

The documentation and process conversion measures necessary to comply with this revision shall be completed by 31 November 2000.

INCH-POUND

MIL-PRF-19500/376E  
 31 August 2000  
 SUPERSEDING  
 MIL-PRF-19500/376D  
 21 August 1998

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, LOW-POWER  
 TYPES 2N2484, 2N2484UA, 2N2484UB, JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

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, low-power transistors. Four levels of product assurance is provided for each device type as specified in MIL-PRF-19500. Two levels of product assurance are provided for die.

1.2 Physical dimensions. See figure 1 (similar to T0-18), figures 2 and 3 (surface mount case outlines UA and UB), and figures 4 and 5 (die).

1.3 Maximum ratings.

| Types    | P <sub>T</sub>         | V <sub>CBO</sub> | V <sub>EBO</sub> | V <sub>CEO</sub> | I <sub>C</sub> | T <sub>J</sub> and T <sub>STG</sub> | R <sub>θJA</sub> | R <sub>θJC</sub> |
|----------|------------------------|------------------|------------------|------------------|----------------|-------------------------------------|------------------|------------------|
|          | T <sub>A</sub> = +25°C |                  |                  |                  |                |                                     |                  |                  |
|          | mW                     | V dc             | V dc             | V dc             | mA dc          | °C                                  | °C/W             | °C/W             |
| 2N2484   | 500 (1)                | 60               | 6                | 60               | 50             | -65 to +200                         | 325              | 146              |
| 2N2484UA | 650 (2)                | 60               | 6                | 60               | 50             | -65 to +200                         | 210              | 160              |
| 2N2484UB | 500 (1)                | 60               | 6                | 60               | 50             | -65 to +200                         | 325              | 146              |

- (1) Derate linearly at 3.08 mW/°C above T<sub>A</sub> = +37.5°C
- (2) Derate linearly at 4.76 mW/°C above T<sub>A</sub> = +63.5°C.

1.4 Primary electrical characteristics.

| Limits | h <sub>fe</sub>   | C <sub>obo</sub>  | h <sub>fe</sub>   <sup>2</sup>                                       | V <sub>CE(sat)</sub> (1)                                 |
|--------|---|---|--|--|
|        | V <sub>CE</sub> = 5 V dc<br>I <sub>C</sub> = 1 mA dc<br>f = 1 kHz | I <sub>E</sub> = 0<br>V <sub>CB</sub> = 5 V dc<br>100 kHz ≤ f ≤ 1 MHz | I <sub>C</sub> = 500 μA dc<br>V <sub>CE</sub> = 5 V dc<br>f = 30 MHz | I <sub>C</sub> = 1.0 mA dc<br>I <sub>B</sub> = 0.1 mA dc |
|        |   | pF  |  | V dc   |
| Min    | 250   |   | 2.0  |  |
| Max    | 900   | 5.0   | 7.0  | 0.3  |

- (1) Pulsed (see 4.5.1).

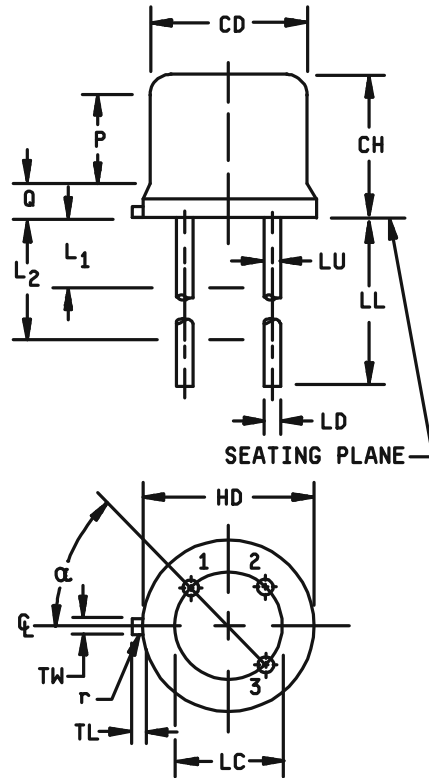
Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Defense Supply Center, Columbus, ATTN: DSCC/VAC, Post Office Box 3990, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal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

