

ESD Protection Diodes Silicon Epitaxial Planar

# DF2B29FU

## 1. Applications

- ESD Protection

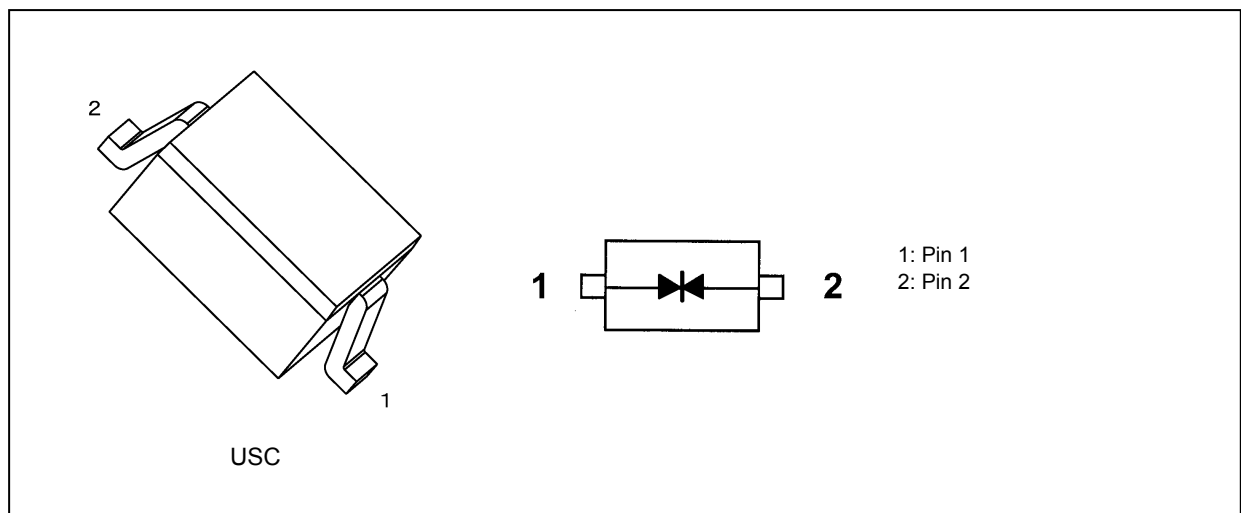
Note: This product is designed for protection against electrostatic discharge (ESD) and is not intended for any other purpose, including, but not limited to, voltage regulation.

## 2. Features

- (1) AEC-Q101 qualified (Note 1)

Note 1: For detail information, please contact to our sales.

## 3. Packaging and Internal Circuit



Start of commercial production

2015-05

## 4. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_a = 25^{\circ}\text{C}$ )

| Characteristics   | Symbol           | Note     | Rating     | Unit               |
|---|------------------|----------|------------|--------------------|
| Electrostatic discharge voltage (IEC61000-4-2)(Contact) | $V_{\text{ESD}}$ | (Note 1) | $\pm 25$   | kV                 |
| Electrostatic discharge voltage (IEC61000-4-2)(Air)     |                  |          |            |                    |
| Electrostatic discharge voltage (ISO10605)(Contact)     | $V_{\text{ESD}}$ | (Note 2) | $\pm 30$   | kV                 |
| Electrostatic discharge voltage (ISO10605)(Air)         |                  |          |            |                    |
| Peak pulse power  | $P_{\text{PK}}$  |          | 140        | W                  |
| Peak pulse current                                      | $I_{\text{PP}}$  | (Note 3) | 3          | A                  |
| Junction temperature                                    | $T_j$            |          | 150        | $^{\circ}\text{C}$ |
| Storage temperature                                     | $T_{\text{stg}}$ |          | -55 to 150 | $^{\circ}\text{C}$ |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: According to IEC61000-4-2.

Note 2: According to ISO10605. (@  $C = 330 \text{ pF}$ ,  $R = 2 \text{ k}\Omega$ )

Note 3: According to IEC61000-4-5.

