

# Type KV<sup>x</sup>, High-Voltage and Pulse, Mica-Paper/Polymer Capacitors



## Applications

- HV Power Supplies
- AC Voltage Dividers
- Pulse-forming Networks
- Down-hole Applications
- Jet Engine Ignition
- Aircraft and Shipboards
- Filters and Multipliers
- Satellites
- Snubbers
- EFI Devices
- X-Ray Equipment

## Performance Highlights

- **Capacitance Range:** 1pF to 10  $\mu$ F
- **Tolerance:**  $\pm 0.5\%$  to  $\pm 20\%$
- **Voltage Range:** 100 V to 150 kVdc
- **Temperature Range:** -55°C to 125°C standard, -65°C to 200°C available.
- Negligible capacitance change, all environments
- **Insulation Resistance:** 5 G $\Omega$  $\mu$ F min at 500 Vdc, 2 min.
- **Dissipation Factor:** Characteristic S-.5%, C-.05%

## KV<sup>x</sup> High-Voltage and Pulse Capacitors Ignite Your World

### Voltage, Current and Temperature to New Heights

KaBOOM! Another exploding foil initiator successfully detonates a military smart bomb thanks to a KV<sup>x</sup> capacitor. Jet engines roar with KV<sup>x</sup> ignition capacitors. KV<sup>x</sup> will ignite your applications with its high reliability, high energy density, high peak current capability, and excellent mechanical properties.

Spanning voltages up to 150kV, peak currents up to 100kA, and temperatures from -65°C to +200°C, Type KV<sup>x</sup> capacitors are it for applications like pulse ignition, corona-free signal coupling, high-voltage energy storage and voltage division of high AC voltages.

### Wide Selection of Capabilities

The Type KV<sup>x</sup> capacitor draws on an unprecedented selection of three dielectric systems, three impregnating systems, and three package types to deliver its superior capabilities.

The dielectric is high-purity mica plates, flexible reconstituted mica paper, or a polymer film/mica paper combination. Mica is the proven reliable dielectric for high voltage and temperature stress, even with continuous corona and radiation. We combine mica synergistically with polymer films to provide pulse capacitors of extremely high energy density (to over .1 J/cc).

High value with three impregnation systems: **Epoxy**—for best value operation through 125°C; **Polyester Resin**—for continuous operation up to 200°C.

### Five Package Types Deliver Custom Fit

**Package Type B:** Bare sections—if you want to design your own package.

**Package Type C:** Metal Can—to be worked out individually.

**Package Type T:** For minimum size and quick availability, the Type T package wraps the rectangular capacitor element with high temperature, heat-cured polyester tape and closes each end with a thick poured section of epoxy. The finished capacitor is sealed and is suitable for potted-in and many low humidity applications.

**Package Type G:** In applications requiring superior mechanical integrity, such as metal clamp mounting, moisture exposure, and mechanical vibration and shock, the Type G package adds that needed strength by vacuum potting the capacitor element in a laminated fiberglass epoxy tube.

**Package Type M:** For the ultimate in environmental protection and operation up to 150kV, the Type M package provides a fully molded, vacuum-encapsulated system. The final capacitor shape can exactly meet your application mechanical requirements and fit where no other can.

### Operating Life Guaranteed for 10 Years

KV<sup>x</sup> capacitors are not ordinary high voltage capacitors. Manufacturing processes developed and proven over 50 years of continuous manufacture of transmitting, pulse and high-voltage capacitors allow us to make a remarkable guarantee. Cornell Dubilier guarantees that KV<sup>x</sup> capacitors will operate ten years or more when operated within specified limits. Cornell Dubilier warrants that if a KV<sup>x</sup> capacitor fails during normal use within 10 years of the date of purchase, it will replace the capacitor at no charge if CDE analysis confirms that the capacitor was not abused by operating beyond product limits for humidity, temperature, voltage, and current.

