

**N-CHANNEL ENHANCEMENT MODE FIELD EFFECT TRANSISTOR**
**Product Summary**

| Device | V <sub>DSS</sub> | R <sub>DS(ON)</sub> Max       | I <sub>D</sub> Max<br>T <sub>A</sub> = +25°C |
|--------|------------------|-------------------------------|--|
| Q1     | 30V              | 1.5Ω @ V <sub>GS</sub> = 4.5V | 350mA  |
|        |                  | 2.0Ω @ V <sub>GS</sub> = 2.5V |  |

**Description**

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

**Applications**

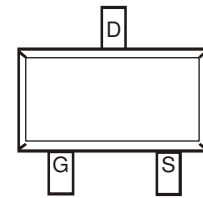
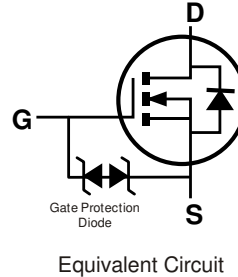
- Motor Control
- Power Management Functions

**Features**

- Low On-Resistance: R<sub>DS(ON)</sub>
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **ESD Protected Gate**
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

**Mechanical Data**

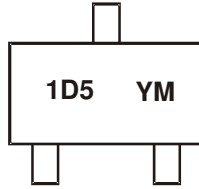
- Case: SOT523
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020D
- Terminals: Finish — Matte Tin Annealed over Alloy 42 Leadframe. Solderable per MIL-STD-202, Method 208 Ⓔ
- Terminal Connections: See Diagram
- Weight: 0.002 grams (Approximate)


**SOT523**

**Top View  
Pin Out Configuration**
**Ordering Information** (Note 4)

| Part Number  | Case   | Packaging          |
|--------------|--------|--------------------|
| DMN31D6UT-7  | SOT523 | 3,000/Tape & Reel  |
| DMN31D6UT-13 | SOT523 | 10,000/Tape & Reel |

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  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



1D5 = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: B = 2014)  
 M = Month (ex: 9 = September)

Date Code Key

| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|------|------|------|------|------|------|------|------|------|
| Code | B    | C    | D    | E    | F    | G    | H    | I    |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Code  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | O   | N   | D   |

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

| Characteristic                | Symbol           | Value | Units |
|-------------------------------|------------------|-------|-------|
| Drain-Source Voltage          | V <sub>DSS</sub> | 30    | V     |
| Gate-Source Voltage           | V <sub>GSS</sub> | ±12   | V     |
| Drain Current (Note 6)        | I <sub>D</sub>   | 350   | mA    |
| Pulsed Drain Current (Note 6) | I <sub>DM</sub>  | 800   | mA    |

## Thermal Characteristics

| Characteristic                                   | Symbol                            | Value        | Units |
|--|-----------------------------------|--------------|-------|
| Total Power Dissipation (Note 5)                 | P <sub>D</sub>                    | 210          | mW    |
| Thermal Resistance, Junction to Ambient (Note 5) | R <sub>θJA</sub>                  | Steady State | 593   |
|  |                                   | t < 5s       | 542   |
| Total Power Dissipation (Note 6)                 | P <sub>D</sub>                    | 320          | mW    |
| Thermal Resistance, Junction to Ambient (Note 6) | R <sub>θJA</sub>                  | Steady State | 398   |
|  |                                   | t < 5s       | 363   |
| Operating and Storage Temperature Range          | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150  | °C    |

Notes: 5. Device mounted on FR-4 PCB, with minimum recommended pad layout  
 6. Device mounted on 1" x 1" FR-4 PCB with high coverage 2oz. copper, single sided.

