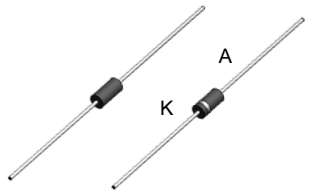
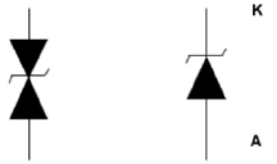
P6KExxA, P6KExxCA

Datasheet

600 W TVS in DO-15



DO-15 (JEDEC DO-204AC)



Bidirectional (CA type) **Unidirectional (A type)**

Product status link	
P6KE6V8A, P6KE12A, P6KE15A, P6KE18A, P6KE27A, P6KE30A, P6KE33A, P6KE36A, P6KE39A, P6KE47A, P6KE150A, P6KE180A, P6KE200A, P6KE220A, P6KE250A, P6KE300A, P6KE400A, P6KE440A.	P6KE6V8CA, P6KE12CA, P6KE15CA, P6KE18CA, P6KE27CA, P6KE30CA, P6KE33CA, P6KE36CA, P6KE39CA, P6KE47CA, P6KE150CA, P6KE180CA, P6KE200CA, P6KE220CA, P6KE250CA, P6KE300CA, P6KE400CA, P6KE440CA.

Features

- Peak pulse power:
  - 600 W (10/1000 µs)
  - up to 4 kW (8/20 µs)
- Stand-off voltage range from 5.8 V to 376 V
- Unidirectional and bidirectional types
- Operating T_j max: 175 °C
- High power capability at T_j max.: up to 420 W (10/1000 µs)
- Lead finishing: matte tin plating

Complies with the following standards

- UL94, V0
- J-STD-020 MSL level 1
- J-STD-002, JESD 22-B102 E3 and MIL-STD-750, method 2026
- JESD-201 class 2 whisker test
- UL 497B file number: QVGQ2.E136224
- IEC 61000-4-4 level 4:
  - 4 k V
- IEC 61000-4-2, C = 150 pF, R = 330 Ω exceeds level 4:
  - 30 kV (air discharge)
  - 30 kV (contact discharge)

Description

The P6KE TVS series is designed to protect sensitive equipment against electrostatic discharges according to IEC 61000-4-2, MIL STD 883 Method 3015, and electrical overstress such as IEC 61000-4-4 and 5. They are used for surges below 600 W 10/1000 µs.

This planar technology makes it compatible with high-end equipment and SMPS where low leakage current and high junction temperature are required to provide reliability and stability over time.

1 Characteristics

Table 1. Absolute maximum ratings (T_{amb} = 25 °C)

Symbol	Parameter		Value	Unit
V_{PP}	Peak pulse voltage	IEC 61000-4-2 (C = 150 pF, R = 330 Ω) Contact discharge Air discharge	 30 30	kV
P_{PP}	Peak pulse power dissipation	10/1000 µs, T_j initial = T_{amb}	600	W
I_{FSM}	Non repetitive surge peak forward current for unidirectional types	t_p = 10 ms, T_j initial = T_{amb}	100	A
T_{stg}	Storage temperature range		-65 to +175	°C
T_j	Operating junction temperature range		-55 to +175	°C
T_L	Maximum lead temperature for soldering during 10 s at 5 mm from case		260	°C

