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# ZXMP6A13G

## 60V P-CHANNEL ENHANCEMENT MODE MOSFET

## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ | $I_D$ $T_A$ = +25°C |
|---|---|---|
| -60V | 390mΩ @ $V_{GS}$ = -10V | -2.3A |
| | 595mΩ @ $V_{GS}$ = -4.5V | -1.9A |

## Description and Applications

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

- Motor control
- DC-DC converters
- Power-management functions
- Uninterrupted power supplies

## Features and Benefits

- Fast Switching Speed
- Low Gate Drive
- Low Input Capacitance
- **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-Q100/101/104/200, 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/**

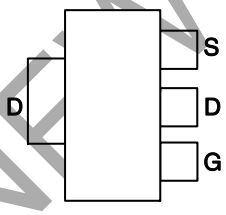
## Mechanical Data

- Package: SOT223
- Package 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: 0.112 grams (Approximate)

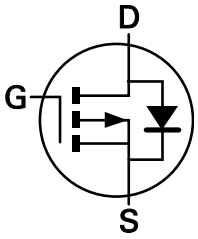
SOT223 (Type DN)



Top View




Pin Out - Top View



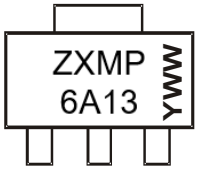

Equivalent Circuit

## Ordering Information (Note 4)

| Orderable Part Number | Package | Packing | |
|---|---|---|---|
| | | Qty. | Carrier |
| ZXMP6A13GTA | 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




ZXMP6A13 = Product Type Marking Code
YWW = Date Code Marking
Y or $\overline{Y}$ = Last Digit of Year (ex: 6 = 2026)
WW or $\overline{WW}$ = Week Code (01 to 53)

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

| Characteristic | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | -60 | V |
| Gate-Source Voltage | | | $V_{GS}$ | ±20 | V |
| Continuous Drain Current | $V_{GS}$ = 10V | (Note 6) | $I_D$ | -2.3 | A |
| | | $T_A$ = +70°C (Note 6) | | -1.9 | |
| | | (Note 5) | | -1.7 | |
| Pulsed Drain Current | $V_{GS}$ = 10V | (Note 7) | $I_{DM}$ | -7.8 | A |
| Continuous Source Current (Body Diode) | | (Note 6) | $I_S$ | -2.3 | A |
| Pulsed Source Current (Body Diode) | | (Note 7) | $I_{SM}$ | -7.8 | A |

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

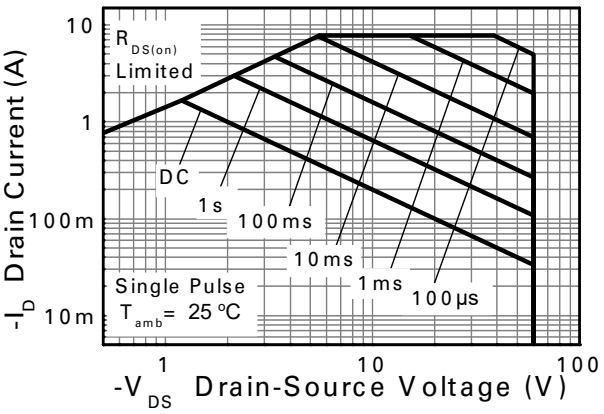
| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation | (Note 5) | $P_D$ | 2.0 | W |
| Linear Derating Factor | | | 16 | mW/°C |
| | (Note 6) | | 3.9 | W |
| | | | 31 | mW/°C |
| Thermal Resistance, Junction to Ambient | (Note 5) | $R_{\theta JA}$ | 62.5 | °C/W |
| | (Note 6) | | 32.0 | |
| Thermal Resistance, Junction to Lead | (Note 8) | $R_{\theta JL}$ | 9.8 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

Notes:
5. 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.
6. Same as Note 5, except the device is measured at t ≤ 10 sec.
7. Same as Note 5, except the device is pulsed with D = 0.02 and pulse width 300µs. The pulse current is limited by the maximum junction temperature.
8. Thermal resistance from junction to solder-point (at the end of the drain lead).

