

The documentation and process conversion measures necessary to comply with this document shall be completed by 14 November 2020.

INCH-POUND

MIL-PRF-19500/177J
14 August 2020
SUPERSEDING
MIL-PRF-19500/177H
29 October 2010

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, PNP, SILICON LOW-POWER
TYPES 2N1131, 2N1131L, 2N1132, 2N1132L, JAN, JANTX, AND JANTXV

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

The requirements for acquiring the product described herein shall consist of
this specification sheet and [MIL-PRF-19500](#).

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 Package outlines. See [figure 1](#), 2N1131 and 2N1132 (TO-39), 2N1131L and 2N1132L (TO-5).

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

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

Types	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 [4.5.1](#)).

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* 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 for encapsulated devices. 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", "JANTX", and "JANTXV".

* 1.5.2 Device type. The designation system for the device types of transistors covered by this specification sheet are as follows.

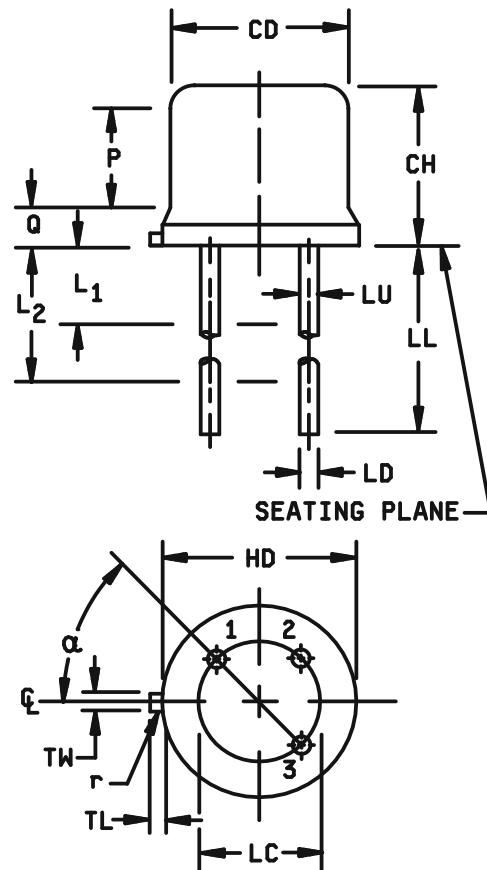
* 1.5.2.1 First number and first letter symbols. The transistors of this specification sheet use the first number and letter symbols "2N".

* 1.5.2.2 Second number symbols. The second number symbols for the transistors covered by this specification sheet are as follows: "1131" and "1132".

* 1.5.2.3 Suffix symbols. The suffix letter "L" is used on devices that are packaged in the TO-5 package of figure 1 that have a long lead length: 1.500 inches (38.10 mm) minimum and 1.750 inches (44.45 mm) maximum. Devices with no suffix (TO-39) package have standard length leads of 0.5 inch (12.7 mm) minimum to .75 inch (19.1 mm) maximum in figure 1.

* 1.5.3 Lead finish. The lead finishes applicable to this specification sheet are listed on [QPDSIS-19500](#).

Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	6
CH	.240	.260	6.12	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		7
LD	.016	.019	0.41	0.48	8,9
LL	See note 14				
LU	.016	.019	0.41	0.48	8,9
L ₁		.050		1.27	8,9
L ₂	.250		6.35		8,9
P	.100		2.54		7
Q		.030		0.76	5
TL	.029	.045	0.74	1.14	3,4
TW	.028	.034	0.71	0.86	3
r		.010		0.25	10
α	45° TP		45° TP		7
1, 2, 10, 12, 13, 14					



NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Beyond r (radius) maximum, TW 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. CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
7. 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 gauging procedure.
8. Dimension LU applies between L₁ and L₂. Dimension LD applies between L₂ and LL minimum. Diameter is uncontrolled in and beyond LL minimum.
9. All three leads.
10. The collector shall be internally connected to the case.
11. Dimension r (radius) applies to both inside corners of tab.
12. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.
13. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
14. For L-suffix devices (TO-5), dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max. For non-L suffix types (TO-39), dimension LL = .5 inch (12.70 mm) min. and .750 inch (19.05 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 of 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 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 <https://quicksearch.dla.mil>.)

2.3 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 manufacturers list ([QML-19500](#)) 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.

R_{BE} External resistance base to emitter.

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in [MIL-PRF-19500](#), and on [figure 1](#).

3.4.1 Lead finish. Lead finish shall be solderable in accordance with [MIL-PRF-19500](#), [MIL-STD-750](#), and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see [6.2](#)).

3.5 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in [1.3](#), [1.4](#), and [table I](#).

