

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_{CEO}	20	Vdc
Collector-Emitter Voltage	V_{CES}	40	Vdc
Collector-Base Voltage	V_{CBO}	40	Vdc
Emitter-Base Voltage	V_{EBO}	5.0	Vdc
Collector Current	I_C	300	mA dc
Power Dissipation	P_T	0.36	Watts
@ $T_A = 25^\circ\text{C}$		2.1	mW/°C
Derate above 25°C		1.2	Watts
@ $T_C = 25^\circ\text{C}$		6.86	mW/°C
Derate above 25°C			
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-65 to 200	°C



CASE 27-02, STYLE 1
TO-206AC (TO-52)

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)				
Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage(1)	$V_{(BR)CEO}$	20	—	Vdc
($I_C = 10\text{ mA dc}$)				
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$	40	—	Vdc
($I_C = 100\text{ }\mu\text{A dc}$)				
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	40	—	Vdc
($I_C = 100\text{ }\mu\text{A dc}$)				
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	5.0	—	Vdc
($I_E = 100\text{ }\mu\text{A dc}$)				
Collector-Emitter Cutoff Current	I_{CES}	—	0.3	$\mu\text{A dc}$
($V_{CE} = 20\text{ Vdc}$)			40	
($V_{CB} = 20\text{ Vdc}, T_A = 125^\circ\text{C}$)				

(continued)

2N3013JAN SERIES

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ELECTRICAL CHARACTERISTICS — continued ($T_A = 25^\circ\text{C}$ unless otherwise noted.)				
Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS				
DC Current Gain ⁽¹⁾ ($I_C = 30\text{ mAdc}$, $V_{CE} = 0.4\text{ Vdc}$) ($I_C = 100\text{ mAdc}$, $V_{CE} = 0.5\text{ Vdc}$) ($I_C = 300\text{ mAdc}$, $V_{CE} = 1.0\text{ Vdc}$) ($I_C = 30\text{ mAdc}$, $V_{CE} = 0.4\text{ Vdc}$, $T_A = -55^\circ\text{C}$)	h_{FE}	35 30 15 15	120 — — —	—
Collector-Emitter Saturation Voltage ⁽¹⁾ ($I_C = 30\text{ mAdc}$, $I_B = 3.0\text{ mAdc}$) ($I_C = 100\text{ mAdc}$, $I_B = 10\text{ mAdc}$) ($I_C = 300\text{ mAdc}$, $I_B = 30\text{ mAdc}$) ($I_C = 30\text{ mAdc}$, $I_B = 3.0\text{ mAdc}$, $T_A = 125^\circ\text{C}$)	$V_{CE(sat)}$	— — — —	0.18 0.28 0.5 0.25	Vdc
Base-Emitter Saturation Voltage ⁽¹⁾ ($I_C = 30\text{ mAdc}$, $I_B = 3.0\text{ mAdc}$) ($I_C = 100\text{ mAdc}$, $I_B = 10\text{ mAdc}$) ($I_C = 300\text{ mAdc}$, $I_B = 30\text{ mAdc}$)	$V_{BE(sat)}$	0.75 — —	0.95 1.2 1.7	Vdc
SMALL-SIGNAL CHARACTERISTICS				
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
SWITCHING CHARACTERISTICS (See Figures 8, 13)				
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	μAdc
DC Current Gain ⁽¹⁾ ($I_C = 30\text{ mAdc}$, $V_{CE} = 0.4\text{ Vdc}$)	h_{FE}	35	120	—
Delta from Pre-Burn-In Measured Values				
Delta Collector Cutoff Current	ΔI_{CES}	—	± 100 or ± 50 whichever is greater	% of Initial Value μAdc
Delta DC Current Gain ⁽¹⁾	Δh_{FE}	—	± 20	% of Initial Value

(1) Pulsed: Pulse Width 250 to 350 μs ; Duty Cycle 1.0 to 2.0%