The documentation and process conversion measures necessary to comply with this revision shall be completed by 5 December 2014.

INCH-POUND

MIL-PRF-19500/730C <u>5 September 2014</u> SUPERCEDING MIL-PRF-19500/730B 26 June 2013

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, SCHOTTKY, DUAL, CENTER TAP, TYPES 1N7037CCU1, 1N7043CAT1, 1N7043CCT1, 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

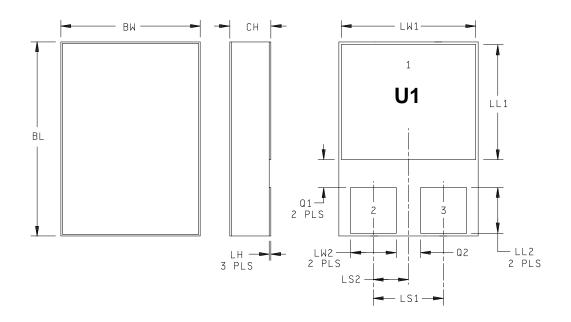
- 1.1 <u>Scope</u>. This specification covers the performance requirements for silicon, schottky power rectifier diodes. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500.
 - 1.2 Physical dimensions. See figure 1 (U1) and figure 2 (TO-254AA).
 - 1.3 Maximum ratings. Unless otherwise specified, maximum ratings (TA = +25°C).

Column 1	Column 2	Column 3	Column 4	Colu	mn 5	Column 6
Types (1)	VRWM	IO (1) (2) T _C = +100°C	IFSM (3) $t_p = 8.3 \text{ ms},$ $T_C = +25^{\circ}C$	R _θ JC (2)	R _θ JC (3)	TSTG and TJ
	V dc	A dc	A (pk)	°C/W	°C/W	°C
1N7037CCU1	100	35	250	0.8	1.6	
1N7043CCT1 1N7043CAT1	100	35	175	1.15	2.3	-65 to +150

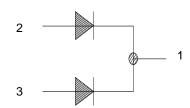
- (1) See temperature-current derating curves on figures 3 and 4.
- (2) For each package.
- (3) For each leg, see figures 5 and 6.
- 1.4 <u>Primary electrical characteristics</u>. $R_{\Theta JC} = 0.8^{\circ}\text{C/W}$ maximum entire package for 1N7037CCU1, $R_{\Theta JC} = 1.15^{\circ}\text{C/W}$ maximum entire package for 1N7043CCT1 and 1N7043CAT1.

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/.

AMSC N/A FSC 5961



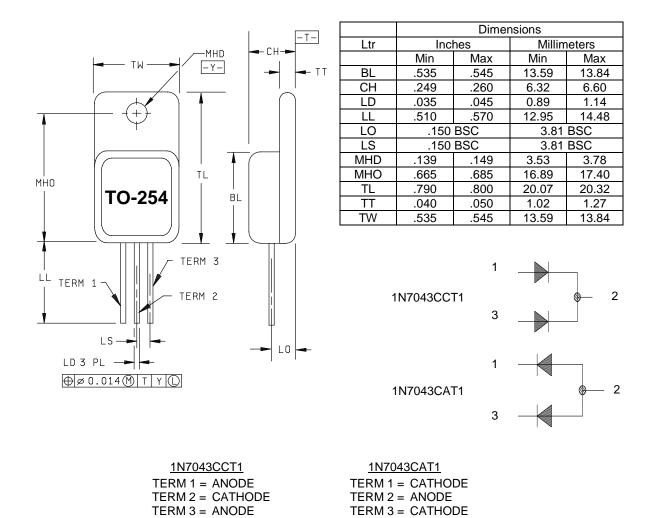
Symbol		Dime	nsions		
	Inc	hes	Millim	eters	
	Min	Max	Min	Max	
BL	.620	.630	15.75	16.00	
BW	.445	.455	11.30	11.56	
CH	.129	.139	3.28	3.53	
LH	.010	.020	0.26	0.51	
LL1	.410	.420	10.41	10.67	
LL2	.152	.162	3.86	4.12	
LS1	.200	.220	5.08	5.59	
LS2	.100	.110	2.54	2.79	
LW1	.370	.380	9.40	9.65	
LW2	.135	.145	3.43	3.68	
Q1	.030		0.76		
Q2	.035		0.89		



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 Φx symbology.

