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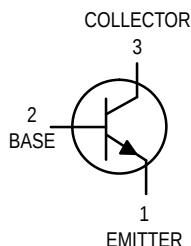
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# General Purpose Transistors

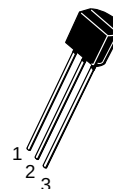
## NPN Silicon

Jameco Part Number 210673



**MPS2222**  
**MPS2222A\***

\*Motorola Preferred Device



CASE 29-04, STYLE 1  
TO-92 (TO-226AA)

### MAXIMUM RATINGS

| Rating                                                                                 | Symbol         | MPS2222     | MPS2222A | Unit                          |
|----------------------------------------------------------------------------------------|----------------|-------------|----------|-------------------------------|
| Collector–Emitter Voltage                                                              | $V_{CEO}$      | 30          | 40       | Vdc                           |
| Collector–Base Voltage                                                                 | $V_{CBO}$      | 60          | 75       | Vdc                           |
| Emitter–Base Voltage                                                                   | $V_{EBO}$      | 5.0         | 6.0      | Vdc                           |
| Collector Current — Continuous                                                         | $I_C$          | 600         |          | mAdc                          |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 625<br>5.0  |          | mW<br>mW/ $^\circ\text{C}$    |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 1.5<br>12   |          | Watts<br>mW/ $^\circ\text{C}$ |
| Operating and Storage Junction<br>Temperature Range                                    | $T_J, T_{stg}$ | –55 to +150 |          | $^\circ\text{C}$              |

### THERMAL CHARACTERISTICS

| Characteristic                          | Symbol          | Max  | Unit               |
|-----------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 200  | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction to Case    | $R_{\theta JC}$ | 83.3 | $^\circ\text{C/W}$ |

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

| Characteristic                                                                                                                                                                                                                                                   | Symbol        | Min              | Max                      | Unit            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------|--------------------------|-----------------|
| <b>OFF CHARACTERISTICS</b>                                                                                                                                                                                                                                       |               |                  |                          |                 |
| Collector–Emitter Breakdown Voltage<br>( $I_C = 10\text{ mAdc}$ , $I_E = 0$ )                                                                                                                                                                                    | $V_{(BR)CEO}$ | 30<br>40         | —<br>—                   | Vdc             |
| Collector–Base Breakdown Voltage<br>( $I_C = 10\text{ }\mu\text{Adc}$ , $I_E = 0$ )                                                                                                                                                                              | $V_{(BR)CBO}$ | 60<br>75         | —<br>—                   | Vdc             |
| Emitter–Base Breakdown Voltage<br>( $I_E = 10\text{ }\mu\text{Adc}$ , $I_C = 0$ )                                                                                                                                                                                | $V_{(BR)EBO}$ | 5.0<br>6.0       | —<br>—                   | Vdc             |
| Collector Cutoff Current<br>( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 3.0\text{ Vdc}$ )                                                                                                                                                                        | $I_{CEX}$     | —                | 10                       | nAdc            |
| Collector Cutoff Current<br>( $V_{CB} = 50\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 60\text{ Vdc}$ , $I_E = 0$ )<br>( $V_{CB} = 50\text{ Vdc}$ , $I_E = 0$ , $T_A = 125^\circ\text{C}$ )<br>( $V_{CB} = 50\text{ Vdc}$ , $I_E = 0$ , $T_A = 125^\circ\text{C}$ ) | $I_{CBO}$     | —<br>—<br>—<br>— | 0.01<br>0.01<br>10<br>10 | $\mu\text{Adc}$ |
| Emitter Cutoff Current<br>( $V_{EB} = 3.0\text{ Vdc}$ , $I_C = 0$ )                                                                                                                                                                                              | $I_{EBO}$     | —                | 100                      | nAdc            |
| Base Cutoff Current<br>( $V_{CE} = 60\text{ Vdc}$ , $V_{EB(off)} = 3.0\text{ Vdc}$ )                                                                                                                                                                             | $I_{BL}$      | —                | 20                       | nAdc            |

Preferred devices are Motorola recommended choices for future use and best overall value.

