

Product Summary

| BV _{DSS} | R _{DS(ON)} Max | I _D Max T _A = +25°C |
|-------------------|------------------------------|--|
| 50V | 3.5Ω @ V _{GS} = 10V | 0.31A |

Description and Applications

This MOSFET is designed to minimize the on-state resistance (R_{DS(ON)}), 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)**

Mechanical Data

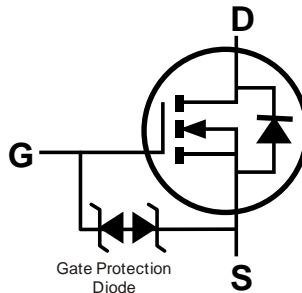
- Case: SOT23
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 **(e3)**
- Terminals Connections: See Diagram Below
- Weight: 0.009 grams (Approximate)



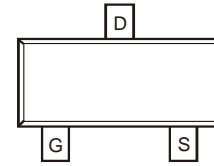
ESD Protected Gate



Top View



Internal Schematic



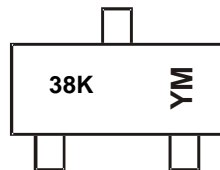
Top View

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 Ȳ = Year (ex: F = 2018)
 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} | ± 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 μs 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 |
|--|--------------|-----|------|----------|---------------|--|
| OFF CHARACTERISTICS (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 | μA | $V_{DS} = 50\text{V}, V_{GS} = 0\text{V}$ |
| Gate-Source Leakage | I_{GSS} | — | — | ± 10 | μA | $V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$ |
| ON CHARACTERISTICS (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 | Ω | $V_{GS} = 10\text{V}, I_D = 0.22\text{A}$ |
| Diode Forward Voltage | V_{SD} | — | 0.8 | 1.2 | V | $V_{GS} = 0\text{V}, I_D = 0.22\text{A}$ |
| DYNAMIC CHARACTERISTICS (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 | — | Ω | $V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1\text{MHz}$ |
| 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.

