PERMLIGHT

brilliant

LED Light Engines®

Integrating LED Light Engines in Luminaires

2010 ENERGY STAR® Products Partner Meeting
Solid State Lighting Technology Updates Session

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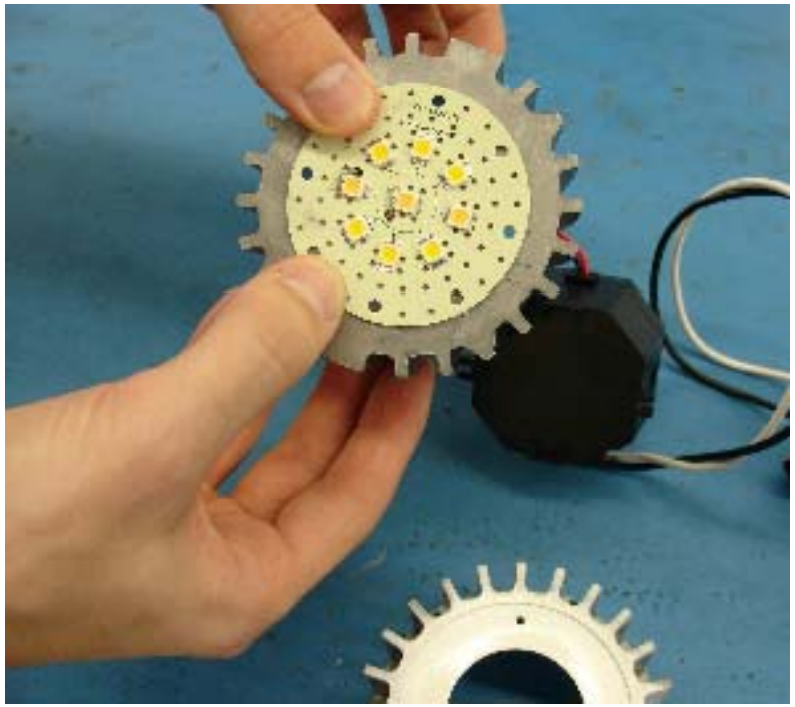
Outline

Topics:

- LED Luminaire design options
  - Retrofit vs. new design
  - Considering a component-based approach
- Critical integration and design factors
- Ways to use LED Light Engines in luminaires
- ENERGY STAR® considerations
- Ongoing SSL Luminaire industry issues



Luminaire Design Options

Two primary ways a luminaire manufacturer can approach SSL luminaire design:

- Retrofit existing design
- New LED luminaire design

Luminaire Design Options

Retrofit Design approach

Assumed advantages:

- Established market for aesthetics
- No need for new tooling
- Quicker to market

Challenges:

- Thermal performance
- Maximizing light output from incumbent style design
- Utilization of proper light engines

Luminaire Design Options

New Design approach

Assumed advantages:

- Maximize design for performance and cost

Progress Lighting®

Challenges:

- Costs for new tooling
- Market acceptance of new design
- Speed to market
- Utilization of proper light engines

Luminaire Design Options

RAB® Lighting

Retrofit LED Wallpack

- Much of housing is wasted space and acts as “oven” trapping heat
- Market accepted aesthetics
- Quick to market

New Design LED “Wallpack”

•Requires market acceptance of new design
•Directional light
•Maximizes light/thermal performance

