



# Technical Seminar Series

*Be Smart — Choose the Right Part*

## Welcome to “Circuit Protection: Don’t Let Transients Kill Your Circuit”



**Circuit Protection – Government regulations, application requirements, technology and supplier options. Confused?**

**Today industry leaders from the Paumanok Group, Bourns, Littelfuse and Raychem will explore the different application and technology options available. So, don’t get burned ... listen in and learn more about circuit protection today!**



# Technical Seminar Series

*Be Smart — Choose the Right Part*

Welcome – Craig Conrad, TTI, Inc.

## Technology Options

### **Market Overview – Paumanok Group**

- Dennis M. Zogbi

### **GDT and LPM – Bourns**

- Craig Shipley
- Bernie Doerrwaechter

### **Telecom Regulatory Standards – Littelfuse**

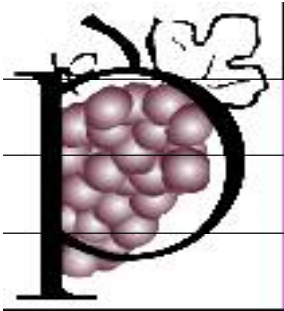
- Phillip Havens

### **PolySwitch PPTC – Raychem Circuit Protection**

- Jim Toth

## Q&A

October 2005



### RESEARCH & PRESENTATION

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## Electronic Circuit Protection Components

## Global Markets, Technologies & Opportunities: 2005

### TTI Webcast October 2005



# Electronic Circuit Protection: Component Definitions

## Overcurrent Protection Components

Fuses: Solid Matrix, Blade & Cartridge  
PTC Thermistors: Polymer and Ceramic  
NTC Thermistors: Mixed Metal Oxide  
Bi-Metallic Switch: DC Motor Protection

Overcurrent

\$2.3 Billion USD

## Overvoltage Protection Components

Metal Oxide Varistors (Zinc-Oxide MLV, Disc, Block)  
Silicon Surge Protection  
    Zener Diodes  
    Silicon Avalanche Diodes  
    Thyristors (Protection Only)  
Gas Discharge Tubes (Ceramic/gas and glass)  
Line Feed Resistors (Thick Film On Ceramic; Wirewound)  
IGBT Snubber Capacitors (Power PET Film Capacitor)

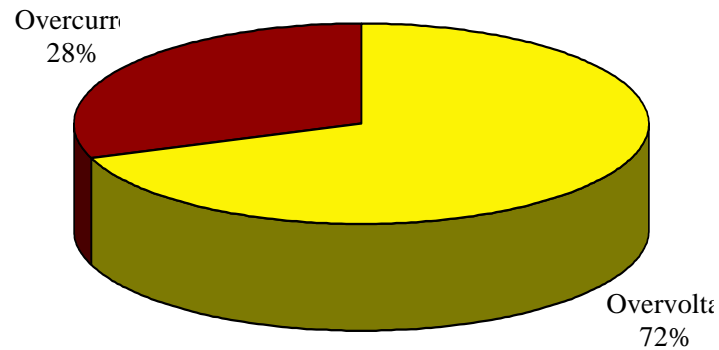
Overvoltage

\$2.0 Billion USD



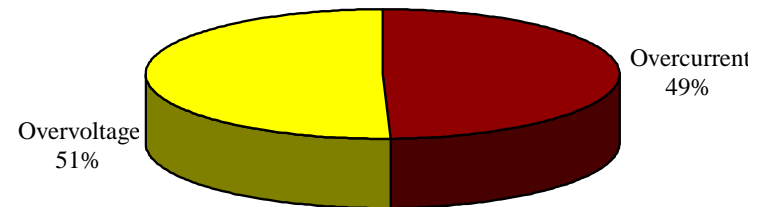
# Value and Volume Of Global Consumption For Circuit Protection Components By Type: 2005F

Global Unit Demand For Circuit Protection Component  
*64 Billion Piece Global Market In 2005*



