# 60V +175°C DUAL N-CHANNEL ENHANCEMENT MODE MOSFET

## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ Max | $I_D$ $T_C$ = +25°C |
|---|---|---|
| 60V | 27mΩ @ $V_{GS}$ = 10V | 22.6A |
| | 30mΩ @ $V_{GS}$ = 6V | 21.5A |

## 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

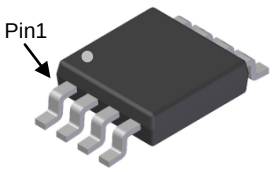
## Features and Benefits

- 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 $Q_g$ – Minimizes Switching Losses
- **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)**

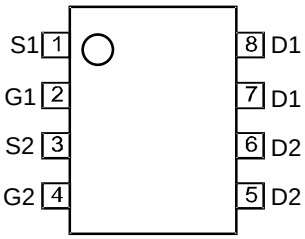
## Mechanical Data

- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound; UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe; Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.074 grams (Approximate)

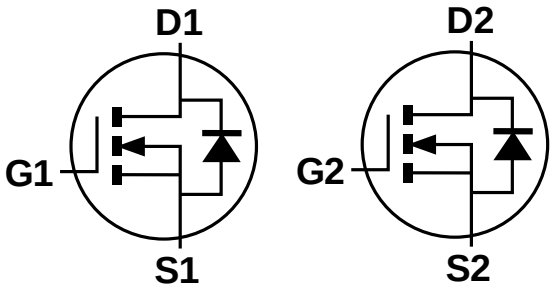
SO-8




Top View




Top View
Pin Configuration




Equivalent Circuit

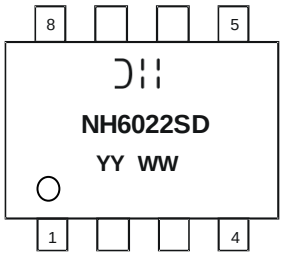
## Ordering Information (Note 5)

| Part Number | Case | Packaging |
|---|---|---|
| DMNH6022SSDQ-13 | SO-8 | 2,500 / 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 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.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

## Marking Information

SO-8




= Manufacturer's Marking
NH6022SD = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 16 = 2016)
WW = Week (01 to 53)

## Maximum Ratings (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 60 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current $V_{GS}$ = 10V (Note 7) | $T_C$ = +25°C<br>$T_C$ = +100°C | $I_D$ | 22.6<br>16.0 | A |
| | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 7.1<br>5.9 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | $I_{DM}$ | 45 | A |
| Maximum Continuous Body Diode Forward Current (Note 7) | | $I_S$ | 2 | A |
| Avalanche Current L = 0.1mL (Note 8) | | $I_{AS}$ | 22 | A |
| Avalanche Energy L = 0.1mL (Note 8) | | $E_{AS}$ | 24 | mJ |

## Thermal Characteristics

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Total Power Dissipation (Note 6) | $T_A$ = +25°C | $P_D$ | 1.5 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | $R_{\theta JA}$ | 104 | °C/W |
| | t<10s | | 60 | |
| Total Power Dissipation (Note 7) | $T_A$ = +25°C | $P_D$ | 2.1 | W |
| Thermal Resistance, Junction to Ambient (Note 7) | Steady State | $R_{\theta JA}$ | 74 | °C/W |
| | t<10s | | 42 | |
| Thermal Resistance, Junction to Case (Note 7) | | $R_{\theta JC}$ | 7.25 | |
| 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 9)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 60 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250µA |
| Zero Gate Voltage Drain Current $T_J$ = +25°C | $I_{DSS}$ | — | — | 1 | µA | $V_{DS}$ = 60V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 9)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | 1.0 | — | 3.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 21 | 27 | mΩ | $V_{GS}$ = 10V, $I_D$ = 5A |
| | | | 24 | 30 | | $V_{GS}$ = 6V, $I_D$ = 5A |
| Diode Forward Voltage | $V_{SD}$ | — | 0.8 | 1.2 | V | $V_{GS}$ = 0V, $I_S$ = 1.7A |
| **DYNAMIC CHARACTERISTICS (Note 10)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 2127 | — | pF | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 86 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 54 | — | pF | |
| Gate Resistance | $R_g$ | — | 2.0 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1MHz |
| Total Gate Charge at ($V_{GS}$ = 10V) | $Q_g$ | — | 32 | — | nC | $V_{DS}$ = 30V, $I_D$ = 6A |
| Total Gate Charge at ($V_{GS}$ = 4.5V) | $Q_g$ | — | 14 | — | nC | |
| Gate-Source Charge | $Q_{gs}$ | — | 7 | — | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 4 | — | nC | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 5.4 | — | ns | $V_{GS}$ = 10V, $V_{DS}$ = 30V, $R_G$ = 6Ω, $I_D$ = 1A |
| Turn-On Rise Time | $t_R$ | — | 4.4 | — | ns | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 30.4 | — | ns | |
| Turn-Off Fall Time | $t_F$ | — | 8.4 | — | ns | |
| Body Diode Reverse Recovery Time | $t_{RR}$ | — | 18.1 | — | ns | $I_F$ = 1.7A, di/dt = 100A/µs |
| Body Diode Reverse Recovery Charge | $Q_{RR}$ | — | 12.5 | — | nC | $I_F$ = 1.7A, di/dt = 100A/µs |

