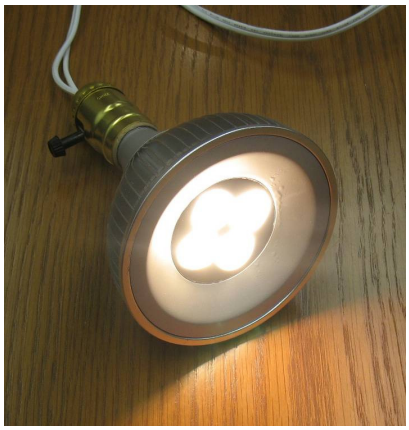
CRI 95 PAR 38 Reference Design



Welcome to the PAR 38 Reference Design by OSRAM Opto Semiconductors. The PAR 38 reference design incorporates the latest high CRI LEDs from OSRAM Opto Semiconductors, particularly suited for premium indoor lighting applications where natural color rendering is required.

LED Light for you is a partner network established to provide solutions for Solid State Lighting Applications. The LED Light for you network partners participating in this reference design were Infineon, who provided the driver board, Cooler Master, who provided the housing, and Carclo-Optics, who provided the lenses.

LED

Providing Unique Advantages – Performance, Reliability, Features!

- **High energy efficiency**
  LED efficacies of more than 110 lm/W
- **High system efficiency (directional light)**
  High luminaire efficiency
  "Light where you need it, when you need it!"
- **Long lifetime**
  More than 50,000 hrs of life
- **Design & Aesthetics**
  Freedom of design, high functionality
- **Quality of Light**
  Color quality, component quality and reliability

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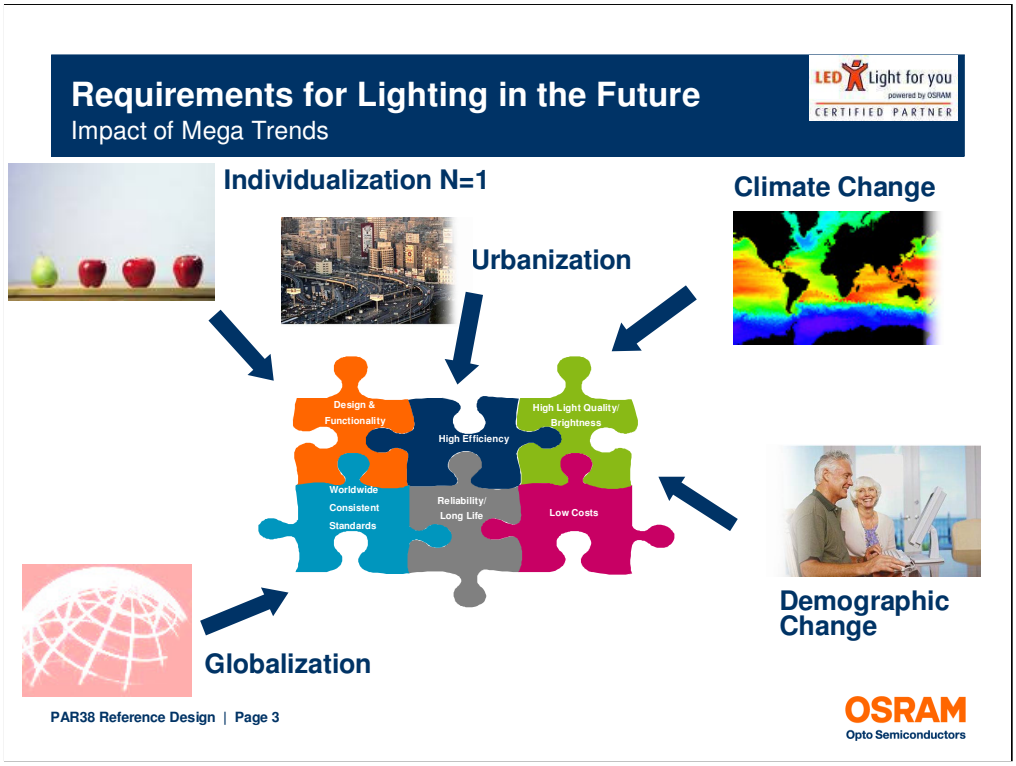
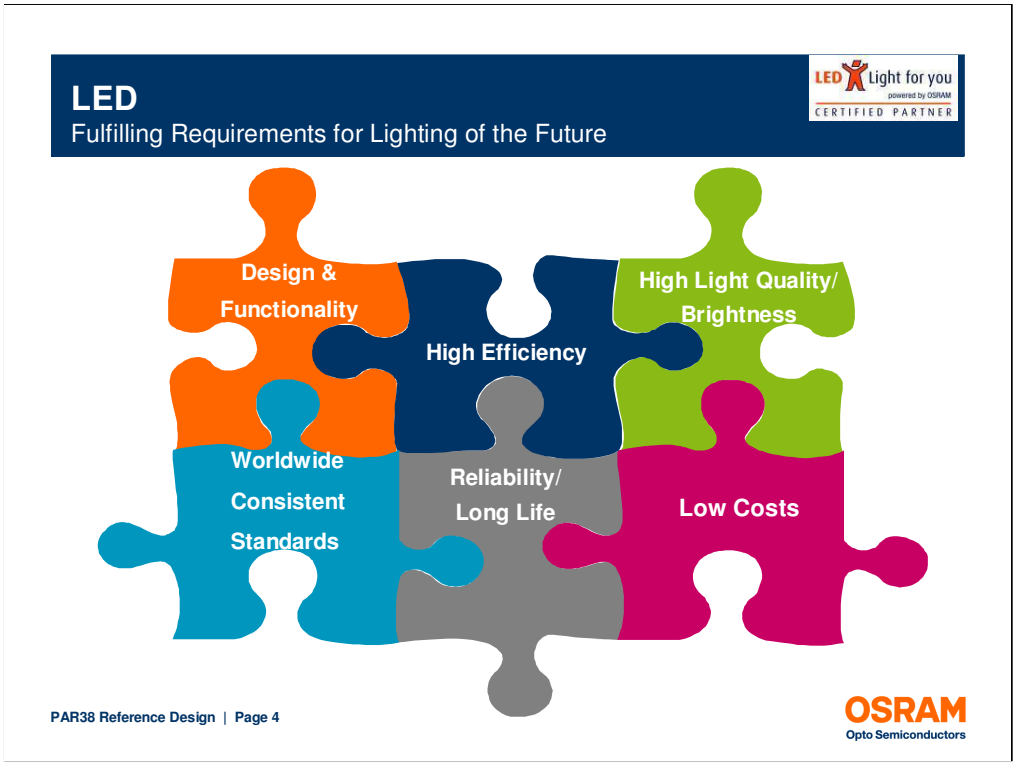
Solid State Lighting provides unique advantages where traditional lighting sources fall short.



