

### MAXIMUM RATINGS

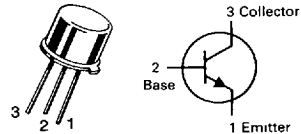
| Rating   | Symbol         | Value       | Unit                          |
|--|----------------|-------------|-------------------------------|
| Collector-Emitter Voltage  | $V_{CEO}$      | 65          | Vdc                           |
| Collector-Emitter Voltage, $R_{\theta E} \leq 10$ Ohms                                 | $V_{CER}$      | 80          | Vdc                           |
| Collector-Base Voltage   | $V_{CBO}$      | 120         | Vdc                           |
| Emitter-Base Voltage   | $V_{EBO}$      | 7.0         | Vdc                           |
| Collector Current — Continuous   | $I_C$          | 1.0         | Adc                           |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.0<br>5.71 | Watt<br>mW/ $^\circ\text{C}$  |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 5.0<br>28.6 | Watts<br>mW/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$ | -65 to +200 | $^\circ\text{C}$              |

### THERMAL CHARACTERISTICS

| Characteristic                          | Symbol             | Max | Unit                      |
|---|--------------------|-----|---------------------------|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}(1)$ | 175 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction to Case    | $R_{\theta JC}$    | 35  | $^\circ\text{C}/\text{W}$ |

## 2N2102

CASE 79-04, STYLE 1  
TO-39 (TO-205AD)



AMPLIFIER TRANSISTOR

NPN SILICON

Refer to 2N3019 for graphs.

### ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

#### OFF CHARACTERISTICS

|   |                |     |   |     |                 |
|---|----------------|-----|---|-----|-----------------|
| Collector-Emitter Breakdown Voltage ( $I_C = 100$ mAdc, $R_{\theta E} \leq 10$ ohms)(2) | $V_{CER(sus)}$ | 80  | — | —   | Vdc             |
| Collector-Emitter Sustaining Voltage(2) ( $I_C = 100$ mAdc, $I_B = 0$ )(2)              | $V_{CEO(sus)}$ | 65  | — | —   | Vdc             |
| Collector-Emitter Breakdown Voltage ( $I_C = 100$ $\mu\text{Adc}$ , $V_{EB} = 1.5$ Vdc) | $V_{(BR)CEX}$  | 120 | — | —   | Vdc             |
| Collector-Base Breakdown Voltage ( $I_C = 100$ $\mu\text{Adc}$ , $I_E = 0$ )            | $V_{(BR)CBO}$  | 120 | — | —   | Vdc             |
| Emitter-Base Breakdown Voltage ( $I_E = 100$ $\mu\text{Adc}$ , $I_C = 0$ )              | $V_{(BR)EBO}$  | 7.0 | — | —   | Vdc             |
| Collector Cutoff Current ( $V_{CB} = 60$ Vdc, $I_E = 0$ )                               | $I_{CBO}$      | —   | — | 2.0 | nAdc            |
| ( $V_{CB} = 60$ Vdc, $I_E = 0$ , $T_A = 150^\circ\text{C}$ )                            |                | —   | — | 2.0 | $\mu\text{Adc}$ |
| Emitter Cutoff Current ( $V_{EB} = 5.0$ Vdc, $I_C = 0$ )                                | $I_{EBO}$      | —   | — | 2.0 | nAdc            |

