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# DF3D29FU

## 1. Applications

- ESD Protection

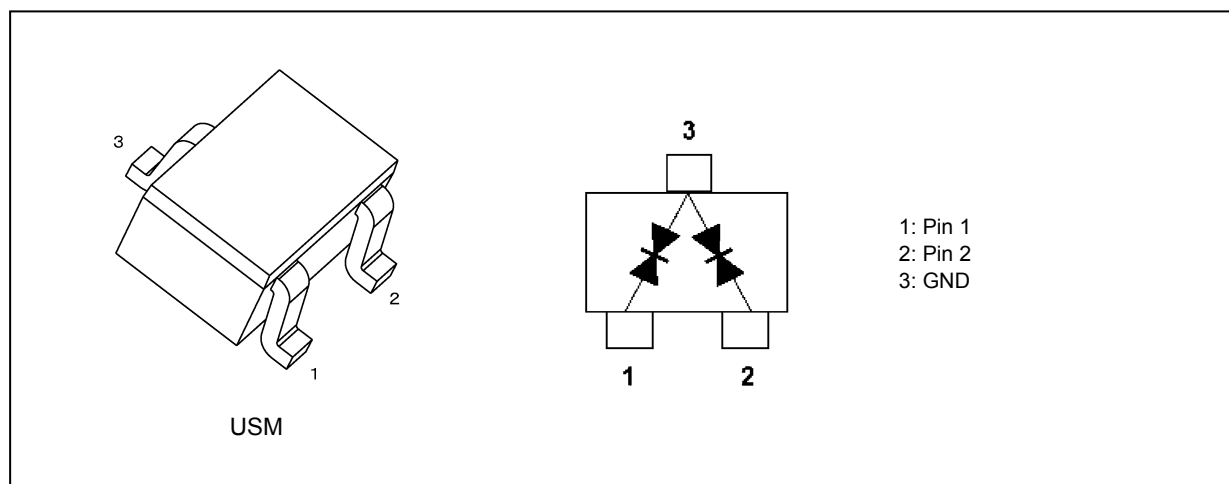
Note: This product is designed for protection against electrostatic discharge (ESD) and is not intended for any other purpose, including, but not limited to, voltage regulation.

## 2. Features

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

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

## 3. Packaging and Internal Circuit



## 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)	$V_{ESD}$	(Note 1)	$\pm 25$	kV
Electrostatic discharge voltage(IEC61000-4-2)(Air)				
Electrostatic discharge voltage(ISO10605)(Contact)	$V_{ESD}$	(Note 2)	$\pm 30$	kV
Electrostatic discharge voltage(ISO10605)(Air)				
Peak pulse power	$P_{PK}$		140	W
Peak pulse current	$I_{PP}$	(Note 3)	3	A
Junction temperature	$T_j$		150	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-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 pF, R = 2 k $\Omega$ )

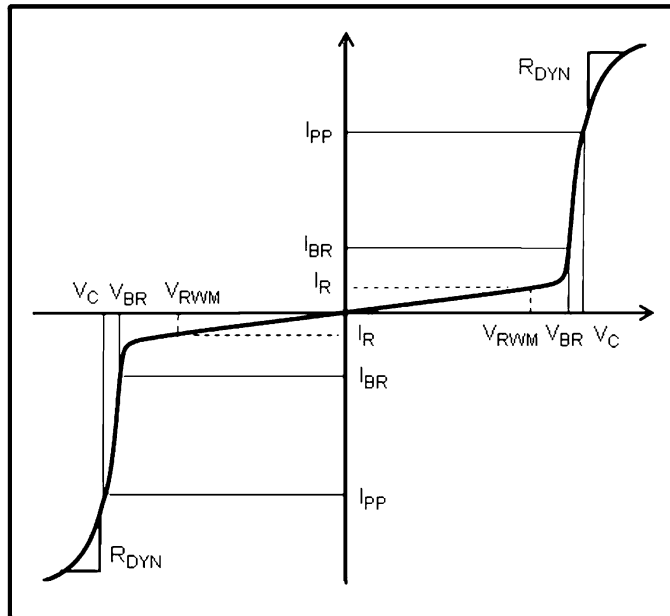
Note 3: According to IEC61000-4-5.

