# 60V N-CHANNEL ENHANCEMENT MODE MOSFET

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ Max | $I_D$ $T_A$ = +25°C |
|---|---|---|
| 60V | 44mΩ @ $V_{GS}$ = 10V | 5.0A |
| | 60mΩ @ $V_{GS}$ = 4.5V | 4.3A |

## Features and Benefits

- 100% Unclamped Inductive Switch (UIS) Test in Production
- Low Input Capacitance
- Low On-Resistance
- Fast Switching Speed
- **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**
- **PPAP Capable (Note 4)**

## Description and Applications

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

- DC-DC Converters
- Power Management Functions
- Backlighting

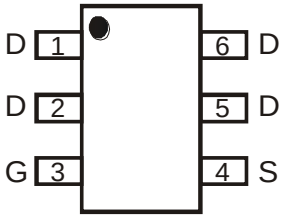
## Mechanical Data

- Case: TSOT26
- 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 – Tin Finish Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.013 grams (Approximate)

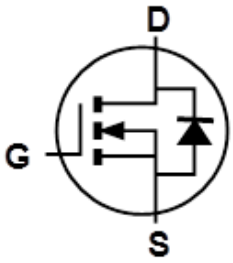
**TSOT26**



Top View




Top View
Pin Configuration



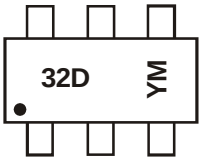

Equivalent Circuit

## Ordering Information (Note 5)

| Part Number | Case | Packaging |
|---|---|---|
| DMN6040SVTQ-7 | TSOT26 | 3,000/Tape & Reel |
| DMN6040SVTQ-13 | TSOT26 | 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/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. Automotive products are AEC-Q101 qualified and are PPAP capable. Please refer to http://www.diodes.com/quality/product_compliance_definitions/.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

## Marking Information




32D = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: X = 2010)
M = Month (ex: 9 = September)

Date Code Key

| Year | 2010 | … | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | X | … | E | F | G | H | I | J | K | L | M |

| 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 |


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

| Characteristic | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 60 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current (Note 7) $V_{GS}$ = 10V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 5.0<br>4.0 | A |
| | t<10s | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 6.3<br>5.0 | A |
| Continuous Drain Current (Note 7) $V_{GS}$ = 5V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 4.3<br>3.4 | A |
| | t<10s | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 5.4<br>4.3 | A |
| Maximum Body Diode Forward Current (Note 7) | | | $I_S$ | 2.1 | A |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) | | | $I_{DM}$ | 30 | A |
| Avalanche Current (Note 8) L = 0.1mH | | | $I_{AR}$ | 14.2 | A |
| Avalanche Energy (Note 8) L = 0.1mH | | | $E_{AR}$ | 10 | mJ |

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

| Characteristic | | Symbol | Value | Units |
|---|---|---|---|---|
| Total Power Dissipation (Note 6) | $T_A$ = +25°C | $P_D$ | 1.2 | W |
| | $T_A$ = +70°C | | 0.75 | |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | $R_{\theta JA}$ | 106 | °C/W |
| | t<10s | | 69 | °C/W |
| Total Power Dissipation (Note 7) | $T_A$ = +25°C | $P_D$ | 1.8 | W |
| | $T_A$ = +70°C | | 1.1 | |
| Thermal Resistance, Junction to Ambient (Note 7) | Steady State | $R_{\theta JA}$ | 68 | °C/W |
| | t<10s | | 44 | °C/W |
| Thermal Resistance, Junction to Case (Note 7) | | $R_{\theta JC}$ | 20 | °C/W |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

Notes: 6. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
7. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
8. $I_{AR}$ and $E_{AR}$ rating are based on low frequency and duty cycles to keep $T_J$ = +25°C.