High-Voltage  
& Pulse  
Mica Capacitors

**CDE**

**CORNELL  
DUBILIER**

Your Source For Capacitor Solutions

140 Technology Place  
Liberty, SC 29657  
(864) 843-2277, Fax (864) 843-3800  
<http://www.cornell-dubilier.com>  
E-mail: [cde@cornell-dubilier.com](mailto:cde@cornell-dubilier.com)

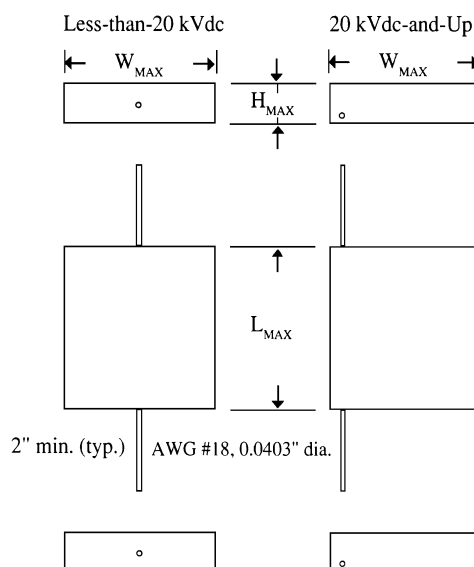
# Type KV<sup>x</sup>, High-Voltage and Pulse, Mica-Paper/Polymer Capacitors

## Ratings

Cap. $\mu$ F	Catalog Number	Length $L_{MAX}$	Width $W_{MAX}$	Height $H_{MAX}$	Max. PRF	Max. $I_{PEAK}$
1 kVdc (500 V repetitive)						
0.047	KVX01S473KOT	1.81	1.02	0.14	14000	40
0.10	KVX01S104KOT	1.81	1.47	0.17	9500	50
0.22	KVX01S224KOT	2.06	1.74	0.24	6000	60
0.47	KVX01S474KOT	3.06	1.98	0.24	4500	100
0.68	KVX01S105KOT	3.56	2.04	0.27	3800	150
1.0	KVX01S105KOT	3.81	2.19	0.35	3100	300
2.2	KVX01S225KOT	4.56	3.04	0.41	2300	700
3.3	KVX01S335KOT	4.56	3.29	0.55	1700	1000
4.7	KVX01S475KOT	4.56	3.09	0.84	1300	1500
6.8	KVX01S685KOT	3.06	3.07	1.93	900	2000
2 kVdc (1 kV repetitive)						
0.033	KVX02S333KOT	1.56	1.07	0.18	4800	70
0.68	KVX02S105KOT	3.56	1.96	0.40	1000	200
1.0	KVX02S105KOT	3.81	2.41	0.47	900	500
3.3	KVX02S335KOT	4.56	2.79	0.91	430	1000
4.7	KVX02S475KOT	3.56	2.37	2.06	320	1500
3 kVdc (1.5 kV repetitive)						
0.010	KVX03S103KOT	1.31	1.10	0.19	6200	130
0.022	KVX03S223KOT	1.56	1.24	0.20	3700	150
0.33	KVX03S334KOT	3.81	2.24	0.34	1000	200
0.47	KVX03S474KOT	3.56	2.41	0.50	800	300
1.0	KVX03S105KOT	3.56	2.08	1.15	450	600
3.3	KVX03S335KOT	3.81	2.80	2.25	250	1500
4 kVdc (2 kV repetitive)						
0.0068	KVX04S682KOT	1.56	1.32	0.15	6700	60
0.010	KVX04S103KOT	1.81	1.32	0.15	5300	70
0.10	KVX04S104KOT	3.06	2.00	0.26	1400	700
0.22	KVX04S224KOT	4.06	2.47	0.30	1000	800
1.0	KVX04S105KOT	3.81	2.85	1.04	330	1000
2.2	KVX04S225KOT	3.81	2.81	2.32	220	1500
5 kVdc (2.5 kV repetitive)						
0.0047	KVX05S472KOT	1.81	1.24	0.14	6700	60
0.010	KVX05S103KOT	2.06	1.26	0.17	3700	100
0.068	KVX05S683KOT	3.56	1.82	0.25	1400	500
0.10	KVX05S104KOT	2.06	1.78	0.65	720	1100
1.0	KVX05S105KOT	4.56	2.84	1.27	260	2000
6 kVdc (3 kV repetitive)						
0.010	KVX06S103KOT	2.06	1.30	0.19	2700	120
0.022	KVX06S223KOT	2.06	1.60	0.25	1600	140
0.10	KVX06S104KOT	3.06	2.22	0.38	720	1000
1.0	KVX06S105KOT	4.56	2.94	1.57	210	2000

