

## Product Summary

| BV <sub>DSS</sub> | R <sub>DS(on)</sub>            | I <sub>D</sub><br>T <sub>A</sub> = +25°C |
|-------------------|--------------------------------|------------------------------------------|
| 60V               | 0.04Ω @ V <sub>GS</sub> = 10V  | 7.5A                                     |
|                   | 0.06Ω @ V <sub>GS</sub> = 4.5V | 6.2A                                     |

## Description

This new generation trench MOSFET features a unique structure combining the benefits of low on-resistance and fast switching, making it ideal for high-efficiency power management applications.

## Applications

- DC-DC converters
- Power management functions
- Disconnect switches
- Motor control

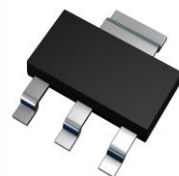
## Features and Benefits

- 100% Unclamped Inductive Switch (UIS) Test in Production
- High Voltage
- Low On-Resistance
- Fast Switching Speed
- Low Gate Drive
- Low Threshold
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e.: parts qualified to AEC-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please refer to the related automotive grade (Q-suffix) part. A listing can be found at <https://www.diodes.com/products/automotive/automotive-products/>.**
- **This part is qualified to JEDEC standards (as references in AEC-Q) for High Reliability. <https://www.diodes.com/quality/product-definitions/>**

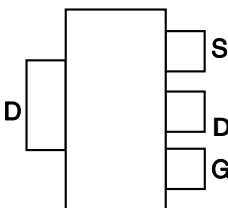
## Mechanical Data

- Package: SOT223 (Type DN)
- Package Material: Molded Plastic, "Green" Molding Compound; UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 
- Weight: 0.112 grams (Approximate)

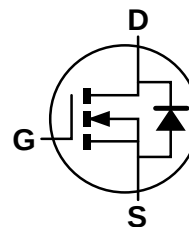
SOT223 (Type DN)



Top View



Pin Out - Top View



Equivalent Circuit

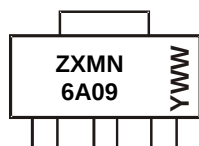
## Ordering Information (Note 4)

| Part Number | Package          | Packing |             |
|-------------|------------------|---------|-------------|
|             |                  | Qty.    | Carrier     |
| ZXMN6A09GTA | SOT223 (Type DN) | 1,000   | Tape & Reel |

- Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
  2. See <https://www.diodes.com/quality/lead-free/> 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 <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information

SOT223 (Type DN)



ZXMN6A09 = Product Type Marking Code

YWW = Date Code Marking

Y = Last Digit of Year (ex: 2 = 2022)

WW = Week Code (01 to 53)

