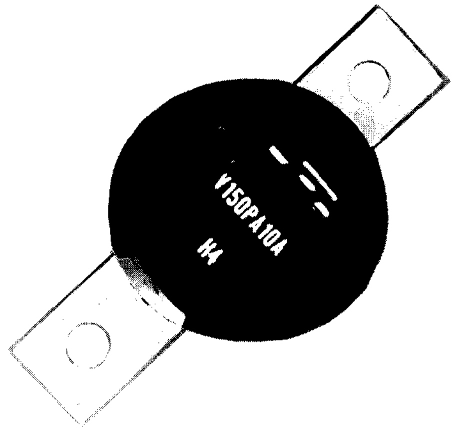
PA SERIES



Rigid Mounting • Up to 15W Dissipation • Voltage Range 130-575 VRMS, 170-750 VDC • Peak Pulse Current to 4000A • Meets NEMA Creep and Strike Distance • For Complete Specifications, see *Page No. 1432.*

MODEL NUMBER	MAXIMUM APPLIED VOLTAGE AC-RMS	AC-PEAK 50-60Hz	DC	MAXIMUM ENERGY JOULES	MAXIMUM NON-REPETITIVE PEAK PULSE CURRENT tp ≤ 6 μS	MAXIMUM AVERAGE POWER DISSIPATION	MAXIMUM VARISTOR VOLTAGE AT 10 AMP/ PEAK
	VOLTS	VOLTS	VOLTS	(WATT-SEC)	AMPS	WATTS	VOLTS
V130PA10A	130	184	170	10	4000	8	350
V130PA20A				20		15	350
V130PA20B				20		15	340
V130PA20C				20		15	320
V150PA10A	150	212	195	10		8	410
V150PA20A				20		15	410
V150PA20B				20		15	390
V150PA20C				20		15	360
V250PA10A	250	354	330	10		4	670
V250PA20A				20		7	670
V250PA40A				40		13	670
V250PA40B				40		13	640
V250PA40C				40		13	600
V275PA10A	275	389	360	10		4	740
V275PA20A				20		7	740
V275PA40A				40		13	740
V275PA40B				40		13	700
V275PA40C				40		13	650
V320PA40A	320	452	415	40		12	850
V320PA40B				40		12	810
V320PA40C				40		12	780
V420PA20A	420	595	540	20		5	1120
V420PA40A				40		10	1120
V420PA40B				40		10	1090
V420PA40C				40		10	1000
V460PA20A	460	650	600	20		5	1280
V460PA40A				40		10	1280
V460PA40B				40		10	1200
V460PA40C				40		10	1120
V480PA20A	480	679	625	20		3	1320
V480PA40A				40		5	1320
V480PA80A				80		10	1320
V480PA80B				80		10	1250
V480PA80C				80		10	1180
V510PA20A	510	721	655	20		3	1400
V510PA40A				40		5	1400
V510PA80A				80		10	1400
V510PA80B				80		10	1310
V510PA80C				80		10	1280
V550PA20A	550	778	720	20		3	1500
V550PA40A				40		5	1500
V550PA80A				80		9	1500
V550PA80B				80		9	1410
V550PA80C				80		9	1340
V575PA20A	575	813	750	20		3	1520
V575PA40A				40		5	1520
V575PA80A				80		9	1520
V575PA80B				80		9	1460
V575PA80C				80		9	1400

MA SERIES

Low Cost • Designed for Automatic Insertion • Molded Axial Package • Voltages 18-264 VRMS, 26-365 VDC • Energy Absorption to 700 milli Joules • Peak Pulse Current to 20A • For Complete Specifications see *Page No. 1426.*

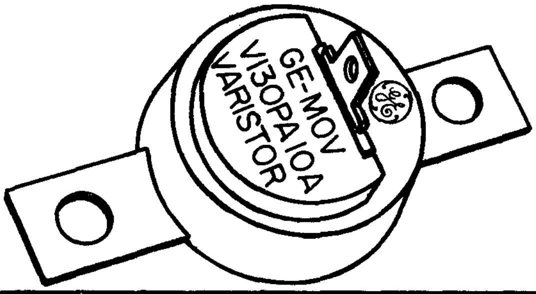
NOTE: GE-MOV™ Varistor MA Series Models from 20-75 VRMS, 26-102 VDC See page 1426

