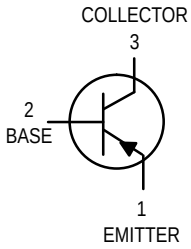
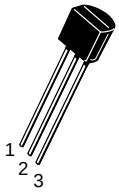
Switching Transistors
PNP Silicon

MPS3638,A





CASE 29–04, STYLE 1
TO–92 (TO–226AA)

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		h_{FE}			—
(I_C = –1.0 mAdc, V_{CE} = –10 Vdc)	MPS3638A		80	—	
(I_C = –10 mAdc, V_{CE} = –10 Vdc)	MPS3638		20	—	
	MPS3638A		100	—	
(I_C = –50 mAdc, V_{CE} = –1.0 Vdc)	MPS3638		30	—	
	MPS3638A		100	—	
(I_C = –300 mAdc, V_{CE} = –2.0 Vdc)	MPS3638		20	—	
	MPS3638A		20	—	
Collector–Emitter Saturation Voltage		$V_{CE(sat)}$			Vdc
(I_C = –50 mAdc, I_B = –2.5 mAdc)			—	–0.25	
(I_C = –300 mAdc, I_B = –30 mAdc)			—	–1.0	
Base–Emitter Saturation Voltage		$V_{BE(sat)}$			Vdc
(I_C = –50 mAdc, I_B = –2.5 mAdc)			—	–1.1	
(I_C = –300 mAdc, I_B = –30 mAdc)			–0.80	–2.0	
SMALL–SIGNAL CHARACTERISTICS					
Current–Gain — Bandwidth Product		f_T			MHz
(V_{CE} = –3.0 Vdc, I_C = –50 mAdc, f = 100 MHz)	MPS3638		100	—	
	MPS3638A		150	—	
Output Capacitance		C_{obo}			pF
(V_{CB} = –10 Vdc, I_E = 0, f = 1.0 MHz)	MPS3638		—	20	
	MPS3638A		—	10	
Input Capacitance		C_{ibo}			pF
(V_{EB} = –0.5 Vdc, I_C = 0, f = 1.0 MHz)	MPS3638		—	65	
	MPS3638A		—	25	
Input Impedance		h_{ie}	—	2000	kΩ
(I_C = –10 mAdc, V_{CE} = –10 Vdc, f = 1.0 kHz)					
Voltage Feedback Ratio		h_{re}			X 10^{-4}
(I_C = –10 mAdc, V_{CE} = –10 Vdc, f = 1.0 kHz)	MPS3638		—	26	
	MPS3638A		—	15	
Small–Signal Current Gain		h_{fe}			—
(I_C = –10 mAdc, V_{CE} = –10 Vdc, f = 1.0 kHz)	MPS3638		25	—	
	MPS3638A		100	—	
Output Admittance		h_{oe}	—	1.2	mmhos
(I_C = –10 mAdc, V_{CE} = –10 Vdc, f = 1.0 kHz)					
SWITCHING CHARACTERISTICS					
Delay Time	(V_{CC} = –10 Vdc, I_C = –300 mAdc, I_{B1} = –30 mAdc)	t_d	—	20	ns
Rise Time		t_r	—	70	ns
Storage Time	(V_{CC} = –10 Vdc, I_C = –300 mAdc, I_{B1} = –30 mAdc, I_{B2} = –30 mAdc)	t_s	—	140	ns
Fall Time		t_f	—	70	ns
Turn–On Time	(I_C = –300 mAdc, I_{B1} = –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

