

# ESD5Z2.5-Q1 Thru ESD5Z15-Q1

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**ESD5Z2.5-Q1 Thru ESD5Z15-Q1**

**Surface Mount Uni-Directional TVS**  
**For ESD Protection Diode : 2.5V- 15V**

**Features**

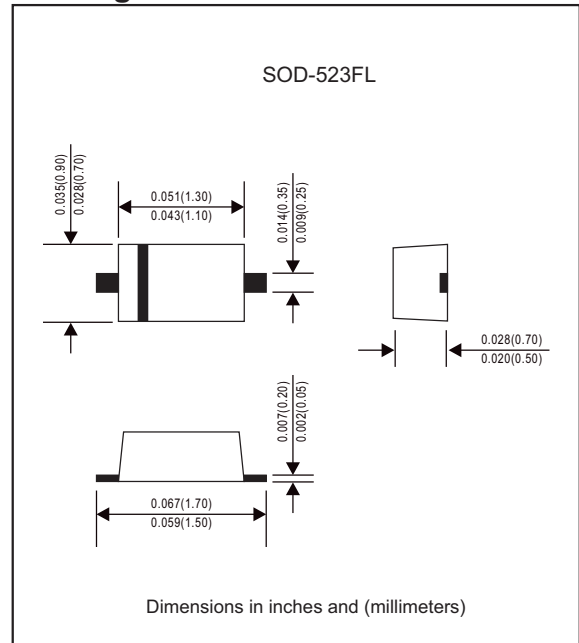
- Small body outline dimensions
- Low body height
- Stand off voltage: 2.5V, 3.3V, 5.0V, 7.0V, 12V, 15V
- Peak power up to 200 Watts @ 8 x 20us Pulse
- Low leakage
- Response time is typically < 1 ns
- Provide transient protection:  
IEC 61000-4-2 (ESD) level 4  
IEC 61000-4-4 (EFT) 40A (5/50ns)  
IEC 61000-4-5 (Surge) (8/20us)
- Lead-free parts meet RoHS requirements.
- Qualified to AEC-Q101 standards for high reliability.
- Suffix "-H" indicates Halogen-free part, ex. ESD5Z2.5-Q1-H

**Applications**

- Cellular phones
- Portable devices
- Digital cameras
- Power supplies

**Mechanical data**

- Epoxy: UL94-V0 rated flame retardant
- Case : Molded plastic, SOD-523FL
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026
- Polarity : Indicated by cathode band
- Mounting Position : Any
- Weight : Approximated 0.002 gram

**Package outline****Maximum ratings** (at  $T_A=25^\circ\text{C}$  unless otherwise noted)

| PARAMETER                       | CONDITIONS                                                   | Symbol    | Value               | UNIT             |
|---------------------------------|--------------------------------------------------------------|-----------|---------------------|------------------|
| Total power dissipation         | Peak pulse power (tp = 8/20us)                               | $P_{PP}$  | 200                 | W                |
| Electrostatic discharge         | IEC61000-4-2 air discharge<br>IEC61000-4-2 contact discharge | $E_{SD}$  | $\pm 15$<br>$\pm 8$ | kV               |
| ESD voltage                     | Per human body model                                         | $E_{SD}$  | 16                  | kV               |
| Electrostatic discharge         | IEC61000-4-4                                                 | $E_{FT}$  | 40                  | A                |
| Lead solder temperature-maximum | 10 second duration                                           | $T_L$     | 260                 | $^\circ\text{C}$ |
| Maximum junction temperature    |                                                              | $T_J$     | +150                | $^\circ\text{C}$ |
| Storage temperature range       |                                                              | $T_{STG}$ | -55~+150            | $^\circ\text{C}$ |
| Operating temperature range     |                                                              | $T_{OP}$  | -40~+125            | $^\circ\text{C}$ |

