# [MOSFET](#) – N-Channel, SOT-23

## 2.8 A, 20 V

# MGSF2N02EL, MVSF2N02EL

These miniature surface mount MOSFETs low $R_{DS(on)}$ assure minimal power loss and conserve energy, making these devices ideal for use in space sensitive power management circuitry.

### Features

- Low $R_{DS(on)}$ Provides Higher Efficiency and Extends Battery Life
- Miniature SOT-23 Surface Mount Package Saves Board Space
- $I_{DSS}$ Specified at Elevated Temperature
- AEC Q101 Qualified and PPAP Capable − MVSF2N02EL
- These Devices are Pb-Free and are RoHS Compliant

### Applications

- DC-DC Converters
- Power Management in Portable and Battery Powered Products, ie: Computers, Printers, PCMCIA Cards, Cellular and Cordless Telephones
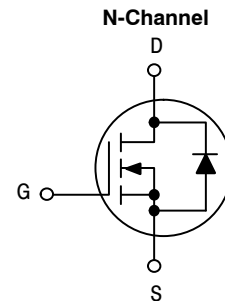
**2.8 A, 20 V**

$R_{DS(on)}$ = 85 mΩ (max)

**N-Channel**



**MARKING DIAGRAM**



SOT-23
CASE 318
STYLE 21

| | |
|---|---|
| xxx | = Specific Device Code |
| M | = Date Code |
| ▪ | = Pb-Free Package |

**PIN ASSIGNMENT**
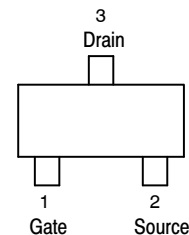


**ORDERING INFORMATION**

See detailed ordering and shipping information on page 2 of this data sheet.

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

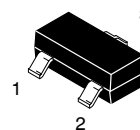| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Drain-to-Source Voltage | $V_{DSS}$ | 20 | Vdc |
| Gate-to-Source Voltage – Continuous | $V_{GS}$ | ± 8.0 | Vdc |
| Drain Current <br> – Continuous @ $T_A$ = 25 °C <br> – Single Pulse ($t_p$ = 10 μs) | $I_D$ <br> $I_{DM}$ | 2.8 <br> 5.0 | A |
| Total Power Dissipation @ $T_A$ = 25°C | $P_D$ | 1.25 | W |
| Operating and Storage Temperature Range | $T_J$, $T_{stg}$ | − 55 to 150 | °C |
| Thermal Resistance Junction-to-Ambient (Note 1) <br> Thermal Resistance Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 100 <br><br> 300 | °C/W |
| Maximum Lead Temperature for Soldering Purposes, 1/8″ from case 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.
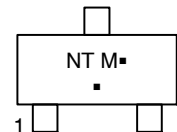1. 1" Pad, t < 10 sec.
2. Min pad, steady state.

