

Product Summary

- Continuous Drain Source Voltage: $V_{DS} = 60V$
- On-State Resistance: 500m Ω
- Max Nominal Load Current ($V_{IN} = 5V$): 1.1A
- Min Nominal Load Current ($V_{IN} = 5V$): 0.7A
- Clamping Energy: 550mJ

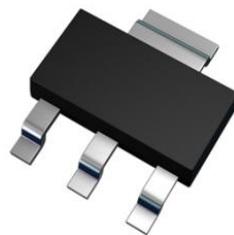
Description

The DIODES™ BSP75NQ is a self-protected low-side MOSFET. It features monolithic overtemperature, overcurrent, overvoltage (active clamp) and ESD protected logic level functionality. It is intended as a general purpose switch.

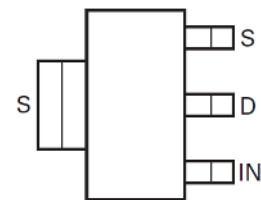
Applications

- Especially suited for loads with a high in-rush current such as lamps and motors
- All types of resistive, inductive and capacitive loads in switching applications
- μC compatible power switches for 12v and 24v DC applications
- Automotive rated
- Replaces electromechanical relays and discrete circuits
- Linear mode capability - the current-limiting protection circuitry is designed to de-activate at low V_{DS} in order not to compromise the load current during normal operation. The maximum DC operating current is therefore determined by the thermal capability of the package/board combination, rather than by the protection circuitry. This does not compromise the product's ability to self-protect at low V_{DS} .

SOT223 (Type DN)



Top View



Top View
Pin Out

Note: The tab is connected to the source pin and must be electrically isolated from the drain pin. Connection of significant copper to the drain pin is recommended for best thermal performance.

Ordering Information (Note 4)

| Part Number | Package | Marking | Reel Size (inches) | Tape Width (mm) | Packing | |
|-------------|------------------|---------|--------------------|-----------------|-------------|---------|
| | | | | | Qty. | Carrier |
| BSP75NQTA | SOT223 (Type DN) | BSP75N | 7 | 12 | 1,000 Units | 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/>.

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Features and Benefits

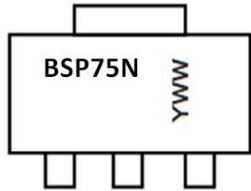
- Short Circuit Protection with Auto Restart
- Over Voltage Protection (Active Clamp)
- Thermal Shutdown with Auto Restart
- Over-Current Protection
- Input Protection (ESD)
- Load Dump Protection (Actively Protects Load)
- Logic Level Input
- High Continuous Current Rating
- **Lead-Free Finish; RoHS Compliant (Note 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The BSP75NQ is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF16949 certified facilities.**

