

## Product Summary

BV <sub>DSS</sub>	R <sub>DS(ON)</sub> MAX	I <sub>D</sub> T <sub>A</sub> = +25°C
12V	28mΩ @ V <sub>GS</sub> = 4.5V	5.0A

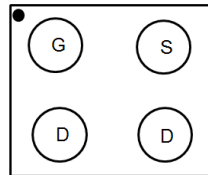
## Description

This 2<sup>nd</sup> generation Lateral MOSFET (LD-MOS) is engineered to minimize on-state losses and switch ultra-fast, making it ideal for high efficiency power transfer. It uses Chip-Scale Package (CSP) to increase power density by combining low thermal impedance with minimal R<sub>DS(ON)</sub> per footprint area.

## Applications

- DC-DC converters
- Battery management
- Load switches

X1-DSN1010-4 (Type B)



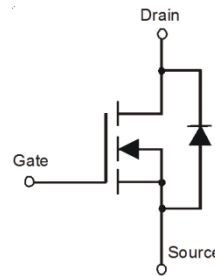
Top View

## Features

- LD-MOS Technology with the Lowest Figure of Merit:  
R<sub>DS(ON)</sub> = 18mΩ to Minimize On-State Losses  
Q<sub>g</sub> = 3.2nC for Ultra-Fast Switching
- V<sub>GS(th)</sub> = 0.8V Typ. for a Low Turn-On Potential
- CSP with Footprint 1.0mm x 1.0mm
- Height = 0.45mm for Low Profile
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](mailto:contact_us) or your local Diodes representative.**  
<https://www.diodes.com/quality/product-definitions/>

## Mechanical Data

- Package: X1-DSN1010-4
- Terminal Connections: See Diagram Below
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal: Finish - SnAg over Cu Pillar (e1)
- Solder Cap Material: SnAg (Ag: 2.0+/-0.5%)
- UBM Size: 320μm
- Weight: 0.0012 grams (Approximate)



Equivalent Circuit

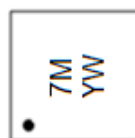
## Ordering Information (Note 4)

Part Number	Package	Packing	
		Qty.	Carrier
DMN1032UCP4-7	X1-DSN1010-4 (Type B)	3,000	Tape & Reel

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> 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 <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information

X1-DSN1010-4 (Type B)



7M = Product Type Marking Code  
 YW = Date Code Marking  
 Y or Y\_ = Year (ex: 2 = 2022)  
 W or W\_ = Week (ex: a = week 27; z represents week 52 and 53)

### Date Code Key

Year	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Code	2	3	4	5	6	7	8	9	0	1	2	3

Week	1-26	27-52	53
Code	A-Z	a-z	z

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V <sub>DSS</sub>	12	V
Gate-Source Voltage			V <sub>GSS</sub>	±8	V
Continuous Drain Current (Note 5) V <sub>GS</sub> = 4.5V	Steady State	T <sub>A</sub> = +25°C	I <sub>D</sub>	5.0	A
		T <sub>A</sub> = +70°C		4.0	
Continuous Drain Current (Note 5) V <sub>GS</sub> = 2.5V	Steady State	T <sub>A</sub> = +25°C	I <sub>D</sub>	4.8	A
		T <sub>A</sub> = +70°C		3.8	
Pulsed Drain Current (Note 6)			I <sub>DM</sub>	15	A

