

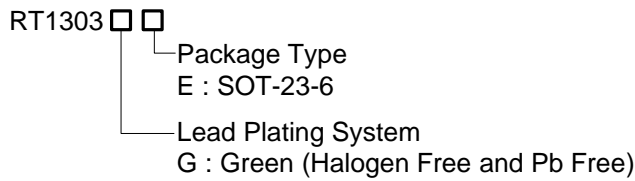
## Low Capacitance ESD Protection for Four High Speed I/O Lines

### General Description

The RT1303 is a low capacitance and high ESD-immunity unidirectional TVS (Transient Voltage Suppressor) which integrates four-line diode arrays and is designed to protect ESD (Electrostatic Discharge) sensitive components used in high speed I/O ports, such as USB 2.0... etc.

The RT1303 may be used to protect four high speed I/O lines to meet the ESD immunity requirements of IEC 61000-4-2 level 4 ( $\pm 8\text{kV}$  contact discharge,  $\pm 15\text{kV}$  air discharge).

### Ordering Information

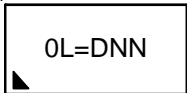


Note :

Richtek products are :

- ▶ RoHS compliant and compatible with the current requirements of IPC/JEDEC J-STD-020.
- ▶ Suitable for use in SnPb or Pb-free soldering processes.

### Marking Information



0L= : Product Code

DNN : Date Code

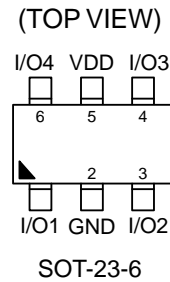
### Features

- ESD Protection for Four I/O Lines
- IEC 61000-4-2 (ESD)  $\pm 22\text{kV}$  (air),  $\pm 17\text{kV}$  (contact)
- IEC 61000-4-4 (EFT) 40A (5/50ns)
- IEC 61000-4-5 (Lightning) 5.5A (8/20 $\mu\text{s}$ )
- Low Operating Voltage : 5V
- Low Clamping Voltage
- RoHS Compliant and Halogen Free

### Applications

- Video Graphics Cards
- Notebook and PC Computers
- USB2.0
- LCDTV and Monitors
- Set-top Box

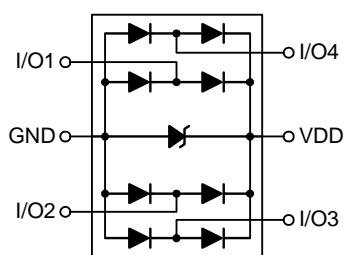
### Pin Configurations



## Functional Pin Description

Pin No.	Pin Name	Pin Function
1	I/O1	ESD Protection.
2	GND	Ground. Connect this pin to the ground of the I/O signals.
3	I/O2	ESD Protection.
4	I/O3	ESD Protection.
5	VDD	ESD Protection for Power Rail and Bias Voltage Input.
6	I/O4	ESD Protection.

## Function Block Diagram



**Absolute Maximum Ratings** (Note 1)

- Peak Pulse Current (tp = 8 / 20μs) for Each I/O Pin, I<sub>PP</sub> ----- 5.5A
- Operating Supply Voltage VDD to GND Pin ----- 6V
- Lead Temperature (Soldering, 10 sec.) ----- 260°C
- Operating Temperature Range ----- -55°C to 125°C
- Storage Temperature Range ----- -65°C to 150°C
- ESD Susceptibility
  - ESD per IEC 61000-4-2 (Air) ----- ±22kV
  - ESD per IEC 61000-4-2 (Contact) ----- ±17kV

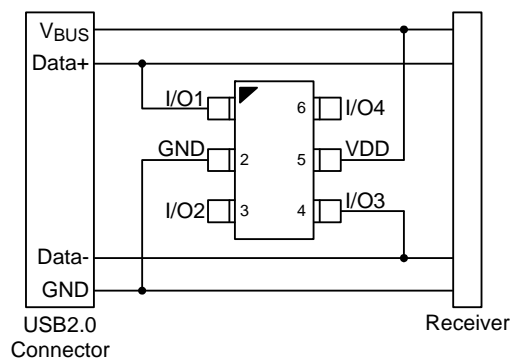
**Electrical Characteristics**

(T<sub>A</sub> = 25°C , unless otherwise specified)

