



New Form Factor Integrated GDT + MOV

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 **PEG** PROTECTION
ENGINEERS
GROUP

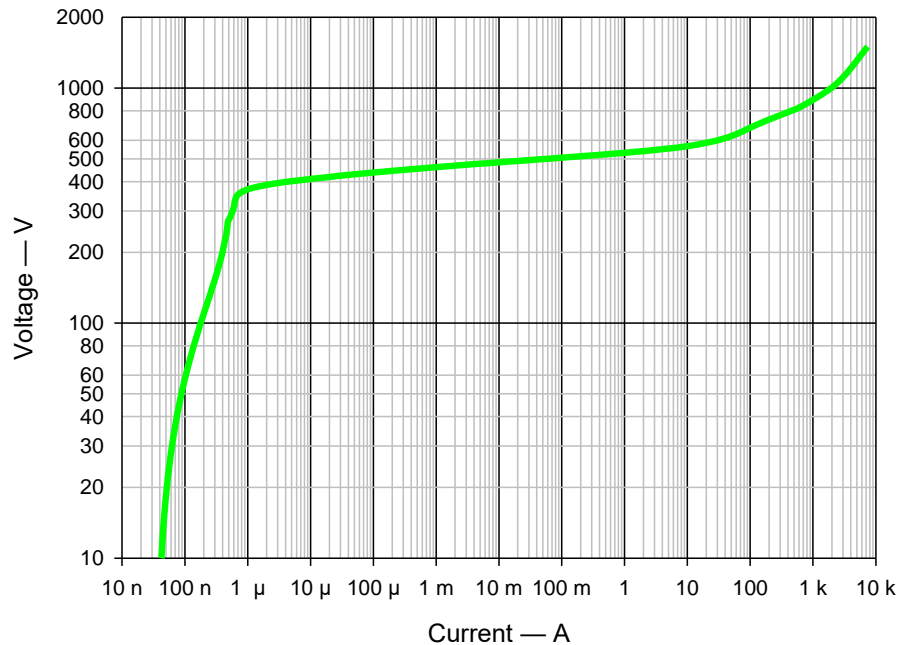
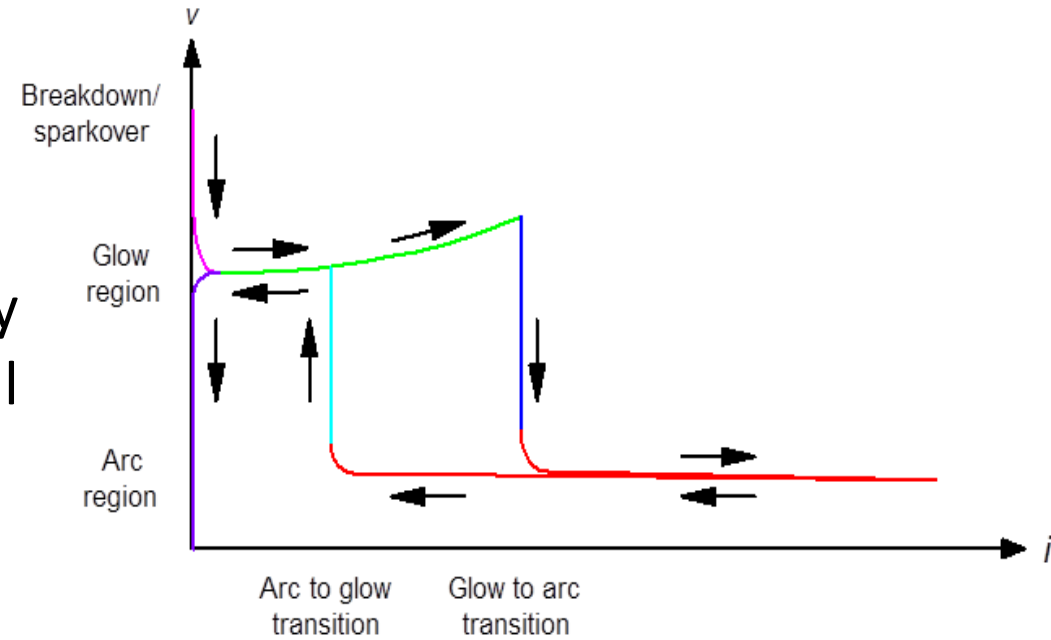
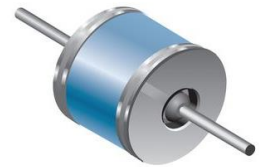
Electrical Protection of Communications Networks

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What is a Gas Discharge Tube, GDT?

A voltage-activated electric switch made by sealing a gas mixture between metal electrodes in a ceramic body.



