

# Boca Semiconductor Corp. (BSC)

## MAXIMUM RATINGS

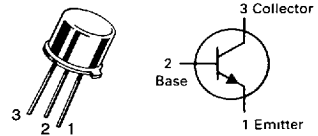
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CE0}$	150	Vdc
Collector-Base Voltage	$V_{CBO}$	150	Vdc
Emitter-Base Voltage	$V_{EBO}$	6.0	Vdc
Collector Current — Continuous	$I_C$	300	mAdc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.0 5.71	Watt mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	5.0 28.6	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	$R_{\theta JA}$	175	$^\circ\text{C/W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	35	$^\circ\text{C/W}$

**2N3500**  
**2N3501★**

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



**GENERAL PURPOSE**  
**TRANSISTORS**

**NPN SILICON**

★2N3501 is a Motorola  
designated preferred device.

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage (1) ( $I_C = 10 \text{ mAdc}, I_B = 0$ )	2N3500, 2N3501	$V_{(BR)CE0}$	150	—	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 10 \mu\text{Adc}, I_E = 0$ )	2N3500, 2N3501	$V_{(BR)CBO}$	150	—	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 10 \mu\text{Adc}, I_C = 0$ )		$V_{(BR)EBO}$	6.0	—	—	Vdc
Collector Cutoff Current ( $V_{CB} = 75 \text{ Vdc}, I_E = 0$ ) ( $V_{CB} = 75 \text{ Vdc}, I_E = 0, T_A = 150^\circ\text{C}$ )	2N3500, 2N3501	$I_{CBO}$	—	—	0.05 50	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB(\text{off})} = 4.0 \text{ Vdc}, I_C = 0$ )		$I_{EBO}$	—	—	25	nAdc

### ON CHARACTERISTICS

DC Current Gain ( $I_C = 0.1 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ )	2N3500 2N3501	$h_{FE}$	20 35	—	—	—
( $I_C = 1.0 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ )	2N3500 2N3501		25 50	—	—	
( $I_C = 10 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ ) (1)	2N3500 2N3501		35 75	—	—	
( $I_C = 150 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ ) (1)	2N3500 2N3501		40 100	—	120 300	
( $I_C = 300 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ ) (1)	2N3500 2N3501		15 20	—	—	
Collector-Emitter Saturation Voltage (1) ( $I_C = 10 \text{ mAdc}, I_B = 1.0 \text{ mAdc}$ ) ( $I_C = 50 \text{ mAdc}, I_B = 5.0 \text{ mAdc}$ ) ( $I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc}$ )	All Types All Types 2N3500, 2N3501	$V_{CE(\text{sat})}$	— — —	— — —	0.2 0.25 0.4	Vdc

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

Characteristic	Symbol	Min	Typ	Max	Unit
Base-Emitter Saturation Voltage (1) ( $I_C = 10\text{ mAdc}$ , $I_B = 1.0\text{ mAdc}$ ) ( $I_C = 50\text{ mAdc}$ , $I_B = 5.0\text{ mAdc}$ ) ( $I_C = 150\text{ mAdc}$ , $I_B = 15\text{ mAdc}$ )	$V_{BE(sat)}$	— — —	— — —	0.8 0.9 1.2	Vdc

**SMALL-SIGNAL CHARACTERISTICS**

Current-Gain — Bandwidth Product (2) ( $V_{CE} = 20\text{ Vdc}$ , $I_C = 20\text{ mAdc}$ , $f = 100\text{ MHz}$ )	$f_T$	150	—	—	MHz
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{obo}$	—	—	8.0	pF
Input Capacitance ( $V_{EB} = 0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ibo}$	—	—	80	pF
Input Impedance ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{ie}$	0.2 0.25	— —	1.0 1.25	k ohms
Voltage Feedback Ratio ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{re}$	— —	— —	2.5 4.0	$\times 10^{-4}$
Small-Signal Current Gain ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	50 75	— —	300 375	—
Output Admittance ( $I_C = 10\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{oe}$	— —	— —	100 200	$\mu\text{mhos}$

