

The documentation and process conversion measures necessary to comply with this document shall be completed by 9 April 2015.

INCH-POUND

MIL-PRF-19500/678C
 9 January 2015
 SUPERSEDING
 MIL-PRF-19500/678B
 22 February 2013

PERFORMANCE SPECIFICATION SHEET

* RECTIFIER, SEMICONDUCTOR DEVICE, SILICON, DUAL SCHOTTKY CENTER TAP, FOR POWER APPLICATIONS, SURFACE MOUNT, TYPES 1N6840 AND 1N6841, QUALITY LEVELS JAN, JANTX, JANTXV, AND JANS

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 a silicon, dual Schottky power rectifier in a surface mount package. Four levels of product assurance (JAN, JANTX, JANTXV, and JANS) are provided for each device type as specified in [MIL-PRF-19500](#).
- * 1.2 Package outlines. The device package outline is a TO-276AA in accordance with [figure 1](#) for all encapsulated device types.
- 1.3 Maximum ratings. Unless otherwise specified, $T_C = +25^\circ\text{C}$.

Type	V_{RWM}	I_O (1) $T_C = +100^\circ\text{C}$	I_{FSM} $T_C = +25^\circ\text{C}$ $t_p = 8.3\text{ ms}$	C_J at 5 V	$R_{\theta JC}$ (2)	T_{STG} and T_J
	<u>V</u>	<u>A dc</u>	<u>A (pk)</u>	<u>pF</u>	<u>°C/W</u>	<u>°C</u>
1N6840U3	35	10	200	400	2.8	-65 to +150
1N6841U3	45	10	200	400	2.8	-65 to +150

- (1) Derate linearly at 200 mA/°C from $T_J = T_C = +100^\circ\text{C}$ to + 150°C.
- (2) Each individual diode.

1.4 Primary electrical characteristics. $R_{\theta JC} = 1.7^\circ\text{C/W}$ both legs tied together.

* 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@dla.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/>.



- * 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. The quality level designators for encapsulated devices that are applicable for this specification sheet are "JAN", "JANTX", "JANTXV" and "JANS".
- * 1.5.2 Device type. The designation system for the device types of power rectifiers covered by this specification sheet are as follows.
- * 1.5.2.1 First number and first letter symbols. The power rectifiers of this specification sheet use the first number and letter symbols "1N".
- * 1.5.2.2 Second number symbols. The second number symbols for the power rectifiers covered by this specification sheet are as follows: "6840" and "6841".
- * 1.5.3 Suffix symbols. The following suffix symbols are incorporated in the PIN for this specification sheet:

U3	Indicates a metal lidded 3 pad surface mount package similar to a TO-276AA (SMD-0.5) (see figure 1).
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- * 1.5.4 Lead finish designator. The lead finishes applicable to this specification sheet are listed on [QML-19500](#).

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

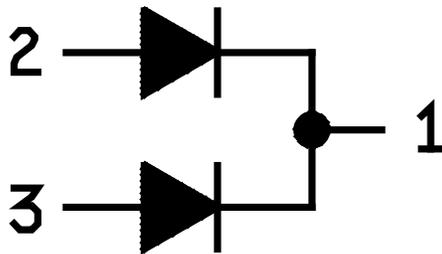
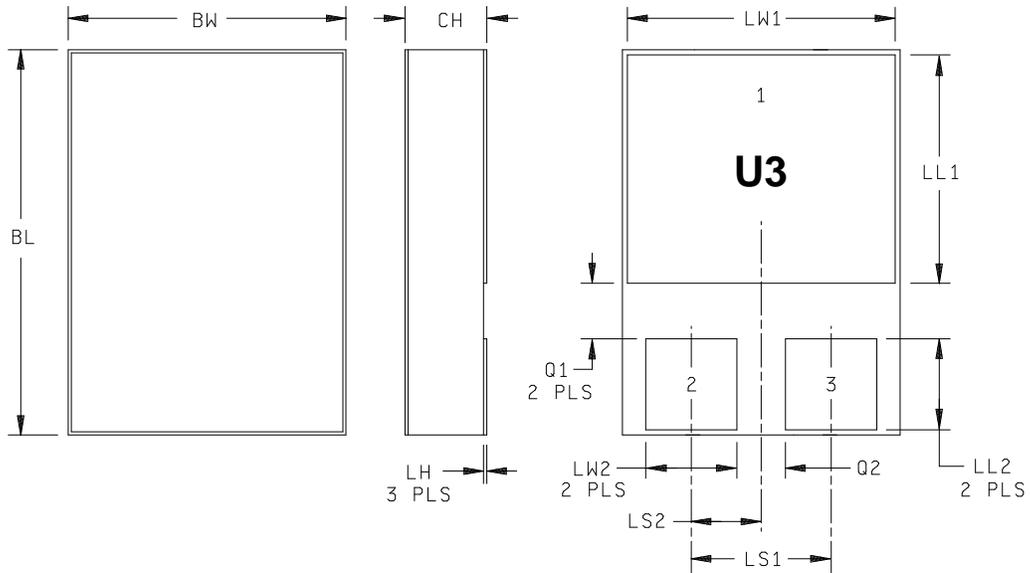
[MIL-STD-750](#) – Test Methods for Semiconductor Devices.

