

The documentation and process conversion measures necessary to comply with this revision shall be completed by 24 October 2009.

INCH-POUND

MIL-PRF-19500/735A
 24 July 2009
 SUPERSEDING
 MIL-PRF-19500/735
 4 October 2006

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, DIODE, SILICON, SCHOTTKY, DUAL, CENTER TAP,
 TYPE 1N7041CCU1 AND SINGLE DIODE TYPE 1N7045T3, 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 silicon, schottky, power rectifier diodes for use in high frequency switching applications. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (U-1) and figure 2 (TO-257AA).

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

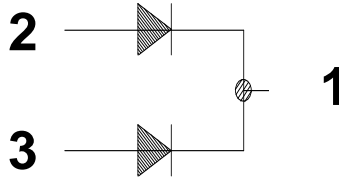
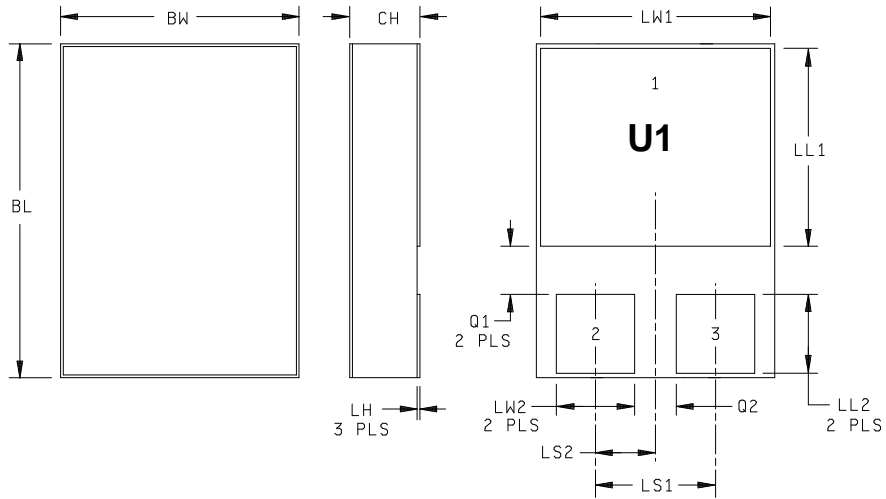
Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Types	V_{RWM}	I_O (1)(2) $T_C = +100^\circ\text{C}$	I_{FSM} (3) $t_p = 8.3 \text{ ms}$, $T_C = +25^\circ\text{C}$	$R_{\theta JC}$	T_{STG} And T_J
	V dc	A dc	A (pk)	$^\circ\text{C/W}$	$^\circ\text{C}$
1N7041CCU1	45	20	250	1.67 (3)	-65 to +150
1N7045T3	45	10	110	2.6	

- (1) See temperature-current derating curves in figures 3 and 4 .
- (2) Entire package.
- (3) Each leg.

1.4 Primary electrical characteristics. $R_{\theta JC} = 0.83^\circ\text{C/W}$ maximum for entire package for 1N7041CCU1; $R_{\theta JC} = 2.6^\circ\text{C/W}$ maximum for 1N7045T3; $R_{\theta JA} = 80^\circ\text{C/W}$ maximum.

Comments, suggestions, or questions on this document should be addressed to Defense Supply Center, Columbus, ATTN: DSCC-VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to semiconductor@dsc.dla.mil . Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at <http://assist.daps.dla.mil> .

