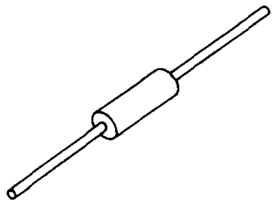
GE-MOV®

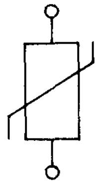
Metal Oxide Varistors

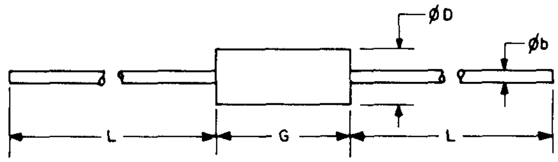
33-430 VOLTS D.C. NOMINAL VARISTOR VOLTAGE
RATINGS OF 23-365 VOLTS D.C., 18-264 VOLTS RMS, .1-.7 JOULES

SERIES MA



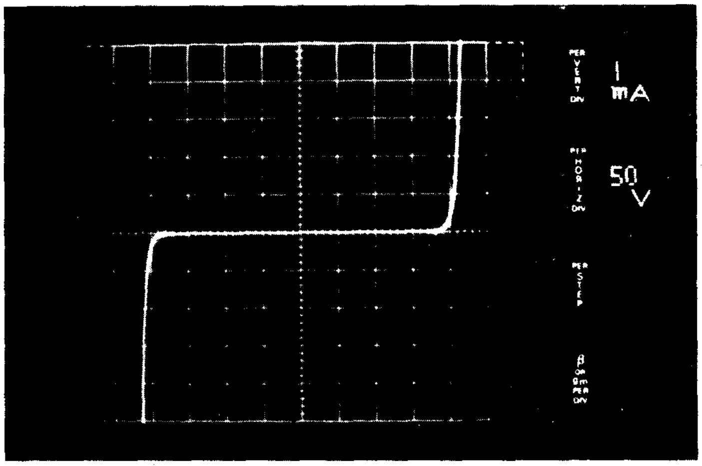
SYMBOL	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
ϕb	79	.83	.031	.033
ϕD	3.43	3.68	.135	.145
G	8.01	8.50	.315	.335
L	26.0	29.0	1.03	1.14





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 MA (molded axial) 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)

Features:

- Excellent Clamping
- Peak Transient Current Capability Up To 20 Amps
- Wide Operating Temperature Range (-40°C to 125°C)
- Low Temperature Coefficient (-.03%/°C)
- Low Capacitance
- Low Standby Drain
- Compact and Lightweight
- Compatible With Automatic Insertion

Benefits:

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

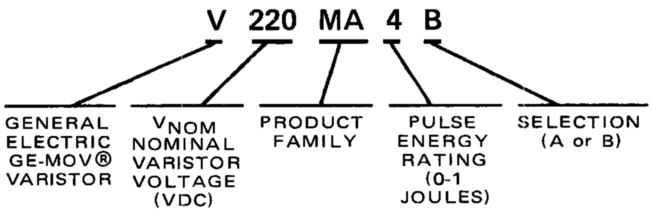
Replacement For The Following When Used As Transient Suppressors:

- Zener Diodes
- Silicon Carbide
- Selenium Thyrectors
- R-C Networks (non dv/dt)
- Neon Bulbs
- Miniature Electronic Crowbars

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
- Automobiles
- Solid State Security Systems
- Medical Equipment
- Fire Alarms

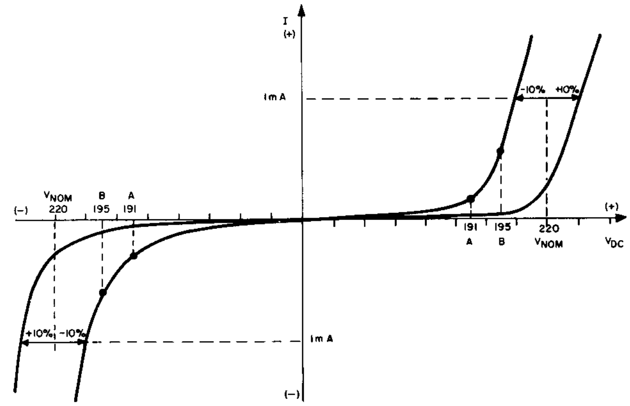
Model Number Nomenclature:



The MA series GE-MOV® varistors are characterized at the 1mADC varistor voltage according to EIA values.

