


### HA Varistor Series



#### Agency Approvals

Agency	Agency Approval	Agency File Number
	UL1449	E320116

#### Additional Information



**Datasheet**



**Resources**



**Samples**

#### Description

HA Series transient surge suppressors are industrial high energy Metal-Oxide Varistors (MOVs). They are designed to provide secondary surge protection in the outdoor and service entrance environment (distribution panels) of buildings, and also in industrial applications for motor controls and power supplies used in the oil-drilling, mining, and transportation fields.

The design of the HA Series of MOVs provide rigid terminals for screw mounting. Also available in a clipped lead version for through hole board placement or to accommodate soldered leads designation "HC."

See Ratings and Specifications Table for part number and brand information.

#### Features

- Lead-free, Halogen-Free and RoHS compliant.
- Wide operating voltage range  
 $V_{M(AC)RMS}$   
110V to 750V
- Two disc sizes available  
32mm and 40mm
- High energy absorption capability  
 $W_{TM} = 170J$  to 1050J
- High peak pulse current capability, ITM = 25,000A to 40,000A
- Rigid terminals for secure mounting
- Available in trimmed version for through hole board mounting – Designation "HC"
- No derating up to 85°C ambient

#### Absolute Maximum Ratings

• For ratings of individual members of a series, see Device Ratings and Specifications chart

Continuous		HA Series	Units
<b>Steady State Applied Voltage:</b>			
AC Voltage Range ( $V_{M(AC)RMS}$ )		110 to 750	V
DC Voltage Range ( $V_{M(DC)}$ )		148 to 970	V
<b>Transients:</b>			
Peak Pulse Current ( $I_{TM}$ )			
For 8/20 $\mu$ s Current Wave (See Figure 2)		25,000 to 40,000	A
Single Pulse Energy Range			
For 2ms Current Squarewave ( $W_{TM}$ )		160 to 1050	J
Operating Ambient Temperature Range ( $T_A$ )		-55 to +85	°C
Storage Temperature Range ( $T_{STG}$ )		-55 to +125	°C
Temperature Coefficient ( $\alpha^V$ ) of Clamping Voltage ( $V_C$ ) at Specified Test Current		<0.01	%/°C
Hi-Pot Encapsulation (COATING Isolation Voltage Capability) (Dielectric must withstand indicated DC voltage for one minute per MIL-STD 202, Method 301)		2500	V
COATING Insulation Resistance		1000	M $\Omega$

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### HA Series Ratings & Specifications

