

## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ Max              | $Q_G$ Typ | $I_D$ Max<br>$T_C = +25^\circ\text{C}$<br>(Note 10) |
|------------|-------------------------------|-----------|-----------------------------------------------------|
| 60V        | 3.8mΩ @ $V_{GS} = 10\text{V}$ | 95.4nC    | 100A                                                |

## Features

- Rated to  $+175^\circ\text{C}$  – Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switching – Ensures More Reliable and Robust End Application
- Low  $R_{DS(ON)}$  – Minimizes Power Losses
- Low  $Q_G$  – Minimizes Switching Losses
- 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)**

## Description and Applications

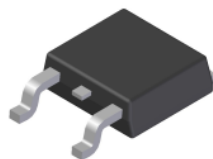
This MOSFET is designed to meet the stringent requirements of automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- Engine Management Systems
- Body Control Electronics
- DC-DC Converters
- Motor Control

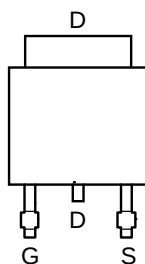
## Mechanical Data

- Case: TO252 (DPAK)
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (E3)
- Weight: 0.33 grams (Approximate)

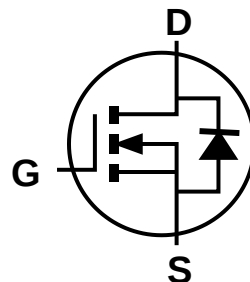
TO252 (DPAK)



Top View



Top View Pin Out



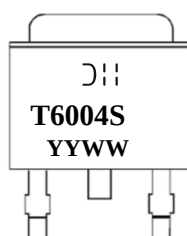
Internal Schematic

## Ordering Information (Note 5)

| Part Number     | Case         | Packaging         |
|-----------------|--------------|-------------------|
| DMTH6004SK3Q-13 | TO252 (DPAK) | 2,500/Tape & Reel |

- Notes:
- EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
  - 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.
  - Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  - Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to [http://www.diodes.com/product\\_compliance\\_definitions.html](http://www.diodes.com/product_compliance_definitions.html).
  - For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



**DII** = Manufacturer's Marking  
**T6004S** = Product Type Marking Code  
**YYWW** = Date Code Marking  
 YY = Last Two Digits of Year (ex: 16 = 2016)  
 WW = Week Code (01 to 53)

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                                     | Symbol           | Value     | Unit |
|----------------------------------------------------|------------------|-----------|------|
| Drain-Source Voltage                               | V <sub>DSS</sub> | 60        | V    |
| Gate-Source Voltage                                | V <sub>GSS</sub> | ±20       | V    |
| Continuous Drain Current (Note 7)                  | I <sub>D</sub>   | 100<br>75 | A    |
| Maximum Body Diode Forward Current (Note 7)        | I <sub>S</sub>   | 100       | A    |
| Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%) | I <sub>DM</sub>  | 150       | A    |
| Avalanche Current, L = 0.2mH                       | I <sub>AS</sub>  | 45        | A    |
| Avalanche Energy, L = 0.2mH                        | E <sub>AS</sub>  | 200       | mJ   |

**Thermal Characteristics**

| Characteristic                                   | Symbol                            | Value       | Unit |
|--------------------------------------------------|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 6)                 | P <sub>D</sub>                    | 3.9         | W    |
| Thermal Resistance, Junction to Ambient (Note 6) | R <sub>θJA</sub>                  | 38          | °C/W |
| Total Power Dissipation (Note 7)                 | P <sub>D</sub>                    | 180         | W    |
| Thermal Resistance, Junction to Case (Note 7)    | R <sub>θJC</sub>                  | 0.8         | °C/W |
| Operating and Storage Temperature Range          | T <sub>J</sub> , T <sub>STG</sub> | -55 to +175 | °C   |

