

Industrial High Energy Metal-Oxide Disc Varistors

The CA Series of transient surge suppressors are industrial high-energy disc varistors (MOVs) intended for special applications requiring unique electrical contact or packaging methods provided by the customer. The electrode finish of these devices is solderable and can also be used with pressure contacts. Discs of the same diameter may be stacked.

This series of industrial disc varistors are available in three diameter sizes of 32, 40, and 60mm, with disc thicknesses ranging from 1.8mm minimum to 32mm maximum. They offer a wide voltage range of from 130 to 2800 $V_{M(AC)RMS}$.

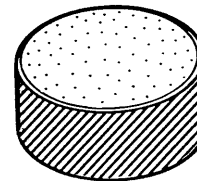
For information on soldering considerations, refer to AN8820 "Recommendations for Soldering Terminal Leads to MOV Varistor Discs".

Features

- Provided In Disc Form For Unique Packaging By Customer
- Solderable Electrode Finish Options
- Pressure Contacts and/or Disc Stacking May be Utilized
- Standard Disc Sizes 32mm, 40mm, and 60mm Diameter
- Available Edge Passivation Insulation
- Wide Operating Voltage Range $V_{M(AC)RMS}$ 130V to 2800V
- High Peak Pulse Current Range . . I_{TM} 20,000A to 70,000A
- Very High Energy Capability W_{TM} 200J to 10,000J
- No Derating Up to 85°C Ambient

Packaging

CA SERIES



CA Series

Absolute Maximum Ratings

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

	CA SERIES	UNITS
Continuous:		
Steady State Applied Voltage:		
AC Voltage Range ($V_{M(AC)RMS}$)	130 to 2800	V
DC Voltage Range ($V_{M(DC)}$)	175 to 3500	V
Transient:		
Peak Pulse Current (I_{TM})		
For 8/20 μ s Current Wave (See Figure 2)	20,000 to 70,000	A
Single Pulse Energy Range		
For 2ms Current Square Wave (W_{TM})	200 to 10,000	J
Operating Ambient Temperature Range (T_A)	-55 to 85	$^{\circ}C$
Storage Temperature Range (T_{STG})	-55 to 125	$^{\circ}C$
Temperature Coefficient (αV) of Clamping Voltage (V_C) at Specified Test Current	<0.01	%/ $^{\circ}C$

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.

Device Ratings and Specifications

MODEL NUMBER	SIZE (mm)	MAXIMUM RATINGS (85 $^{\circ}C$)				SPECIFICATIONS (25 $^{\circ}C$)				
		CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE AT 1mA DC TEST CURRENT			MAX CLAMPING VOLT V_C AT 200A CURRENT (8/20 μ s)	TYPICAL CAPACI- TANCE
		V_{RMS}	V_{DC}	ENERGY (2ms)	PEAK CURRENT (8/20 μ s)					
		$V_{M(AC)}$	$V_{M(DC)}$	W_{TM}	I_{TM}	MIN	$V_{N(DC)}$	MAX		
		(V)	(V)	(J)	(A)	(V)	(V)	(V)	(V)	f = 1MHz (pF)
V131CA32 V131CA40	32 40	130	175	200 270	20000 30000	184	200	228	350 345	4700 10000
V151CA32 V151CA40	32 40	150	200	220 300	20000 30000	212	240	268	410 405	4000 8000
V251CA32 V251CA40 V251CA60	32 40 60	250	330	330 370 880	20000 30000 50000	354	390	429	680 650 620	2500 5000 10000
V271CA32 V271CA40 V271CA60	32 40 60	275	369	360 400 950	20000 30000 50000	389	430	473	750 730 680	2200 4500 9000
V321CA32 V321CA40 V321CA60	32 40 60	320	420	390 460 1100	20000 30000 50000	462	510	561	850 830 760	1900 3800 7500
V421CA32 V421CA40 V421CA60	32 40 60	420	560	400 600 1500	25000 40000 70000	610	680	748	1200 1130 1060	1500 3000 6000
V481CA32 V481CA40 V481CA60	32 40 60	480	640	450 650 1600	25000 40000 70000	670	750	825	1300 1240 1160	1300 2700 5500
V511CA32 V511CA40 V511CA60	32 40 60	510	675	500 700 1800	25000 40000 70000	735	820	910	1440 1350 1300	1200 2500 5000
V571CA32 V571CA40 V571CA60	32 40 60	575	730	550 770 2100	25000 40000 70000	805	910	1000	1600 1480 1420	1100 2200 4500
V661CA32 V661CA40 V661CA60	32 40 60	660	850	600 900 2300	25000 40000 70000	940	1050	1160	1820 1720 1640	1000 2000 4000

