

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ Max}$       | $I_D$<br>$T_C = +25^\circ\text{C}$ |
|---------------|--------------------------------|------------------------------------|
| -40V          | 11mΩ @ $V_{GS} = -10\text{V}$  | -35A                               |
|               | 15mΩ @ $V_{GS} = -4.5\text{V}$ | -30A                               |

## Description

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.

## Applications

- DC-DC Converters
- Power Management Functions
- Backlighting

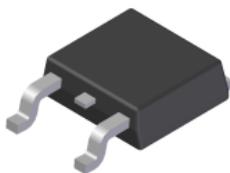
## Features and Benefits

- 100% Unclamped Inductive Switch (UIS) Test In Production
- Low On-Resistance
- Fast Switching Speed
- **Lead-Free Finish; 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)

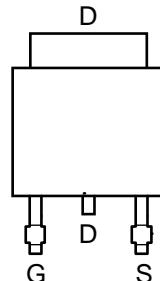
## Mechanical Data

- Case: TO252 (DPAK)
- 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 – Matte Tin Finish Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (e3)
- Weight: 0.33 grams (Approximate)

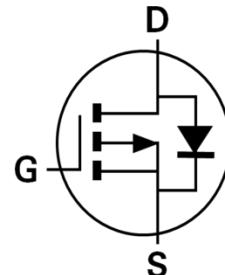
TO252 (DPAK)



Top View



Top View  
Pin-Out



Equivalent Circuit

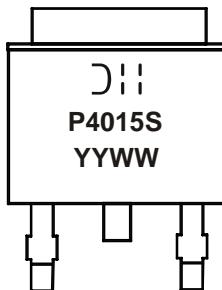
## Ordering Information (Notes 4 & 5)

| Part Number    | Compliance | Case         | Packaging         |
|----------------|------------|--------------|-------------------|
| DMP4015SK3Q-13 | Automotive | TO252 (DPAK) | 2,500/Tape & Reel |

Notes:

1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
2. See [http://www.diodes.com/quality/lead\\_free.html](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. Refer to [http://www.diodes.com/quality/product\\_compliance\\_definitions/](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



DII = Manufacturer's Marking  
 P4015S = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 13 = 2013)  
 WW = Week (01 - 53)

## Maximum Ratings (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Characteristic   |                  |  | Symbol    | Value      | Units |
|--|------------------|--|-----------|------------|-------|
| Drain-Source Voltage   |                  |  | $V_{DSS}$ | -40        | V     |
| Gate-Source Voltage  |                  |  | $V_{GSS}$ | $\pm 25$   | V     |
| Continuous Drain Current (Note 6) $V_{GS} = -10\text{V}$       | Steady State     | $T_C = +25^\circ\text{C}$<br>$T_C = +70^\circ\text{C}$ | $I_D$     | -35<br>-27 | A     |
| Continuous Drain Current (Note 6) $V_{GS} = -10\text{V}$       | Steady State     | $T_A = +25^\circ\text{C}$<br>$T_A = +70^\circ\text{C}$ | $I_D$     | -14<br>-11 | A     |
|  | $t < 10\text{s}$ | $T_A = +25^\circ\text{C}$<br>$T_A = +70^\circ\text{C}$ | $I_D$     | -22<br>-18 | A     |
| Pulsed Drain Current (10 $\mu\text{s}$ pulse, duty cycle = 1%) |                  |  | $I_{DM}$  | -100       | A     |
| Maximum Body Diode Forward Current (Note 6)                    |                  |  | $I_S$     | -5.5       | A     |
| Avalanche Current (Note 7)                                     |                  |  | $I_{AS}$  | -22        | A     |
| Avalanche Energy (Note 7)                                      |                  |  | $E_{AS}$  | 242        | mJ    |