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                          | Symbol              | Min | Typ   | Max  | Unit | Test Condition                                                                            |
|-----------------------------------------|---------------------|-----|-------|------|------|-------------------------------------------------------------------------------------------|
| <b>OFF CHARACTERISTICS (Note 8)</b>     |                     |     |       |      |      |                                                                                           |
| Drain-Source Breakdown Voltage          | BV <sub>DSS</sub>   | 60  | —     | —    | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = 1mA                                                |
| Zero Gate Voltage Drain Current         | I <sub>DSS</sub>    | —   | —     | 1    | μA   | V <sub>DS</sub> = 48V, V <sub>GS</sub> = 0V                                               |
| Gate-Source Leakage                     | I <sub>GSS</sub>    | —   | —     | ±100 | nA   | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V                                              |
| <b>ON CHARACTERISTICS (Note 8)</b>      |                     |     |       |      |      |                                                                                           |
| Gate Threshold Voltage                  | V <sub>GS(TH)</sub> | 2   | —     | 4    | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                |
| Static Drain-Source On-Resistance       | R <sub>DS(ON)</sub> | —   | 3     | 3.8  | mΩ   | V <sub>GS</sub> = 10V, I <sub>D</sub> = 90A                                               |
| Diode Forward Voltage                   | V <sub>SD</sub>     | —   | 0.9   | 1.2  | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 20A                                                |
| <b>DYNAMIC CHARACTERISTICS (Note 9)</b> |                     |     |       |      |      |                                                                                           |
| Input Capacitance                       | C <sub>ISS</sub>    | —   | 4,556 | —    | pF   | V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V, f = 1MHz                                     |
| Output Capacitance                      | C <sub>OSS</sub>    | —   | 1,383 | —    |      |                                                                                           |
| Reverse Transfer Capacitance            | C <sub>RSS</sub>    | —   | 105.2 | —    |      |                                                                                           |
| Gate Resistance                         | R <sub>G</sub>      | —   | 0.66  | —    | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz                                      |
| Total Gate Charge                       | Q <sub>G</sub>      | —   | 95.4  | —    | nC   | V <sub>DS</sub> = 30V, I <sub>D</sub> = 90A, V <sub>GS</sub> = 10V                        |
| Gate-Source Charge                      | Q <sub>GS</sub>     | —   | 21.6  | —    |      |                                                                                           |
| Gate-Drain Charge                       | Q <sub>GD</sub>     | —   | 20.4  | —    |      |                                                                                           |
| Turn-On Delay Time                      | t <sub>D(ON)</sub>  | —   | 13.2  | —    | ns   | V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V, I <sub>D</sub> = 90A, R <sub>G</sub> = 3.5Ω |
| Turn-On Rise Time                       | t <sub>R</sub>      | —   | 11.7  | —    |      |                                                                                           |
| Turn-Off Delay Time                     | t <sub>D(OFF)</sub> | —   | 31    | —    |      |                                                                                           |
| Turn-Off Fall Time                      | t <sub>F</sub>      | —   | 12    | —    |      |                                                                                           |
| Body Diode Reverse Recovery Time        | t <sub>RR</sub>     | —   | 50.5  | —    | ns   | I <sub>F</sub> = 50A, di/dt = 100A/μs                                                     |
| Body Diode Reverse Recovery Charge      | Q <sub>RR</sub>     | —   | 80.8  | —    | nC   |                                                                                           |

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper pad layout.
  - Thermal resistance from junction to soldering point (on the exposed drain pad).
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to production testing.
  - Package limited.

