

The documentation and process conversion measures necessary to comply with this document shall be completed by 16 May 2013.

INCH-POUND

MIL-PRF-19500/291U  
16 February 2013  
SUPERSEDING  
MIL-PRF-19500/291T  
23 September 2011

## PERFORMANCE SPECIFICATION SHEET

\* SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, SWITCHING, TYPES 2N2906A, 2N2906AL, 2N2907A, 2N2907AL, 2N2906AUA, 2N2907AUA, 2N2906AUB, 2N2906AUBC, 2N2907AUB, 2N2907AUBC, 2N2906AUBN, 2N2906AUBCN, 2N2907AUBN, AND 2N2907AUBCN, JAN, JANTX, JANTXV, JANS, JANSM, JANSJ, JANSK, JANSL, JANSR, JANSF, JANSJ, JANSK, JANSH, JANHC, JANKC, JANKCM, JANKCD, JANKCP, JANKCL, JANKCR, JANKCF, JANKCG, AND JANKCH

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 PNP, silicon, switching transistors. Five levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500 and two levels of product assurance are provided for each unencapsulated device type. Radiation hardness assurance (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 a TO-18), figure 2, (surface mount case outlines UA, figure 3 UB (metal lid, as shield, connected to fourth pad), UBC (ceramic lid, braze-ring connected to fourth pad), UBN (3-pin, isolated metal lid), and UBCN (3-pin, isolated ceramic lid) and figures 4, and 5 (JANHC and JANKC).

1.3 Maximum ratings. Unless otherwise specified  $T_A = +25^\circ\text{C}$ .

Types	$I_C$	$V_{CBO}$	$V_{EBO}$	$V_{CEO}$	$T_J$ and $T_{STG}$
	<u>mA dc</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>°C</u>
All devices	600	60	5	60	-65 to +200

\* 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](mailto: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.dla.mil>.

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1.3 Maximum ratings. Unless otherwise specified  $T_A = +25^\circ\text{C}$ . - Continued.

Types	$P_T$	$P_T$	$P_T$	$P_T$	$R_{\theta JA}$	$R_{\theta JC}$	$R_{\theta JSP(IS)}$	$R_{\theta JSP(AM)}$
	$T_A = +25^\circ\text{C}$ (1) (2)	$T_C = +25^\circ\text{C}$ (1) (2)	$T_{SP(IS)} = +25^\circ\text{C}$ (1) (2)	$T_{SP(AM)} = +25^\circ\text{C}$ (1) (2)	(2) (3)	(2) (3)	(2) (3)	(2) (3)
	<u>W</u>	<u>W</u>	<u>W</u>	<u>W</u>	<u>°C/W</u>	<u>°C/W</u>	<u>°C/W</u>	<u>°C/W</u>
2N2906A, L,	0.5	1.0	N/A	N/A	325	150	N/A	N/A
2N2907A, L	0.5	1.0	N/A	N/A	325	150	N/A	N/A
2N2906AUA,	(4) 0.5	N/A	1.0	1.5	(4) 325	N/A	110	40
2N2907AUA	(4) 0.5	N/A	1.0	1.5	(4) 325	N/A	110	40
2N2906AUB, and UBN	(4)0.5	N/A	1.0	N/A	(4) 325	N/A	90	N/A
2N2907AUB and UBN	(4) 0.5	N/A	1.0	N/A	(4) 325	N/A	90	N/A
2N2906AUBC and UBCN	(4) 0.5	N/A	1.0	N/A	(4) 325	N/A	90	N/A
2N2907AUBC and UBCN	(4) 0.5	N/A	1.0	N/A	(4) 325	N/A	90	N/A

- (1) For derating, see figures 6, 7, 8, 9, and 10.
- (2) See 3.3 for abbreviations.
- (3) For thermal curves, see figures 11, 12, 13, 14, and 15.
- (4) For non-thermal conductive PCB or unknown PCB surface mount conditions in free air, substitute figures 6 and 11 for the UA, UB,, UBC, UBN, and UBCN package and use  $R_{\theta JA}$ .

1.4 Primary electrical characteristics. Unless otherwise specified  $T_A = +25^\circ\text{C}$ .

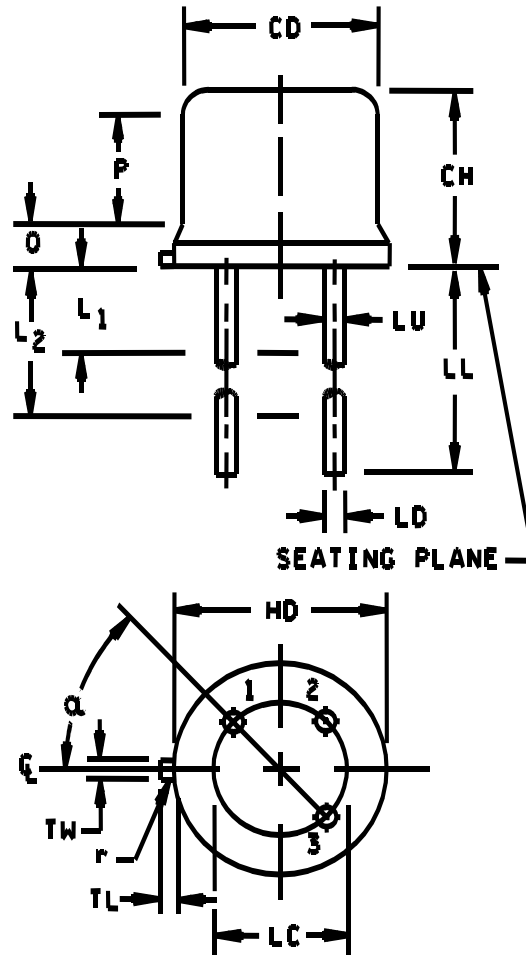
$h_{FE}$ at $V_{CE} = 10\text{ V dc}$										
	$h_{FE1}$ $I_C = 0.1\text{ mA dc}$		$h_{FE2}$ $I_C = 1.0\text{ mA dc}$		$h_{FE3}$ $I_C = 10\text{ mA dc}$		$h_{FE4}$ (1) $I_C = 150\text{ mA dc}$		$h_{FE5}$ (1) $I_C = 500\text{ mA dc}$	
	2N2906A, L, UA,UB, UBC, UBN, UBCN	2N2907A, L, UA,UB, , UBC, UBN, UBCN	2N2906A L, UA,UB, UBC, UBN, UBCN	2N2907A L, UA,UB, UBC, UBN, UBCN	2N2906A L, UA,UB, UBC, UBN, UBCN	2N2907A L, UA,UB, UBC, UBN, UBCN	2N2906A L, UA,UB, UBC, UBN, UBCN	2N2907A L, UA,UB, UBC, UBN, UBCN	2N2906A L, UA,UB, UBC, UBN, UBCN	2N2907A L, UA,UB, UBC, UBN, UBCN
Min	40	75	40	100	40	100	40	100	40	50
Max			175	450			120	300		

Types	Limit	$ h_{fe} $ $f = 100\text{ MHz } V_{CE} = 20\text{ V dc},$ $I_C = 20\text{ mA dc}$	$C_{obo}$ $100\text{ kHz } \leq f \leq 1\text{ MHz}$ $V_{CB} = 10\text{ V dc}, I_E = 0$	Switching (saturated)	
				$t_{on}$ See figure 16	$t_{off}$ See figure 17
2N2906A, 2N2907A, L, UA, UB, UBC, UBN, UBCN	Min Max	2.0	$\mu\text{F}$	ns	ns
			8	45	300

Types	Limits	$V_{CE(sat)1}$ (1) $I_C = 150\text{ mA dc}$ $I_B = 15\text{ mA dc}$	$V_{CE(sat)2}$ (1) $I_C = 500\text{ mA dc}$ $I_B = 50\text{ mA dc}$	$V_{BE(sat)1}$ (1) $I_C = 150\text{ mA dc}$ $I_B = 15\text{ mA dc}$	$V_{BE(sat)2}$ (1) $I_C = 500\text{ mA dc}$ $I_B = 50\text{ mA dc}$
2N2906A, 2N2907A, L, UA, UB, UBC UBN, UBCN	Min Max	<u>V dc</u> 0.4	<u>V dc</u> 1.6	<u>V dc</u> 0.6 1.3	<u>V dc</u> 2.6

- (1) Pulsed see 4.5.1.

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7,8
LL	.500	.750	12.70	19.05	7,8,13
LU	.016	.019	0.41	0.48	7,8
L <sub>1</sub>		.050		1.27	7,8
L <sub>2</sub>	.250		6.35		7,8
P	.100		2.54		
Q		.030		0.76	5
TL	.028	.048	0.71	1.22	3,4
TW	.036	.046	0.91	1.17	3
r		.010		0.25	10
α	45° TP		45° TP		6

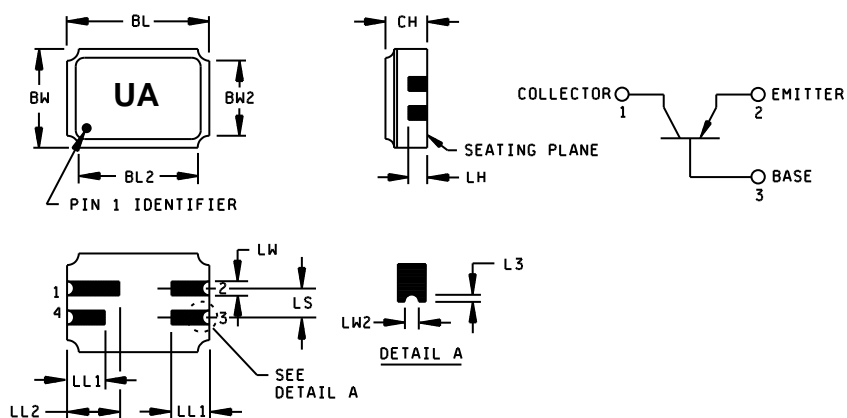


NOTES:

1. Dimension are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of .011 inch (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<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum. Diameter is uncontrolled in L<sub>1</sub> 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. In accordance with ASME Y14.5M, diameters are equivalent to φx symbology.
12. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
13. For L suffix devices, dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max.

FIGURE 1. Physical dimensions (similar to TO-18).

