## 20V N-CHANNEL ENHANCEMENT MODE MOSFET

## Features

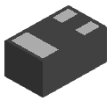
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Ultra-Small Surface Mount Package
- Ultra-Low Package Profile, 0.4mm Maximum Package Height
- ESD Protected up to 1.5kV
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 standards for High Reliability**

## Mechanical Data

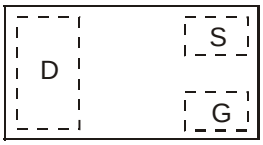
- Case: X2-DFN1006-3
- Case Material: Molded Plastic, "Green" Molding Compound; UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — NiPdAu over Copper Leadframe; Solderable per MIL-STD-202, Method 208 e4
- Weight: 0.001 grams (Approximate)

X2-DFN1006-3

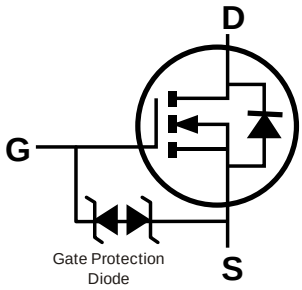
ESD PROTECTED TO 1.5kV



Bottom View




Top View
Package Pin Configuration



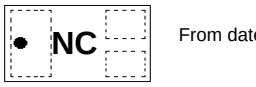
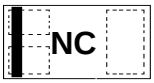
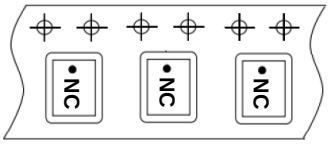
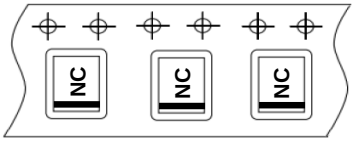
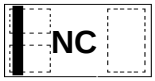
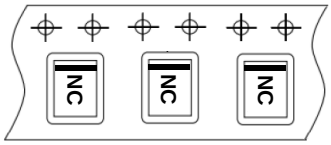
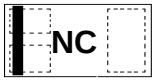
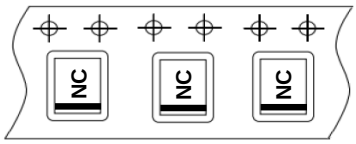

Equivalent Circuit

## Ordering Information (Note 4)

| Part Number | Marking | Reel Size (inches) | Tape Width (mm) | Tape Pitch (mm) | Quantity per Reel |
|---|---|---|---|---|---|
| DMN2400UFB4-7 | NC | 7 | 8 | 4 | 3,000 |
| DMN2400UFB4-7R | NC | 7 | 8 | 4 | 3,000 |
| DMN2400UFB4-7B | NC | 7 | 8 | 2 | 10,000 |

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/quality/lead_free.html 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/products/packages.html.

## Marking Information

| | |
|---|---|
| DMN2400UFB4-7 |  Top View Dot Denotes Drain Side<br>From date code 1527 (YYWW), this changes to:<br>  Top View Bar Denotes Gate and Source Side<br>  <br>  |
| DMN2400UFB4-7R |  Top View Bar Denotes Gate and Source Side<br>  <br>NC = Part Marking Code |
| DMN2400UFB4-7B |  Top View Bar Denotes Gate and Source Side<br>  <br>NC = Part Marking Code |

## Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 20 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±12 | V |
| Continuous Drain Current (Note 5) $V_{GS}$ = 4.5V | Steady State | $T_A$ = +25°C<br>$T_A$ = +85°C | $I_D$ | 0.75<br>0.55 | A |
| Pulsed Drain Current (Notes 5 & 6) | | | $I_{DM}$ | 3 | A |

## Thermal Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Total Power Dissipation (Note 5) | $P_D$ | 0.47 | mW |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 258 | °C/W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | °C |

Notes: 5. Device mounted on FR-4 PCB, with minimum recommended pad layout, single sided.
6. Device mounted on minimum recommended pad layout test board, 10µs pulse duty cycle = 1%.

## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 7)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 20 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250µA |
| Zero Gate Voltage Drain Current $T_J$ = +25°C | $I_{DSS}$ | — | — | 100<br>50 | nA | $V_{DS}$ = 20V, $V_{GS}$ = 0V<br>$V_{DS}$ = 5V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±3V, $V_{DS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±1.0 | µA | $V_{GS}$ = ±4.5V, $V_{DS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±50 | µA | $V_{GS}$ = ±10V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 7)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | 0.5 | — | 0.9 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | — | 0.55 | Ω | $V_{GS}$ = 4.5V, $I_D$ = 600mA |
| | | — | — | 0.75 | | $V_{GS}$ = 2.5V, $I_D$ = 500mA |
| | | — | — | 0.9 | | $V_{GS}$ = 1.8V, $I_D$ = 350mA |
| Forward Transfer Admittance | $\|Y_{fs}\|$ | — | 1.0 | — | S | $V_{DS}$ = 10V, $I_D$ = 400mA |
| Diode Forward Voltage | $V_{SD}$ | | 0.7 | 1.2 | V | $V_{GS}$ = 0V, $I_S$ = 150mA |
| **DYNAMIC CHARACTERISTICS (Note 8)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 36.0 | — | pF | $V_{DS}$ =16V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 5.7 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 4.2 | — | pF | |
| Total Gate Charge | $Q_g$ | — | 0.5 | — | nC | $V_{GS}$ = 4.5V, $V_{DS}$ = 10V, $I_D$ = 250mA |
| Gate-Source Charge | $Q_{gs}$ | — | 0.07 | — | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 0.1 | — | nC | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 4.11 | — | ns | $V_{DD}$ = 10V, $V_{GS}$ = 4.5V, $R_L$ = 47Ω, $R_g$ = 10Ω, $I_D$ = 200mA |
| Turn-On Rise Time | $t_R$ | — | 3.82 | — | ns | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 14.8 | — | ns | |
| Turn-Off Fall Time | $t_F$ | — | 9.6 | — | ns | |

Notes: 7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.

