

The documentation process conversion measures necessary to comply with this revision shall be completed by 3 April 2001

INCH-POUND

MIL-PRF-19500/561D  
3 January 2001  
SUPERSEDING  
MIL-PRF-19500/561C  
28 July 1999

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, SWITCHING  
TYPE 2N6193 AND 2N6193U3 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 PNP silicon switching transistors. Four levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500 and two levels of product assurance are provided for each unencapsulated device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (TO-39), figures 2, 3 and 4 for JANHC and JANKC (die) and figure 5 for U3 device dimensions.

1.3 Maximum ratings.

| Types    | $P_T$ (1)<br>$T_A = +25^\circ\text{C}$ | $P_T$ (2)<br>$T_C = +25^\circ\text{C}$ | $V_{CBO}$   | $V_{CEO}$   | $V_{EBO}$   | $I_C$       | $I_B$       | $T_{OP}$ and $T_{STG}$ |
|----------|--|--|-------------|-------------|-------------|-------------|-------------|------------------------|
|          | <u>W</u>                               | <u>W</u>                               | <u>V dc</u> | <u>V dc</u> | <u>V dc</u> | <u>A dc</u> | <u>A dc</u> | <u>°C</u>              |
| 2N6193   | 1.0                                    |  | 100         | 100         | 6.0         | 5.0         | 1.0         | -65 to +200            |
| 2N6193U3 | 1.0                                    | 100                                    | 100         | 100         | 6.0         | 5.0         | 1.0         | -65 to +200            |

(1) Derate linearly at 5.71 mW/°C above  $T_A > +25^\circ\text{C}$ .

(2) Derate linearly from 80 mW/°C to 571 mW/°C.

1.4 Primary electrical characteristics  $T_A = +25^\circ\text{C}$ . (Unless otherwise indicated, applies to all devices.)

| Types    | $h_{FE1}$ (1)<br>$V_{CE} = 2.0 \text{ V dc};$<br>$I_C = 0.5 \text{ A dc}$ |            | $h_{FE2}$ (1)<br>$V_{CE} = 2.0 \text{ V dc};$<br>$I_C = 2.0 \text{ A dc}$ |            | $h_{FE3}$ (1)<br>$V_{CE} = 2.0 \text{ V dc};$<br>$I_C = 5.0 \text{ A dc}$ |            | $R_{\theta JC}$ |            |
|----------|---|------------|---|------------|---|------------|-----------------|------------|
|          | <u>Min</u>  | <u>Max</u> | <u>Min</u>  | <u>Max</u> | <u>Min</u>  | <u>Max</u> | <u>Min</u>      | <u>Max</u> |
| 2N6193   | 60  |            | 60  | 240        | 40  |            |                 | 17.5       |
| 2N6193U3 | 60  |            | 60  | 240        | 40  |            |                 | 12.5       |

(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: Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. 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.

1.4 Primary electrical characteristics  $T_A = +25^\circ\text{C}$ . (Unless otherwise indicated, applies to all devices.) - Continued.

| Limits | $ h_{FE} $<br>f = 10 MHz<br>$V_{CE} = 10\text{ V dc}$<br>$I_C = 0.5\text{ A dc}$ | $C_{obo}$<br>$V_{CB} = 10\text{ V dc}$<br>$I_E = 0$<br>$100\text{ kHz} \leq f \leq 1\text{ MHz}$ | Switching                |                           | $V_{CE(SAT)1}$<br>$I_C = 2.0\text{ A dc}$<br>$I_B = 0.2\text{ A dc}$<br>(1) | $V_{BE(SAT)1}$<br>$I_C = 2.0\text{ A dc}$<br>$I_B = 0.2\text{ A dc}$<br>(1) |
|--------|--|--|--------------------------|---------------------------|---|---|
|        |  |  | See figure 4<br>$t_{on}$ | See figure 5<br>$t_{off}$ |   |   |
|        |  | $\mu\text{F}$  | $\mu\text{s}$            | $\mu\text{s}$             | $\text{V dc}$   | $\text{V dc}$   |
| Min    | 3.0  |  |                          |                           |   |   |
| Max    | 15   | 300  | 0.2                      | 2.2                       | 0.7   | 1.2   |

(1) Pulsed (see 4.5.1).

