

6792335 ONEIDA ELECTRONIC MFG INC

58C 00300 DT-11-25

#4



Oneida

## Z-MOV Transient Voltage Suppressors

Data Sheet No. O-101



File # E71220

Zenamic®

## Z7, Z10, Z15, Z21, &amp; Z33 SERIES



Oneida

## Description/Features

Z-MOV Zenamic Metal Oxide Varistors are Transient Voltage Suppressors having a non-linear current-voltage characteristic which sustains an almost constant voltage over a wide range of current. They are ideally suited to all transient voltage protection applications and their high clamping efficiency and low steady state power dissipation offer considerable circuit advantages over most existing methods of protection.

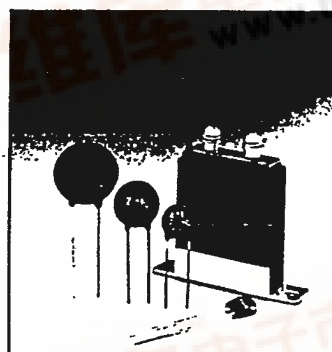
During operation, the Zenamic idles at a low current level at the nominal voltage. When a transient over voltage occurs, Zenamic current increases rapidly, its voltage remaining virtually constant, and the transient energy content is thus absorbed.

## FEATURES

- High surge current capability
- Excellent voltage clamping characteristic
- Symmetrical characteristic — use on AC or DC
- Instantaneous response
- Compact and robust
- Low idling current

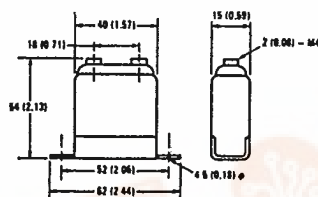
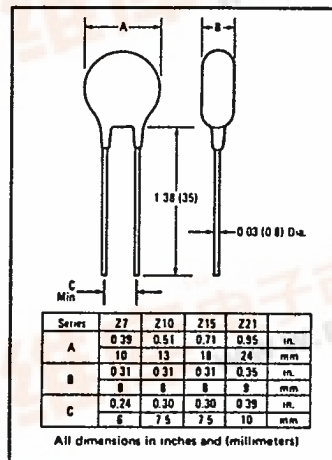
## APPLICATIONS

- Protection of all types of semiconductors
- Absorption of surges associated with lightning
- Suppression of switching surges
- Protection in inductive switching circuits
- Prolongation of contact life
- Voltage clipping



## Major Ratings and Characteristics

|                                         |    | Z7         | Z10    | Z15    | Z21    | Z33     | Units |
|-----------------------------------------|----|------------|--------|--------|--------|---------|-------|
| Voltage Range                           | AC | 12-600     | 17-600 | 20-600 | 25-600 | 130-600 | V     |
|                                         | DC | 15-810     | 23-810 | 27-810 | 33-810 | 170-810 | V     |
| Energy                                  |    | 3-24       | 18-60  | 30-90  | 33-80  | 150-300 | J     |
| Operating and Storage Temperature Range |    | -20 to 110 |        |        |        |         | °C    |

Z33  
Outer dimensions of M type

Z7, Z10, Z15, Z21 AND Z33 SERIES — Z-MOV TRANSIENT VOLTAGE SUPPRESSORS —

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**ZENAMIC SELECTION PROCEDURE:**

- 1) Choose the AC or DC voltage rating, from columns 2 or 3 to be equal or marginally greater than the maximum steady state circuit value.
- 2) Calculate or estimate the maximum transient energy possible in the circuit. For example, a transient produced by switching a transformer will have an energy content of  $\frac{1}{2}LI^2$ , where L is the transformer leakage inductance and I is the peak current flowing through the winding.
- 3) Ensure that  $I_{peak}$ , from column 6, will not be exceeded for the selected zenamic.
- 4) The chosen zenamic can now be assessed from fig. 3 for its voltage clamping characteristic at a specified current.

