

## Transil™, transient voltage surge suppressor (TVS)

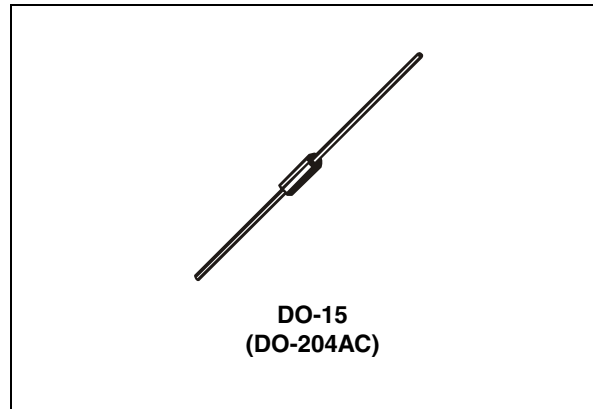
Datasheet — production data

### Features

- Peak pulse power: 600 W (10/1000  $\mu$ s )
- Stand-off voltage range 6.8 to 440 V
- Unidirectional and bidirectional types
- Low clamping factor
- Fast response time
- UL recognized

### Complies with the following standards

- IEC 61000-4-2 level 4
  - 15 kV (air discharge)
  - 8 kV (contact discharge)
- MIL STD 883G, method 3015-7 Class 3
  - HBM (human body model)



### Description

Transil diodes provide high overvoltage protection by clamping action. Their instantaneous response to transient overvoltages makes them particularly suited to protect voltage sensitive devices such as MOS Technology and low voltage supplied IC's.

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# 1 Characteristics

**Table 1. Absolute maximum ratings ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )**

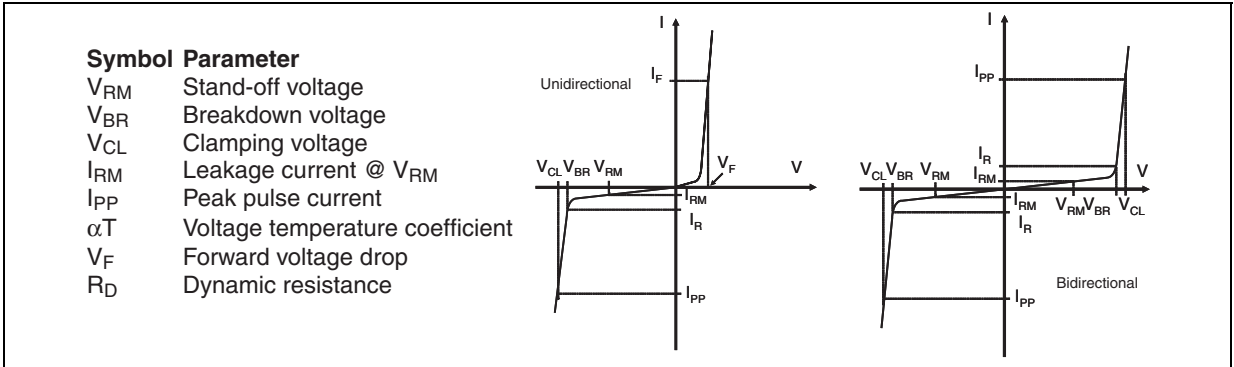
| Symbol    | Parameter                                                             | Value                                                    | Unit               |
|-----------|-----------------------------------------------------------------------|----------------------------------------------------------|--------------------|
| $P_{PP}$  | Peak pulse power dissipation <sup>(1)</sup>                           | $T_{j\text{ initial}} = T_{amb}$                         | 600 W              |
| $P$       | Power dissipation on infinite heatsink                                | $T_{amb} = 75\text{ }^{\circ}\text{C}$                   | 5 W                |
| $I_{FSM}$ | Non repetitive surge peak forward current for unidirectional types    | $t_p = 10\text{ ms}$<br>$T_{j\text{ initial}} = T_{amb}$ | 100 A              |
| $T_{stg}$ | Storage temperature range                                             | -65 to + 175                                             | $^{\circ}\text{C}$ |
| $T_j$     | Maximum operating junction temperature                                | 175                                                      | $^{\circ}\text{C}$ |
| $T_L$     | Maximum lead temperature for soldering during 10 s at 5 mm from case. | 260                                                      | $^{\circ}\text{C}$ |

