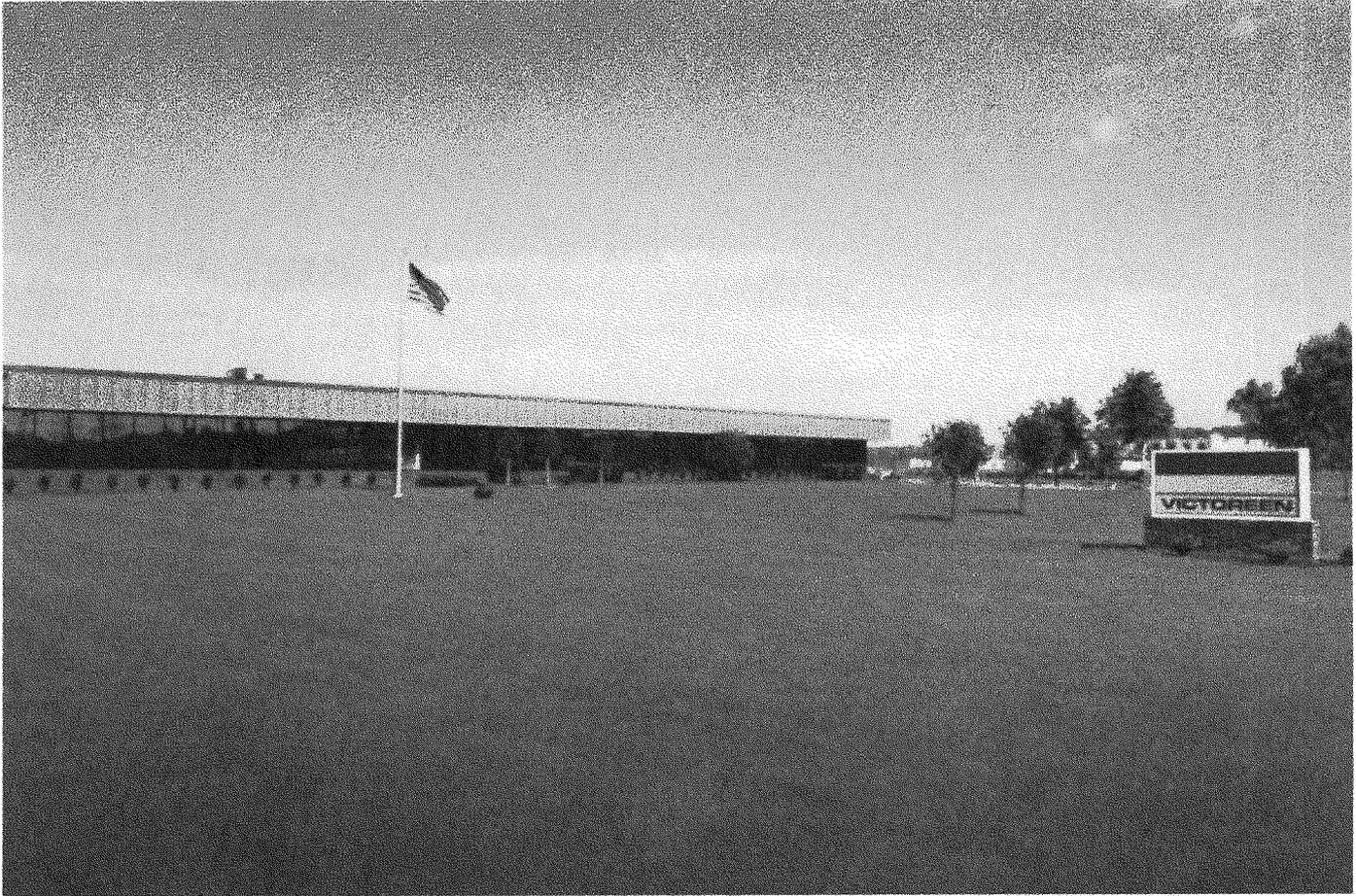


VICTOREEN TUBES CATALOG



A Major International Supplier



Victoreen, Inc. is a major international supplier of high value, high voltage resistors, custom resistor networks, high voltage regulating diodes, high voltage spark gaps, Geiger-Mueller tubes; microprocessor-based nuclear instrumentation; and radiation monitoring systems.

For over 60 years, Victoreen has provided the electronics marketplace with high quality, cost effective solutions to special application problems. Historically, Victoreen's niche was in high voltage electronics and high value resistive products. The addition of standard resistive products and custom precision resistive networks to the product line has augmented Victoreen's position within the electronics field.

All these products are marketed through a network of sales and service representatives in more than 60 nations around the world.

Victoreen's family of radiation detection instruments is designed expressly for use in medical, health physics, and non-destructive testing applications. Many of our medical instruments are specified for safety and quality assurance programs to help certify the accuracy of therapeutic radiological equipment.

We have also integrated advanced electronics into the design of sophisticated systems capable of sensing, monitoring, and precisely calculating the amount of radiation in the environment. Microprocessor based plant process and area radiation monitors collect and assimilate wide ranges of radiation levels in all parts of a nuclear power plant and other nuclear facilities. In addition, on-line, real time computer based data acquisition systems collect and consolidate data and display it in meaningful form on color-graphic cathode ray tubes. With these monitoring systems, plant operators can quickly ascertain radiation levels to ensure safe operations.

The Nuclear Associates Division of Victoreen markets a wide range of high technology equipment and accessories for the nuclear, medical, and health physics industry.

This catalog outlines the capabilities of Victoreen tube products. For more information on these, or help with other Victoreen products, please contact us.

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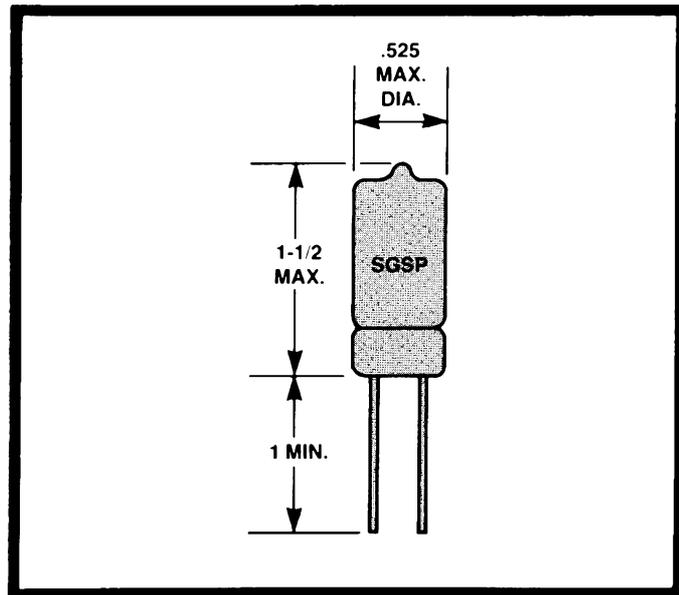
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SPARK GAPS

GLASS BOTTLE SPARK GAPS

- Rugged glass construction capable of handling up to ten times the energy of "button" gaps
- Firing voltage range 150 to 5,000 volts
- Ideal for ignition and over-voltage protection
- PC board or socket mountable



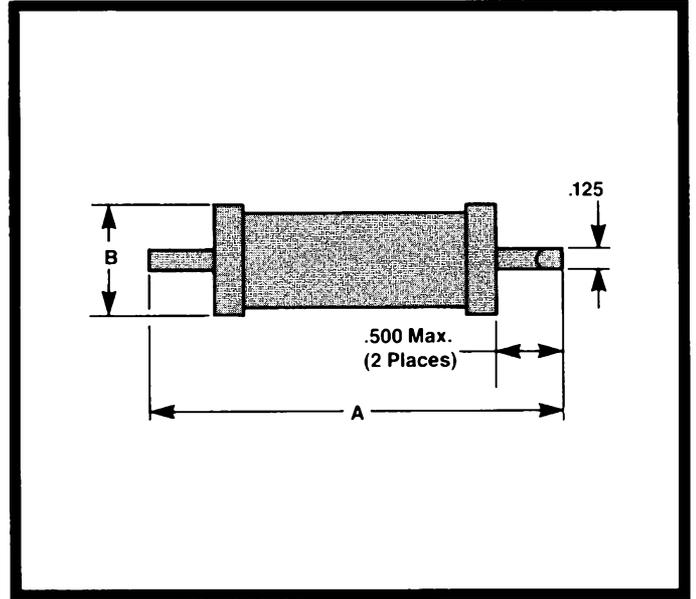
TYPICAL DATA FOR COMMON TYPES OF SPARK GAPS

| Type | Nominal DC Firing Volt. ± 10% | Firing Voltage at | | Energy Dissipation Capability* |
|------------------|----------------------------------|-------------------|------------------|--------------------------------|
| | | 1V/ μs Rise | 100V/ μs Rise | |
| SGSP 1000 | 1,000 | 1,200 | 2,000 | 65 Joules |
| SGSP 2500 | 2,500 | 3,100 | 4,200 | 65 Joules |
| SGSP 5000 | 5,000 | 7,000 | 8,500 | 65 Joules |

*This is the maximum energy for a single pulse situation. Contact Victoreen's Application Engineering Department for pulse life information for lower energy/pulse applications.

