

TOSHIBA Zener Diode Silicon Epitaxial Planar Type

# MSZ Series

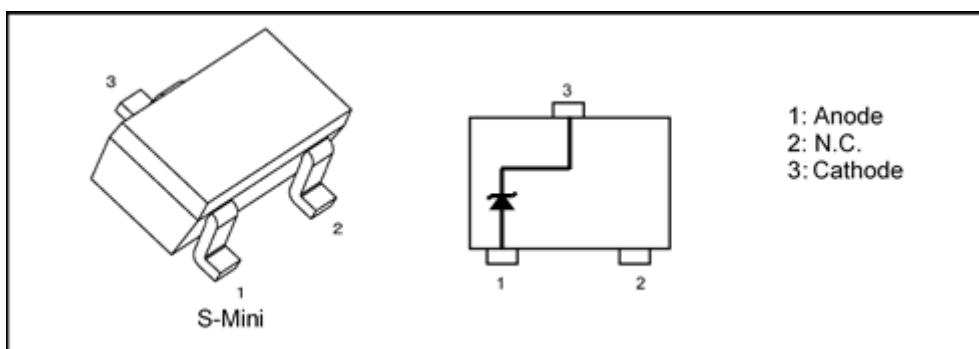
## Applications

Voltage surge protection

## Features

- Small package
- The typical voltage of V<sub>Z</sub> is accorded to E24 series

## Packaging and Internal Circuit



## Absolute Maximum Ratings 1 (Note) (Unless otherwise specified, Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Power dissipation	P <sub>D</sub>	200	mW
	P <sub>D</sub> <sup>*1</sup>	600	mW
Junction temperature	T <sub>j</sub>	150	°C
Storage temperature	T <sub>stg</sub>	-55 to 150	°C

## Absolute Maximum Ratings 2 (Note) (Unless otherwise specified, Ta = 25°C)

Type No.	Electrostatic discharge voltage *2		Peak pulse power *3	Peak pulse current *3	Type No.	Electrostatic discharge voltage *2		Peak pulse power *3	Peak pulse current *3
	Contact	Air				Contact	Air		
	VESD(kV)					VESD(kV)			
MSZ5V6	± 30		155	12	MSZ16V	± 30		200	5.5
MSZ6V2	± 30		175	11	MSZ20V	± 30		200	5
MSZ6V8	± 30		180	10	MSZ24V	± 30		200	4.5
MSZ8V2	± 30		200	8.5	MSZ30V	± 20		200	4
MSZ12V	± 30		200	7	MSZ36V	± 12		200	3

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.).

\*1: Mounted on a glass epoxy circuit board of 25.4 mm × 25.4 mm, Cu pad: 645 mm<sup>2</sup>

\*2: according to IEC61000-4-2

\*3: according to IEC61000-4-5, t<sub>p</sub> = 8 / 20 μs

Start of commercial production  
2020-07

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

Type No.	Zener Voltage				Dynamic Impedance		Dynamic resistance	Clamp voltage	Total capacitance	Reverse Current	
	V <sub>Z</sub> (V)			Test Current I <sub>Z</sub> (mA)	Z <sub>Z</sub> (Ω)	Test Current I <sub>Z</sub> (mA)	R <sub>DYN</sub> (Ω) * <sup>1</sup>	V <sub>C</sub> (V) * <sup>1,2</sup>	C <sub>t</sub> (pF) * <sup>3</sup>	I <sub>R</sub> (μA)	Test Voltage V <sub>R</sub> (V)
	Min	Typ.	Max		Max					Max	
MSZ5V6	5.3	5.6	6.0	5	30	5	0.16	9	125	1	3.5
MSZ6V2	5.8	6.2	6.6	5	30	5	0.21	10	105	2.5	5.0
MSZ6V8	6.4	6.8	7.2	5	30	5	0.27	13	88	1.5	5.5
MSZ8V2	7.7	8.2	8.7	5	30	5	0.37	16.5	67	0.1	7
MSZ12V	11.4	12	12.6	5	30	5	0.7	26	44	0.1	10
MSZ16V	15.3	16	17.1	5	35	5	0.5	27	35	0.1	14
MSZ20V	18.8	20	21.2	5	70	5	0.35	30.5	29	0.1	17.6
MSZ24V	22.8	24	25.6	5	70	5	0.6	36.5	26	0.1	19
MSZ30V	28.0	30	32.0	2	100	2	1.25	47.5	21	0.1	27
MSZ36V	34.0	36	38.0	2	100	2	2.6	63	18	0.1	32.5

\*1: TLP parameters:  $Z_0 = 50 \Omega$ ,  $t_p = 100 \text{ ns}$ ,  $t_r = 300 \text{ ps}$ , averaging window:  $t_1 = 30 \text{ ns}$  to  $t_2 = 60 \text{ ns}$ ,

extraction of dynamic resistance using least squares fit of TLP characteristics between  $I_{TLP1} = 16 \text{ A}$  and  $I_{TLP2} = 30 \text{ A}$ .

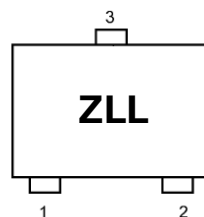
\*2:  $I_{TLP} = 16 \text{ A}$

\*3:  $V_R = 0 \text{ V}$ ,  $f = 1 \text{ MHz}$

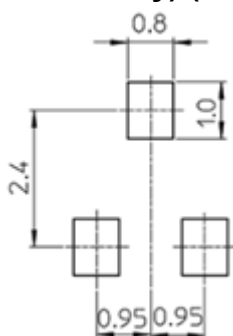
### Marking List

Type No.	Marking	Type No.	Marking
MSZ5V6	ZLL	MSZ16V	ZM7
MSZ6V2	ZLM	MSZ20V	ZM9
MSZ6V8	ZLN	MSZ24V	ZMB
MSZ8V2	ZLQ	MSZ30V	ZMD
MSZ12V	ZM4	MSZ36V	ZMF

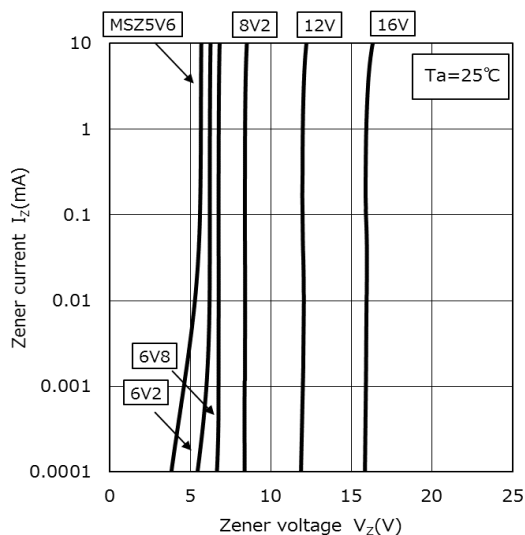
### Marking (MSZ5V6)



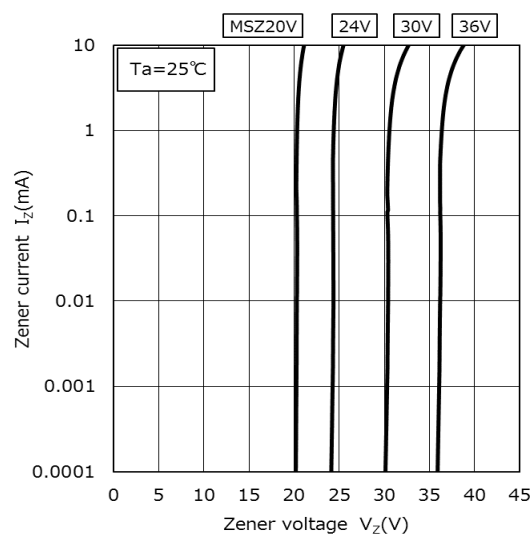
### Land Pattern Dimensions (for reference only) (Unit: mm)



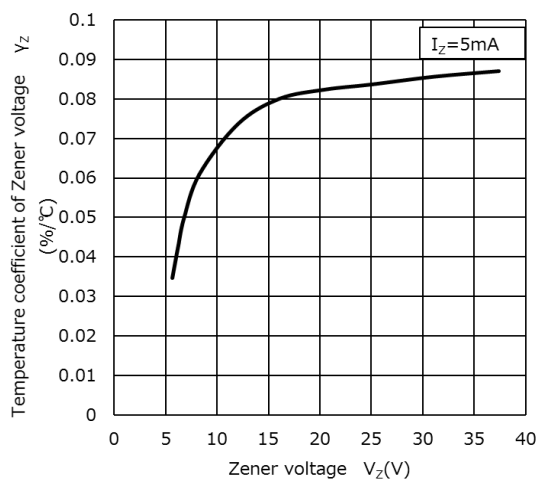
### MSZ series Characteristics Curves (Note 1)



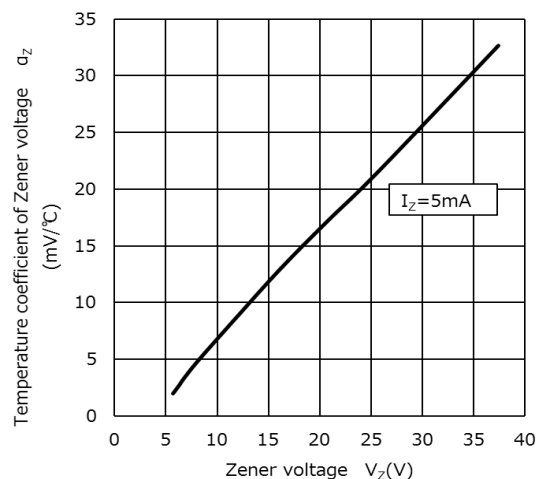
$I_Z - V_Z$  (1)



