The documentation and process conversion measures necessary to comply with this document shall be completed by 24 October, 2003.

INCH-POUND

MIL-PRF-19500/694A
24 August 2003
SUPERSEDING
MIL-PRF-19500/694
30 April 2001

PERFORMANCE SPECIFICATION

-

SEMICONDUCTOR DEVICE, TRANSISTOR, PLASTIC, NPN,
SILICON, SWITCHING, TYPE 2N3700UE1,
JAN, JANTX, JANJ

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 plastic NPN, silicon, switching transistors. Three levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1, SOT-23 (similar to TO-236AB).

* 1.3 Maximum ratings.

Types	P_T T_A =+25°C (1) (2)	I_C	V_{CBO}	V_{CEO}	V_{EBO}	T_J and T_{STG}	$R_{\theta JA}$
	mW	A	V	V	V	°C	°C/W
2N3700UE1	500	1	140	80	7	-55 to +150	560 (2)

(1) If the printed wiring board is made of alumina substrate; alumina = 0.4 x 0.3 x 0.024 inch (10.16 X 7.62 X 0.61 mm, 99.5 percent alumina: Derate linearly 2.4 mW/°C for T_A > +25°C.
(2) If the printed wiring board is made of FR5 substrate; FR5 = 1.0 (25.4 mm) x 0.75 (19.05 mm) x 0.062 (1.57 mm) in. Derate linearly 1.8 mW/°C for T_A > +25°C. See derating curve, figure 2.

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

AMSC N/A FSC 5961

1.4 Primary electrical characteristics at T_A = +25°C.

Limits	h_{FE1} V_{CE} = 10 V dc I_C = 150 mA dc	h_{FE2} V_{CE} = 10 V dc I_C = 0.1 mA dc	h_{FE3} (1) V_{CE} = 10 V dc I_C = 10 mA dc	$\|h_{fe}\|$ V_{CE} = 10 V dc I_C = 50 mA dc f = 20 MHz	$V_{CE(sat)1}$ (1) I_C = 150 mA dc I_B = 15 mA dc
					V dc
Min	100	50	90	5	
Max	300	200		20	0.20

(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 there to, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

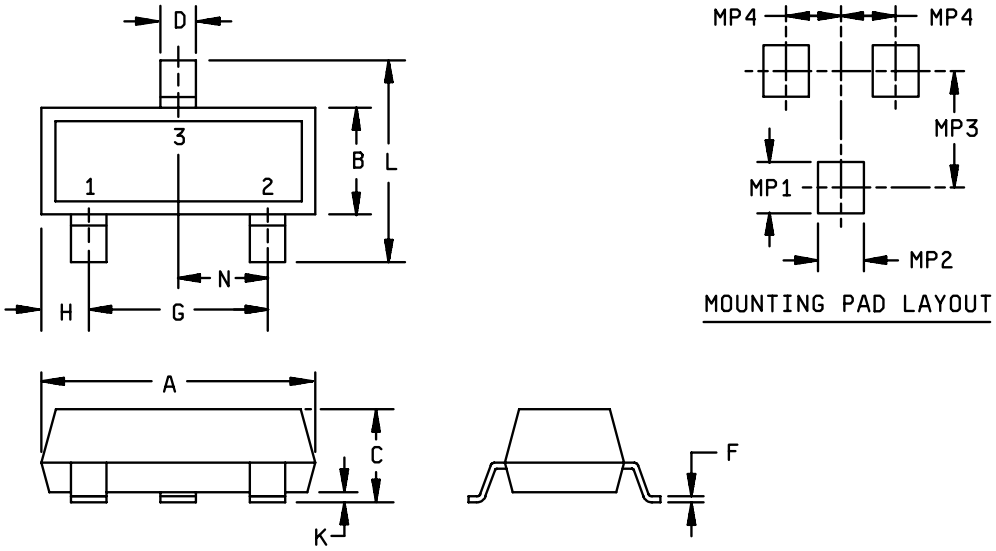
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

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.)



NOTES:
1. All dimensions are in inches.
2. Millimeters given for general information only.
3. Terminal numbers are shown for reference.
   1 = Base, 2 = Emitter, 3 = Collector

Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.110	.123	2.8	3.1
B	.051	.057	1.32	1.43
C	.037	.046	0.95	1.15
D	.015	.017	0.39	0.41
F	.005	.007	0.125	0.175
G	.074	.076	1.88	1.92
H	.018	.024	0.46	0.59
K	0	.004	0	0.1
L	.094	.103	2.4	2.6
N	.037	.038	0.94	0.96
MP1	.035	.036	0.89	0.91
MP2	.031	.032	0.79	0.81
MP3	.078	.080	1.99	2.01
MP4	.037	.038	0.94	0.96

FIGURE 1. Physical dimensions (SOT-23, similar to TO-236).