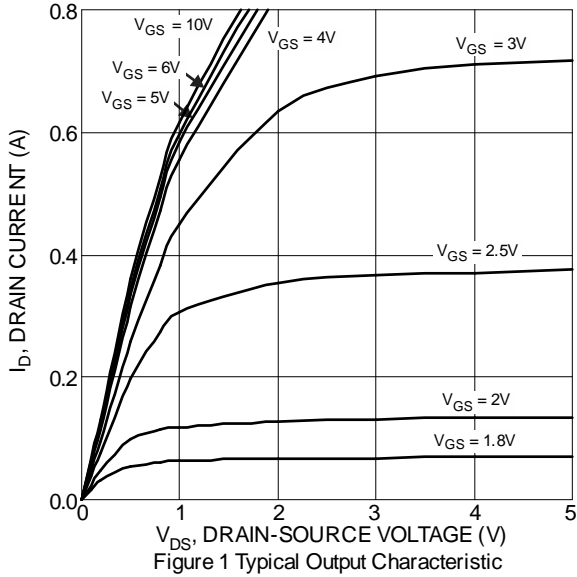


Figure 1 Typical Output Characteristic

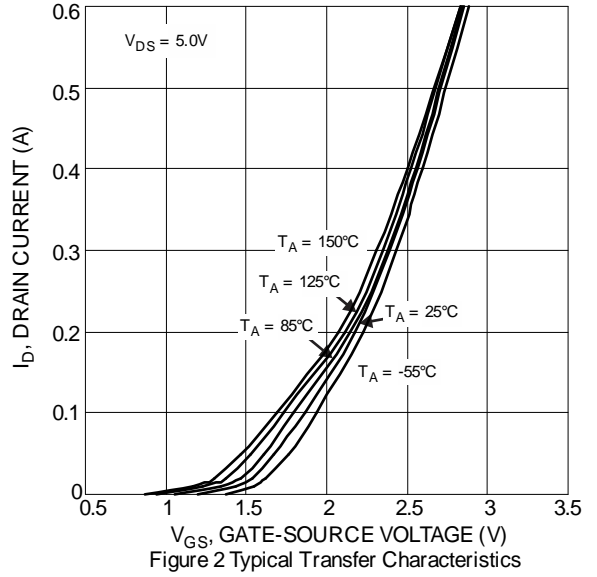


Figure 2 Typical Transfer Characteristics

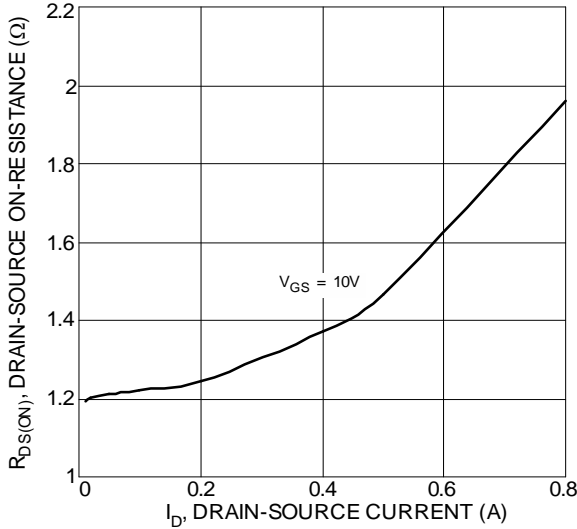


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

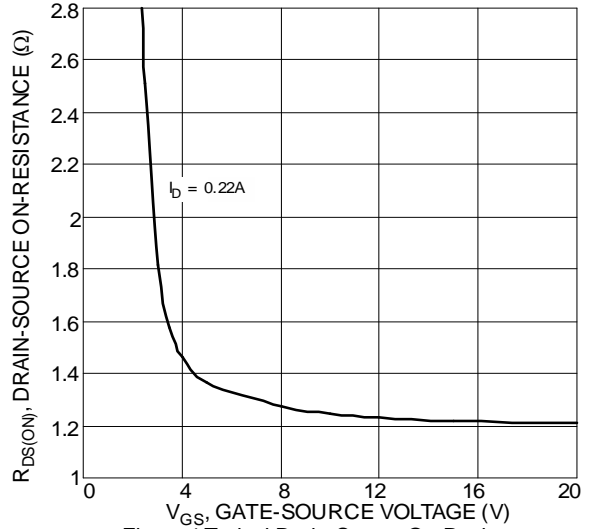


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

