The documentation and process conversion measures necessary to comply with this revision shall be completed by 25 July 2011.

INCH-POUND

MIL-PRF-19500/349J
10 June 2011
SUPERSEDING
MIL-PRF-19500/349H
25 August 2009

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, SWITCHING,
TYPES 2N3506, 2N3506A, 2N3506L, 2N3506AL, 2N3506U4, 2N3506AU4, 2N3507, 2N3507L,
2N3507A, 2N3507AL, 2N3507U4, AND 2N3507AU4, JAN, JANTX, JANTXV, JANS, JANSM, JANSD,
JANSP, JANSL, JANSR, JANSF, JANSG, JANSH, JANHCA, JANKCA, JANKCAM,
JANKCAD, JANKCAP, JANKCAL, JANKCAR, JANKCAF, JANKCAG, and JANKCAH

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the product described herein shall consist of this specification sheet and MIL-PRF-19500.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for NPN, silicon, switching transistors. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500. Two levels of product assurance are provided for each unencapsulated device type. Provisions for radiation hardness assurance (RHA) to eight radiation levels is provided for JANTXV, JANS, JANHC, and JANKC product assurance levels. RHA level designators “M”, “D”, “P“, “L”, “R”, “F”, “G”, and “H” are appended to the device prefix to identify devices, which have passed RHA requirements.

1.2 Physical dimensions. See figure 1 (similar to TO-39) and figure 2 (U4), and figure 3 for JANHC and JANKC (die) dimensions.

1.3 Maximum ratings unless otherwise specified T_A = +25°C. (1)

Types	P_T T_A = +25°C (1)	P_T T_C = +25°C (1)	$R_{\theta JA}$ (2)	$R_{\theta JC}$ (2)	V_{CBO}	V_{CEO}	V_{EBO}	I_C	T_J and T_{STG}
	W	W	°C/W	°C/W	V dc	V dc	V dc	A dc	°C
2N3506, 2N3506A,	1.0	5.0	175	18	60	40	5.0	3.0	
2N3506L, 2N3506AL	1.0	5.0	175	18	60	40	5.0	3.0	
2N3506U4	1.0	5.0	175	7	60	40	5.0	3.0	-65 to
2N3507, 2N3507A,	1.0	5.0	175	18	80	50	5.0	3.0	+200
2N3507L, 2N3507AL	1.0	5.0	175	18	80	50	5.0	3.0	
2N3507U4	1.0	5.0	175	7	80	50	5.0	3.0	

(1) For derating see figures 4, 5, and 6.
(2) For thermal impedance see figures 7, 8, and 9.

* Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.daps.dla.mil

1.4 Primary electrical characteristics. (1)

	h_{FE2} (1)		h_{FE4} (1)		$V_{CE(sat)}$	$\|h_{fe}\|$	C_{obo}	t_{on}	t_{off}
Limits	V_{CE} = 2.0 V dc I_C = 1.5 A dc		V_{CE} = 5.0 V dc I_C = 3.0 A dc		I_C = 1.5 A dc I_B = 150 mA dc	f = 20 Mhz V_{CE} = 5 V dc I_C = 100 mA dc	V_{CB} = 10 V dc I_E = 0 100 kHz ≤ f ≤ 1 MHz	I_C = 1.5 A dc I_B = 150 mA dc	
	2N3506, 2N3506A, 2N3506L, 2N3506AL, 2N3506U4 2N3506AU4	2N3507, 2N3507A, 2N3507L, 2N3507AL, 2N3507U4 2N3507AU4	2N3506, 2N3506A, 2N3506L, 2N3506AL, 2N3506U4 2N3506AU4	2N3507, 2N3507A, 2N3507L, 2N3507AL, 2N3507U4 2N3507AU4					
					V dc		pF	ns	ns
Min	40	30	25	20		3			
Max	200	150			1.0	15	40	45	90

(1) Pulsed (see 4.5.1).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

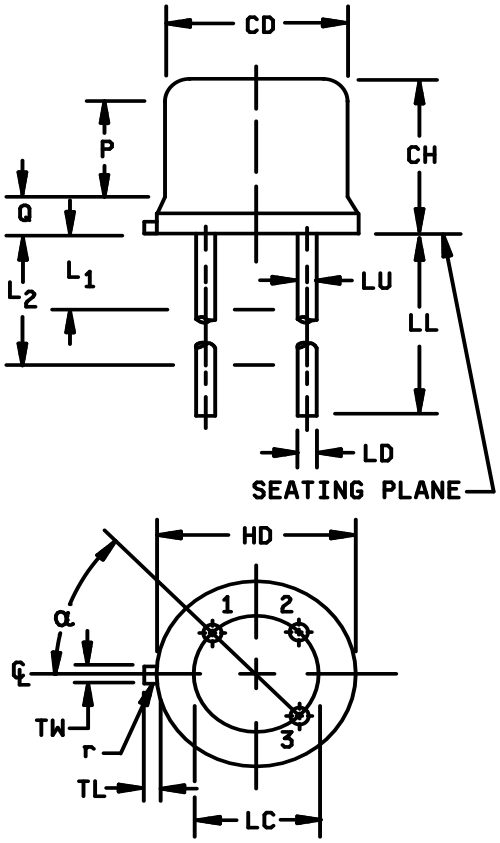
DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-750 - Test Methods for Semiconductor Devices.

* (Copies of these documents are available online at https://assist.daps.dla.mil/quicksearch or https://assist.daps.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

* 2.3 Order of precedence. Unless otherwise noted herein or in the contract, in the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes laws and regulations unless a specific exemption has been obtained.

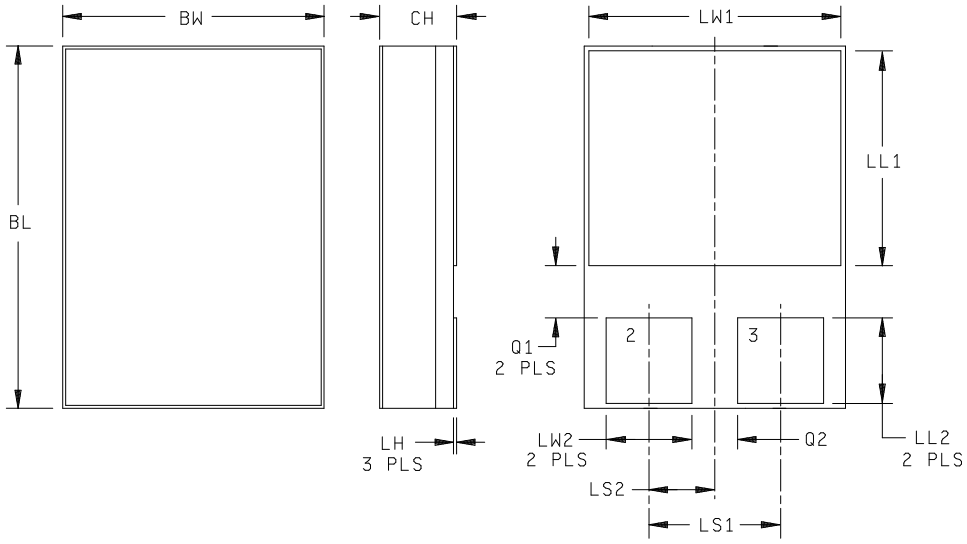
Dimensions					
Symbol	Inches		Millimeters		Notes
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		6
LD	.016	.021	0.41	0.53	7, 8
LL	See notes				7, 8, 11,12
LU	.016	.019	0.41	0.48	7, 8
L_1		.050		1.27	7, 8
L_2	.250		6.35		7, 8
P	.100		2.54		5
Q		.050		1.27	4
r		.010		0.25	10
TL	.029	.045	0.74	1.14	3
TW	.028	.034	0.71	0.86	2
α	45° TP		45° TP		6