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

| Characteristic                          | Symbol              | Min | Typ  | Max | Unit | Test Condition  |
|---|---------------------|-----|------|-----|------|---|
| <b>OFF CHARACTERISTICS</b> (Note 7)     |                     |     |      |     |      |   |
| Drain-Source Breakdown Voltage          | BV <sub>DSS</sub>   | 30  | —    | —   | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA  |
| Zero Gate Voltage Drain Current         | I <sub>DSS</sub>    | —   | —    | 100 | nA   | @T <sub>C</sub> = +25°C<br>V <sub>DS</sub> = 24V, V <sub>GS</sub> = 0V                        |
| Gate-Source Leakage                     | I <sub>GSS</sub>    | —   | —    | ±10 | μA   | V <sub>GS</sub> = ±10V, V <sub>DS</sub> = 0V  |
| <b>ON CHARACTERISTICS</b> (Note 7)      |                     |     |      |     |      |   |
| Gate Threshold Voltage                  | V <sub>GS(TH)</sub> | 0.4 | —    | 1.4 | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                    |
| Static Drain-Source On-Resistance       | R <sub>DS(ON)</sub> | —   | 1.1  | 1.5 | Ω    | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 100mA  |
|   |                     | —   | 1.6  | 2.0 |      | V <sub>GS</sub> = 2.5V, I <sub>D</sub> = 50mA   |
| Diode Forward Voltage                   | V <sub>SD</sub>     | —   | 0.6  | 1.0 | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 10mA   |
| <b>DYNAMIC CHARACTERISTICS</b> (Note 8) |                     |     |      |     |      |   |
| Input Capacitance                       | C <sub>iss</sub>    | —   | 13.6 | —   | pF   | V <sub>DS</sub> = 15V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz                                    |
| Output Capacitance                      | C <sub>oss</sub>    | —   | 3.1  | —   | pF   |   |
| Reverse Transfer Capacitance            | C <sub>rss</sub>    | —   | 2.2  | —   | pF   |   |
| Total Gate Charge                       | Q <sub>g</sub>      | —   | 0.35 | —   | nC   | V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 15V,<br>I <sub>D</sub> = 200mA                      |
| Gate-Source Charge                      | Q <sub>gs</sub>     | —   | 0.06 | —   | nC   |   |
| Gate-Drain Charge                       | Q <sub>gd</sub>     | —   | 0.19 | —   | nC   |   |
| Turn-On Delay Time                      | t <sub>D(ON)</sub>  | —   | 3.3  | —   | ns   | V <sub>DD</sub> = 15V, V <sub>GS</sub> = 4.5V,<br>R <sub>G</sub> = 2Ω, I <sub>D</sub> = 200mA |
| Turn-On Rise Time                       | t <sub>R</sub>      | —   | 2.3  | —   | ns   |   |
| Turn-Off Delay Time                     | t <sub>D(OFF)</sub> | —   | 7.4  | —   | ns   |   |
| Turn-Off Fall Time                      | t <sub>F</sub>      | —   | 4.4  | —   | ns   |   |

Notes: 7. Short duration pulse test used to minimize self-heating effect.  
8. Guaranteed by design. Not subject to product testing.