Device Ratings and Specifications (Continued)

MODEL NUMBER	SIZE (mm)	MAXIMUM RATINGS (85°C)				SPECIFICATIONS (25°C)				
		CONTINUOUS		TRANSIENT		VARISTOR VOLTAGE AT 1mA DC TEST CURRENT			MAX CLAMPING VOLT V_C AT 200A CURRENT (8/20 μ s)	TYPICAL CAPACI- TANCE
		V_{RMS}	V_{DC}	ENERGY (2ms)	PEAK CURRENT (8/20 μ s)					
		$V_{M(AC)}$	$V_{M(DC)}$	W_{TM}	I_{TM}	MIN	$V_{N(DC)}$	MAX	V_C	f = 1MHz
		(V)	(V)	(J)	(A)	(V)	(V)	(V)	(V)	(pF)
V751CA32	32	750	970	700	25000	1080	1200	1320	2050	800
V751CA40	40			1050	40000				2000	1800
V751CA60	60			2600	70000				1880	3500
V881CA60	60	880	1150	3200	70000	1290	1500	1650	2340	2700
V112CA60	60	1100	1400	3200	70000	1620	1800	2060	2940	2200
V142CA60	60	1400	1750	5000	70000	2020	2200	2550	3600	1800
V172CA60	60	1700	2150	6000	70000	2500	2700	3030	4300	1500
V202CA60	60	2000	2500	7500	70000	2970	3300	3630	5200	1200
V242CA60	60	2400	3000	8600	70000	3510	3900	4290	6200	1000
V282CA60	60	2800	3500	10000	70000	4230	4700	5170	7400	800

NOTE: Average power dissipation of transients not exceed 1.5W, 2.0W and 2.5W for model 32mm, 40mm and 60mm, respectively.

Power Dissipation Ratings

Should transients occur in rapid succession, the average power dissipation result is 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 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.

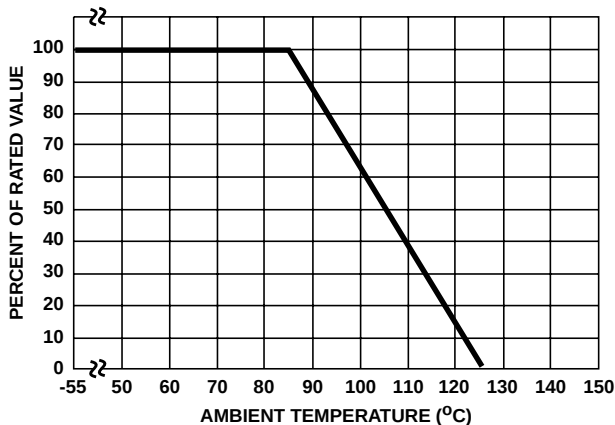
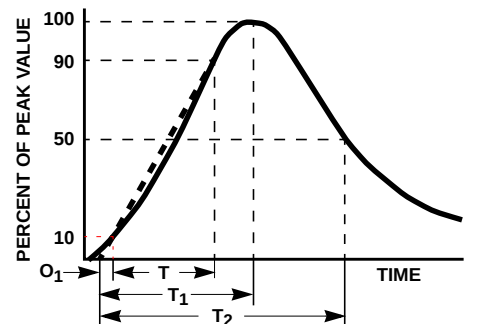


