



Siemens Matsushita Components

# SIOV

# Metal Oxide

# Varistors

Varistors for Automotive Applications

# Disk Varistors, S

## Construction

- Round varistor element
- Coating: epoxy resin (D1: phenolic resin), flame-retardant to UL 94 V-0
- Terminals: tinned copper wire

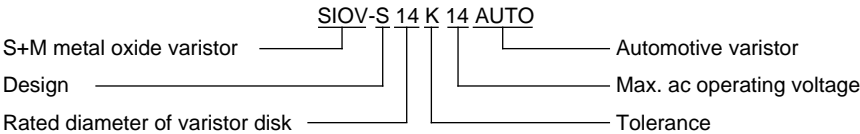
## Features

- High energy absorption, particularly in case of load dump
- Jump-start strength
- Stable protection level, minimum leakage current
- High resistance to cyclic temperature stress
- PSpice models
- Types for  $T_A = 125\text{ °C}$

## Taping

- All types available taped and reeled upon request

## Type designation



## General technical data

Climatic category	40/85/56 (D1: 40/125/56)	as per IEC 68-1
LCT	– 40 °C	
UCT	+ 85 °C (D1: + 125 °C)	
Damp heat, steady state (93 % r.h., 40 °C)	56 days	as per IEC 68-2-3
Operating temperature	– 40 ... + 85 °C (D1: ... + 125 °C)	as per CECC 42 000
Storage temperature	– 40 ... + 125 °C (D1: ... + 150 °C)	
Electric strength	> 2,5 kV (not D1)	as per CECC 42 000
Insulation resistance	> 1,0 GΩ (not D1)	as per CECC 42 000
Response time	< 25 ns	

**Maximum ratings** ( $T_A = 85\text{ °C}$ ,  $T_A = 125\text{ °C}$  für S...D1)

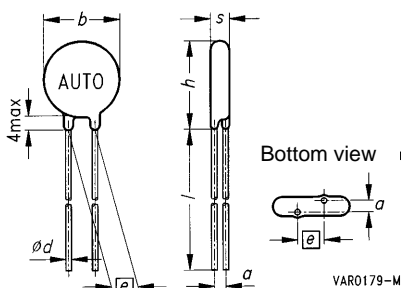
Type (untaped) SIOV-	Ordering code	$V_{RMS}$ V	$V_{DC}$ V	$i_{max}$ 8/20 $\mu$ s A	$W_{max}$ (2 ms) J	$P_{max}$ W	$W_{LD}$ (10x) J
12-V supply systems							
S07K14AUTOS2D1	Q69X4309	14	16	250	0,9	0,02	12
S10K14AUTO	Q69X3859	14	16	500	2,0	0,05	25
S10K14AUTOS5D1	Q69X4310	14	16	500	2,0	0,05	25
S14K14AUTO	Q69X4482	14	16	1000	4,0	0,10	50
S14K14AUTOS5D1	Q69X4311	14	16	1000	4,0	0,10	50
S20K14AUTO	Q69X3625	14	16	2000	12,0	0,20	100
S10K17AUTO	Q69X4570	17	20	500	2,5	0,05	25
S14K17AUTO	Q69X4325	17	20	1000	5,0	0,10	50
S20K17AUTO	Q69X4569	17	20	2000	14,0	0,20	100
24-V supply systems							
S20K25AUTO	Q69X4885	25	28	2000	22,0	0,20	100
S14K30AUTO	Q69X3889	30	34	1000	9,0	0,10	50
S20K30AUTO	Q69X3803	30	34	2000	26,0	0,20	100

