# TYPES 2N4026 THRU 2N4033
# P-N-P SILICON TRANSISTORS

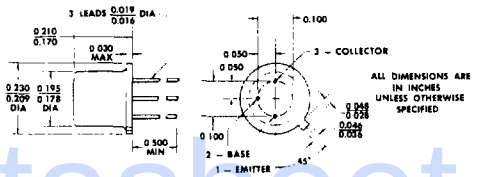
BULLETIN NO. DLS 7311982, MARCH 1973

## MEDIUM POWER P-N-P TRANSISTORS FOR COMPUTER MEMORY APPLICATIONS

- Increased Dissipation at 25°C Case Temperature . . . 10 W Max (2N4030 thru 2N4033)
- High $V_{(BR)CEO}$ . . . 80 V Min (2N4027, 2N4029, 2N4031, 2N4033)

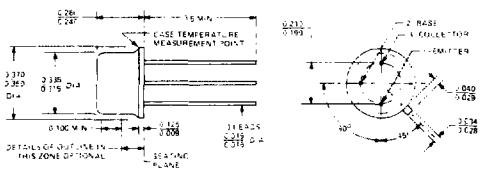
**mechanical data**

**2N4026 THRU 2N4029**
**THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE**




ALL JEDEC TO-18 DIMENSIONS AND NOTES ARE APPLICABLE*

**2N4030 THRU 2N4033**
**THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE**




ALL JEDEC TO-39 DIMENSIONS AND NOTES ARE APPLICABLE♦

**absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)**

| | 2N4026 2N4028 | 2N4027 2N4029 | 2N4030 2N4032 | 2N4031 2N4033 | UNIT |
|---|---|---|---|---|---|
| Collector-Base Voltage | −60* | −80* | −60* | −80* | V |
| Collector-Emitter Voltage (See Note 1) | −60* | −80* | −60* | −80* | V |
| Emitter-Base Voltage | −5* | | −5* | | V |
| Continuous Collector Current | −1* | | −1* | | A |
| Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 2) | 0.5* | | 0.8* | | W |
| Continuous Device Dissipation at (or below) 25°C Case Temperature (See Note 3) | 2* | | 10† 4* | | W |
| Storage Temperature Range | −65 to 200* | | −65 to 200* | | °C |
| Lead Temperature 1/16 Inch from Case for 60 Seconds | 300* | | 300* | | °C |

NOTES: 1. These values apply between 0 and 10 mA collector current when the base-emitter diode is open-circuited.
2. Derate linearly to 200°C free-air temperature at the rates of 2.86 mW/°C for 2N4026 through 2N4029 and 4.56 mW/°C for 2N4030 through 2N4033
3. Derate linearly to 200°C case temperature at the following rates: 11.4 mW/°C for the 2 watt rating, 57.1 mW/°C for the 10-watt rating, and 22.8 mW/°C for the 4-watt rating.

♦The JEDEC registered outline for these devices is TO-5. TO-39 falls within TO-5 with the exception of lead length.
*JEDEC registered data. This data sheet contains all applicable registered data in effect at the time of publication
†This value is guaranteed by Texas Instruments in addition to the JEDEC registered value which is also shown.

**USES CHIP P16**



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# TYPES 2N4026 THRU 2N4033
# P-N-P SILICON TRANSISTORS

