

ESD Protection Diodes Silicon Epitaxial Planar

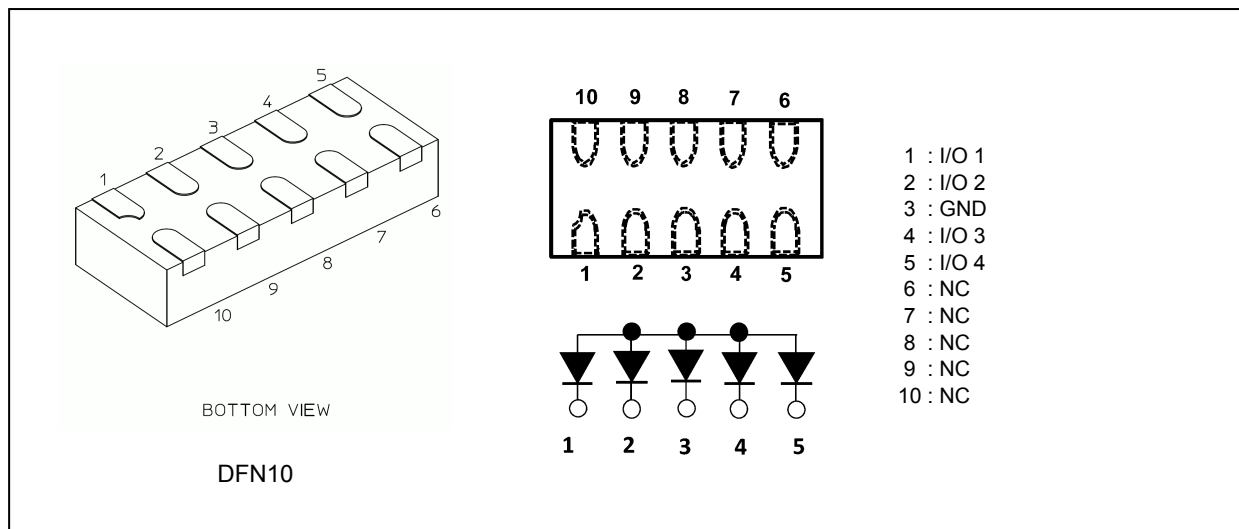
# DF10G5M4N

## 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. Packaging and Internal Circuit



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

Characteristics	Symbol	Note	Rating	Unit
Electrostatic discharge voltage (IEC61000-4-2)(Contact)	$V_{ESD}$	(Note 1)	$\pm 20$	kV
Electrostatic discharge voltage (IEC61000-4-2)(Air)			$\pm 20$	
Peak pulse power ( $t_p = 8/20\ \mu\text{s}$ )	$P_{PK}$		30	W
Peak pulse current ( $t_p = 8/20\ \mu\text{s}$ )	$I_{PP}$	(Note 2)	2	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 IEC61000-4-5.