Cap. $\mu$ F	Catalog Number	Length $L_{MAX}$	Width $W_{MAX}$	Height $H_{MAX}$	Max. PRF	Max. $I_{PEAK}$
8 kVdc (4 kV repetitive)						
0.0033	KVX08S332KOT	2.06	1.54	0.16	5200	80
0.010	KVX08S103KOT	3.06	1.50	0.20	2500	250
0.022	KVX08S223KOT	3.06	2.08	0.23	1600	500
0.10	KVX08S104KOT	3.06	2.14	0.76	480	900
0.68	KVX08S684KOT	4.56	2.97	1.94	190	1700
10 kVdc (5 kV repetitive)						
0.0010	KVX10S102KOT	1.81	1.48	0.13	9100	25
0.0022	KVX10S222KOT	2.81	1.46	0.13	6200	75
0.010	KVX10S103KOT	3.56	1.69	0.19	2100	250
0.047	KVX10S473KOT	4.56	2.84	0.28	940	500
0.33	KVX10S334KOT	4.56	2.88	1.64	225	1000
12 kVdc (6 kV repetitive)						
0.010	KVX12S103KOT	4.06	1.89	0.20	1800	300
0.033	KVX12S333KOT	4.56	2.82	0.27	920	600
0.33	KVX12S334KOT	4.56	3.63	1.93	200	1100
15 kVdc (7.5 kV repetitive)						
0.00047	KVX15S471KOT	2.06	1.81	0.14	12000	30
0.00068	KVX15S681KOT	2.06	1.25	0.17	6000	40
0.0010	KVX15S102KOT	3.06	1.64	0.15	7500	50
0.010	KVX15S103KOT	4.31	2.10	0.26	1400	300
0.22	KVX15S224KOT	4.56	3.76	2.15	210	2000
20 kVdc (10 kV repetitive)						
0.00033	KVX20S331KOT	1.81	1.60	0.18	7800	30
0.0010	KVX20S102KOT	3.06	1.66	0.19	4400	70
0.010	KVX20S103KOT	3.81	2.24	0.42	810	1100
0.047	KVX20S473KOT	4.31	2.86	1.02	310	1500
25 kVdc (12.5 kV repetitive)						
0.00010	KVX25S101KOT	2.06	1.16	0.17	14000	20
0.00022	KVX25S221KOT	2.06	1.23	0.25	7200	30
0.0047	KVX25S471KOT	3.06	1.24	0.27	5000	50
0.0010	KVX25S102KOT	3.06	2.29	0.20	3800	120
0.0022	KVX25S222KOT	3.06	1.59	0.45	1500	300
0.0033	KVX25S332KOT	3.06	2.02	0.49	1200	350
0.0047	KVX25S472KOT	3.06	2.45	0.53	1000	600
0.010	KVX25S103KOT	4.06	2.35	0.55	610	1000
0.033	KVX25S333KOT	4.56	2.49	1.29	290	2000
30 kVdc (15 kV repetitive)						
0.0001	KVX30S101KOT	2.06	1.58	0.22	13000	30
0.0010	KVX30S102KOT	3.06	1.70	0.30	2200	150
0.010	KVX30S103KOT	4.81	2.783	0.55	580	1200
0.022	KVX30S223KOT	4.81	2.89	1.11	330	1800

