## LSI/CSI





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Power supply for LS9200 can be provided from any voltage source from 5V DC to rectified 240VAC or higher with a current limiting series resistor. The internal supply voltage in all cases is regulated at 5V.

## INPUTS/OUTPUTS:

VCC (pin 1). Power supply positive terminal. DC voltage supply can be provided from a very wide range of levels from 5VDC to rectified 240VAC. Supply voltages ranging between 5V and 10V can be directly applied to VCC pin. For supply voltages exceeding 10V a current limiting series resistor must be used between the supply and VCC to set the current between 550uA and 650uA. The resistor value is estimated as follows:

R = ( Vsupply – 10V ) / 600uA

 $V_{REG}$  (pin 2). The regulated internal 5V supply is brought out on pin 2. A 0.5uF or larger filter capacitor should be connected from pin 2 to ground.

Vdim (pin 3). Vdim input controls the LOAD output duty cycle and can operate in one of two ways selected by the EXPWM/ input. When EXPWM/ input is high, an analog voltage applied to pin 3 controls the load output duty cycle. Duty cycle is adjustable from 0% to 100% by varying the voltage between 0.5V and 3.2V. The variable voltage may be generated by using a potentiometer connected between VDD and GND. The duty cycle percentage can be estimated as follows:

[(Vdim - 0.5) / 2.7] x 100

When EXPWM/ input is low, Vdim input operates with an external PWM signal. In this mode dimming operation of several LS9200 devices can be synchronized with a single PWM signal produced by one device in the group.

**EXPWM**/ (pin 4). A low at the EXPWM/ input selects the mode in which an external PWM signal is applied to the Vdim input for LOAD output duty cycle control. A high at the EXPWM/ input selects the mode wherein an analog voltage at the Vdim input controls the LOAD output duty cycle as per fig 4.

**GND** (pin 5). Power supply ground, to be connected to the power supply negative terminal.

**RES** (pin 6). Current regulation resistor input. The LED maximum load current is set by a resistor connected between RES and GND as shown in fig 3A and 3B.

LOAD (pin 7). Current sink output for driving the negative terminal of the LED bank. The absolute maximum power dissipation of the driver output is 4W which decreases as the junction temperature increases. Up to 1.5W device dissipation thermal shutdown can be avoided without the use of any heatsink. For dissipations > 1.5W proper heat sink must be added to the PCB making direct contact with the exposed pad underneath the IC package. The maximum dissipation in watts can be estimate by:

Pmax = (120 -Tc)/11 where, Tc is the case temperature.

**PWMO** (pin 8). The internal PWM signal which controls the LOAD duty cycle is buffered out at this pin. This signal can be used by multiple LS9200 devices for synchronized dimming control.

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ABSOLUTE MAXIMUM RATINGS:

 $\begin{array}{l} \mbox{Power dissipation, } (V_{LOAD}-V_{RES}) \ x \ I_{LOAD}......5W \\ \mbox{Input voltages (all inputs)...... -0.3V min, } V_{REG} + 0.3V max \\ \mbox{Operating temperature}....-40^{\circ}C \ to +125^{\circ}C \\ \mbox{Storage temperature}....-65^{\circ}C \ to +150^{\circ}C \end{array}$ 

The information included herein is believed to be accurate and reliable. However, LSI Computer Systems, Inc. assumes no responsibilities for inaccuracies, or for any infringements of patent rights of others which may result from its use

WARNING: In all applications incorporating LS9200, proper and adequate heat dissipation measures must be taken to keep the junction temperature equal to or below 125°C. LSI Computer Systems, Inc. will not be held responsible for any damage caused by improper use of this part.

