

**TRANSZORB® Transient Voltage Suppressors****Case Style 1.5KE****PRIMARY CHARACTERISTICS**

V_{BR} uni-directional	6.8 V to 540 V
V_{BR} bi-directional	6.8 V to 440 V
P_{PPM}	1500 W
P_D	6.5 W
I_{FSM} (uni-directional only)	200 A
T_J max.	175 °C

DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional types, use C or CA suffix (e.g. 1.5KE440CA).

Electrical characteristics apply in both directions.

FEATURES

- Glass passivated chip junction
- Available in uni-directional and bi-directional
- 1500 W peak pulse power capability with a 10/1000 μ s waveform, repetitive rate (duty cycle): 0.01 %
- Excellent clamping capability
- Very fast response time
- Low incremental surge resistance
- Solder dip 260 °C, 40 s
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



RoHS
COMPLIANT

TYPICAL APPLICATIONS

Use in sensitive electronics protection against voltage transients induced by inductive load switching and lighting on ICs, MOSFET, signal lines of sensor units for consumer, computer, industrial, automotive and telecommunication.

MECHANICAL DATA

Case: Molded epoxy body over passivated junction
Molding compound meets UL 94 V-0 flammability rating

Base P/N-E3 - RoHS compliant, commercial grade
Base P/NHE3 - RoHS compliant, high reliability/automotive grade (AEC Q101 qualified)

Terminals: Matte tin plated leads, solderable per J-STD-002 and JESD22-B102

E3 suffix meets JESD 201 class 1A whisker test, HE3 suffix meets JESD 201 class 2 whisker test

Note:

- 1.5KE250 ~ 1.5KE540A and 1.5KE250C ~ 1.5KE440CA for commercial grade only

Polarity: For uni-directional types the color band denotes cathode end, no marking on bi-directional types

MAXIMUM RATINGS ($T_A = 25$ °C unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Peak pulse power dissipation with a 10/1000 μ s waveform ⁽¹⁾ (Fig. 1)	P_{PPM}	1500	W
Peak pulse current with a 10/1000 μ s waveform ⁽¹⁾	I_{PPM}	See next table	A
Power dissipation on infinite heatsink at $T_L = 75$ °C (Fig. 5)	P_D	6.5	W
Peak forward surge current 8.3 ms single half sine-wave uni-directional only ⁽²⁾	I_{FSM}	200	A
Maximum instantaneous forward voltage at 100 A for uni-directional only ⁽³⁾	V_F	3.5/5.0	V
Operating junction and storage temperature range	T_J, T_{STG}	- 55 to + 175	°C

Notes:

(1) Non-repetitive current pulse, per Fig. 3 and derated above $T_A = 25$ °C per Fig. 2

(2) Measured on 8.3 ms single half sine-wave or equivalent square wave, duty cycle = 4 pulses per minute maximum

(3) $V_F = 3.5$ V for 1.5KE220 (A) and below; $V_F = 5.0$ V for 1.5KE250(A) and above

ELECTRICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

JEDEC TYPE NUMBER	GENERAL SEMICONDUCTOR PART NUMBER	BREAKDOWN VOLTAGE V_{BR} AT I_T ⁽¹⁾ (V)		TEST CURRENT I_T (mA)	STAND-OFF VOLTAGE V_{WM} (V)	MAXIMUM REVERSE LEAKAGE AT V_{WM} I_D ⁽⁴⁾ (μA)	MAXIMUM PEAK PULSE CURRENT AT I_{PPM} ⁽²⁾ (A)	MAXIMUM CLAMPING VOLTAGE AT I_{PPM} V_C (V)	MAXIMUM TEMP. COEFFICIENT OF V_{BR} (%/°C)
		MIN.	MAX.						
1N6267	(+) $1.5\text{KE}6.8$	6.12	7.48	10	5.50	1000	139	10.8	0.057
1N6267A	(+) $1.5\text{KE}6.8\text{A}$	6.45	7.14	10	5.80	1000	143	10.5	0.057
1N6268	(+) $1.5\text{KE}7.5$	6.75	8.25	10	6.05	500	128	11.7	0.061
1N6268A	(+) $1.5\text{KE}7.5\text{A}$	7.13	7.88	10	6.40	500	133	11.3	0.061
1N6269	(+) $1.5\text{KE}8.2$	7.38	9.02	10	6.63	200	120	12.5	0.065
1N6269A	(+) $1.5\text{KE}8.2\text{A}$	7.79	8.61	10	7.02	200	124	12.1	0.065
1N6270	(+) $1.5\text{KE}9.1$	8.19	10.0	1.0	7.37	50	109	13.8	0.068
1N6270A	(+) $1.5\text{KE}9.1\text{A}$	8.65	9.55	1.0	7.78	50	112	13.4	0.068
1N6271	(+) $1.5\text{KE}10$	9.00	11.0	1.0	8.10	10	100	15.0	0.073
1N6271A	(+) $1.5\text{KE}10\text{A}$	9.50	10.5	1.0	8.55	10	103	14.5	0.073
1N6272	(+) $1.5\text{KE}11$	9.90	12.1	1.0	8.92	5.0	92.6	16.2	0.075
1N6272A	(+) $1.5\text{KE}11\text{A}$	10.5	11.6	1.0	9.40	5.0	96.2	15.6	0.075
1N6273	(+) $1.5\text{KE}12$	10.8	13.2	1.0	9.72	5.0	86.7	17.3	0.076
1N6273A	(+) $1.5\text{KE}12\text{A}$	11.4	12.6	1.0	10.2	5.0	89.8	16.7	0.078
1N6274	(+) $1.5\text{KE}13$	11.7	14.3	1.0	10.5	5.0	78.9	19.0	0.081
1N6274A	(+) $1.5\text{KE}13\text{A}$	12.4	13.7	1.0	11.1	5.0	82.4	18.2	0.081
1N6275	(+) $1.5\text{KE}15$	13.5	16.5	1.0	12.1	1.0	68.2	22.0	0.084
1N6275A	(+) $1.5\text{KE}15\text{A}$	14.3	15.8	1.0	12.8	1.0	70.8	21.2	0.084
1N6276	(+) $1.5\text{KE}16$	14.4	17.6	1.0	12.9	1.0	63.8	23.5	0.086
1N6276A	(+) $1.5\text{KE}16\text{A}$	15.2	16.8	1.0	13.6	1.0	66.7	22.5	0.086
1N6277	(+) $1.5\text{KE}18$	16.2	19.8	1.0	14.5	1.0	56.6	26.5	0.088
1N6277A	(+) $1.5\text{KE}18\text{A}$	17.1	18.9	1.0	15.3	1.0	59.5	25.2	0.089
1N6278	(+) $1.5\text{KE}20$	18.0	22.0	1.0	16.2	1.0	51.5	29.1	0.090
1N6278A	(+) $1.5\text{KE}20\text{A}$	19.0	21.0	1.0	17.1	1.0	54.2	27.7	0.090
1N6279	(+) $1.5\text{KE}22$	19.8	24.2	1.0	17.8	1.0	47.0	31.9	0.092
1N6279A	(+) $1.5\text{KE}22\text{A}$	20.9	23.1	1.0	18.8	1.0	49.0	30.6	0.092
1N6280	(+) $1.5\text{KE}24$	21.6	26.4	1.0	19.4	1.0	43.2	34.7	0.094
1N6280A	(+) $1.5\text{KE}24\text{A}$	22.8	25.2	1.0	20.5	1.0	45.2	33.2	0.094
1N6281	(+) $1.5\text{KE}27$	24.3	29.7	1.0	21.8	1.0	38.4	39.1	0.096
1N6281A	(+) $1.5\text{KE}27\text{A}$	25.7	28.4	1.0	23.1	1.0	40.0	37.5	0.096
1N6282	(+) $1.5\text{KE}30$	27.0	33.0	1.0	24.3	1.0	34.5	43.5	0.097
1N6282A	(+) $1.5\text{KE}30\text{A}$	28.5	31.5	1.0	25.6	1.0	36.2	41.4	0.097
1N6283	(+) $1.5\text{KE}33$	29.7	36.3	1.0	26.8	1.0	31.4	47.7	0.098
1N6283A	(+) $1.5\text{KE}33\text{A}$	31.4	34.7	1.0	28.2	1.0	32.8	45.7	0.098
1N6284	(+) $1.5\text{KE}36$	32.4	39.6	1.0	29.1	1.0	28.8	52.0	0.099
1N6284A	(+) $1.5\text{KE}36\text{A}$	34.2	37.8	1.0	30.8	1.0	30.1	49.9	0.099
1N6285	(+) $1.5\text{KE}39$	35.1	42.9	1.0	31.6	1.0	26.6	56.4	0.100
1N6285A	(+) $1.5\text{KE}39\text{A}$	37.1	41.0	1.0	33.3	1.0	27.8	53.9	0.100
1N6286	(+) $1.5\text{KE}43$	38.7	47.3	1.0	34.8	1.0	24.2	61.9	0.101
1N6286A	(+) $1.5\text{KE}43\text{A}$	40.9	45.2	1.0	36.8	1.0	25.3	59.3	0.101
1N6287	(+) $1.5\text{KE}47$	42.3	51.7	1.0	38.1	1.0	22.1	67.8	0.101
1N6287A	(+) $1.5\text{KE}47\text{A}$	44.7	49.4	1.0	40.2	1.0	23.1	64.8	0.101
1N6288	(+) $1.5\text{KE}51$	45.9	56.1	1.0	41.3	1.0	20.4	73.5	0.102
1N6288A	(+) $1.5\text{KE}51\text{A}$	48.5	53.6	1.0	43.6	1.0	21.4	70.1	0.102
1N6289	(+) $1.5\text{KE}56$	50.4	61.8	1.0	45.4	1.0	18.6	80.5	0.103
1N6289A	(+) $1.5\text{KE}56\text{A}$	53.2	58.8	1.0	47.8	1.0	19.5	77.0	0.103
1N6290	(+) $1.5\text{KE}62$	55.8	68.2	1.0	50.2	1.0	16.9	89.0	0.104
1N6290A	(+) $1.5\text{KE}62\text{A}$	58.9	65.1	1.0	53.0	1.0	17.6	85.0	0.104
1N6291	(+) $1.5\text{KE}68$	61.2	74.8	1.0	55.1	1.0	15.3	98.0	0.104
1N6291A	(+) $1.5\text{KE}68\text{A}$	64.6	71.4	1.0	58.1	1.0	16.3	92.0	0.104
1N6292	(+) $1.5\text{KE}75$	67.5	82.5	1.0	60.7	1.0	13.9	109	0.105
1N6292A	(+) $1.5\text{KE}75\text{A}$	71.3	78.8	1.0	64.1	1.0	14.6	104	0.105



