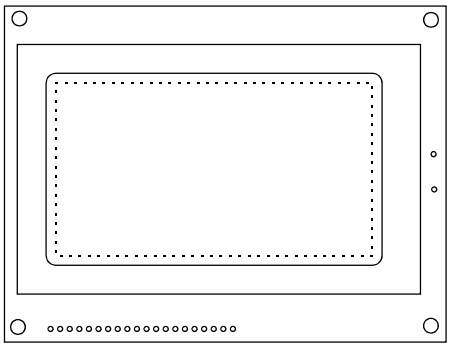
HANTRONIX

PRODUCT SPECIFICATION

HDM64GS12

128 x 64 GRAPHICS
LCD DISPLAY MODULE



HANTRONIX, INC. 10080 BUBB RD. CUPERTINO, CA 95014	**Q.A.:** JK	**REV.:** 2.2	HDM64GS12	SHEET 1 OF 22 **DATE:** 9/18/02

1. MECHANICAL DATA

(1) Part Name		**HDM64GS12**
(2) Module Size		93.0(W)mm X 70.0(H)mm X MAX8.5(D)mm (W/O,EL B/L) 93.0(W)mm X 70.0(H)mm X MAX14.0(D)mm (5.2mm LED B/L) 93.0(W)mm X 70.0(H)mm X **Max.12.5(D)mm** (White LED B/L)
(3) Dot Size		0.48 (W)mm x 0.48 (H)mm
(4) Dot Pitch		0.52 (W)mm x 0.52 (H)mm
(5) Number of Dots		128 (W) x 64 (H)Dots
(6) Duty		1/64
(7) LCD Display Mode	STN:	☐ Gray Mode ☐ Yellow Mode ☐ Normal White
	FSTN:	☐ Black and White(Normal White/Positive Image)
		☐ Black and White(Normal Black/Negative Image)
	Rear Polarizer:	☐ Reflective ☐ Transflective(High Transparency)
(8) Viewing Direction		☐ 6 O'clock ☐ 12 O'clock
(9) Backlight		☐ LED B/L ☐ EL B/L ☐ W/O B/L
(10) Weight		W/O B/L: 54.5 g (APPROX.) EL B/L: 56.5 g (APPROX.) LED B/L: 76.5 g (APPROX.)

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	
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.				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 2,4		Note 3,4		Note 4,5		Note 4,6	

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 changes slightly depending on ambient temperature. This phenomenon is reversible.

Note 5 Ta ≦ 70°C : 75%RH max
Ta > 70°C : Absolute humidity must be lower than 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

3-1. ELECTRICAL CHARACTERISTICS OF LCM

(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 (WIDE TEMPERATURE)	VDD-VO	Duty= 1/64 Bias= 1/8	-20°C	9.5	9.8	10.0	V
			0°C	9.2	9.5	9.6	
			25°C	8.9	9.2	9.5	
			50°C	8.8	9.1	9.4	
			70°C	8.5	8.8	9.1	
Recommended LC Driving Voltage (NORMAL TEMPERATURE)	VDD-VO	Duty= 1/64 Bias= 1/8	0°C	9.2	9.5	9.6	V
			25°C	8.9	9.2	9.5	
			50°C	8.8	9.1	9.4	
Power Supply Current (WIDE TEMPERATURE)	IDD	FLM=79 Hz VDD=5.0 V VDD-VO=9.2 V PATTERN :		–	1.9	2.9	mA
Power Supply Current (NORMAL TEMPERATURE)	IDD	FLM=79 Hz VDD=5.0 V VDD-VO=9.2 V PATTERN :		–	1.9	2.9	mA
Surface Luminance	LMC97H436A(D)(L)_	<Data All On> PATTERN:		–	2.8	–	cd/m²
		<Data All Off> PATTERN:		–	8.9	–	
	LMC97H436C(D)(L)_	<Data All On> PATTERN:		–	3.2	–	
		<Data All Off> PATTERN:		–	9.8	–	
	LMD97H436A(D)(L)_	<Data All On> PATTERN:		–	4.5	–	
		<Data All Off> PATTERN:		–	13.5	–	
	LMD97H436C(D)(L)_	<Data All On> PATTERN:		–	3.9	–	
		<Data All Off> PATTERN:		–	12.8	–	

3. ELECTRICAL CHARACTERISTICS

3-1. ELECTRICAL CHARACTERISTICS OF LCM

(White LED)

(VDD = 5V±10%)

ITEM	SYMBOL	CONDITION		MIN.	TYP.	MAX.	UNIT
Input Voltage	VIH	H level		0.7VDD	–	VDD	V
	VIL	L level		0	–	0.3VDD	V
Recommended LC Driving Voltage	VDD–VO	Bias= 1/8 Duty= 1/64	0°C	9.2	9.5	9.6	V
			25°C	8.9	9.2	9.5	
			50°C	8.8	9.1	9.4	
Power Supply Current	IDD	VDD= 5.0V VDD–VO=9.2V FLM=79 Hz PATTERN : ■□■□■□ □■□■□■		–	9.4	14.0	mA
	IEE			–	0.5	0.8	
LCM Surface Luminance	–	(Dots All On) PATTERN: ■■■■ ■■■■		–	5.8	–	cd/m²
		(Dots All Off) PATTERN: □□□□ □□□□		–	20.0	–	

3-2.ELECTRICAL CHARACTERISTICS OF LED BACKLIGHT

Used LED Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Peak forward current	I_P	–	–	540	mA	–
Maximum reverse voltage	V_R	–	–	8	V	–
Applied forward current	I_F	–	250	540	mA	at V_F = 4.2 V
Applied forward voltage	V_F	–	4.2	–	V	at I_F = 250 mA
LED power consumption	P_F	–	1.1	–	W	–
LED life time	L_L	–	40000	–	hrs	at I_F = 250 mA (*1)

(*1) LED life time is defined as follows : The final brightness is at 50% of original brightness .

