MILITARY SPECIFICATION

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, POWER
TYPES 2N6671, AND 2N6673, JAN, JANTX, AND JANTXV

This specification is approved for use by Rome Air Development
Center, Department of the Air Force, and is available for use
by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the detail requirements for NPN, silicon,
power transistors for use in high-speed power-switching applications. Three levels
of product assurance are provided for each device type as specified in MIL-S-19500.

1.2 Physical dimensions. See figure 1 (TO-3).

1.3 Maximum ratings.

<table>
<thead>
<tr>
<th>Types</th>
<th>$P_T$ 1/</th>
<th>$P_T$ 1/</th>
<th>$V_CBO$</th>
<th>$V_CEO$</th>
<th>$I_B$</th>
<th>$I_C$</th>
<th>$T_STG$ and</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N6671</td>
<td>$+25^\circ C$</td>
<td>$+25^\circ C$</td>
<td>$450$</td>
<td>$300$</td>
<td>$8$</td>
<td>$4$</td>
<td>$8$ $-65$ to $+200^\circ C$</td>
</tr>
<tr>
<td>2N6673</td>
<td>$+25^\circ C$</td>
<td>$+25^\circ C$</td>
<td>$450$</td>
<td>$300$</td>
<td>$8$</td>
<td>$4$</td>
<td>$8$ $-65$ to $+200^\circ C$</td>
</tr>
</tbody>
</table>

1/ Derate linearly 0.857 W/°C for $T_C 25^\circ C$.
Derate linearly 34.2 mW/°C for $T_A 25^\circ C$.

1.4 Primary electrical characteristics at $T_C = +25^\circ C \pm 3^\circ C$.

<table>
<thead>
<tr>
<th>Limit</th>
<th>$R_{OJC}$</th>
<th>$V_{BE(gat)}$</th>
<th>$V_{CE(gat)}$</th>
<th>$I_C = 5$ Adc</th>
<th>$I_B = 1$ Adc</th>
<th>$V_{GB} = 0$</th>
<th>$V_{CG} = 10$ Vdc</th>
<th>$f = 1$ MHz</th>
<th>$f = 5$ kHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>$^\circ C/W$</td>
<td>Vdc</td>
<td>Vdc</td>
<td>pF</td>
<td>Min</td>
<td>---</td>
<td>---</td>
<td>50</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Max</td>
<td>1.17</td>
<td>1.6</td>
<td>1.0</td>
<td>300</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Limit</th>
<th>$h_{FE1}$</th>
<th>$h_{FE2}$</th>
<th>Switching parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CG} = 3$ Vdc</td>
<td>$V_{CE} = 3$ Vdc</td>
<td>$I_C = 5$ Adc</td>
<td>$I_C = 1$ Adc</td>
</tr>
<tr>
<td>$t_d$</td>
<td>$t_r$</td>
<td>$t_s$</td>
<td>$t_f$</td>
</tr>
<tr>
<td>Min</td>
<td>10</td>
<td>10</td>
<td>--</td>
</tr>
<tr>
<td>Max</td>
<td>80</td>
<td>40</td>
<td>0.1</td>
</tr>
</tbody>
</table>

1/ Pulsed (see 4.5.1).

Benificial comments (recommendations, additions, deletions) and any pertinent
data which may be of use in improving this document should be addressed to:
Rome Air Development Center (RDE-2), Griffiss AFB, NY 13441, by using the
self-addressed Standardization Document Improvement Proposal (DD Form 1426)
appearing at the end of this document or by letter.

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2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATION

MILITARY


STANDARDS

MILITARY


(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Detail specification. The individual item requirements shall be in accordance with MIL-S-19500, and as specified herein.

3.2 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-S-19500 and as follows:

* \( \Delta t_{\text{off}} \) - Cross over time. The time interval during which the collector voltage rises from 10 percent of its peak off state value and the collector current falls to 10 percent of its peak on state value (see figure 2).

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-S-19500 and figure 1 herein. Current density of internal conductors shall be as specified in 3.6.5 of MIL-S-19500. No aluminum case shall be permitted.

