

The documentation and process conversion measures necessary to comply with this document shall be completed by 4 March 2003.

INCH-POUND  
MIL-PRF-19500/441G  
4 December 2002  
SUPERSEDING  
MIL-PRF-19500/441F  
6 June 2001

## PERFORMANCE SPECIFICATION

### SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, POWER TYPES 2N3740 AND 2N3741, 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, power 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 for each unencapsulated device type die.

1.2 Physical dimensions. See figure 1, TO-213AA (formerly TO-66) encapsulated devices and figures 2 and 3 for unencapsulated devices (JANHC and JANKC).

#### 1.3 Maximum ratings.

Types	$P_T$ (1)		$V_{CBO}$	$V_{CEO}$	$V_{EBO}$	$I_B$	$I_C$	$T_{STG}$ and $T_J$
	$T_C = +25^\circ\text{C}$	$T_C = +100^\circ\text{C}$						
	<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>
2N3740	25	14	60	60	7	2	4	-65 to +200
2N3741	25	14	80	80	7	2	4	-65 to +200

(1) Derate at 143 mW/°C above  $T_C = +25^\circ\text{C}$ .

#### 1.4 Primary electrical characteristics at $T_C = +25^\circ\text{C}$ .

Limits	$h_{FE2}$ (1)	$h_{FE4}$ (1)	$ h_{fe} $	$V_{CE(sat)}^2$ (1)	$C_{obo}$	Pulse response		$R_{\theta JC}$
	$V_{CE} = 1 \text{ V dc}$ $I_C = 250 \text{ mA dc}$	$V_{CE} = 1 \text{ V dc}$ $I_C = 1 \text{ A dc}$	$V_{CE} = 10 \text{ V dc}$ $I_C = 100 \text{ mA dc}$ $f = 5 \text{ MHz}$	$I_C = 1.0 \text{ A dc}$ $I_B = 125 \text{ mA dc}$	$V_{CB} = 10 \text{ V dc}$ $I_E = 0$ $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	$t_{on}$	$t_{off}$	
Min	30	10	1	<u>V dc</u>	<u>pF</u>	<u>ns</u>	<u>µs</u>	<u>°C/W</u>
Max	120		12	0.6	100	400	1	7

(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.

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FSC 5961

## 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.

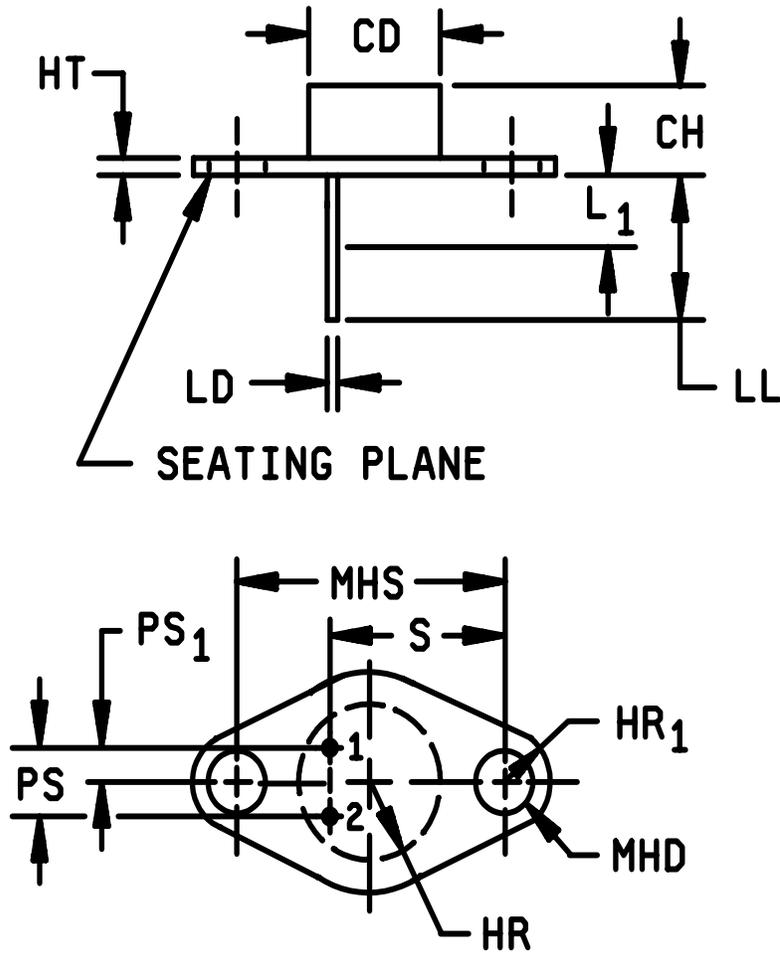


FIGURE 1. Physical dimensions, TO-213AA.

