

The documentation and process conversion measures necessary to comply with this revision shall be completed by 4 November 1999.

INCH-POUND

MIL-PRF-19500/177F
4 August 1999
SUPERSEDING
MIL-S-19500/177E
8 February 1995

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, LOW-POWER
TYPES 2N1131, 2N1131L, 2N1132, 2N1132L, 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 PNP silicon, low-power transistors. Two levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1, 2N1131 and 2N1132 (TO-39), 2N1131L and 2N1132L (TO-5).

1.3 Maximum ratings.

P_T 1/ $T_C = +25^\circ\text{C}$	P_T 2/ $T_A = +25^\circ\text{C}$	V_{CBO}	V_{CEO}	V_{EBO}	I_C	T_{OP} and T_J
<u>W</u>	<u>W</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>mA dc</u>	<u>°C</u>
2.0	0.6	50	40	5.0	600	-65 to +200

1/ Derate linearly 11.4 mW/°C for $T_C \geq +25^\circ\text{C}$.

2/ Derate linearly 3.4 mW/°C for $T_A \geq +25^\circ\text{C}$.

1.4 Primary electrical characteristics.

	h_{FE1} 1/		h_{fe1}		$V_{BE(SAT)}$ 1/		$V_{CE(SAT)}$ 1/		C_{obo}		h_{fe}	
	$V_{CE} = 10 \text{ V dc}$ $I_C = 150 \text{ mA dc}$		$V_{CE} = 5.0 \text{ V dc}$ $I_C = 1.0 \text{ mA dc}$ $f = 1 \text{ kHz}$		$I_C = 150 \text{ mA dc}$ $I_B = 15 \text{ mA dc}$		$I_C = 150 \text{ mA dc}$ $I_B = 15 \text{ mA dc}$		$f = 1 \text{ MHz}$ $V_{CB} = 10 \text{ V dc}$ $I_E = 0$		$f = 20 \text{ MHz}$ $I_C = 50 \text{ mA dc}$ $V_{CE} = 10 \text{ V dc}$	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
2N1131,L	20	45	15	50		1.5		1.3		45	2.5	20
2N1132,L	30	90	30	90		1.5		1.3		45	3.0	20

1/ Pulsed (see 4.4.1).

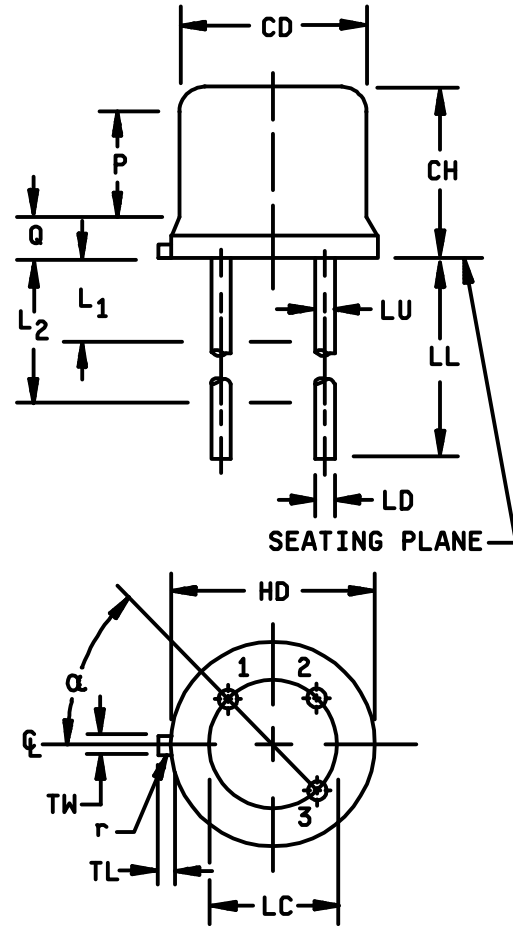
Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAC, 3990 East Broad St., Columbus, OH 43216-5000, by using the addressed Standardization Document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

