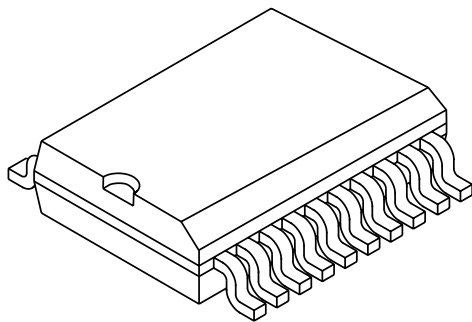


DATA SHEET



BZA109 9-fold ESD transient voltage suppressor

Product specification
Supersedes data of 1997 Oct 27
File under Discrete Semiconductors, SC01

1997 Dec 01

9-fold ESD transient voltage suppressor

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FEATURES

- ESD rating >8 kV, according to IEC1000-4-2
- SOT163-1 surface mount package
- Common anode configuration
- Non-clamping range 0.5 to 6.8 V
- Maximum non-repetitive peak reverse power dissipation: 25 W at $t_p = 1$ ms
- Maximum clamping voltage at peak pulse current: 10 V at $I_{ZSM} = 2.5$ A.

APPLICATIONS

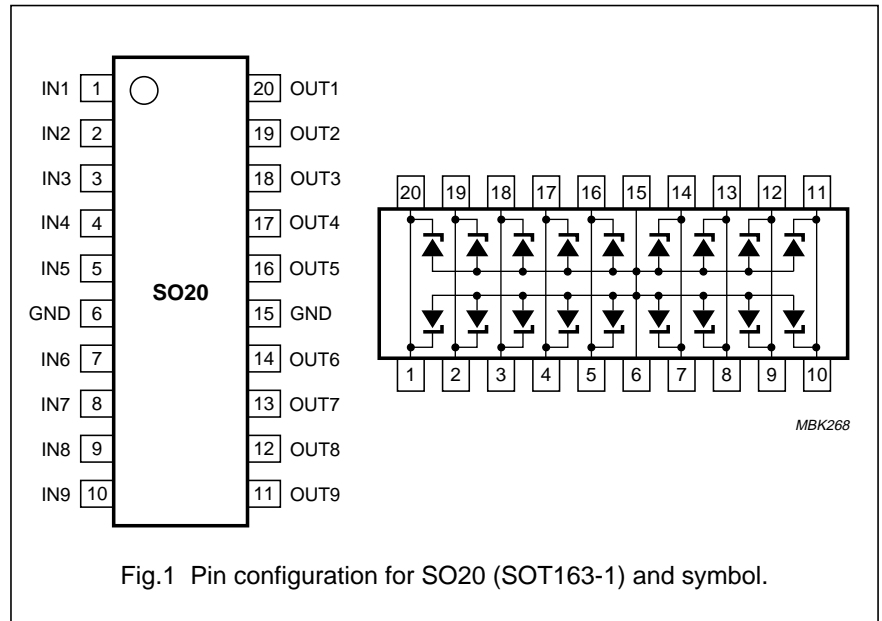
- For 9-bit wide undershoot/overshoot clamping and fast ESD transient suppression in:
 - Computers and peripherals
 - Audio and video equipment
 - Business machines
 - Communication systems
 - Medical equipment.

DESCRIPTION

9-fold monolithic transient voltage suppressor in an SO20; SOT163-1 surface mount package. The device is ideal in situations where board space is a premium.