## 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.

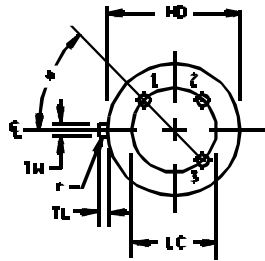
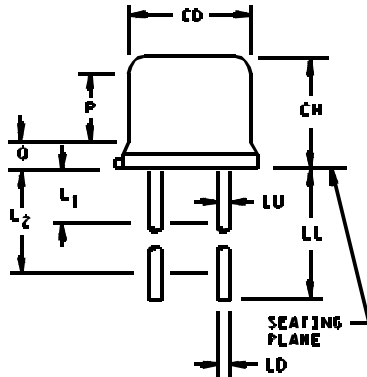
#### STANDARD

##### 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.



| Ltr      | Dimensions |       |             |       | Notes |
|----------|------------|-------|-------------|-------|-------|
|          | Inches     |       | Millimeters |       |       |
|          | Min        | Max   | Min         | Max   |       |
| CD       | 0.305      | 0.355 | 7.75        | 9.02  |       |
| CH       | 0.240      | 0.260 | 6.10        | 6.60  |       |
| HD       | 0.355      | 0.370 | 9.02        | 9.40  |       |
| LC       | 0.200 TP   |       | .200 TP     |       | 6     |
| LD       | 0.016      | 0.021 | 0.41        | 0.53  | 7     |
| LL       | 0.500      | 0.750 | 12.70       | 19.05 | 7     |
| LU       | 0.016      | 0.019 | 0.41        | 0.48  | 7     |
| L1       | ---        | 0.050 | ---         | 1.27  | 7     |
| L2       | 0.250      | ---   | 6.35        | ---   | 7     |
| TL       | 0.029      | 0.045 | 0.74        | 1.14  | 3     |
| TW       | 0.028      | 0.034 | 0.71        | 0.86  | 10    |
| P        | 0.100      | ---   | 2.54        | ---   | 5     |
| Q        | ---        | 0.040 | ---         | 1.02  | 4     |
| R        | ---        | 0.010 | ---         | 0.25  | 11    |
| $\alpha$ | 45° TP     |       | 45° TP      |       | 6     |
| Notes    | 1, 2, 8, 9 |       |             |       |       |

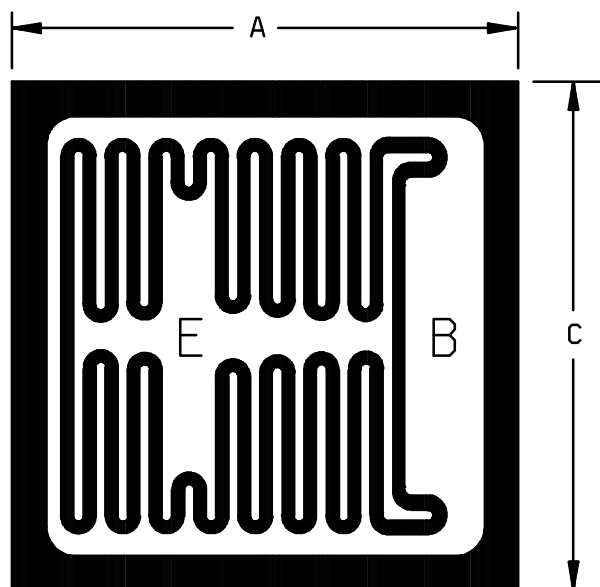
NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Symbol TL is measured from HD maximum.
4. Details of outline in this zone are optional.
5. Symbol CD shall not vary more than 0.010 (0.25 mm) in zone P. This zone is controlled for automatic handling.
6. Leads at gauge plane 0.054 inch (1.37 mm) +0.001 inch (0.03 mm) -0.000 inch (0.00 mm) below seating plane shall be within 0.007 inch (0.18 mm) radius of true position (TP) relative to tab. Device may be measured by direct methods or by gauge.
7. Symbol LD applies between L<sub>1</sub> and L<sub>2</sub>. Dimension LD applies between L<sub>2</sub> and LL minimum
8. Lead designation, depending on device type, shall be as follows:

| Lead number | TO-39     |
|-------------|-----------|
| 1           | Emitter   |
| 2           | Base      |
| 3           | Collector |

9. Lead number three is electrically connected to case.
10. Beyond r maximum, TW shall be held for a minimum length of 0.011 inch (0.28 mm).
11. Symbol r applied to both inside corners of tab.

FIGURE 1. Physical dimensions (TO-39).

