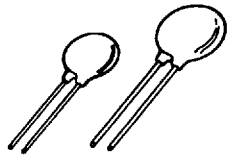
HARRIS SEMICONDUCTOR

LA Series

HARRIS SEMICOND SECTOR

UL Recognized Radial Lead Metal-Oxide Varistors for Line Voltage Operation

August 1993



7mm, 10mm, 14mm, 20mm
LA SERIES

Features

- **Recognized as "Transient Voltage Surge Suppressors", UL File #E75961 to Standard 1449**
- **Recognized as "Across-The-Line Components", UL File #E56529 to Standard 1414**
- **Recognized as "Transient Voltage Surge Suppressors", CSA File #LR91788 to Standard C22.2 No. 1 - M1981**
- **High Energy Absorption Capability W_{TM} ..... Up to 360J**
- **Wide Operating Voltage Range $V_{M(AC)RMS}$ ..... 130V to 750V**
- **Line-Voltage Operation - Can be Operated Directly Across 120V, 240V, etc., AC Power Lines**
- **Available in Tape and Reel for Automatic Insertion Equipment**

Description

LA series transient surge suppressors are radial-lead varistors that can be operated continuously across AC power lines. These UL recognized varistors "across-the-line" components, because of their radial lead construction, require very little mounting space. This feature is particularly important in compact, hard wired system designs.

LA series varistors are available in four model sizes: 7mm, 10mm, 14mm and 20mm; and have a $V_{M(AC)RMS}$ voltage range from 130V to 1000V, and an energy absorption capability up to 360J. Some LA series model numbers are available with two clamping voltage selections, designated by a model number prefix of either A or B. The "A" selection is the standard model; the "B" selection provides a tighter clamping voltage.

Absolute Maximum Ratings

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

	"C" SERIES	UNITS
Continuous:		
Steady State Applied Voltage:		
AC Voltage Range ($V_{M(AC)RMS}$)	130 to 1000	V
DC Voltage Range ($V_{M(DC)}$)	175 to 1200	V
Transients:		
Peak Pulse Current (I_{TM})		
For 8/20μs Current Wave (See Figure 2)	1200 to 6500	A
Single Pulse Energy Range		
For 10/1000μs Current Wave (W_{TM})	11 to 360	J
Operating Ambient Temperature Range (T_A)	-55 to +85	°C
Storage Temperature Range (T_{STG})	-55 to +125	°C
Temperature Coefficient (αV) of Clamping Voltage (V_C) at Specified Test Current	<0.01	%/°C
Hi-Pot Encapsulation (Isolation Voltage Capability) (Dielectric must withstand indicated DC voltage for one minute per MIL-STD 202, Method 301)	2500	V
Insulation Resistance	1000	MΩ

9 VARISTOR PRODUCTS

File Number **2190.2**

Device Ratings and Characteristics

Series LA Varistors are listed under UL file #E75961 and E56529 as a recognized component.
Series LA Varistors are listed under CSA file #LR91788 as a recognized component.

