Electronics Industry Design Trends and Drivers

Chris Cleet – Information Technology Industry Council (ITI)
September 27, 2018

Outline

- General design trends for electronics

- Drivers

- The design cycle for electronics

- Material selection trends

# General Design Trends for Electronic Products

- Move to more mobile devices

- Power and versatility
  - No longer single function devices

- Aesthetically pleasing

- Environmentally friendly and sustainable
  - Materials and energy efficiency are being maximized

Photo source: https://funalive.com/articles/the-evolution-of-cell-phones_W3M.html
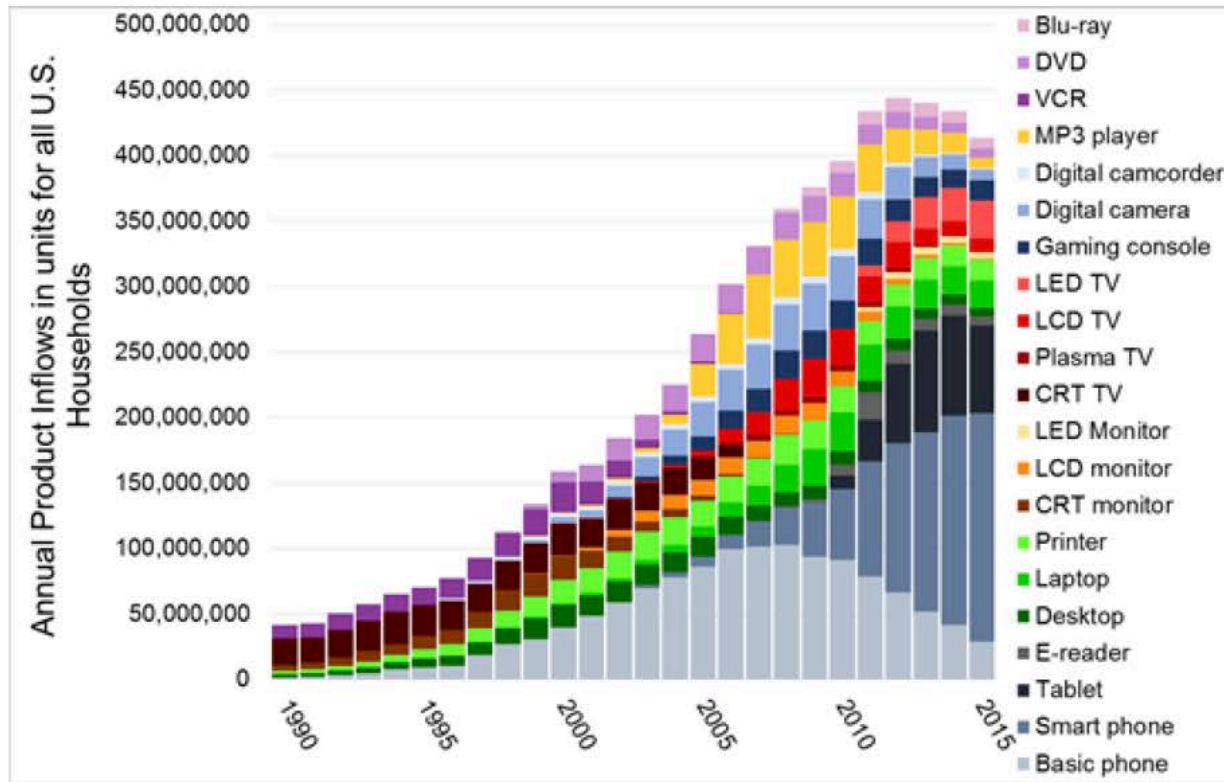
Computing Continues to Shift Between Formfactors
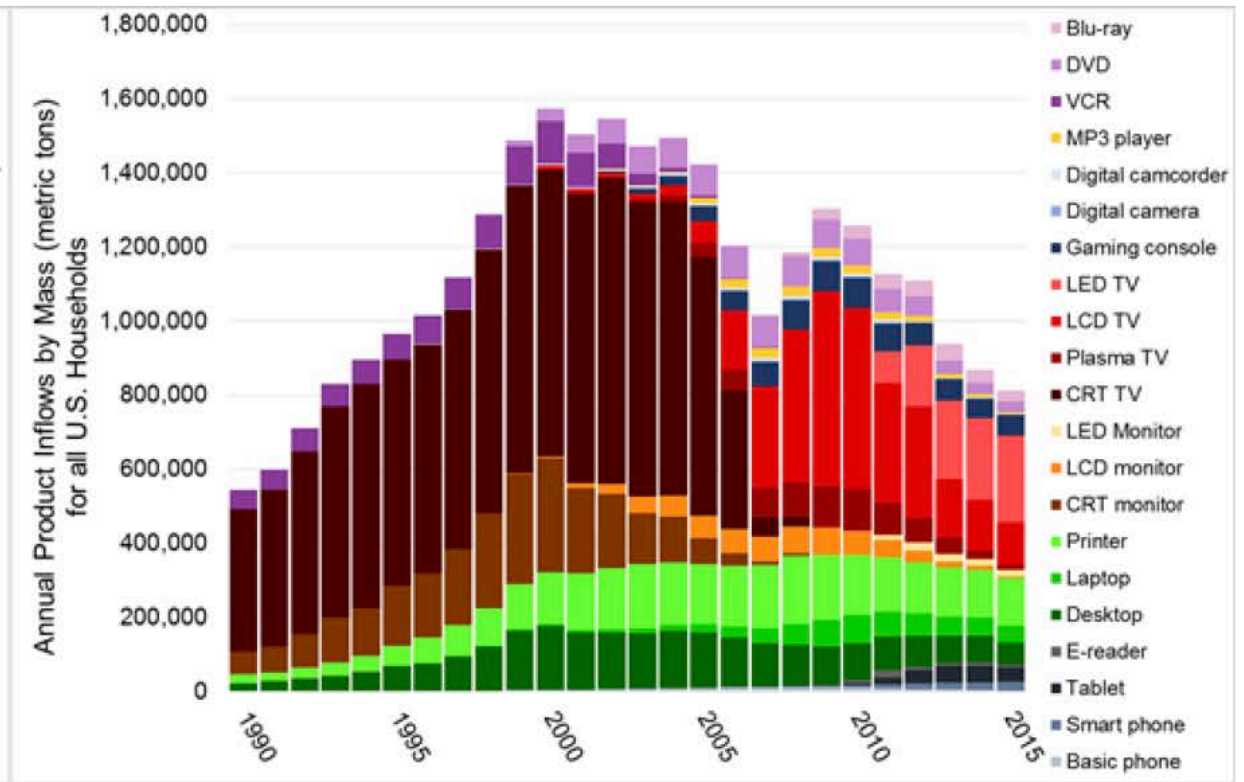
Household Ownership Computing Devices