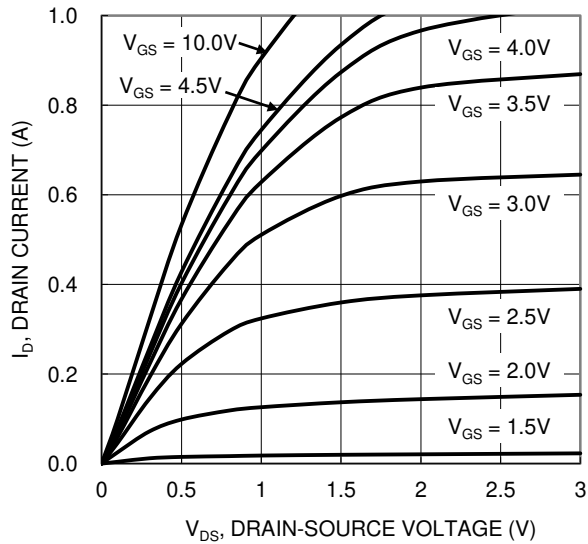


Figure 1. Typical Output Characteristic

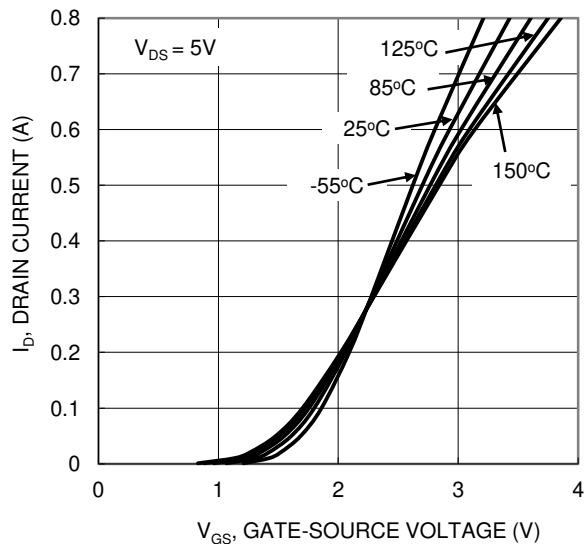


Figure 2. Typical Transfer Characteristic

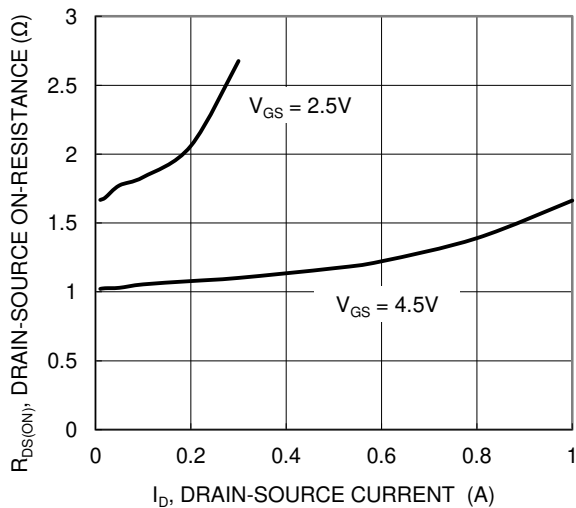


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

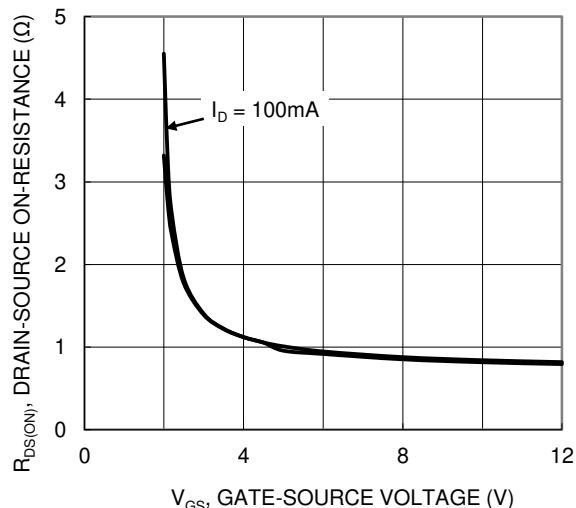


Figure 4. Typical Transfer Characteristic

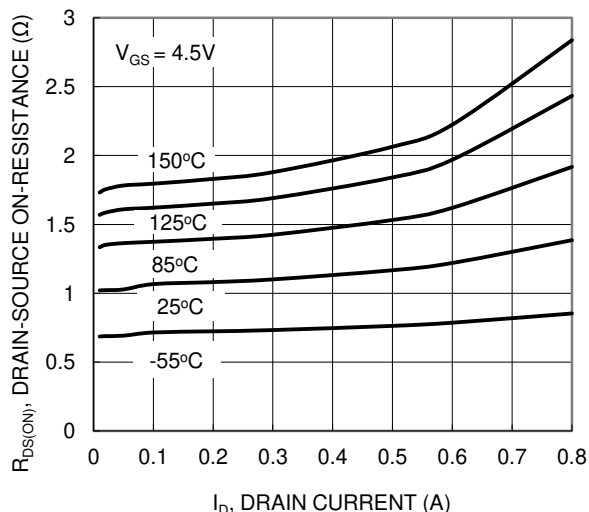


Figure 5. Typical On-Resistance vs. Drain Current and Junction Temperature

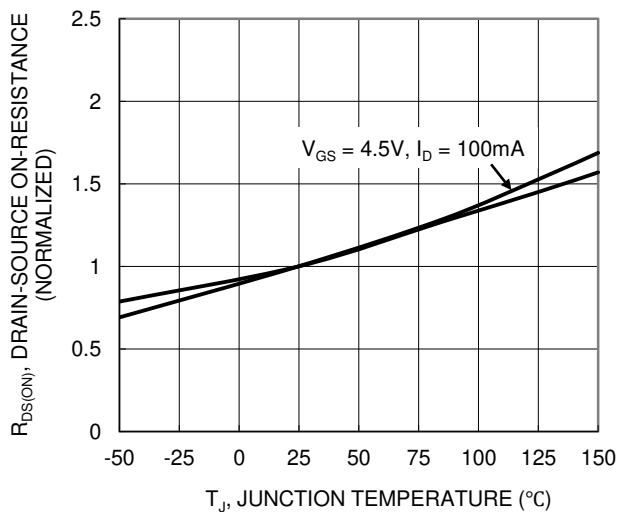


Figure 6. On-Resistance Variation with Junction Temperature

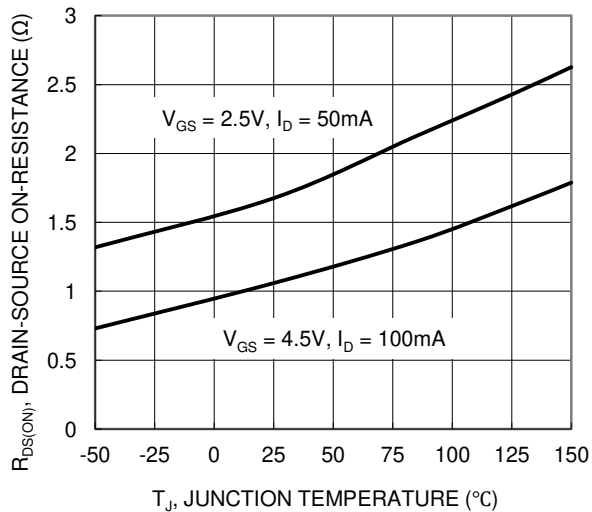


