

**20V P-CHANNEL ENHANCEMENT MODE MOSFET**

**Product Summary**

BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> Max @ T <sub>A</sub> = +25°C (Note 5)
-20V	495mΩ @ V <sub>GS</sub> = -4.5V	-0.77A
	690mΩ @ V <sub>GS</sub> = -2.5V	-0.67A
	960mΩ @ V <sub>GS</sub> = -1.8V	-0.57A

**Description and Applications**


This MOSFET has been designed to minimize the on-state resistance (R<sub>DS(ON)</sub>) yet maintain superior switching performance, which makes it ideal for high-efficiency power management applications.

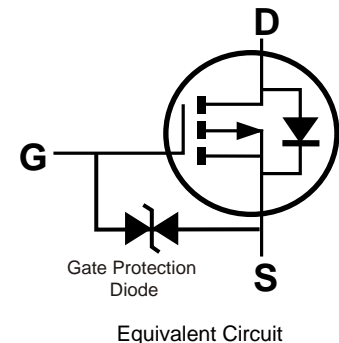
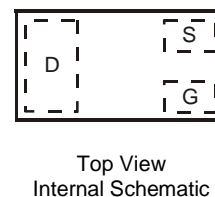
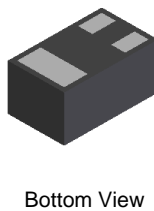
- Portable Electronics

**Features and Benefits**

- Footprint of Just 0.6mm<sup>2</sup>—13 Times Smaller Than SOT23
- Low Gate Threshold Voltage
- Fast Switching Speed
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **ESD Protected Gate 3kV**
- **Qualified to AEC-Q101 Standards for High Reliability**

**Mechanical Data**

- Case: X1-DFN1006-3
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish—NiPdAu Over Copper Leadframe. Solderable per MIL-STD-202, Method 208 
- Weight: 0.001 grams (Approximate)



**Ordering Information** (Note 4)

Part Number	Case	Packaging
DMP21D0UFB-7B	X1-DFN1006-3	10,000/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, see <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

**Marking Information**

X1-DFN1006-3



Top View  
Bar Denotes Gate  
and Source Side

NG = Product Type Marking Code

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

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			V <sub>DSS</sub>	-20	V
Gate-Source Voltage			V <sub>GSS</sub>	±8	V
Continuous Drain Current	Steady State V <sub>GS</sub> =-4.5V	T <sub>A</sub> = +25°C (Note 5)	I <sub>D</sub>	-0.77	A
		T <sub>A</sub> = +85°C (Note 5)		-0.55	
		T <sub>A</sub> = +25°C (Note 6)		-1.17	
Pulsed Drain Current (Note 7)			I <sub>DM</sub>	-5.0	A

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

Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P <sub>D</sub>	0.43	W
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	293	°C/W
Power Dissipation (Note 6)	P <sub>D</sub>	0.99	W
Thermal Resistance, Junction to Ambient (Note 6)	R <sub>θJA</sub>	126	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