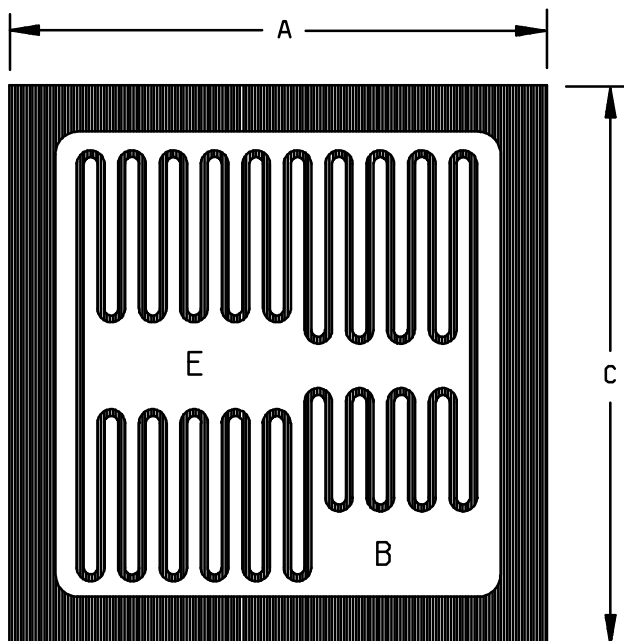


| Letter | Dimensions |       |             |      |
|--------|------------|-------|-------------|------|
|        | Inches     |       | Millimeters |      |
|        | Min        | Max   | Min         | Max  |
| A      | 0.120      | 0.124 | 3.05        | 3.15 |
| C      | 0.120      | 0.124 | 3.05        | 3.15 |

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The physical characteristics of the die are:  
 Thickness: 0.008 inch (0.20 mm) to 0.012 inch (0.30 mm).  
 Top metal: Aluminum 40,000 Å minimum, 50,000 Å nominal.  
 Back metal: Gold 2,500 Å minimum, 3,000 Å nominal.  
 Back side: Collector.  
 Bonding pad: B = 0.015 inch (0.38 mm) x 0.072 inch (1.83 mm).  
 E = 0.015 inch (0.38 mm) x 0.060 inch (1.52 mm).
4. Unless otherwise specified, tolerance is  $\pm 0.005$  inch (0.13 mm).

FIGURE 2. Physical dimensions JANHCA and JANKCA.

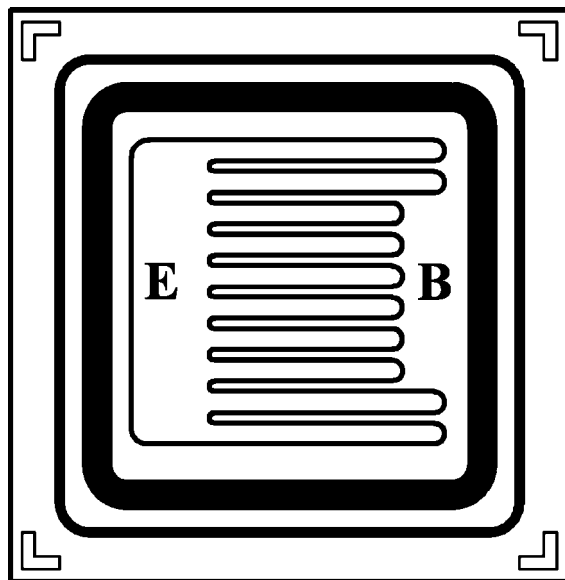


| Letter | Dimensions |       |             |      |
|--------|------------|-------|-------------|------|
|        | Inches     |       | Millimeters |      |
|        | Min        | Max   | Min         | Max  |
| A      | 0.098      | 0.102 | 2.49        | 2.59 |
| C      | 0.098      | 0.102 | 2.49        | 2.59 |

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The physical characteristics of the die are:  
 Thickness: 0.006 inch (0.15 mm) to 0.010 inch (0.25 mm).  
 Top metal: Aluminum 25,000 Å minimum, 33,000 Å nominal.  
 Back metal: Gold 1,500 Å minimum, 2,500 Å nominal.  
 Back side: Collector.  
 Bonding pad: B = 0.014 inch (0.36 mm) x 0.030 inch (0.76 mm).
4. Unless otherwise specified, tolerance is  $\pm 0.005$  inch (0.13 mm).

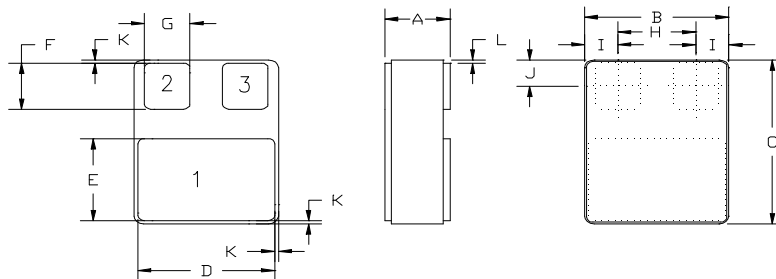
FIGURE 3. Physical dimensions JANHCB and JANKCB.



