



## **SIOV metal oxide varistors**

Housed (ThermoFuse) varistors, AdvancedD series

**Series/Type:**        **ETFV20**  
**Date:**                February 2010

**ThermoFuse varistors, ETFV20 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

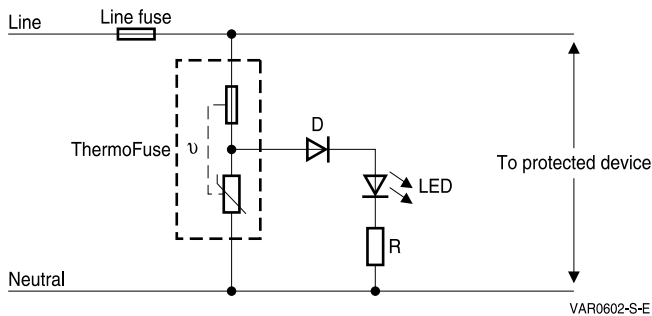
**Applications**

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

**Delivery mode**

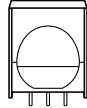
- Bulk (standard)

**Typical applications**



**General technical data**

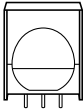
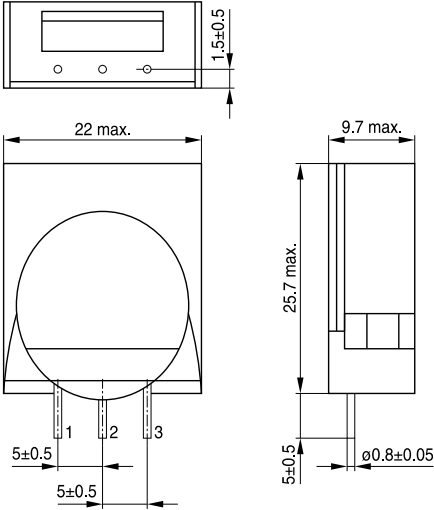
Climatic category	to IEC 60068-1	40/85/56	
Operating temperature	to CECC 42 000	-40 ... + 85	°C
Storage temperature		-40 ... +125	°C
Electric strength	to CECC 42 000	≥ 2.5	kV <sub>RMS</sub>
Response time		< 25	ns


**Electrical specifications and ordering codes**
**Maximum ratings ( $T_A = 85\text{ °C}$ )**

Ordering code	Type (untaped) SIOV-	$V_{RMS}$ V	$V_{DC}$ V	$i_{max}$ (8/20 $\mu$ s) A	$W_{max}$ (2 ms) J	$P_{max}$ W
B72220T2131K101	ETFV20K130E2	130	170	10000	100	1.0
B72220T2141K101	ETFV20K140E2	140	180	10000	110	1.0
B72220T2151K101	ETFV20K150E2	150	200	10000	120	1.0
B72220T2171K101	ETFV20K175E2	175	225	10000	135	1.0
B72220T2211K101	ETFV20K210E2	210	270	10000	160	1.0
B72220T2231K101	ETFV20K230E2	230	300	10000	180	1.0
B72220T2251K101	ETFV20K250E2	250	320	10000	195	1.0
B72220T2271K101	ETFV20K275E2	275	350	10000	215	1.0
B72220T2301K101	ETFV20K300E2	300	385	10000	250	1.0
B72220T2321K101	ETFV20K320E2	320	420	10000	273	1.0
B72220T2351K101	ETFV20K350E2	350	460	10000	273	1.0
B72220T2381K101	ETFV20K385E2	385	505	10000	273	1.0
B72220T2421K101	ETFV20K420E2	420	560	10000	273	1.0

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

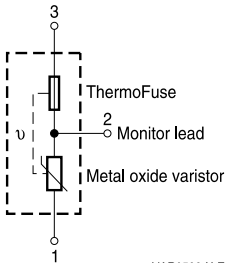
Ordering code	Type (untaped) SIOV-	$V_v$ (1 mA) V	$\Delta V_v$ (1 mA) %	$V_{c,max}$ ( $i_c$ ) V	$i_c$ A	$C_{typ}$ (1 kHz) pF
B72220T2131K101	ETFV20K130E2	205	$\pm 10$	340	100	1340
B72220T2141K101	ETFV20K140E2	220	$\pm 10$	360	100	1240
B72220T2151K101	ETFV20K150E2	240	$\pm 10$	395	100	1160
B72220T2171K101	ETFV20K175E2	270	$\pm 10$	455	100	1000
B72220T2211K101	ETFV20K210E2	330	$\pm 10$	545	100	835
B72220T2231K101	ETFV20K230E2	360	$\pm 10$	595	100	760
B72220T2251K101	ETFV20K250E2	390	$\pm 10$	650	100	700
B72220T2271K101	ETFV20K275E2	430	$\pm 10$	710	100	630
B72220T2301K101	ETFV20K300E2	470	$\pm 10$	775	100	580
B72220T2321K101	ETFV20K320E2	510	$\pm 10$	840	100	540
B72220T2351K101	ETFV20K350E2	560	$\pm 10$	910	100	500
B72220T2381K101	ETFV20K385E2	620	$\pm 10$	1025	100	450
B72220T2421K101	ETFV20K420E2	680	$\pm 10$	1120	100	420