**ELECTRICAL CHARACTERISTICS**

| Part Number | Applied Voltage   |        | Max. Operating Conditions        |                                                |                                                                               | Peak Voltage (Clamping) @ 1 mA ( $V_1$ ) |          | Clamping Ratio $\pm 20\%$ | Capacitance Reference Value (pF) |
|-------------|-------------------|--------|----------------------------------|------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------|----------|---------------------------|----------------------------------|
|             | AC (RMS) Max. (V) | DC (V) | PAV (W) $\text{\textcircled{1}}$ | Energy Joules @ 10 ms $\text{\textcircled{1}}$ | $I_{peak}$ Surge Current Capacity 8 x 20 $\mu\text{sec.}$ (A) (nonrepetitive) | Min. (V)                                 | Max. (V) |                           |                                  |
| 027L220     | 12                | 15     | 0.03                             | 3                                              | 200                                                                           | 19                                       | 25       | 2.20                      | 4200                             |
| 027L270     | 14                | 19     | 0.03                             | 3                                              | 200                                                                           | 23                                       | 31       | 2.20                      | 3300                             |
| 027L330     | 17                | 23     | 0.03                             | 3                                              | 200                                                                           | 28                                       | 38       | 2.20                      | 2700                             |
| 027L390     | 20                | 27     | 0.03                             | 6                                              | 200                                                                           | 33                                       | 45       | 2.20                      | 2200                             |
| 027L470     | 25                | 33     | 0.03                             | 3                                              | 200                                                                           | 39                                       | 54       | 1.83                      | 1400                             |
| 027L560     | 30                | 40     | 0.03                             | 3                                              | 200                                                                           | 47                                       | 64       | 1.83                      | 1100                             |
| 027L680     | 36                | 48     | 0.03                             | 3                                              | 200                                                                           | 57                                       | 78       | 1.83                      | 870                              |
| 027L820     | 44                | 58     | 0.03                             | 6                                              | 200                                                                           | 69                                       | 94       | 1.83                      | 700                              |
| 027L101     | 54                | 72     | 0.03                             | 6                                              | 200                                                                           | 85                                       | 115      | 1.83                      | 520                              |
| 027L121     | 65                | 72     | 0.03                             | 6                                              | 200                                                                           | 102                                      | 138      | 1.83                      | 420                              |
| 027L151     | 90                | 120    | 0.2                              | 3                                              | 500                                                                           | 135                                      | 165      | 2.00                      | 410                              |
| 027L181     | 110               | 140    | 0.2                              | 6                                              | 500                                                                           | 162                                      | 198      | 2.00                      | 350                              |
| 027L201     | 120               | 160    | 0.2                              | 6                                              | 500                                                                           | 180                                      | 220      | 1.83                      | 320                              |
| 027L221     | 130               | 170    | 0.2                              | 6                                              | 500                                                                           | 198                                      | 242      | 1.83                      | 300                              |
| 027L271     | 160               | 210    | 0.2                              | 6                                              | 500                                                                           | 243                                      | 297      | 1.83                      | 250                              |
| 027L331     | 200               | 260    | 0.2                              | 6                                              | 500                                                                           | 297                                      | 363      | 1.83                      | 210                              |
| 027L391     | 230               | 310    | 0.2                              | 12                                             | 500                                                                           | 351                                      | 429      | 1.83                      | 180                              |
| 027L441     | 260               | 350    | 0.2                              | 12                                             | 500                                                                           | 396                                      | 484      | 1.83                      | 160                              |
| 027L471     | 280               | 380    | 0.2                              | 12                                             | 500                                                                           | 423                                      | 517      | 1.83                      | 150                              |
| 027L561     | 340               | 450    | 0.2                              | 12                                             | 500                                                                           | 504                                      | 616      | 1.83                      | 140                              |
| 027L681     | 410               | 550    | 0.2                              | 12                                             | 500                                                                           | 612                                      | 748      | 1.83                      | 110                              |