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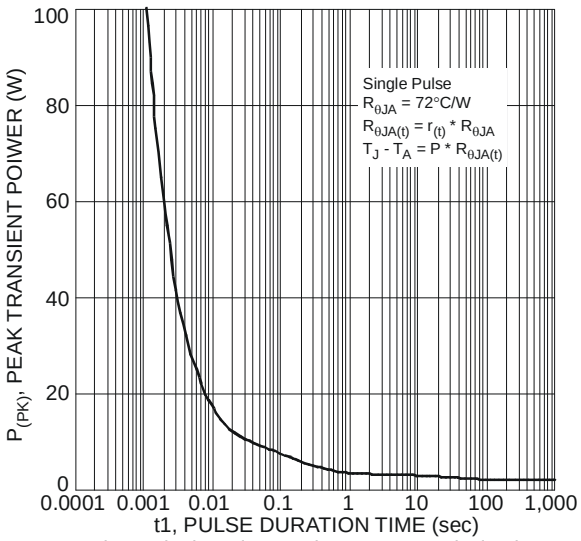


Fig. 1 Single Pulse Maximum Power Dissipation

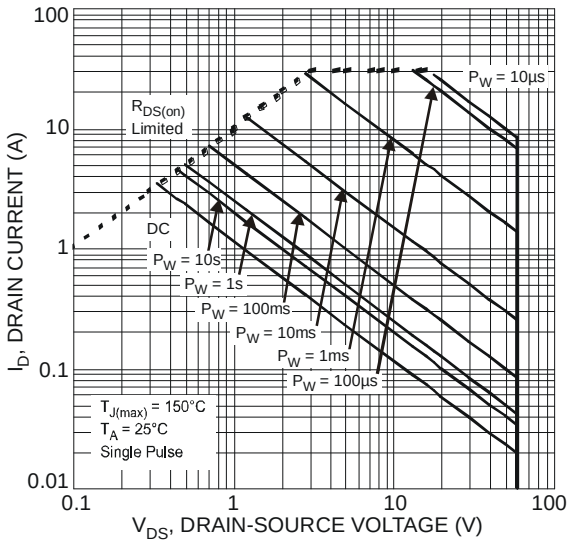


Fig. 2 SOA, Safe Operation Area

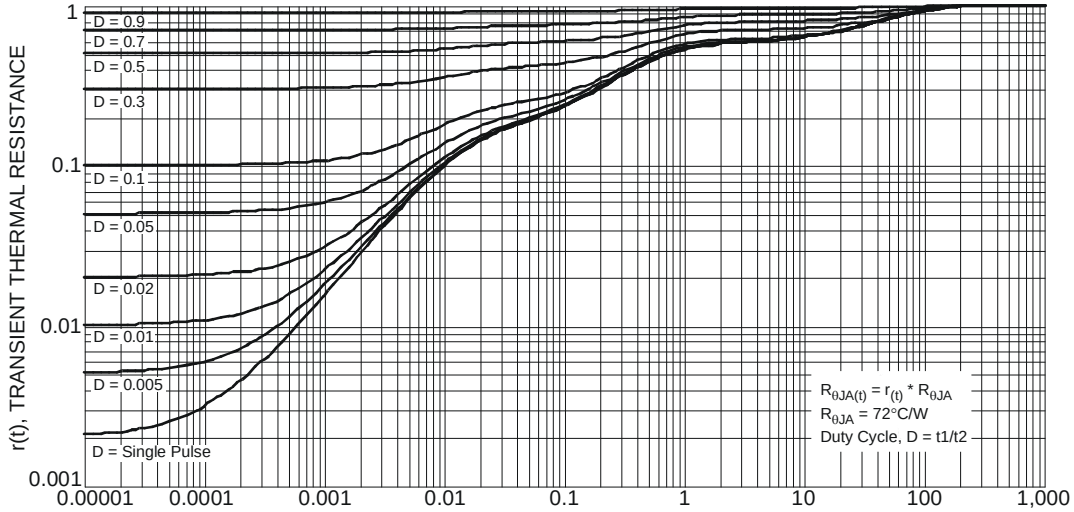


Fig. 3 Transient Thermal Resistance


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## Electrical Characteristics @$T_A$ = 25°C unless otherwise specified

