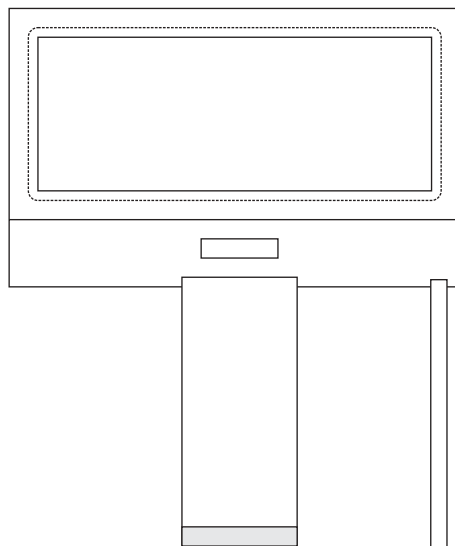




PRODUCT SPECIFICATION

HDG12864L-4

128x64 GRAPHICS
Chip-On-Glass
LCD DISPLAY MODULE



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I . General Specifications

1. General

- Chip-On-Glass graphics LCD
- LED Backlight
- Built-in Controller : Epson SED1565 series
- Built-in Inverter

2. Features

- A. Direct display of RAM data through the display data RAM
- B. RAM capacity 65x132=8580 bits
- C. High-speed 8-bit MPU interface/serial interfaces are supported.
- D. Abundant command functions
- E. Static drive circuit equipped internally for indicators.
- F. Low-power liquid crystal display power supply circuit equipped internally.
- G. CR oscillator circuit equipped internally
- H. Extremely low power consumption
- I. CMOS process
- J. Shipping forms include bare chip and TCP
- K. Drive Method: 1/64 Duty, 1/9 Bias
- L. The Module Operating Voltage: 5V
- M. The LCD Operating Voltage : 8.5V
- N. Viewing Direction: 6:00h or 12:00h
- O. Operating Temperature: -20°C~70°C
- P. Storage Temperature: -30°C~80°C

3.Mechanical Data:

- (1) Module Size ----- 93.2 l * 53.0 w mm
- (2) Viewing Area ----- 70.7 l * 38.8 w mm
- (3) Dot Size ----- 0.48 w * 0.48 h mm
- (4) Dot Quality ----- 128 * 64
- (5) FPC Size ----- 70.0 l * 13.5 w mm

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4. Pin Connections:

Pin No.	Symbol	LEVEL	Function
1	/CS1	H/L	Chip select signal
2	/RES	H,H-L	Reset signal
3	A0	H/L	Control/data select signal
4	R/W	H/L	Signal to select read and write
5	E	H/L	Enable clock input
6-13	D0-D7	H/L	Data bit
14	VDD	+5V	Power supply for logic
15	VSS	0V(GND)	Ground
16	VOUT	OUTPUT	DC/DC converter output
17	CAP3-	OUTPUT	DC/DC voltage converter capacitor 3 negative connection
18	CAP1+	OUTPUT	DC/DC voltage converter capacitor 1 positive connection
19	CAP1-	OUTPUT	DC/DC voltage converter capacitor 1 negative connection
20	CAP2-	OUTPUT	DC/DC voltage converter capacitor 2 negative connection
21	CAP2+	OUTPUT	DC/DC voltage converter capacitor 2 positive connection
22-26	V1-V5	INPUT	This is a multi-level power supply for the liquid crystal drive $VDD \geq V1 \geq V2 \geq V3 \geq V4 \geq V5$

