The documentation and process conversion measures necessary to comply with this revision shall be completed by 5 August 2000.

INCH POUND

MIL-PRF-19500/336E
5 May 2000
SUPERSEDING
MIL-PRF-19500/336D
21 May 1997

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, UNITIZED, DUAL-TRANSISTOR, PNP, SILICON TYPES 2N3810, 2N3810L, 2N3810U, 2N3811, 2N3811L AND 2N3811U 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 two electrically isolated, matched PNP, silicon transistors as one dual unit. Four levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500, and two levels of product assurance are provided for each unencapsulated device type.

1.2. Physical dimensions. See figure 1 (similar to TO-78) and figure 2, and 3 for unencapsulated devices.

1.3. Maximum ratings.

Types	P_T T_A = +25°C		V_{CBO}	V_{EBO}	V_{CEO}	I_C	T_{STG} and T_J
	One section 1/	Both sections 2/					
	W	W	V dc	V dc	V dc	mA dc	°C
2N3810, 2N3811	0.5	0.6	60	5	60	50	-65 to +200
2N3810L, 2N3811L	0.5	0.6	60	5	60	50	-65 to +200
2N3810U, 2N3811U	0.5	0.6	60	5	60	50	-65 to +200

1/ Derate linearly, 2.86 mW/°C for T_A > +25°C.
2/ Derate linearly, 3.43 mW/°C for T_A > +25°C.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAC, Post Office Box 3900, Columbus, OH 43216- 5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of the document or by letter.

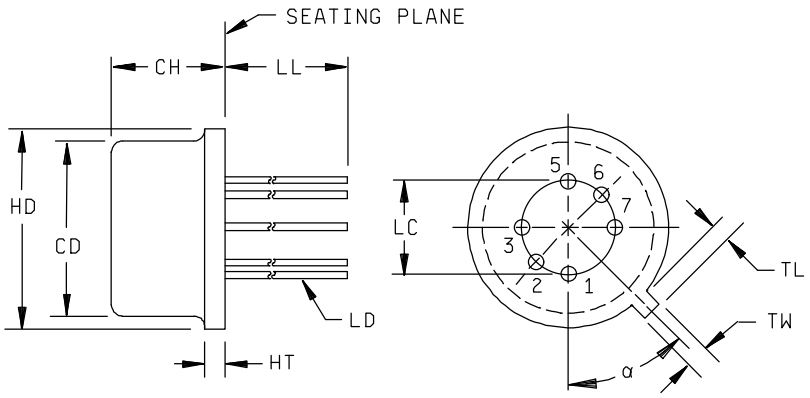
1.4. Primary electrical characteristics at T_A = +25°C, Pulsed (see 4.5.2).

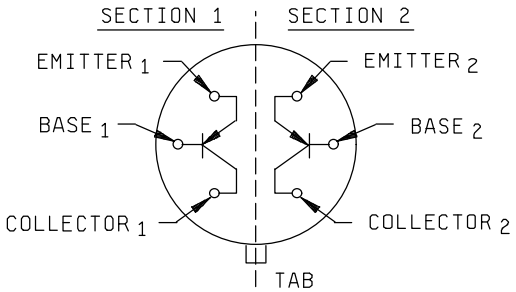
Limit	h_{FE3} through h_{FE5} V_{CE} = 5 V dc; I_C = 100 µA dc Through I_C = 1 mA dc		$\lvert h_{fe} \rvert_2$ V_{CE} = 5 V dc; I_C = 1 mA dc; f = 100 MHz	$V_{BE\ (sat)\ 2}$ I_C = 1 mA dc; I_B = 100 µA dc	$V_{CE\ (sat)\ 2}$ I_C = 1 mA dc; I_B = 100 µA dc
	2N3810 2N3810L	2N3811 2N3811L		V dc	V dc
Minimum	150	300	1		
Maximum	450	900	5	0.8	0.25

1.5. Primary electrical matching characteristics of each individual section.

Limit	$\frac{h_{FE3-1}}{h_{FE3-2}}$ V_{CE} = 5 V dc; I_C = 100 µA dc See note 1	$\lvert V_{BE1} - V_{BE2} \rvert_2$ V_{CE} = 5 V dc; I_C = 100 µA dc	$\lvert \Delta (V_{BE1} - V_{BE2}) \Delta T_A \rvert 1$ V_{CE} = 5 V dc I_C = 100 µA dc T_A = +25°C and -65°C	$\lvert \Delta (V_{BE1} - V_{BE2}) \Delta T_A \rvert 2$ V_{CE} = 5 V dc; I_C = 100 µA dc T_A = +125°C and +25°C
		mV dc	mV dc	mV dc
Minimum	0.9	3	0.8	1.0
Maximum	1.0			

Note:
1. The larger number will be placed in the denominator.





