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

INCH-POUND

MIL-PRF-19500/270H
24 July 2003
SUPERSEDING
MIL-PRF-19500/270G
10 August 1998

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, UNITIZED, DUAL-TRANSISTOR, NPN,
SILICON, TYPES 2N2060 AND 2N2060L
JAN, JANTX, JANTXV, AND JANS

This specification is approved for use by all Department and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for two electrically isolated, matched NPN, silicon transistors as one dual unit. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (similar to TO-77 or TO-99).

1.3 Maximum ratings.

P_{T1} T_A = +25°C		P_{T2} T_C = +25°C		I_C	V_{CBO}	V_{CEO}	V_{EBO}	T_{STG} and T_J
One section (1)	Both sections (2)	One section (1)	Both sections (2)					
mW	mW	W	W	mA dc	V dc	V dc	V dc	°C
540	600	1.5	2.12	500	100	60	7	-65 to +200

(1) For T_A > +25°C, derate linearly 3.08 mW/°C one section, 3.48 mW/°C both sections.
(2) For T_C > +25°C, derate linearly 8.6 mW/°C one section, 12.1 mW/°C both sections.

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, P.O. 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.

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

Limit	h_{FE1}	h_{FE2}	h_{FE3}	h_{FE4} (1)	$\lvert h_{fe} \rvert$	$V_{CE(sat)}$	$V_{BE(sat)}$
	V_{CE} = 5 V dc I_C = 10 μA dc	V_{CE} = 5 V dc I_C = 100 μA dc	V_{CE} = 5 V dc I_C = 1 mA dc	V_{CE} = 5 V dc I_C = 10 mA dc	V_{CE} = 10 V dc I_C = 50 mA dc f = 20 MHz	I_C = 50 mA dc I_B = 5 mA dc	I_C = 50 mA dc I_B = 5 mA dc
						V dc	V dc
Min	25	30	40	50	3	0.3	0.9
Max	75	90	120	150	25		

(1) Pulsed (see 4.5.1).

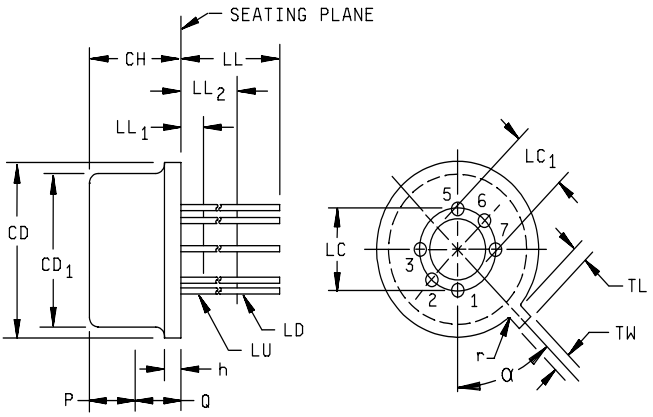
1.5 Primary electrical matching characteristics of each individual section.

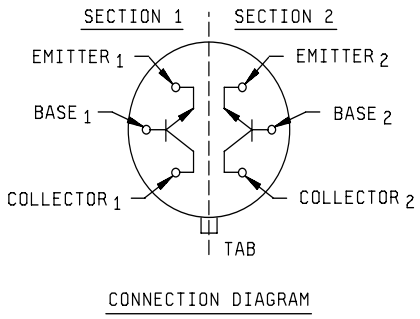
Limit	$\frac{h_{FE2-1}}{h_{FE2-2}}$ (1)	$\lvert V_{BE1} - V_{BE2} \rvert$	$\lvert \Delta(V_{BE1} - V_{BE2}) \Delta T_A \rvert 1$	$\lvert \Delta(V_{BE1} - V_{BE2}) \Delta T_A \rvert 2$
	V_{CE} = 5 V dc; I_C = 100 μA dc 1/	V_{CE} = 5 V dc; I_C = 100 μA dc	V_{CE} = 5 V dc; I_C = 100 μA dc T_A = +25°C and -55°C	V_{CE} = 5 V dc; I_C = 100 μA dc T_A = +125°C and +25°C
		mV dc	mV dc	mV
Min	0.9			
Max	1.0	5	0.8	1.0

(1) The larger number will be placed in the denominator.

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.