MODEL NUMBER	MAXIMUM APPLIED VOLTAGE AC-RMS	AC-PEAK 50-60Hz	DC	MAXIMUM ENERGY JOULES	MAXIMUM NON-REPETITIVE PEAK PULSE CURRENT tp ≤ 6 μS	MAXIMUM AVERAGE POWER DISSIPATION	MAXIMUM VARISTOR VOLTAGE AT 1 AMP/ PEAK
	VOLTS	VOLTS	VOLTS	(WATT-SECS)	AMPS	M-WATTS	VOLTS
V150MA1A	88	124	121	.10	10	200	280
V150MA2B	92	130	127	.20	20		250
V180MA1A	105	148	144	.15	10	200	350
V180MA3B	110	156	152	.30	20		320
V220MA2A	132	187	181	.20	10	200	420
V220MA4B	138	195	191	.40	20		390
V270MA2A	163	230	224	.20	10	200	530
V270MA4B	171	242	235	.40	20		480
V330MA2A	188	266	257	.25	10	200	640
V330MA5B	200	283	274	.50	20		580
V390MA3A	234	331	322	.30	10	200	750
V390MA6B	242	342	334	.60	20		700
V430MA3A	253	358	340	.35	10	200	840
V430MA7B	264	373	365	.70	20		780

GE-MOV®
Metal Oxide Varistors

RATINGS OF 170-750 VOLTS D.C., 130-575 VOLTS RMS.

SERIES PA

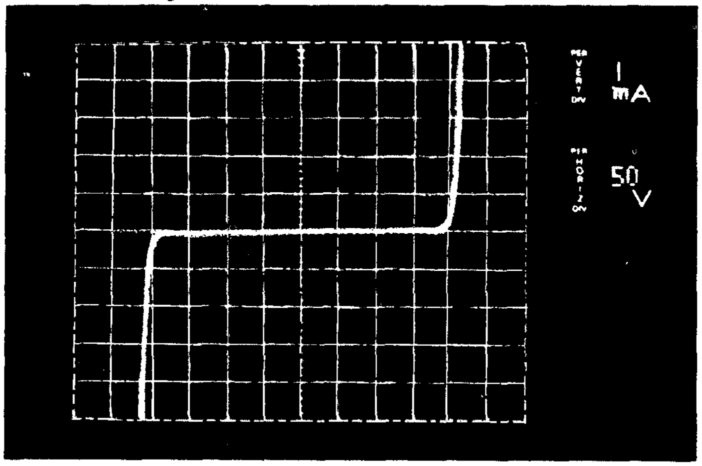


Description:

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 offers advantages in performance and economics. When exposed to high energy voltage transients, the varistor impedence changes from a very high standby valve to a very low conducting valve thus clamping the transient voltage to a safe level. The energy of the incoming high voltage pulse is absorbed by the GE-MOV® varistor, thus protecting sensitive circuit components.

Replacement For:

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



I-V Oscillograph (Actual Photo)

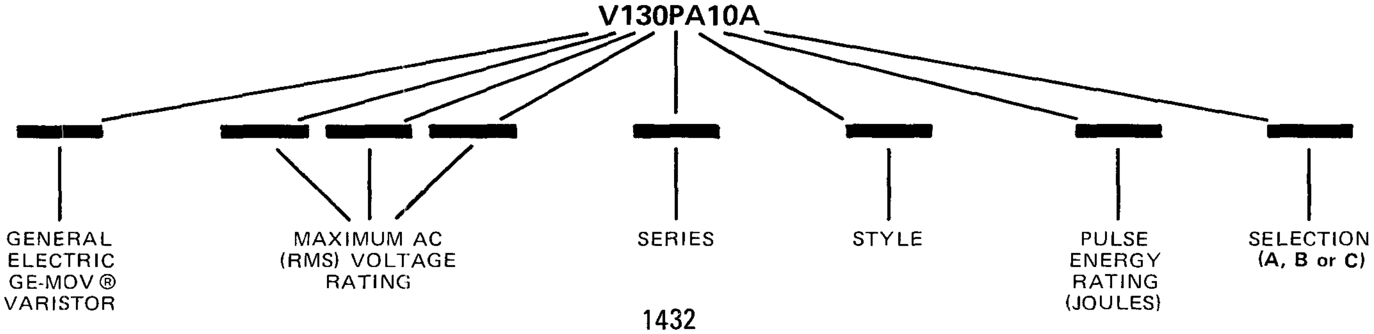
Features:

- Up to 15 Watt Average Power Dissipation
- NEMA Creep and Strike Distances
- Excellent Clamping (as low as 1.7 @ 200 amps.)
- Discharge Current Capability as high as 4000 amps.
- Energy Dissipation up to 80 watt-seconds
- Nanosecond Response
- Low Standby Power Dissipation
- Quick Connect Terminal

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

Model Number Nomenclature:



Ratings:

Maximum Energy, Power and Peak Current . . . . See Rating Table
Storage Temperature, T_{STG} . . . . -40°C to +125°C
Maximum Hot Spot Temperature, T_{HS} . . . . 125°C
Operating Case Temperature (without derating) . . . . 70°C
Maximum Thermal Impedance Case to Ambient for Maximum Recurrent Peak AC Voltage . . . . $\leq$ 8°C/Watt
Maximum Thermal Impedance Case to Ambient for Maximum DC Input . . . . $\leq$ 5°C/Watt
Maximum Voltage Temperature Coefficient . . . . -0.05%/°C

