CTVS - Ceramic transient voltage suppressors

Multilayer varistors (MLVs), standard series

Series/Type: **CT0402S28G_X**
Ordering code: **B72590X0280S060**

Date: 2026-02-19
Version: 1

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Designation system

CT	Chip with three-layer-termination (Ag/Ni/Sn)
0402	Dimensions of the device 04 x 02 (length x width in 1/100 inch)
S	Special tolerance of the varistor voltage
28	Maximum RMS operating voltage
G	Taped version, blister tape, 7" reel (10000 pcs./ reel)

Electrical data

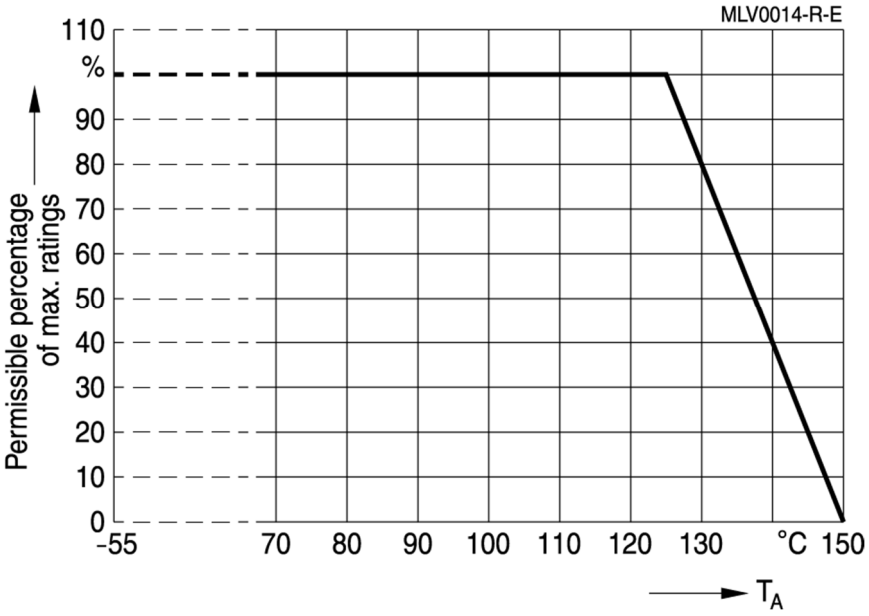
Maximum operating voltage

- RMS voltage	V_{RMS}	= 28 V
- DC voltage	V_{DC}	= 36 V

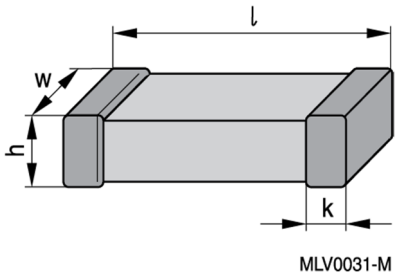
Varistor voltage (@ 1 mA, +25 °C)	V_V	= 45 … 65 V
Maximum clamping voltage (@ 1 A)	$V_{clamp,max}$	= 130 V
Maximum surge current (8/20 µs)	$I_{surge,max}$	= 1 x 1A
Contact discharge ESD capability (IEC 61000-4-2)	$V_{ESD,Contact}$	= 8 kV
Air discharge ESD capability (IEC 61000-4-2)	$V_{ESD,Air}$	= 15 kV
Capacitance (@ 1 MHz, 1 V, 25 °C; typical)	C_{typ}	= 6 pF
Response time	t_{resp}	= < 0.5 ns
Operating temperature	T_{op}	= –40 ... +125 °C
Storage temperature (mounted parts)	T_{stg}	= –40 ... +125 °C

Temperature derating

The specified ratings for I_{max}, and $I_{surge,max}$ are valid up to 125 °C.
For operation above 125 °C, we recommend the derating below.



