Zener Diode Silicon Epitaxial Planar

CEZ series

1. Applications

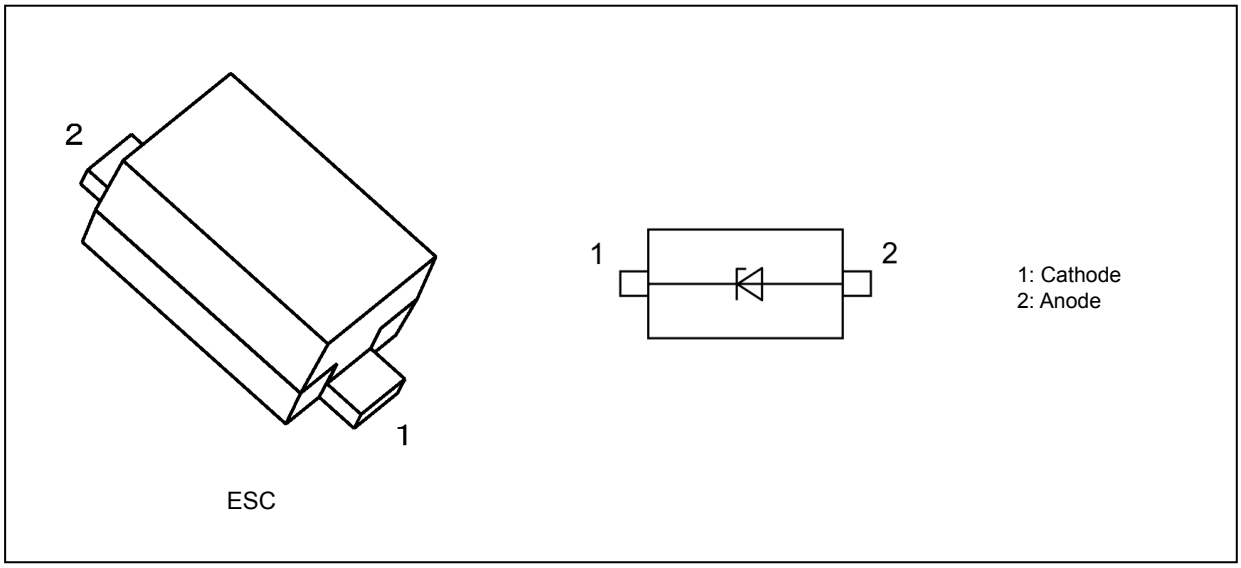
(1) Voltage surge protection

2. Features

(1) Small package

(2) The typical voltage of VZ is accorded to E24 series.

3. Packaging and Internal Circuit



4. Absolute Maximum Ratings 1 (Note) (Unless otherwise specified, T_a = 25 °C)

Characteristics	Symbol	Note	Rating	Unit
Power dissipation	P_D	(Note 1)	150	mW
		(Note 2)	300	
Junction temperature	T_j		150	°C
Storage temperature	T_{stg}		-55 to 150	

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: Mounted on a glass epoxy circuit board of 20 mm × 20 mm, Cu pad: 4 mm × 4 mm.

Note 2: Mounted on a glass epoxy circuit board of 25.4 mm × 25.4 mm × 1.6 mm, Cu pad: 645 mm^2

Start of commercial production
2020-07

5. Absolute Maximum Ratings 2 (Note) (Unless otherwise specified, T_a = 25 °C)

Type No.	Electrostatic discharge voltage (Contact, Air) V_{ESD}(kV) (Note 1)	Peak pulse power P_{PK}(W) (Note 2)	Peak pulse current I_{PP}(A) (Note 2)
CEZ5V6	±30	155	12.0
CEZ6V2	±30	175	11.0
CEZ6V8	±30	180	10.0
CEZ7V5	±30	190	9.5
CEZ8V2	±30	200	8.5
CEZ9V1	±30	200	8.0
CEZ10V	±30	200	7.5
CEZ11V	±30	200	7.25
CEZ12V	±30	200	7.0
CEZ13V	±30	200	6.5
CEZ15V	±30	200	5.6
CEZ16V	±30	200	5.5
CEZ18V	±30	200	5.1
CEZ20V	±30	200	5.0
CEZ22V	±30	200	4.75
CEZ24V	±30	200	4.5
CEZ27V	±20	200	4.1
CEZ30V	±20	200	4.0
CEZ33V	±17	200	3.5
CEZ36V	±12	200	3.0

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).

Note1: According to IEC61000-4-2.

Note2: According to IEC61000-4-5 (tp = 8 / 20 μs)

6. Electrical Characteristics (Unless otherwise specified, T_a = 25 °C)

	Zener Voltage V_Z (V)				Dinamic Impedance Z_Z (Ω)		Dynamic Resistance R_{DYN} (Ω) (Note 1)	Clamp Voltage V_C (V) (Note 1) (Note 2)	Total Capacit-ance C_t (pF) (Note 3)	Reverse Current I_R (μA)	
Type No.	Min	Typ.	Max	Test Current I_Z (mA)	Max	Test Current I_Z (mA)	Typ.	Typ.	Typ.	Max	Test Voltage V_R (V)
CEZ5V6	5.3	5.6	6.0	5	30	5	0.16	9.0	125	1	3.5
CEZ6V2	5.8	6.2	6.6	5	30	5	0.21	10.0	105	2.5	5.0
CEZ6V8	6.4	6.8	7.2	5	30	5	0.27	13.0	88	1.5	5.5
CEZ7V5	7.0	7.5	7.9	5	30	5	0.32	14.0	78	0.1	6.0
CEZ8V2	7.7	8.2	8.7	5	30	5	0.37	16.5	67	0.1	7.0
CEZ9V1	8.5	9.1	9.6	5	30	5	0.44	17.0	62	0.1	7.5
CEZ10V	9.4	10.0	10.6	5	30	5	0.52	19.0	60	0.1	8.0
CEZ11V	10.4	11.0	11.6	5	30	5	0.60	24.0	48	0.1	9.0
CEZ12V	11.4	12.0	12.6	5	30	5	0.70	26.0	44	0.1	10.0
CEZ13V	12.4	13.0	14.1	5	30	5	0.80	27.0	42	0.1	11.0
CEZ15V	13.8	15.0	15.6	5	30	5	0.60	24.0	36	0.1	12.0
CEZ16V	15.3	16.0	17.1	5	35	5	0.50	27.0	35	0.1	14.0
CEZ18V	16.8	18.0	19.1	5	45	5	0.40	28.5	31	0.1	16.0
CEZ20V	18.8	20.0	21.2	5	70	5	0.35	30.5	29	0.1	17.6
CEZ22V	20.8	22.0	23.3	5	70	5	0.40	32.0	27	0.1	18.0
CEZ24V	22.8	24.0	25.6	5	70	5	0.60	36.5	26	0.1	19.0
CEZ27V	25.1	27.0	28.9	2	70	2	0.90	45.0	23	0.1	23.0
CEZ30V	28.0	30.0	32.0	2	100	2	1.25	47.5	21	0.1	27.0
CEZ33V	31.0	33.0	35.0	2	100	2	1.80	57.0	19	0.1	30.0
CEZ36V	34.0	36.0	38.0	2	100	2	2.60	63.0	18	0.1	32.5

Note1: TLP parameters: Z0 = 50 Ω, t_p = 100 ns, t_r = 300 ps, averaging window: t1 = 30 ns to t2 = 60 ns, extraction of dynamic resistance using least squares fit of TLP characteristics between I_{TLP1} = 16 A and I_{TLP2} = 30 A.