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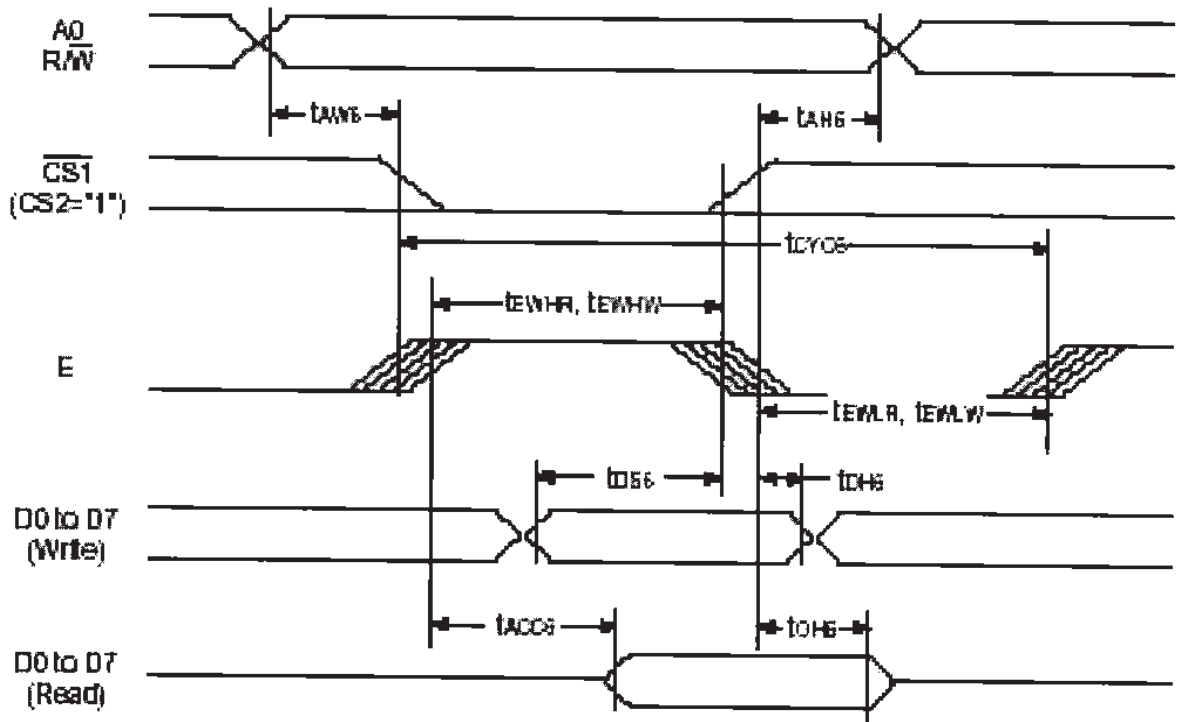
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5. Timing Characteristics: (VDD=4.5V-5.5V)

System bus read/write characteristics (6800 series MPU)

Characteristic		Signal	Symbol	Min.	Typ.	Max.	Unit
Address hold time		A0	t_{AH6}	0	--	--	ns
Address setup time			t_{AW6}	0	--	--	
System cycle time		A0	t_{CYC6}	166	--	--	
Data setup time		D0 -D7	t_{DS6}	30	--	--	
Data hold time			t_{DH6}	10	--	--	
Access time			t_{ACC6}	-	--	70	
Output disable time			t_{OH6}	10	--	50	
Enable H pulse time	Read	E	t_{EWHR}	70	--	--	
	Write		t_{EWHW}	30	--	--	
Enable L pulse time	Read	E	t_{EWLR}	30	--	--	
	Write		t_{EWLW}	30	--	--	