PINNING

| PIN | DESCRIPTION |
|----------|-----------------------|
| 1 to 5 | input (IN1 to IN5) |
| 6 and 15 | common anode (GND) |
| 7 to 10 | input (IN6 to IN9) |
| 11 to 14 | output (OUT9 to OUT6) |
| 16 to 20 | output (OUT5 to OUT1) |



LIMITING VALUES

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

| SYMBOL | PARAMETER | CONDITIONS | MIN. | MAX. | UNIT |
|------------------|---|---|------|------|------------------|
| Per diode | | | | | |
| I_Z | working current | $T_{amb} = 25\text{ }^\circ\text{C}$ | – | 20 | mA |
| I_F | continuous forward current | $T_{amb} = 25\text{ }^\circ\text{C}$ | – | 100 | mA |
| I_{FT} | feed-through current | $T_{amb} = 25\text{ }^\circ\text{C}$; note 1 | – | 100 | mA |
| I_{FSM} | non-repetitive peak forward current | $t_p = 1$ ms; square pulse | – | 4.5 | A |
| I_{ZSM} | non-repetitive peak reverse current | $t_p = 1$ ms; square pulse; see Fig.2 | – | 2.5 | A |
| P_{tot} | total power dissipation | $T_{amb} \leq 25\text{ }^\circ\text{C}$; note 2; see Fig.3 | – | 1.25 | W |
| P_{ZSM} | non-repetitive peak reverse power dissipation | $t_p = 1$ ms; square pulse; see Fig.4 | – | 25 | W |
| T_{stg} | storage temperature | | –65 | +150 | $^\circ\text{C}$ |
| T_j | operating junction temperature | | –65 | +150 | $^\circ\text{C}$ |

Notes

1. Current is flowing from input to corresponding output.
2. One or more diodes loaded.

9-fold ESD transient voltage suppressor

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THERMAL CHARACTERISTICS

| SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT |
|---------------|---|---------------------------|-------|------|
| $R_{th\ j-a}$ | thermal resistance from junction to ambient | one or more diodes loaded | 100 | K/W |

ELECTRICAL CHARACTERISTICS $T_j = 25\text{ °C}$ unless otherwise specified.

| SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|------------------|--|---|------|------|------|---------------|
| Per diode | | | | | | |
| V_Z | working voltage | $I_Z = 250\ \mu\text{A}$ | 6.4 | 6.8 | 7.2 | V |
| V_F | forward voltage | $I_F = 100\ \text{mA}$ | – | – | 1.1 | V |
| V_{ZSM} | non-repetitive peak reverse voltage | $I_{ZSM} = 2.5\ \text{A}; t_p = 1\ \text{ms}$ | – | – | 10 | V |
| I_H | input high current | $V_{IN} = 5.25\ \text{V}$ | – | – | 0.5 | μA |
| r_{dif} | differential resistance | $I_Z = 250\ \mu\text{A}$ | – | – | 100 | Ω |
| S_Z | temperature coefficient of working voltage | $I_Z = 5\ \text{mA}$ | – | 3 | – | mV/K |
| C_d | diode capacitance | see Fig.5 $V_R = 0; f = 1\ \text{MHz}$ | – | – | 200 | pF |
| | | $V_R = 5.25\ \text{V}; f = 1\ \text{MHz}$ | – | – | 100 | pF |

