# 40V 175°C P-CHANNEL ENHANCEMENT MODE MOSFET

## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ Max | $I_D$ Max $T_C$ = +25°C |
|---|---|---|
| -40V | 26mΩ @ $V_{GS}$ = -10V | -50A |

## Features

- Rated to +175°C — Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switch (UIS) Test in Production
- Low On-Resistance
- Fast Switching Speed
- Low Input/Output Leakage
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The DMPH4023SK3Q is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**
  **https://www.diodes.com/quality/product-definitions/**

## Description and Applications

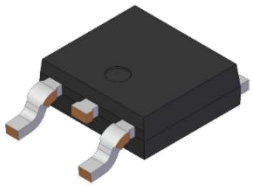
This MOSFET is designed to meet the stringent requirements of automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- Motor control
- Backlighting
- DC-DC converters
- Printer equipment

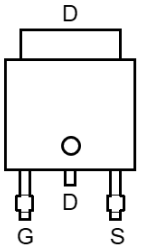
## Mechanical Data

- Package: TO252
- Package 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 208e3
- Weight: 0.33 grams (Approximate)

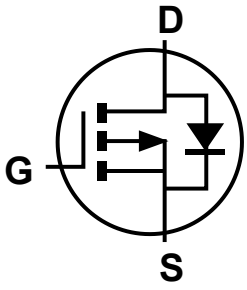
**TO252 (DPAK)**



Top View




Pin Out
Top View



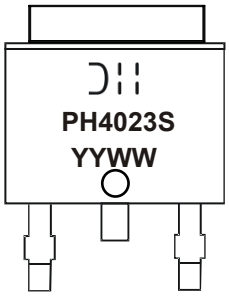

Equivalent Circuit

## Ordering Information (Note 4)

| Orderable Part Number | Package | Packing | |
|---|---|---|---|
| | | Qty. | Carrier |
| DMPH4023SK3Q-13 | TO252 (DPAK) | 2500 | Tape & Reel |

Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
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




= Manufacturer's Marking
PH4023S = Product Type Marking Code
YYWW = Date Code Marking
YY = Last Two Digits of Year (ex: 26 = 2026)
WW = Week Code (01 to 53)


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

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | -40 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current (Note 6) $V_{GS}$ = -10V | $T_C$ = +25°C<br>$T_C$ = +100°C | $I_D$ | -50<br>-35 | A |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) | | $I_{DM}$ | -70 | A |
| Maximum Continuous Body Diode Forward Current (Note 6) | | $I_S$ | -4 | A |
| Pulsed Body Diode Forward Current (10µs Pulse, Duty Cycle = 1%) | | $I_{SM}$ | -70 | A |
| Avalanche Current, L = 0.1mH (Note 7) | | $I_{AS}$ | -40 | A |
| Avalanche Energy, L = 0.1mH (Note 7) | | $E_{AS}$ | 85 | mJ |

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

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Total Power Dissipation (Note 5) | | $P_D$ | 2.1 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State | $R_{\theta JA}$ | 71 | °C/W |
| Total Power Dissipation (Note 6) | | $P_D$ | 3.6 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | $R_{\theta JA}$ | 41 | °C/W |
| Thermal Resistance, Junction to Case | | $R_{\theta JC}$ | 1.5 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +175 | °C |

Notes: 5. Device mounted on FR-4 substrate PCB, 2oz copper, with minimum recommended pad layout.
6. Device mounted on FR-4 substrate PCB, 2oz copper, with 1inch square copper plate.
7. $I_{AS}$ and $E_{AS}$ ratings are based on low frequency and duty cycles to keep $T_J$ = +25°C.