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** (Note 9) | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 60 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250µA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | 100 | nA | $V_{DS}$ = 60V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS** (Note 9) | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | 1 | — | 3 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 30 | 44 | mΩ | $V_{GS}$ = 10V, $I_D$ = 4.3A |
| | | — | 35 | 60 | | $V_{GS}$ = 4.5V, $I_D$ = 4A |
| Forward Transfer Admittance | $\|Y_{FS}\|$ | — | 4.5 | — | S | $V_{DS}$ = 10V, $I_D$ = 4.3A |
| Diode Forward Voltage | $V_{SD}$ | — | 0.7 | 1.2 | V | $V_{GS}$ = 0V, $I_S$ = 1A |
| **DYNAMIC CHARACTERISTICS** (Note 10) | | | | | | |
| Input Capacitance | $C_{ISS}$ | — | 1,287 | — | pF | $V_{DS}$ = 25V, $V_{GS}$ = 0V<br>f = 1.0MHz |
| Output Capacitance | $C_{OSS}$ | — | 57 | — | | |
| Reverse Transfer Capacitance | $C_{RSS}$ | — | 44 | — | | |
| Gate Resistance | $R_G$ | — | 1.2 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1.0MHz |
| Total Gate Charge ($V_{GS}$ = 10V) | $Q_G$ | — | 22.4 | — | nC | $V_{DS}$ = 30V, $I_D$ = 4.3A |
| Total Gate Charge ($V_{GS}$ = 4.5V) | $Q_G$ | — | 10.4 | — | | |
| Gate-Source Charge | $Q_{GS}$ | — | 4.9 | — | | |
| Gate-Drain Charge | $Q_{GD}$ | — | 3.0 | — | | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 6.6 | — | ns | $V_{GS}$ = 10V, $V_{DD}$ = 30V, $R_G$ = 6Ω,<br>$I_D$ = 4.3A |
| Turn-On Rise Time | $t_R$ | — | 8.1 | — | | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 20.1 | — | | |
| Turn-Off Fall Time | $t_F$ | — | 4.0 | — | | |
| Body Diode Reverse Recovery Time | $t_{RR}$ | — | 18 | — | ns | $I_S$ = 4.3A, dI/dt = 100A/µs |
| Body Diode Reverse Recovery Charge | $Q_{RR}$ | — | 11.9 | — | nC | $I_S$ = 4.3A, dI/dt = 100A/µs |

Notes: 9. Short duration pulse test used to minimize self-heating effect.
10. Guaranteed by design. Not subject to product testing.


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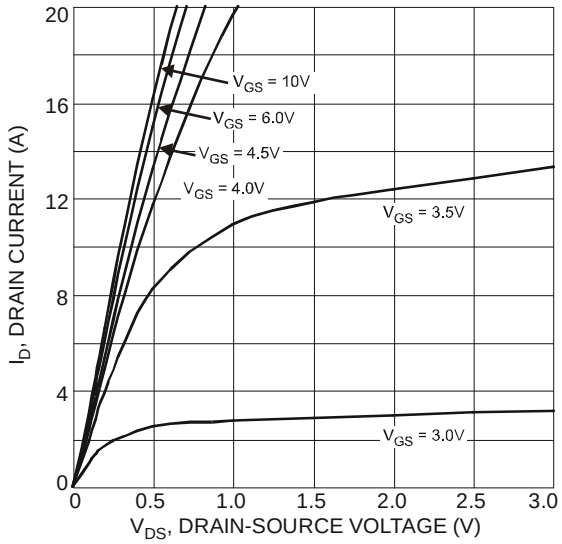