3-2.ELECTRICAL CHARACTERISTICS OF BACKLIGHT
(White LED)

Used LED Rating — Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Peak forward current	I_P	–	–	60	mA	–
Maximum reverse voltage	V_R	–	–	10	V	–
Applied forward current	I_F	–	20	30	mA	at V_F = 7.2 V
Applied forward voltage	V_F	–	7.2	–	V	at I_F = 20 mA
LED power consumption	P_F	–	0.15	0.25	W	–
LED life time	L_L	–	40000	–	hrs	at I_F = 20 mA (*1)
AVG. X OF 1931 C.I.E.	X	0.25	0.29	0.33	–	at I_F = 20 mA
AVG. Y OF 1931 C.I.E.	Y	0.26	0.31	0.36	–	

(*1) LED life time is defined as follows : The final brightness is at 50% of original brightness .

3-3.ELECTRICAL CHARACTERISTICS OF EL BACKLIGHT

Used EL Rating

Temp.=25°C

ITEM	SYMBOL	MIN.	TYP.	MAX.	UNIT	REMARK
Maximum applied voltage	V_L	–	–	150	Vrms	–
Maximum applied frequcncy	F_L	–	–	1000	Hz	–
EL current	I_L	–	5.0	8.0	mArms	at 110 Vrms 400 Hz
EL power consumption	P_L	–	0.55	–	W	(*1)
EL life time	L_L	–	1000	–	hrs	at 110 Vrms 400 Hz (*2)

(*1) Power consumption excluded inverter loss .

(*2) EL life time is defined as follows : The final brightness is at 50% of original brightness .

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.
H	A	2.0	3.0	2.5	3.5	3.0	4.0	2.5	3.5	1.5	2.5	-	28-20	-	±22
H	C	2.5	3.5	3.0	4.0	3.5	4.5	3.0	4.0	2.0	3.0	-	31-23	-	±25
Note		NOTE 6										NOTE 5			

(White LED)

ITEM / MODE		Cr(Contrast Ratio)						θ(Viewing Angle)		ϕ(Viewing Angle)	
		0℃		25℃		50℃		25℃		25℃	
		MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.	MIN.	TYP.
H	J	4.5	6.0	4.5	6.0	3.5	5.0	-	36-26	-	±31
Note		NOTE 6						NOTE 5			

Note:

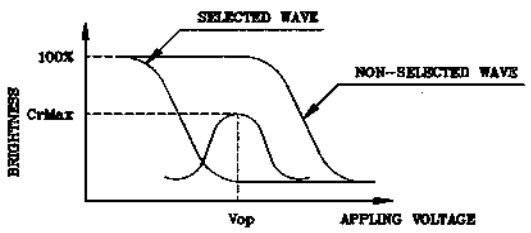
H: Transflective(High Transparency)
A: Gray , 6 Clock
C: Yellow , 6 O'clock
J: Normally White , 6 O'clock

AT $\phi=0°$ $\theta=0°$

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	NOTE
Response Time (rise)	Tr	-20℃	2800	3500	5200	ms	Fig. 2
		0℃	680	850	1270		
		25℃	160	200	300		
		50℃	95	120	180		
		70℃	45	60	90		
Response Time (fall)	Tf	-20℃	1900	2400	3600	ms	Fig. 2
		0℃	400	500	600		
		25℃	95	120	180		
		50℃	40	50	75		
		70℃	30	40	60		

(NOTE 1)

Definition of Operation Voltage(Vop)



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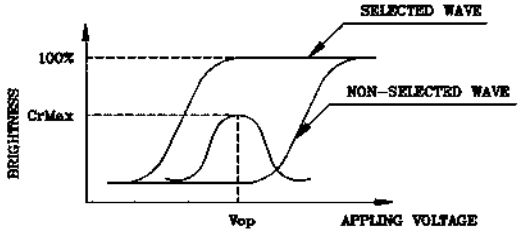


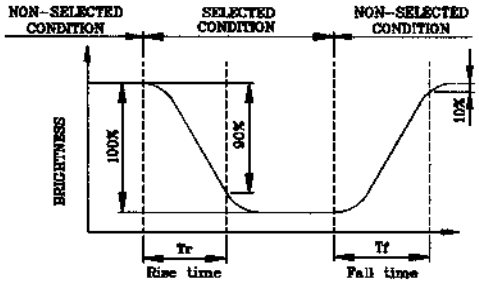
(negative type)

*Conditions

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

(NOTE 2)

Definition of Response Time(Tr,Tf)



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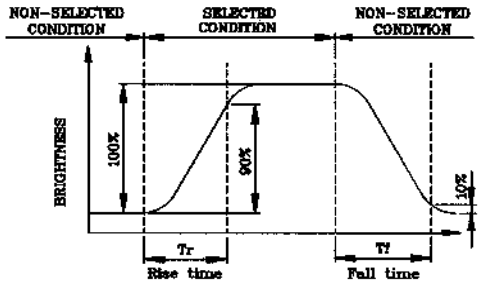