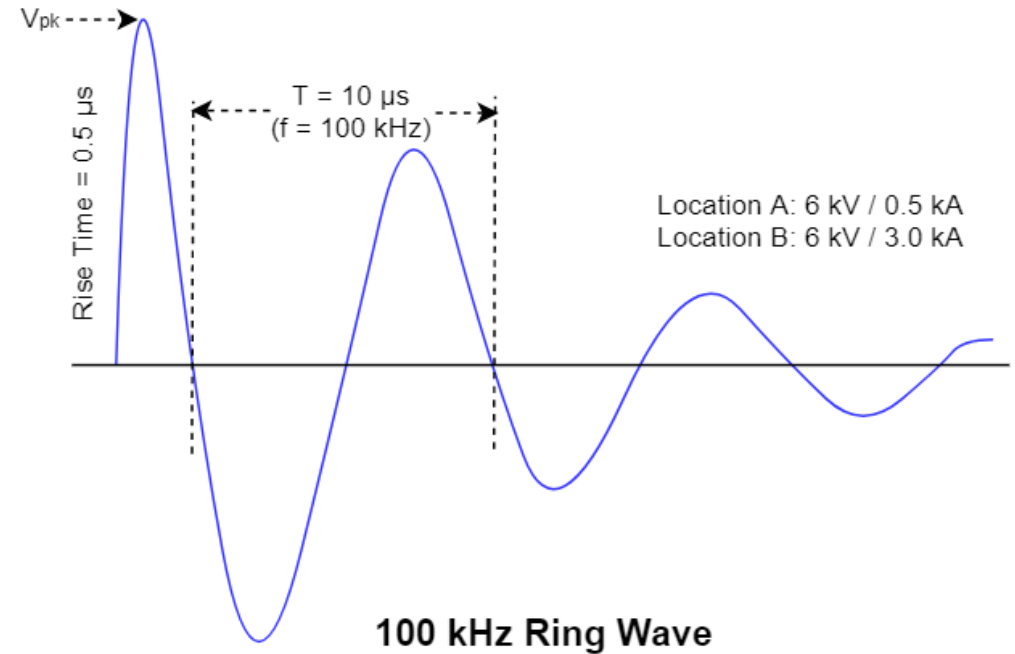
What is an Metal Oxide Varistor, MOV?

A voltage clamp made from a doped zinc oxide ceramic disk with an electrode on either side.



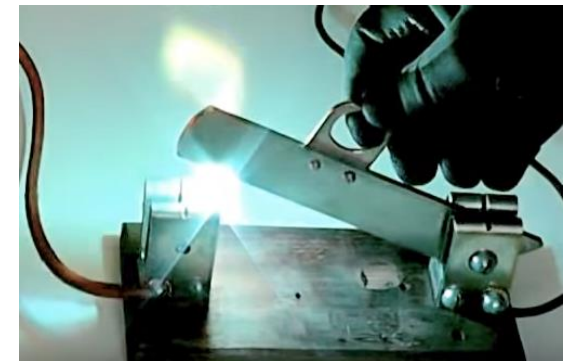
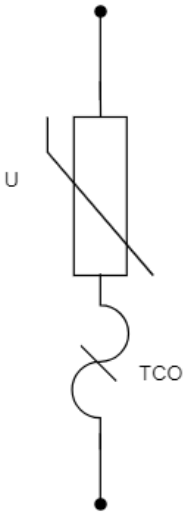
Issues With Standard MOV Solutions

- MOV degradation
- Ring-Wave requirements (UL 864)
- “Lost Neutral” test
- High capacitance (PLC)



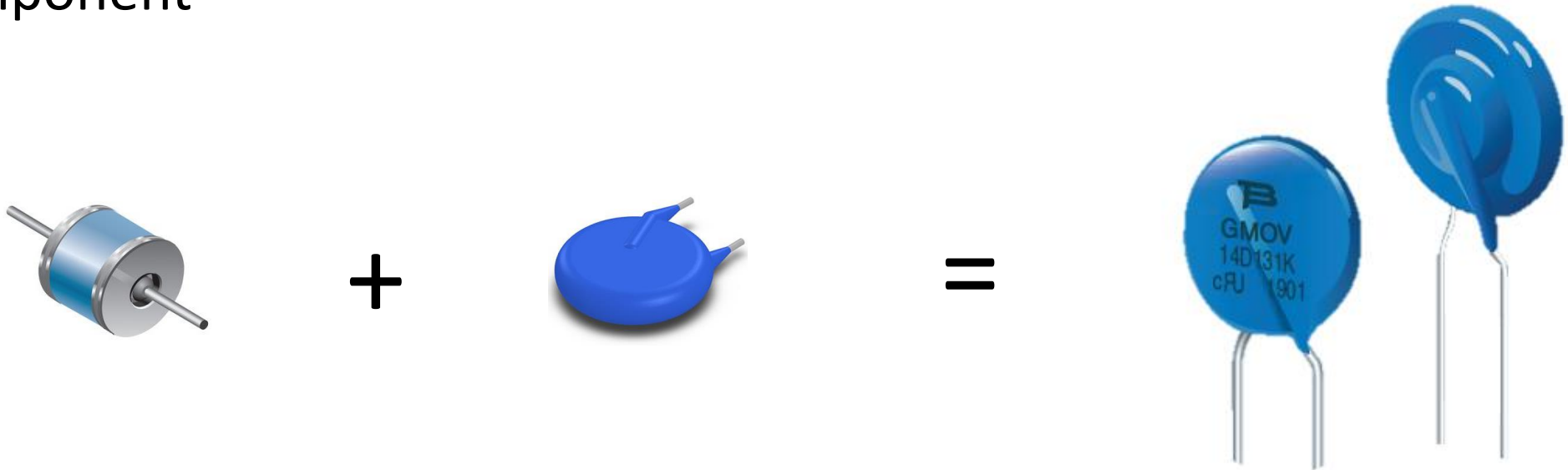
Current solution?