Mechanical:

Insulating Resistance – Megohms . . . . > 1000
Hipot Encapsulation – Volts DC for 1 Minute 2500
Maximum Weight . . . . 45 Grams

MAXIMUM RATINGS AND CHARACTERISTICS

MODEL NUMBER [5]	RATINGS: RMS [1,2] APPLIED VOLTAGE 50-60 HZ	RECURRENT PEAK APPLIED VOLTAGE	DC [1] APPLIED VOLTAGE	ENERGY [3]	AVERAGE [3] POWER DISSIPATION	PEAK [4] CURRENT	CHARACTERISTICS: VARISTOR PEAK VOLTAGE @ 1MA AC MIN.	MAX.	THERMAL RESISTANCE HOT SPOT TO CASE
	VOLTS	VOLTS	VOLTS	JOULES	WATTS	AMPERES	VOLTS	VOLTS	°C/WATT
V130PA10 (–)	130	184	170	10	8	4000	185	255	6.8
20 (–)				20	15	4000			3.6
V150PA10 (–)	150	212	195	10	8	4000	214	298	6.8
20 (–)				20	15	4000			3.6
V250PA10 (–)	250	354	330	10	4	4000	358	480	13.7
20 (–)				20	7	4000			7.8
40 (–)				40	13	4000			4.2
V275PA10 (–)	275	389	360	10	4	4000	390	523	13.7
20 (–)				20	7	4000			7.8
40 (–)				40	13	4000			4.2
V320PA40 (–)	320	452	415	40	12	4000	448	601	4.5
V420PA20 (–)	420	595	540	20	5	4000	585	802	11.0
40 (–)				40	10	4000			5.5
V460PA20 (–)	460	650	600	20	5	4000	648	880	11.0
40 (–)				40	10	4000			5.5
V480PA20 (–)	480	679	625	20	3	4000	680	918	18.3
40 (–)				40	5	4000			11.0
80 (–)				80	10	4000			5.5
V510PA20 (–)	510	721	655	20	3	4000	713	962	18.3
40 (–)				40	5	4000			11.0
80 (–)				80	10				5.5
V550PA20 (–)	550	778	720	20	3	4000	782	1072	18.3
40 (–)				40	5	4000			11.0
80 (–)				80	9	4000			6.1
V575PA20 (–)	575	813	750	20	3	4000	816	1119	18.3
40 (–)				40	5	4000			11.0
80 (–)				80	9	4000			6.1

1. Applied voltage is that voltage which appears across the varistor terminals when no transient is present. High line voltage conditions must be included in the value for applied voltage used to select the correct model.
2. 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.
3. See Figure 12.
4. See Figure 13. Peak currents apply for full rated bias.
5. (–) indicates A, B or C selection. See Figures 1-11.