The future of lighting, led by solid state lighting, will be determined by changes in the demographics of world population, urbanization, and greater emphasis on energy conservation.



LEDs are the perfect light source to fulfill the requirements for lighting the future.

The PAR 38 case

Energy Saving with Solid State Lighting

LED Light for you powered by OSRAM CERTIFIED PARTNER

Main PAR 38 Applications

- Retail lighting
- Museum Lighting
- Residential lighting
- Architectural accent lighting

Requirements for PAR38

- Energy Star requirements
- Conforms to ANSI standards for PAR38 lamp envelopes
- Mid-output light levels

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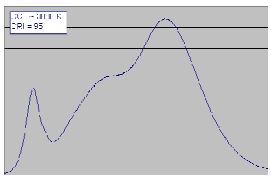
The High CRI PAR 38 reference design was chosen to meet the requirements stated in this slide and serve as an excellent demonstration for this technology.

Other features of the OSLON SSL family include a package size measuring only 3 x 3 mm, and two beam angles: a narrow beam angle of 80° or a wide beam angle of 150°. The OSLON SSL can be closely clustered without any shadow effects, increasing luminaire efficiency. The low thermal resistance of 7 Kelvin/Watt makes thermal management much easier. And like all the other members of the OSLON family, the high light output is thanks to the latest chip technology.

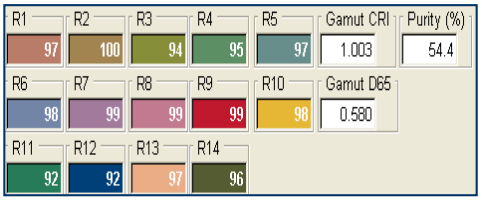
OSLON SSL for High CRI



Maximized Light quality

- **Typ. CRI of 95**
- **R9 > 90 / R13 > 90**

	LCW .CC (color champ)
Product target	**Warm/neutral white Maximized light quality**
CCT range	2700-4000K
Typ. CRI	95
Applications	Premium Indoor Lighting (e.g. Shop / Museum)



