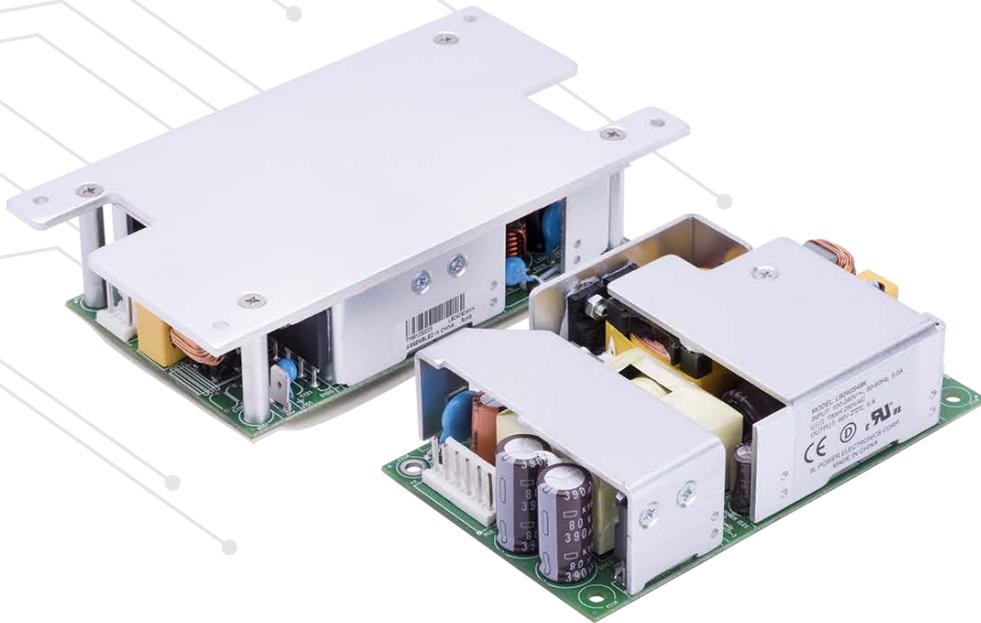


# LB240S Family LED 240W Power Supplies



## Conduction Cooling and Thermal Considerations AN-P022



### OVERVIEW

The SL Power Electronics LB240S model is the highest-density conduction-cooled power supply in a compact 3"X 5" package. Providing 240 Watts of power at 50°C ambient with 300 LFM airflow, the LB240S is designed to meet global lighting requirements and has a built-in EMI filter to meet EN55015. It has a universal AC input range of 100 to 240 VAC. All models are CE marked to low voltage directive and approved to safety standard EN60950 2nd edition and UL8750.

The versatility of the thermal design of the LB240 offers significant advantages over standard convection or force air cooling alone. The conduction cooled surface provides additional power handling capability while taking advantage of system enclosures as a means to extract heat from the power supply.

For long-term reliability, this model family has been designed using high quality components to provide long life, thoroughly tested and approved by regulatory agencies. See the product datasheet for more details.

Additionally, the LB240S series of supplies has been designed for top-side conductive cooling, offering the customer either two, partial, co-planar top plates (standard) or one complete top plate (option "H" – see datasheet). This application note provides guidance on how to effectively use these plates to maximize the total wattage rating of the power supply.

### CONDUCTION COOLING RATING

As the datasheet specifies, the LB240S is rated to 130W in 70°C ambient air if the two top-cooling heatsinks are kept to under 85°C. Please see the table below for wattage ratings versus various ambient temperatures and cooling methods. Note the product Datasheet takes precedence over this app note in case of discrepancies:

Ambient	Cooling Method	Wattage (watts)
50°C	Forced Air, 300 LFM	240
60°C	Forced Air, 200 LFM	190
70°C	Forced Air, 200 LFM	160
70°C with Max. Temperature of primary heat-sink to be kept under 85°C	Conduction	130
50°C	Convection	160
40°C with "H" option, Max. Temp of cold plate to be under 60°C	Conduction	200



### CONDUCTION COOLING WITH OR WITHOUT "OPTION H"

To aid our customers in conduction cooling, SL Power offers the LB240S with an attached plate (option H) which will easily couple to different surfaces which can conduct heat away from the LB240S power supply such as:

- A metal cabinet of a system
- Flooring
- A liquid-cooled plate
- A Peltier cold plate
- Other heatsinking or cooling options

This metal plate is thermally coupled to the two top-side heatsinks plates by way of an electrically insulating, thermally conductive material.

Customers may choose not to elect for the "option H" plate, but can still take advantage of conductive cooling using the two heatsinks, however they must apply their own thermal coupling and electrically isolating material. SL Power recommends gap-pad material such as Bergquist's Sil-pad for this purpose. Films like Kapton with thermal grease or paste may also be used for this application. The LB240s's two heatsinks are designed to be coplanar within 0.005" for this purpose.

### CALCULATING YOUR THERMAL IMPEDANCE

Thermal impedance is measured as T degrees temperature rise per P watts(s) of power dissipation while heat is flowing through the interface.. For example, at the worst case ambient air temperature (70°C), 15°C or less temperature rise must be achieved while power is transferred out of the heatsinks to stay under the 85°C maximum. At worst case operating input for heat generation (90Vac input) and the least efficient output voltage of the family (24V), we lose 10% of the rated 130W power to heat. Of that heat, approximately 5.4W will be transferred through the mating surfaces to the heatsink (the rest dissipates as convection from the hotter components).

The choice of gap-pad or other electrically insulating but thermally conductive material (coupling material) must also be factored into the equation. Continuing the previous example, if the thermal impedance must be kept under 15°C/5.4W (2.78°C/W) and said material has a thermal impedance of 0.5°/W, then the cold plate's thermal impedance to the ambient air must be less than or equal to 2.28°C/W.

