

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, DIODE, GALLIUM ARSENIDE, POWER RECTIFIER,
COMMON CATHODE TYPE 1N6753, JANTX, JANTXV, AND JANS

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 Gallium arsenide rectifier diodes. Three 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-257AA).

1.3 Maximum ratings. (1) Unless otherwise specified, primary electrical characteristics at +25°C and per diode.

| Type | V _{RRM} | V _{RWM} | I _O (2, 3) | I _{FSM} (3, 4) | T _{STG} | T _{OP} | R _{θJC} | R _{θJA} |
|--------|------------------|------------------|-----------------------|-------------------------|------------------|-----------------|------------------|------------------|
| | <u>V(pk)</u> | <u>V(pk)</u> | <u>A</u> | <u>A(pk)</u> | <u>°C</u> | <u>°C</u> | <u>°C/W</u> | <u>°C/W</u> |
| 1N6753 | 250 | 250 | 9 | 35 | -55 to +175 | -55 to +175 | 3.9 | 65 |

NOTES:

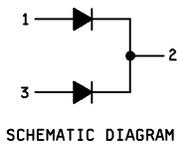
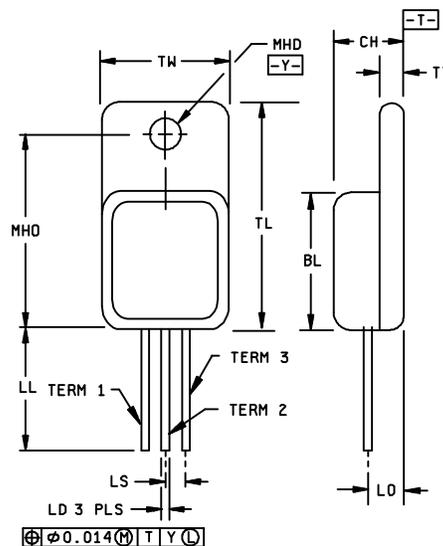
- (1) Total package current is limited to 16 A.
- (2) Derate at 112 mA/°C (isolated) or 125 mA/°C (non-isolated) above T_C = +95°C.
- (3) Per diode.
- (4) Surge applied at rated load conditions, half wave, 1Φ 60 Hz.

1.4 Primary electrical characteristics.

| Type | V _{F1} I _{FM} = I _O (see 1.3) | V _{F2} I _F = 5A | I _{R1} V _R = 125 V | I _{R2} V _R = 250 V | I _{R3} V _R = 125 V T _A = +125°C | I _{R4} V _R = 250 V T _A = +125°C | I _{RM} | t _{rr} | C _J V _R = 5 V |
|--------|--|--|--|--|--|--|-----------------|-----------------|--|
| | <u>V dc</u> | <u>V dc</u> | <u>μA dc</u> | <u>μA dc</u> | <u>μA dc</u> | <u>μA dc</u> | <u>A</u> | <u>ns</u> | <u>pF</u> |
| 1N6753 | 30 | 1.60 | 2.0 | 30 | 130 | 450 | 1.50 | 12.0 | 300 |

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.

| Dimensions <u>1/ 2/</u> | | | | |
|-------------------------|-------------|-------|-----------|-------|
| Symbol | Millimeters | | Inches | |
| | Min | Max | Min | Max |
| BL | 10.4 | 10.90 | 0.410 | 0.430 |
| CH | 4.82 | 5.10 | 0.190 | 0.200 |
| LD | 0.63 | 0.90 | 0.025 | 0.035 |
| LO | 3.05 typ | | 0.120 typ | |
| LL | 12.70 | 19.05 | 1.500 | 1.750 |
| LS | 2.50 typ | | 0.100 typ | |
| MHD | 3.55 | 3.80 | 0.140 | 0.150 |
| MHO | 13.4 | 13.6 | 0.527 | 0.537 |
| TL | 16.4 | 16.9 | 0.645 | 0.655 |
| TT | 0.90 | 1.15 | 0.035 | 0.045 |
| TW | 10.4 | 10.7 | 0.410 | 0.420 |



| Terminal | Description |
|----------|-------------|
| 1 | Anode |
| 2 | Cathode |
| 3 | Anode |

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only (see 3.3).
3. All terminals are isolated from case.

