

TOSHIBA Zener Diode Silicon Epitaxial Planar Type

# MUZ Series

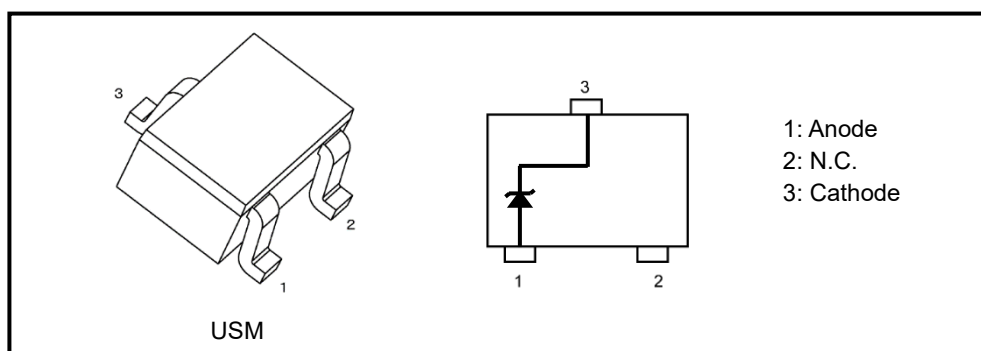
## Applications

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> <sup>*1</sup>	150	mW
	P <sub>D</sub> <sup>*2</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 *3		Peak pulse power *4	Peak pulse current *4	Type No.	Electrostatic discharge voltage *3		Peak pulse power *4	Peak pulse current *4
	Contact	Air				Contact	Air		
	VESD(kV)					VESD(kV)			
MUZ5V6	± 30		155	12	MUZ16V	± 30		200	5.5
MUZ6V2	± 30		175	11	MUZ20V	± 30		200	5
MUZ6V8	± 30		180	10	MUZ24V	± 30		200	4.5
MUZ8V2	± 30		200	8.5	MUZ30V	± 20		200	4
MUZ12V	± 30		200	7	MUZ36V	± 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 × 1.6 mm, Cu pad: 0.5 mm<sup>2</sup> × 3

\*2: Mounted on a glass epoxy circuit board of 25.4 mm × 25.4 mm × 1.6 mm, Cu pad: 645 mm<sup>2</sup>

\*3: according to IEC61000-4-2

\*4: according to IEC61000-4-5, tp = 8 / 20 μs

Start of commercial production  
2020-07

### MUZ series Electrical Characteristics (Unless otherwise specified, Ta = 25°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		Typ.	Typ.	Typ.	Max	
MUZ5V6	5.3	5.6	6.0	5	30	5	0.16	9	125	1	3.5
MUZ6V2	5.8	6.2	6.6	5	30	5	0.21	10	105	2.5	5.0
MUZ6V8	6.4	6.8	7.2	5	30	5	0.27	13	88	1.5	5.5
MUZ8V2	7.7	8.2	8.7	5	30	5	0.37	16.5	67	0.1	7
MUZ12V	11.4	12	12.6	5	30	5	0.7	26	44	0.1	10
MUZ16V	15.3	16	17.1	5	35	5	0.5	27	35	0.1	14
MUZ20V	18.8	20	21.2	5	70	5	0.35	30.5	29	0.1	17.6
MUZ24V	22.8	24	25.6	5	70	5	0.6	36.5	26	0.1	19
MUZ30V	28.0	30	32.0	2	100	2	1.25	47.5	21	0.1	27
MUZ36V	34.0	36	38.0	2	100	2	2.6	63	18	0.1	32.5

\*1: TLP parameters: Z0 = 50 Ω, tp = 100 ns, tr = 300 ps, averaging window: t1 = 30 ns to t2 = 60 ns,

extraction of dynamic resistance using least squares fit of TLP characteristics between ITLP1 = 16 A and ITLP2 = 30 A.

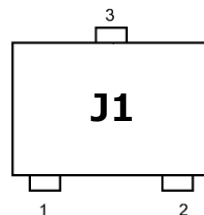
\*2: ITLP = 16 A

\*3: VR = 0 V, f = 1 MHz

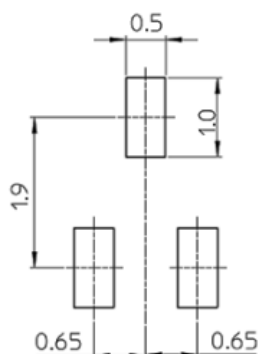
### Marking List

Type No.	Marking	Type No.	Marking
MUZ5V6	J1	MUZ16V	J7
MUZ6V2	J2	MUZ20V	JA
MUZ6V8	J3	MUZ24V	JB
MUZ8V2	J4	MUZ30V	JC
MUZ12V	J6	MUZ36V	JD

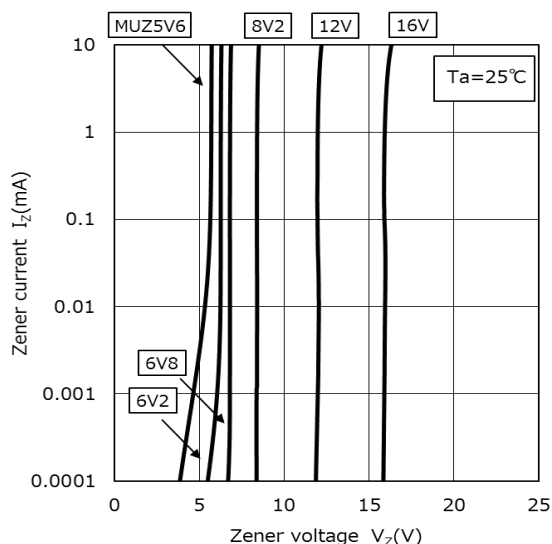
### Marking (MUZ5V6)



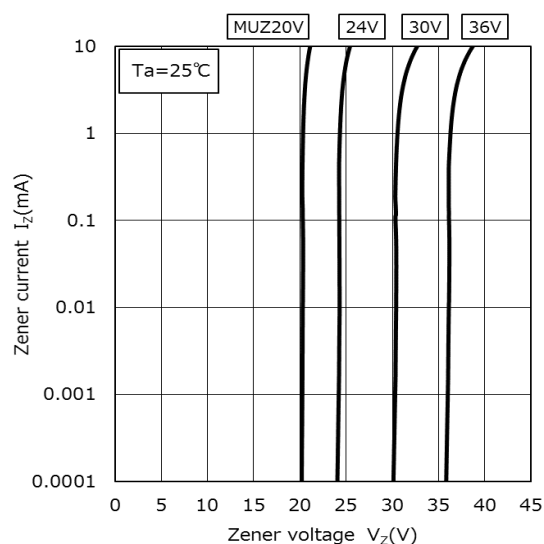
### Land Pattern Dimensions (for reference only) (Unit: mm)



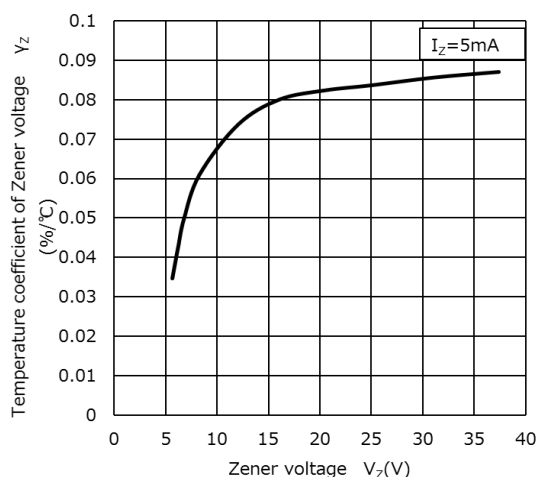
### MUZ series Characteristics Curves (Note 1)



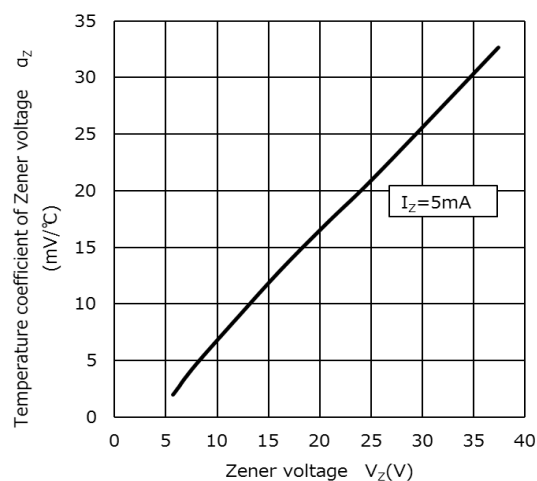
$I_Z - V_Z$  (1)



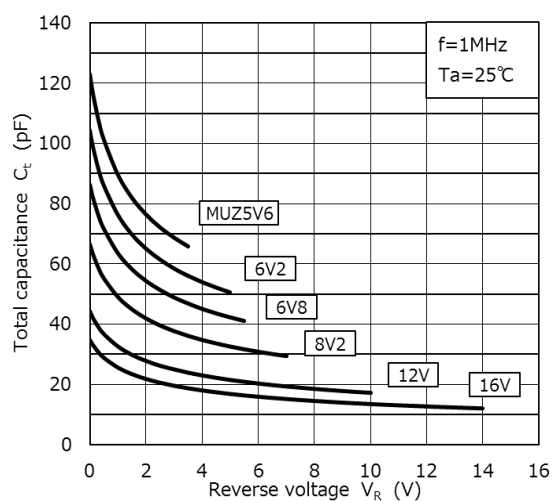
$I_Z - V_Z$  (2)