For example – V220MA4B; the nominal varistor voltage is 220VDC, ±10%, at 1mADC. The maximum allowable steady state applied voltages, 191 VDC and 195 VAC (peak) fall below the low side nominal varistor voltage of 198 VDC (220 – 10%) to insure the maximum idle power dissipation characteristics (See V-I curve to the right).

Example:
V220MA4B V-1 Characteristics:



A – Maximum allowable steady state DC applied voltage.
See Ratings Table.
B – Maximum allowable steady state recurrent peak applied voltage.
See Ratings Table.
V_{NOM} – Nominal Varistor voltage at 1mADC.
See Characteristics Table.

ABSOLUTE MAXIMUM RATINGS

Maximum Electrical Ratings:

Maximum Energy, Power and Peak Current	See Rating Table
Storage Temperature, T_{STG}	-55°C to +125°C
Operating Ambient Temperature (Without Derating)	75°C
Maximum Voltage Temperature Coefficient	-.03%/°C

Mechanical Ratings:

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

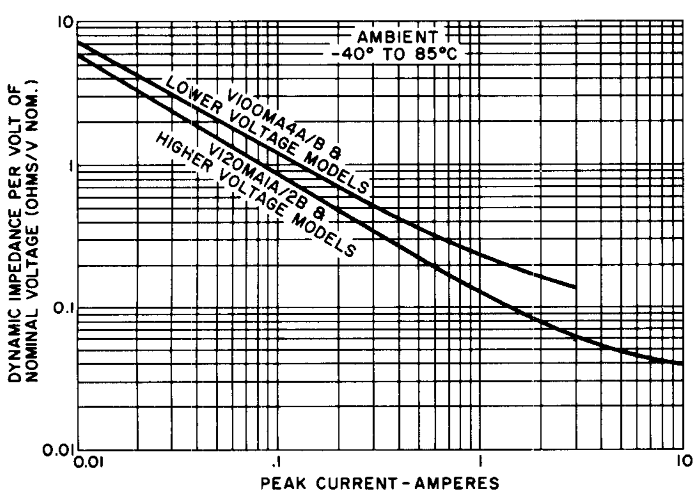


FIGURE 1 TYPICAL CHARACTERISTIC OF DYNAMIC IMPEDANCE VS. PEAK CURRENT

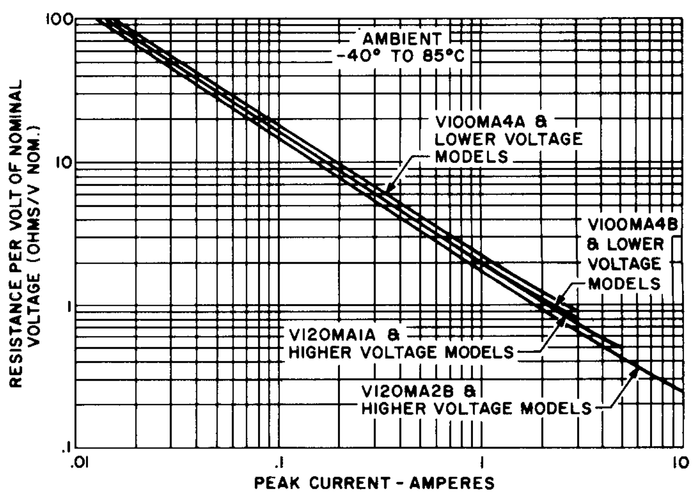


FIGURE 2 MAXIMUM STATIC RESISTANCE VS. PEAK CURRENT

MAXIMUM RATINGS TABLE

MODEL NUMBER	STEADY STATE (1)			TRANSIENT		
	DC APPLIED VOLTAGE (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)	NON-RECURRENT PEAK PULSE CURRENT (4, 5)
	VOLTS	VOLTS	VOLTS	JOULES (WATT-SECS)	MILLIWATTS (FREE AIR)	AMPERES
V33MA1A V33MA1B	23 26	18 20	26 28	.13 .15	200	10
V39MA2A V39MA2B	28 31	22 25	31 35	.16 .18	200	10
V47MA2A V47MA2B	34 38	27 30	38 42	.19 .21	200	10
V56MA2A V56MA2B	40 45	32 35	45 49	.23 .25	200	10
V68MA3A V68MA3B	48 56	38 40	54 57	.26 .30	200	10
V82MA3A V82MA3B	60 66	45 50	65 71	.33 .37	200	10
V100MA4A V100MA4B	72 81	57 60	80 85	.40 .45	200	10
V120MA1A V120MA2B	97 101	72 75	102 106	.10 .20	200	10 20
V150MA1A V150MA2B	121 127	88 92	124 130	.10 .20	200	10 20
V180MA1A V180MA3B	144 152	105 110	148 156	.15 .30	200	10 20
V220MA2A V220MA4B	181 191	132 138	187 195	.20 .40	200	10 20
V270MA2A V270MA4B	224 235	163 171	230 242	.20 .40	200	10 20
V330MA2A V330MA5B	257 274	188 200	266 283	.25 .50	200	10 20
V390MA3A V390MA6B	322 334	234 242	331 342	.30 .60	200	10 20
V430MA3A V430MA7B	349 365	253 264	358 373	.35 .70	200	10 20

