

## 60V N-CHANNEL ENHANCEMENT MODE MOSFET

### Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)}$                    | $I_D$<br>$T_A = 25^\circ C$ |
|---------------|---------------------------------|-----------------------------|
| 60V           | 68m $\Omega$ @ $V_{GS} = 10V$   | 5.6A                        |
|               | 100m $\Omega$ @ $V_{GS} = 4.5V$ | 4.7A                        |

### Description and Applications

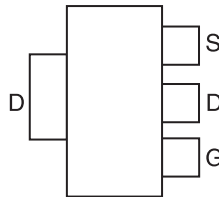
This MOSFET has been designed to minimize the on-state resistance and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Motor control
- Transformer driving switch
- DC-DC Converters
- Power management functions
- Uninterrupted power supply

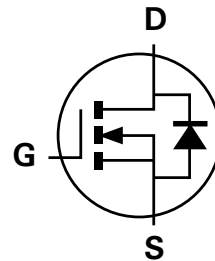
SOT223



Top View



Pin Out - Top View



Equivalent Circuit

### Features and Benefits

- 100% Unclamped Inductive Switch (UIS) test in production
- Low on-resistance
- Fast switching speed
- "Green" component and RoHS compliant (Note 1)
- Qualified to AEC-Q101 Standards for High Reliability

### Mechanical Data

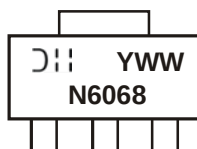
- Case: SOT223
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0 (Note 1)
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals Connections: See diagram below
- Terminals: Finish - Matte Tin annealed over Copper lead frame. Solderable per MIL-STD-202, Method 208
- Weight: 0.112 grams (approximate)

### Ordering Information (Note 1)

| Product      | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|--------------|---------|--------------------|-----------------|-------------------|
| DMN6068SE-13 | N6068   | 13                 | 12              | 4,000             |

Notes: 1. Diodes, Inc. defines "Green" products as those which are RoHS compliant and contain no halogens or antimony compounds; further information about Diodes Inc.'s "Green" Policy can be found on our website. For packaging details, go to our website.

### Marking Information



311 = Manufacturer's Marking  
N6068 = Product Type Marking Code  
YWW = Date Code Marking  
Y = Year (ex: 9 = 2009)  
WW = Week (01 - 53)