Figure 7. On-Resistance Variation with Junction Temperature

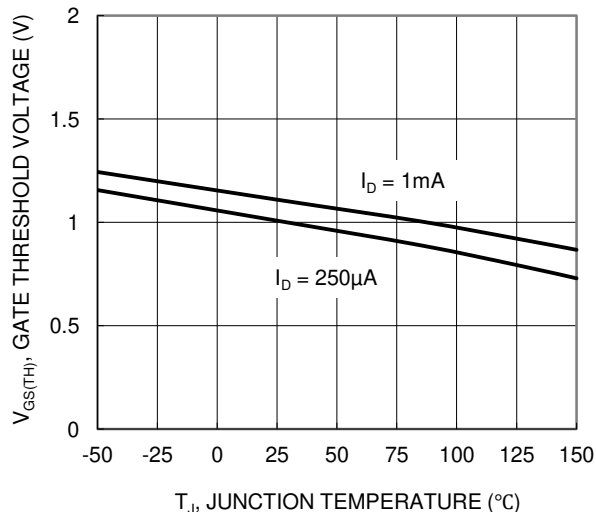


Figure 8. Gate Threshold Variation vs. Junction Temperature

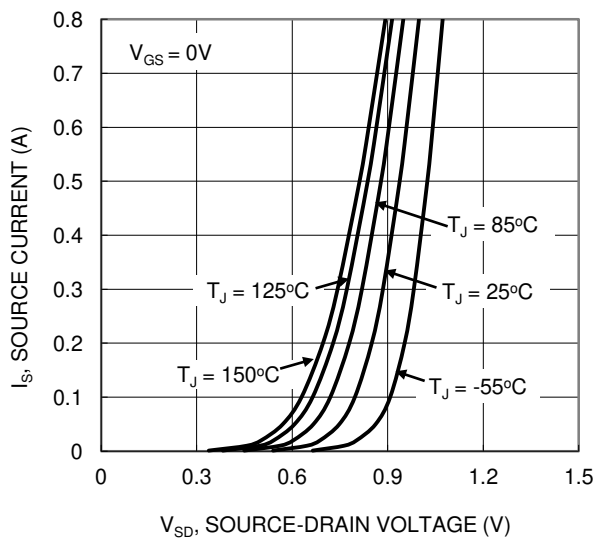


Figure 9. Diode Forward Voltage vs. Current

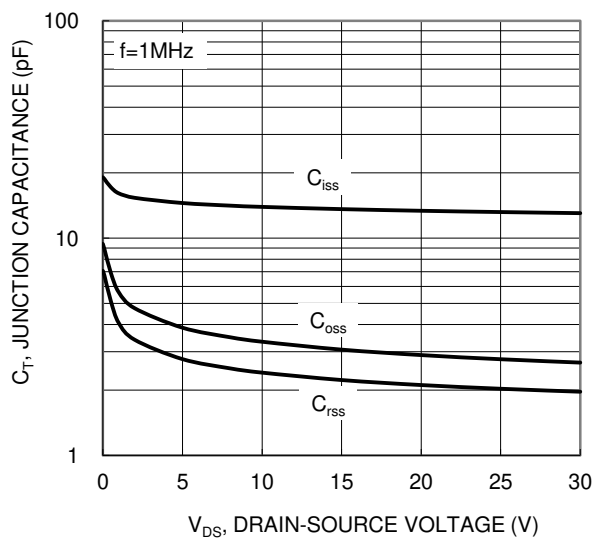


Figure 10. Typical Junction Capacitance

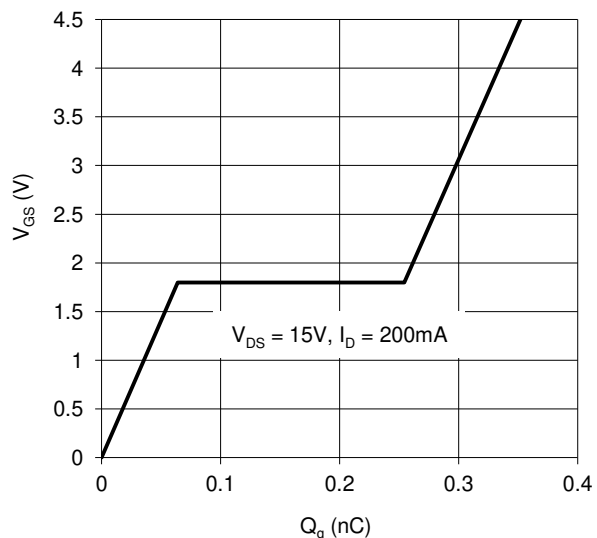


Figure 11. Gate Charge

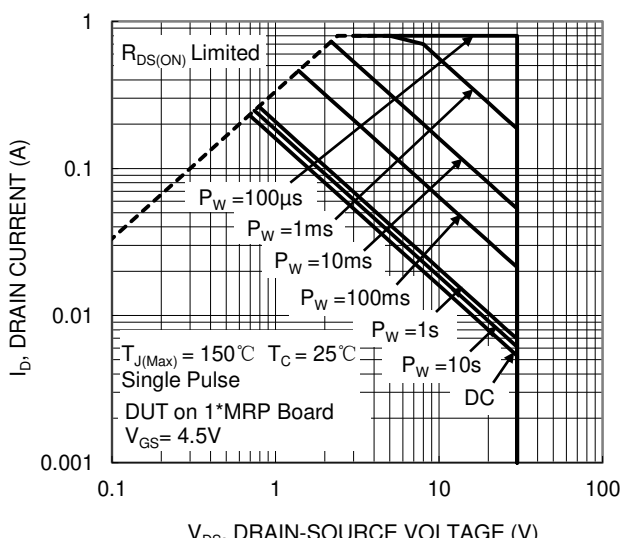


Figure 12. SOA, Safe Operation Area

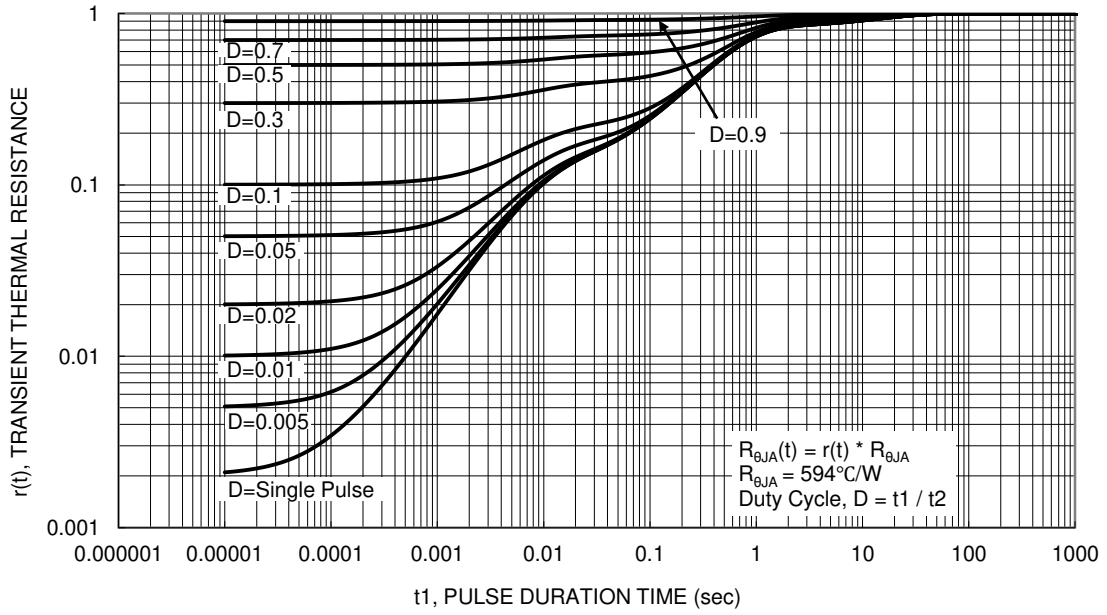
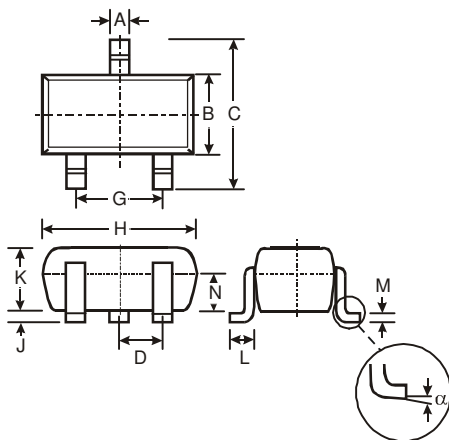


Figure 13. Transient Thermal Resistance