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## 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 | $BV_{DSS}$ | -40 | — | — | V | $V_{GS}$ = 0, $I_D$ = -250µA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | -1 | µA | $V_{DS}$ = -40V, $V_{GS}$ = 0 |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0 |
| **ON CHARACTERISTICS (Note 8)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | -1 | — | -3 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 21 | 26 | mΩ | $V_{GS}$ = -10V, $I_D$ = -10A |
| Diode Forward Voltage | $V_{SD}$ | — | -0.75 | -1.2 | V | $V_{GS}$ = 0, $I_S$ = -1A |
| **DYNAMIC CHARACTERISTICS (Note 9)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 1091 | — | pF | $V_{DS}$ = -20V, $V_{GS}$ = 0, f = 1MHz |
| Output Capacitance | $C_{oss}$ | — | 288 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 111 | — | pF | |
| Gate Resistance | $R_g$ | — | 14 | — | Ω | $V_{DS}$ = 0, $V_{GS}$ = 0, f = 1MHz |
| Total Gate Charge | $Q_g$ | — | 18.7 | — | nC | $V_{DS}$ = -20V, $I_D$ = -10A, $V_{GS}$ = -10V |
| Gate-Source Charge | $Q_{gs}$ | — | 4.2 | — | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 5.0 | — | nC | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 5.3 | — | ns | $V_{DD}$ = -20V, $V_{GS}$ = -10V, $R_G$ = 6Ω, $I_D$ = -10A |
| Turn-On Rise Time | $t_R$ | — | 4.8 | — | ns | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 30.7 | — | ns | |
| Turn-Off Fall Time | $t_F$ | — | 23.4 | — | ns | |
| Reverse-Recovery Time | $t_{RR}$ | — | 17.8 | — | ns | $I_F$ = -10A, di/dt = -100A/µs |
| Reverse-Recovery Charge | $Q_{RR}$ | — | 9.2 | — | nC | |

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


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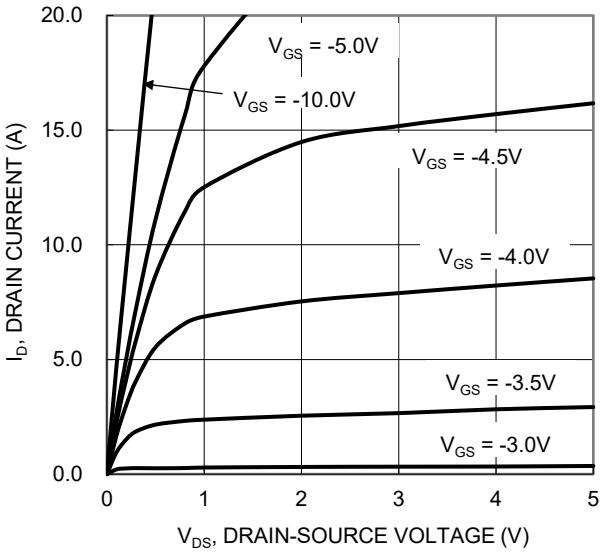



