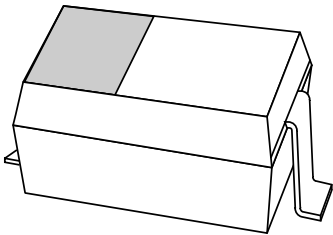


# DATA SHEET



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## **BZX399 series** Voltage regulator diodes

Product specification

1999 Jun 04

# Voltage regulator diodes

# BZX399 series

### FEATURES

- Total power dissipation: max. 300 mW
- Tolerance:  $\pm 5\%$
- Working voltage range: nom. 1.8 to 43 V (E24 range)
- Improved  $I_Z/V_Z$  characteristic at low currents ( $I_Z = 50 \mu A$ ). This results in a noise free and sharp breakdown knee.

### APPLICATIONS

- General regulation functions, where low noise at low currents is required
- Low power consumption applications (e.g. hand-held applications).

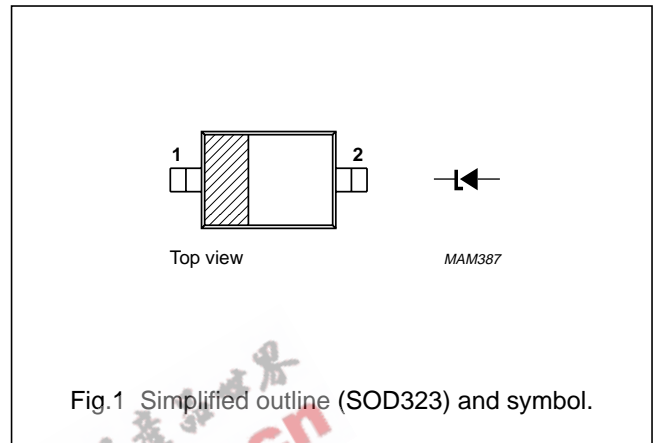
### DESCRIPTION

Low-power low noise voltage regulator diodes in SOD323 plastic SMD package.

The diodes are available in the normalized E24  $\pm 5\%$  tolerance range. The series consists of 34 types with nominal working voltages from 1.8 to 43 V.

### PINNING

| PIN | DESCRIPTION |
|-----|-------------|
| 1   | cathode     |
| 2   | anode       |



### MARKING

| TYPE NUMBER | MARKING CODE | TYPE NUMBER | MARKING CODE | TYPE NUMBER | MARKING CODE | TYPE NUMBER | MARKING CODE |
|-------------|--------------|-------------|--------------|-------------|--------------|-------------|--------------|
| BZX399-C1V8 | B1           | BZX399-C4V3 | B0           | BZX399-C10  | BJ           | BZX399-C24  | BT           |
| BZX399-C2V0 | B2           | BZX399-C4V7 | BA           | BZX399-C11  | BK           | BZX399-C27  | BU           |
| BZX399-C2V2 | B3           | BZX399-C5V1 | BB           | BZX399-C12  | BL           | BZX399-C30  | BV           |
| BZX399-C2V4 | B4           | BZX399-C5V6 | BC           | BZX399-C13  | BM           | BZX399-C33  | BW           |
| BZX399-C2V7 | B5           | BZX399-C6V2 | BD           | BZX399-C15  | BN           | BZX399-C36  | BX           |
| BZX399-C3V0 | B6           | BZX399-C6V8 | BE           | BZX399-C16  | BP           | BZX399-C39  | BY           |
| BZX399-C3V3 | B7           | BZX399-C7V5 | BF           | BZX399-C18  | BQ           | BZX399-C43  | BZ           |
| BZX399-C3V6 | B8           | BZX399-C8V2 | BG           | BZX399-C20  | BR           |             |              |
| BZX399-C3V9 | B9           | BZX399-C9V1 | BH           | BZX399-C22  | BS           |             |              |

## Voltage regulator diodes

## BZX399 series

**LIMITING VALUES**

In accordance with the Absolute Maximum Rating System (IEC 134).

