## Product Summary (typ. @ $V_{GS}$ = 4.5V, $T_A$ = +25°C )

| $BV_{SSS}$ | $R_{SS(ON)}$ | $Q_g$ | $Q_{gd}$ | $I_S$ |
|---|---|---|---|---|
| 20V | 20mΩ | 28.5nC | 0.6nC | 8.3A |

## Description

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

## Applications

- Battery managements
- Load switches
- Battery protections

## Features

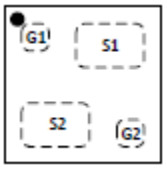
- Common Drain Configuration with:
  $R_{SS(ON)}$ = 20mΩ to Minimize On-State Losses
  $Q_g$ = 28.5nC for Ultra-Fast Switching
  $V_{GS(TH)}$ = 0.9V typ. for a Low Turn-On Potential
- CSP with Footprint 1.35mm × 1.35mm
- Height = 0.22mm for Low Profile
- ESD Protection of Gate
- **Totally Lead-Free & 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 or your local Diodes representative.**
  **https://www.diodes.com/quality/product-definitions/**

## Mechanical Data

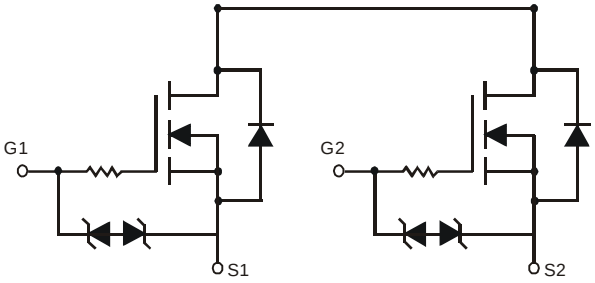
- Package: X4-DSN1313-4
- Terminal Connections: See Diagram Below
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — NiPdAu or NiAu. Solderable per MIL-STD-202, Method 208e4
- Weight: 0.0026 grams (Approximate)

ESD PROTECTED

**X4-DSN1313-4**




Top View




Equivalent Circuit

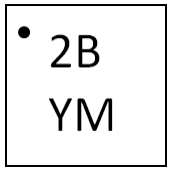
## Ordering Information (Note 4)

| Part Number | Package | Packing | |
|---|---|---|---|
| | | Qty. | Carrier |
| DMN2024LCA4-7 | X4-DSN1313-4 | 3000 | 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

**X4-DSN1313-4**




2B = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: K = 2023)
M = Month (ex: 9 = September)

Date Code Key

| Year | 2020 | … | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | H | … | K | L | M | N | P | R | S | T | U | V |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D |

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

| Characteristic | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 20 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±10 | V |
| Continuous Source Current (Note 5) $V_{GS}$ = 4.5V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_S$ | 8.3<br>6.7 | A |
| Continuous Source Current (Note 5) $V_{GS}$ = 2.5V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_S$ | 6.9<br>5.5 | A |
| Pulsed Source Current (Note 6) | | | $I_{SM}$ | 50 | A |

## Thermal Characteristics

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Power Dissipation (Note 7) | $P_D$ | 1.1 | W |
| Thermal Resistance, Junction to Ambient @$T_A$ = +25°C (Note 7) | $R_{\theta JA}$ | 111 | °C/W |
| Power Dissipation (Note 5) | $P_D$ | 2.4 | W |
| Thermal Resistance, Junction to Ambient @$T_A$ = +25°C (Note 5) | $R_{\theta JA}$ | 52 | °C/W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | °C |

