

The documentation and process conversion measures necessary to comply with this document shall be completed by 20 August 2013.

MIL-PRF-19500/408K
20 February 2013
SUPERSEDING
MIL-PRF-19500/408J
5 June 2008

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, HIGH-POWER,
TYPES 2N3715 AND 2N3716, 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 NPN, silicon, high-power transistors. Four 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-204AA (formerly TO-3) in accordance with [figure 1](#).

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

Types	P_T (1) $T_A = +25^\circ\text{C}$	P_T (2) $T_C = +25^\circ\text{C}$	$R_{\theta JC}$ (3)	V_{CBO}	V_{CEO}	V_{EBO}	I_B	I_C	T_J and T_{STG}
	<u>W</u>	<u>W</u>	<u>$^\circ\text{C}/\text{W}$</u>	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>A dc</u>	<u>A dc</u>	<u>$^\circ\text{C}$</u>
2N3715	5.0	117	1.5	80	60	7.0	4.0	10	-65 to +200
2N3716	5.0	117	1.5	100	80	7.0	4.0	10	-65 to +200

(1) Derate linearly 28.57 mW/ $^\circ\text{C}$ above $T_A = +25^\circ\text{C}$.

(2) See [figure 2](#) for temperature-power derating curves.

(3) See [figure 3](#) for transient thermal impedance graph.

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, $T_c = +25^\circ\text{C}$.

Limit	h_{FE2} (1) $V_{CE} = 2.0 \text{ V dc}$ $I_C = 3.0 \text{ A dc}$	h_{FE4} (1) $V_{CE} = 4.0 \text{ V dc}$ $I_C = 10 \text{ A dc}$	$V_{BE(SAT)1}$ (1) $I_C = 5.0 \text{ A dc}$ $I_B = 0.5 \text{ A dc}$	$V_{CE(SAT)1}$ (1) $I_C = 5.0 \text{ A dc}$ $I_B = 0.5 \text{ A dc}$	C_{obo} $V_{CB} = 10 \text{ V dc}$, $I_E = 0$ $f = 1 \text{ MHz}$	$ h_{fe} $ $V_{CE} = 10 \text{ V dc}$ $I_C = 0.5 \text{ A dc}$ $f = 1 \text{ MHz}$
Min	30	5.0	<u>V dc</u>	<u>V dc</u>	<u>pF</u>	4.0
Max	120		1.5	1.0	500	20

(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

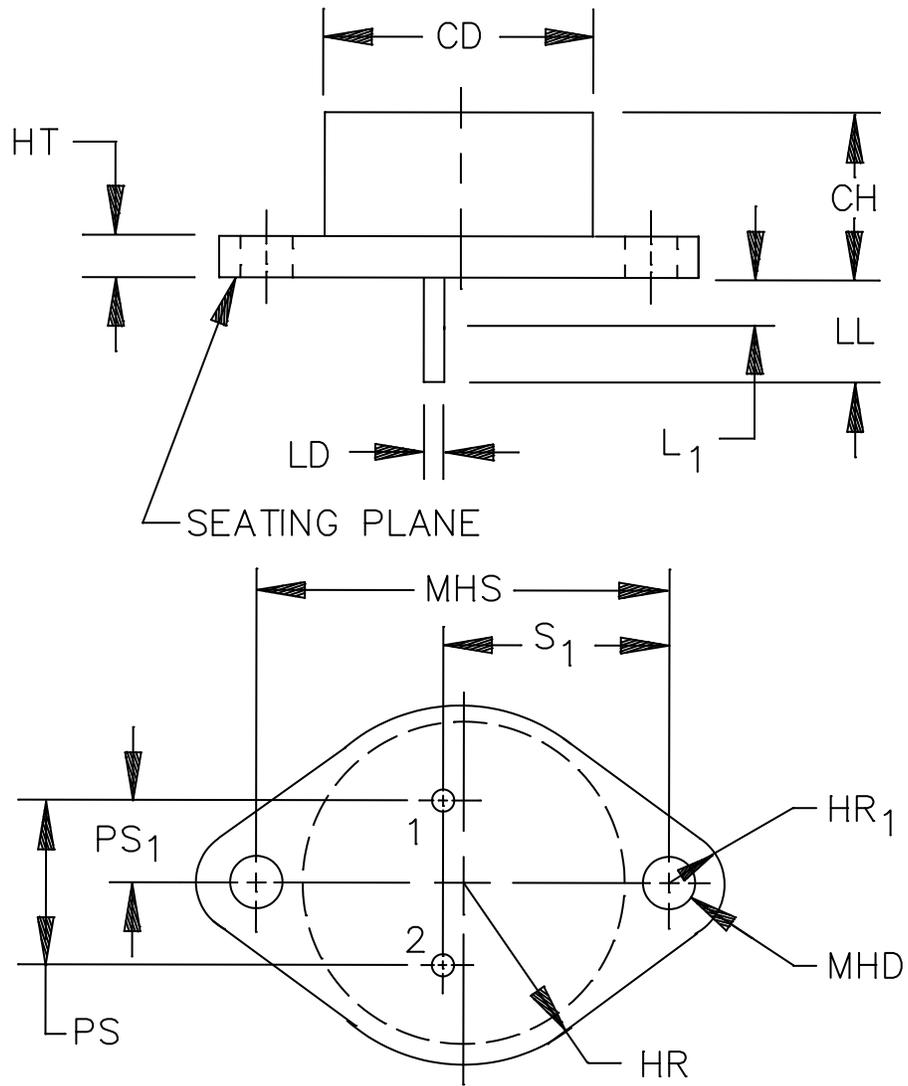
[MIL-PRF-19500](#) – Semiconductor Devices, General Specification for.