FIGURE 1. CURRENT, ENERGY AND POWER DERATING CURVE



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

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

FIGURE 2. PEAK PULSE CURRENT TEST WAVEFORM

Transient V-I Characteristics Curves

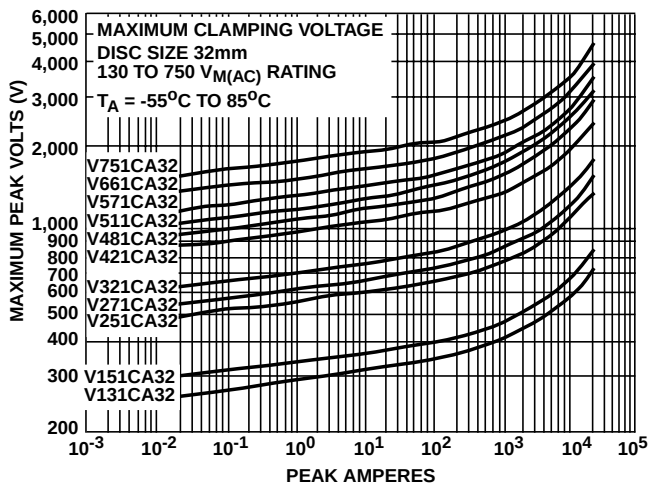


FIGURE 3. CLAMPING VOLTAGE FOR V131CA32 - C751CA32

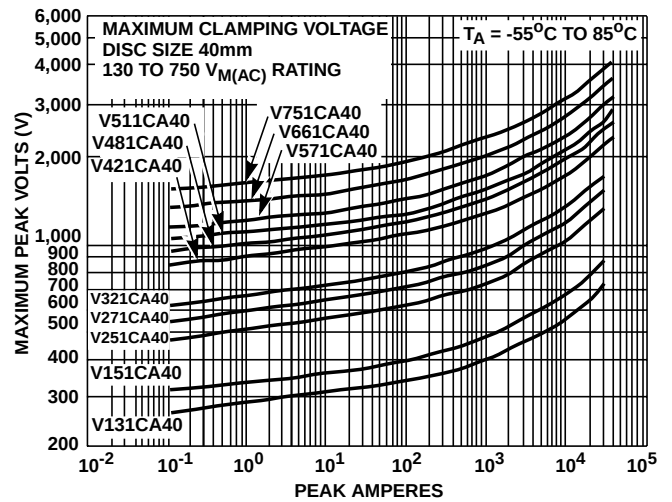


FIGURE 4. CLAMPING VOLTAGE FOR V131CA40 - V751CA40

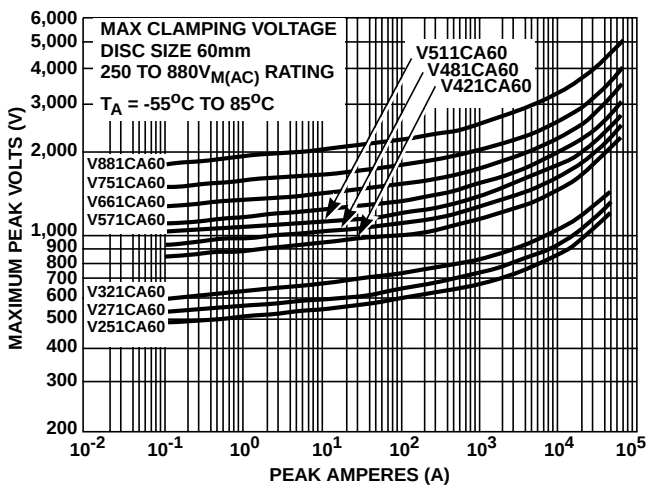


