



# Gas Discharge Tube Protection

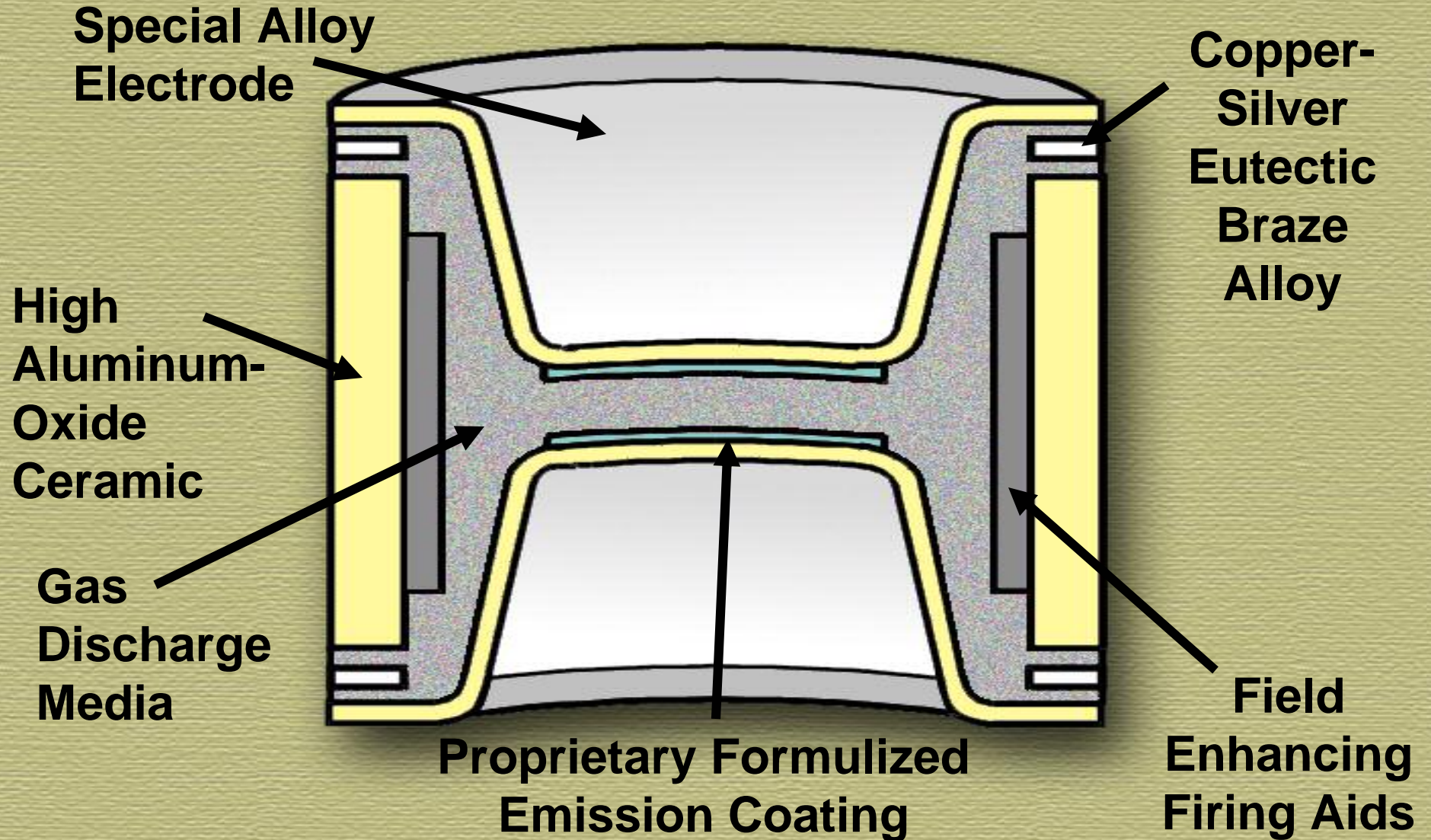
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# Basics of GDT's

- GDTs are basically on-off switches, commonly referred to as crowbar devices
- Under normal conditions they are invisible to the circuitry due to their high impedance state
- Under surge conditions the gas in the internal chamber(s) gas ionizes providing a low impedance state (arc-mode or short circuit), conducting the transient safely away from the protected component to the ground reference.
- Once the transient passes the GDT returns to it's normal operating condition, the high impedance state.