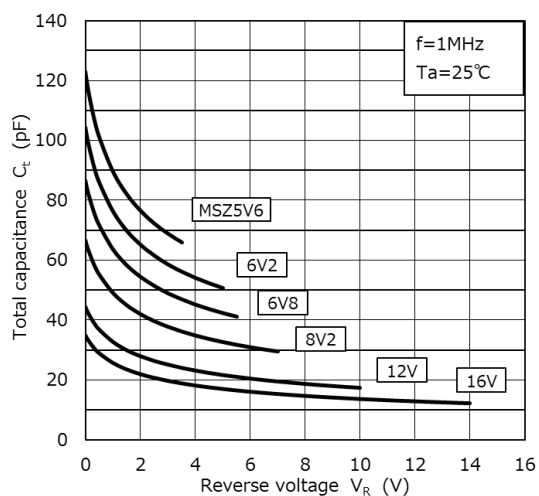
$I_Z - V_Z$  (2)



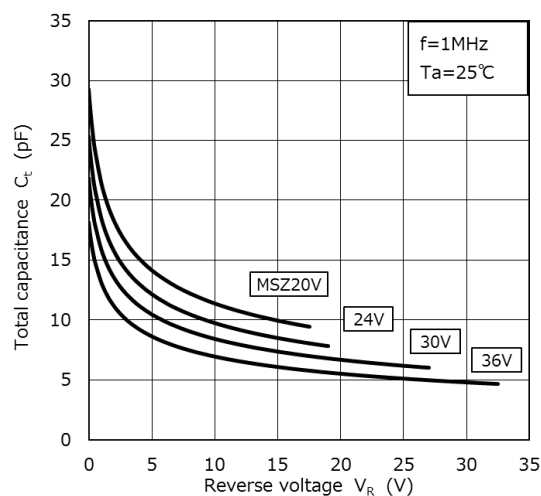
$\gamma_Z - V_Z$



$\alpha_Z - V_Z$



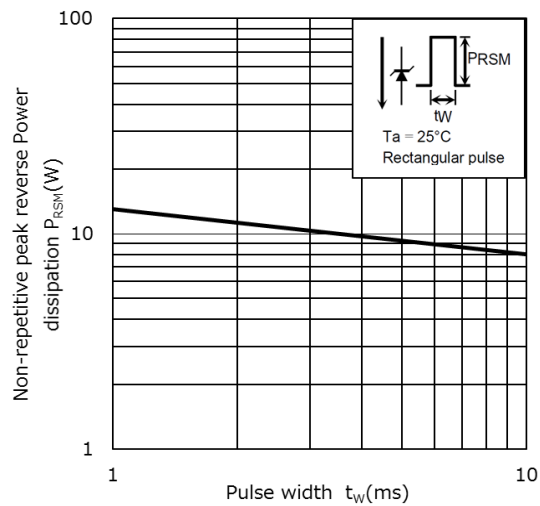
$C_t - V_R$  (1)



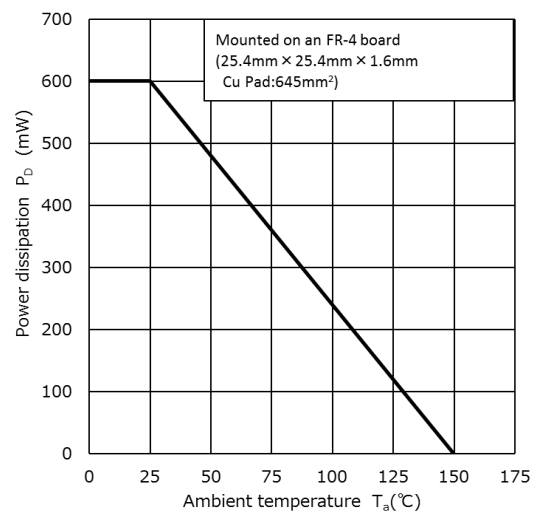
$C_t - V_R$  (2)

Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

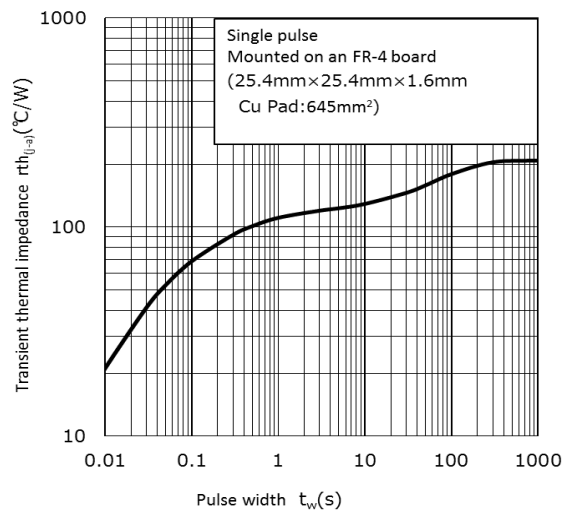
### MSZ series Characteristics Curves (Note 1)



$P_{RSM} - t_w$



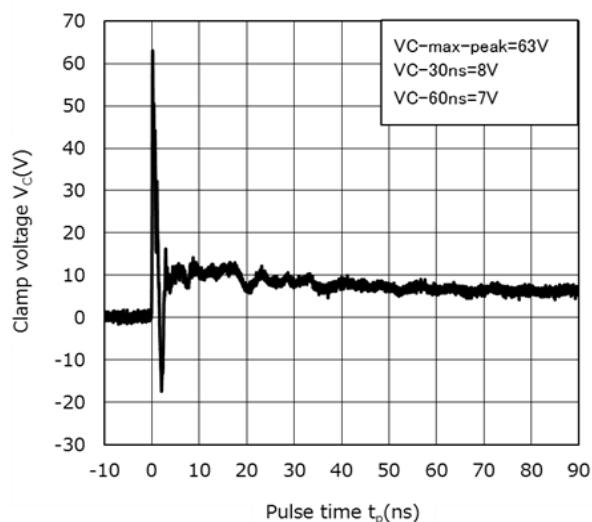
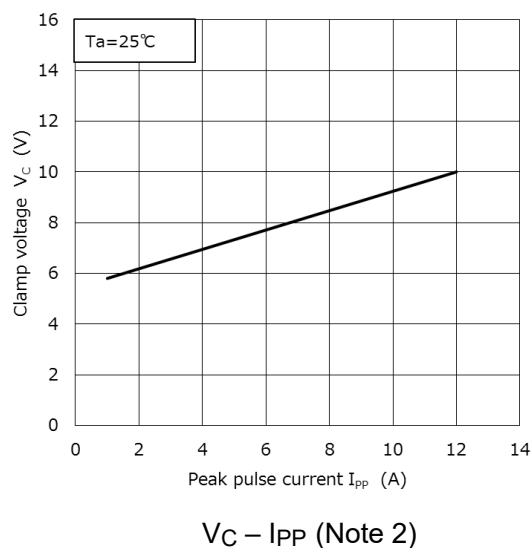
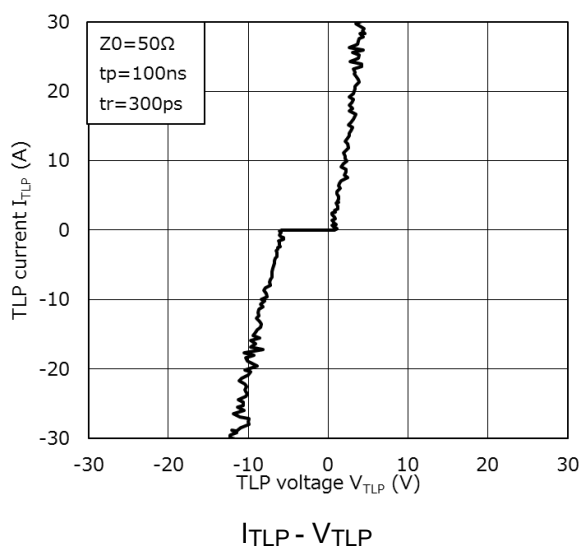
$P_D - T_a$



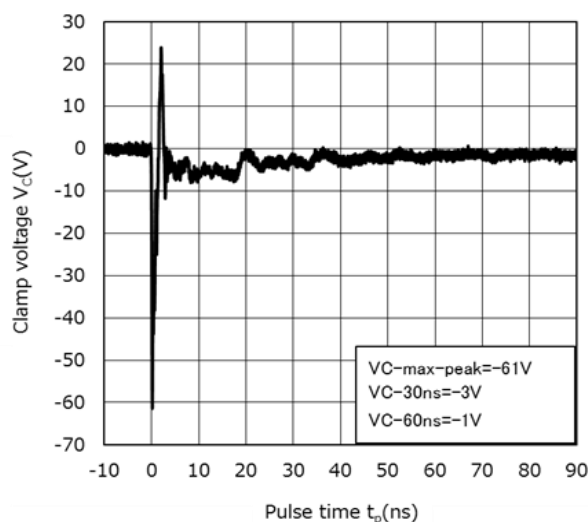
$r_{th(j-a)} - t_w$

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### MSZ5V6 Characteristics Curves (Note 1)



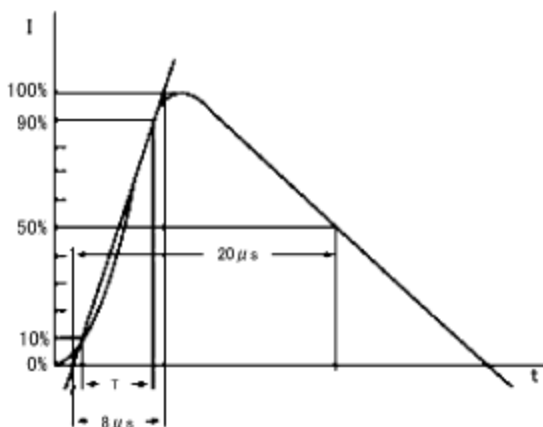
Clamp Waveform +8 kV (Note 3)