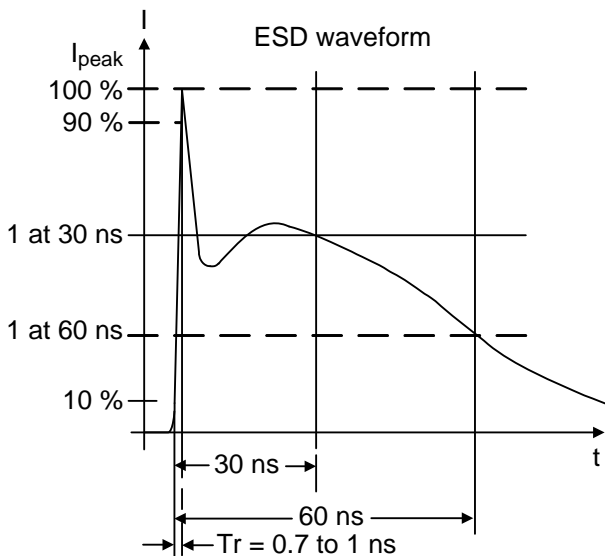
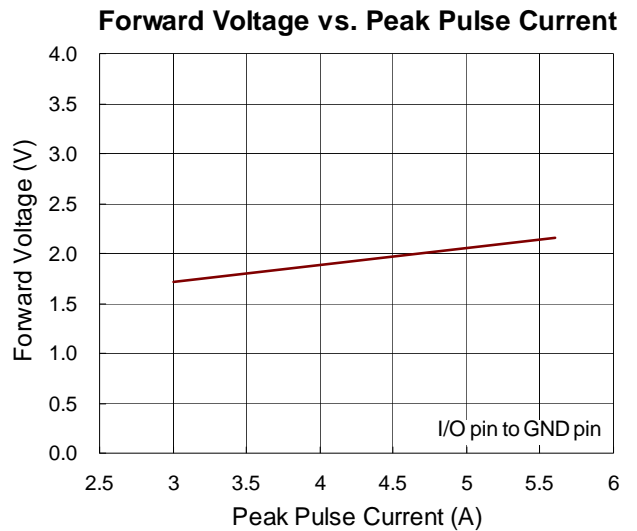
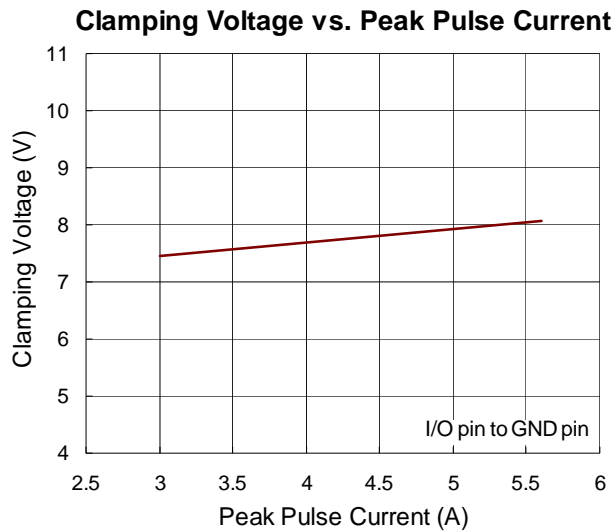
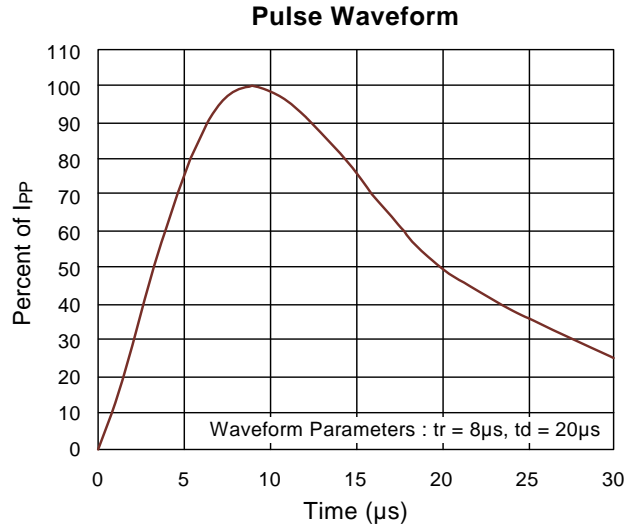
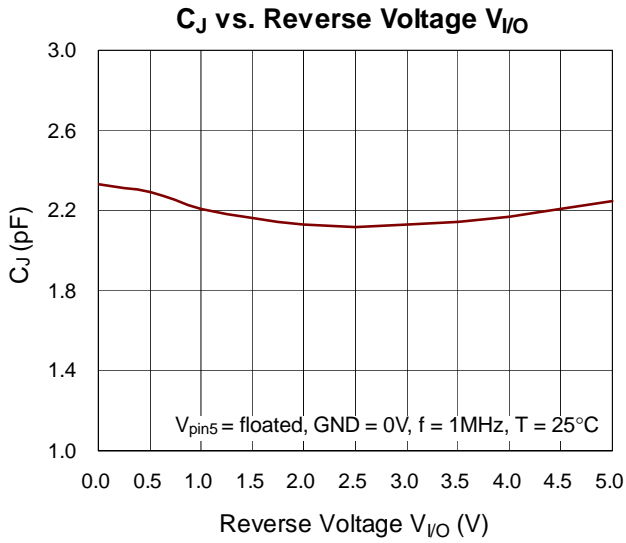
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Reverse Stand-Off Voltage	V <sub>RWM</sub>	VDD to GND pin	--	--	5	V
Reverse Breakdown Voltage	V <sub>BD</sub>	I <sub>BD</sub> = 1mA, VDD to GND pin	6	--	--	V
Diode Forward Voltage	V <sub>F</sub>	I <sub>F</sub> = 15mA, VDD to GND pin	--	0.8	1.1	V
Reverse Leakage Current	I <sub>LK</sub>	V <sub>pin5</sub> = 5V, VDD to GND pin	--	--	1	μA
Clamping Voltage	V <sub>CLAMP</sub>	I <sub>PP</sub> = 5.5A, tp = 8 / 20μs, Any I/O to GND pin	--	--	10	V
I/O-to-GND Junction Capacitance	C <sub>J1</sub>	V <sub>pin5</sub> = 5V, V <sub>I/O</sub> = 2.5V, f = 1MHz, between I/O to GND	--	--	1.8	pF
	C <sub>J2</sub>	V <sub>pin5</sub> = Floated, V <sub>I/O</sub> = 2.5V, f = 1MHz, between I/O to GND	--	--	2.4	
I/O-to-I/O Junction Capacitance	C <sub>J3</sub>	V <sub>pin5</sub> = 5V, V <sub>I/O</sub> = 2.5V, f = 1MHz, between I/O pins, V <sub>Pin2</sub> = 0V	--	--	0.18	pF
	C <sub>J4</sub>	V <sub>pin5</sub> = Floated, V <sub>I/O</sub> = 2.5V, f = 1MHz, between I/O pins, V <sub>Pin2</sub> = 0V	--	--	0.24	