3.3.1 Lead material and finish. Lead material shall be Kovar or Alloy 52. Lead finish shall be gold plated, tin plated, or solder dipped. Where a choice of lead material or finish is desired, it shall be specified in the contract (see 6.2).

3.4 Marking. Devices shall be marked in accordance with MIL-S-19500. At the option of the manufacturer, the marking of the country of origin may be omitted from the body of the transistor.

4. QUALITY ASSURANCE PROVISIONS.

4.1 Sampling and inspection. Sampling and inspection shall be in accordance with MIL-S-19500, and as specified herein.

4.2 Screening (JANTX and JANTXV levels only). Screening shall be in accordance with MIL-S-19500 (table II) 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.

<table>
<thead>
<tr>
<th>Screen (see table II of MIL-S-19500)</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>IC(\text{EX1})</td>
</tr>
<tr>
<td>11</td>
<td>IC(\text{EX1}) and h(\text{PE2}); (\Delta IC\text{EX1} = 100% \text{ of initial value or } 50 \mu\text{A}\text{dc, whichever is greater})</td>
</tr>
<tr>
<td>12</td>
<td>See 4.2.1</td>
</tr>
<tr>
<td>13</td>
<td>Subgroup 2 of table I herein; (\Delta IC\text{EX1} = 100% \text{ of initial value or } 50 \mu\text{A}\text{dc, whichever is greater};) (\Delta h\text{PE2} = \pm 20% \text{ of initial value})</td>
</tr>
</tbody>
</table>
4.2.1 **Power burn-in conditions.** Power burn-in conditions are as follows:

\[ T_J = +187.5 \pm 12.5^\circ C; \quad V_{CB} = 100 \text{ Vdc}; \quad T_A \leq 100^\circ C \]

4.3 **Qualification inspection.** Qualification inspection shall be in accordance with MIL-S-19500.

4.4 **Quality conformance inspection.** Quality conformance inspection shall be in accordance with MIL-S-19500.

4.4.1 **Group A inspection.** Group A inspection shall be conducted in accordance with MIL-S-19500 and Table I herein. End point electrical measurements shall be in accordance with the applicable steps of Table IV herein.

4.4.2 **Group B inspection.** Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing table IVb. (JAN, JANTX, and JANTXV) of MIL-S-19500 and Table II herein. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of Table IV herein.

4.4.3 **Group C inspection.** Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in Table V of MIL-S-19500 and Table III herein. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of Table IV herein.

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

4.5.1 **Pulse measurement.** 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 Method 3131 of MIL-STD-750. The following conditions apply:

   a. Collector current magnitude during power applications shall be 2.5 Adc.
   b. Collector to emitter voltage magnitude shall be 20 Vdc.
   c. Reference temperature measuring point shall be the case.
   d. Reference point temperature shall be 25°C to 75°C.
   e. Mounting arrangement shall be with heat sink to case.
   f. Maximum limit shall be 1.17°C/W.

4.5.3 **Group C life test.** If the option of "T_C\" life test is conducted in group B inspection, the test sample may be continued as subgroup 6 of group C inspection in accordance with MIL-S-19500 and Table III herein.

4.5.4 **Inspection conditions.** Unless otherwise specified in MIL-S-19500 or herein, all inspections shall be conducted at a case temperature \((T_C)\) of 25° ± 3°C.

5. **PACKAGING**

5.1 **Packaging requirements.** The requirements for packaging shall be in accordance with MIL-S-19500.