- **Thermally protected MOVs** were invented to solve the problem with the thermal runaway of the MOV.
- **Sounds like a good solution, why fix it?**
 - "Protected" equipment is left fully exposed after thermal fuse operates
 - Breaking DC Current
 - A good reference video:
<https://www.youtube.com/watch?v=Zez2r1RPpWY>

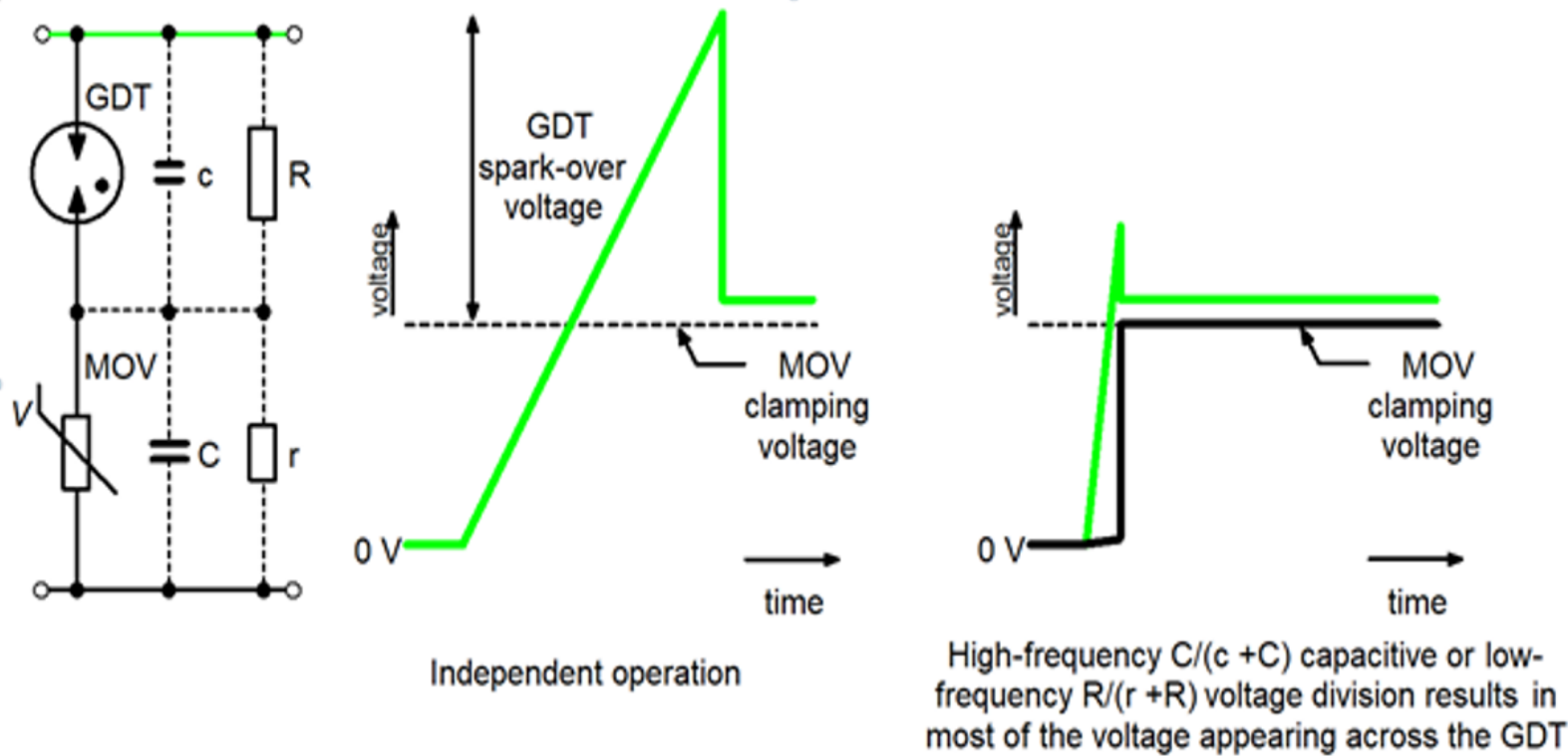


Is there another solution?