| SYMBOL           | PARAMETER                           | CONDITIONS  | MIN.               | MAX. | UNIT             |
|------------------|-------------------------------------|---|--------------------|------|------------------|
| $I_F$            | continuous forward current          |   | –                  | 250  | mA               |
| $I_{ZSM}$        | non-repetitive peak reverse current | $t_p = 100 \mu\text{s}$ ; square wave;<br>$T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ prior to surge | see Tables 1 and 2 |      |                  |
| $P_{\text{tot}}$ | total power dissipation             | $T_{\text{amb}} = 25 \text{ }^\circ\text{C}$ ; note 1   | –                  | 300  | mW               |
| $T_{\text{stg}}$ | storage temperature                 |   | –65                | +150 | $^\circ\text{C}$ |
| $T_j$            | junction temperature                |   | –                  | 150  | $^\circ\text{C}$ |

**Note**

1. Device mounted on a FR4 printed circuit-board.

**ELECTRICAL CHARACTERISTICS****Total BZX399-C series**

$T_j = 25 \text{ }^\circ\text{C}$  unless otherwise specified.

| SYMBOL           | PARAMETER                  | CONDITIONS                         | MAX.          | UNIT          |
|------------------|----------------------------|------------------------------------|---------------|---------------|
| $V_F$            | forward voltage            | $I_F = 10 \text{ mA}$ ; see Fig.5  | 0.9           | V             |
|                  |                            | $I_F = 100 \text{ mA}$ ; see Fig.5 | 1.0           | V             |
| $I_R$            | reverse current            |                                    |               |               |
|                  | BZX399-C1V8                | $V_R = 1 \text{ V}$                | 2             | $\mu\text{A}$ |
|                  | BZX399-C2V0                | $V_R = 1 \text{ V}$                | 1             | $\mu\text{A}$ |
|                  | BZX399-C2V2                | $V_R = 1 \text{ V}$                | 0.5           | $\mu\text{A}$ |
|                  | BZX399-C2V4                | $V_R = 1 \text{ V}$                | 0.2           | $\mu\text{A}$ |
|                  | BZX399-C2V7                | $V_R = 1 \text{ V}$                | 0.05          | $\mu\text{A}$ |
|                  | BZX399-C3V0                | $V_R = 1 \text{ V}$                | 0.02          | $\mu\text{A}$ |
|                  | BZX399-C3V3                | $V_R = 2 \text{ V}$                | 2             | $\mu\text{A}$ |
|                  | BZX399-C3V6                | $V_R = 2 \text{ V}$                | 1             | $\mu\text{A}$ |
|                  | BZX399-C3V9                | $V_R = 2 \text{ V}$                | 0.5           | $\mu\text{A}$ |
|                  | BZX399-C4V3                | $V_R = 2 \text{ V}$                | 0.1           | $\mu\text{A}$ |
|                  | BZX399-C4V7                | $V_R = 3 \text{ V}$                | 2             | $\mu\text{A}$ |
|                  | BZX399-C5V1                | $V_R = 3 \text{ V}$                | 1             | $\mu\text{A}$ |
|                  | BZX399-C5V6                | $V_R = 4 \text{ V}$                | 1             | $\mu\text{A}$ |
|                  | BZX399-C6V2                | $V_R = 5 \text{ V}$                | 0.1           | $\mu\text{A}$ |
|                  | BZX399-C6V8                | $V_R = 5 \text{ V}$                | 0.01          | $\mu\text{A}$ |
|                  | BZX399-C7V5                | $V_R = 5 \text{ V}$                | 0.1           | $\mu\text{A}$ |
|                  | BZX399-C8V2                | $V_R = 6 \text{ V}$                | 0.2           | $\mu\text{A}$ |
|                  | BZX399-C9V1                | $V_R = 7 \text{ V}$                | 0.1           | $\mu\text{A}$ |
|                  | BZX399-C10                 | $V_R = 7 \text{ V}$                | 0.1           | $\mu\text{A}$ |
| BZX399-C11       | $V_R = 8 \text{ V}$        | 0.05                               | $\mu\text{A}$ |               |
| BZX399-C12       | $V_R = 9 \text{ V}$        | 0.05                               | $\mu\text{A}$ |               |
| BZX399-C13       | $V_R = 10 \text{ V}$       | 0.05                               | $\mu\text{A}$ |               |
| BZX399-C15 to 43 | $V_R = 0.7V_{Z\text{nom}}$ | 0.01                               | $\mu\text{A}$ |               |