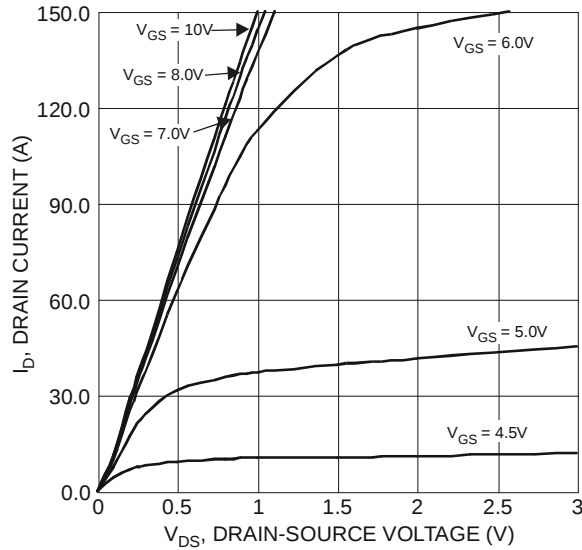


Figure 1 Typical Output Characteristics

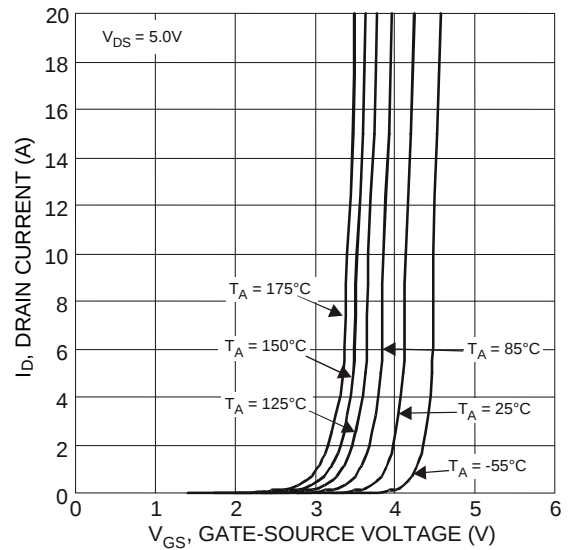


Figure 2 Typical Transfer Characteristics

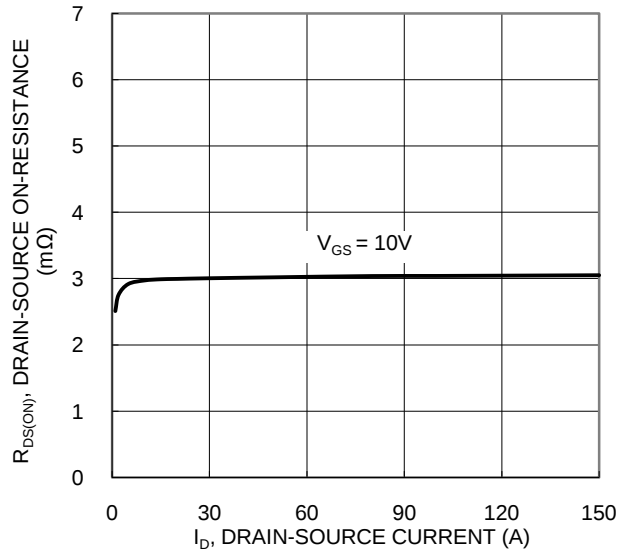


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

