# 60V DUAL N-CHANNEL ENHANCEMENT MODE MOSFET

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)}$ | $I_D$ $T_A$ = +25°C |
|---|---|---|
| 60V | 66mΩ @ $V_{GS}$ = 10V | 4.4A |
| | 97mΩ @ $V_{GS}$ = 4.5V | 3.6A |

## Features and Benefits

- Low on-resistance
- Fast switching speed
- 100% Unclamped Inductive Switch (UIS) test in production
- **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)**

## Description and Applications

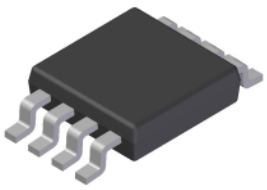
This MOSFET is designed to minimize the on-state resistance and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Motor Control
- Backlighting
- DC-DC Converters
- Power Management Functions

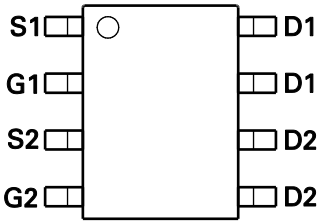
## Mechanical Data

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

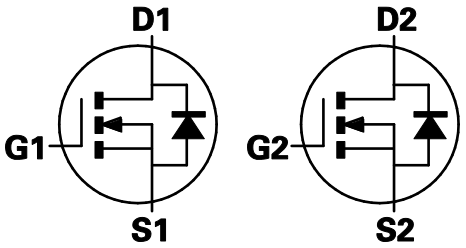
SO-8



Top View




Top View




Equivalent Circuit

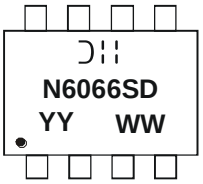
## Ordering Information (Notes 4 & 5)

| Part Number | Compliance | Case | Packaging |
|---|---|---|---|
| DMN6066SSD-13 | Commercial | SO-8 | 2,500/Tape & Reel |
| DMN6066SSDQ-13 | Automotive | 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. 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/.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

## Marking Information

SO-8




= Manufacturer's Marking
N6066SD = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 09 = 2009)
WW = Week (01 - 53)

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

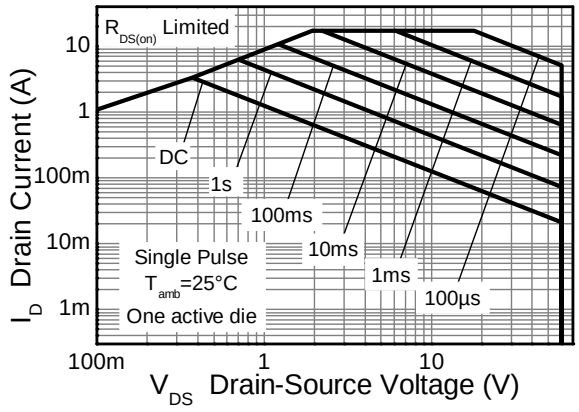
| Characteristic | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 60 | V |
| Gate-Source Voltage | | (Note 6) | $V_{GS}$ | ±20 | V |
| Single Pulsed Avalanche Energy | | (Note 13) | $E_{AS}$ | 37.5 | mJ |
| Single Pulsed Avalanche Current | | (Note 13) | $I_{AS}$ | 5.0 | A |
| Continuous Drain Current | $V_{GS}$ = 10V | (Note 8) | $I_D$ | 4.4 | A |
| | | $T_A$ = +70°C (Note 8) | | 3.5 | |
| | | (Note 7) | | 3.3 | |
| Pulsed Drain Current | $V_{GS}$ = 10V | (Note 9) | $I_{DM}$ | 17.0 | A |
| Continuous Source Current (Body diode) | | (Note 8) | $I_S$ | 3.2 | A |
| Pulsed Source Current (Body diode) | | (Note 9) | $I_{SM}$ | 17.0 | A |