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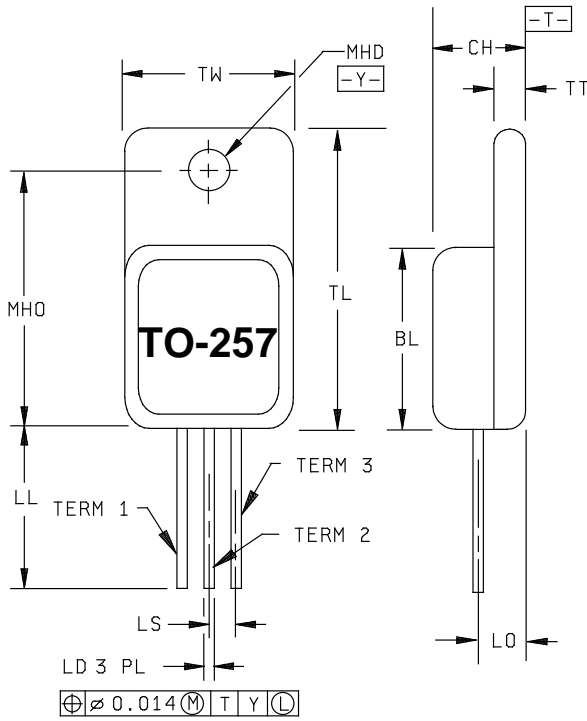


Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.620	.630	15.75	16.00
BW	.445	.455	11.30	11.56
CH	.129	.141	3.28	3.58
LH	.010	.020	0.25	0.51
LL1	.410	.420	10.41	10.67
LL2	.152	.162	3.86	4.11
LS1	.200	.220	5.08	5.59
LS2	.100	.110	2.54	2.79
LW1	.370	.380	9.40	9.65
LW2	.135	.145	3.43	3.68
Q1	.030		0.76	
Q2	.035		0.89	
Term 1	Cathode			
Term 2	Anode			
Term 3	Anode			

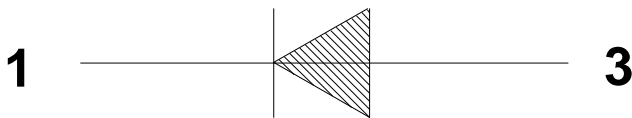
NOTES:

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.

FIGURE 1. Physical dimensions and configuration for 1N7041CCU1.



Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.410	.430	10.41	10.92
CH	.190	.200	4.83	5.08
LD	.025	.035	0.64	0.88
LL	.500	.750	12.70	19.05
LO	.120 BSC		3.05 BSC	
LS	.100 BSC		2.54 BSC	
MHD	.140	.150	3.56	3.81
MHO	.527	.537	13.39	13.64
TL	.645	.665	16.38	16.89
TT	.035	.045	0.89	1.14
TW	.410	.420	10.41	10.67



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.

FIGURE 2. Dimensions and configuration for 1N7045T3.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 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 must meet all specified requirements of documents cited in sections 3, 4, or 5 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://assist.daps.dla.mil/quicksearch/> or <http://assist.daps.dla.mil> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

* 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 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 and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figures 1 and 2 herein. Methods used for electrical isolation of the terminal feedthroughs for the TO-257 package 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 Lead finish and formation. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of finish is desired, it shall be specified in the acquisition document (see 6.2). When lead formation is performed on the TO-257, as a minimum, the vendor shall perform 100 percent hermetic seal in accordance with screen 14 of MIL-PRF-19500 and 100 percent dc testing in accordance with table I, subgroup 2 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 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 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 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 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 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 Screening (JANS, JANTXV, and JANTX levels). 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 (see table E-IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
(1) (2) 3b	Method 4066 of MIL-STD-750, condition A, one pulse, $t_p = 8.3\text{ms}$, $I_O = 0$, $V_{RWM} = 0$, $I_{FSM} = \text{see 1.3 herein}$.	Method 4066 of MIL-STD-750, condition A, one pulse, $t_p = 8.3\text{ms}$, $I_O = 0$, $V_{RWM} = 0$, $I_{FSM} = \text{see 1.3 herein}$.
(2) 3c	Thermal impedance (see 4.3.2)	Thermal impedance (see 4.3.2)
3d	Peak reverse energy test (see 4.3.3)	Peak reverse energy test (see 4.3.3)
4	Required	Optional
5	Required	Not applicable
8	Required	Not applicable
9, 10	Not applicable	Not applicable
11	V_{F1} and I_{R1}	V_{F1} and I_{R1}
12	See 4.3.1, 240 hours	See 4.3.1, 48 hours
13	Subgroup 2 and 3, of table I herein, V_{F1} and I_{R1} ; $\Delta V_{F1} \leq 50\text{ mV (pk)}$; $\Delta I_{R1} = \pm 100\text{ percent from the initial value or } \pm 100\text{ }\mu\text{A dc, whichever is greater.}$	Subgroup 2, of table I herein; V_{F1} and I_{R1} ; $\Delta V_{F1} \leq 50\text{ mV (pk)}$; $\Delta I_{R1} = \pm 100\text{ percent from the initial value or } \pm 100\text{ }\mu\text{A dc, whichever is greater.}$