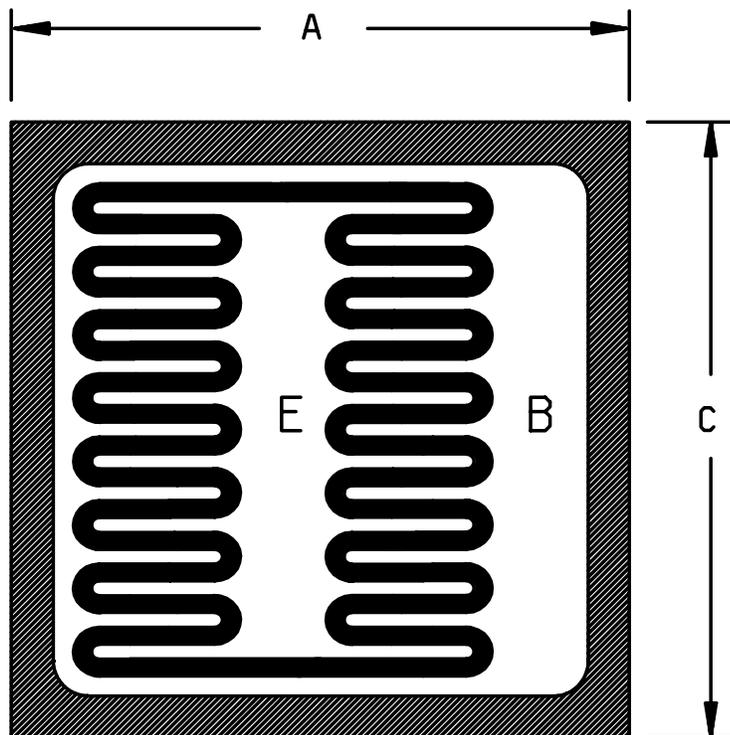
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Symbol	Dimensions				Notes	Symbol	Dimensions				Notes
	Inches		Millimeter				Inches		Millimeters		
	Min	Max	Min	Max			Min	Max	Min	Max	
CD		.620		15.75	9	LL	.360	.500	9.14	12.70	4, 8
CH	.250	.340	6.35	8.54		L <sub>1</sub>		.050		1.27	4, 8
HT	.050	.075	1.27	1.91		MHD	.142	.152	3.61	3.86	6, 9
HR		.350		8.89		MHS	.958	.962	24.33	24.43	
HR <sub>1</sub>	.115	.145	2.92	3.68	5	PS	.190	.210	4.83	5.33	3
LD	.028	.034	0.71	0.86	4, 8, 9	PS <sub>1</sub>	.093	.107	2.36	2.72	3
						S <sub>1</sub>	.570	.590	14.48	14.99	3

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. These dimensions should be measured at points .050 to .055 inch (1.27 to 1.33 mm) below seating plane. When gauge is not used, measurement will be made at seating plane.
4. Both terminals.
5. At both ends.
6. Two holes.
7. The collector shall be electrically connected to the case.
8. LD applies between L<sub>1</sub> and LL. Diameter is uncontrolled in L<sub>1</sub>.
9. In accordance with ANSI Y14.5M, diameters are equivalent to  $\phi$  symbology.

FIGURE 1. Physical dimensions, TO-213AA - Continued.



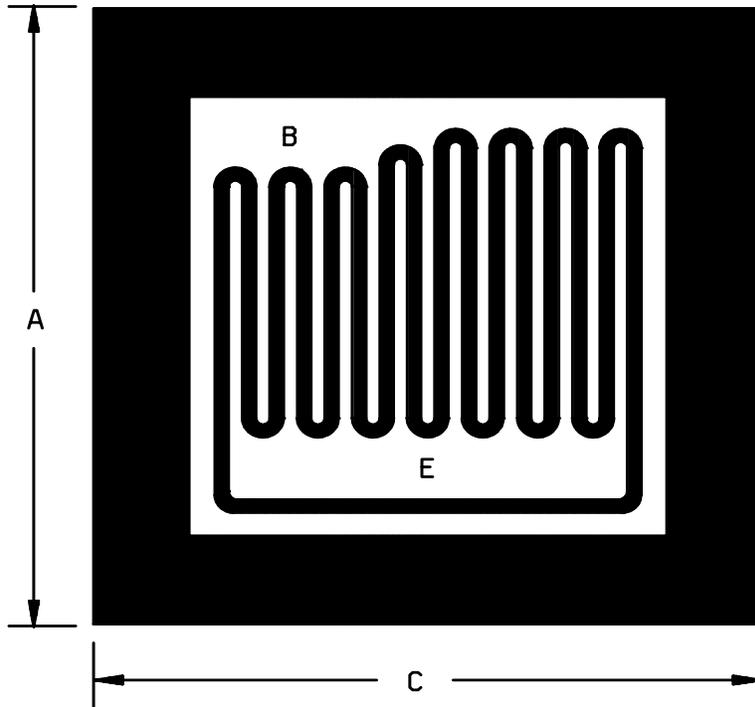
A - version

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.059	.069	1.49	1.76
C	.059	.069	1.49	1.76

NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The physical characteristics of the die are:  
 Thickness: .008 inch (0.20 mm) to .012 inch (0.30 mm).  
 Top metal: Aluminum 25,000 Å minimum, 30,000 Å nominal.  
 Back metal: Gold 2,500 Å minimum, 3,000 Å nominal.  
 Back side: Collector.  
 Bonding pad:  
 B = .045 inch (1.14 mm) x .0075 inch (0.19 mm).  
 E = .039 inch (0.99 mm) x .0075 inch (0.19 mm).
4. Element evaluation shall be performed on case outline TO-213AA.

FIGURE 2. Physical dimensions, JANHC and JANKC die.



B - version

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.083	.087	2.11	2.21
C	.083	.087	2.11	2.21

NOTES:

- Dimensions are in inches.
- Metric equivalents are given for general information only.
- The physical characteristics of the die are:  
 Thickness: .014 inch (0.36 mm) to .018 inch (0.46 mm).  
 Top metal: Aluminum 20,000 Å minimum, 30,000 Å nominal 50,000 Å maximum.  
 Back metal: T1 = 5,000 Å nominal  $\pm 2,000$  Å; N1 = 10,000 Å nominal  $\pm 2,000$  Å;  
 AG = 10,000 Å nominal  $\pm 2,000$  Å.  
 Back side: Collector.  
 Bonding pad: B = .021 inch (0.53 mm) x .008 inch (0.20 mm)  $\pm .002$  inch (0.05 mm).  
 E = .040 inch (1.01 mm) x .008 inch (0.20 mm)  $\pm .002$  inch (0.05 mm).
- Element evaluation shall be performed on case outline TO-213AA.