Start of commercial production

2022-03

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

$V_{RWM}$ : 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

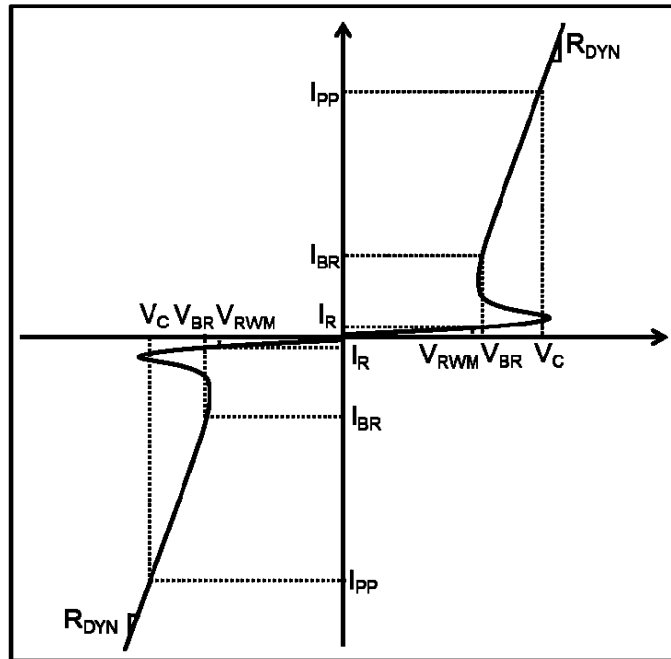


Fig. 4.1 Definitions of Electrical Characteristics

Characteristics	Symbol	Note	Test Condition	Min	Typ.	Max	Unit
Working peak reverse voltage	$V_{RWM}$		—	—	—	3.6	V
Reverse breakdown voltage	$V_{BR}$		$I_{BR} = 1\text{ mA}$	4.0	5.0	6.0	V
Reverse current	$I_R$		$V_{RWM} = 3.6\text{ V}$	—	—	0.1	$\mu\text{A}$
Clamp voltage	$V_C$	(Note 1)	$I_{PP} = 1\text{ A}$	—	7.5	—	V
			$I_{PP} = 2\text{ A}$	—	10	15	
Clamp voltage	$V_C$	(Note 2)	$I_{TLP} = 16\text{ A}$	—	17	—	V
			$I_{TLP} = 30\text{ A}$	—	24	—	
Dynamic resistance	$R_{DYN}$	(Note 2)	—	—	0.5	—	$\Omega$
Total capacitance	$C_t$	(Note 3)	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$	—	0.2	0.3	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.

5. Marking

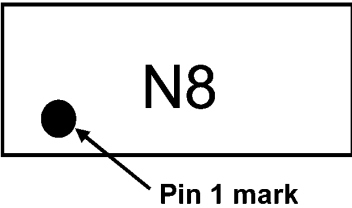


Fig. 5.1 Marking

Marking Code	Part Number
N8	DF10G5M4N

6. Land Pattern Dimensions (for reference only)

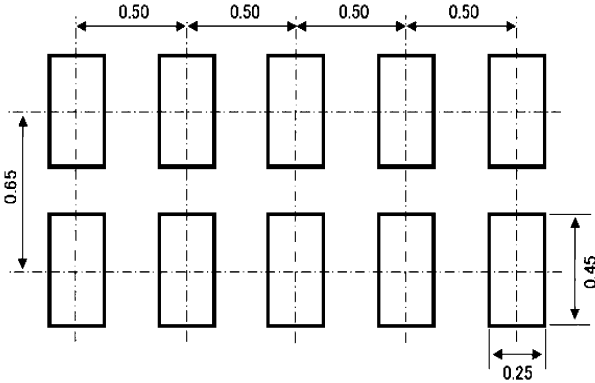


Fig. 6.1 Land Pattern Dimensions (Unit: mm)