FIGURE 1. <u>Dimensions and configuration 1N7037CCU1</u>.



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 Φx symbology.

FIGURE 2. Dimensions and configuration 1N7043CAT1 and 1N7043CCT1 (TO-254AA).

2. APPLICABLE DOCUMENTS

* 2.1 <u>General</u>. The documents listed in this section are specified in sections 3 or 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 or 4 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 <u>Specifications, standards, and handbooks</u>. 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 <u>Order of precedence</u>. 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 <u>Qualification</u>. 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 <u>Abbreviations, symbols, and definitions</u>. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500.
- 3.4 <u>Interface and physical dimensions</u>. The interface and physical dimensions shall be as specified in <u>MIL-PRF-19500</u>, and on figure 1 (U1) and figure 2 herein. Methods used for electrical isolation of the terminal feedthroughs for the TO-254 shall employ materials that contain a minimum of 90 percent Al₂O₃ (ceramic).
 - 3.4.1 Polarity. Polarity and terminal configuration shall be in accordance with figures 1 and 2 herein.
- 3.4.2 <u>Lead material, finish, and formation</u>. Lead material shall be Kovar or Alloy 52; a copper core or plated core is permitted. Lead finish shall be solderable in accordance with <u>MIL-PRF-19500</u>, <u>MIL-STD-750</u>, and herein. Where a choice of lead formation, material, or finish is desired, it shall be specified in the acquisition document (see 6.2). When lead formation is performed, as a minimum, the vendor shall perform 100 percent hermetic seal in accordance with screen 14 of table E-IV of <u>MIL-PRF-19500</u> and 100 percent dc testing in accordance with table I, subgroup 2 herein.

- 3.5 <u>Electrical performance characteristics</u>. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3 and table I herein.
 - 3.6 Electrical test requirements. The electrical test requirements shall be as specified in tables I and II herein.
 - 3.7 Marking. Marking shall be in accordance with MIL-PRF-19500 and herein.
- 3.8 <u>Workmanship</u>. 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 and tables I and II herein).
- 4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500 and as specified herein.
- 4.2.1 <u>Group E qualification</u>. 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 III tests, the tests specified in table III 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 <u>Screening (JANS, JANTXV and JANTX levels)</u>. Screening shall be in accordance with table E-IV of <u>MIL-PRF-19500</u>, 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 E-IV of	Measurement				
MIL-PRF-19500)	JANS level	JANTX and JANTXV levels			
3b	Condition A, one pulse, tp = 8.3 ms, $I_O = 0$, $V_{RWM} = 0$, $I_{FSM} = \text{see } 1.3 \text{ herein.}$	Condition A, one pulse, tp = 8.3 ms, $I_O = 0$, $V_{RWM} = 0$, $I_{FSM} = \sec 1.3$ herein.			
(1) 3c	Thermal impedance (see 4.3.2).	Thermal impedance (see 4.3.2).			
3d	Avalanche energy test (see 4.3.3).	Avalanche energy test (see 4.3.3).			
9, 10	Not applicable.	Not applicable.			
11	VF1 and IR1	VF1 and IR1			
12	See 4.3.1, 240 hours, minimum.	See 4.3.1, 48 hours minimum.			
13	Subgroup 2 and 3, of table I herein, V_{F1} and I_{R1} , excluding thermal impedance; $\Delta V_{F1} = \pm 50$ mV (pk); $\Delta I_{R1} = \pm 100$ percent from the initial value or ± 500 uA, whichever is greater.	Subgroup 2, of table I herein excluding thermal impedance; V _{F1} and I _{R1} ; Δ V _{F1} = \pm 50 mV (pk); Δ I _{R1} = \pm 100 percent from the initial value or \pm 500 uA, whichever is greater.			
14	Required.	Required.			
15	Required.	Not applicable.			
16	Required.	Not applicable.			
(2) 17	Method 1081 of MIL-STD-750 (see 4.3.4), Endpoints: Subgroup 2 of table I herein.	Method 1081 of MIL-STD-750 (see 4.3.4), Endpoints: Subgroup 2 of table I herein.			

