

Product Summary

| BV _{DSS} | R _{DS(ON)} Max | Qg Typ | I _D T _C = +25°C (Note 9) |
|-------------------|-------------------------------|--------|--|
| 40V | 3.2mΩ @ V _{GS} = 10V | 68.6nC | 100A |

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

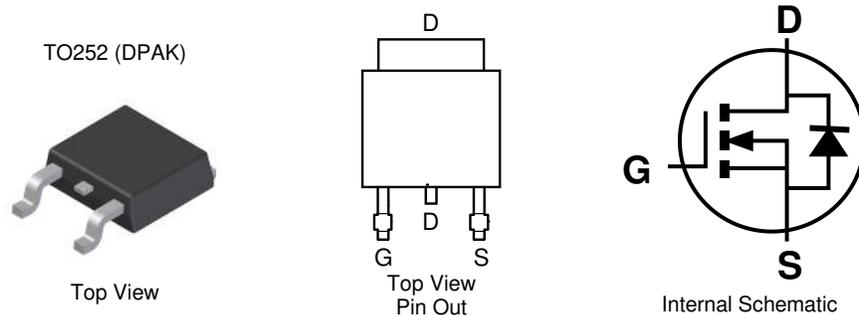
Features

- Rated to +175°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 Qg – Minimizes Switching Losses
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. “Green” Device (Note 3)**
- **The DIODES™ DMTH4004SK3Q 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/>

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

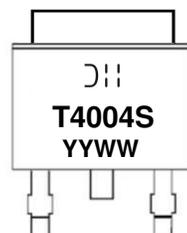


Ordering Information (Note 4)

| Part Number | Package | Packing | |
|-----------------|--------------|---------|-------------|
| | | Qty. | Carrier |
| DMTH4004SK3Q-13 | TO252 (DPAK) | 2,500 | 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
 T4004S = Product Type Marking Code
 YYWW = Date Code Marking
 YY = Last Two Digits of Year (ex: 22 = 2022)
 WW = Week Code (01 to 53)

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) | I _D | T _C = +25°C (Note 9) | 100 |
| | | T _C = +100°C | 100 |
| Maximum Body Diode Forward Current (Note 6) | I _S | 100 | A |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) | I _{DM} | 160 | A |
| Avalanche Current, L=0.2mH | I _{AS} | 40 | A |
| Avalanche Energy, L=0.2mH | E _{AS} | 160 | mJ |

Thermal Characteristics

| Characteristic | Symbol | Value | Unit |
|--|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 5) | P _D | 3.9 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | R _{θJA} | 38 | °C/W |
| Total Power Dissipation (Note 6) | P _D | 180 | W |
| Thermal Resistance, Junction to Case (Note 6) | R _{θJC} | 0.8 | °C/W |
| Operating and Storage Temperature Range | T _J , T _{STG} | -55 to +175 | °C |

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---------------------|-----|-------|------|------|---|
| OFF CHARACTERISTICS (Note 7) | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | 40 | — | — | V | V _{GS} = 0V, I _D = 1mA |
| Zero Gate Voltage Drain Current | I _{DSS} | — | — | 1 | µA | V _{DS} = 32V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | ±100 | nA | V _{GS} = ±20V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 7) | | | | | | |
| Gate Threshold Voltage | V _{GS(TH)} | 2 | — | 4 | V | V _{DS} = V _{GS} , I _D = 250µA |
| Static Drain-Source On-Resistance | R _{DS(ON)} | — | 2.6 | 3.2 | mΩ | V _{GS} = 10V, I _D = 90A |
| Diode Forward Voltage | V _{SD} | — | 0.9 | 1.2 | V | V _{GS} = 0V, I _S = 20A |
| DYNAMIC CHARACTERISTICS (Note 8) | | | | | | |
| Input Capacitance | C _{iss} | — | 4,305 | — | pF | V _{DS} = 25V, V _{GS} = 0V, f = 1MHz |
| Output Capacitance | C _{oss} | — | 1,441 | — | | |
| Reverse Transfer Capacitance | C _{rss} | — | 102 | — | | |
| Gate Resistance | R _G | — | 0.77 | — | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1MHz |
| Total Gate Charge | Q _g | — | 68.6 | — | nC | V _{DS} = 20V, I _D = 90A, V _{GS} = 10V |
| Gate-Source Charge | Q _{gs} | — | 16.8 | — | | |
| Gate-Drain Charge | Q _{gd} | — | 14.2 | — | | |
| Turn-On Delay Time | t _{D(ON)} | — | 9.5 | — | ns | V _{DD} = 20V, V _{GS} = 10V, I _D = 90A, R _G = 3.5Ω |
| Turn-On Rise Time | t _R | — | 6.7 | — | | |
| Turn-Off Delay Time | t _{D(OFF)} | — | 26.4 | — | | |
| Turn-Off Fall Time | t _F | — | 8.1 | — | | |
| Body Diode Reverse Recovery Time | t _{RR} | — | 52.4 | — | ns | I _F = 50A, di/dt = 100A/µs |
| Body Diode Reverse Recovery Charge | Q _{RR} | — | 78.2 | — | nC | |

