

SP3213 0.09pF 12kV Bidirectional Discrete TVS



Description

The SP3213 is a bidirectional TVS Diode that provides ultra low capacitance and a high level of protection for electronic equipment that may experience destructive electrostatic discharges (ESD). The typical capacitance of 0.09pF helps ensure signal integrity on the most challenging consumer electronics interfaces such as USB 3.2, 3.1, HDMI 2.1, 2.0, DisplayPort, Thunderbolt, and V-by-One®.

It can safely absorb repetitive ESD strikes at $\pm 12\text{kV}$ (contact discharge, IEC 61000-4-2) without performance degradation and safely dissipate 2A of 8/20 μs surge current (IEC 61000-4-5 2nd edition).

Pinout



Features

- ESD, IEC 61000-4-2, $\pm 12\text{kV}$ contact, $\pm 18\text{kV}$ air
- EFT, IEC 61000-4-4, 40A (5/50ns)
- Lightning, 2A (8/20 as defined in IEC 61000-4-5 2nd Edition)
- Low leakage current of 0.02 μA (TYP) at 5V
- Space efficient 0201 footprint
- AEC-Q101 qualified and PPAP capable
- Halogen free, lead free and RoHS compliant
- Moisture Sensitivity Level(MSL -1)

Functional Block Diagram



Applications

- Ultra-high speed data lines
- USB 3.2, 3.1, 3.0, and 2.0
- HDMI 2.1, 2.0, 1.4a, 1.3
- DisplayPort(TM)
- Thunderbolt (Light Peak)
- V-by-One®
- LVDS interfaces
- Consumer, mobile and portable electronics
- Tablet PC and external storage with high speed interfaces

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.

Absolute Maximum Ratings

Symbol	Parameter	Value	Units
I_{PP}	Peak Pulse Current ($t_p=8/20\mu s$)	2	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.

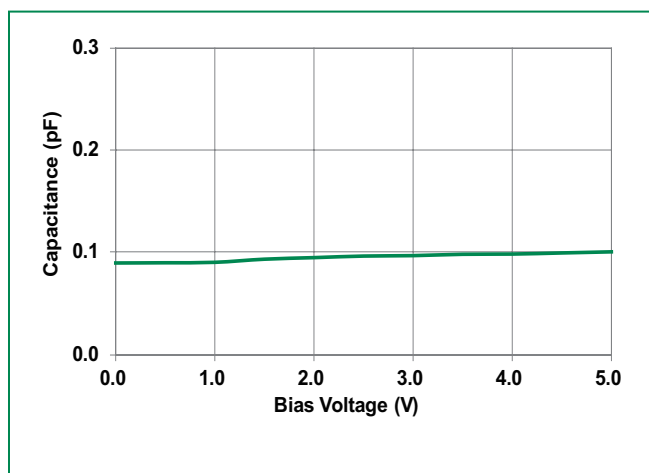
Electrical Characteristics ($T_{OP}=25^{\circ}C$)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Reverse Standoff Voltage	V_{RWM}	$I_R=1\mu A$, I/O to I/O			5	V
Breakdown Voltage	V_{BR}	$I_R=1mA$, I/O to I/O	6.2	7.5		V
Reverse Leakage Current	I_{LEAK}	$V_R=5V$		0.02	0.1	μA
Clamp Voltage ¹	V_C	$I_{PP}=1A$, $t_p=8/20\mu s$, I/O to I/O		12	15	V
		$I_{PP}=2A$, $t_p=8/20\mu s$, I/O to I/O		14.5	18	V
Dynamic Resistance ²	R_{DYN}	TLP, $t_p=100ns$, I/O to I/O		1.2		Ω
ESD Withstand Voltage ¹	V_{ESD}	IEC 61000-4-2 (Contact Discharge)	± 12			kV
		IEC 61000-4-2 (Air Discharge)	± 18			kV
Diode Capacitance ¹	$C_{I/O-I/O}$	Reverse Bias=0V, $f=1MHz$, I/O to I/O		0.09		pF

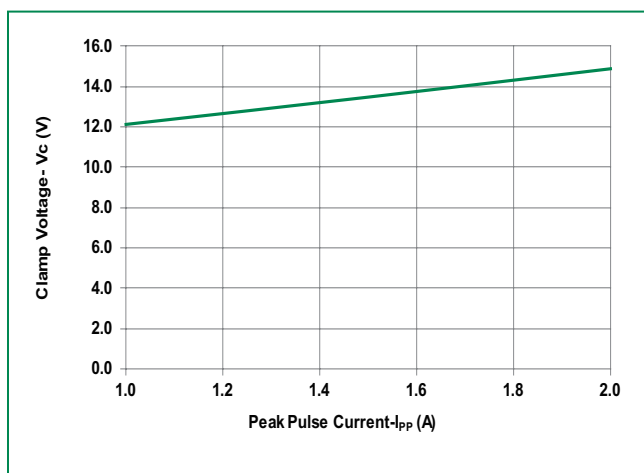
Note: 1 Parameter is guaranteed by design and/or component characterization.

