

POWERTIP TECH. CORP.

DISPLAY DEVICES FOR BETTER ELECTRONIC DESIGN

Specification For Approval

Customer : _____

Model Type : LCD Module

Sample Code : PG9732LRS-CE3-H

Mass Production Code : _____

Edit : 0

Customer Sign	Sales Sign	Approved By	Prepared By

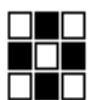
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1. SPECIFICATIONS

1.1 Features

- 97 *32 dot graphics display
- 1/33 Duty, 1/6 bias
- STN, positive, Transflective, gray
- 6 o'clock viewing angle
- Control IC EPSON SED1530
- For 6800 series microprocessor interface

1.2 Mechanical Specifications

- Outline dimension : 49.7mm(L) *31.3mm(W)*6.6mm max.(H)
- Viewing area : 43.5 mm *21.5mm
- Active area : 35.84mm *14.35mm
- Dot size : 0.32mm *0.40mm
- Dot pitch : 0.37mm *0.45mm

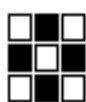
1.3 Absolute Maximum Ratings

Item		Symbol	Min.	Max.	Unit
Supply voltage range	Triple boosting	VDD	-0.3	6.0	V
	Quadruple boosting		-0.3	4.5	
Supply voltage range (1) (V _{DD} Level)		V5, VOUT	-18.0	0.3	V
Supply voltage range (2) (V _{DD} Level)		V1,V2,V3,V4	V5	0.3	V
Input voltage range		VIN	-0.3	VDD+0.3	V
Output voltage range		VO	-0.3	VDD+0.3	V
Operating temperature		TOPR	-20	70	°C
Storage temperature		TSTR	-30	70	°C
Humidity		HD	-	90	%RH

1.4 DC Electrical Characteristics

Recommended operation VDD=3V±10% (@ Ta=25°C± 2°C)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Logic Supply voltage	VDD	-	2.4	-	6.0	V
“H” input voltage	VIH	VDD=2.7	0.8VDD	-	VDD	V
“L” input voltage	VIL	VDD=2.7	VSS	-	0.2VDD	V
“H” output voltage	VOH	VDD=2.7	0.8VDD	-	VDD	V
“L” output voltage	VOL	VDD=2.7	VSS	-	0.2VDD	V
Supply current	IDD	VDD=3.0	-	0.146	-	mA
LCD driving voltage	VOP	-	-	6.2	-	V



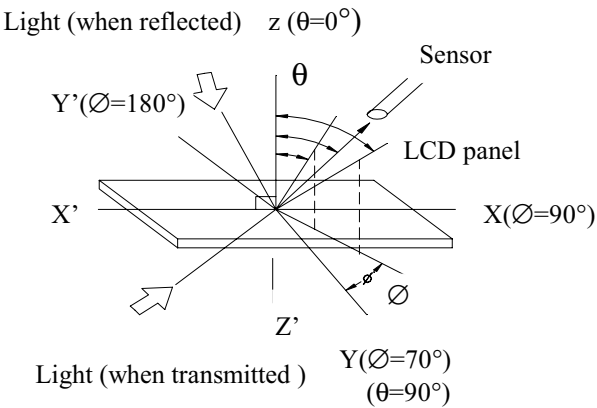
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1.5 Optical Characteristics

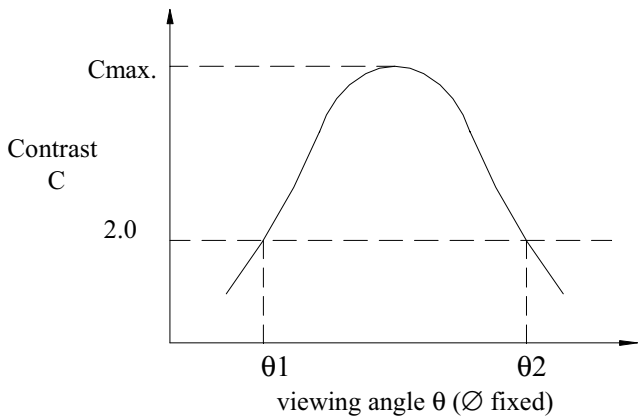
1/33 duty, 1/6 bias, Vopr=6.2, Ta=25°C

Item	Symbol	Conditions	Min.	Typ.	Max	Reference
Viewing angle	θ	$C \geq 2.0, \varnothing = 0^\circ C$	30°	-	-	Notes 1 & 2
Contrast	C	$\theta = 5^\circ, \varnothing = 0^\circ$	-	3	-	Note 3
Response time(rise)	tr	$\theta = 5^\circ, \varnothing = 0^\circ$	-	120ms	180ms	Note 4
Response time(fall)	tf	$\theta = 5^\circ, \varnothing = 0^\circ$	-	150ms	225ms	Note 4

