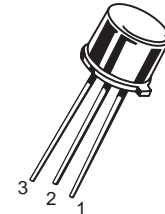
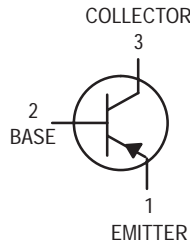


General Purpose Transistors

PNP Silicon

2N4032
2N4033



CASE 79-04, STYLE 1
TO-39 (TO-205AD)

MAXIMUM RATINGS

Rating	Symbol	2N4032	2N4033	Unit
Collector–Emitter Voltage	V_{CEO}	-60	-80	Vdc
Collector–Base Voltage	V_{CBO}	-60	-80	Vdc
Emitter–Base Voltage	V_{EBO}	-5.0	-5.0	Vdc
Collector Current — Continuous	I_C	-1.0		Adc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	0.8	4.56	Watts mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	4.0	22.8	Watts mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200		$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	140	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	25	$^\circ\text{C}/\text{W}$

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 ⁽¹⁾ ($I_C = -10 \text{ mAdc}$)	2N4032 2N4033	$V_{(BR)CEO}$	-60 -80	— —	Vdc
Collector–Base Breakdown Voltage ($I_C = -10 \mu\text{Adc}$)	2N4032 2N4033	$V_{(BR)CBO}$	-60 -80	— —	Vdc
Emitter–Base Breakdown Voltage ($I_E = -10 \mu\text{Adc}$)		$V_{(BR)EBO}$	-5.0	—	Vdc
Collector Cutoff Current ($V_{CB} = -50 \text{ Vdc}$) ($V_{CB} = -60 \text{ Vdc}$) ($V_{CB} = -50 \text{ Vdc}, T_A = 150^\circ\text{C}$) ($V_{CB} = -60 \text{ Vdc}, T_A = 150^\circ\text{C}$)	2N4032 2N4033 2N4032 2N4033	I_{CBO}	— — — —	-50 -50 -50 -50	nAdc μAdc
Emitter Cutoff Current ($V_{EB} = -5.0 \text{ Vdc}$)		I_{EBO}	—	-10	μAdc

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

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

Characteristic	Symbol	Min	Max	Unit	
ON CHARACTERISTICS					
DC Current Gain ($I_C = -100\text{ mAdc}$, $V_{CE} = -5.0\text{ Vdc}$, @ -55°C) ⁽¹⁾	2N4032,33	h_{FE}	40	—	—
($I_C = -100\ \mu\text{Adc}$, $V_{CE} = -5.0\text{ Vdc}$)	2N4032,33		75	—	
($I_C = -100\text{ mAdc}$, $V_{CE} = -5.0\text{ Vdc}$) ⁽¹⁾	2N4032,33		100	300	
($I_C = -500\text{ mAdc}$, $V_{CE} = -5.0\text{ Vdc}$) ⁽¹⁾	2N4032,33		70	—	
($I_C = -1.0\text{ Adc}$, $V_{CE} = -5.0\text{ Vdc}$) ⁽¹⁾	2N4032 2N4033		40 25	— —	
Collector–Emitter Saturation Voltage ⁽¹⁾ ($I_C = -150\text{ mAdc}$, $I_B = -15\text{ mAdc}$) ($I_C = -500\text{ mAdc}$, $I_B = -50\text{ mAdc}$) ($I_C = -1.0\text{ Adc}$, $I_B = -100\text{ mAdc}$)	2N4032	$V_{CE(sat)}$	— — —	—0.15 —0.5 —1.0	Vdc
Base–Emitter Saturation Voltage ⁽¹⁾ ($I_C = -150\text{ mAdc}$, $I_B = -15\text{ mAdc}$)		$V_{BE(sat)}$	—	—0.9	Vdc
Base–Emitter On Voltage ($I_C = -1.0\text{ Adc}$, $V_{CE} = -1.0\text{ Vdc}$) ($I_C = -500\text{ mAdc}$, $V_{CE} = -0.5\text{ Vdc}$) ⁽¹⁾	2N4032	$V_{BE(on)}$	— —	—1.2 —1.1	Vdc
SMALL–SIGNAL CHARACTERISTICS					
Output Capacitance ($V_{CE} = -10\text{ Vdc}$, $f = 1.0\text{ MHz}$)		C_{obo}	—	20	pF
Input Capacitance ($V_{EB} = -0.5\text{ Vdc}$, $f = 1.0\text{ MHz}$)		C_{ibo}	—	110	pF
Small Signal Current Gain ($I_C = -50\text{ mAdc}$, $V_{CE} = -10\text{ Vdc}$, $f = 100\text{ MHz}$)		h_{fe}	1.5	5.0	—
SWITCHING CHARACTERISTICS					
Storage Time ($I_C = -500\text{ mAdc}$, $I_{B1} = I_{B2} = -50\text{ mAdc}$)		t_s	—	350	ns
Turn–On Time ($I_C = -500\text{ mAdc}$, $I_{B1} = -50\text{ mAdc}$)		t_{on}	—	100	ns
Fall Time ($I_C = -500\text{ mAdc}$, $I_{B1} = I_{B2} = -50\text{ mAdc}$)		t_f	—	50	ns