NOTES:

1. Dimension are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TH shall be held for a minimum length of .011 (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
7. Dimension LU applies between L_1 and L_2. Dimension LD applies between L_2 and LL minimum. Diameter is uncontrolled in L_1 and beyond LL minimum.
8. All three leads.
9. The collector shall be internally connected to the case.
10. Dimension r (radius) applies to both inside corners of tab.
11. For 2N3506L, 2N3507L, 2N3506AL, and 2N3507AL, dimension LL shall be 1.5 inches (38.1mm) minimum and 1.75 inches (44.4 mm) maximum.
12. For 2N3506, 2N3506A, 2N3507, and 2N3507A dimension LL shall be .5 inches (12.7mm) minimum and .75 inches (19.0 mm) maximum.
13. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.
14. Lead 1 = emitter, lead 2 = base, lead 3 = collector.

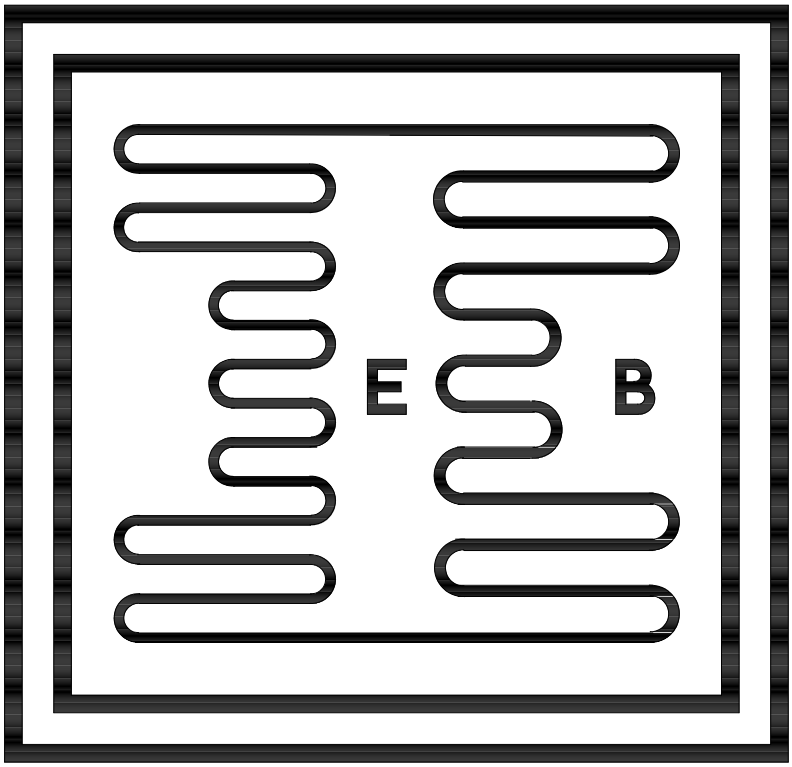
FIGURE 1. Physical dimensions (similar to TO-39).



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.215	.225	5.46	5.72
BW	.145	.155	3.68	3.94
CH	.049	.075	1.24	1.91
LH		.02		0.51
LW1	.135	.145	3.43	3.68
LW2	.047	.057	1.19	1.45
LL1	.085	.125	2.16	3.17
LL2	.045	.075	1.14	1.9
LS1	.070	.095	1.78	2.41
LS2	.035	.048	0.89	1.21
Q1	.03	.070	0.76	1.78
Q2	.02	.035	0.51	0.88
TERM 1	Collector			
TERM 2	Base			
TERM 3	Emitter			

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 2. Physical dimensions, surface mount version (U4).



NOTES:

1. Chip size: .060 x .060 inch ±.002 inch (1.52 x 1.52 mm ±.05 mm).
2. Chip thickness: .010 ±.0015 inch (.25 ±.038 mm) nominal.
3. Top metal: Aluminum 30,000 Å minimum, 33,000Å nominal.
4. Back metal: Silver 7000Å minimum, 10,000Å nominal.
5. Backside: Collector.
6. Bonding pad: B = .005 x .005 inch (.127 x .127 mm), E = .005 x .005 inch (.127 x .127 mm).

FIGURE 3. Physical dimensions JANHCA and JANKCA.

3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturers list before contract award (see 4.2 and 6.3).

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500.

$R_{\theta JA}$	Thermal resistance junction to ambient.
$R_{\theta JC}$	Thermal resistance junction to case.
TRB	Technical review board.

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and figure 1 (similar to TO-39), figure 2 (U4), and figure 3 (JANHCA and JANKCA).

3.4.1 Lead finish. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.4.2 Construction. These devices shall be constructed in a manner and using materials which enable the devices to meet the applicable requirements of MIL-PRF-19500 and this document.

3.5 Radiation hardness assurance (RHA). Radiation hardness assurance requirements, PIN designators, and test levels shall be as defined in MIL-PRF-19500.

3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I.

3.7 Electrical test requirements. The electrical test requirements shall be as specified in table I.

3.8 Marking. Marking shall be in accordance with MIL-PRF-19500. The radiation hardened designator M, D, P, L, R, F, G, or H shall immediately precede (or replace) the device “2N” identifier (depending upon degree of abbreviation required).

3.9 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3).

c. Conformance inspection (see 4.4 and, tables I II, and III).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500, 4.2.1, and as specified herein.

4.2.1 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of table III tests, the tests specified in table III herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

4.2.2 JANHC and JANKC die. Qualification for die shall be in accordance with MIL-PRF-19500.

4.3 Screening (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with table E-IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
(1) 3c	Thermal impedance, method 3131 of MIL-STD-750, (see 4.3.2)	Thermal impedance, method 3131 of MIL-STD-750, (see 4.3.2)
9	I_{CEX1}, h_{FE2}	Not applicable
10	48 hours minimum	48 hours minimum
11	I_{CEX1}; h_{FE2}; ΔI_{CEX1} = 100 percent of initial value or 200 nA dc, whichever is greater; Δh_{FE2} = ±15 percent of initial value	I_{CEX1} and h_{FE2}
12	See 4.3.1	See 4.3.1
13	Subgroups 2 and 3 of table I herein; ΔI_{CEX1} = 100 percent of initial value or 200 nA dc, whichever is greater; Δh_{FE2} = ±15 percent of initial value	Subgroup 2 of table I herein; ΔI_{CEX1} = 100 percent of initial value or 200 nA dc, whichever is greater; Δh_{FE2} = ±15 percent of initial value

(1) Shall be performed anytime after temperature cycling, screen 3a and does not need to be repeated in screening requirements, for JANTX and JANTXV level devices.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: V_{CB} = 10 - 30 V dc. Power shall be applied to achieve T_J = +135°C minimum using a minimum P_D = 75 percent of P_T maximum rated as defined in 1.3. With approval of the qualifying activity and preparing activity, alternate burn-in criteria (hours, bias conditions, T_J, and mounting conditions) may be used. A justification demonstrating equivalence is required. In addition, the manufacturing site's burn-in data and performance history will be essential criteria for burn-in modification approval. This option is limited to plants who are at least transitional (QML) approved or have an approved technical review board (TRB).