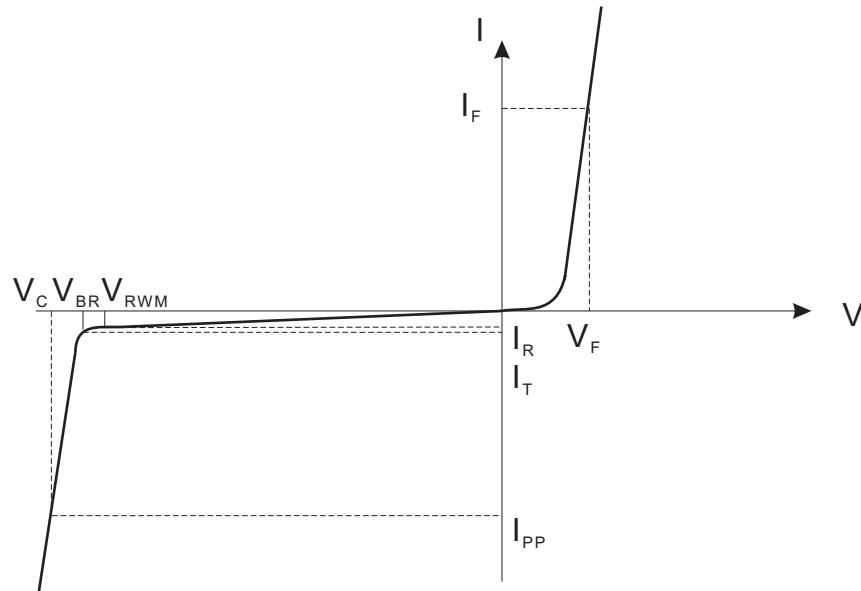
**Electrical characteristics** (at  $T_A=25^\circ\text{C}$  unless otherwise noted,  $V_F = 0.9\text{V}$  Max. @  $I_F=10\text{mA}$  for all types)

| Part No.    | $V_{RWM}$<br>(V)<br>Max. | $I_R(\mu\text{A})$<br>@ $V_{RWM}$<br>Max. | $V_{BR}(\text{V})@I_T$<br>(Note 2)<br>Min. | $I_T$<br>(mA) | $V_C(\text{V})$<br>@ $I_{PP}=5.0\text{A}$<br>(Note 1)<br>Max. | $I_{PP}(\text{A})$<br>(Note 1)<br>Max. | $V_C(\text{V})$<br>@ Max $I_{PP}$<br>(Note 1)<br>Max. | $P_{PK}$<br>(W)<br>(Note 1)<br>Max. | $C_J(\text{pF})$<br>$V_R=0\text{V}$ and<br>$f=1\text{MHz}$<br>Typ. |
|-------------|--------------------------|-------------------------------------------|--------------------------------------------|---------------|---------------------------------------------------------------|----------------------------------------|-------------------------------------------------------|-------------------------------------|--------------------------------------------------------------------|
| ESD5Z2.5-Q1 | 2.5                      | 6.0                                       | 4.0                                        | 1.0           | 6.5                                                           | 11                                     | 10.9                                                  | 120                                 | 145                                                                |
| ESD5Z3.3-Q1 | 3.3                      | 1.0                                       | 5.0                                        | 1.0           | 8.4                                                           | 11.2                                   | 14.1                                                  | 158                                 | 105                                                                |
| ESD5Z5.0-Q1 | 5.0                      | 1.0                                       | 6.2                                        | 1.0           | 11.6                                                          | 9.4                                    | 18.6                                                  | 174                                 | 80                                                                 |
| ESD5Z7.0-Q1 | 7.0                      | 1.0                                       | 7.5                                        | 1.0           | 13.5                                                          | 8.8                                    | 22.7                                                  | 200                                 | 65                                                                 |
| ESD5Z12-Q1  | 12                       | 1.0                                       | 13.5                                       | 1.0           | 17.0                                                          | 9.6                                    | 25.0                                                  | 240                                 | 55                                                                 |
| ESD5Z15-Q1  | 15                       | 1.0                                       | 16.5                                       | 1.0           | 22.0                                                          | 10.0                                   | 26.0                                                  | 260                                 | 65                                                                 |

Note 1. Surge current waveform per Fig.1

2.  $V_{BR}$  is measured with a pulse test current  $I_T$  at an ambient temperature of  $25^\circ\text{C}$ .

