



## **SIOV metal oxide varistors**

Housed (ThermoFuse) varistors, AdvanceD series

**Series/Type:**            **ETFV14**  
**Date:**                     December 2007

## Housed varistors

### ThermoFuse varistors, ETFV14 series

#### Construction

- Round varistor element, leaded
- Coating: epoxy resin, flame-retardant to UL 94 V-0
- Terminals: tinned copper wire, metal compound wire
- Housing: thermoplastic, flame-retardant to UL 94 V-0

#### Features

- Wide operating voltage range 130 ... 420 V<sub>RMS</sub>
- Self-protected under abnormal overvoltage conditions
- High-energy Advanced series E2

#### Approvals

- UL

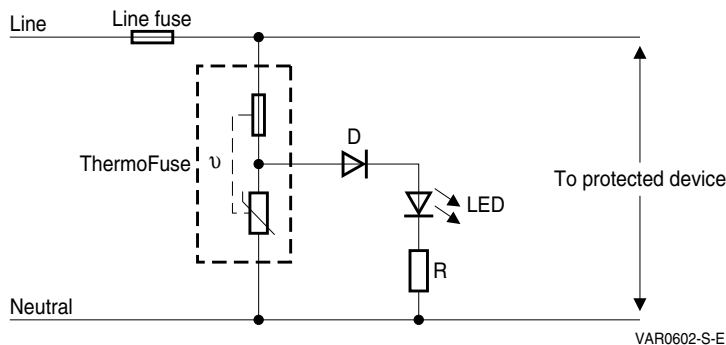
#### Applications

- Air conditioner, refrigerator, TV, etc.
- Power meter, inverter, telecom equipment, etc.
- Transient voltage surge suppressors (TVSS)

#### Delivery mode

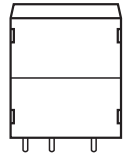
- Bulk (standard)

#### Typical applications



#### General technical data

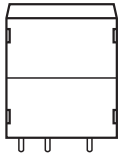
|                       |                |              |                   |
|-----------------------|----------------|--------------|-------------------|
| Climatic category     | to IEC 60068-1 | 40/85/56     |                   |
| Operating temperature | to CECC 42 000 | -40 ... + 85 | °C                |
| Storage temperature   |                | -40 ... +125 | °C                |
| Electric strength     | to CECC 42 000 | ≥2.5         | kV <sub>RMS</sub> |
| Response time         |                | <25          | ns                |


**Maximum ratings** ( $T_A = 85\text{ °C}$ )

| Ordering code   | Type<br>(untaped)<br>SIOV- | $V_{RMS}$<br>V | $V_{DC}$<br>V | $i_{max}$<br>(8/20 $\mu$ s)<br>A | $W_{max}$<br>(2 ms)<br>J | $P_{max}$<br>W |
|-----------------|----------------------------|----------------|---------------|----------------------------------|--------------------------|----------------|
| B72214T2131K101 | ETFV14K130E2               | 130            | 170           | 6000                             | 50                       | 0.6            |
| B72214T2141K101 | ETFV14K140E2               | 140            | 180           | 6000                             | 55                       | 0.6            |
| B72214T2151K101 | ETFV14K150E2               | 150            | 200           | 6000                             | 60                       | 0.6            |
| B72214T2171K101 | ETFV14K175E2               | 175            | 225           | 6000                             | 70                       | 0.6            |
| B72214T2211K101 | ETFV14K210E2               | 210            | 270           | 6000                             | 80                       | 0.6            |
| B72214T2231K101 | ETFV14K230E2               | 230            | 300           | 6000                             | 90                       | 0.6            |
| B72214T2251K101 | ETFV14K250E2               | 250            | 320           | 6000                             | 100                      | 0.6            |
| B72214T2271K101 | ETFV14K275E2               | 275            | 350           | 6000                             | 110                      | 0.6            |
| B72214T2301K101 | ETFV14K300E2               | 300            | 385           | 6000                             | 125                      | 0.6            |
| B72214T2321K101 | ETFV14K320E2               | 320            | 420           | 6000                             | 136                      | 0.6            |
| B72214T2351K101 | ETFV14K350E2               | 350            | 460           | 6000                             | 136                      | 0.6            |
| B72214T2381K101 | ETFV14K385E2               | 385            | 505           | 6000                             | 136                      | 0.6            |
| B72214T2421K101 | ETFV14K420E2               | 420            | 560           | 6000                             | 136                      | 0.6            |