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Drain-to-Source Breakdown Voltage (Note 3) ($V_{GS}$ = 0 Vdc, $I_D$ = 10 µAdc) Temperature Coefficient (Positive) | $V_{(BR)DSS}$ | 20 – | – 22 | – – | Vdc mV/°C |
| Zero Gate Voltage Drain Current ($V_{DS}$ = 20 Vdc, $V_{GS}$ = 0 Vdc) ($V_{DS}$ = 20 Vdc, $V_{GS}$ = 0 Vdc, $T_J$ = 125 °C) | $I_{DSS}$ | – – | – – | 1.0 10 | µAdc |
| Gate-Source Leakage Current ($V_{GS}$ = ± 8.0 Vdc, $V_{DS}$ = 0 Vdc) | $I_{GSS}$ | – | – | ± 100 | nA |
| **ON CHARACTERISTICS** (Note 3) | | | | | |
| Gate-Source Threshold Voltage ($V_{DS}$ = $V_{GS}$, $I_D$ = 250 µAdc) Threshold Temperature Coefficient (Negative) | $V_{GS(th)}$ | 0.5 – | – –2.3 | 1.0 – | Vdc mV/°C |
| Static Drain-to-Source On-Resistance ($V_{GS}$ = 4.5 Vdc, $I_D$ = 3.6 A) ($V_{GS}$ = 2.5 Vdc, $I_D$ = 3.1 A) | $R_{DS(on)}$ | – – | 78 105 | 85 115 | mΩ |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Input Capacitance | | $C_{iss}$ | – | 150 | – | pF |
| Output Capacitance | ($V_{DS}$ = 5.0 Vdc, $V_{GS}$ = 0 V, f = 1.0 MHz) | $C_{oss}$ | – | 130 | – | |
| Transfer Capacitance | | $C_{rss}$ | – | 45 | – | |
| **SWITCHING CHARACTERISTICS** (Note 4) | | | | | |
