

## 2009 iNEMI Roadmap — Highlights & Trends

State of the Art		
Situation	Examples	Implications
Ongoing market / product sector convergence	Wireless / portable products continue to drive this convergence	Greater integration than last cycle (i.e., more cross-market connections).
Application of SIPs / MEMs / digital data storage	Smart phones Automobile electronics	Allows continued integration of products and functions into smaller form factors.
Increased use of touch screens	New cell phone models	Reconfigurable “buttons” provide significant increase in functionality – needed for “bundled” portable products.
R&D moving to lower-cost regions / emerging markets	Technology centers in China, Taiwan & India	More responsive to local needs; moving away from “one size fits all;” changing role for developed regions.
Photovoltaics deployment increasing as energy cost / source of supply are of greater concern	Greatest market penetration in countries such as Germany where there are significant incentives	More investments will be made to increase efficiency and reduce manufacturing costs; however, lower price of oil could once again cause delays.
RFID ILT starting to be deployed; however, cost is still a major issue for high-volume applications	Initial applications for security on high-priced items and regulated products (e.g., pharmaceuticals)	Further investments will be needed in areas such as large area flexible electronics to drive cost down.
Solid state illumination (e.g., LEDs) is an excellent alternative to CFLs (cold cathode fluorescent lighting) for a number of applications, especially those needing directional light	Display illumination, safety signals, medical applications	Lower operating cost; however, lifecycle cost is still a challenge with today’s technology. Technology investments and volume can drive more cost-effective solutions.
Anticipated Paradigm Shifts		
Shift	Examples	Implications
Next step in optical integration is smart optical links	Frame-to-frame interconnect	More efficient conversion of optics to electronics.
Packaging materials will continue to change to facilitate higher performance and greater density	Current material properties limit both physical and electrical parameters	New business models may be required to support R&D needed.
Wafer-level packaging finally being deployed, primarily in portable consumer products	Wafer-level chip scale packaging (CSP): build up substrates through wafer-level fabrication	Increase density; reduce cost.
Strategic approach to improving environmental performance	Elimination of halogenated flame retardants (HFRs); removal of PVC materials	Difficult to orchestrate change across supply chain when there is no regulatory deadline. Consortia like iNEMI can drive a coordinated approach.
Energy-efficient lighting for the home	CFL, solid state lighting	New opportunities for growth of high-volume applications — such as general home and office lighting — as well as greater penetration for automotive.

Impact of Recession	
Strengthening of vertical development teams (across design / supply chain)	Example: 3D packaging
Will delay new technologies requiring significant investments (both capital and R&D)	Example: through-silicon vias
Increased consortial activity on environmental efforts (reduce total industry investments)	Examples: iNEMI's HFR elimination projects and common "building blocks" for lifecycle assessment (LCA) initiative
Long-Term Challenges	
Technology Challenges	Description
"More than Moore"	Advanced packaging is becoming critical for semiconductor growth; however, recession will delay development and qualification.
Thermal management challenge remains, but is not as critical	New materials and active cooling techniques being developed, but at a slower pace (due to multi-core processors).
Design and simulation tools	Ability to do concurrent design for circuit, thermal, mechanical, etc. Major issue is business case for investments needed.
Science-based environmental improvements	Current regulations are proliferating rapidly with harmonization less likely. Market-driven changes will make the situation even more complex.
New Product Markets with Social Value	
IT industry has a major role to play in helping society reduce carbon footprint	Smart city planning Smart buildings Smart appliances Dematerialization (reduce materials used in products and packaging) Smart industry Smart grid Intelligent transport
Energy: Higher efficiency Alternate sources	Higher efficiency power supplies; new energy sources for portable products; accelerated solid state lighting deployment; solar power development.
Healthcare	Realize major opportunities to drive down healthcare cost and improve outcomes, such as digital records, home diagnostics, etc.