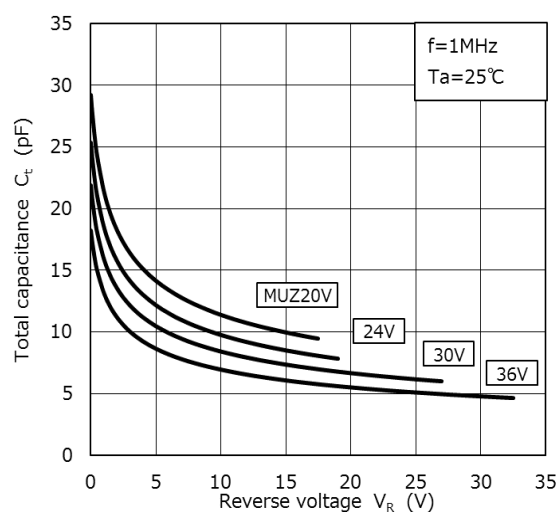
$\gamma_Z - V_Z$



$\alpha_Z - V_Z$



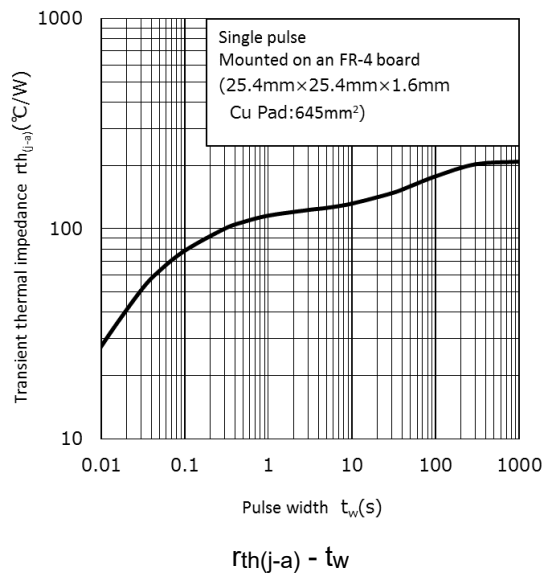
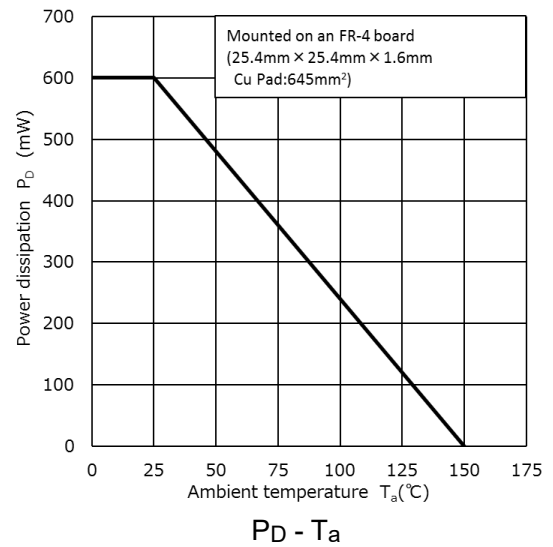
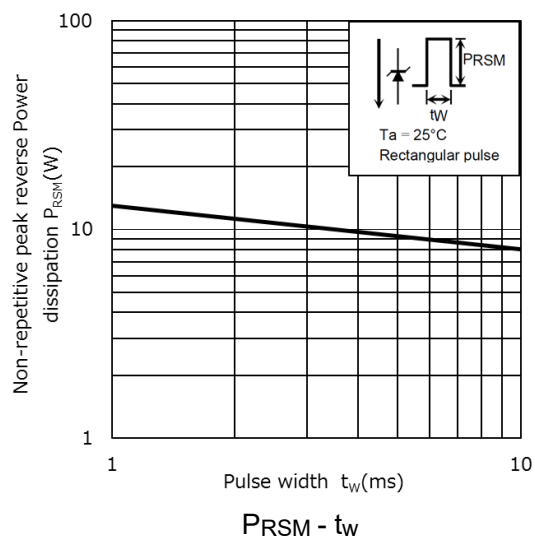
$C_t - V_R$  (1)



$C_t - V_R$  (2)

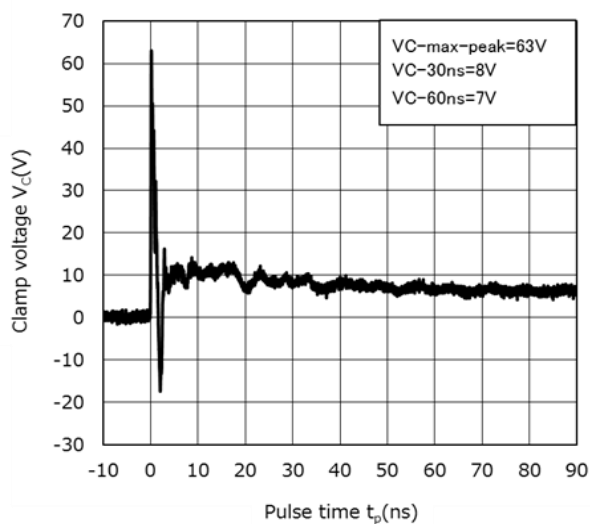
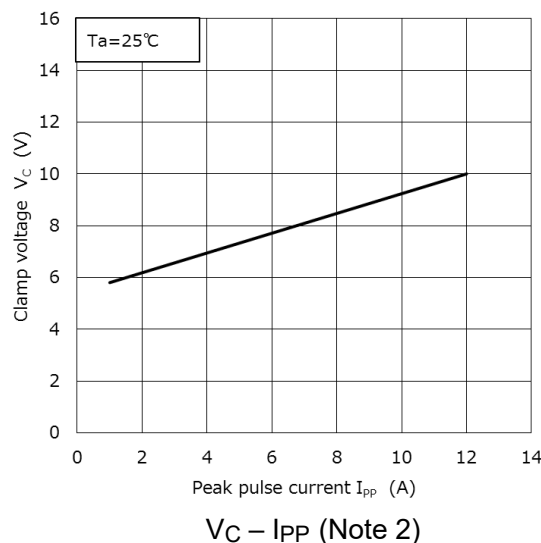
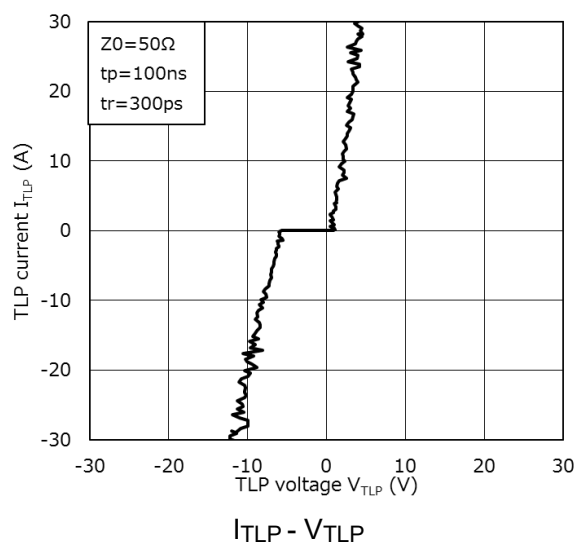
Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

### MUZ series Characteristics Curves (Note 1)

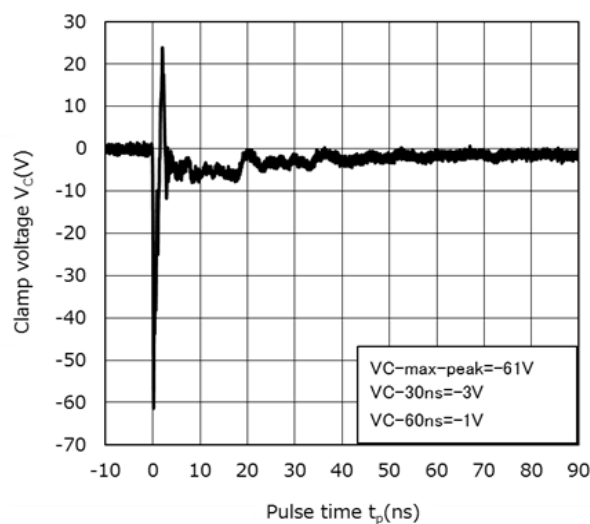


Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

### MUZ5V6 Characteristics Curves (Note 1)

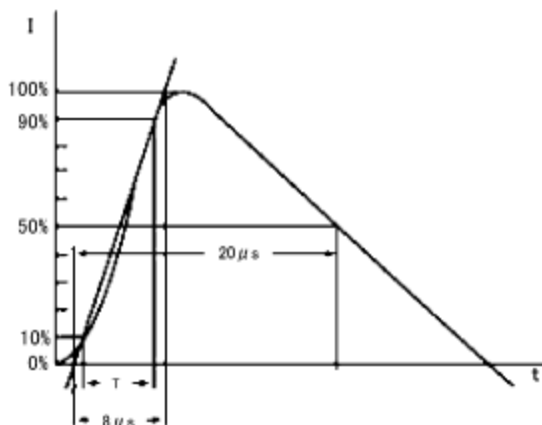


Clamp Waveform +8 kV (Note 3)