CONNECTION DIAGRAM

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.335	.370	8.51	9.40	
CD_1	.305	.335	7.75	8.51	
CH	.150	.260	3.81	7.60	
LC	.200 TP		5.08 TP		9
LC_1	.140	.160	3.56	4.06	
LD	.016	.021	0.41	0.53	10
LL	See notes 10, 12, and 13				
LL_1		.050		1.27	10
LL_2	.250		6.35		10
LU	.016	.019	0.41	0.48	10
P	.100		2.54		8
Q		.050		1.27	7
TL	.029	.045	0.74	1.14	5, 6
TW	.028	.034	0.71	0.86	4, 5
h	.009	.041	0.23	1.04	
r		.010		0.25	11
α	45°TP		45°TP		9

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. Beyond r, TW must be held to a minimum length of .021 inch (.53 mm).
6. TL measured from maximum CD.
7. Details of outline in this zone optional.
8. CD_1 shall not vary more than .010 inch (.25 mm) 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 inch (.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. LU applies between LL_1 and LL_2 LD applies between LL_2 and LL minimum. Diameter is uncontrolled in LL_1 and beyond minimum.
11. r (radius) applies to both inside corners of tab.
12. For transistor types 2N2060, LL is .500 inch (12.70 mm) minimum, and .750 inch (19.50 mm) maximum.
13. For transistor types 2N2060L, LL is 1.500 inches (38.10 mm) minimum, and 1.750 inches (44.45 mm) maximum.

FIGURE 1. Physical dimensions.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

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

STANDARD

DEPARTMENT OF DEFENSE

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Document Automation Production Services (DAPS), 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, 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.

$\frac{h_{FE-1}}{h_{FE-2}}$	Static forward-current-gain-ratio. The matching ratio of the static forward-current transfer ratios of each section.
$\lvert V_{BE1} - V_{BE2} \rvert$	Absolute value of base-emitter-voltage differential between the individual sections.
$\lvert \Delta(V_{BE1} - V_{BE2}) \Delta T_A \rvert$	Absolute value of the algebraic difference between the base-emitter-voltage differentials between the individual sections at two different temperatures.

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 as defined in MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition requirements (see 6.2).

3.5 Electrical performance characteristics. Unless otherwise specified, 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 4.4.2 and 4.4.3 herein.

3.7 Marking. Devices shall be marked as specified in MIL-PRF-19500.

3.8 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3).

c. Conformance inspection (see 4.4).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500.

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 associated specification that did not request the performance of table II tests, the tests specified in table II herein shall be performed by the first inspection lot of this revision to maintain qualification.

4.3 Screening (JANS, JANTX, and JANTXV levels only). 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.

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}, $\frac{h_{FE2-1}}{h_{FE2-2}}$, and h_{FE3}	Not applicable
10	48 hours minimum	48 hours minimum
11	I_{CBO2}, $\frac{h_{FE2-1}}{h_{FE2-2}}$, and h_{FE3} I_{CBO2} = 100 percent of initial value or 2 nA dc, whichever is greater. Δh_{FE3} = ± 15 percent	I_{CBO2} and h_{FE30-}
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 percent of initial value or 2 nA dc, whichever is greater. Δh_{FE3} = ±15 percent	Subgroup 2 of table I herein; ΔI_{CBO2} = 100 percent of initial value or 2 nA dc, whichever is greater. Δh_{FE3} = ±15 percent
13(a)	Method 1016 of MIL-STD-750, test condition A (collector to collector) R_{C1-C2} = 10^9 ohms minimum.	Not applicable

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

a. JANS level (all device types) ..... V_{CB} = 10 - 40 V dc, P_T = 300 mW (each section) at T_A = +25°C ± 3°C.
V_{CB} = 10 - 40 V dc, P_T = 600 mW (both sections) at T_A = +25°C ± 3°C.

b. JANTX and JANTXV levels
(all device types)..... V_{CB} = 10 - 40 V dc, P_T = 300 mW (each section) at T_A = +25°C ± 3°C.
V_{CB} = 10 - 40 V dc, P_T = 600 mW (both sections) at T_A = +25°C ± 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 method 3131, of MIL-STD-750.

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

b. I_H forward heating current ----------200 mA (min).

c. t_H heating time ----------25 - 30 ms.

d. t_{md} measurement delay time --------60 μs max.

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

The maximum limit for $Z_{\theta JX}$ under these test conditions are $Z_{\theta JX}$ (max) = 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 in accordance with 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 in accordance with 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. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, subgroup 2 and 4.5.9 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 table I, subgroup 2 and 4.5.9 herein.

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

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

4.4.2.2 Group B inspection, (JAN, JANTX, and JANTXV). Separate samples may be used for each step. In the event of a lot failure, the resubmission requirements of MIL-PRF-19500 shall apply. In addition, all catastrophic failures during CI shall be analyzed to the extent possible to identify root cause and corrective action. Whenever a failure is identified as wafer lot and /or wafer processing related, the entire wafer lot and related devices assembled from the wafer lot shall be rejected unless an appropriate determined corrective action to eliminate the failures mode has been implemented and the devices from the wafer lot are screened to eliminate the failure mode.