## Thermal Characteristics

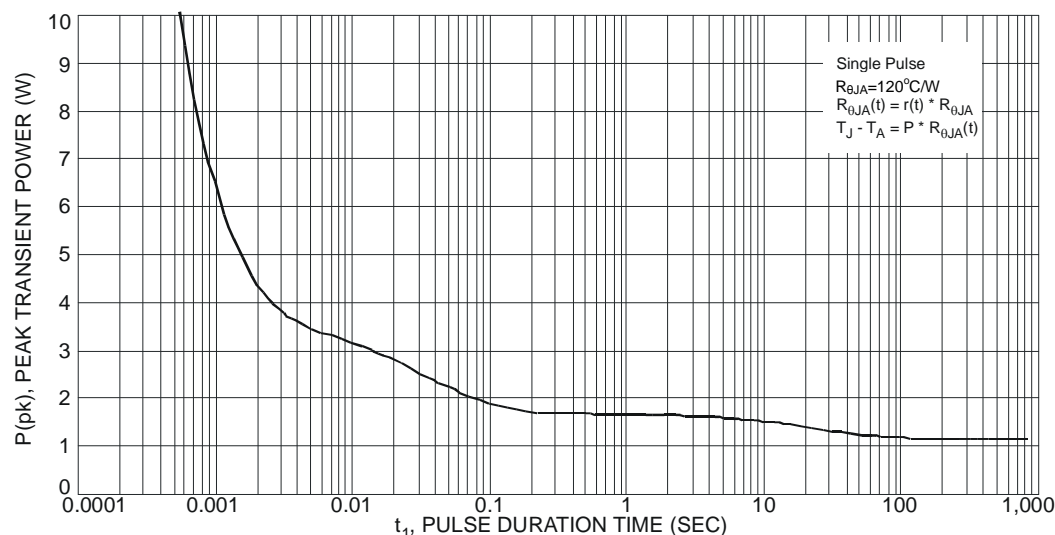


Fig. 1 Single Pulse Maximum Power Dissipation

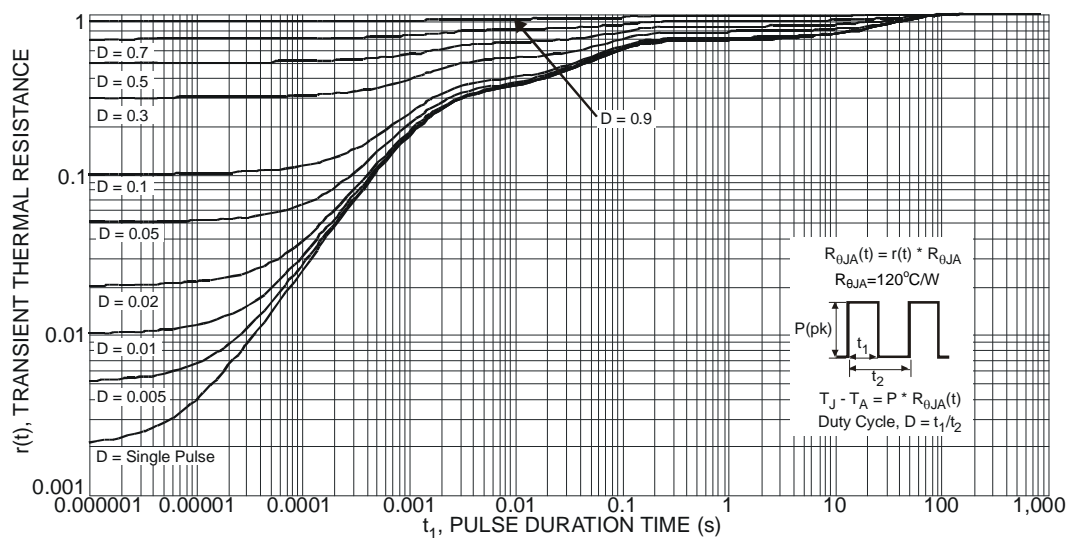


Fig. 2 Transient Thermal Response

## 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>	-20	—	—	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	μA	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	—	—	±10	μA	V <sub>GS</sub> = ±8V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	-0.5	-0.7	-1.0	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	—	495	mΩ	V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -400mA
				690		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -300mA
				960		V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -100mA
Forward Transfer Admittance	Y <sub>fs</sub>	50	-	—	mS	V <sub>DS</sub> = -3V, I <sub>D</sub> = -300mA
Diode Forward Voltage	V <sub>SD</sub>	-	-	-1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -300mA
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	C <sub>iss</sub>	—	76.5	—	pF	V <sub>DS</sub> = -10V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	13.7	—	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	10.7	—	pF	
Gate Resistance	R <sub>g</sub>	—	195	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz
Total Gate Charge	Q <sub>g</sub>	—	1.5	—	nC	V <sub>GS</sub> = -8V, V <sub>DS</sub> = -15V, I <sub>D</sub> = -1A
Total Gate Charge	Q <sub>g</sub>	—	1.0	—	nC	V <sub>GS</sub> = -4.5V, V <sub>DS</sub> = -15V, I <sub>D</sub> = -1A
Gate-Source Charge	Q <sub>gs</sub>	—	0.2	—	nC	
Gate-Drain Charge	Q <sub>gd</sub>	—	0.3	—	nC	
Turn-On Delay Time	t <sub>D(ON)</sub>	—	7.1	—	ns	V <sub>DS</sub> = -10V, I <sub>D</sub> = -1A V <sub>GS</sub> = -4.5V, R <sub>G</sub> = 6Ω
Turn-On Rise Time	t <sub>r</sub>	—	8.0	—	ns	
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	31.7	—	ns	
Turn-Off Fall Time	t <sub>f</sub>	—	18.5	—	ns	

- Notes:
5. Device mounted on FR-4 substrate PCB, 2oz copper, with minimum recommended pad layout.
  6. Device mounted on FR-4 substrate PCB, 2oz copper, with thermal vias to bottom layer 1inch square copper plate.
  7. Device mounted on minimum recommended pad layout test board, 10μs pulse duty cycle = 1%.
  8. Short duration pulse test used to minimize self-heating effect.
  9. Guaranteed by design. Not subject to product testing.