Note 1: Definition of angles θ and $\varnothing$



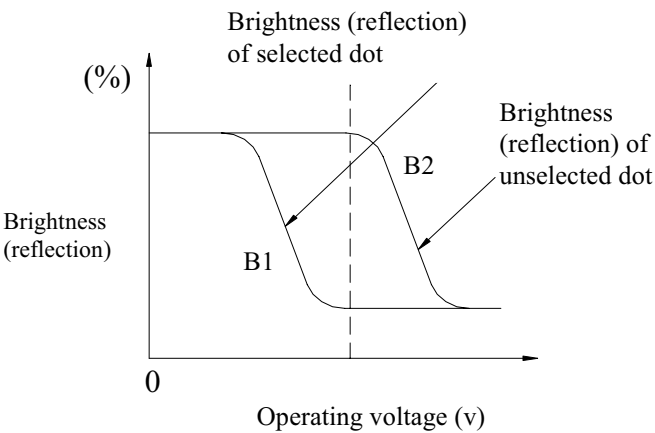
Note 2: Definition of viewing angles θ_1 and θ_2



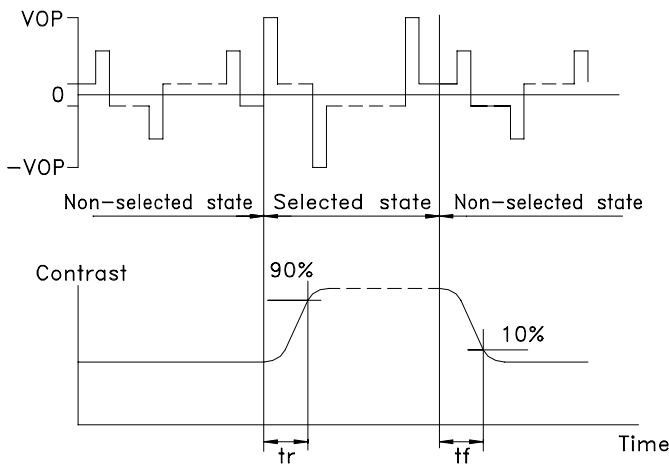
Note : Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same.

Note 3: Definition of contrast C

$$C = \frac{\text{Brightness (reflection) of unselected dot (B2)}}{\text{Brightness (reflection) of selected dot (B1)}}$$



Note 4: Definition of response time



Note: Measured with a transmissive LCD panel which is displayed 1 cm²

V_{OPR} : Operating voltage
t_r : Response time (rise)
f_{FRM} : Frame frequency
t_f : Response time (fall)



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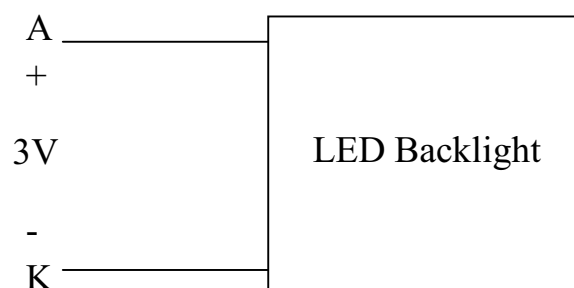
1.6 Backlight Characteristic

•Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward current	I _F	T _A =25°C	-	200	mA
Reverse voltage	V _R	T _A =25°C	-	4	V
Power dissipation	P _O	T _A =25°C	-	0.5	W
Operating Temperature	T _{OPR}	-	-20	70	°C
Storage temperature	T _{STG}	-	-40	80	°C