- * (Copies of these documents are available online at <http://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 specified 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](#).
- * 3.4 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in [MIL-PRF-19500](#) and herein. The device package style is a TO-276AA in accordance with [figure 1](#) herein.
- * 3.4.1 Lead finish. The lead finishes applicable to this specification sheet are listed on [QML-19500](#). Unless otherwise specified, 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](#)).
- * 3.4.2 Polarity. Polarity and terminal configuration shall be in accordance with [figure 1](#) herein.
- 3.5 Marking. Marking shall be in accordance with [MIL-PRF-19500](#).
- 3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in [1.3](#), [1.4](#) and [table I](#) herein.
- * 3.7 Workmanship. Power rectifiers 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.



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.395	.405	10.03	10.29
BW	.291	.301	7.39	7.65
CH	.108	.124	2.74	3.15
LH	.010	.020	0.25	0.51
LL1	.220	.230	5.59	5.84
LL2	.115	.125	2.92	3.18
LS1	.150 BSC		3.81 BSC	
LS2	.075 BSC		1.91 BSC	
LW1	.281	.291	7.14	7.39
LW2	.090	.100	2.29	2.54
Q1	.030		0.76	
Q2	.030		0.76	

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to Φ x symbology.
4. Terminal 1 is common cathode.
5. Terminal 2 is anode 1.
6. Terminal 3 is anode 2.

FIGURE 1. Physical dimensions and configuration (SMD.5)

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 and tables I and II).

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

* 4.3 Screening of encapsulated devices. 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	Measurement	
	JANS level	JANTX and JANTXV levels
(1) 3c	Method 3101 of MIL-STD-750, (see 4.3.2).	Method 3101 of MIL-STD-750, (see 4.3.2).
9 and 10	Not applicable.	Not applicable.
11	V_{F2} and I_{R1} .	V_{F2} and I_{R1} .
12	Condition A. See 4.3.1, t = 240 hours.	Condition A. See 4.3.1, t = 48 hours.
13	Subgroups 2 and 3 of table I herein; $\Delta V_{F2} = \pm 50$ mV, $\Delta I_{R1} = 100$ percent of initial value or 25 μ A, whichever is greater.	Subgroup 2 of table I herein; $\Delta V_{F2} = \pm 50$ mV, $\Delta I_{R1} = 100$ percent of initial value or 25 μ A, whichever is greater.
* 17	For TO-276AA packages: Method 1081 of MIL-STD-750 (see 4.3.3), Endpoints: Subgroup 2 of table I herein.	For TO-276AA packages: Method 1081 of MIL-STD-750 (see 4.3.3), Endpoints: Subgroup 2 of table I herein.

(1) Shall be performed anytime after temperature cycling, screen 3a. JANTX and JANTXV levels do not need to be repeated in screening requirements.

4.3.1 Power burn-in conditions. The burn-in conditions shall be as follows: Method 1038 of MIL-STD-750, test condition A. $T_C = +125^\circ\text{C}$; $V_R = 80$ percent of rated V_{RWM} dc.

4.3.2 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3101 of MIL-STD-750 using the guidelines in that method for determining I_M , I_H , t_M , t_{SW} , (and V_H where appropriate). Measurement delay time (t_{MD}) = 100 μ s max. See table III, group E, subgroup 4 herein.