## Maximum Ratings @T<sub>A</sub> = 25°C unless otherwise specified

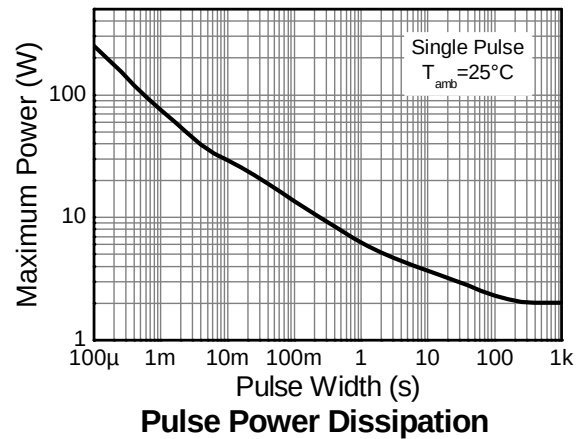
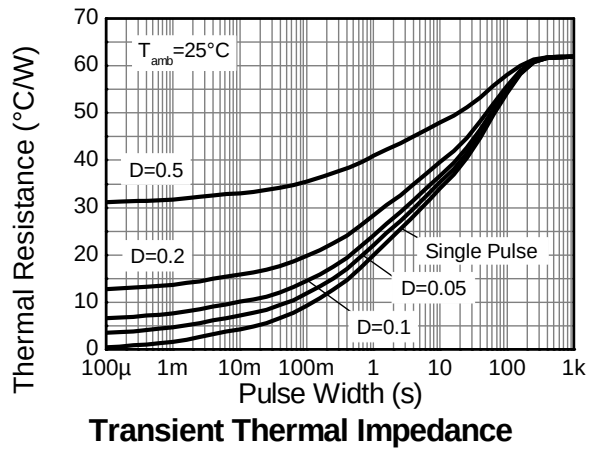
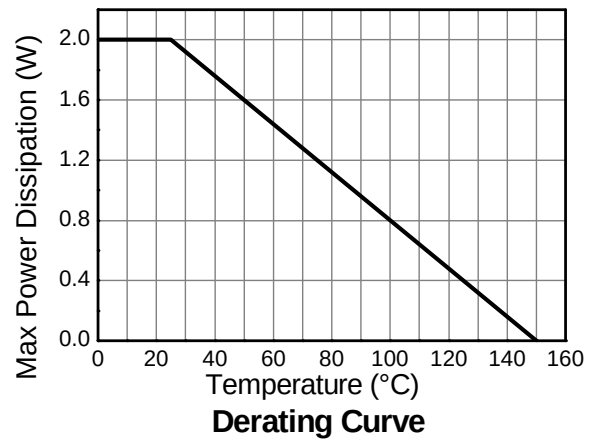
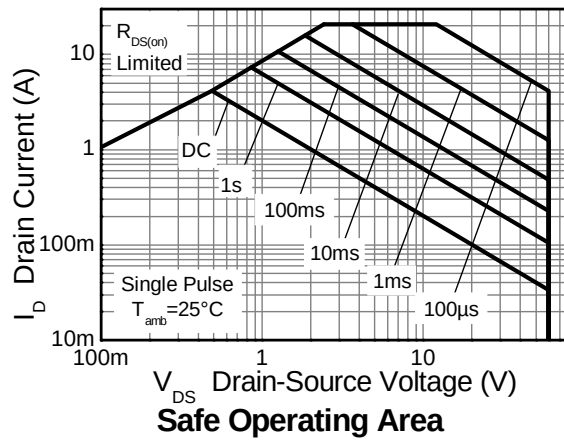
| Characteristic                         |                       |                                | Symbol           | Value | Unit |
|----------------------------------------|-----------------------|--------------------------------|------------------|-------|------|
| Drain-Source voltage                   |                       |                                | V <sub>DSS</sub> | 60    | V    |
| Gate-Source voltage                    | (Note 2)              |                                | V <sub>GS</sub>  | ±20   | V    |
| Single Pulsed Avalanche Energy         | (Note 7)              |                                | E <sub>AS</sub>  | 37.5  | mJ   |
| Single Pulsed Avalanche Current        | (Note 7)              |                                | I <sub>AS</sub>  | 5.0   | A    |
| Continuous Drain current               | V <sub>GS</sub> = 10V | (Note 4)                       | I <sub>D</sub>   | 5.6   | A    |
|                                        |                       | T <sub>A</sub> = 70°C (Note 4) |                  | 4.5   |      |
|                                        |                       | (Note 3)                       |                  | 4.1   |      |
| Pulsed Drain current                   | V <sub>GS</sub> = 10V | (Note 5)                       | I <sub>DM</sub>  | 20.8  | A    |
| Continuous Source current (Body diode) |                       |                                | I <sub>S</sub>   | 4.9   | A    |
| Pulsed Source current (Body diode)     |                       |                                | I <sub>SM</sub>  | 20.8  | A    |

## Thermal Characteristics @T<sub>A</sub> = 25°C unless otherwise specified

| Characteristic                          |          | Symbol                            | Value      | Unit  |
|-----------------------------------------|----------|-----------------------------------|------------|-------|
| Power dissipation                       | (Note 3) | P <sub>D</sub>                    | 2.0        | W     |
|                                         |          |                                   | 16.0       |       |
| Linear derating factor                  | (Note 4) |                                   | 3.7        | mW/°C |
|                                         |          |                                   | 29.5       |       |
| Thermal Resistance, Junction to Ambient | (Note 3) | R <sub>θJA</sub>                  | 62.5       | °C/W  |
|                                         | (Note 4) |                                   | 34         |       |
| Thermal Resistance, Junction to Lead    | (Note 6) | R <sub>θJL</sub>                  | 11.5       |       |
| Operating and storage temperature range |          | T <sub>J</sub> , T <sub>STG</sub> | -55 to 150 | °C    |

