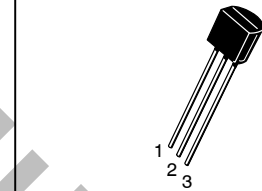**ON Semiconductor™**

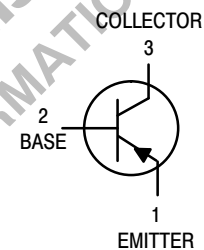# Switching Transistor
PNP Silicon

- This device is available in Pb−free package(s). Specifications herein apply to both standard and Pb−free devices. Please see our website at www.onsemi.com for specific Pb−free orderable part numbers, or contact your local ON Semiconductor sales office or representative.

MPS3638A

CASE 29−11, STYLE 1
TO−92 (TO−226AA)

COLLECTOR
3

2
BASE

1
EMITTER

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector – Emitter Voltage	V_{CEO}	−25	Vdc
Collector – Emitter Voltage	V_{CES}	−25	Vdc
Collector – Base Voltage	V_{CBO}	−25	Vdc
Emitter – Base Voltage	V_{EBO}	−4.0	Vdc
Collector Current — Continuous	I_C	−500	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	Watts mW/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	− 55 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$[1]	200	°C/W
Thermal Resistance, Junction to Case	$R_{\theta JC}$	83.3	°C/W

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector – Emitter Breakdown Voltage (I_C = −100 μAdc, V_{BE} = 0)	$V_{(BR)CES}$	−25	—	Vdc
Collector – Emitter Sustaining Voltage[2] (I_C = −10 mAdc, I_B = 0)	$V_{CEO(sus)}$	−25	—	Vdc
Collector – Base Breakdown Voltage (I_C = −100 μAdc, I_E = 0)	$V_{(BR)CBO}$	−25	—	Vdc
Emitter – Base Breakdown Voltage (I_E = −100 μAdc, I_C = 0)	$V_{(BR)EBO}$	−4.0	—	Vdc
Collector Cutoff Current (V_{CE} = −15 Vdc, V_{BE} = 0) (V_{CE} = −15 Vdc, V_{BE} = 0, T_A = −65°C)	I_{CES}	— —	−0.035 −2.0	μAdc
Emitter Cutoff Current (V_{EB} = −3.0 V, I_C = 0)	I_{EBO}	—	−35	nA
Base Current (V_{CE} = −15 Vdc, V_{BE} = 0)	I_B	—	−0.035	μAdc

1. $R_{\theta JA}$ is measured with the device soldered into a typical printed circuit board.
2. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2.0%.

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

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS[2]				
DC Current Gain (I_C = −1.0 mAdc, V_{CE} = −10 Vdc) (I_C = −10 mAdc, V_{CE} = −10 Vdc) (I_C = −50 mAdc, V_{CE} = −1.0 Vdc) (I_C = −300 mAdc, V_{CE} = −2.0 Vdc)	h_{FE}	 80 100 100 20	 — — — —	—
Collector − Emitter Saturation Voltage (I_C = −50 mAdc, I_B = −2.5 mAdc) (I_C = −300 mAdc, I_B = −30 mAdc)	$V_{CE(sat)}$	 — —	 −0.25 −1.0	Vdc
Base − Emitter Saturation Voltage (I_C = −50 mAdc, I_B = −2.5 mAdc) (I_C = −300 mAdc, I_B = −30 mAdc)	$V_{BE(sat)}$	 — −0.80	 −1.1 −2.0	Vdc
SMALL − SIGNAL CHARACTERISTICS				
Current − Gain — Bandwidth Product (V_{CE} = −3.0 Vdc, I_C = −50 mAdc, f = 100 MHz)	f_T	150	—	MHz
Output Capacitance (V_{CB} = −10 Vdc, I_E = 0, f = 1.0 MHz)	C_{obo}	—	10	pF
Input Capacitance (V_{EB} = −0.5 Vdc, I_C = 0, f = 1.0 MHz)	C_{ibo}	—	25	pF
Input Impedance (I_C = −10 mAdc, V_{CE} = −10 Vdc, f = 1.0 kHz)	h_{ie}	—	2000	kΩ
Voltage Feedback Ratio (I_C = −10 mAdc, V_{CE} = −10 Vdc, f = 1.0 kHz)	h_{re}	—	15	X 10^{-4}
Small−Signal Current Gain (I_C = −10 mAdc, V_{CE} = −10 Vdc, f = 1.0 kHz)	h_{fe}	100	—	—
Output Admittance (I_C = −10 mAdc, V_{CE} = −10 Vdc, f = 1.0 kHz)	h_{oe}	—	1.2	mmhos
SWITCHING CHARACTERISTICS				
Delay Time	t_d	—	20	ns
Rise Time	t_r	—	70	ns
Storage Time	t_s	—	140	ns
Fall Time	t_f	—	70	ns
Turn−On Time (I_C = −300 mAdc, I_B = −30 mAdc)	t_{on}	—	75	ns
Turn−Off Time (I_C = −300 mAdc, I_{B1} = −30 mAdc, I_{B2} = 30 mAdc)	t_{off}	—	170	ns