| 027L821     | 490               | 660    | 0.2                              | 24                                             | 500                                                                           | 738                                      | 902      | 1.75                      | 96                               |
| 027L102     | 600               | 810    | 0.2                              | 24                                             | 500                                                                           | 900                                      | 1100     | 1.75                      | 86                               |
| 0210L330    | 17                | 23     | 0.06                             | 18                                             | 500                                                                           | 28                                       | 38       | 2.20                      | 4600                             |
| 0210L390    | 20                | 27     | 0.06                             | 24                                             | 500                                                                           | 33                                       | 45       | 2.20                      | 3800                             |
| 0210L470    | 25                | 33     | 0.06                             | 18                                             | 500                                                                           | 39                                       | 54       | 1.83                      | 2400                             |
| 0210L560    | 30                | 40     | 0.06                             | 18                                             | 500                                                                           | 47                                       | 64       | 1.83                      | 1900                             |
| 0210L680    | 36                | 48     | 0.06                             | 18                                             | 500                                                                           | 57                                       | 78       | 1.83                      | 1500                             |
| 0210L820    | 44                | 58     | 0.06                             | 24                                             | 500                                                                           | 69                                       | 94       | 1.83                      | 1200                             |
| 0210L101    | 54                | 72     | 0.06                             | 24                                             | 500                                                                           | 85                                       | 115      | 1.83                      | 900                              |
| 0210L121    | 65                | 86     | 0.06                             | 24                                             | 500                                                                           | 102                                      | 138      | 1.83                      | 720                              |
| 0210L151    | 90                | 120    | 0.4                              | 18                                             | 1000                                                                          | 135                                      | 165      | 1.83                      | 700                              |
| 0210L181    | 110               | 140    | 0.4                              | 24                                             | 1000                                                                          | 162                                      | 198      | 1.83                      | 600                              |
| 0210L201    | 120               | 160    | 0.4                              | 24                                             | 1000                                                                          | 180                                      | 220      | 1.75                      | 550                              |
| 0210L221    | 130               | 170    | 0.4                              | 30                                             | 1000                                                                          | 198                                      | 242      | 1.75                      | 520                              |
| 0210L271    | 160               | 210    | 0.4                              | 30                                             | 1000                                                                          | 243                                      | 297      | 1.75                      | 440                              |
| 0210L331    | 200               | 280    | 0.4                              | 36                                             | 1000                                                                          | 297                                      | 363      | 1.75                      | 370                              |
| 0210L391    | 230               | 310    | 0.4                              | 45                                             | 1000                                                                          | 351                                      | 429      | 1.75                      | 330                              |
| 0210L441    | 260               | 350    | 0.4                              | 45                                             | 1000                                                                          | 396                                      | 484      | 1.75                      | 310                              |
| 0210L471    | 280               | 380    | 0.4                              | 45                                             | 1000                                                                          | 423                                      | 517      | 1.75                      | 280                              |
| 0210L561    | 340               | 450    | 0.4                              | 45                                             | 1000                                                                          | 504                                      | 616      | 1.75                      | 250                              |
| 0210L681    | 410               | 550    | 0.4                              | 45                                             | 1000                                                                          | 612                                      | 748      | 1.75                      | 220                              |
| 0210L821    | 490               | 660    | 0.4                              | 60                                             | 1000                                                                          | 738                                      | 902      | 1.65                      | 190                              |
| 0210L102    | 600               | 810    | 0.4                              | 60                                             | 1000                                                                          | 900                                      | 1100     | 1.65                      | 170                              |