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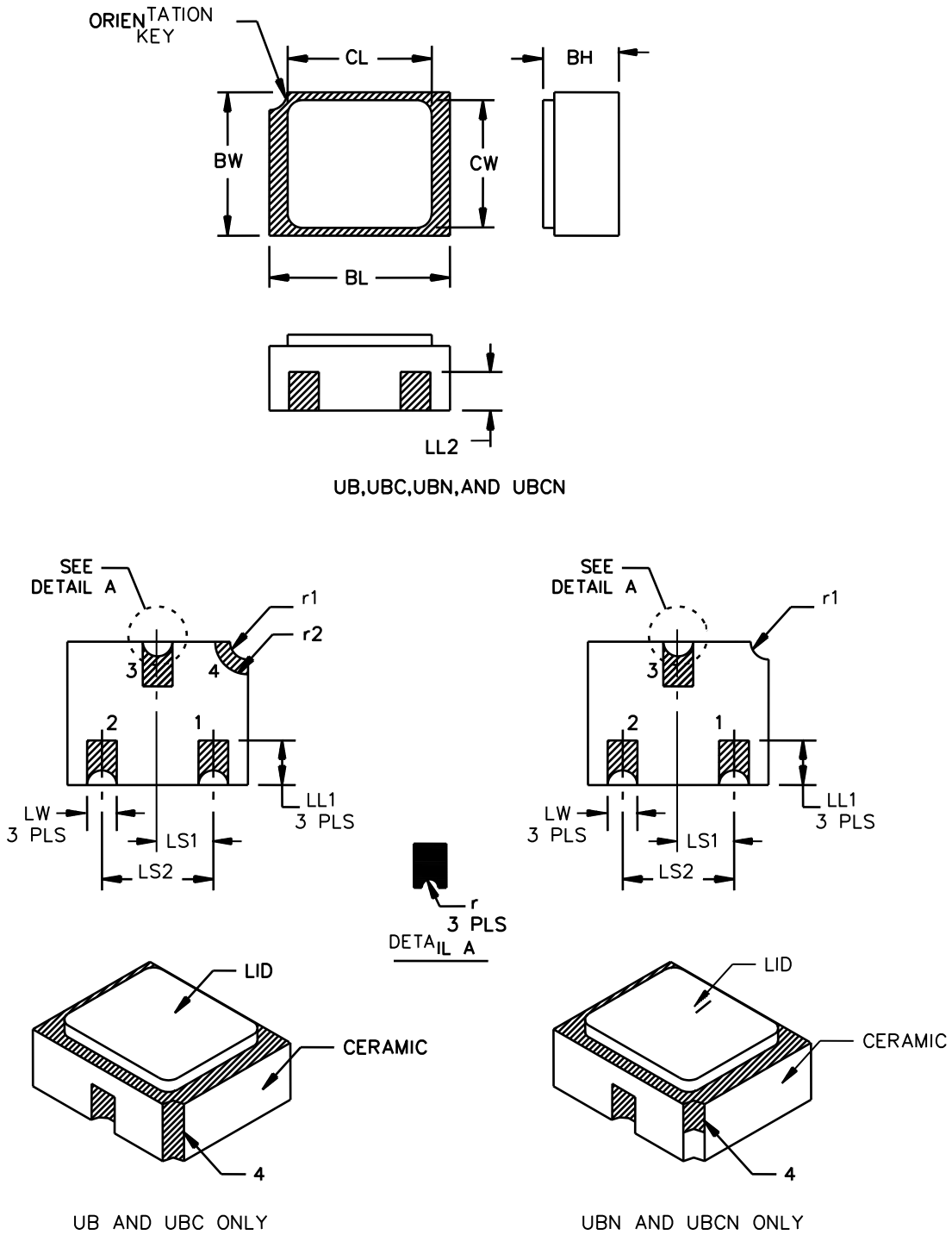
Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BL	.215	.225	5.46	5.71	
BL2		.225		5.71	
BW	.145	.155	3.68	3.93	
BW2		.155		3.93	
CH	.061	.075	1.55	1.90	3
* L3	.003		0.08		5
LH	.029	.042	0.74	1.07	
LL1	.032	.048	0.81	1.22	
LL2	.072	.088	1.83	2.23	
LS	.045	.055	1.14	1.39	
LW	.022	.028	0.56	0.71	
LW2	.006	.022	0.15	0.56	5

Pin no.	1	2	3	4
Transistor	Collector	Emitter	Base	N/C

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Dimension "CH" controls the overall package thickness. When a window lid is used, dimension "CH" must increase by a minimum of .010 inch (0.254 mm) and a maximum of .040 inch (1.020 mm).
4. The corner shape (square, notch, radius) may vary at the manufacturer's option, from that shown on the drawing.
5. Dimensions "LW2" minimum and "L3" minimum and the appropriate castellation length define an unobstructed three-dimensional space traversing all of the ceramic layers in which a castellation was designed. (Castellations are required on bottom two layers, optional on top ceramic layer.) Dimension "LW2" maximum and "L3" maximum define the maximum width and depth of the castellation at any point on its surface. Measurement of these dimensions may be made prior to solder dipping.
6. The coplanarity deviation of all terminal contact points, as defined by the device seating plane, shall not exceed .006 inch (0.15 mm) for solder dipped leadless chip carriers.
7. In accordance with ASME Y14.5M, diameters are equivalent to  $\phi x$  symbology.

\* FIGURE 2. Physical dimensions, surface mount (UA version).



\* FIGURE 3. Physical dimensions, surface mount (UB, UBN, UBC, and UBCN versions).

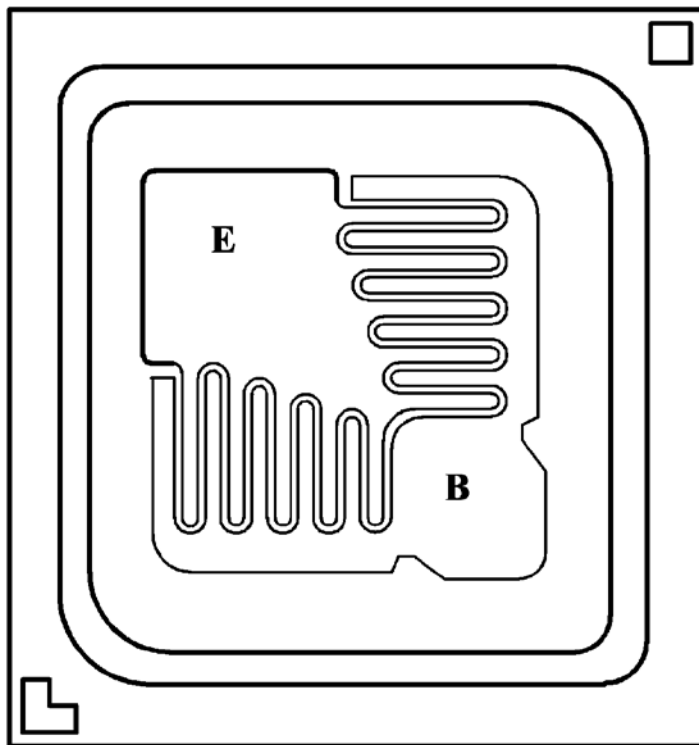
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Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BL	.115	.128	2.92	3.25	
BW	.095	.108	2.41	2.74	
BH	.046	.056	1.17	1.42	UB only, 4
BH	.046	.056	1.17	1.42	UBN only, 5
BH	.055	.069	1.40	1.75	UBC only, 6
BH	.055	.069	1.40	1.75	UBCN only, 7
CL		.128		3.25	
CW		.108		2.74	
* LL1	.022	.038	0.56	0.97	3 PLS
LL2	.014	.035	0.356	0.89	3 PLS
* LS <sub>1</sub>	.035	.040	0.89	1.02	
LS <sub>2</sub>	.071	.079	1.80	2.01	
LW	.016	.024	0.41	0.61	
r		.008		0.20	6
* r1		.012		0.30	8
r2		.022		0.56	UB & UBC only, 8

NOTES:

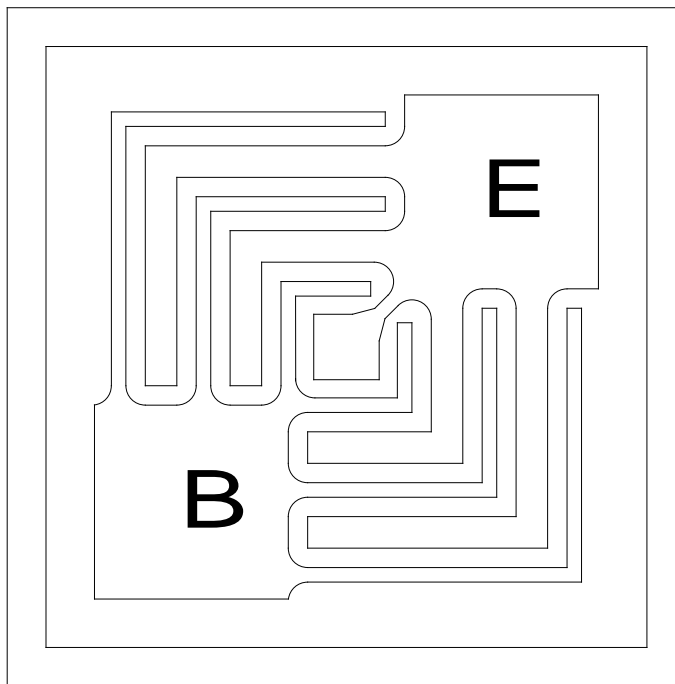
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas on package denote metallized areas.
4. UB only: Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the metal lid.
5. UBN only: Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Isolated lid with three pads only.
6. UBC (ceramic lid) only: Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the lid.
7. UBCN (ceramic lid) only: Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Isolated lid with 3 pads only.
8. For design reference only.
9. In accordance with ASME Y14.5M, diameters are equivalent to  $\phi$ x symbology.

\* FIGURE 3. Physical dimensions, surface mount (UB, UBN, UBC, and UBCN versions) - Continued.



