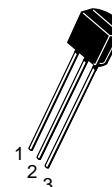
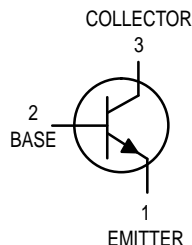


# General Purpose Transistors

## NPN Silicon

**2N4123**  
**2N4124**



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

### MAXIMUM RATINGS

| Rating   | Symbol         | 2N4123      | 2N4124 | Unit                          |
|--|----------------|-------------|--------|-------------------------------|
| Collector–Emitter Voltage  | $V_{CEO}$      | 30          | 25     | Vdc                           |
| Collector–Base Voltage   | $V_{CBO}$      | 40          | 30     | Vdc                           |
| Emitter–Base Voltage   | $V_{EBO}$      | 5.0         |        | Vdc                           |
| Collector Current — Continuous   | $I_C$          | 200         |        | mAdc                          |
| Total Device Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$          | 625         | 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         | 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  | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance, Junction to Case    | $R_{\theta JC}$ | 83.3 | $^\circ\text{C}/\text{W}$ |

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

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

### OFF CHARACTERISTICS

|   |               |          |        |      |
|---|---------------|----------|--------|------|
| Collector–Emitter Breakdown Voltage <sup>(1)</sup><br>( $I_C = 1.0 \text{ mAdc}, I_E = 0$ ) | $V_{(BR)CEO}$ | 30<br>25 | —<br>— | Vdc  |
| Collector–Base Breakdown Voltage<br>( $I_C = 10 \mu\text{Adc}, I_E = 0$ )                   | $V_{(BR)CBO}$ | 40<br>30 | —<br>— | Vdc  |
| Emitter–Base Breakdown Voltage<br>( $I_E = 10 \mu\text{Adc}, I_C = 0$ )                     | $V_{(BR)EBO}$ | 5.0      | —      | Vdc  |
| Collector Cutoff Current<br>( $V_{CB} = 20 \text{ Vdc}, I_E = 0$ )                          | $I_{CBO}$     | —        | 50     | nAdc |
| Emitter Cutoff Current<br>( $V_{EB} = 3.0 \text{ Vdc}, I_C = 0$ )                           | $I_{EBO}$     | —        | 50     | nAdc |

1. Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle = 2.0%.

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

| Characteristic  | Symbol        | Min | Max  | Unit |
|---|---------------|-----|------|------|
| <b>ON CHARACTERISTICS</b>   |               |     |      |      |
| DC Current Gain <sup>(1)</sup><br>( $I_C = 2.0\text{ mAdc}$ , $V_{CE} = 1.0\text{ Vdc}$ )                   | $h_{FE}$      | 50  | 150  | —    |
|   | 2N4123        | 120 | 360  |      |
|   | 2N4124        |     |      |      |
| ( $I_C = 50\text{ mAdc}$ , $V_{CE} = 1.0\text{ Vdc}$ )  |               | 25  | —    |      |
|   | 2N4123        | 60  | —    |      |
|   | 2N4124        |     |      |      |
| Collector–Emitter Saturation Voltage <sup>(1)</sup><br>( $I_C = 50\text{ mAdc}$ , $I_B = 5.0\text{ mAdc}$ ) | $V_{CE(sat)}$ | —   | 0.3  | Vdc  |
| Base–Emitter Saturation Voltage <sup>(1)</sup><br>( $I_C = 50\text{ mAdc}$ , $I_B = 5.0\text{ mAdc}$ )      | $V_{BE(sat)}$ | —   | 0.95 | Vdc  |

