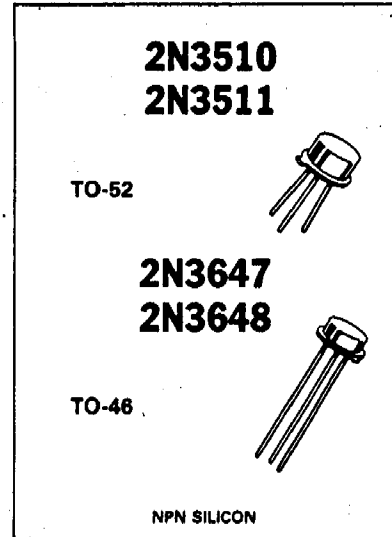


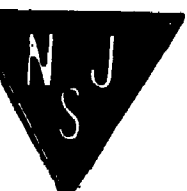
MAXIMUM RATINGS

Rating	Symbol	2N3510 2N3647	2N3511 2N3648	Unit
Collector-Emitter Voltage	V _{CEO}	10	15	V _{dc}
Collector-Base Voltage	V _{CBO}	40	40	V _{dc}
Emitter-Base Voltage	V _{EBO}	6.0		V _{dc}
Collector Current — Continuous	I _C	500		mAdc
Total Device Dissipation @ T _A = 25°C. Derate above 25°C	P _D	TO-46 2N3647 2N3648	TO-52 2N3510 2N3511	mW mW/°C
		400 2.28	380 2.06	
Total Device Dissipation @ T _C = 25°C. Derate above 25°C	P _D	2.0 11.43	1.2 6.9	Watts mW/°C
Operating and Storage Junction Temperature Range	T _J , T _{stg}	-85 to +200		°C



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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage(1) (I _C = 10 mAdc, I _B = 0)	V _{(BR)CEO}	10 15	—	V _{dc}
Collector-Base Breakdown Voltage (I _C = 10 μAdc, I _E = 0)	V _{(BR)CBO}	40	—	V _{dc}
Emitter-Base Breakdown Voltage (I _E = 10 μAdc, I _C = 0)	V _{(BR)EBO}	6.0	—	V _{dc}
Collector Cutoff Current (V _{CE} = 10 Vdc, V _{EB(off)} = 1.0 Vdc) (V _{CE} = 10 Vdc, V _{EB(off)} = 1.0 Vdc, T _A = 150°C)	I _{CEX}	—	.025 50	μAdc
Base Cutoff Current (V _{CE} = 10 Vdc, V _{OB} = 1.0 Vdc)		—	.025	μAdc
ON CHARACTERISTICS				
DC Current Gain (I _C = 1.0 mAdc, V _{CE} = 1.0 Vdc)	h _{FE}	12 15	—	—
(I _C = 10 mAdc, V _{CE} = 1.0 Vdc)		20 25	—	
(I _C = 150 mAdc, V _{CE} = 1.0 Vdc)		25 30	150 120	
(I _C = 150 mAdc, V _{CE} = 1.0 Vdc, T _A = -55°C)		12	—	
(I _C = 300 mAdc, V _{CE} = 1.0 Vdc)		15	—	
(I _C = 500 mAdc, V _{CE} = 1.0 Vdc)		12	—	
Collector-Emitter Saturation Voltage(1) (I _C = 10 mAdc, I _B = 1.0 mAdc)	V _{CE(sat)}	—	0.25	V _{dc}
(I _C = 150 mAdc, I _B = 15 mAdc)		—	0.4	
(I _C = 300 mAdc, I _B = 30 mAdc)		—	0.6	
(I _C = 500 mAdc, I _B = 50 mAdc)		—	0.8	
Base-Emitter Saturation Voltage(1) (I _C = 10 mAdc, I _B = 1.0 mAdc)	V _{BE(sat)}	—	0.8	V _{dc}
(I _C = 150 mAdc, I _B = 15 mAdc)		0.8	1.0	
(I _C = 300 mAdc, I _B = 30 mAdc)		—	1.15	
(I _C = 500 mAdc, I _B = 50 mAdc)		—	1.5	



ELECTRICAL CHARACTERISTICS (continued) ($T_A = 25^\circ\text{C}$ unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit	
Input Capacitance ($V_{BE} = 1.0\text{ Vdc}$, $I_C = 0$, $f = 140\text{ kHz}$)	C_{ibo}	—	4.0	pF	
Small-Signal Current Gain ($I_C = 10\text{ mAdc}$, $V_{CE} = 10\text{ Vdc}$, $f = 100\text{ MHz}$)	h_{fe}	5.0	—	—	
SWITCHING CHARACTERISTICS					
Storage Time ($I_C = I_{B1} = I_{B2} = 10\text{ mA}$)	$t_s(t_s)$	—	13	ns	
Turn-On Time ($I_C = 10\text{ mA}$, $I_{B1} = 3.0\text{ mA}$, $V_{CC} = 3.0\text{ V}$, $V_{OB} = 1.5\text{ V}$)	t_{on}	—	12	ns	
Turn-Off Time ($I_C = 10\text{ mA}$, $I_{B1} = 3.0\text{ mA}$, $I_{B2} = 1.5\text{ mA}$, $V_{CC} = 3.0\text{ V}$)	t_{off}	—	18	ns	
Total Control Charge ($I_C = 10\text{ mA}$, $I_B = 1.0\text{ mA}$, $V_{CC} = 3.0\text{ V}$)	Q_r	—	50	pC	
Delay Time	$V_{CC} = 10\text{ V}$, $V_{EB} = 2.0\text{ V}$, $I_C = 100\text{ mA}$, $I_{B1} = 10\text{ mA}$	t_d	—	5.0	ns
Rise Time		t_r	—	18	ns
Storage Time	$V_{CC} = 10\text{ V}$, $I_C = 100\text{ mA}$, $I_{B1} = I_{B2} = 10\text{ mA}$	t_s	—	13	ns
Fall Time		t_f	—	15	ns

(1) Pulse Test: $PW = 300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$.