# BSS138L, BVSS138L

# Power MOSFET 200 mA, 50 V

## N−Channel SOT−23

Typical applications are DC−DC converters, power management in portable and battery−powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

### Features

- Low Threshold Voltage ($V_{GS(th)}$: 0.85 V−1.5 V) Makes it Ideal for Low Voltage Applications
- Miniature SOT−23 Surface Mount Package Saves Board Space
- BVSS Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

**MAXIMUM RATINGS** ($T_A$ = 25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Drain−to−Source Voltage | $V_{DSS}$ | 50 | Vdc |
| Gate−to−Source Voltage − Continuous | $V_{GS}$ | ± 20 | Vdc |
| Drain Current<br>− Continuous @ $T_A$ = 25°C<br>− Pulsed Drain Current ($t_p \le 10$ μs) | <br>$I_D$<br>$I_{DM}$ | <br>200<br>800 | mA |
| Total Power Dissipation @ $T_A$ = 25°C | $P_D$ | 225 | mW |
| Operating and Storage Temperature Range | $T_J$, $T_{stg}$ | − 55 to 150 | °C |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 556 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, for 10 seconds | $T_L$ | 260 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**ON Semiconductor®**

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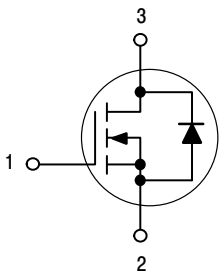
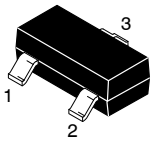
**200 mA, 50 V**
**$R_{DS(on)}$ = 3.5 Ω**

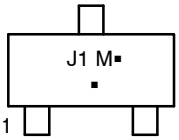
**N−Channel**




**SOT−23**
**CASE 318**
**STYLE 21**

**MARKING DIAGRAM**




J1 = Device Code
M = Date Code*
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or overbar may vary depending upon manufacturing location.

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| BSS138LT1G, BVSS138LT1G | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| BSS138LT7G | SOT−23 (Pb−Free) | 3,500 / Tape & Reel |
| BSS138LT3G, BVSS138LT3G | SOT−23 (Pb−Free) | 10,000 / Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted)

| Characteristic | | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain−to−Source Breakdown Voltage ($V_{GS}$ = 0 Vdc, $I_D$ = 250 μAdc) | | $V_{(BR)DSS}$ | 50 | – | – | Vdc |
| Zero Gate Voltage Drain Current | | $I_{DSS}$ | | | | μAdc |
| ($V_{DS}$ = 25 Vdc, $V_{GS}$ = 0 Vdc, 25°C) | | | – | – | 0.1 | |
| ($V_{DS}$ = 50 Vdc, $V_{GS}$ = 0 Vdc, 25°C) | | | – | – | 0.5 | |
| ($V_{DS}$ = 50 Vdc, $V_{GS}$ = 0 Vdc, 150°C) | | | – | – | 5.0 | |
| Gate−Source Leakage Current ($V_{GS}$ = ± 20 Vdc, $V_{DS}$ = 0 Vdc) | | $I_{GSS}$ | – | – | ±0.1 | μAdc |
| **ON CHARACTERISTICS** (Note 1) | | | | | | |
| Gate−Source Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 1.0 mAdc) | | $V_{GS(th)}$ | 0.85 | – | 1.5 | Vdc |
| Static Drain−to−Source On−Resistance | | $r_{DS(on)}$ | | | | Ω |
| ($V_{GS}$ = 2.75 Vdc, $I_D$ < 200 mAdc, $T_A$ = −40°C to +85°C) | | | – | 5.6 | 10 | |
| ($V_{GS}$ = 5.0 Vdc, $I_D$ = 200 mAdc) | | | – | – | 3.5 | |
| Forward Transconductance ($V_{DS}$ = 25 Vdc, $I_D$ = 200 mAdc, f = 1.0 kHz) | | $g_{fs}$ | 100 | – | – | mmhos |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | ($V_{DS}$ = 25 Vdc, $V_{GS}$ = 0, f = 1 MHz) | $C_{iss}$ | – | 40 | 50 | pF |
| Output Capacitance | ($V_{DS}$ = 25 Vdc, $V_{GS}$ = 0, f = 1 MHz) | $C_{oss}$ | – | 12 | 25 | |
| Transfer Capacitance | ($V_{DG}$ = 25 Vdc, $V_{GS}$ = 0, f = 1 MHz) | $C_{rss}$ | – | 3.5 | 5.0 | |
| **SWITCHING CHARACTERISTICS** (Note 2) | | | | | | |
| Turn−On Delay Time | ($V_{DD}$ = 30 Vdc, $I_D$ = 0.2 Adc,) | $t_{d(on)}$ | – | – | 20 | ns |
| Turn−Off Delay Time | | $t_{d(off)}$ | – | – | 20 | |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
2. Switching characteristics are independent of operating junction temperature.

