

The documentation and process conversion measures necessary to comply with this document shall be completed by 2 December 2022.

INCH-POUND

MIL-PRF-19500/182J
w/AMENDMENT 2
2 September 2022
SUPERSEDING
MIL-PRF-19500/182J
w/AMENDMENT 1
1 November 2017

PERFORMANCE SPECIFICATION SHEET

TRANSISTOR, NPN, SILICON, LOW-POWER,
TYPES 2N720A, 2N1893, AND 2N1893S, JANS, JAN, JANTX, JANTXV, JANHC, JANKC

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, low-power 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 die. 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 Package outlines and die topography. The device package for the encapsulated device type are as follows: (similar to TO-18) in accordance with [figure 1](#), (similar to TO-5) in accordance with [figure 2](#), and (UB) surface mount versions in accordance with [figure 3](#). The dimensions and topography for JANHC and JANKC unencapsulated die are as follows: The A version die in accordance with [figure 4](#).

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

Type	P_{T1} (1) $T_C =$ $+25^{\circ}\text{C}$	P_{T2} (2) $T_A =$ $+25^{\circ}\text{C}$	P_{T3} (2) $T_{SP} =$ $+25^{\circ}\text{C}$	$R_{\theta JA}$ (3)	$R_{\theta JC}$ (3)	$R_{\theta JSP(IS)}$	V_{CBO}	V_{CEO}	V_{EBO}	I_C	T_J and T_{STG}
	<u>W</u>	<u>W</u>	<u>W</u>	<u>$^{\circ}\text{C/W}$</u>	<u>$^{\circ}\text{C/W}$</u>	<u>$^{\circ}\text{C/W}$</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>mA dc</u>	<u>$^{\circ}\text{C}$</u>
2N720A	1.8	0.5		325	97		120	80	7	500	-65 to
2N720AUB	1.16		0.5	325		150	120	80	7	500	+200
2N1893	3.0	0.8		195	58		120	80	7	500	
2N1893S	3.0	0.8		195	58		120	80	7	500	

- * (1) Derate linearly at 10.3 mW/ $^{\circ}\text{C}$ for type 2N720A (TO-18), 6.63 mW/ $^{\circ}\text{C}$ for type 2N720AUB, and 17.2 mW/ $^{\circ}\text{C}$ for type 2N1893 and 2N1893S (TO-5) for $T_C > +25^{\circ}\text{C}$.
- * (2) Derate linearly at 3.08 mW/ $^{\circ}\text{C}$ for types 2N720A (TO-18) and 2N720AUB; for $T_A > +37.5^{\circ}\text{C}$; and 5.1 mW/ $^{\circ}\text{C}$ for types 2N1893 and 2N1893S for $T_A > +60^{\circ}\text{C}$.
- * (3) For thermal impedance curves see [figure 5](#), [figure 6](#), [figure 7](#), and [figure 8](#).

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.dla.mil>.

AMSC N/A

* DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.

FSC 5961



MIL-PRF-19500/182J
w/AMENDMENT 2

1.4 Primary electrical characteristics.

Limits	h_{FE1} (1)	h_{FE2} (1)	h_{FE3} (1)	$ h_{fe} $	$V_{CE(SAT)}$ (1)
	$V_{ce} = 10 \text{ V dc}$ $I_C = 0.1 \text{ mA dc}$	$V_{ce} = 10 \text{ V dc}$ $I_C = 10 \text{ mA dc}$	$V_{ce} = 10 \text{ V dc}$ $I_C = 150 \text{ mA dc}$	$f = 20 \text{ MHz}$ $V_{ce} = 10 \text{ V dc}$ $I_C = 50 \text{ mA dc}$	$I_C = 50 \text{ mA dc}$ $I_B = 5.0 \text{ mA dc}$
Min Max	20	35	40 120	3.0 10	<u>V dc</u> 1.2

(1) Pulsed (see 4.5.1).

1.5 Part or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-19500, and as specified herein. See 6.5 for PIN construction example and 6.6 for a list of available PINs.

1.5.1 JAN certification mark and quality level.

1.5.1.1 Quality level designators for encapsulated devices. The quality level designators for encapsulated devices that are applicable for this specification sheet from the lowest to the highest level are as follows: "JAN", "JANTX", "JANTXV", and "JANS".

1.5.1.2 Quality level designators for unencapsulated devices (die). The quality level designators for unencapsulated devices (die) that are applicable for this specification sheet from the lowest to the highest level are as follows: "JANHC" and "JANKC".

1.5.2 Radiation hardness assurance (RHA) designator. The RHA levels that are applicable for this specification sheet from lowest to highest are as follows: "M", "D", "P", "L", "R", "F", "G", and "H").

1.5.3 Device type. The designation system for the device types of transistors covered by this specification sheet are as follows.

1.5.3.1 First number and first letter symbols. The transistors of this specification sheet use the first number and letter symbols "2N".

1.5.3.2 Second number symbols. The second number symbols for the transistors covered by this specification sheet are as follows: "720A" and "1893".

1.5.4 Suffix symbols. The following suffix letters are incorporated in the PIN in the order listed in the table as applicable:

A	Indicates a modified version of the non-suffix device.
UB	Indicates a 4 pad surface mount package. The metal lid is connected to pad 4 (see figure 3)
S	Indicates a shorter lead length than the non-suffix device.

1.5.5 Lead finish. The lead finishes applicable to this specification sheet are listed on QML-19500.

1.5.6 Die identifiers for unencapsulated devices (manufacturers and critical interface identifiers). The manufacturer die identifiers that are applicable for this specification sheet are "A".

MIL-PRF-19500/182J
w/AMENDMENT 2

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 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 and 4 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

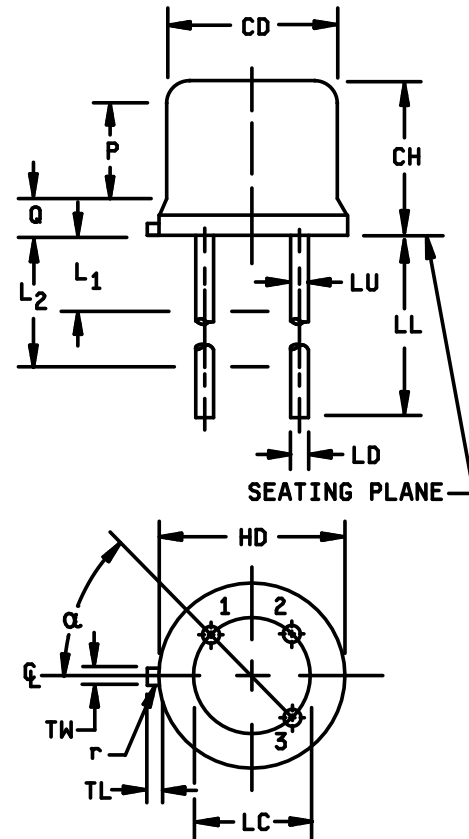
MIL-STD-750 - Test Methods for Semiconductor Devices.