Part Number Device Branding	Maximum Rating (85°C)				Specifications (25°C)				
	Continuous		Transient		Varistor Voltage at 1mA DC Test Current			Maximum Clamping Volt $V_c$ at 200A Current (8/20 $\mu$ s)	Typical Capacitance $f = 1\text{MHz}$
	$V_{RMS}$	$V_{DC}$	Energy (2ms)	Peak Current 8 x 20 $\mu$ s					
	$V_{M(AC)}$ (V)	$V_{M(DC)}$ (V)	$W_{TM}$ Energy	$I_{TM}$ (A)	(V)	(V)	(V)	$V_c$ (A)	C (pF)
V111HA32	110	148	160	25000 40000 <sup>1</sup>	156	173	190	293	5450 11600
V111HA40	110	148	220		156	173	190	288	
V131HA32	130	175	200	25000 40000 <sup>2</sup>	184.5	205	225.5	350	4700 10000
V131HA40	130	175	270		184.5	205	225.5	345	
V141HA32	140	188	210	25000 40000 <sup>3</sup>	198	220	242	380	4230 9000
V141HA40	140	188	290		198	220	242	375	
V151HA32	150	200	220	25000 40000 <sup>4</sup>	216	240	264	410	4000 8000
V151HA40	150	200	300		216	240	264	405	
V181HA32	180	240	240	25000 40000	254	282	310	475	3200 6800
V181HA40	180	240	330		254	282	310	468	
V201HA32	200	265	260	25000 40000	283	314	345	540	3180 6350
V201HA40	200	265	350		283	314	345	533	
V251HA32	250	330	330	25000 40000	351	390	429	650	2500 5000
V251HA40	250	330	370		351	390	429	630	
V271HA32	275	369	360	25000 40000	387	430	473	710	2200 4500
V271HA40	275	369	400		387	430	473	690	
V301HA32	300	410	370	25000 40000	423	470	517	795	2050 4100
V301HA40	300	410	430		423	470	517	780	
V321HA32	320	420	390	25000 40000	459	510	561	845	1900 3800
V321HA40	320	420	460		459	510	561	825	
V331HA32	330	435	385	25000 40000	467	518.5	570	860	1870 3750
V331HA40	330	435	475		467	518.5	570	843	
V351HA32	350	460	390	25000 40000	495	549.5	604	910	1800 3600
V351HA40	350	460	500		495	549.5	604	894	
V391HA32	385	510	395	25000 40000	545	604	663	1020	1750 3500
V391HA40	385	510	550		545	604	663	1000	
V421HA32	420	560	400	25000 40000	612	680	748	1120	1500 3000
V421HA40	420	560	600		612	680	748	1100	
V441HA32	440	585	420	25000 40000	622	690	758	1200	1450 2900
V441HA40	440	585	630		622	690	758	1147	
V481HA32	480	640	450	25000 40000	675	750	825	1290	1300 2700
V481HA40	480	640	650		675	750	825	1230	
V511HA32	510	675	500	25000 40000	738	820	902	1355	1200 2500
V511HA40	510	675	700		738	820	902	1295	
V551HA32	550	710	530	25000 40000	778	863.5	949	1515	1190 2390
V551HA40	550	710	755		778	863.5	949	1430	
V571HA32	575	730	550	25000 40000	819	910	1001	1570	1100 2200
V571HA40	575	730	770		819	910	1001	1480	
V661HA32	660	850	600	25000 40000	945	1050	1155	1820	1000 2000
V661HA40	660	850	900		945	1050	1155	1720	
V681HA32	680	875	610	25000	962	1067.5	1173	1830	850
V681HA40	680	875	925	40000	962	1067.5	1173	1780	
V751HA32	750	970	700	25000	1080	1200	1320	2050	800
V751HA40	750	970	1050	40000	1080	1200	1320	2000	

**Note:** Average power dissipation of transients not to exceed 2.0W per varistor  
 1. 40kA capability depends on applications rated up to 97Vrms. 30kA applies if > 97 Vrms.  
 2. 40kA capability depends on applications rated up to 115Vrms. 30kA applies if > 115 Vrms.  
 3. 40kA capability depends on applications rated up to 123Vrms. 30kA applies if > 123 Vrms.  
 4. 40kA capability depends on applications rated up to 132Vrms. 30kA applies if > 132Vrms.

**Power Dissipation Ratings**

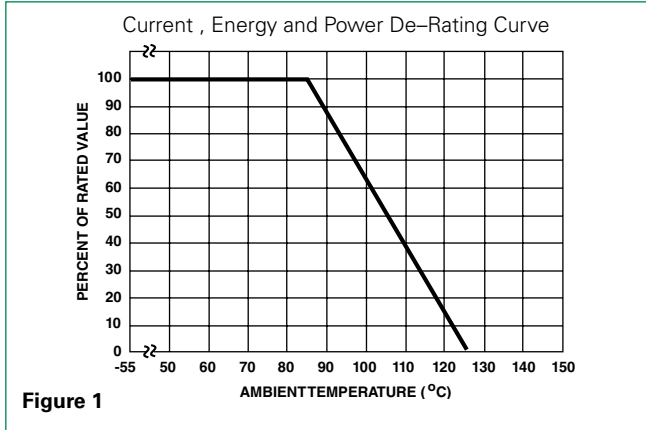


Figure 1

Should transients occur in rapid succession, the average power dissipation required is simply the energy (watt-seconds) per pulse times the number of pulses per second. The power so developed must be within the specifications shown on the Device Ratings and Specifications table for the specific device. Furthermore, the operating values need to be derated at high temperatures as shown in above. Because varistors can only dissipate a relatively small amount of average power they are, therefore, not suitable for repetitive applications that involve substantial amounts for average power dissipation.

