

**SEMICONDUCTOR  
TECHNICAL DATA**

**2N3013.**

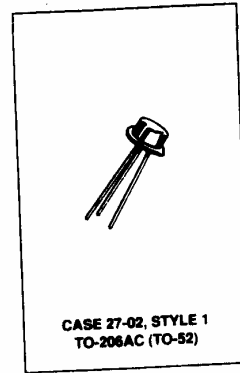
**NPN Silicon  
Small-Signal Transistor**

designed for general-purpose switching applications.

**CRYSTALONCS  
2805 Veterans Highway  
Suite 14  
Ronkonkoma, N.Y. 11779**

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MAXIMUM RATINGS			
Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V <sub>CEO</sub>	20	V <sub>dc</sub>
Collector-Emitter Voltage	V <sub>CES</sub>	40	V <sub>dc</sub>
Collector-Base Voltage	V <sub>CBO</sub>	40	V <sub>dc</sub>
Emitter-Base Voltage	V <sub>EBO</sub>	5.0	V <sub>dc</sub>
Collector Current	I <sub>C</sub>	300	mAdc
Power Dissipation	P <sub>T</sub>	0.36	Watts
@ T <sub>A</sub> = 25 C		2.1	mW/°C
Derate above 25 C		1.2	Watts
@ T <sub>C</sub> = 25 C		6.86	mW/°C
Derate above 25 C			
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to 200	°C



ELECTRICAL CHARACTERISTICS (T <sub>A</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> = 10 mAdc)	V <sub>(BR)CEO</sub>	20	—	V <sub>dc</sub>
Collector-Emitter Breakdown Voltage (I <sub>C</sub> = 100 μAdc)	V <sub>(BR)CES</sub>	40	—	V <sub>dc</sub>
Collector-Base Breakdown Voltage (I <sub>C</sub> = 100 μAdc)	V <sub>(BR)CBO</sub>	40	—	V <sub>dc</sub>
Emitter-Base Breakdown Voltage (I <sub>E</sub> = 100 μAdc)	V <sub>(BR)EBO</sub>	5.0	—	V <sub>dc</sub>
Collector-Emitter Cutoff Current (V <sub>CE</sub> = 20 Vdc) (V <sub>CB</sub> = 20 Vdc, T <sub>A</sub> = 125 C)	I <sub>CES</sub>	—	0.3 40	μAdc

(continued)

2N3013JAN SERIES

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ELECTRICAL CHARACTERISTICS — continued ( $T_A = 25^\circ\text{C}$ unless otherwise noted.)				
Characteristic	Symbol	Min	Max	Unit
<b>ON CHARACTERISTICS</b>				
DC Current Gain <sup>(1)</sup> ( $I_C = 30\text{ mAdc}$ , $V_{CE} = 0.4\text{ Vdc}$ ) ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 0.5\text{ Vdc}$ ) ( $I_C = 300\text{ mAdc}$ , $V_{CE} = 1.0\text{ Vdc}$ ) ( $I_C = 30\text{ mAdc}$ , $V_{CE} = 0.4\text{ Vdc}$ , $T_A = -55^\circ\text{C}$ )	$h_{FE}$	35 30 15 15	120 — — —	—
Collector-Emitter Saturation Voltage <sup>(1)</sup> ( $I_C = 30\text{ mAdc}$ , $I_B = 3.0\text{ mAdc}$ ) ( $I_C = 100\text{ mAdc}$ , $I_B = 10\text{ mAdc}$ ) ( $I_C = 300\text{ mAdc}$ , $I_B = 30\text{ mAdc}$ ) ( $I_C = 30\text{ mAdc}$ , $I_B = 3.0\text{ mAdc}$ , $T_A = 125^\circ\text{C}$ )	$V_{CE(sat)}$	— — — —	0.18 0.28 0.5 0.25	Vdc
Base-Emitter Saturation Voltage <sup>(1)</sup> ( $I_C = 30\text{ mAdc}$ , $I_B = 3.0\text{ mAdc}$ ) ( $I_C = 100\text{ mAdc}$ , $I_B = 10\text{ mAdc}$ ) ( $I_C = 300\text{ mAdc}$ , $I_B = 30\text{ mAdc}$ )	$V_{BE(sat)}$	0.75 — —	0.95 1.2 1.7	Vdc
<b>SMALL-SIGNAL CHARACTERISTICS</b>				
Small-Signal Current Transfer Ratio, Magnitude ( $I_C = 30\text{ mAdc}$ , $V_{CE} = 10\text{ Vdc}$ , $f = 100\text{ MHz}$ )	$ h_{fe} $	3.5	12	—
Output Capacitance ( $V_{CB} = 5.0\text{ Vdc}$ , $f = 140\text{ kHz}$ )	$C_{obo}$	—	5.0	pF
Input Capacitance ( $V_{BE} = 0.5\text{ Vdc}$ , $f = 140\text{ kHz}$ )	$C_{ibo}$	—	8.0	pF
<b>SWITCHING CHARACTERISTICS (See Figures 8, 13)</b>				
Turn-On Time	$t_{on}$	—	15	ns
Turn-Off Time	$t_{off}$	—	25	ns
Storage Time	$t_s$	—	18	ns

ASSURANCE TESTING (Pre/Post Burn-In)				
Burn-In Conditions: $T_A = 30 \pm 5^\circ\text{C}$ , $V_{CB} \geq 10\text{ Vdc}$ $P_T = 360\text{ mW}$				
Characteristics Tested	Symbol	Initial and End Point Limits		Unit
		Min	Max	
Collector Cutoff Current ( $V_{CE} = 20\text{ Vdc}$ )	$I_{CES}$	—	0.3	$\mu\text{A dc}$
DC Current Gain <sup>(1)</sup> ( $I_C = 30\text{ mAdc}$ , $V_{CE} = 0.4\text{ Vdc}$ )	$h_{FE}$	35	120	—
Delta from Pre-Burn-In Measured Values		Min	Max	
Delta Collector Cutoff Current	$\Delta I_{CES}$	—	$\pm 100$ or $\pm 50$ whichever is greater	% of Initial Value $\mu\text{A dc}$
Delta DC Current Gain <sup>(1)</sup>	$\Delta h_{FE}$	—	$\pm 20$	% of Initial Value

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