•Electrical Ratings

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Forward voltage	V _F	I _F =100mA	-	2.1	2.5	V
Reverse current	I _R	V _R =8V	-	-	0.2	mA
Luminous intensity	I _V	I _F =100mA	14	17	-	cd/m ²
Wavelength	HUE	I _F =100mA	569	-	576	nm
Color	Yellow Green					



2. MODULE STRUCTURE

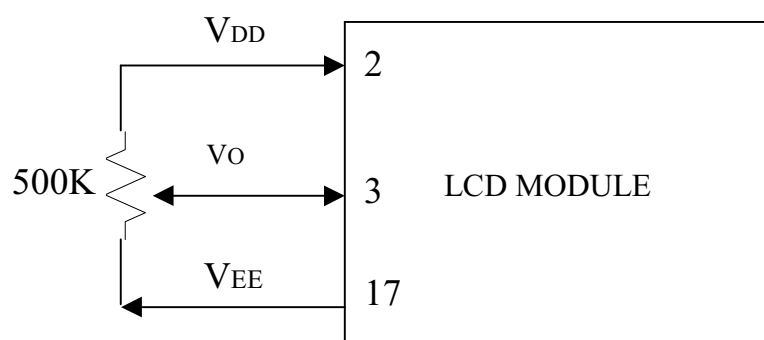
2.1 Counter Drawing

*See Appendix 1

2.2 Pin Description

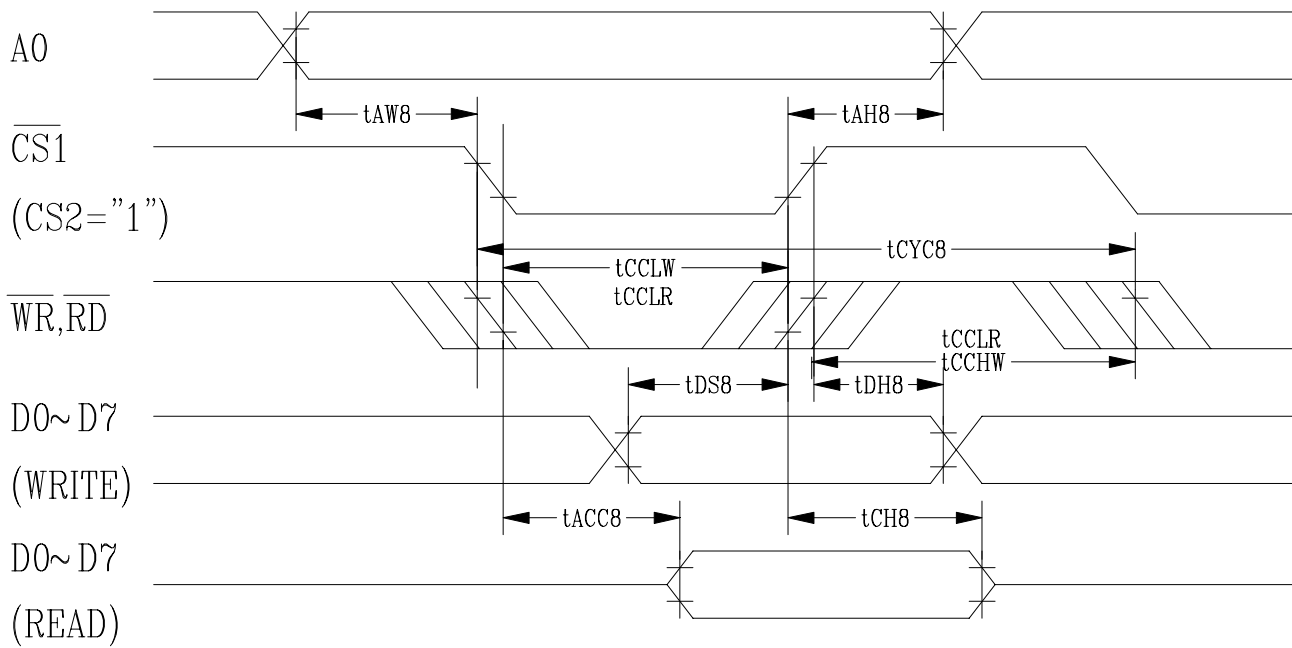
Pin No.	Symbol	Function
1	VSS	Signal ground (GND)
2	VDD	Power supply for logic
3	VO	Adjust pin for LCD driving Voltage
4	A0	Control/Display data flag input
5	$\overline{\text{WR}}$	Write enable input (write is active low)
6	$\overline{\text{RD}}$	Enable clock input (active low)
7-14	DB0~ DB7	8-bit bi-directional data bus to be connected to the standard 8-bit or 16-bit microprocessor data bus. When the serial interface selects; D7:Serial data input (SI) D6:Serial clock input (SCL)
15	$\overline{\text{CS1}}$	Chip select input.
16	$\overline{\text{RST}}$	Reset signal
17	VEE	DC/DC converter (booster) output
18	NC	No Connection
19	A	LED Backlight(+)
20	K	LED Backlight(-)

