

## Product Summary

| BV <sub>DSS</sub> | R <sub>DS(ON)</sub> Max     | I <sub>D</sub> Max<br>T <sub>A</sub> = +25°C |
|-------------------|-----------------------------|--|
| 60V               | 1.8Ω @ V <sub>GS</sub> = 5V | 470mA  |
|                   | 2.4Ω @ V <sub>GS</sub> = 3V |  |

## Description and Applications

The DMN61D8LQ provides a single component solution for switching inductive loads such as relays, solenoids, and small DC motors in automotive applications, without the need of a freewheeling diode. DMN61D8LQ accepts logic level inputs, thus allowing it to be driven by logic gates, inverters, and microcontrollers.

## Features and Benefits

- Provides A More Reliable And Robust Interface Between Sensitive Logic And DC Relay Coils
- Replaces 3 to 4 Discrete Components Enabling PCB Footprint To Be Reduced
- Internal Active Clamp Removes The Need For External Zener Diode
- **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**
- **PPAP Capable (Note 4)**

## Mechanical Data

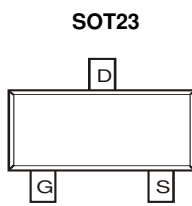
- Case: SOT23
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish Annealed over Alloy 42 Leadframe (Lead-Free Plating). Solderable per MIL-STD-202, Method 208 (3)
- Terminal Connections: See Diagram
- Weight: 0.008 grams (Approximate)



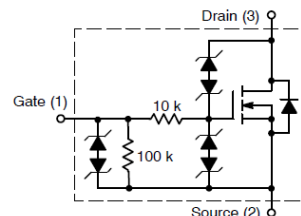
ESD protected



Top View



Top View  
Internal Schematic



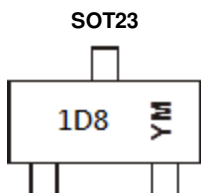
Equivalent Circuit

## Ordering Information (Note 5)

| Part Number  | Case  | Packaging          |
|--------------|-------|--------------------|
| DMN61D8LQ-7  | SOT23 | 3,000/Tape & Reel  |
| DMN61D8LQ-13 | SOT23 | 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. 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).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



1D8 = Product Type Marking Code  
 YM = Date Code Marking  
 Y = Year (ex: D = 2016)  
 M = Month (ex: 9 = September)

### Date Code Key

| Year  | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |     |     |     |     |     |
|-------|------|------|------|------|------|------|------|-----|-----|-----|-----|-----|
| Code  | D    | E    | F    | G    | H    | I    | J    |     |     |     |     |     |
| 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** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Characteristic  |              |                           | Symbol    | Value    | Unit |
|---|--------------|---------------------------|-----------|----------|------|
| Drain-Source Voltage  |              |                           | $V_{DSS}$ | 60       | V    |
| Gate-Source Voltage   |              |                           | $V_{GSS}$ | $\pm 12$ | V    |
| Continuous Drain Current (Note 7)   | Steady State | $T_A = +25^\circ\text{C}$ | $I_D$     | 470      | mA   |
|   |              | $T_A = +70^\circ\text{C}$ |           | 370      |      |
| Maximum Continuous Body Diode Forward Current (Note 6)  |              |                           | $I_S$     | 0.5      | A    |
| Single Pulse Drain-to-Source Avalanche Energy<br>(For Relay's Coils/Inductive Loads of 80Ω or Higher) ( $T_J$ Initial = $+85^\circ\text{C}$ )   |              |                           | $E_Z$     | 200      | mJ   |
| Peak Power Dissipation, Drain-to-Source (Non repetitive current square pulse 1.0ms duration) ( $T_J$ Initial = $+85^\circ\text{C}$ )  |              |                           | $P_{PK}$  | 20       | W    |
| Load Dump Pulse, Drain-to-Source, $R_{SOURCE} = 0.5\Omega$ , $t = 300\text{ms}$<br>(For Relay's Coils/Inductive Loads of 80Ω or Higher) ( $T_J$ Initial = $+85^\circ\text{C}$ )                                 |              |                           | $E_{LD1}$ | 60       | V    |
| Inductive Switching Transient 1, Drain-to-Source<br>(Waveform: $R_{SOURCE} = 10\Omega$ , $t = 2.0\text{ms}$ )<br>(For Relay's Coils/Inductive Loads of 80Ω or Higher) ( $T_J$ Initial = $+85^\circ\text{C}$ )   |              |                           | $E_{LD2}$ | 100      | V    |
| Inductive Switching Transient 2, Drain-to-Source<br>(Waveform: $R_{SOURCE} = 4.0\Omega$ , $t = 50\mu\text{s}$ )<br>(For Relay's Coils/Inductive Loads of 80Ω or Higher) ( $T_J$ Initial = $+85^\circ\text{C}$ ) |              |                           | $E_{LD3}$ | 300      | V    |
| Reverse Battery, 10 Minutes (Drain-to-Source)<br>(For Relay's Coils/Inductive Loads of 80Ω or more)   |              |                           | Rev-Bat   | -14      | V    |
| Dual Voltage Jump Start, 10 Minutes (Drain-to-Source)   |              |                           | Dual-Volt | 28       | V    |
| ESD Human Body Model (HBM)  |              |                           | ESD       | 4,000    | V    |