(Copies of these documents are available online at <https://quicksearch.dla.mil>.)

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.

MIL-PRF-19500/182J
w/AMENDMENT 2

Ltr	Dimensions		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		5
LD		.021		0.53	3, 8
LL	.500		12.70		8, 9
LU	.016	.019	0.41	0.48	3, 8, 9
L ₁		.050		1.27	9
L ₂	.250		6.35		9
P	.100		2.54		
Q		.030		0.76	4
TL	.028	.048	0.71	1.22	7
TW	.036	.046	0.91	1.17	
r		.010		0.25	
α	45° TP		45° TP		



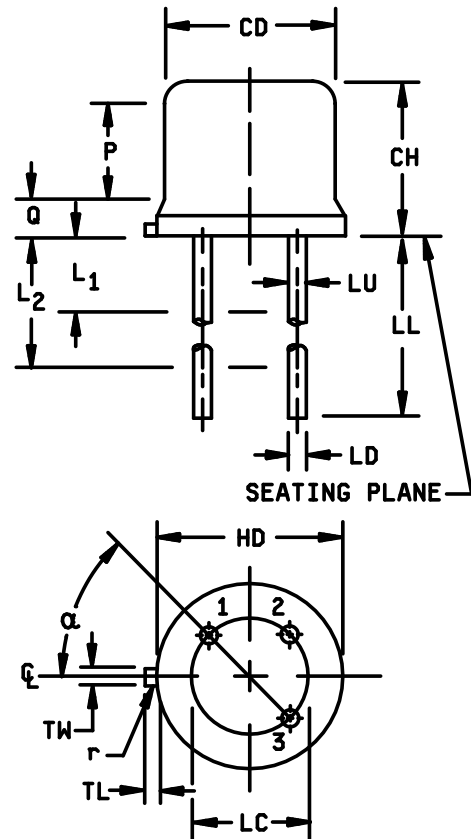
NOTES:

1. Dimensions are in inches.
2. Millimeters equivalents are given for general information only.
3. Measured in the zone beyond .250 inch (6.35 mm) from the seating plane.
4. Details of outline in this zone are optional.
5. When measured in a gauging plane .054 +.001 -.000 inch (1.37 +0.03 -.00 mm) below the seating plane of the transistor, maximum diameter leads shall be within .007 inch (0.18 mm) of their true location relative to a maximum width tab. Smaller diameter leads shall fall within the outline of the maximum diameter lead tolerance.
6. The collector shall be internally connected to the case.
7. Measured from the maximum diameter of the actual device.
8. All three leads.
- * 9. Dimension LU applies between L₁ and L₂. Dimension LD applies between L₂ and LL minimum.
Lead diameter shall not exceed .042 inch (1.07 mm) within L₁ and beyond LL minimum.
10. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
- * 11. In accordance with ASME Y14.5, diameters are equivalent to ϕ x symbology.

FIGURE 1. Physical dimensions for device type 2N720A (TO-18).

MIL-PRF-19500/182J
w/AMENDMENT 2

Symbol	Dimensions		Dimensions		Notes
	Inches		Millimeters		
	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	3
α	45°	TP	45°	TP	6

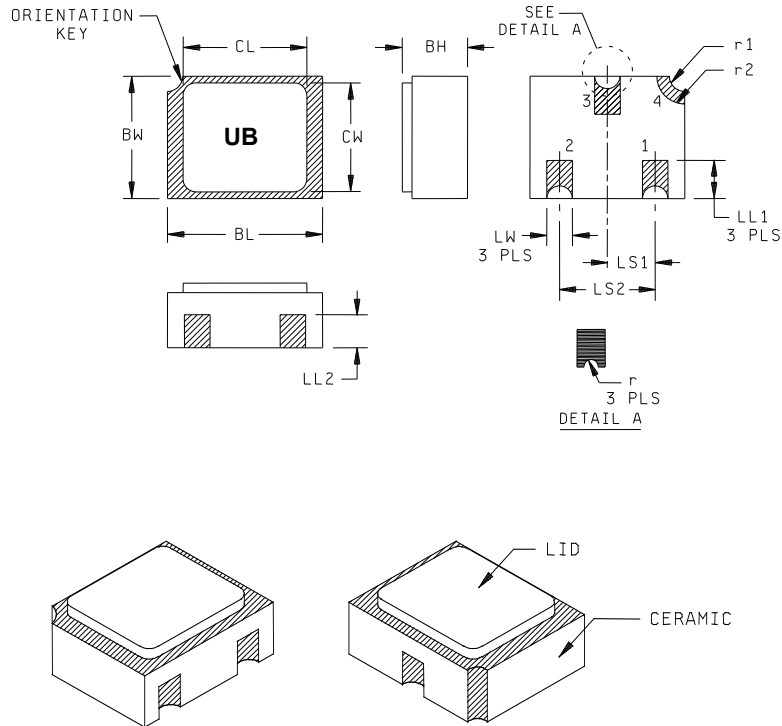


NOTES:

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 (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 L₁ and L₂. Dimension LD applies between L₂ and LL minimum. Diameter is uncontrolled in L₁ 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 2N1893, dimension LL shall be 1.5 inches (38.1mm) minimum and 1.75 inches (44.4 mm) maximum.
12. For 2N1893S, dimension LL shall be .5 inch (12.7mm) minimum and .75 inch (19.0 mm) maximum.
- * 13. In accordance with ASME Y14.5, diameters are equivalent to ϕ x symbology.
14. Lead 1 = emitter, lead 2 = base, lead 3 = collector.

FIGURE 2. Physical dimensions for device types 2N1893 and 2N1893S (similar to TO-5).