**64 Billion Pieces**

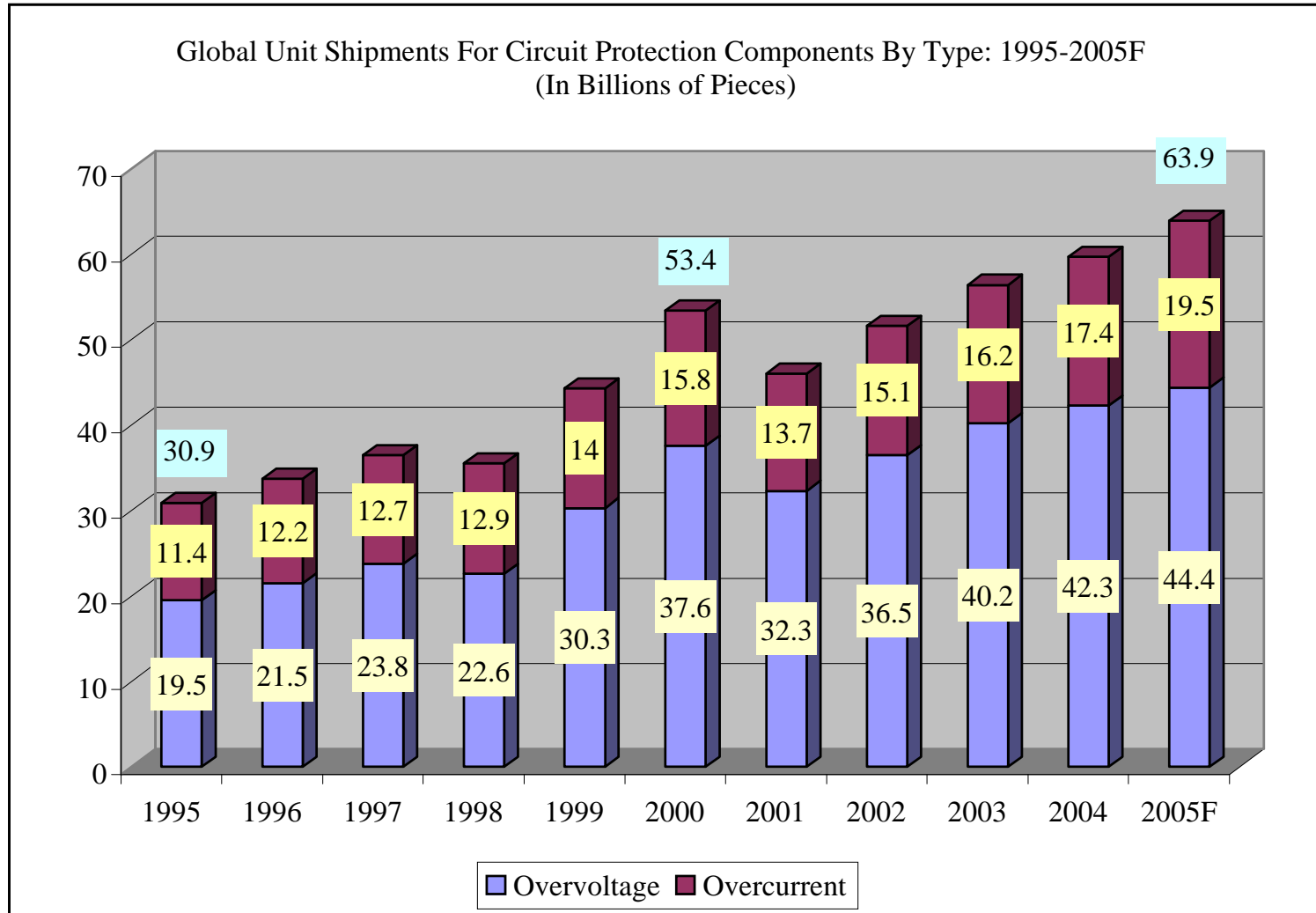
Global Consumption Value For Circuit Protection Component  
By Type: 2005F  
*(\$4 Billion USD Market Combine)*