## Outline Drawings



## Specifications

**Terminations** available differ according to package type:

Package Type	I	G	M
Ribbon leads	X	X	X
Wire leads	X	X	X
Threaded studs	X	X	X
Threaded inserts		X	X
Turret terminals		X	X
HV Connectors		X	X
Quick Connect			

**Ribbon leads** are typically tin-plated copper, 0.005"x0.5"x2" on small units (<1 in<sup>3</sup>) and 0.020"x0.987"x2" on larger.

**Wire leads** are typically bare AWG #18 or #20, 2" minimum.

**Threaded studs or inserts** are standard from 4-40 to 1/4-20 and typically tin-plated brass.

**Turret terminals** are brass with silver or tin plate.

**High voltage connectors** are available with creepage, tracking and clearance distances to meet requirements up to 150 kV.

**ID Marking** includes manufacturer, CDM, capacitance in  $\mu$ F, rated voltage, identification number and date code YYWW (2 digit year and week of manufacture).

**Capacitance** is within tolerance when measured at 1 kHz (1 MHz if C<1000 pF). Standard tolerance:

- $\pm 5\% \geq 10$  kV
- $\pm 10\% \geq 100$  pF & 5 kV
- $\pm 20\% < 100$  pF & 5 kV

**Dissipation Factor** is no more than 0.5%, **S** characteristic, when measured at 1 kHz (1 MHz if C<1000 pF) and room temperature. Lower dissipation factor specification is available, to 0.1% for mica-plate capacitors, characteristic **C**.

**Insulation Resistance** is no less than the lesser of 100 G $\Omega$  and 5 G $\Omega\mu$ F, when measured at 500 Vdc after 2 minutes, and at room temperature (1 G $\Omega$  or 25 M $\Omega\mu$ F at 125°C).

**Rated Voltage** is the maximum peak voltage for actual use.

**Withstanding Voltage:** Apply a DC test voltage for 5 seconds with the charge and discharge current limited to one ampere and with the capacitor immersed in an insulating fluid when needed to prevent external arcing.

Look up the test voltage as a multiple of the Rated Voltage in this table:

Rated Voltage	Test Voltage
0 to 8 kV	200%
8.1 to 10 kV	175%
10.1 to 12 kV	150%
12.1 to 20 kV	140%
20.1 to 30 kV	130%
30.1 kV and up	120%

**Corona-Free** capacitors are readily available and certification for corona-free operation up to 50 kVdc or kVdc is available.

**Life Test:** Subject capacitors to rated maximum temperature  $\pm 3^\circ\text{C}$  with rated voltage applied for 2000(+72,-2) hours. There will be no visual damage and the capacitance will not have changed more than the greater of  $\pm 3\%$  and  $\pm 1$  pF.

**Vibration Resistance:** Subject the capacitors to simple harmonic motion with an amplitude of 0.06 inches; vary the frequency uniformly from 10 to 55 Hz and return to 10 Hz, all in one minute. Repeat that cycle continuously for 2 hours in each of 3 mutually perpendicular directions. There will be no visual damage, the capacitance will not change more than the greater of  $\pm 3\%$  and  $\pm 1$  pF, and the insulation resistance will be no less than the lesser of 7.5 G $\Omega$  and 5 G $\Omega\mu$ F.

**Moisture Resistance:** Subject **G** or **M** package capacitors to 40 $\pm 2^\circ\text{C}$  at 90 to 95% humidity for 500(+24,-0) hours. Return to room ambient for 24 hours. There will be no visual damage, the capacitance will not change more than the greater of  $\pm 4\%$  or 1 pF, and the insulation resistance will be no less than the lesser of 7.5 G $\Omega$  and 5 G $\Omega\mu$ F.