Figure 1. Electrical characteristics - parameter definitions

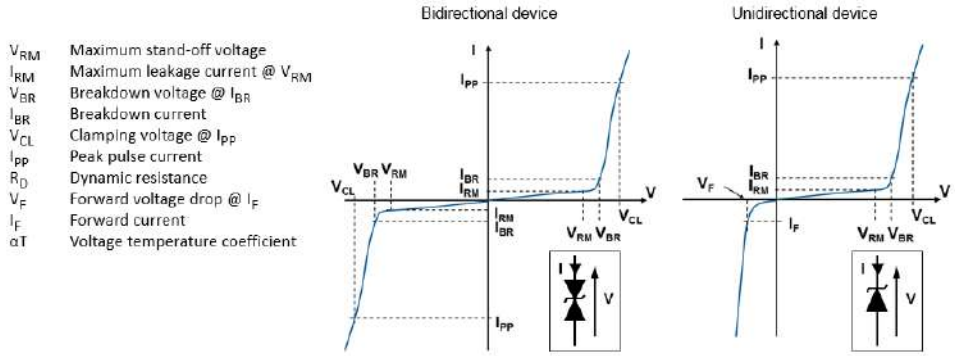


Figure 2. Pulse definition for electrical characteristics

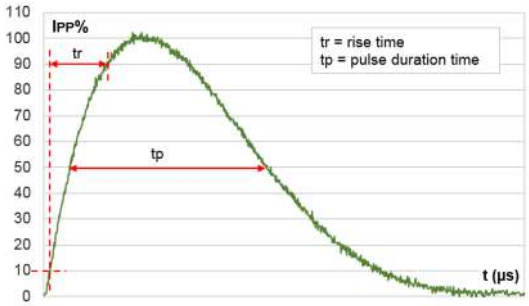


Table 2. Electrical characteristics - parameter values (T_{amb} = 25 °C, unless otherwise specified)

Type	I_{RM} max at V_{RM}		V_{BR} at I_{BR} (1)				10 / 1000 µs			8 / 20µs			αT
							V_{CL}(2)(3)	I_{PP}(4)	R_D	V_{CL}(2)(3)	I_{PP}(4)	R_D	
	25 °C		Min.	Typ.	Max.		Max.		Max.	Max.		Max.	Max.
	µA	V	V			mA	V	A	Ω	V	A	Ω	10^{-4}/°C
P6KE6V8A/CA	10	5.8	6.45	6.8	7.14	10	10.5	57	0.059	13.4	298	0.021	5.7
P6KE12A/CA	0.5	10	11.4	12	12.6	1	16.7	36	0.114	21.7	184	0.049	7.8
P6KE15A/CA	0.5	13	14.3	15	15.8	1	21.2	28	0.193	27.2	147	0.078	8.4
P6KE18A/CA	0.5	15	17.1	18	18.9	1	25.2	24	0.263	32.5	123	0.111	8.8
P6KE27A/CA	0.5	23	25.7	27	28.4	1	37.5	16	0.569	48.5	83	0.240	9.6
P6KE30A/CA	0.5	26	28.5	30	31.5	1	41.5	14.5	0.690	53.5	75	0.293	9.7
P6KE33A/CA	0.5	28	31.4	33	34.7	1	45.7	13.1	0.840	59	68	0.357	9.8
P6KE36A/CA	0.5	31	34.2	36	37.8	1	49.9	12	1.01	64.3	62	0.427	9.9
P6KE39A/CA	0.5	33	37.1	39	41.0	1	53.9	11.1	1.16	69.7	57	0.504	10.0
P6KE47A/CA	0.5	40	44.7	47	49.4	1	64.8	9.3	1.66	84	48	0.721	10.1
P6KE150A/CA	0.5	128	143	150	158	1	207	2.9	16.9	265	15	7.13	10.8
P6KE180A/CA	0.5	154	171	180	189	1	246	2.4	23.8	317	12.6	10.2	10.8
P6KE200A/CA	0.5	171	190	200	210	1	274	2.2	29.1	353	11.3	12.7	10.8
P6KE220A/CA	0.5	188	209	220	231	1	328	1.85	52.4	388	10.3	15.2	10.8
P6KE250A/CA	0.5	213	237	250	263	1	344	1.75	46.3	442	9	19.9	11
P6KE300A/CA	0.5	256	285	300	315	1	414	1.45	68.3	529	7.6	28.2	11
P6KE400A/CA	0.5	342	380	400	420	1	548	1.1	116	706	5.7	50.2	11
P6KE440A/CA	0.5	376	418	440	462	1	603	1.0	141	776	5.2	60.4	11

1. *To calculate V_{BR} versus T_j : V_{BR} at T_j = V_{BR} at 25 °C x (1 + αT x (T_j - 25))*
2. *To calculate V_{CL} versus T_j : V_{CL} at T_j = V_{CL} at 25 °C x (1 + αT x (T_j - 25))*
3. *To calculate V_{CL} max versus $I_{PPappli}$: V_{CL} max = V_{BR} + R_D x $I_{PPappli}$*
4. *Surge capability given for both directions for unidirectional (A type) and bidirectional (CA type) devices*

