

## 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               | 23mΩ @ V <sub>GS</sub> = 10V  | 50A                                          |
|                   | 28mΩ @ V <sub>GS</sub> = 4.5V | 45A                                          |

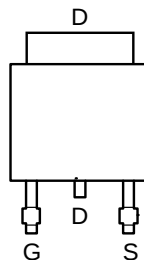
## Description and Applications

This new generation MOSFET is designed to minimize the on-state resistance (R<sub>DS(ON)</sub>) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

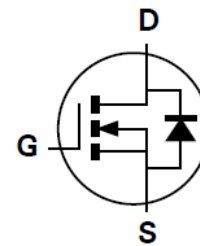
- Power Management
- Driving Solenoids
- Motor Control



Top View



Pin Out Top View



Equivalent Circuit

## 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
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**
- **An Automotive-Compliant Part is Available Under Separate Datasheet ([DMNH6021SK3Q](#))**

## Mechanical Data

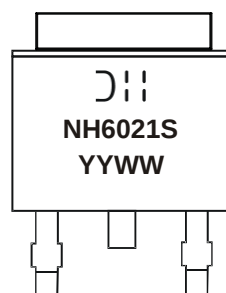
- Case: TO252 (DPAK)
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (B3)
- Terminal Connections: See Diagram
- Weight: 0.33 grams (Approximate)

## Ordering Information (Note 4)

| Part Number    | Case         | Packaging         |
|----------------|--------------|-------------------|
| DMNH6021SK3-13 | 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. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



⏏ = Manufacturer's Marking  
 NH6021S = 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) V <sub>GS</sub> = 10V | I <sub>D</sub>   | 50    | A    |
|                                                         |                  | 35    |      |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%)      | I <sub>DM</sub>  | 80    | A    |
| Maximum Continuous Body Diode Forward Current (Note 7)  | I <sub>S</sub>   | 40    | A    |
| Avalanche Current, L = 0.1mH (Note 8)                   | I <sub>AS</sub>  | 35    | A    |
| Avalanche Energy, L = 0.1mH (Note 8)                    | E <sub>AS</sub>  | 64    | mJ   |

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

| Characteristic                                   | Symbol                            | Value       | Unit |
|--------------------------------------------------|-----------------------------------|-------------|------|
| Total Power Dissipation (Note 5)                 | P <sub>D</sub>                    | 2.1         | W    |
| Thermal Resistance, Junction to Ambient (Note 5) | R <sub>θJA</sub>                  | 73          | °C/W |
| Steady State                                     |                                   |             |      |
| Total Power Dissipation (Note 6)                 | P <sub>D</sub>                    | 3.7         | W    |
| Thermal Resistance, Junction to Ambient (Note 6) | R <sub>θJA</sub>                  | 40          | °C/W |
| Steady State                                     |                                   |             |      |
| Thermal Resistance, Junction to Case (Note 7)    | R <sub>θJC</sub>                  | 1.8         | °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 9)</b>        |                     |     |      |      |      |                                                                                           |
| Drain-Source Breakdown Voltage             | BV <sub>DSS</sub>   | 60  | -    | -    | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250µA                                              |
| Zero Gate Voltage Drain Current            | I <sub>DSS</sub>    | -   | -    | 1    | µA   | V <sub>DS</sub> = 60V, 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 9)</b>         |                     |     |      |      |      |                                                                                           |
| Gate Threshold Voltage                     | V <sub>GS(TH)</sub> | 1   | -    | 3    | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA                                |
| Static Drain-Source On-Resistance          | R <sub>DS(ON)</sub> | -   | 13   | 23   | mΩ   | V <sub>GS</sub> = 10V, I <sub>D</sub> = 12A                                               |
|                                            |                     | -   | 18   | 28   |      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 12A                                              |
| Diode Forward Voltage                      | V <sub>SD</sub>     | -   | 0.75 | 1.2  | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 20A                                                |
| <b>DYNAMIC CHARACTERISTICS (Note 10)</b>   |                     |     |      |      |      |                                                                                           |
| Input Capacitance                          | C <sub>ISS</sub>    | -   | 1143 | -    | pF   | V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz                                     |
| Output Capacitance                         | C <sub>OSS</sub>    | -   | 168  | -    | pF   |                                                                                           |
| Reverse Transfer Capacitance               | C <sub>RSS</sub>    | -   | 69   | -    | pF   |                                                                                           |
| Gate Resistance                            | R <sub>g</sub>      | -   | 2.5  | -    | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1MHz                                      |
| Total Gate Charge (V <sub>GS</sub> = 10V)  | Q <sub>g</sub>      | -   | 20.1 | -    | nC   | V <sub>DS</sub> = 30V, I <sub>D</sub> = 20A                                               |
| Total Gate Charge (V <sub>GS</sub> = 4.5V) | Q <sub>g</sub>      | -   | 12.1 | -    | nC   |                                                                                           |
| Gate-Source Charge                         | Q <sub>gs</sub>     | -   | 4.3  | -    | nC   |                                                                                           |
| Gate-Drain Charge                          | Q <sub>gd</sub>     | -   | 5.5  | -    | nC   |                                                                                           |
| Turn-On Delay Time                         | t <sub>D(ON)</sub>  | -   | 4.4  | -    | ns   | V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V, R <sub>G</sub> = 4.7Ω, I <sub>D</sub> = 10A |
| Turn-On Rise Time                          | t <sub>R</sub>      | -   | 6.0  | -    | ns   |                                                                                           |
| Turn-Off Delay Time                        | t <sub>D(OFF)</sub> | -   | 14.2 | -    | ns   |                                                                                           |
| Turn-Off Fall Time                         | t <sub>F</sub>      | -   | 5.4  | -    | ns   | I <sub>F</sub> = 20A, di/dt = 100A/µs                                                     |
| Reverse Recovery Time                      | t <sub>RR</sub>     | -   | 21.2 | -    | ns   |                                                                                           |
| Reverse Recovery Charge                    | Q <sub>RR</sub>     | -   | 15.2 | -    | nC   |                                                                                           |