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

SWITCHING TIME EQUIVALENT TEST CIRCUITS

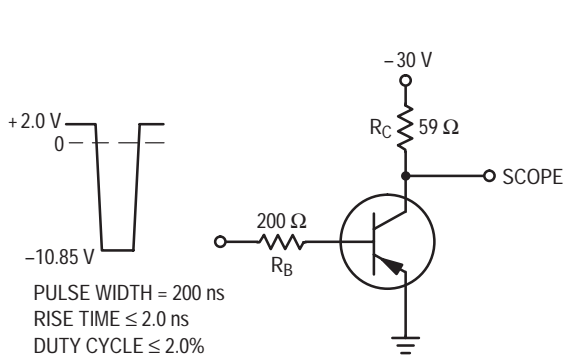


Figure 1. Turn-On

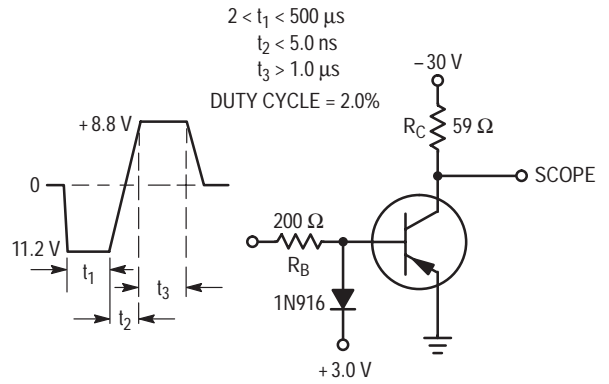


Figure 2. Turn-Off

TRANSIENT CHARACTERISTICS

25°C 100°C

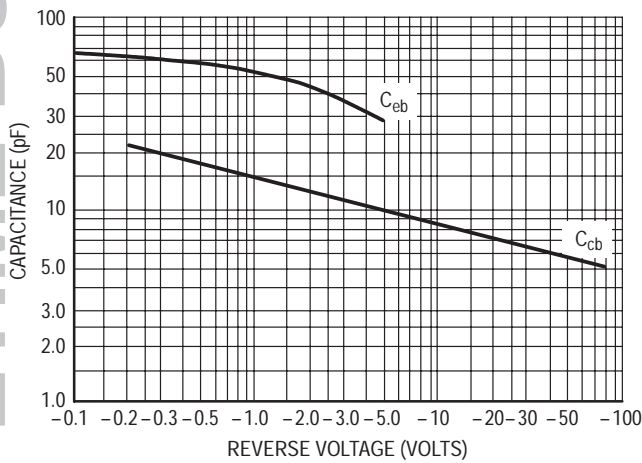