CERAMIC SPARK GAPS

- Energy discharge capability up to 70% better than similar glass spark gaps
- Firing voltage from 1 KV to 35 KV
- Ideal for ignition or over-voltage protection



TYPICAL DATA FOR COMMON TYPES OF SPARK GAPS

| Type | D.C. Firing ¹ Voltage Range | Tol. | Max. Energy/ ² Pulse | Dimensions (Inches) | |
|------|--|-------|------------------------------------|---------------------|-----------|
| | | | | A | B |
| SGCA | 1,000 - 12,000 | ± 10% | 100 Joules | 1.930 Ref. | .562 Ref. |
| SGCB | 12,000 - 20,000 | ± 10% | 100 Joules | 2.180 Ref. | .562 Ref. |
| SGCC | 20,000 - 35,000 | ± 10% | 100 Joules | 2.680 Ref. | .562 Ref. |

NOTES:

- 1) D.C. is defined as a ramp rate of less than 5 volts/microsecond. A typical firing time of 1 microsecond or less could result in some overshoot, depending on the ramp rate of the pulse.
- 2) This is the maximum energy for a single pulse situation. Contact Victoreen's Application Engineering Department for pulse life information for lower energy/pulse applications.

COROTRON TUBES

Application Notes

A High Voltage Equivalent of the Zener Diode

The Victoreen HV Regulator is a high-voltage, low-current device operating in the corona mode of discharge. The same techniques employed in the application of zeners to the design of low-voltage power supplies can be used with the Victoreen HV Regulator to design high-voltage supplies.

Transistors and Zeners can be used to design some very excellent low voltage power supplies, but their virtues diminish when the designer attempts to use them at high voltages.

The Victoreen HV Regulator provides the high voltage equivalent of the Zener diode. It is a miniature or micro-miniature gas tube operating in the corona mode of discharge. Its characteristics more nearly resemble those of the Zener than they do those of the well-known glow discharge tubes.

It may readily be seen that the Victoreen HV Regulator is a high-voltage, low-current device; while the Zener is a high-current, low-voltage component.

The slope of the regulation curve for both the Victoreen HV Regulator and the Zener is positive, so each may be considered as a d.c. voltage in series with a resistor. In the case of the Zener, the d.c. voltage is the voltage at the Zener knee, while for the Victoreen HV Regulator, it is the voltage at which gaseous conduction begins. In both cases, the value of the series resistor is the value of the dynamic resistance of the device ($\Delta E/\Delta I$).

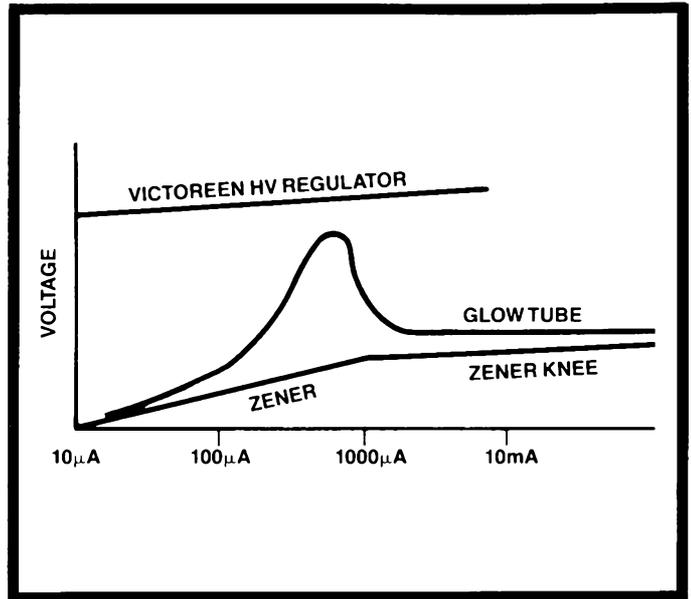
AVAILABLE VOLTAGE

Zeners are available in any voltage from a few volts to 50 or more, although the best characteristics are exhibited by those in the range of 6 volts to 12 volts where good temperature compensation is possible. Victoreen HV Regulators are available in any desired nominal voltage from 350 volts to 30,000 volts. Like Zeners, the Victoreen HV Regulators may be used in series stacks to increase the total voltage.

Temperature: The Victoreen HV Regulator is less susceptible to temperature variations than its solid state counterpart, being operable from -65°C to $+125^{\circ}\text{C}$ with some models being capable of operation to 200°C .

CURRENT RANGE

Originally Zeners were designed in fairly low power units but more recently, much greater current capabilities are available. However, since the Zener is useful as either a regulator or a reference only at currents above the Zener knee, the minimum current is determined by the location of the knee. This knee generally occurs above 1 ma. Popular low power Zeners have a test point of 10 ma. This is usually selected as the point at which temperature compensation can best be affected. If Zeners are stacked for higher vol-



tage operation this 10 ma current results in considerable power being dissipated in the reference circuit. Many types of Victoreen HV Regulators operate at currents as low as 5 ua, making them economical as a high voltage reference, but restricting their usefulness to low power applications when employed as a shunt regulator. The "minimum current" listing for a Zener diode indicates the value of the current at the Zener knee and the device is useless below this region. The "minimum current" of the Victoreen HV Regulators is the value of current below which noise may be generated. It may however, be used at currents below this minimum listing if adequate by-passing is employed to filter the noise.

MINIMUM CURRENT

It is important to use low currents in reference circuits because the error signal is developed across a resistor in series with the reference element. The value of the minimum current required for the reference element determines the maximum resistance value of this series resistor. The anticipated percentage swing in error voltage will then determine the required percentage swing in reference current.

There is a maximum current rating for both the Victoreen HV Regulator and the Zener. This is usually established by the limit of the tolerable dissipation value. Exceeding the maximum current rating for a Zener, even as a result of transients or other short duration phenomena, may permanently damage the Zener, but there is an additional rating for the Victoreen HV Regulator known as "Peak Current."

Transients and other low duty cycle phenomena may safely cause currents to approach this value and even exceeding this value generally produces no permanent damage to the Victoreen HV Regulator.

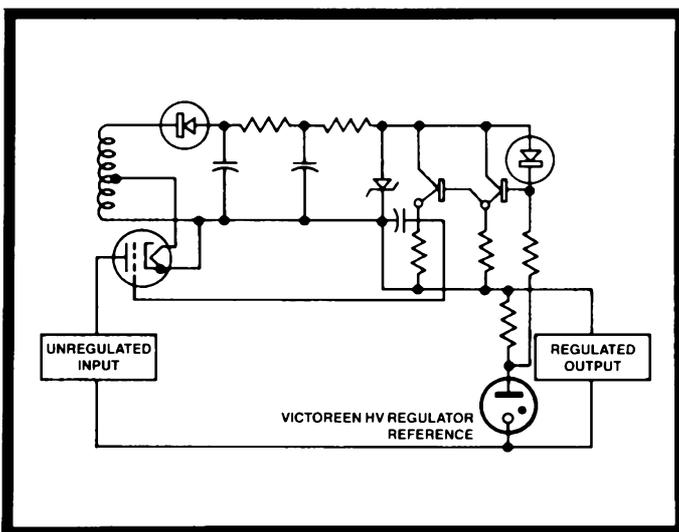
Use of Shunt Capacity: Like the Zener and unlike the glow tube, shunt capacity may be used across the Victoreen HV Regulator to reduce the a.c. impedance of the circuit without encountering relaxation oscillation. Negative resistance, a prerequisite of relaxation oscillation, is completely absent in the Victoreen HV Regulator.

Radiation Damage: Unlike solid state devices, the Victoreen HV Regulator is not damaged by alpha, beta, gamma or neutron radiation. They have been tested in flux values as high as 7×10^{14} neutrons per square centimeter per second with no permanent damage.

APPLICATIONS OF THE VICTOREEN HV REGULATOR: These circuits illustrate a few of the many applications for which the Victoreen HV Regulator is suited.

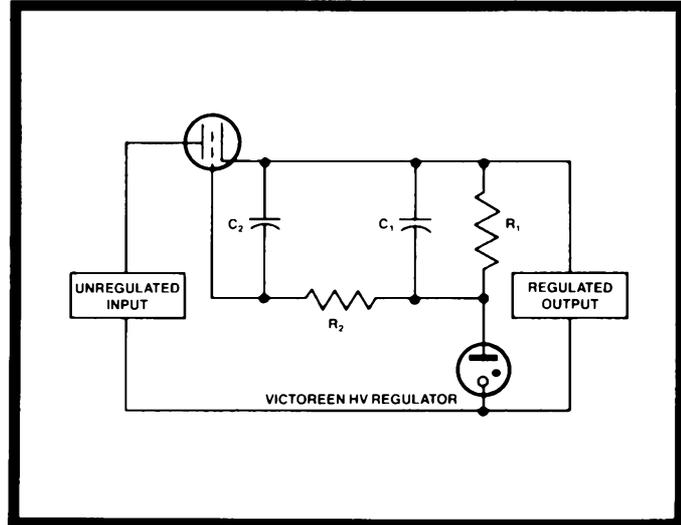
SIMPLE SHUNT REGULATORS: Best stabilization is accomplished by using a high value for the series resistor. This is adequate for power supplies for photo-multiplier tubes or CRT's – particularly where beam intensity is not modulated.