## TYPICAL ELECTRICAL CHARACTERISTICS

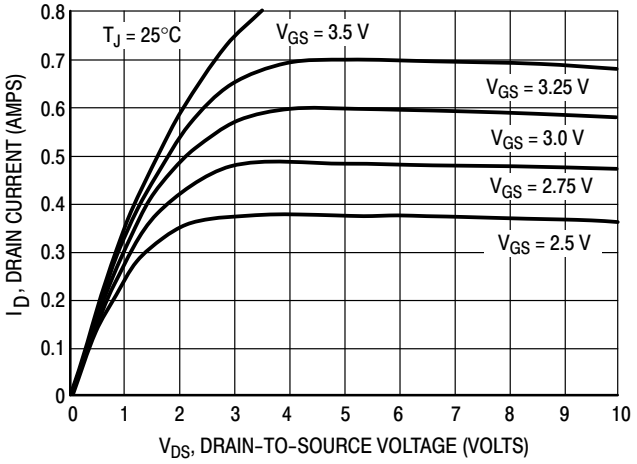



**Figure 1. On−Region Characteristics**

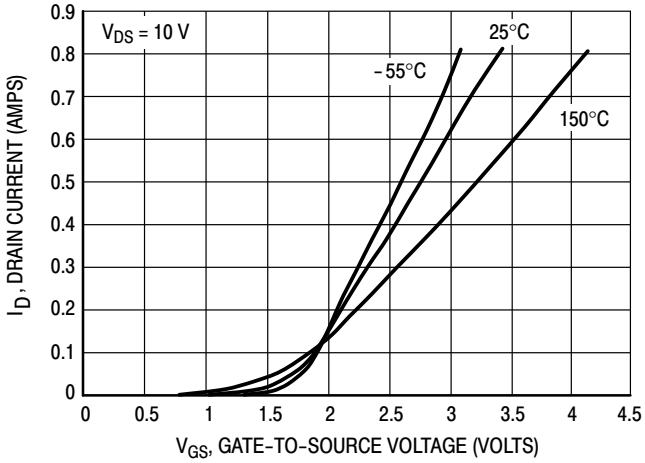



**Figure 2. Transfer Characteristics**

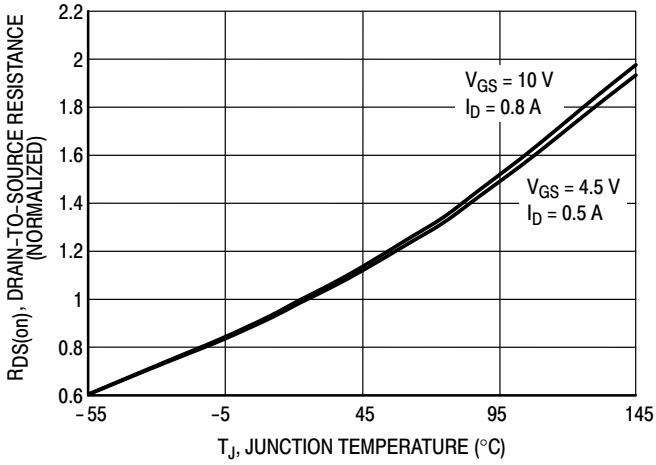



**Figure 3. On−Resistance Variation with Temperature**

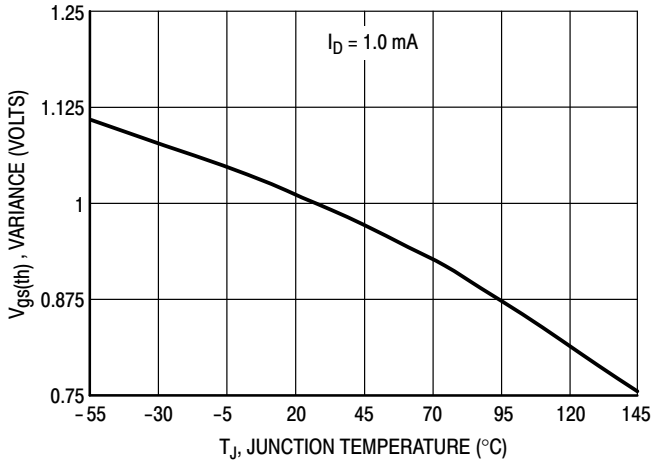



**Figure 4. Threshold Voltage Variation with Temperature**

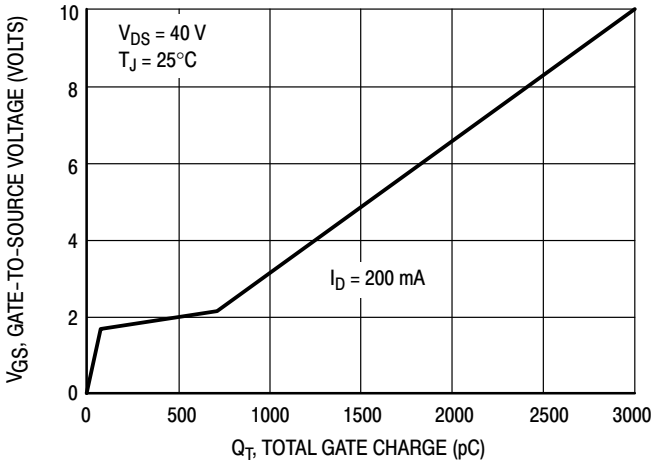



**Figure 5. Gate Charge**

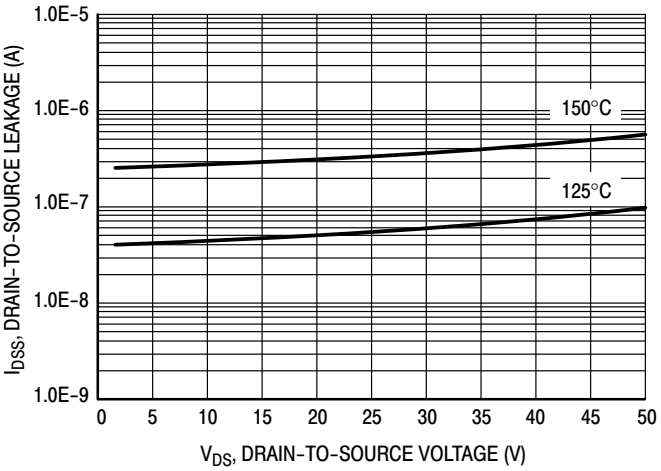



**Figure 6. IDSS**

## TYPICAL ELECTRICAL CHARACTERISTICS

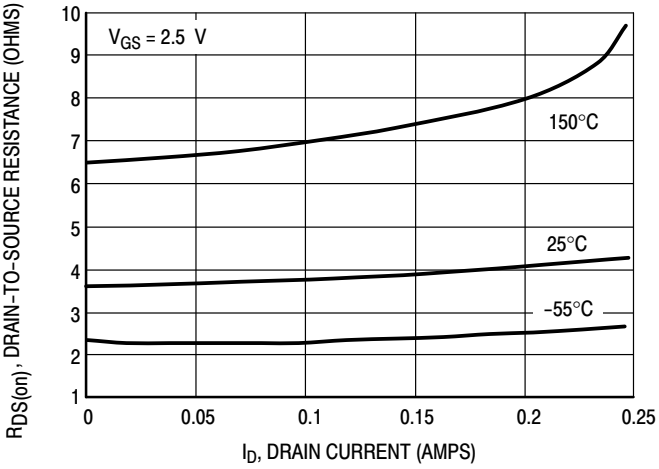



**Figure 7. On−Resistance versus Drain Current**

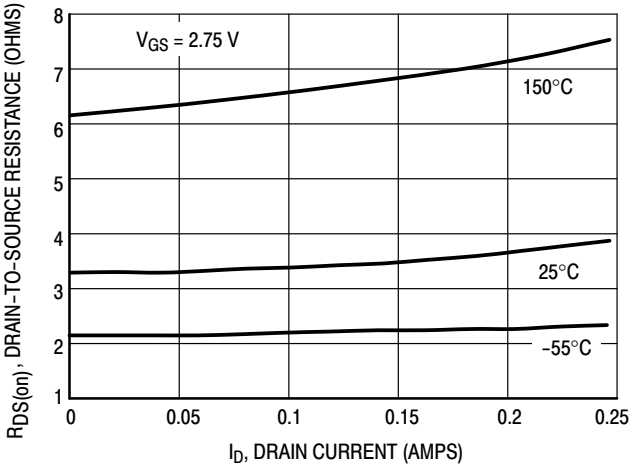