MAXIMUM VOLT-AMPERE CHARACTERISTICS

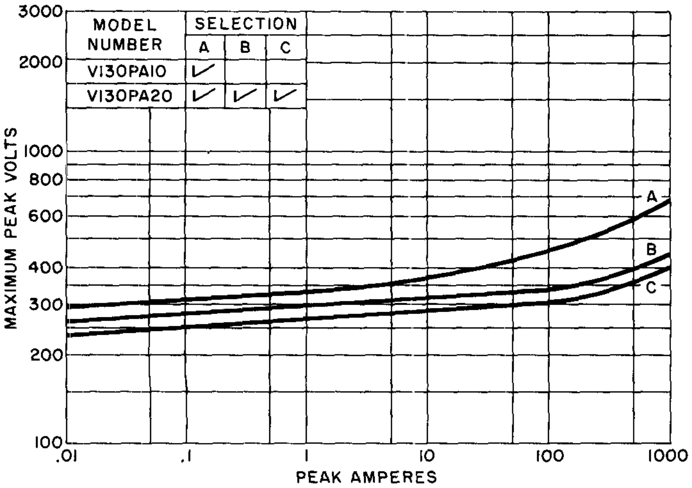


FIGURE 1

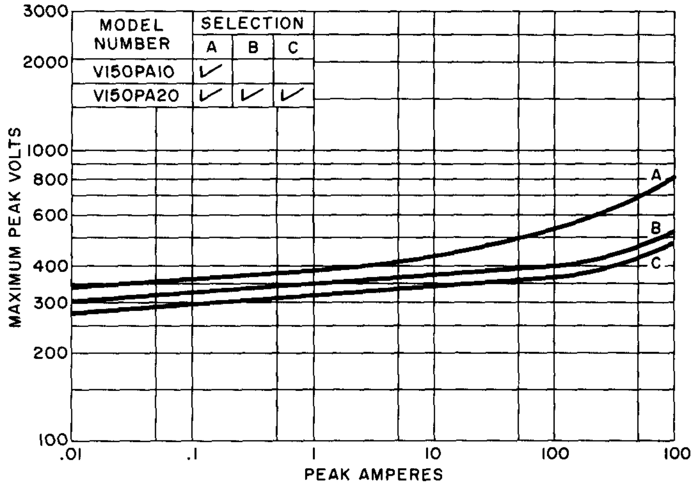


FIGURE 2

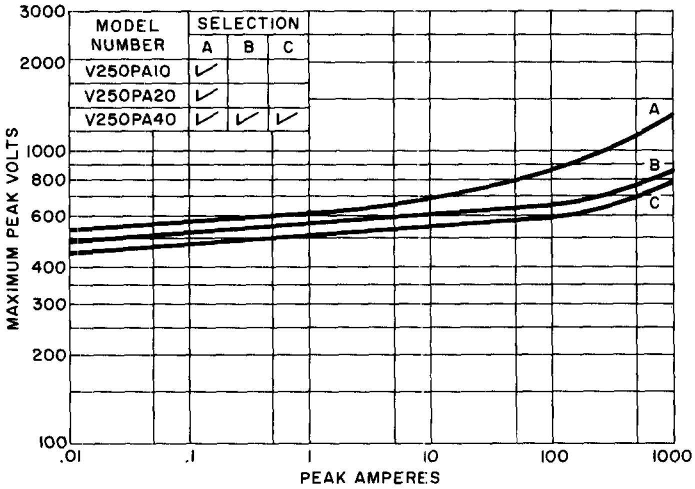


FIGURE 3

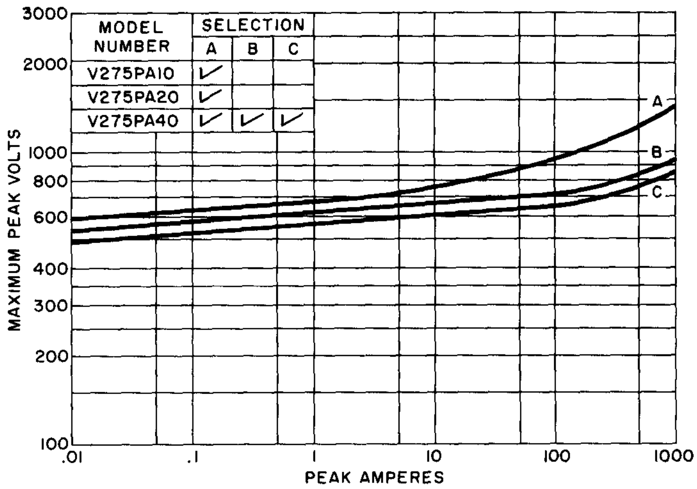


FIGURE 4

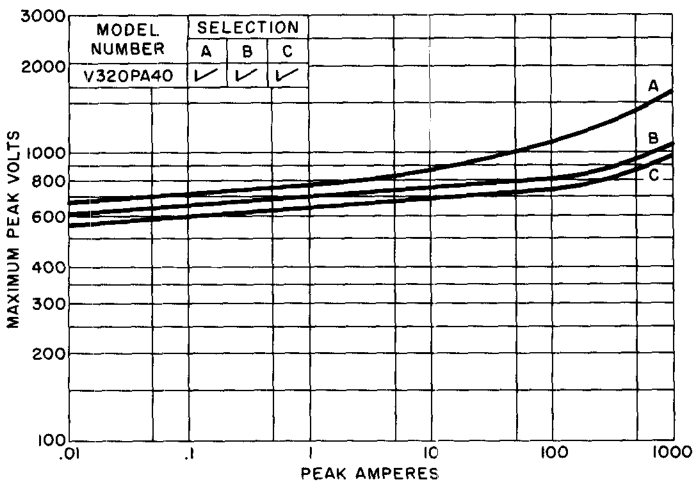


FIGURE 5

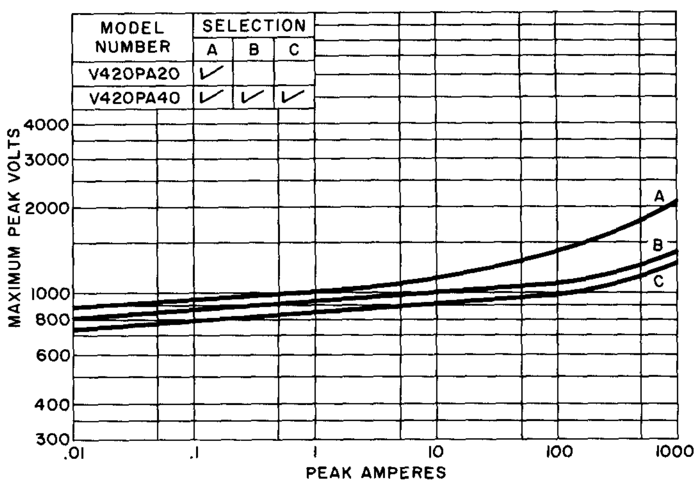


FIGURE 6

MAXIMUM VOLT-AMPERE CHARACTERISTICS

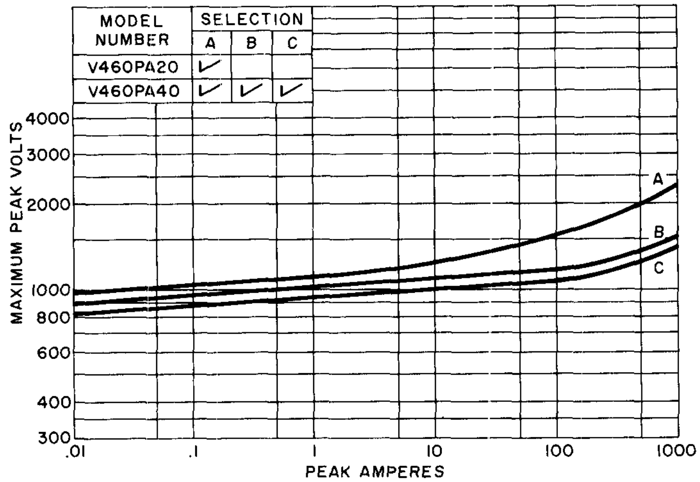


FIGURE 7