Note for Delay Time / Rise Time: (V_{CC} = −10 Vdc, I_C = −300 mAdc, I_{B1} = −30 mAdc)

Note for Storage Time / Fall Time: (V_{CC} = −10 Vdc, I_C = −300 mAdc, I_{B1} = −30 mAdc, I_{B2} = −30 mAdc)

2. Pulse Test: Pulse Width ≤ 300 μs; Duty Cycle ≤ 2.0%.

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SWITCHING TIME EQUIVALENT TEST CIRCUIT

Figure 1. Turn−On Time

+2 V
0
−16 V

< 2 ns

10 to 100 μs,
DUTY CYCLE = 2%

1.0 kΩ

− 30 V
200 Ω

$C_S* < 10$ pF

Figure 2. Turn−Off Time

+14 V
0
−16 V

< 20 ns

1.0 to 100 μs,
DUTY CYCLE = 2%

1.0 kΩ

+ 4.0 V

− 30 V
200 Ω

$C_S* < 10$ pF

Scope rise time < 4.0 ns

*Total shunt capacitance of test jig connectors, and oscilloscope

TRANSIENT CHARACTERISTICS

25°C   100°C

Figure 3. Capacitances

CAPACITANCE (pF)
REVERSE VOLTAGE (VOLTS)
C_{eb}
C_{cb}

Figure 4. Charge Data
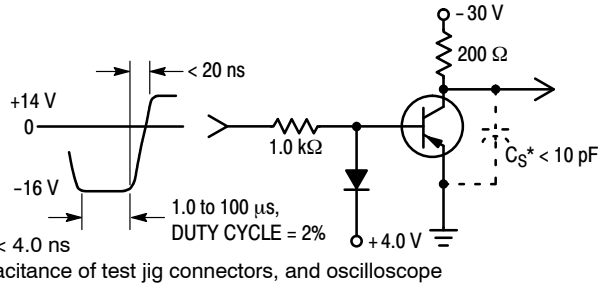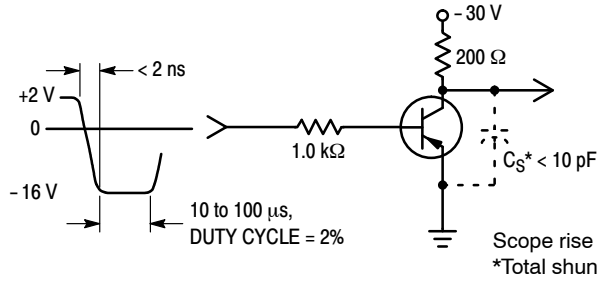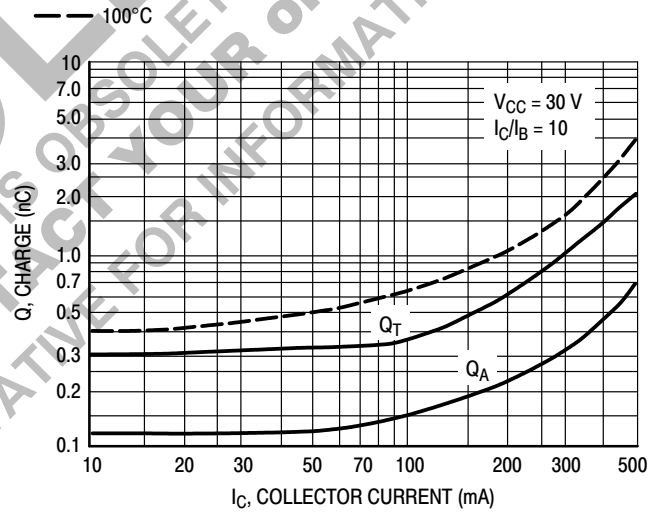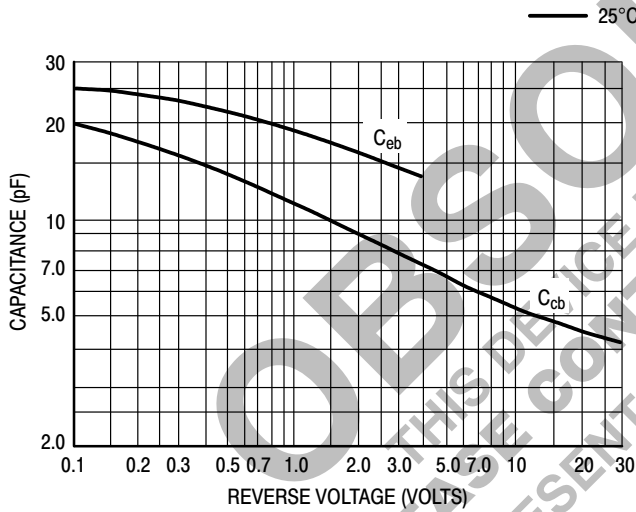
Q, CHARGE (nC)
I_C, COLLECTOR CURRENT (mA)
$V_{CC} = 30$ V
$I_C/I_B = 10$
Q_T
Q_A

TRANSIENT CHARACTERISTICS (Continued)

—— 25°C   — — 100°C
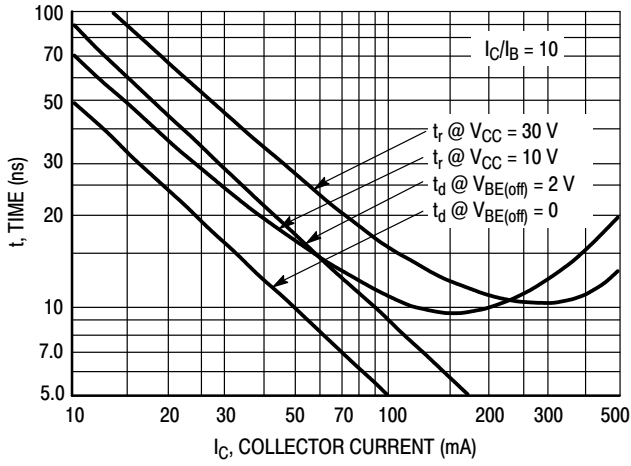
Figure 5. Turn−On Time
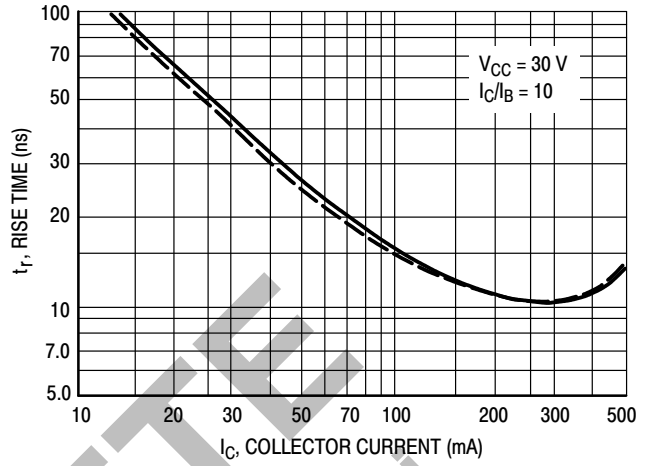
Figure 6. Rise Time
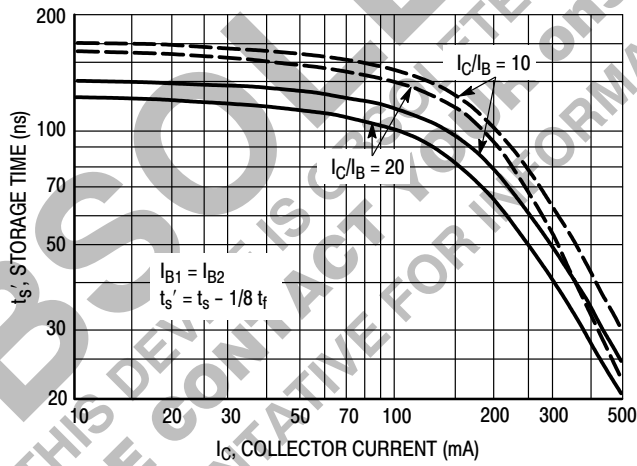
Figure 7. Storage Time