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

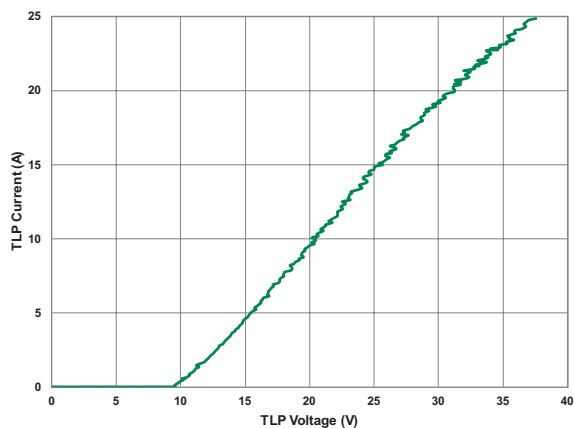
Capacitance vs. Reverse Bias



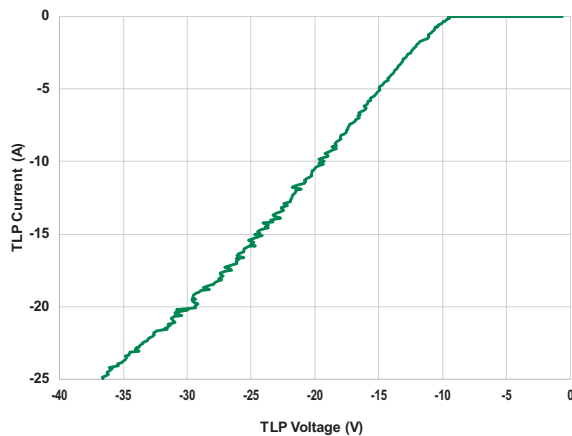
Clamping Voltage vs. I_{PP}



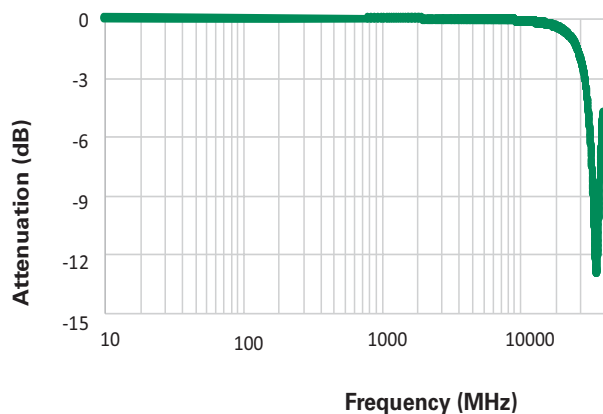
Positive Transmission Line Pulsing(TLP) Plot



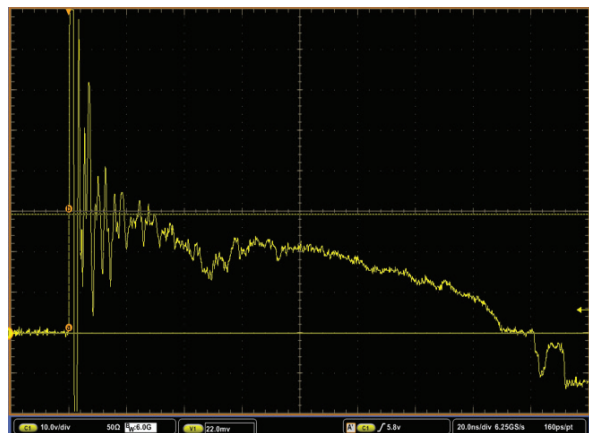
Negative Transmission Line Pulsing(TLP) Plot