**Thermal Characteristics**

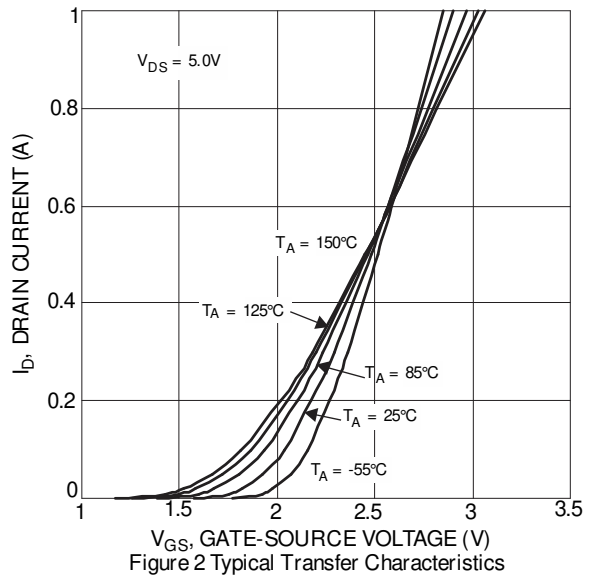
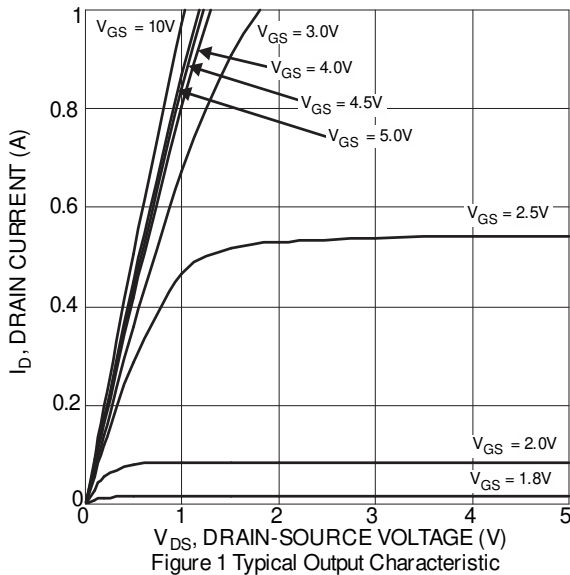
| Characteristic                                   |  |              | Symbol          | Value       | Unit               |
|--|--|--------------|-----------------|-------------|--------------------|
| Total Power Dissipation (Note 6)                 |  |              | $P_D$           | 390         | mW                 |
| Thermal Resistance, Junction to Ambient (Note 6) |  | Steady State | $R_{\theta JA}$ | 321         | $^\circ\text{C/W}$ |
| Total Power Dissipation (Note 7)                 |  |              | $P_D$           | 610         | mW                 |
| Thermal Resistance, Junction to Ambient (Note 7) |  | Steady State | $R_{\theta JA}$ | 208         | $^\circ\text{C/W}$ |
| Operating and Storage Temperature Range          |  |              | $T_J, T_{STG}$  | -55 to +150 | $^\circ\text{C}$   |

