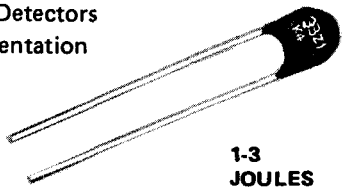
ZA SERIES

APPLICATIONS

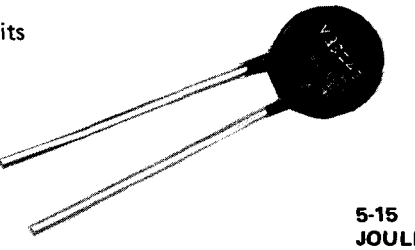
- Solid State Motor Control
- Solid State Relays/Timers
- AC Line Cord Protection
- Control Arc Suppression
- Traffic Controllers
- Communication Equipment
- Automobiles
- Calculators
- Smoke Detectors
- Instrumentation



1-3 JOULES

REPLACEMENT FOR the following when used as transient suppressor:

- Selenium Tryectors
- Zener Diodes
- Silicon Carbide
- Gas Discharge Tubes
- R-C Networks (non-dv/dt)
- Neon Bulbs
- Electronic Crowbar Circuits



5-15 JOULES

Replaces Many Zeners • Voltages 12-115 VRMS, 16-153 VDC • Energy Absorption to 15 Joules • Peak Pulse Current to 1000A • Characterized @ 1mA DC • For Complete Specifications, see *Page No. 1438.*

MODEL NUMBER	MAXIMUM APPLIED VOLTAGE			MAXIMUM ENERGY JOULES	MAXIMUM NON-REPETITIVE PEAK PULSE CURRENT $t_p \leq 6\ \mu S$	MAXIMUM AVERAGE POWER DISSIPATION	MAXIMUM VARISTOR VOLTAGE AT 1 AMP/ PEAK
	AC-RMS	AC-PEAK 50-60Hz	DC				
	VOLTS	VOLTS	VOLTS	(WATT-SECS)	AMPS	WATTS	VOLTS
V18ZA1	10	14	14	0.5	250	0.18	35
V18ZA3				3.0	1000	0.40	32
V22ZA1	12	17	16	0.6	250	0.17	46
V22ZA3				3.0	1000	0.40	43
V24ZA1	15	21	19	0.8	250	0.18	46
V24ZA4				4.0	1000	0.40	43
V27ZA1	15	21	20	0.8	250	0.18	54
V27ZA4				4.0	1000	0.40	52
V33ZA1	20	28	26	1.0	250	0.19	60
V33ZA5				5.0	1000	0.40	58
V39ZA1	25	35	31	1.2	250	0.20	70
V39ZA6				6.0	1000	0.45	65
V47ZA1	30	42	38	1.4	250	0.21	82
V47ZA7				7.0	1000	0.45	76
V56ZA2	35	49	45	1.7	250	0.22	86
V56ZA8				8.0	1000	0.45	91
V68ZA2	40	57	56	2.0	250	0.24	112
V68ZA10				10.0	1000	0.50	108
V82ZA2	50	71	66	2.5	250	0.25	135
V82ZA12				12.0	1000	0.50	130
V100ZA3	60	85	81	3.0	250	0.26	160
V100ZA15				15.0	1000	0.55	154
V120ZA1	75	106	102	1.0	500	0.20	200
V120ZA6	75	106	102	6.0	2000	0.45	190
V150ZA1	95	134	127	1.2	500	0.20	245
V150ZA8	95	134	127	8.0	2000	0.45	240
V180ZA1	115	163	153	1.5	500	0.20	285
V180ZA10	115	163	153	10.0	2000	0.45	290

