

The documentation and process conversion measures necessary to comply with this revision shall be completed by 05 November 1999.

INCH-POUND

MIL-PRF-19500/370D  
05 August 1999  
SUPERSEDING  
MIL-S-19500/370C  
25 September 1994

## PERFORMANCE SPECIFICATION SHEET

### SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, HIGH-POWER TYPE 2N3442, JAN, JANTX AND JANTXV

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

#### 1. SCOPE

1.1 Scope. This specification covers the performance requirements for NPN silicon, high-power transistor. Three levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (similar to TO-3), (see 3.3).

1.3 Maximum ratings.

$P_T$ 1/ $T_C = +25^\circ\text{C}$	$P_T$ 2/ $T_C = +25^\circ\text{C}$	$V_{CBO}$	$V_{CEO}$	$V_{EBO}$	$V_{CER}$	$I_B$	$I_C$	$T_{OP}$ and $T_{STG}$
<u>W</u>	<u>W</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>A dc</u>	<u>A dc</u>	<u><math>^\circ\text{C}</math></u>
6.0	117	160	140	7	150	7	10	-65 to +200

1/ Derate linearly 34.2 mW/ $^\circ\text{C}$  above  $T_A = +25^\circ\text{C}$ .

2/ Derate linearly 668 mW/ $^\circ\text{C}$  above  $T_C = +25^\circ\text{C}$ .

1.4 Primary electrical characteristics.

	$h_{FE1}$ 1/	$V_{CE(sat)}$ 1/	$h_{fe}$	$R_{\theta JC}$
	$V_{CE} = 4 \text{ V dc}$ $I_C = 3 \text{ A dc}$	$I_C = 3 \text{ A dc}$ $I_B = 300 \text{ mA dc}$	$V_{CE} = 4 \text{ V dc}$ $I_C = 3 \text{ A dc}$ $f = 100 \text{ kHz}$	
Min	20	<u>V dc</u>	1.0	<u><math>^\circ\text{C/W}</math></u>
Max	70	1.0		1.5

1/ Pulsed (see 4.5.1).

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAC, 3990 East Broad St., Columbus, OH 43216-5000, by using the addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A

FSC 5961

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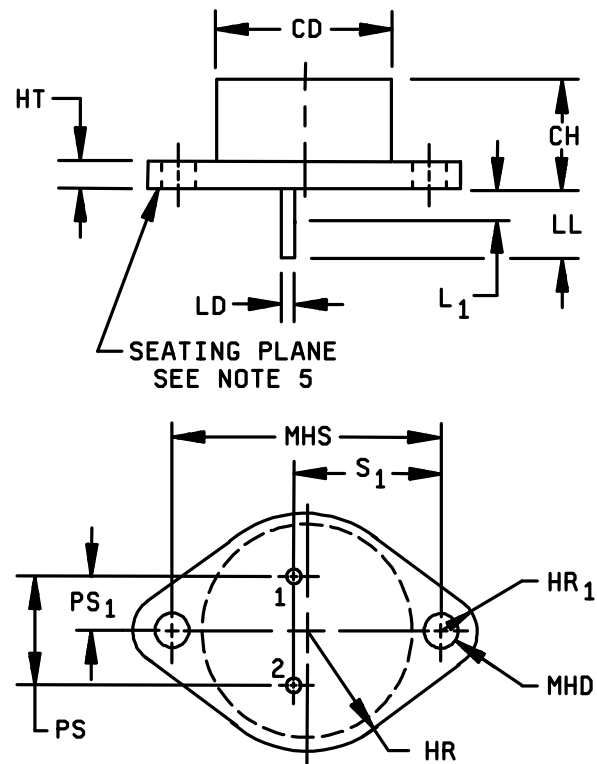


FIGURE 1. Physical dimensions (similar to TO-3).

Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD		.875		22.22	
CH	.270	.350	6.86	8.89	
HR	.495	.525	12.57	13.34	
HR <sub>1</sub>	.131	.188	3.33	4.78	
HT	.060	.135	1.52	3.43	
LD	.038	.043	0.97	1.09	
LL	.312	.500	7.92	12.70	
L <sub>1</sub>		.050		1.27	
MHD	.151	.165	3.84	4.19	
MHS	1.177	1.197	29.90	30.40	
PS	.420	.440	10.67	11.18	4,5
PS <sub>1</sub>	.205	.225	5.21	5.72	4,5
s <sub>1</sub>	.655	.675	16.64	17.15	

## NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Lead 1 is base; lead 2 is emitter, and case is collector.
4. Measured at points .050 inch (1.27 mm) - .055 inch (1.4 mm) below the seating plane. When gauge is not used, measurement will be made at the seating plane.
5. The seating plane of the header shall be flat within .001 inch (0.03 mm) concave to .004 inch (0.10 mm) convex inside a .930 inch (23.62 mm) diameter circle on the center of the header and flat within .001 inch (0.03 mm) concave to .006 inch (0.15 mm) convex overall.
6. In accordance with ANSI Y14.5M, diameters are equivalent to  $\phi$ x symbology.

FIGURE 1. Physical dimensions (similar to TO-3) – Continued.

## 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 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

#### SPECIFICATION

##### DEPARTMENT OF DEFENSE

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

#### STANDARD

##### DEPARTMENT OF DEFENSE

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Defense Automated Printing Service, 700 Robbins Avenue, Building 4D (DPM – DODSSP), Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), 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 Associated specification. The individual item requirements shall be in accordance with MIL-PRF-19500 and as specified herein.

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

3.3 Interface requirements and physical dimensions. The Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and figure 1.

3.3.1 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 Marking. Marking shall be in accordance with MIL-PRF-19500.

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

3.6 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I herein.

3.7 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified manufacturers list before contract award (see 4.2 and 6.4).

#### 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).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500.

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

Screen (see table IV of MIL-PRF-19500)	Measurement JANTX, JANTXV levels only
11	$h_{FE1}$ , $I_{CEX}$
12	See 4.3.1
13	Subgroup 2 of table I herein. $\Delta I_{CEX}$ = 100 percent or 500 $\mu A$ dc whichever is greater; $\Delta h_{FE1}$ = 25 percent of initial value.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows:

$$T_J = +187.5^{\circ}C \pm 12.5^{\circ}C; V_{CB} = 24 \text{ V dc}; T_A \leq +35^{\circ}C.$$

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500.

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

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4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and paragraph 4.4.2.1 herein. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, group A, subgroup 2 herein. Delta measurements shall be in accordance with table II herein.

## 4.4.2.1 Group B inspection, table VIb (JAN, JANTX and JANTXV) of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
B3	1037	For solder die attach: 2,000 cycles; $V_{CB} \geq 10$ V dc, $T_A \leq 35^\circ\text{C}$ .
B3	1026	For eutectic die attach: $V_{CB} \geq 10$ V dc, $T_A \leq 35^\circ\text{C}$ , adjust $P_T$ to achieve $T_J = 175^\circ\text{C}$ minimum.
B5	3131	See 4.5.2.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500, and as follows. Electrical measurements (end-points) shall be in accordance with table I, group A, subgroup 2 herein. Delta measurements shall be in accordance with table II herein.

## 4.4.3.1. Group C inspection, table VII of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
C2	2036	Test condition A, weight = 10 pounds $\pm 10$ oz., $t = 15$ s.
C6	1037	For solder die attach: 6,000 cycles; $V_{CB} \geq 10$ V dc, $T_A \leq 35^\circ\text{C}$ .
C6	1026	For eutectic die attach: $V_{CB} \geq 10$ V dc, $T_A \leq 35^\circ\text{C}$ , adjust $P_T$ to achieve $T_J = 175^\circ\text{C}$ minimum.

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 Thermal resistance. Thermal resistance measurements shall be conducted in accordance with test method 3131 of MIL-STD-750. The following details shall apply.

