LED Device Technology and Packaging

This program is sponsored by:

Kulim Hi-Tech Park

Conducted by:

DreamCatcher Consulting Sdn Bhd

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SYPNOSIS

The field of optoelectronics has witnessed a tremendous growth in the last two decades with continuous advances made in the field of LEDs, particularly since the breakthrough in the development of the blue and white LEDs in the early 1990s. With interest in LED research and development growing rapidly, advances were also made in the area of material systems supporting the LED industry, including chip substrate and epitaxial growth, encapsulants, interconnects, package substrates (leadframe, PCB, metal-plated plastics/ceramics and other novel substrates). These developments has spin-off benefits for a host of other optoelectronic devices including emitters, detectors and transceivers incorporating IRLEDs, LEDs, photodiodes, laser diodes and even non-emissive semiconductor devices using III-V systems.

Optoelectronic devices are devices, which feature both optical and electronic/electrical characteristics, in the form of light or near infra-red/UV emission or detection, and with electrical input and/or output, respectively. With the rapid growth of the optoelectronic industry, there is a corresponding need to educate personnel involved in this industry to equip them further in their career.

This course is designed to introduce the field of optoelectronics devices and packaging, using the LED device and packaging as an example to the participants. It presumes little or no knowledge of optical devices on the part of the participants. Description of the devices and packaging aspects are presented in a concise manner, and the theories and equations involved in understanding the mechanical and thermal stresses in packages are kept to a minimum, sufficient for understanding the interaction between properties of material and stress generation, and the knowledge gained is applied in a practical manner, viz. guiding material selection and good design practices.

In this course, the packaging aspect of optoelectronic devices is illustrated by the example in LED device packaging. LED devices, having much in common with other optoelectronic devices, has requirements ranging from partially opaque to transparent encapsulating materials, low to high heat dissipation capabilities, low moisture sensitivity and high reliability when subjected to thermal and mechanical stress. This course introduces the participants to the basics of LED packaging as well as the LED device chip structure, its optical and electrical characteristics.

The various package types and package constructions are described. The package substrates, encapsulants and interconnects used are also introduced, together with an understanding of its thermal and mechanical properties. Later, it is shown how the thermal and mechanical properties of the materials are linked to the generation of stress and device failure in the package. It concludes with appropriate material selection and good package design practices.

Course Highlight

This course starts with an introduction to a typical optoelectronic device i.e. an LED. The device chip structure is explained, and its electrical and optical characteristics introduced. The relationships between the various electrical and optical characteristics are also explained. Later, its geometrical construction is presented, followed by a detailed description of the piece-parts that make up the device packaging. The piece-parts described includes package substrates, encapsulants and interconnects. The origins of package stress is described in simple terms, and how it is related to the properties of the material system of the package substrate, encapsulant and interconnect. It concludes with an overview of the material selection process and of good package design practices.

What previous participants say about this course:
Answers to the question 'what did you like most about the course'

- "Can learn both theory and application sides of LEDs" - 21 Apr 08
- "Example given on the packages" - 25 Feb 08
- "Calculation of thernal Rosistane and sharing beyond courses contains" - 25 Feb 08
- "Concept of light reflection" - 25 Feb 08
- "Examples and good clear handout" - 21 Apr 08
- "LED electrical characteristics" - 21 Apr 08
- "Material selection, pakaging stress, encapsulation, factors of LED" - 15 Oct 08
- "Interprete data from data sheet and understand the reason behind those data needed" - 15 Oct 08

WHAT YOU WILL LEARN

- LED device chip structure and fabrication
- LED device optical characteristics
- LED device electrical characteristics
- LED device mechanical, thermal and reliability characteristics
- LED package types and construction
- LED package piece-parts including substrate, interconnects and encapsulants
- Package reliability and failure modes
- Understanding of the origin of thermo-mechanical stress in package
- Understanding of material and package characteristics
- Good package design practices
- Material selection

WHO SHOULD ATTEND

The primary target audience for this course is technicians and engineers involved in product design and development, manufacturing, marketing, test and development, characterization and QA of optoelectronics related components and systems, particularly optical emitters including LEDs and IRLEDs. This course is also applicable to a broad audience who need to have strong basic understanding of the various concepts, terms and technologies of optoelectronic devices, packaging and design including IRLEDs, laser diodes, photo-detectors/sensors, optical transceivers and opto-couplers.