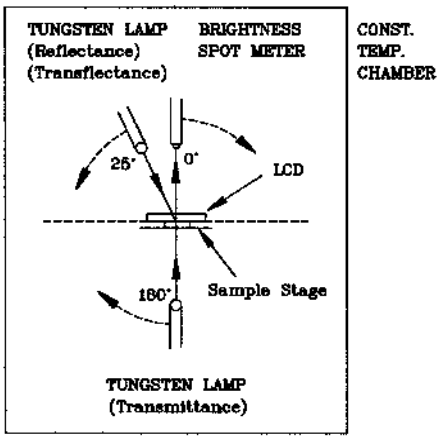
(negative type)

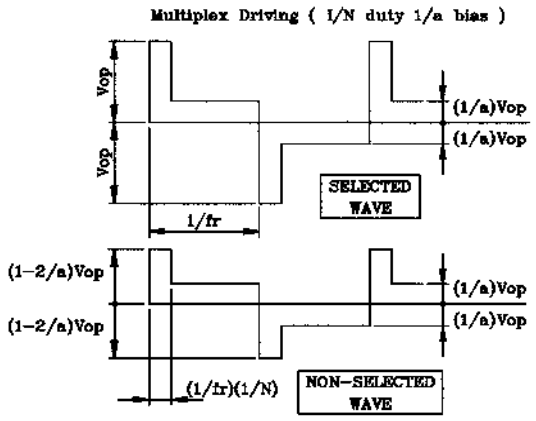
*Conditions

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

(NOTE 3)

Description of Measuring Equipment and Driving Waveforms





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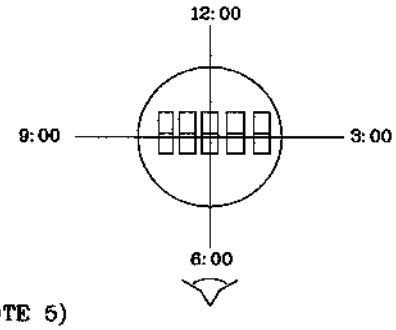
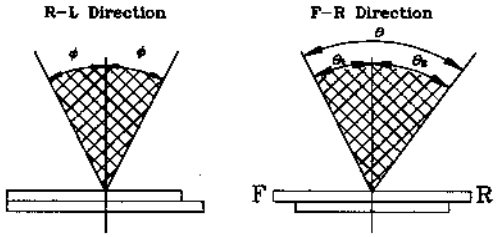
(NOTE 4)

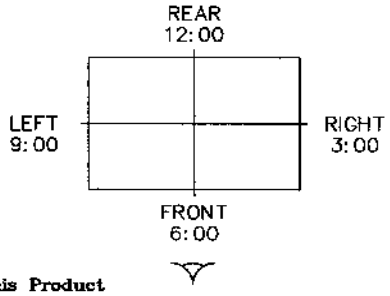
Definition of Viewing Direction



(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

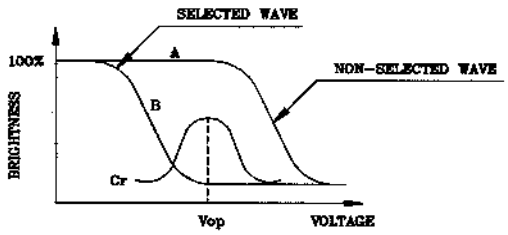
Frame Frequency : 70Hz

Appling Waveform : 1/N duty 1/a bias

Contrast Ratio : larger than 2

(NOTE 6)

Definition of Contrast Ratio (Cr)



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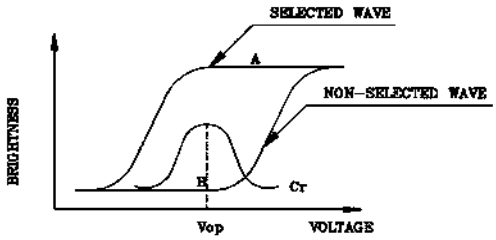

(negative type)