<https://www.diodes.com/quality/product-definitions/>

Mechanical Data

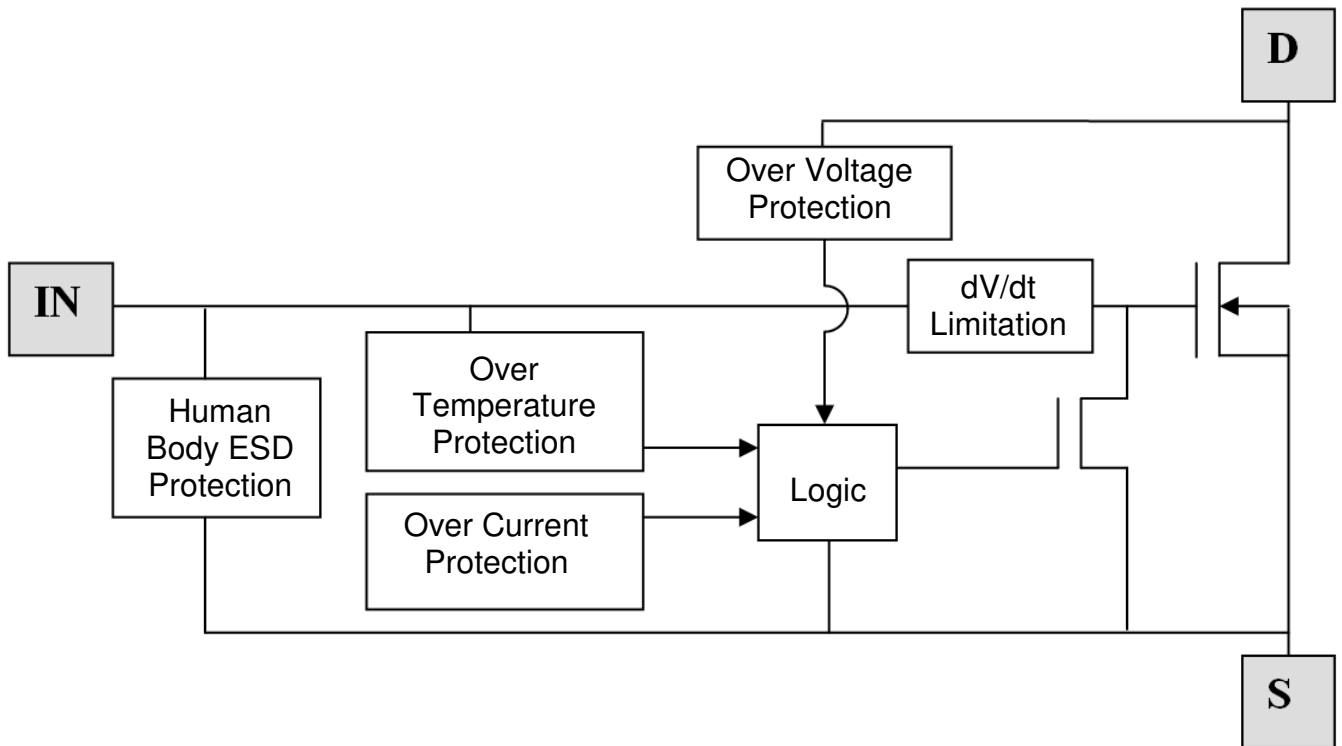
- Package: SOT223
- Package Material: Molded Plastic, "Green" Molding Compound
UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish e3
- Weight: 0.112 grams (Approximate)

Marking Information



BSP75N = Product Type Marking Code
 YWW = Date Code Marking
 Y or \bar{Y} = Last Digit of Year (ex: 2 = 2022)
 WW or $\bar{W}W$ = Week Code (01 to 53)

Functional Block Diagram



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

| Parameter | Symbol | Limit | Unit |
|--|------------------------|-------------|------|
| Continuous Drain-Source Voltage | V _{DS} | 60 | V |
| Drain-Source Voltage for Short Circuit Protection V _{IN} = 5V | V _{DS(SC)} | 36 | V |
| Drain-Source Voltage for Short Circuit Protection V _{IN} = 10V | V _{DS(SC)} | 20 | V |
| Continuous Input Voltage | V _{IN} | -0.2 to 10 | V |
| Peak Input Voltage | V _{IN} | -0.2 to 20 | V |
| Operating Temperature Range | T _J | -40 to +150 | °C |
| Storage Temperature Range | T _{STG} | -55 to +150 | °C |
| Power Dissipation at T _A = +25°C (Note 5) | P _D | 1.5 | W |
| Power Dissipation at T _A = +25°C (Note 6) | P _D | 0.6 | W |
| Continuous Drain Current @ V _{IN} =10V; T _A = +25°C (Note 5) | I _D | 1.3 | A |
| Continuous Drain Current @ V _{IN} =5V; T _A = +25°C (Note 5) | I _D | 1.1 | A |
| Continuous Drain Current @ V _{IN} =5V; T _A = +25°C (Note 6) | I _D | 0.7 | A |
| Continuous Source Current (Body Diode) (Note 5) | I _S | 2.0 | A |
| Pulsed Source Current (Body Diode) (Note 7) | I _S | 3.3 | A |
| Unclamped Single Pulse Inductive Energy | E _{AS} | 550 | mJ |
| Load Dump Protection | V _{LOAD_DUMP} | 80 | V |
| Electrostatic Discharge (Human Body Model) | V _{ESD} | 4000 | V |
| DIN Humidity Category, DIN 40 040 | — | E | — |
| IEC Climatic Category, DIN IEC 68-1 | — | 40/150/56 | — |

