

# P6KE SERIES

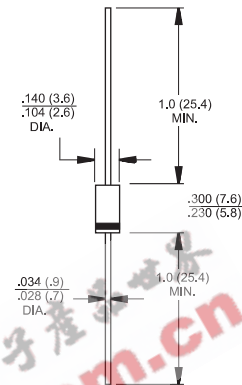
## 600 Watts Transient Voltage Suppressor Diodes

### DO-15



### Features

- ✦ UL Recognized File # E-96005
- ✦ Plastic package has Underwriters Laboratory Flammability Classification 94V-0
- ✦ Exceeds environmental standards of MIL-STD-19500
- ✦ 600W surge capability at 10 x 100 us waveform, duty cycle: 0.01%
- ✦ Excellent clamping capability
- ✦ Low zener impedance
- ✦ Fast response time: Typically less than 1.0ps from 0 volts to VBR for unidirectional and 5.0 ns for bidirectional
- ✦ Typical  $I_R$  less than 1uA above 10V
- ✦ High temperature soldering guaranteed: 260°C / 10 seconds / .375", (9.5mm) lead length / 5lbs., (2.3kg) tension



Dimensions in inches and (millimeters)

### Mechanical Data

- ✦ Case: Molded plastic
- ✦ Lead: Pure tin plated lead free,, solderable per MIL-STD-202, Method 208
- ✦ Polarity: Color band denotes cathode except bipolar
- ✦ Weight: 0.42gram

### Maximum Ratings and Electrical Characteristics

Rating at 25 °C ambient temperature unless otherwise specified.  
Single phase, half wave, 60 Hz, resistive or inductive load.  
For capacitive load, derate current by 20%

| Type Number                                                                                                 | Symbol         | Value        | Units              |
|-------------------------------------------------------------------------------------------------------------|----------------|--------------|--------------------|
| Peak Power Dissipation at $T_A=25^{\circ}\text{C}$ , $T_p=1\text{ms}$ (Note 1)                              | $P_{PK}$       | Minimum 600  | Watts              |
| Steady State Power Dissipation at $T_L=75^{\circ}\text{C}$<br>Lead Lengths .375", 9.5mm (Note 2)            | $P_D$          | 5.0          | Watts              |
| Peak Forward Surge Current, 8.3 ms Single Half Sine-wave Superimposed on Rated Load (JEDEC method) (Note 3) | $I_{FSM}$      | 100          | Amps               |
| Maximum Instantaneous Forward Voltage at 50.0A for Unidirectional Only (Note 4)                             | $V_F$          | 3.5 / 5.0    | Volts              |
| Operating and Storage Temperature Range                                                                     | $T_J, T_{STG}$ | -55 to + 175 | $^{\circ}\text{C}$ |

- Notes:
1. Non-repetitive Current Pulse Per Fig. 3 and Derated above  $T_A=25^{\circ}\text{C}$  Per Fig. 2.
  2. Mounted on Copper Pad Area of 1.6 x 1.6" (40 x 40 mm) Per Fig. 4.
  3. 8.3ms Single Half Sine-wave or Equivalent Square Wave, Duty Cycle=4 Pulses Per Minutes Maximum.
  4.  $V_F=3.5\text{V}$  for Devices of  $V_{BR} \leq 200\text{V}$  and  $V_F=5.0\text{V}$  Max. for Devices of  $V_{BR}>200\text{V}$ .

#### Devices for Bipolar Applications

1. For Bidirectional Use C or CA Suffix for Types P6KE6.8 through Types P6KE400.
2. Electrical Characteristics Apply in Both Directions.