Contrast Ratio : Cr=A/B

*Conditions

Viewing Angle : 0

Frame Frequency : 70Hz

Appling Waveform : 1/N duty 1/a bias

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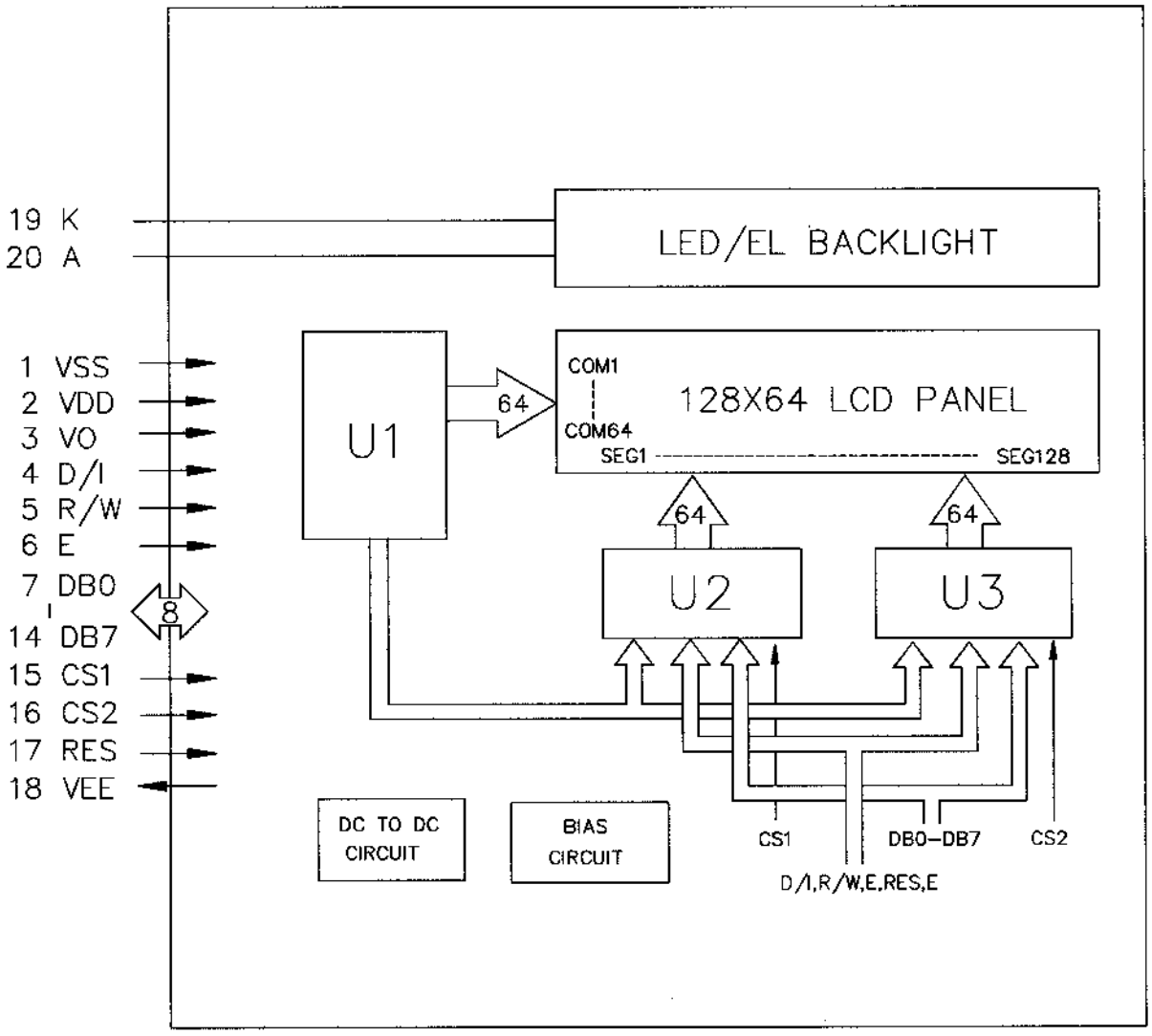
5. BLOCK DIAGRAM



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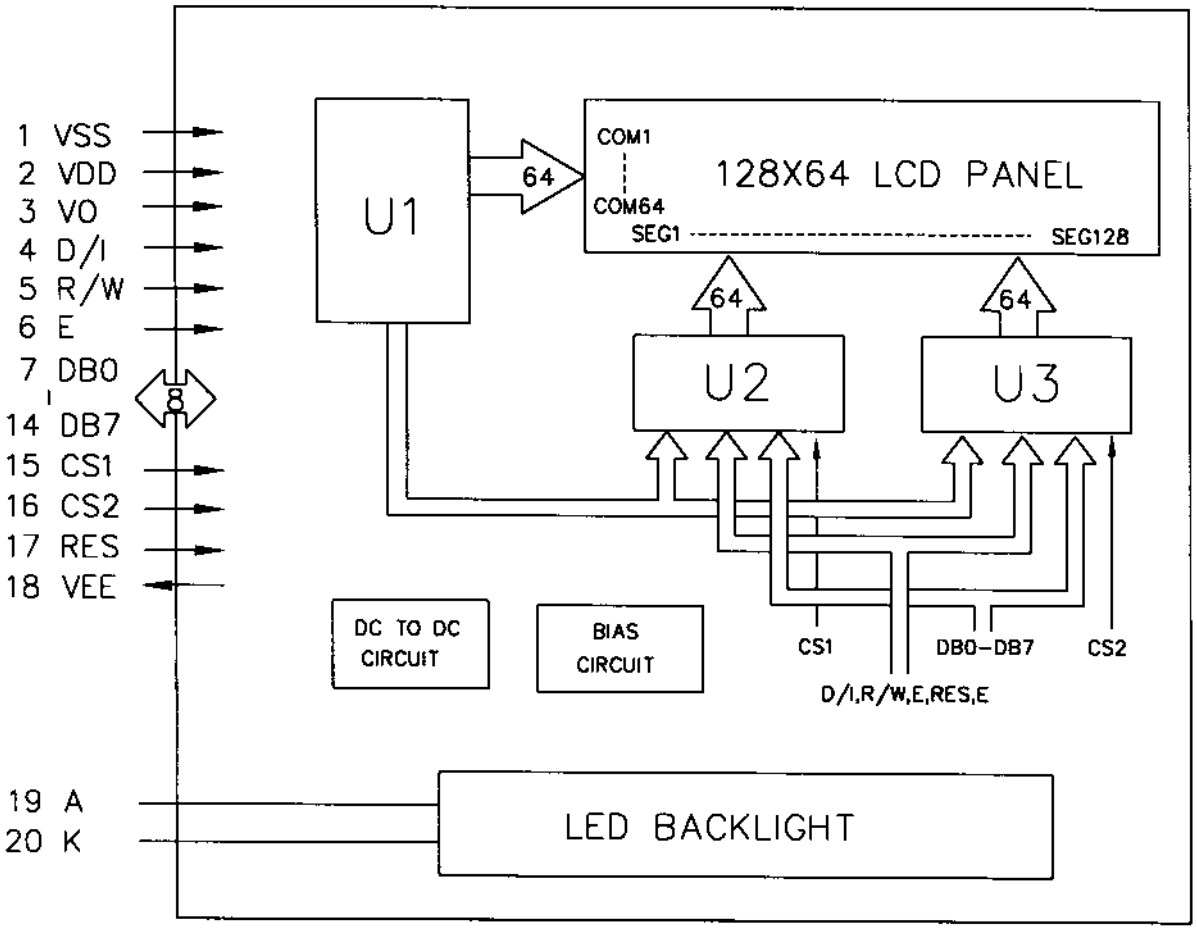
5. BLOCK DIAGRAM