# Gas Discharge Tube Construction



# Today's GDT's

- Much more stable over Live
- Life Expectancy (20+ yrs)
- UL approved to require no Air - Back Up Gap (BUG)
- Surface mount packages available
- Very low capacitance for broadband protection

# Product Offering

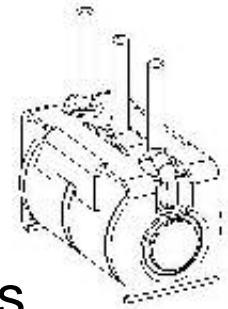
- Standard 3 Element, Common Chamber
  - Used in protectors to meet GR 974/1361 requirements
  - Available with patented switch-grade, thermal failshort mechanism
- Standard 2 Element
  - Used in conventional protectors with individual GTD's for T-G & R-G protection
- Mini 3 Element, Common Chamber balanced protection
  - Used to meet ITU requirements
  - Available in service mount
- Mini 2 Element
  - Recent demand for CPE board level protection
  - Available in service mount



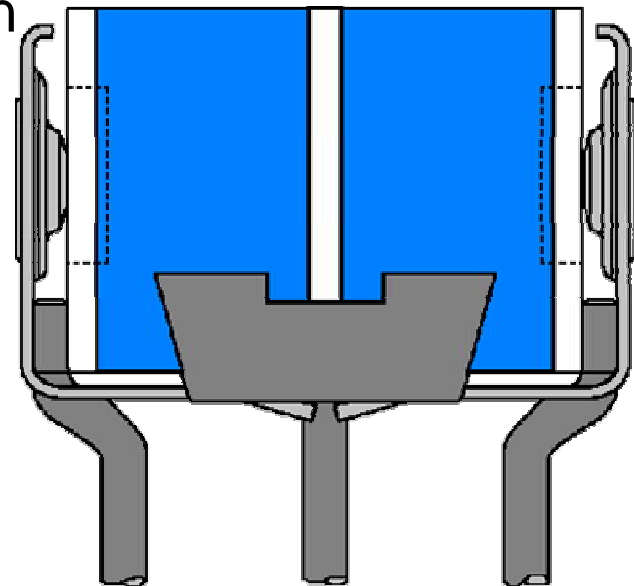
# Quick Comparison of Models

Series	Size	DCBD	Max Surge (8/20 us)	Surge Life (10/1000)	Max AC Discharge (11 cycles)	AC Discharge Life (10 reps)	Capacitance	Failshort Available?	Surface Mount?
2026	8x11 mm	75-600V	40kA	1kA, >400 rep	130 A	20A	<2 pF	Yes	No
2027	6x8m m	90-600V	20kA	500A, >400 rep	65A	10A	<1 pF	Yes	2006
2036	5x7.5 mm	75-600V	20kA	200A, >300 rep	20A	10A	<2 pF	No	Yes
2035	4x5m m	90-600V	10kA	100A, >300 rep	20A	5A	<1 pF	No	Yes

# MSP™ – Multi-Stage Protector



- Combines benefits of solid state and GDT protectors
- Lower capacitance, higher surge handling capability than Silicon based solutions
- Lower let-through voltage than standalone GDTs
- Integrated MOV back-up device for vent-safe operation
- Snap action, patented, switch-grade fail-short provides best thermal-Overload protection vs. burn-through or solder pellet alternatives
- No Air Back-up-Gap to fail
- 20(+) years service life



# Where Are GDTs Used?

- Telephone Central Offices
- Customer Premises
- Modems, DSU/CSU's, ISDN NT1's
- Network Interface Devices
- Building Entrance Terminals
- Consumer Electronics
- Antennas
- Station Protectors
- Signal & Dataline Protectors
- Coaxial Cable Protectors
- Medical Devices
- Ignition Circuits
- Computers
- CRT Displays
- Automotive Components
- Microwave
- Industrial Process & Control Devices
- Missile Firing Systems
- Line Interface Cards
- Uninterruptible Power Supplies (UPS)
- Repeaters
- Printed Circuit Boards
- Data Logging Equipment