## 7. Characteristics Curves (Note)

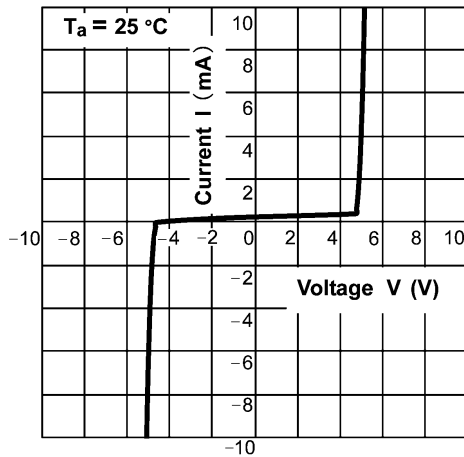


Fig. 7.1 I - V

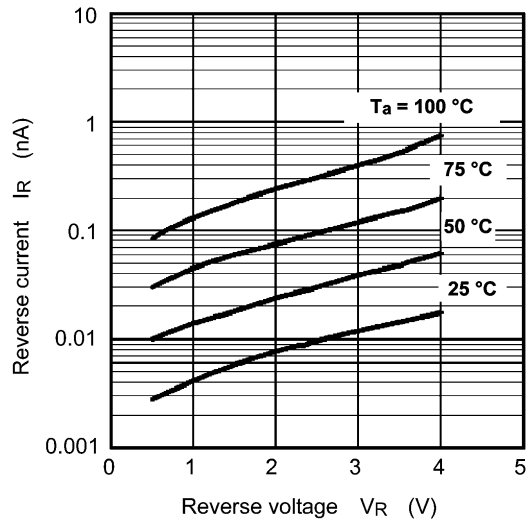


Fig. 7.2  $I_R - V_R$

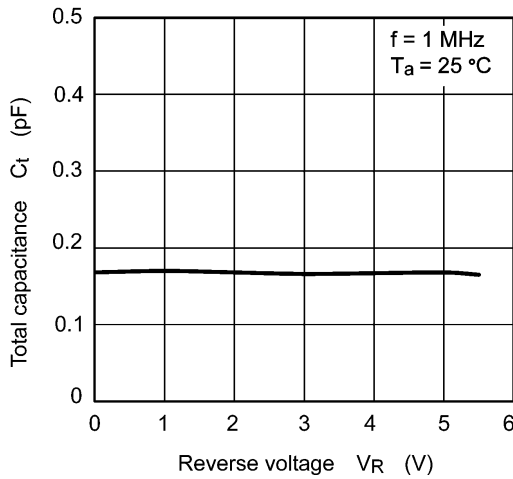


Fig. 7.3  $C_t - V_R$

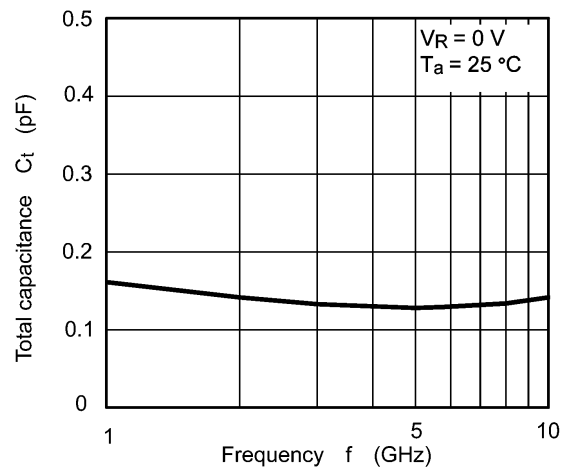
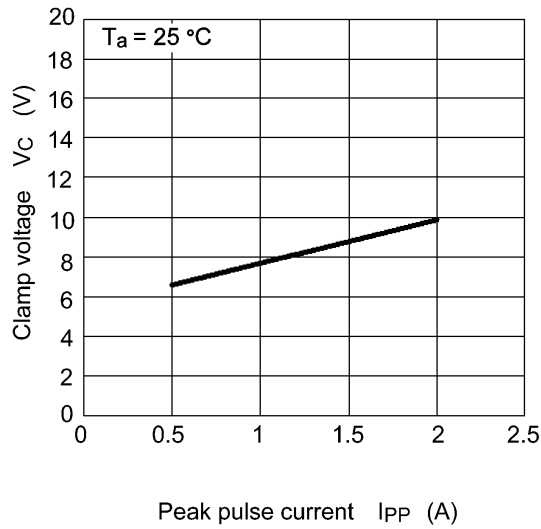