THE CASCADED SHUNT REGULATOR provides a "stiff" power supply since the first Victoreen HV Regulator stabilizes the variable input voltage, while the second regulates against variation due to variable output load currents.



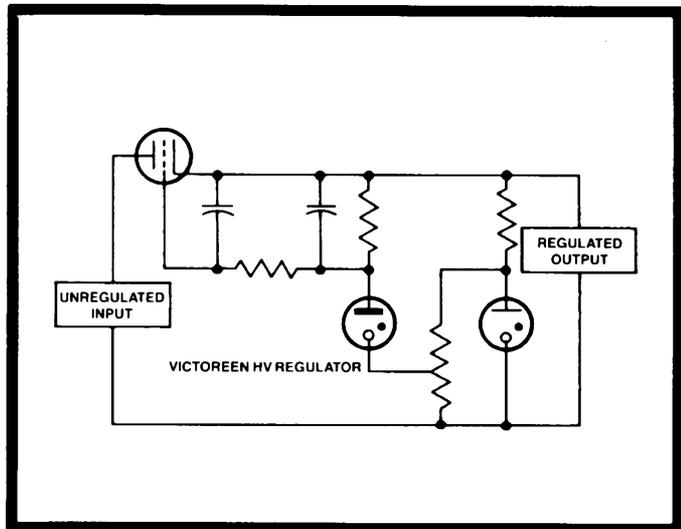
FOR UNUSUALLY EXACTING REQUIREMENTS:

If the basic series regulator circuit previously described does not supply sufficient regulation, it may be enhanced by the addition of a transistorized d.c. amplifier which uses the error voltage as its input and whose output becomes the grid voltage to control the pass tube.



AS A REFERENCE TO A SERIES PASS TUBE:

Fundamentally a cathode follower, this circuit is used where requirements are too stringent for a simple shunt regulator. Reference current should be as low as possible, limited by the maximum resistance R_1 , that the grid circuit of the pass tube can tolerate. Pi network filters out any noise generated by the Victoreen HV Regulator in this region and enhances the regulation.



AS A POWER SUPPLY FOR TWT'S OR BWO'S:

When the voltage must be adjustable over a small range to meet the precise needs of a TWT or BWO this configuration may be used. The reference tube is connected to the center arm of a pot across a well-regulated portion of the output voltage divider. Output voltage now becomes the reference voltage, plus the bias voltage, plus the error signal.

Specifications, Ratings and Definitions

When the Victoreen HV Regulator is connected in a circuit as illustrated in Fig. 1 with the supply voltage being variable from a low value to a high value, and the current through the circuit is monitored while the voltage drop across the Victoreen HV Regulator is measured, and the volt-ampere relations is plotted for various volts and amperes that occur as the supply voltage is raised, we find a plot, similar to that illustrated in Fig. 2.

It will be noted that no current flows until the breakdown voltage for the Victoreen HV Regulator has been attained. Further increase in the supply voltage causes only a slight rise in corona voltage with a large rise in circuit current, and the difference between the supply voltage and the Victoreen HV Regulator voltage then appears across the series resistor.

From this information, it may be seen that the equivalent circuit for a Victoreen HV Regulator is that of Fig. 3. It consists of a dc voltage equal to the breakdown voltage of the Victoreen HV Regulator in series with a resistor whose value is equal to the slope of the regulation curve $\Delta E/\Delta I$.

VOLTAGE REGULATION

This is generally considered to be the ability of the circuit to maintain a constant voltage output when load current varies, assuming a constant input voltage. The voltage regulation of any Victoreen HV Regulator circuit is inversely proportional to the dynamic resistance of the Victoreen HV Regulator $\Delta E/\Delta I$.

VOLTAGE STABILIZATION

This is generally considered to be the ability of the circuit to maintain a constant output voltage when the load current is constant and the input voltage is varied.

It can be seen that the designer has little control over the voltage regulation once he has selected the Victoreen HV Regulator he is going to use since that determines the dynamic resistance of the supply. However, he has full control over voltage stabilization. It can be seen that the voltage stabilization is the result of the ratio of the series resistor to the dynamic resistance of the Victoreen HV Regulator, and therefore, maximum stabilization occurs when the largest practical series resistance is employed.

The terms discovered on the individual data sheets are explained as follows:

TUBE NOMENCLATURE

Tube nomenclature is intended to be descriptive of the tube. "GV" stands for glass voltage regulator, while "M" refers to a metal regulator. The next number, such as 3, 5, etc. indicate the diameter of the Victoreen HV Regulator and is taken from the T nomenclature, commonly used in glass manufacturing and vacuum tube nomenclature. The T number stands for the number of 1/8" in diameter. Thus a

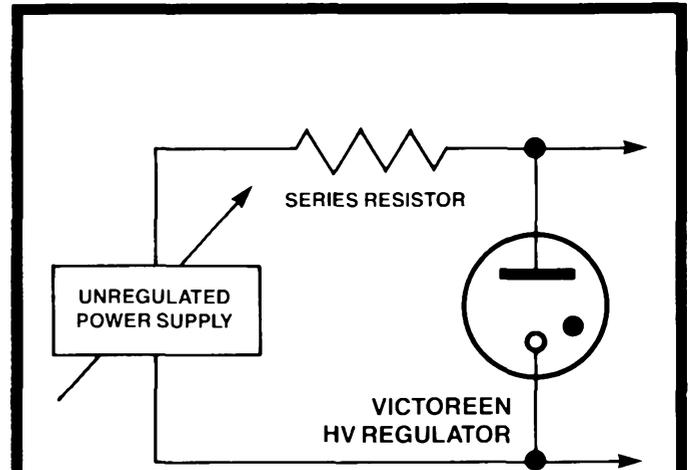


Fig. 1

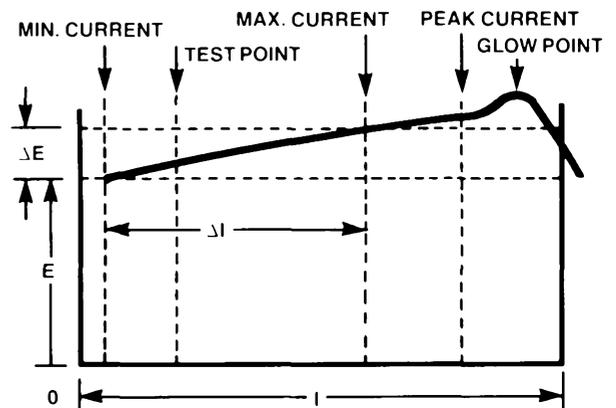


Fig. 2

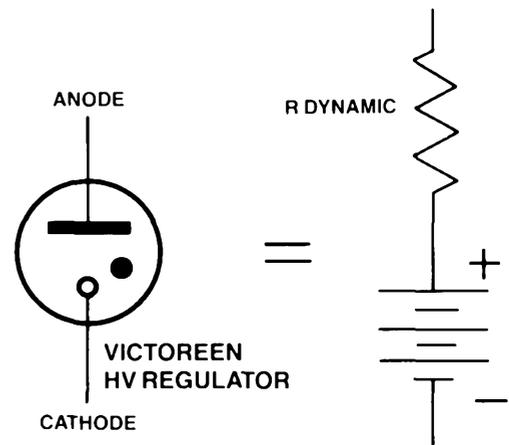


Fig. 3

T3 tube has a diameter of 3/8". The following number is the nominal operating voltage.

NOMINAL OPERATING VOLTAGE

Since the tube has a positive slope to its regulation characteristics, the nominal voltage must be measured at some predetermined test point. This test point is selected as an appropriate quiescent condition for typical circuits in which this particular tube type has been employed.

TOLERANCE

This is the value by which the voltage for the specific tube type may vary from its nominal value at the test point.

MINIMUM CURRENT

This is that value of current below which noise may be encountered unless the Victoreen HV Regulator is bypassed by a small value of capacitance and above which quiet operation may be expected.

MAXIMUM CURRENT

This is the highest value of current at which the tube may safely be operated in a steady state condition without affecting the life of the tube.

PEAK CURRENT

Peak current is that value of current to which transients or other low duty cycle phenomena may cause current excursions without introducing malfunctions.

GLOW POINT

Glow point is that value of current at which the mode of discharge shifts from the corona mode to the glow mode. This value of current should never be permitted to occur since it will cause the output voltage of the power supply to drop to an excessively low value and cause currents through the tube to reach dangerous magnitudes. It can be seen that since the slope of the regulation curve of the Victoreen HV Regulator is positive, there is no danger from relaxation oscillation provided that the glow point is never exceeded even for a fraction of a microsecond.

REGULATION

Regulation is assumed to be the change in operating voltage as the current through the tube is increased from its minimum value to its maximum value. Since this total excursion is rarely, if ever encountered in a well designed circuit, the output voltage of the supply will always be held to a lower value than that listed in the column headed "REGULATION". Since the regulation curve is linear, one may readily compute the change in voltage to be anticipated for any fractional value of the previously mentioned current excursion.