4.3.2 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3131 of MIL-STD-750 using the guidelines in that method for determining I_M, I_H, t_H, t_{SW} (and V_C and V_H where appropriate). Measurement delay time (t_{MD}) = 70 μs max. See table III, group E, subgroup 4 herein.

4.3.3 Screening (JANHC and JANKC). Screening of JANHC and JANKC die shall be in accordance with MIL-PRF-19500, "Discrete Semiconductor Die/Chip Lot Acceptance". Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein. If alternate screening is being performed in accordance with MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of group A1 and A2 inspection only (table E-VIb, group B, subgroup 1 is not required to be performed again if group B has already been satisfied in accordance with 4.4.2).

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500, and table I herein. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, subgroup 2 herein.

* 4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table E-VIa (JANS) of MIL-PRF-19500 and 4.4.2.1. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. See 4.4.2.2 for JAN, JANTX, and JANTXV group B testing. Electrical measurements (end-points) for JAN, JANTX, and JANTXV shall be after each step in 4.4.2.2 and shall be in accordance with table I, subgroup 2 herein.

* 4.4.2.1 Group B inspection, table E-VIa (JANS) of MIL-PRF-19500.

Subgroup	Method	Condition
* B3	2037	Test condition D.
B4	1037	V_{CB} = 10 V dc.
B5	1027	V_{CB} = 10 V dc; $P_D \geq$ 100 percent of maximum rated P_T (see 1.3). (NOTE: If a failure occurs, resubmission shall be at the test conditions of the original sample.) Option 1: 96 hours minimum sample size in accordance with table E-VIa of MIL-PRF-19500, adjust T_A or P_D to achieve T_J = +275°C minimum. Option 2: 216 hours minimum, sample size = 45, c = 0; adjusted T_A or P_D to achieve a T_J = +225°C minimum.

4.4.2.2 Group B inspection, (JAN, JANTX, and JANTXV). Separate samples may be used for each step. In the event of a lot failure, the resubmission requirements of MIL-PRF-19500 shall apply. In addition, all catastrophic failures during CI shall be analyzed to the extent possible to identify root cause and corrective action. Whenever a failure is identified as wafer lot or wafer processing related, the entire wafer lot and related devices assembled from the wafer lot shall be rejected unless an appropriate determined corrective action to eliminate the failures mode has been implemented and the devices from the wafer lot are screened to eliminate the failure mode.

Step	Method	Condition
1	1026	Steady-state life: 1,000 hours, V_{CB} = 10 V dc, power shall be applied to achieve T_J = +150°C minimum using a minimum power dissipation P_D = 75 percent of P_T maximum rated as defined in 1.3 herein. n= 45 devices, c = 0. The sample size may be increased and the test time decreased so long as the devices are stressed for a total of 45,000 device hours minimum, and the actual time of test is at least 340 hours.
2	1048	Blocking life, T_A = +150°C, V_{CB} = 80 percent of rated voltage, 48 hours minimum. n = 45 devices, c = 0.
3	1032	High-temperature life (non-operating), t = 340 hours, T_A = +200°C. n = 22, c = 0.

4.4.2.3 Group B sample selection. Samples selected from group B inspection shall meet all of the following requirements:

a. Samples shall be selected from each wafer from a die fabrication line that the manufacturer chooses to certify for the die design used in products manufactured to this specification.

b. Shall be chosen from an inspection lot that has been submitted to and passed group A conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (subgroups B3 and B5 for JANS, and group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

4.4.3 Group C inspection, Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VII of MIL-PRF-19500, and in 4.4.3.1 (JANS) and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

4.4.3.1 Group C inspection, table E-VII (JANS) of MIL-PRF-19500.

Subgroup	Method	Condition
C2	2036	Test condition E, not applicable for U4 devices.
C5	3131	$R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3 and 4.3.2).
C6	1026	Steady-state life: 1,000 hours, V_{CB} = 10 V dc, power shall be applied to achieve T_J = +150°C minimum using a minimum of P_D = 75 percent of maximum rated P_T as defined in 1.3. n = 45 devices, c = 0. The sample size may be increased and the test time decreased as long as the devices are stressed for a total of 45,000 device hours minimum, and the actual time of test is at least 340 hours.

4.4.3.2 Group C inspection, table E-VII (JAN, JANTX, and JANTXV) of MIL-PRF-19500.

Subgroup	Method	Condition
C2	2036	Test condition E, not applicable for U4 devices.
C5	3131	$R_{\theta JA}$ and $R_{\theta JC}$ (see 1.3 and 4.3.2).
C6		Not applicable.

4.4.3.3 Group C sample selection. Samples for subgroups in group C shall be chosen at random from any inspection lot containing the intended package type and lead finish procured to the same specification which is submitted to and passes group A tests for conformance inspection. Testing of a subgroup using a single device type enclosed in the intended package type shall be considered as complying with the requirements for that subgroup.

4.4.4 Group D inspection. Conformance inspection for hardness assured JANS and JANKC types shall include the group D tests specified in table II herein. These tests shall be performed as required in accordance with MIL-PRF-19500 and method 1019 of MIL-STD-750, for total ionizing dose or method 1017 of MIL-STD-750 for neutron fluence as applicable (see 6.2.e herein), except group D, subgroup 2 may be performed separate from other subgroups. Group D inspection may also be performed ahead of the screening lot using die selected in accordance with MIL-PRF-19500 and related documents. Alternate package options may also be substituted for the testing provided there is no adverse effect to the fluence profile.

4.4.5 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-IX of MIL-PRF-19500 and as specified in table III herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

4.5 Method of inspection. Methods of inspection shall be as specified in the appropriate tables and as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

TABLE I. Group A inspection.

Inspection 1/ 2/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 3/						
Visual and mechanical 4/ examination	2071	JAN, JANTX: n = 45 devices, c = 0 JANTXV: n = devices, c = 0				
Solderability 4/ 5/	2026	n = 15 leads, c = 0				
Resistance to solvents 4/ 5/ 6/	1022	n = 15 devices, c = 0				
Temp cycling 4/ 5/	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal 5/ Fine leak Gross leak	1071	n = 22 devices, c = 0				
Electrical measurements 5/		Table I, subgroup 2				
Bond strength 4/ 5/	2037	Precondition T_A = +250°C at t = 24 hrs or T_A = 300°C at t = 2 hrs n = 11 wires, c = 0				
Decap internal visual (design verification) 4/	2075	n = 4 devices, c = 0				
Subgroup 2						
Thermal impedance 7/	3131	See 4.3.2	$Z_{\theta JX}$			°C/W
Breakdown voltage collector to base	3001	Bias condition D, I_C = 100 µA dc	$V_{(BR)CBO}$			
2N3506				60		V dc
2N3507				80		V dc
Breakdown voltage emitter to base	3026	Bias condition D, I_E = 10 µA dc	$V_{(BR)EBO}$	5		V dc
Breakdown voltage collector to emitter	3011	Bias condition D, I_C = 10 mA dc, pulsed (see 4.5.1)	$V_{(BR)CEO}$			
2N3506				40		V dc
2N3507				50		V dc
Collector to emitter cutoff current	3041	Bias condition A, V_{EB} = 4 V dc	I_{CEX1}		1	µA dc
2N3506		V_{CE} = 40 V dc				
2N3507		V_{CE} = 60 V dc				
Forward-current transfer ratio	3076	V_{CE} = 1 V dc, I_C = 500 mA dc, pulsed (see 4.5.1)	h_{FE1}			
2N3506				50	250	
2N3507				35	175	

See footnotes at the end of table

TABLE I. Group A inspection - Continued.