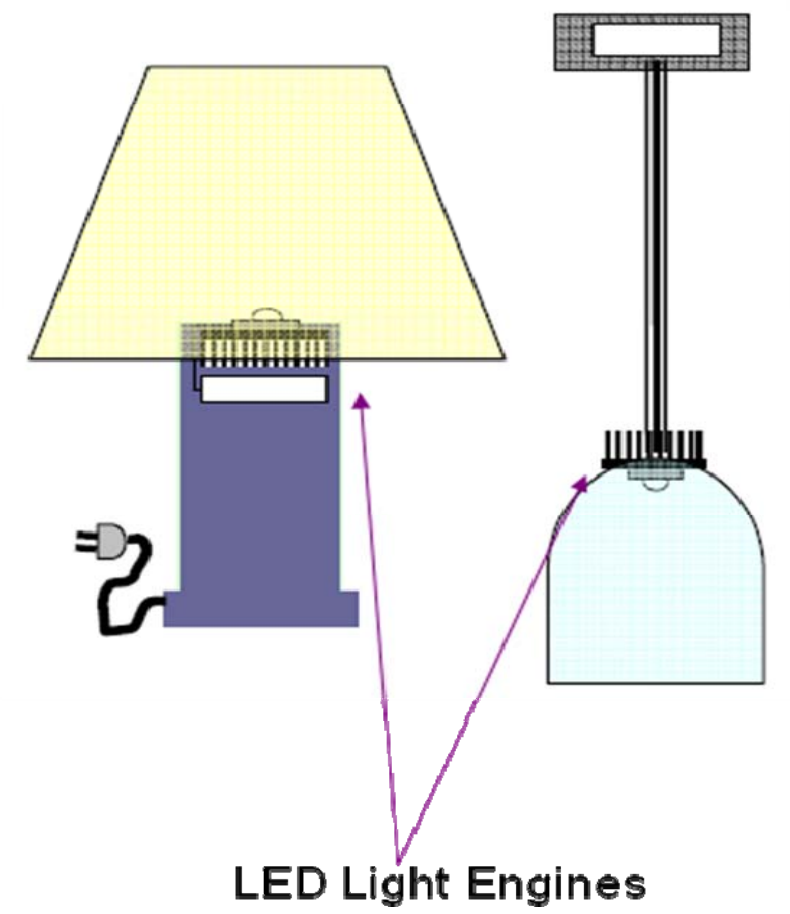
Luminaire Design Options

- Most luminaire manufacturers are not positioned for LED luminaire development
  - Limited equipment, expertise, and proper QC measures for SSL products
- SSL requires a complete **system** approach to the luminaire design taking thermal, optical, and performance considerations into account at the beginning of the design phase

Luminaire Design Options

- All SSL luminaires need a light engine
  - By definition, a Light Engine is comprised of three components:
    1. LED Module
    2. LED Driver
    3. Heat Sink

- Manufacturers have the option to:
  - Make their own LED modules, drivers, and heat sinks
  - Acquire the light engine components from suppliers



Luminaire Design Options

Manufacturer, “in-house” produced Light Engines

Assumed advantages:

- Exact engine for fixture need
- Minimize costs for high volume products

Challenges:

- Design expertise required in electrical, mechanical, and optical
- Speed to market
- Managing inventory of LED packages
- Managing MOQs for manufacturing and inventory
- Listing costs for components
- Complexity of various engines needed
- Supply-chain issues

HALO® Lighting

Luminaire Design Options

Supplier-provided LED Light Engines

Assumed advantages:

- No need for high MOQs
- In-house engineering expertise not needed
- Lower cost due to volume
- No need to deal with LED inventory
- Components already safety listed
- Speed to market

Challenges:

- At high volumes maybe lower cost can be obtained from in-house production
- Exact configuration needed may not be available
- Uniqueness of product design

Brillia BEH09 BD Series
9-LED, 12W, 595 lumen (@3500K), Dimmable
Standard LED Light Engine