NOTES:

- |  |   |
|--|---|
| <p>1. Chip size</p> <p>2. Chip thickness</p> <p>3. Top metal</p> <p>4. Back metal</p> <p>nom.</p> <p>5. Backside</p> <p>6. Bonding pad</p> | <p>128 x 128 mils <math>\pm</math> 2 mils.</p> <p>10 <math>\pm</math> 1.5 mils nominal.</p> <p>Aluminum 30,000Å minimum, 33,000Å nominal.</p> <p>A. Al/Ti/Ni/Ag 15kÅ/2kÅ/7kÅ/7kÅ min. 18kÅ/3kÅ/10kÅ/10kÅ</p> <p>B. Gold 2,500Å minimum, 3,000Å nominal.</p> <p>Collector</p> <p>B = 52 x 12 mils, E = 84 x 12 mils.</p> |
|--|---|

FIGURE 4. Physical dimensions JANHCC and JANKCC.



BOTTOM VIEW

| Symbol | Dimensions    |       |             |       |
|--------|---------------|-------|-------------|-------|
|        | Inches        |       | Millimeters |       |
|        | Min           | Max   | Min         | Max   |
| A      | 0.111         | 0.122 | 2.82        | 3.10  |
| B      | 0.291         | 0.301 | 7.39        | 7.65  |
| C      | 0.395         | 0.405 | 10.03       | 10.29 |
| D      | 0.281         | 0.291 | 7.14        | 7.39  |
| E      | 0.220         | 0.230 | 5.59        | 5.84  |
| F      | 0.115         | 0.125 | 2.92        | 3.18  |
| G      | 0.09          | 0.100 | 2.29        | 2.54  |
| H      | 0.145         | 0.155 | 3.68        | 3.94  |
| I      | 0.073<br>TYP. | -     | 1.85 TYP.   | -     |
| J      | 0.083<br>TYP. | -     | 2.11 TYP.   | -     |
| K      | 0.005<br>TYP. | -     | 0.13 TYP.   |       |
| L      | 0.015<br>TYP. | -     | 0.38 TYP.   | -     |

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.

SCHEMATIC

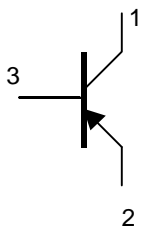


FIGURE 5. Physical dimensions and configuration 2N6193U3.

### 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 on figure 1 (TO-39), figures 2 and 3 (JANH and JANKC) and figure 4 for U3 devices herein.

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).

3.5 Marking. Devices shall be marked 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, the electrical performance characteristics are as specified in 1.3, 1.4, and table I herein.

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.



4.3 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 MIL-PRF-19500) | Measurements   |  |
|----------------------------|--|--|
|                            | JANS level   | JANTX and JANTXV levels  |
| 9                          | $I_{CBO1}$ and $h_{FE2}$   | Not applicable   |
| 11                         | $I_{CBO1}$ ; $h_{FE2}$ ,<br>$\Delta I_{CBO1} = \pm 100$ percent of initial value or $1.0 \mu A$ dc whichever is greater;<br>$\Delta h_{FE2} = \pm 15$ percent              | $I_{CBO1}$ and $h_{FE2}$   |
| 12                         | See 4.3.1  | See 4.3.1  |
| 13                         | Subgroups 2 and 3 of table I herein;<br>$\Delta I_{CBO1} = \pm 100$ percent of initial value or $1.0 \mu A$ dc, whichever is greater;<br>$\Delta h_{FE2} = \pm 15$ percent | Subgroup 2 of table I herein;<br>$\Delta I_{CBO1} = \pm 100$ percent of initial value or $1.0 \mu A$ dc, whichever is greater;<br>$\Delta h_{FE2} = \pm 15$ percent. |

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows:  $T_A$  = Room ambient as defined in the general requirements of 4.5 of MIL-STD-750, power shall be applied to the device to achieve  $T_J$  = minimum  $175^\circ C$  and minimum power dissipation of  $P_D = 75$  percent  $P_T$  max as defined in 1.3.

