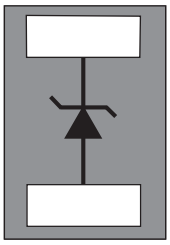
ESD051-1F4

Datasheet

Low clamping single line unidirectional ESD



ST0201 package



Features

- Low clamping voltage:
  - -3 V / +9 V (IEC 61000-4-2 contact discharge at 30 ns)
- Unidirectional diode
- Low leakage current
- ST0201 package
- Complies with the following standards: IEC 61000-4-2 level 4 (exceeds level 4)
  - ±30 kV (air discharge)
  - ±30 kV (contact discharge)

Application

Where transient over voltage protection in ESD sensitive equipment is required, such as:

- Smartphones, mobile phones and accessories
- Tablet, PC, netbooks and notebooks
- Portable multimedia devices and accessories
- Digital cameras and camcorders
- Communication and highly integrated systems

Description

Product status link
ESD051-1F4

The ESD051-1F4 is a unidirectional single line TVS diode designed to protect the power line against EOS and ESD transients.

This ESD suppressor is ideal for applications where PCB space saving is required such as cellular handsets and accessories, wearable devices, USB buses, battery lines.

1 Characteristics

Table 1. Absolute maximum ratings (T_{amb} = 25 °C)

Symbol	Parameter		Value	Unit
V_{pp}	Peak pulse voltage	IEC 61000-4-2 contact discharge IEC 61000-4-2 air discharge	±30 ±30	kV
P_{pp}	Peak pulse power (8/20 µs)		110	W
I_{pp}	Peak pulse current (8/20 µs)		11	A
T_{op}	Operating junction temperature range		-55 to 150	°C
T_{stg}	Storage junction temperature range		-65 to 150	
T_L	Maximum lead temperature for soldering during 10 s		260	

Figure 1. Electrical characteristics (definitions)

V_{RM} Stand-off voltage
V_{BR} Breakdown voltage at I_R
V_{CL} Clamping voltage
I_{RM} Leakage current at V_{RM}
I_{PP} Peak pulse current
V_F Forward voltage drop
R_d Dynamic resistance

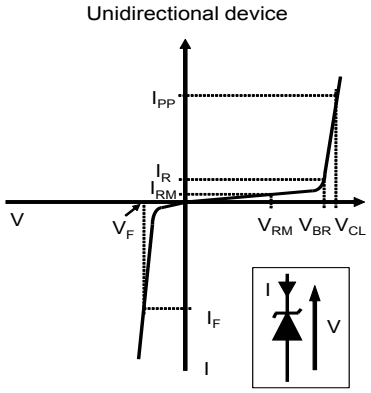


Table 2. Electrical characteristics (values) (T_{amb} = 25° C)

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
V_{RM}	Reverse working voltage				5.5	V
V_{BR}	Breakdown voltage	I_R = 1 mA	5.8			V
I_{RM}	Leakage current	V_{RM} = 5.5 V			100	nA
V_{CL}	Clamping voltage	IEC 61000-4-2, +8 kV contact measured at 30 ns		9.0		V
		IEC 61000-4-2, -8 kV contact measured at 30 ns		-3.0		
R_D	Dynamic resistance, pulse duration 100 ns (1)	Direct		0.17		Ω
		Forward		0.14		Ω
C_{LINE}	Line capacitance	V_{LINE} = 0 V, F = 1 MHz, V_{OSC} = 30 mV		110		pF

1. *More information are available in ST application note: AN4022*

1.1 Characteristics (curves)

Figure 2. Variation of leakage current versus junction temperature

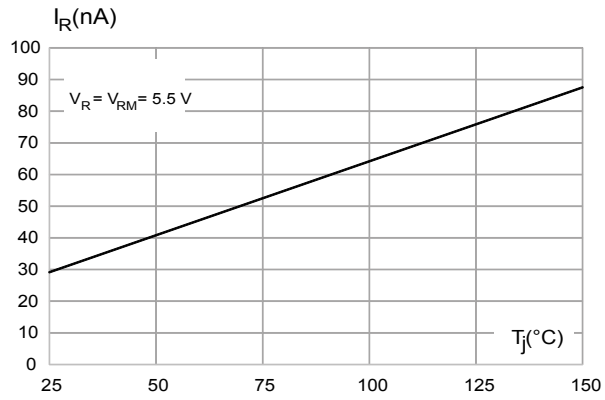


Figure 3. Junction capacitance versus frequency

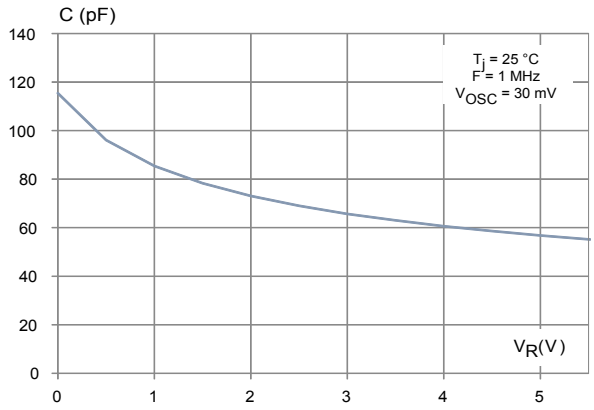


Figure 4. ESD response to IEC 61000-4-2 (+8 kV contact discharge)