3.6 Electrical test requirements. The electrical test requirements shall be as specified in [table I](#).

3.7 Marking. Marking shall be in accordance with [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](#) 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 level only). Screening shall be in accordance with table E-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	Measurements
	JANTX and JANTXV levels only
(1) 3c	Thermal impedance method 3131 of MIL-STD-750 (see 4.3.2)
9	Not applicable
11	I_{CBO1} and h_{FE2}
12	See 4.3.1
13	ΔI_{CBO1} = 100 percent of initial value or 1 μA dc whichever is greater; Δh_{FE2} = ± 20 percent of initial value; subgroup 2 of table I herein

- (1) Shall be performed anytime after temperature cycling, screen 3a; and does not need to be repeated in screening requirements.

* 4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: $V_{CB} = -10$ to -30 V dc. Power shall be applied to achieve $T_J = +135^\circ\text{C}$ minimum using a minimum $P_D = 75$ percent of P_T maximum rated as defined in 1.3. With approval of the qualifying activity and preparing activity, alternate burn-in criteria (hours, bias conditions, T_J , and mounting conditions) may be used for JANTX quality level. A justification demonstrating equivalence is required. In addition, the manufacturing site's burn-in data and performance history will be essential criteria for burn-in modification approval. Use method 3100 of MIL-STD-750 to measure T_J .

* 4.3.2 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3131 of MIL-STD-750 using the guidelines in that method for determining I_M , I_H , t_H , t_{MD} , and t_{SW} (V_C and V_H where appropriate). -See table II, group E, subgroup 4 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 tests and conditions specified for subgroup testing in table E-VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500 and as follows. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
* 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 D.
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 test and conditions specified for subgroup testing in table E-VII of MIL-PRF-19500 and as follows. Electrical measurements (end-points) requirements shall be in accordance with table I, subgroup 2 herein.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E
C5	3131	$R_{\theta JX}$ only, as applicable (see 1.3) and in accordance with thermal impedance curves.
* 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.

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-IX of MIL-PRF-19500 and as specified in table II herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

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 <u>1</u> /	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Thermal Impedance	3131	See 4.3.2.	Z _{θJX}			°C/W
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 2N1131, L 2N1132, L	3076	V _{CE} = -10 V dc; I _C = -150 mA dc; pulsed (see 4.5.1)	h _{FE1}	20 30	45 90	
Forward-current transfer ratio 2N1131, L 2N1132, L	3076	V _{CE} = -10 V dc; I _C = -5.0 mA dc; pulsed (see 4.5.1)	h _{FE2}	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

See footnote at end of table.

* TABLE I. Group A inspection – Continued.

Inspection 1/ <u>Subgroup 3</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
High-temperature operation:		$T_A = +150^\circ\text{C}$				
* Collector - base cutoff current	3036	Bias condition D; $V_{CE} = -30\text{ V dc}$	I_{CBO3}		-100	$\mu\text{A dc}$
Low-temperature operation:		$T_A = -55^\circ\text{C}$				
* Forward-current transfer ratio 2N1131, L 2N1132, L	3076	$V_{CE} = -10\text{ V dc}$; $I_C = -150\text{ mA dc}$; pulsed (see 4.5.1)	h_{FE3}	10 15		
<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	$V_{CE} = -5.0\text{ V dc}$; $I_C = -1.0\text{ mA dc}$; $f = 1\text{ kHz}$	h_{ob1}		1.0	μmho
* Small-signal open-circuit output admittance	3216	$V_{CE} = -10\text{ V dc}$; $I_C = -5.0\text{ mA dc}$; $f = 1\text{ kHz}$	h_{ob2}		5.0	μmho
* Small-signal short-circuit input impedance	3201	$V_{CE} = -5.0\text{ V dc}$; $I_C = -1.0\text{ mA dc}$; $f = 1\text{ kHz}$	h_{ib1}	25	35	Ω
* Small-signal short-circuit input impedance	3201	$V_{CE} = -10\text{ V dc}$; $I_C = -5.0\text{ mA dc}$; $f = 1\text{ kHz}$	h_{ib2}		10	Ω