- * 4.3.3 Dielectric withstanding voltage.
 - a. Magnitude of test voltage.....600V dc.
 - b. Duration of application of test voltage.....15 seconds (min).
 - c. Points of application of test voltage.....All leads to case (bunch connection).
 - d. Method of connection.....Mechanical.
 - e. Kilovolt-ampere rating of high voltage source.....1,200 V/1.0 mA (min).
 - f. Maximum leakage current.....1.0 mA.
 - g. Voltage ramp up time.....500 V/second
- 4.4 Conformance inspection. Conformance inspection shall be in accordance with [MIL-PRF-19500](#).

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with table E-V of [MIL-PRF-19500](#), and [table I](#) herein. Electrical measurements (end points) shall be as specified in [table I](#) subgroup 2 herein.

- * 4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VIA (JANS) and table E-VIB (JAN, JANTX and JANTXV) of [MIL-PRF-19500](#).

4.4.2.1 Quality level JANS (see table E-VIA of [MIL-PRF-19500](#)).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	4066	$I_{FSM} = 200$ A; 1 surge of 8.3 ms superimposed on I_O . Condition A, $T_A = 25^\circ\text{C}$; $V_R = 0$; $I_O = 10$ A continuous half-wave.
B4	1037	Each diode: I_F or $I_O = 2$ A (minimum) $\Delta T_J = 85^\circ\text{C}, + 15^\circ\text{C}, - 5^\circ\text{C}$.
B5	1038	Condition B, $T_{JMAX} = +150^\circ\text{C}$, $T_A = 100^\circ\text{C}$, 240 hrs.
B6	3101	Limit for thermal resistance is 2.80°C/W per side.

- * 4.4.2.2 Quality levels JAN, JANTX, and JANTXV (table E-VIB of [MIL-PRF-19500](#)).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B2	4066	$I_{FSM} = 200$ A; 1 surge of 8.3 ms superimposed on I_O . Condition A, $T_A = 25^\circ\text{C}$; $V_R = 0$; $I_O = 10$ A continuous half-wave.
B3	1037	Each diode: I_F or $I_O = 2$ A (minimum) $\Delta T_J = 85^\circ\text{C}, +15^\circ\text{C}, - 5^\circ\text{C}$.
B5		Not applicable.

- * 4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VII of [MIL-PRF-19500](#).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C3	2006	Conditions are as follows: X ₁ , Y ₁ , Z ₁ and Z ₂ axis.
C5	3101	See 4.3.2, R _{θJC} = 2.80°C/W maximum, per side.
C6	1037	Each diode: I _F or I _O = 2 A (minimum) ΔT _J = 85°C, +15°C, -5°C.

4.4.4 Group E inspection. Group E inspection shall be performed for qualification or requalification only. The tests specified in [table III](#) herein must be performed to maintain qualification.

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> <u>2/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical inspection	2071					
<u>Subgroup 2</u>						
Thermal impedance <u>3/</u>	3101	See 4.3.2	$Z_{\theta JX}$			$^{\circ}\text{C/W}$
Forward voltage	4011	Condition B. $I_{FM} = 3 \text{ A (dc) pulsed (see 4.5.1).}$ $I_{FM} = 10 \text{ A (dc) pulsed (see 4.5.1).}$ $I_{FM} = 20 \text{ A (dc) pulsed (see 4.5.1).}$	V_{F1} V_{F2} V_{F3}	0.62 0.75 0.88		V dc V dc V dc
Reverse current leakage 1N6840U3 1N6841U3	4016	DC method, (see 4.5.1.) $V_R = 35 \text{ V dc}$ $V_R = 45 \text{ V dc}$	I_{R1}		100	$\mu\text{A dc}$
<u>Subgroup 3</u>						
High temperature operation:		$T_A = +100^{\circ}\text{C}$				
Reverse current leakage 1N6840U3 1N6841U3	4016	DC method, pulsed (see 4.5.1). $V_R = 35 \text{ V dc}$ $V_R = 45 \text{ V dc}$	I_{R2}		15	mA dc
Forward voltage	4011	Condition B. $I_F = 10 \text{ A pulsed (see 4.5.1)}$	V_{F4}		0.63	V dc
Forward voltage	4011	$I_F = 20 \text{ A pulsed (see 4.5.1)}$ $T_A = -55^{\circ}\text{C}$ Condition B. Pulsed (see 4.5.1), $I_F = 10 \text{ A (dc).}$	V_{F5} V_{F6}		0.70 0.85	V dc