MIL-PRF-19500/182J
w/AMENDMENT 2



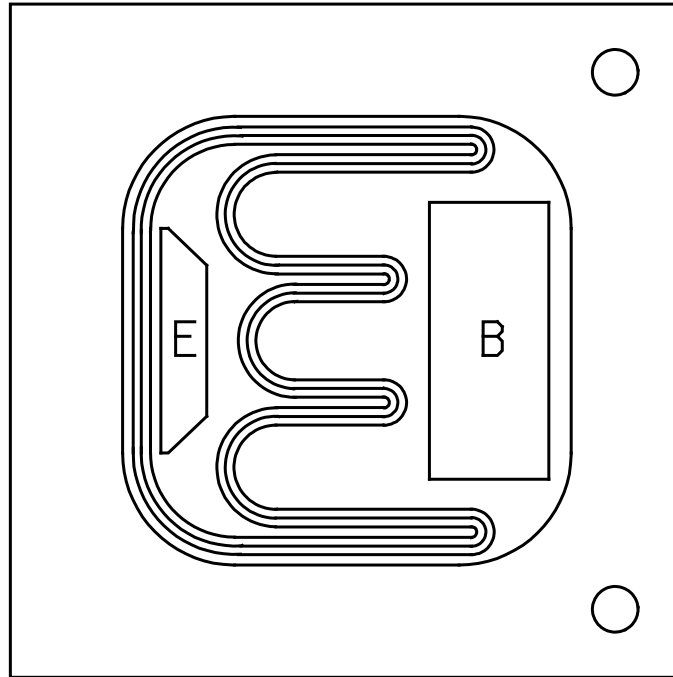
Symbol	Dimensions		Dimensions		Note
	Inches		Millimeters		
	Min	Max	Min	Max	
BH	.046	.056	1.17	1.42	
BL	.115	.128	2.92	3.25	
BW	.085	.108	2.16	2.74	
CL		.128		3.25	
CW		.108		2.74	
LL1	.022	.038	0.56	0.96	4
LL2	.014	.035	0.36	0.89	4
LS1	.036	.040	0.91	1.02	
LS2	.071	.079	1.80	2.01	
LW	.016	.024	0.41	0.61	
r		.008		.203	
r1		.012		.305	
r2		.022		.559	

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas on package denote metallized areas.
4. Applies to 3 pads.
- * 5. Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the lid.
6. In accordance with ASME Y14.5, diameters are equivalent to ϕ x symbology.

FIGURE 3. Physical dimensions, surface mount (2N720AUB).

MIL-PRF-19500/182J
w/AMENDMENT 2



Die size:	.030 x .030 inch (0.76 mm x 0.76 mm).
Die thickness:	.008 ±.0016 inch (0.20 mm ±0.041 mm).
Base pad	.004 x .010 inch (0.10 mm x 0.254 mm).
Emitter pad:	.0023 x .007 inch (0.058 mm x 0.18 mm).
Back metal:	Gold, 6.5 kÅ ±1.95 kÅ.
Top metal:	Aluminum, 12 kÅ. Minimum; 14.5 kÅ. nominal.
Back side:	Collector.
Glassivation:	SiO ₂ , 7.5 kÅ ±1.5 kÅ.

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
- * 3. In accordance with ASME Y14.5, diameters are equivalent to ϕ x symbology.

FIGURE 4. JANHCA2N720A and JANKCA2N720A die dimensions.

MIL-PRF-19500/182J
w/AMENDMENT 2

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.

R _{θJA}	Thermal resistance junction to ambient.
R _{θJC}	Thermal resistance junction to case.
UB	Surface mount case outlines (see figure 3).

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in [MIL-PRF-19500](#), and on [figure 1](#) (TO-18), [figure 2](#) (TO-5), [figure 3](#) (UB), and [figure 4](#) (die version A).

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 Marking. Devices shall be marked in accordance with [MIL-PRF-19500](#). The prefixes JAN, JANTX, JANTXV, and JANS can be abbreviated as J, JX, JV, and JS respectively. 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).

3.5 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 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 [table I](#) and [table II](#)).

MIL-PRF-19500/182J
w/AMENDMENT 2

4.2 Qualification inspection. Qualification inspection shall be in accordance with [MIL-PRF-19500](#) 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 qualification. JANHC and JANKC qualification inspection shall be in accordance with [MIL-PRF-19500](#).

4.3 Screening (list applicable JANS, JANTX, and JANTXV levels). 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	Measurements for JANS	Measurements for JANTX and JANTXV levels
(1) 3c	Thermal impedance (see 4.3.2).	Thermal impedance (see 4.3.2).
9	I_{CBO2} , h_{FE3}	Not applicable
11	I_{CBO2} , h_{FE3} ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE3} = 15 percent of initial value.	I_{CBO2} , h_{FE3}
12	See 4.3.1 .	See 4.3.1 .
13	ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE3} = 15 percent of initial value, subgroup 2 and 3 of table I herein.	ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE3} = 15 percent of initial value, subgroup 2 of table I herein.

(1) Shall be performed anytime after temperature cycling, screen 3a; JANTX and JANTXV levels do not need to be repeated in screening requirements.

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 for JANTX and JANTXV quality levels. 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.

* 4.3.2 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_{MD} , t_{SW} (V_C and V_H where appropriate). See group E, subgroup 4 herein.

MIL-PRF-19500/182J
w/AMENDMENT 2

4.3.3 Screening (JANHNC and JANKC). Screening of JANHC and JANKC die shall be in accordance with MIL-PRF-19500, "Discrete Semiconductor Die/Chip Lot Acceptance". As a minimum, die shall be 100-percent probed to ensure compliance with group A, subgroup 2. 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.

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.

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

Subgroup	Method	Condition
----------	--------	-----------

B4	1037	$V_{CB} = 10$ V dc, adjust device current, or power, to achieve a minimum ΔT_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, $c = 0$; adjust T_A or P_D to achieve a $T_J = +225^\circ\text{C}$ 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.

Step	Method	Condition
------	--------	-----------

1	1026	Steady-state life: 1,000 hours minimum, $V_{CB} = 10$ V dc, power 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 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.
---	------	--

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:

- 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.
- 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 (group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

MIL-PRF-19500/182J
w/AMENDMENT 2

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the tests and 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.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E (not applicable to the 2N720AUB).
C5	3131	$R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3 and 4.3.2).
C6	1026	1,000 hours at $V_{CB} = 10$ V dc; power shall be applied to achieve $T_J = +150^{\circ}\text{C}$ minimum and a minimum of $P_D = 75$ percent of maximum rated P_T as defined in 1.3 $n = 45$, $c = 0$. 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 (JAN, JANTX, and JANTXV), table E-VII of [MIL-PRF-19500](#).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E (not applicable to the 2N720AUB).
C5	3131	$R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3 and 4.3.2).
C6	1026	Not applicable.