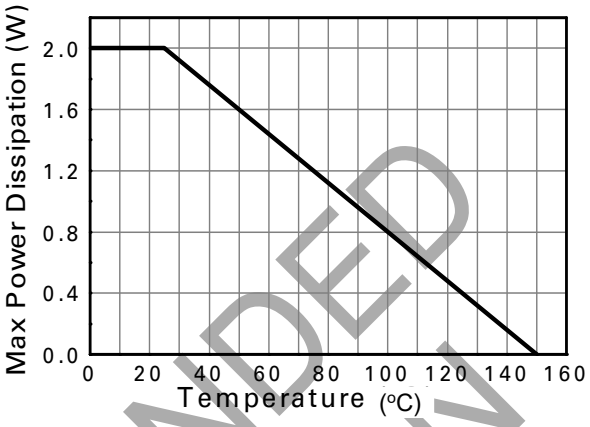
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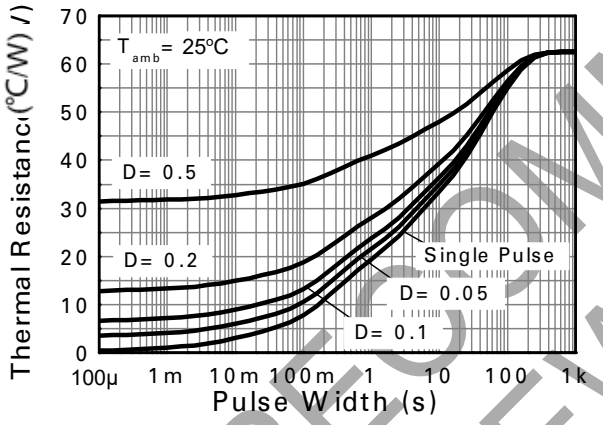
## Thermal Characteristics