- Notes: 6. Device mounted on FR-4 PCB, with minimum recommended pad layout.  
7. 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 8)     |                     |     |      |            |      |  |
| Drain-Source Breakdown Voltage          | BV <sub>DSS</sub>   | 60  | —    | —          | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = 10mA  |
| Zero Gate Voltage Drain Current         | I <sub>DSS</sub>    | —   | —    | 50<br>0.5  | μA   | V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V<br>V <sub>DS</sub> = 12V, V <sub>GS</sub> = 0V |
| Gate-Source Leakage                     | I <sub>GSS</sub>    | —   | —    | ±90<br>±60 | μA   | V <sub>GS</sub> = ±5V, V <sub>DS</sub> = 0V<br>V <sub>GS</sub> = ±3V, V <sub>DS</sub> = 0V |
| <b>ON CHARACTERISTICS</b> (Note 8)      |                     |     |      |            |      |  |
| Gate Threshold Voltage                  | V <sub>GS(TH)</sub> | 1.3 | —    | 2.0        | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1mA                                   |
| Static Drain-Source On-Resistance       | R <sub>DS(ON)</sub> | —   | 1.1  | 1.8        | Ω    | V <sub>GS</sub> = 5V, I <sub>D</sub> = 0.15A   |
|   |                     |     | 1.4  | 2.4        |      | V <sub>GS</sub> = 3V, I <sub>D</sub> = 0.15A   |
| Forward Transfer Admittance             | Y <sub>fs</sub>     | 80  | —    | —          | ms   | V <sub>DS</sub> = 12V, I <sub>D</sub> = 0.15A  |
| Diode Forward Voltage                   | V <sub>SD</sub>     | —   | —    | 1.2        | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 0.15A   |
| <b>DYNAMIC CHARACTERISTICS</b> (Note 9) |                     |     |      |            |      |  |
| Input Capacitance                       | C <sub>iss</sub>    | —   | 12.9 | —          | pF   | V <sub>DS</sub> = 12V, V <sub>GS</sub> = 0V<br>f = 1.0MHz                                  |
| Output Capacitance                      | C <sub>oss</sub>    | —   | 17   | —          | pF   |  |
| Reverse Transfer Capacitance            | C <sub>rss</sub>    | —   | 0.84 | —          | pF   |  |
| Total Gate Charge                       | Q <sub>g</sub>      | —   | 0.74 | —          | nC   | V <sub>GS</sub> = 5V, V <sub>DS</sub> = 12V,<br>I <sub>D</sub> = 150mA                     |
| Gate-Source Charge                      | Q <sub>gs</sub>     | —   | 0.19 | —          | nC   |  |
| Gate-Drain Charge                       | Q <sub>gd</sub>     | —   | 0.16 | —          | nC   |  |
| Turn-On Delay Time                      | t <sub>D(ON)</sub>  | —   | 131  | —          | ns   | V <sub>DD</sub> = 12V, V <sub>GS</sub> = 5V.   |
| Turn-On Rise Time                       | t <sub>R</sub>      | —   | 301  | —          | ns   |  |
| Turn-Off Delay Time                     | t <sub>D(OFF)</sub> | —   | 582  | —          | ns   |  |
| Turn-Off Fall Time                      | t <sub>F</sub>      | —   | 440  | —          | ns   |  |