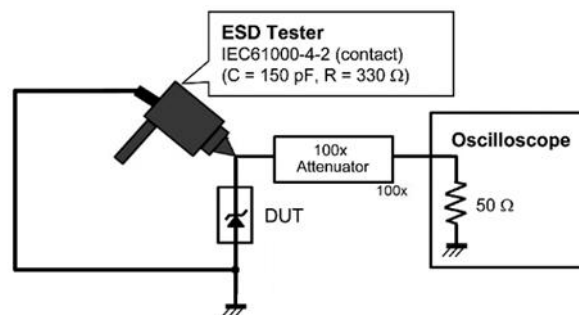
Clamp Waveform -8 kV (Note 3)

#### (Note 2) Peak Pulse Current ( $V_C - I_{PP}$ )

#### (Note 3) Clamp waveform measurement circuit



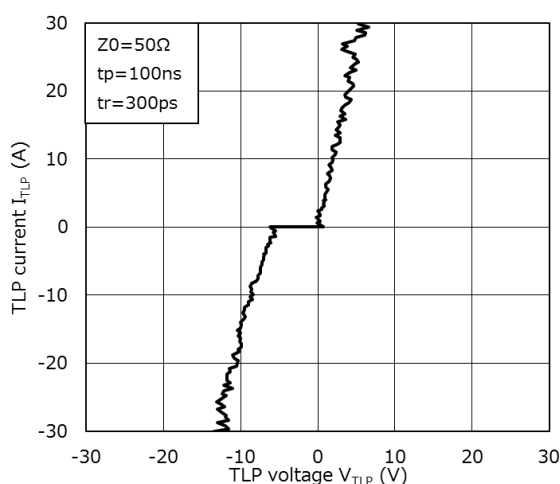
Based on IEC61000-4-5 8/20  $\mu s$  pulse.



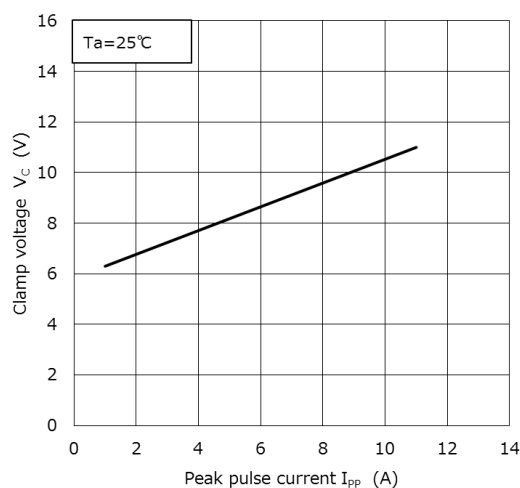
IEC61000-4-2 (Contact)

Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

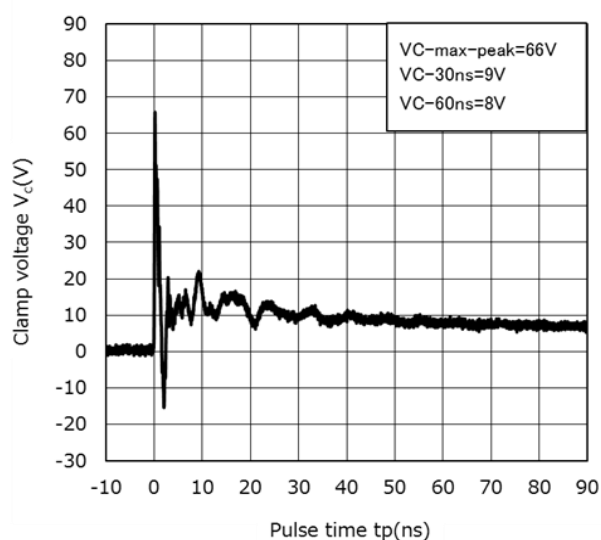
## MSZ6V2 Characteristics Curves (Note 1)



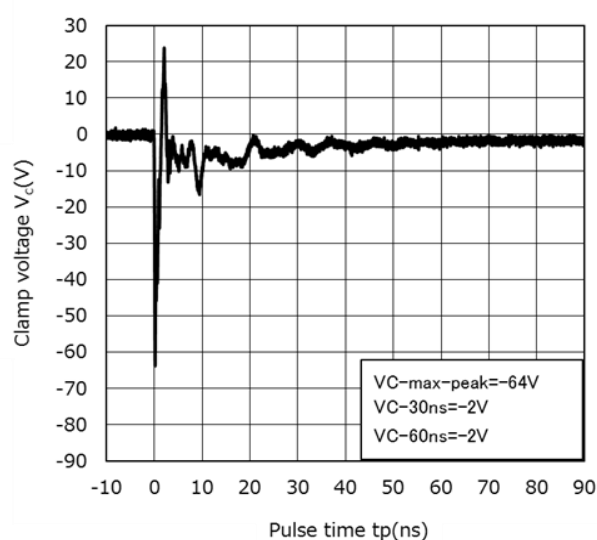
$I_{TLP} - V_{TLP}$



$V_C - I_{PP}$  (Note 2)



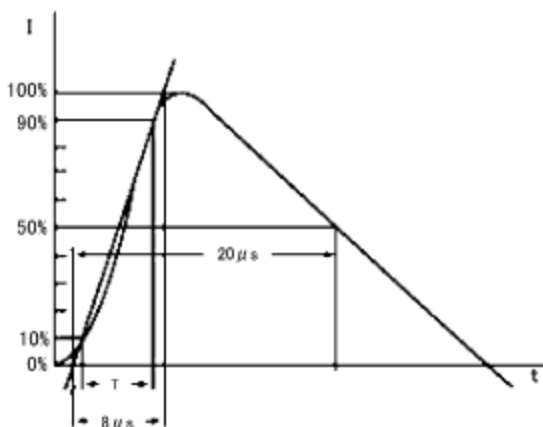
Clamp Waveform +8 kV (Note 3)



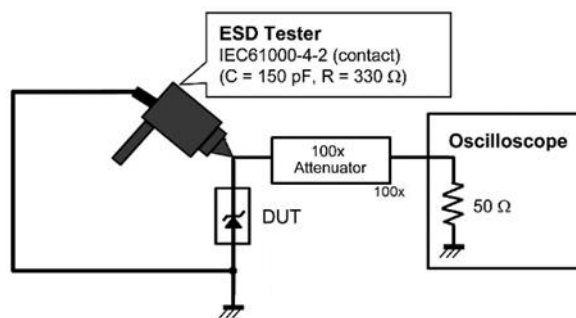
Clamp Waveform -8 kV (Note 3)

### (Note 2) Peak Pulse Current ( $V_C - I_{PP}$ )

### (Note 3) Clamp waveform measurement circuit



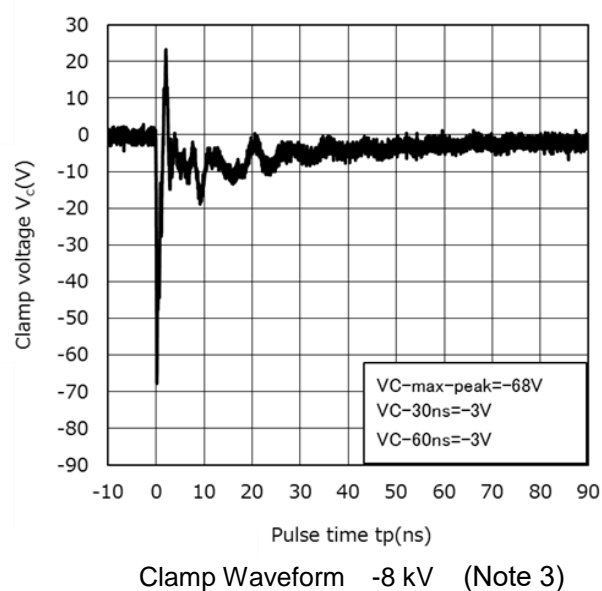
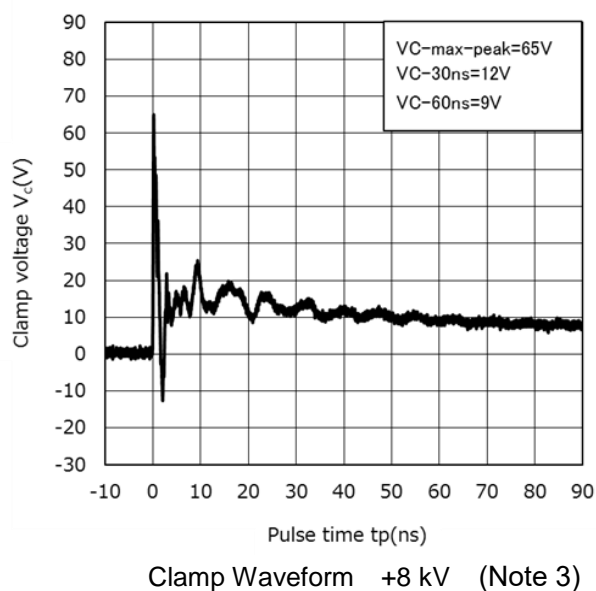
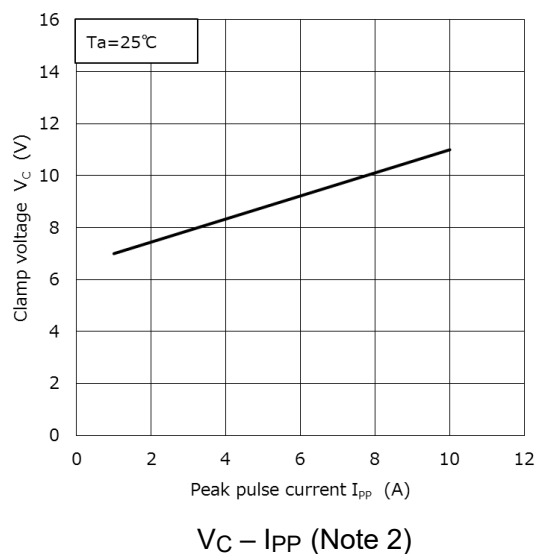
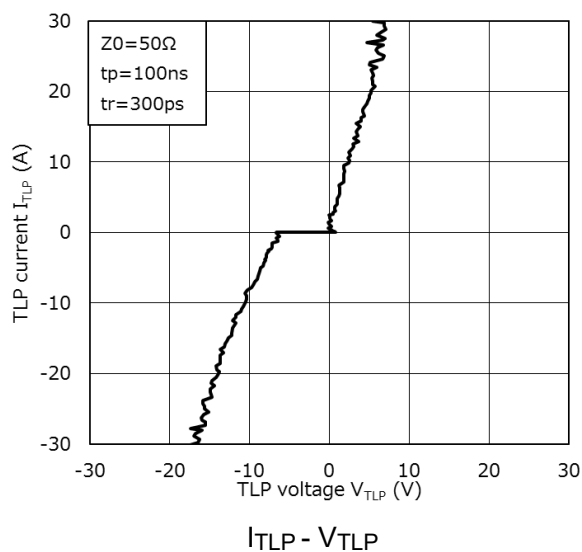
Based on IEC61000-4-5 8/20  $\mu s$  pulse.