Notes: 6. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
7. Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate.
8. $I_{AS}$ and $E_{AS}$ rating are based on low frequency and duty cycles to keep $T_J$ = +25°C.
9. Short duration pulse test used to minimize self-heating effect.
10. Guaranteed by design. Not subject to product testing.

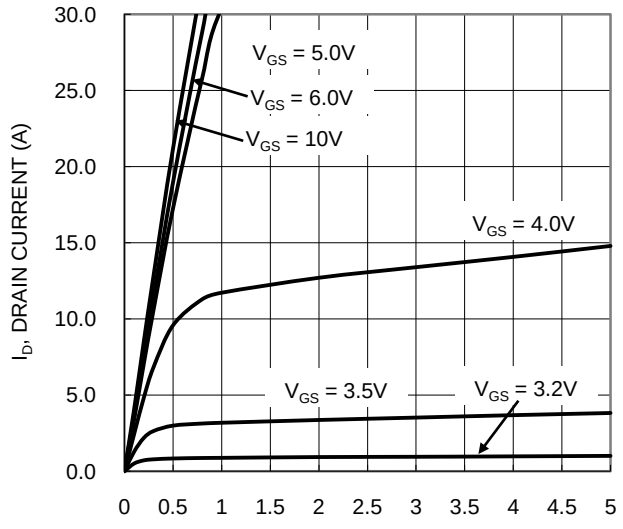



Figure 1. Typical Output Characteristic

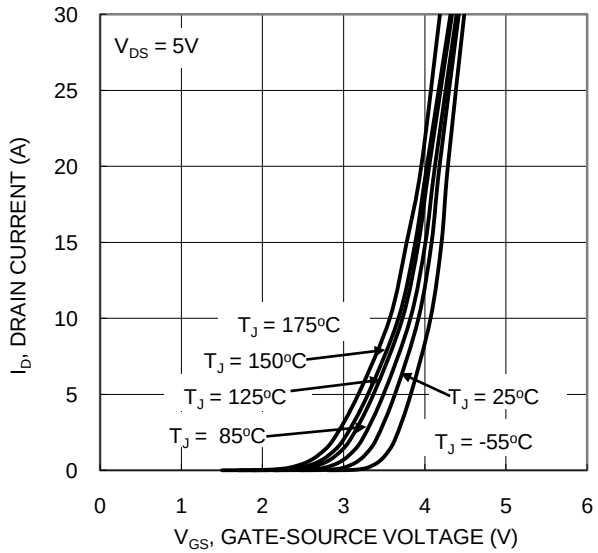