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

Type (untaped) SIOV-	$V_{\text{Jump}}$ (5 min) V	$V_V$ (1 mA) V	$\Delta V_V$ (1 mA) %	Max. clamping		$C_{\text{typ.}}$ (1 kHz) nF	Derating curves Page	V/I cha- racteristic Page
12-V supply system								
S07K14AUTOS2D1	25	22	± 10	43	2,5	2,5	15	20
S10K14AUTO	25	22	± 10	43	5,0	5,2	16	21
S10K14AUTOS5D1	25	22	± 10	43	5,0	5,2	16	21
S14K14AUTO	25	22	± 10	43	10,0	9,0	16	22
S14K14AUTOS5D1	25	22	± 10	43	10,0	9,0	16	22
S20K14AUTO	25	22	± 10	43	20,0	15,0	17	23
S10K17AUTO	30	27	± 10	53	5,0	4,0	16	21
S14K17AUTO	30	27	± 10	53	10,0	7,0	16	22
S20K17AUTO	30	27	± 10	53	20,0	13,0	17	23
24-V supply system								
S20K25AUTO	40	39	± 10	77	20,0	10,0	17	23
S14K30AUTO	50	47	± 10	93	10,0	3,5	16	22
S20K30AUTO	50	47	± 10	93	20,0	9,0	17	23

### Notes

- If the maximum loads specified for load dump and jump start are fully utilized, subsequent polarity reversal of the AUTO varistors is inadmissible.
- If the load remains under the maximum ratings, polarity reversal may be admissible.  
Contact S+M Components for consultancy on this problem.
- Load dump and jump start can decrease the varistor voltage in load direction by max. 15%.
- Load dump: min. time of energy input 30 ms, interval 60 s.
- Further automotive varistors are contained in the new data book (German edition due to appear in November 96, ordering no. B462-P6213) and in the short form catalog (ordering no. B462-P6211-X-X-7400).



## Dimensions

Type	$e \pm 1$ mm	$a \pm 1$ mm	$b_{\text{max}}$ mm	$s_{\text{max}}$ mm	$h_{\text{max}}$ mm	$l_{\text{min}}$ mm	$d$ mm
SIOV-S07K14AUTOS2D1	5,0	1,3	9,0	3,6	13,0	30,0	0,6
SIOV-S10K14AUTO	7,5	1,5	13,5	5,2	17,5	30,0	0,8
SIOV-S10K14AUTOS5D1	7,5	1,5	12,5	4,2	16,0	30,0	0,8
SIOV-S14K14AUTO	7,5	1,5	17,5	5,3	22,0	30,0	0,8
SIOV-S14K14AUTOS5D1	7,5	1,5	16,5	4,2	20,0	30,0	0,8
SIOV-S20K14AUTO	10,0	1,6	24,0	5,6	29,0	30,0	1,0
SIOV-S10K17AUTO	7,5	1,6	13,5	5,3	17,5	30,0	0,8
SIOV-S14K17AUTO	7,5	1,7	17,5	5,4	22,0	30,0	0,8
SIOV-S20K17AUTO	10,0	1,6	24,0	5,8	29,0	30,0	1,0
SIOV-S20K25AUTO	10,0	2,9	24,0	6,2	29,0	30,0	1,0
SIOV-S14K30AUTO	7,5	1,8	17,5	5,8	22,0	30,0	0,8
SIOV-S20K30AUTO	10,0	3,2	24,0	6,5	29,0	30,0	1,0

For crimp styles S2 and S5 see data book or short form catalog.

## Weight

Size	approx.
S07	0,6 ... 0,8 g
S10	1,0 ... 2,0 g
S14	2,0 ... 4,0 g
S20	3,0 ... 6,0 g

## Disk Varistors, S

### Tests

Tests of SIOV disks are made according to IEC 68 and the harmonized system of quality assessment CECC 42 000 .

