

## Product Summary

- Continuous Drain Source Voltage:  $V_{DS} = 60V$
- On-State Resistance: 700m $\Omega$
- Nominal Load Current ( $V_{IN} = 5V$ ): 1.1A
- Clamping Energy: 90mJ

## Description

The DIODES™ ZXMS6008FF is a self-protected low-side IntelliFET® MOSFET with logic level input. It integrates overtemperature, overcurrent, overvoltage (active clamp), and ESD-protected logic level functionality. The ZXMS6008FF is ideal as a general purpose switch driven from 3.3V or 5V microcontrollers in harsh environments where standard MOSFETs are not rugged enough.

## Applications

- Especially suited for loads with a high inrush current, such as lamps and motors
- All types of resistive, inductive and capacitive loads in switching applications
- $\mu$ C compatible power switch for 12V and 24V DC applications
- Replaces electromechanical relays and discrete circuits
- Linear mode capability: the current-limiting protection circuitry is designed to deactivate at low  $V_{DS}$  to minimize on-state power dissipation. 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  $V_{DS}$ .

## 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
- **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 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/>**

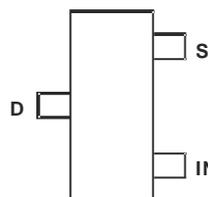
## Mechanical Data

- Package: SOT23F
- 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 (Ⓔ3)
- Weight: 0.012 grams (Approximate)

SOT23F



Top View



Top View  
Pin Out

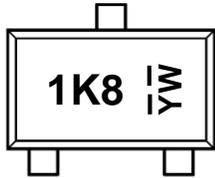
## Ordering Information (Note 4)

Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Packing	
					Qty.	Carrier
ZXMS6008FF-7	SOT23F	1K8	7	8	3,000	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/>.

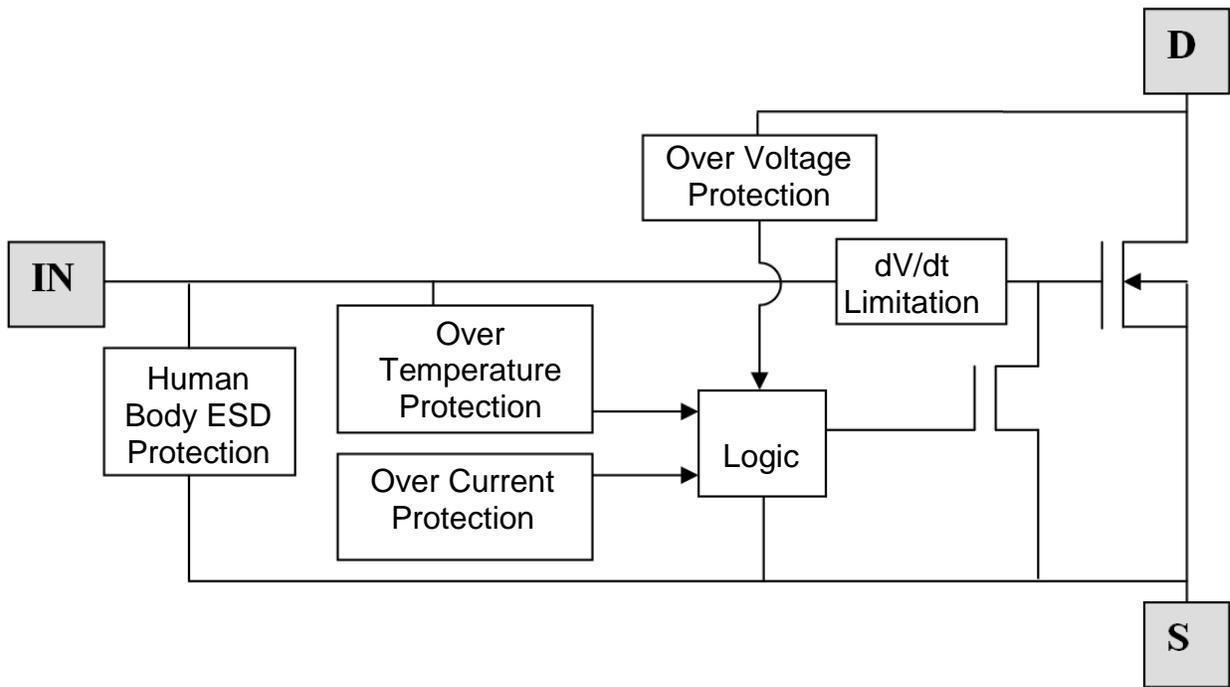
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**Marking Information**



