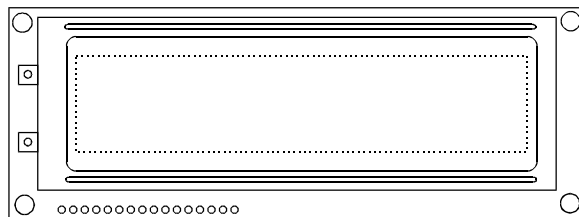




PRODUCT SPECIFICATION

HDM32GS12L-4

128x32 GRAPHICS
LCD DISPLAY MODULE



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MECHANICAL DATA

(1) Part Name LMCC4_126_____M
 (2) Module Size 122.0(W)mm X 44.0(H)mm X MAX14.5(D)mm
 (3) Dot Size 0.70 (W)mm x 0.60 (H)mm
 (4) Dot Pitch 0.74 (W)mm x 0.64 (H)mm
 (5) Number of Dots 128 (W) x 32 (H)Dots
 (6) Duty 1/32
 (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
 (8) Viewing Direction 6 O'clock 12 O'clock ___O'clock
 (9) Backlight LED (Color : Yellow-Green)
 (10) LCD Controller BUILT-IN LC7981 (SANYO)
 (11) Weight 78 g

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ABSOLUTE MAXIMUM RATINGS

(1) ELECTRICAL ABSOLUTE RATINGS

V_{SS}=0V

ITEM	SYMBOL	MIN	MAX	UNIT	COMMENT
Power Supply for Logic	VCC-VSS	-0.3	6.5	V	
Static Electricity	-	-	-	-	Note 1

Note 1 LCM should be grounded during handling LCM.

(2) ENVIRONMENTAL ABSOLUTE MAXIMUM RATINGS

ITEM	NORMAL TEMP.				WIDE TEMP.			
	OPERATING		STORAGE		OPERATING		STORAGE	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
Ambient Temperature	0	50	-20	70	-20	70	-30	80
Humidity (Without Condensation)	Note 1,3		Note 2,3		Note 3,4		Note 3,5	

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 < 120hrs

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

Note 4 Ta ≤ 70°C : 75%RH max

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

Note 5 Ta at -30°C will be < 48hrs, at 80°C will be < 120hrs

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ELECTRICAL CHARACTERISTICS

(at 25°C & f_{FRAME} = 70HZ)

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Logic Circuit Power Supply	VCC-VSS	-	4.80	5.0	5.20	V
Input Voltage	V _{IH}	H level	0.8VCC	VCC	-	V
	V _{IL}	L level	-	VSS	0.2VCC	V
Supply Current for Logic	ICC	VCC = 5.0V	-	-	5	mA
LED Forward Voltage	V _F	I _F = 160mA	-	4.2	4.6	V
LED Luminous Intensity	L	I _F = 160mA	-	100	-	cd/m ²

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OPTICAL CHARACTERISTICS

(For Normal Temperature Mode LCM)

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.
S	A,B	-	-	-	-	-	-
	C,D	-	-	-	-	-	-
	J,K	-	-	-	-	-	-
T	A,B	-	-	-	-	-	-
	C,D	-	-	-	-	-	-
	J,K	-	-	-	-	-	-
	E,F	-	-	-	-	-	-
	G,H	-	-	-	-	-	-
note		NOTE6		NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	0 τ	-			ms	NOTE 2
		25 τ	-				
		50 τ	-				
Response Time (fall)	Tf	0 τ	-			ms	NOTE 2
		25 τ	-				
		50 τ	-				

note:

S: TRANSFLECTIVE

T: TRANSMISSIVE

A: GRAY,6 O'clock

C: YELLOW,6 O'clock

E: BLUE,6 O'clock

G: NORMALLY BLACK,6 O'clock

J: NORMALLY WHITE,6 O'clock

B: GRAY,12 O'clock

D: YELLOW,12 O'clock

F: BLUE,12 O'clock

H: NORMALLY BLACK,12 O'clock

K: NORMALLY WHITE,12 O'clock

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OPTICAL CHARACTERISTICS

(For Wide Temperature Mode LCM)