# MPS2222 MPS2222A

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted) (Continued)

| Characteristic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Symbol               | Min                                           | Max                                    | Unit            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------------------------------------------|----------------------------------------|-----------------|
| <b>ON CHARACTERISTICS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |                                               |                                        |                 |
| DC Current Gain<br>(I <sub>C</sub> = 0.1 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> )<br>(I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> )<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> )<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , T <sub>A</sub> = -55°C) (MPS2222A only)<br>(I <sub>C</sub> = 150 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> ) <sup>(1)</sup><br>(I <sub>C</sub> = 150 mA <sub>dc</sub> , V <sub>CE</sub> = 1.0 V <sub>dc</sub> ) <sup>(1)</sup><br>(I <sub>C</sub> = 500 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> ) <sup>(1)</sup> MPS2222<br>MPS2222A | h <sub>FE</sub>      | 35<br>50<br>75<br>35<br>100<br>50<br>30<br>40 | —<br>—<br>—<br>—<br>300<br>—<br>—<br>— | —               |
| Collector–Emitter Saturation Voltage <sup>(1)</sup><br>(I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B</sub> = 15 mA <sub>dc</sub> ) MPS2222<br>MPS2222A<br><br>(I <sub>C</sub> = 500 mA <sub>dc</sub> , I <sub>B</sub> = 50 mA <sub>dc</sub> ) MPS2222<br>MPS2222A                                                                                                                                                                                                                                                                                                                                                                                                                                                        | V <sub>CE(sat)</sub> | —<br>—<br><br>—<br>—                          | 0.4<br>0.3<br><br>1.6<br>1.0           | V <sub>dc</sub> |
| Base–Emitter Saturation Voltage <sup>(1)</sup><br>(I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B</sub> = 15 mA <sub>dc</sub> ) MPS2222<br>MPS2222A<br><br>(I <sub>C</sub> = 500 mA <sub>dc</sub> , I <sub>B</sub> = 50 mA <sub>dc</sub> ) MPS2222<br>MPS2222A                                                                                                                                                                                                                                                                                                                                                                                                                                                             | V <sub>BE(sat)</sub> | —<br>0.6<br><br>—<br>—                        | 1.3<br>1.2<br><br>2.6<br>2.0           | V <sub>dc</sub> |

## SMALL–SIGNAL CHARACTERISTICS

|                                                                                                                                                                                                                                            |                   |             |             |                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------|-------------|--------------------|
| Current–Gain — Bandwidth Product <sup>(2)</sup><br>(I <sub>C</sub> = 20 mA <sub>dc</sub> , V <sub>CE</sub> = 20 V <sub>dc</sub> , f = 100 MHz) MPS2222<br>MPS2222A                                                                         | f <sub>T</sub>    | 250<br>300  | —<br>—      | MHz                |
| Output Capacitance<br>(V <sub>CB</sub> = 10 V <sub>dc</sub> , I <sub>E</sub> = 0, f = 1.0 MHz)                                                                                                                                             | C <sub>obo</sub>  | —           | 8.0         | pF                 |
| Input Capacitance<br>(V <sub>EB</sub> = 0.5 V <sub>dc</sub> , I <sub>C</sub> = 0, f = 1.0 MHz) MPS2222<br>MPS2222A                                                                                                                         | C <sub>ibo</sub>  | —<br>—      | 30<br>25    | pF                 |
| Input Impedance<br>(I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz) MPS2222A<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz) MPS2222A           | h <sub>ie</sub>   | 2.0<br>0.25 | 8.0<br>1.25 | kΩ                 |
| Voltage Feedback Ratio<br>(I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz) MPS2222A<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz) MPS2222A    | h <sub>re</sub>   | —<br>—      | 8.0<br>4.0  | X 10 <sup>-4</sup> |
| Small–Signal Current Gain<br>(I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz) MPS2222A<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz) MPS2222A | h <sub>fe</sub>   | 50<br>75    | 300<br>375  | —                  |
| Output Admittance<br>(I <sub>C</sub> = 1.0 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz) MPS2222A<br>(I <sub>C</sub> = 10 mA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , f = 1.0 kHz) MPS2222A         | h <sub>oe</sub>   | 5.0<br>25   | 35<br>200   | μmhos              |
| Collector Base Time Constant<br>(I <sub>E</sub> = 20 mA <sub>dc</sub> , V <sub>CB</sub> = 20 V <sub>dc</sub> , f = 31.8 MHz) MPS2222A                                                                                                      | rb'C <sub>C</sub> | —           | 150         | ps                 |
| Noise Figure<br>(I <sub>C</sub> = 100 μA <sub>dc</sub> , V <sub>CE</sub> = 10 V <sub>dc</sub> , R <sub>S</sub> = 1.0 kΩ, f = 1.0 kHz) MPS2222A                                                                                             | NF                | —           | 4.0         | dB                 |

