

## Product Summary

$V_{(BR)DSS}$	$R_{DS(on) \max}$	$I_D$ $T_A = 25^\circ\text{C}$
-20V	1.0Ω @ $V_{GS} = -4.5\text{V}$	-700mA
	1.5Ω @ $V_{GS} = -2.5\text{V}$	-600mA
	2.0Ω @ $V_{GS} = -1.8\text{V}$	-500mA
	3.0Ω @ $V_{GS} = -1.5\text{V}$	-380mA

## Features and Benefits

- Low On-Resistance
- Very Low Gate Threshold Voltage  $V_{GS(TH)}$ , 1.0V max
- Low Input Capacitance
- Fast Switching Speed
- Ultra-Small Surfaced Mount Package
- Ultra-low package profile, 0.4mm maximum package height
- ESD Protected Gate
- **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**

## Description and Applications

This new generation MOSFET has been designed to minimize the on-state resistance ( $R_{DS(on)}$ ) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- DC-DC Converters
- Power management functions

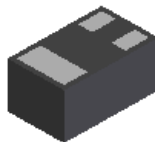
## Mechanical Data

- Case: X2-DFN1006-3
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – NiPdAu over Copper leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.001 grams (approximate)

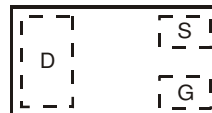


ESD PROTECTED

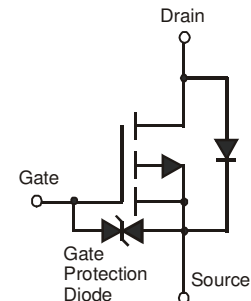
X2-DFN1006-3



Bottom View



Top View  
Internal Schematic



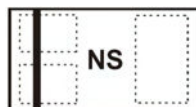
Equivalent Circuit

## Ordering Information (Note 4)

Part Number	Case	Packaging
DMP21D5UFB4-7B	X2-DFN1006-3	10,000/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



NS = Product Type Marking Code

Top View  
Bar Denotes Gate  
and Source Side

**Maximum Ratings** @T<sub>A</sub> = 25°C unless otherwise specified

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V <sub>DSS</sub>	-20	V
Gate-Source Voltage			V <sub>GSS</sub>	±8	V
Continuous Drain Current (Note 6) V <sub>GS</sub> = -4.5V	Steady State	T <sub>A</sub> = 25°C T <sub>A</sub> = 70°C	I <sub>D</sub>	-700 -600	mA
	t < 10s	T <sub>A</sub> = 25°C T <sub>A</sub> = 70°C	I <sub>D</sub>	-850 -670	mA
Continuous Drain Current (Note 6) V <sub>GS</sub> = -1.8V	Steady State	T <sub>A</sub> = 25°C T <sub>A</sub> = 70°C	I <sub>D</sub>	-500 -400	mA
	t < 10s	T <sub>A</sub> = 25°C T <sub>A</sub> = 70°C	I <sub>D</sub>	-600 -550	mA
Pulsed Drain Current (10µs pulse, duty cycle = 1%)			I <sub>DM</sub>	-2	A
Maximum Body Diode continuous Current			I <sub>S</sub>	-800	mA