9-fold ESD transient voltage suppressor

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GRAPHICAL DATA

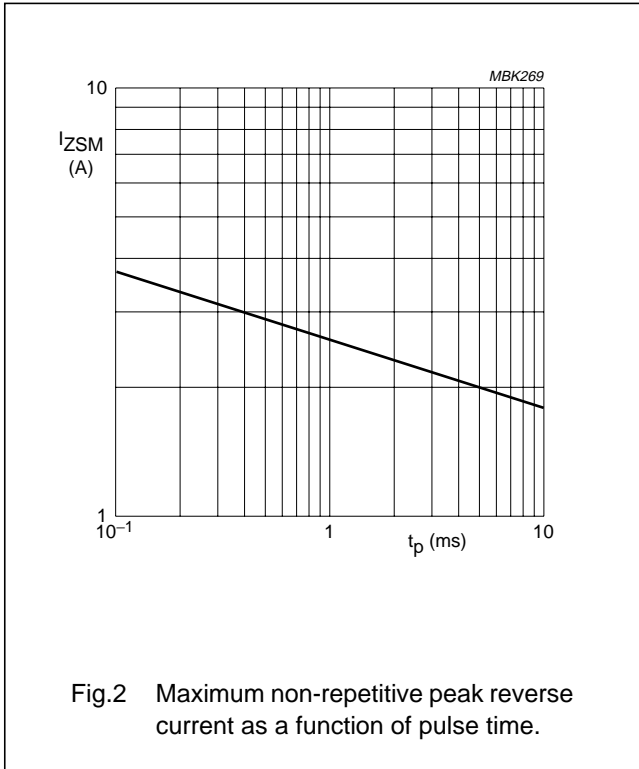
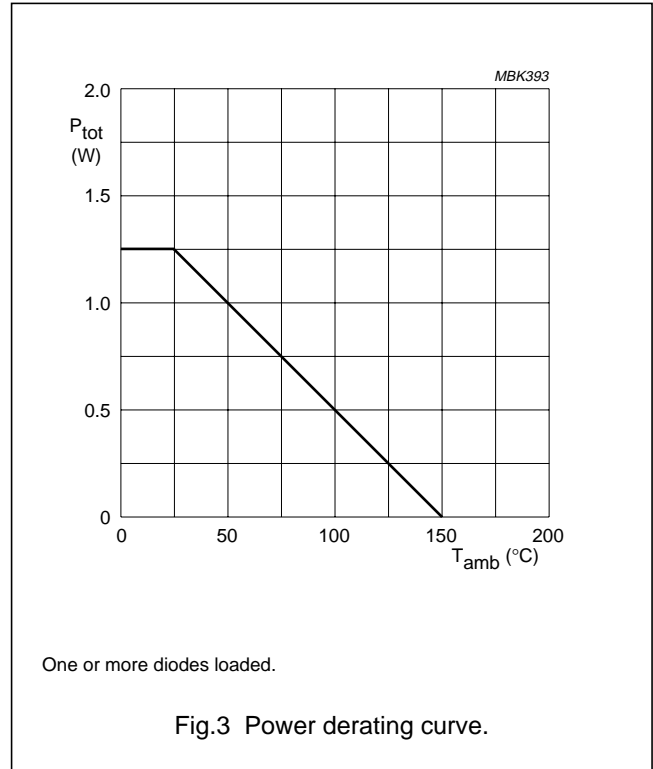


Fig.2 Maximum non-repetitive peak reverse current as a function of pulse time.



One or more diodes loaded.

Fig.3 Power derating curve.

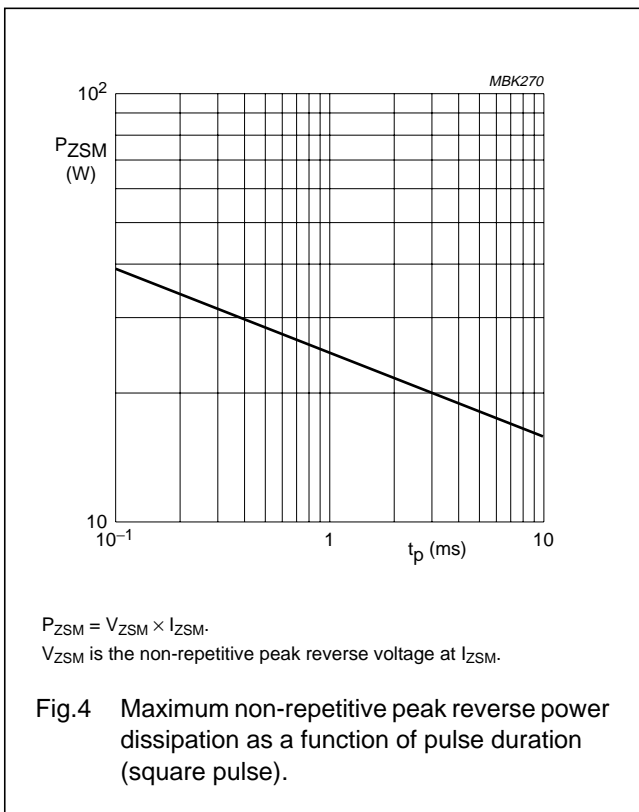


Fig.4 Maximum non-repetitive peak reverse power dissipation as a function of pulse duration (square pulse).