FIGURE 5. CLAMPING VOLTAGE FOR V251CA60 - V881CA60

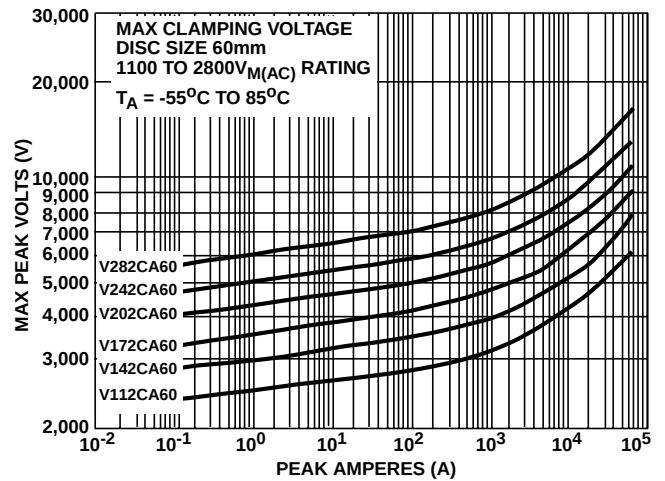


FIGURE 6. CLAMPING VOLTAGE FOR V112CA60 - V282CA60

Pulse Rating Curves

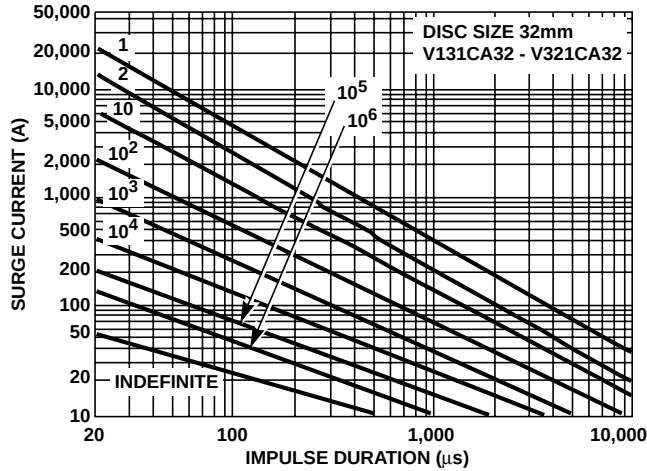


FIGURE 7. SURGE CURRENT RATING CURVES FOR V131CA32 - V321CA32

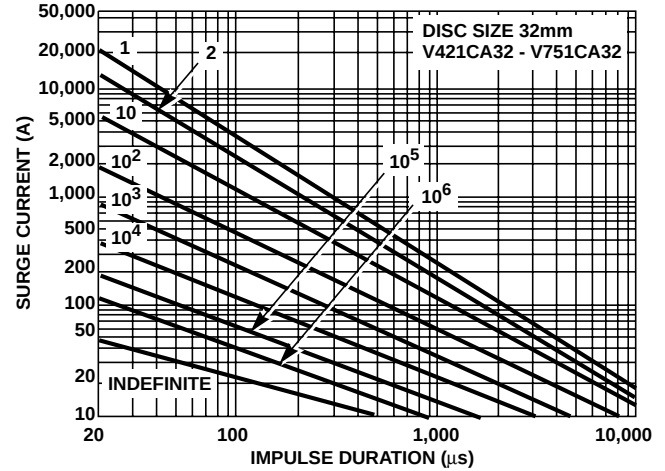


FIGURE 8. SURGE CURRENT RATING CURVES FOR V421CA32 - V751CA32

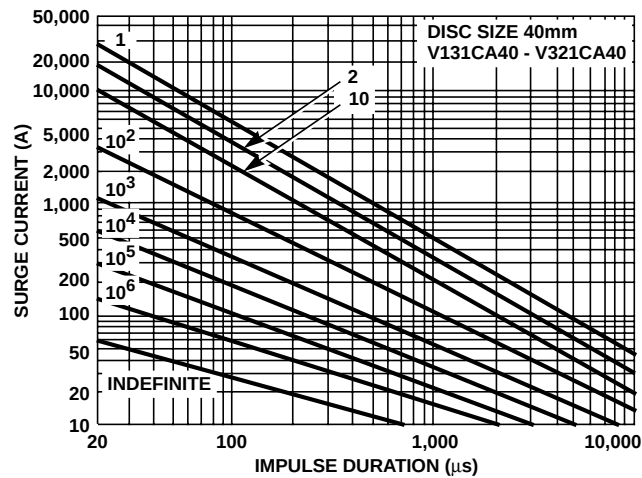


FIGURE 9. SURGE CURRENT RATING CURVES FOR V131CA40 - V321CA40

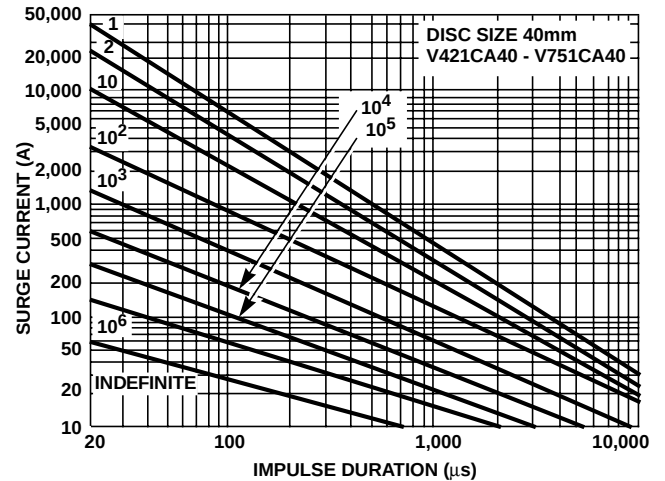