Figure 1. Typical Output Characteristic

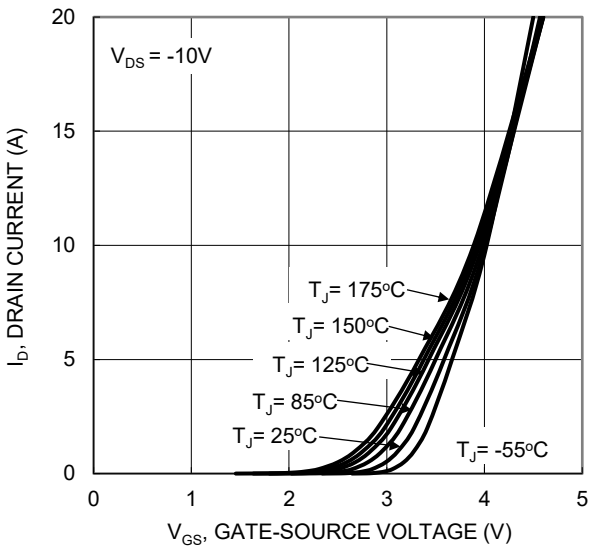



Figure 2. Typical Transfer Characteristic

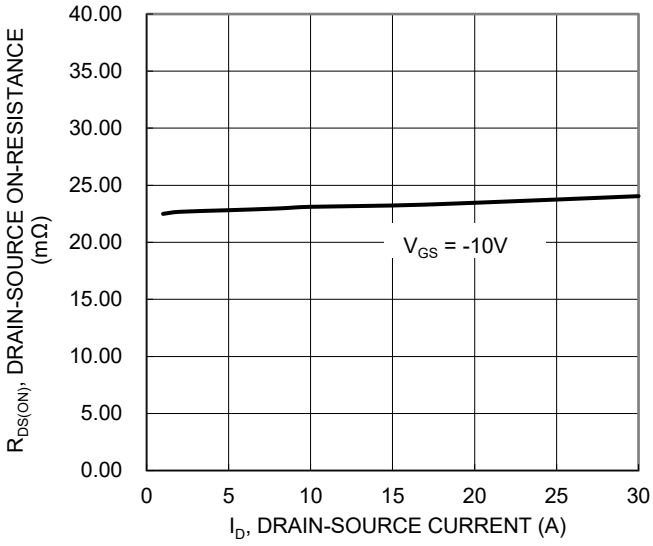



Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

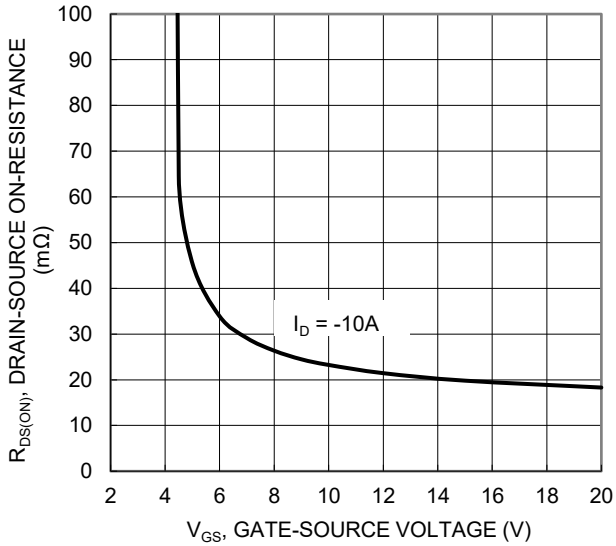



Figure 4. Typical Transfer Characteristic

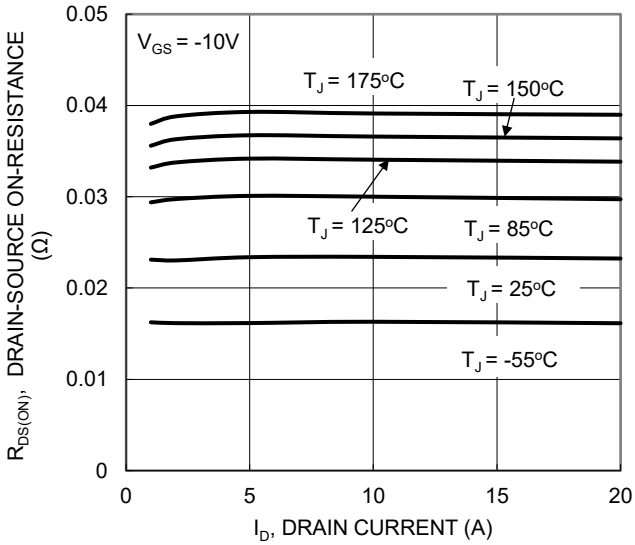



Figure 5. Typical On-Resistance vs. Drain Current and Temperature

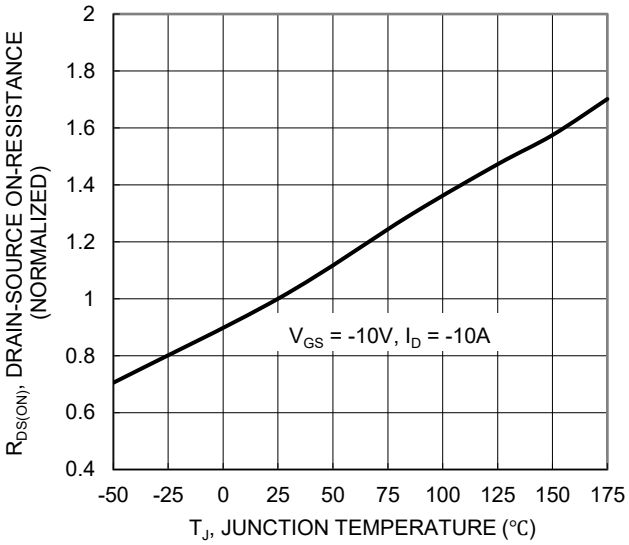



Figure 6. On-Resistance Variation with Junction Temperature


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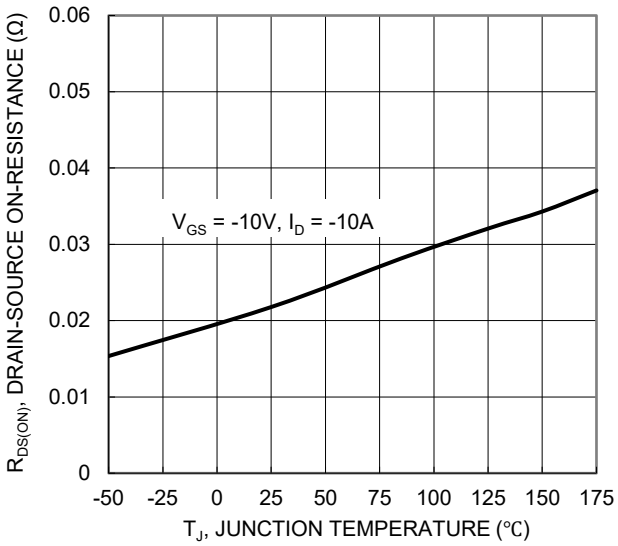



