

## Product Summary

| BV <sub>DSS</sub> | R <sub>DS(ON)</sub> Max         | I <sub>D</sub> Max<br>T <sub>C</sub> = +25°C |
|-------------------|---------------------------------|----------------------------------------------|
| 60V               | 10mΩ @ V <sub>GS</sub> = 10V    | 59A                                          |
|                   | 12.8mΩ @ V <sub>GS</sub> = 4.5V | 52A                                          |

## 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:

- Power Management Functions
- DC-DC Converters
- Backlighting

## Features

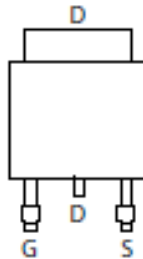
- Rated to +175°C – ideal for high ambient temperature environments
- Low R<sub>DS(ON)</sub> – Ensures On State Losses Are Minimized
- Excellent Q<sub>gd</sub> x R<sub>DS(ON)</sub> Product (FOM)
- Advanced Technology for DC/DC Converters
- Small Form Factor Thermally Efficient Package Enables Higher Density End Products
- **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

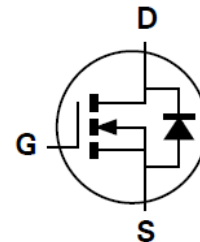
- Case: TO252
- Case Material: Molded Plastic, "Green" Molding Compound.
- UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Finish - Matte Tin Annealed over Copper Leadframe; Solderable per MIL-STD-202, Method 208 @3
- Weight: 0.33 grams (Approximate)



Top View



Pin Out Top View



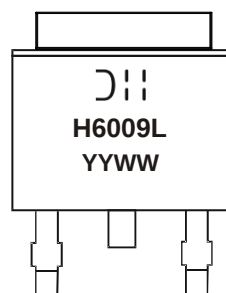
Equivalent Circuit

## Ordering Information (Note 5)

| Part Number     | Case  | Packaging         |
|-----------------|-------|-------------------|
| DMTH6009LK3Q-13 | TO252 | 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. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to [http://www.diodes.com/quality/product\\_grade\\_definitions/](http://www.diodes.com/quality/product_grade_definitions/).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



DII = Manufacturer's Marking  
 H6009L = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Last Two Digits of Year (ex: 15 = 2015)  
 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 6) V <sub>GS</sub> = 10V | I <sub>D</sub>   | 14.2<br>11.9 | A    |
| Continuous Drain Current (Note 7) V <sub>GS</sub> = 10V | I <sub>D</sub>   | 59<br>49     | A    |
| Maximum Continuous Body Diode Forward Current (Note 7)  | I <sub>S</sub>   | 80           | A    |
| Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%)      | I <sub>DM</sub>  | 90           | A    |
| Avalanche Current, L=0.1mH                              | I <sub>AS</sub>  | 20.3         | A    |
| Avalanche Energy, L=0.1mH                               | E <sub>AS</sub>  | 20.6         | mJ   |