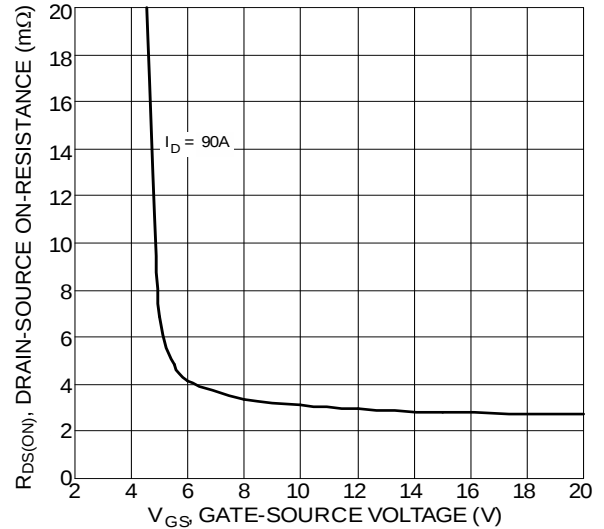


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

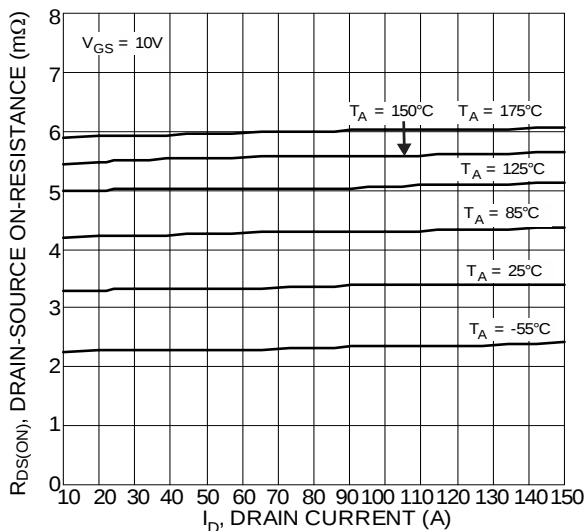


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

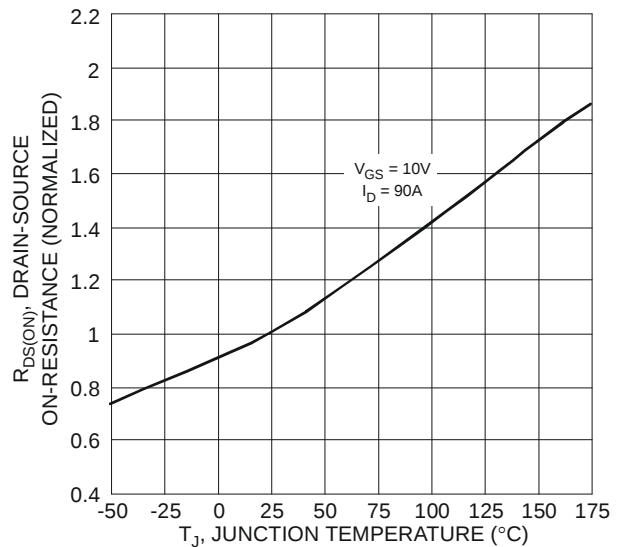
