



## New Package Technology for SSL High Power

Regensburg | 11.2017

Light is OSRAM

# LED EVENT 2017

Design en engineering trends voor LED-applicaties

BE WOENSDAG 29 NOVEMBER 2017  
TECHNOPOLIS, MECHELEN

NL DONDERDAG 30 NOVEMBER 2017  
CONGRESCENTRUM 1931  
BRABANTHALLEN, DEN BOSCH

# Product Challenge

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- Optimum cycle stability and easy handling are not the key advantages of large ceramics
- SSL benefits from successful long time automotive experience with epoxy packages materials for high power LEDs.
- Together with our unique chip technology we enable outdoor usage fulfilling the same high expectations as in automotive applications.

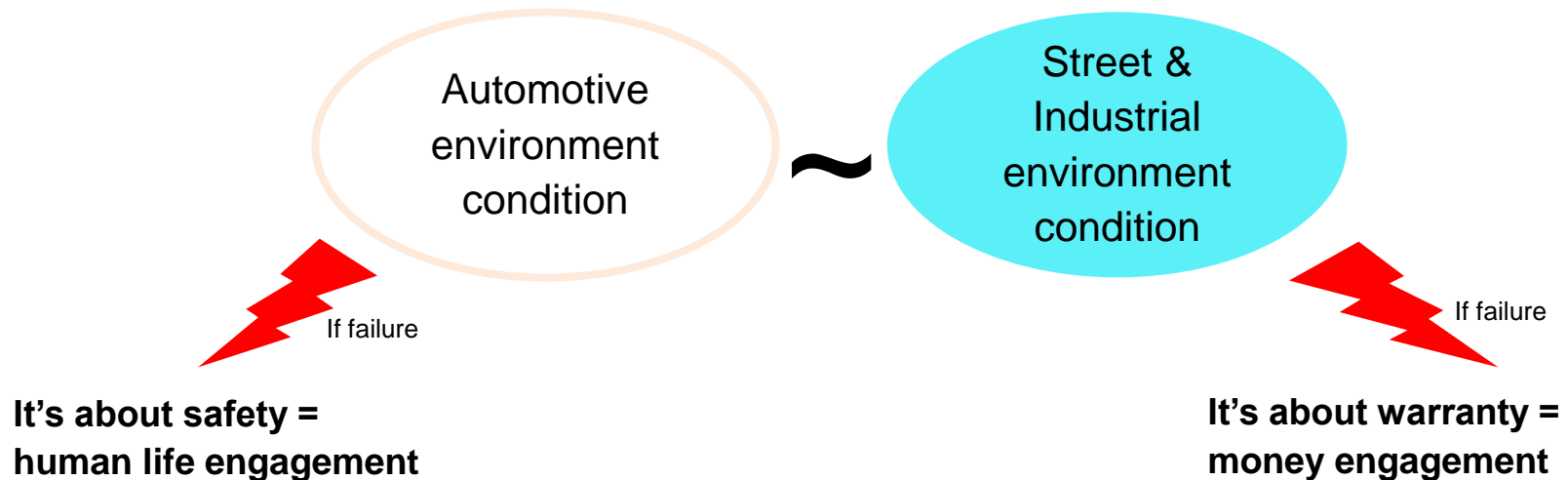
# Introduction

## How to improve reliability?

### Use expertise from OSRAM OS:



**Take Away:**  
OSRAM OptoSemiconductors  
has the best knowledge on  
**reliability** for **outdoor**  
environment



# Street & Industrial Lighting

## How to secure reliability?

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Lifetime based in LM80/TM21 is not enough for outdoor applications.