DYNAMIC RESISTANCE

Dynamic Resistance is another way of expressing the slope of the regulation curve. $R_{\text{dynamics}} = \Delta E / \Delta I$.

TEMPERATURE DEPENDENCE

Temperature dependence indicates the change in operating voltage to be anticipated when a change in ambient temperature is encountered. From the individual regulation curves shown for the individual tube types one can see that this temperature dependence is minimal at low currents and becomes greater at higher currents. It is, therefore, recommended that all circuits be designed to provide the lowest practical value of regulating currents.

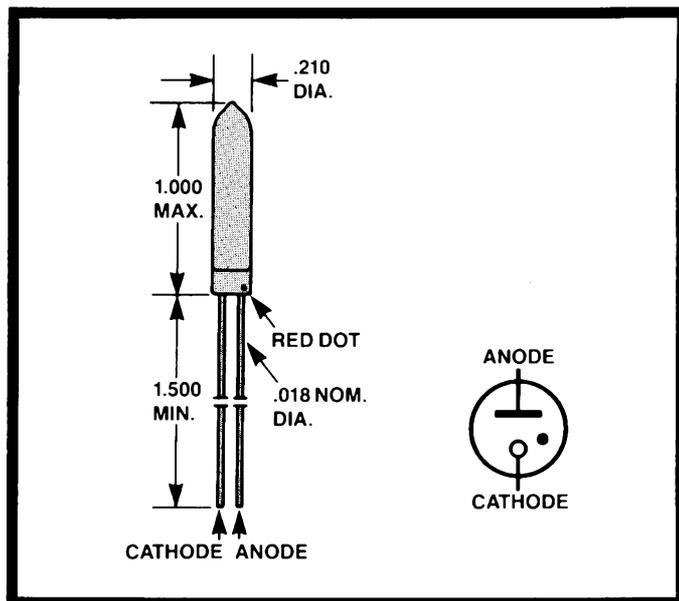
For additional information concerning the Victoreen HV Regulators or for design assistance in their application, you are invited to consult our Applications Engineering Department.

ALTITUDE RATING

The various altitude ratings shown on the individual Victoreen HV Regulator data sheets represent the arc-over path in free air for that voltage. Altitude limitations may be disregarded if the Victoreen HV Regulators are applied in sealed or potted power supplies.

COROTRON GV1A Tubes

- Current capabilities to 100ua
- Designed for use as shunt regulator and reference voltages in satellite applications and other high voltage power supplies where the ultimate in miniaturization is paramount
- Shock: 100g- 11 ms per Mil. Std. 202C method 202B
- Vibration: 10-55 cps- 10 g
- Maximum Temperature Coefficient: .009%/°C to + 125° C



HI-Voltage Regulating Diode

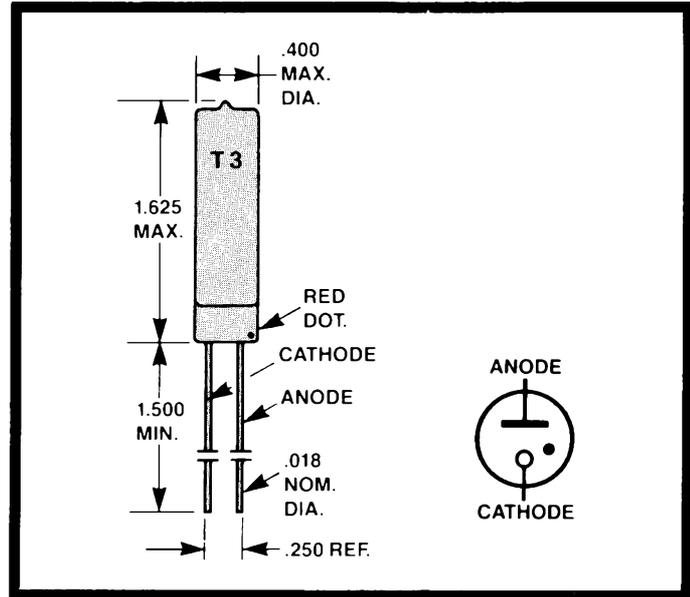
These Victoreen HV Regulators are available in any desired nominal voltage $\pm 2.5\%$ from 350 volts to 2000 volts at the customary test point of 25ua. All characteristics such as maximum and minimum currents, regulation, etc., may be interpolated from the table below.

| COMMONLY USED TYPES | | | | | | | |
|---------------------|---------------------------------|-----------|-------------------------|------|------|--------------------|---|
| Type | Nom. Voltage @ 25 ua Test Point | Tolerance | Current in Microamperes | | | Regulation* (Max.) | Altitude |
| | | | Min. | Max. | Peak | | |
| GV1A-350 | 350V | $\pm 10V$ | 5 | 100 | 200 | 4V | Unlimited if diodes are potted to prevent external arc-over between leads |
| GV1A-700 | 700V | $\pm 12V$ | 5 | 100 | 125 | 10V | |
| GV1A-950 | 950V | $\pm 15V$ | 5 | 100 | 200 | 10V | |
| GV1A-1000 | 1000V | $\pm 15V$ | 5 | 100 | 200 | 10V | |
| GV1A-1250 | 1250V | $\pm 19V$ | 10 | 100 | 250 | 10V | |
| GV1A-1650 | 1650V | $\pm 25V$ | 20 | 100 | 300 | 15V | |
| GV1A-1800 | 1800V | $\pm 28V$ | 25 | 100 | 350 | 18V | |
| GV1A-2000 | 2000V | $\pm 30V$ | 25 | 100 | 350 | 18V | |

*This regulation is the change in voltage over useful range of current from MIN. to MAX.

COROTRON GV3A Tubes

- Low operating current
- Regulation of the order of 10 volts per 100 micro-amps
- Designed to regulate high voltage power supplies for portable radiation detection instruments and photo-multiplier tubes, as D.C. coupling elements and for other high voltage-low current applications
- Shock: 100g- 11 ms per Mil. Std. 202C method 202B
- Vibration: 10-55 cps-10g



HI-Voltage Regulating Diode

These Victoreen HV Regulators are available in any desired nominal voltage $\pm 2.5\%$ from 400 volts to 2500 volts at the customary test point of 50ua. All characteristics such as maximum and minimum currents, regulation, etc., may be interpolated from the table below.

COMMONLY USED TYPES

| Type | Nom. Voltage @ 50 ua Test Point | Tolerance | Current In Microamperes | | | Regulation* (Max.) | Altitude |
|-----------|---------------------------------|-----------|-------------------------|------|------|--------------------|----------|
| | | | Min. | Max. | Peak | | |
| GV3A-400 | 400V | $\pm 10V$ | 5 | 300 | 400 | 20V | 72,000 |
| GV3A-500 | 500V | $\pm 10V$ | 5 | 300 | 400 | 30V | 71,000 |
| GV3A-600 | 600V | $\pm 12V$ | 5 | 300 | 400 | 32V | 70,000 |
| GV3A-700 | 700V | $\pm 14V$ | 5 | 300 | 400 | 35V | 69,000 |
| GV3A-800 | 800V | $\pm 16V$ | 5 | 400 | 500 | 35V | 68,000 |
| GV3A-900 | 900V | $\pm 13V$ | 10 | 500 | 700 | 35V | 66,000 |
| GV3A-1000 | 1000V | $\pm 15V$ | 10 | 500 | 750 | 40V | 65,000 |
| GV3A-1200 | 1200V | $\pm 18V$ | 15 | 600 | 800 | 60V | 63,000 |
| GV3A-1400 | 1400V | $\pm 21V$ | 15 | 700 | 850 | 85V | 60,000 |
| GV3A-1800 | 1800V | $\pm 27V$ | 20 | 550 | 1000 | 85V | 57,000 |
| GV3A-2000 | 2000V | $\pm 30V$ | 20 | 500 | 1100 | 85V | 55,000 |
| GV3A-2200 | 2200V | $\pm 33V$ | 25 | 450 | 1200 | 85V | 53,000 |
| GV3A-2500 | 2500V | $\pm 37V$ | 25 | 400 | 1400 | 85V | 50,000 |

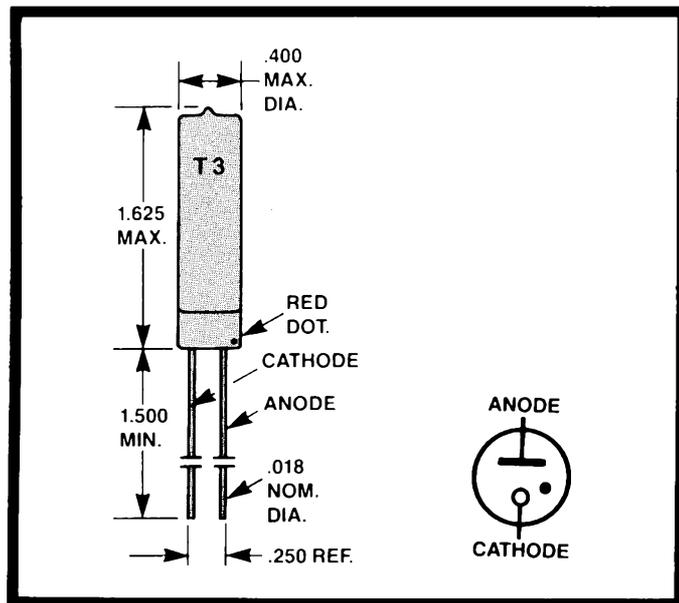
*This regulation is the change in voltage over useful range of current from MIN. to MAX.

