

The documentation and process conversion measures necessary to comply with this document shall be completed by 27 May 2015.

INCH-POUND

MIL-PRF-19500/694B
27 February 2015
SUPERSEDING
MIL-PRF-19500/694A
24 August 2003

PERFORMANCE SPECIFICATION

* TRANSISTOR, NPN, PLASTIC,
SILICON, SWITCHING, TYPE 2N3700UE1, JAN and JANTX

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. Two levels of product assurance are provided for each device type as specified in [MIL-PRF-19500](#).

* 1.2 Package outlines. The device package outlines are as follows: SOT 23 (similar to TO-236AB) in accordance with figure 1 for packaged device type.

* 1.3 Maximum ratings. Unless otherwise specified, $T_A = +25^\circ\text{C}$.

Types	P_T $T_A = +25^\circ\text{C}$ (1) (2)	I_C	V_{CBO}	V_{CEO}	V_{EBO}	T_J and T_{STG}	$R_{\theta JA}$
	<u>mW</u>	<u>A</u>	<u>V</u>	<u>V</u>	<u>V</u>	<u>°C</u>	<u>°C/W</u>
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 $T_A > +25^\circ\text{C}$.

(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 $T_A > +25^\circ\text{C}$. See derating curve, figure 2.

* Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <https://assist.dla.mil>.



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

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

(1) Pulsed see 4.5.1.

* 1.5 Part or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-19500, and as specified herein. See 6.4 for PIN construction example and 6.5 for a list of available PINs.

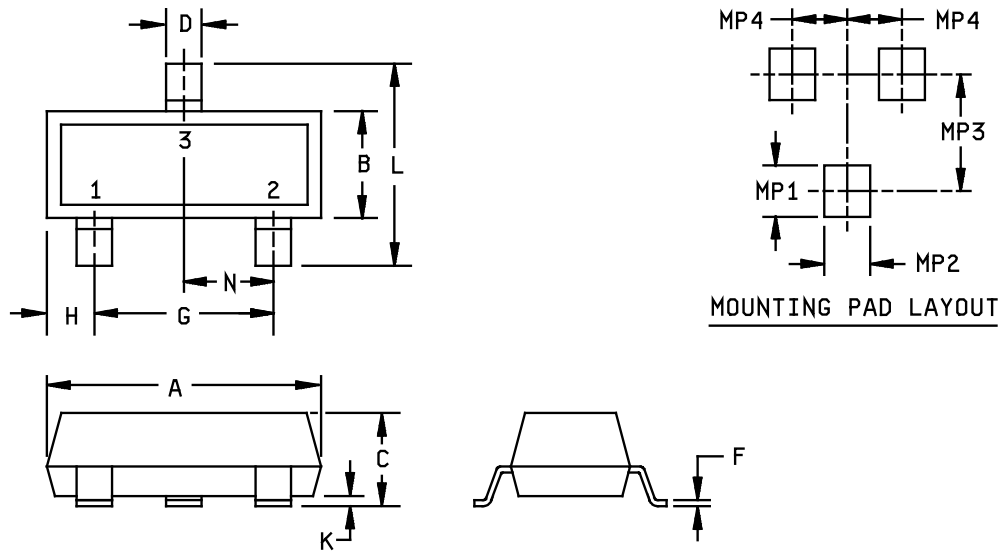
* 1.5.1 JAN certification mark and quality level. The quality level designators for encapsulated devices that are applicable for this specification sheet from the lowest to the highest level are as follows: "JAN" and "JANTX".

* 1.5.2 Device type. The designation system for the device type of transistor covered by this specification sheet is as follows.

* 1.5.2.1 First number and first letter symbols. The transistor of this specification sheet is identified by the first number and letter symbols "2N".

* 1.5.2.2 Second number symbols. The second number symbols for the transistor covered by this specification sheet is as follow: "3700UE1".

* 1.5.3 Lead finish. The lead finishes applicable to this specification sheet are listed on QML-19500.



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. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 or 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 of documents cited in sections 3 or 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 cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

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

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-750 - Test Methods for Semiconductor Devices.

