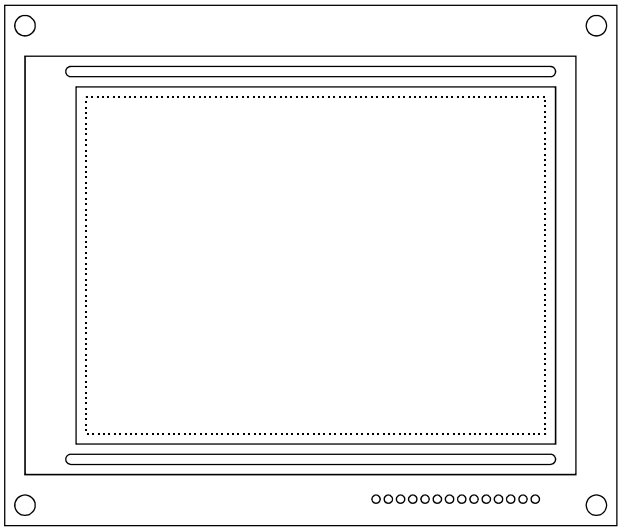
HANTRONIX

PRODUCT SPECIFICATION

HDM3224-5

320x240 GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	**Q.A.:** JK	**REV.:** 2.1	HDM3224-5	SHEET 1 OF 22 **DATE:** 7/2/02

1. MECHANICAL DATA

(1) Product No.		HDM3224-5
(2) Module Size		134.5 (W)mm x 117.0 (H)mm x MAX 14.0 (D)mm
(3) Dot Size		0.27 (W)mm x 0.27 (H)mm
(4) Dot Pitch		0.30 (W)mm x 0.30 (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(Normal White/Positive Image)
		☐ Black and White(Normal Black/Negative Image)
	Rear Polarizer:	☐ Transflective ☐ Transmissive
		☐ Transflective (High Transmissive)
(8) Viewing Direction		☐ 6 O'clock ☐ 12 O'clock ☐____O'clock
(9) Backlight		LED, White LED
(10) Weight		190 g

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 will change slightly depending on ambient temperature. That phenomenon is reversible.

2. ABSOLUTE MAXIMUM RATINGS
(White LED)

(1) ELECTRICAL ABSOLUTE RATINGS

VSS=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VDD−VSS	−0.3	6.5	V	
Power Supply for LCD Drive	VDD−VO	0	26.0	V	
Input Voltage	VI	−0.3	VDD+0.3	V	
Static Electricity	−	−	−	−	Note 1

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	NORMAL TEMP.				WIDE TEMP.			
	OPERATION		STORAGE		OPERATION		STORAGE	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	−20	70	−20	70	−30	80
Humidity(Without Condensation)	Note 2,4		Note 3,4		Note 5,4		Note 6,4	

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 will change slightly depending on ambient temperature. That phenomenon is reversible.

Note 5 Ta≤70°C : 75%RH max
Ta>70°C : Absolute humidity must be lower then the humidity of 75%RH at 70°C

Note 6 Ta at −30°C will be < 48hrs, at 80°C will be 120hrs

3. ELECTRICAL CHARACTERISTICS

(VDD = 5V±5%)

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic	VDD−VSS	−		4.75	5.0	5.25	V
Recommended Operating Voltage for LCD	Vop	Duty=1/240 Bias=1/13	-20°C	−	25	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 Voltage	VIH	H level		0.8VDD	−	VDD	V
	VIL	L level		0	−	0.2VDD	V
Power Supply Current	IDD	FLM = 70 Hz VDD = 5.0 V VEE = −27.0 V Vop = 22.9 V PATTERN : □ ■ □ ■ □ ■ ■ □ ■ □ ■ □		−	4.5	−	mA
	IEE			−	5.2	−	mA
LED Power Supply Voltage	VLED	−		21	24	27	V
LED Power Consumption	ILED	VLED = 24V		−	40	−	mA
LCM Surface Luminance	L	All On		−	2.0	−	cd/m²
		All Off		−	6.5	−	

3. ELECTRICAL CHARACTERISTICS
(White LED)

(VDD = 5V±5%)

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Power Supply for Logic	VDD−VSS	−		4.75	5.0	5.25	V
Supply Voltage For LC	VDD−VO	Duty=1/240 Bias=1/13	−20°C	24.5	24.8	25.1	V
			0°C	23.2	23.5	23.8	V
			25°C	22.4	22.7	23.0	V
			50°C	21.5	21.8	22.1	V
			70°C	21.0	21.3	21.6	V
Input Voltage	VIH	H level		0.7VDD	−	VDD	V
	VIL	L level		0	−	0.3VDD	V
Power Supply Current	IDD	FLM = 70 Hz VDD = 5.0 V VEE = −27.0 V VDD−VO= 22.7V PATTERN :		−	5.4	8.0	mA
	IEE			−	5.3	8.0	mA
LED Power Supply Voltage	VLED	−		−	9.8	−	V
LED Power Consumption	ILED	VLED = 9.8V RLED = 0Ω		−	35	−	mA
LCM Surface Luminance (LMC0BH078J13GK_)	L	ALL PIXEL ON		−	3.4	−	cd/m^2
		ALL PIXEL OFF		−	9.0	−	cd/m^2

3.2 LED BACKLIGHT : (EDGE LED BACKLIGHT)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
LUMINOUS INTENSITY	IN	IF=35mA TA=25°	32	35	−	cd/m2
AVG.X OF 1931 C.I.E.	X		0.19	0.27	0.35	−
AVG.Y OF 1931 C.I.E.	Y		0.24	0.32	0.40	−
FORWARD VOLTAGE	VF		8.7	10.2	11.7	V
REVERSE CURRENT	IR	VR=15V	−	−	0.4	mA

