

The documentation and process conversion measures necessary to comply with this document shall be completed by 16 April 2011.

INCH POUND

MIL-PRF-19500/181J
 16 February 2011
 SUPERSEDING
 MIL-PRF-19500/181H
 28 June 2006

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, LOW-POWER,
 TYPES 2N718A, 2N1613, AND 2N1613L, JAN, JANTX, AND JANTXV

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 NPN silicon, low-power transistors. 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-18) and figure 2, (similar to TO-39 and TO-5).

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

Type	P_T (1) $T_C = +25^\circ\text{C}$	P_T (2) $T_A = +25^\circ\text{C}$	V_{CBO}	V_{CEO}	V_{EBO}	I_C	V_{CER} $R_{BE} = 10 \Omega$	$R_{\theta JC}$	$R_{\theta JA}$	T_J and T_{STG}
	<u>W</u>	<u>W</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>mA dc</u>	<u>V dc</u>	<u>°C/W</u>	<u>°C/W</u>	<u>°C</u>
2N718A	1.8	0.5	75	30	7	500	50	97	325	-65
2N1613	3.0	0.8	75	30	7	500	50	58	175	to
2N1613L	3.0	0.8	75	30	7	500	50	58	175	+200

(1) Derate linearly at 17.2 mW/°C for type 2N1613 and 2N1613L and at 10.3 mW/°C for type 2N718A for $T_C > +25^\circ\text{C}$.

(2) See figures 3 and 4.

* 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.daps.dla.mil>.

1.4 Primary electrical characteristics.

Limits	h_{FE1} (1)	h_{FE2} (1)	h_{FE3} (1)	h_{FE4} (1)	$V_{CE(SAT)}$ (1)	$ h_{FE} $ at 20 MHz
	$V_{CE} = 10 \text{ V dc}$ $I_C = 0.1 \text{ mA dc}$	$V_{CE} = 10 \text{ V dc}$ $I_C = 10 \text{ mA dc}$	$V_{CE} = 10 \text{ V dc}$ $I_C = 150 \text{ mA dc}$	$V_{CE} = 10 \text{ V dc}$ $I_C = 500 \text{ mA dc}$	$I_C = 150 \text{ mA dc}$ $I_B = 15 \text{ mA dc}$	$V_{CE} = 10 \text{ V dc}$ $I_C = 50 \text{ mA dc}$ $f = 20 \text{ MHz}$
Min Max	20	35	40 120	20	<u>V dc</u> 1.5	3

(1) Pulsed (see 4.5.1).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, and 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 documents cited in sections 3, 4, and 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 <https://assist.daps.dla.mil/quicksearch> or <https://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.

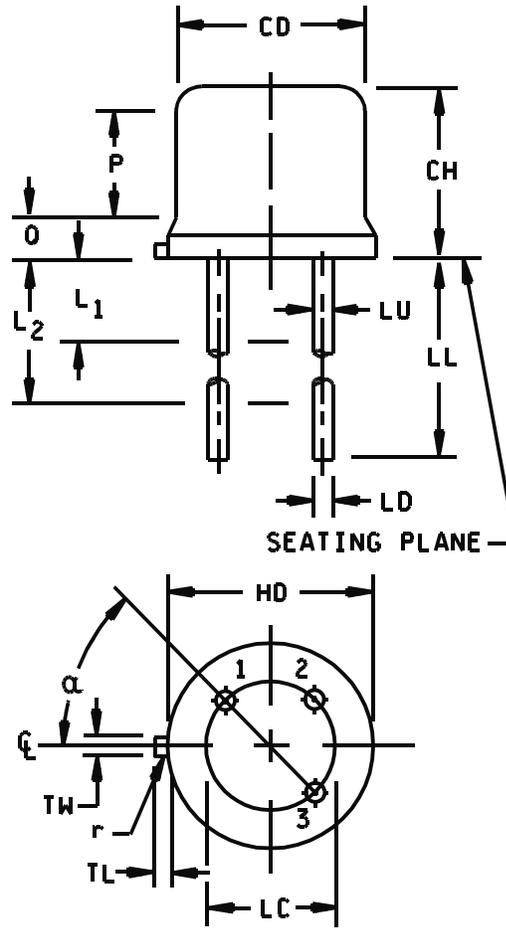
3. REQUIREMENTS

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 manufacturers list 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.