AMSC N/A

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

FSC 5961

Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	5.33	5
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	5
LC	.100 TP		2.54 TP		6
LD	.016	.021	0.41	0.53	7,8
LL	.500	.750	12.70	19.05	7,8,13
LU	.016	.019	0.41	0.48	7,8
L1	---	.050	---	1.27	7,8
L2	.250	---	6.35	---	7,8
P	.100	---	2.54		
Q	---	---	---	---	5
TL	.028	.048	0.71	1.22	3,4
TW	.028	.034	0.71	0.86	
r	---	.010	---	0.25	10
α	45° TP		45° TP		6



NOTES:

1. Dimension are in inches.
2. Metric equivalents are given for general information only.
3. Beyond r (radius) maximum, TL shall be held for a minimum length of .011 (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC. The device may be measured by direct methods or by the gauge and gauging procedure shown in figure 2.
7. Dimension LU applies between L₁ and L₂. Dimension LD applies between L₂ and LL minimum. Diameter is uncontrolled in L₁ and beyond LL minimum.
8. All three leads.
9. The collector shall be electrically connected to the case.
10. Dimension r (radius) applies to both inside corners of tab.
11. In accordance with ANSI Y14.5M, diameters are equivalent to ϕ x symbology.
12. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
13. For L suffix devices, dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max.

FIGURE 1. Physical dimensions 2N1131 and 2N1132 (TO-39), 2N1131L and 2N1132L (TO-5).

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

MILITARY

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, Building 4D (NPM-DODSSP), 700 Robbins Avenue, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (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 Associated specifications. The individual item requirements shall be in accordance with MIL-PRF-19500, and as specified herein.

3.2 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500, and as follows:

R_{BE} External resistance, base to emitter.

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-PRF-19500, MIL-STD-750, and herein (see 6.2).

3.4 Marking. Marking shall be 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.

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

3.7 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified manufacturers list before contract award (see 4.2 and 6.4).

4. VERIFICATION

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

- a. Qualification inspection (see 4.2).
- b. Screening (see 4.3)
- c. Conformance inspection (see 4.4).

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

4.2.1 Thermal resistance. Thermal resistance testing shall be performed in accordance with MIL-STD-750, method 3151 for qualification only.

4.3 Screening (JANTX level only). Screening shall be in accordance with table IV of MIL-PRF-19500, and as specified herein. The following measurement shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screening (see table IV of MIL-PRF-19500)	Measurements
	JANTX level only
9	Not applicable
11	I_{CBO1} and h_{FE2}
12	T_A = room ambient as defined in the general requirements of MIL-STD-750, $V_{CB} = 30$ V dc; adjust P_T to achieve $T_J = 150^\circ\text{C}$ min.
13	$\Delta I_{CBO1} = 100$ percent of initial value or $10 \mu\text{A}$ dc whichever is greater; $\Delta h_{FE2} = \pm 20$ percent of initial value; subgroup 2 of table I herein.

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 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 VIb (JAN and JANTX) of MIL-PRF-19500, and as follows. Electrical measurements (end-points) shall be in accordance with table I, group A, subgroup 2 herein.

Subgroup	Method	Conditions
B3	1027	T_A = room ambient as defined in the general requirements of MIL-STD-750, $V_{CB} = 30$ V dc; adjust P_T to achieve $T_J = 150^\circ\text{C}$ min.
B3	2037	Test condition A.
B5	3161	For qualification only.
B6	1032	$T_{STG(max)} = +175^\circ\text{C}$

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 as follows. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, group A, subgroup 2 herein.

Subgroup	Method	Conditions
C2	2036	Test condition E.
C6	1026	T_A = room ambient as defined in the general requirements of MIL-STD-750, $V_{CB} = 30$ V dc; adjust P_T to achieve $T_J = 150^\circ\text{C}$ min.

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

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

TABLE I. Group A inspection.