**Thermal Characteristics**

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 7)	P <sub>D</sub>	0.79	W
Thermal Resistance, Junction to Ambient @T <sub>A</sub> = +25°C (Note 7)	R <sub>θJA</sub>	158	°C/W
Thermal Resistance, Junction to Case @T <sub>C</sub> = +25°C (Note 7)	R <sub>θJC</sub>	31.3	°C/W
Power Dissipation (Note 5)	P <sub>D</sub>	1.01	W
Thermal Resistance, Junction to Ambient @T <sub>A</sub> = +25°C (Note 5)	R <sub>θJA</sub>	124	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 8)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	12	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
Zero Gate Voltage Drain Current T <sub>J</sub> = +25°C	I <sub>DSS</sub>	—	—	1.0	μA	V <sub>DS</sub> = 9.6V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±100	nA	V <sub>GS</sub> = ±8V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	0.4	0.8	1.2	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance	R <sub>DS(on)</sub>	—	18	28	mΩ	V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 1A
		—	21	32		V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 1A
		—	27	42		V <sub>GS</sub> = 1.8V, I <sub>D</sub> = 1A
Diode Forward Voltage	V <sub>SD</sub>	—	0.7	1.0	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 1A
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	—	325	—	pF	V <sub>DS</sub> = 6V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	183	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	31	—		
Series Gate Resistance	R <sub>G</sub>	—	3.1	—	Ω	f = 1MHz, V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V
Total Gate Charge	Q <sub>g</sub>	—	3.2	—	nC	V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 6V, I <sub>D</sub> = 1A
Gate-Source Charge	Q <sub>gs</sub>	—	0.4	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	0.3	—		
Gate Charge at V <sub>th</sub>	Q <sub>g(th)</sub>	—	0.2	—		
Turn-On Delay Time	t <sub>D(on)</sub>	—	3.3	—	ns	V <sub>DS</sub> = 6V, V <sub>GS</sub> = 4.5V, R <sub>G</sub> = 20Ω, I <sub>D</sub> = 1A
Turn-On Rise Time	t <sub>r</sub>	—	5.6	—		
Turn-Off Delay Time	t <sub>D(off)</sub>	—	24	—		
Turn-Off Fall Time	t <sub>f</sub>	—	9	—		

- Notes:
- Device mounted on FR4 material with 1inch<sup>2</sup> (6.45cm<sup>2</sup>), 2oz. (0.071mm thick) Cu.
  - Repetitive rating, pulse width limited by junction temperature.
  - Device mounted on FR-4 PCB with minimum recommended pad layout, single sided.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to production testing.