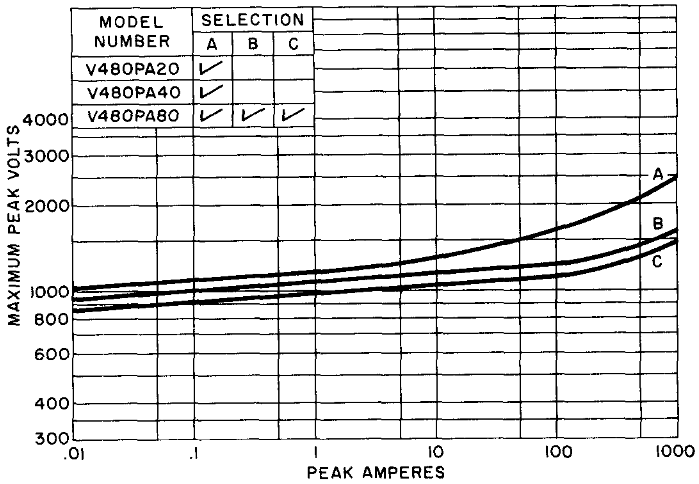


FIGURE 8

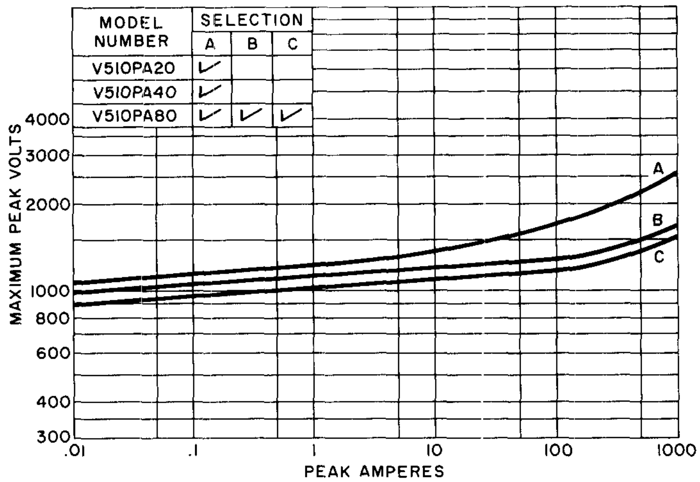


FIGURE 9

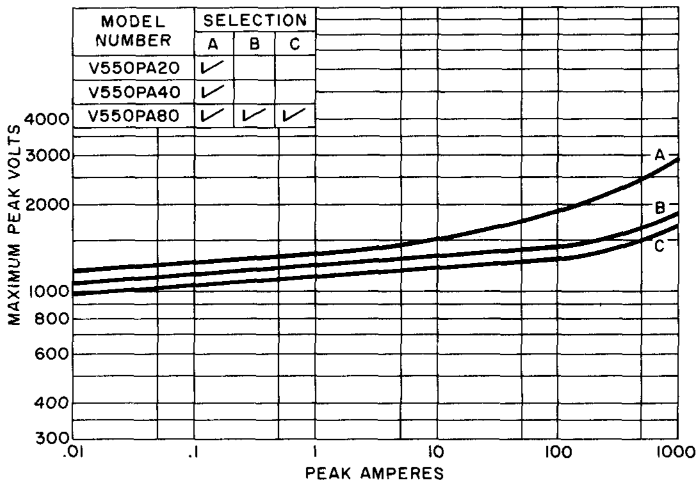


FIGURE 10

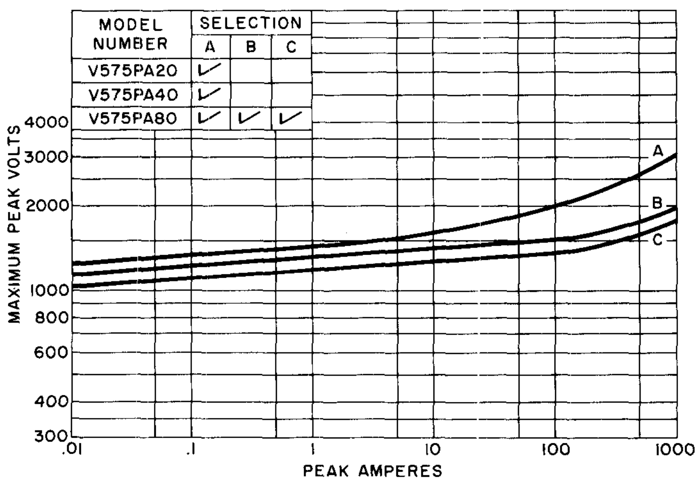


FIGURE 11

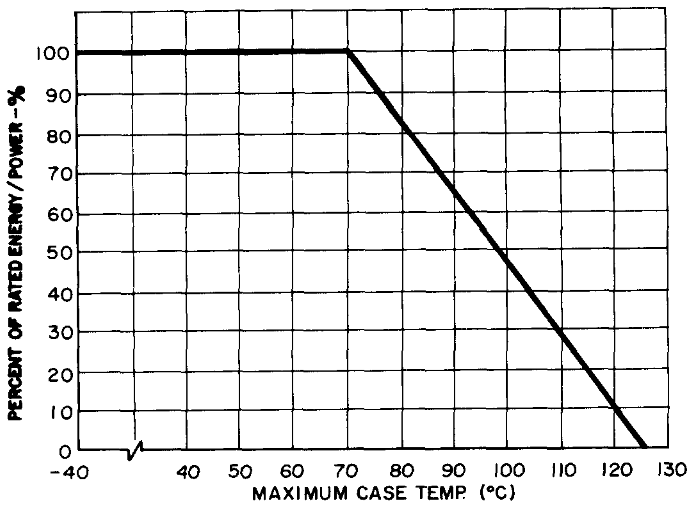


FIGURE 12

ENERGY AND POWER RATING VS. CASE TEMPERATURE

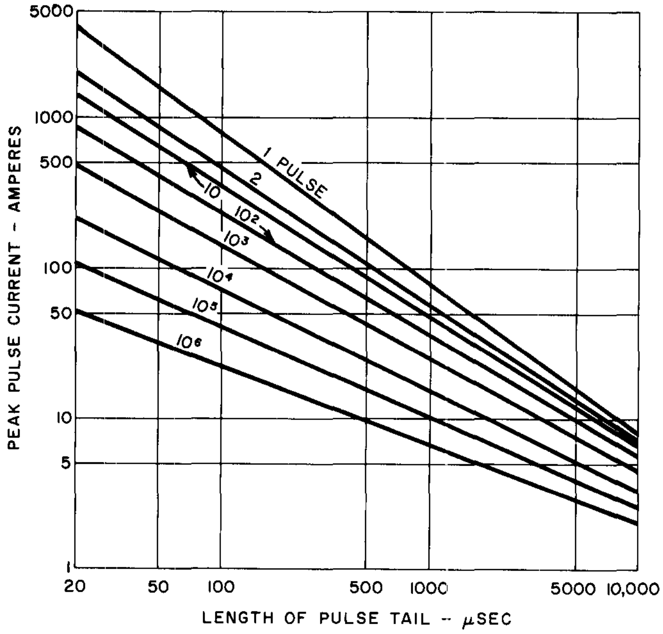


FIGURE 13

PULSE LIFE DERATING CURVE

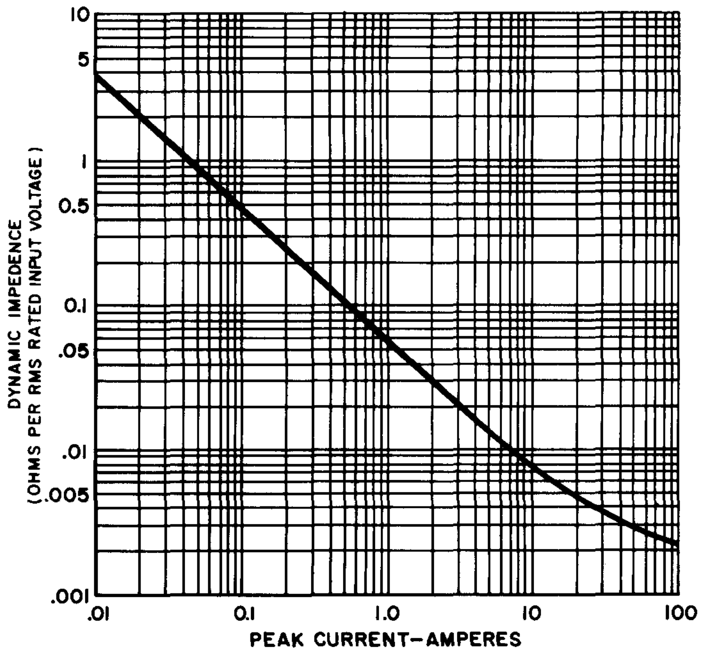


FIGURE 14

DYNAMIC IMPEDANCE VS. PEAK CURRENT