**Note 1.** Stresses beyond those listed “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions may affect device reliability.

## Typical Application Circuit



**Typical Operating Characteristics**



## Applications Information

### ESD Protection for four Data Lines and Power Supply Rail

As shown in Figure 1, the RT1303 can be used to protect four data lines and power supply rail against electrostatic discharge (ESD). In this application, the operating voltages on the data lines must be less than the supply voltage ( $V_{BUS}$ ).

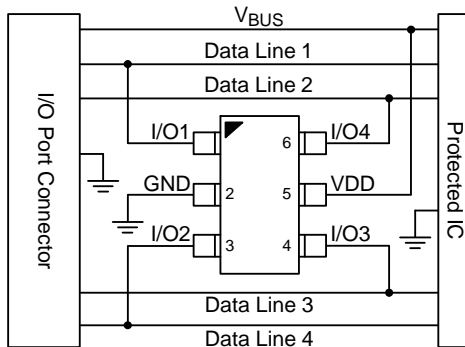


Figure 1. Pin Connections-1 of the RT1303

The four data lines are connected to the I/O1 to I/O4 pins of the RT1303. The GND pin must be connected directly to system ground plane. The VDD pin connected to the power supply rail ( $V_{BUS}$ ). The lengths of the connecting paths on the PCB must be kept as short as possible to minimize their parasitic inductance and capacitance.