1. For a surge greater than the maximum values, the diode will fail in short-circuit.

**Table 2. Thermal resistances**

| Symbol        | Parameter                                                         | Value | Unit                 |
|---------------|-------------------------------------------------------------------|-------|----------------------|
| $R_{th(j-l)}$ | Junction to leads                                                 | 20    | $^{\circ}\text{C/W}$ |
| $R_{th(j-a)}$ | Junction to ambient on printed circuit. $L_{lead} = 10\text{ mm}$ | 75    |                      |

**Figure 1. Electrical characteristics - definitions**



**Figure 2. Pulse definition for electrical characteristics**

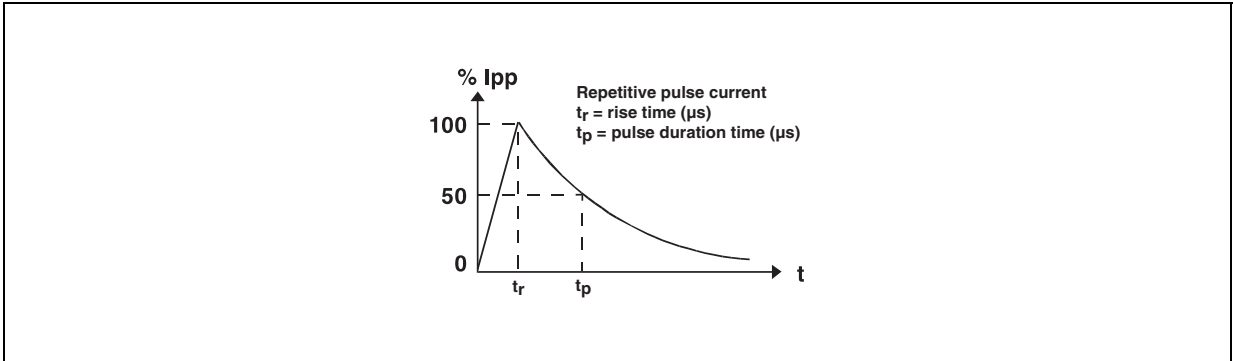
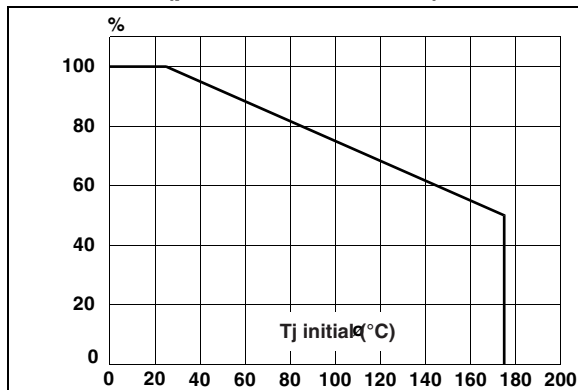


Table 3. Electrical characteristics - values ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