■ 2012 ■ 2013 ■ 2014 ■ 2015 ■ 2016 ■ 2017 ■ 2018

Notebook/Laptop PCs   Tablets   Desktop PCs
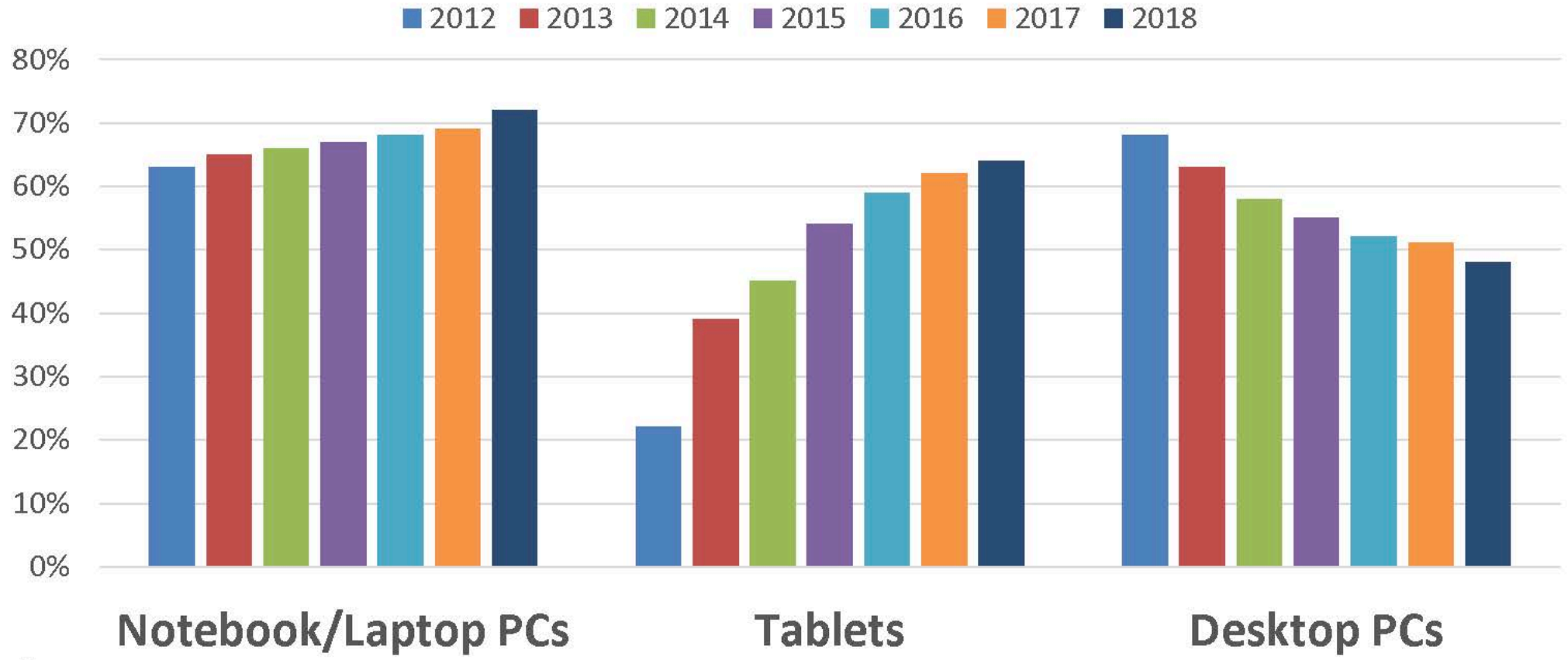
Source: CTA 20th Annual Ownership & Market Potential Study

Material Impacts

Sales (Units) — Annual Product Inflows in units for all U.S. Households

Weight (metric tons) — Annual Product Inflows by Mass (metric tons) for all U.S. Households