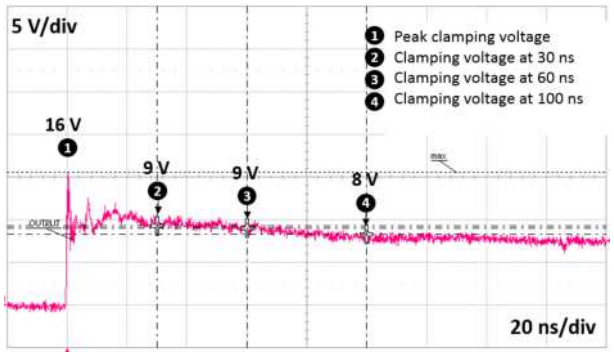


Figure 5. ESD response to IEC 61000-4-2 (-8 kV contact discharge)

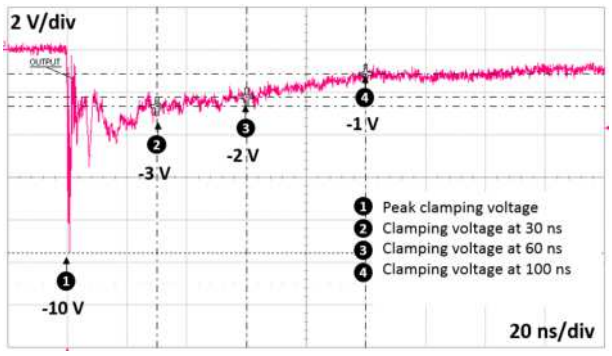


Figure 6. TLP

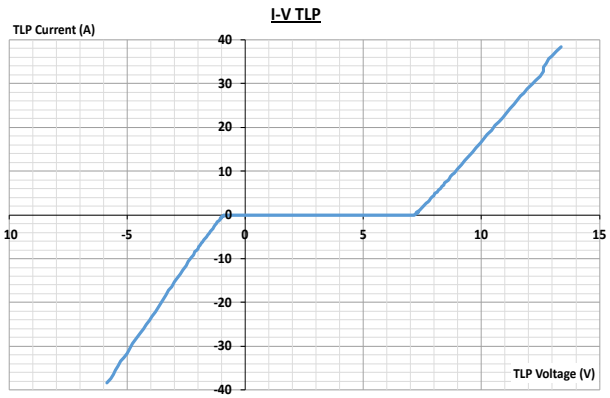
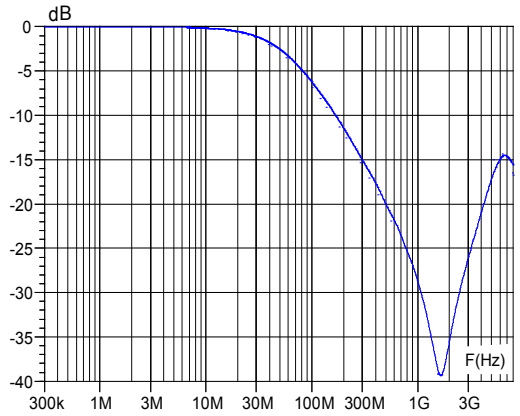


Figure 7. S21 attenuation



2 Package information

To meet environmental requirements, ST offers these devices in different grades of ECOPACK packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions, and product status are available at: www.st.com. ECOPACK is an ST trademark.

2.1 ST0201 package information

Figure 8. ST0201 package outline

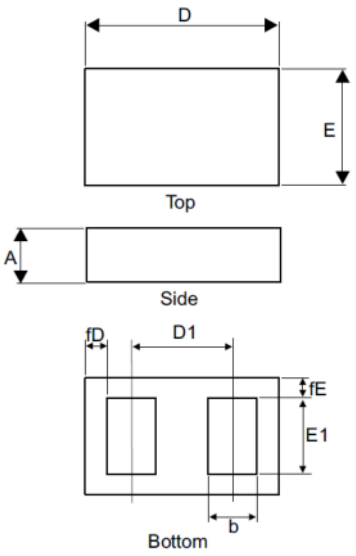
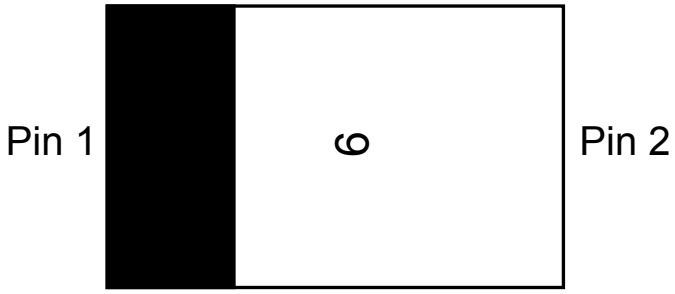


