

**60V N-CHANNEL SELF-PROTECTED ENHANCEMENT MODE  
IntelliFET MOSFET**
**Product Summary**

$V_{DS}$	$R_{DS(ON)}$	$I_D$ $V_{IN} = 5V$	$E_{AS}$
60V	100m $\Omega$	2.8A	490mJ

**Description and Applications**

The ZXMS6006DGQ is a self-protected low side IntelliFET<sup>®</sup> MOSFET with logic level input. It integrates overtemperature, overcurrent, overvoltage (active clamp) and ESD protected logic level functionality. The ZXMS6006DGQ is ideal as a general-purpose switch driven from 3.3V or 5V microcontrollers in harsh environments where standard MOSFETs are not rugged enough.

- Lamp drivers
- Motor drivers
- Relay drivers
- Solenoid drivers

**Features and Benefits**

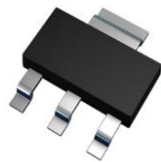
- Compact High-Power Dissipation Package
- Low Input Current
- Logic Level Input (3.3V and 5V)
- Short-Circuit Protection with Auto Restart
- Overvoltage Protection (Active Clamp)
- Thermal Shutdown with Auto Restart
- Overcurrent Protection
- Input Protection (ESD)
- High Continuous Current Rating
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The ZXMS6006DGQ is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**

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

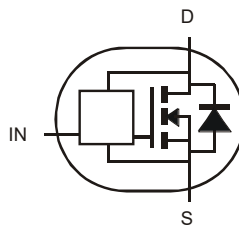
**Mechanical Data**

- 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
- Weight: 0.112 grams (Approximate)

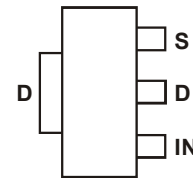
SOT223 (Type DN)



Top View



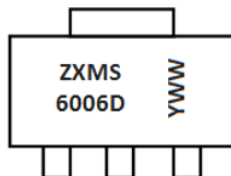
Device Symbol


 Top View  
Pin Out

**Ordering Information** (Note 4)

Orderable Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
ZXMS6006DGQ-13	SOT223 (Type DN)	ZXMS6006D	13	12	2,500	Reel

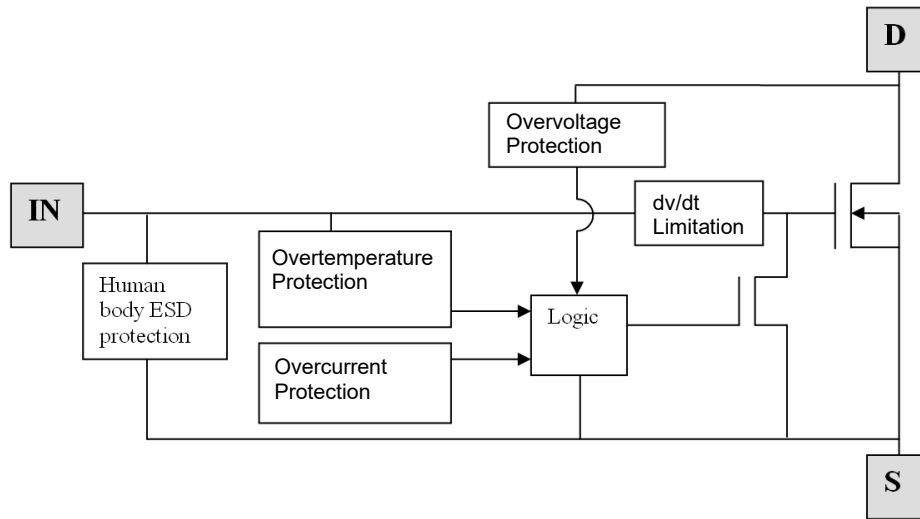
- Notes:
1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
  2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  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**