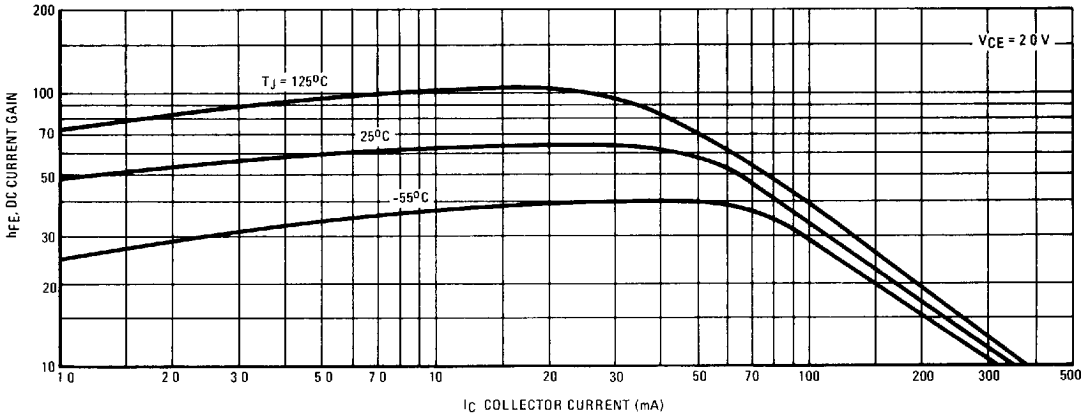
**SWITCHING CHARACTERISTICS**

Delay Time ( $I_C = 150\text{ mAdc}$ , $I_{B1} = 15\text{ mAdc}$ , $V_{CC} = 100\text{ Vdc}$ , $V_{BE(off)} = -2.0\text{ Vdc}$ )	$t_d$	—	20	—	ns
Rise Time ( $I_C = 150\text{ mAdc}$ , $I_{B1} = 15\text{ mAdc}$ , $V_{CC} = 100\text{ Vdc}$ , $V_{BE(off)} = -2.0\text{ Vdc}$ )	$t_r$	—	35	—	ns
Storage Time ( $I_C = 150\text{ mAdc}$ , $I_{B1} = I_{B2} = 15\text{ mAdc}$ , $V_{CC} = 100\text{ Vdc}$ )	$t_s$	—	800	—	ns
Fall Time ( $I_C = 150\text{ mAdc}$ , $I_{B1} = I_{B2} = 15\text{ mAdc}$ , $V_{CC} = 100\text{ Vdc}$ )	$t_f$	—	80	—	ns

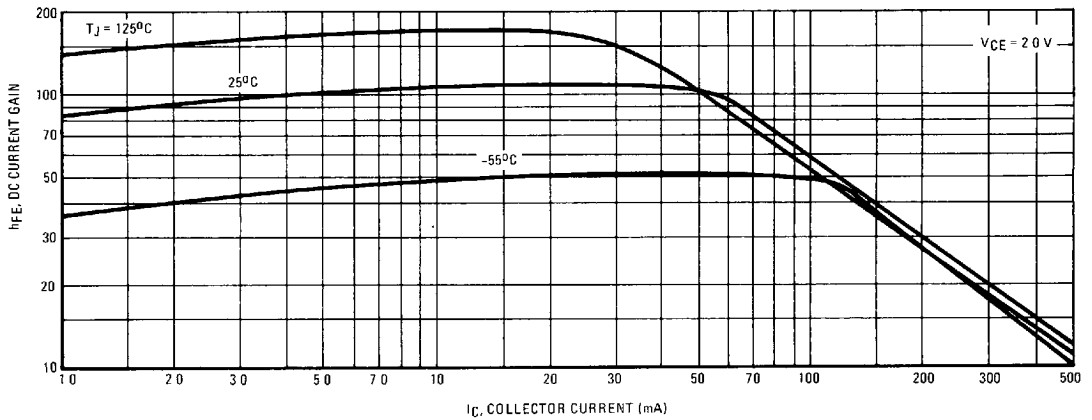
(1) Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ (2)  $f_T = |h_{fe}| \cdot f_{test}$ .