Symbol	Inches		Millimeters		Notes
	Min	Max	Min	Max	
CD	.178	.195	4.52	4.95	
CH	.170	.210	4.32	5.33	
HD	.209	.230	5.31	5.84	
LC	.100 TP		2.54 TP		5
LD	.016	.021	0.41	0.53	8, 9
LL	.500	.750	12.70	19.05	7, 9
LU	.016	.019	0.41	0.48	4, 8, 9
L1		.050		1.27	9
L2	.250		6.35		9
TL	.028	.048	0.71	1.22	5
TW	.036	.046	.91	1.17	
P	.100		2.54		3
Q		.030		0.76	6
r		.010		.025	
α	45° TP		45° TP		

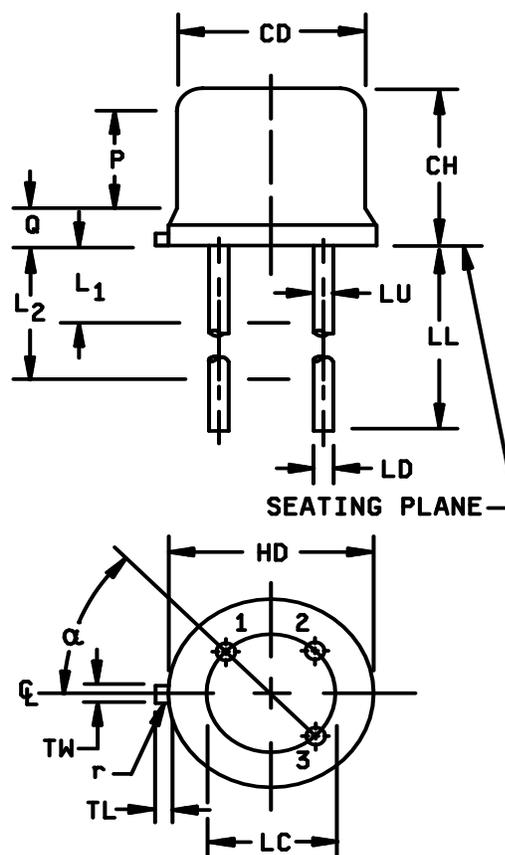


NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. This zone is controlled for automatic handling. The variation in actual diameter within this zone shall not exceed .010 inch (0.254 mm).
4. (Three leads) LU applies between L_1 and L_2 . LD applies between L_2 and .5 inch (12.70 mm) from seating plane. Diameter is uncontrolled in L_1 and beyond .5 inch (12.70 mm) from seating plane.
5. Measured from maximum diameter of the actual device.
6. Details of outline in this zone optional.
7. The collector shall be electrically connected to the case.
8. Lead number 1 - emitter; lead number 2 - base; lead number 3 - collector.
9. All three leads.
10. In accordance with ANSI Y14.5M, diameters are equivalent to Φ x symbology.

FIGURE 1. Physical dimensions 2N718A (TO-18).

Symbol	Dimensions				Notes
	Inches		Millimeter		
	Min	Max	Min	Max	
CH	.240	.260	6.10	6.60	
LC	.200 TP		5.08 TP		7
LD	.016	.021	0.41	0.53	8,9
LL	See notes 12, and 13				
LU	.016	.019	0.41	0.48	8,9
L ₁		.050		1.27	8, 9
L ₂	.250		6.35		8, 9
HD	.335	.370	8.51	9.40	
CD	.305	.335	7.75	8.51	
P	.100		2.54		6
Q		.050		1.27	5
r		.010		0.25	
TL	.029	.045	0.74	1.14	4
TW	.028	.034	0.71	0.86	0.71
α	45° TP		45° TP		7



NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of 0.011 inch (0.28 mm).
4. TL measured from maximum HD.
5. Outline in this zone is not controlled.
6. CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
7. Leads at gauge plane .054 +.001, -.000 inch (1.37 +0.03, -0.000 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at a maximum material condition (MMC) relative to the tab at MMC. The device may be measured by direct methods or by the gauging procedure.
8. LU applies between L₁ and L₂. LU applies between L₂ and LL minimum. Diameter is uncontrolled in L₁ and beyond LL minimum.
9. All three leads.
10. The collector shall be electrically and mechanically connected to the case.
11. r (radius) applies to both inside corners of tab.
12. For transistor types 2N1613, dimension LL is .500 inch (12.70 mm) minimum, and .750 inch (19.05 mm) maximum.
13. For transistor types 2N1613L, dimension LL is 1.500 inches (38.10 mm) minimum, and 1.750 inches (44.45 mm) maximum.
14. Lead number 1 - emitter; lead number 2 - base; lead number 3 - collector.

