

MIL-PRF-19500 Appendix J Task Group Summary Status September 2021 JEDEC

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MIL-PRF-19500 Appendix J Status

- DLA Land and Maritime released the second draft of MIL-PRF-19500 Revision R with Appendix J incorporated on April 19, 2021. Comments were due to DLA on May 19, 2021.
- Comments reviewed and adjudicated by DLA, NASA, Army, and NSWC Crane during June and July 2021.
- MIL-PRF-19500 Revision R with Appendix J released on July 24, 2021.
- A proposed slash sheet for a non hermetic 1500-Watt Transient Voltage Suppressor has been submitted to DLA Land and Maritime to be qualified per the new appendix.
- Proposed Part Identifying Number nomenclature is JANP1 Nxxxx, JANPTX1 Nxxxx, JANPTXV1 Nxxxx, JANP2 Nxxxx, JANPTX2 Nxxxx, and JANPTXV2 Nxxxx.

MIL-PRF-19500 Revision R with Appendix J Dated

The documentation and process conversion measures necessary to comply with this revision shall be completed by 24 January 2022.

INCH-POUND
MIL-PRF-19500R
24 July 2021
SUPERSEDING
MIL-PRF-19500P
w/AMENDMENT 4
18 May 2018

PERFORMANCE SPECIFICATION SEMICONDUCTOR DEVICES, GENERAL SPECIFICATION FOR



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

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MIL-PRF-19500R
APPENDIX J

VERIFICATION SYSTEM FOR NON-HERMETIC QUALIFIED PRODUCTS

J.1 SCOPE

J.1.1 Scope. This appendix contains the verification system for non-hermetic semiconductor devices (hereafter referred to as 'devices'), when performed in its entirety, assures that the product will meet the performance requirements. This appendix contains details of the screening and conformance inspection procedures. (See [tables J-1 through J-VI](#).) In order to supply non-hermetic JANP, JANPTX, or JANPTXV devices to this appendix a manufacturer needs to first be DLA certified and qualified for hermetic devices in accordance with [appendix C](#) or [D](#) and perform all of the required screening and quality conformance testing specified herein and in accordance with [3.2.1.1](#). This appendix is a mandatory part of the specification. The information contained herein is intended for compliance.

Non-hermetic packages are packages that do not contain a cavity and are molded such that the entire die is encapsulated by an epoxy thermoset molding compound. The requirements for this type of package are defined in the following paragraphs.

J.2 APPLICABLE DOCUMENTS

J.2.1 General. The documents listed in this section are specified in sections [J.3](#), [J.4](#) and [J.5](#) 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 shall meet all specified requirements of documents cited in sections [J.3](#), [J.4](#) and [J.5](#) of this specification, whether or not they are listed.

J.2.1.1 Government documents

DEPARTMENT OF DEFENSE STANDARDS

[MIL-STD-883, Method 5011](#) Evaluation and Acceptance of Procedures for Polymeric Materials

(copies of these documents are available online at <https://quicksearch.dla.mil>.)

J.2.2 Non-Government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents are those cited in the solicitation or contract.

ASTM INTERNATIONAL (ASTM)

- ASTM E1640 - Standard Test Method for Assignment of the Glass Transition Temperature By Dynamic Mechanical Analysis
- ASTM E595 - Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment

(Copies of this document are available online at <https://www.astm.org> or from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959)

International Organization for Standardization (ISO)

- ISO/IEC 17025 - General requirements for the competence of testing and calibration laboratories

(Copies of these documents are available online at <https://www.iso.org> or from ISO Central Secretariat, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland.)

First MIL-PRF-19500 Appendix J Initial Draft Slash Sheet

The documentation and process conversion measures necessary to comply with this document shall be completed by 90 days from date.

INCH-POUND
MIL-PRF-19500/672A
DRAFT
SUPERSEDING
MIL-PRF-19500/672
30 April 2001

SEMICONDUCTOR DEVICE, TRANSISTOR, PLASTIC, NPN, SILICON, SWITCHING,
NON-HERMETIC, SURFACE MOUNT, TYPE 2N2222AUE1
QUALITY LEVELS JANP AND JANPTX, JANP

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 non-hermetic plastic encapsulated NPN, silicon, switching transistors. Three Two levels of product assurance (JANP and JANPTX) are provided for each device type as specified in MIL-PRF-19500.