## ESD5Z2.5-Q1 Thru ESD5Z15-Q1

Typical characteristics (at  $T_A = 25^\circ\text{C}$  unless otherwise noted)

Uni-Directional TVS

$V_C$  : Clamping Voltage @  $I_{PP}$   
 $I_{PP}$  : Maximum Reverse Peak Pulse Current  
 $V_{RWM}$  : Maximum 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 @  $I_F$   
 $C_J$  : Capacitance @  $V_R = 0\text{V}$  and  $f = 1\text{MHz}$

## Rating and characteristic curves (ESD5Z2.5-Q1 Thru ESD5Z15-Q1)

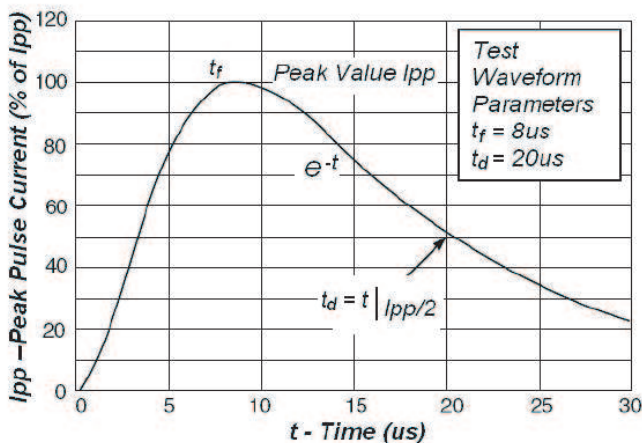


Fig1. Pulse Waveform

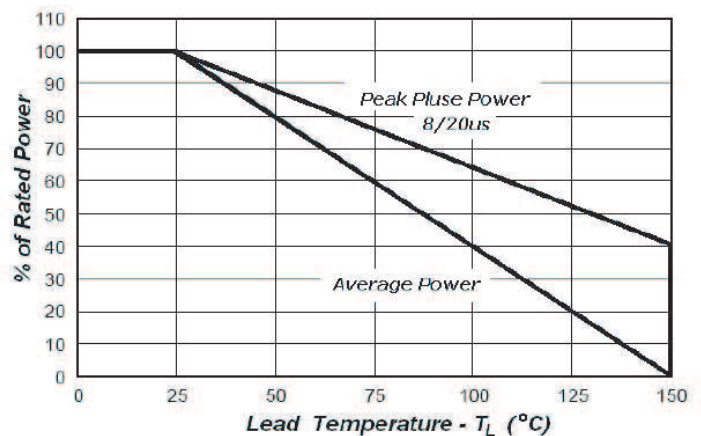
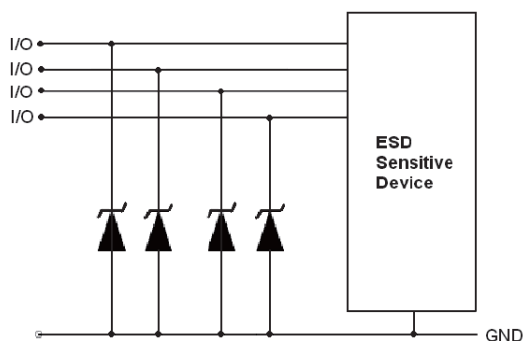


Fig2. Power Derating

# ESD5Z2.5-Q1 Thru ESD5Z15-Q1

## Application Note

Electrostatic discharge (ESD) is a major cause of failure in electronic system. Transient Voltage Suppressors (TVS) are an ideal choice for ESD protection. They are capable of clamping the incoming transient to a low enough level such that damage to the protected semiconductor is prevented. Surface mount TVS offers the best choice for minimal lead inductance. They serve as parallel protection elements, connected between the signal lines to ground. As the transient rise above the operating voltage of the device, the TVS becomes a low impedance path diverting the transient current to ground. The ESD5Z2.5-Q1 Thru ESD5Z15-Q1 is the ideal board level protection of ESD sensitive semiconductor components. The tiny SOD-523FL package allows design flexibility in the design of high density boards where the space is at a premium. This enables to shorten the routing and contributes to hardening against ESD.