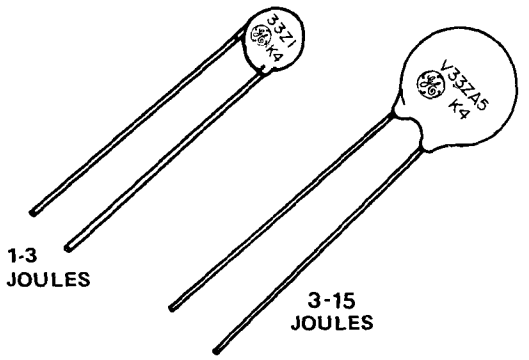
GE-MOV®

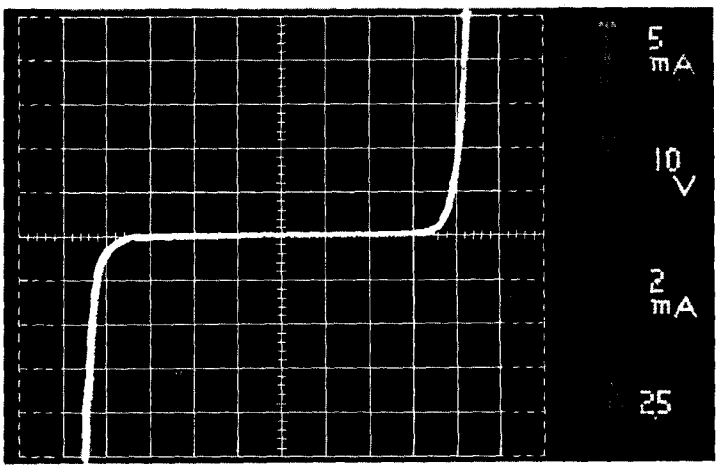
Metal Oxide Varistors

18-180 VOLTS D.C. NOMINAL VARISTOR VOLTAGE
RATINGS OF 14-153 VOLTS D.C., 20-115 VOLTS RMS, 1-15 JOULES

SERIES ZA

Description:
GE-MOV® zinc oxide varistors are voltage dependent, symmetrical resistors which perform in a manner similar to back-to-back zener diodes in circuit protective functions and offer advantages in performance and economics. The ZA series is characterized at the 1mADC varistor voltage following ±10% EIA values as are zener diodes and other varistors used as transient suppressors. When exposed to high energy voltage transients, the varistor impedance changes from a very high standby value to a very low conducting value thus clamping the transient voltage to a safe level. The dangerous energy of the incoming high voltage pulse is absorbed by the GE-MOV® varistor, thus protecting your voltage sensitive circuit components.





I-V Oscillograph
(Actual Photo)

Replacement For:
- Zener Diodes
- Silicon Carbide
- Selenium Thyrectors
- R-C Networks (non dv/dt)

Features:
- Low Voltage Design
- Excellent Clamping
- High Transient Current Capability (2000 Amps)
- Nanosecond Response
- High Energy Capability
- Wide Operating Temperature Range
- Low Temperature Coefficient
- Low Standby Drain
- Compact and Lightweight

Benefits:
- Improves Circuit, Component and System Reliability
- Extends Contact Life
- Reduction of Lightning Effects
- Promotes System Cost Reduction
- Reduces System Size and Weight Requirements
- Increases Product Safety
- No Follow-On Current

Applications:
- Telephone Relays
- Telephone Solid State Circuits
- Communication Equipment
- Relay Coils
- Traffic Controllers
- Computer Equipment
- Railroad Circuitry
- Numerical Control
- Test Equipment
- Instrumentation
- Solid State Motor Control
- Television
- Copier Machines
- Calculators
- Contact Arc Suppression
- Solid State Relays/Timers
- Power Supplies
- Solid State Security Systems
- Medical Equipment
- Fire Alarms

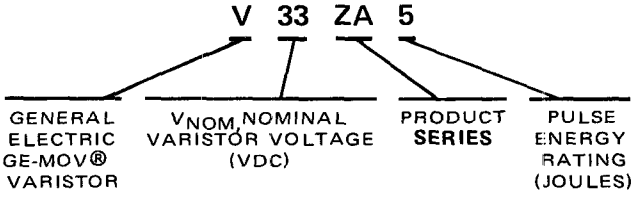
Maximum Electrical Ratings:

Maximum Energy, Power and Peak Current	See Rating Table
Storage Temperature, T_{STG}	-40°C to +125°C
Operating Surface Temperature, T_S	115°C
Operating Ambient Temperature (without derating)	85°C
Maximum Voltage Temperature Coefficient	-0.05%/°C

Mechanical Ratings:

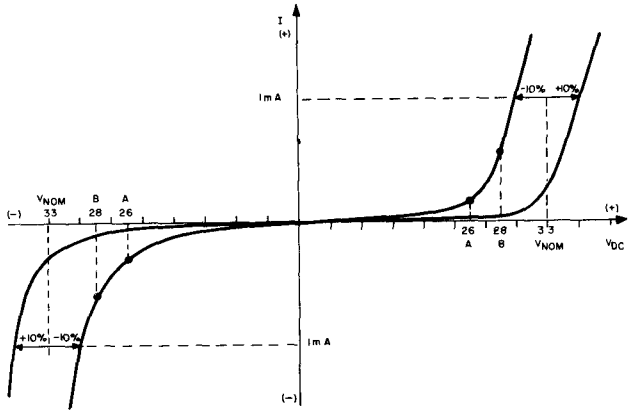
Insulation Resistance–Megohms	> 1000
Hipot Encapsulation–Volts D.C. for 1 Minute	2500
Solderability	Per Mil Std 202C Method 208C