MODEL NUMBER	MODEL SIZE DISC DIA. (mm)	DEVICE MARKING	MAXIMUM RATINGS (+85°C)				CHARACTERISTICS (+25°C)					
			CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE AT 1mA DC TEST CURRENT			MAXIMUM CLAMPING VOLTAGE V_C AT TEST CURRENT (8/20µs)		TYPICAL CAPACITANCE
			RMS VOLTAGE $V_{M(AC)}$ (V)	DC VOLTAGE $V_{M(DC)}$ (V)	ENERGY (10/1000µs) W_{TM} (J)	PEAK CURRENT (8/20µs) I_{TM} (A)	MIN (V)	$V_{N(DC)}$ (V)	MAX (V)	V_C (V)	I_p (A)	f = 1MHz (pF)
V130LA1	7	1301	130	175	11	1200	184	200	255	390	10	180
V130LA2	7	1302	130	175	11	1200	184	200	228	340	10	180
V130LA5	10	1305	130	175	20	2500	184	200	228	340	25	450
V130LA10A	14	130L10	130	175	38	4500	184	200	228	340	50	1000
V130LA20A	20	130L20	130	175	70	6500	184	200	228	340	100	1900
V130LA20B	20	130L20B	130	175	70	6500	184	200	220	325	100	1900
V140LA2	7	1402	140	180	12	1200	198	220	242	360	10	160
V140LA5	10	1405	140	180	22	2500	198	220	242	360	25	400
V140LA10A	14	140L10	140	180	42	4500	198	220	242	360	50	900
V150LA1	7	1501	150	200	13	1200	212	240	284	430	10	150
V150LA2	7	1502	150	200	13	1200	212	240	268	395	10	150
V150LA5	10	1505	150	200	25	2500	212	240	268	395	25	360
V150LA10A	14	150L10	150	200	45	4500	212	240	268	395	50	800
V150LA20A	20	150L20	150	200	80	6500	212	240	268	395	100	1600
V150LA20B	20	150L20B	150	200	80	6500	212	240	243	360	100	1600
V175LA2	7	1752	175	225	15	1200	247	270	303	455	10	130
V175LA5	10	1755	175	225	30	2500	247	270	303	455	25	350
V175LA10A	14	175L10	175	225	55	4500	247	270	303	455	50	700
V175LA20A	20	175L20	175	225	90	6500	247	270	303	455	100	1400
V230LA4	7	2304	230	300	20	1200	324	360	396	595	10	100
V230LA10	10	230L	230	300	35	2500	324	360	396	595	25	250
V230LA20A	14	230L20	230	300	70	4500	324	360	396	595	50	550
V250LA2	7	2502	250	330	21	1200	354	390	473	730	10	90
V250LA4	7	2504	250	330	21	1200	354	390	429	650	10	90
V250LA10	10	250L	250	330	40	2500	354	390	429	650	25	220
V250LA20A	14	250L20	250	330	72	4500	354	390	429	650	50	500
V250LA40A	20	250L40	250	330	130	6500	354	390	429	650	100	1000
V250LA40B	20	250L40B	250	330	130	6500	354	390	413	620	100	1000
V275LA2	7	2752	275	369	23	1200	389	430	515	775	10	80
V275LA4	7	2754	275	369	23	1200	389	430	473	710	10	80
V275LA10	10	275L	275	369	45	2500	389	430	473	710	25	200
V275LA20A	14	275L20	275	369	75	4500	389	430	473	710	50	450
V275LA40A	20	275L40	275	369	140	6500	389	430	473	710	100	900
V275LA40B	20	275L40B	275	369	140	6500	389	430	453	680	100	900
V300LA2	7	3002	300	405	25	1200	420	470	565	870	10	70
V300LA4	7	3004	300	405	25	1200	420	470	517	775	10	70
V320LA20A	14	320L20	320	420	90	4500	462	510	565	850	50	380
V320LA40B	20	320L40	320	420	160	6500	462	510	540	810	100	750
V420LA10	10	420L	420	560	45	2500	610	680	748	1120	25	140
V420LA20A	14	420L20	420	560	90	4500	610	680	748	1120	50	300
V420LA40B	20	420L40	420	560	160	6500	610	680	720	1060	100	600
V480LA40A	14	480L40	480	640	105	4500	670	750	825	1240	50	270
V480LA80B	20	480L80	480	640	180	6500	670	750	790	1160	100	550
V510LA40A	14	510L40	510	675	110	4500	735	820	910	1350	50	250
V510LA80B	20	510L80	510	675	190	6500	735	820	860	1280	100	500
V575LA40A	14	575L40	575	730	120	4500	805	910	1000	1500	50	220
V575LA80B	20	575L80	575	730	220	6500	805	910	960	1410	100	450
V660LA50A	14	660L50	660	850	140	4500	940	1050	1210	1820	50	200
V660LA100B	20	660L100	660	850	250	6500	940	1050	1100	1650	100	400
V1000LA80A	14	1000L80	1000	1200	220	4500	1425	1600	1800	2700	50	130
V1000LA160B	20	1000L160	1000	1200	360	6500	1425	1600	1600	2420	100	250

NOTE: Average power dissipation of transients not to exceed 0.25W, 0.4W, 0.6W or 1W for model sizes 7mm, 10mm, 14mm and 20mm, respectively.