Examples of target audience :

- Project Managers
- Program Managers
- Test Engineers
- Manufacturing / Process Engineers & Technicians
- Mechanical Engineers
- Quality and Reliability Engineers
- R&D Engineers
- Failure Analysis Engineers
- Technical Marketing and Sales Engineers

PEREQUISITE

Interest in the reliability, packaging and design aspects of optoelectronic devices. Technical background in electrical/electronic/mechanical engineering or physics degree would be desirable.

COURSE METHODOLOGY

Class room training.

COURSE DURATION

2 days, 9am - 5pm

COURSE STRUCTURE

<u>LED Device- An Introduction</u>

Compound semiconductor systems
Band-gap and light emission
Device fabrication - Epi growth processes
Device structure for light extraction
LED efficiency and trends for backlighting/illumination
Understanding LED datasheets
LED optical characteristics
LED electrical characteristics
LED electrical and optical abnormalities and defects
LED thermal characteristics

LED Packaging

Through hole packages
SMT Packages
SMT Package Substrates and material properties

- Leadframes
- PCB
- Flex PC
- Ceramics
- Conductive plated plastics
- Electrical interconnects

- Die-attach
- Wire-bond
- Flip-chip and solder bumps
- Encapsulants and material properties
- Molding
- Casting
- Glob top

Package reliability and major causes of electronic failures LED chip failures, infant failures, fatigue failures, end-of-life failures, mixed mode failures Origins of thermal and mechanical stress Hooke's law Glatransition temperatures Coefficient of thermal expansion LED degradation and contributing factors. Light output drop and color shifts in LED Thermal resistance in LED and heat transfer fundamentals. Thermal/mechanical stress modelling. Good package design practices.Material selection for encapsulants, package substrates and interconnects

COURSE INSTRUCTOR(S)

Chew studied Mechanical Engineering at University Malaya and graduated with a BSc in Engineering (Hons) degree with First Class Honours in 1985. While he was working, he did part-time studies and obtained his MSc degree from the School of Mathematical Sciences, University Science Malaysia in 2004. Chew also won the USM best thesis award for his MSc thesis.

Chew has 24 years of working experience in the electronics and manufacturing industry, including 20 years n Avago and its predecessors, Agilent and Hewlett-Packard Malaysia. He has held various positions including Product Engineering Manager, Technology Development Manager, R&D Manager in the Opto-Electronics Division of Agilent Technologies, and Intellectual Properties Manager in Avago Technologies Malaysia.

dream CATCHER

KULIM HI-TECH PARK

KTPC KULIM TECHNOLOGY PARK CORPORATION

REGISTRATION FORM
PUBLIC TRAINING PROGRAM

Course Title [Code]	**LED Device Technology and Packaging**		
Duration	**2 days**	Date	**2nd-3rd Aug 2010**
Venue	DreamCatcher Consulting Sdn Bhd ***303-5-5 Block B, Krystal Point 1,*** ***Jalan Sultan Azlan Shah,*** ***11900 Penang***		
COMPANY INFORMATION			
Company Name / Address			
Contact Person			
Designation			
Tel			
Fax			
E-mail			

PARTICIPANT/S

No.	Name	Designation	IC Number
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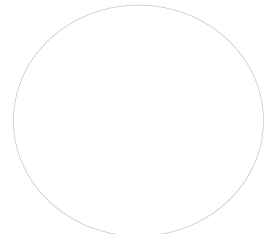

Date: ______________________

Kindly fax / email your registration form before
For further information please call Eunice Ooi/ Celine Chang at 04-6407111/7112
Or email : euniceooi@dreamcatcher.asia/ celine@dreamcacther.asia or fax: 04-6407110