**Thermal Characteristics** @T<sub>A</sub> = 25°C unless otherwise specified

Characteristic		Symbol	Value	Units
Total Power Dissipation (Note 5)		P <sub>D</sub>	0.46	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady state	R <sub>θJA</sub>	279	°C/W
	t < 10s		210	°C/W
Total Power Dissipation (Note 6)		P <sub>D</sub>	0.95	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady state	R <sub>θJA</sub>	134	°C/W
	t < 10s		100	°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 7)</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	-20	-	-	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = -1mA
Zero Gate Voltage Drain Current T <sub>J</sub> = 25°C	I <sub>DSS</sub>	-	-	-100	nA	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V
Gate-Source Leakage	I <sub>GSS</sub>	-	-	±1.0	µA	V <sub>GS</sub> = ±5V, V <sub>DS</sub> = 0V
		-	-	±5.0		V <sub>GS</sub> = ±8V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	-0.5	-	-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>	-	0.67	0.97	Ω	V <sub>GS</sub> = -5V, I <sub>D</sub> = -100mA
		-	0.7	1.0		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -100mA
		-	0.9	1.5		V <sub>GS</sub> = -2.5V, I <sub>D</sub> = -80mA
		-	1.2	2.0		V <sub>GS</sub> = -1.8V, I <sub>D</sub> = -40mA
		-	1.5	3.0		V <sub>GS</sub> = -1.5V, I <sub>D</sub> = -30mA
		-	5	-		V <sub>GS</sub> = -1.2V, I <sub>D</sub> = -1mA
Forward Transfer Admittance	Y <sub>fs</sub>	-	0.7	-	S	V <sub>DS</sub> = -3V, I <sub>D</sub> = -100mA
Diode Forward Voltage	V <sub>SD</sub>	-	-0.75	-1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = -330mA,
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iss</sub>	-	46.1	-	pF	V <sub>DS</sub> = 10V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	-	7.2	-		
Reverse Transfer Capacitance	C <sub>rss</sub>	-	4.9	-		
Gate Resistance	R <sub>g</sub>	-	14.3	-	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz
Total Gate Charge V <sub>GS</sub> = -4.5V	Q <sub>g</sub>	-	0.5	-	nC	V <sub>DS</sub> = -10V, I <sub>D</sub> = -250mA
Gate-Source Charge	Q <sub>gs</sub>	-	0.09	-		
Gate-Drain Charge	Q <sub>gd</sub>	-	0.09	-		
Turn-On Delay Time	t <sub>D(on)</sub>	-	8.5	-	ns	V <sub>DD</sub> = -3V, V <sub>GS</sub> = -2.5V, R <sub>L</sub> = 300Ω, R <sub>G</sub> = 25Ω, I <sub>D</sub> = -100mA
Turn-On Rise Time	t <sub>r</sub>	-	4.3	-		
Turn-Off Delay Time	t <sub>D(off)</sub>	-	20.2	-		
Turn-Off Fall Time	t <sub>f</sub>	-	19.2	-		

- Notes: 5. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.  
6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.  
7. Short duration pulse test used to minimize self-heating effect.  
8. Guaranteed by design. Not subject to product testing.

