INCH–POUND

The documentation and process conversion measures necessary to comply with this document shall be completed by 21 August 2013.

MIL–PRF–19500/581C
21 February 2013
SUPERSEDING
MIL–PRF–19500/581B
10 March 2005

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON AMPLIFIER,
TYPES 2N4237, 2N4238, AND 2N4239, 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, amplifier transistors. Three levels of product assurance are provided for each device type as specified in MIL–PRF–19500.

1.2 Physical dimensions. The device package style is TO–205AD (formerly TO–39) in accordance with figure 1.

1.3 Maximum ratings. Unless otherwise specified, T_A = +25°C.

Type	P_T T_A = +25°C (1)	P_T T_C = +25°C (2)	$R_{\theta JA}$	$R_{\theta JC}$	V_{CBO}	V_{CEO}	V_{EBO}	I_C	I_B	T_J and T_{STG}
	W	W	°C/W	°C/W	V dc	V dc	V dc	A dc	A dc	°C
2N4237	1.0	6.0	175	18	50	40	6.0	1.0	0.5	
2N4238	1.0	6.0	175	18	80	60	6.0	1.0	0.5	–65 to +200
2N4239	1.0	6.0	175	18	100	80	6.0	1.0	0.5	

(1) See figure 2.
(2) See figure 3.

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.

1.4 Primary electrical characteristics. Unless otherwise specified, at T_A = +25°C.

Limits	h_{FE} at V_{CE} = 1.0 V dc (1)			| h_{fe} | f = 10 MHz V_{CE} = 10 V dc I_C = 100 mA dc	C_{obo} f = 1.0 MHz V_{CB} = 10 V dc I_C = 0	$V_{CE(sat)2}$ 1/ I_C = 1.0 A dc I_B = 0.1 A dc	$V_{BE(sat)2}$ 1/ I_C = 1.0 A dc I_B = 0.1 A dc
	h_{FE1} I_C = 100 mA dc	h_{FE2} I_C = 250 mA dc	h_{FE3} I_C = 500 mA dc				
Min	30	30	30	3.0	pF		V dc
Max		150			100	0.6	1.5

(1) Pulsed see 4.5.1.

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.

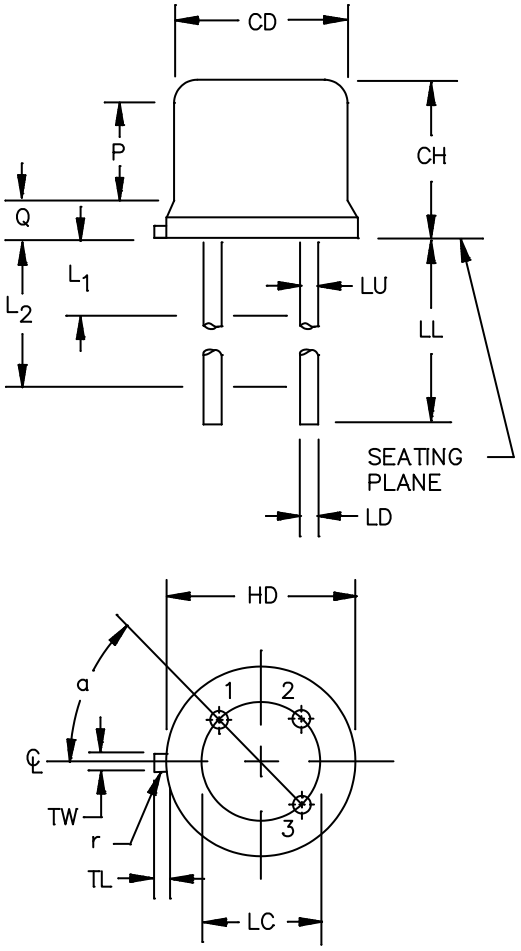
(Copies of these documents are available online at https://assist.dla.mil/quicksearch or https://assist.dla.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111–5094.)

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).



