

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

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



### Applications

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

### 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 150 kV, peak currents up to 100 kA, 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 150 kV, 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 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.

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## Specifications

**Operating Temperature:** -55 °C to +125 °C standard, -65 °C up to 200 °C available

**Rated Voltage:** 100 V to 150 kVdc

**Capacitance:** 1 pF to 10 µF ±0.5% to ±20% , negligible capacitance change, all environments

**Dissipation Factor:** Characteristic S - .5%, C - .05%

**Insulation Resistance:** 5 GΩµF min at 500 Vdc, 2 min.

Terminations available differ according to package type:

| Package Type     | T | 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" x 0.5" x 2" on small units (<1 in3) and 0.020" x 0.987" x 2" 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 tinplate.

**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 µF, 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:**

±5% ≥10 kV

±10% ≥100 pF & 5 kV

±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 GΩ and 5 GΩµF, when measured at 500 Vdc after 2 minutes, and at room temperature (1 GΩ or 25 MΩµF 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 kVac or kVdc is available.

**Life Test:** Subject capacitors to rated maximum temperature ±3 °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 ±3% and ±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 ±3% and ±1 pF, and the insulation resistance will be no less than the lesser of 7.5 GΩ and 5 GΩµF.

**Moisture Resistance:** Subject G or M package capacitors to 40 ±2 °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 ±4% or 1 pF, and the insulation resistance will be no less than the lesser of 7.5 GΩ and 5 GΩµF.

Moisture resistance is not specified for T 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 ±3 °C after stabilizing at each temperature. The capacitance temperature coefficient will be less than or equal to ±500 ppm/°C, and the capacitance

will not have changed more than ±(0.5%+0.1 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 10 kV repetition-rated capacitor application, use a 20 kVdc rated capacitor.

The Ratings table on the page after next lists maximum pulse repetition frequency (PRF) and maximum peak current (IPEAK) 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.

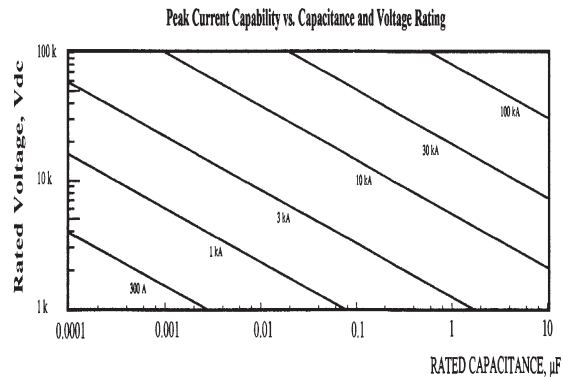
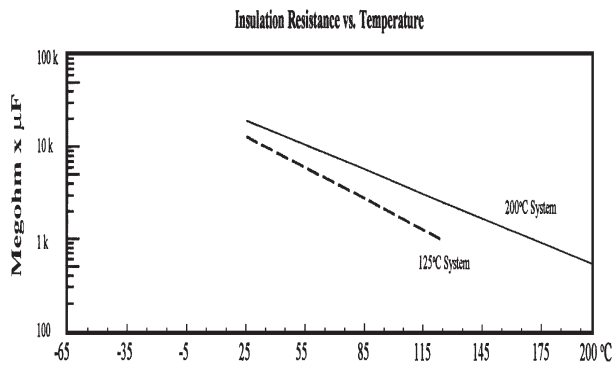
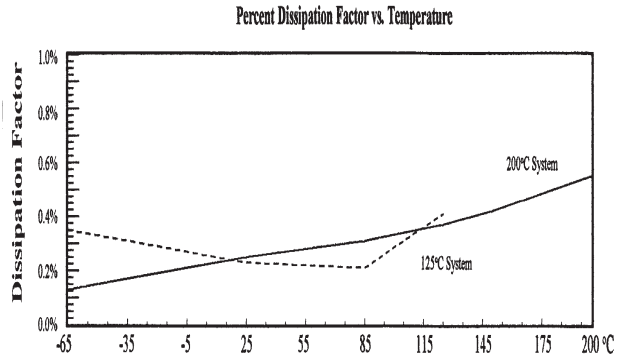
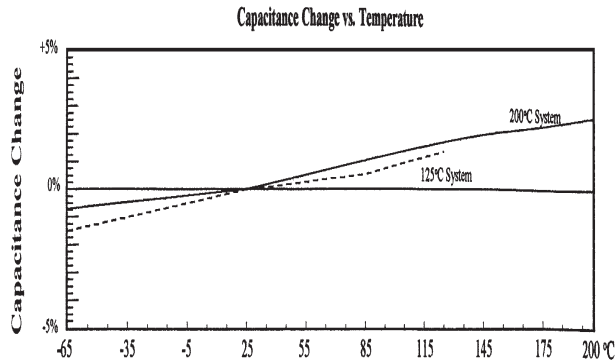
For higher rep rate applications, or to enable higher peak current without the above derating, contact us for alternatives. Also we can recommend active cooling strategies for your high energy density application.