FIGURE 3. Physical dimensions, JANHC and JANKC die.

### 3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturers' list (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 herein.

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

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

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

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 table II herein.

4.2.1 JANHC and JANKC devices. JANHC and JANKC devices are qualified in accordance with MIL-PRF-19500.

\* 4.2.2 Group E qualification. Group E qualification shall be performed herein for qualification or requalification only. In case qualification was awarded to a prior revision of the associated specification that did not request the performance of group E tests, the tests specified in group E herein shall be performed on the first inspection lot to this revision to maintain qualification.

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4.3 Screening (JANS, JANTXV, and JANTX levels only). Screening shall be in accordance with appendix E, 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 appendix E, table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
1a	Not required	Not required
1b	Required	Required
2	Optional	Optional
3a	Required	Required
3b	Not applicable	Not applicable
*(1) 3c	Thermal impedance method 3131 of MIL-STD-750.	Thermal response method 3131 of MIL-STD-750.
4	Required	Optional
5	Required	Not applicable
6	Required	Not applicable
7a and 7b	Required	Required
8	Required	Not required
9	$I_{CEX1}$ and $h_{FE2}$	Not applicable
10	48 hours minimum	48 hours minimum
11	$I_{CEX1}$ and $h_{FE2}$ ; $\Delta I_{CEX1}$ = 100 percent of initial value or 50 nA dc, whichever is greater, $\Delta h_{FE2}$ = $\pm$ 25 percent of initial value.	$I_{CEX1}$ and $h_{FE2}$
12	See 4.3.1	See 4.3.1
13	Subgroups 2 and 3 of table I herein; $\Delta I_{CEX1}$ = 100 percent of initial value or 50 nA dc; whichever is greater; $\Delta h_{FE2}$ = $\pm$ 25 percent of initial value.	Subgroup 2 of table I herein; $\Delta I_{CEX1}$ = 100 percent of initial value or 50 nA dc, whichever is greater; $\Delta h_{FE2}$ = $\pm$ 25 percent of initial value.
14a and 14b	Optional	Optional
15	Required	Not required
16	Required	Not required

(1) This test shall be performed anytime before screen 9.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows:  $V_{CB} = 10 - 30$  V dc. Power shall be applied to the device to achieve a junction temperature,  $T_J = +175$  °C minimum and a minimum  $P_D = 75$  percent of  $P_T$  maximum rated as defined in 1.3.

\* 4.3.2 Screening (JANH and JANKC). Screening of JANHC and JANKC die shall be in accordance with MIL-PRF-19500, "Discrete Semiconductor Die/Chip Lot Acceptance". Burn-in duration for the JANKC level follows JANS requirements; the JANHC follows JANTX requirements.

4.3.3 Thermal response ( $\Delta V_{BE}$  measurements). The  $\Delta V_{BE}$  measurements shall be performed in accordance with method 3131 of MIL-STD-750. The  $\Delta V_{BE}$  conditions ( $I_H$  and  $V_H$ ) and maximum limit shall be derived by each vendor. The chosen  $\Delta V_{BE}$  measurement and conditions for each device in the qualification lot shall be submitted in the qualification report and a thermal response curve shall be plotted. The chosen  $\Delta V_{BE}$  shall be considered final after the manufacturer has had the opportunity to test five consecutive lots. One-hundred percent safe operating area (SOA) testing may be performed in lieu of thermal response testing herein, provided that the appropriate conditions of temperature, time, current, and voltage to achieve die attach integrity are approved by the qualifying activity. The following parameter measurements shall apply:

- |  |                        |
|--|------------------------|
| a. $I_M$ measurement .....                       | 10 mA.                 |
| b. $V_{CE}$ measurement voltage .....            | 16 V (same as $V_H$ ). |
| c. $I_H$ collector heating current .....         | 1 A (minimum).         |
| d. $V_H$ collector-emitter heating voltage ..... | 16 V (minimum).        |
| e. $t_H$ heating time .....                      | 10 ms.                 |
| f. $t_{MD}$ measurement delay time .....         | 50 $\mu$ s.            |
| g. $t_{SW}$ sample window time .....             | 10 $\mu$ s (maximum).  |

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 appendix E, table V of MIL-PRF-19500, and table I herein. End-point electrical measurements shall be in accordance with the applicable 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 VIa (JANS) of MIL-PRF-19500 and 4.4.2.1 herein. Electrical measurements (end-points) requirements shall be in accordance with table I, subgroup 2 herein. Delta requirements shall be in accordance with 4.5.4 herein. See 4.4.2.2 herein for JAN, JANTX, and JANTXV group B testing.

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

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
B4	1037	$V_{CB} \geq 10V$ for 2,000 cycles.
* B5	1027	(NOTE: If a failure occurs, resubmission shall be at the test conditions of the original sample.) $V_{CB} = 10 V$ dc, $P_D \geq 100$ percent of maximum rated $P_T$ (see 1.3).  Option 1: 96 hours minimum sample size in accordance with table VIa of MIL-PRF-19500, adjust $T_A$ or $P_D$ to achieve $T_J = +275^\circ C$ minimum.  Option 2: 216 hours minimum, sample size = 45, $c = 0$ ; adjust $T_A$ or $P_D$ to achieve $T_J = +225^\circ C$ minimum.
B6	3131	Thermal resistance; see 4.5.2 herein.