## Typical Characteristics

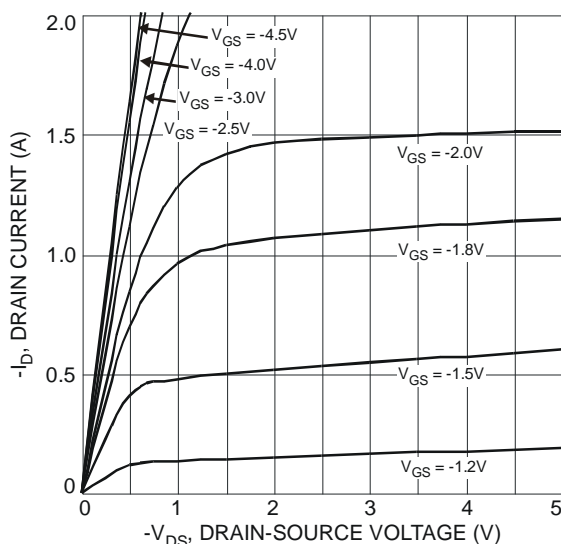


Fig. 3 Typical Output Characteristic

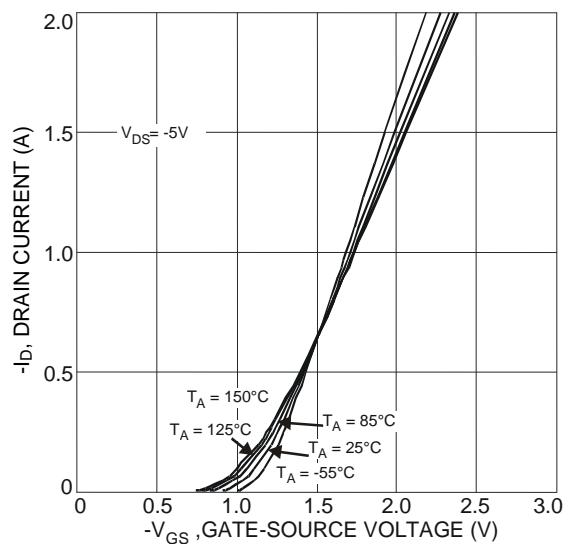


Fig. 4 Typical Transfer Characteristic

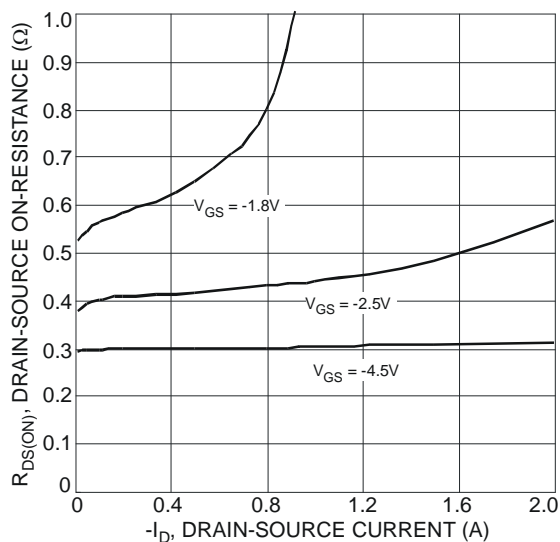


Fig. 5 Typical On-Resistance vs. Drain Current and Gate Voltage

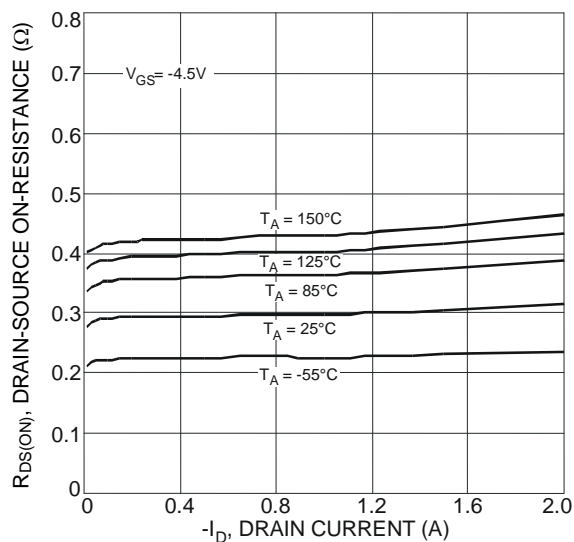


Fig. 6 Typical On-Resistance vs. Drain Current and Temperature

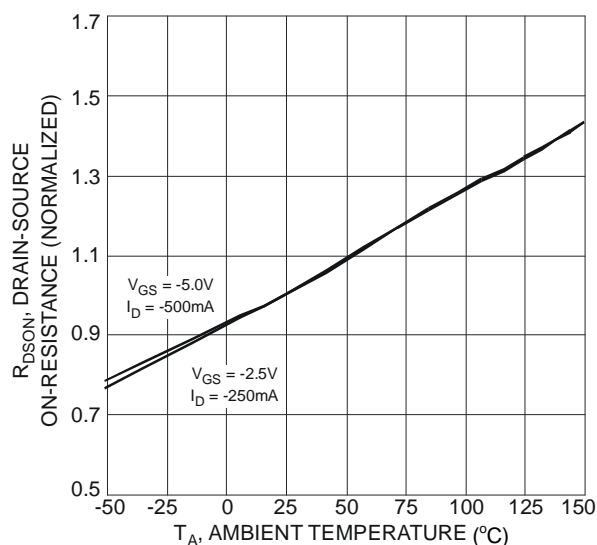