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

| Characteristic                                   | Symbol                            | Value       | Unit |
|--------------------------------------------------|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 6)                 | P <sub>D</sub>                    | 3.2         | W    |
| Thermal Resistance, Junction to Ambient (Note 6) | R <sub>θJA</sub>                  | 47          | °C/W |
| Total Power Dissipation (Note 7)                 | P <sub>D</sub>                    | 60          | W    |
| Thermal Resistance, Junction to Case (Note 7)    | R <sub>θJC</sub>                  | 2.5         | °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> = ±16V, V <sub>DS</sub> = 0V                                                 |
| <b>ON CHARACTERISTICS (Note 8)</b>         |                     |     |       |      |      |                                                                                              |
| Gate Threshold Voltage                     | V <sub>GS(TH)</sub> | 0.7 | 1.4   | 2    | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                   |
| Static Drain-Source On-Resistance          | R <sub>DS(ON)</sub> | -   | 8.3   | 10   | mΩ   | V <sub>GS</sub> = 10V, I <sub>D</sub> = 13.5A                                                |
|                                            |                     | -   | 9.6   | 12.8 | mΩ   | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 11.5A                                               |
| 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>    | -   | 1,925 | -    | pF   | V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V,<br>f = 1MHz                                     |
| Output Capacitance                         | C <sub>oss</sub>    | -   | 438   | -    |      |                                                                                              |
| Reverse Transfer Capacitance               | C <sub>rss</sub>    | -   | 41    | -    |      |                                                                                              |
| Gate Resistance                            | R <sub>g</sub>      | -   | 1.7   | -    | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz                                         |
| Total Gate Charge (V <sub>GS</sub> = 4.5V) | Q <sub>g</sub>      | -   | 15.6  | -    | nC   | V <sub>DS</sub> = 30V, I <sub>D</sub> = 13.5A                                                |
| Total Gate Charge (V <sub>GS</sub> = 10V)  | Q <sub>g</sub>      | -   | 33.5  | -    |      |                                                                                              |
| Gate-Source Charge                         | Q <sub>gs</sub>     | -   | 4.7   | -    |      |                                                                                              |
| Gate-Drain Charge                          | Q <sub>gd</sub>     | -   | 5.3   | -    |      |                                                                                              |
| Turn-On Delay Time                         | t <sub>D(ON)</sub>  | -   | 4.5   | -    | ns   | V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V,<br>R <sub>G</sub> = 6Ω, I <sub>D</sub> = 13.5A |
| Turn-On Rise Time                          | t <sub>r</sub>      | -   | 8.6   | -    |      |                                                                                              |
| Turn-Off Delay Time                        | t <sub>D(OFF)</sub> | -   | 35.9  | -    |      |                                                                                              |
| Turn-Off Fall Time                         | t <sub>f</sub>      | -   | 15.7  | -    |      |                                                                                              |
| Body Diode Reverse Recovery Time           | t <sub>RR</sub>     | -   | 18.2  | -    | ns   | I <sub>F</sub> = 13.5A, di/dt = 400A/μs                                                      |
| Body Diode Reverse Recovery Charge         | Q <sub>RR</sub>     | -   | 33.1  | -    | nC   |                                                                                              |

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper pad layout.
  - Device mounted on infinite heat sink and measured by thermal couple attached on bottom heat sink of package.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