6. **NOTES**

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

6.2 **Ordering data.** Procurement documents should specify the following:

   a. Lead material and finish (see 3.3.1).
<table>
<thead>
<tr>
<th>Inspection</th>
<th>Method</th>
<th>Conditions</th>
<th>JAM TX TXV</th>
<th>Limits</th>
<th>Symbol</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual and mechanical examination</td>
<td>2071</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td><strong>Subgroup 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakdown voltage, collector to emitter</td>
<td>3011</td>
<td>Bias condition D; $I_C = \frac{V_{BE}}{200 \text{ mA}}$; pulsed (see 4.5.1)</td>
<td></td>
<td></td>
<td>$V(\text{BR})_{CEO}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N6671</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>2N6673</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>600</td>
</tr>
<tr>
<td>Collector to emitter cutoff current</td>
<td>3041</td>
<td>Bias condition A; $V_{BE} = -1.5 \text{ Vdc}$</td>
<td></td>
<td></td>
<td>$I_{CEO}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N6671</td>
<td>$V_{CE} = 450 \text{ Vdc}$</td>
<td></td>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>2N6673</td>
<td>$V_{CE} = 650 \text{ Vdc}$</td>
<td></td>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>Collector to base, cutoff current</td>
<td>3036</td>
<td>Bias condition D; $V_{BE} = -8 \text{ Vdc}$</td>
<td></td>
<td></td>
<td>$I_{CBO}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N6671</td>
<td>$V_{CB} = 450 \text{ Vdc}$</td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>2N6673</td>
<td>$V_{CB} = 650 \text{ Vdc}$</td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>Emitter to base cutoff current</td>
<td>3061</td>
<td>Bias condition D; $V_{BE} = -8 \text{ Vdc}$</td>
<td></td>
<td></td>
<td>$I_{CEO}$</td>
<td></td>
</tr>
<tr>
<td>Base emitter voltage (saturated)</td>
<td>3066</td>
<td>Test condition A; $I_C = 5 \text{ A}; I_B = 1 \text{ A}$; pulsed (see 4.5.1)</td>
<td></td>
<td></td>
<td>$V_{BE}(\text{sat})$</td>
<td>1.6</td>
</tr>
<tr>
<td>Collector to emitter voltage (saturated)</td>
<td>3071</td>
<td>$I_C = 5 \text{ A}; I_B = 1 \text{ A}$; pulsed (see 4.5.1)</td>
<td></td>
<td></td>
<td>$V_{CE}(\text{sat})1$</td>
<td>1.0</td>
</tr>
<tr>
<td>Collector to emitter voltage (saturated)</td>
<td>3071</td>
<td>$I_C = 8 \text{ A}; I_B = 4 \text{ A}$; pulsed (see 4.5.1)</td>
<td></td>
<td></td>
<td>$V_{CE}(\text{sat})2$</td>
<td>2.0</td>
</tr>
<tr>
<td>Forward-current transfer ratio</td>
<td>3076</td>
<td>$V_{CE} = 3 \text{ Vdc}; I_C = 1 \text{ A}$; pulsed (see 4.5.1)</td>
<td></td>
<td></td>
<td>$h_{FE1}$</td>
<td>10</td>
</tr>
<tr>
<td>Forward-current transfer ratio</td>
<td>3076</td>
<td>$V_{CE} = 3 \text{ Vdc}$; pulsed (see 4.5.1); $I_C = 5 \text{ A}$</td>
<td></td>
<td></td>
<td>$h_{FE2}$</td>
<td>10</td>
</tr>
<tr>
<td><strong>Subgroup 3</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>High-temperature operation</td>
<td></td>
<td>$T_A = 125^\circ$C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector to emitter cutoff current</td>
<td>3041</td>
<td>Bias condition A; $V_{BE} = -1.5 \text{ Vdc}$; pulsed (see 4.5.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N6671</td>
<td>$V_{CE} = 450 \text{ Vdc}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2N6673</td>
<td>$V_{CE} = 650 \text{ Vdc}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector to emitter voltage (saturated)</td>
<td>3071</td>
<td>$I_C = 5 \text{ A}; I_B = 1 \text{ A}$; pulsed (see 4.5.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching parameters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse delay time</td>
<td>See figure 2</td>
<td>$t_d$</td>
<td></td>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>Pulse rise time</td>
<td>See figure 2</td>
<td>$t_r$</td>
<td></td>
<td></td>
<td></td>
<td>0.8</td>
</tr>
<tr>
<td>Pulse storage time</td>
<td>See figure 2</td>
<td>$t_b$</td>
<td></td>
<td></td>
<td></td>
<td>4.0</td>
</tr>
<tr>
<td>Pulse fall time</td>
<td>See figure 2</td>
<td>$t_f$</td>
<td></td>
<td></td>
<td></td>
<td>0.8</td>
</tr>
<tr>
<td>Cross-over time</td>
<td>See figure 2</td>
<td>$t_c$</td>
<td></td>
<td></td>
<td></td>
<td>0.8</td>
</tr>
<tr>
<td>Low temperature operation</td>
<td></td>
<td>$T_A = -55^\circ$C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE I. Group A inspection - Continued.

