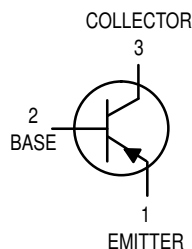


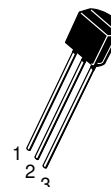
General Purpose Transistors

PNP Silicon



2N3905
2N3906*

*Motorola Preferred Device



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

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	40	Vdc
Collector–Base Voltage	V_{CBO}	40	Vdc
Emitter–Base Voltage	V_{EBO}	5.0	Vdc
Collector Current — Continuous	I_C	200	mA _{dc}
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	625 5.0	mW mW/ $^\circ\text{C}$
Total Power Dissipation @ $T_A = 60^\circ\text{C}$	P_D	250	mW
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°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(1)

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 (2) ($I_C = 1.0 \text{ mA}_{dc}$, $I_B = 0$)	$V_{(BR)CEO}$	40	—	Vdc
Collector–Base Breakdown Voltage ($I_C = 10 \text{ }\mu\text{A}_{dc}$, $I_E = 0$)	$V_{(BR)CBO}$	40	—	Vdc
Emitter–Base Breakdown Voltage ($I_E = 10 \text{ }\mu\text{A}_{dc}$, $I_C = 0$)	$V_{(BR)EBO}$	5.0	—	Vdc
Base Cutoff Current ($V_{CE} = 30 \text{ Vdc}$, $V_{EB} = 3.0 \text{ Vdc}$)	I_{BL}	—	50	nA _{dc}
Collector Cutoff Current ($V_{CE} = 30 \text{ Vdc}$, $V_{EB} = 3.0 \text{ Vdc}$)	I_{CEX}	—	50	nA _{dc}

1. Indicates Data in addition to JEDEC Requirements.
2. Pulse Test: Pulse Width $\leq 300 \text{ }\mu\text{s}$; Duty Cycle $\leq 2.0\%$.

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

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

Characteristic		Symbol	Min	Max	Unit
ON CHARACTERISTICS⁽¹⁾					
DC Current Gain ($I_C = 0.1\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	2N3905 2N3906	h_{FE}	30 60	— —	—
($I_C = 1.0\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	2N3905 2N3906		40 80	— —	
($I_C = 10\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	2N3905 2N3906		50 100	150 300	
($I_C = 50\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	2N3905 2N3906		30 60	— —	
($I_C = 100\text{ mA}$, $V_{CE} = 1.0\text{ Vdc}$)	2N3905 2N3906		15 30	— —	
Collector–Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) ($I_C = 50\text{ mA}$, $I_B = 5.0\text{ mA}$)		$V_{CE(sat)}$	— —	0.25 0.4	Vdc
Base–Emitter Saturation Voltage ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$) ($I_C = 50\text{ mA}$, $I_B = 5.0\text{ mA}$)		$V_{BE(sat)}$	0.65 —	0.85 0.95	Vdc