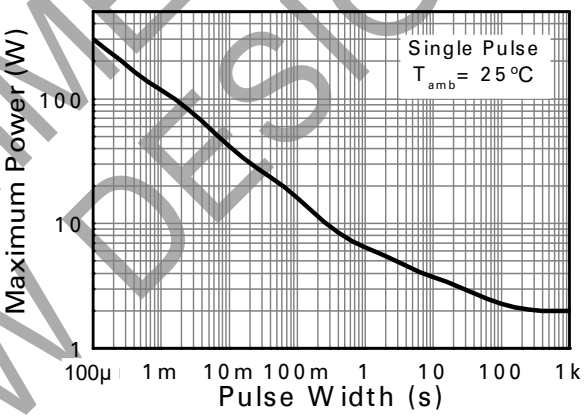

Safe Operating Area




Derating Curve




Transient Thermal Impedance




Pulse Power Dissipation

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

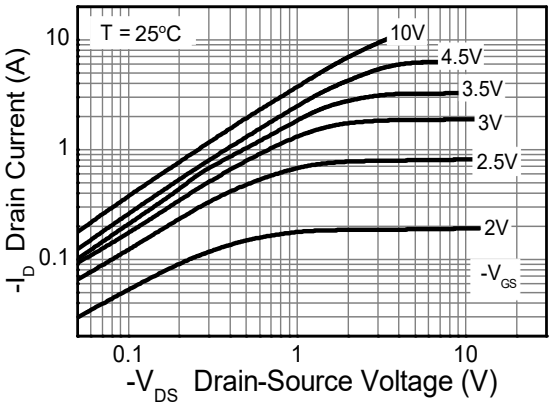
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | -60 | — | — | V | $I_D$ = -250µA, $V_{GS}$ = 0 |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | -0.5 | µA | $V_{DS}$ = -60V, $V_{GS}$ = 0 |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0 |
| **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 9) | $R_{DS(ON)}$ | — | — | 0.390 | Ω | $V_{GS}$ = -10V, $I_D$ = -0.9A |
| | | | | 0.595 | | $V_{GS}$ = -4.5V, $I_D$ = -0.8A |
| Forward Transconductance (Notes 9 & 10) | $g_{fs}$ | — | 1.8 | — | S | $V_{DS}$ = -15V, $I_D$ = -0.9A |
| Diode Forward Voltage (Note 9) | $V_{SD}$ | — | -0.85 | -0.95 | V | $I_S$ = -0.8A, $V_{GS}$ = 0, $T_J$ = +25°C |
| Reverse-Recovery Time (Note 10) | $t_{RR}$ | — | 21.1 | — | ns | $I_S$ = -0.9A, di/dt = 100A/µs, |
| Reverse-Recovery Charge (Note 10) | $Q_{RR}$ | — | 19.3 | — | nC | $T_J$ = +25°C |
| **DYNAMIC CHARACTERISTICS (Note 10)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 219 | — | pF | $V_{DS}$ = -30V, $V_{GS}$ = 0 f = 1MHz |
| Output Capacitance | $C_{oss}$ | — | 25.7 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 20.5 | — | pF | |
| Total Gate Charge (Note 11) | $Q_g$ | — | 2.9 | — | nC | $V_{GS}$ = -4.5V |
| Total Gate Charge (Note 11) | $Q_g$ | — | 5.9 | — | nC | $V_{DS}$ = -30V, $I_D$ = -0.9A, $V_{GS}$ = -10V |
| Gate-Source Charge (Note 11) | $Q_{gs}$ | — | 0.74 | — | nC | |
| Gate-Drain Charge (Note 11) | $Q_{gd}$ | — | 1.5 | — | nC | |
| Turn-On Delay Time (Note 11) | $t_{D(ON)}$ | — | 1.6 | — | ns | $V_{DD}$ = -30V, $V_{GS}$ = -10V, $I_D$ = -1A, $R_G \cong 6.0\Omega$ |
| Turn-On Rise Time (Note 11) | $t_R$ | — | 2.2 | — | ns | |
| Turn-Off Delay Time (Note 11) | $t_{D(OFF)}$ | — | 11.2 | — | ns | |
| Turn-Off Fall Time (Note 11) | $t_F$ | — | 5.7 | — | ns | |

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

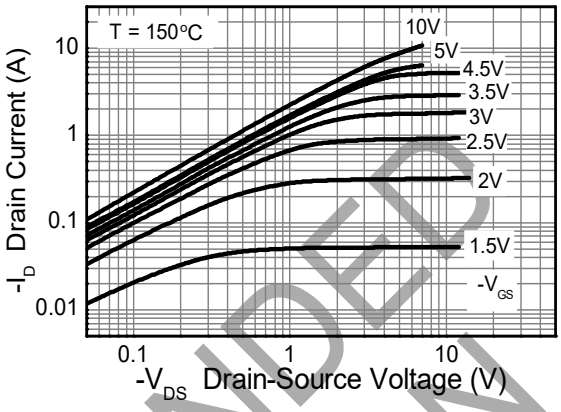
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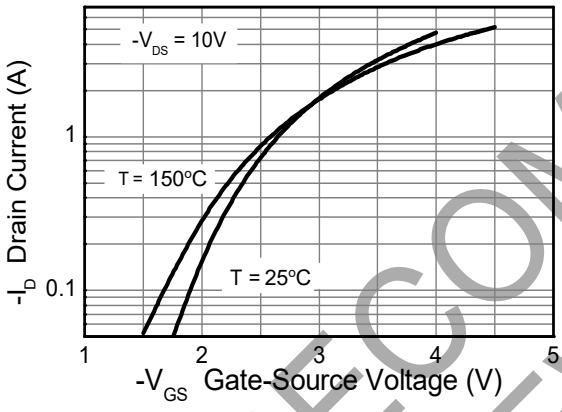
## Typical Characteristics