**\$4.3 Billion USD**



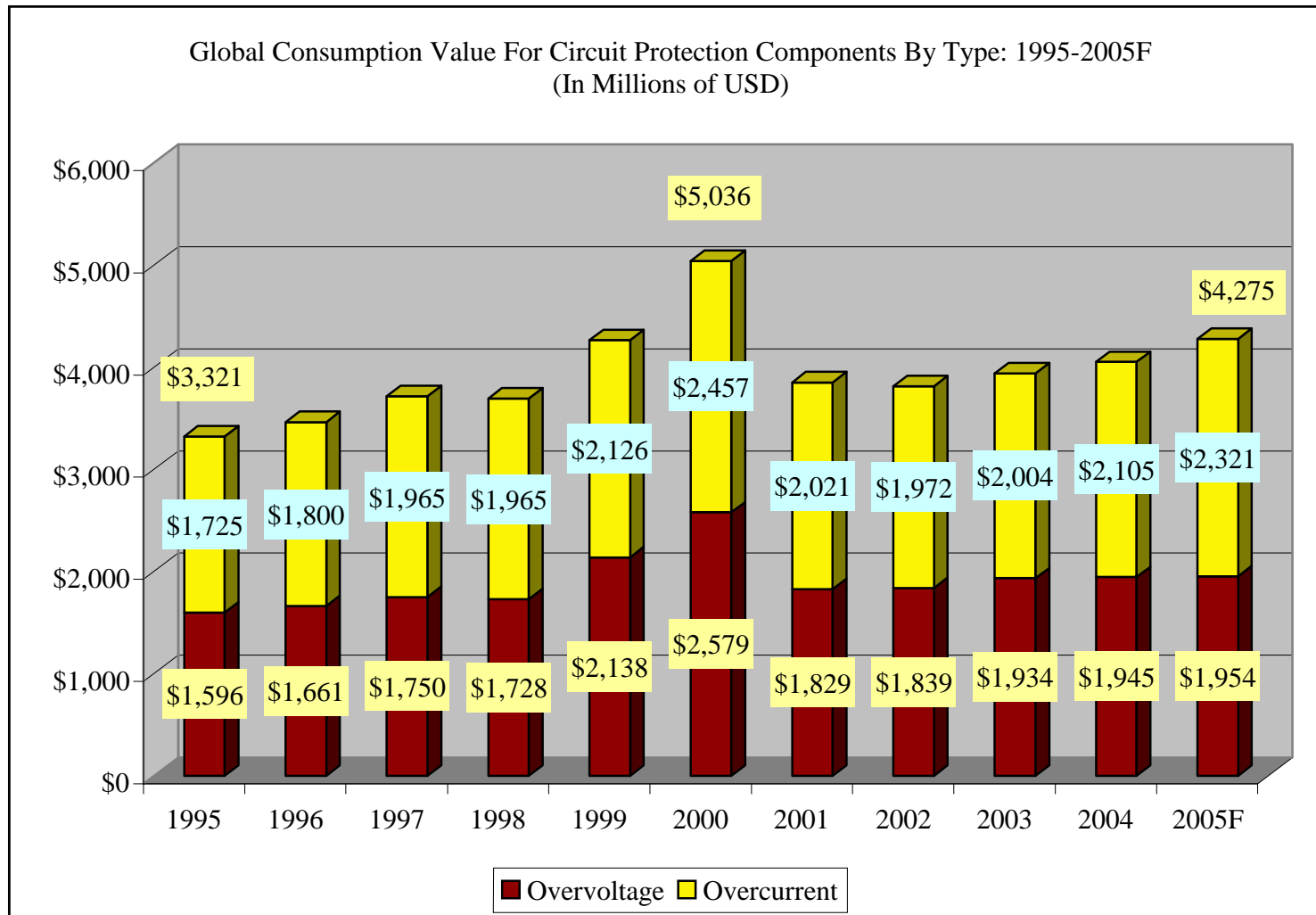
# Global Unit Shipments Of Circuit Protection Components By Type: 1995-2005



10 Year AAG= 7% 10 Year AAG Overcurrent= 5.5% 10 Year AAG Overvoltage= 8.6%



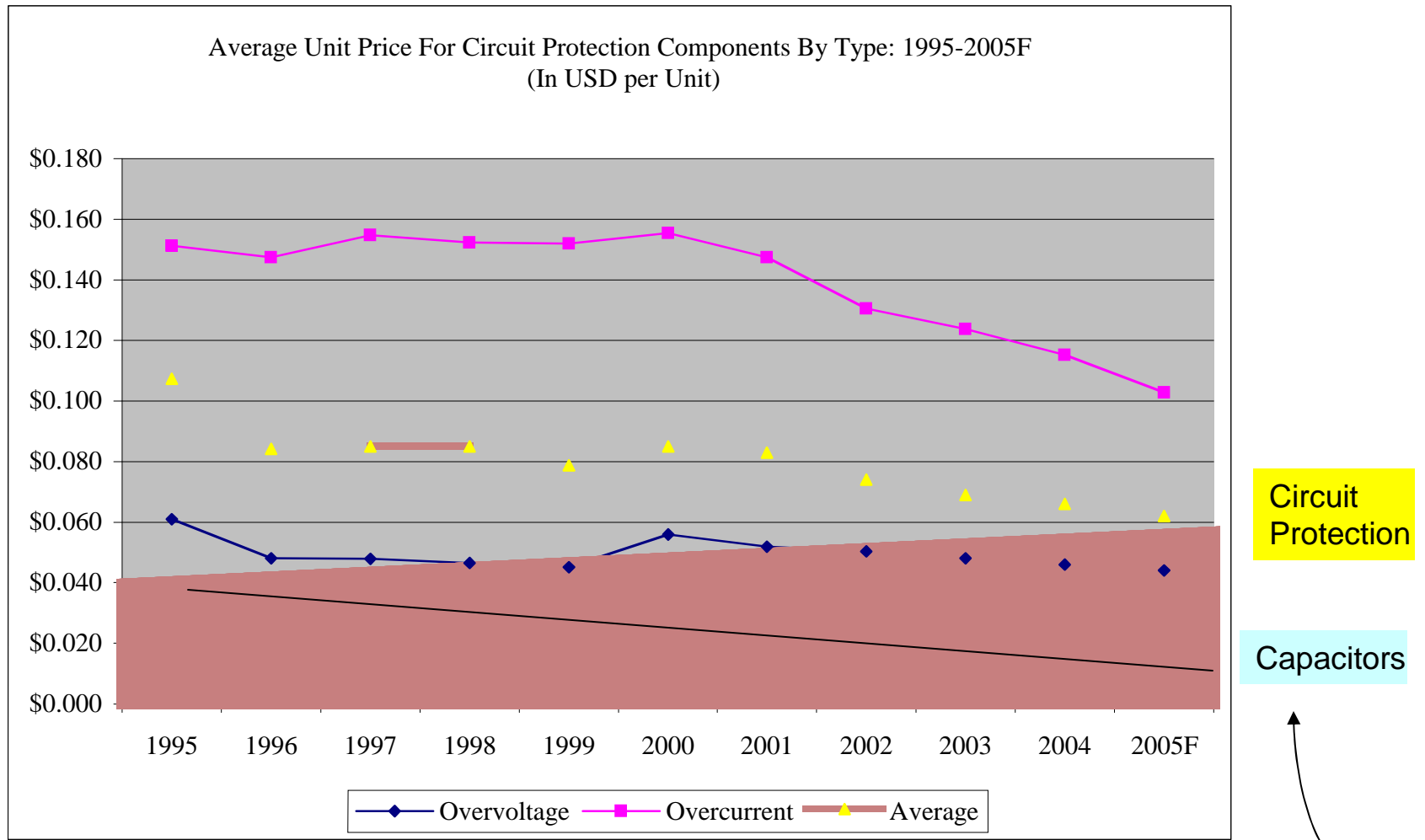
# Global Dollar Value For Circuit Protection Components By Type: 1995-2005F