IEC61000-4-2 (Contact)

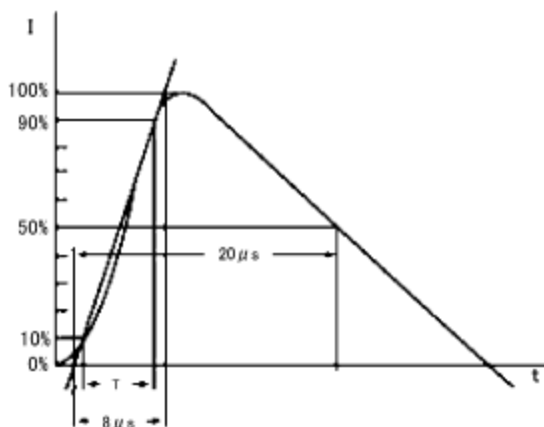
Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

### MSZ6V8 Characteristics Curves (Note 1)

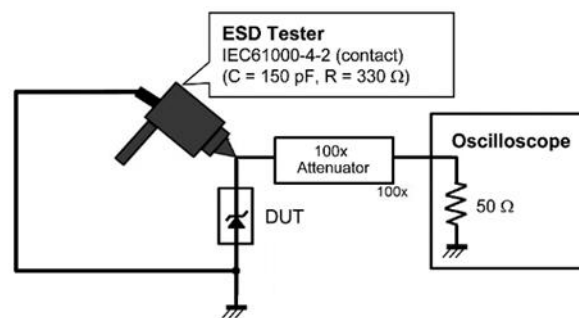


#### (Note 2) Peak Pulse Current ( $V_C - I_{PP}$ )

#### (Note 3) Clamp waveform measurement circuit



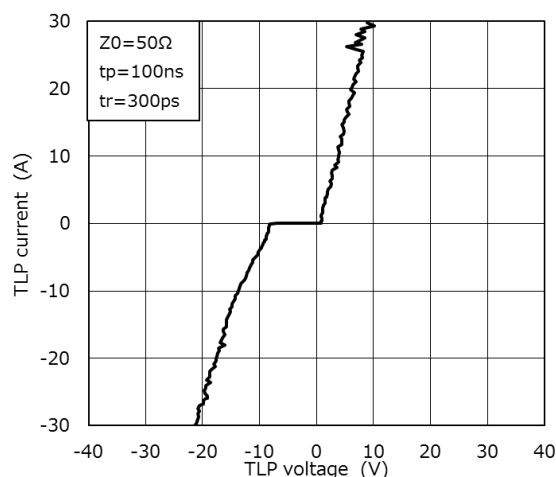
Based on IEC61000-4-5 8/20  $\mu s$  pulse.



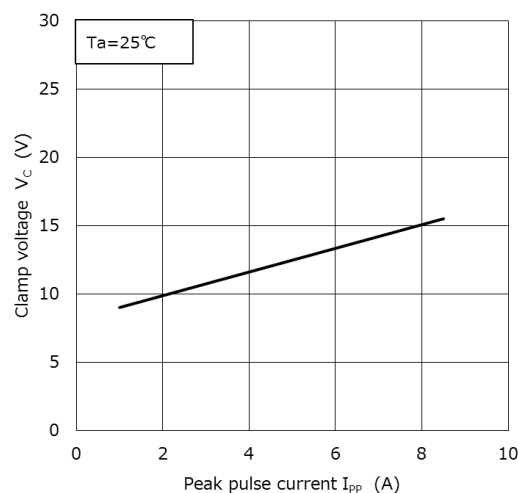
IEC61000-4-2 (Contact)

Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

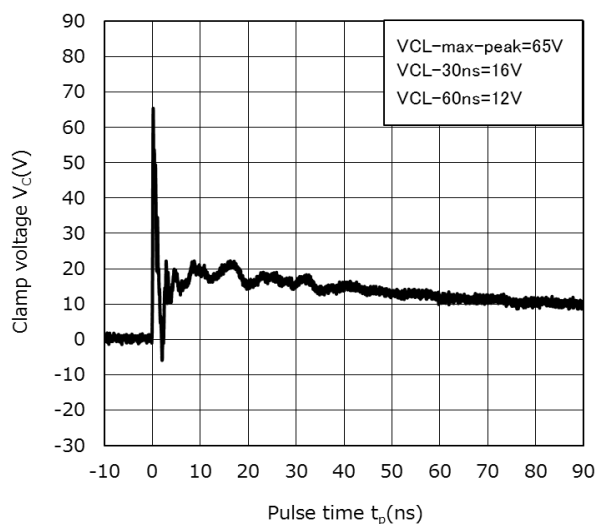
### MSZ8V2 Characteristics Curves (Note 1)



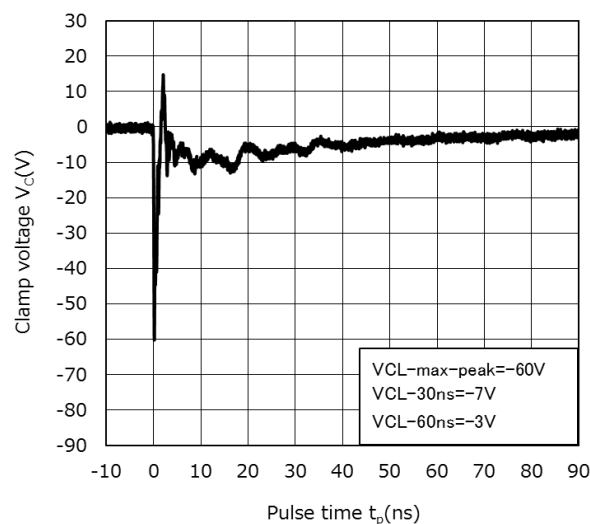
$I_{TLP} - V_{TLP}$



$V_C - I_{PP}$  (Note 2)

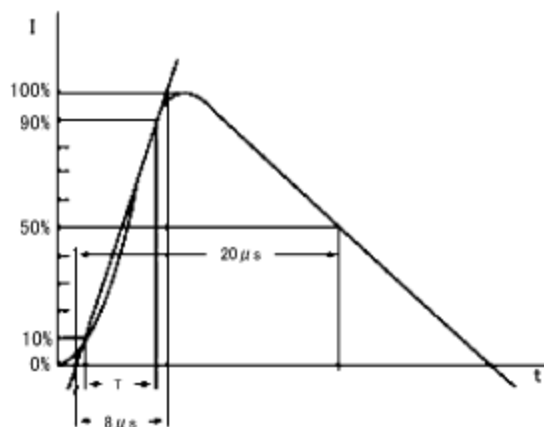


Clamp Waveform +8 kV (Note 3)



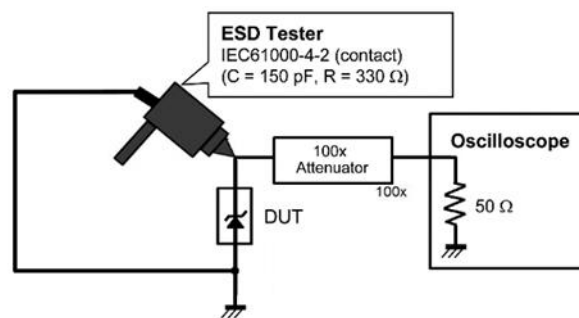
Clamp Waveform -8 kV (Note 3)