**SMALL–SIGNAL CHARACTERISTICS**

|  |            |     |     |     |
|--|------------|-----|-----|-----|
| Current–Gain — Bandwidth Product<br>( $I_C = 10\text{ mAdc}$ , $V_{CE} = 20\text{ Vdc}$ , $f = 100\text{ MHz}$ )                     | $f_T$      | 250 | —   | MHz |
|  | 2N4123     | 300 | —   |     |
|  | 2N4124     |     |     |     |
| Input Capacitance<br>( $V_{EB} = 0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )  | $C_{ibo}$  | —   | 8.0 | pF  |
| Collector–Base Capacitance<br>( $I_E = 0$ , $V_{CB} = 5.0\text{ V}$ , $f = 1.0\text{ MHz}$ )   | $C_{cb}$   | —   | 4.0 | pF  |
| Small–Signal Current Gain<br>( $I_C = 2.0\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $R_S = 10\text{ k ohm}$ , $f = 1.0\text{ kHz}$ ) | $h_{fe}$   | 50  | 200 | —   |
|  | 2N4123     | 120 | 480 |     |
|  | 2N4124     |     |     |     |
| Current Gain — High Frequency<br>( $I_C = 10\text{ mAdc}$ , $V_{CE} = 20\text{ Vdc}$ , $f = 100\text{ MHz}$ )                        | $ h_{fe} $ | 2.5 | —   | —   |
|  | 2N4123     | 3.0 | —   |     |
|  | 2N4124     |     |     |     |
| ( $I_C = 2.0\text{ mAdc}$ , $V_{CE} = 10\text{ V}$ , $f = 1.0\text{ kHz}$ )  |            | 50  | 200 |     |
| ( $I_C = 2.0\text{ mAdc}$ , $V_{CE} = 10\text{ V}$ , $f = 1.0\text{ kHz}$ )  |            | 120 | 480 |     |
|  | 2N4123     |     |     |     |
|  | 2N4124     |     |     |     |
| Noise Figure<br>( $I_C = 100\text{ }\mu\text{Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ , $R_S = 1.0\text{ k ohm}$ , $f = 1.0\text{ kHz}$ )   | NF         | —   | 6.0 | dB  |
|  | 2N4123     | —   | 5.0 |     |
|  | 2N4124     |     |     |     |