## 5. Electrical Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$ )

$V_{RWM}$ : Working peak reverse voltage  
 $V_{BR}$ : Reverse breakdown voltage  
 $I_{BR}$ : Reverse breakdown current  
 $I_R$ : Reverse current  
 $V_C$ : Clamp voltage  
 $I_{PP}$ : Peak pulse current  
 $R_{DYN}$ : Dynamic resistance

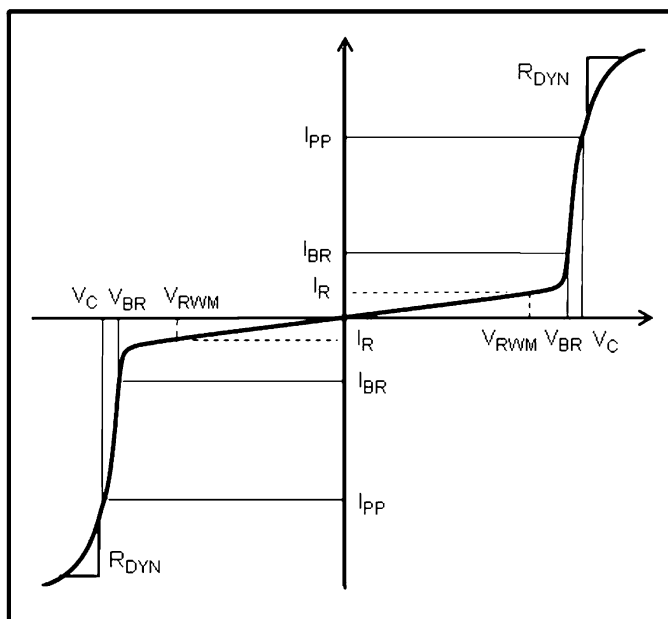


Fig. 5.1 Definitions of Electrical Characteristics

| Characteristics              | Symbol    | Note               | Test Condition                            | Min | Typ. | Max | Unit          |
|------------------------------|-----------|--------------------|---|-----|------|-----|---------------|
| Working peak reverse voltage | $V_{RWM}$ |                    | —   | —   | —    | 24  | V             |
| Reverse breakdown voltage    | $V_{BR}$  |                    | $I_{BR} = 1 \text{ mA}$                   | 26  | —    | 32  | V             |
| Reverse current              | $I_R$     |                    | $V_{RWM} = 24 \text{ V}$                  | —   | —    | 0.1 | $\mu\text{A}$ |
| Clamp voltage                | $V_C$     | (Note 1), (Note 3) | $I_{PP} = 1 \text{ A}$                    | —   | 30   | —   | V             |
|                              |           |                    | $I_{PP} = 3 \text{ A}$                    | —   | 37   | 47  |               |
| Dynamic resistance           | $R_{DYN}$ | (Note 2)           | —   | —   | 1.1  | —   | $\Omega$      |
| Total capacitance            | $C_t$     |                    | $V_R = 0 \text{ V}$ , $f = 1 \text{ MHz}$ | —   | 9    | 10  | pF            |

Note 1: Based on IEC61000-4-5 8/20  $\mu\text{s}$  pulse.

Note 2: TLP parameter:  $Z_0 = 50 \Omega$ ,  $t_p = 100 \text{ ns}$ ,  $t_r = 300 \text{ ps}$ , averaging window:  $t_1 = 30 \text{ ns}$  to  $t_2 = 60 \text{ ns}$ , extraction of dynamic resistance using a least-squares fit of TLP characteristics at  $I_{PP}$  between 8 A to 16 A.

Note 3: Guaranteed by design.