## Voltage regulator diodes

## BZX399 series

**Table 1** Per type BZX399-C1V8 to C15 $T_j = 25\text{ °C}$  unless otherwise specified.

| BZX399-C<br>XXX | WORKING<br>VOLTAGE<br>$V_Z$ (V)<br>$I_Z = 50\ \mu\text{A}$ |       | VOLTAGE<br>CHANGE<br>$\Delta V_Z$ (V)<br>(note 1) | TEMP. COEFF.<br>$S_Z$ (mV/K)<br>$I_Z = 50\ \mu\text{A}$<br>(see Figs 2, 3 and 4) | DIODE CAP.<br>$C_d$ (pF)<br>at $f = 1\ \text{MHz}$ ;<br>$V_R = 0\ \text{V}$ | NON-REPETITIVE PEAK<br>REVERSE CURRENT<br>$I_{ZSM}$ (A) at $t_p = 100\ \mu\text{s}$ ;<br>$T_{amb} = 25\text{ °C}$ |
|-----------------|--|-------|---|--|---|---|
|                 | Tol. $\pm 5\%$   |       |   |  |   |   |
|                 | MIN.   | MAX.  | MAX.  | TYP.   | MAX.  | MAX.  |
| 1V8             | 1.71   | 1.89  | 0.65  | -0.85  | 425   | 6.0   |
| 2V0             | 1.90   | 2.10  | 0.70  | -0.95  | 410   | 6.0   |
| 2V2             | 2.09   | 2.31  | 0.75  | -1.05  | 390   | 6.0   |
| 2V4             | 2.28   | 2.52  | 0.80  | -1.15  | 370   | 6.0   |
| 2V7             | 2.57   | 2.84  | 0.85  | -1.35  | 350   | 6.0   |
| 3V0             | 2.85   | 3.15  | 0.90  | -1.50  | 325   | 6.0   |
| 3V3             | 3.14   | 3.47  | 0.93  | -1.65  | 310   | 6.0   |
| 3V6             | 3.42   | 3.78  | 0.95  | -1.80  | 300   | 6.0   |
| 3V9             | 3.71   | 4.10  | 0.97  | -1.95  | 290   | 6.0   |
| 4V3             | 4.09   | 4.52  | 0.99  | -2.05  | 280   | 6.0   |
| 4V7             | 4.47   | 4.94  | 0.97  | -1.90  | 275   | 6.0   |
| 5V1             | 4.85   | 5.36  | 0.60  | 0.15   | 300   | 5.0   |
| 5V6             | 5.32   | 5.88  | 0.20  | 1.75   | 275   | 4.0   |
| 6V2             | 5.89   | 6.51  | 0.10  | 2.35   | 250   | 3.0   |
| 6V8             | 6.46   | 7.14  | 0.10  | 3.00   | 215   | 3.0   |
| 7V5             | 7.13   | 7.88  | 0.15  | 3.60   | 170   | 3.0   |
| 8V2             | 7.79   | 8.61  | 0.15  | 4.25   | 150   | 3.0   |
| 9V1             | 8.65   | 9.56  | 0.10  | 5.00   | 120   | 3.0   |
| 10              | 9.50   | 10.50 | 0.10  | 5.80   | 110   | 3.0   |
| 11              | 10.45  | 11.55 | 0.11  | 6.70   | 110   | 2.5   |
| 12              | 11.40  | 12.60 | 0.12  | 7.65   | 105   | 2.5   |
| 13              | 12.35  | 13.65 | 0.13  | 8.60   | 105   | 2.5   |
| 15              | 14.25  | 15.75 | 0.15  | 10.50  | 100   | 2.0   |