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

SWITCHING TIME EQUIVALENT TEST CIRCUIT

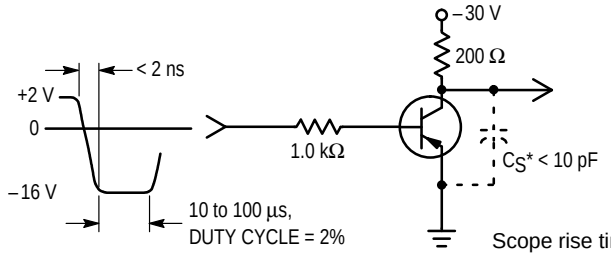
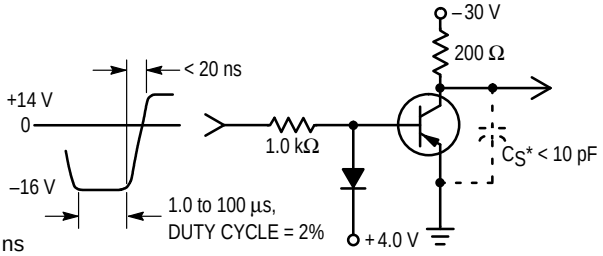


Figure 1. Turn–On Time



Scope rise time < 4.0 ns
*Total shunt capacitance of test jig connectors, and oscilloscope

Figure 2. Turn–Off Time

TRANSIENT CHARACTERISTICS

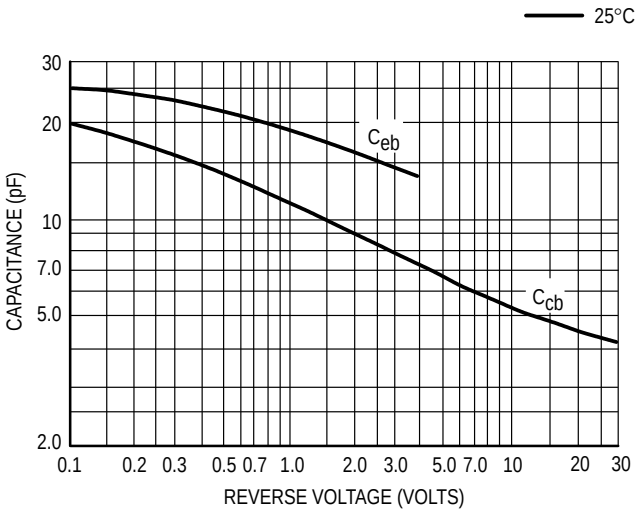


Figure 3. Capacitances

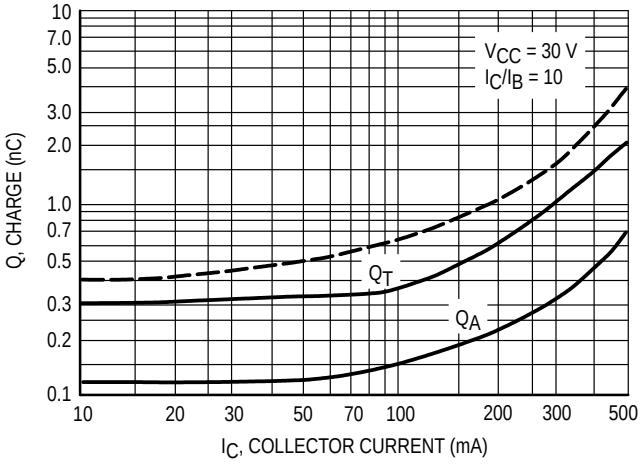


Figure 4. Charge Data

TRANSIENT CHARACTERISTICS (Continued)