CONNECTION DIAGRAM

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.150	.185	3.81	4.70	
HD	.335	.370	8.51	9.40	
HT	.009	.041	0.23	1.04	
LC	.200 BSC		5.08 BSC		
LD	.016	.021	0.41	0.53	10
LL	See notes 10, 12, and 13				
α	45°TP		45°TP		9
TL	.029	.045	0.74	1.14	5, 6
TW	.028	.034	0.71	0.86	4, 5

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Refer to rules for dimensioning Semiconductor Product Outlines included in Publication No. 95.
4. Lead number 4 and 8 omitted on this variation.
5. TW must be held to a minimum length of .021 inch (0.53 mm).
6. LL measured from maximum HD.
7. Details of outline in this zone optional.
8. CD shall not vary more than .010 inch (.25mm) in zone P. This zone is controlled for automatic handling.
9. Leads at gauge plane .054 - .055 inch (1.37 - 1.40 mm) below seating plane shall be within .007 (.18 mm) radius of true position (TP) at a maximum material condition (MMC) relative to the tab at MMC. The device may be measured by direct methods or by the gauge and gauging procedure described on gauge drawing GS-1.
10. LD applies to LL minimum.
11. r (radius) applies to both inside corners of tab.
12. For transistor types 2N3810 and 2N3811, LL is .500 inch (12.70 mm) minimum, and .750 inch (19.50 mm) maximum. (TO-99)
13. For transistor types 2N3810L and 2N3811L, LL is 1.500 inches (38.10 mm) minimum, and 1.750 inches (44.45 mm) maximum.

FIGURE 1. Physical dimensions (similar to TO-78)

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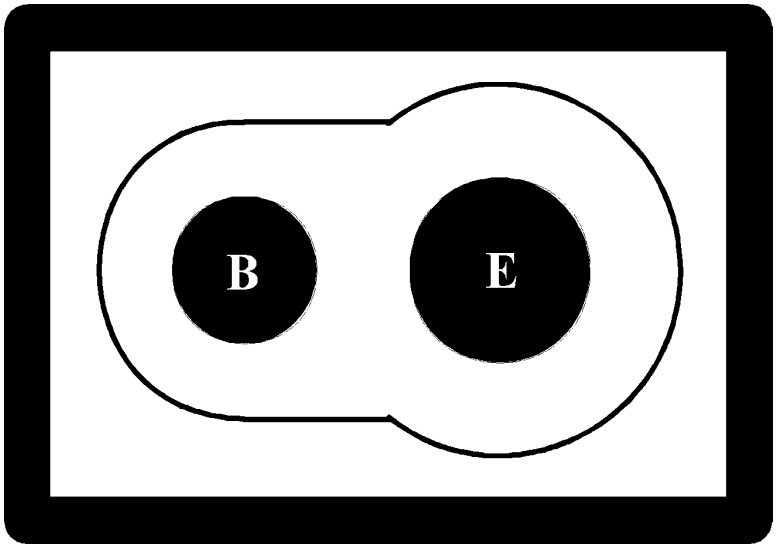
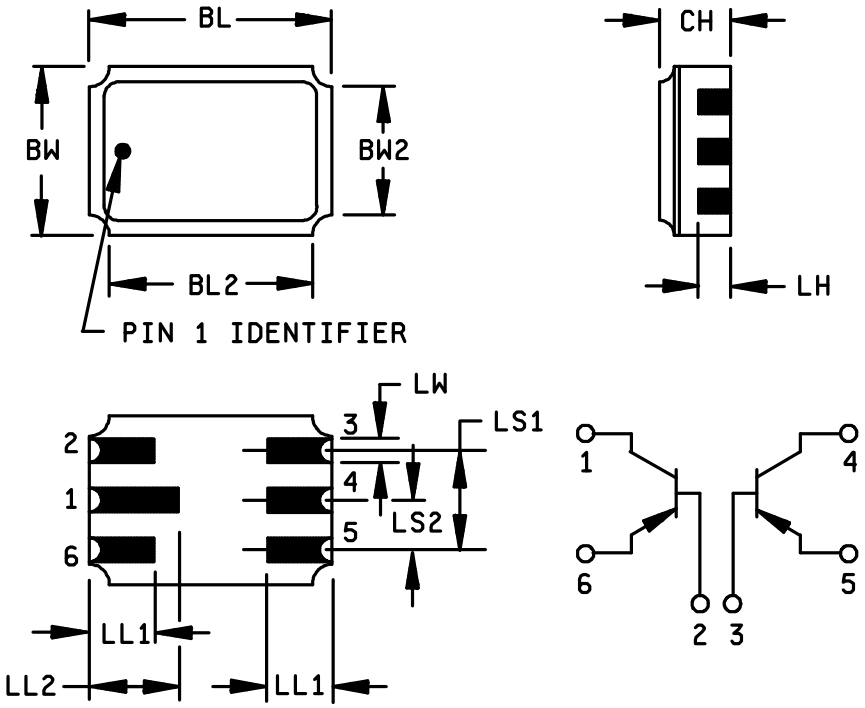