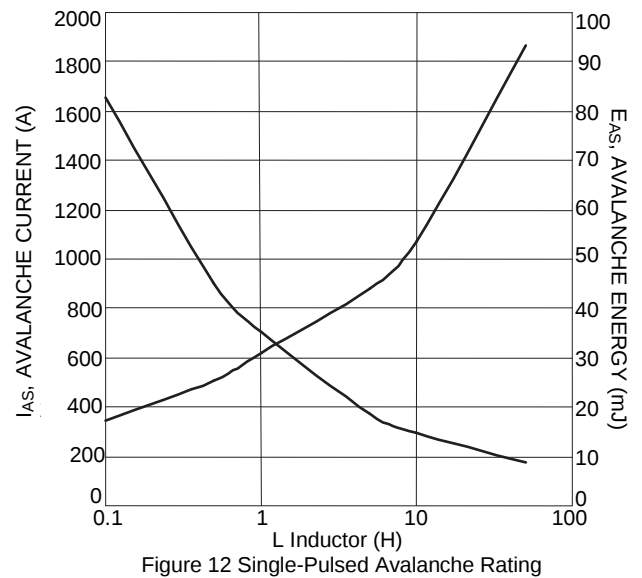
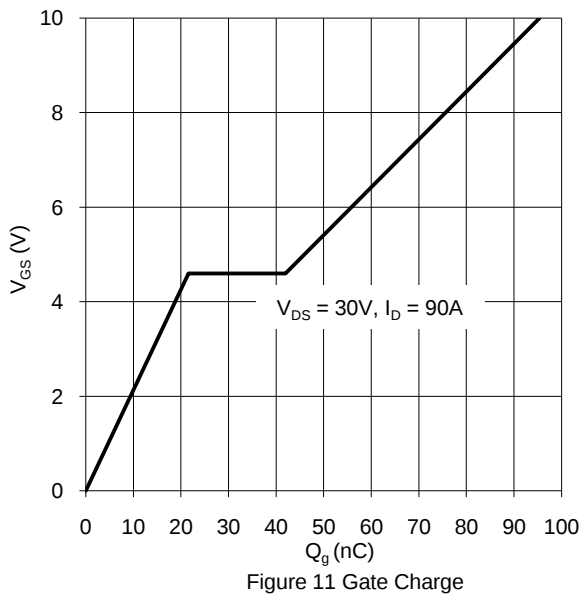
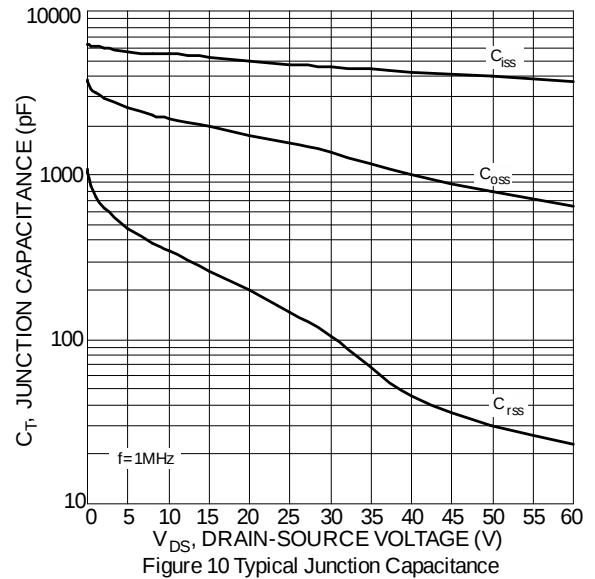
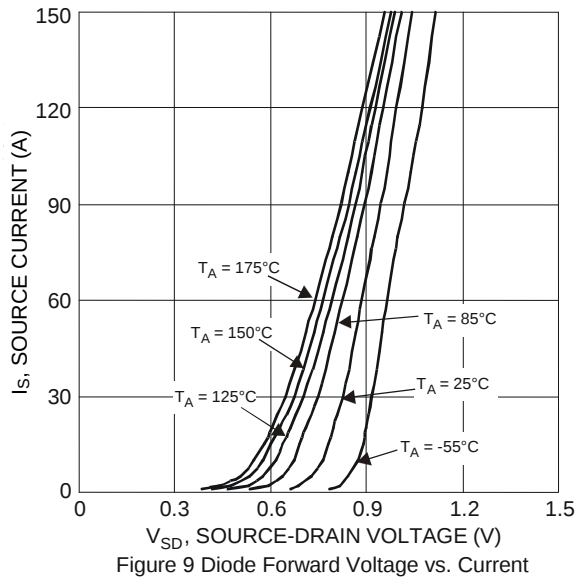
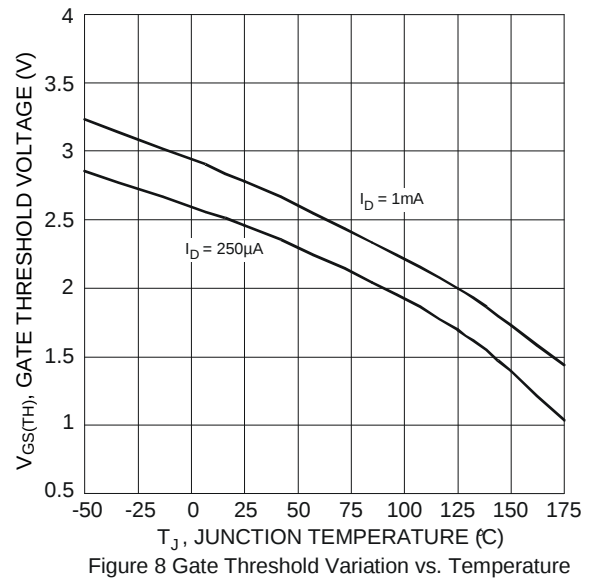
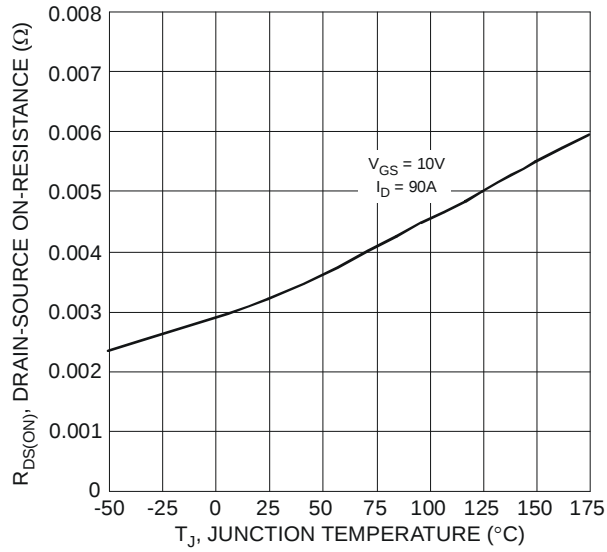