- Yes - a series combination of a GDT and an MOV into a single component

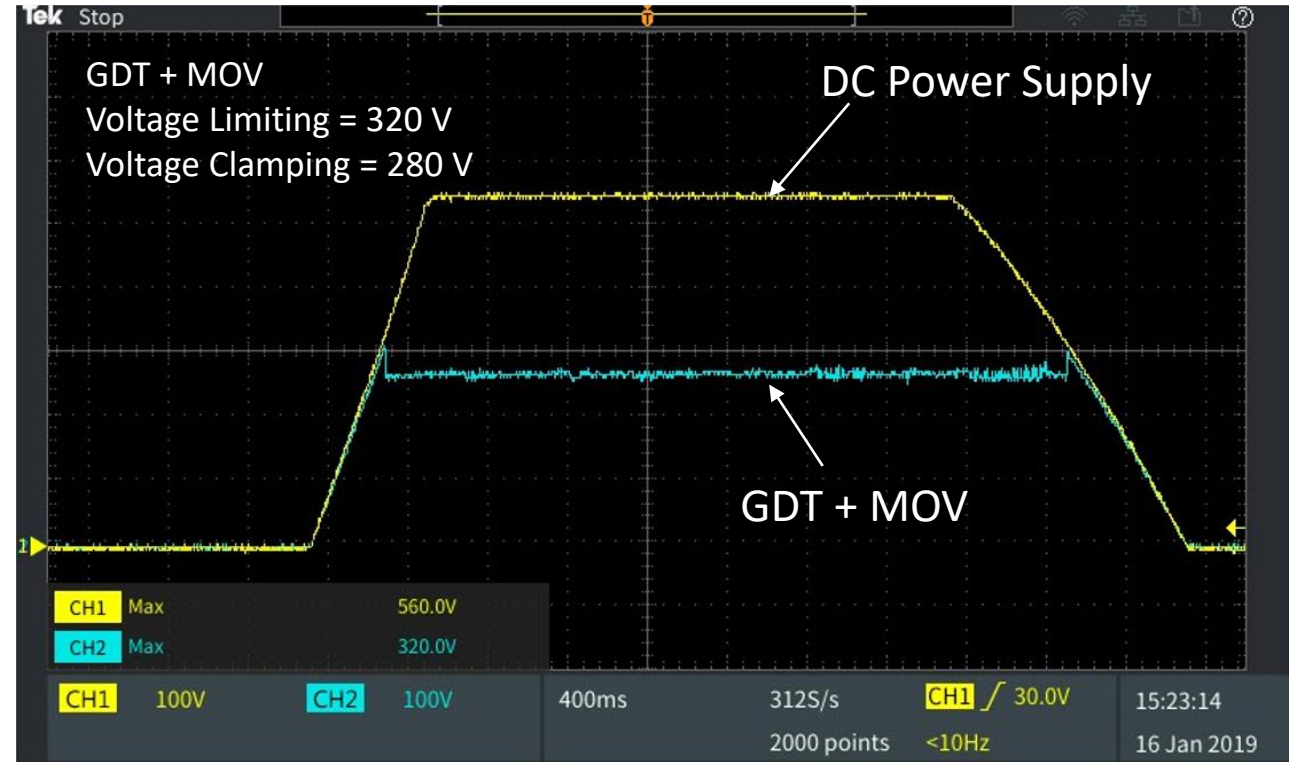
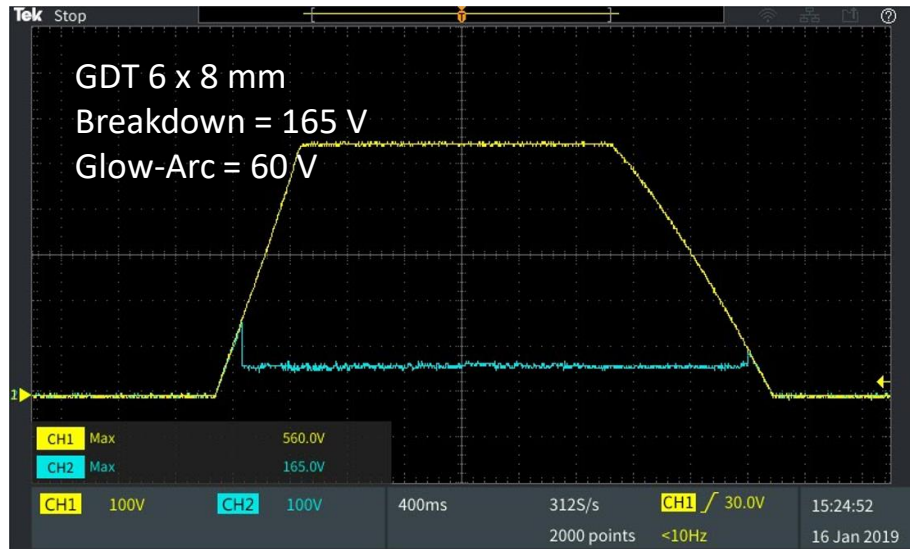


How does a GDT+MOV Protect?