(1) Surge shall precede thermal impedance.

(2) Thermal impedance and surge shall be performed any time after screen 3a and before screen 13.

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* 4.3.1 Power burn-in conditions. Burn-in conditions are as follows: Method 1038 of MIL-STD-750, test condition A. $V_R = 36$ V dc; $T_J = +125^\circ\text{C}$.

4.3.2 Thermal impedance measurements. 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 , t_{MD} and V_C . Measurement delay time (t_{MD}) = 70 μs max. See table III, group E, subgroup 4 herein.

4.3.3 Peak reverse energy test. The peak reverse energy test is to be performed using the circuit as shown on figure 7 or equivalent. The Schottky rectifier under test must be capable of absorbing the reverse energy, as follows: $I_{RM} = 1$ A, $V_{RSM} = 45$ V minimum, $L = 100$ μH .

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) and delta requirements shall be in accordance with the applicable steps of table II herein.

4.4.2 Group B inspection. 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.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B4	1037	$\Delta T_C = +85^\circ\text{C}$, $I_F = 2$ A minimum for 2,000 cycles.
B5	1038	Condition A, $V_R = 36$ V dc, $T_J = +125^\circ\text{C}$, $t = 340$ hours min; heat sinking allowed. This test shall be extended to 1000 on each JANS wafer lot.

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
B3	1037	$\Delta T_C = +85^\circ\text{C}$, $I_F = 2$ A minimum for 2,000 cycles.

* 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. 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.

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Condition A, weight = 10 lbs, $t = 15$ seconds. Not required for 1N7041CCU1.
C5	4081	Limit for thermal resistance for 1N7041 is 1.67°C/W for each leg. Limit for thermal resistance for 1N7045 is 2.6°C/W .
C6	1037	$\Delta T_C = +85^\circ\text{C}$, $I_F = 2$ A minimum for 6,000 cycles.
C6	1038	Condition A, $V_R = 36$ V dc, $T_J = +125^\circ\text{C}$, $t = 1,000$ hours minimum; (heat sinking allowed). (required for TX and TXV levels only)

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4.4.4 Group E inspection. 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 III herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein except $Z_{\Theta J X}$ need not be performed after group E subgroup 2.

4.5 Methods of inspection. Methods of inspection shall be as specified in the appropriate tables as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

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* TABLE I. Group A inspection.

Inspection <u>1/ 2/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u>						
Visual and mechanical examination	2071					
<u>Subgroup 2</u>						
Forward voltage	4011	Pulsed (see 4.5.1)	VF1			
1N7041		I _F = 10A (pk)		0.57	V dc	
1N7045		I _F = 10A (pk)		0.73	V dc	
Forward voltage	4011	Pulsed (see 4.5.1)	VF2			
1N7041		I _F = 20 A(pk)		0.69	V dc	
1N7045		I _F = 20 A(pk)		1.02	V dc	
Reverse current	4016	DC method	I _{R1}			
1N7041		V _R = 45 V		0.5	mA dc	
1N7045		V _R = 45 V		0.5	mA dc	
<u>Subgroup 3</u>						
High temperature operation:		T _C = +125 °C				
Forward voltage	4011	Pulsed (see 4.5.1)	VF3			
1N7041		I _F = 10 A(pk)		0.48	V dc	
1N7045		I _F = 10 A(pk)		0.70	V dc	
Forward voltage	4011	Pulsed (see 4.5.1)	VF4			
1N7041		I _F = 20 A(pk)		0.61	V dc	
1N7045		I _F = 20 A(pk)		1.10	V dc	
Reverse current	4016	DC method;	I _{R2}			
1N7041		V _R = 45 V		67	mA dc	
1N7045		V _R = 45 V		67	mA dc	
Low temperature operation:		T _C = -55°C				
Forward voltage	4011	Pulsed (see 4.5.1)	VF5			
1N7041		I _F = 10 A dc		0.65	V dc	
1N7045		I _F = 10 A dc		0.74	V dc	
Forward voltage	4011	Pulsed (see 4.5.1)	VF6			
1N7041		I _F = 20 A dc		0.74	V dc	
1N7045		I _F = 20 A dc		0.95	V dc	