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

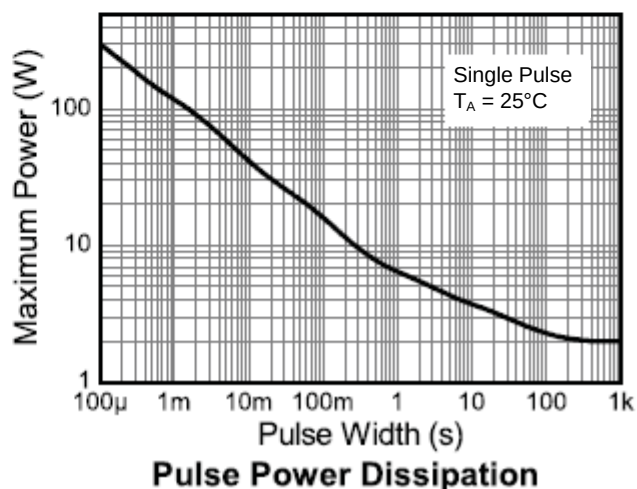
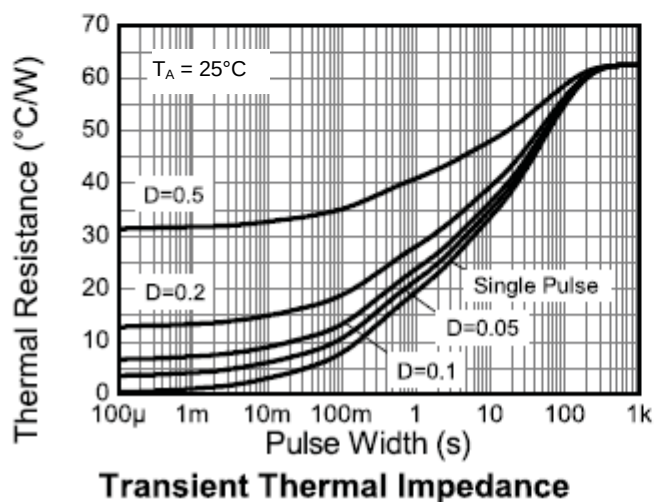
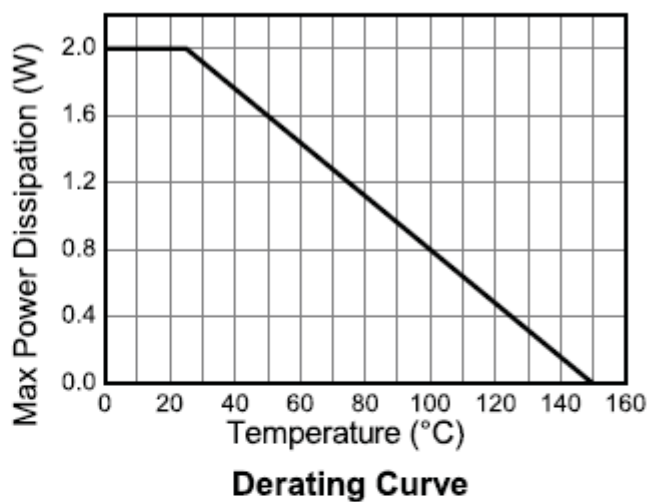
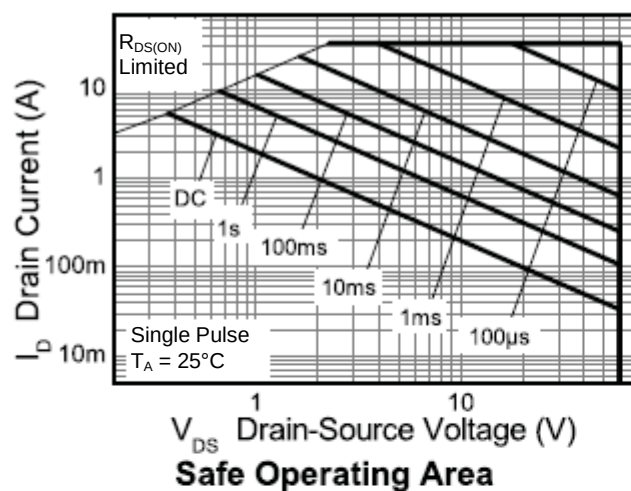
| Characteristic                                                                   | Symbol           | Value | Unit |
|----------------------------------------------------------------------------------|------------------|-------|------|
| Drain-Source Voltage                                                             | V <sub>DSS</sub> | 60    | V    |
| Gate-Source Voltage                                                              | V <sub>GSS</sub> | ±20   | V    |
| Continuous Drain Current @V <sub>GS</sub> = 10V; T <sub>A</sub> = +25°C (Note 6) | I <sub>D</sub>   | 7.5   | A    |
| @V <sub>GS</sub> = 10V; T <sub>A</sub> = +70°C (Note 6)                          |                  | 6     |      |
| @V <sub>GS</sub> = 10V; T <sub>A</sub> = +25°C (Note 5)                          |                  | 5.4   |      |
| Pulsed Drain Current (Note 7)                                                    | I <sub>DM</sub>  | 33    | A    |
| Continuous Source Current (Body Diode) (Note 6)                                  | I <sub>S</sub>   | 3.5   | A    |
| Pulsed Source Current (Body Diode) (Note 7)                                      | I <sub>SM</sub>  | 33    | A    |
| Avalanche Current, L = 0.1mH                                                     | I <sub>AS</sub>  | 1.17  | A    |
| Avalanche Energy, L = 0.1mH                                                      | E <sub>AS</sub>  | 0.07  | mJ   |

