

Features

- Formerly a KEKO VARICON product
- Five model sizes available - 7, 10, 14, 20 and 23 mm
- Broad range of current and energy handling capabilities
- 60 to 550 V_{rms} AC voltage range; higher voltages available upon request
- 85 to 745 Vdc DC operating voltage range
- Available in tape and reel packaging for automatic pick-and-place (7-20 mm)
- RoHS compliant*

CVQ Series – Extended Medium Voltage Disc Varistors

General Information

The CVQ series of transient surge suppressors is the extended version of CV series disc shaped varistors. The CVQ series consists of 7 mm, 10 mm, 14 mm, 20 mm and 23 mm sized varistors with extremely high current and energy capabilities. This series provides an increased level of protection for the transients expected in telecommunication and AC power networks. The AC operating voltage of these varistors ranges from 60 V to 550 V.

Absolute Maximum Ratings

Parameter	Value	Units
Continuous:		
Steady State Applied Voltage		
DC Voltage Range (V_{dc})	85 to 745	V
AC Voltage Range (V_{rms})	60 to 550	V
Transient:		
Peak Single Pulse Surge Current, 8/20 μs Waveform (I_{max})	1750 to 15000	A
Single Pulse Surge Energy, 10/1000 μs Waveform (W_{max})	9 to 627	J
Operating Ambient Temperature	-40 to +85	°C
Storage Temperature Range	-40 to +125	°C
Threshold Voltage Temperature Coefficient	< +0.05	%/°C
Insulation Resistance	> 1	GΩ
Isolation Voltage Capability	> 2.5	kV
Response Time	< 25	ns
Climatic Category	40 / 85 / 56	

Additional Information

Click these links for more information:

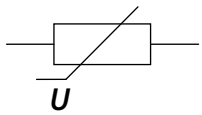
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Agency Recognition

Standard	UL 1449
File Number	E313168**

**Not all rated voltages are UL recognized; check the file for details.

Varistor Symbol



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WARNING Cancer and Reproductive Harm - www.P65Warnings.ca.gov

*RoHS Directive 2015/863, Mar 31, 2015 and Annex.
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Device Ratings

Model	V_{rms}	V_{dc}	V_n @ 1 mA	V_c	I_c	W_{max} 10/1000 μs	P max.	I_{max} 8/20 μs	C Typ. @ 1 kHz
	V	V	V	V	A	J	W	A	pF
CVQ 60 K 7	60	85	100	165	10	9	0.25	1750	680
CVQ 60 K 10	60	85	100	165	25	18	0.4	3500	1200
CVQ 60 K 14	60	85	100	165	50	38	0.6	6000	2200
CVQ 60 K 20	60	85	100	165	100	77	1	12000	4100
CVQ 75 K 7	75	100	120	200	10	11	0.25	1750	550
CVQ 75 K 10	75	100	120	200	25	24	0.4	3500	950
CVQ 75 K 14	75	100	120	200	50	46	0.6	6000	1800
CVQ 75 K 20	75	100	120	200	100	88	1	12000	3300
CVQ 95 K 7	95	125	150	250	10	14	0.25	1750	440
CVQ 95 K 10	95	125	150	250	25	28	0.4	3500	750
CVQ 95 K 14	95	125	150	250	50	58	0.6	6000	1400
CVQ 95 K 20	95	125	150	250	100	116	1	12000	2600
CVQ 115 K 7	115	150	180	300	10	16	0.25	1750	360
CVQ 115 K 10	115	150	180	300	25	34	0.4	3500	650
CVQ 115 K 14	115	150	180	300	50	71	0.6	6000	1200
CVQ 115 K 20	115	150	180	300	100	128	1	12000	2100
CVQ 130 K 7	130	170	205	340	10	19	0.25	1750	360
CVQ 130 K 10	130	170	205	340	25	38	0.4	3500	580
CVQ 130 K 14	130	170	205	340	50	77	0.6	6000	1050
CVQ 130 K 20	130	170	205	340	100	154	1	12000	1900
CVQ 130 K 23	130	170	205	340	100	172	1	15000	3500
CVQ 140 K 7	140	180	220	360	10	22	0.25	1750	300
CVQ 140 K 10	140	180	220	360	25	42	0.4	3500	540
CVQ 140 K 14	140	180	220	360	50	85	0.6	6000	980
CVQ 140 K 20	140	180	220	360	100	170	1	12000	1800
CVQ 140 K 23	140	180	220	360	100	190	1	15000	3200
CVQ 150 K 7	150	200	240	395	10	23	0.25	1750	280
CVQ 150 K 10	150	200	240	395	25	46	0.4	3500	510
CVQ 150 K 14	150	200	240	395	50	92	0.6	6000	900
CVQ 150 K 20	150	200	240	395	100	185	1	12000	1600
CVQ 150 K 23	150	200	240	395	100	207	1	15000	2900
CVQ 175 K 7	175	225	270	455	10	26	0.25	1750	250
CVQ 175 K 10	175	225	270	455	25	53	0.4	3500	440
CVQ 175 K 14	175	225	270	455	50	108	0.6	6000	800
CVQ 175 K 20	175	225	270	455	100	210	1	12000	1400
CVQ 175 K 23	175	225	270	455	100	235	1	15000	2500
CVQ 230 K 7	230	300	360	595	10	35	0.25	1750	190
CVQ 230 K 10	230	300	360	595	25	71	0.4	3500	350
CVQ 230 K 14	230	300	360	595	50	143	0.6	6000	620
CVQ 230 K 20	230	300	360	595	100	280	1	12000	1100
CVQ 230 K 23	230	300	360	595	100	313	1	15000	2200
CVQ 250 K 7	250	320	390	650	10	38	0.25	1750	180
CVQ 250 K 10	250	320	390	650	25	77	0.4	3500	320
CVQ 250 K 14	250	320	390	650	50	154	0.6	6000	580
CVQ 250 K 20	250	320	390	650	100	300	1	12000	1000

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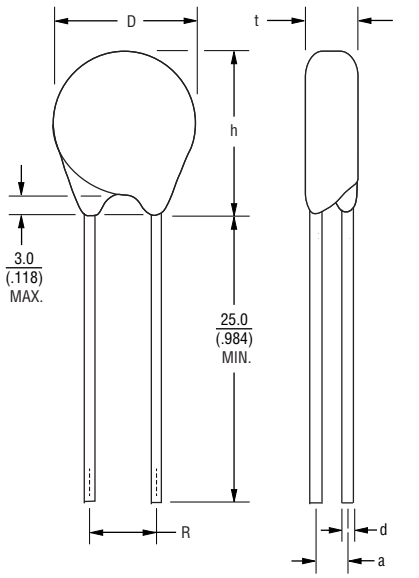
Device Ratings (Continued)

