ON Semiconductor™

# General Purpose Transistors
PNP Silicon

2N4403

**ON Semiconductor Preferred Device**

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	600	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	625 5.0	mW mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.5 12	Watt mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−55 to +150	°C

**CASE 29–11, STYLE 1
TO–92 (TO–226AA)**
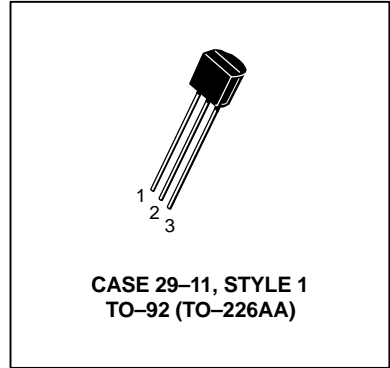
THERMAL CHARACTERISTICS

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

COLLECTOR
3

2
BASE

1
EMITTER
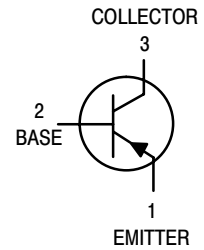
ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector–Emitter Breakdown Voltage[1] (I_C = 1.0 mAdc, I_B = 0)	$V_{(BR)CEO}$	40	—	Vdc
Collector–Base Breakdown Voltage (I_C = 0.1 mAdc, I_E = 0)	$V_{(BR)CBO}$	40	—	Vdc
Emitter–Base Breakdown Voltage (I_E = 0.1 mAdc, I_C = 0)	$V_{(BR)EBO}$	5.0	—	Vdc
Base Cutoff Current (V_{CE} = 35 Vdc, V_{EB} = 0.4 Vdc)	I_{BEV}	—	0.1	μAdc
Collector Cutoff Current (V_{CE} = 35 Vdc, V_{EB} = 0.4 Vdc)	I_{CEX}	—	0.1	μAdc

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

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

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS				
DC Current Gain (I_C = 0.1 mAdc, V_{CE} = 1.0 Vdc) (I_C = 1.0 mAdc, V_{CE} = 1.0 Vdc) (I_C = 10 mAdc, V_{CE} = 1.0 Vdc) (I_C = 150 mAdc, V_{CE} = 2.0 Vdc)[1] (I_C = 500 mAdc, V_{CE} = 2.0 Vdc)[1]	h_{FE}	30 60 100 100 20	— — — 300 —	—
Collector–Emitter Saturation Voltage[1] (I_C = 150 mAdc, I_B = 15 mAdc) (I_C = 500 mAdc, I_B = 50 mAdc)	$V_{CE(sat)}$	— —	0.4 0.75	Vdc
Base–Emitter Saturation Voltage[1] (I_C = 150 mAdc, I_B = 15 mAdc) (I_C = 500 mAdc, I_B = 50 mAdc)	$V_{BE(sat)}$	0.75 —	0.95 1.3	Vdc
SMALL–SIGNAL CHARACTERISTICS				
Current–Gain — Bandwidth Product (I_C = 20 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)	f_T	200	—	MHz
Collector–Base Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	C_{cb}	—	8.5	pF
Emitter–Base Capacitance (V_{EB} = 0.5 Vdc, I_C = 0, f = 1.0 MHz)	C_{eb}	—	30	pF
Input Impedance (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{ie}	1.5 k	15 k	ohms
Voltage Feedback Ratio (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{re}	0.1	8.0	X 10^{-4}
Small–Signal Current Gain (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{fe}	60	500	—
Output Admittance (I_C = 1.0 mAdc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{oe}	1.0	100	μmhos
SWITCHING CHARACTERISTICS				
Delay Time	(V_{CC} = 30 Vdc, V_{BE} = +2.0 Vdc, I_C = 150 mAdc, I_{B1} = 15 mAdc)	t_d	—	15	ns
Rise Time		t_r	—	20	ns
Storage Time	(V_{CC} = 30 Vdc, I_C = 150 mAdc, I_{B1} = 15 mA, I_{B2} = 15 mA)	t_s	—	225	ns
Fall Time		t_f	—	30	ns