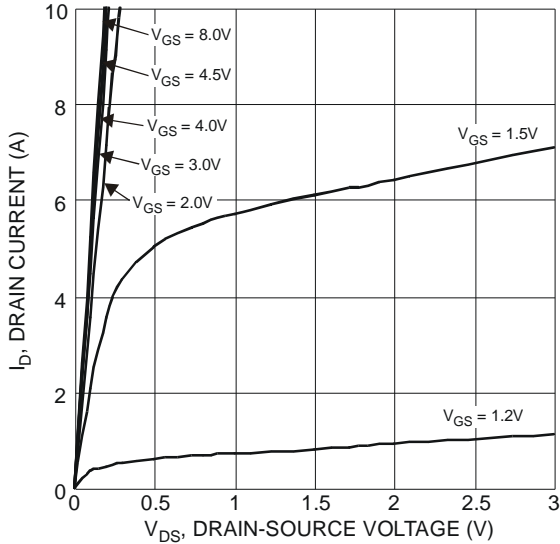


Figure 1 Typical Output Characteristics

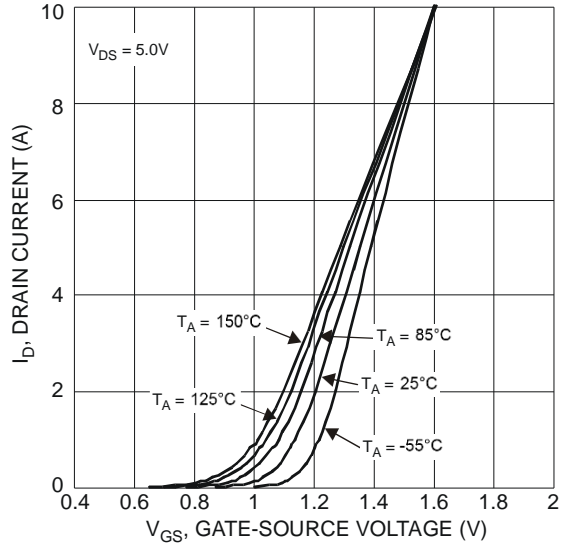


Figure 2 Typical Transfer Characteristics

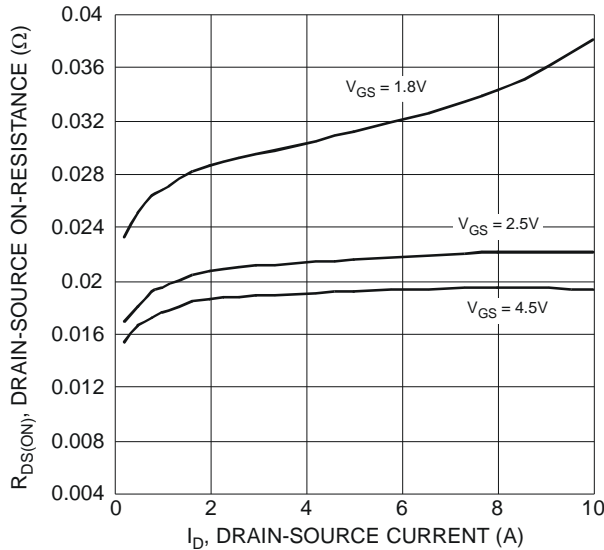


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

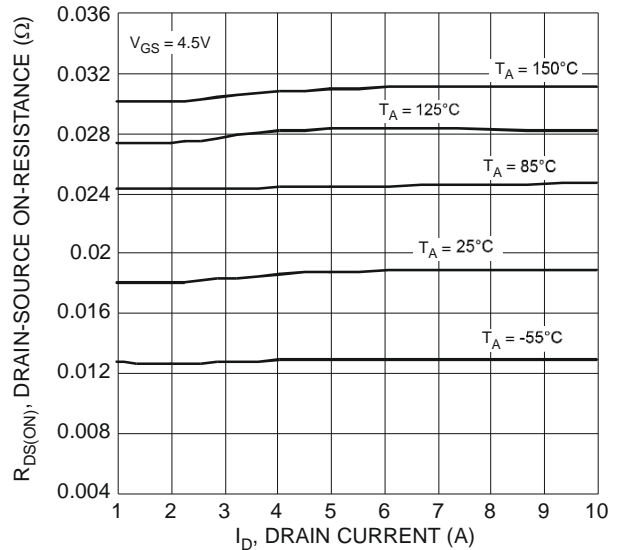


Figure 4 Typical On-Resistance vs. Drain Current and Temperature