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.
S	C		5.0		5.5		6.0		4.5		3.5		60		56
note		NOTE6										NOTE5			

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	120		
Response Time (fall)	Tf	-20℃	—	2600	3900	ms	NOTE 2
		0℃	—	560	840		
		25℃	—	90	140		
		50℃	—	75	110		
		70℃	—	50	70		

note:
S: TRANSFLECTIVE
C: YELLOW

4. OPTICAL CHARACTERISTICS
(White LED)

AT V_{OP}

ITEM / MODE		Cr(Contrast Ratio)										φ(Viewing Angle)		θ(Viewing Angle)	
		-20℃		0℃		25℃		50℃		70℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
H	J	–	5.0	–	5.5	–	5.5	–	4.5	–	3.0	–	32	–	±36
note		NOTE6										NOTE5			

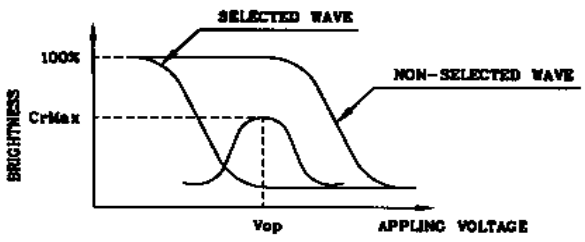
Note: H: Transflective(High transparency)
J: Normally White

AT $\phi=0°$ $\theta=0°$

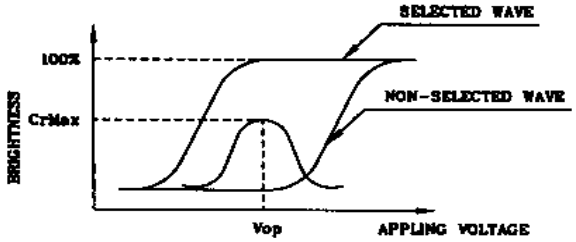
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	2600	3300	4900	ms	NOTE 2
		0℃	600	750	1100		
		25℃	200	250	300		
		50℃	80	100	150		
		70℃	50	60	70		
Response Time (fall)	Tf	-20℃	1500	1900	2800	ms	NOTE 2
		0℃	350	450	670		
		25℃	90	130	170		
		50℃	40	60	80		
		70℃	20	30	40		

(NOTE 1)

Definition of Operation Voltage(Vop)



(positive type)



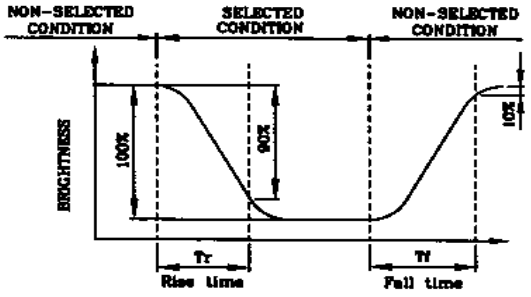
(negative type)

*Conditions

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

(NOTE 2)

Definition of Response Time(Tr,Tf)



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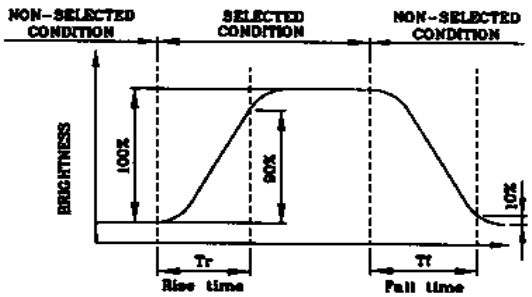


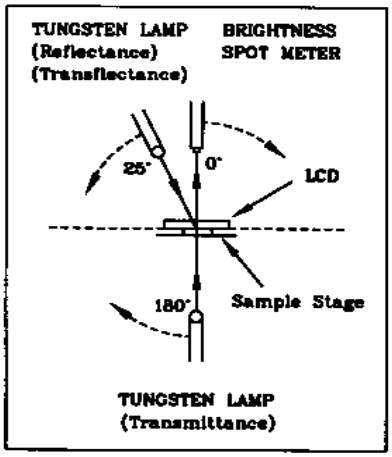
(negative type)

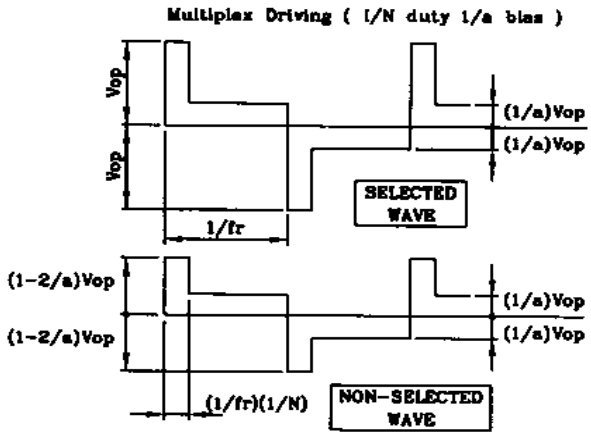
*Conditions

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

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms





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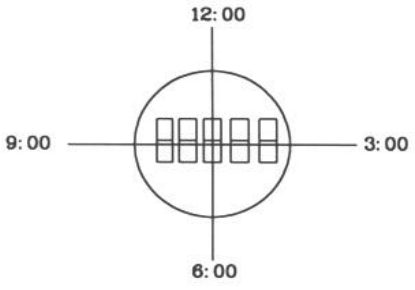
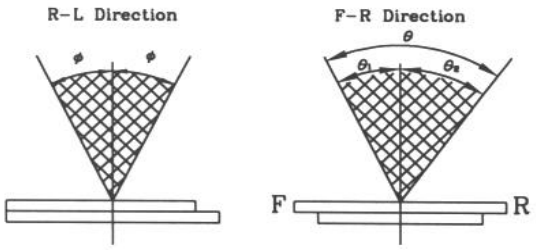
(NOTE 4)