| Turn-On Delay Time | | $t_{d(on)}$ | – | 6.0 | – | ns |
| Rise Time | ($V_{DD}$ = 16 Vdc, $I_D$ = 2.8 Adc, $V_{gs}$ = 4.5 V, $R_G$ = 2.3 Ω) | $t_r$ | – | 95 | – | |
| Turn-Off Delay Time | | $t_{d(off)}$ | – | 28 | – | |
| Fall Time | | $t_f$ | – | 125 | – | |
| Gate Charge | | $Q_T$ | – | 3.5 | – | nC |
| | ($V_{DS}$ = 16 Vdc, $I_D$ = 1.75 Adc, $V_{GS}$ = 4.0 Vdc) (Note 3) | $Q_{gs}$ | – | 0.6 | – | |
| | | $Q_{gd}$ | – | 1.5 | – | |
| **SOURCE–DRAIN DIODE CHARACTERISTICS** | | | | | |
| Forward Voltage | ($I_S$ = 1.0 Adc, $V_{GS}$ = 0 Vdc) (Note 3) | $V_{SD}$ | – – | 0.76 – | 1.2 – | V |
| Reverse Recovery Time | | $t_{rr}$ | – | 104 | – | ns |
| | ($I_S$ = 1.0 Adc, $V_{GS}$ = 0 Vdc, $dI_S$/ dt = 100 A/µs) (Note 3) | $t_a$ | – | 42 | – | |
| | | $t_b$ | – | 62 | – | |
| Reverse Recovery Stored Charge | | $Q_{RR}$ | – | 0.20 | – | µC |

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.

3. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperature.
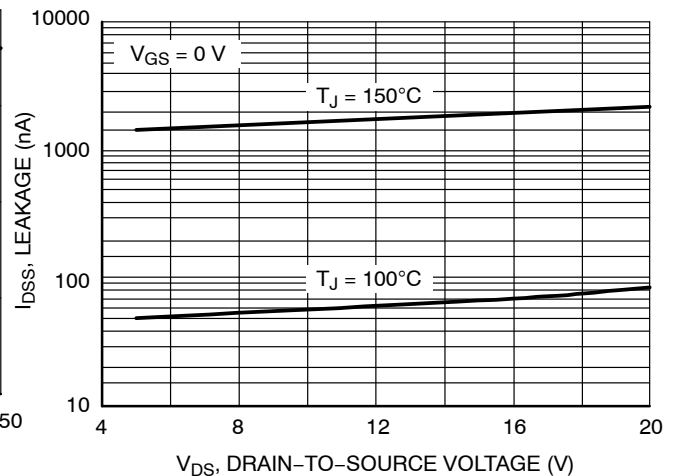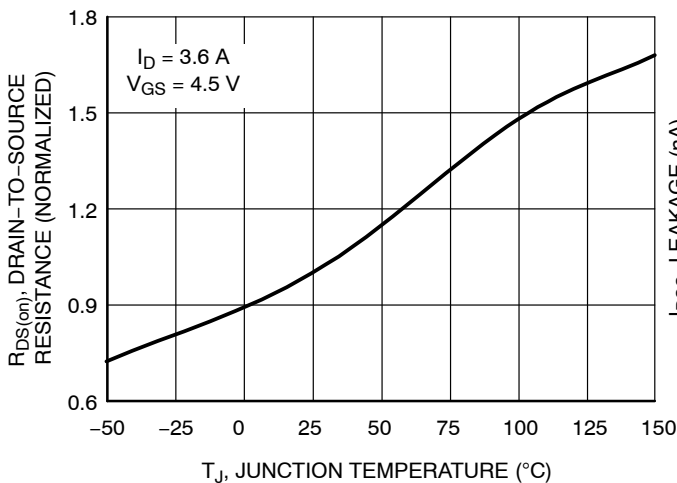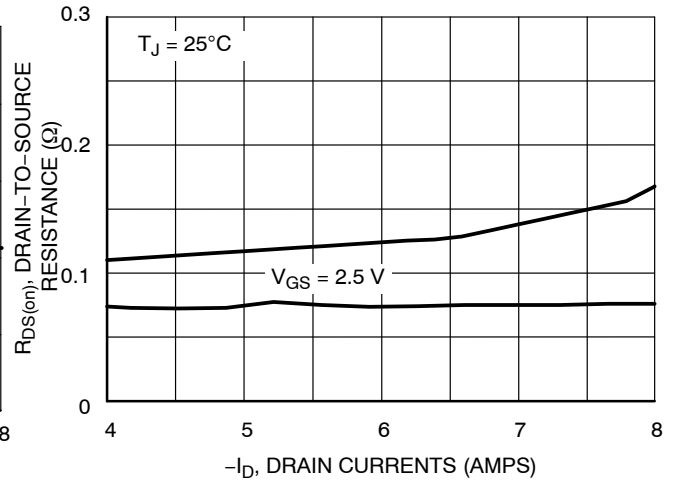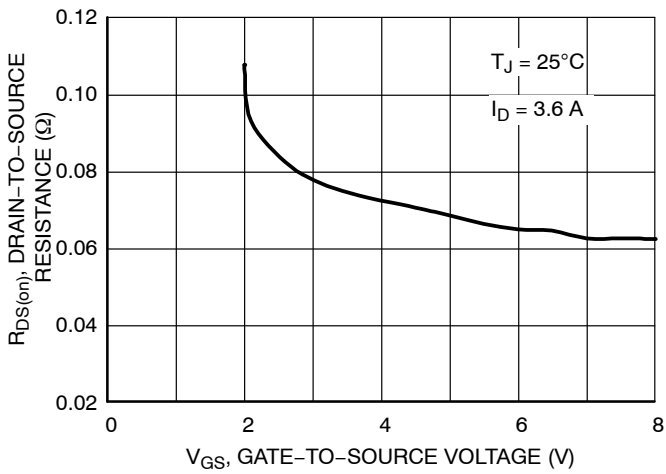
## ORDERING INFORMATION