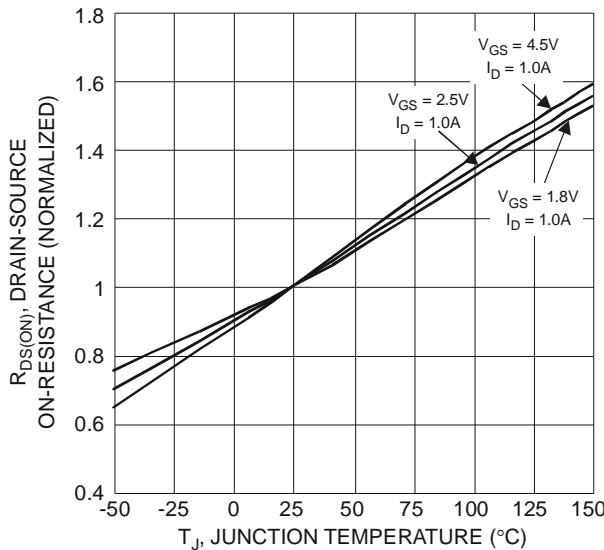


Figure 5 On-Resistance Variation with Temperature

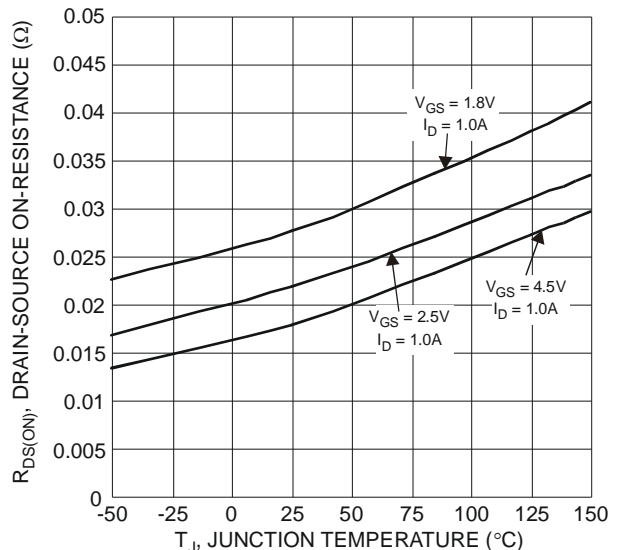


Figure 6 On-Resistance Variation with Temperature

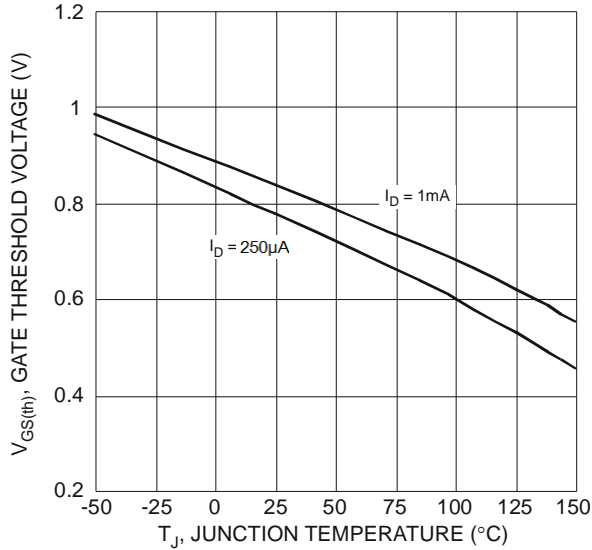


Figure 7 Gate Threshold Variation vs. Junction Temperature

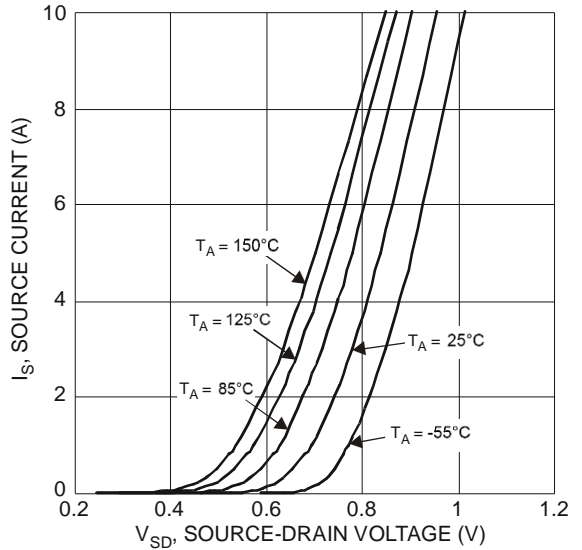


Figure 8 Diode Forward Voltage vs. Current