**Peak Pulse Current Test Waveform**

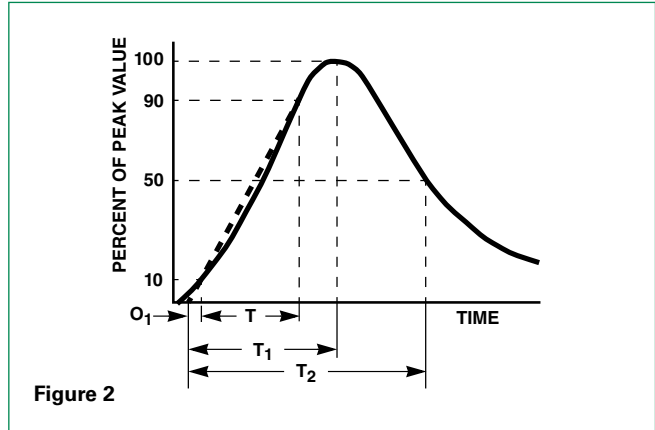


Figure 2

- $O_1$  = Virtual Origin of Wave
- $T$  = Time from 10% to 90% of Peak
- $T_1$  = Rise Time =  $1.25 \times T$
- $T_2$  = Decay Time

**Example** - For an  $8/20 \mu s$  Current Waveform:

- $8 \mu s = T_1 = \text{Rise Time}$
- $20 \mu s = T_2 = \text{Decay Time}$

**Maximum Clamping Voltage for 32mm Parts**

V111HA32-V751HA32

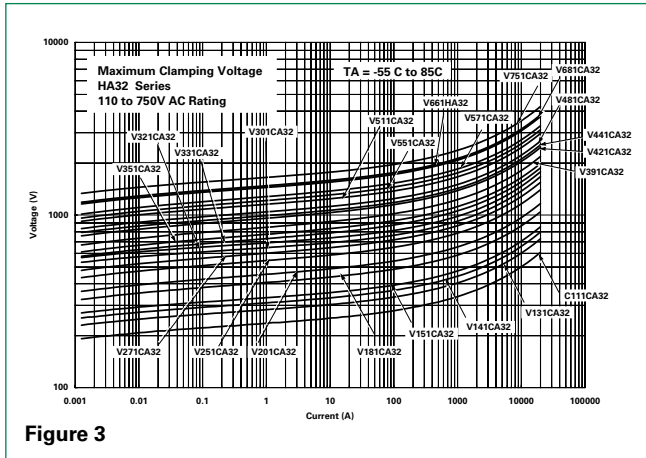


Figure 3

**Maximum Clamping Voltage for 40mm Parts**

V111HA40-V751HA40

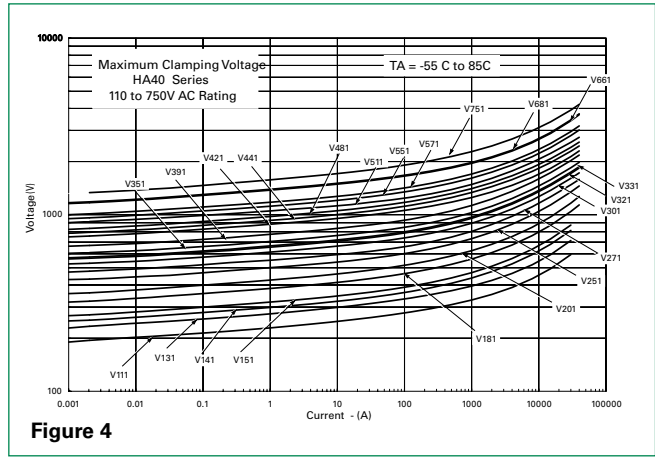


Figure 4

### Repetitive Surge Capability for 32mm Parts

V111HA32 – V751HA32

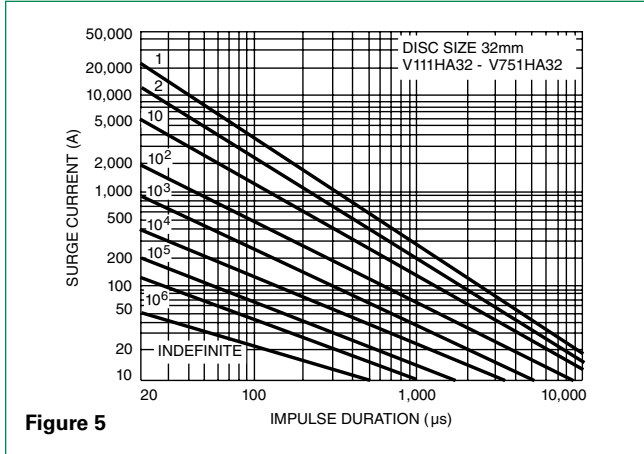


Figure 5

### Repetitive Surge Capability for 40mm Parts

V111HA40 – V751HA40

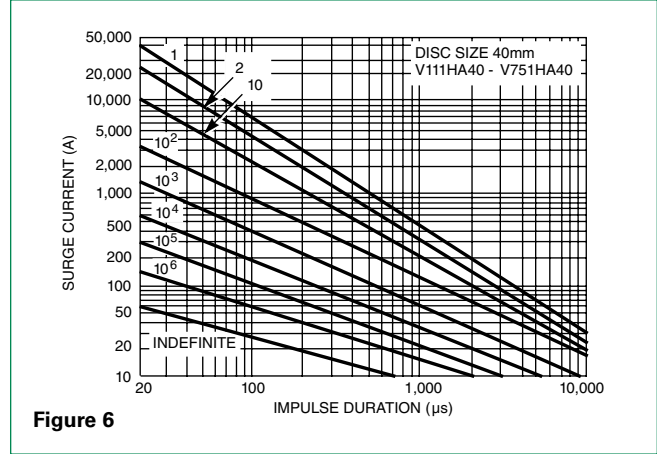


Figure 6