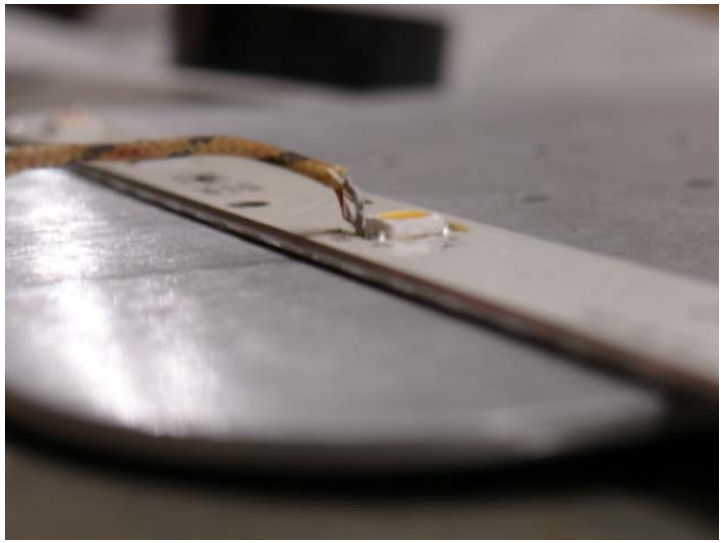
PERMLIGHT

brilli® LED Light Engines

Critical integration and design factors for LED light engine components

Integration and Design Considerations

Understanding Temperature Measurement Points

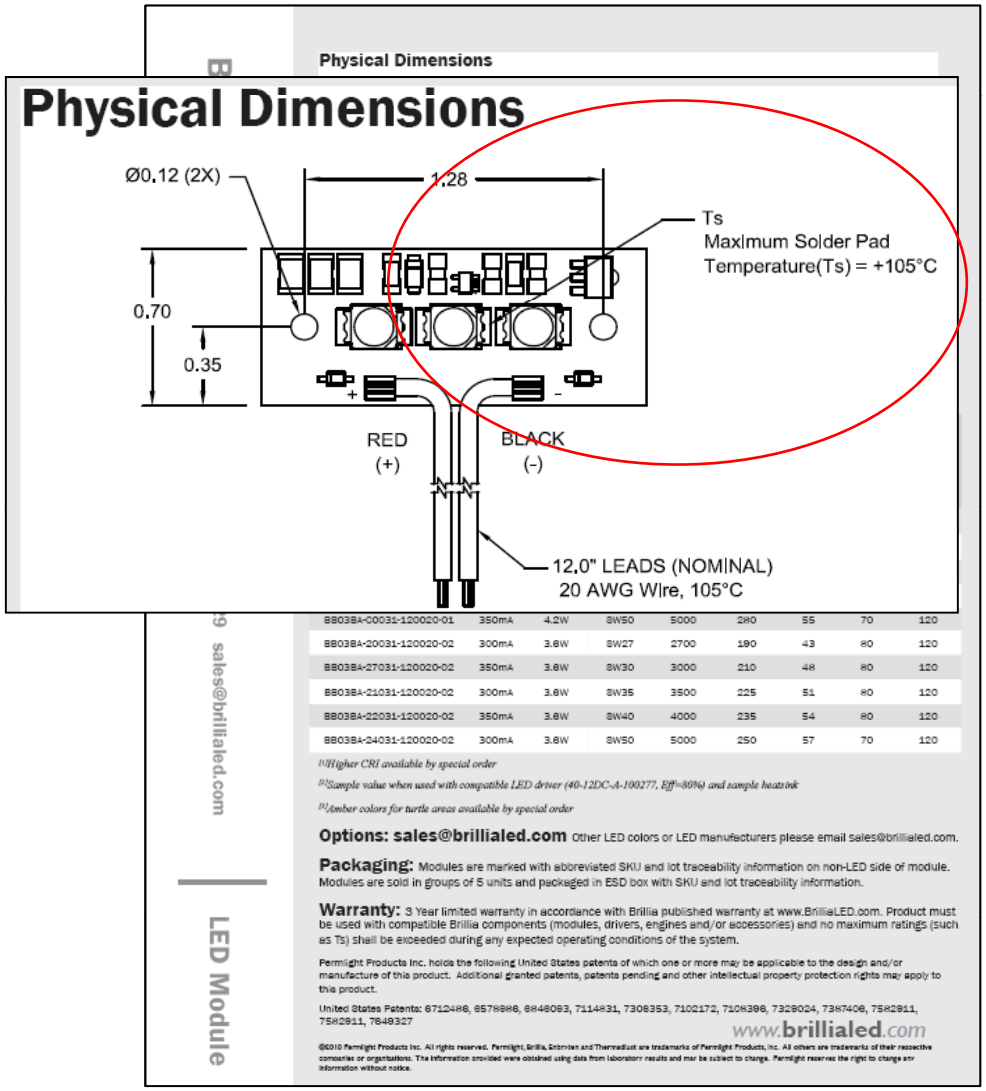


The most important factor in the life and performance of LED light engines is maintaining proper thermal conditions. When the luminaire is in operation, it is important to maintain the temperature on and around the LED driver and LED module at or below the recommended maximum levels. Component mfr. documentation should be configured to assist luminaire mfrs. on how to design to proper performance targets.