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.355	7.75	9.02	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08TP		3
LD	.016	.021	0.41	0.53	4
LL	.500	.750	12.70	19.05	4
LU	.016	.019	0.41	0.48	4
L1		.050		1.27	4
L2	.250		6.35		4
TL	.029	.045	0.74	1.14	5
TW	.028	.034	0.71	0.86	6
P	.100		2.54		7
Q		.050		1.27	8
R		.010		0.25	9
α	45° TP		45° TP		3
Notes	1, 2, 8, 9				

NOTES:

1. Dimensions are in inches. Millimeters are given for general information only.
2. Lead designation shall be as follows: Terminal 1 is the emitter, terminal 2 is the base, and terminal 3 is the collector. Lead number three is electrically connected to case.
3. Leads at gauge plane .054 inch (1.37 mm) +.001 inch (0.03 mm) -.000 inch (0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) relative to tab. Device may be measured by direct methods or by gauge.
4. Dimension LD applies between L_1 and L_2. Dimension LD applies between dimension L_2 and LL minimum.
5. Dimension TL is measured from dimension HD maximum.
6. Beyond dimension r maximum, dimension TW shall be held for a minimum length of .011 inch (0.28 mm).
7. Dimension CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
8. Details of outline in this zone are optional.
9. Dimension r applied to both inside corners of tab.
10. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 1. Physical dimensions (TO–205AD formerly TO–39).

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

$R_{\theta JA}$	Thermal resistance junction to ambient.
$R_{\theta JC}$	Thermal resistance junction to case.

3.4 Interface and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL–PRF–19500 and on figure 1 (TO–205AD, formerly TO-39) herein.

3.4.1 Lead finish. Unless otherwise specified, lead finish shall be solderable in accordance with MIL–STD–750, MIL–PRF–19500, 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. The identification of terminals of the device package shall be as shown on figure 1. Terminal 1 shall be connected to the emitter, terminal 2 shall be connected to the base, and terminal 3 shall be connected to the collector. The collector shall be electrically connected to the case.

3.5 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I.

3.6 Electrical test requirements. The electrical test requirements shall be as specified in table I herein.

3.7 Marking. Marking shall be in accordance with MIL–PRF–19500.

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).

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.

4.3 Screening (quality levels JANTX and JANTXV 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 level
3c (1)	Thermal impedance (see 4.3.1)
11	I_{CBO} and h_{FE2}
12	See 4.3.2.
13	See table I, subgroup 2 herein ΔI_{CBO} = 100 percent of initial value, or 10 nA dc whichever is greater; Δh_{FE2} = ±15 percent of initial value.

(1) Thermal impedance shall be performed anytime before screen 10 and does not need to be repeated in the screening requirements.

4.3.1 Thermal impedance. The thermal impedance measurements shall be performed in accordance with test method 3131 of MIL–STD–750 using the guidelines in that test method for determining I_H, I_M, t_H, t_{SW}, (and V_C where appropriate). The thermal impedance limit used in 4.3, screen 3c and table I, subgroup 2 shall comply with the thermal impedance graph on figures 4 and 5 (less than or equal to the curve value at the same t_H time) and shall be less than the process determined statistical maximum limit as outlined in test method 3131 of MIL–STD–750.

4.3.2 Power burn-in conditions. Power burn-in conditions shall be as follows: V_{CB} = 10 to 30 V dc. Power shall be applied to achieve T_J = +135°C minimum using a minimum P_D = 75 percent of P_T maximum, T_A ambient 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. 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.

4.4 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 table I, subgroups 1 and 2 herein. Table E–VIB, subgroup 1, of MIL–PRF–19500 is not required to be performed again since solderability and resistance to solvents testing is performed in table I, subgroup 1 herein.