1K8 = Product Type Marking Code  
 Y or  $\bar{Y}$ : Year: 0-9  
 W or  $\bar{W}$ : Week: A-Z: 1-26  
           a-z: 27-52  
           z: Represents 52 & 53 Week

**Functional Block Diagram**



**Absolute Maximum Ratings** (@  $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Continuous Drain-Source Voltage	$V_{DS}$	60	V
Drain-Source Voltage for Short Circuit Protection	$V_{DS(SC)}$	36	V
Continuous Input Voltage	$V_{IN}$	-0.5 to +6	V
Continuous Input Current @ $-0.2\text{V} \leq V_{IN} \leq 6\text{V}$	$I_{IN}$	No Limit $ I_{IN}  \leq 2$	mA
Continuous Input Current @ $V_{IN} < -0.2\text{V}$ or $V_{IN} > 6\text{V}$			
Pulsed Drain Current @ $V_{IN} = 3.3\text{V}$	$I_{DM}$	1.4	A
Pulsed Drain Current @ $V_{IN} = 5\text{V}$	$I_{DM}$	1.8	A
Continuous Source Current (Body Diode) (Note 5)	$I_S$	0.7	A
Pulsed Source Current (Body Diode)	$I_{SM}$	4	A
Unclamped Single Pulse Inductive Energy, $T_J = +25^\circ\text{C}$ , $I_D = 0.5\text{A}$ , $V_{DD} = 24\text{V}$	$E_{AS}$	90	mJ
Electrostatic Discharge (Human Body Model)	$V_{ESD}$	4000	V
Charged Device Model	$V_{CDM}$	1000	V

**Thermal Resistance**

Characteristic	Symbol	Value	Unit
Power Dissipation at $T_A = +25^\circ\text{C}$ (Note 5) Linear Derating Factor	$P_D$	0.81	W
		6.54	mW/ $^\circ\text{C}$
Power Dissipation at $T_A = +25^\circ\text{C}$ (Note 6) Linear Derating Factor	$P_D$	1.5	W
		12	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	153	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient (Note 6)	$R_{\theta JA}$	83	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Lead (Note 7)	$R_{\theta JC}$	65	$^\circ\text{C}/\text{W}$
Operating Temperature Range	$T_J$	-40 to +150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-55 to +150	$^\circ\text{C}$