FIGURE 2. Physical dimensions 2N1613 and 2N1613L (similar to TO-5 and TO-39).

3.4 Interface and physical dimensions. The design, construction and physical dimensions shall be as specified on figures 1 and 2 herein.

3.4.1 Lead finish. Lead finish shall be solderable as defined in 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).

3.5 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.

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I 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).

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 II tests, the tests specified in table II herein that were not performed in the prior revision shall be performed on the first inspection lot of this revision to maintain qualification.

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4.3 Screening (JANTX and JANTXV levels only). 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
	JANTX and JANTXV levels
(1) 3c	Thermal impedance see 4.3.2
9	Not applicable
10	48 hours minimum
11	I_{CBO2} , h_{FE3}
12	See 4.3.1
13	Subgroup 2 of table I herein; ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE3} = ± 15 percent

(1) Shall be performed anytime after temperature cycling, screen 3a; and does not need to be repeated in screening requirements.

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: $V_{CB} = 10 - 30$ V dc. Power shall be applied to achieve $T_J = +135^\circ\text{C}$ minimum using a minimum $P_D = 75$ percent of P_T maximum rated as defined in 1.3. With approval of the qualifying activity and preparing activity, alternate burn-in criteria (hours, bias conditions, T_J , and mounting conditions) may be used for JANTX and JANTXV quality levels. A justification demonstrating equivalence is required. In addition, the manufacturing site's burn-in data and performance history will be essential criteria for burn-in modification approval.

4.3.2 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3131 of MIL-STD-750 using the guidelines in that method for determining I_M , I_H , t_H , t_{SW} (V_C and V_H where appropriate). Measurement delay time (t_{MD}) = 70 μs max. See table II, group E, subgroup 4 herein.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500 and as specified herein. If alternate screening is being performed in accordance with MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of group A1 and A2 inspection only (table E-VIb, group B, subgroup 1 is not required to be performed again if group B has already been satisfied in accordance with 4.4.2).

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and table I herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in 4.4.2.1 for JAN, JANTX, and JANTXV group B testing. Electrical measurements (end-points) and delta requirements for JAN, JANTX, and JANTXV shall be after each step in 4.4.2.1 and shall be in accordance with table I, subgroup 2, and 4.5.2 herein.

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* 4.4.2.1 Group B inspection, (JAN, JANTX, and JANTXV). Separate samples may be used for each step. In the event of a group B failure, the manufacturer may pull a new sample at double size from either the failed assembly lot or from another assembly lot from the same wafer lot. If the new "assembly lot" option is exercised, the failed assembly lot shall be scrapped.

<u>Step</u>	<u>Method</u>	<u>Condition</u>
1	1026	Steady-state life: 1,000 hours minimum, $V_{CB} = 10$ V dc, power shall be applied to achieve $T_J = +150^\circ\text{C}$ minimum using a minimum of $P_D = 75$ percent of maximum rated P_T as defined in 1.3. $n = 45$ devices, $c = 0$. The sample size may be increased and the test time decreased as long as the devices are stressed for a total of 45,000 device hours minimum, and the actual time of test is at least 340 hours.
* 2	1048	Blocking life, $T_A = 150^\circ\text{C}$, $V_{CB} = 80$ percent of rated voltage, without going over the maximum rated V_{CE} , 48 hours minimum. $n = 45$ devices, $c = 0$.
3	1032	High-temperature life (non-operating), $t = 340$ hours, $T_A = +200^\circ\text{C}$. $n = 22$, $c = 0$.

4.4.2.2 Group B sample selection. Samples selected from group B inspection shall meet all of the following requirements:

- a. For JAN, JANTX, and JANTXV samples shall be selected randomly from a minimum of three wafers (or from each wafer in the lot) from each wafer lot. See MIL-PRF-19500.
- b. Shall be chosen from an inspection lot that has been submitted to and passed table I, subgroup 2, conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

* 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 4.4.3.1 herein for group C testing. Electrical measurements (end-points) and delta requirements shall be in accordance with table I, subgroup 2 herein.

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

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
C2	2036	Test condition E.
C5	3131	$R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3) and in accordance with thermal impedance curves.
* C6		Not applicable.