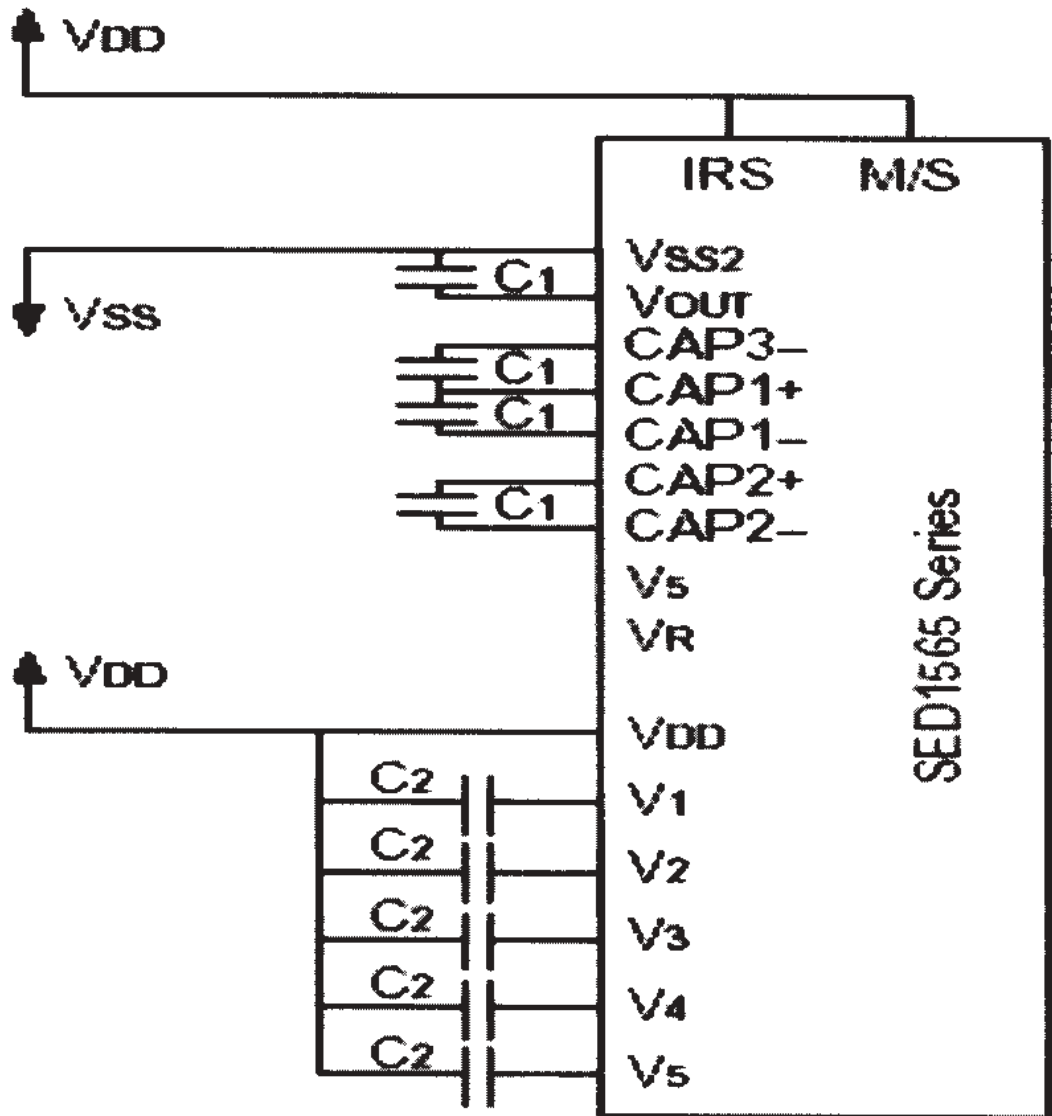


6. Reference circuit examples

When used all of the step-up circuit, voltage regulating circuit and V/F circuit

When the voltage regulator internal resistor is used.

Example where $VSS2=VSS$, with 4x step-up



II.The Characteristics and The Reliability Test

1.Electro-Optic Characteristics:

Condition:TEMP=(23±3)°C Hum=(70±5)%RH

V_{dd}: 5.0V

NO	Item	Symbol	Min	Typ.	Max	Unit	Condition
1	Supply Voltage(Logic)	Vdd-Vss	3.0	5.0	5.5	V	
2	Supply Current (Logic)	I _{dd}		7.45		mA	V _{dd} =5V
3	LCD Operating Voltage	V _{dd} -V ₀		8.7		V	0°C
				8.5		V	25°C
				8.3		V	50°C
4	Response Time	T _{on}		289		ms	
		T _{off}		61		ms	
5	Contrast	CR	3				
6	Viewing Angel	12H	θ 1		25	Deg	(CR≥3.0)
		6H	θ 2		49		
		3H	θ 3		50		
		9H	θ 4		50		
7	LCD Threshold Voltage	V _{th}		7.66		V	25°C

2. Characteristics of backlight (LED unit)

(1).Absolute Maximum Ratings:

Item	Symbol	Rating	Unit	Condition
Forward Current	IFM	150	mA	Ta=25°C
Reverse Voltage	VR	5	V	Ta=25°C
Power Dissipation	PD	600	mW	Ta=25°C

(2).Electrical-optical Characteristics:

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward Voltage	VF	3.9	4.1	4.3	V	IF=90mA
Reverse current	IR			100	uA	VR=3V

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The Characteristics of White LED Backlight

2. Characteristics of backlight (LED unit)

(1).Absolute Maximum Ratings:

Item	Symbol	Rating.	Unit	Condition
Forward Current	IFM	225	mA	Ta=25 °C
Peak forward current	IFP	540	mA	1 msec plus 10% duty cycle
Reverse Voltage	VR	1.0	V	Ta=25 °C
Power Dissipation	PD	675	mW	Ta=25 °C