**Note**1.  $\Delta V_Z = V_Z$  at  $100\ \mu\text{A}$  minus  $V_Z$  at  $10\ \mu\text{A}$ .

## Voltage regulator diodes

## BZX399 series

**Table 2** Per type BZX399-C16 to C43 $T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified.

| BZX399- C<br>XXX | WORKING<br>VOLTAGE<br>$V_Z$ (V)<br>$I_Z = 50\ \mu\text{A}$ |       | VOLTAGE<br>CHANGE<br>$\Delta V_Z$ (V)<br>(note 1) | TEMP. COEFF.<br>$S_Z$ (mV/K)<br>$I_Z = 50\ \mu\text{A}$<br>(see Fig.4) | DIODE CAP.<br>$C_d$ (pF)<br>at $f = 1\ \text{MHz}$ ;<br>$V_R = 0\ \text{V}$ | NON-REPETITIVE PEAK<br>REVERSE CURRENT<br>$I_{ZSM}$ (A) at $t_p = 100\ \mu\text{s}$ ;<br>$T_{\text{amb}} = 25\text{ }^\circ\text{C}$ |
|------------------|--|-------|---|--|---|--|
|                  | Tol. $\pm 5\%$   |       |   |  |   |  |
|                  | MIN.   | MAX.  | MAX.  | TYP.   | MAX.  | MAX.   |
| 16               | 15.20  | 16.80 | 0.16  | 11.4   | 95  | 1.5  |
| 18               | 17.10  | 18.90 | 0.18  | 13.3   | 95  | 1.5  |
| 20               | 19.00  | 21.00 | 0.20  | 15.3   | 90  | 1.5  |
| 22               | 20.90  | 23.10 | 0.22  | 17.2   | 85  | 1.25   |
| 24               | 22.80  | 25.20 | 0.24  | 19.2   | 80  | 1.25   |
| 27               | 25.65  | 28.35 | 0.27  | 22.0   | 75  | 1.0  |
| 30               | 28.50  | 31.50 | 0.30  | 25.2   | 65  | 1.0  |
| 33               | 31.35  | 34.65 | 0.30  | 28.5   | 60  | 0.9  |
| 36               | 34.20  | 37.80 | 0.30  | 32.0   | 60  | 0.8  |
| 39               | 37.05  | 40.95 | 0.30  | 35.1   | 60  | 0.7  |
| 43               | 40.85  | 45.15 | 0.30  | 39.4   | 55  | 0.6  |

**Note**

- $\Delta V_Z = V_Z$  at  $100\ \mu\text{A}$  minus  $V_Z$  at  $10\ \mu\text{A}$ .

**THERMAL CHARACTERISTICS**

| SYMBOL        | PARAMETER   | CONDITIONS | VALUE | UNIT |
|---------------|---|------------|-------|------|
| $R_{th\ j-a}$ | thermal resistance from junction to ambient         | note 1     | 415   | K/W  |
| $R_{th\ j-s}$ | thermal resistance from junction to soldering point | note 2     | 110   | K/W  |