(1) Steady State defined as the normal input conditions existing when no transients are present.

(2) Applied Voltage is that voltage which appears across the varistor terminals when no transient is present. High line voltage conditions should be included in the value for Applied Voltage used to select the correct model. (i.e., applications for 117 V_{RMS} should use ratings of 129 V_{RMS} or more.)

(3) For AC applications a sinusoidal Applied Voltage is assumed to be the normal input condition. If Applied Voltage is non-sinusoidal, Recurrent Peak Applied Voltage values should be used to select correct model.

(4) See Figure 3.

(5) See Figure 8.

CHARACTERISTICS TABLE

MODEL NUMBER	V_{NOM} VARISTOR VOLTAGE @ 1.0mA DC CURRENT (6)		LEAKAGE CURRENT @ MAX. RATED DC VOLTAGE		ALPHA (7) $I_2 = 1mA, I_1 = 0.1mA$			MAXIMUM AC IDLE POWER	MAXIMUM THERMAL RESISTANCE BODY TO AIR	TYPICAL CAPACITANCE
	VOLTS	± TOL. %	TYP.	MAX.	MIN.	TYP.	MAX.			
			MICROAMPERES					MILLIWATTS	°C/W	PICOFARADS
V33MA1A V33MA1B	33	20 10	10	250	12	20	55	8	250	300
V39MA2A V39MA2B	39	20 10						9		250
V47MA2A V47MA2B	47	20 10			↓	↓		11		210
V56MA2A V56MA2B	56	20 10			16	25		13		180
V68MA3A V68MA3B	68	20 10						15		150
V82MA3A V82MA3B	82	20 10						18		120
V100MA4A V100MA4B	100	20 10			↓	↓		20		100
V120MA1A V120MA2B	120	15 10			25	32		22		40
V150MA1A V150MA2B	150	15 10						25		32
V180MA1A V180MA3B	180	15 10						30		27
V220MA2A V220MA4B	220	15 10						40		21
V270MA2A V270MA4B	270	15 10						45		17
V330MA2A V330MA5B	330	15 10						55		14
V390MA3A V390MA6B	390	15 10						65		12
V430MA3A V430MA7B	430	15 10	↓	↓	↓	↓	↓	70	↓	11

(6) 1mA DC current pulse, 10-50 msec.

(7) $1 = KV^{\alpha}$, Where $\alpha = \frac{\text{Log } I_2/I_1}{\text{Log } V_2/V_2}$

NOTE:
The GE-MOV® varistor may be operated at maximum energy, power, peak pulse current, and applied voltage (AC or DC) ratings up to 75°C ambient. Above 75°C ambient these values must be derated in order to remain below a limit of 125°C average surface temperature. The magnitude of total average power dissipation is determined by averaging the energy of repetitive transients over their time base (0.1 Watt = 0.1 Joules/Sec) and then adding the idle power dissipation of the varistor.