- (1) Thermal impedance shall be performed any time after screen 3.
- (2) Not applicable for U1 package.
- 4.3.1 <u>Power burn-in conditions</u>. Burn-in conditions are as follows: Method 1038 of MIL-STD-750, test condition A. $T_J = +125^{\circ}C$; $V_R = 80 \text{ V dc}$.
- 4.3.2 <u>Thermal impedance</u>. The thermal impedance measurements shall be performed in accordance with method 3101 or 4081 of MIL-STD-750 using the guidelines in that method for determining I_M , I_H , t_H , and t_{MD} . Measurement delay time (t_{MD}) = 70 μ s max. See table III, subgroup 4, and figures 5 and 6.
- 4.3.3 <u>Avalanche energy test</u>. The avalanche energy test is to be performed in accordance with method 4064 of MIL-STD-750 using the circuit as shown on figure 7 or equivalent. The Schottky rectifier under test shall be capable of absorbing the reverse energy, as follows: $I_{AS} = 1A$, $V_{DS} = 100$ V minimum, L = 100 μ H.

4.3.4 Dielectric withstanding voltage.

- a. Magnitude of test voltage900 V dc.
- b. Duration of application of test voltage 15 seconds (min).
- d. Method of connection.......Mechanical.
- e. Kilovolt-ampere rating of high voltage source 1,200V /1.0 mA (min).
- g. Voltage ramp up time500V /second.
- 4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500.
- 4.4.1 <u>Group A inspection</u>. Group A inspection shall be conducted in accordance with appendix E, table E-V of <u>MIL-PRF-19500</u>, and table I herein. Electrical measurements (end-points) and delta requirements shall be in accordance with the applicable steps of table II herein.
- 4.4.2 <u>Group B inspection</u>. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in tables E-VIA (JANS) and 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, forward voltage test (V_{F1}) and reverse leakage test (I_{R1}) herein. Delta measurements shall be in accordance with table II herein.
- 4.4.2.1 Group B inspection, table E-VIA (JANS) of MIL-PRF-19500.

	Subgroup	<u>ivietnoa</u>	Condition
*	B4	1037	$\Delta T_C = +85^{\circ}C$, $I_F = 2$ A minimum.
*	B5	1038	Condition A, V_R = 80 V dc, T_J = +125°C, t = 1,000 hours minimum; heat sinking allowed.

As an alternative method a five (5) dice sample from each individual wafer from the wafer lot shall be qualified for 1,000 hours minimum then each conformance inspection lot requires 340 hours minimum when selected from qualified wafers. This option must be approved by the qualifying activity based on data from at least 3 wafer lots. Any change to the die design, or a conformance inspection failure of the alternate method, requires the 3 wafer lot qualification prior to using this alternative method.

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

Subgroup	Method	Condition
В3	1037	$\Delta T_{\mbox{\scriptsize C}}$ = +85°C, I _F = 2 A minimum for 2,000 cycles.

* 4.4.3 <u>Group C inspection</u>. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VII of MIL-PRF-19500. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2, forward voltage test (VF1) and reverse leakage test (IR1) herein. Delta measurements shall be in accordance with table II herein.

<u>S</u>	<u>ubgroup</u>	Method	Condition
	C2	2036	Condition A, weight = 10 lbs, t = 15 seconds. Not applicable to U1 package.
	C5	4081	Limit for thermal resistance for 1N7037 is 1.6°C/W for each diode. Limit for thermal resistance for 1N7043 is 2.3°C/W for each diode.
	C6	1037	$\Delta T_C = +85^{\circ}C$, I _F = 2 A minimum for 6,000 cycles.
	C6	1038	Condition A, V_R = 80 V dc, T_J = +125°C, t = 1,000 hours minimum; heat sinking allowed.
			As an alternative method a five (5) dice sample from each individual wafer from the wafer lot shall be qualified for 1,000 hours minimum then each conformance inspection lot requires 340 hours minimum when selected from qualified wafers. This option must be approved by the qualifying activity based on data from at least 3 wafer lots. Any change to the die design, or a conformance inspection failure of the alternate method, requires the 3 wafer lot qualification prior to using this alternative method.