### (Note 2) Peak Pulse Current ( $V_C - I_{PP}$ )



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

### (Note 3) Clamp waveform measurement circuit

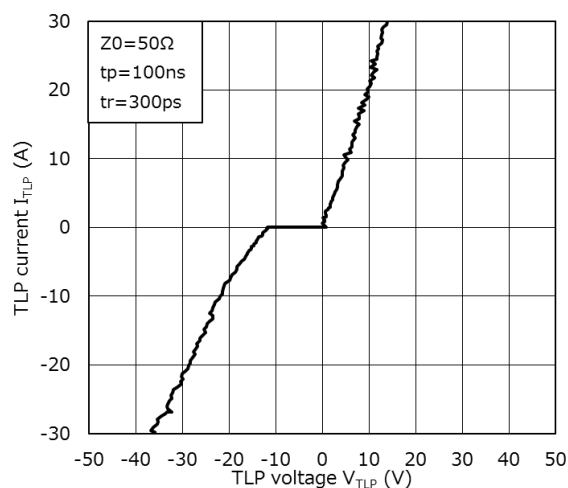


IEC61000-4-2 (Contact)

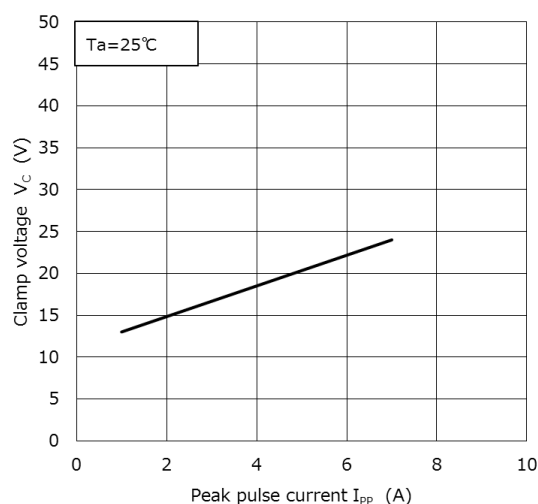
Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



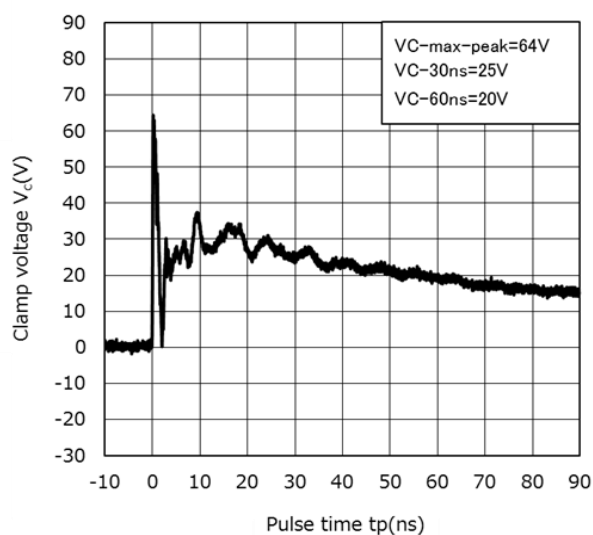
### MSZ12V Characteristics Curves (Note 1)



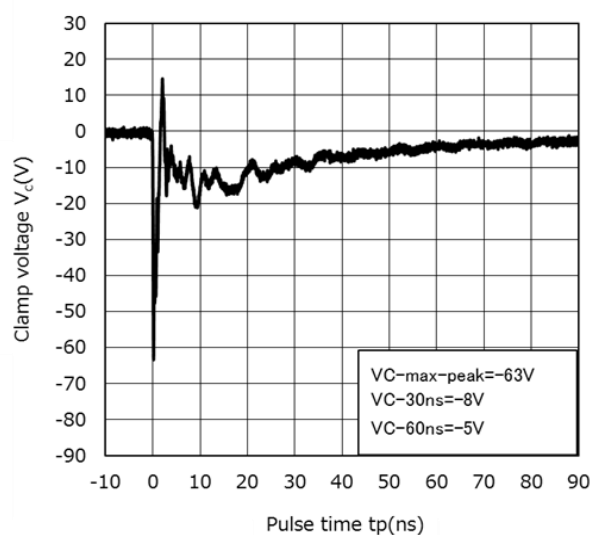
$I_{TLP} - V_{TLP}$



$V_C - I_{PP}$  (Note 2)



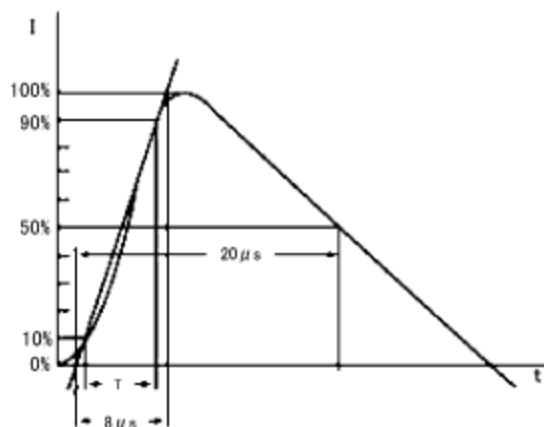
Clamp Waveform +8 kV (Note 3)



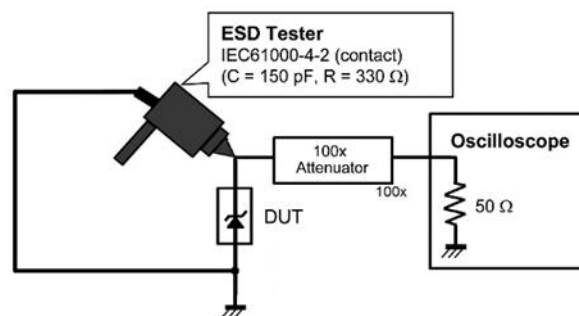
Clamp Waveform -8 kV (Note 3)

#### (Note 2) Peak Pulse Current ( $V_C - I_{PP}$ )

#### (Note 3) Clamp waveform measurement circuit



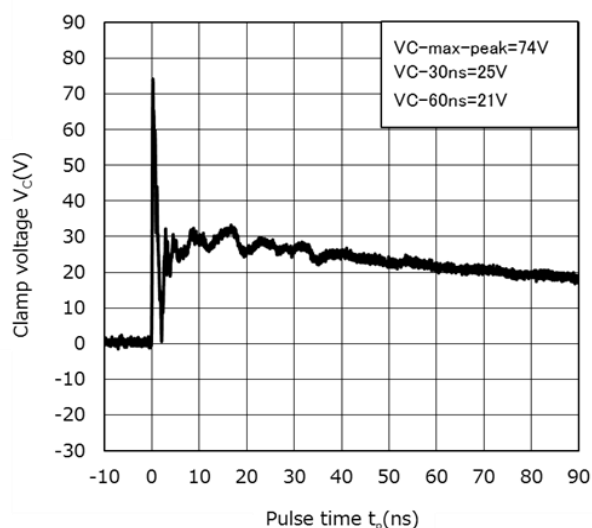
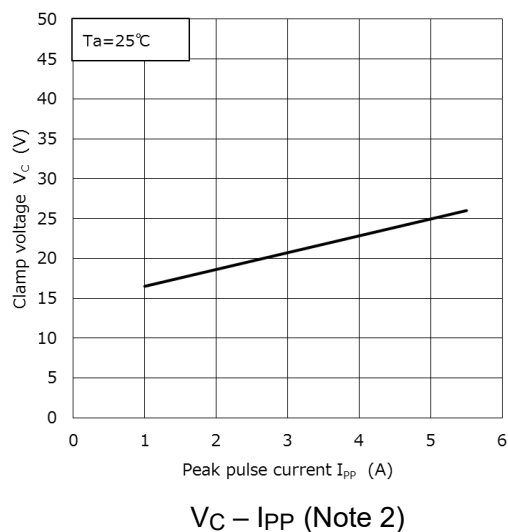
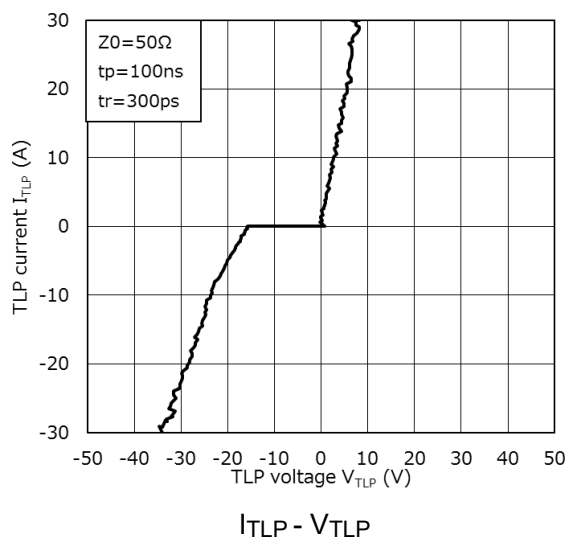
Based on IEC61000-4-5 8/20  $\mu s$  pulse.