25°C 100°C

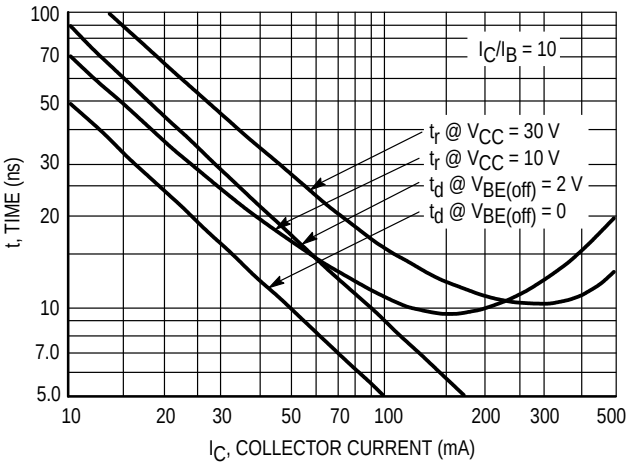


Figure 5. Turn–On Time

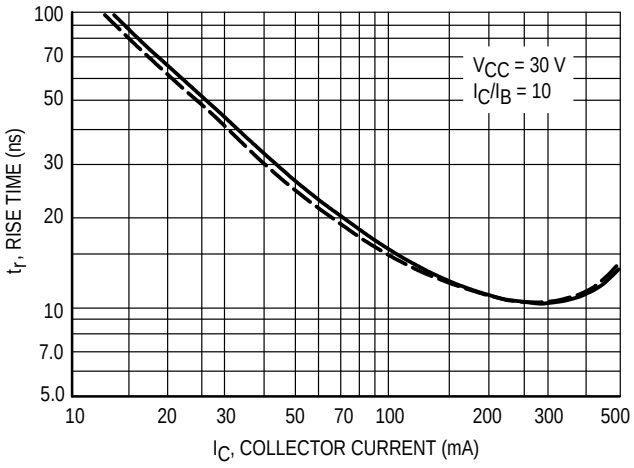


Figure 6. Rise Time

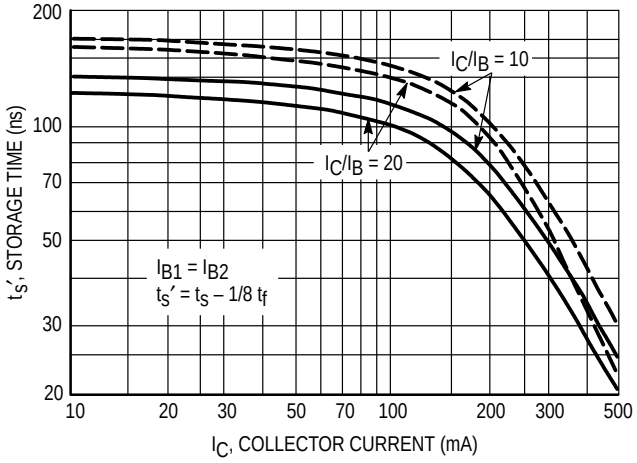


Figure 7. Storage Time

SMALL–SIGNAL CHARACTERISTICS

NOISE FIGURE

V_{CE} = –10 Vdc, T_A = 25°C
Bandwidth = 1.0 Hz

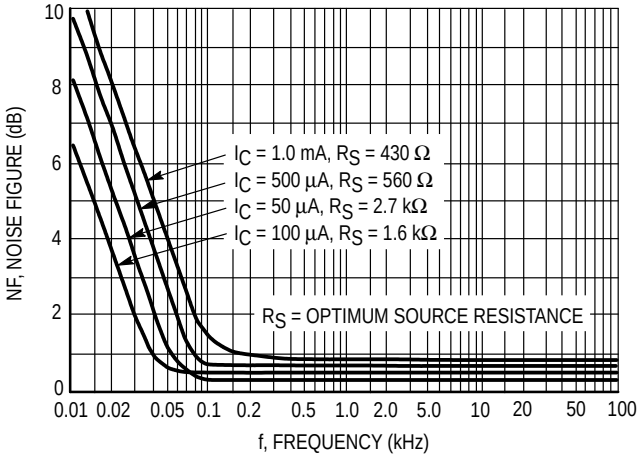


Figure 8. Frequency Effects

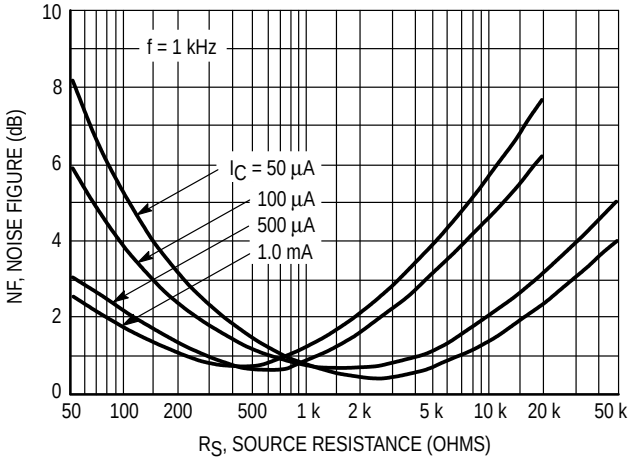


Figure 9. Source Resistance Effects

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 both the 2N4402 and 2N4403 lines, and the same units were used to develop the correspondingly–numbered curves on each graph.