Integration and Design Considerations

- LED modules should feature a specified Ts point on the datasheet. This point is called the solder point temperature, and allows calculation of the internal operating temperature of the LED package, known as Junction Temperature (Tj)

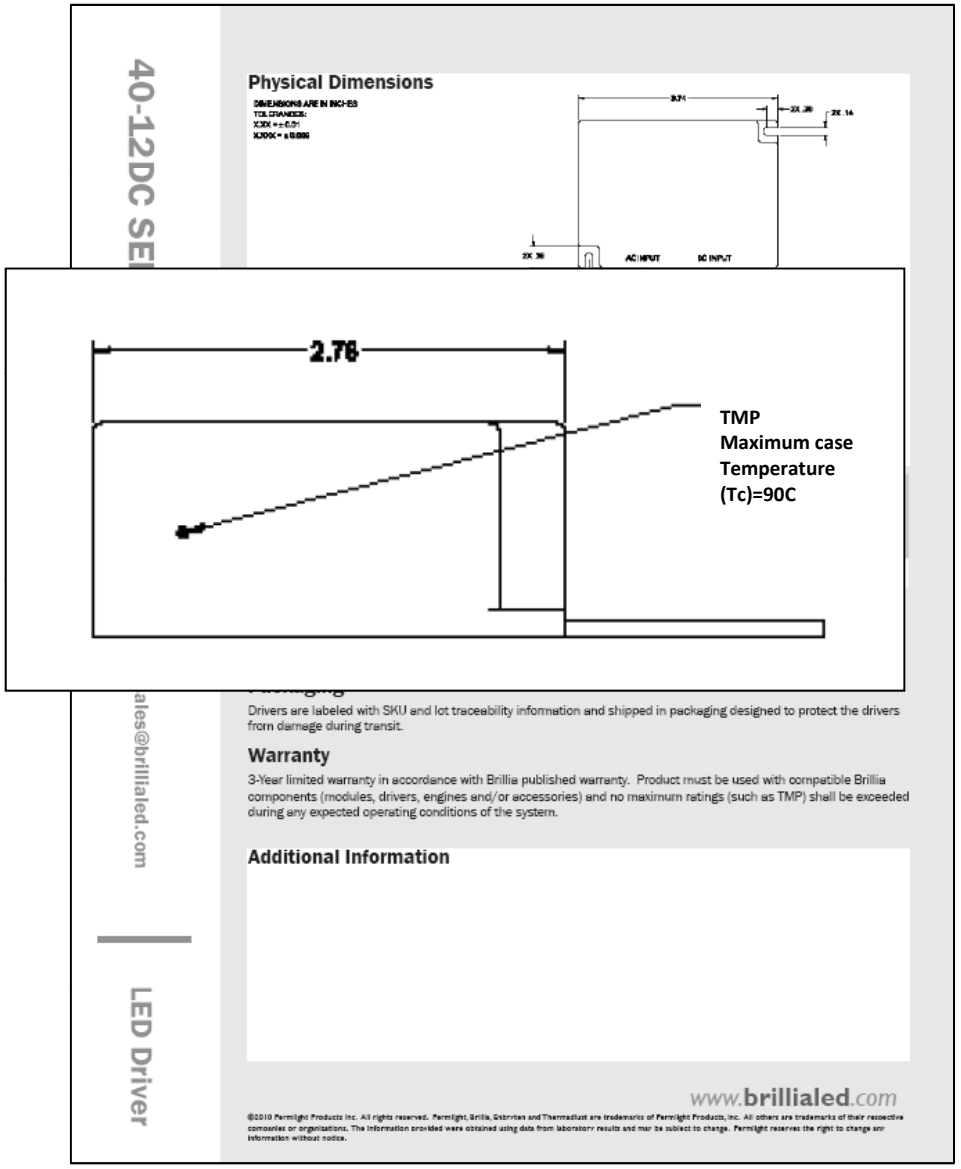
- Exceeding this value would overheat LEDs and lead to decreased life and performance



Integration and Design Considerations

- LED drivers should feature a specified TMP point on the datasheet. This point is called the temperature measurement point, and corresponds to maximum case temperature of the LED driver.