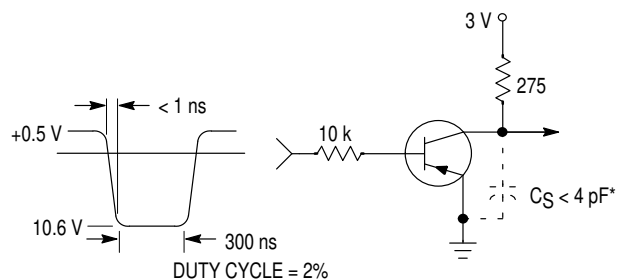
SMALL–SIGNAL CHARACTERISTICS

Current–Gain — Bandwidth Product ($I_C = 10\text{ mA}$, $V_{CE} = 20\text{ Vdc}$, $f = 100\text{ MHz}$)	2N3905 2N3906	f_T	200 250	— —	MHz
Output Capacitance ($V_{CB} = 5.0\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)		C_{obo}	—	4.5	pF
Input Capacitance ($V_{EB} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 1.0\text{ MHz}$)		C_{ibo}	—	10.0	pF
Input Impedance ($I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$)	2N3905 2N3906	h_{ie}	0.5 2.0	8.0 12	k Ω
Voltage Feedback Ratio ($I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$)	2N3905 2N3906	h_{re}	0.1 0.1	5.0 10	$\times 10^{-4}$
Small–Signal Current Gain ($I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$)	2N3905 2N3906	h_{fe}	50 100	200 400	—
Output Admittance ($I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ Vdc}$, $f = 1.0\text{ kHz}$)	2N3905 2N3906	h_{oe}	1.0 3.0	40 60	μmhos
Noise Figure ($I_C = 100\text{ }\mu\text{A}$, $V_{CE} = 5.0\text{ Vdc}$, $R_S = 1.0\text{ k}\Omega$, $f = 1.0\text{ kHz}$)	2N3905 2N3906	NF	— —	5.0 4.0	dB

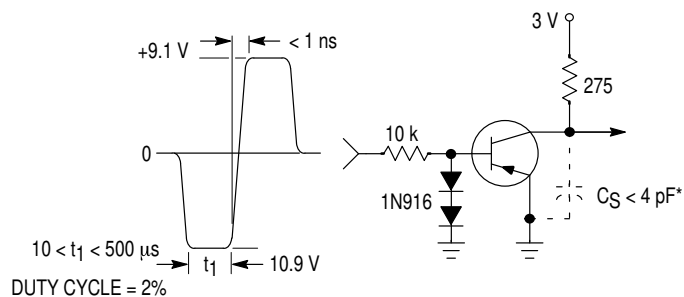
SWITCHING CHARACTERISTICS

Delay Time	(V _{CC} = 3.0 Vdc, V _{BE} = 0.5 Vdc, I _C = 10 mA, I _{B1} = 1.0 mA)	t _d	—	35	ns
Rise Time		t _r	—	35	ns
Storage Time	2N3905 2N3906	t _s	— —	200 225	ns
Fall Time	(V _{CC} = 3.0 Vdc, I _C = 10 mA, I _{B1} = I _{B2} = 1.0 mA)	t _f	— —	60 75	ns

