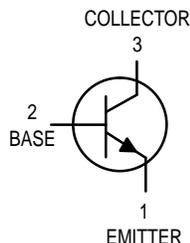


# General Purpose Transistors

## 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 @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	625	5.0	mW mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5	12	Watts mW/ $^\circ\text{C}$
Operating and Storage Junction 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
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### OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage <sup>(1)</sup> ( $I_C = 1.0 \text{ mAdc}, I_E = 0$ )	$V_{(BR)CEO}$	30 25	— —	Vdc
Collector–Base Breakdown Voltage ( $I_C = 10 \mu\text{Adc}, I_E = 0$ )	$V_{(BR)CBO}$	40 30	— —	Vdc
Emitter–Base Breakdown Voltage ( $I_E = 10 \mu\text{Adc}, I_C = 0$ )	$V_{(BR)EBO}$	5.0	—	Vdc
Collector Cutoff Current ( $V_{CB} = 20 \text{ Vdc}, I_E = 0$ )	$I_{CBO}$	—	50	nAdc
Emitter Cutoff Current ( $V_{EB} = 3.0 \text{ Vdc}, I_C = 0$ )	$I_{EBO}$	—	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> ( $I_C = 2.0\text{ mAdc}$ , $V_{CE} = 1.0\text{ Vdc}$ )	$h_{FE}$	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> ( $I_C = 50\text{ mAdc}$ , $I_B = 5.0\text{ mAdc}$ )	$V_{CE(sat)}$	—	0.3	Vdc
Base–Emitter Saturation Voltage <sup>(1)</sup> ( $I_C = 50\text{ mAdc}$ , $I_B = 5.0\text{ mAdc}$ )	$V_{BE(sat)}$	—	0.95	Vdc