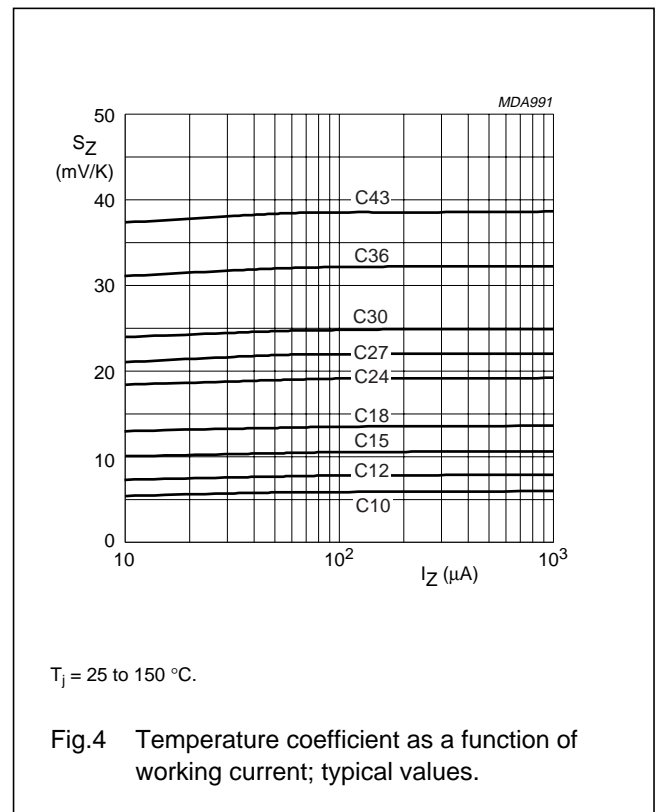
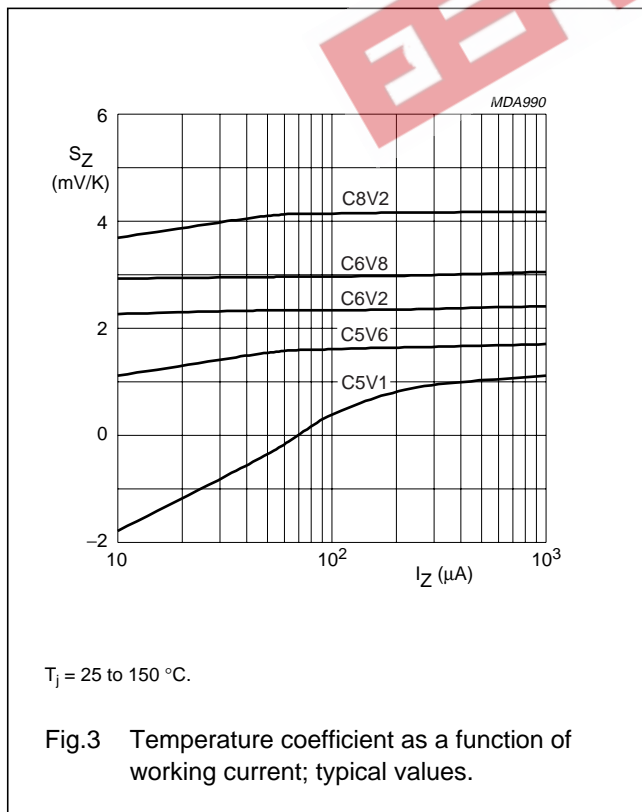