**Package Outline Dimensions**

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

SOT523

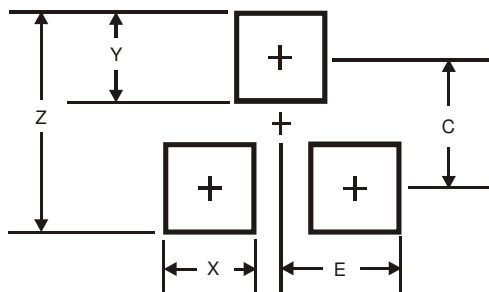


| SOT523               |      |      |      |
|----------------------|------|------|------|
| Dim                  | Min  | Max  | Typ  |
| A                    | 0.15 | 0.30 | 0.22 |
| B                    | 0.75 | 0.85 | 0.80 |
| C                    | 1.45 | 1.75 | 1.60 |
| D                    | —    | —    | 0.50 |
| G                    | 0.90 | 1.10 | 1.00 |
| H                    | 1.50 | 1.70 | 1.60 |
| J                    | 0.00 | 0.10 | 0.05 |
| K                    | 0.60 | 0.80 | 0.75 |
| L                    | 0.10 | 0.30 | 0.22 |
| M                    | 0.10 | 0.20 | 0.12 |
| N                    | 0.45 | 0.65 | 0.50 |
| α                    | 0°   | 8°   | —    |
| All Dimensions in mm |      |      |      |

**Suggested Pad Layout**

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

SOT523



| Dimensions | Value (in mm) |
|------------|---------------|
| Z          | 1.8           |
| X          | 0.4           |
| Y          | 0.51          |
| C          | 1.3           |
| E          | 0.7           |

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