4.4.3.3 Group C sample selection. Samples selected from group C inspection shall be chosen at random from any 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. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for C6 life test may be pulled prior to the application of final lead finish. Testing of a group 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.e 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 table E-IX of [MIL-PRF-19500](#) and as specified in [table III](#) herein.

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

4.5.1 Pulse measurements. Conditions for pulse measurements shall be as specified in section 4 of [MIL-STD-750](#).

MIL-PRF-19500/182J
w/AMENDMENT 2

* TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit	Limit	Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1 2/</u>						
* Visual and mechanical examination <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				
* Salt atmosphere (corrosion)	1041	n = 6 devices, c = 0, (For laser marked devices only)				
* Temp cycling <u>3/ 4/</u>	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
* Hermetic seal <u>4/ 6/</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 _A = +250°C at t = 24 hours or T _A = +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 <u>7/</u>	3131	See 4.3.2	Z _{θJX}			°C/W
Collector to base cutoff current	3036	Bias condition D, V _{CB} = 120 V dc pulsed (see 4.5.1).	I _{CB01}		100	μA dc
Emitter to base cutoff current	3061	Bias condition D, V _{EB} = 7 V dc pulsed (see 4.5.1).	I _{EB01}		100	μA dc
Breakdown voltage, collector-emitter	3011	Bias condition D; I _C = 30 mA dc; pulsed (see 4.5.1)	V _{(BR)CEO}	80		V dc
Breakdown voltage collector-emitter	3011	Bias condition D, I _C = 10 mA dc, pulsed (see 4.5.1), R _{BE} = 10 Ω	V _{(BR)CER}	100		V dc

See footnotes at end of table.

MIL-PRF-19500/182J
w/AMENDMENT 2

* TABLE I. Group A inspection - Continued.

Inspection <u>1</u> /	MIL-STD-750		Symbol	Limit	Limit	Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - Continued						
Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 90$ V dc	I_{CBO2}		10	nA dc
Emitter-base cutoff current	3061	Bias condition D, $V_{EB} = 5$ V dc	I_{EBO2}		10	nA dc
Collector-emitter saturated voltage	3071	$I_C = 150$ mA dc, $I_B = 15$ mA dc, pulsed (see 4.5.1)	$V_{CE(sat)1}$		5.0	V dc
Collector-emitter saturated voltage	3071	$I_C = 50$ mA dc, $I_B = 5$ mA dc, pulsed (see 4.5.1)	$V_{CE(sat)2}$		1.2	V dc
Base-emitter saturated voltage	3066	Test condition A, $I_C = 150$ mA dc, $I_B = 15$ mA dc, pulsed (see 4.5.1)	$V_{BE(sat)1}$		1.3	V dc
Base-emitter saturated voltage	3066	Test condition A, $I_C = 50$ mA dc, $I_B = 5$ mA dc, pulsed (see 4.5.1)	$V_{BE(sat)2}$		1.2	V dc
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 0.1$ mA dc, pulsed (see 4.5.1)	h_{FE1}	20		
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 10$ mA dc, pulsed (see 4.5.1)	h_{FE2}	35		
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 150$ mA dc, pulsed (see 4.5.1)	h_{FE3}	40	120	
<u>Subgroup 3</u>						
High temperature operation:		$T_A = +150^{\circ}\text{C}$				
Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 90$ V dc	I_{CBO3}		15	μA dc
Low temperature operation		$T_A = -55^{\circ}\text{C}$				
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 10$ mA dc, pulsed (see 4.5.1)	h_{FE4}	20		

See footnotes at end of table.

MIL-PRF-19500/182J
w/AMENDMENT 2

* TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit	Limit	Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4</u>						
Small signal short circuit forward current transfer ratio	3206	$V_{CE} = 5 \text{ V dc}$, $f = 1 \text{ kHz}$, $I_C = 1 \text{ mA dc}$:	h_{fe}	35	100	
		$V_{CE} = 10 \text{ V dc}$, $f = 1 \text{ kHz}$, $I_C = 5 \text{ mA dc}$	h_{fe}	45	150	
Magnitude of common emitter small-signal short-circuit forward-current transfer ratio	3306	$V_{CE} = 10 \text{ V dc}$, $f = 20 \text{ MHz}$, $I_C = 50 \text{ mA dc}$	$ h_{fe} $	3	10	
Small signal short circuit input impedance	3201	$V_{CB} = 10 \text{ V dc}$, $I_C = 5 \text{ mA dc}$	h_{ib}	4	8	ohms
Small signal short circuit output admittance	3216	$V_{CB} = 10 \text{ V dc}$, $I_C = 5 \text{ mA dc}$	h_{ob}	0	0.5	μmhos
Small signal open circuit reverse voltage transfer ratio	3211	$V_{CB} = 10 \text{ V dc}$, $I_C = 5 \text{ mA dc}$	h_{rb}		1.5×10^{-4}	
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}	2	15	pF
Pulse response	3251	Test condition A, except test circuit and pulse requirements. See figure 9 herein.	$t_{on} + t_{off}$		30	ns
<u>Subgroups 5, 6, and 7</u>						
Not applicable						

1/ For sampling plan see [MIL-PRF-19500](#).

2/ For resubmission of failed test in subgroup 1 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 hermetic seal test is an end-point to temp-cycling in addition to electrical measurements.

* 7/ For end-point measurements, this test is required for the following subgroups:

Group B, subgroups 3, 4 and 5 (JANS).

Group B, step 1(JAN, JANTX, JANTXV).

Group C, subgroups 2 and 6.

Group E, subgroup 1.

MIL-PRF-19500/182J
w/AMENDMENT 2

* TABLE II. Group D inspection and end-point limits.