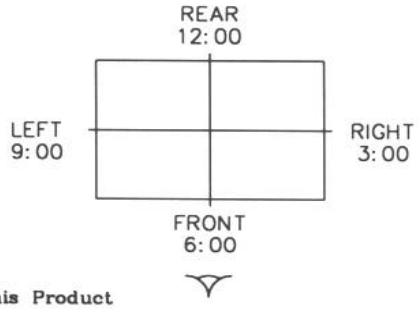
Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle





*For This Product

The Viewing Direction Is 6 O'clock

So $\theta_1 > \theta_2$

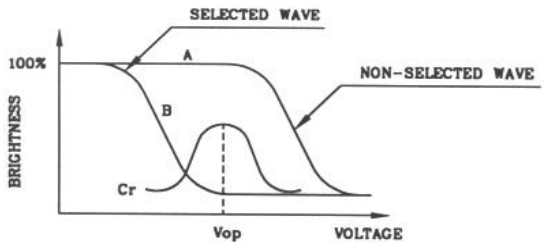
$\theta = \theta_1 + \theta_2$

*Conditions

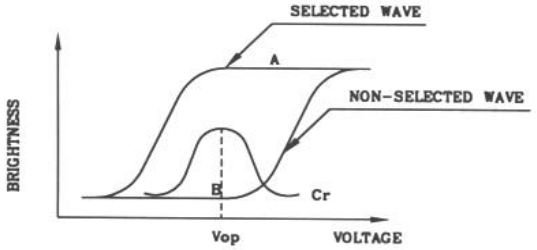
Operating Voltage : Vop
Frame Frequency : 70Hz
Appling Waveform : 1/N duty 1/a bias
Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



(positive type)



(negative type)

Contrast Ratio : Cr=A/B

*Conditions

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

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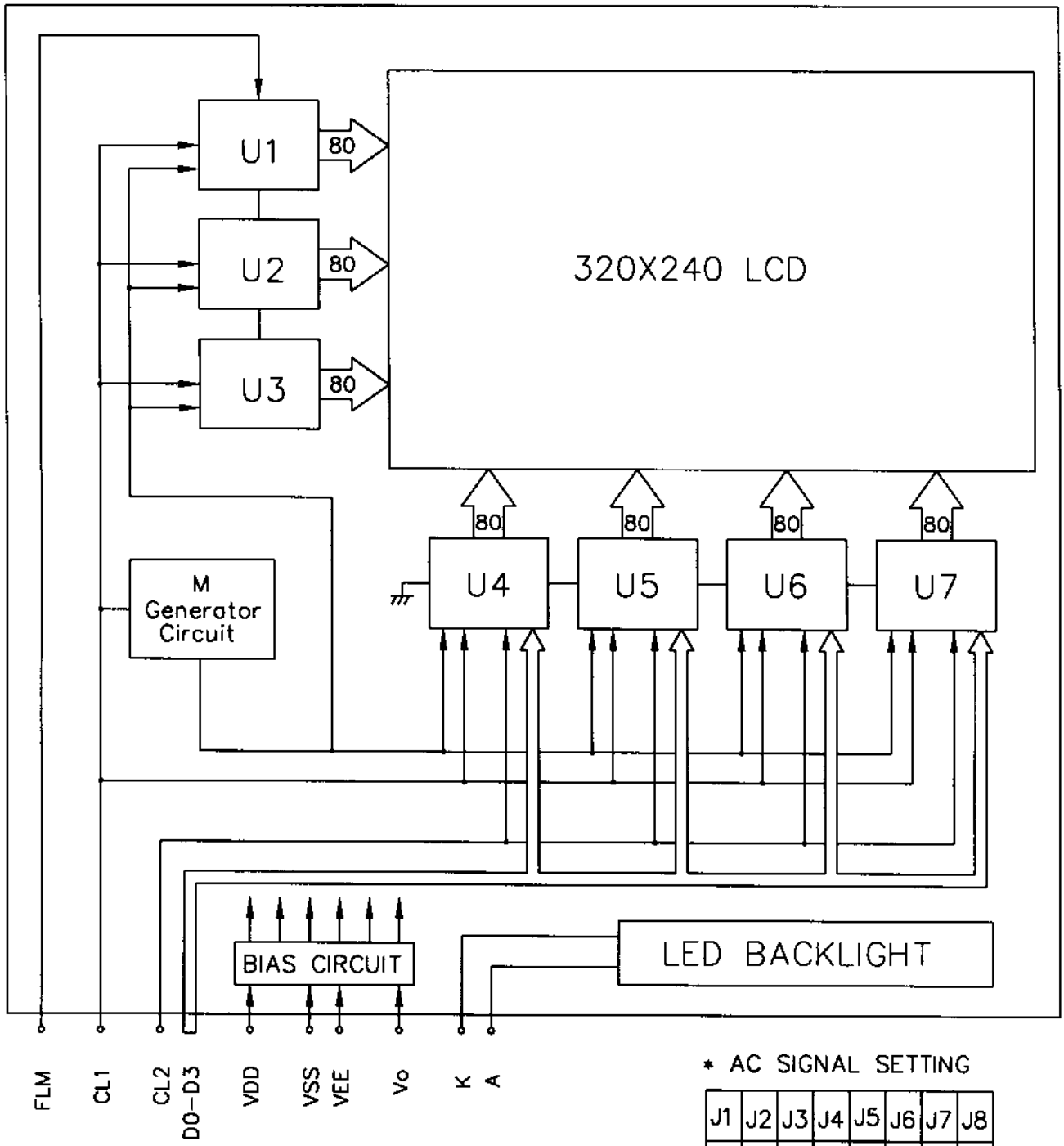
5. BLOCK DIAGRAM



