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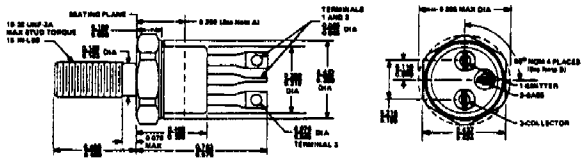
TYPES 2N4998, 2N5000, 2N5148, 2N5150
N-P-N SILICON POWER TRANSISTORS

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

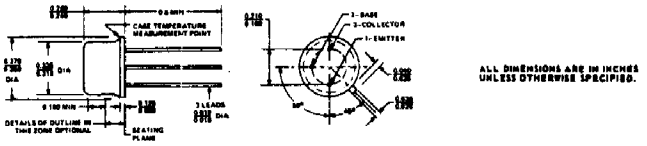
2N4998, 2N5000 ALL TERMINALS ARE INSULATED FROM THE CASE



ALL JEDEC TO-59 DIMENSIONS AND NOTES ARE APPLICABLE

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.

2N5148, 2N5150 THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE



ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.

ALL JEDEC TO-39 DIMENSIONS AND NOTES ARE APPLICABLE

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

	2N4998 2N5000	2N5148 2N5150
Collector-Base Voltage	← 100 V* →	
Collector-Emitter Voltage (See Note 1)	← 80 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 $t_w \leq 8.3$ 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_{BB1} = 20 Ω, R_{BB2} = 100 Ω, V_{BB1} = 10 V, V_{BB2} = 4 V, R_L = 0.1 Ω, V_{CC} = 10 V, I_{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 5-1 of this data book.

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 MIN	2N4998 2N5148 MAX	2N5000 2N5150 MIN	2N5000 2N5150 MAX	UNIT
$V_{(BR)CEO}$	Collector-Emitter Breakdown Voltage	I_C = 100 mA, I_B = 0,	See Note 6	80		80		V
I_{CEO}	Collector Cutoff Current	V_{CE} = 40 V, I_B = 0			50		50	μA
I_{CES}	Collector Cutoff Current	V_{CE} = 60 V, V_{BE} = 0			1		1	μA
		V_{CE} = 100 V, V_{BE} = 0			1		1	mA
I_{CEV}	Collector Cutoff Current	V_{CE} = 60 V, V_{BE} = −2 V, T_C = 150°C			500		500	μA
I_{EBO}	Emitter Cutoff Current	V_{EB} = 5 V, I_C = 0			1		1	μA
		V_{EB} = 6 V, I_C = 0			1		1	mA
h_{FE}	Static Forward Current Transfer Ratio	V_{CE} = 5 V, I_C = 50 mA	See Notes 6 and 7	20		50		
		V_{CE} = 5 V, I_C = 1 A		30	90	70	200	
		V_{CE} = 5 V, I_C = 2 A		15		30		
		V_{CE} = 5 V, I_C = 3 A		5		15		
		V_{CE} = 5 V, I_C = 1 A, T_C = −55°C		15		35		
V_{BE}	Base-Emitter Voltage	I_B = 100 mA, I_C = 1 A	See Notes 6 and 7		1.2		1.2	V
		I_B = 200 mA, I_C = 2 A			1.5		1.5	
		V_{CE} = 5 V, I_C = 2 A			1.5		1.5	
		V_{CE} = 5 V, I_C = 3 A			3		3	
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	I_B = 100 mA, I_C = 1 A	See Notes 6 and 7		0.46		0.46	V
		I_B = 200 mA, I_C = 2 A			0.85		0.85	
		I_B = 600 mA, I_C = 3 A			5		5	
h_{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = 5 V, I_C = 0.1 A, f = 1 kHz		20		50		
h_{fe}	Small-Signal Common-Emitter Forward Current Transfer Ratio	V_{CE} = 5 V, I_C = 0.2 A, f = 20 MHz		2.5		3		
C_{obo}	Common-Base Open-Circuit Output Capacitance	V_{CB} = 10 V, I_E = 0, f = 1 MHz			70		70	pF

NOTES: 6. These parameters must be measured using pulse techniques. t_w = 300 μs, duty cycle ≤ 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		2N4998 2N5000 MAX	2N5148 2N5150 MAX	UNIT
$R_{\theta JC}$	Junction-to-Case Thermal Resistance	5	25	°C/W
$R_{\theta JA}$	Junction-to-Free-Air Thermal Resistance	87.5	175	

switching characteristics at 25°C case temperature

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

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