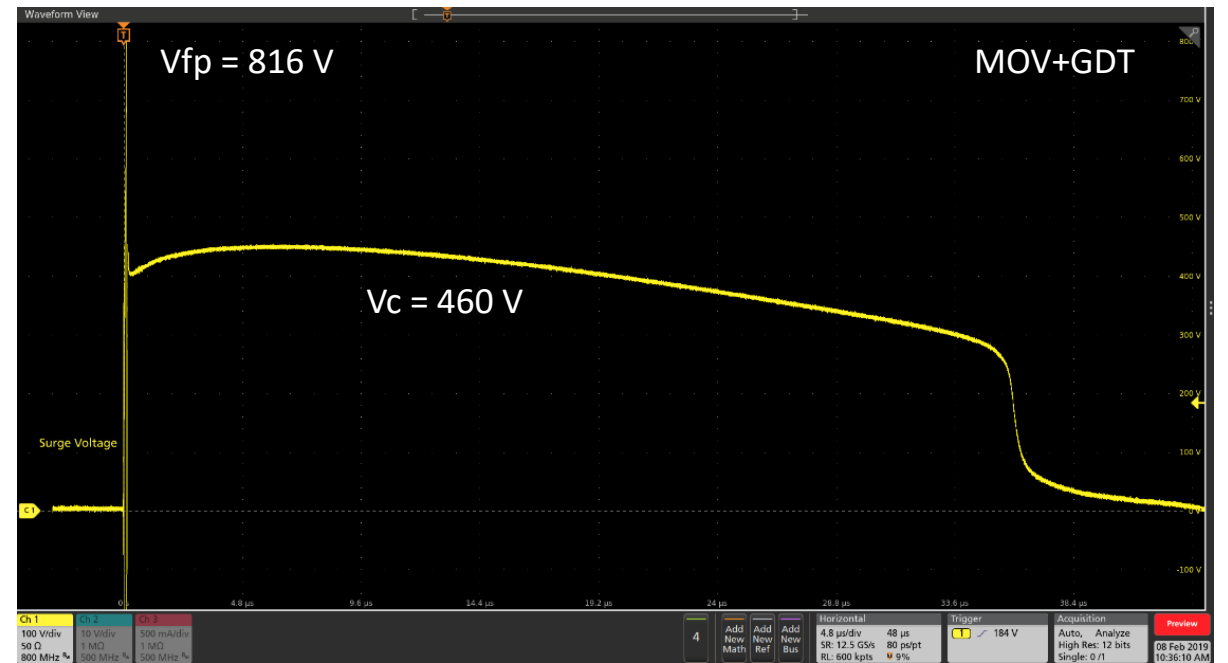
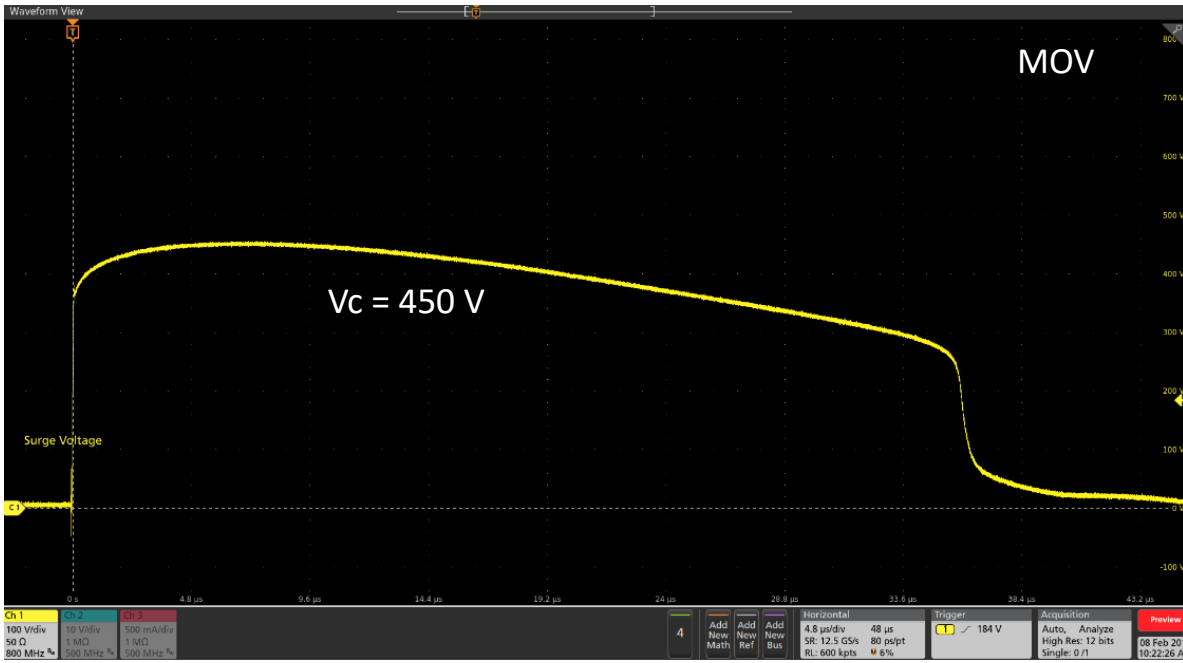


- At slow rates of voltage rise (<100 V/s) GDT has most of the voltage across it due to resistive division.
- At fast rates of voltage rise (>1 V/us) GDT has most of the voltage across it due to capacitive division.