Power Dissipation Requirements

Transients in a suppressor generate heat too quickly for it to be transferred to the surroundings during the pulse interval. Continuous power dissipation capability, therefore, is not a necessary design requirement for a suppressor, unless transients occur in rapid succession. Under this condition, 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 Characteristics table for the specific device. Furthermore, the operating values need to be derated at high temperatures as shown in Figure 1. Because varistors can only dissipate a relatively small amount of average power they are, therefore, not suitable for repetitive applications that involve substantial amounts of average power dissipation.

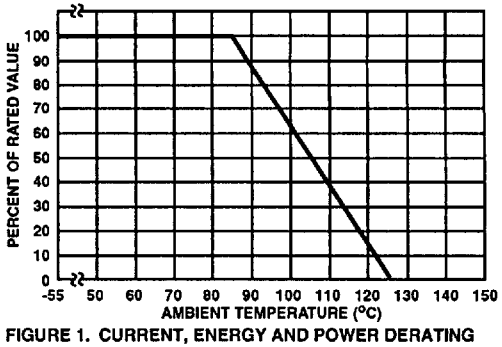
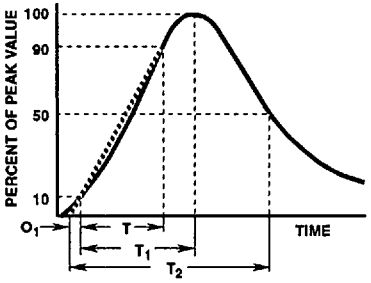


FIGURE 1. CURRENT, ENERGY AND POWER DERATING CURVE



O_1 = Virtual Origin of Wave
T = Time From 10% to 90% of Peak
T_1 = Virtual Front Time = 1.25 • t
T_2 = Virtual Time to Half Value (Impulse Duration)

Example: For an 8/20μs Current Waveform:
8μs = T_1 = Virtual Front Time
20μs = T_2 = Virtual Time to Half Value

FIGURE 2. PEAK PULSE CURRENT TEST WAVEFORM

Transient V-I Characteristics Curves

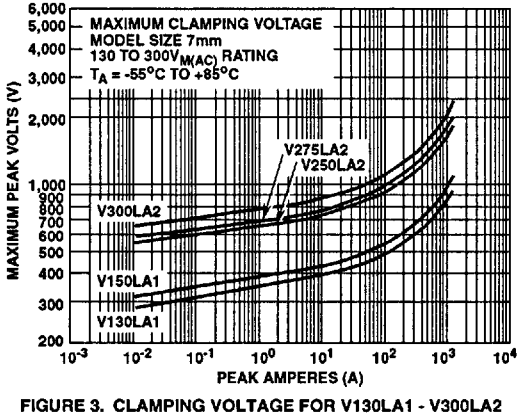


FIGURE 3. CLAMPING VOLTAGE FOR V130LA1 - V300LA2

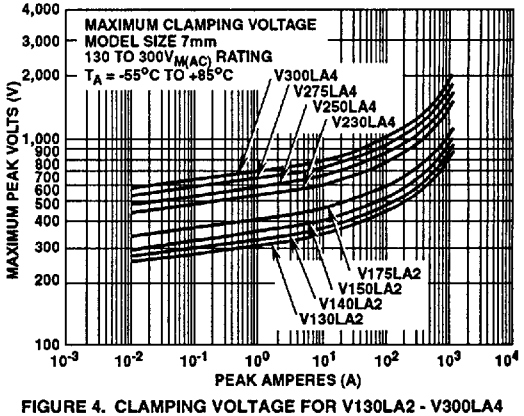


FIGURE 4. CLAMPING VOLTAGE FOR V130LA2 - V300LA4

9
VARISTOR PRODUCTS

Transient V-I Characteristics Curves (Continued)