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

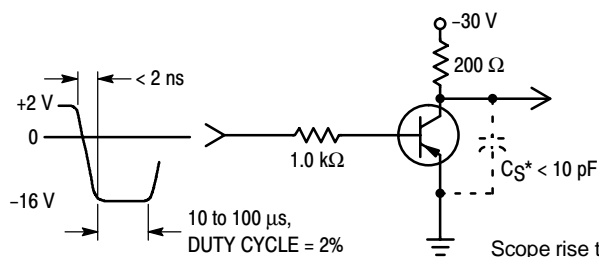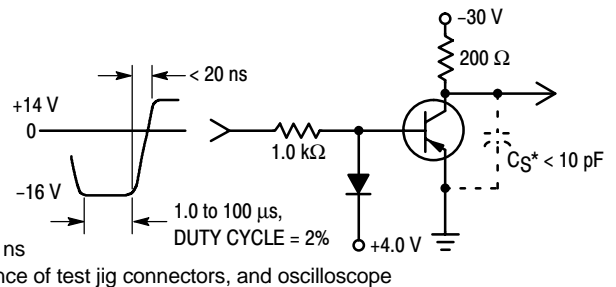## SWITCHING TIME EQUIVALENT TEST CIRCUIT

Figure 1. Turn–On Time

Figure 2. Turn–Off Time

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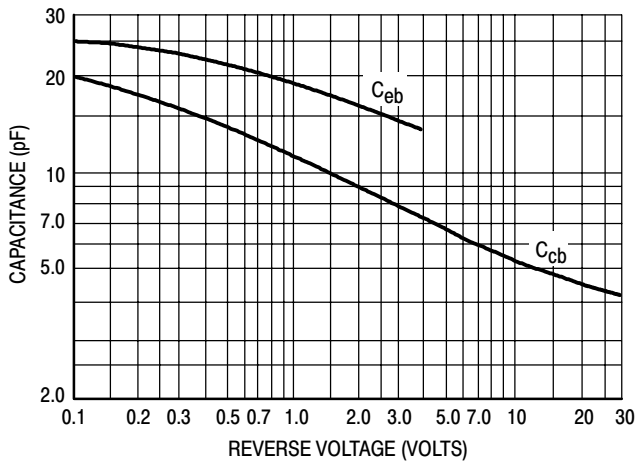## TRANSIENT CHARACTERISTICS

——— 25°C   — — 100°C

Figure 3. Capacitances
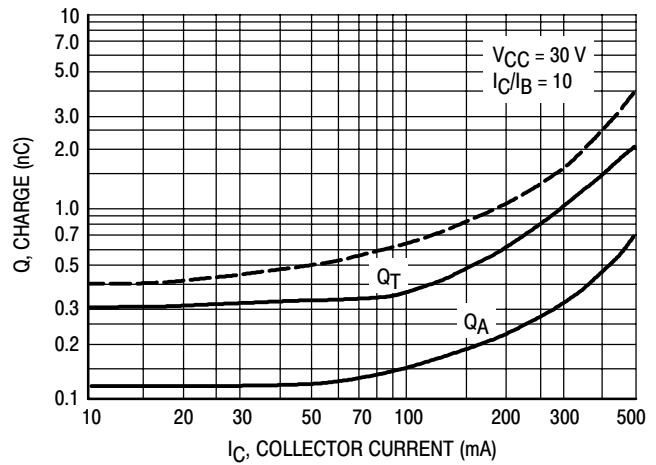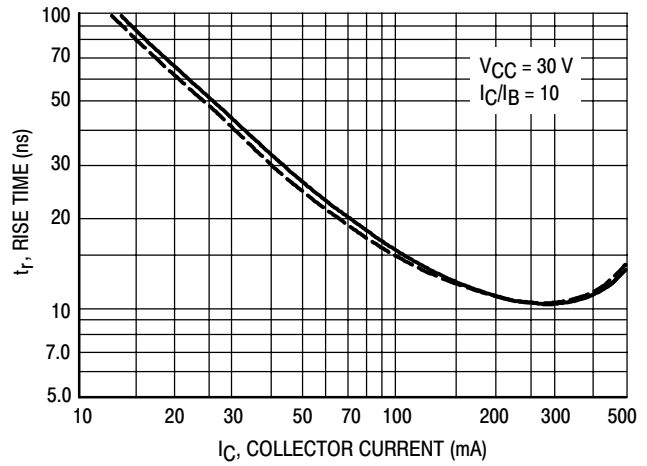