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



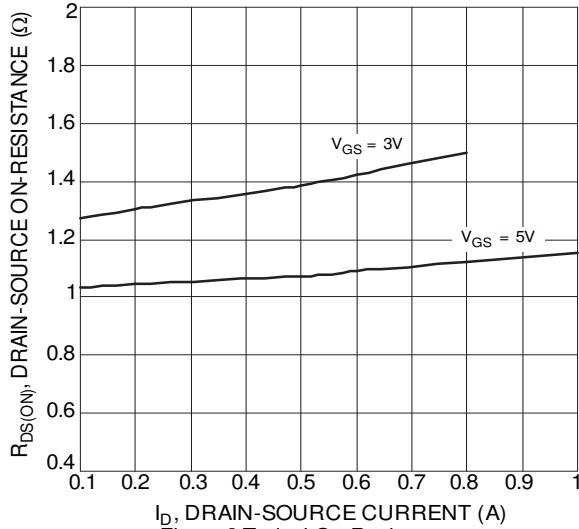


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

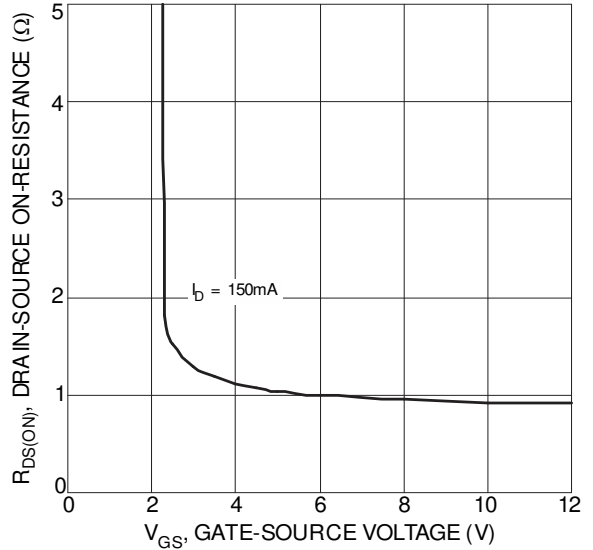


Figure 4 Typical Transfer Characteristic

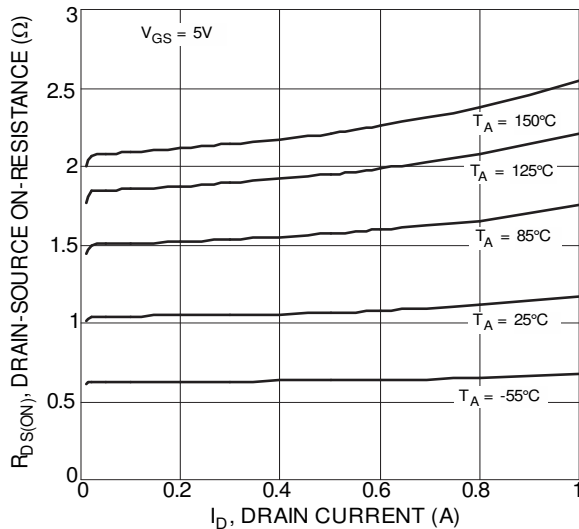


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

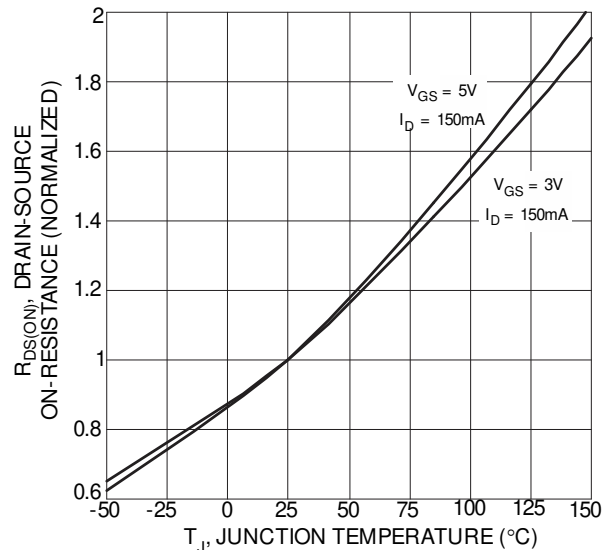


Figure 6 On-Resistance Variation with Temperature

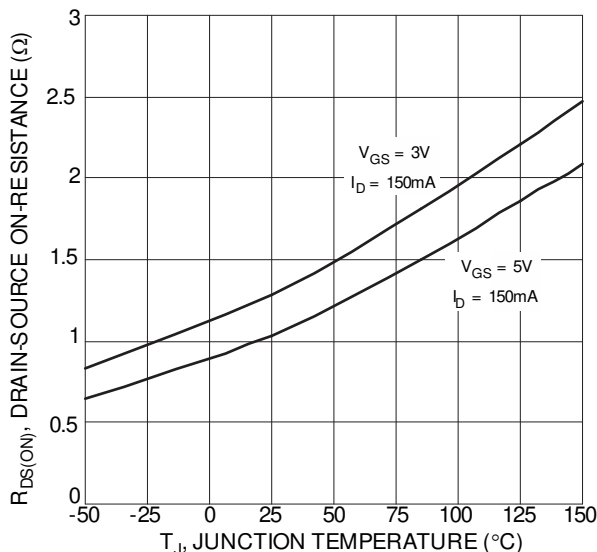


Figure 7 On-Resistance Variation with Temperature

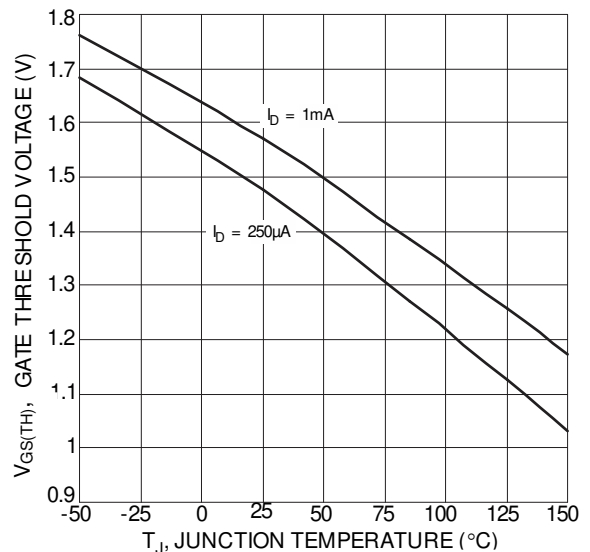