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

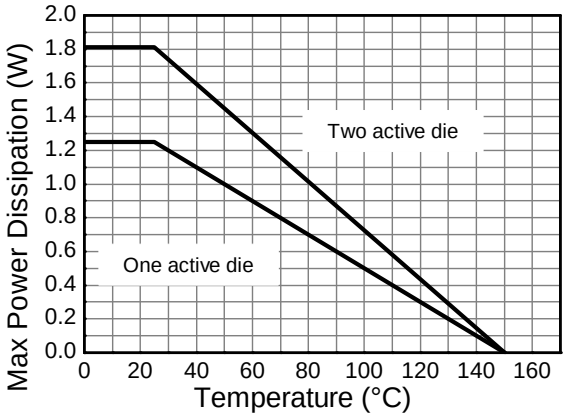
| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation<br>Linear Derating Factor | (Notes 7 & 10) | $P_D$ | 1.25<br>10 | W<br>mW/°C |
| | (Notes 7 & 11) | | 1.8<br>14.3 | |
| | (Notes 8 & 10) | | 2.14<br>17.2 | |
| Thermal Resistance, Junction to Ambient | (Notes 7 & 10) | $R_{\theta JA}$ | 100 | °C/W |
| | (Notes 7 & 11) | | 70 | |
| | (Notes 8 & 10) | | 58 | |
| Thermal Resistance, Junction to Lead | (Notes 10 & 12) | $R_{\theta JL}$ | 55 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |

Notes:
6. AEC-Q101 $V_{GS}$ maximum is ±16V.
7. For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
8. Same as note (3), except the device is measured at t ≤ 10 sec.
9. Same as note (3), except the device is pulsed with D = 0.02 and pulse width 300µs. The pulse current is limited by the maximum junction temperature.
10. For a dual device with one active die.
11. For a device with two active die running at equal power.
12. Thermal resistance from junction to solder-point (at the end of the drain lead).
13. UIS in production with L = 3.0mH, $I_{AS}$ = 5.0A, $R_G$ = 25Ω, $V_{DD}$ = 50V, starting $T_J$ = +25°C.

