

# 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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DISPLAY DEVICES FOR BETTER ELECTRONIC DESIGN

## 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 <sub>DD</sub> Level)	V5, VOUT	-18.0	0.3	V	
Supply voltage range (2) (V <sub>DD</sub> 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	V <sub>IH</sub>	VDD=2.7	0.8VDD	-	VDD	V
“L” input voltage	V <sub>IL</sub>	VDD=2.7	VSS	-	0.2VDD	V
“H” output voltage	V <sub>OH</sub>	VDD=2.7	0.8VDD	-	VDD	V
“L” output voltage	V <sub>OL</sub>	VDD=2.7	VSS	-	0.2VDD	V
Supply current	I <sub>DD</sub>	VDD=3.0	-	0.146	-	mA
LCD driving voltage	VOP	-	-	6.2	-	V



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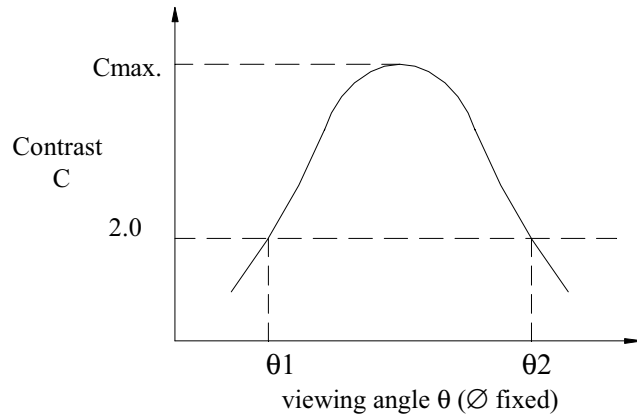
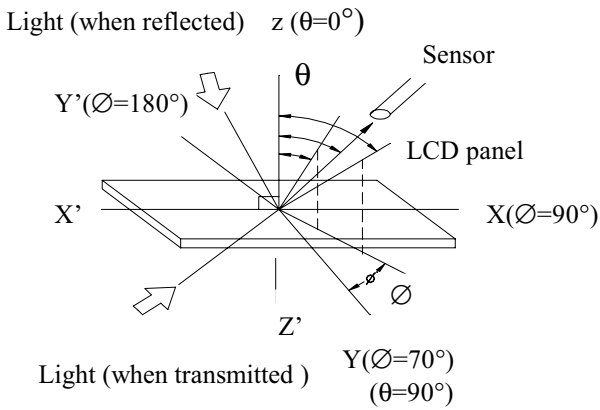
### 1.5 Optical Characteristics

1/33 duty, 1/6 bias,  $V_{opr}=6.2$ ,  $T_a=25^\circ C$

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

Note 1: Definition of angles  $\theta$  and  $\phi$

Note 2: Definition of viewing angles  $\theta_1$  and  $\theta_2$

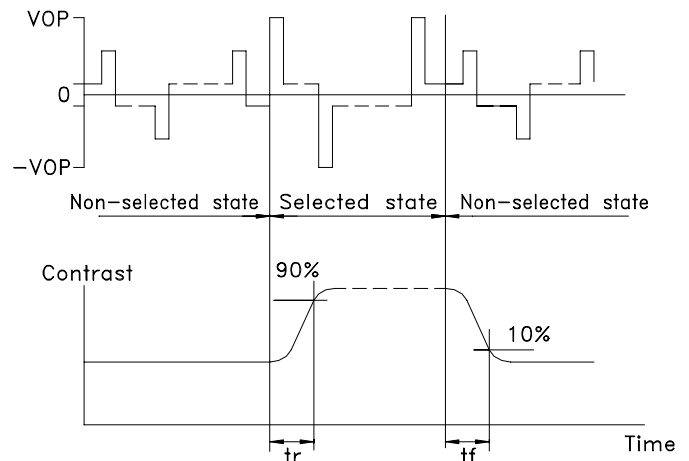
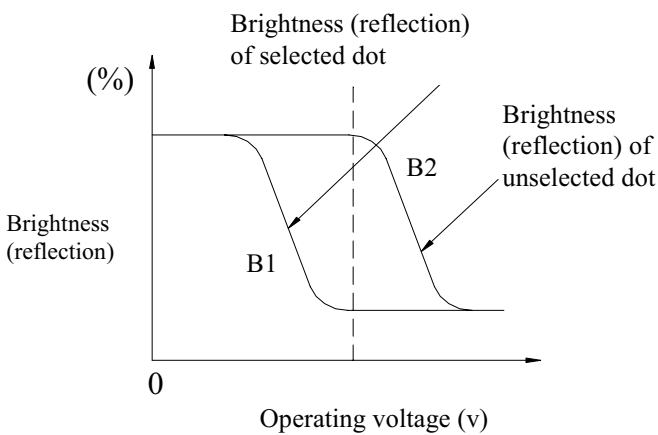


Note : Optimum viewing angle with the naked eye and viewing angle  $\theta$  at  $C_{max}$ . Above are not always the same.