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 8)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{SSS}$ | 20 | — | — | V | $V_{GS}$ = 0V, $I_S$ = 250μA |
| Zero Gate Voltage Drain Current $T_J$ = +25°C | $I_{SSS}$ | — | — | 1 | μA | $V_{SS}$ = 16V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | 0.5 | μA | $V_{GS}$ = 6V, $V_{DD}$ = 0V |
| | | — | — | 4 | | $V_{GS}$ = 10V, $V_{DD}$ = 0V |
| **ON CHARACTERISTICS (Note 8)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | 0.68 | 0.9 | 1.3 | V | $V_{SS}$ = $V_{GS}$, $I_S$ = 250μA |
| Static Source-Source On-Resistance | $R_{SS(ON)}$ | — | — | 21 | mΩ | $V_{GS}$ = 6.5V, $I_S$ = 2A |
| | | — | — | 23 | | $V_{GS}$ = 4.5V, $I_S$ = 2A |
| | | — | — | 34 | | $V_{GS}$ = 2.5V, $I_S$ = 2A |
| Diode Forward Voltage | $V_{SS}$ | — | 0.6 | 1 | V | $V_{GS}$ = 0V, $I_S$ = 2A |
| **DYNAMIC CHARACTERISTICS (Note 9)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 991 | — | pF | $V_{SS}$ = 10V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 137 | — | | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 81 | — | | |
| Total Gate Charge | $Q_g$ | — | 28.5 | — | nC | $V_{GS}$ = 10V, $V_{SS}$ = 10V, $I_S$ = 2A |
| Gate-Source Charge | $Q_{gs}$ | — | 7.4 | — | | |
| Gate-Drain Charge | $Q_{gd}$ | — | 0.6 | — | | |
| Gate Charge at $V_{TH}$ | $Q_{G(TH)}$ | — | 4.7 | — | | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 8.7 | — | ns | $V_{SS}$ = 10V, $V_{GS}$ = 4.5V, $R_G$ = 0Ω, $I_S$ = 2A |
| Turn-On Rise Time | $t_R$ | — | 2.5 | — | | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 17.6 | — | | |
| Turn-Off Fall Time | $t_F$ | — | 8.4 | — | | |