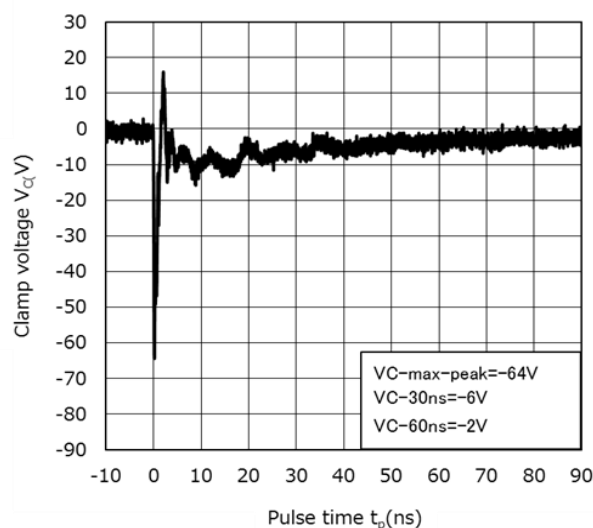
IEC61000-4-2 (Contact)

Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

### MSZ16V Characteristics Curves (Note 1)



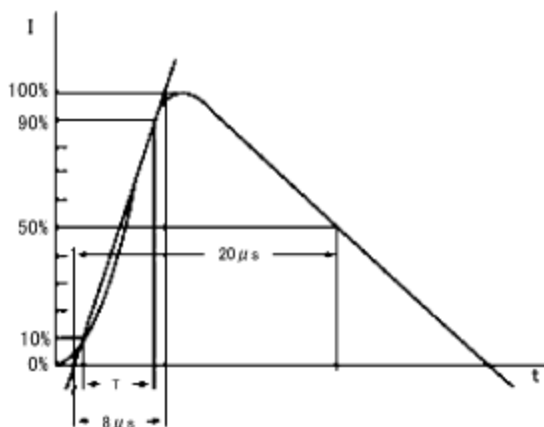
Clamp Waveform +8 kV (Note 3)



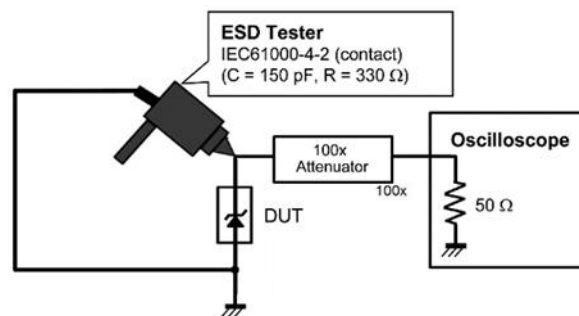
Clamp Waveform -8 kV (Note 3)

#### (Note 2) Peak Pulse Current ( $V_C - I_{PP}$ )

#### (Note 3) Clamp waveform measurement circuit



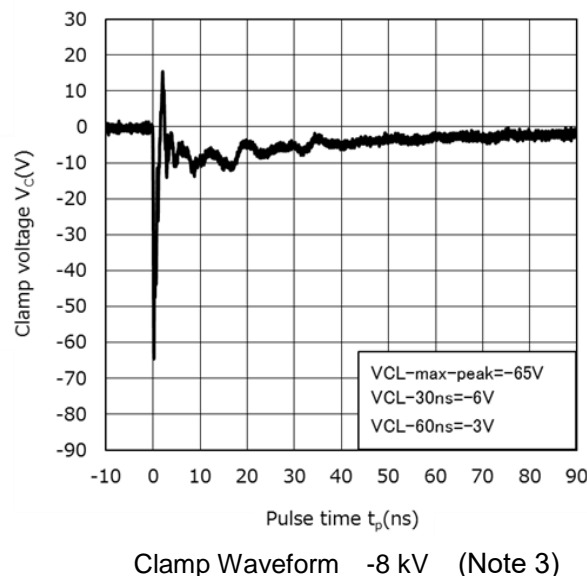
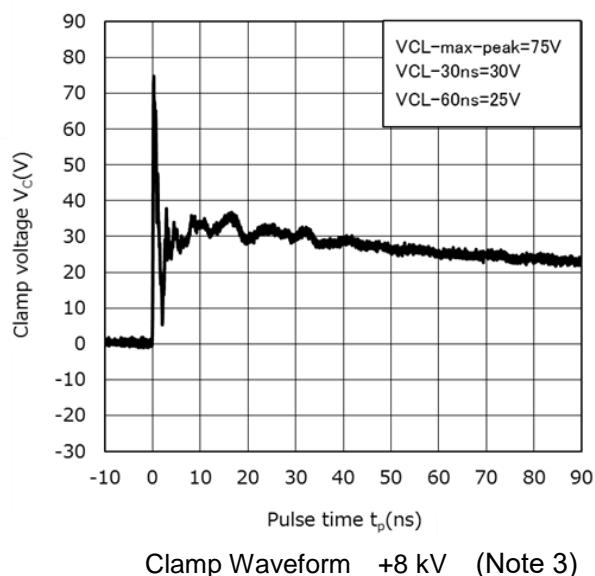
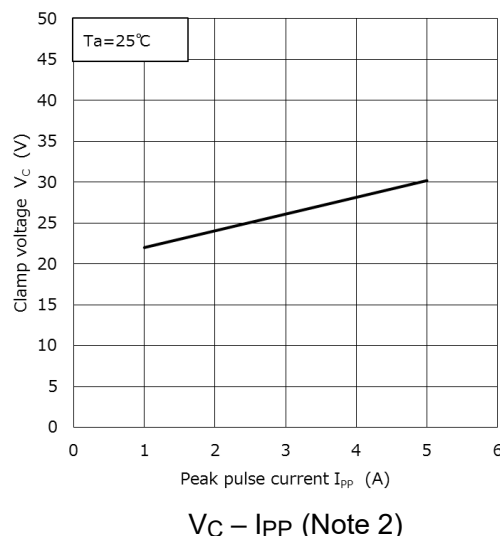
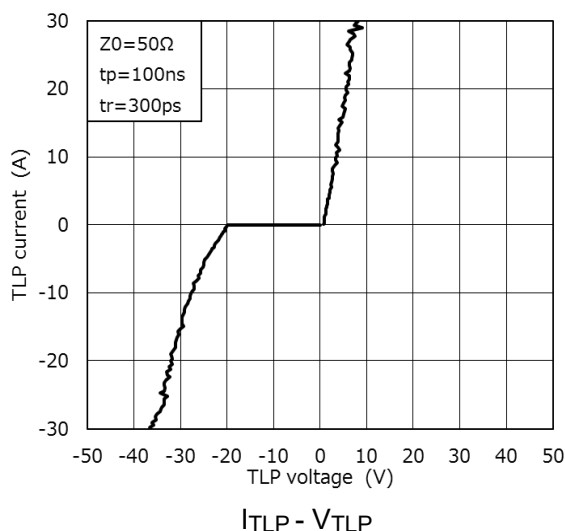
Based on IEC61000-4-5 8/20  $\mu s$  pulse.



IEC61000-4-2 (Contact)

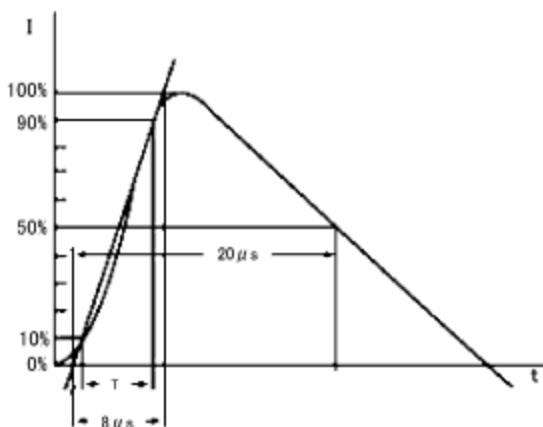
Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

### MSZ20V Characteristics Curves (Note 1)

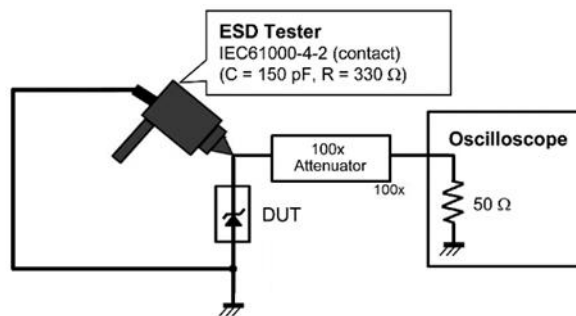


#### (Note 2) Peak Pulse Current ( $V_c - I_{pp}$ )

#### (Note 3) Clamp waveform measurement circuit



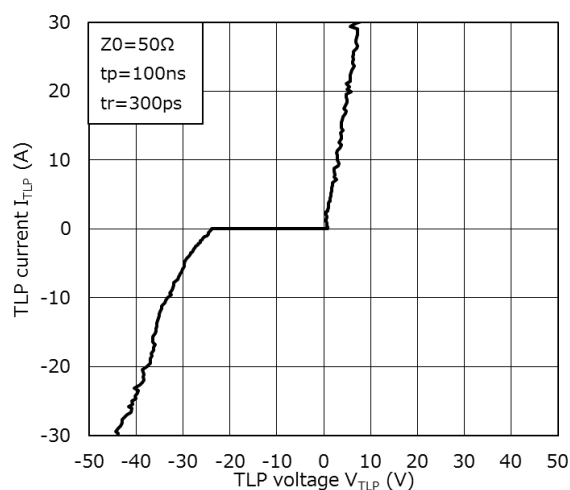
Based on IEC61000-4-5 8/20  $\mu\text{s}$  pulse.