See footnotes at end of table.

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* TABLE I. Group A inspection - Continued.

Inspection 1/ 2/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4</u> Junction capacitance	4001	$V_R = 5 \text{ V dc}$, $f = 1 \text{ MHz}$, $V_{SIG} = 50 \text{ mV (p-p)}$	C_J		900	pF
<u>Subgroup 5</u> Not applicable						
<u>Subgroup 6</u> Surge	4066	See column 4 of 1.3. Ten surges for each internal diode. 60 seconds between surges. (see 4.5.1)				
Electrical measurements		See table I, subgroup 2 herein.				
<u>Subgroup 7</u> Dielectric withstanding voltage	1016	$V_R = 500 \text{ V dc}$; all leads shorted, measure from leads to case	DWV		10	$\mu\text{A dc}$
Scope display evaluation	4023	Stable only				
Electrical measurements		See table I, subgroup 2 herein.				

1/ For sampling plan, see MIL-PRF-19500.

2/ Electrical characteristics apply to all package styles and polarities.

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

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Forward voltage 1N7041 1N7045	4011	$I_F = 10 \text{ A (pk)}$ pulsed (see 4.5.1) $I_F = 10 \text{ A (pk)}$ pulsed (see 4.5.1)	ΔV_{F1}	$\pm 50 \text{ mV dc}$ from initial reading.		
2.	Reverse current	4016	$V_R = 45\text{V}$	ΔI_{R1}	± 100 percent from the initial value or $\pm 100\mu\text{A dc}$, whichever is greater.		
3.	Thermal impedance	4081	See 4.3.2	$Z_{\Theta JX}$			

1/ Each internal diode.

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

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

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

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

5/ Devices which exceed the table I limits for this test shall not be accepted.

6/ The electrical 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.

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

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
<u>Subgroup 1</u>			n = 12, c = 0
Temperature cycling (air to air)	1051	Test condition G, 500 cycles, -55°C to +150°C.	
Hermetic seal	1071		
Electrical measurements		See table I, subgroup 2.	
<u>Subgroup 2</u>			n = 12, 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.	
<u>Subgroup 4</u>			
Thermal impedance curves		See MIL-PRF-19500.	
<u>Subgroup 6</u>			n = 3
ESD	1020		
<u>Subgroup 10 1/</u>			n = 5, c = 0
Surge	4066		
1N7041		Condition A, T _A = +25°C I _{FSM} = 250 A, 100 surges of 8.3 ms superimposed on I _O . V _R = 0; I _O = 10 A pk half sine wave, continuous.	
1N7045		Condition A, T _A = +25°C I _{FSM} = 110 A, 100 surges 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 (V _F and I _R only).	

1/ Each individual diode.