## Thermal Characteristics

| Characteristic                                   |                           | Symbol          | Value       | Units |
|--|---------------------------|-----------------|-------------|-------|
| Total Power Dissipation (Note 6)                 | $T_A = +25^\circ\text{C}$ | $P_D$           | 3.5         | W     |
|  | $T_A = +70^\circ\text{C}$ |                 | 2.2         |       |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State              | $R_{\theta JA}$ | 36          | °C/W  |
|  | $t < 10\text{s}$          |                 | 15          |       |
| Thermal Resistance, Junction to Case (Note 6)    | Steady State              | $R_{\theta JC}$ | 4.5         |       |
| Operating and Storage Temperature Range          |                           | $T_J, T_{STG}$  | -55 to +150 | °C    |

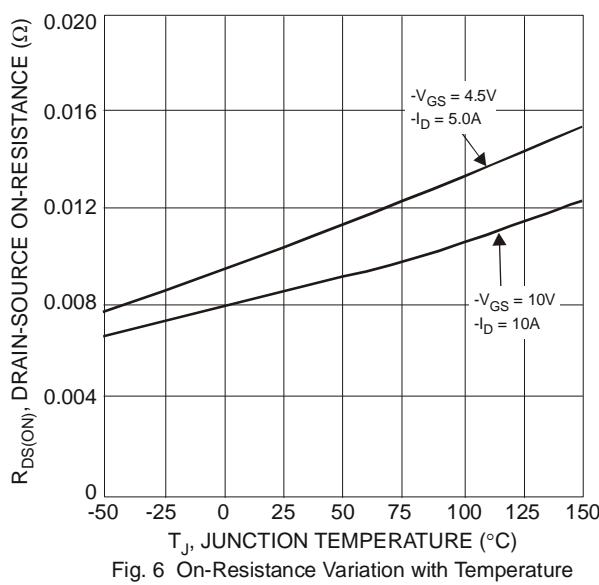
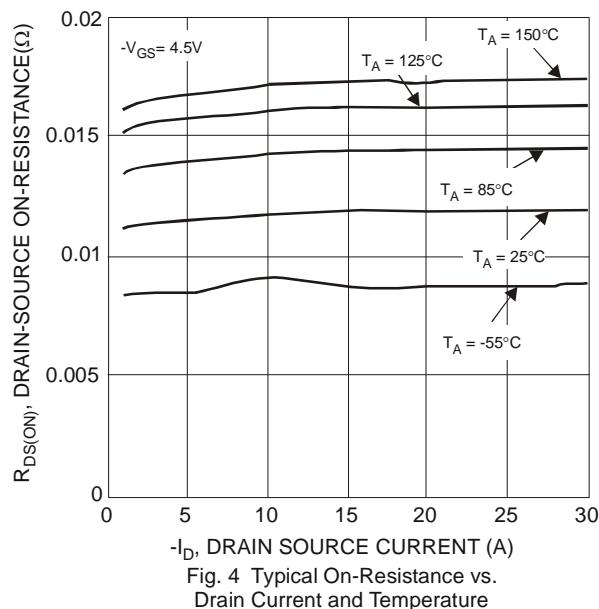
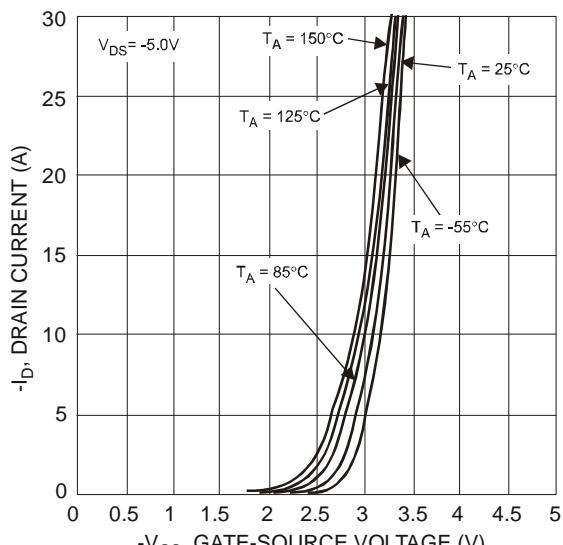
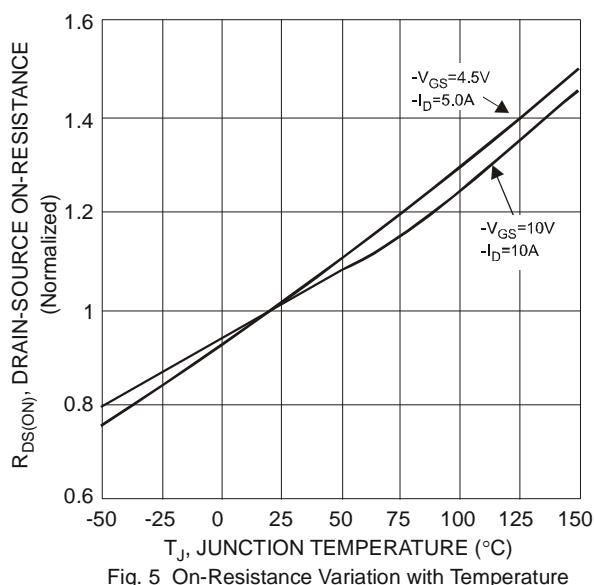
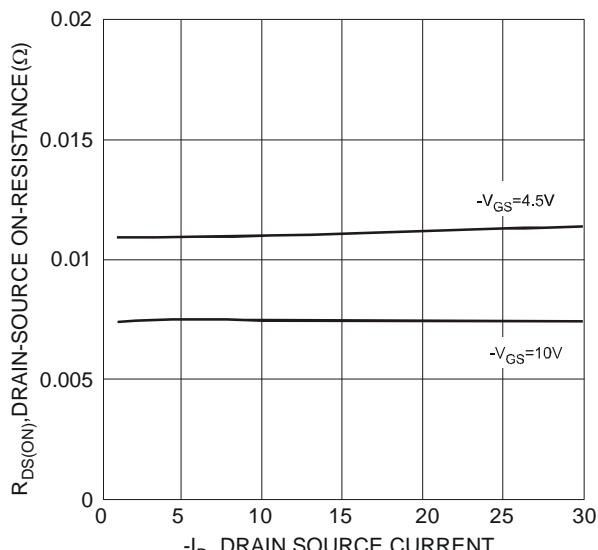
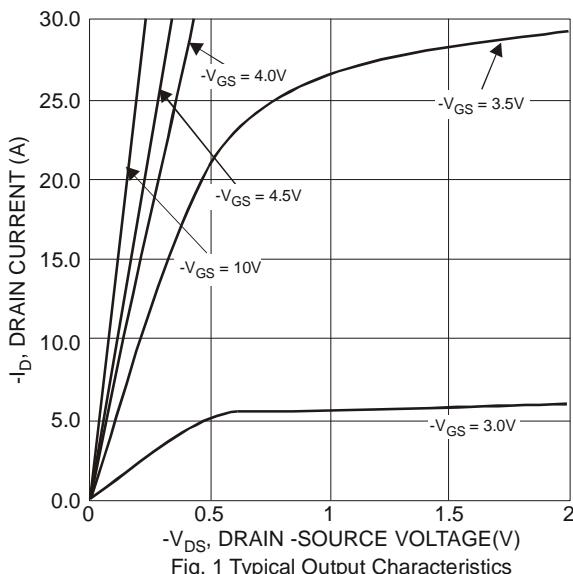
Notes: 6. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1-inch square copper plate.  
 7. UIS in production with  $L = 0.1\text{mH}$ ,  $T_J = +25^\circ\text{C}$ .