Figure 2. Typical Transfer Characteristic

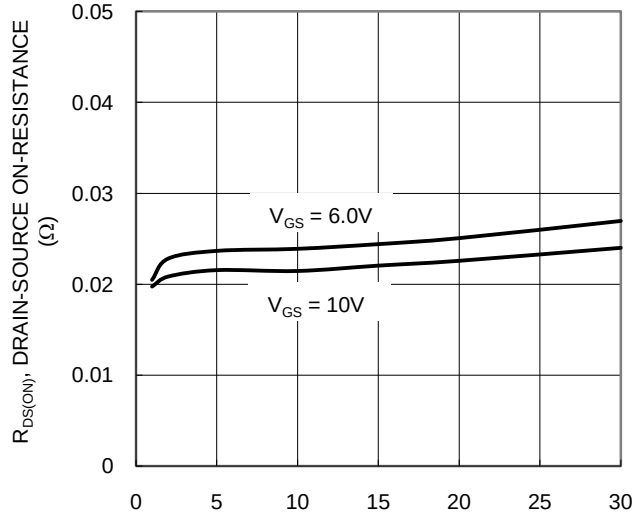



Figure 3. Typical On-Resistance vs Drain Current and Gate Voltage

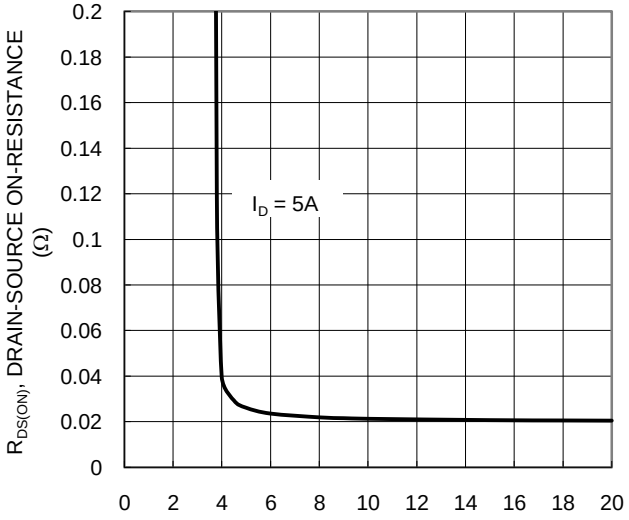



Figure 4. Typical Transfer Characteristic

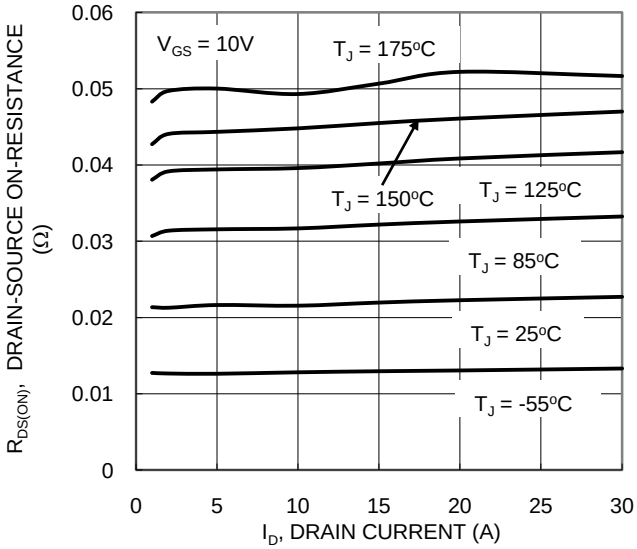



Figure 5. Typical On-Resistance vs Drain Current and Junction Temperature

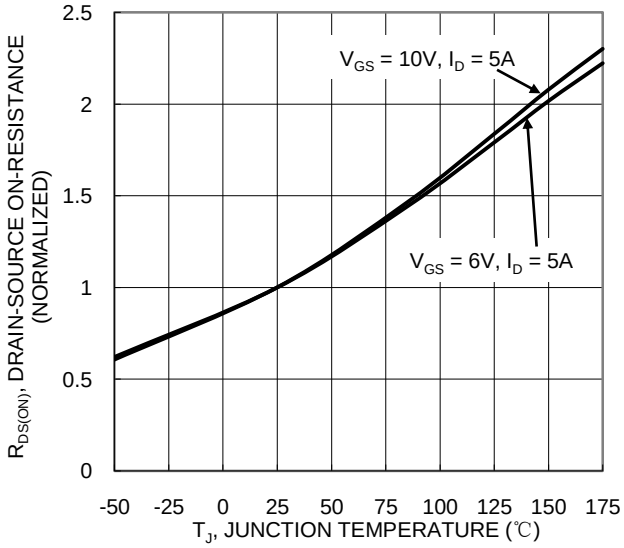



Figure 6. On-Resistance Variation with Junction Temperature

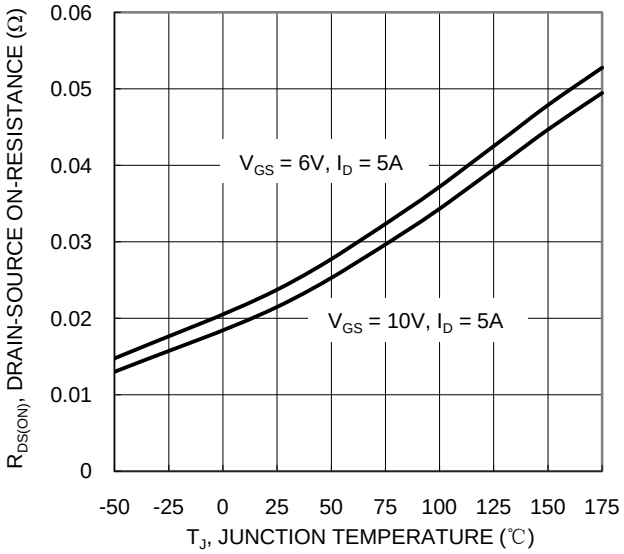