4.4.2.2 Group B inspection, (JAN, JANTX and JANTXV) herein. 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>Conditions</u>
1	1037	$V_{CB} \geq 10 V$ dc.
2	1037	The life test of step 1 shall be extended to 6,000 cycles for each die design. Samples shall be selected from a wafer lot every twelve months of wafer production, however, group B shall not be required more than once for any single wafer lot. $n = 45$ , $c = 0$ .
3	1032	High-temperature life (non-operating), $T = +200^\circ C$ . $n = 22$ , $c = 0$ .

4.4.2.3 Group B sample selection. Samples selected from group B inspection shall meet all of the following requirements:

- For JAN, JANTX, and JANTXV, samples shall be selected randomly from a minimum of three wafers (or from each wafer in the lot) from each wafer lot. For JANS, samples shall be selected from each inspection lot. See MIL-PRF-19500.
- Must be chosen from an inspection lot that has been submitted to and passed table I, subgroup 2, conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (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 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 as specified in table I, subgroup 2. Delta requirements shall be in accordance with 4.5.4 herein.

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

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
C2	2036	Test condition E.
C6	1037	Intermittent operation life (sampling plan); $V_{CB} \geq 10$ V dc, $t_{on} \geq 1$ minute, $t_{off} \geq t_{on}$ , for 6,000 cycles.

4.4.3.2 Group C inspection, table VII (JAN, JANTX, and JANTXV) of MIL-PRF-19500.

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
C2	2036	Test condition E.
* C5	3131	See 4.5.2.
C6		Not applicable.

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

\* 4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500 and as specified herein. Electrical measurements (end-points) and delta measurements shall be in accordance with the applicable steps of table I, subgroup 2 and table II herein.

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

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

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

- a.  $I_M$  measurement ..... 10 mA.
- b.  $V_{CE}$  measurement voltage ..... 16 V dc.
- c.  $I_H$  collector heating current ..... 0.5 A, minimum.
- d.  $V_H$  collector-emitter heating voltage ..... 16 V dc.
- e.  $t_H$  heating time ..... Steady-state (see method 3131 of MIL-STD-750 for definitions) or 1.0 s minimum.
- f.  $t_{MD}$  measurement delay time ..... 50 to 80  $\mu$ s.
- g.  $t_{SW}$  sample window time ..... 10  $\mu$ s maximum

4.5.3 Inspection conditions. Unless otherwise specified, all inspections shall be conducted at a case temperature of  $+25^\circ\text{C} \pm 3^\circ\text{C}$ .

4.5.4 Delta requirements. Delta requirements shall be as specified below.

Step	Inspection (1) (2) (3)	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Collector to emitter cutoff current  2N3740 2N3741	3041	Bias condition A; $V_{BE} = 1.5 \text{ V dc}$  $V_{CE} = 60 \text{ V dc}$ $V_{CE} = 80 \text{ V dc}$	$\Delta I_{CEX1}$			100 percent of initial value or 50 nA dc, whichever is greater.
2.	Forward-current transfer ratio	3076	$V_{CE} = 1 \text{ V dc};$ $I_C = 250 \text{ mA dc};$ pulsed (see 4.5.1)	$\Delta h_{FE2}$			$\pm 25$ percent change from initial reading.
3.	Saturation voltage and resistance	3071	$I_C = 250 \text{ mA dc};$ $I_B = 25 \text{ mA dc};$ pulsed (see 4.5.1)	$\Delta V_{CE(sat)1}$			50 mV dc change from initial value
4.	Thermal response (4)	3131	See 4.3.3	$\Delta V_{BE}$			

- (1) The delta measurements for table VIa (JANS) of MIL-PRF-19500 are as follows:
  - a. Subgroup 4, see 4.5.4, steps 3, 4.
  - b. Subgroup 5, see 4.5.4, steps 1, 2, 3, 4.
- (2) The delta measurements for table VIb (JANTX and JANTXV) of MIL-PRF-19500 are as follows: Subgroup 3, see 4.5.4, step 4.
- (3) The delta measurements for table VII of MIL-PRF-19500 are as follows: Subgroup 6, see 4.5.4, steps 1, 2, and 4 (JANS only).
- (4) SOA testing may be performed in lieu of thermal response testing herein provided that appropriate conditions of temperature, time, current, and voltage to achieve die attach integrity are submitted to the qualifying activity.

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TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1 2/</u>						
Visual and mechanical <u>3/</u> examination	2071	n = 45 devices, c = 0				
Solderability <u>3/ 4/</u>	2026	n = 15 leads, c = 0				
Resistance to <u>3/ 4/ 5/</u> solvent	1022	n = 15 devices, c = 0				
Temp cycling <u>3/ 4/</u>	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal <u>4/</u>	1071	n = 22 devices, c = 0				
Fine leak Gross leak						
Electrical measurements <u>4/</u>	2037	Subgroup 2 herein				
Bond strength <u>3/ 4/</u>		Precondition T <sub>A</sub> = +250°C at t = 24 hrs or T <sub>A</sub> = +300°C at t = 2 hrs, n = 11 wires, c = 0				
<u>Subgroup 2</u>						
Breakdown voltage, collector to emitter 2N3740 2N3741	3011	Bias condition D; I <sub>C</sub> = 100 mA dc; pulsed (see 4.5.1)	V <sub>(BR)CEO</sub>	60 80		V dc V dc
Collector to emitter cutoff current 2N3740 2N3741	3041	Bias condition D  V <sub>CE</sub> = 40 V dc V <sub>CE</sub> = 60 V dc	I <sub>CEO</sub>		10	μA dc
Emitter to base cutoff current	3061	Bias condition D; V <sub>EB</sub> = 7 V dc	I <sub>EBO</sub>		100	nA dc
Collector to emitter cutoff current 2N3740 2N3741	3041	Bias condition A; V <sub>BE</sub> = 1.5 V dc  V <sub>CE</sub> = 60 V dc V <sub>CE</sub> = 80 V dc	I <sub>CEX1</sub>		300	nA dc
Collector to base cutoff current 2N3740 2N3741	3036	Bias condition D  V <sub>CE</sub> = 60 V dc V <sub>CE</sub> = 80 V dc	I <sub>CBO</sub>		100	nA dc