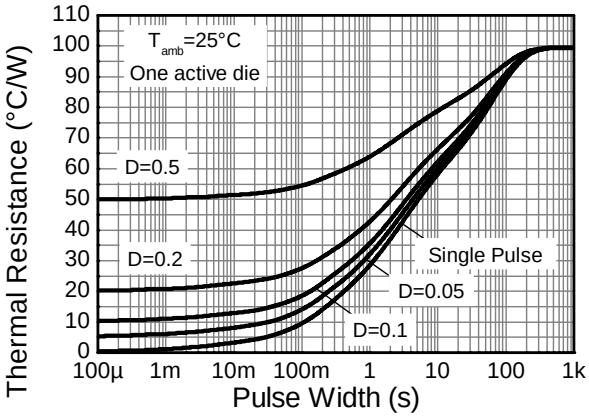
## Thermal Characteristics



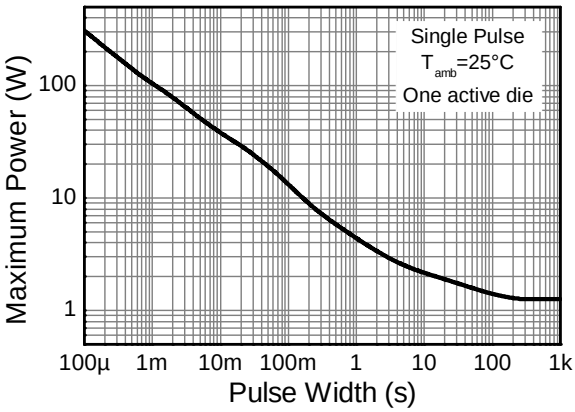

**Safe Operating Area**




**Derating Curve**




**Transient Thermal Impedance**



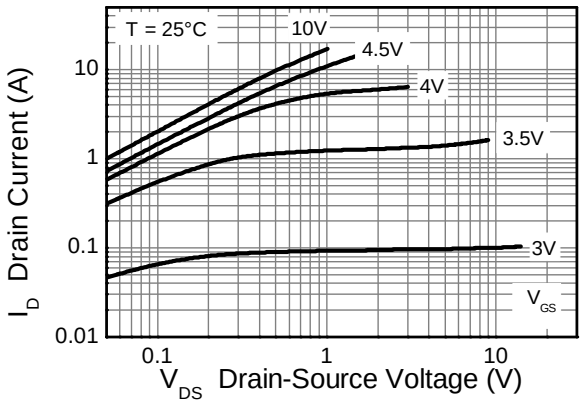

**Pulse Power Dissipation**

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

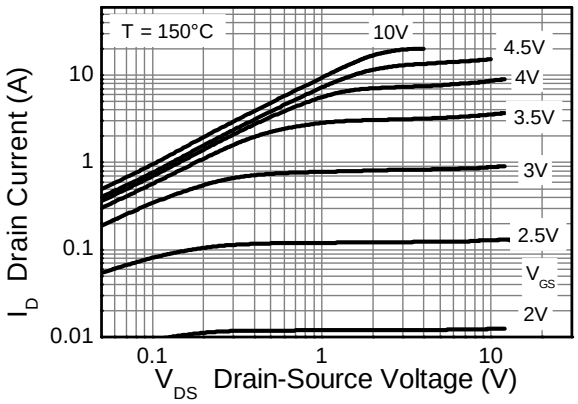
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 60 | — | — | V | $I_D$ = 250µA, $V_{GS}$= 0V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | 0.5 | µA | $V_{DS}$= 60V, $V_{GS}$= 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$= ±20V, $V_{DS}$= 0V |
| **ON CHARACTERISTICS** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | 1.0 | — | 3.0 | V | $I_D$= 250µA, $V_{DS}$= $V_{GS}$ |
| Static Drain-Source On-Resistance (Note 14) | $R_{DS\ (ON)}$ | — | 0.048 | 0.066 | Ω | $V_{GS}$= 10V, $I_D$= 4.5A |
| | | | 0.068 | 0.097 | | $V_{GS}$= 4.5V, $I_D$= 3.5A |
| Forward Transconductance (Notes 14 & 15) | $g_{fs}$ | — | 19.2 | — | S | $V_{DS}$= 15V, $I_D$= 6A |
| Diode Forward Voltage (Note 14) | $V_{SD}$ | — | 0.89 | 1.15 | V | $I_S$= 4.5A, $V_{GS}$= 0V |
| Reverse recovery time (Note 15) | $t_{rr}$ | | 22.2 | — | ns | $I_S$= 1.9A, di/dt= 100A/µs |