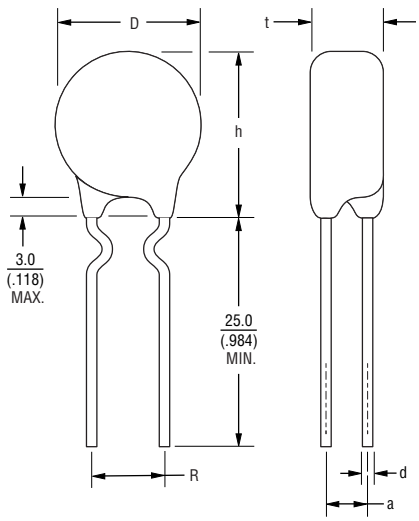
Model	V_{rms}	V_{dc}	V_n @ 1 mA	V_c	I_c	W_{max} 10/1000 μs	P max.	I_{max} 8/20 μs	C Typ. @ 1 kHz
	V	V	V	V	A	J	W	A	pF
CVQ 250 K 23	250	320	390	650	100	336	1	15000	1900
CVQ 275 K 7	275	350	430	710	10	44	0.25	1750	160
CVQ 275 K 10	275	350	430	710	25	88	0.4	3500	300
CVQ 275 K 14	275	350	430	710	50	170	0.6	6000	530
CVQ 275 K 20	275	350	430	710	100	330	1	12000	900
CVQ 275 K 23	275	350	430	710	100	370	1	15000	1600
CVQ 300 K 7	300	385	470	775	10	46	0.25	1750	150
CVQ 300 K 10	300	385	470	775	25	93	0.4	3500	280
CVQ 300 K 14	300	385	470	775	50	192	0.6	6000	490
CVQ 300 K 20	300	385	470	775	100	380	1	12000	850
CVQ 300 K 23	300	385	470	775	100	426	1	15000	1300
CVQ 320 K 10	320	420	510	840	25	104	0.4	3500	260
CVQ 320 K 14	320	420	510	840	50	209	0.6	6000	460
CVQ 320 K 20	320	420	510	840	100	420	1	12000	800
CVQ 320 K 23	320	420	510	840	100	470	1	15000	1100
CVQ 385 K 10	385	505	620	1025	25	106	0.4	3500	230
CVQ 385 K 14	385	505	620	1025	50	219	0.6	6000	390
CVQ 385 K 20	385	505	620	1025	100	430	1	12000	650
CVQ 385 K 23	385	505	620	1025	100	480	1	15000	1000
CVQ 420 K 10	420	560	680	1120	25	110	0.4	3500	210
CVQ 420 K 14	420	560	680	1120	50	230	0.6	6000	370
CVQ 420 K 20	420	560	680	1120	100	460	1	12000	620
CVQ 420 K 23	420	560	680	1120	100	515	1	15000	950
CVQ 460 K 10	460	615	750	1240	25	120	0.4	3500	200
CVQ 460 K 14	460	615	750	1240	50	250	0.6	6000	340
CVQ 460 K 20	460	615	750	1240	100	500	1	12000	560
CVQ 460 K 23	460	615	750	1240	100	560	1	15000	900
CVQ 510 K 10	510	670	820	1355	25	131	0.4	3500	180
CVQ 510 K 14	510	670	820	1355	50	258	0.6	6000	310
CVQ 510 K 20	510	670	820	1355	100	520	1	12000	510
CVQ 510 K 23	510	670	820	1355	100	582	1	15000	650
CVQ 550 K 10	550	745	910	1500	25	153	0.4	3500	170
CVQ 550 K 14	550	745	910	1500	50	300	0.6	6000	290
CVQ 550 K 20	550	745	910	1500	100	560	1	12000	480
CVQ 550 K 23	550	745	910	1500	100	627	1	15000	800

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Product Dimensions

Model	Dimension					
	D (Max.)	**t** (Max.)	**R**	**d**	**h** (Max.)	**a**
CVQ 60 K 7	9 (.354)	3.5 (.138)	5 (.197)	0.6 (.024)	11.5 (.453)	1.1 (.043)
CVQ 60 K 10	12.5 (.492)	4.1 (.161)	7.5 (.295)	0.8 (.031)	15 (.591)	1.4 (.055)
CVQ 60 K 14	16.5 (.650)	4.2 (.165)	7.5 (.295)	0.8 (.031)	20 (.787)	1.5 (.059)
CVQ 60 K 20	22.5 (.886)	4.6 (.186)	10 (.394)	1.0 (.039)	26 (1.024)	1.7 (.067)
CVQ 75 K 7	9 (.354)	3.6 (.142)	5 (.197)	0.6 (.024)	11.5 (.453)	1.2 (.047)
CVQ 75 K 10	12.5 (.492)	4.2 (.165)	7.5 (.295)	0.8 (.031)	15 (.591)	1.5 (.059)
CVQ 75 K 14	16.5 (.650)	4.2 (.165)	7.5 (.295)	0.8 (.031)	20 (.787)	1.5 (.059)
CVQ 75 K 20	22.5 (.886)	4.6 (.186)	10 (.394)	1.0 (.039)	26 (1.024)	1.7 (.067)
CVQ 95 K 7	9 (.354)	3.8 (.150)	5 (.197)	0.6 (.024)	11.5 (.453)	1.4 (.055)
CVQ 95 K 10	12 (.472)	4.3 (.169)	7.5 (.295)	0.8 (.031)	15 (.591)	1.7 (.067)
CVQ 95 K 14	16 (.630)	4.3 (.169)	7.5 (.295)	0.8 (.031)	20 (.787)	1.7 (.067)
CVQ 95 K 20	22.5 (.886)	4.6 (.186)	10 (.394)	1.0 (.039)	26 (1.024)	1.9 (.075)
CVQ 115 K 7	9 (.354)	4.0 (.157)	5 (.197)	0.6 (.024)	11.5 (.453)	1.6 (.063)
CVQ 115 K 10	12.5 (.492)	4.3 (.169)	7.5 (.295)	0.8 (.031)	15 (.591)	1.9 (.075)
CVQ 115 K 14	16.5 (.650)	4.4 (.173)	7.5 (.295)	0.8 (.031)	20 (.787)	1.9 (.075)
CVQ 115 K 20	22.5 (.886)	4.8 (.189)	10 (.394)	1.0 (.039)	26 (1.024)	2.1 (.083)
CVQ 130 K 7	9 (.354)	4.0 (.157)	5 (.197)	0.6 (.024)	11.5 (.453)	1.8 (.071)
CVQ 130 K 10	12.5 (.492)	4.5 (.177)	7.5 (.295)	0.8 (.031)	15 (.591)	2.0 (.079)
CVQ 130 K 14	16.5 (.650)	4.6 (.181)	7.5 (.295)	0.8 (.031)	20 (.787)	2.0 (.079)
CVQ 130 K 20	22.5 (.886)	5.0 (.197)	10 (.394)	1.0 (.039)	26 (1.024)	2.2 (.087)
CVQ 130 K 23	25 (.984)	5.0 (.197)	10 (.394)	1.0 (.039)	27 (1.063)	2.2 (.087)
CVQ 140 K 7	9 (.354)	4.1 (.161)	5 (.197)	0.6 (.024)	11.5 (.453)	1.9 (.075)
CVQ 140 K 10	12.5 (.492)	4.6 (.181)	7.5 (.295)	0.8 (.031)	15 (.591)	2.1 (.083)
CVQ 140 K 14	16.5 (.650)	4.7 (.185)	7.5 (.295)	0.8 (.031)	20 (.787)	2.1 (.083)
CVQ 140 K 20	22.5 (.886)	5.1 (.201)	10 (.394)	1.0 (.039)	26 (1.024)	2.3 (.091)
CVQ 140 K 23	25 (.984)	5.1 (.201)	10 (.394)	1.0 (.039)	27 (1.063)	2.3 (.091)
CVQ 150 K 7	9 (.354)	4.3 (.169)	5 (.197)	0.6 (.024)	11.5 (.453)	2.0 (.079)
CVQ 150 K 10	12.5 (.492)	4.6 (.181)	7.5 (.295)	0.8 (.031)	15 (.591)	2.2 (.087)
CVQ 150 K 14	16.5 (.650)	4.8 (.189)	7.5 (.295)	0.8 (.031)	20 (.787)	2.2 (.087)
CVQ 150 K 20	22.5 (.886)	5.2 (.205)	10 (.394)	1.0 (.039)	26 (1.024)	2.4 (.094)