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## ELECTRICAL CHARACTERISTICS (Continued)

| Part Number | Applied Voltage   |        | Max. Operating Conditions |                         |                                                                           | Peak Voltage (Clamping) @ 1 mA (V <sub>I</sub> ) |          | ① Clamping Ratio ±20% | Capacitance Reference Value (pF) |
|-------------|-------------------|--------|---------------------------|-------------------------|---------------------------------------------------------------------------|--------------------------------------------------|----------|-----------------------|----------------------------------|
|             | AC (RMS) Max. (V) | DC (V) | PAV (W) ①                 | Energy Joules @ 10 ms ① | I <sub>peak</sub> Surge Current Capacity 8 x 20 μsec. (A) (nonrepetitive) | Min. (V)                                         | Max. (V) |                       |                                  |
| OZ15L390    | 20                | 27     | 0.1                       | 30                      | 1000                                                                      | 33                                               | 45       | 2.20                  | 8000                             |
| OZ15L470    | 25                | 33     | 0.1                       | 24                      | 1000                                                                      | 39                                               | 54       | 1.83                  | 5000                             |
| OZ15L560    | 30                | 40     | 0.1                       | 24                      | 1000                                                                      | 47                                               | 64       | 1.83                  | 4000                             |
| OZ15L680    | 38                | 48     | 0.1                       | 24                      | 1000                                                                      | 57                                               | 78       | 1.83                  | 3100                             |
| OZ15L820    | 44                | 58     | 0.1                       | 30                      | 1000                                                                      | 69                                               | 94       | 1.83                  | 2500                             |
| OZ15L101    | 54                | 72     | 0.1                       | 30                      | 1000                                                                      | 85                                               | 115      | 1.83                  | 1900                             |
| OZ15L121    | 65                | 86     | 0.1                       | 36                      | 1000                                                                      | 102                                              | 138      | 1.83                  | 1500                             |
| OZ15L151    | 90                | 120    | 0.6                       | 30                      | 2000                                                                      | 135                                              | 165      | 1.83                  | 1600                             |
| OZ15L181    | 110               | 140    | 0.6                       | 36                      | 2000                                                                      | 162                                              | 198      | 1.75                  | 1400                             |
| OZ15L201    | 120               | 160    | 0.6                       | 36                      | 2000                                                                      | 180                                              | 220      | 1.67                  | 1200                             |
| OZ15L221    | 130               | 170    | 0.6                       | 45                      | 2000                                                                      | 198                                              | 242      | 1.67                  | 1100                             |
| OZ15L271    | 160               | 210    | 0.6                       | 45                      | 2000                                                                      | 243                                              | 297      | 1.67                  | 970                              |
| OZ15L331    | 200               | 260    | 0.6                       | 51                      | 2000                                                                      | 297                                              | 363      | 1.67                  | 820                              |
| OZ15L391    | 230               | 310    | 0.6                       | 60                      | 2000                                                                      | 351                                              | 429      | 1.67                  | 700                              |
| OZ15L411    | 250               | 330    | 0.6                       | 60                      | 2000                                                                      | 373                                              | 456      | 1.67                  | 680                              |
| OZ15L441    | 260               | 350    | 0.6                       | 60                      | 2000                                                                      | 396                                              | 484      | 1.67                  | 640                              |
| OZ15L471    | 280               | 380    | 0.6                       | 60                      | 2000                                                                      | 423                                              | 517      | 1.67                  | 600                              |
| OZ15L561    | 340               | 450    | 0.6                       | 60                      | 2000                                                                      | 504                                              | 616      | 1.67                  | 520                              |
| OZ15L681    | 410               | 550    | 0.6                       | 75                      | 2000                                                                      | 612                                              | 748      | 1.67                  | 440                              |
| OZ15L751    | 450               | 610    | 0.6                       | 75                      | 2000                                                                      | 675                                              | 825      | 1.67                  | 400                              |
| OZ15L821    | 490               | 660    | 0.6                       | 90                      | 2000                                                                      | 738                                              | 902      | 1.58                  | 380                              |
| OZ15L102    | 600               | 810    | 0.6                       | 90                      | 2000                                                                      | 900                                              | 1100     | 1.58                  | 330                              |
| OZ21L470    | 25                | 33     | 0.15                      | 33                      | 2000                                                                      | 39                                               | 54       | 1.80                  | 7800                             |
| OZ21L560    | 30                | 40     | 0.15                      | 33                      | 2000                                                                      | 47                                               | 64       | 1.80                  | 6200                             |