| Reverse recovery charge (Note 15) | $Q_{rr}$ | — | 16.9 | — | nC | |
| **DYNAMIC CHARACTERISTICS (Note 15)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 502 | — | pF | $V_{DS}$= 30V, $V_{GS}$= 0V<br>f= 1MHz |
| Output Capacitance | $C_{oss}$ | — | 45.7 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 27.1 | — | pF | |
| Total Gate Charge (Note 16) | $Q_g$ | — | 5.4 | — | nC | $V_{GS}$= 4.5V; $V_{DS}$= 30V, $I_D$= 4.5A |
| Total Gate Charge (Note 16) | $Q_g$ | — | 10.3 | — | nC | $V_{GS}$= 10V; $V_{DS}$= 30V, $I_D$= 4.5A |
| Gate-Source Charge (Note 16) | $Q_{gs}$ | — | 1.7 | — | nC | $V_{GS}$= 10V; $V_{DS}$= 30V, $I_D$= 4.5A |
| Gate-Drain Charge (Note 16) | $Q_{gd}$ | — | 3.2 | — | nC | $V_{GS}$= 10V; $V_{DS}$= 30V, $I_D$= 4.5A |
| Turn-On Delay Time (Note 16) | $t_{D(on)}$ | — | 2.7 | — | ns | $V_{DD}$= 30V, $V_{GS}$= 10V<br>$I_D$= 1A, $R_G \cong$ 6.0Ω |
| Turn-On Rise Time (Note 16) | $t_r$ | — | 2.4 | — | ns | |
| Turn-Off Delay Time (Note 16) | $t_{D(off)}$ | — | 14.7 | — | ns | |
| Turn-Off Fall Time (Note 16) | $t_f$ | — | 5.4 | — | ns | |

Notes: 14. Measured under pulsed conditions. Pulse width ≤ 300µs; duty cycle ≤ 2%.
15. For design aid only, not subject to production testing.
16. Switching characteristics are independent of operating junction temperatures.

