

Features

- IEC 61000-4-2 (ESD): Air ± 15 kV, Contact ± 8 kV
- 4 Channels of ESD Protection
- Low Channel Input Capacitance of 0.85pF Typical
- Typically Used at High Speed Ports such as USB 2.0, IEEE1394, Serial ATA, DVI, HDMI, PCI
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- Qualified to AEC-Q101 Standards for High Reliability

Mechanical Data

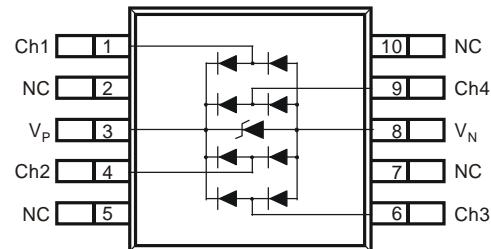
- Case: MSOP-10
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish annealed over Copper leadframe (Lead Free Plating). Solderable per MIL-STD-202, Method 208 (e3)
- Weight: 0.026 grams (approximate)

Pin#	Description
1, 4, 6, 9	Inputs
2, 5, 7, 10	No Connection
8	V_N , Ground
3	V_P , Power

Pin Description



Top View



Device Schematic

Ordering Information (Note 4)

Part Number	Case	Packaging
D1213A-04MR-13	MSOP-10	2500/Tape & Reel

Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See <http://www.diodes.com> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
4. For packaging details, go to our website at <http://www.diodes.com>.

Marking Information



TV13 = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Last Two Digits of Year (ex: 12 = 2012)
 WW = Week Code (01 ~ 53)

Maximum Ratings (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Value	Unit	Conditions
Operating Supply Voltage	$V_P - V_N$	6.0	V	-
DC Voltage at any Channel Input	-	($V_N - 0.5$) to ($V_P + 0.5$)	V	-
Peak Pulse Current	I_{PP}	5	A	8/20 μs , Per Fig. 3
ESD Protection – Contact Discharge	$V_{ESD_Contact}$	± 8	kV	Standard IEC 61000-4-2
ESD Protection – Air Discharge	V_{ESD_Air}	± 15	kV	Standard IEC 61000-4-2