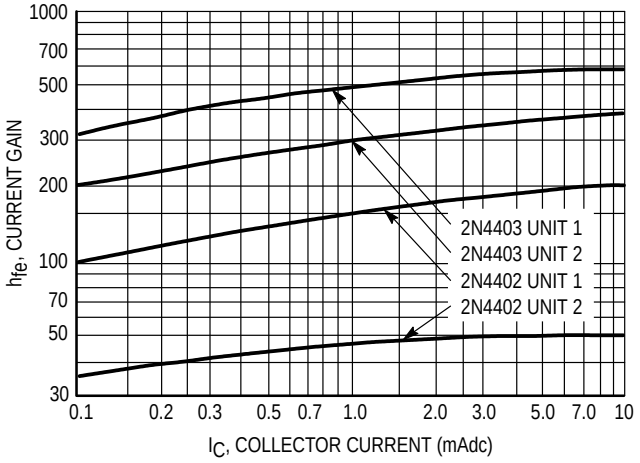


Figure 10. Current Gain

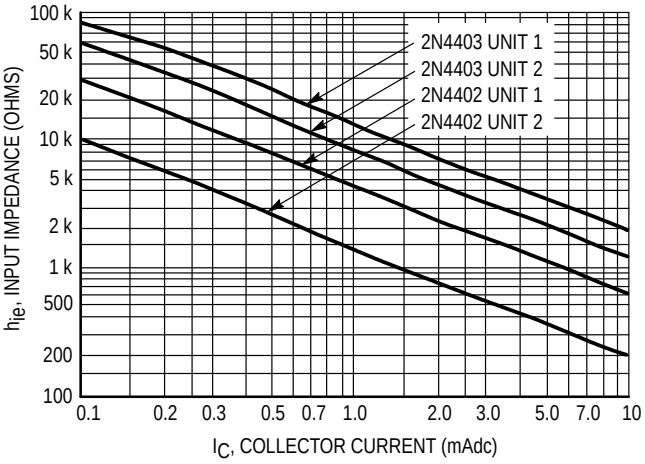


Figure 11. Input Impedance

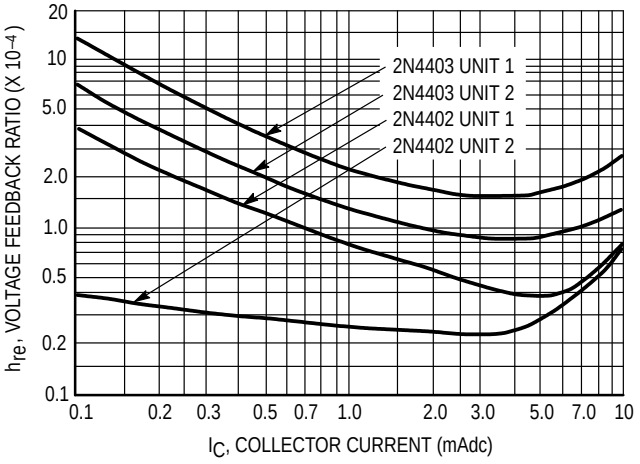


Figure 12. Voltage Feedback Ratio

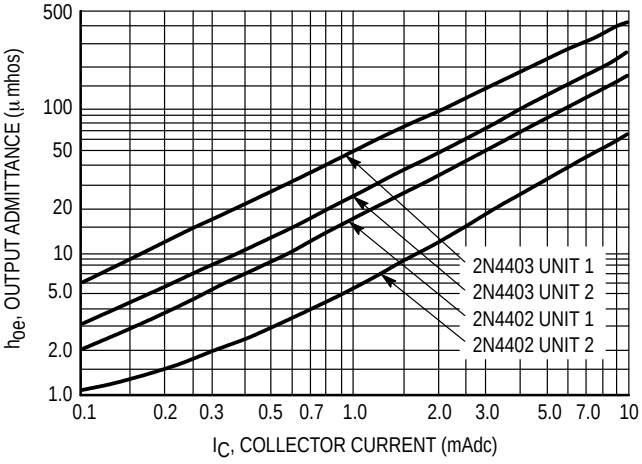


Figure 13. Output Admittance

STATIC CHARACTERISTICS

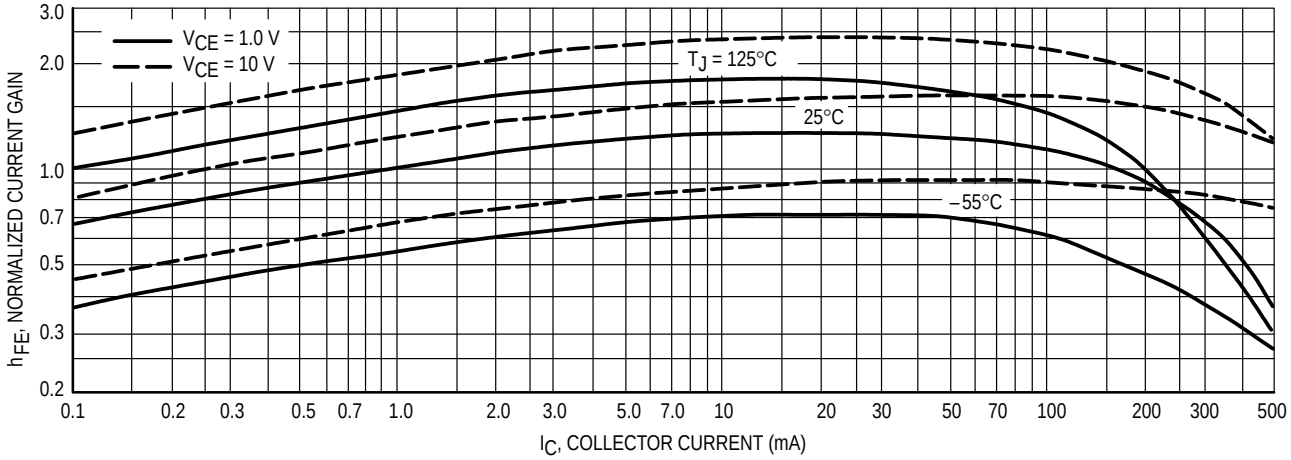