**Characteristics** ( $T_A = 25\text{ °C}$ )

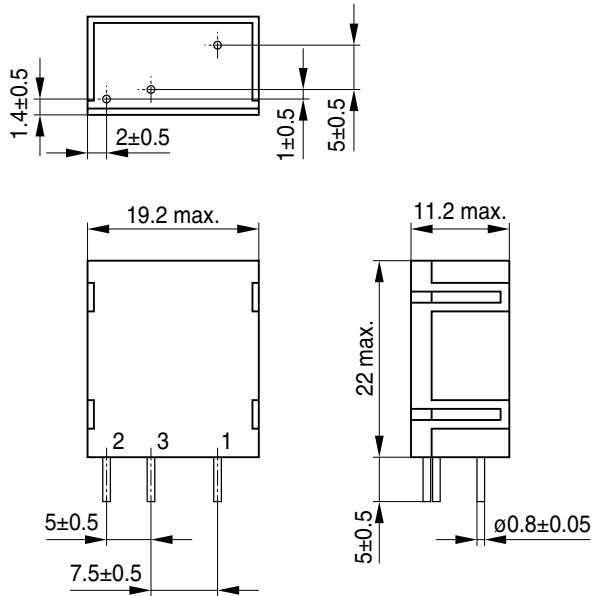
| Ordering code   | Type<br>(untaped)<br>SIOV- | $V_V$<br>(1 mA)<br>V | $\Delta V_V$<br>(1 mA)<br>% | $V_{c, max}$<br>( $i_c$ )<br>V | $i_c$<br>A | $C_{typ}$<br>(1 kHz)<br>pF |
|-----------------|----------------------------|----------------------|-----------------------------|--------------------------------|------------|----------------------------|
| B72214T2131K101 | ETFV14K130E2               | 205                  | $\pm 10$                    | 340                            | 50         | 650                        |
| B72214T2141K101 | ETFV14K140E2               | 220                  | $\pm 10$                    | 360                            | 50         | 610                        |
| B72214T2151K101 | ETFV14K150E2               | 240                  | $\pm 10$                    | 395                            | 50         | 570                        |
| B72214T2171K101 | ETFV14K175E2               | 270                  | $\pm 10$                    | 455                            | 50         | 490                        |
| B72214T2211K101 | ETFV14K210E2               | 330                  | $\pm 10$                    | 545                            | 50         | 410                        |
| B72214T2231K101 | ETFV14K230E2               | 360                  | $\pm 10$                    | 595                            | 50         | 380                        |
| B72214T2251K101 | ETFV14K250E2               | 390                  | $\pm 10$                    | 650                            | 50         | 350                        |
| B72214T2271K101 | ETFV14K275E2               | 430                  | $\pm 10$                    | 710                            | 50         | 320                        |
| B72214T2301K101 | ETFV14K300E2               | 470                  | $\pm 10$                    | 775                            | 50         | 300                        |
| B72214T2321K101 | ETFV14K320E2               | 510                  | $\pm 10$                    | 840                            | 50         | 280                        |
| B72214T2351K101 | ETFV14K350E2               | 560                  | $\pm 10$                    | 910                            | 50         | 260                        |
| B72214T2381K101 | ETFV14K385E2               | 620                  | $\pm 10$                    | 1025                           | 50         | 240                        |
| B72214T2421K101 | ETFV14K420E2               | 680                  | $\pm 10$                    | 1120                           | 50         | 220                        |