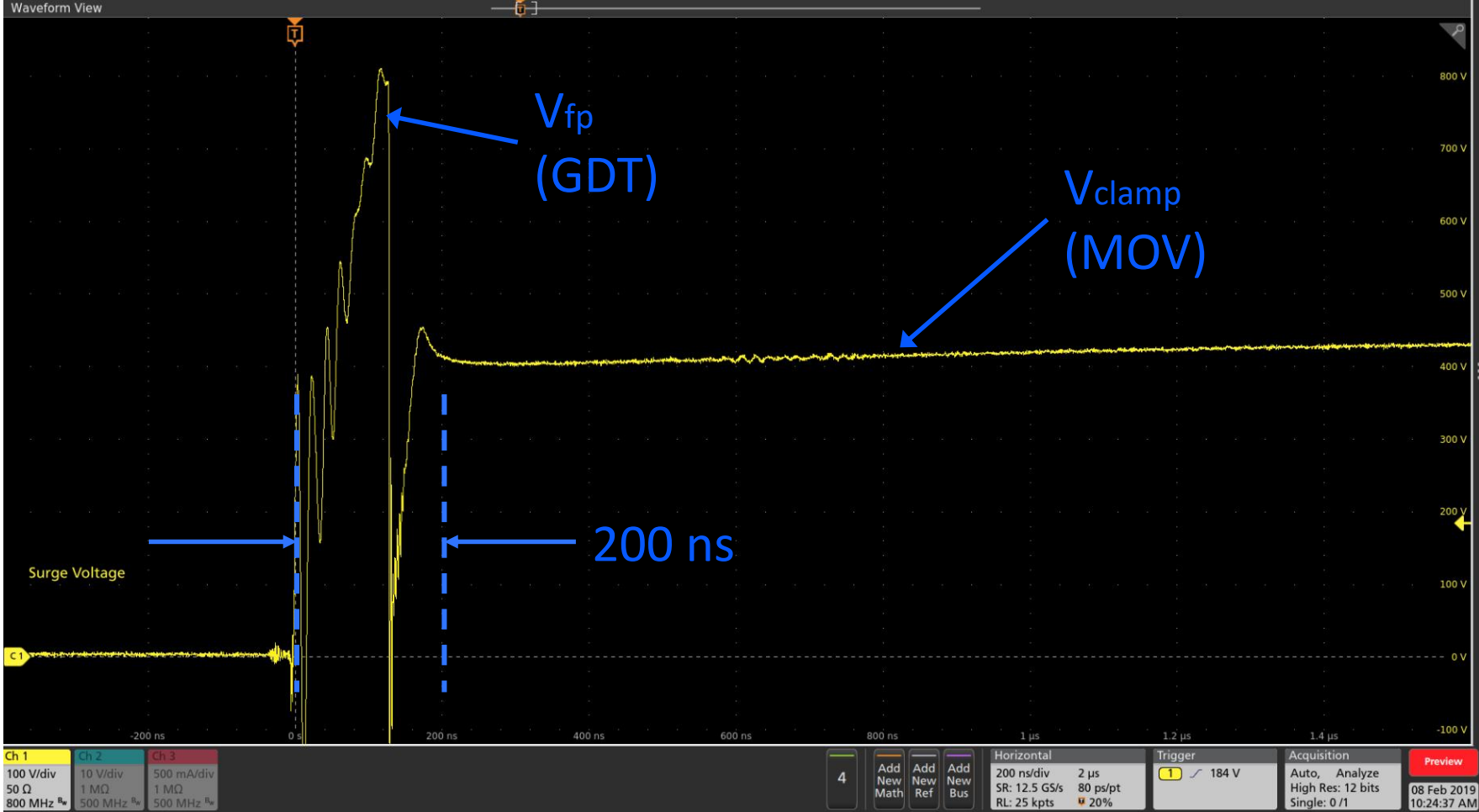
GDT + MOV Discrete Measurements



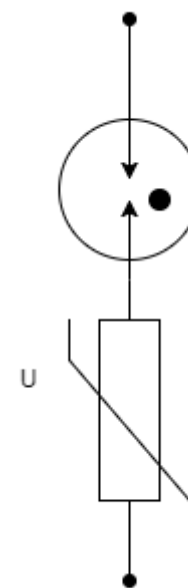
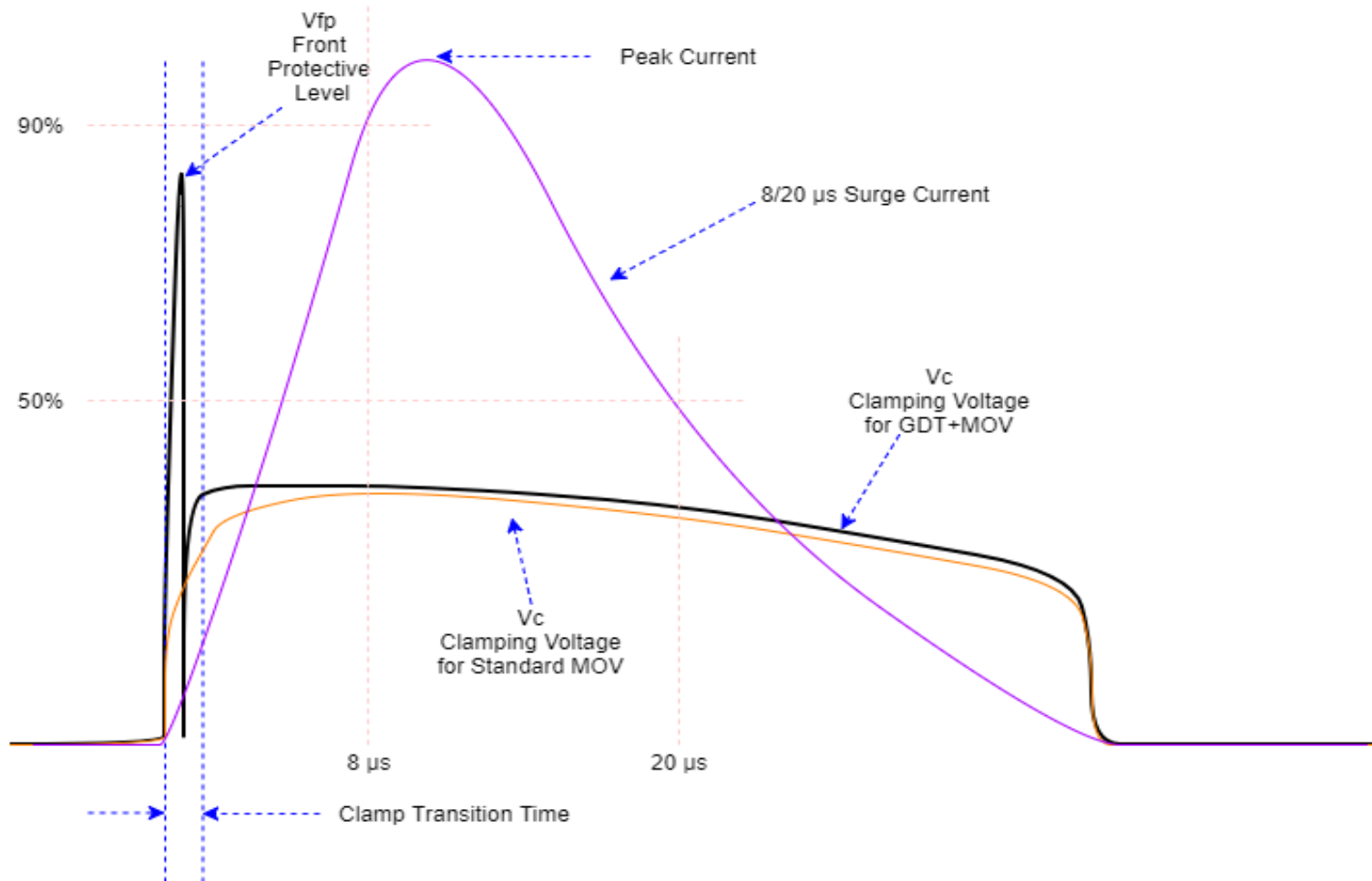
GDT + MOV Measurements under 8/20 μ s Combination Wave Generator @ 1.5 kA



GDT+MOV Front Protection Voltage Waveform



Put It All Together



Technology Comparison

Technology	Clamp Voltage	Leakage Current	Aging	UL1449 Lost Neutral
Standard MOV	340	High	Short Life	No