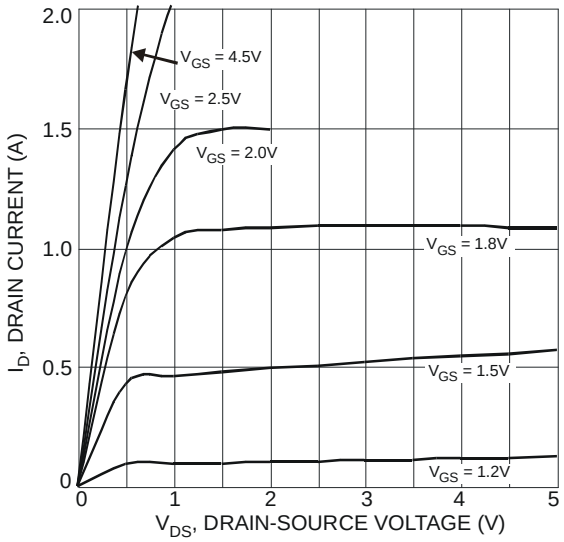



Fig. 1 Typical Output Characteristics

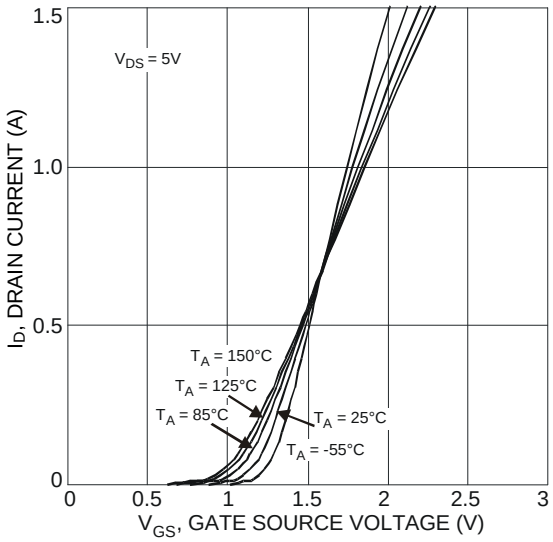



Fig. 2 Typical Transfer Characteristics

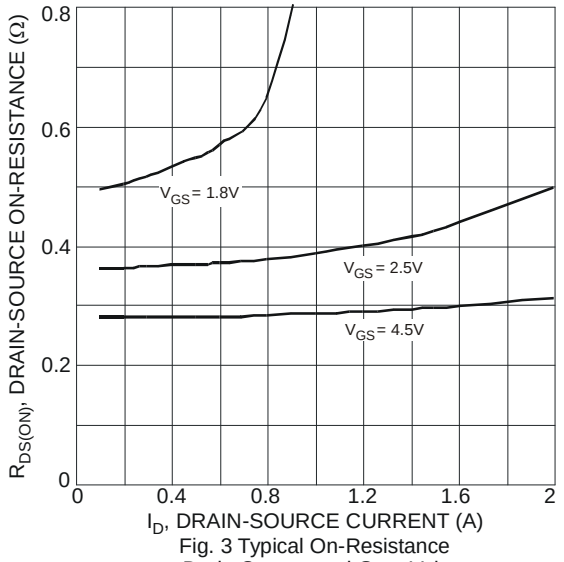



Fig. 3 Typical On-Resistance
vs. Drain Current and Gate Voltage

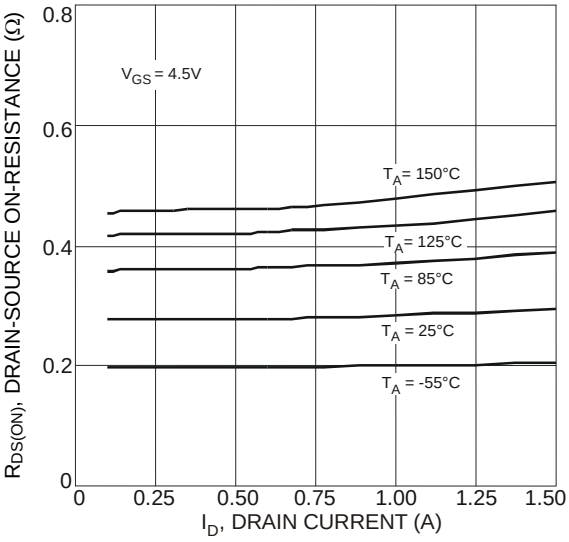