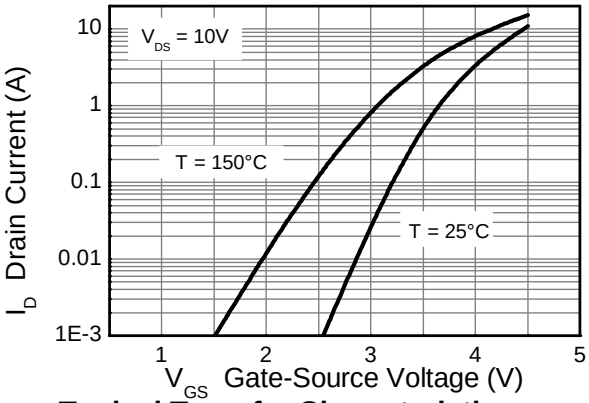
## Typical Characteristics



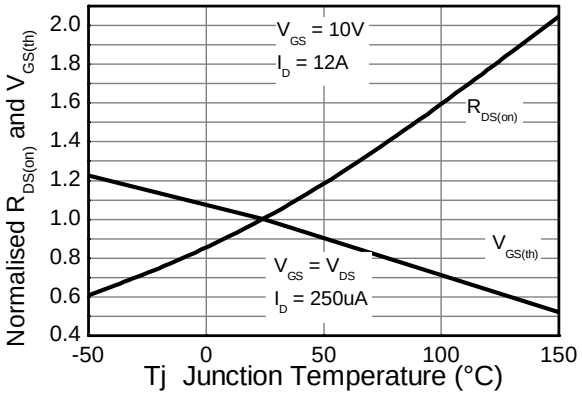

**Output Characteristics**



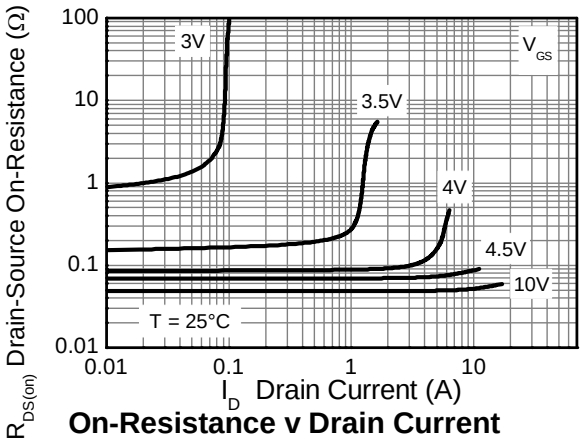

**Output Characteristics**



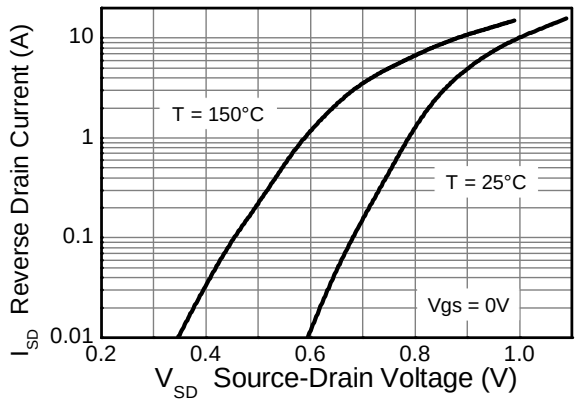

**Typical Transfer Characteristics**




**Normalised Curves v Temperature**

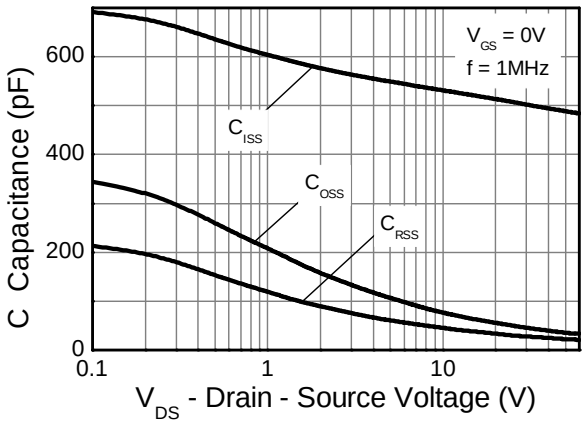



**On-Resistance v Drain Current**

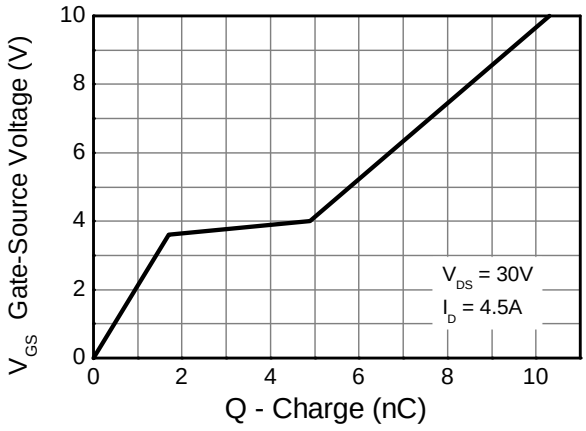



**Source-Drain Diode Forward Voltage**

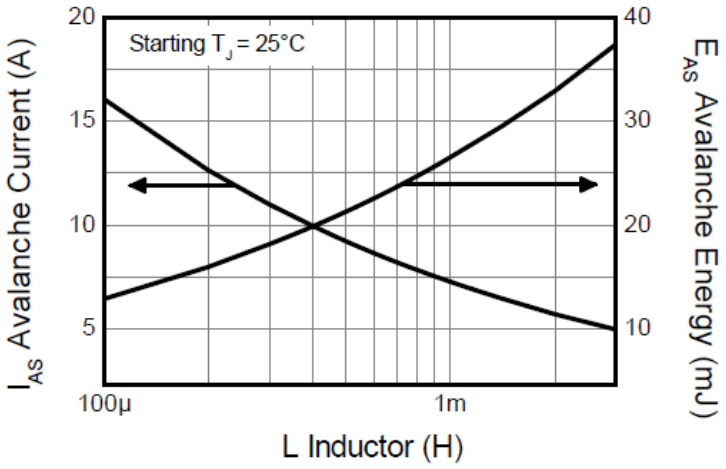
## Typical Characteristics (continued)