**SMALL–SIGNAL CHARACTERISTICS**

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

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

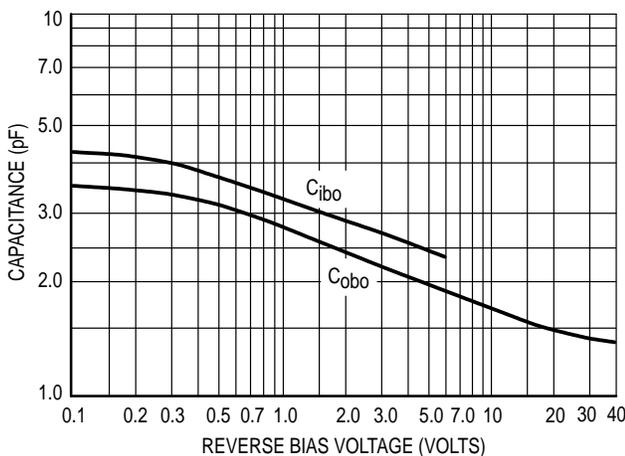


Figure 1. Capacitance

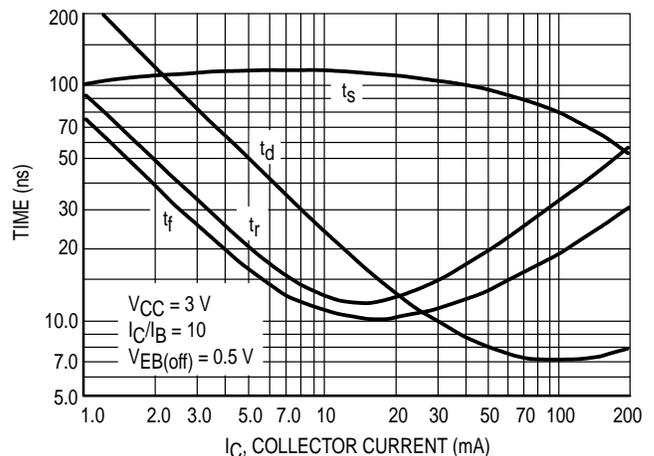


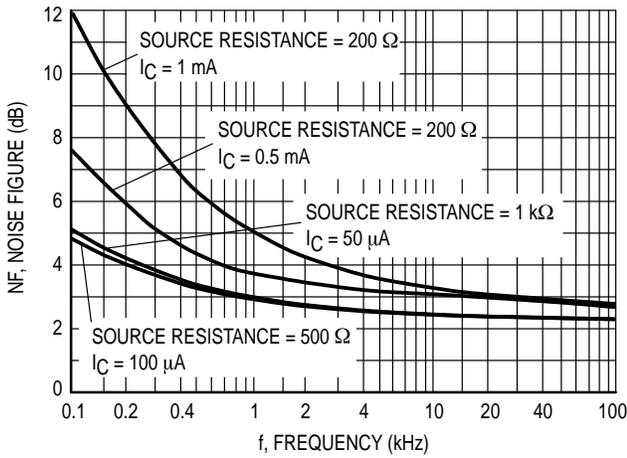
Figure 2. Switching Times

**AUDIO SMALL-SIGNAL CHARACTERISTICS**

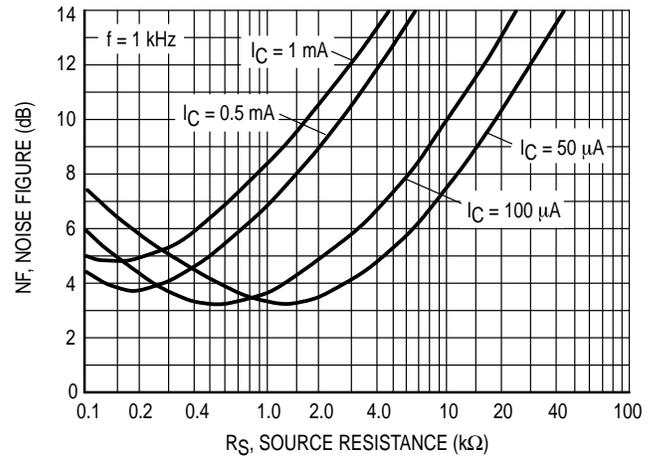
**NOISE FIGURE**

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

Bandwidth = 1.0 Hz



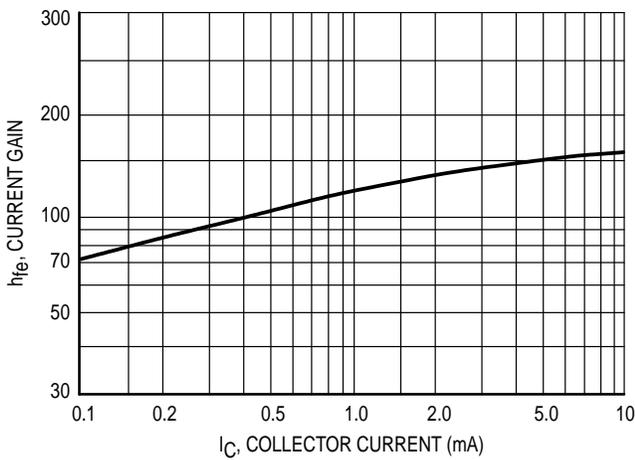
**Figure 3. Frequency Variations**



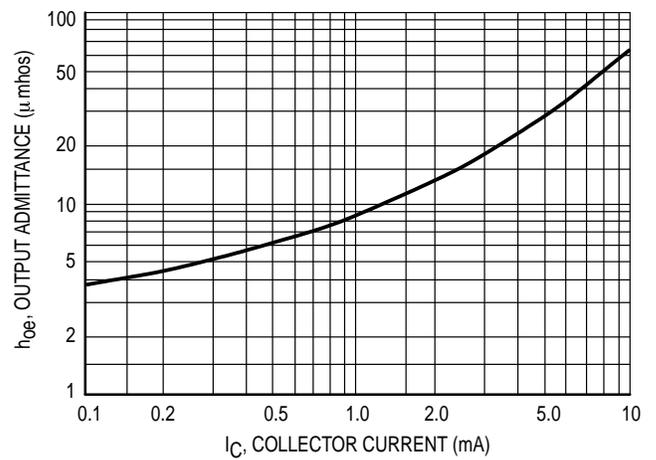
**Figure 4. Source Resistance**

**h PARAMETERS**

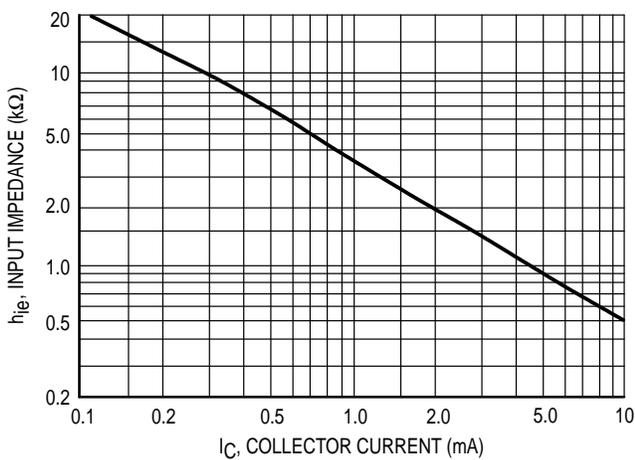
( $V_{CE} = 10 \text{ V}$ ,  $f = 1 \text{ kHz}$ ,  $T_A = 25^\circ\text{C}$ )



