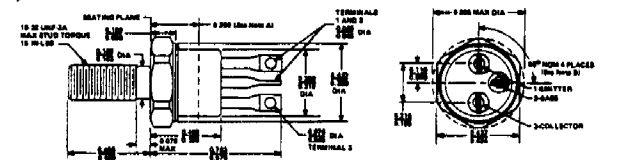

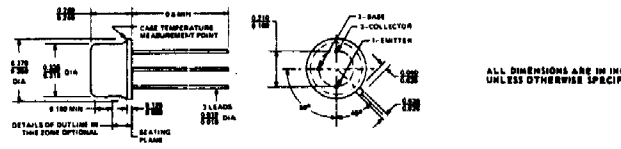



**TYPES 2N4998, 2N5000, 2N5148, 2N5150
N-P-N SILICON POWER TRANSISTORS**

**HIGH-FREQUENCY POWER TRANSISTORS WITH
COMPUTER-DESIGNED ISOTHERMAL GEOMETRY**

- For Complementary Use With 2N4999, 2N5001, 2N5147, and 2N5149
- 6 mJ Reverse Energy Rating with $I_C = 5$ A and 4 V Reverse Bias

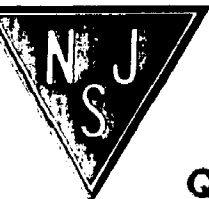
***mechanical data**

<p>2N4998, 2N5000 ALL TERMINALS ARE INSULATED FROM THE CASE</p>  <p>ALL JEDEC TO-59 DIMENSIONS AND NOTES ARE APPLICABLE</p> <p>NOTES: A. Within this dimension, case diameter may vary. B. Position of terminals with respect to hexagon is not controlled. C. The case temperature may be measured anywhere on the seating plane within 0.125 inch of the stud. D. All dimensions are in inches unless otherwise specified.</p>	
<p>2N5148, 2N5150 THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE</p>  <p>ALL JEDEC TO-39 DIMENSIONS AND NOTES ARE APPLICABLE</p>	

absolute maximum ratings at 25°C case temperature (unless otherwise noted)

	2N4998 2N5000	2N5148 2N5150
Collector-Base Voltage	100 V*	80 V*
Collector-Emitter Voltage (See Note 1)	80 V*	6 V*
Emitter-Base Voltage	6 V*	
Continuous Collector Current	2 A*	2 A*
Peak Collector Current (See Note 2)	5 A*	5 A*
Continuous Base Current	1 A*	1 A*
Safe Operating Areas	See Figures 7* and 8	
Continuous Device Dissipation at 50°C Case Temperature (See Note 3)	30 W*	6 W*
Continuous Device Dissipation at 100°C Case Temperature (See Note 3)	20 W	4 W
Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 4)	2 W	1 W*
Unclamped Inductive Load Energy (See Note 5)	6 mJ	
Operating Collector Junction Temperature Range	-65°C to 200°C*	
Storage Temperature Range	-65°C to 200°C*	
Lead or Terminal Temperature 1/8 Inch from Case for 60 Seconds	300°C*	

- NOTES: 1. This value applies when the base-emitter diode is open-circuited.
2. This value applies for $t_{\text{tr}} < 0.3$ ms, duty cycle $< 1\%$.
3. For operation above (or below) 50°C case temperature, refer to Dissipation Derating Curves Figures 9 and 10.
4. Derate linearly to 200°C free-air temperature at the rate of 11.4 mW/°C for 2N4998 and 2N5000, 5.7 mW/°C for 2N5148 and 2N5150.
5. This rating is based on the capability of the transistors to operate safely in the unclamped inductive load circuit of Section 3.2 of the forthcoming JEDEC publication *Suggested Standards on Power Transistors*. $L = 0.48$ mH, $R_{\text{BB1}} = 20$ Ω, $R_{\text{BB2}} = 100$ Ω, $V_{\text{BB1}} = 10$ V, $V_{\text{BB2}} = 4$ V, $R_L = 0.1$ Ω, $V_{\text{CC}} = 10$ V, $I_{\text{CM}} = 5$ A. Energy = $I_C^2 L / 2$.
- *JEDEC registered data. This data sheet contains all applicable registered data in effect at the time of publication.
†This circuit appears on page B-1 of this data book.