Moisture resistance is not specified for **I** package capacitors and product warranty is void if used regularly beyond 50% relative humidity.

**Temperature Coefficient and Drift:** Measure the

capacitor's capacitance at 25°C, -55°C, 25°C, 125°C, and at 25°C...all  $\pm 3^\circ\text{C}$ ...after stabilizing at each temperature. The capacitance temperature coefficient will be less than or equal to  $\pm 500$  ppm/ $^\circ\text{C}$ , and the capacitance will not have changed more than  $\pm (0.5\% + 0.1 \text{ pF})$ .

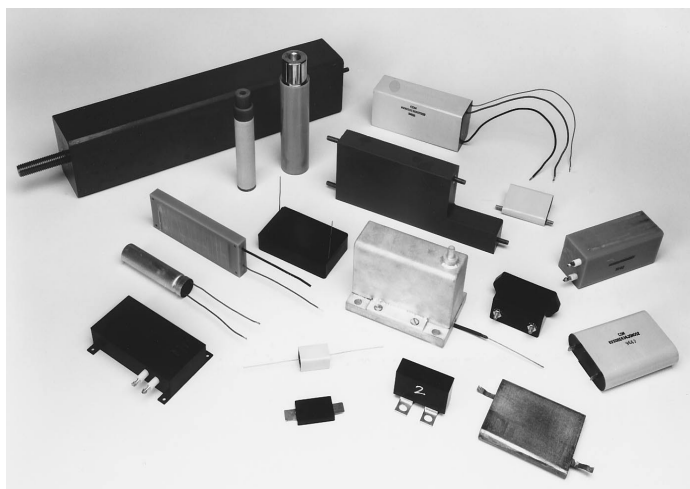
**Pulse Capability:** Maximum achievable peak current is usually limited by the inductance of the discharge circuit, not by rise-time effects of the dielectric.

For repetition-rated applications, use double the dc rating in the **Typical Ratings** table on the following page. In other words, for a 10kV repetition-rated capacitor application, use a 20 kVdc rated capacitor.

The table of **Typical Ratings** on the following page lists maximum pulse repetition frequency (PRF) and maximum peak current ( $I_{\text{PEAK}}$ ) at the maximum PRF at room temperature ambient conditions. To use higher peak current, derate the PRF as the square of the peak current ratio. For example, to use double the maximum rated peak current, use one-quarter of the maximum rated repetition rate.