- Notes:
- Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate.
  - Thermal resistance from junction to soldering point (on the exposed drain pad).
  - I<sub>AS</sub> and E<sub>AS</sub> ratings are based on low frequency and duty cycles to keep T<sub>J</sub> = +25°C.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

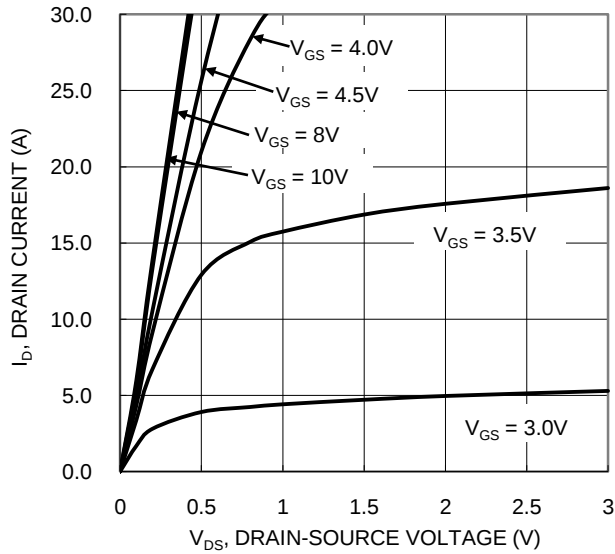