FIGURE 1. Physical dimensions (TO-257AA).

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 Document Automation and Production Services (DAPS), Building 4D (DPM-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, 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 requirements for acquiring the product described herein shall consist of this document and MIL-PRF-19500.

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 6.4).

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

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figure 1 herein. Methods used for electrical isolation of the terminal feedthroughs shall employ materials that contain a minimum of 90 percent Al_2O_3 (ceramic). Examples of such construction techniques are metallized ceramic eyelets or ceramic walled packages. The preferred system of measurement used herein is the metric SI system. However, since this item was designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound units shall take precedence.

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

3.4.2 Polarity. Polarity and terminal configuration shall be in accordance with figure 1 herein.

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 Marking. Marking shall be in accordance with MIL-PRF-19500.

3.7 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 in table III herein.

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 |
| (1) 3C | Thermal impedance (see 4.3.2) | Thermal impedance (see 4.3.2) |
| 9 and 10 | Not applicable | Not applicable |
| 11 | I_{R1} , V_{F1} | I_{R1} and V_{F1} |
| 12 | See 4.3.1, $t = 240$ hours | See 4.3.1, $t = 48$ hours |
| (2) 13 | Subgroups 2 and 3 of table I herein; $\Delta I_{R1} \leq 100$ percent of initial value or 250 nA, whichever is greater. $\Delta V_{F1} \leq \pm 50$ mV. | Subgroup 2 of table I herein; $\Delta I_{R1} \leq 100$ percent of initial value or 250 nA dc, whichever is greater. $\Delta V_{F1} \leq \pm 50$ mV. |

- (1) Thermal impedance shall be performed any time after screen 3.
(2) $Z_{\theta JX}$ is not required in screen 13 if already performed.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: Method 1038 of MIL-STD-750, test condition A. $T_C = +125^\circ\text{C}$; $V_R = 80$ percent of rated V_{RRM} dc (see 1.3).

4.3.2 Thermal impedance measurements for screening. The thermal impedance ($Z_{\theta JX}$) measurements shall be performed in accordance with method 3101 of MIL-STD-750. The maximum limit (not to exceed the group A, subgroup 2 limit) for $Z_{\theta JX}$ in screening (table IV of MIL-PRF-19500) shall be derived by each vendor by means of statistical process control. When the process has exhibited control and capability, the capability data shall be used to establish the fixed screening limit. In addition to screening, once a fixed limit has been established, monitor all future sealing lots using a random five piece sample from each lot to be plotted on the applicable X, R chart. If a lot exhibits an out of control condition, the entire lot shall be removed from the line and held for engineering evaluation and disposition.

4.3.3 Thermal impedance measurements for initial qualification or requalification. The $Z_{\theta JX}$ measurements shall be performed in accordance with method 3101 of MIL-STD-750 (read and record data $Z_{\theta JX}$). Derived conditions limits and thermal response curve shall be supplied to the qualifying activity on the qualification lot prior to qualification approval.

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. The following test conditions shall be used for $Z_{\theta JX}$, group A inspection.

- a. $I_H = 9 \text{ A}$.
- b. $t_H = 50 \text{ ms}$.
- c. $I_M = 10 \text{ mA}$.
- d. $t_{MD} = 100 \mu\text{s}$ minimum.

The maximum limit for $Z_{\theta JX}$ under these test conditions are $Z_{\theta JX} (\text{max}) \leq 3.9^\circ\text{C/W}$ (isolated); $Z_{\theta JX} (\text{max}) \leq 3.1^\circ\text{C/W}$ (non-isolated).