1. Chip size.....0.015 x 0.019 mils ±0.001 mil
2. Chip thickness.....0.010 ±0.0015 mil
3. Top metal.....Aluminum 15,000Å minimum, 18,000Å nominal
4. Back metal.....A. Gold 2,500Å minimum, 3,000Å nominal
   B. Eutectic Mount - No Gold
5. Backside.....Collector
6. Bonding pad.....B = 0.003 mils, E = 0.004 mils diameter
7. Passivation.....Si_3N_4 (Silicon Nitride) 2kÅ minimum, 2.2kÅ nominal.

FIGURE 2. JANHC and JANKC A-version die dimensions.



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.240	.250	6.10	6.35
BL_2	- - -	.250	- - -	6.35
BW	.165	.175	4.19	4.44
BW_2		.175		4.44
CH	.066	.080	1.68	2.03
LH	.026	.034	0.66	0.86
LL_1	.060	.070	1.52	1.78
LL_2	.082	.098	2.08	2.49
LS_1	.095	.105	1.14	2.67
LS_2	.045	.055	1.14	1.39
LW	.022	.028	0.56	0.71

Pin no.	Transistor
1	Collector no. 1
2	Base no. 1
3	Base no. 2
4	Collector no. 2
5	Emitter no. 2
6	Emitter no. 1

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The coplanarity deviation of all terminal contr

FIGURE 3. Physical Dimensions (2N3810U and 2N3811U).

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 Defense
Automated Printing Service, 700 Robbins Avenue, Building 4D (DPM-DODSSP), 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 (except for related associated specifications or specification sheets), 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. Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.4).

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

$\frac{h_{FE3-1}}{h_{FE3-2}}$ - Static forward-current-gain-ratio. The matching ratio of the static forward-current transfer ratios of each section.

$|V_{BE1} - V_{BE2}|$ - Absolute value of base-emitter-voltage differential between the individual sections.

$|\Delta(V_{BE1} - V_{BE2})\ \Delta T_A|$ - Absolute value of the algebraic difference between the base-emitter-voltage differentials between the individual sections at two different temperatures.

3.3. Interface requirements and physical dimensions. The Interface requirements and physical dimensions shall be as specified in MIL-PRF-19500, and herein.

3.3.1. Lead finish. Lead finish shall be solderable in accordance with MIL-STD-750 and MIL-PRF-19500.

3.4. Marking. Devices shall be marked in accordance with MIL-PRF-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 the subgroups specified in table I, subgroup 2, herein.

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.

4.3. Screening (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with MIL-PRF-19500 (table IV), 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 table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
3c	Thermal impedance (see 4.3.2)	Thermal impedance (see 4.3.2)
9	I_{CBO2}, h_{FE5}	Not applicable
10	48 hours minimum	48 hours minimum
11	I_{CBO2}; h_{FE5}; ΔI_{CBO2} = 100% of initial value or 5 nA dc, whichever is greater. Δh_{FE2} = ±15%	I_{CBO2} ,h_{FE5}
12	See 4.3.1 240 hours minimum	See 4.3.1 80 hours minimum
13	Subgroups 2 and 3 of table I herein; ΔI_{CBO2} = 100% of initial value or 5 nA dc, whichever is greater; Δh_{FE5} = ±15%	Subgroup 2 of table I herein; ΔI_{CBO2} = 100% of initial value or 5 nA dc, whichever is greater; Δh_{FE5} = ±15%

4.3.1. Power burn-in conditions. Power burn-in conditions are as follows:

T_A = room ambient as defined in the general requirements of MIL-STD-750, section 4.5;
JANS level (all device types) - - - - - - - - - V_{CB} = 10 - 30 V dc, P_T = 300 mW (each section).
V_{CB} = 10 - 30 V dc, P_T = 600 mW (both sections).