(White LED)



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6. INTERNAL PIN CONNECTION

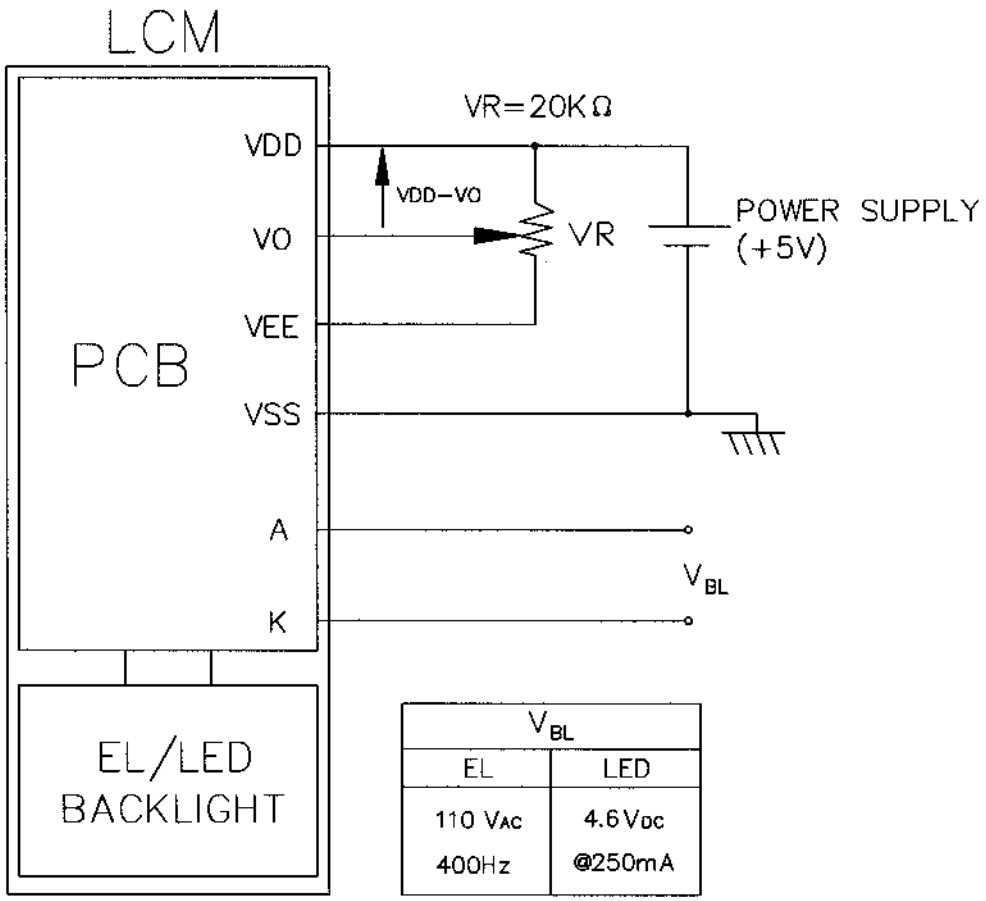
Pin No.	Symbol	Level	Function	
1	Vss	–	0V	Power Supply
2	V DD	–	+5V	
3	Vo	–	OPERATING VOLTAGE FOR LCD DRIVING	
4	D/I	H/L	H: DATA INPUT L: INSTRUCTION CODE INPUT	
5	R/W	H/L	H: DATA READ (LCM TO MPU) L: DATA WRITE (MPU TO LCM)	
6	E	H,H->L	ENABLE SIGNAL	
7	DB0	H/L	DATA BUS LINE	
8	DB1	H/L		
9	DB2	H/L		
10	DB3	H/L		
11	DB4	H/L		
12	DB5	H/L		
13	DB6	H/L		
14	DB7	H/L		
15	CS1	H	CHIP SELECT FOR IC1	
16	CS2	H	CHIP SELECT FOR IC2	
17	RES	L	RESET ACTIVE "L"	
18	VEE	–	NEGATIVE VOLTAGE OUTPUT	
19	K	–	CATHODE FOR EL/LED BACKLIGHT	
20	A	–	ANODE FOR EL/LED BACKLIGHT	

6. INTERNAL PIN CONNECTION

(White LED)

