

## Product Summary

BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> Max T <sub>A</sub> = +25°C
50V	3.5Ω @ V <sub>GS</sub> = 10V	0.31A

## Description and Applications

This MOSFET is designed to minimize the on-state resistance (R<sub>DS(ON)</sub>), yet maintain superior switching performance, making it ideal for high efficiency power management applications.

- Load Switch

## Features

- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- **ESD Protected Gate**
- **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-Q101, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](mailto:contact@diodes.com) or your local Diodes representative.
- <https://www.diodes.com/quality/product-definitions/>

## Mechanical Data

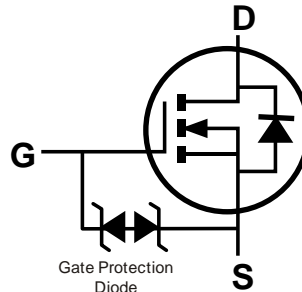
- Case: SOT23
- Case Material: Molded Plastic, "Green" Molding Compound.
- UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208
- Terminals Connections: See Diagram Below
- Weight: 0.009 grams (Approximate)



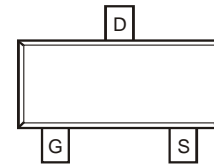
ESD Protected Gate



Top View



Internal Schematic  
Gate Protection Diode



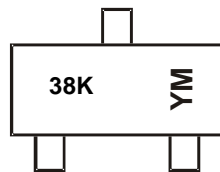
Top View

## Ordering Information (Note 4)

Part Number	Case	Packaging
BSS138K-7	SOT23	3,000/Tape & Reel
BSS138K-13	SOT23	10,000/Tape & 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



38K = Product Type Marking Code  
 YM = Date Code Marking  
 Y or  $\bar{Y}$  = Year (ex: G = 2019)  
 M = Month (ex: 9 = September)

### Date Code Key

Year	2018	2019	2020	2021	2022	2023	2024	2025	2026			
Code	F	G	H	I	J	K	L	M	N			
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

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

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			$V_{DSS}$	50	V
Gate-Source Voltage			$V_{GSS}$	$\pm 20$	V
Continuous Drain Current (Note 6) $V_{GS} = 10\text{V}$	Steady State	$T_A = +25^\circ\text{C}$	$I_D$	0.31	A
		$T_A = +70^\circ\text{C}$		0.25	
Maximum Continuous Body Diode Forward Current (Note 6)			$I_S$	0.5	A
Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%)			$I_{DM}$	0.8	A