Model Number Nomenclature:



The ZA series GE-MOV ® varistors are characterized at the 1mADC varistor voltage according to RETMA values. For example–V33ZA5: The nominal varistor voltage is 33VDC, ±10%, at 1mADC. The maximum allowable steady state applied voltages, 26VDC and 28VAC (peak) fall below the low side nominal varistor voltage of 29.7VDC (33VDC–10%) to insure the maximum idle power dissipation characteristics are not exceeded.

V33ZA5 Typical V-I Characteristics:



A–Maximum allowable steady state DC applied voltage. *See Ratings Table.*

B–Maximum allowable steady state recurrent peak applied voltage. *See Ratings Table.*

VNOM–Nominal Varistor voltage at 1mADC. *See Characteristics Table.*

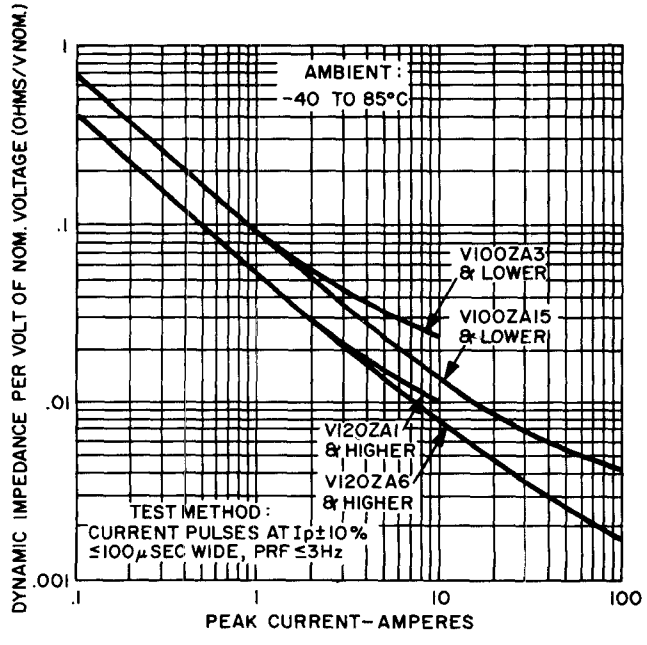


FIGURE 1 TYPICAL CHARACTERISTIC OF DYNAMIC IMPEDANCE VS. PEAK CURRENT

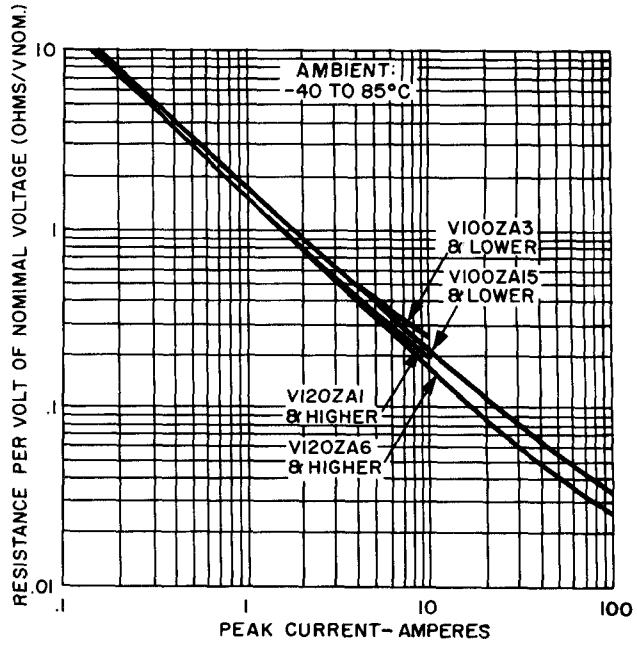


FIGURE 2 MAXIMUM RESISTANCE VS. PEAK CURRENT

SERIES ZA	MAXIMUM RATINGS						CHARACTERISTICS		
	STEADY STATE (1)			TRANSIENT					
MODEL NUMBER	DC APPLIED VOLTAGE (1,2,4)	RMS (2,3,4) APPLIED VOLTAGE 50-60 Hz AC	RECURRENT PEAK APPLIED VOLTAGE (2,3,4)	ENERGY (4)	AVERAGE POWER DISSIPATION (4)	PEAK PULSE CURRENT (6)	V_{NOM} VARISTOR VOLTAGE @ 1.0 mA DC CURRENT (5)		TYPICAL CAPACITANCE
	VOLTS	VOLTS	VOLTS	JOULES (WATT-SECS)	WATTS	AMPS	VOLTS	TOL.	PICOFARADS
V18ZA1	14	10	14	0.5	.18	250	18	± 20%	2500
V18ZA3	14	10	14	3.0	.40	1000	18	± 20%	12000
V22ZA1	18	14	19	0.6	.18	250	22	± 15%	2000
V22ZA3	18	14	19	3.0	.40	1000	22	± 15%	10000
V24ZA1	20	15	21	0.8	.18	250	24	± 10%	1700