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u> <u>2/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4</u> Junction capacitance	4001	$V_R = 5 \text{ V dc}$; $f = 1 \text{ MHz}$, $V_{SIG} = 50 \text{ mV (p-p)}$ (max)	C_J		400	pF
<u>Subgroup 5</u> Insulation resistance (Dielectric withstanding voltage)	1016	$V_R = 600 \text{ V dc}$; from lid to bottom case. All terminals shorted.	D_{WV}		10	μA
<u>Subgroup 6 and 7</u> Not applicable						

1/ For sampling plan, see [MIL-PRF-19500](#).

2/ All measurements are for each side.

3/ If this test is performed 100 percent in screening, this test need not be performed in group A.

TABLE II. Groups B and C delta measurement. 1/ 2/ 3/

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	Condition B. $I_F = 10 \text{ A (pk)}$ pulsed (see 4.5.1)	ΔV_{F2}		± 50	mV
2.	Reverse current leakage	4016	DC method $V_R = V_{RWM}$	ΔI_{R1}		25 μA or 100 percent of initial reading, whichever is greater.	

1/ The delta measurements for table E-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 and 2.
- c. Subgroup 5, see [table II](#) herein, steps 1 and 2.

2/ The delta measurements for table E-VIB (JAN, 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 and 2.
- c. Subgroup 6, see [table II](#) herein, steps 1 and 2.

3/ The delta measurements for table E-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 and 2 for all levels.

TABLE III. Group E inspection (all quality levels) for qualification only.

Inspection	MIL-STD-750		Qualification inspection
	Method	Conditions	
<u>Subgroup 1</u>			45 devices, c = 0
Thermal shock (temperature cycling)	1051	500 cycles. Condition G.	
Hermetic seal Fine leak Gross leak	1071		
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 2</u>			45 devices, c = 0
Burn-in (steady-state blocking life)	1038	t = 1,000 hours, T _J = + 125°C; V _R = 80 percent of rated V _{RWM} .	
Electrical measurements		See table I , subgroup 2.	
<u>Subgroup 3</u>			
Not applicable			
<u>Subgroup 4</u>			Sample size N/A
Thermal impedance curves	3101	See MIL-PRF-19500 .	
<u>Subgroup 5</u>			5 devices, c = 0
Surge	4066	Condition A, T _A = +25°C I _{FSM} = 200 A, one surge of 8.3 ms superimposed on I _O . V _R = 0; I _O = 10 A pk half sine wave, continuous.	
Electrical measurements		See table I , subgroup 2.	

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 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. The notes specified in MIL-PRF-19500 are applicable to this specification.)

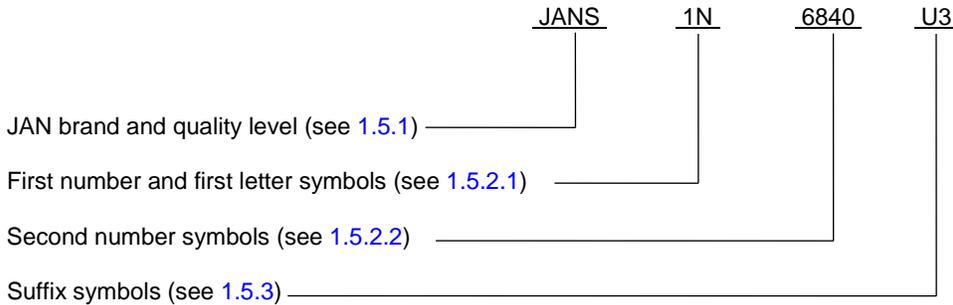
6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

* 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 PIN, see 1.5.

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. The PINs for encapsulated devices are constructed using the following form:



- * 6.5 List of PINs. The following is a list of possible PINs (without JAN brand) available on this specification sheet.

1N6840U3	TX1N6840U3	TXV1N6040U3	S1N6840U3
1N6841U3	TX1N6841U3	TXV1N6841U3	S1N6840U3

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 last previous issue.

Custodians:
 Navy - EC
 Air Force - 85
 NASA - NA
 DLA - CC

Preparing activity:
 DLA - CC
 (Project 5961-2015-003)

Review activity:
 Air Force - 99

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