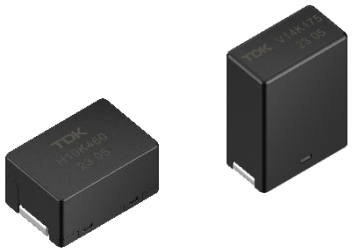
SIOV Metal Oxide Varistors

SMD high surge series

Series/Type:	**V14K*, H14K***
Ordering code:	**B72214M*K00***
Date:	2024-06-19
Version:	3

Features

- Suitable for surface mount device assembly
- AEC-Q200-Rev E qualified
- Optional for vertical version or horizontal version



Applications

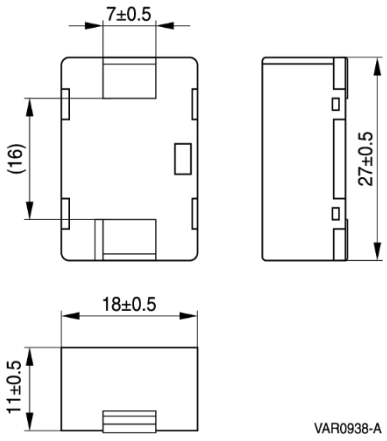
Overvoltage protection, especially on-board chargers

SIOV nomenclature

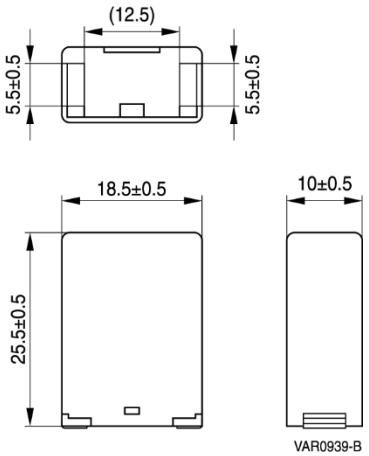
V(H)	Vertical version or horizontal version
14	Rated disk dimension
K	Tolerance of V_V at 1 mA: ±10%
175 – 460	Max. AC operating voltage
*	Optional, typical design of customer

Dimensional drawings in mm

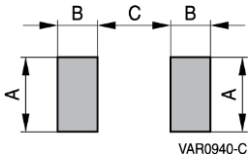
Horizontal version



Vertical version



Recommended solder pad layout in mm



Type	A	B	C
V14K*	8.5	5.3	9.9
H14K*	10.0	7.5	14.0

Electrical specifications and ordering codes

Maximum ratings (T_A = 125 °C)

Type	Ordering code	V_{RMS} V	V_{DC} V
V14K175	B72214M0171K000	175	225
H14K175	B72214M0171K001	175	225
V14K210	B72214M0211K000	210	270
H14K210	B72214M0211K001	210	270
V14K230	B72214M0231K000	230	300
H14K230	B72214M0231K001	230	300
V14K250	B72214M0251K000	250	320
H14K250	B72214M0251K001	250	320
V14K275	B72214M0271K000	275	350
H14K275	B72214M0271K001	275	350
V14K300	B72214M0301K000	300	385
H14K300	B72214M0301K001	300	385
V14K320	B72214M0321K000	320	420
H14K320	B72214M0321K001	320	420
V14K350	B72214M0351K000	350	460
H14K350	B72214M0351K001	350	460
V14K385	B72214M0381K000	385	505
H14K385	B72214M0381K001	385	505
V14K420	B72214M0421K000	420	560
H14K420	B72214M0421K001	420	560
V14K460	B72214M0461K000	460	615
H14K460	B72214M0461K001	460	615

Characteristics (T_A = 25 °C)