## 6. Marking

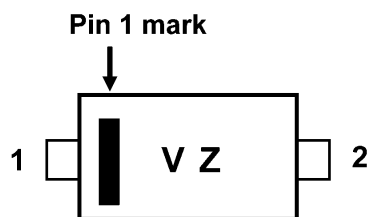


Fig. 6.1 Marking

## 7. Land Pattern Dimensions (for reference only)

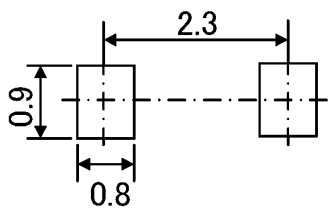


Fig. 7.1 Land Pattern Dimensions (Unit: mm)

8. Characteristics Curves (Note)

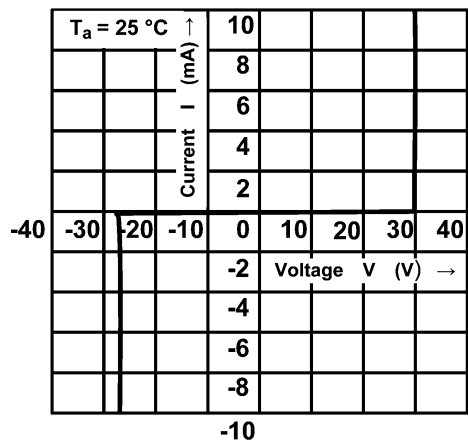


Fig. 8.1  $I - V$

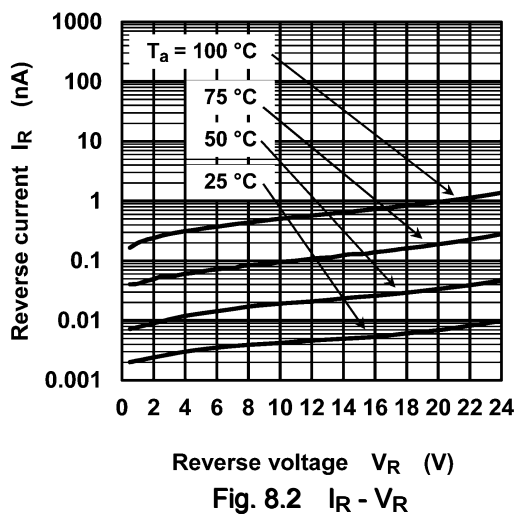


Fig. 8.2  $I_R - V_R$

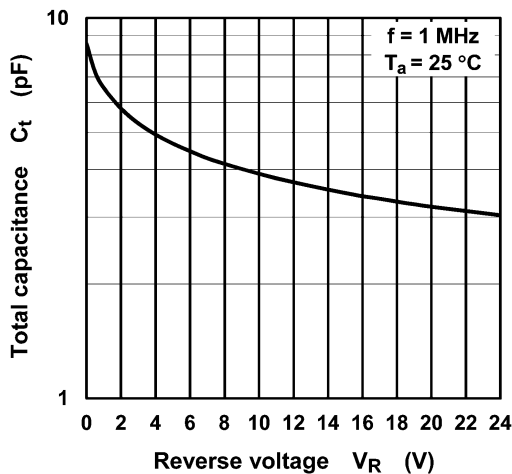


Fig. 8.3  $C_t - V_R$

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

9. Clamp Voltage  $V_C$  - Peak Pulse Current ( $I_{PP}$ ) (Note)

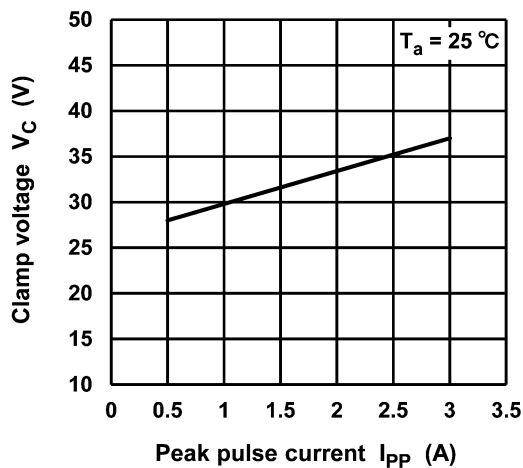


Fig. 9.1  $V_C$  -  $I_{PP}$

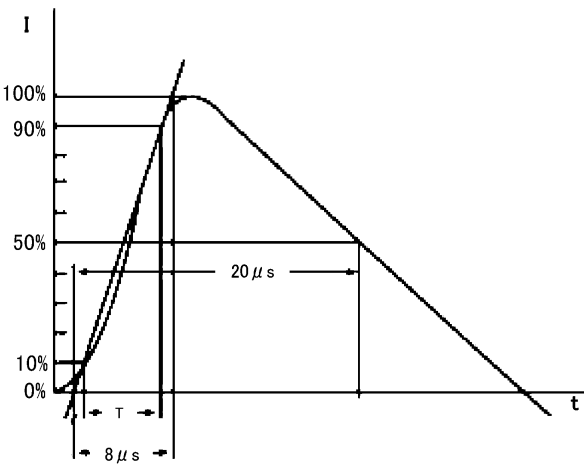


Fig. 9.2 Based on IEC61000-4-5 8/20  $\mu\text{s}$  pulse.  
(Ed.2)