AT V_{OP}

ITEM MODE		Cr(Contrast Ratio)		θ (Viewing Angle)		ϕ (Viewing Angle)	
		25 τ		25 τ		25 τ	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
S	A,B	-	-	-	-	-	-
	C,D	6	11	50	75	30	40
	J,K	-	-	-	-	-	-
T	A,B	-	-	-	-	-	-
	C,D	-	-	-	-	-	-
	J,K	-	-	-	-	-	-
	E,F	-	-	-	-	-	-
	G,H	-	-	-	-	-	-
note		NOTE6		NOTE5			

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

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20 τ	-	1100	2200	ms	NOTE 2
		25 τ	-	80	160		
		70 τ	-	40	80		
Response Time (fall)	Tf	-20 τ	-	2400	4800	ms	NOTE 2
		25 τ	-	125	250		
		70 τ	-	60	120		

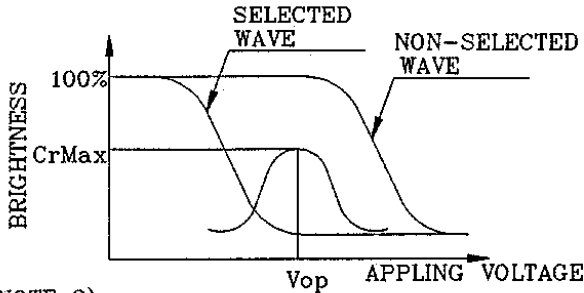
note:

- | | |
|--|--|
| S: TRANSFLECTIVE
T: TRANSMISSIVE
A: GRAY,6 O'clock
C: YELLOW,6 O'clock
E: BLUE,6 O'clock
G: NORMALLY BLACK,6 O'clock
J: NORMALLY WHITE,6 O'clock | B: GRAY,12 O'clock
D: YELLOW,12 O'clock
F: BLUE,12 O'clock
H: NORMALLY BLACK,12 O'clock
K: NORMALLY WHITE,12 O'clock |
|--|--|

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(NOTE 1)

Definition of Operation Voltage(V_{op})

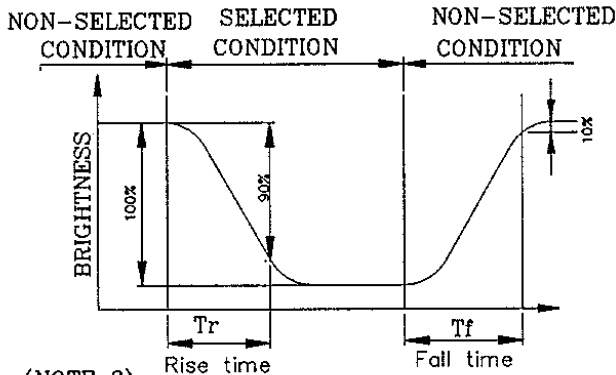


*Conditions

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

(NOTE 2)

Definition of Response Time(T_r, T_f)

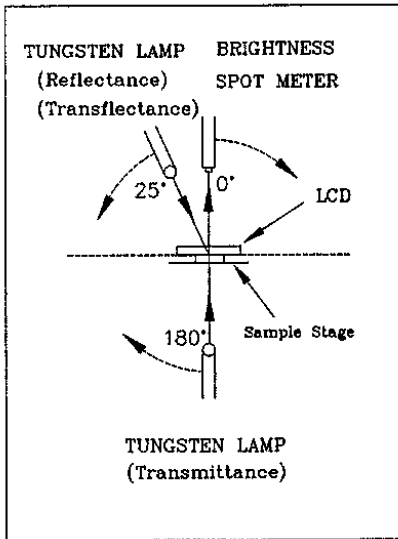


*Conditions

Operating Voltage: V_{op}
 Viewing Angle: 0
 Frame Frequency: 70Hz
 Applying Waveform: 1/N duty 1/a bias