## RATINGS AND CHARACTERISTIC CURVES (P6KE SERIES)

FIG.1- PEAK PULSE POWER RATING CURVE

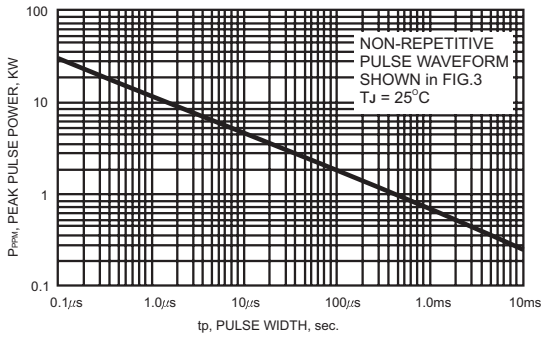


FIG.2- PULSE DERATING CURVE

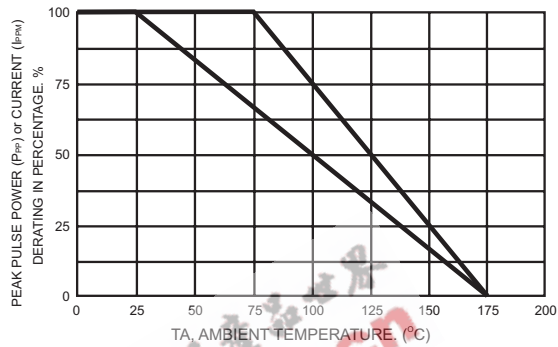


FIG.3- CLAMPING POWER PULSE WAVEFORM

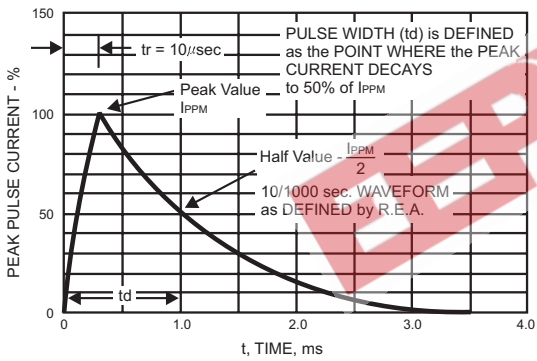


FIG.4- MAXIMUM NON-REPETITIVE FORWARD SURGE CURRENT UNIDIRECTIONAL ONLY

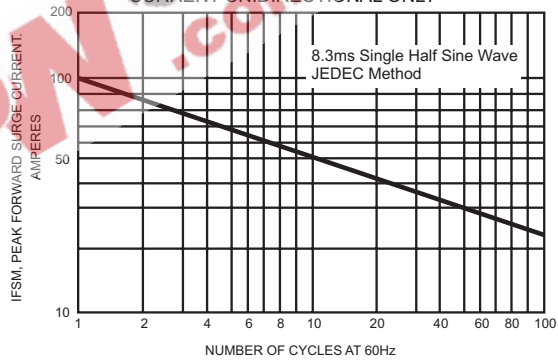
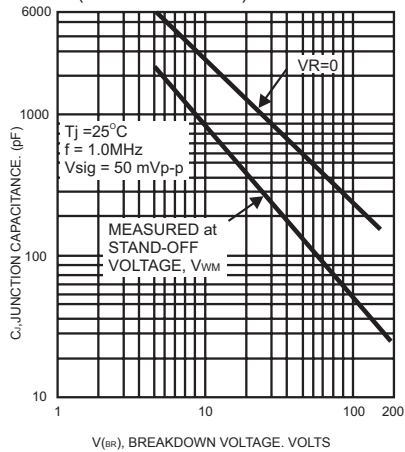


FIG.5- TYPICAL JUNCTION CAPACITANCE (UNIDIRECTIONAL)



ELECTRICAL CHARACTERISTICS (TA=25°C unless otherwise noted)

