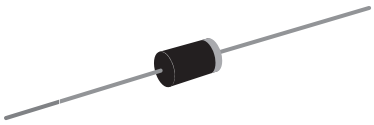
TRANSZORB® Transient Voltage Suppressors



DO-204AC (DO-15)

FEATURES

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

PRIMARY CHARACTERISTICS	
V_{BR} uni-directional	6.8 V to 540 V
V_{BR} bi-directional	6.8 V to 440 V
P_{PPM}	600 W
P_D	5.0 W
I_{FSM} (uni-directional only)	100 A
T_J max.	175 °C

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.

DEVICES FOR BI-DIRECTION APPLICATIONS

For bi-directional types, use C or CA suffix (e.g. P6KE440CA).

Electrical characteristics apply in both directions.

MECHANICAL DATA

Case: DO-204AC, molded epoxy over passivated chip

Epoxy meets UL 94V-0 flammability rating

Terminals: Matte tin plated leads, solderable per J-STD-002B and JESD22-B102D

E3 suffix for commercial grade, HE3 suffix for high reliability grade (AEC Q101 qualified)

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	VALUE	UNIT
Peak power dissipation with a 10/1000 µs waveform (1) (Fig. 1)	P_{PPM}	600	W
Peak pulse current with a 10/1000 µs waveform (1)	I_{PPM}	See next table	A
Power dissipation on infinite heatsink at T_L = 75 °C (Fig. 5)	P_D	5.0	W
Peak forward surge current, 8.3 ms single half sine-wave (2)	I_{FSM}	100	A
Maximum instantaneous forward voltage at 50 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 per minute maximum