* AC SIGNAL SETTING

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

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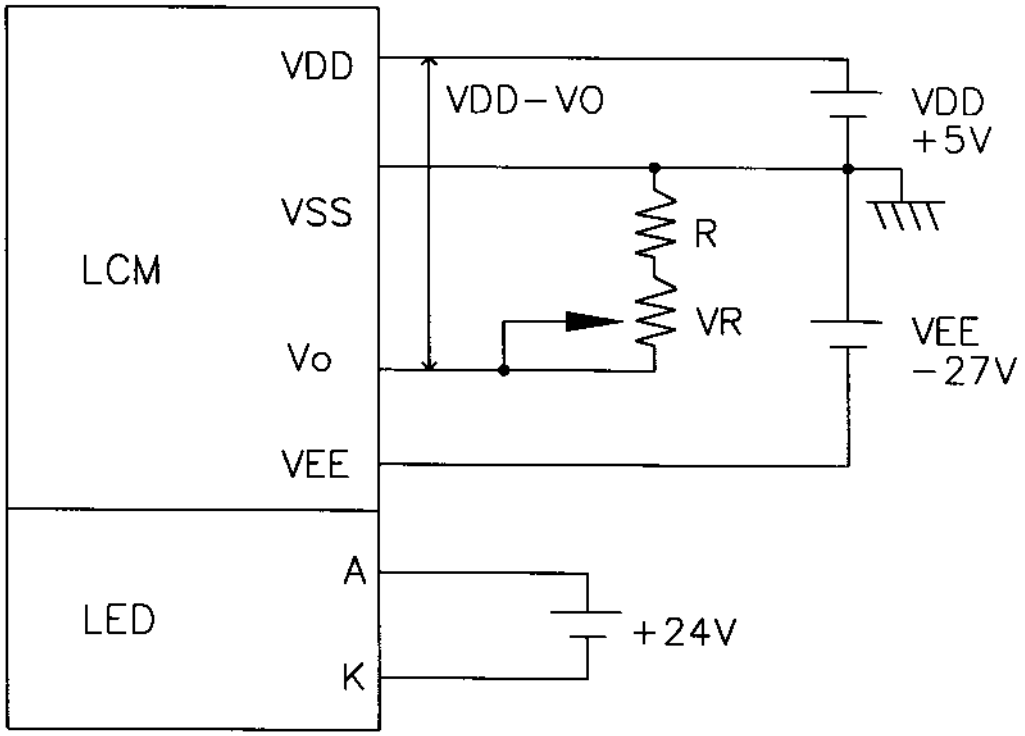
6. INTERNAL PIN CONNECTION

CN1

PIN NO.	SYMBOL	LEVEL	FUNCTION
1	VO	–	OPERATING VOLTAGE FOR LCD
2	VEE	–	POWER SUPPLY FOR LCD
3	D3	H/L	DISPLAY DATA 3
4	D2	H/L	DISPLAY DATA 2
5	D1	H/L	DISPLAY DATA 1
6	D0	H/L	DISPLAY DATA 0
7	VSS	–	GND
8	VDD	–	POWER SUPPLY FOR LOGIC
9	CL2	H→L	DATA SHIFT
10	CL1	H→L	DATA LATCH
11	FLM	H/L	SCAN START PULSE
12	K	–	POWER SUPPLY FOR LED BACKLIGHT
13	A	–	POWER SUPPLY FOR LED BACKLIGHT
14	NC	–	NO CONNECTION

7. POWER SUPPLY



RECOMMENDED VR : 30K~50KΩ
R : 4.3KΩ

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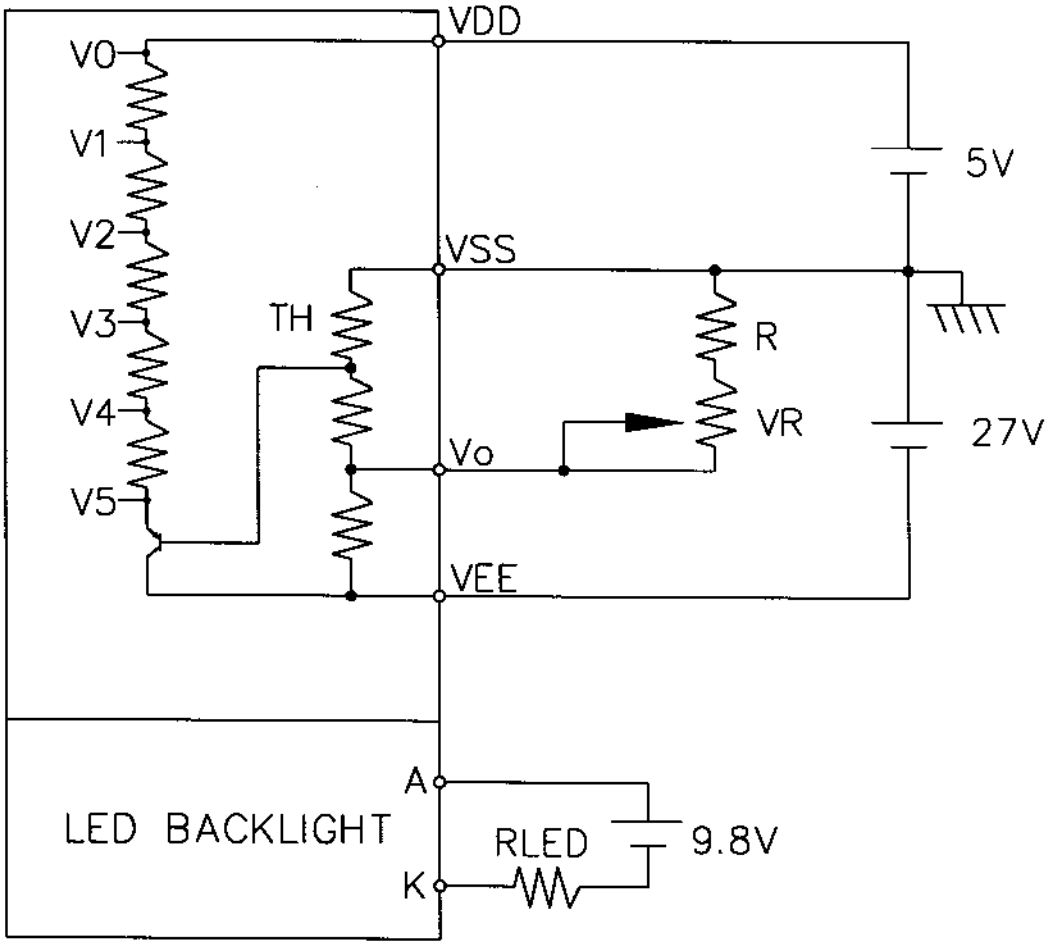
7. POWER SUPPLY