Figure 3. Capacitances

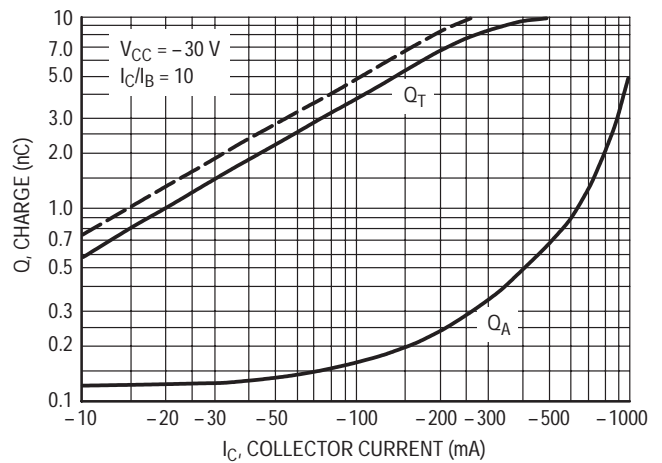


Figure 4. Charge Data

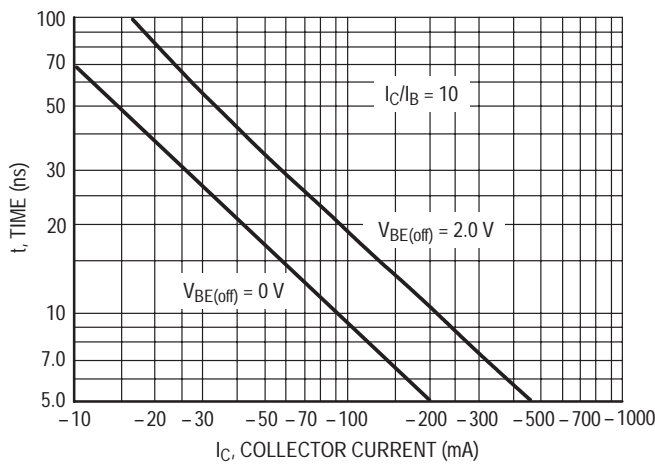


Figure 5. Delay Time

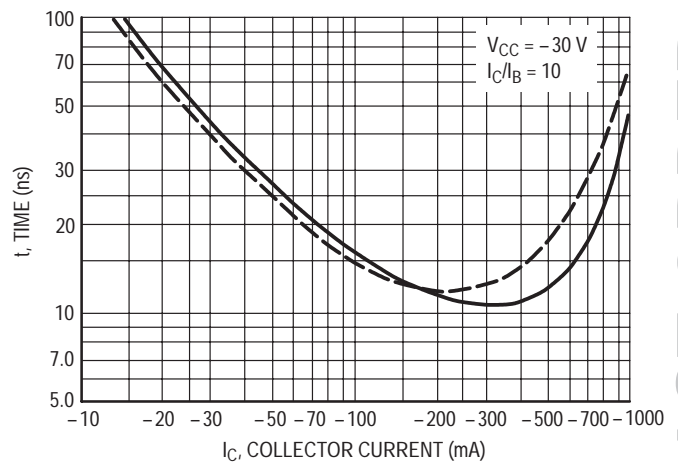


Figure 6. Rise Time

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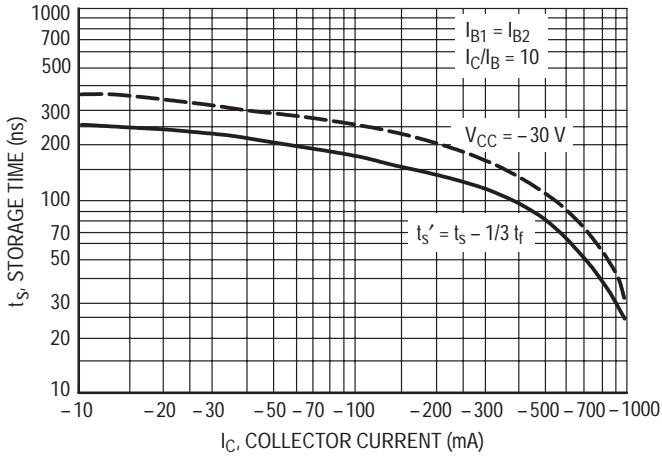