Figure 7. On-Resistance Variation with Junction Temperature

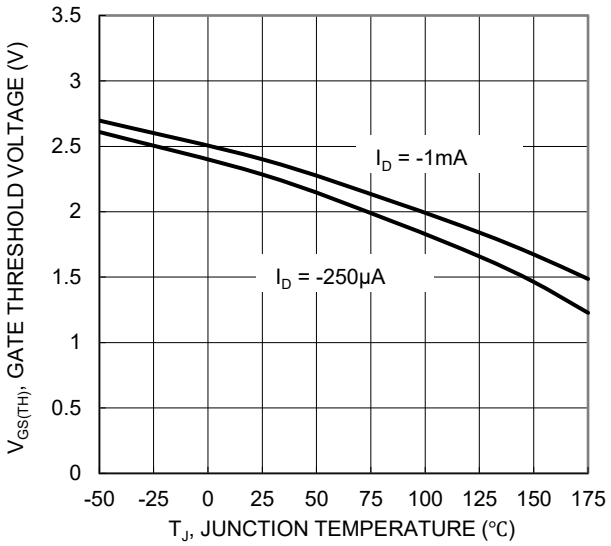



Figure 8. Gate Threshold Variation vs. Junction Temperature

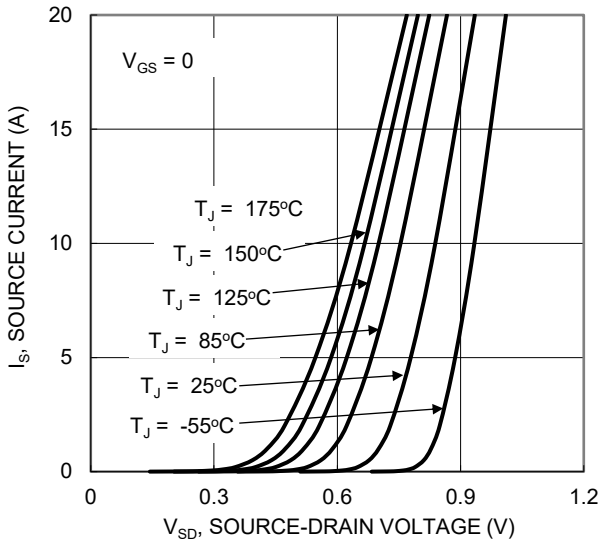



Figure 9. Diode Forward Voltage vs. Current

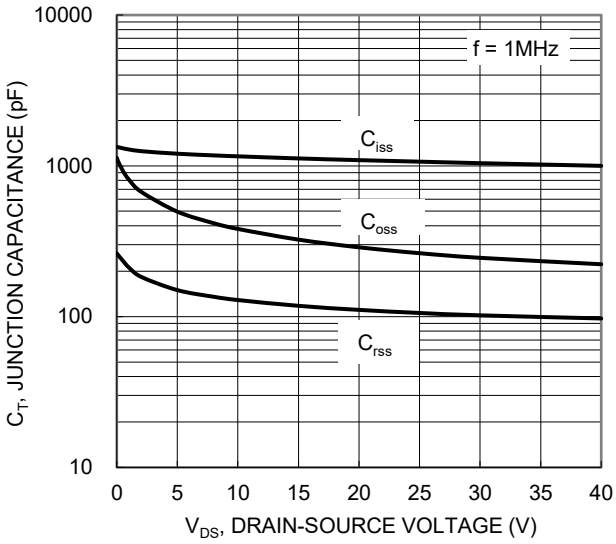



