ESD7383

USB-OTG 3-Line Protection

ON Semiconductor®

http://onsemi.com

Product Description

The ESD7383 is a 4−bump very low capacitance ESD protection device in 0.4 mm CSP form factor. It is fully compliant with IEC 61000−4−2. The ESD7383 is RoHS II compliant.

Features

- These Devices are Pb−Free and are RoHS Compliant

Applications

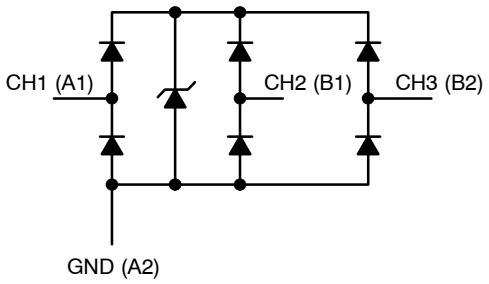
- ESD protection for USB (including USB OTG)
  - ♦ USB compliance
    High Speed USB port
    Up to 480 Mb/s according to USB 2.0 high speed specification

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Peak Pulse Power Dissipation, 8 x 20 μs	P_{pk}	50	W
Maximum Peak Pulse Current, 8 x 20 μs	I_{PP}	2.5	A
Operating Junction Temperature Range	T_J	−40 to +85	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C
IEC 61000−4−2 Contact (ESD)	ESD	±8000	V

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.

ELECTRICAL SCHEMATIC

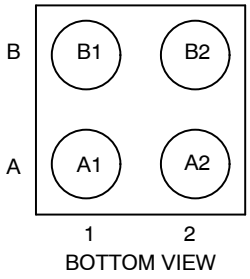


WLCSP4
CASE 567CB

MARKING DIAGRAM

7 = Specific Device Code
M = Date Code

PINOUT



BOTTOM VIEW

PIN DESCRIPTIONS

Pin	Description
A1	ESD Channel 1
A2	Device Ground
B1	ESD Channel 2
B2	ESD Channel 3

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

ELECTRICAL SPECIFICATIONS AND CONDITIONS

ELECTRICAL OPERATING CHARACTERISTICS (Note 1)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IN}	Input Operating Supply Voltage			3.0	5.5	V
V_{BR}	Breakdown Voltage	I_T = 8 mA	6			V
I_R	Reverse Leakage Current	V_{RM} = 3 V			100	nA
C_{IN}	Channel Input Capacitance	At 1 MHz, V_{IN} = 0 V			1.5	pF
ΔC_{IN}	Channel Input Capacitance Matching	At 1 MHz, V_{IN} = 0 V		0.02		pF
V_{CL}	Channel Clamp Voltage Positive Transients Negative Transients	I_{PP} = 1 A, t_P = 8/20 μs		 +10 −1.5		V
R_{DYN}	Dynamic Resistance Positive Transients Negative Transients	I_{PP} = 1 A, t_P = 8/20 μs Any I/O pin to Ground		 0.6 0.5		 Ω Ω

1. All parameters specified at T_A = 25°C unless otherwise noted.

ORDERING INFORMATION

Part Number	Bumps	Variation	Part Marking	Package	Shipping†
ESD7383	4	WLCSP4	7	CSP (Pb−Free)	5000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