4.4.1 Group A inspection (small die flow). Group A inspection shall be conducted in accordance with table E–V of MIL–PRF–19500 and table I herein. The small die flow part of table E–V, subgroup 1 shall apply. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

4.4.2 Group B inspection (small die flow). Group B inspection shall be conducted in accordance with the test methods and conditions specified for the applicable steps in table E–VIC of MIL–PRF–19500 and herein. Electrical measurements (end-points) and delta requirements shall be taken after each step in 4.4.2.1. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. Delta requirements shall be in accordance with the applicable step of 4.6 herein.

4.4.2.1 Group B small die flow inspection details (for quality levels JAN, JANTX, and JANTXV). Separate samples may be used for each step. In the event of a lot failure, the resubmission requirements of MIL–PRF–19500 shall apply. In addition, all catastrophic failures during CI shall be analyzed to the extent possible to identify root cause and corrective action. Whenever a failure is identified as wafer lot, or wafer processing related, the entire wafer lot, and related devices assembled from the wafer lot, shall be rejected unless an appropriate determined corrective action to eliminate the failure mode has been implemented and the devices from the wafer lot are screened to eliminate the failure mode.

Step	Method	Conditions
1	1026	Steady-state operation life: 1,000 hours minimum, V_{CB} = 10 V dc, power shall be applied to achieve T_J = +150°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°C, V_{CB} = 80 percent of rated voltage, 48 hours minimum. n = 45 devices, c = 0.
3	1032	High-temperature life (non-operating), t = 340 hours, T_A = +200°C. n = 22, c = 0.

4.4.2.2 Group B small die flow sample selection (for quality levels JAN, JANTX, and JANTXV). Samples selected for group B inspection shall meet the following requirements:

a. 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. Samples shall be chosen from an inspection lot that has 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 may be selected prior to the application of final lead finish.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the tests and conditions specified for subgroup testing in table E–VII of MIL–PRF–19500 and as follows herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

Subgroup	Method	Conditions
C2	2036	Test condition E.
C5	3131	See 1.3.

4.4.3.1 Group C sample selection. Samples for subgroups in group C shall be chosen at random from any inspection lot containing the intended package type and lead finish procured to the same specification which is submitted to and passes table I tests herein for conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for C6 life test may be pulled prior to the application of final lead finish. Testing of a subgroup using a single device type enclosed in the intended package type shall be considered as complying with the requirements for that subgroup.

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 as specified in table II herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein. Delta requirements shall be in accordance with the applicable step of 4.6 herein.

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

4.5.1 Pulse response measurements. The conditions for the pulse response measurement shall be as specified in section 4 of MIL–STD–750.

4.5.2 Input capacitance. This test shall be conducted in accordance with test method 3240 of MIL–STD–750, except the output capacitor shall be omitted.

4.6 Delta requirements. The requirements for delta measurements for groups B, C, and E shall be as specified below. (1)

Step	Inspection	MIL–STD–750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1	Collector to base cutoff current 2N4237 2N4238 2N4239	3036	Bias condition D V_{CB} = 50 V dc V_{CB} = 80 V dc V_{CB} = 100 V dc	ΔI_{CBO} (1)	100 percent of initial value or 10 nA dc whichever is greater.		
2	Forward current transfer ratio	3076	I_C = 250 mA dc V_{CE} = 1.0 V dc; Pulsed (see 4.5.1)	Δh_{FE2} (1)	±25 percent change from initial recorded value.		

(1) Devices which exceed the table I limits for this test shall not be shipped.

TABLE I. Group A inspection.

Inspection 1/	MIL–STD–750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical examination	2071	See MIL–PRF–19500				
Solderability 3/	2026					
Resistance to solvents 3/ 4/	1022					
Temperature cycling (air to air) 3/	1051					
Hermetic seal Fine leak Gross leak	1071					
Electrical measurements		See subgroup 2 of this table				
Bond strength (destructive bond pull test) 3/	2037	Precondition T_A = +250°C at t = 24 hrs or T_A = +300°C at t = 2 hrs, n = 11 wires, c = 0				
Subgroup 2						
Thermal impedance	3131	See 4.3.1	$Z_{\theta JX}$			°C/W
Breakdown voltage, collector to emitter 2N4237 2N4238 2N4239	3011	Bias condition D, pulsed (see 4.5.1) I_C = 100 mA dc	$V_{(BR)CEO}$	 50 80 100		Vdc
Collector to emitter cutoff current 2N4237 2N4238 2N4239	3041	Bias condition A, V_{BE} = 1.5 V dc V_{CE} = 50 V dc V_{CE} = 80 V dc V_{CE} = 100 V dc	I_{CEX1}		100	nA dc
Collector to base cutoff current 2N4237 2N4238 2N4239	3036	Bias condition D V_{CB} = 50 V dc V_{CB} = 80 V dc V_{CB} = 100 V dc	I_{CBO}		100	nA dc
Emitter to base cutoff current	3061	Bias condition D, V_{BE} = 6 V dc	I_{EBO}		0.5	mA dc

See footnotes at end of table.

TABLE I. Group A inspection – Continued.

Inspection 1/	MIL–STD–750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 2 – Continued						
Forward- current transfer ratio	3076	Pulsed (see 4.5.1), I_C = 100 mA dc V_{CE} = 1.0 V dc	h_{FE1}	30		
Forward-current transfer ratio	3076	Pulsed (see 4.5.1), I_C = 250 mA dc V_{CE} = 1.0 V dc	h_{FE2}	30	150	
Forward-current transfer ratio	3076	Pulsed (see 4.5.1), I_C = 500 mA dc V_{CE} = 1.0 V dc	h_{FE3}	30		
Saturation voltage and resistance, collector to emitter	3071	Pulsed (see 4.5.1), I_C = 500 mA dc I_B = 50 mA dc	$V_{CE(sat)1}$		0.3	V dc
Saturation voltage and resistance, collector to emitter	3071	Pulsed (see 4.5.1), I_C = 1.0 A dc I_B = 0.1 A dc	$V_{CE(sat)2}$		0.6	V dc
Base emitter voltage (saturated)	3066	Test condition A, pulsed (see 4.5.1), I_C = 500 mA dc, I_B = 50 mA dc	$V_{BE(sat)1}$		1.0	V dc
Base emitter voltage (saturated)	3066	Test condition A, pulsed (see 4.5.1), I_C = 1.0 A dc, I_B = 0.1 A dc	$V_{BE(sat)2}$		1.5	V dc
Subgroup 3						
High-temperature operation:		T_A = +150°C				
Collector to emitter cutoff current 2N4237 2N4238 2N4239	3041	Bias condition A, V_{BE} = 1.5 V dc V_{CE} = 30 V dc V_{CE} = 50 V dc V_{CE} = 70 V dc	I_{CEX2}		25	µA dc
Low-temperature operation:		T_A = –55°C				
Forward-current transfer ratio	3076	Pulsed (see 4.5.1), I_C = 250 mA dc V_{CE} = 1.0 V dc	h_{FE4}	15		
Subgroup 4						
Magnitude of small-signal, short-circuit forward-current transfer ratio	3306	I_C = 100 mA dc, V_{CE} = 10 V dc, f = 10 MHz	$\lvert h_{FE} \rvert$	3		
Open–circuit output capacitance	3236	I_E = 0, V_{CB} = 10 V dc, f = 100 kHz	C_{obo}		100	pF

See footnotes at end of table.