* (Copies of these documents are available online at <http://quicksearch.dla.mil>)

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. Unless otherwise noted herein or in the contract, 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).

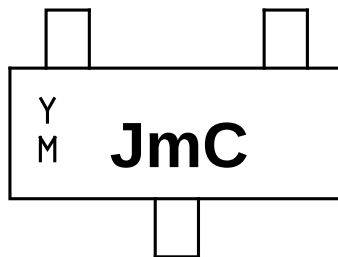
* 3.4 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in [MIL-PRF-19500](#), and [figure 1](#) herein.

* 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](#)). A list of default lead finishes are available on [QML-19500](#).

* 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. Transistors, Plastic, NPN, Silicon, Switching 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 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the specification sheet that did not request the performance of [table II](#) tests, the tests specified in [table II](#) herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification

* 4.3 **Screening (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). 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 MIL-PRF-19500)	Measurement	
	JANS level (for reference only)	JANTX level
1a	Required	Not required
1b	Required	Not required
2	Not required	Not required
3a	Required	Required
3b	Not applicable	Not applicable
(1) 3c	Thermal impedance (see 4.3.3)	Thermal impedance (see 4.3.3)
4	Not applicable	Not applicable
5	Not applicable	Not applicable
6	Not applicable	Not applicable
7a	Not applicable	Not applicable
7b	Not applicable	Not applicable
8	Required	Not required
9	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
11	I_{CES1} ; h_{FE1} ; ΔI_{CES1} = 100 percent of initial value or +5 nA dc, whichever is greater; Δh_{FE1} = ± 15 percent.	I_{CBO2} , h_{FE4}
12	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; Δh_{FE1} = ± 15 percent.	Subgroup 2 of table I herein; ΔI_{CBO2} = 100 percent of initial value or +5 nA dc, whichever is greater; Δh_{FE2} = ± 15 percent
13b	Group A, subgroup 3	Not required
14a	Not applicable	Not applicable
14b	Not applicable	Not applicable
15	Required	Not required
16	Required	Not required

- (1) Shall be performed any time after temperature cycling, screen 3a; JANTX and JANTXV levels do not need to be repeated in screening requirements.

* 4.3.1 QML JANTX 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 $< 6 \times 10^{-9}$ 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)
				≤ 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)
				≤ 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)
				≤ 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):

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

T_u = use environment junction temperature (in $^\circ\text{K}$).
 T_t = test environment junction temperature (in $^\circ\text{K}$).
 A_f = acceleration factor.
 k = Boltzman's Constant (8.6171×10^{-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, (ΔV_{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 ΔV_{be} limits are fixed to 100 mV minimum and 200 mV 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 table E-V of MIL-PRF-19500 and table I herein. End-point electrical measurements shall be in accordance with table I, subgroup 2 herein.

* 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 and JANTX and as follows. 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.

<u>Step</u>	<u>Method</u>	<u>Condition</u>
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 . d.-Thermal cycle: condition G, 100 cycles.
	1051	
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). 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 and JANTX. Group C inspection (JAN and JANTX) 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. 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 and JANTX).