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

## 10. ESD Clamp Waveform (Note)

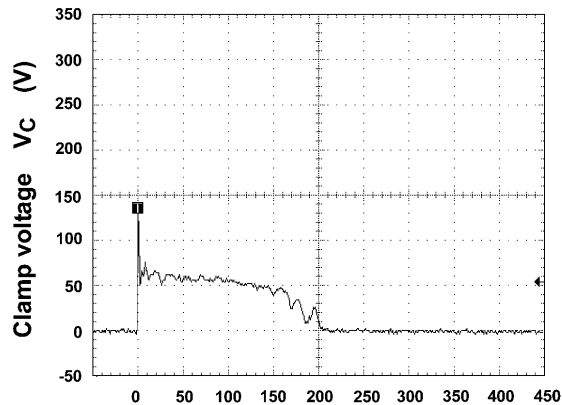


Fig. 10.1 +8 kV

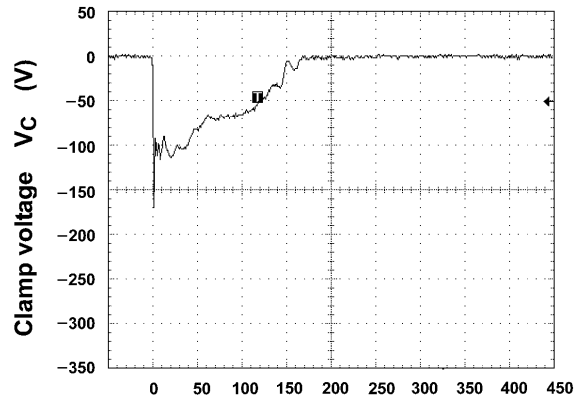


Fig. 10.2 -8 kV

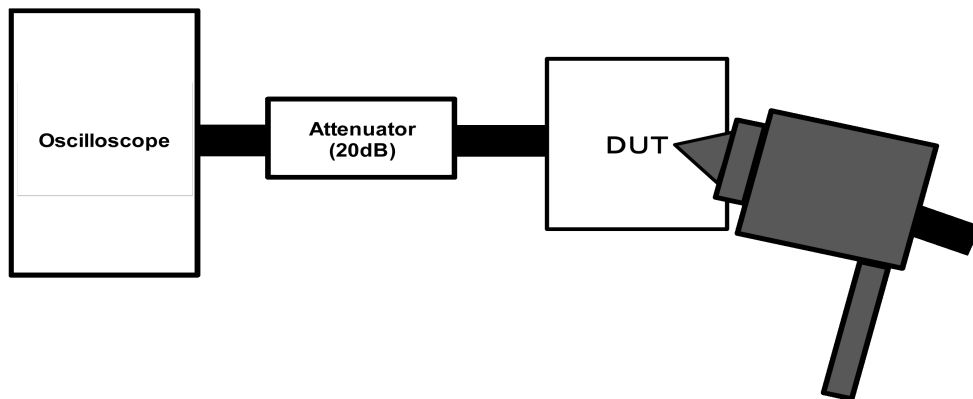
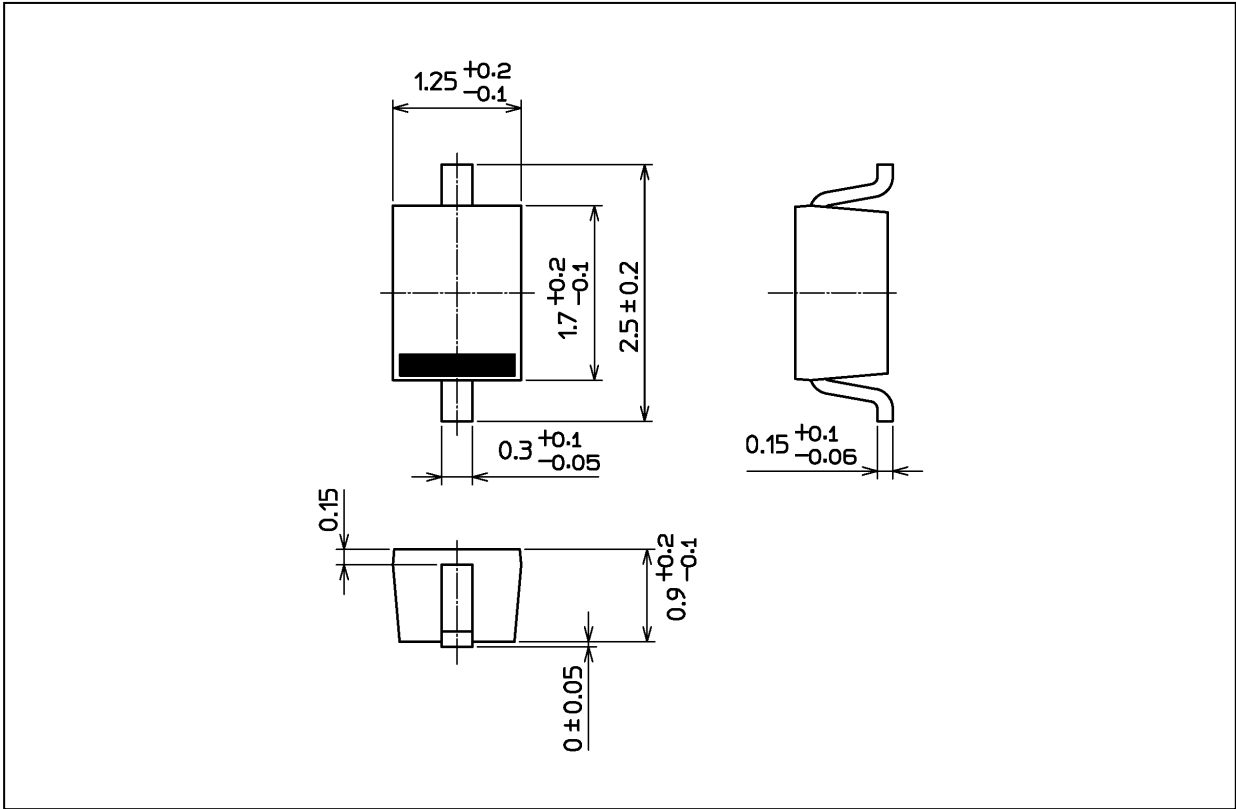


Fig. 10.3 IEC61000-4-2 (Contact)

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

Package Dimensions

Unit: mm



Weight: 4.5 mg (typ.)

|                 |
|-----------------|
| Package Name(s) |
| Nickname: USC   |



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