| Device   | Nominal Voltage (Volts) | Breakdown Voltage                |       | Test Current @I <sub>T</sub> (mA) | Stand-Off Voltage V <sub>WM</sub> (Volts) | Maximum Reverse Leakage at V <sub>WM</sub> I <sub>D</sub> (uA) | Maximum Peak Pulse Current I <sub>PSM</sub> (Note 2)(Amps) | Maximum Clamping Voltage at I <sub>PSM</sub> V <sub>C</sub> (Volts) | Maximum Temperature Coefficient of V <sub>BR</sub> (%/°C) |
|----------|-------------------------|----------------------------------|-------|-----------------------------------|-------------------------------------------|----------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------|
|          |                         | V <sub>BR</sub> (Volts) (Note 1) |       |                                   |                                           |                                                                |                                                            |                                                                     |                                                           |
|          |                         | Min                              | Max   |                                   |                                           |                                                                |                                                            |                                                                     |                                                           |
| PRKE6.8  | 6.8                     | 6.12                             | 7.48  | 10                                | 5.50                                      | 1000                                                           | 58                                                         | 10.8                                                                | 0.057                                                     |
| PRKE6.8A | 6.8                     | 6.45                             | 7.14  | 10                                | 5.80                                      | 1000                                                           | 60                                                         | 10.5                                                                | 0.057                                                     |
| PRKE7.5  | 7.5                     | 6.75                             | 8.25  | 10                                | 6.05                                      | 500                                                            | 53                                                         | 11.7                                                                | 0.061                                                     |
| PRKE7.5A | 7.5                     | 7.13                             | 7.88  | 10                                | 6.40                                      | 500                                                            | 55                                                         | 11.3                                                                | 0.061                                                     |
| PRKE8.2  | 8.2                     | 7.38                             | 9.02  | 10                                | 6.63                                      | 200                                                            | 50                                                         | 12.5                                                                | 0.065                                                     |
| PRKE8.2A | 8.2                     | 7.79                             | 8.61  | 1.0                               | 7.02                                      | 200                                                            | 52                                                         | 12.1                                                                | 0.065                                                     |
| PRKE9.1  | 9.1                     | 8.19                             | 10.0  | 1.0                               | 7.37                                      | 50                                                             | 45                                                         | 13.8                                                                | 0.068                                                     |
| PRKE9.1A | 9.1                     | 8.65                             | 9.55  | 1.0                               | 7.78                                      | 50                                                             | 47                                                         | 13.4                                                                | 0.068                                                     |
| PRKE10   | 10                      | 9.00                             | 11.0  | 1.0                               | 8.10                                      | 10                                                             | 42                                                         | 15.0                                                                | 0.073                                                     |
| PRKE10A  | 10                      | 9.50                             | 10.5  | 1.0                               | 8.55                                      | 10                                                             | 43                                                         | 14.5                                                                | 0.073                                                     |
| PRKE11   | 11                      | 9.90                             | 12.1  | 1.0                               | 8.92                                      | 5.0                                                            | 38                                                         | 16.2                                                                | 0.075                                                     |
| PRKE11A  | 11                      | 10.5                             | 11.6  | 1.0                               | 9.40                                      | 5.0                                                            | 40                                                         | 15.6                                                                | 0.075                                                     |
| PRKE12   | 12                      | 10.8                             | 13.2  | 1.0                               | 9.72                                      | 5.0                                                            | 36                                                         | 17.3                                                                | 0.078                                                     |
| PRKE12A  | 12                      | 11.4                             | 12.6  | 1.0                               | 10.2                                      | 5.0                                                            | 37                                                         | 16.7                                                                | 0.078                                                     |
| PRKE13   | 13                      | 11.7                             | 14.3  | 1.0                               | 10.5                                      | 5.0                                                            | 33                                                         | 19.0                                                                | 0.081                                                     |
| PRKE13A  | 13                      | 12.4                             | 13.7  | 1.0                               | 11.1                                      | 5.0                                                            | 34                                                         | 18.2                                                                | 0.081                                                     |
| PRKE15   | 15                      | 13.5                             | 16.5  | 1.0                               | 12.1                                      | 5.0                                                            | 28                                                         | 22.0                                                                | 0.084                                                     |
| PRKE15A  | 15                      | 14.3                             | 15.8  | 1.0                               | 12.8                                      | 5.0                                                            | 29                                                         | 21.2                                                                | 0.084                                                     |
| PRKE16   | 16                      | 14.4                             | 17.6  | 1.0                               | 12.9                                      | 5.0                                                            | 26                                                         | 23.5                                                                | 0.086                                                     |