Figure 6 On-Resistance Variation with Temperature



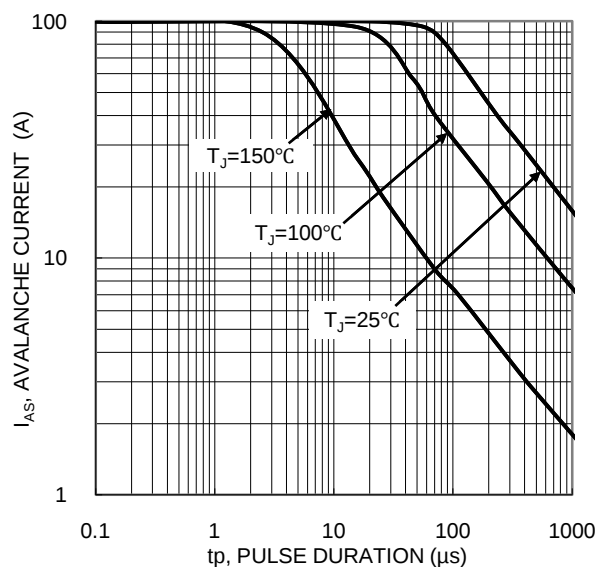


Figure 13 Avalanche Current vs. Pulse Duration

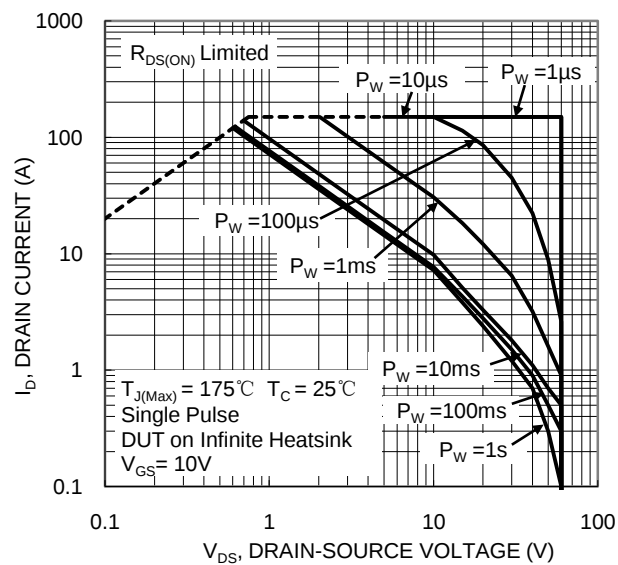


Figure 14 SOA, Safe Operation Area

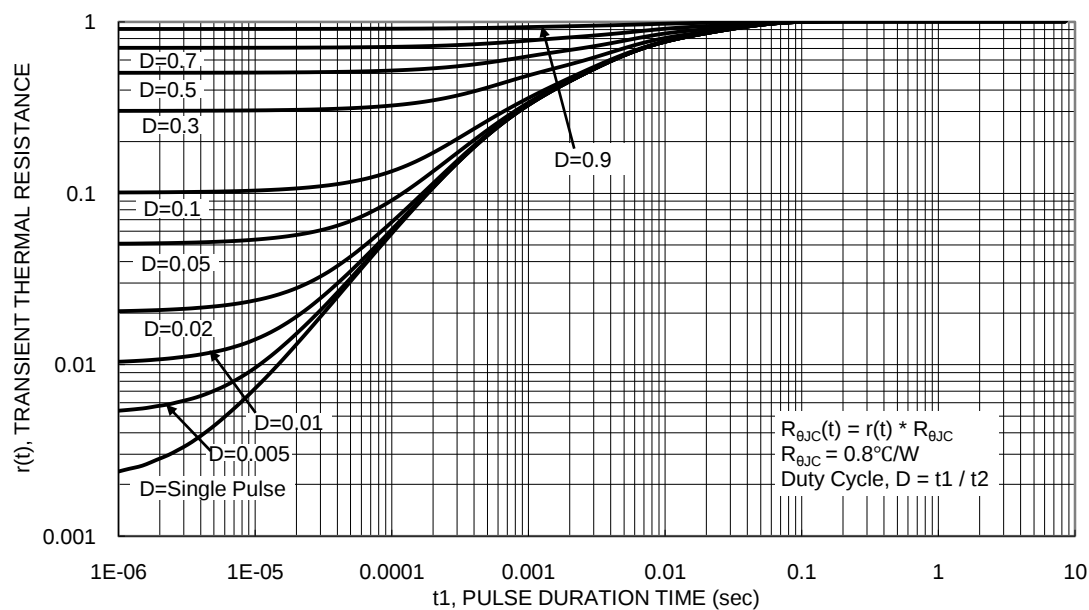
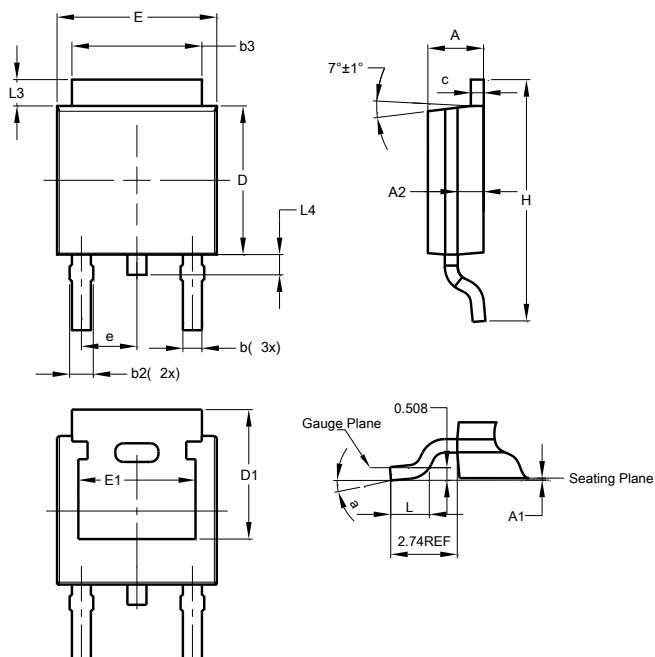


Figure 15 Transient Thermal Resistance

## Package Outline Dimensions

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

### TO252 (DPAK)

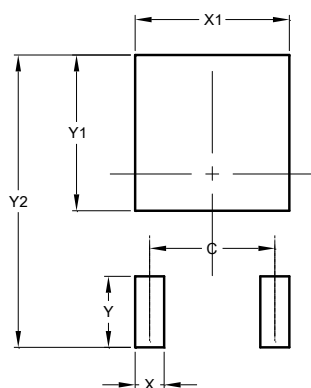


| TO252 (DPAK)         |      |       |       |
|----------------------|------|-------|-------|
| Dim                  | Min  | Max   | Typ   |
| A                    | 2.19 | 2.39  | 2.29  |
| A1                   | 0.00 | 0.13  | 0.08  |
| A2                   | 0.97 | 1.17  | 1.07  |
| b                    | 0.64 | 0.88  | 0.783 |
| b2                   | 0.76 | 1.14  | 0.95  |
| b3                   | 5.21 | 5.46  | 5.33  |
| c                    | 0.45 | 0.58  | 0.531 |
| D                    | 6.00 | 6.20  | 6.10  |
| D1                   | 5.21 | —     | —     |
| e                    | —    | —     | 2.286 |
| 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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