Figure 10. Typical Junction Capacitance

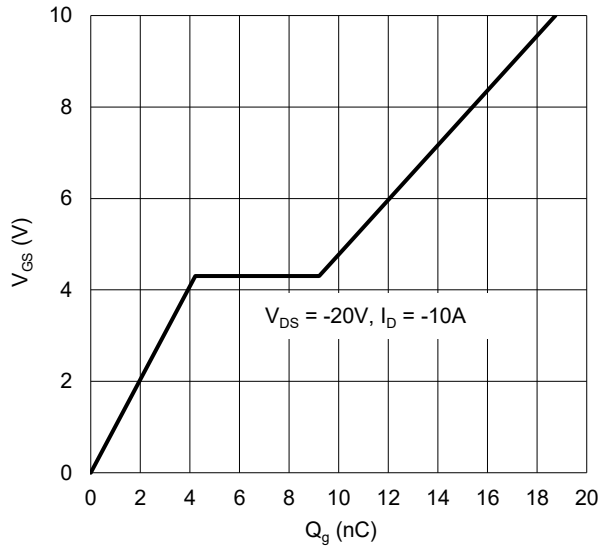



Figure 11. Gate Charge

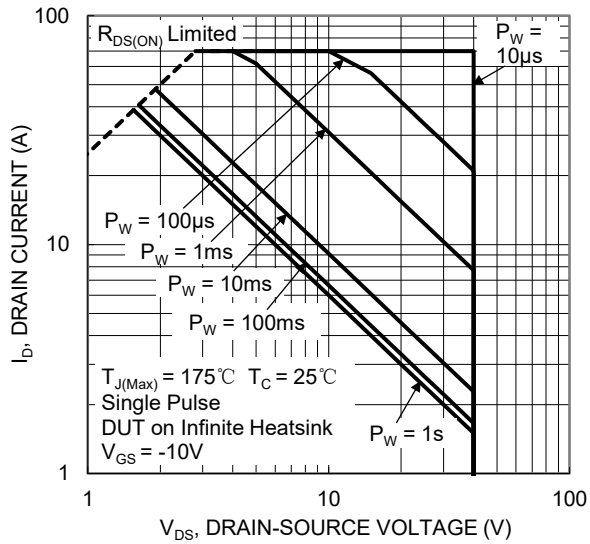



Figure 12. SOA, Safe Operation Area


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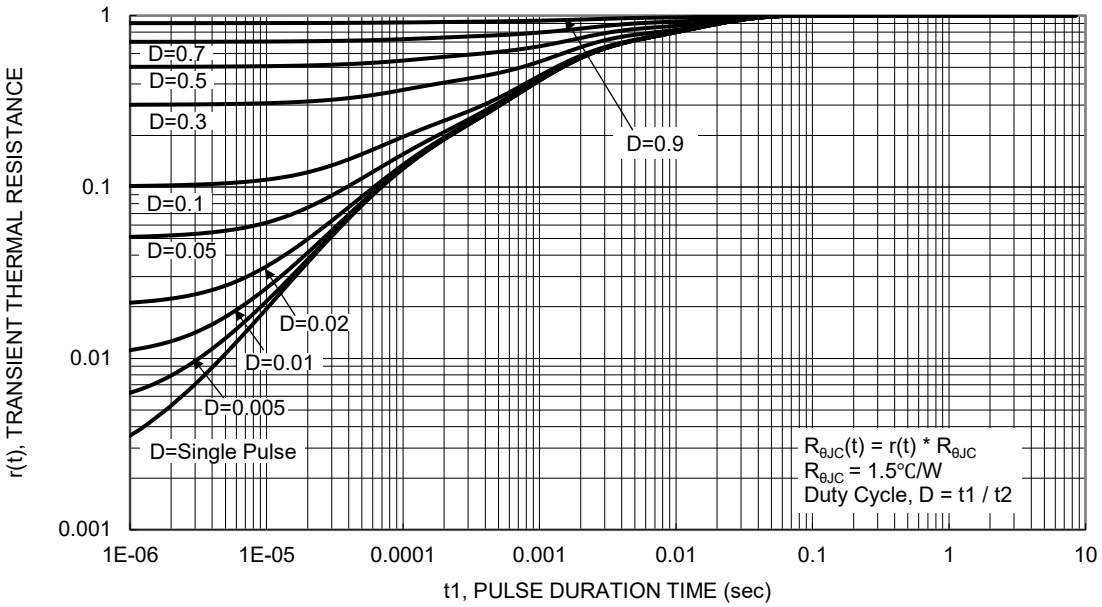