Figure 7. On-Resistance Variation with Junction Temperature

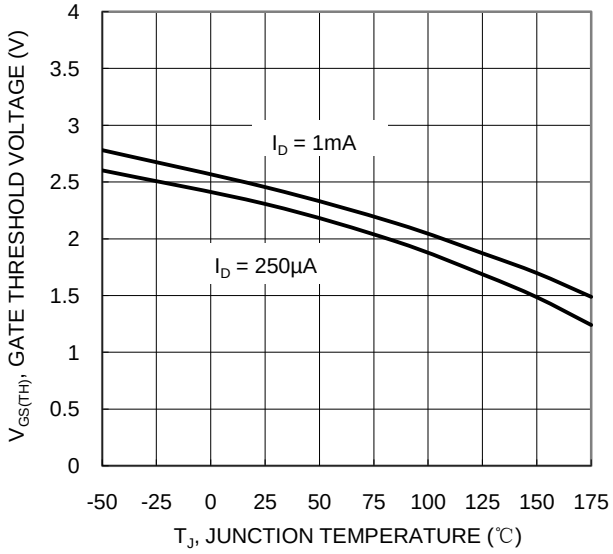



Figure 8. Gate Threshold Variation vs Junction Temperature

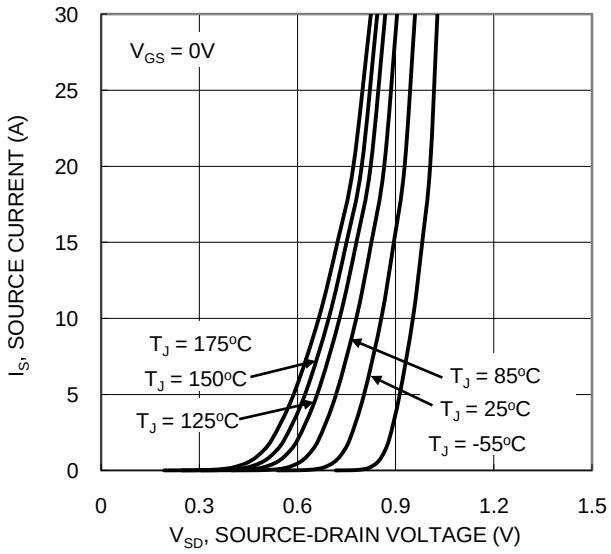



Figure 9. Diode Forward Voltage vs Current

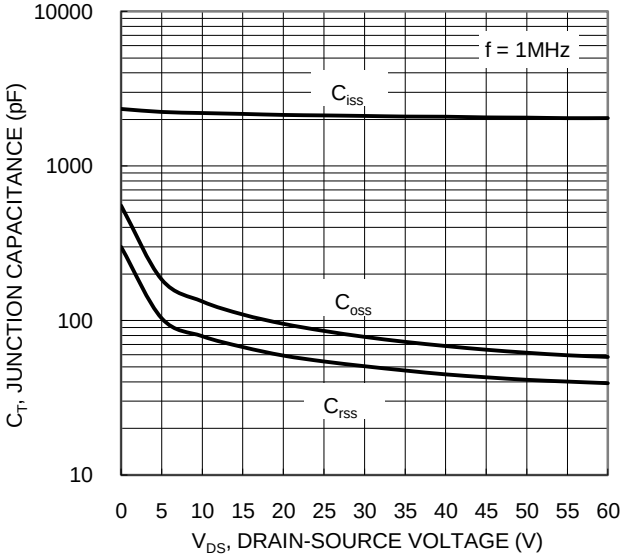



Figure 10. Typical Junction Capacitance

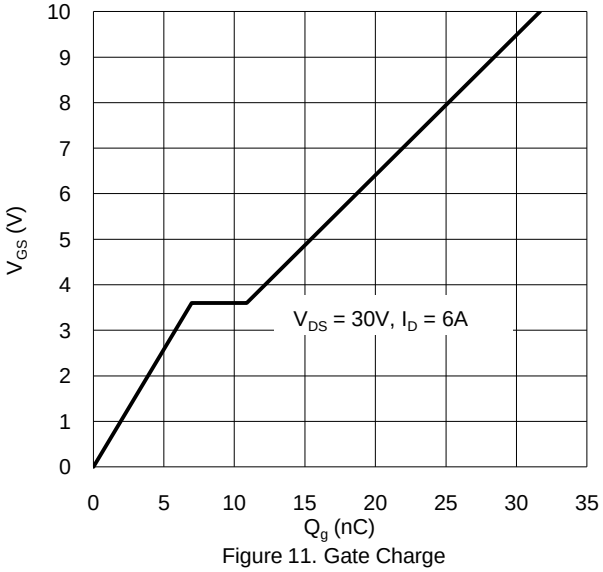



Figure 11. Gate Charge

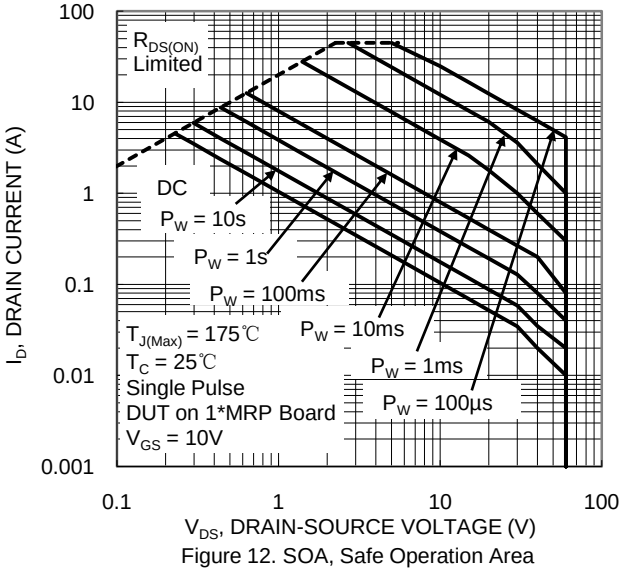



Figure 12. SOA, Safe Operation Area