2.3 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

JEDEC Standard 20	-	Moisture Reflow Sensitivity Classification for Surface Mount Devices.
JESD22-A101	-	Steady State Temperature Humidity Bias Life Test.
JESD22-A102	-	Autoclave.
JESD22-A103	-	High temperature storage life.
JESD22-A113	-	Preconditioning.

(Applications for copies should be addressed to the Electronics Industries Association (EIA), 2500 Wilson Boulevard, Arlington, VA 22201-3834.)

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents may also be available in or through libraries or other informational services.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

* 3.1 General. The 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 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 and as follows.

FIT - Failure in time.
UE1 - Unleaded encapsulated plastic over epoxy wire bonded frame (non-hermetic).

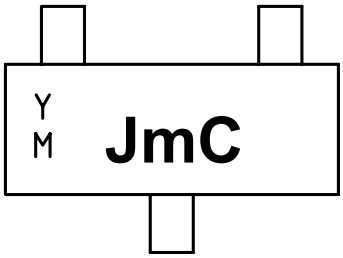
3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and figure 1 herein.

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 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 group A as specified herein.

3.7 Marking. Marking shall be in accordance with MIL-PRF-19500, except as specified herein. The part marking shall consist of an abbreviated date code (Y, M), JAN brand (J), manufacturer code (m), and part number code (C) due to space limitations as shown below.



3.7.1 Date code. The date code shall be as follows:

a. 1st character: Designator of the manufacturing year, where Y will be "M" through "Z" to indicate the year. The sequence starts back at "A" after the year 2011. This sequence will repeat every 24 years. Letters "I" and "O" will not be used.

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
M	N	P	R	S	T	U	V	W	X	Y	Z	A

b. 2nd character: Designator of the manufacturing month, where M will be "1" through "D" to indicate the month.

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	2	3	4	5	6	7	8	9	O	N	D

3.7.2 JAN brand. The "J" denotes the JAN brand. Refer to the certificate of conformance or unit packaging for quality assurance level.

3.7.3 Manufacturers code. The "m" (which will progress: A, B, C, etc.) denotes the manufacturer. The letter "A" is assigned to manufacturer CAGE code 14936. Contact the preparing activity for new letter assignments.

3.7.4 Part code. The 'C' is the part number code on a TO-236AB (SOT-23) for a 2N3700UE1.

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, and table I, table II, and table III).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.

4.2.1 JANJ qualification. For JANJ qualification, 4.4.2.1 herein shall be performed as required by the qualifying activity.

4.2.2 JANJ devices. For JANJ level, 3.3.1 through 3.3.1.3 of MIL-PRF-19500 shall apply, except as modified herein. Supplier imposed requirements as well as alternate screens, procedures, and/or controls shall be documented in the QM plan and must be submitted to the qualifying activity for approval. When alternate screens, procedures, and/or controls are used, in lieu of the JANJ screens herein equivalency shall be proven and documented in the QM plan. Radiation characterization may be submitted in the QM plan at the option of the manufacturer, however, 3.3.1.1 of MIL-PRF-19500 is not required. Die lot control and rework for JANJ shall be in accordance with the JANS requirements of 3.13 and D3.13.2.1 of MIL-PRF-19500. Lot formation and conformance inspection requirements for JANJ shall be those used for JANTXV devices as a minimum.

4.3 Screening (JANJ, JANTX). For appendix D qualified suppliers, 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. For appendix C qualified suppliers (QML), and for JANJ, refer to QM plan for screening requirements. The level of screening for screens 3a, 10, and 12 will be determined based on the reliability FIT (failure in time) level (see 4.3.1).