Inspection <u>1/</u> <u>2/</u> <u>3/</u>	MIL-STD-750		Symbol	Limits	Limits	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; $V_{CB} = 120$ V dc; pulsed (see 4.5.1)	I_{CBO1}		200	μ A dc
Emitter to base cutoff current	3061	Bias condition D; $V_{EB} = 7.0$ V dc; pulsed (see 4.5.1)	I_{EBO1}		200	μ A dc
Breakdown voltage, collector - emitter	3011	Bias condition D; $I_C = 30$ mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	80		V dc
Breakdown voltage, collector - emitter	3011	Bias condition D; $I_C = 10$ mA dc; pulsed (see 4.5.1), $R_{BE} = 10 \Omega$	$V_{(BR)CER}$	100		V dc
Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 90$ V dc	I_{CBO2}		20	η A dc
Emitter - base cutoff current	3061	Bias condition D; $V_{EB} = 5$ V dc	I_{EBO2}		20	η A dc
Collector – emitter saturated voltage	3071	$I_C = 150$ mA dc; $I_B = 15$ mA dc; pulsed (see 4.5.1)	$V_{CE(sat)1}$		5.75	V dc
Collector – emitter saturated voltage	3071	$I_C = 50$ mA dc; $I_B = 5$ mA dc; pulsed (see 4.5.1)	$V_{CE(sat)2}$		1.38	V dc
Base - emitter saturated voltage	3066	Test condition A; $I_C = 150$ mA dc; $I_B = 15$ mA dc, pulsed (see 4.5.1)	$V_{BE(sat)1}$		1.50	V dc
Base - emitter saturated voltage	3066	Test condition A; $I_C = 50$ mA dc; $I_B = 5$ mA dc, pulsed (see 4.5.1)	$V_{BE(sat)2}$		1.38	V dc
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 0.1$ mA dc, pulsed (see 4.5.1)	$[h_{FE1}]$ <u>5/</u>	[10]		
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 10$ mA dc, pulsed (see 4.5.1)	$[h_{FE2}]$ <u>5/</u>	[17.5]		
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 150$ mA dc, pulsed (see 4.5.1)	$[h_{FE3}]$ <u>5/</u>	[20]	120	

See footnotes at end of table.

MIL-PRF-19500/182J
w/AMENDMENT 2

* TABLE II. Group D inspection and end-point limits - Continued.

Inspection <u>1/</u> <u>2/</u> <u>3/</u>		MIL-STD-750	Symbol	Limits	Limits	Unit
	Method	Conditions		Min	Max	
Subgroup 2						
Steady-state total dose irradiation	1019	Gamma exposure $V_{CES} = 64$ V Bias condition A				
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 120$ V dc; pulsed (see 4.5.1)	I_{CBO1}		200	μA dc
Emitter to base cutoff current	3061	Bias condition D; $V_{EB} = 7.0$ V dc; pulsed (see 4.5.1)	I_{EBO1}		200	μA dc
Breakdown voltage, collector - emitter	3011	Bias condition D; $I_C = 30$ mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	80		V dc
Breakdown voltage, collector - emitter	3011	Bias condition D; $I_C = 10$ mA dc; pulsed (see 4.5.1), $R_{BE} = 10 \Omega$	$V_{(BR)CER}$	100		V dc
Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 90$ V dc	I_{CBO2}		20	ηA dc
Emitter - base cutoff current	3061	Bias condition D; $V_{EB} = 5$ V dc	I_{EBO2}		20	ηA dc
Collector – emitter saturated voltage	3071	$I_C = 150$ mA dc; $I_B = 15$ mA dc; pulsed (see 4.5.1)	$V_{CE(sat)1}$		5.75	V dc
Collector – emitter saturated voltage	3071	$I_C = 50$ mA dc; $I_B = 5$ mA dc; pulsed (see 4.5.1)	$V_{CE(sat)2}$		1.38	V dc
Base - emitter saturated voltage	3066	Test condition A; $I_C = 150$ mA dc; $I_B = 15$ mA dc, pulsed (see 4.5.1)	$V_{BE(sat)1}$		1.50	V dc
Base - emitter saturated voltage	3066	Test condition A; $I_C = 50$ mA dc; $I_B = 5$ mA dc, pulsed (see 4.5.1)	$V_{BE(sat)2}$		1.38	V dc
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 0.1$ mA dc, pulsed (see 4.5.1)	$[h_{FE1}]$ <u>5/</u>	[10]		
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 10$ mA dc, pulsed (see 4.5.1)	$[h_{FE2}]$ <u>5/</u>	[17.5]		
Forward-current transfer ratio	3076	$V_{CE} = 10$ V dc, $I_C = 150$ mA dc, pulsed (see 4.5.1)	$[h_{FE3}]$ <u>5/</u>	[20]	120	

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, and UBC suffix versions 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} . 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.

MIL-PRF-19500/182J
w/AMENDMENT 2

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

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
<u>Subgroup 1</u>			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.	
<u>Subgroup 2</u>			45 devices c = 0
Intermittent life	1037	Intermittent operation life: $V_{CB} = 10 \text{ V dc}$, 6,000 cycles. Adjust device current, or power, to achieve a minimum ΔT_J of $+100^\circ\text{C}$.	
Electrical measurements		See table I , subgroup 2 herein.	
<u>Subgroup 4</u>			
Thermal resistance	3131	$R_{\theta JSP(IS)}$ can be calculated but shall be measured once in the same package with a similar die size to confirm calculations (may apply to multiple specification sheets).	15 devices, c = 0
Thermal impedance curves.		See table E-IX of MIL-PRF-19500 , group E, subgroup 4.	Sample size N/A
<u>Subgroup 5</u>			
Not applicable			
<u>Subgroup 8</u>			
Reverse stability	1033	Condition B.	45 devices c = 0