1. Pulse Test: Pulse Width = 300  $\mu\text{s}$ , Duty Cycle = 2.0%.

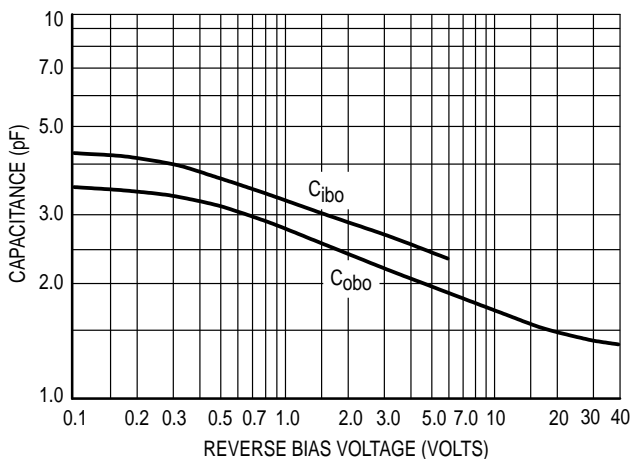


Figure 1. Capacitance

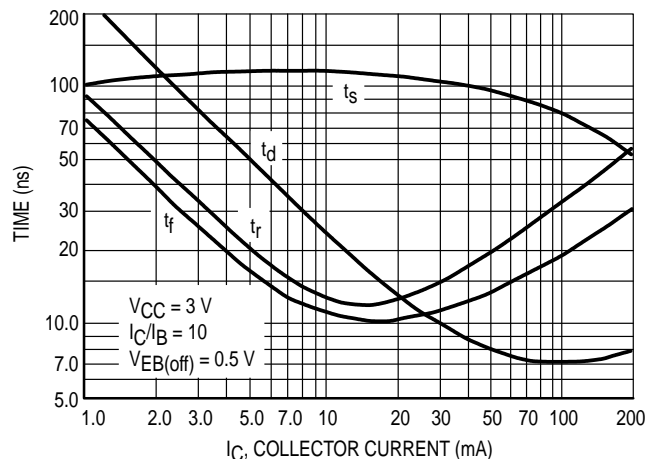


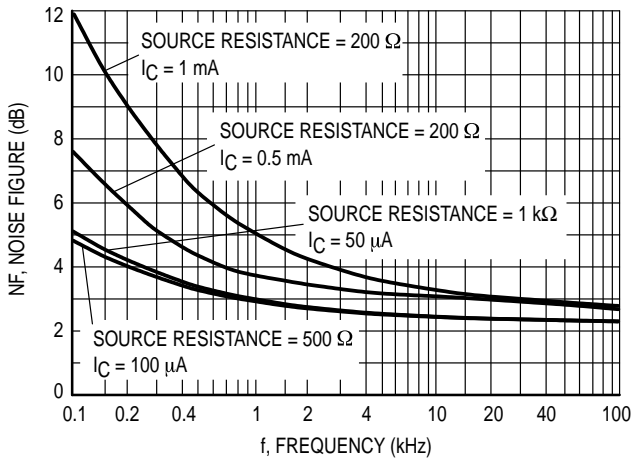
Figure 2. Switching Times

**AUDIO SMALL-SIGNAL CHARACTERISTICS**

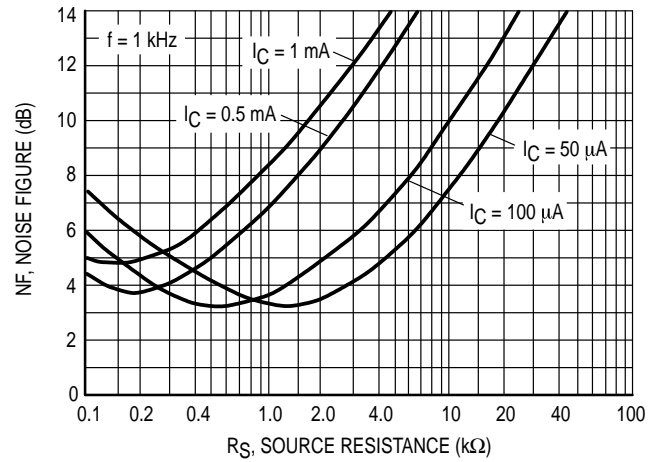
**NOISE FIGURE**

( $V_{CE} = 5 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ )

Bandwidth = 1.0 Hz



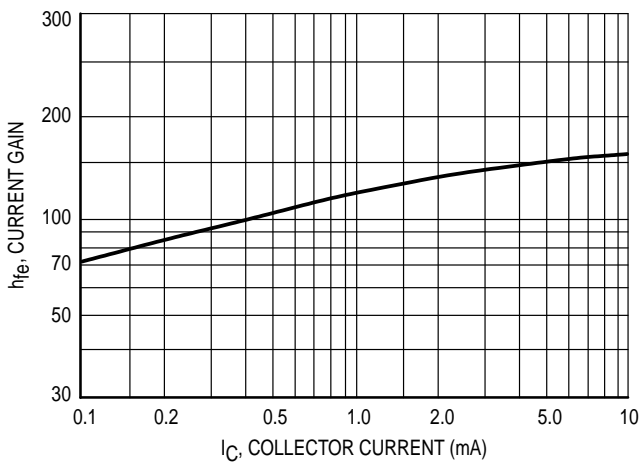
**Figure 3. Frequency Variations**



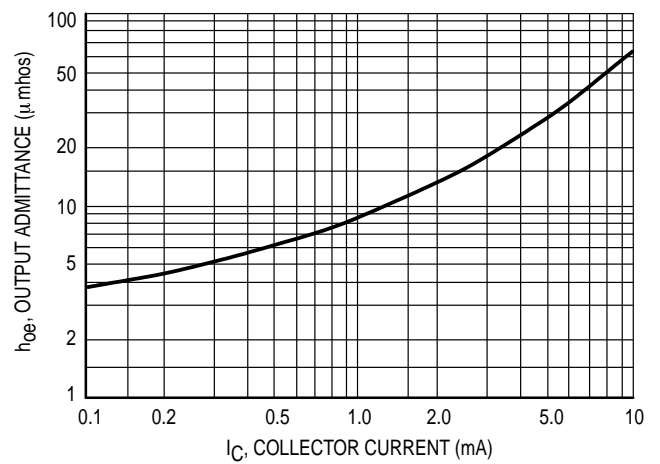
**Figure 4. Source Resistance**

**h PARAMETERS**

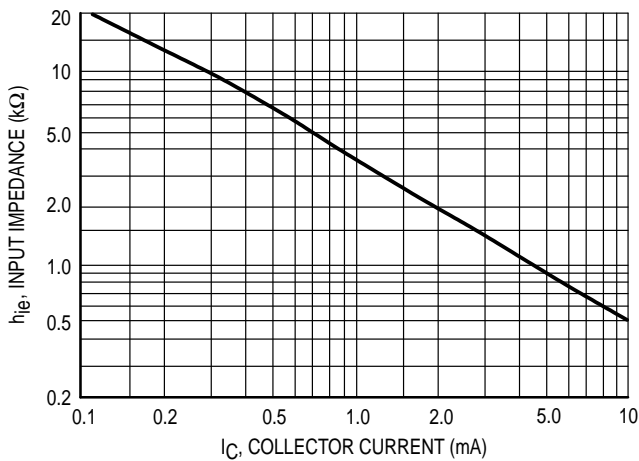
( $V_{CE} = 10 \text{ V}$ ,  $f = 1 \text{ kHz}$ ,  $T_A = 25^\circ\text{C}$ )



