

SP33R6

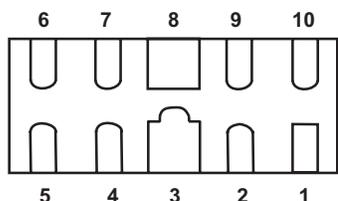
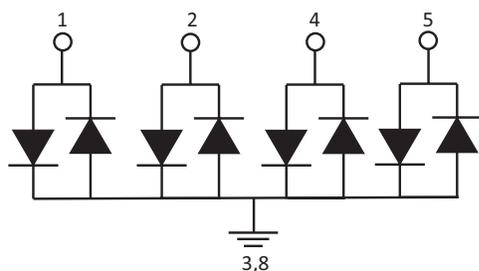
0.2pF, 12KV Diode Array, Low Voltage Low Capacitance ESD Protection

PRELIMINARY & CONFIDENTIAL

Littelfuse, Inc. has characterized initial samples of this device and is currently conducting reliability testing. Parts numbers and specifications are subject to change until the datasheet is made final.



Note: This package image is for example and reference only. For detail package drawing, please refer to the package section in this datasheet.

Pinout**Functional Block Diagram****Life Support Note:**

Not Intended for Use in Life Support or Life Saving Applications

The products shown herein are not designed for use in life sustaining or life saving applications unless otherwise expressly indicated.

Description

The SP33R6 forward PN junction diode fabricated in a proprietary silicon technology protect each I/O pin to provide a high level of protection for electronic equipment that may experience destructive electrostatic discharges (ESD). These robust diodes can safely absorb repetitive ESD strikes above the maximum level specified in IEC 61000-4-2 international standard (Level 4, $\pm 8\text{kV}$ contact discharge) without performance degradation. Their very low loading capacitance also makes them ideal for protecting high speed signal pins.

Features

- ESD, IEC 61000-4-2, $\pm 12\text{kV}$ contact, $\pm 15\text{kV}$ air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, 3A (8/20 μs as defined in IEC 61000-4-5, 2nd Edition)
- Low capacitance of 0.2pF (TYP) per I/O
- Halogen free, lead free and RoHS compliant

Applications

- USB 3.x
- Thunderbolt 3.0
- PCIE

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Absolute Maximum Ratings

| Symbol | Parameter | Value | Units |
|------------|----------------------------------|------------|-------|
| I_{PP} | Peak Current ($t_p=8/20\mu s$) | 3 | A |
| 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 component. This is a stress only rating and operation of the component at these or any other conditions above those indicated in the operational sections of this specification is not implied.

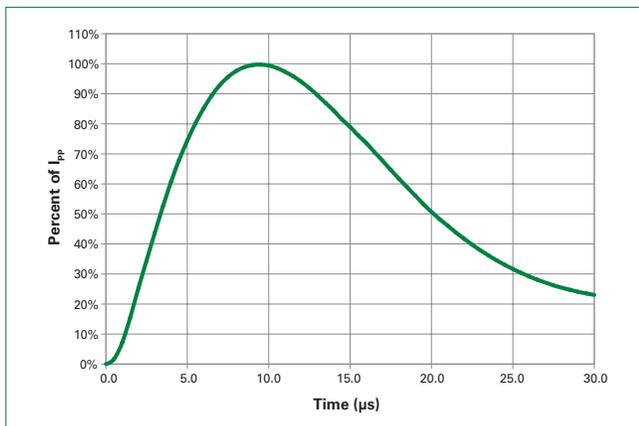
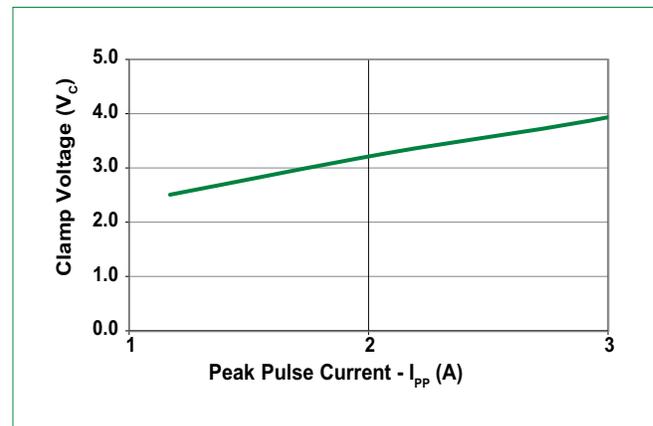
Electrical Characteristics ($T_{OP}=25^\circ C$)

| Parameter | Symbol | Test Conditions | Min | Typ | Max | Units |
|------------------------------------|------------|-----------------------------------|----------|-----|-----|----------|
| Reverse Standoff Voltage | V_{RWM} | $I_R=1\mu A$ | | | 0.3 | V |
| Breakdown Voltage | V_{BR} | $I_R=1mA$ | 0.7 | | 0.9 | V |
| Reverse Leakage Current | I_{LEAK} | $V_R=0.3V$, Any I/O to GND | | | 100 | nA |
| Clamp Voltage ¹ | V_C | $I_{PP}=1A$, $t_p=8/20\mu s$ | | 2.5 | | V |
| | | $I_{PP}=2A$, $t_p=8/20\mu s$ | | 3.3 | | |
| Dynamic Resistance ³ | R_{DYN} | TLP, $t_p=100ns$ | | 0.3 | | Ω |
| ESD Withstand Voltage ¹ | V_{ESD} | IEC 61000-4-2 (Contact Discharge) | ± 12 | | | kV |
| | | IEC 61000-4-2 (Air Discharge) | ± 15 | | | kV |
| Line Capacitance ^{1,2} | C_L | Reverse Bias=0V, $f=3GHz$ | | 0.2 | | pF |

Note 1: Parameter is guaranteed by design and/or component characterization.

Note 2: Test equipment accuracy $\pm 50fF$.

Note 3: Transmission Line Pulse (TLP) with 100ns width, 2ns rise time, and average window $t_1=70ns$ to $t_2=90ns$

8/20 μs Pulse Waveform**Clamping Voltage vs I_{PP}** 

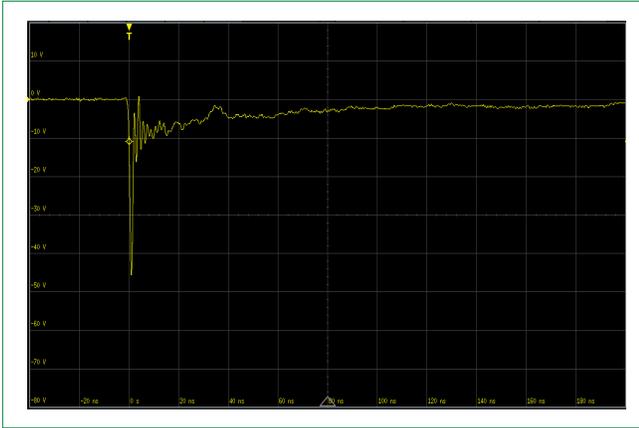
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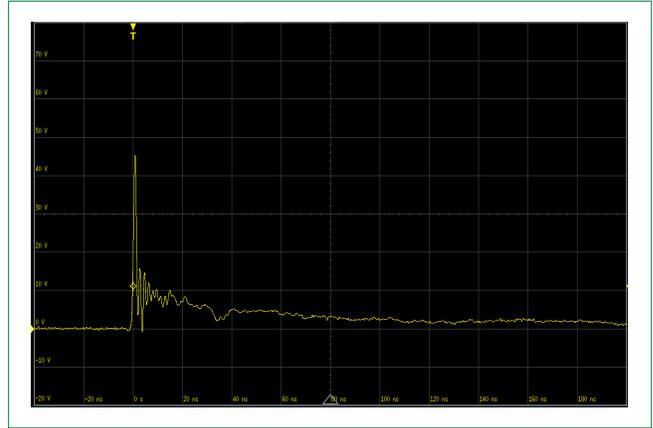
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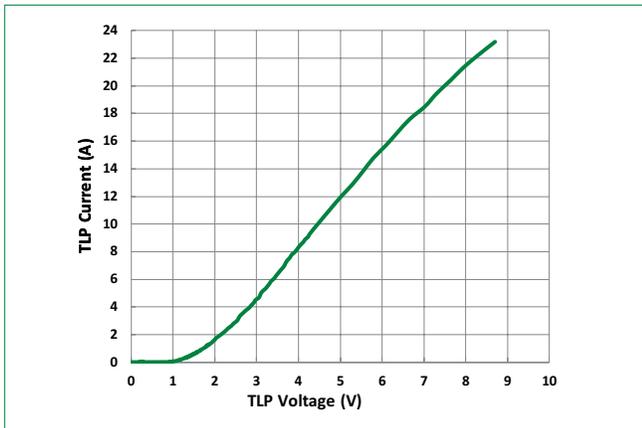
IEC 61000-4-2 +8 kV Contact ESD Clamping Voltage



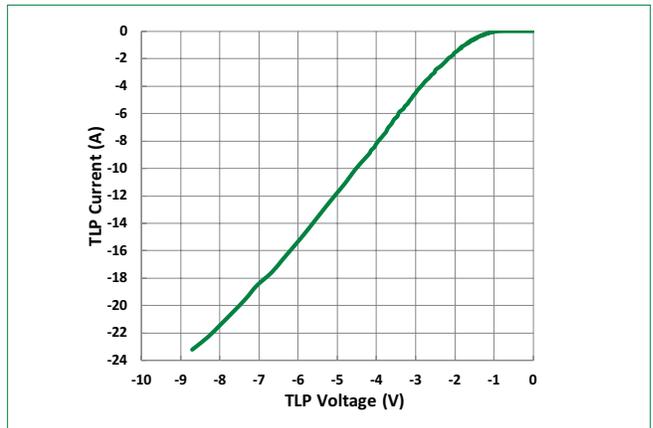
IEC 61000-4-2 -8 kV Contact ESD Clamping Voltage



Positive Transmission Line Pulsing (TLP) Plot



Negative Transmission Line Pulsing (TLP) Plot



SP33R6

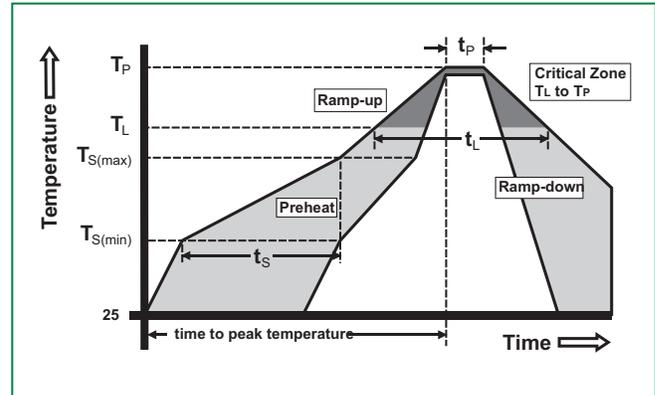
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Soldering Parameters

| | | |
|--|------------------------------------|-------------------------|
| 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 |



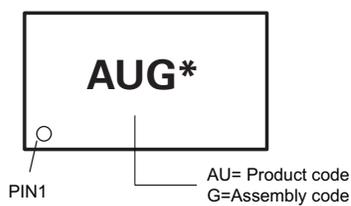
Ordering Information

| Part Number | Package | Min. Order Qty. |
|--------------|---------|-----------------|
| SP33R6-04UTG | μDFN-10 | 3000 |

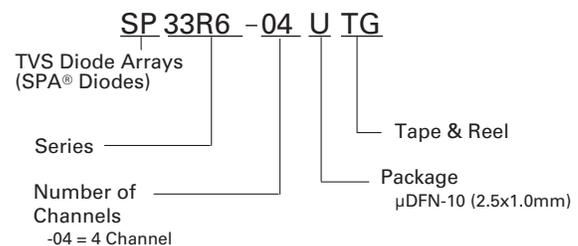
Product Characteristics

| | |
|---------------------------|--|
| Lead Plating | PPF |
| Lead material | Copper Alloy |
| Substrate Material | Silicon |
| Body Material | Molded Compound |
| Flammability | UL Recognized compound meeting flammability rating V-0 |

Part Marking System



Part Numbering System

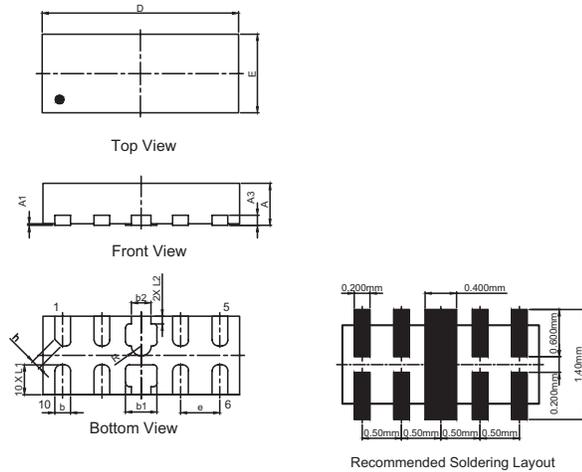


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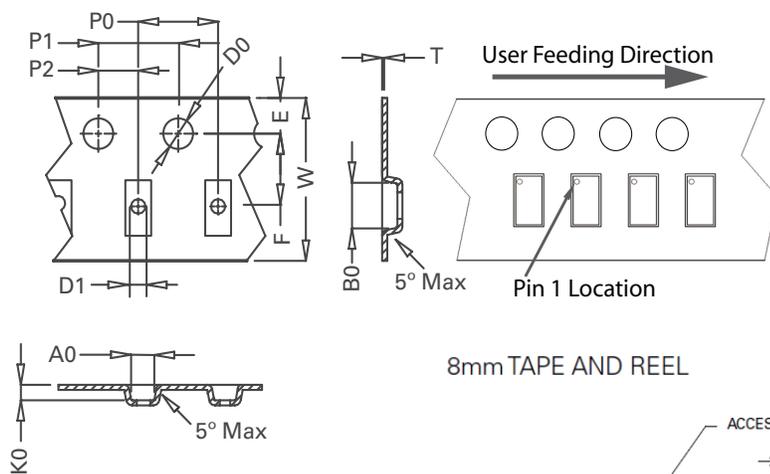
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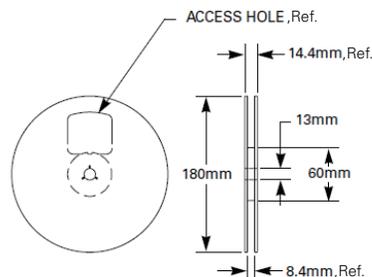
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Package Dimensions — μ DFN-10 (2.5x1.0x0.5mm)

| Symbol | Millimeters | | Inches | |
|--------|-------------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.50 | 0.60 | 0.020 | 0.024 |
| A1 | 0.00 | 0.05 | 0.000 | 0.002 |
| A3 | 0.125 | 0.175 | 0.005 | 0.007 |
| b | 0.15 | 0.25 | 0.006 | 0.010 |
| b2 | 0.20 | 0.30 | 0.008 | 0.012 |
| D | 2.45 | 2.55 | 0.096 | 0.100 |
| E | 0.95 | 1.05 | 0.037 | 0.041 |
| L1 | 0.28 | 0.48 | 0.011 | 0.019 |
| L2 | 0.05 | 0.15 | 0.002 | 0.006 |
| e | 0.500 BASIC | | 0.020 BASIC | |
| R | 0.125 REF | | 0.005 REF | |
| h | 0.08 | 0.16 | 0.003 | 0.006 |

Embossed Carrier Tape & Reel Specification — μ DFN-10

| Symbol | Millimeters |
|--------|---------------------|
| A0 | 1.30 +/- 0.10 |
| B0 | 2.83 +/- 0.10 |
| D0 | Ø 1.50 + 0.10 |
| D1 | Ø 1.00 + 0.25 |
| E | 1.75 +/- 0.10 |
| F | 3.50 +/- 0.05 |
| K0 | 0.65 +/- 0.10 |
| P0 | 4.00 +/- 0.10 |
| P1 | 4.00 +/- 0.10 |
| P2 | 2.00 +/- 0.05 |
| T | 0.254 +/- 0.02 |
| W | 8.00 + 0.30 /- 0.10 |



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