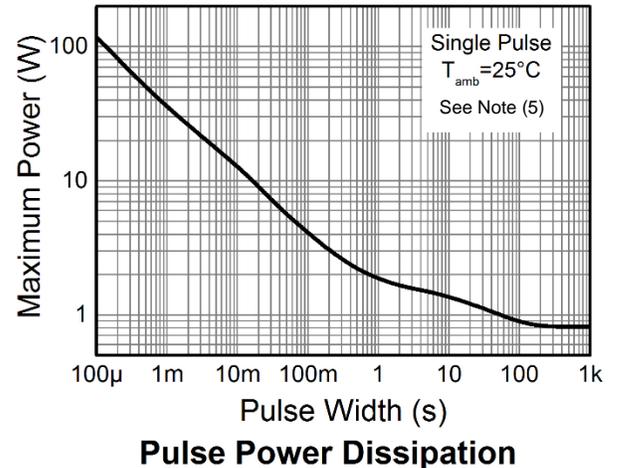
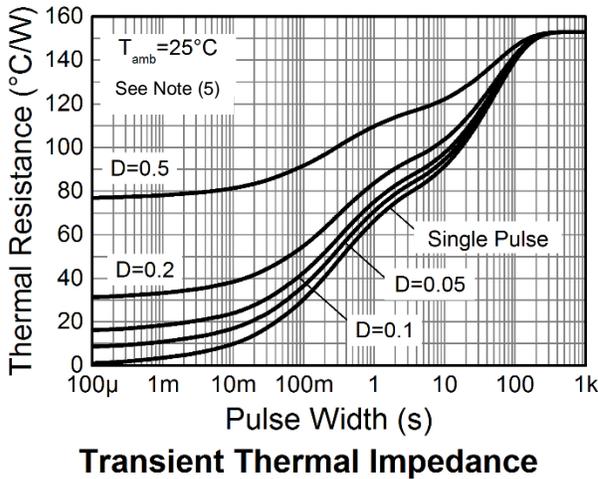
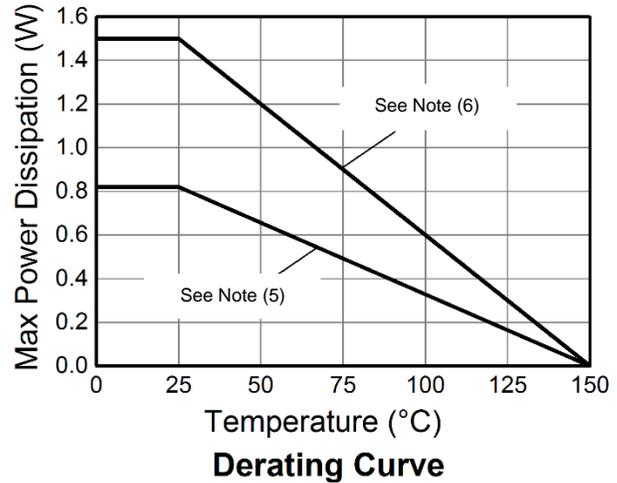
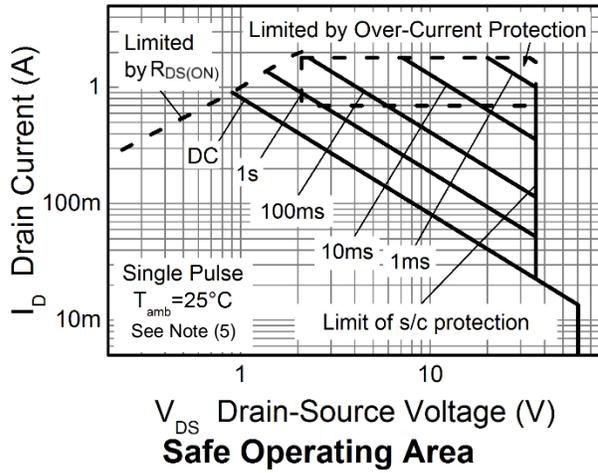
Notes: 5. For a device surface mounted on 15mm x 15mm single sided 1oz weight copper on 1.6mm FR-4 board, in still air conditions.  
6. For a device surface mounted on 50mm x 50mm single sided 2oz weight copper on 1.6mm FR-4 board, in still air conditions.  
7. Thermal resistance between junction and the mounting surfaces of drain and source pins.

**Recommended Operating Conditions**

The ZXMS6008FF is optimized for use with  $\mu\text{C}$  operating from 3.3V and 5V supplies.

Characteristic	Symbol	Min	Max	Unit
Input Voltage Range	$V_{IN}$	0	5.5	V
Ambient Temperature Range	$T_A$	-40	+125	$^\circ\text{C}$
High Level Input Voltage for MOSFET to be on	$V_{IH}$	3	5.5	V
Low Level Input Voltage for MOSFET to be off	$V_{IL}$	0	0.7	V
Peripheral Supply Voltage (Voltage to Which Load is Referred)	$V_P$	0	36	V