Screen (see table IV of MIL-PRF-19500)	Measurement		
	JANS level (for reference only)	JANJ level	JANTX level
1a	Required	Required	Not required
1b	Required	Required	Not required
2	Not required	Not required	Not required
3a	Required	Required	Required
3b	Not applicable	Not applicable	Not applicable
(1) 3c	Thermal impedance (see 4.3.3)	Thermal impedance (see 4.3.3)	Thermal impedance (see 4.3.3)
4	Not applicable	Not applicable	Not applicable
5	Not applicable	Not applicable	Not applicable
6	Not applicable	Not applicable	Not applicable
7a	Not applicable	Not applicable	Not applicable
7b	Not applicable	Not applicable	Not applicable
8	Required	Wafer level traceability	Not required
9	I_{CES1} and h_{FE1}	I_{CES1} and h_{FE1}	Not applicable
10	Method 1039 of MIL-STD-750, condition A, 48 hrs minimum	Method 1039 of MIL-STD-750, condition A, 48 hrs minimum	Method 1039 of MIL-STD-750, condition A, 48 hrs minimum
11	I_{CES1}; h_{FE1}; ΔI_{CES1} = 100 percent of initial value or +5 nA dc, whichever is greater; $\Delta h_{FE1} = \pm 15$ percent.	I_{CES1}; h_{FE1}; ΔI_{CES1} = 100 percent of initial value or +5 nA dc, whichever is greater; $\Delta h_{FE1} = \pm 15$ percent.	I_{CBO2}, h_{FE4}
12	Required 240 hours minimum See 4.3.2	Required 240 hours minimum See 4.3.2	Required 80 hours minimum See 4.3.2
13a	Subgroup 2 of table I herein; ΔI_{CES1} = 100 percent of initial value or +5 nA dc, whichever is greater; $\Delta h_{FE1} = \pm 15$ percent.	Subgroup 2 of table I herein; ΔI_{CES1} = 100 percent of initial value or +5 nA dc, whichever is greater; $\Delta h_{FE1} = \pm 15$ percent.	Subgroup 2 of table I herein; ΔI_{CBO2} = 100 percent of initial value or +5 nA dc, whichever is greater; $\Delta h_{FE2} = \pm 15$ percent
13b	Group A, subgroup 3	1) 100 percent in-line electricals at 85°C.	Not required
		2) Group A, subgroup 3, high temp, 100 percent.	
		3) Group A, subgroup 3, low temp, n = 116, c = 0.	
14a	Not applicable	Not applicable	Not applicable
14b	Not applicable	Not applicable	Not applicable
15	Required	Required	Not required
16	Required	Required	Not required

(1) Thermal impedance shall be performed any time after screen 3.

* 4.3.1 QML JANTX, JANJ screening requirements. The level of screening will be determined by demonstration of reliability performance. The reliability models and methods will be in accordance with the models below. The table below will be used to determine the level of screening for the individual screens based on the reliability performance. NOTE: Each screen test will be determined individually by the reliability performance demonstrated. As an example there can be a demonstrated performance of temperature cycle to a level below $< 6x10^{-9}$ which would result in a screen of the group B temperature cycle test at a n = 116, c = 0, but the HTRB (high temperature reverse bias) may only demonstrate a reliability level of ≤ 10, > 1, which would require a screen of group B, n = 500, c = 0. Confidence level will be 60 percent.

Screen test	Reliability model (1) (2) (3)	Constants for model	Unit of measure	Level	Screen level
Temp cycle 3a	Coffin Manson	M = 4 <T use = 55°C	Failure / cycle	$> 6x10^{-8}$	4.3, screening 100 percent (JANJ, JANTX)
				$\leq 6x10^{-8}$, $> 6x10^{-9}$	Group B, n = 500, c = 0
				$< 6x10^{-9}$	Group B, n = 116, c = 0
HTRB 10	Arrhenious	Ea = .7 T_J use = 55°C	FIT	> 10	4.3, screening 100 percent (JANJ, JANTX)
				$\leq 10, > 1$	Group B, n = 500, c = 0
				< 1	Group B, n = 116, c = 0
OP Life 12	Arrhenious	Ea = .7 T_J use = 55°C	FIT	> 10	4.3, screening 100 percent (JANJ, JANTX)
				$\leq 10, > 1$	Group B, n = 500, c = 0
				< 1	Group B, n = 116, c = 0
13b	Group A, subgroup 3 will be in accordance with 4.3, screening table for JANJ				

(1) Thermal Effects (Arrhenius):

$$A_f = \exp\left[\frac{E_a}{k} \bullet \left(\frac{1}{T_u} - \frac{1}{T_t}\right)\right]$$

T_u = use environment junction temperature (in °K).
T_t = test environment junction temperature (in °K).
A_f = acceleration factor.
k = Boltzman's Constant (8.6171 x 10^{-5} eV).
E_a = activation energy, typical value for a given failure mechanism or derived from empirical data.