Thermally Protected MOV	340	High	Short Life	Yes
High voltage MOV	710	Medium	Medium Life	Yes
GDT+MOV	~360	Low	Long Life	Yes



What are the advantages?

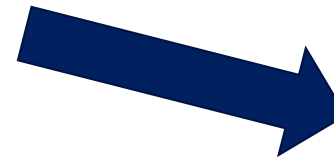
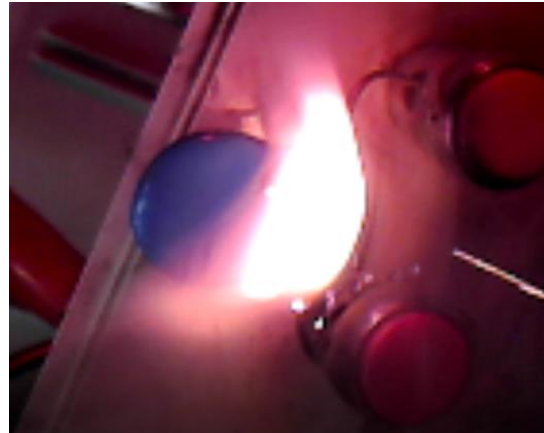
- Very low capacitance
- Very high insulation resistance
- Virtually no leakage current, which extends the life of the product
- Failure Mode: The MOV will fail short, but the GDT will still continue to provide protection

