# SD Series

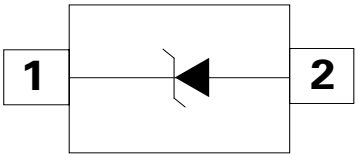
## 450W Discrete Unidirectional TVS Diode

AUTOMOTIVE GRADE | RoHS | Pb | GREEN

## Additional Information

Resources | Accessories | Samples

### Pinout and Functional Block Diagram




## Description

The Unidirectional SD series is designed for use in electronic equipment for low speed and DC applications. It will protect any sensitive equipment from damage due to electrostatic discharge (ESD) and other transient events.

The SD series can safely absorb repetitive ESD strikes at ±30kV (contact discharge, IEC 61000-4-2) without performance degradation and safely dissipate 30A (SD05) of 8/20µs induced surge current (IEC61000-4-5 2nd edition) with very low clamping voltages.

## Features & Benefits

- ESD, IEC 61000-4-2, ±30kV contact, ±30kV air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, 30A (8/20µs as defined in IEC 61000-4-5 2nd edition) SD05
- Low clamping voltage
- Low leakage current
- Small SOD323 package fits 0805 footprints
- AEC-Q101 qualified
- RoHS Compliant and Lead Free
- Moisture Sensitivity Level

## Applications

- Switches / Buttons
- Test Equipment / Instrumentation
- Point-of-Sale Terminals
- Medical Equipment
- Notebooks / Desktops / Servers
- Computer Peripherals
- Automotive Electronics



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### Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $P_{pk}$ | Peak Pulse Power ($t_p$=8/20µs) | 450 | W |
| $T_{OP}$ | Operating Temperature | -40 to 125 | °C |
| $T_{STOR}$ | Storage Temperature | -55 to 150 | °C |

**Caution**: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

### SD05 Electrical Characteristics ($T_{OP}$=25°C)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Reverse Standoff Voltage | $V_{RWM}$ | $I_R$=1µA | - | - | 5.0 | V |
| Breakdown Voltage | $V_{BR}$ | $I_R$=1mA | 6.0 | - | - | V |
| Reverse Leakage Current | $I_{LEAK}$ | $V_R$=5V | - | - | 1.0 | µA |
| Clamp Voltage[1] | $V_C$ | $I_{PP}$=1A, $t_p$=8/20µs, Fwd | - | - | 9.8 | V |
| | | $I_{PP}$=10A, $t_p$=8/20µs, Fwd | - | - | 13.0 | V |
| Dynamic Resistance[2] | $R_{DYN}$ | TLP, $t_p$=100ns, I/O to Ground | - | 0.22 | - | Ω |
| Peak Pulse Current | $I_{pp}$ | $t_p$=8/20µs | - | - | 30.0 | A |
| ESD Withstand Voltage[1] | $V_{ESD}$ | IEC 61000-4-2 (Contact Discharge) | ±30 | - | - | kV |
| | | IEC 61000-4-2 (Air Discharge) | ±30 | - | - | kV |
| Diode Capacitance[1] | $C_{I/O-GND}$ | Reverse Bias=0V, f=1MHz | - | - | 350 | pF |

### SD12 Electrical Characteristics ($T_{OP}$=25°C)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Reverse Standoff Voltage | $V_{RWM}$ | $I_R$=1µA | | | 12.0 | V |
| Breakdown Voltage | $V_{BR}$ | $I_R$=1mA | 13.3 | | | V |
| Reverse Leakage Current | $I_{LEAK}$ | $V_R$=12V | | | 1.0 | µA |
| Clamp Voltage[1] | $V_C$ | $I_{PP}$=1A, $t_p$=8/20µs, Fwd | | | 18.5 | V |
| | | $I_{PP}$=10A, $t_p$=8/20µs, Fwd | | | 22.5 | V |
| Dynamic Resistance[2] | $R_{DYN}$ | TLP, $t_p$=100ns, I/O to Ground | | 0.29 | | Ω |
| Peak Pulse Current | $I_{pp}$ | $t_p$=8/20µs | | | 17.0 | A |
| ESD Withstand Voltage[1] | $V_{ESD}$ | IEC 61000-4-2 (Contact Discharge) | ±30 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ±30 | | | kV |
| Diode Capacitance[1] | $C_{I/O-GND}$ | Reverse Bias=0V, f=1MHz | | | 150 | pF |