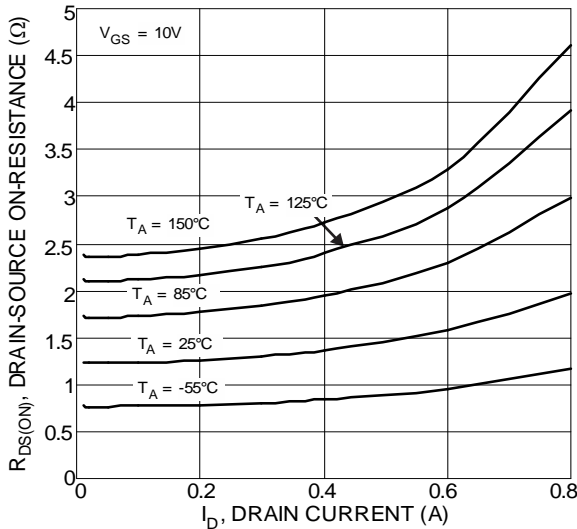


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

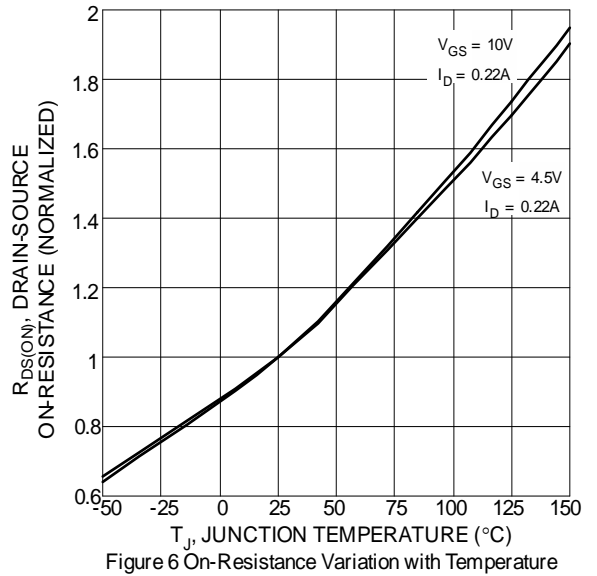


Figure 6 On-Resistance Variation with Temperature

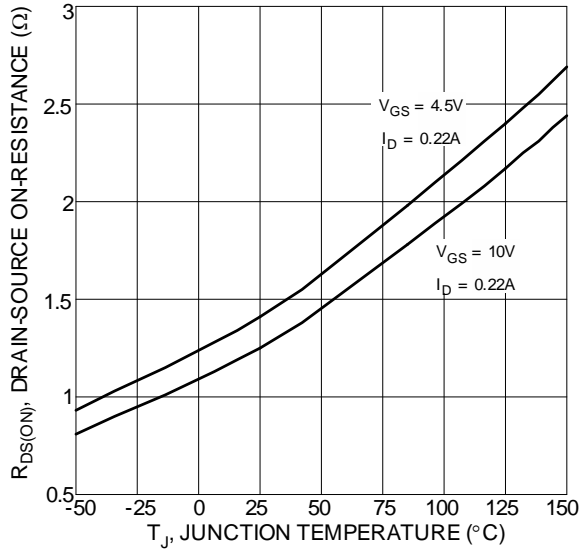


Figure 7 On-Resistance Variation with Temperature

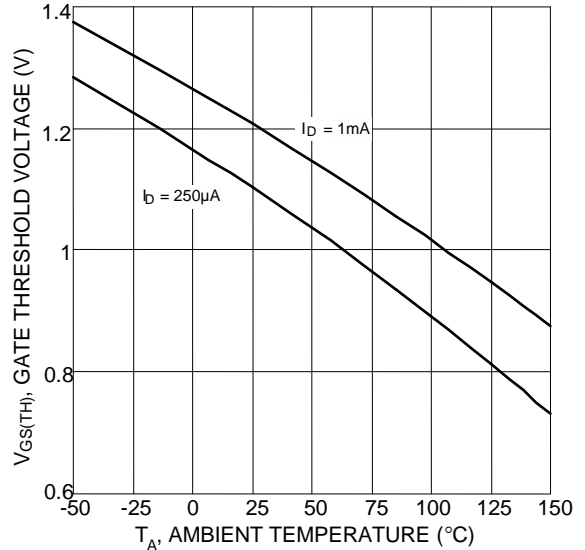