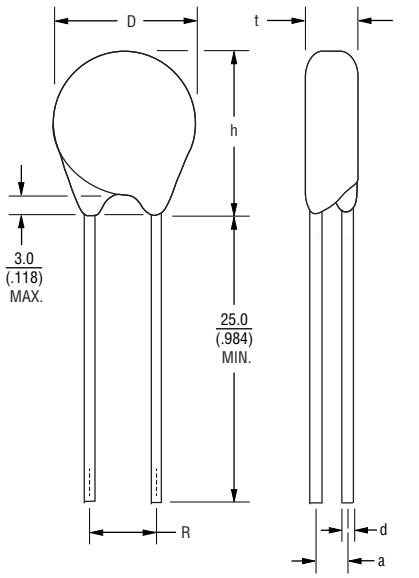


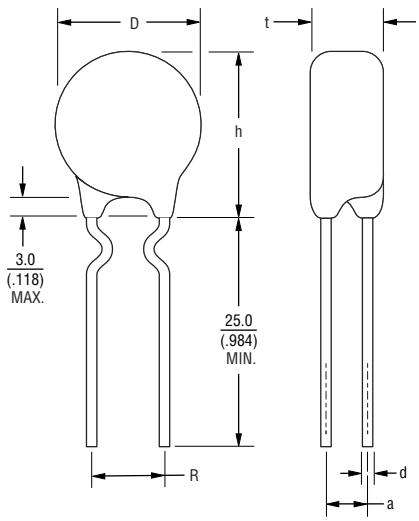
DIMENSIONS: MM (INCHES)

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CVQ 150 K 23	25 (.984)	5.2 (.205)	10 (.394)	1.0 (.039)	27 (1.063)	2.4 (.094)
CVQ 175 K 7	9 (.354)	4.8 (.189)	5 (.197)	0.6 (.024)	11.5 (.453)	2.1 (.083)
CVQ 175 K 10	12.5 (.492)	4.9 (.193)	7.5 (.295)	0.8 (.031)	15 (.591)	2.3 (.091)
CVQ 175 K 14	16.5 (.650)	4.9 (.193)	7.5 (.295)	0.8 (.031)	20 (.787)	2.3 (.091)
CVQ 175 K 20	22.5 (.886)	5.3 (.209)	10 (.394)	1.0 (.039)	26 (1.024)	2.5 (.098)
CVQ 175 K 23	25 (.984)	5.3 (.209)	10 (.394)	1.0 (.039)	27 (1.063)	2.5 (.098)
CVQ 230 K 7	9 (.354)	4.8 (.189)	5 (.197)	0.6 (.024)	11.5 (.453)	2.6 (.102)
CVQ 230 K 10	12.5 (.492)	5.4 (.213)	7.5 (.295)	0.8 (.031)	15 (.591)	2.8 (.110)
CVQ 230 K 14	16.5 (.650)	5.5 (.217)	7.5 (.295)	0.8 (.031)	20 (.787)	2.8 (.110)
CVQ 230 K 20	22.5 (.886)	5.9 (.232)	10 (.394)	1.0 (.039)	26 (1.024)	3.0 (.118)
CVQ 230 K 23	25 (.984)	5.9 (.232)	10 (.394)	1.0 (.039)	27 (1.063)	3.0 (.118)
CVQ 250 K 7	9 (.354)	5.0 (.197)	5 (.197)	0.6 (.024)	11.5 (.453)	2.8 (.110)
CVQ 250 K 10	12.5 (.492)	5.6 (.220)	7.5 (.295)	0.8 (.031)	15 (.591)	3.0 (.118)
CVQ 250 K 14	16.5 (.650)	5.7 (.224)	7.5 (.295)	0.8 (.031)	20 (.787)	3.0 (.118)
CVQ 250 K 20	22.5 (.886)	6.1 (.240)	10 (.394)	1.0 (.039)	26 (1.024)	3.2 (.126)
CVQ 250 K 23	25 (.984)	6.1 (.240)	10 (.394)	1.0 (.039)	27 (1.063)	3.2 (.126)
CVQ 275 K 7	9 (.354)	5.6 (.220)	5 (.197)	0.6 (.024)	11.5 (.453)	3.0 (.118)
CVQ 275 K 10	12.5 (.492)	5.8 (.228)	7.5 (.295)	0.8 (.031)	15 (.591)	3.2 (.126)
CVQ 275 K 14	16.5 (.650)	5.9 (.232)	7.5 (.295)	0.8 (.031)	20 (.787)	3.2 (.126)
CVQ 275 K 20	22.5 (.886)	6.3 (.248)	10 (.394)	1.0 (.039)	26 (1.024)	3.4 (.134)
CVQ 275 K 23	25 (.984)	6.3 (.248)	10 (.394)	1.0 (.039)	27 (1.063)	3.4 (.134)
CVQ 300 K 7	9 (.354)	5.8 (.228)	5 (.197)	0.6 (.024)	11.5 (.453)	3.2 (.126)
CVQ 300 K 10	12.5 (.492)	6.1 (.240)	7.5 (.295)	0.8 (.031)	15 (.591)	3.4 (.134)
CVQ 300 K 14	16.5 (.650)	6.1 (.240)	7.5 (.295)	0.8 (.031)	20 (.787)	3.4 (.134)
CVQ 300 K 20	22.5 (.886)	6.0 (.236)	10 (.394)	1.0 (.039)	27 (1.063)	3.6 (.142)
CVQ 300 K 23	25 (.984)	6.6 (.260)	10 (.394)	1.0 (.039)	29 (1.142)	3.6 (.142)
CVQ 320 K 10	12.5 (.492)	5.9 (.232)	7.5 (.295)	0.8 (.031)	16 (.630)	3.6 (.142)
CVQ 320 K 14	16.5 (.650)	6.5 (.256)	7.5 (.295)	0.8 (.031)	21 (.827)	3.6 (.142)
CVQ 320 K 20	22.5 (.886)	6.8 (.268)	10 (.394)	1.0 (.039)	27 (1.063)	3.8 (.150)
CVQ 320 K 23	25 (.984)	6.8 (.268)	10 (.394)	1.0 (.039)	29 (1.142)	3.8 (.150)





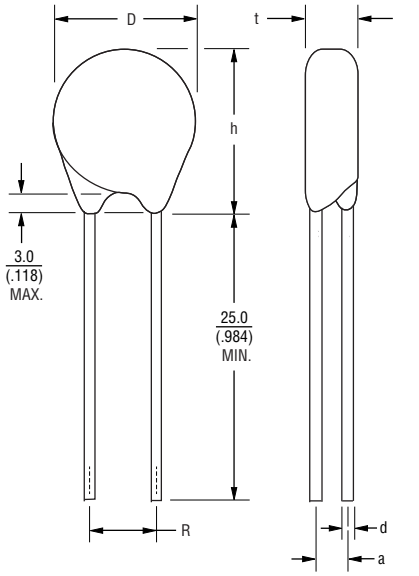
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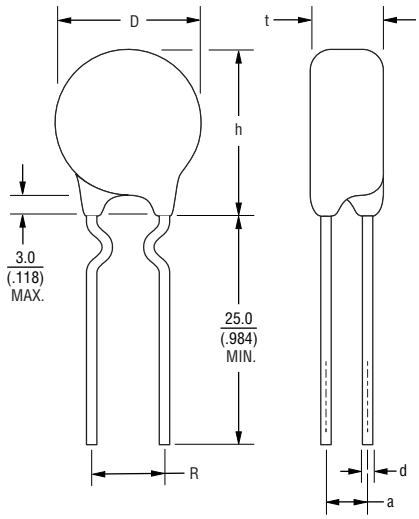
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Product Dimensions (Continued)

