# CTVS - Ceramic transient voltage suppressors

## Multilayer varistors (MLVs), automotive X series

**Series/Type:** **CT1210S14BAUTOG_X1**
**Ordering code:** **B72530X1140S162**

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Version: 1

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## Features

- Reliable ESD protection up to 30 kV acc. to IEC 61000-4-2
- High energy absorption capability
- Low leakage current
- No temperature derating up to 150 °C
- High lifetime robustness
- Stable protection level
- RoHS-compatible, lead-free
- Qualified based on AEC-Q200
- PSpice simulation models available

## Designation system

| | |
|---|---|
| CT | Chip with three-layer-termination (Ag/Ni/Sn) |
| 1210 | Dimensions of the device 12 x 10 (length x width in 1/100 inch) |
| S … B | Special tolerance B of the varistor voltage |
| 14 | Maximum RMS operating voltage |
| G | Taped version, blister tape, 7" reel (3000 pcs./ reel) |

## Electrical data

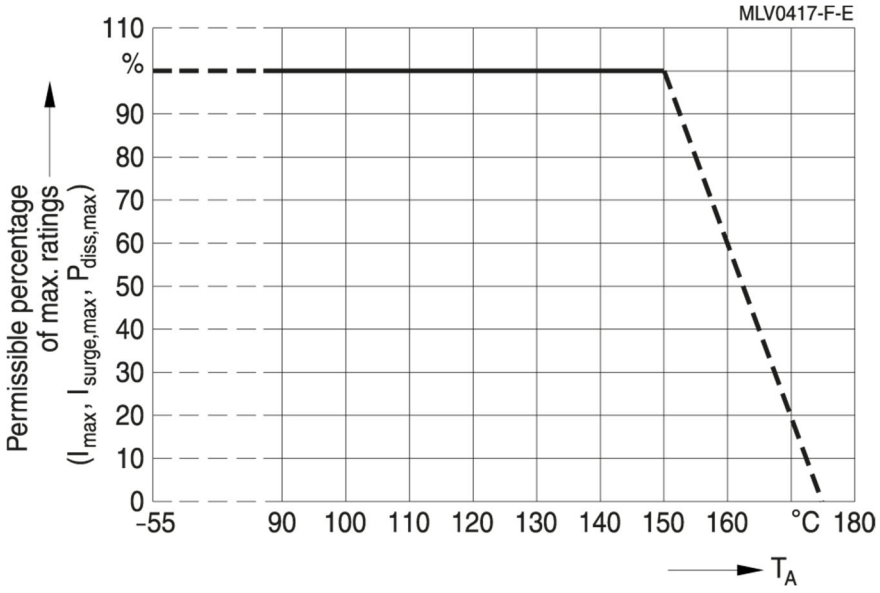
Maximum operating voltage

| | | |
|---|---|---|
| - RMS voltage | $V_{RMS}$ | = 14 V |
| - DC voltage | $V_{DC}$ | = 16 V |

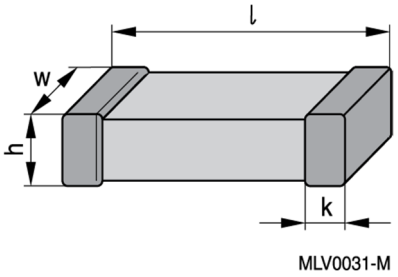
| | | |
|---|---|---|
| Varistor voltage (@ 1 mA, +25 °C) | $V_V$ | = 22 … 27 V |
| Maximum clamping voltage (@ 5 A) | $V_{clamp,max}$ | = 40 V |
| Maximum leakage current (@ 16 V, 25 °C) | $I_{leak,max}$ | = 5 µA |
| Maximum surge current (8/20 µs) | $I_{surge,max}$ | = 1 x 400 A |
| Load dump | $W_{LD}$ | = 10 x 3 J |
| Jump-start | $V_{jump}$ | = 24.5 V, 5 min. |
| Capacitance (@ 1 kHz, 1 V, 25 °C; typical) | $C_{typ}$ | = 2.8 nF |
| Response time | $t_{resp}$ | = < 0.5 ns |
| Operating temperature | $T_{op}$ | = –55 ... +150 °C |
| Storage temperature (mounted parts) | $T_{stg}$ | = –55 ... +150 °C |

### Temperature derating

The specified ratings for $I_{max}$, $I_{surge,max}$ and $P_{diss,max}$ are valid up to 150 °C.
For operation above 150 °C, we recommend the derating below.