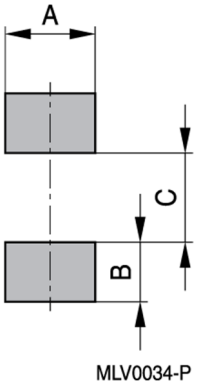
Dimensional drawing



Dimensions in mm

Case size	l	w	h	k
0402	1.0 ±0.1	0.5 ±0.1	0.6 max.	0.10 … 0.30

Recommended solder pad layout



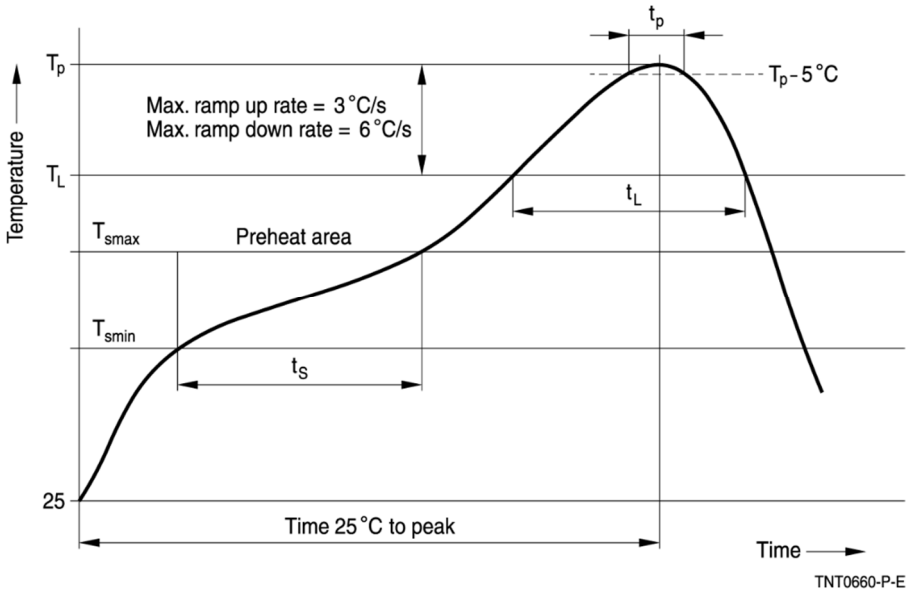
Dimensions in mm

Case size	A	B	C
0402	0.6	0.6	0.5

Recommended soldering profiles

Reflow soldering

Temperature ranges for reflow soldering acc. to IEC 60068-2-58 recommendations



Profile feature		Sn-Pb eutectic assembly	Pb-free assembly
Preheat and soak - Temperature min - Temperature max - Time	 T_{smin} T_{smax} t_s	 +100 °C +150 °C 60 … 120 s	 +150 °C +200 °C 60 … 120 s
Average ramp-up rate	T_{smax} to T_p	+3 °C/s max.	+3 °C/s max.
Liquidous temperature Time at liquidous	T_L t_L	+183 °C 40 … 150 s	+217 °C 40 … 150 s
Peak package body temperature	T_p[1)]	+215 °C … +260 °C	+235 °C … +260 °C
Time (t_p) above (T_p –5 °C)	t_p	10 ... 40 s	10 ... 40 s
Average ramp-down rate	T_p to T_{smax}	+6 °C/s max.	+6 °C/s max.
Time 25 °C to peak temperature		max. 8 min	max. 8 min

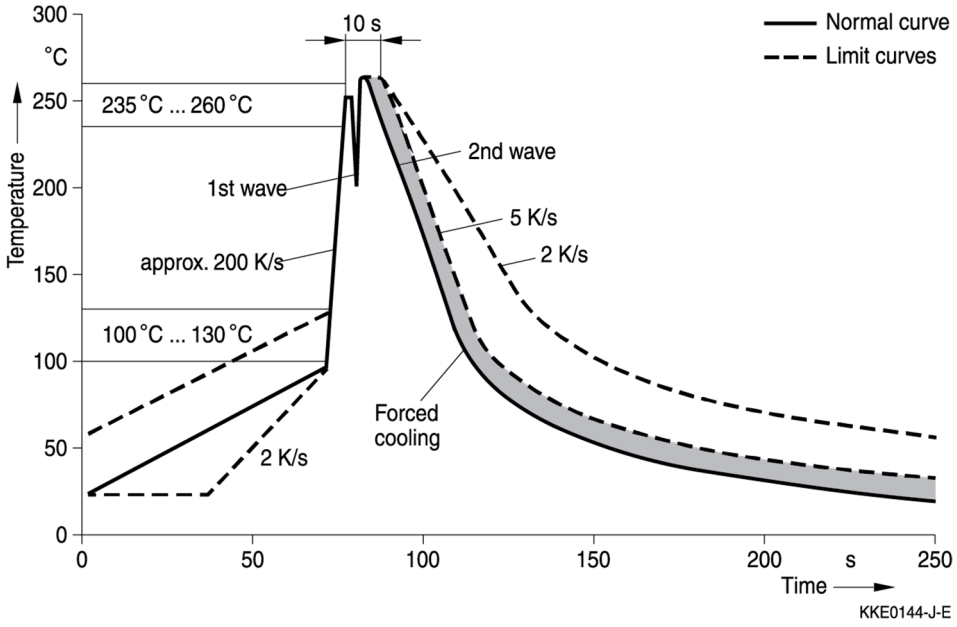
[1)] Depending on package thickness

Note:

- All temperatures refer to the topside of the package, measured on the package body surface.
- Number of reflow cycles: 3
- Iron soldering should be avoided. Hot air methods are recommended for repair purposes.

Wave soldering temperature profile

Temperature characteristic at component terminal with dual-wave soldering



Recommended solder

The use of no-clean solder products is recommended. In any case, mild, non-activated fluxes should be used. Flux residues after soldering should be minimized.

Storage conditions

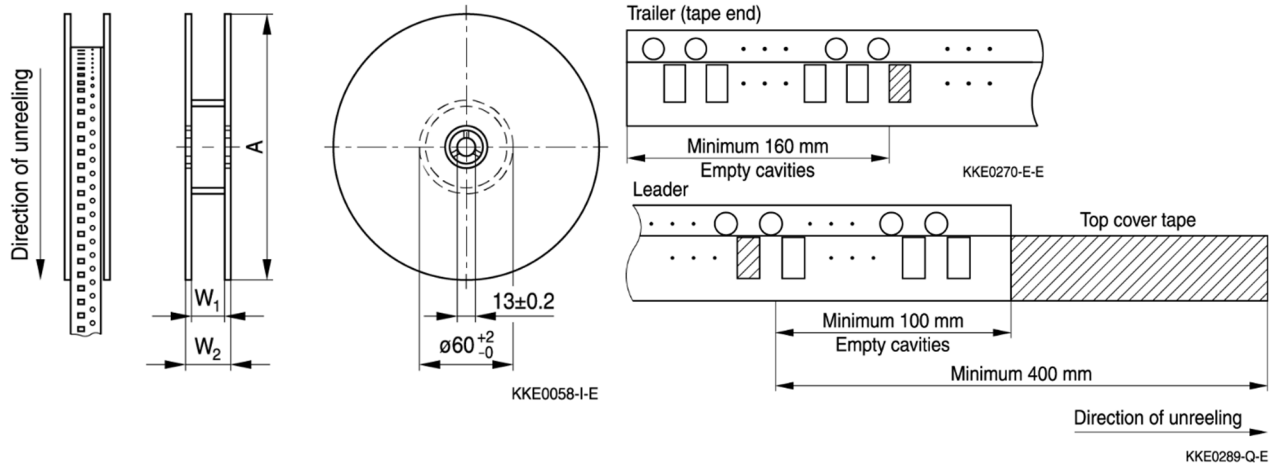
- In order to maintain solderability, the components must be stored in a non-corrosive atmosphere. Humidity, temperature, and container materials are critical factors.
- Do not store the components where they are exposed to heat or direct sunlight. Otherwise, the packing material may be deformed, or the components may stick together, causing problems during mounting. After opening the factory seals, such as polyvinyl-sealed packages, use the components as soon as possible.
- The components should be left in the original packaging. Touching the metallization of unsoldered components may change their soldering properties.
- Storage temperature: –25 to +45 °C
- Relative humidity: < 75% annual average, < 95% on a maximum of 30 days per year, dew precipitation and wetness are inadmissible.
- Solder the components listed in this data sheet after shipment from TDK within 12 months.

Taping and packaging

- Tape and reel packaging according to IEC 60286-3
- Tape material: Cardboard
- Dimensions and tolerances

Definition	Symbol	Dimension [mm]	Tolerance [mm]
Tape width	W	8.00	±0.30

- Package: 8-mm tape
- Packaging material: plastic
- Reel dimensions



Definition	Symbol	Dimension [mm]	Tolerance [mm]
Reel diameter	A	180	+0/–3
Reel width (inside)	W_1	8.4	+1.5/–0
Reel width (outside)	W_2	14.4	max.