| OZ21L680    | 36                | 48     | 0.15                      | 39                      | 2000                                                                      | 57                                               | 78       | 1.80                  | 5000                             |
| OZ21L820    | 44                | 58     | 0.15                      | 45                      | 2000                                                                      | 69                                               | 94       | 1.80                  | 4000                             |
| OZ21L101    | 54                | 72     | 0.15                      | 45                      | 2000                                                                      | 85                                               | 115      | 1.80                  | 3000                             |
| OZ21L121    | 65                | 86     | 0.15                      | 45                      | 2000                                                                      | 102                                              | 138      | 1.80                  | 2300                             |
| OZ21L151    | 90                | 120    | 0.8                       | 45                      | 4000                                                                      | 135                                              | 165      | 1.67                  | 2300                             |
| OZ21L181    | 110               | 140    | 0.8                       | 54                      | 4000                                                                      | 162                                              | 198      | 1.58                  | 2000                             |
| OZ21L201    | 120               | 160    | 0.8                       | 54                      | 4000                                                                      | 180                                              | 220      | 1.58                  | 1800                             |
| OZ21L221    | 130               | 170    | 0.8                       | 66                      | 4000                                                                      | 198                                              | 242      | 1.58                  | 1700                             |
| OZ21L271    | 160               | 210    | 0.8                       | 66                      | 4000                                                                      | 243                                              | 297      | 1.58                  | 1400                             |
| OZ21L331    | 200               | 260    | 0.8                       | 75                      | 4000                                                                      | 297                                              | 363      | 1.58                  | 1200                             |
| OZ21L391    | 230               | 310    | 0.8                       | 90                      | 4000                                                                      | 351                                              | 429      | 1.58                  | 1050                             |
| OZ21L441    | 260               | 350    | 0.9                       | 90                      | 4000                                                                      | 396                                              | 484      | 1.58                  | 950                              |
| OZ21L471    | 280               | 380    | 0.8                       | 90                      | 4000                                                                      | 423                                              | 517      | 1.58                  | 900                              |
| OZ21L561    | 340               | 450    | 0.8                       | 70                      | 4000                                                                      | 504                                              | 616      | 1.58                  | 800                              |
| OZ21L681    | 410               | 550    | 0.8                       | 70                      | 4000                                                                      | 612                                              | 748      | 1.58                  | 680                              |
| OZ21L821    | 490               | 660    | 0.8                       | 70                      | 4000                                                                      | 738                                              | 902      | 1.58                  | 580                              |
| OZ21L102    | 600               | 810    | 0.8                       | 80                      | 4000                                                                      | 900                                              | 1100     | 1.58                  | 500                              |
| OZ33M221    | 130               | 170    | 2.4                       | 150                     | 20000                                                                     | 198                                              | 242      | 1.58                  | 5000                             |
| OZ33M271    | 160               | 210    | 2.4                       | 150                     | 20000                                                                     | 243                                              | 297      | 1.58                  | 4000                             |
| OZ33M331    | 200               | 260    | 2.4                       | 180                     | 20000                                                                     | 297                                              | 363      | 1.58                  | 3200                             |
| OZ33M391    | 230               | 310    | 2.4                       | 225                     | 20000                                                                     | 357                                              | 429      | 1.58                  | 2700                             |
| OZ33M441    | 260               | 350    | 2.4                       | 225                     | 20000                                                                     | 396                                              | 484      | 1.58                  | 2400                             |
| OZ33M471    | 280               | 380    | 2.4                       | 225                     | 20000                                                                     | 423                                              | 517      | 1.58                  | 2200                             |
| OZ33M561    | 340               | 450    | 2.4                       | 255                     | 20000                                                                     | 504                                              | 616      | 1.58                  | 1800                             |
| OZ33M681    | 410               | 550    | 2.4                       | 255                     | 20000                                                                     | 612                                              | 748      | 1.58                  | 1500                             |
| OZ33M821    | 490               | 660    | 2.4                       | 300                     | 20000                                                                     | 738                                              | 902      | 1.50                  | 1200                             |
| OZ33M102    | 600               | 810    | 2.4                       | 300                     | 20000                                                                     | 900                                              | 1100     | 1.50                  | 1000                             |