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### SD15 Electrical Characteristics ($T_{OP}$=25°C)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Reverse Standoff Voltage | $V_{RWM}$ | $I_R$=1µA | | | 15.0 | V |
| Breakdown Voltage | $V_{BR}$ | $I_R$=1mA | 16.7 | | | V |
| Reverse Leakage Current | $I_{LEAK}$ | $V_R$=15V | | | 1.0 | µA |
| Clamp Voltage[1] | $V_C$ | $I_{PP}$=1A, $t_p$=8/20µs, Fwd | | | 24.0 | V |
| | | $I_{PP}$=10A, $t_p$=8/20µs, Fwd | | | 30.0 | V |
| Dynamic Resistance[2] | $R_{DYN}$ | TLP, $t_p$=100ns, I/O to Ground | | 0.34 | | Ω |
| Peak Pulse Current | $I_{pp}$ | $t_p$=8/20µs | | | 12.0 | A |
| ESD Withstand Voltage[1] | $V_{ESD}$ | IEC 61000-4-2 (Contact Discharge) | ±30 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ±30 | | | kV |
| Diode Capacitance[1] | $C_{I/O-GND}$ | Reverse Bias=0V, f=1MHz | | | 100 | pF |

### SD24 Electrical Characteristics ($T_{OP}$=25°C)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Reverse Standoff Voltage | $V_{RWM}$ | $I_R$=1µA | | | 24.0 | V |
| Breakdown Voltage | $V_{BR}$ | $I_R$=1mA | 26.7 | | | V |
| Reverse Leakage Current | $I_{LEAK}$ | $V_R$=24V | | | 1.0 | µA |
| Clamp Voltage[1] | $V_C$ | $I_{PP}$=1A, $t_p$=8/20µs, Fwd | | | 36.0 | V |
| | | $I_{PP}$=5A, $t_p$=8/20µs, Fwd | | | 42.0 | V |
| Dynamic Resistance[2] | $R_{DYN}$ | TLP, $t_p$=100ns, I/O to Ground | | 0.49 | | Ω |
| Peak Pulse Current | $I_{pp}$ | $t_p$=8/20µs | | | 7.0 | A |
| ESD Withstand Voltage[1] | $V_{ESD}$ | IEC 61000-4-2 (Contact Discharge) | ±30 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ±30 | | | kV |
| Diode Capacitance[1] | $C_{I/O-GND}$ | Reverse Bias=0V, f=1MHz | | | 65 | pF |

### SD36 Electrical Characteristics ($T_{OP}$=25°C)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| Reverse Standoff Voltage | $V_{RWM}$ | $I_R$=1µA | | | 36.0 | V |
| Breakdown Voltage | $V_{BR}$ | $I_R$=1mA | 40.0 | | | V |
| Reverse Leakage Current | $I_{LEAK}$ | $V_R$=36V | | | 1.0 | µA |
| Clamp Voltage[1] | $V_C$ | $I_{PP}$=1A, $t_p$=8/20µs, Fwd | | | 52.0 | V |
| | | $I_{PP}$=4A, $t_p$=8/20µs, Fwd | | | 62.0 | V |
| Dynamic Resistance[2] | $R_{DYN}$ | TLP, $t_p$=100ns, I/O to Ground | | 0.61 | | Ω |
| Peak Pulse Current | $I_{pp}$ | $t_p$=8/20µs | | | 5.0 | A |
| ESD Withstand Voltage[1] | $V_{ESD}$ | IEC 61000-4-2 (Contact Discharge) | ±30 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ±30 | | | kV |
| Diode Capacitance[1] | $C_{I/O-GND}$ | Reverse Bias=0V, f=1MHz | | | 50 | pF |

**Note:**

1. Parameter is guaranteed by design and/or component characterization.
2. Transmission Line Pulse (TLP) with 100ns width and 200ps rise time.