**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Characteristic                          | Symbol                            | Min  | Typ   | Max       | Unit             | Test Condition   |
|---|-----------------------------------|------|-------|-----------|------------------|--|
| <b>OFF CHARACTERISTICS</b> (Note 8)     |                                   |      |       |           |                  |  |
| Drain-Source Breakdown Voltage          | $\text{BV}_{\text{DSS}}$          | -40  | —     | —         | V                | $\text{V}_{\text{GS}} = 0\text{V}$ , $\text{I}_D = -250\mu\text{A}$  |
| Zero Gate Voltage Drain Current         | $\text{I}_{\text{DSS}}$           | —    | —     | -1        | $\mu\text{A}$    | $\text{V}_{\text{DS}} = -40\text{V}$ , $\text{V}_{\text{GS}} = 0\text{V}$  |
| Gate-Source Leakage                     | $\text{I}_{\text{GSS}}$           | —    | —     | $\pm 100$ | nA               | $\text{V}_{\text{GS}} = \pm 25\text{V}$ , $\text{V}_{\text{DS}} = 0\text{V}$   |
| <b>ON CHARACTERISTICS</b> (Note 8)      |                                   |      |       |           |                  |  |
| Gate Threshold Voltage                  | $\text{V}_{\text{GS}(\text{th})}$ | -1.5 | -2    | -2.5      | V                | $\text{V}_{\text{DS}} = \text{V}_{\text{GS}}$ , $\text{I}_D = -250\mu\text{A}$   |
| Static Drain-Source On-Resistance       | $\text{R}_{\text{DS}(\text{ON})}$ | —    | 7     | 11        | $\text{m}\Omega$ | $\text{V}_{\text{GS}} = -10\text{V}$ , $\text{I}_D = -9.8\text{A}$   |
|   |                                   | —    | 9     | 15        |                  | $\text{V}_{\text{GS}} = -4.5\text{V}$ , $\text{I}_D = -9.8\text{A}$  |
| Forward Transfer Admittance             | $ \text{Y}_{\text{fs}} $          | —    | 26    | —         | S                | $\text{V}_{\text{DS}} = -20\text{V}$ , $\text{I}_D = -9.8\text{A}$   |
| Diode Forward Voltage                   | $\text{V}_{\text{SD}}$            | —    | -0.7  | -1        | V                | $\text{V}_{\text{GS}} = 0\text{V}$ , $\text{I}_S = -1\text{A}$   |
| <b>DYNAMIC CHARACTERISTICS</b> (Note 9) |                                   |      |       |           |                  |  |
| Input Capacitance                       | $\text{C}_{\text{iss}}$           | —    | 4,234 | —         | pF               | $\text{V}_{\text{DS}} = -20\text{V}$ , $\text{V}_{\text{GS}} = 0\text{V}$<br>$f = 1\text{MHz}$   |
| Output Capacitance                      | $\text{C}_{\text{oss}}$           | —    | 1,036 | —         |                  |  |
| Reverse Transfer Capacitance            | $\text{C}_{\text{rss}}$           | —    | 526   | —         |                  |  |
| Gate Resistance                         | $\text{R}_{\text{G}}$             | —    | 7.77  | —         | $\Omega$         | $\text{V}_{\text{DS}} = 0\text{V}$ , $\text{V}_{\text{GS}} = 0\text{V}$ , $f = 1\text{MHz}$  |
| Total Gate Charge                       | $\text{Q}_{\text{g}}$             | —    | 47.5  | —         | nC               | $\text{V}_{\text{DS}} = -20\text{V}$ , $\text{V}_{\text{GS}} = -5\text{V}$<br>$\text{I}_D = -9.8\text{A}$                                    |
| Gate-Source Charge                      | $\text{Q}_{\text{gs}}$            | —    | 14.2  | —         |                  |  |
| Gate-Drain Charge                       | $\text{Q}_{\text{gd}}$            | —    | 13.5  | —         |                  |  |
| Turn-On Delay Time                      | $\text{t}_{\text{D}(\text{on})}$  | —    | 13.2  | —         | nS               | $\text{V}_{\text{GS}} = -10\text{V}$ , $\text{V}_{\text{DD}} = -20\text{V}$ ,<br>$\text{R}_{\text{G}} = 6\Omega$ , $\text{I}_D = -1\text{A}$ |
| Turn-On Rise Time                       | $\text{t}_{\text{r}}$             | —    | 10    | —         |                  |  |
| Turn-Off Delay Time                     | $\text{t}_{\text{D}(\text{off})}$ | —    | 302.7 | —         |                  |  |
| Turn-Off Fall Time                      | $\text{t}_{\text{f}}$             | —    | 137.9 | —         |                  |  |

Notes:

8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to production testing.



