Lead-free Green

# 250V N-CHANNEL ENHANCEMENT MODE MOSFET

## Product Summary

| $BV_{DSS}$ | Max $R_{DS(ON)}$ | Max $I_D$ $T_A$ = +25°C |
|---|---|---|
| 250V | 8.5Ω @ $V_{GS}$ = 10V | 230mA |

## Description and Applications

This 250V enhancement mode N-channel MOSFET provides users with a competitive specification. It offers efficient power handling capability, high impedance and is free from thermal runaway and thermally induced secondary breakdowns. Applications benefiting from this device include a variety of telecom and general high-voltage circuits.

SOT89 and SOT223 versions are also available.

- Earth recall and dialing switches
- Electronic hook switches
- High-voltage power MOSFET drivers
- Telecom call routers
- Solid-state relays

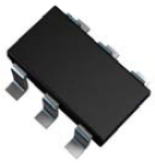
## Features and Benefits

- High Voltage
- Low On-Resistance
- Fast Switching Speed
- Low Threshold
- Low Gate Drive
- Complementary P-Channel Type ZVP4525E6
- **Totally Lead-Free & Fully 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-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

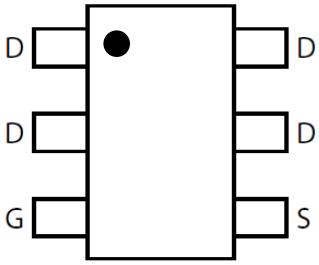
## Mechanical Data

- Package: SOT26
- 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 e3
- Weight: 0.015 grams (Approximate)

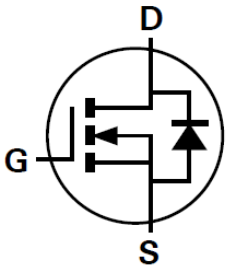
SOT26



Top View




Pinout Top-View




Device Symbol

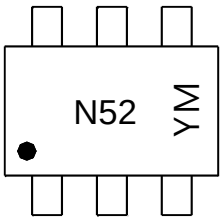
## Ordering Information (Note 4)

| Part Number | Package | Reel Size (inch) | Tape Width (mm) | Packing | |
|---|---|---|---|---|---|
| | | | | Qty. | Carrier |
| ZVN4525E6TA | SOT26 | 7 | 8 | 3000 | Reel |
| ZVN4525E6TC | SOT26 | 13 | 8 | 10,000 | Reel |

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
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

SOT26




N52 = Product Type Marking Code
YM = Date Code Marking
Y or $\overline{Y}$ = Year (ex: L = 2024)
M or $\overline{M}$ = Month (ex: 4 = April)

Date Code Key

| Year | 2015 | - | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | C | - | L | M | N | P | R | S | T | U | V | W |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D |


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

| Characteristic | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 250 | V |
| Gate-Source Voltage | | | $V_{GS}$ | ±40 | V |
| Continuous Drain Current | $V_{GS}$ = 10V | $T_A$ = +25°C (Note 5) | $I_D$ | 230 | mA |
| | | $T_A$ = +70°C (Note 5) | | 183 | |
| Pulsed Drain Current (Note 7) | | | $I_{DM}$ | 1.44 | A |
| Continuous Source Current (Body Diode) | | | $I_S$ | 1.1 | A |
| Pulsed Source Current (Body Diode) | | | $I_{SM}$ | 1.44 | A |