AMSC N/A

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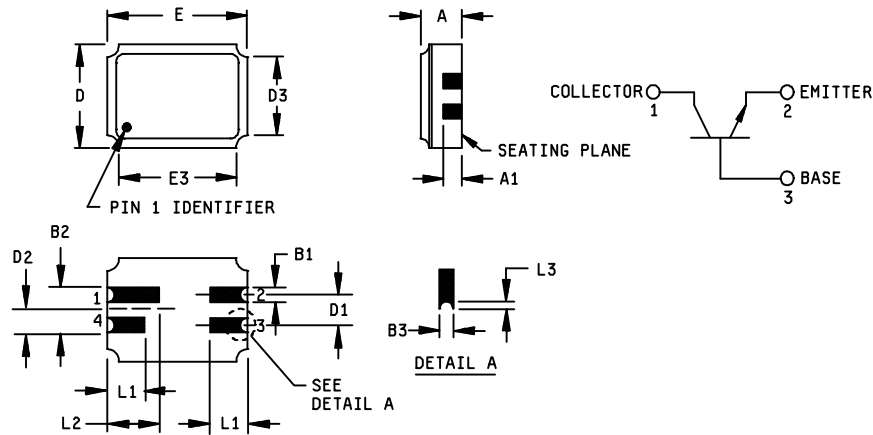
| Symbol   | Dimensions |      |             |       | Note |
|----------|------------|------|-------------|-------|------|
|          | Inches     |      | Millimeters |       |      |
|          | Min        | Max  | Min         | Max   |      |
| CD       | .178       | .195 | 4.52        | 4.95  |      |
| 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 | 12.7        | 19.05 | 7,8  |
| LU       | .016       | .019 | 0.41        | 0.48  | 7,8  |
| L1       | ---        | .050 | ---         | 1.27  | 7,8  |
| L2       | .250       | ---  | 6.35        | ---   | 7,8  |
| Q        | ---        | .040 | ---         | 0.86  | 5    |
| TL       | .028       | .048 | 0.71        | 1.22  | 3,4  |
| TW       | .036       | .046 | 0.91        | 1.17  | 3    |
| r        | ---        | .010 | ---         | 0.25  | 10   |
| $\alpha$ | 45° TP     |      | 45° TP      |       | 6    |



NOTES:

1. Dimension are in inches.
2. Metric equivalents 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 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 ANSI Y14.5M, diameters are equivalent to  $\phi$ x symbology.
12. Lead 1 = emitter, lead 2 = base, lead 3 = collector.

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

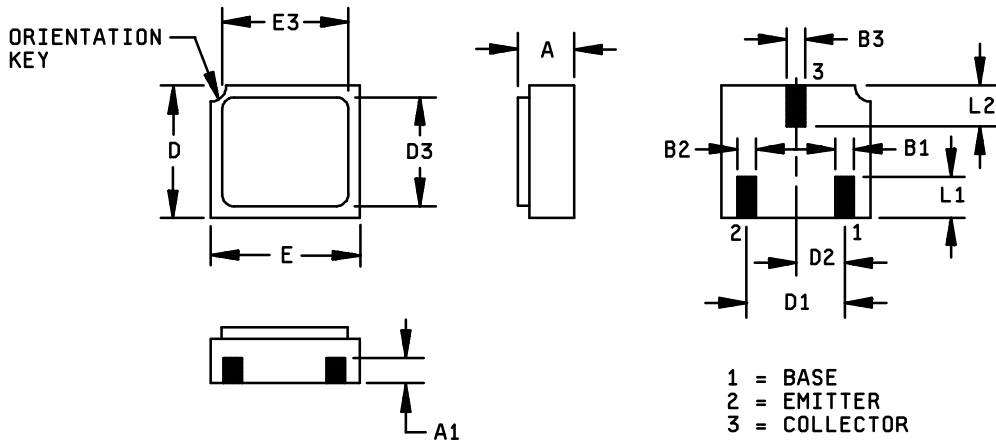


| Symbol | Dimensions |      |             |      | Note |
|--------|------------|------|-------------|------|------|
|        | Inches     |      | Millimeters |      |      |
|        | Min        | Max  | Min         | Max  |      |
| A      | .061       | .075 | 1.55        | 1.90 | 3    |
| A1     | .029       | .041 | 0.74        | 1.04 |      |
| B1     | .022       | .028 | 0.56        | 0.71 |      |
| B2     | .075 REF   |      | 1.91 REF    |      |      |
| B3     | .006       | .022 | 0.15        | 0.56 | 5    |
| D      | .145       | .155 | 3.68        | 3.93 |      |
| D1     | .045       | .055 | 1.14        | 1.39 |      |
| D2     | .0375 BSC  |      | .952 BSC    |      |      |
| D3     | ---        | .155 | ---         | 3.93 |      |
| E      | .215       | .225 | 5.46        | 5.71 |      |
| E3     | ---        | .225 | ---         | 5.71 |      |
| L1     | .032       | .048 | 0.81        | 1.22 |      |
| L2     | .072       | .088 | 1.83        | 2.23 |      |
| L3     | .003       | .007 | 0.08        | 0.18 | 5    |

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimension "A" controls the overall package thickness. When a window lid is used, dimension "A" 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, etc.) may vary at the manufacturer's option, from that shown on the drawing.
5. Dimensions "B3" minimum and "L3" minimum and the appropriately 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 "B3" 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. Lead 4 = no connection.