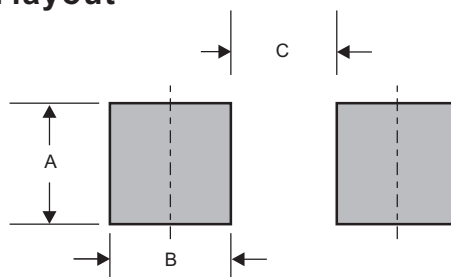
## Pinning information

| Pin                        | Simplified outline | Symbol |
|----------------------------|--------------------|--------|
| Pin1 cathode<br>Pin2 anode |                    |        |

## Marking

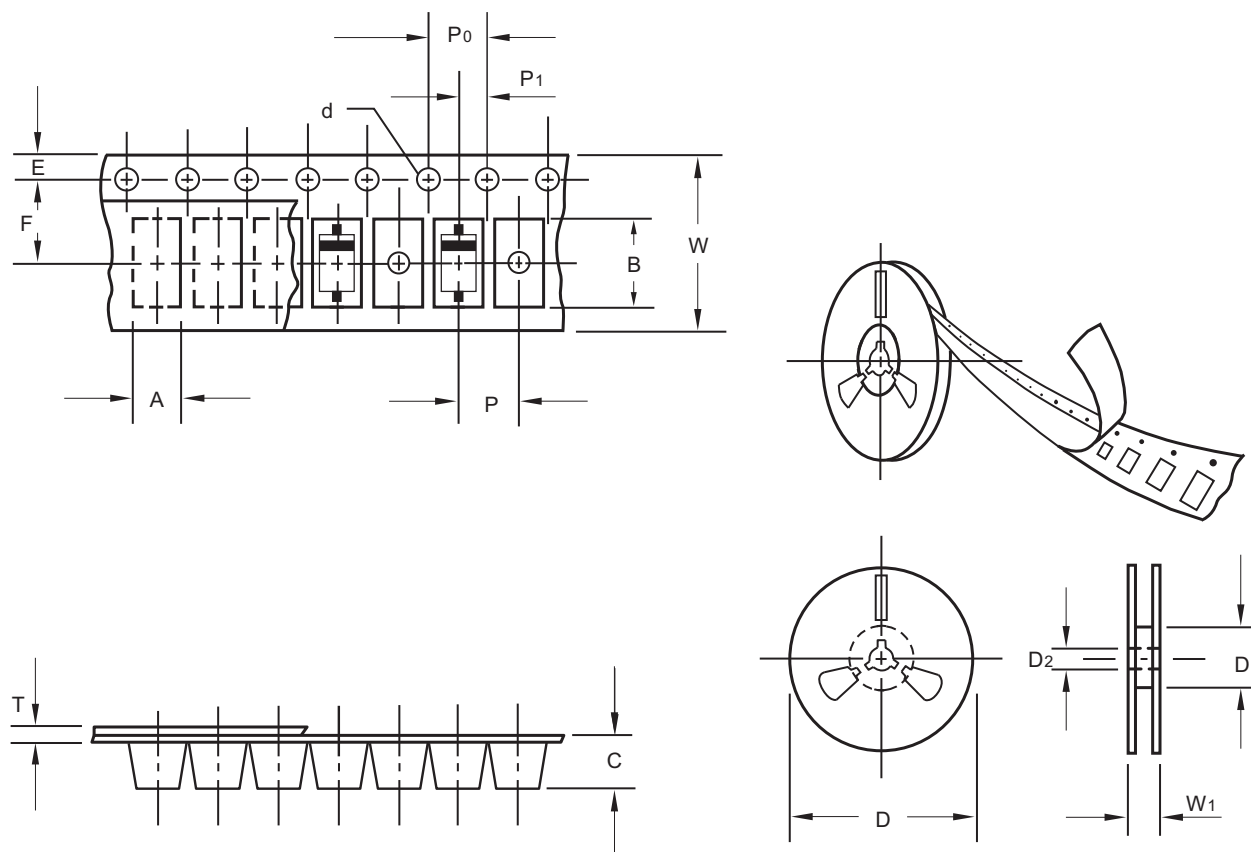
| Type number | Marking code |
|-------------|--------------|
| ESD5Z2.5-Q1 | ZD,02        |
| ESD5Z3.3-Q1 | ZE,03        |
| ESD5Z5.0-Q1 | ZF,05        |
| ESD5Z7.0-Q1 | ZH,07        |
| ESD5Z12-Q1  | ZM,12        |
| ESD5Z15-Q1  | ZN,15        |