<table>
<thead>
<tr>
<th>Inspection</th>
<th>MIL-STD-750 Method Conditions</th>
<th>Limits</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>JAN Symbol TX TXV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroup 3 - continued</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward-current transfer ratio</td>
<td>$V_{CC} = 3$ Vdc; pulsed (see 4.3.1); $I_C = 5$ Adc</td>
<td>$h_{FE}$</td>
<td>4</td>
</tr>
<tr>
<td>Subgroup 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnitude of small signal short circuit forward current transfer ratio</td>
<td>$V_{CE} = 10$ Vdc; $I_C = 0.2$ Adc; $f = 5$ MHz</td>
<td>$</td>
<td>h_{FE}</td>
</tr>
<tr>
<td>Open circuit output capacitance</td>
<td>$V_{GB} = 10$ Vdc; $I_G = 0$; 100 kHz &lt; $f$ &lt; 1 MHz</td>
<td>$C_{obo}$</td>
<td>50</td>
</tr>
<tr>
<td>Switching parameters:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse delay time</td>
<td>See figure 2</td>
<td>$t_d$</td>
<td>---</td>
</tr>
<tr>
<td>Pulse rise time</td>
<td>See figure 2</td>
<td>$t_r$</td>
<td>---</td>
</tr>
<tr>
<td>Pulse short time</td>
<td>See figure 2</td>
<td>$t_s$</td>
<td>---</td>
</tr>
<tr>
<td>Pulse fall time</td>
<td>See figure 2</td>
<td>$t_f$</td>
<td>---</td>
</tr>
<tr>
<td>Cross-over time</td>
<td>See figure 2</td>
<td>$t_c$</td>
<td>---</td>
</tr>
<tr>
<td>Subgroup 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safe operating area (continuous dc)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N6671, 2N6673</td>
<td>$V_{CE} = 18.75$ Vdc; $I_C = 8$ Adc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N6671, 2N6673</td>
<td>$V_{CE} = 25$ Vdc; $I_C = 6$ Adc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N6671, 2N6673</td>
<td>$V_{CE} = 100$ Vdc; $I_C = 0.25$ Adc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test 4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N6671</td>
<td>$V_{CE} = 300$ Vdc; $I_C = 38$ mA dc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N6673</td>
<td>$V_{CE} = 400$ Vdc; $I_C = 23$ mA dc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safe operating area (clamped switching)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test 5</td>
<td>$T_A = 25^\circ$C; $V_{CE} = 15$ Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(see figures 5 and 6)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N6671</td>
<td>clamp voltage = 350 Vdc; $I_C = 5$ Adc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N6671</td>
<td>clamp voltage = 200 Vdc; $I_C = 8$ Adc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N6673</td>
<td>clamp voltage = 450 Vdc; $I_C = 5$ Adc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2N6673</td>
<td>clamp voltage = 300 Vdc; $I_C = 8$ Adc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>End point electrical measurements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>See table IV, steps 1, 4, and 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroups 6 and 7</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table II. Group B inspection (all quality levels).

