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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_{EBO}	6.0		Vdc
Collector Current — Continuous — Peak	I_C	1.0 2.0		Adc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	0.5 28.6		Watt mW/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	1.4 6.8		Watts 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)	2N4014 2N4013	$V_{(BR)CEO}$	 50 30	 — —	 — —	Vdc
Collector-Emitter Breakdown Voltage (I_C = 10 μAdc, V_{BE} = 0)	2N4014 2N4013	$V_{(BR)CES}$	 80 50	 — —	 — —	Vdc
Collector-Base Breakdown Voltage (I_C = 10 μAdc, I_E = 0)	2N4014 2N4013	$V_{(BR)CBO}$	 80 50	 — —	 — —	Vdc
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) (V_{CB} = 40 Vdc, I_E = 0) (V_{CB} = 60 Vdc, I_E = 0, T_A = 100°C) (V_{CB} = 40 Vdc, I_E = 0, T_A = 100°C)	 2N4014 2N4013 2N4014 2N4013	I_{CBO}	 — — — —	 0.12 0.12 — —	 1.7 1.7 120 120	μAdc
Collector Cutoff Current (V_{CE} = 80 Vdc, V_{EB} = 0) (V_{CE} = 50 Vdc, V_{EB} = 0)	 2N4014 2N4013	I_{CES}	 — —	 0.15 0.15	 10 10	μAdc
ON CHARACTERISTICS(1)						
DC Current Gain (I_C = 10 mAdc, V_{CE} = 1.0 Vdc) (I_C = 100 mAdc, V_{CE} = 1.0 Vdc) (I_C = 100 mAdc, V_{CE} = 1.0 Vdc, T_A = −55°C) (I_C = 300 mAdc, V_{CE} = 1.0 Vdc) (I_C = 500 mAdc, V_{CE} = 1.0 Vdc) (I_C = 500 mAdc, V_{CE} = 1.0 Vdc, T_A = −55°C) (I_C = 800 mAdc, V_{CE} = 2.0 Vdc)	 2N4014 2N4013	h_{FE}	 30 60 30 40 35 20 20 25	 — — — — — — —	 — 150 — — — — —	—
(I_C = 1.0 Adc, V_{CE} = 5.0 Vdc)	2N4014 2N4013		25 30	 —	 —	
Collector-Emitter Saturation Voltage (I_C = 10 mAdc, I_B = 1.0 mAdc) (I_C = 100 mAdc, I_B = 10 mAdc)	 2N4014 2N4013 2N4014 2N4013	$V_{CE(sat)}$	 — — — —	 0.17 0.17 0.19 0.19	 0.25 0.25 0.26 0.20	Vdc

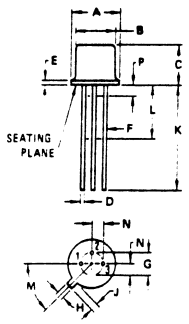
Quality Semi-Conductors

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

Characteristic		Symbol	Min	Typ	Max	Unit
(I_C = 300 mAdc, I_B = 30 mAdc)	2N4014		—	0.25	0.40	
	2N4013		—	0.25	0.32	
(I_C = 500 mAdc, I_B = 50 mAdc)	2N4014		—	0.30	0.52	
	2N4013		—	0.30	0.42	
(I_C = 800 mAdc, I_B = 80 mAdc)	2N4014		—	0.43	0.80	
	2N4013		—	0.43	0.65	
(I_C = 1.0 Adc, I_B = 100 mAdc)	2N4014		—	0.55	0.95	
	2N4013		—	0.55	0.75	
Base-Emitter Saturation Voltage		$V_{BE(sat)}$				Vdc
(I_C = 10 mAdc, I_B = 1.0 mAdc)			—	—	0.76	
(I_C = 100 mAdc, I_B = 10 mAdc)			—	—	0.86	
(I_C = 300 mAdc, I_B = 30 mAdc)			—	—	1.1	
(I_C = 500 mAdc, I_B = 50 mAdc)			0.8	—	1.1	
(I_C = 800 mAdc, I_B = 80 mAdc)			—	—	1.5	
(I_C = 1.0 Adc, I_B = 100 mAdc)			—	—	1.7	
SMALL-SIGNAL CHARACTERISTICS						
Current-Gain — Bandwidth Product(2) (I_C = 50 mAdc, V_{CE} = 10 Vdc, f = 100 MHz)		f_T	300	—	—	MHz
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f = 1.0 MHz)	2N4014	C_{obo}	—	—	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 mAdc, I_{B1} = 50 mAdc) (Figures 8, 10)	t_d	—	5.0	10	ns
Rise Time		t_r	—	15	30	ns
Storage Time	(V_{CC} = 30 Vdc, I_C = 500 mAdc, I_{B1} = I_{B2} = 50 mAdc) (Figures 9, 10) 2N4014	t_s	—	30	50	ns
Fall Time	2N4013	t_f	—	20 25	25 30	ns
Turn-On Time	(V_{CC} = 30 Vdc, $V_{BE(off)}$ = 3.8 Vdc, I_C = 500 mAdc, I_{B1} = 50 mAdc) (Figures 8, 10)	t_{on}	—	20	35	ns
Turn-Off Time	(V_{CC} = 30 Vdc, I_C = 500 mAdc, I_{B1} = I_{B2} = 50 mAdc) (Figures 9, 10) 2N4014 2N4013	t_{off}	—	50	60	ns

(1) Pulse Test: Pulse Width = 300 μs, Duty Cycle = 1.0%.
(2) $f_T = |h_{fe}| \cdot f_{test}$.

TO-18 (TO-206AA)



DIM	MILLIMETERS MIN	MAX	INCHES MIN	MAX
A	5.31	5.84	0.209	0.230
B	4.52	4.95	0.178	0.195
C	4.32	5.33	0.170	0.210
D	0.406	0.533	0.016	0.021
E	–	0.762	–	0.030
F	0.406	0.483	0.016	0.019
G	2.54 BSC		0.100 BSC	
H	0.914	1.17	0.036	0.046
J	0.711	1.22	0.028	0.048
K	12.70	–	0.500	–
L	6.35	–	0.250	–
M	45° BSC		45° BSC	
N	1.27 BSC		0.050 BSC	
P	–	1.27	–	0.050