- Collector current magnitude during power applications shall be 2 A dc.
- Collector to emitter voltage magnitude shall be 20 V dc.
- Reference temperature measuring point shall be the case.
- Reference point temperature shall be  $+25^\circ\text{C} \leq T_R \leq +75^\circ\text{C}$  and recorded before the test is started.

TABLE I. Group A inspection. 1/

Inspection	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Collector to emitter breakdown voltage	3011	Bias condition D; $I_C = 3 \text{ A dc}$ , pulsed (see 4.5.1),	$V_{(BR)CEO}$	140		V dc
Collector to emitter breakdown voltage	3011	Bias condition B; $I_C = 1.5 \text{ A dc}$ , $R_{BE} = 100 \Omega$ , see figure 2	$V_{(BR)CER}$	150		V dc
Collector to emitter breakdown voltage	3011	Bias condition A; $I_C = 1.5 \text{ A dc}$ , $V_{EB} = 1.5 \text{ V dc}$ , see figure 2	$V_{(BR)CEX}$	160		V dc
Collector to emitter cutoff current	3041	Bias condition A; $V_{CE} = 140 \text{ V dc}$ , $V_{EB} = 1.5 \text{ V dc}$	$I_{CEX}$		1.0	mA dc
Emitter to base cutoff current	3061	Bias condition D; $V_{EB} = 7 \text{ V dc}$	$I_{EBO}$		1.0	mA dc
Base emitter voltage (nonsaturated)	3066	Test condition B; pulsed (see 4.5.1) $I_C = 3 \text{ A dc}$ , $V_{CE} = 4.0 \text{ V dc}$	$V_{BE}$		1.7	V dc
Saturation voltage and resistance	3071	Pulsed (see 4.5.1) $I_C = 3 \text{ A dc}$ , $I_B = 300 \text{ mA dc}$	$V_{CE(sat)}$		1.0	V dc
Forward-current transfer ratio	3076	$V_{CE} = 4 \text{ V dc}$ , $I_C = 3 \text{ A dc}$ , pulsed (see 4.5.1)	$h_{FE1}$	20	70	mA

See footnote at end of table.

TABLE I. Group A inspection – Continued. 1/

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		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; $V_{CB} = 140\text{ V dc}$	ICBO		10	mA dc
Low temperature operation		$T_A = -55^{\circ}\text{C}$				
Forward current transfer ratio	3076	$V_{CE} = 4\text{ V dc}$ , $I_C = 3\text{ A dc}$ , pulsed (see 4.5.1)	hFE2	15		
<u>Subgroup 4</u>						
Small-signal short-circuit forward-current transfer ratio	3306	$V_{CE} = 4\text{ V dc}$ , $I_C = 3\text{ A dc}$ , $f = 100\text{ kHz}$	hfe	1.0		
<u>Subgroup 5</u>						
Safe operating area (continuous dc)	3051	$T_C = +25^{\circ}\text{C}$ ; $t = 1\text{ s}$				
<u>Test 1</u>		$V_{CE} = 11.7\text{ V dc}$ , $I_C = 10\text{ A dc}$				
<u>Test 2</u>		$V_{CE} = 78\text{ V dc}$ , $I_C = 1.5\text{ A dc}$				
<u>Test 3</u>		$V_{CE} = 140\text{ V dc}$ , $I_C = 0.5\text{ A dc}$ , see figure 3				
Electrical measurements		See table I, subgroup 2 herein				
<u>Subgroups 6 and 7</u>						
Not applicable						

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



TABLE II. Groups A, B, and C delta measurements. 1/ 2/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Collector to emitter cutoff current	3041	Bias condition A; VCE = 140 V dc VEB = 1.5 V dc	$\Delta I_{CEX}$ 3/	100 percent of initial reading or 500 $\mu$ A dc, whichever is greater.		

1/ The delta measurements for table VIb (JAN, JANTX and JANTXV) of MIL-PRF-19500 are as follows:

- a. Subgroup 3, see table II herein, step 1.
- b. Subgroup 6, see table II herein, step 1.