## Suggested solder pad layout



Dimensions in inches and (millimeters)

| PACKAGE   | A            | B            | C            |
|-----------|--------------|--------------|--------------|
| SOD-523FL | 0.032 (0.80) | 0.024 (0.60) | 0.044 (1.10) |

**ESD5Z2.5-Q1 Thru ESD5Z15-Q1****Packing information**

unit:mm

| Item                     | Symbol         | Tolerance | SOD-523FL |
|--------------------------|----------------|-----------|-----------|
| Carrier width            | A              | 0.05      | 0.96      |
| Carrier length           | B              | 0.05      | 1.94      |
| Carrier depth            | C              | 0.1       | 0.76      |
| Sprocket hole            | d              | 0.1       | 1.50      |
| 7" Reel outside diameter | D              | 1.0       | 178.00    |
| 7" Reel inner diameter   | D <sub>1</sub> | 0.4       | 54.40     |
| Feed hole diameter       | D <sub>2</sub> | 0.05      | 1.30      |
| Sprocket hole position   | E              | 0.01      | 1.75      |
| Punch hole position      | F              | 0.05      | 3.50      |
| Punch hole pitch         | P              | 0.05      | 2.00      |
| Sprocket hole pitch      | P <sub>0</sub> | 0.1       | 4.00      |
| Embossment center        | P <sub>1</sub> | 0.05      | 2.00      |
| Overall tape thickness   | T              | 0.02      | 0.18      |
| Tape width               | W              | 0.4       | 8.00      |
| Reel width               | W <sub>1</sub> | 0.2       | 12.30     |

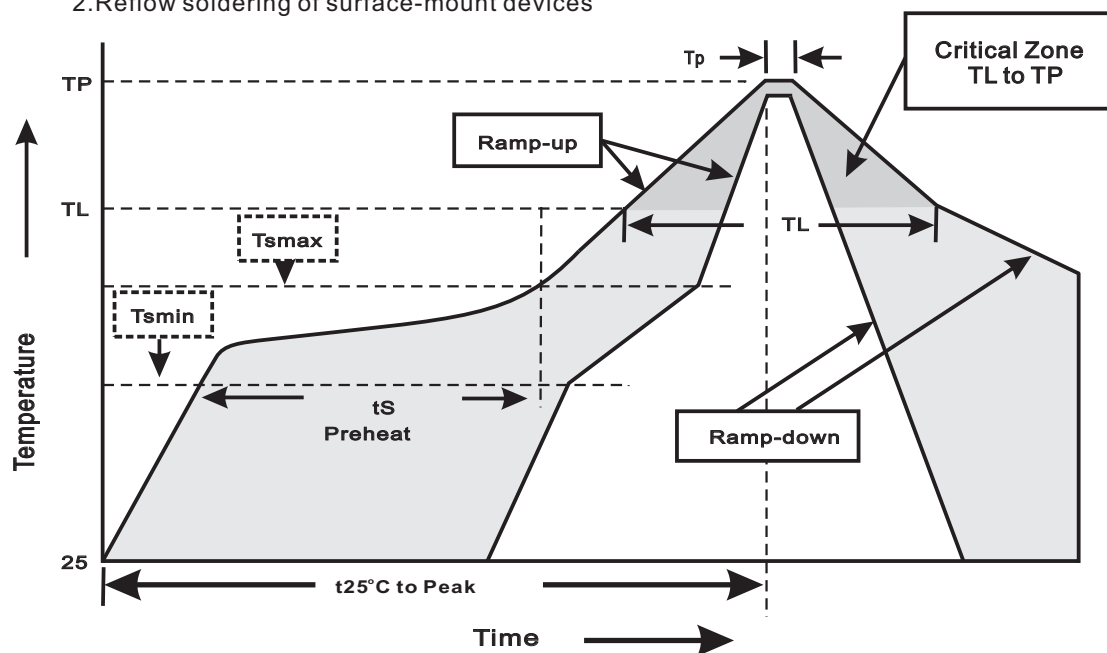
Note: Devices are packed in accordance with EIA standard RS-481-A and specifications listed above.