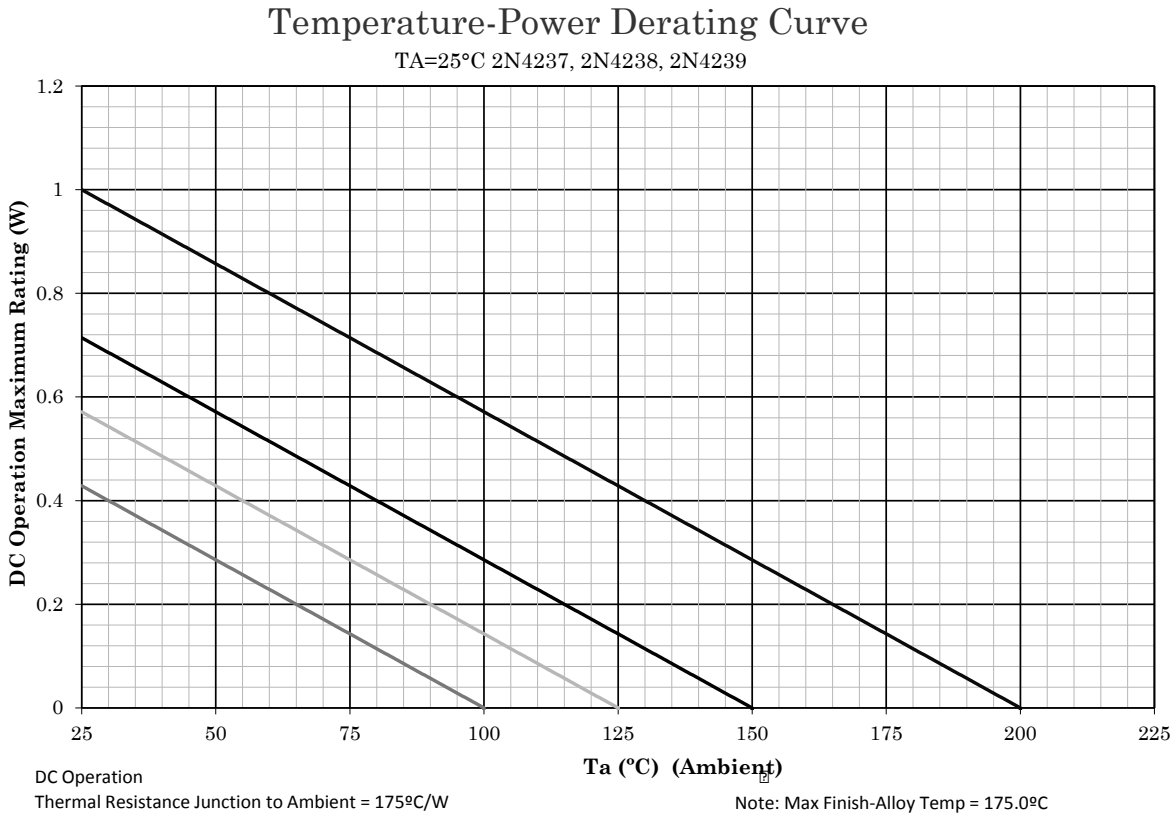
TABLE I. Group A inspection – Continued.

Inspection 1/	MIL–STD–750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 5						
Safe operating area (continuous dc) 5/	3051	T_C = +25°C; t ≥ 0.5 s, 1 cycle				
Test 1		I_C = 1.0 A dc, V_{CE} = 6 V dc				
Test 2		I_C = 500 mA dc, V_{CE} = 12 V dc				
Test 3						
2N4237		I_C = 166 mA dc, V_{CE} = 30 V dc				
2N4238		I_C = 100 mA dc, V_{CE} = 50 V dc				
2N4239		I_C = 71 mA dc, V_{CE} = 70 V dc				
End-point electrical measurements		See subgroup 2 of this table				
Subgroups 6 and 7						
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 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.
5/ L = 5 mH (2 each Essex Stancor C-2688 in parallel 1A, 0.5 ohm, or equivalent (see 4.5.2).