FIGURE 2. Physical dimensions, surface mount (2N2484UA).

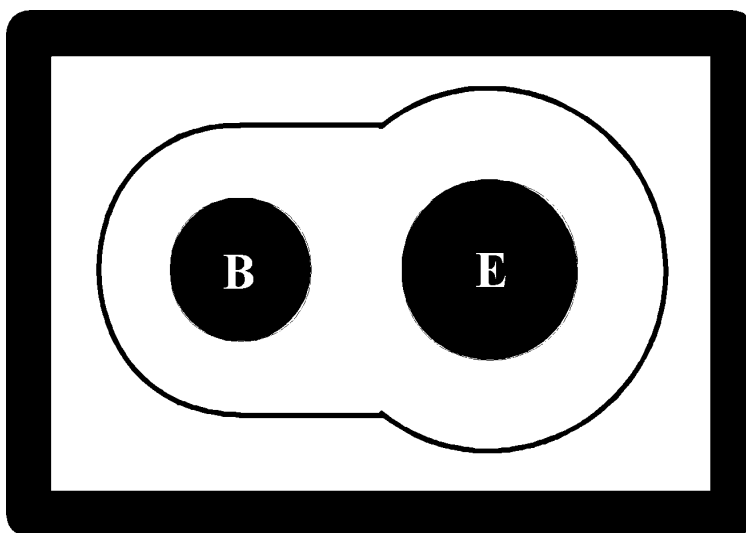


| Ltr | Dimensions |      |             |      | Notes |
|-----|------------|------|-------------|------|-------|
|     | Inches     |      | Millimeters |      |       |
|     | Min.       | Max. | Min.        | Max. |       |
| A   | .046       | .056 | 0.97        | 1.42 |       |
| A1  | .017       | .035 | 0.43        | 0.89 |       |
| B1  | .016       | .024 | 0.41        | 0.61 | 3     |
| D   | .085       | .108 | 2.41        | 2.74 |       |
| D1  | .071       | .079 | 1.81        | 2.01 |       |
| D2  | .035       | .039 | 0.89        | 0.99 |       |
| D3  |            |      |             |      |       |
| E   | .115       | .128 | 2.82        | 3.25 |       |
| E3  |            |      |             |      |       |
| L1  | .022       | .038 | 0.56        | 0.96 | 4     |

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Dimensions B2 and B3 are identical to B1
4. Dimension L2 is identical to L1.

FIGURE 3. Physical dimensions, surface mount (2N2484UB).

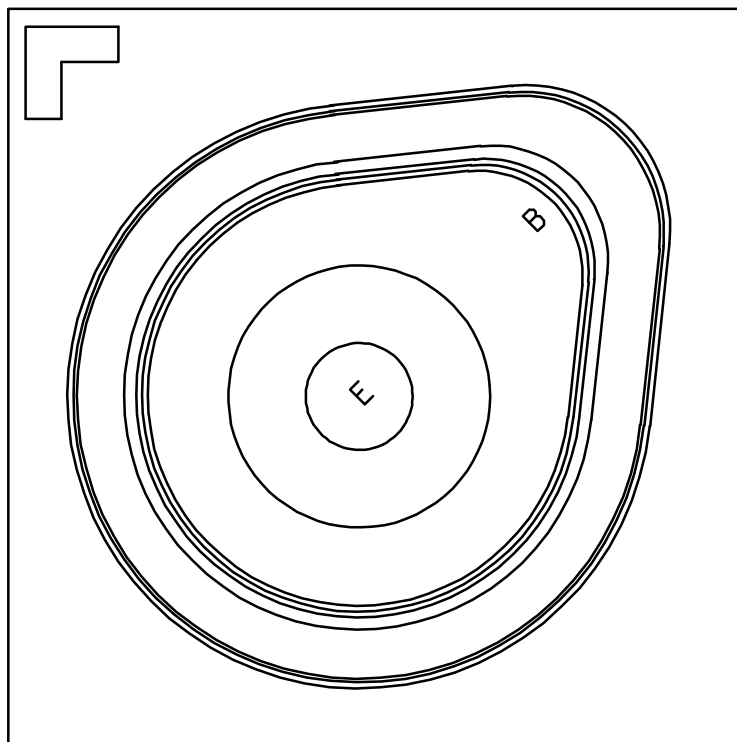


A- version

NOTES:

1. Die size.....0.015 x 0.019 inches  $\pm$  0.001 inch
2. Die thickness.....0.010  $\pm$  0.0015 inches
3. Top metal.....Aluminum 15,000Å minimum, 18,000Å nominal
4. Back metal.....A. Gold 2,500Å minimum, 3,000Å nominal  
B. Eutectic Mount – No Gold
5. Backside .....Collector
6. Bonding pad.....B = 0.003 inches, E = 0.004 inches diameter
7. Passivation .....Si<sub>3</sub>N<sub>4</sub> (Silicon Nitride) 2kÅ min, 2.2kÅ nom.