Figure 7. Storage Time

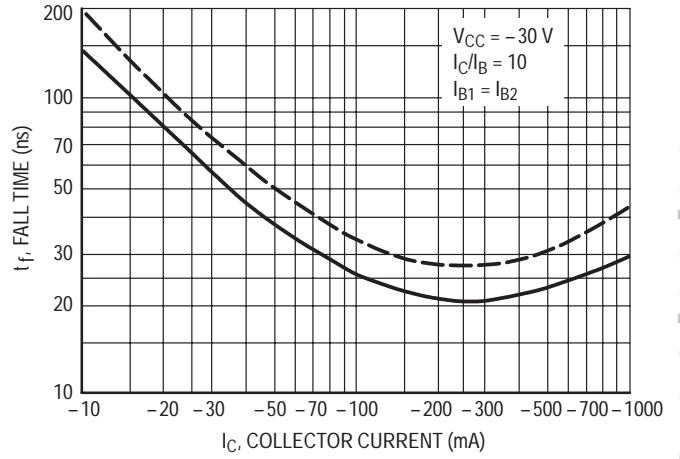


Figure 8. Fall Time

SMALL-SIGNAL CHARACTERISTICS
NOISE FIGURE

$V_{CE} = 10 \text{ Vdc}$, $T_A = 25^\circ\text{C}$

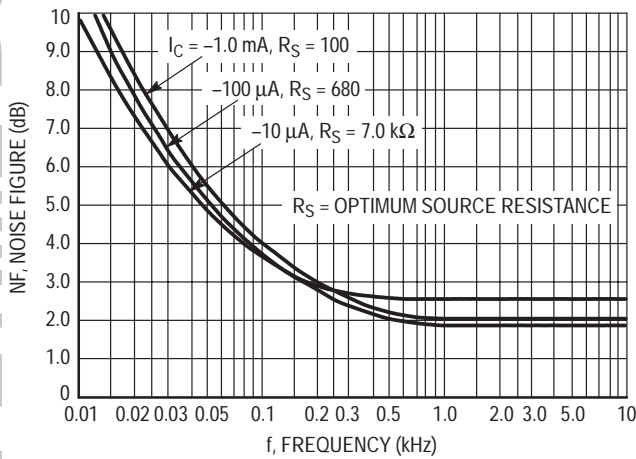


Figure 9. Frequency Effects

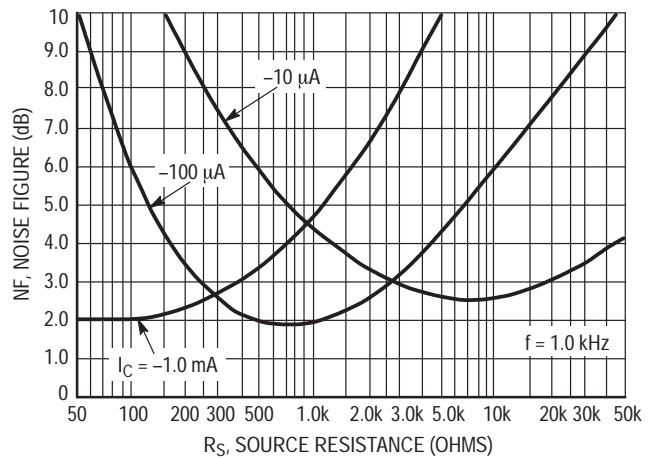


Figure 10. Source Resistance Effects

h PARAMETERS

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

This group of graphs illustrates the relationship of the "h" parameters for this series of transistors. To obtain these curves, 4 units were selected and identified by number - the same units were used to develop curves on each graph.