**Thermal Characteristics**

Characteristic			Symbol	Value	Unit
Total Power Dissipation (Note 5)			$P_D$	0.38	W
Thermal Resistance, Junction to Ambient (Note 5)		Steady State	$R_{\theta JA}$	338	$^\circ\text{C/W}$
Total Power Dissipation (Note 6)			$P_D$	0.54	W
Thermal Resistance, Junction to Ambient (Note 6)		Steady State	$R_{\theta JA}$	237	$^\circ\text{C/W}$
Operating and Storage Temperature Range			$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b> (Note 7)						
Drain-Source Breakdown Voltage	$BV_{DSS}$	50	—	—	V	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	1	$\mu\text{A}$	$T_J = +25^\circ\text{C}, V_{DS} = 50\text{V}, V_{GS} = 0\text{V}$
Gate-Source Leakage	$I_{GSS}$	—	—	$\pm 10$	$\mu\text{A}$	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$
<b>ON CHARACTERISTICS</b> (Note 7)						
Gate Threshold Voltage	$V_{GS(TH)}$	0.5	1.1	1.5	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	1.3	3.5	$\Omega$	$V_{GS} = 10\text{V}, I_D = 0.22\text{A}$
Diode Forward Voltage	$V_{SD}$	—	0.8	1.2	V	$V_{GS} = 0\text{V}, I_D = 0.22\text{A}$
<b>DYNAMIC CHARACTERISTICS</b> (Note 8)						
Input Capacitance	$C_{iss}$	—	23.2	—	pF	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}$ $f = 1.0\text{MHz}$
Output Capacitance	$C_{oss}$	—	3.1	—	pF	
Reverse Transfer Capacitance	$C_{rss}$	—	2.2	—	pF	
Gate Resistance	$R_g$	—	69	—	$\Omega$	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$
Total Gate Charge ( $V_{GS} = 4.5\text{V}$ )	$Q_g$	—	0.45	—	nC	$V_{DS} = 25\text{V}, I_D = 0.2\text{A}$
Total Gate Charge ( $V_{GS} = 10\text{V}$ )	$Q_g$	—	0.95	—	nC	
Gate-Source Charge	$Q_{gs}$	—	0.10	—	nC	
Gate-Drain Charge	$Q_{gd}$	—	0.14	—	nC	
Turn-On Delay Time	$t_{D(ON)}$	—	3.2	—	ns	$V_{DS} = 25\text{V}, V_{GS} = 10\text{V},$ $R_G = 50\Omega, I_D = 0.2\text{A}$
Turn-On Rise Time	$t_R$	—	2.5	—	ns	
Turn-Off Delay Time	$t_{D(OFF)}$	—	13.8	—	ns	
Turn-Off Fall Time	$t_F$	—	7.6	—	ns	
Reverse Recovery Time	$t_{RR}$	—	8.8	—	ns	$I_F = 0.2\text{A}, di/dt = 100\text{A}/\mu\text{s}$
Reverse Recovery Charge	$Q_{RR}$	—	2.6	—	nC	$I_F = 0.2\text{A}, di/dt = 100\text{A}/\mu\text{s}$

- Notes:
- Device mounted on FR-4 PCB, with minimum recommended pad layout.
  - Device mounted on 1" x 1" FR-4 PCB with high coverage 2oz. Copper, single sided.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