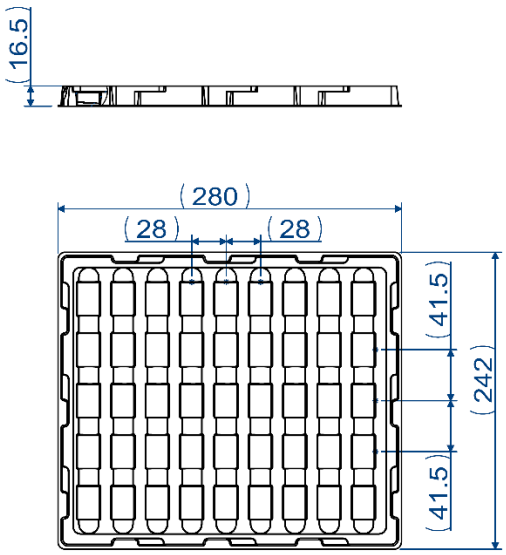
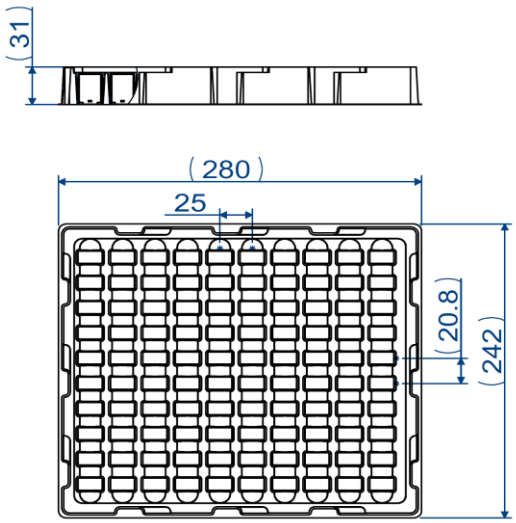
Type	I_{max} (8/20 µs) 1 time A	I_n [1)] (8/20 µs) 15 times A	W_{max} (2 ms) J	P_{max} W	V_v (1 mA) V ±10%	$v_{c,max}$ (i_c=35A) V	C_{typ} (1 kHz) pF
V14K175	10000	5000	100.0	0.80	270	455	1150
H14K175	10000	5000	100.0	0.80	270	455	1150
V14K210	10000	5000	115.0	0.80	330	545	870
H14K210	10000	5000	115.0	0.80	330	545	870
V14K230	10000	5000	130.0	0.80	360	595	820
H14K230	10000	5000	130.0	0.80	360	595	820
V14K250	10000	5000	140.0	0.80	390	650	760
H14K250	10000	5000	140.0	0.80	390	650	760
V14K275	10000	5000	150.0	0.80	430	710	700
H14K275	10000	5000	150.0	0.80	430	710	700
V14K300	10000	5000	175.0	0.80	470	775	650
H14K300	10000	5000	175.0	0.80	470	775	650
V14K320	10000	5000	185.0	0.80	510	840	600
H14K320	10000	5000	185.0	0.80	510	840	600
V14K350	10000	5000	200.0	0.80	560	910	550
H14K350	10000	5000	200.0	0.80	560	910	550
V14K385	10000	5000	225.0	0.80	620	1025	500
H14K385	10000	5000	225.0	0.80	620	1025	500
V14K420	10000	5000	245.0	0.80	680	1120	460
H14K420	10000	5000	245.0	0.80	680	1120	460
V14K460	10000	5000	270.0	0.80	750	1240	440
H14K460	10000	5000	270.0	0.80	750	1240	440

1) Note: Nominal discharge current I_n according to UL 1449, 4th edition.