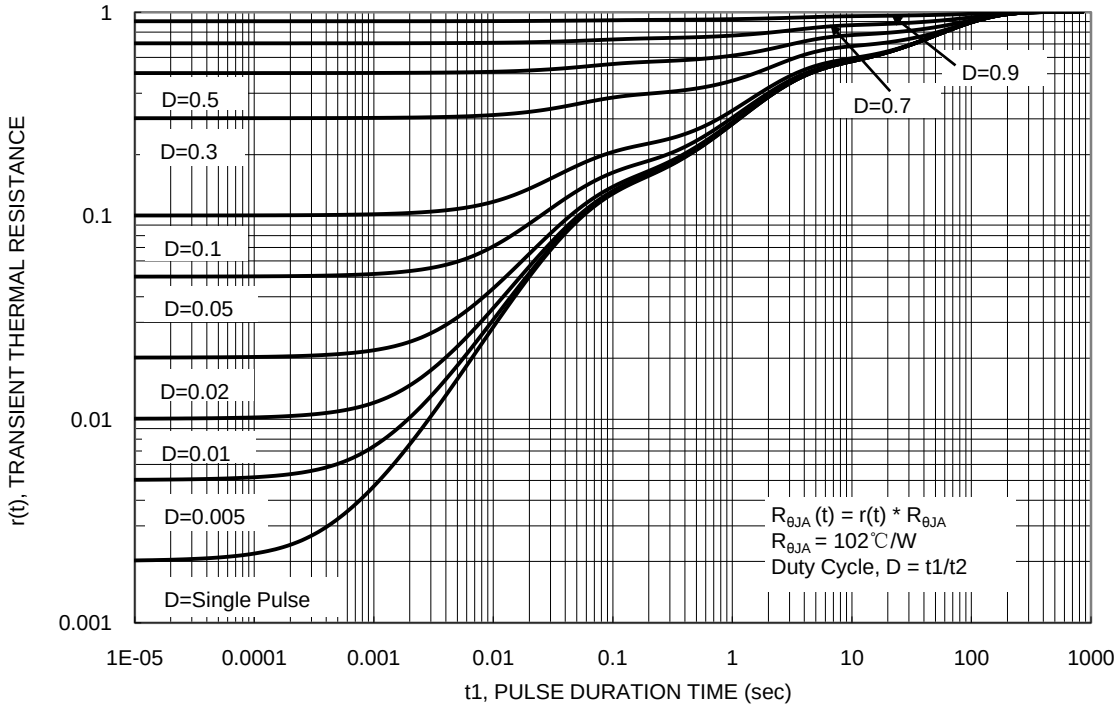
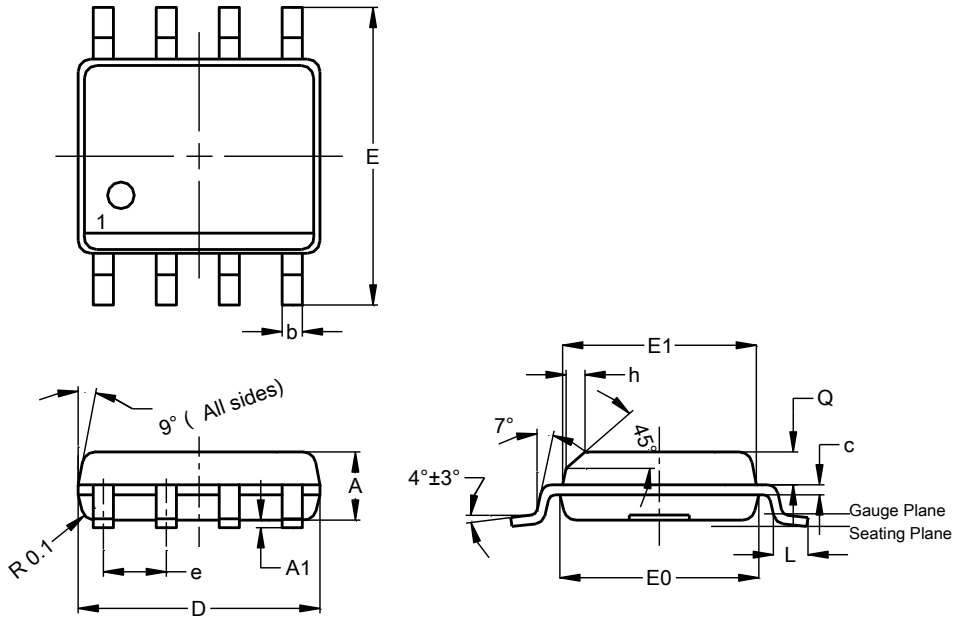



Figure 13. Transient Thermal Resistance

## Package Outline Dimensions

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

**SO-8**

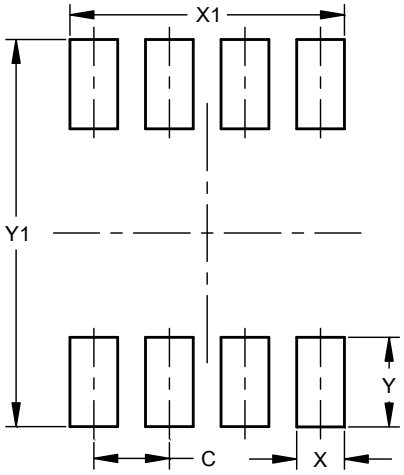



| SO-8 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 1.40 | 1.50 | 1.45 |
| **A1** | 0.10 | 0.20 | 0.15 |
| **b** | 0.30 | 0.50 | 0.40 |
| **c** | 0.15 | 0.25 | 0.20 |
| **D** | 4.85 | 4.95 | 4.90 |
| **E** | 5.90 | 6.10 | 6.00 |
| **E1** | 3.80 | 3.90 | 3.85 |
| **E0** | 3.85 | 3.95 | 3.90 |
| **e** | -- | -- | 1.27 |
| **h** | - | -- | 0.35 |
| **L** | 0.62 | 0.82 | 0.72 |
| **Q** | 0.60 | 0.70 | 0.65 |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

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

**SO-8**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 1.27 |
| **X** | 0.802 |
| **X1** | 4.612 |
| **Y** | 1.505 |
| **Y1** | 6.50 |

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