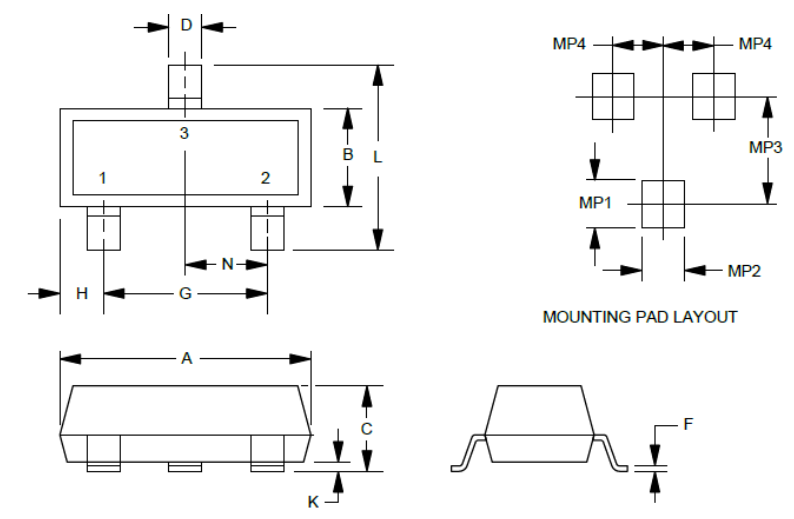
1.2 Physical dimensions. The device package for the encapsulated device type is a See figure 1, SOT-23 (similar to TO-236AB) in accordance with figure 1 (PE1).

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

Types	P_T $T_A = +25^\circ\text{C}$ (1) (2)	I_C	V_{CBO}	V_{CEO}	V_{EBO}	$R_{\theta JA}$	T_{OP} and T_{STG}
2N2222AUE1	$\frac{mW}{500}$	$\frac{mA}{600}$	$\frac{V}{75}$	$\frac{V}{50}$	$\frac{V}{6}$	$\frac{^\circ\text{C}/W}{417 (1)556 (2)}$	$\frac{^\circ\text{C}}{-55 \text{ to } +150}$

- (1) If the printed wiring board is made of an alumina substrate; alumina = 0.4 x 0.3 x 0.024 inch, 99.5% alumina: Derate linearly 2.4 mW/°C for $T_A > +25^\circ\text{C}$. (See figure 4 for layout for $R_{\theta JA}$ test).
- (2) If the printed wiring board is made of a FR5 substrate; FR5 = 1.0 x 0.75 x 0.062 inch: Derate linearly 1.8 mW/°C for $T_A > +25^\circ\text{C}$.

First MIL-PRF-19500 Appendix J Initial Draft Slash Sheet /672 package



Symbol	Dimensions				Symbol	Dimensions			
	Inches		Millimeters			Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
A	.110	.122	2.8	3.1	K	.0004	.004	0.01	0.10
B	.047	.056	1.20	1.43	L	.083	.102	2.1	2.6
C	.035	.045	0.90	1.15	N	.037	.038	0.94	0.96
D	.012	.020	0.30	0.50	MP1	.035	.036	0.89	0.91
F	.003	.008	0.08	0.20	MP2	.031	.032	0.79	0.81
G	.074	.076	1.88	1.92	MP3	.078	.079	1.99	2.01
H	.018	.023	0.46	0.59	MP4	.037	.038	0.94	0.96

- NOTES:
- 1. All dimensions are in inches. 2. Millimeters are given for general information only.
 - 2 3. Terminal numbers are shown for reference. 1 = Base, 2 = Emitter, 3 = Collector.
 - 3. In accordance with ASME Y14.5, measurements are equivalent to Øx symbology.

FIGURE 1. Physical dimensions of SOT-23 (similar to TO-236AB) package.

Planned slash sheets for Appendix J Qualification

19500 Slash sheet	Device Type	Part number	Additional information
672	NPN Silicon Switching Transistor	2N2222	Cross references to hermetic /255
674	NPN Silicon LowPower Transistor	2N2484	Cross references to hermetic /376
686	PNP Silicon Switching transistor	2N2907	Cross references to hermetic /291
691	Silicon switching diode		Cross references to hermetic /116
694	NPN Silicon LowPower Transistor	2N3700	Cross references to hermetic /391

Planned slash sheets for Appendix J Qualification

19500 Slash sheet	Device Type	Part number	Additional information
695	PNP Silicon Switching transistor	2N4033	Cross references to hermetic /512
696	N-Channel Power MOSFET		
714	N-Channel Power MOSFET	2N7558 – 2N7560	
715	N-Channel Power MOSFET	2N7563 – 2N7565	
716	Unipolar Transient Voltage Suppressor diode	1N5555 and others	Cross references to hermetic /500
717	Bipolar Transient Voltage Suppressor diode	1N6036 – 1N6072	Cross references to hermetic /507

MIL-PRF-19500 Appendix J Part Advantages

- DLA Land and Maritime overview and audits of qualified manufacturers
- DLA certified manufacturer and DLA qualified manufacturing lines
- Standard military qualified nonhermetic discrete component
- Standard screening and qualification conformance inspection flows
- Screening and qualification conformance flows based on hermetic flow and proven Army testing.
- No up-screening required or schedule delays due to up-screening saving schedule and money for most military applications...
 - COTS appear cheaper at purchase because the cost of up-screening the lot is not included in the program parts cost for many programs.