ZXMS6006D = Product Type Marking Code  
 YWW = Date Code Marking  
 Y or  $\bar{Y}$  = Last Digit of Year (ex: 6 = 2026)  
 WW or  $\bar{W}W$  = Week Code (01 to 53)

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## Functional Block Diagram



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

Characteristic	Symbol	Value	Unit
Continuous Drain-Source Voltage	V <sub>DS</sub>	60	V
Drain-Source Voltage for Short-Circuit Protection	V <sub>DS(SC)</sub>	16	V
Continuous Input Voltage	V <sub>IN</sub>	-0.5 to +6.0	V
Continuous Input Current @-0.2V ≤ V <sub>IN</sub> ≤ 6V	I <sub>IN</sub>	No Limit	mA
Continuous Input Current @V <sub>IN</sub> < -0.2V or V <sub>IN</sub> > 6V	I <sub>IN</sub>	I <sub>IN</sub>   ≤ 2	mA
Pulsed Drain Current @V <sub>IN</sub> = 3.3V	I <sub>DM</sub>	11	A
Pulsed Drain Current @V <sub>IN</sub> = 5V	I <sub>DM</sub>	13	A
Continuous Source Current (Body Diode) (Note 5)	I <sub>S</sub>	2	A
Pulsed Source Current (Body Diode)	I <sub>SM</sub>	12	A
Unclamped Single Pulse Inductive Energy, T <sub>J</sub> = +25°C, I <sub>D</sub> = 0.5A, V <sub>DD</sub> = 24V	E <sub>AS</sub>	490	mJ
Electrostatic Discharge (Human Body Model)	V <sub>ESD</sub>	4000	V
Charged Device Model	V <sub>CDM</sub>	1000	V

## 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>	1.27	W
Linear Derating Factor		10.1	mW/°C
Power Dissipation at T <sub>A</sub> = +25°C (Note 6)	P <sub>D</sub>	1.82	W
Linear Derating Factor		14.5	mW/°C
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	99	°C/W
Thermal Resistance, Junction to Ambient (Note 6)	R <sub>θJA</sub>	69	°C/W
Thermal Resistance, Junction to Case (Note 7)	R <sub>θJC</sub>	6.98	°C/W
Operating Temperature Range	T <sub>J</sub>	-40 to +150	°C
Storage Temperature Range	T <sub>STG</sub>	-55 to +150	°C