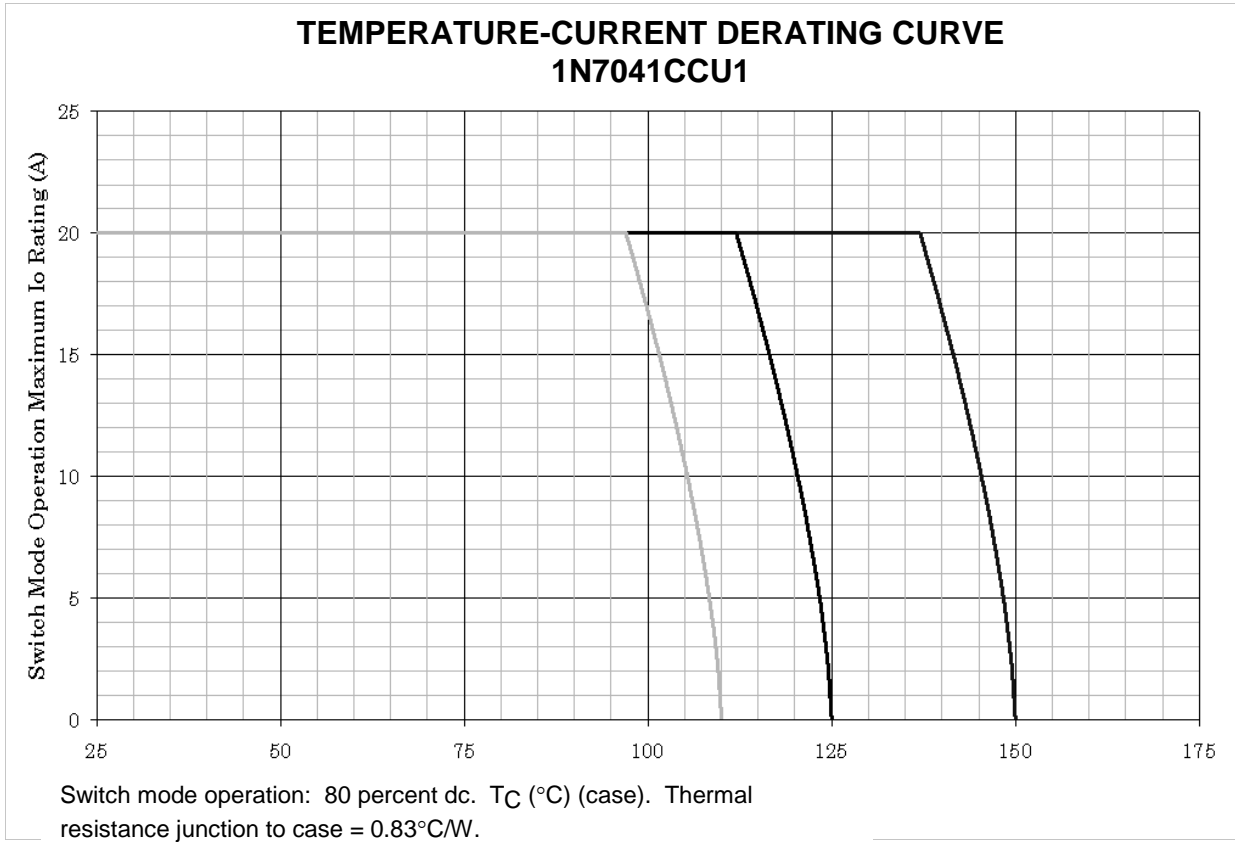