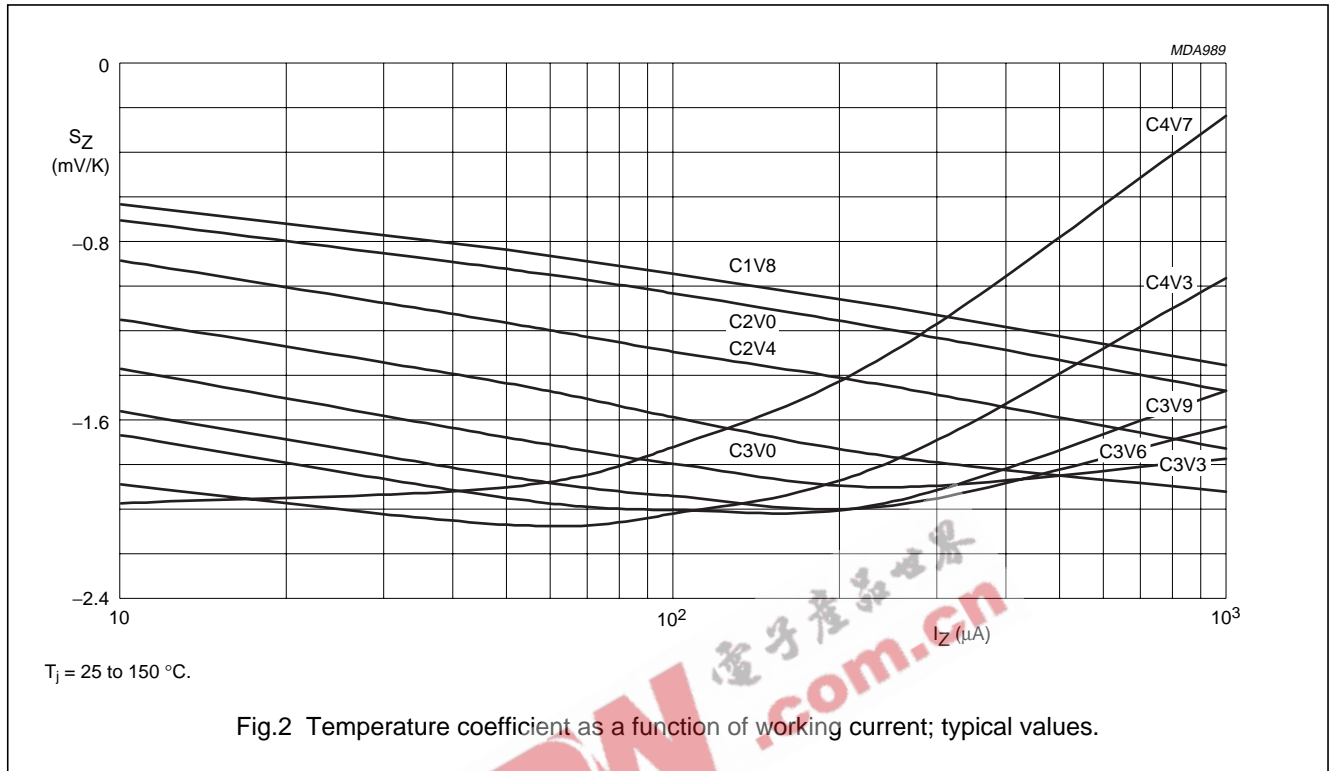
**Notes**