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CVQ 385 K 10	12.5 (.492)	6.4 (.252)	7.5 (.295)	0.8 (.031)	16 (.630)	4.2 (.165)
CVQ 385 K 14	16.5 (.650)	6.9 (.272)	7.5 (.295)	0.8 (.031)	21 (.827)	4.2 (.165)
CVQ 385 K 20	22.5 (.886)	7.5 (.295)	10 (.394)	1.0 (.039)	27 (1.063)	4.4 (.173)
CVQ 385 K 23	25 (.984)	7.5 (.295)	10 (.394)	1.0 (.039)	29 (1.142)	4.4 (.173)
CVQ 420 K 10	12.5 (.492)	7.3 (.287)	7.5 (.295)	0.8 (.031)	16 (.630)	4.4 (.173)
CVQ 420 K 14	16.5 (.650)	7.4 (.291)	7.5 (.295)	0.8 (.031)	21 (.827)	4.4 (.173)
CVQ 420 K 20	22.5 (.886)	7.8 (.307)	10 (.394)	1.0 (.039)	27 (1.063)	4.6 (.181)
CVQ 420 K 23	25 (.984)	7.8 (.307)	10 (.394)	1.0 (.039)	29 (1.142)	4.6 (.181)
CVQ 460 K 10	12.5 (.492)	7.8 (.307)	7.5 (.295)	0.8 (.031)	16 (.630)	4.8 (.189)
CVQ 460 K 14	16.5 (.650)	7.8 (.307)	7.5 (.295)	0.8 (.031)	21 (.827)	4.8 (.189)
CVQ 460 K 20	22.5 (.886)	8.2 (.323)	10 (.394)	1.0 (.039)	27 (1.063)	5.0 (.197)
CVQ 460 K 23	25 (.984)	8.2 (.323)	10 (.394)	1.0 (.039)	29 (1.142)	5.0 (.197)
CVQ 510 K 10	12.5 (.492)	8.2 (.323)	7.5 (.295)	0.8 (.031)	16 (.630)	5.1 (.201)
CVQ 510 K 14	16.5 (.650)	8.2 (.323)	7.5 (.295)	0.8 (.031)	21 (.827)	5.1 (.201)
CVQ 510 K 20	22.5 (.886)	8.7 (.343)	10 (.394)	1.0 (.039)	27 (1.063)	5.3 (.209)
CVQ 510 K 23	25 (.984)	8.7 (.343)	10 (.394)	1.0 (.039)	29 (1.142)	5.3 (.209)
CVQ 550 K 10	12.5 (.492)	8.8 (.346)	7.5 (.295)	0.8 (.031)	16 (.630)	5.6 (.220)
CVQ 550 K 14	16.5 (.650)	8.8 (.346)	7.5 (.295)	0.8 (.031)	21 (.827)	5.6 (.220)
CVQ 550 K 20	22.5 (.886)	9.2 (.362)	10 (.394)	1.0 (.039)	27 (1.063)	5.8 (.228)
CVQ 550 K 23	25 (.984)	9.2 (.362)	10 (.394)	1.0 (.039)	29 (1.142)	5.8 (.228)

DIMENSIONS: MM / (INCHES)





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How to Order

C V Q 1 5 0 K 2 0 R L 1 y y

Series Designator
CVQ = CVQ Series

Max. Continuous Operating Voltage (V_{rms})

V_n Tolerance
K = ±10 %

Model Size
7 = 7 mm
10 = 10 mm
14 = 14 mm
20 = 20 mm
23 = 23 mm

Packaging
R = Reel*
B = Bulk
A = Ammo Pack (Available only upon special request)*
**Reel and Ammo Pack options not available for Model Sizes 20 and 23.*

Lead Style
L1 = Straight Leads
L5 = Crimped Leads

Special Parameters
yy = Unique two digit suffix is assigned to each customer requesting special parameters. Please contact Bourns for more information.

Instructions for Creating Orderable Part Number:

1) Start with base part number in characteristics table

(example: CVQ150K20).

2) Add Packaging: R

(example part number becomes CVQ150K20R).

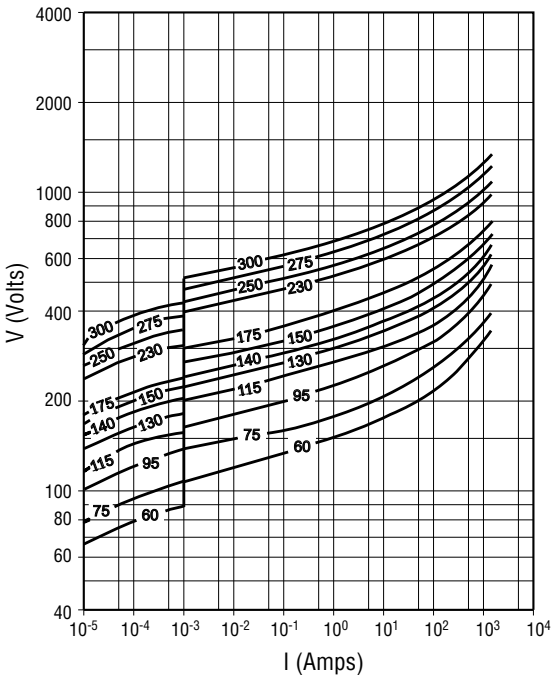
3) Add Lead Style: L1

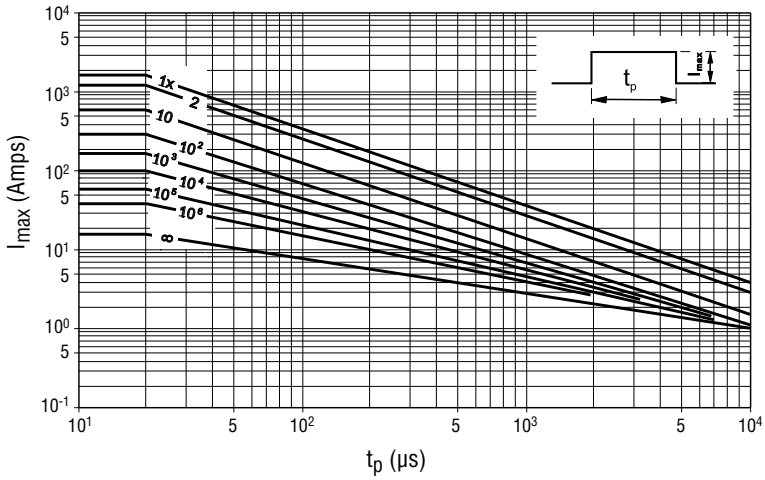
(example part number becomes CVQ150K20RL1).

4) Part number can have no spaces or lower case letters.

Pulse Rating Curves - Protection level with worst-case condition in the tolerance region

Model Size 7 - (CVQ 60 ~ CVQ 300)