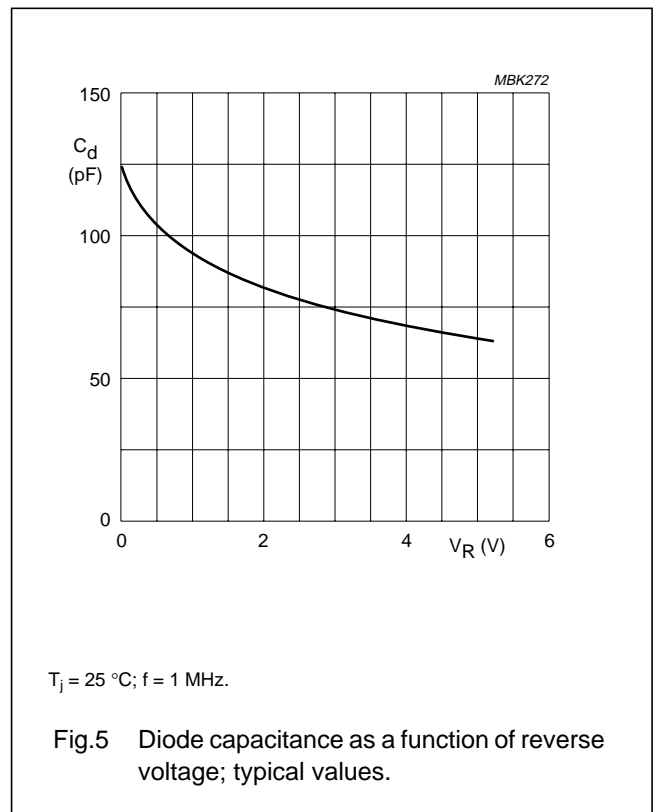
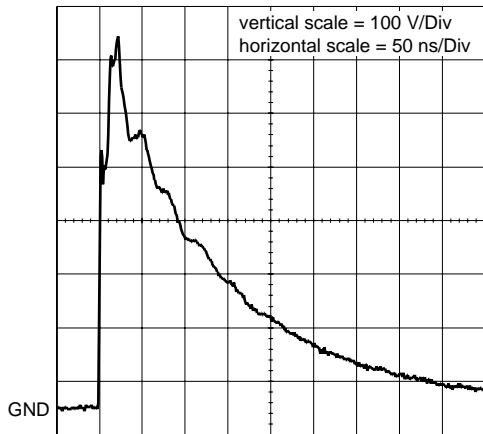
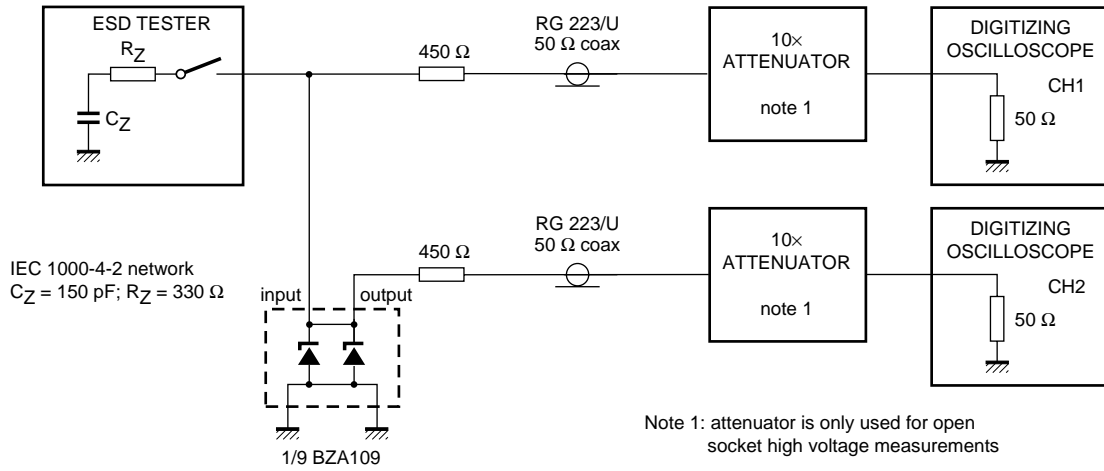