| ELECTRICAL AND TRANSIENT CHARACTERISTICS; unless specified otherwise VCC = 6V, T <sub>A</sub> = -40° to +85° C |                    |       |      |       |      |                                                                                                         |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------|--------------------|-------|------|-------|------|---------------------------------------------------------------------------------------------------------|--|--|--|--|
| Parameter                                                                                                      | Symbol             | Min   | Тур  | Max   | Unit | Condition                                                                                               |  |  |  |  |
| Supply voltage                                                                                                 | VCC                | 5     | -    | 10    | V    | For Vsupply >10V, supply current must be limited to 900uA max with external resistor in series with VCC |  |  |  |  |
| Supply current                                                                                                 | lcc                | -     | 600  | 900   | uA   | Current limited with external series resistor                                                           |  |  |  |  |
| Regulated voltage                                                                                              | V <sub>REG</sub>   | -     | 4.6  | -     | V    | @ IV <sub>REG</sub> = 200uA                                                                             |  |  |  |  |
| Output sink current                                                                                            | ILOAD              | 0.005 | -    | 200   | mA   | @ $V_{LOAD} \ge 7V$ ; current adjusted with sense resistor at pin-6                                     |  |  |  |  |
| Output voltage                                                                                                 | VLOAD              | 5.0   | -    | 75.0  | V    | LOAD output dissipation limited to 4W                                                                   |  |  |  |  |
| EXPWM/ input hi                                                                                                | VEPWH              | -     | 2.8  | 3.4   | V    |                                                                                                         |  |  |  |  |
| EXPWM/ input lo                                                                                                | VEPWL              | 1.2   | 1.8  | -     | V    |                                                                                                         |  |  |  |  |
| V <sub>dim</sub> input ,                                                                                       | V <sub>dimlo</sub> | -     | 0.5  | -     | V    | LOAD output duty cycle = 0%                                                                             |  |  |  |  |
| thresholds                                                                                                     | V <sub>dimhi</sub> | -     | 3.2  | -     | V    | LOAD output duty cycle = 100%                                                                           |  |  |  |  |
| EXPWM/,V <sub>DIM</sub> input<br>high current                                                                  | I <sub>EPDMH</sub> | -     | 6    | 10    | uA   | Vin = 4.5V                                                                                              |  |  |  |  |
| EXPWM/, V <sub>DIM</sub><br>input low current                                                                  | I <sub>EPDML</sub> | -     | -8   | -14.0 | uA   | Vin = 0.5V                                                                                              |  |  |  |  |
| PWM frequency                                                                                                  | f <sub>PWM</sub>   | 15    | 22   | 30    | KHz  |                                                                                                         |  |  |  |  |
| PWMO output sink                                                                                               | I <sub>PSNK</sub>  | 750   | 1400 | -     | uA   | @V <sub>0</sub> = 0.5V                                                                                  |  |  |  |  |
| PWMO output src                                                                                                | I <sub>PSRC</sub>  | -200  | -300 | -     | uA   | @V <sub>0</sub> = VDD – 1V                                                                              |  |  |  |  |
| PWMO rise time                                                                                                 | t <sub>PR</sub>    | -     | 250  | 330   | nS   | @ 100pf load                                                                                            |  |  |  |  |
| PWMO fall time                                                                                                 | T <sub>PF</sub>    | -     | 90   | 160   | nS   | @100pf load                                                                                             |  |  |  |  |
| LOAD output                                                                                                    |                    | -     | 1.0  | -     | %    | $(\Delta I_{LOAD}/\Delta V_{LOAD}) \times 100, \Delta V_{LOAD} = 70V - 10V, I_{LOAD} (nom) = 25mA$      |  |  |  |  |
| current regulation                                                                                             |                    | -     | 6.6  | -     | %    | $(\Delta I_{LOAD}/\Delta V_{LOAD})$ x100, $\Delta V_{LOAD}$ =40V–10V, $I_{LOAD}$ (nom)=120mA            |  |  |  |  |
| (See Note 1)                                                                                                   |                    | -     | 9.0  | -     | %    | $(\Delta I_{LOAD}/\Delta V_{LOAD})$ x100, $\Delta V_{LOAD}$ =20V–10V, $I_{LOAD}$ (nom)=200mA            |  |  |  |  |
| LOAD output<br>dissipation                                                                                     | P <sub>LOAD</sub>  | -     | -    | 4.0   | Watt | $P_{LOAD} = (V_{LOAD} - V_{RES}) \times I_{LOAD}, T_A \le 50^{\circ}C$                                  |  |  |  |  |
| Thermal shutdown                                                                                               | T <sub>SHTDN</sub> | -     | 120  | -     | °C   | Thermal shutdown in temperature upswing                                                                 |  |  |  |  |
| Shutdown recovery                                                                                              | T <sub>RCVR</sub>  | -     | 105  | -     | °C   | Recovery from shutdown in temperature downswing                                                         |  |  |  |  |
| Thermal resistance                                                                                             | R <sub>ΦJC</sub>   | -     | 11   | -     | °C/W | Thermal resistance between junction and case                                                            |  |  |  |  |

Note 1. For  $I_{LOAD}$  = 120mA and 200mA  $V_{LOAD}$  have been limited to 40V and 20V to limit  $P_{LOAD}$  to 4W.

**Note 2**. For  $P_{LOAD} > 1.5W$ , adequate heat sink must be used to prevent thermal shutdown. Maximum  $P_{LOAD}$  dissipation can be estimated by:  $Pmax = (T_{SHTDN} - Tc)/R_{\Phi Jc}$ , where Tc = case temperature



Fig 3A. Load current vs resistor (R<sub>RES</sub>) at pin 6

Fig 3B. Load current vs resistor ( $R_{RES}$ ) at pin 6



Fig 4. V<sub>DIM</sub> voltage vs PWM duty cycle



9200-012022-4











9200-092222-6

## Package Outline: EP-SOP-8





| SVMPOL |            | MILLIMETE | R    | INCHES     |       |            |
|--------|------------|-----------|------|------------|-------|------------|
| STWBOL | MIN        | NOM       | MAX  | MIN        | NOM   | MAX        |
| А      | -          | -         | 1.75 | -          | -     | 0.069      |
| A1     | 0.1        | -         | 0.25 | 0.04       | -     | 0.1        |
| A2     | 1.25       | -         | -    | 0.049      | -     | -          |
| С      | 0.1        | 0.2       | 0.25 | 0.0075     | 0.008 | 0.01       |
| D      | 4.7        | 4.9       | 5.1  | 0.185      | 0.193 | 0.2        |
| E      | 3.7        | 3.9       | 4.1  | 0.146      | 0.154 | 0.161      |
| Н      | 5.8        | 6         | 6.2  | 0.228      | 0.236 | 0.244      |
| L      | 0.4        | -         | 1.27 | 0.015      | -     | 0.05       |
| b      | 0.31       | 0.41      | 0.51 | 0.012      | 0.016 | 0.02       |
| е      |            | 1.27 BSC  |      | 0.050 BSC  |       |            |
| У      | -          | -         | 0.1  | -          | -     | 0.004      |
| θ      | <b>0</b> 0 | -         | 80   | <b>0</b> 0 | -     | <b>8</b> 0 |