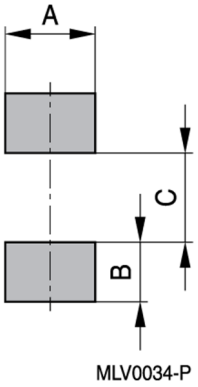

### Dimensional drawing




Dimensions in mm

| Case size | l | w | h | k |
|---|---|---|---|---|
| 1210 | 3.2 ±0.3 | 2.5 ±0.25 | 1.7 max. | 0.25 … 0.75 |

### Recommended solder pad layout



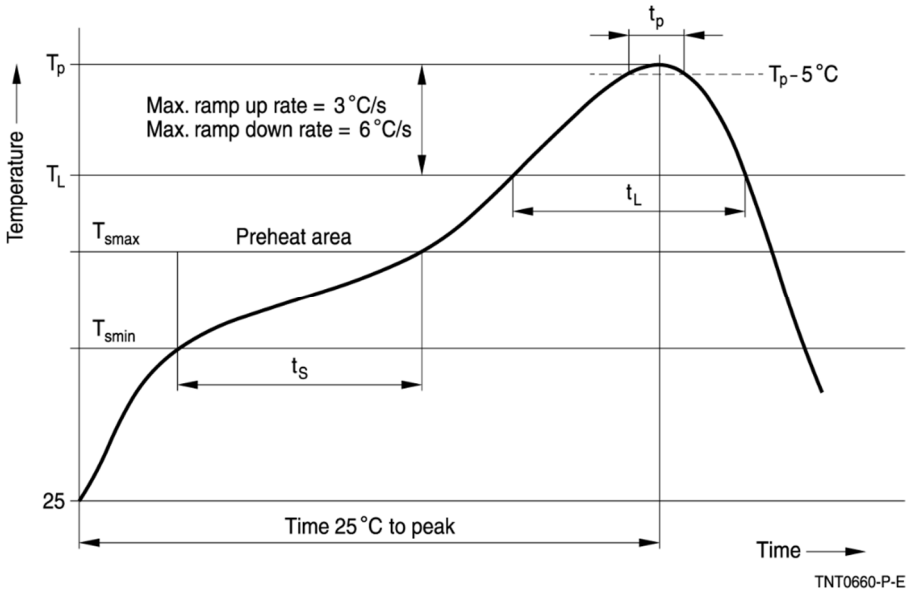

Dimensions in mm

| Case size | A | B | C |
|---|---|---|---|
| 1210 | 2.8 | 1.2 | 2.1 |

## 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<br>- Temperature min<br>- Temperature max<br>- Time | <br>$T_{smin}$<br>$T_{smax}$<br>$t_s$ | <br>+100 °C<br>+150 °C<br>60 … 120 s | <br>+150 °C<br>+200 °C<br>60 … 120 s |
| Average ramp-up rate | $T_{smax}$ to $T_p$ | +3 °C/s max. | +3 °C/s max. |
| Liquidous temperature<br>Time at liquidous | $T_L$<br>$t_L$ | +183 °C<br>40 … 150 s | +217 °C<br>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 |