- Notes:
- Device mounted with exposed drain pad on 25mm by 25mm 2oz copper on a single-sided 1.6mm FR-4 PCB; device is measured under still air conditions whilst operating in a steady state.
 - Thermal resistance from junction to solder point (on the exposed drain pin).
 - Short duration pulse test used to minimize self-heating effect.
 - Guaranteed by design. Not subject to production testing.
 - Package limited.

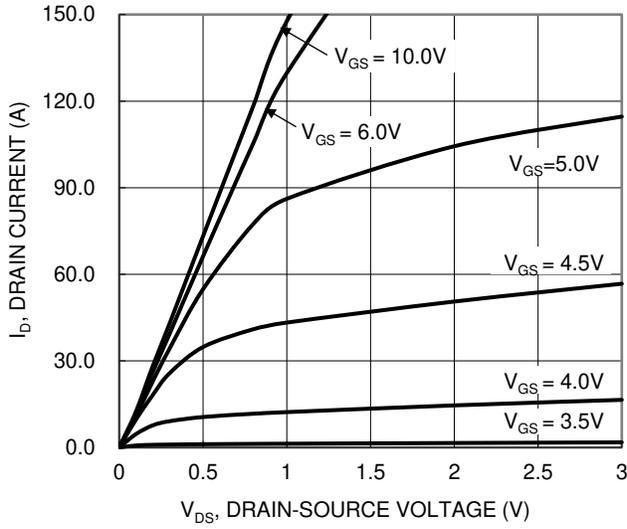


Figure 1. Typical Output Characteristic

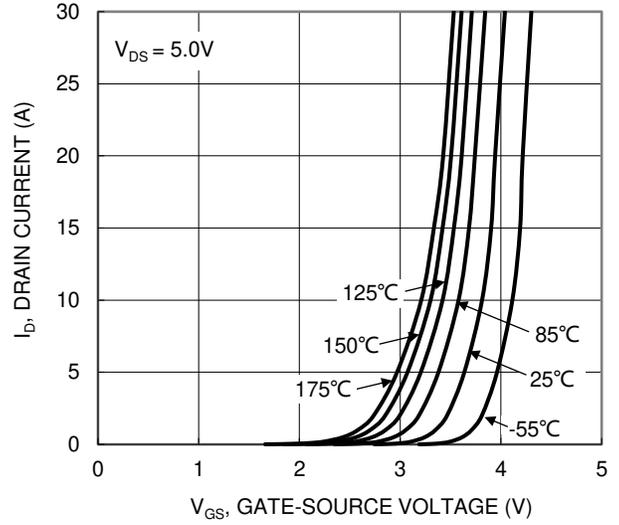


Figure 2. Typical Transfer Characteristic

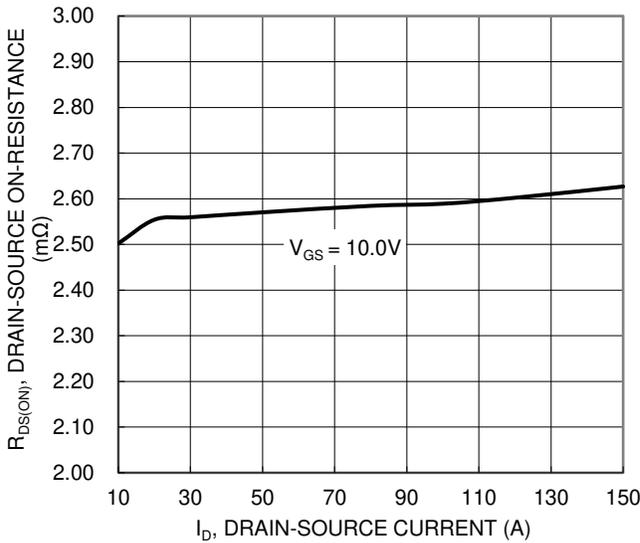


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

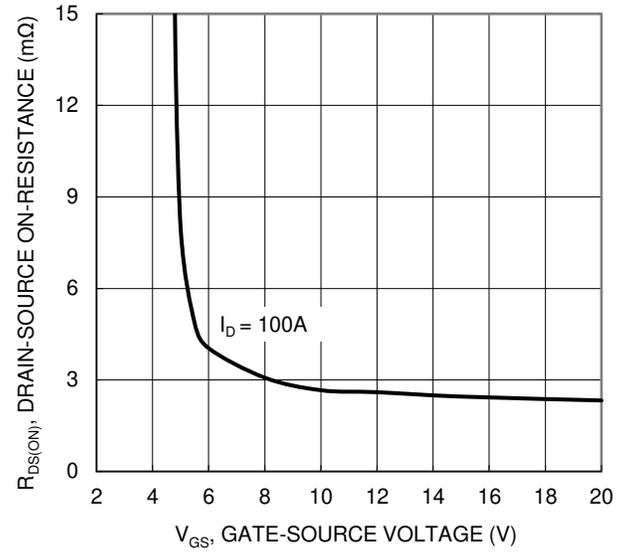


Figure 4. Typical Transfer Characteristic