COROTRON GV3A High Temperature

- Operate to 150°C
- Low operating current
- Shock: 100g - 11 ms per MIL. STD. 202C, Test Method 202B
- Vibration: 10-55 CPS-10g

HI-Voltage Regulating Diode

These tubes are specifically designed and processed for operation at extremely high temperatures. The suffix "H" following the voltage designation in the tube type number identifies it as a tube designed for operation up to 150°C. Temperature dependence has been reduced to a minimum. The change in operating voltage over the ambient temperature range of minus 65°C to plus 150°C varies from approximately 1% of specified voltage for lowest nominal voltage (400 volts) to approximately 2% for the highest available nominal voltage (2500 volts). Of course, this assumes operation at the standard test point of 50 microamperes. At lower currents the temperature dependence is less while at higher currents it is greater. In addition, these tubes will withstand 100G-11ms shock and vibration of 10G over 10 -55 cps.



COMMONLY USED TYPES

| Type | Nom. Voltage @ 50 ua Test Point | Tolerance | Current In Microamperes | | | Regulation* (Max.) At 25°C | Approx. Voltage Change From - 65°C To + 150°C @ 25 ua |
|-------------------|---------------------------------|-----------|-------------------------|------|------|----------------------------|---|
| | | | Min. | Max. | Peak | | |
| GV3A-400H | 400V | ± 10V | 5 | 270 | 350 | 20V | 4.0V |
| GV3A-500H | 500V | ± 10V | 5 | 270 | 350 | 30V | 6.0V |
| GV3A-600H | 600V | ± 12V | 5 | 270 | 350 | 32V | 7.0V |
| GV3A-700H | 700V | ± 14V | 5 | 270 | 350 | 35V | 11.0V |
| GV3A-800H | 800V | ± 16V | 5 | 350 | 450 | 35V | 14.0V |
| GV3A-900H | 900V | ± 13V | 10 | 450 | 550 | 35V | 16.0V |
| GV3A-1000H | 1000V | ± 15V | 10 | 450 | 650 | 40V | 18.0V |
| GV3A-1200H | 1200V | ± 18V | 15 | 450 | 750 | 60V | 22.0V |
| GV3A-1400H | 1400V | ± 21V | 15 | 410 | 750 | 85V | 26.0V |
| GV3A-1800H | 1800V | ± 27V | 20 | 390 | 850 | 85V | 32.0V |
| GV3A-2000H | 2000V | ± 30V | 20 | 350 | 950 | 85V | 40.0V |

*This regulation is the change in voltage over useful range of current from MIN. to MAX.

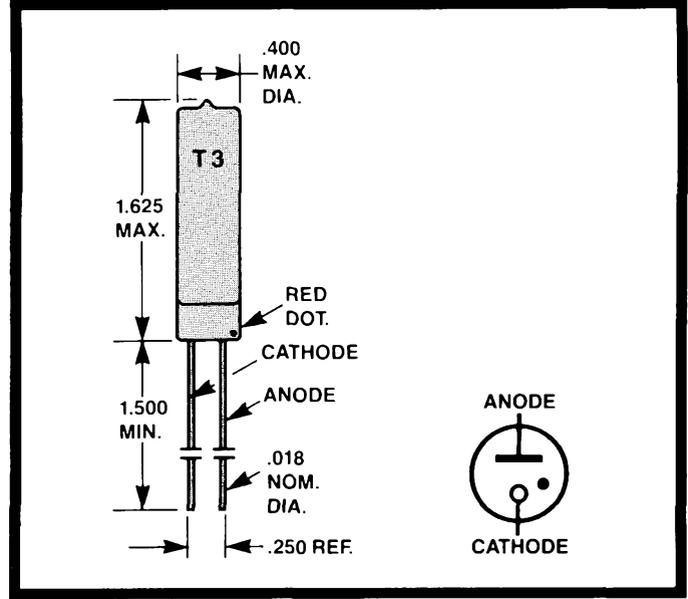
COROTRON GV3S Tubes

- Ruggedized HV Regulator
- Designed to withstand shock 2000G – .4ms
- Vibration: 10-2000 CPS – 10g
- Regulation Range: 400 to 3000 Volts

HI-Voltage Regulating Diode

The GV3S is a premium ruggedized Victoreen HV Regulator primarily designed to withstand shocks as high as 2000G for 0.4 milliseconds followed by a drag phase of 750 G for 15 milliseconds and vibration of 10-2000 cycles at 10 G. Its small size and extreme ruggedness make it ideal for missile applications and mobile ground equipment. These Victoreen HV Regulators will start with practically no over-shoot even with ramp rates of 100,000V/sec.

They are available in any desired nominal voltage $\pm 1\text{-}1/2\%$ from 400 volts to 3000 volts at the test point of 50ua. Characteristics such as minimum and maximum current, regulation and altitude can be interpolated from the following table.



| COMMONLY USED TYPES | | | | | | | |
|---------------------|---------------------------------|-----------|-------------------------|------|------|--------------------|------------------|
| Type | Nom. Voltage @ 50 ua Test Point | Tolerance | Current In Microamperes | | | Regulation* (Max.) | Altitude In Feet |
| | | | Min. | Max. | Peak | | |
| GV3S-400 | 400V | $\pm 10V$ | 10 | 250 | 300 | 14V | 72,000 |
| GV3S-600 | 600V | $\pm 10V$ | 10 | 300 | 350 | 17V | 70,000 |
| GV3S-800 | 800V | $\pm 12V$ | 10 | 450 | 600 | 21V | 68,000 |
| GV3S-1000 | 1000V | $\pm 15V$ | 10 | 500 | 750 | 25V | 65,000 |
| GV3S-1200 | 1200V | $\pm 18V$ | 15 | 600 | 750 | 25V | 63,000 |
| GV3S-1500 | 1500V | $\pm 23V$ | 15 | 650 | 750 | 30V | 60,000 |
| GV3S-1800 | 1800V | $\pm 27V$ | 20 | 550 | 850 | 50V | 57,000 |
| GV3S-2000 | 2000V | $\pm 30V$ | 20 | 500 | 950 | 65V | 55,000 |
| GV3S-2200 | 2200V | $\pm 33V$ | 30 | 450 | 1000 | 65V | 53,000 |
| GV3S-2400 | 2400V | $\pm 36V$ | 30 | 410 | 1200 | 65V | 51,000 |
| GV3S-2600 | 2600V | $\pm 39V$ | 30 | 380 | 1200 | 65V | 49,000 |
| GV3S-2800 | 2800V | $\pm 42V$ | 35 | 350 | 1200 | 65V | 47,000 |
| GV3S-3000 | 3000V | $\pm 45V$ | 35 | 330 | 1200 | 65V | 45,000 |

*This regulation is the change in voltage over useful range of current from MIN. to MAX.

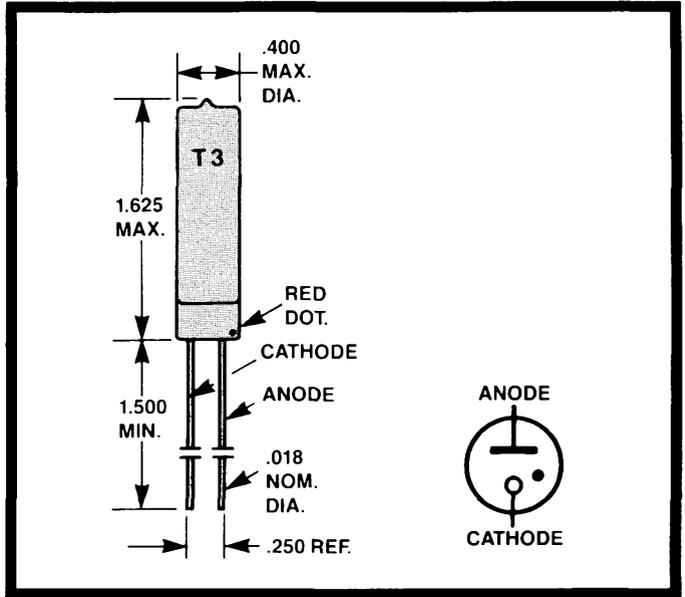
COROTRON GV3S High Temperature

- Ideal for Petroleum well logging
- Operate to withstand shock 2000G – .4ms
- Vibration: 10-2000 CPS-10g
- Regulation Range: 400 to 3000 Volts
- Operate to 200°C

HI-Voltage Regulating Diode

The GV3S series whose voltage designation is followed by the suffix "H" is designed for operation up to 200°C, and is available in voltages from 400 volts to 3000 volts. In addition, these tubes are capable of withstanding shocks as high as 2000G for 0.4 milli-seconds followed by a drag phase of 750G for 15 milli-seconds and vibration of 10-2000 cycles at 10G. The temperature dependence of these tubes has been minimized. The total change in operating voltage over the ambient temperature range minus 65°C to plus 200°C varies from approximately 1% of specified voltage for the lowest nominal voltage to approximately 2% for the highest nominal voltage when operated at standard test point. At lower currents the temperature dependence is less while at higher currents it is greater.