| PRKE16A  | 16                      | 15.2                             | 16.8  | 1.0                               | 13.6                                      | 5.0                                                            | 28                                                         | 22.5                                                                | 0.086                                                     |
| PRKE18   | 18                      | 16.2                             | 19.8  | 1.0                               | 14.5                                      | 5.0                                                            | 23                                                         | 26.5                                                                | 0.088                                                     |
| PRKE18A  | 18                      | 17.1                             | 18.9  | 1.0                               | 15.3                                      | 5.0                                                            | 25                                                         | 25.2                                                                | 0.088                                                     |
| PRKE20   | 20                      | 18.0                             | 22.0  | 1.0                               | 16.2                                      | 5.0                                                            | 21                                                         | 29.1                                                                | 0.090                                                     |
| PRKE20A  | 20                      | 19.0                             | 21.0  | 1.0                               | 17.1                                      | 5.0                                                            | 22                                                         | 27.7                                                                | 0.090                                                     |
| PRKE22   | 22                      | 19.8                             | 24.2  | 1.0                               | 17.8                                      | 5.0                                                            | 19                                                         | 31.9                                                                | 0.092                                                     |
| PRKE22A  | 22                      | 20.9                             | 23.1  | 1.0                               | 18.8                                      | 5.0                                                            | 20                                                         | 30.6                                                                | 0.092                                                     |
| PRKE24   | 24                      | 21.6                             | 26.4  | 1.0                               | 19.4                                      | 5.0                                                            | 18                                                         | 34.7                                                                | 0.094                                                     |
| PRKE24A  | 24                      | 22.8                             | 25.2  | 1.0                               | 20.5                                      | 5.0                                                            | 19                                                         | 33.2                                                                | 0.094                                                     |
| PRKE27   | 27                      | 24.3                             | 29.7  | 1.0                               | 21.8                                      | 5.0                                                            | 16                                                         | 39.1                                                                | 0.096                                                     |
| PRKE27A  | 27                      | 25.7                             | 28.4  | 1.0                               | 23.1                                      | 5.0                                                            | 16.8                                                       | 37.5                                                                | 0.096                                                     |
| PRKE30   | 30                      | 27.0                             | 33.0  | 1.0                               | 24.3                                      | 5.0                                                            | 14                                                         | 43.5                                                                | 0.097                                                     |
| PRKE30A  | 30                      | 28.5                             | 31.5  | 1.0                               | 25.6                                      | 5.0                                                            | 15                                                         | 41.4                                                                | 0.097                                                     |
| PRKE33   | 33                      | 29.7                             | 36.3  | 1.0                               | 26.8                                      | 5.0                                                            | 13.0                                                       | 47.7                                                                | 0.098                                                     |
| PRKE33A  | 33                      | 31.4                             | 34.7  | 1.0                               | 28.2                                      | 5.0                                                            | 13.8                                                       | 45.7                                                                | 0.098                                                     |
| PRKE36   | 36                      | 32.4                             | 39.6  | 1.0                               | 29.1                                      | 5.0                                                            | 12                                                         | 52.0                                                                | 0.099                                                     |
| PRKE36A  | 36                      | 34.2                             | 37.8  | 1.0                               | 30.8                                      | 5.0                                                            | 12.6                                                       | 49.9                                                                | 0.099                                                     |
| PRKE39   | 39                      | 35.1                             | 42.9  | 1.0                               | 31.6                                      | 5.0                                                            | 11.1                                                       | 56.4                                                                | 0.100                                                     |
| PRKE39A  | 39                      | 37.1                             | 41.0  | 1.0                               | 33.3                                      | 5.0                                                            | 11.6                                                       | 53.9                                                                | 0.100                                                     |
| PRKE43   | 43                      | 38.7                             | 47.3  | 1.0                               | 34.8                                      | 5.0                                                            | 10.0                                                       | 61.9                                                                | 0.101                                                     |
| PRKE43A  | 43                      | 40.9                             | 45.2  | 1.0                               | 36.8                                      | 5.0                                                            | 10.6                                                       | 59.3                                                                | 0.101                                                     |
| PRKE47   | 47                      | 42.3                             | 51.7  | 1.0                               | 38.1                                      | 5.0                                                            | 9.2                                                        | 67.8                                                                | 0.101                                                     |