Maximum Thermal Impedance

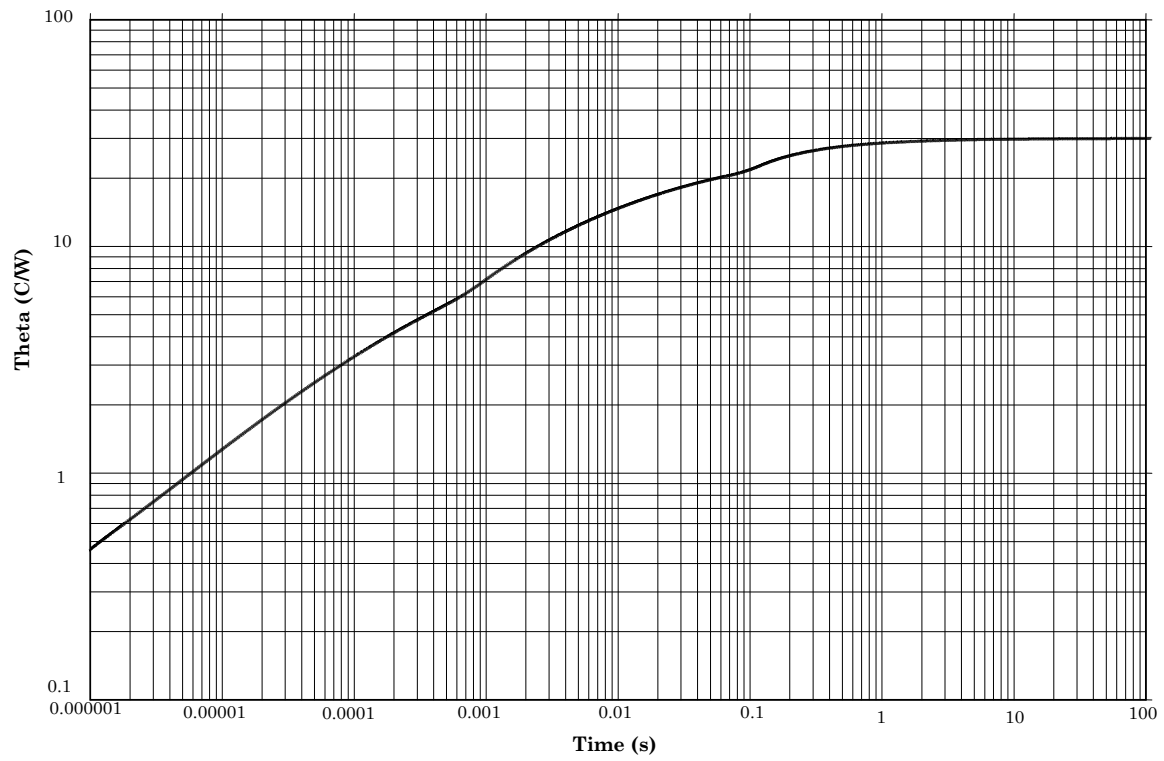


FIGURE 5. Thermal impedance graph ($R_{\theta JC}$) for 2N1893 and 2N1893S (TO-5).

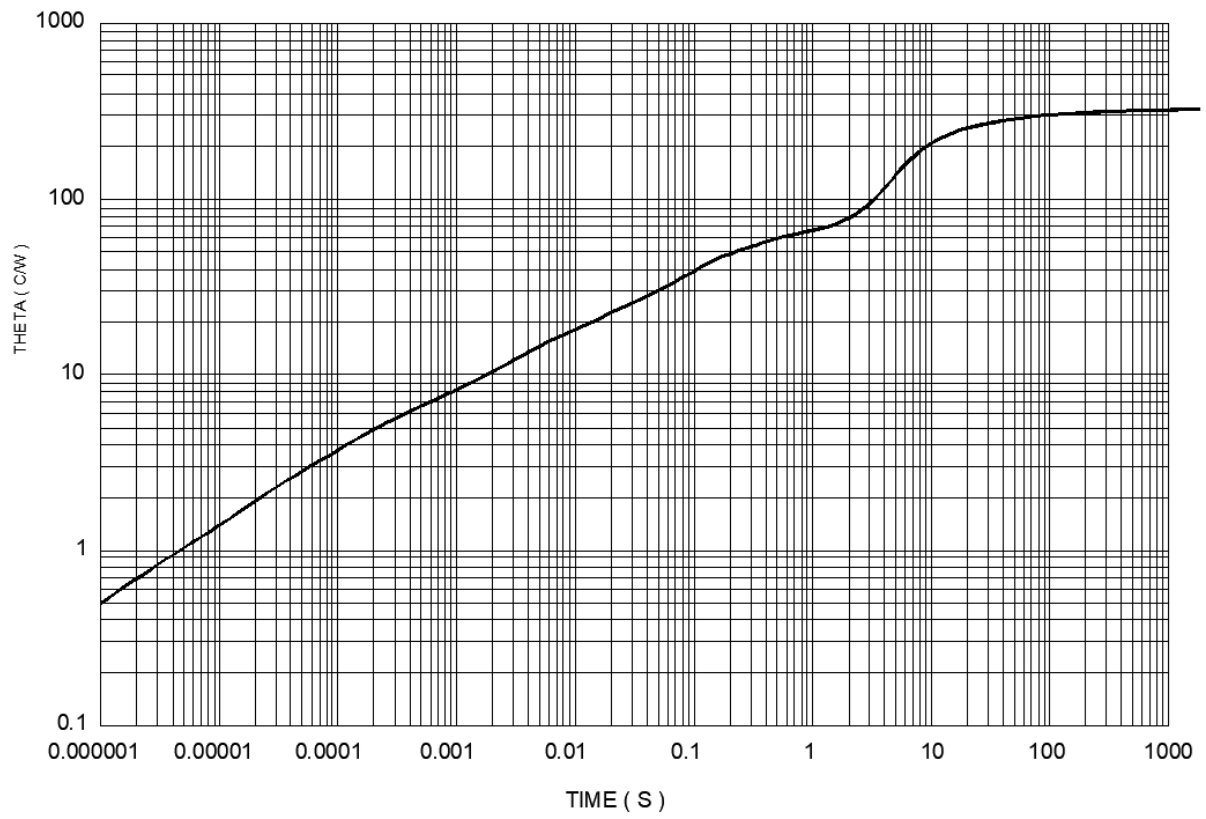


FIGURE 6. Thermal impedance graph ($R_{\theta JC}$) for 2N720A (TO-18).