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



**Figure 1. Delay and Rise Time
Equivalent Test Circuit**



**Figure 2. Storage and Fall Time
Equivalent Test Circuit**

* Total shunt capacitance of test jig and connectors

TYPICAL TRANSIENT CHARACTERISTICS

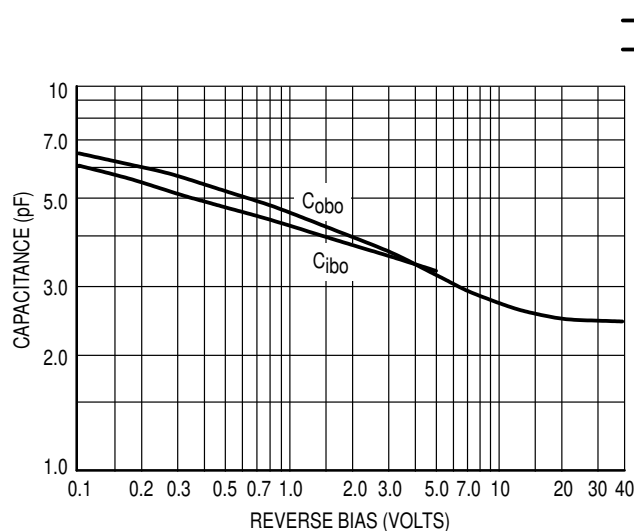


Figure 3. Capacitance

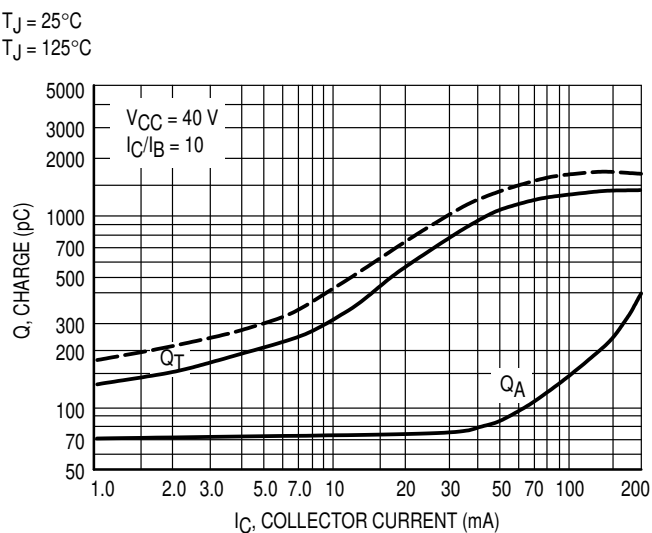


Figure 4. Charge Data

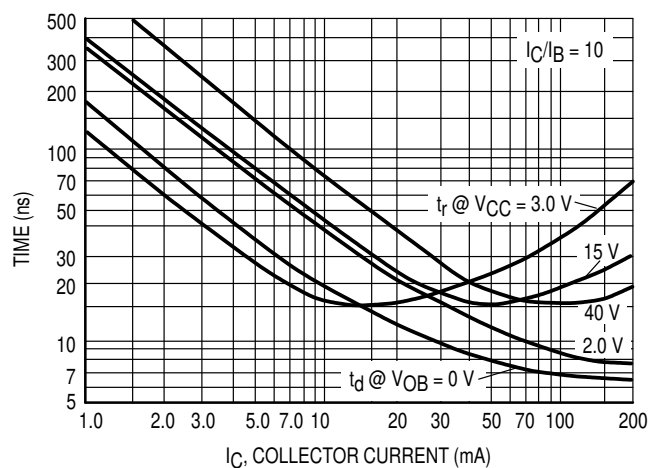


Figure 5. Turn-On Time

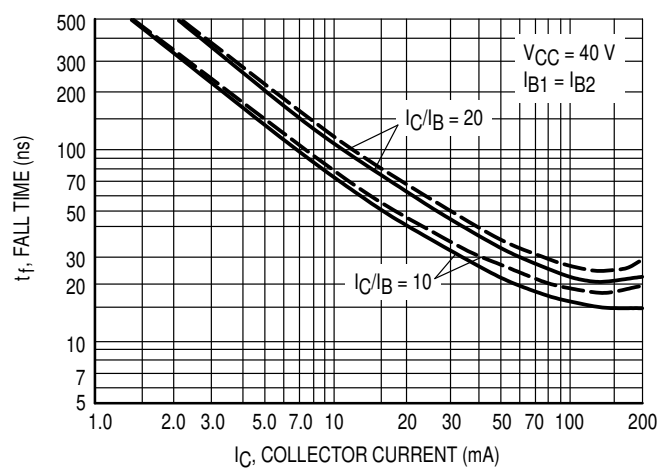


Figure 6. Fall Time

TYPICAL AUDIO SMALL-SIGNAL CHARACTERISTICS NOISE FIGURE VARIATIONS

($V_{CE} = -5.0$ Vdc, $T_A = 25^\circ\text{C}$, Bandwidth = 1.0 Hz)

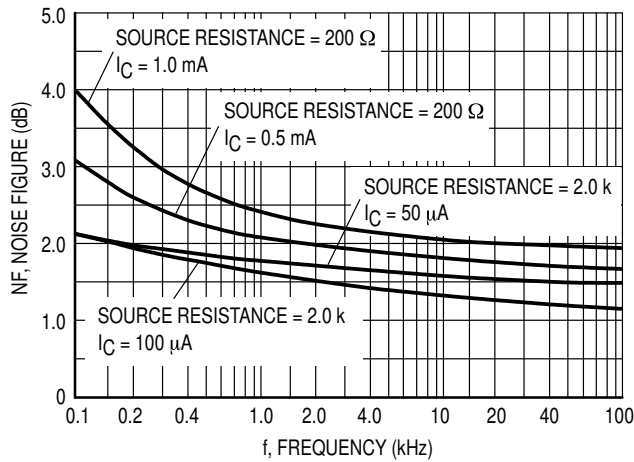


Figure 7.