FIGURE 4. Physical dimensions, JANHC and JANKC die, A - version.



B - version

Die size: .....0.018 x 0.018 inches  
Die thickness: .....0.008 ± 0.0016 inches  
Base pad: .....0.0025 inches diameter  
Emitter pad: .....0.003 inches diameter  
Back metal:.....Gold, 6500 ± 1950 Å  
Top metal: .....Aluminum, 19500 ± 2500 Å  
Back side: .....Collector  
Glassivation: .....SiO<sub>2</sub>, 7500 ± 1500 Å

FIGURE 5. Physical dimensions, JANHC and JANKC die, B - version.

1.4 Primary electrical characteristics.

|     | NF<br>$I_C = 10 \mu\text{A dc}$ , $V_{CE} = 5 \text{ V dc}$<br>$R_g = 10 \text{ k}\Omega$ |                       |                      | $h_{FE2}$  | $h_{FE5}$  |
|-----|---|-----------------------|----------------------|--|--|
|     | $f = 100 \text{ Hz}$  | $f = 1000 \text{ Hz}$ | $f = 10 \text{ kHz}$ | $V_{CE} = 5 \text{ V dc}$<br>$I_C = 10 \mu\text{A dc}$ | $V_{CE} = 5 \text{ V dc}$<br>$I_C = 1 \text{ mA dc}$ |
|     | <u>dB</u>   | <u>dB</u>             | <u>dB</u>            |  |  |
| Min |   |                       |                      | 200  | 250  |
| Max | 7.5   | 3                     | 2                    | 500  | 800  |

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 Document Automation and Production Services (DAPS), Building 4D (DPM-DODSSP), 700 Robbins Avenue, 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, 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 requirements for acquiring the product described herein shall consist of this document and MIL-PRF-19500.

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 manufacturer's list (QML) 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.

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500 and figures 1, 2, 3, 4, and 5 herein.

3.4.1 Lead finish. Unless otherwise specified, lead finish shall be solderable in accordance with MIL-PRF-19500, and herein.

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500. At the option of the manufacturer, marking may be omitted from the body, but shall be retained on the initial container.

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 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).

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.



4.3 Screening (JANS, JANTX, and JANTXV levels only). 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  |   |
|--|--|---|
|  | JANS level   | JANTX and JANTXV levels   |
| 3c                                     | Thermal impedance (see 4.3.2)  | Thermal impedance (see 4.3.2)   |
| 9                                      | $I_{CBO2}$ , $h_{FE4}$   | Not applicable  |
| 10                                     | 48 hours minimum   | 48 hours minimum  |
| 11                                     | $I_{CBO2}$ ; $h_{FE4}$ ;<br>$\Delta I_{CBO2}$ = 100% of initial value or 2 nA dc, whichever is greater.<br>$\Delta h_{FE4}$ = $\pm 15\%$             | $I_{CBO2}$ , $h_{FE4}$  |
| 12                                     | See 4.3.1<br>240 hours minimum   | See 4.3.1<br>80 hours minimum   |
| 13                                     | Subgroups 2 and 3 of table I herein;<br>$\Delta I_{CBO2}$ = 100% of initial value or 2 nA dc, whichever is greater;<br>$\Delta h_{FE4}$ = $\pm 15\%$ | Subgroup 2 of table I herein;<br>$\Delta I_{CBO2}$ = 100% of initial value or 2 nA dc, whichever is greater;<br>$\Delta h_{FE4}$ = $\pm 25\%$ |

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows:  $V_{CB}$  = 10 to 30 V dc:

Power shall be applied to achieve  $T_J$  = 135°C minimum and a minimum power dissipation = 75 percent of maximum rated  $P_T$  (see 1.3).  $T_A$  = room ambient as defined in 4.5 of MIL-STD-750.

NOTE: No heat sink or forced air cooling on the devices shall be permitted.

4.3.2 Thermal impedance ( $Z_{\theta JX}$  measurements). The  $Z_{\theta JX}$  measurements shall be performed in accordance with method 3131 of MIL-STD-750.