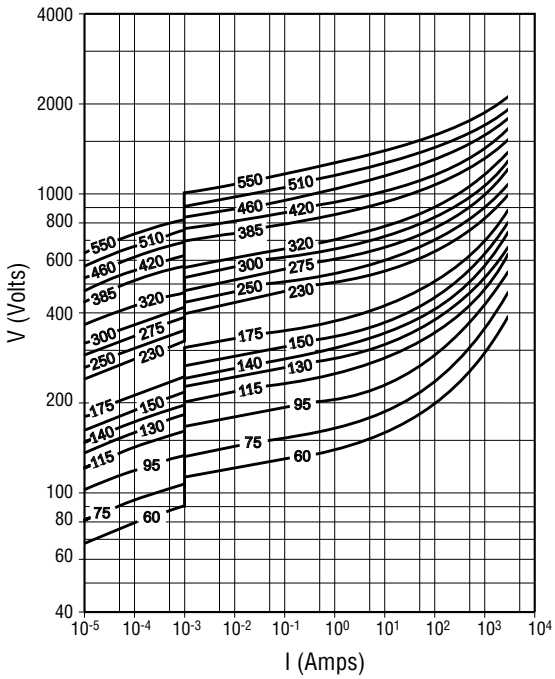


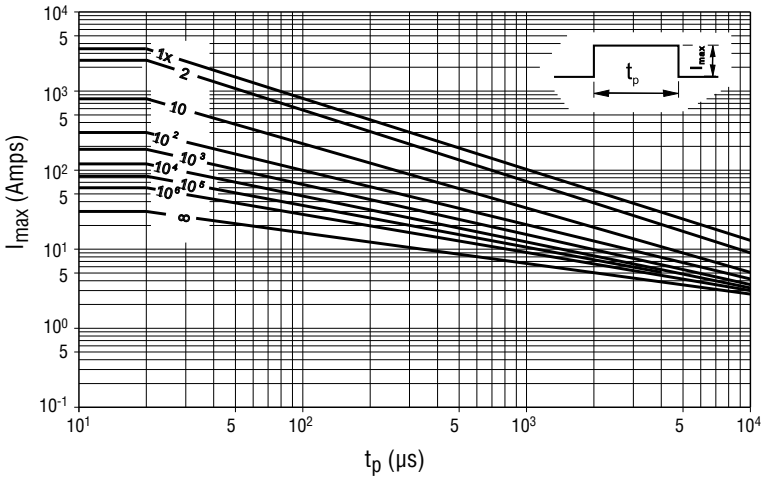


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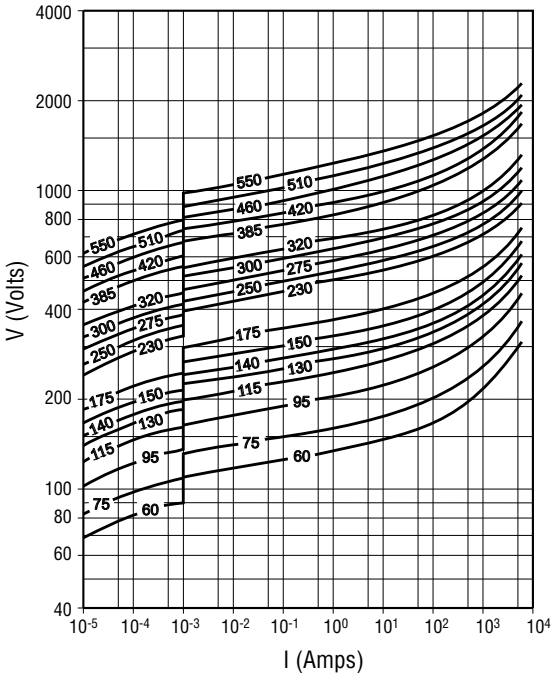
Pulse Rating Curves (Continued) - Protection level with worst-case condition in the tolerance region

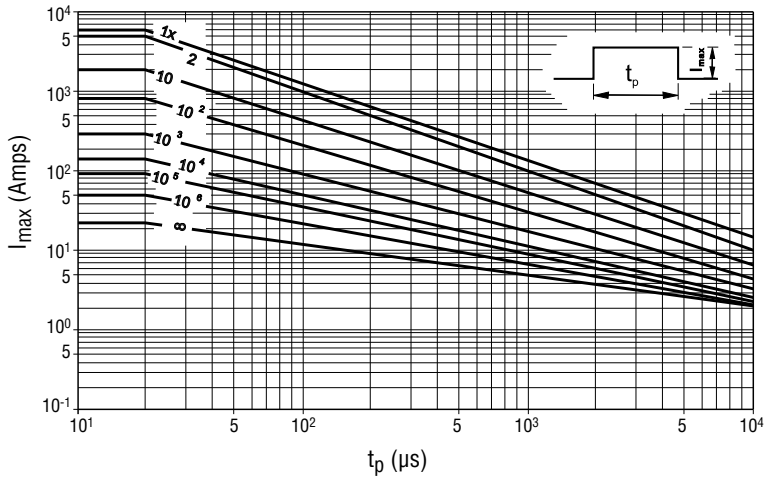
Model Size 10 - (CVQ 60 ~ CVQ 550)





Model Size 14 - (CVQ 60 ~ CVQ 550)

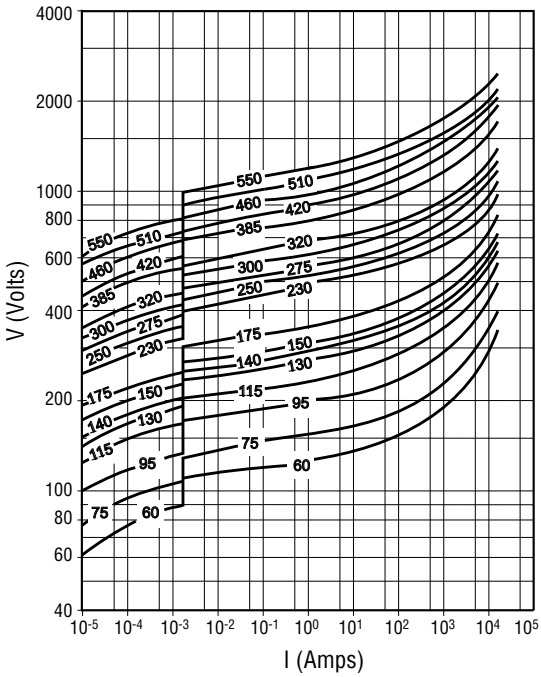


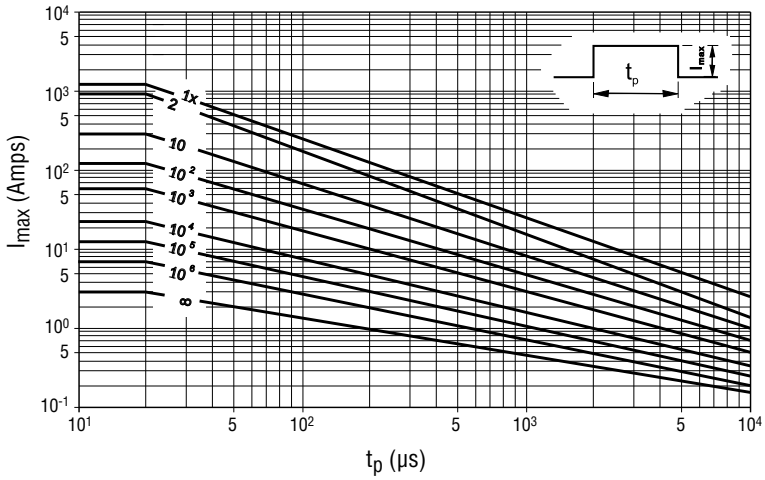


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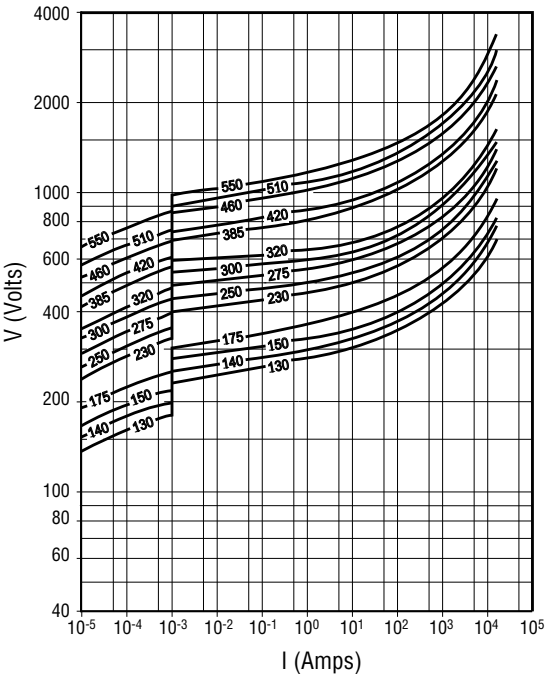
Pulse Rating Curves (Continued) - Protection level with worst-case condition in the tolerance region