T_A = room ambient as defined in the general requirements of MIL-STD-750, section 4.5;
JANTX and JANTXV levels
(all device types) - - - - - - - - - - - - - - - - - - - V_{CB} = 45 V dc, P_T = 300 mW (each section) at T_A = +25° ±3°C.
V_{CB} = 45 V dc, P_T = 600 mW (both sections) at T_A = 25° ±3°C.

NOTE: No heat sink or forced air cooling on the devices shall be permitted.

4.3.2. Thermal impedance ($Z_{\theta JX}$ measurements). The $Z_{\theta JX}$ measurements shall be performed in accordance with
MIL-STD-750, Method 3131.

a. I_M measurement current ---------- 5mA.
b. I_H forward heating current ---------- 200 mA (minimum).
c. t_H heating time ---------- 25 - 30 ms.
d. t_{md} measurement delay time ------ 60 µs maximum
e. V_{CE} collector-emitter voltage ------ 10 V dc minimum

The maximum limit for $Z_{\theta JX}$ under these test conditions are $Z_{\theta JX}$ (maximum) = 72 °C/W.

4.4. Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein. If alternate screening is being performed per MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of group A1 and A2 inspection only (table VIb, group B, subgroup 1 is not required to be performed again if group B has already been satisfied per 4.4.2).

4.4.1. Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and 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 table VIa (JANS) of MIL-PRF-19500 and 4.4.2.1 herein. Electrical measurements (end-points) and delta requirements shall be in accordance with group A, subgroup 2 and 4.5.3 herein. See 4.4.2.2 for JAN, JANTX, and JANTXV group B testing. Electrical measurements (end-points) and delta requirements for JAN, JANTX, and JANTXV shall be after each step in 4.4.2.2 and shall be in accordance with group A, subgroup 2 and 4.5.3 herein.

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

Subgroup	Method	Conditions
B4	1037	V_{CB} = 10 V dc; P_T = 300 mW (each section); P_T = 600 mW (both sections) at T_A = room ambient as defined in the general requirements of MIL-STD-750, section 4.5; $t_{on} = t_{off}$ = three minutes minimum for 2,000 cycles. No heat sink or forced-air cooling on devices shall be permitted.
B5	1027	V_{CB} = 10 V dc; P_T = 300 mW (each section); P_T = 600 mW (both sections) at T_A = +100°C for 96 hours, or T_A = +125°C ±25°C for 96 hours with P_T adjusted according to the chosen T_A to give and average T_J = +275°C.

4.4.2.2. Group B inspection, (JAN, JANTX, and JANTXV). Separate samples may be used for each step. In the event of a group B failure, the manufacturer may pull a new sample at double size from either the failed assembly lot or from another assembly lot from the same wafer lot. If the new “assembly lot” option is exercised, the failed assembly lot shall be scrapped.

Step	Method	Condition
1	1039	Steady-state life: Test condition B, 340 hours, V_{CB} = 10 -30 V dc, T_J = +150°C min. No heat sink or forced-air cooling on the devices shall be permitted. n = 45 devices, c = 0
2	1039	The steady state life test of step 1 shall be extended to 1,000 hrs for each die design. Samples shall be selected from a wafer lot every twelve months of wafer production. Group B step 2 shall not be required more than once for any single wafer lot. n = 45, c = 0.
3	1032	High-Temperature life (non-operating), T_A = +200°C. n = 22, c = 0, t = 340 hours

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

a. 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.

b. Must be chosen from an inspection lot that has been submitted to and passed group A, 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 in 4.4.3.1 (JANS).and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Electrical measurements (end points) and delta requirements shall be in accordance with group A, subgroup 2 and 4.5.3 herein.