Table 3. ST0201 package mechanical data

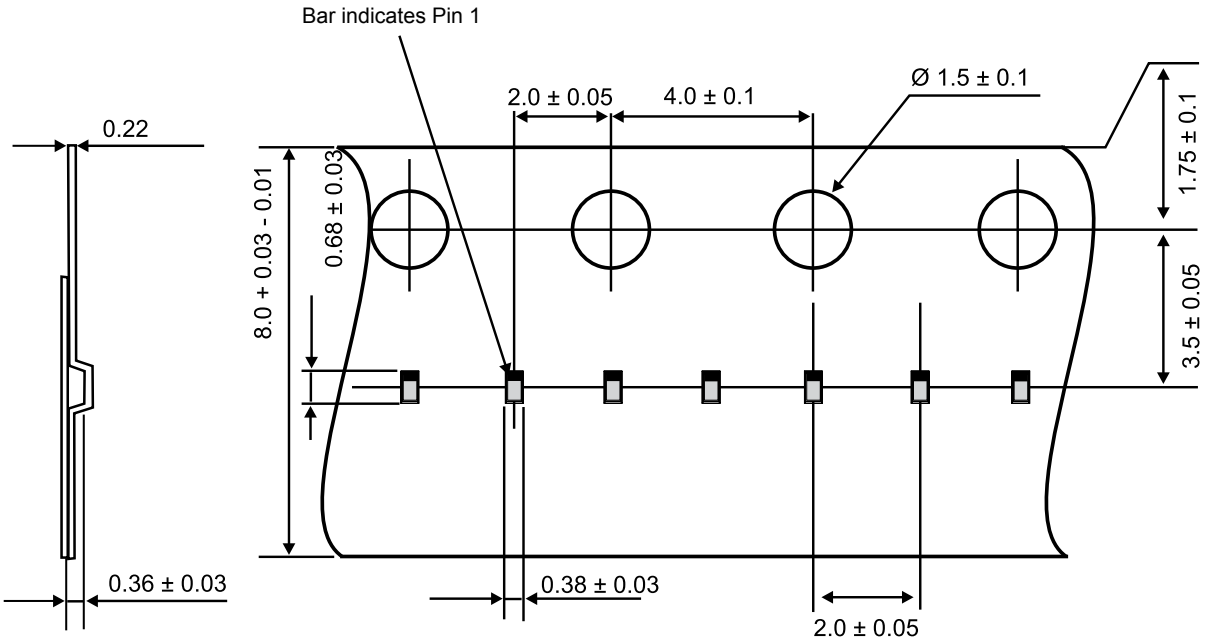
Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.280	0.300	0.320	0.011	0.0118	0.0126
b	0.125	0.140	0.155	0.0049	0.0055	0.0061
D	0.560	0.580	0.600	0.0220	0.0228	0.0236
D1		0.350			0.0138	
E	0.260	0.280	0.300	0.0102	0.0110	0.0119
E1	0.175	0.190	0.205	0.0069	0.0075	0.0081
fD	0.030	0.045	0.060	0.0011	0.0017	0.0024
fE	0.030	0.045	0.060	0.0011	0.0017	0.0024

Figure 9. **Marking**



Note: Marking can be rotated by 90° or 180° to differentiate assembly location.

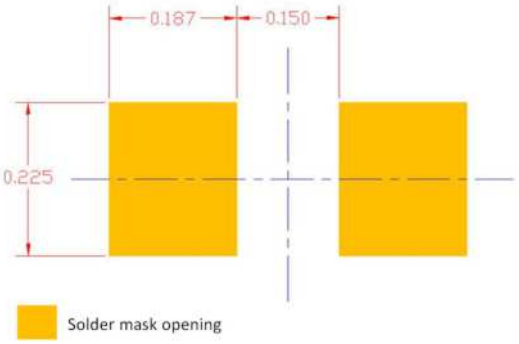
Figure 10. **Tape and reel specification**