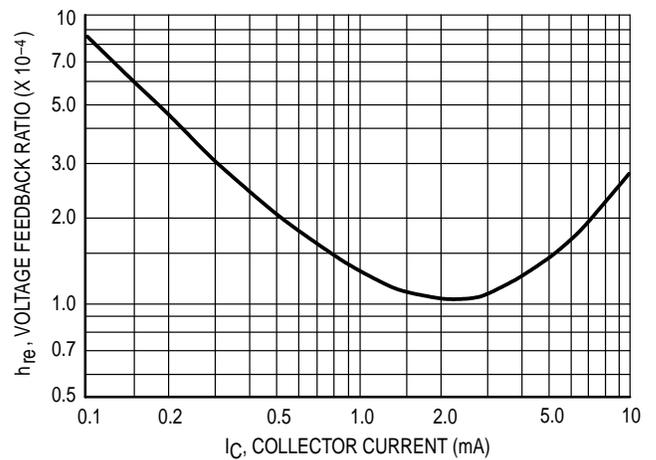
**Figure 5. Current Gain**



**Figure 6. Output Admittance**



**Figure 7. Input Impedance**



**Figure 8. Voltage Feedback Ratio**

STATIC CHARACTERISTICS

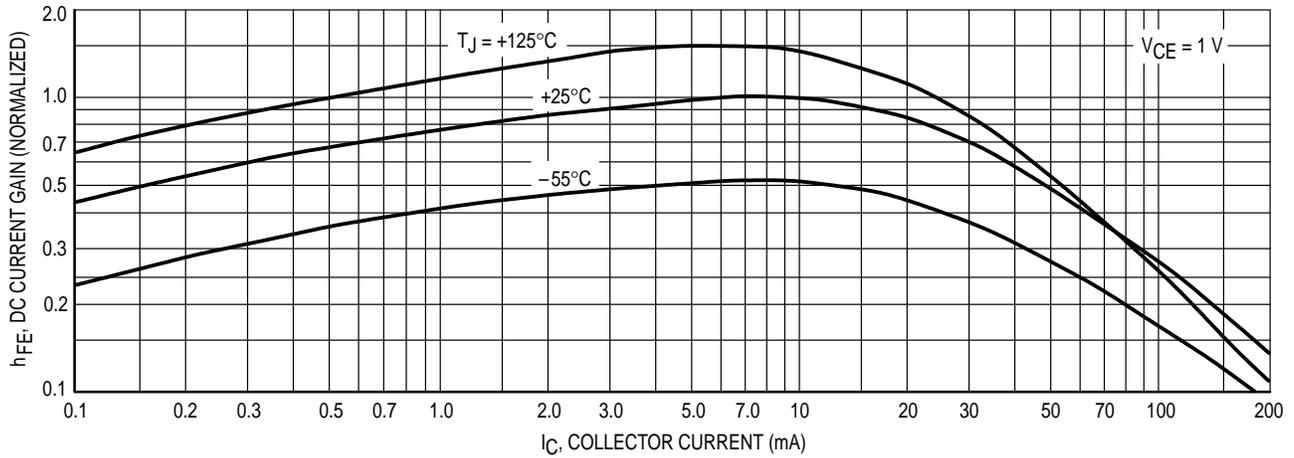


Figure 9. DC Current Gain

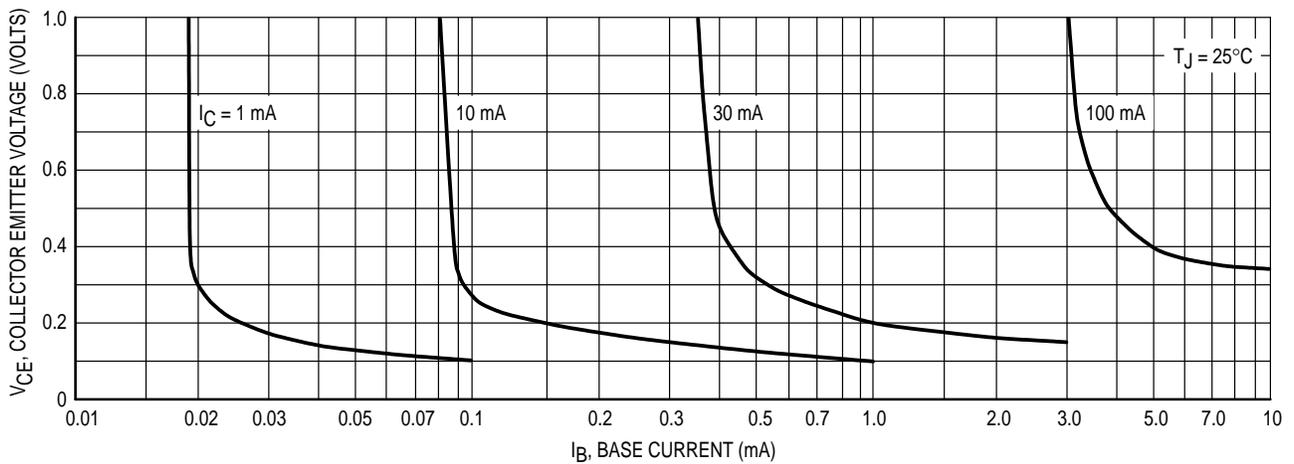


Figure 10. Collector Saturation Region