4.4.3.1. Group C inspection, appendix E, table VII (JANS) of MIl-PRF-19500.

Subgroup	Method	Conditions
C2	2036	Test condition E.
C6	1026	1,000 hours at V_{CB} = 10 V dc; T_J = +150°C. No heat sink or forced-air cooling on device shall be permitted.

4.4.3.2. Group C inspection, appendix E, table VII (JAN, JANTX, JANTXV) of MIl-PRF-19500.

Subgroup	Method	Conditions
C2	2036	Test condition E.
C6	1026	Not applicable

4.4.3.3. Group C sample selection. Samples for subgroups in group C shall be chosen at random from any inspection lot containing the intended package type and lead finish procured to the same specification which is submitted to and passes group A tests for conformance inspection. Testing of a subgroup 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 performed for qualification or re-qualification only. The tests specified in table II herein must be performed to maintain qualification.

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

4.5.1. Testing of units. All specified electrical tests, including electrical measurements (end points) and delta requirement tests, shall be performed equally on both sections of the transistor types covered herein, except where the electrical characteristic being evaluated applies to the transistor as a device entity.

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

4.5.3. Delta Requirements. Delta requirements shall be as specified below:

Step	Inspection	MIL-STD-750		Symbol	Limit	Unit
		Method	Conditions			
1	Collector-base cutoff current	3036	Bias condition D, V_{CB} = 50 V dc	ΔI_{CB02} 1/	100% of initial value or 4 nA dc, whichever is greater.	
2	Forward current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 1 mA dc; pulsed see 4.5.2	Δh_{FE5} 1/	±25% change from initial reading.	

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

4.5.4. Disposition of leads when testing characteristics of each section. During the measurement of the characteristic of each section, the leads of the section not under test shall be open-circuited.

4.5.5. Forward-current-gain ratio. The value for the forward-current-gain ratio for each individual section of a dual unit shall be measured using method 3076 of MIL-STD-750. The forward-current-gain ratio shall be calculated by dividing one of the values by the other. If possible, this ratio shall be measured directly to improve accuracy.

4.5.6. Base-emitter-voltage differential. The base-emitter-voltage differential shall be determined by connecting the emitters of the individual sections together, applying specified electrical test conditions to each individual section in accordance with test condition B, method 3066 of MIL-STD-750, and measuring the absolute value of the voltage between the bases of the individual sections of a dual unit.

TABLE I. Group A inspection

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical 3/ examination	2071	n = 45 devices, c = 0				
Solderability 3/, 5/	2026	n = 15 leads, c = 0				
Resistance to solvents 3/, 4/, 5/	1022	n = 15 devices, c = 0				
Temp Cycling 3/, 5/	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Heremetic Seal 5/ Fine leak Gross leak	1071	n = 22 devices, c = 0				
Electrical measurements 5/		Group A, subgroup 2				
Bond strength 3/ 5/	2037	Precondition T_A = +250°C at t = 24 hrs or T_A = +300°C at t = 2 hrs n = 11 wires, c = 0				
Subgroup 2						
Collector to base, cutoff current	3036	Bias condition D, V_{cb} = 60 V dc	I_{CBO1}		10	µA dc
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = 100 µA dc; pulsed (see 4.5.2)	$V_{(BR)CEO}$	60		V dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = 5 V dc;	I_{EBO1}		10	mA dc
Collector to base cutoff current	3036	Bias condition D, V_{CB} = 50 V dc	I_{CBO2}		10	nA dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = 5 V dc	I_{EBO2}		<10	µA dc
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 1 µA dc	h_{FE1}			
2N3811, 2N3811L only				75		
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 10 µA dc	h_{FE2}			
2N3810, 2N3810L				100		
2N3811, 2N3811L				225		

See footnotes at end of table.