1.1 Characteristics (curves)

Figure 3. Maximum peak power dissipation versus initial junction temperature

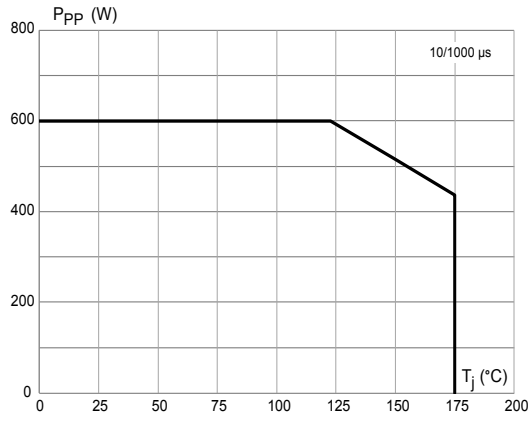


Figure 4. Maximum peak pulse power versus exponential pulse duration

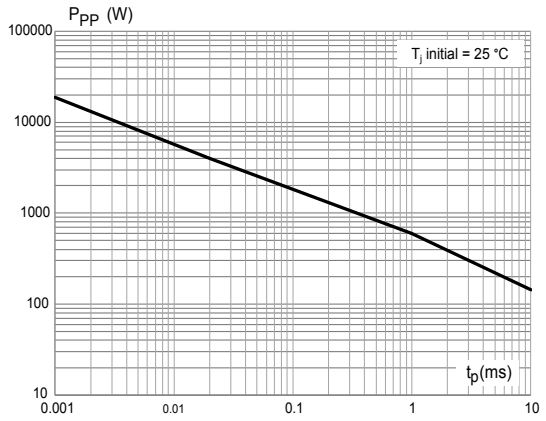


Figure 5. Maximum peak pulse current versus clamping voltage

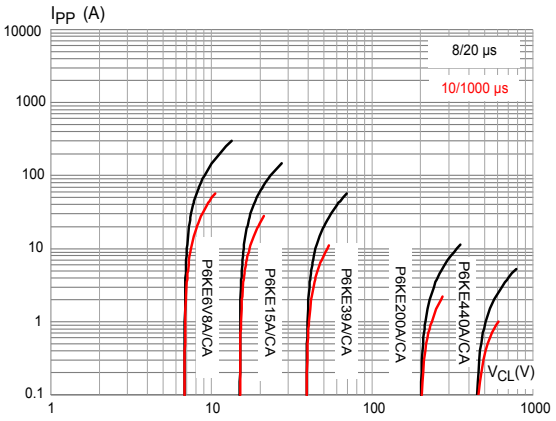


Figure 6. Dynamic resistance versus pulse duration

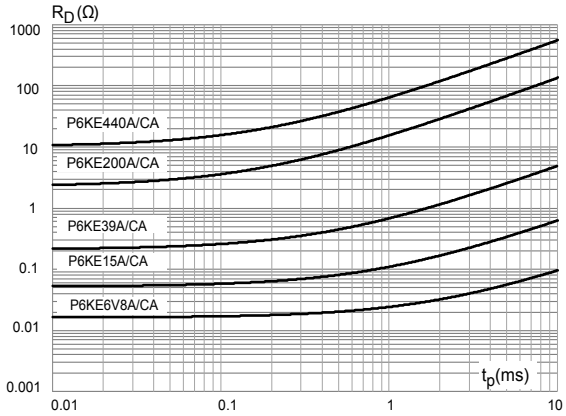


Figure 7. Junction capacitance versus reverse applied voltage (unidirectional type)

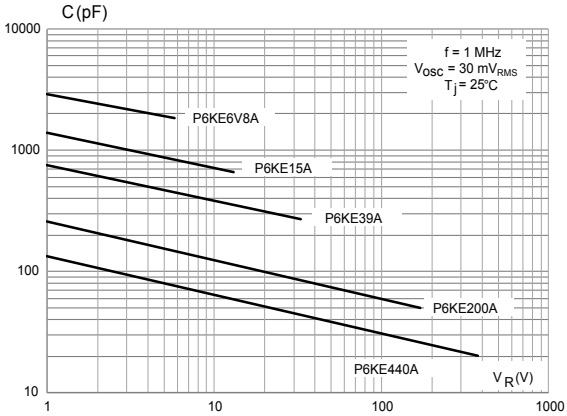


Figure 8. Junction capacitance versus applied voltage (bidirectional type)