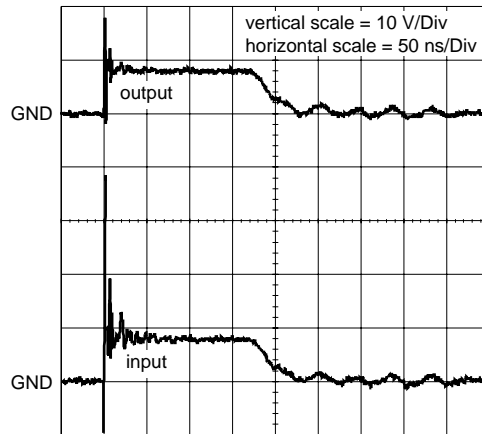
Fig.5 Diode capacitance as a function of reverse voltage; typical values.

9-fold ESD transient voltage suppressor

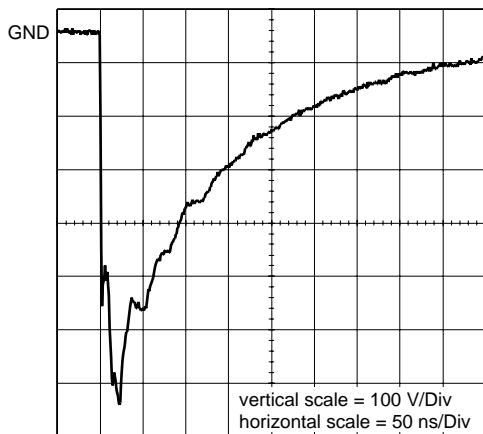
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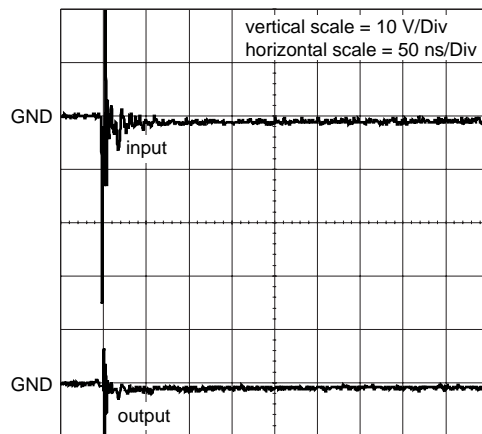
unclamped +1 kV ESD voltage waveform (IEC1000-4-2 network)



clamped +1 kV ESD voltage waveform (IEC1000-4-2 network)



unclamped -1 kV ESD voltage waveform (IEC1000-4-2 network)



clamped -1 kV ESD voltage waveform (IEC1000-4-2 network)

MBK273

Fig.6 ESD clamping test set-up and waveforms.