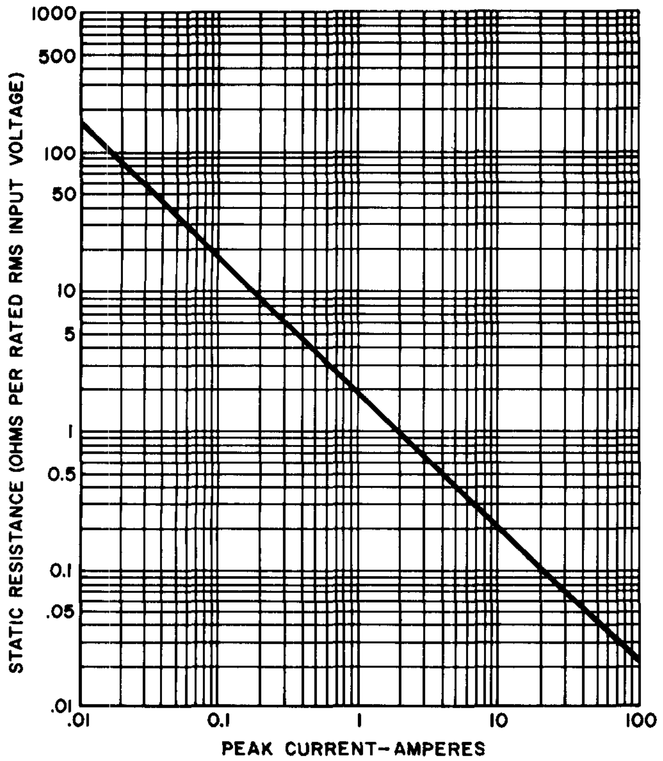
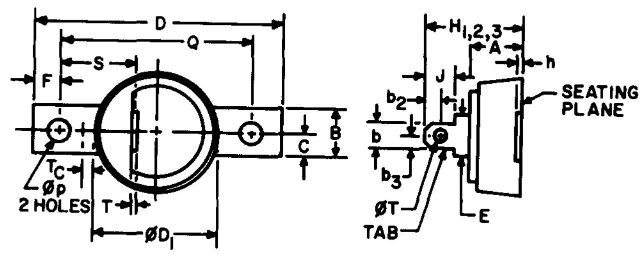


FIGURE 15

TYPICAL RESISTANCE VS. PEAK CURRENT



SYMBOL	INCHES			MILLIMETERS			NOTES
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.	
A			.57			14.3	
b			.26			6.6	1
b_2		.16			4.1		
b_3		.13			3.2		
B			.51			12.9	
C			.26			6.5	
D			2.61			66.2	
ϕD_1			1.32			33.5	
E		.44			11.2		
F		.30			7.7		
h		.03	.04		.8	.9	
H_1	.91		1.01	23.2		25.5	3
H_2	.96		1.12	24.6		28.3	3
H_3	1.03		1.29	26.3		32.6	3
J			.32			8.1	
ϕp	.22		.24	5.8		6.0	
Q	1.99	2.00	2.01	50.6	50.8	51.0	
S		.76			19.2		
T			.04			1.0	1
ϕT	.11			2.8			
T_c		.13			3.2		2

NOTES:

1. Tab is designed to fit 1/4″ quick connect terminal.
2. Case temperature is measured at T_C on top surface of base plate.
3. H_1 (130-150 V_{RMS} devices)
   H_2 (250-320 V_{RMS} devices)
   H_3 (420-575 V_{RMS} devices)
4. Electrical connection: top terminal and base plate.

