

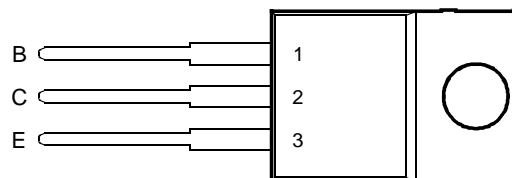
# BD539, BD539A, BD539B, BD539C, BD539D NPN SILICON POWER TRANSISTORS

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JUNE 1973 - REVISED MARCH 1997

- Designed for Complementary Use with the BD540 Series
- 45 W at 25°C Case Temperature
- 5 A Continuous Collector Current
- Up to 120 V  $V_{CEO}$  rating

TO-220 PACKAGE  
(TOP VIEW)



Pin 2 is in electrical contact with the mounting base.

MDTRACA

## absolute maximum ratings at 25°C case temperature (unless otherwise noted)

| RATING   |        | SYMBOL    | VALUE       | UNIT |
|--|--------|-----------|-------------|------|
| Collector-base voltage   | BD539  | $V_{CBO}$ | 40          | V    |
|  | BD539A |           | 60          |      |
|  | BD539B |           | 80          |      |
|  | BD539C |           | 100         |      |
|  | BD539D |           | 120         |      |
| Collector-emitter voltage (see Note 1)   | BD539  | $V_{CEO}$ | 40          | V    |
|  | BD539A |           | 60          |      |
|  | BD539B |           | 80          |      |
|  | BD539C |           | 100         |      |
|  | BD539D |           | 120         |      |
| Emitter-base voltage   |        | $V_{EBO}$ | 5           | V    |
| Continuous collector current   |        | $I_C$     | 5           | A    |
| Continuous device dissipation at (or below) 25°C case temperature (see Note 2)     |        | $P_{tot}$ | 45          | W    |
| Continuous device dissipation at (or below) 25°C free air temperature (see Note 3) |        | $P_{tot}$ | 2           | W    |
| Operating free air temperature range   |        | $T_A$     | -65 to +150 | °C   |
| Operating junction temperature range   |        | $T_j$     | -65 to +150 | °C   |
| Storage temperature range  |        | $T_{stg}$ | -65 to +150 | °C   |
| Lead temperature 3.2 mm from case for 10 seconds                                   |        | $T_L$     | 260         | °C   |

- NOTES: 1. These values apply when the base-emitter diode is open circuited.  
 2. Derate linearly to 150°C case temperature at the rate of 0.36 W/°C.  
 3. Derate linearly to 150°C free air temperature at the rate of 16 mW/°C.

## PRODUCT INFORMATION

Information is current as of publication date. Products conform to specifications in accordance with the terms of Power Innovations standard warranty. Production processing does not necessarily include testing of all parameters.



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## NPN SILICON POWER TRANSISTORS

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### electrical characteristics at 25°C case temperature

| PARAMETER  | TEST CONDITIONS   |   | MIN                 | TYP | MAX  | UNIT |
|--|---|---|---------------------|-----|------|------|
| $V_{(BR)CEO}$ Collector-emitter breakdown voltage      | $I_C = 30 \text{ mA}$<br>$I_B = 0$<br>(see Note 4)  | BD539                                   | 40                  |     |      | V    |
|  |   | BD539A                                  | 60                  |     |      |      |
|  |   | BD539B                                  | 80                  |     |      |      |
|  |   | BD539C                                  | 100                 |     |      |      |
|  |   | BD539D                                  | 120                 |     |      |      |
| $I_{CES}$ Collector-emitter cut-off current            | $V_{CE} = 40 \text{ V}$<br>$V_{CE} = 60 \text{ V}$<br>$V_{CE} = 80 \text{ V}$<br>$V_{CE} = 100 \text{ V}$<br>$V_{CE} = 120 \text{ V}$ | $V_{BE} = 0$ BD539                      |                     |     | 0.2  | mA   |
|  |   | $V_{BE} = 0$ BD539A                     |                     |     | 0.2  |      |
|  |   | $V_{BE} = 0$ BD539B                     |                     |     | 0.2  |      |
|  |   | $V_{BE} = 0$ BD539C                     |                     |     | 0.2  |      |
|  |   | $V_{BE} = 0$ BD539D                     |                     |     | 0.2  |      |
| $I_{CEO}$ Collector cut-off current                    | $V_{CE} = 30 \text{ V}$<br>$V_{CE} = 60 \text{ V}$<br>$V_{CE} = 90 \text{ V}$   | $I_B = 0$ BD539/539A                    |                     |     | 0.3  | mA   |
|  |   | $I_B = 0$ BD539B/539C                   |                     |     | 0.3  |      |
|  |   | $I_B = 0$ BD539D                        |                     |     | 0.3  |      |
| $I_{EBO}$ Emitter cut-off current                      | $V_{EB} = 5 \text{ V}$  | $I_C = 0$                               |                     |     | 1    | mA   |
| $h_{FE}$ Forward current transfer ratio                | $V_{CE} = 4 \text{ V}$<br>$V_{CE} = 4 \text{ V}$<br>$V_{CE} = 4 \text{ V}$  | $I_C = 0.5 \text{ A}$                   | 40                  |     |      |      |
|  |   | $I_C = 1 \text{ A}$ (see Notes 4 and 5) | 30                  |     |      |      |
|  |   | $I_C = 3 \text{ A}$                     | 12                  |     |      |      |
| $V_{CE(sat)}$ Collector-emitter saturation voltage     | $I_B = 125 \text{ mA}$<br>$I_B = 375 \text{ mA}$<br>$I_B = 1 \text{ A}$   | $I_C = 1 \text{ A}$                     |                     |     | 0.25 | V    |
|  |   | $I_C = 3 \text{ A}$ (see Notes 4 and 5) |                     |     | 0.8  |      |
|  |   | $I_C = 5 \text{ A}$                     |                     |     | 1.5  |      |
| $V_{BE(on)}$ Base-emitter voltage                      | $V_{CE} = 4 \text{ V}$  | $I_C = 3 \text{ A}$                     |                     |     | 1.25 | V    |
| $h_{fe}$ Small signal forward current transfer ratio   | $V_{CE} = 10 \text{ V}$   | $I_C = 0.5 \text{ A}$                   | $f = 1 \text{ kHz}$ | 20  |      |      |
| $ h_{fe} $ Small signal forward current transfer ratio | $V_{CE} = 10 \text{ V}$   | $I_C = 0.5 \text{ A}$                   | $f = 1 \text{ MHz}$ | 3   |      |      |