V24ZA4	20	15	21	4.0	.40	1000	24	± 10%	8500
V27ZA1	22	17	24	0.8	.18	250	27	± 15%	1700
V27ZA4	22	17	24	4.0	.40	1000	27	± 15%	8500
V33ZA1	26	20	28	1.0	.19	250	33	± 10%	1400
V33ZA5	26	20	28	5.0	.40	1000	33	± 10%	7000
V39ZA1	31	25	35	1.2	.20	250	39	± 10%	1200
V39ZA6	31	25	35	6.0	.45	1000	39	± 10%	6000
V47ZA1	38	30	42	1.4	.21	250	47	± 10%	1000
V47ZA7	38	30	42	7.0	.45	1000	47	± 10%	5000
V56ZA2	45	35	49	1.7	.22	250	56	± 10%	800
V56ZA8	45	35	49	8.0	.45	1000	56	± 10%	4000
V68ZA2	56	40	57	2.0	.24	250	68	± 10%	700
V68ZA10	56	40	57	10.0	.50	1000	68	± 10%	3500
V82ZA2	66	50	71	2.5	.25	250	82	± 10%	600
V82ZA12	66	50	71	12.0	.50	1000	82	± 10%	3000
V100ZA3	81	60	85	3.0	.26	250	100	± 10%	500
V100ZA15	81	60	85	15.0	.55	1000	100	± 10%	2500
V120ZA1	102	75	106	1.0	.20	500	120	± 10%	200
V120ZA6	102	75	106	6.0	.45	2000	120	± 10%	1200
V150ZA1	127	95	134	1.2	.20	500	150	± 10%	170
V150ZA8	127	95	134	8.0	.45	2000	150	± 10%	1000
V180ZA1	153	115	163	1.5	.20	500	180	± 10%	140
V180ZA10	153	115	163	10.0	.45	2000	180	± 10%	800

1. Leakage current @ max DC rated voltage = 20 μA typical 200 μA max.
2. Applied Voltage is that voltage across the varistor terminals when no transient is present. Include high line conditions on selection.
3. For AC applications a sinusoidal Applied Voltage is assumed assumed to be the normal input condition. If Applied Voltage is non-sinusoidal, Recurrent Peak Applied Voltage values should be used to select the correct model.
4. See Figure 11.
5. 1mA DC current pulse, 20 msec min.
6. See Figures 7 thru 10.