- $I_M$  measurement current -----5 mA.
- $I_H$  forward heating current -----50 mA (min).
- $t_H$  heating time -----25 - 30 ms.
- $t_{md}$  measurement delay time -----60  $\mu$ s max.
- $V_{CE}$  collector-emitter voltage -----10 V dc minimum.

The maximum limit for  $Z_{\theta JX}$  under these test conditions are  $Z_{\theta JX}$  (max) = 150°C/W for 2N2484,  $Z_{\theta JX}$  (max) = 67°C/W for 2N2484UA and 2N2484UB.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein. If alternate screening is being performed in accordance with MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of group A1 and A2 inspection only (table 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 VIa (JANS) of MIL-PRF-19500 and 4.4.2.1. Electrical measurements (end-points) shall be in accordance with group A, subgroup 2 herein. Delta requirements shall be in accordance with table III herein. See 4.4.2.2 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 group A, subgroup 2 herein. Delta requirements shall be after each step and shall be in accordance with table III herein.

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

| <u>Subgroup</u> | <u>Method</u> | <u>Condition</u>   |
|-----------------|---------------|--|
| B4              | 1037          | $V_{CB} = 10 \text{ V dc}$   |
| B5              | 1027          | $V_{CB} = 10 \text{ V dc}$ ; $T_A = +125^\circ\text{C} \pm 25^\circ\text{C}$ for 96 hours with $P_T$ adjusted according to the chosen $T_A$ to give $T_J = +275^\circ\text{C}$ minimum. Optionally, the test may be conducted for minimum 216 hours with $P_T$ adjusted to achieve $T_J = 225^\circ\text{C}$ minimum, sample size (for option) $n = 45$ , $c = 0$ . In this case, the ambient temperature shall be adjusted such that a minimum 75 percent of maximum rated $P_T$ (see 1.3) is applied to the device under test. (Note: If a failure occurs, resubmission shall be at the test conditions of the original sample.) |

4.4.2.2 Group B inspection, (JAN, JANTX, and JANTXV). Separate samples may be used for each step. In the event of a group B failure, the manufacturer may pull a new sample at double size from either the failed assembly lot or from another assembly lot from the same wafer lot. If the new "assembly lot" option is exercised, the failed assembly lot shall be scrapped.

| <u>Step</u> | <u>Method</u> | <u>Condition</u>   |
|-------------|---------------|--|
| 1           | 1039          | Steady-state life: Test condition B, 340 hours, $V_{CB} = 10 - 30 \text{ V dc}$ , $T_J = 150^\circ\text{C min.}$ , external heating of the device under test to achieve $T_J = +150^\circ\text{C}$ minimum is allowed provided that a minimum of 75% of rated power is dissipated. No heat sink or forced-air cooling on the devices shall be permitted. $n = 45$ devices, $c = 0$ |
| 2           | 1039          | The steady state life test of step 1 shall be extended to 1,000 hours for each die design. Samples shall be selected from a wafer lot every twelve months of wafer production. Group B, step 2 shall not be required more than once for any single wafer lot. $n = 45$ , $c = 0$ .   |
| 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. Must be chosen from an inspection lot that has been submitted to and passed group A, 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 VII of MIL-PRF-19500, and in 4.4.3.1 (JANS) and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Electrical measurements (end-points) shall be in accordance with group A, subgroup 2 herein. Delta requirements shall be in accordance with table III herein.

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

| <u>Subgroup</u> | <u>Method</u> | <u>Condition</u> |
|-----------------|---------------|------------------|
|-----------------|---------------|------------------|

|    |      |   |
|----|------|---|
| C2 | 2036 | Test condition E (not applicable to UA and UB suffix devices).  |
| C6 | 1026 | 1,000 hours at $V_{CB} = 10 - 30$ V dc; power shall be applied to achieve $T_J = 150^\circ\text{C}$ minimum and a minimum power dissipation $P_D = 75$ percent of maximum rated $P_T$ as defined in 1.3 herein. |

4.4.3.2 Group C inspection, table 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 to UA and UB suffix devices). |
| C6 |      | Not applicable.  |

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

4.4.4 Group E inspection. Group E inspection shall be performed for qualification or re-qualification only. The tests specified in table II herein must be performed to maintain qualification.

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.