**Capacitance v Drain-Source Voltage**

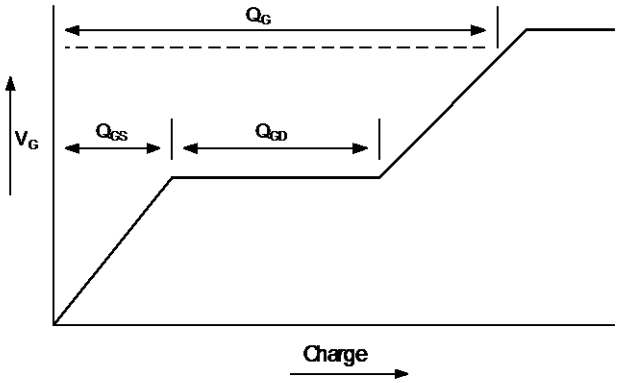



**Gate-Source Voltage v Gate Charge**

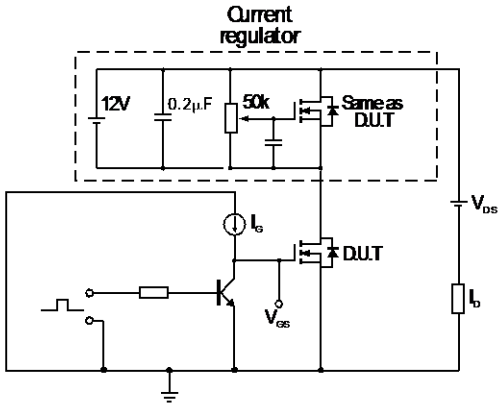



**Single-Pulsed Avalanche Rating**

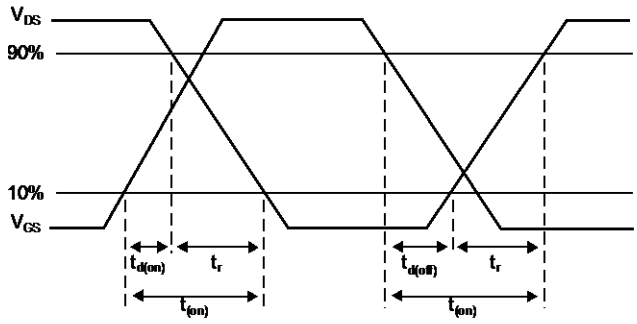
## Test Circuits



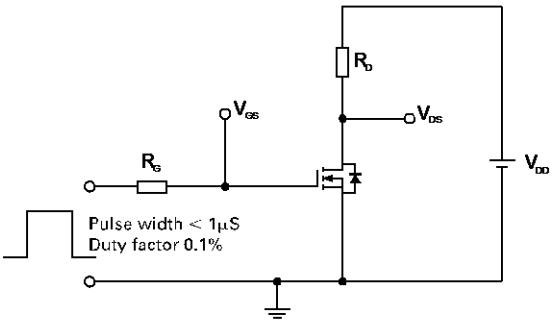

**Basic gate charge waveform**




**Gate charge test circuit**



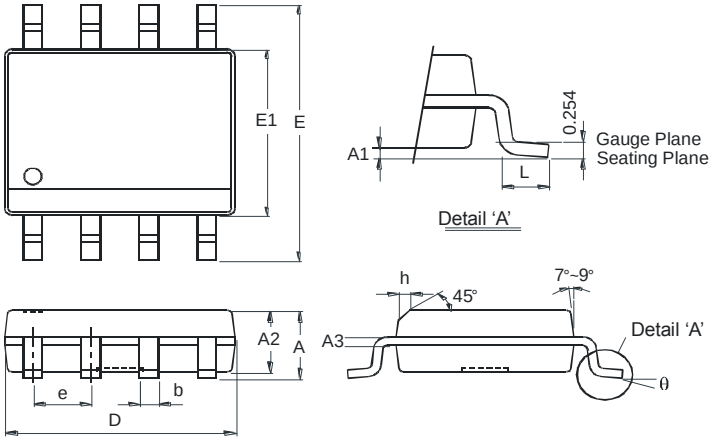

**Switching time waveforms**




**Switching time test circuit**

## Package Outline Dimensions

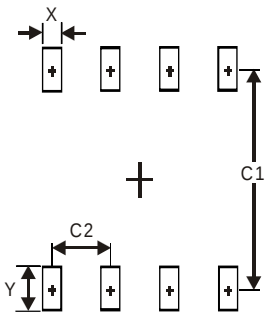
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.




| SO-8 | | |
|---|---|---|
| **Dim** | **Min** | **Max** |
| **A** | - | 1.75 |
| **A1** | 0.10 | 0.20 |
| **A2** | 1.30 | 1.50 |
| **A3** | 0.15 | 0.25 |
| **b** | 0.3 | 0.5 |
| **D** | 4.85 | 4.95 |
| **E** | 5.90 | 6.10 |
| **E1** | 3.85 | 3.95 |
| **e** | 1.27 Typ | |
| **h** | - | 0.35 |
| **L** | 0.62 | 0.82 |
| **θ** | 0° | 8° |
| **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) |
|---|---|
| **X** | 0.60 |
| **Y** | 1.55 |
| **C1** | 5.4 |
| **C2** | 1.27 |

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