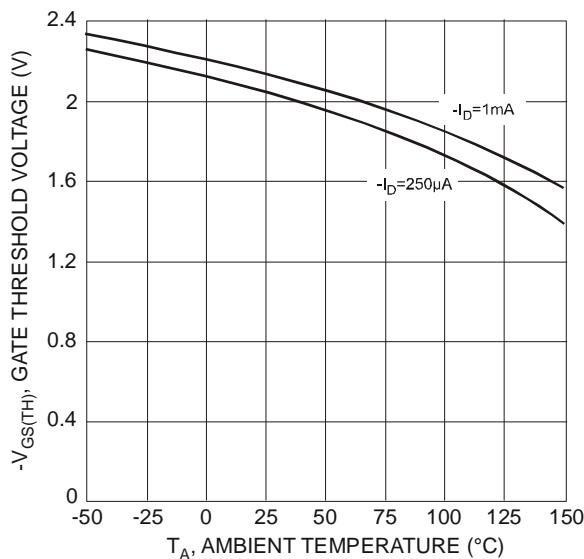


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

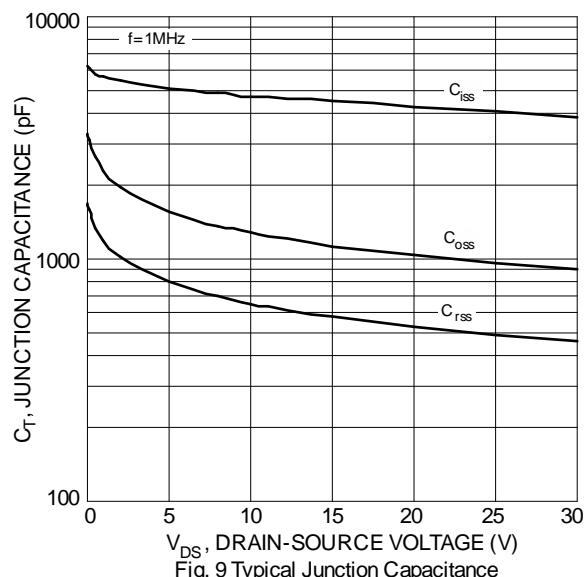


Fig. 9 Typical Junction Capacitance

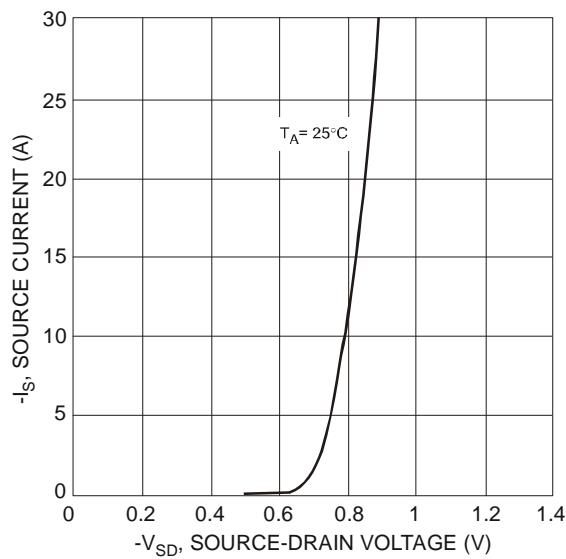


Fig. 8 Diode Forward Voltage vs. Current