Maximum Thermal Impedance

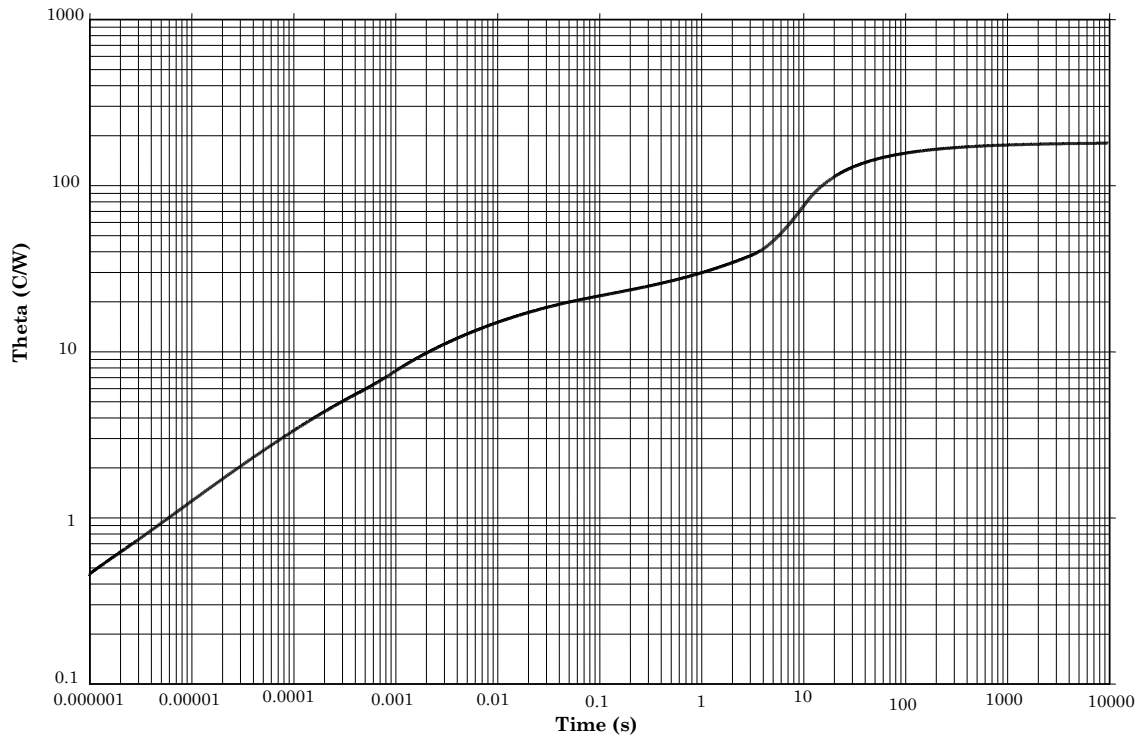


FIGURE 7. Thermal impedance graph ($R_{\theta JA}$) for 2N1893 and 2N1893S (TO-5).

Maximum Thermal Impedance

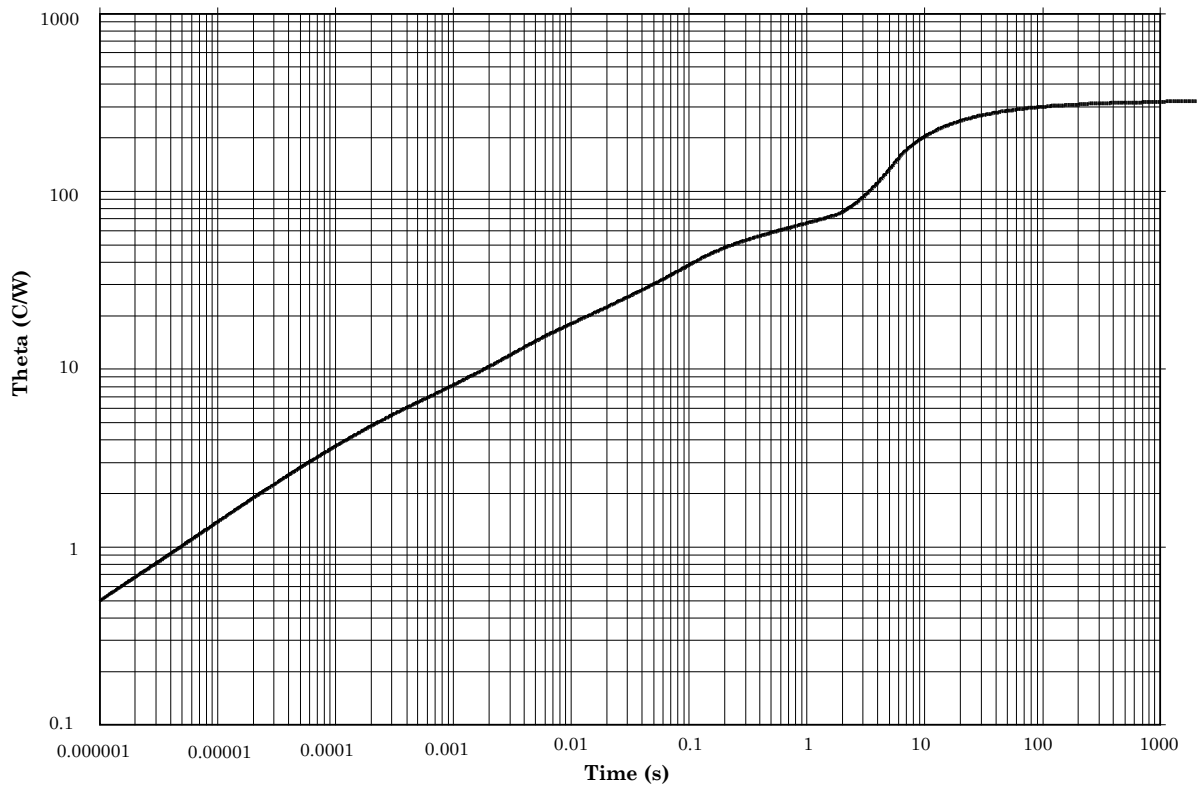
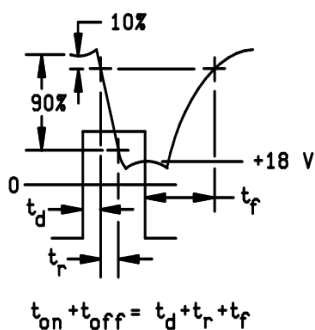
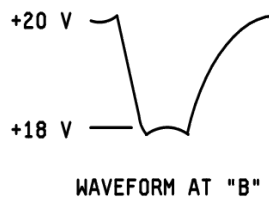
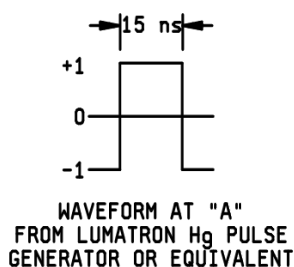
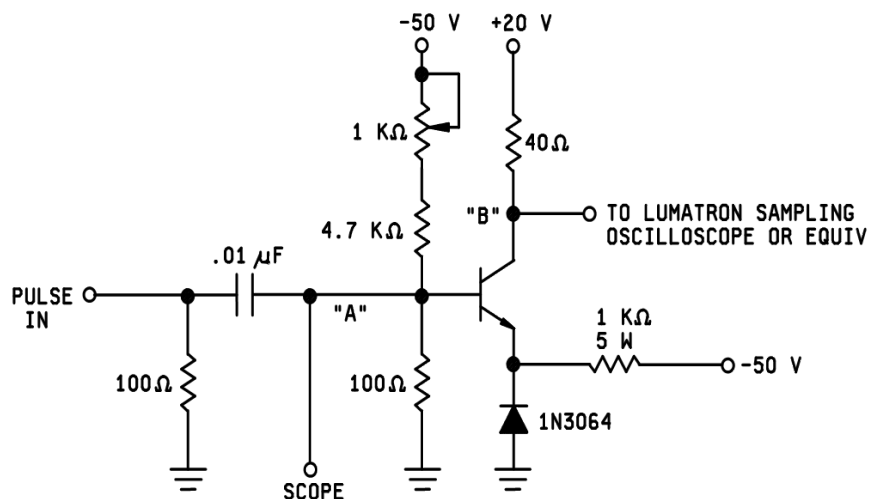