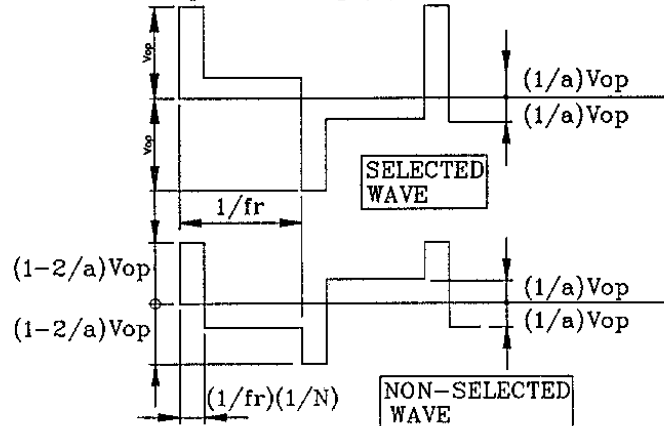
(NOTE 3)

Description of Measuring Equipment and Driving Waveforms



CONST.
TEMP.
CHAMBER

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



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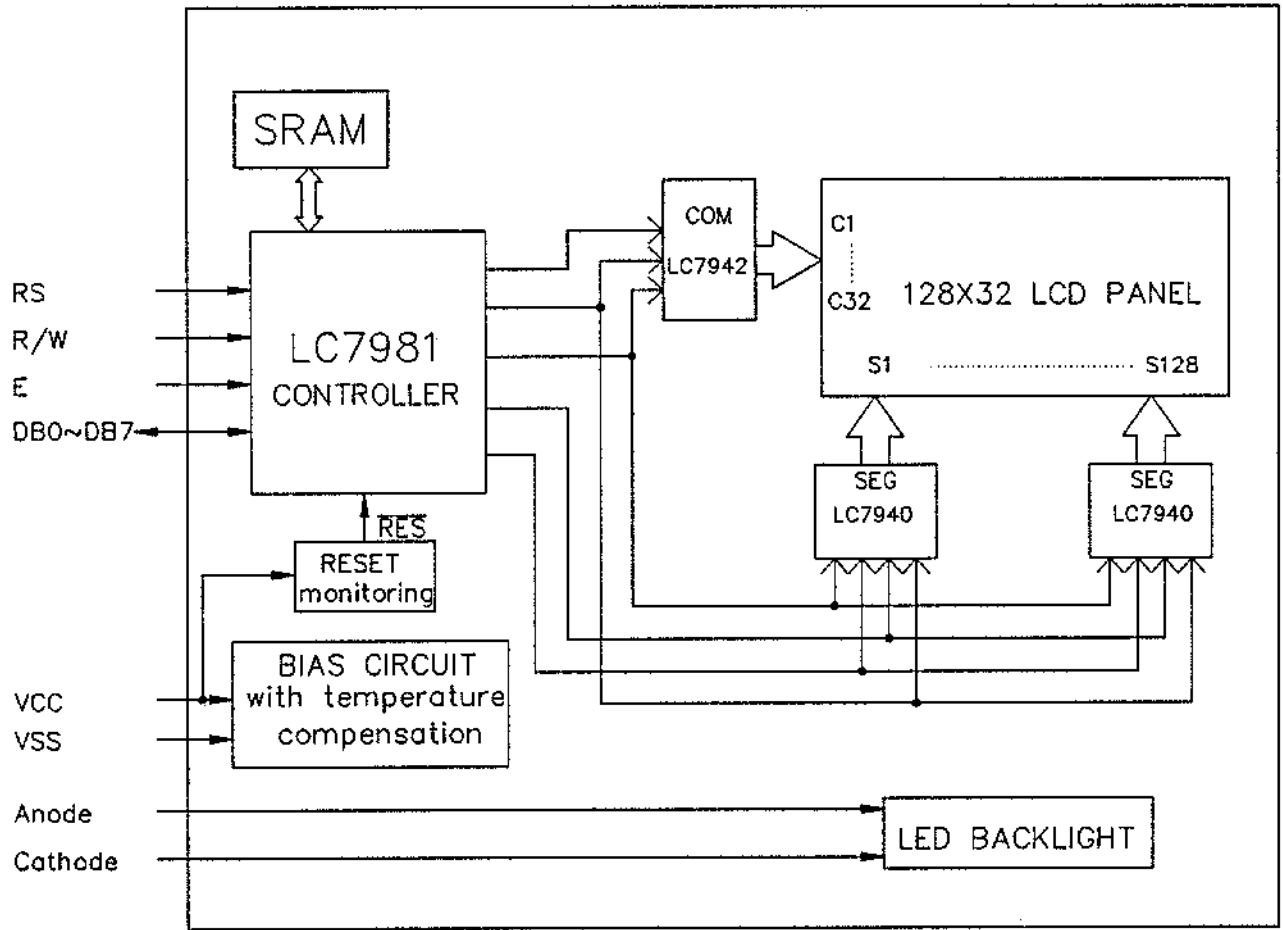
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BLOCK DIAGRAM