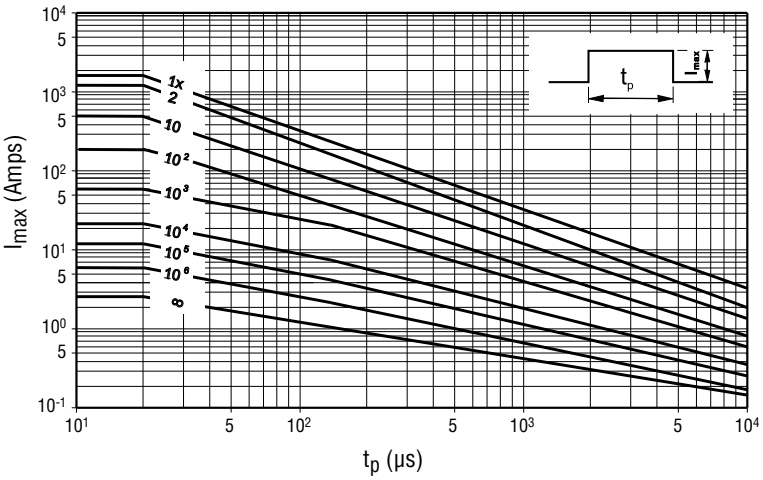
Model Size 20 - (CVQ 60 ~ CVQ 550)





Model Size 23 - (CVQ 60 ~ CVQ 550)



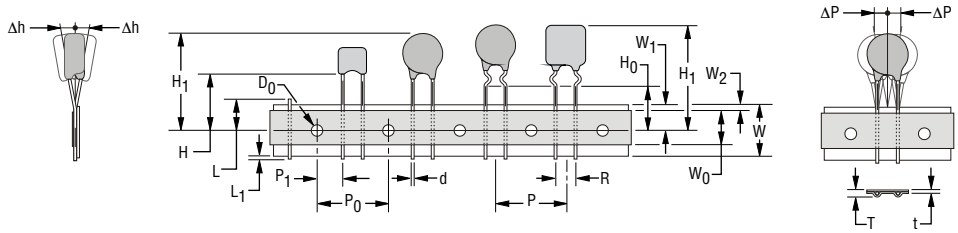


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Packaging Specifications - Tape

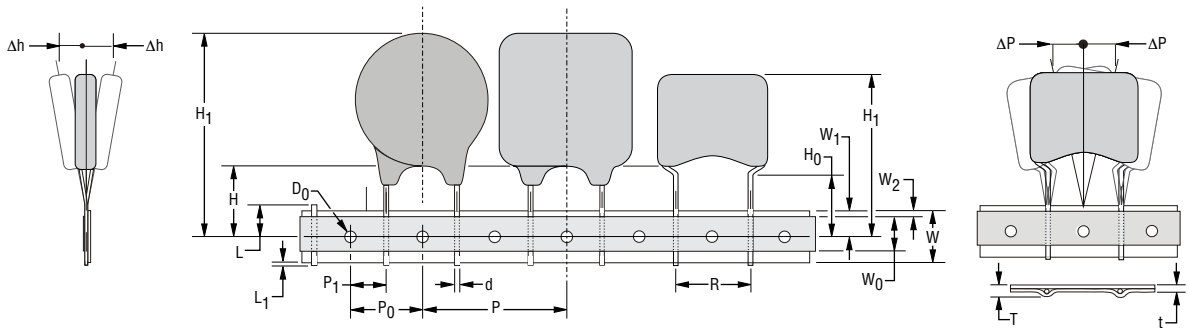
Conforms to IES Publication 286-2 Ed. 3: 2008-03

Dimension R = 5 mm



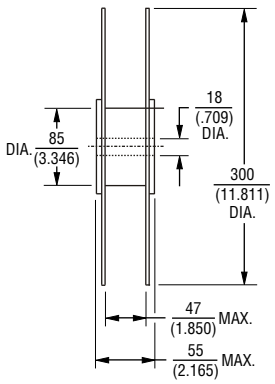
Dimensions on Next Page

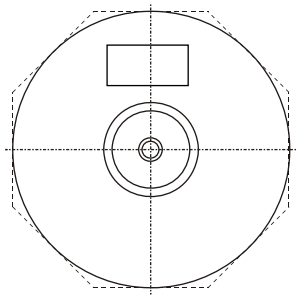
Dimension R = 7.5 mm & 10 mm



Dimensions on Next Page

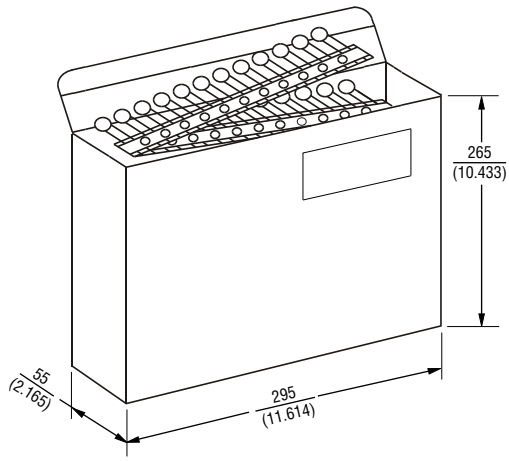
Reel





DIMENSIONS: MM / (INCHES)

Ammo Pack (Available upon Special Request)



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Packaging Specifications - Tape (Continued)

Symbol	Parameter	Model Size				
		7	10	14	20	23
W	Carrier tape width	18 +1.0/-0.5 (.709 +.039/-.020)				
W_0	Hold down tape width	5 (.197) MIN.				
W_1	Sprocket hole position	9 +0.75/-0.5 (.354 +.030/-.020)				
W_2	Distance between the upper edges of the carrier tape and hold down tape	3 (.118) MAX.				
T	Total tape thickness	1.5 (.059) MAX.	1.7 (.067) MAX.		1.9 (.075) MAX.	
t	Tape thickness	0.9 (.035) MAX.				
P	Pitch of component	12.7 ± 1.0 (.500 ± .039)		25.4 ± 1.0 (1.000 ± .039)		
P_0	Feed hole pitch	12.7 ± 0.3 (.500 ± .012)				
P_1	Feed hole center to pitch	3.85 ± 0.7 (.152 ± .028)	8.95± 0.7 (.352 ± .028)		7.7 ± 0.7 (.303 ± .028)	
R	Lead spacing	5 +0.5/-0.2 (.197 +.020/-.008)	7.5 +0.5/-0.2 (.295 +.020/-.008)		10 +0.5/-0.2 (.394 +.020/-.008)	
ΔP	Component alignment	±1.3 (±.051) MAX.				
Δh	Component alignment	±2 (±.079) MAX.				
d	Wire diameter	0.6 (.024) MAX.	0.8 (.031) MAX.		1 (.039) MAX.	
D_0	Feed hold diameter	4 ± 0.2 (.157 ± .008)				
H	Height from tape center to component base	18 +2.0/-0.0 (.709 +.079/-.000)				
H_0	Seating plane height	16 ± 0.5 (.630 ± .020)				
H_1	Component height	32.2 (1.268) MAX.	46.5 (1.831) MAX.			
L	Protrusion - cut out	11 (.433) MAX.				
L_1	Protrusion - cut off	0.5 (.020) MAX.				