## SWITCHING CHARACTERISTICS MPS2222A only

|              |                                                                                                                                                                                     |                |   |     |    |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---|-----|----|
| Delay Time   | (V <sub>CC</sub> = 30 V <sub>dc</sub> , V <sub>BE(off)</sub> = -0.5 V <sub>dc</sub> ,<br>I <sub>C</sub> = 150 mA <sub>dc</sub> , I <sub>B1</sub> = 15 mA <sub>dc</sub> ) (Figure 1) | t <sub>d</sub> | — | 10  | ns |
| Rise Time    |                                                                                                                                                                                     | t <sub>r</sub> | — | 25  | ns |
| Storage Time | (V <sub>CC</sub> = 30 V <sub>dc</sub> , I <sub>C</sub> = 150 mA <sub>dc</sub> ,<br>I <sub>B1</sub> = I <sub>B2</sub> = 15 mA <sub>dc</sub> ) (Figure 2)                             | t <sub>s</sub> | — | 225 | ns |
| Fall Time    |                                                                                                                                                                                     | t <sub>f</sub> | — | 60  | ns |

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

2. f<sub>T</sub> is defined as the frequency at which |h<sub>fe</sub>| extrapolates to unity.

## SWITCHING TIME EQUIVALENT TEST CIRCUITS

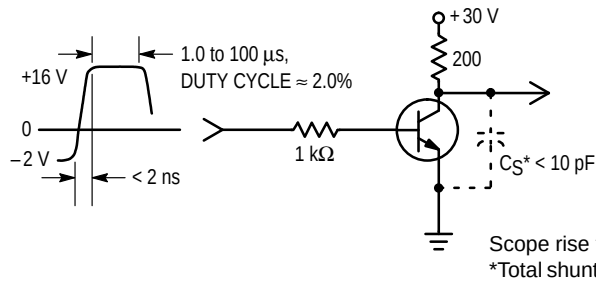


Figure 1. Turn-On Time

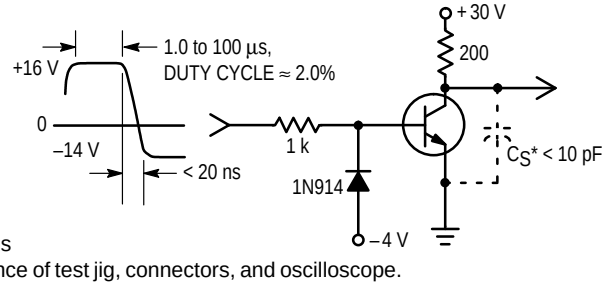


Figure 2. Turn-Off Time

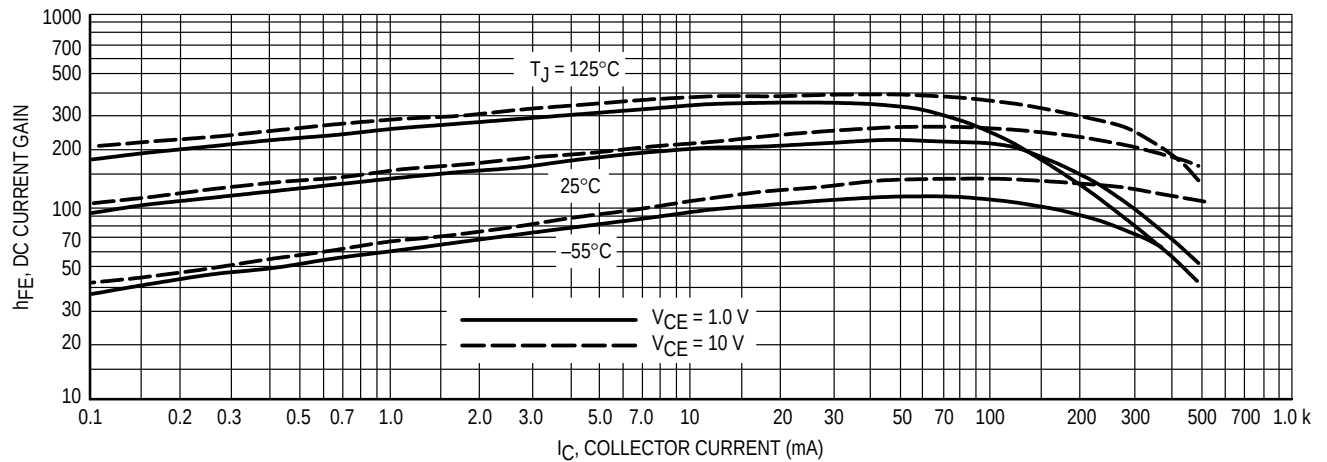


Figure 3. DC Current Gain

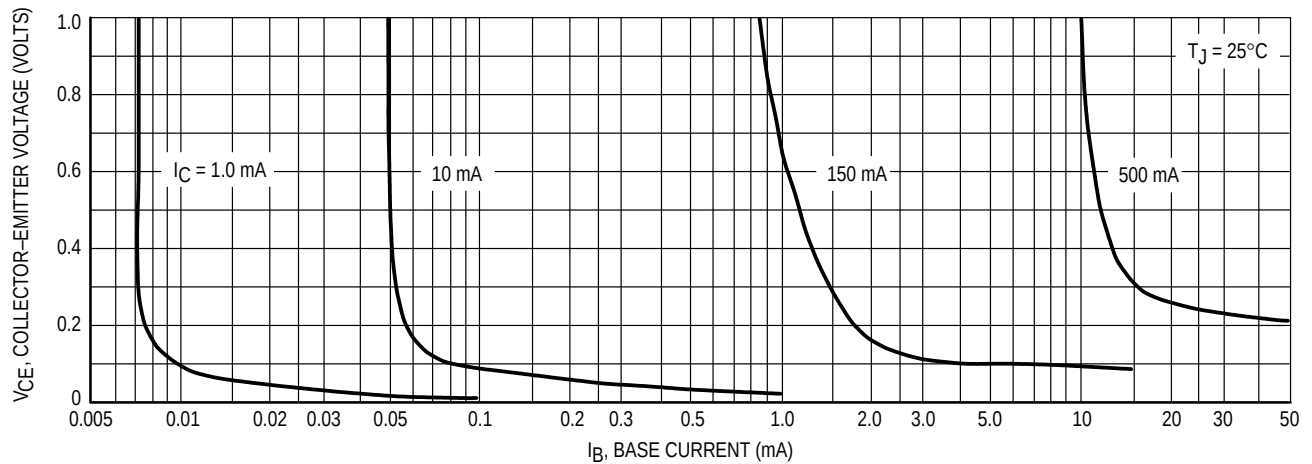


Figure 4. Collector Saturation Region