(White LED)



RECOMMENDED VR : 30K~50KΩ

R : 4.3KΩ

RLED : 0Ω

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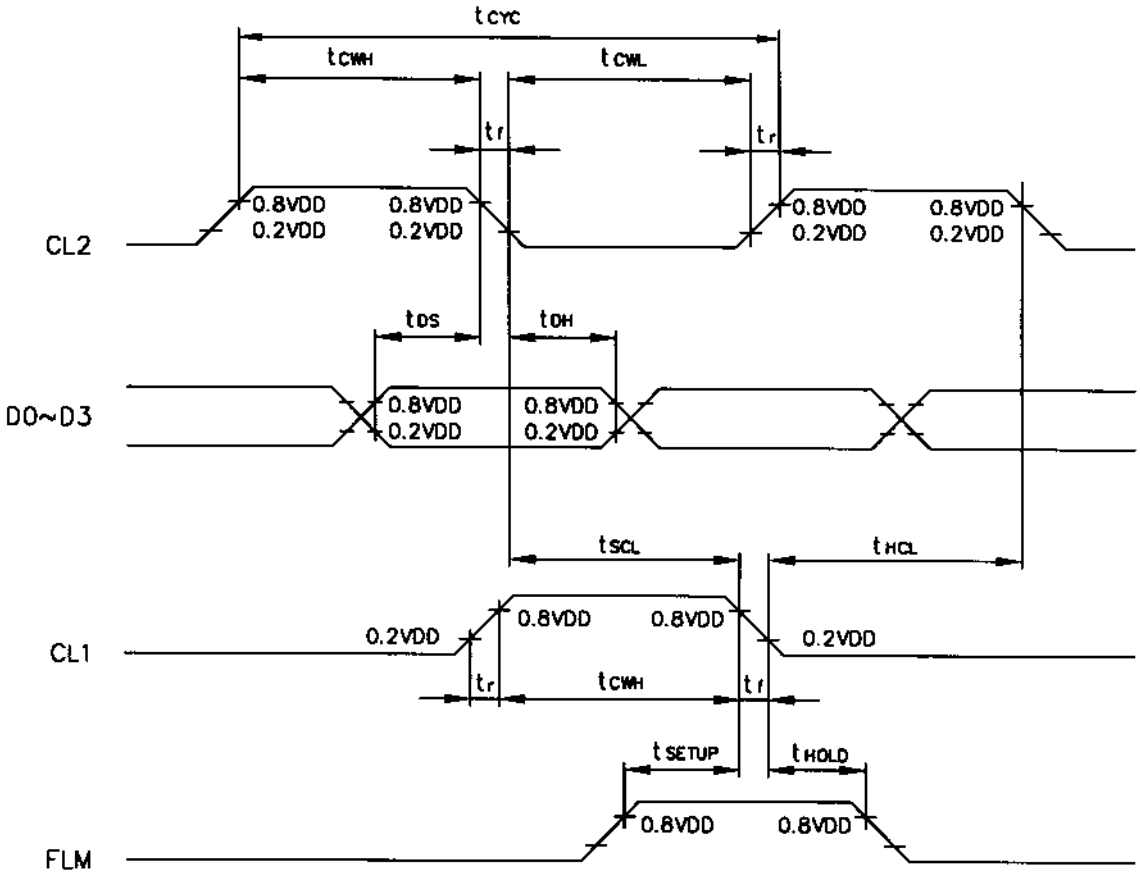
8.1TIMING CHARACTERISTICS

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT
CLOCK CYCLE TIME	t_{CYC}	125	–	–	ns
CLOCK HIGH LEVEL WIDTH	t_{CWH}	45	–	–	ns
CLOCK LOW LEVEL WIDTH	t_{CWL}	45	–	–	ns
CLOCK RISE TIME	t_r	–	–	30	ns
CLOCK FALL TIME	t_f	–	–	30	ns
DATA SETUP TIME	t_{DS}	30	–	–	ns
DATA HOLD TIME	t_{DH}	30	–	–	ns
CLOCK SETUP TIME	t_{SCL}	80	–	–	ns
CLOCK HOLD TIME	t_{HCL}	80	–	–	ns
FRAME SETUP TIME	t_{SETUP}	30	–	–	ns
FRAME HOLD TIME	t_{HOLD}	30	–	–	ns