| Device | Package | Shipping[†] |
|---|---|---|
| MGSF2N02ELT1G | SOT-23 (Pb-Free) | 3,000 / Tape & Reel |
| MVSF2N02ELT1G* | | |

†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.
*MVSF Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q101 Qualified and PPAP Capable.

# MGSF2N02EL, MVSF2N02EL

## TYPICAL CHARACTERISTICS



Figure 1. On-Region Characteristics



Figure 2. Transfer Characteristics



Figure 3. On-Resistance vs. Gate-to-Source Voltage



Figure 4. On-Resistance vs. Gate Voltage



Figure 5. On-Resistance Variation with Temperature



Figure 6. Drain-to-Source Leakage
Current vs. Voltage
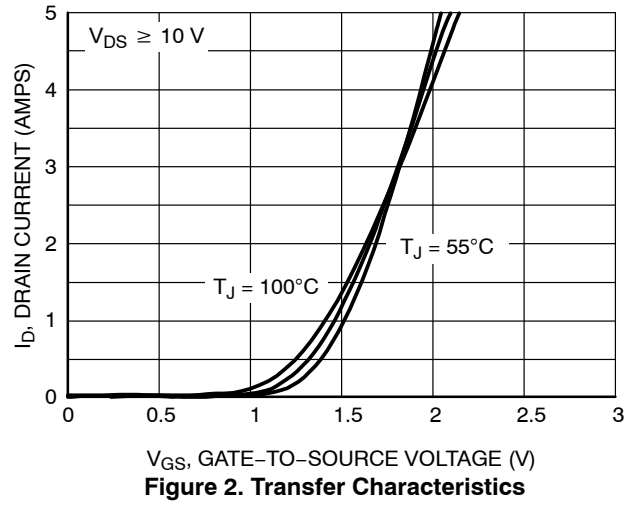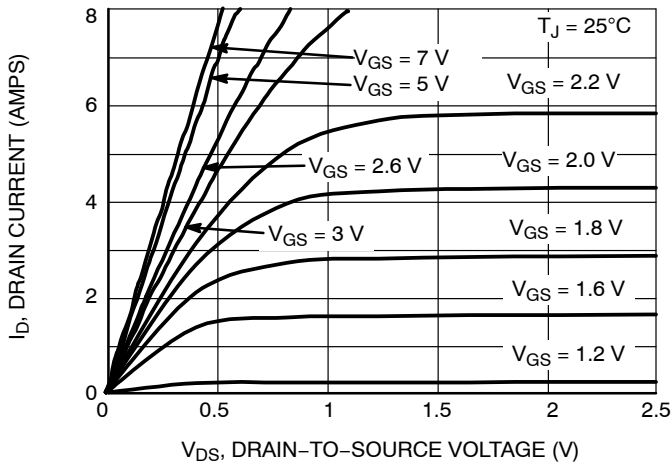
## TYPICAL CHARACTERISTICS
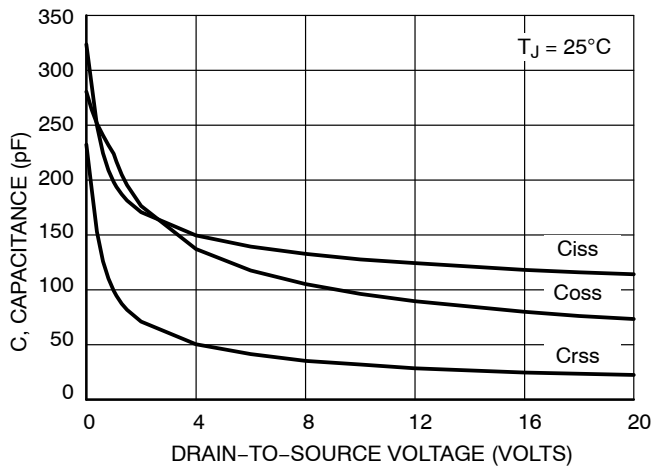