## Housed varistors

### ThermoFuse varistors, ETFV14 series

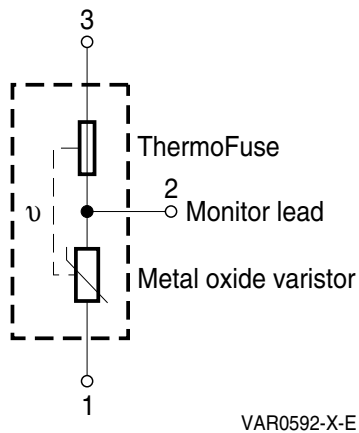
#### Dimensional drawing

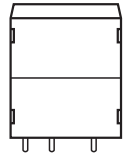


#### Weight

| Nominal diameter<br>mm | $V_{RMS}$<br>V | Weight<br>g |
|------------------------|----------------|-------------|
| 14                     | 130 ... 420    | 4.3 ... 5.3 |

#### Lead configuration



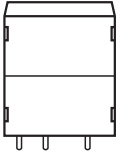


**Housed varistors**

**ThermoFuse varistors, ETFV14 series**

**Reliability data**

| Test                            | Test methods/conditions   | Requirement   |
|---------------------------------|---|---|
| Varistor voltage                | The voltage between two terminals with the specified measuring current applied is called $V_V$ (1 mA <sub>DC</sub> @ 0.2 ... 2 s).  | To meet the specified value.  |
| Clamping voltage                | The maximum voltage between two terminals with the specified standard impulse current (8/20 μs) applied.  | To meet the specified value.  |
| Surge current derating, 8/20 μs | CECC 42 000, test C 2.1<br>100 surge currents (8/20 μs), unipolar, interval 30 s, amplitude corresponding to derating curve for 100 impulses at 20 μs   | $ \Delta V/V (1 \text{ mA})  \leq 10\%$<br>(measured in direction of surge current)<br>No visible damage  |
| Surge current derating, 2 ms    | CECC 42 000, test C 2.1<br>100 surge currents (2 ms), unipolar, interval 120 s, amplitude corresponding to derating curve for 100 impulses at 2 ms  | $ \Delta V/V (1 \text{ mA})  \leq 10\%$<br>(measured in direction of surge current)<br>No visible damage  |
| Abnormal overvoltage test       | UL1449, limited current abnormal overvoltage test. Apply a high AC voltage to ThermoFuse varistor, the amplitude of overvoltage and current limit will be adopted from UL1449 general instruction in section 37. The specimen will be tested on a softwood surface covered with a double layer of white tissue paper. The specimen is to be loosely draped with a double layer of cheesecloth. The cheesecloth shall cover openings where flame, molten or other particles may be expelled as a result of the test. The test result will be visually inspected. | Any of these phenomena shall not be observed, or this specimen will be judged as failed part. <ul style="list-style-type: none"> <li>1. Emission of flame, molten metal, glowing or flaming particles through any openings (pre-existed or created as a result of the test) in the product.</li> <li>2. Charring, glowing, or flaming of the supporting surface, tissue paper, or cheesecloth.</li> <li>3. Ignition of the enclosure.</li> <li>4. Creation of any openings in the enclosure that result in accessibility of live parts, when judged in accordance with accessibility of live parts, UL1449 section 13.</li> </ul> |