10 Year AAG= 3% 10 Year AAG Overcurrent= 3.1% 10 Year AAG Overvoltage= 2.2%



# Average Unit Selling Prices For Circuit Protection Components By Type: 1995-2005F



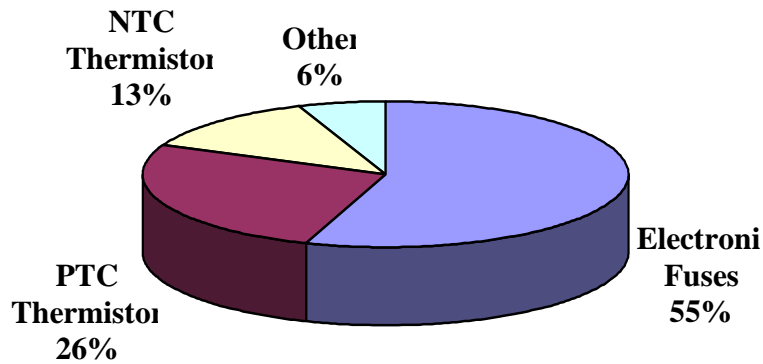
10 Year AAG= -4% 10 Year AAG Overcurrent=-4.1% 10 Year AAG Overvoltage=-3.8%

**Capacitor Manufacturers View The ECPC Market As Value-Added Because of The 4X ASP Factor.**



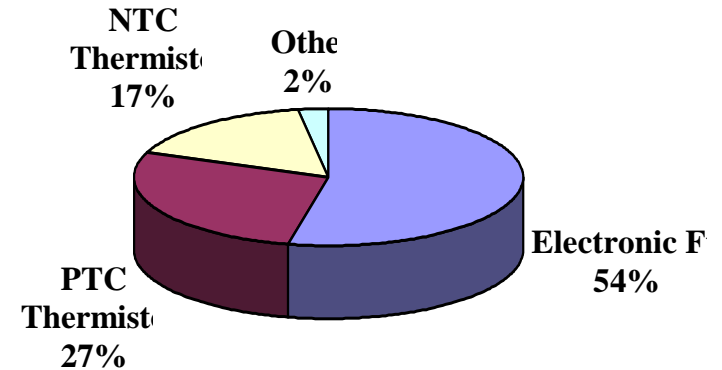
# Global Overcurrent Protection Markets By Component Type: 2005F