General technical data

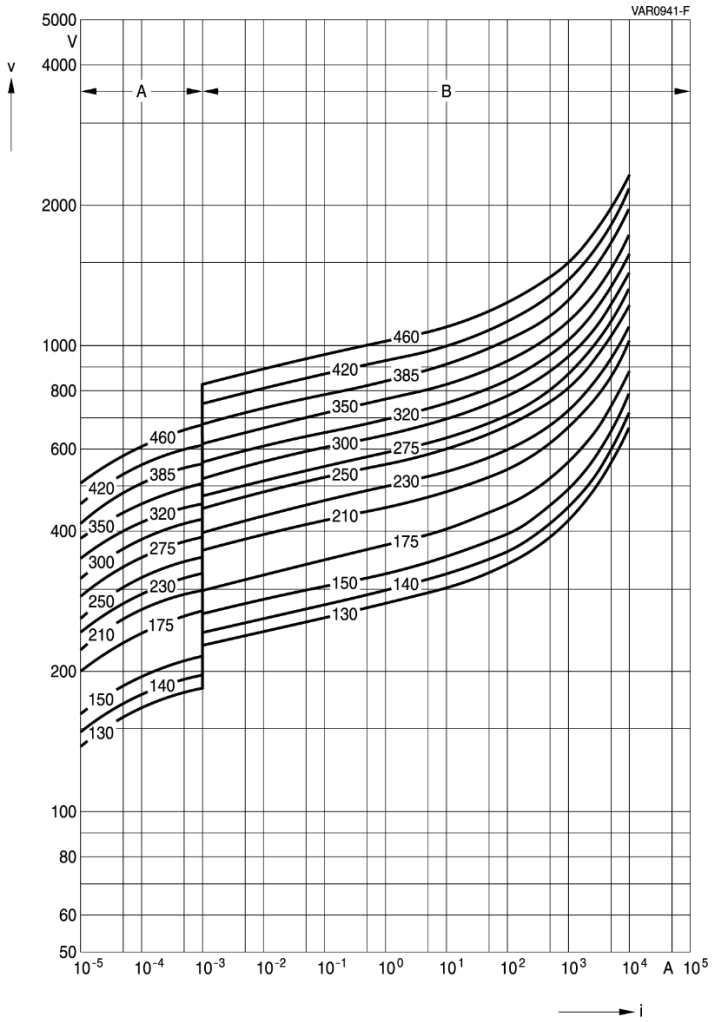
Climatic category	to IEC 60068-1	40/125/56
Operating temperature	to IEC 61051	-40 … +125 °C
Storage temperature		-40 … +150 °C
Electric strength	to IEC 61051	≥ 2.5 kV_{RMS}
Insulation resistance	to IEC 61051	≥ 100 MΩ

Packaging

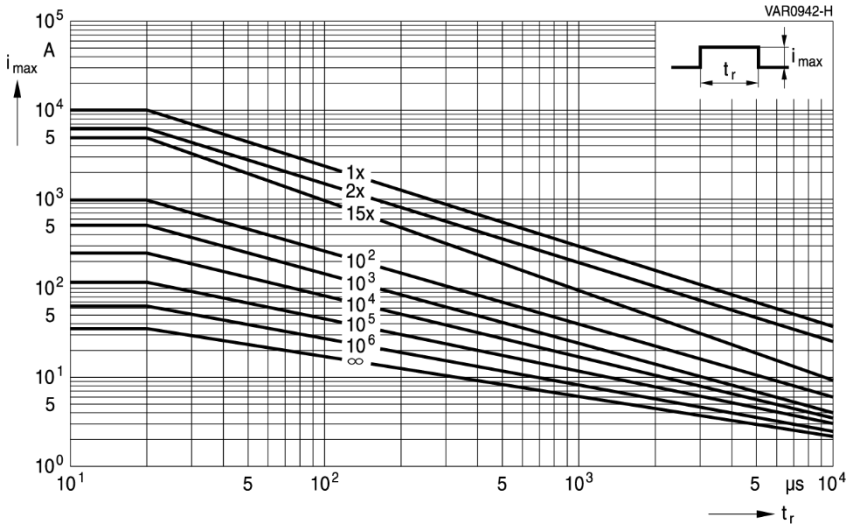
Horizontal version	Vertical version
▪ Standard packaging is in trays ▪ Quantity per tray: 45 pcs ▪ Quantity per box: 135 pcs	▪ Standard packaging is in trays ▪ Quantity per tray: 100 pcs ▪ Quantity per box: 200 pcs
	