MAXIMUM VOLT-AMPERE CHARACTERISTICS

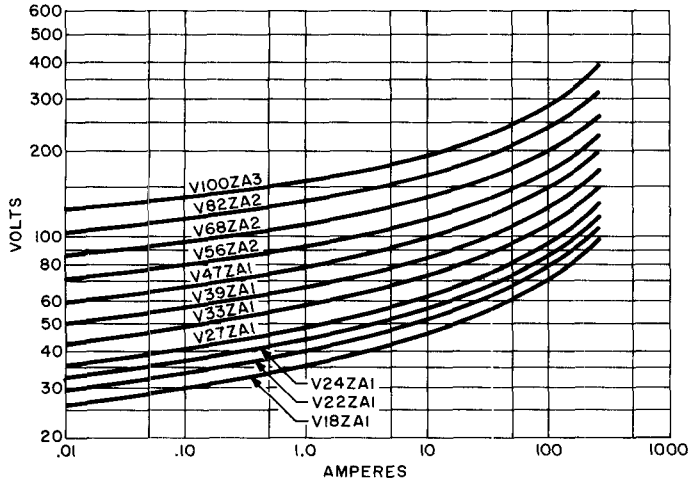


FIGURE 3

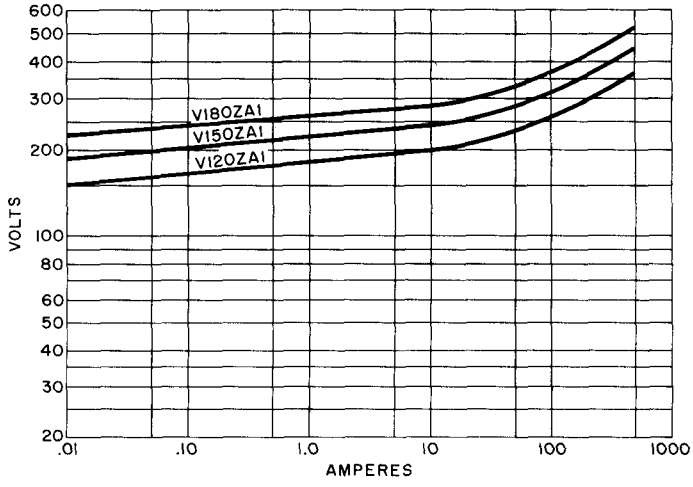


FIGURE 4

MAXIMUM VOLT-AMPERE CHARACTERISTICS

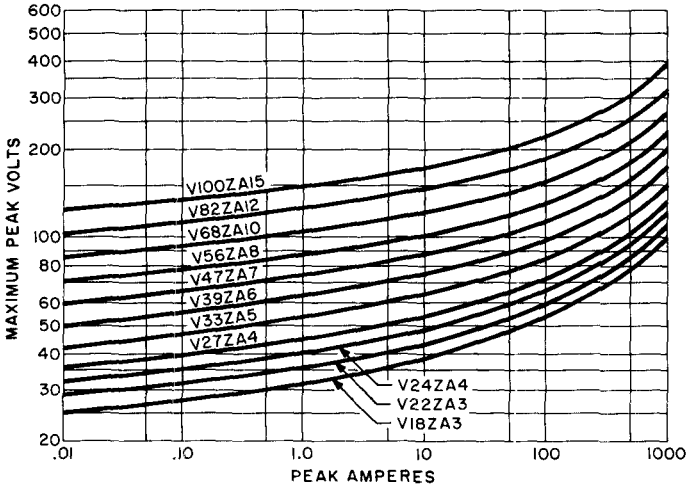


FIGURE 5

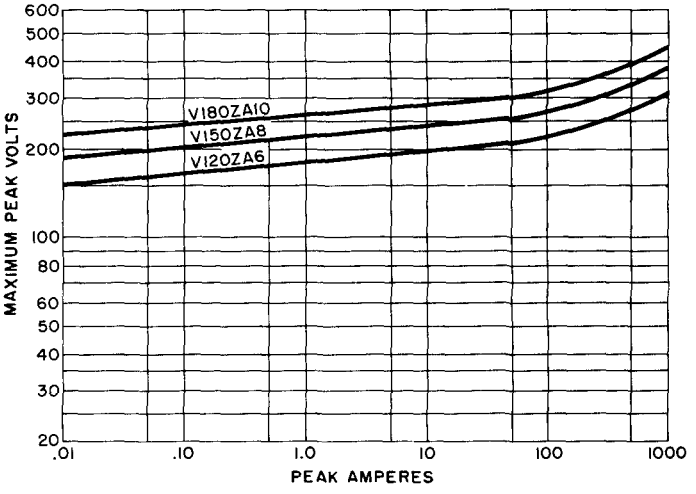