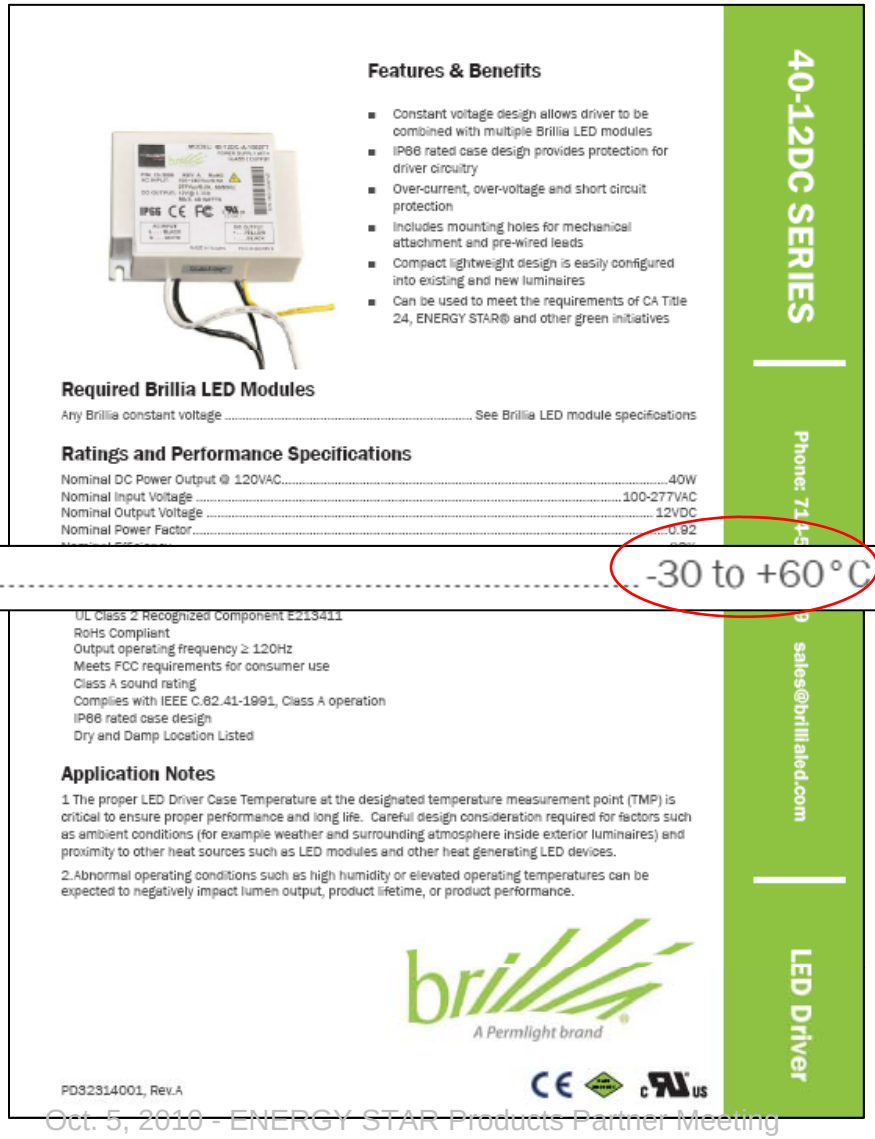
- Exceeding this value would overheat critical electronic components and potentially lead to decreased life and performance



Integration and Design Considerations

- Additionally, LED drivers should specify a maximum ambient operating temperature (air temp surrounding the driver) value on the datasheet

- This represents limits for proper lifetime and performance



40-12DC SERIES

LED Driver

Phone: 714-5 sales@brillialed.com

Features & Benefits

- Constant voltage design allows driver to be combined with multiple Brillia LED modules
- IP66 rated case design provides protection for driver circuitry
- Over-current, over-voltage and short circuit protection
- Includes mounting holes for mechanical attachment and pre-wired leads
- Compact lightweight design is easily configured into existing and new luminaires
- Can be used to meet the requirements of CA Title 24, ENERGY STAR® and other green initiatives

Required Brillia LED Modules

Any Brillia constant voltage ..... See Brillia LED module specifications

Ratings and Performance Specifications

Nominal DC Power Output @ 120VAC 40W
Nominal Input Voltage 100-277VAC
Nominal Output Voltage 12VDC
Nominal Power Factor 0.92

Maximum Operating Range Ambient Temperature (Ta) ..... -30 to +60°C

UL Class 2 Recognized Component E213411
RoHs Compliant
Output operating frequency ≥ 120Hz
Meets FCC requirements for consumer use
Class A sound rating
Complies with IEEE C.62.41-1991, Class A operation
IP66 rated case design
Dry and Damp Location Listed

Application Notes

1 The proper LED Driver Case Temperature at the designated temperature measurement point (TMP) is critical to ensure proper performance and long life. Careful design consideration required for factors such as ambient conditions (for example weather and surrounding atmosphere inside exterior luminaires) and proximity to other heat sources such as LED modules and other heat generating LED devices.