Fig. 4 Typical Drain-Source On-Resistance
vs. Drain Current and Temperature

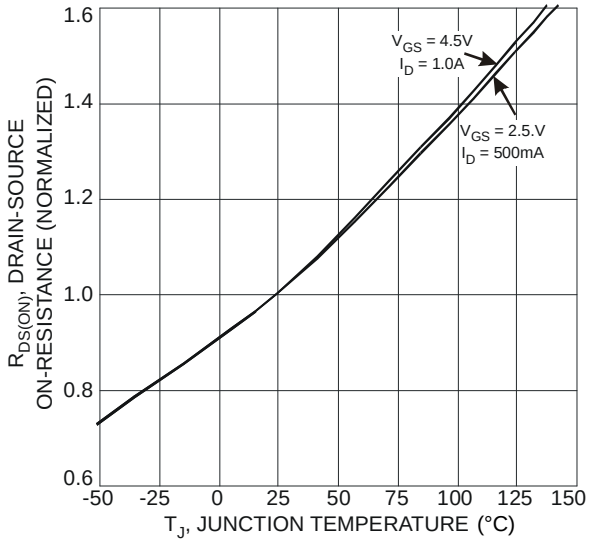



Fig. 5 On-Resistance Variation with Temperature

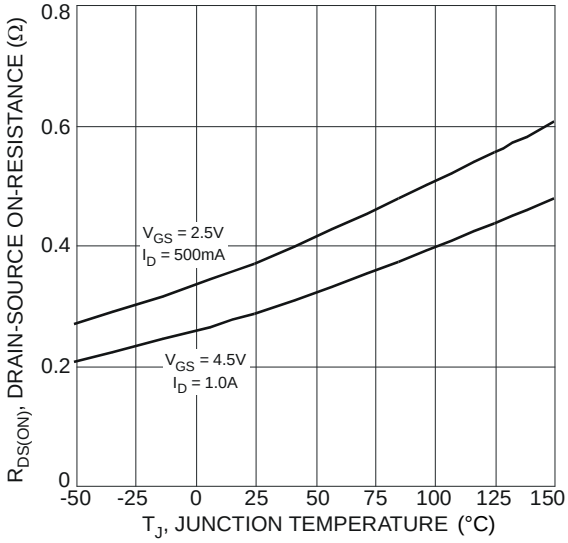



Fig. 6 On-Resistance Variation with Temperature

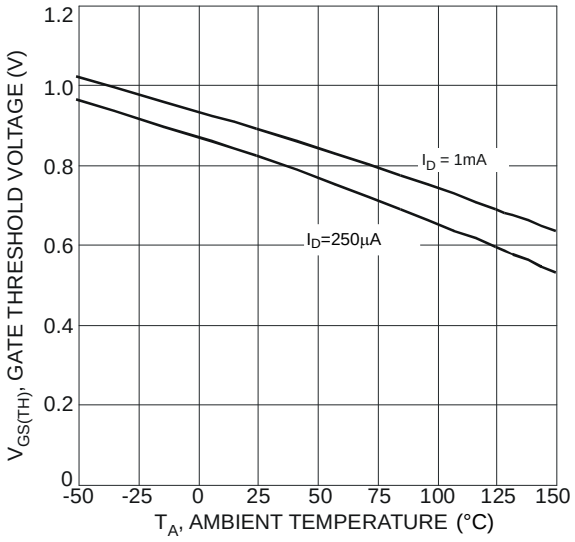