Figure 8 Gate Threshold Variation vs. Ambient Temperature

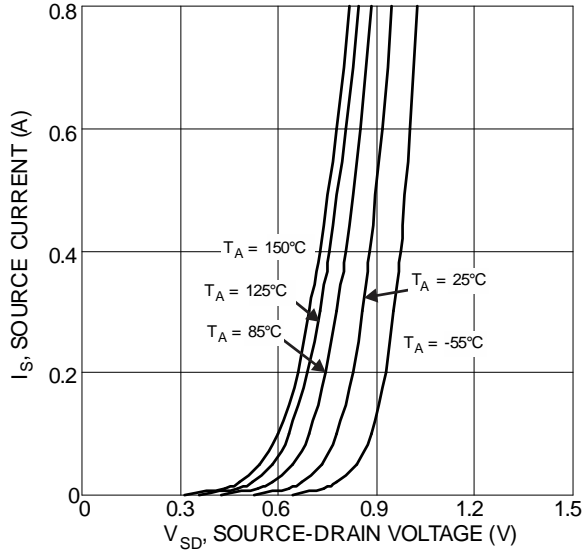


Figure 9 Diode Forward Voltage vs. Current

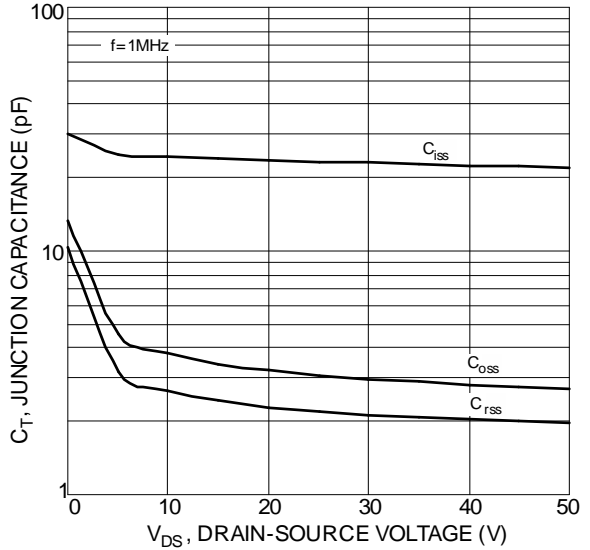


Figure 10 Typical Junction Capacitance

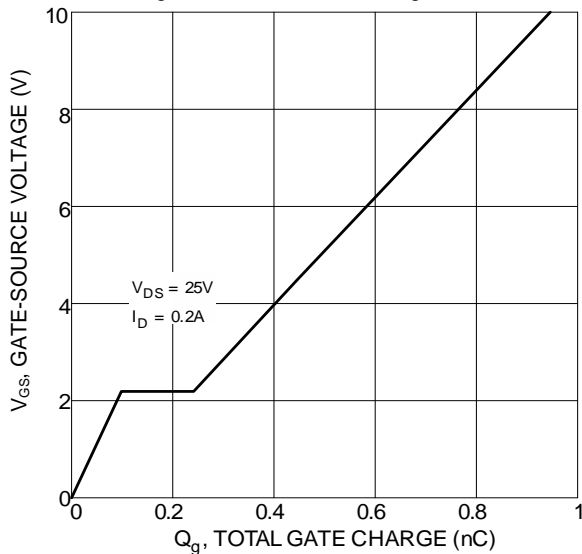


Figure 11 Gate Charge

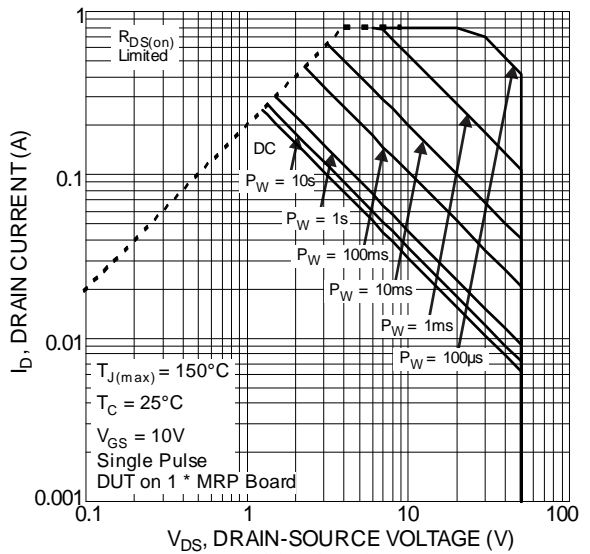
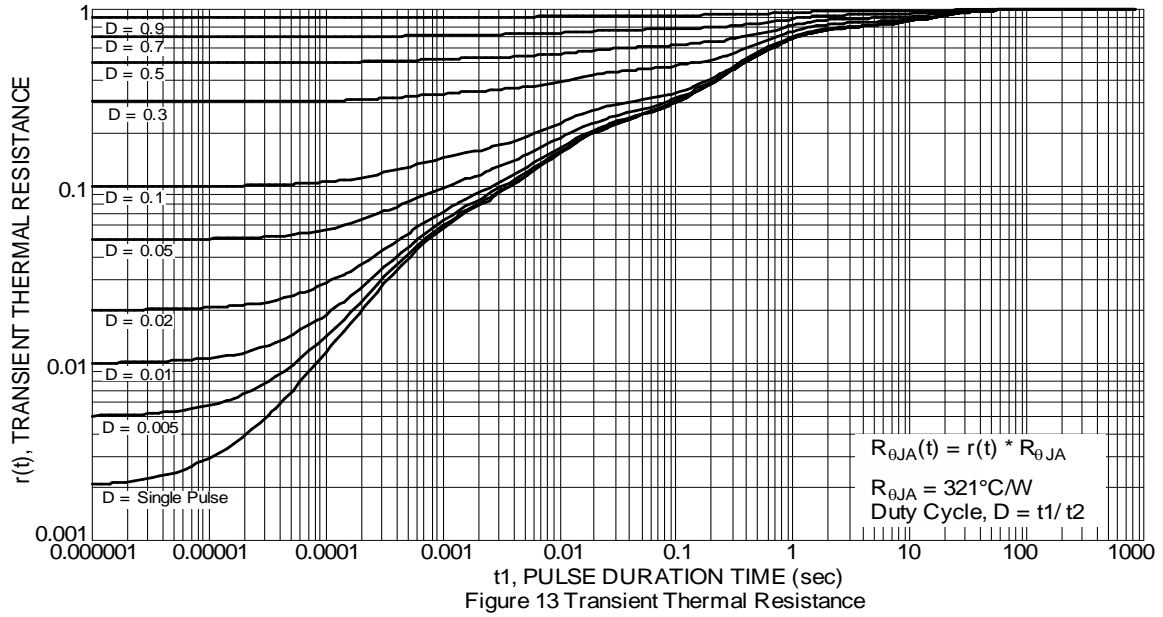