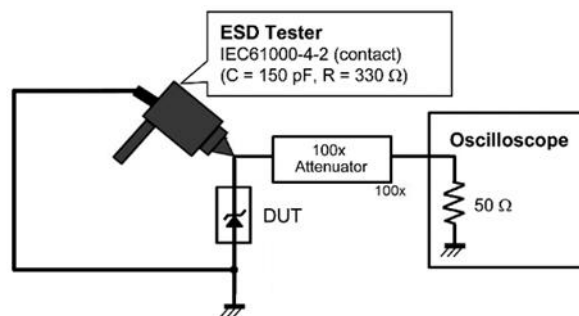
Clamp Waveform -8 kV (Note 3)

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



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

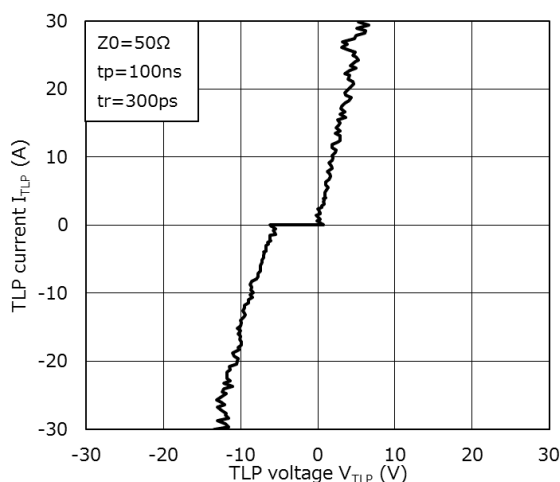
### (Note 3) Clamp waveform measurement circuit



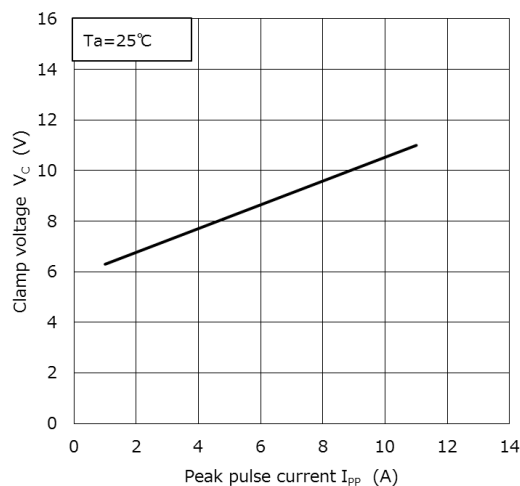
IEC61000-4-2 (Contact)

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

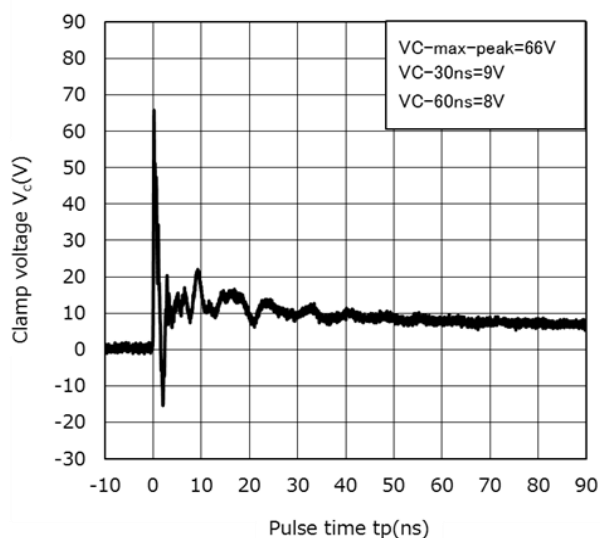
### MUZ6V2 Characteristics Curves (Note 1)



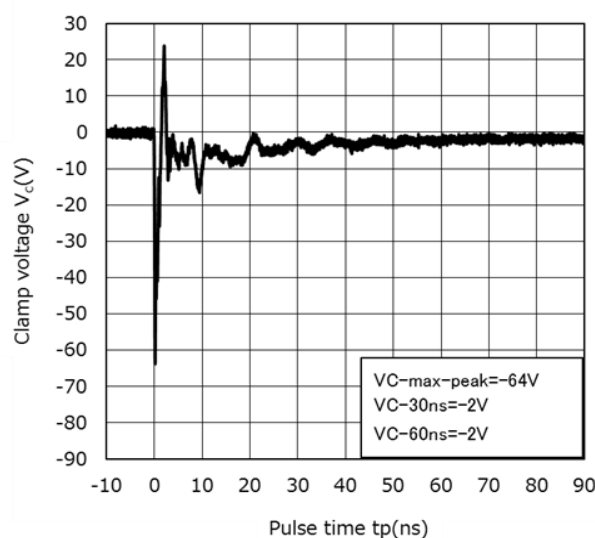
$I_{TLP} - V_{TLP}$



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



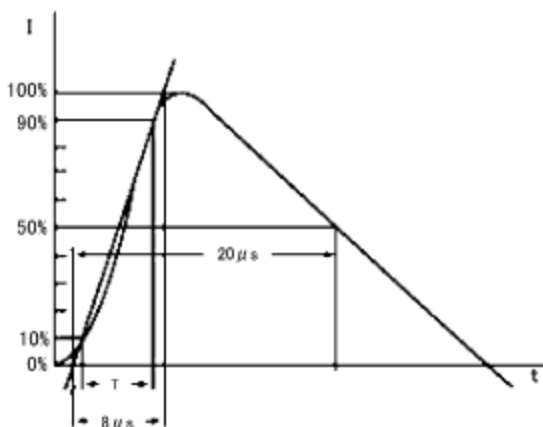
Clamp Waveform +8 kV (Note 3)



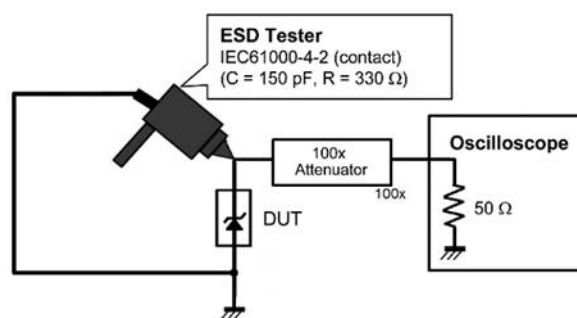
Clamp Waveform -8 kV (Note 3)

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

### (Note 3) Clamp waveform measurement circuit



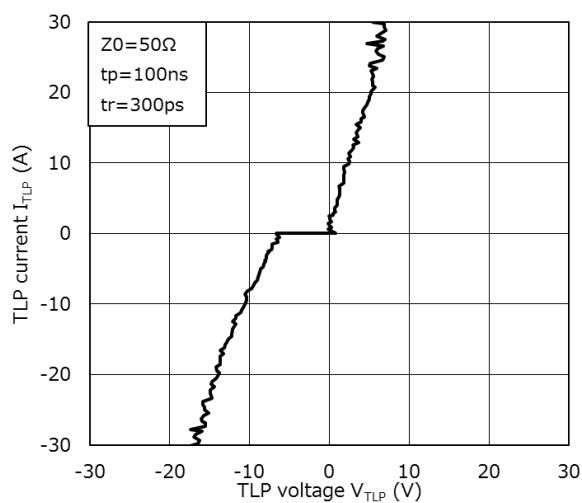
Based on IEC61000-4-5 8/20  $\mu s$  pulse.



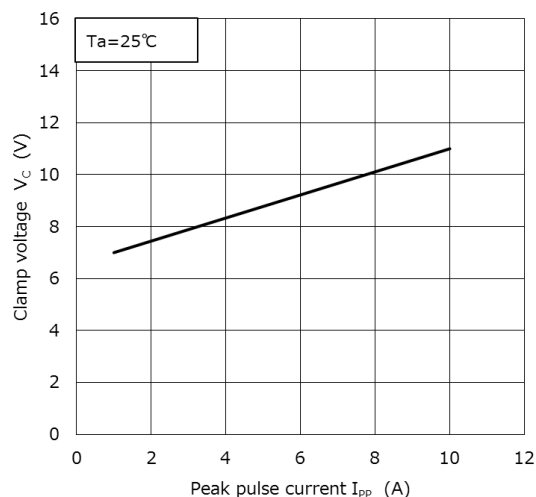
IEC61000-4-2 (Contact)

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

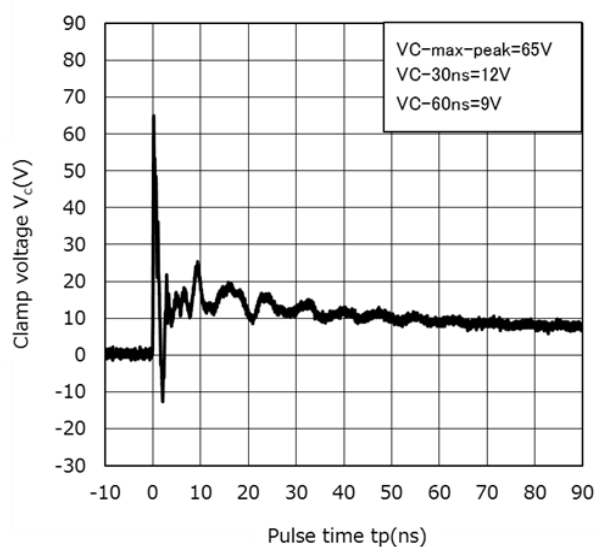
### MUZ6V8 Characteristics Curves (Note 1)