Figure 4. Charge Data
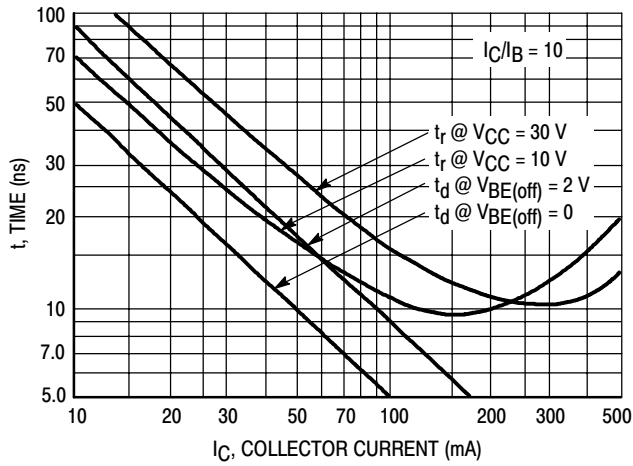
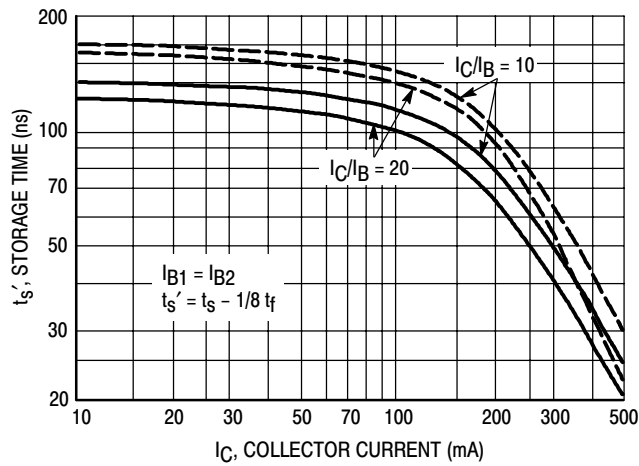

Figure 5. Turn–On Time

Figure 6. Rise Time

Figure 7. Storage Time

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SMALL–SIGNAL CHARACTERISTICS
NOISE FIGURE
V_{CE} = −10 Vdc, T_A = 25°C; Bandwidth = 1.0 Hz
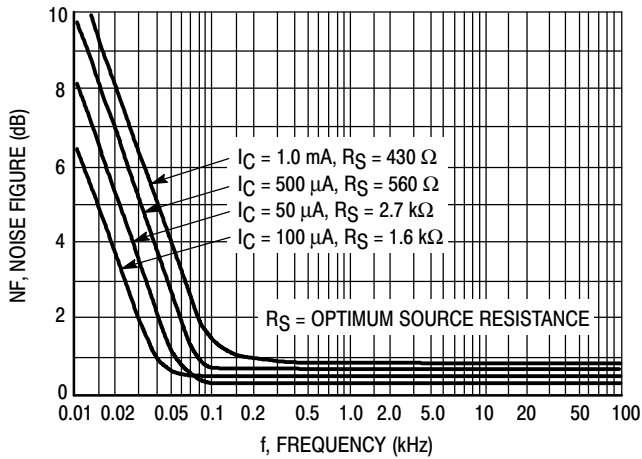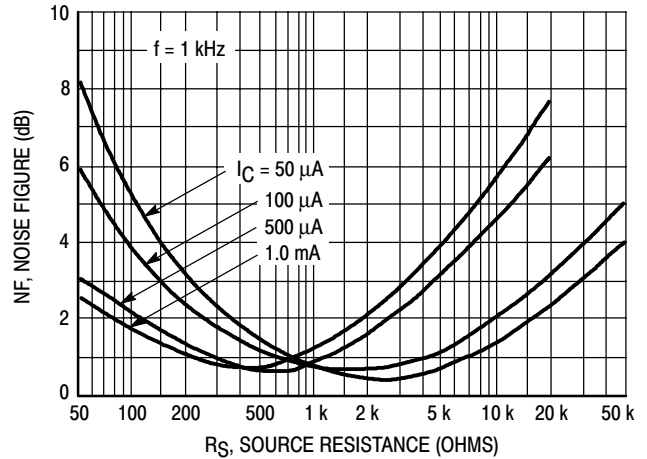