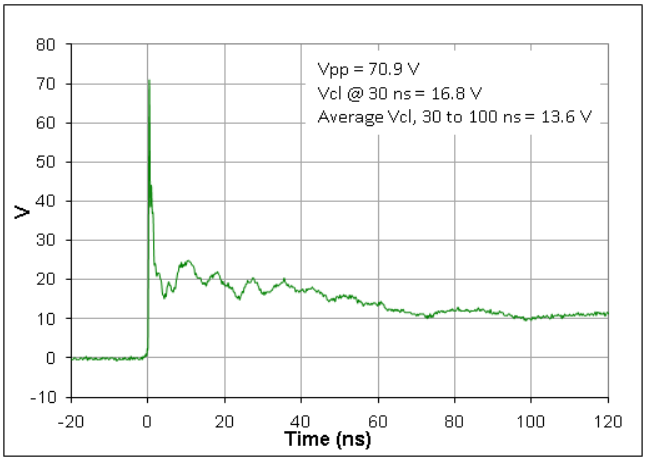


Figure 1. ESD Clamping Voltage Screenshot Positive 8 kV Contact per IEC61000−4−2

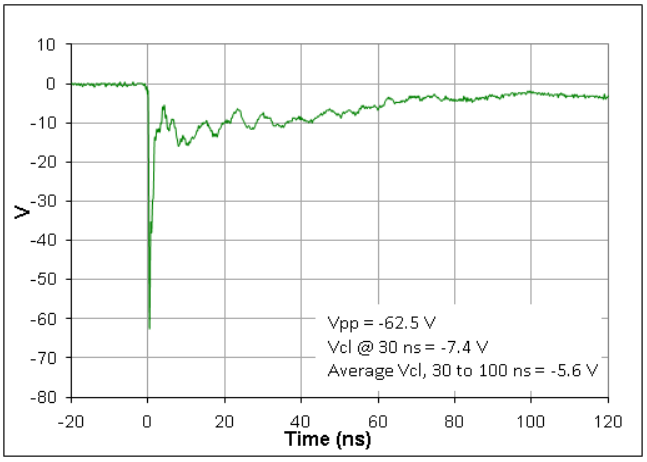


Figure 2. ESD Clamping Voltage Screenshot Negative 8 kV Contact per IEC61000−4−2

IEC61000−4−2 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

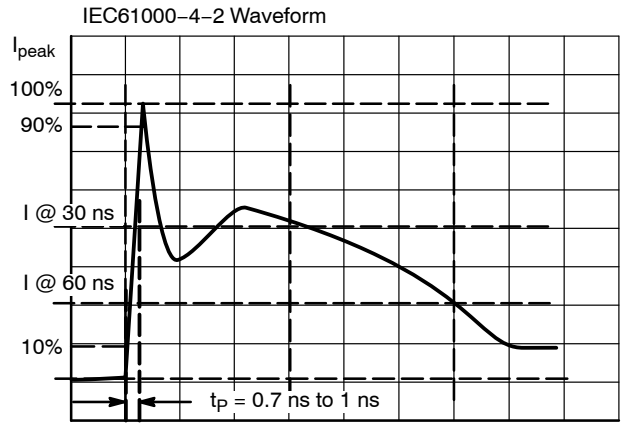


Figure 3. IEC61000−4−2 Spec

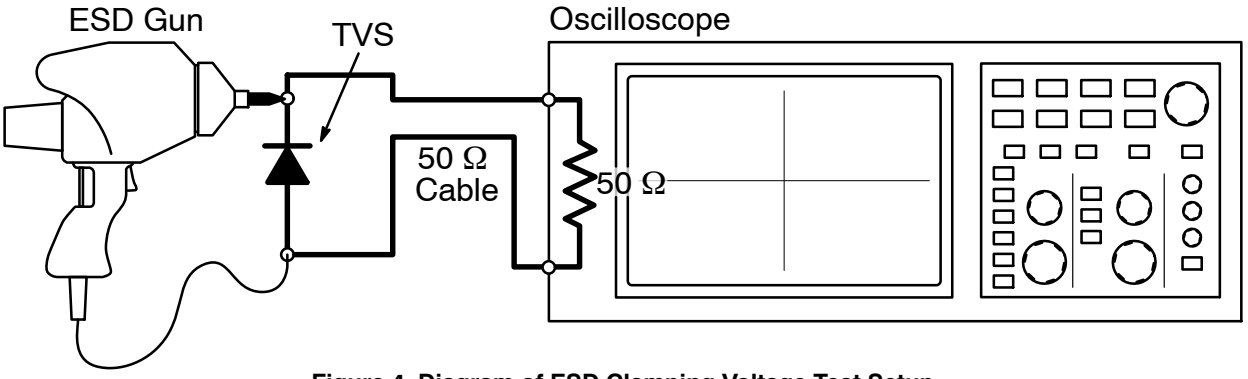


Figure 4. Diagram of ESD Clamping Voltage Test Setup

The following is taken from Application Note AND8308/D − Interpretation of Datasheet Parameters for ESD Devices.

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. For more information on how ON Semiconductor creates these screenshots and how to interpret them please refer to AND8307/D.

