# MMBT2369L, MMBT2369AL

# Switching Transistors

## NPN Silicon

ON Semiconductor®

www.onsemi.com

### Features

- S 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

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector−Emitter Voltage | $V_{CEO}$ | 15 | Vdc |
| Collector−Emitter Voltage | $V_{CES}$ | 40 | Vdc |
| Collector−Base Voltage | $V_{CBO}$ | 40 | Vdc |
| Emitter−Base Voltage | $V_{EBO}$ | 4.5 | Vdc |
| Collector Current − Continuous | $I_C$ | 200 | mAdc |

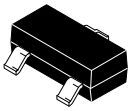
### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Total Device Dissipation FR−5 Board (Note 1) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 225<br>1.8 | mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 556 | °C/W |
| Total Device Dissipation Alumina Substrate, (Note 2) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 300<br>2.4 | mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 417 | °C/W |
| Junction and Storage Temperature | $T_J$, $T_{stg}$ | −55 to +150 | °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.

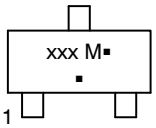
1. FR−5 = 1.0 × 0.75 × 0.062 in.
2. Alumina = 0.4 × 0.3 × 0.024 in. 99.5% alumina.

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



**SOT−23**
**CASE 318**
**STYLE 6**

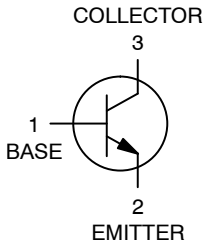
**MARKING DIAGRAM**




xxx = M1J or 1JA
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† |
|---|---|---|
| MMBT2369LT1G | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| MMBT2369LT3G | SOT−23 (Pb−Free) | 10,000 / Tape & Reel |
| SMMBT2369LT1G | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| MMBT2369ALT1G | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| SMMBT2369ALT1G | SOT−23 (Pb−Free) | 3,000 / 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** | | | | | |
| Collector – Emitter Breakdown Voltage (Note 3)<br>($I_C$ = 10 mAdc, $I_B$ = 0) | $V_{(BR)CEO}$ | 15 | – | – | Vdc |
| Collector – Emitter Breakdown Voltage<br>($I_C$ = 10 μAdc, $V_{BE}$ = 0) | $V_{(BR)CES}$ | 40 | – | – | Vdc |
| Collector – Base Breakdown Voltage<br>($I_C$ = 10 μAdc, $I_E$ = 0) | $V_{(BR)CBO}$ | 40 | – | – | Vdc |
| Emitter – Base Breakdown Voltage<br>($I_E$ = 10 μAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | 4.5 | – | – | Vdc |
| Collector Cutoff Current<br>($V_{CB}$ = 20 Vdc, $I_E$ = 0)<br>($V_{CB}$ = 20 Vdc, $I_E$ = 0, $T_A$ = 150°C) | $I_{CBO}$ | –<br>– | –<br>– | 0.4<br>30 | μAdc |
