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TECHNICAL DATA SHEET

NPN POWER SWITCHING SILICON TRANSISTOR

Qualified per MIL-PRF-19500/374

DEVICES

2N3996 2N3997 2N3998 2N3999

LEVELS

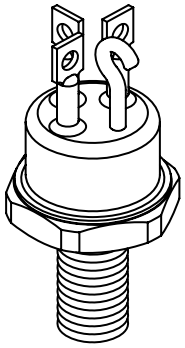
JAN
JANTX
JANTXV

ABSOLUTE MAXIMUM RATINGS *(T_C = +25°C unless otherwise noted)*

Parameters / Test Conditions	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	80	Vdc
Collector-Base Voltage	V_{CBO}	100	Vdc
Emitter-Base Voltage	V_{EBO}	8.0	Vdc
Base Current	I_B	0.5	Adc
Collector Current	I_C	10 (1)	Adc
Total Power Dissipation @ T_A = +25°C (2) @ T_C = +100°C (3)	P_T	2.0 30	W
Operating & Storage Junction Temperature Range	T_J, T_{stg}	-65 to +200	°C
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	3.33	°C/W

Note:

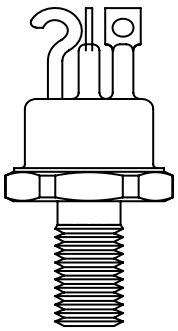
(1) This value applies for Tp ≤ 1.0ms, duty cycle ≤ 50%
(2) Derate linearly 11.4 mW/°C for T_A > +25°C
(3) Derate linearly 300 mW/°C for T_C > +100°C



TO-111
2N3996, 2N3997

ELECTRICAL CHARACTERISTICS *(T_A = +25°C, unless otherwise noted)*

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
OFF CHARACTERTICS				
Collector-Emitter Breakdown Voltage I_C = 50mAdc	$V_{(BR)CEO}$	80		Vdc
Collector-Emitter Breakdown Voltage I_C = 10µAdc	$V_{(BR)CBO}$	100		Vdc
Collector-Emitter Cutoff Current V_{CE} = 60Vdc	I_{CEO}		10	µAdc
Collector-Emitter Cutoff Current V_{CE} = 80Vdc, V_{BE} = 0V	I_{CES}		200	ηAdc
Emitter-Base Cutoff Current V_{EB} = 5.0Vdc V_{EB} = 8.0Vdc	I_{EBO}		200 10	ηAdc µAdc



TO-59
2N3998, 2N3999

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ELECTRICAL CHARACTERISTICS *(T_A = +25°C, unless otherwise noted)*

Parameters / Test Conditions		Symbol	Min.	Max.	Unit
ON CHARACTERISTICS (2)					
Forward-Current Transfer Ratio					
I_C = 50mAdc, V_{CE} = 2.0Vdc	2N3996, 2N3998		30		
I_C = 1.0Adc, V_{CE} = 2.0Vdc			40	120	
I_C = 5.0Adc, V_{CE} = 5.0Vdc		h_{FE}	15		
I_C = 50mAdc, V_{CE} = 2.0Vdc	2N3997, 2N3999		60		
I_C = 1.0Adc, V_{CE} = 2.0Vdc			80	240	
I_C = 5.0Adc, V_{CE} = 5.0Vdc			20		
Collector-Emitter Saturation Voltage					
I_C = 1.0Adc, I_B = 0.1Adc		$V_{CE(sat)}$		0.25	Vdc
I_C = 5.0Adc, I_B = 0.5Adc				2.0	
Base-Emitter Saturation Voltage					
I_C = 1.0Adc, I_B = 0.1Adc		$V_{BE(sat)}$	0.6	1.2	Vdc
I_C = 5.0Adc, I_B = 0.5Adc				1.6	

DYNAMIC CHARACTERISTICS

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
Magnitude of Common Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio I_C = 1.0Adc, V_{CE} = 5.0Vdc, f = 10MHz	$\|h_{fe}\|$	3.0	12	
Output Capacitance V_{CB} = 10Vdc, I_E = 0, 100kHz ≤ f ≤ 1.0MHz	C_{obo}		150	pF

SAFE OPERATING AREA

DC Tests
T_C = +100°C, 1 Cycle, t = 1.0s
Test 1
V_{CE} = 80Vdc, I_C = 0.08Adc
Test 2
V_{CE} = 20Vdc, I_C = 1.5Adc

(4) Pulse Test: Pulse Width = 300µs, Duty Cycle ≤ 2.0%.