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TIMING CHARACTERISTICS

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cyc}	Fig. a, Fig. b	1.0	-	-	us
Enable pulse width	PW_{EH}	Fig. a, Fig. b	450	-	-	ns
Enable rise/fall time	t_{Er}, t_{Ef}	Fig. a, Fig. b	-	-	25	ns
RS,R/W set up time	t_{AS}	Fig. a, Fig. b	140	-	-	ns
Data delay time	t_{DDR}	Fig. b	-	-	225	ns
Data set up time	t_{DSW}	Fig. a	225	-	-	ns
Hold time	t_H	Fig. a, Fig. b	20	-	-	ns

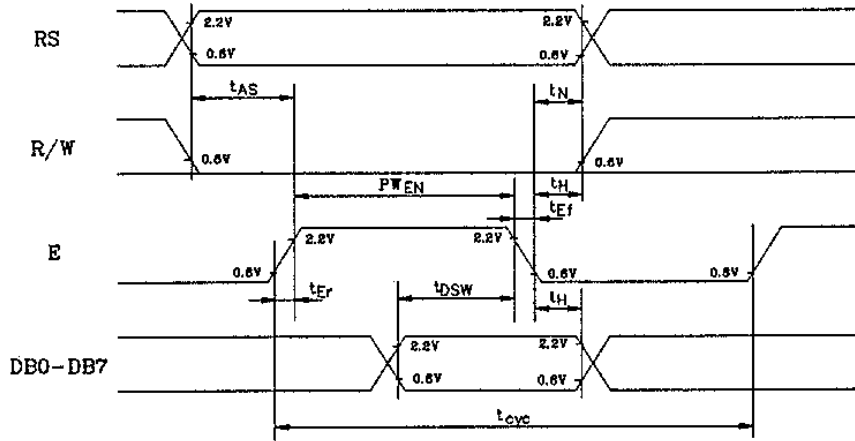


Fig. a Interface timing (data write)

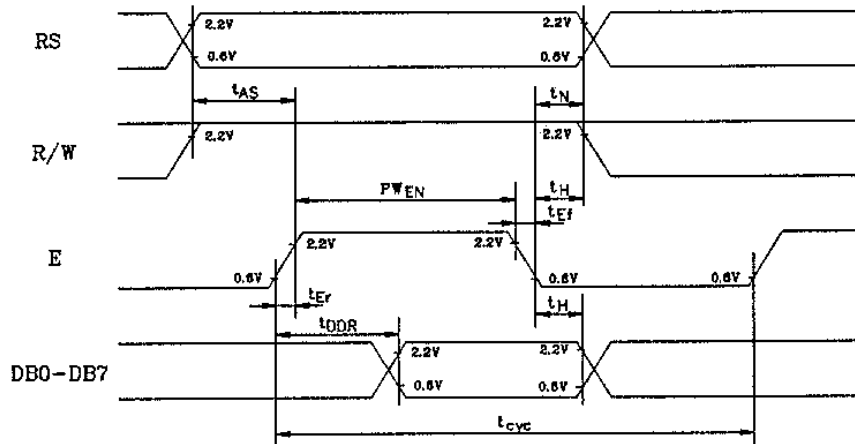


Fig. b Interface timing (data read)