Figure 1. Typical Output Characteristic

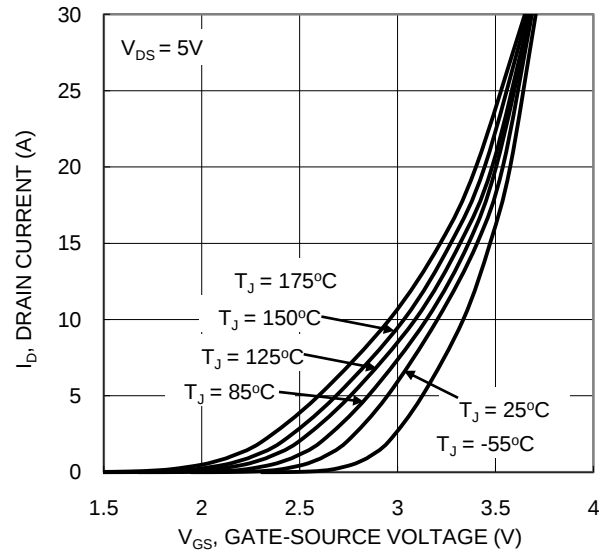


Figure 2. Typical Transfer Characteristic

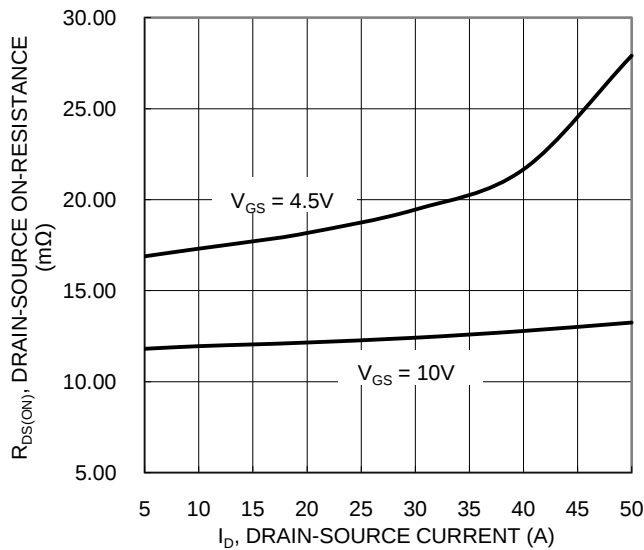


Figure 3. Typical On-Resistance vs Drain Current and Gate Voltage

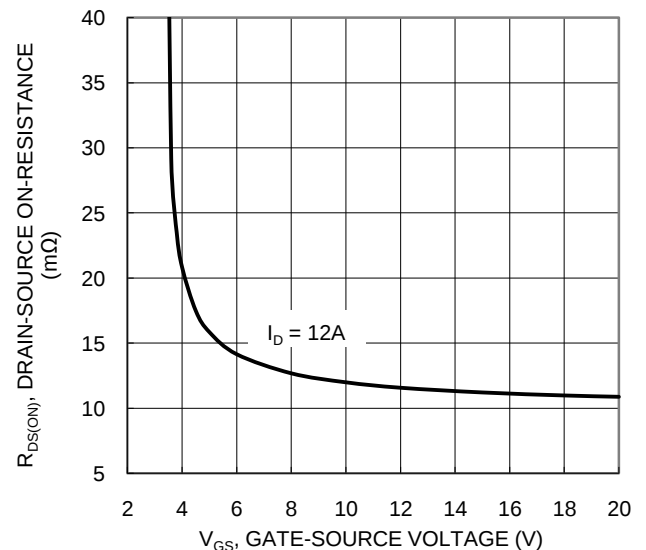


Figure 4. Typical Transfer Characteristic