Legend: Blu-ray, DVD, VCR, MP3 player, Digital camcorder, Digital camera, Gaming console, LED TV, LCD TV, Plasma TV, CRT TV, LED Monitor, LCD monitor, CRT monitor, Printer, Laptop, Desktop, E-reader, Tablet, Smart phone, Basic phone
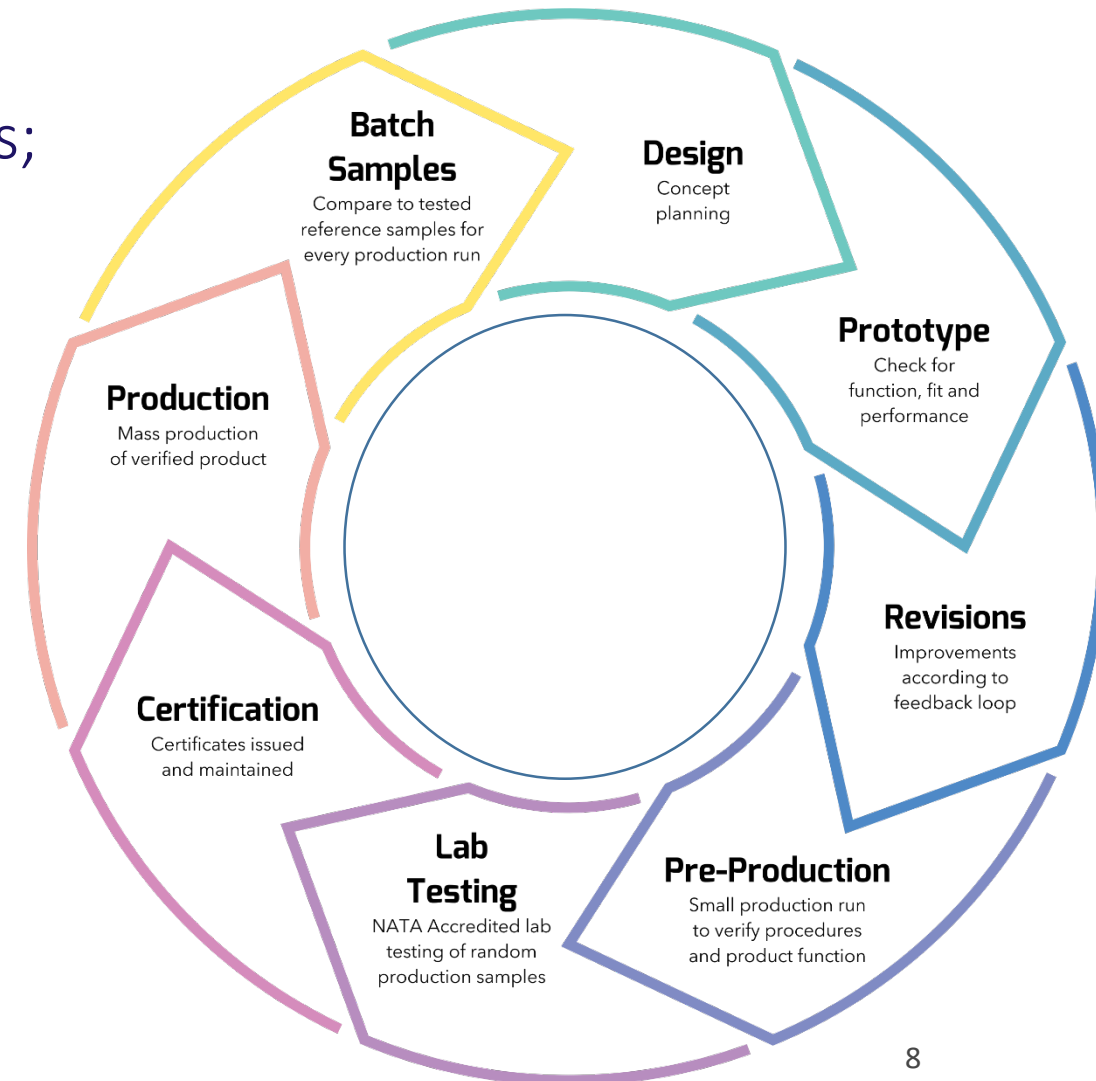
Drivers for Design Trends

- Customer demand

- Standards

- Innovation

- Laws and regulations

- Trade-offs

The Design Cycle

- Design cycle is 18 – 36 months for most IT devices; longer for large devices

- Considerations
  - o Drivers (as before -- what does the customer want)
  - o Lifecycle of the product
  - o Risk/hazard/liability
  - o Costs to the customer
  - o Value recovery – Circular economy