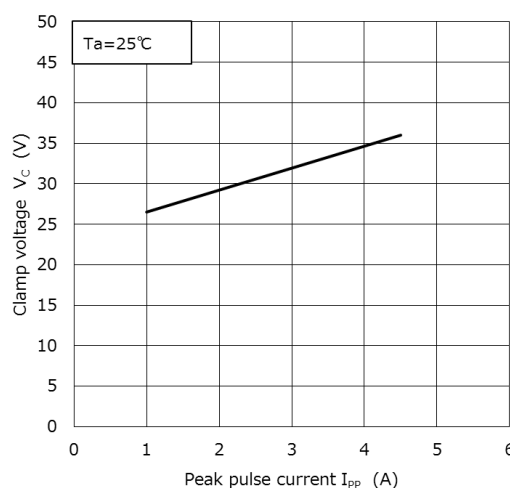
IEC61000-4-2 (Contact)

Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

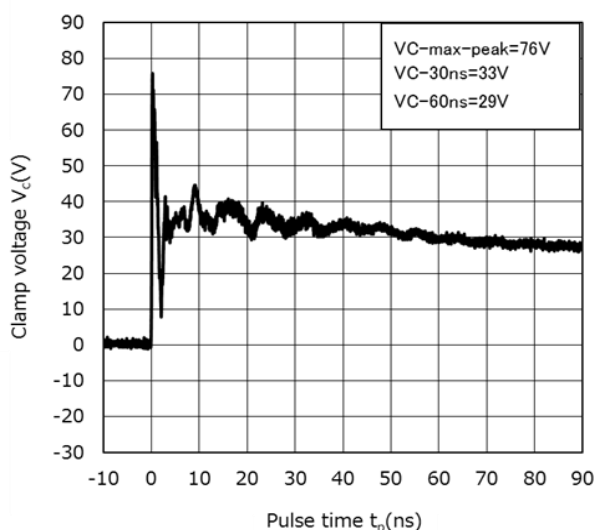
### MSZ24V Characteristics Curves (Note 1)



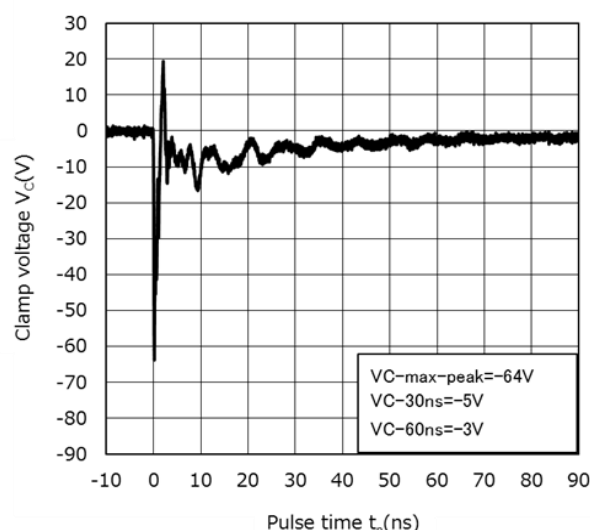
$I_{TLP} - V_{TLP}$



$V_C - I_{PP}$  (Note 2)



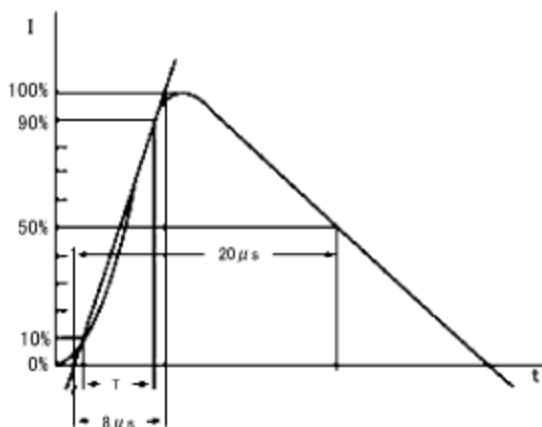
Clamp Waveform +8 kV (Note 3)



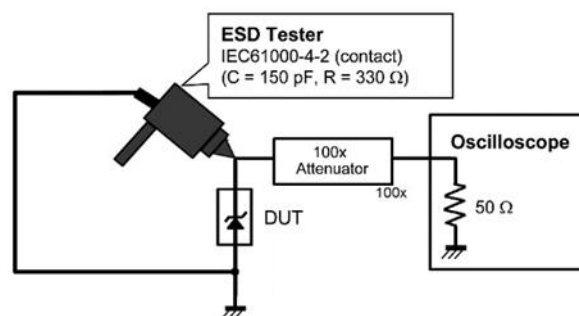
Clamp Waveform -8 kV (Note 3)

### (Note 2) Peak Pulse Current ( $V_C - I_{PP}$ )

### (Note 3) Clamp waveform measurement circuit



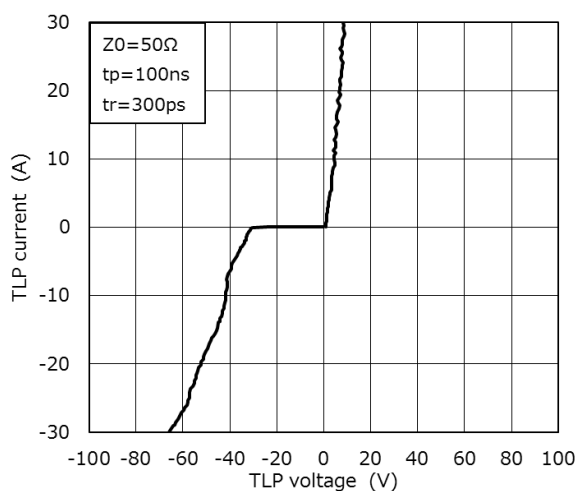
Based on IEC61000-4-5 8/20  $\mu s$  pulse.



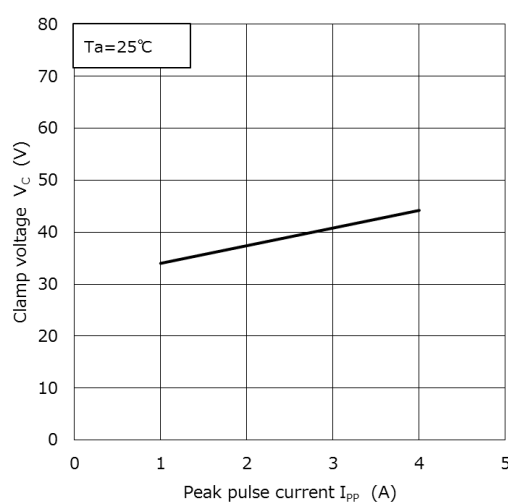
IEC61000-4-2 (Contact)

Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

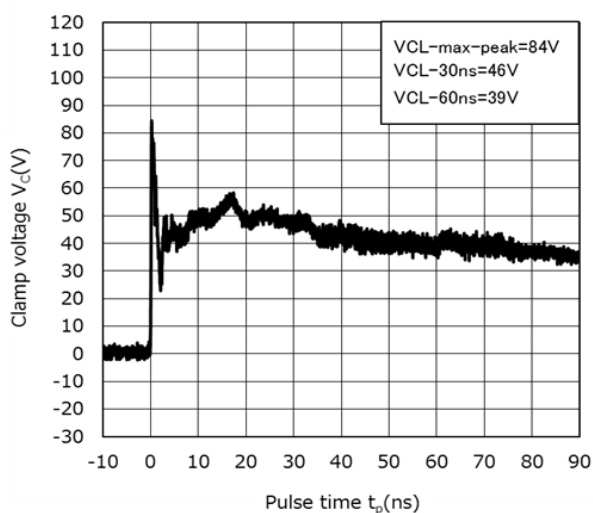
### MSZ30V Characteristics Curves (Note 1)



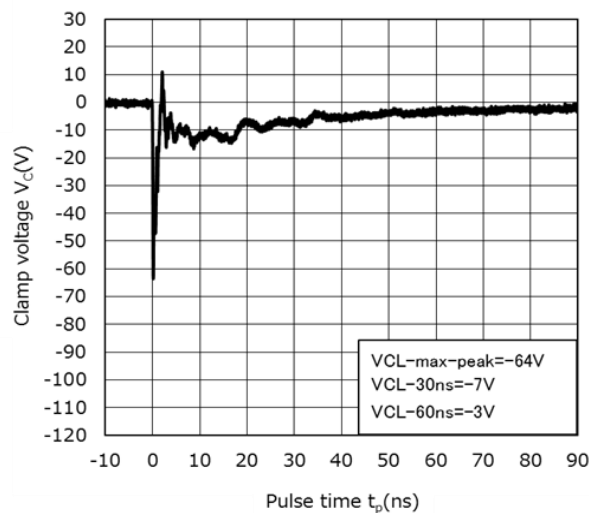
$I_{\text{TLP}} - V_{\text{TLP}}$



$V_C - I_{\text{PP}}$  (Note 2)

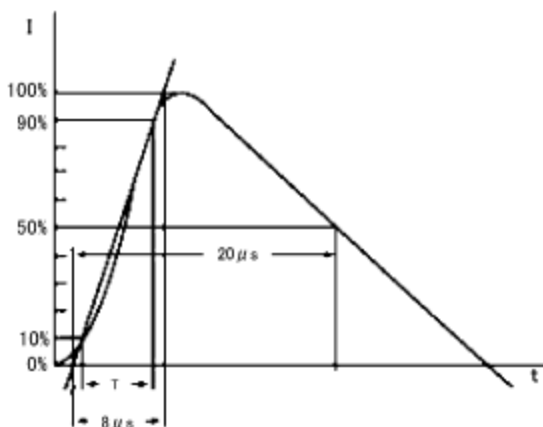


Clamp Waveform +8 kV (Note 3)



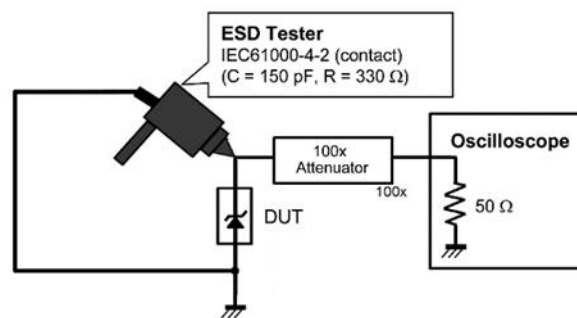
Clamp Waveform -8 kV (Note 3)