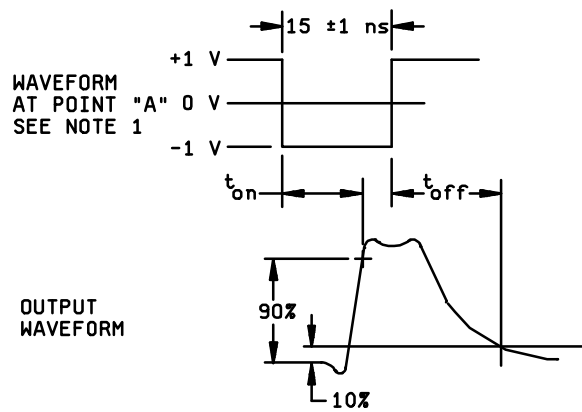
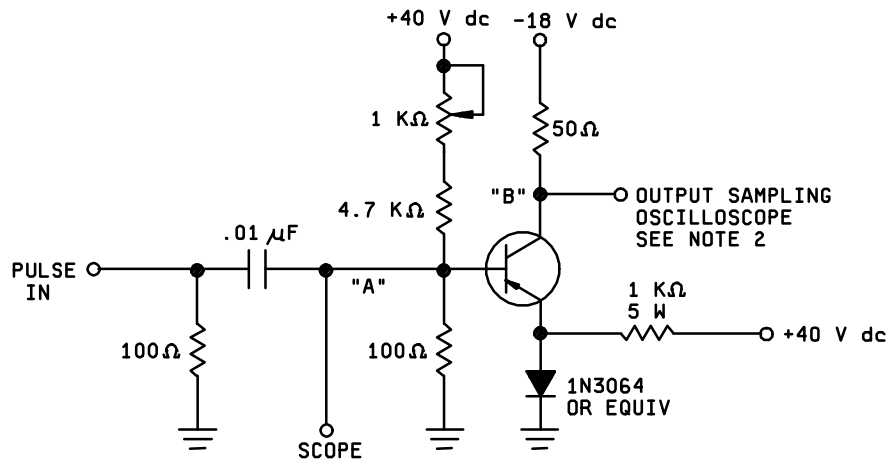
Inspection	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Collector - emitter breakdown voltage	3011	Bias condition D; I _C = 10 mA dc; pulsed (see 4.5.1)	V _{(BR)CEO}		40	V dc
Collector - base breakdown voltage	3001	Bias condition D; I _C = 10 μA dc	V _{(BR)CBO}		50	V dc
Collector - base cutoff current	3036	Bias condition D; V _{CB} = 50 V dc	I _{CBO1}		10	μA dc
Collector - emitter cutoff current	3041	Bias condition B; V _{CE} = 50 V dc; pulsed (see 4.5.1); R _{BE} ≤ 10 ohms	I _{CER}		10	mA dc
Collector – base cutoff current	3036	Bias condition D; V _{CB} = 30 V dc	I _{CBO2}		1.0	μA dc
Emitter - base cutoff current	3061	Bias condition D; V _{EB} = 5.0 V dc	I _{EBO}		100	μA dc
Forward-current transfer ratio	3076	V _{CE} = 10 V dc; I _C = 150 mA dc; pulsed (see 4.5.1)	h _{FE1}			
2N1131, L 2N1132, L				20 30	45 90	
Forward-current transfer ratio	3076	V _{CE} = 10 V dc; I _C = 5.0 mA dc; pulsed (see 4.5.1)	h _{FE2}			
2N1131, L 2N1132, L				15 25		
Collector - emitter saturated voltage	3071	I _C = 150 mA dc; I _B = 15 mA dc; pulsed (see 4.5.1)	V _{CE(SAT)}		1.3	V dc
Base – emitter saturated voltage	3066	Test condition A; I _C = 150 mA dc; I _B = 15 mA dc; pulsed (see 4.5.1)	V _{BE(SAT)}		1.5	V dc
<u>Subgroup 3</u>						
High-temperature operation:		T _A = +150°C				
Collector - base cutoff current	3036	Bias condition D; V _{CE} = 30 V dc	I _{CBO3}		100	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 _{FE3}			
2N1131, L 2N1132, L				10 15		

See footnote at end of table.

TABLE I. Group A inspection.