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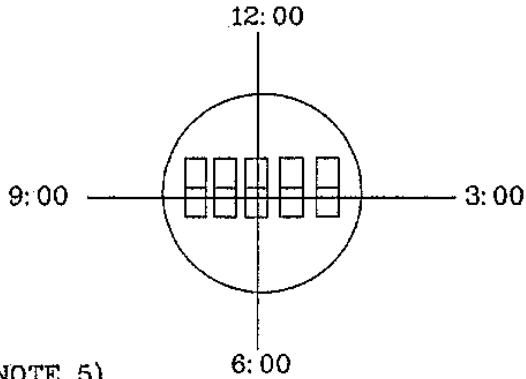
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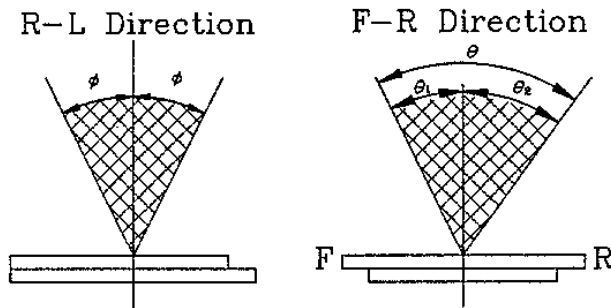
(NOTE 4)

Definition of Viewing Direction



(NOTE 5)

Definition of Viewing Angle



*Conditions

Operating Voltage: V_{op}

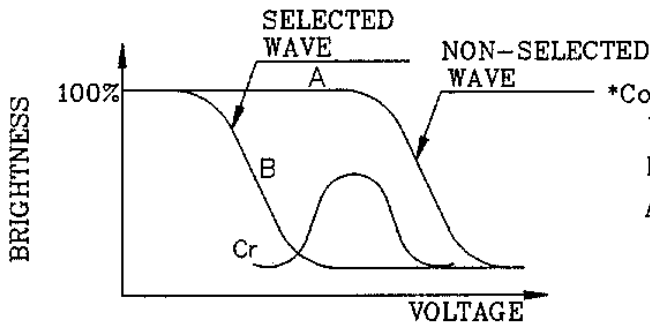
Frame Frequency: 70Hz

Applying Waveform: 1/N duty 1/a bias

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

(NOTE 6)

Definition of Contrast Ratio (Cr)