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> -Continued						
Base emitter voltage (nonsaturated)	3066	Test condition B; $V_{CE} = 1$ V dc; $I_C = 250$ mA dc pulsed (see 4.5.1)	$V_{BE}$		1	V dc
Saturation voltage and resistance	3071	$I_C = 250$ mA dc; $I_B = 25$ mA dc pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.4	V dc
Saturation voltage and resistance	3071	$I_C = 1$ A dc; $I_B = 125$ mA dc pulsed (see 4.5.1)	$V_{CE(sat)2}$		0.6	V dc
Forward-current transfer ratio	3076	$V_{CE} = 1$ V dc; pulsed (see 4.5.1)				
		$I_C = 100$ mA dc	$h_{FE1}$	40		
		$I_C = 250$ mA dc	$h_{FE2}$	30		
		$I_C = 500$ mA dc	$h_{FE3}$	20	120	
		$I_C = 1$ A dc	$h_{FE4}$	10		
Forward-current transfer ratio	3076	$V_{CE} = 5$ V dc; $I_C = 4$ A dc pulsed (see 4.5.1)	$h_{FE5}$	3		
<u>Subgroup 3</u>						
High temperature operation:		$T_A = +150^\circ\text{C}$				
Collector to emitter cutoff current 2N3740 2N3741	3041	Bias condition A, $V_{BE} = 1.5$ V dc  $V_{CE} = 60$ V dc $V_{CE} = 80$ V dc	$I_{CEX2}$		25	$\mu\text{A}$ dc
Low temperature operation:	3076	$T_A = -55^\circ\text{C}$				
Forward-current transfer ratio		$V_{CE} = 1$ V dc; $I_C = 250$ mA dc pulsed (see 4.5.1)	$h_{FE6}$	10		
<u>Subgroup 4</u>						
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CE} = 10$ V dc; $I_C = 50$ mA dc; $f = 1$ kHz	$h_{fe}$	25	250	
Small-signal short-circuit forward-current transfer ratio	3306	$V_{CE} = 10$ V dc; $I_C = 100$ mA dc; $f = 5$ MHz	$ h_{fe} $	1	12	
Open circuit output capacitance	3236	$V_{CB} = 10$ V dc; $I_E = 0$ ; $100$ KHz $\leq f \leq 1$ MHz	$C_{obo}$		100	pF

See footnotes at end of table.

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TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4</u> - Continued						
Pulse response						
Turn-on time		$I_C = 1 \text{ A dc}; I_{B1} = 0.1 \text{ A dc}$ (see figure 4)	$t_{on}$	400		ns
Turn-off time		$I_C = 1 \text{ A dc}; I_{B1} = I_{B2} = 0.1 \text{ A dc}$ (see figure 4)	$t_{off}$	1		$\mu\text{s}$
<u>Subgroup 5</u>						
SOA (continuous dc)	3051	$T_C = +25^\circ\text{C}$ ; power application time = 1 s; 1 cycle (see figure 5)				
Test 1		$V_{CE} = 6.25 \text{ V dc}; I_C = 4 \text{ A dc}$				
Test 2		$V_{CE} = 20 \text{ V dc}; I_C = 1.25 \text{ A dc}$				
Test 3		$I_C = 150 \text{ mA dc}$				
2N3740		$V_{CE} = 50 \text{ V dc}$				
2N3741		$V_{CE} = 65 \text{ V dc}$				
SOA (clamped switching)		$T_A = +25^\circ\text{C}$ ; $V_{CC} = 15 \text{ V dc}$ ; duty cycle $\leq 5$ percent, $t_p = 1.5 \text{ ms}$ (vary to obtain $I_C$ ), $I_C = 4 \text{ A dc}$ (see figures 6 and 7)				
2N3740 2N3741		Clamp voltage = 60 V dc Clamp voltage = 80 V dc				
End-point electrical measurements		See table I, subgroup 2 herein.				
SOA (switching)	3053	Load condition C (unclamped inductive) (see figure 8); $T_A = +25^\circ\text{C}$ ; duty cycle $\leq 5$ percent, $R_S = 0.1\Omega$ ; $t_r = t_f \leq 500 \text{ ns}$ ; $R_{BB1} = 50 \Omega$ ; $V_{BB1} = 10 \text{ V dc}$ ; $R_{BB2} = \infty$ ; $V_{BB2} = 0$ ; $V_{CC} \geq 20 \text{ V dc}$				
Test 1		$t_p = 375 \mu\text{s}$ (vary to obtain $I_C$ ); $I_C = 1 \text{ A dc}$ ; $L = 5 \text{ mH}$ (min) at 1 A with maximum dc resistance of 0.5 $\Omega$ . For reference only: 2 ESSEX Stancor C-2688 (in parallel), or equivalent.				

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 5</u> - Continued						
Test 2		$t_p = 1.5$ ms (vary to obtain $I_C$ ); $I_C = .25$ A dc; L = 80 mH (min) at .25 A with a maximum dc resistance of 1 $\Omega$ . For reference only. ESSEX Stancor C-2691 or Triad C = 48				
<u>Subgroup 5</u>						
SOA (clamped switching) (destructive)		$T_A = +25^\circ\text{C}$ ; $V_{CC} = 55$ V dc (see figures 6 and 7); duty cycle $\leq 5$ percent, $t_p = 1.5$ ms (vary to obtain $I_C$ ); $I_C = 4$ A dc				
2N3740 2N3741		Clamp voltage = 60 V dc Clamp voltage = 80 V dc				
End-point electrical measurements		See table I, subgroup 2 herein.				
<u>Subgroups 6 and 7</u>						
Not applicable						

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.