| PRKE47A  | 47                      | 44.7                             | 49.4  | 1.0                               | 40.2                                      | 5.0                                                            | 9.7                                                        | 64.8                                                                | 0.101                                                     |
| PRKE51   | 51                      | 45.9                             | 56.1  | 1.0                               | 41.3                                      | 5.0                                                            | 8.5                                                        | 73.5                                                                | 0.102                                                     |
| PRKE51A  | 51                      | 48.5                             | 53.6  | 1.0                               | 43.6                                      | 5.0                                                            | 8.9                                                        | 70.1                                                                | 0.102                                                     |
| PRKE56   | 56                      | 50.4                             | 61.6  | 1.0                               | 45.4                                      | 5.0                                                            | 7.8                                                        | 80.5                                                                | 0.103                                                     |
| PRKE56A  | 56                      | 53.2                             | 58.8  | 1.0                               | 47.8                                      | 5.0                                                            | 8.1                                                        | 77.0                                                                | 0.103                                                     |
| PRKE62   | 62                      | 55.8                             | 68.2  | 1.0                               | 50.2                                      | 5.0                                                            | 7.0                                                        | 89.0                                                                | 0.104                                                     |
| PRKE62A  | 62                      | 58.9                             | 65.1  | 1.0                               | 53.0                                      | 5.0                                                            | 7.4                                                        | 85.0                                                                | 0.104                                                     |
| PRKE68   | 68                      | 61.2                             | 74.8  | 1.0                               | 55.1                                      | 5.0                                                            | 6.4                                                        | 98.0                                                                | 0.104                                                     |
| PRKE68A  | 68                      | 64.6                             | 71.4  | 1.0                               | 58.1                                      | 5.0                                                            | 6.8                                                        | 92.0                                                                | 0.104                                                     |
| PRKE75   | 75                      | 67.5                             | 82.5  | 1.0                               | 60.7                                      | 5.0                                                            | 5.8                                                        | 108.0                                                               | 0.105                                                     |
| PRKE75A  | 75                      | 71.3                             | 78.8  | 1.0                               | 64.1                                      | 5.0                                                            | 6.1                                                        | 103.0                                                               | 0.105                                                     |
| PRKE82   | 82                      | 73.8                             | 90.2  | 1.0                               | 66.4                                      | 5.0                                                            | 5.3                                                        | 118.0                                                               | 0.105                                                     |
| PRKE82A  | 82                      | 77.9                             | 86.1  | 1.0                               | 70.1                                      | 5.0                                                            | 5.5                                                        | 113.0                                                               | 0.105                                                     |
| PRKE91   | 91                      | 81.9                             | 100.0 | 1.0                               | 73.7                                      | 5.0                                                            | 4.8                                                        | 131.0                                                               | 0.106                                                     |
| PRKE91A  | 91                      | 86.5                             | 95.5  | 1.0                               | 77.8                                      | 5.0                                                            | 5.0                                                        | 125.0                                                               | 0.106                                                     |
| PRKE100  | 100                     | 90.0                             | 110.0 | 1.0                               | 81.0                                      | 5.0                                                            | 4.3                                                        | 144.0                                                               | 0.106                                                     |
| PRKE100A | 100                     | 95.0                             | 105.0 | 1.0                               | 85.5                                      | 5.0                                                            | 4.5                                                        | 137.0                                                               | 0.106                                                     |
| PRKE110  | 110                     | 99.0                             | 121.0 | 1.0                               | 89.2                                      | 5.0                                                            | 3.9                                                        | 158.0                                                               | 0.107                                                     |
| PRKE110A | 110                     | 105.0                            | 116.0 | 1.0                               | 94.0                                      | 5.0                                                            | 4.1                                                        | 152.0                                                               | 0.107                                                     |
| PRKE120  | 120                     | 108.0                            | 132.0 | 1.0                               | 97.2                                      | 5.0                                                            | 3.6                                                        | 173.0                                                               | 0.107                                                     |
| PRKE120A | 120                     | 114.0                            | 126.0 | 1.0                               | 102.0                                     | 5.0                                                            | 3.8                                                        | 165.0                                                               | 0.107                                                     |
| PRKE130  | 130                     | 117.0                            | 143.0 | 1.0                               | 105.0                                     | 5.0                                                            | 3.3                                                        | 187.0                                                               | 0.107                                                     |
| PRKE130A | 130                     | 124.0                            | 137.0 | 1.0                               | 111.0                                     | 5.0                                                            | 3.5                                                        | 179.0                                                               | 0.107                                                     |