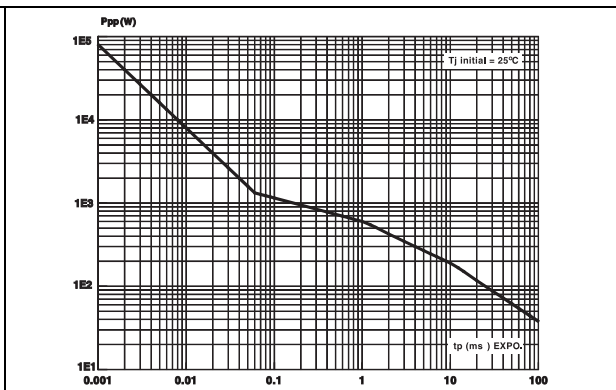
| Order code     |               | $I_{RM} @ V_{RM}^{(1)}$ |      | $V_{BR} @ I_R^{(2)}$ |     |      |    | $V_{CL} @ I_{PP}$<br>10/1000 $\mu\text{s}$ |      | $V_{CL} @ I_{PP}$<br>8/20 $\mu\text{s}$ |      | $\alpha T^{(3)}$           | $C^{(4)}$ |
|----------------|---------------|-------------------------|------|----------------------|-----|------|----|--------------------------------------------|------|-----------------------------------------|------|----------------------------|-----------|
|                |               | max                     |      | min                  | nom | max  |    | max                                        |      | max                                     |      | max                        | typ       |
| Unidirectional | Bidirectional | $\mu\text{A}$           | V    | V                    | V   | V    | mA | V                                          | A    | V                                       | A    | $10^{-4}/^{\circ}\text{C}$ | pF        |
| P6KE6V8A       | P6KE6V8CA     | 10                      | 5.8  | 6.45                 | 6.8 | 7.14 | 10 | 10.5                                       | 57   | 13.4                                    | 298  | 5.7                        | 4000      |
| P6KE7V5A       | P6KE7V5CA     | 10                      | 6.4  | 7.13                 | 7.5 | 7.88 | 10 | 11.3                                       | 53   | 14.5                                    | 276  | 6.1                        | 3700      |
| P6KE10A        | P6KE10CA      | 1                       | 8.55 | 9.5                  | 10  | 10.5 | 1  | 14.5                                       | 41   | 18.6                                    | 215  | 7.5                        | 2800      |
| P6KE12A        | P6KE12CA      | 0.5                     | 10   | 11.4                 | 12  | 12.6 | 1  | 16.7                                       | 36   | 21.7                                    | 184  | 7.8                        | 2300      |
| P6KE15A        | P6KE15CA      | 0.5                     | 13   | 14.3                 | 15  | 15.8 | 1  | 21.2                                       | 28   | 27.2                                    | 147  | 8.4                        | 1900      |
| P6KE18A        | P6KE18CA      | 0.5                     | 15   | 17.1                 | 18  | 18.9 | 1  | 25.2                                       | 24   | 32.5                                    | 123  | 8.8                        | 1600      |
| P6KE22A        | P6KE22CA      | 0.5                     | 19   | 20.9                 | 22  | 23.1 | 1  | 30.6                                       | 20   | 39.3                                    | 102  | 9.2                        | 1350      |
| P6KE24A        | P6KE24CA      | 0.5                     | 20   | 22.8                 | 24  | 25.2 | 1  | 33.2                                       | 18   | 42.8                                    | 93   | 9.4                        | 1250      |
| P6KE27A        | P6KE27CA      | 0.5                     | 23   | 25.7                 | 27  | 28.4 | 1  | 37.5                                       | 16   | 48.3                                    | 83   | 9.6                        | 1150      |
| P6KE30A        | P6KE30CA      | 0.5                     | 26   | 28.5                 | 30  | 31.5 | 1  | 41.5                                       | 14.5 | 53.5                                    | 75   | 9.7                        | 1075      |
| P6KE33A        | P6KE33CA      | 0.5                     | 28   | 31.4                 | 33  | 34.7 | 1  | 45.7                                       | 13.1 | 59                                      | 68   | 9.8                        | 1000      |
| P6KE36A        | P6KE36CA      | 0.5                     | 31   | 34.2                 | 36  | 37.8 | 1  | 49.9                                       | 12   | 64.3                                    | 62   | 9.9                        | 950       |
| P6KE39A        | P6KE39CA      | 0.5                     | 33   | 37.1                 | 39  | 41.0 | 1  | 53.9                                       | 11.1 | 69.7                                    | 57   | 10.0                       | 900       |
| P6KE47A        | P6KE47CA      | 0.5                     | 40   | 44.7                 | 47  | 49.4 | 1  | 64.8                                       | 9.3  | 84                                      | 48   | 10.1                       | 800       |
| P6KE56A        | P6KE56CA      | 0.5                     | 48   | 53.2                 | 56  | 58.8 | 1  | 77                                         | 7.8  | 100                                     | 40   | 10.3                       | 700       |
| P6KE68A        | P6KE68CA      | 0.5                     | 58   | 64.6                 | 68  | 71.4 | 1  | 92                                         | 6.5  | 121                                     | 33   | 10.4                       | 625       |
| P6KE82A        | P6KE82CA      | 0.5                     | 70   | 77.9                 | 82  | 86.1 | 1  | 113                                        | 5.3  | 146                                     | 27   | 10.5                       | 550       |
| P6KE100A       | P6KE100CA     | 0.5                     | 85   | 95.0                 | 100 | 105  | 1  | 137                                        | 4.4  | 178                                     | 22.5 | 10.6                       | 500       |
| P6KE120A       | P6KE120CA     | 0.5                     | 102  | 114                  | 120 | 126  | 1  | 165                                        | 3.6  | 212                                     | 19   | 10.7                       | 450       |
| P6KE150A       | P6KE150CA     | 0.5                     | 128  | 143                  | 150 | 158  | 1  | 207                                        | 2.9  | 265                                     | 15   | 10.8                       | 400       |
| P6KE180A       | P6KE180CA     | 0.5                     | 154  | 171                  | 180 | 189  | 1  | 246                                        | 2.4  | 317                                     | 12.6 | 10.8                       | 360       |
| P6KE200A       | P6KE200CA     | 0.5                     | 171  | 190                  | 200 | 210  | 1  | 274                                        | 2.2  | 353                                     | 11.3 | 10.8                       | 350       |
| P6KE220A       | P6KE220CA     | 0.5                     | 188  | 209                  | 220 | 231  | 1  | 328                                        | 1.85 | 388                                     | 10.3 | 10.8                       | 330       |
| P6KE250A       | P6KE250CA     | 0.5                     | 213  | 237                  | 250 | 263  | 1  | 344                                        | 1.75 | 442                                     | 9    | 11                         | 310       |
| P6KE300A       | P6KE300CA     | 0.5                     | 256  | 285                  | 300 | 315  | 1  | 414                                        | 1.45 | 529                                     | 7.6  | 11                         | 290       |
| P6KE350A       | P6KE350CA     | 0.5                     | 299  | 332                  | 350 | 368  | 1  | 482                                        | 1.25 | 618                                     | 6.5  | 11                         | 270       |
| P6KE400A       | P6KE400CA     | 0.5                     | 342  | 380                  | 400 | 420  | 1  | 548                                        | 1.1  | 706                                     | 5.7  | 11                         | 360       |
| P6KE440A       | P6KE440CA     | 0.5                     | 376  | 418                  | 440 | 462  | 1  | 603                                        | 1.0  | 776                                     | 5.2  | 11                         | 350       |