### ELECTRICAL AND THERMAL SAFETY WHEN USING A COLD PLATE

To safely use the LB240S with a conduction cooled plate, the application must use a coupling material that has a dielectric breakdown of no less than 2,550Vac. This means care must be taken to maintain sufficient thickness of the coupling material. The material must extend 0.16" (4mm) beyond the mating surface between the heatsinks and the cold plate. The material should be rated to UL 94V-0 for flame-resistance and self-extinguishing. The cold plate should be connected to safety (earth) ground.



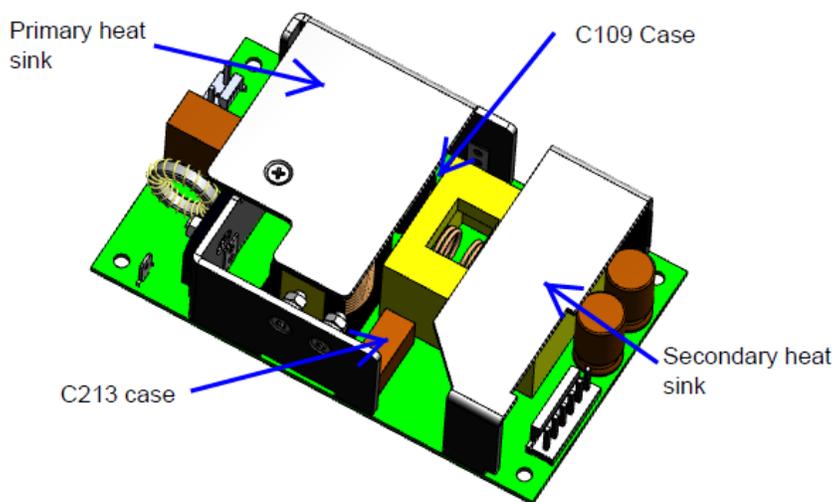
### A NOTE ON COUPLING-MATERIAL COMPRESSION

If one wishes to use conduction cooling without the SL Power-supplied plate (option H), consideration should be paid to the necessary pressure applied when “sandwiching” the thermally coupling material between the heatsink and the cold plate. As previously mentioned, some materials can be spread too thin and would thus lose their dielectric strength, creating a safety hazard. Another potential pitfall of over-compression is flexing the PCB which can permanently damage the power supply. However, under-compression of the coupling material may increase thermal impedance above what is needed to maintain full rating. Attention must be paid to the thermal and mechanical specifications of whatever material is chosen for thermal coupling.

### SAFETY-CRITICAL AND EXPOSED COMPONENTS

Below, as an illustration, are the components of the LB240S to which careful consideration must be paid, to maintain a safe temperature. We also list two, worst-case operating temperatures at full load. To avoid malfunction or shortening of power supply life, it is important that these components not exceed their max allowable temperature as listed below. When measuring the temperature of these components, only qualified individuals should attempt to take these measurements and safe practices should always be used with regards to both high temperatures and voltages that may be present in the area. Please refer to the product CB report to verify the allowable component temperature.

Model LB240S24K: With Conduction Cooled and Output 130W	90Vac, 60Hz temp °C	264Vac, 50Hz temp °C	max allowable temp °C	delta LV	delta HV
C109 Case	93	96	105	12	9
C213 Case	85	98	105	20	7
Primary Heat Sink	77	82	85	8	3
Secondary Heat Sink	72	80	85	13	5



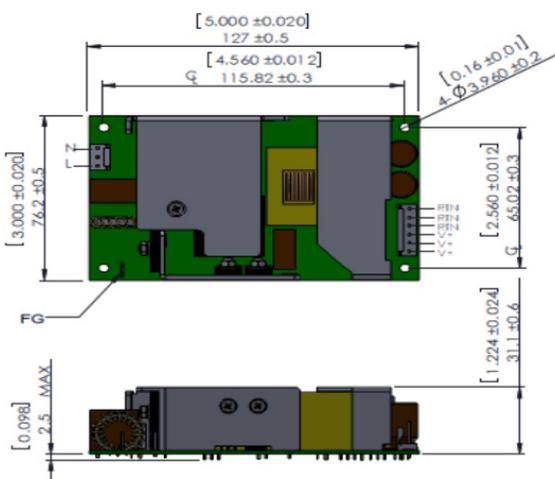


### MECHANICAL DRAWINGS

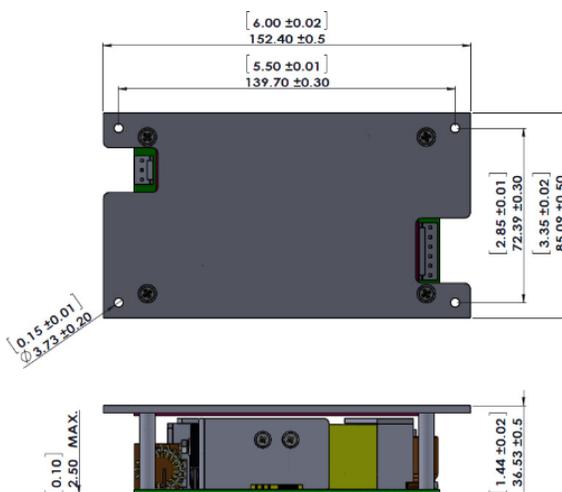
Notes:

- All dimensions are in millimeters and [inches]
- Mounting holes should be grounded for EMI purposes
- "FG" is the safety ground connection
- Power supply requires mounting on metal standoffs min. of 5mm [0.20"] in height

#### LB240SXXK



#### LB240SXXKH





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