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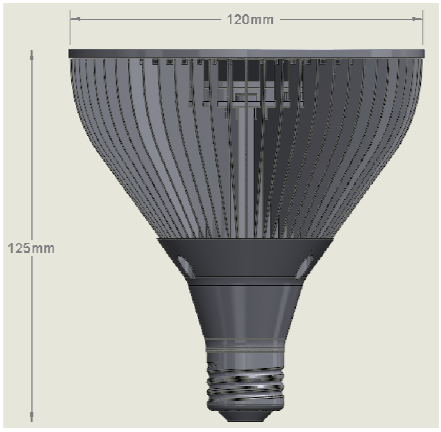
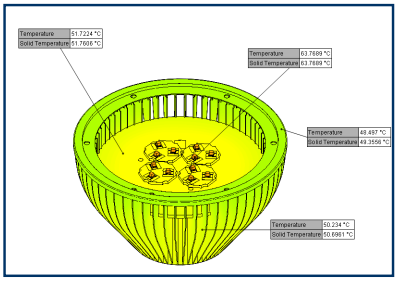
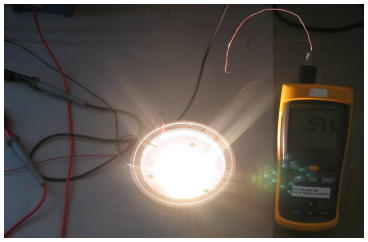
The OSLON SSL is available in high color rendering index, or (CRI), which means that objects appear in their “true” colors to the human eye. The high quality of light remains stable for a long period of time.

The LED can achieve a CRI value greater than 90 under all application conditions. The R values for color rendering are greater than 90 for R9(red) as well as for R13(skin tone).

Housing







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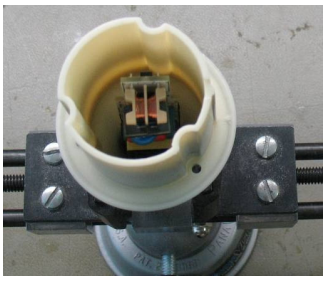
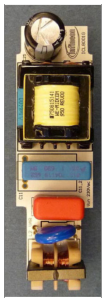
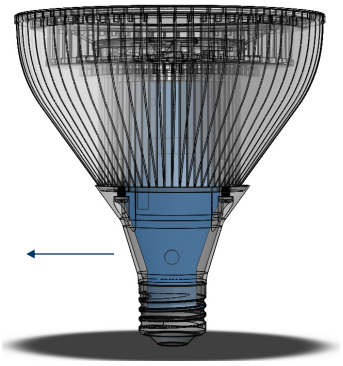
Within the housing of the PAR lamp the LEDs are mounted on Metal core printed circuit boards. The housing for the PAR lamp consists of a stacked fin heat sink design which is light-weight and also provides good thermal performance. The housing also conforms to ANSI standards for PAR38 lamp envelopes.

Driver

Vin (V_{RMS})	Pin (W)	Vout (V)	Iout (A)	Efficiency(%)
120	13.23	36.5	0.290	80



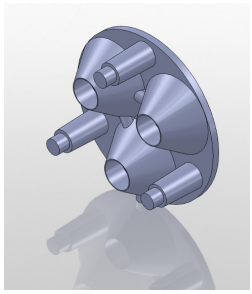


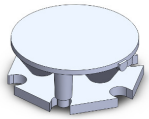


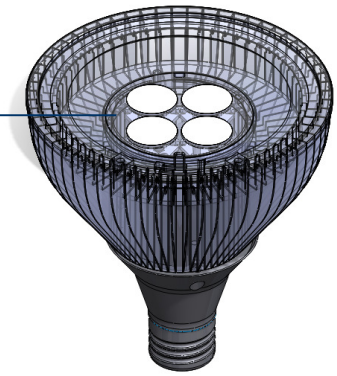
The driver board has a small form factor which fits in the base of the lamp. It provides a constant current of 290mA per LED with an efficiency of 80%. It has a power factor of 97%. It has output short circuit and output overvoltage protection. Also, it is phase cut dimmable with most off the shelf dimmers.

Optics

LED	Efficiency	FWHM	Spot
OSLON SSL	84.3 %	30	







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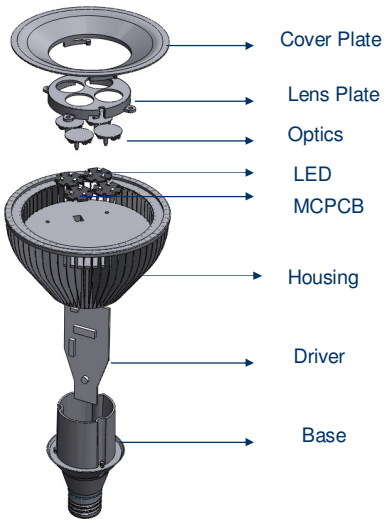
The PAR lamp has 4 secondary optics, which provide a tight beam with a full width half maximum angle of 30 degrees. Each 3-LED 20mm lens has three separate optics packaged closely together and is designed to create a specific illumination pattern. The optical efficiency of the secondary optics is 84.3%.