Note2: I_{TLP} = 16 A

Note3: V_R = 0 V, f = 1 MHz

7. Marking List

Type No.	Marking	Type No.	Marking	Type No.	Marking
CEZ5V6	LL	CEZ11V	M3	CEZ22V	MA
CEZ6V2	LM	CEZ12V	M4	CEZ24V	MB
CEZ6V8	LN	CEZ13V	M5	CEZ27V	MC
CEZ7V5	LP	CEZ15V	M6	CEZ30V	MD
CEZ8V2	LQ	CEZ16V	M7	CEZ33V	ME
CEZ9V1	LR	CEZ18V	M8	CEZ36V	MF
CEZ10V	M2	CEZ20V	M9	—	—

8. Marking

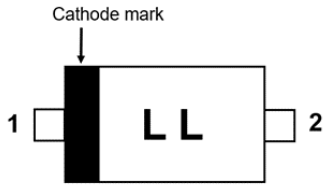


Fig. 8.1 CEZ5V6

9. Land Pattern Dimensions (for reference only)

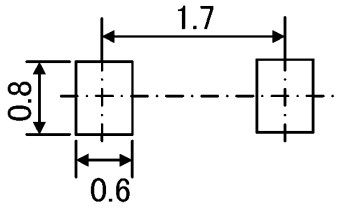


Fig. 9.1 Land Pattern Dimensions
(for reference only) (Unit: mm)

10. Characteristics Curves

10.1. CEZ series Characteristics Curves(Note)

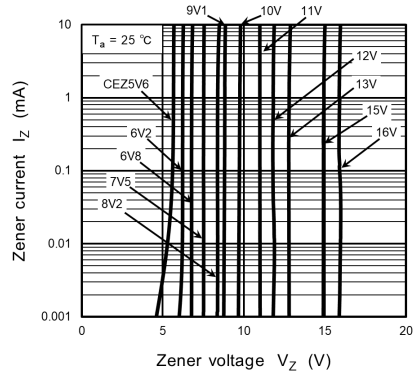


Fig. 10.1.1 I_Z - V_Z(1)

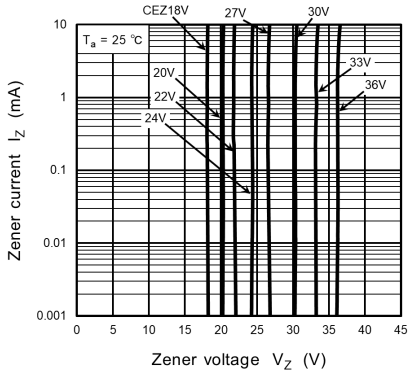


Fig. 10.1.2 I_Z - V_Z(2)

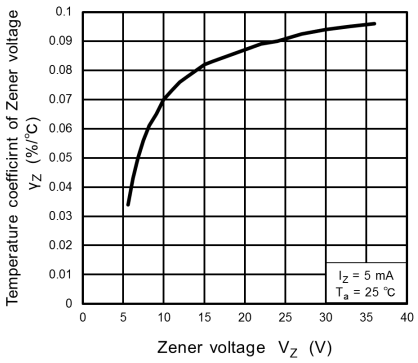


Fig. 10.1.3 γ_Z - V_Z

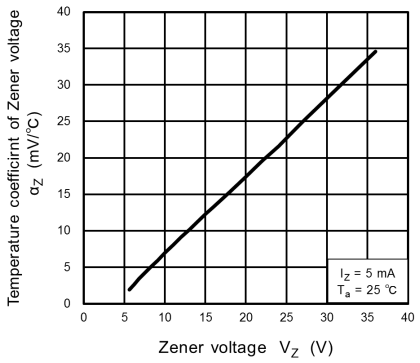


Fig. 10.1.4 α_Z - V_Z

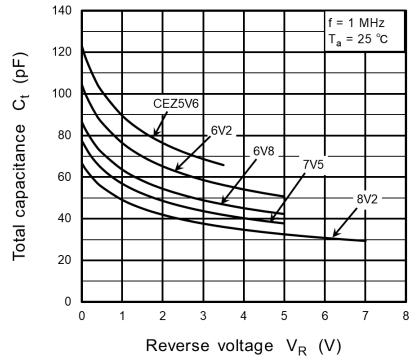


Fig. 10.1.5 C_t - V_R (1)

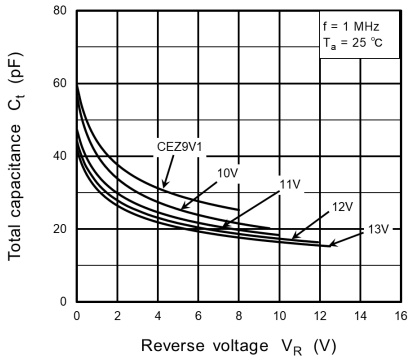


Fig. 10.1.6 C_t - V_R (2)

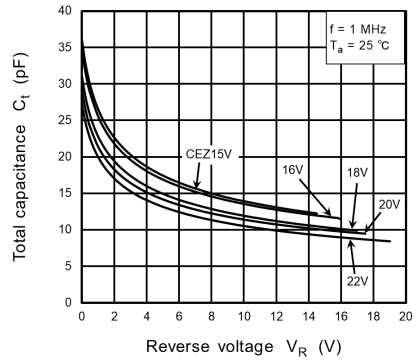


Fig. 10.1.7 C_t - V_R (3)

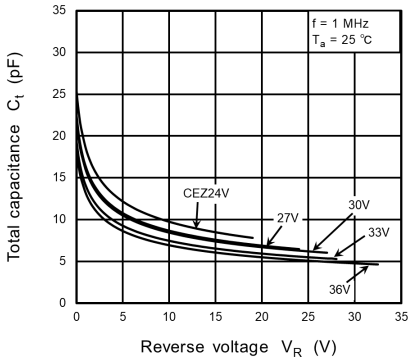


Fig. 10.1.8 C_t - V_R (4)

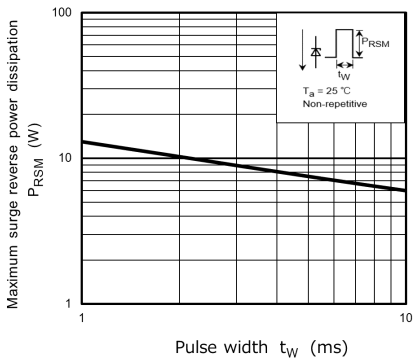


Fig. 10.1.9 P_{RSM} - t_w

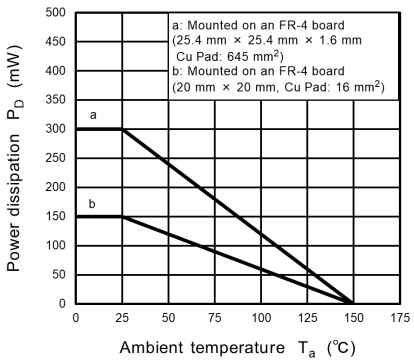


Fig. 10.1.10 P_D - T_a

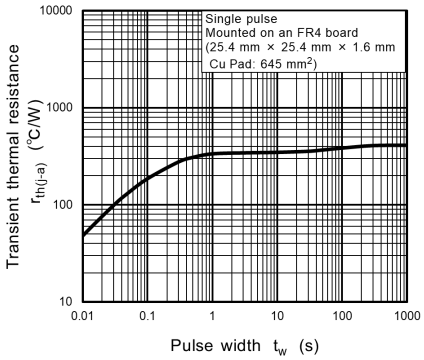


Fig. 10.1.11 $r_{th(j-a)}$ - t_w

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

10.2. CEZ5V6 Characteristics Curves(Note)

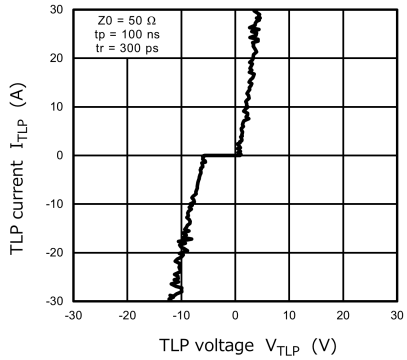


Fig. 10.2.1 I_{TLP} - V_{TLP}

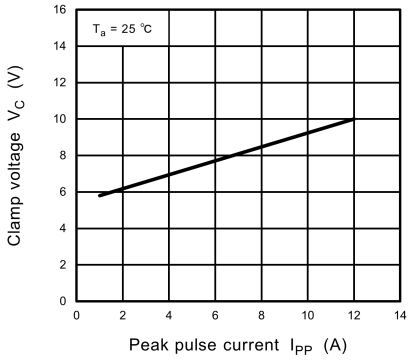


Fig. 10.2.2 V_C - I_{PP}

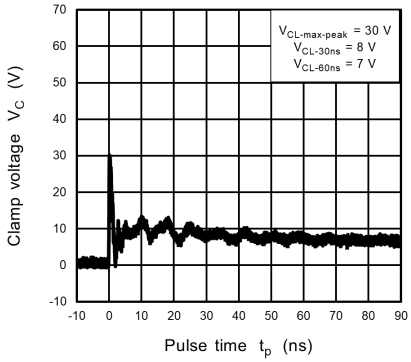


Fig. 10.2.3 IEC61000-4-2 Clamp Waveform +8 kV

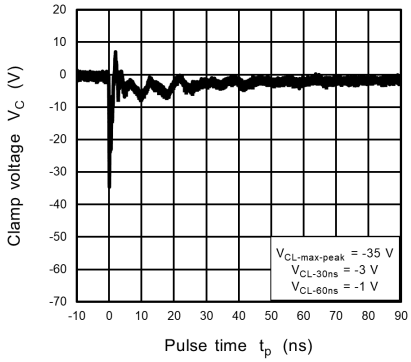


Fig. 10.2.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.3. CEZ6V2 Characteristics Curves(Note)