**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 Ratings table.



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## 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.

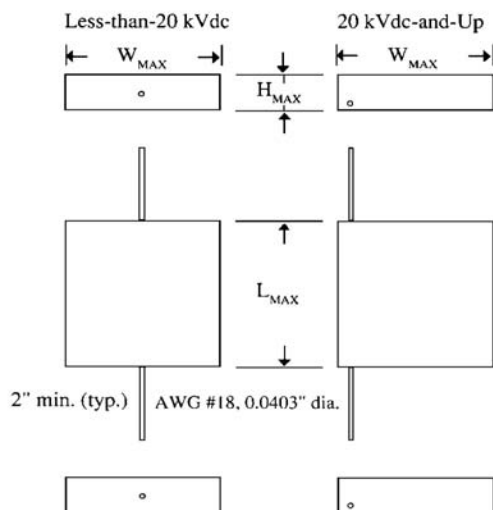
## Part Numbering System

| KV <sup>X</sup> | 10                      | S                                                                                 | 473                                                                | J                                                                  | O                                                                                                                    | T                                                                                        | 001                   |
|-----------------|-------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------|
| Type            | Rated Voltage           | Characteristic                                                                    | Capacitance                                                        | Tolerance                                                          | Temperature                                                                                                          | Package                                                                                  | Standard Catalog Part |
|                 | 10 = 10 kV<br>05 = 5 kV | S = Standard Performance<br>C = High Current, <5% tol.<br>E = High Energy Density | 471 = 470 pF<br>472 = 4700 pF<br>4732 = 47300 pF<br>47R3 = 47.3 pF | E = ±0.5%<br>F = ±1%<br>G = ±2%<br>J = ±5%<br>K = ±10%<br>M = ±20% | 0 = -55 °C to 125 °C<br>1 = -65 °C to 125 °C<br>2 = -65 °C to 150 °C<br>3 = -65 °C to 200 °C<br>4 = -65 °C to 260 °C | T = Tape wrap/end fill<br>M = Molded, vacuum<br>G = Glass/epoxy tube<br>B = Bare element |                       |

Order by complete Part Number. For capacitors with special requirements we will assign you a new number at order entry. 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.