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

| Characteristic                                       | Symbol                            | Value       | Unit  |
|------------------------------------------------------|-----------------------------------|-------------|-------|
| Power Dissipation at T <sub>A</sub> = +25°C (Note 5) | P <sub>D</sub>                    | 2.0         | W     |
| Linear Derating Factor                               |                                   | 16          | mW/°C |
| Power Dissipation at T <sub>A</sub> = +25°C (Note 6) | P <sub>D</sub>                    | 3.9         | W     |
| Linear Derating Factor                               |                                   | 31          | mW/°C |
| Thermal Resistance, Junction to Ambient (Note 5)     | R <sub>θJA</sub>                  | 62.5        | °C/W  |
| Thermal Resistance, Junction to Ambient (Note 6)     | R <sub>θJA</sub>                  | 32.2        | °C/W  |
| Operating and Storage Temperature Range              | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C    |

Notes:

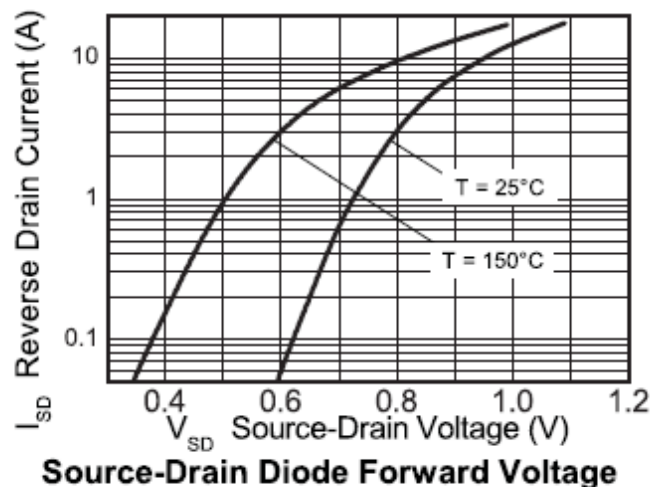
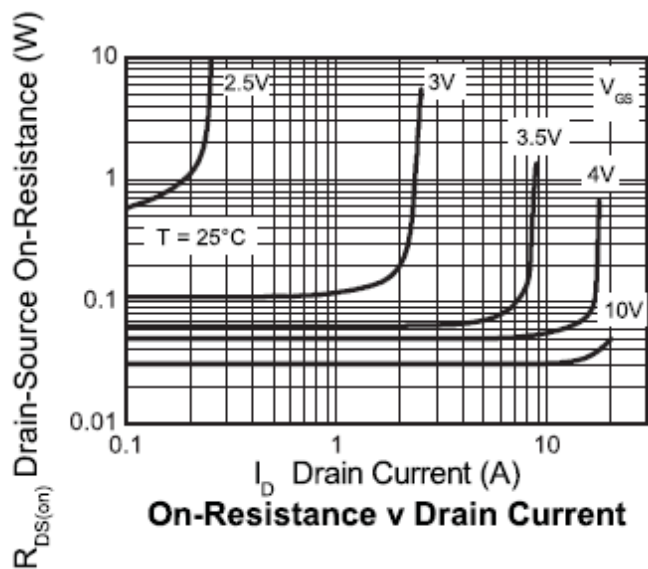
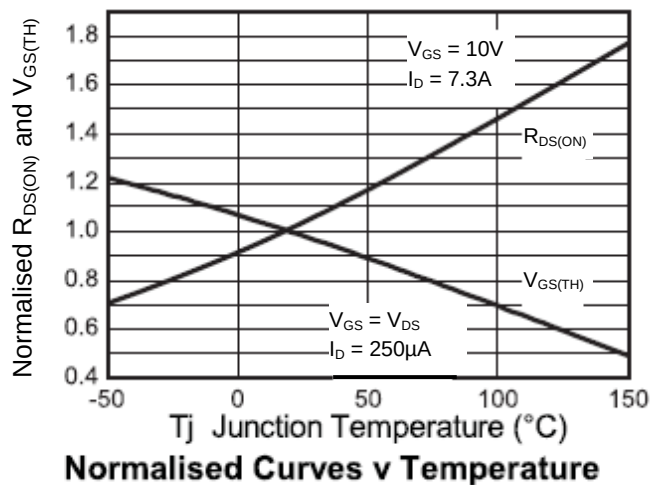
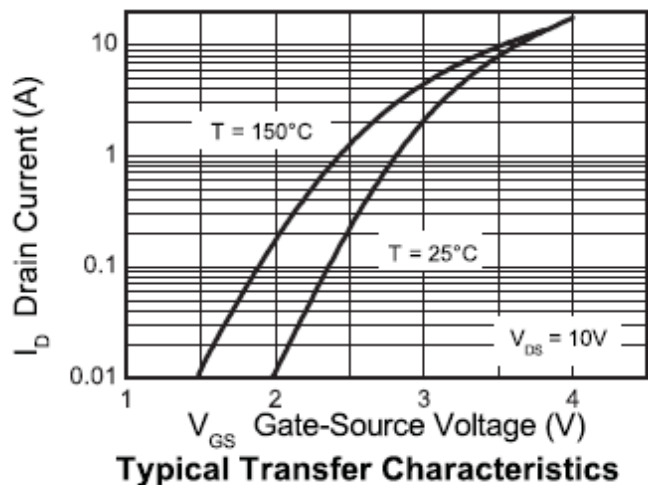
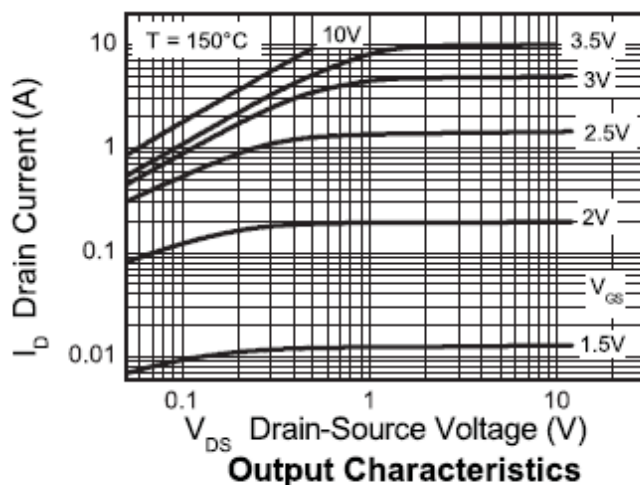
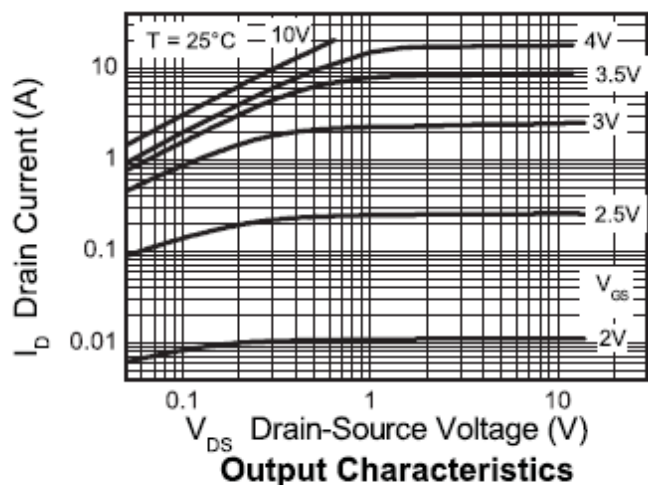
- For a device surface mounted on 25mm × 25mm FR-4 PCB with high coverage of single sided 1oz copper, in still air conditions.
- For a device surface mounted on FR-4 PCB measured at t ≤ 10s.
- Repetitive rating 25mm × 25mm FR-4 PCB, D = 0.02 pulse width = 300μs - pulse width limited by maximum junction temperature.