- Device mounted on a FR4 printed circuit-board.
- Soldering point of the cathode tab.

Voltage regulator diodes

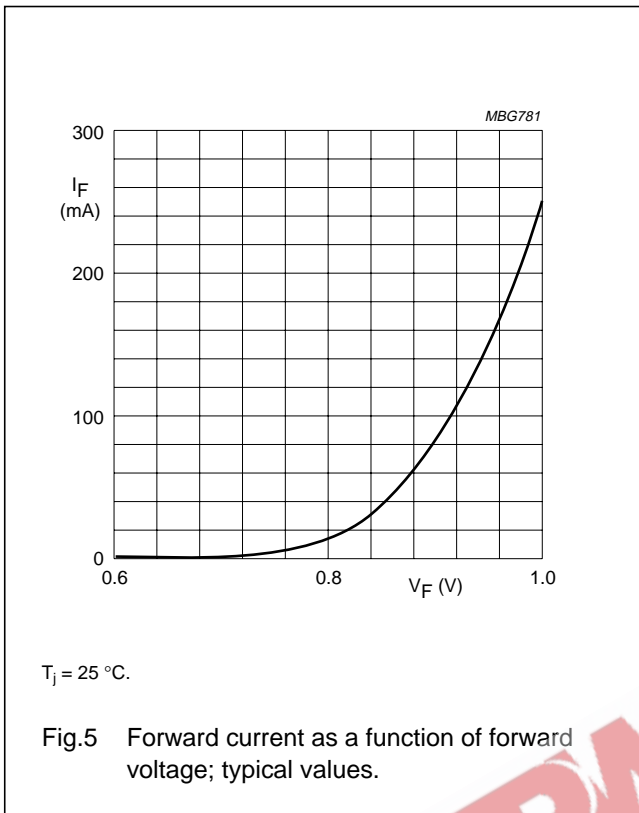
BZX399 series

GRAPHICAL DATA



Voltage regulator diodes

BZX399 series



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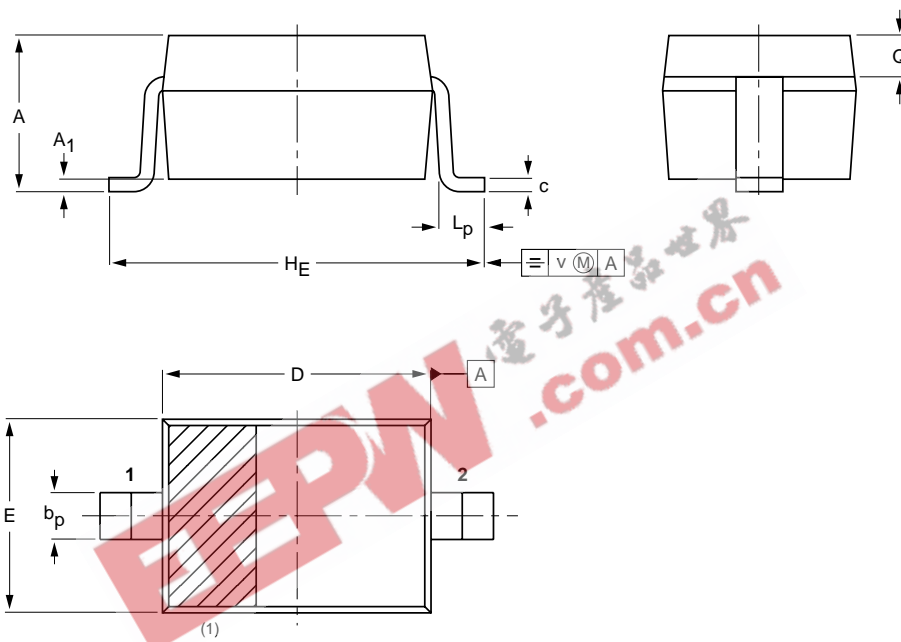
Voltage regulator diodes

BZX399 series

PACKAGE OUTLINE

Plastic surface mounted package; 2 leads

SOD323



DIMENSIONS (mm are the original dimensions)

| UNIT | A          | A <sub>1</sub><br>max. | b <sub>p</sub> | c            | D          | E            | H <sub>E</sub> | L <sub>p</sub> | Q            | v   |
|------|------------|------------------------|----------------|--------------|------------|--------------|----------------|----------------|--------------|-----|
| mm   | 1.1<br>0.8 | +0.05<br>-0.05         | 0.40<br>0.25   | 0.25<br>0.10 | 1.8<br>1.6 | 1.35<br>1.15 | 2.7<br>2.3     | 0.45<br>0.15   | 0.25<br>0.15 | 0.2 |

Note

1. The marking bar indicates the cathode.

| OUTLINE VERSION | REFERENCES |       |      | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|-------|------|---------------------|------------|
|                 | IEC        | JEDEC | EIAJ |                     |            |
| SOD323          |            |       |      |                     | 98-09-14   |



## Voltage regulator diodes

## BZX399 series

**DEFINITIONS**

|   |   |
|---|---|
| <b>Data sheet status</b>  |   |
| Objective specification   | This data sheet contains target or goal specifications for product development.       |
| Preliminary specification   | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification   | This data sheet contains final product specifications.                                |
| <b>Limiting values</b>  |   |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability. |   |
| <b>Application information</b>  |   |
| Where application information is given, it is advisory and does not form part of the specification.   |   |

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Voltage regulator diodes

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NOTES



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NOTES



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Printed in The Netherlands

115002/01/pp12

Date of release: 1999 Jun 04

Document order number: 9397 750 06054

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