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TYPES 2N4998, 2N5000, 2N5148, 2N5150
N-P-N SILICON POWER TRANSISTORS

*electrical characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	2N4998 2N5148		2N5000 2N5150		UNIT
		MIN	MAX	MIN	MAX	
$V_{(BR)CEO}$ Collector-Emitter Breakdown Voltage	$I_C = 100 \text{ mA}$, $I_B = 0$, See Note 6	80		80		V
I_{CEO} Collector Cutoff Current	$V_{CE} = 40 \text{ V}$, $I_B = 0$	50		50		μA
I_{CES} Collector Cutoff Current	$V_{CE} = 60 \text{ V}$, $V_{BE} = 0$	1		1		μA
I_{CEV} Collector Cutoff Current	$V_{CE} = 100 \text{ V}$, $V_{BE} = 0$	1		1		mA
I_{CEV} Collector Cutoff Current	$V_{CE} = 60 \text{ V}$, $V_{BE} = -2 \text{ V}$, $T_C = 150^\circ\text{C}$	500		500		μA
I_{EBO} Emitter Cutoff Current	$V_{EB} = 5 \text{ V}$, $I_C = 0$	1		1		μA
I_{EBO} Emitter Cutoff Current	$V_{EB} = 6 \text{ V}$, $I_C = 0$	1		1		mA
h_{FE} Static Forward Current Transfer Ratio	$V_{CE} = 5 \text{ V}$, $I_C = 50 \text{ mA}$	20		50		
	$V_{CE} = 5 \text{ V}$, $I_C = 1 \text{ A}$	30	90	70	200	
	$V_{CE} = 5 \text{ V}$, $I_C = 2 \text{ A}$	15		30		
	$V_{CE} = 5 \text{ V}$, $I_C = 3 \text{ A}$	5		15		
V_{BE} Base-Emitter Voltage	$I_B = 100 \text{ mA}$, $I_C = 1 \text{ A}$		1.2		1.2	V
	$I_B = 200 \text{ mA}$, $I_C = 2 \text{ A}$		1.5		1.5	
	$V_{CE} = 5 \text{ V}$, $I_C = 2 \text{ A}$		1.5		1.5	
	$V_{CE} = 5 \text{ V}$, $I_C = 3 \text{ A}$		3		3	
$V_{CE(sat)}$ Collector-Emitter Saturation Voltage	$I_B = 100 \text{ mA}$, $I_C = 1 \text{ A}$		0.46		0.46	V
	$I_B = 200 \text{ mA}$, $I_C = 2 \text{ A}$		0.85		0.85	
	$I_B = 600 \text{ mA}$, $I_C = 3 \text{ A}$		5		5	
h_{fe} Small-Signal Common-Emitter Forward Current Transfer Ratio	$V_{CE} = 5 \text{ V}$, $I_C = 0.1 \text{ A}$, $f = 1 \text{ kHz}$	20		50		
h_{fe} Small-Signal Common-Emitter Forward Current Transfer Ratio	$V_{CE} = 5 \text{ V}$, $I_C = 0.2 \text{ A}$, $f = 20 \text{ MHz}$	2.5		3		
C_{obo} Common-Base Open-Circuit Output Capacitance	$V_{CB} = 10 \text{ V}$, $I_E = 0$, $f = 1 \text{ MHz}$		70		70	pF

NOTES: 6. These parameters must be measured using pulse techniques, $t_w = 300 \mu\text{s}$, duty cycle $\leq 1\%$.
 7. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts and located within 0.125 inch from the device body.

*JEDEC registered data

thermal characteristics

PARAMETER	DESCRIPTION	2N4998 2N5000	2N5148 2N5150	UNIT
		MAX	MAX	
$R_{\theta JC}$	Junction-to-Case Thermal Resistance	5	25	$^\circ\text{C/W}$
$R_{\theta JA}$	Junction-to-Free-Air Thermal Resistance	87.5	175	$^\circ\text{C/W}$

switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS†	ALL TYPES		UNIT
		TYP		
t_{on} Turn-On Time	$I_C = 2 \text{ A}$, $I_{B(1)} = 200 \text{ mA}$, $I_{B(2)} = -200 \text{ mA}$,		0.1	μs
t_{off} Turn-Off Time	$V_{BE(off)} = -3.7 \text{ V}$, $R_L = 15 \Omega$, See Figure 1		1.1	

† Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.