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

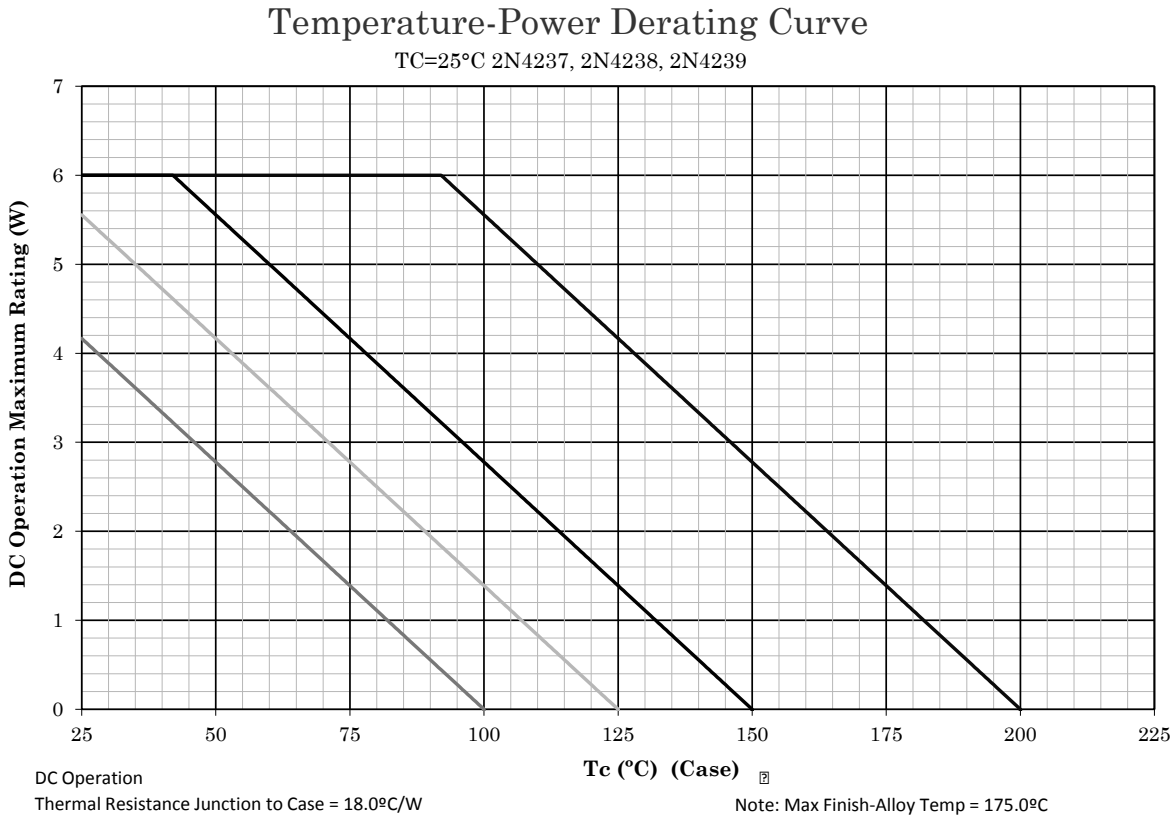
Inspection	MIL–STD–750		Qualification sample plan
	Method	Conditions	
Subgroup 1			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles.	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table I, subgroup 2 and 4.6 herein.	
Subgroup 2			45 devices c = 0
Intermittent life	1037	V_{CB} = 10 V dc, 6,000 cycles, forced air cooling allowed on cooling cycle only.	
Electrical measurements		See table I, subgroup 2 and 4.6 herein.	
Subgroup 4			Sample size N/A
Thermal impedance curves		See MIL–PRF–19500.	
Subgroup 5			
Not applicable			
Subgroup 8			45 devices c = 0
Reverse voltage leakage stability	1033	Condition B for devices < 400 V.	



NOTES:

1. Top curve is thermal runaway loci and cannot be used as a derate design curve since it exceeds the maximum ratings for this part. Operating under this curve using these mounting conditions assures the device will not have a thermal runaway. This is the true inverse of the worst case thermal resistance value extrapolated out to the thermal runaway point.
2. Derate design curve constrained by the maximum junction temperature ($T_J \leq 200°C$) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at $T_J \leq 150°C$, where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at $T_J \leq 125°C$, and 110°C to show power rating where most users want to limit T_J in their application.