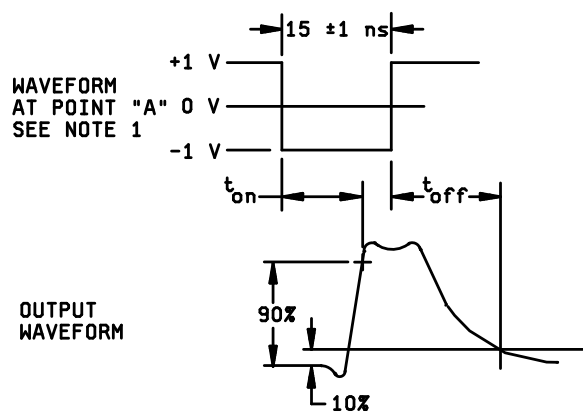
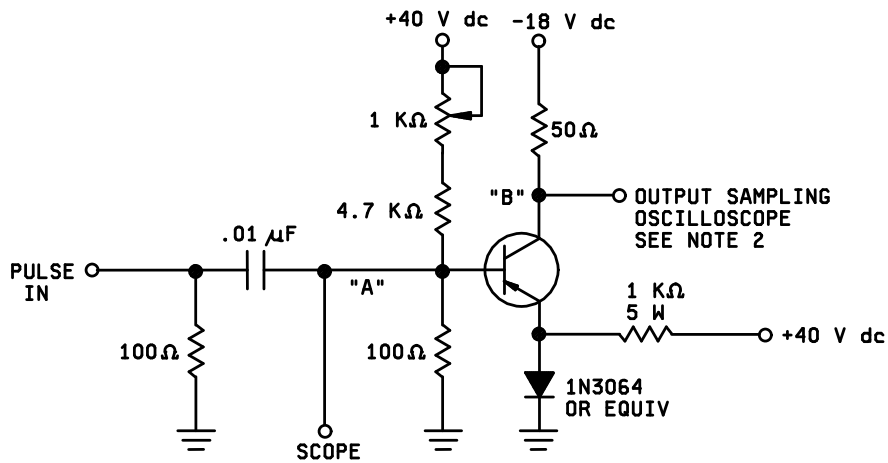
* TABLE I. Group A inspection – Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4</u> Continued						
* Small-signal open-circuit reverse-voltage transfer ratio	3211	$V_{CE} = -5.0 \text{ V dc}; I_C = -1.0 \text{ mA dc}$ $f = 1 \text{ kHz}$	h_{rb1}		8×10^{-4}	
* Small-signal open-circuit reverse-voltage transfer ratio	3211	$V_{CE} = -10 \text{ V dc}; I_C = -5.0 \text{ mA dc}$ $f = 1 \text{ kHz}$	h_{rb2}		8×10^{-4}	
* Magnitude of common emitter small-signal short-circuit forward-current transfer ratio	3306	$V_{CE} = -10 \text{ V dc}; I_C = -50 \text{ mA dc};$ $f = 20 \text{ MHz}$	$ h_{fe} $			
2N1131, L 2N1132, L				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.

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

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
<u>Subgroup 1</u>			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 table I , subgroup 2 herein.	
<u>Subgroup 2</u>			45 devices c = 0
Intermittent life	1037	Intermittent operation life: $V_{CB} = 10$ V dc, 6,000 cycles. Adjust device current, or power, to achieve a minimum ΔT_J of +100°C.	
Electrical measurements		See table I , subgroup 2 herein.	
<u>Subgroup 4</u>			
Thermal impedance curves		See table E-IX of MIL-PRF-19500 , group E, subgroup 4.	
<u>Subgroup 5</u>			
Not applicable			
<u>Subgroup 6</u>			
Electrostatic discharge (ESD)	1020		
<u>Subgroup 8</u>			45 devices c = 0
Reverse stability	1033	Condition B for devices < 400 V.	



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. Non-saturated 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 packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. 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.

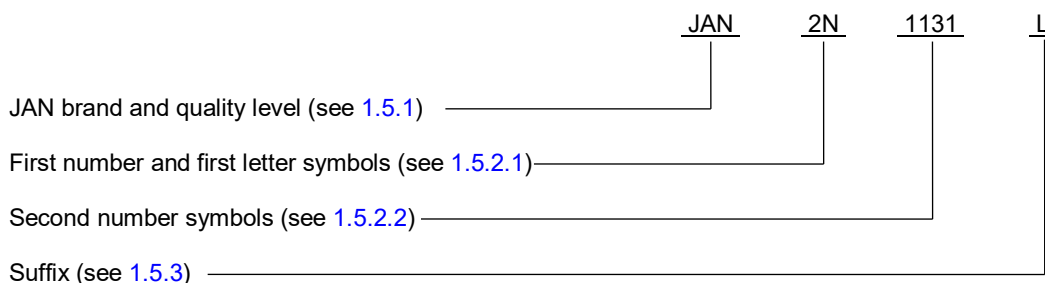
6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory. The notes specified in [MIL-PRF-19500](#) are applicable to this specification.)

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 should 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 1.5 and 6.4.
- * 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.
- * 6.4.1 PIN construction example. The PINs for encapsulated devices are constructed using the following form.



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

PINs for devices of the base quality level	PINs for devices of the "TX" quality level	PINs for devices of the "TXV" quality level
JAN2N1131	JANTX2N1131	JANTXV2N1131
JAN2N1131L	JANTX2N1131L	JANTXV2N1131L
JAN2N1132	JANTX2N1132	JANTXV2N1132
JAN2N1132L	JANTX2N1132L	JANTXV2N1132L

* 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:
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 Navy - EC
 Air Force - 85
 DLA - CC

Preparing activity:
 DLA - CC

(Project 5961-2020-071)

Review activities:
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