

2N4013
2N4014

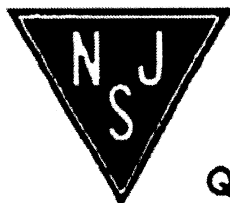
TO-18 (TO-206AA)
SWITCHING TRANSISTOR
NPN SILICON

MAXIMUM RATINGS

Rating	Symbol	2N4013	2N4014	Unit
Collector-Emitter Voltage	V _{CEO}	30	50	Vdc
Collector-Base Voltage	V _{CBO}	50	80	Vdc
Emitter-Base Voltage	V _{EB0}	6.0		Vdc
Collector Current — Continuous	I _C	1.0		Adc
— Peak		2.0		
Total Device Dissipation (i _C = 25°C)	P _D	0.5		Watt
Derate above 25°C		28.6		mW/°C
Total Device Dissipation (i _C = 25°C)	P _D	1.4		Watts
Derate above 25°C		6.8		mW/°C
Operating and Storage Junction Temperature Range	T _J , T _{stg}	-65 to +200		°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage(1) (I _C = 10 mAdc, I _B = 0)	V _{(BR)CEO}	50	—	—	Vdc
		30	—	—	
Collector-Emitter Breakdown Voltage (I _C = 10 μAdc, V _{BE} = 0)	V _{(BR)CES}	80	—	—	Vdc
		50	—	—	
Collector-Base Breakdown Voltage (I _C = 10 μAdc, I _E = 0)	V _{(BR)CBO}	80	—	—	Vdc
		50	—	—	
Emitter-Base Breakdown Voltage (I _E = 10 μAdc, I _C = 0)	V _{(BR)EBO}	6.0	—	—	Vdc
Collector Cutoff Current (V _{CB} = 60 Vdc, I _E = 0)	I _{CBO}	—	0.12	1.7	μAdc
(V _{CB} = 40 Vdc, I _E = 0)		—	0.12	1.7	
(V _{CB} = 60 Vdc, I _E = 0, T _A = 100°C)		—	—	120	
(V _{CB} = 40 Vdc, I _E = 0, T _A = 100°C)		—	—	120	
Collector Cutoff Current (V _{CE} = 80 Vdc, V _{EB} = 0)	I _{CES}	—	0.15	10	μAdc
(V _{CE} = 50 Vdc, V _{EB} = 0)		—	0.15	10	
ON CHARACTERISTICS(1)					
DC Current Gain (I _C = 10 mAdc, V _{CE} = 1.0 Vdc)	h _{FE}	30	—	—	—
(I _C = 100 mAdc, V _{CE} = 1.0 Vdc)		60	—	150	
(I _C = 100 mAdc, V _{CE} = 1.0 Vdc, T _A = -55°C)		30	—	—	
(I _C = 300 mAdc, V _{CE} = 1.0 Vdc)		40	—	—	
(I _C = 500 mAdc, V _{CE} = 1.0 Vdc)		35	—	—	
(I _C = 500 mAdc, V _{CE} = 1.0 Vdc, T _A = -55°C)		20	—	—	
(I _C = 800 mAdc, V _{CE} = 2.0 Vdc)		20	—	—	
		25	—	—	
(I _C = 1.0 Adc, V _{CE} = 5.0 Vdc)		25	—	—	
		30	—	—	
Collector-Emitter Saturation Voltage (I _C = 10 mAdc, I _B = 1.0 mAdc)	V _{CE(sat)}	—	0.17	0.25	Vdc
		—	0.17	0.25	
(I _C = 100 mAdc, I _B = 10 mAdc)		—	0.19	0.26	
		—	0.19	0.20	



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ELECTRICAL CHARACTERISTICS (continued) (T_A = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
I _C = 300 mA, I _B = 30 mA	2N4014	—	0.25	0.40	
	2N4013	—	0.25	0.32	
I _C = 500 mA, I _B = 50 mA	2N4014	—	0.30	0.52	
	2N4013	—	0.30	0.42	
I _C = 800 mA, I _B = 80 mA	2N4014	—	0.43	0.80	
	2N4013	—	0.43	0.65	
I _C = 1.0 A, I _B = 100 mA	2N4014	—	0.55	0.95	
	2N4013	—	0.55	0.75	
Base-Emitter Saturation Voltage	V _{BE(sat)}				Vdc
I _C = 10 mA, I _B = 1.0 mA		—	—	0.76	
I _C = 100 mA, I _B = 10 mA		—	—	0.86	
I _C = 300 mA, I _B = 30 mA		—	—	1.1	
I _C = 500 mA, I _B = 50 mA		0.8	—	1.1	
I _C = 800 mA, I _B = 80 mA		—	—	1.5	
I _C = 1.0 A, I _B = 100 mA		—	—	1.7	

SMALL-SIGNAL CHARACTERISTICS

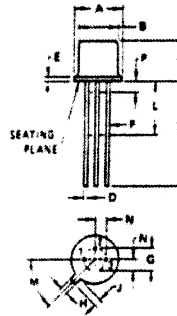
Current-Gain — Bandwidth Product(2) I _C = 50 mA, V _{CE} = 10 Vdc, f = 100 MHz	f _T	300	—	—	MHz
Output Capacitance V _{CB} = 10 Vdc, I _E = 0, f = 1.0 MHz	C _{obo}	2N4014	—	10	pF
		2N4013	—	12	
Input Capacitance V _{EB} = 0.5 Vdc, I _C = 0, f = 1.0 MHz	C _{ibo}	—	—	55	pF

SWITCHING CHARACTERISTICS

Delay Time	(V _{CC} = 30 Vdc, V _{BE(off)} = 3.8 Vdc, I _C = 500 mA, I _{B1} = 50 mA) (Figures 8, 10)	t _d	—	50	10	ns
Rise Time		t _r	—	15	30	ns
Storage Time	(V _{CC} = 30 Vdc, I _C = 500 mA, I _{B1} = I _{B2} = 50 mA) (Figures 9, 10)	t _s	—	30	50	ns
Fall Time		t _f	—	20	25	ns
				25	30	
Turn-On Time	(V _{CC} = 30 Vdc, V _{BE(off)} = 3.8 Vdc, I _C = 500 mA, I _{B1} = 50 mA) (Figures 8, 10)	t _{on}	—	20	35	ns
Turn-Off Time	(V _{CC} = 30 Vdc, I _C = 500 mA, I _{B1} = I _{B2} = 50 mA) (Figures 9, 10)	2N4014	—	50	60	ns
		2N4013				

- (1) Pulse Test: Pulse Width = 300 μs, Duty Cycle = 1.0%.
 (2) f_T = h_{FE} · f_{test}.

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DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	5.31	5.84	0.209	0.230
B	4.57	4.85	0.176	0.195
C	6.37	5.33	0.190	0.210
D	0.468	0.513	0.018	0.021
E	—	0.742	—	0.030
F	0.406	0.443	0.016	0.019
G	2.54 BSC	—	0.100 BSC	—
H	0.814	1.17	0.032	0.046
J	0.711	1.27	0.028	0.050
K	17.78	—	0.700	—
L	0.25	—	0.010	—
M	4.57 BSC	—	0.180 BSC	—
N	1.27 BSC	—	0.050 BSC	—
P	—	1.27	—	0.050