① Derating above 60°C.

① Applied 1000 times.

① Ratio of voltage at specified amps to voltage at 1 mA.

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## Z7, Z10, Z15, Z21 and Z33 Series, Data Sheet No. PD-5.006A

## Reliability Test and Criteria

| Test                                              | Method                                                                                                                                                                                                       |         |         |         |         |         |         |         |     |     |      |      |      |
|---------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|-----|-----|------|------|------|
| 1. I <sub>peak</sub><br>Maximum allowable current | V <sub>1</sub> is measured, the rated current value with the waveform of Figure 2 is applied twice in the same direction at a 2 min. interval. V <sub>1</sub> is measured 30 min. later.                     |         |         |         |         |         |         |         |     |     |      |      |      |
| 2. Surge life expectancy                          | V <sub>1</sub> is measured, the tabulated current with the waveform of Figure 2 is applied 10,000 times in the same direction. V <sub>1</sub> is measured 30 min. later.                                     |         |         |         |         |         |         |         |     |     |      |      |      |
|                                                   | <table><tr><th>Type</th><th>Z7 ...</th><th>Z10 ...</th><th>Z15 ...</th><th>Z21 ...</th><th>Z33 ...</th></tr><tr><th>I(peak)</th><td>25A</td><td>50A</td><td>100A</td><td>200A</td><td>600A</td></tr></table> | Type    | Z7 ...  | Z10 ... | Z15 ... | Z21 ... | Z33 ... | I(peak) | 25A | 50A | 100A | 200A | 600A |
| Type                                              | Z7 ...                                                                                                                                                                                                       | Z10 ... | Z15 ... | Z21 ... | Z33 ... |         |         |         |     |     |      |      |      |
| I(peak)                                           | 25A                                                                                                                                                                                                          | 50A     | 100A    | 200A    | 600A    |         |         |         |     |     |      |      |      |
| 3. Maximum storage temperature                    | Measure V <sub>1</sub> at T = 25°C. Store the device at 110°C for 1000 hr., allow to cool to T = 25°C, measure V <sub>1</sub> 30 min. later.                                                                 |         |         |         |         |         |         |         |     |     |      |      |      |
| 4. Humidity tolerance                             | Measure V <sub>1</sub> at T = 25°C. Store the device at 40°C in a 90-95% relative humidity and apply the rated AC voltage for 1000 hr. Allow to cool to T = 25°C, measure V <sub>1</sub> 30 min. later.      |         |         |         |         |         |         |         |     |     |      |      |      |
| 5. Temperature cycling                            | Measure V <sub>1</sub> at T = 25°C. Perform 5 cycles of T = -25°C for t = 30 min.; T = 25°C for t = 15 min.; T = 85°C for t = 30 min.; T = 25°C for t = 15 min. Measure V <sub>1</sub> .                     |         |         |         |         |         |         |         |     |     |      |      |      |
| 6. Boiling water                                  | Measure V <sub>1</sub> at T = 25°C. Perform 6 cycles of immerse in boiling water for t = 8 hr., leave under ambient conditions for t = 16 hr. Measure V <sub>1</sub> .                                       |         |         |         |         |         |         |         |     |     |      |      |      |

The criteria for all these tests is that the change of V<sub>1</sub> is to be less than 10%, and additionally for test 5, that the outside surface appearance should not be affected.

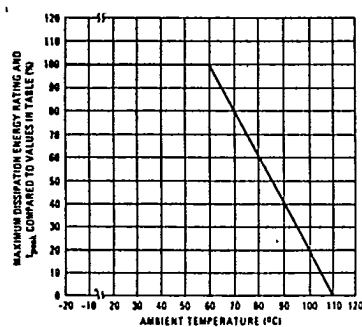


Fig. 1 - Energy Dissipation Rating Vs. Ambient Temperature

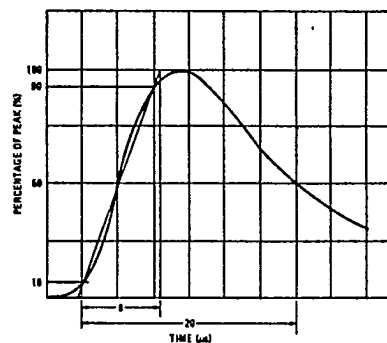


Fig. 2 - Test Current Waveform

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## Z7, Z10, Z15, Z21 and Z33 Series, Data Sheet No. PD-5.006A