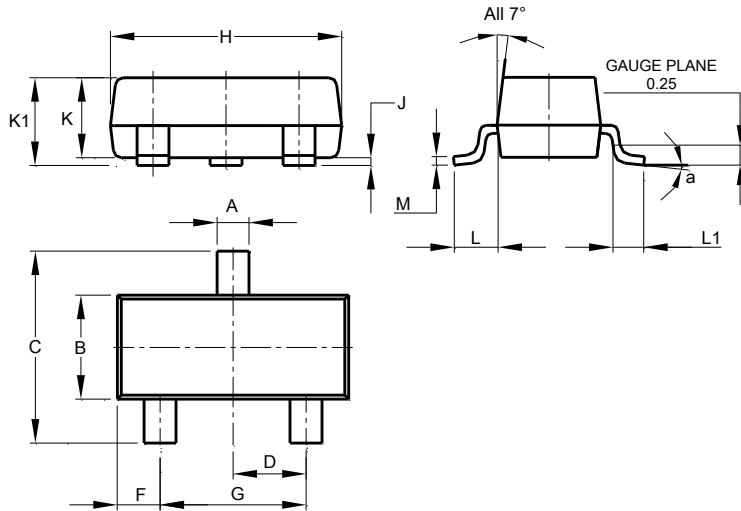
Figure 12 SOA, Safe Operation Area



Package Outline Dimensions

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

SOT23

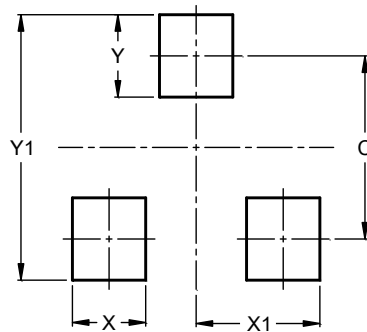


| SOT23 | | | |
|-----------------------------|-------|-------|-------|
| Dim | Min | Max | Typ |
| A | 0.37 | 0.51 | 0.40 |
| B | 1.20 | 1.40 | 1.30 |
| C | 2.30 | 2.50 | 2.40 |
| D | 0.89 | 1.03 | 0.915 |
| F | 0.45 | 0.60 | 0.535 |
| G | 1.78 | 2.05 | 1.83 |
| H | 2.80 | 3.00 | 2.90 |
| J | 0.013 | 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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