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

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 table V of MIL-PRF-19500 and table I herein. Electrical measurements (end-points) shall be in accordance with group A, subgroup 2 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 of MIL-PRF-19500 (JANS) and 4.4.2.1 herein. Electrical measurements (end-points) requirements shall be in accordance with group A, subgroup 2 herein. See table VIb of MIL-PRF-19500 and 4.4.2.2 herein for JAN, JANTX, and JANTXV group B testing. Electrical measurements (end-points) requirements shall be in accordance with group A, subgroup 2 herein.

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

| <u>Subgroup</u> | <u>Method</u> | <u>Conditions</u>   |
|-----------------|---------------|---|
| B4              | 1037          | $V_{CB} \geq 10$ V dc.  |
| B5              | 1027          | $V_{CB} = 10 - 30$ 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 this test may be performed for 216 hours minimum with $P_T$ adjusted to achieve $T_J = +225^\circ\text{C}$ minimum, $n = 45$ devices, $c = 0$ . In this case the ambient temperature shall be adjusted such that a minimum of 75 percent of maximum rated $P_T$ (see 1.3) is applied to the DUT. (NOTE: If a failure occurs, resubmission shall be at the test conditions of the original sample.) |
| B5              | 2037          | Test condition A.   |

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           | 1027          | Steady-state life: Test condition B, 340 hours, $V_{CB} = 10 - 30$ V dc, power shall be applied to the device to achieve $T_J = +175^\circ\text{C}$ minimum, and minimum power dissipation of 75 percent of max rated $P_T$ (see 1.3 herein); $n = 45$ , $C = 0$ .                |
| 2           | 1027          | 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), $T_A = +200^\circ\text{C}$ , $t = 340$ hours, $n = 22$ , $C = 0$ .  |

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 group A, subgroup 2 herein.

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

| <u>Subgroup</u> | <u>Method</u> | <u>Condition</u>  |
|-----------------|---------------|---|
| C2              | 2036          | Test condition E.   |
| C6              | 1037          | For solder die attach: $V_{CB} \geq 10$ V dc, $T_A =$ Room ambient as defined in the general requirements of MIL-STD-750. 6,000 cycles. |
| C6              | 1027          | For eutectic die attach: Adjust $P_T$ to achieve $T_J = +175^\circ\text{C}$ minimum. $V_{CB} \geq 10$ V dc.                             |

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

4.4.4.1 Group E inspection, table IX of MIL-PRF-19500.

| <u>Subgroup</u> | <u>Method</u> | <u>Condition</u>  | <u>Sampling plan</u> |
|-----------------|---------------|---|----------------------|
| E1              | 1051          | 500 cycles<br>Electrical measurements<br>See table I, subgroup 2.             | 22 devices, c = 0    |
| E2              | 1039          | Condition A, 340 hours<br>Electrical measurements<br>See table I, subgroup 2. | 22 devices, c = 0    |
| E3              |               | Not applicable  |                      |
| E4              | 3131          | See 4.5.3   | 22 devices, c = 0    |

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

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

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

4.5.3 Thermal resistance (to be performed for qualification inspection only). The thermal resistance measurements shall be conducted in accordance with method 3131 of MIL-STD-750. The following details shall apply:

- a. Collector current magnitude during power application shall be 0.15 A dc.
- b. Collector to emitter voltage magnitude shall be 20 V dc.
- c. Reference temperature measuring point shall be the case.
- d. Reference point temperature shall be  $+ 25^{\circ}\text{C} \leq T_R \leq +35^{\circ}\text{C}$  and recorded before the test is started.
- e. Mounting arrangement shall be with heat sink to case.
- f. Maximum limit shall be  $R_{\theta JC} = 17.5^{\circ}\text{C/W}$  for TO-39 devices and  $1.7.5^{\circ}\text{C/W}$  for U3 devices.

## MIL-PRF-19500/561D

TABLE I. Group A inspection.