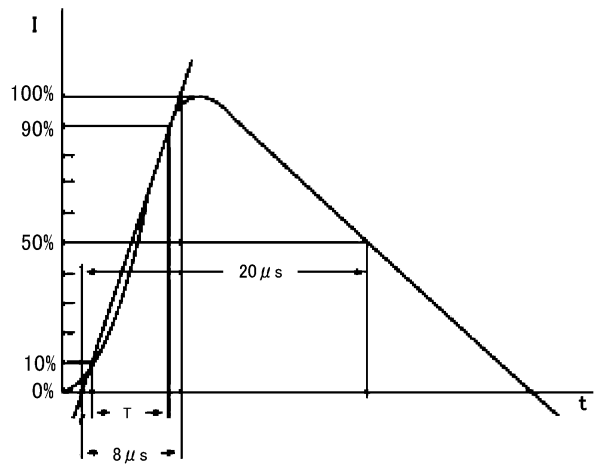
Fig. 7.4  $C_t - f$

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

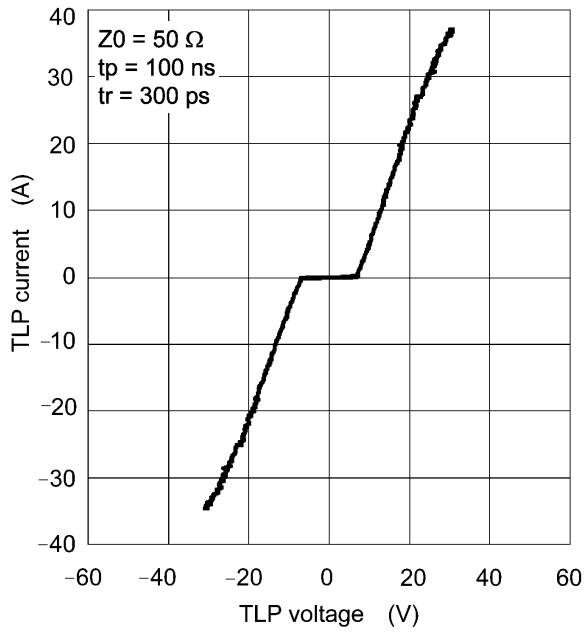
**8. Clamp Voltage  $V_C$  - Peak Pulse Current ( $I_{PP}$ ) (Note)**



**Fig. 8.1  $V_C$  -  $I_{PP}$**



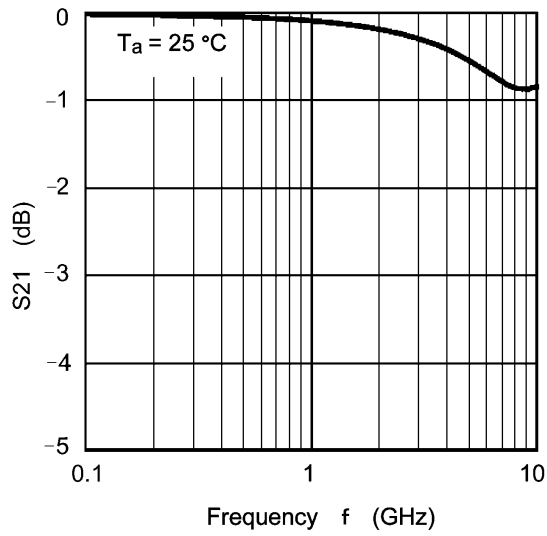
**Fig. 8.2 Based on IEC61000-4-5 8/20  $\mu$ s pulse.(Ed.2)**