Fig. 7 Gate Threshold Variation vs. Ambient Temperature

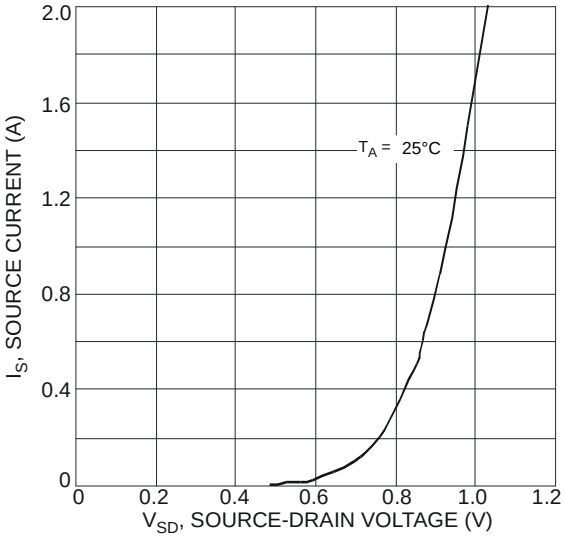



Fig. 8 Diode Forward Voltage vs. Current

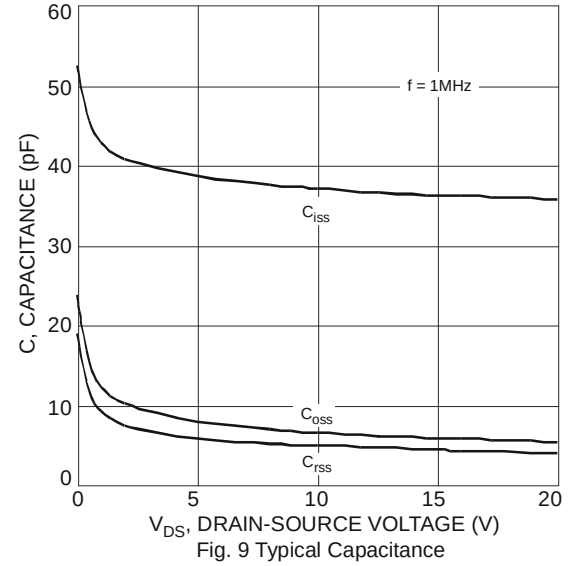



Fig. 9 Typical Capacitance

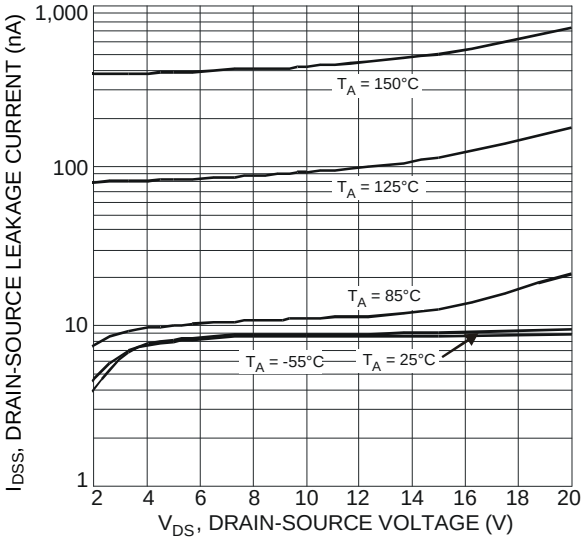



Fig. 10 Typical Drain-Source Leakage Current vs. Drain-Source Voltage