Note 3: Definition of contrast C

Note 4: Definition of response time

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



Note: Measured with a transmissive LCD panel which is displayed  $1 \text{ cm}^2$

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



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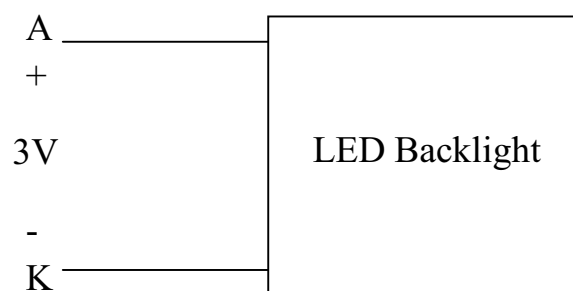
## 1.6 Backlight Characteristic

### •Maximum Ratings

Item	Symbol	Conditions	Min.	Max.	Unit
Forward current	I <sub>F</sub>	T <sub>A</sub> =25°C	-	200	mA
Reverse voltage	V <sub>R</sub>	T <sub>A</sub> =25°C	-	4	V
Power dissipation	P <sub>O</sub>	T <sub>A</sub> =25°C	-	0.5	W
Operating Temperature	T <sub>OPR</sub>	-	-20	70	°C
Storage temperature	T <sub>STG</sub>	-	-40	80	°C

### •Electrical Ratings

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



## 2. MODULE STRUCTURE

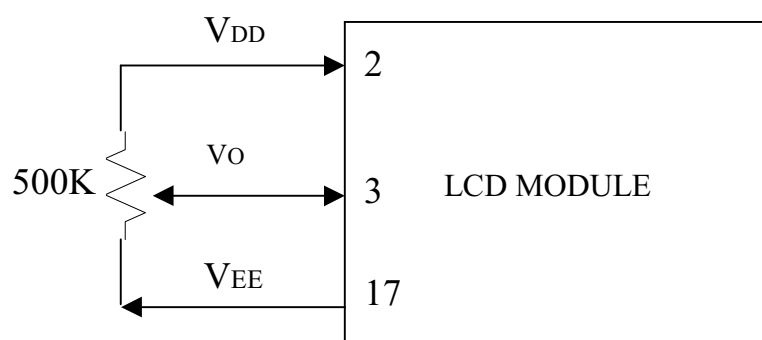
### 2.1 Counter Drawing

\*See Appendix 1

### 2.2 Pin Description

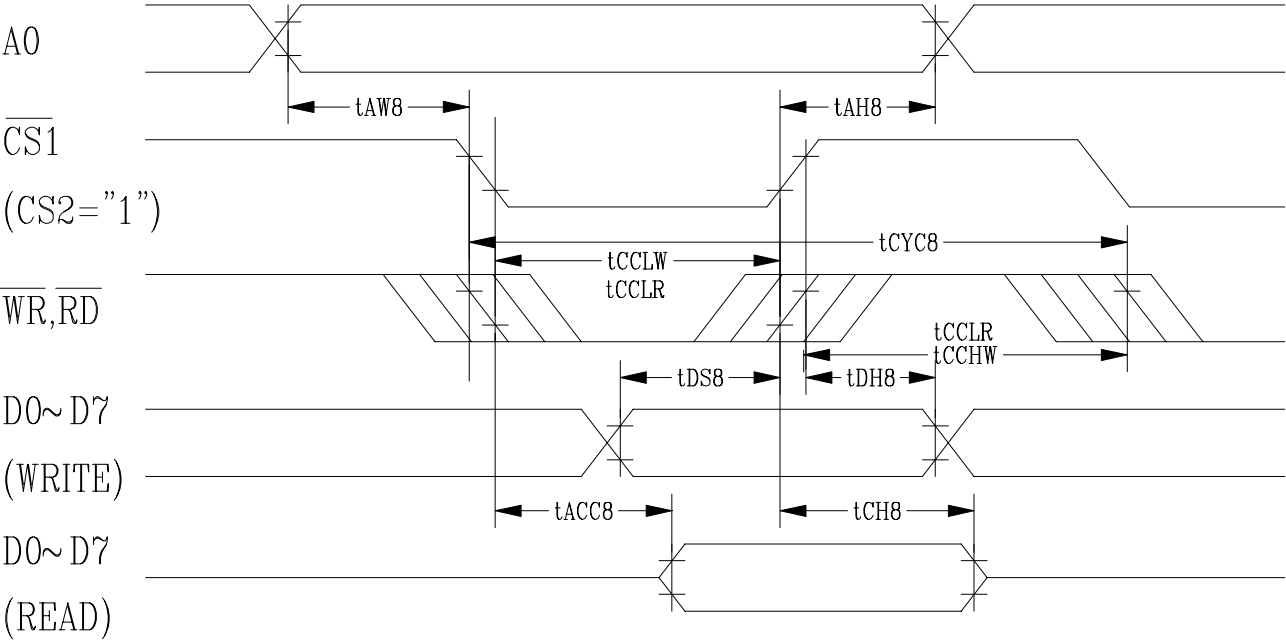
Pin No.	Symbol	Function
1	VSS	Signal ground (GND)
2	VDD	Power supply for logic
3	VO	Adjust pin for LCD driving Voltage
4	A0	Control/Display data flag input
5	$\overline{\text{WR}}$	Write enable input (write is active low)
6	$\overline{\text{RD}}$	Enable clock input (active low)
7-14	DB0~ DB7	8-bit bi-directional 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:

