DESIGN NOTE

Solve DC Breakdown Issue with Bourns® Next-Generation GDT Design

INTRODUCTION

Gas Discharge Tubes (GDTs) are common overvoltage protection devices frequently used in a variety of exposed or sensitive telecommunication and industrial equipment. Because GDTs contain inert gas that ionizes to conduct during a transient or fault event, they offer the capability to divert the current to ground, thereby protecting the load from damaging voltage.

GDTs are constructed using multiple electrodes (most commonly two or three) separated by ceramic tube(s) to create a gap between the opposing electrodes. The ceramic tubes used in GDTs traditionally have been cylindrical in design, but are offered in other shapes as well including rectangular or square and even flat discs. The two most common inert gasses used in GDTs are argon and neon. With argon, the minimum DC Breakdown (DCBD) voltage that can be stabilized is typically around 230 V.

To achieve lower DCBD, neon gas can be used, which can enable DCBD ratings as low as 70 V. Argon tubes typically ionize and react to a transient threat in microseconds, while neon tubes are commonly slower to react. Therefore, a higher voltage gas tube is many times specified due to its lower breakdown voltage during a transient event.

Argon and neon are often used independently in GDTs, but the unique properties of each gas naturally beg the question: "What if you mixed the two gasses together?" Mixing argon and neon is not as straight-forward as it might sound as the gas mixed inside the furnace may not float evenly and the ratio may, therefore, be difficult to control. The most common voltage rating for mixed argon-neon GDTs is 150 V.

Achieving a lower rating for most GDT manufacturers can be challenging and lead to unacceptable production yields. For these reasons, some GDT manufacturers only offer 90 V (pure neon) and 150 V (mixed), but nothing in-between. The histogram plot of several Bourns® GDT35 models in Figure 2 shows that the mixture of gas produces an equivalent or faster impulse breakdown compared to the standalone neon gas. GDTs with voltages of 230 V and above are all pure argon gas.

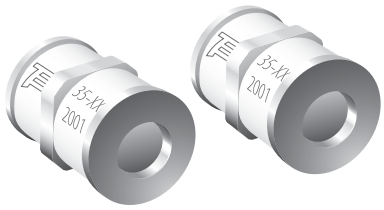

Figure 1 | Bourns® Next-Generation Model GDT35 Series

With the introduction of the Bourns® Model GDT35 Series, the Company's engineers have developed and implemented a proprietary method for achieving optimum mixed-gas ratios with strict controls. As a result, the Bourns® Model GDT35-11 (110 V) provides designers a fast conduction time and even lower impulse voltage than either its 90 V neon-only GDT model or its 150 V mixed argon-neon GDT model. The histogram in Figure 3 plots the impulse voltage of the Bourns® Model GDT35-11 (110 V) compared to Models GDT35-09 (90 V) and GDT35-15 (150 V).

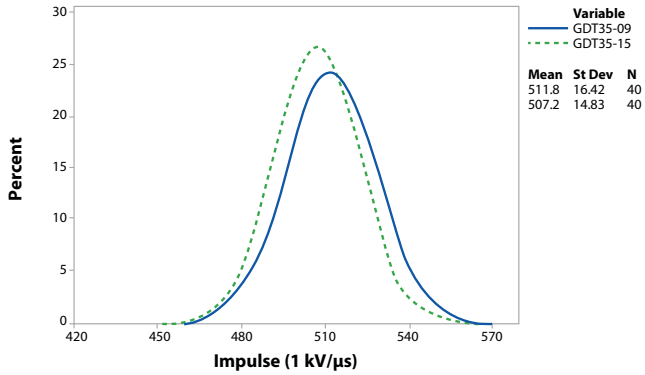

Figure 2 | Histogram of Models GDT35-09 and GDT35-15

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Figure 3 clearly demonstrates that the Model GDT35-11 achieves a notably faster impulse voltage compared to the 90 V Model GDT35-09 and the 150 V Model GDT35-15. The Model GDT35-11 is an optimal solution for designs that require fast impulse voltage protection.

The advanced features designed into the Bourns® Model GDT35-11 also provide performance improvements compared to the highly-popular Bourns® Model GDT 2036-15 (150 V). The table below summarizes some key performance metrics of the two models.

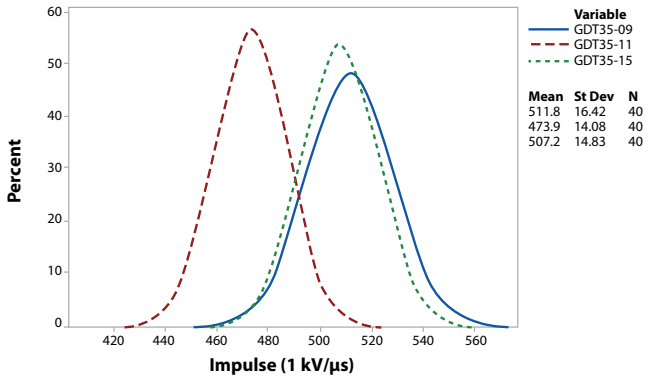

Figure 3 | Histogram of Models GDT35-09, GDT35-11 and GDT35-15

Characteristics	Bourns® Model GDT35-11	Bourns® Model 2036-15
DC Sparkover	110 V	150 V
Surge Rating (8/20 µs) I_{max}	10 kA (each side), 20 kA total	10 kA (each side), 20 kA total
Surge Rating (8/20 µs) 10 ops.	7 kA (each side), 14 kA total	5 kA (each side), 10 kA total
Capacitance	< 0.7 pF (L-G)	< 2 pF (L-G)
Insulation Resistance (50 V)	2 GΩ	1 GΩ
Coplanarity Resolved	Yes	No

The new Model GDT35 from Bourns offers designers enhanced performance in an industry-standard, space-saving 5 mm diameter package.

For more information on the Model GDT35 Series, please refer to a white paper that explains how Bourns' GDT35 design also helps resolve long-standing coplanarity issues experienced with 3-element GDTs.

ADDITIONAL RESOURCES

Readers may also be interested in the following resources from Bourns:

- Data Sheet: Model GDT35 Series
- White Paper: Advancing GDT Technology to Meet Higher Surge and Multi-Level Protection Requirements
- Design Note: Model GDT35 vs. Model 2036 Histogram Comparison
- Design Note: Next Generation GDT Design Resolves Coplanarity Issues
- Design Kit: DK-GDT35-01

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