(2).Electrical-optical Characteristics:

Ltem	Symbol	Min	Typ	Max	Unit	Condition
Forward Voltage	VF	3.2	3.5	3.8	V	IF=135mA
Reverse current	IR			30	uA	VR=0.8V
Color	WHITE					

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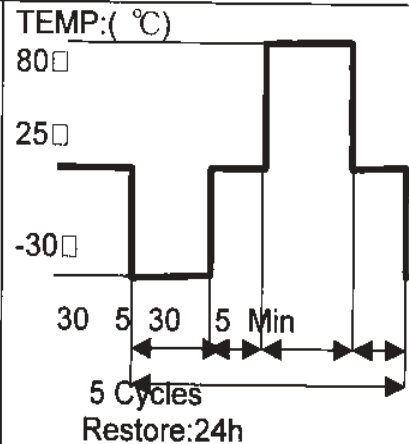
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3. Reliability Test

No	Items	Test Condition	Equipment	Test Result
1	High TEMP Storage	TEMP: 80±2°C Time: 96h Restore:24h	Tenny	Passed
2	Low TEMP Storage	TEMP: -30±3°C Time: 96h Restore:24h	Tenny	Passed
3	High TEMP Operating	TEMP:70±2°C Vop: 5V Timp: 24h Restore:24h	Tenny	Passed
4	Low TEMP Operating	TEMP:-20±2°C Vop: 5V Timp: 24h Restore:24h	Tenny	Passed
5	High TEMP High Hum Storage	TEMP:40±2°C Hum: 95%Rh Time: 96h Restore:24h	Tenny	Passed
6	Thermal Shock	TEMP:(°C)  <p>80□ 25□ -30□</p> <p>30 5 30 5 Min</p> <p>5 Cycles</p> <p>Restore:24h</p>	Tenny	Passed

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IV. Instruction Sets

Command	Command Code											Function
	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address					1	Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data							Writes to the display RAM	
(7) Display data read	1	0	1	Read data							Reads from the display RAM	
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/reverse	0	1	0	1	0	1	0	0	1	1	0	Sets the LCD display normal/reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0	Sets the LCD drive voltage bias ratio SED1565** 0: 1/9, 1: 1/7 SED1566** /SED1568** /SED1569** 0: 1/8, 1: 1/6 SED1567** 0: 1/8, 1: 1/5
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0	*	*	*	Select COM output scan direction 0: normal direction, 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode		Select internal power supply operating mode	
(17) Vs voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio		Select internal resistor ratio (Rb/Ra) mode	
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	Set the Vs output voltage electronic volume register
Electronic volume register set	0	1	0	*	*	Electronic volume value						
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	0: OFF, 1: ON
Static indicator register set	0	1	0	*	*	*	*	*	*	Mode		Set the flashing mode
(20) Power saver												Display OFF and display all points ON compound command
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(22) Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

(Note) *: disabled data

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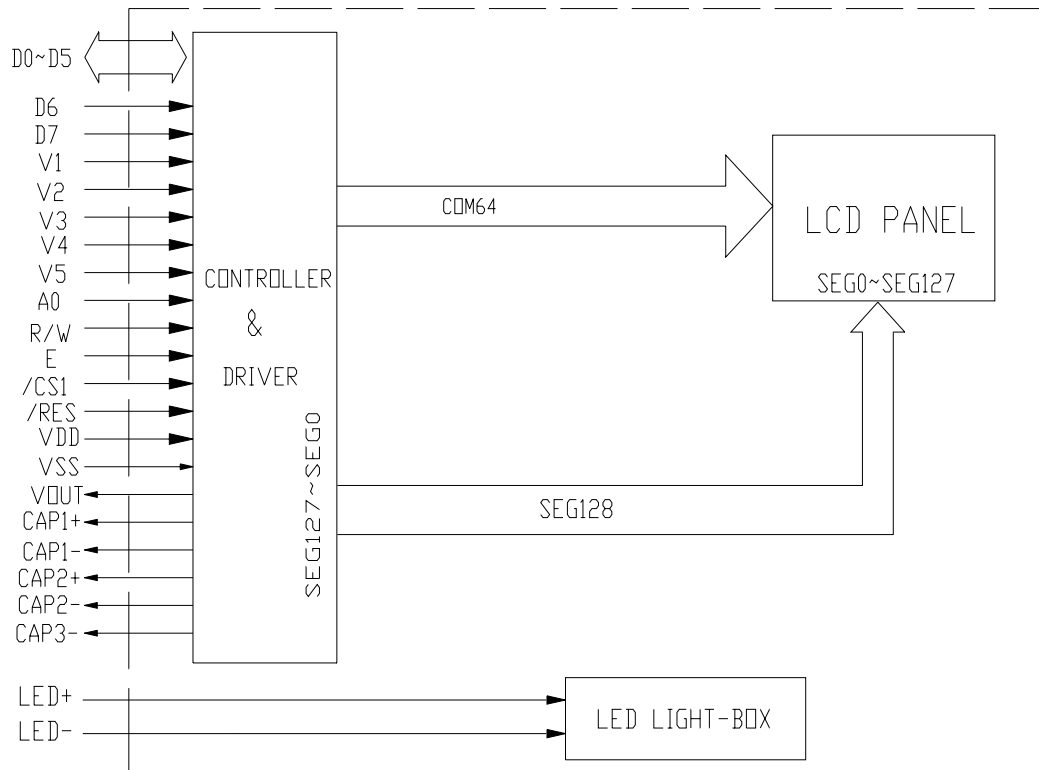
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V. Block Diagram



PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13
SYMBOL	/CS1	/RES	A0	R/W	E	D0	D1	D2	D3	D4	D5	D6	D7
PIN NO.	14	15	16	17	18	19	20	21	22	23	24	25	26
SYMBOL	VDD	VSS	VOUT	CAP3-	CAP1+	CAP1-	CAP2-	CAP2+	V1	V2	V3	V4	V5

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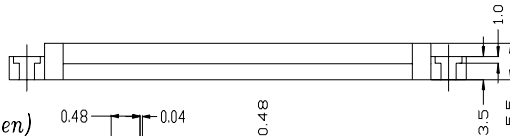
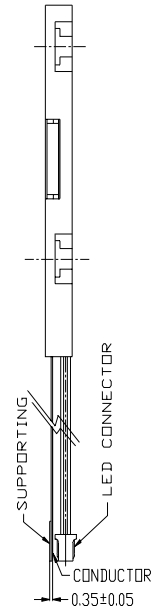
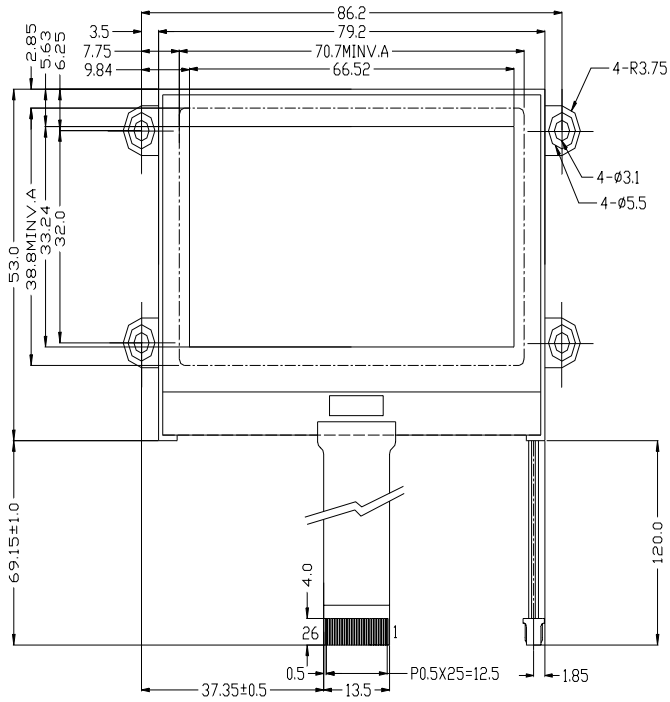
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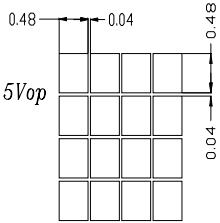
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Note:

1. Display Type: STN(Yellow-Green)
2. Rear Polarizer Type: I
3. Drive Method: 1/64Duty, 1/9 Bias, 8.5Vop
4. Viewing Direction: 6:00
5. Operating Temp: -20°C~70°C
Storage Temp: -30°C~85°C
6. Backlight: LED Yellow-Green
7. Resolution: 128X64 Dots



DISPLAY PATTERN

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