Fig. 4 Typical Output Characteristic

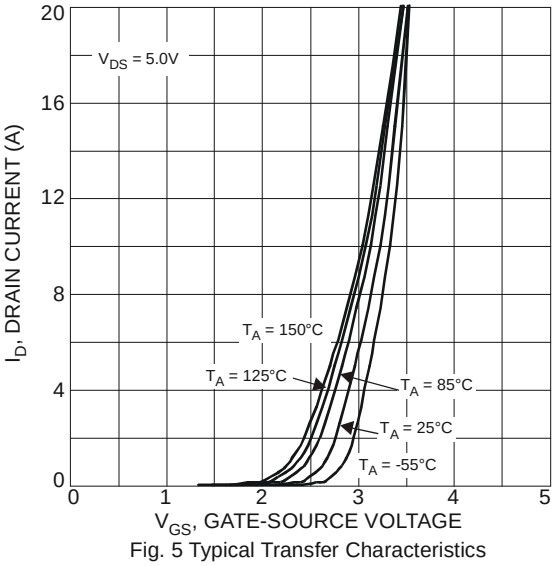



Fig. 5 Typical Transfer Characteristics

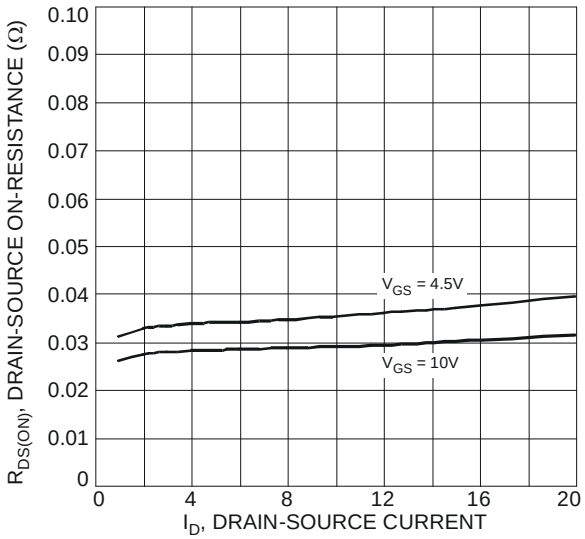



Fig. 6 Typical On-Resistance vs. Drain Current and Gate Voltage

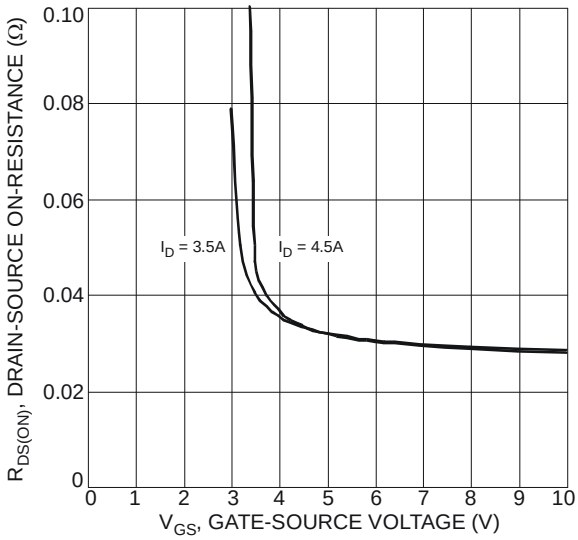



Fig. 7 Typical On-Resistance vs. Drain Current and Gate Voltage

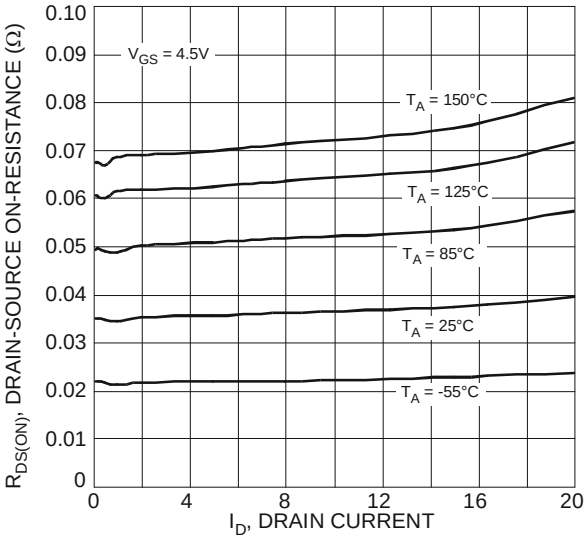



Fig. 8 Typical On-Resistance vs. Drain Current and Temperature

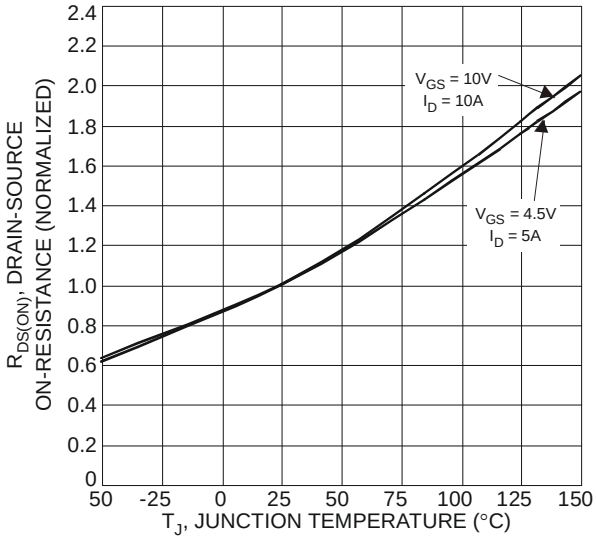



Fig. 9 On-Resistance Variation with Temperature


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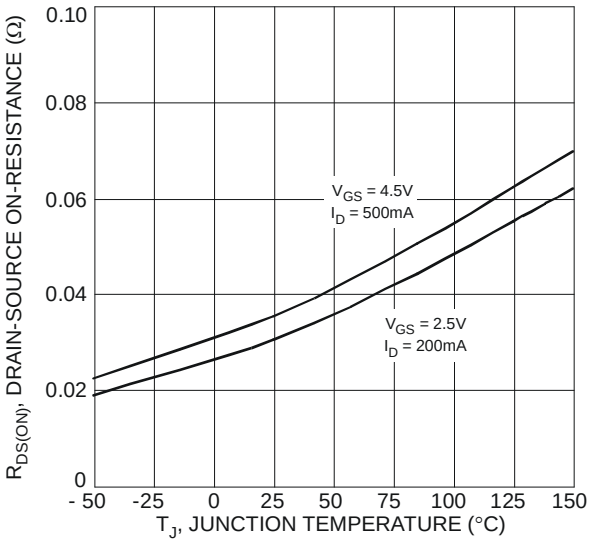