- 4.4.4 <u>Group E inspection</u>. Group E inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table E-IX of MIL-PRF-19500, and table II herein.
 - 4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables as follows.
 - 4.5.1 <u>Pulse measurements</u>. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

* TABLE I. Group A inspection.

Inspection		MIL-STD-750		Liı	mits	11-2
<u>1</u> / <u>2</u> /	Method	Conditions	Symbol	Min	Max	Unit
Subgroup 1						
Visual and mechanical examination	2071					
Subgroup 2						
Thermal impedance 3/	3101	See 4.3.2	$Z_{\Theta}JX$			°C/W
Forward voltage	4011	Pulsed test (see 4.5.1)	V _{F1}			
1N7037 1N7043		I _F = 15A (pk) I _F = 15A (pk)			.90 .95	V V
Forward voltage	4011	Pulsed test (see 4.5.1)	V _{F2}			
1N7037 1N7043		I _F = 35 A(pk) I _F = 35 A(pk)			1.22 1.30	V V
Reverse current	4016	DC method	I _{R1}			
1N7037 1N7043		V _R = 100 V V _R = 100 V			.5 .5	mA mA
Subgroup 3						
High temperature operation:		T _C = +125 °C				
Forward voltage	4011	Pulsed test (see 4.5.1)	V _{F3}			
1N7037 1N7043		I _F = 35 A(pk) I _F = 35 A(pk)			1.00 1.20	V V
Reverse current	4016	DC method;	I _{R2}			
1N7037 1N7043		V _R = 100 V V _R = 100 V			15 15	mA mA
Low temperature operation:		T _C = -55°C				
Forward voltage	4011	Pulsed test (see 4.5.1)	VF4			
1N7037 1N7043		I _F = 35 A dc I _F = 35 A dc			1.35 1.84	V V

See footnotes at end of table.

* TABLE I. Group A inspection - Continued.

	Inspection		MIL-STD-750	Symbol	Lim	Limits	
	<u>1</u> / <u>2</u> /	Method	Conditions		Min	Max	
	Subgroup 4						
	Junction capacitance	4001	$V_R = 5 \text{ V dc, } f = 1 \text{ MHz,}$ $V_{SIG} = 50 \text{ mV (p-p)}$	СЈ		600	pF
	Subgroup 5						
	Not applicable						
	Subgroup 6						
*	Surge	4066	Condition A, see column 4 of 1.3. Ten surges per diode. 60 seconds between surges. (See 4.5.1)				
	Electrical measurements		See table I, subgroup 2 herein				
	Subgroup 7						
	Insulation Resistance	1016	V_R = 500 V dc; all leads shorted; TO-254AA package: V_R applied across leads to case; U1 package: V_R applied across lid to case bottom.	l _R		10	μА
	Scope display evaluation	4023	Stable only				
	Electrical measurements		See table I, subgroup 2 herein				

^{1/} For sampling plan, see MIL-PRF-19500.
2/ Each individual diode.
3/ This test required for the following end-point measurements only: Group B, subgroups 3 and 4 (JANS).
Group B, subgroups 2 and 3 (JAN, JANTX, JANTXV).
Group C, subgroups 2 and 6.
Group E, subgroup 1.

* TABLE II. Groups B, C, and E delta requirements. 1/2/3/4/5/6/

Step	Inspection	N	IIL-STD-750	Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage	4011	I _F = 15 A (pk) pulsed (see 4.5.1)	ΔVF1	± 50 m	nV dc from reading.	initial
2.	Reverse current	4016	Vr = 100V	∆lR1	±100% fro ±5000	om initial re uA whichev greater.	
3.	Thermal impedance	3101	See 4.3.2	$Z_{\Theta}J\chi$			°C/W