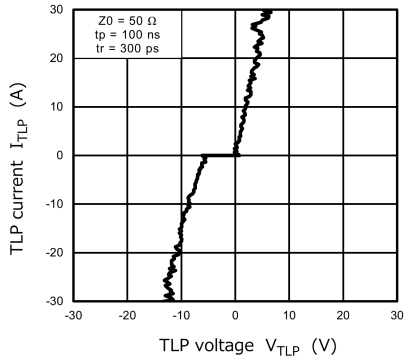


Fig. 10.3.1 I_{TLP} - V_{TLP}

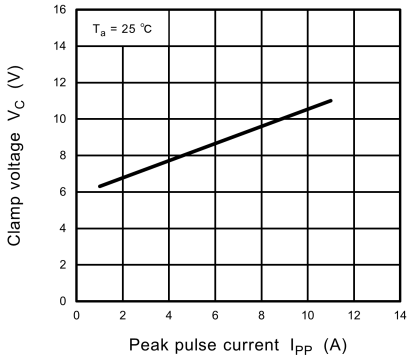


Fig. 10.3.2 V_C - I_{PP}

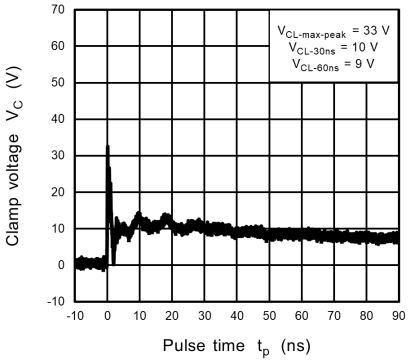


Fig. 10.3.3 IEC61000-4-2 Clamp Waveform +8 kV

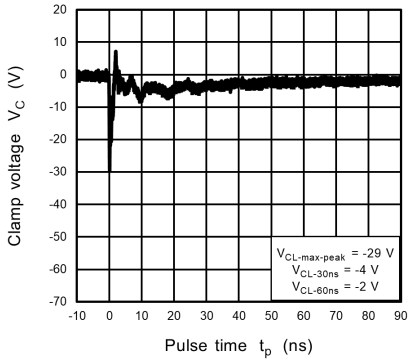


Fig. 10.3.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.4. CEZ6V8 Characteristics Curves(Note)

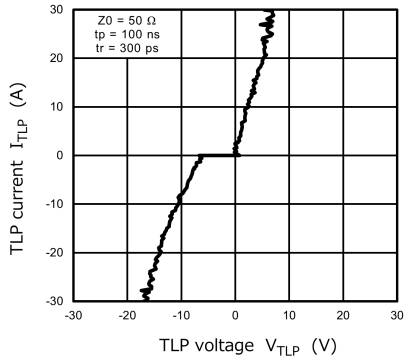


Fig. 10.4.1 I_{TLP} - V_{TLP}

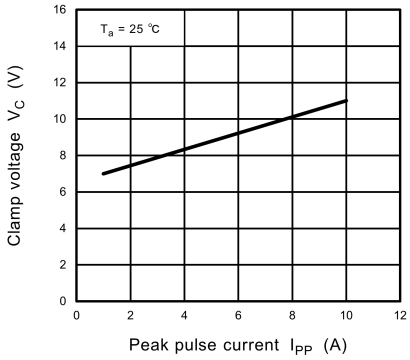


Fig. 10.4.2 V_C - I_{PP}

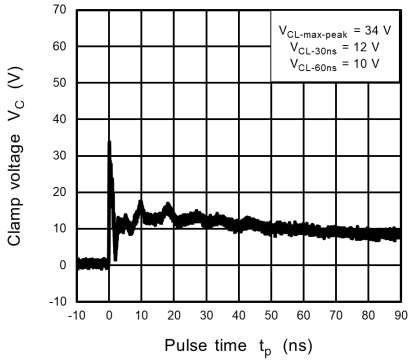


Fig. 10.4.3 IEC61000-4-2
Clamp Waveform +8 kV

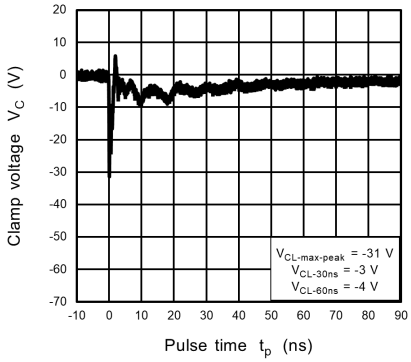


Fig. 10.4.4 IEC61000-4-2
Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_c-I_{PP}) and clamp waveform measurement circuit.

10.5. CEZ7V5 Characteristics Curves(Note)

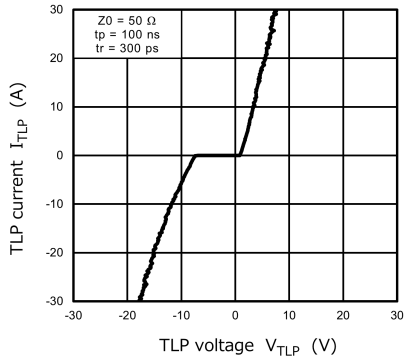


Fig. 10.5.1 I_{TLP} - V_{TLP}

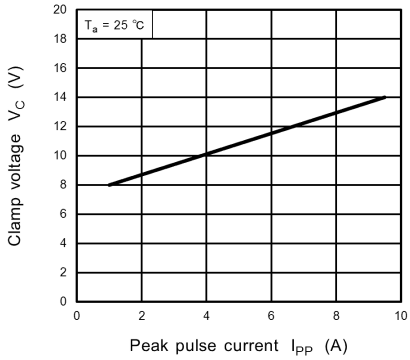


Fig. 10.5.2 V_C - I_{PP}

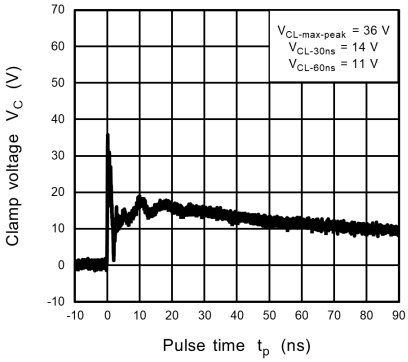


Fig. 10.5.3 IEC61000-4-2 Clamp Waveform +8 kV

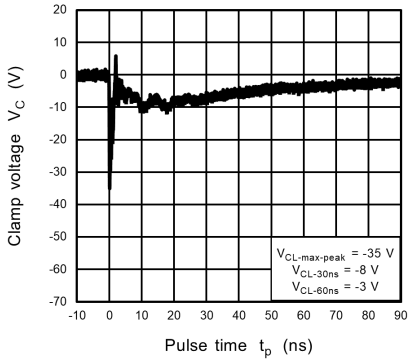


Fig. 10.5.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.6. CEZ8V2 Characteristics Curves(Note)