SMALL−SIGNAL CHARACTERISTICS
NOISE FIGURE
$V_{CE} = -10$ Vdc, $T_A = 25°C$
Bandwidth = 1.0 Hz
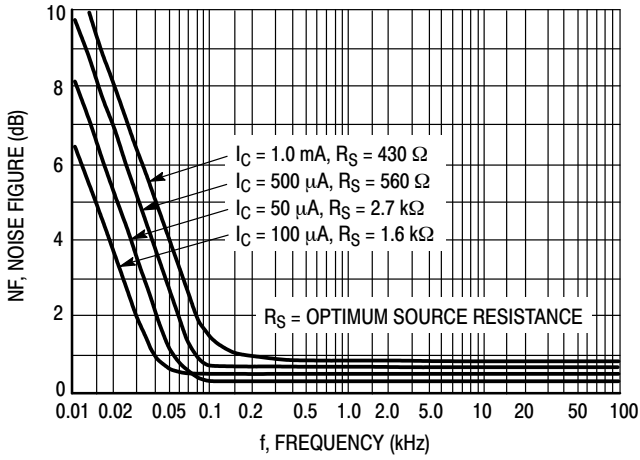
Figure 8. Frequency Effects
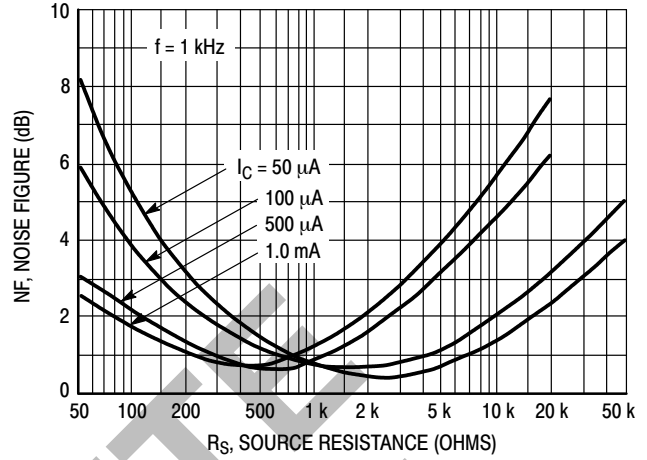
Figure 9. Source Resistance Effects