Thermal Resistance

| Parameter | Symbol | Limit | Unit |
|------------------------------|------------------|-------|------|
| Junction to Ambient (Note 5) | R _{θJA} | 83 | °C/W |
| Junction to Ambient (Note 7) | R _{θJA} | 45 | °C/W |
| Junction to Ambient (Note 6) | R _{θJA} | 208 | °C/W |

- Notes:
5. For a device surface mounted on 25mm x 25mm x 1.6mm FR-4 board with a high coverage of single sided 2oz weight copper. Allocation of 6cm² copper 33% to source tab and 66% to drain pin with source tab and drain pin electrically isolated.
 6. For a device surface mounted on FR-4 board with the minimum copper required for electrical connections.
 7. For a device surface mounted on FR-4 board as (a) and measured at t < =10s.

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Conditions |
|--|-------------------------------------|------|------|-----|------|--|
| Static Characteristics | | | | | | |
| Drain-Source Clamp Voltage | V _{DS(AZ)} | 60 | 70 | 75 | V | I _D = 10mA |
| Off State Drain Current | I _{DSS} | — | 0.1 | 3 | μA | V _{DS} = 12V, V _{IN} = 0V |
| Off State Drain Current | I _{DSS} | — | 3 | 15 | μA | V _{DS} = 32V, V _{IN} = 0V |
| Input Threshold Voltage (Note 8) | V _{IN(TH)} | 1 | 2.1 | — | V | V _{DS} = V _{GS} , I _D = 1mA |
| Input Current | I _{IN} | — | 0.7 | 1.2 | mA | V _{IN} = 5V |
| Input Current | I _{IN} | — | 1.5 | 2.7 | mA | V _{IN} = 7V |
| Input Current | I _{IN} | — | 4 | 7 | mA | V _{IN} = 10V |
| Static Drain-Source On-State Resistance | R _{DS(ON)} | — | 520 | 675 | mΩ | V _{IN} = 5V, I _D = 0.7A |
| Static Drain-Source On-State Resistance | R _{DS(ON)} | — | 385 | 550 | mΩ | V _{IN} = 10V, I _D = 0.7A |
| Current Limit (Note 9) | I _{D(LIM)} | 0.7 | 1.0 | 1.5 | A | V _{IN} = 5V, V _{DS} > 5V |
| Current Limit (Note 9) | I _{D(LIM)} | 1 | 1.8 | 2.3 | A | V _{IN} = 10V, V _{DS} > 5V |
| Dynamic Characteristics | | | | | | |
| Turn-On Time (V _{IN} to 90% I _D) | t _{ON} | — | 3 | — | μs | R _L = 22Ω, V _{IN} = 0V to 10V V _{DD} = 12V |
| Turn-Off time (V _{IN} to 90% I _D) | t _{OFF} | — | 13 | — | μs | R _L = 22Ω, V _{IN} = 10V to 0V V _{DD} = 12V |
| Slew Rate On (70 to 50% V _{DD}) | -dV _{DS} /dt _{ON} | — | 8 | — | V/μs | R _L = 22Ω, V _{IN} = 0V to 10V V _{DD} = 12V |
| Slew Rate Off (50 to 70% V _{DD}) | dV _{DS} /dt _{ON} | — | 3.2 | — | V/μs | R _L = 22Ω, V _{IN} = 10V to 0V V _{DD} = 12V |
| Protection Functions (Note 10) | | | | | | |
| Minimum Input Voltage for Over Temperature Protection | V _{PROT} | 4.5 | — | — | V | — |
| Thermal Overload Trip Temperature | T _{JT} | +150 | +175 | — | °C | — |
| Thermal Hysteresis | — | — | +1 | — | °C | — |
| Unclamped Single Pulse Inductive Energy T _J = +25°C | E _{AS} | 550 | — | — | mJ | I _{D(ISO)} = 0.7A, V _{DD} = 32V |
| Unclamped Single Pulse Inductive Energy T _J = +150°C | E _{AS} | 200 | — | — | mJ | I _{D(ISO)} = 0.7A, V _{DD} = 32V |
| Inverse Diode | | | | | | |
| Source Drain Voltage | V _{SD} | — | — | 1 | V | V _{IN} = 0V, -I _D = 1.4A |

Notes: 8. Protection features may operate outside spec for V_{IN} < 4.5V.