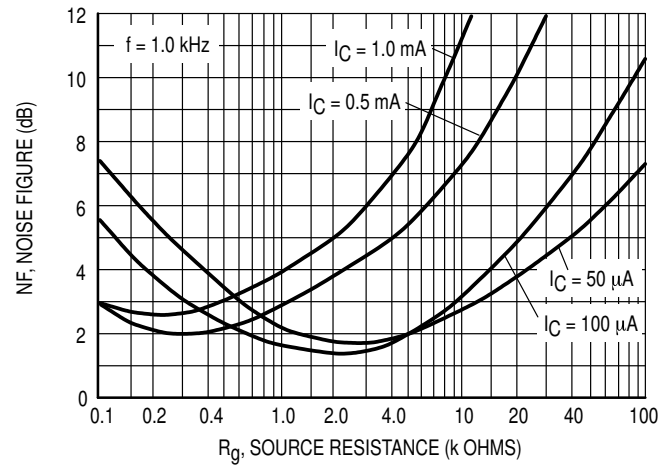


Figure 8.

h PARAMETERS

($V_{CE} = -10$ Vdc, $f = 1.0$ kHz, $T_A = 25^\circ\text{C}$)

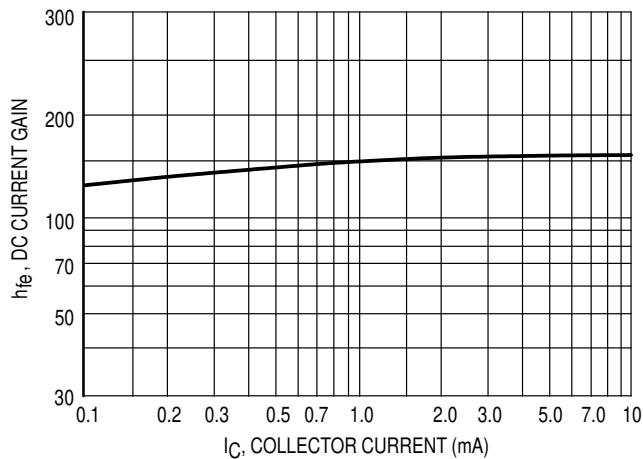


Figure 9. Current Gain

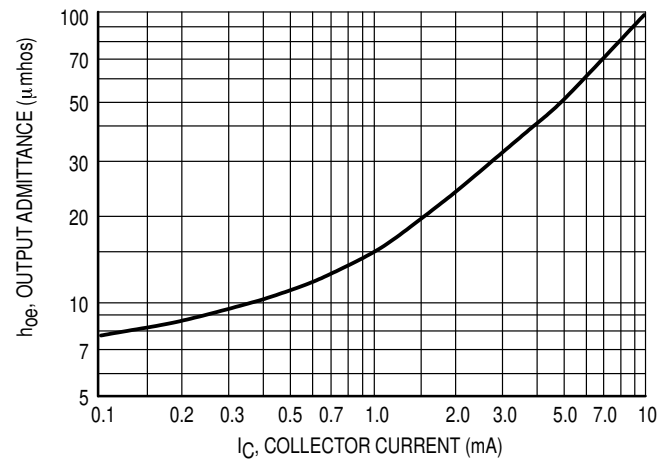


Figure 10. Output Admittance

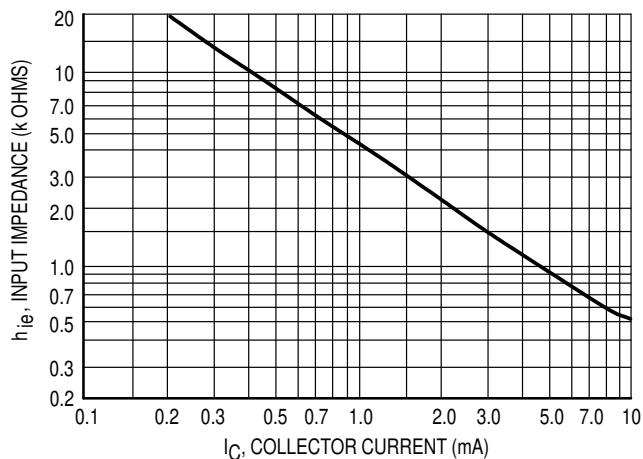