**Thermal Characteristics**



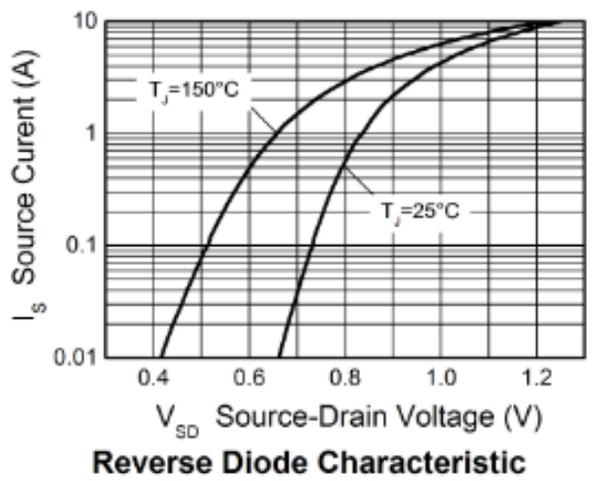
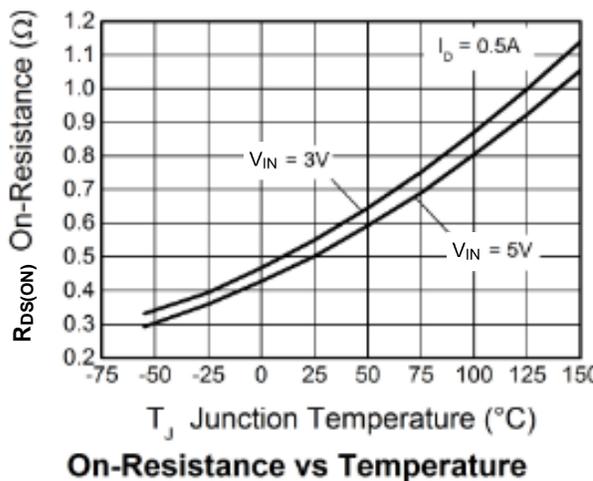
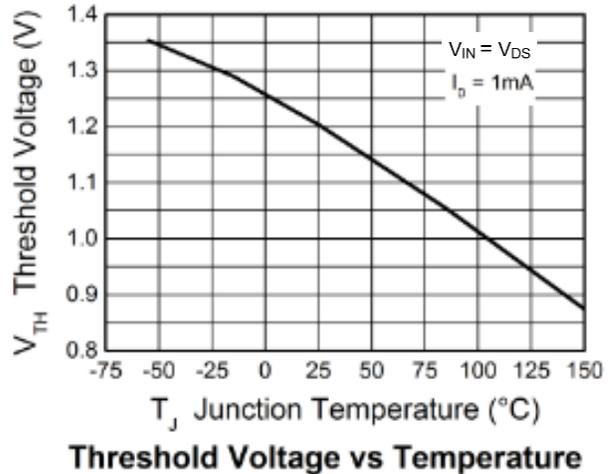
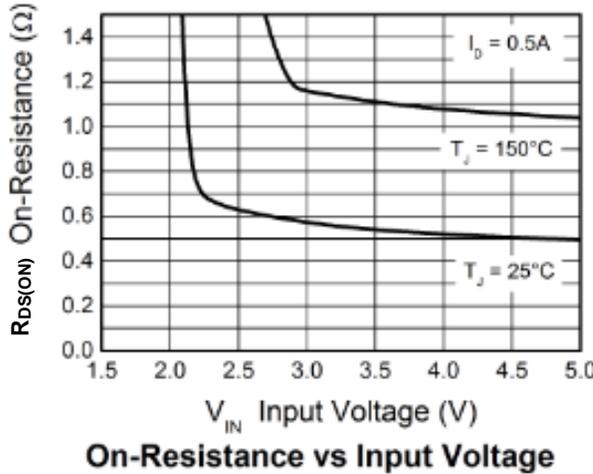
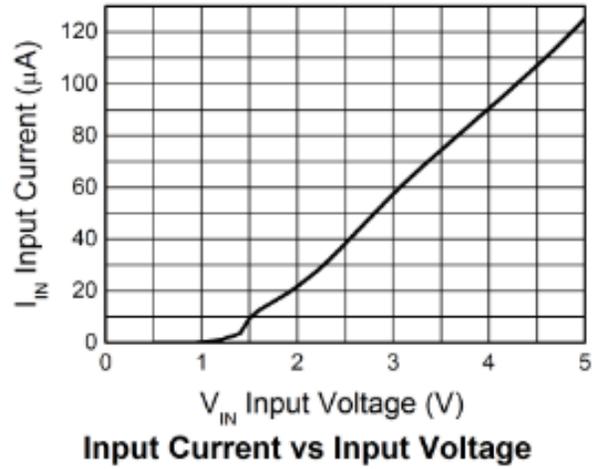
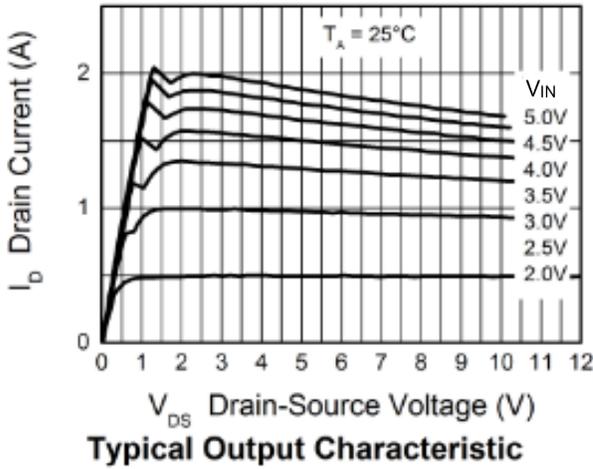
- Notes:
5. For a device surface mounted on 15mm x 15mm single sided 1oz weight copper on 1.6mm FR-4 board, in still air conditions.
  6. For a device surface mounted on 50mm x 50mm single sided 2oz weight copper on 1.6mm FR-4 board, in still air conditions.

