Bourns® FLAT® Technology Gas Discharge Tube (GDT) Surge Arrestors

WHITE PAPER

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2017-xx-A
No Leads

INTRODUCTION

The demands of electronic equipment designs continually require high density and fast speed in small packages. These compact designs can increase the susceptibility to damage from transients such as lightning and other high voltage surges. This trend presents a challenge to circuit protection manufacturers who now must create smaller and more robust circuit protection devices in support of shrinking and sensitive electronics equipment.

2015-xx-SMH
2017-xx-SMH
Horizontal Mount

2015-xx-SMC
2017-xx-SMC
Vertical Mount

CONVENTIONAL GAS DISCHARGE TUBE TECHNOLOGY

Figure 1. | *2-Electrode GDT*

Gas Discharge Tube (GDT) devices have gained popularity as overvoltage protection devices due to their extremely low capacitance and low leakage characteristics, along with their high surge current handling capabilities. These characteristics make GDT devices ideal for use in a wide array of telecommunications, industrial and medical equipment designs requiring robust overvoltage protection.

Figure 2. | *3-Electrode GDT*

A GDT device is an arrangement of electrodes and gas contained within a ceramic envelope.

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CONVENTIONAL GAS DISCHARGE TUBE TECHNOLOGY *(Continued)*

GDT devices are typically placed in a circuit to limit voltage and to divert surge current to ground (common mode) or to a source (differential mode). The GDT device has very high impedance (>1 Gohm), so it is virtually invisible to the circuit during normal operation. When a voltage disturbance exceeds the GDT's sparkover value, the GDT will switch into a virtual short circuit, known as arc mode, diverting the surge current and protecting the equipment.

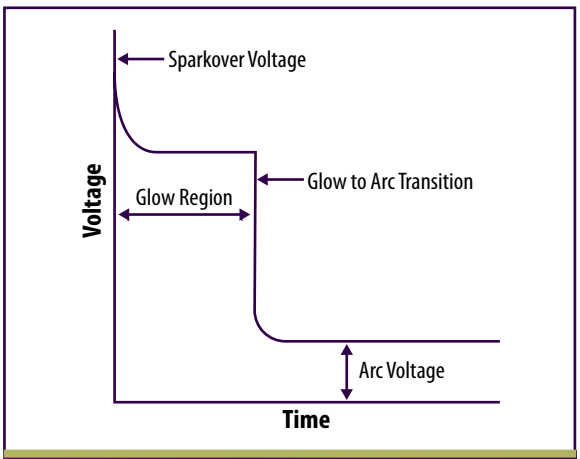

Figure 3. | *General Operation of a GDT*

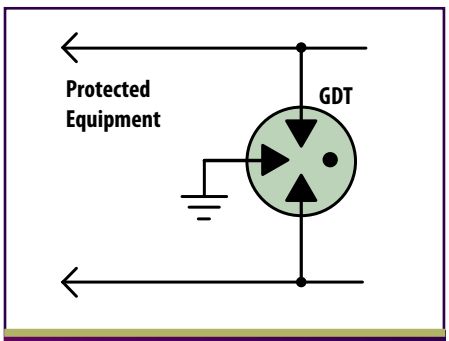

Figure 4. | *Common Mode*

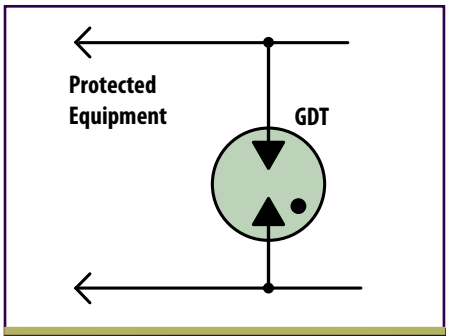

Figure 5. | *Differential Mode*

The size of a conventional GDT device is defined by its overall diameter and length. These dimensions are critical to the GDT device's ability to handle surge energy as well as its ability to maintain electrical isolation. Figure 6 details the cross section of a typical GDT design that is considered state-of-the-art conventional technology today. The red arrow depicts the insulating pathway distance for creepage current. This distance is critical in providing a high level of electrical isolation to the GDT design. The diameter of the GDT and its thermal mass provide much of the current handling capabilities for the GDT.

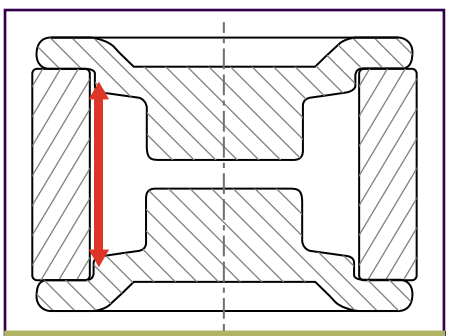

Figure 6. | *Cross Section of a Typical GDT*

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CONVENTIONAL GAS DISCHARGE TUBE TECHNOLOGY *(Continued)*

Table 1 below provides an overview of how size and surge current handling capabilities correlate.

	Size (diameter x length)	Typical 8/20 µs rating *	Maximum 8/20 µs rating *
	5 mm x 5 mm	3 kA	5 kA
	8 mm x 6 mm	10 kA	20 kA
	12 mm x 12 mm	40 kA	50 kA

Table 1. | *Overview of GDT Size and Current Handling Capabilities*

**As specified in ITU K.12 for 10 operations*

Although conventional GDT devices provide robust overvoltage protection, they do so at the cost of valuable printed circuit board space.

GDT DESIGNED WITH BOURNS® FLAT® TECHNOLOGY

Bourns has developed an innovative FLAT® GDT technology that effectively reduces the size of a GDT while maintaining its isolation and current handling capabilities. The cross section in figure 7 shows the insulating pathway in red.