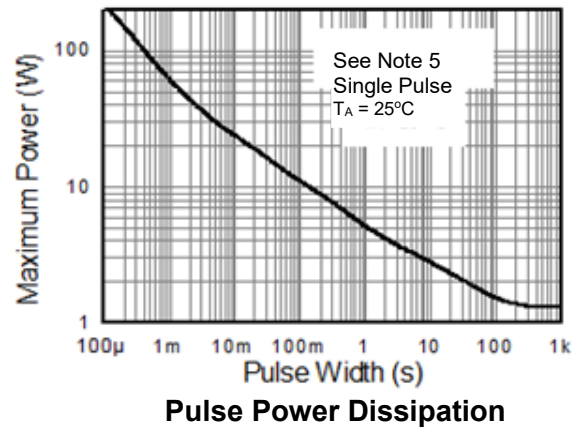
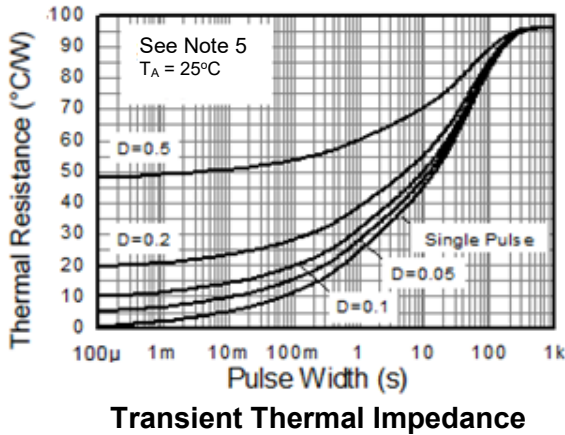
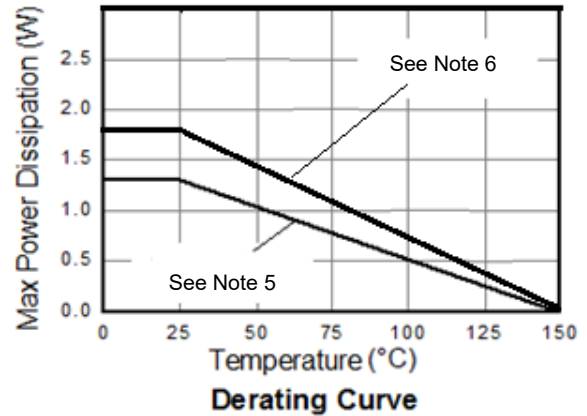
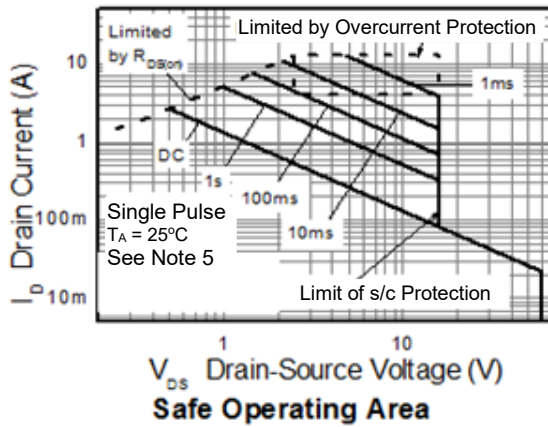
- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  - Thermal resistance between junction and the mounting surfaces of drain and source pins.

## Recommended Operating Conditions

The ZXMS6006DGQ is optimized for use with  $\mu\text{C}$  operating from 3.3V and 5V supplies.

Characteristic	Symbol	Min	Max	Unit
Input Voltage Range	$V_{\text{IN}}$	0	5.5	V
Ambient Temperature Range	$T_{\text{A}}$	-40	+125	$^{\circ}\text{C}$
High-Level Input Voltage for MOSFET to Be On	$V_{\text{IH}}$	3	5.5	V
Low-Level Input Voltage for MOSFET to Be Off	$V_{\text{IL}}$	0	0.7	V
Peripheral Supply Voltage (Voltage to Which Load is Referred)	$V_{\text{P}}$	0	16	V