Inspection 1/ 2/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 2 - Continued						
Forward-current transfer ratio	3076	V_{CE} = 2 V dc, I_C = 1.5 A dc, pulsed (see 4.5.1)	h_{FE2}			
2N3506				40	200	
2N3507				30	150	
Forward-current transfer ratio	3076	V_{CE} = 3 V dc, I_C = 2.5 A dc, pulsed (see 4.5.1)	h_{FE3}			
2N3506				30		
2N3507				25		
Forward-current transfer ratio	3076	V_{CE} = 5 V dc, I_C = 3.0 A dc, pulsed (see 4.5.1)	h_{FE4}			
2N3506				25		
2N3507				20		
Saturation voltage and resistance	3071	I_C = 500 mA dc, I_B = 50 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.5	V dc
Saturation voltage and resistance	3071	I_C = 1.5 A dc, I_B = 150 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)2}$		1.0	V dc
Saturation voltage and resistance	3071	I_C = 2.5 A dc, I_B = 250 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)3}$		1.5	V dc
Base to emitter saturated voltage	3066	Test condition A, I_C = 500 mA dc, I_B = 50 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)1}$		1.0	V dc
Base to emitter saturated voltage	3066	Test condition A, I_C = 1.5 A dc, I_B = 150 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)2}$	0.8	1.3	V dc
Base to emitter saturated voltage	3066	Test condition A, I_C = 2.5 A dc, I_B = 250 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)3}$		2.0	V dc
Subgroup 3						
High-temperature operation		T_A = +150°C				
Collector to emitter cutoff current	3041	Bias condition A, V_{EB} = 4 V dc.	I_{CEX2}		1	mA dc
2N3506		V_{CE} = 40 V dc				
2N3507		V_{CE} = 60 V dc				
Low-temperature operation		T_A = -55°C				
Forward-current transfer ratio	3076	I_C = 500 mA dc, pulsed (see 4.5.1)	h_{FE5}			
2N3506, L, U4		V_{CE} = 1.0 V dc		25		
2N3507, L, U4		V_{CE} = 1.0 V dc		17		
2N3506A, 2N3506AL		V_{CE} = 2.0 V dc		25		
2N3507A, 2N3507AL		V_{CE} = 2.0 V dc		17		

See footnotes at end of table

TABLE I. Group A inspection - Continued.

Inspection 1/ 2/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 4						
Small-signal short- circuit forward-current transfer ratio	3206	V_{CE} = 5 V dc, I_C = 100 mA dc, f = 20 MHz	$\|h_{fe}\|$	3	15	
Open circuit output capacitance	3236	V_{CB} = 10 V dc, I_E = 0, 100 kHz ≤ f ≤ 1 MHz	C_{obo}		40	pF
Input capacitance (output open-circuited)	3240	V_{EB} = 3 V dc, I_C = 0, 100 kHz ≤ f ≤ 1 MHz	C_{ibo}		300	pF
Pulse response:						
Delay time	3251	Test condition A, I_C = 1.5 A dc, I_{B1} = 150 mA dc, (see figure 10)	t_d		15	ns
Rise time	3251	Test condition A, I_C = 1.5 A dc, I_{B1} = 150 mA dc, (see figure 10)	t_r		30	ns
Storage time	3251	Test condition A, I_C = 1.5 A dc, I_{B1} = I_{B2} = 150 mA dc, (see figure 11)	t_S		55	ns
Fall time	3251	Test condition A, I_C = 1.5 A dc, I_{B1} = I_{B2} = 150 mA dc, (see figure 11)	t_f		35	ns

1/ For sampling plan see MIL-PRF-19500.
2/ Electrical characteristics for "A", "AL", "U4", “AU4” and "L" suffix devices are identical to non-suffix devices unless otherwise noted.
3/ For resubmission of failed subgroup 1, double the sample size of the failed test or sequence of tests. A failure in table I, subgroup 1 shall not require retest of the entire subgroup. Only the failed test shall be rerun upon submission.
4/ Separate samples may be used.
5/ Not required for JANS devices.
6/ Not required for laser marked devices.
7/ This test is required for the following end-point measurements only. JANS - group B, subgroup 3 and 4. JANTX and JANTXV – group B, step 1 group C, subgroup 2; group E, subgroup 1 and 2.

* TABLE II. Group D inspection.

	Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Limit		Unit
		Method	Conditions		Min	Max	
	Subgroup 1 4/						
	Neutron irradiation	1017	Neutron exposure Vces = 0V				
	Breakdown voltage collector to base	3001	Bias condition D, I_C = 100 μA dc	$V_{(BR)CBO}$			
	2N3506				60		V dc
	2N3507				80		V dc
	Breakdown voltage emitter to base	3026	Bias condition D, I_E = 10 μA dc	$V_{(BR)EBO}$	5		V dc
	Breakdown voltage collector to emitter	3011	Bias condition D, I_C = 10 mA dc, pulsed (see 4.5.1)	$V_{(BR)CEO}$			
	2N3506				40		V dc
	2N3507				50		V dc
	Collector to emitter cutoff current	3041	Bias condition A, V_{EB} = 4 V dc	I_{CEX1}		2	μA dc
	2N3506		V_{CE} = 40 V dc				
	2N3507		V_{CE} = 60 V dc				
	Forward-current transfer ratio	3076	V_{CE} = 1 V dc, I_C = 500 mA dc, pulsed (see 4.5.1)	[h_{FE1}] 5/			
	2N3506				[25]	250	
	2N3507				[17.5]	175	
	Forward-current transfer ratio	3076	V_{CE} = 2 V dc, I_C = 1.5 A dc, pulsed (see 4.5.1)	[h_{FE2}] 5/			
	2N3506				[20]	200	
	2N3507				[15]	150	
	Forward-current transfer ratio	3076	V_{CE} = 3 V dc, I_C = 2.5 A dc, pulsed (see 4.5.1)	[h_{FE3}] 5/			
	2N3506				[15]		
	2N3507				[12.5]		
	Forward-current transfer ratio	3076	V_{CE} = 5 V dc, I_C = 3.0 A dc, pulsed (see 4.5.1)	[h_{FE4}] 5/			
	2N3506				[12.5]		
	2N3507				[10]		
*	Collector to emitter saturation voltage	3071	I_C = 500 mA dc, I_B = 50 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.575	V dc
*	Collector to emitter saturation voltage	3071	I_C = 1.5 A dc, I_B = 150 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)2}$		1.15	V dc

See footnotes at end of table.