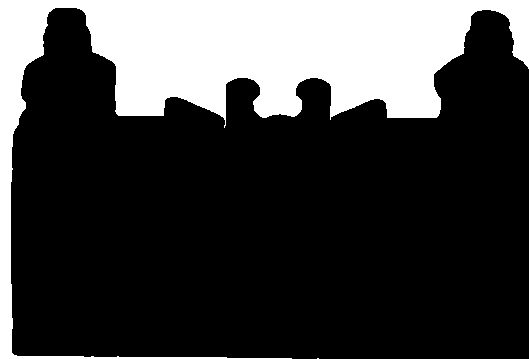


# Regulatory Standards

- GR 974
- GR 1361
- GR 1089
- UL 497
- UL 60950
- TIA-968-A
- ITU-T K.12 / K.20 / K.21 / K.45
- IEC 61643-21 / 22
- IEC 61643-311

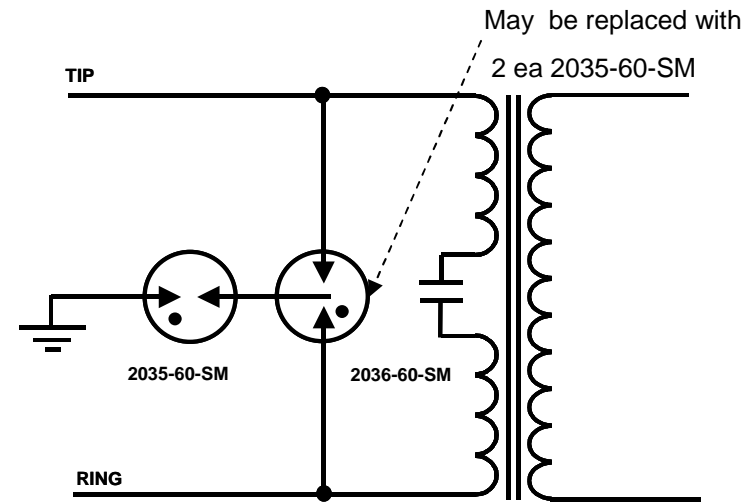
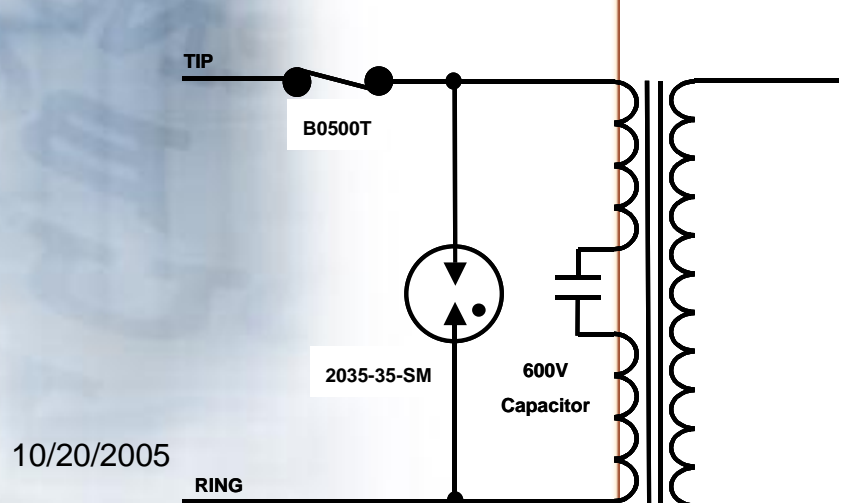
# Primary Protection

- Bourns offers MSP primary protection for both customer premise and CO with:
  - ◆ 2377 and 2378 binding post protectors
  - ◆ 2410 series 5 pins