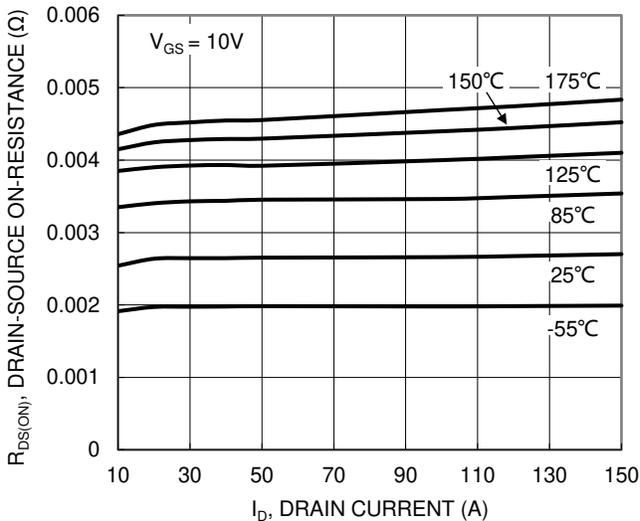


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

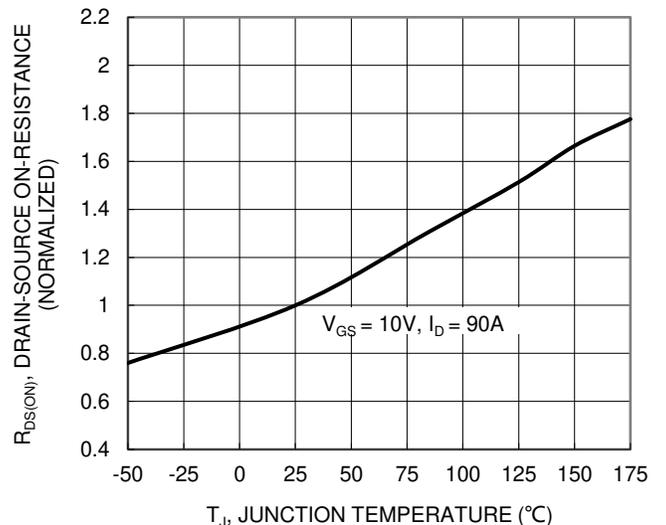


Figure 6. On-Resistance Variation with Temperature

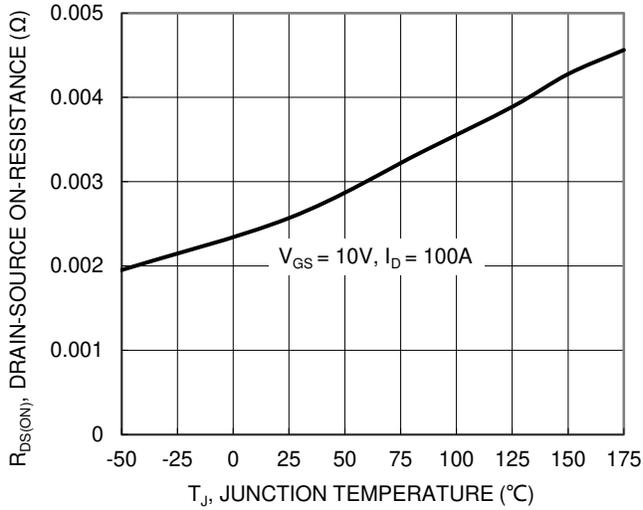


Figure 7. On-Resistance Variation with Temperature

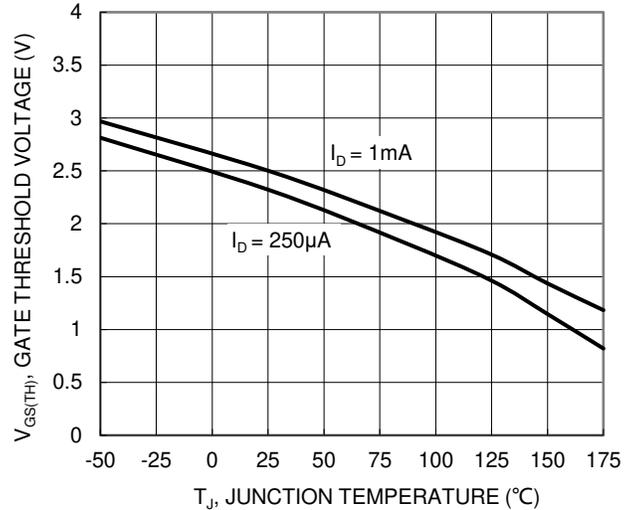


Figure 8. Gate Threshold Variation vs. Temperature