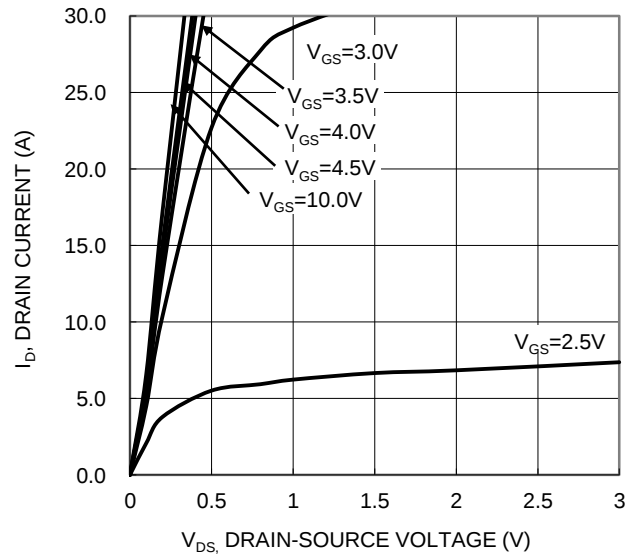


Figure 1. Typical Output Characteristic

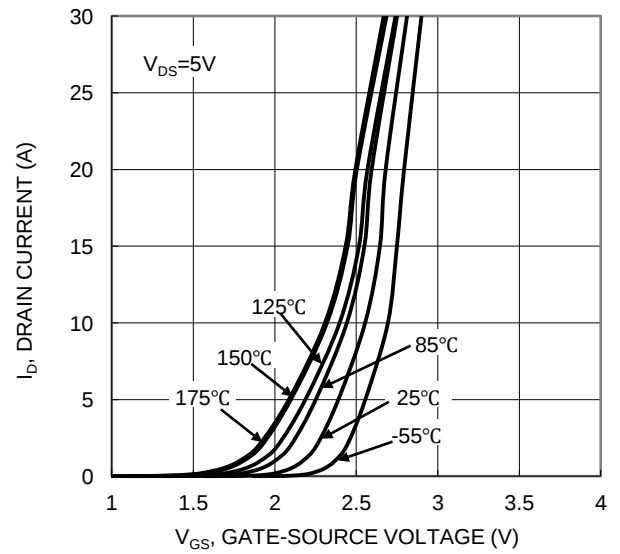


Figure 2. Typical Transfer Characteristic

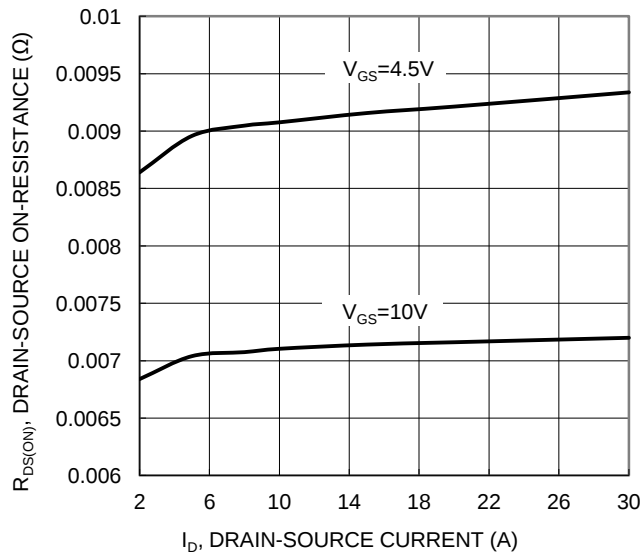


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

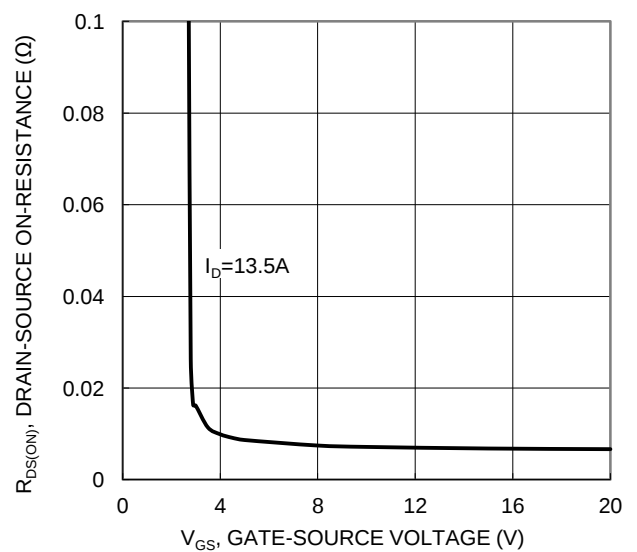


Figure 4. Typical Transfer Characteristic

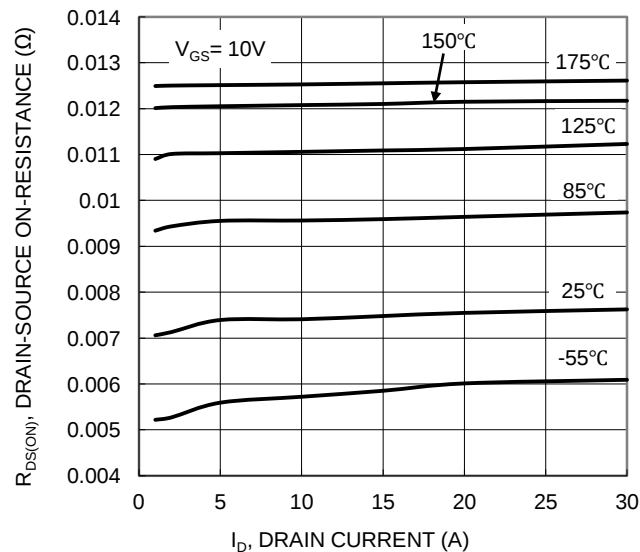