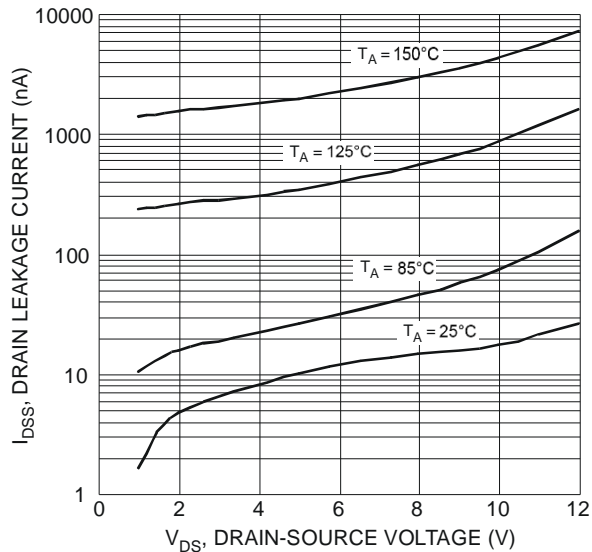


Figure 9 Typical Drain-Source Leakage Current vs. Voltage

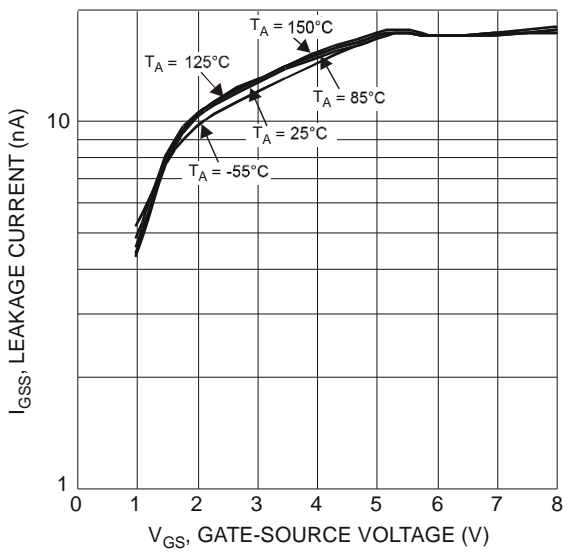


Figure 10 Gate-Source Leakage Current vs. Voltage

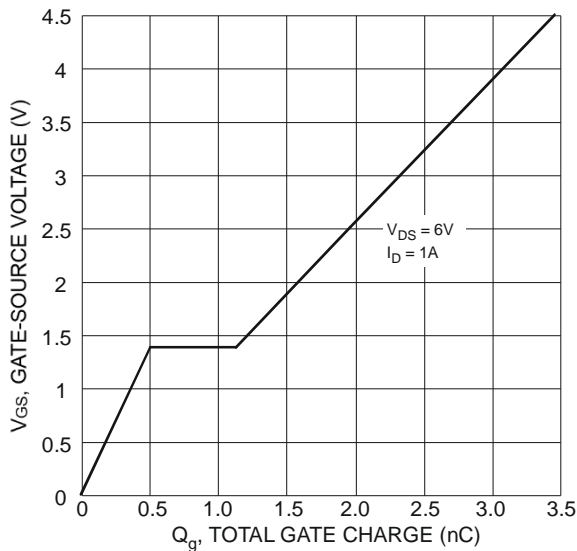


Figure 11 Gate Charge

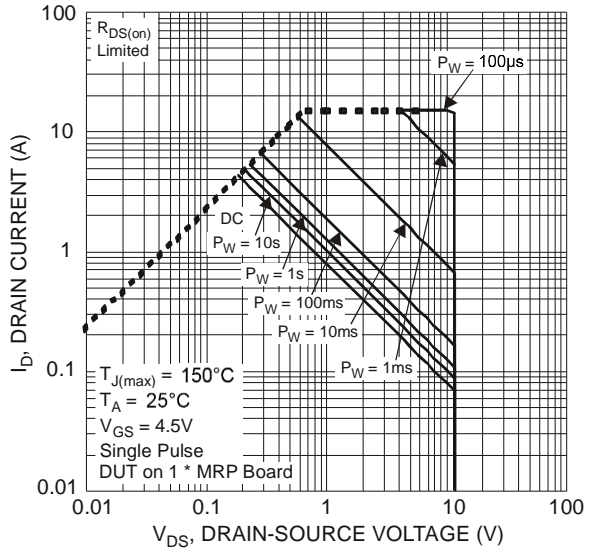
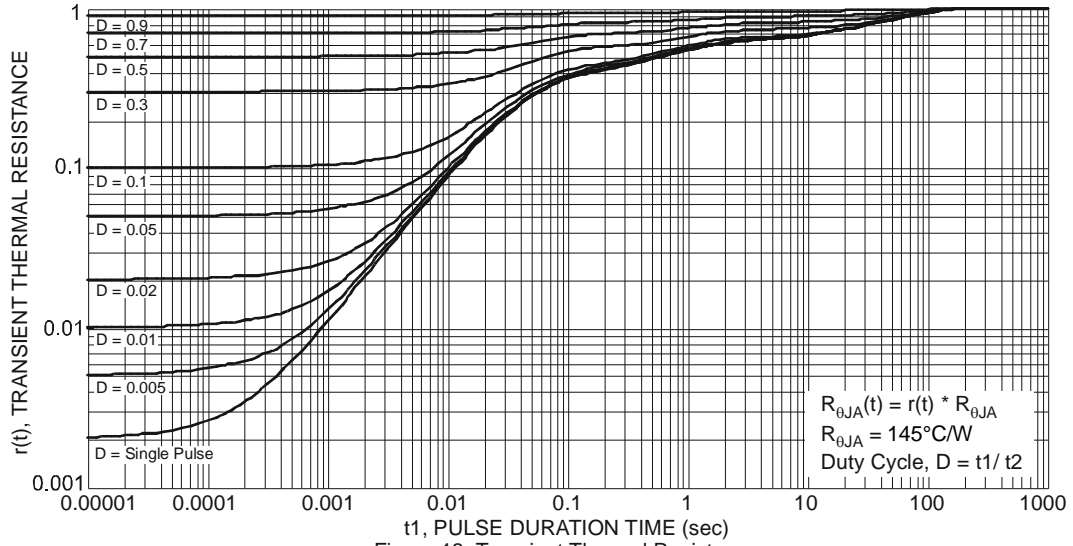