### (Note 2) Peak Pulse Current ( $V_C - I_{\text{PP}}$ )



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

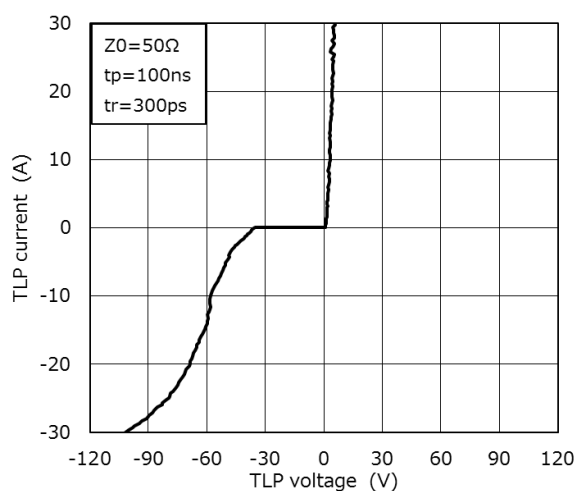
### (Note 3) Clamp waveform measurement circuit



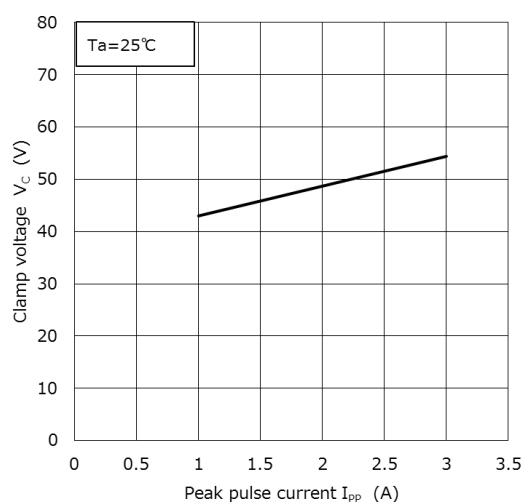
IEC61000-4-2 (Contact)

Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

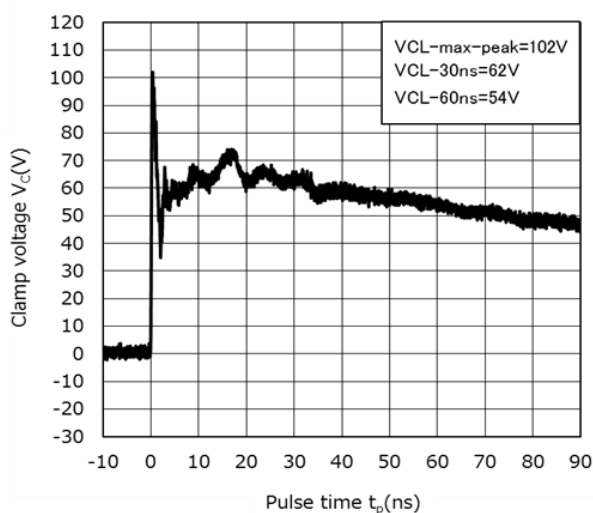
### MSZ36V Characteristics Curves (Note 1)



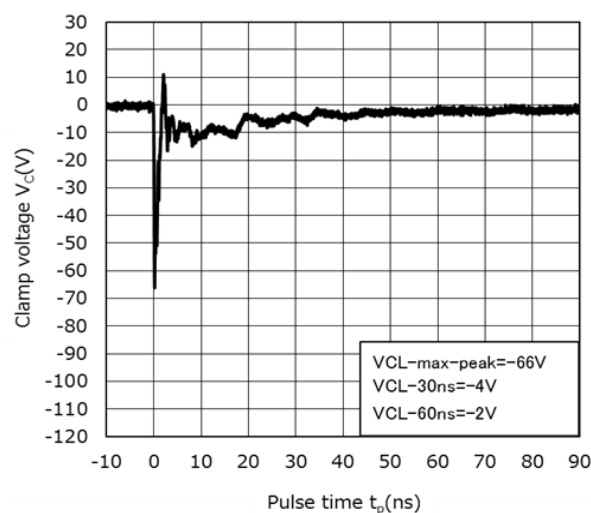
$I_{\text{TLP}} - V_{\text{TLP}}$



$V_c - I_{pp}$  (Note 2)

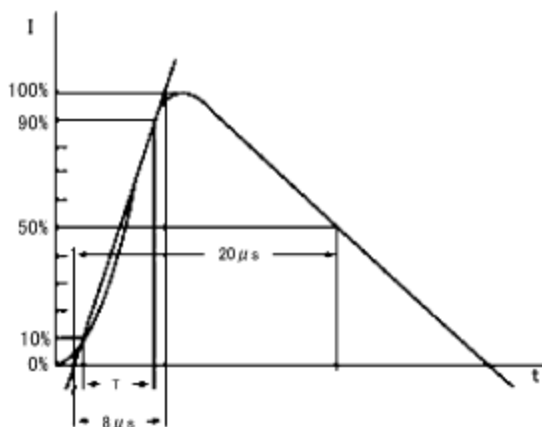


Clamp Waveform +8 kV (Note 3)



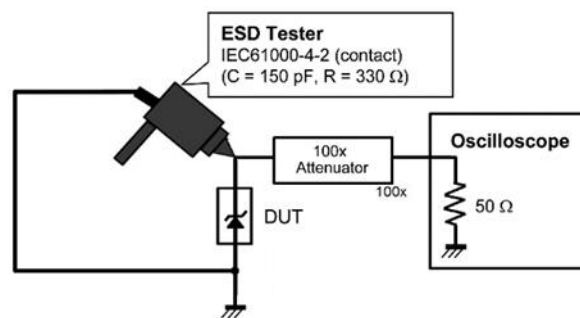
Clamp Waveform -8 kV (Note 3)

### (Note 2) Peak Pulse Current ( $V_c - I_{pp}$ )



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

### (Note 3) Clamp waveform measurement circuit

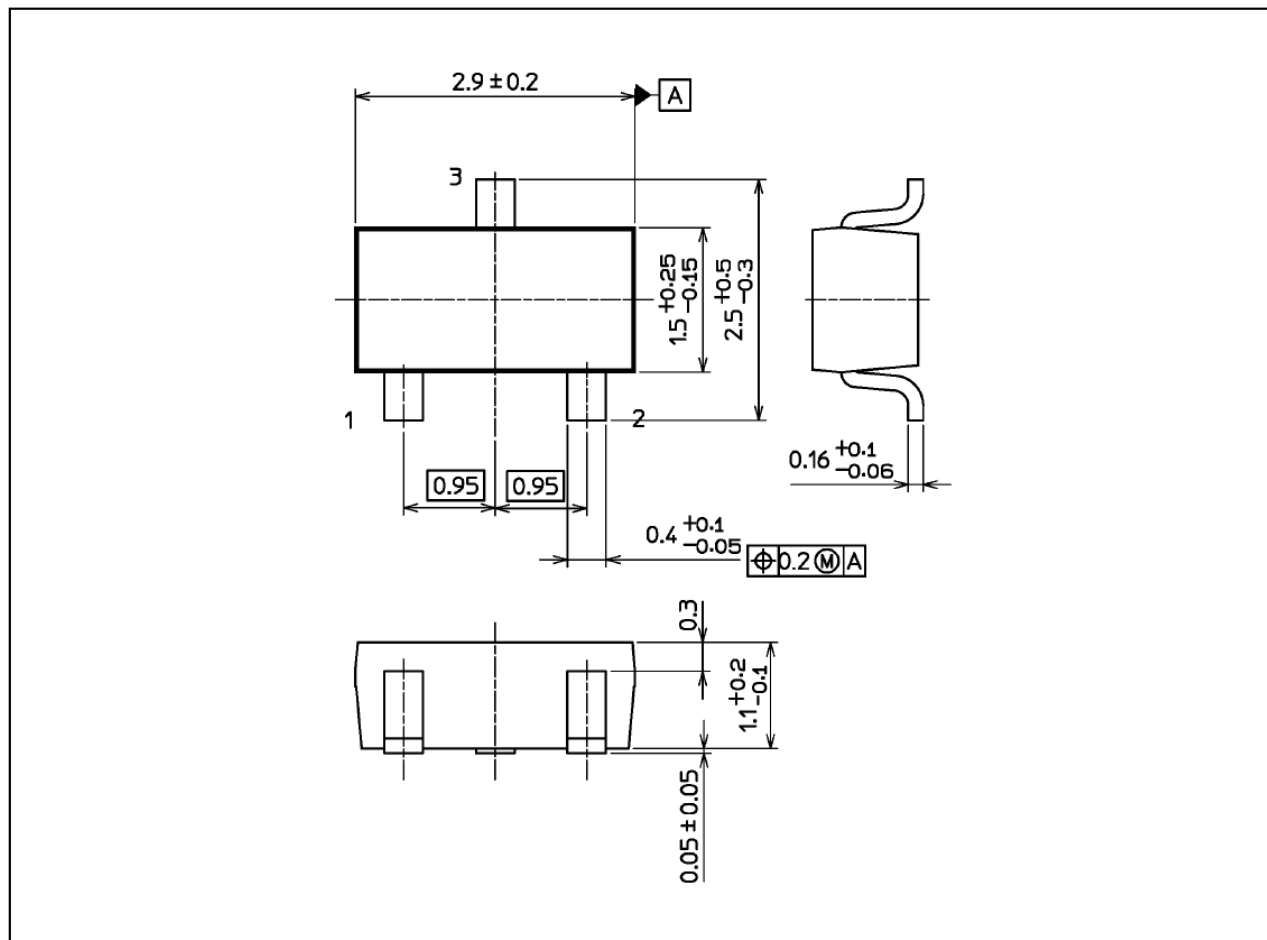


IEC61000-4-2 (Contact)

Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

### Package Dimensions

Unit: mm



Weight: 12mg (typ.)

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