- |                    |  |
|--------------------|--|
| 1. Chip size:      | .023 x .023 inch $\pm$ .002 inch (0.584 mm x 0.584 mm $\pm$ 0.0508 mm).  |
| 2. Chip thickness: | .010 $\pm$ .0015 inch (0.254 mm $\pm$ 0.038 mm).   |
| 3. Top metal:      | Aluminum 15,000 Å minimum, 18,000 Å nominal.   |
| 4. Back metal:     | A. Al/Ti/Ni/Ag 15kÅ/5kÅ/10kÅ/10kÅ.<br>B. Gold 2.5 kÅ minimum, 3.0 kÅ nominal.<br>C. Eutectic Die Mount - No metal. |
| 5. Glassivation:   | Si <sub>3</sub> N <sub>4</sub> 2kÅ minimum, 2.2k nominal.  |
| 6. Backside:       | Collector.   |
| 7. Bonding pad:    | B = .0042 x .0042 inch (0.107 mm x 0.107 mm).<br>E = .0042 x .0042 inch (0.107 mm x 0.107 mm).                     |

FIGURE 4. JANHC and JANKC (B-version) die dimensions.



1. Die size: .020 x .020 inch square (0.508 mm x 0.508 mm).
2. Die thickness: .008 ±.0016 inch (0.203 mm ±0.041 mm).
3. Base pad: .004 x .004 inch (0.101 mm x 0.101 mm).
4. Emitter pad: .004 x .004 inch (0.101 mm x 0.101 mm).
5. Back metal: Gold, 6,500 ±1,950 Å.
6. Top metal: Aluminum, 20,000 ±2,000 Å.
7. Back side: Collector.
8. Glassivation: SiO<sub>2</sub>, 7,500 ±1,500 Å.

FIGURE 5. JANHC and JANKC (D-version) die dimensions.



## 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.dla.mil/quicksearch> or <https://assist.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 applicable laws and regulations unless a specific exemption has been obtained.

## 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 and as follows.

PCB	Printed circuit board
$R_{\theta JA}$	Thermal resistance junction to ambient.
$R_{\theta JC}$	Thermal resistance junction to case.
$R_{\theta JSP(AM)}$	Thermal resistance junction to solder pads (adhesive mount to PCB).
$R_{\theta JSP(IS)}$	Thermal resistance junction to solder pads (infinite sink mount to PCB).
$T_{SP(AM)}$	Temperature of solder pads (adhesive mount to PCB).
$T_{SP(IS)}$	Temperature of solder pads (infinite sink mount to PCB).
* UA,	Surface mount case outlines (see figure 2).
* UB, UBC	Surface mount case outlines (see figure 3).
* UBN, UBCN	Surface mount case outlines (see figure 3).

\* 3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figures 1, 2, 3, 4, and 5 herein. Epoxy die attach may be used when a moisture monitor plan has been submitted and approved by the qualifying activity.

3.4.1 Lead finish. Lead finish shall be solderable as defined in MIL-PRF-19500. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

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 the subgroups specified in table I herein.

\* 3.8 Marking. Marking shall be in accordance with MIL-PRF-19500, except for the UB, UBC, UBN, and UBCN suffix packages. Marking on the UB, UBC, UBN, and UBCN packages shall consist of an abbreviated part number, the date code, and the manufacturer's symbol or logo. The prefixes JAN, JANTX, JANTXV, and JANS can be abbreviated as J, JX, JV, and JS respectively. The "2N" prefix and the "AUB" and "AUBC" suffix can also be omitted. 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, and as specified herein.

4.2.1 JANHC and JANKC qualification. JANHC and JANKC qualification inspection shall be in accordance with MIL-PRF-19500.

4.2.2 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.

4.3 Screening (JANTX, JANTXV, and JANS 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 E-IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTXV and JANTX level
1b	Required	Required (JANTXV only)
2	Optional	Optional
3a 3b (1) 3c	Required Not applicable Required method 3131 of MIL-STD-750	Required Not applicable Required method 3131 of MIL-STD-750
4	Required	Optional
5	Required	Not required
6	Not applicable	Not applicable
8	Required	Not required
9	$I_{CBO2}$ , $h_{FE4}$ , read and record	Not applicable
10	24 hours minimum	24 hours minimum
11	$I_{CBO2}$ ; $h_{FE4}$ ; $\Delta I_{CBO2}$ = 100 percent of initial value or 5 nA dc, whichever is greater. $\Delta h_{FE4}$ = $\pm 15$ percent	$I_{CBO2}$ , $h_{FE4}$
12	See <a href="#">4.3.2</a>	See <a href="#">4.3.2</a>
(2) 13	Subgroups 2 and 3 of <a href="#">table I</a> herein; $\Delta I_{CBO2}$ = 100 percent of initial value or 5 nA dc, whichever is greater; $\Delta h_{FE4}$ = $\pm 15$ percent	Subgroup 2 of <a href="#">table I</a> herein; $\Delta I_{CBO2}$ = 100 percent of initial value or 5 nA dc, whichever is greater; $\Delta h_{FE4}$ = $\pm 15$ percent
15	Required	Not required
16	Required	Not required

- (1) Shall be performed anytime after temperature cycling, screen 3a; TX and TXV do not need to be repeated in screening requirements.
- (2) PDA = 5 percent for screen 13, applies to  $\Delta I_{CBO2}$ ,  $\Delta h_{FE4}$ ,  $I_{CBO2}$ , and  $h_{FE4}$ . Thermal impedance ( $Z_{\theta JX}$ ) is not required in screen 13.

4.3.1 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.

4.3.2 Power burn-in conditions. Power burn-in conditions are as follows:  $V_{CB} = 10 - 30$  V dc. Power shall be applied to achieve  $T_J = +135^\circ\text{C}$  minimum using a minimum  $P_D = 75$  percent of  $P_T$  maximum,  $T_A$  ambient 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) for JANTX and JANTXV quality levels 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.

4.3.3 Thermal impedance measurements. The thermal impedance measurements shall be performed in accordance with method 3131 of MIL-STD-750 using the guidelines in that method for determining  $I_M$ ,  $I_H$ ,  $t_H$ , and  $t_{MD}$  (and  $V_C$  where appropriate). The thermal impedance limit used in screen 3c of 4.3 herein and subgroup 2 of table I shall comply with the thermal impedance graphs in figures 12, 13, 14, 15, and 16 (less than or equal to the curve value at the same  $t_H$  time) and shall be less than the process determined statistical maximum limit as outlined in method 3131. See table III, subgroup 4 herein.

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 subgroups 1 and 2, of table I herein, 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.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VIa (JANS) of MIL-PRF-19500 and 4.4.2.1 herein. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, subgroup 2 and 4.5.3 herein. See 4.4.2.2 herein for JAN, JANTX, and JANTXV, group B testing. Electrical measurements (end-points) and delta requirements 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 and 4.5.3 herein.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B4	1037	$V_{CB} = 10 - 30$ V dc. Adjust device current, or power, to achieve a minimum $\Delta T_J$ of $100^\circ\text{C}$ .
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 MIL-PRF-19500, table E-VIa, adjust $T_A$ or $P_D$ to achieve $T_J = +275^\circ\text{C}$ minimum.  Option 2: 216 hours minimum, sample size = 45, $c = 0$ ; adjusted $T_A$ or $P_D$ to achieve a $T_J = +225^\circ\text{C}$ minimum.
B6	3131	$R_{\theta JA}$ , $R_{\theta JC}$ only (see 1.3).

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 conformance inspection shall be analyzed to the extent possible to identify root cause and corrective action. Whenever a failure is identified as wafer lot and 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.

<u>Step</u>	<u>Method</u>	<u>Condition</u>
1	1026	Steady-state life: 1,000 hours minimum, $V_{CB} = 10$ dc, power and ambient shall be applied to achieve $T_J = +150^\circ\text{C}$ 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 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, $T_A = +150^\circ\text{C}$ , $V_{CB} = 80$ percent of rated voltage, 48 hours minimum. $n = 45$ devices, $c = 0$ .
3	1032	High-temperature life (non-operating), $t = 340$ hours, $T_A = +200^\circ\text{C}$ . $n = 22$ , $c = 0$ .

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

- a. For JAN, JANTX, and JANTXV samples shall be selected randomly from a minimum of three wafers (or from each wafer in the lot) from each wafer lot. For JANS, samples shall be selected from each inspection lot. See MIL-PRF-19500.
- b. Shall be chosen from an inspection lot that has been submitted to and passed [table I](#), subgroup 2, conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (subgroups B4 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) and delta requirements shall be in accordance with [table I](#), subgroup 2 and [4.5.3](#) herein.

\* [4.4.3.1 Group C inspection, table E-VII \(JANS\) of MIL-PRF-19500.](#)

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
* C2	2036	Test condition E, (not applicable for UA, UB, UBC, UBN, and UBCN devices).
C6	1026	1,000 hours, $V_{CB} = 10$ V dc, power and ambient temperature shall be applied to the device to achieve $T_J = +150^\circ\text{C}$ minimum, and minimum power dissipation of 75 percent of max rated $P_T$ (see <a href="#">1.3</a> herein); $n = 45$ , $c = 0$ . 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.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
* C2	2036	Test condition E, (not applicable for UA, UB, UBC, UBN, and UBCN devices).
C5	3131	R <sub>θJA</sub> R <sub>θJC</sub> only (see 1.3).
C6		Not applicable.

4.4.3.3 Group C sample selection. Samples for steps 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 [table I](#) 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 JANTXV 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 herein), except group D, subgroup 2 may be performed separate from other subgroups. 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 appendix E, 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. Delta measurements shall be in accordance with the applicable steps of [4.5.3](#).

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.

4.5.2 Input capacitance. This test shall be conducted in accordance with method 3240 of MIL-STD-750, except the output capacitor shall be omitted.

4.5.3 Delta requirements. Delta requirements shall be as specified below:

Step	Inspection	MIL-STD-750		Symbol	Limit
		Method	Conditions		
1	Collector-base cutoff current	3036	Bias condition D, V <sub>CB</sub> = 50 V dc	ΔI <sub>CB02</sub> (1)	100 percent of initial value or 10 nA dc, whichever is greater.
2	Forward current transfer ratio	3076	V <sub>CE</sub> = 10 V dc; I <sub>C</sub> = 150 mA dc; pulsed see <a href="#">4.5.1</a>	Δh <sub>FE4</sub> (1)	±25 percent change from initial reading.

(1) Devices which exceed the [table I](#) limits for this test shall not be accepted.