2.Abnormal operating conditions such as high humidity or elevated operating temperatures can be expected to negatively impact lumen output, product lifetime, or product performance.

A Permlight brand

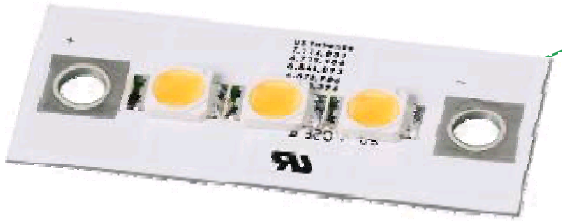
PD32314001, Rev.A

Using LED Light Engines in Luminaires

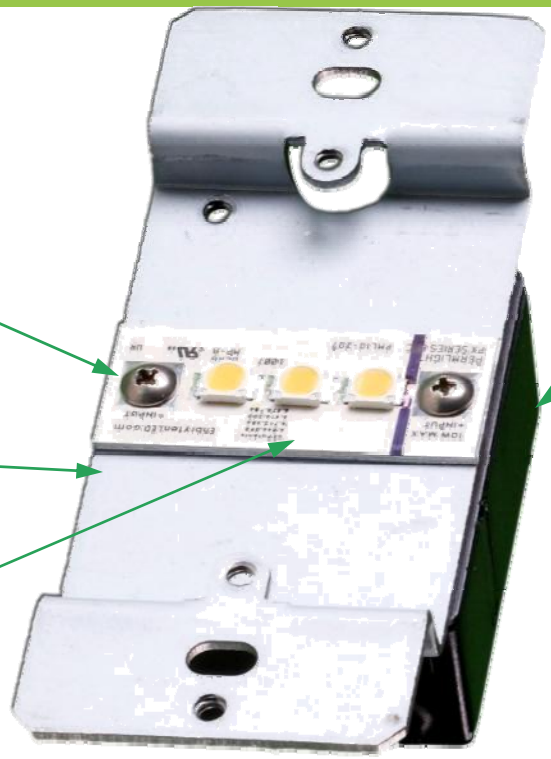
Integral Engine Designs

(2) Conducting screws provide mechanical and electrical attachment

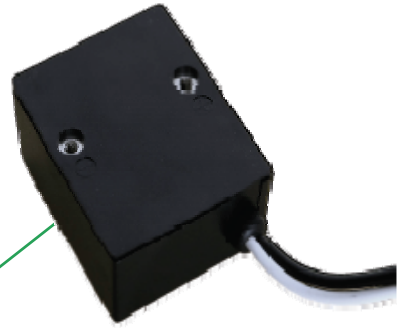
Metal fixture body acts as heat sink
"Sandwiched" between LED module & Driver



Brillia LED Module



Wall/steplight LED light engine



Brillia 120VAC to 12VDC LED Driver

Sample faceplate option
(supplied by manufacturer)