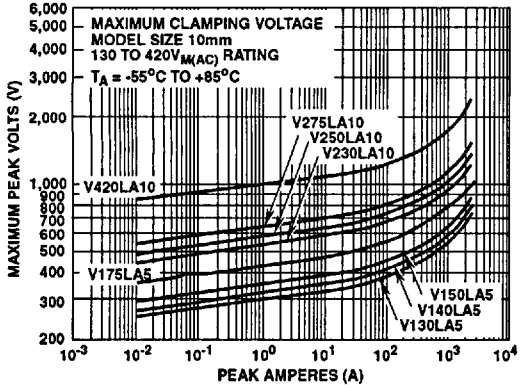


FIGURE 5. CLAMPING VOLTAGE FOR V130LA5 - V420LA10

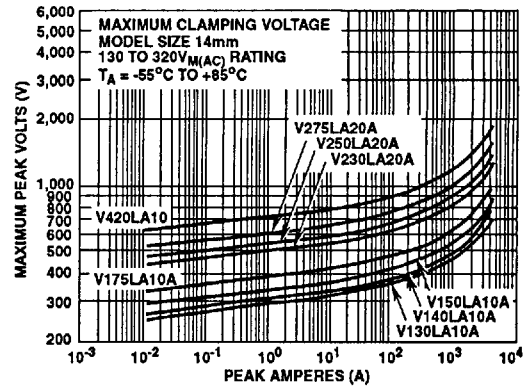


FIGURE 6. CLAMPING VOLTAGE FOR V130LA10A - V320LA20A

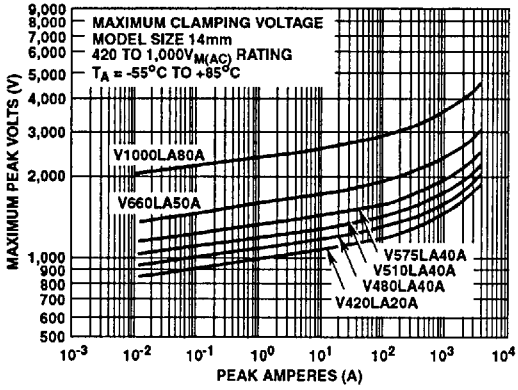


FIGURE 7. CLAMPING VOLTAGE FOR V420LA20A - V1000LA80A

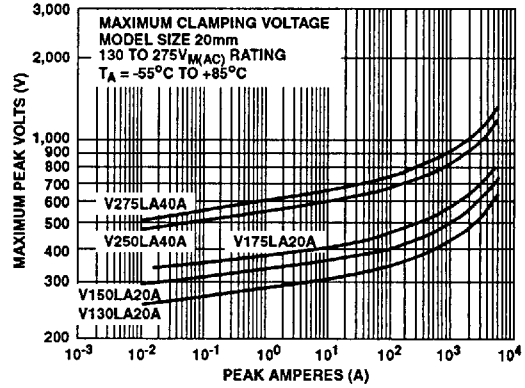


FIGURE 8. CLAMPING VOLTAGE FOR V130LA20A - V275LA40A

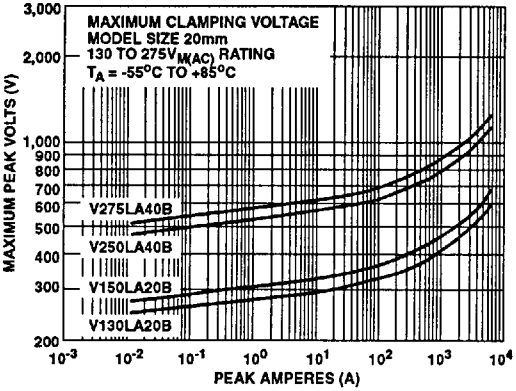


FIGURE 9. CLAMPING VOLTAGE FOR V130LA20B - V275LA40B

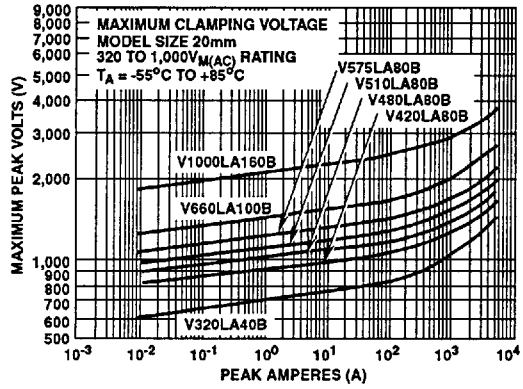


FIGURE 10. CLAMPING VOLTAGE FOR V320LA40B - V1000LA160B