Figure 8. Frequency Effects

Figure 9. Source Resistance Effects

h PARAMETERS
V_{CE} = −10 Vdc, f = 1.0 kHz, T_A = 25°C

This group of graphs illustrates the relationship between h_{fe} and other "h" parameters for this series of transistors. To obtain these curves, a high–gain and a low–gain unit were selected from the 2N4403 lines, and the same units were used to develop the correspondingly–numbered curves on each graph.
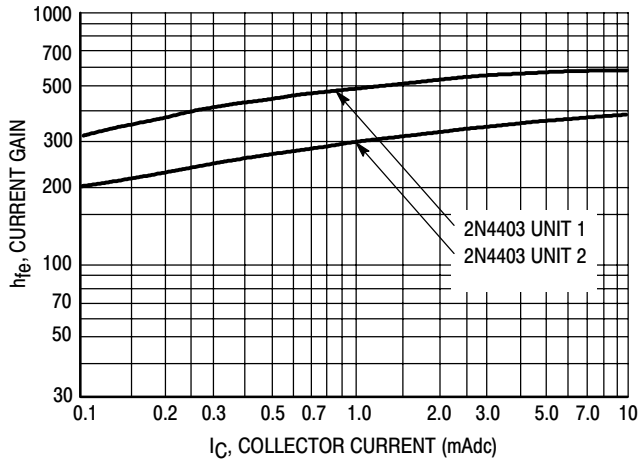
Figure 10. Current Gain
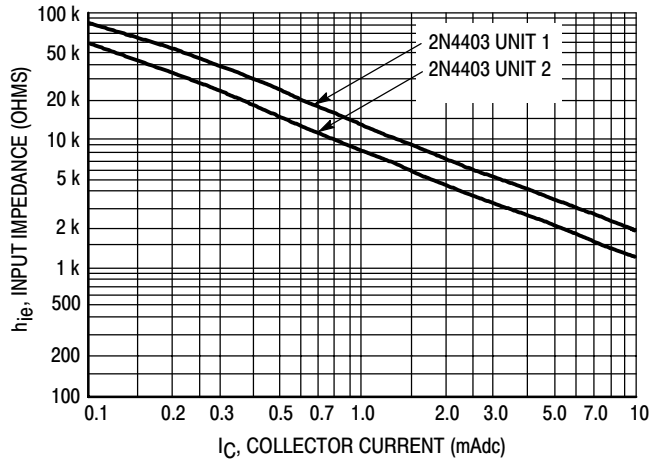
Figure 11. Input Impedance
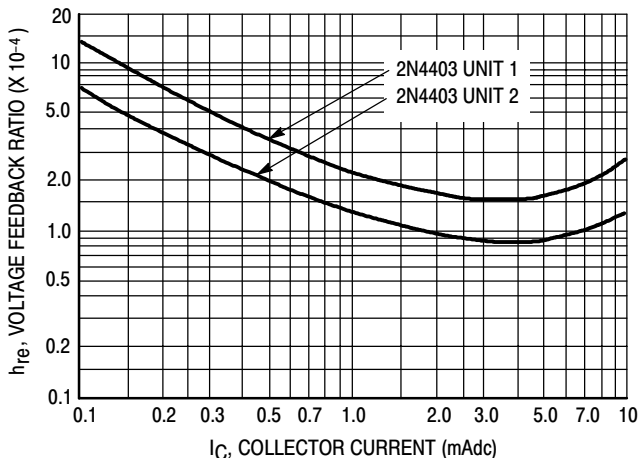
Figure 12. Voltage Feedback Ratio
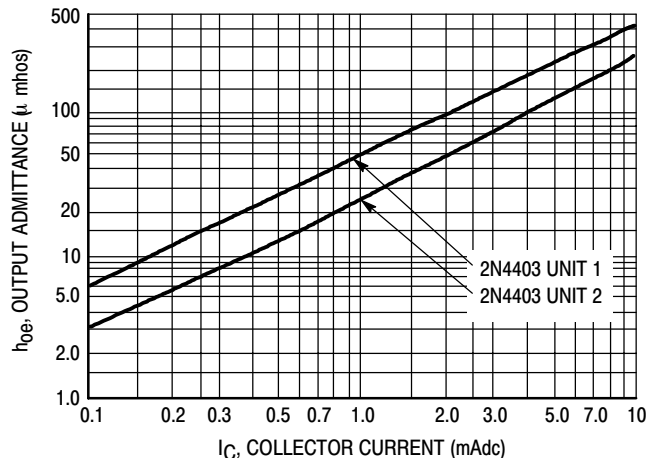
Figure 13. Output Admittance