Max. ac operating voltage	MIL STD 202F, method 108A UCT <sup>1)</sup> , V <sub>DC</sub> , 1000 h	$I \Delta V/V (1 \text{ mA}) I^3 \leq 10 \%$ No visible damage
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 corr. to derating curve for 20 $\mu$ s	$I \Delta V/V (1 \text{ mA}) I \leq 10 \%$ (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 corr. to derating curve for 2 ms	$I \Delta V/V (1 \text{ mA}) I \leq 10 \%$ (measured in direction of surge current) No visible damage
Electric strength	CECC 42 000, test 4.7 Metal-sphere method	$\geq 2,5 \text{ kV}$ (not D1)
Climatic sequence	CECC 42 000, test 4.16 a) dry heat, UCT <sup>1)</sup> , 16 h b) damp heat, cyclic, 1st cycle: 55 °C, 93 % RH, 24 h c) cold, LCT <sup>1)</sup> , 2 h d) damp heat, additional 5 cycles: 55 °C, 93 % RH, 24 h/cycle	$I \Delta V/V (1 \text{ mA}) I \leq 10 \%$ $R_{is}^2 \geq 1 \text{ M}\Omega$ (not D1)
Fast temperature cycling	IEC 68-2-14, test Na UCT/LCT <sup>1)</sup> , dwell time 15 min, 100 cycles: SIOV-S...AUTO 1000 cycles: SIOV-S...AUTOD1	$I \Delta V/V (1 \text{ mA}) I \leq 10 \%$ No visible damage
Damp heat, steady state	Similar to IEC 68-2-3 85 °C, 85 % RH, V <sub>DC</sub> , 1000 h	$I \Delta V/V (1 \text{ mA}) I^3 \leq 10 \%$ No visible damage
Solderability	IEC 68-2-20, test Ta, method 1, 235 °C, 5 s;	Solderable upon delivery and after 6 months of storage
Resistance to soldering heat	IEC 68-2-20, test Tb, method 1A 260 °C, 10 s	$I \Delta V/V (1 \text{ mA}) I \leq 5 \%$

1) UCT = Upper Category Temperature; LCT = Lower Category Temperature

2)  $R_{is}$ : Insulation resistance as per CECC 42 000, test 4.8

3) Measured in load direction

Tensile strength	IEC 68-2-21, test Ua1 Tensile force for wire diameter 0,5 mm                      5 N 0,6 mm                      10 N 0,8 mm                      10 N 1,0 mm                      20 N	$I \Delta V/V (1 \text{ mA}) \leq 5 \%$ No break of solder joint, no wire break
Vibration	IEC 68-2-6, test Fc Frequency range 10 ... 55 Hz Amplitude:    0,75 mm or                      98 m/s <sup>2</sup> Duration:       6 h (3 × 2 h) Pulse:           sine wave	$I \Delta V/V (1 \text{ mA}) \leq 5 \%$ No visible damage
Bump	IEC 68-2-29, test Eb Pulse duration:    6 ms Max. acceleration: 400 m/s <sup>2</sup> No. of bumps:     4000 Pulse:               half sine	$I \Delta V/V (1 \text{ mA}) \leq 5 \%$ No visible damage

# SMD Varistors, CN

## Construction

- Rectangular varistor element in multilayer technology, without encapsulation
- Termination: silver palladium

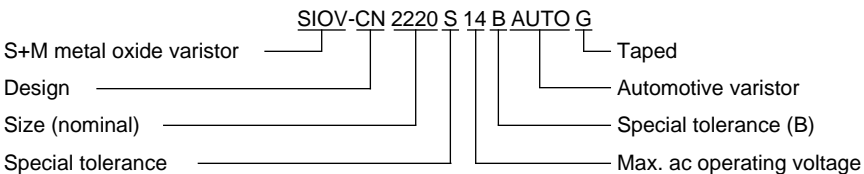
## Features

- High energy absorption, particularly in case of load dump
- Jump-start strength
- Stable protection level, minimum leakage current
- High resistance to cyclic temperature stress
- Wide range of operating temperature
- Low inductance (suitable for ESD protection)
- PSpice models

## Taping

- Supply on 8/12-mm tape  
For tape dimensions see page 11  
For reel dimensions and packing units see page 12

## Type designation



## General technical data

Climatic category	55/125/56	as per IEC 68-1
LCT	– 55 °C	
UCT	+ 125 °C	
Damp heat, steady state (93 % r.h., 40 °C)	56 days	as per IEC 68-2-3
Operating temperature	– 55 ... + 125 °C	as per CECC 42 000
Storage temperature	– 55 ... + 150 °C	
Response time	< 0,5 ns	
Solderability	235 °C, 2 s	as per IEC 68-2-58
Resistance to soldering heat	260 °C, 10 s	as per IEC 68-2-20

Recommended cleaning agents: fluorinated or chlorinated hydrocarbons.