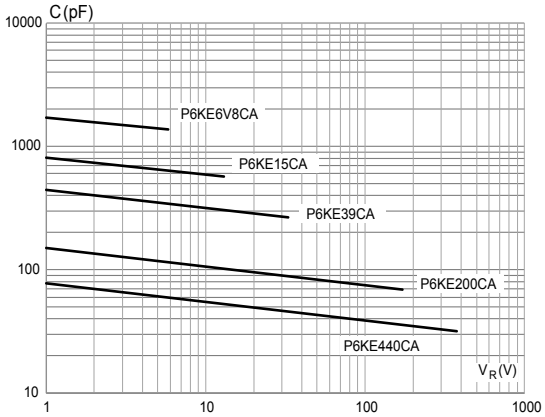


Figure 9. Leakage current versus junction temperature

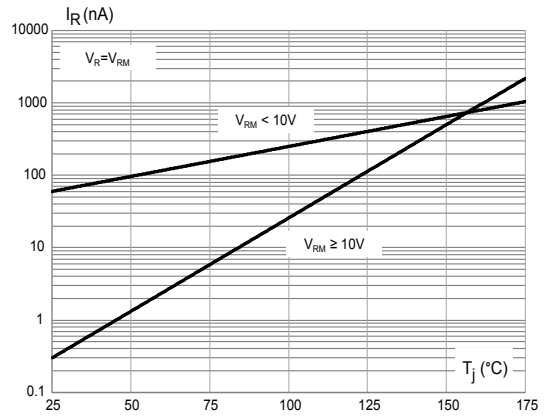


Figure 10. Peak forward voltage drop versus peak forward current

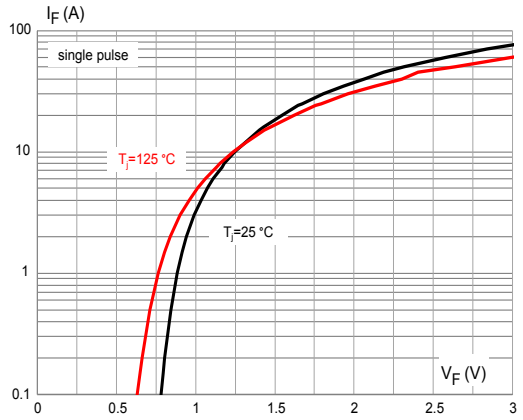


Figure 11. Thermal impedance junction to ambient versus pulse duration

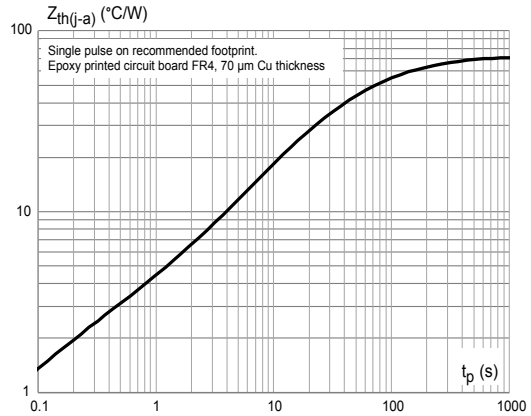
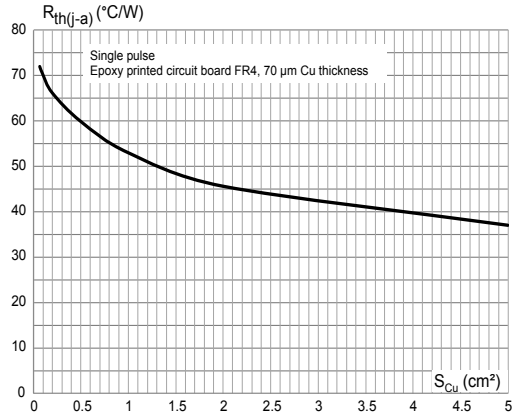


Figure 12. Thermal resistance junction to ambient versus copper area under each lead