Figure 11. Input Impedance

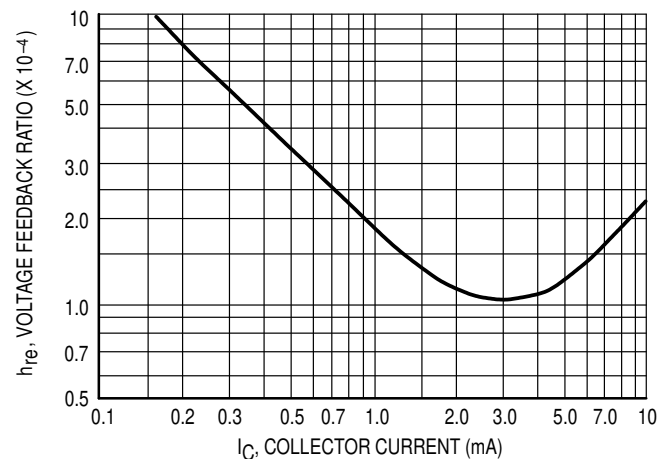


Figure 12. Voltage Feedback Ratio

TYPICAL STATIC CHARACTERISTICS

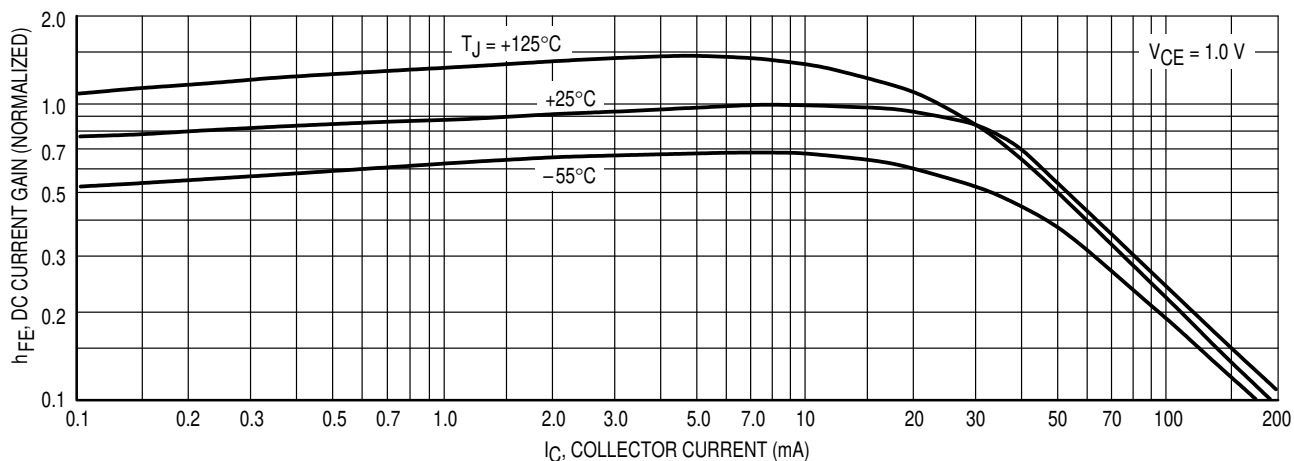


Figure 13. DC Current Gain

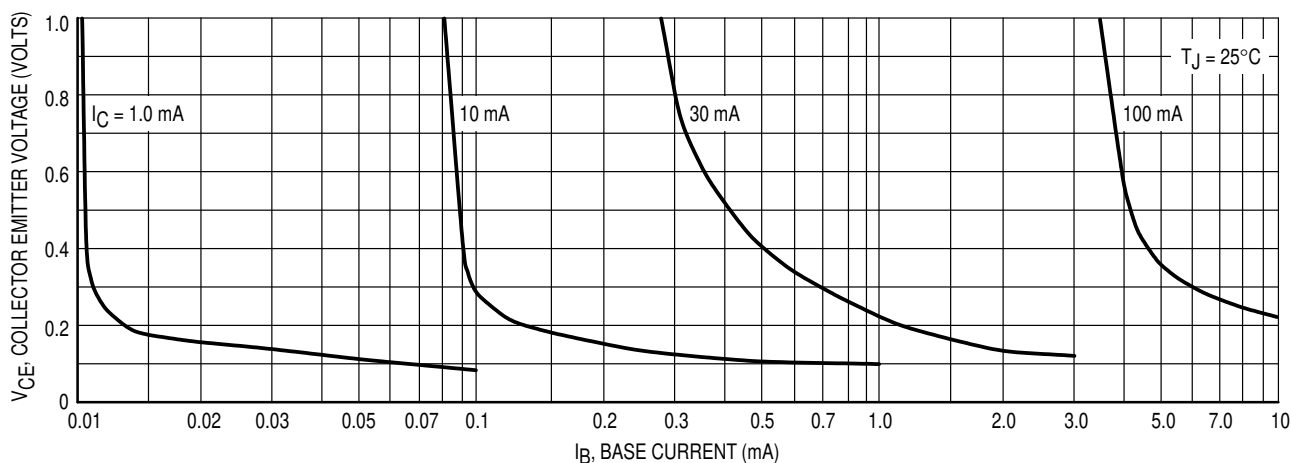


Figure 14. Collector Saturation Region

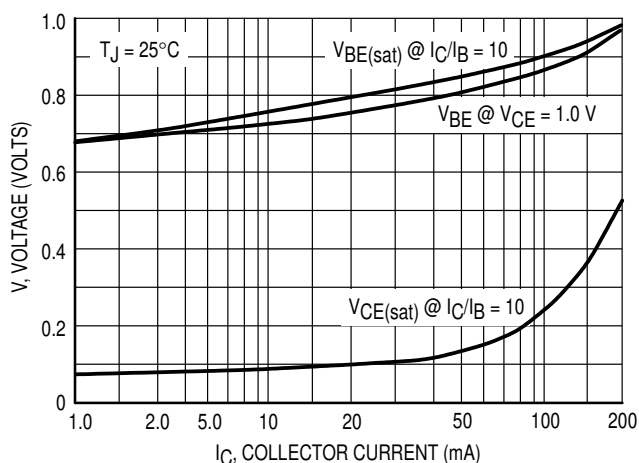