(2) Thermo-mechanical Effects (Coffin-Manson):

$$A_f = \left(\frac{\Delta T_t}{\Delta T_u}\right)^m$$

A_f = acceleration factor.
ΔT_t = thermal cycle temperature change in the test environment.
ΔT_u = thermal cycle temperature change in the use environment.
m = constant, typical value for a given failure mechanism or derived from empirical data.

(3) Failure Rate Estimating Methodology:

$$\lambda = \frac{\chi^2(\alpha, d.f.)}{2 \bullet A_f \bullet t} \bullet 10^9$$

λ = failure rate (Failures-In-Time).
χ^2 = chi-square function.
α = (100 - confidence level) / 100.
d.f. = (2n + 2) degrees of freedom.
n = number of failures.
A_f = acceleration factor.
t = (sample size x total test time) device-hours .

4.3.2 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; 2N3700UE1: V_{CB} = 10 - 30 V dc, power shall be applied to achieve a T_J of +135°C minimum and a minimum power dissipation of 75 percent of rated P_T as defined in 1.3.

4.3.3 Thermal impedance measurements, (delta V_{be}). One hundred percent screening in accordance with method 3131 of MIL-STD-750.

a. I_M measurement current ----------5 mA.

b. I_H forward heating current ----------200 mA minimum.

c. t_H heating time ----------20 - 30 ms.

d. t_{md} measurement delay time ----------5 ms maximum.

e. V_{CE} collector-emitter voltage during heating----------10 V dc.

The delta V_{be} limits are fixed to 100 mV minimum and 200 mV maximum.

4.4 Conformance inspection. For appendix D qualified suppliers, conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein. For appendix C qualified suppliers (QML), and for JANJ, refer to QM plan for “On-Going Reliability Monitor Requirements”.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and table I herein. Separate samples may be used for each subgroup.

* 4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified in 4.4.2.1 for JAN, JANTX, and JANJ and as follows. Electrical measurements (end-points) for JAN, JANTX and JANJ shall be as specified below. Delta requirements shall be as specified below and shall be the steps of table III herein. Separate samples may be used for each step, however, preconditioning shall be performed on each sample.

Step	Method	Condition
0		Preconditioning: a.-Dipping of devices in a perfluoropolyter liquid: 10 sec. +150°C 2 times. b.-Rinse of devices in deionized water. c.-Dry of the devices at $T_{A.}$
	1051	d.-Thermal cycle: condition G, 100 cycles.
1	2026	Solderability: n = 15, c = 0.
2	1051	Temp. cycle: Condition G, 25 cycles, n = 15, c = 0.
3	JESD22-A102	Autoclave: Condition C, 96 hours, n = 15, c = 0.
4	2031	Soldering heat: T = +260°C, 10 sec., n = 20, c = 0.
5		PCB simulation.
6	1039	Steady-state operation life: Condition B, T_J = +135°C minimum, 340 hrs, 20 V, 13.6mA, T_A = +45°C. n = 45, c = 0.
7	1039	HTRB: Condition A, +150°C minimum, 168 hours minimum, 80V, n = 45, c = 0.
	Electrical measurements	Table I, subgroup 2.
	Delta shift	See table III.

4.4.2.1 Group B sample selection. 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. Samples selected for group B inspection for JAN and JANTX shall be selected randomly from a minimum of three wafers (or from each wafer in the lot). JANJ samples will be from each wafer. When the QML screening option is used, (see 4.3.1) the tests used will replace the tests in group B, but the remainder of group B will be performed.

4.4.3 Group C inspection, JAN, JANTX, and JANJ. Group C inspection (JAN, JANTX, and JANJ) shall be as specified in 4.4.3.1 and shall include tests which are performed periodically. Group C test on each structurally identical device grouping shall be performed on devices from each three months production (once per quarter) of devices (based on inspection lot identification codes) for each assembly location and die attach method. When there is a JANJ lot available the JANJ lot will be selected for the sample. Electrical measurements (end-points) shall be as specified below and in accordance with table I, subgroup 2 herein. Delta requirements shall be as specified below and shall be the steps of table III herein. The sample size for each of these steps is: 45 devices, c = 0. Separate samples may be used for each step, however, preconditioning shall be performed on all samples. For rules on resubmission for failed steps, see MIL-PRF-19500 rules on resubmission of failed subgroups.