**Electrical Characteristics** (@  $T_A = +25^\circ\text{C}$ , unless otherwise stated.)

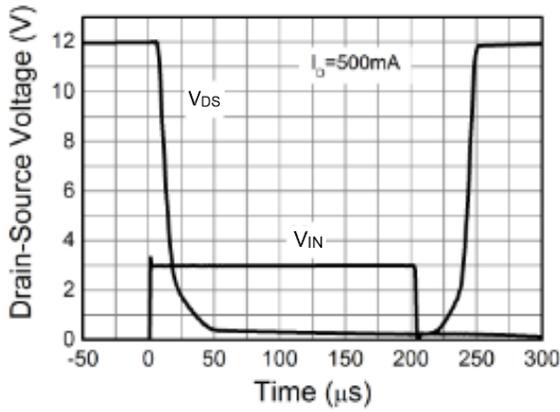
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>Static Characteristics</b>						
Drain-Source Clamp Voltage	$V_{DS(AZ)}$	60	65	70	V	$I_D = 10\text{mA}$
Off State Drain Current	$I_{DSS}$	—	—	0.5	$\mu\text{A}$	$V_{DS} = 12\text{V}, V_{IN} = 0\text{V}$
		—	—	1		$V_{DS} = 36\text{V}, V_{IN} = 0\text{V}$
Input Threshold Voltage	$V_{IN(TH)}$	0.7	1.2	1.5	V	$V_{DS} = V_{GS}, I_D = 1\text{mA}$
Input Current	$I_{IN}$	—	60	100	$\mu\text{A}$	$V_{IN} = 3\text{V}$
		—	120	200		$V_{IN} = 5\text{V}$
Input Current While Over Temperature Active	—	—	—	350	$\mu\text{A}$	$V_{IN} = 5\text{V}$
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	—	550	800	m $\Omega$	$V_{IN} = 3\text{V}, I_D = 0.5\text{A}$
		—	500	700		$V_{IN} = 5\text{V}, I_D = 0.5\text{A}$
Continuous Drain Current (Note 5)	$I_D$	0.6	—	—	A	$V_{IN} = 3\text{V}, T_A = +25^\circ\text{C}$
		0.7	—	—		$V_{IN} = 5\text{V}, T_A = +25^\circ\text{C}$
Continuous Drain Current (Note 6)		0.8	—	—		$V_{IN} = 3\text{V}, T_A = +25^\circ\text{C}$
		0.9	—	—		$V_{IN} = 5\text{V}, T_A = +25^\circ\text{C}$
Current Limit (Note 8)	$I_{D(LIM)}$	0.5	1.2	—	A	$V_{IN} = 3\text{V}$
		0.7	1.6	—		$V_{IN} = 5\text{V}$
<b>Dynamic Characteristics</b>						
Turn On Delay Time	$t_{D(ON)}$	—	5	—	$\mu\text{s}$	$V_{DD} = 12\text{V}, I_D = 0.5\text{A}, V_{GS} = 5\text{V}$
Rise Time	$t_R$	—	10	—		
Turn Off Delay Time	$t_{D(OFF)}$	—	45	—		
Fall Time	$t_F$	—	15	—		
<b>Overtemperature Protection</b>						
Thermal Overload Trip Temperature (Note 9)	$T_{JT}$	+150	+175	—	$^\circ\text{C}$	—
Thermal Hysteresis (Note 9)	—	—	+10	—	$^\circ\text{C}$	—

- Notes:
- For a device surface mounted on 15mm x 15mm single sided 1oz weight copper on 1.6mm FR-4 board, in still air conditions.
  - For a device surface mounted on 50mm x 50mm single sided 2oz weight copper on 1.6mm FR-4 board, in still air conditions.
  - 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.