**Figure 8. On−Resistance versus Drain Current**

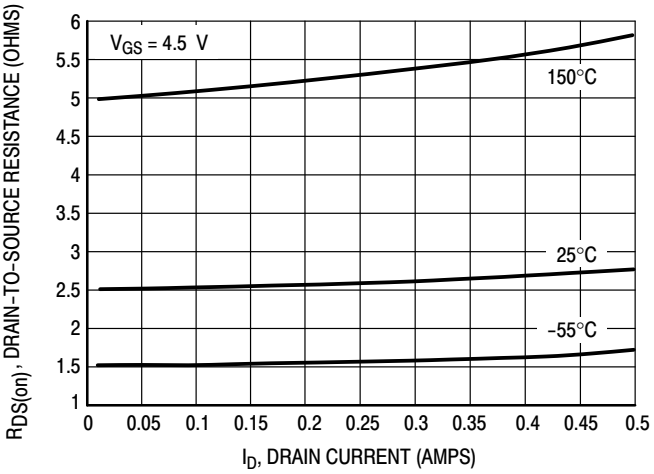



**Figure 9. On−Resistance versus Drain Current**

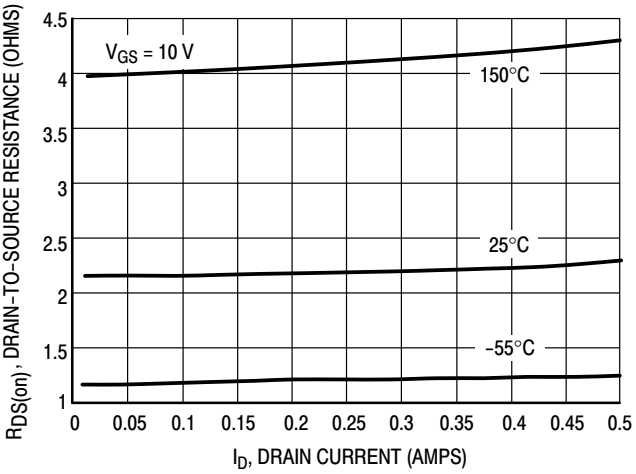



**Figure 10. On−Resistance versus Drain Current**

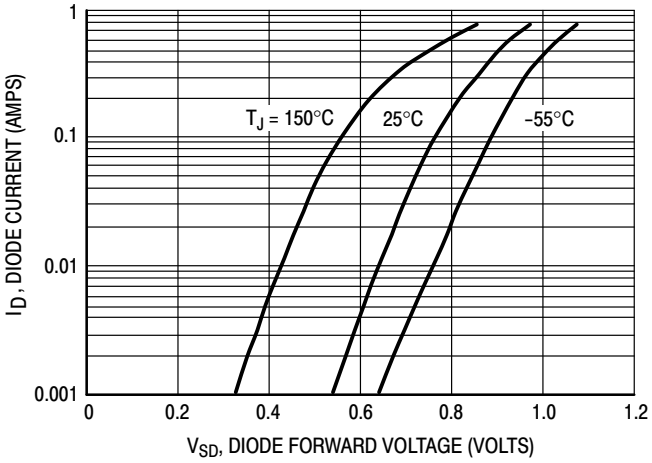



**Figure 11. Body Diode Forward Voltage**

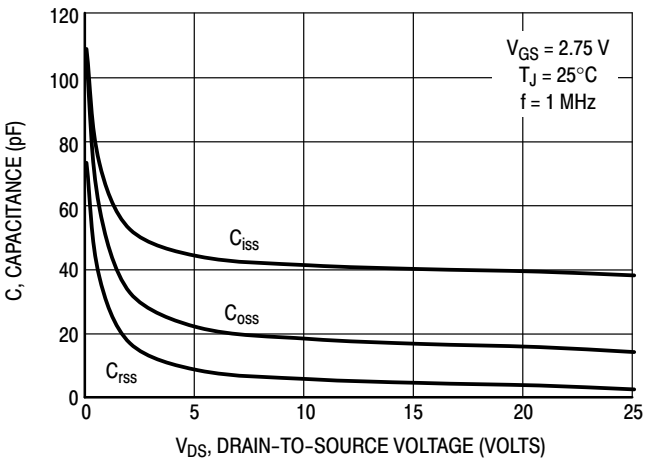



**Figure 12. Capacitance**

## TYPICAL ELECTRICAL CHARACTERISTICS

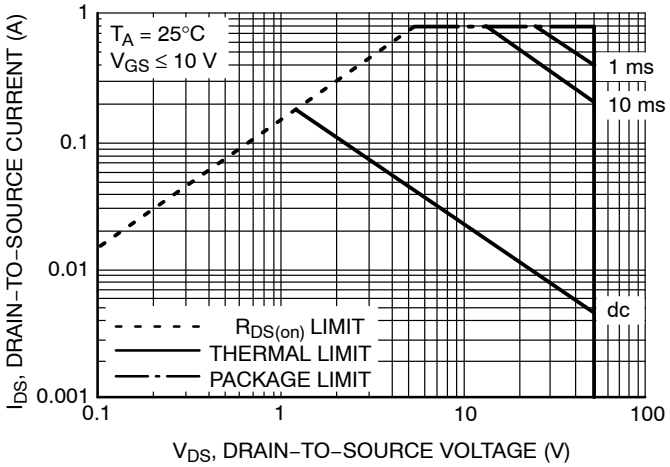
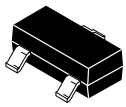



**Figure 13. Safe Operating Area**

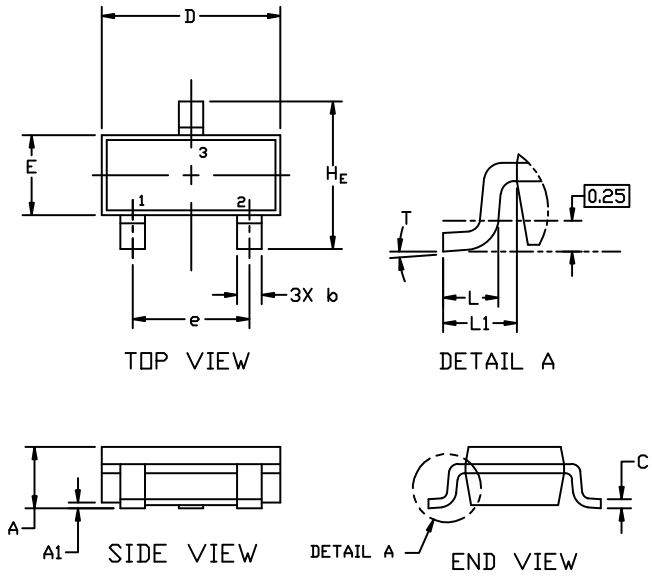
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

**SOT−23 (TO−236)**
CASE 318
ISSUE AT

DATE 01 MAR 2023