- Packing unit: 10000 pcs./reel

Cautions and warnings

General

Some parts of this publication contain statements about the suitability of our ceramic transient voltage suppressor (CTVS) components (multilayer varistors (MLVs)), CeraDiodes, ESD/EMI filters, leaded transient voltage/ RFI suppressors (SHCV types)) for certain areas of application, including recommendations about incorporation/design-in of these products into customer applications. The statements are based on our knowledge of typical requirements often made of our CTVS devices in the particular areas. We nevertheless expressly point out that such statements cannot be regarded as binding statements about the suitability of our CTVS components for a particular customer application. As a rule, TDK Electronics is either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always incumbent on the customer to check and decide whether the CTVS devices with the properties described in the product specification are suitable for use in a particular customer application.

- Do not use TDK Electronics CTVS components for purposes not identified in our specifications, application notes and data books.
- Ensure the suitability of a CTVS in particular by testing it for reliability during design-in. Always evaluate a CTVS component under worst-case conditions.
- Pay special attention to the reliability of CTVS devices intended for use in safety-critical applications (e.g., medical equipment, automotive, spacecraft, nuclear power plant).

Design notes

- Always connect a CTVS in parallel with the electronic circuit to be protected.
- Consider maximum rated power dissipation if a CTVS has insufficient time to cool down between a number of pulses occurring within a specified isolated time period. Ensure that electrical characteristics do not degrade.
- Consider derating at higher operating temperatures. Choose the highest voltage class compatible with derating at higher temperatures.
- Consider appropriate safety measures for measurement (e.g., high voltage) across the CTVS components.
- Surge currents beyond specified values will puncture a CTVS. In extreme cases a CTVS will burst.
- If steep surge current edges are to be expected, make sure your design is as low-inductance as possible.
- In some cases, the malfunctioning of passive electronic components or failure before the end of their service life cannot be completely ruled out in the current state of the art, even if they are operated as specified. In applications requiring a very high level of operational safety and especially when the malfunction or failure of a passive electronic component could endanger human life or health (e.g., in accident prevention, life-saving systems, or automotive battery line applications such as clamp 30), ensure by suitable design of the application or other measures (e.g., installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of such a malfunction or failure. Only use CTVS components from the automotive series in safety-relevant applications.

- Specified values only apply to CTVS components that have not been subject to prior electrical, mechanical or thermal damage. For the use of MLVs in line-to-ground circuits we recommend that the customer checks whether restrictions exist, or additional safety measures are required based on various international and local standards.

Storage

- Only store CTVS in their original packaging. Do not open the package before storage.
- Storage conditions in original packaging: temperature −25 to +45°C, relative humidity ≤75% annual average, maximum 95%, dew precipitation is inadmissible.
- Do not store CTVS devices where they are exposed to heat or direct sunlight. Otherwise, the packaging material may be deformed or CTVS may stick together, causing problems during mounting.
- Avoid contamination of the CTVS surface during storage, handling and processing.
- Avoid storing CTVS devices in harmful environments where they are exposed to corrosive gases for example (SO_x, Cl).
- Use CTVS as soon as possible after opening factory seals such as polyvinyl-sealed packages.
- Solder CTVS components after shipment from TDK Electronics within the time specified:
  - CTVS with Ni barrier termination: 12 months
  - CTVS with AgPt termination: 6 months
  - SHCV: 24 months

Handling

- Do not drop CTVS components and allow them to be chipped.
- Do not touch CTVS with your bare hands - gloves are recommended.
- Avoid contamination of the CTVS surface during handling.
- Washing processes may damage the product due to the possible static or cyclic mechanical loads (e.g., ultrasonic cleaning). They may cause cracks to develop on the product and its parts, which might lead to reduced reliability or lifetime.

Mounting

- When CTVS devices are encapsulated with sealing material or overmolded with plastic material, electrical characteristics might be degraded and the lifetime reduced.
- Make sure an electrode is not scratched before, during or after the mounting process.
- Make sure contacts and housings used for assembly with CTVS components are clean before mounting.
- The surface temperature of an operating CTVS can be higher. Ensure that adjacent components are placed at a sufficient distance from a CTVS to allow proper cooling.
- Avoid contamination of the CTVS surface during processing.

Soldering

- Complete removal of flux is recommended to avoid surface contamination that can result in an instable and/or high leakage current.
- Use resin-type or non-activated flux.
- Bear in mind that insufficient preheating may cause ceramic cracks.
- Rapid cooling by dipping in solvent is not recommended, otherwise a component may crack.

