LED Forward Integration

LED Engines

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Growth in LEDs coming from Level 2 / L2+ Customers seeing more value in turnkey solutions

Integration Path -

Die+ Optics: L1
L2 LED board + Driver board
L2+: integrated LED’s + Driver
L2+: integrated LED’s + Optics
L2+: integrated LED’s on heat sink, ceramic or composite materials, active cooling + Optics

Projected overall L2 market CAGR ~35%
MP LED Luminaire Manufacturing Value Chain

![Graph showing revenue for different product/integration stages: LED, L2, L2+ Mech, L2+ Mech & Optical, L2+ Mech & Optical & Driver.](image)
LED – Light Engines

Infinately configurable LED boards, modules
  - Wide ranging, turnkey LED solutions for a variety of applications.
  - Custom designs leveraging broad technology portfolio and understanding
  - Engineered LED solutions enhance Time to Market for luminaire manufacturers

Value Proposition for Customers

- In-line application of L1 production data for improved L2 performance
- Seamless adoption of next gen LEDs for cost-down and performance up
- Future cost-down through board-level innovation and technology roadmap
- Expertise in handling LEDs; proven quality and reliability
- Complete set of L2 capabilities
  - Dedicated application support L2 design and add system know-how
  - L2+ Capabilities, Optical, Mechanical and Electronics

Simplified Value Chain

- Turn key solutions; single point of contact for Light Engine
- No liabilities for LED yield, as L2s offered as complete, yielded products
- No liabilities for LED inventory at EMS, as LED are held by manufacturer

Level Collapse Opportunities

- L2 + capability enhanced by on board LED customization
- LED solutions delivered to optimize driver efficiencies and costs
- Optical / Thermal system modelling with broad range of substrates and lens capabilities leveraging adjacent markets to Illumination.
– Turnkey manufacturing for LED Engines is a rapidly emerging model – this is enhanced by technology driving “level collapse”

– Functional Integration will drive LED Engine development

– Many customers will move from “make” to “buy” decisions as light engine functionality increases, to improve ease of use, access critical technology and enhance time to market

– Opportunity for LED manufacturers to move up the value chain

  • Enabled by unique capabilities intrinsic to control of LED design and manufacture
  • Develop new ways of working including
    – Joint developments, custom L2 /L2+ solutions and standard off the shelf modules.
  • Add unique value with customized LED solutions and higher levels of integration
Thank you