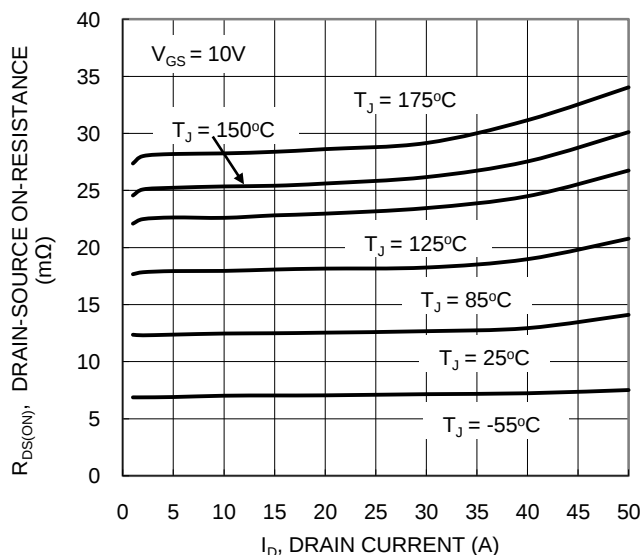


Figure 5. Typical On-Resistance vs Drain Current and Temperature

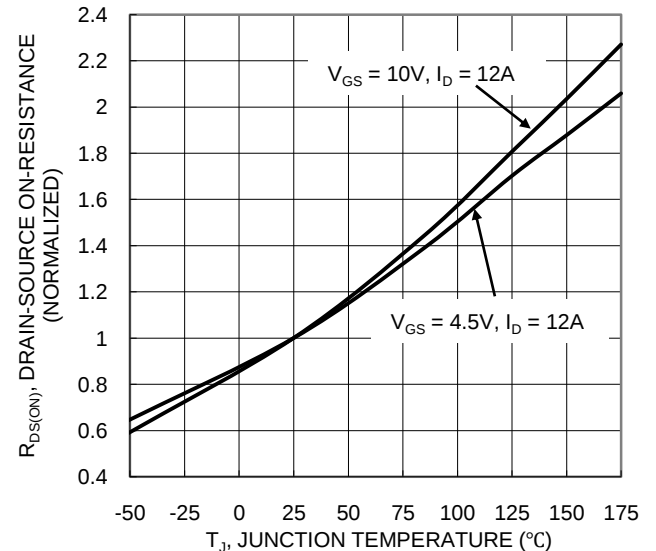


Figure 6. On-Resistance Variation with Temperature

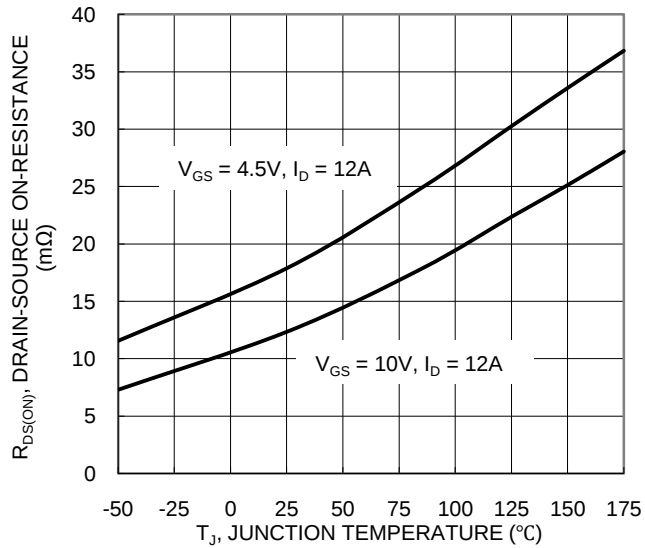


Figure 7. On-Resistance Variation with Temperature

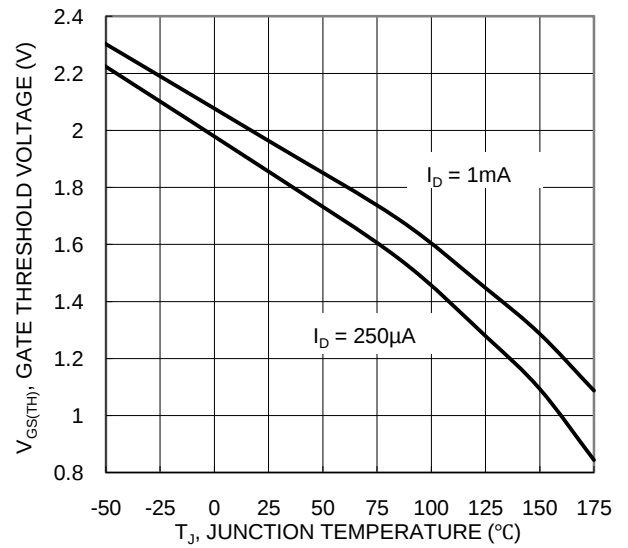