1.5KE6.8 thru 1.5KE540A, 1N6267 thru 1N6303

Vishay General Semiconductor

ELECTRICAL CHARACTERISTICS (T _A = 25 °C unless otherwise noted)									
JEDEC TYPE NUMBER	GENERAL SEMICONDUCTOR PART NUMBER	BREAKDOWN VOLTAGE V _{BR} AT I _T ⁽¹⁾ (V)		TEST CURRENT I _T (mA)	STAND-OFF VOLTAGE V _{WM} (V)	MAXIMUM REVERSE LEAKAGE AT V _{WM} I _D ⁽⁴⁾ (μA)	MAXIMUM PEAK PULSE CURRENT I _{PPM} ⁽²⁾ (A)	MAXIMUM CLAMPING VOLTAGE AT I _{PPM} V _C (V)	MAXIMUM TEMP. COEFFICIENT OF V _{BR} (%/°C)
		MIN.	MAX.						
1N6293	(+)1.5KE82	73.8	90.2	1.0	66.4	1.0	12.7	118	0.105
1N6293A	(+)1.5KE82A	77.9	86.1	1.0	70.1	1.0	13.3	113	0.105
1N6294	(+)1.5KE91	81.9	100.0	1.0	73.7	1.0	11.5	131	0.106
1N6294A	(+)1.5KE91A	86.5	95.5	1.0	77.8	1.0	12.0	125	0.106
1N6295	(+)1.5KE100	90.0	110	1.0	81.0	1.0	10.4	144	0.106
1N6295A	(+)1.5KE100A	95.0	105	1.0	85.5	1.0	10.9	137	0.106
1N6296	(+)1.5KE110	99.0	121	1.0	89.2	1.0	9.5	158	0.107
1N6296A	(+)1.5KE 110A	105	116	1.0	94.0	1.0	9.9	152	0.107
1N6297	(+)1.5KE120	108	132	1.0	97.2	1.0	8.7	173	0.107
1N6297A	(+)1.5KE120A	114	126	1.0	102	1.0	9.1	165	0.107
1N6298	(+)1.5KE130	117	143	1.0	105	1.0	8.0	187	0.107
1N6298A	(+)1.5KE130A	124	137	1.0	111	1.0	8.4	179	0.107
1N6299	(+)1.5KE150	136	165	1.0	121	1.0	7.0	215	0.108
1N6299A	(+)1.5KE150A	143	158	1.0	128	1.0	7.2	207	0.106
1N6300	(+)1.5KE160	144	176	1.0	130	1.0	6.5	230	0.106
1N6300A	(+)1.5KE160A	152	168	1.0	136	1.0	6.8	219	0.108
1N6301	(+)1.5KE170	153	187	1.0	138	1.0	6.1	244	0.108
1N6301A	(+)1.5KE170A	162	179	1.0	145	1.0	6.4	234	0.108
1N6302	1.5KE180	162	198	1.0	146	1.0	5.8	258	0.108
1N6302A	1.5KE180A	171	189	1.0	154	1.0	6.1	246	0.108
1N6303	1.5KE200	180	220	1.0	162	1.0	5.2	287	0.108
1N6303A	1.5KE200A*	190	210	1.0	171	1.0	5.5	274	0.108
	1.5KE220	198	242	1.0	175	1.0	4.4	344	0.108
	1.5KE220A*	209	231	1.0	185	1.0	4.6	328	0.108
	1.5KE250	225	275	1.0	202	1.0	4.2	360	0.110
	1.5KE250A	237	263	1.0	214	1.0	4.4	344	0.110
	1.5KE300	270	330	1.0	243	1.0	3.5	430	0.110
	1.5KE300A	285	315	1.0	256	1.0	3.6	414	0.110
	1.5KE350	315	385	1.0	284	1.0	3.0	504	0.110
	1.5KE350A	333	368	1.0	300	1.0	3.1	482	0.110
	1.5KE400	360	440	1.0	324	1.0	2.6	574	0.110
	1.5KE400A	380	420	1.0	342	1.0	2.7	548	0.110
	1.5KE440	396	484	1.0	356	1.0	2.4	631	0.110
	1.5KE440A	418	462	1.0	376	1.0	2.5	602	0.110
	1.5KE480	432	528	1.0	389	1.0	2.19	686	0.110
	1.5KE480A	456	504	1.0	408	1.0	2.28	658	0.110
	1.5KE510	459	561	1.0	413	1.0	2.06	729	0.110
	1.5KE510A	485	535	1.0	434	1.0	2.15	698	0.110
	1.5KE540	486	594	1.0	437	1.0	1.94	772	0.110
	1.5KE540A	513	567	1.0	459	1.0	2.03	740	0.110