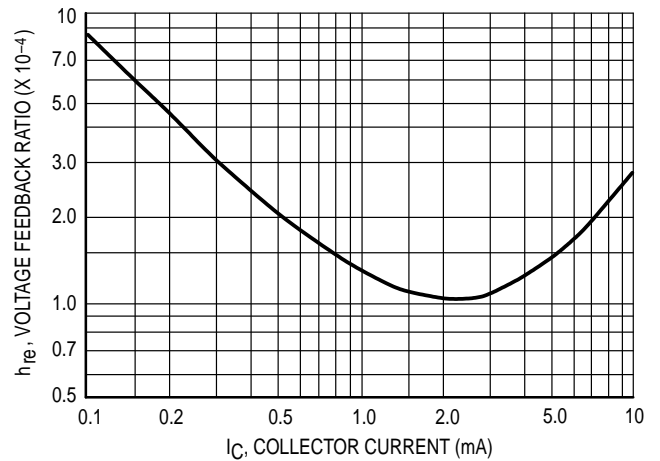
**Figure 5. Current Gain**



**Figure 6. Output Admittance**



**Figure 7. Input Impedance**



**Figure 8. Voltage Feedback Ratio**

STATIC CHARACTERISTICS

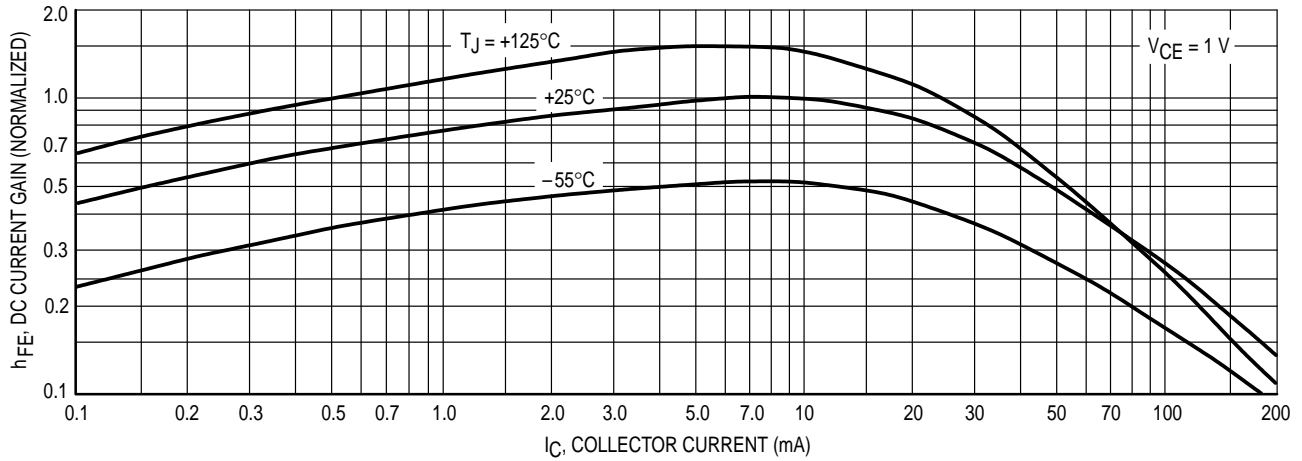


Figure 9. DC Current Gain

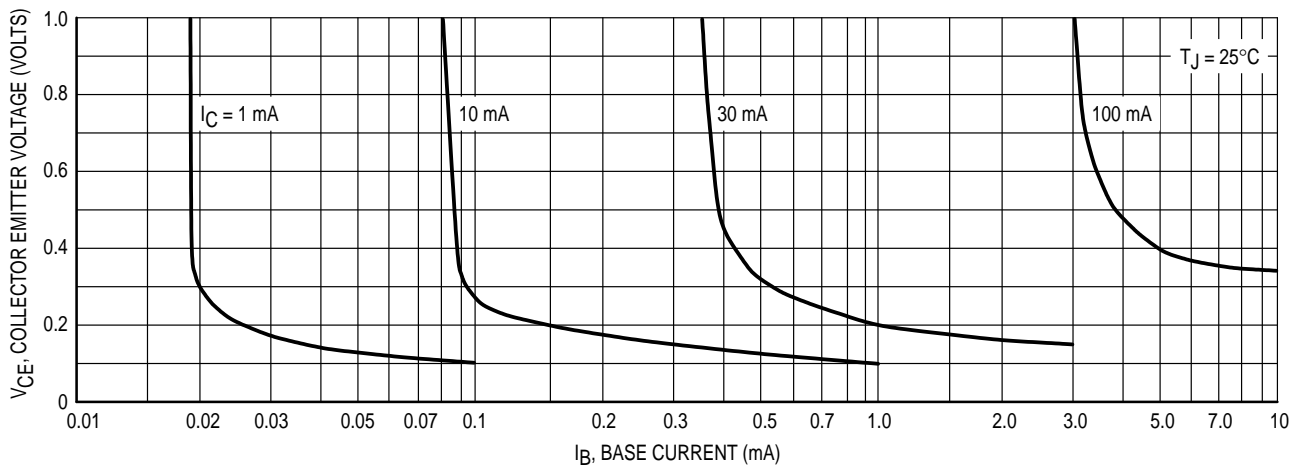


Figure 10. Collector Saturation Region