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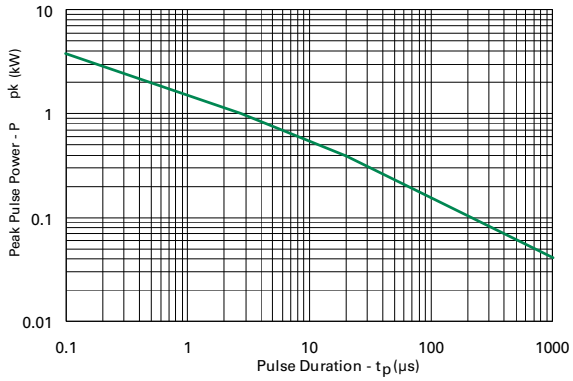
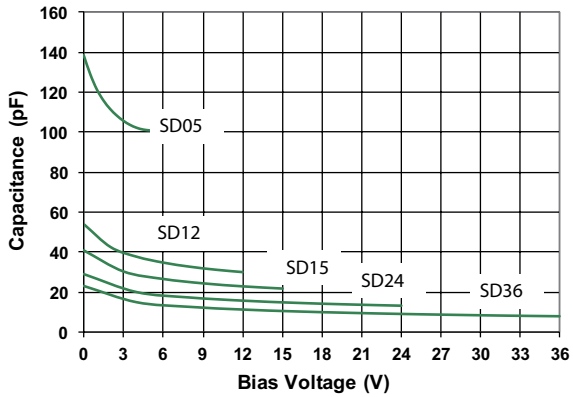
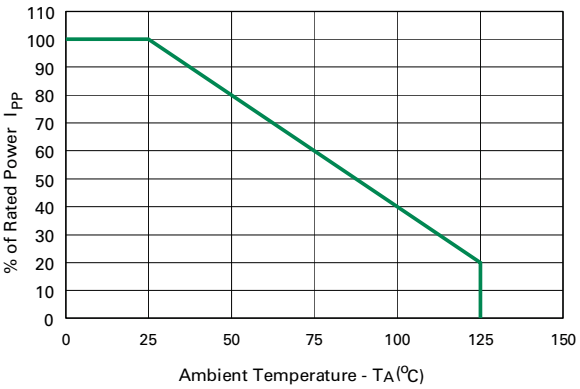
### Non-Repetitive Peak Pulse Power vs. Pulse Time