- 1/ Each individual diode.
- 2/ The delta measurements for appendix E, table E-VIA (JANS) of MIL-PRF-19500 are as follows:
 - a. Subgroup 3, see table II herein, steps 1, 2, and 3.
 - b. Subgroup 4, see table II herein, steps 1, 2, and 3.
 - c. Subgroup 5, see table II herein, steps 1 and 2.
- The delta measurements for appendix E, table E-VIB (JANTX and JANTXV) of MIL-PRF-19500 are as follows:
 - a. Subgroup 2, see table II herein, steps 1, 2, and 3.
 - b. Subgroup 3, see table II herein, steps 1, 2, and 3.
 - c. Subgroup 6, see table II herein, steps 1 and 2.
- 4/ The delta measurements for appendix E, table E-VII of MIL-PRF-19500 are as follows:
 - a. Subgroup 2, see table II herein, steps 1, 2, and 3 for all levels.
 - b. Subgroup 3, see table II herein, steps 1 and 2 for all levels.
 - c. Subgroup 6, see table II herein, steps 1, 2, and 3 for all levels.
- 5/ The delta measurements for table E-IX of MIL-PRF-19500 are as follows:
 - a. Subgroup 1, see table II herein, steps 1, 2, and 3.
 - b. Subgroup 2, see table II herein, steps 1 and 2.
- 6/ Devices which exceed the table I, limits for this test shall not be accepted.

* TABLE III. Group E inspection (all quality levels) – for qualification and requalification only.

	Inspection		MIL-STD-750	Qualification
		Method	Conditions	
	Subgroup 1			n = 45, c = 0
	Temperature cycling (air to air)	1051	Test condition G, 500 cycles, -55°C to +150°C.	
*	Electrical measurements		See table I subgroup 2 and delta requirements of table II herein.	
	Subgroup 2			n = 45, c = 0
	Life test	1048	t = 1,000 hours, T _J = +125°C, V _R = 80 percent rated voltage (see 1.3, column 2 herein).	
*	Electrical measurements		See table I subgroup 2 and delta requirements of table II herein.	
	Subgroup 4			
	Thermal impedance curves		See MIL-PRF-19500.	
	Subgroup 10 1/			n = 5, c = 0
	Surge	4066		
	1N7037		Condition A, T _A = +25°C I _{FSM} = 250 A, 10 surge of 8.3 ms, superimposed on I _O , V _R = 0; I _O = 10 A pk half sine wave, continuous.	
	1N7043		Condition A, $T_A = +25^{\circ}\text{C I}_{FSM} = 175 \text{ A}$, 10 surge of 8.3 ms, superimposed on I_O , $V_R = 0$; $I_O = 10 \text{ A}$ pk half sine wave, continuous.	
	Electrical measurements		See table I subgroup 2 (V _F and I _R only).	

^{1/} Each individual diode.

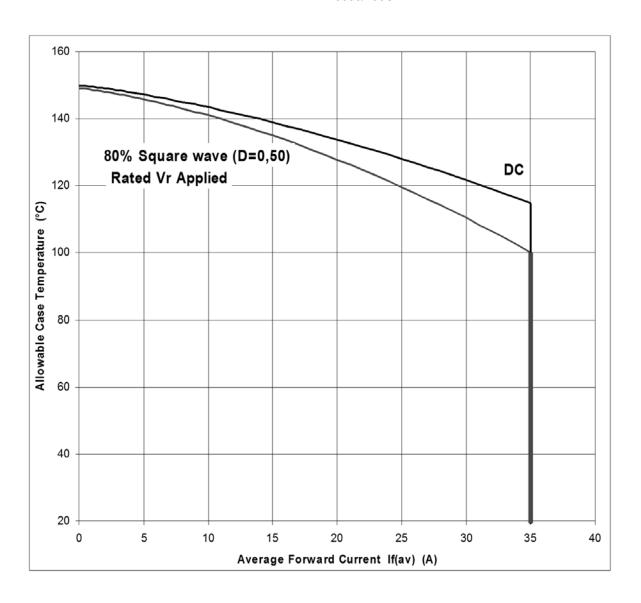


FIGURE 3. Temperature-current derating curve - 1N7037 (entire package).