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

## Outline Drawings



## Ratings

| Case Dimensions (in)              |                     |                  |                 |                  |          |                 |
|-----------------------------------|---------------------|------------------|-----------------|------------------|----------|-----------------|
| Cap. (μF)                         | Catalog Part Number | Length $L_{MAX}$ | Width $W_{MAX}$ | Height $H_{MAX}$ | Max. PRF | Max. $I_{PEAK}$ |
| <b>1 kVdc (500 V repetitive)</b>  |                     |                  |                 |                  |          |                 |
| 0.047                             | KVX01S473K0T001     | 1.81             | 1.02            | 0.14             | 14000    | 40              |
| 0.1                               | KVX01S104K0T001     | 1.81             | 1.47            | 0.17             | 9500     | 50              |
| 0.22                              | KVX01S224K0T001     | 2.06             | 1.74            | 0.24             | 6000     | 60              |
| 0.47                              | KVX01S474K0T001     | 3.06             | 1.98            | 0.24             | 4500     | 100             |
| 0.68                              | KVX01S105K0T001     | 3.56             | 2.04            | 0.27             | 3800     | 150             |
| 1                                 | KVX01S105K0T001     | 3.81             | 2.19            | 0.35             | 3100     | 300             |
| 2.2                               | KVX01S225K0T001     | 4.56             | 3.04            | 0.41             | 2300     | 700             |
| 3.3                               | KVX01S335K0T001     | 4.56             | 3.29            | 0.55             | 1700     | 1000            |
| 4.7                               | KVX01S475K0T001     | 4.56             | 3.09            | 0.84             | 1300     | 1500            |
| 6.8                               | KVX01S685K0T001     | 3.06             | 3.07            | 1.93             | 900      | 2000            |
| <b>2 kVdc (1 kV repetitive)</b>   |                     |                  |                 |                  |          |                 |
| 0.033                             | KVX02S333K0T001     | 1.56             | 1.07            | 0.18             | 4800     | 70              |
| 0.68                              | KVX02S105K0T001     | 3.56             | 1.96            | 0.40             | 1000     | 200             |
| 1                                 | KVX02S105K0T001     | 3.81             | 2.41            | 0.47             | 900      | 500             |
| 3.3                               | KVX02S335K0T001     | 4.56             | 2.79            | 0.91             | 430      | 1000            |
| 4.7                               | KVX02S475K0T001     | 3.56             | 2.37            | 2.06             | 320      | 1500            |
| <b>3 kVdc (1.5 kV repetitive)</b> |                     |                  |                 |                  |          |                 |
| 0.01                              | KVX03S103K0T001     | 1.31             | 1.10            | 0.19             | 6200     | 130             |
| 0.022                             | KVX03S223K0T001     | 1.56             | 1.24            | 0.20             | 3700     | 150             |
| 0.33                              | KVX03S334K0T001     | 3.81             | 2.24            | 0.34             | 1000     | 200             |
| 0.47                              | KVX03S474K0T001     | 3.56             | 2.41            | 0.50             | 800      | 300             |
| 1                                 | KVX03S105K0T001     | 3.56             | 2.08            | 1.15             | 450      | 600             |
| 3.3                               | KVX03S335K0T001     | 3.81             | 2.80            | 2.25             | 250      | 1500            |
| <b>4 kVdc (2 kV repetitive)</b>   |                     |                  |                 |                  |          |                 |
| 0.0068                            | KVX04S682K0T001     | 1.56             | 1.32            | 0.15             | 6700     | 60              |
| 0.01                              | KVX04S103K0T001     | 1.81             | 1.32            | 0.15             | 5300     | 70              |
| 0.1                               | KVX04S104K0T001     | 3.06             | 2.00            | 0.26             | 1400     | 700             |
| 0.22                              | KVX04S224K0T001     | 4.06             | 2.47            | 0.30             | 1000     | 800             |
| 1                                 | KVX04S105K0T001     | 3.81             | 2.85            | 1.04             | 330      | 1000            |
| 2.2                               | KVX04S225K0T001     | 3.81             | 2.81            | 2.32             | 220      | 1500            |
| <b>5 kVdc (2.5 kV repetitive)</b> |                     |                  |                 |                  |          |                 |
| 0.0047                            | KVX05S472K0T001     | 1.81             | 1.24            | 0.14             | 6700     | 60              |
| 0.01                              | KVX05S103K0T001     | 2.06             | 1.26            | 0.17             | 3700     | 100             |
| 0.068                             | KVX05S683K0T001     | 3.56             | 1.82            | 0.25             | 1400     | 500             |
| 0.1                               | KVX05S104K0T001     | 2.06             | 1.78            | 0.65             | 720      | 1100            |
| 1                                 | KVX05S105K0T001     | 4.56             | 2.84            | 1.27             | 260      | 2000            |
| <b>6 kVdc (3 kV repetitive)</b>   |                     |                  |                 |                  |          |                 |
| 0.01                              | KVX06S103K0T001     | 2.06             | 1.30            | 0.19             | 2700     | 120             |
| 0.022                             | KVX06S223K0T001     | 2.06             | 1.60            | 0.25             | 1600     | 140             |
| 0.1                               | KVX06S104K0T001     | 3.06             | 2.22            | 0.38             | 720      | 1000            |
| 1                                 | KVX06S105K0T001     | 4.56             | 2.94            | 1.57             | 210      | 2000            |