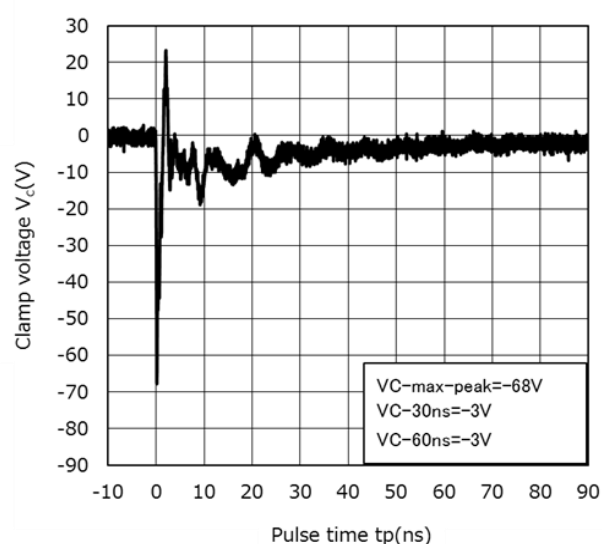
$I_{TLP} - V_{TLP}$



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



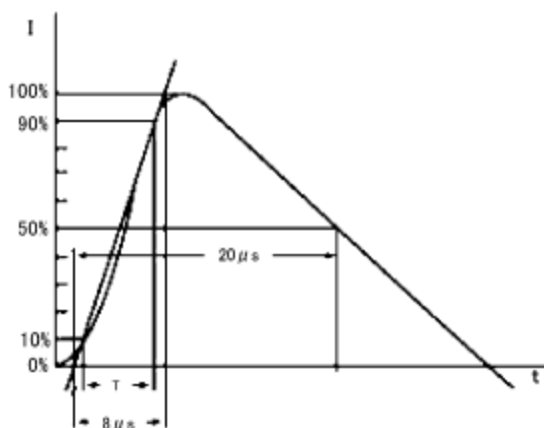
Clamp Waveform +8 kV (Note 3)



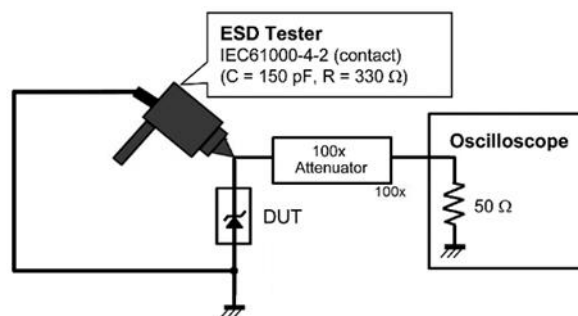
Clamp Waveform -8 kV (Note 3)

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

### (Note 3) Clamp waveform measurement circuit



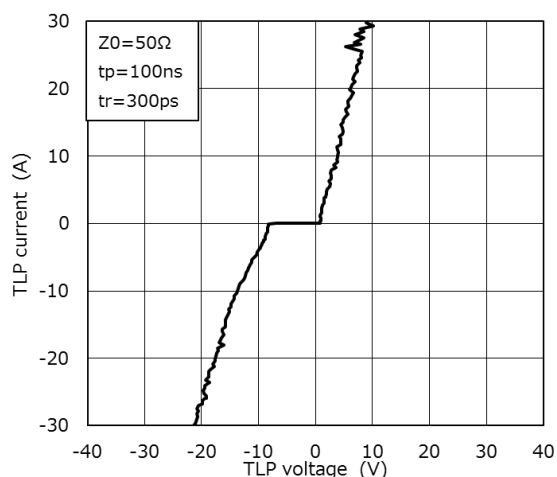
Based on IEC61000-4-5 8/20  $\mu s$  pulse.



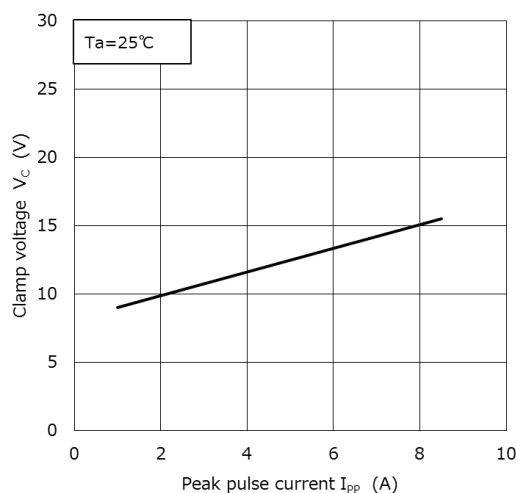
IEC61000-4-2 (Contact)

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

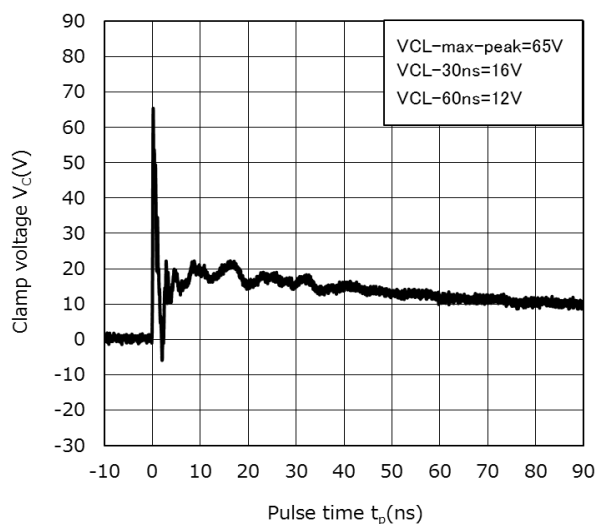
### MUZ8V2 Characteristics Curves (Note 1)



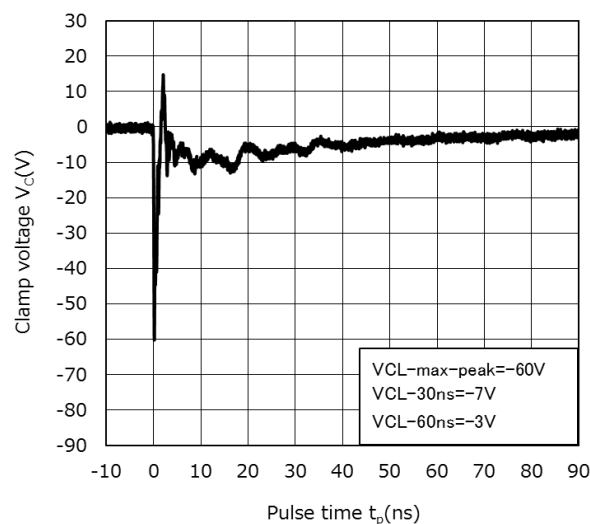
$I_{TLP} - V_{TLP}$



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

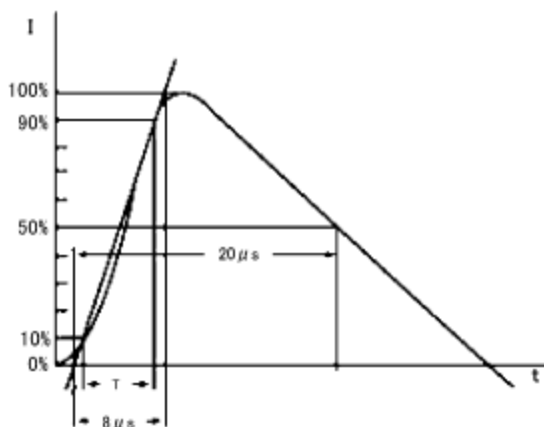


Clamp Waveform +8 kV (Note 3)



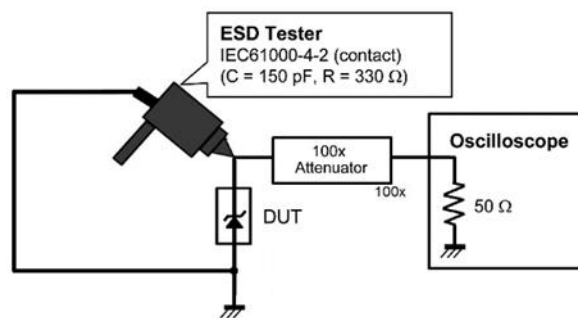
Clamp Waveform -8 kV (Note 3)