Pulse Rating Curves

HARRIS SEMICOND SECTOR

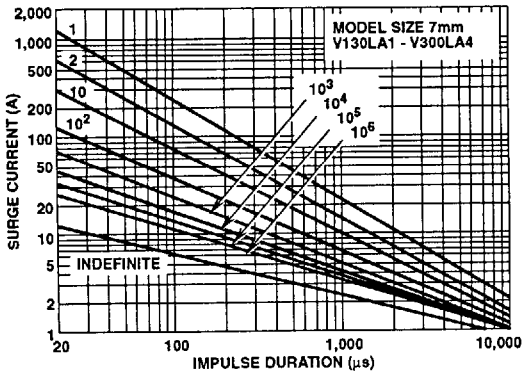


FIGURE 11. SURGE CURRENT RATING CURVES FOR V130LA1 - V300LA4

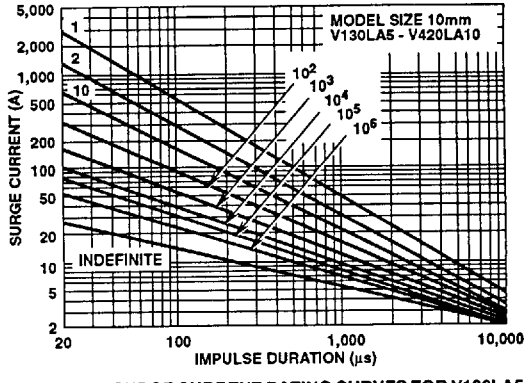


FIGURE 12. SURGE CURRENT RATING CURVES FOR V130LA5 - V420LA10

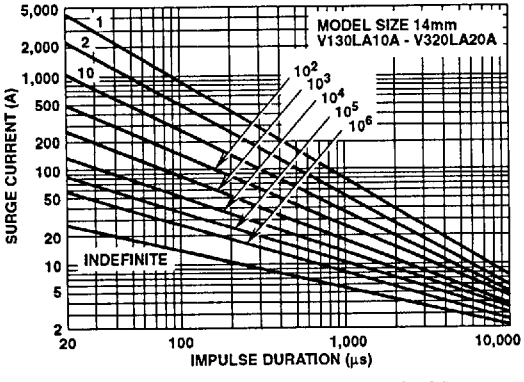


FIGURE 13. SURGE CURRENT RATING CURVES FOR V130LA10A - V320LA20A

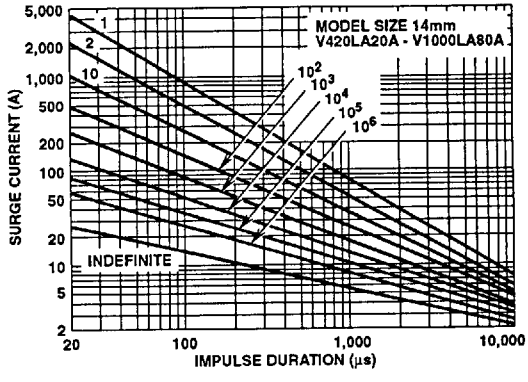


FIGURE 14. SURGE CURRENT RATING CURVES FOR V420LA20A - V1000LA80A

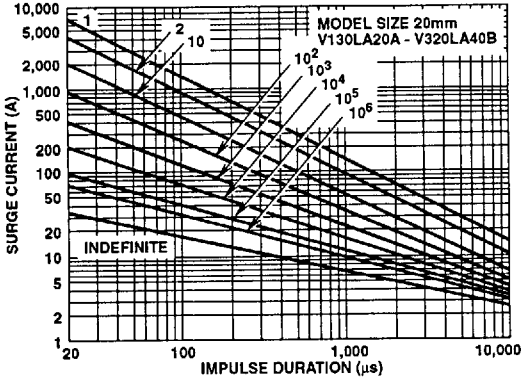