*Contrast Adjust:

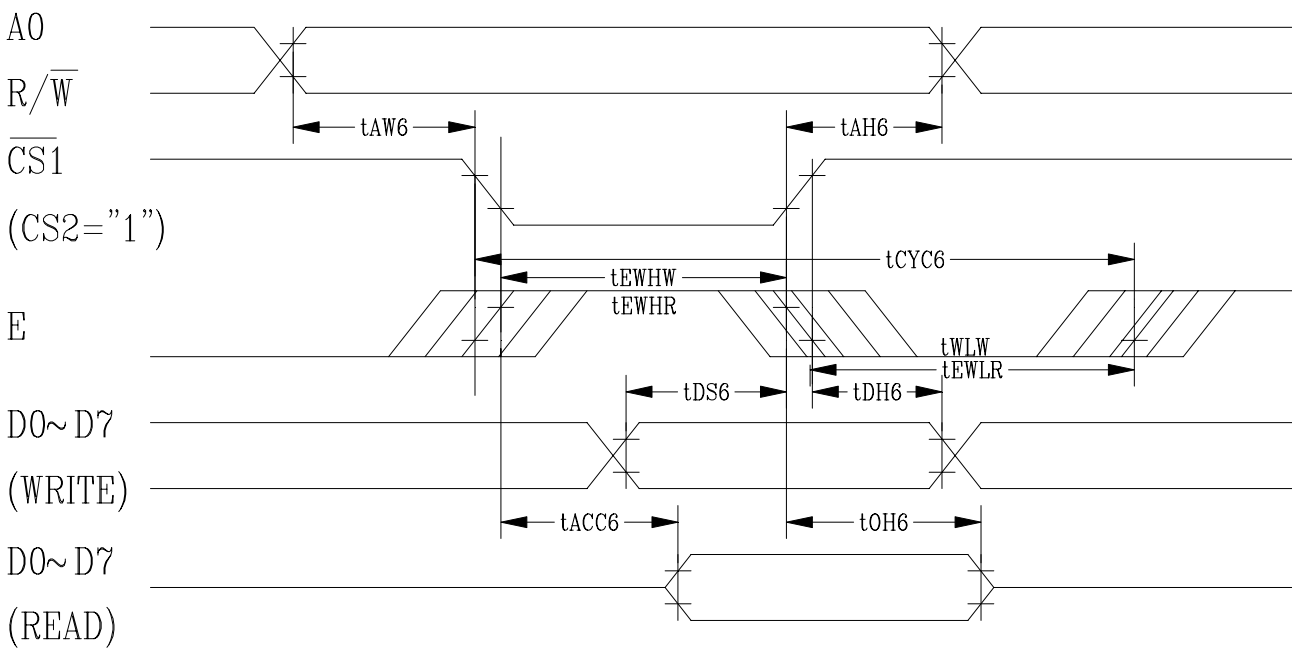


2.3 Timing Characteristics

•MPU Bus Read/Write I (80-family MPU)



•MPU Bus Read/Write II (68-family MPU)



•MPU Bus Read/Write I (80-family MPU)

