

Light Emitting Diode (LED) Failure Modes

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Learning Made Simple, Visual, and Interactive



The THORS *Light Emitting Diode (LED) Failure Modes* course introduces learners to the various failure modes resulting from failure mechanisms in the LED chip, which consists of substrate, support layers, and Multiple Quantum Wells (MQWs). The course also examines common failure mechanisms and their associated failure modes in LED packages, including the encapsulant, package lens, and interconnect. Additionally, the course explores failure modes arising from the failure mechanisms in the lighting module and system. Presented in THORS' highly visual and interactive learning format, this course will equip learners with a complete understanding of the common failure mechanisms in LEDs and their related failure modes.

Credit Hours **2.0**

Learning Objectives

- Recognize the common failure mechanisms and the resulting failure modes in the various layers in an LED chip, such as the substrate, support layers, and Multiple Quantum Wells (MQWs).
- Identify the failure mechanisms and the resulting failure modes in the components of an LED package, such as the encapsulant, package lens, and interconnect.
- Explain the different components of a lighting module, such as a ceramic substrate, thermal pad contact, lead frame, and reflector, along with their associated failure mechanisms and failure modes.
- Describe a lighting system that includes all the components involved in thermal design, optical design, mechanical design, power design, and control design, along with their failure modes.

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I. LED Chip

- Substrate and Support Layers
 - Defects
 - Chip Cracking
 - Failure Mechanisms
 - Failure Modes
 - Nonuniform Doping
- Multiple Quantum Wells (MQWs)
 - Composition Nonuniformity
 - Metal Atom Migration
 - Electrostatic Breakdown
 - Interface Issues

II. LED Package

- Encapsulant
 - Phosphor Deterioration
 - Carbonization
 - Phosphor Thermal Quenching
 - Encapsulant Yellowing
 - Delamination
- Package Lens
- Interconnect
 - Solder Joint Fatigue
 - Bonding Wire Failure
 - Wire Ball Bond Failure

III. Lighting Module and System

- Lighting Module
 - Ceramic Substrate
 - Thermal Pad Contact
 - Lead Frame
 - Reflector
- Lighting System