DIMENSIONS: MM (INCHES)

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Packaging Quantities - Bulk

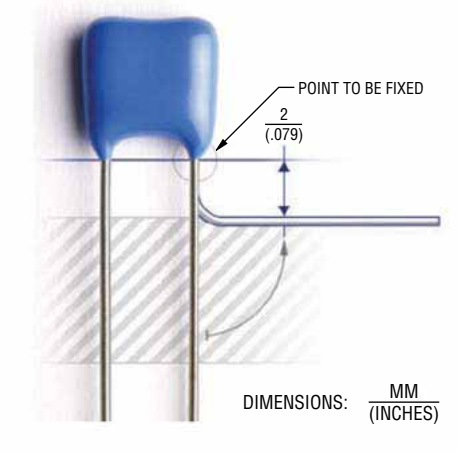
Voltage	Model Size				
	7	10	14	20	23
60	1500	600	400	300	
75	1500	600	400	300	
95	1000	600	400	300	
115	1000	500	400	300	
130	1000	500	400	300	250
140	1000	500	400	300	250
150	1000	500	400	300	250
175	1000	500	400	300	250
230	1000	500	300	200	200
250	1000	500	300	200	200
275	1000	500	300	200	200
300	1000	500	300	200	200
320		500	300	200	200
385		400	300	200	200
420		400	300	200	150
460		400	300	200	150
510		400	300	200	150
550		400	300	200	150

Packaging Quantities - Reel

Voltage	Model Size				
	7	10	14	20	23
60	1500	1300	700		
75	1500	1300	700		
95	1000	1300	600		
115	1000	1000	600		
130	1000	1000	600		
140	1000	1000	600		
150	1000	1000	600		
175	1000	1000	500		
230	1000	1000	500		
250	1000	800	400		
275	1000	800	400		
300	1000	800	400		
320		800	400		
385		700	400		
420		700	300		
460		600	300		
510		600	300		
550		600	300		

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Assembly Recommendations for Through-Hole Components



Very often before soldering through-hole components, their leads get bent. It is important not to damage the components during lead bending. Damage incurred during bending is cracks in epoxy parts, which can lead to increased humidity sensitivity of a component and, consequentially, a shorter lifetime.

In order to avoid epoxy damage, it is necessary to:
- fix the most sensitive point (epoxy parts) of a component body
- bend the wire at least 2 mm below the end of epoxy parts

Other potential damage to a component which can lead to component failure or a shorter lifetime is thermal shock during manual soldering with a soldering iron. This can occur when a soldering iron is placed too close to one point of the component body and it happens most often when the solder joint is too close to the varistor body.

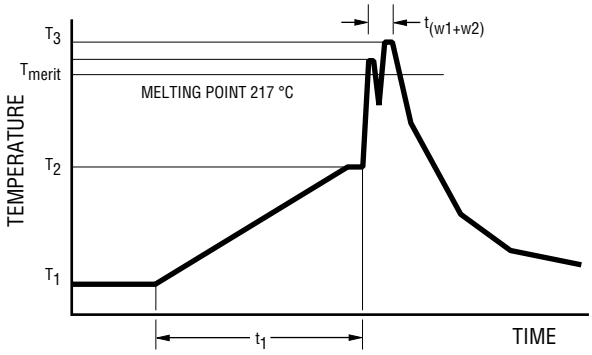
Resistance to Soldering Heat

In the case of automatic wave soldering, it is important to provide sufficient resistance to soldering heat. In order to prevent any potential problems, internal standards were introduced for testing the resistance to soldering heat of through-hole components: 300 °C, 10 seconds.

Pb-free Wave Soldering Profile Recommendations

Recommended soldering profiles for all above components are in accordance with JEDEC standard curves (J-STD-020D) and are, therefore, compatible with the Pb-free process.

Lead-free Wave Soldering Profile - Pb-free wave profile requirements for soldering heat resistance of components



Parameter	Symbol	Specification
Preheating temperature gradient		4 °C/sec. max.
Preheating time	t_1	2 to 5 min.
Min. preheating temperature	T_1	130 °C
Max. preheating temperature	T_2	180 °C
Melting temperature/point	T_{meltv}	217 °C
Time in wave soldering phase (w_1+w_2)	t_{w1+w2}	10 sec.
Max. wave temperature (w_1+w_2)	T_s	265 °C +0/-5 °C
Cooling temperature gradient		6° C/sec. max.
Temperature jump from T_2 to T_3 (w_1)	$T_{3(w1)}$ - T_2	120 °C max
Time from 25 °C to T_3 (wave temperature)		8 min. max.

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Reliability Testing Procedures

Varistor test procedures comply with CECC 42200, IEC 1051-1/2 (and AEC-Q200, if applicable). Test results are available upon customer request. Special tests can be performed upon customer request.

Reliability Parameter	Test	Tested According to	Condition to be Satisfied after Testing
AC/DC Bias Reliability	AC/DC Life Test	CECC 42200, Test 4.20 or IEC 1051-1, Test 4.20, AEC-Q200 Test 8 - 1000 h at UCT	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 %
Pulse Current Capability	I_{max} 8/20 μs	CECC 42200, Test C 2.1 or IEC 1051-1, Test 4.5 10 pulses in the same direction at 2 pulses per minute at maximum peak current for 10 pulses	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 % no visible damage
Pulse Energy Capability	W_{max} 10/1000 μs	CECC 42200, Test C 2.1 or IEC 1051-1, Test 4.5 10 pulses in the same direction at 1 pulse every 2 minutes at maximum peak current for 10 pulses	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 % no visible damage
WLD Capability	WLD x 10	ISO 7637, Test pulse 5, 10 pulses at rate of 1 per minute	$\lvert\delta V_n$ (1 mA)$\rvert$ < 15 % no visible damage
V_{jump} Capability	V_{jump} 5 min.	Increase of supply voltage to V ≥ V_{jump} for 1 minute	$\lvert\delta V_n$ (1 mA)$\rvert$ < 15 % no visible damage
Environmental and Storage Reliability	Climatic Sequence	CECC 42200, Test 4.16 or IEC 1051-1, Test 4.17 a) Dry heat, 16h, UCT, Test Ba, IEC 68-2-2 b) Damp heat, cyclic, the first cycle: 55 °C, 93 % RH, 24 h, Test Db 68-2-4 c) Cold, LCT, 2 h, Test Aa, IEC 68-2-1 d) Damp heat cyclic, remaining 5 cycles: 55 °C, 93 % RH, 24 h/cycle, Test Bd, IEC 68-2-30	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 %
	Thermal Shock	CECC 42200, Test 4.12, Test Na, IEC 68-2-14, AEC-Q200 Test 16, 5	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 % no visible damage
	Steady State Damp Heat	CECC 42200, Test 4.17, Test Ca, IEC 68-2-3, AEC-Q200 Test 6, 56 days, 40 °C, 93 % RH, AEC-Q200 Test 7: Bias, Rh, T all at 85.	$\lvert\delta V_n$ (1 mA)$\rvert$ < 10 %
	Storage Test	IEC 68-2-2, Test Ba, AEC-Q200 Test 3, 1000 h at maximum storage temperature	$\lvert\delta V_n$ (1 mA)$\rvert$ < 5 %

Continued on Next Page

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Reliability Testing Procedures (Continued)