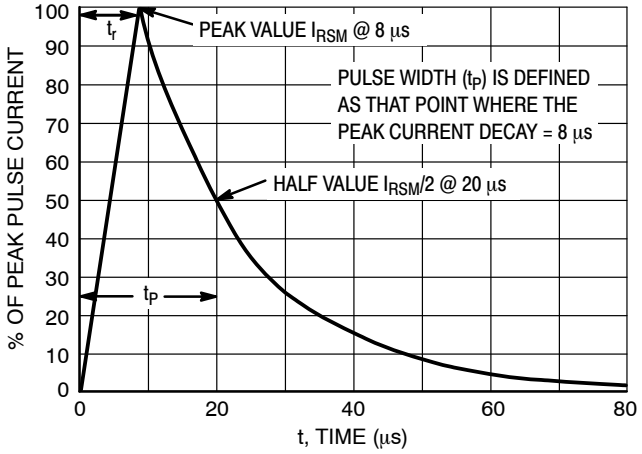


Figure 5. 8 x 20 μs Pulse Waveform

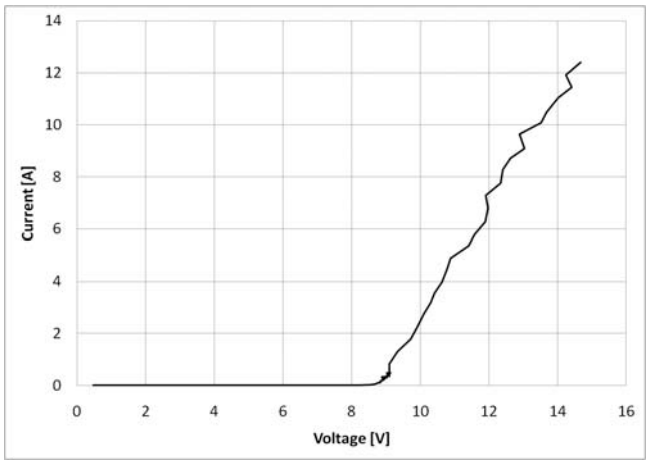


Figure 6. Positive TLP I–V Curve

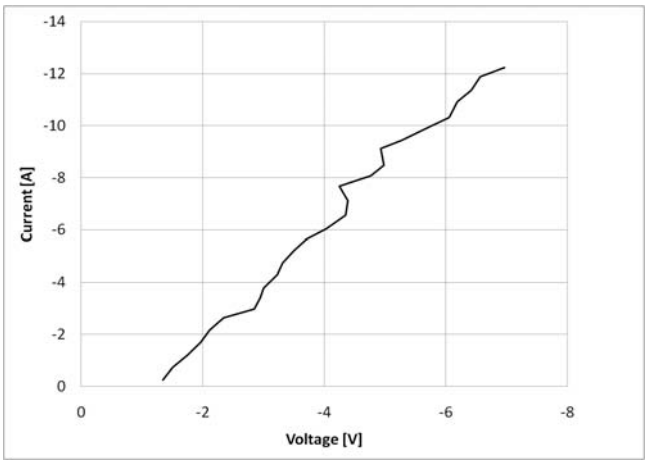


Figure 7. Negative TLP I–V Curve

Transmission Line Pulse (TLP) Measurement

Transmission Line Pulse (TLP) provides current versus voltage (I–V) curves in which each data point is obtained from a 100 ns long rectangular pulse from a charged transmission line. A simplified schematic of a typical TLP system is shown in Figure 8. TLP I–V curves of ESD protection devices accurately demonstrate the product's ESD capability because the 10s of amps current levels and under 100 ns time scale match those of an ESD event. This is illustrated in Figure 9 where an 8 kV IEC61000–4–2 current waveform is compared with TLP current pulses at 8 A and 16 A. A TLP I–V curve shows the voltage at which the device turns on as well as how well the device clamps voltage over a range of current levels. A typical TLP I–V curve for the ESD7383 is shown in Figures 6 and 7.