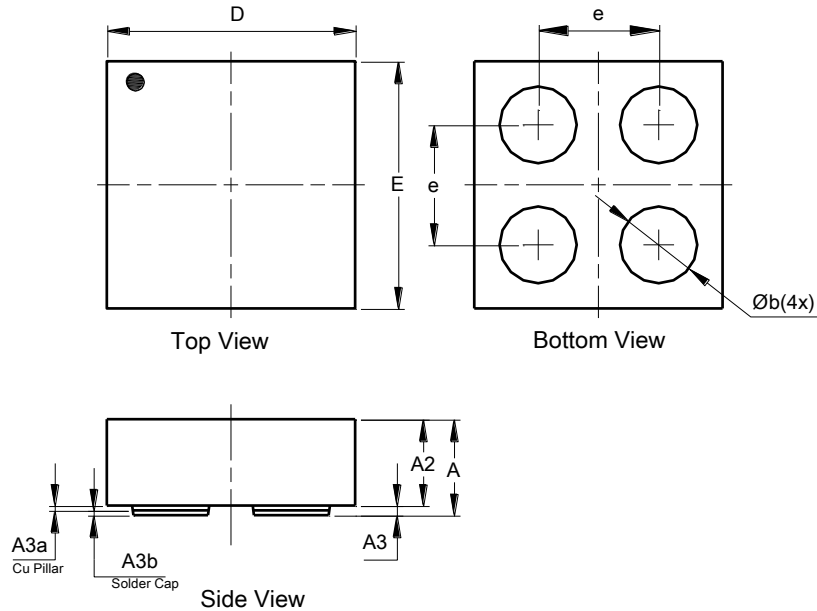
Figure 12 SOA, Safe Operation Area



## Package Outline Dimensions

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### X1-DSN1010-4 (Type B)

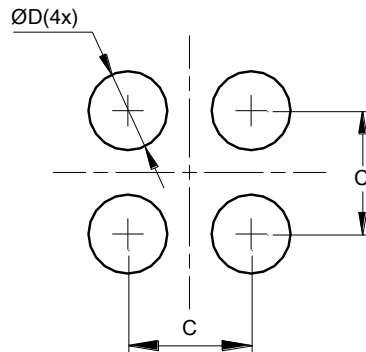


X1-DSN1010-4 (Type B)			
Dim	Min	Max	Typ
A	--	0.45	0.40
A2	--	--	0.36
A3	0.034	0.046	0.040
A3a	0.015	0.025	0.020
A3b	0.017	0.023	0.02
b	0.27	0.37	0.32
D	1.02	1.08	1.05
E	1.02	1.08	1.05
e	--	--	0.50
Co-planarity	≤0.005		
All Dimensions in mm			

## Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

### X1-DSN1010-4 (Type B)



Dimensions	Value (in mm)
C	0.50
D	0.25

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