***electrical characteristics at 25°C free-air temperature (unless otherwise noted)**

| PARAMETER | | TEST CONDITIONS | | 2N4026 2N4030 | | 2N4027 2N4031 | | 2N4028 2N4032 | | 2N4029 2N4033 | | UNIT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | MIN | MAX | MIN | MAX | MIN | MAX | MIN | MAX | |
| $V_{(BR)CBO}$ | Collector-Base Breakdown Voltage | $I_C = -10\ \mu A$, $I_E = 0$ | | −60 | | −80 | | −60 | | −80 | | V |
| $V_{(BR)CEO}$ | Collector-Emitter Breakdown Voltage | $I_C = -10$ mA, See Note 4 | $I_B = 0$, | −60 | | −80 | | −60 | | −80 | | V |
| $V_{(BR)EBO}$ | Emitter-Base Breakdown Voltage | $I_E = -10\ \mu A$, $I_C = 0$ | | −5 | | −5 | | −5 | | −5 | | V |
| $I_{CBO}$ | Collector Cutoff Current | $V_{CB} = -50$ V, $I_E = 0$ | | | −50 | | | | −50 | | | nA |
| | | $V_{CB} = -60$ V, $I_E = 0$ | | | | | −50 | | | | −50 | |
| | | $V_{CB} = -50$ V, $I_E = 0$, $T_A = 150°C$ | | | −50 | | | | −50 | | | μA |
| | | $V_{CB} = -60$ V, $I_E = 0$, $T_A = 150°C$ | | | | | −50 | | | | −50 | |
| $I_{EBO}$ | Emitter Cutoff Current | $V_{EB} = -5$ V, $I_C = 0$ | | | −10 | | −10 | | −10 | | −10 | μA |
| $h_{FE}$ | Static Forward Current Transfer Ratio | $V_{CE} = -5$ V, $I_C = -100\ \mu A$ | | 30 | | 30 | | 75 | | 75 | | |
| | | $V_{CE} = -5$ V, $I_C = -100$ mA | | 40 | 120 | 40 | 120 | 100 | 300 | 100 | 300 | |
| | | $V_{CE} = -5$ V, $I_C = -100$ mA, $T_A = -55°C$ | See Note 4 | 15 | | 15 | | 40 | | 40 | | |
| | | $V_{CE} = -5$ V, $I_C = -500$ mA | | 25 | | 25 | | 70 | | 70 | | |
| | | $V_{CE} = -5$ V, $I_C = -1$ A | | 15 | | 10 | | 40 | | 25 | | |
| $V_{BE}$ | Base-Emitter Voltage | $I_B = -15$ mA, $I_C = -150$ mA | | | −0.9 | | −0.9 | | −0.9 | | −0.9 | V |
| | | $V_{CE} = -0.5$ V, $I_C = -500$ mA | See Note 4 | | −1.1 | | −1.1 | | −1.1 | | −1.1 | |
| | | $V_{CE} = -1$ V, $I_C = -1$ A | | | −1.2 | | | | −1.2 | | | |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $I_B = -15$ mA, $I_C = -150$ mA | | | −0.15 | | −0.15 | | −0.15 | | −0.15 | V |
| | | $I_B = -50$ mA, $I_C = -500$ mA | See Note 4 | | −0.5 | | −0.5 | | −0.5 | | −0.5 | |
| | | $I_B = -100$ mA, $I_C = -1$ A | | | −1 | | | | −1 | | | |
| $\lvert h_{fe} \rvert$ | Small-Signal Common-Emitter Forward Current Transfer Ratio | $V_{CE} = -10$ V, $I_C = -50$ mA, f = 100 MHz | | 1 | 4 | 1 | 4 | 1.5 | 5 | 1.5 | 5 | |
| $C_{cb}$ | Collector-Base Capacitance | $V_{CB} = -10$ V, $I_E = 0$, f = 1 MHz, See Note 5 | | | 20 | | 20 | | 20 | | 20 | pF |
| $C_{ibo}$ | Common-Base Open-Circuit Input Capacitance | $V_{EB} = -0.5$ V, $I_C = 0$, f = 1 MHz | | | 110 | | 110 | | 110 | | 110 | pF |

NOTES: 4. These parameters must be measured using pulse techniques. $t_w = 300\ \mu s$, duty cycle ≤ 1%.
5. $C_{cb}$ measurement employs a three-terminal capacitance bridge incorporating a guard circuit. The emitter is connected to the guard terminal of the bridge.