The key design feature of Bourns® FLAT® GDT technology is the wrinkled creepage pathway that allows the GDT to be "squeezed" in the axial direction. When comparing the wrinkled pathway of a Bourns® FLAT® GDT to that of a similarly rated conventional GDT, the lengths would be similar. However, by squeezing the GDT into a Bourns® FLAT® technology configuration, the height, weight and overall volume is significantly reduced.

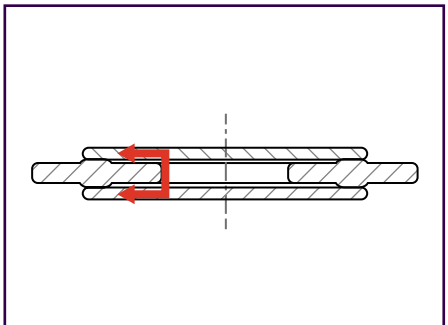

Figure 7. | *Cross Section of a FLAT® Technology GDT*

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THE FEATURES AND BENEFITS OF BOURNS® FLAT® GDT TECHNOLOGY

Bourns® FLAT® GDT technology provides the key features and benefits of conventional GDT technology in a volume and space saving design.

Features

- Compact, space saving design
- Robust surge current ratings
- Stable performance over life
- Low leakage and insertion loss
- Capacitance is constant regardless of voltage
- Low arc voltage
- Wide voltage range (90-600 V)
- Low oscillation design

Benefits

- Horizontal design provides a significant height savings versus Bourns' standard 5 mm GDTs
- Flexible mounting options including vertical and bottom side PCB
- Minimal impact on signal or system operation
- Voltage limiting performance suitable for sensitive equipment
- Long-term reliability and performance

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Bourns® Model	ITU K.12 Class	8/20 µs 10 operations	100 A 10/1000 µs	10 A 10/1000 µs	AC Life
2015 Series	II	5 kA	1 kA	>300 operations	5 A_{rms}, 1s, 10 operations
2017 Series	III	10 kA	2.5 kA	>1500 operations	10 A_{rms}, 1s, 10 operations

Table 2. | *Key Performance Characteristics of Bourns® FLAT® GDT Series*

Space Saving Advantage

When compared to a surface mount 8 mm Bourns® GDT, the horizontal mount Bourns® FLAT® 2017 GDT design is reduced in volume by an impressive 75 %, while maintaining the performance of the standard device.

Figure 8. | *Horizontal Mount FLAT® GDT Design*

Figure 9. | *Bourns' standard 8 mm GDT*

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THE FEATURES AND BENEFITS OF BOURNS® FLAT® GDT TECHNOLOGY

Horizontal Mount

For designs with space constraints that can be solved by mounting on the bottom side of the PCB, the horizontally mounted Bourns® FLAT® GDT is also an ideal solution. With a 1.6 mm maximum height, this low profile design has minimal impact to the bottom side of the printed circuit board and minimizes space constraints.

Figure 10. | *Example of Horizontally Mounted Bourns® FLAT® GDTs*

Vertical Mount

The vertically mounted Bourns® FLAT® GDT design provides the most impressive space-saving option. This option typically allows for approximately twice* the number of devices to be mounted in the same space as 8 mm surface mount Bourns® GDTs. This provides the ultimate solution for designers seeking to increase board density while providing robust overvoltage protection.

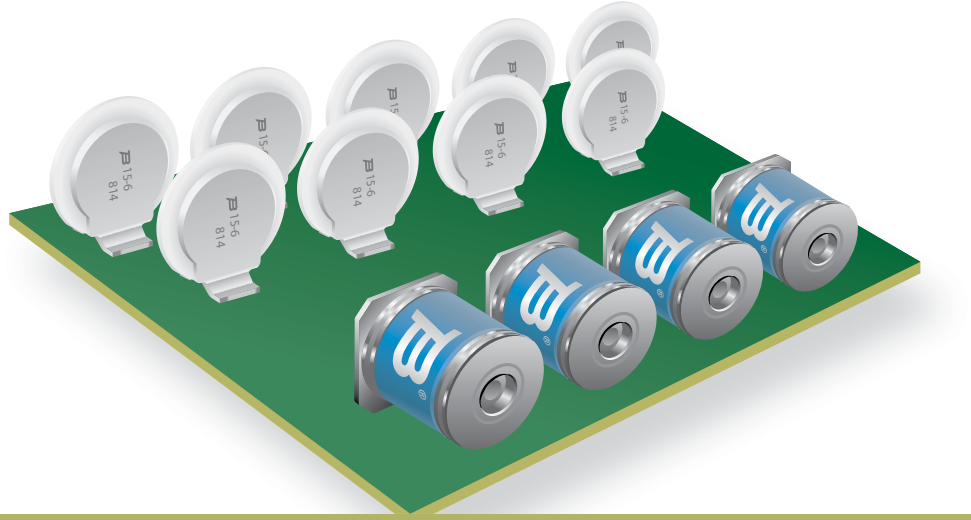

Figure 11. | *Spatial Comparison of Bourns® FLAT® and Standard GDTs*

** Depends on specific PCB design and trace routings*

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SUMMARY

Bourns addresses the need for smaller and more robust overvoltage protection with its new and innovative Bourns® FLAT® GDT technology. This solution reduces the size of comparable standard GDTs while maintaining the overvoltage protection performance. Flexible mounting options provide electronic designers with solutions that can help reduce the size of their equipment designs or increase the density of existing designs while still providing an enhanced level of protection.

ADDITIONAL RESOURCES

For more information about Bourns' complete line of circuit protection products, please visit:

www.bourns.com

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