4.4.3.1 Group C inspection, (JAN, JANTX, JANJ).

Step	Method	Condition
0		Preconditioning: a.-Dipping of devices in a perfluoropolyter liquid: 10 sec. +150°C 2 times. b.-Rinse of devices in deionized water. c.-Dry of the devices at $T_{A.}$
	1051	d.-Thermal cycle: condition G, 100 cycles.
1	JESD22-A103	Low temp storage (substitute low temperature condition): -50°C, 1,000 hours.
2	1051	Temp. cycle: condition G, 1,000 cycles.
3	JESD22-A102	Autoclave: condition C, 96 hours.
4	JESD22-A101	Moisture resistance (85/85 biased): 50V.
5		PCB simulation.
6	1039	Steady-state operation life: Condition B, T_J = +150°C minimum, 1,000 hrs, 32V, 10 mA, T_A = +45°C.
7	1039	HTRB: Condition A, +150°C, 1,000 hours, 80 V.
	Electrical measurements	Table I, subgroup 2.
	Delta shift	See table III.

4.4.3.2 Group C sample selection. Samples for subgroups in group C shall be in accordance with MIL-PRF-19500.

4.4.4 Group E Inspection. Group E inspection shall be performed for qualification or re-qualification only. The tests specified in table II herein must be performed to maintain qualification. Subgroup 7 and 8 are for characterization of the devices and have no pass or fail criteria. These subgroups are intended for user information only. Separate samples may be used for each subgroup, however, preconditioning shall be performed on all samples.

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.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Resistance to solvents 3/	1022	15 devices, c = 0				
Subgroup 2						
Collector to base cutoff current	3036	Bias condition D; V_{CB} = 140 V dc	I_{CBO1}		10	μA dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = 7 V dc	I_{EBO1}		10	μA dc
Collector to emitter breakdown voltage	3011	Bias condition D; I_C = 30 mA dc pulsed (see 4.5.1)	$V_{(BR)CEO}$	80		V dc
Collector to emitter cutoff current	3041	Bias condition C; V_{CE} = 90 V dc	I_{CES1}		10	nA dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = 5 V dc	I_{EBO2}		10	nA dc
Forward current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 150 mA dc; pulsed (see 4.5.1)	h_{FE1}	100	300	
Forward current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 0.1 mA dc	h_{FE2}	50	200	
Forward current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 10 mA dc; pulsed (see 4.5.1)	h_{FE3}	90		
Forward current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 500 mA dc; pulsed (see 4.5.1)	h_{FE4}	50	200	
Forward current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 1 A dc; pulsed (see 4.5.1)	h_{FE5}	15		
Collector to emitter voltage (saturated)	3071	I_C = 150 mA dc; I_B = 15 mA dc pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.2	V dc

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 2 - Continued						
Collector to emitter voltage (saturated)	3071	I_C = 500 mA dc; I_B = 50 mA dc pulsed (see 4.5.1)	$V_{CE(sat)2}$		0.5	V dc
Base to emitter voltage (saturated)	3066	Test condition A; I_C = 150 mA dc; I_B = 15 mA dc; pulsed (see 4.5.1)	$V_{BE(sat)}$		1.1	V dc
Subgroup 3						
High-temperature operation		T_A = +150°C				
Collector to emitter cutoff current	3041	Bias condition C; V_{CE} = 90 V dc	I_{CES2}		10	μA dc
Low-temperature operation		T_A = -55°C				
Forward current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 150 mA dc; pulsed (see 4.5.1)	h_{FE6}	40		
Subgroup 4						
Small-signal short- circuit forward-current transfer ratio	3206	V_{CE} = 5 V dc; I_C = 1 mA dc, f = 1 kHz	h_{fe}	80	400	
Magnitude of small-signal short-circuit forward-current transfer ratio	3306	V_{CE} = 10 V dc; I_C = 50 mA dc; f = 20 MHz	$\lvert h_{fe} \rvert$	5	20	
Input capacitance (output open circuited)	3240	V_{EB} = 0.5 V dc; I_C = 0; 100 kHz ≤ f ≤ 1 MHz	C_{ibo}		60	pF
Open circuit output capacitance	3236	V_{CB} = 10 V dc; I_E = 0; 100 kHz ≤ f ≤ 1 MHz	C_{obo}		12	pF
Noise figure	3246	V_{CE} = 10 V dc; I_C = 100 μA dc; R_g = 1 kΩ; Power bandwidth = 200 Hz	NF		4	dB
Collector to base time constant		V_{CB} = 10 V dc; I_C = 10 mA dc; f = 79.8 MHz (see 4.5.2)	$r'_b C_c$		400	ps
Pulse response		See figure 3	$t_{on} + t_{off}$		30	ns
Subgroups 5,6 and 7						
Not applicable						