Pin No.	Symbol	Level	Function	
1	VSS	-	0V	Power Supply
2	VDD	-	+5V	
3	V0	-	Operating Voltage for LCD Driving	
4	D/I	H/L	H : Data Input L : Instruction Code Input	
5	R/W	H/L	H : Data Read (LCM to MPU) L : Data Write (MPU to LCM)	
6	E	H,H→L	Enable Signal	
7	DB0	H/L	Data Bus Line	
8	DB1			
9	DB2			
10	DB3			
11	DB4			
12	DB5			
13	DB6			
14	DB7			
15	CS1	H	Chip Select for IC1	
16	CS2	H	Chip Select for IC2	
17	RES	L	Reset Active "L"	
18	VEE	-	Negative Voltage Output	
19	A	-	For LED Backlight (+)	
20	K	-	For LED Backlight (-)	

7. POWER SUPPLY



V_{BL}	
EL	LED
110 V_{AC} 400Hz	4.6 V_{DC} @250mA

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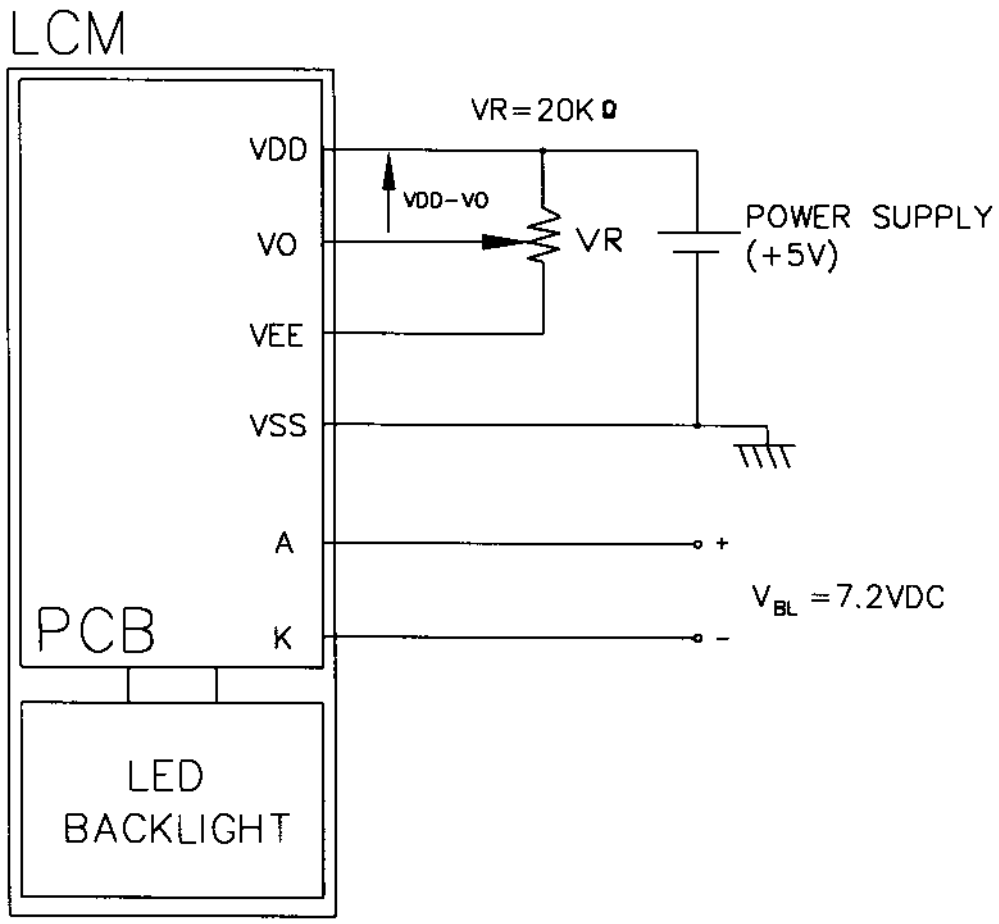
7. POWER SUPPLY

(White LED)



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8. TIMING CHARACTERISTICS

8-1 INTERFACE TIMING

Item	Symbol	Test condition	Min.	Typ.	Max.	Unit
Enable cycle time	t_{cyc}	Fig.a , Fig.b	1000	–	–	ns
E high level width	P_{WEH}	Fig.a , Fig.b	450	–	–	ns
E low level width	P_{WEL}	Fig.a , Fig.b	450	–	–	ns
E rise/fall time	t_r , t_f	Fig.a , Fig.b	–	–	25	ns
Address set up time	t_{AS}	Fig.a , Fig.b	140	–	–	ns
Address hold time	t_{AH}	Fig.a , Fig.b	10	–	–	ns
Data delay time	t_{DDR}	Fig.b	–	–	320	ns
Data set up time	t_{DSW}	Fig.a	200	–	–	ns
Data hold time (WR)	t_{DHW}	Fig.a	10	–	–	ns
Data hold time (RD)	t_{DHR}	Fig.b	20	–	–	ns