3/ Separate samples may be used.

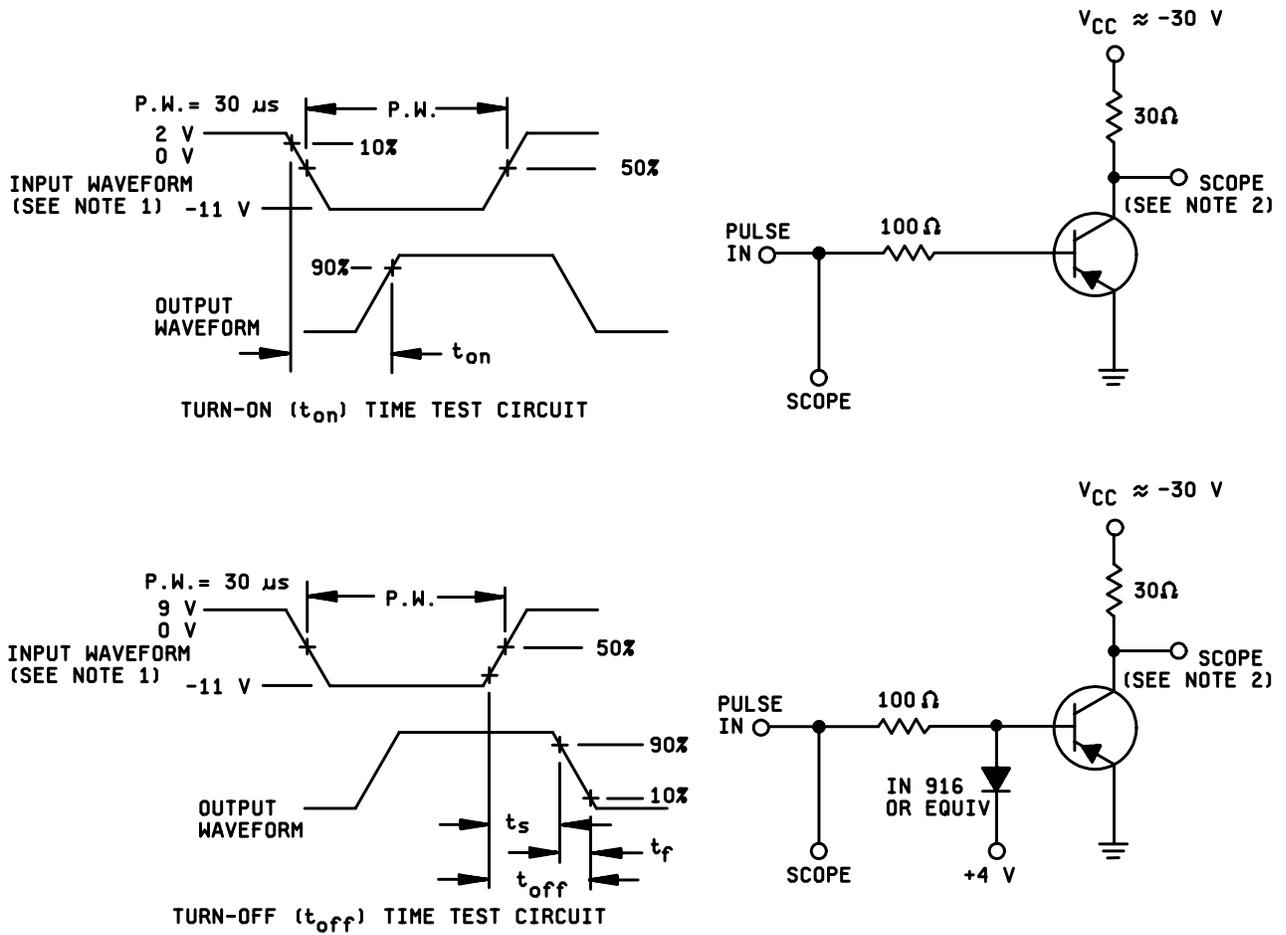
4/ Not required for JANS.

5/ Not required for laser marked devices.

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

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
* <u>Subgroup 1</u>			
Temperature cycling (air to air)	1051	Test condition C, 500 cycles	45 devices c = 0
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table I, subgroup 2 herein.	
* <u>Subgroup 2</u>			
Intermittent life	1037	V <sub>CB</sub> = 10 V dc, 6,000 cycles.	45 devices c = 0
Electrical measurements		See table I, subgroup 2 herein.	
<u>Subgroups 3, 4, 5, 6, and 7</u>			
Not applicable			
* <u>Subgroup 8</u>			
Reverse stability	1033	Condition A for devices ≥ 400 V dc. Condition B for devices < 400 V dc.	45 devices c = 0



NOTES:

1. The rise time ( $t_r$ ) of the applied pulse shall be  $\leq 20$  ns; duty cycle  $\leq 2$  percent; generator source impedance shall be 50  $\Omega$ .
2. Output sampling oscilloscope:  $Z_{in} \geq 100$  k $\Omega$ ;  $C_{in} \leq 12$  pF; rise time  $\leq 2$  ns.

FIGURE 4. Pulse response test circuits.