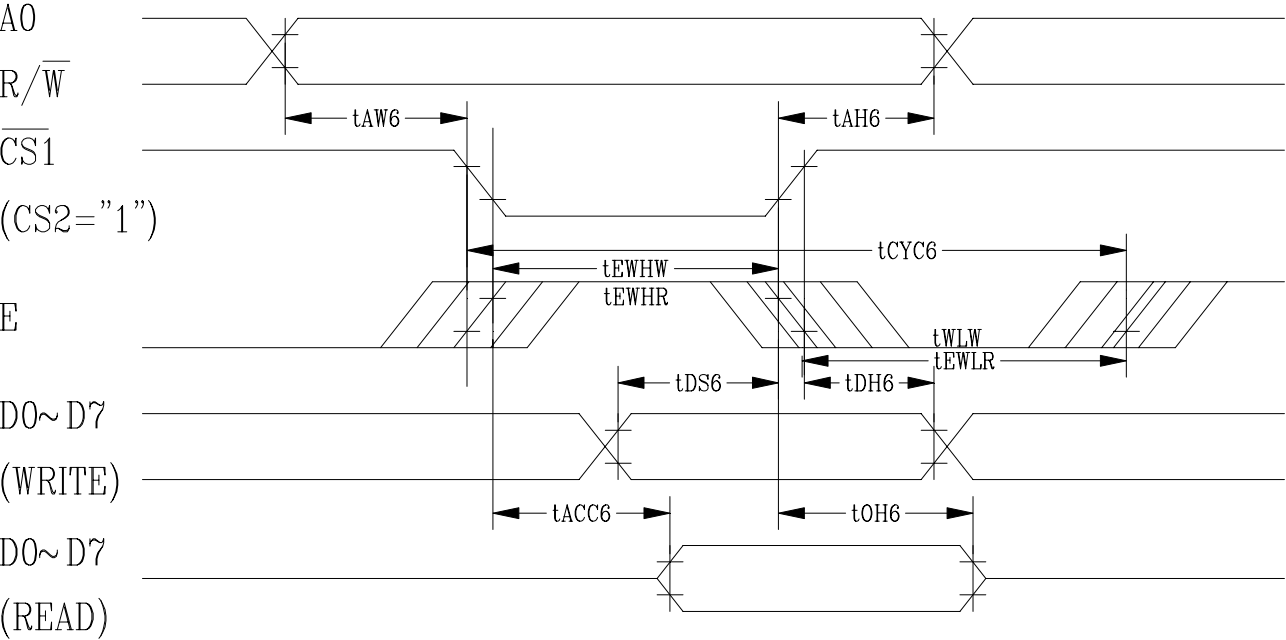


### 2.3 Timing Characteristics

•MPU Bus Read/Write I (80-family MPU)



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



## •MPU Bus Read/Write I (80-family MPU)

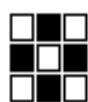
VDD=3V±10%,Ta=25°C

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

## •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 <sub>CYC6</sub>	-	450	-	ns		
Address setup time	t <sub>AW6</sub>	-	15	-	ns	A0	
Address hold time	t <sub>AH6</sub>	-	19	-	ns	W/R	
Data hold time	t <sub>DS6</sub>	-	40	-	ns	D0 to D7	
Data hold time	t <sub>DH6</sub>	-	15	-	ns		
Output disable time	t <sub>OH6</sub>	CL=100 PF	10	100	ns		
Access time	t <sub>ACC6</sub>		-	140	ns		
Enable L pulse width	Read	t <sub>EWHR</sub>	-	140	-	ns	E
	Write	t <sub>EWHW</sub>	-	60	-	ns	
Enable H pulse width	Read	t <sub>EWLR</sub>	-	140	-	ns	E
	Write	t <sub>EWLw</sub>	-	200	-	ns	
Rise and fall time	t <sub>r</sub> ,t <sub>f</sub>	-	-	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	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	0	Releases the Read-Modify-Write.
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	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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