() means reference dimensions
Unit: mm

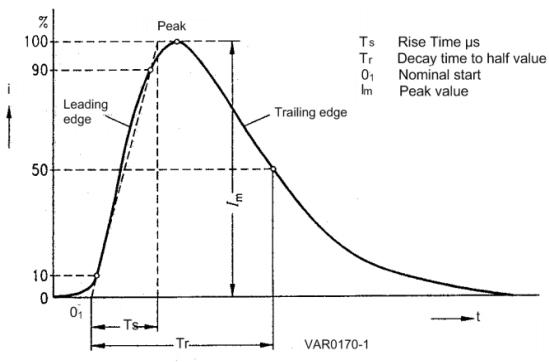
V/I characteristics



Derating curves



Electrical reliability data

Characteristics	Test methods/description	Specifications
Varistor voltage	The voltage between two terminals with the specified measuring current applied is called V_V (1 mA_{DC} @ 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) illustrated below applied. 	To meet the specified value
Surge current derating, 8/20 µs	10 surge currents (8/20 µs), unipolar, interval 30 s, amplitude corresponding to derating curve for 10 impulses at 20 µs	$\lvert\Delta V / V\ (1\ mA)\rvert \leq 10\%$ (measured in direction of surge current) No visible damage
Surge current derating, 2 ms	10 surge currents (2 ms), unipolar, interval 120 s, amplitude corresponding to derating curve for 10 impulses at 2 ms	$\lvert\Delta V / V\ (1\ mA)\rvert \leq 10\%$ (measured in direction of surge current) No visible damage

Mechanical reliability data

Characteristics	Test methods/description	Specifications
Vibration	AEC-Q200-Rev E MIL-STD-202 method 204 5 *g* for 20 min., 12 cycles each of 3 orientations Test from 10 to 2000 Hz	$\lvert\Delta V / V\ (1\ mA)\rvert \leq 5\%$ No visible damage
Mechanical shock	AEC-Q200-Rev E MIL-STD-202 Method 213 Figure 1 of Method 213 Condition C	$\lvert\Delta V / V\ (1\ mA)\rvert \leq 5\%$ No visible damage
Solderability	IEC 60068-2-58, test Td1, method 1 Solder bath, Sn96.5Ag3Cu0.5 T = 245 ±3 °C t = 2 s	The terminations shall be uniformly tinned for soldering test.
Resistance to soldering heat	IEC60068-2-58, test Td2, method 1 Solder bath, Sn96.5Ag3Cu0.5 T = 260 ±5 °C D = 10 ±1 s	$\lvert\Delta V / V\ (1\ mA)\rvert \leq 5\%$ No visible damage
Board flex	AEC-Q200-Rev E 005 60 seconds minimum holding time	$\lvert\Delta V / V\ (1\ mA)\rvert \leq 5\%$ No visible damage
Electric strength	IEC 61051-1, test 4.9.2 Metal balls method, 2500 VRMS, 60 s The varistor is placed in a container holding 1.6 ±0.2 mm diameter metal balls such that only the terminations of the varistor are protruding. The specified voltage shall be applied between both terminals of the specimen connected together and the electrode inserted between the metal balls.	No breakdown

Environmental reliability data

Characteristics	Test methods/description	Specifications
Max. DC operating voltage	MIL-STD-202F, method 108A, UCT, V_{DC}, 1000 h	$\|\Delta V / V$ (1 mA)$\| \leq 10\%$ No visible damage
Damp heat, steady state	IEC 60068-2-67, test Cy, 85 °C, 85% RH, 0.85 * V_v (1 mA), 1000 h	$\|\Delta V / V$ (1 mA)$\| \leq 10\%$ No visible damage
Climatic sequence	The specimen shall be subjected to: a) IEC 60068-2-2, test Ba, dry heat at UCT, 16 h b) IEC 60068-2-30, test Db, damp heat, 1st cycle: 55 °C, 93% RH, 24 h c) IEC 60068-2-1, test Aa, cold, LCT, 2 h d) IEC 60068-2-30, test Db, damp heat, additional 5 cycles: 55 °C/25 °C, 93% RH, 24 h/cycle Then the specimen shall be stored at room temperature and normal humidity for 1 to 2 h. Thereafter, the change of V_v shall be measured. Thereafter, insulation resistance R_{ins} shall be measured at V = 500 V.	$\|\Delta V / V$ (1 mA)$\| \leq 10\%$ $R_{ins} \geq 100$ MΩ
Rapid change of temperature	IEC 60068-2-14, test Na, LCT/UCT, dwell time 10 min., 1000 cycles	$\|\Delta V / V$ (1 mA)$\| \leq 5\%$ No visible damage