Step	Method	Condition
1	1039	Steady-state life: Test condition B, 1,000 hours, V_{CB} = 10 V dc, power shall be applied to achieve T_J = +150°C minimum using a minimum of P_D = 75 percent of maximum rated P_T as defined in 1.3. n = 45 devices, c = 0.
2	1038	HTRB: Test condition A, 48 hours minimum. n = 45 devices, c = 0.
3	1032	High-temperature life (non-operating), t = 340 hours, T_A = +200°C. n = 22, c = 0.

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

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 table I, subgroup 2, conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (subgroups B4 and B5 for JANS, and group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table VII of MIL-PRF-19500, and 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 of table I, subgroup 2 and 4.5.9 herein.

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

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

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

Subgroup	Method	Condition
C2	2036	Test condition E.
C6		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 conducted in accordance with the conditions specified for subgroup testing in table IX of MIL-PRF-19500, appendix E and as specified in table II herein.

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 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.

4.5.3 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.

4.5.4 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.

4.5.5 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 method 3066 of MIL-STD-750, test condition B, and measuring the absolute value of the voltage between the bases of the individual sections of a dual unit.

4.5.6 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 4.5.5 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:

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

4.5.7 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.

4.5.8 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.

4.5.9 Delta requirements. Delta requirements shall be as specified below:

Step	Inspection	MIL-STD-750		Symbol	Limit
		Method	Conditions		
1.	Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 1 mA dc	Δh_{FE3}	± 25 percent change from initial reading.
2.	Collector to base cutoff current	3036	Bias condition D; V_{CB} = 80 V dc	ΔI_{CBO2} (1)	100 percent or 2 nA dc, whichever is greater.
3.	Saturation voltage and resistance (collector to emitter voltage)	3071	I_C = 50 mA dc, I_B = 5 mA dc	$\Delta V_{CE(sat)}$ (2)	± 50 mV dc from initial reading.
4.	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 4.5.6)	$\lvert\Delta(V_{BE1} - V_{BE2})\Delta T_A\rvert 2$ (2)	0.80 mV dc maximum
5.	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 +125°C (see 4.5.6)	$\lvert\Delta(V_{BE1} - V_{BE2})\Delta T_A\rvert 2$ (2)	1.0 mV dc maximum

(1) Devices which exceed the group A limits for this test shall not be accepted.
(2) JANS only.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical examination 3/	2071	n = 45 devices, c = 0				
Solderability 3/ 4/	2026	n = 15 leads, c = 0				
Resistance to solvents 3/ 4/ 5/	1022	n = 15 devices, c = 0				
Temp cycling 3/ 4/	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Heremetic seal 4/ Fine leak Gross leak	1071	n = 22 devices, c = 0				
Electrical measurements, 4/		Table I, subgroup 2				
Bond strength 3/ 4/	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} = 100 V dc	I_{CBO1}		10	µA dc
Breakdown voltage, collector to emitter	3011	Bias condition B, I_C = 10 mA dc $R_{BE} \leq$ 10 ohms, pulsed (see 4.5.1)	$V_{(BR)CER}$	80		V dc
Breakdown voltage, collector to emitter	3011	Bias condition D, I_C = 30 mA dc pulsed (see 4.5.1)	$V_{(BR)CEO}$	60		V dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = 7 V dc	I_{EBO1}		10	µA dc
Collector to base cutoff current	3036	Bias condition D; V_{CB} = 80 V dc	I_{CBO2}		2	nA dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = 5 V dc	I_{EBO2}		2	nA dc
Saturation voltage and resistance	3071	I_C = 50 mA dc; I_B = 5 mA dc	$V_{CE(sat)}$		0.3	V dc
Base emitter voltage (saturated)	3066	Test condition A, I_C = 50 mA dc; I_B = 5 mA dc	$V_{BE(sat)}$		0.9	V dc
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 10 µA dc	h_{FE1}	25	75	
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 100 µA dc	h_{FE2}	30	90	