FIGURE 15. SURGE CURRENT RATING CURVES FOR V130LA20A - V320LA40B

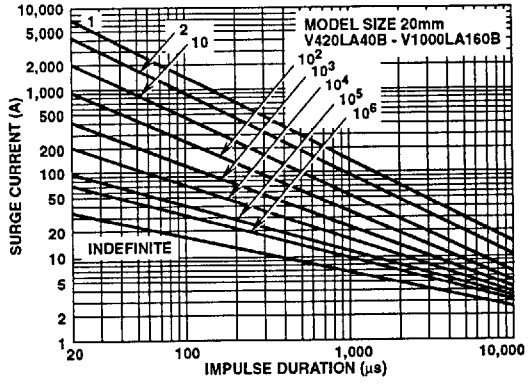
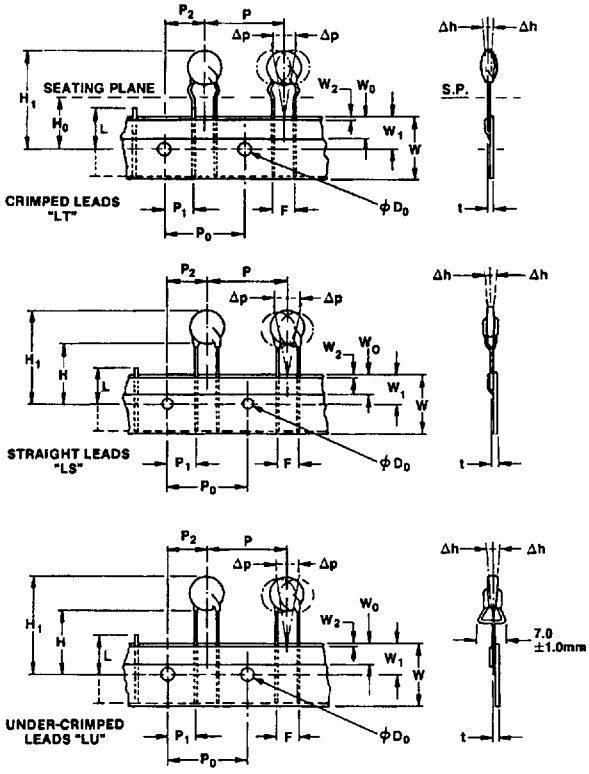


FIGURE 16. SURGE CURRENT RATING CURVES FOR V420LA40B - V1000LA160B

NOTE: If pulse ratings are exceeded, a shift of $V_{N(DC)}$ (at specified current) of more than ±10% could result. This type of shift, which normally results in a decrease of $V_{N(DC)}$, may result in the device not meeting the original published specifications, but does not prevent the device from continuing to function, and to provide ample protection.