2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

2.1 DO-15 package information

Figure 13. DO-15 package outline

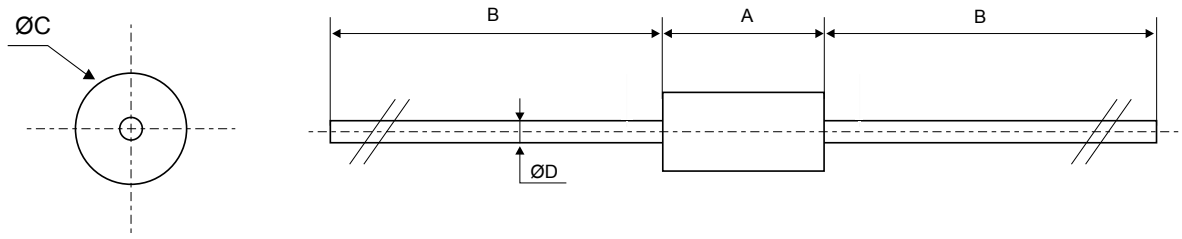


Table 3. DO-15 package mechanical data

Ref.	Dimensions					
	Millimeters			Inches (for reference only)		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	6.05	6.40	6.75	0.238	0.252	0.266
B	26.00	28.5	31.00	1.023	1.122	1.221
C	2.95	3.24	3.53	0.116	0.128	0.139
D	0.71	0.80	0.88	0.027	0.031	0.035