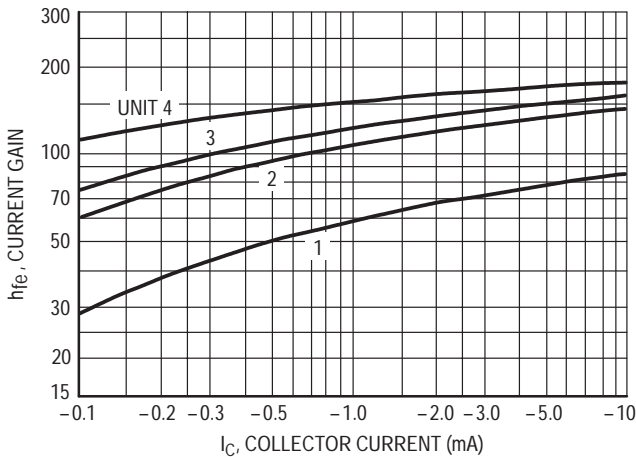


Figure 11. Current Gain

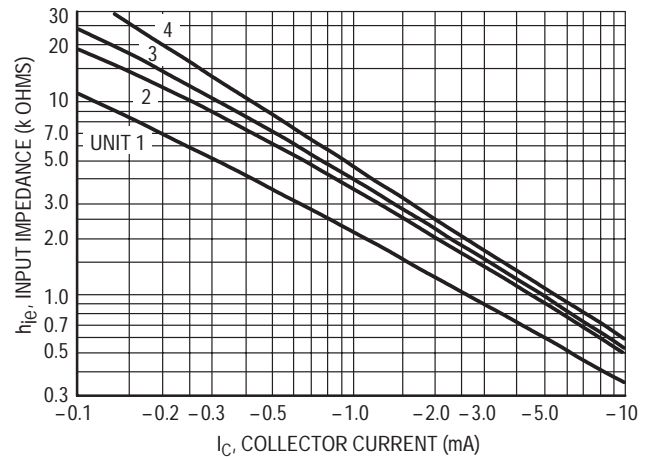


Figure 12. Input Impedance

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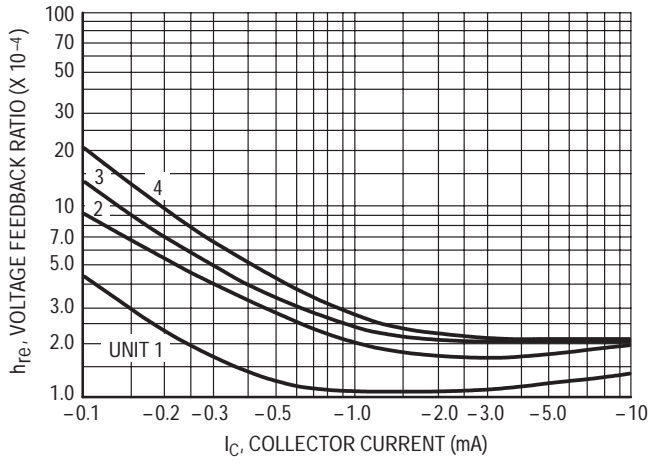