NOTES: 4. These parameters must be measured using pulse techniques,  $t_p = 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .

5. These parameters must be measured using voltage-sensing contacts, separate from the current carrying contacts.

### thermal characteristics

| PARAMETER   | MIN | TYP | MAX  | UNIT |
|---|-----|-----|------|------|
| $R_{\theta JC}$ Junction to case thermal resistance     |     |     | 2.78 | °C/W |
| $R_{\theta JA}$ Junction to free air thermal resistance |     |     | 62.5 | °C/W |

### resistive-load-switching characteristics at 25°C case temperature

| PARAMETER               | TEST CONDITIONS †              |                             |  | MIN | TYP | MAX | UNIT          |
|-------------------------|--------------------------------|-----------------------------|--|-----|-----|-----|---------------|
| $t_{on}$ Turn-on time   | $I_C = 1 \text{ A}$            | $I_{B(on)} = 0.1 \text{ A}$ | $I_{B(off)} = -0.1 \text{ A}$          |     | 0.5 |     | $\mu\text{s}$ |
| $t_{off}$ Turn-off time | $V_{BE(off)} = -4.3 \text{ V}$ | $R_L = 30 \Omega$           | $t_p = 20 \mu\text{s}$ , dc $\leq 2\%$ |     | 2   |     | $\mu\text{s}$ |

† Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.

TYPICAL CHARACTERISTICS

TYPICAL DC CURRENT GAIN  
VS  
COLLECTOR CURRENT

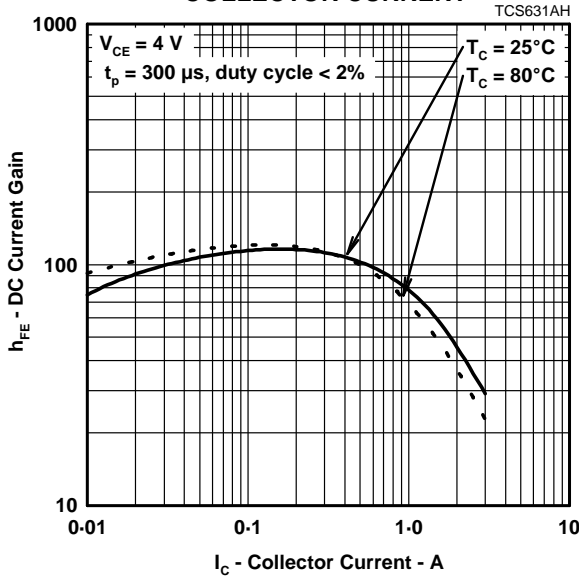


Figure 1.