MPS3638A

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 2N4402 line, and the same units were used to develop the correspondingly−numbered curves on each graph.
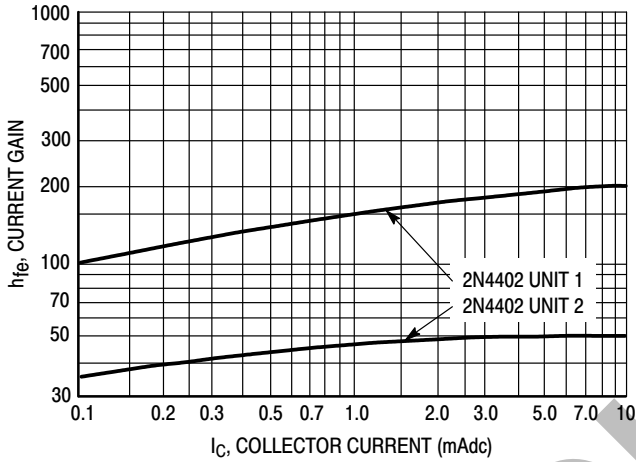
Figure 10. Current Gain
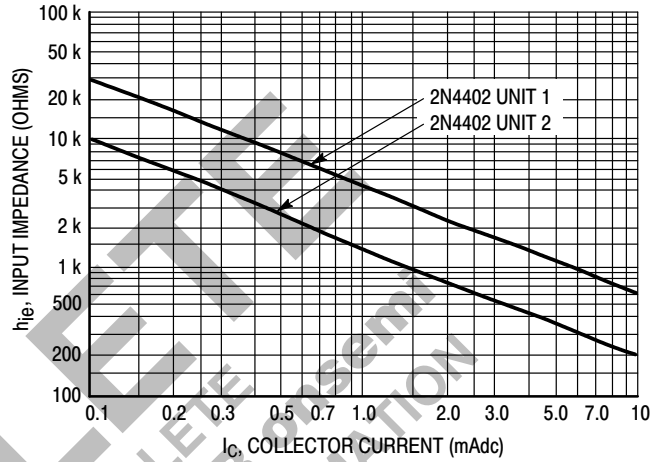
Figure 11. Input Impedance
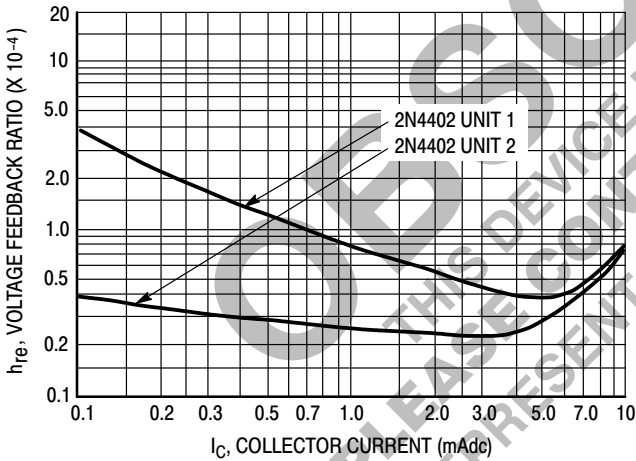
Figure 12. Voltage Feedback Ratio
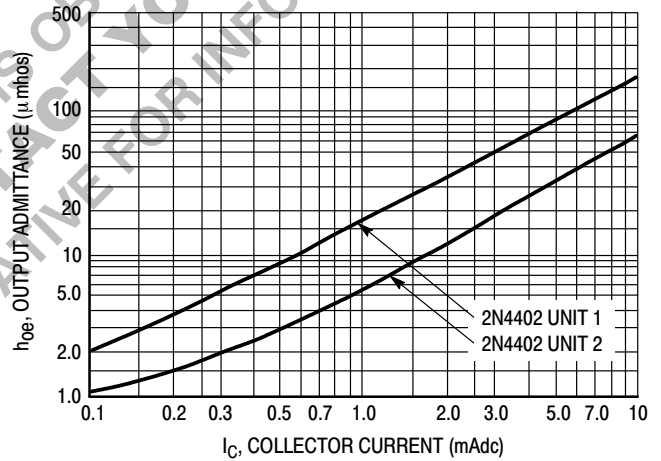
Figure 13. Output Admittance