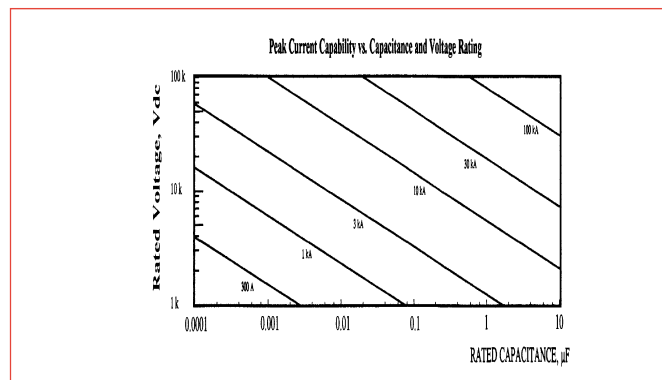
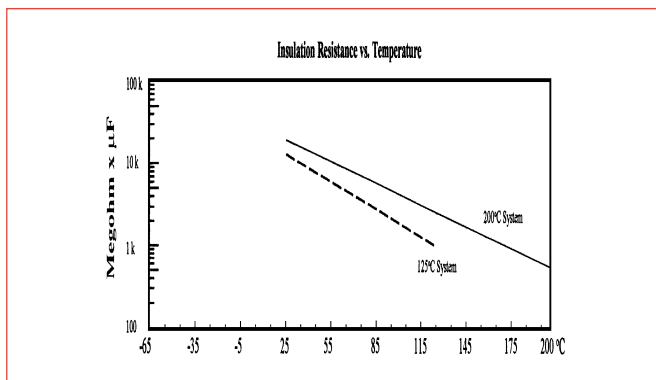
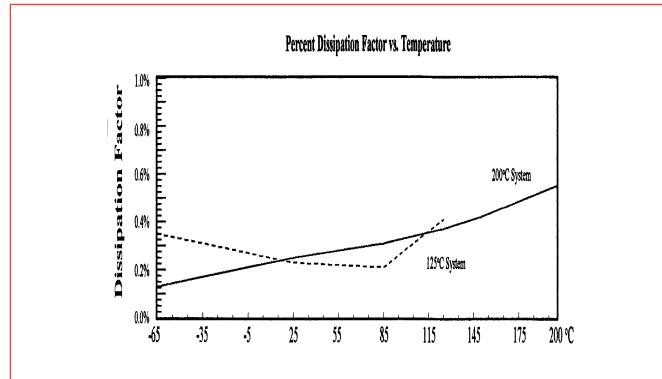
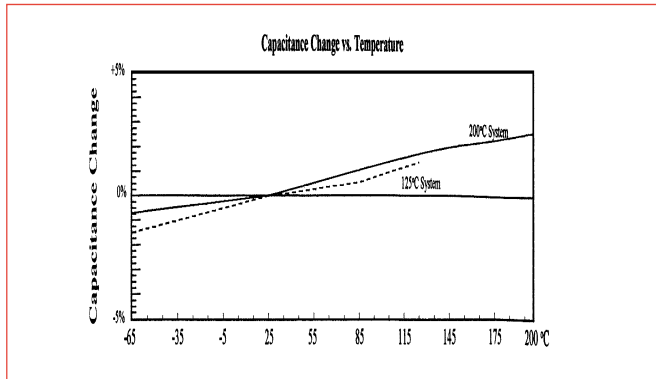
For higher rep rate applications, or to enable higher peak current without the above derating, contact us for alternatives. Also we can recommend active cooling strategies for your high energy density application.

**Capacitor Size** is determined by your choice of package, the capacitance and the rated voltage. For new designs, we will furnish your capacitor's size with our quotation. For a first estimate of capacitor size refer to the **Typical Ratings** table page 46.



# Type KV<sup>x</sup>, High-Voltage and Pulse, Mica-Paper/Polymer Capacitors

## Typical Performance Curves



These are typical curves for KV<sup>x</sup> capacitors with mica-paper dielectric. Other dielectric systems are available with improved characteristics. Please contact us for information.

## Ordering Information

KV <sup>x</sup>	10	S	473	J	0	T
Type						
Characteristic		S = Standard Performance C = High Current, <5% tol. E = High Energy Density				
Tolerance				E = $\pm$ 0.5% F = $\pm$ 1% G = $\pm$ 2% J = $\pm$ 5% K = $\pm$ 10% M = $\pm$ 20%		
Package						T = Tape wrap/end fill M = Molded, vacuum G = Glass/epoxy tube B = Bare element
Rated Voltage	10 = 10kV 05 = 5kV					
Capacitance			471 = 470pF 472 = 4700pF 4732 = 47300pF 47R3 = 47.3pF			
Temperature					0 = -55°C to 125°C 1 = -65°C to 125°C 2 = -65°C to 150°C 3 = -65°C to 200°C 4 = -65°C to 260°C	

Order by complete Part Number. We will assign you a new number when your part is manufactured.

Use Outline Drawings and Typical Ratings as a capability guide. They are for mica-paper capacitors in Type T packages with S characteristic. Standard leads are AWG #18 centered on the ends for less than 20 kVdc and offset as shown for 20 kVdc and up. See Terminations for optional leads and terminals.

We invite you to challenge us with your special requirements for high-voltage and pulse capacitors.

Also feel free to request custom shapes for G and M package units. Those packages can deliver unique shapes and configurations and are not limited to the simple, rectangular shapes shown here.