Start of commercial production

2015-05

**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
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)	$I_{PP} = 1 \text{ A}$	—	30	—	V
			$I_{PP} = 3 \text{ A}$	—	37	47	V
Dynamic resistance	$R_{DYN}$	(Note 2)	—	—	1.1	—	$\Omega$
Total capacitance	$C_t$	(Note 3)	$V_R = 0 \text{ V}, f = 1 \text{ MHz}$	—	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

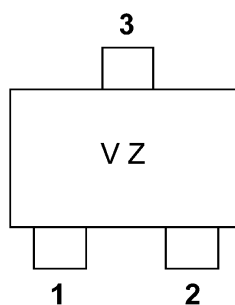


Fig. 6.1 Marking

7. Land Pattern Dimensions (for reference only)

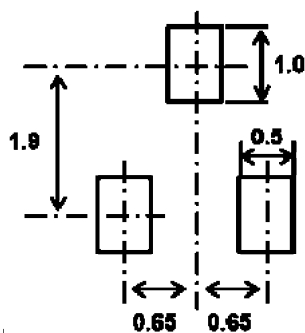


Fig. 7.1 Land Pattern Dimensions (Unit: mm)

8. Characteristics Curves (Note)

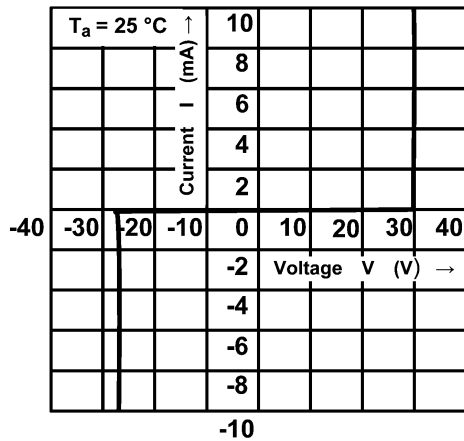


Fig. 8.1 I - V

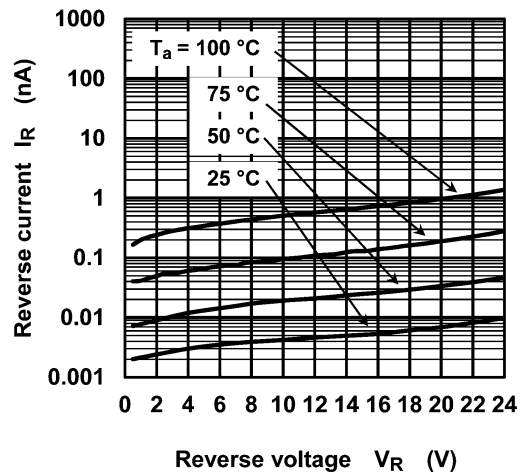


Fig. 8.2  $I_R - V_R$

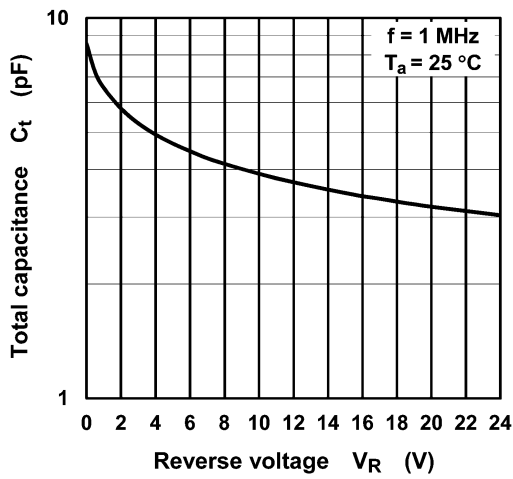


Fig. 8.3  $C_t - V_R$

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)