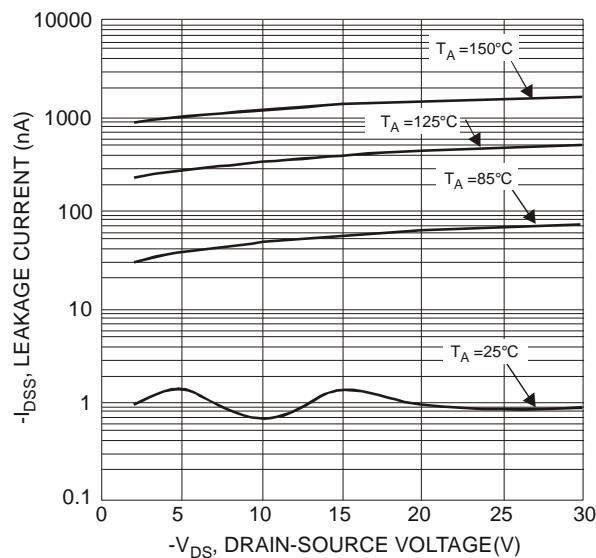


Fig. 10 Typical Drain-Source Leakage Current vs. Voltage

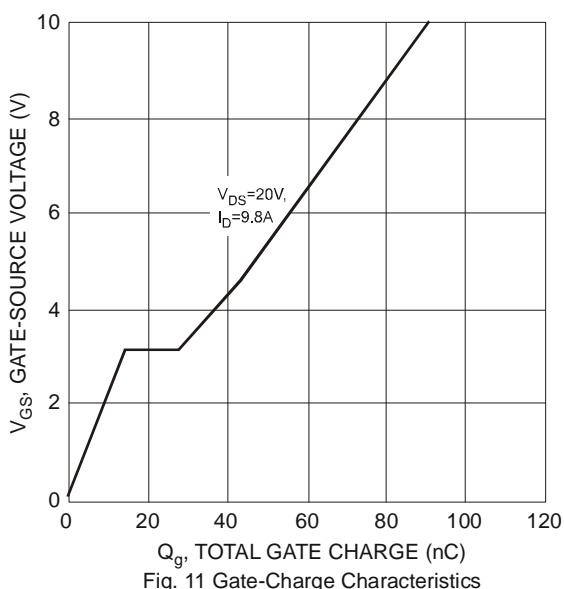


Fig. 11 Gate-Charge Characteristics

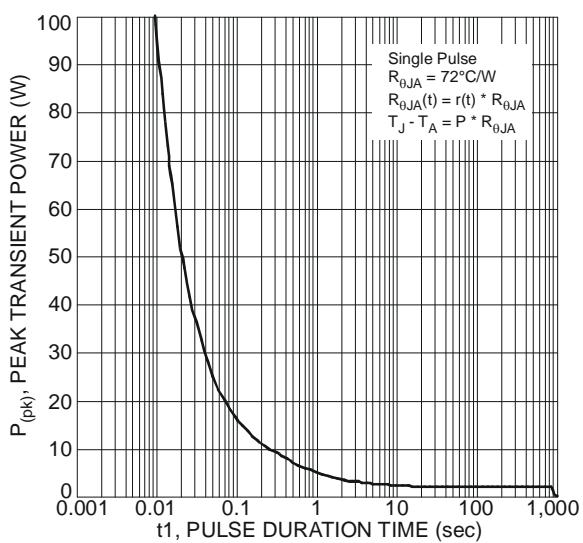


Fig. 12 Single Pulse Maximum Power Dissipation

