

**SEMICONDUCTOR  
TECHNICAL DATA**

**2N3019S**

**2N3057A**

**2N3700.**

**NPN Silicon  
Small-Signal Transistors**

...designed for general-purpose switching and amplifier applications.

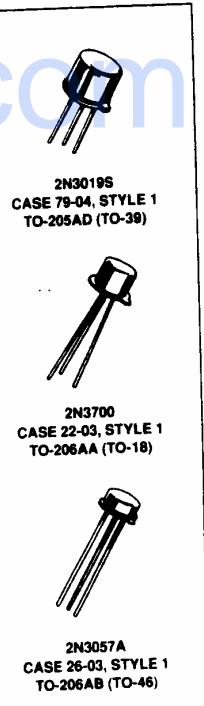
**CRYSTALONICS**  
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MAXIMUM RATINGS					
Rating	Symbol	2N3019S	2N3057A	2N3700	Unit
Collector-Base Voltage	V <sub>CBO</sub>		140		Vdc
Collector-Emitter Voltage	V <sub>CEO</sub>		80		Vdc
Emitter-Base Voltage	V <sub>EBO</sub>		7.0		Vdc
Collector Current	I <sub>C</sub>		1.0		Adc
Device Dissipation @ T <sub>A</sub> = 25 C	P <sub>T</sub>	0.8 4.6	0.4 2.3	0.5 2.85	Watts mW·C
Derate above 25 C @ T <sub>C</sub> = 25 C		5.0 28.6	1.8 10.3	1.8 10.3	Watts mW·C
Derate above 25 C					
Operating Junction and Storage Temperature Range	T <sub>J</sub> T <sub>SIG</sub>		-65 to 200		C

ELECTRICAL CHARACTERISTICS (T <sub>C</sub> = 25 C unless otherwise noted.)				
Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Breakdown Voltage <sup>(1)</sup> (I <sub>C</sub> = 30 mAdc)	V <sub>(BR)CEO</sub>	80	—	Vdc
Emitter-Base Breakdown Voltage (I <sub>E</sub> = 100 μAdc)	V <sub>(BR)EBO</sub>	7.0	—	Vdc
Collector-Base Breakdown Voltage (I <sub>C</sub> = 100 μAdc)	V <sub>(BR)CBO</sub>	140	—	Vdc
Collector Cutoff Current (V <sub>CE</sub> = 90 Vdc) (V <sub>CE</sub> = 90 Vdc, T <sub>A</sub> = 150 C)	I <sub>CES</sub>	— —	10 10	nAdc μAdc
Emitter Cutoff Current (V <sub>BE</sub> = 5.0 Vdc)	I <sub>EBO</sub>	—	10	nAdc