1/ For sampling plan see MIL-PRF-19500.
2/ For resubmission of failed subgroup 1, double the sample size of the failed test or sequence of tests. A failure in table I, subgroup 1 shall not require retest of the entire subgroup. Only the failed test shall be rerun upon submission.
3/ Not required for laser marked parts.

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

Inspection	MIL-STD-750 (unless otherwise noted)		Qualification
	Method	Conditions	
Preconditioning	JESD22-A113 1/	Level 1	All
Subgroup 1			
Temperature cycling (air to air)	1051	Test condition G, 1000 cycles	n = 77, c = 0
Electrical measurements		See table I, subgroup 2.	
Subgroup 2 2/			
Steady-state operation life	1039	1,000 hours, condition B.	n = 77, c = 0
Electrical measurements		See table I, subgroup 2.	
Subgroup 2A 2/			
HTRB	1039	1,000 hours, condition A.	n = 77, c = 0
Electrical measurements		See table I, subgroup 2.	
Subgroup 2B 2/			
Intermittent life	1037	Intermittent operation life: V_{CB} = 10 V dc, 15,000 cycles, $\Delta T_J \geq +100°C$; forced air cooling allowed on cooling cycle only.	n = 77, c = 0
Electrical measurements		See table I, subgroup 2.	
Subgroups 3			
DPA	2102		3 devices c = 0
Subgroup 4			n = 77, c = 0
Moisture resistance	JESD22-A101 1/	1,000 hours	
Electrical measurements		See table I, subgroup 2.	
Subgroup 4b			n = 77, c = 0
Autoclave	JESD22-A102 1/	96 hours	
Electrical measurements		See table I, subgroup 2.	
Subgroup 5			
Thermal resistance	3131	See figures 4 and 5.	n = 10, c = 0
Subgroup 6			3 devices c = 0
ESD	1020		

See footnotes at end of table.

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

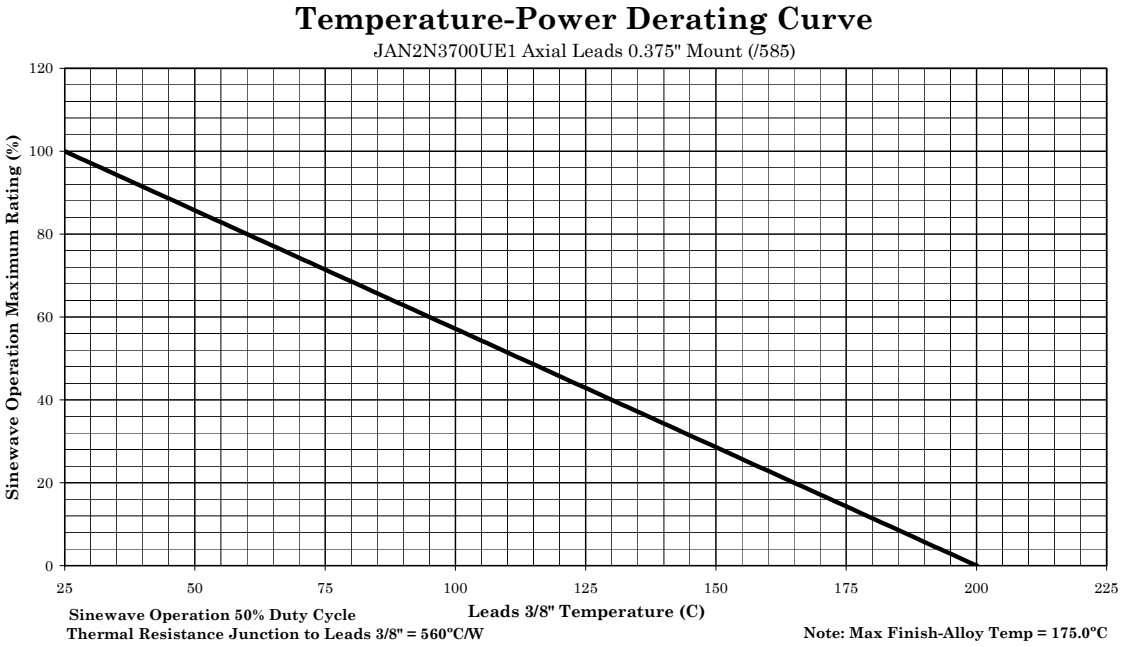
Inspection	MIL-STD-750 (unless otherwise noted)		Qualification
	Method	Conditions	
Subgroup 7			
Moisture reflow sensitivity classification for surface mount devices	J-STD-20 1/		n = 100
Subgroup 8			n = 25 for 3 lots
Parametric characterization	Table I, subgroup 2	-50°C, 25°C, +100°C	