<table>
<thead>
<tr>
<th>Inspection</th>
<th>Method</th>
<th>Conditions</th>
<th>LTPD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subgroup 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solderability</td>
<td>2026</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Resistance to solvents</td>
<td>1022</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal shock</td>
<td>1051</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>(temperature cycling)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hermetic seal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Fine leak</td>
<td>1071</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Gross leak</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical measurements</td>
<td></td>
<td>See table IV, steps 1 and 3</td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steady-state operation life (LTPD)</td>
<td>1027</td>
<td>$T_J = 187.5 \pm 12.5^\circ C$; $V_{CB} = 100$ Vdc; $T_A \leq 100^\circ C$</td>
<td>5</td>
</tr>
<tr>
<td>Electrical measurements</td>
<td></td>
<td>See table IV, steps 1, 6, 7, and 8</td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 4</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decap internal visual design verification</td>
<td>2075</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bond strength</td>
<td>2037</td>
<td>Test condition A; all internal wires for each device shall be pulled separately</td>
<td>1 device/0 failure for each lot</td>
</tr>
<tr>
<td><strong>Subgroup 5</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal resistance</td>
<td>3131</td>
<td>See 4.5.3</td>
<td>15</td>
</tr>
<tr>
<td><strong>Subgroup 6</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High temperature non-operating life (LTPD)</td>
<td>1032</td>
<td>$T_A = 200^\circ C$</td>
<td>7</td>
</tr>
<tr>
<td>Electrical measurements</td>
<td></td>
<td>See table IV, steps 1, 3, 6, and 8</td>
<td></td>
</tr>
<tr>
<td><strong>Subgroup 7</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safe operating area</td>
<td>3053</td>
<td>Load condition C; (unclamped inductive load) (see figure 4); $T_A = 25^\circ C$; duty cycle $\leq 10%$; $R_S = 0.1 \Omega$; $t_r = t_f \leq 500$ ns</td>
<td>10</td>
</tr>
<tr>
<td><strong>Test 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>t_{pv} = 5 ms (vary to obtain $I_C$);</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R_{BB1} = 2\Omega$; $V_{BB1} = 10$ Vdc;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R_{BB2} = 50\Omega$; $V_{BB2} = -4$ Vdc;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$V_{CC} = 20$ Vdc; $I_C = 8$ Adc; $L = 10 \mu H$ (approximately 10 turns, 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>row of #16 ASG wire on air core 2 7/8&quot; @ 1D); .0007 ohms or equivalent</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE II. Group B inspection (all quality levels) - Continued.

<table>
<thead>
<tr>
<th>Inspection</th>
<th>Method</th>
<th>MIL-STD-750 Conditions</th>
<th>LTPD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subgroup 7 - continued</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Test 2</strong></td>
<td></td>
<td>$t_p = 5 \text{ ms (vary to obtain } I_C)$;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$R_{BB1} = 100\Omega; \ V_{BB1} = 10 \text{ Vdc};$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$R_{BB2} = 50\Omega; \ V_{BB2} = -4 \text{ Vdc};$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_{CC} = 20 \text{ Vdc; } I_C = 100 \text{ mA dc; }$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$L = 1 \text{ mH (1 each Miller type 7827 in parallel with 2 each series strung Miller type 7827 and this in series with 2 each series strung)}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$\text{.45 ohms or equivalent}$</td>
<td></td>
</tr>
<tr>
<td>Safe operating area</td>
<td>$305^\circ$</td>
<td>$T_A = 25^\circ \text{C (see figures 5 and 6)}$</td>
<td></td>
</tr>
<tr>
<td>(clamped switching)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(destructive)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Test 1</strong></td>
<td></td>
<td>$V_{CC} = 125 \text{ Vdc; } I_C = 5 \text{ A dc}$</td>
<td></td>
</tr>
<tr>
<td>2N6671</td>
<td></td>
<td>$\text{Clamp voltage} = 350 \text{ Vdc}$</td>
<td></td>
</tr>
<tr>
<td>2N6673</td>
<td></td>
<td>$\text{Clamp voltage} = 450 \text{ Vdc}$</td>
<td></td>
</tr>
<tr>
<td><strong>Test 2</strong></td>
<td></td>
<td>$V_{CC} = 200 \text{ Vdc; } I_C = 8 \text{ A dc}$</td>
<td></td>
</tr>
<tr>
<td>2N6671</td>
<td></td>
<td>$\text{Clamp voltage} = 200 \text{ Vdc}$</td>
<td></td>
</tr>
<tr>
<td>2N6673</td>
<td></td>
<td>$\text{Clamp voltage} = 300 \text{ Vdc}$</td>
<td></td>
</tr>
<tr>
<td>End point electrical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>measurements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>See table IV, steps 1, 4, and 6</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE III. Group C inspection (all quality levels).