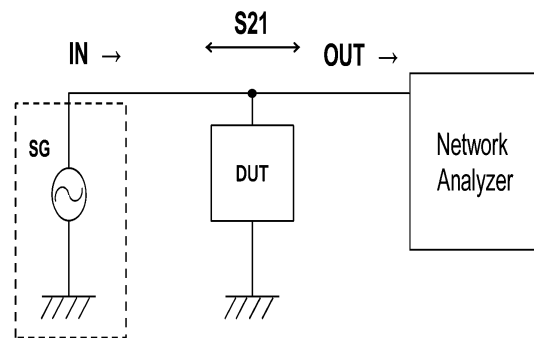
**Fig. 8.3 TLP**

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

## 9. Insertion Loss (S21) (Note)

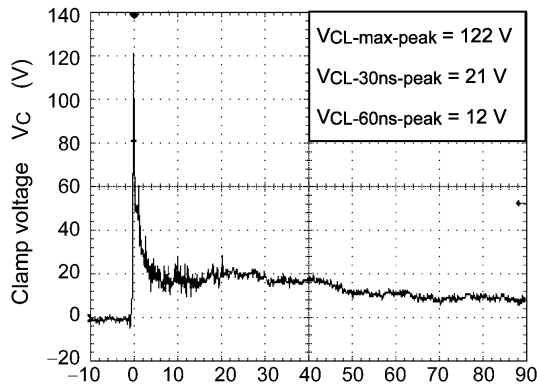


**Fig. 9.1 S21 - f**



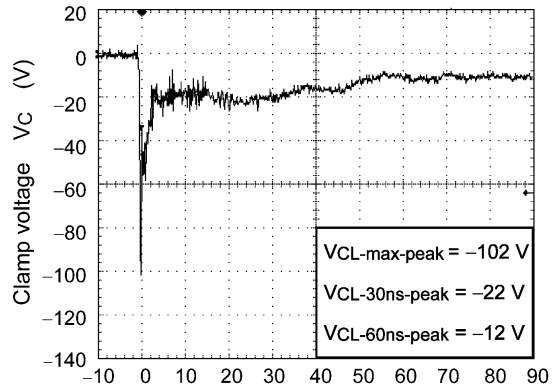
Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

## 10. ESD Clamp Waveform (Note)



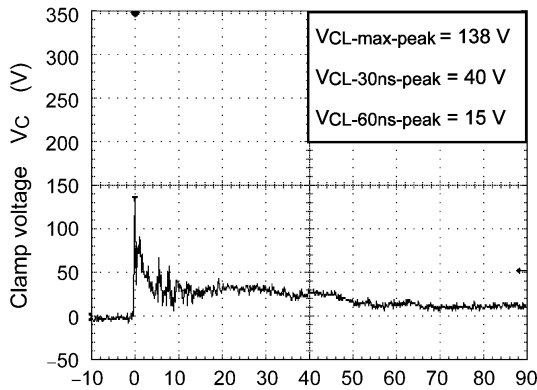
Pulse time  $t_p$  (ns)

**Fig. 10.1 +8 kV**



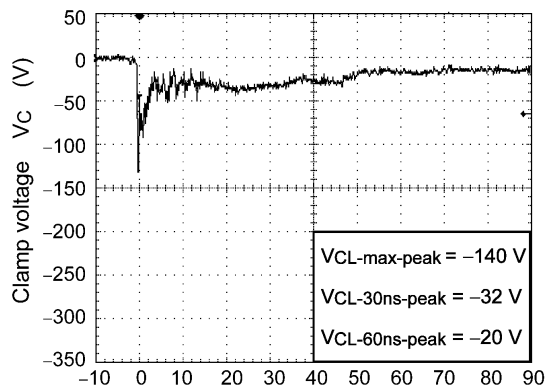
Pulse time  $t_p$  (ns)

**Fig. 10.2 -8 kV**



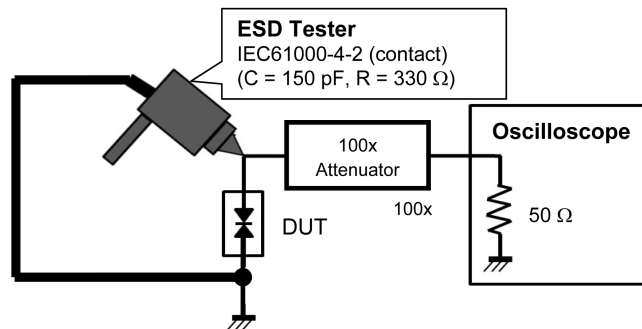
Pulse time  $t_p$  (ns)

**Fig. 10.3 +15 kV**



Pulse time  $t_p$  (ns)

**Fig. 10.4 -15 kV**



**Fig. 10.5 IEC61000-4-2 (Contact)**

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



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