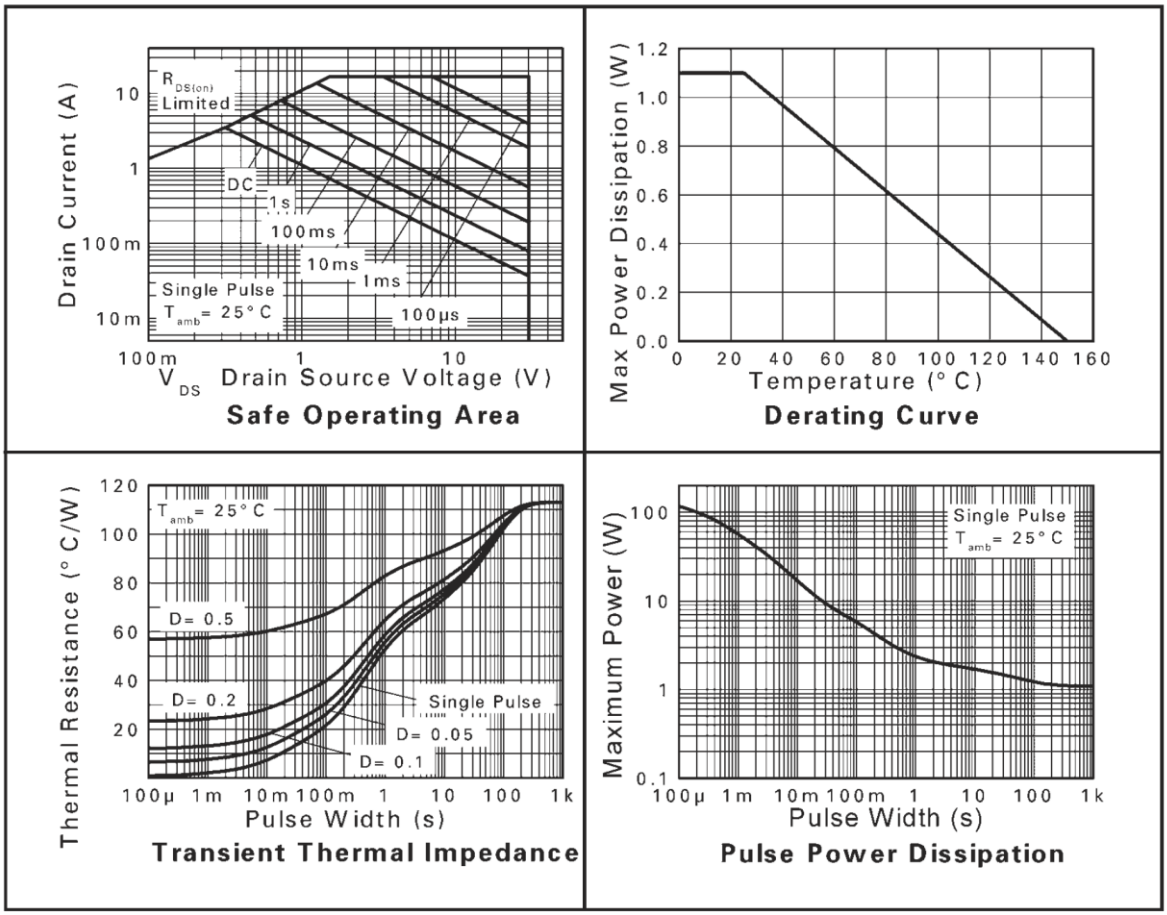
## Thermal Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Power Dissipation at $T_A$ = +25°C (Note 5)<br>Linear Derating Factor | $P_D$ | 1.1<br>8.8 | W<br>mW/°C |
| Junction to Ambient (Note 5) | $R_{\theta JA}$ | 113 | °C/W |
| Junction to Ambient (Note 6) | $R_{\theta JA}$ | 65 | °C/W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | °C |

Notes: 5. For a device surface mounted on 25mm × 25mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions.
6. For a device surface mounted on FR4 PCB measured at t ≤ 5 secs.
7. Repetitive rating - pulse width limited by maximum junction temperature. Refer to Transient Thermal.

**NB High Voltage Applications**
For high voltage applications, the appropriate industry sector guidelines should be considered with regards to voltage spacing between conductors.