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

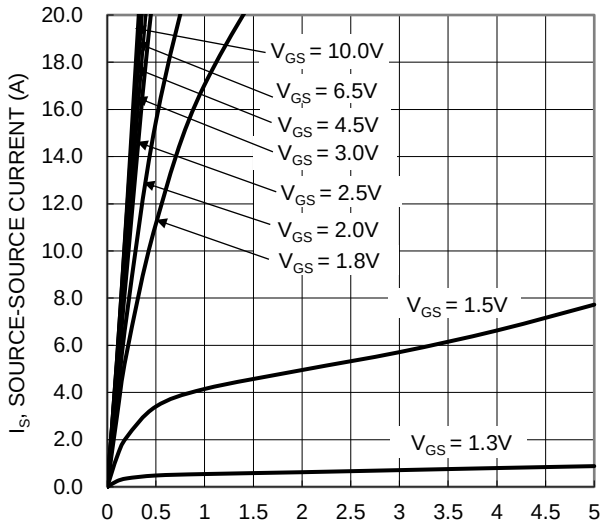


Figure 1. Typical Output Characteristic

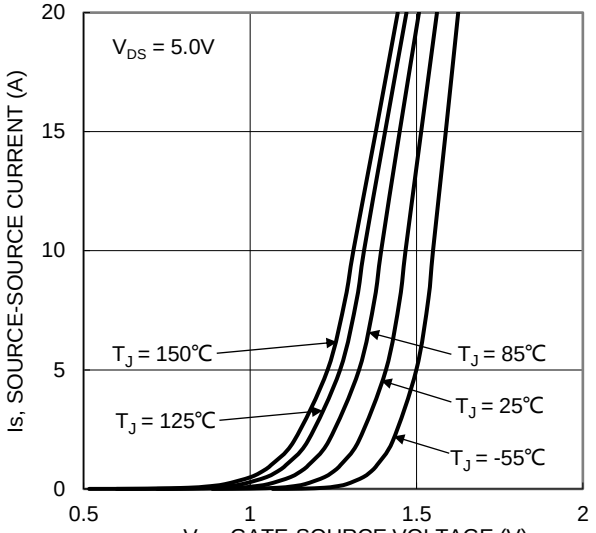


Fig.2 Typical Transfer Characteristic

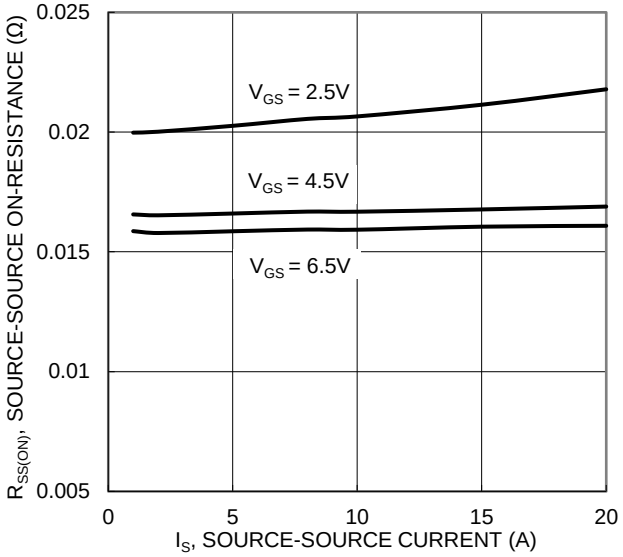


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

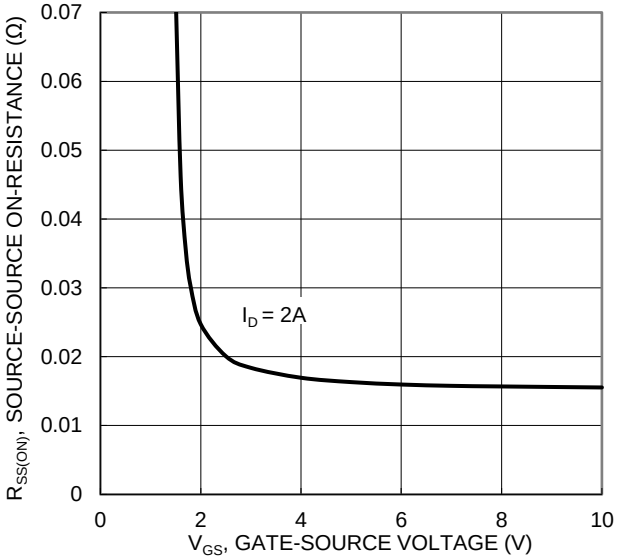


Figure 4. Typical Transfer Characteristic

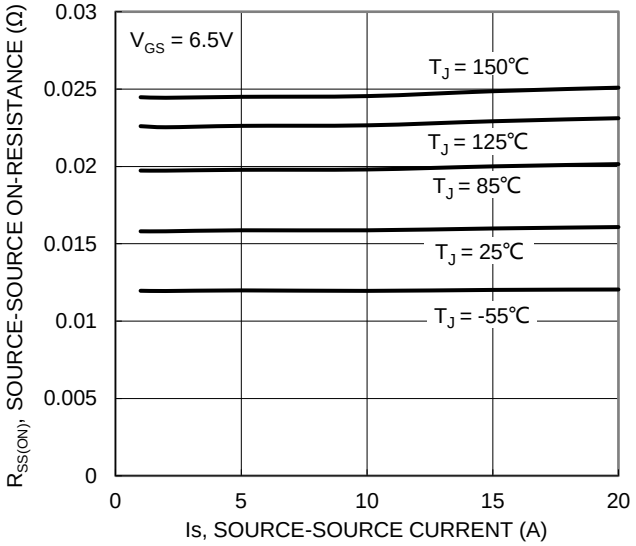


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

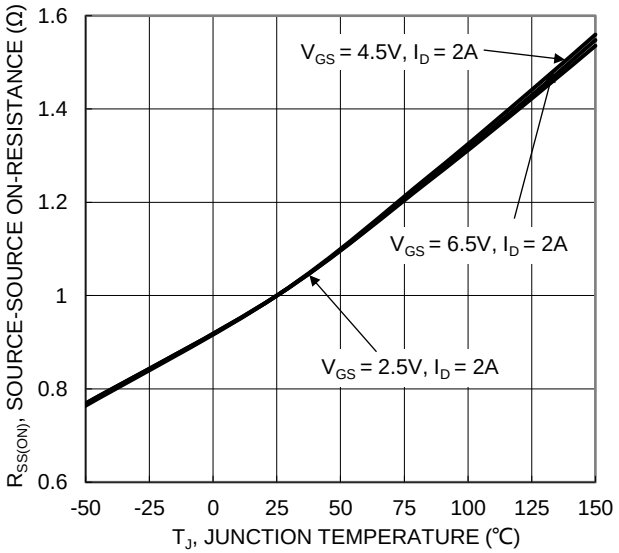