* TABLE II. Group D inspection - Continued.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 - Continued.						
* Collector to emitter saturation voltage	3071	I_C = 2.5 A dc, I_B = 250 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)3}$		1.73	V dc
Base to emitter saturated voltage	3066	Test condition A, I_C = 500 mA dc, I_B = 50 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)1}$		1.15	V dc
Base to emitter saturated voltage	3066	Test condition A, I_C = 1.5 A dc, I_B = 150 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)2}$	0.8	1.5	V dc
Base to emitter saturated voltage	3066	Test condition A, I_C = 2.5 A dc, I_B = 250 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)3}$		2.3	V dc
Subgroup 2						
Total dose irradiation	1019	Gamma exposure				
2N3506		V_{CES} = 32 V				
2N3507		V_{CES} = 40 V				
Breakdown voltage collector to base	3001	Bias condition D, I_C = 100 µA dc	$V_{(BR)CBO}$			
2N3506				60		V dc
2N3507				80		V dc
Breakdown voltage emitter to base	3026	Bias condition D, I_E = 10 µA dc	$V_{(BR)EBO}$	5		V dc
Breakdown voltage collector to emitter	3011	Bias condition D, I_C = 10 mA dc, pulsed (see 4.5.1)	$V_{(BR)CEO}$			
2N3506				40		V dc
2N3507				50		V dc
Collector to emitter cutoff current	3041	Bias condition A, V_{EB} = 4 V dc	I_{CEX1}		2	µA dc
2N3506		V_{CE} = 40 V dc				
2N3507		V_{CE} = 60 V dc				
Forward-current transfer ratio	3076	V_{CE} = 1 V dc, I_C = 500 mA dc, pulsed (see 4.5.1)	[hFE1] 5/			
2N3506				[25]	250	
2N3507				[17.5]	175	
Forward-current transfer ratio	3076	V_{CE} = 2 V dc, I_C = 1.5 A dc, pulsed (see 4.5.1)	[h_{FE2}] 5/			
2N3506				[20]	200	
2N3507				[15]	150	

See footnotes at end of table.

* TABLE II. Group D inspection - Continued.

	Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Limit		Unit
		Method	Conditions		Min	Max	
	Subgroup 2 - Continued.						
	Forward-current transfer ratio	3076	V_{CE} = 3 V dc, I_C = 2.5 A dc, pulsed (see 4.5.1)	[h_{FE3}] 5/			
	2N3506 2N3507				[15] [12.5]		
	Forward-current transfer ratio	3076	V_{CE} = 5 V dc, I_C = 3.0 A dc, pulsed (see 4.5.1)	[h_{FE4}] 5/			
	2N3506 2N3507				[12.5] [10]		
*	Collector to emitter saturation voltage	3071	I_C = 500 mA dc, I_B = 50 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.575	V dc
*	Collector to emitter saturation voltage	3071	I_C = 1.5 A dc, I_B = 150 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)2}$		1.15	V dc
*	Collector to emitter saturation voltage	3071	I_C = 2.5 A dc, I_B = 250 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)3}$		1.73	V dc
*	Base to emitter saturated voltage	3066	Test condition A, I_C = 500 mA dc, I_B = 50 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)1}$		1.15	V dc
*	Base to emitter saturated voltage	3066	Test condition A, I_C = 1.5 A dc, I_B = 150 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)2}$	0.8	1.5	V dc
*	Base to emitter saturated voltage	3066	Test condition A, I_C = 2.5 A dc, I_B = 250 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)3}$		2.3	V dc

1/ Tests to be performed on all devices receiving radiation exposure.
2/ For sampling plan, see MIL-PRF-19500.
3/ Electrical characteristics apply to all device types unless otherwise noted.
4/ See 6.2.e herein.
5/ See method 1019, of MIL-STD-750, for how to determine [h_{FE}] by first calculating the delta($1/h_{FE}$) from the pre- and post-radiation h_{FE}. NOTE: The [h_{FE}] is not the same as h_{FE} and cannot be measured directly. The [h_{FE}] value can never exceed the pre-radiation minimum h_{FE} that it is based upon.

* TABLE III Group E inspection (all quality levels) - for qualification or re-qualification only.

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
Subgroup 1			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table I, subgroup 2 herein.	
Subgroup 2			45 devices c = 0
Intermittent life	1037	Intermittent operation life: V_{CB} = 10 V dc, 6,000 cycles. Adjust device current, or power, to achieve a minimum ΔT_J of +100°C.	
Electrical measurements		See table I, subgroup 2 herein.	
Subgroup 4			
Thermal impedance curves		See MIL-PRF-19500. table E-IX, group E, subgroup 4.	Sample size N/A
Subgroup 5			
Not applicable			
* Subgroup 6			11 devices c = 0
ESD (electrostatic discharge)	1020		
Subgroup 8			45 devices c = 0
Reverse stability	1033	Condition B.	