Topics from the September 15, 2021, Appendix J Task JEDEC Task Group Meeting

- Questions involved TM5011 and a type of construction that involves using a glass diode inside a plastic encapsulant.
- Does the TM5011 still apply to this encapsulant over glass diode construction? Believe that it still would but don't know whether that type construction might require a different set of conditions.
- Would an encapsulant over glass construction still require all of the sequential testing?
- Would an encapsulant over glass construction require other modifications to the test flow?
- Glass transition temperature testing – can it be moved from Appendix J Group B subgroup 7 performed on every lot to Group C Annual testing in new subgroup 7?

MIL-PRF-19500 Appendix J Task Group Summary

- MIL-PRF-19500 Revision R with Appendix J for nonhermetic devices was dated on 24 July 2021
- First nonhermetic slash draft released MIL-PRF-19500/672 for review and comments. Nonhermetic version of the 2N2222.
- Ten additional nonhermetic slash sheets planned to be sent out as drafts.

MIL-PRF-19500 Appendix J Future Plans

- Plan to start having regular webex meetings to address test method issues related to Appendix J devices.
 - First test methods for review will be the external visual inspection MIL-STD-750-2, test method 2071 and JESD22-B101C.
 - Review is being planned for additional JEDEC and military test methods such as: Acoustic Microscopy, HAST, Autoclave etc.
 - Results of task group test method reviews will be presented to DLA
- Address epoxy encapsulant over glass construction in regards to TM5011, sequential testing, and/or modifications to the test flow

Thank you!

- We would like to express our appreciation to the task group members, NASA NEPAG and SLS programs, Government Working Group, and Microchip Technologies for their continued support of this effort.

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Acronyms

- AC – Autoclave
- CDM – Charged Device Model
- DLA – Defense Logistics Agency
- DPA – Destructive Physical Analysis
- EEE – Electrical, Electronic, and Electromechanical
- EP – Engineering Practice
- ESD – Electrostatic Discharge
- HAST – Highly Accelerated Stress Testing
- HTRB – High Temperature Reverse Bias
- IOL – Intermittent Operating Life

Acronyms

- JAN – Joint Army Navy
- JANP – Joint Army Navy Plastic
- JANPTX- Joint Army Navy Plastic eXtra Testing
- JANPTXV - Joint Army Navy Plastic eXtra Testing with Visual
- JANPS – Joint Army Navy Plastic Space
- JANS – Joint Army Navy Space
- JANTX – Joint Army Navy eXtra Testing
- JANTXV – Joint Army Navy eXtra Testing with Visual
- JEDEC – Joint Electronic Devices Council
- NASA – National Aeronautics and Space Administration

Acronyms

- NEPAG – NASA EEE Parts Assurance Group
- PEDS – Plastic Encapsulated Discrete Semiconductors
- RH – Relative Humidity
- SAE – Society of Automotive Engineers
- SLS – Space Launch System
- t – time (i.e. t = 96 hours)
- Tg – Glass Transition Temperature
- Tj – Junction Temperature
- THB – Temperature Humidity Bias
- TS – Terminal Strength
- UHAST – Unbiased Highly Accelerated Stress Test

Backup

MIL-PRF-19500 Appendix J Comparison to SAE AS6294/3,/4

- SAE AS6294/3 and AS6294/4 PEDS documents were developed to provide the user community with standard screening and qualification guidelines for commercial off the shelf discrete semiconductors utilized in space and military applications.
- MIL-PRF-19500 Appendix J document development focus has been to provide government and military users with the following: DLA Land and Maritime audited and certified manufacturers, DLA qualified military product, standard screening flows, non-hermetic part number prefix scheme, and standard products.
 - DLA Land and Maritime initial manufacturer audits required to certify and qualify manufacturing lines to supply military qualified non-hermetic MIL-PRF-19500 product.
 - Periodic DLA manufacturer re-certification audits identical to the hermetic audits with exceptions due to packaging are required.
 - Initial DLA Land and Maritime device qualification will be for JANTXV-like and JANTX-like levels only. Initial part numbering scheme prefix is planned to be JANP, JANPTX, and JANPTXV.

MIL-PRF-19500 Appendix J Screening and Qualification

- 19500 Appendix J provides standard military screening and qualification flows based on:
 - MIL-PRF-19500 hermetic qualification flows with exceptions due to packaging.
 - Some example portions of SAE 6294/3 and 6294/4 that were incorporated into Appendix J such as:
 - Construction analysis
 - Sequential test flow
 - Moisture Sensitivity level
- Major change table added to Appendix J to address different requalification requirements for plastic military qualified devices.

MIL-PRF-19500 Appendix J Differences Summary

- Non-hermetic screening flow follows the hermetic screening and qualification flows with differences listed below and as shown in the following slides:
 - Temperature cycling is performed at a lower temperature range than hermetic devices.
 - High Temperature Reverse Bias performed at 125°C ambient temperature or 80 percent of maximum operating temperature if maximum operating temperature is less than 150°C.
 - Burn-in performed at 125°C junction temperature or 80 percent of maximum operating temperature if maximum operating temperature is less than 150°C.
 - Radiography 'as specified'.
 - Acoustic Microscopy screening 'as specified'.
 - Sequential testing required during Group B conformance inspection now, maybe moved to Group C instead.