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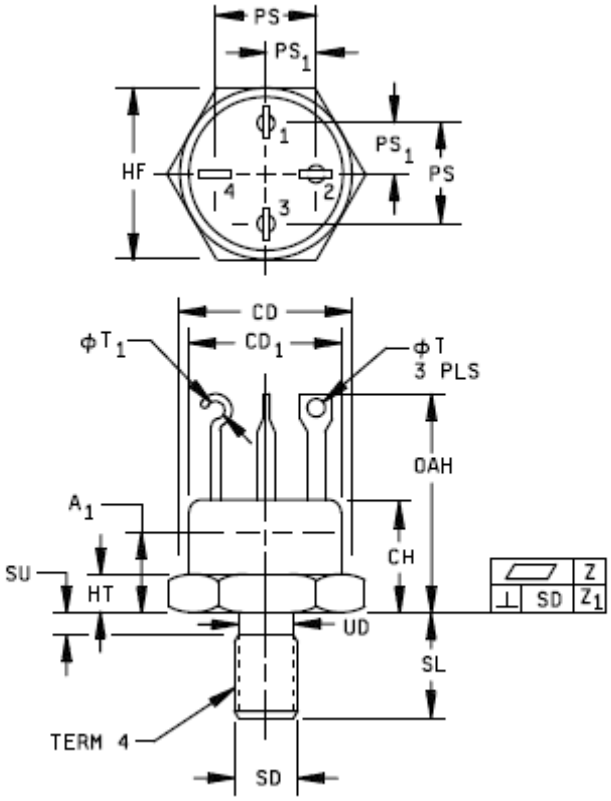
PACKAGE DIMENSIONS



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CH	.345	.400	8.76	10.16	
A_1		.250		6.35	3
CD	.370	.437	9.40	11.10	3
CD_1	.318	.380	8.08	9.65	
HF	.424	.437	10.77	11.10	
PS	.180	.215	4.57	5.46	5
PS_1	.080	.110	2.03	2.79	5
HT	.090	.140	2.29	3.56	2, 6
OAH	.575	.675	14.61	17.15	1
UD	.155	.189	3.94	4.80	
SL	.400	.455	10.16	11.56	
SU		.078		1.98	7
ϕT	.040	.065	1.02	1.65	
$ϕT_1$	.040	.065	1.02	1.65	4
SD	.190-32 UNF-2A				8
Z		.002		0.05	
Z_1		.006		0.15	

NOTES:

1. Terminal 1, emitter; terminal 2, base; terminal 3, collector; terminal 4, case.
2. Chamfer or undercut on one or both ends of hexagonal portion is optional.
3. The outline contour with the exception of the hexagon is optional within cylinder defined by CD1 and A1.
4. Terminal r can be flattened and pierced or hook type. A visual index is required when the flattened and pierced tab terminal contour (identical to the adjacent terminals) option is used. The case terminal (hook) is mechanically connected to the case. The other three terminals shall be electrically isolated from the case.
5. Angular orientation of terminals with respect to hexagon is optional.
6. HT dimension does not include sealing flanges.
7. SU is the length of incomplete or undercut threads.
8. SD is the pitch diameter of coated threads. Reference: Screw threads standards for Federal Service Handbook H28, part I.
9. Dimensions are in inches.
* 10. Millimeters are giving for general information only.
* 11. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