Figure 6. On-Resistance Variation with Temperature

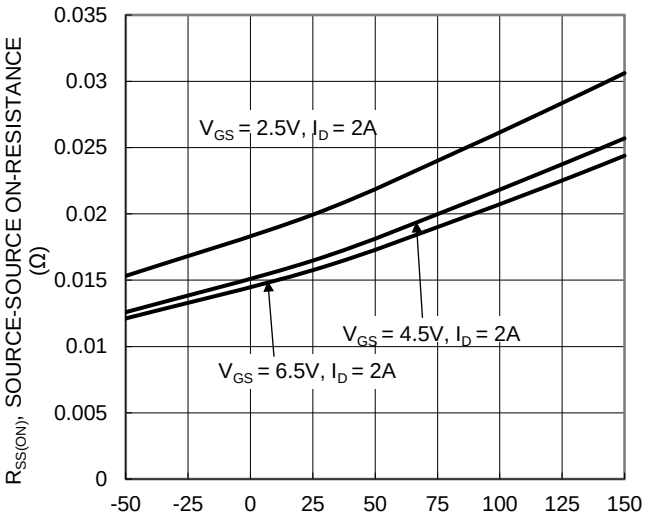


Figure 7. On-Resistance Variation with Temperature

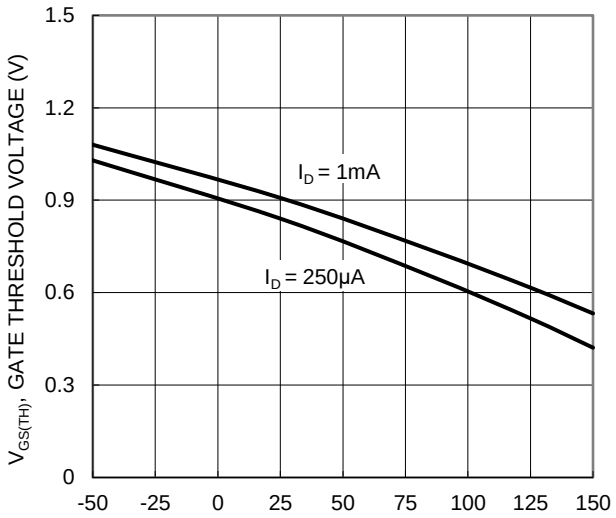


Figure 8. Gate Threshold Variation vs. Junction Temperature

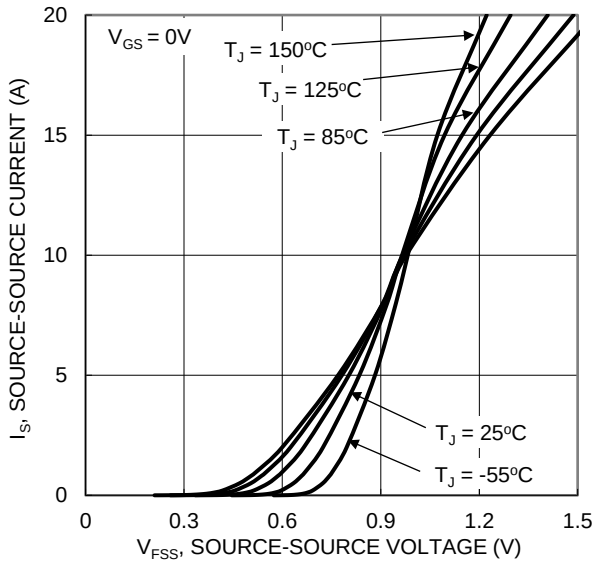


Figure 9. Diode Forward Voltage vs. Current

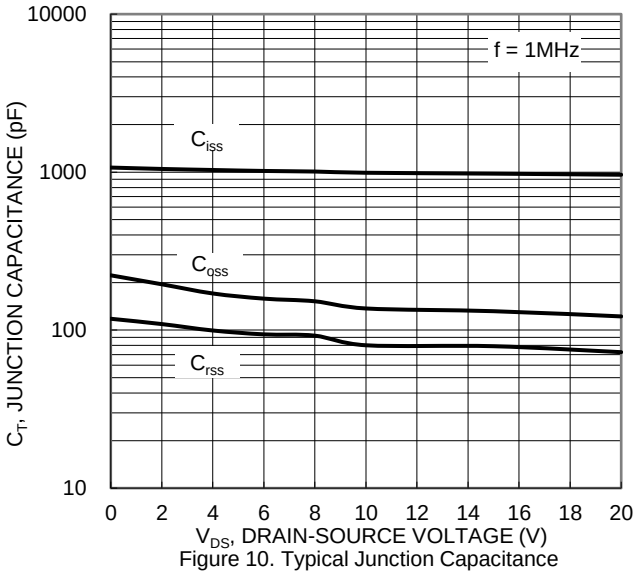


Figure 10. Typical Junction Capacitance

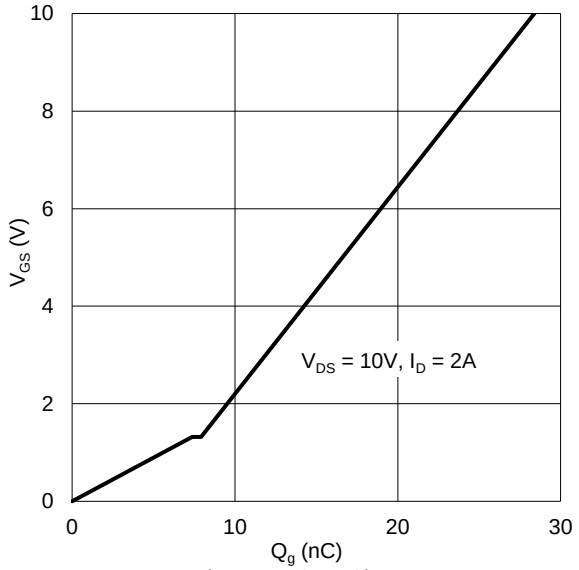


Figure 11. Gate Charge

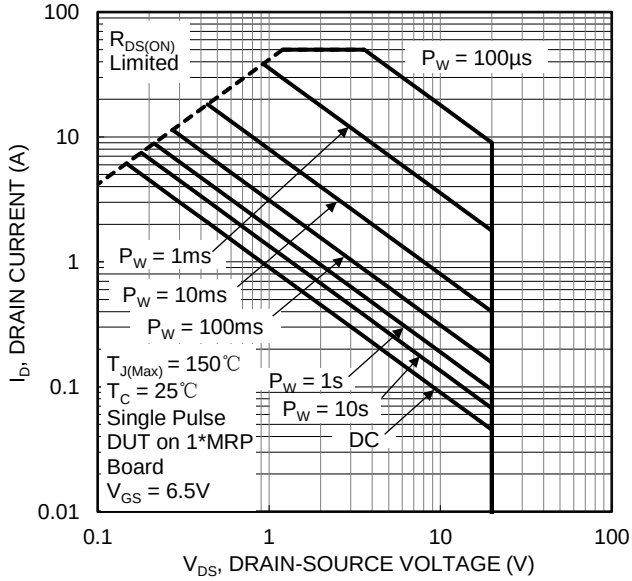


