

# Boca Semiconductor Corp.

## MAXIMUM RATINGS

Rating	Symbol	2N3019 2N3020	2N3700	Unit
Collector-Emitter Voltage	$V_{CEO}$	80	80	Vdc
Collector-Base Voltage	$V_{CBO}$	140	140	Vdc
Emitter-Base Voltage	$V_{EBO}$	7.0	7.0	Vdc
Collector Current — Continuous	$I_C$	1.0	1.0	Adc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	0.8 4.6	0.5 2.85	Watts $\text{mW}/^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	5.0 28.6	1.8 10.6	Watts $\text{mW}/^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +200		$^\circ\text{C}$

## THERMAL CHARACTERISTICS

Characteristic	Symbol	2N3019 2N3020	2N3700	Unit
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	217	350	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Case	$R_{\theta JC}$	35	97	$^\circ\text{C}/\text{W}$

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Breakdown Voltage(1) ( $I_C = 30 \text{ mAdc}, I_B = 0$ )	$V_{(BR)CEO}$	80	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 100 \mu\text{Adc}, I_E = 0$ )	$V_{(BR)CBO}$	140	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 100 \mu\text{Adc}, I_C = 0$ )	$V_{(BR)EBO}$	7.0	—	Vdc
Collector Cutoff Current ( $V_{CB} = 90 \text{ Vdc}, I_E = 0$ ) ( $V_{CB} = 90 \text{ Vdc}, I_E = 0, T_A = +150^\circ\text{C}$ )	$I_{CBO}$	— —	0.01 10	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 5.0 \text{ Vdc}, I_C = 0$ )	$I_{EBO}$	—	0.010	$\mu\text{Adc}$

## ON CHARACTERISTICS

DC Current Gain ( $I_C = 0.1 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ )		2N3700, 2N3019 2N3020	$h_{FE}$	50 30	— 100	—
( $I_C = 10 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ )(1)		2N3700, 2N3019 2N3020		90 40	— 120	
( $I_C = 150 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ )(1)		2N3700, 2N3019 2N3020		100 40	300 120	
( $I_C = 150 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, T_C = -55^\circ\text{C}$ )(1)		2N3700, 2N3019		40	—	
( $I_C = 500 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}$ )(1)		2N3700, 2N3019 2N3020		50 30	— 100	
( $I_C = 1.0 \text{ Adc}, V_{CE} = 10 \text{ Vdc}$ )(1)		All Types		15	—	
Collector-Emitter Saturation Voltage(1) ( $I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc}$ ) ( $I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc}$ )	$V_{CE(sat)}$			— —	0.2 0.5	Vdc
Base-Emitter Saturation Voltage(1) ( $I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc}$ )	$V_{BE(sat)}$			—	1.1	Vdc

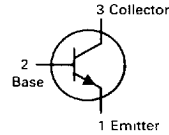
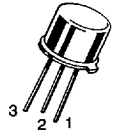
## SMALL-SIGNAL CHARACTERISTICS

Current-Gain — Bandwidth Product ( $I_C = 50 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, f = 20 \text{ MHz}$ )	$f_T$	2N3020 2N3019, 2N3700		80 100	— 400	MHz
--	-------	--------------------------	--	-----------	----------	-----

**2N3019★**

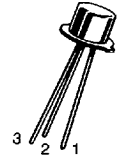
**2N3020**

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



**2N3700★**

CASE 22-03, STYLE 1  
TO-18 (TO-206AA)



**GENERAL TRANSISTORS**

**NPN SILICON**

★2N3019 and 2N3700  
are Motorola designated  
preferred devices.

**2N3019 2N3020 2N3700**

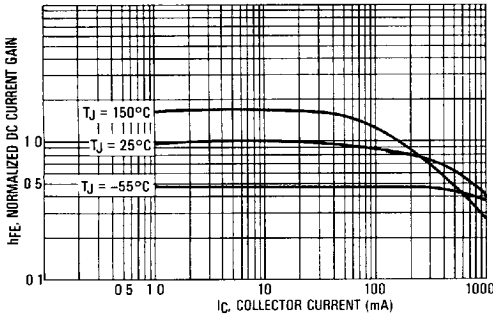
**ELECTRICAL CHARACTERISTICS** (continued) ( $T_A = 25^\circ\text{C}$  unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
Output Capacitance ( $V_{CB} = 10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{obo}$	—	12	pF
Input Capacitance ( $V_{EB} = 0.5\text{ Vdc}$ , $I_C = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ibo}$	—	60	pF
Small-Signal Current Gain ( $I_C = 1.0\text{ mAdc}$ , $V_{CE} = 5.0\text{ Vdc}$ , $f = 1.0\text{ kHz}$ )	$h_{fe}$	80 30	400 200	—
Collector Base Time Constant ( $I_E = 10\text{ mAdc}$ , $V_{CB} = 10\text{ Vdc}$ , $f = 79.8\text{ MHz}$ )	$r_b' C_c$	— 15	400 400	ps
Noise Figure ( $I_C = 100\ \mu\text{Adc}$ , $V_{CE} = 10\text{ Vdc}$ , $R_S = 1.0\text{ k ohms}$ , $f = 1.0\text{ kHz}$ )	NF	—	4	dB

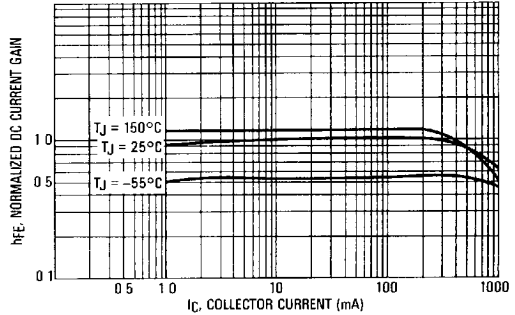
(1) Pulse Test: Pulse Width  $\leq 300\ \mu\text{s}$ , Duty Cycle  $\leq 1.0\%$ .