Figure 8 Gate Threshold Variation vs. Junction Temperature

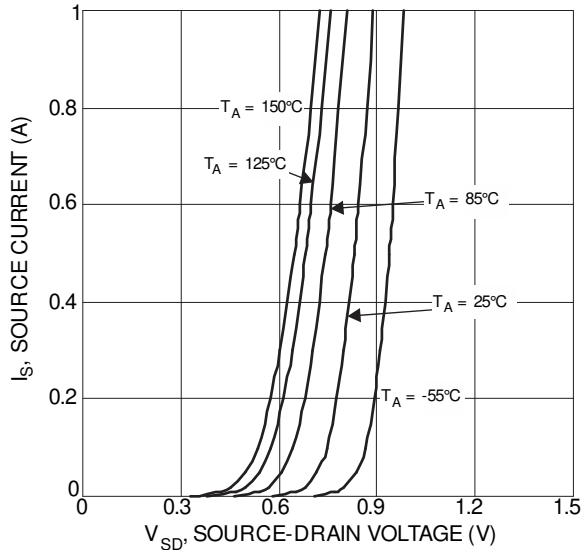


Figure 9 Diode Forward Voltage vs. Current

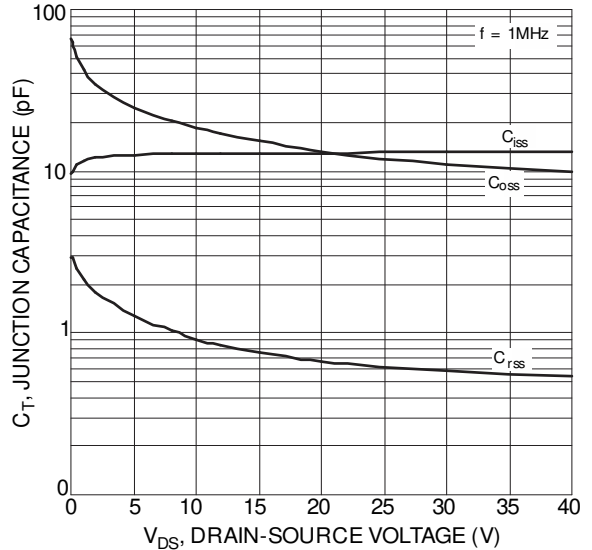


Figure 10 Typical Junction Capacitance

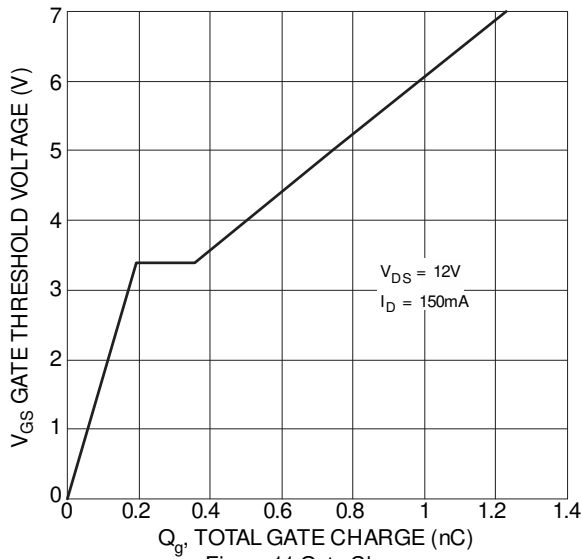


Figure 11 Gate Charge

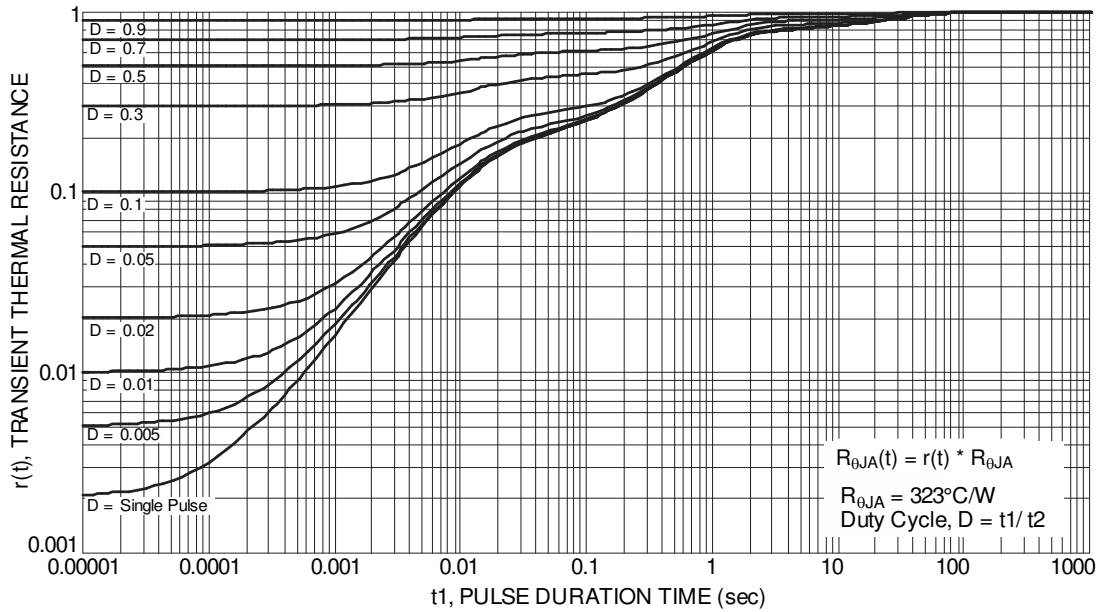
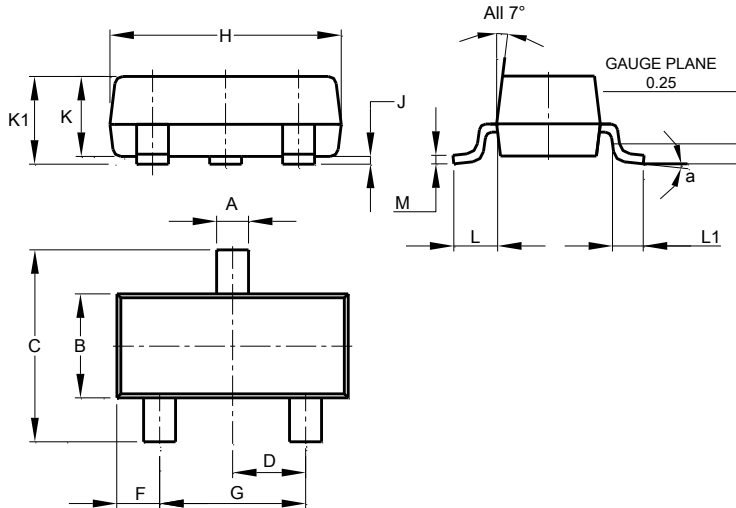


Figure 12 Transient Thermal Resistance

**Package Outline Dimensions**

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

**SOT23**

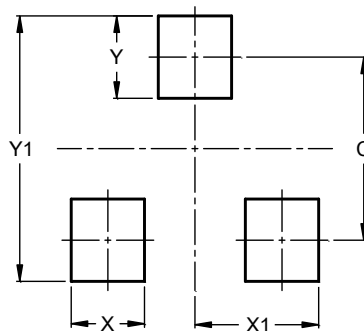


| SOT23                |       |       |       |
|----------------------|-------|-------|-------|
| Dim                  | Min   | Max   | Typ   |
| A                    | 0.37  | 0.51  | 0.40  |
| B                    | 1.20  | 1.40  | 1.30  |
| C                    | 2.30  | 2.50  | 2.40  |
| D                    | 0.89  | 1.03  | 0.915 |
| F                    | 0.45  | 0.60  | 0.535 |
| G                    | 1.78  | 2.05  | 1.83  |
| H                    | 2.80  | 3.00  | 2.90  |
| J                    | 0.013 | 0.10  | 0.05  |
| K                    | 0.890 | 1.00  | 0.975 |
| K1                   | 0.903 | 1.10  | 1.025 |
| L                    | 0.45  | 0.61  | 0.55  |
| L1                   | 0.25  | 0.55  | 0.40  |
| M                    | 0.085 | 0.150 | 0.110 |
| a                    | 0°    | 8°    | --    |
| All Dimensions in mm |       |       |       |

**Suggested Pad Layout**

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

**SOT23**



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 2.0           |
| X          | 0.8           |
| X1         | 1.35          |
| Y          | 0.9           |
| Y1         | 2.9           |

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