Low-Cost LED Luminaire for General Illumination
#DE-EE0005846
Project Overview

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Project Objectives

• Develop a low-cost, high efficacy LED architectural troffer suitable for indoor lighting providing 4000 lumens and 90 LPW at 3500 K with CRI ≥90 at a cost reduction of 30%.
  - The luminaire will be suitable for commercial and retail lighting applications.

<table>
<thead>
<tr>
<th>SSL Product</th>
<th>Features</th>
<th>Benefits</th>
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<tbody>
<tr>
<td>LED Chip</td>
<td>60% EQE</td>
<td>High Efficiency (state-of-the-art chips)</td>
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<tr>
<td>Primary Optic</td>
<td>Uniform broad-angle emission</td>
<td>Eliminate hot spots; reduce glare; increased LED spacing</td>
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<tr>
<td></td>
<td>Enhanced color mixing</td>
<td>Less need for diffusers; lower system optical loss</td>
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<tr>
<td>Board Integration</td>
<td>COB LED attach</td>
<td>Cost-effective, scalable fabrication</td>
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<tr>
<td></td>
<td>Minimal heat sinking</td>
<td>Fewer piece parts; reduced cost</td>
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<tr>
<td>Luminaire Integration</td>
<td>Direct-view illumination</td>
<td>Simplified optical cavity: simplified manufacturing</td>
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<tr>
<td></td>
<td>Integrated heat sink</td>
<td>Reduced mechanical cost, simplified manufacturing</td>
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Troffer State of the Art

- Cree manufactures and markets a series of high-end architectural troffers utilizing a vertically integrated approach with system performance dictating design choices.

### Cree CR Series Troffers

<table>
<thead>
<tr>
<th>Model</th>
<th>Dimensions</th>
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<tbody>
<tr>
<td>CR22</td>
<td>2’ x 2’</td>
</tr>
<tr>
<td>CR14</td>
<td>1’ x 4’</td>
</tr>
<tr>
<td><strong>CR24</strong></td>
<td><strong>2’ x 4’</strong></td>
</tr>
</tbody>
</table>

- Output Range: 2200-5000 lm
- Efficacy: 90 – 130 LPW
- CRI: 90 min.
- CCT: 3000K, 3500K, 4000K
- Dimming:
  - Step: 50%
  - 0-10V: 5%
Project Elements and Technology

• Key technology enablers drive performance improvements and cost reductions through:
  - Reduced component count
  - Fewer mechanical parts
  - Simplified integration and assembly

Key Technology Enabler

Beam Shaping Primary Optic

Performance Opportunity

Uniform Emission with Less LEDs
Direct View Troffer with Low Glare

Cost Reduction Benefits

Lower Light Engine Costs
Lower Mechanical Parts Cost
Lower Assembly Cost
Task 2: Light Engine Development

- The light engine is an area of significant potential cost reductions for the luminaire
- Light intensity profiles, color mixing and thermal management are critical design elements
- Three Subtasks of Task 2 are:
  2.1 LED primary optics design
  2.2 Board integration
  2.3 White light engine reliability testing
Task 3: Fixture Design and Development

• Mechanical piece parts often make up the largest BOM segment for LED luminaires

• Eliminating materials, simplifying assembly processes lower bottom line cost

• Example: Cree’s downlight evolution from LR6 to CR6

• Similar strategies will be used to eliminate both the material and integration costs of massive heat sinks
Task 4: Luminaire Integration

- Schematic of elements for luminaire integration

![Schematic](image)

- Advantages of direct view approach:
  - Reduced number of sheet metal pieces and reduced assembly costs
  - Fewer optical elements: lower BOM
Q & A

www.cree.com