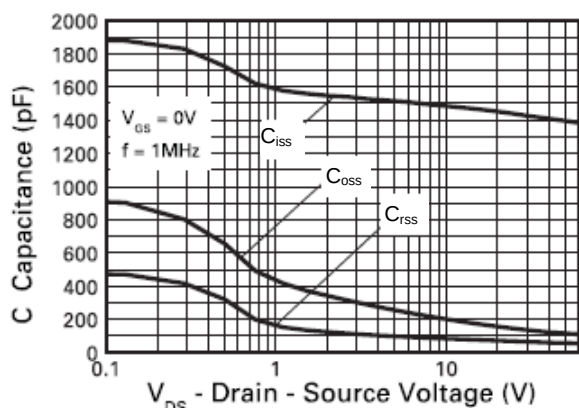


**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

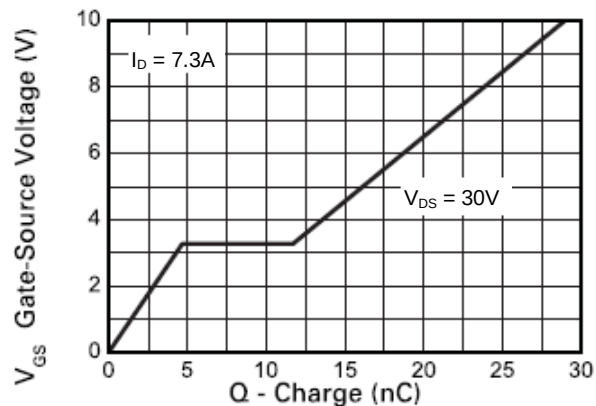
| Characteristic                                         | Symbol              | Min | Typ  | Max  | Unit | Test Condition                                                      |
|--------------------------------------------------------|---------------------|-----|------|------|------|---------------------------------------------------------------------|
| <b>OFF CHARACTERISTICS</b>                             |                     |     |      |      |      |                                                                     |
| Drain-Source Breakdown Voltage                         | BV <sub>DSS</sub>   | 60  | —    | —    | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA                        |
| Zero Gate Voltage Drain Current                        | I <sub>DSS</sub>    | —   | —    | 1    | 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                        |
| <b>ON CHARACTERISTICS</b>                              |                     |     |      |      |      |                                                                     |
| Gate Threshold Voltage                                 | V <sub>GS(TH)</sub> | 1   | —    | 3    | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA          |
| Static Drain-Source On-Resistance (Note 8)             | R <sub>DS(ON)</sub> | —   | 0.02 | 0.04 | Ω    | V <sub>GS</sub> = 10V, I <sub>D</sub> = 8.2A                        |
|                                                        |                     | —   | 0.03 | 0.06 | Ω    | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 7.4A                       |
| Diode Forward Voltage (Note 8)                         | V <sub>SD</sub>     | —   | 0.85 | 0.95 | V    | I <sub>S</sub> = 6.6A, V <sub>GS</sub> = 0V, T <sub>J</sub> = +25°C |
| <b>DYNAMIC CHARACTERISTICS</b>                         |                     |     |      |      |      |                                                                     |
| Input Capacitance (Note 10)                            | C <sub>iss</sub>    | —   | 1407 | —    | pF   | V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz          |
| Output Capacitance (Note 10)                           | C <sub>oss</sub>    | —   | 121  | —    | pF   |                                                                     |
| Reverse Transfer Capacitance (Note 10)                 | C <sub>rss</sub>    | —   | 59   | —    | pF   |                                                                     |
| Total Gate Charge (Notes 9 & 10) V <sub>GS</sub> = 5V  | Q <sub>g</sub>      | —   | 12.4 | —    | nC   | V <sub>DS</sub> = 15V<br>I <sub>D</sub> = 3.5A                      |
| Total Gate Charge (Notes 9 & 10) V <sub>GS</sub> = 10V | Q <sub>g</sub>      | —   | 24.2 | —    | nC   |                                                                     |
| Gate-Source Charge (Notes 9 & 10)                      | Q <sub>gs</sub>     | —   | 5.2  | —    | nC   |                                                                     |
| Gate-Drain Charge (Notes 9 & 10)                       | Q <sub>gd</sub>     | —   | 3.5  | —    | nC   |                                                                     |
| Turn-On Delay Time (Notes 9 & 10)                      | t <sub>D(ON)</sub>  | —   | 4.9  | —    | ns   | V <sub>DD</sub> = 15V, I <sub>D</sub> = 3.5A, V <sub>GS</sub> = 5V  |
| Turn-On Rise Time (Note 9 & 10)                        | t <sub>r</sub>      | —   | 5.0  | —    | ns   |                                                                     |
| Turn-Off Delay Time (Notes 9 & 10)                     | t <sub>D(OFF)</sub> | —   | 25.3 | —    | ns   |                                                                     |
| Turn-Off Fall Time (Notes 9 & 10)                      | t <sub>f</sub>      | —   | 4.6  | —    | ns   |                                                                     |
| Reverse Recovery Time (Note 10)                        | t <sub>RR</sub>     | —   | 26.3 | —    | ns   | I <sub>F</sub> = 3.5A, di/dt = 100A/μs,<br>T <sub>J</sub> = +25°C   |
| Reverse Recovery Charge (Note 10)                      | Q <sub>RR</sub>     | —   | 26.6 | —    | nC   |                                                                     |