FIGURE 10. SURGE CURRENT RATING CURVES FOR V421CA40 - V751CA40

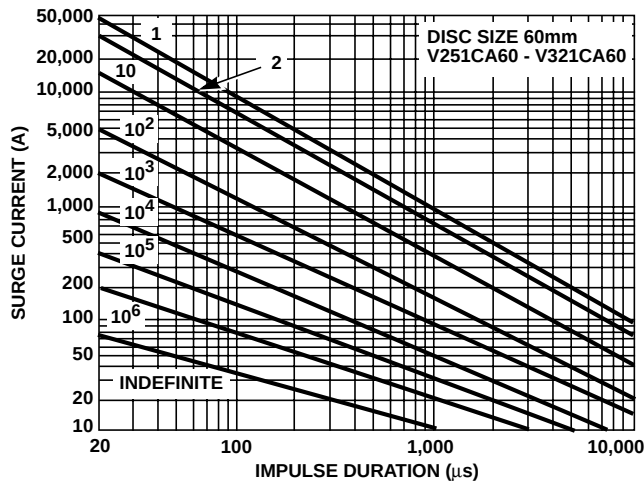


FIGURE 11. SURGE CURRENT RATING CURVES FOR V251CA60 - V321CA60

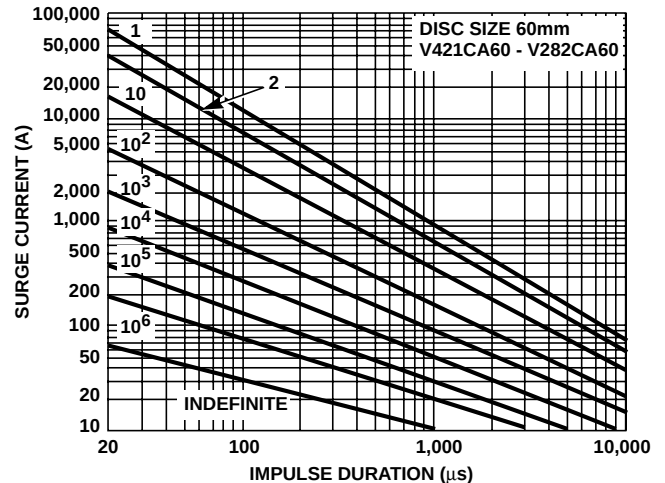
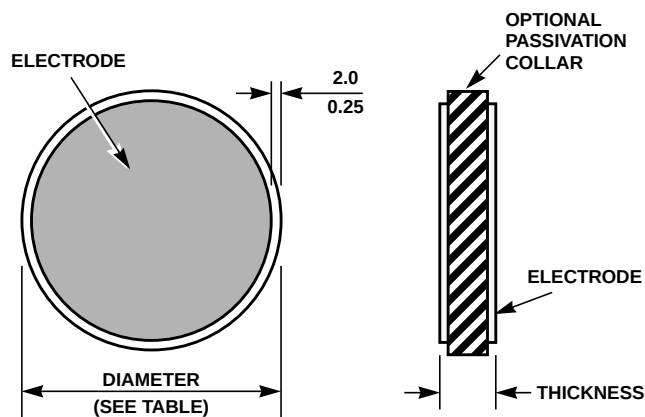


FIGURE 12. SURGE CURRENT RATING CURVES FOR V421CA60 - V282CA60

NOTE: If pulse ratings are exceeded, a shift of $V_{N(DC)}$ (at specified current) of more than $\pm 10\%$ 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.