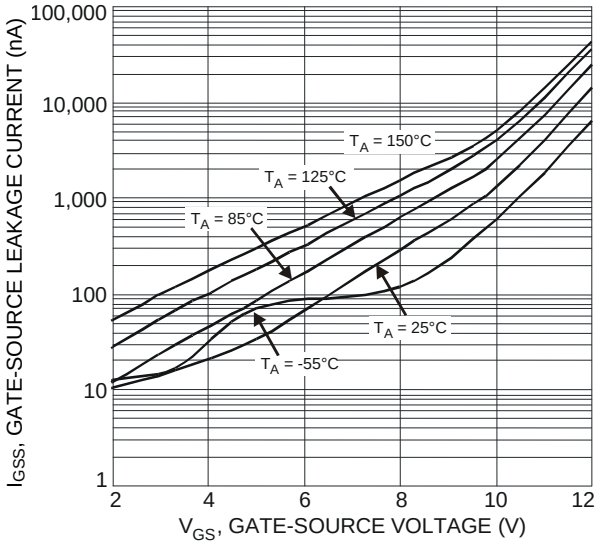



Fig. 11 Typical Gate-Source Leakage Current vs. Gate-Source Voltage

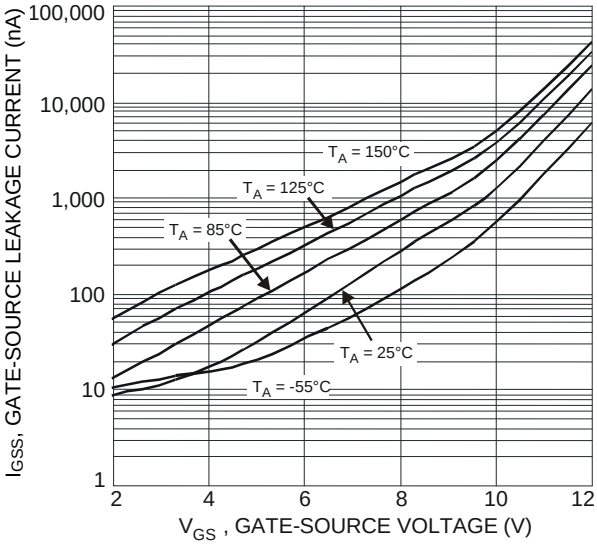



Fig. 12 Typical Gate-Source Leakage Current vs. Gate-Source Voltage

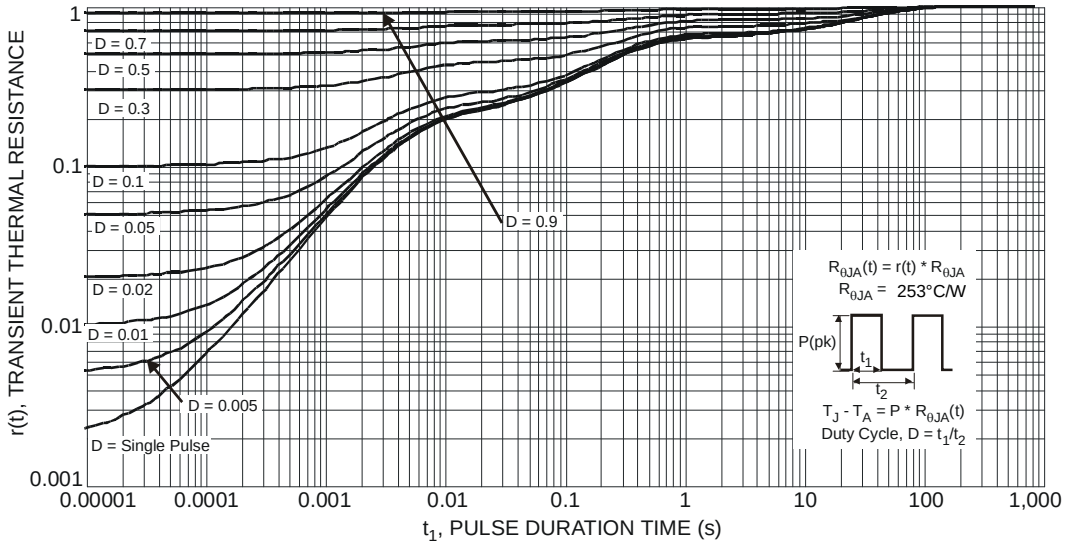
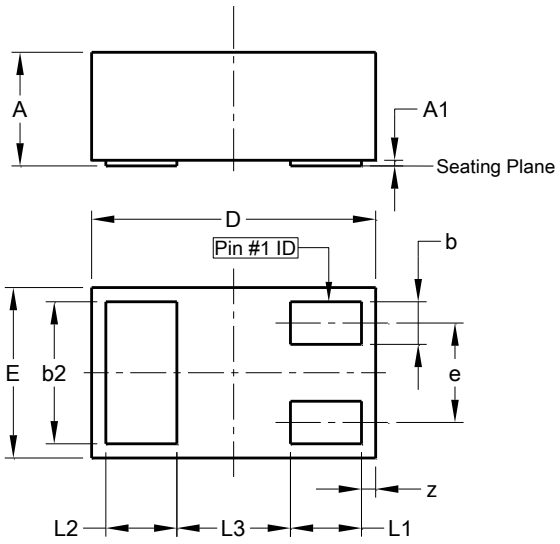