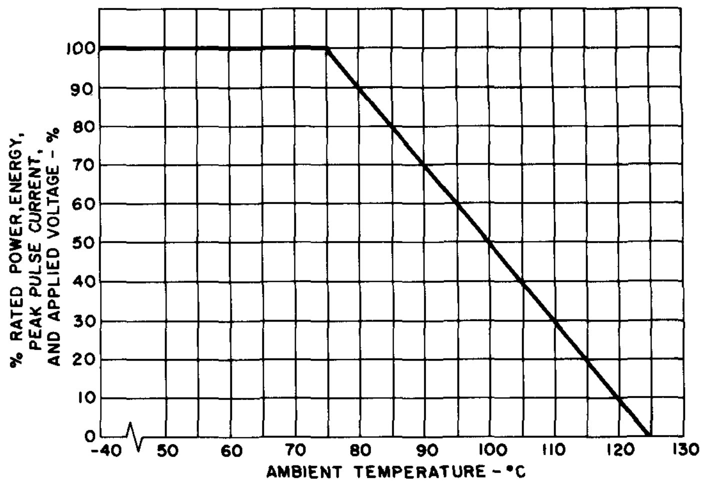


FIGURE 3 % RATED POWER, ENERGY, PEAK PULSE CURRENT AND APPLIED VOLTAGE (AC OR DC) VS T_A

SERIES MA

MAXIMUM VOLT – AMPERE CHARACTERISTICS (T_A = 25°C)