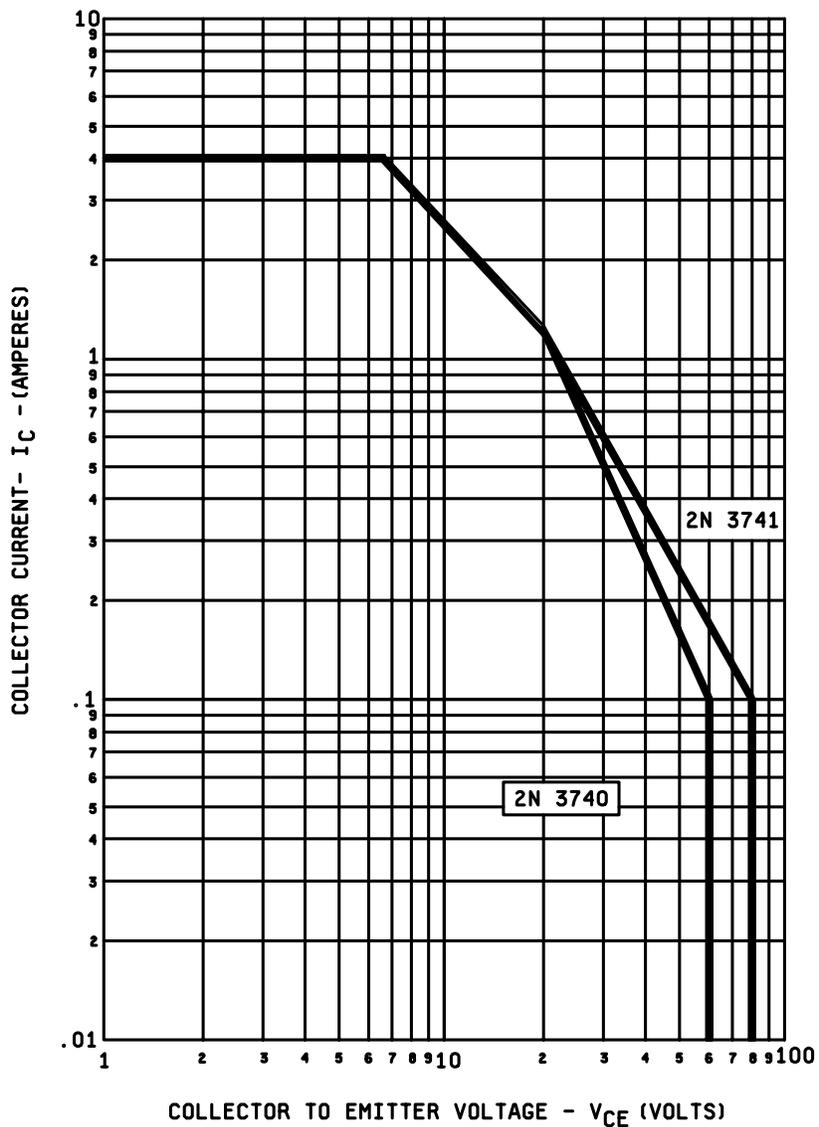
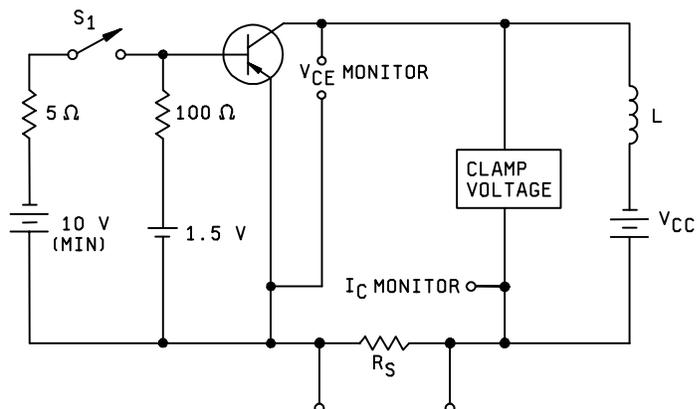


FIGURE 5. Maximum SOA graph (continuous dc).



$R_S \leq .1\Omega$  12W; 1 percent tolerance maximum (noninductive).

$L = 5$  mH at 4 A with a maximum dc resistance of 0.5  $\Omega$ .  
Reference only: 2 ESSEX Stancor C-2688 (in parallel), or equivalent.

Procedure

1. With switch  $S_1$  closed, set the specified test conditions.
2. Open  $S_1$ . Device fails if the clamp voltage is not reached.
3. Perform specified end-point tests.

FIGURE 6. Clamped inductive sweep test circuit.

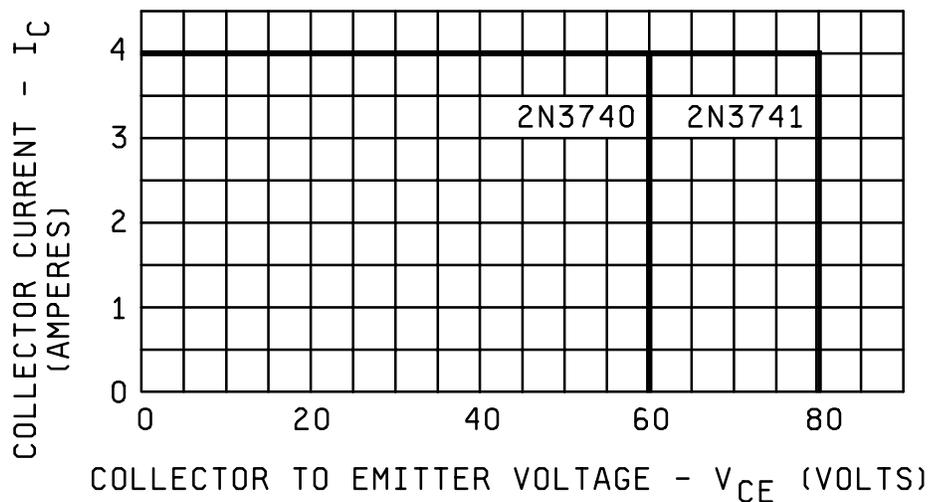


FIGURE 7. SOA for switching between saturation and cutoff (clamped inductive load).