| Inspection <u>1/</u>                     | MIL-STD-750 |  | Symbol         | Limit |     | Unit             |
|--|-------------|--|----------------|-------|-----|------------------|
|  | Method      | Conditions   |                | Min   | Max |                  |
| <u>Subgroup 1</u>                        |             |  |                |       |     |                  |
| Visual and mechanical inspection         | 2071        |  |                |       |     |                  |
| <u>Subgroup 2</u>                        |             |  |                |       |     |                  |
| Breakdown voltage, collector to emitter  | 3011        | Bias condition D; $I_C = 50 \text{ mA dc}$ ; pulsed (see 4.5.1)                              | $V_{(BR)CEO}$  | 100   |     | V dc             |
| Collector to emitter cutoff current      | 3041        | Bias condition D; $V_{CE} = 100 \text{ V dc}$ ;  | $I_{CEO}$      |       | 100 | $\mu\text{A dc}$ |
| Collector to emitter cutoff current      | 3041        | Bias condition A; $V_{BE} = 1.5 \text{ V dc}$ ; $V_{CE} = 90 \text{ V dc}$                   | $I_{CEX1}$     |       | 10  | $\mu\text{A dc}$ |
| Collector to base cutoff current         | 3036        | Bias condition D; $V_{CB} = 100 \text{ V dc}$  | $I_{CBO}$      |       | 10  | $\mu\text{A dc}$ |
| Emitter to base, cutoff current          | 3061        | Bias condition D; $V_{EB} = 6.0 \text{ V dc}$  | $I_{EBO}$      |       | 100 | $\mu\text{A dc}$ |
| Forward - current transfer ratio         | 3076        | $V_{CE} = 2.0 \text{ V dc}$ ; $I_C = 0.5 \text{ A dc}$ , pulsed (see 4.5.1)                  | $h_{FE1}$      | 60    |     |                  |
| Forward - current transfer ratio         | 3076        | $V_{CE} = 2.0 \text{ V dc}$ ; $I_C = 2.0 \text{ A dc}$ ; pulsed (see 4.5.1)                  | $h_{FE2}$      | 60    | 240 |                  |
| Forward - current transfer ratio         | 3076        | $V_{CE} = 2.0 \text{ V dc}$ ; $I_C = 5.0 \text{ A dc}$ ; pulsed (see 4.5.1)                  | $h_{FE3}$      | 40    |     |                  |
| Collector to emitter voltage (saturated) | 3071        | $I_C = 2.0 \text{ A dc}$ ; $I_B = 0.2 \text{ A dc}$ ; pulsed (see 4.5.1)                     | $V_{CE(SAT)1}$ |       | 0.7 | V dc             |
| Collector to emitter voltage (saturated) | 3071        | $I_C = 5.0 \text{ A dc}$ ; $I_B = 0.5 \text{ A dc}$ ; pulsed (see 4.5.1)                     | $V_{CE(SAT)2}$ |       | 1.2 | V dc             |
| Base to emitter voltage (saturated)      | 3066        | Test condition A; $I_C = 2.0 \text{ A dc}$ ; $I_B = 0.2 \text{ A dc}$ ; ; pulsed (see 4.5.1) | $V_{BE(SAT)1}$ |       | 1.2 | V dc             |
| Base to emitter voltage (saturated)      | 3066        | Test condition A; $I_C = 5.0 \text{ A dc}$ ; $I_B = 0.5 \text{ A dc}$ ; pulsed (see 4.5.1)   | $V_{BE(SAT)2}$ |       | 1.8 | V dc             |

See footnote at end of table.

TABLE I. Group A inspection - Continued.

| Inspection <u>1/</u>                                      | MIL-STD-750 |  | Symbol     | Limit |       | Unit          |
|---|-------------|--|------------|-------|-------|---------------|
|   | Method      | Conditions   |            | Min   | Max   |               |
| <u>Subgroup 3</u>   |             |  |            |       |       |               |
| High - temperature operation                              |             | $T_A = +150^\circ\text{C}$   |            |       |       |               |
| Collector to emitter cutoff current                       |             | Bias condition A; $V_{CE} = 90\text{ V dc}$ ; $V_{BE} = 1.5\text{ V dc}$ ;         | $I_{CEX2}$ |       | 1.0   | mA dc         |
| Low - temperature operation                               |             | $T_A = -55^\circ\text{C}$  |            |       |       |               |
| Forward - current transfer ratio                          | 3076        | $V_{CE} = 2.0\text{ V dc}$ ; $I_C = 2.0\text{ A dc}$ ; Pulsed (see 4.5.1)          | $h_{FE4}$  | 12    |       |               |
| <u>Subgroup 4</u>   |             |  |            |       |       |               |
| Small-signal short-circuit forward-current transfer ratio | 3306        | $V_{CE} = 10\text{ V dc}$ ; $I_C = 0.5\text{ A dc}$ ; $f = 10\text{ MHz}$          | $ h_{fe} $ | 3     | 15    |               |
| Open circuit output capacitance                           | 3236        | $V_{CB} = 10\text{ V dc}$ ; $I_E = 0$ ; $100\text{ kHz} \leq f \leq 1\text{ MHz}$  | $C_{obo}$  |       | 300   | pF            |
| Input capacitance (output open-circuited)                 | 3240        | $V_{BE} = 2.0\text{ V dc}$ ; $I_C = 0$ ; $100\text{ kHz} \leq f \leq 1\text{ MHz}$ | $C_{ibo}$  |       | 1,250 | pF            |
| Pulse response  |             |  |            |       |       |               |
| Pulse delay time  | 3251        | See figure 6   | $t_d$      |       | 100   | ns            |
| Pulse rise time   | 3251        | See figure 6   | $t_r$      |       | 100   | ns            |
| Pulse storage time  | 3251        | See figure 7   | $t_s$      |       | 2     | $\mu\text{s}$ |
| Pulse fall time   | 3251        | See figure 7   | $t_f$      |       | 200   | ns            |