TABLE I. Group A inspection

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 2 - Continued						
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 100 µA dc	h_{FE3}			
2N3810, 2N3810L				150	450	
2N3811, 2N3811L				300	900	
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 500 µA dc	h_{FE4}			
2N3810, 2N3810L				150	450	
2N3811, 2N3811L				300	900	
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 1 mA dc	h_{FE5}			
2N3810, 2N3810L				150	450	
2N3811, 2N3811L				300	900	
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 10 mA dc	h_{FE6}			
2N3810, 2N3810L				125		
2N3811, 2N3811L				250		
Collector to emitter voltage (saturated)	3071	I_C = 100 µA dc, I_B = 10 µA dc	$V_{CE(sat)1}$		0.2	V dc
Collector to emitter voltage (saturated)	3071	I_C = 1 mA dc, I_B = 100 µA dc	$V_{CE(sat)2}$		0.25	V dc
Base-emitter voltage (saturated)	3066	Test condition A I_C = 100 µA dc, I_B = 10 µA dc	$V_{BE(sat)1}$		0.7	V dc
Base-emitter voltage (saturated)	3066	Test condition A I_C = 1 mA dc, I_B = 100 µA dc	$V_{BE(sat)2}$		0.8	V dc
Base-emitter voltage (nonsaturated)	3066	Test condition A V_{CE} = 5 V dc; I_C = 100 µA dc	$V_{BE(sat)3}$		0.7	V dc
Forward-current transfer ratio (gain ratio)	3076	V_{CE} = 5 V dc; I_C = 100 µA dc (see 4.5.5)	h_{FE3-1} / h_{FE3-2}	0.9	1.0	
Base emitter voltage (nonsaturated) (absolute value of differential)	3066	Test condition B V_{CE} = 5 V dc; I_C = 10 µA dc (see 4.5.6)	$\lvert V_{BE1} - V_{BE2}\rvert 1$		5	mV dc
Base emitter voltage (nonsaturated) (absolute value of differential)	3066	Test condition B V_{CE} = 5 V dc; I_C = 100 µA dc (see 4.5.6)	$\lvert V_{BE1} - V_{BE2}\rvert 2$		3	mV dc

See footnotes at end of table.

TABLE I. Group A inspection

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 2 - Continued						
Base emitter voltage (nonsaturated) (absolute value of differential)	3066	Test condition B V_{CE} = 5 V dc; I_C = 10 mA dc (see 4.5.6)	$\lvert V_{BE1} - V_{BE2} \rvert$3		5	mV dc
Base emitter voltage (nonsaturated) (absolute value of differential-change with temperature)	3066	Test condition B V_{CE} = 5 V dc; I_C = 100 µA dc T_A = +25°C and -55°C (see 4.5.7)	$\lvert \Delta V_{BE1} - V_{BE2} \Delta T_A \rvert$1		0.8	mV dc
Base emitter voltage (nonsaturated) (absolute value of differential-change with temperature)	3066	Test condition B V_{CE} = 5 V dc; I_C = 100 µA dc T_A = +125°C and -55°C (see 4.5.7)	$\lvert \Delta V_{BE1} - V_{BE2} \Delta T_A \rvert$2		1.0	mV dc
Subgroup 3						
High temperature operation:		T_A = +150°C				
Collector to base cutoff current	3036	Bias condition D, V_{CB} = 50 V dc	I_{CBO3}		10	µA dc
Low-temperature operation:		T_A = -55°C				
Forward-current transfer ratio 2N3810, 2N3810L 2N3811, 2N3811L	3076	V_{CE} = 5 V dc; I_C = 100 µA dc	h_{FE7}	 60 100		
Subgroup 4						
Open circuit output capacitance	3236	V_{CB} = 5 V dc; I_E = 0; 100 kHz ≤ f ≤ 1 MHz	C_{obo}		5	pF

See footnotes at end of table.

TABLE I. Group A inspection

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 4 - Continued						
Input capacitance (output open-circuited)	3240	V_{EB} = 0.5 V dc; I_C = 0 ; 100 kHz ≤ f ≤ 1 MHz	C_{ibo}		8	pF
Magnitude of small-signal short-circuit forward-current transfer ratio	3306	V_{CE} = 5 V dc; I_C = 500 µA dc f = 30 MHz	$\|h_{FE}\|1$	1.0		
Magnitude of small-signal short-circuit forward-current transfer ratio	3306	V_{CE} = 5 V dc; I_C = 1 mA dc f = 100 MHz	$\|h_{FE}\|2$	1.0	5	
Small-signal short-circuit forward current transfer ratio	3206	V_{CE} = 10 V dc; I_C = 1 mA dc f = 1 kHz	h_{fe}			
2N3810, 2N3810L 2N3811, 2N3811L				150 300	600 900	
Small-signal short-circuit input impedance	3201	V_{CE} = 10 V dc; I_C = 1 mA dc; f = 1 kHz	h_{ie}			
2N3810, 2N3810L 2N3811, 2N3811L				3 3	30 40	kΩ kΩ
Small-signal open-circuit output admittance	3216	V_{CE} = 10 V dc; I_C = 1 mA dc; f = 1 kHz	h_{oe}	5	60	µmhos
Small-signal open-circuit reverse-voltage transfer ratio	3211	V_{CE} = 10 V dc; I_C = 1 mA dc; f = 1 kHz	h_{re}		$25x10^{-4}$	
Noise figure	3246	V_{CE} = 10 V dc; I_C = 100 µA dc; Rg = 3 kΩ, f = 100 Hz (see 4.5.8)	F1			
2N3810, 2N3810L 2N3811, 2N3811L					7 4	dB dB
Noise figure	3246	V_{CE} = 10 V dc; I_C = 100 µA dc; Rg = 3 kΩ, f = 1 kHz (see 4.5.8)	F2			
2N3810, 2N3810L 2N3811, 2N3811L					3 1.5	dB dB