## MIL-PRF-19500/376E

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 examination <u>3/</u>                     | 2071        | n = 45 devices, c = 0   |                      |       |     |       |
| 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   |                      |       |     |       |
| Temperature cycling <u>3/ 4/</u>                                | 1051        | Test condition C, 25 cycles.<br>n = 22 devices, c = 0   |                      |       |     |       |
| Hermetic seal <u>4/</u><br>Fine leak<br>Gross leak              | 1071        | n = 22 devices, c = 0   |                      |       |     |       |
| Electrical measurements <u>4/</u><br>Bond strength <u>3/ 4/</u> | 2037        | Group A, subgroup 2<br>Precondition T <sub>A</sub> = +250°C at<br>t = 24 hrs or T <sub>A</sub> = 300°C at<br>t = 2 hrs; n = 11 wires, c = 0 |                      |       |     |       |
| <u>Subgroup 2</u>   |             |   |                      |       |     |       |
| Collector to emitter breakdown voltage                          | 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 base cutoff current                                | 3036        | Bias condition D; V <sub>CB</sub> = 60 V dc   | I <sub>CB01</sub>    |       | 10  | μA dc |
| Emitter to base cutoff current                                  | 3061        | Bias condition D; V <sub>EB</sub> = 6 V dc  | I <sub>EB01</sub>    |       | 10  | μA dc |
| Collector to base cutoff current                                | 3036        | Bias condition D; V <sub>CB</sub> = 45 V dc   | I <sub>CB02</sub>    |       | 5   | nA dc |
| Collector to emitter cutoff current                             | 3041        | Bias condition D; V <sub>CE</sub> = 5 V dc  | I <sub>CE0</sub>     |       | 2   | nA dc |
| Emitter to base cutoff current                                  | 3061        | Bias condition D; V <sub>EB</sub> = 5 V dc  | I <sub>EB02</sub>    |       | 2   | nA dc |
| Collector to emitter cutoff current                             | 3041        | Bias condition C; V <sub>CE</sub> = 45 V dc   | I <sub>CES</sub>     |       | 5   | nA dc |
| Forward-current transfer ratio                                  | 3076        | V <sub>CE</sub> = 5 V dc; I <sub>C</sub> = 1 μA dc  | h <sub>FE1</sub>     | 45    |     |       |

See footnote 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   | 3076        | $V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}$                           | $h_{FE2}$     | 200   | 500                  |                  |
| Forward-current transfer ratio   | 3076        | $V_{CE} = 5 \text{ V dc}; I_C = 100 \mu\text{A dc}$                          | $h_{FE3}$     | 225   | 675                  |                  |
| Forward-current transfer ratio   | 3076        | $V_{CE} = 5 \text{ V dc}; I_C = 500 \mu\text{A dc}$                          | $h_{FE4}$     | 250   | 800                  |                  |
| Forward-current transfer ratio   | 3076        | $V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc}$                             | $h_{FE5}$     | 250   | 800                  |                  |
| Forward-current transfer ratio   | 3076        | $V_{CE} = 5 \text{ V dc}; I_C = 10 \text{ mA dc}$<br>pulsed (see 4.5.1)      | $h_{FE6}$     | 225   | 800                  |                  |
| Collector to emitter voltage<br>(saturated)  | 3071        | $I_C = 1.0 \text{ mA dc}; I_B = 100 \mu\text{A dc}$                          | $V_{CE(sat)}$ |       | 0.3                  | V dc             |
| Base emitter voltage<br>(nonsaturated)   | 3066        | Test condition B; $V_{CE} = 5 \text{ V dc};$<br>$I_C = 100 \mu\text{A dc}$   | $V_{BE(ON)}$  | 0.5   | 0.7                  | V dc             |
| <u>Subgroup 3</u>  |             |  |               |       |                      |                  |
| High-temperature operation   |             | $T_A = +150^\circ\text{C}$   |               |       |                      |                  |
| Collector to base cutoff current   | 3036        | Bias condition D; $V_{CB} = 45 \text{ V dc}$                                 | $I_{CB03}$    |       | 10                   | $\mu\text{A dc}$ |
| Low-temperature operation  |             | $T_A = -55^\circ\text{C}$  |               |       |                      |                  |
| Forward-current transfer ratio   | 3076        | $V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}$                           | $h_{FE7}$     | 35    |                      |                  |
| <u>Subgroup 4</u>  |             |  |               |       |                      |                  |
| Magnitude of common emitter<br>small-signal short-circuit<br>forward-current transfer ratio  | 3306        | $V_{CE} = 5 \text{ V dc}; I_C = 50 \mu\text{A dc};$<br>$f = 5 \text{ MHz}$   | $ h_{fe} 1$   | 3.0   |                      |                  |
| Magnitude of common emitter<br>small-signal short-circuit<br>forward- current transfer ratio | 3306        | $V_{CE} = 5 \text{ V dc}; I_C = 500 \mu\text{A dc};$<br>$f = 30 \text{ MHz}$ | $ h_{fe} 2$   | 2.0   | 7.0                  |                  |
| Small-signal open-circuit<br>output admittance   | 3216        | $V_{CE} = 5 \text{ V dc}; I_C = 1.0 \text{ mA dc};$<br>$f = 1 \text{ kHz}$   | $h_{oe}$      |       | 40                   | $\mu\text{hos}$  |
| Small-signal open- circuit<br>reverse-voltage transfer ratio                                 | 3211        | $V_{CE} = 5 \text{ V dc}; I_C = 1.0 \text{ mA dc};$<br>$f = 1 \text{ kHz}$   | $h_{re}$      |       | $8.0 \times 10^{-4}$ |                  |
| Small-signal short- circuit input<br>impedance   | 3201        | $V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc};$<br>$f = 1 \text{ kHz}$     | $h_{ie}$      | 3.5   | 24                   | $\text{k}\Omega$ |