**SCALE 4:1**

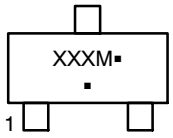



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M,1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

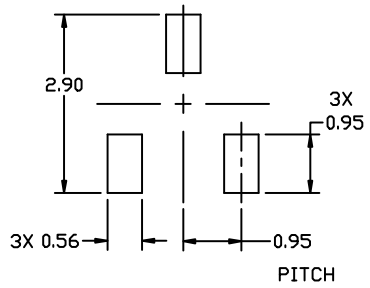
| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.039 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.017 | 0.020 |
| c | 0.08 | 0.14 | 0.20 | 0.003 | 0.006 | 0.008 |
| D | 2.80 | 2.90 | 3.04 | 0.110 | 0.114 | 0.120 |
| E | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| e | 1.78 | 1.90 | 2.04 | 0.070 | 0.075 | 0.080 |
| L | 0.30 | 0.43 | 0.55 | 0.012 | 0.017 | 0.022 |
| L1 | 0.35 | 0.54 | 0.69 | 0.014 | 0.021 | 0.027 |
| $H_E$ | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| T | 0° | --- | 10° | 0° | --- | 10° |

### GENERIC MARKING DIAGRAM*




XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.




RECOMMENDED MOUNTING FOOTPRINT

* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**STYLES ON PAGE 2**

| | | | |
|---|---|---|---|
| **DOCUMENT NUMBER:** | **98ASB42226B** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. | |
| **DESCRIPTION:** | **SOT−23 (TO−236)** | | **PAGE 1 OF 2** |

**SOT−23 (TO−236)**
CASE 318
ISSUE AT

DATE 01 MAR 2023

STYLE 1 THRU 5:
CANCELLED

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE−ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE−ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE

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