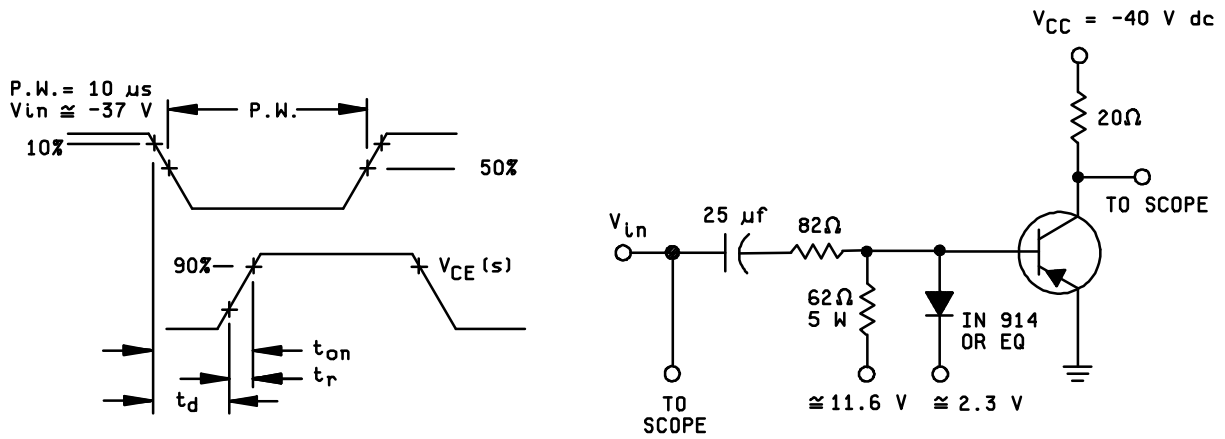
See footnote at end of table.

MIL-PRF-19500/561D

TABLE I. Group A inspection - Continued.

| Inspection <u>1</u> /                  | MIL-STD-750 |  | Symbol | Limit |     | Unit |
|--|-------------|--|--------|-------|-----|------|
|  | Method      | Conditions   |        | Min   | Max |      |
| <u>Subgroup 5</u>                      | 3051        | $T_C = +25^\circ\text{C}; t \geq 0.5 \text{ s}; 1 \text{ cycle}$ |        |       |     |      |
| Safe operating area<br>(continuous dc) |             |  |        |       |     |      |
| Test 1                                 |             | $V_{CE} = 2.0 \text{ V dc}; I_C = 5.0 \text{ A dc}$              |        |       |     |      |
| Test 2                                 |             | $V_{CE} = 90 \text{ V dc}; I_C = 55 \text{ mA dc}$               |        |       |     |      |
| End-point electrical<br>measurements   |             | See table I, subgroup 2 herein.                                  |        |       |     |      |
| <u>Subgroups 6 and 7</u>               |             |  |        |       |     |      |
| Not applicable                         |             |  |        |       |     |      |

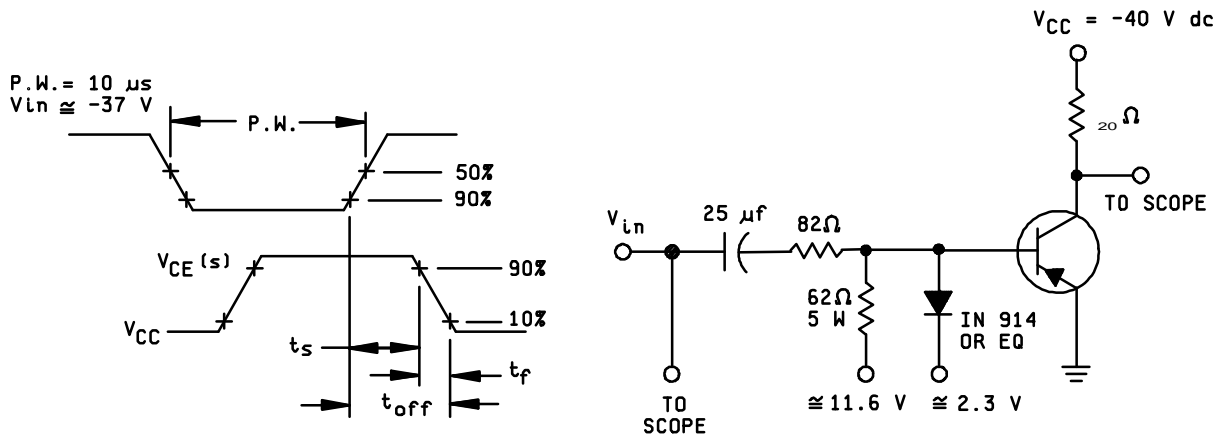
1/ For sampling plan, see MIL-PRF-19500.