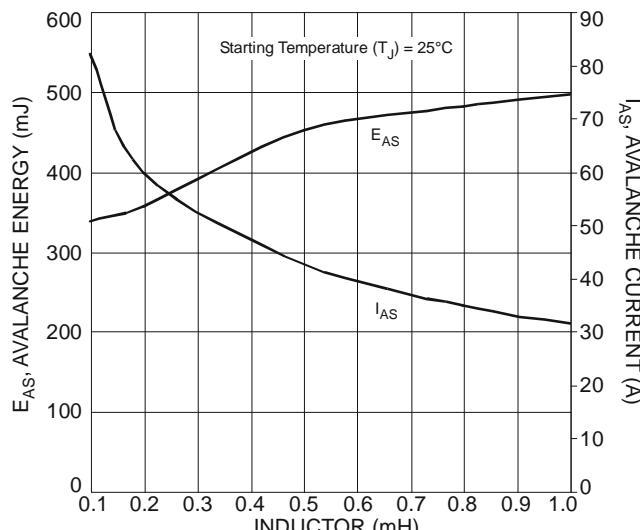


Fig. 13 Single-Pulse Avalanche Tested

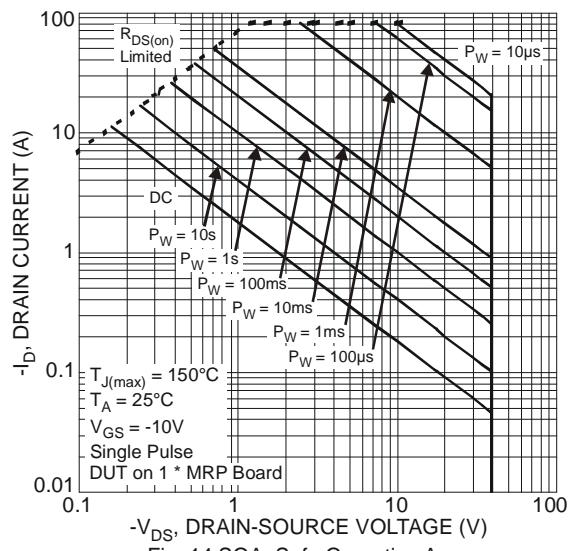


Fig. 14 SOA, Safe Operation Area

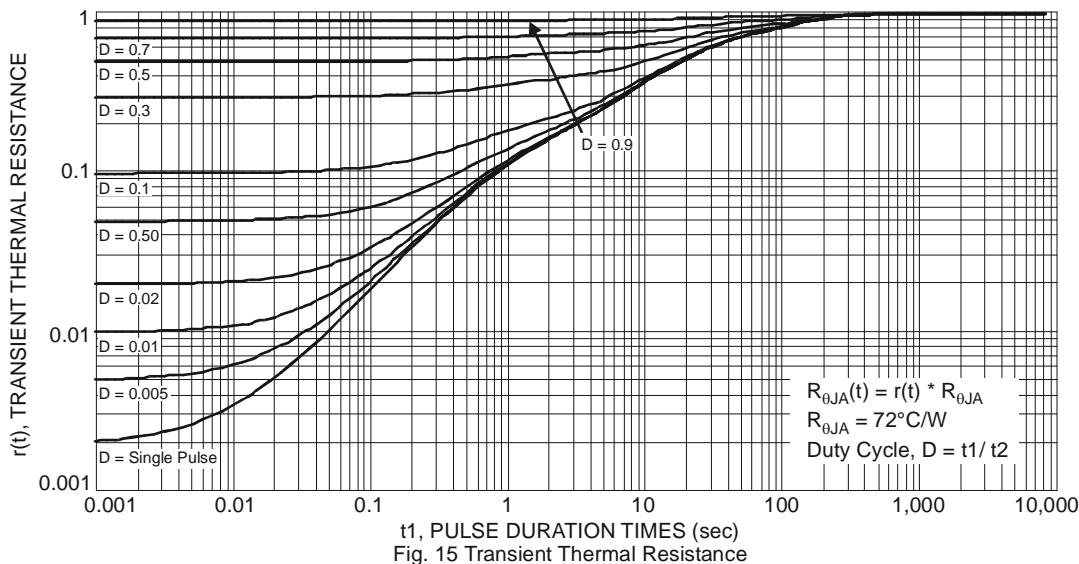
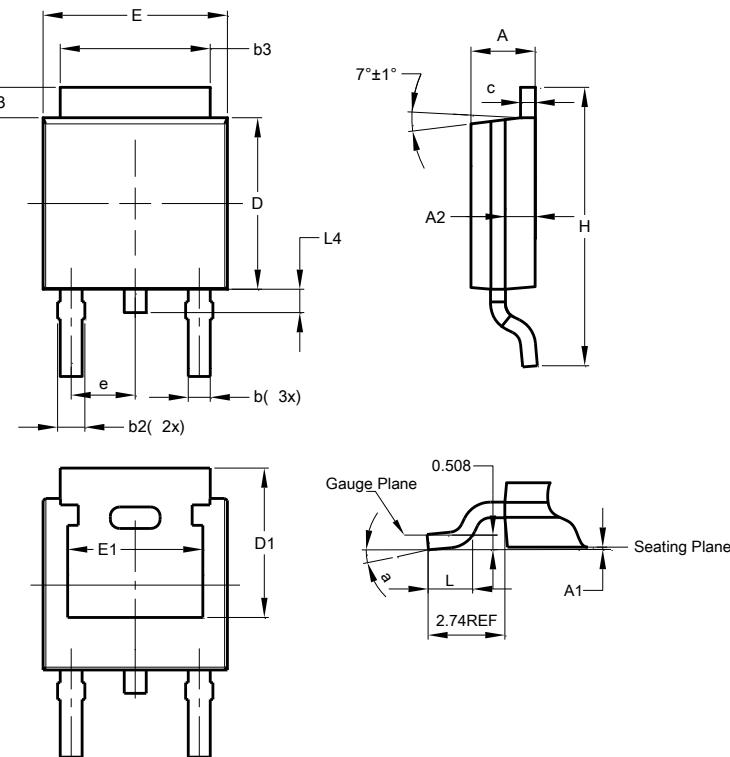