FIGURE 16

DIMENSION TABLE

PROPER MOUNTING OF THE "PA" SERIES VARISTOR

When applying the varistor in a manner which requires high power dissipation capability, the possibility of necessary heat sinking should be taken into consideration. Figure 12 allows one to determine the maximum power dissipation for a given case temperature. To determine if a varistor has been properly heat sinked, a measurement of strap temperature, T_C, (see outline drawing) should be made under required worst case power and thermal conditions.

To describe the proper heat sink for any application, a fundamental knowledge of heat transference is required. Heat generated by power dissipated in the varistor, will flow through the mounting junction, to the heat sink, and finally to the surrounding ambient. The varistor case temperature (T_C) is a function of both the heat sink temperature (T_S) and the ambient temperature (T_A) which are directly proportional to the amount of heat flow (P) from the junction and the thermal resistances of the mounting ($R\theta_{CS}$) and the heat sink ($R\theta_{SA}$). Figure 17 shows a thermal schematic of a mounted varistor.

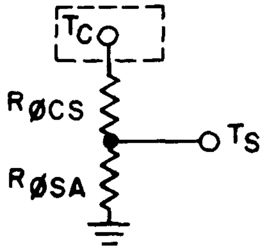


FIGURE 17
EQUIVALENT THERMAL RESISTANCE NETWORK FOR A POWER VARISTOR

The relationship between power dissipated (P), or heat flow, and temperature may be expressed as:

$$\frac{T_C - T_A}{P} = R\theta_{CS} + R\theta_{SA}$$

Table I lists some typical values for $R\theta_{CS}$ for various mounting methods.[1]

TABLE I

EXPECTED $R\theta_{CS}$ FOR
FOR GE-MOV® VARISTOR POWER PACKAGE

MOUNTING DESCRIPTION	TYPICAL $R\theta_{CS}$*
Screws (a)	0.9 °C/Watt
Screws (a) With Thermal Grease	0.3 °C/Watt
Screws (b) With Insulation Kit	2.0 °C/Watt
Screws (b) With Insulation Kit and Thermal Grease Both Faces	1.0 °C/Watt

(a) 10-32 Screw Torqued to 12-15 in lbs.
(b) 6-32 Screw Torqued to 405 in lbs.

*Values given in the table are for devices mounted on a clean, flat heatsink. The surface under the varistor contact surface should be flat to within .001 in. per inch with a surface finish of 63 micro-inches or smoother. Surfaces must be free of burrs, holes, paint or other foreign material and should be cleaned just prior to varistor mounting. Rough, curved or bent heatsink surfaces will cause increased thermal resistance and may result in premature device failure.

[1] For further information on heatsinking and values of $R\theta_{SA}$, refer to Application Note #200.55 *Handling and Thermal Considerations for General Electric Power Devices.*

TYPICAL NON-ISOLATED MOUNTING

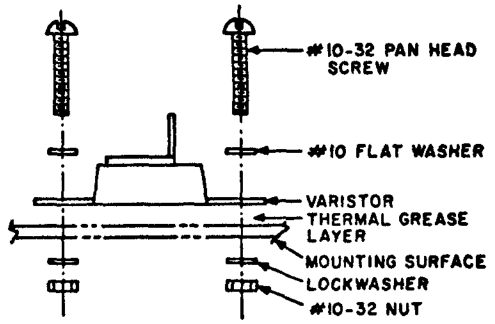


FIGURE 18

TYPICAL ISOLATED MOUNTING

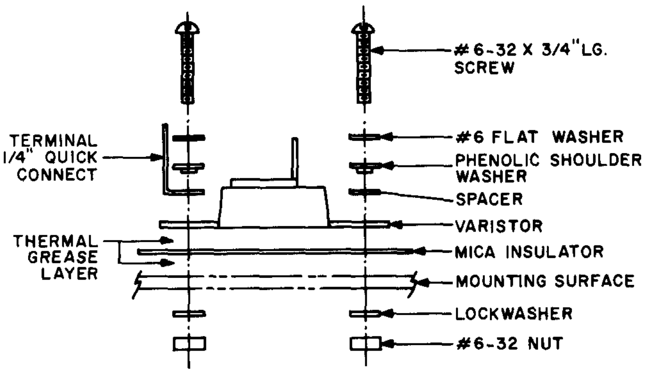


FIGURE 19

NOTE:

1 GE G623, Dow Corning, DC3, 4, 340, or 640 Thermal Grease is recommended.

2 Isolation kits containing the following parts can be ordered by part #A7811055.

(1) MICA insulation 1" x 3.1" x .005" thick.
(2) #6-32 x 3/4" screw.
(2) #6 flat washer.
(2) Phenolic shoulder washer.
(2) #6 internal tooth lock washer.
(2) #6-32 nut.
(1) 1/4" quick connect terminal.
(1) Spacer