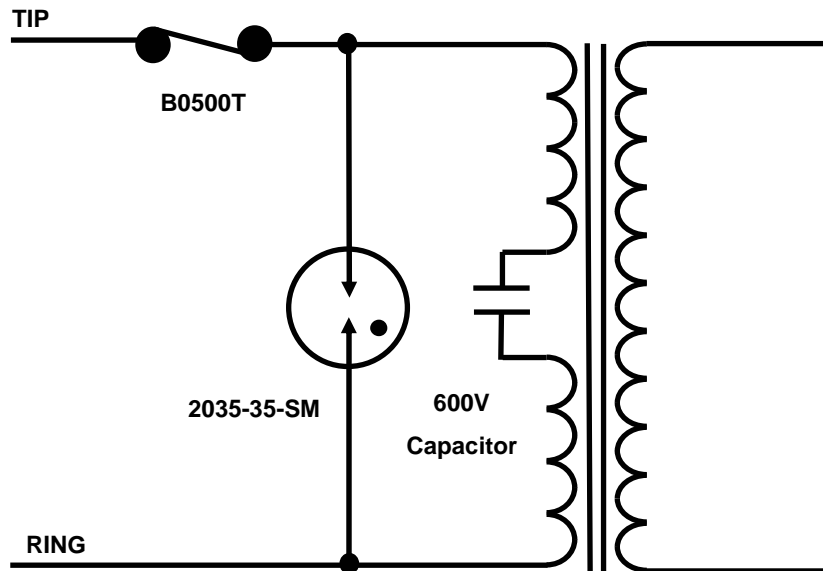
# CPE – Benefits/Design Considerations

- The 2035 series has  $<1\text{pF}$  capacitance
- Available in surface mount
- Popular configuration is 3 ea 600V devices in Y configuration
- Primary considerations are AC power cross and impulses let through



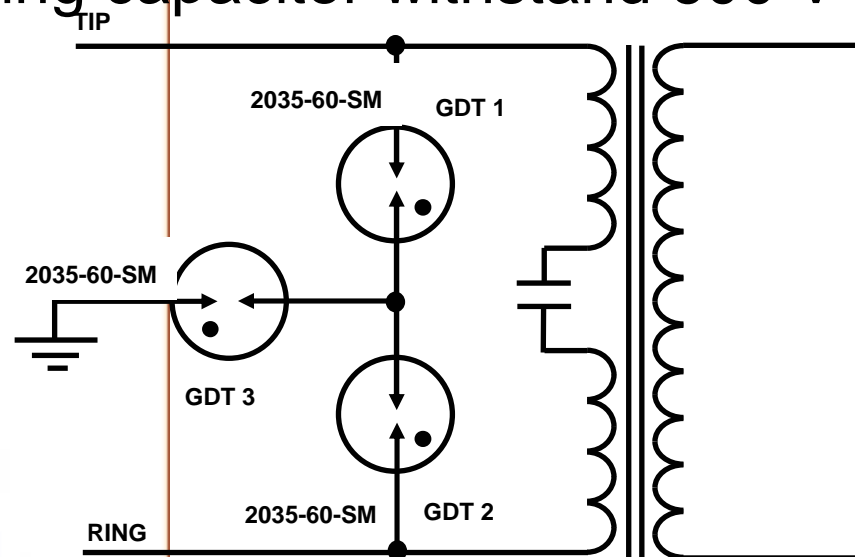
# CPE Design Considerations

- Figure shows transformer isolation protecting against longitudinal disturbances
- 2036-35-SM can be used for ground referenced protection
- B0500T fuse or a suitable PTC can be used as the over current protector. B1250T is unsuitable
- 600 V coupling capacitor is required



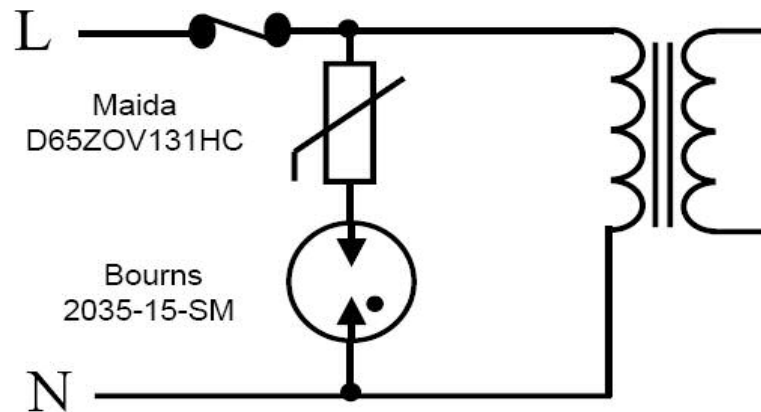
# CPE Design Considerations

- “Y” configuration allows for over current protectors to be removed
- Ensure protection does not operate under 600 V rms in UL 60950
- Transformer properties ensure 600 V rms capability.
- May need to increase protection on secondary-side of transformer
- Coupling capacitor withstand 600 V rms