| Collector Cutoff Current<br>MMBT2369A ($V_{CE}$ = 20 Vdc, $V_{BE}$ = 0) | $I_{CES}$ | – | – | 0.4 | μAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain (Note 3)<br>MMBT2369 ($I_C$ = 10 mAdc, $V_{CE}$ = 1.0 Vdc)<br>MMBT2369A ($I_C$ = 10 mAdc, $V_{CE}$ = 1.0 Vdc)<br>MMBT2369A ($I_C$ = 10 mAdc, $V_{CE}$ = 0.35 Vdc)<br>MMBT2369A ($I_C$ = 10 mAdc, $V_{CE}$ = 0.35 Vdc, $T_A$ = −55°C)<br>MMBT2369A ($I_C$ = 30 mAdc, $V_{CE}$ = 0.4 Vdc)<br>MMBT2369 ($I_C$ = 100 mAdc, $V_{CE}$ = 2.0 Vdc)<br>MMBT2369A ($I_C$ = 100 mAdc, $V_{CE}$ = 1.0 Vdc) | $h_{FE}$ | <br>40<br>–<br>40<br>20<br>30<br>20<br>20 | <br>–<br>–<br>–<br>–<br>–<br>–<br>– | <br>120<br>120<br>–<br>–<br>–<br>–<br>– | – |
| Collector – Emitter Saturation Voltage (Note 3)<br>MMBT2369 ($I_C$ = 10 mAdc, $I_B$ = 1.0 mAdc)<br>MMBT2369A ($I_C$ = 10 mAdc, $I_B$ = 1.0 mAdc)<br>MMBT2369A ($I_C$ = 10 mAdc, $I_B$ = 1.0 mAdc, $T_A$ = +125°C)<br>MMBT2369A ($I_C$ = 30 mAdc, $I_B$ = 3.0 mAdc)<br>MMBT2369A ($I_C$ = 100 mAdc, $I_B$ = 10 mAdc) | $V_{CE(sat)}$ | <br>–<br>–<br>–<br>–<br>– | <br>–<br>–<br>–<br>–<br>– | <br>0.25<br>0.20<br>0.30<br>0.25<br>0.50 | Vdc |
| Base – Emitter Saturation Voltage (Note 3)<br>MMBT2369/A ($I_C$ = 10 mAdc, $I_B$ = 1.0 mAdc)<br>MMBT2369A ($I_C$ = 10 mAdc, $I_B$ = 1.0 mAdc, $T_A$ = −55°C)<br>MMBT2369A ($I_C$ = 30 mAdc, $I_B$ = 3.0 mAdc)<br>MMBT2369A ($I_C$ = 100 mAdc, $I_B$ = 10 mAdc) | $V_{BE(sat)}$ | <br>0.7<br>–<br>–<br>– | <br>–<br>–<br>–<br>– | <br>0.85<br>1.02<br>1.15<br>1.60 | Vdc |
| **SMALL– SIGNAL CHARACTERISTICS** | | | | | |
| Output Capacitance<br>($V_{CB}$ = 5.0 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{obo}$ | – | – | 4.0 | pF |
| Small Signal Current Gain<br>($I_C$ = 10 mAdc, $V_{CE}$ = 10 Vdc, f = 100 MHz) | $h_{fe}$ | 5.0 | – | – | – |
| **SWITCHING CHARACTERISTICS** | | | | | |
| Storage Time<br>($I_{B1}$ = $I_{B2}$ = $I_C$ = 10 mAdc) | $t_s$ | – | 5.0 | 13 | ns |
| Turn–On Time<br>($V_{CC}$ = 3.0 Vdc, $I_C$ = 10 mAdc, $I_{B1}$ = 3.0 mAdc) | $t_{on}$ | – | 8.0 | 12 | ns |
| Turn–Off Time<br>($V_{CC}$ = 3.0 Vdc, $I_C$ = 10 mAdc, $I_{B1}$ = 3.0 mAdc, $I_{B2}$ = 1.5 mAdc) | $t_{off}$ | – | 10 | 18 | ns |

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 ≤ 2.0%.

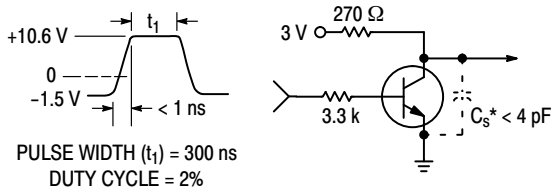



**Figure 1. $t_{on}$ Circuit – 10 mA**

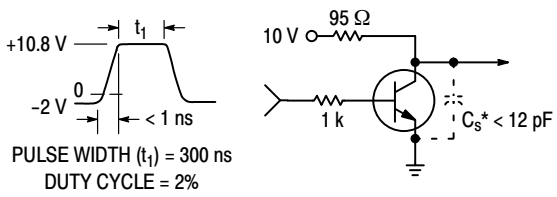



**Figure 2. $t_{on}$ Circuit – 100 mA**

*Total shunt capacitance of test jig and connectors.