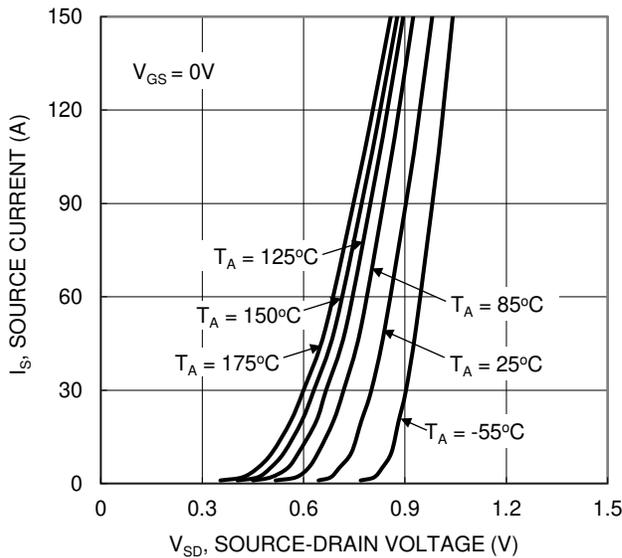


Figure 9. Diode Forward Voltage vs. Current

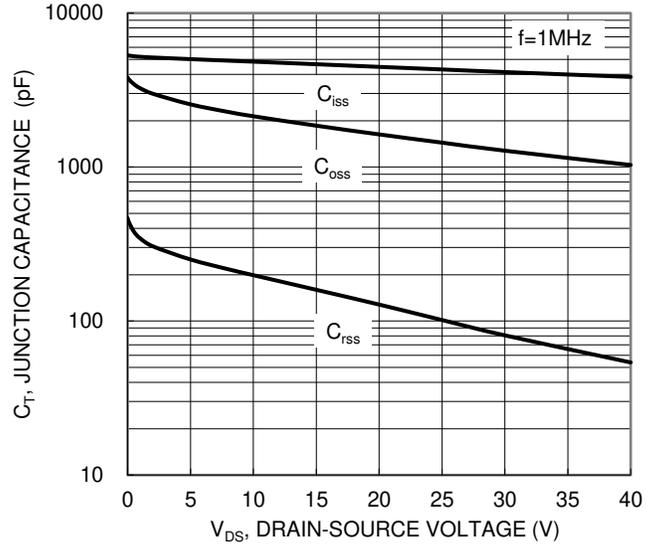


Figure 10. Typical Junction Capacitance

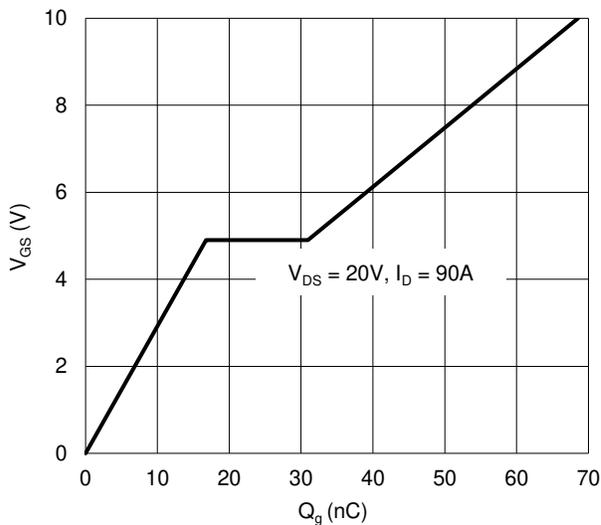


Figure 11. Gate Charge

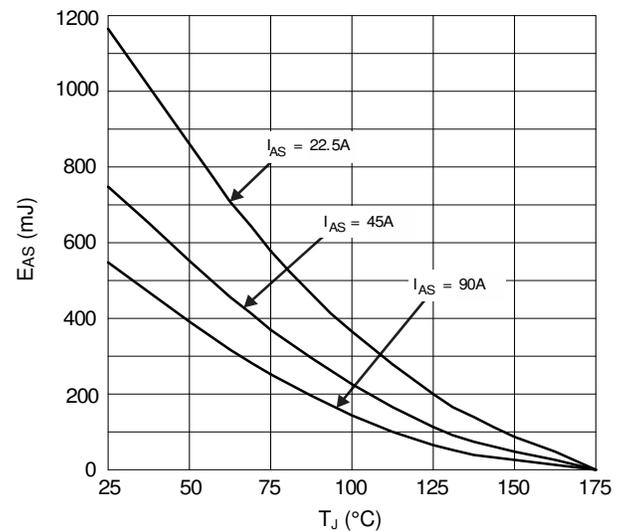
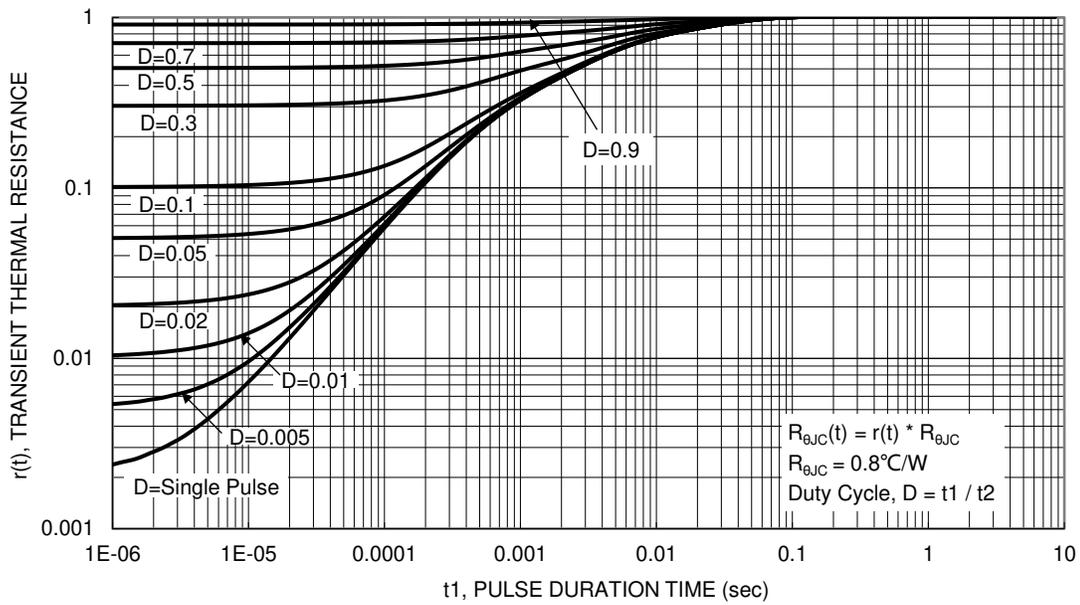
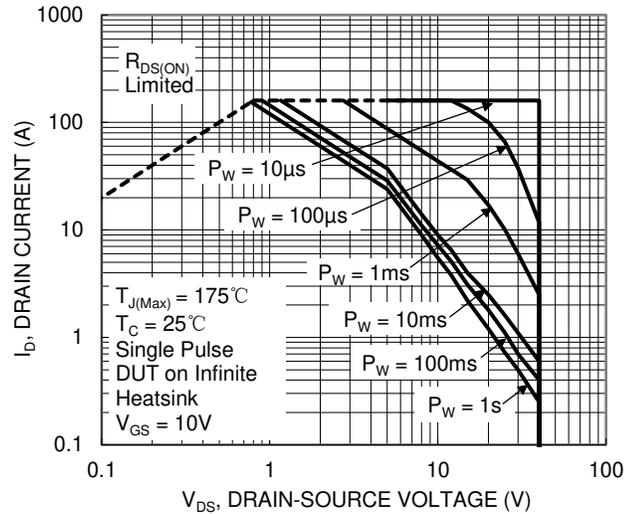