Figure 8. Gate Threshold Variation vs Junction Temperature

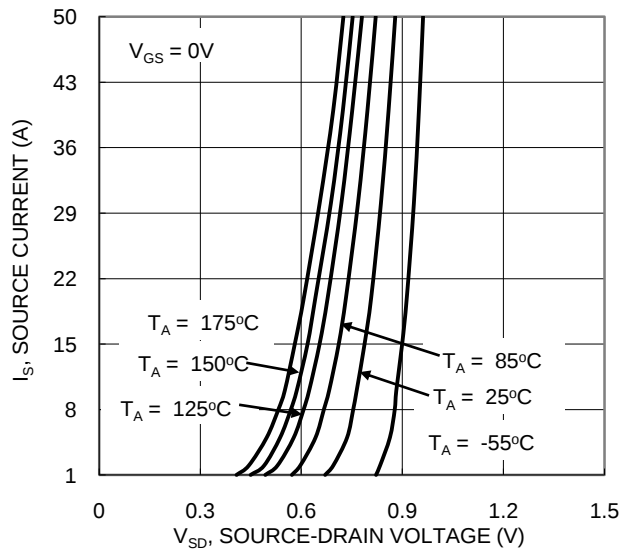


Figure 9. Diode Forward Voltage vs. Current

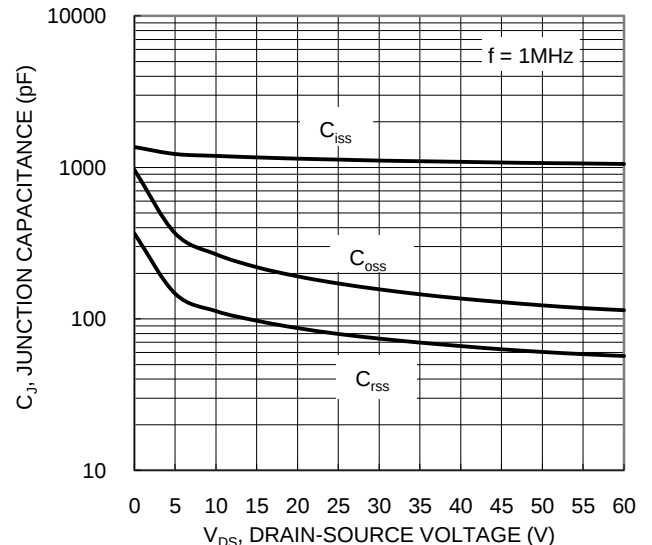


Figure 10. Typical Junction Capacitance

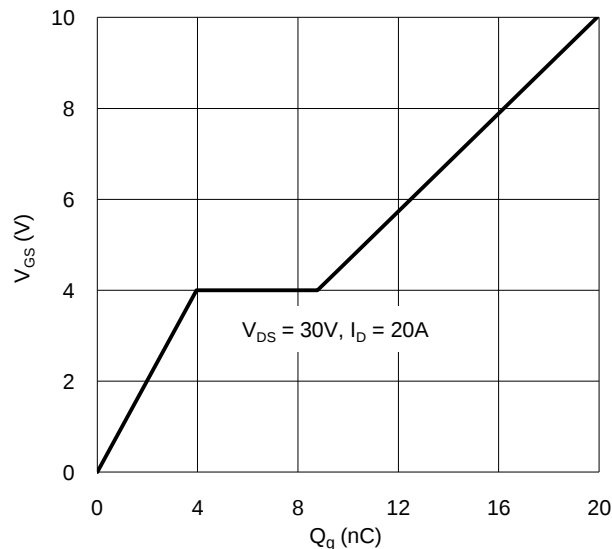


Figure 11. Gate Charge

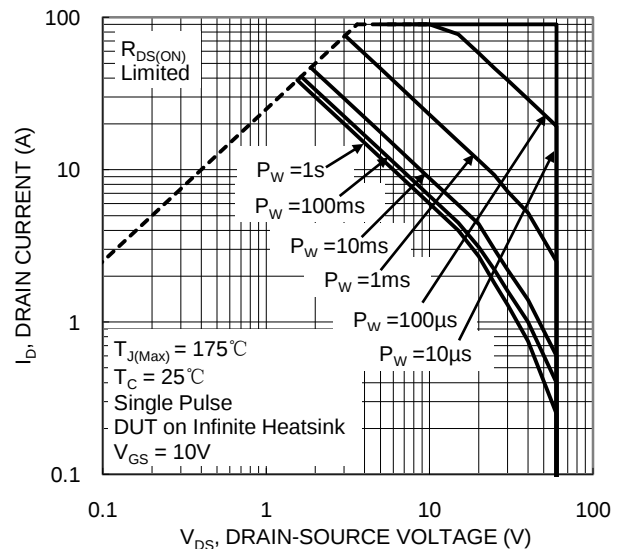
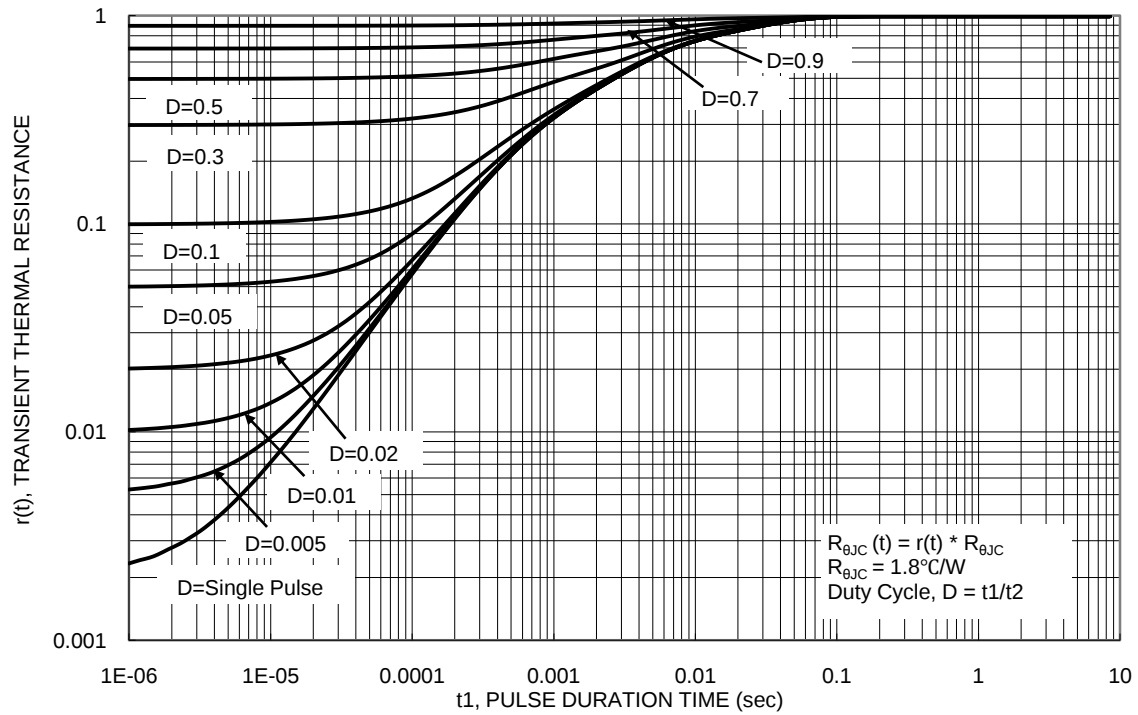