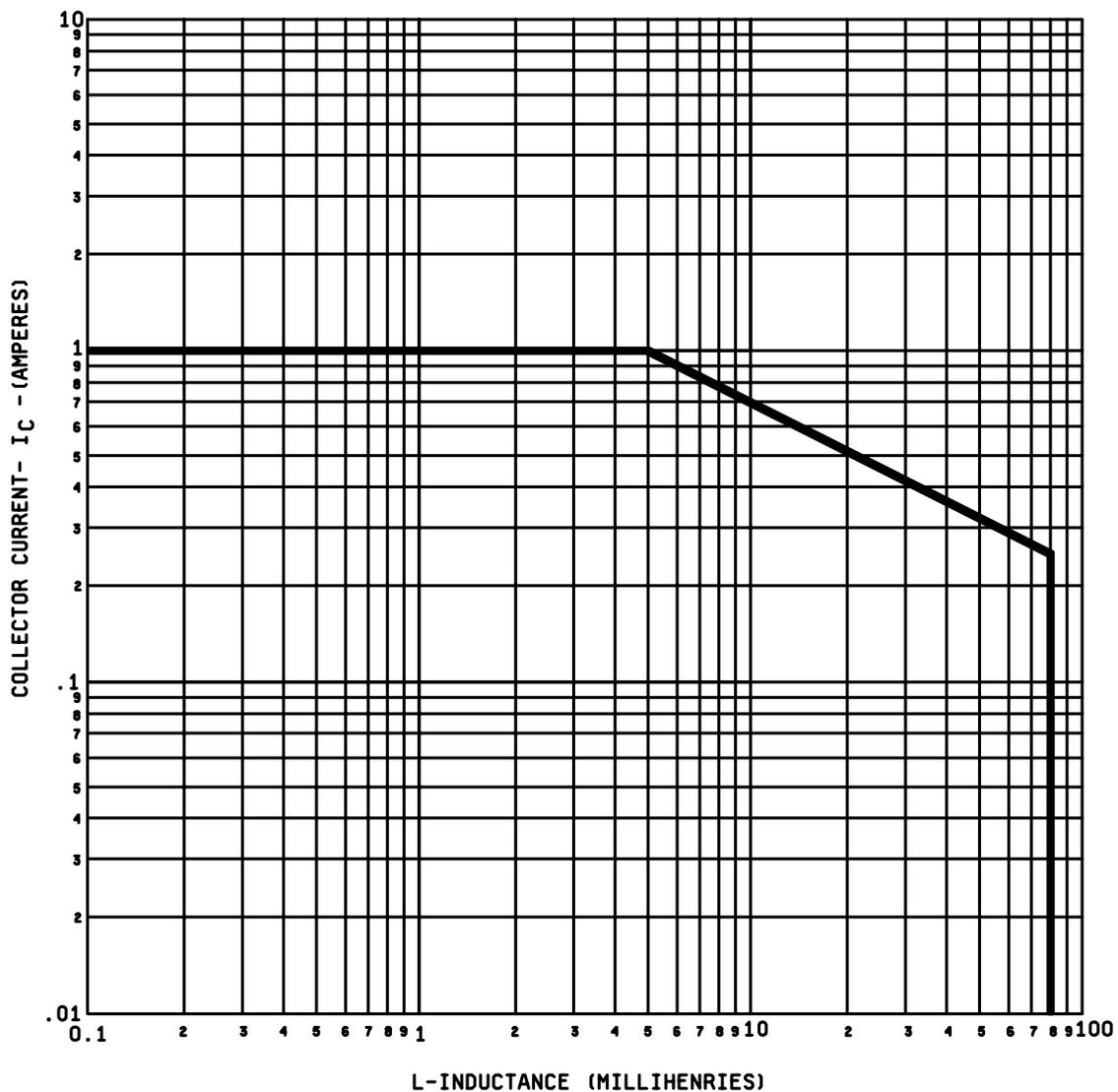


FIGURE 8. Safe operating area for switching between saturation and cutoff (unclamped inductive load).

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 2.2).
- c. Lead finish as specified (see 3.4.1).
- d. Product assurance level and type designator.
- 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 Manufacturer 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 and JANKC die. The qualified JANHC and JANKC suppliers with the applicable letter version (example, JANHCA3740) will be identified on the QML.

JANC ordering information		
PIN	Manufacturer	
	33178	43611
2N3740	JANHCA2N3740	JANHCB2N3740
2N3740	JANKCA2N3740	JANKCB2N3740
2N3741	JANHCA2N3741	JANHCB2N3741
2N3741	JANKCA2N3741	JANKCB2N3741

\* 6.5 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

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

Review activities:

Army - AV, MI, SM  
Navy - AS, MC  
Air Force - 19, 71, 99

Preparing activity:

DLA - CC

(Project 5961-2582)

**STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL**

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2. The submitter of this form must complete blocks 4, 5, 6, and 7.
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<b>I RECOMMEND A CHANGE:</b>	1. DOCUMENT NUMBER	2. DOCUMENT DATE
	MIL-PRF-19500/441G	4 December 2002

**3. DOCUMENT TITLE**  
SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, POWER TYPES 2N3740 AND 2N3741, 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)	7. DATE SUBMITTED
	COMMERCIAL DSN FAX EMAIL	

8. PREPARING ACTIVITY

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