1/ Non-Government standard document, see 2.3.
2/ Subgroups 2, 2A, and 2B do not need to be performed sequentially.

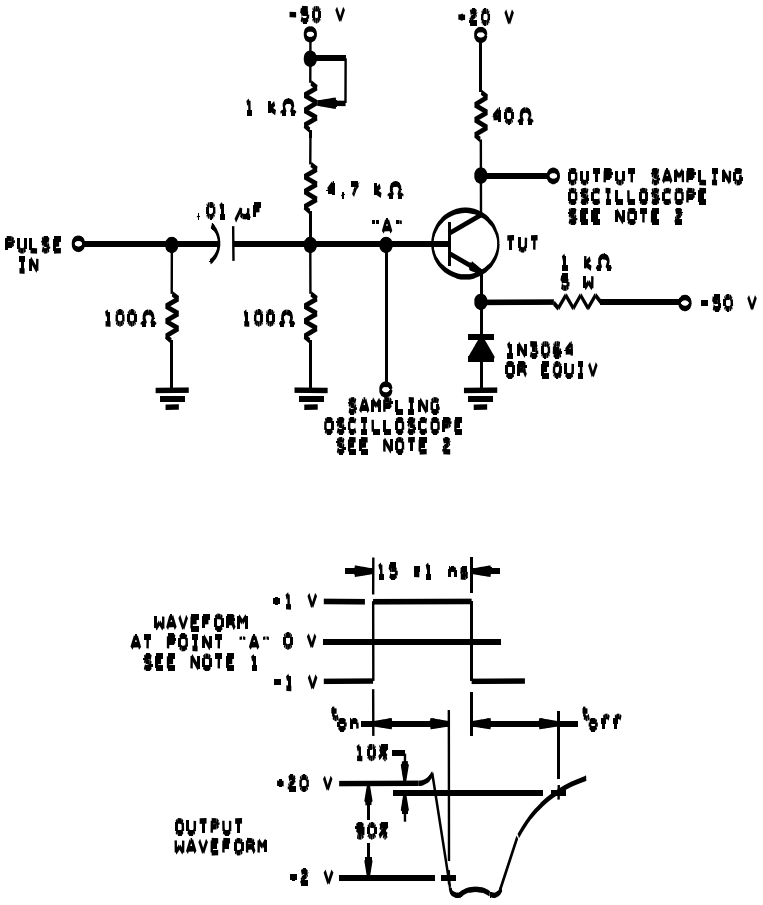
TABLE III. Groups B and C delta measurements.

Step	Inspection	MIL-STD-750		Symbol	Limit
		Method	Conditions		
1.	Collector-emitter cutoff current	3036	Bias condition C, V_{CE} = 90 V dc	ΔI_{Ces1} 1/	Pre-test distribution to average +3σ and -3σ. Post-test distribution to average +4σ and -4σ of the pre-test results
2.	Forward current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 150 mA dc; pulsed see 4.5.1	Δh_{FE1} 1/	Pre-test distribution to average +3σ and -3σ. Post-test distribution to average +4σ and -4σ of the pre-test results