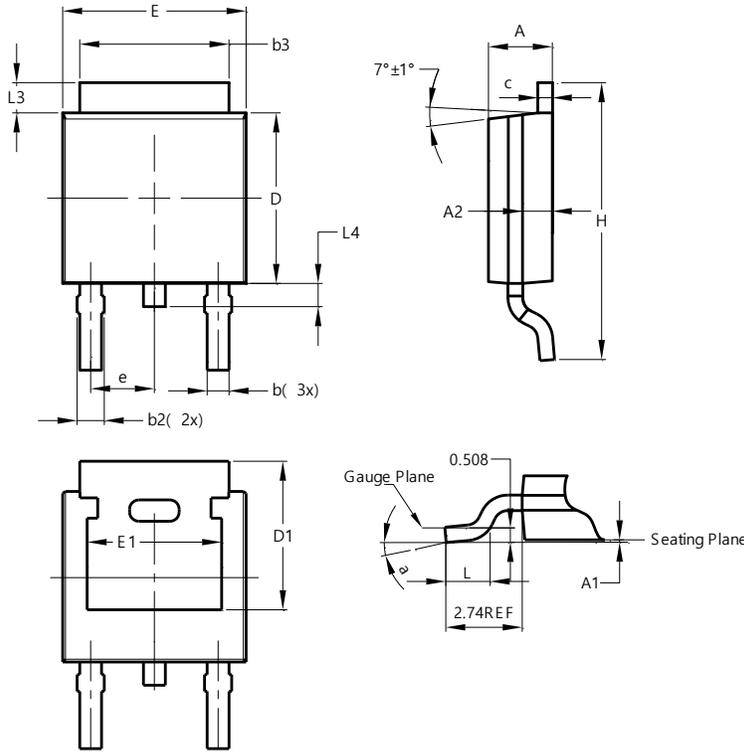
Figure 12. E_{AS} vs T_J



Package Outline Dimensions

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

TO252 (DPAK)

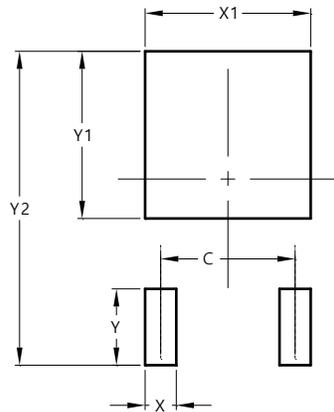


| TO252 (DPAK) | | | |
|-----------------------------|-----------|-------|-------|
| Dim | Min | Max | Typ |
| A | 2.19 | 2.39 | 2.29 |
| A1 | 0.00 | 0.13 | 0.08 |
| A2 | 0.97 | 1.17 | 1.07 |
| b | 0.64 | 0.88 | 0.783 |
| b2 | 0.76 | 1.14 | 0.95 |
| b3 | 5.21 | 5.50 | 5.33 |
| c | 0.45 | 0.58 | 0.531 |
| 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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