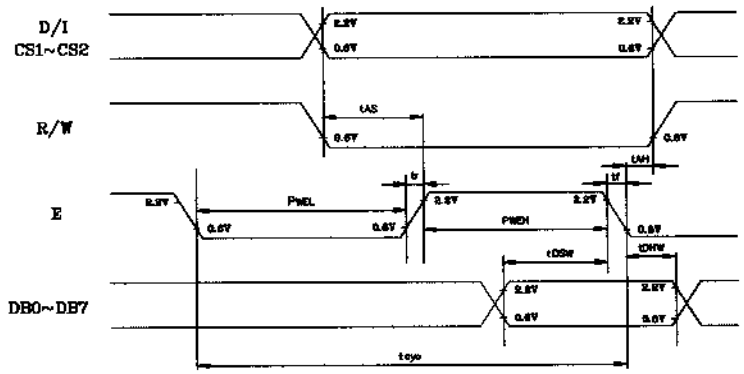


Fig . a Interface timing (data write)

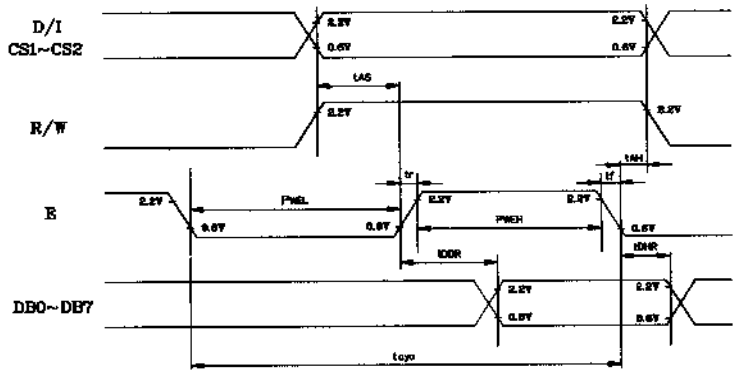
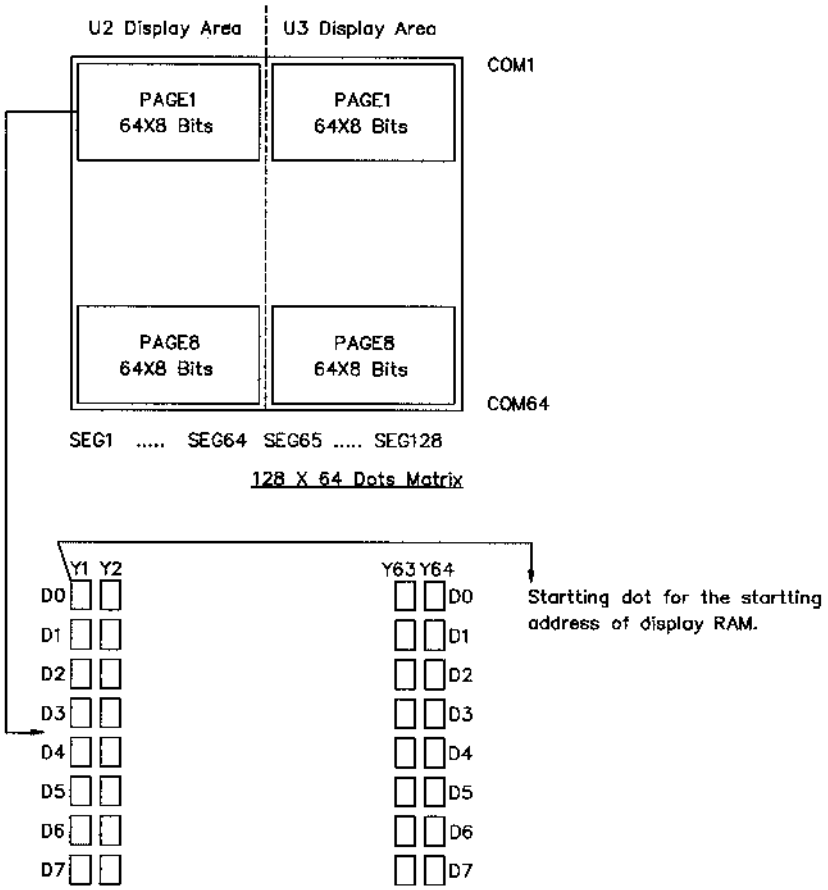


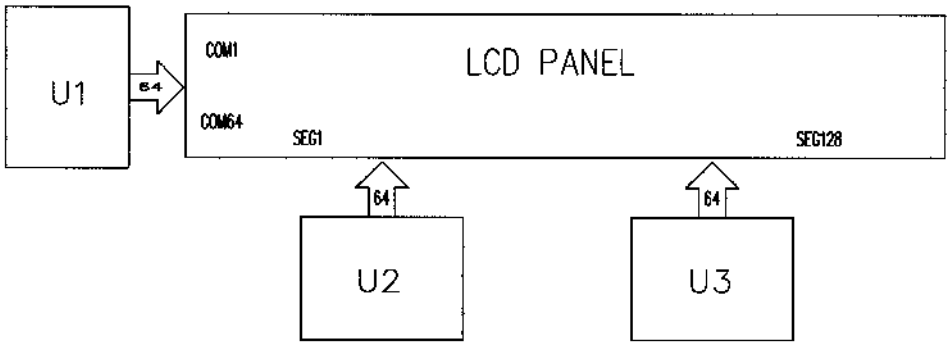
Fig . b Interface timing (data read)

Fig. b Interface timing (data read)

8-2 DISPLAY PATTERN



Each segment driver has 8 pages RAM , and each page has 64 x 8 bits RAM .
D0~D7 are 8 bits transmitted data , where D0 is LSB and D7 is MSB .