Thermal Characteristics

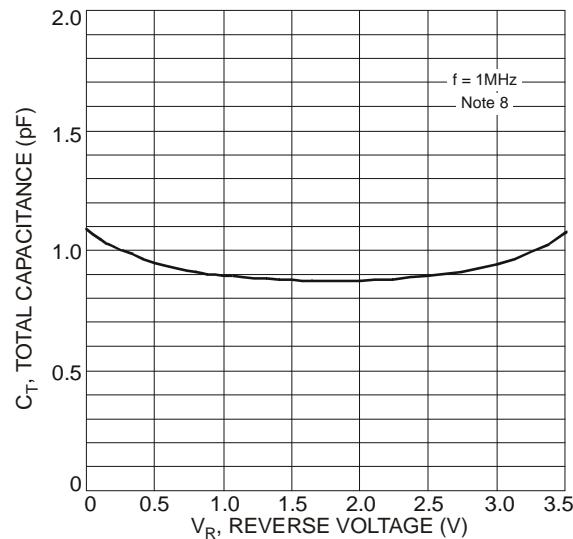
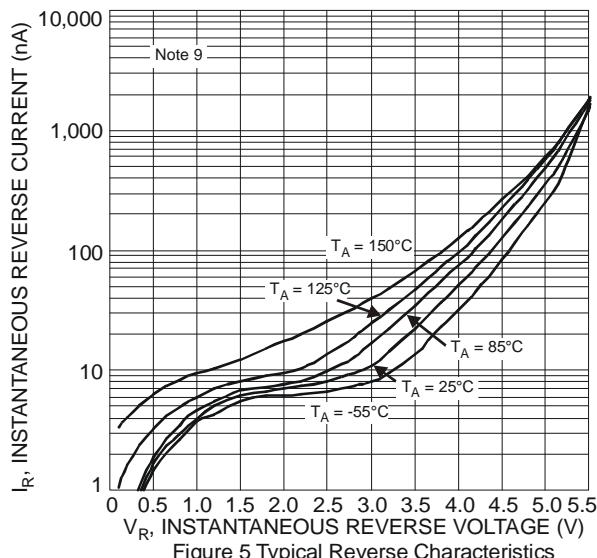
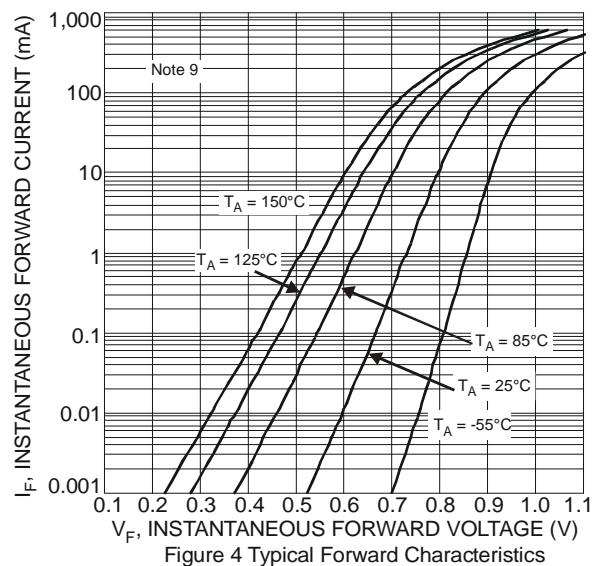
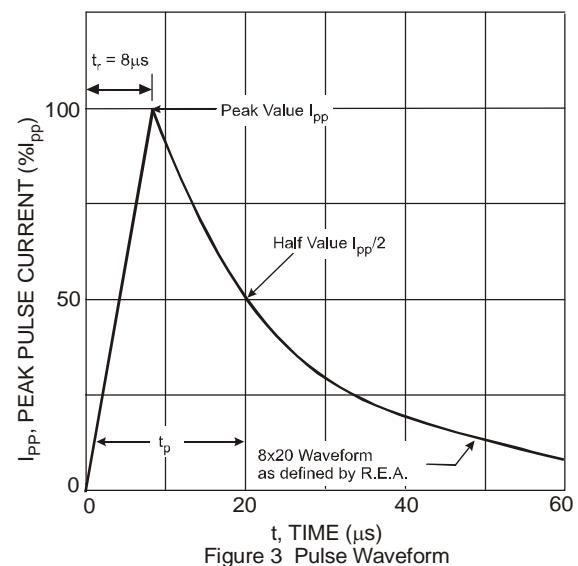
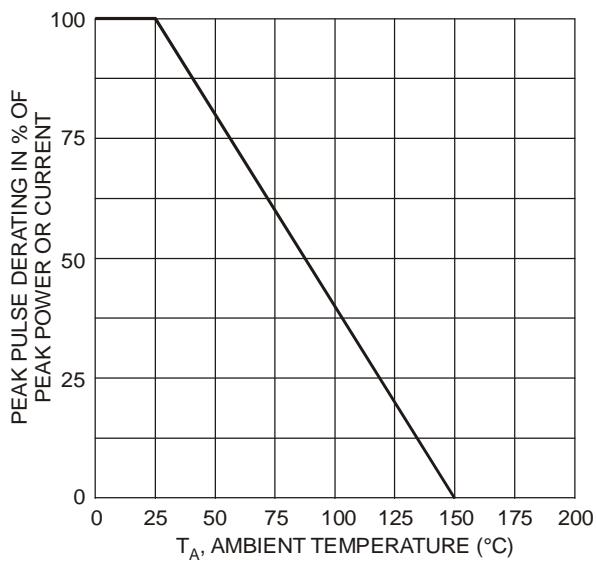
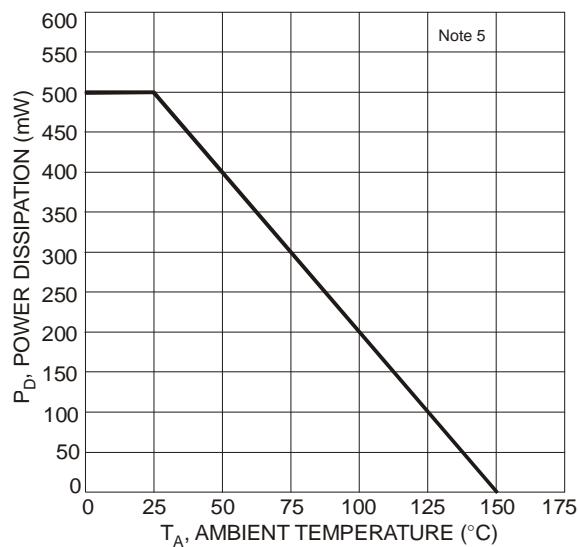
Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P_D	500	mW
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	250	$^\circ\text{C}/\text{W}$
Operating and Storage Temperature Range	T_J, T_{STG}	-65 to +150	$^\circ\text{C}$

Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Conditions
Operating Supply Voltage	V_P	-	3.3	5.5	V	-
Operating Supply Current (Note 6)	I_P	-	-	8.0	μA	$(V_P - V_N) = 3.3\text{V}$
Channel Leakage Current (Note 6)	I_R	-	0.1	1.0	μA	$V_P = 5\text{V}, V_N = 0\text{V}$
Reverse breakdown voltage	V_{BR}	6.0	-	-	V	$I_R = 1\text{mA}$
Clamping Voltage, Positive Transients	V_{CL1}	-	10.0	-	V	$I_{PP} = 1\text{A}$ (Note 7)
Clamping Voltage, Negative Transients	V_{CL2}	-	-1.7	-	V	$I_{PP} = -1\text{A}$ (Note 7)
Forward Voltage for Top Diode	V_{FD1}	0.60	0.80	0.95	V	$I_F = 8\text{mA}$, any channel to V_P
Forward Voltage for Bottom Diode	V_{FD2}	0.60	0.80	0.95	V	$I_F = 8\text{mA}$, V_N to and channel
Dynamic Resistance	R_{DYN}	-	0.9	-	Ω	$I_{PP} = 1\text{A}$ (Note 7)
Channel Input Capacitance	C_T	-	0.85	1.2	pF	$V_{IN} = 1.65\text{V}, V_P = 3.3\text{V},$ $V_N = 0\text{V}, f = 1\text{MHz}$

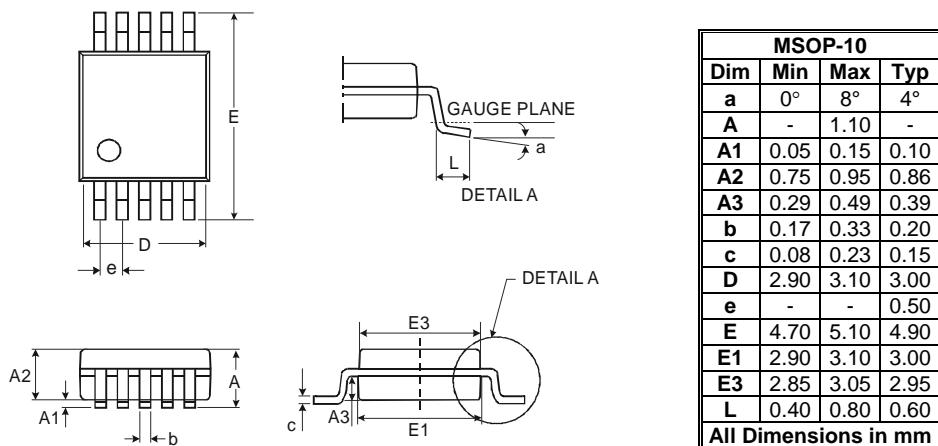
Notes:

5. Device mounted on FR-4 PCB pad layout (2oz copper) as shown on Diodes, Inc. suggested pad layout AP02001, which can be found on our website at <http://www.diodes.com>.
6. Short duration pulse test used to minimize self-heating effect.
7. Clamping voltage value is based on an 8x20 μs peak pulse current (I_{PP}) waveform.
8. Measured from any channel to V_N .
9. Measured from V_P to V_N .
10. For information on the impact of Diodes' USB 2.0 compatible ESD protectors on signal integrity including eye diagram plots, please refer to AN77 at the following URL: http://www.diodes.com/destools/appnote_dnote.html.



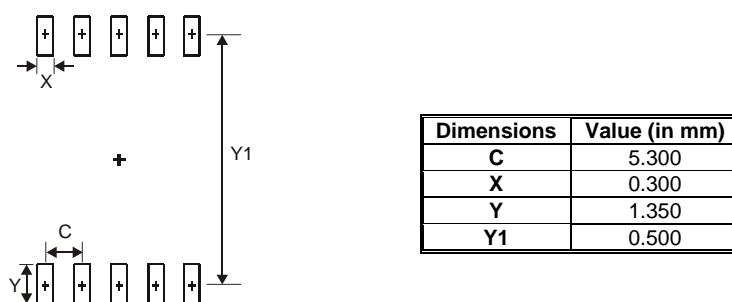
Package Outline Dimensions

Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



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