*Conditions

Viewing Angle : 0

Frame Frequency: 70Hz

Applying Waveform: 1/N duty 1/a bias

Contrast Ratio : $Cr = A/B$

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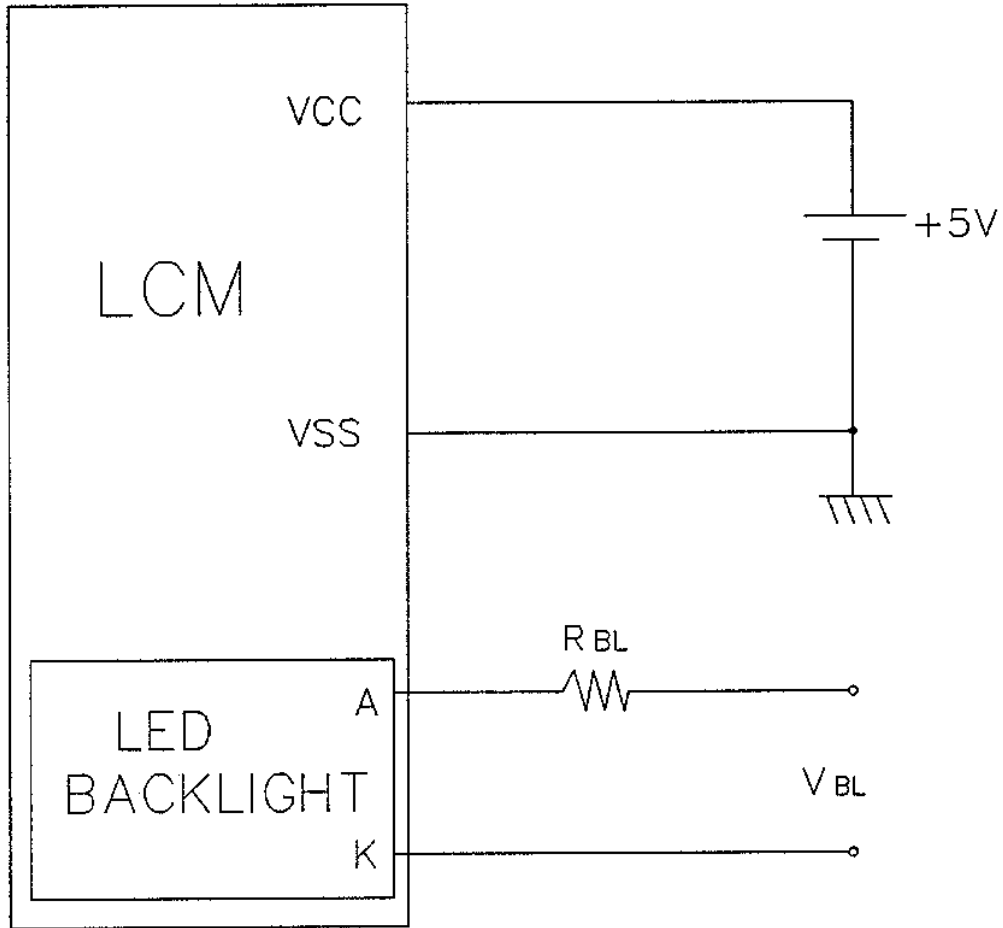
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INTERNAL PIN CONNECTION

PinNo.	Symbol	Level	Function
1	ANODE	—	ANODE FOR LED
2	CATHODE	—	CATHODE FOR LED
3	VSS	—	POWER SUPPLY
4	VCC	—	
5	—	—	NON CONNECTION
6	RS	H/L	H: INSTRUCTION CODE INPUT L: DATA INPUT
7	R/W	H/L	H: DATA READ (LCM TO MPU) L: DATA WRITE (MPU TO LCM)
8	E	H, H->L	ENABLE SIGNAL
9	DB0	H/L	DATA BUS LINE
10	DB1	H/L	
11	DB2	H/L	
12	DB3	H/L	
13	DB4	H/L	
14	DB5	H/L	
15	DB6	H/L	
16	DB7	H/L	

POWER SUPPLY



Recommended Value for R_{BL} and V_{BL}

ITEM Back Light Interface	R_{BL}	V_{BL}	R_{BL}	V_{BL}
	LED	LED	LED	LED
A,K PIN	5 Ω	5V _{DC}	49 Ω	12V _{DC}