COLLECTOR-EMITTER SATURATION VOLTAGE  
VS  
BASE CURRENT

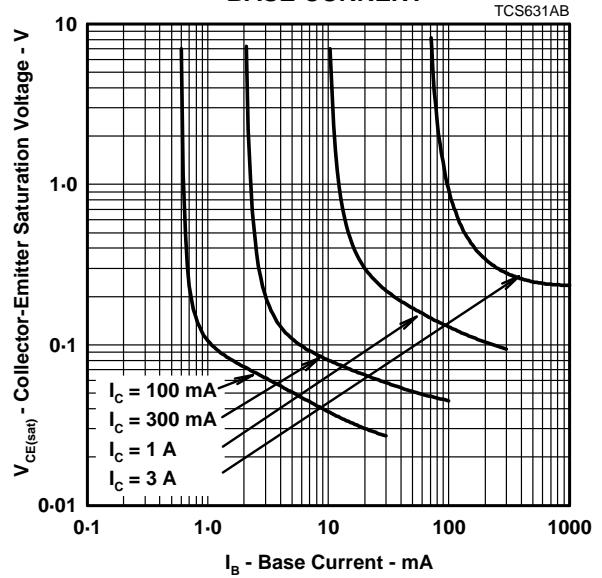


Figure 2.

BASE-EMITTER VOLTAGE  
VS  
COLLECTOR CURRENT

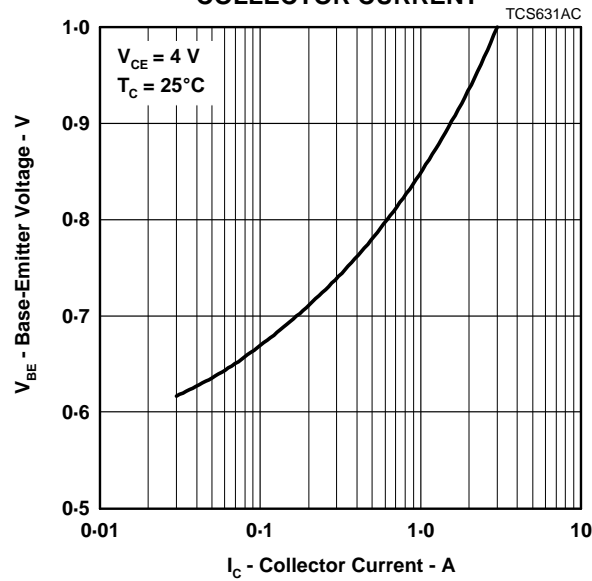


Figure 3.

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## MAXIMUM SAFE OPERATING REGIONS

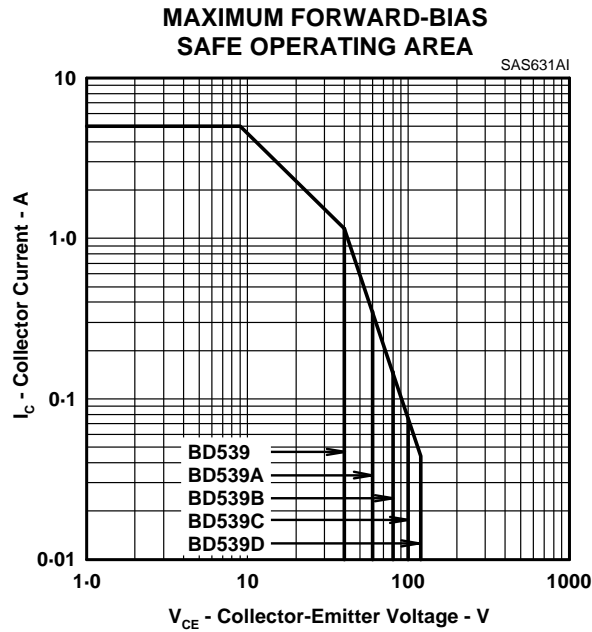


Figure 4.

## THERMAL INFORMATION

### MAXIMUM POWER DISSIPATION vs CASE TEMPERATURE

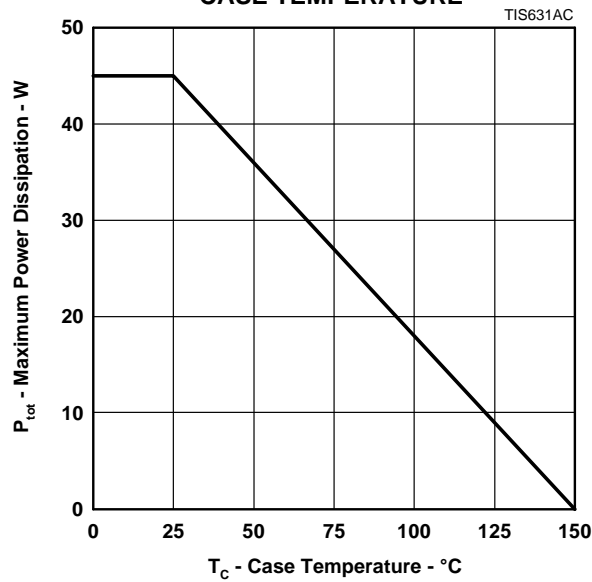


Figure 5.