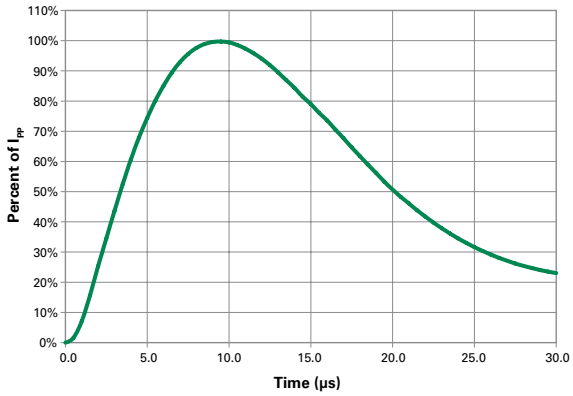

### Capacitance vs. Bias



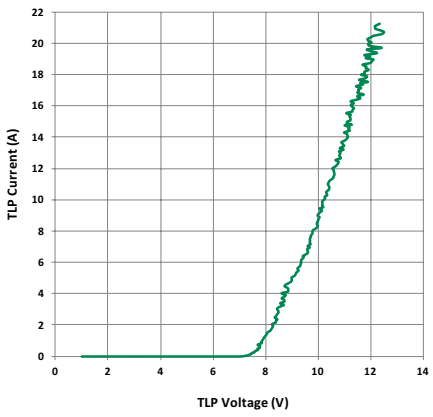

### Power Derating Curve



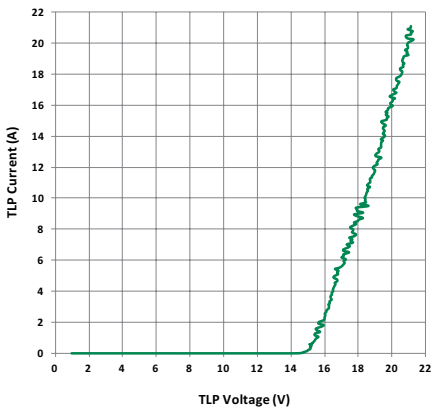

### 8/20 µs Pulse Waveform




### SD05 Transmission Line Pulsing(TLP) Plot




### SD12 Transmission Line Pulsing(TLP) Plot



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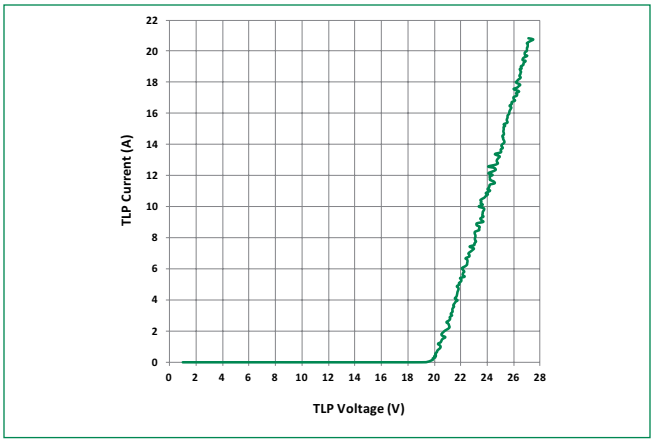
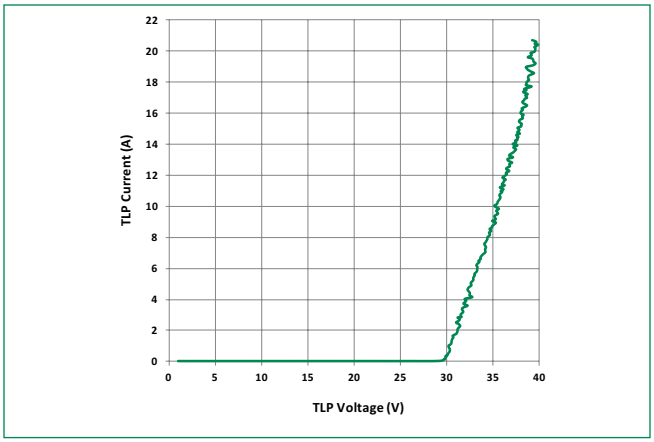
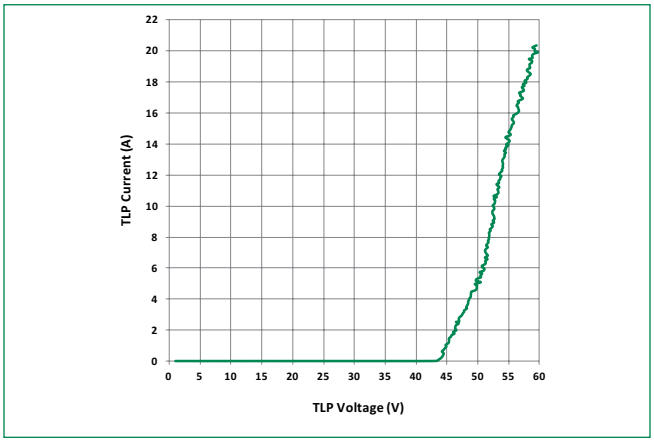
### SD15 Transmission Line Pulsing(TLP) Plot