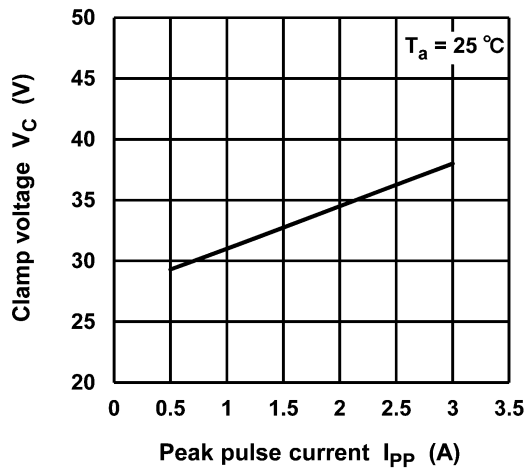


Fig. 9.1  $V_C$  -  $I_{PP}$

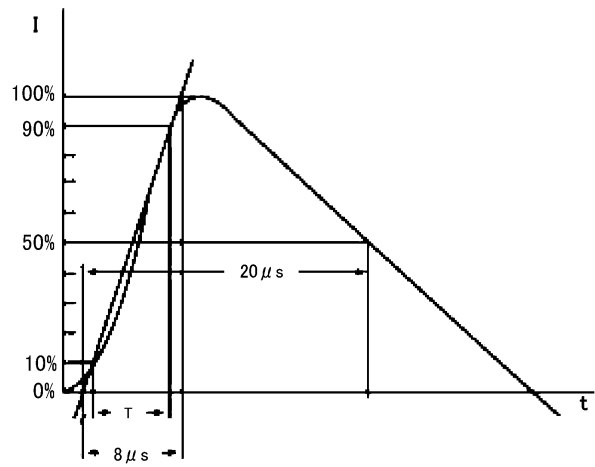


Fig. 9.2 Based on IEC61000-4-5 8/20  $\mu$ s pulse. (Ed.2)