Figure 14. **Marking layout**

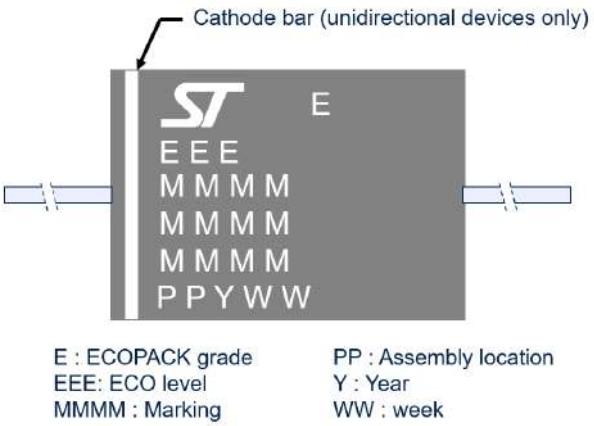


Figure 15. **Tape and reel orientation**

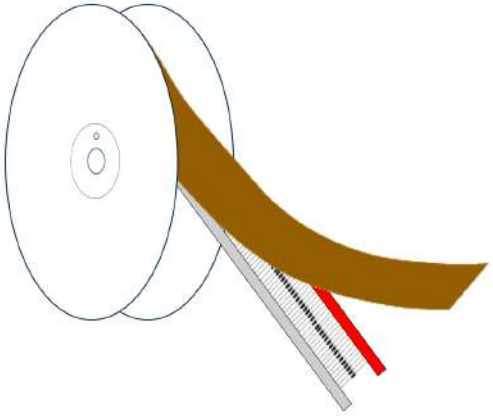


Figure 16. **Reel dimension values (mm)**

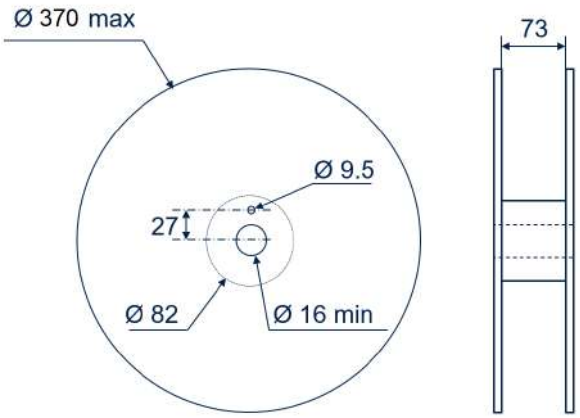


Figure 17. **Inner box dimension values (mm)**

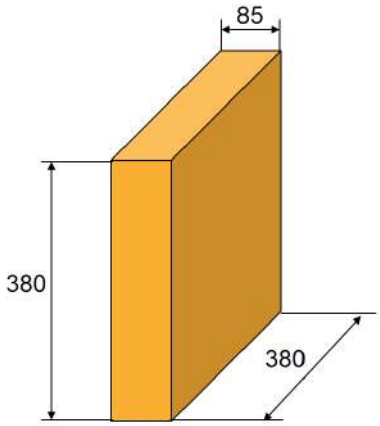


Figure 18. **Ammopack dimension values (mm)**

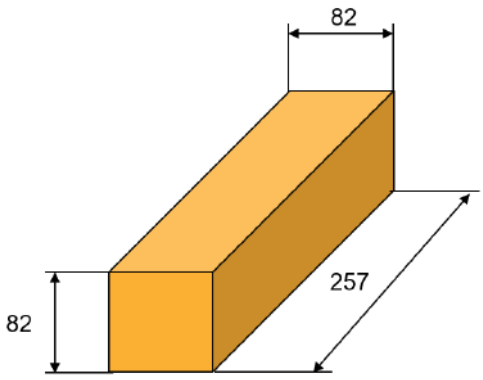
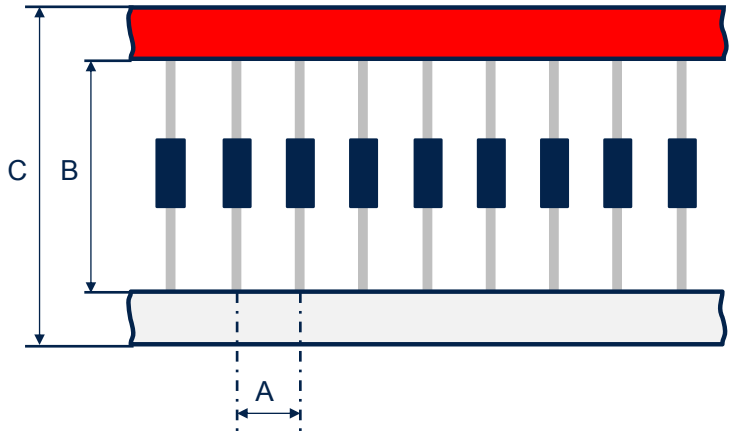


Figure 19. **Tape outline**



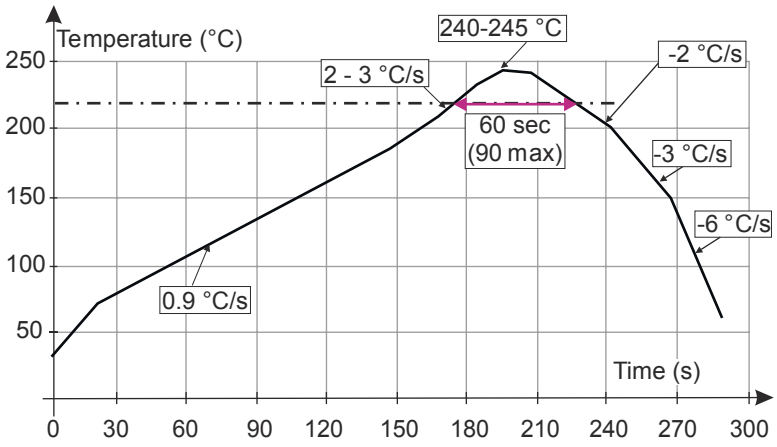
Dimensions are not to scale
Unidirectional components are oriented with red tape on the cathode and white tape on the anode.
Bidirectional components have red tape on both sides.

Table 4. **Tape dimension values**

Ref.	Dimensions		
	Millimeters		
	Min.	Typ.	Max.
A	4.5	5	5.5
B	51	53	55
C	62	65	68

2.2 Reflow profile

Figure 20. ST ECOPACK recommended soldering reflow profile for PCB mounting



Note: Minimize air convection currents in the reflow oven to avoid component movement. Maximum soldering profile corresponds to the latest IPC/JEDEC J-STD-020.

For wave soldering profile refer to AN5088 chapter 1.5.

- AN5088: Rectifiers thermal management, handling and mounting recommendations.

3 Ordering information

Table 5. Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
P6KExxARL/CARL[1]	Equal to order code (without RL suffix)	DO-15	0.4 g	6000	Reel
P6KExxA/CA	Equal to order code			1000	Ammopack

1. *Where xx is nominal value of V_{BR} and A or CA indicates unidirectional or bidirectional version.*

Revision history

Table 6. **Document revision history**

Date	Revision	Changes
Feb-2003	4A	Last update
Oct-2004	5	1/ Note 5, figure 7 on page 4, updated from V_{BR} > 220V to V_{BR} ≥ 200V. 2/ Types table on page 2: I_{PP} (@10/1000µs) changed for P6KE220xx to P6KE440xx
14-Sep-2011	6	Updated I_{RM} @ V_{RM} values, V_{BR}max @ I_R for P6KE33 and order codes in Table 3. Updated footnotes to Table 5. Updated T_L temperature in Table 1.
26-Apr-2012	7	Corrected typographical area Table 3.
29-Nov-2022	8	Updated package information. Minor text changes.