Tape and Reel Specifications



Tape And Reel Data

- Conforms to ANSI and EIA specifications
- Can be supplied to IEC Publication 286-2
- Radial devices on tape are supplied with crimped leads, straight leads, or under-crimped leads

HARRIS SEMICOND SECTOR

SYMBOL	PARAMETER	MODEL SIZE			
		7mm	10mm	14mm	20mm
P	Pitch of Component	12.7 ± 1.0	25.4 ± 1.0	25.4 ± 1.0	25.4 ± 1.0
P_0	Feed Hole Pitch	12.7 ± 0.2	12.7 ± 0.2	12.7 ± 0.2	12.7 ± 0.2
P_1	Feed Hole Center to Pitch	3.85 ± 0.7	2.6 ± 0.7	2.6 ± 0.7	2.6 ± 0.7
P_2	Hole Center to Component Center	6.35 ± 0.7	6.35 ± 0.7	6.35 ± 0.7	6.35 ± 0.7
F	Lead to Lead Distance	5.0 ± 0.8	7.5 ± 0.8	7.5 ± 0.8	7.5 ± 0.8
Δh	Component Alignment	2.0 Max	2.0 Max	2.0 Max	2.0 Max
W	Tape Width	18.0 + 1.0 18.0 - 0.5	18.0 + 1.0 18.0 - 0.5	18.0 + 1.0 18.0 - 0.5	18.0 + 1.0 18.0 - 0.5
W_0	Hold Down Tape Width	6.0 ± 0.3	6.0 ± 0.3	6.0 ± 0.3	12.0 ± 0.3
W_1	Hole Position	9.0 + 0.75 9.0 - 0.50	9.0 + 0.75 9.0 - 0.50	9.0 + 0.75 9.0 - 0.50	9.0 + 0.75 9.0 - 0.50
W_2	Hold Down Tape Position	0.5 Max	0.5 Max	0.5 Max	0.5 Max
H	Height from Tape Center to Component Base	18.0 + 2.0 18.0 - 0.0	18.0 + 2.0 18.0 - 0.0	18.0 + 2.0 18.0 - 0.0	18.0 + 2.0 18.0 - 0.0
H_0	Seating Plane Height	16.0 ± 0.5	16.0 ± 0.5	16.0 ± 0.5	16.0 ± 0.5
H_1	Component Height	32.0 Max	36.0 Max	40.0 Max	46.5 Max
D_0	Feed Hole Diameter	4.0 ± 0.2	4.0 ± 0.2	4.0 ± 0.2	4.0 ± 0.2
t	Total Tape Thickness	0.7 ± 0.2	0.7 ± 0.2	0.7 ± 0.2	0.7 ± 0.2
L	Length of Clipped Lead	11.0 Max	11.0 Max	11.0 Max	11.0 Max
Δp	Component Alignment	3° Max 1.00mm	3° Max 1.00mm	3° Max 1.00mm	3° Max

NOTE: Dimensions are in mm.

Tape and Reel Ordering Information

Crimped leads are standard on LA types supplied in tape and reel and are denoted by the model letter "T". Model letter "S" denotes straight leads and letter "U" denotes special under-crimped leads.

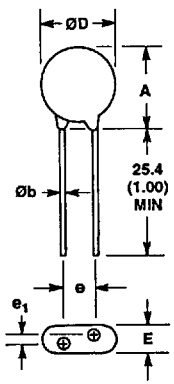
Example:

STANDARD MODEL	CRIMPED LEADS	STRAIGHT LEADS	UNDER-CRIMPED LEADS
V130LA2	V130LT2	V130LS2	V130LU2

SHIPPING QUANTITY

SIZE	RMS (MAX) VOLTAGE	QUANTITY PER REEL		
		"T" REEL	"S" REEL	"U" REEL
7mm	All	1000	1000	1000
10mm	All	1000	1000	1000
14mm	< 300V	500	500	500
14mm	≥ 300V	500	500	500
20mm	<300V	500	500	500
20mm	≤ 300V	500	500	500