9. The drain current is limited to a reduced value when V_{DS} exceeds a safe level.

10. Integrated protection functions are designed to prevent IC destruction under fault conditions described in the datasheet. Fault conditions are considered as "outside" normal operating range. Protection functions are not designed for continuous, repetitive operation.

Application Information

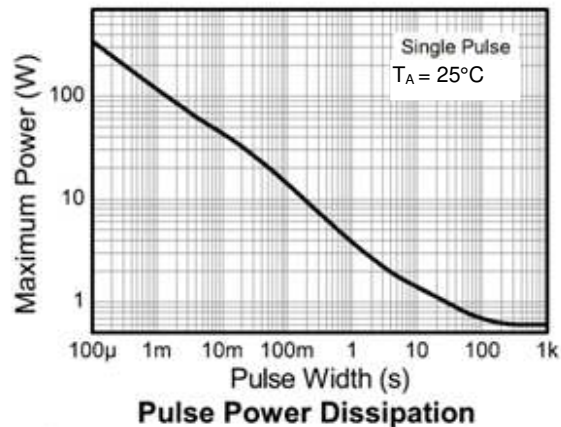
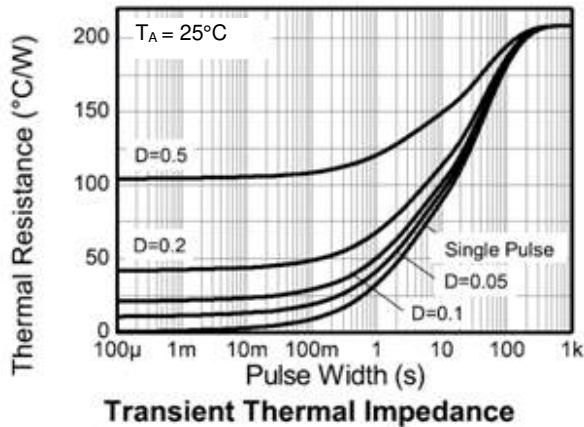
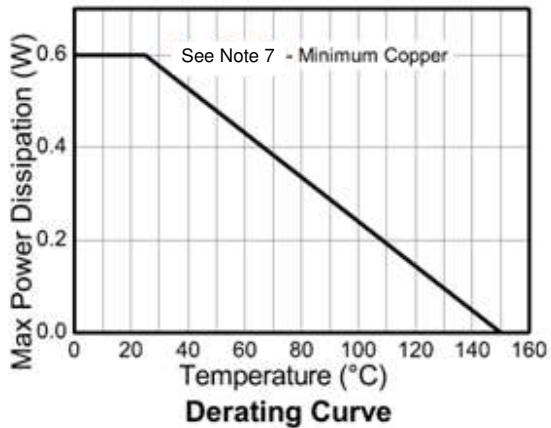
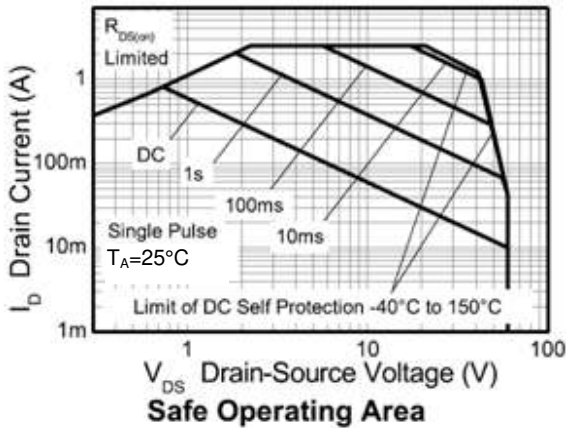
The current-limit protection circuitry is designed to de-activate at low V_{DS} to prevent the load current from being unnecessarily restricted during normal operation. The design max DC operating current is therefore determined by the thermal capability of the package/board combination, rather than by the protection circuitry (see *Typical Characteristics* graphs). This does not compromise the products ability to self protect at low V_{DS} .