Fig. 7 On-Resistance Variation with Temperature

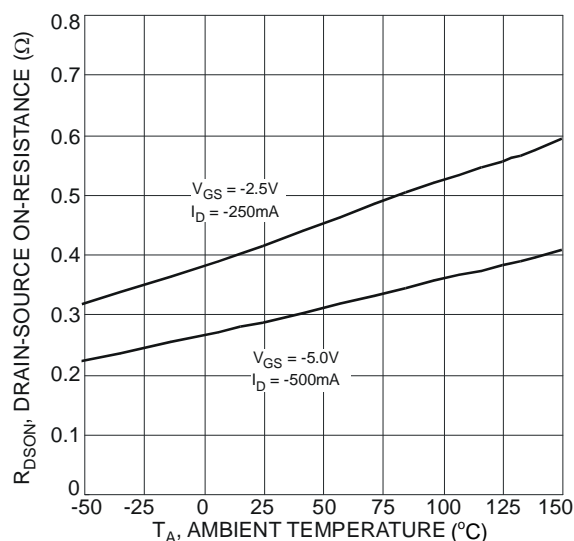


Fig. 8 On-Resistance Variation with Temperature

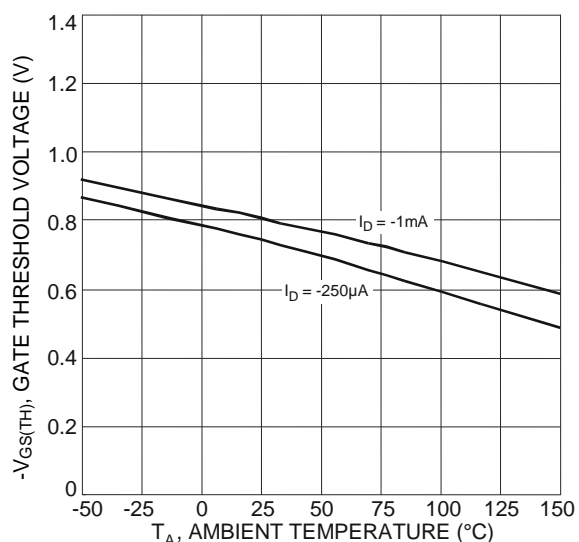


Fig. 9 Gate Threshold Variation vs. Ambient Temperature

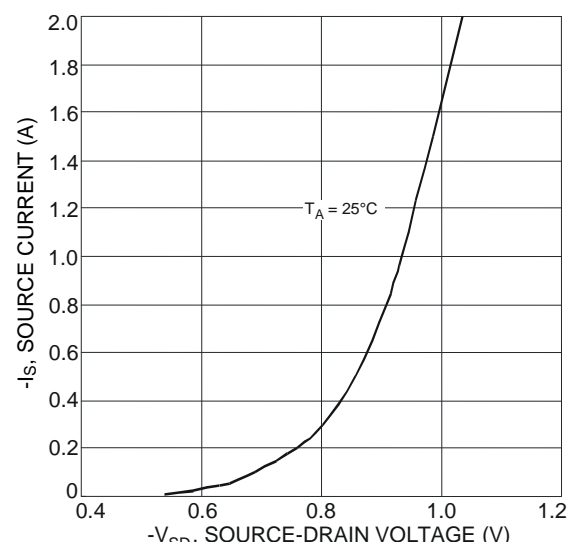


Fig. 10 Diode Forward Voltage vs. Current

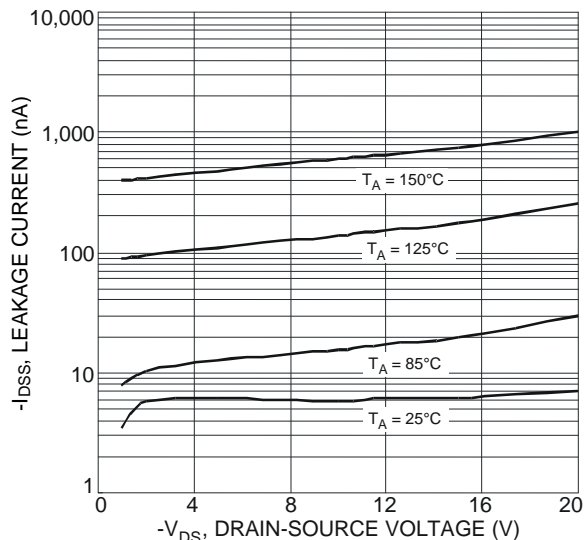


Fig. 11 Typical Leakage Current vs. Drain-Source Voltage

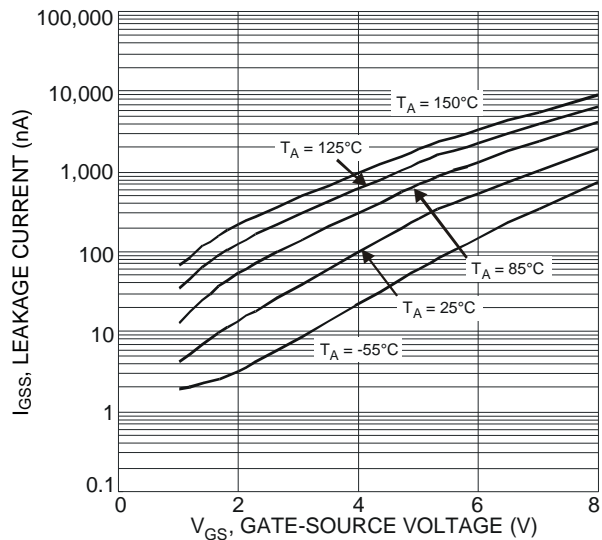


