Transient Voltage Suppressors

ESD Protection Diodes with Ultra−Low Leakage

The ESD9R is designed to provide ESD protection for ASSPs and ASICs used in ultra low current applications such as human body sensors. These devices have been designed for leakage under 1 nA from 0°C to 50°C when turned off. During an ESD event, these devices turn on to clamp the ESD to a safe voltage level for the IC. These devices have the added benefits of low capacitance for high speed data lines and small package size for space constrained designs.

Specification Features:

- Ultra−Low Leakage < 1 nA
- Ultra−Low Capacitance 0.5 pF
- Low Clamping Voltage
- Small Body Outline Dimensions:
  0.039″ x 0.024″ (1.00 mm x 0.60 mm)
- Low Body Height: 0.016″ (0.4 mm)
- Stand−off Voltage: 3.3 V
- Response Time < 1.0 ns
- IEC61000−4−2 Level 4 ESD Protection
- This is a Pb−Free and Halogen−Free Device

Mechanical Characteristics:

CASE: Void-free, transfer-molded, thermosetting plastic
Epoxy Meets UL 94 V−0
LEAD FINISH: 100% Matte Sn (Tin)
MOUNTING POSITION: Any
QUALIFIED MAX REFLOW TEMPERATURE: 260°C
Device Meets MSL 1 Requirements

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
IEC 61000−4−2 (ESD) Contact Air HBM		±10 ±15 ±16	kV
Total Power Dissipation on FR−5 Board (Note 1) @ T_A = 25°C	P_D	150	mW
Storage Temperature Range	T_{stg}	−55 to +150	°C
Junction Temperature Range	T_J	−55 to +125	°C
Lead Solder Temperature − Maximum (10 Second Duration)	T_L	260	°C

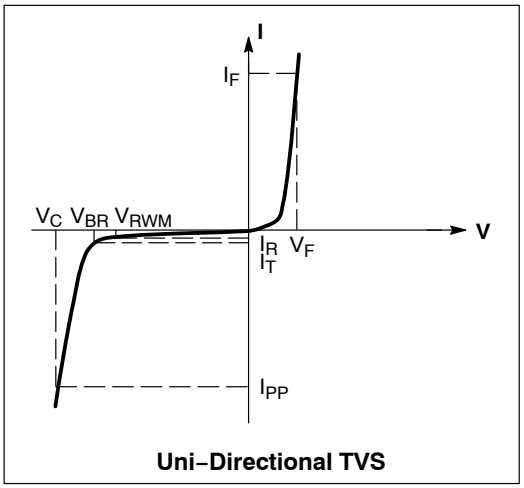
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. FR−5 = 1.0 x 0.75 x 0.62 in.

ELECTRICAL CHARACTERISTICS

(T_A = 25°C unless otherwise noted)

Symbol	Parameter
I_{PP}	Maximum Reverse Peak Pulse Current
V_C	Clamping Voltage @ I_{PP}
V_{RWM}	Working Peak Reverse Voltage
I_R	Maximum Reverse Leakage Current @ V_{RWM}
V_{BR}	Breakdown Voltage @ I_T
I_T	Test Current
I_F	Forward Current
V_F	Forward Voltage @ I_F
P_{pk}	Peak Power Dissipation
C	Max. Capacitance @ V_R = 0 and f = 1.0 MHz



Uni−Directional TVS

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted, V_F = 1.0 V Max. @ I_F = 10 mA for all types)

Device	Device Marking	V_{RWM} (V)	I_R (nA) @ 1 V T_A = 0°C to 50°C (Note 4)	V_{BR} (V) @ I_T (Note 2)	I_T	C (pF)		V_C (V) @ I_{PP} = 1 A (Note 5)	V_C
		Max	Max	Min	mA	Typ	Max	Max	Per IEC61000−4−2 (Note 3)
ESD9R3.3ST5G	J*	3.3	1.0	4.8	1.0	0.5	0.9	7.8	Figures 1 and 2 See Below

*Rotated 270°.

2. V_{BR} is measured with a pulse test current I_T at an ambient temperature of 25°C.
3. For test procedure see Figures 3 and 4 and Application Note AND8307/D.
4. Limits over temperature are guaranteed by design, not production tested.
5. V_C measured using pulse waveform in Figure 5.