While these tubes were primarily designed for use in the petroleum well logging industry, they have found many other applications, both military, and commercial-industrial.



COMMONLY USED TYPES

| Type | Nom. Voltage @ 50 ua Test Point | Tolerance | Current In Microamperes | | | Regulation* (Max.) At 25°C | Approx. Voltage Change From - 65°C To + 150°C @ 25 ua |
|------------|---------------------------------|-----------|-------------------------|------|------|----------------------------|---|
| | | | Min. | Max. | Peak | | |
| GV3S-400H | 400V | ± 10V | 10 | 250 | 300 | 14V | 10V |
| GV3S-600H | 600V | ± 10V | 10 | 270 | 300 | 17V | 12V |
| GV3S-800H | 800V | ± 12V | 10 | 400 | 450 | 21V | 20V |
| GV3S-1000H | 1000V | ± 15V | 10 | 450 | 550 | 25V | 25V |
| GV3S-1200H | 1200V | ± 18V | 15 | 550 | 650 | 27V | 27V |
| GV3S-1500H | 1500V | ± 23V | 15 | 600 | 700 | 30V | 30V |
| GV3S-1800H | 1800V | ± 27V | 20 | 500 | 750 | 50V | 32V |
| GV3S-2000H | 2000V | ± 30V | 20 | 450 | 850 | 65V | 40V |
| GV3S-2200H | 2200V | ± 33V | 25 | 400 | 900 | 65V | 50V |
| GV3S-2400H | 2400V | ± 36V | 25 | 350 | 1000 | 65V | 60V |
| GV3S-2600H | 2600V | ± 39V | 25 | 350 | 1000 | 65V | 65V |
| GV3S-2800H | 2800V | ± 42V | 25 | 350 | 1000 | 65V | 65V |
| GV3S-3000H | 3000V | ± 45V | 25 | 300 | 1000 | 65V | 65V |

*This regulation is the change in voltage over useful range of current from MIN. to MAX.

Victoreen, Inc., 6000 Cochran Road, Cleveland, Ohio 44139 U.S.A.

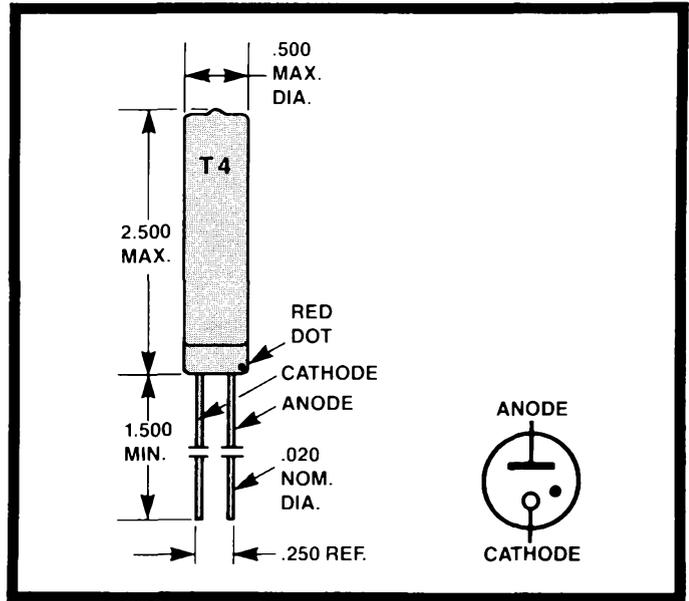
COROTRON GV4S Tubes

- Ruggedized HV Regulator
- Shock: 2000G -2ms
- Regulation Range: 400 to 3500 Volts

HI-Voltage Regulating Diode

The GV4S is a premium ruggedized Victoreen HV Regulator primarily intended for military applications which involve extreme environmental conditions. Electrically the GV4S line of tubes resembles the GV5A & GV5B Series. It is designed to take shock of 2000 G for 2.0 milli-second impact phase and 500 G drag phase, while withstanding vibration as high as .036" double amplitude from 10 to 2000 cycles or 10 G's. Being smaller in size than the commercial GV5 Series it is particularly suitable for missile applications and airborne installations where space is at a premium.

These Victoreen HV Regulators are available in any desired nominal voltage $\pm 1\text{-}1/2\%$ from 400 volts to 3500 volts at the customary test point of 100 ua. All characteristics such as maximum and minimum currents, regulations, etc., may be interpolated from the table.



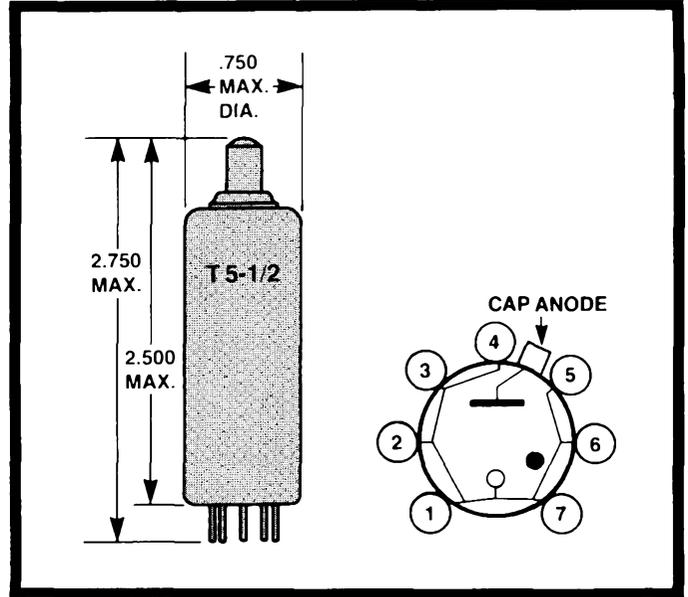
COMMONLY USED TYPES

| Type | Nom. Voltage @ 100 ua Test Point | Tolerance | Current In Microamperes | | | Regulation* (Max.) | Altitude (Feet) |
|-----------|----------------------------------|-----------|-------------------------|------|------|--------------------|-----------------|
| | | | Min. | Max. | Peak | | |
| GV4S-400 | 400V | $\pm 12V$ | 10 | 200 | 300 | 8V | 72,000 |
| GV4S-600 | 600V | $\pm 12V$ | 10 | 300 | 350 | 14V | 70,000 |
| GV4S-800 | 800V | $\pm 12V$ | 10 | 375 | 500 | 18V | 68,000 |
| GV4S-1000 | 1000V | $\pm 15V$ | 10 | 500 | 600 | 22V | 65,000 |
| GV4S-1200 | 1200V | $\pm 18V$ | 15 | 600 | 750 | 28V | 65,000 |
| GV4S-1600 | 1600V | $\pm 24V$ | 20 | 800 | 1100 | 45V | 60,000 |
| GV4S-2000 | 2000V | $\pm 30V$ | 20 | 1000 | 1300 | 85V | 55,000 |
| GV4S-2400 | 2400V | $\pm 36V$ | 25 | 1000 | 1500 | 100V | 50,000 |
| GV4S-2600 | 2600V | $\pm 39V$ | 30 | 950 | 1600 | 100V | 50,000 |
| GV4S-2800 | 2800V | $\pm 42V$ | 30 | 900 | 1700 | 100V | 47,000 |
| GV4S-3000 | 3000V | $\pm 45V$ | 30 | 850 | 1750 | 100V | 45,000 |
| GV4S-3200 | 3200V | $\pm 48V$ | 35 | 750 | 1900 | 100V | 42,000 |
| GV4S-3500 | 3500V | $\pm 58V$ | 35 | 750 | 1900 | 100V | 40,000 |

*This regulation is the change in voltage over useful range of current from MIN. to MAX.

COROTRON GV5A, GV5B Tubes

- Current capabilities to 1 ma
- Regulation of the order of 5.0 volts per 100 microamps
- Designed to regulate the high voltage power supplies for oscilloscopes, Cathode-ray tubes etc., and to provide reference voltages
- Shock: 100g- 11ms per Mil. Std. 202C method 202B
- Vibration: 10 -55 cps- 10g



Hi-Voltage Regulating Diode

These Victoreen HV Regulators are available in any desired nominal voltage $\pm 2.5\%$ from 400 volts to 3500 volts at the customary test point of 100ua. All characteristics such as maximum and minimum currents, regulation, etc., may be interpolated from the table below.