Figure 13. Voltage Feedback Ratio

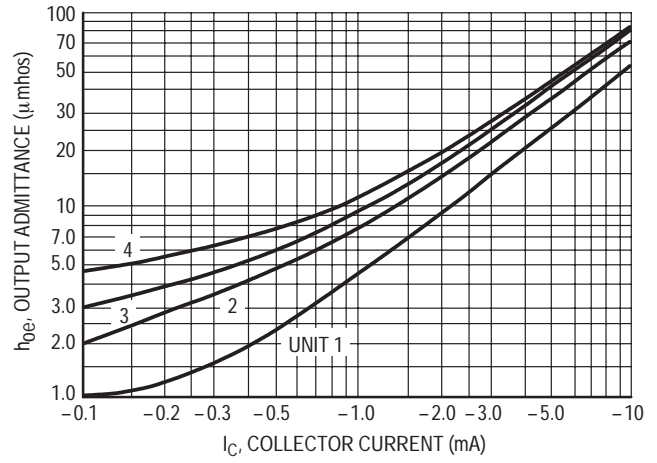


Figure 14. Output Admittance

STATIC CHARACTERISTICS

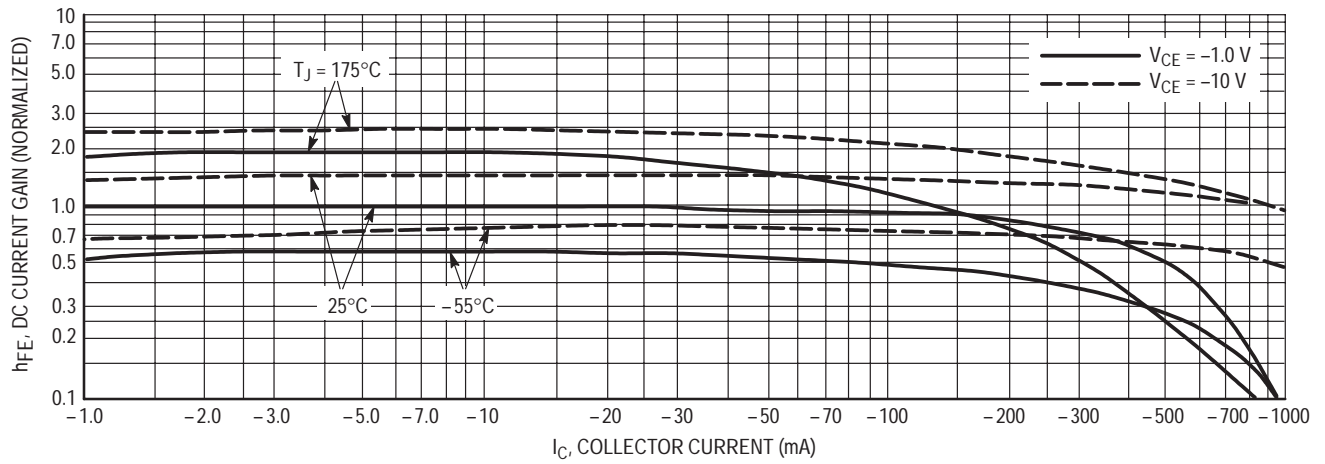


Figure 15. DC Current Gain

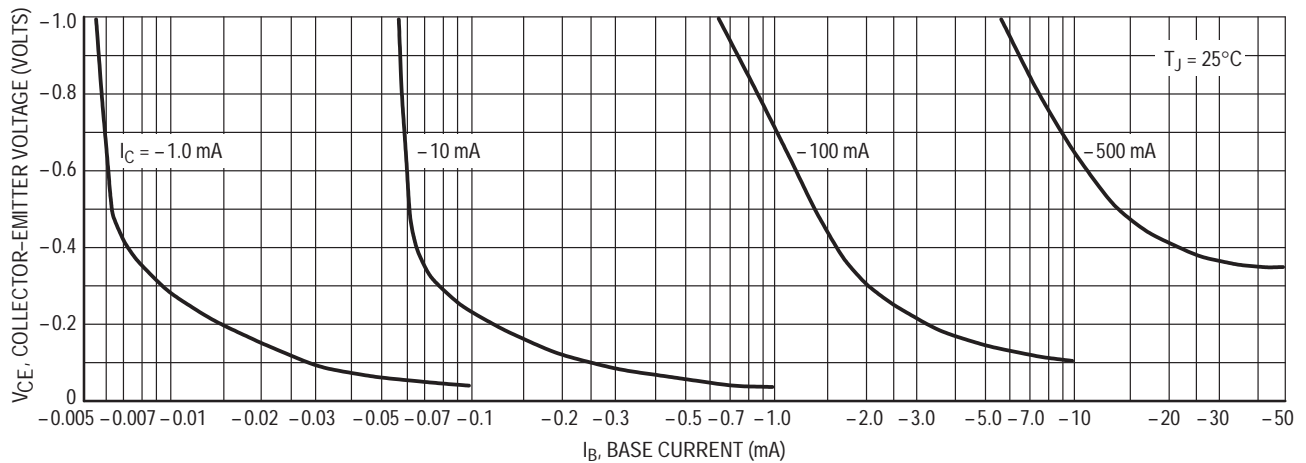


Figure 16. Collector Saturation Region

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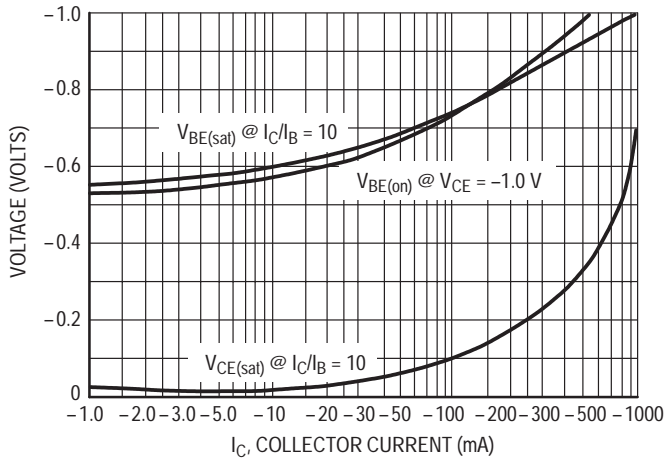