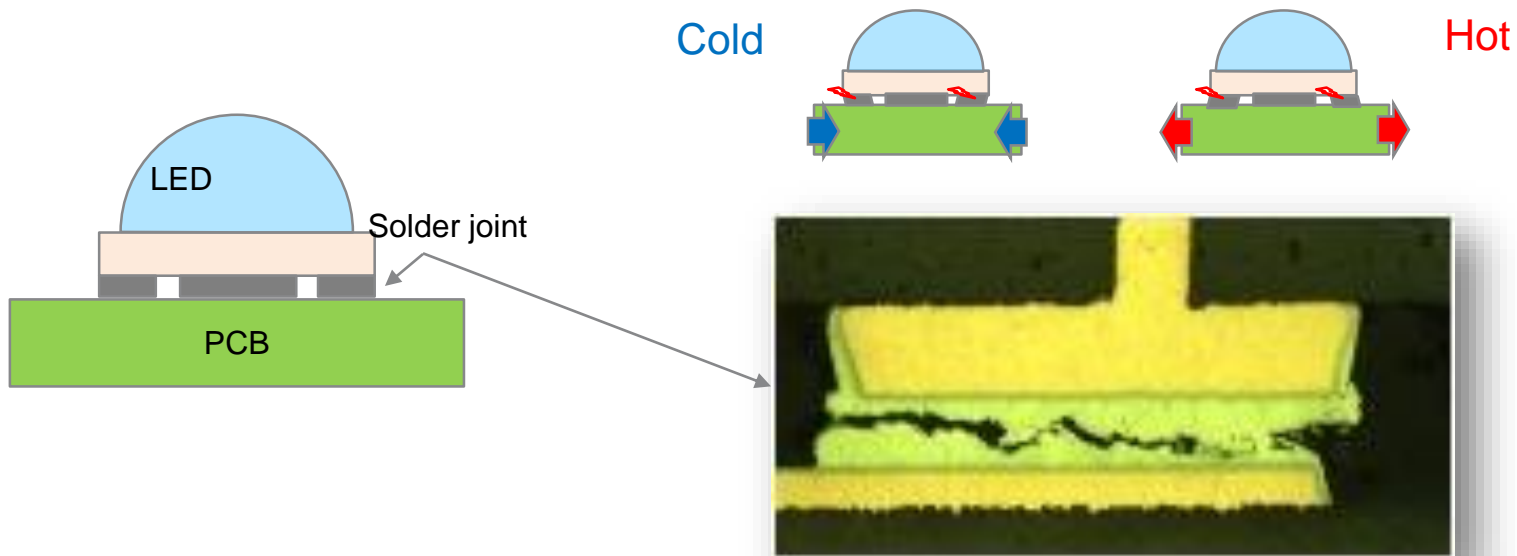
# Street & Industrial Lighting

## How to secure reliability?

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What happens when using non-reliable LED?

### Failure Mechanism in Thermal Cycling



Ceramic based LEDs show more stress and shorter lifetime

# System Level Benefit

## Solder Joint Reliability

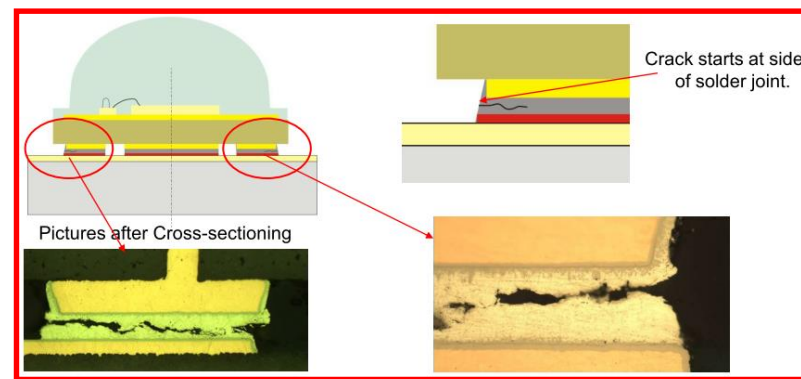
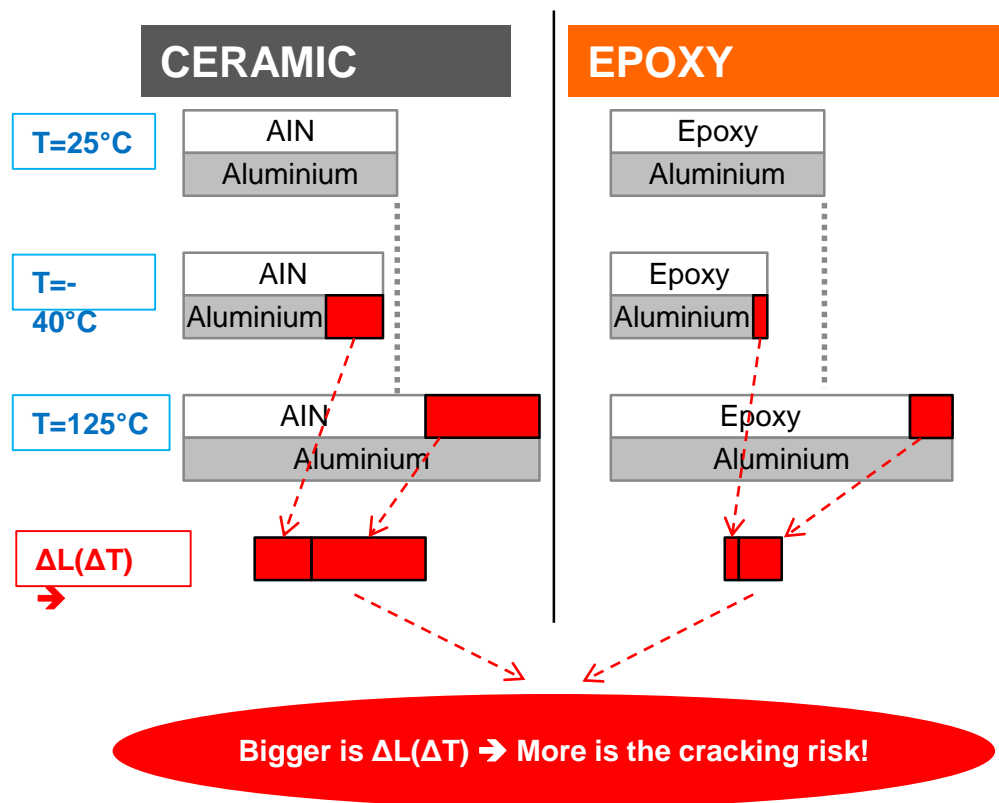
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### Why do solder joints fail in thermal cycles?