### ESD Protections for four Data Lines only

As shown in Figure 2, the RT1303 can be used to protect four data lines only against electrostatic discharge (ESD). In this application, the VDD pin of the RT1303 is not connected. The considerations for the other connections are same as the description in the section “ESD Protections for four Data Lines and Power Supply Rail”.

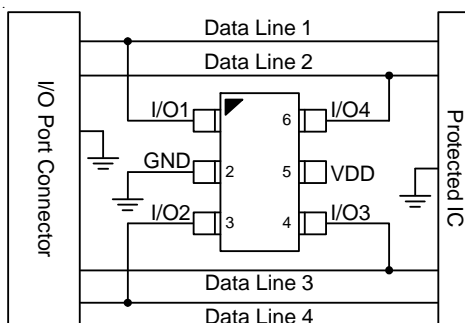


Figure 2. Pin Connections-2 of the RT1303

### ESD Discharge Current Path

Figure 3 (a) and Figure 3 (b) show the current paths during an electrostatic discharge. When the transient voltage on the protected lines exceeds the voltage threshold “the breakdown voltage of the TVS diode plus one diode drop”, the TVS diode conducts current to clamp the transient voltage. The ESD surge current flows through the internal diode array and the TVS diode. Therefore, the RT1303 prevents the transient voltage on the data lines and power rail to protect the IC.

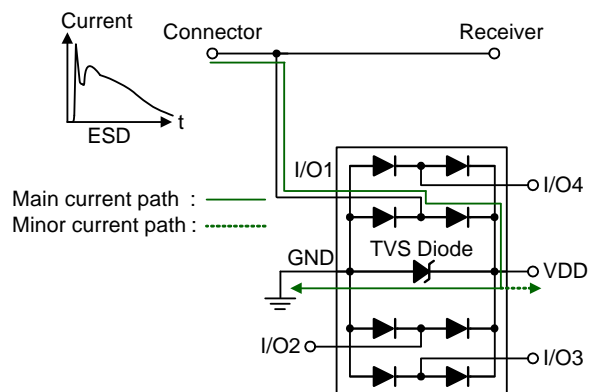


Figure 3 (a). ESD Discharge Current Path-1

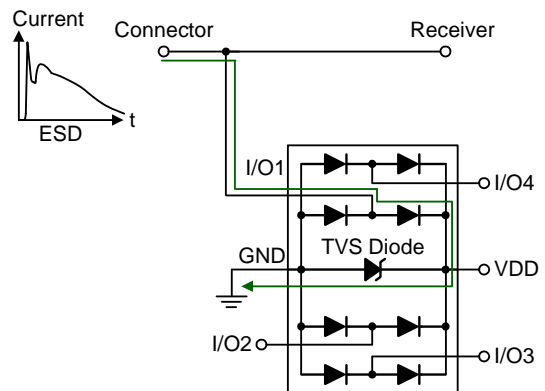
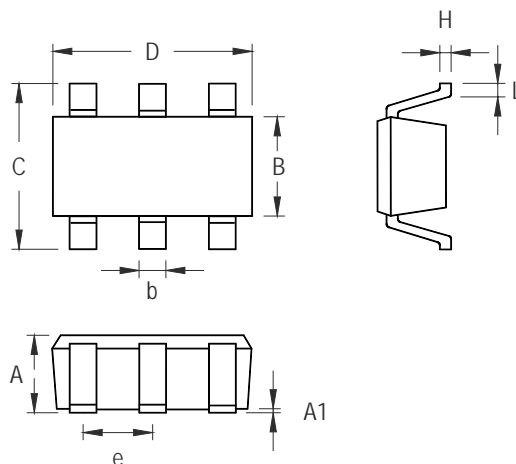


Figure 3 (b). ESD Discharge Current Path-2

**Outline Dimension**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.031	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.250	0.560	0.010	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

**SOT-23-6 Surface Mount Package**

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