<u>Step</u>	<u>Method</u>	<u>Condition</u>
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 . d.-Thermal cycle: condition G, 100 cycles.
	1051	
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 <u>1</u> /	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1 2</u> /						
Resistance to solvents <u>3</u> /	1022	15 devices, $c = 0$				
<u>Subgroup 2</u>						
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 140$ V dc	I_{CBO1}		10	μ A dc
Emitter to base cutoff current	3061	Bias condition D; $V_{EB} = 7$ V dc	I_{EBO1}		10	μ A 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 <u>1</u> /	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - 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
<u>Subgroup 3</u>						
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		
<u>Subgroup 4</u>						
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	h _{fe}	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,Cc}		400	ps
Pulse response		See figure 3	t _{on} + t _{off}		30	ns
<u>Subgroups 5,6 and 7</u>						
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	
<u>Preconditioning</u>	JESD22-A113 <u>1/</u>	Level 1	All
<u>Subgroup 1</u>			
Temperature cycling (air to air)	1051	Test condition G, 1000 cycles	n = 77, c = 0
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 2 2/</u>			
Steady-state operation life	1039	1,000 hours, condition B.	n = 77, c = 0
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 2A 2/</u>			
HTRB	1039	1,000 hours, condition A.	n = 77, c = 0
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 2B 2/</u>			
Intermittent life	1037	Intermittent operation life: $V_{CB} = 10$ V dc, 15,000 cycles, $\Delta T_J \geq +100^\circ\text{C}$; forced air cooling allowed on cooling cycle only.	n = 77, c = 0
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 4</u>			
Moisture resistance	JESD22-A101 <u>1/</u>	1,000 hours	n = 77, c = 0
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 4b</u>			
Autoclave	JESD22-A102 <u>1/</u>	96 hours	n = 77, c = 0
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 5</u>			
Thermal resistance	3131	See figures 4 and 5.	n = 10, c = 0
<u>Subgroup 6</u>			
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	
<u>Subgroup 7</u> Moisture reflow sensitivity classification for surface mount devices	J-STD-20 <u>1</u> /		n = 100
<u>Subgroup 8</u> Parametric characterization	Table I, subgroup 2	-50°C, 25°C, +100°C	n = 25 for 3 lots

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} <u>1/</u>	Pre-test distribution to average $+3\sigma$ and -3σ . Post-test distribution to average $+4\sigma$ 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} <u>1/</u>	Pre-test distribution to average $+3\sigma$ and -3σ . Post-test distribution to average $+4\sigma$ and -4σ of the pre-test results

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

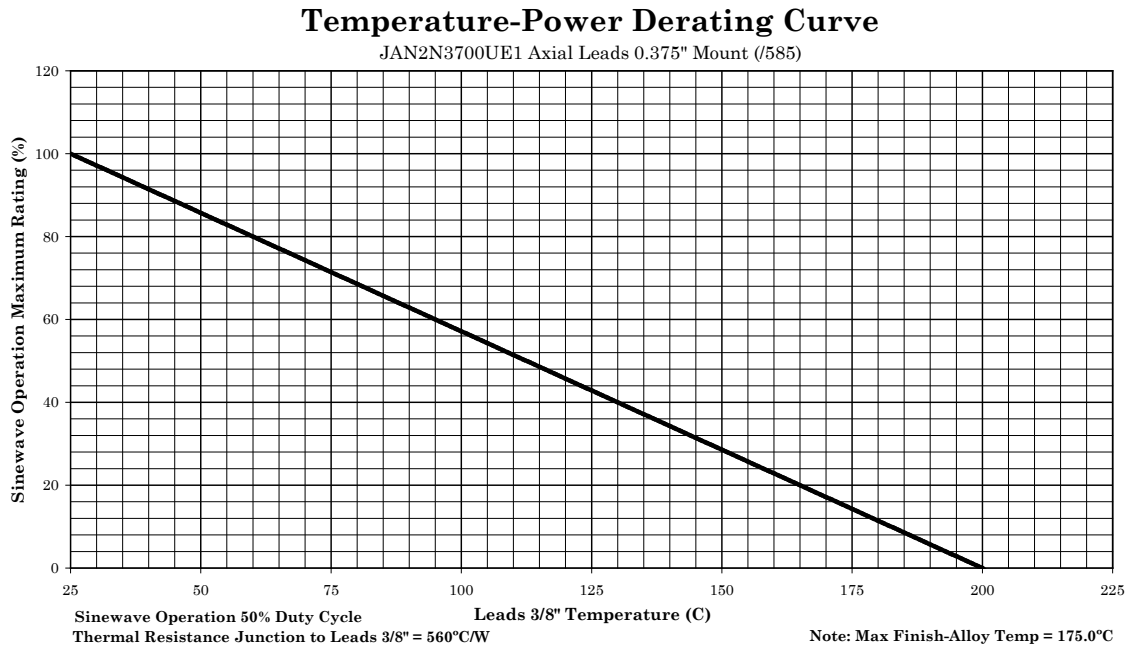
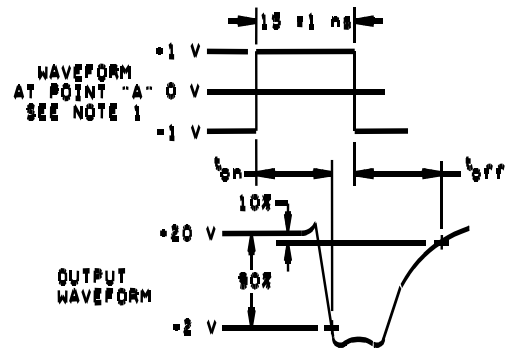
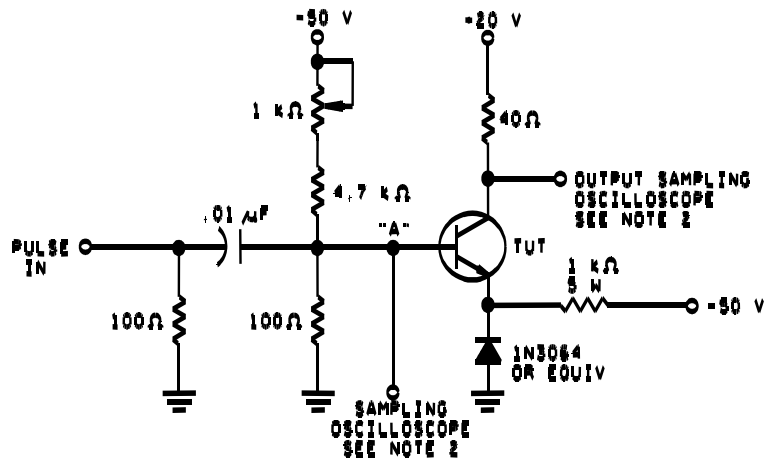