FIGURE 6

PULSE LIFETIME RATINGS

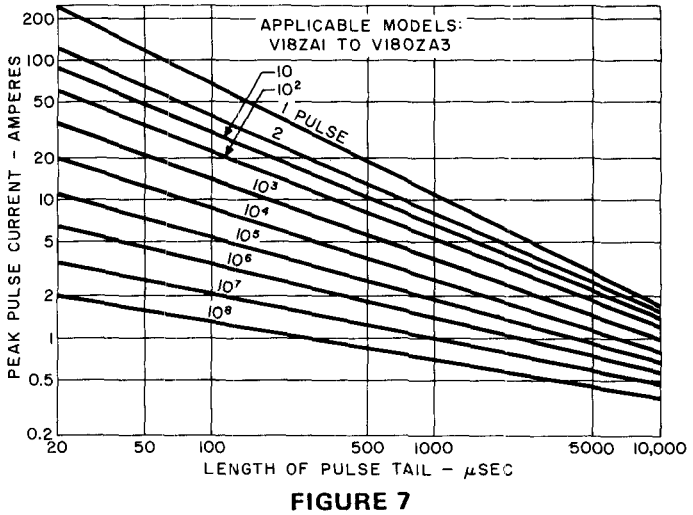


FIGURE 7

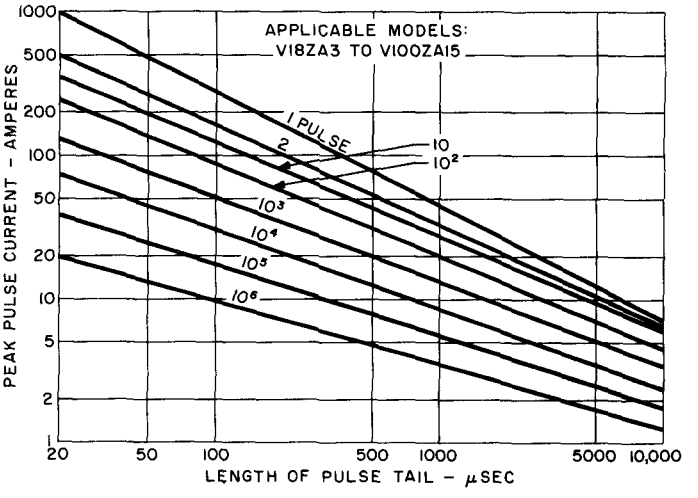


FIGURE 8

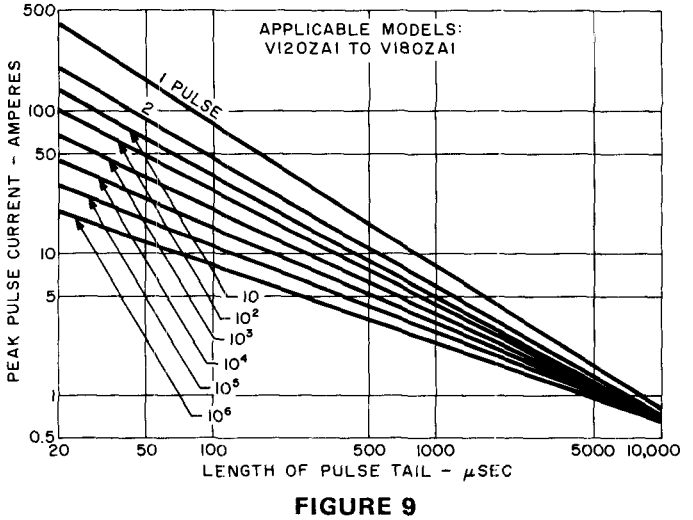


FIGURE 9

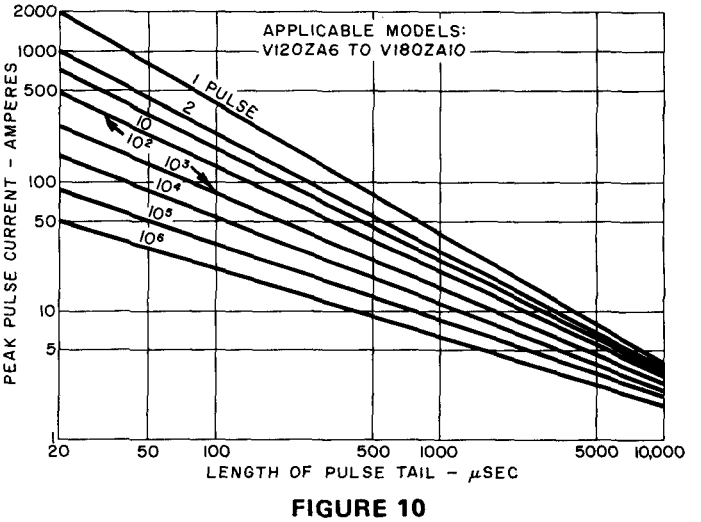
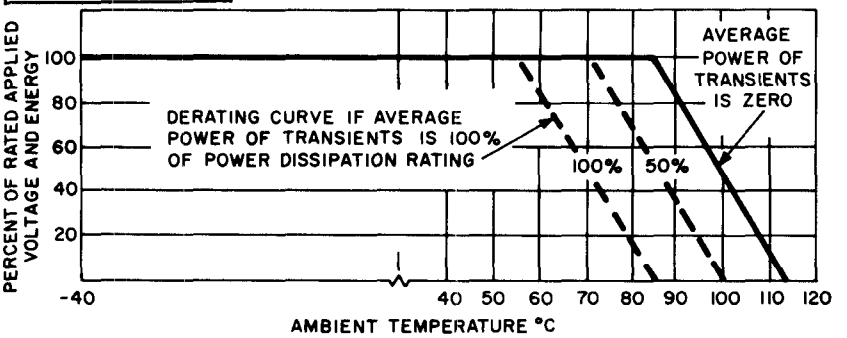