## Thermal Characteristics





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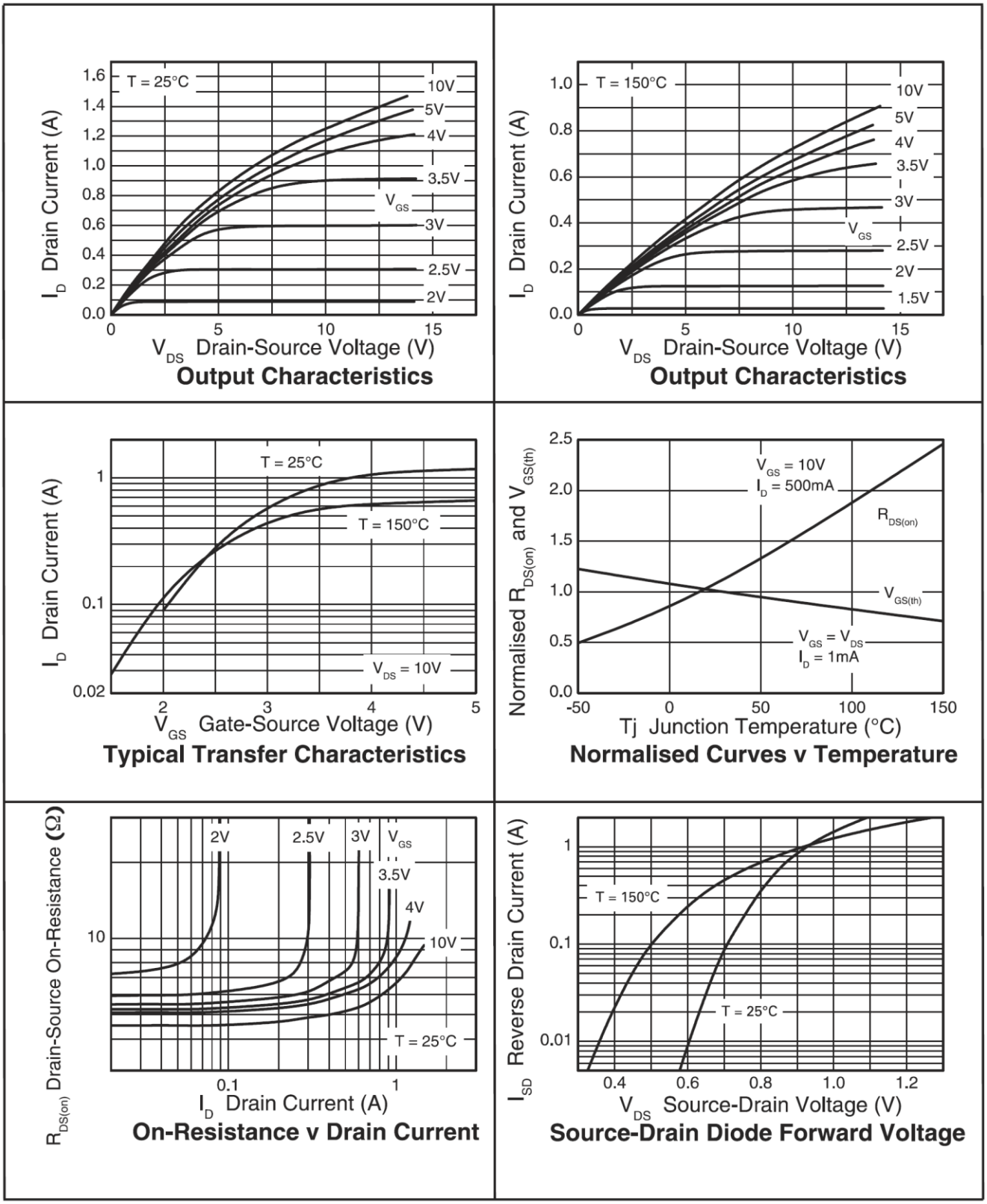
## Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 250 | 285 | — | V | $I_D$ = 1mA, $V_{GS}$ = 0 |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | 35 | 500 | nA | $V_{DS}$ = 250V, $V_{GS}$ = 0 |
| Gate-Body Leakage | $I_{GSS}$ | — | ±1 | 100 | nA | $V_{GS}$ = ±40V, $V_{DS}$ = 0 |
| **ON CHARACTERISTICS** | | | | | | |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | 0.8 | 1.4 | 1.8 | V | $I_D$ = 1mA, $V_{DS}$ = $V_{GS}$ |
| Static Drain-Source On-State Resistance (Note 8) | $R_{DS(ON)}$ | — | 5.6 | 8.5 | Ω | $V_{GS}$ = 10V, $I_D$ = 500mA |
| | | | 5.9 | 9.0 | | $V_{GS}$ = 4.5V, $I_D$ = 360mA |
| | | | 6.4 | 9.5 | | $V_{GS}$ = 2.4V, $I_D$ = 20mA |
| Forward Transconductance (Note 10) | $g_{fs}$ | 0.3 | 0.475 | — | S | $V_{DS}$ = 10V, $I_D$ = 0.3A |
| Diode Forward Voltage (Note 8) | $V_{SD}$ | — | — | 0.97 | V | $T_J$ = +25°C, $I_S$ = 360mA, $V_{GS}$ = 0 |
| **DYNAMIC CHARACTERISTICS** (Notes 9 & 10) | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 72 | — | pF | $V_{DS}$ = 25V, $V_{GS}$ = 0, f = 1MHz |
| Output Capacitance | $C_{oss}$ | — | 11 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 3.6 | — | pF | |
| Total Gate Charge | $Q_g$ | — | 2.6 | 3.65 | nC | $V_{GS}$ = 10V, $V_{DS}$ = 25V, $I_D$ = 360mA (refer to test circuit) |
| Gate-Source Charge | $Q_{gs}$ | — | 0.2 | 0.28 | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 0.5 | 0.7 | nC | |
| Reverse-Recovery Time (Note 10) | $t_{rr}$ | — | 186 | 260 | ns | $T_J$ = +25°C, $I_F$ = 360A, di/dt = 100A/µs |
| Reverse-Recovery Charge (Note 10) | $Q_{rr}$ | — | 34 | 48 | nC | |
| Turn-On Delay Time | $t_{d(on)}$ | — | 1.25 | — | ns | $V_{DD}$ = 30V, $V_{GS}$ = 10V, $I_D$ = 360mA, $R_G$ = 50Ω (refer to test circuit) |
| Turn-On Rise Time | $t_r$ | — | 1.7 | — | ns | |
| Turn-Off Delay Time | $t_{d(off)}$ | — | 11.40 | — | ns | |
| Turn-Off Fall Time | $t_f$ | — | 3.5 | — | ns | |