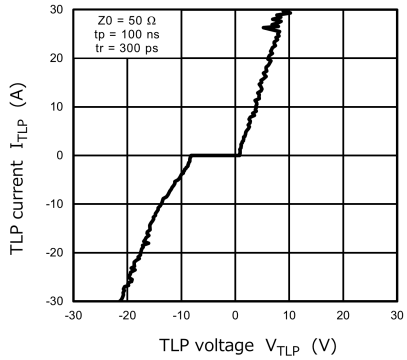


Fig. 10.6.1 I_{TLP} - V_{TLP}

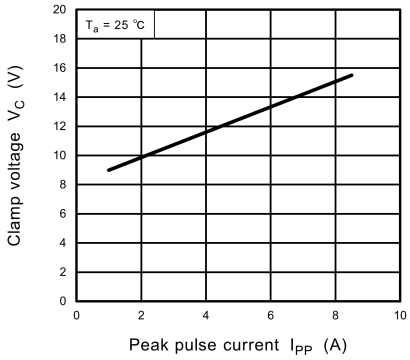


Fig. 10.6.2 V_C - I_{PP}

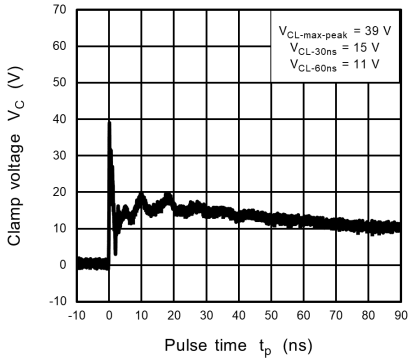


Fig. 10.6.3 IEC61000-4-2 Clamp Waveform +8 kV

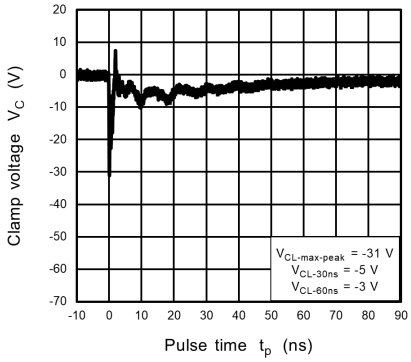


Fig. 10.6.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.7. CEZ9V1 Characteristics Curves(Note)

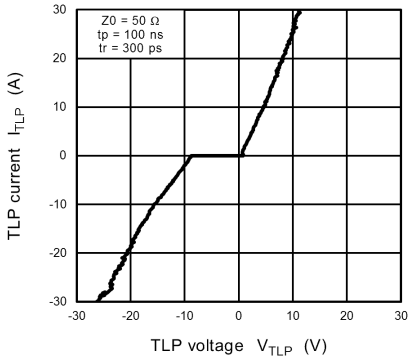


Fig. 10.7.1 I_{TLP} - V_{TLP}

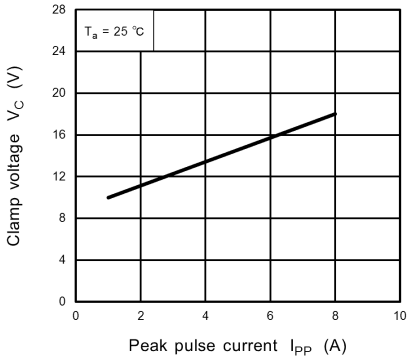


Fig. 10.7.2 V_C - I_{PP}

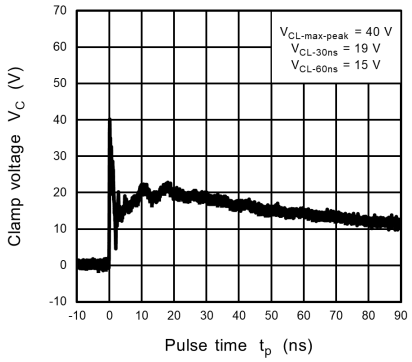


Fig. 10.7.3 IEC61000-4-2
Clamp Waveform +8 kV

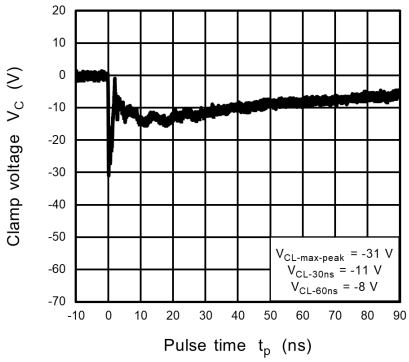


Fig. 10.7.4 IEC61000-4-2
Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.8. CEZ10V Characteristics Curves(Note)

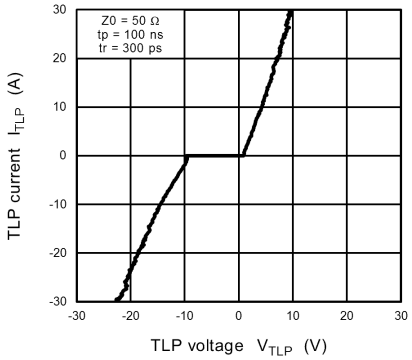


Fig. 10.8.1 I_{TLP} - V_{TLP}

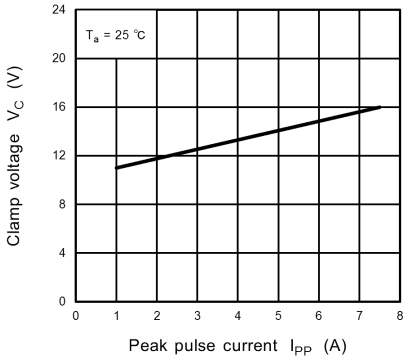


Fig. 10.8.2 V_C - I_{PP}

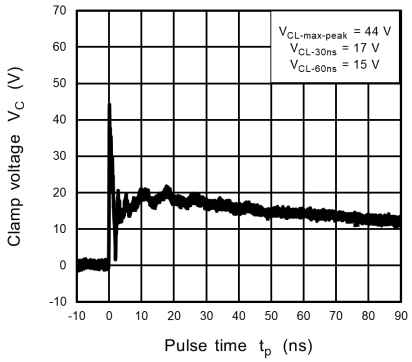


Fig. 10.8.3 IEC61000-4-2 Clamp Waveform +8 kV

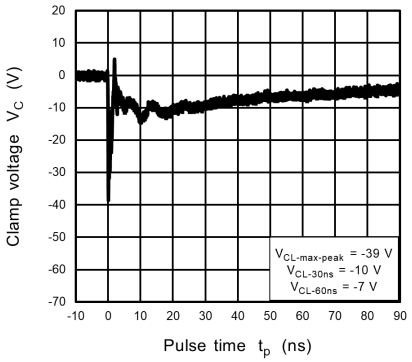


Fig. 10.8.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.9. CEZ11V Characteristics Curves(Note)

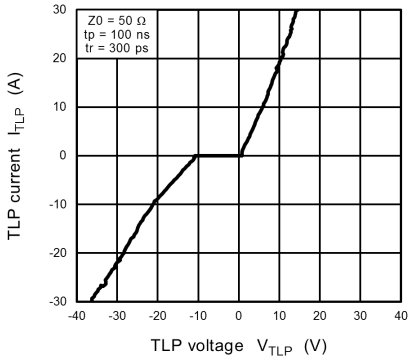


Fig. 10.9.1 I_{TLP} - V_{TLP}

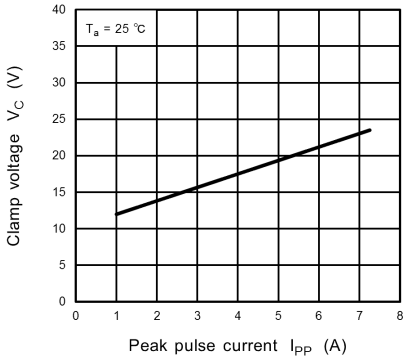


Fig. 10.9.2 V_C - I_{PP}

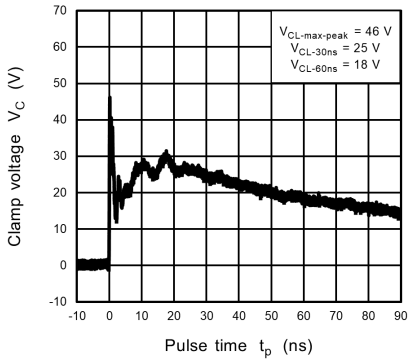


Fig. 10.9.3 IEC61000-4-2 Clamp Waveform +8 kV

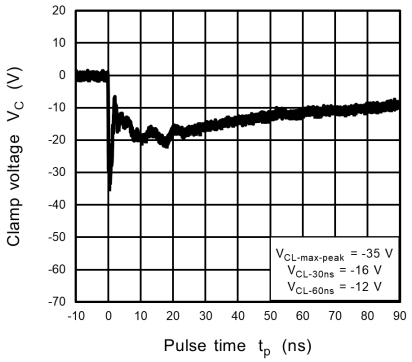


Fig. 10.9.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.10. CEZ12V Characteristics Curves(Note)