<table>
<thead>
<tr>
<th>Inspection</th>
<th>Method</th>
<th>Conditions</th>
<th>LTPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subgroup 1</td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Physical dimensions</td>
<td>2066</td>
<td>See figure 1</td>
<td></td>
</tr>
<tr>
<td>Subgroup 2</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Thermal shock (glass strain)</td>
<td>1056</td>
<td>Test condition B</td>
<td></td>
</tr>
<tr>
<td>Terminal strength (tension)</td>
<td>2036</td>
<td>Test condition A; weight = 10 lbs; time = 15 s</td>
<td></td>
</tr>
<tr>
<td>Hermetic seal</td>
<td>1071</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Fine leak</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Gross leak</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moisture resistance</td>
<td>1021</td>
<td></td>
<td></td>
</tr>
<tr>
<td>External visual</td>
<td>2071</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical measurements</td>
<td>See table IV, steps 1 and 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroup 3</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>Shock</td>
<td>2016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vibration, variable frequency</td>
<td>2056</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant acceleration</td>
<td>2006</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical measurements</td>
<td>See table IV, steps 1 and 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroup 4</td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Salt atmosphere (corrosion)</td>
<td>1041</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroup 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subgroup 6</td>
<td></td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>
| Steady-state operation life | 1027 | \[ V_{OP} = 20 \text{ Vdc}; P_T = 85 \text{ W @ } T_C \]
| | | \[ = 100^\circ \text{C or } +100^\circ \text{C} \leq T_C \leq 125^\circ \text{C} \]
| | | with \( P_T \) varied according to the chosen \( T_C \) to achieve a \( T_J = 187.5^\circ +12.5^\circ \text{C} \) (see 4.5.3 and 4.5.4) |
| Electrical measurements | See table IV, steps 1, 2, 3, 5, 7, 8 and 9 |      |      |
### TABLE IV. Groups A, B, and C electrical measurements.

<table>
<thead>
<tr>
<th>Step</th>
<th>Inspection</th>
<th>Method</th>
<th>Conditions</th>
<th>Symbol</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Min</td>
</tr>
<tr>
<td>1</td>
<td>Collector to emitter cutoff current</td>
<td>3041</td>
<td>Bias condition A; VBE = -1.5 Vdc</td>
<td>ICEX1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VCE = 450 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VCE = 650 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Collector to emitter voltage (saturated)</td>
<td>3071</td>
<td>IC = 5 Adc; IB = 1 Adc; pulsed (see 4.5.1)</td>
<td>VCE(sat)</td>
<td>---</td>
</tr>
<tr>
<td>3</td>
<td>Base emitter voltage (saturated)</td>
<td>3066</td>
<td>Test condition A; IC = 5 Adc; IB = 1 Adc; pulsed (see 4.5.1)</td>
<td>VBE(sat)</td>
<td>---</td>
</tr>
<tr>
<td>4</td>
<td>Breakdown voltage collector to emitter</td>
<td>3011</td>
<td>Bias condition D; IC = 200 mA dc</td>
<td>V(BR)CEO</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>300</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>400</td>
</tr>
<tr>
<td>5</td>
<td>Forward current transfer ratio</td>
<td>3076</td>
<td>VCE = 3 Vdc; IC = 1 Adc pulsed (see 4.5.1)</td>
<td>hfg1</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Forward current transfer ratio</td>
<td>3076</td>
<td>VCE = 3 Vdc; IC = 5 Adc pulsed (see 4.5.1)</td>
<td>hfg2</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>Collector to emitter cutoff current</td>
<td>3041</td>
<td>Bias condition A; VBE = -1.5 Vdc</td>
<td>ΔICEX1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VCE = 450 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>VCE = 650 Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Forward current transfer ratio</td>
<td>3076</td>
<td>VCE = 3 Vdc; IC = 5 Adc pulsed (see 4.5.1)</td>
<td>Δhfg2</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Collector to emitter voltage (saturated)</td>
<td>3071</td>
<td>IC = 5 Adc; IB = 1 Adc; pulsed (see 4.5.1)</td>
<td>ΔVCE(sat)</td>
<td></td>
</tr>
</tbody>
</table>