## Thermal Characteristics

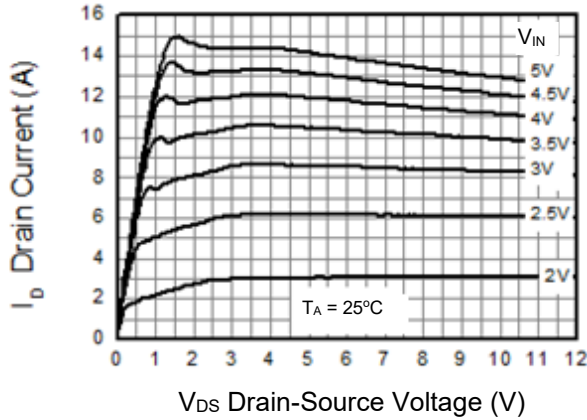


**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

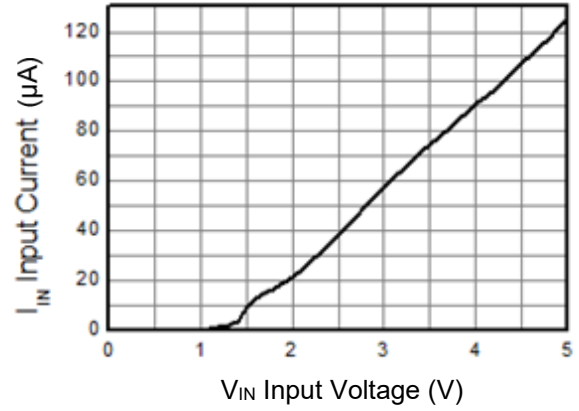
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>Static Characteristics</b>						
Drain-Source Clamp Voltage	V <sub>DS(AZ)</sub>	60	65	70	V	I <sub>D</sub> = 10mA
Off State Drain Current	I <sub>DSS</sub>	—	—	1	μA	V <sub>DS</sub> = 12V, V <sub>IN</sub> = 0
		—	—	2		V <sub>DS</sub> = 36V, V <sub>IN</sub> = 0
Input Threshold Voltage	V <sub>IN(TH)</sub>	0.7	1.15	1.5	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 1mA
Input Current	I <sub>IN</sub>	—	60	100	μA	V <sub>IN</sub> = 3V
		—	120	200		V <sub>IN</sub> = 5V
Input Current While Overtemperature Active	—	—	—	400	μA	V <sub>IN</sub> = 5V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	—	85	125	mΩ	V <sub>IN</sub> = 3V, I <sub>D</sub> = 1A
		—	75	100		V <sub>IN</sub> = 5V, I <sub>D</sub> = 1A
Continuous Drain Current (Note 5)	I <sub>D</sub>	2.0	—	—	A	V <sub>IN</sub> = 3V, T <sub>A</sub> = +25°C
		2.2	—	—		V <sub>IN</sub> = 5V, T <sub>A</sub> = +25°C
Continuous Drain Current (Note 6)		2.6	—	—		V <sub>IN</sub> = 3V, T <sub>A</sub> = +25°C
		2.8	—	—		V <sub>IN</sub> = 5V, T <sub>A</sub> = +25°C
Current Limit (Note 8)	I <sub>D(LIM)</sub>	4	8	—	A	V <sub>IN</sub> = 3V
		6	13	—		V <sub>IN</sub> = 5V
<b>Dynamic Characteristics</b>						
Turn-On Delay Time	t <sub>D(ON)</sub>	—	8.6	—	μs	V <sub>DD</sub> = 12V, I <sub>D</sub> = 1A, V <sub>GS</sub> = 5V
Rise Time	t <sub>R</sub>	—	18	—		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	34	—		
Fall Time	t <sub>F</sub>	—	15	—		
<b>Overtemperature Protection</b>						
Thermal Overload Trip Temperature (Note 9)	T <sub>JT</sub>	+150	+175	—	°C	—
Thermal Hysteresis (Note 9)	—	—	+10	—	°C	—

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
  - Thermal resistance between junction and the mounting surfaces of drain and source pins.
  - The drain current is restricted only when the device is in saturation (see graph 'Typical Output Characteristic'). This allows the device to be used in the fully on state without interference from the current limit. The device is fully protected at all drain currents, as the low power dissipation generated outside saturation makes current limit unnecessary.
  - Overtemperature protection is designed to prevent device destruction under fault conditions. Fault conditions are considered as "outside" normal operating range, so this part is not designed to withstand overtemperature for extended periods.