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) and table VIb (JANTX and JANTXV) of MIL-PRF-19500 and as follows. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table II herein.

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

| <u>Subgroup</u> | <u>Method</u> | <u>Inspection</u> |
|-----------------|---------------|--|
| 3 | 4066 | $T_A = 25^\circ\text{C} \pm 5^\circ\text{C}$. See table I, subgroup 6 herein. |

4.4.2.2 Group B inspection, table VIb (JANTX and JANTXV) of MIL-PRF-19500.

| <u>Subgroup</u> | <u>Method</u> | <u>Inspection</u> |
|-----------------|---------------|--|
| 2 | 4066 | $T_A = 25^\circ\text{C} \pm 5^\circ\text{C}$. See table I, subgroup 6 herein. |

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 the applicable steps of table II herein.

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

| <u>Subgroup</u> | <u>Method</u> | <u>Inspection</u> |
|-----------------|---------------|--|
| 2 | 2036 | Test condition A, 5 pounds, $t = 15 \text{ s} \pm 3 \text{ s}$. |

4.4.4 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table III herein. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps and footnotes of table II 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 | 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 1N6753 | 3101 | See 4.4.1 | $Z_{\theta JX}$ | | 3.9 | °C/W |
| Forward voltage | 4011 | Pulse test <u>1</u> / $I_F = I_O$ (see 1.3) $I_F = 5$ A | V_{F1} V_{F2} | | 2.30 1.60 | V dc V dc |
| Reverse current | 4016 | DC method $V_R = 125$ V dc $V_R = 250$ V dc | I_{R1} I_{R2} | | 2.0 30 | μ A dc μ A dc |
| <u>Subgroup 3</u> | | | | | | |
| High temperature operation | | $T_A = 125^\circ\text{C}$ | | | | |
| Reverse current | 4016 | DC method $V_R = 125$ V dc $V_R = 250$ V dc | I_{R3} I_{R4} | | 130 450 | μ A dc μ A dc |
| Forward voltage | 4011 | Pulse test <u>1</u> / $I_F = I_O$ (see 1.3) | V_{F3} | | 2.60 | V dc |
| Low temperature operation | | $T_A = -55^\circ\text{C}$ | | | | |
| Forward voltage | 4011 | Pulse test <u>1</u> / $I_F = I_O$ (see 3.1) | V_{F4} | | 2.30 | V dc |
| <u>Subgroup 4</u> | | | | | | |
| Reverse recovery time | 4031 | Condition A $V_R = 200$ V, $I_F = 5$ A $di/dt = 200$ A/ μ s | t_{rr} | | 12.0 | ns |
| <u>Subgroup 5</u> | | | | | | |
| Not applicable | | | | | | |

See footnote at end of table.

TABLE I. Group A inspection - Continued.

| Inspection | MIL-STD-750 | | Symbol | Limits | | Unit |
|------------------------------------|-------------|--|--------|--------|-----|------|
| | Method | Conditions | | Min | Max | |
| <u>Subgroup 6</u> Surge current | 4066 | I_{fsm} = see 1.3 V_{RM} = 250 V(pk) I_O = see 1.3 Ten surges of 8.3 ms each at 1 minute intervals | | | | |
| Electrical measurements | | See table II herein | | | | |
| <u>Subgroup 7</u> Capacitance | 4001 | V_R = 5 V dc f = 1 MHz | C_J | | 300 | pF |

1/ Pulse test: Pulse width = 300 μ s duty cycle \leq 2 percent.