1. Thermal coefficients  $\alpha$  of PCB and LED are different
  2. When heating up, the board expands more than the LED  
→ Stress in solder joint
  3. When cooling down, the board shrinks more than the LED  
→ Stress in solder joint
  4. Over time, cracks evolve in the solder joint
  5. When the solder joint is fully cracked the electrical connection fails
- This kind of failure is known and can be modelled using a lifetime model
  - QFN (Leadframe) based LEDs like DURIS **match** the PCB very well in terms of thermal expansion coefficient  
→ Less stress, longer lifetime



# Second Board Reliability: EPOXYvs Ceramic



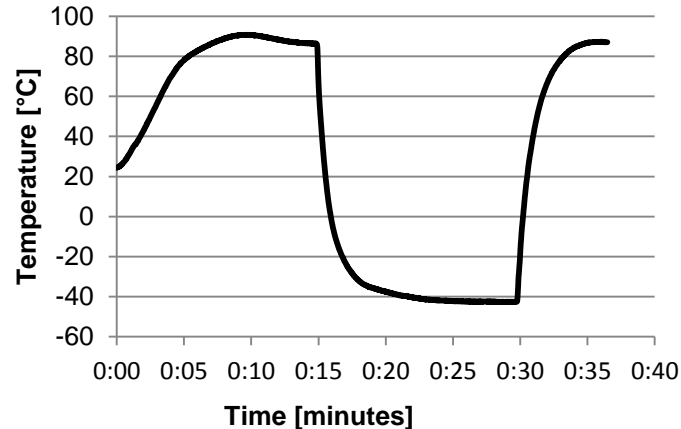
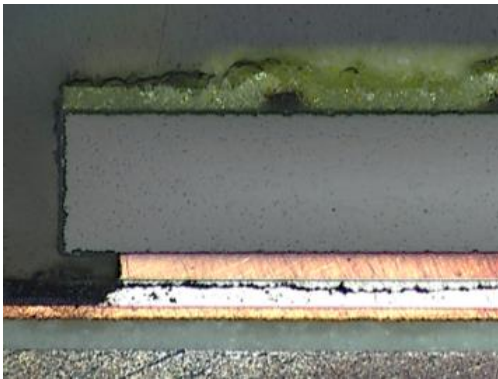
# System Level Benefit

## Solder Joint Reliability

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### Failure Criteria for Thermal Cycling Testing

- In thermal cycling testing, failure behavior of the solder joints between LED and PCB is investigated
- Standard IPC-9701 (PERFORMANCE TEST METHODS AND QUALIFICATION REQUIREMENTS FOR SURFACE MOUNT SOLDER ATTACHMENTS) defines **20%** increase of resistance as a failure





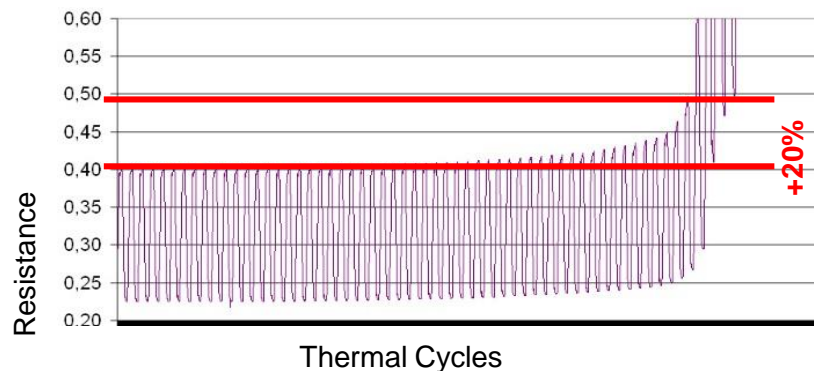
# System Level Benefit

## Solder Joint Reliability

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### Failure Criteria for Thermal Cycling Testing