See footnote at end of table.

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TABLE I. Group A inspection - Continued.

| Inspection <u>1/</u>                                       | MIL-STD-750 |  | Symbol    | Limit |     | Unit |
|--|-------------|--|-----------|-------|-----|------|
|  | Method      | Conditions   |           | Min   | Max |      |
| <u>Subgroup 4 - continued.</u>                             |             |  |           |       |     |      |
| Small-signal short- circuit forward current transfer ratio | 3206        | $V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ mA dc}; f = 1 \text{ kHz}$  | $h_{fe}$  | 250   | 900 |      |
| Open circuit output capacitance                            | 3236        | $V_{CB} = 5 \text{ V dc}; I_E = 0; 100 \text{ kHz} \leq f \leq 1 \text{ MHz}$                                      | $C_{obo}$ |       | 5.0 | pF   |
| Input capacitance (output open-circuited)                  | 3240        | $V_{EB} = 0.5 \text{ V dc}; I_C = 0; 100 \text{ kHz} \leq f \leq 1 \text{ MHz}$                                    | $C_{ibo}$ |       | 6.0 | pF   |
| Noise figure   | 3246        | $f = 100 \text{ Hz}; V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}; R_g = 10 \text{ k}\Omega;$                  | NF1       |       | 7.5 | dB   |
| Noise figure   | 3246        | $f = 1 \text{ kHz}; V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}; R_g = 10 \text{ k}\Omega;$                   | NF2       |       | 3   | dB   |
| Noise figure   | 3246        | $f = 10 \text{ kHz}; V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}; R_g = 10 \text{ k}\Omega;$                  | NF3       |       | 2   | dB   |
| Noise figure (wideband)                                    | 3246        | Noise bandwidth = 10 Hz to 15.7 kHz; $V_{CE} = 5 \text{ V dc}; I_C = 10 \mu\text{A dc}; R_g = 10 \text{ k}\Omega;$ | NF4       |       | 3   | dB   |
| <u>Subgroups 5 and 6</u>                                   |             |  |           |       |     |      |
| Not applicable   |             |  |           |       |     |      |
| <u>Subgroup 7 4/</u>                                       |             |  |           |       |     |      |
| Decap internal visual (design verification)                | 2075        | $n = 1 \text{ device}, c = 0$  |           |       |     |      |

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

2/ For resubmission of failed subgroup A1, double the sample size of the failed test or sequence of tests. A failure in group A, 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.

TABLE II. Group E inspection (all quality levels) - For qualification only.

| Inspection                          | MIL-STD-750 |  | Qualification       |
|-------------------------------------|-------------|--|---------------------|
|                                     | Method      | Conditions   |                     |
| <u>Subgroup 1</u>                   |             |  | 12 devices<br>c = 0 |
| Temperature cycling<br>(air to air) | 1051        | Test condition C, 500 cycles   |                     |
| Hermetic seal                       | 1071        |  |                     |
| Fine leak                           |             |  |                     |
| Gross leak                          |             |  |                     |
| Electrical measurements             |             | See group A, subgroup 2 and table III herein.                              |                     |
| <u>Subgroup 2</u>                   |             |  | 45 devices<br>c = 0 |
| Intermittent life                   | 1037        | Intermittent operation life: $V_{CB} = 10 \text{ V dc}$ ,<br>6,000 cycles. |                     |
| Electrical measurements             |             | See group A, subgroup 2 and table III herein.                              |                     |
| <u>Subgroup 3</u>                   |             |  |                     |
| Not applicable                      |             |  |                     |
| <u>Subgroup 4</u>                   |             |  |                     |
| Not applicable                      |             |  |                     |
| <u>Subgroup 5</u>                   |             |  |                     |
| Not applicable                      |             |  |                     |