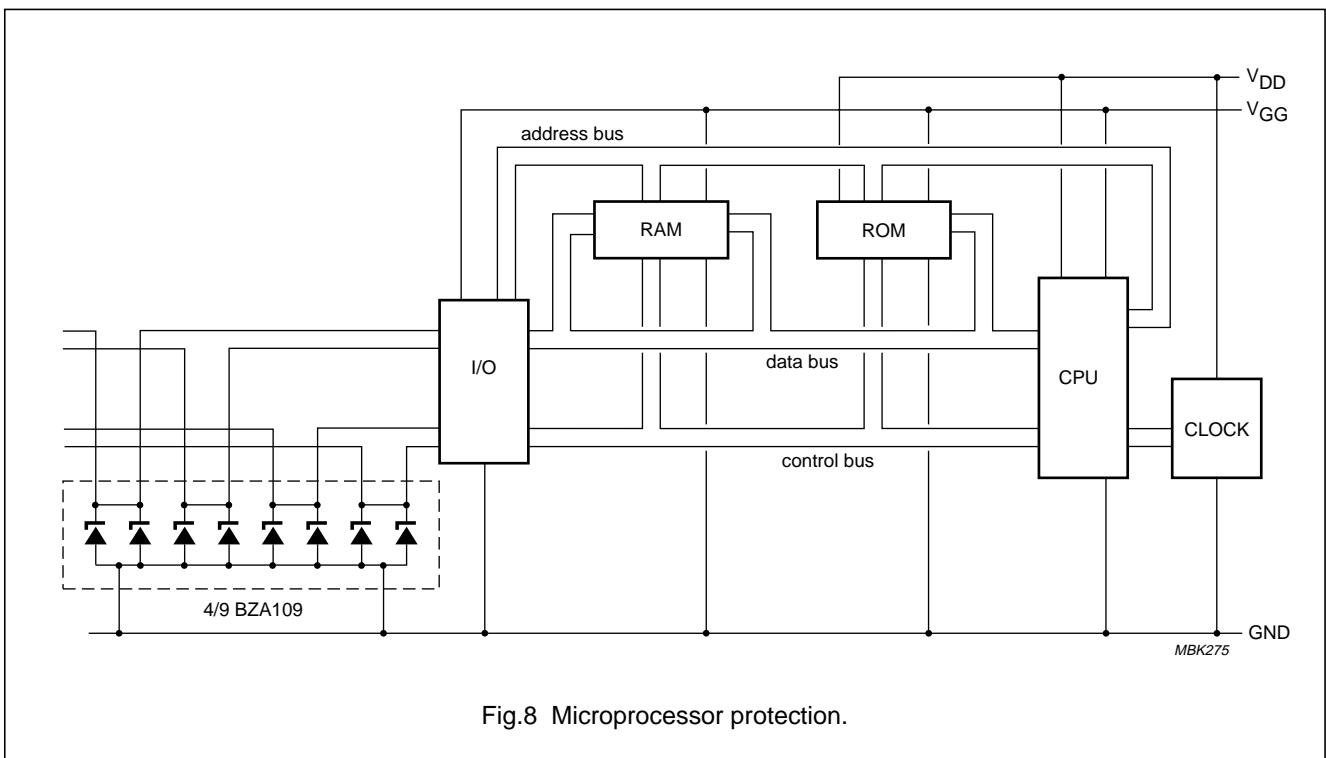
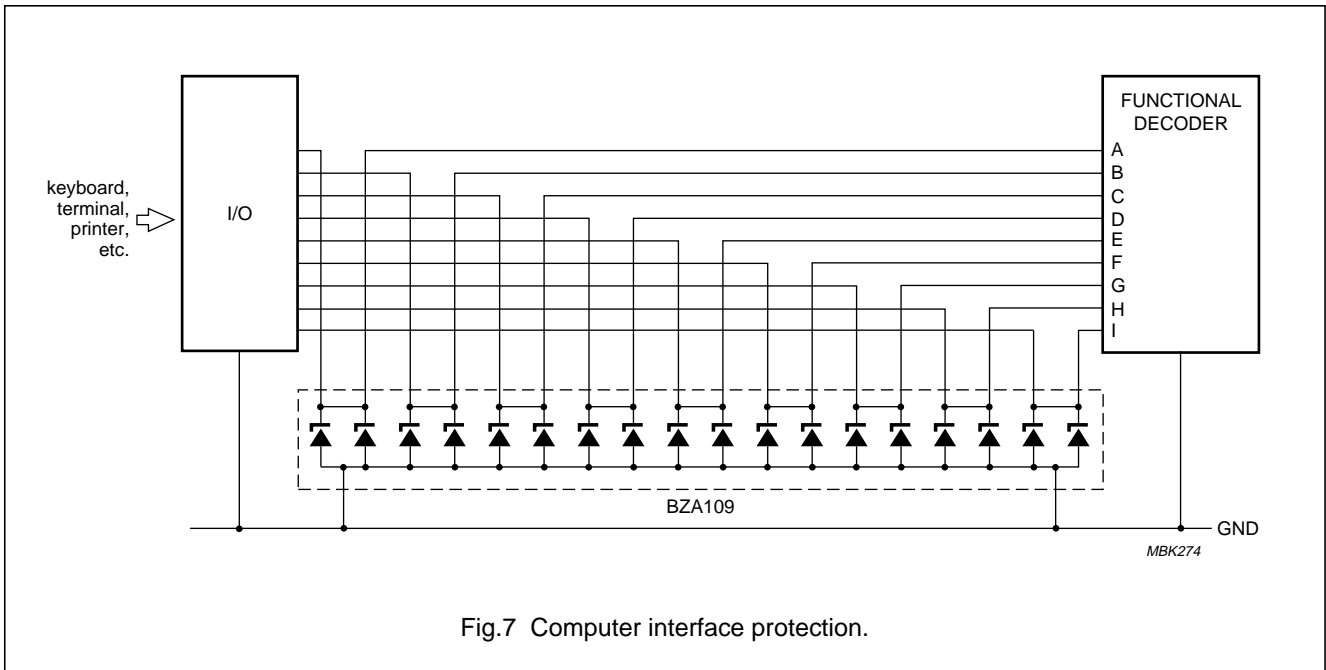
9-fold ESD transient voltage suppressor