**Maximum ratings** ( $T_A = 125\text{ }^{\circ}\text{C}$ )

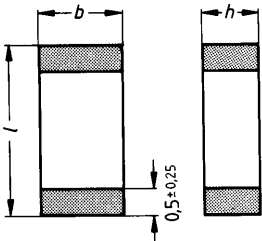
Type	Ordering code	$V_{RMS}$	$V_{DC}$	$i_{max}$ 8/20 $\mu\text{s}$	$W_{max}$ (2 ms)	$P_{max}$	$W_{LD}$ (10x)
SIOV-		V	V	A	J	W	J
12-V supply systems							
CN0805S14BAUTOG	Q69510-V1140-S262	14	16	120	0,3	0,008	1,0
CN1206S14BAUTOG	Q69520-V1140-S262	14	16	200	0,6	0,008	1,5
CN1210S14BAUTOG	Q69530-V1140-S262	14	16	400	1,6	0,010	3,0
CN1812S14BAUTOG	Q69580-V1140-S262	14	16	800	2,4	0,015	6,0
CN2220S14BAUTOG	Q69540-V1140-S262	14	16	1200	5,8	0,030	12,0
CN2220S14BAUTOE2G2	Q69540-V3140-S272	14	16	1200	5,8	0,030	25,0
24-V supply systems							
CN2220K30AUTOG	Q69540-V1300-K062	30	34	1200	12,0	0,030	12,0

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


Type	$V_{Jump}$ (5 min)	$V_v$ (1 mA)	$\Delta V_v$ (1 mA)	Max. clamping		$C_{typ}$ (1 kHz)	$L_{typ}$	Der. curve	V/I char.
SIOV-	V	V	%	v	i	nF	nH	Page	Page
12-V supply systems									
CN0805S14BAUTOG	24,5	22	+23/-0	42	1,0	0,4	1,5	13	19
CN1206S14BAUTOG	24,5	22	+23/-0	40	1,0	0,8	1,8	13	19
CN1210S14BAUTOG	24,5	22	+23/-0	40	2,5	1,7	1,8	14	19
CN1812S14BAUTOG	24,5	22	+23/-0	40	5,0	5,6	2,5	14	19
CN2220S14BAUTOG	24,5	22	+23/-0	40	10,0	9,5	3,0	15	19
CN2220S14BAUTOE2G2	24,5	22	+23/-0	40	10,0	15,0	3,0	15	19
24-V supply systems									
CN2220K30AUTOG	50,0	47	$\pm 10$	77	10,0	4,0	3,0	15	18

**Notes**

- If the maximum loads specified for load dump and jump start are fully utilized, subsequent polarity reversal of the AUTO varistors is inadmissible.
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- Load dump and jump start can decrease the varistor voltage in load direction by max. 15%.
- Load dump: min. time of energy input 30 ms, interval 60 s.
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Weight: < 0,2 g

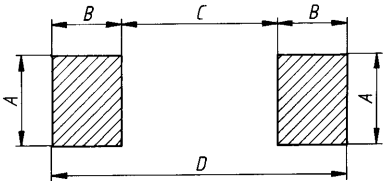
 Termination

VAR0013-T

**Dimensions**

Type	<i>l</i> mm	<i>b</i> mm	<i>h</i> mm
SIOV-CN0603	1,6 ± 0,15	0,80 ± 0,10	1,3 max.
SIOV-CN0805	2,0 ± 0,20	1,25 ± 0,15	1,3 max.
SIOV-CN1206	3,2 ± 0,20	1,60 ± 0,15	1,7 max.
SIOV-CN1210	3,2 ± 0,20	2,50 ± 0,20	1,7 max.
SIOV-CN1812	4,5 ± 0,20	3,20 ± 0,20	2,3 max.
SIOV-CN2220	5,7 ± 0,20	5,00 ± 0,20	1,7 max.