- Notes:
- AEC-Q101 V<sub>GS</sub> maximum is ±16V.
  - For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 2oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  - Same as note (3), except the device is measured at t ≤ 10 sec.
  - Same as note (3), except the device is pulsed with D= 0.02 and pulse width 300 μs. The pulse current is limited by the maximum junction temperature.
  - Thermal resistance from junction to solder-point (at the end of the drain lead).
  - UIS in production with L = 3.0mH, I<sub>AS</sub> = 5.0A, R<sub>G</sub> = 25Ω, V<sub>DD</sub>=50V, starting T<sub>J</sub> = 25°C.

## Thermal Characteristics

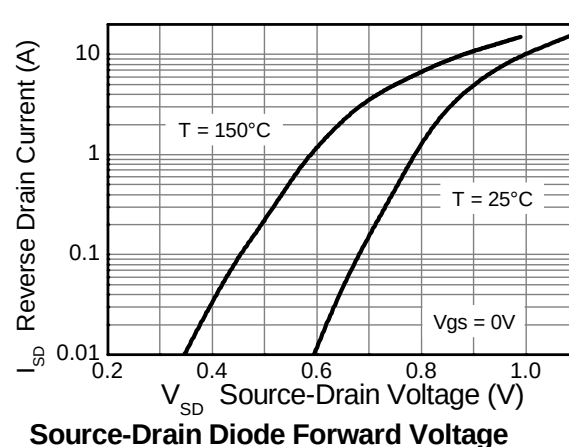
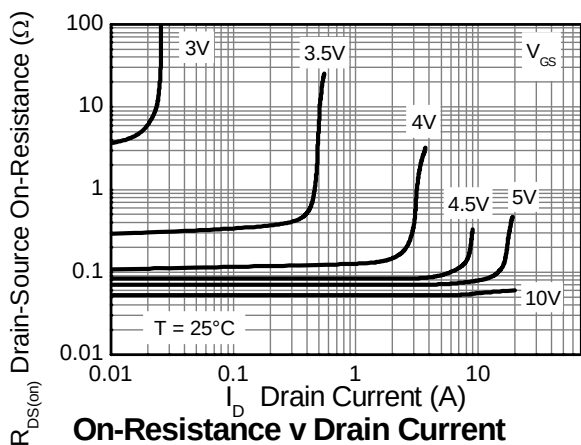
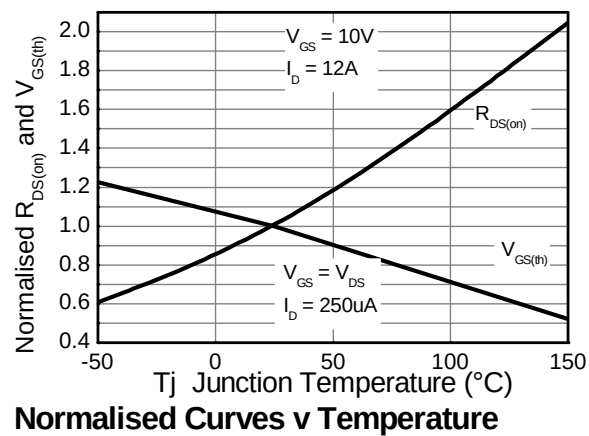
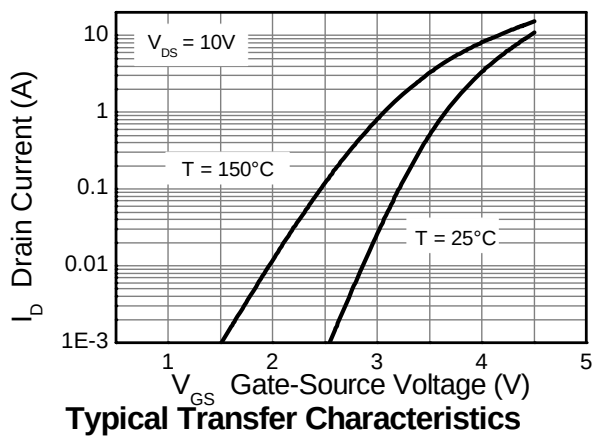
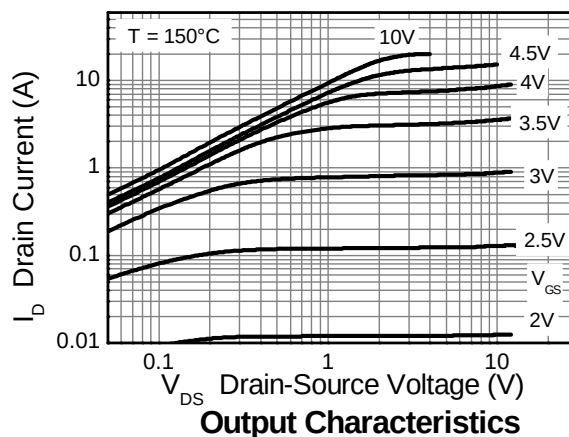
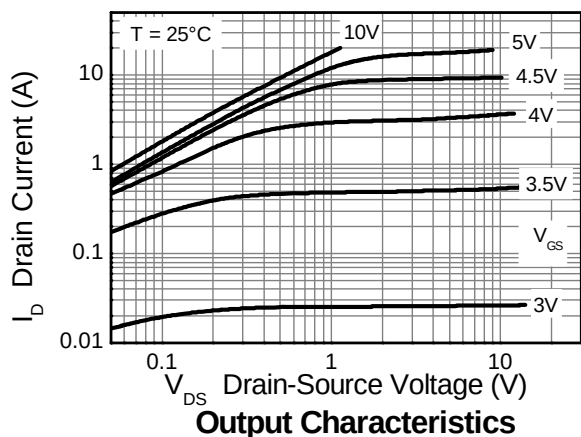