3 Recommendation on PCB assembly

3.1 Footprint

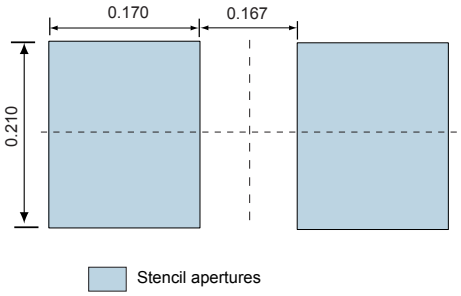
Figure 11. **Footprint in mm**



3.2 Stencil opening design

1. Recommended design reference
   a. Stencil opening dimensions: 75 µm

Figure 12. **Stencil opening recommendations**



3.3 Solder paste

1. Halide-free flux qualification ROL0 according to ANSI/J-STD-004.
2. “No clean” solder paste is recommended.
3. Offers a high tack force to resist component movement during high speed.
4. Use solder paste with fine particles: powder particle size 20-38 µm.

3.4 Placement

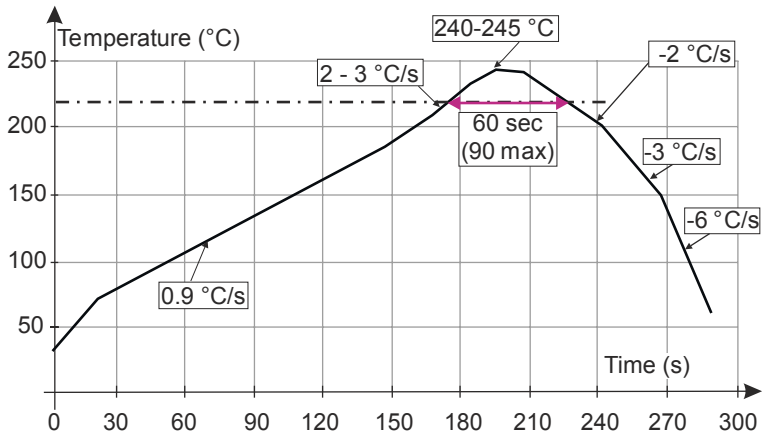
1. Manual positioning is not recommended.
2. It is recommended to use the lead recognition capabilities of the placement system, not the outline centering
3. Standard tolerance of ±0.05 mm is recommended.
4. 1.0 N placement force is recommended. Too much placement force can lead to squeezed out solder paste and cause solder joints to short. Too low placement force can lead to insufficient contact between package and solder paste that could cause open solder joints or badly centered packages.
5. To improve the package placement accuracy, a bottom side optical control should be performed with a high resolution tool.
6. For assembly, a perfect supporting of the PCB (all the more on flexible PCB) is recommended during solder paste printing, pick and place and reflow soldering by using optimized tools.

3.5 PCB design preference

1. To control the solder paste amount, the closed via is recommended instead of open vias.
2. The position of tracks and open vias in the solder area should be well balanced. A symmetrical layout is recommended, to avoid any tilt phenomena caused by asymmetrical solder paste due to solder flow away.

3.6 Reflow profile

Figure 13. ST ECOPACK recommended soldering reflow profile for PCB mounting



Note: Minimize air convection currents in the reflow oven to avoid component movement. Maximum soldering profile corresponds to the latest IPC/JEDEC J-STD-020.

4 Ordering information

Figure 14. **Ordering information scheme**

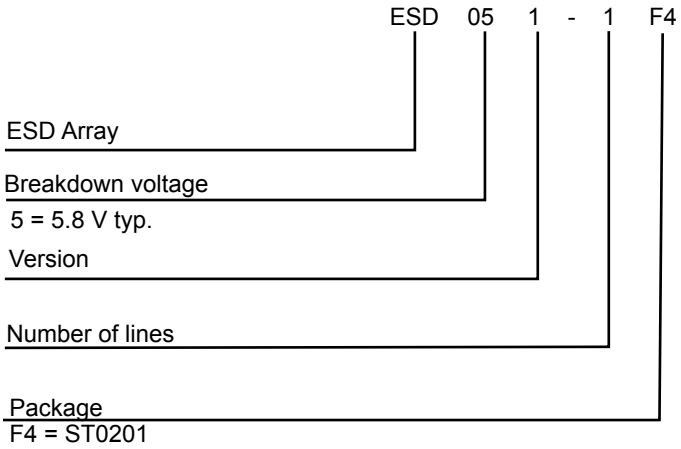


Table 4. **Ordering information**

Order code	Marking	Weight	Base qty.	Delivery mode
ESD051-1F4	6	0.12 mg	15000	Tape and reel

Revision history

Table 5. **Document revision history**

Date	Revision	Changes
11-Jun-2018	1	First issue.
02-Jul-2018	2	Updated Table 3. ST0201 package mechanical data.
24-Sep-2024	3	Updated Figure 6.

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