Termination: silver palladium

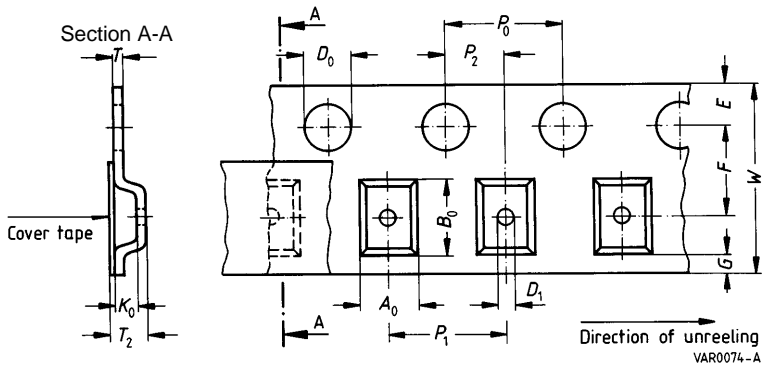


VAR0117-X

**Recommended solder pad layout**

Type	<i>A</i> mm	<i>B</i> mm	<i>C</i> mm	<i>D</i> mm
SIOV-CN0603	1,0	1,0	0,6	3,0
SIOV-CN0805	1,4	1,2	1,0	3,4
SIOV-CN1206	1,8	1,2	2,1	4,5
SIOV-CN1210	2,8	1,2	2,1	4,5
SIOV-CN1812	3,6	1,5	3,0	6,0
SIOV-CN2220	5,5	1,5	4,2	7,2

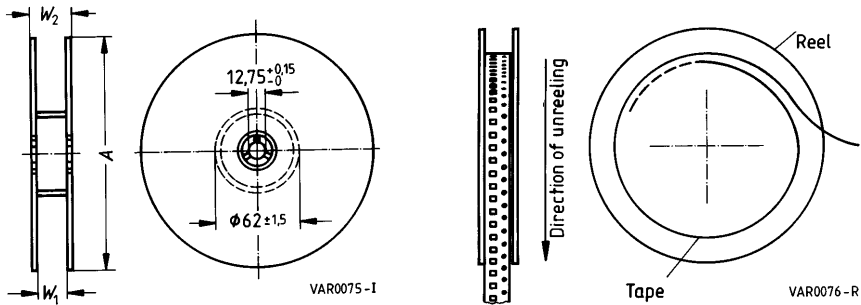
## Blister tape



## Tape dimensions (in mm)

Tape Size	8 mm 0805 1206 1210	12 mm 1812 2220	16 mm 3225 4032	Tolerance
$A_0 \times B_0$	1,60 × 2,40 (0805) 1,90 × 3,50 (1206) 2,80 × 3,50 (1210)	3,5 × 4,8 5,1 × 6,0	7,0 × 8,7 8,6 × 10,6	± 0,20
$K_0$	1,80	1,80	5,00	max.
$T_2$	2,50	3,00	5,50	max.
$T$	0,30	0,30	0,30	max.
$D_0$	1,50	1,50	1,50	+ 0,10/- 0 min.
$D_1$	1,00	1,50	1,50	
$P_0$	4,00	4,00	4,00	± 0,10 <sup>1)</sup>
$P_2$	2,00	2,00	2,00	± 0,05
$P_1$	4,00	8,00	12,00	± 0,10
$W$	8,00	12,00	16,00	± 0,30
$E$	1,75	1,75	1,75	± 0,10
$F$	3,50	5,50	7,50	± 0,05
$G$	0,75	0,75	0,75	min.

1)  $\leq \pm 0,2$  mm over 10 sprocket holes



## Reel dimensions

Size	CN0603 CN0805 CN1206 CN1210 ... G	CN1812 CN2220 ... G	CN ... G2
A (mm)	180 <sub>-2</sub>	180 <sub>-2</sub>	330 <sub>-2</sub>
W <sub>1</sub> (mm)	8,4 <sub>+1,5/-0</sub>	12,4 <sub>+1,5/-0</sub>	8,4 <sub>+1,5/-0</sub> /12,4 <sub>+1,5/-0</sub>
W <sub>2</sub> (mm)	14,4 max.	18,4 max.	14,4 max./18,4 max.

## Packing units

Type	Pieces/reel
CN0603M4-K14G	4000
CN0805M4G-K14G	3000
CN1206M4G-K20G	3000
CN1206K25G-K60G	2000
CN1210M4G-K20G	3000
CN1210K25G-K60G	2000
CN1812M4G-K14G	1500
CN1812K17G-S60AG	1000
CN1812S95AG2	3000
CN2220M4G-K17G	1500
CN2220K20G-K60G	1000