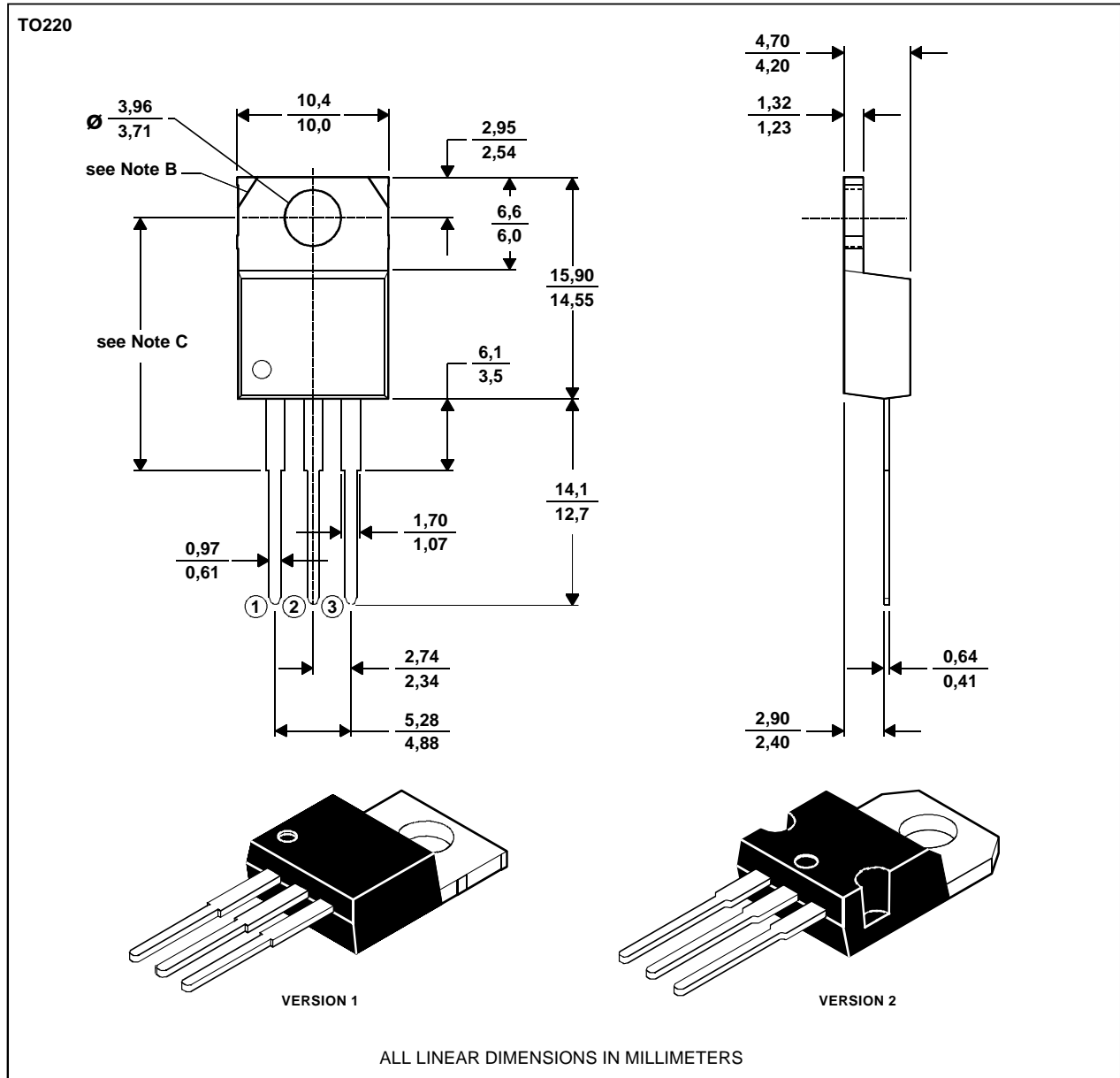
## PRODUCT INFORMATION

MECHANICAL DATA

TO-220

3-pin plastic flange-mount package

This single-in-line package consists of a circuit mounted on a lead frame and encapsulated within a plastic compound. The compound will withstand soldering temperature with no deformation, and circuit performance characteristics will remain stable when operated in high humidity conditions. Leads require no additional cleaning or processing when used in soldered assembly.



- NOTES: A. The centre pin is in electrical contact with the mounting tab.  
 B. Mounting tab corner profile according to package version.  
 C. Typical fixing hole centre stand off height according to package version.  
 Version 1, 18.0 mm. Version 2, 17.6 mm.

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