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

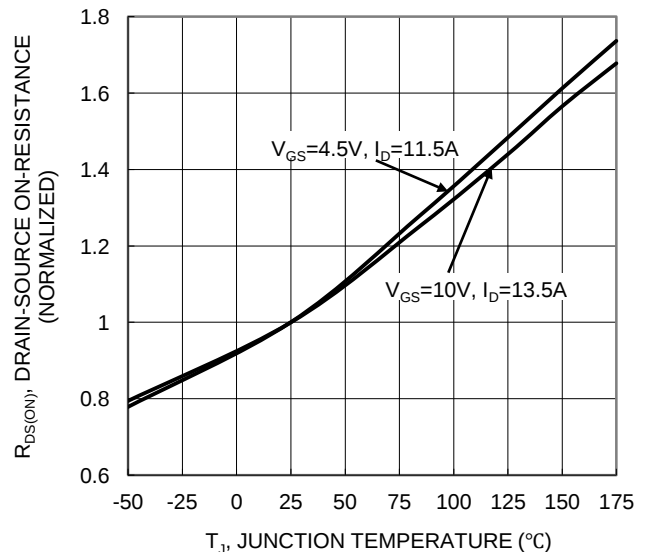


Figure 6. On-Resistance Variation with Junction Temperature

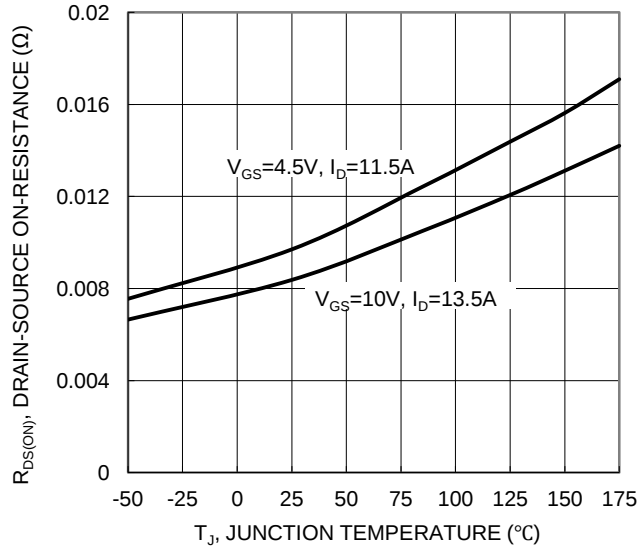


Figure 7. On-Resistance Variation with Junction Temperature

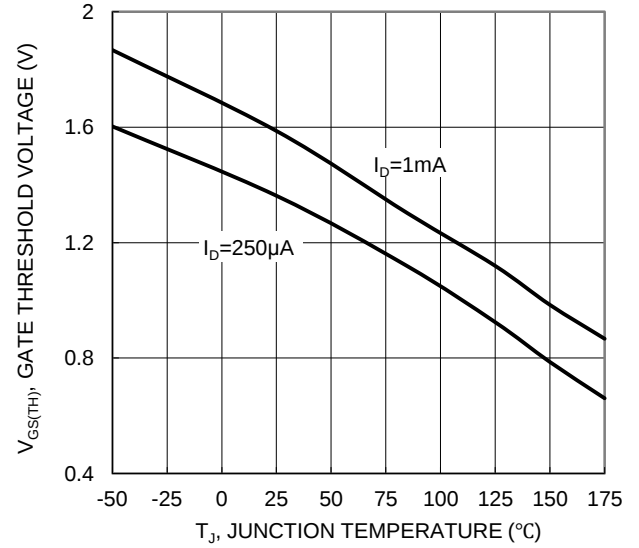


Figure 8. Gate Threshold Variation vs. Junction Temperature