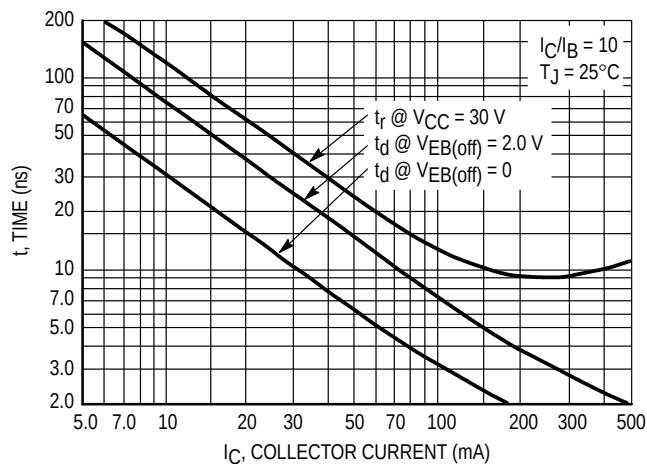


Figure 5. Turn-On Time

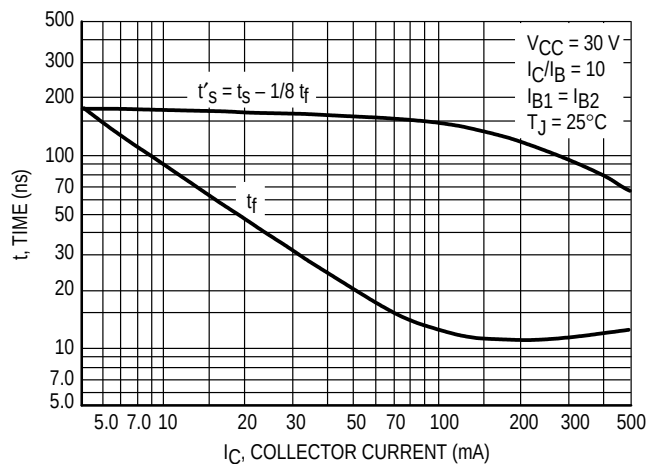


Figure 6. Turn-Off Time

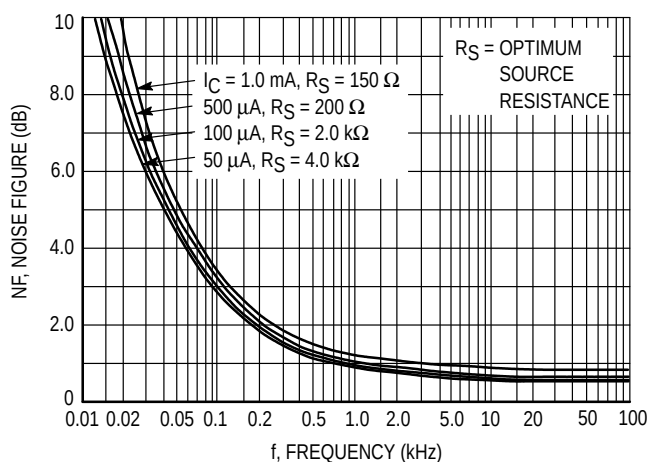


Figure 7. Frequency Effects

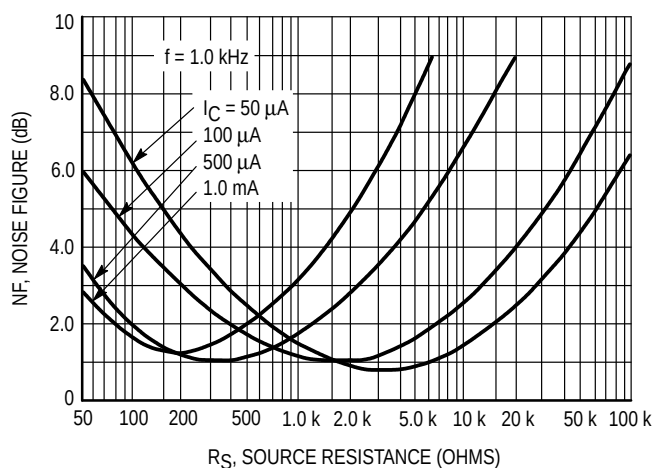


Figure 8. Source Resistance Effects

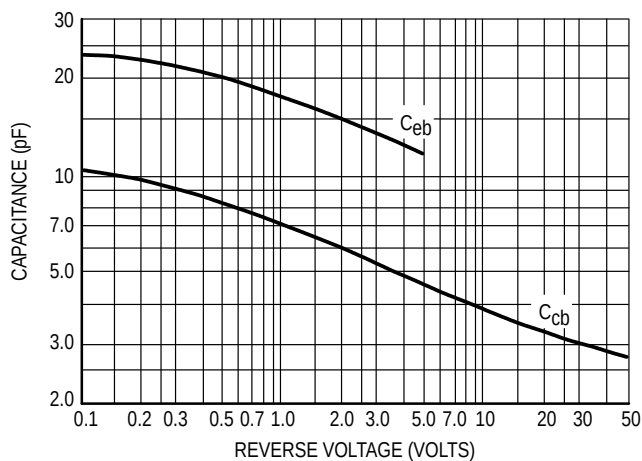


Figure 9. Capacitances

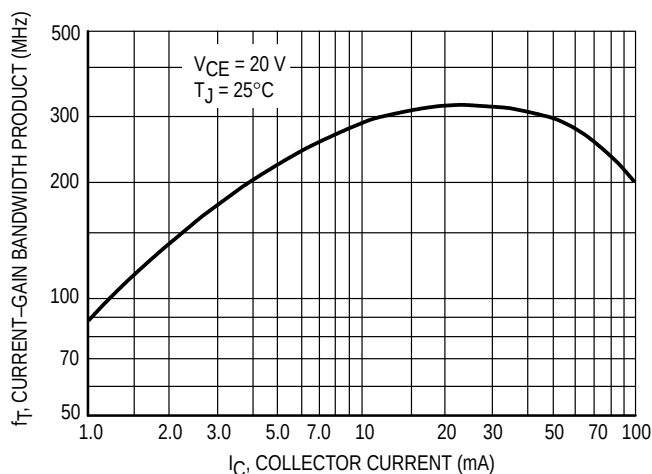


Figure 10. Current-Gain Bandwidth Product

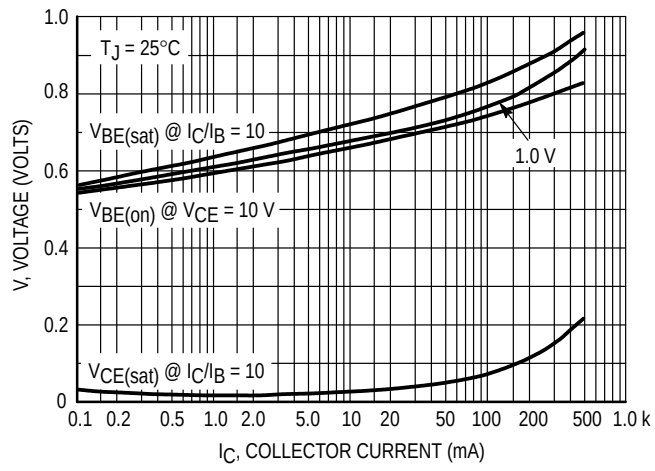


Figure 11. "On" Voltages

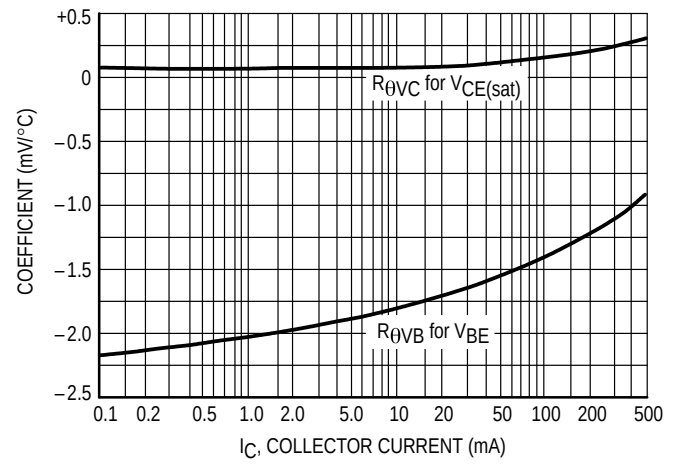
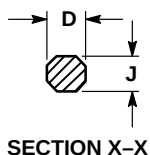
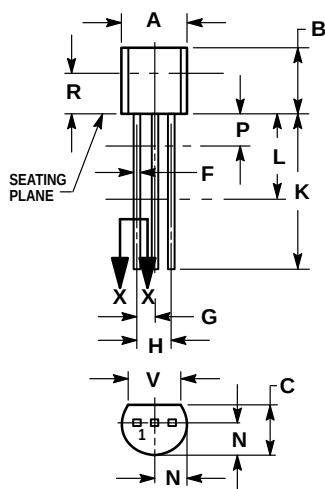


Figure 12. Temperature Coefficients

## PACKAGE DIMENSIONS



**CASE 029-04  
(TO-226AA)  
ISSUE AD**

## NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K. MINIMUM LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

| DIM | INCHES |       | MILLIMETERS |      |
|-----|--------|-------|-------------|------|
|     | MIN    | MAX   | MIN         | MAX  |
| A   | 0.175  | 0.205 | 4.45        | 5.20 |
| B   | 0.170  | 0.210 | 4.32        | 5.33 |
| C   | 0.125  | 0.165 | 3.18        | 4.19 |
| D   | 0.016  | 0.022 | 0.41        | 0.55 |
| F   | 0.016  | 0.019 | 0.41        | 0.48 |
| G   | 0.045  | 0.055 | 1.15        | 1.39 |
| H   | 0.095  | 0.105 | 2.42        | 2.66 |
| J   | 0.015  | 0.020 | 0.39        | 0.50 |
| K   | 0.500  | —     | 12.70       | —    |
| L   | 0.250  | —     | 6.35        | —    |
| N   | 0.080  | 0.105 | 2.04        | 2.66 |
| P   | —      | 0.100 | —           | 2.54 |
| R   | 0.115  | —     | 2.93        | —    |
| V   | 0.135  | —     | 3.43        | —    |

## STYLE 1:

1. PIN 1. EMITTER
2. BASE
3. COLLECTOR

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