Fig. 15 Transient Thermal Resistance

## Package Outline Dimensions

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

**TO252 (DPAK)**



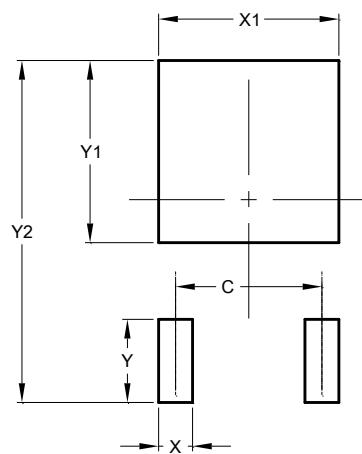
| <b>TO252 (DPAK)</b> |            |            |            |
|---------------------|------------|------------|------------|
| <b>Dim</b>          | <b>Min</b> | <b>Max</b> | <b>Typ</b> |
| <b>A</b>            | 2.19       | 2.39       | 2.29       |
| <b>A1</b>           | 0.00       | 0.13       | 0.08       |
| <b>A2</b>           | 0.97       | 1.17       | 1.07       |
| <b>b</b>            | 0.64       | 0.88       | 0.783      |
| <b>b2</b>           | 0.76       | 1.14       | 0.95       |
| <b>b3</b>           | 5.21       | 5.46       | 5.33       |
| <b>c</b>            | 0.45       | 0.58       | 0.531      |
| <b>D</b>            | 6.00       | 6.20       | 6.10       |
| <b>D1</b>           | 5.21       | —          | —          |
| <b>e</b>            | —          | —          | 2.286      |
| <b>E</b>            | 6.45       | 6.70       | 6.58       |
| <b>E1</b>           | 4.32       | —          | —          |
| <b>H</b>            | 9.40       | 10.41      | 9.91       |
| <b>L</b>            | 1.40       | 1.78       | 1.59       |
| <b>L3</b>           | 0.88       | 1.27       | 1.08       |
| <b>L4</b>           | 0.64       | 1.02       | 0.83       |
| <b>a</b>            | 0°         | 10°        | —          |

**All Dimensions in mm**

## Suggested Pad Layout

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

**TO252 (DPAK)**



| <b>Dimensions</b> | <b>Value (in mm)</b> |
|-------------------|----------------------|
| <b>C</b>          | 4.572                |
| <b>X</b>          | 1.060                |
| <b>X1</b>         | 5.632                |
| <b>Y</b>          | 2.600                |
| <b>Y1</b>         | 5.700                |
| <b>Y2</b>         | 10.700               |

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