Reliability Parameter	Test	Tested According to	Condition to be Satisfied after Testing
Mechanical Reliability	Solderability	CECC 42200, Test 4.10.1, Test Ta, IEC 68-2-20 solder bath and reflow method	Solderable at shipment and after 2 years of storage, criteria: >95% must be covered by solder for reflow meniscus
	Resistance to Soldering Heat	CECC 42200, Test 4.10.2, Test Tb, IEC 68-2-20 solder bath nad reflow method	$\lvert\delta V_n$ (1 mA)$\rvert < 5$ %
	Terminal Strength	JIS-C-6429, App. 1, 18N for 60 sec. - same for AEC-Q200 Test 22	No visual damage
	Board Flex	JIS-C-6429, App. 2, 2 mm min. AEC-Q200 test 21 - Board flex: 2 mm flex min.	$\lvert\delta V_n$ (1 mA)$\rvert < 2$ % No visible damage
	Vibration	CECC 42200, Test 4.15, Test Fc, IEC 68-2-6, AEC-Q200 Test 14 Frequency range 10 to 55 Hz (AEC: 10-2000 Hz) Amplitude 0.75 m/s^2 or 98 m/s^2 (AEC: 5 g for 20 minutes) Total duration 6 h (3x2 h) (AEC: 12 cycles each of 3 directions) Waveshape - half sine	$\lvert\delta V_n$ (1 mA)$\rvert < 2$ % No visible damage
	Mechanical Shock	CECC 42200, Test 4.14, Test Ea, IEC 68-2-27, AEC-Q200 Test 13. Acceleration = 490 m/s^2 (AEC: MIL-STD-202-Method 213), Pulse duration = 11 ms, Waveshape - half sine; Number of shocks = 3x6	$\lvert\delta V_n$ (1 mA)$\rvert < 10$ % No visible damage
Electrical Transient Conduction	ISO-7637-1 Pulses	AEC-Q200 Test 30: Test pulses 1 to 3. Also other pulses - freestyle.	$\lvert\delta V_n$ (1 mA)$\rvert < 10$ % No visible damage

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Terminology

Term	Symbol	Definition
Rated AC Voltage	V_{rms}	Maximum continuous sinusoidal AC voltage (<5 % total harmonic distortion) which may be applied to the component under continuous operation conditions at +25 °C
Rated DC Voltage	V_{dc}	Maximum continuous DC voltage (<5 % ripple) which may be applied to the component under continuous operating conditions at +25 °C
Supply Voltage	V	The voltage by which the system is designated and to which certain operating characteristics of the system are referred; V_{rms} = 1.1 x V
Leakage Current	I_{dc}	The current passing through the varistor at V_{dc} and at +25 ° or at any other specified temperature
Varistor Voltage	V_n	Voltage across the varistor measured at a given reference current (I_n)
Reference Current	I_n	Reference current = 1 mA DC
Clamping Voltage Protection Level	V_c	The peak voltage developed across the varistor under standard atmospheric conditions, when passing an 8/20 μs class current pulse
Class Current	I_c	A peak value of current which is 1/10 of the maximum peak current for 100 pulses at two per minute for the 8/20 μs pulse
Voltage Clamping Ratio	V_c/V_{app}	A figure of merit measure of the varistor clamping effectiveness as defined by the symbols V_c/V_{app}, where (V_{app} = V_{rms} or V_{dc})
Jump Start Transient	V_{jump}	The jump start transient results from the temporary application of an overvoltage in excess of the rated battery voltage. The circuit power supply may be subjected to a temporary overvoltage condition due to the voltage regulation failing or it may be deliberately generated when it becomes necessary to boost start the car.
Rated Single Pulse Transient Energy	W_{max}	Energy which may be dissipated for a single 10/1000 μs pulse of a maximum rated current, with rated AC voltage or rated DC voltage also applied, without causing device failure
Load Dump Transient	WLD	Load Dump is a transient which occurs in automotive environments. It is an exponentially decaying positive voltage which occurs in the event of a battery disconnect while the alternator is still generating charging current with other loads remaining on the alternator circuit at the time of battery disconnect.
Rated Peak Single Pulse Transient Current	I_{max}	Maximum peak current which may be applied for a single 8/20 μs pulse, with rated line voltage also applied, without causing device failure
Rated Transient Average Power Dissipation	P	Maximum average power which may be dissipated due to a group of pulses occurring within a specified isolated time period, without causing device failure at 25 °C
Capacitance	C	Capacitance between two terminals of the varistor measured @ 1 kHz
Non-linearity Exponent	α	A measure of varistor nonlinearity between two given operating currents, I_n and I_1 as described by I = k V exp(a), where: - k is a device constant, - $I_1 < I < I_n$ and - a log $(I_1/I_n)/\log(V_1/V_n)$ = 1/log (V_1/V_n), where: - I_r is reference current (1 mA) and V_n is varistor voltage - I_1 = 10 I_n, V_1 is the voltage measured at I_1
Response Time	tr	The time lag between application of a surge and varistor's "turn-on" conduction action
Varistor Voltage Temperature Coefficient	TC	(V_n @ 85 °C - V_n @ 25 °C) / (V_n @ 25 °C) x 60 °C) x 100
Insulation Resistance	IR	Minimum resistance between shorted terminals and varistor surface
Isolation Voltage		The maximum peak voltage which may be applied under continuous operating conditions between the varistor terminations and any conducting mounting surface
Operating Temperature		The range of ambient temperature for which the varistor is designed to operate continuously as defined by the temperature limits of its climatic category
Climatic Category	LCT/UCT/DHD	LCT & UCT = Lower and Upper Category Temperature - the minimum and maximum ambient temperatures for which a varistor has been designed to operate continuously. DHD = Dump Heat Test Duration
Storage Temperature		Storage temperature range without voltage applied
Current/Energy Derating		Derating of maximum values when operated above UCT

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Unless Bourns has explicitly designated an individual Bourns® product as meeting the requirements of a particular industry standard (e.g., IATF 16949) or a particular qualification (e.g., UL listed or recognized), Bourns is not responsible for any failure of an individual Bourns® product to meet the requirements of such industry standard or particular qualification even if such industry standard or qualification is a "state of art". Users of Bourns® products are responsible for ensuring compliance with safety-related requirements and standards applicable to their devices or applications.

Bourns® products are not recommended, authorized or intended for use in applications where failure or malfunction may result in personal injury, death, or severe property or environmental damage, such as without limitation nuclear, life-critical medical and certain automotive and aviation applications. Except as set forth in the bullet points below or unless expressly and specifically approved in writing on a case-by-case basis by an authorized Bourns' representative, use of any Bourns® products in such unauthorized high-risk applications is at the user's sole risk.

- Bourns considers implantable/invasive devices and devices/procedures designed as life-supporting or life-sustaining by the U.S. Food and Drug Administration or equivalent organizations outside of the United States as "life-critical" medical applications. Bourns expressly identifies those Bourns® standard products that are suitable for use in typical medical applications that are not life-critical in its publication entitled "Bourns Medical Grade Component Guide."

- Bourns expressly identifies those Bourns® standard products that are suitable for use in typical automotive applications associated with any Automate Safety Integrity Level (ASIL) in its publication entitled "Bourns Automotive Grade Component Guide." Bourns' designation of Bourns® product as compliant with the AEC-Q standard does not by itself mean that Bourns has approved such product for use in an automotive application.

- Bourns expressly identifies Bourns® standard products that are suitable for use in the typical aviation applications/systems requiring System Design Assurance Level (RTCA DO-254 DAL) of C, D or E in its publication entitled "Bourns Civilian Aerospace/Aviation Grade Component Guide." Bourns does not test its products for compliance with United States Federal Aviation Administration standards or any other generally equivalent governmental organization standard applicable to products designed or manufactured for use in aviation applications. Use of Bourns® standard components in aviation applications associated with RTCA DO-254 DAL A or B without proper approval noted above shall be at the user's sole risk.

- Bourns will review and authorize on a case-by-case basis the use of Bourns® standard products which are at least AEC-Q compliant in space-related civil applications (rockets, satellites) with a negotiated cross-waiver and indemnity agreement.

The use and level of testing applicable to Bourns® custom products shall be negotiated on a case-by-case basis by Bourns and the user for which such Bourns® custom products are specially designed. Absent a written agreement between Bourns and the user regarding the use and level of such testing, the above provisions applicable to Bourns® standard products shall also apply to such Bourns® custom products.

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