| PRKE150  | 150                     | 135.0                            | 165.0 | 1.0                               | 121.0                                     | 5.0                                                            | 2.9                                                        | 215.0                                                               | 0.108                                                     |
| PRKE150A | 150                     | 143.0                            | 158.0 | 1.0                               | 128.0                                     | 5.0                                                            | 3.0                                                        | 207.0                                                               | 0.108                                                     |
| PRKE160  | 160                     | 144.0                            | 176.0 | 1.0                               | 130.0                                     | 5.0                                                            | 2.7                                                        | 230.0                                                               | 0.108                                                     |
| PRKE160A | 160                     | 152.0                            | 168.0 | 1.0                               | 136.0                                     | 5.0                                                            | 2.8                                                        | 219.0                                                               | 0.108                                                     |
| PRKE170  | 170                     | 153.0                            | 187.0 | 1.0                               | 138.0                                     | 5.0                                                            | 2.5                                                        | 244.0                                                               | 0.108                                                     |
| PRKE170A | 170                     | 162.0                            | 179.0 | 1.0                               | 145.0                                     | 5.0                                                            | 2.6                                                        | 234.0                                                               | 0.108                                                     |
| PRKE180  | 180                     | 162.0                            | 198.0 | 1.0                               | 146.0                                     | 5.0                                                            | 2.4                                                        | 258.0                                                               | 0.108                                                     |
| PRKE180A | 180                     | 171.0                            | 189.0 | 1.0                               | 154.0                                     | 5.0                                                            | 2.5                                                        | 246.0                                                               | 0.108                                                     |
| PRKE200  | 200                     | 180.0                            | 220.0 | 1.0                               | 162.0                                     | 5.0                                                            | 2.1                                                        | 287.0                                                               | 0.108                                                     |
| PRKE200A | 200                     | 190.0                            | 210.0 | 1.0                               | 171.0                                     | 5.0                                                            | 2.2                                                        | 274.0                                                               | 0.108                                                     |
| PRKE220  | 220                     | 198.0                            | 242.0 | 1.0                               | 175.0                                     | 5.0                                                            | 1.8                                                        | 344.0                                                               | 0.108                                                     |
| PRKE220A | 220                     | 209.0                            | 231.0 | 1.0                               | 185.0                                     | 5.0                                                            | 1.9                                                        | 328.0                                                               | 0.108                                                     |
| PRKE250  | 250                     | 225.0                            | 275.0 | 1.0                               | 202.0                                     | 5.0                                                            | 1.7                                                        | 360.0                                                               | 0.110                                                     |
| PRKE250A | 250                     | 237.0                            | 263.0 | 1.0                               | 214.0                                     | 5.0                                                            | 1.8                                                        | 344.0                                                               | 0.110                                                     |
| PRKE300  | 300                     | 270.0                            | 330.0 | 1.0                               | 243.0                                     | 5.0                                                            | 1.4                                                        | 430.0                                                               | 0.110                                                     |
| PRKE300A | 300                     | 285.0                            | 315.0 | 1.0                               | 256.0                                     | 5.0                                                            | 1.5                                                        | 414.0                                                               | 0.110                                                     |
| PRKE350  | 350                     | 315.0                            | 385.0 | 1.0                               | 284.0                                     | 5.0                                                            | 1.2                                                        | 504.0                                                               | 0.110                                                     |
| PRKE350A | 350                     | 332.0                            | 368.0 | 1.0                               | 300.0                                     | 5.0                                                            | 1.3                                                        | 482.0                                                               | 0.110                                                     |
| PRKE400  | 400                     | 360.0                            | 440.0 | 1.0                               | 324.0                                     | 5.0                                                            | 1.05                                                       | 574.0                                                               | 0.110                                                     |
| PRKE400A | 400                     | 380.0                            | 420.0 | 1.0                               | 342.0                                     | 5.0                                                            | 1.1                                                        | 548.0                                                               | 0.110                                                     |
| PRKE440  | 440                     | 396.0                            | 484.0 | 1.0                               | 356.0                                     | 5.0                                                            | 0.99                                                       | 631.0                                                               | 0.110                                                     |
| PRKE440A | 440                     | 418.0                            | 462.0 | 1.0                               | 376.0                                     | 5.0                                                            | 1.04                                                       | 600.0                                                               | 0.110                                                     |