1. For bidirectional types having  $V_{RM} \leq 10\text{V}$ ,  $I_{RM}$  is multiplied by 2
2. Pulse test:  $t_p < 50\text{ ms}$ .
3.  $\Delta V_{BR} = \alpha T * (T_{amb} - 25) * V_{BR}(25^{\circ}\text{C})$ .
4.  $V_R = 0\text{ V}$ ,  $F = 1\text{ MHz}$ . For bidirectional types, capacitance value is divided by 2.

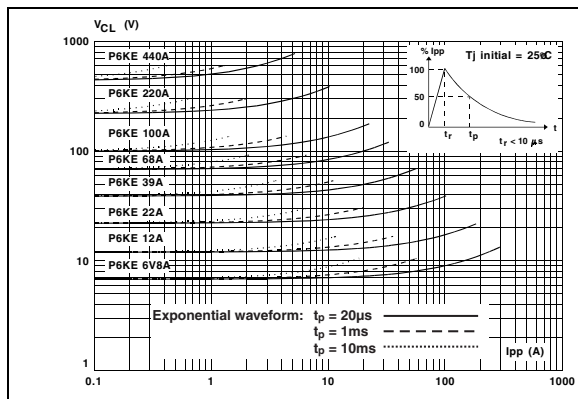
**Figure 3. Peak power dissipation vs. initial junction temperature (printed circuit board)**