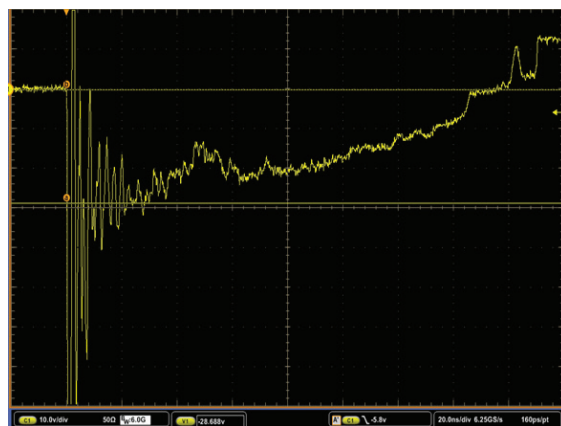
Insertion Loss (S21) I/O to GND



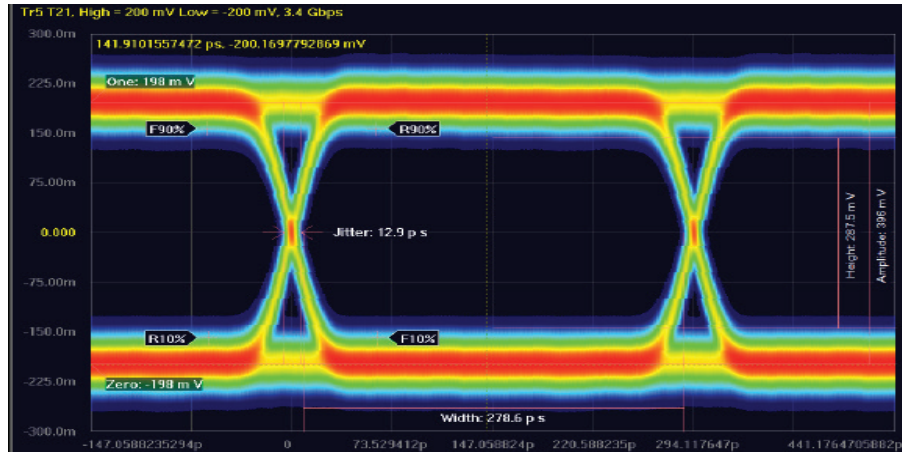
IEC 61000-4-2 +8kV Contact ESD Clamping Voltage



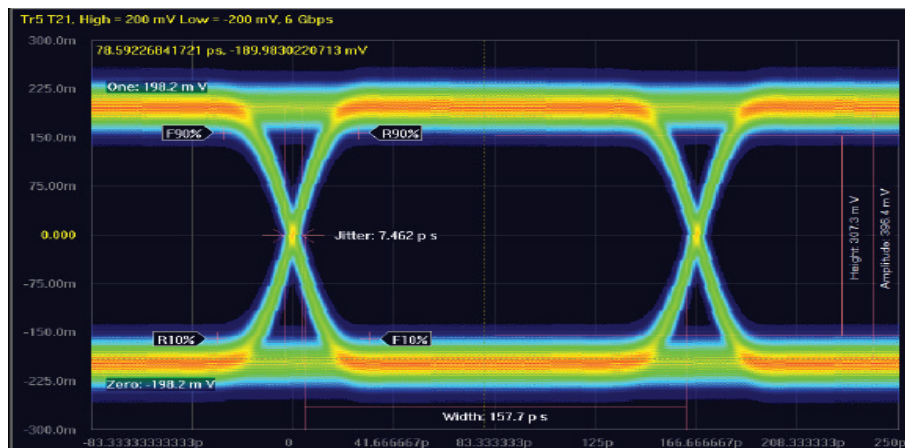
IEC 61000-4-2 -8kV Contact ESD Clamping Voltage