STATIC CHARACTERISTICS
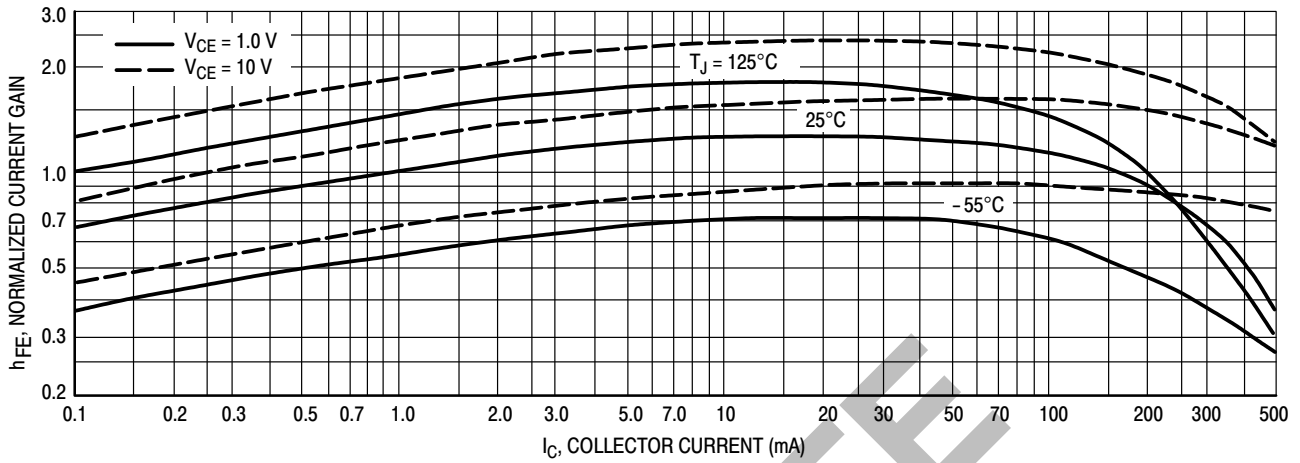
Figure 14. DC Current Gain
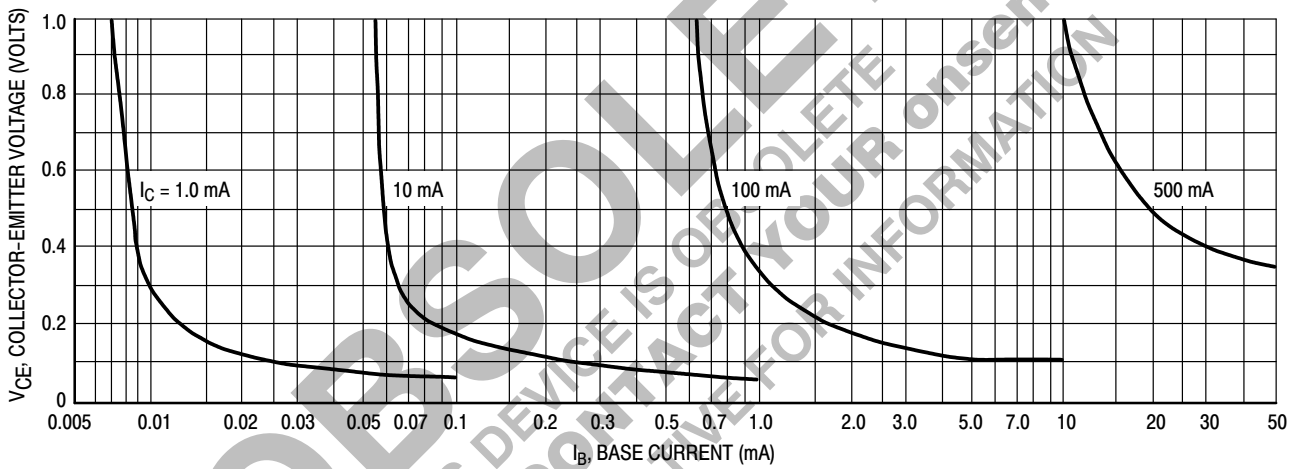
Figure 15. Collector Saturation Region
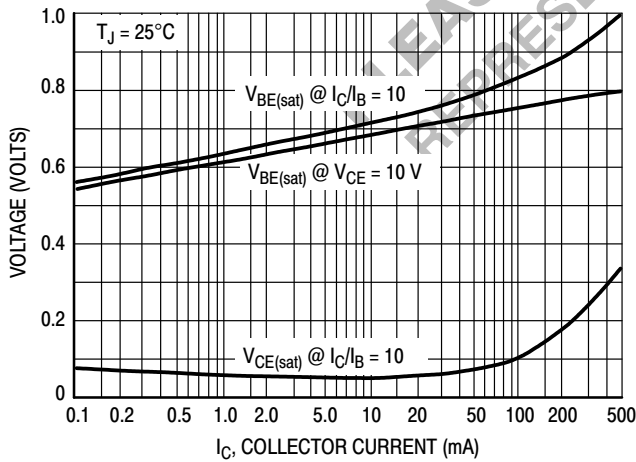
Figure 16. "On" Voltages
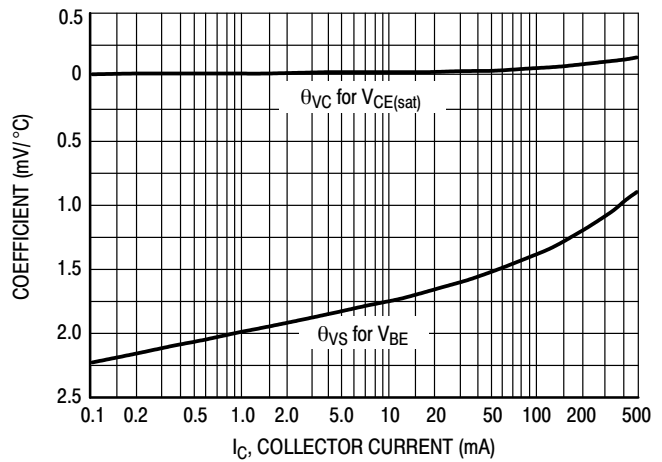
Figure 17. Temperature Coefficients