*JEDEC registered data



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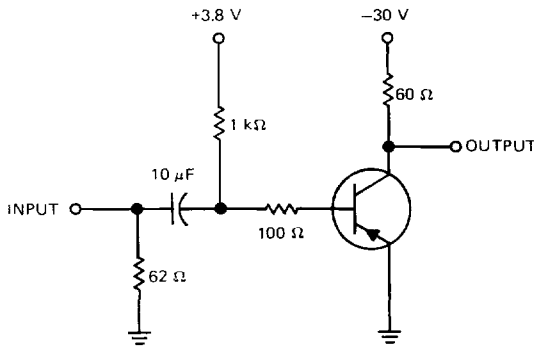
## switching characteristics at 25°C free-air temperature

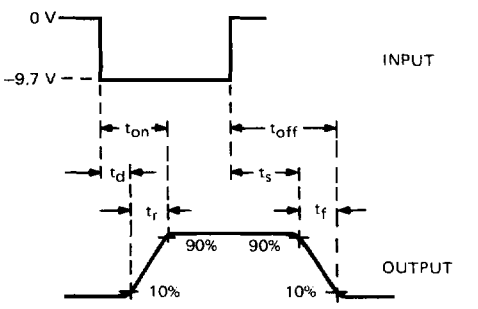
| PARAMETER | | TEST CONDITIONS† | | MAX | UNIT |
|---|---|---|---|---|---|
| $t_{on}$ | Turn-On Time | $V_{CC}$ = −30 V, | $I_C$ = −500 mA, | 100 | ns |
| $t_s$ | Storage Time | $I_{B(1)}$ = −50 mA, | $I_{B(2)}$ = 50 mA, | 350 | ns |
| $t_f$ | Fall Time | $V_{BE(off)}$ = 3.8 V, | See Figure 1 | 50 | ns |

† Voltage and current values shown are nominal, exact values vary slightly with transistor parameters.
*JEDEC registered data

## PARAMETER MEASUREMENT INFORMATION




TEST CIRCUIT




(See Notes a and b)
VOLTAGE WAVEFORMS

NOTES: a. The input waveform is supplied by a generator with the following characteristics: $Z_{out}$ = 50 Ω, $t_r \leq 20$ ns, $t_f \leq 20$ ns, $t_w \approx 10$ μs, duty cycle ≤ 2%.
b. Waveforms are monitored on an oscilloscope with the following characteristics: $t_r \approx 10$ ns, $R_{in} \geq 100$ kΩ.

**FIGURE 1—500-mA SWITCHING TIMES**

## THERMAL INFORMATION

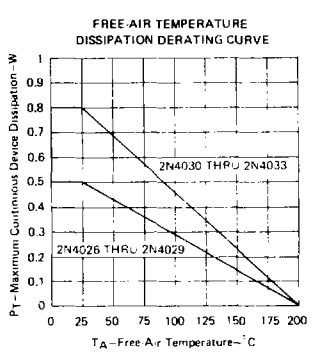



**FIGURE 2**

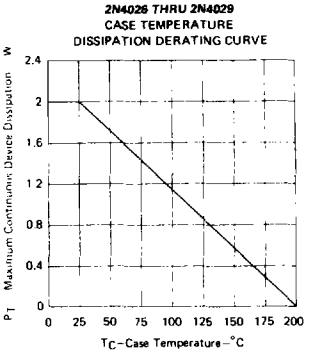



**FIGURE 3**

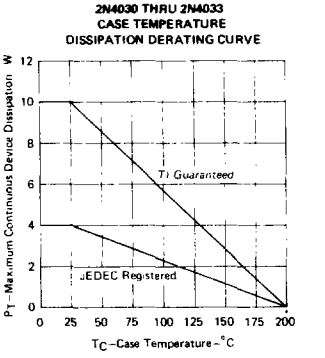



**FIGURE 4**