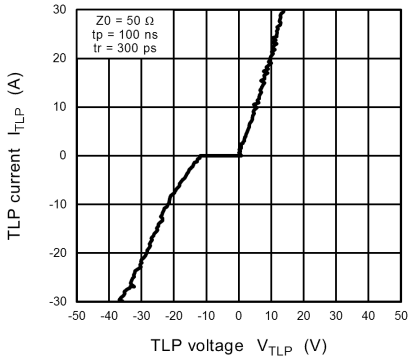


Fig. 10.10.1 I_{TLP} - V_{TLP}

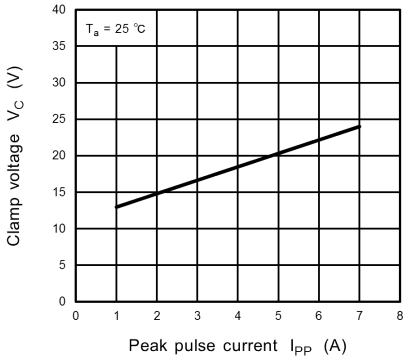


Fig. 10.10.2 V_C - I_{PP}

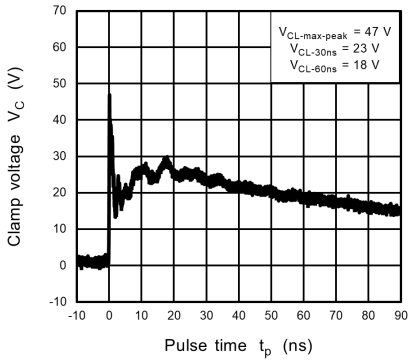


Fig. 10.10.3 IEC61000-4-2 Clamp Waveform +8 kV

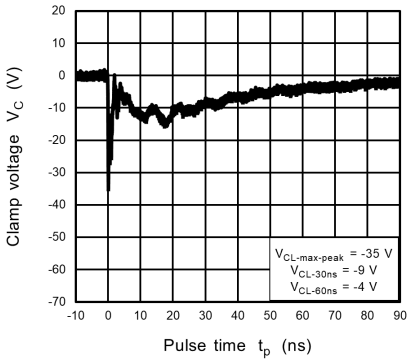


Fig. 10.10.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.11. CEZ13V Characteristics Curves(Note)

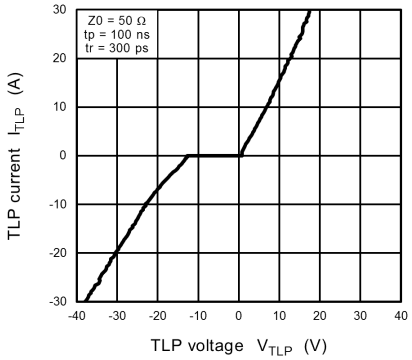


Fig. 10.11.1 I_{TLP} - V_{TLP}

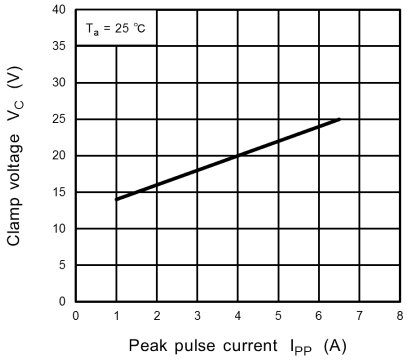


Fig. 10.11.2 V_C - I_{PP}

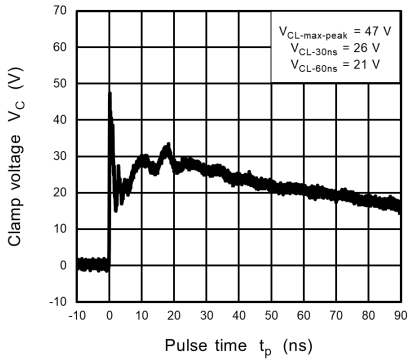


Fig. 10.11.3 IEC61000-4-2 Clamp Waveform +8 kV

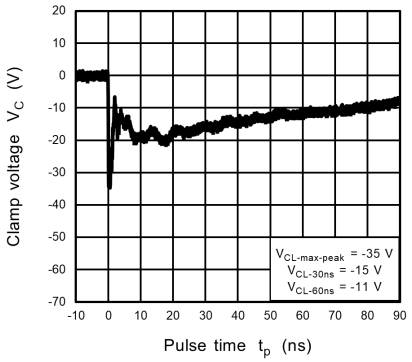


Fig. 10.11.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.12. CEZ15V Characteristics Curves(Note)

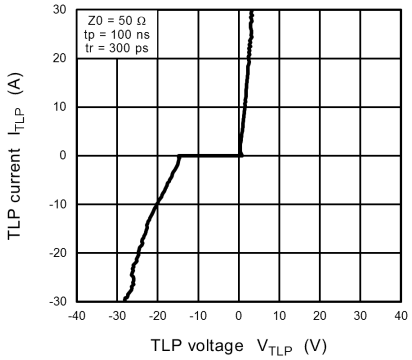


Fig. 10.12.1 I_{TLP} - V_{TLP}

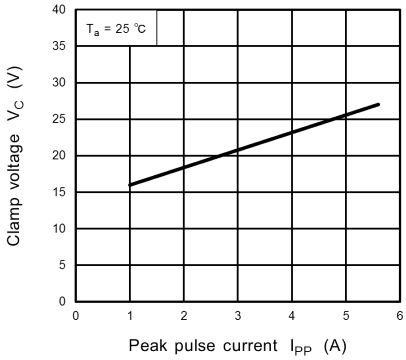


Fig. 10.12.2 V_C - I_{PP}

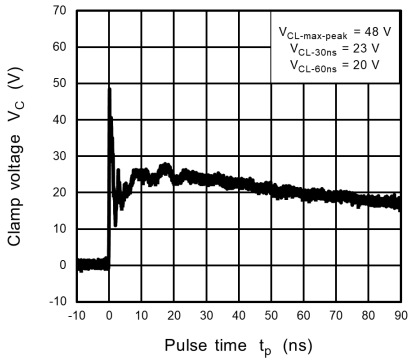


Fig. 10.12.3 IEC61000-4-2 Clamp Waveform +8 kV

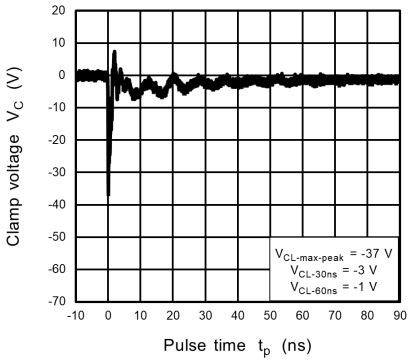


Fig. 10.12.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.13. CEZ16V Characteristics Curves(Note)

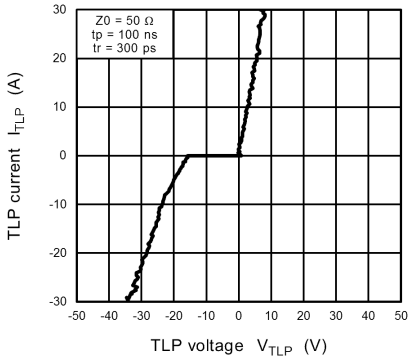


Fig. 10.13.1 I_{TLP} - V_{TLP}

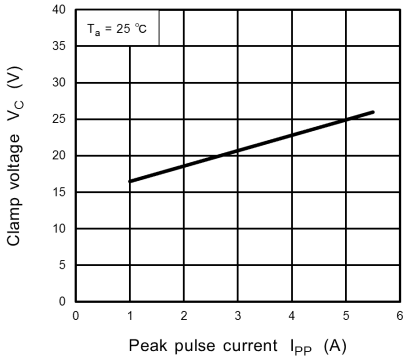


Fig. 10.13.2 V_C - I_{PP}

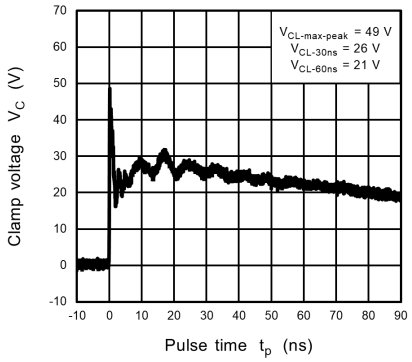


Fig. 10.13.3 IEC61000-4-2 Clamp Waveform +8 kV

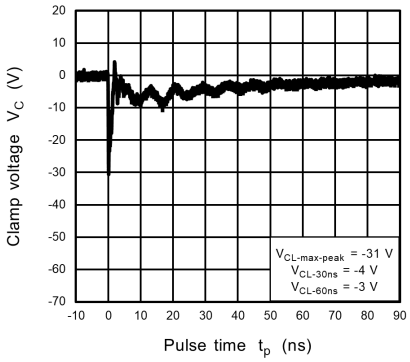


Fig. 10.13.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.14. CEZ18V Characteristics Curves(Note)