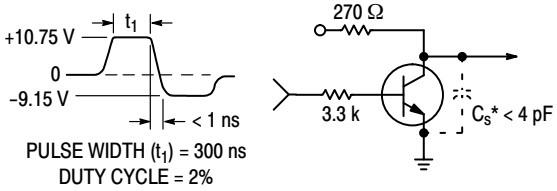
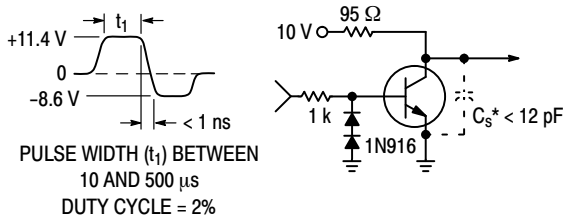



**Figure 3. $t_{off}$ Circuit – 10 mA**




*Total shunt capacitance of test jig and connectors.

**Figure 4. $t_{off}$ Circuit – 100 mA**

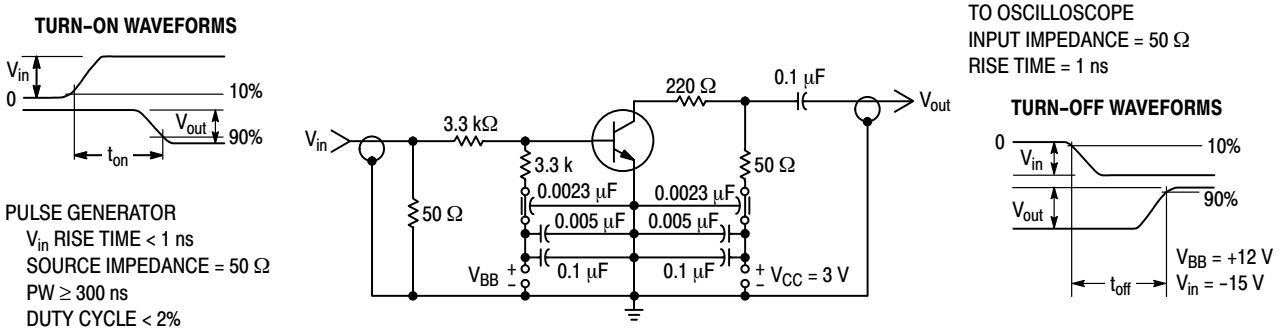



**Figure 5. Turn–On and Turn–Off Time Test Circuit**

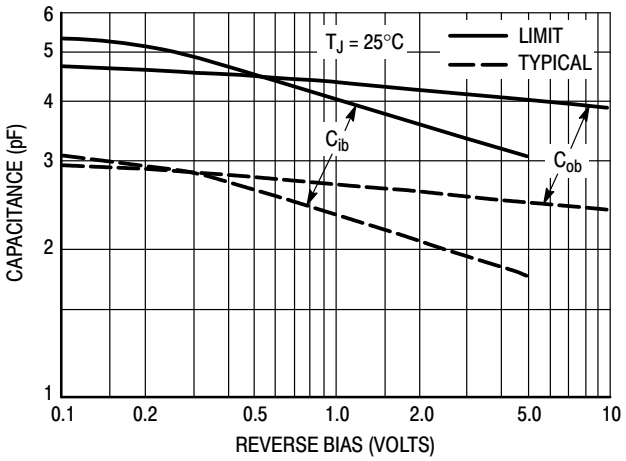



**Figure 6. Junction Capacitance Variations**

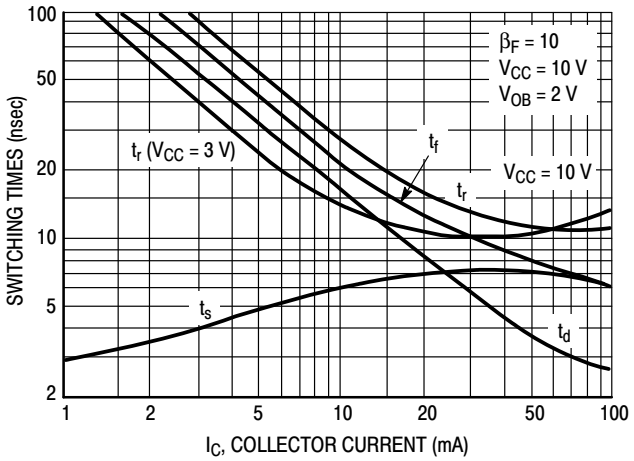



**Figure 7. Typical Switching Times**

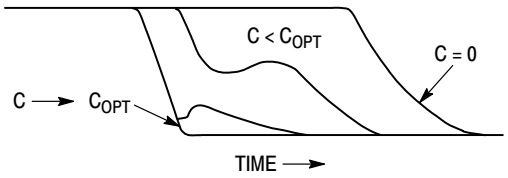



**Figure 8. Turn−Off Waveform**

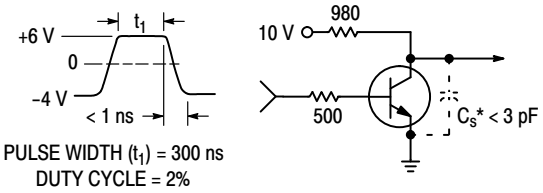



**Figure 9. Storage Time Equivalent Test Circuit**

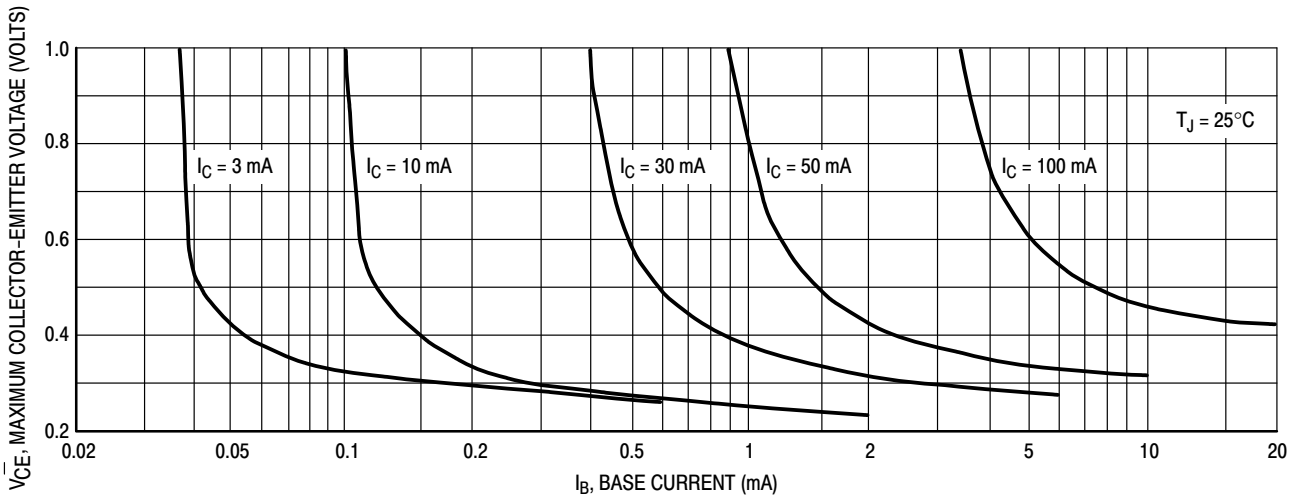