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STATIC CHARACTERISTICS
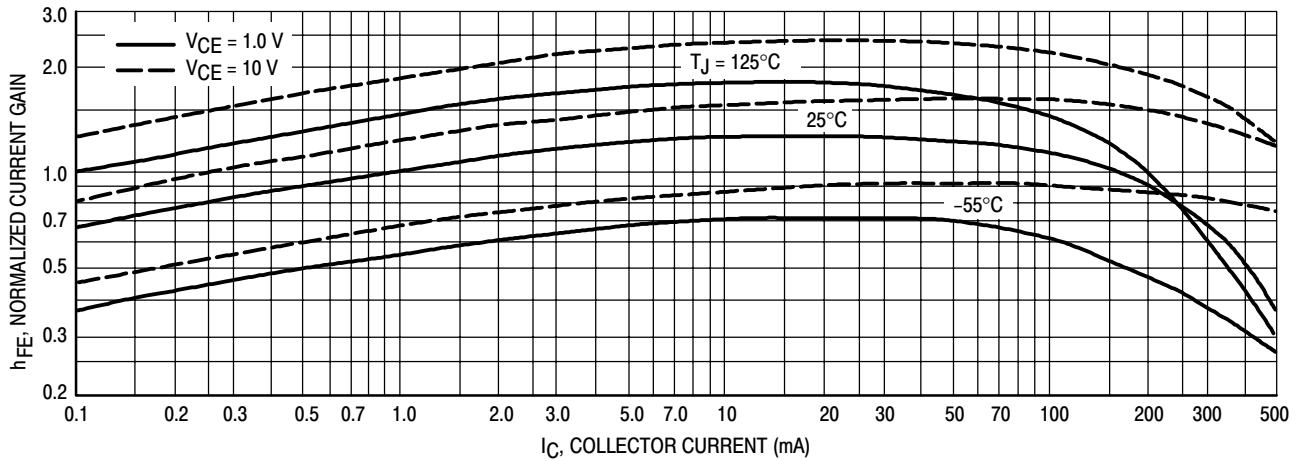
Figure 14. DC Current Gain
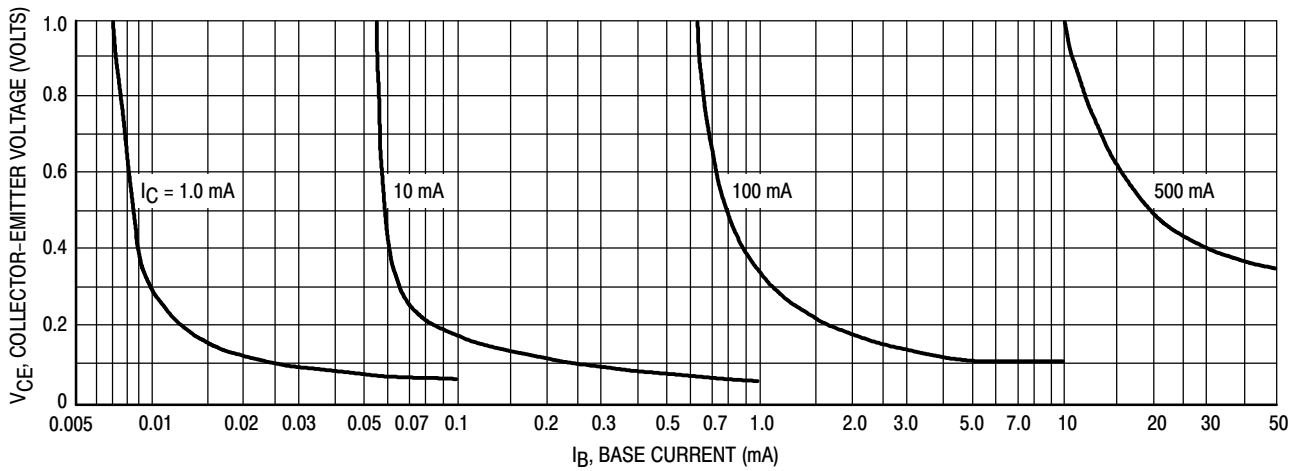
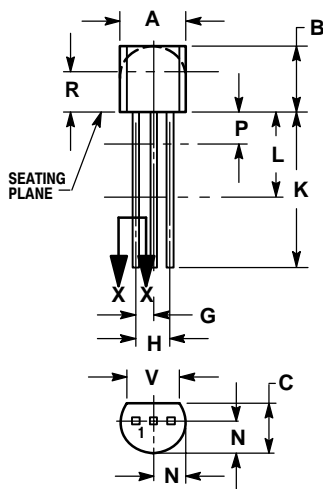