Inspection	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4</u>						
Small-signal short circuit forward-current transfer ratio 2N1131, L 2N1132, L	3206	$V_{CE} = 5.0 \text{ V dc}; I_C = 1.0 \text{ mA dc}; f = 1 \text{ kHz}$	h_{fe1}	15 30	50 90	
Small-signal short circuit forward-current transfer ratio 2N1131, L 2N1132, L	3206	$V_{CE} = 10 \text{ V dc}; I_C = 5.0 \text{ mA dc}; f = 1 \text{ kHz}$	h_{fe2}	20 30		
Small-signal open-circuit output admittance	3216	$V_{CE} = 5.0 \text{ V dc}; I_C = 1.0 \text{ mA dc}$	h_{ob1}		1.0	μmho
Small-signal open-circuit output admittance	3216	$V_{CE} = 10 \text{ V dc}; I_C = 5.0 \text{ mA dc}$	h_{ob2}		5.0	μmho
Small-signal short-circuit input impedance	3201	$V_{CE} = 5.0 \text{ V dc}; I_C = 1.0 \text{ mA dc}$	h_{ib1}	25	35	Ω
Small-signal short-circuit input impedance	3201	$V_{CE} = 10 \text{ V dc}; I_C = 5.0 \text{ mA dc}$	h_{ib2}		10	Ω
Small-signal open-circuit reverse-voltage transfer ratio	3211	$V_{CE} = 5.0 \text{ V dc}; I_C = 1.0 \text{ mA dc}$	h_{rb1}		8×10^{-4}	
Small-signal open-circuit reverse-voltage transfer ratio	3211	$V_{CE} = 10 \text{ V dc}; I_C = 5.0 \text{ mA dc}$	h_{rb2}		8×10^{-4}	
Magnitude of common emitter small-signal short-circuit forward-current transfer ratio 2N1131, L 2N1132, L	3306	$V_{CE} = 10 \text{ V dc}; I_C = 50 \text{ mA dc}; f = 20 \text{ MHz}$	$ h_{fe} $	2.5 3.0	20 20	
Open circuit output capacitance	3236	$V_{CB} = 10 \text{ V dc}; I_E = 0;$ $100 \text{ kHz} \leq f \leq 1.0 \text{ MHz}$	C_{obo}		45	pF
Input capacitance (output open-circuited)	3240	$V_{EB} = 0.5 \text{ V dc}; I_C = 0;$ $100 \text{ kHz} \leq f \leq 1.0 \text{ MHz}$	C_{ibo}		80	pF
Pulse response		(see figure 2)	$t_{on} + t_{off}$		50	ns
<u>Subgroups 5, 6 and 7</u>						
Not applicable						

1/ For sampling plan, see MIL-PRF-19500.



NOTES:

1. The rise time (t_r) of the applied pulse shall be ≤ 2.0 ns, duty cycle ≤ 2 percent, and the generator source shall be 50Ω .
2. Sampling oscilloscope: $Z_{in} \geq 100 \text{ k}\Omega$, $C_{in} \leq 12 \text{ pF}$, rise time $\leq .5$ ns.

FIGURE 2. Nonsaturated switching time test circuit.

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 and, if required, the specific issue of individual documents referenced (see 2.2.1).
- b. Lead finish (see 3.3.1).
- c. Type designation and product assurance level.
- d. Packaging requirements (see 5.1).

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, DSCC-VQE, Columbus, OH 43216.

CONCLUDING MATERIAL

Custodians:

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

Preparing activity:
DLA - CC

(Project 5961-1920)

Review activities:

Army - AR, AV, MI, SM
Navy - AS, CG, MC
Air Force - 13, 19, 99

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL			
<u>INSTRUCTIONS</u>			
<p>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.</p> <p>2. The submitter of this form must complete blocks 4, 5, 6, and 7.</p> <p>3. The preparing activity must provide a reply within 30 days from receipt of the form.</p> <p>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.</p>			
I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/177F		2. DOCUMENT DATE 99/08/04
3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON, LOW-POWER TYPES 2N1131, 2N1131L, 2N1132, 2N1132L, JAN AND JANTX			
4. NATURE OF CHANGE <i>(Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)</i>			
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 DSN FAX EMAIL 614-692-0510 850-0510 614-692-6939 alan_barone@dscclia.mil	
c. ADDRESS Defense Supply Center Columbus ATTN: DSCC-VAC 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 Road, Suite 2533 Fort Belvoir, Virginia 22060-6221 Telephone (703) 767-6888 DSN 427-6888	