The overtemperature protection circuit trips at a minimum of +150°C. So the available package dissipation reduces as the maximum required ambient temperature increases. This leads to the following maximum recommended continuous operating currents.

Minimum Copper Area Characteristics

For minimum copper condition as described in Note 8.

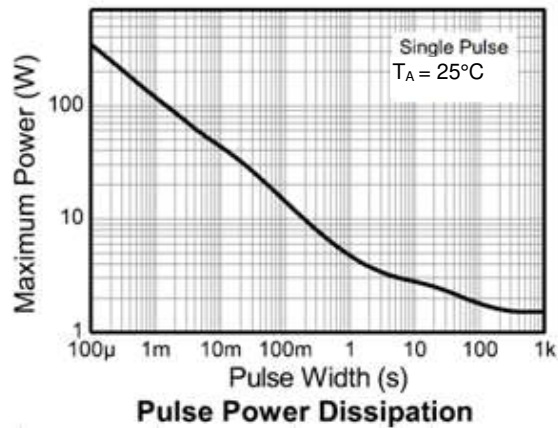
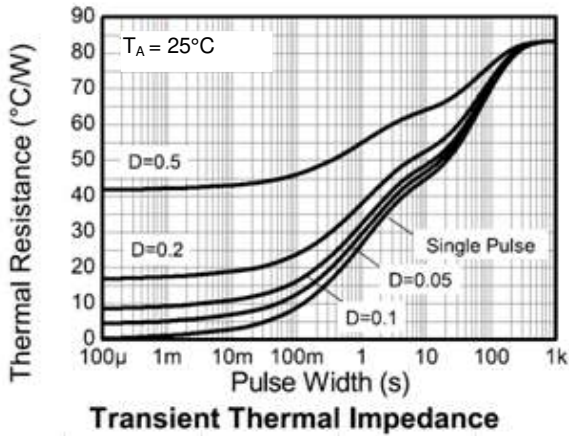
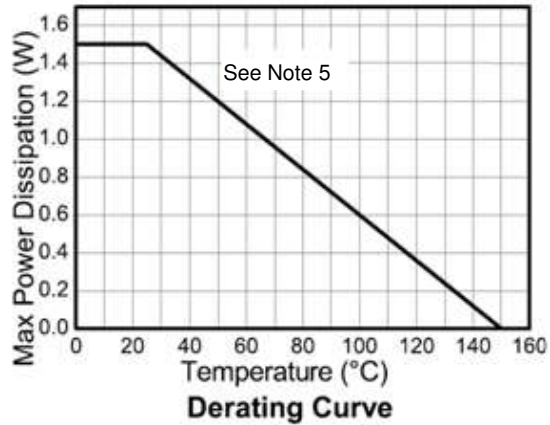
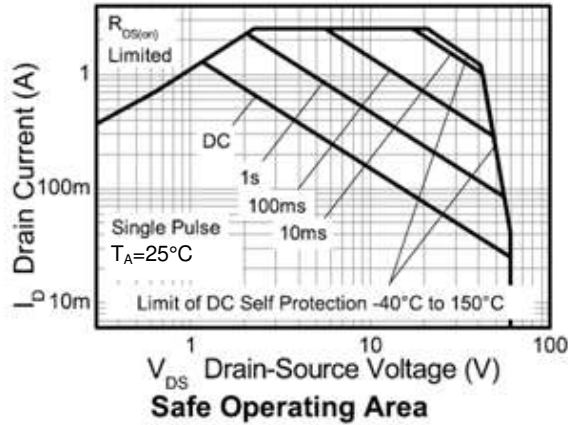
| Max Ambient Temperature T_A | Maximum Continuous Current | |
|-------------------------------|----------------------------|----------------|
| | $V_{IN} = 5V$ | $V_{IN} = 10V$ |
| +25°C at $V_{IN} = 5V$ | 720mA | 840mA |
| +70°C at $V_{IN} = 5V$ | 575mA | 670mA |
| +85°C at $V_{IN} = 5V$ | 520mA | 605mA |
| +125°C at $V_{IN} = 5V$ | 320mA | 375mA |