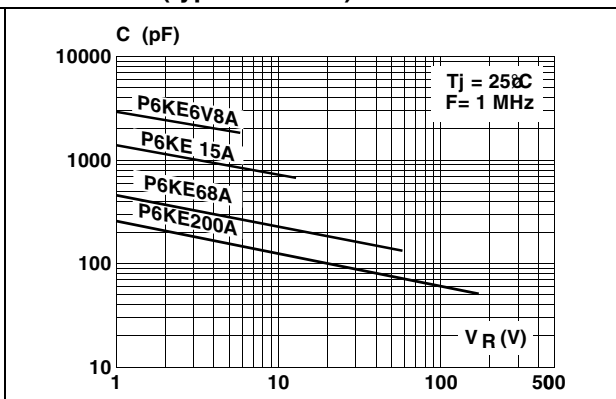
**Figure 4. Peak pulse power vs. exponential pulse duration.**



**Figure 5. Clamping voltage vs. peak pulse current<sup>(1)</sup>**

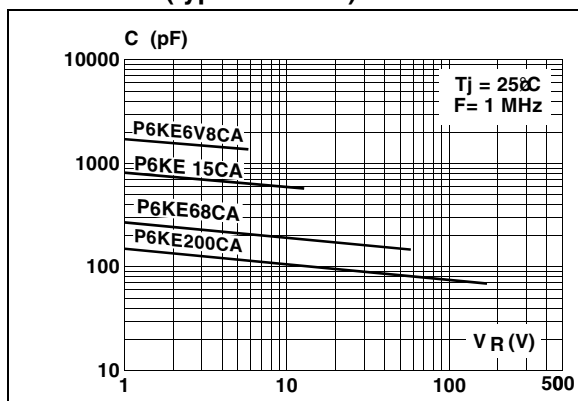


**Figure 6. Capacitance vs. reverse applied voltage for unidirectional types (typical values).**

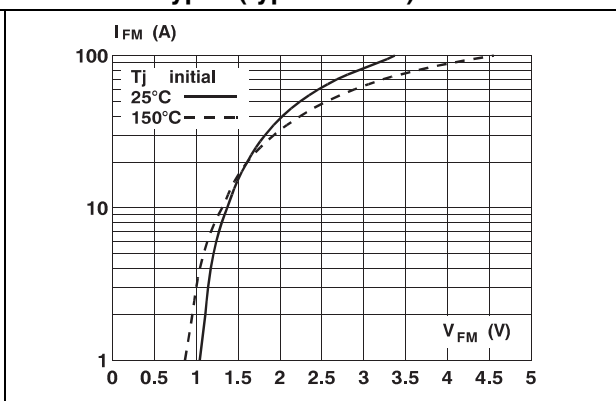


1. The curves in Figure 5 are specified for a junction temperature of 25°C before surge. The given results may be extrapolated for other junction temperatures by using the following formula :  $\Delta V_{BR} = \alpha T \times [T_{amb} - 25] \times V_{BR}(25^\circ C)$   
For intermediate voltages, extrapolate the given results.