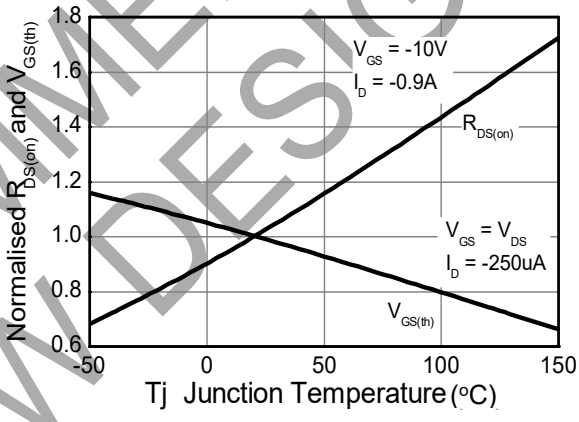

**Output Characteristics**



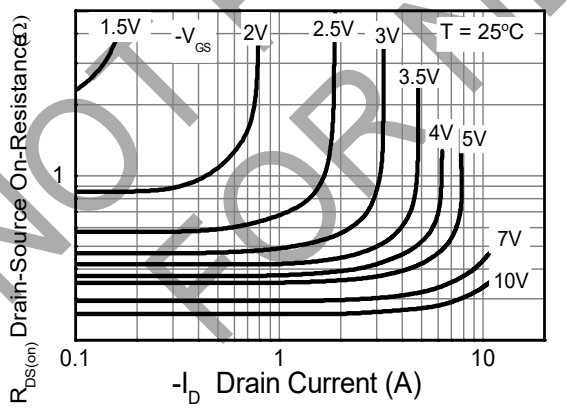

**Output Characteristics**



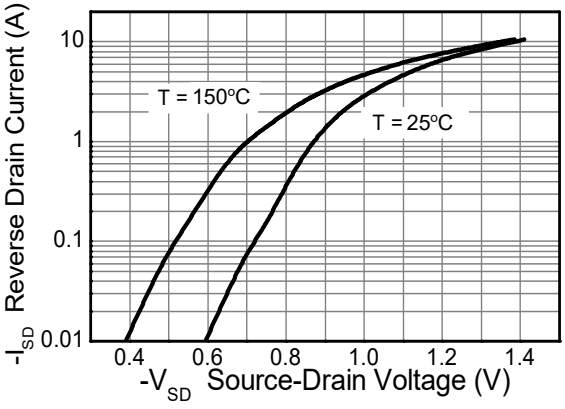

**Typical Transfer Characteristics**




**Normalised Curves v Temperature**




**On-Resistance v Drain Current**

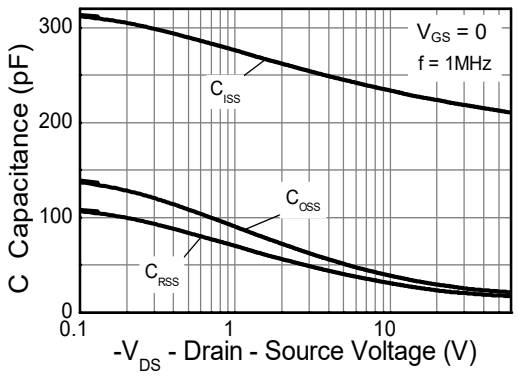



**Source-Drain Diode Forward Voltage**

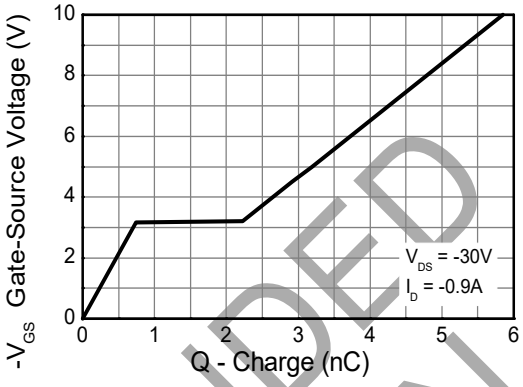
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## Typical Characteristics (continued)