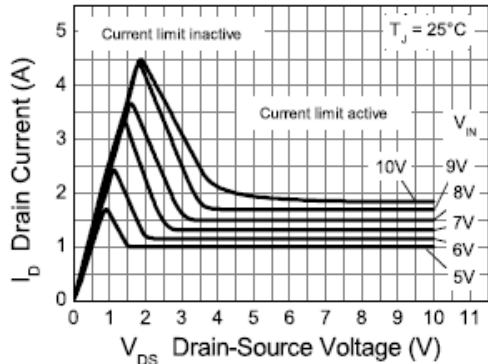
Large Copper Area Characteristics

For large copper area as described in Note 5.

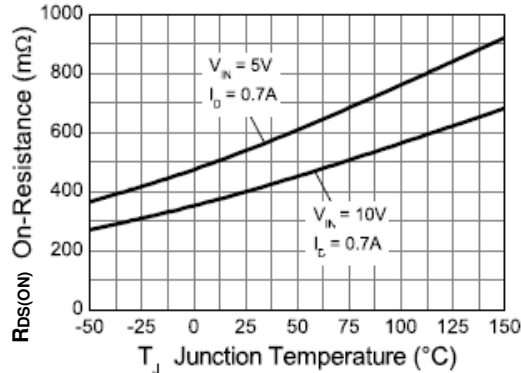
| Max Ambient Temperature T_A | Maximum Continuous Current | |
|-------------------------------|----------------------------|----------------|
| | $V_{IN} = 5V$ | $V_{IN} = 10V$ |
| +25°C at $V_{IN} = 5V$ | 1140mA | 1325mA |
| +70°C at $V_{IN} = 5V$ | 915mA | 1060mA |
| +85°C at $V_{IN} = 5V$ | 825mA | 955mA |
| +125°C at $V_{IN} = 5V$ | 510mA | 590mA |