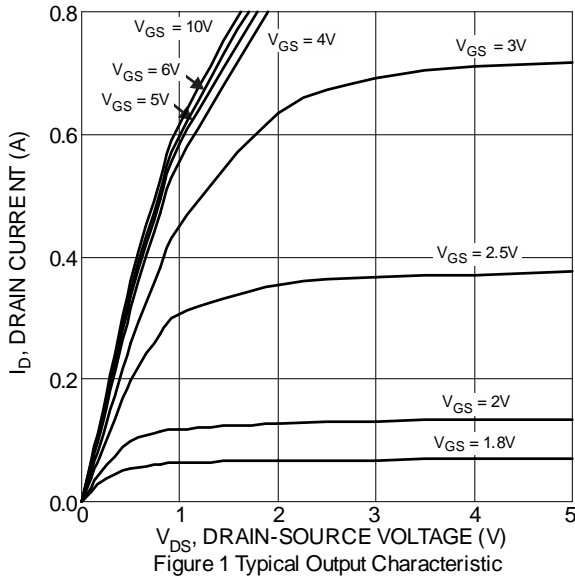


Figure 1 Typical Output Characteristic

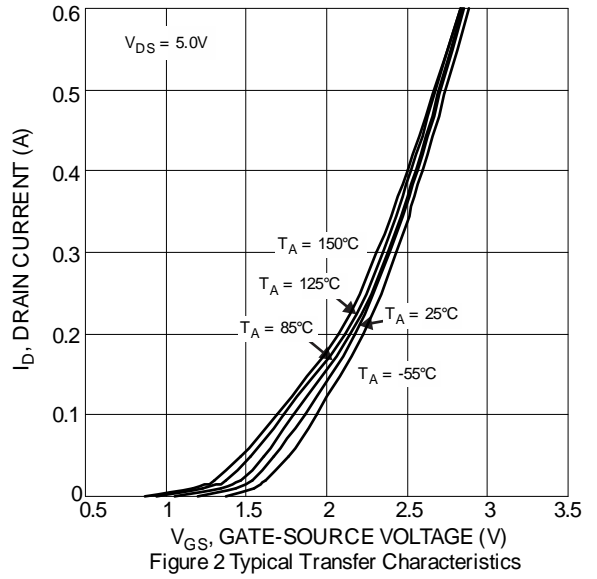


Figure 2 Typical Transfer Characteristics

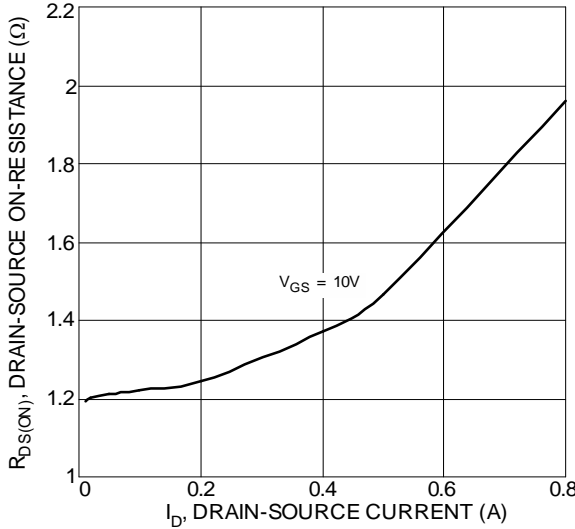


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

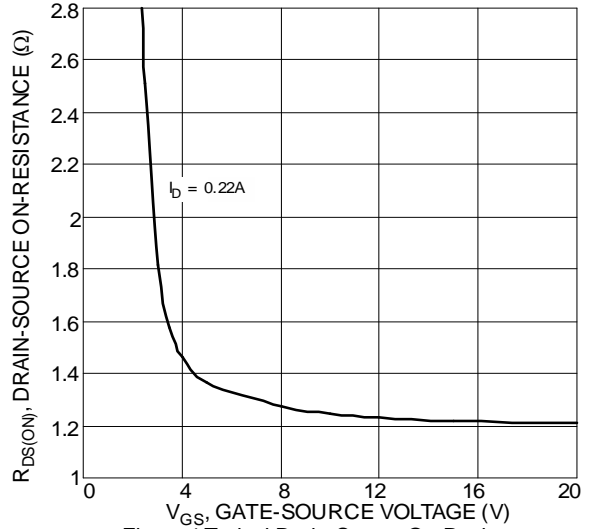


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

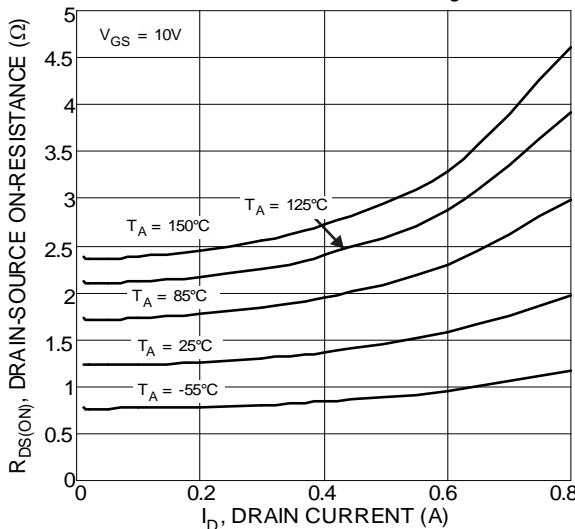