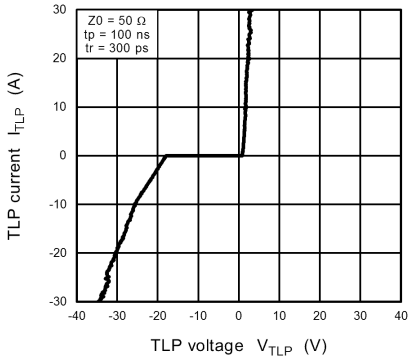


Fig. 10.14.1 I_{TLP} - V_{TLP}

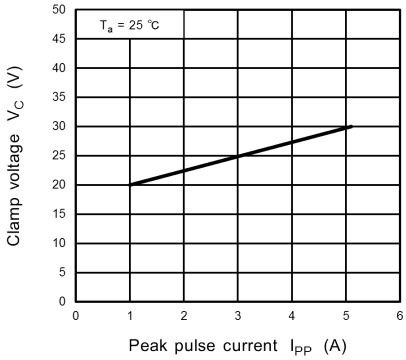


Fig. 10.14.2 V_C - I_{PP}

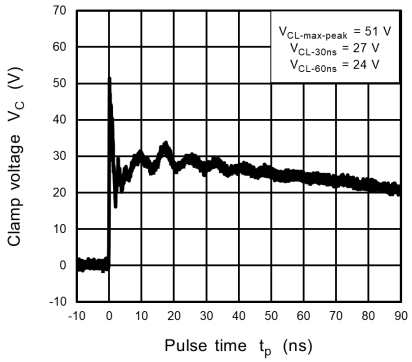


Fig. 10.14.3 IEC61000-4-2 Clamp Waveform +8 kV

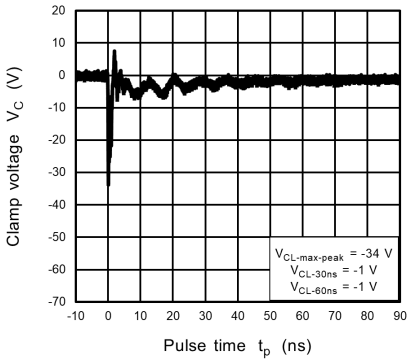


Fig. 10.14.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.15. CEZ20V Characteristics Curves(Note)

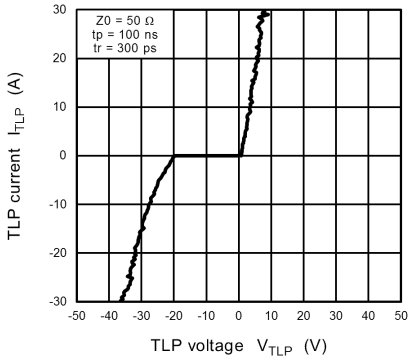


Fig. 10.15.1 I_{TLP} - V_{TLP}

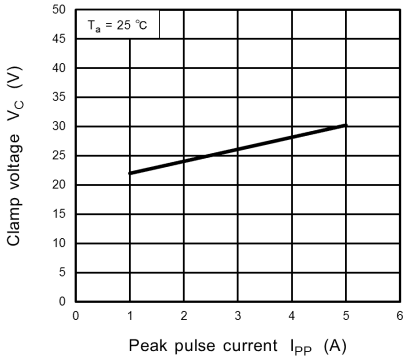


Fig. 10.15.2 V_C - I_{PP}

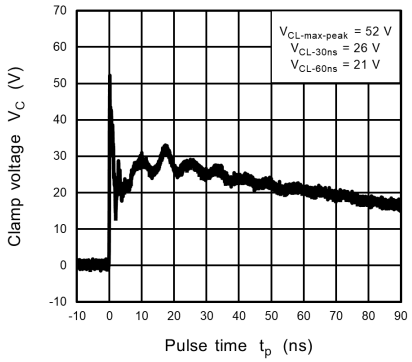


Fig. 10.15.3 IEC61000-4-2 Clamp Waveform +8 kV

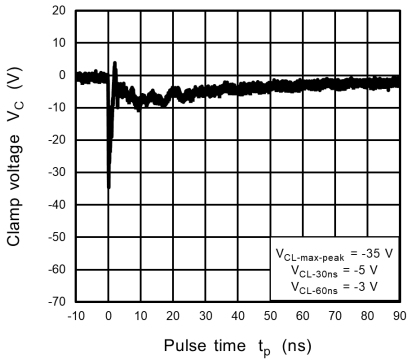


Fig. 10.15.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.16. CEZ22V Characteristics Curves(Note)

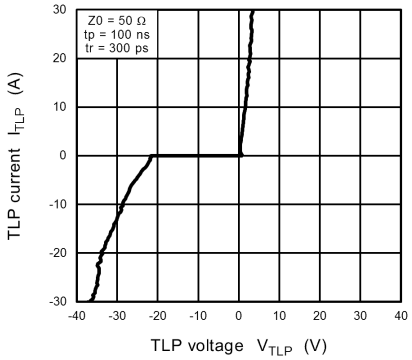


Fig. 10.16.1 I_{TLP} - V_{TLP}

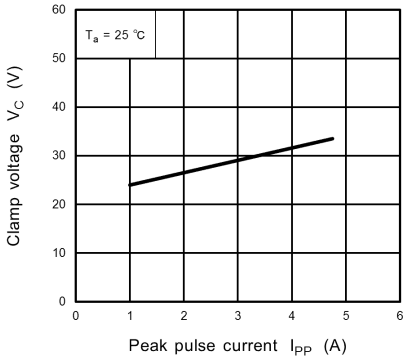


Fig. 10.16.2 V_C - I_{PP}

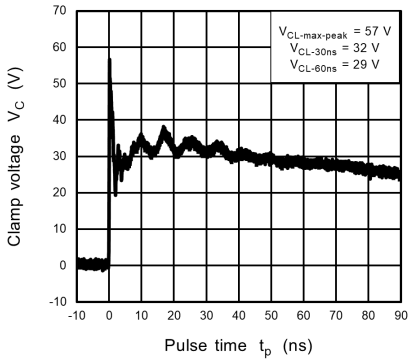


Fig. 10.16.3 IEC61000-4-2 Clamp Waveform +8 kV

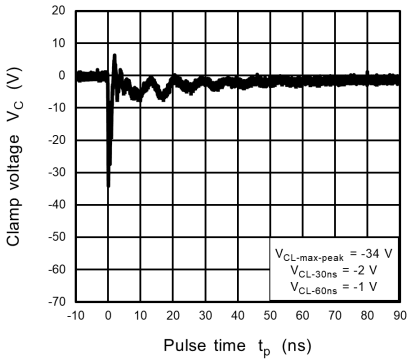


Fig. 10.16.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.17. CEZ24V Characteristics Curves(Note)