### (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

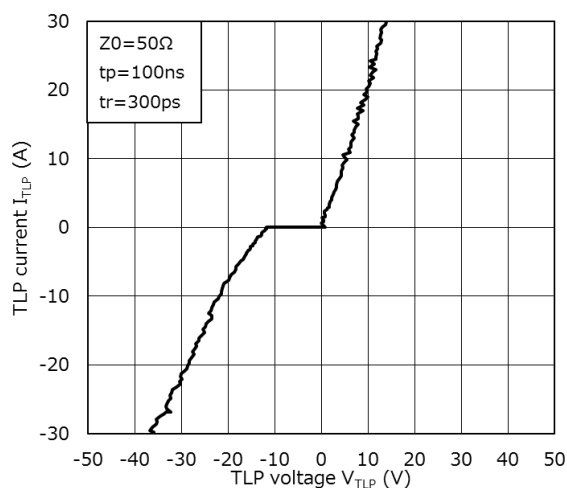


IEC61000-4-2 (Contact)

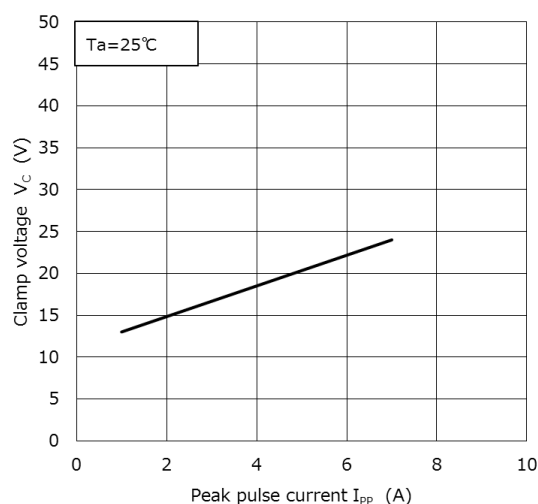
Note 1: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.



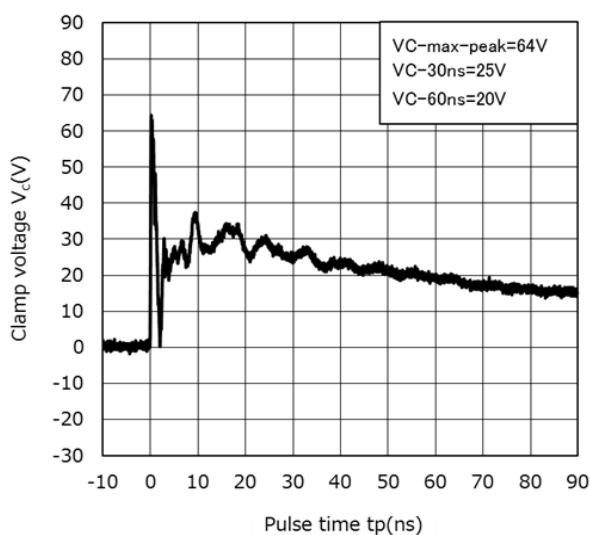
### MUZ12V Characteristics Curves (Note 1)



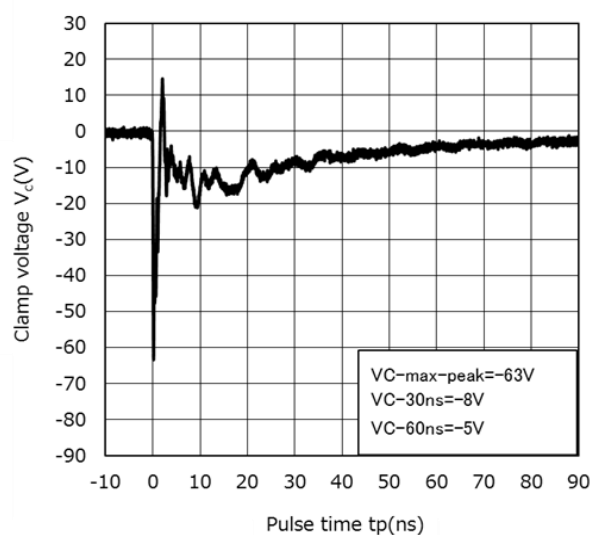
$I_{TLP} - V_{TLP}$



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



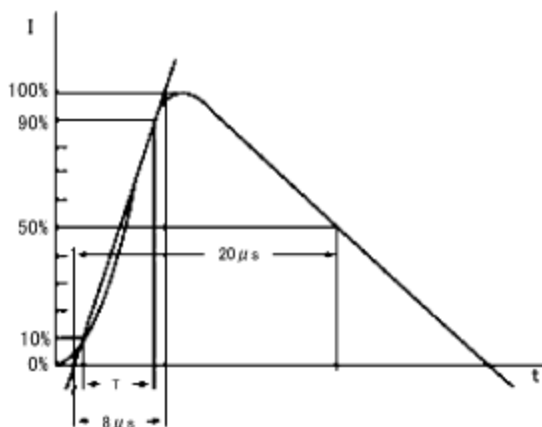
Clamp Waveform +8 kV (Note 3)



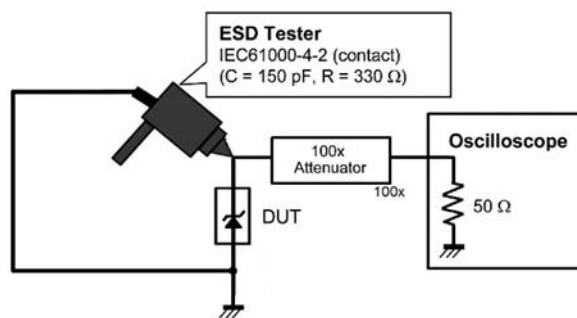
Clamp Waveform -8 kV (Note 3)

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

### (Note 3) Clamp waveform measurement circuit



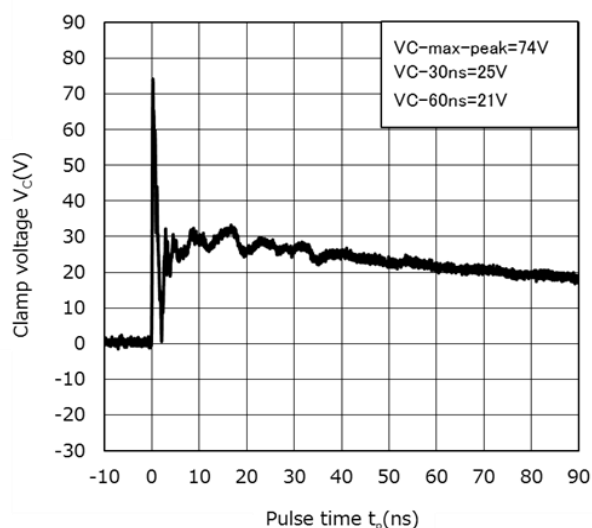
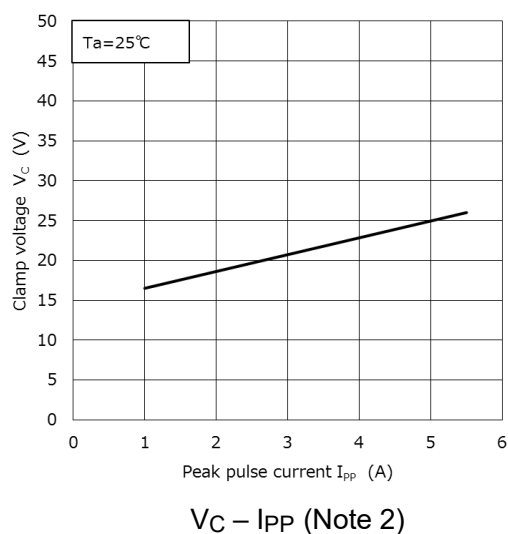
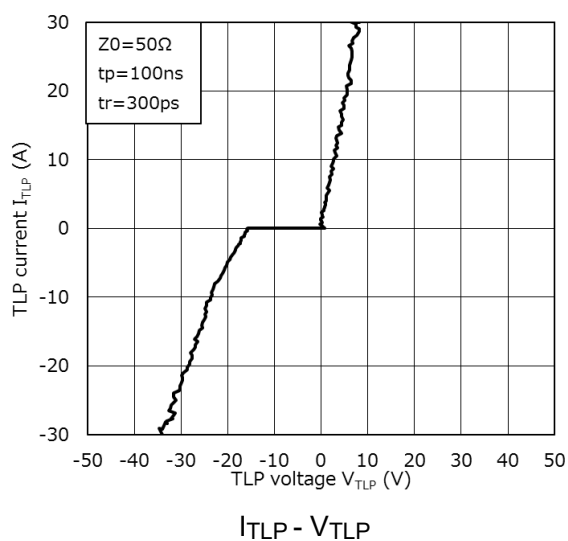
Based on IEC61000-4-5 8/20  $\mu s$  pulse.