#### ON CHARACTERISTICS

|  |               |    |      |     |     |
|--|---------------|----|------|-----|-----|
| DC Current Gain ( $I_C = 0.1$ mAdc, $V_{CE} = 10$ Vdc)                       | $h_{FE}$      | 20 | —    | —   | —   |
| ( $I_C = 10$ mAdc, $V_{CE} = 10$ Vdc)(2)                                     |               | 35 | —    | —   | —   |
| ( $I_C = 10$ mAdc, $V_{CE} = 10$ Vdc, $T_A = -55^\circ\text{C}$ )(2)         |               | 20 | —    | —   | —   |
| ( $I_C = 150$ mAdc, $V_{CE} = 10$ Vdc)(2)                                    |               | 40 | —    | 120 | —   |
| ( $I_C = 500$ mAdc, $V_{CE} = 10$ Vdc)(2)                                    |               | 25 | —    | —   | —   |
| ( $I_C = 1.0$ Adc, $V_{CE} = 10$ Vdc)(2)                                     |               | 10 | —    | —   | —   |
| Collector-Emitter Saturation Voltage ( $I_C = 150$ mAdc, $I_B = 15$ mAdc)(2) | $V_{CE(sat)}$ | —  | 0.15 | 0.5 | Vdc |
| Base-Emitter Saturation Voltage ( $I_C = 150$ mAdc, $I_B = 15$ mAdc)(2)      | $V_{BE(sat)}$ | —  | 0.88 | 1.1 | Vdc |

#### SMALL-SIGNAL CHARACTERISTICS

|   |           |      |     |     |                  |
|---|-----------|------|-----|-----|------------------|
| Current-Gain — Bandwidth Product ( $I_C = 50$ mAdc, $V_{CE} = 10$ Vdc, $f = 20$ MHz)                                  | $f_T$     | 60   | —   | —   | MHz              |
| Output Capacitance ( $V_{CB} = 10$ Vdc, $I_E = 0$ , $f = 1.0$ MHz)  | $C_{obe}$ | —    | 6.0 | 15  | pF               |
| Input Capacitance ( $V_{EB} = 0.5$ Vdc, $I_C = 0$ , $f = 1.0$ MHz)  | $C_{ibo}$ | —    | 50  | 80  | pF               |
| Input Impedance ( $I_C = 1.0$ mAdc, $V_{CE} = 5.0$ Vdc, $f = 1.0$ kHz)  | $h_{ib}$  | 24   | —   | 34  | Ohms             |
| ( $I_C = 5.0$ mAdc, $V_{CE} = 10$ Vdc, $f = 1.0$ kHz)   |           | 4.0  | —   | 8.0 |                  |
| Voltage Feedback Ratio ( $I_C = 1.0$ mAdc, $V_{CE} = 5.0$ Vdc, $f = 1.0$ kHz)   | $h_{rb}$  | —    | —   | 3.0 | $\times 10^{-4}$ |
| ( $I_C = 5.0$ mAdc, $V_{CE} = 10$ Vdc, $f = 1.0$ kHz)   |           | —    | —   | 3.0 |                  |
| Small-Signal Current Gain ( $I_C = 1.0$ mAdc, $V_{CE} = 5.0$ Vdc, $f = 1.0$ kHz)                                      | $h_{fe}$  | 30   | —   | 100 | —                |
| ( $I_C = 5.0$ mAdc, $V_{CE} = 10$ Vdc, $f = 1.0$ kHz)   |           | 35   | —   | 150 |                  |
| Output Admittance ( $I_C = 1.0$ mAdc, $V_{CE} = 5.0$ Vdc, $f = 1.0$ kHz)  | $h_{ob}$  | 0.01 | —   | 0.5 | $\mu\text{mho}$  |
| ( $I_C = 5.0$ mAdc, $V_{CE} = 10$ Vdc, $f = 1.0$ kHz)   |           | 0.01 | —   | 1.0 |                  |
| Noise Figure ( $I_C = 300$ $\mu\text{Adc}$ , $V_{CE} = 10$ Vdc, $R_S = 1.0$ k Ohm, $f = 1.0$ kHz, Bandwidth = 1.0 Hz) | NF        | —    | 4.0 | 6.0 | dB               |

#### SWITCHING CHARACTERISTICS

|                |                   |   |   |    |    |
|----------------|-------------------|---|---|----|----|
| Switching Time | $t_d + t_r + t_f$ | — | — | 30 | ns |
|----------------|-------------------|---|---|----|----|

(1)  $R_{\theta JA}$  is measured with the device soldered into a typical printed circuit board. (2) Pulse Test Pulse Width  $\leq 300$   $\mu\text{s}$ , Duty Cycle  $\leq 20\%$ .