## Housed varistors

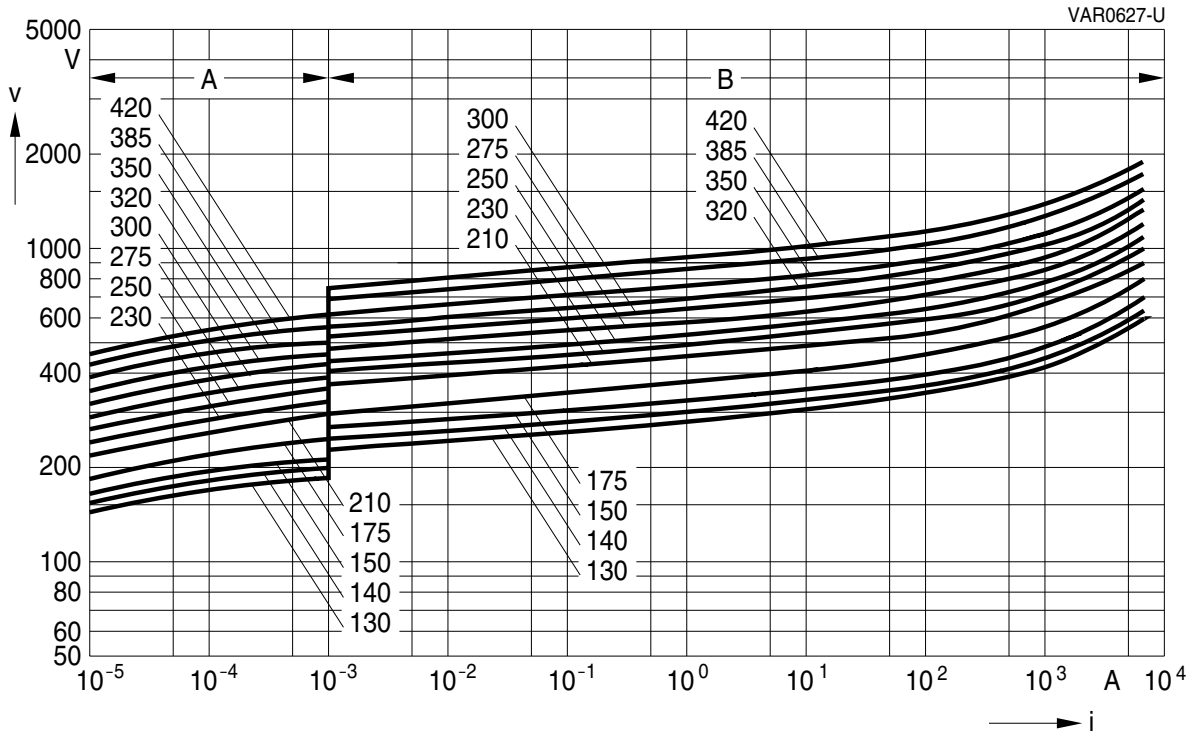
### ThermoFuse varistors, ETFV14 series

#### v/i characteristics

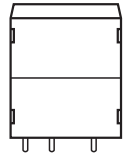
$v = f(i)$  – for explanation of the characteristics refer to “General technical information”, 1.6.3