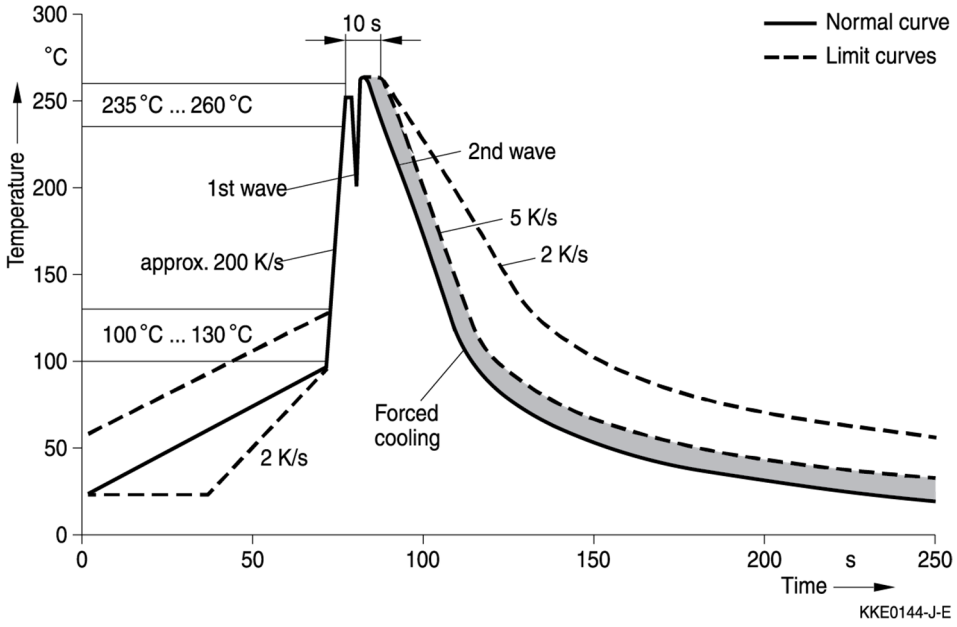
[1)] Depending on package thickness

**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

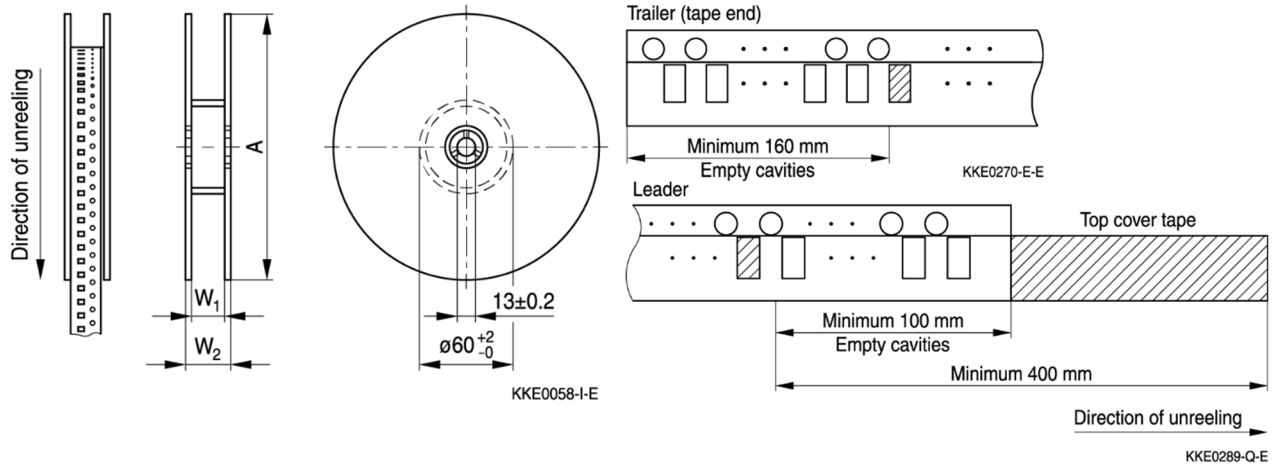
- In order to maintain solderability, the components must be stored in a non-corrosive atmosphere. Humidity, temperature, and container materials are critical factors.
- Do not store the components where they are exposed to heat or direct sunlight. Otherwise, the packing material may be deformed, or 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: Blister
- 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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## Important notes

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