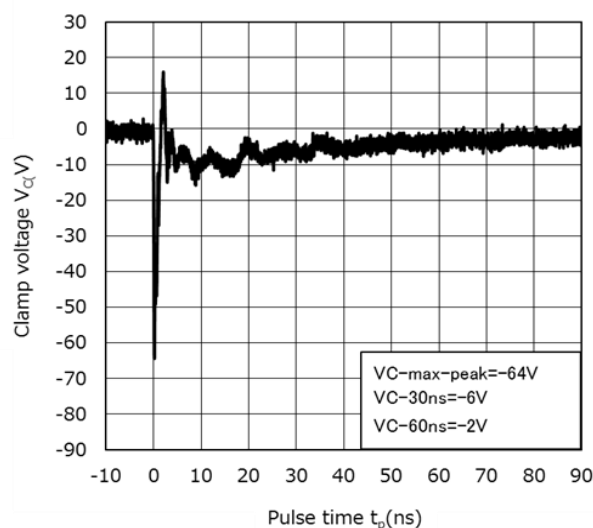
IEC61000-4-2 (Contact)

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

### MUZ16V Characteristics Curves (Note 1)



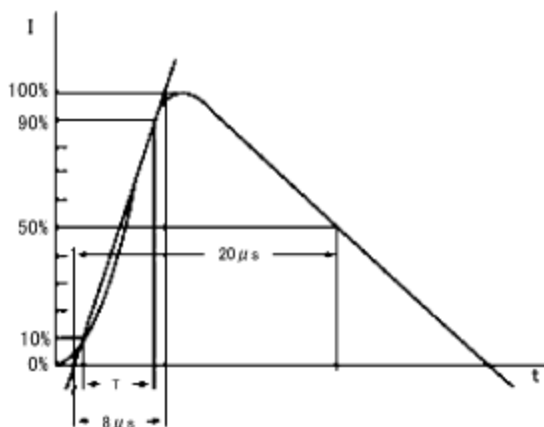
Clamp Waveform +8 kV (Note 3)



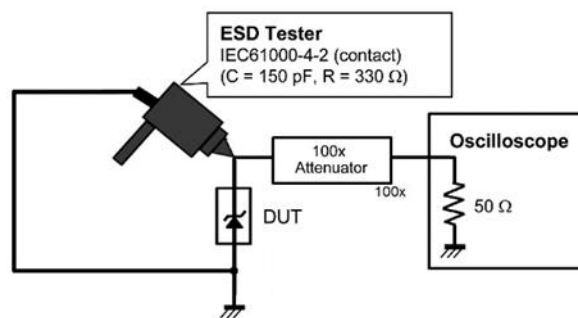
Clamp Waveform -8 kV (Note 3)

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

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



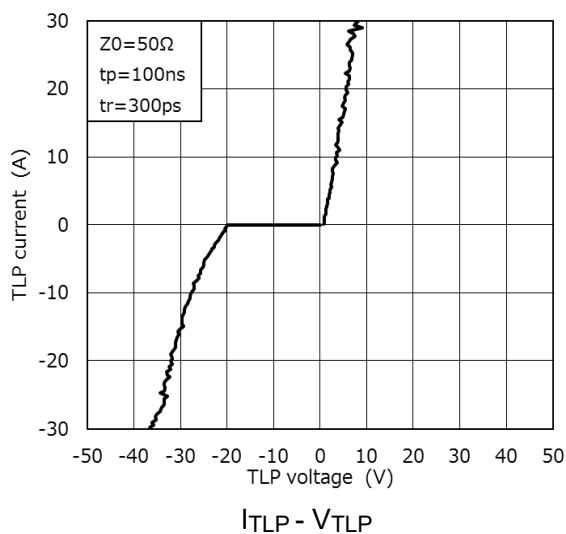
Based on IEC61000-4-5 8/20 μs pulse.



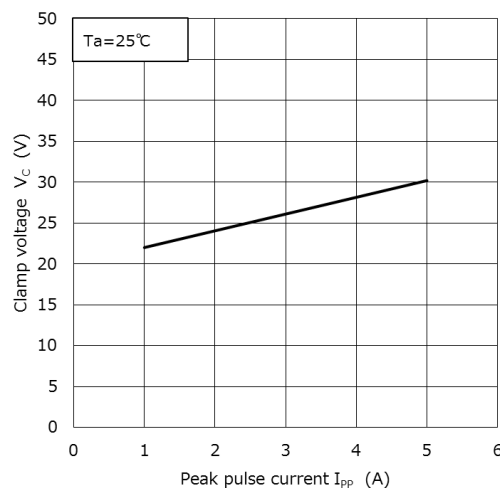
IEC61000-4-2 (Contact)

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

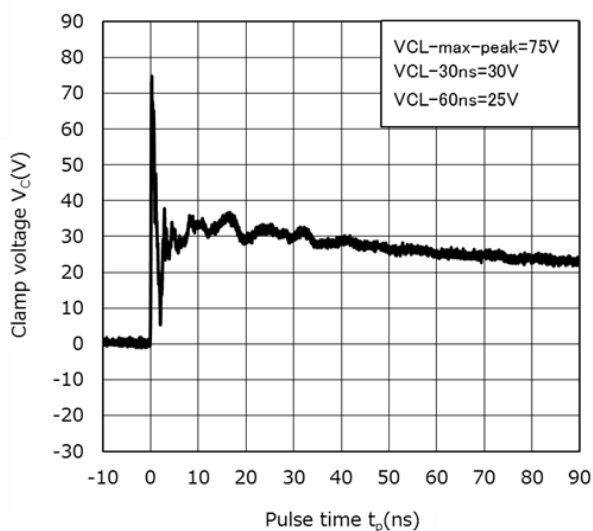
### MUZ20V Characteristics Curves (Note 1)



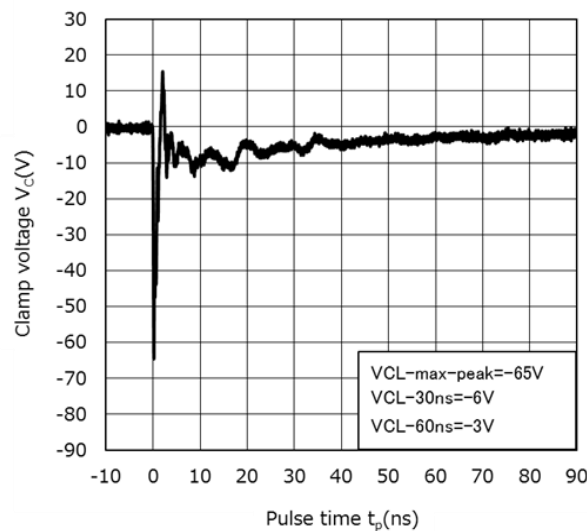
$I_{TLP} - V_{TLP}$



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



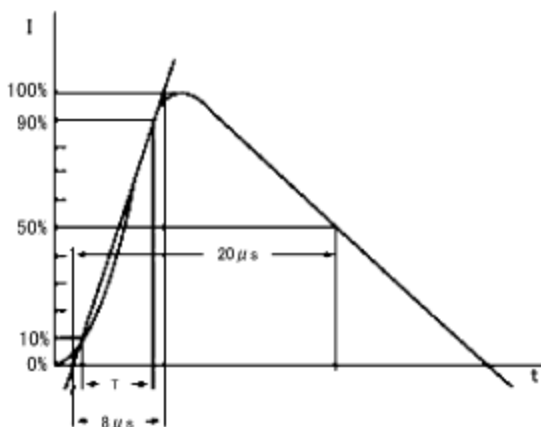
Clamp Waveform +8 kV (Note 3)



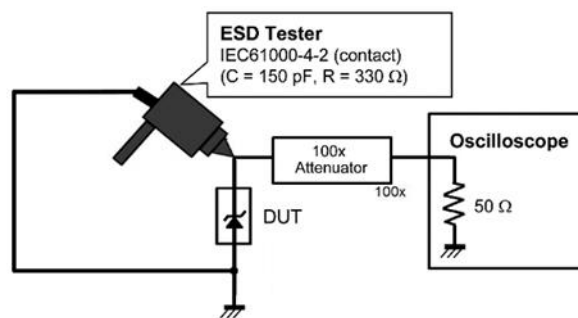
Clamp Waveform -8 kV (Note 3)

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

### (Note 3) Clamp waveform measurement circuit



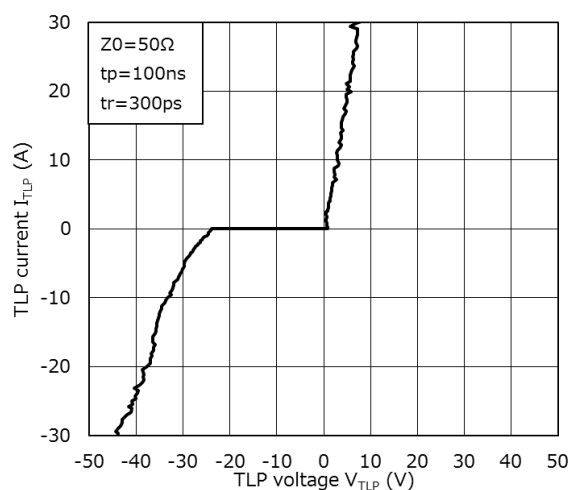
Based on IEC61000-4-5 8/20  $\mu\text{s}$  pulse.