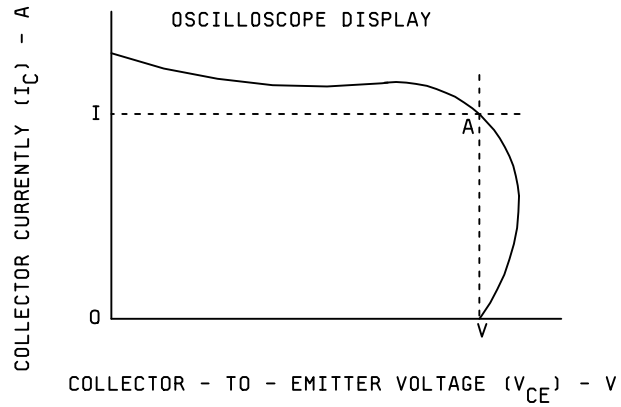
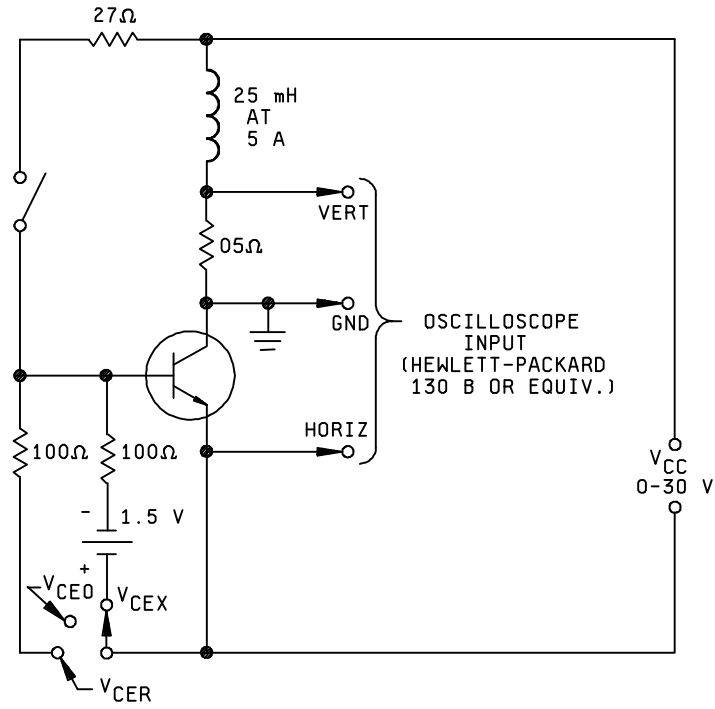
2/ The delta measurements for table VII of MIL-PRF-19500 are as follows:

- a. Subgroup 6, see table II herein, step 1.

3/ Devices which exceed the group A limits for this test shall not be accepted.