* 4.4.4 Group E Inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table IX of MIL-PRF-19500 and as specified in table II herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 and 4.5.2 herein.

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

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

* 4.5.2 Delta requirements. Delta requirements shall be as specified below:

Step	Inspection	MIL-STD-750		Symbol	Limit	Unit
		Method	Conditions			
1	Collector-base cutoff current	3036	Bias condition D, $V_{CB} = 60 \text{ V dc}$	ΔI_{CB02} (1)	100 percent of initial value or 5 nA dc, whichever is greater.	
2	Forward current transfer ratio	3076	$V_{CE} = 10 \text{ V dc};$ $I_C = 150 \text{ mA dc};$ pulsed see 4.5.1	Δh_{FE3} (1)	± 25 percent change from initial reading.	

(1) Devices which exceed the group A limits for this test shall not be accepted.

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* TABLE I. Group A inspection.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1 2/</u>						
Visual and mechanical <u>3/</u> examination	2071	n = 45 devices, c = 0				
Solderability <u>3/</u>	2026	n = 15 leads, c = 0				
Resistance to solvents <u>3/ 4/</u>	1022	n = 15 devices, c = 0				
Temp cycling <u>3/</u>	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal Fine leak Gross leak	1071	n = 22 devices, c = 0				
Electrical measurements		Group A, subgroup 2				
Bond strength <u>3/</u>	2037	Precondition T _A = +250°C at t = 24 hrs or T _A = +300°C at t = 2 hrs n = 11 wires, c = 0				
* Decap internal visual	2075	n = 4 device, c = 0				
<u>Subgroup 2</u>						
Collector-to-base cutoff current	3036	Bias condition D, V _{CBO} = 75 V dc pulsed (see 4.5.1)	I _{CBO1}		10	μA dc
Emitter to base cutoff current	3061	Bias condition D; V _{EBO} = 7 V dc pulsed (see 4.5.1)	I _{EBO1}		10	μA dc
Breakdown voltage, collector-emitter	3011	Bias condition D; I _C = 100 μA dc; pulsed (see 4.5.1)	V _{(BR)CEO}	30		V dc
Breakdown voltage collector-emitter	3011	Bias condition D, I _C = 100 μA dc, pulsed (see 4.5.1), R _{BE} = 10 Ω	V _{(BR)CER}	50		V dc
Collector to base cutoff current	3036	Bias condition D, V _{CB} = 60 V dc	I _{CBO2}		10	nA dc
Emitter-base cutoff current	3061	Bias condition D, V _{EB} = 5 V dc	I _{EBO2}		10	nA dc
Collector-emitter saturated voltage	3071	I _C = 150 mA dc, I _B = 15 mA dc, pulsed (see 4.5.1)	V _{CE(sat)1}		1.5	V dc
Base-emitter saturated voltage	3066	Test condition A, I _C = 150 mA dc, I _B = 15 mA dc, pulsed (see 4.5.1)	V _{BE(sat)1}		1.3	V dc

See footnotes at end of table.

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* TABLE I. Group A inspection - Continued.

Inspection <u>1</u> /	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - Continued						
Forward-current transfer ratio	3076	$V_{CE} = 10 \text{ V dc}$, $I_C = 0.1 \text{ mA dc}$, pulsed (see 4.5.1)	h_{FE1}	20		
Forward-current transfer ratio	3076	$V_{CE} = 10 \text{ V dc}$, $I_C = 10 \text{ mA dc}$, pulsed (see 4.5.1)	h_{FE2}	35		
Forward-current transfer ratio	3076	$V_{CE} = 10 \text{ V dc}$; $I_C = 150 \text{ mA dc}$ pulsed (see 4.5.1)	h_{FE3}	40	120	
Forward-current transfer ratio	3076	$V_{CE} = 10 \text{ V dc}$; $I_C = 500 \text{ mA dc}$, pulsed (see 4.5.1)	h_{FE4}	20		
<u>Subgroup 3</u>						
High temperature operation:		$T_A = +150^\circ\text{C}$				
Collector to base cutoff current	3036	Bias condition D, $V_{CB} = 60 \text{ V dc}$	I_{CBO3}		10	$\mu\text{A dc}$
Low temperature operation		$T_A = -55\text{C}$				
Forward-current transfer ratio	3076	$V_{CE} = 10 \text{ V dc}$, $I_C = 10 \text{ mA dc}$, pulsed (see 4.5.1)	h_{FE5}	20		
<u>Subgroup 4</u>						
Small signal short circuit forward current transfer ratio	3206	$V_{CE} = 5 \text{ V dc}$, $f = 1 \text{ kHz}$, $I_C = 1 \text{ mA dc}$:	h_{fe}	30	100	
		$V_{CE} = 10 \text{ V dc}$, $f = 1 \text{ kHz}$, $I_C = 5 \text{ mA dc}$	h_{fe}	35	150	
Magnitude of common emitter small-signal short-circuit forward-current transfer ratio	3306	$V_{CE} = 10 \text{ V dc}$, $f = 20 \text{ MHz}$, $I_C = 50 \text{ mA dc}$	$ h_{fe} $	3		
Small signal short circuit input impedance	3201	$V_{CB} = 10 \text{ V dc}$, $f = 1 \text{ kHz}$, $I_C = 5 \text{ mA dc}$	h_{ib}	4	8	ohms
Small signal open-circuit output admittance	3216	$V_{CB} = 10 \text{ V dc}$, $f = 1 \text{ kHz}$, $I_C = 5 \text{ mA dc}$	h_{ob}	0	1.0	$\mu\text{ ohms}$