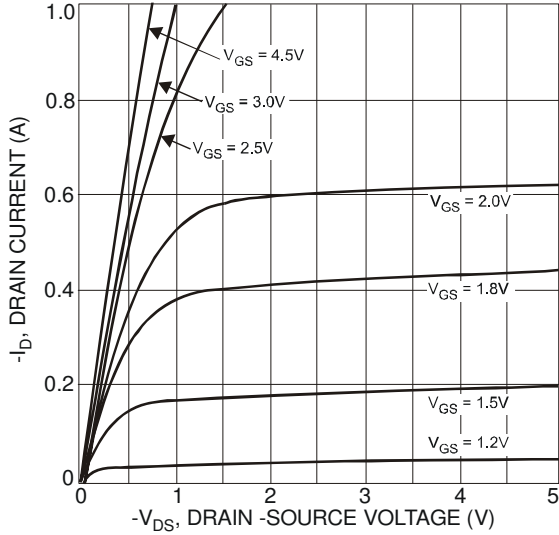


Fig. 1 Typical Output Characteristics

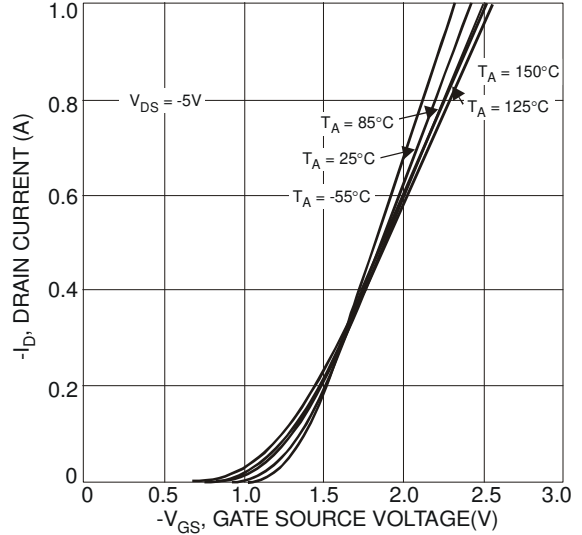


Fig. 2 Typical Transfer Characteristics

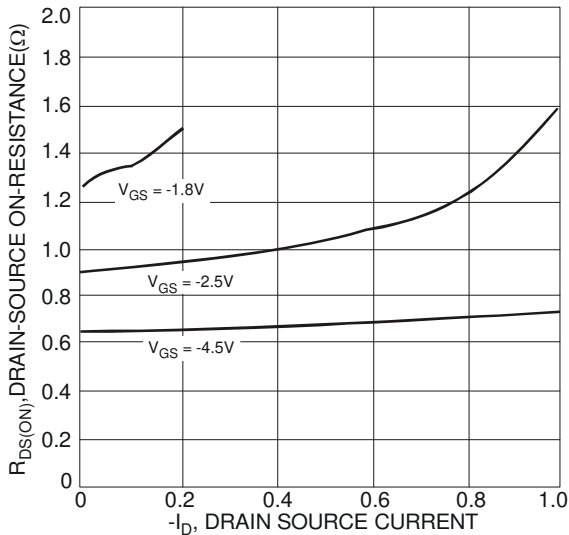


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

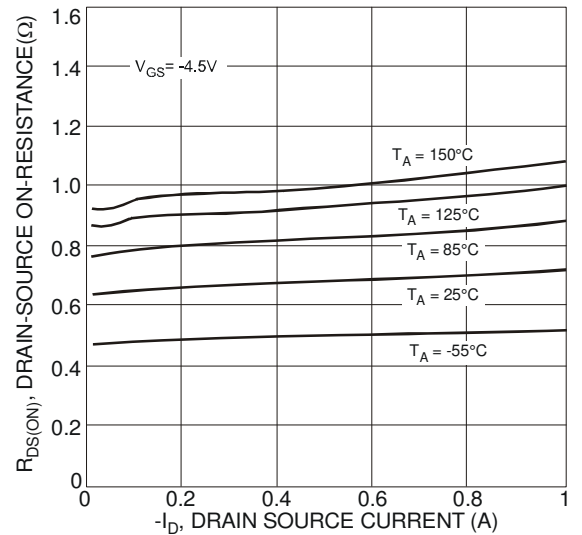


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

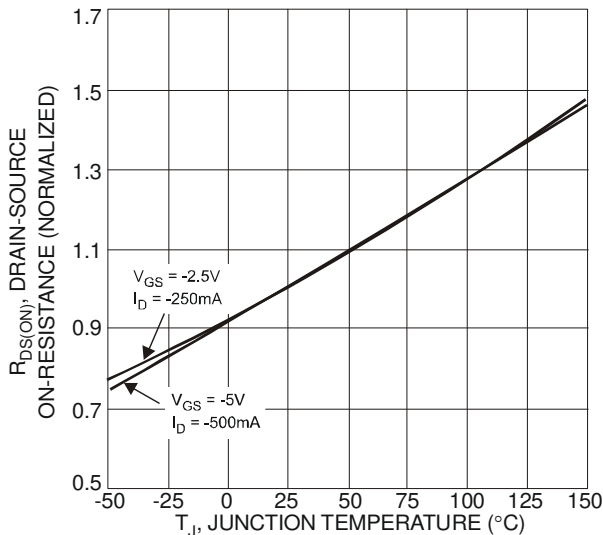