Figure 17. "On" Voltages

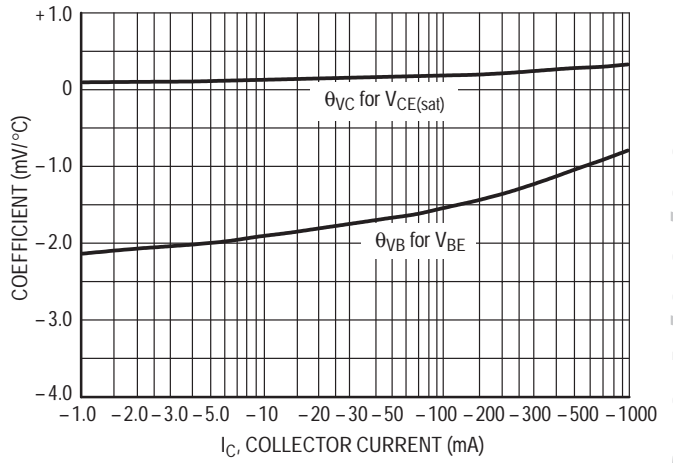


Figure 18. Temperature Coefficients

RATINGS AND THERMAL DATA

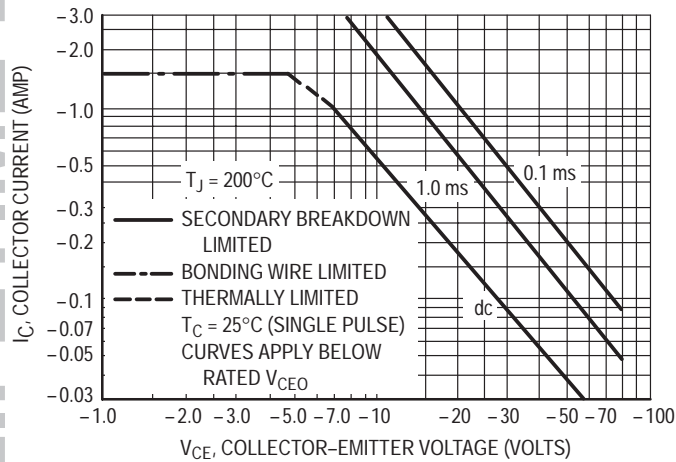


Figure 19. Safe Operating Area

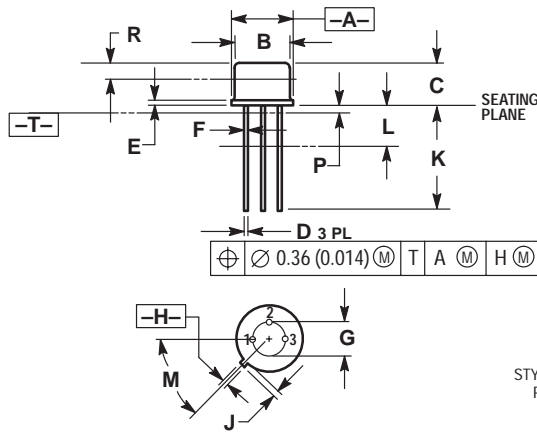
The safe operating area curves indicate I_C - V_{CE} limits of the transistor that must be observed for reliable operation. Collector load lines for specific circuits must fall below the limits indicated by the applicable curve.

The data of Figure 19 is based upon $T_{J(pk)} = 200^\circ\text{C}$; T_C is variable depending upon conditions. Pulse curves are valid for duty cycles to 10% provided $T_{J(pk)} \leq 200^\circ\text{C}$. $T_{J(pk)}$ may be calculated from the data in Figure 20. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

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PACKAGE DIMENSIONS



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

CASE 079-04
 (TO-205AD)
 ISSUE N

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION J MEASURED FROM DIMENSION A MAXIMUM.
4. DIMENSION B SHALL NOT VARY MORE THAN 0.25 (0.010) IN ZONE R. THIS ZONE CONTROLLED FOR AUTOMATIC HANDLING.
5. DIMENSION F APPLIES BETWEEN DIMENSION P AND L. DIMENSION D APPLIES BETWEEN DIMENSION L AND K MINIMUM. LEAD DIAMETER IS UNCONTROLLED IN DIMENSION P AND BEYOND DIMENSION K MINIMUM.


DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.335	0.370	8.51	9.39
B	0.305	0.335	7.75	8.50
C	0.240	0.260	6.10	6.60
D	0.016	0.021	0.41	0.53
E	0.009	0.041	0.23	1.04
F	0.016	0.019	0.41	0.48
G	0.200 BSC		5.08 BSC	
H	0.028	0.034	0.72	0.86
J	0.029	0.045	0.74	1.14
K	0.500	0.750	12.70	19.05
L	0.250	---	6.35	---
M	45° BSC		45° BSC	
P	---	0.050	---	1.27
R	0.100	---	2.54	---

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