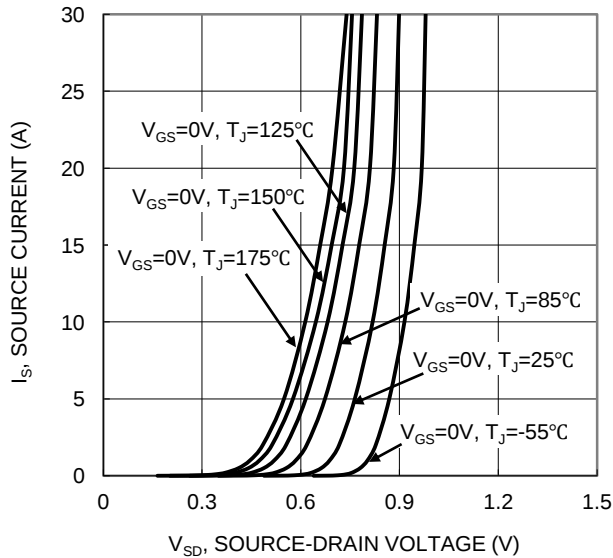


Figure 9. Diode Forward Voltage vs. Current

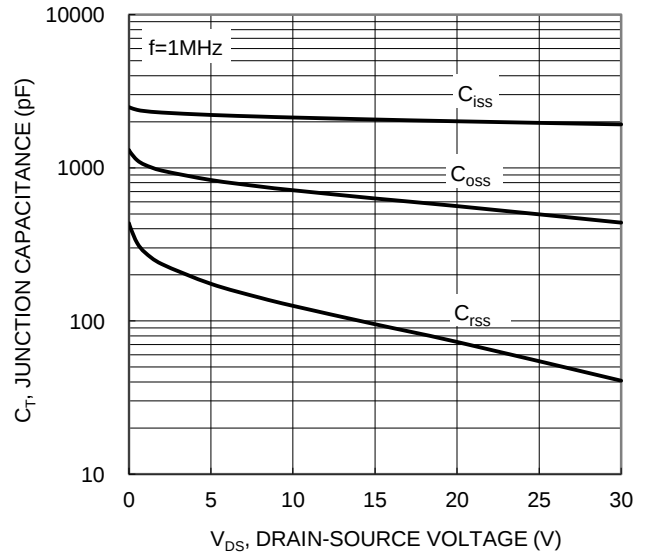


Figure 10. Typical Junction Capacitance

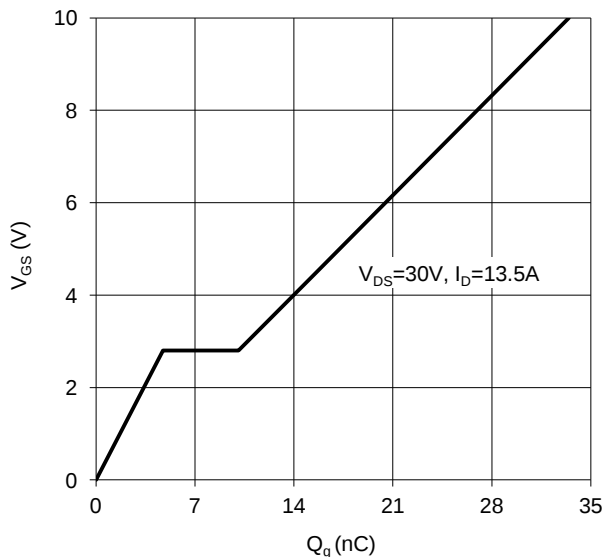


Figure 11. Gate Charge

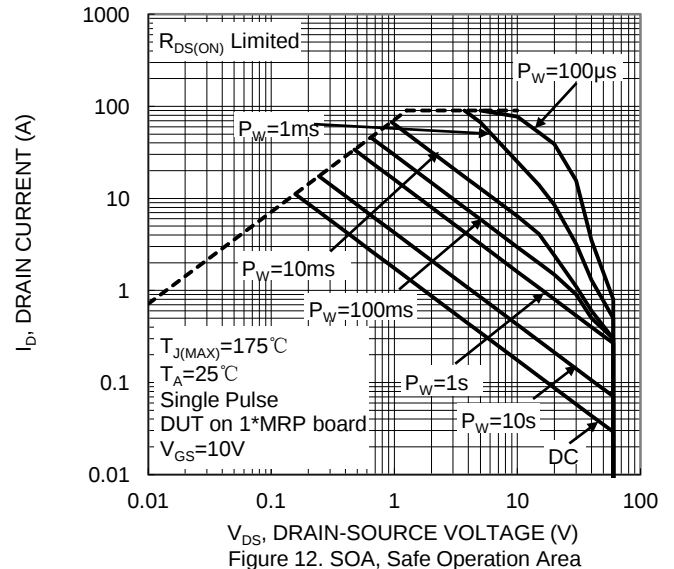
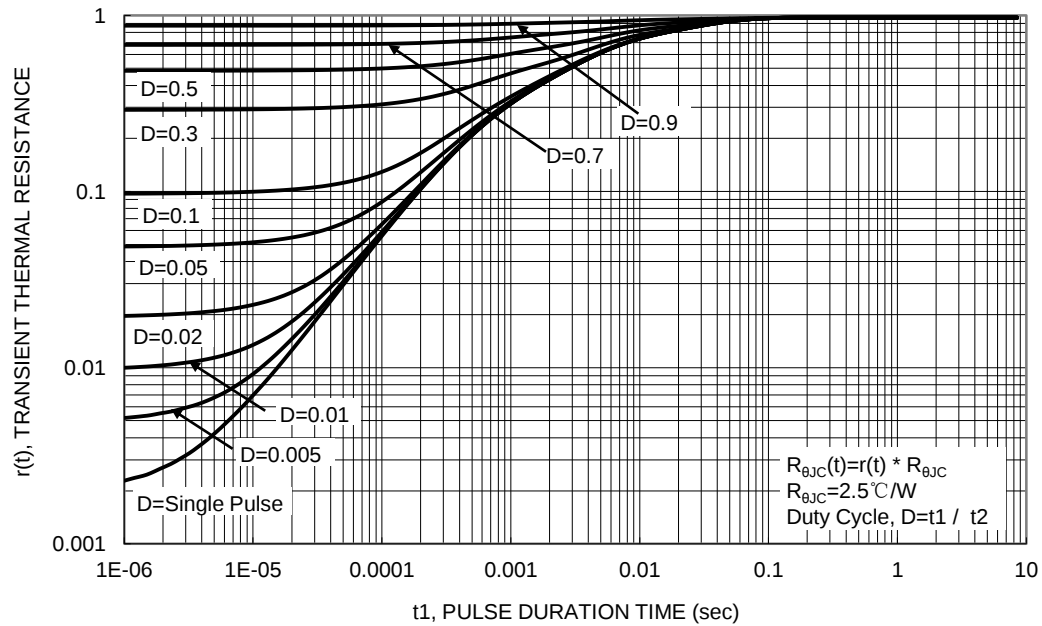
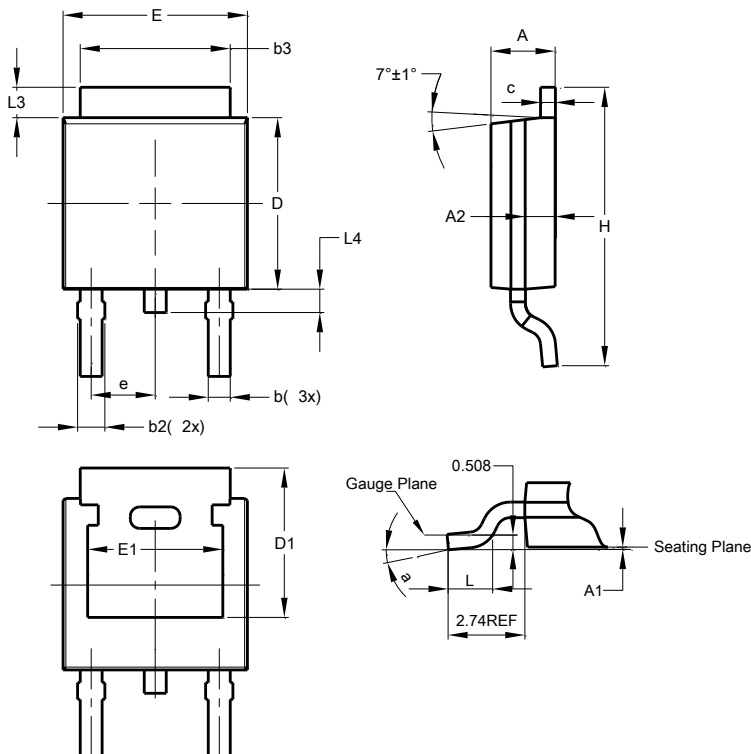


Figure 12. SOA, Safe Operation Area



## Package Outline Dimensions

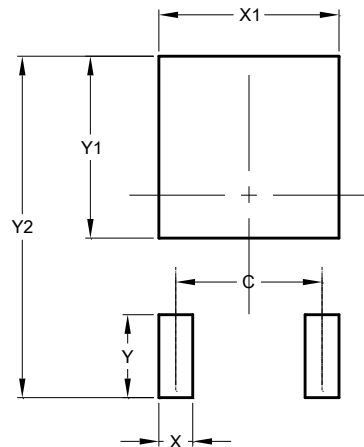
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



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



| 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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**Наши контакты:**

**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331