FIGURE 2. Temperature-power derating at T_A for device types 2N4237, 2N4238, and 2N4239.



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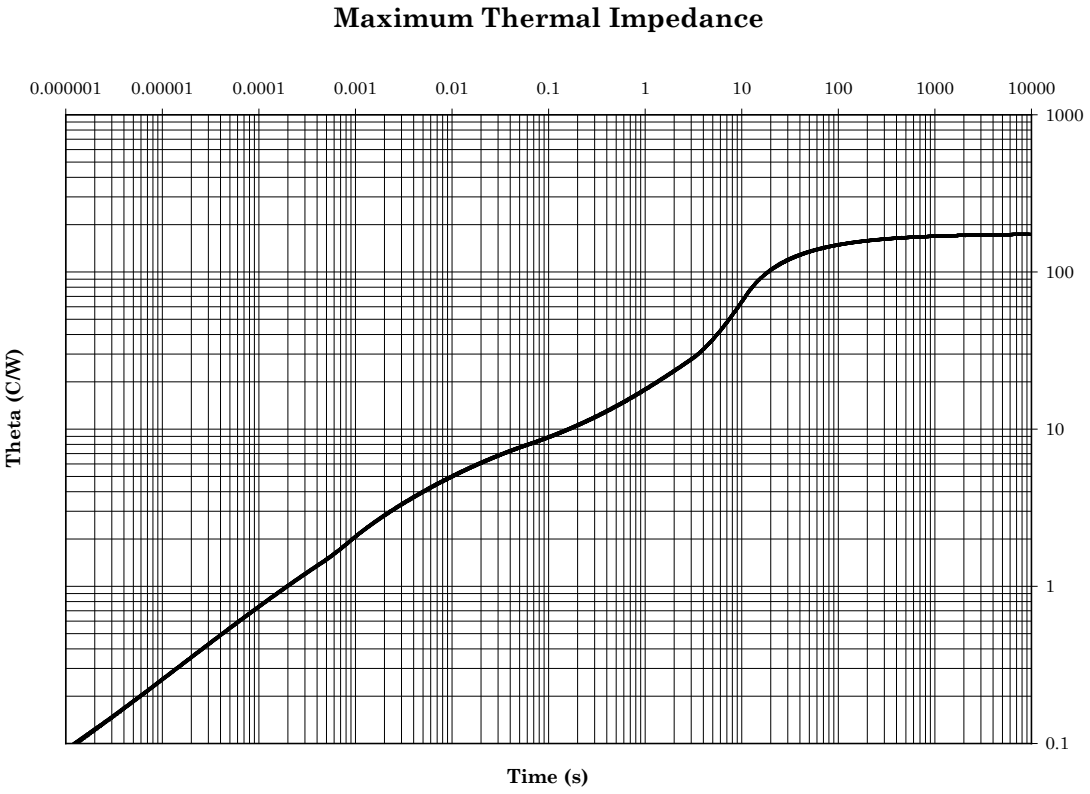
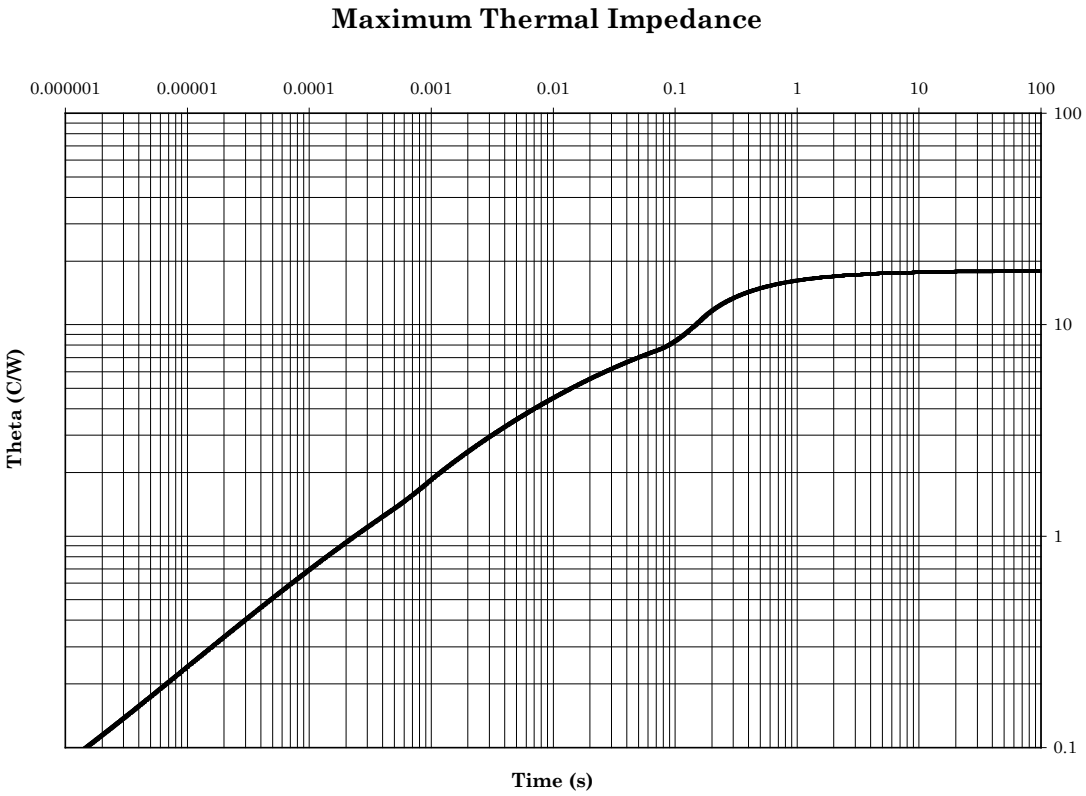
3. Derate design curve chosen at $T_J \leq 150°C$, where the maximum temperature of electrical test is performed.
4. Derate design curve chosen at $T_J \leq 125°C$, and 110°C to show power rating where most users want to limit T_J in their application.