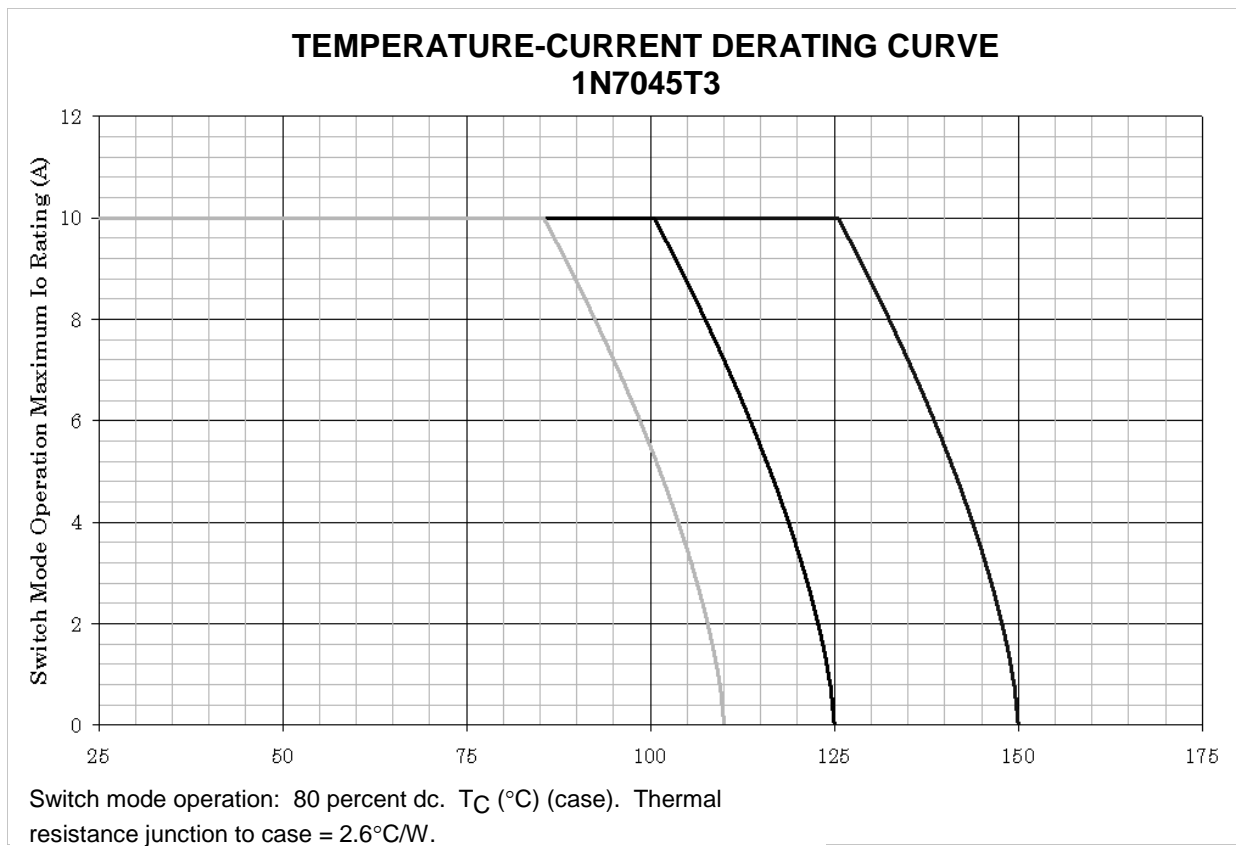