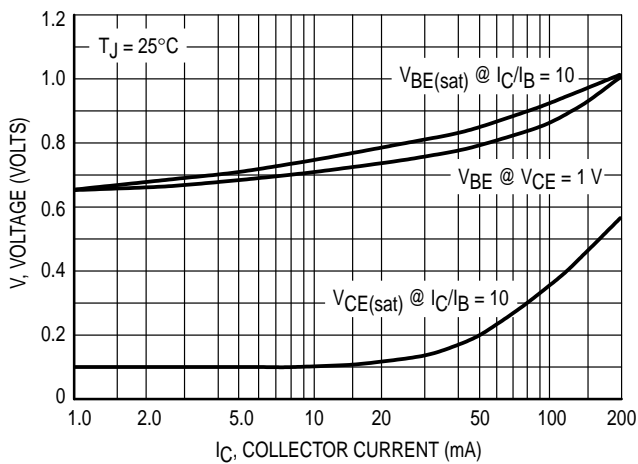


Figure 11. "On" Voltages

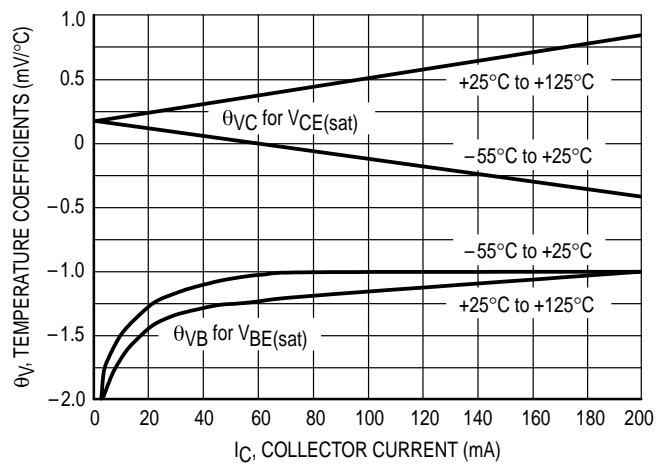
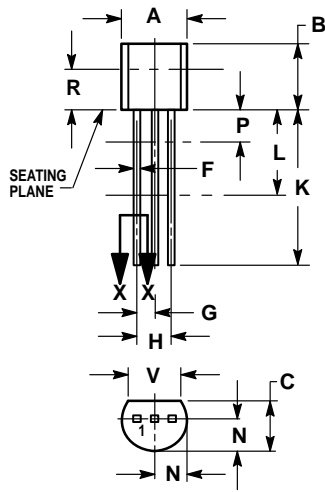


Figure 12. Temperature Coefficients

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. EMITTER
  2. BASE
  3. COLLECTOR

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