| Case Dimensions (in)                |                     |                  |                 |                  |          |                 |
|-------------------------------------|---------------------|------------------|-----------------|------------------|----------|-----------------|
| Cap. (μF)                           | Catalog Part Number | Length $L_{MAX}$ | Width $W_{MAX}$ | Height $H_{MAX}$ | Max. PRF | Max. $I_{PEAK}$ |
| <b>8 kVdc (4 kV repetitive)</b>     |                     |                  |                 |                  |          |                 |
| 0.0033                              | KVX08S332K0T001     | 2.06             | 1.54            | 0.16             | 5200     | 80              |
| 0.01                                | KVX08S103K0T001     | 3.06             | 1.50            | 0.20             | 2500     | 250             |
| 0.022                               | KVX08S223K0T001     | 3.06             | 2.08            | 0.23             | 1600     | 500             |
| 0.1                                 | KVX08S104K0T001     | 3.06             | 2.14            | 0.76             | 480      | 900             |
| 0.68                                | KVX08S684K0T001     | 4.56             | 2.97            | 1.94             | 190      | 1700            |
| <b>10 kVdc (5 kV repetitive)</b>    |                     |                  |                 |                  |          |                 |
| 0.001                               | KVX10S102K0T001     | 1.81             | 1.48            | 0.13             | 9100     | 25              |
| 0.0022                              | KVX10S222K0T001     | 2.81             | 1.46            | 0.13             | 6200     | 75              |
| 0.01                                | KVX10S103K0T001     | 3.56             | 1.69            | 0.19             | 2100     | 250             |
| 0.047                               | KVX10S473K0T001     | 4.56             | 2.84            | 0.28             | 940      | 500             |
| 0.33                                | KVX10S334K0T001     | 4.56             | 2.88            | 1.64             | 225      | 1000            |
| <b>12 kVdc (6 kV repetitive)</b>    |                     |                  |                 |                  |          |                 |
| 0.01                                | KVX12S103K0T001     | 4.06             | 1.89            | 0.20             | 1800     | 300             |
| 0.033                               | KVX12S333K0T001     | 4.56             | 2.82            | 0.27             | 920      | 600             |
| 0.33                                | KVX12S334K0T001     | 4.56             | 3.63            | 1.93             | 200      | 1100            |
| <b>15 kVdc (7.5 kV repetitive)</b>  |                     |                  |                 |                  |          |                 |
| 0.00047                             | KVX15S471K0T001     | 2.06             | 1.81            | 0.14             | 12000    | 30              |
| 0.00068                             | KVX15S681K0T001     | 2.06             | 1.25            | 0.17             | 6000     | 40              |
| 0.001                               | KVX15S102K0T001     | 3.06             | 1.64            | 0.15             | 7500     | 50              |
| 0.01                                | KVX15S103K0T001     | 4.31             | 2.10            | 0.26             | 1400     | 300             |
| 0.22                                | KVX15S224K0T001     | 4.56             | 3.76            | 2.15             | 210      | 2000            |
| <b>20 kVdc (10 kV repetitive)</b>   |                     |                  |                 |                  |          |                 |
| 0.00033                             | KVX20S331K0T001     | 1.81             | 1.60            | 0.18             | 7800     | 30              |
| 0.001                               | KVX20S102K0T001     | 3.06             | 1.66            | 0.19             | 4400     | 70              |
| 0.01                                | KVX20S103K0T001     | 3.81             | 2.24            | 0.42             | 810      | 1100            |
| 0.047                               | KVX20S473K0T001     | 4.31             | 2.86            | 1.02             | 310      | 1500            |
| <b>25 kVdc (12.5 kV repetitive)</b> |                     |                  |                 |                  |          |                 |
| 0.0001                              | KVX25S101K0T001     | 2.06             | 1.16            | 0.17             | 14000    | 20              |
| 0.00022                             | KVX25S221K0T001     | 2.06             | 1.23            | 0.25             | 7200     | 30              |
| 0.0047                              | KVX25S471K0T001     | 3.06             | 1.24            | 0.27             | 5000     | 50              |
| 0.001                               | KVX25S102K0T001     | 3.06             | 2.29            | 0.20             | 3800     | 120             |
| 0.0022                              | KVX25S222K0T001     | 3.06             | 1.59            | 0.45             | 1500     | 300             |
| 0.0033                              | KVX25S332K0T001     | 3.06             | 2.02            | 0.49             | 1200     | 350             |
| 0.0047                              | KVX25S472K0T001     | 3.06             | 2.45            | 0.53             | 1000     | 600             |
| 0.01                                | KVX25S103K0T001     | 4.06             | 2.35            | 0.55             | 610      | 1000            |
| 0.033                               | KVX25S333K0T001     | 4.56             | 2.49            | 1.29             | 290      | 2000            |
| <b>30 kVdc (15 kV repetitive)</b>   |                     |                  |                 |                  |          |                 |
| 0.0001                              | KVX30S101K0T001     | 2.06             | 1.58            | 0.22             | 13000    | 30              |
| 0.001                               | KVX30S102K0T001     | 3.06             | 1.70            | 0.30             | 2200     | 150             |
| 0.01                                | KVX30S103K0T001     | 4.81             | 2.78            | 0.55             | 580      | 1200            |
| 0.022                               | KVX30S223K0T001     | 4.81             | 2.89            | 1.11             | 330      | 1800            |