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

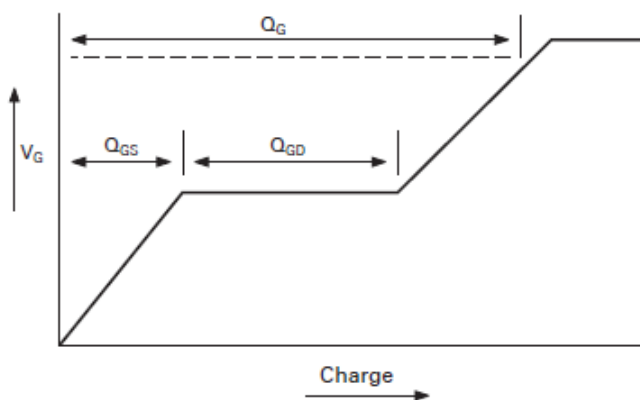




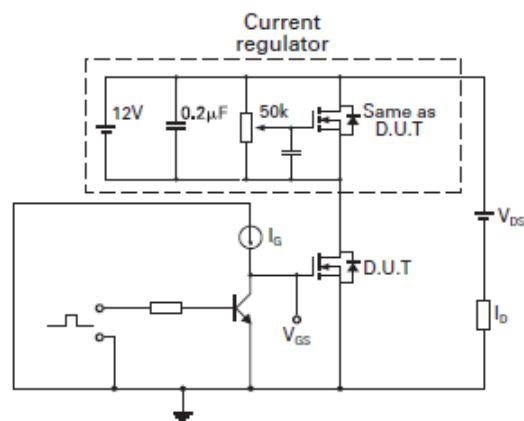
**Capacitance v Drain-Source Voltage**



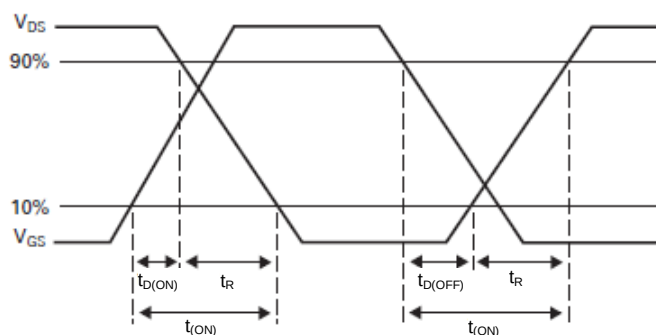
**Gate-Source Voltage v Gate Charge**



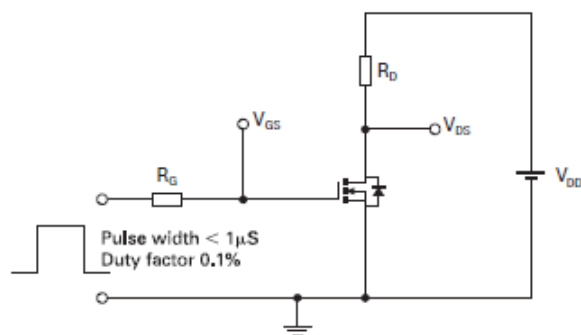
**Basic gate charge waveform**



**Gate charge test circuit**



**Switching time waveforms**

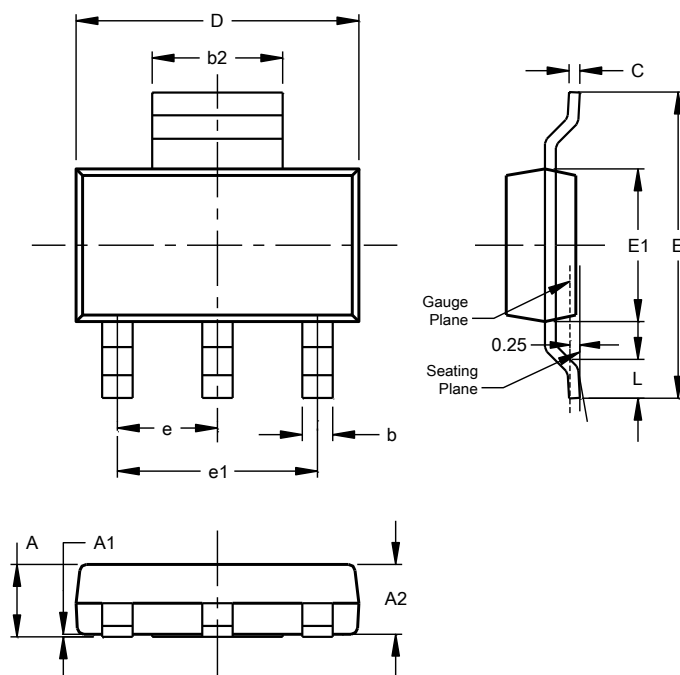


**Switching time test circuit**

## Package Outline Dimensions

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

**SOT223 (Type DN)**

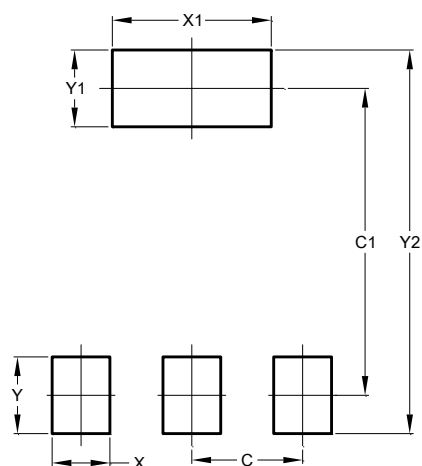


| SOT223 (Type DN)     |      |      |      |
|----------------------|------|------|------|
| Dim                  | Min  | Max  | Typ  |
| A                    | --   | 1.70 | --   |
| A1                   | 0.01 | 0.15 | --   |
| A2                   | 1.50 | 1.68 | 1.60 |
| b                    | 0.60 | 0.80 | 0.70 |
| b2                   | 2.90 | 3.10 | --   |
| c                    | 0.20 | 0.32 | --   |
| D                    | 6.30 | 6.70 | --   |
| E                    | 6.70 | 7.30 | --   |
| E1                   | 3.30 | 3.70 | --   |
| e                    | --   | --   | 2.30 |
| e1                   | --   | --   | 4.60 |
| L                    | 0.85 | --   | --   |
| All Dimensions in mm |      |      |      |

## Suggested Pad Layout

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

**SOT223 (Type DN)**



| Dimensions | Value (in mm) |
|------------|---------------|
| C          | 2.30          |
| C1         | 6.40          |
| X          | 1.20          |
| X1         | 3.30          |
| Y          | 1.60          |
| Y1         | 1.60          |
| Y2         | 8.00          |

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