Notes:

(1) Pulse test: t_p ≤ 50 ms

(2) Surge current waveform per Fig. 3 and derate per Fig. 2

(3) All terms and symbols are consistent with ANSI/IEEE CA62.35

(4) For bi-directional types with V_R 10 V and less the I_D limit is doubled

* Bi-directional versions are UL approved under component across the line protection, ULV1414 file number E108274 (1.5KE200CA, 1.5KE220CA)

(+) Underwriters laboratory recognition for the classification of protectors (QVGQ2) under the UL standard for safety 497B and file number E136766 for both uni-directional and bi-directional devices

THERMAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	VALUE	UNIT
Typical thermal resistance, junction to ambient	$R_{\theta JA}$	75	$^{\circ}\text{C/W}$
Typical thermal resistance, junction to lead	$R_{\theta JL}$	15.4	

ORDERING INFORMATION (Example)

PREFERRED P/N	UNIT WEIGHT (g)	PREFERRED PACKAGE CODE	BASE QUANTITY	DELIVERY MODE
1.5KE6.8A-E3/54	0.968	54	1400	13" diameter paper tape and reel
1.5KE6.8AHE3/54 ⁽¹⁾	0.968	54	1400	13" diameter paper tape and reel

Note:

(1) Automotive grade AEC-Q101 qualified

RATINGS AND CHARACTERISTICS CURVES($T_A = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

Figure 1. Peak Pulse Power Rating Curve



Figure 3. Pulse Waveform



Figure 2. Pulse Power or Current vs. Initial Junction Temperature



Figure 4. Typical Junction Capacitance



Figure 5. Power Derating Curve



Figure 8. Incremental Clamping Voltage Curve (Uni-Directional)



Figure 6. Maximum Non-Repetitive Forward Surge Current
Uni-Directional only



Figure 9. Incremental Clamping Voltage Curve (Bi-directional)



Figure 7. Incremental Clamping Voltage Curve (Uni-Directional)



Figure 10. Incremental Clamping Voltage Curve (Bi-Directional)



Figure 11. Instantaneous Forward Voltage Characteristics Curve



Figure 12. Typical Transient Thermal Impedance

PACKAGE OUTLINE DIMENSIONS in inches (millimeters)



APPLICATION NOTES

- This series of Silicon Transient Suppressors is used in applications where large voltage transients can permanently damage voltage-sensitive components.
- The TVS diode can be used in applications where induced lightning on rural or remote transmission lines presents a hazard to electronic circuitry (ref: R.E.A. specification P.E. 60).
- This Transient Voltage Suppressor diode has a pulse power rating of 1500 W for 1 ms. The response time of TVS diode clamping action is effectively instantaneous (1×10^{-9} s bi-directional); therefore, they can protect integrated circuits, MOS devices, hybrids, and other voltage sensitive semiconductors and components. TVS diodes can also be used in series or parallel to increase the peak power ratings.



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