**Figure 7. Capacitance Variation**
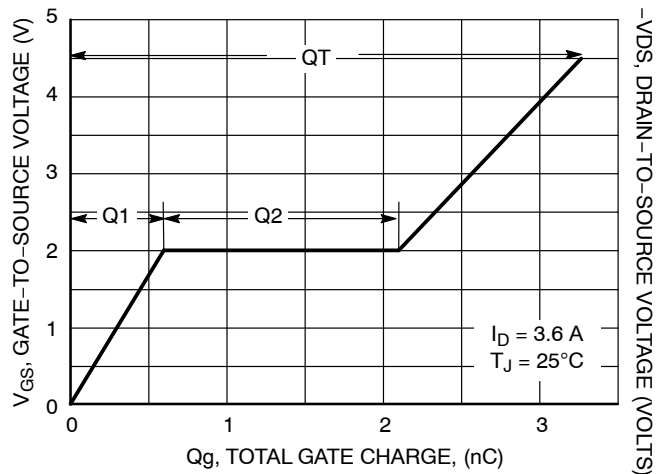


**Figure 8. Gate-to-Source Voltage vs. Total Charge**
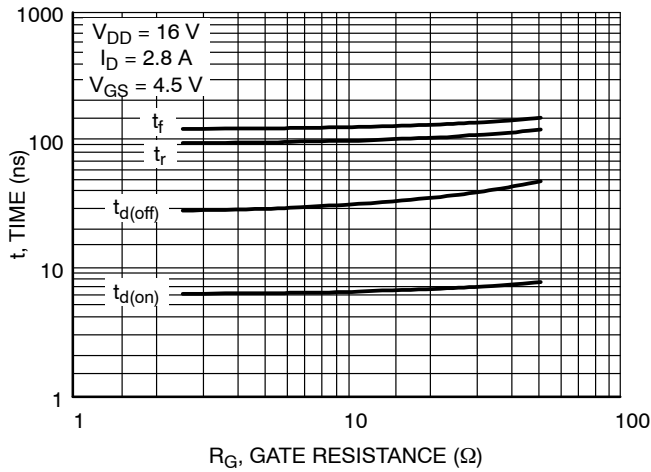


**Figure 9. Resistive Switching Time Variation vs. Gate Resistance**
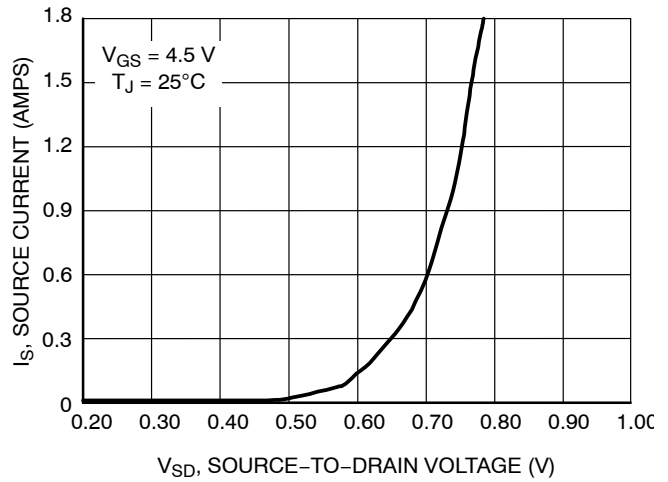


**Figure 10. Diode Forward Voltage vs. Current**
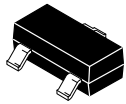
**SOT−23 (TO−236) 2.90x1.30x1.00 1.90P**
CASE 318
ISSUE AU

DATE 14 AUG 2024

**SCALE 4:1**



TOP VIEW

SIDE VIEW

END VIEW

DETAIL "A"
Scale 3:1

SEATING PLANE
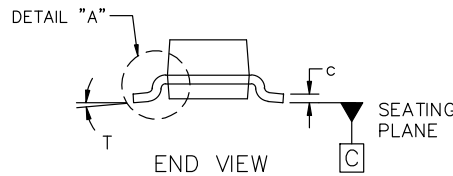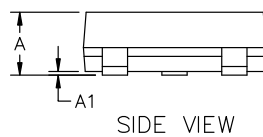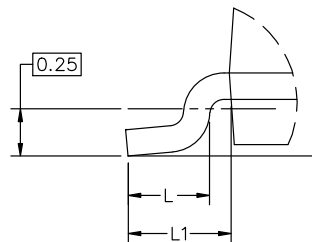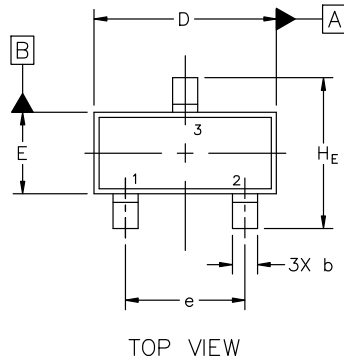
| MILLIMETERS | | | |
|---|---|---|---|
| DIM | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 |
| A1 | 0.01 | 0.06 | 0.10 |
| b | 0.37 | 0.44 | 0.50 |
| c | 0.08 | 0.14 | 0.20 |
| D | 2.80 | 2.90 | 3.04 |
| E | 1.20 | 1.30 | 1.40 |
| e | 1.78 | 1.90 | 2.04 |
| L | 0.30 | 0.43 | 0.55 |
| L1 | 0.35 | 0.54 | 0.69 |
| $H_E$ | 2.10 | 2.40 | 2.64 |
| T | 0° | −−− | 10° |

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSIONS: 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.

**GENERIC MARKING DIAGRAM\***

XXXM▪
▪

1
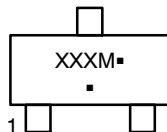
XXX = Specific Device Code
M   = Date Code
▪   = Pb−Free Package

\*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

2.90

3X 0.95

3X 0.56

0.95

PITCH
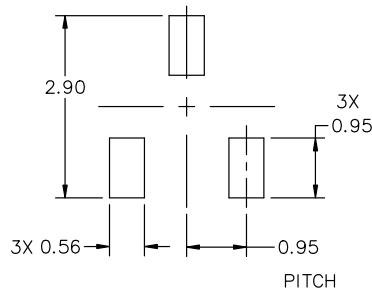
\* For additional information on our Pb−Free strategy and soldering details, please download the onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**STYLES ON PAGE 2**

| DOCUMENT NUMBER: | 98ASB42226B | | |
|---|---|---|---|
| DESCRIPTION: | SOT−23 (TO−236) 2.90x1.30x1.00 1.90P | | PAGE 1 OF 2 |

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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|---|---|---|---|
| DESCRIPTION: | SOT−23 (TO−236) 2.90x1.30x1.00 1.90P | | **PAGE 2 OF 2** |

## ADDITIONAL INFORMATION

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