FIGURE 3. Temperature-current derating curve (for each leg) 1N7041CCU1.

FIGURE 4. Temperature-current derating curve for 1N7045T3.

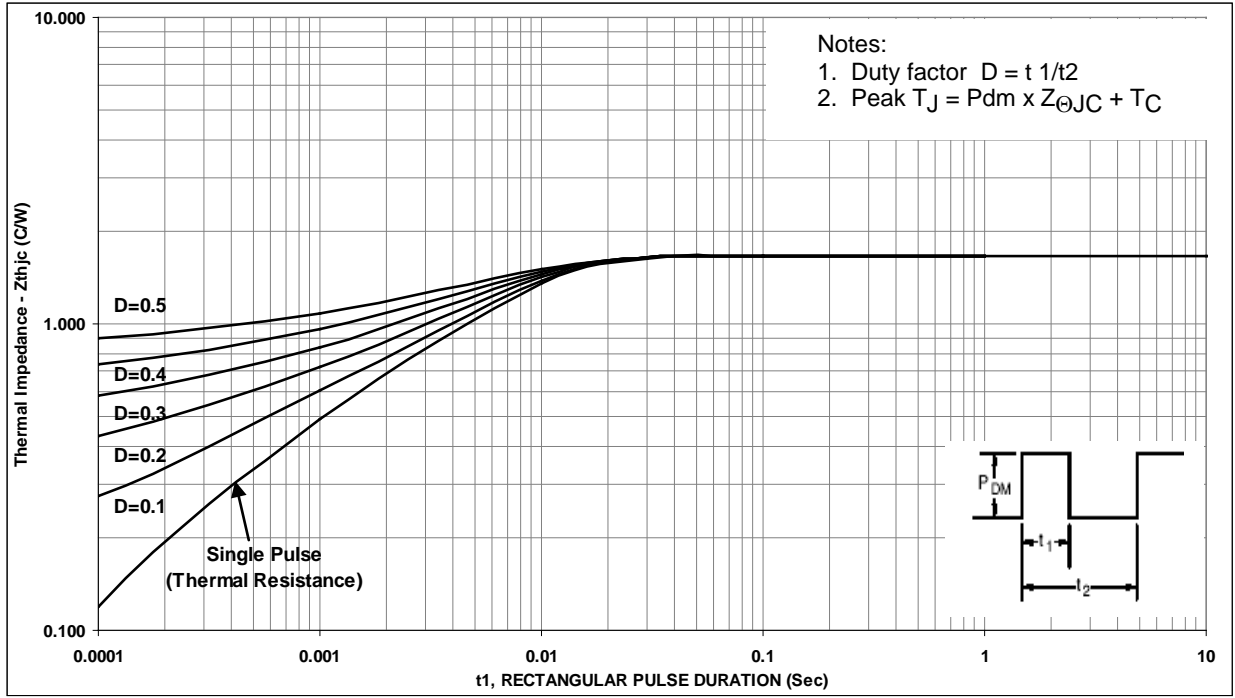


FIGURE 5. Thermal impedance (for each leg) 1N7041CCU1.

