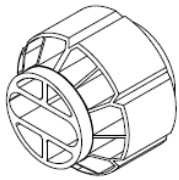
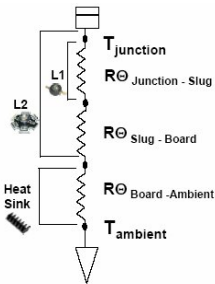


LED Specialists Newsletter

Managing Heat in LED Fixtures – New Perspective to Lighting Fixture Industrial Design



LED Bulb Heat-sink/Housing
(Patent pending)



Calculating LED Junction Temperature

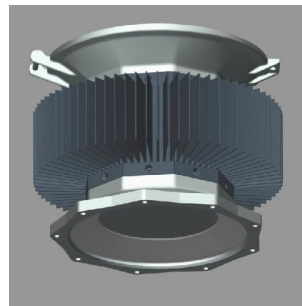
As lighting manufacturers continue to migrate fixture designs to LED, an early appreciation of what one might call “inverse thermal management perspective” needs to be acquired. Traditional light fixtures using incandescent, fluorescent and HID sources are designed to insulate the fixture from the large amount of heat energy (mostly infrared) produced by the bulb. Most of this energy is radiated from the fixture. Heat insulating materials are often employed (e.g. ceramic sockets) to protect the fixture.

With LEDs, while more efficiently converting electrical energy into photons, the majority of the energy is still converted to heat but not in a radiated form. The heat generated must be effectively conducted away from the LED device, into the fixture and then dissipated to the ambient environment. If the LED junction

temperature is too hot, lumen depreciation may be unacceptably rapid.

For fixture designers, this requires a whole new way of thinking:

- How do I make an appealing light fixture that is also really good at



100W LED Fixture

dissipating heat?

- How do I conduct the LED heat to the fixture surfaces exposed to

the ambient air? What are the ambient air temperatures I must design for?

- How much surface area do I need to dissipate the heat?
- How much airflow will I have as installed in the real application and environment?
- What materials should I use? (e.g. aluminum has 15 times the thermal conductivity of stainless steel, but is not as corrosion resistant or attractive).
- How will decorative finishes affect heat dissipation?

In our view, the most elegant fixture designs of the future will find creative ways of merging the heat sinking features of the fixture with pleasing industrial design. Seeing a beautiful fixture with no obvious thermal management features - that’s where the innovation will be.

LED Drivers – Designing for “Embedded” Applications

When designing LED light fixtures for “space constrained” application, the designer is compelled to use interior fixture space for the electronic driver. Often this means that an “off-the-shelf” driver just won’t do because of the volume it requires or its rated case temperature limits.

Obviously, products like LED PAR lamps must have the drive electronics embedded within the lamp. But there are many light fixture applications where the external driver box is undesirable.

Designing embedded LED drivers has a number of considerations:

- Is the driver “isolated” or “non-isolated” design, the latter usually

means eliminating a large transformer

- Components must be selected for higher temperature ranges (e.g. electrolytic capacitors that tend to have greater temperature sensi-



Custom 120VAC LED “embedded” Driver

tivity are avoided)

- Potting or other means to remove heat generated by the driver PCB

must be employed, if fully enclosed

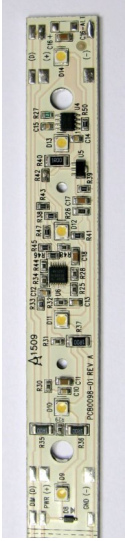
- Electronic components (ceramic capacitors and inductors) can create audible noise, especially when phase dimming is employed. This must be mitigated.
- EMI filter designs are required to use small components, while meeting FCC radiated and conducted emissions limits. Transient suppressors may also be employed to protect against voltage spikes

Embedding a constant current LED driver has distinct advantages in overall fixture design, but requires a careful evaluation of trade-offs in the design and integration process.



Custom low voltage “embedded” LED Driver

LED “Engines” for Lighting OEMs



24V LED Linear Array with 0-10V Dimming



3 High Power LEDs with collimating optics

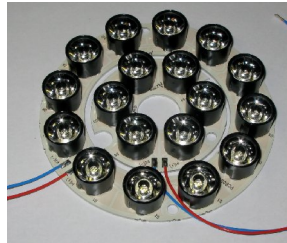
LED Specialists has developed, and now supplies, a range of LED Engines which have become the key components for lighting fixture manufacturers (OEMs) in various lighting markets.

There is a broad range of offerings to support a variety of fixture requirements:

- High power linear LED arrays, with or without collimating optics, to support floodlight and wall wash applications
- Low power linear arrays to support decorative fixture applications for cove, pathway and accent lighting applications
- High power circular arrays, with or without collimating optics, for high power spot or floodlights
- Low power circular arrays with or without collimating

optics, for low power spot or task lighting.

- LED engines are available with and without on-board constant current driver electronics
- LED engines are available with various dimming fea-



tures including PWM, 0-10V and phase control dimming

- Remote drivers are also available

These LED Engine products generally have Metal Core Printed Circuit Boards (MCPCB) to support efficient heat transfer from the LEDs to the host

fixture.

Integration to the host fixture is generally accomplished through screw mounting. This may (or may not) be done with a thermal interface supplement such as thermal grease, thermal pad or thermal epoxy. LED Specialists will support the client in determining the best attachment method for their application.

Various types of optics are available to support beam pattern design. LED Specialists provides consultation with the client on fixture lighting design objectives and other secondary optical features the client is planning to use.

Bare wire leads may be attached or SMD connectors (e.g. “poke-in”) provided. Feel free to contact us at info@ledspecialists or call 631-269-0841 ext. 11 for more information.

“LED Specialists” – Entering our 7th year of Support to the Lighting Industry

Wow! A new decade! — LED Specialists is now in its seventh year of supporting the Lighting Industry in its migration to LED lighting.

Looking back, we’re very proud of the of the development projects we have been involved with and - the most important measure - the client success we have been part of. While our customer relationships are for the most part confidential, here are some highlights of our recent client

projects:

- LED GU-24 replacement lamp for residential fixtures (400 lumens +)



- Industrial grade fixture design for hazardous environments (3000 lumens+).

- Low profile LED “Wall Pack” design for exterior commercial applications
- Lighting for commercial aviation
- LED lighting for recreational and commercial marine
- LED engines for architectural lighting products

We look forward to supporting many more clients as we enter this new “decade of LED”!

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