A = Leakage current  
B = Protection level

for worst-case varistor tolerances



SIOV-ETFV14 ... E2



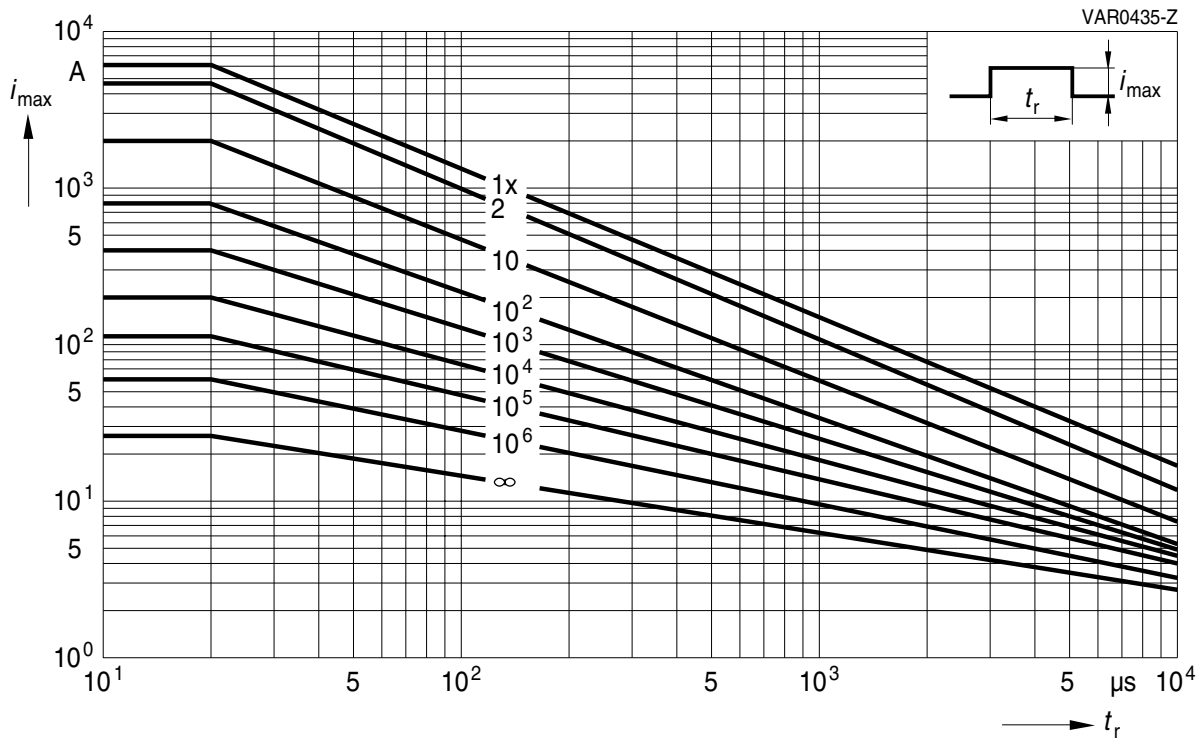
**Housed varistors**

**ThermoFuse varistors, ETFV14 series**

**Derating curves**

Maximum surge current  $i_{max} = f(t_r, \text{pulse train})$

For explanation of the derating curves refer to “General technical information”, section 1.8.1



**SIOV-ETFV14 ... E2**

## Cautions and warnings

### General

1. EPCOS metal oxide varistors (SIOVs) are designed for specific applications and should not be used for purposes not identified in our specifications, application notes and data books unless otherwise agreed with EPCOS during the design-in-phase.
2. Ensure suitability of SIOVs through reliability testing during the design-in phase. SIOVs should be evaluated taking into consideration worst-case conditions.
3. For applications of SIOVs in line-to-ground circuits based on various international and local standards there are restrictions existing or additional safety measures required.

### Storage

1. Store SIOVs only in original packaging. Do not open the package before storage.
2. Storage conditions in original packaging:  
Storage temperature:  $-25\text{ °C} \dots +45\text{ °C}$   
Relative humidity:  $<75\%$  annual average,  
 $<95\%$  on maximum 30 days a year.  
Dew precipitation: Is to be avoided.
3. Avoid contamination of an SIOV's surface during storage, handling and processing.
4. Avoid storage of SIOVs in harmful environments that can affect the function during long-term operation (examples given under operation precautions).
5. The SIOV type series should be soldered within the time specified:  
SIOV-S, -Q, -LS      24 months  
ETFV and SFS types   12 months.

### Handling

1. SIOVs must not be dropped.
2. Components must not be touched with bare hands. Gloves are recommended.
3. Avoid contamination of the surface of SIOV electrodes during handling, be careful of the sharp edge of SIOV electrodes.

### Soldering (where applicable)

1. Use rosin-type flux or non-activated flux.
2. Insufficient preheating may cause ceramic cracks.
3. Rapid cooling by dipping in solvent is not recommended.
4. Complete removal of flux is recommended.



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#### Mounting

1. Potting, sealing or adhesive compounds can produce chemical reactions in the SIOV ceramic that will degrade the component's electrical characteristics.
2. Overloading SIOVs may result in ruptured packages and expulsion of hot materials. For this reason SIOVs should be physically shielded from adjacent components.

#### Operation

1. Use SIOVs only within the specified temperature operating range.
2. Use SIOVs only within the specified voltage and current ranges.
3. Environmental conditions must not harm SIOVs. Use SIOVs only in normal atmospheric conditions. Avoid use in the presence of deoxidizing gases (chlorine gas, hydrogen sulfide gas, ammonia gas, sulfuric acid gas, etc), corrosive agents, humid or salty conditions. Avoid contact with any liquids and solvents.

## 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, EPCOS is 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 an EPCOS product with the properties described in the product specification is suitable for use in a particular customer application.
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