Series Dimensions



MODEL SIZE	DISC DIAMETER			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
32	31.0	33.0	1.220	1.299
40	38.0	40.0	1.496	1.575
60	58.0	62.0	2.283	2.441

MODEL V_{RMS} $V_{M(AC)}$	THICKNESS (32mm DISC MODELS)				THICKNESS (40mm AND 60mm DISC MODELS)			
	MILLIMETERS		INCHES		MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
130†	1.8	2.4	0.071	0.094	2.5	3.4	0.098	0.134
150†	2.1	2.8	0.083	0.110	2.8	3.8	0.110	0.150
250	1.6	2.2	0.063	0.087	2.0	2.7	0.079	0.106
275	1.8	2.5	0.071	0.098	2.2	3.0	0.087	0.118
320	2.1	2.9	0.083	0.114	2.6	3.5	0.102	0.138
420	2.9	3.9	0.114	0.154	3.5	4.7	0.138	0.185
480	3.1	4.3	0.122	0.169	3.8	5.2	0.150	0.205
510	3.5	4.7	0.138	0.185	4.2	5.7	0.165	0.224
575	3.8	5.1	0.150	0.201	4.6	6.3	0.181	0.248
660	4.4	6.0	0.173	0.236	5.3	7.2	0.209	0.283
750	5.1	6.9	0.240	0.327	6.1	8.3	0.240	0.327
880††	-	-	-	-	7.3	10.3	0.287	0.406
1100††	-	-	-	-	9.2	13.0	0.362	0.512
1400††	-	-	-	-	11.5	16.0	0.453	0.630
1700††	-	-	-	-	14.0	19.0	0.551	0.748
2000††	-	-	-	-	17.0	22.5	0.669	0.886
2400††	-	-	-	-	20.0	27.0	0.787	1.063
2800††	-	-	-	-	24.0	32.0	0.945	1.260

† Available in 32mm and 40mm only.

†† Available in 60mm size only.

MODEL NUMBER	SIZE (mm)	TYPICAL DISC WEIGHT (GRAMS)
V131CA32	32	9
V131CA40	40	21
V151CA32	32	11
V151CA40	40	23
V251CA32	32	8
V251CA40	40	17
V251CA60	60	39
V271CA32	32	10
V271CA40	40	18
V271CA60	60	42
V321CA32	32	11
V321CA40	40	22
V321CA60	60	50
V421CA32	32	15
V421CA40	40	28
V421CA60	60	66
V481CA32	32	16
V481CA40	40	31
V481CA60	60	71
V511CA32	32	18
V511CA40	40	35
V511CA60	60	80
V571CA32	32	20
V571CA40	40	38
V571CA60	60	88
V661CA32	32	23
V661CA40	40	44
V661CA60	60	101
V751CA32	32	26
V751CA40	40	51
V751CA60	60	116
V881CA60	60	141
V112CA60	60	178
V142CA60	60	220
V172CA60	60	265
V202CA60	60	317
V242CA60	60	377
V282CA60	60	450

Passivation Layer

The standard CA Series is supplied with passivation layer around the outside perimeter of the disc forming an electrical insulator as detailed in the dimensional drawing. The CA Series is also available without a passivation layer for applications where the customer provides a suitable encapsulation or potting material as recommended below. (See Ordering Information.)

Encapsulated Recommendations

After lead attachment, the disc/lead assembly may be coated or encapsulated in a package to provide electrical insulation and isolation from environmental contamination as required by the application. Coating/Filler materials for containers may include silicones, polyurethanes, and some epoxy resins. Two examples of acceptable polyurethanes are Dexter Hysol (US7013, parts A and B) and Rhenatech (resin 4714, hardener 4900), or their equivalents. Materials containing halogens, sulfides, or alkalines are not recommended.

Electrode Metallization

The CA Series is available with either a sintered silver or an arc-sprayed copper-over-aluminum metallization for the electrode finish. In general, when discs are stacked to attain a specific operating voltage or energy capability, the copper finish is typically chosen. Likewise, the copper finish is used with high temperature lead attach soldering operations (wave solder). The silver metallization is typically used for solder reflow lead attach operations (I-R, Vapour-Phase).