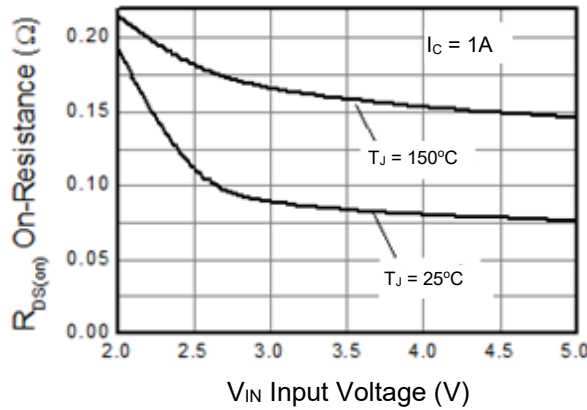
**Typical Characteristics**



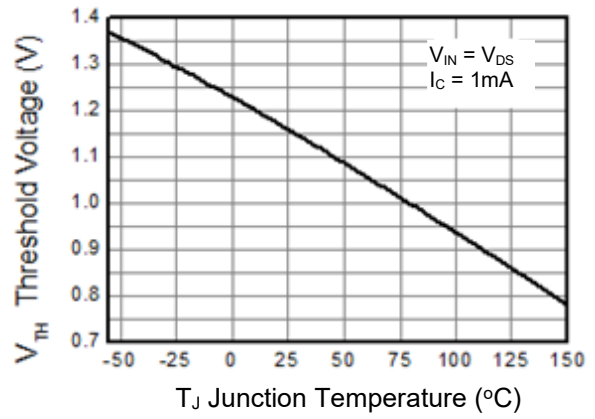
**Typical Output Characteristic**



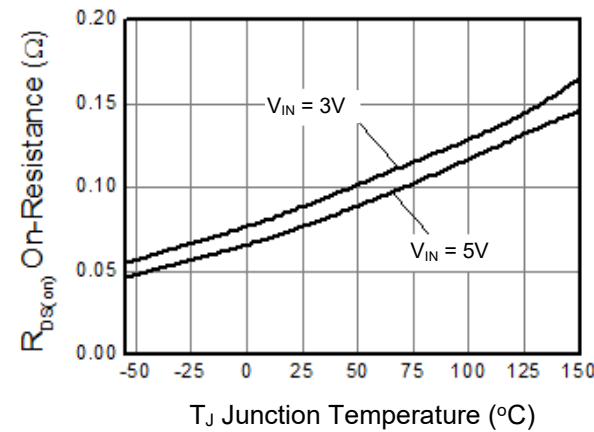
**Input Current vs Input Voltage**



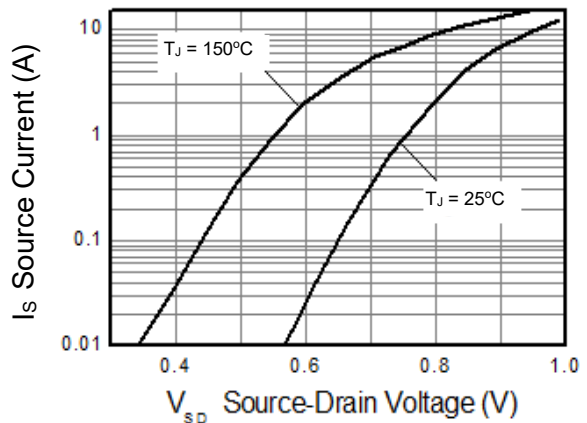
**On-Resistance vs Input Voltage**



**Threshold Voltage vs Temperature**

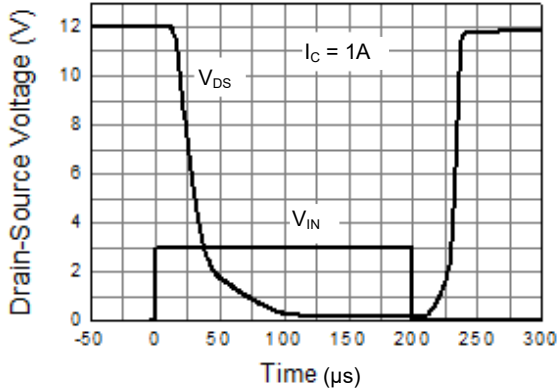


**On-Resistance vs Temperature**

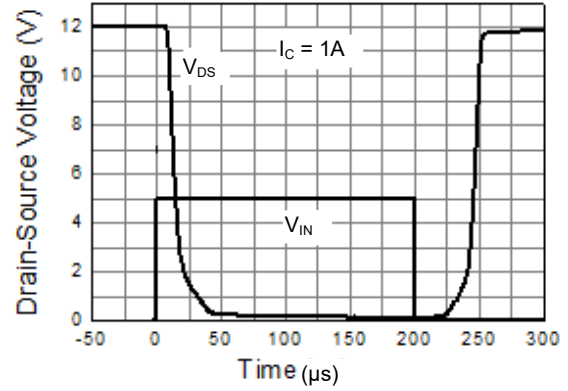


**Reverse Diode Characteristic**

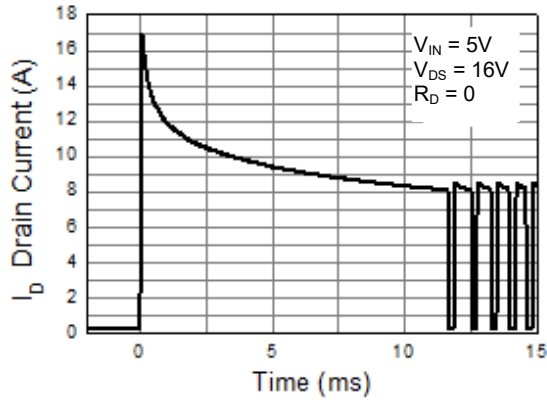