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

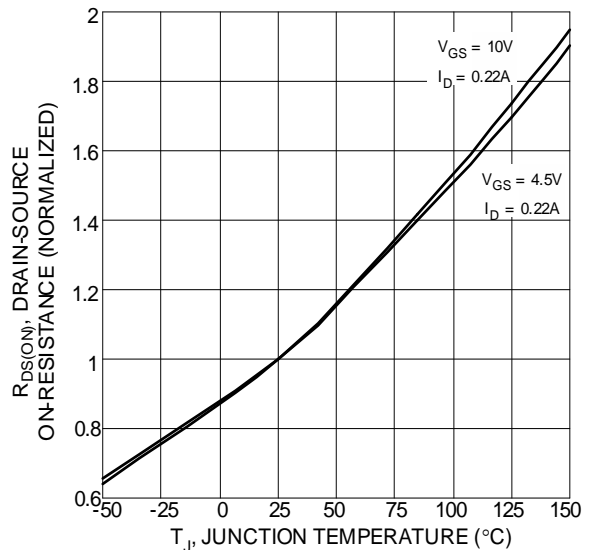


Figure 6 On-Resistance Variation with Temperature

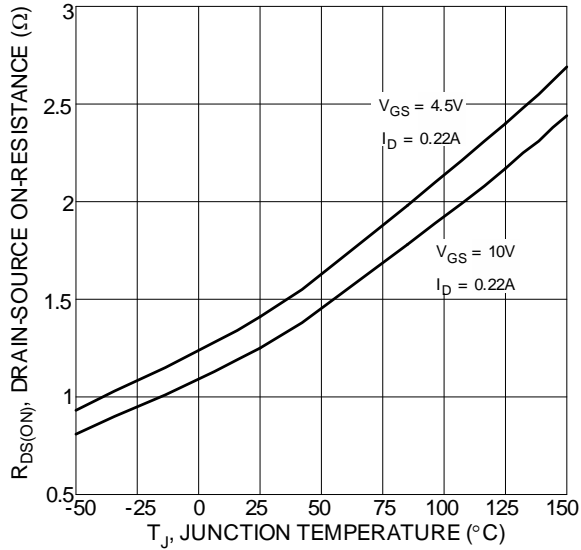


Figure 7 On-Resistance Variation with Temperature

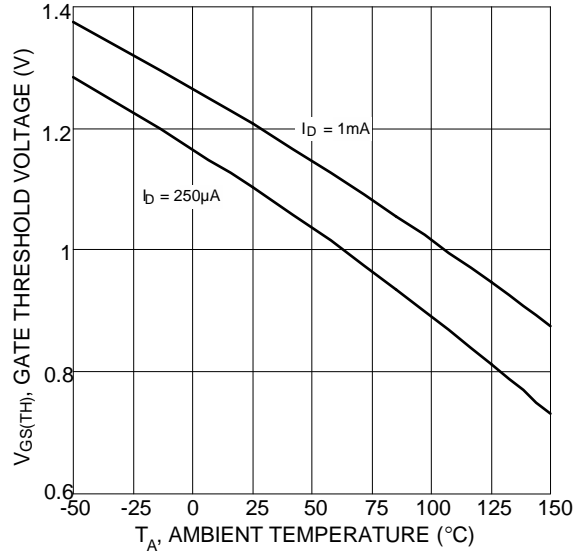


Figure 8 Gate Threshold Variation vs. Ambient Temperature

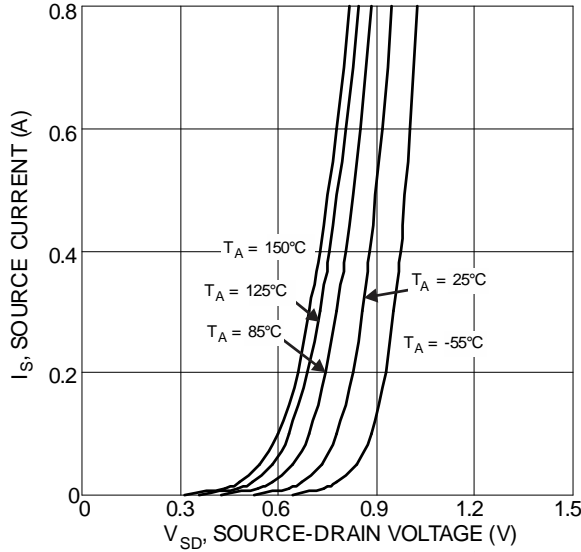