The recommended temperature profile of a belt-fed convection oven is shown in Figure 13.

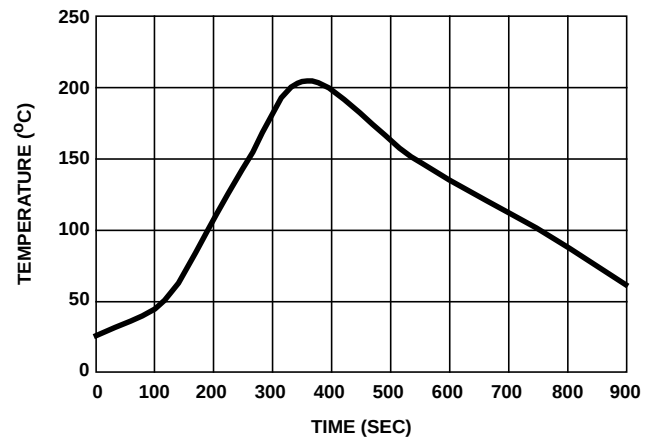


FIGURE 13. TYPICAL BELT OVEN TEMPERATURE PROFILE

Stacking and Contact Pressure Recommendations

When applications require the stacking of Harris CA discs or when electrical connection is made by pressure contacts, the minimum pressure applied to the disc electrode surface should be 2.2kGs (5 pounds). The maximum recommended pressure applied to the disc electrode is dependent upon diameter size and is given in the following table.

MODEL SIZE (mm)	MAXIMUM PRESSURE
32	16N/CM ² (23LBS/IN ²)
40	8N/CM ² (11.5LBS/IN ²)
60	4N/CM ² (5.7LBS/IN ²)

CA Series

Ordering Information

The CA Series offers optional electrode finish materials and a glass passivation edge option which must be designated. When ordering, the code letters suffix as shown in the following table must be selected and appended to the standard Model number.

ELECTRODE MATERIAL	NON-PASSIVATED DISC	PASSIVATED DISC
Arc-Sprayed Copper	NC	PC
Sintered Silver	NS	PS

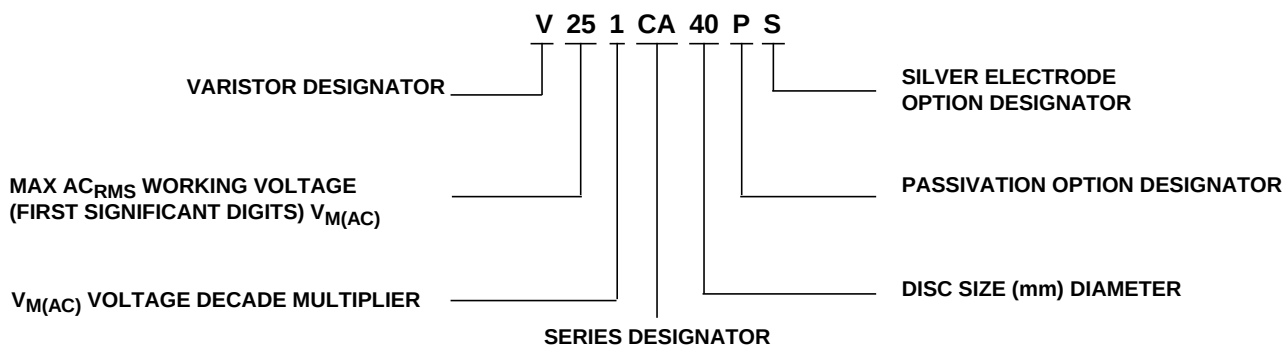
NOTES:

1. The 60mm disc types V112CA60 to V282CA60, inclusive, are only supplied with glass passivation and arc-sprayed copper finish electrodes. (That is, with the "PC" option suffix code.)
2. The 32mm size discs are only available with silver metallization.

Note also that the CA Series receives no branding on the disc itself.

Packaging and Shipping

The CA Series is supplied in bulk for shipment. Discs are packaged in compartmentalized cartons to protect from scratching or edge-chipping during shipment.



All Harris Semiconductor products are manufactured, assembled and tested under **ISO9000** quality systems certification.

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