VDD=3V±10%,Ta=25°C

Item	Symbol	Conditions	Min.	Max.	Unit	Signal
Address hold time	t _{AH8}	-	19	-	ns	A0
Address setup time	t _{AW8}	-	15	-	ns	
System cycle time	t _{CYC8}	-	450	-	ns	
Control L pulse width	t _{CCLW}	-	60	-	ns	$\overline{\text{WR}}$
Control L pulse width	t _{CCLR}	-	140	-	ns	$\overline{\text{RD}}$
Control H pulse width	t _{CCHW}	-	200	-	ns	$\overline{\text{WR}}$
Control H pulse width	t _{CCHR}	-	140	-	ns	$\overline{\text{RD}}$
Data setup time	t _{DS8}	-	40	-	ns	D0 to D7
Data hold time	t _{DH8}	-	15	-	ns	
RD access time	t _{ACC8}	CL=100 PF	-	140	ns	
Output disable time	t _{CH8}		10	100	ns	
Rise and fall time	t _r ,t _f	-	-	15	ns	

•MPU Bus Read/Write II (68-family MPU)

VDD=3V±10%,Ta=25°C

Item	Symbol	Conditions	Min.	Max.	Unit	Signal
System cycle time	t _{CYC6}	-	450	-	ns	
Address setup time	t _{AW6}	-	15	-	ns	A0 W/R
Address hold time	t _{AH6}	-	19	-	ns	
Data hold time	t _{DS6}	-	40	-	ns	D0 to D7
Data hold time	t _{DH6}	-	15	-	ns	
Output disable time	t _{OH6}	CL=100 PF	10	100	ns	
Access time	t _{ACC6}		-	140	ns	
Enable L pulse width	Read t _{EWHR}	-	140	-	ns	E
	Write t _{EWHW}	-	60	-	ns	
Enable H pulse width	Read t _{EWLR}	-	140	-	ns	E
	Write t _{EWLW}	-	200	-	ns	
Rise and fall time	t _r ,t _f	-	-	1.5	ns	-

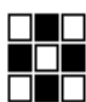


2.4 Display Command

Reference SED 1530 technical Manual

Command	Code											Function
	A0	$\overline{RD}$	$\overline{WR}$	D7	D6	D5	D4	D3	D2	D1	D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	Turns on LCD panel when goes high, and turns off when goes low.
(2) Initial Display Line	0	1	0	0	1	Start display address						Specifies RAM display line for COM0.
(3) Set Page Address	0	1	0	1	0	1	1	Page address				Sets the display RAM page in Page Address register.
(4) Set Column Address 4 higher bits	0	1	0	0	0	0	1	Higher column address				Sets 4 higher bits of column address of display RAM in register
(4) Set Column Address 4 lower bits	0	1	0	0	0	0	0	Lower column address				Sets 4 lower bits of column address of display RAM in register
(5) Read Status	0	0	1	Status				0	0	0	0	Reads the status information.
(6) Write Display Data	1	1	0	Write data								Writes data in display RAM.
(7) Read Display Data	1	0	1	Read data								Reads data from display RAM.
(8) ADC Select	0	1	0	1	0	1	0	0	0	0	0 1	Sets normal relationship between RAM column address and segment driver when low, but reverses the relationship when high.
(9) Normal/Reverse Display	0	1	0	1	0	1	0	0	1	1	0 1	Normal indication when low, but full indication when high.
(10) Entire Display ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	Selects normal display (0) or Entire display ON (1).
(11) Set LCD Bias	0	1	0	1	0	1	0	0	0	1	0 1	Sets LCD drive voltage bias ratio.
(12) Read-Modify- Write	0	1	0	1	1	1	0	0	0	0	0	Increments Column Address counter during each write when high and during each read when low.
(13) End	0	1	0	1	1	1	0	1	1	1	0	Releases the Read-Modify-Write.
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	Resets internal functions.
(15) Set Output Status Register	0	1	0	1	1	0	0	0	*	*	*	Selects COM output scan direction. * Invalid data
(16) Set Power Control	0	1	0	0	0	1	0	1	Operation status			Selects the power circuit operation mode.
(17) Set Electronic Control Register	0	1	0	1	0	0	Electronic control value					Sets V5 output voltage to Electronic Control register.
(18) Set Standby	0	1	0	1	0	1	0	1	1	0	0 1	Selects standby status. 0: OFF 1:ON
(19) Power Save	-	-	-	-	-	-	-	-	-	-	-	Compound command of display OFF and entire display ON
(20) Test Command	0	1	0	1	1	1	1	*	*	*	*	IC Test command. Do not use!

Note: Do not use any other command, or the system malfunction may result.



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