**Typical Characteristics** (continued)



**Switching Speed**



**Switching Speed**

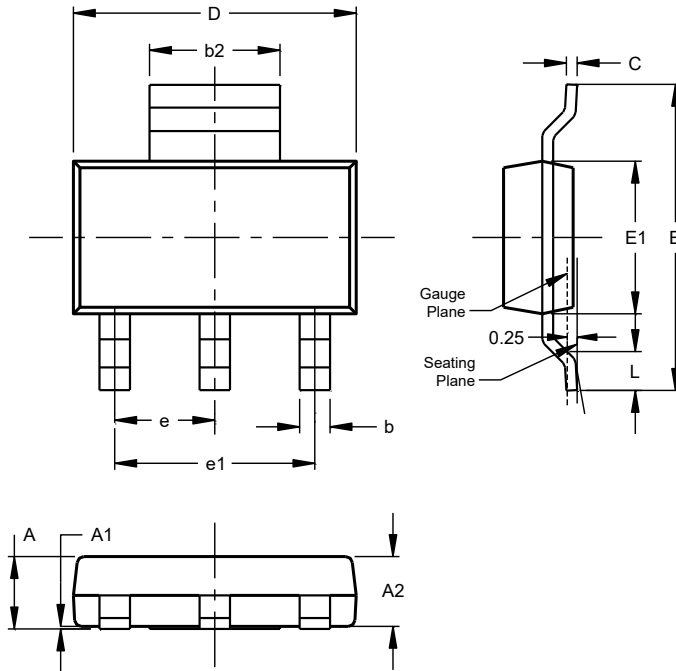


**Typical Short-Circuit Protection**

## Package Outline Dimensions

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

SOT223 (Type DN)

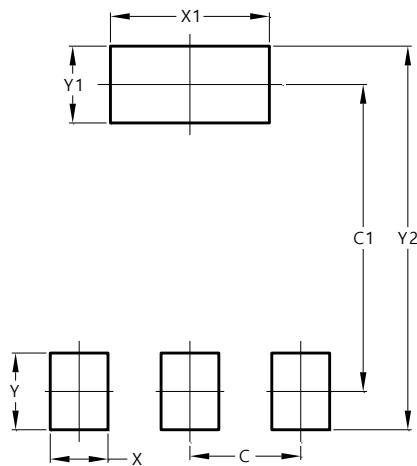


SOT223 (Type DN)			
Dim	Min	Max	Typ
A	--	1.70	--
A1	0.01	0.15	--
A2	1.50	1.68	1.60
b	0.60	0.80	0.70
b2	2.90	3.10	--
c	0.20	0.32	--
D	6.30	6.70	--
E	6.70	7.30	--
E1	3.30	3.70	--
e	--	--	2.30
e1	--	--	4.60
L	0.85	--	--
All Dimensions in mm			

## 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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