Best practices in selecting packaging for electrical sensitive components

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1 “The ‘Real’ Cost of ESD Damage”, Terry Welsher, pp.1-10 (2010)
Objectives

• The change in the automobile

• ESD
  • 6 Basic Principles of Static Control
  • Scale Guide
  • ESD Protective Area (EPA)
  • Life Cycle

• Return on Investment
Annual Growth Rate in Electronic Systems

Automotive: 4.9%
Consumer: 3.9%
Computer: 2.8%
Communication: 1.5%

Increase In Battery Electric Vehicle Sales

Number of BEV sales expected to surpass number of ICE vehicles before 2050

Electronic Systems as % of Total Car Cost

- 2030 F: 50%
- 2010: 35%
- 2000: 22%
- 1990: 15%
- 1980: 10%
- 1970: 5%

6 Basic Principles of Static Control

1) Design in Protection
   • Design the product to protect from ESD

2) Define the level of control
   • How much protection is needed?

3) Identify and define ESD Protective Areas
   • These are areas where ESD products are handled

4) Reduce Electrostatic charge generation
   • Limiting static charge generation processes

5) Dissipate and neutralize
   • Grounding, ionization, and either conductive or dissipative materials

6) Protect products from ESD
   • Using static control packaging and material handling products
Protect Products from ESD: Packaging

• Protect from triboelectric charge generation, direct discharge, and electrostatic fields

• 3 Requirements
  • Low charging material
  • Material can be grounded
    • Conductive or Static Dissipative
  • Outside of an EPA electrostatic discharge shielding is needed
Resistance Classification taken from ANSI-ESD S541-2018.

- **Conductive**
  - Surface resistance of $< 10^4$ Ohms
  - Displaces charge quickly, helping to protect direct discharges from reaching sensitive products.
  - Helps drain existing charge away from products.
  - If a sensitive device becomes charged, dissipative material will slowly control the discharge to protect the product.

- **Static Dissipative**
  - Surface resistance of $10^5$ to $< 10^{11}$ Ohms
  - Displaces charge slower than conductive materials.
  - Helps drain existing charge away from products.
  - If a sensitive device becomes charged, dissipative material will slowly control the discharge to protect the product.

- **Insulative**
  - Surface resistance of $≥ 10^{11}$ Ohms
  - Discharges slower than most static charges are created.
  - Standard, does not dissipate—holds charge.
What is an EPA?

EPA – ESD Protective Area
ESD Life Cycle

The life cycle of an ESD product depends on what materials the product is made out of:

- **Pink-Poly**
  - These polymers also typically only have a shelf life somewhere in the 3-6 month range

- **Carbon**
  - Black carbon materials are permanent and are unaffected by washing
ESD Life Cycle

• Antistat Sprays
  • These polymers can be sprayed onto a product and have a similar life cycle to pink-poly bags

• Static Shielding Bags
  • These bags are “permanent” in that the material doesn’t degrade over time like pink poly does
  • The bags being crinkled and folded can make the bags a one-time use
Return on Investment

• Lockheed Missiles and Space Company\(^2\) (1983)
  • Failure data before and after ESD program implementation
  • $2 million/year in savings

• Western Electric North Andover Works\(^3\) (1983)
  • Three experiments on ESD Programs
  • Up to 950% return on investment

• AT&T (1999)
  • Over 50% savings in return and repair costs after implementing ESD Control Program

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Key Takeaways

• Electronic systems are increasing in every industry

• Not all products are created equal. Usable life varies for different materials. Make sure the right packaging is used

• It is worth investing in an ESD program to protect your products
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What questions do you have?