- Compliance and documentation

Batch Samples
Compare to tested reference samples for every production run

Design
Concept planning

Prototype
Check for function, fit and performance

Revisions
Improvements according to feedback loop

Pre-Production
Small production run to verify procedures and product function

Lab Testing
NATA Accredited lab testing of random production samples

Certification
Certificates issued and maintained

Production
Mass production of verified product

Considerations in Material Selection

Manufacturability	Durability	Appearance	Temperature	Specialty
• Part geometry & quantity vs. cost equation • Thickness	• Impact • Load? • Chemical resistance • Wear resistance?	• Specific integrated color • Texture • Gloss • Translucent...tints?	• Low (with mechanical stress?) • High (with mech. stress?) • Broad range?	• Combination: Electrical insulation & thermally conductive? • EMI/RFI

- Flame Retardants, if used, are part of a comprehensive engineered solution
  - No "one size fits all" chemical, physical or design solution for flame protection

Material Selection – Standards

End Products

- End product standards (PCs, copiers, phones, dishwashers, etc.)
- UL746C (electrical enclosures, barriers, etc.)
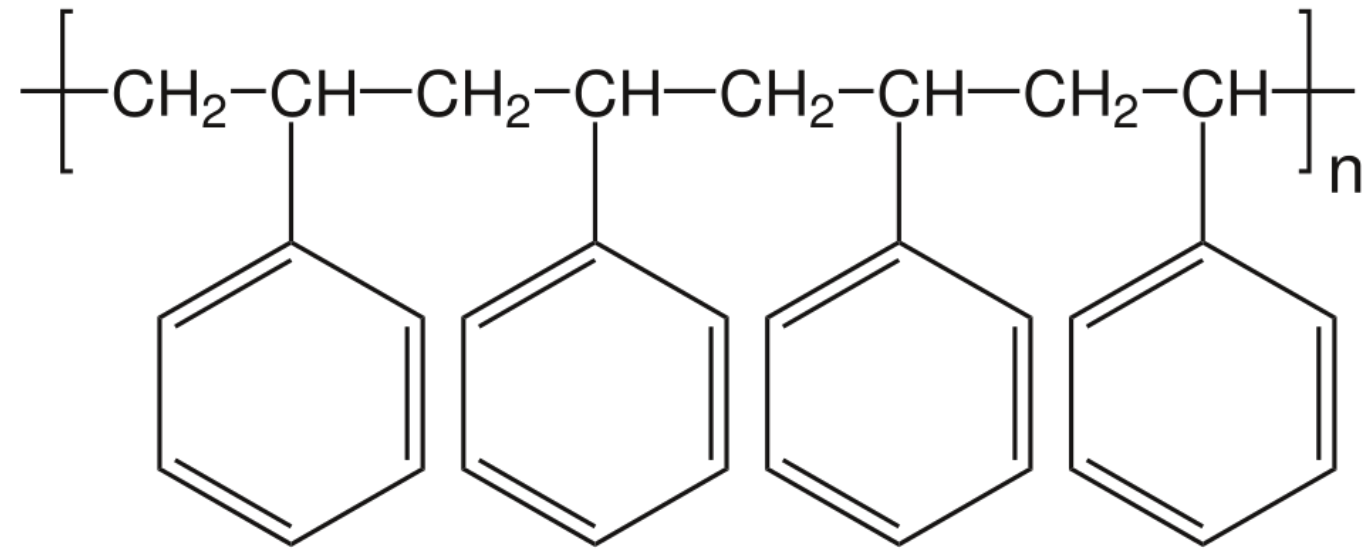- **Material Pre-selection Guidance**