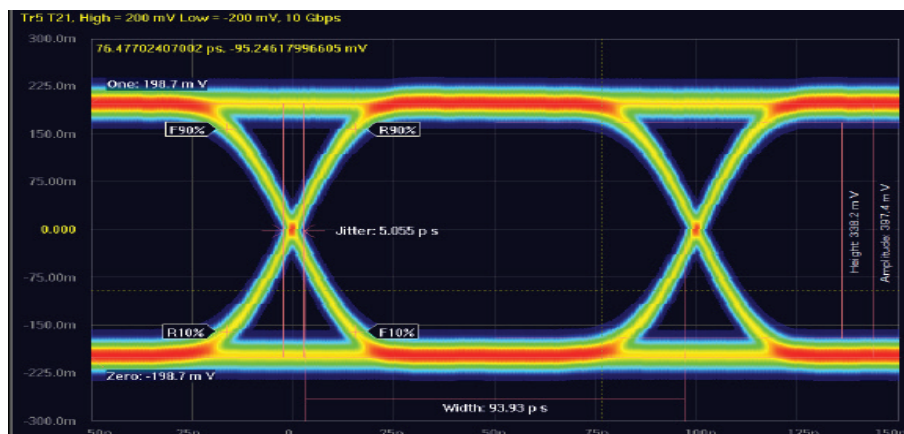
3.4 Gbps, High Speed Display interfaces



6 Gbps, SATA, HDMI 2.x interfaces

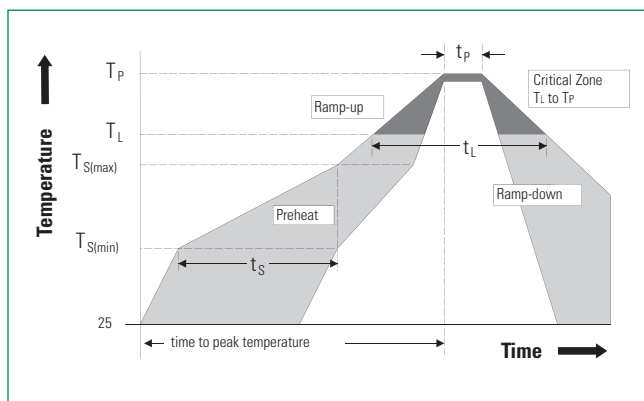


10 Gbps, USB 3.1 Gen 2, Thunderbolt

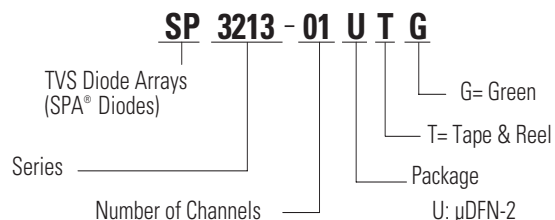


Soldering Parameters

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 – 180 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)		20 – 40 seconds
Ramp-down Rate		6°C/second max
Time 25°C to peak Temperature (T_p)		8 minutes Max.



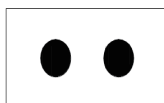
Part Numbering System



Product Characteristics

Lead Plating	Pre-Plated Frame
Lead Material	Copper Alloy
Substrate Material	Silicon
Body Material	Molded Compound
Flammability	UL Recognized compound meeting flammability rating V-0

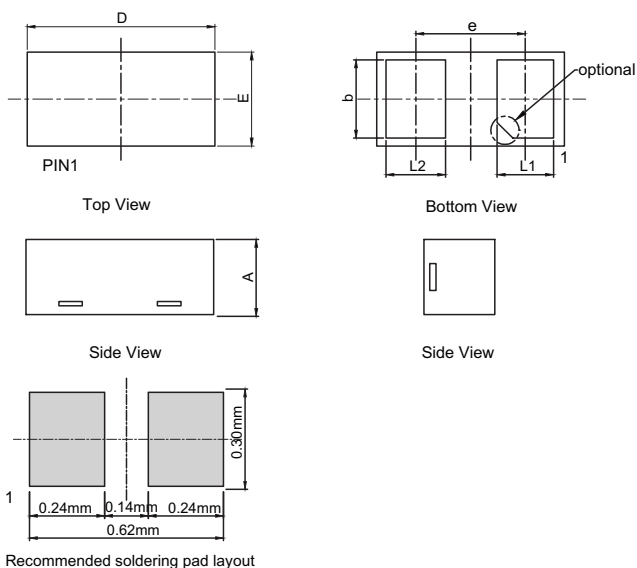
Part Marking System



Ordering Information

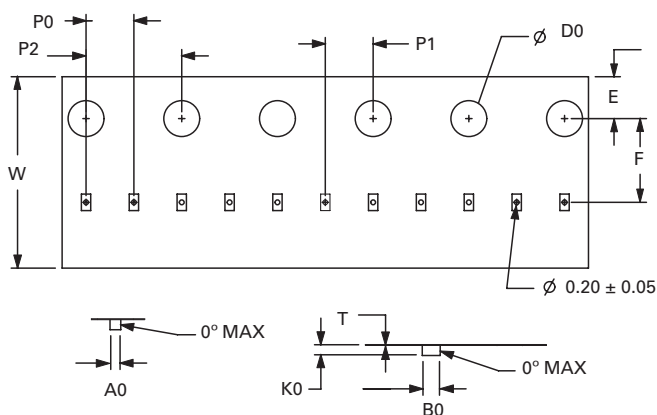
Part Number	Package	Min. Order Qty.
SP3213-01UTG	μDFN-2	15000

Package Dimensions — μ DFN-2 (0201)



Package	μ DFN-2 (0201)			
JEDEC	MO-236			
Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	0.25	0.33	0.010	0.013
b	0.18	0.28	0.007	0.011
L1	0.12	0.22	0.005	0.009
L2	0.13	0.23	0.005	0.009
D	0.60 BSC		0.024 BSC	
E	0.30 BSC		0.012 BSC	
e	0.35 REF		0.014 REF	

Embossed Carrier Tape & Reel Specification — μ DFN-2



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A0	0.33	0.40	0.013	0.016
B0	0.63	0.70	0.025	0.028
D0	1.40	1.60	0.055	0.063
E	1.65	1.85	0.065	0.073
F	3.45	3.55	0.136	0.140
K0	0.30	0.39	0.012	0.015
P0	1.90	2.10	0.075	0.083
P1	1.95	2.05	0.077	0.081
P2	3.90	4.10	0.154	0.161
T	0.13	0.25	0.005	0.010
W	7.90	8.30	0.311	0.327