**Global Unit Demand For Overcurrent Protection Compo  
Type: 2005F (19.5 Billion Pieces)**



Other- Bi-Metallic Switch

**Global Consumption Value For Circuit Protection  
Type: 2005F**



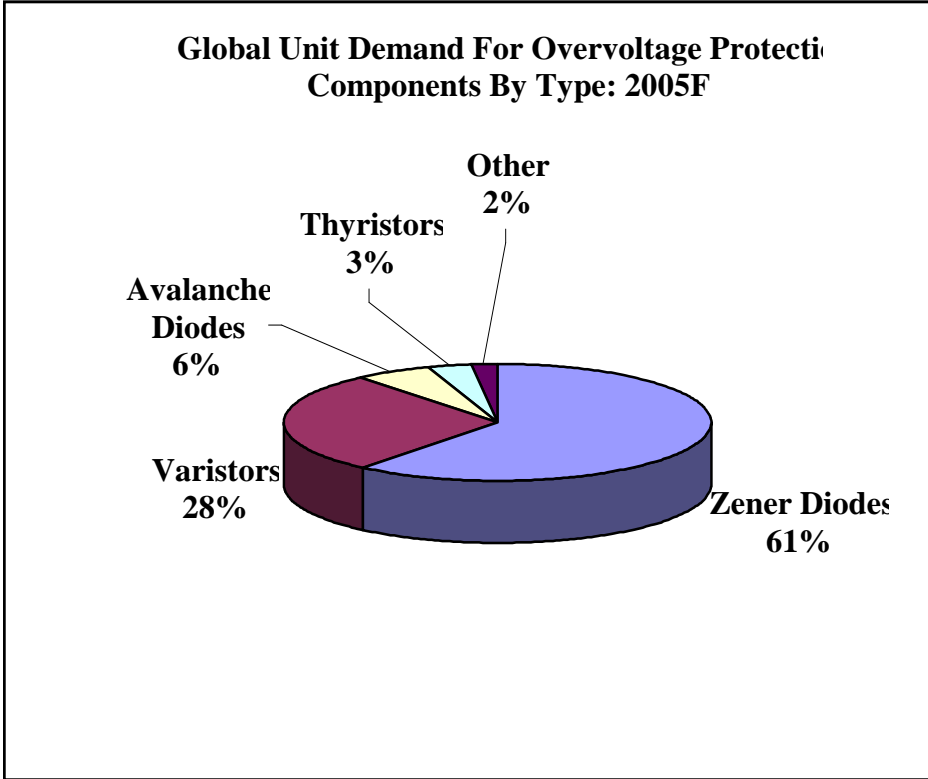
Other- Bi-Metallic Switch

**19.5 Billion Pieces**

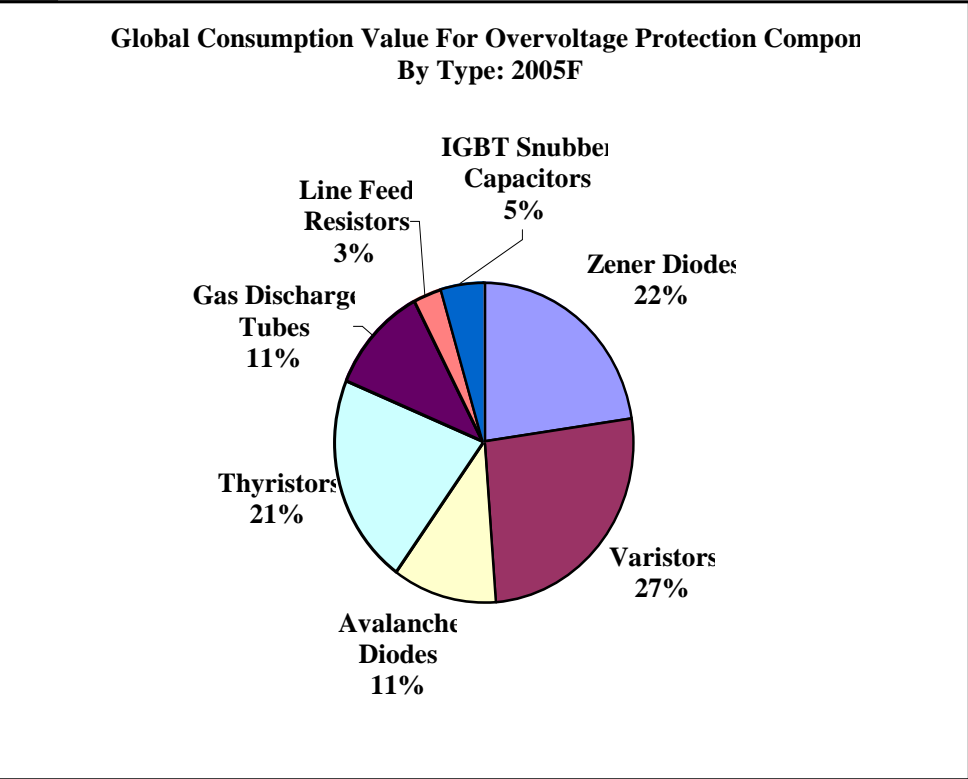
**\$2,321 Million USD**



# Global Overvoltage Protection Markets By Component Type: 2005F