**Figure 10. Maximum Collector Saturation Voltage Characteristics**

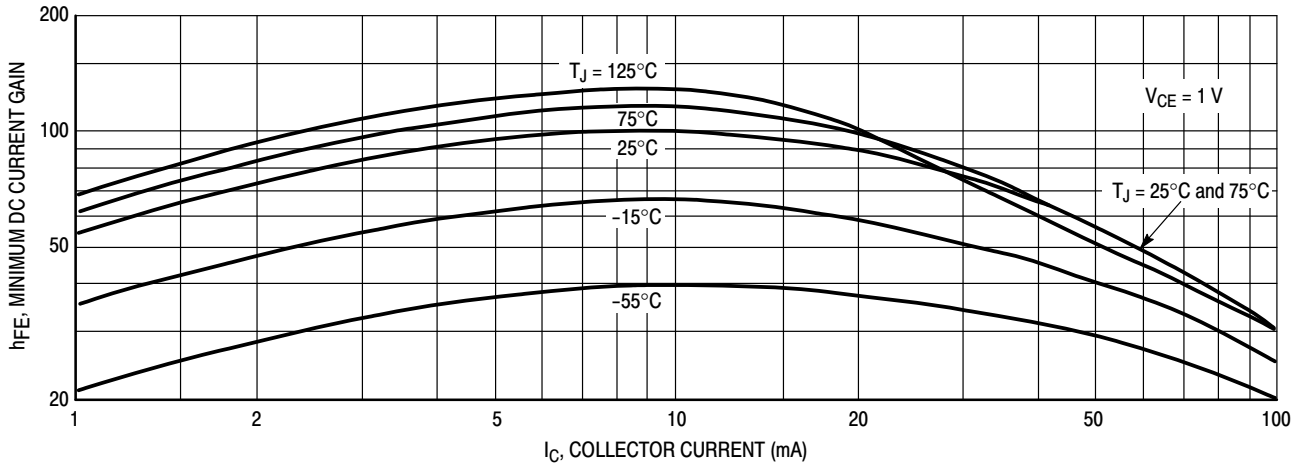



**Figure 11. Minimum Current Gain Characteristics**

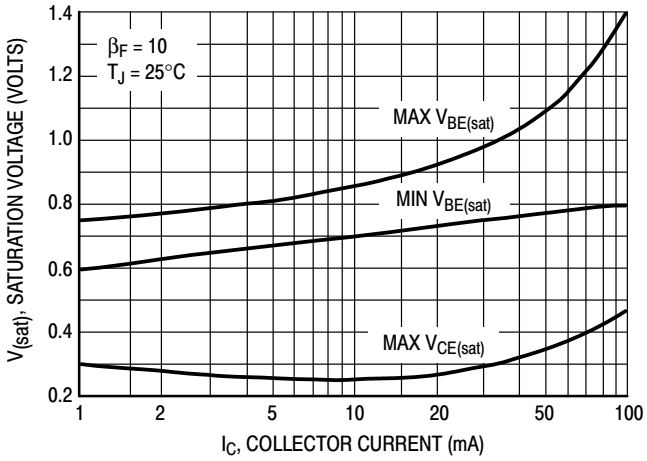



**Figure 12. Saturation Voltage Limits**

# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

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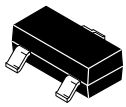
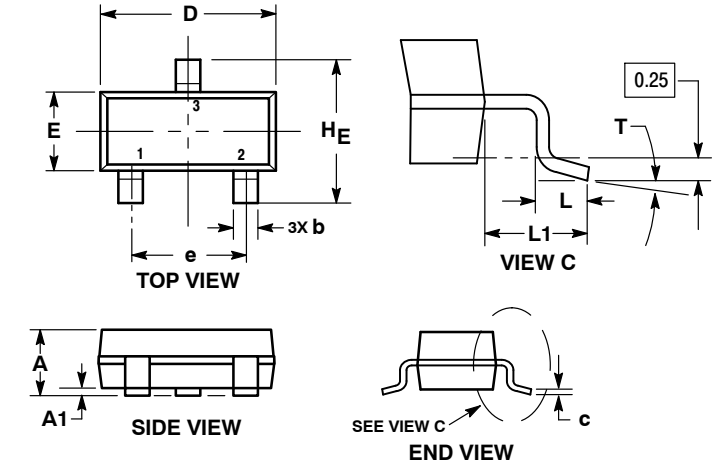


**SOT−23 (TO−236)**
CASE 318−08
ISSUE AS

DATE 30 JAN 2018

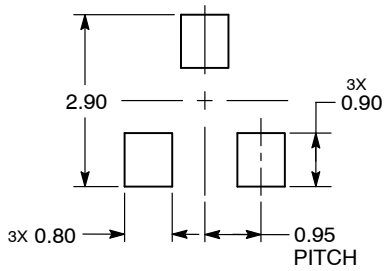
SCALE 4:1




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.

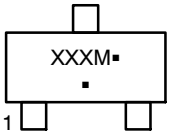
| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.039 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.017 | 0.020 |
| c | 0.08 | 0.14 | 0.20 | 0.003 | 0.006 | 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° |

### RECOMMENDED SOLDERING FOOTPRINT




DIMENSIONS: MILLIMETERS

### 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.

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) | PAGE 1 OF 1 |

## PUBLICATION ORDERING INFORMATION

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**Europe, Middle East and Africa Technical Support:**
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For additional information, please contact your local Sales Representative

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# Mouser Electronics

Authorized Distributor

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