Figure 12. SOA, Safe Operation Area

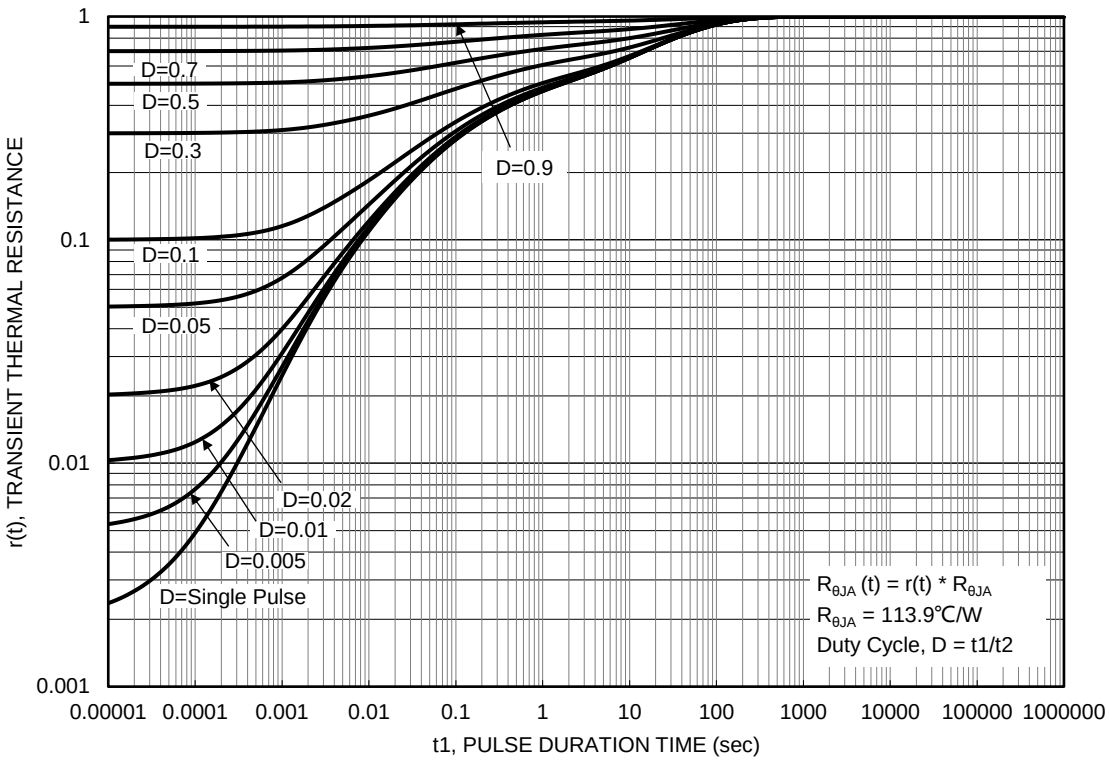
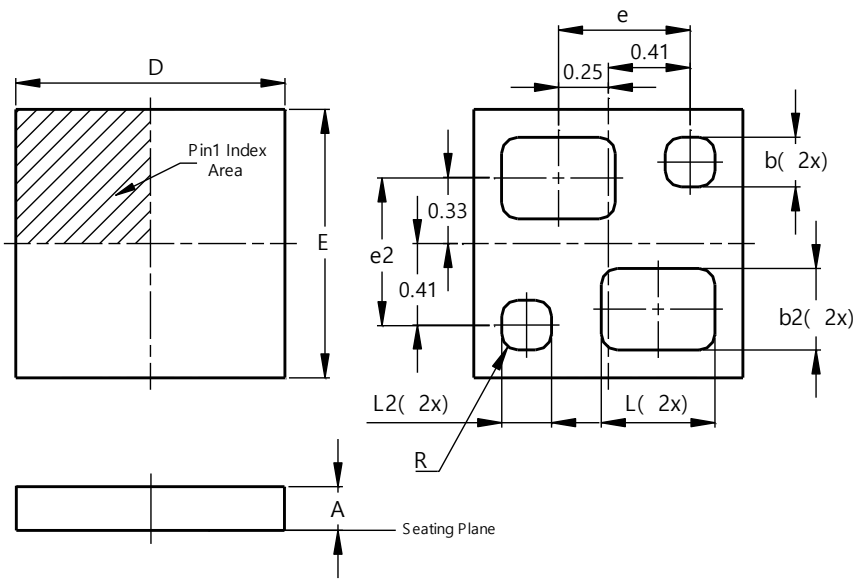



Figure 13. Transient Thermal Resistance

## Package Outline Dimensions

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

**X4-DSN1313-4**

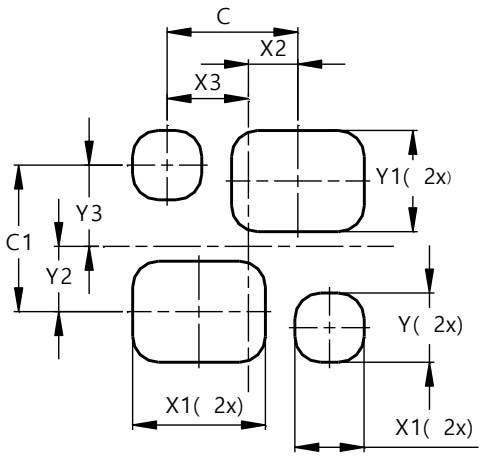



| X4-DSN1313-4 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.15 | 0.25 | 0.20 |
| **b** | 0.24 | 0.26 | 0.25 |
| **b2** | 0.40 | 0.42 | 0.41 |
| **D** | 1.30 | 1.40 | 1.35 |
| **E** | 1.30 | 1.40 | 1.35 |
| **e** | -- | -- | 0.66 |
| **e2** | -- | -- | 0.74 |
| **L** | 0.56 | 0.58 | 0.57 |
| **L2** | 0.24 | 0.26 | 0.25 |
| **r** | -- | -- | 0.08 |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

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

**X4-DSN1313-4**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 0.66 |
| **C1** | 0.74 |
| **X** | 0.67 |
| **X1** | 0.35 |
| **X2** | 0.25 |
| **X3** | 0.41 |
| **Y** | 0.35 |
| **Y1** | 0.51 |
| **Y2** | 0.33 |
| **Y3** | 0.41 |

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