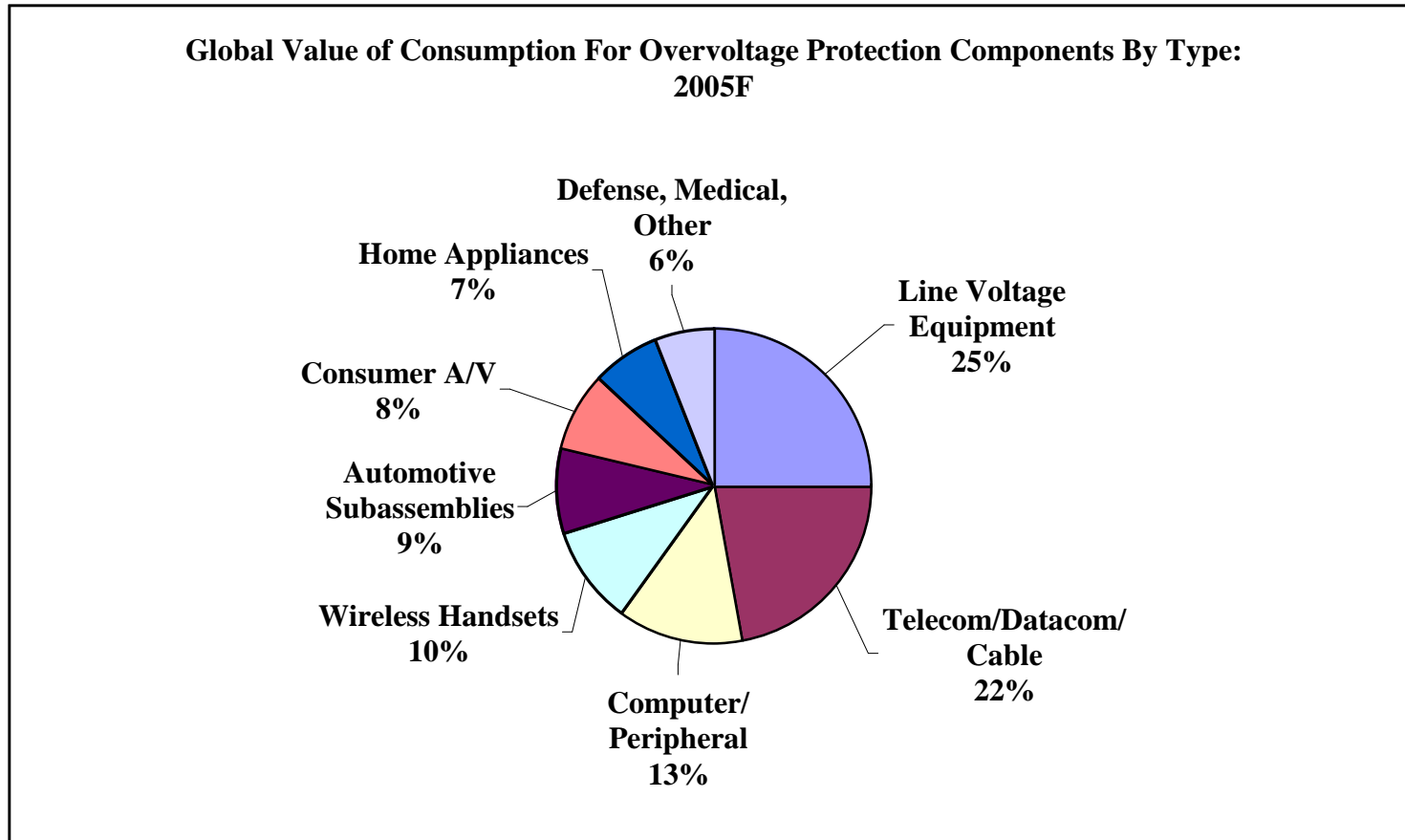
44.4 Billion Pieces



\$1,954 Million USD



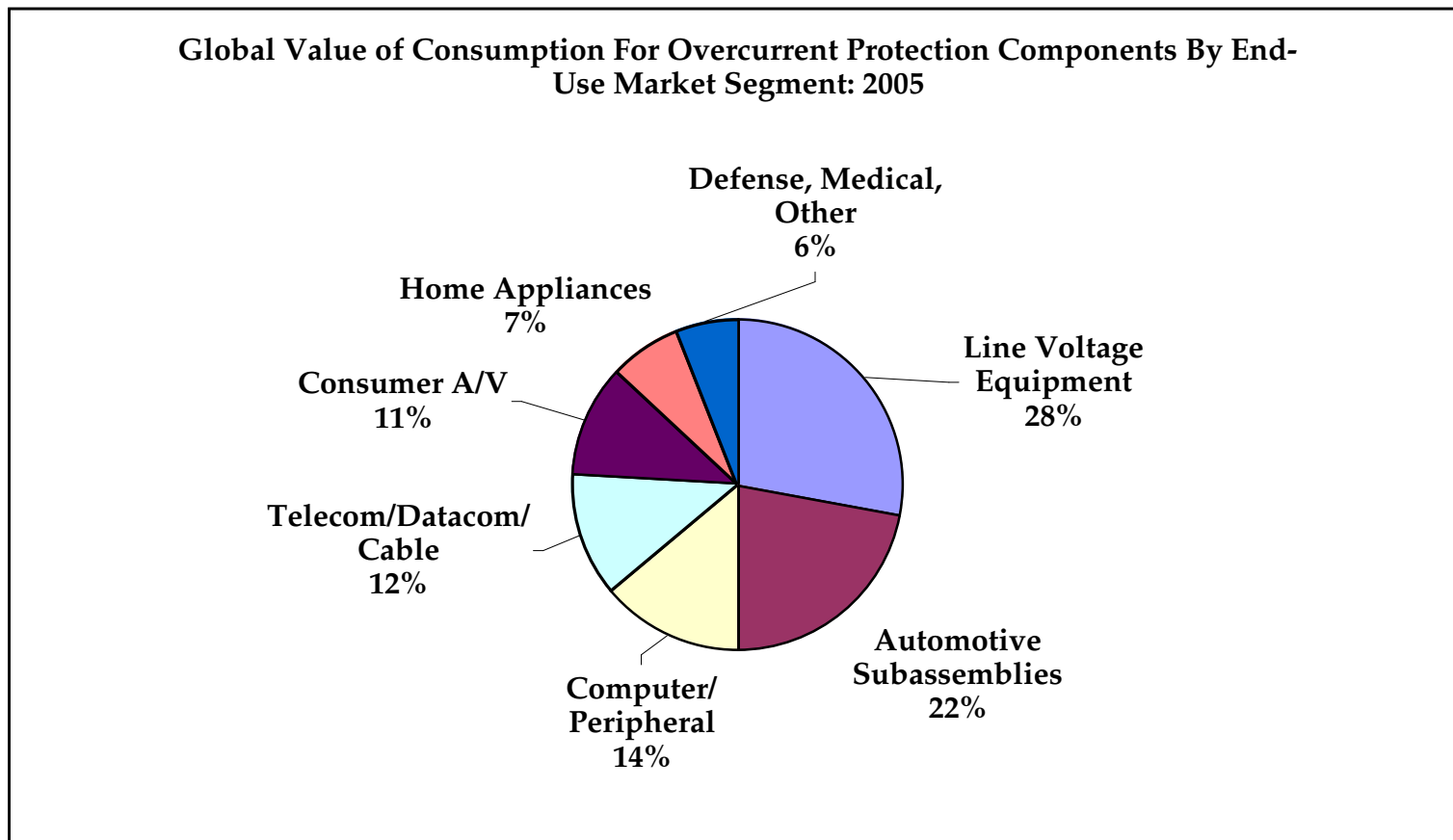
# Global Overvoltage Protection Markets By End-Use Market Segment: 2005F