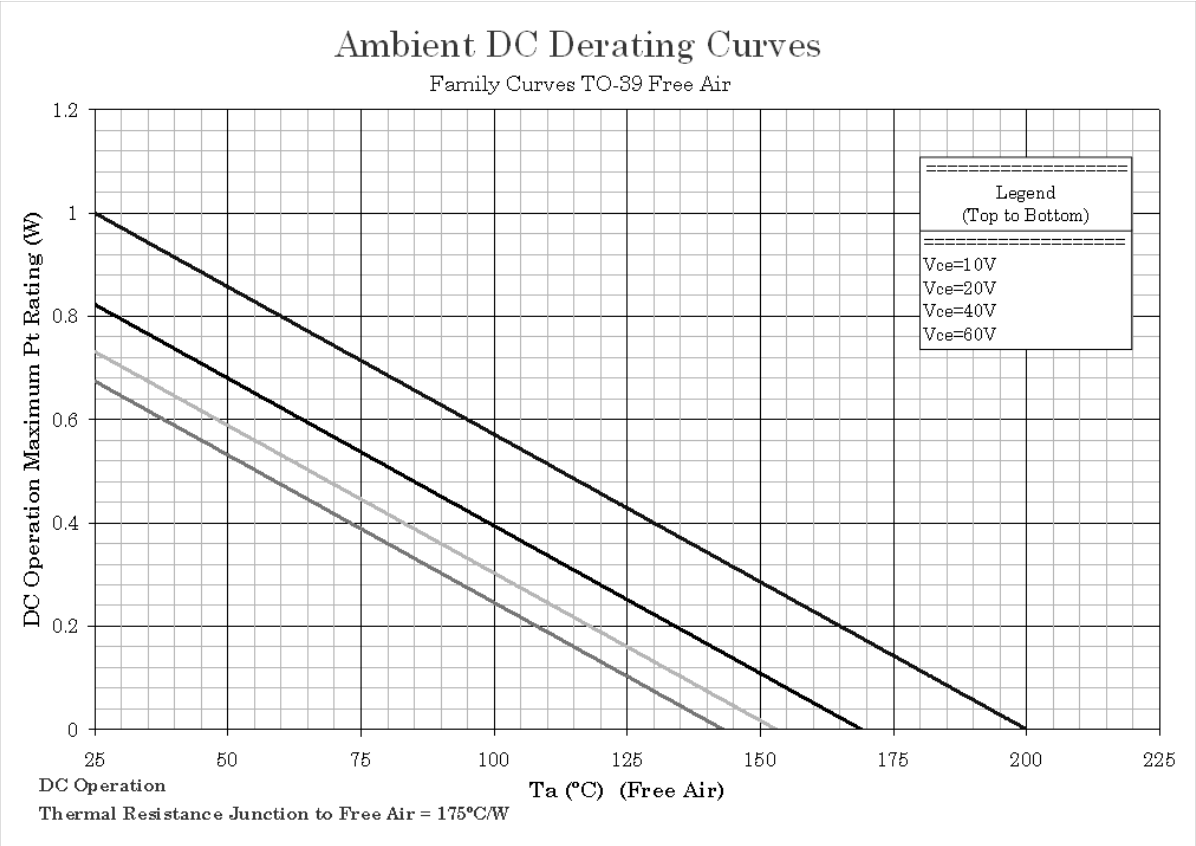


FIGURE 4. Temperature-power derating for 2N3506, 2N3506A, 2N3506L, 2N3506AL, 2N3506U4, 2N3507, 2N3507A, 2N3507L, 2N3507AL, 2N3507U4.

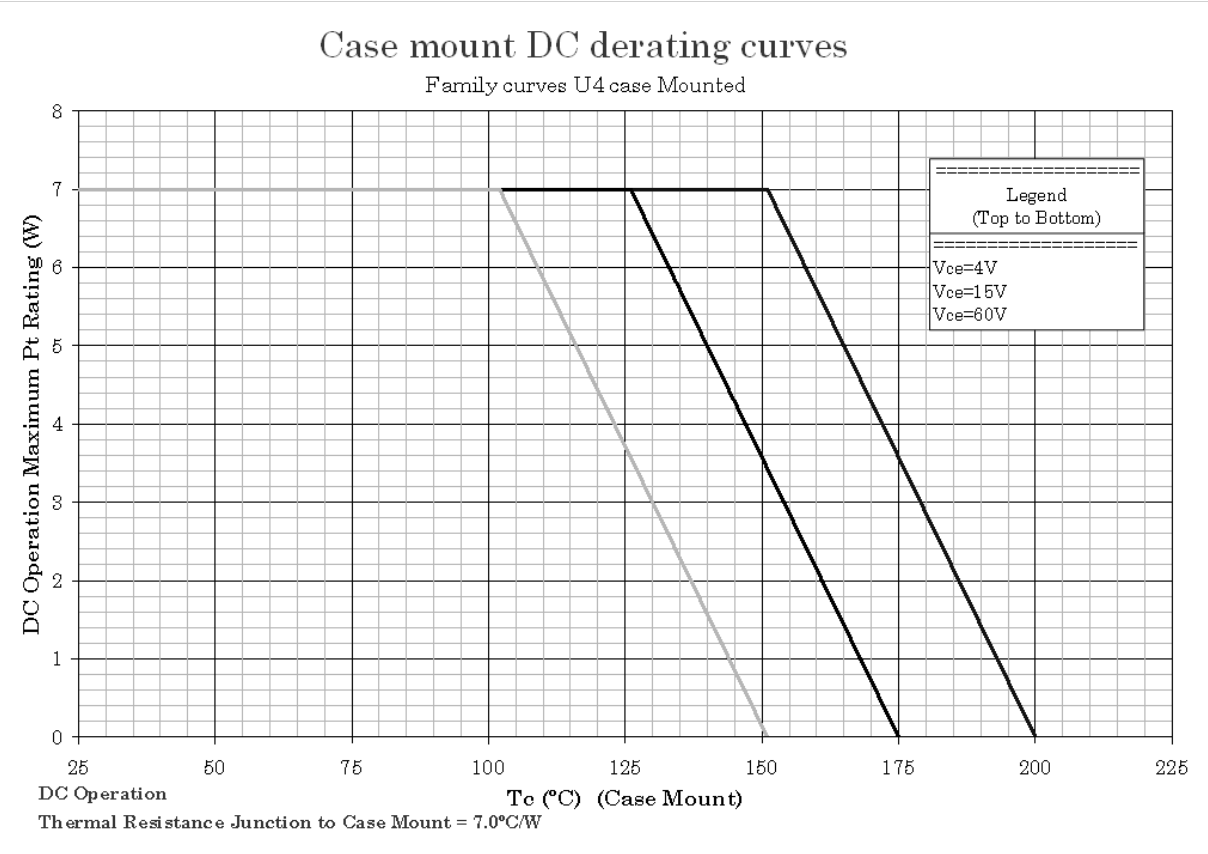


FIGURE 5. Temperature-power derating for 2N3506U4, 2N3506AU4, 2N3507U4, and 2N3507AU4.