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\* TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u> <u>2/</u>						
Visual and mechanical inspection <u>3/</u>	2071					
Solderability <u>3/ 4/</u>	2026	n = 15 leads, c = 0				
Resistance to solvents <u>3/ 4/ 5/</u>	1022	n = 15 devices, c = 0				
Temp cycling <u>3/ 4/</u>	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal <u>4/</u> Fine leak Gross leak	1071	n = 22 devices, c = 0				
Electrical measurements <u>4/</u>		Table I, subgroup 2				
Bond strength <u>3/ 4/</u>	2037	Precondition T <sub>A</sub> = +250°C at t = 24 hours or T <sub>A</sub> = +300°C at t = 2 hours n = 11 wires, c = 0				
Decap internal visual (design verification) <u>4/</u>	2075	n = 4 devices, c = 0				
<u>Subgroup 2</u>						
Thermal impedance	3131	See 4.3.3	Z <sub>θJX</sub>			°C/W
Collector to base cutoff current	3036	Bias condition D; V <sub>CB</sub> = 60 V dc	I <sub>CBO1</sub>		10	μA dc
Cutoff current, emitter to base	3061	Bias condition D; V <sub>EB</sub> = 5 V dc	I <sub>EBO1</sub>		10	μA dc
Breakdown voltage, collector to emitter	3011	Bias condition D; I <sub>C</sub> = 10 mA dc; pulsed (see 4.5.1)	V <sub>(BR)CEO</sub>	60		V dc
Collector to emitter cutoff current	3041	Bias condition C; V <sub>CE</sub> = 50 V dc	I <sub>CES</sub>		50	nA dc
Collector to base cutoff current	3036	Bias condition D; V <sub>CB</sub> = 50 V dc	I <sub>CBO2</sub>		10	nA dc
Emitter to base cutoff current	3061	Bias condition D; V <sub>EB</sub> = 4 V dc	I <sub>EBO2</sub>		50	nA dc

See footnotes at end of table.

\* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2 - Continued</u>						
Forward-current transfer ratio 2N2906A, L, UA, UB, UBC UBN, and UBCN 2N2907A, L, UA, UB, UBC UBN, and UBCN	3076	$V_{CE} = 10 \text{ V dc}; I_C = 0.1 \text{ mA dc}$	$h_{FE1}$	40 75		
Forward-current transfer ratio 2N2906A, L, UA, UB, UBC UBN, and UBCN 2N2907A, L, UA, UB, UBC UBN, and UBCN	3076	$V_{CE} = 10 \text{ V dc}; I_C = 1.0 \text{ mA dc}$	$h_{FE2}$	40 100	175 450	
Forward-current transfer ratio 2N2906A, L, UA, UB, UBC UBN, and UBCN 2N2907A, L, UA, UB, UBC UBN, and UBCN	3076	$V_{CE} = 10 \text{ V dc}; I_C = 10 \text{ mA dc}$	$h_{FE3}$	40 100		
Forward-current transfer ratio 2N2906A, L, UA, UB, UBC UBN, and UBCN 2N2907A, L, UA, UB, UBC UBN, and UBCN	3076	$V_{CE} = 10 \text{ V dc}; I_C = 150 \text{ mA dc};$ pulsed (see 4.5.1)	$h_{FE4}$	40 100	120 300	
Forward-current transfer ratio 2N2906A, L, UA, UB, UBC UBN, and UBCN 2N2907A, L, UA, UB, UBC UBN, and UBCN	3076	$V_{CE} = 10 \text{ V dc}; I_C = 500 \text{ mA dc};$ pulsed (see 4.5.1)	$h_{FE5}$	40 50		
Collector-emitter saturation voltage	3071	$I_C = 150 \text{ mA dc}; I_B = 15 \text{ mA dc},$ pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.4	V dc
Collector-emitter saturation voltage	3071	$I_C = 500 \text{ mA dc}; I_B = 50 \text{ mA dc};$ pulsed (see 4.5.1)	$V_{CE(sat)2}$		1.6	V dc
Base-emitter saturation voltage	3066	Test condition A; $I_C = 150 \text{ mA dc};$ $I_B = 15 \text{ mA dc};$ pulsed (see 4.5.1)	$V_{BE(sat)1}$	0.6	1.3	V dc
Base-emitter saturation voltage	3066	Test condition A; $I_C = 500 \text{ mA dc}; I_B =$ $50 \text{ mA dc};$ pulsed (see 4.5.1)	$V_{BE(sat)2}$		2.6	V dc

See footnotes at end of table.



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\* TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 3</u>						
High temperature operation		$T_A = +150^\circ\text{C}$				
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 50\text{ V dc}$	$I_{CBO3}$		10	$\mu\text{A dc}$
Low temperature operation		$T_A = -55^\circ\text{C}$				
Forward-current transfer ratio	3076	$V_{CE} = 10\text{ V dc}; I_C = 10\text{ mA dc}$	$h_{FE6}$	20	50	
2N2906A, L, UA, UB, UBC, UBN, and UBCN						
2N2907A, L, UA, UB, UBC, UBN, and UBCN						
<u>Subgroup 4</u>						
Small-signal short-circuit forward current transfer ratio	3206	$V_{CE} = 10\text{ V dc}; I_C = 1\text{ mA dc}; f = 1\text{ kHz}$	$h_{fe}$	40	100	
2N2906A, L, UA, UB, UBC, UBN, and UBCN						
2N2907A, L, UA, UB, UBC, UBN, and UBCN						
Magnitude of small-signal short-circuit forward current transfer ratio	3306	$V_{CE} = 20\text{ V dc}; I_C = 20\text{ mA dc}; f = 100\text{ MHz}$	$ h_{fe} $	2.0		
Open circuit output capacitance	3236	$V_{CB} = 10\text{ V dc}; I_E = 0; 100\text{ kHz} \leq f \leq 1\text{ MHz}$	$C_{obo}$		8	pF
Input capacitance (output open-circuited)	3240	$V_{EB} = 2.0\text{ V dc}; I_C = 0; 100\text{ kHz} \leq f \leq 1\text{ MHz}$ See 4.5.2.	$C_{ibo}$		30	pF
Saturated turn-on time		(See figure 16)	$t_{on}$		45	ns
Saturated turn-off time		(See figure 17)	$t_{off}$		300	ns
<u>Subgroups 5, 6, and 7</u>						
Not applicable						

See footnotes at end of table.

\* TABLE I. Group A inspection - Continued.

- 1/ For sampling plan see MIL-PRF-19500.
- 2/ For resubmission of failed test subgroup of [table I](#), 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.
- 3/ Separate samples may be used.
- 4/ Not required for JANS devices.
- 5/ Not required for laser marked devices.
- 6/ This test required for the following end-point measurements only:
  - Group B, subgroup 3, 4, and 5 (JANS).
  - Group B, step 1 (TX and TXV).
  - Group C, subgroup 2 and 6.

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\* TABLE II. Group D inspection.

Inspection <u>1/ 2/ 3/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1 4/</u>						
Neutron irradiation	1017	Neutron exposure $V_{CES} = 0$ V				
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 60$ V dc	$I_{CBO1}$		20	$\mu$ A dc
Cutoff current, emitter to base	3061	Bias condition D; $V_{EB} = 5$ V dc	$I_{EBO1}$		20	$\mu$ A dc
Breakdown voltage, collector to emitter	3011	Bias condition D; $I_C = 10$ mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	60		V dc
* Collector to emitter cutoff current	3041	Bias condition C; $V_{CE} = 50$ V dc	$I_{CES}$		100	nA dc
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 50$ V dc	$I_{CBO2}$		20	nA dc
Emitter to base cutoff current	3061	Bias condition D; $V_{EB} = 4$ V dc	$I_{EBO2}$		100	nA dc
Forward-current transfer ratio M through H2N2906A M through H2N2907A	3076	$V_{CE} = 10$ V dc; $I_C = 0.1$ mA dc	$[h_{FE1}]$ <u>5/</u>	[20] [37.5]		
Forward-current transfer ratio M through H2N2906A M through H2N2907A	3076	$V_{CE} = 10$ V dc; $I_C = 1.0$ mA dc	$[h_{FE2}]$ <u>5/</u>	[20] [50]	175 450	
Forward-current transfer ratio M through H2N2906A M through H2N2907A	3076	$V_{CE} = 10$ V dc; $I_C = 10$ mA dc	$[h_{FE3}]$ <u>5/</u>	[20] [50]		
Forward-current transfer ratio M through H2N2906A M through H2N2907A	3076	$V_{CE} = 10$ V dc; $I_C = 150$ mA dc	$[h_{FE4}]$ <u>5/</u>	[20] [50]	120 300	
Forward-current transfer ratio M through H2N2906A M through H2N2907A	3076	$V_{CE} = 10$ V dc; $I_C = 500$ mA dc	$[h_{FE5}]$ <u>5/</u>	[20] [25]		
Collector-emitter saturation voltage	3071	$I_C = 150$ mA dc; $I_B = 15$ mA dc	$V_{CE(sat)1}$		.46	V dc
Collector-emitter saturation voltage	3071	$I_C = 500$ mA dc; $I_B = 50$ mA dc	$V_{CE(sat)2}$		1.84	V dc
Base-emitter saturation voltage	3066	Test condition A; $I_C = 150$ mA dc; $I_B = 15$ mA dc; pulsed (see 4.5.1)	$V_{BE(sat)1}$	0.6	1.5	V dc
Base-emitter saturation voltage	3066	Test condition A; $I_C = 500$ mA dc; $I_B = 50$ mA dc; pulsed (see 4.5.1)	$V_{BE(sat)2}$		3.0	

See footnotes at end of table.

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\* TABLE II. Group D inspection - Continued.