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


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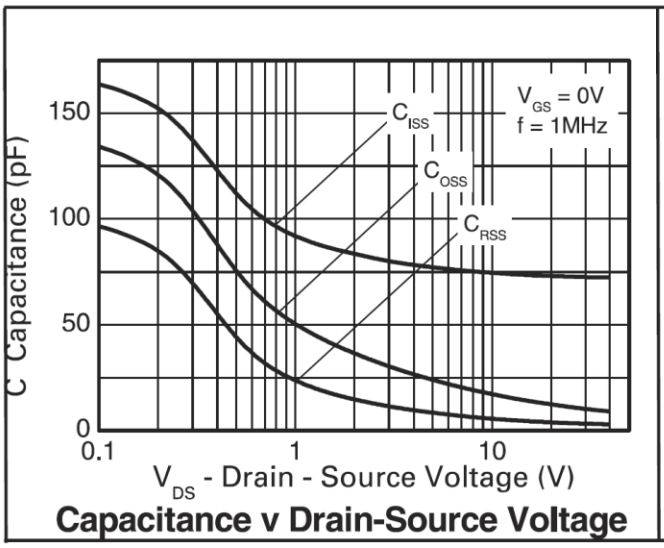
## Typical Characteristics



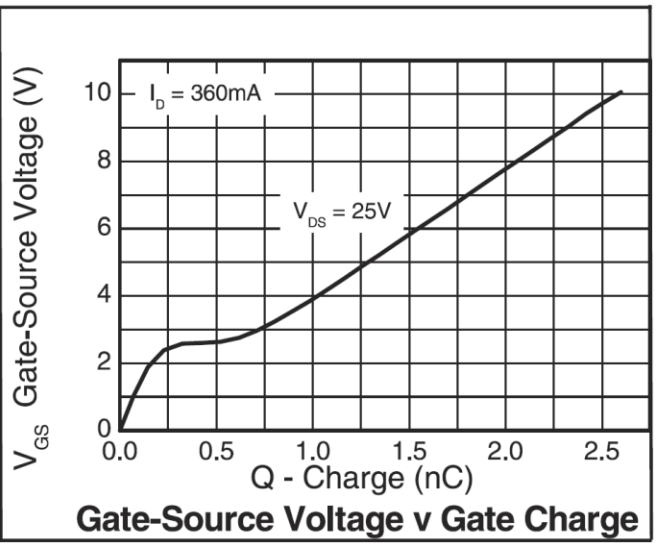


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## Typical Characteristics (continued)