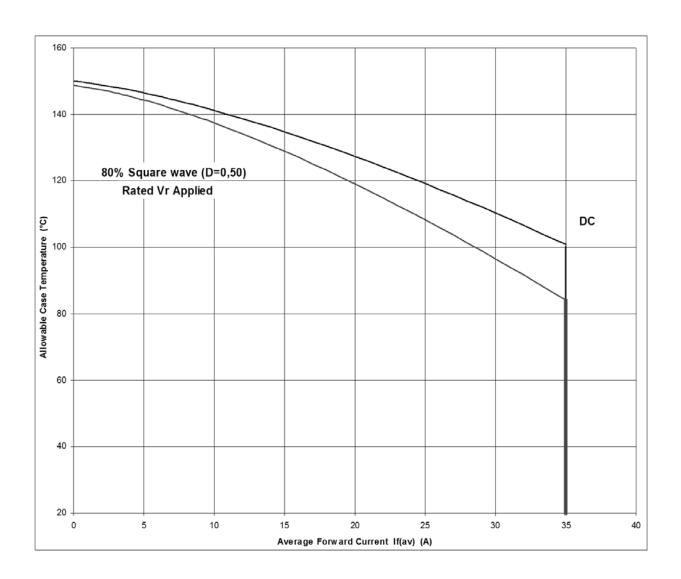


FIGURE 4. Temperature-current derating curve - 1N7043 (entire package).

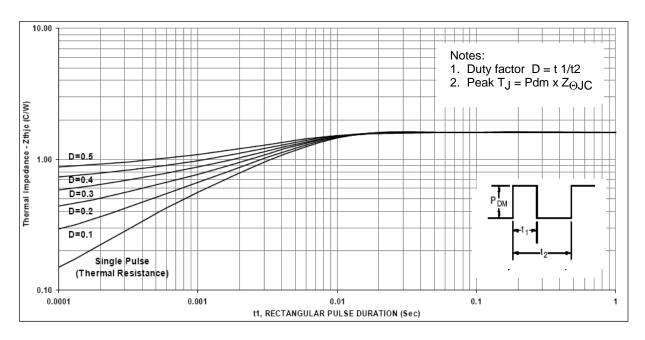


FIGURE 5. Thermal impedance - 1N7037 (for each leg).

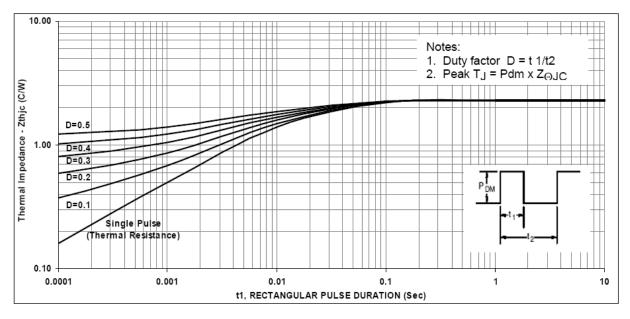
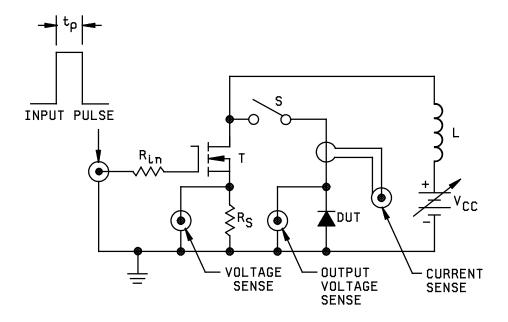


FIGURE 6. Thermal impedance - 1N7043 (for each leg).



Input pulse $~R_{in}$ = 50 ohms, 1 watt $~V_G$ = 10 Volts, R_S = 0.1 ohms, 1 watt Z_G = 50 ohms $_L$ = 100 $_\mu H$ $_P.W. <math display="inline">_\approx$ 30 $_\mu s$ $_Duty~cycle \le$ 1 percent, T = IRF250/2N6766 or equivalent

PROCEDURES:

- 1. With S open, adjust pulse width to test current of 1 amps through R_S.
- 2. Close S, verify test current with current sense.
- 3. Read peak output voltage (see 4.3.3).

FIGURE 7. Avalanche energy test circuit.

5. PACKAGING

5.1 <u>Packaging</u>. 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 <u>Intended use</u>. 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 title and section 1.
- 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 <u>Cross reference substitution list</u>. A PIN for PIN replacement table follows, and these devices are directly interchangeable.

Non-preferred PIN	Preferred PIN
15CGQ100	JANS, JANTXV, JANTX1N7043CCT1
15JGQ100	JANS, JANTXV, JANTX1N7043CAT1
15CLQ100	JANS, JANTXV, JANTX1N7037CCU1

6.5 <u>Changes from previous issue</u>. 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:

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