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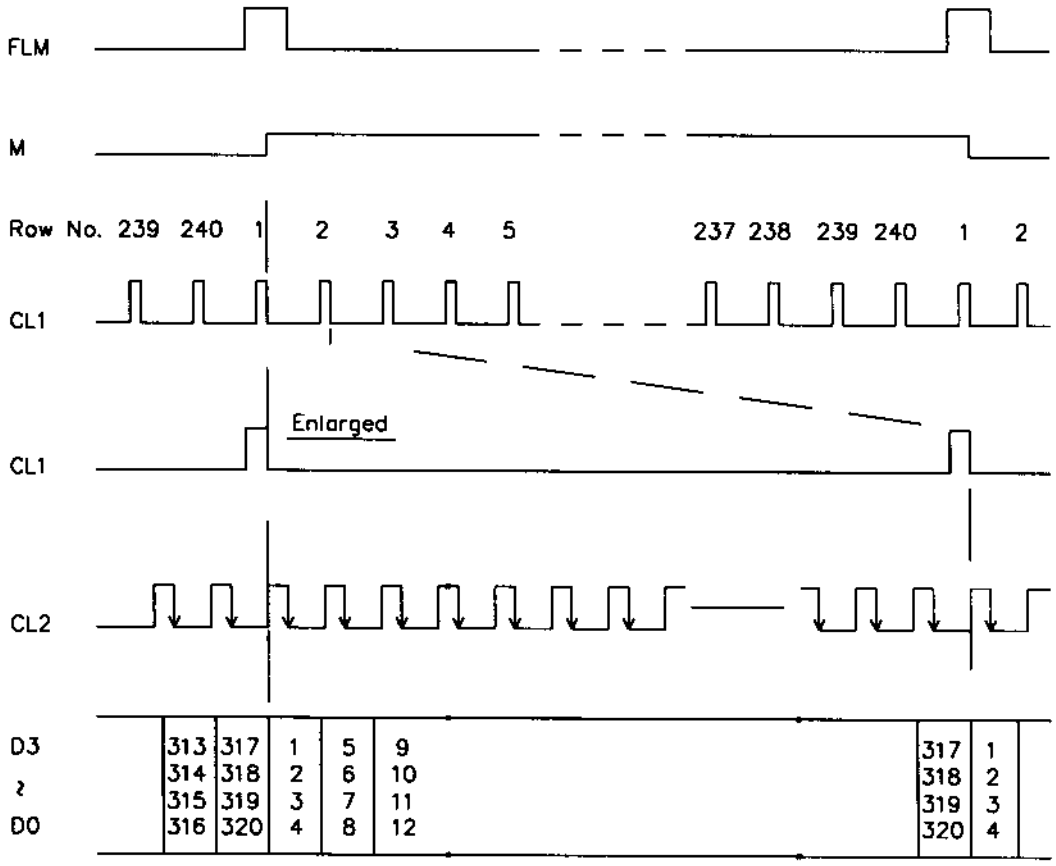
8.2TIMING CHART OF INPUT SIGNALS



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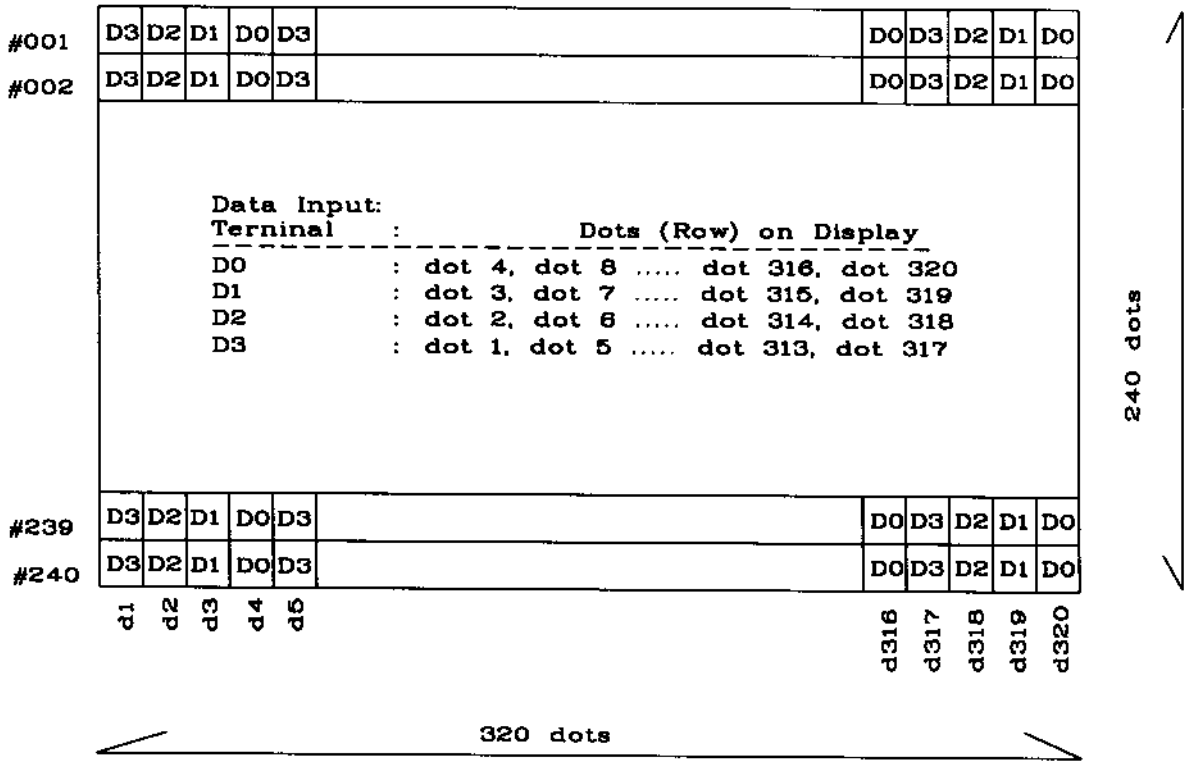
8.3DISPLAY PATTERN