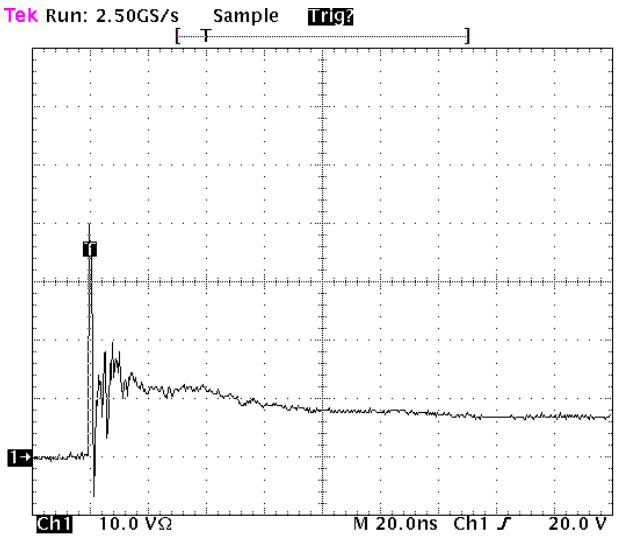


Figure 1. ESD Clamping Voltage Screenshot Positive 8 kV Contact per IEC61000−4−2

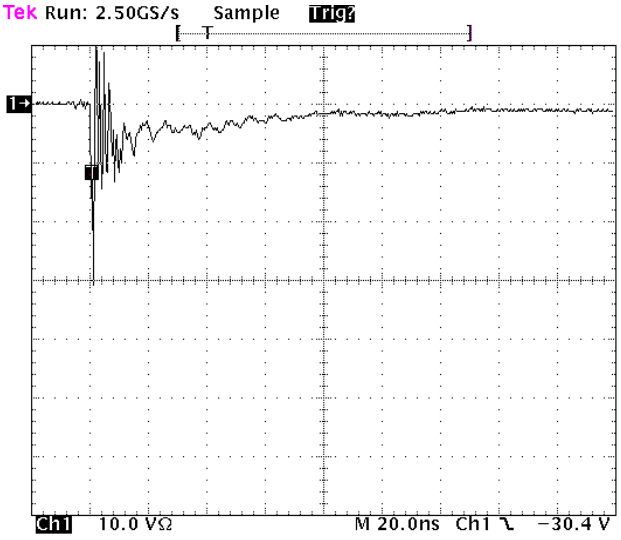


Figure 2. ESD Clamping Voltage Screenshot Negative 8 kV Contact per IEC61000−4−2

IEC 61000−4−2 Spec.

Level	Test Voltage (kV)	First Peak Current (A)	Current at 30 ns (A)	Current at 60 ns (A)
1	2	7.5	4	2
2	4	15	8	4
3	6	22.5	12	6
4	8	30	16	8

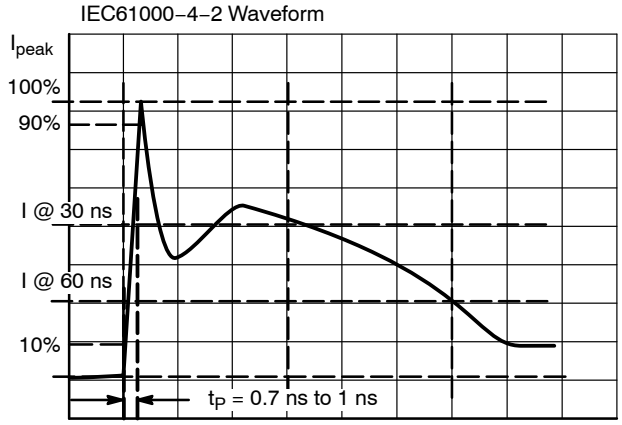


Figure 3. IEC61000−4−2 Spec

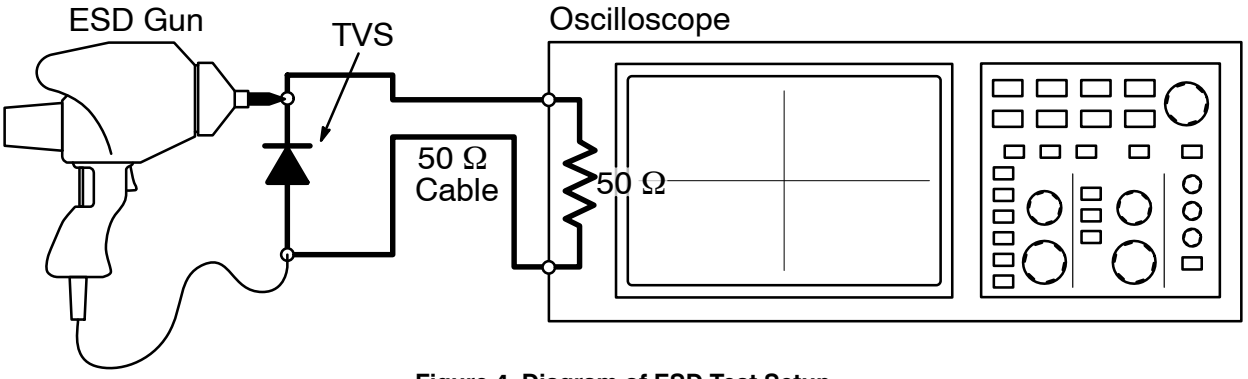


Figure 4. Diagram of ESD Test Setup

ESD Voltage Clamping

For sensitive circuit elements it is important to limit the voltage that an IC will be exposed to during an ESD event to as low a voltage as possible. The ESD clamping voltage is the voltage drop across the ESD protection diode during an ESD event per the IEC61000−4−2 waveform. Since the IEC61000−4−2 was written as a pass/fail spec for larger systems such as cell phones or laptop computers it is not clearly defined in the spec how to specify a clamping voltage at the device level. ON Semiconductor has developed a way to examine the entire voltage waveform across the ESD protection diode over the time domain of an ESD pulse in the form of an oscilloscope screenshot, which can be found on the datasheets for all ESD protection diodes.

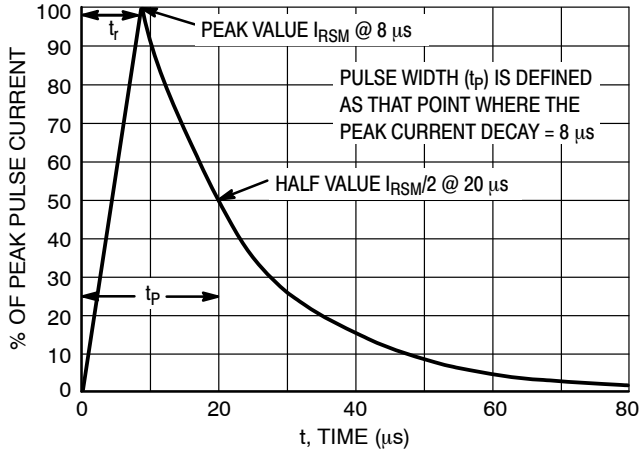


Figure 5. 8 X 20 μs Pulse Waveform