(3) V_F = 3.5 V for P6KE220(A) and below; V_F = 5.0 V for P6KE250(A) and above

ELECTRICAL CHARACTERISTICS (T_A = 25 °C unless otherwise noted)								
DEVICE TYPE	**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} (3) I_D (µA)**	**PEAK PULSE CURRENT I_{PPM} (2) (A)**	**MAXIMUM CLAMPING VOLTAGE AT I_{PPM} V_C (V)**	**MAXIMUM TEMPERATURE COEFFICIENT OF V_{BR} (%/°C)**
	MIN	**MAX**						
(+)P6KE6.8	6.12	7.48	10	5.50	1000	55.6	10.8	0.057
(+)P6KE6.8A	6.45	7.14	10	5.80	1000	57.1	10.5	0.057
(+)P6KE7.5	6.75	8.25	10	6.05	500	51.3	11.7	0.061
(+)P6KE7.5A	7.13	7.88	10	6.40	500	53.1	11.3	0.061
(+)P6KE8.2	7.38	9.02	10	6.63	200	48.0	12.5	0.065
(+)P6KE8.2A	7.79	8.61	10	7.02	200	49.6	12.1	0.065
(+)P6KE9.1	8.19	10.0	1.0	7.37	50	43.5	13.8	0.068
(+)P6KE9.1A	8.65	9.55	1.0	7.78	50	44.8	13.4	0.068
(+)P6KE10	9.00	11.0	1.0	8.10	10	40.0	15.0	0.073
(+)P6KE10A	9.50	10.5	1.0	8.55	10	41.4	14.5	0.073
(+)P6KE11	9.90	12.1	1.0	8.92	5.0	37.0	16.2	0.075
(+)P6KE11A	10.5	11.6	1.0	9.40	5.0	38.5	15.6	0.075
(+)P6KE12	10.8	13.2	1.0	9.72	5.0	34.7	17.3	0.078
(+)P6KE12A	11.4	12.6	1.0	10.2	5.0	35.9	16.7	0.078
(+)P6KE13	11.7	14.3	1.0	10.5	5.0	31.6	19.0	0.081
(+)P6KE13A	12.4	13.7	1.0	11.1	5.0	33.0	18.2	0.081
(+)P6KE15	13.5	16.5	1.0	12.1	1.0	27.3	22.0	0.084
(+)P6KE15A	14.3	15.8	1.0	12.8	1.0	28.3	21.2	0.084
(+)P6KE16	14.4	17.6	1.0	12.9	1.0	25.5	23.5	0.086
(+)P6KE16A	15.2	16.8	1.0	13.6	1.0	26.7	22.5	0.086
(+)P6KE18	16.2	19.8	1.0	14.5	1.0	22.6	26.5	0.088
(+)P6KE18A	17.1	18.9	1.0	15.3	1.0	23.8	25.2	0.088
(+)P6KE20	18.0	22.0	1.0	16.2	1.0	20.6	29.1	0.090
(+)P6KE20A	19.0	21.0	1.0	17.1	1.0	21.7	27.7	0.090
(+)P6KE22	19.8	24.2	1.0	17.8	1.0	18.8	31.9	0.092
(+)P6KE22A	20.9	23.1	1.0	18.8	1.0	19.6	30.6	0.092
(+)P6KE24	21.6	26.4	1.0	19.4	1.0	17.3	34.7	0.094
(+)P6KE24A	22.8	25.2	1.0	20.5	1.0	18.1	33.2	0.094
(+)P6KE27	24.3	29.7	1.0	21.8	1.0	15.3	39.1	0.096
(+)P6KE27A	25.7	28.4	1.0	23.1	1.0	16.0	37.5	0.096
(+)P6KE30	27.0	33.0	1.0	24.3	1.0	13.8	43.5	0.097
(+)P6KE30A	28.5	31.5	1.0	25.6	1.0	14.5	41.4	0.097
(+)P6KE33	29.7	36.3	1.0	26.8	1.0	12.6	47.7	0.098
(+)P6KE33A	31.4	34.7	1.0	28.2	1.0	13.1	45.7	0.098
(+)P6KE36	32.4	39.6	1.0	29.1	1.0	11.5	52.0	0.099
(+)P6KE36A	34.2	37.8	1.0	30.8	1.0	12.0	49.9	0.099
(+)P6KE39	35.1	42.9	1.0	31.6	1.0	10.6	56.4	0.100
(+)P6KE39A	37.1	41.0	1.0	33.3	1.0	11.1	53.9	0.100
(+)P6KE43	38.7	47.3	1.0	34.8	1.0	9.7	61.9	0.101
(+)P6KE43A	40.9	45.2	1.0	36.8	1.0	10.1	59.3	0.101
(+)P6KE47	42.3	51.7	1.0	38.1	1.0	8.8	67.8	0.101
(+)P6KE47A	44.7	49.4	1.0	40.2	1.0	9.3	64.8	0.101