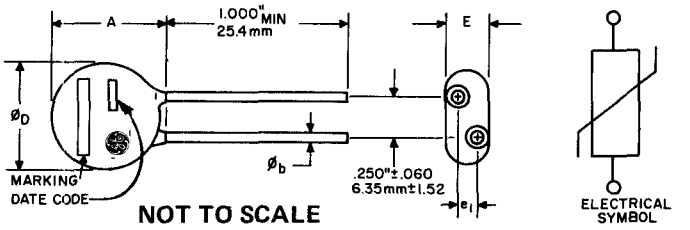
FIGURE 10



The maximum allowable operating ambient temperature without derating is 85°C if the average power of the input transients is zero. This condition is satisfied if the voltage transients are random and non repetitive. Above 85°C the applied voltage and energy ratings both are reduced.

If the voltage transients are repetitive the allowable ambient is reduced according to the level of the average power input. For example, if the average power of the transients is 50% of the dissipation rating the maximum allowable ambient temperature without derating is 70°C. Then, for operation above 70°C the applied voltage and energy ratings are linearly reduced to zero at 100°C.

Figure 11. VOLTAGE AND ENERGY RATINGS VS. AMBIENT TEMPERATURE AND AVERAGE POWER OF INPUT TRANSIENTS



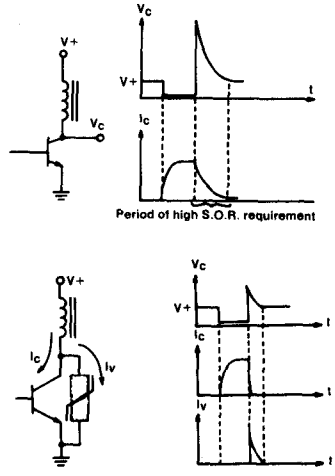
NOT TO SCALE

MODEL NUMBER	MARKING	A		ØD		E		e1				Øb			
		MAX.		MAX.		MAX.		MIN.		MAX.		MIN.		MAX.	
		IN	MM	IN	MM	IN	MM	IN	MM	IN	MM	IN	MM	IN	MM
V18ZA1	18Z1	.461	11.7	.335	8.51	.158	4.0	.038	0.98	.079	2.0	.023	.59	.027	.68
V18ZA3	V18ZA3	.745	16.9	.636	16.15	.173	4.4	.043	1.09	.079	2.0	.030	.77	.034	.86
V22ZA1	22Z1	.461	11.7	.335	8.51	.158	4.0	.038	0.98	.079	2.0	.023	.59	.027	.68
V22ZA3	V22ZA3	.745	16.9	.636	16.15	.173	4.4	.043	1.09	.079	2.0	.030	.77	.034	.86
V24ZA1	24Z1	.461	11.7	.315	8.51	.158	4.0	.038	0.98	.079	2.0	.023	.59	.027	.68
V24ZA4	V24ZA4	.745	18.9	.636	16.15	.173	4.4	.043	1.09	.079	2.0	.030	.77	.034	.86
V27ZA1	27Z1	.461	11.7	.335	8.51	.158	4.0	.038	0.98	.079	2.0	.023	.59	.027	.68
V27ZA4	V27ZA4	.745	18.9	.636	16.15	.197	5.0	.054	1.36	.099	2.5	.030	.77	.034	.86
V33ZA1	33Z1	.461	11.7	.335	8.51	.158	4.0	.038	0.98	.079	2.0	.023	.59	.027	.68
V33ZA5	V33ZA5	.745	18.9	.636	16.15	.197	5.0	.054	1.36	.099	2.5	.030	.77	.034	.86
V39ZA1	39Z1	.461	11.7	.335	8.51	.178	4.5	.048	1.24	.099	2.5	.023	.59	.027	.68
V39ZA6	V39ZA6	.745	18.9	.636	16.15	.197	5.0	.054	1.36	.099	2.5	.030	.77	.034	.86
V47ZA1	47Z1	.461	11.7	.335	8.51	.197	5.0	.059	1.50	.119	3.0	.023	.59	.027	.68
V47ZA7	V47ZA7	.745	18.9	.636	16.15	.212	5.4	.065	1.63	.119	3.0	.030	.77	.034	.86
V56ZA2	56Z2	.461	11.7	.335	8.51	.197	5.0	.059	1.50	.119	3.0	.023	.59	.027	.68
V56ZA8	V56ZA8	.745	18.9	.636	16.15	.237	6.0	.075	1.90	.138	3.5	.030	.77	.024	.68
V68ZA2	68Z2	.461	11.7	.335	8.51	.217	5.5	.068	1.75	.138	3.5	.023	.59	.027	.68
V68ZA10	V68ZA10	.745	18.9	.636	16.15	.251	6.4	.086	2.17	.158	4.0	.030	.77	.034	.86
V82ZA2	82Z2	.461	11.7	.335	8.51	.237	6.0	.079	2.01	.158	4.0	.023	.59	.027	.68
V82ZA12	V82ZA12	.745	18.9	.636	16.15	.275	7.0	.097	2.44	.178	4.5	.030	.77	.034	.86
V100ZA3	100Z	.461	11.7	.335	8.51	.256	6.5	.089	2.27	.178	4.5	.023	.59	.027	.68
V100ZA15	V100ZA15	.745	18.9	.636	16.15	.291	7.4	.107	2.71	.197	5.0	.030	.77	.034	.86
V120ZA1	120Z	.461	11.7	.335	8.51	.158	4.0	.038	0.98	.079	2.0	.023	.59	.027	.68
V120ZA6	V120ZA6	.745	18.9	.636	16.15	.197	5.0	.059	1.36	.099	2.5	.030	.77	.034	.86
V150ZA1	150Z	.461	11.7	.335	8.51	.178	4.5	.048	1.24	.099	2.5	.023	.59	.027	.68
V150ZA8	V150ZA8	.745	18.9	.636	16.15	.197	5.0	.054	1.36	.099	2.5	.030	.77	.034	.86
V180ZA1	180Z	.461	11.7	.335	8.51	.178	4.5	.048	1.24	.099	2.5	.023	.59	.027	.68
V180ZA10	V180ZA10	.745	18.9	.636	16.15	.212	5.4	.065	1.63	.119	3.0	.030	.77	.034	.86