MOV: Forced Failure Mode (14mm)

Applied 3.3 kA Combination Wave and switch in MCOV within 1 second

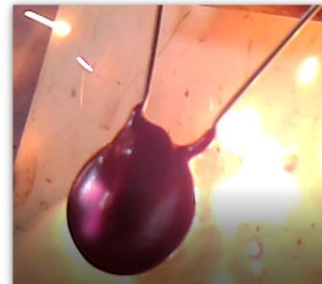


5 Surges



10 A Fuse Blown

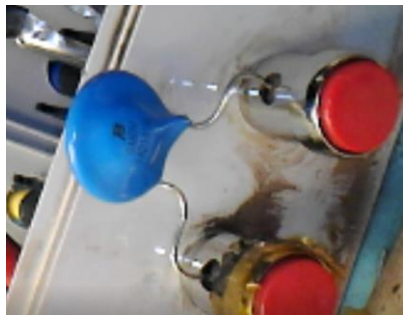
Example of other compromised MOVs



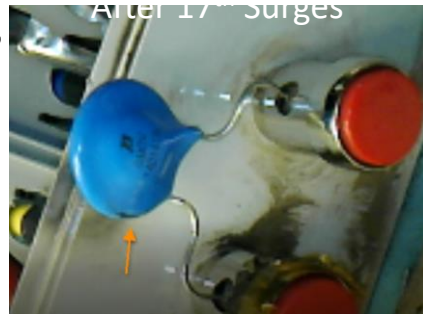
MCOV = Maximum Continuous Operating Voltage

GDT+MOV: Forced Failure Mode (14mm)

Applied 3.3 kA Combination Wave and switch in MCOV within 1 second



17 Surges



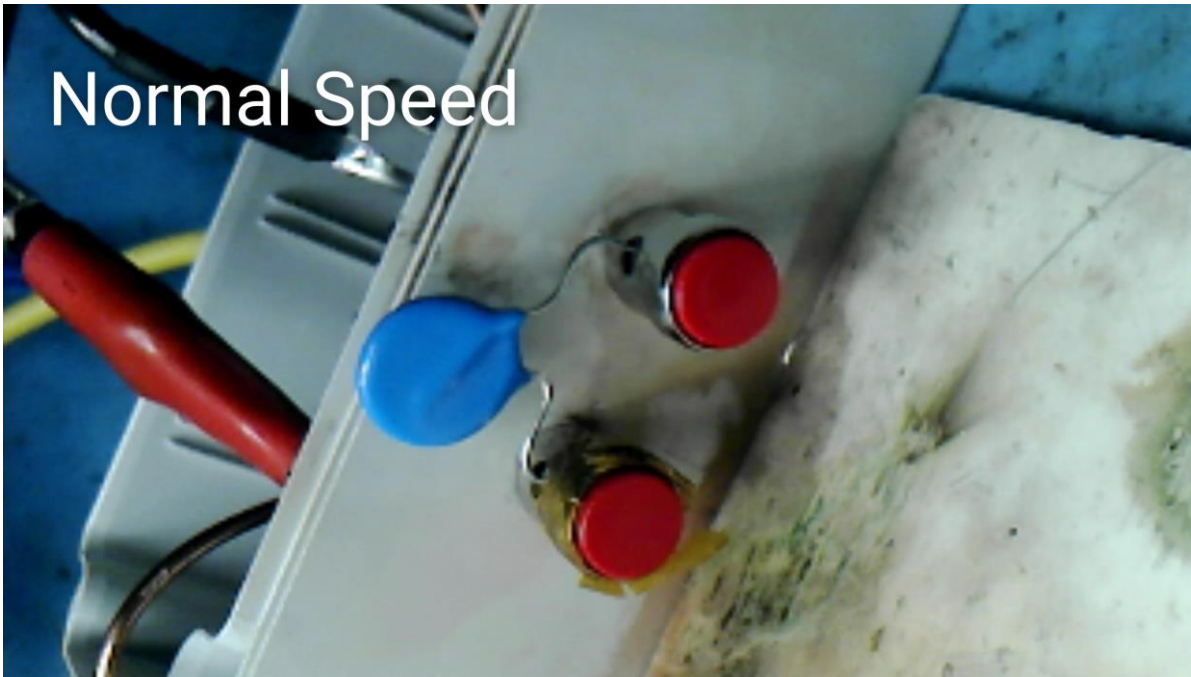
Example of another Scenario where MOV rupture





End of Life Videos

Normal Speed





Summary

Why is this better?

- The GDT prevents leakage through the MOV
- The MOV prevents follow-on current through the GDT
- The GDT allows the pair to operate at higher temperatures
- GDT+MOV Component will pass the Ring Wave requirement.
- The series combination results in a very low capacitance
- Virtually no leakage current, which extends the life of the product
- Failure Mode: The MOV will fail short, but the GDT will still continuing to provide protection
- Space-saving package fits into conventional MOV radial package profile.



Thank You