See footnotes at end of table.

TABLE I. Group A inspection

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 4 - Continued						
Noise figure	3246	V_{CE} = 10 V dc; I_C = 100 µA dc; Rg = 3 kΩ, f = 10 kHz	F3			
2N3810, 2N3810L		(see 4.5.8)			2.5	dB
2N3811, 2N3811L					2.0	dB
Noise figure (wideband)	3246	V_{CE} = 10 V dc; I_C = 100 µA dc; Rg = 3 kΩ,	F1			
2N3810, 2N3810L		noise bandwidth 10 Hz to			3.5	dB
2N3811, 2N3811L		15.7 kHz (see 4.5.9)			2.5	dB
Subgroup 5 and 6						
Not applicable						
Subgroup 7 2/						
Decap internal visual (design verification)	2075	n = 1 device, c = 0				

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 laser marked devices.

5/ Not required for JANS devices.

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

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
Subgroup 1			12 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See group A, subgroup 2 and 4.5.3 herein.	
Subgroup 2			45 devices c = 0
Intermittent life	1037	Intermittent operation life: V_{CB} = 10 V dc, 6,000 cycles, $\Delta T_J \geq +100°C$; forced air cooling allowed on cooling cycle only.	
Electrical measurements		See group A, subgroup 2 and 4.5.3 herein.	
Subgroup 3			
Not applicable			
Subgroup 4			
Not applicable			
Subgroup 5			
Not applicable			

4.5.7 Base-emitter-voltage differential change with temperature. The value of the base-emitter-voltage differential shall be measured at the two specified temperatures in accordance with 4.4.5 except that the identities of the individual sections shall be maintained. The absolute value of the algebraic difference between the values at the two temperature extremes shall be calculated. A mathematical formula for this parameter is:

$$\left|(V_{BE1} - V_{BE2})_{T1} - (V_{BE1} - V_{BE2})_{T2}\right|$$

4.5.8 Noise figure test. Noise figure shall be measured using a model No. 2173C/2181 Quan Tech Laboratories test set, or equivalent. Conditions shall be as specified in table I.

4.5.9 Noise figure (wideband) test. Wideband noise figure shall be measured using a model No. 512 Quan Tech Laboratories test set, or equivalent. Conditions shall be as specified in table I.

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 material 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. Notes. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2. Acquisition requirements. Acquisition documents should specify the following:

a. Issue of DODISS to be cited in the solicitation.

b. Lead finish as specified (see 3.3.1).

c. Product assurance level and type designator.

6.3. Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

6.4. 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 purchase 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, 3990 East Broad Street, Columbus, OH 43216-5000.

CONCLUDING MATERIAL

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

Review activities:
Army - AV, MI
Navy - AS, CG, MC
Air Force - 13, 19, 99

Preparing activity:
DLA - CC

(Project 5961-2200)

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/336E	2. DOCUMENT DATE

3. **DOCUMENT TITLE** DOCUMENT TITLE SEMICONDUCTOR DEVICE, UNITIZED, DUAL-TRANSISTOR, PNP, SILICON TYPES 2N3810, 2N3810L, 2N3810U, 3N3811 2N3811L, and 2N3811U, JAN, JANTX, JANTXV, AND JANS

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 Al Barone	b. TELEPHONE Commercial DSN FAX EMAIL (614)692-0510 850-0510 (614)692-6939 alan_barone@dscc.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

DD Form 1426, Feb 1999 (EG) Previous editions are obsolete WHS/DIOR, Feb 99