ELECTRICAL CHARACTERISTICS (T_A = 25 °C unless otherwise noted)								
DEVICE TYPE	**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} (3) I_D (µA)**	**PEAK PULSE CURRENT I_{PPM} (2) (A)**	**MAXIMUM CLAMPING VOLTAGE AT I_{PPM} V_C (V)**	**MAXIMUM TEMPERATURE COEFFICIENT OF V_{BR} (%/°C)**
	MIN	**MAX**						
(+)P6KE51	45.9	56.1	1.0	41.3	1.0	8.2	73.5	0.102
(+)P6KE51A	48.5	53.6	1.0	43.6	1.0	8.6	70.1	0.102
(+)P6KE56	50.4	61.6	1.0	45.4	1.0	7.5	80.5	0.103
(+)P6KE56A	53.2	58.8	1.0	47.8	1.0	7.8	77.0	0.103
(+)P6KE62	55.8	68.2	1.0	50.2	1.0	6.7	89.0	0.104
(+)P6KE62A	58.9	65.1	1.0	53.0	1.0	7.1	85.0	0.104
(+)P6KE68	61.2	74.8	1.0	55.1	1.0	6.1	98.0	0.104
(+)P6KE68A	64.6	71.4	1.0	58.1	1.0	6.5	92.0	0.104
(+)P6KE75	67.5	82.5	1.0	60.7	1.0	5.6	108	0.105
(+)P6KE75A	71.3	78.8	1.0	64.1	1.0	5.8	103	0.105
(+)P6KE82	73.8	90.2	1.0	66.4	1.0	5.1	118	0.105
(+)P6KE82A	77.9	86.1	1.0	70.1	1.0	5.3	113	0.105
(+)P6KE91	81.9	100	1.0	73.7	1.0	4.6	131	0.106
(+)P6KE91A	86.5	95.5	1.0	77.8	1.0	4.8	125	0.106
(+)P6KE100	90.0	110	1.0	81.0	1.0	4.2	144	0.106
(+)P6KE100A	95.0	105	1.0	85.5	1.0	4.4	137	0.106
(+)P6KE110	99.0	121	1.0	89.2	1.0	3.8	158	0.107
(+)P6KE110A	105	116	1.0	94.0	1.0	3.9	152	0.107
(+)P6KE120	108	132	1.0	97.2	1.0	3.5	173	0.107
(+)P6KE120A	114	126	1.0	102	1.0	3.6	165	0.107
(+)P6KE130	117	143	1.0	105	1.0	3.2	187	0.107
(+)P6KE130A	124	137	1.0	111	1.0	3.4	179	0.107
(+)P6KE150	135	165	1.0	121	1.0	2.8	215	0.108
(+)P6KE150A	143	158	1.0	128	1.0	2.9	207	0.108
(+)P6KE160	144	176	1.0	130	1.0	2.6	230	0.108
(+)P6KE160A	152	168	1.0	136	1.0	2.7	219	0.108
(+)P6KE170	153	187	1.0	138	1.0	2.5	244	0.108
(+)P6KE170A	162	179	1.0	145	1.0	2.6	234	0.108
(+)P6KE180	162	198	1.0	146	1.0	2.3	258	0.108
(+)P6KE180A	171	189	1.0	154	1.0	2.4	246	0.108
(+)P6KE200	180	220	1.0	162	1.0	2.1	287	0.108
(+)P6KE200A	190	210	1.0	171	1.0	2.2	274	0.108
(+)P6KE220	198	242	1.0	175	1.0	1.7	344	0.108
(+)P6KE220A	209	231	1.0	185	1.0	1.8	328	0.108
(+)P6KE250	225	275	1.0	202	1.0	1.7	360	0.110
(+)P6KE250A	237	263	1.0	214	1.0	1.7	344	0.110
(+)P6KE300	270	330	1.0	243	1.0	1.4	430	0.110
(+)P6KE300A	285	315	1.0	256	1.0	1.4	414	0.110
(+)P6KE350	315	385	1.0	284	1.0	1.2	504	0.110
(+)P6KE350A	333	368	1.0	300	1.0	1.2	482	0.110
(+)P6KE400	360	440	1.0	324	1.0	1.0	574	0.110
(+)P6KE400A	380	420	1.0	342	1.0	1.1	548	0.110

ELECTRICAL CHARACTERISTICS (T_A = 25 °C unless otherwise noted)								
DEVICE TYPE	**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} (3) I_D (µA)**	**PEAK PULSE CURRENT I_{PPM} (2) (A)**	**MAXIMUM CLAMPING VOLTAGE AT I_{PPM} V_C (V)**	**MAXIMUM TEMPERATURE COEFFICIENT OF V_{BR} (%/°C)**
	MIN	**MAX**						
(+)P6KE440	396	484	1.0	356	1.0	0.95	631	0.110
(+)P6KE440A	418	462	1.0	376	1.0	1.00	602	0.110
P6KE480	432	528	1.0	389	1.0	0.88	686	0.110
P6KE480A	456	504	1.0	408	1.0	0.91	658	0.110
P6KE510	459	561	1.0	413	1.0	0.82	729	0.110
P6KE510A	485	535	1.0	434	1.0	0.86	698	0.110
P6KE540	486	594	1.0	437	1.0	0.78	772	0.110
P6KE540A	513	567	1.0	459	1.0	0.81	740	0.110

Notes:

(1) Pulse test: $t_p \leq 50$ ms

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

(3) For bi-directional types with V_{WM} of 10 V and less, the I_D limit is doubled

(4) All terms and symbols are consistent with ANSI/IEEE C62.35

(+) 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 °C unless otherwise noted)			
PARAMETER	**SYMBOL**	**VALUE**	**UNIT**
Typical thermal resistance, junction to lead	$R_{\theta JL}$	20	°C/W
Typical thermal resistance, junction to ambient	$R_{\theta JA}$	75	°C/W