<http://www.bocasemi.com>

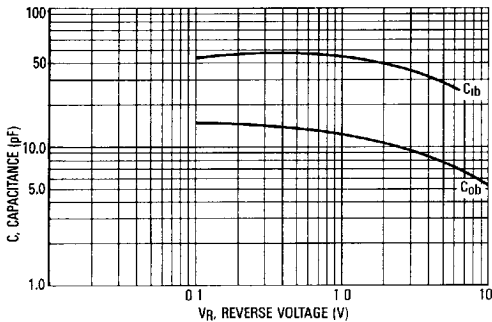
**DC CURRENT GAIN**  
**2N3019, 2N3700**



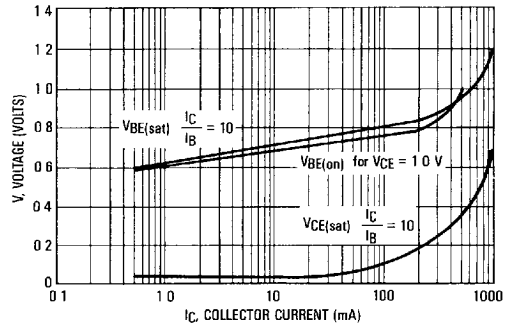
**DC CURRENT GAIN**  
**2N3020**



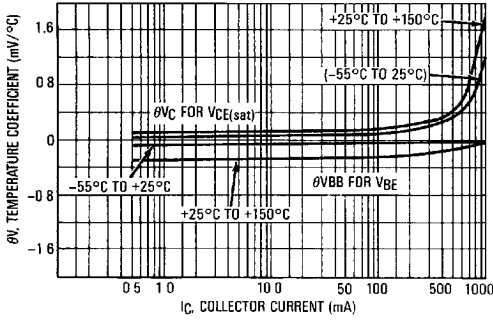
**CAPACITANCE**



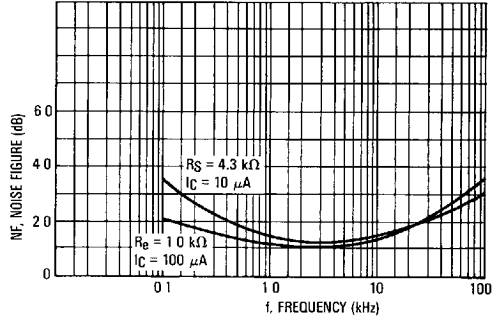
**"ON" VOLTAGES**



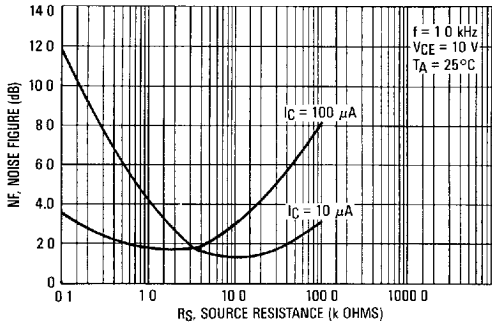
TEMPERATURE COEFFICIENTS



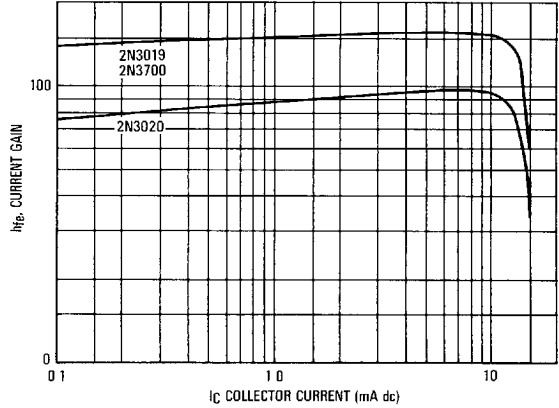
FREQUENCY EFFECTS



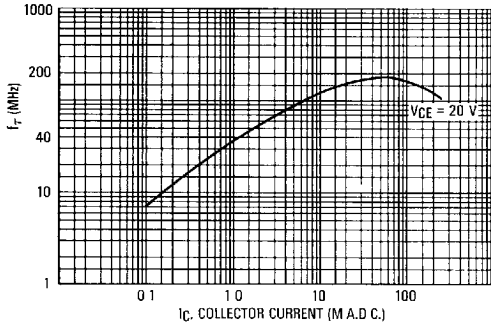
SOURCE RESISTANCE EFFECTS



CURRENT GAIN BANDWIDTH PRODUCT versus COLLECTOR CURRENT — 1 kHz  $h_{fe}$



CURRENT GAIN — BANDWIDTH PRODUCT



ACTIVE REGION SAFE OPERATING AREA