1/ Devices which exceed the group A limits for this test shall not be acceptable.
### Dimensions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Inches</th>
<th>Millimeters</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.270</td>
<td>6.86</td>
<td>9.65</td>
</tr>
<tr>
<td>φb</td>
<td>.038</td>
<td>.97</td>
<td>1.09</td>
</tr>
<tr>
<td>φD</td>
<td>---</td>
<td>.875</td>
<td>---</td>
</tr>
<tr>
<td>c</td>
<td>.420</td>
<td>10.67</td>
<td>11.18</td>
</tr>
<tr>
<td>c₁</td>
<td>.205</td>
<td>5.21</td>
<td>5.72</td>
</tr>
<tr>
<td>F</td>
<td>.060</td>
<td>1.52</td>
<td>3.43</td>
</tr>
<tr>
<td>L</td>
<td>.312</td>
<td>7.92</td>
<td>12.70</td>
</tr>
<tr>
<td>L₁</td>
<td>---</td>
<td>.050</td>
<td>---</td>
</tr>
<tr>
<td>φP</td>
<td>.151</td>
<td>3.84</td>
<td>4.09</td>
</tr>
<tr>
<td>q</td>
<td>1.177</td>
<td>29.90</td>
<td>30.40</td>
</tr>
<tr>
<td>R</td>
<td>.495</td>
<td>12.57</td>
<td>13.34</td>
</tr>
<tr>
<td>R₁</td>
<td>.131</td>
<td>3.33</td>
<td>4.78</td>
</tr>
<tr>
<td>s</td>
<td>.655</td>
<td>16.64</td>
<td>17.14</td>
</tr>
</tbody>
</table>

**NOTES:**

1. Dimensions are in inches.
2. Metric equivalents are given for general information only and are based upon 1.00 inch = 25.4 mm.
3. Terminal 1, base; terminal 2, emitter; case, collector.
4. These dimensions should be measured at points .050-.055 (1.27-1.40 mm) below seating plane. When gage is not used, measurement will be made at the seating plane.
5. The seating plane of the header shall be flat within .001 (.03 mm) concave to .004 (.10 mm) convex inside a .930 (23.62 mm) diameter circle on the center of the header and flat within .001 (.03 mm) concave to .006 (.15 mm) convex overall.
6. Collector shall be electrically connected to the case.

**FIGURE 1.** Physical dimensions of transistor types 2N6671 and 2N6673.
FIGURE 2. Pulse response test circuits.
NOTES:
1. The rise time ($t_r$) of the applied pulse shall be $\leq 20$ ns; duty cycle $\leq 2\%$; generator source impedance shall be 50Ω.
2. Output sampling oscilloscope: $Z_{in} \geq 100$ kΩ; $C_{in} \leq 12$ pF; rise time $\leq 20$ ns.

FIGURE 2. Pulse response test circuits - Continued.
FIGURE 3. Maximum safe operating graph (DC).
FIGURE 4. Safe operating area for switching between saturation and cutoff (unclamped inductive load).
FIGURE 5. Safe operating area for switching between saturation and cutoff (clamped inductive load).
MIL-S-19500/536(USAF)

![Circuit Diagram]

* \( L = 170 \, \mu\text{H}, \, 0.05\Omega, \, 8 \, \text{A} \).

Procedure:
1. With switch \( S_1 \) closed, set the specified test conditions.
2. Open \( S_1 \). Device fails if clamp voltage not reached.
3. Perform specified end point tests.

FIGURE 6. Clamped inductive sweep test circuit.