Inspection <u>1/ 2/ 3/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u>						
Total dose irradiation	1019	Gamma exposure $V_{CES} = 48$ V				
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 60$ V dc	$I_{CBO1}$		20	$\mu$ A dc
Cutoff current, emitter to base	3061	Bias condition D; $V_{EB} = 5$ V dc	$I_{EBO1}$		20	$\mu$ A dc
Breakdown voltage, collector to emitter	3011	Bias condition D; $I_C = 10$ mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	60		V dc
* Collector to emitter cutoff current	3041	Bias condition C; $V_{CE} = 50$ V dc	$I_{CES}$		100	nA dc
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 50$ V dc	$I_{CBO2}$		20	nA dc
Emitter to base cutoff current	3061	Bias condition D; $V_{EB} = 4$ V dc	$I_{EBO2}$		100	nA dc
Forward-current transfer ratio M through H2N2906A M through H2N2907A	3076	$V_{CE} = 10$ V dc; $I_C = 0.1$ mA dc	$[h_{FE1}]$ <u>5/</u>	[20] [37.5]		
Forward-current transfer ratio M through H2N2906A M through H2N2907A	3076	$V_{CE} = 10$ V dc; $I_C = 1.0$ mA dc	$[h_{FE2}]$ <u>5/</u>	[20] [50]	175 400	
Forward-current transfer ratio M through H2N2906A M through H2N2907A	3076	$V_{CE} = 10$ V dc; $I_C = 10$ mA dc	$[h_{FE3}]$ <u>5/</u>	[20] [50]		
Forward-current transfer ratio M through H2N2906A M through H2N2907A	3076	$V_{CE} = 10$ V dc; $I_C = 150$ mA dc	$[h_{FE4}]$ <u>5/</u>	[20] [50]	120 300	
Forward-current transfer ratio M through H2N2906A M through H2N2907A	3076	$V_{CE} = 10$ V dc; $I_C = 500$ mA dc	$[h_{FE5}]$ <u>5/</u>	[20] [25]		
Collector-emitter saturation voltage	3071	$I_C = 150$ mA dc; $I_B = 15$ mA dc;	$V_{CE(sat)1}$		.46	V dc
Collector-emitter saturation voltage	3071	$I_C = 500$ mA dc; $I_B = 50$ mA dc;	$V_{CE(sat)2}$		1.84	V dc

See footnotes at end of table.

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\* TABLE II. Group D inspection - Continued.

Inspection <u>1/</u> <u>2/</u> <u>3/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - Continued.						
Base-emitter saturation voltage	3066	Test condition A; $I_C = 150$ mA dc; $I_B = 15$ mA dc; pulsed (see 4.5.1)	$V_{BE(sat)1}$	0.6	1.5	V dc
Base-emitter saturation voltage	3066	Test condition A; $I_C = 500$ mA dc; $I_B = 50$ mA dc; pulsed (see 4.5.1)	$V_{BE(sat)2}$		3.0	

1/ Tests to be performed on all devices receiving radiation exposure.

2/ For sampling plan, see MIL-PRF-19500.

\* 3/ Electrical characteristics apply to the corresponding AL, UA, UB, UBC, UBN, and UBCN suffix versions unless otherwise noted.

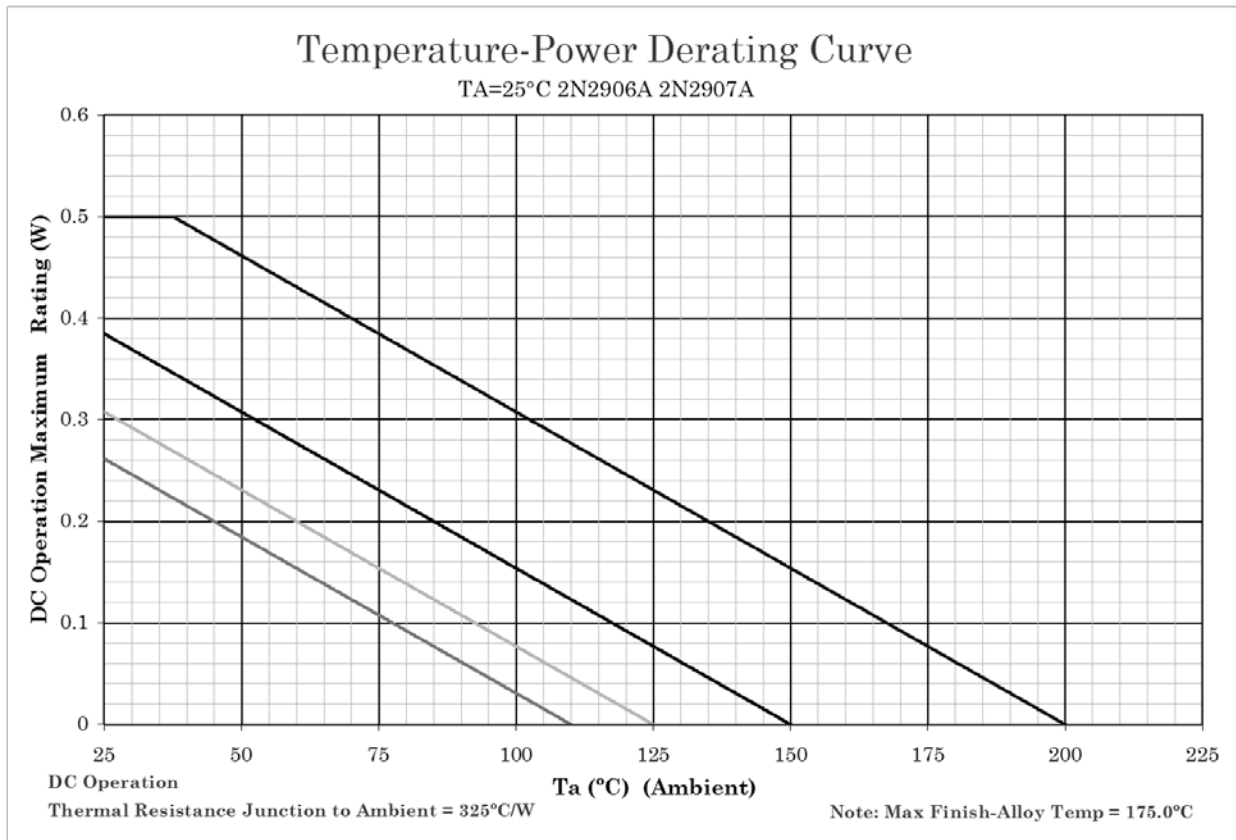
4/ See 6.2.f herein.

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  $h_{FE}$ . Notice 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.

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

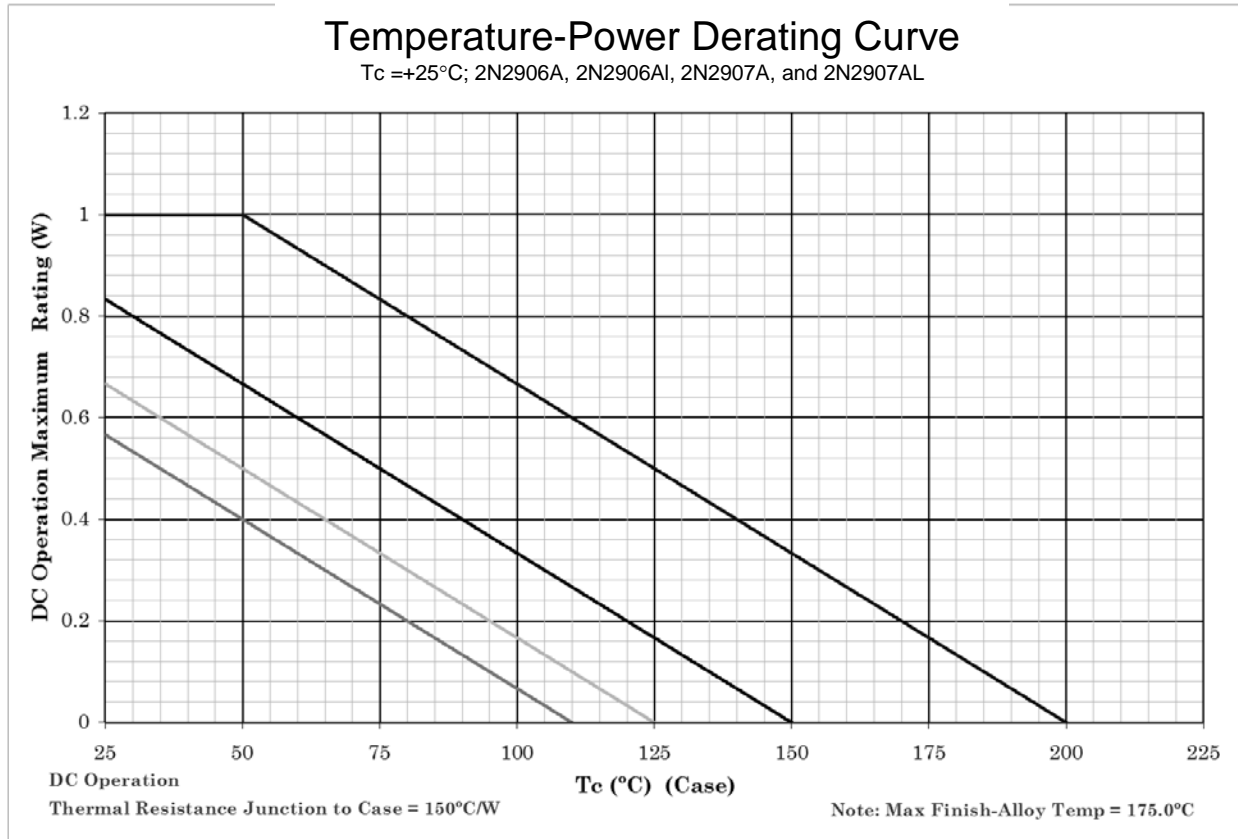
Inspection	MIL-STD-750		Qualification
	Method	Conditions	
<u>Subgroup 1</u>			
Temperature cycling (air to air)	1051	Test condition C, 500 cycles.	45 devices c = 0
Hermetic seal	1071		
Fine leak			
Gross leak			
Electrical measurements		See <a href="#">table I</a> , subgroup 2 and <a href="#">4.5.3</a> herein.	
<u>Subgroup 2</u>			
Intermittent life	1037	$V_{CB} = 10$ V dc, 6,000 cycles. Adjust device current, or power, to achieve a minimum $\Delta T_J$ of 100°C.	45 devices c = 0
Electrical measurements		See <a href="#">table I</a> , subgroup 2 and <a href="#">4.5.3</a> herein.	
<u>Subgroup 4</u>			
Thermal resistance	3131	$R_{\theta JSP(JS)}$ may be calculated but shall be measured once in the same package with a similar die size to confirm calculations (may apply to multiple slash sheets).  $R_{\theta JSP(AM)}$ need be calculated only.	15 devices c = 0
Thermal impedance curves		See MIL-PRF-19500, table E-IX, group E, subgroup 4.	Sample size N/A
<u>Subgroup 5</u>			
Not applicable			
<u>Subgroup 6</u>			
ESD	1020		11 devices
<u>Subgroup 8</u>			
Reverse stability	1033	Condition B.	45 devices c = 0



## NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at  $\leq T_J$  specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum  $T_J$  allowed.
2. Derate design curve constrained by the maximum junction temperatures and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at  $T_J \leq +150^\circ\text{C}$ , where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at  $T_J \leq +125^\circ\text{C}$ , and  $+110^\circ\text{C}$  to show power rating where most users want to limit  $T_J$  in their application.