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

10. ESD Clamp Waveform (Note)

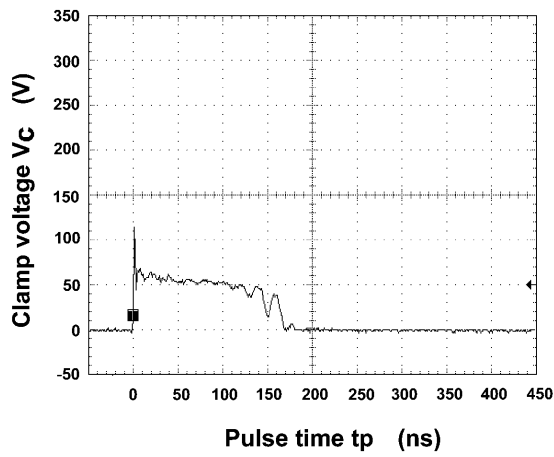


Fig. 10.1 +8 kV

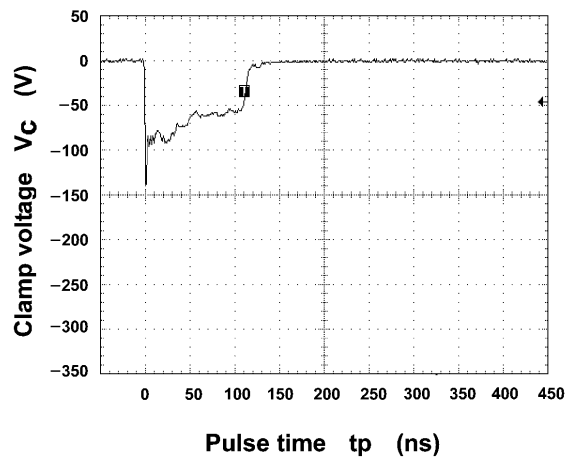


Fig. 10.2 -8 kV

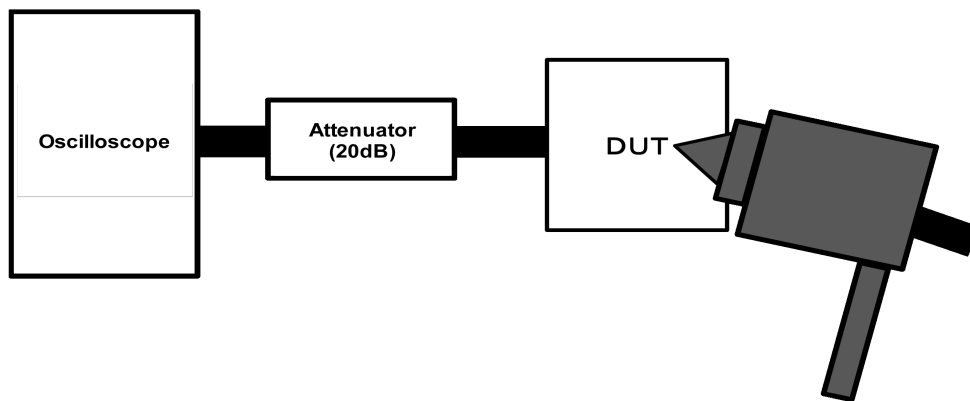
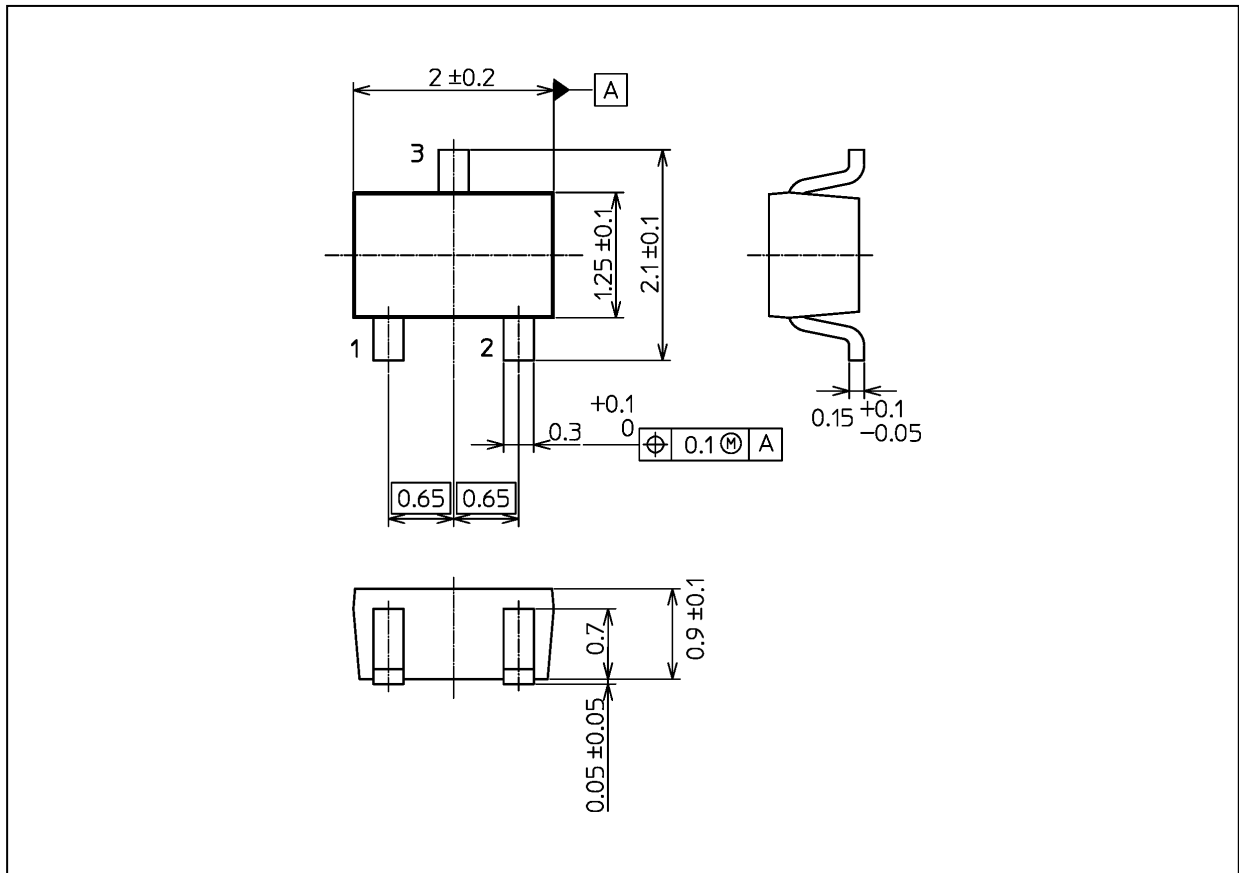


Fig. 10.3 IEC61000-4-2 (Contact)

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

Package Dimensions

Unit: mm



Weight: 6.0 mg (typ.)

Package Name(s)
TOSHIBA: 2-2E1S
Nickname: USM

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