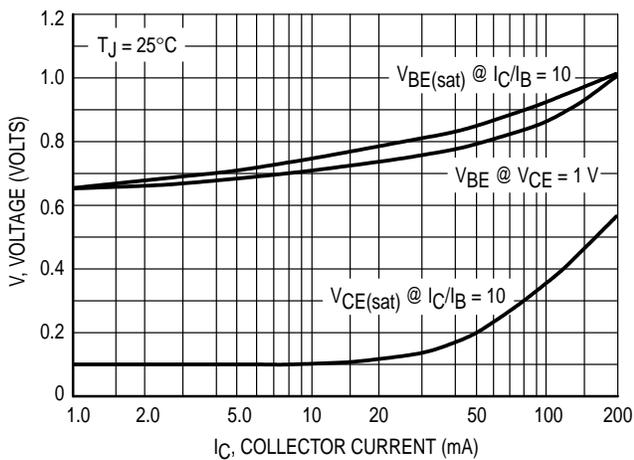


Figure 11. "On" Voltages

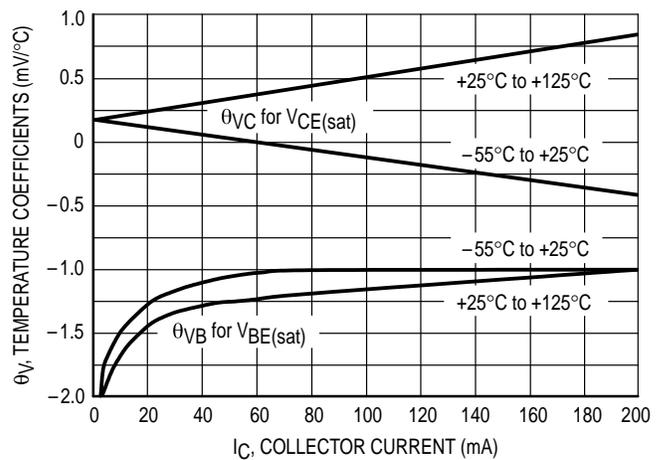
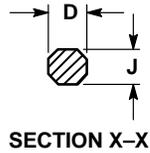
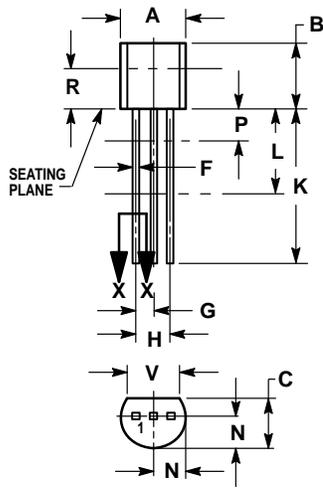


Figure 12. Temperature Coefficients

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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**2N4123/D**