1. Pulse Pulse Width 25, 10, 140 μsec Duty Cycle 1:1 to 2:1

continued



**2N3019SJAN, 2N3057AJAN, 2N3700JAN SERIES**

ELECTRICAL CHARACTERISTICS — continued ( $T_C = 25^\circ C$ unless otherwise noted.)				
Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS</b>				
DC Current Gain ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 150 \text{ mA}\text{dc}$ ) ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 0.1 \text{ mA}\text{dc}$ ) ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 10 \text{ mA}\text{dc}$ ) ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 500 \text{ mA}\text{dc}$ ) ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 1.0 \text{ mA}\text{dc}$ ) ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 150 \text{ mA}\text{dc}$ , $T_A = -65^\circ C$ ) <sup>(1)</sup>	$h_{FE}$	100 50 90 50 15 40	300 200 — 200 — —	—
Collector-Emitter Saturation Voltage <sup>(1)</sup> ( $I_C = 150 \text{ mA}\text{dc}$ , $I_B = 15 \text{ mA}\text{dc}$ ) ( $I_C = 500 \text{ mA}\text{dc}$ , $I_B = 50 \text{ mA}\text{dc}$ )	$V_{CE(\text{sat})}$	— —	0.2 0.5	Vdc
Base-Emitter Saturation Voltage <sup>(1)</sup> ( $I_C = 150 \text{ mA}\text{dc}$ , $I_B = 15 \text{ mA}\text{dc}$ )	$V_{BE(\text{sat})}$	—	1.1	Vdc
<b>SMALL-SIGNAL CHARACTERISTICS</b>				
Small-Signal Current Gain ( $V_{CE} = 5.0 \text{ Vdc}$ , $I_C = 1.0 \text{ mA}\text{dc}$ , $f = 1.0 \text{ kHz}$ ) ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 50 \text{ mA}\text{dc}$ , $f = 20 \text{ MHz}$ )	$h_{re}$	80 5.0	400 20	—
Input Capacitance ( $V_{EB} = 0.5 \text{ Vdc}$ , $I_C = 0$ , $f = 0.1$ to $1.0 \text{ MHz}$ )	$C_{ib0}$	—	60	pF
Output Capacitance ( $V_{CB} = 10 \text{ Vdc}$ , $I_E = 0$ , $f = 0.1$ to $1.0 \text{ MHz}$ )	$C_{ob0}$	—	12	pF
Noise Figure ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 100 \mu\text{A}\text{dc}$ , $f = 1.0 \text{ kHz}$ $R_G = 1.0 \text{ kohm}$ , Pwr. B.W. = 200 Hz)	NF	—	4.0	dB
Collector Base Time Constant ( $V_{CB} = 10 \text{ Vdc}$ , $I_C = 10 \text{ mA}\text{dc}$ , $f = 79.8 \text{ MHz}$ )	$r_b' C_C$	—	400	ps
<b>SWITCHING CHARACTERISTICS (See Figure 21)</b>				
Turn-On + Turn-Off Time	$t_{on} + t_{off}$	—	30	ns
<b>SAFE OPERATING AREA</b>				
<b>DC Tests</b>				
( $T_C = 25^\circ C$ , $t \geq 10 \text{ ms}$ , one cycle )				
<b>Test 1</b> ( $I_C = 500 \text{ mA}\text{dc}$ , $V_{CE} = 10 \text{ Vdc}$ ) ( $I_C = 180 \text{ mA}\text{dc}$ , $V_{CE} = 10 \text{ Vdc}$ )	2N3019 2N3700, 2N3057A			
<b>Test 2</b> ( $I_C = 125 \text{ mA}\text{dc}$ , $V_{CE} = 40 \text{ Vdc}$ ) ( $I_C = 45 \text{ mA}\text{dc}$ , $V_{CE} = 40 \text{ Vdc}$ )	2N3019 2N3700, 2N3057A			
<b>Test 3</b> ( $I_C = 60 \text{ mA}\text{dc}$ , $V_{CE} = 80 \text{ Vdc}$ ) ( $I_C = 22.5 \text{ mA}\text{dc}$ , $V_{CE} = 80 \text{ Vdc}$ )	2N3019 2N3700, 2N3057A			
<b>END POINT ELECTRICAL MEASUREMENTS</b>				
Collector-Emitter Cutoff Current ( $V_{CE} = 90 \text{ Vdc}$ ) (Relaxed Limit)	$I_{CES}$	—	20	nA\text{dc}
Collector-Base Saturation Voltage <sup>(1)</sup> ( $I_C = 150 \text{ Vdc}$ , $I_B = 15 \text{ mA}\text{dc}$ )	$V_{CE(\text{sat})}$	—	0.2	Vdc
DC Current Gain <sup>(1)</sup> ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 150 \text{ mA}\text{dc}$ )	$h_{FE}$	100	300	—

<sup>(1)</sup> Pulsed Pulse Width 250 to 350  $\mu\text{s}$ . Duty Cycle 1.0 to 2.0%.

**ASSURANCE TESTING (Pre/Post Burn-In)**

Burn-In Conditions:  $T_A = 25 \pm 5^\circ C$ ,  $V_{CB} = 60 \text{ Vdc}$ ,  $10 \text{ Vdc JANS}$

$P_T = 600 \text{ mW } 2N3019S$ ,  $400 \text{ mW } 2N3057A$ ,  $500 \text{ mW } 2N3700$

Characteristics Tested	Symbol	Initial and End Point Limits		Unit
		Min	Max	
Collector Cutoff Current ( $V_{CE} = 90 \text{ Vdc}$ )	$I_{CES}$	—	10	nA\text{dc}
DC Current Gain <sup>(1)</sup> ( $V_{CE} = 10 \text{ Vdc}$ , $I_C = 150 \text{ mA}\text{dc}$ )	$h_{FE}$	100	300	—

Delta from Pre-Burn-In Measured Values		Min	Max	
Delta Collector Cutoff Current	$\Delta I_{CES}$	—	$\pm 100$ or $\pm 5.0$ whichever is greater	% of Initial Value nA\text{dc}
Delta DC Current Gain <sup>(1)</sup>	$\Delta h_{FE}$	—	$\pm 15$	% of Initial Value

<sup>(1)</sup> Pulsed Pulse Width 250 to 350  $\mu\text{s}$ . Duty Cycle 1.0 to 2.0%.