### Wave Solder Profile

#### Non Lead-free Profile

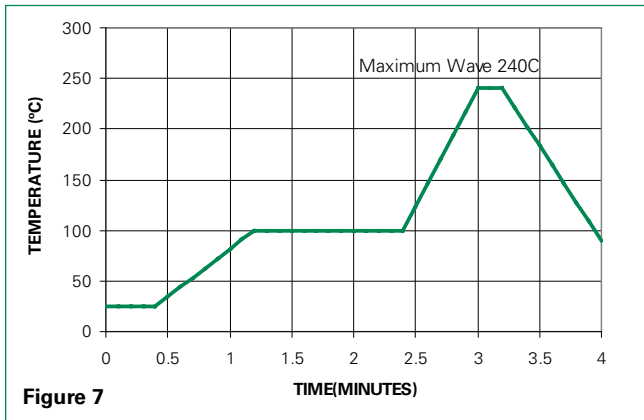


Figure 7

#### Lead-free Profile

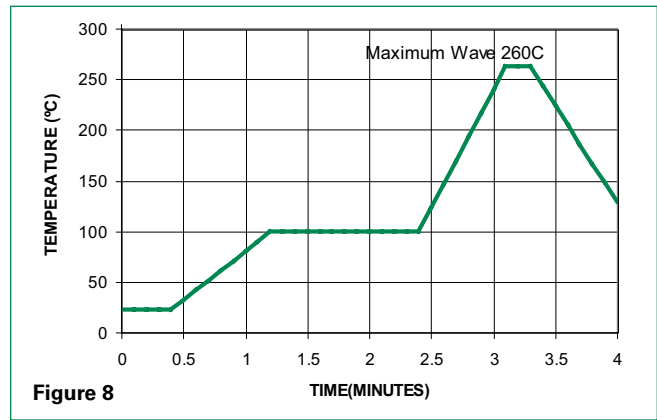


Figure 8

### Physical Specifications

<b>Lead Material</b>	Tin-plated Copper
<b>Soldering Characteristics</b>	Solderability per MIL-STD-202, Method 208
<b>Insulating Material</b>	Cured, flame retardant epoxy polymer meets UL94V-0 requirements.
<b>Device Labeling</b>	LF, Part Number and date code

### Environmental Specifications

<b>Operating Temperature</b>	-55°C to +85°C/
<b>Storage Temperature</b>	-55°C to +125°C
<b>Humidity Aging</b>	+85°C, 85% RH, 1000 hours +/- 10% typical resistance change
<b>Thermal Shock</b>	+85°C to -40°C 5 times +/- 10% typical resistance change
<b>Solvent Resistance</b>	MIL-STD-202, Method 215
<b>Moisture Sensitivity</b>	Level 1, J-STD-020