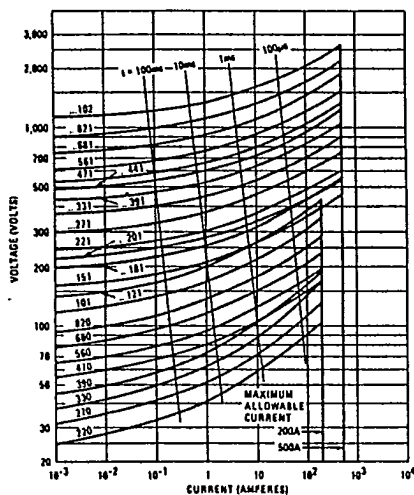


Fig. 3 - Voltage Vs. Current Characteristics, Z7L Series

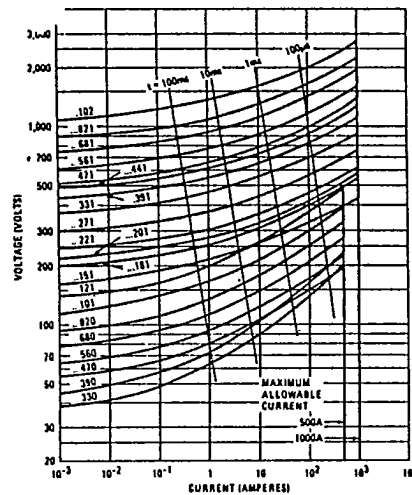


Fig. 4 - Voltage Vs. Current Characteristics, Z10L Series

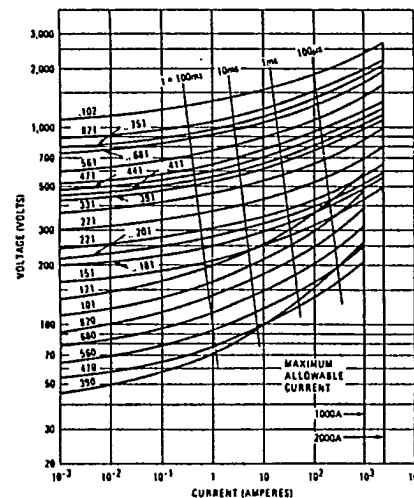


Fig. 5 - Voltage Vs. Current Characteristics, Z15L Series

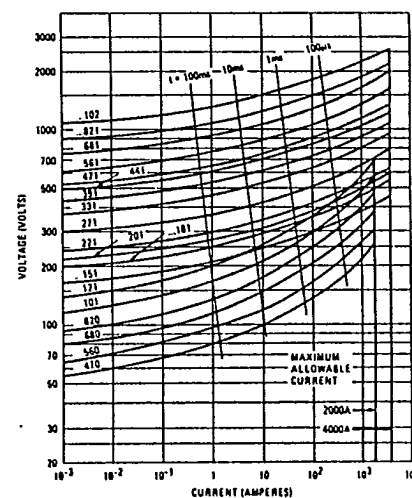


Fig. 6 - Voltage Vs. Current Characteristics, Z21L Series

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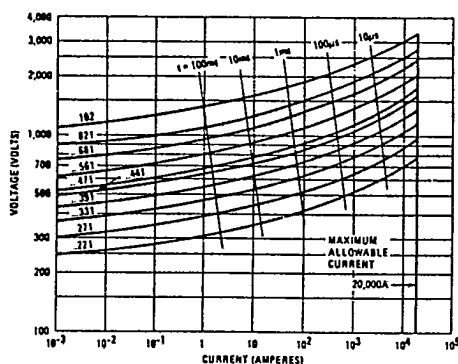


Fig. 7 - Voltage Vs. Current Characteristics, Z33L Series

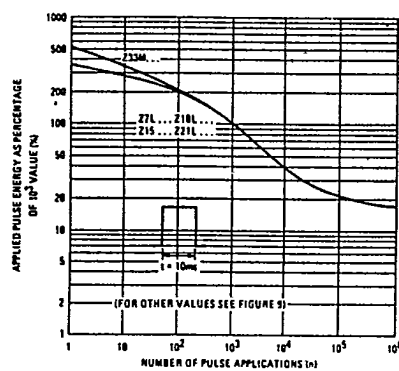


Fig. 8 - Life Expectancy Vs. Applied Pulse Energy

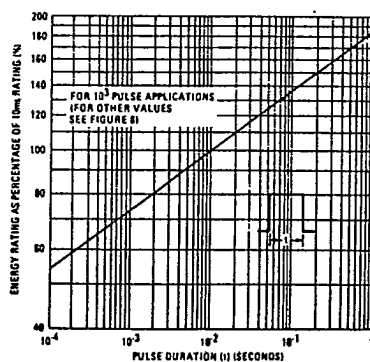


Fig. 9 - Energy Dissipation Rating Vs. Pulse Duration



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