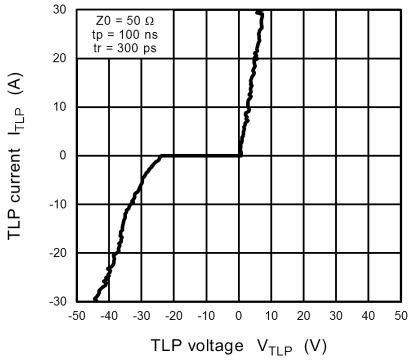


Fig. 10.17.1 I_{TLP} - V_{TLP}

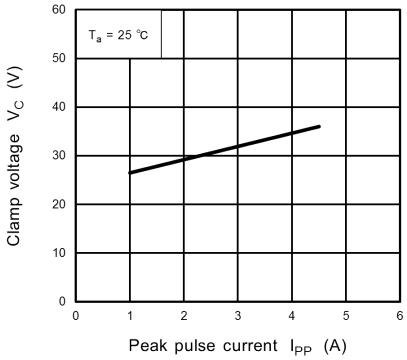


Fig. 10.17.2 V_C - I_{PP}

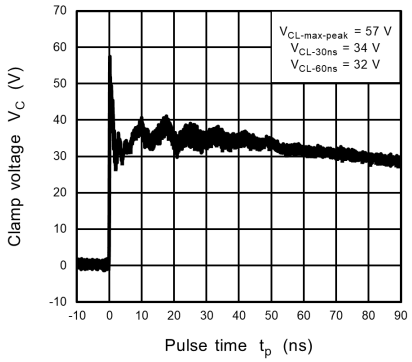


Fig. 10.17.3 IEC61000-4-2 Clamp Waveform +8 kV

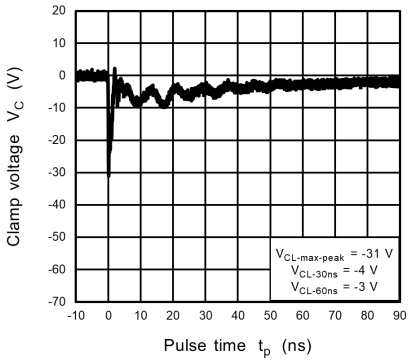


Fig. 10.17.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.18. CEZ27V Characteristics Curves(Note)

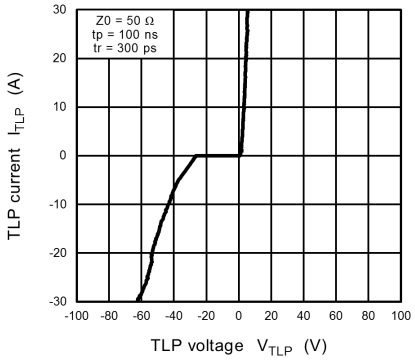


Fig. 10.18.1 I_{TLP} - V_{TLP}

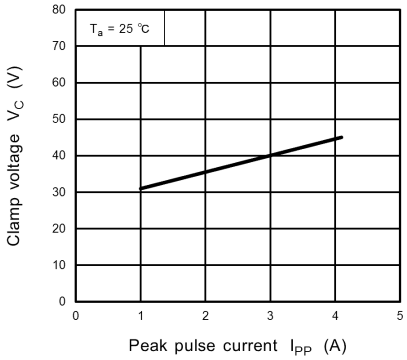


Fig. 10.18.2 V_C - I_{PP}

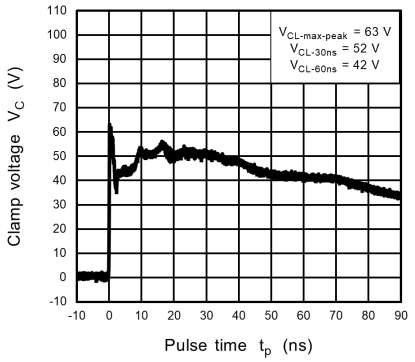


Fig. 10.18.3 IEC61000-4-2 Clamp Waveform +8 kV

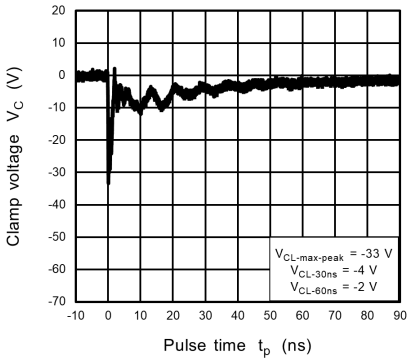


Fig. 10.18.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.19. CEZ30V Characteristics Curves(Note)

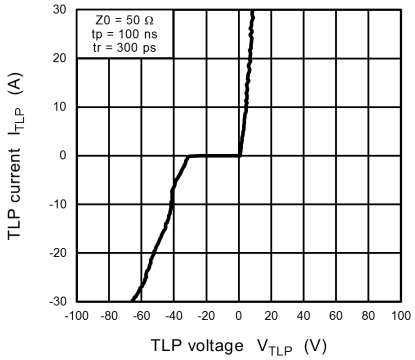


Fig. 10.19.1 I_{TLP} - V_{TLP}

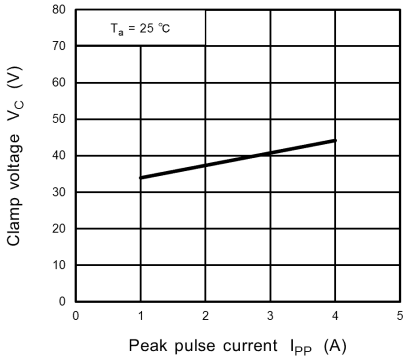


Fig. 10.19.2 V_C - I_{PP}

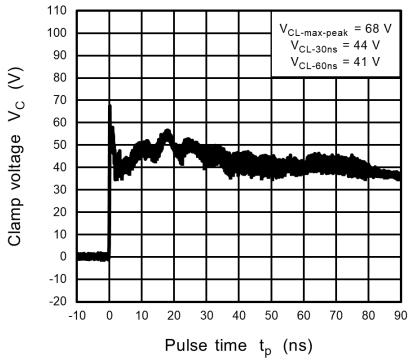


Fig. 10.19.3 IEC61000-4-2 Clamp Waveform +8 kV

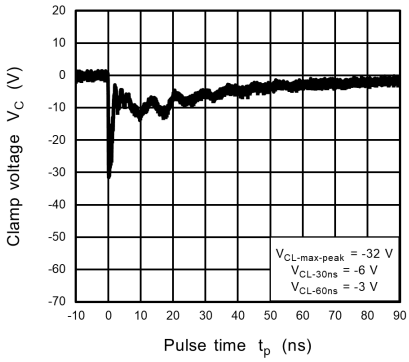


Fig. 10.19.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.20. CEZ33V Characteristics Curves(Note)

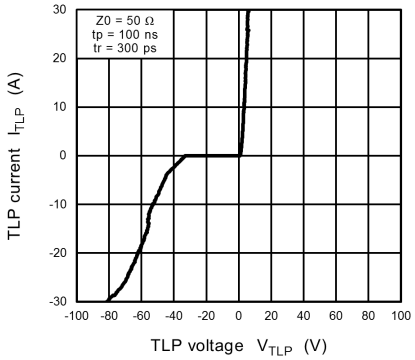


Fig. 10.20.1 I_{TLP} - V_{TLP}

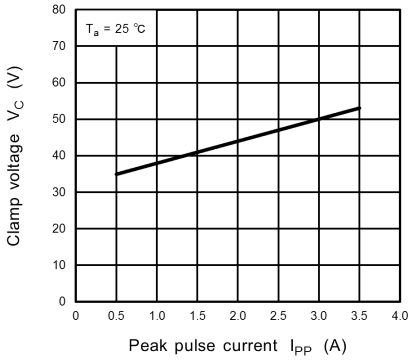


Fig. 10.20.2 V_C - I_{PP}

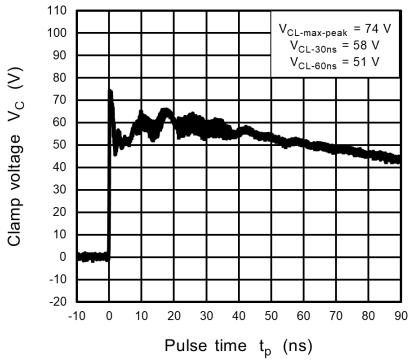


Fig. 10.20.3 IEC61000-4-2 Clamp Waveform +8 kV

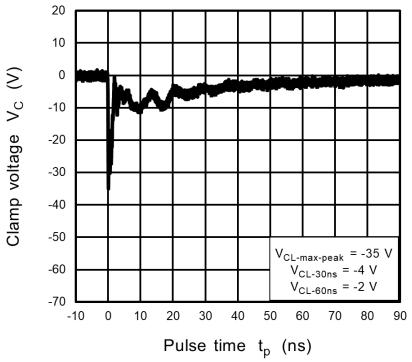


Fig. 10.20.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_c-I_{PP}) and clamp waveform measurement circuit.