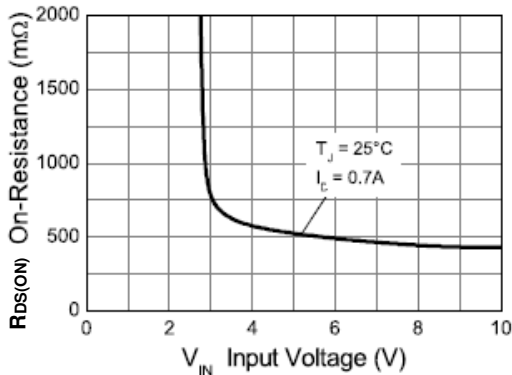
Typical Characteristics



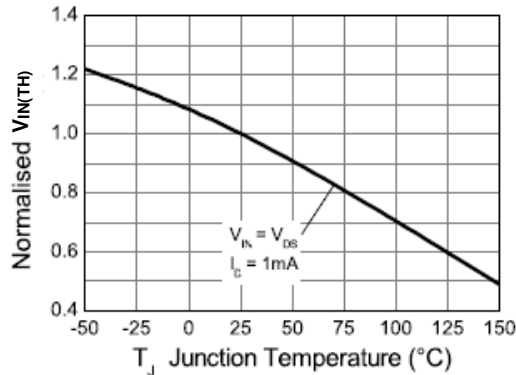
Typical Output Characteristic



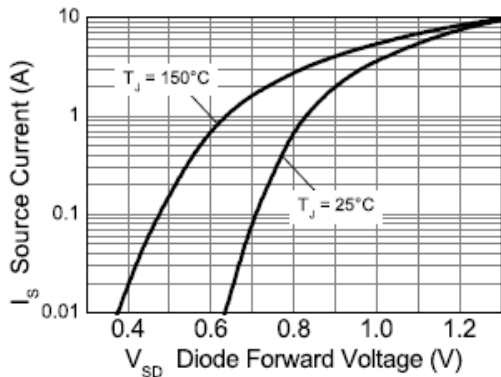
On-State Resistance vs Temperature



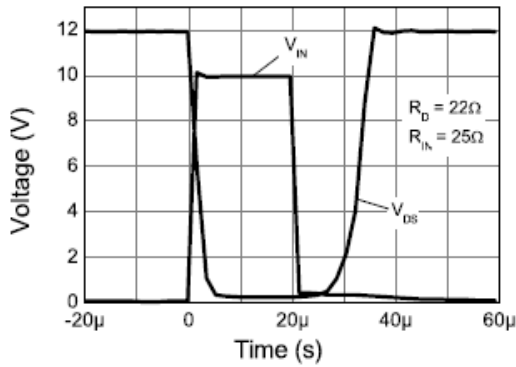
On-Resistance vs Input Voltage



Threshold Voltage vs Temperature



Source-Drain Diode Forward Voltage

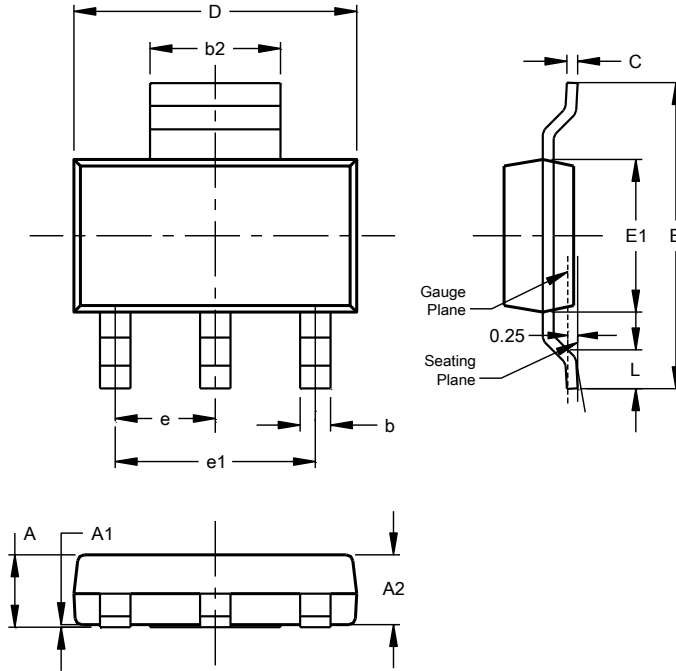


Switching Speed

Package Outline Dimensions

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

SOT223 (Type DN)

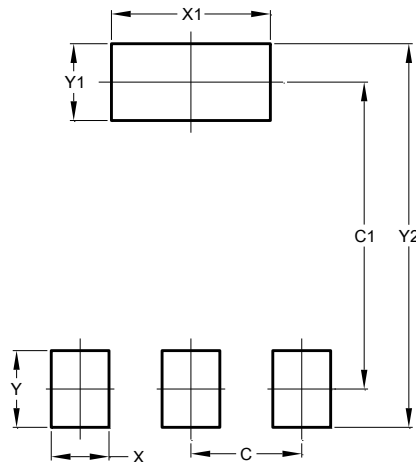


| SOT223 (Type DN) | | | |
|----------------------|------|------|------|
| Dim | Min | Max | Typ |
| A | -- | 1.70 | -- |
| A1 | 0.01 | 0.15 | -- |
| A2 | 1.50 | 1.68 | 1.60 |
| b | 0.60 | 0.80 | 0.70 |
| b2 | 2.90 | 3.10 | -- |
| c | 0.20 | 0.32 | -- |
| D | 6.30 | 6.70 | -- |
| E | 6.70 | 7.30 | -- |
| 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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