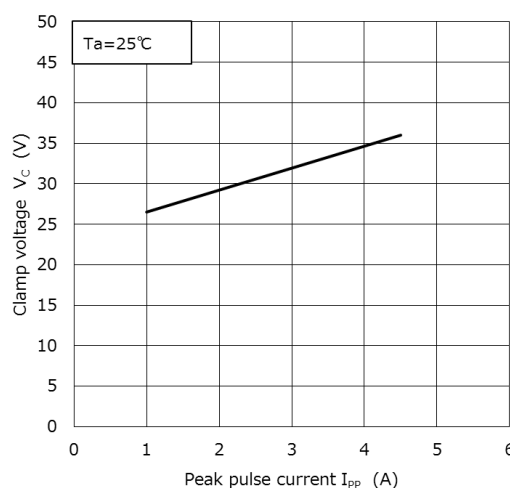
IEC61000-4-2 (Contact)

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

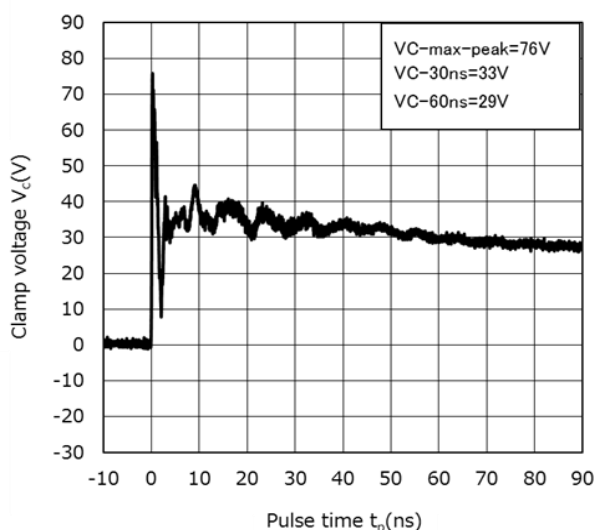
### MUZ24V Characteristics Curves (Note 1)



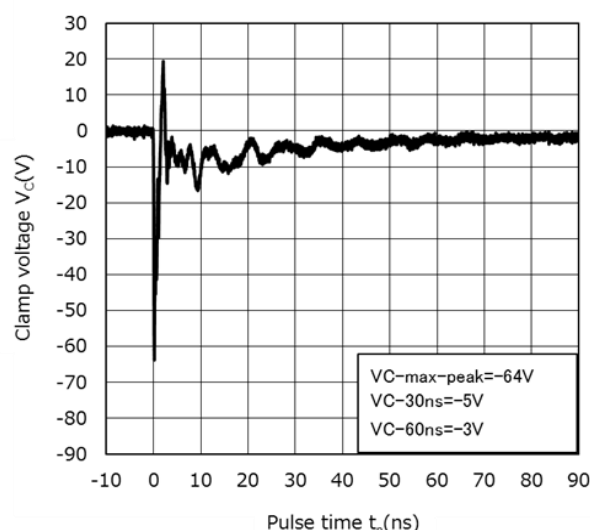
$I_{TLP} - V_{TLP}$



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



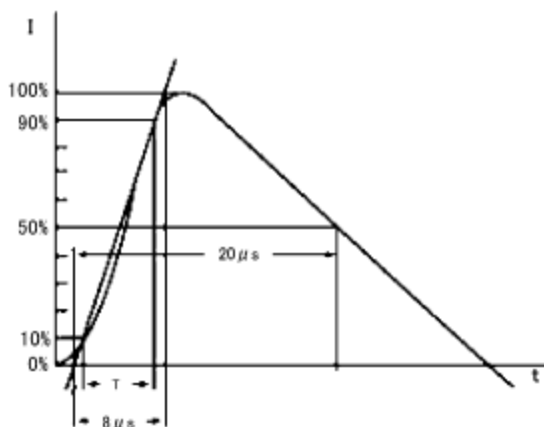
Clamp Waveform +8 kV (Note 3)



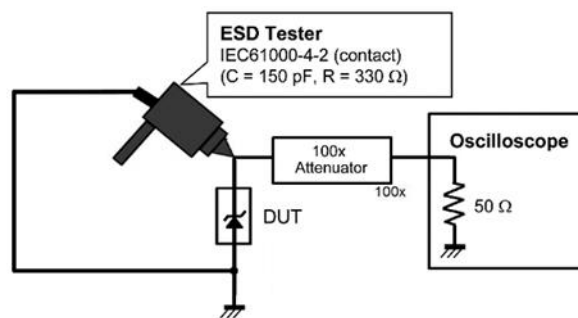
Clamp Waveform -8 kV (Note 3)

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

### (Note 3) Clamp waveform measurement circuit



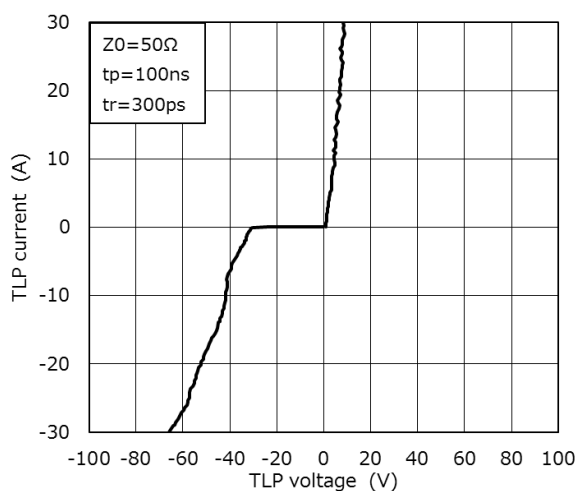
Based on IEC61000-4-5 8/20  $\mu s$  pulse.



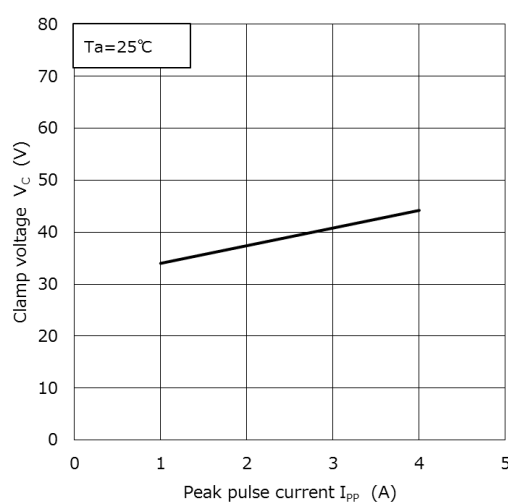
IEC61000-4-2 (Contact)

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

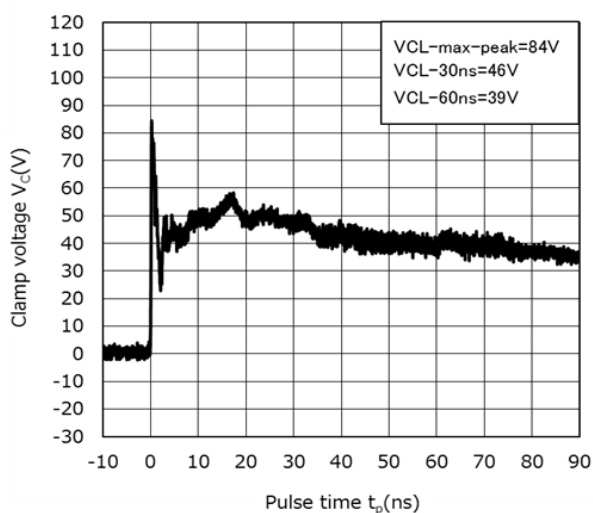
### MUZ30V Characteristics Curves (Note 1)



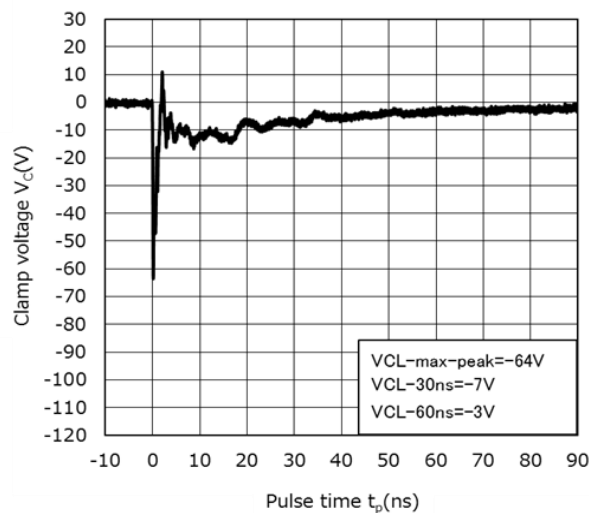
$I_{TLP} - V_{TLP}$



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

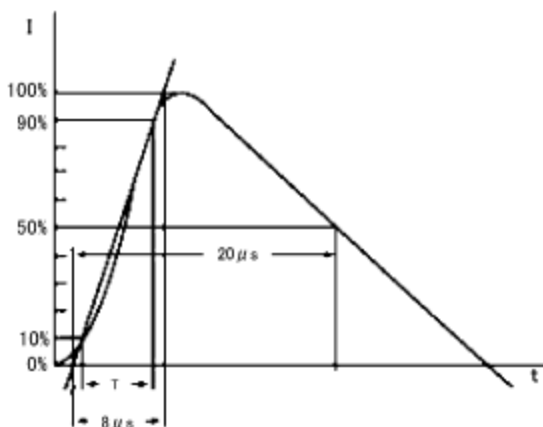


Clamp Waveform +8 kV (Note 3)



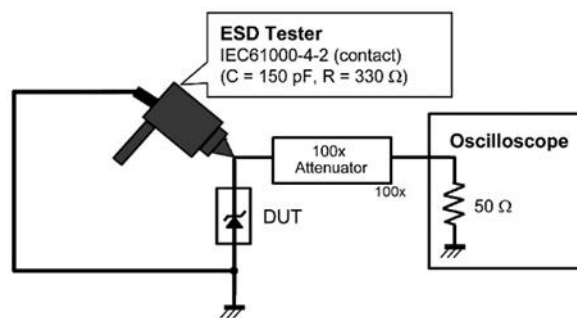
Clamp Waveform -8 kV (Note 3)