### SD24 Transmission Line Pulsing(TLP) Plot

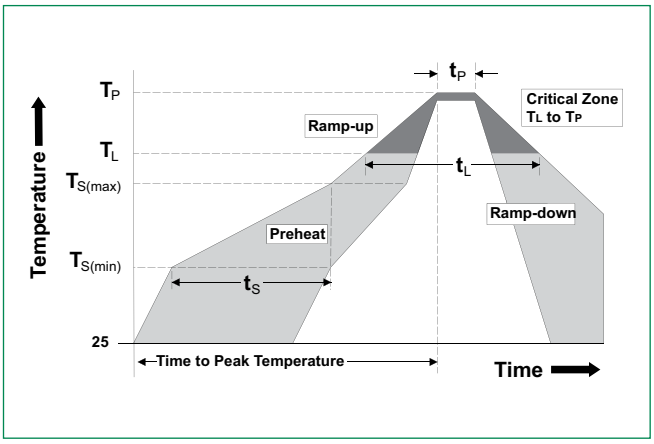



### SD36 Transmission Line Pulsing(TLP) Plot




### Soldering Parameters

| | | |
|---|---|---|
| **Reflow Condition** | | Pb – Free assembly |
| **Pre Heat** | **- Temperature Min ($T_{s(min)}$)** | 150°C |
| | **- Temperature Max ($T_{s(max)}$)** | 200°C |
| | **- Time (min to max) ($t_s$)** | 60 – 120 secs |
| **Average ramp up rate (Liquidus) Temp ($T_L$) to peak** | | 3°C/second max |
| **$T_{S(max)}$ to $T_L$ - Ramp-up Rate** | | 3°C/second max |
| **Reflow** | **- Temperature ($T_L$) (Liquidus)** | 217°C |
| | **- Temperature ($t_L$)** | 60 – 150 seconds |
| **Peak Temperature ($T_P$)** | | $260^{+0/-5}$ °C |
| **Time within 5°C of actual peak Temperature ($t_p$)** | | 30 seconds |
| **Ramp-down Rate** | | 6°C/second max |
| **Time 25°C to peak Temperature ($T_P$)** | | 8 minutes Max. |
| **Do not exceed** | | 260°C |



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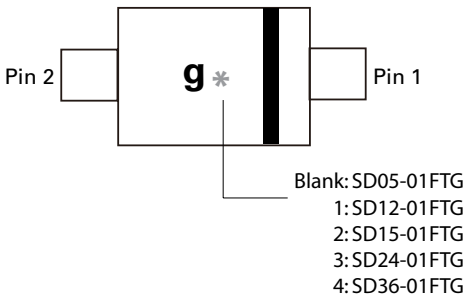
### Product Characteristics

| | |
|---|---|
| **Lead Plating** | Matte Tin |
| **Lead Material** | Copper Alloy |
| **Lead Coplanarity** | 0.0004 inches (0.102mm) |
| **Substrate material** | Silicon |
| **Body Material** | Molded Compound |
| **Flammability** | UL Recognized compound meeting flammability rating V-0 |

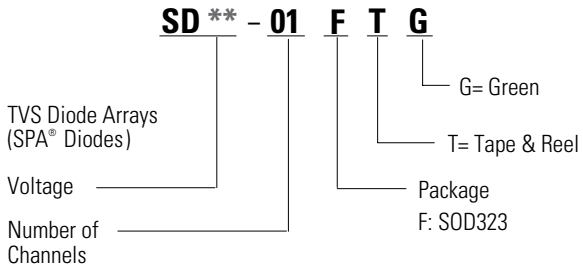
### Ordering Information

| Part Number | Package | Min. Order Qty. |
|---|---|---|
| SD05-01FTG | SOD323 | 3000 |
| SD12-01FTG | SOD323 | 3000 |
| SD15-01FTG | SOD323 | 3000 |
| SD24-01FTG | SOD323 | 3000 |
| SD36-01FTG | SOD323 | 3000 |