See footnotes at end of table.

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* TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 4</u> – Continued						
Small signal open circuit reverse voltage transfer ratio	3211	$V_{CB} = 10 \text{ V dc}$, $f = 1 \text{ kHz}$, $I_C = 5 \text{ mA dc}$	h_{rb}		3×10^{-4}	
Open circuit output capacitance	3236	$V_{CB} = 10 \text{ V dc}$, $I_E = 0$, $100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	C_{obo}		25	pF
Pulse response	3251	Test condition A, except test circuit and pulse requirements. See figure 5 herein.	$t_{on} + t_{off}$		30	ns
<u>Subgroups 5 and 6</u>						
Not applicable						

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

* 2/ For resubmission of failed subgroup 1, double the sample size of the failed test or sequence of tests. A failure in table I, subgroup 1 shall not require retest of the entire subgroup. Only the failed test shall be rerun upon submission.

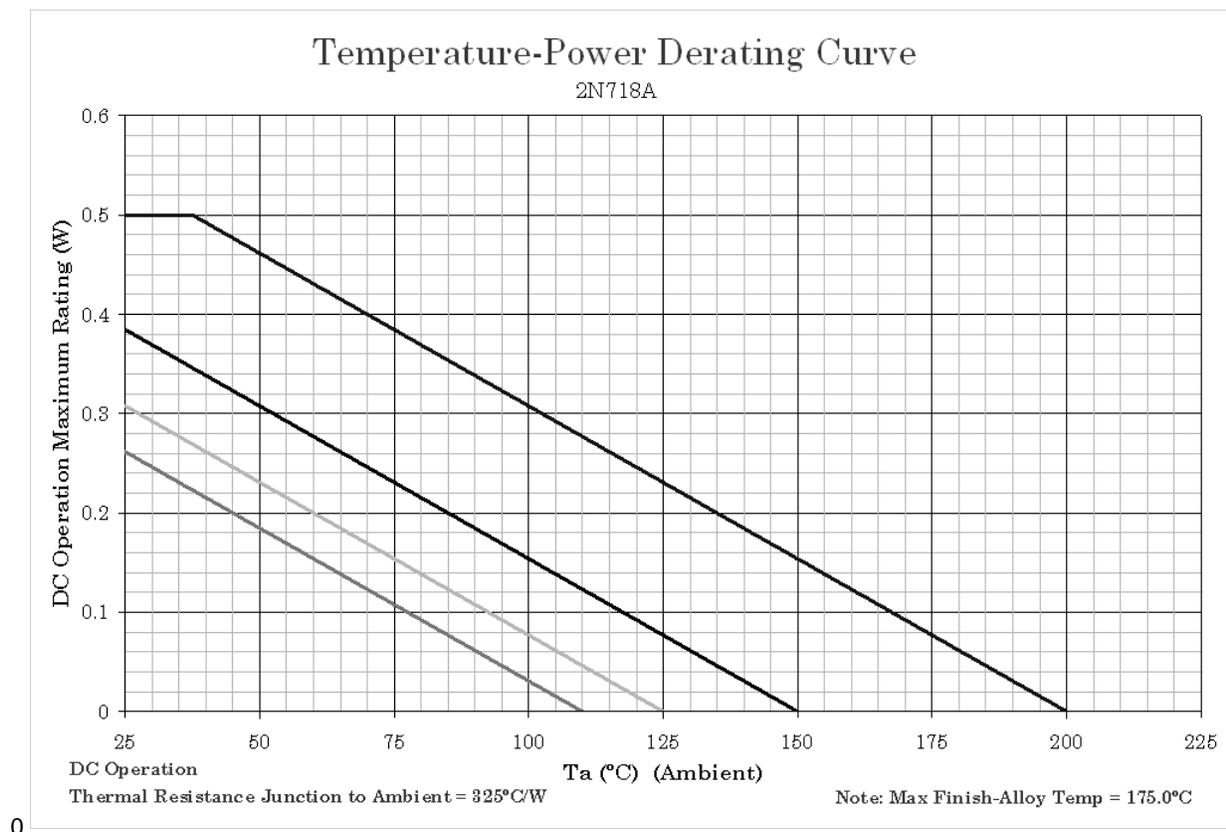
3/ Separate samples may be used.