Figure 14. DC Current Gain

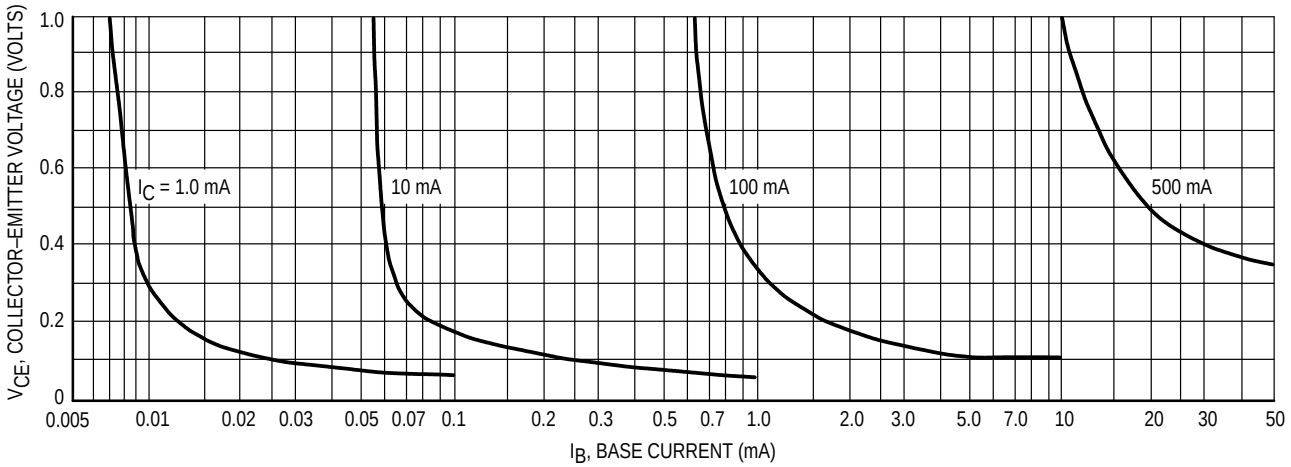


Figure 15. Collector Saturation Region

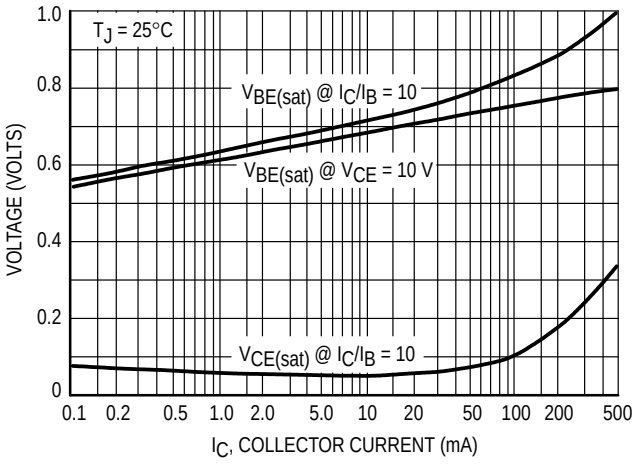


Figure 16. “On” Voltages

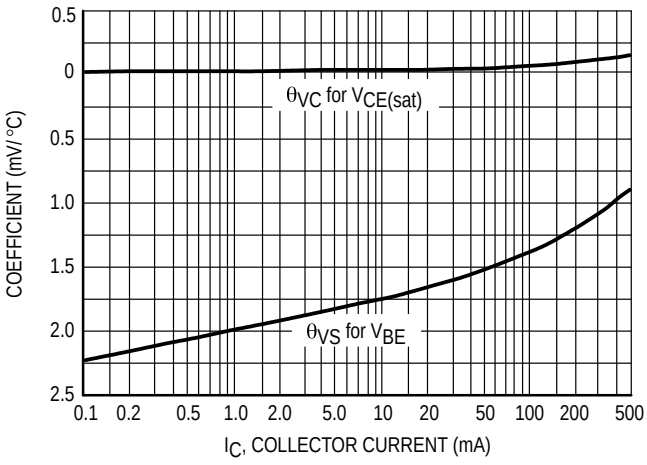
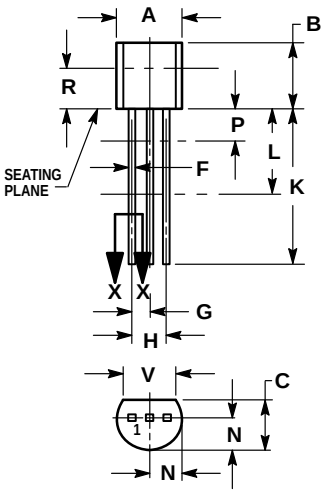
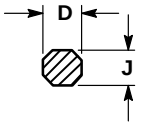


Figure 17. Temperature Coefficients

PACKAGE DIMENSIONS





SECTION X–X

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.

	INCHES		MILLIMETERS	
DIM	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	—

CASE 029–04
(TO–226AA)
ISSUE AD

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

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