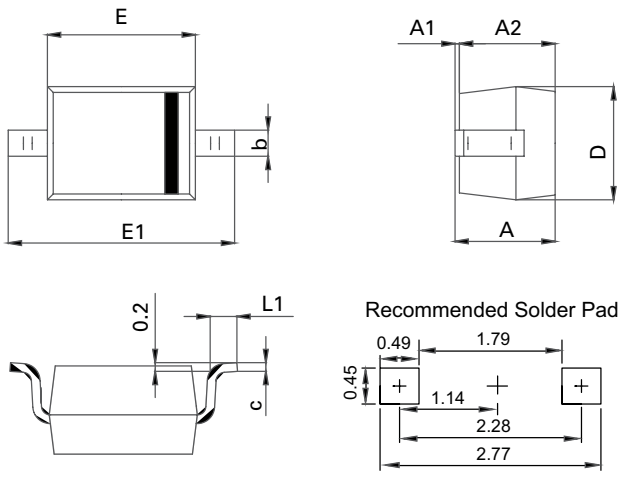
### Part Marking System




### Part Numbering System




### Package Dimensions -SOD323




Unit: mm

| Symbol | SOD323 | | | |
|---|---|---|---|---|
| | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| **A** | 0.8 | 1.14 | 0.031 | 0.045 |
| **A1** | 0.00 | 0.10 | 0.000 | 0.004 |
| **A2** | 0.80 | 1.04 | 0.031 | 0.014 |
| **b** | 0.25 | 0.35 | 0.010 | 0.014 |
| **c** | 0.08 | 0.15 | 0.003 | 0.006 |
| **D** | 1.15 | 1.45 | 0.045 | 0.057 |
| **E** | 1.60 | 1.90 | 0.063 | 0.075 |
| **E1** | 2.44 | 2.70 | 0.096 | 0.106 |
| **L1** | 0.25 | 0.45 | 0.010 | 0.018 |

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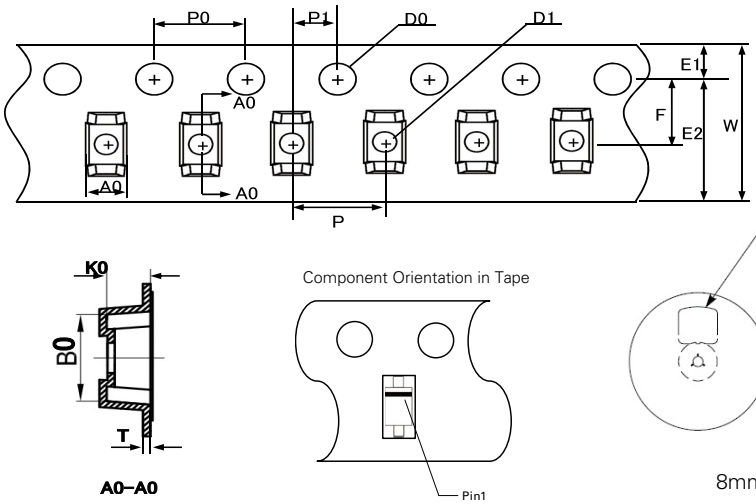
### Embossed Carrier Tape & Reel Specification — SOD323




| Symbol | Millimeters |
|---|---|
| **A0** | 1.46+/-0.10 |
| **B0** | 2.90+/-0.10 |
| **W** | 8.0+0.3/-0.10 |
| **D0** | 1.50+0.10 |
| **D1** | 0.45min/1.15max |
| **E1** | 1.75+/-0.10 |
| **E2** | - |
| **F** | 3.50+/-0.10 |
| **P0** | 4.00+/-0.10 |
| **P** | 4.00+/-0.10 |
| **P1** | 2.00+/-0.05 |
| **K0** | 1.25+/-0.10 |
| **T** | 0.254+/-0.02 |



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