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8-3 DISPLAY CONTROL INSTRUCTION

The display control instructions control the internal state of the KS0108B. Instructions is received from MPU to KS0108B for the display control.

Instruction	D/I	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	FUNCTION
Display ON/OFF	0	0	0	0	1	1	1	1	1	0/1	Controls the display on or off. Internal status and display RAM data is not affected. 0: OFF , 1: ON
Set Address	0	0	0	1	Y address(0~63)						Sets the Y address in the Y address counter.
Set Page (X address)	0	0	1	0	1	1	1	Page(0~7)			Sets the X address at the X address register.
Display Start Line	0	0	1	1	Display start line(0~63)						Indicates the display data RAM displayed at the top of the the screen.
Status Read	0	1	BUSY	0	ON/OFF	RESET	0	0	0	0	Read status. BUSY 0: Ready 1: In operation ON/OFF 0: Display ON 1: Display OFF RESET 0: Normal 1: Reset
Write Display Data	1	0	Write Data								Writes data(DB0:7) into display data RAM. After writing instruction, Y address is increased by 1 automatically.
Read Display Data	1	1	Read Data								Reads data(DB0:7) from display data RAM to the data bus.

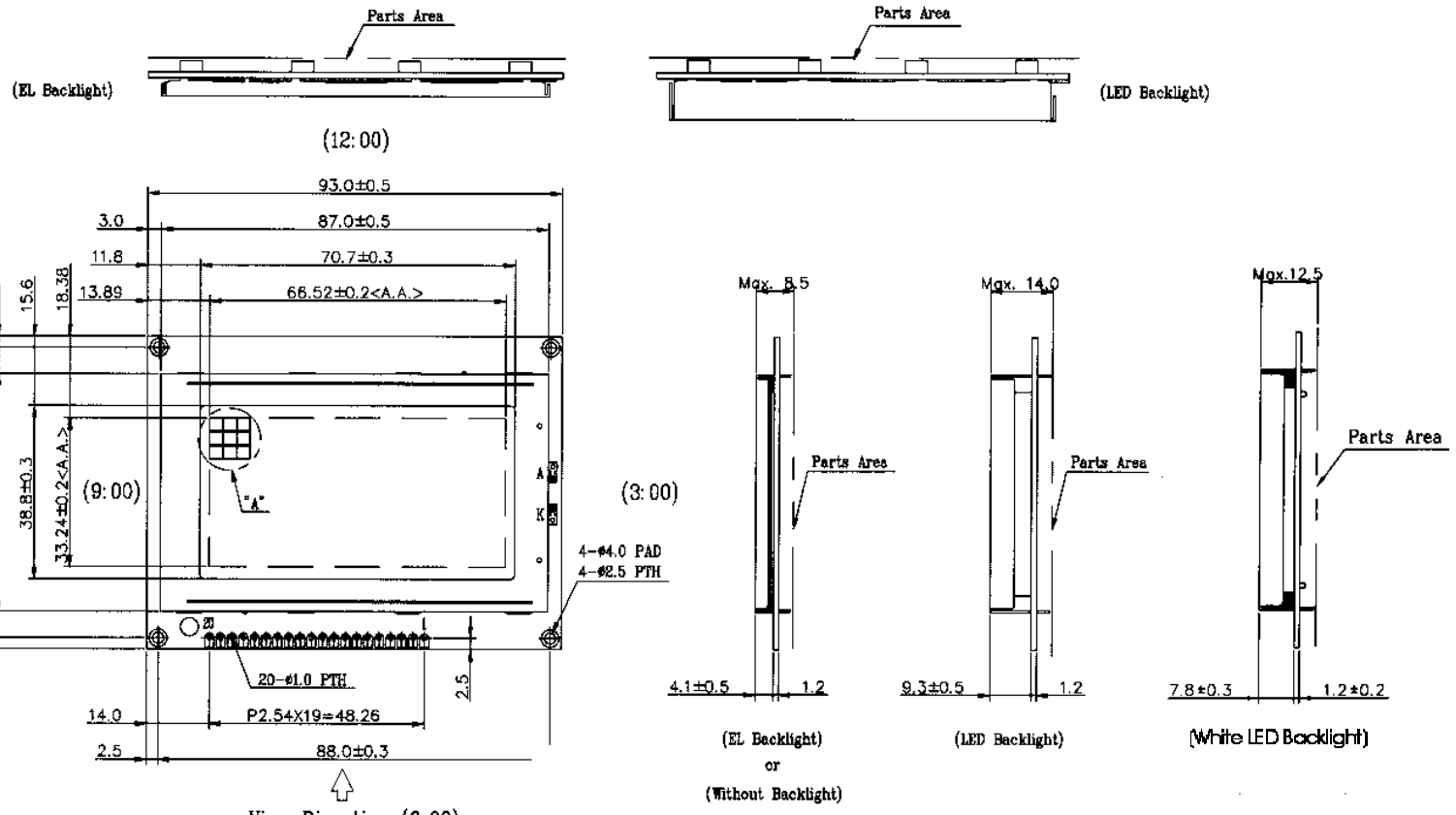
NOTICE:

- 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.



- Notes :

1. Resolution : 128 x 64 Dots
2. Backlight : EL (White)
   LED
   Yellow-Green, White
3. Frame : SPCC (0.5 t)
4. DC/DC Converter : Built-In

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DATE:	9/18/02
	HDM64GS12
REV.:	2.2
Q.A.:	JK

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