Brillia 3-LED, 250 lumen* Light Engine

* Sample values measured at 3500K

Using LED Light Engines in Luminaires

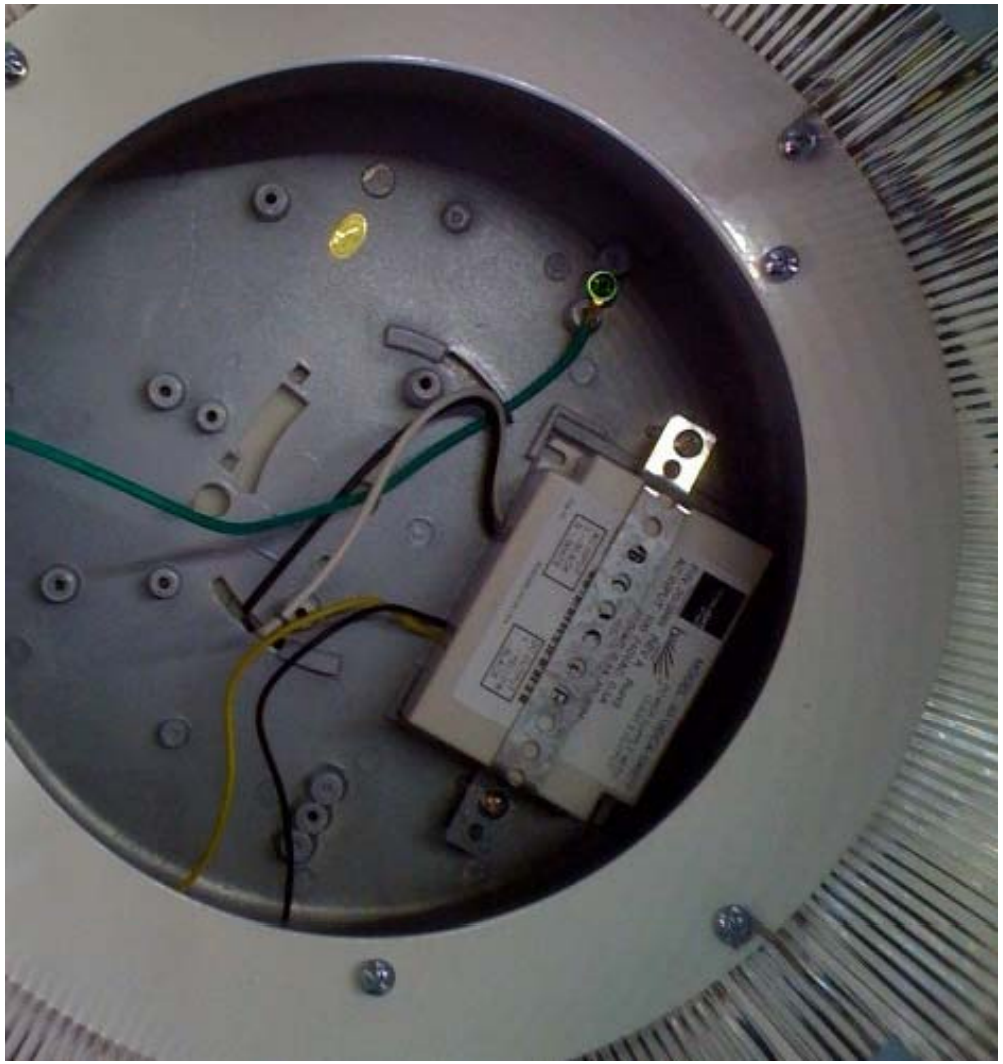
Remote Designs

- LED modules MUST be mounted to a flat metal heat sink surface.
- For best performance this heat sink is thermally contiguous with the body of the luminaire and provides not only conductive cooling to the LED modules, but convective cooling (due to air circulation around the heat sink or luminaire body)

Using LED Light Engines in Luminaires

Remote Designs

- The remote LED driver should be mounted in an area that allows maximum thermal isolation from the heat that will be generated by the LEDs and associated heat sink



ENERGY STAR Considerations

- When designing for ENERGY STAR , minimum lumen levels (as well as efficacy) are critical factors in design consideration
- Cost of components to reach lumen targets and testing costs must be carefully considered

ENERGY STAR Considerations

ENERGY STAR example

Ceiling-mounted Luminaire with Diffuser > 8”

Qualification requirement:
750lm min.
30 lpw
2700K, 3000K, 3500K only

- Since LEDs are high cost item, must work backwards and have idea of luminaire light loss and determine min. qty of LEDs needed to meet qualification
- For the LED package alone, a customer could pay up to 2 cents per lumen for popular high brightness low cost LEDs (which are approx. 80-90lm each)
- Cost of product can be considerably higher than incumbent technology

Continuing SSL Luminaire Industry Issues

Ongoing SSL Luminaire issues:

- Price
  - Continues to get better
- Color consistency
  - Binning issues not as bad as before, but still present
- Standards
  - Testing, reporting, labeling, interconnects, etc.
- Dimming compatibility
  - Technology of dimmers and LED drivers don't always "get along"
- Electronic component shortages
  - Component shortages industry-wide not common in traditional luminaire industry
  - Are suppliers interested in lighting business vs. other opportunities?
  - Forecasting LED products continues to be an issue

Lutron®

Continuing SSL Luminaire Industry Issues

Component lead time issues

Component(s)	Pre-recession	Post-recession
LED	Stock to 4 wks	4-16 wks
Passives	Stock	3-8 wks
Actives	Stock to 4 wks	3-12 wks
MCPCB	3-4 wks	4-8 wks
Drivers	3-6 wks	12-18 wks
Contract Assy	days	wks

THANK YOU!

For questions related to any information in this document please contact:

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