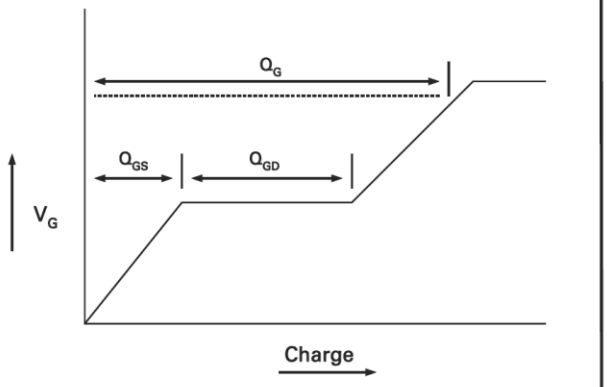



Capacitance v Drain-Source Voltage

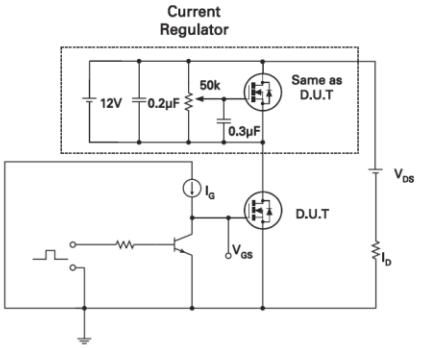



Gate-Source Voltage v Gate Charge

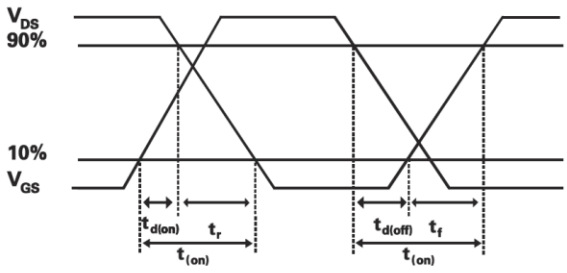
## Test Circuits



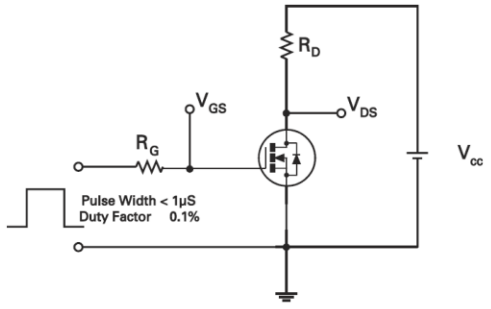

Basic Gate Charge Waveform




Gate Charge Test Circuit




Switching Time Waveforms



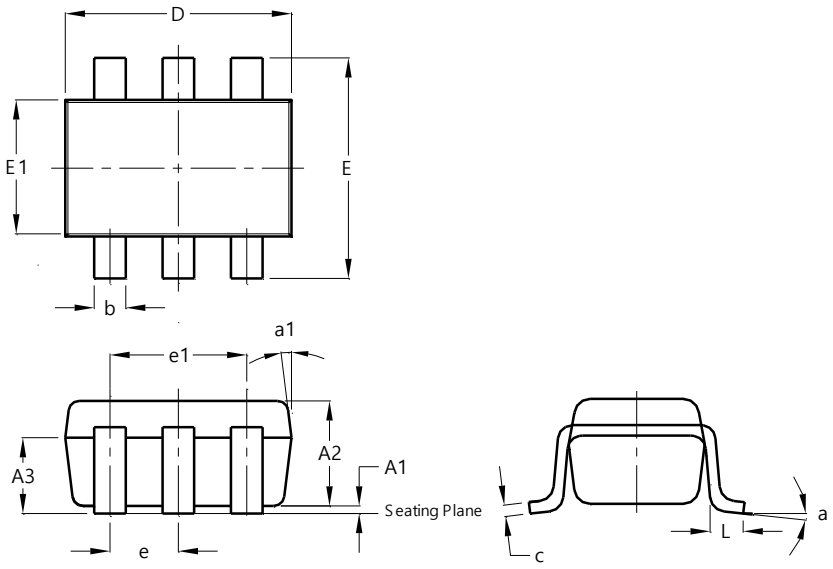

Switching Time Test Circuit


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## Package Outline Dimensions

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

**SOT26**

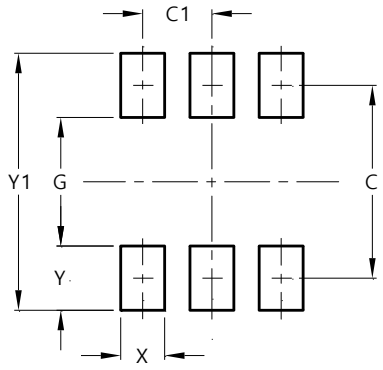



| SOT26 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A1** | 0.013 | 0.10 | 0.05 |
| **A2** | 1.00 | 1.30 | 1.10 |
| **A3** | 0.70 | 0.80 | 0.75 |
| **b** | 0.35 | 0.50 | 0.38 |
| **c** | 0.10 | 0.20 | 0.15 |
| **D** | 2.90 | 3.10 | 3.00 |
| **e** | - | - | 0.95 |
| **e1** | - | - | 1.90 |
| **E** | 2.70 | 3.00 | 2.80 |
| **E1** | 1.50 | 1.70 | 1.60 |
| **L** | 0.35 | 0.55 | 0.40 |
| **a** | - | - | 8° |
| **a1** | - | - | 7° |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

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

**SOT26**




| Dimensions | Value (in mm) |
|---|---|
| **C** | 2.40 |
| **C1** | 0.95 |
| **G** | 1.60 |
| **X** | 0.55 |
| **Y** | 0.80 |
| **Y1** | 3.20 |


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