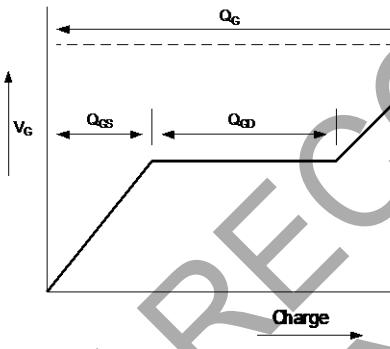



**Capacitance v Drain-Source Voltage**

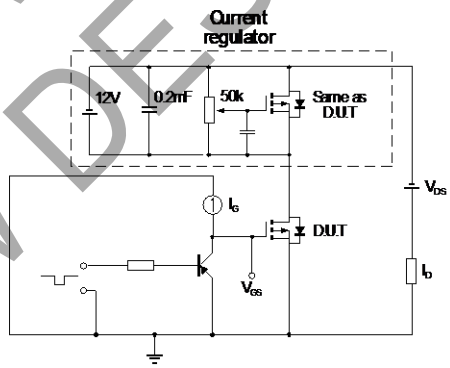



**Gate-Source Voltage v Gate Charge**

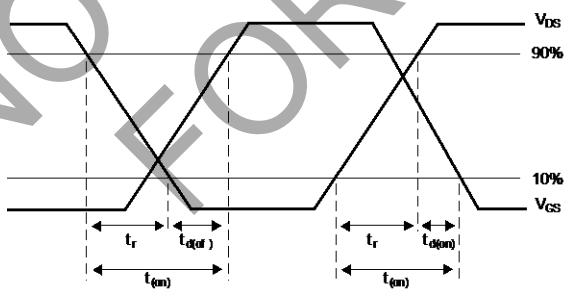
## Test Circuits



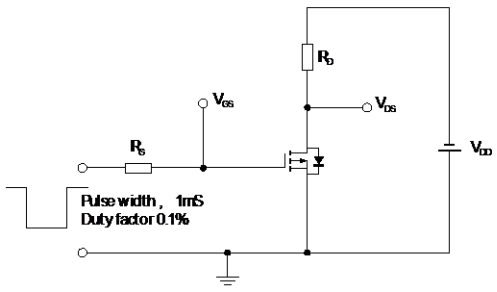

**Basic gate charge waveform**




**Gate charge test circuit**




**Switching time waveforms**




**Switching time test circuit**

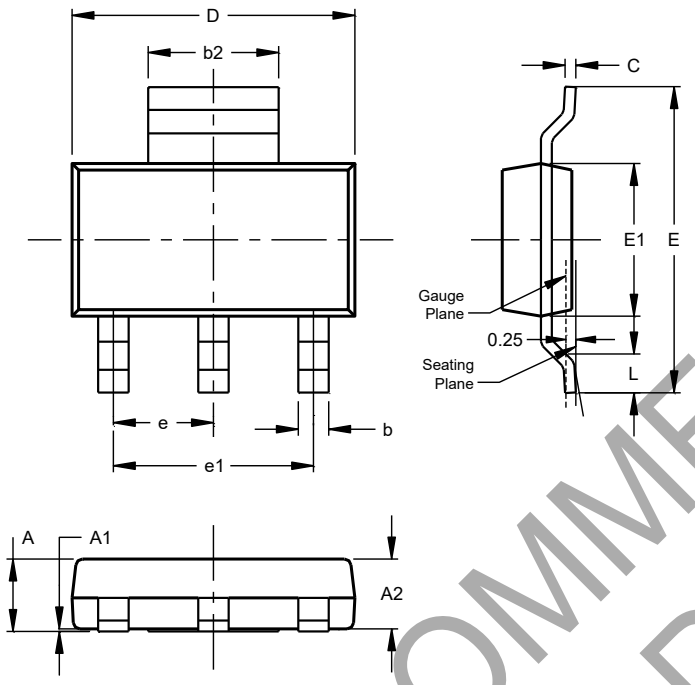
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## Package Outline Dimensions

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**SOT223 (Type DN)**



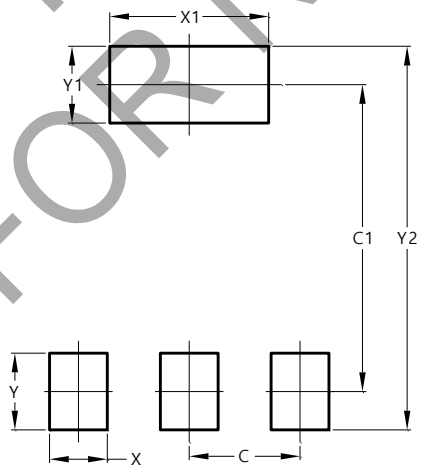

| SOT223 (Type DN) | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | -- | 1.70 | -- |
| **A1** | 0.01 | 0.15 | -- |
| **A2** | 1.50 | 1.68 | 1.60 |
| **b** | 0.60 | 0.80 | 0.70 |
| **b2** | 2.90 | 3.10 | -- |
| **c** | 0.20 | 0.32 | -- |
| **D** | 6.30 | 6.70 | -- |
| **E**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

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## 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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