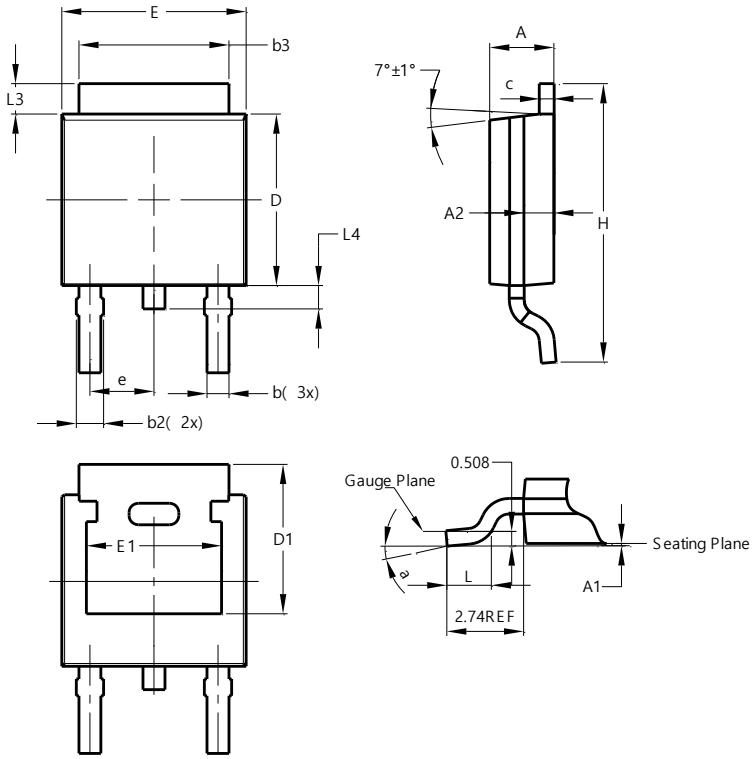

Figure 13. Transient Thermal Resistance


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## Package Outline Dimensions

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

**TO252 (DPAK)**

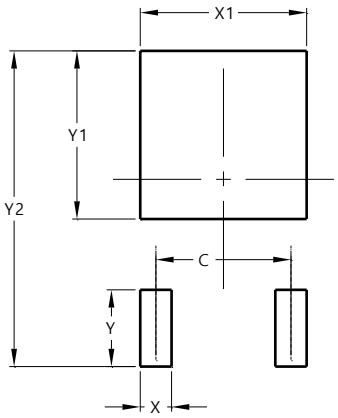



| TO252 (DPAK) | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 2.19 | 2.39 | 2.29 |
| **A1** | 0.00 | 0.13 | 0.08 |
| **A2** | 0.97 | 1.17 | 1.07 |
| **b** | 0.64 | 0.88 | 0.783 |
| **b2** | 0.76 | 1.14 | 0.95 |
| **b3** | 5.21 | 5.50 | 5.33 |
| **c** | 0.45 | 0.58 | 0.531 |
| **D** | 6.00 | 6.20 | 6.10 |
| **D1** | 5.21 | -- | -- |
| **e** | 2.286 BSC | | |
| **E** | 6.45 | 6.70 | 6.58 |
| **E1** | 4.32 | -- | -- |
| **H** | 9.40 | 10.41 | 9.91 |
| **L** | 1.40 | 1.78 | 1.59 |
| **L3** | 0.88 | 1.27 | 1.08 |
| **L4** | 0.64 | 1.02 | 0.83 |
| **a** | 0° | 10° | -- |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

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

**TO252 (DPAK)**




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


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