FIGURE 3. Temperature-power derating at T_C for device types 2N4237, 2N4238, and 2N4239.



T_A = +25°C, thermal resistance = 175°C/W.

FIGURE 4. Thermal impedance graph at T_A for device types 2N4237, 2N4238, and 2N4239.



T_C = +25°C, thermal resistance = 18°C/W.

FIGURE 5. Thermal impedance graph at T_C for device types 2N4237, 2N4238, and 2N4239.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel is to be performed by DoD 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 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 Part or Identifying Number (PIN), see 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 Application guidance. The following NPN type transistors are complementary to the PNP devices of MIL–PRF–19500/580 listed below.

NPN	PNP
2N4237	2N4234
2N4238	2N4235
2N4239	2N4236

6.5 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's Part or Identifying Number (PIN). This information in no way implies that manufacturer's PIN's are suitable for the military PIN.

Military PIN	Manufacturer's CAGE Code	Manufacturer's and user's PIN
JAN2N4237 or JANTX2N4237 or JANTXV2N4237	43611	2N4237 ST1027H
JAN2N4238 or JANTX2N4238 or JANTXV2N4238	43611	2N4238 ST1375H
JAN2N4239 or JANTX2N4239 or JANTXV2N4239	43611	2N4239 ST690H2 ST693H1 ST693H2 ST693H3 ST693H4 ST693H32 ST7008H1 ST7008H2 ST7008H3 ST7008H4 ST7008H21 ST7008H32

6.6 Changes from previous issue. The margins of this specification are marked with vertical lines 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
DLA – CC

Review activities:
Army – AR, MI, SM
Navy – AS, MC, OS
Air Force – 19, 99

Preparing activity:
DLA – CC

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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.dla.mil.