Operation

- Use CTVS only within the specified operating temperature range.
- Use CTVS only within specified voltage and current ranges.
- Environmental conditions must not harm a CTVS. Only use them in normal atmospheric conditions. Reducing the atmosphere (e.g., hydrogen or nitrogen atmosphere) is prohibited.
- Prevent a CTVS from contacting liquids and solvents. Make sure that no water enters a CTVS (e.g., through plug terminals).
- Avoid dewing and condensation.
- TDK Electronics CTVS components are mainly designed for encased applications. Under all circumstances avoid exposure to:
  - direct sunlight
  - rain or condensation
  - steam, saline spray
  - corrosive gases
  - atmosphere with reduced oxygen content
- TDK Electronics CTVS devices are not suitable for switching applications or voltage stabilization where static power dissipation is required.

This listing does not claim to be complete but merely reflects the experience of TDK Electronics AG.

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The ordering code for one and the same product can be represented differently in data sheets, data books, other publications, on the company website, or in order-related documents such as shipping notes, order confirmations and product labels. **The varying representations of the ordering codes are due to different processes employed and do not affect the specifications of the respective products**. Detailed information can be found on the Internet under www.tdk-electronics.tdk.com/orderingcodes.

Important notes

The following applies to all products named in this publication:

1. Some parts of this publication contain **statements about the suitability of our products for certain areas of application**. These statements are based on our knowledge of typical requirements that are often placed on our products in the areas of application concerned. We nevertheless expressly point out **that such statements cannot be regarded as binding statements about the suitability of our products for a particular customer application.** As a rule, we are either unfamiliar with individual customer applications or less familiar with them than the customers themselves. For these reasons, it is always ultimately incumbent on the customer to check and decide whether a product with the properties described in the product specification is suitable for use in a particular customer application.
2. We also point out that **in individual cases, a malfunction of electronic components or failure before the end of their usual service life cannot be completely ruled out in the current state of the art, even if they are operated as specified.** In customer applications requiring a very high level of operational safety and especially in customer applications in which the malfunction or failure of an electronic component could endanger human life or health (e.g., in accident prevention or life-saving systems), it must therefore be ensured by means of suitable design of the customer application or other action taken by the customer (e.g., installation of protective circuitry or redundancy) that no injury or damage is sustained by third parties in the event of malfunction or failure of an electronic component.
3. **The warnings, cautions and product-specific notes must be observed.**
4. In order to satisfy certain technical requirements, **some of the products described in this publication may contain substances subject to restrictions in certain jurisdictions (e.g., because they are classed as hazardous)**. Useful information on this will be found in our Material Data Sheets on the Internet (www.tdk-electronics.tdk.com/material). Should you have any more detailed questions, please contact our sales offices.
5. We constantly strive to improve our products. Consequently, **the products described in this publication may change from time to time**. The same is true of the corresponding product specifications. Please check therefore to what extent product descriptions and specifications contained in this publication are still applicable before or when you place an order.

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7. **Our manufacturing sites serving the automotive business apply the IATF 16949 standard.** The IATF certifications confirm our compliance with requirements regarding the quality management system in the automotive industry. Referring to customer requirements and customer specific requirements (“CSR”) TDK always has and will continue to have the policy of respecting individual agreements. Even if IATF 16949 may appear to support the acceptance of unilateral requirements, we hereby like to emphasize that **only requirements mutually agreed upon can and will be implemented in our Quality Management System.** For clarification purposes we like to point out that obligations from IATF 16949 shall only become legally binding if individually agreed upon.

Important notes

8. The trade names EPCOS, CarXield, CeraCharge, CeraDiode, CeraLink, CeraPad, CeraPlas, CSMP, CTVS, DeltaCap, DigiSiMic, FilterCap, FormFit, InsuGate, LeaXield, MediPlas, MiniBlue, MiniCell, MKD, MKK, ModCap, MotorCap, PCC, PhaseCap, PhaseCube, PhaseMod, PhiCap, PiezoBrush, PlasmaBrush, PowerHap, PQSine, PQvar, SIFERRIT, SIFI, SIKOREL, SilverCap, SIMDAD, SiMic, SIMID, SineFormer, SIOV, SurfIND, ThermoFuse, WindCap, XieldCap are **trademarks registered or pending** in Europe and in other countries. Further information will be found on the Internet at www.tdk-electronics.tdk.com/trademarks.

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