Figure 9 Diode Forward Voltage vs. Current

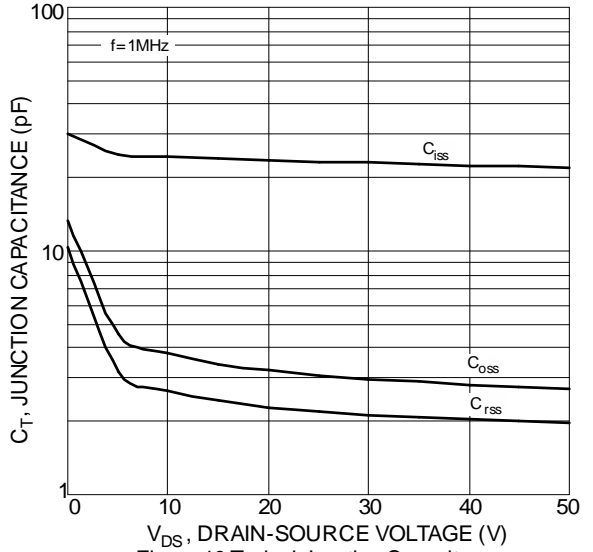


Figure 10 Typical Junction Capacitance

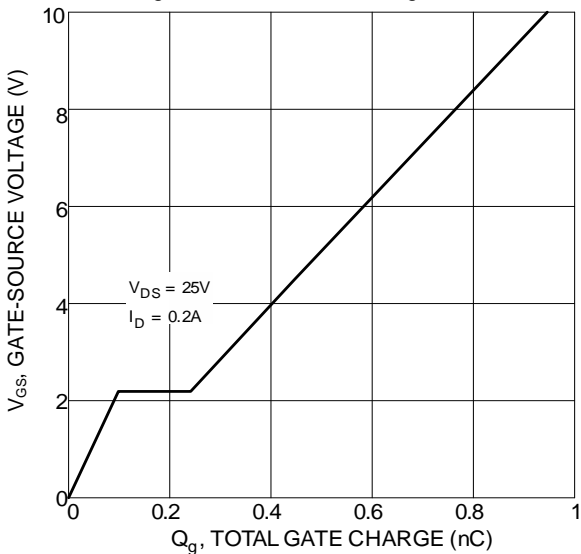


Figure 11 Gate Charge

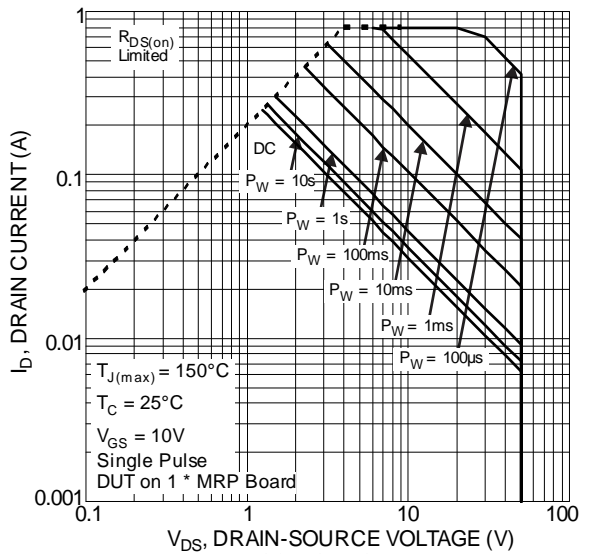
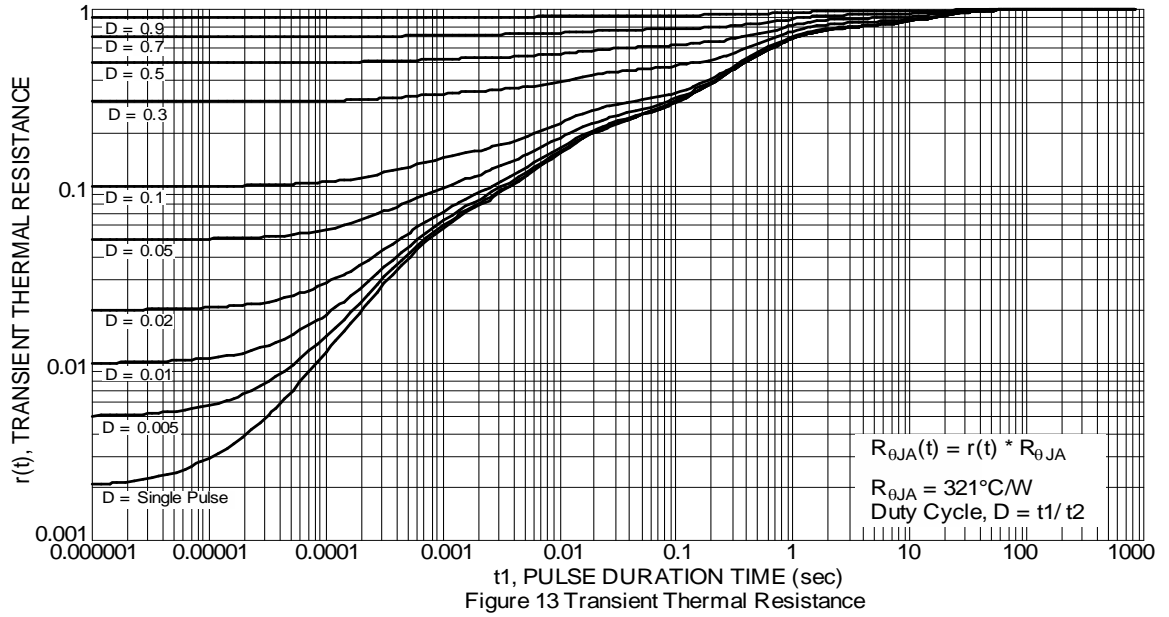


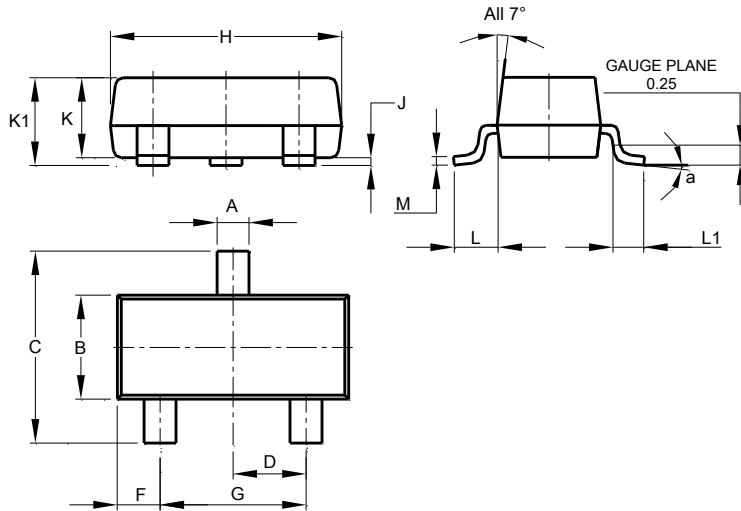
Figure 12 SOA, Safe Operation Area



**Package Outline Dimensions**

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

**SOT23**

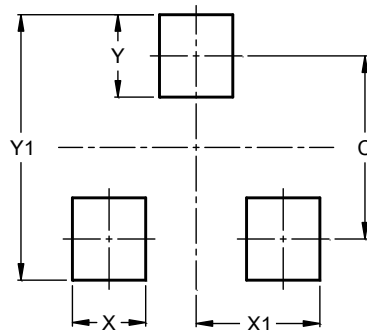


SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			

**Suggested Pad Layout**

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

**SOT23**



Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

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