**\$1,954 Million USD Market**



# Global Overcurrent Protection Component Markets By End-Use Market Segment: 2005F



**\$2,321 Million USD**

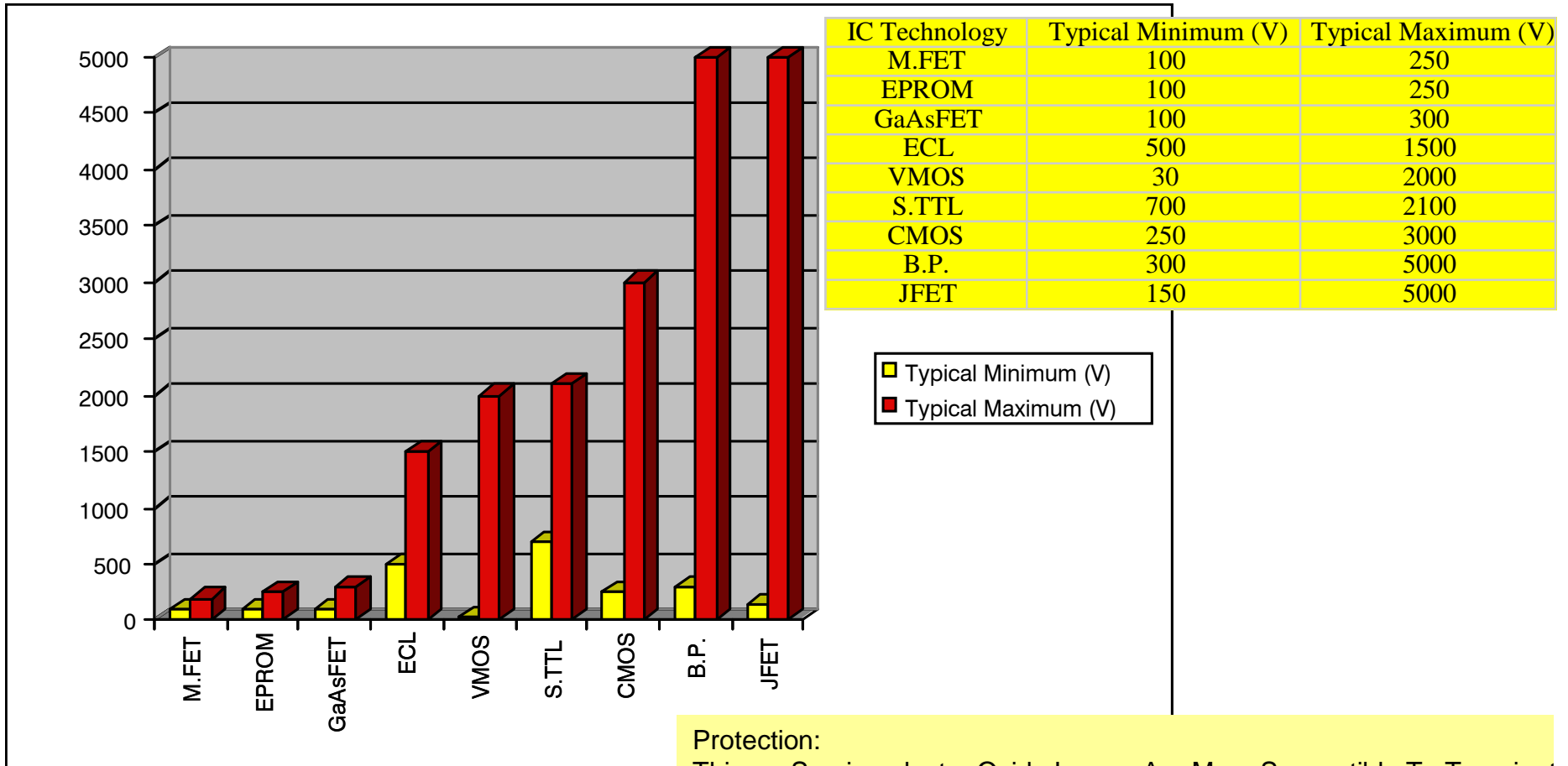


# Design-In By Component Type & Market Segment

Market Segment	Electronic Fuses	Polymer PTC Thermistors	Ceramic PTC Thermistors	NTC Thermistors	Zener Diodes	Thyristors	SAD Diodes	Varistor	Gas Tube	LFR	Snubber
Computers/Peripherals											
Telecom/Datacom Infrastructure											
Wireless Communications											
Consumer A/V Equipment											
Rechargeable Battery											
Medical Electronics											
Defense Electronics											
Automotive Electronics											
Line Voltage Equipment											
Power Supplies/DC Converters											
Lighting/Ballasts											
Large Home Appliance											
Small Home Appliance											
Other Line Voltage											



# Market Driver 1: Semiconductor Protection



Protection:  
 Thinner Semiconductor Oxide Layers Are More Susceptible To Transients  
 Resulting in Redundant Design Solutions To Meet Regulations and Standards



# Market Driver 2: Regulations & Standards

Primary Regulations & Suggested Compliance For Electronic Subassemblies Sold Worldwide:

- GR-1089 BellCore (Telecom)/TELCORDIA
- IEC 61000 4-2 Specifications (Power/ESD)
- ITU-T K-20 and K-21 (Telecom)
- FCC Part 66 (Telecom)
- UL1459, 2nd Edition (Telecom)
- UL 1950 3rd Edition (Telecom)
- UL 497 Series (A & B) (Telecom)
- MIL 883 (Defense/Medical)
- QS (Automotive)

Overcurrent and Overvoltage Protection Components Discussed In This Report Help OEM and ODM Designers Meet The Above Mentioned Criteria



# Forecasts: 2005-2010

- Combined Technologies (PPTC Softerm® With MLV©) Millman/Zogbi
- Vertical Integration Of Components Into Modules & Subassemblies
- Joint Ventures Between ECPC Vendors (Littelfuse/Spectrum)
- Greater Attention On This Large Market Space (High Volume, High Value)
- Continued Automation Of Existing Factories (Less Personnel, More Machines)
- Movement To Surface Mount (Only 20% in 05) (Transition to New Machines)
- ROHs Compliance (New Machines for Tin Terminations)
- New Competition From Capacitor and Resistor Vendors In Korea, China and Japan With Experience In Much Larger Economies of Scale.
- A Strong ODM Market In USA, Germany and Japan coinciding with value-added and application specific consumption in Asia.