Fig. 5 On-Resistance Variation with Temperature

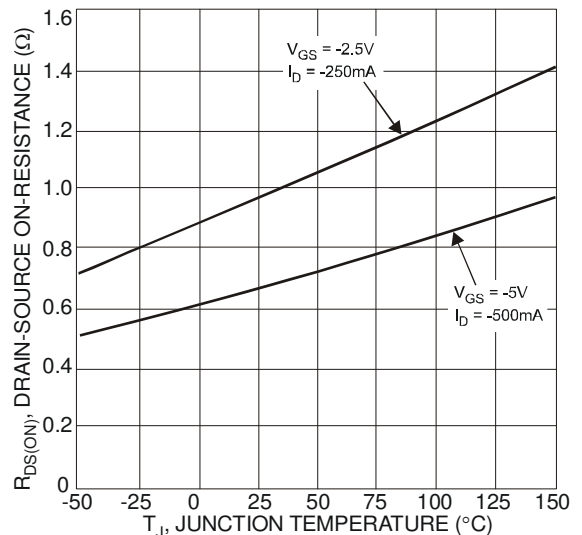


Fig. 6 On-Resistance vs. Temperature

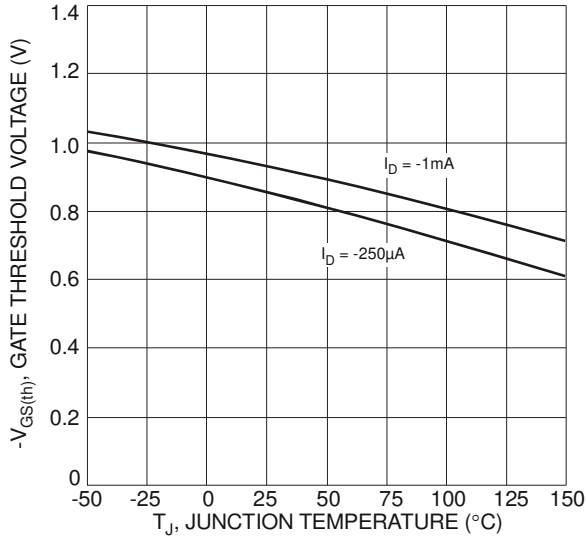


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

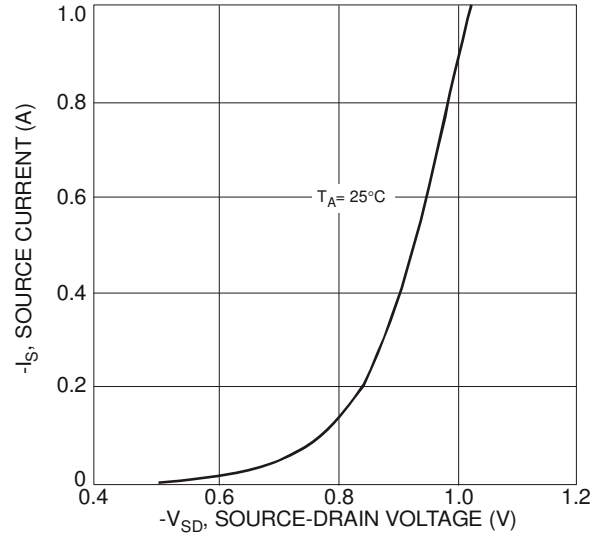


Fig. 8 Diode Forward Voltage vs. Current

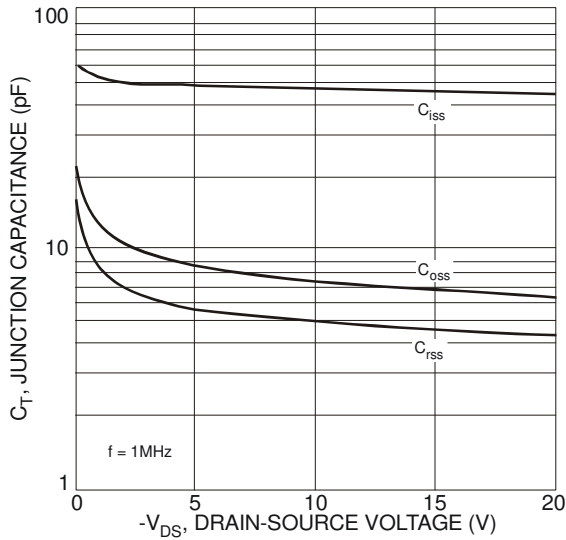


Fig. 9 Typical Junction Capacitance