Notes:

1. V<sub>BR</sub> measured after I<sub>T</sub> applied for 300us, I<sub>T</sub>=square wave pulse or equivalent.
2. Surge current waveform per Figure 3 and derate per Figure 2.
3. For bipolar types having V<sub>WM</sub> of 10 volts and under, the I<sub>D</sub> limit is doubled.
4. All terms and symbols are consistent with ANSI/IEEE C62.35.

## TVS APPLICATION NOTES:

Transient Voltage Suppressors may be used at various points in a circuit to provide various degrees of protection. The following is a typical linear power supply with transient voltage suppressor units placed at different points. All provide protection of the load.

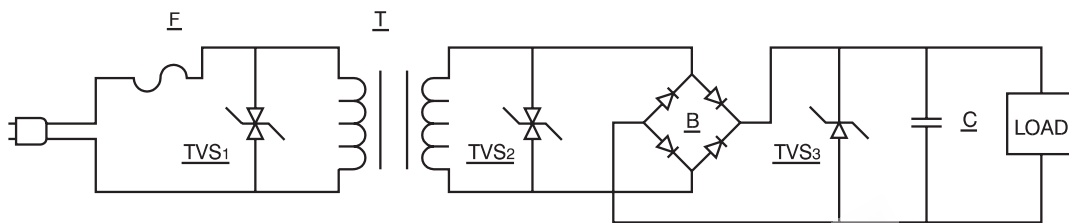


FIGURE 1

Transient Voltage Suppressors 1 provides maximum protection. However, the system will probably require replacement of the line fuse(F) since it provides a dominant portion of the series impedance when a surge is encountered.

However, we do not recommend to use the TVS diode here, unless we can know the electric circuit impedance and the magnitude of surge rushed into the circuit. Otherwise the TVS diode is easy to be destroyed by voltage surge.

Transient Voltage Suppressor 2 provides excellent protection of circuitry excluding the transformer(T). However, since the transformer is a large part of the series impedance, the chance of the line fuse opening during the surge condition is reduced.

Transient Voltage Suppressor 3 provides the load with complete protection. It uses a unidirectional Transient Voltage Suppressor, which is a cost advantage. The series impedance now includes the line fuse, transformer, and bridge rectifier(B) so failure of the line fuse is further reduced. If only Transient Voltage Suppressor 3 is in use, then the bridge rectifier is unprotected and would require a higher voltage and current rating to prevent failure by transients.

Any combination of these three, or any one of these applications, will prevent damage to the load. This would require varying trade-offs in power supply protection versus maintenance(changing the time fuse).

An additional method is to utilize the Transient Voltage Suppressor units as a controlled avalanche bridge. This reduces the parts count and incorporates the protection within the bridge rectifier.

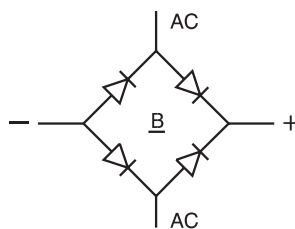


FIGURE 2