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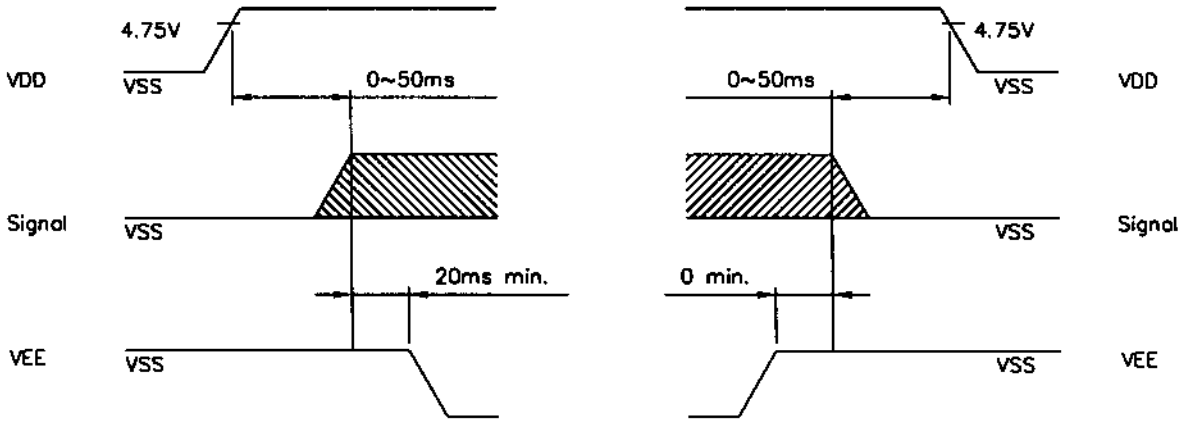
8.4POWER ON/OFF TIMING



POWER ON

POWER OFF

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

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 Humi. Storage	40°C 90%RH	120HR		Appearance without defect	
4	Thermal Shock	−20°C, 30min → 25°C.5min → 60°C, 30min → 25°C.5min (1cycle)			Appearance without defect	5 cycles

(2) NOTE:

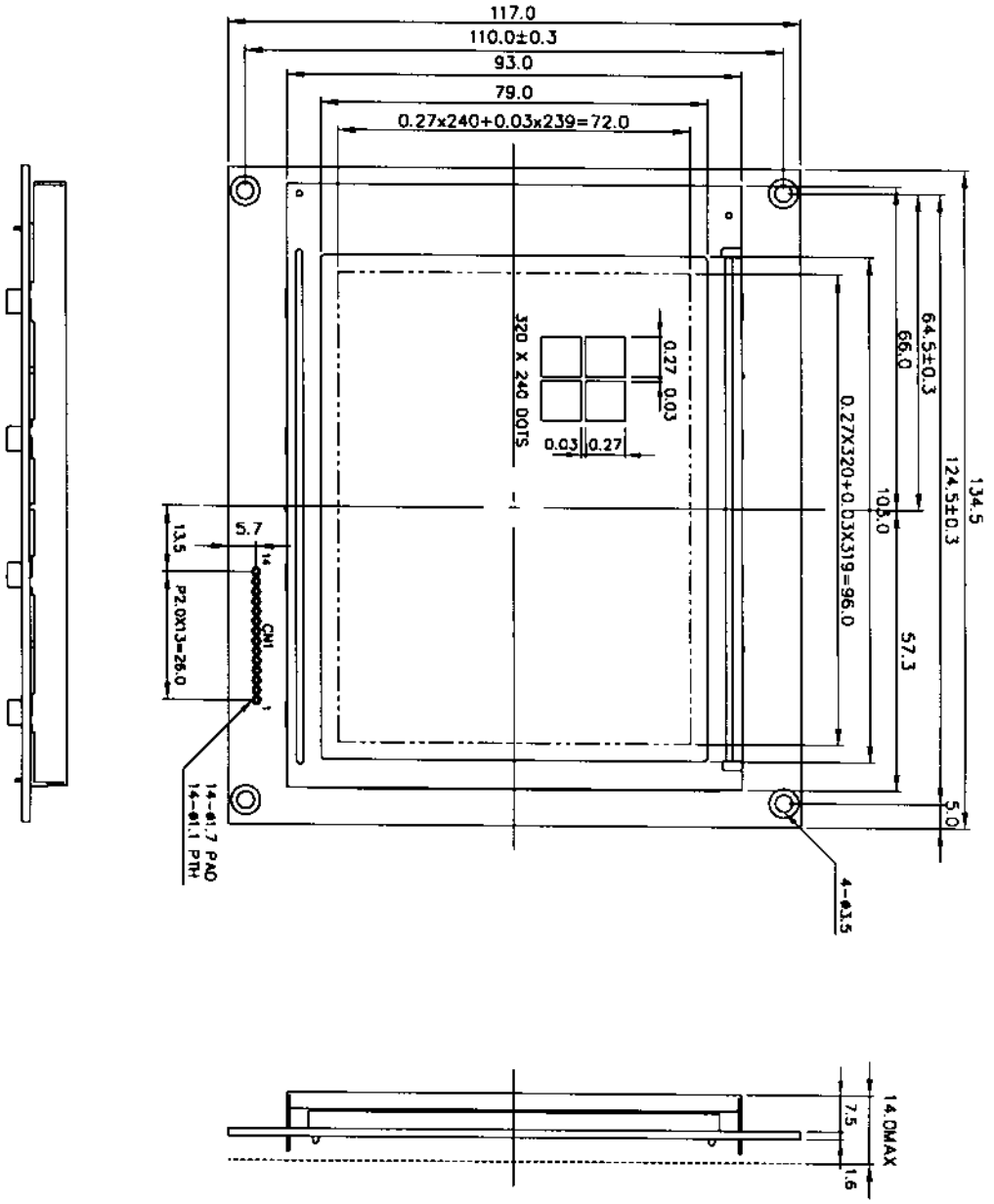
- SAFETY
  1. If the LCD panel breaks, be careful not to get the liquid crystal to touch your skin.
  2. If the liquid crystal touches your skin or clothes, please wash it off immediately by using soap and water.