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



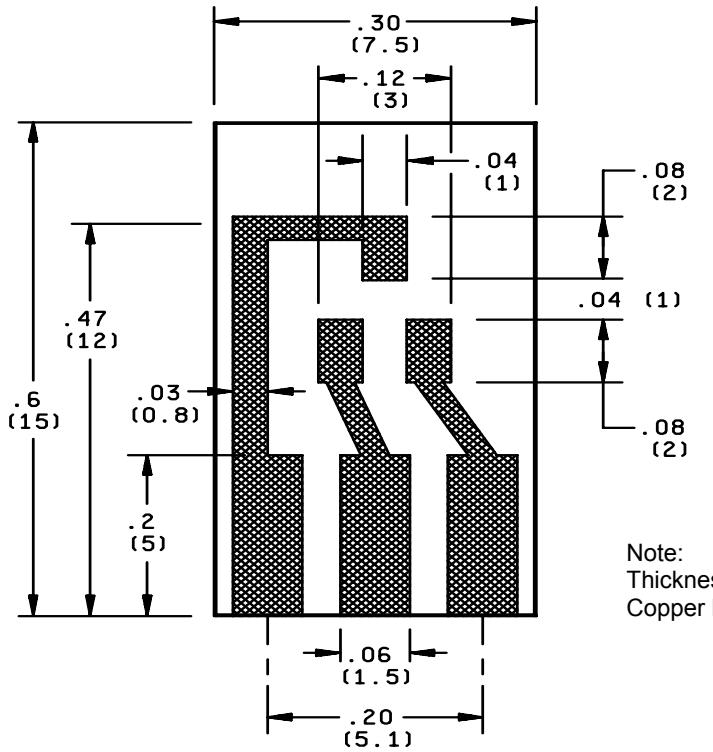
* FIGURE 2. Derating for 2N3700UE1 (SOT-23 similar to TO-236).



NOTES:

1. The rise time (t_r) of the applied pulse shall be ≤ 2.0 ns, duty cycle ≤ 2 percent and the generator source impedance shall be 50 ohms.
2. Sampling oscilloscope: $Z_{IN} \geq 100$ kΩ, $C_{IN} \leq 12$ pF, rise time ≤ 2.0 ns.

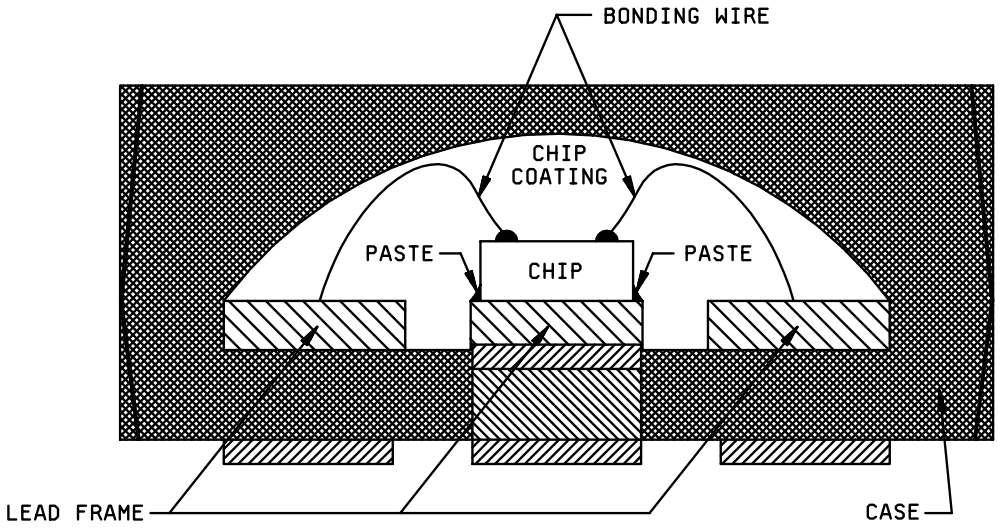
FIGURE 3. Nonsaturated switching-time test circuit.



Note:
Thickness: 1.5 mm (0.059 in)
Copper leads: 0.3 mm (0.012 in)

* FIGURE 4. Layout for $R_{\theta JA}$ test.

SOT 23



* FIGURE 5. Sample construction.

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 Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

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. Packaging requirements (see 5.1).

d. Lead finish (see 3.4.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers' List (QML) 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 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
NASA - NA
DLA - CC

Preparing activity:
DLA - CC

(Project 5961-2748)

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.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/694A	2. DOCUMENT DATE 24 August 2003

3. **DOCUMENT TITLE**
SEMICONDUCTOR DEVICE, TRANSISTOR, PLASTIC, NPN, SILICON, SWITCHING, TYPE 2N3700UE1, JAN, JANTX, JANJ

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) COMMERCIAL DSN FAX EMAIL	7. DATE SUBMITTED

8. PREPARING ACTIVITY

a. Point of Contact Alan Barone	b. TELEPHONE Commercial 614-692-0510 DSN 850-0510 FAX 614-692-6939 EMAIL alan.barone@dla.mil
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