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



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

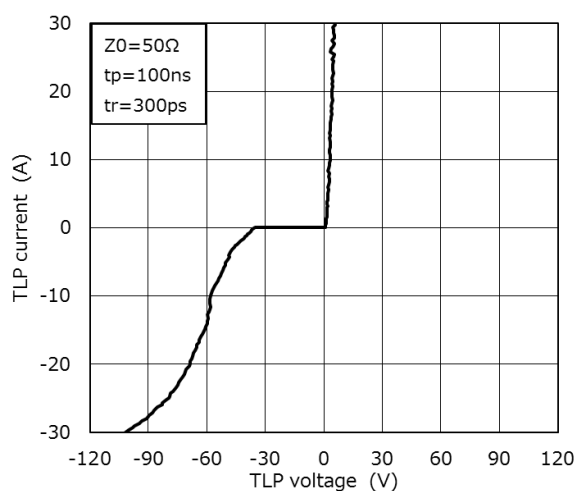
### (Note 3) Clamp waveform measurement circuit



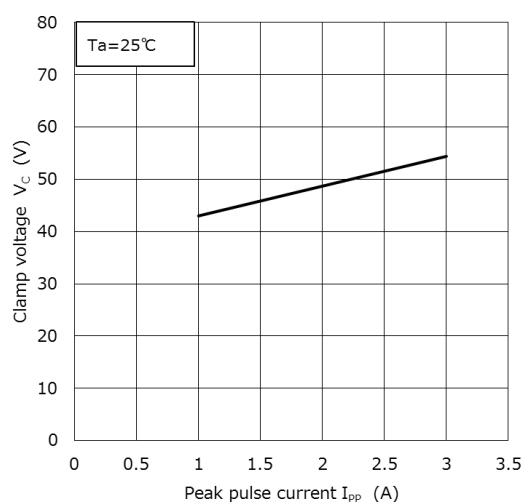
IEC61000-4-2 (Contact)

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

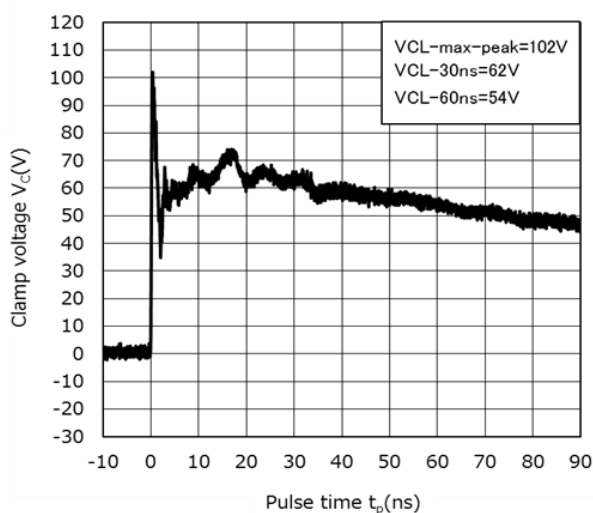
### MUZ36V Characteristics Curves (Note 1)



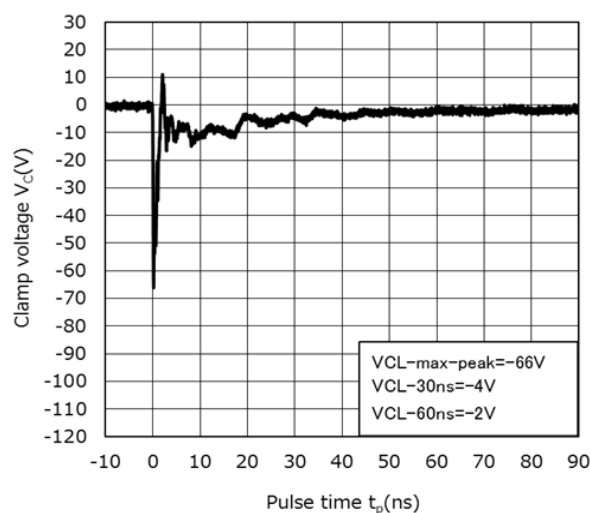
$I_{TLP} - V_{TLP}$



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

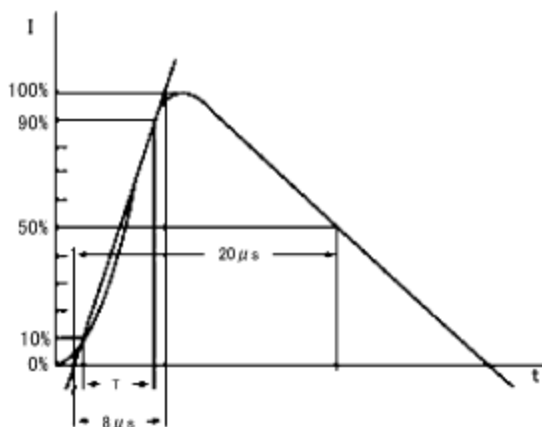


Clamp Waveform +8 kV (Note 3)



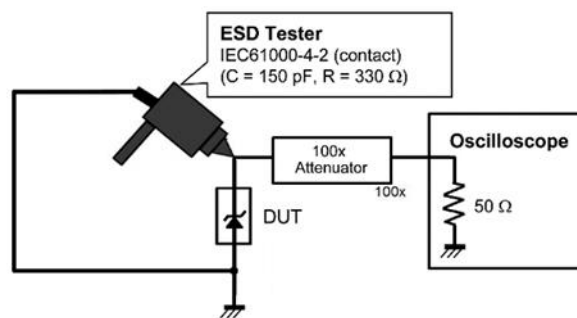
Clamp Waveform -8 kV (Note 3)

### (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

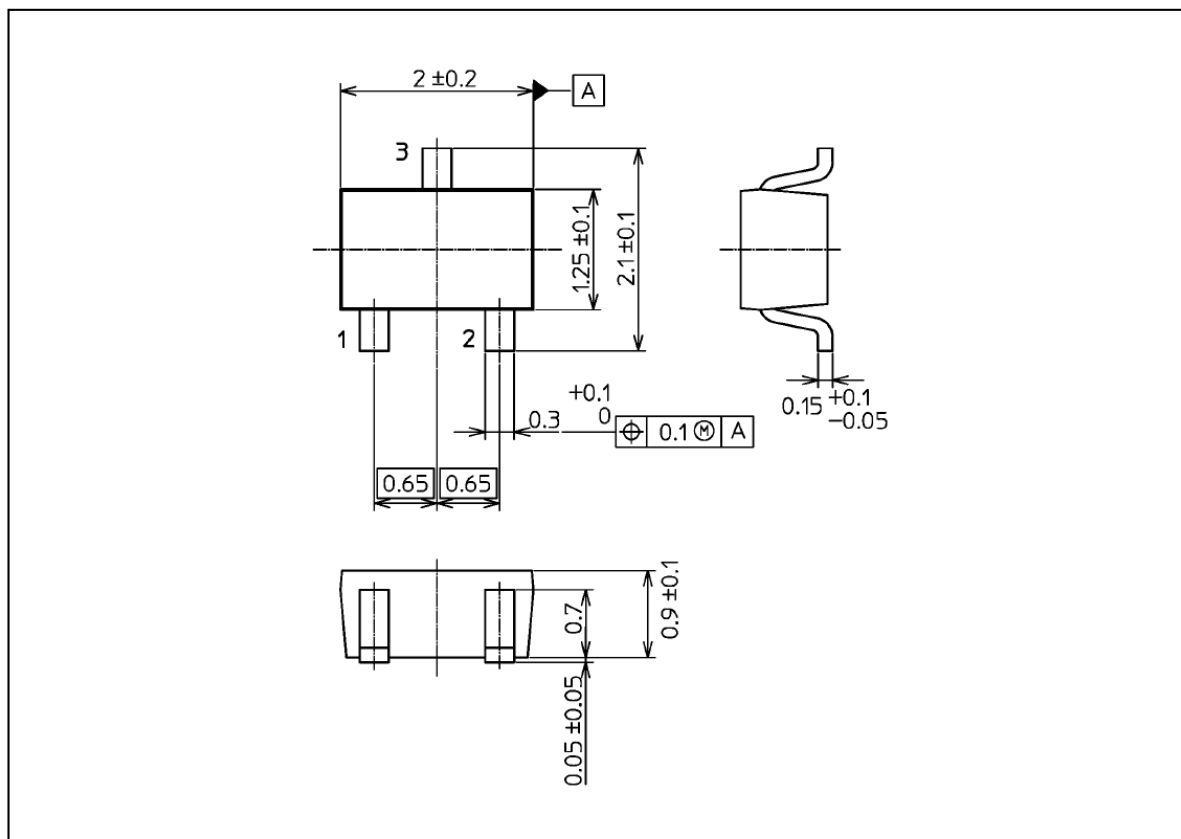


IEC61000-4-2 (Contact)

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

### Package Dimensions

Unit: mm



Weight: 6.0 mg (typ.)

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