TABLE II. Groups A, B, C, and E electrical measurements. 1/ 2/ 3/

| Step | Inspection | MIL-STD-750 | | Symbol | Limits | | Unit |
|------|--------------------------|-------------|---|-----------------|--------|--|----------------|
| | | Method | Conditions | | Min | Max | |
| 1. | Forward voltage | 4011 | $I_F = I_O$ (see 1.3) pulsed | V_{F1} | | 2.30 | Vdc |
| 2. | Reverse leakage current | 4016 | $V_R = 125$ V dc pulsed, DC method | I_{R1} | | 2.0 | μ Adc |
| 3. | Forward voltage | 4011 | $I_F = I_O$ (see 1.3) pulsed | ΔV_{F1} | | ± 50 mV dc from initial reading. | |
| 4. | Reverse leakage current | 4016 | $V_R = 125$ V dc pulsed, DC method See 4.4.1 | ΔI_{R1} | | 100 percent or ± 250 nA dc whichever is greater. | |
| 5. | Thermal impedance 1N6753 | 3101 | | $Z_{\theta JX}$ | | 3.90 | $^{\circ}$ C/W |

1/ The electrical measurements for table VIa (JANS) of MIL-PRF-19500 are as follows:

- a. Subgroup 3, see table II herein, steps 1 and 2.
- b. Subgroup 4, see table II herein, steps 1, 2, 3, 4, and 5.
- c. Subgroup 5, see table II herein, steps 1, 2, 3, and 4.

2/ The electrical measurements for table VIb (JANTX and JANTXV) of MIL-PRF-19500 are as follows:

- a. Subgroup 2, see table II herein, steps 1 and 2.
- b. Subgroup 3, see table II herein, steps 1, 2, and 5.
- c. Subgroup 6, see table II herein, steps 1 and 2.

3/ The electrical measurements for table VII of MIL-PRF-19500 are as follows:

- a. Subgroups 2 and 3, see table II herein, steps 1 and 2 for all levels.
- b. Subgroup 6, see table II herein, steps 1, 2, and 5 for all levels.

TABLE III. Group E inspection (all quality levels) for qualification only. ^{1/}

| Inspection | MIL-STD-750 | | Sampling plan |
|-------------------------------------|-------------|--|---------------------|
| | Method | Conditions | |
| <u>Subgroup 1</u> | | | 22 devices c = 0 |
| Thermal shock (temperature cycling) | 1051 | 500 cycles | |
| Hermetic seal | 1071 | | |
| Fine leak | | Test condition H 5 x 10 ⁻⁷ atm cc/s | |
| Gross leak | | Test condition C or K | |
| Electrical measurement | | See table II herein, steps 1 and 2 | |
| <u>Subgroup 2</u> | | | 22 devices c = 0 |
| Steady-state reverse bias | 1038 | Test condition A; 1,000 hours, V _R = 200 V | |
| Electrical measurement | | See table II herein, steps 1 and 2 | |
| <u>Subgroup 3</u> | | | 3 devices c = 0 |
| Destructive physical analysis | | | |
| <u>Subgroup 4</u> | | | 22 devices c = 0 |
| Thermal resistance | 3101 | See 4.4.1 | |
| <u>Subgroup 5</u> | | | |
| Not applicable | | | |

^{1/} For initial design and process change verification only (one time testing).

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 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 Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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.)

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. 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 finish (see 3.3.1).
- e. Type designation and product assurance level.

6.3 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's Part or Identifying Number (PIN).

| Preferred types | Commercial PIN |
|-----------------|----------------|
| JANTX1N6753 | 1N6753 |
| JANTXV1N6753 | 1N6753 |

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) 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.

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

Preparing activity:
 DLA - CC
 (Project 5961-1887)

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.

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.

| | | |
|------------------------------|---|-------------------------------------|
| I RECOMMEND A CHANGE: | 1. DOCUMENT NUMBER MIL-PRF-19500/640 | 2. DOCUMENT DATE 21 October 1996 |
|------------------------------|---|-------------------------------------|

3. DOCUMENT TITLE
SEMICONDUCTOR DEVICE, DIODE, GALLIUM ARSENIDE, POWER RECTIFIER, TYPE 1N6753, 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 DSN FAX EMAIL (614) 692-0510 850-0510 (614)-692-6939 alan_barone@dsc.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 | | |