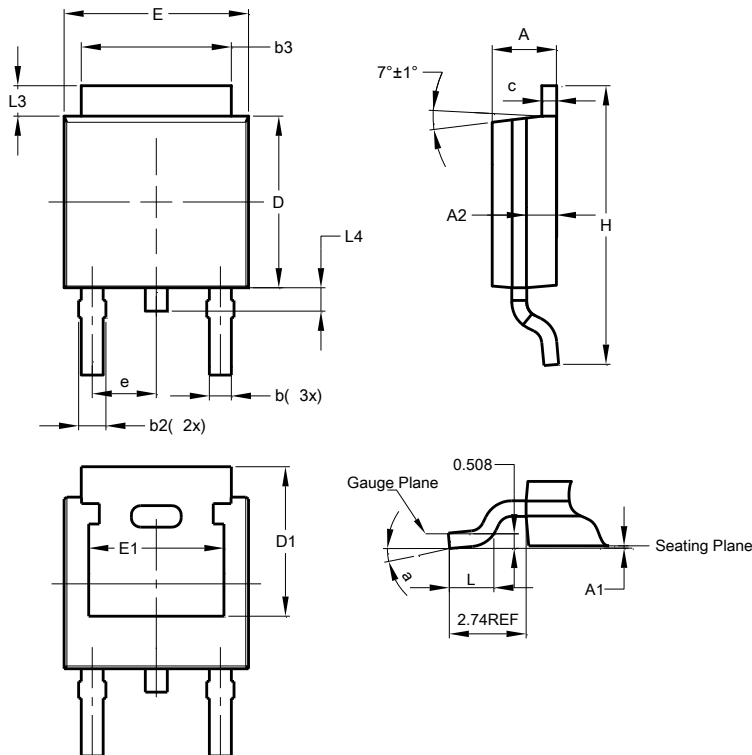
Figure 12. SOA, Safe Operation Area



## Package Outline Dimensions

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

TO252 (DPAK)

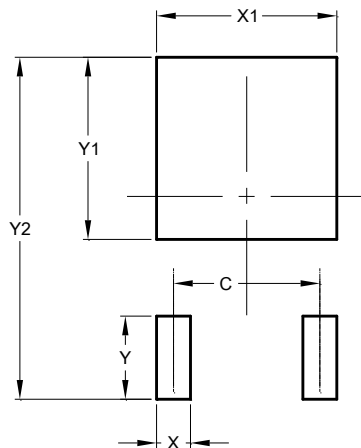


| TO252 (DPAK)         |      |       |       |
|----------------------|------|-------|-------|
| Dim                  | Min  | Max   | Typ   |
| A                    | 2.19 | 2.39  | 2.29  |
| A1                   | 0.00 | 0.13  | 0.08  |
| A2                   | 0.97 | 1.17  | 1.07  |
| b                    | 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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