Fig. 12 Leakage Current vs. Gate-Source Voltage

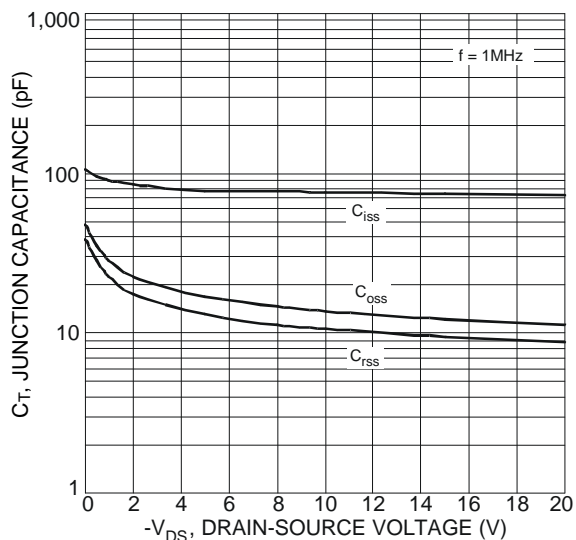


Fig. 13 Typical Junction Capacitance

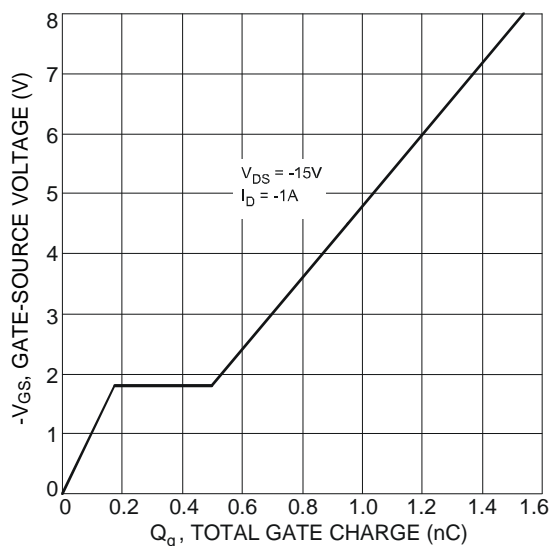


Fig. 14 Gate-Charge Characteristics

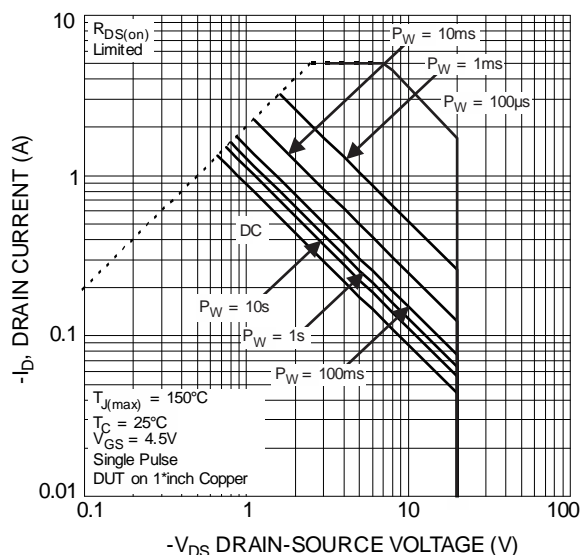
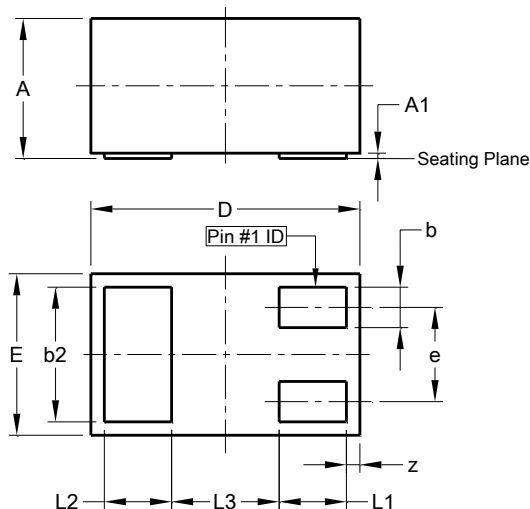


Figure 15 SOA, Safe Operation Area

## Package Outline Dimensions

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

**X1-DFN1006-3**

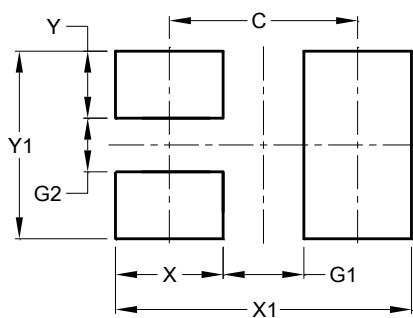


X1-DFN1006-3			
Dim	Min	Max	Typ
A	0.47	0.53	0.50
A1	0.00	0.05	0.03
b	0.10	0.20	0.15
b2	0.45	0.55	0.50
D	0.95	1.075	1.00
E	0.55	0.675	0.60
e	-	-	0.35
L1	0.20	0.30	0.25
L2	0.20	0.30	0.25
L3	-	-	0.40
z	0.02	0.08	0.05
All Dimensions in mm			

## Suggested Pad Layout

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

**X1-DFN1006-3**



Dimensions	Value (in mm)
C	0.70
G1	0.30
G2	0.20
X	0.40
X1	1.10
Y	0.25
Y1	0.70

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