COMMONLY USED TYPES

| Type | Nom. Voltage @ 100 ua Test Point | Tolerance | Current In Microamperes | | | Regulation* (Max.) | Altitude (Feet) |
|-----------|----------------------------------|-----------|-------------------------|------|------|--------------------|-----------------|
| | | | Min. | Max. | Peak | | |
| GV5B-400 | 400V | $\pm 10V$ | 10 | 400 | 600 | 18V | 70,000 |
| GV5B-700 | 700V | $\pm 17V$ | 10 | 450 | 600 | 40V | 70,000 |
| GV5B-900 | 900V | $\pm 22V$ | 10 | 550 | 750 | 50V | 70,000 |
| GV5A-1000 | 1000V | $\pm 25V$ | 10 | 650 | 800 | 20V | 70,000 |
| GV5A-1200 | 1200V | $\pm 30V$ | 15 | 700 | 800 | 28V | 70,000 |
| GV5A-1600 | 1600V | $\pm 40V$ | 20 | 800 | 950 | 42V | 70,000 |
| GV5A-2000 | 2000V | $\pm 50V$ | 20 | 1000 | 1300 | 62V | 70,000 |
| GV5A-2400 | 2400V | $\pm 60V$ | 25 | 1000 | 1700 | 65V | 70,000 |
| GV5A-2600 | 2600V | $\pm 65V$ | 30 | 950 | 1800 | 60V | 70,000 |
| GV5A-2800 | 2800V | $\pm 70V$ | 30 | 900 | 1800 | 55V | 70,000 |
| GV5A-3000 | 3000V | $\pm 75V$ | 30 | 850 | 1800 | 50V | 70,000 |
| GV5A-3200 | 3200V | $\pm 80V$ | 35 | 800 | 1800 | 40V | 70,000 |
| GV5A-3500 | 3500V | $\pm 90V$ | 35 | 700 | 1800 | 30V | 70,000 |

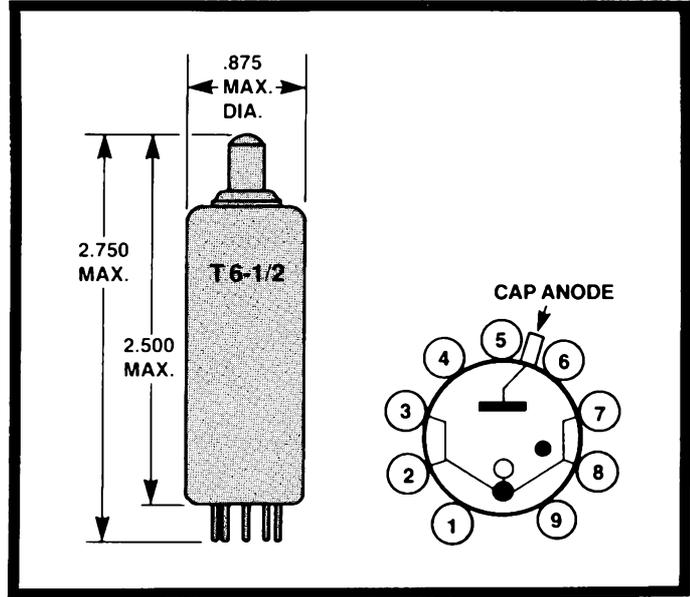
*This regulation is the change in voltage over useful range of current from MIN. to MAX.

COROTRON GV6A Tubes

- Current capabilities to 2 ma
- Regulation of the order of 5.0 volts per 100 microamps
- Designed for use in Klystron and traveling wave tube power supplies, radar systems with multiple display tubes, etc
- Shock: 100g - 11 ms. per Mil. Std. 202C, Method 202B
- Vibration: 10-500 cps - 10g

HI-Voltage Regulating Diode

These Victoreen HV Regulators are available in any desired nominal voltage $\pm 2.5\%$ from 400 volts to 3500 volts at the customary test point of 500ua. All characteristics such as maximum and minimum currents, regulations, etc., may be interpolated from the table.



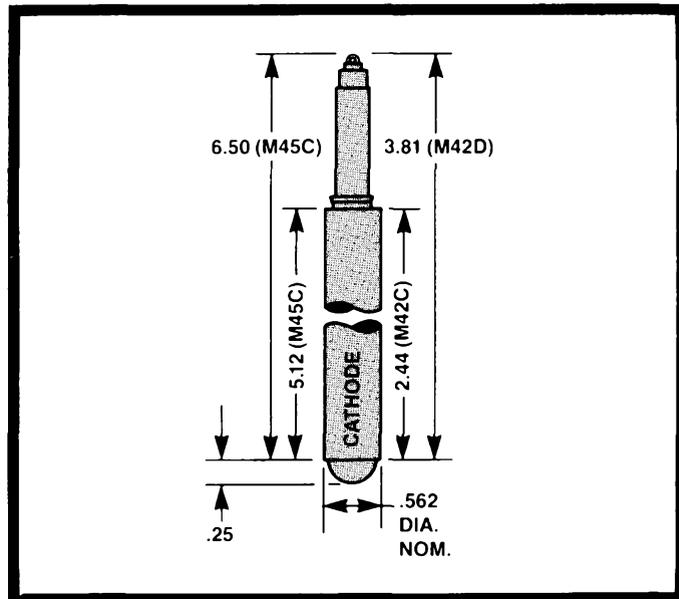
COMMONLY USED TYPES

| Type | Nom. Voltage @ 500 ua Test Point | Tolerance | Current In Microamperes | | | Regulation* (Max.) | Altitude (Feet) |
|-----------|----------------------------------|-----------|-------------------------|------|------|--------------------|-----------------|
| | | | Min. | Max. | Peak | | |
| GV6A-400 | 400V | $\pm 10V$ | 50 | 1000 | 1100 | 25V | 70,000 |
| GV6A-600 | 600V | $\pm 15V$ | 50 | 750 | 900 | 30V | 70,000 |
| GV6A-800 | 800V | $\pm 20V$ | 50 | 1000 | 1100 | 40V | 70,000 |
| GV6A-1000 | 1000V | $\pm 25V$ | 50 | 1000 | 1100 | 40V | 70,000 |
| GV6A-1200 | 1200V | $\pm 30V$ | 50 | 1200 | 1300 | 45V | 70,000 |
| GV6A-1400 | 1400V | $\pm 35V$ | 50 | 1600 | 1900 | 70V | 70,000 |
| GV6A-1600 | 1600V | $\pm 40V$ | 50 | 1800 | 2100 | 95V | 70,000 |
| GV6A-1800 | 1800V | $\pm 45V$ | 50 | 2000 | 2400 | 105V | 70,000 |
| GV6A-2000 | 2000V | $\pm 50V$ | 50 | 2000 | 2700 | 115V | 70,000 |
| GV6A-2200 | 2200V | $\pm 55V$ | 50 | 1800 | 2700 | 115V | 70,000 |
| GV6A-2400 | 2400V | $\pm 60V$ | 50 | 1600 | 2900 | 115V | 70,000 |
| GV6A-2600 | 2600V | $\pm 65V$ | 50 | 1500 | 2900 | 120V | 70,000 |
| GV6A-3000 | 3000V | $\pm 75V$ | 50 | 1300 | 2900 | 110V | 70,000 |

*This regulation is the change in voltage over useful range of current from MIN. to MAX.

COROTRON M42D, M45C Tubes

- Current to 1 mA
- Rugged – Fail Safe
- Voltages 6 to 12kV
- Metal Envelope
- Designed for High Voltage, Compact Power Supplies. Extremely Applicable for Military Equipment
- Shock: 100g, Mil. Std. 202C, Method 202B
- Vibration: 10g, 10-500 cps



HI-Voltage Regulating Diode

These Victoreen HV Regulators are available in any desired nominal voltage 6kV to 12kV at the customary test point of 300ua. All characteristics such as maximum and minimum currents, regulations, etc., may be interpolated from the table.

COMMONLY USED TYPES

| Type | Nom. Voltage @ 300 ua Test Point | Tolerance | Current In Microamperes | | | Regulation* (Max.) | Altitude (Feet) |
|----------------|----------------------------------|-----------|-------------------------|------|------|--------------------|-----------------|
| | | | Min. | Max. | Peak | | |
| M42D-6 | 6kV | ± 300V | 25 | 1000 | 1500 | 550V | 25,000 |
| M42D-8 | 8kV | ± 300V | 25 | 1000 | 1500 | 650V | 25,000 |
| M42D-10 | 10kV | ± 300V | 25 | 1000 | 1500 | 750V | 25,000 |
| M42D-12 | 12kV | ± 300V | 25 | 1000 | 1500 | 850V | 25,000 |
| M45C-8 | 8kV | ± 300V | 25 | 1000 | 1500 | 300V | 25,000 |
| M45C-10 | 10kV | ± 300V | 25 | 1000 | 1500 | 400V | 25,000 |
| M45C-12 | 12kV | ± 300V | 25 | 1000 | 1500 | 500V | 25,000 |

*This regulation is the change in voltage over useful range of current from MIN. to MAX.

E.I.A. REGISTERED

HI-Voltage Regulating Diode

The Victoreen diodes listed below have been E.I.A. registered to facilitate design, acceptance and procurement by the military. For some of the earlier registration numbers, improved performance may be anticipated either by our current production of E.I.A. registered tubes or by use of the cross-referenced commercial type. The Victoreen diodes which are glass encased (T-3, T-4, T-5 and T-6 types) are capable of operation from -65°C to $+125^{\circ}\text{C}$, even though the appropriate specification may demand operation over a more limited temperature range.

The utmost in physical durability is offered in the metal-shelled diodes (8069, 8206 and 6392). These Victoreen diodes are entirely of metal and ceramic construction with welded and high-temperature brazed seams, these diodes are capable of withstanding shock and vibration of a high magnitude.

Additional physical, environmental and electrical information for the above Victoreen diodes may be found on the data sheet listing the particular commercial equivalent.