FIGURE 6. Temperature-power derating for 2N2906A, 2N2906AL, 2N2907A and 2N2907AL  
( $R_{\theta JA}$ ) leads .125 inch (3.18 mm) PCB (TO-18).

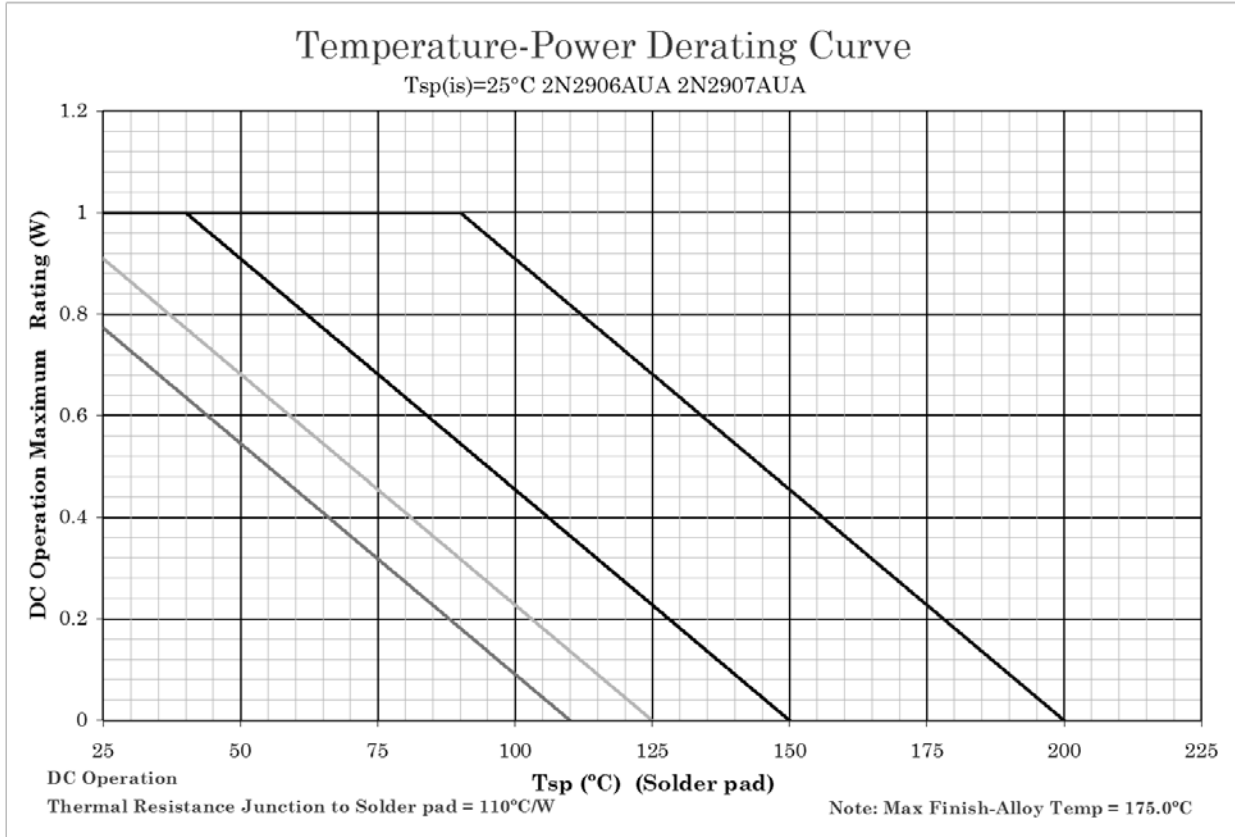


## NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at  $\leq T_J$  specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum  $T_J$  allowed.
2. Derate design curve constrained by the maximum junction temperatures and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at  $T_J \leq +150^\circ\text{C}$ , where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at  $T_J \leq +125^\circ\text{C}$ , and  $+110^\circ\text{C}$  to show power rating where most users want to limit  $T_J$  in their application.

FIGURE 7. Temperature-power derating for 2N2906A, 2N2906AL, 2N2907A and 2N2907AL  
( $R_{\theta JC}$ ), base case mount (TO-18).

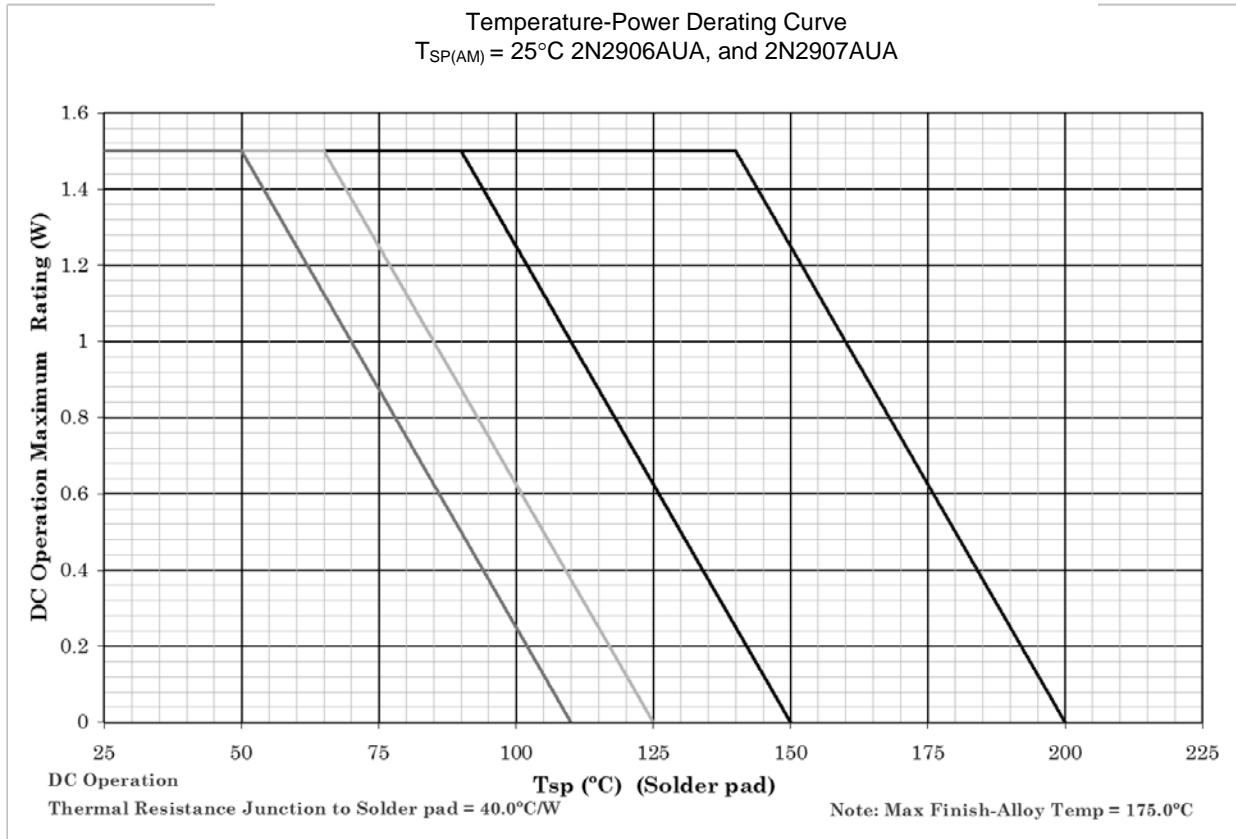




**NOTES:**

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at  $\leq T_J$  specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum  $T_J$  allowed.
2. Derate design curve constrained by the maximum junction temperatures and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at  $T_J \leq +150^{\circ}\text{C}$ , where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at  $T_J \leq +125^{\circ}\text{C}$ , and  $+110^{\circ}\text{C}$  to show power rating where most users want to limit  $T_J$  in their application.

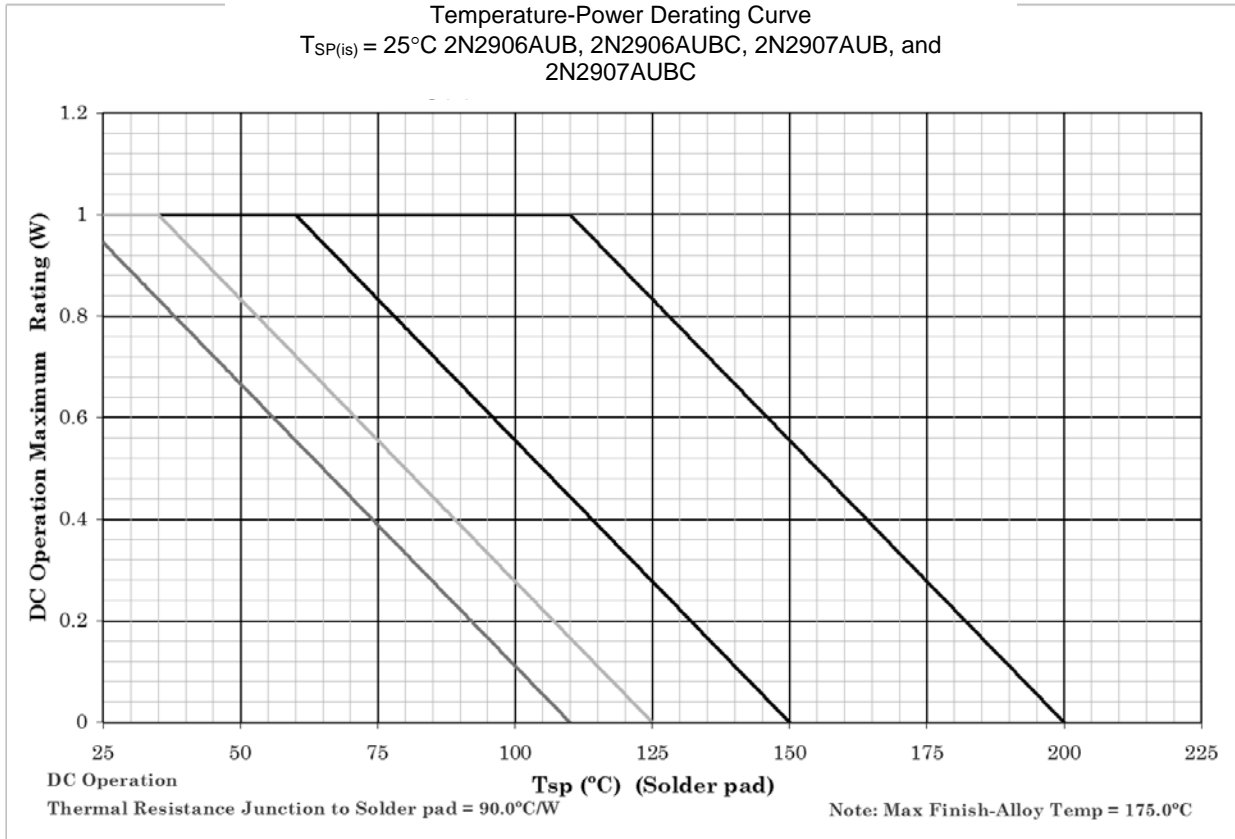
FIGURE 8. Temperature-power derating for 2N2906AUA and 2N2907AUA ( $R_{0JSP(IS)}$ ), infinite sink 4-points.



## NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at  $\leq T_J$  specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum  $T_J$  allowed.
2. Derate design curve constrained by the maximum junction temperatures and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at  $T_J \leq +150^{\circ}\text{C}$ , where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at  $T_J \leq +125^{\circ}\text{C}$ , and  $+110^{\circ}\text{C}$  to show power rating where most users want to limit  $T_J$  in their application.

FIGURE 9. Temperature-power derating for 2N2906AUA and 2N2907AUA ( $R_{\theta JSP(AM)}$ )  
4-point solder pad (adhesive mount to PCB).



**NOTES:**

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at  $\leq T_J$  specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum  $T_J$  allowed.
2. Derate design curve constrained by the maximum junction temperatures and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at  $T_J \leq +150^{\circ}\text{C}$ , where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at  $T_J \leq +125^{\circ}\text{C}$ , and  $+110^{\circ}\text{C}$  to show power rating where most users want to limit  $T_J$  in their application.

\* FIGURE 10. Temperature-power derating for 2N2906AUB, UBC, UBN, and UBCN  
 2N2907AUB, UBC, UBN, and UBCN ( $R_{\theta JSP(is)}$ ) infinite sink 3-point.

Maximum Thermal Impedance  
2N2906A and 2N2907A TO-18 package with 0.125" lead mount to PCB

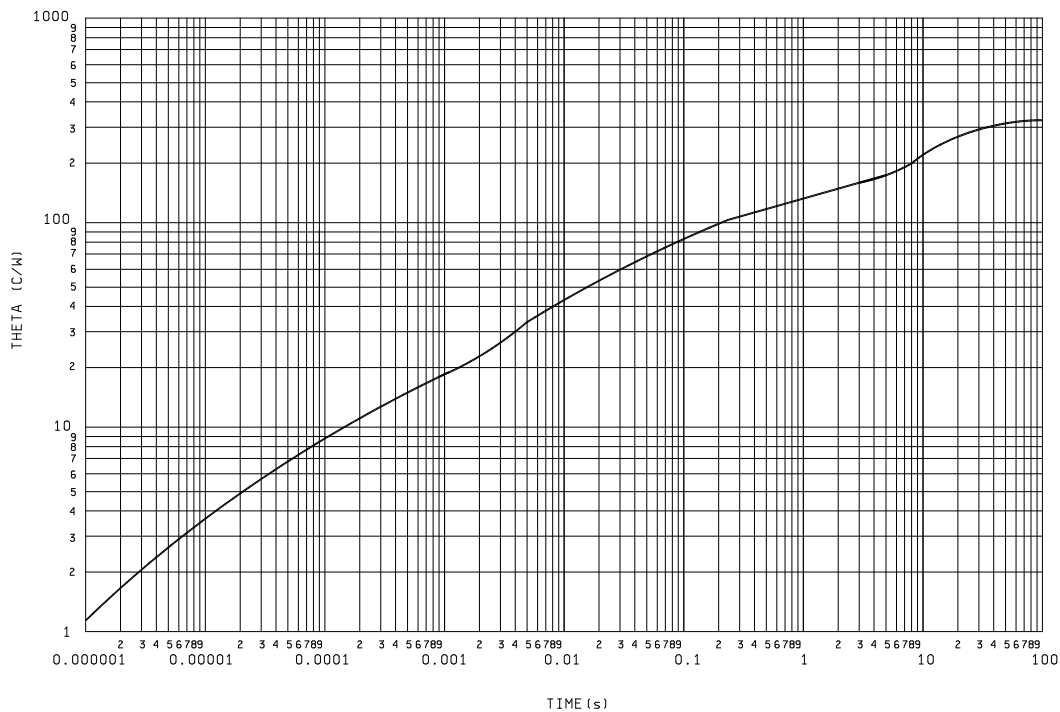


FIGURE 11. Thermal impedance graph ( $R_{\theta JA}$ ) for 2N2906A, 2N2906AL, 2N2907A, and 2N2907AL (TO-18).

**Maximum Thermal Impedance**  
 2N2906A and 2N2907A TO-18 package with case base in copper sink.

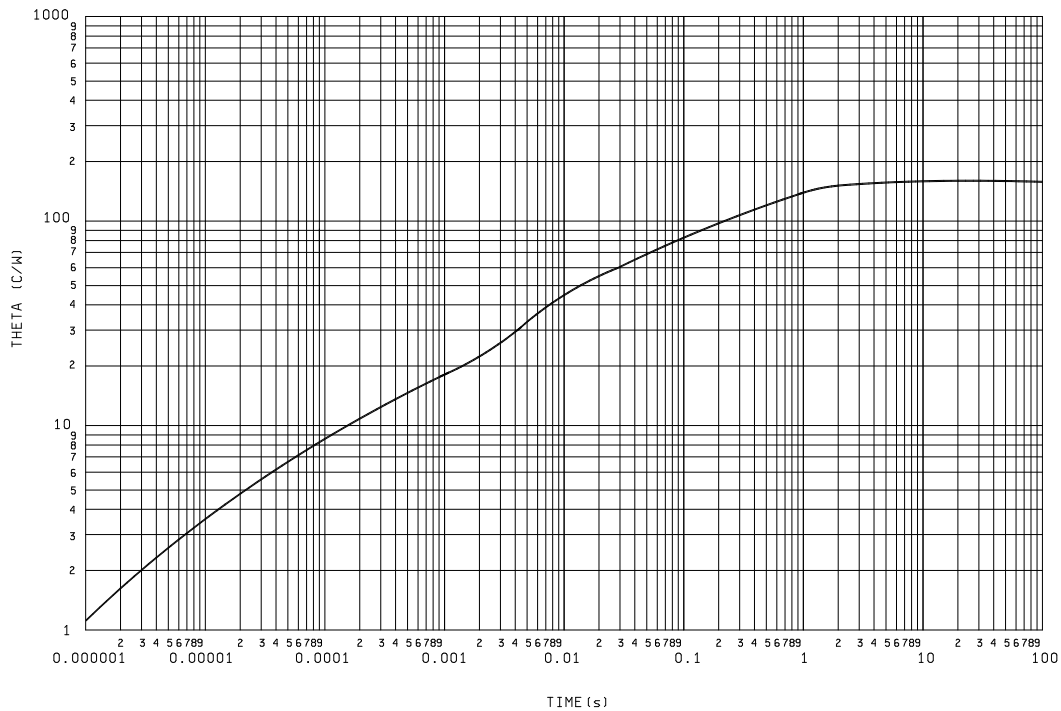


FIGURE 12. Thermal impedance graph ( $R_{\theta JC}$ ) for 2N2906A, 2N2906AL, 2N2907A, and 2N2907AL (TO-18).

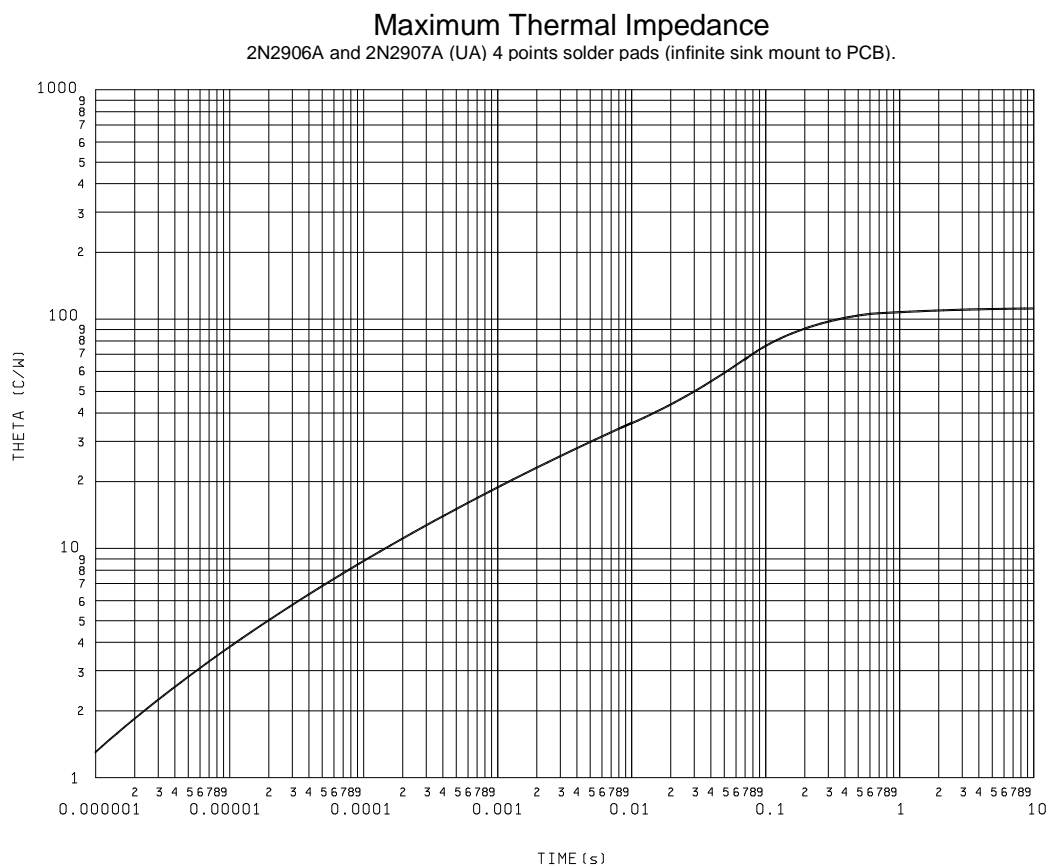


FIGURE 13. Thermal impedance graph ( $R_{\theta JSP(IS)}$ ) for 2N906A and 2N2907A (UA).