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						
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 1 mA dc	h_{FE3}	40	120	
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 10 mA dc; pulsed (see 4.5.1)	h_{FE4}	50	150	
Forward-current transfer ratio (gain ratio)	3076	V_{CE} = 5 V dc; I_C = 100 µA dc; pulsed (see 4.5.1)	$\frac{h_{FE2-1}}{h_{FE2-2}}$ 6/	0.9	1.0	
Forward-current transfer ratio (gain ratio)	3076	V_{CE} = 5 V dc; I_C = 1.0 mA dc; pulsed (see 4.5.1)	$\frac{h_{FE3-1}}{h_{FE3-2}}$ 6/	0.9	1.0	
Absolute value of base emitter-voltage differential	3066	Test condition B; V_{CE} = 5 V dc; I_C = 100 µA dc (see 4.5.5)	$\lvert V_{BE} - V_{BE2} \rvert$ 1		5	mV dc
Absolute value of base emitter-voltage differential	3066	Test condition B; V_{CE} = 5 V dc; I_C = 1 mA dc (see 4.5.5)	$\lvert V_{BE} - V_{BE2} \rvert$ 2		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 (see 4.5.5) T_A = +25°C and -55°C (see 4.5.6)	$\lvert \Delta(V_{BE1} - V_{BE2})\Delta T_A \rvert$1		.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 = +25°C and +125°C (see 4.5.6)	$\lvert \Delta(V_{BE1} - V_{BE2})\Delta T_A \rvert$2		1	mV dc
Subgroup 3						
High temperature operation:		T_A = +150°C				
Collector to base cutoff current	3036	Bias condition D, V_{CB} = 80 V dc	I_{CBO3}		10	µA dc
Low temperature operation:		T_A = -55°C				
Forward-current transfer ratio	3076	V_{CE} = 5 V dc; I_C = 100 µA dc	h_{FE5}	10		
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}	50	150	
Common emitter small-signal short-circuit forward-current transfer ratio	3306	V_{CE} = 10 V dc; I_C = 50 mA dc; f = 20 MHz	$\lvert h_{fe} \rvert$	3	25	
Small-signal short-circuit input impedance	3201	V_{CB} = 5 V dc; I_C = 1 mA dc; f = 1 kHz	h_{ib}	20	30	Ω

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 4						
Small-signal short circuit input impedance	3201	V_{CE} = 5 V dc; I_C = 1 mA dc; f = 1 kHz	h_{ie}	1,000	4,000	Ω
Small-signal open-circuit output admittance	3216	V_{CE} = 5 V dc; I_C = 1 mA dc; f = 1 kHz	h_{oe}	0	16	μmhos
Output capacitance (input open circuited)	3236	V_{CB} = 10 V dc; I_E = 0; 100 kHz ≤ f ≤ 1 MHz	C_{obo}		15	pF
Input capacitance (output open circuited)	3240	V_{EB} = 0.5 V dc; I_E = 0; 100 kHz ≤ f ≤ 1 MHz	C_{ibo}		85	pF
Noise figure	3246	V_{CE} = 10 V dc; I_C = 300 μA dc; Rg = 510 Ω; f = 1 kHz (see 4.5.7)	F1		8	dB
Noise figure	3246	V_{CE} = 10 V dc; I_C = 300 μA dc; Rg = 1 kΩ; f = 10 kHz (see 4.5.7)	F2		8	dB
Collector to collector leakage		Test condition (see 4.5.3) $V_{(collector\ 1\ to\ collector\ 2)}$ = 100 V dc	$I_{(collector\ 1\ to\ collector2)}$		100	nA dc

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 subgroup 1 of table I shall not require retest of the entire subgroup. Only the failed test shall be rerun upon submission.
3/ Separate samples may be used.
4/ Not required for JANS devices.
5/ Not required for laser marked devices.
6/ The larger number will be placed in the denominator.

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

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
Subgroup 1			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See subgroup 2 of table I and 4.4.4 herein.	
Subgroup 2			45 devices c = 0
Intermittent life	1037	Intermittent operation life: V_{CB} = 10 V dc, 6000 cycles	
Electrical measurements		See subgroup 2 of table I and 4.4.4 herein.	
Subgroup 3			
DPA	2102		3 devices c = 0
Subgroup 4			
Thermal impedance, thermal resistance curves		Each supplier shall submit their (typical) design thermal impedance curves. In addition, test conditions and $Z_{\theta JX}$ limit shall be provided to the qualifying activity in the qualification report	Sample size N/A
Subgroup 5			
Not applicable			
Subgroup 6			3 devices c = 0
ESD	1020		
Subgroup 7			
Not applicable			
Subgroup 8			45 devices c = 0
Reverse stability	1033	Condition A for devices ≥ 400 V, condition B for devices < 400 V.	

5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. When actual packaging of materiel is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. Acquisition documents must specify the following:

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

b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1).

c. Packaging requirements (see 5.1).

d. Lead formation and finish may be specified (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
DLA - CC

Review activities:
Army - AR, AV, MI, SM
Navy - AS, MC, OS, SH
Air Force - 19, 99

Preparing activity:
DLA - CC

(Project 5961-2696)

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.

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I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/270H	2. DOCUMENT DATE 24 July 2003

3. **DOCUMENT TITLE** SEMICONDUCTOR DEVICE, UNITIZED, DUAL-TRANSISTOR, NPN, SILICON, TYPES 2N2060 AND 2N2060L, 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 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			