Fig. 10 On-Resistance Variation with Temperature

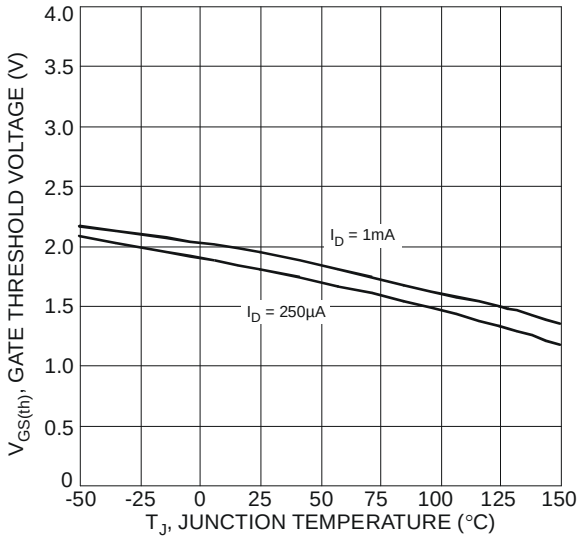



Fig. 11 Gate Threshold Variation vs. Ambient Temperature

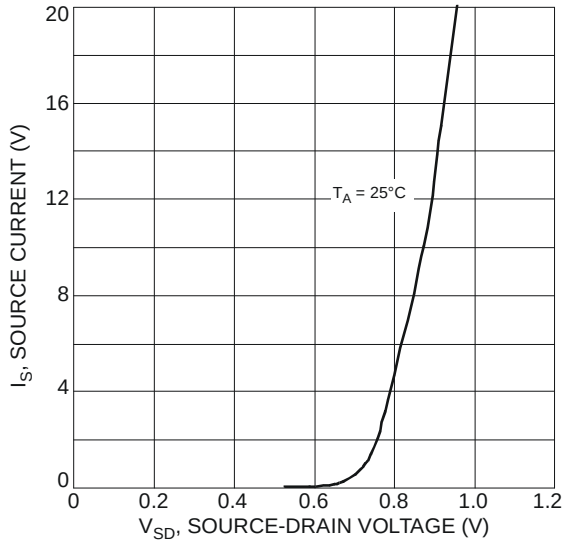



Fig. 12 Diode Forward Voltage vs. Current

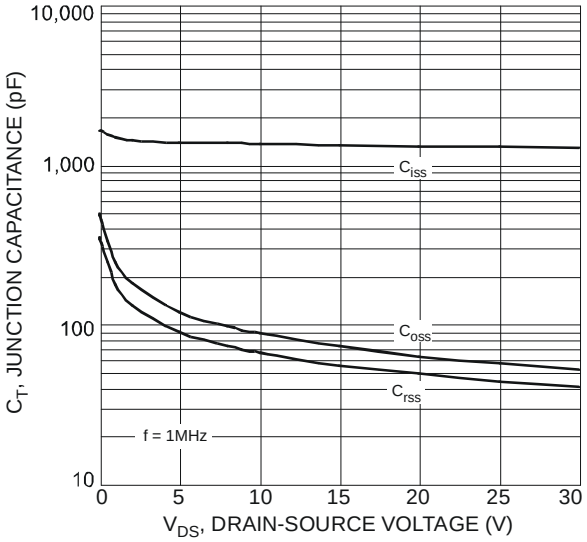



Fig. 13 Typical Junction Capacitance

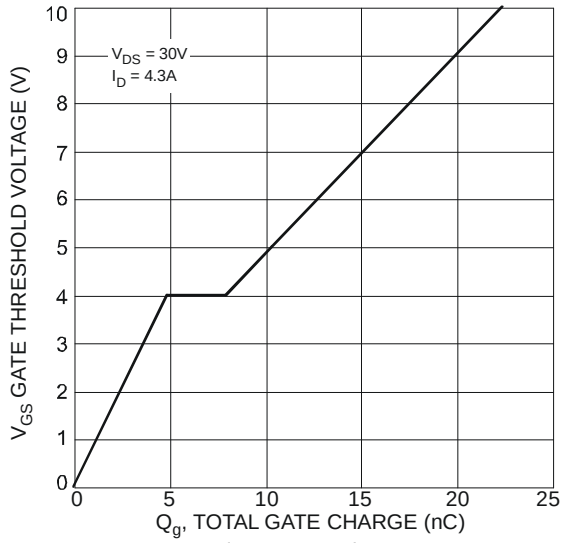


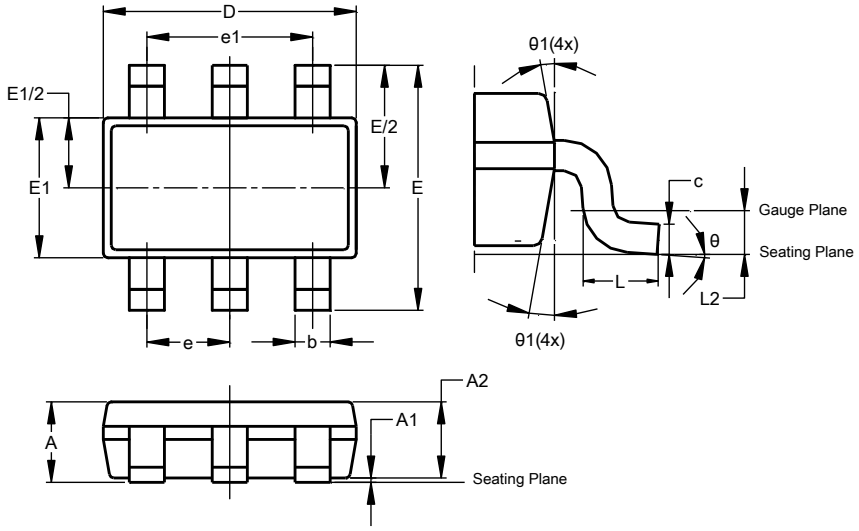

Fig. 14 Gate Charge


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## Package Outline Dimensions

Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.

**TSOT26**

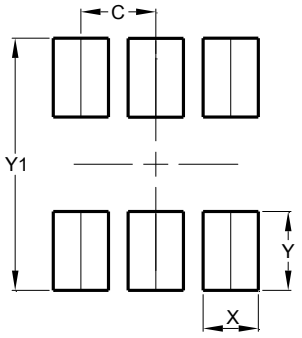



| TSOT26 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | – | 1.00 | – |
| **A1** | 0.010 | 0.100 | – |
| **A2** | 0.840 | 0.900 | – |
| **D** | 2.800 | 3.000 | 2.900 |
| **E** | 2.800 BSC | | |
| **E1** | 1.500 | 1.700 | 1.600 |
| **b** | 0.300 | 0.450 | – |
| **c** | 0.120 | 0.200 | – |
| **e** | 0.950 BSC | | |
| **e1** | 1.900 BSC | | |
| **L** | 0.30 | 0.50 | |
| **L2** | 0.250 BSC | | |
| **θ** | 0° | 8° | 4° |
| **θ1** | 4° | 12° | – |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.

**TSOT26**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 0.950 |
| **X** | 0.700 |
| **Y** | 1.000 |
| **Y1** | 3.199 |


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