NOTES:

1. The rise time ( $t_r$ ) of the applied pulse shall be  $\leq 2.0$  ns, duty cycle  $\leq 2$  percent, and the generator source impedance shall be  $50\Omega$ .
2. Sampling oscilloscope:  $Z_{in} \geq 1\text{ M}\Omega$ ,  $C_{in} \leq 20\text{ pF}$ , rise time  $\leq 0.2$  ns.
3.  $I_C = 2\text{ A}$ ,  $I_{B1} = 200\text{ mA}$ .

FIGURE 6. Saturated turn-on switching waveform and time test circuit.



NOTES:

1. The rise time ( $t_r$ ) of the applied pulse shall be  $\leq 2.0$  ns, duty cycle  $\leq 2$  percent, and the generator source impedance shall be  $50\Omega$ .
2. Sampling oscilloscope:  $Z_{in} \geq 1\text{ M}\Omega$ ,  $C_{in} \leq 20\text{ pF}$ , rise time  $\leq 0.20$  ns.
3.  $C_1 = 2\text{ A}$ ,  $I_{B1} = I_{B2} = 200\text{ mA}$ .

FIGURE 7. Pulse response test circuit for  $t_s$  and  $t_f$ .

## 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 must 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 2.1.1).
- c. The lead finish as specified (see 3.4.1).
- d. Type designation and quality assurance level.
- e. Packaging requirements (see 5.1).
- f. For die acquisition, the JANHC or JANKC letter version shall be specified (see figures 2 and 3 herein).

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 Manufacturer's List QML No.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 Application guidance. The following NPN type transistor is complimentary to the PNP device listed herein.

|            |            |
|------------|------------|
| <u>NPN</u> | <u>PNP</u> |
| 2N5339     | 2N6193     |



6.5 Suppliers of JANHC and JANKC die. The qualified die suppliers with the applicable letter version (example, JANHCA2N6193) will be identified on the QML.

| JANC ordering information |                              |                              |                              |
|---------------------------|------------------------------|------------------------------|------------------------------|
| PIN                       | Manufacturers                |                              |                              |
|                           | 33178                        | 34156                        | 43611                        |
| 2N6193                    | JANHCA2N6193<br>JANKCA2N6193 | JANHCB2N6193<br>JANKCB2N6193 | JANHCC2N6193<br>JANKCC2N6193 |

6.6 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.

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

Preparing activity:  
 DLA - CC  
 (Project 5961-2259)

Review activities:  
 Air Force - 19

**STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL**

INSTRUCTIONS

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-19500/561D | 2. DOCUMENT DATE<br>010103 |
|------------------------------|--|----------------------------|

**3. DOCUMENT TITLE**  
SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, SWITCHING TYPE 2N6193 AND 2N6193U3 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

|                                       |   |                   |
|---------------------------------------|---|-------------------|
| <b>6. SUBMITTER</b>                   |   |                   |
| 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 |

|   |  |                                    |                     |
|---|--|------------------------------------|---------------------|
| <b>8. PREPARING ACTIVITY</b>  |  |                                    |                     |
| a. Point of Contact<br>Alan Barone  | b. TELEPHONE<br>Commercial<br>614-692-0510   | DSN<br>850-0510                    | FAX<br>614-692-6939 |
|   |  | EMAIL<br>alan_barone@dsccl.dla.mil |                     |
| c. ADDRESS<br>Defense Supply Center Columbus,<br>ATTN: DSCC-VAC, 3990 East Broad<br>Street, Columbus, OH 43213-1199 | 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, Fort Belvoir, VA 22060-6221<br>Telephone (703) 767-6888 DSN 427-6888 |                                    |                     |