TABLE III. Groups B and C delta measurements. 1/ 2/ 3/

| Step | Inspection                               | MIL-STD-750 |   | Symbol                               | Limit  | Unit |
|------|--|-------------|---|--------------------------------------|--|------|
|      |  | Method      | Conditions  |                                      |  |      |
| 1    | Forward-current transfer ratio           | 3076        | $V_{CE} = 5 \text{ V dc}; I_C = 500 \mu\text{A dc};$ pulsed see 4.5.1 | $\Delta h_{FE4}$<br><u>4/</u>        | $\pm 25$ percent change from initial recorded reading          |      |
| 2.   | Collector to emitter voltage (saturated) | 3071        | $I_C = 1.0 \text{ mA dc}; I_B = 100 \mu\text{A dc}$                   | $\Delta V_{CE(sat)}$<br><u>4/ 5/</u> | $\pm 50$ mV dc change from previously measured value.          |      |
| 3.   | Collector to emitter cutoff current      | 3041        | Bias condition C;<br>$V_{CB} = 45 \text{ V dc}$                       | $\Delta I_{CES}$<br><u>4/</u>        | 100 percent of initial value or 2 nA dc, whichever is greater. |      |

1/ The delta measurements for group B, table VIa (JANS) of MIL-PRF-19500 are as follows:

- a. Subgroup 4, see table III herein, step 2.
- b. Subgroup 5, see table III herein, steps 1 and 3.

2/ The delta measurements for 4.4.2.2 herein (group B, JAN, JANTX, and JANTXV) are as follows: Steps 2 and 3 of table III shall be performed after each step in 4.4.2.2 herein.

3/ The delta measurements for group C, table VII of MIL-PRF-19500 are as follows: Subgroup 6, see table III herein, steps 1 and 3 for JANS, step 1 for JAN, JANTX, and JANTXV.

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

5/ Applies to JANS level only.



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 materiel 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 Departments' 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.)

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

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1).
- c. Lead formation and finish may be specified (see 3.4.1).
- d. Type designation and product assurance level.
- e. Packaging requirements (see 5.1).

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 Defense Supply Center, Columbus, ATTN: DSCC-VQE, P.O. Box 3990, Columbus, OH 43216-5000.

6.4 Suppliers of JANHC die. The qualified JANHC suppliers with the applicable letter version (example JANHCA1N645-1) will be identified on the QML.

| JANC ordering information |                              |                              |
|---------------------------|------------------------------|------------------------------|
| PIN                       | Manufacturer                 |                              |
|                           | 43611                        | 34156                        |
| 2N2484                    | JANHCA2N2484<br>JANKCA2N2484 | JANHCB2N2484<br>JANKCB2N2484 |

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

Custodians:

Army - CR  
Navy - EC  
Air Force - 11  
NASA - NA  
DLA - CC

Preparing activity:  
DLA - CC

(Project 5961-2309)

Review activities:

Army - AR, MI, SM  
Navy - AS, CG, MC, SH  
Air Force - 13, 19

## STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.
2. The submitter of this form must complete blocks 4, 5, 6, and 7.
3. The preparing activity must provide a reply within 30 days from receipt of the form.

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

|                              |  |                                    |
|------------------------------|--|------------------------------------|
| <b>I RECOMMEND A CHANGE:</b> | 1. DOCUMENT NUMBER<br>MIL-PRF-19500/376E | 2. DOCUMENT DATE<br>31 August 2000 |
|------------------------------|--|------------------------------------|

3. **DOCUMENT TITLE**  
SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, LOW-POWER TYPES 2N2484, 2N2484UA, 2N2484UB, JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

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   |                   |
| c. ADDRESS (Include Zip Code)         | d. TELEPHONE (Include Area Code)<br>COMMERCIAL<br>DSN<br>FAX<br>EMAIL | 7. DATE SUBMITTED |

8. PREPARING ACTIVITY

|   |   |  |  |
|---|---|--|--|
| a. Point of Contact<br>Alan Barone  | b. TELEPHONE<br>Commercial      DSN      FAX      EMAIL<br>614-692-0510    850-0510    614-692-6939 <a href="mailto:alan_barone@dsccl.dla.mil">alan_barone@dsccl.dla.mil</a>  |  |  |
| c. ADDRESS<br>Defense Supply Center, Columbus<br>ATTN: DSCC-VAC<br>P.O. Box 3990<br>Columbus, OH 43216-5000 | IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:<br>Defense Standardization Program Office (DLSC-LM)<br>8725 John J. Kingman, Suite 2533<br>Fort Belvoir, VA 22060-6221<br>Telephone (703) 767-6888    DSN 427-6888 |  |  |