**2N3500 2N3501**

**FIGURE 1 — CURRENT GAIN CHARACTERISTICS versus JUNCTION TEMPERATURE**  
**2N3500**



**2N3501**



**FIGURE 2 — CURRENT GAIN CHARACTERISTICS versus COLLECTOR-EMITTER VOLTAGE**

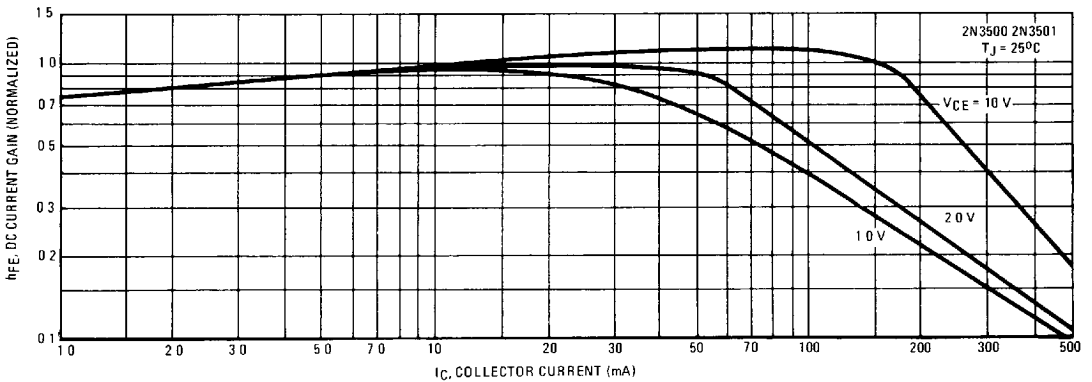


FIGURE 3 — "ON" VOLTAGES

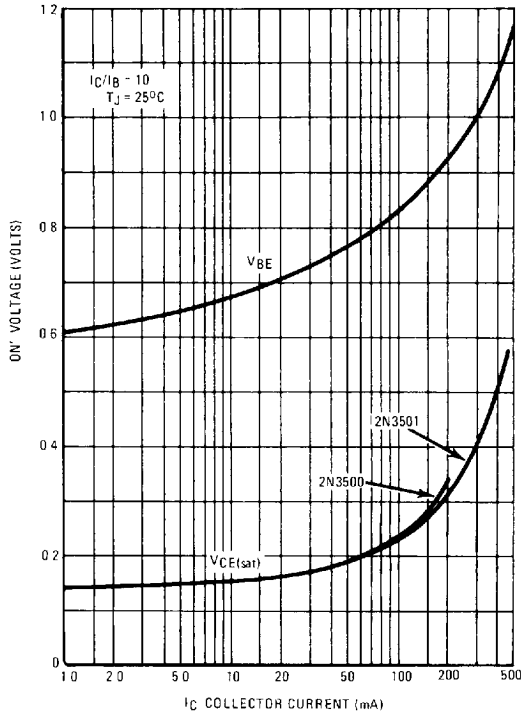


FIGURE 4 — TEMPERATURE COEFFICIENTS

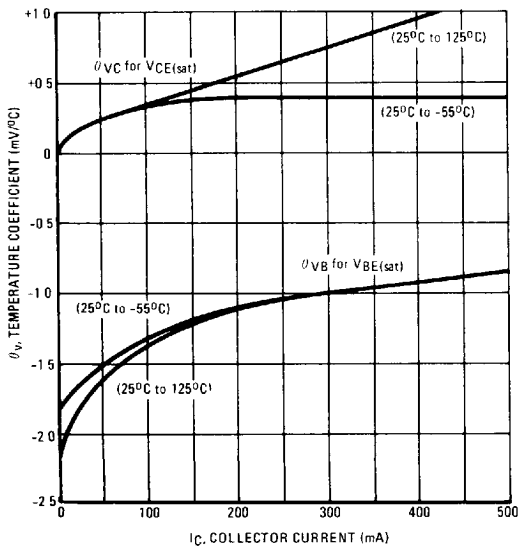
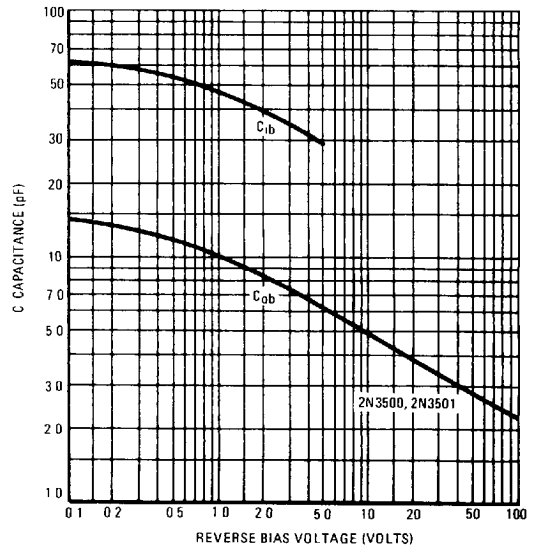