FIGURE 2. Derating for 2N3700UE1 (SOT-23 similar to TO-236).

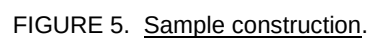


NOTES:

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: $Z_{IN} \geq 100$ k Ω , $C_{IN} \leq 12$ pF, rise time ≤ 2.0 ns.

FIGURE 3. Nonsaturated switching-time test circuit.

SOT 23



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. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

* 6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

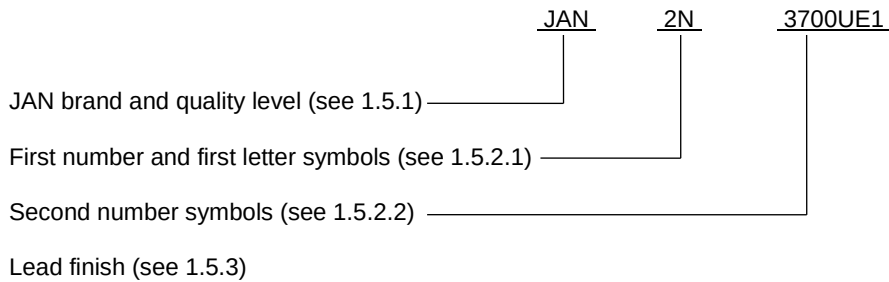
b. Packaging requirements (see 5.1).

c. Lead finish (see 3.4.1).

* d. The complete Part or Identifying Number (PIN), see title and section 1.

* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at <https://assist.dla.mil/>.

- * 6.4 PIN construction example. The PINs for encapsulated devices are constructed using the following form.



- * 6.5 List of PINs. The following is a list of possible PINs available on this specification sheet.

PINs for devices in a modified TO-236AB package (standard lead lengths)
JAN2N3700UE1
JANTX2N3700UE1

- * 6.6 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 previous issue.

Custodians:
 Army - CR
 Navy - EC
 Air Force - 85
 NASA - NA
 DLA - CC

Preparing activity:
 DLA - CC
 (Project 5961-2014-136)

- * NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <https://assist.dla.mil>.