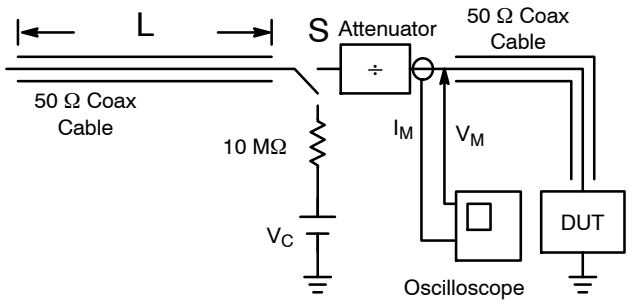


Figure 8. Simplified Schematic of a Typical TLP System

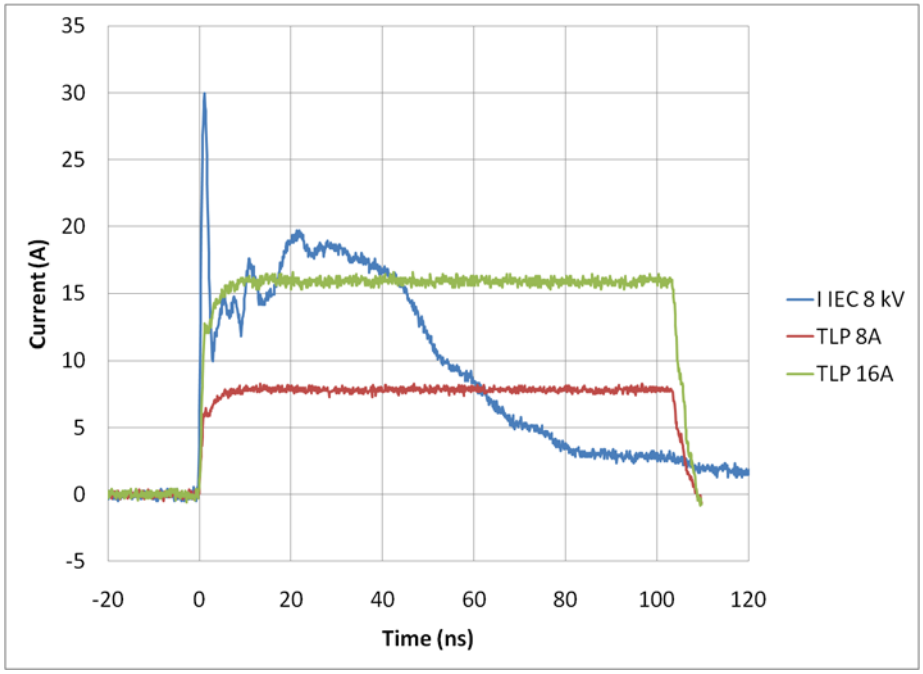


Figure 9. Comparison Between 8 kV IEC61000–4–2 and 8 A and 16 A TLP Waveforms

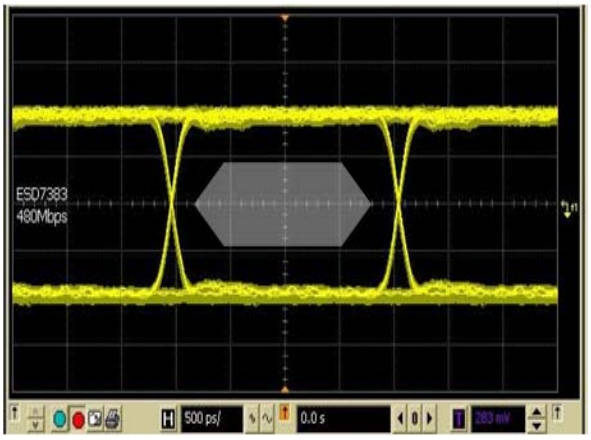
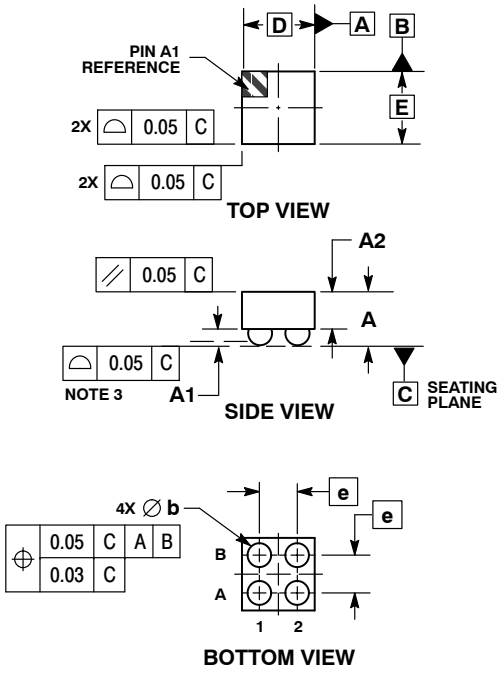


Figure 10. 480 Mb/s USB Source Clears USB 2.0 Hi Speed Mask

PACKAGE DIMENSIONS

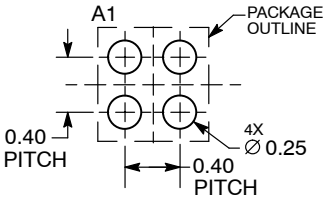
WLCSP4, 0.8x0.8
CASE 567CB
ISSUE O



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

DIM	MILLIMETERS MIN	MAX
A	0.57	0.63
A1	0.17	0.24
A2	0.41 REF	
b	0.24	0.29
D	0.80 BSC	
E	0.80 BSC	
e	0.40 BSC	

RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303−675−2175 or 800−344−3860 Toll Free USA/Canada
Fax: 303−675−2176 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800−282−9855 Toll Free USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81−3−5773−3850

ON Semiconductor Website: **www.onsemi.com**

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative