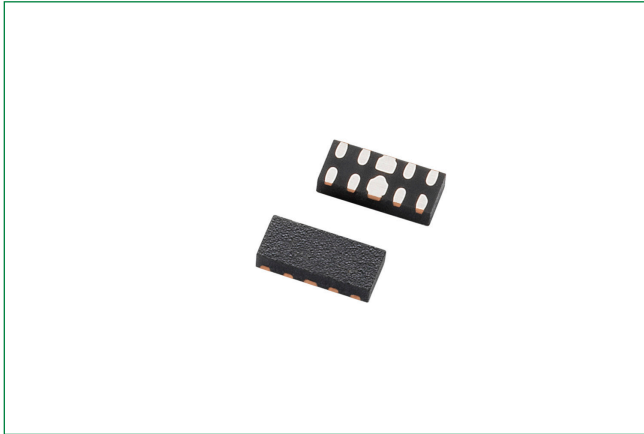


SP33R6

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

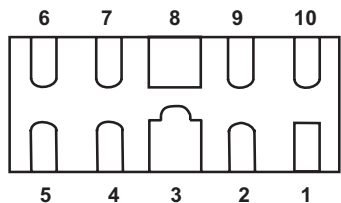
PRELIMINARY & CONFIDENTIAL

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.

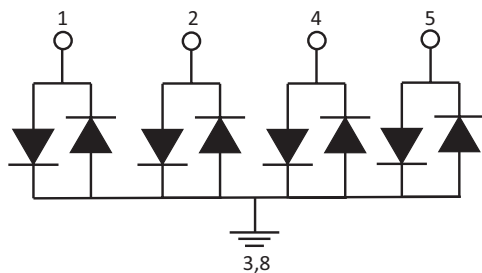
HF **RoHS** **Pb**

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



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

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.

SP33R6

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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.

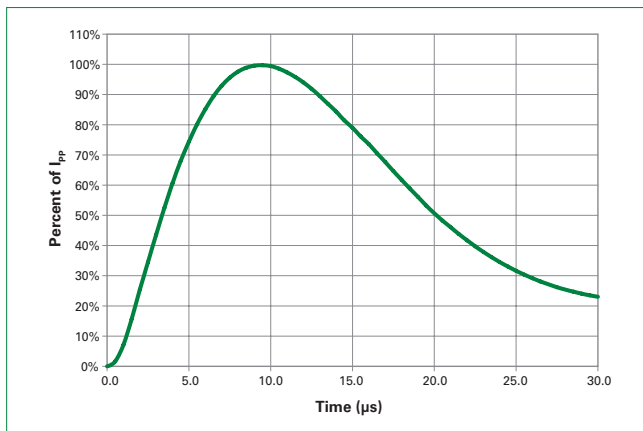
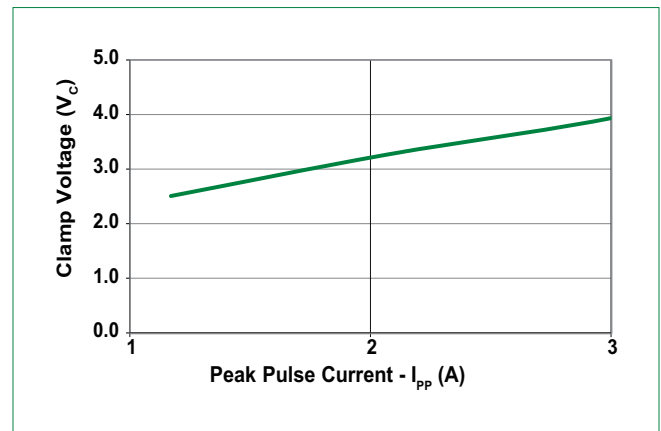
Electrical Characteristics ($T_{OP}=25^\circ C$)

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.

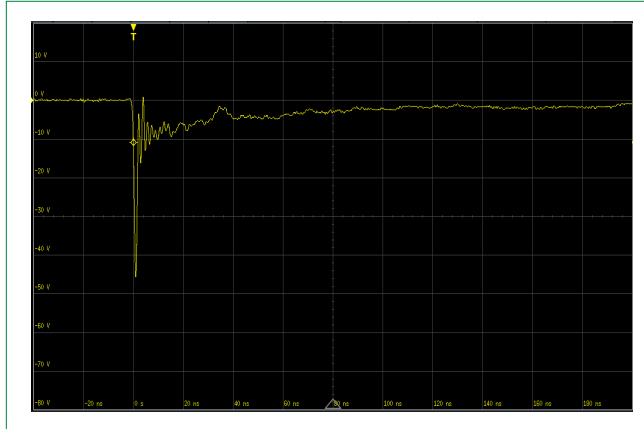
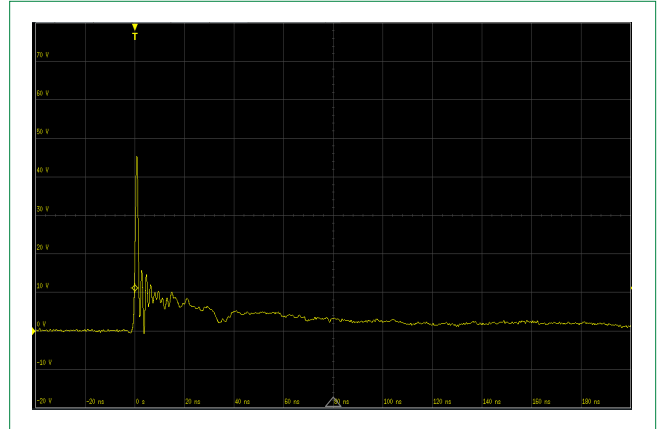
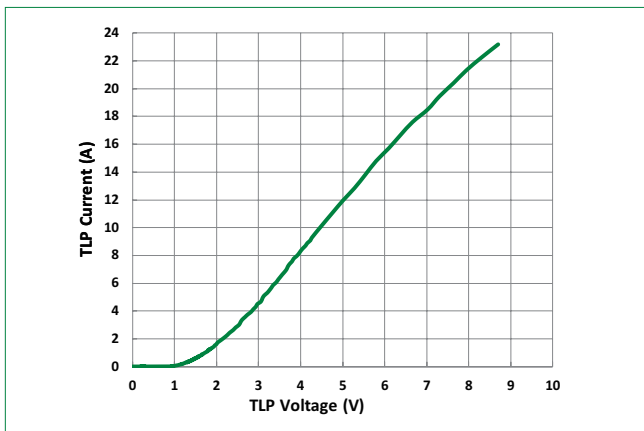
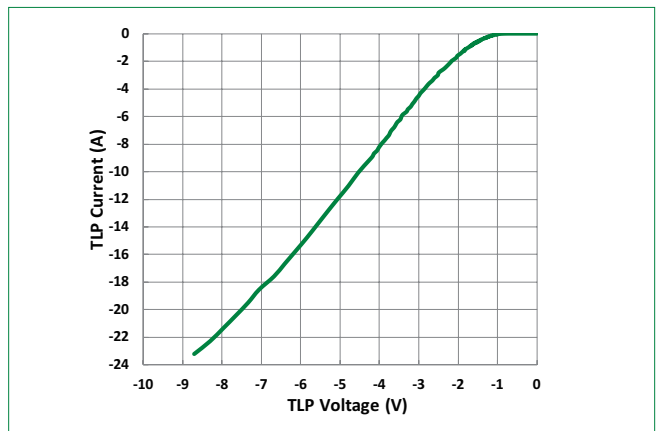
Note 2: Test equipment accuracy $\pm 50\text{fF}$.

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}** 

SP33R6**0.2pF, 12KV Diode Array, Low Voltage Low Capacitance ESD Protection****PRELIMINARY & CONFIDENTIAL**

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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

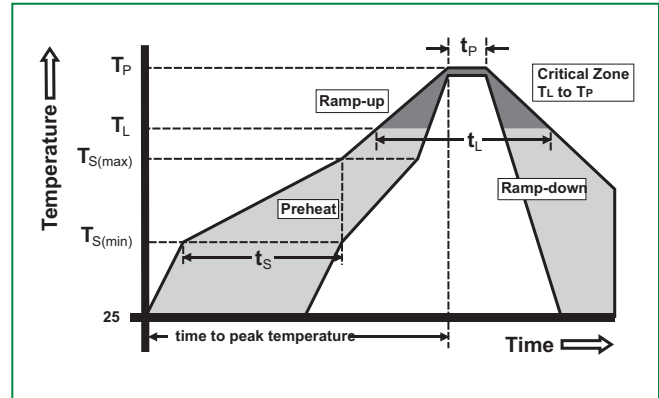
0.2pF, 12KV Diode Array, Low Voltage Low Capacitance ESD Protection

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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



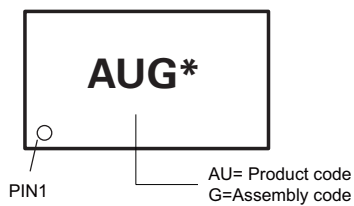
Ordering Information

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

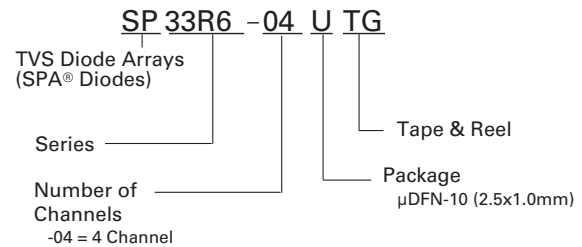
Product Characteristics

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

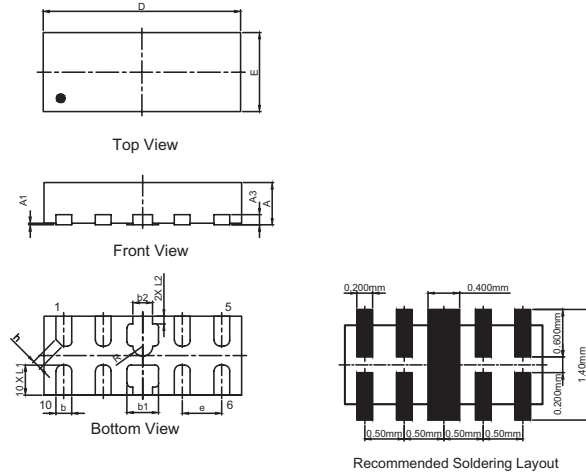


Part Numbering System

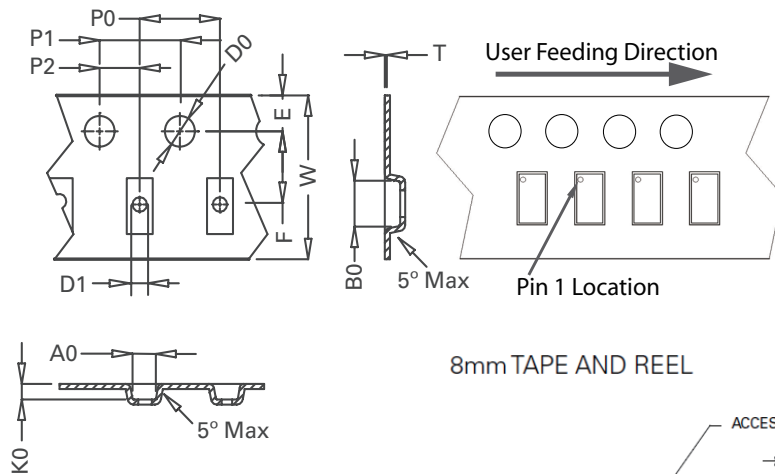


SP33R6**0.2pF, 12KV Diode Array, Low Voltage Low Capacitance ESD Protection****PRELIMINARY & CONFIDENTIAL**

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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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