Figure 15. "ON" Voltages

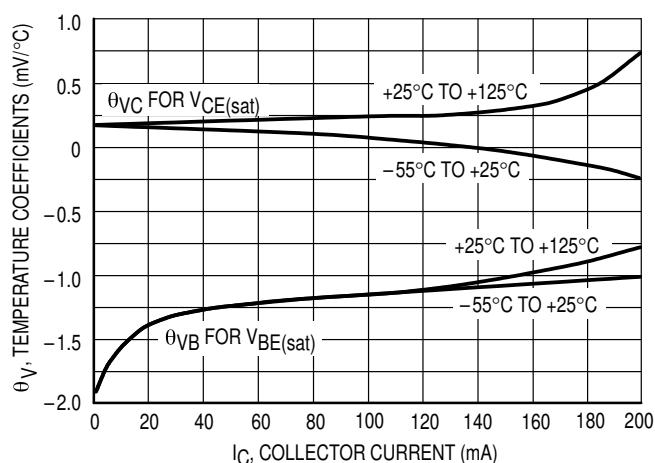
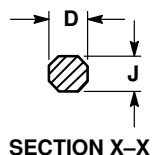
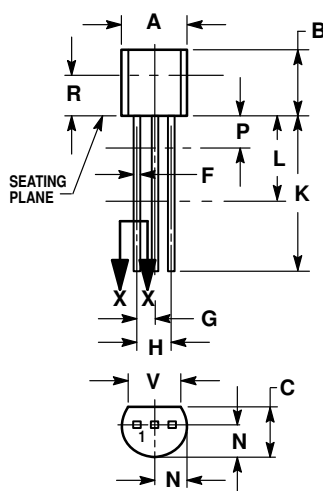


Figure 16. Temperature Coefficients

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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