PAR 38 Assembly



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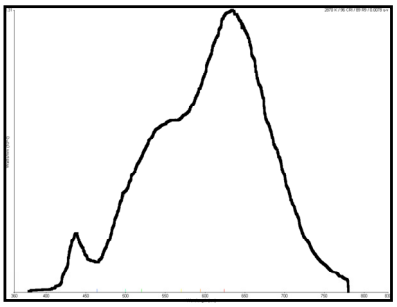
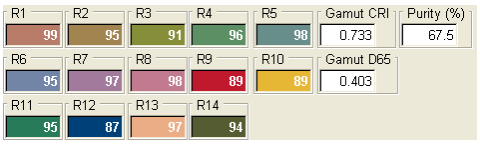
This slide shows the complete assembly of the PAR lamp.

Measured Performance

Parameter	Value	Energy Star
Delivered Lumens	600	
CCT	2800K	2700K – 4000K
CRI	96	≥ 80; R9 > 0
Power	13W	
Beam Angle	30˚	
Efficiency	46lm/W	40lm/W
Dimmable	Yes	Yes
Power Factor	0.97	≥ 0.70
CBCP	2400 cd	2100cd
Mechanical	ANSI standards for PAR lamps	ANSI standards for PAR lamps



Output Spectrum



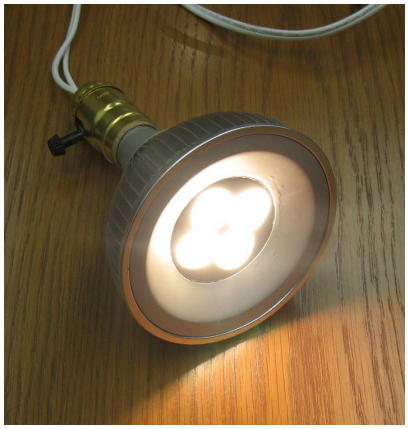
R values

Thermally stable optical measurements show the PAR lamp meets Energy Star Requirements.

Also, the spectral output and R values show the excellent color rendering of all pastel and saturated colors.

High CRI (95) PAR 38 Reference Design Summary

- The PAR 38 reference design meets Energy Star system requirements.
- The high CRI (CRI 95) output of the PAR lamp would be an ideal fit for premium indoor applications where natural color rendering is required.
- The PAR38 lamp combines the beauty and intensity of Halogen with exceptional efficiency and longevity.



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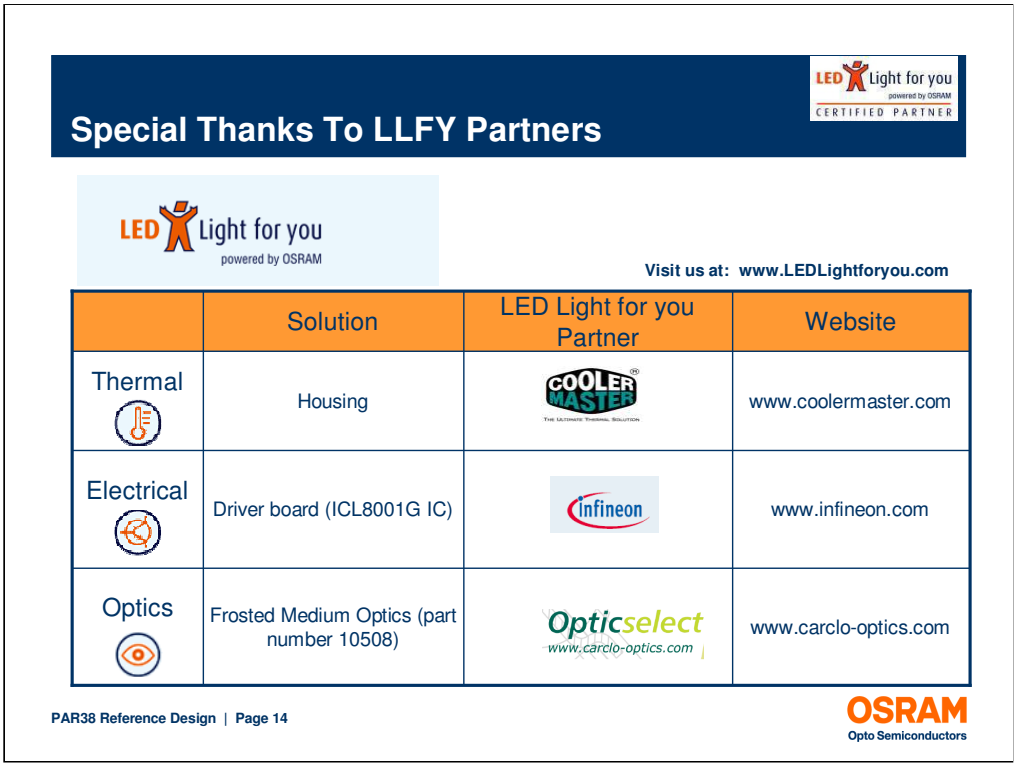
In summary the reference design meets all the requirements and serves as an example to replace traditional halogen PAR lamps.



OSRAM Opto Semiconductors is proud to work with the following companies brought together by the LED light for you partnership.

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