- 20% correspond to a crack larger than 80% of the overall solder joint
- Experimental data shows that further thermal cycling leads to a steep resistance increase and electrical failure
- Considering the LED diode behavior, **+2%** increase in  $U_f$  correspond to **~20%** increase in differential resistance
- OSRAM OS uses 2% increase in  $U_f$  as a failure criteria



# Advantages for Your Design

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**Cost optimized package alternative to well known ceramic based high power LED provide the same performance and reliability**

## **Advantages for Your Design:**

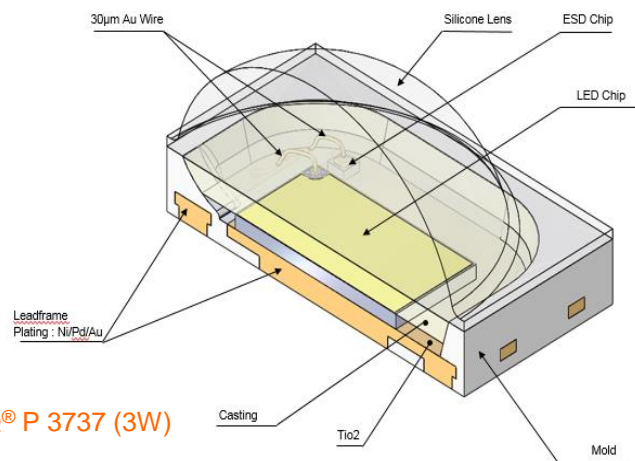
- Better second board reliability than ceramic package
- Closer to real conditions with key parameters binned at 85 °C
- Lower thermal resistance with lower system cost
- Color distribution limited to 5 steps maximum
- Leadframe package for superior lm/\$

## **Portfolio Fit:**

- Extend the high power portfolio by offering alternative package in Leadframe package.
- Targeted with ceramic comparable robustness quality and comparable luminous efficacy.

# Target Application For Epoxy Packages

- Street and tunnel lighting
- Highbay and Lowbay
- Outdoor lighting



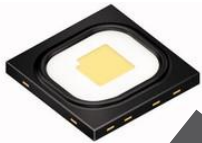
Example OSCONIQ® P 3737 (3W)



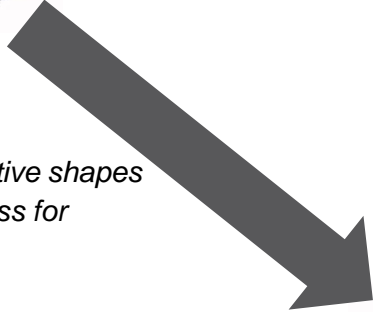
Application	Street light	Tunnel lamp	Highbay
Example (Photo)			
Typ. Power (W)	100W-200W	50 / 70 / 100 W	100W – 300W

# Target Application For Epoxy Packages

Osram Opto Semiconductors #1 Automotive  
(interior and exterior)



*Our leadership in Automotive shapes  
our SSL product robustness for  
outdoor environment.*



- **Osram Optosemiconductors** is the leader of Automotive (interior and exterior)
- *Oslon Black Flat* and variants – based on Epoxy technology - are highrunners for exterior automotive DRL, Headlamp, lowbeam, Highbeam, Fog Lamp...
- Well known as high proven superior robustness, stability and reliability in the market.

Osram Opto Semiconductors is  
leading outdoor & industrial application

## Unique broad portfolio to offer:

- Superior performance - as of today #1 in the market
  - Superior cost down opportunity
    - Superior lifetime >100khours @Ts105 – LM80
    - Superior Corrosion robustness
    - Superior robustness for 2<sup>nd</sup> board reliability



# Osram Opto Semiconductors

## Superior Performance and Robustness

Based on strong experience of EPOXY material for Industrial lighting, Osram Opto Semiconductors has been transferring the know-how into SSL products for outdoor environment



- Superior Performance
- Superior Robustness to corrosion
- Superior lifetime
- With additional superior 2nd board reliability for package >3535 package.

Price of EPOXY device is unbeatable vs standard Ceramic device (high runner for outdoor application) by keeping

Contact our local distributor



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**Thank you.**

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