**Electrical Characteristics** @T<sub>A</sub> = 25°C unless otherwise specified

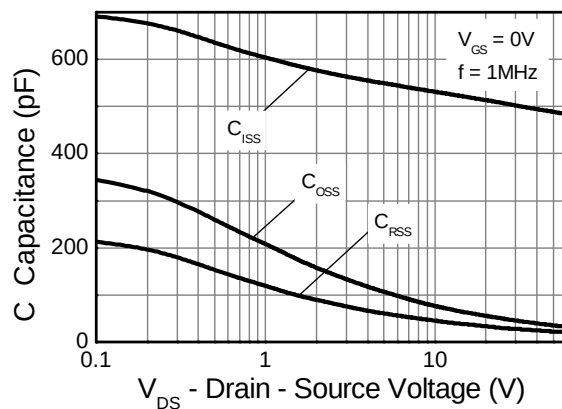
| Characteristic                             | Symbol               | Min | Typ  | Max   | Unit | Test Condition                                                                              |                                               |
|--------------------------------------------|----------------------|-----|------|-------|------|---------------------------------------------------------------------------------------------|-----------------------------------------------|
| OFF CHARACTERISTICS                        |                      |     |      |       |      |                                                                                             |                                               |
| Drain-Source Breakdown Voltage             | BV <sub>DSS</sub>    | 60  | —    | —     | V    | I <sub>D</sub> = 250μA, V <sub>GS</sub> = 0V                                                |                                               |
| Zero Gate Voltage Drain Current            | I <sub>DSS</sub>     | —   | —    | 0.5   | 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                                                |                                               |
| ON CHARACTERISTICS                         |                      |     |      |       |      |                                                                                             |                                               |
| Gate Threshold Voltage                     | V <sub>GS(th)</sub>  | 1.0 | —    | 3.0   | V    | I <sub>D</sub> = 250μA, V <sub>DS</sub> = V <sub>GS</sub>                                   |                                               |
| Static Drain-Source On-Resistance (Note 8) | R <sub>DS (ON)</sub> | —   | —    | 0.068 | Ω    | V <sub>GS</sub> = 10V, I <sub>D</sub> = 12A                                                 |                                               |
|                                            |                      |     |      | 0.100 |      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 6A                                                 |                                               |
| Forward Transconductance (Notes 8 & 9)     | g <sub>fS</sub>      | —   | 19.7 | —     | S    | V <sub>DS</sub> = 15V, I <sub>D</sub> = 12A                                                 |                                               |
| Diode Forward Voltage (Note 8)             | V <sub>SD</sub>      | —   | 0.98 | 1.15  | V    | I <sub>S</sub> = 12A, V <sub>GS</sub> = 0V                                                  |                                               |
| Reverse recovery time (Note 9)             | t <sub>rr</sub>      | —   | 145  | —     | ns   | I <sub>S</sub> = 12A, di/dt= 100A/μs                                                        |                                               |
| Reverse recovery charge (Note 9)           | Q <sub>rr</sub>      | —   | 929  | —     | nC   |                                                                                             |                                               |
| DYNAMIC CHARACTERISTICS (Note 9)           |                      |     |      |       |      |                                                                                             |                                               |
| Input Capacitance                          | C <sub>iss</sub>     | —   | 502  | —     | pF   | V <sub>DS</sub> = 30V, V <sub>GS</sub> = 0V<br>f= 1MHz                                      |                                               |
| Output Capacitance                         | C <sub>oss</sub>     | —   | 45.7 | —     | pF   |                                                                                             |                                               |
| Reverse Transfer Capacitance               | C <sub>rss</sub>     | —   | 27.1 | —     | pF   |                                                                                             |                                               |
| Total Gate Charge (Note 10)                | Q <sub>g</sub>       | —   | 5.55 | —     | nC   | V <sub>GS</sub> = 4.5V                                                                      | V <sub>DS</sub> = 30V<br>I <sub>D</sub> = 12A |
| Total Gate Charge (Note 10)                | Q <sub>g</sub>       | —   | 10.3 | —     | nC   | V <sub>GS</sub> = 10V                                                                       |                                               |
| Gate-Source Charge (Note 10)               | Q <sub>gs</sub>      | —   | 1.6  | —     | nC   |                                                                                             |                                               |
| Gate-Drain Charge(Note 10)                 | Q <sub>gd</sub>      | —   | 3.5  | —     | nC   |                                                                                             |                                               |
| Turn-On Delay Time (Note 10)               | t <sub>D(on)</sub>   | —   | 3.6  | —     | ns   | V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V<br>I <sub>D</sub> = 12A, R <sub>G</sub> ≅ 6.0Ω |                                               |
| Turn-On Rise Time (Note 10)                | t <sub>r</sub>       | —   | 10.8 | —     | ns   |                                                                                             |                                               |
| Turn-Off Delay Time (Note 10)              | t <sub>D(off)</sub>  | —   | 11.9 | —     | ns   |                                                                                             |                                               |
| Turn-Off Fall Time (Note 10)               | t <sub>f</sub>       | —   | 8.7  | —     | ns   |                                                                                             |                                               |

Notes: 8. Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%  
9. For design aid only, not subject to production testing.  
10. Switching characteristics are independent of operating junction temperatures.