GE-MOV® VARISTOR APPLICATIONS

ELECTRONIC SWITCHING OF INDUCTIVE LOADS

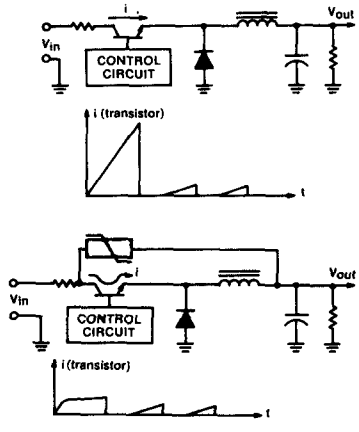
When an inductive load is switched off by a transistor, a high S.O.R. (Safe Operation Region) is required of the transistor to prevent reverse-biased second breakdown. If a GE-MOV® Varistor is connected from collector to emitter, the energy stored in the inductor is no longer forced through the transistor but instead is transferred to the Varistor. This results in a significant decrease in transistor stress and a much more reliable circuit operation.



ELECTRONIC SWITCHING FOR REGULATION

Sudden application of supply voltage (or initial turn-on) can damage a switch mode regulator switching device by subjecting it to the heavy current surge required to charge the uncharged filter capacitor.

A GE-MOV® Varistor can be used to shunt the initial surge around the switching device, precharging the capacitor to a safe value. The Varistor will not affect circuit operation at times other than at initial turn-on because it draws extremely little current at a voltage of $V_{IN} - V_{OUT}$. Applied in this manner, the GE-MOV® Varistor can offer important protection for a line operated power supply.



GE-MOV® VARISTOR APPLICATION NOTES

PUB. NO.	TITLE
200.60	GE-MOV Varistors Voltage Transient Suppressors
200.72	Using GE-MOV Varistors to Extend Contact Life
200.73	Testing GE-MOV Varistors
200.77	Detecting & Suppressing Nanosecond Wide Spikes with GE-MOV® Varistors
201.28	Energy Dissipation in GE-MOV® Varistors for Various Pulse Shapes
660.30	Six Ways to Control Voltage Transients, Reprint from *Electronic Design*
660.32	Transient Suppression . . . Don't Make The Cure Worse Than The Disease, Reprint from *Machine Design*
451.133	Transient Voltage Suppression Manual