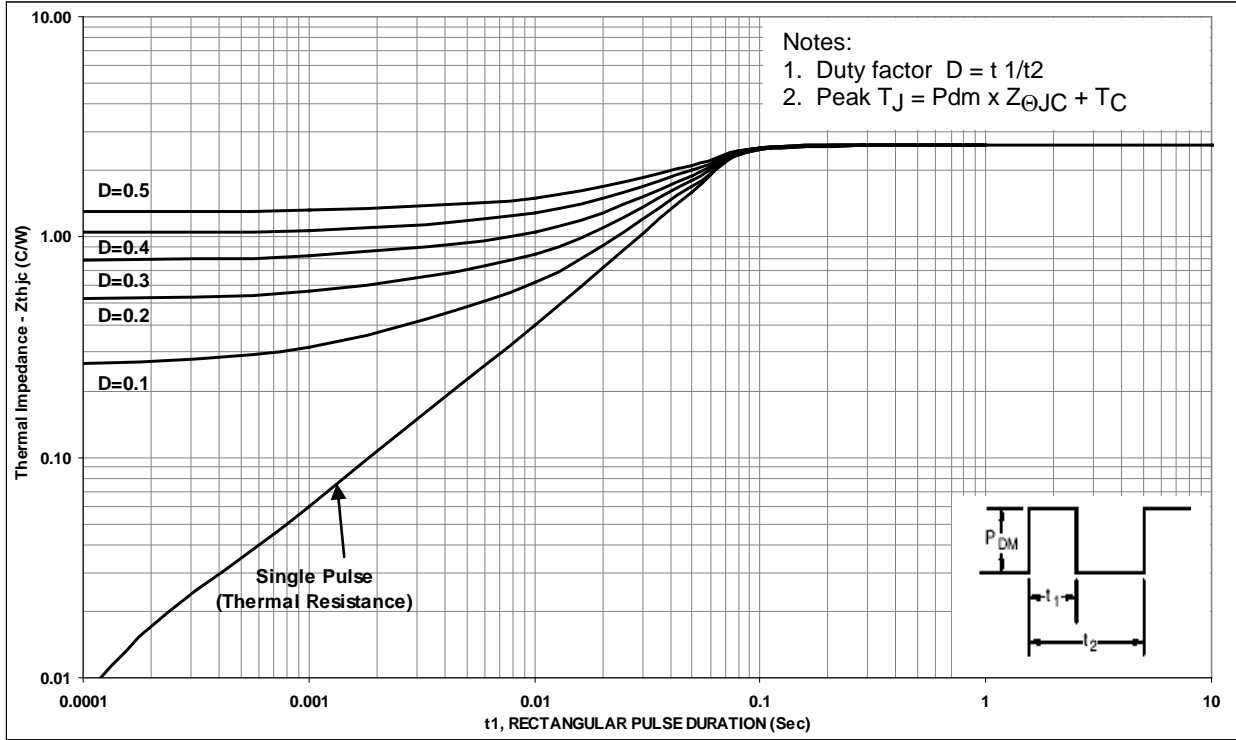
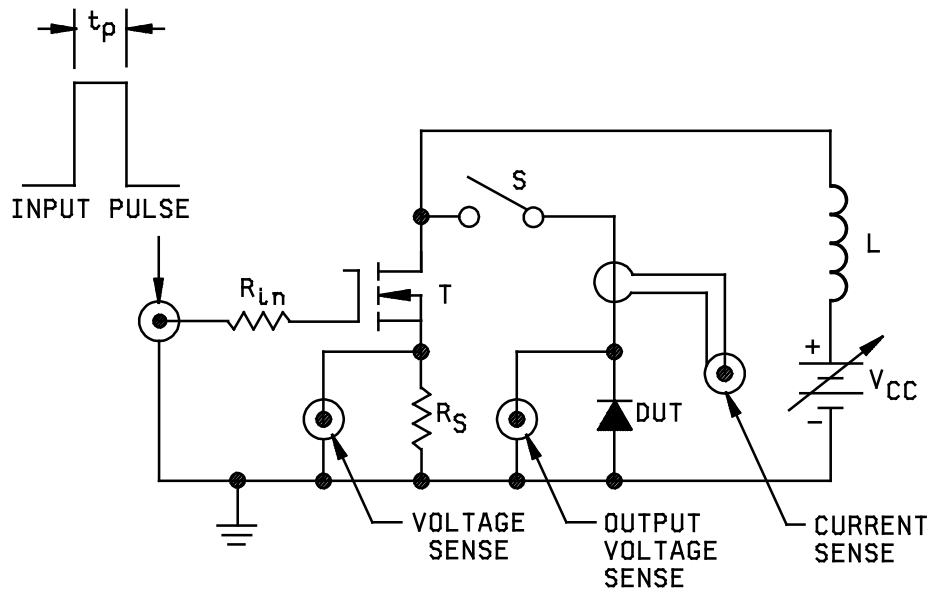


FIGURE 6. Thermal impedance for 1N7045T3.



Input pulse $R_{in} = 50$ ohms, 1 watt
 $V_G = 10$ volts, $R_S = 0.1$ ohms, 1 watt
 $Z_G = 50$ ohms
 $L = 100\mu\text{H}$
 $\text{P.W.} \approx 30 \mu\text{s}$
 Duty cycle ≤ 1 percent, $T = \text{IRF150/2N6764}$ or equivalent

Procedures:

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

FIGURE 7. Peak reverse energy 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.)

* 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 and formation (see 3.4.2).
- d. Product assurance level and type designator.

* 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 Defense Supply Center, Columbus, ATTN: DSCC/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 <http://assist.daps.dla.mil> .

6.4 Cross reference substitution list. A PIN for PIN replacement table follows, and these devices are directly interchangeable.

Non-preferred PIN	Preferred PIN
20CLQ045 10YQ045C	JANS, JANTXV, JANTX, JAN1N7041CCU1 JANS, JANTXV, JANTX, JAN1N7045T3

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

Preparing activity:
 DLA - CC
 (Project 5961-2009-001)

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at <http://assist.daps.dla.mil> .