Polymeric Materials

- UL 94 (flammability)
- UL 746A (short-term properties)
- UL746B (long-term properties)
- UL746C (Use of polymer matls in electrical equipment)
- UL746D (finished parts)
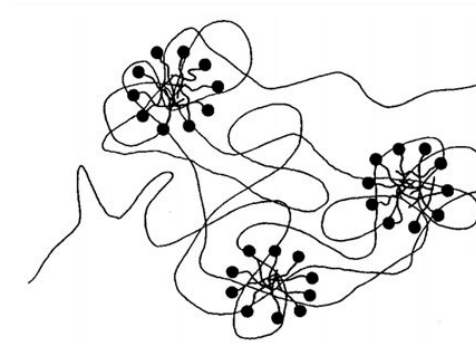
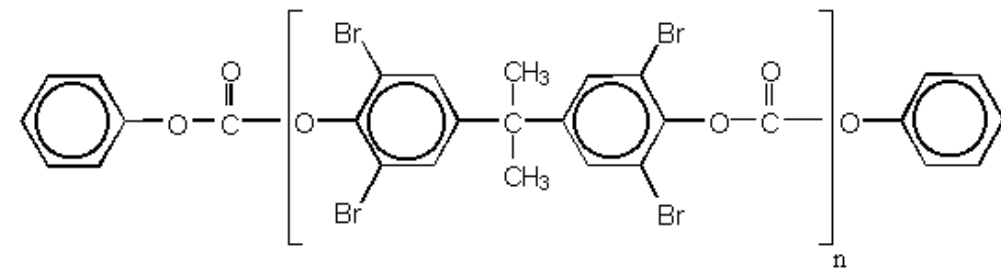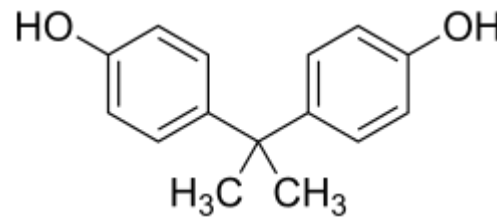# Polymer Chemistry 101
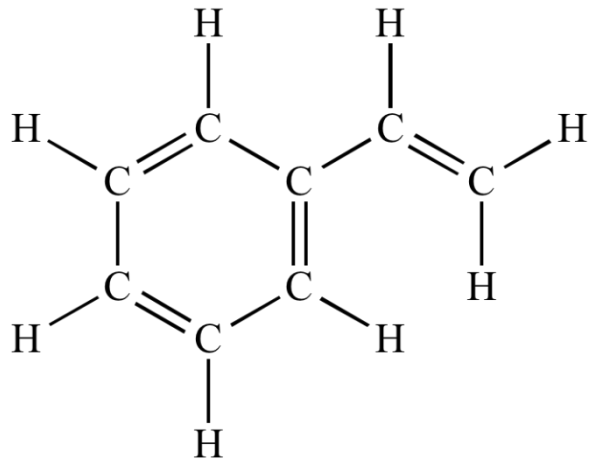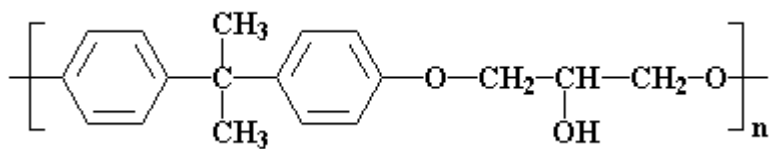

Styrene

Polystyrene

Polymer Chemistry 101

- Additive
  - Materials that are dispersed but do not alter the underlying structure of the polymer

R. Nagarajan, J. Chem. Phys. 90 (3), 1 February 1989

- Reactive
  - Materials that change the polymer structure

n= 3 - 5

Material Selection

- Continual evaluation of potentially hazardous materials
  - Industry continuously reviews materials added to a device
    - Hazard screening
    - Risk assessments
  - Many regulatory restrictions are preceded by industry materials trends
    - Example: RoHS lead restrictions
- The electronics industry works with governments, NGOs and industry to evaluate materials in products
  - IT Industry (among others) worked with Clean Production Action to develop the GreenScreen tool
  - Working on Green Procurement Standards (IEEE, NSF, UL) to establish guidelines
  - Worked with State of California to develop Green Chemistry Alternatives Assessment process

Summary

- Many drivers on electronics design
  - Customer experience is always first driver
    - Wants/needs
    - Safety
  - Regulatory drivers
  - Innovation
    - Electronics industry is always looking for next technological advance

Thank You

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