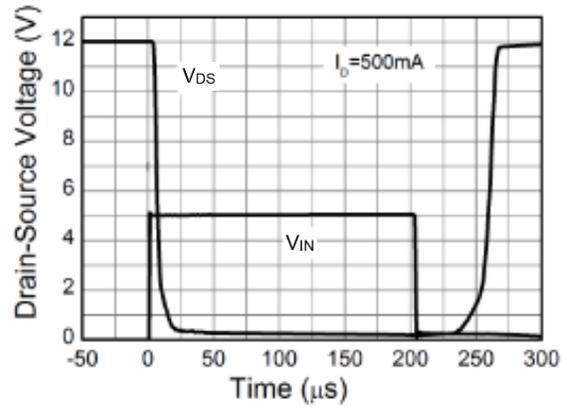
**Typical Characteristics**



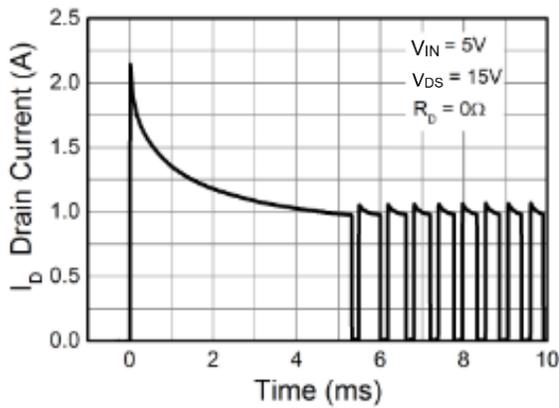
**Typical Characteristics** (continued)



**Switching Speed**



**Switching Speed**

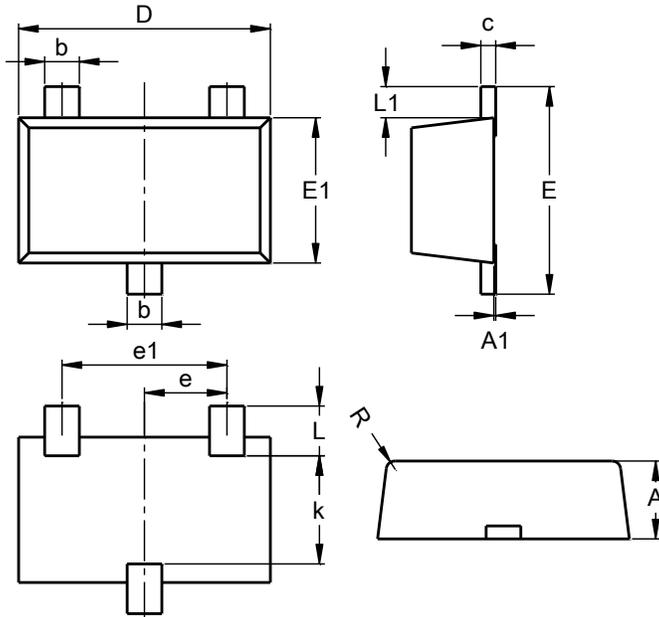


**Typical Short Circuit Protection**

**Package Outline Dimensions**

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

**SOT23F**

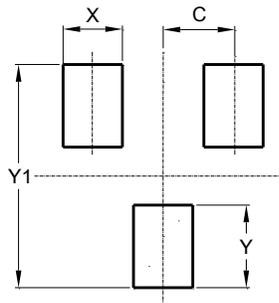


SOT23F			
Dim	Min	Max	Typ
A	0.80	1.00	0.90
A1	0.00	0.10	0.01
b	0.35	0.50	0.44
c	0.10	0.20	0.16
D	2.80	3.00	2.90
e	0.95 REF		
e1	1.90 REF		
E	2.30	2.50	2.40
E1	1.50	1.70	1.65
k	1.20	-	-
L	0.30	0.65	0.50
L1	0.30	0.50	0.40
R	0.05	0.15	-
All Dimensions in mm			

**Suggested Pad Layout**

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

**SOT23F**



Dimensions	Value (in mm)
C	0.95
X	0.80
Y	1.110
Y1	3.000

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