4/ Not required for laser marked devices.

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TABLE II. Group E inspection (all quality levels) - for qualification or re-qualification only.

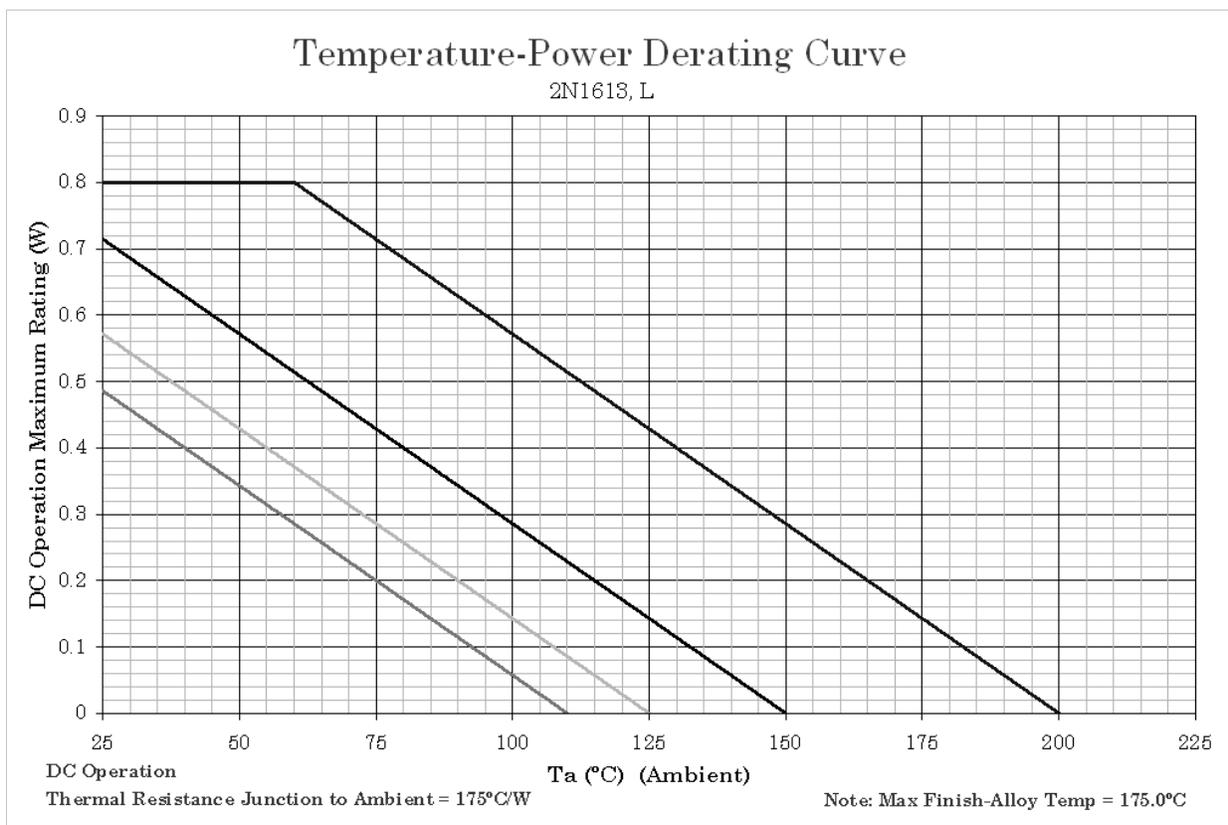
Inspection	MIL-STD-750		Qualification
	Method	Conditions	
<u>Subgroup 1</u>			12 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles.	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See group A, subgroup 2 and 4.5.2 herein.	
<u>Subgroup 2</u>			45 devices C = 0
Intermittent life	1037	Intermittent operation life: $V_{CB} = 10$ V dc, 6,000 cycles, Adjust device current, or power, to achieve a minimum ΔT_J of +100°C.	
Electrical measurements		See group A, subgroup 2 and 4.5.2 herein.	
<u>Subgroup 4</u>			Sample size N/A
Thermal impedance curves.		See MIL-PRF-19500.	
<u>Subgroup 5</u>			
Not applicable			
<u>Subgroup 6</u>			11 devices
Electrostatic discharge (ESD)	1020		
<u>Subgroup 8</u>			45 devices c = 0
Reverse stability	1033	Condition B.	