**Maximum Thermal Impedance**  
2N2906A and 2N2907A (UA) 4 points solder pads (adhesive mount to PCB).

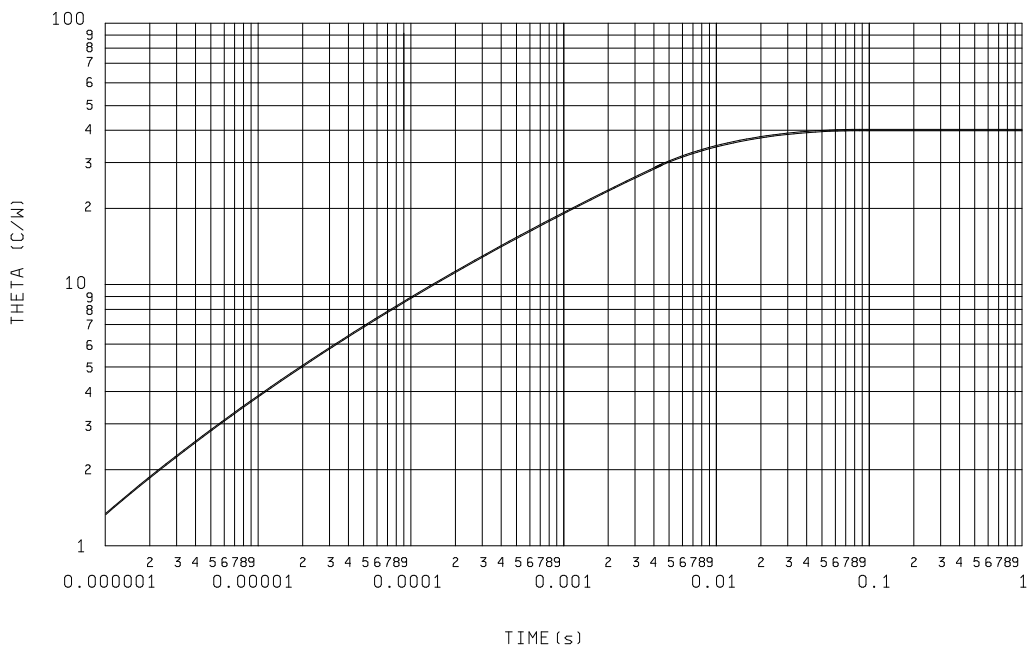
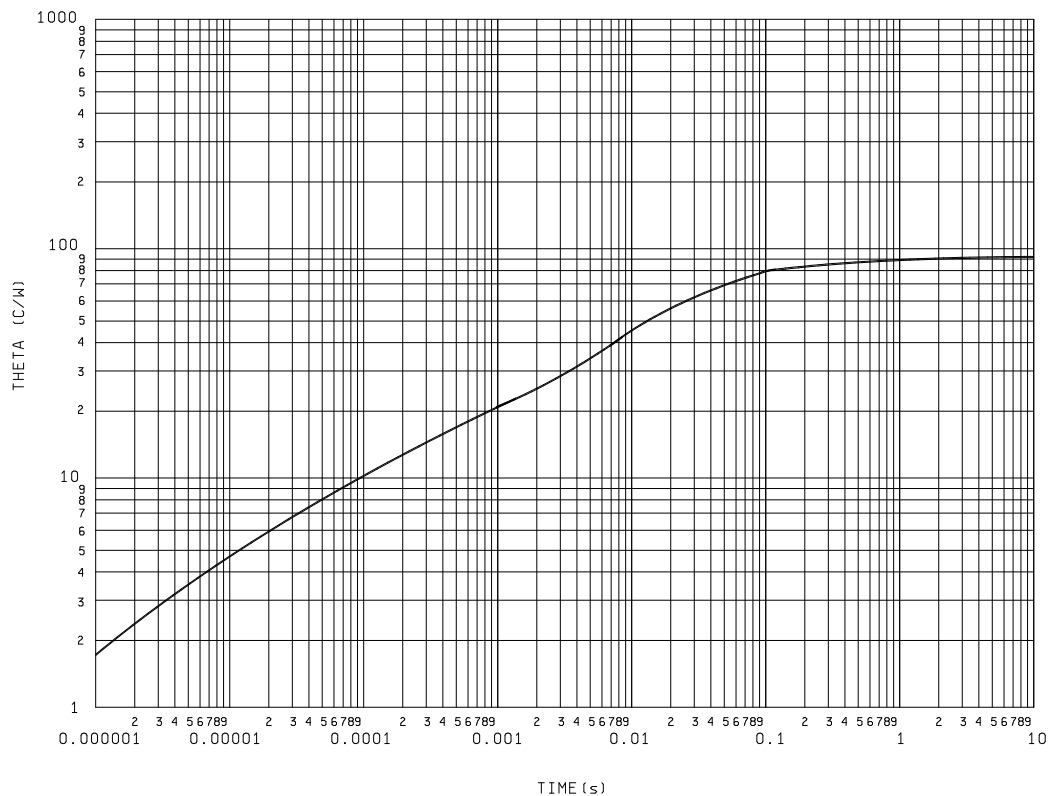


FIGURE 14. Thermal impedance graph ( $R_{\theta JSP(AM)}$ ) for 2N906A and 2N2907A (UA).

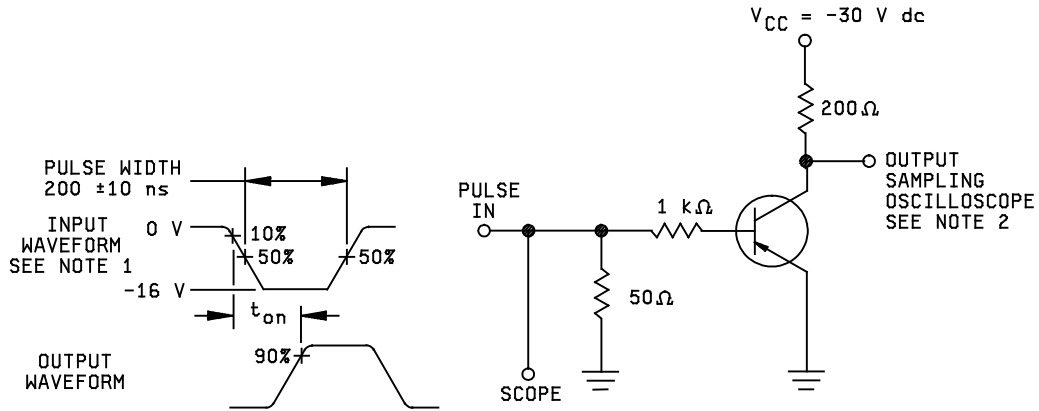
Maximum Thermal Impedance

2N2906A and 2N2907A (UB and UBC) 3 points solder pads (infinite sink mount) to PCB.



\* FIGURE 15. Thermal impedance graph ( $R_{\theta JSP(I)}$ ) for 2N906A and 2N2907A (UB, UBC, UBN, and UBCN).

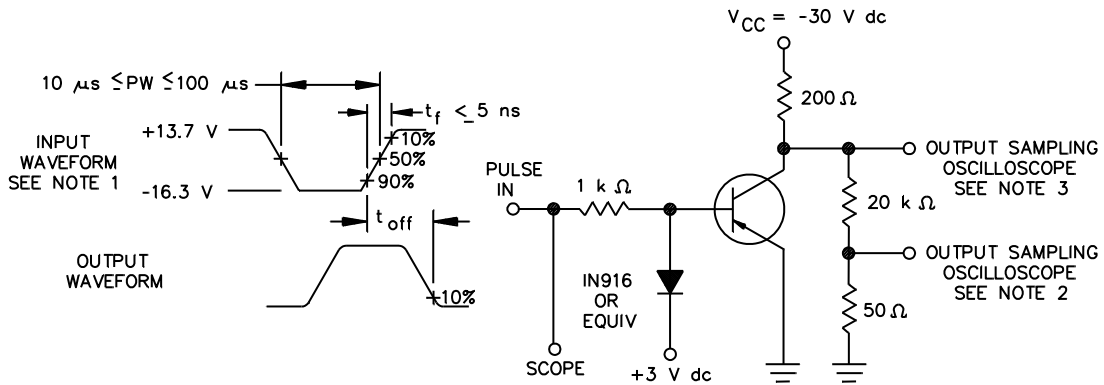




NOTES:

1. The rise time ( $t_r$ ) of the applied pulse shall be  $\leq 2.0$  ns, duty cycle  $\leq 2$  percent and the generator source impedance shall be 50 ohms.
2. Sampling oscilloscope:  $Z_{in} \geq 100$  K ohms,  $C_{in} \leq 12$  pF, rise time  $\leq 5$  ns.

FIGURE 16. Saturated turn-on switching time test circuit.



NOTES:

1. The rise time ( $t_r$ ) of the applied pulse shall be  $\leq 2.0$  ns, duty cycle  $\leq 2$  percent and the generator source impedance shall be 50 ohms.
2. Sampling oscilloscope:  $Z_{in} \geq 100$  K ohms,  $C_{in} \leq 12$  pF, rise time  $\leq 5$  ns.
3. Alternate test point for high impedance attenuating probe.

FIGURE 17. Saturated turn-off switching time test circuit.

## 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 die acquisition, the letter version must be specified (see figures 5 and 6).
- f. For acquisition of RHA designed devices, table II, subgroup 1 testing of group D is optional. If subgroup 1 testing is desired, it must 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](mailto: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.dla.mil>.

6.4 Supersession information. Devices covered by this specification supersede the manufacturers' and users' Part or Identifying Number (PIN). The term Part or Identifying Number (PIN) is equivalent to the term part number which was previously used in this specification. This information in no way implies that manufacturers' PIN's are suitable as a substitute for the military PIN.