- HANDLING
  1. Avoid static electricity which can damage the CMOS LSI.
  2. Do not remove the panel or frame from the module.
  3. The polarizing plate of the display is very fragile. So, please handle it very carefully.
  4. Do not wipe the polarizing plate with a dry cloth, as it may easily scratch the surface of plate.
  5. Do not use ketonics solvent & Aromatic solvent, use with a soft cloth soaked with a cleaning naphtha solvent.

- 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 WARRANT
  1. Acceptance inspection period
     The period is within one month after the arrival of contracted commodity at the buyer's factory site.
  2. Applicable warrant period
     The period is within twelve months since the date of shipping out under normal using and storage conditions.

- THE OPERATING LIFE TIME OF BACK LIGHT
  LED : 50,000HR



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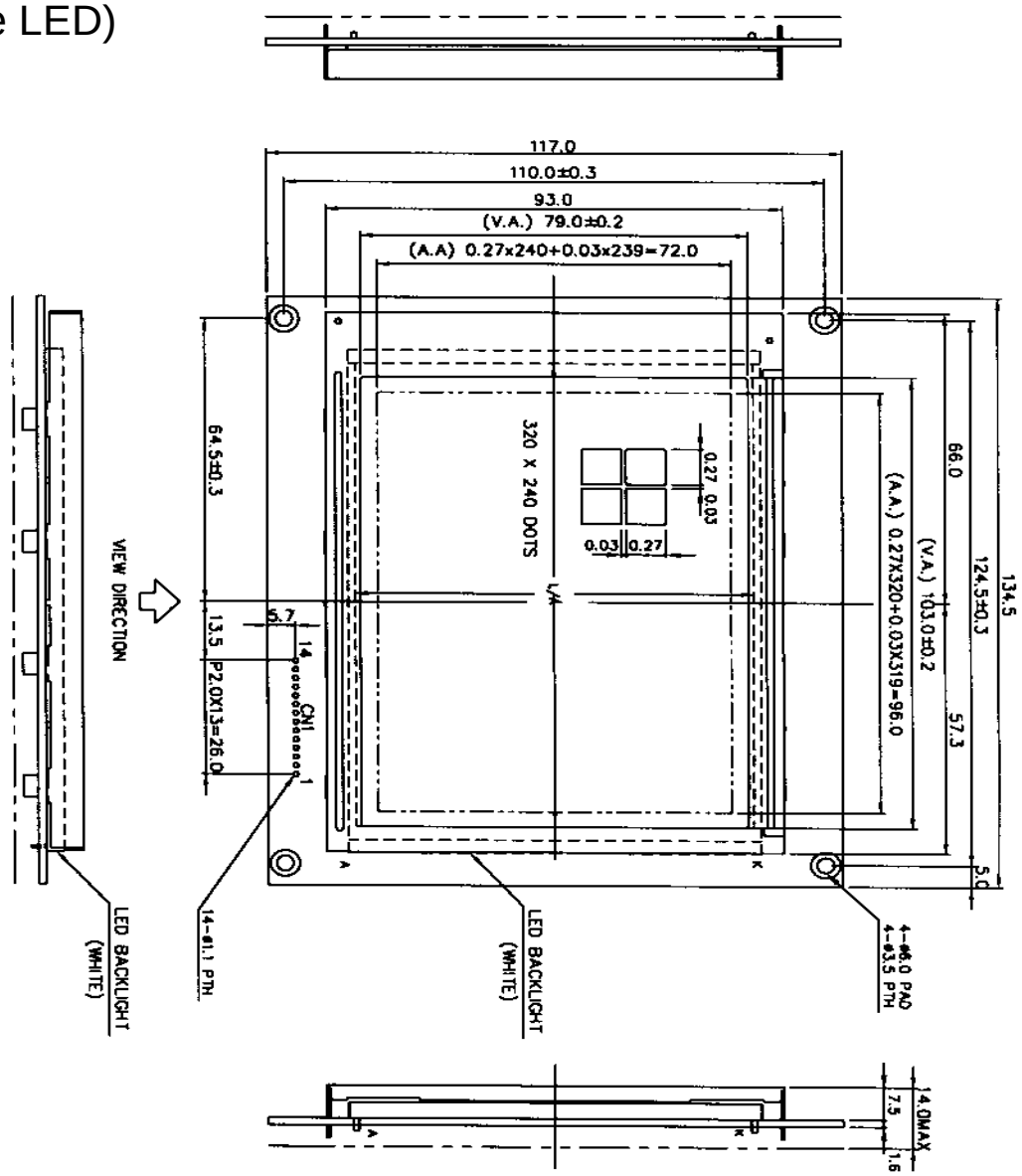
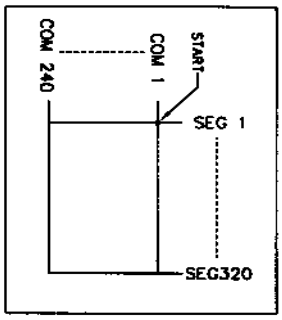


NOTES:
1.RESOLUTION: 320X240 DOTS
2.BACKLIGHT: LED (WHITE)
3.FRAME MATERIAL: SECC

DISPLAY PATTERN



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