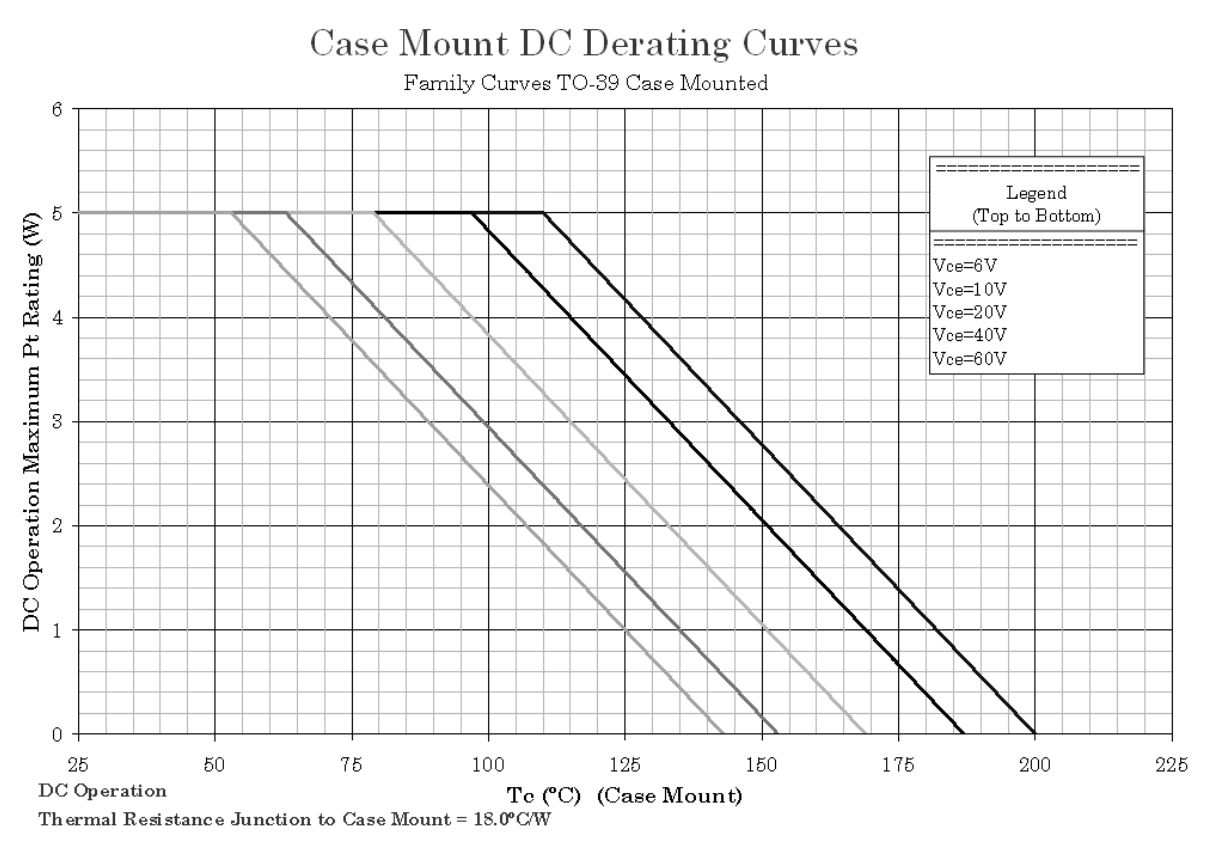


FIGURE 6. Temperature-power derating for 2N3506, 2N3506A, 2N3506L, 2N3506AL,2N3507, 2N3507A, 2N3507L, and 2N3507AL.

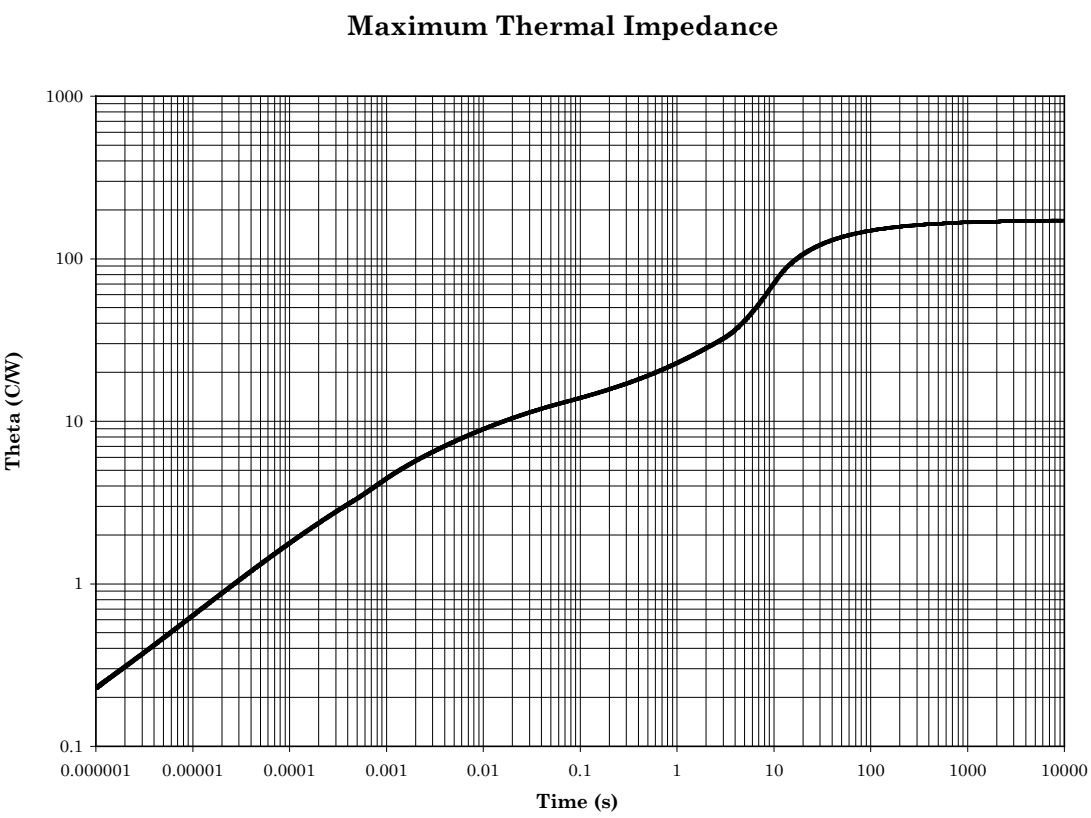


FIGURE 7. Thermal impedance graph ($R_{\theta JA}$) for 2N3506, 2N3506A, 2N3506L, 2N3506AL, 2N3506U4, 2N3506AU4, 2N3507, 2N3507A, 2N3507L, 2N3507AL, 2N3507U4, and 2N3507AU4.

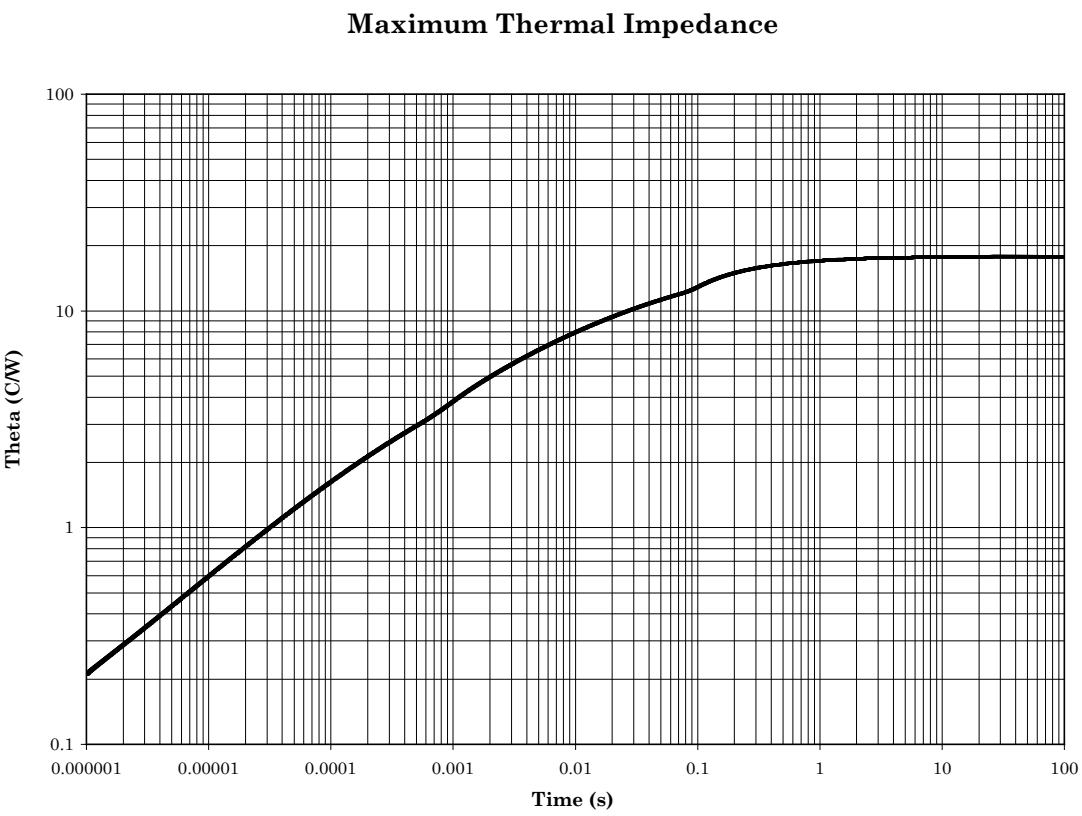


FIGURE 8. Thermal impedance graph ($R_{\theta JC}$) for 2N3506, 2N3506A, 2N3506L, 2N3506AL, 2N3507, 2N3507A, 2N3507L, and 2N3507AL.