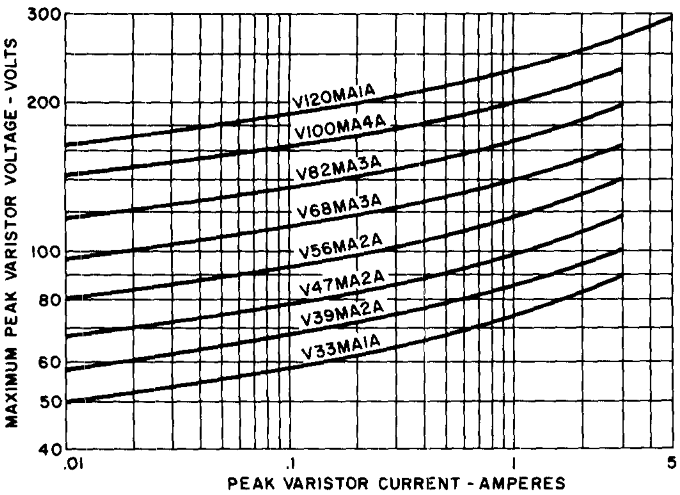


FIGURE 4 PEAK VARISTOR CURRENT – AMPERES

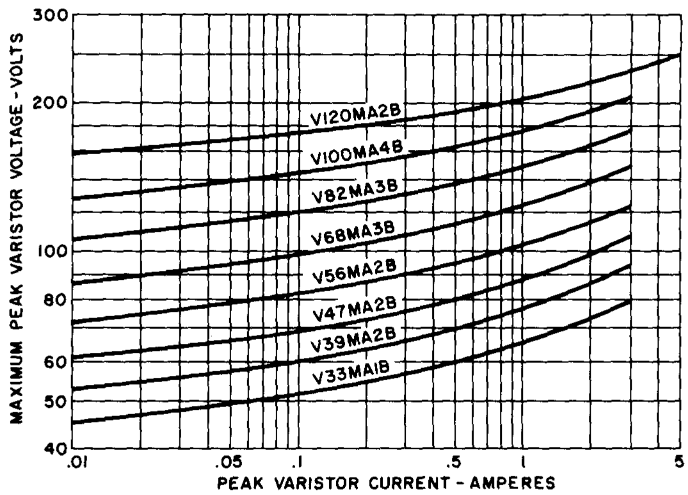


FIGURE 5 PEAK VARISTOR CURRENT – AMPERES

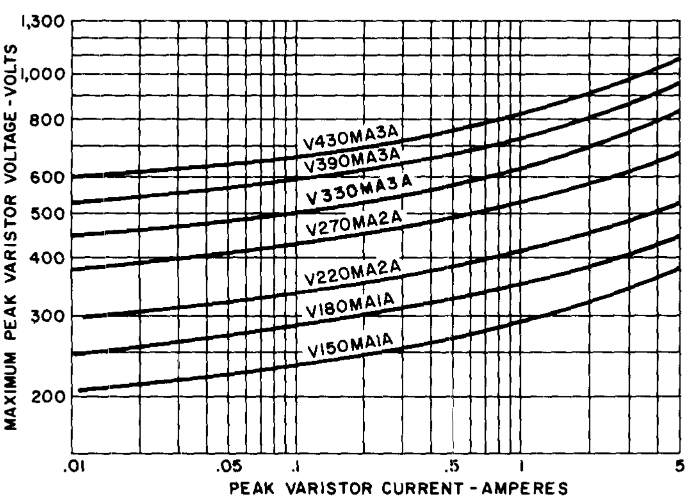


FIGURE 6 PEAK VARISTOR CURRENT – AMPERES

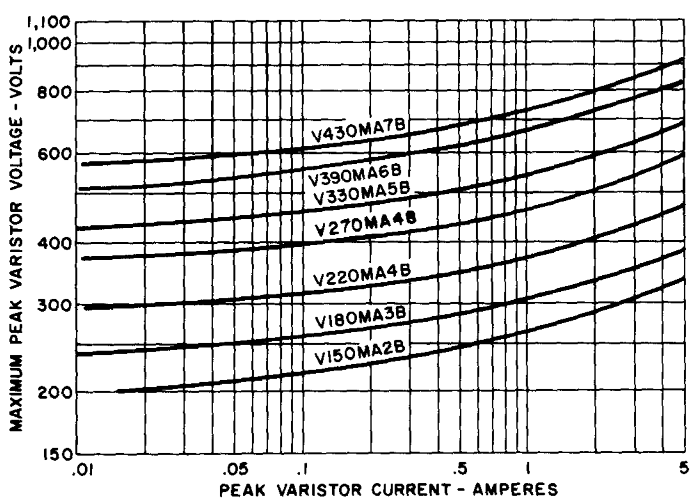


FIGURE 7 PEAK VARISTOR CURRENT – AMPERES

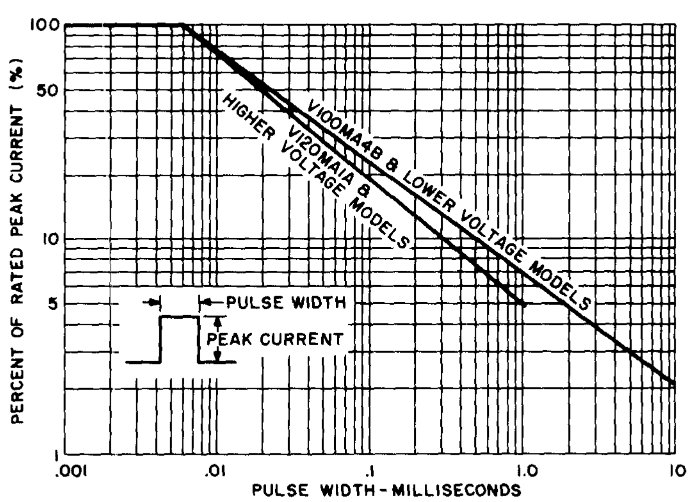
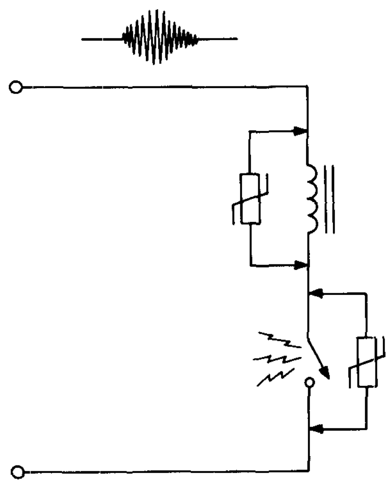


FIGURE 8 % RATED NON-RECURRENT PEAK PULSE CURRENT VS. PULSE WIDTH (T_A = 25°C)

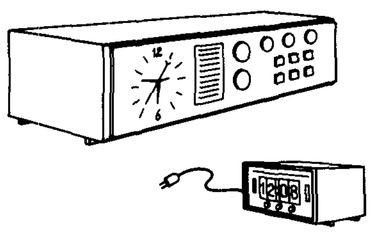
GE-MOV® VARISTOR APPLICATIONS



CONTACT ARCING / NOISE

Switch contacts interrupting an inductive load current will arc causing deterioration of the contacts and noise-generating "spikes" on the power line.

Placing an MA Series GE-MOV® varistor across the load or contacts is a low-cost method to suppress high voltage spikes, and (particularly at lower currents or voltages) to reduce contact damage due to arcing. Their bi-directional characteristic makes them useful for AC or DC applications without affecting load operation or suffering voltage damage themselves, as diodes or capacitors may do.



RESIDENTIAL POWER LINE TRANSIENT VOLTAGES

About 2% of all homes experience repeated transient voltages (over 1200 volts) of a level potentially damaging to home appliances. GE-MOV® axial-leaded varistors provide a reliable, cost-effective way to reduce these voltages to acceptable levels.

GE-MOV® VARISTOR APPLICATION NOTES AND SPECIFICATION SHEETS

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 And 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