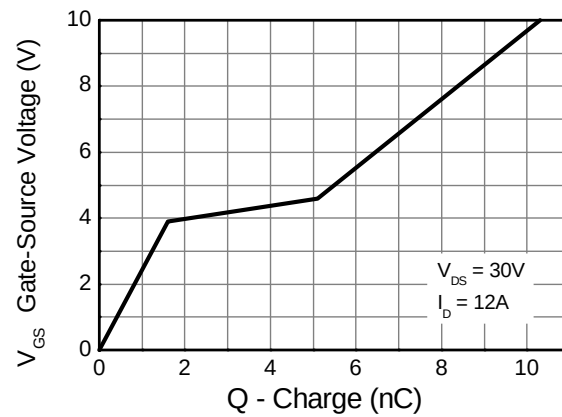
## Typical Characteristics



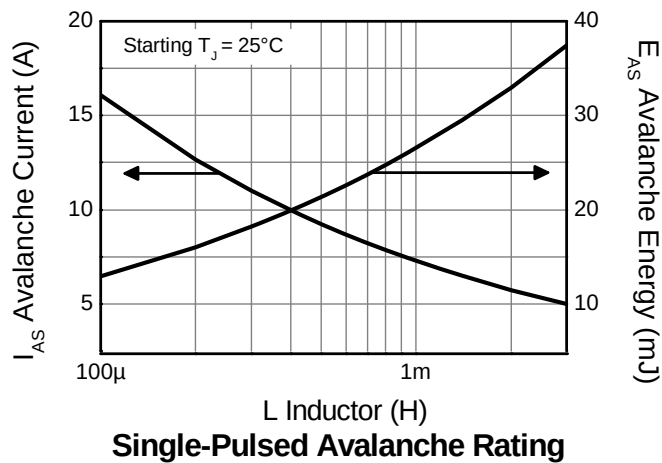
## Typical Characteristics - continued



Capacitance v Drain-Source Voltage

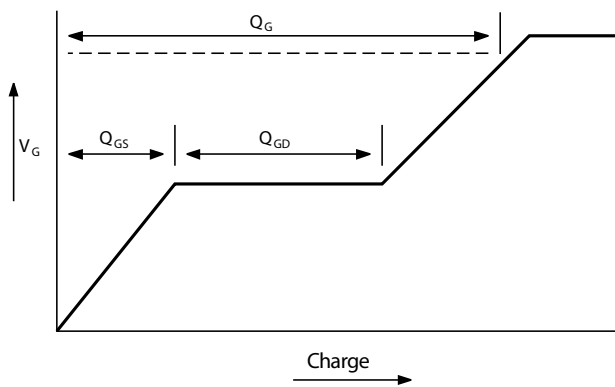


Gate-Source Voltage v Gate Charge

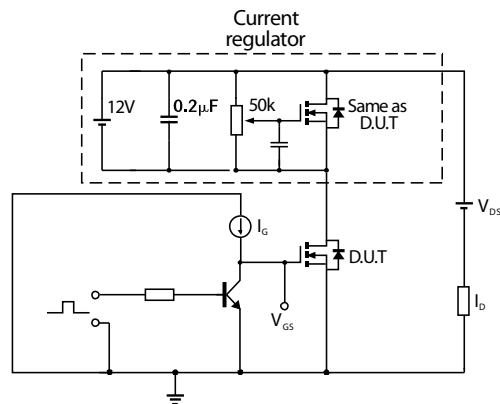


Single-Pulsed Avalanche Rating

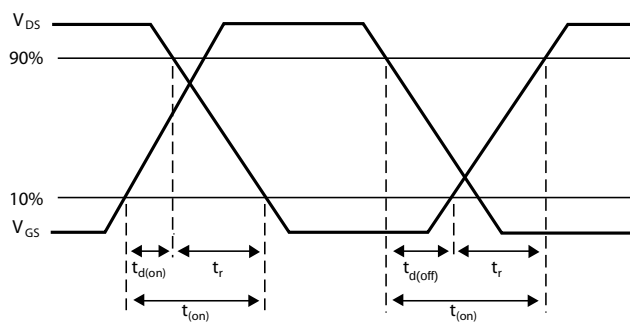
## Test Circuits



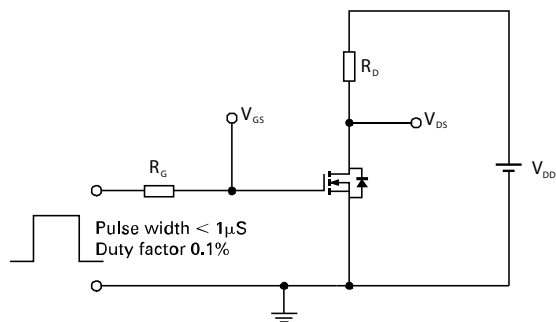
**Basic gate charge waveform**



**Gate charge test circuit**

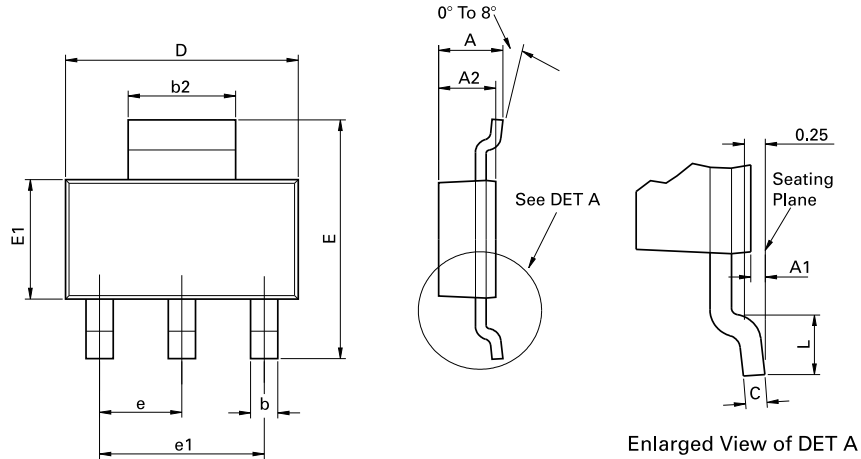


**Switching time waveforms**



**Switching time test circuit**

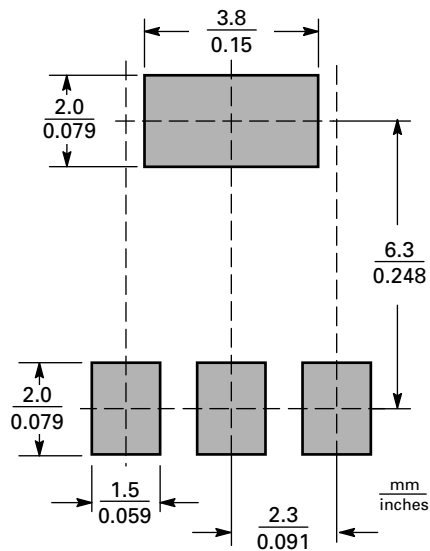
## Package Outline Dimensions



Conforms to JEDEC TO-261 AA Issue B

| DIM | Millimeters |      | Inches |        | DIM | Millimeters |      | Inches     |       |
|-----|-------------|------|--------|--------|-----|-------------|------|------------|-------|
|     | Min         | Max  | Min    | Max    |     | Min         | Max  | Min        | Max   |
| A   | -           | 1.80 | -      | 0.071  | D   | 6.30        | 6.70 | 0.248      | 0.264 |
| A1  | 0.02        | 0.10 | 0.0008 | 0.004  | e   | 2.30 BSC    |      | 0.0905 BSC |       |
| A2  | 1.55        | 1.65 | 0.0610 | 0.0649 | e1  | 4.60 BSC    |      | 0.181 BSC  |       |
| b   | 0.66        | 0.84 | 0.026  | 0.033  | E   | 6.70        | 7.30 | 0.264      | 0.287 |
| b2  | 2.90        | 3.10 | 0.114  | 0.122  | E1  | 3.30        | 3.70 | 0.130      | 0.146 |
| C   | 0.23        | 0.33 | 0.009  | 0.013  | L   | 0.90        | -    | 0.355      | -     |

## Suggested Pad Layout





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