**Figure 7. Capacitance vs. reverse applied voltage for bidirectional types (typical values).**



**Figure 8. Peak forward voltage drop vs. peak forward current for unidirectional types (typical value).<sup>(1)</sup>**



1. Multiply by 2 for units with  $V_{BR} > 220$  V.

Figure 9. Transient thermal impedance junction to ambient vs. pulse duration

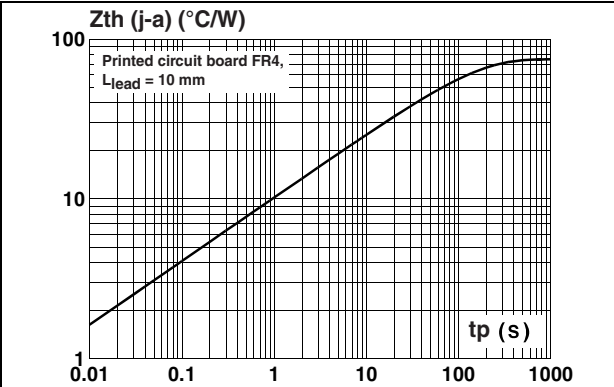
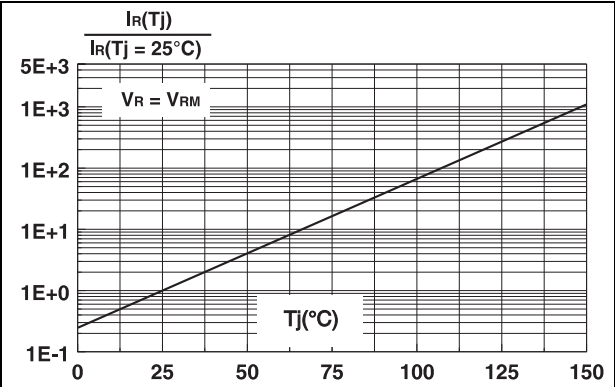
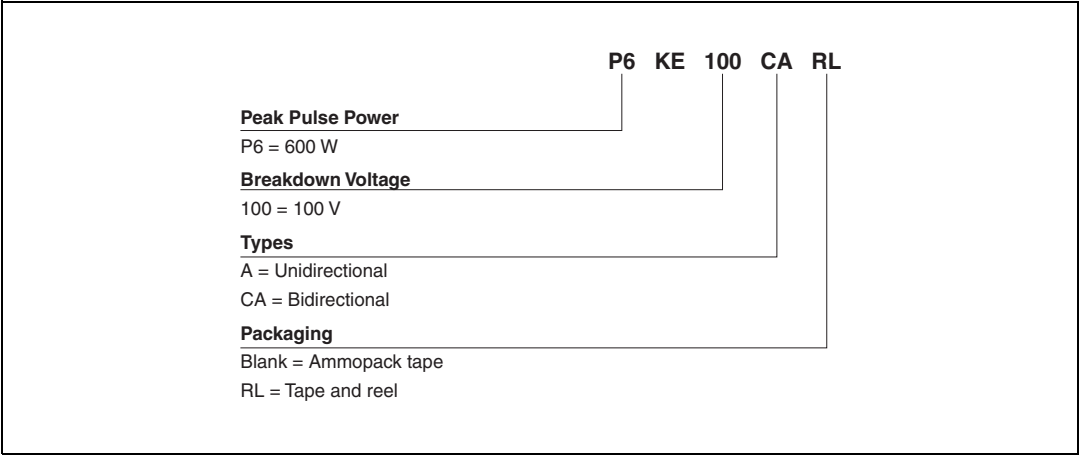


Figure 10. Relative variation of leakage current vs. junction temperature



## 2 Ordering information scheme

Figure 11. Ordering information scheme



## 3 Package information

- Epoxy meets UL94, V0
- Lead-free package

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](http://www.st.com). ECOPACK® is an ST trademark.

Table 4. DO-15 dimensions

| Ref. | Dimensions  |      |        |       |
|------|-------------|------|--------|-------|
|      | Millimeters |      | Inches |       |
|      | Min.        | Max. | Min.   | Max.  |
| A    | 6.05        | 6.75 | 0.238  | 0.266 |
| B    | 2.95        | 3.53 | 0.116  | 0.139 |
| C    | 26          | 31   | 1.024  | 1.220 |
| D    | 0.71        | 0.88 | 0.028  | 0.035 |