**Dimensional drawings**


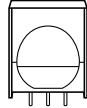
VAR0588-M-E

**Weight**

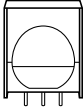
Nominal diameter mm	V <sub>RMS</sub> V	Weight g
20	130 ... 420	6.7 ... 8.3

**Lead configuration**


VAR0592-X-E

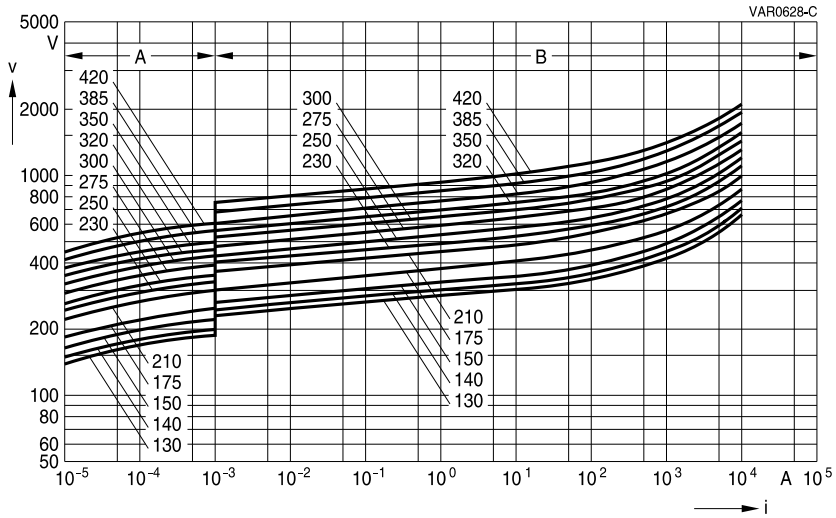

**Reliability data**

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 $\mu$ s) applied.	To meet the specified value
Surge current derating, 8/20 $\mu$ s	CECC 42 000, test C 2.1 100 surge currents (8/20 $\mu$ s), unipolar, interval 30 s, amplitude corresponding to derating curve for 100 impulses at 20 $\mu$ s	$ \Delta V/V (1 \text{ mA})  \leq 10\%$ (measured in direction of surge current) No visible damage
Surge current derating, 2 ms	CECC 42 000, test C 2.1 100 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\%$ (measured in direction of surge current) 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. <ol 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> </ol>

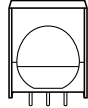


**v/i characteristics**

$v = f(i)$  for explanation of the characteristics refer to "General technical information", chapter 1.6.3  
 A = Leakage current, B = Protection level } for worst-case varistor tolerances



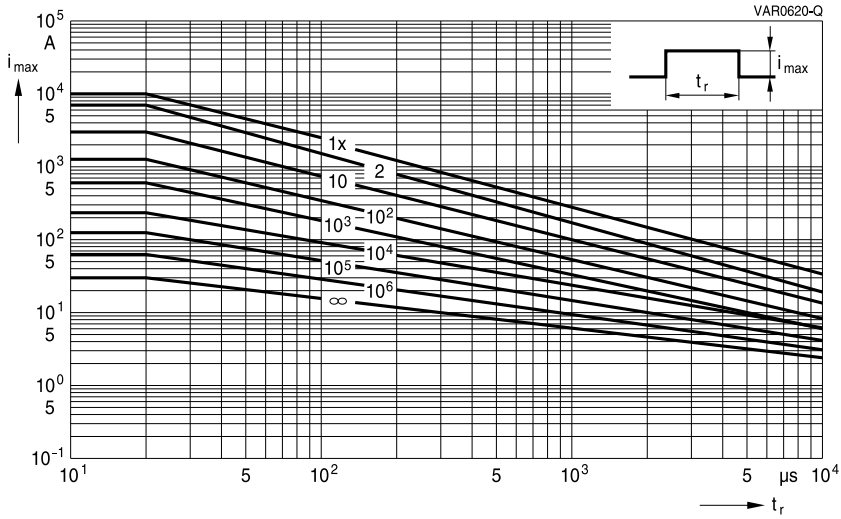
**SIOV-ETFV20 ... E2**



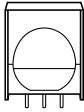
**Derating curves**

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-ETFBV20 ... E2



## Cautions and warnings

### General

1. EPCOS metal oxide varistors 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:  $-25\text{ }^{\circ}\text{C} \dots +45\text{ }^{\circ}\text{C}$ ,  
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.

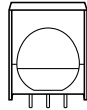
### Handling

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.





### 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.
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 lifesaving 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.
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