TYPES E.I.A. REGISTERED

| Type | Nom. Voltage | Test Point (ua) | Tolerance | Current In Microamperes | | | Regulation* (Max.) | For Environmental And Physical Characteristics Refer To Tube Listed Below |
|-------|--------------|-----------------|-----------|-------------------------|------|------|--------------------|---|
| | | | | Min. | Max. | Peak | | |
| 5841Δ | 900 | 25 | ± 18V | 5 | 100 | 150 | 18V | GV3A-900 |
| 5950 | 700 | 25 | ± 15V | 5 | 100 | 150 | 14V | GV3A-700 |
| 6119 | 2000 | 25 | ± 100V | 15 | 100 | 150 | 40V | GV3A-2000 |
| 6143 | 1200 | 25 | ± 24V | 10 | 100 | 150 | 24V | GV3A-1200 |
| 8469 | 400 | 50 | ± 10V | 5 | 300 | 400 | 20V | GV3A-400 |
| 7859 | 1750 | 100 | ± 35V | 20 | 800 | 1100 | 65V | GV4S-1750 |
| 7894 | 3000 | 100 | ± 60V | 30 | 850 | 1800 | 100V | GV4S-3000 |
| 8089 | 1600 | 100 | ± 32V | 20 | 800 | 1100 | 65V | GV4S-1600 |
| 8256 | 3500 | 100 | ± 70V | 35 | 700 | 1900 | 100V | GV4S-3500 |
| 8257 | 1200 | 100 | ± 24V | 15 | 600 | 750 | 30V | GV4S-1200 |
| 5962 | 700 | 25 | ± 18V | 2 | 55 | | 15V | GV5B-700 |
| 7160 | 4000 | 100 | ± 80V | 40 | 500 | 900 | 120V | GV5C-4000 |
| 7161 | 3500 | 50 | ± 70V | 35 | 500 | 1800 | 105V | GV5A-3500 |
| 7162 | 2500 | 250 | ± 50V | 25 | 500 | 1800 | 75V | GV5A-2500 |
| 7286 | 2710 | 500 | ± 75V | 30 | 750 | 1500 | 60V | GV5A-2710 |
| 8514 | 1000 | 100 | ± 25V | 10 | 650 | 800 | 20V | GV5A-1000 |
| 8515 | 1600 | 100 | ± 40V | 20 | 800 | 950 | 42V | GV5A-1600 |
| 8615 | 1400 | 100 | ± 30V | 10 | 500 | 750 | 30V | GV5A-1400 |
| 8797 | 900 | 100 | ± 22V | 10 | 550 | 750 | 50V | GV5B-900 |
| 8090 | 3500 | 500 | ± 75V | 50 | 1000 | 1500 | 100V | GV6A-3500 |
| 8091 | 4000 | 100 | ± 125V | 50 | 600 | 1000 | 50V | GV6C-4000 |
| 8612 | 6000 | 100 | ± 175V | 50 | 500 | 900 | 55V | GV6C-6000 |
| 8069 | 8000 | 300 | ± 200V | 25 | 1000 | 1500 | 650V | M42D-8 |
| 8206 | 12000 | 300 | ± 200V | 25 | 1000 | 1500 | 500V | M45C-12 |
| 6392 | 18000 | 500 | ± 300V | 50 | 1000 | 1500 | 1100V | M108-18 |

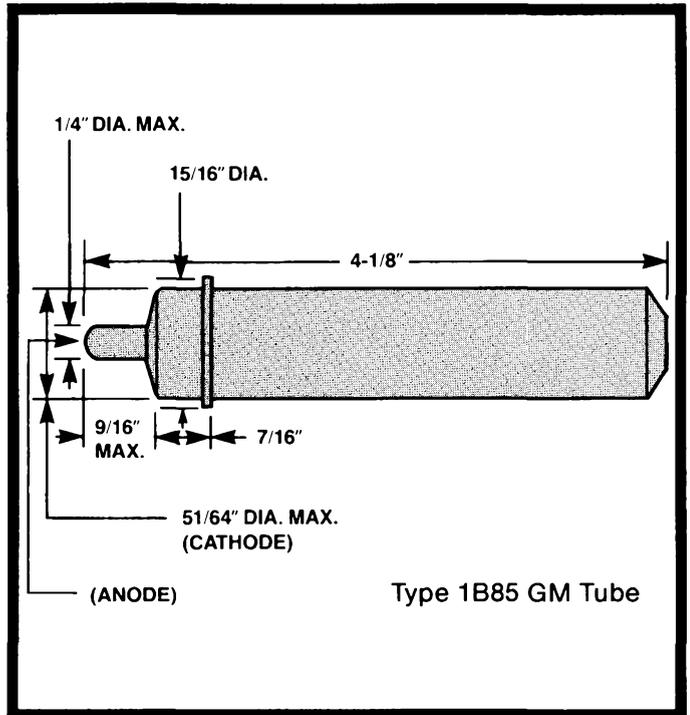
*This regulation is the change in voltage over useful range of current from MIN. to MAX.

ΔNOTE: Has three leads; two for cathode, one center lead for anode.

GM COUNTER TUBES

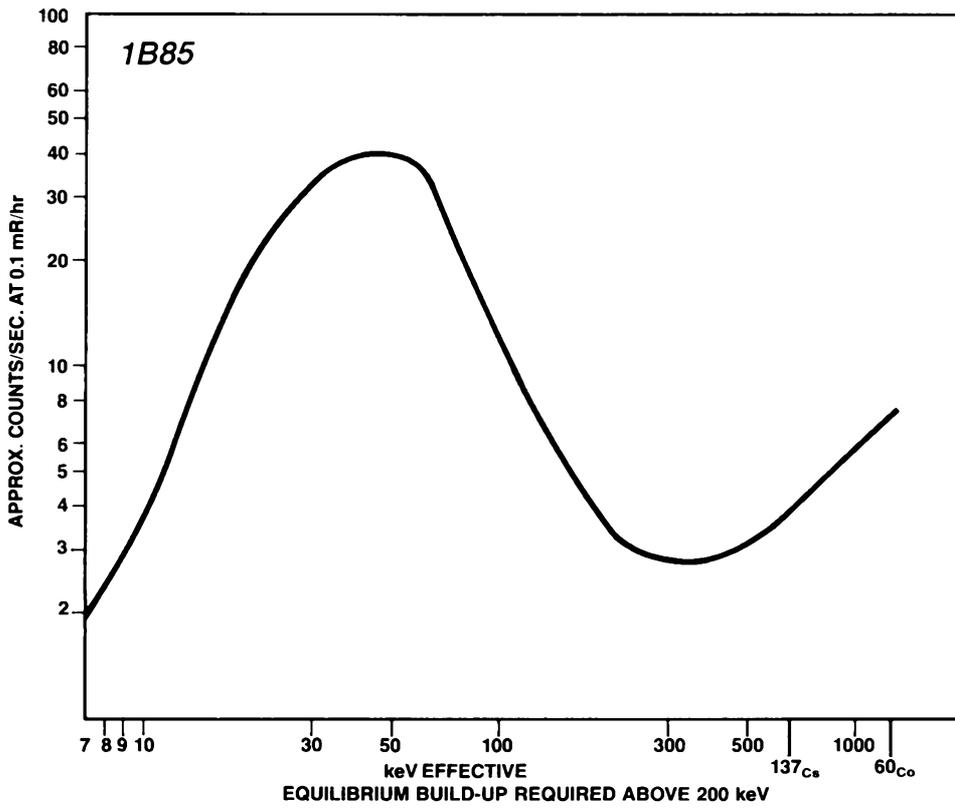
GM COUNTER Tubes

- Aluminum walled and organically, self-quenched
- Ideal general purpose beta-gamma counters.
- High sensitivity, reliability and ruggedness inherent to tube design and construction.
- Suited to survey meters, area monitors, plus several other laboratory radiation measurement applications
- Bismuth coated screen in 6306 enhances gamma response from 30 to 1000 KeV



| HIGH SENSITIVITY GM TUBES | | |
|---|-------|--|
| CHARACTERISTICS | | 1B85 |
| Operating Voltage | (Min) | 850 Volts |
| | (Max) | 950 Volts |
| Ambient Temperature | (Min) | -30 °C |
| | (Max) | 75 °C |
| Relative Humidity | (Max) | 95 % |
| Beta Energy | (Min) | 160 keV |
| Threshold Voltage* | (Max) | 800 Volts |
| Plateau Length* | (Min) | 200 Volts |
| Plateau Slope* | | 5%/100 Volts (V _o = 800 To 1000V) |
| Recovery Time | | 100 μSec. |
| Background (V _o = 900V) | | 40 C/M |
| Life (At 6000 C/M, V _o = 900V) | | 10 ⁸ Counts |
| Life Test End Point, Slope | | 10%/100 Volts (V _o = 850 To 950 V) |
| Active Length | | 2.75 Inches |
| Wall (Aluminum) | | 30 mg/cm ² |
| Screen (Copper) | | ----- |
| Plating (Bismuth) | | ----- |
| Electrode Capacitance | | 2 μμf |
| Quench | | Organic |
| *New Tubes | | |

1B85 RESPONSE CURVE



Advanced Technology Working for People and the Environment



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