**Table 5. Marking**

| Unidirectional<br>order code | Marking <sup>(1)</sup>  | Bidirectional<br>order code | Marking <sup>(1)</sup>   |
|------------------------------|-------------------------|-----------------------------|--------------------------|
| P6KE6V8A                     | P6KE6V8A                | P6KE6V8CA                   | P6KE6V8CA                |
| P6KE7V5A                     | P6KE7V5A                | P6KE7V5CA                   | P6KE7V5CA                |
| P6KE10A                      | P6KE10A                 | P6KE10CA                    | P6KE10CA                 |
| P6KE12A                      | P6KE12A                 | P6KE12CA                    | P6KE12CA                 |
| P6KE15A                      | P6KE15A                 | P6KE15CA                    | P6KE15CA                 |
| P6KE18A                      | P6KE18A                 | P6KE18CA                    | P6KE18CA                 |
| P6KE22A                      | P6KE22A                 | P6KE22CA                    | P6KE22CA                 |
| P6KE24A                      | P6KE24A                 | P6KE24CA                    | P6KE24CA                 |
| P6KE27A                      | P6KE27A                 | P6KE27CA                    | P6KE27CA                 |
| P6KE30A                      | P6KE30A                 | P6KE30CA                    | P6KE30CA                 |
| P6KE33A                      | P6KE33A                 | P6KE33CA                    | P6KE33CA                 |
| P6KE36A                      | P6KE36A                 | P6KE36CA                    | P6KE36CA                 |
| P6KE39A                      | P6KE39A                 | P6KE39CA                    | P6KE39CA                 |
| P6KE47A                      | P6KE47A                 | P6KE47CA                    | P6KE47CA                 |
| P6KE56A                      | P6KE56A                 | P6KE56CA                    | P6KE56CA                 |
| P6KE68A                      | P6KE68A                 | P6KE68CA                    | P6KE68CA                 |
| P6KE82A                      | P6KE82A                 | P6KE82CA                    | P6KE82CA                 |
| P6KE100A                     | P6KE100A                | P6KE100CA                   | P6KE100CA                |
| P6KE120A                     | P6KE120A                | P6KE120CA                   | P6KE120CA                |
| P6KE150A                     | P6KE150A                | P6KE150CA                   | P6KE150CA <sup>(2)</sup> |
| P6KE180A                     | P6KE180A                | P6KE180CA                   | P6KE180CA                |
| P6KE200A                     | P6KE200A                | P6KE200CA                   | P6KE200CA                |
| P6KE220A                     | P6KE220A                | P6KE220CA                   | P6KE220CA                |
| P6KE250A                     | P6KE250A                | P6KE250CA                   | P6KE250CA                |
| P6KE300A                     | P6KE300A                | P6KE300CA                   | P6KE300CA                |
| P6KE350A                     | P6KE350A                | P6KE350CA                   | P6KE350CA                |
| P6KE400A                     | P6KE400A <sup>(2)</sup> | P6KE400CA                   | P6KE400CA                |
| P6KE440A                     | P6KE440A <sup>(2)</sup> | P6KE440CA                   | P6KE440CA                |

1. Includes a space character after P6KE for ECOPACK2 compliant devices

2. Includes a space character after P6KE for ECOPACK1 compliant devices in tape and reel packaging.

## 4 Ordering information

**Table 6. Ordering information**

| Order code | Marking <sup>(1)</sup>      | Package | Weight | Base qty | Delivery mode |
|------------|-----------------------------|---------|--------|----------|---------------|
| P6KExxxx   | See <a href="#">Table 5</a> | DO-15   | 0.4 g  | 1000     | Ammopack      |
| P6KExxxxRL |                             |         |        | 6000     | Tape and reel |

1. Logo, date code, type code, cathode band (for unidirectional types only).

## 5 Revision history

**Table 7. 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 $V_{BR} \geq 200V$ .<br>2/ Types table on page 2: $I_{PP}$ (@ 10/1000 $\mu$ s) changed for P6KE220xx to P6KE440xx                                         |
| 14-Sep-2011 | 6        | Updated $I_{RM}$ @ $V_{RM}$ values, $V_{BRmax}$ @ $I_R$ for P6KE33 and order codes in <a href="#">Table 3</a> . Updated footnotes to <a href="#">Table 5</a> .<br>Updated $T_L$ temperature in <a href="#">Table 1</a> . |
| 26-Apr-2012 | 7        | Corrected typographical area <a href="#">Table 3</a> .                                                                                                                                                                   |

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