Packaging



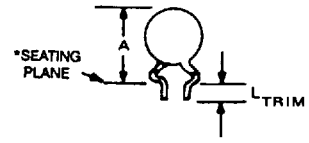
SYMBOL	VOLTAGE MODEL	VARISTOR MODEL SIZE							
		7mm		10mm		14mm		20mm	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	V130LA-V320LA	7.5 (0.295)	12 (0.472)	10 (0.394)	16 (0.630)	13.5 (0.531)	20 (0.787)	17.5 (0.689)	26.5 (1.043)
	V420LA-V1000LA	- -	- -	10 (0.394)	17 (0.689)	13.5 (0.531)	20.5 (0.807)	17.5 (0.689)	28 (1.102)
ØD	All	7.5 (0.295)	9 (0.354)	10 (0.394)	12.5 (0.492)	13.5 (0.531)	17 (0.669)	17.5 (0.689)	23 (0.906)
e (Note 1)	All	4 (0.157)	6 (0.236)	6.5 (0.256)	8.5 (0.335)	6.5 (0.256)	8.5 (0.335)	6.5 (0.256) (Note 1)	8.5 (0.335) (Note 1)
e_1	V130LA-V320LA	1.5 (0.059)	3.5 (0.138)	1.5 (0.059)	3.5 (0.138)	1.5 (0.059)	3.5 (0.138)	1.5 (0.059)	3.5 (0.138)
	V420LA-V1000LA	- -	- -	2.5 (0.098)	5.5 (0.217)	2.5 (0.098)	5.5 (0.217)	2.5 (0.098)	5.5 (0.217)
E	V130LA-V320LA	- -	5.6 (0.220)	- -	5.6 (0.220)	- -	5.6 (0.220)	- -	5.6 (0.220)
	V68ZA-V100ZA	- -	7.3 (0.287)	- -	7.3 (0.287)	- -	7.3 (0.287)	- -	7.3 (0.287)
	V100LA	- -	- -	- -	- -	- -	10.8 (0.425)	- -	10.8 (0.425)
Øb (Note 2)	All	0.585 (0.023)	0.685 (0.027)	0.76 (0.030)	0.86 (0.034)	0.76 (0.030)	0.86 (0.034)	0.76 (0.030) (Note 1)	0.86 (0.034) (Note 1)

NOTE: Dimensions in millimeters, inches in parentheses.

1. 10mm ALSO AVAILABLE; See Ordering Information.
2. 1000V parts only supplied with lead wire of diameter 1.00 ± 0.05 (0.039 ± 0.002).

Available Lead Style

Radial lead types can be supplied with a preformed crimp in the leads, and are available in all model sizes. Lead trim (L_{TRIM}) is supplied to the dimensions shown.



*Seating plane interpretation per IEC-717

CRIMPED AND TRIMMED LEAD

SYMBOL	VARISTOR MODEL SIZE							
	7mm		10mm		14mm		20mm	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	- -	15 (0.591)	- -	19.5 (0.768)	- -	22.5 (0.886)	- -	29.0 (1.142)
L_{TRIM}	2.41 (0.095)	4.69 (0.185)	2.41 (0.095)	4.69 (0.185)	2.41 (0.095)	4.69 (0.185)	2.41 (0.095)	4.69 (0.185)

NOTE: Dimensions in millimeters, inches in parentheses.

Ordering Information

- For crimped and trimmed lead styles, standard radial type model numbers are changed by replacing the model letter "A" with "C".

Example:

STANDARD CATALOG MODEL	ORDER AS:
V130LA2	V130LC2

- For 10/±1mm lead spacing on 20mm diameter models only; append standard model numbers by adding "X10".

Example:

STANDARD CATALOG MODEL	ORDER AS:
V130LA20A	V130LA20AX10

- For crimped leads without trimming and any variations to the above, contact Harris Semiconductor Power Marketing.