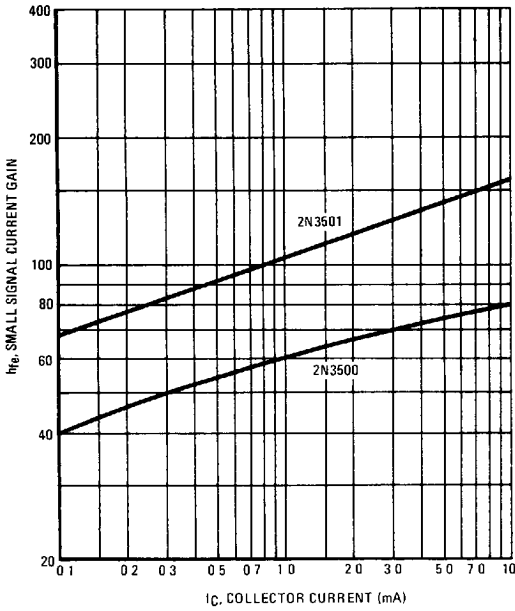
FIGURE 5 — CAPACITANCE



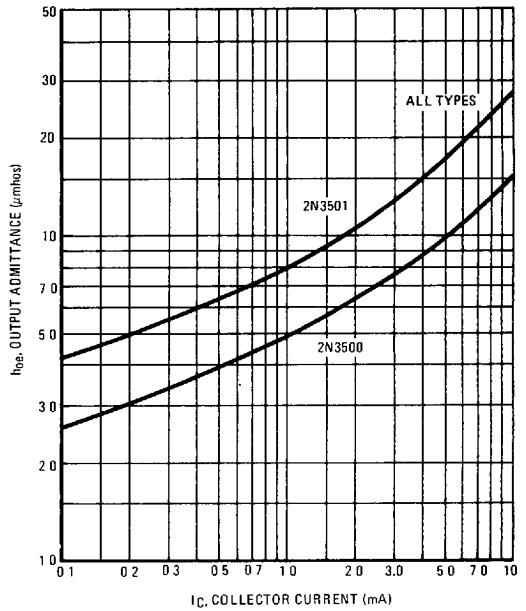
**AUDIO SMALL-SIGNAL h PARAMETER CHARACTERISTICS**

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

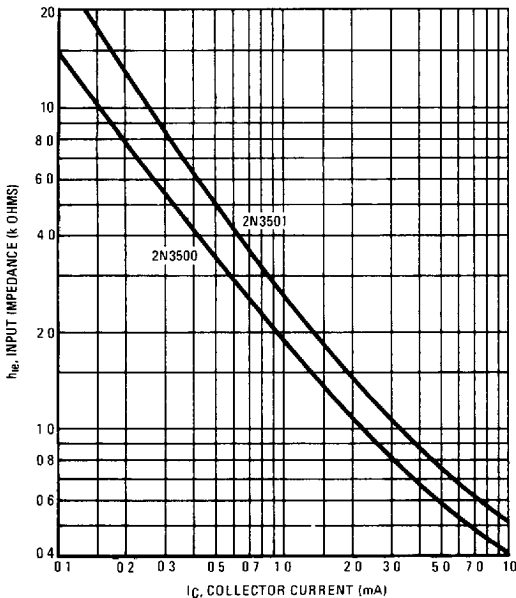
**FIGURE 6 — CURRENT GAIN**



**FIGURE 7 — OUTPUT IMPEDANCE**



**FIGURE 8 — INPUT IMPEDANCE**



**FIGURE 9 — VOLTAGE FEEDBACK RATIO**