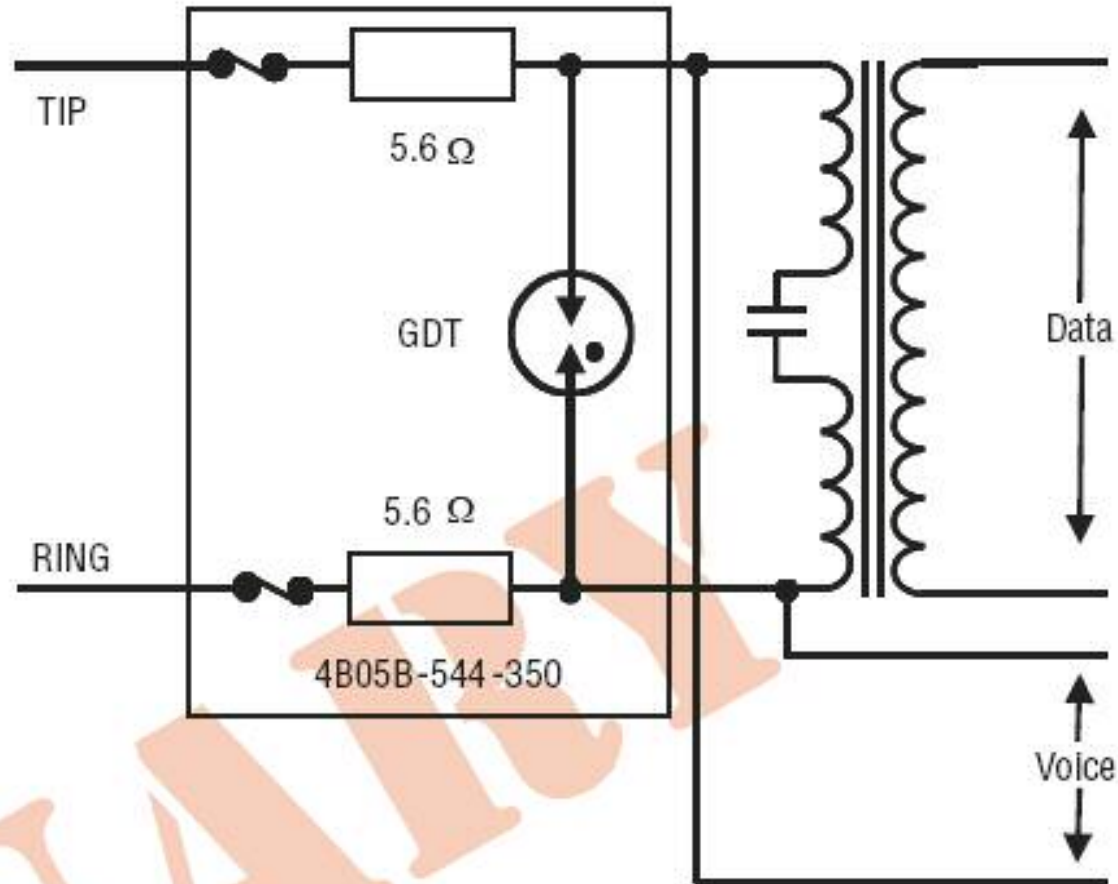


# GDT AC/Home Plug Protection

- High capacitance of MOV (metal oxide varistor) is reduced to the capacitance of the GDT
- Line capacitance is less than 1 pF making it ideal for home-plug protection applications
- MOV voltage rating needs to be higher than the maximum normal mains voltage



# Hybrid Module with GDT's





# Hybrid Module with GDT's for GR-1089-CORE

- Relies on longitudinal protection of the transformer
- Capacitance is less than 1pF for high-speed data communications
- 2x 5.6  $\Omega$  series resistance ensures voltage coordination in issue 3
- Value of resistance can be reduced if required to extend line reach
- Thermal fuses on the line feed resistor ensures GR-1089-CORE second level requirements
- Module for longitudinal protection is currently in design

10/20/2005

# Summary/Conclusion

- GDT's offer robust over voltage protection
- GDT's have extremely low capacitance
- Surface mount version are now available
- More reliable than GDT's from 20 yrs ago
- Considerable growth in board level protection
- Must consider AC characteristics in design efforts