NOTES:

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature ($T_J \leq 200^\circ\text{C}$) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at $T_J \leq 150^\circ\text{C}$, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at $T_J \leq 125^\circ\text{C}$, and 110°C to show power rating where most users want to limit T_J in their application.

FIGURE 3. Temperature-power derating for 2N718A (TO-18 package).

**NOTES:**

1. This is the true inverse of the worst case thermal resistance value. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature ($T_J \leq 200^\circ\text{C}$) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at $T_J \leq 150^\circ\text{C}$, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at $T_J \leq 125^\circ\text{C}$, and 110°C to show power rating where most users want to limit T_J in their application.

FIGURE 4. Temperature-power derating for 2N1613 and 2N1613L (TO-5 and TO-39 package).

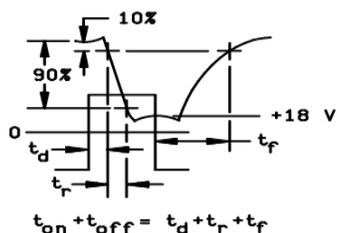
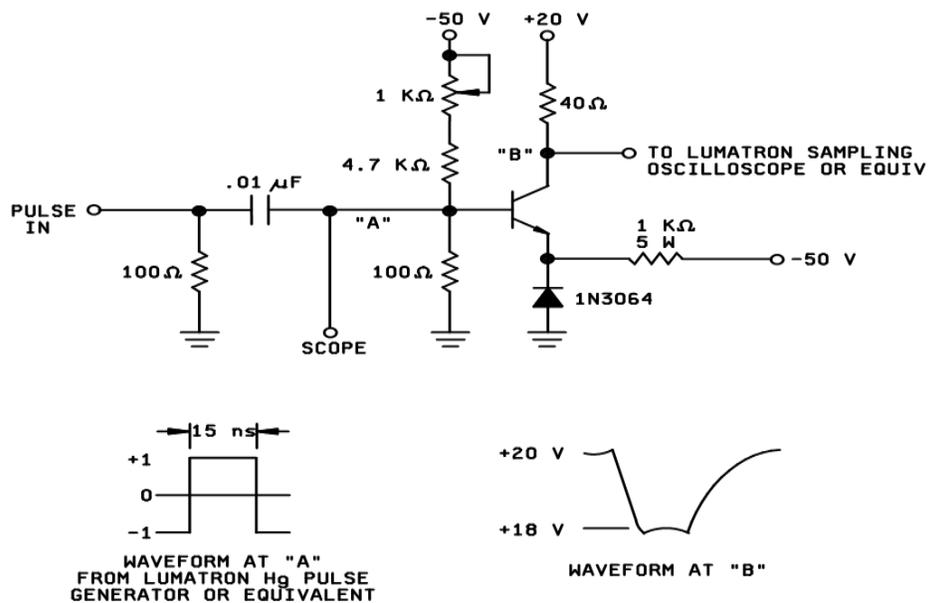


FIGURE 5. Pulse response (turn-on plus turn-off) measurement circuit and waveforms.

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. 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. Packaging requirements (see 5.1).
- c. Lead finish (see 3.4.1).
- 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 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.daps.dla.mil>.

6.4 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:

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

Preparing activity:

DLA - CC

(Project 5961-2010-050)

Review activities:

Army - AR, AV, MI, SM
Navy - AS, MC
Air Force - 19, 99

* 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 <https://assist.daps.dla.mil>.