*** FIGURE 1.** Physical dimensions for transistor types 2N3996 and 2N3997 - Continued.

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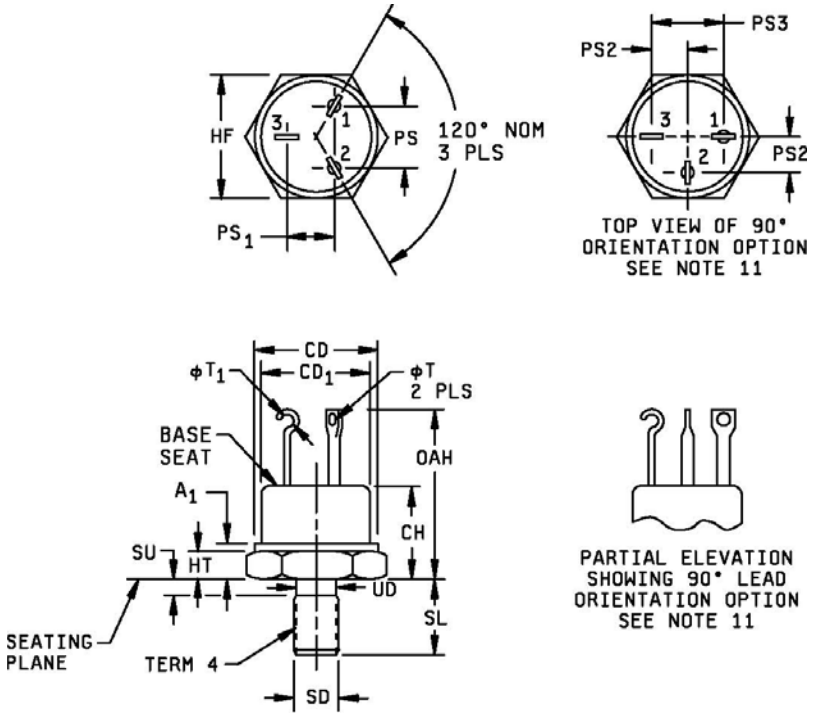

Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CH	.345	.400	8.76	10.16	
A_1		.250		6.35	
CD_1	.318	.380	8.08	9.65	
CD	.370	.437	9.40	11.10	
HF	.424	.437	10.77	11.10	
PS	.125	.165	3.18	4.19	4, 7, 8
PS_1	.110	.145	2.79	3.68	4, 7
PS_2	.090	.140	2.29	3.56	4, 7, 8
PS_3	.185	.215	4.70	5.46	4, 7, 8
HT	.090	.140	2.29	3.56	
OAH	.575	.675	14.61	17.15	5
UD	.155	.189	3.94	4.80	
SL	.400	.455	10.16	11.56	
SU		.078		1.98	9
φT	.040	.065	1.02	1.65	
$φT_1$	.040	.065	1.02	1.65	
SD	.190-32 UNF-2A				3

NOTES:

1. Dimensions are in inches. Millimeters are given for general information only
2. Collector shall be electrically connected to the case. This terminal may be flattened and pierced only when the 90 degree option is used.
3. SD is the pitch diameter of coated threads. Reference: Screw thread standards for Federal Service Handbook H28, part I.
4. The orientation of the terminals in relation to the hex flats is not controlled.
5. All three terminals.
6. The case temperature may be measured anywhere on the seating plane within .125 (3.18 mm) of the stud.
7. Terminal spacing measured at the base seat only.
8. Dimensions PS, PS1, PS2, and PS3 are measured from the centerline of terminals.
9. Maximum unthreaded dimension.
10. This dimension applies to the location of the center line of the terminals.
11. A 90 degree angle lead orientation as shown may be used at the option of the manufacturer. All dimensions of the basic outline except PS, PS1, and the 120□lead angle apply to this option.
12. Terminal 1, emitter; terminal 2, base; terminal 3, collector.
13. A slight chamfer or undercut on one or both ends of the hexagonal is optional.
* 14. In accordance with ASME Y14.5M, diameters are equivalent to φx symbology.

*** FIGURE 2.** Physical dimensions for transistor types 2N3998 and 2N3999

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