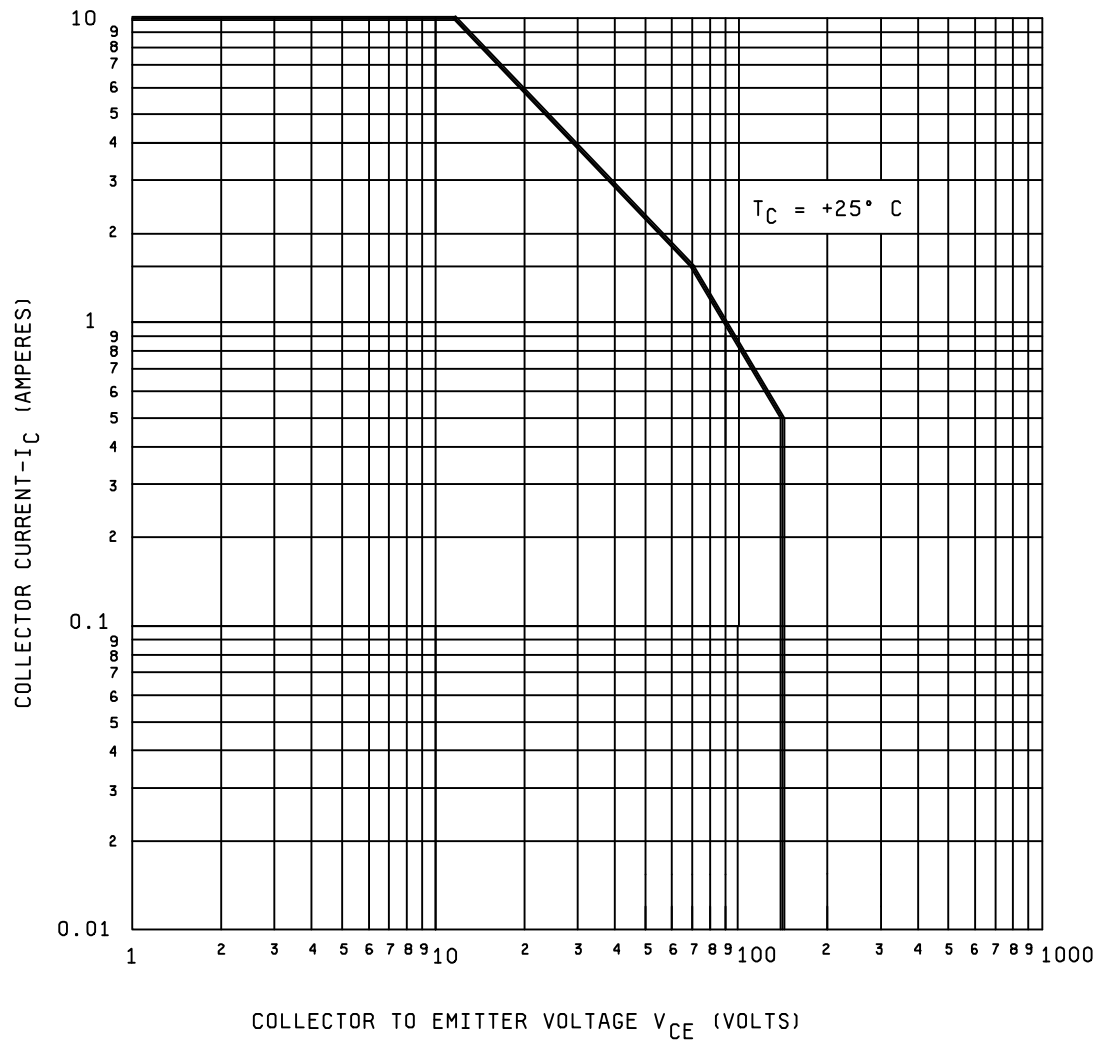
## 5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. 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.



NOTE: The voltages  $V_{CE0}$ ,  $V_{CER}$ , or  $V_{CEX}$  are acceptable when the trace falls to the right and above point "A".

FIGURE 2. Test circuit for  $V_{CE0}$ ,  $V_{CER}$ , and  $V_{CEX}$ .

FIGURE 3. Maximum safe operating graph (dc).

## 6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Notes. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Issue of DODISS to be cited in the solicitation and, if required, the specific issue of individual documents referenced (see 2.2.1).
- b. Lead finish (see 3.3.1).
- c. Type designation and product assurance level.
- d. Packaging requirements (see 5.1).

6.3 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

6.4 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 purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, DSCC-VQE, Columbus, OH 43216.

### Custodians:

Army - CR  
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### Preparing activity:

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### I RECOMMEND A CHANGE:

1. DOCUMENT NUMBER  
MIL-PRF-19500/370D

2. DOCUMENT DATE (YYYYMMDD)

### 3. DOCUMENT TITLE

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, HIGH POWER, TYPE 2N3442, JAN, JANTX AND JANTXV

### 4. NATURE OF CHANGE *(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)*

### 5. REASON FOR RECOMMENDATION

### 6. SUBMITTER

a. NAME *(Last, First Middle Initial)*

b. ORGANIZATION

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(1) Commercial  
(2) DSN  
*(If applicable)*

7. DATE SUBMITTED  
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