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APPLICATION INFORMATION

Typical common anode application

A 9-fold transient suppressor in an SO20; SOT163-1 package makes it possible to protect nine separate lines using only one package. Two simplified examples are shown in Figs 7 and 8.



9-fold ESD transient voltage suppressor

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Device placement and printed-circuit board layout

Circuit board layout is of extreme importance in the suppression of transients. The clamping voltage of the BZA109 is determined by the peak transient current and the rate of rise of that current (di/dt). Since parasitic inductances can further add to the clamping voltage ($V = L di/dt$) the series conductor lengths on the printed-circuit board should be kept to a minimum. This includes the lead length of the suppression element.

In addition to minimizing conductor length the following printed-circuit board layout guidelines are recommended:

1. Place the suppression element close to the input terminals or connectors.
2. Keep parallel signal paths to a minimum.
3. Avoid running protection conductors in parallel with unprotected conductors.
4. Minimize all printed-circuit board loop areas including power and ground loops.
5. Minimize the length of the transient return path to ground.
6. Avoid using shared transient return paths to a common ground point.

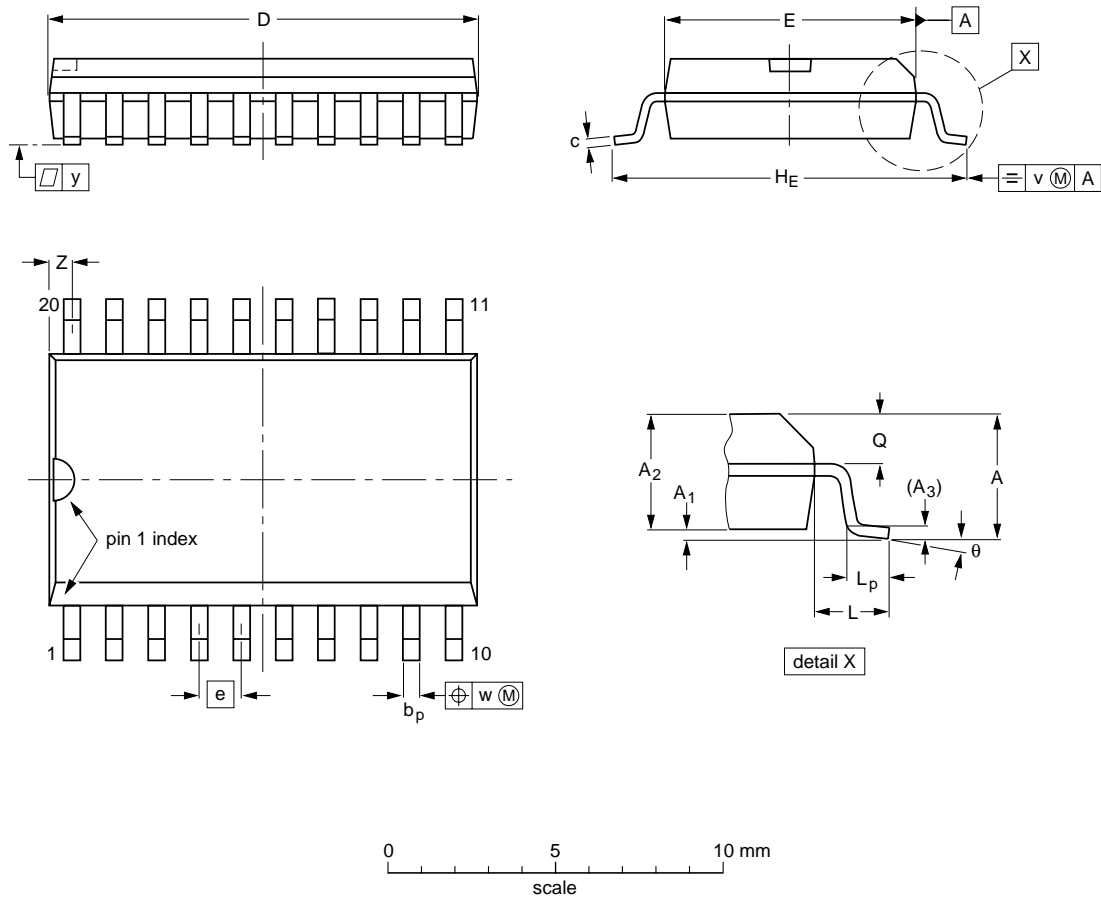
9-fold ESD transient voltage suppressor

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PACKAGE OUTLINE

SO20: plastic small outline package; 20 leads; body width 7.5 mm

SOT163-1



DIMENSIONS (inch dimensions are derived from the original mm dimensions)

| UNIT | A max. | A ₁ | A ₂ | A ₃ | b _p | c | D ⁽¹⁾ | E ⁽¹⁾ | e | H _E | L | L _p | Q | v | w | y | Z ⁽¹⁾ | θ |
|--------|--------|----------------|----------------|----------------|----------------|----------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| mm | 2.65 | 0.30 0.10 | 2.45 2.25 | 0.25 | 0.49 0.36 | 0.32 0.23 | 13.0 12.6 | 7.6 7.4 | 1.27 | 10.65 10.00 | 1.4 | 1.1 0.4 | 1.1 1.0 | 0.25 | 0.25 | 0.1 | 0.9 0.4 | 8° 0° |
| inches | 0.10 | 0.012 0.004 | 0.096 0.089 | 0.01 | 0.019 0.014 | 0.013 0.009 | 0.51 0.49 | 0.30 0.29 | 0.050 | 0.419 0.394 | 0.055 | 0.043 0.016 | 0.043 0.039 | 0.01 | 0.01 | 0.004 | 0.035 0.016 | |

Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

| OUTLINE VERSION | REFERENCES | | | | EUROPEAN PROJECTION | ISSUE DATE |
|-----------------|------------|----------|------|--|---------------------|----------------------|
| | IEC | JEDEC | EIAJ | | | |
| SOT163-1 | 075E04 | MS-013AC | | | | 95-01-24 97-05-22 |

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DEFINITIONS

| Data Sheet Status | |
|---|---|
| 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. |
| Limiting values | |
| 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. | |
| Application information | |
| Where application information is given, it is advisory and does not form part of the specification. | |

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NOTES

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