Note:

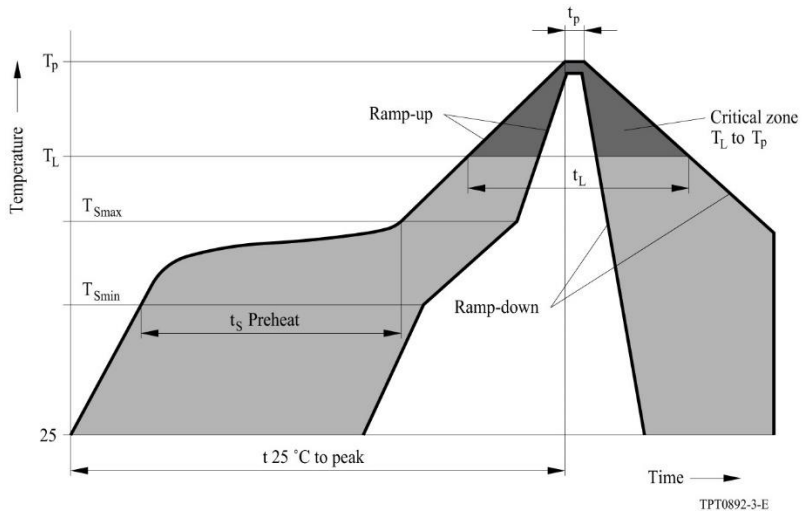
UCT = Upper category temperature

LCT = Lower category temperature

R_{ins} = Insulation resistance

Recommended soldering temperature profiles

Reflow soldering temperature profile



Profile feature	Sn-Pb eutectic assembly	Pb-free assembly
Average ramp-up rate (T_{smax} to T_P)	3 K/s max	3 K/s max
Preheat ▪ Minimum temperature (T_{smin}) ▪ Maximum temperature (T_{smax}) ▪ Time (t_{smin} to t_{smax})	100 °C 150 °C 60 … 120 s	150 °C 200 °C 60…180 s
Time maintained above ▪ Minimum temperature (T_L) ▪ Time (t_L)	183 °C 60 … 150 s	217 °C 60 … 150 s
Peak classification temperature (T_P)	220 °C … 240 °C	240 °C … 260 °C
Time within 5 °C of actual peak temperature (t_p)	10 … 30 s	20 … 40 s
Ramp-down rate	6 K/s max	6 K/s max
Time 25 °C to peak temperature	6 min. max	8 min. max

Note: All temperatures refer to the topside of the package, measured on the package body surface.
Maximum number of reflow cycles: 3

Soldering guidelines

The usage of mild, non-activated fluxes for soldering is recommended, as well as proper cleaning of the PCB.

Cautions and warnings

General

1. TDK Electronics' 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 TDK Electronics during the design-in phase.
2. Ensure suitability of SIOVs through reliability testing during the design-in phase. The 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 restrictions exist or additional safety measures are required.

Storage

1. Store SIOVs only in original packaging. Do not open the package prior to processing.
2. Recommended storage conditions in original packaging:
   - Storage temperature: -25 °C … +45 °C
   - Relative humidity: < 75% annual average, < 95% on maximum 30 days a year
   - Dew precipitation is to be avoided.
3. Avoid contamination of the SIOVs 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 after shipment from TDK Electronics within the time specified:
   - SIOV-S, -Q, -LS, -B, -SNF: 24 months
   - ETFV / T series, -CU: 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 the SIOV's 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.
5. Temperatures of all preheat stages and the solder bath must be strictly controlled especially for T series (T14 and T20).

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, the 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 the 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.

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