**ESD5Z2.5-Q1 Thru ESD5Z15-Q1****Reel packing**

| PACKAGE   | REEL SIZE | REEL (pcs) | COMPONENT SPACING (m/m) | BOX (pcs) | INNER BOX (m/m) | REEL DIA, (m/m) | CARTON SIZE (m/m) | CARTON (pcs) | APPROX. GROSS WEIGHT (kg) |
|-----------|-----------|------------|-------------------------|-----------|-----------------|-----------------|-------------------|--------------|---------------------------|
| SOD-523FL | 7"        | 3,000      | 2.0                     | 30,000    | 183*123*183     | 178             | 382*257*387       | 240,000      | 9.5                       |

**Suggested thermal profiles for soldering processes**

- 1.Storage environment: Temperature=5°C~40°C Humidity=55%±25%
- 2.Reflow soldering of surface-mount devices

**3.Reflow soldering**

| Profile Feature                                                                                                                 | Soldering Condition         |
|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| Average ramp-up rate(T <sub>L</sub> to T <sub>P</sub> )                                                                         | <3°C/sec                    |
| Preheat<br>-Temperature Min(T <sub>smmin</sub> )<br>-Temperature Max(T <sub>smmax</sub> )<br>-Time(min to max)(t <sub>s</sub> ) | 150°C<br>200°C<br>60~120sec |
| T <sub>smmax</sub> to T <sub>L</sub><br>-Ramp-upRate                                                                            | <3°C/sec                    |
| Time maintained above:<br>-Temperature(T <sub>L</sub> )<br>-Time(t <sub>L</sub> )                                               | 217°C<br>60~260sec          |
| Peak Temperature(T <sub>P</sub> )                                                                                               | 255°C-0/+5°C                |
| Time within 5°C of actual Peak Temperature(t <sub>P</sub> )                                                                     | 10~30sec                    |
| Ramp-down Rate                                                                                                                  | <6°C/sec                    |
| Time 25°C to Peak Temperature                                                                                                   | <6minutes                   |

**ESD5Z2.5-Q1 Thru ESD5Z15-Q1****High reliability test capabilities**

| Item Test                                         | Conditions                                                                                                                                                      | Reference                     |
|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 1. MSL Preconditioning                            | 24hr bake@125°C+168hrs@85°C<br>/85%RH+3xIR@260°C+1flux<br>immersion+alcohol+DI H2O rinse                                                                        | JESD22-A113                   |
| 2. High Temperature Reverse Bias                  | $V_{BR}=V_{BR\ NOM}*80\%$ ( $T_j=150^{\circ}C$ ) Test Duration:1000hrs                                                                                          | JESD22-A108                   |
| 3. High Temperature Storage Life                  | $T_a=125^{\circ}C$ Test Duration: 1000hrs                                                                                                                       | JESD22 A-103                  |
| 4. Temperature Cycle                              | $-55^{\circ}C$ (15min) to $150^{\circ}C$ (15min) Test Cycles: 1000cycles                                                                                        | JESD22 A-104                  |
| 5. Autoclave                                      | $P=2atm$ $T_a=121^{\circ}C$ RH=100% Test Duration:96hrs                                                                                                         | JESD22 A-102                  |
| 6. Solderability                                  | $245\pm5^{\circ}C$ for 5sec                                                                                                                                     | J-STD-002                     |
| 7. Moisture Resistance                            | $T_a=85^{\circ}C$ /85% Relative humidity Test Duration:1000hrs                                                                                                  | MIL-STD-750E<br>METHOD 1021.2 |
| 8. Resistance To Solder Heat                      | $260\pm5^{\circ}C$ for 10sec                                                                                                                                    | JESD22 B-106                  |
| 9. High Temperature High Humidity<br>Reverse Bias | $T_a=85^{\circ}C$ , 85%RH, with device reverse<br>biased at 80% of rated breakdown voltage up to a<br>maximum of 100V or limit of chamber Test Duration:1000hrs | JESD22-A101                   |