ORDERING INFORMATION (Example)				
PREFERRED P/N	**UNIT WEIGHT (g)**	**PREFERRED PACKAGE CODE**	**BASE QUANTITY**	**DELIVERY MODE**
P6KE6.8A-E3/54	0.432	54	4000	13" diameter paper tape and reel
P6KE6.8AHE3/54 (1)	0.432	54	4000	13" diameter paper tape and reel

Note:

(1) Automotive grade AEC Q101 qualified

RATINGS AND CHARACTERISTICS CURVES

(T_A = 25 °C unless otherwise noted)

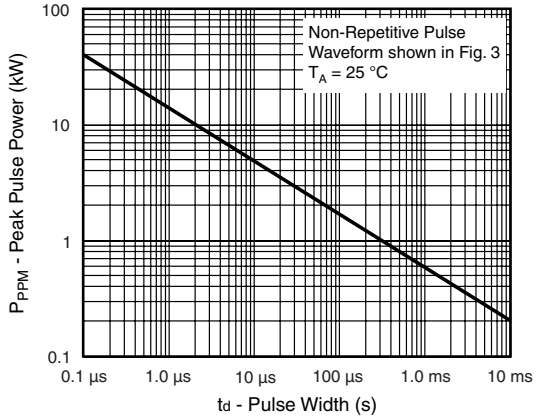


Figure 1. Peak Pulse Power Rating Curve

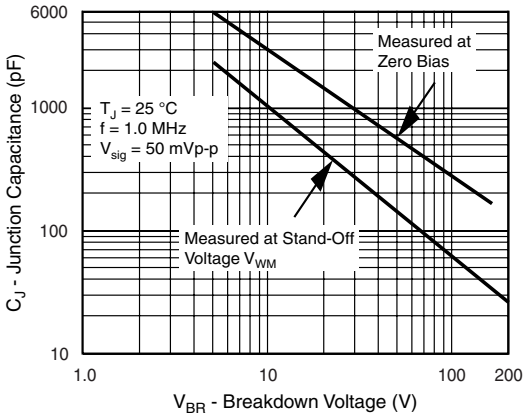


Figure 4. Typical Junction Capacitance Uni-Directional

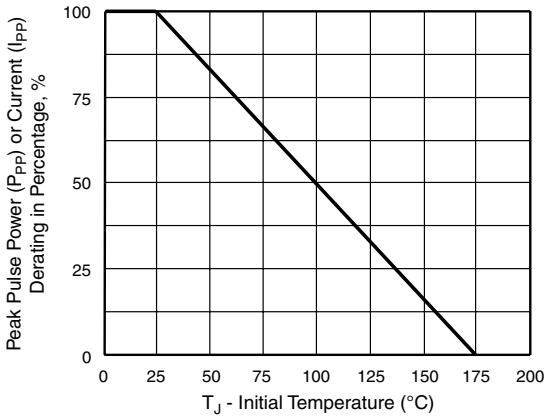


Figure 2. Pulse Power or Current vs. Initial Junction Temperature

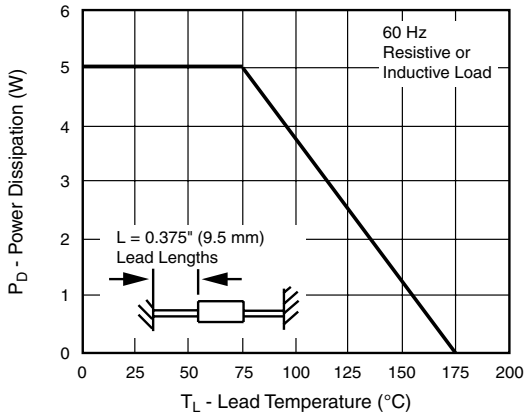


Figure 5. Power Derating Curve

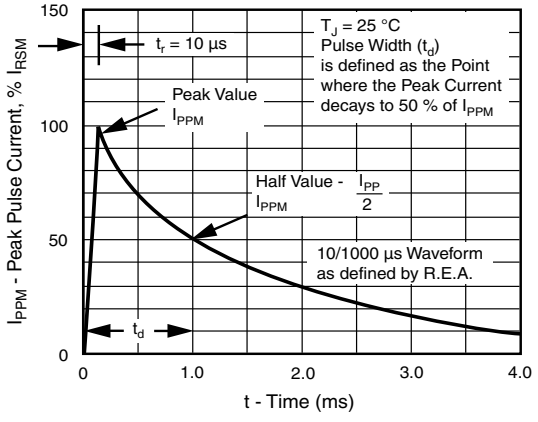


Figure 3. Pulse Waveform

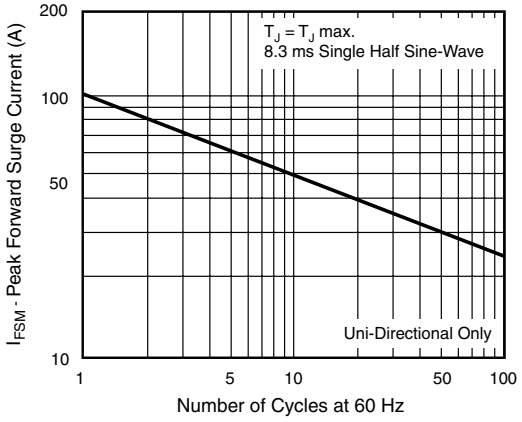


Figure 6. Maximum Non-Repetitive Forward Surge Current

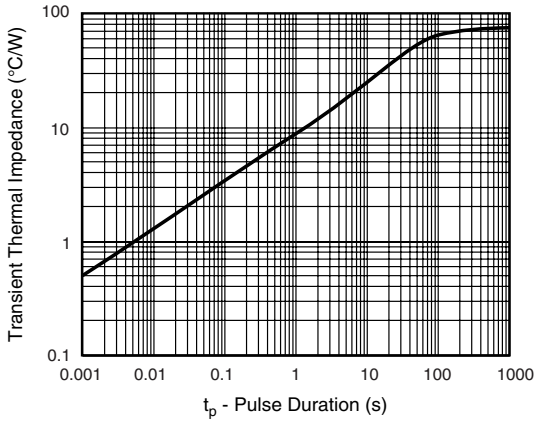
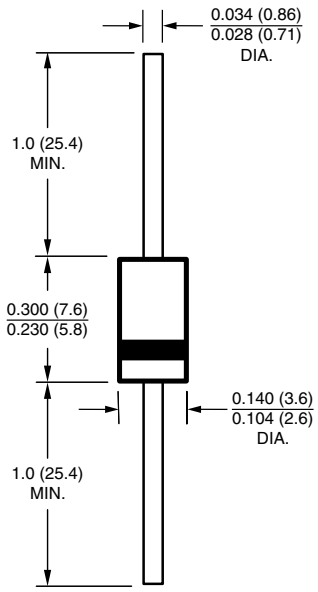


Figure 7. Typical Transient Thermal Impedance

PACKAGE OUTLINE DIMENSIONS in inches (millimeters)

DO-204AC (DO-15)



APPLICATION NOTE

This P6KE TVS series is a low cost commercial product for use in applications where large voltage transients can permanently damage voltage-sensitive components.

The P6KE series device types are designed in a small package size where power and space is a consideration. They are characterized by their high surge capability, extremely fast response time, and low impedance, (R_{on}). Because of the unpredictable nature of transients, and the variation of the impedance with respect to these transients, impedance, per se, is not specified as a parametric value. However, a minimum voltage at low current conditions (BV) and a maximum clamping voltage (V_c) at a maximum peak pulse current is specified.

In some instances, the thermal effect (see V_c Clamping Voltage) may be responsible for 50 % to 70 %. of the observed voltage differential when subjected to high current pulses for several duty cycles, thus making a maximum impedance specification insignificant.

In case of a severe current overload or abnormal transient beyond the maximum ratings, the Transient Voltage Suppressor will initially fail 'short' thus tripping the system's circuit breaker or fuse while protecting the entire circuit. Curves depicting clamping voltage vs. various current pulses are available from the factory. Extended power curves vs. pulse time are also available.

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