Fig. 13 Transient Thermal Response

## Package Outline Dimensions

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

**X2-DFN1006-3**

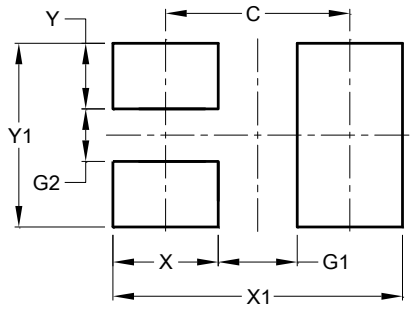



| X2-DFN1006-3 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | — | 0.40 | — |
| **A1** | 0.00 | 0.05 | 0.03 |
| **b** | 0.10 | 0.20 | 0.15 |
| **b2** | 0.45 | 0.55 | 0.50 |
| **D** | 0.95 | 1.05 | 1.00 |
| **E** | 0.55 | 0.65 | 0.60 |
| **e** | - | - | 0.35 |
| **L1** | 0.20 | 0.30 | 0.25 |
| **L2** | 0.20 | 0.30 | 0.25 |
| **L3** | - | - | 0.40 |
| **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.

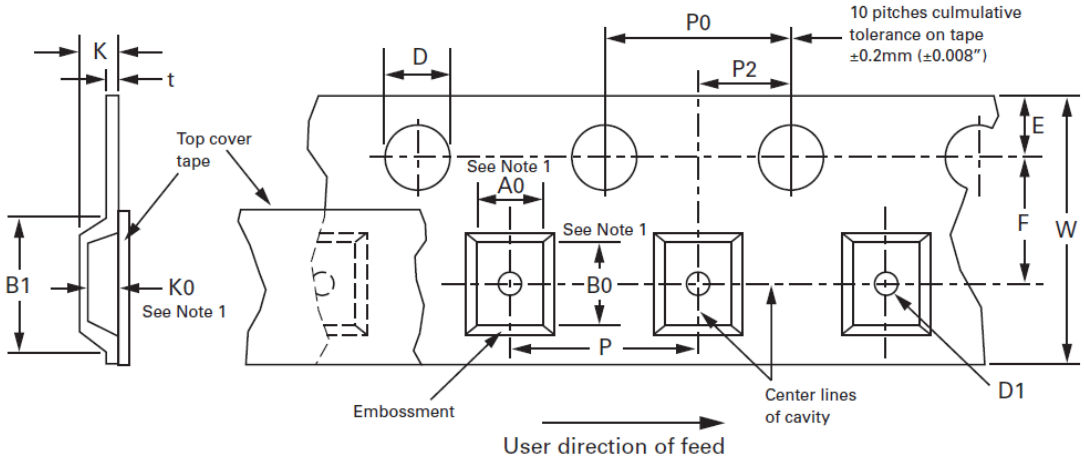
**X2-DFN1006-3**




| 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 |

## Tape Information

### EMBOSSED CARRIER TAPE SPECIFICATIONS




| 8, 12, 16, 24mm EMBOSSED TAPE DIMENSIONS IN mm | | | | | | |
|---|---|---|---|---|---|---|
| **Tape Size** | **D** | **E** | **$P_o$** | **tmax** | **$A_o$ $B_o$ $K_o$** | |
| **8mm** | 1.50 +0.10 –0.0 | 1.75 ± 0.10 | 4.0 ± 0.10 | 0.400 | See Note 9 | **Constant Dimensions** |

| Tape Size | B1 max | D1 min | F | K max | P2 | R min | W | Package Type |
|---|---|---|---|---|---|---|---|---|
| **8mm** | 4.5 | 0.35 | 3.5 ± 0.05 | 2.4 | 2.0 ± 0.05 | 25 | 8.0 ± 0.30 | Refer to 8mm Device Tape Orientation Table |

| P | | | | | |
|---|---|---|---|---|---|
| **Tape Size** | **2.0 ± 0.05** | **4.0 ± 0.10** | **8.0 ± 0.10** | **12.0 ± 0.10** | **16.0 ± 0.10** |
| **8mm** | DFN1006 (-7B) | DFN1006 (-7)<br>DFN1006 (-7R) | — | — | — |

Note: 9. Ao Bo Ko are determined by component size.

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