10.21. CEZ36V Characteristics Curves(Note)

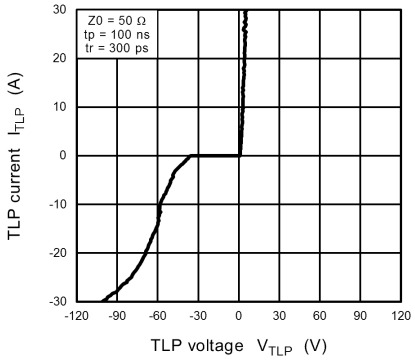


Fig. 10.21.1 I_{TLP} - V_{TLP}

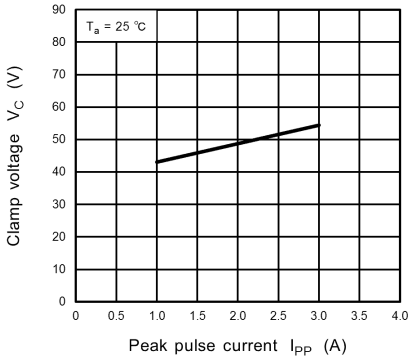


Fig. 10.21.2 V_C - I_{PP}

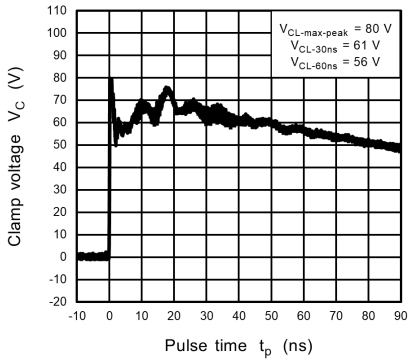


Fig. 10.21.3 IEC61000-4-2 Clamp Waveform +8 kV

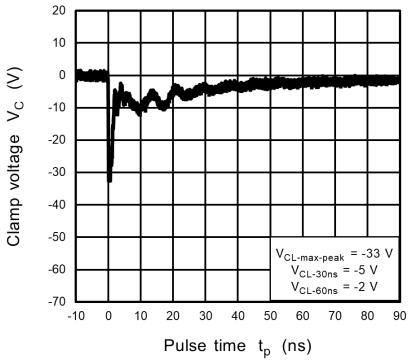


Fig. 10.21.4 IEC61000-4-2 Clamp Waveform -8 kV

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Refer to Fig.10.22.1, Fig.10.22.2 for peak pulse current(V_C-I_{PP}) and clamp waveform measurement circuit.

10.22. V_C-I_{PP} Peak Pulse and Clamp waveform measurement circuit

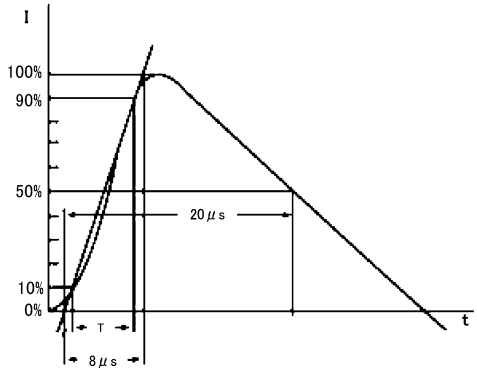


Fig. 10.22.1 V_C-I_{PP} Peak Pulse Current (according to IEC61000-4-5 8/20 μs pulse)

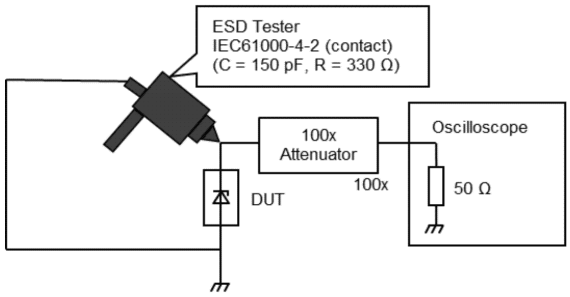
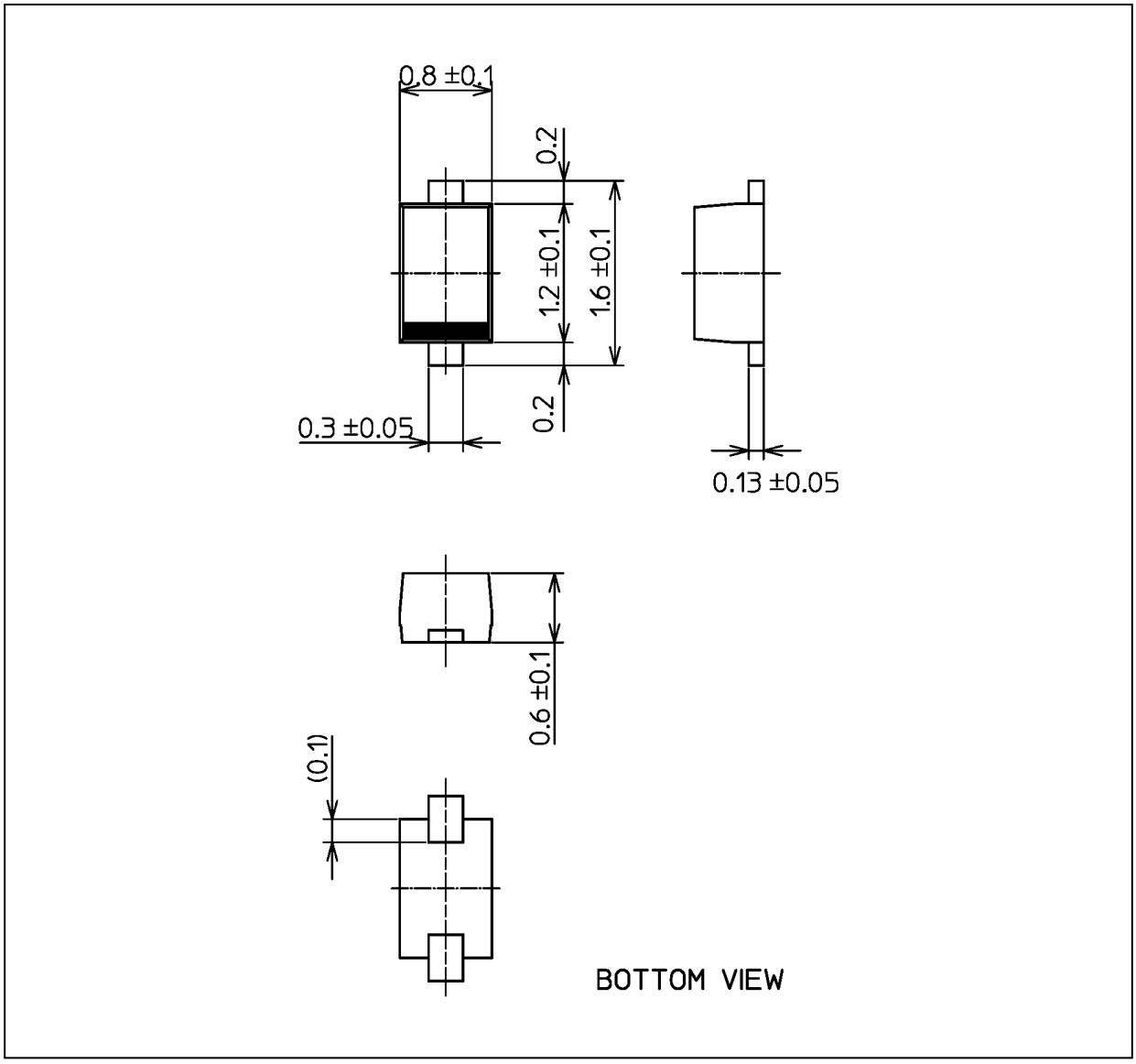


Fig. 10.22.2 Clamp waveform measurement circuit (according to IEC61000-4-2)

Package Dimensions

Unit: mm



Weight: 1.4 mg (typ.)

Package Name(s)
Nickname: ESC

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