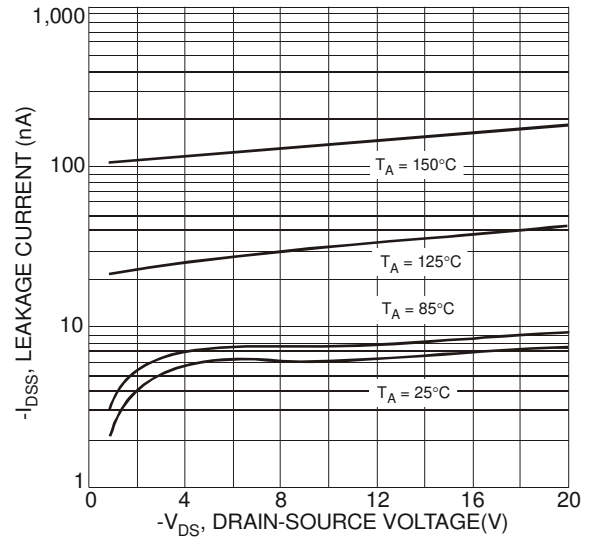


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

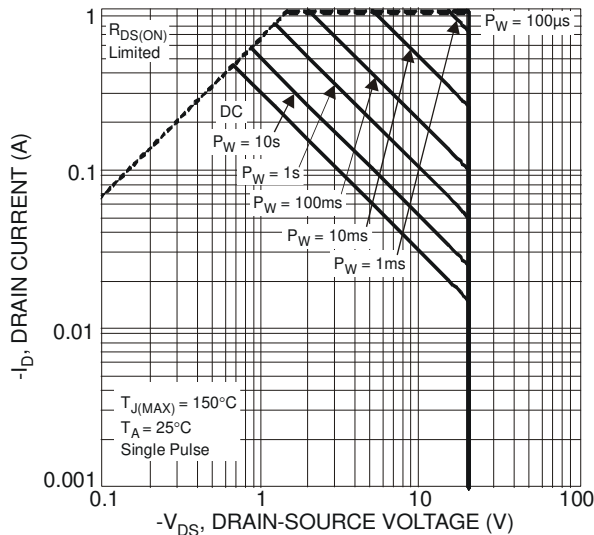


Fig. 11 SOA, Safe Operation Area

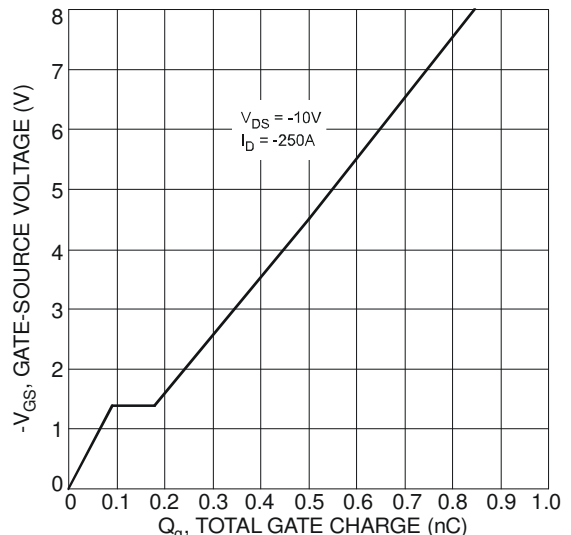


Fig. 12 Gate-Charge Characteristics

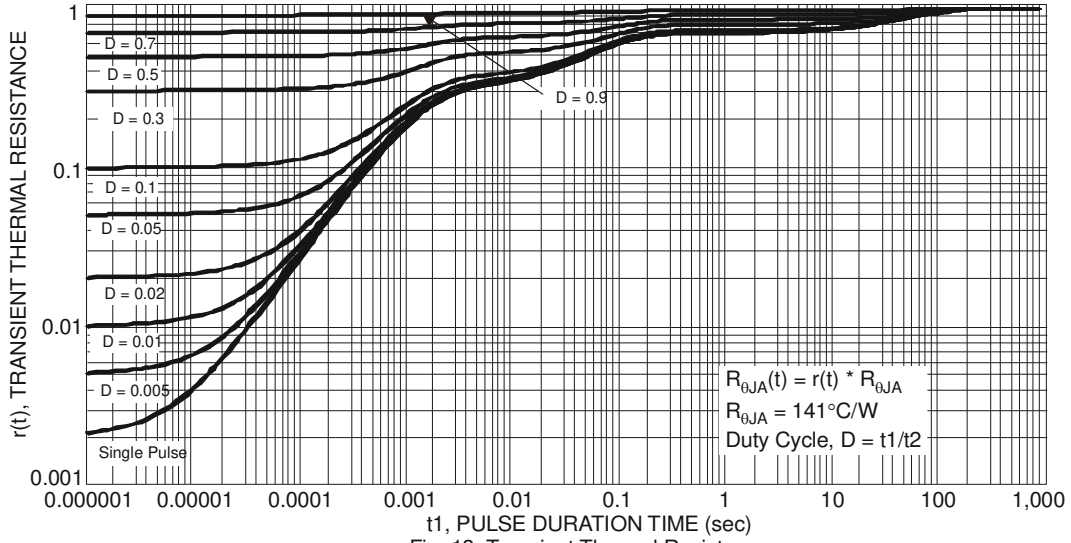
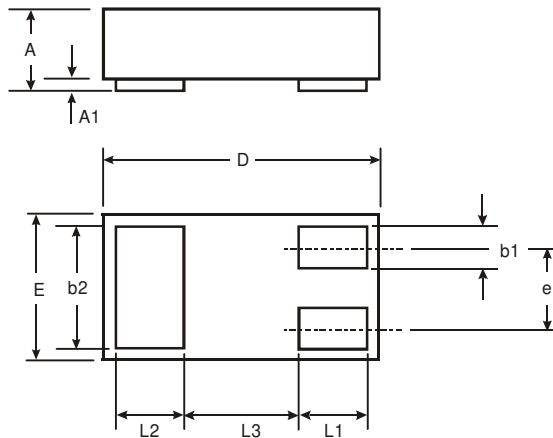


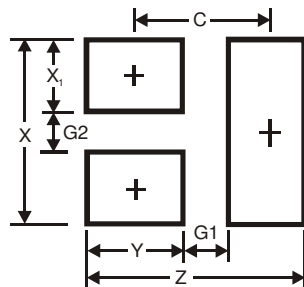
Fig. 13 Transient Thermal Resistance

**Package Outline Dimensions**



X2-DFN1006-3			
Dim	Min	Max	Typ
A	—	0.40	—
A1	0	0.05	0.02
b1	0.10	0.20	0.15
b2	0.45	0.55	0.50
D	0.95	1.05	1.00
E	0.55	0.65	0.60
e	—	—	0.35
L1	0.20	0.30	0.25
L2	0.20	0.30	0.25
L3	—	—	0.40
All Dimensions in mm			

**Suggested Pad Layout**



Dimensions	Value (in mm)
Z	1.1
G1	0.3
G2	0.2
X	0.7
X1	0.25
Y	0.4
C	0.7

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