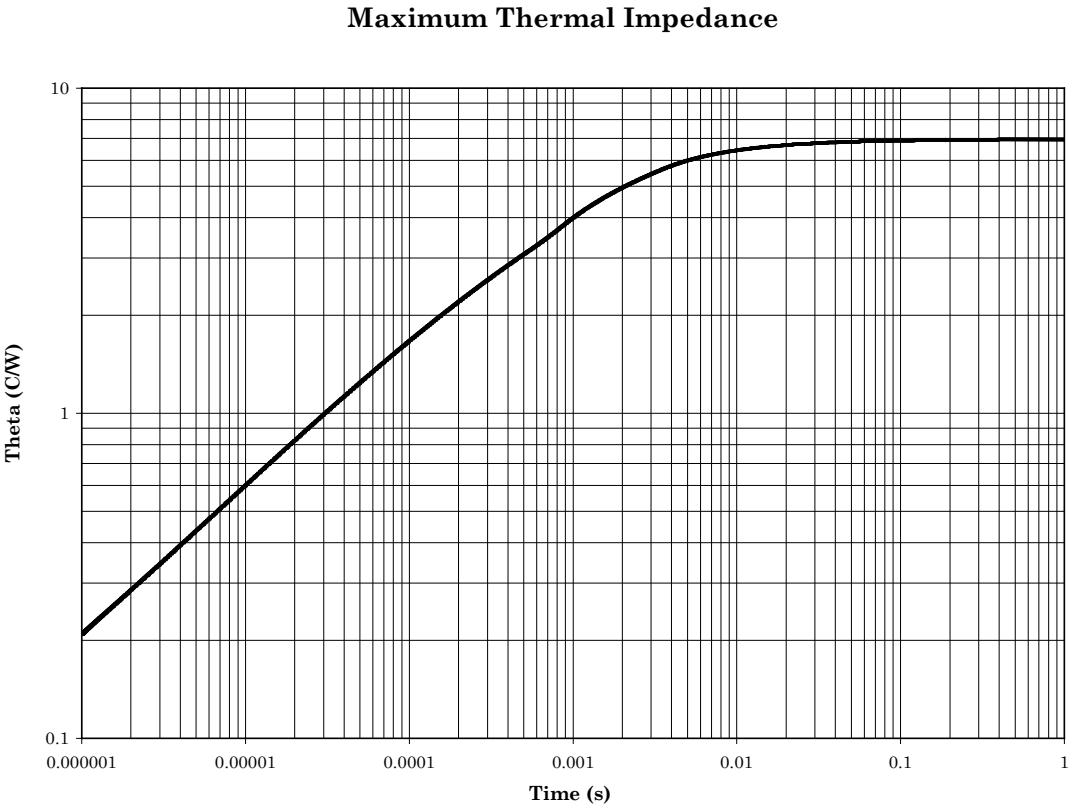


FIGURE 9. Thermal impedance graph ($R_{\theta JC}$) for 2N3506U4, 2N3506AU4, 2N3507U4, and 2N3507AU4.

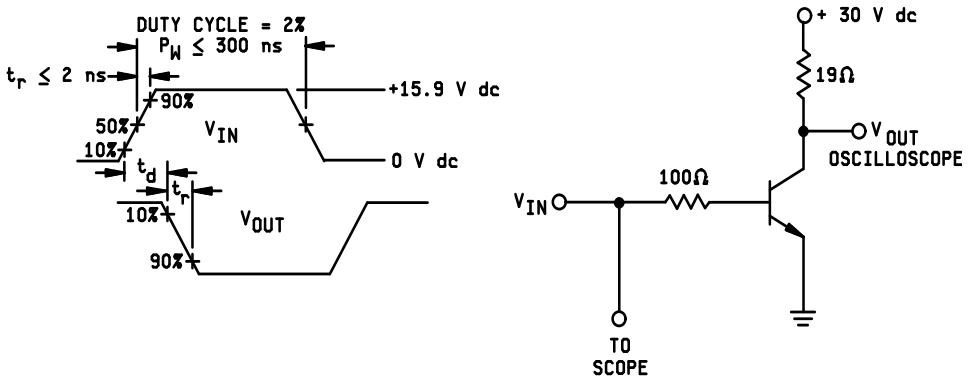


FIGURE 10. Equivalent circuit for measuring delay and rise times.

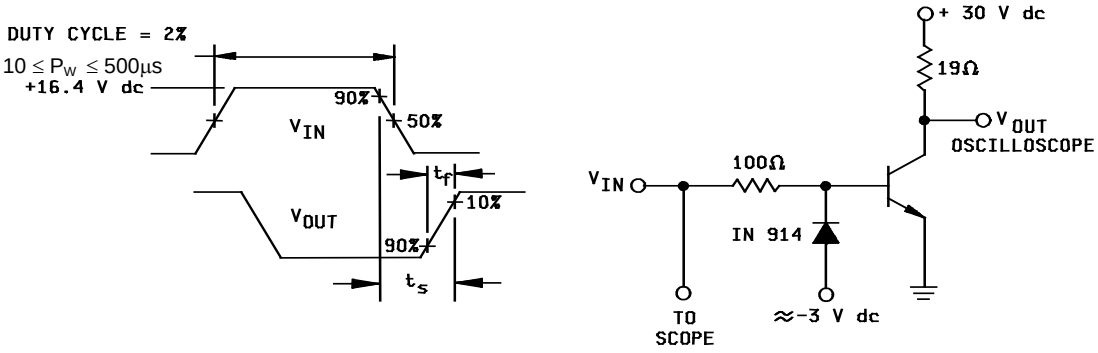


FIGURE 11. Equivalent circuit for measuring storage and fall times.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory. The notes specified in MIL-PRF-19500 are applicable to this specification.)

6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Packaging requirements (see 5.1).

c. Lead finish (see 3.4.1).

d. Product assurance level and type designator.

e. For acquisition of RHA designated devices, table II, subgroup 1 testing of group D is optional. If subgroup 1 testing is desired, it should be specified in the contract.

* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at https://assist.daps.dla.mil .

6.4 Suppliers of JANHC and JANKC die. The qualified JANHC and JANKC suppliers with the applicable letter version (example, JANHCA2N3507) will be identified on the QPL.

Die ordering information	
PIN	Manufacturer
	43611
2N3506	JANHCA2N3506 JANKCA2N35306
2N3507	JANHCA2N3507 JANKCA2N3507

6.5 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army - CR
Navy - EC
Air Force - 85
NASA - NA
DLA - CC

Review activities:
Army - AR, AV, MI
Navy - AS, MC
Air Force - 19

Preparing activity:
DLA - CC

(Project 5961-2010-104)

* NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.daps.dla.mil .