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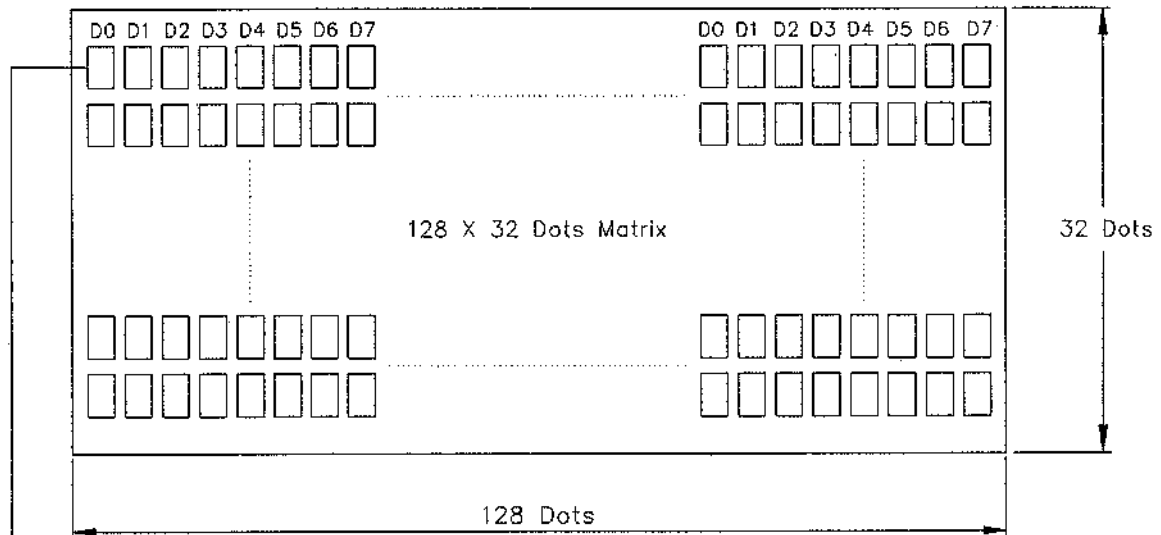
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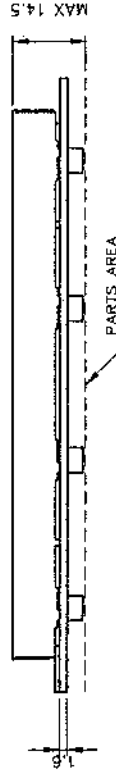
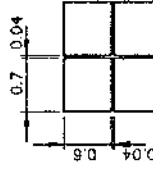
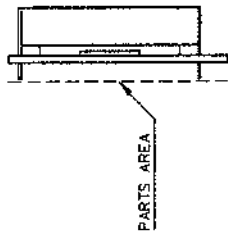
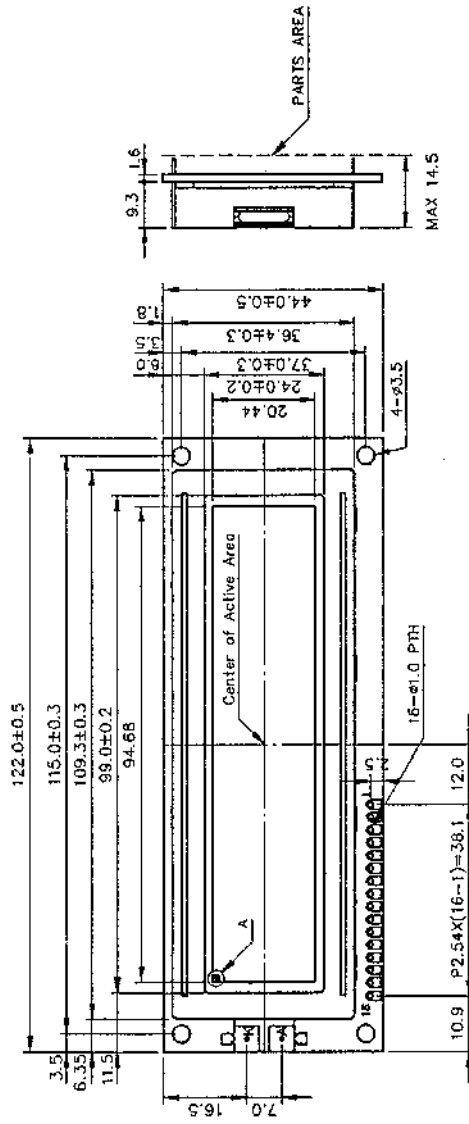
DISPLAY PATTERN



Starting dot for the starting address of display RAM.

D0~D7 are 8 bits transmitted data ,where D0 is LSB and D7 is MSB.

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128 X 32
A DETAIL

Pin No.	Symbol	Description
1	Anode	Anode for LED
2	Cathode	Cathode for LED
3	V _{cc}	Power Supply (GND)
4	V _{cc}	Power Supply (+5V)
5	-	Non Connection
6	RS	Register Selection
7	R/W	Hi: Read/L: Write
8	E	Enable Signal
9	DB0	Data Bus Line
10	DB1	
11	DB2	
12	DB3	
13	DB4	
14	DB5	
15	DB6	
16	DB7	

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