PACKAGE DIMENSIONS

CASE 029–11
(TO–226AA)
ISSUE AD
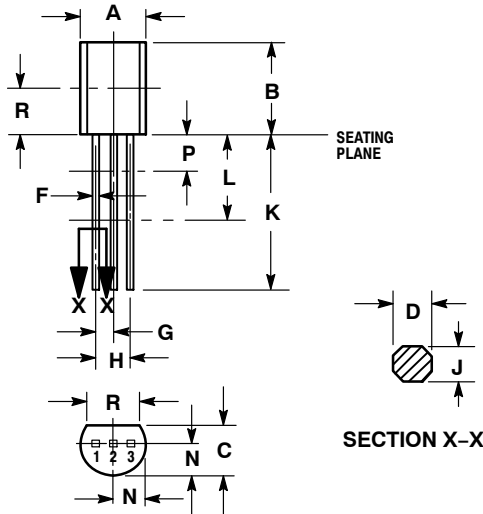
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSIONS D AND J APPLY BETWEEN L AND K MIMIMUM. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

SECTION X–X

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.44	5.21
B	0.290	0.310	7.37	7.87
C	0.125	0.165	3.18	4.19
D	0.018	0.021	0.457	0.533
F	0.016	0.019	0.407	0.482
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.018	0.024	0.46	0.61
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	0.135	---	3.43	---

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