FIGURE 8. Thermal impedance graph ($R_{\theta JA}$) for 2N720A (TO-18).

MIL-PRF-19500/182J
w/AMENDMENT 2



NOTES:

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

FIGURE 9. Pulse response (turn-on plus turn-off) measurement circuit and waveforms.

MIL-PRF-19500/182J
w/AMENDMENT 2

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. The complete Part or Identifying Number (PIN), see title and section 1.
- e. 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. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.dla.mil>.

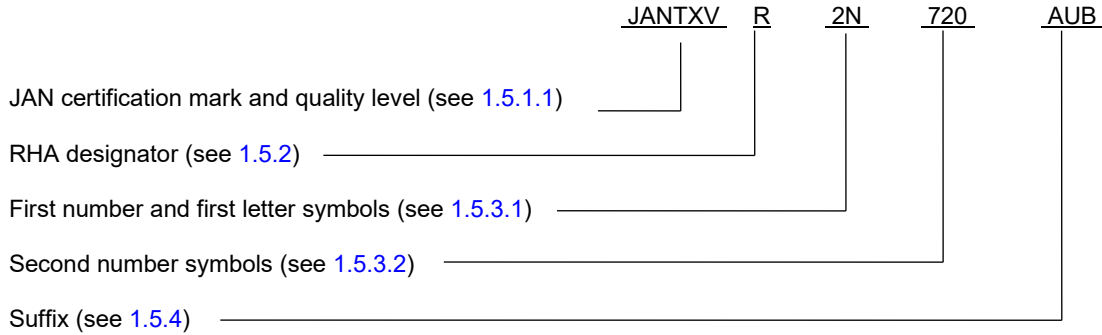
6.4 Suppliers of JANHC and JANKC die. The qualified JANHC and JANKC suppliers with the applicable letter version (example JANHCA2N720A) will be identified on the QML

	Die ordering information
PIN	Manufacturer
	34156
2N720A	JANHCA2N720A JANKCA2N720A

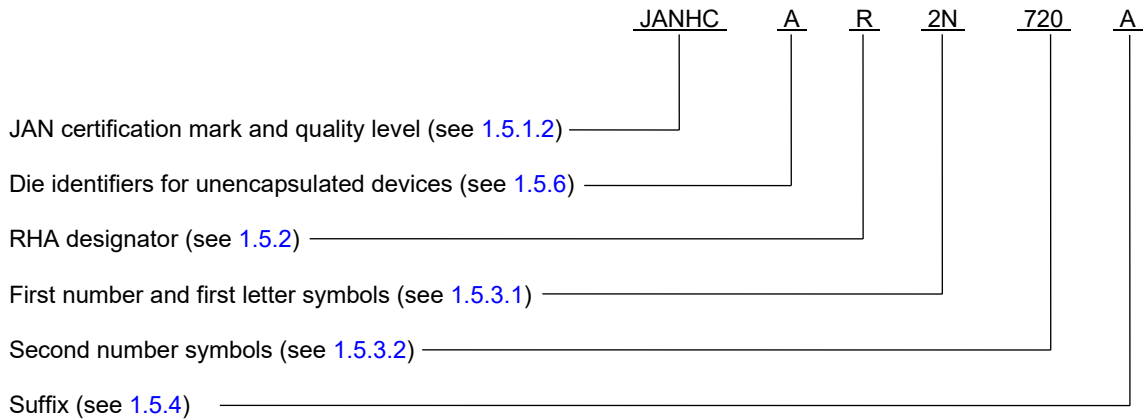
MIL-PRF-19500/182J
w/AMENDMENT 2

6.5 PIN construction example.

6.5.1 Encapsulated devices. The PINs for encapsulated devices are constructed using the following form.



6.5.2 Un-encapsulated devices. The PINs for un-encapsulated devices are constructed using the following form.



6.6 List of PINs.

6.6.1 PINs for encapsulated devices. The following is a list of possible PINs for encapsulated devices available on this specification sheet.

PINs for devices of the base quality level	PINs for devices of the "TX" quality level	PINs for devices of the "TXV" quality level (1)	PINs for devices of the "S" quality level (1)
JAN2N720A	JANTX2N720A	JANTXV#2N720A	JANS#2N720A
JAN2N720AUB	JANTX2N720AUB	JANTXV#2N720AUB	JANS#2N720AUB
JAN2N1893	JANTX2N1893	JANTXV#2N1893	JANS#2N1893
JAN2N1893S	JANTX2N1893S	JANTXV#2N1893S	JANS#2N1893S

- (1) The number sign (#) represent one of eight RHA designators available (M, D, P, L, R, F, G, or H). The PIN is also available without a RHA designator.

MIL-PRF-19500/182J
w/AMENDMENT 2

6.6.2 PINs for unencapsulated devices (die). The following is a list of possible PINs for unencapsulated devices available on this specification sheet.

Quality level HC	Quality level KC
JANHCA#2N720A	JANKCA#2N720A

- (1) The number sign (#) represents one of eight RHA designators available (M, D, P, L, R, F, G, or H). The PIN is also available without a RHA designator.

6.7 Amendment notations. The margins of this specification are marked with asterisks to indicate modifications generated by this amendment. 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 - SH
Air Force - 85
* NASA - NA
DLA - CC

Preparing activity:
DLA - CC

(Project 5961-2022-023)

Review activities:
Army - AR, MI, SM
Navy - AS, MC
* Air Force - 19, 71

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.dla.mil>.