Figure 15. Collector Saturation Region
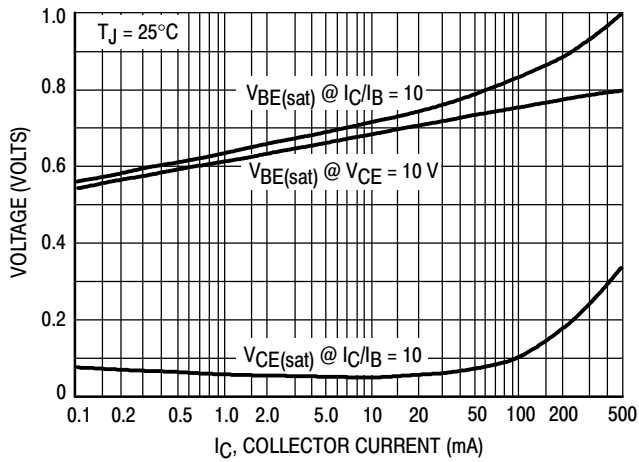
Figure 16. "On" Voltages
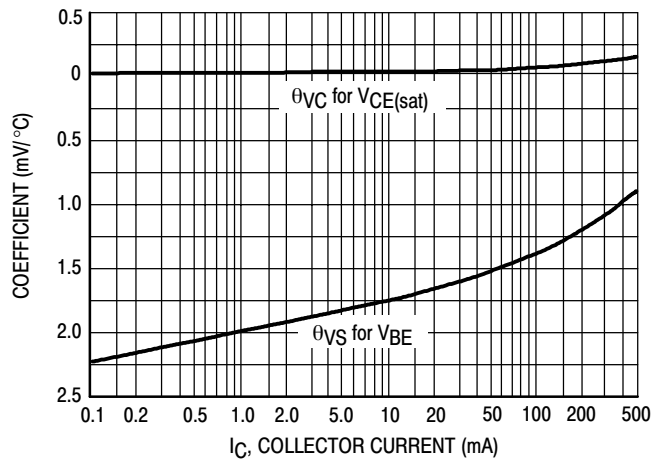
Figure 17. Temperature Coefficients

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PACKAGE DIMENSIONS

TO–92 (TO–226)
CASE 29–11
ISSUE AL

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. 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	0.021	0.407	0.533
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	---

SECTION X–X

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

Notes

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