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.



I

FIGURE 1. Physical dimensions (TO-204AA, formerly TO-3).

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD		.875		22.23	3
CH	.250	.450	6.35	11.43	
HR	.495	.525	12.57	13.34	
HR ₁	.131	.188	3.33	4.78	4
HT	.060	.135	1.52	3.43	
L ₁		.050		1.27	5, 6
LD	.038	.043	0.97	1.09	5, 6
LL	.312	.500	7.92	12.70	5
MHD	.151	.165	3.84	4.19	4
MHS	1.177	1.197	29.90	30.40	
PS	.420	.440	10.67	11.18	7
PS ₁	.205	.225	5.21	5.72	7
S ₁	.655	.675	16.64	17.15	7

NOTES:

1. Dimensions are in inches. Millimeters are given for general information only.
2. Terminal 1 is the emitter; terminal 2 is the base; and the collector shall be electrically connected to the case.
3. Body contour is optional within zone defined by dimension CD.
4. Applies to both ends.
5. Applies to both terminals.
6. Dimension LD applies between dimension L₁ and LL. Lead diameter shall not exceed twice dimension LD within dimension L₁. Diameter is uncontrolled in dimension L₁.
7. These dimensions shall be measured at points .050 inch (1.27 mm) to .055 inch (1.4 mm) below the seating plane. When gauge is not used, measurement will be made at the seating plane.
8. The seating plane of the header shall be flat within .001 inch (0.03 mm) concave to .004 inch (0.10 mm) convex inside a .930 inch (23.62 mm) diameter circle on the center of the header and flat within .001 inch (0.03 mm) concave to .006 inch (0.15 mm) convex overall.
9. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 1. Physical dimensions (TO-204AA, formerly TO-3) – Continued.

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 requirements and physical dimensions shall be as specified in [MIL-PRF-19500](#) and on [figure 1](#) (TO-204AA, formerly TO-3) 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 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](#).

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 JANS, 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	
	JANS level	JANTX and JANTXV levels
3c (1)	Thermal impedance (see 4.3.1).	Thermal impedance (see 4.3.1).
9	I_{CES1} and h_{FE2}	I_{CES1}
11	I_{CES1} and h_{FE2} ; ΔI_{CES1} = 100 percent of initial value or 1 μ A dc, whichever is greater. Δh_{FE2} = ± 15 percent of initial value.	I_{CES1} and h_{FE2} ; ΔI_{CES1} = 100 percent of initial value or 1 μ A dc, whichever is greater.
12	See 4.3.2	See 4.3.2
13	ΔI_{CES1} = 100 percent of initial value or 1 μ A dc, whichever is greater; Δh_{FE2} = ± 15 percent of initial value; subgroup 2 of table I herein	ΔI_{CES1} = 100 percent of initial value or 1 μ A dc, whichever is greater; Δh_{FE2} = ± 20 percent of initial value; subgroup 2 of table I herein

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

4.3.1 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_H where appropriate). See table II, subgroup 4 (group E) herein.

4.3.2 Power burn-in conditions. Power burn-in conditions shall be as follows: $T_J = +187.5 \pm 12.5^\circ\text{C}$; $V_{CE} = 25 \pm 5$ V dc; T_A = room ambient as defined in the general requirements of MIL-STD-750. 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 quality levels JANTX and JANTXV. 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.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with table E-V of MIL-PRF-19500 and table I herein. Electrical measurements (end-points) shall be in accordance with the applicable inspections of table I, subgroup 2 herein.

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VIA (JANS) and table E-VIB (JAN, JANTX and JANTXV) of MIL-PRF-19500, and as follows. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2. Delta requirements shall be in accordance with the applicable steps of 4.6 herein.

4.4.2.1 Quality level JANS (table E–VIA of MIL–PRF–19500).

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
B4	1037	$V_{CB} = 30 \text{ V dc}$, $P_T = 4 \text{ W}$ at $T_A = +25^\circ\text{C} \pm 3^\circ\text{C}$, $t_{on} = t_{off} = 3 \text{ minutes}$ minimum for 2,000 cycles. No heat sink or forced air on the device shall be permitted. A separate sample may be selected for each test.
B5	1027	$V_{CB} = 30 \text{ V dc}$, $T_A = +125^\circ\text{C} \pm 25^\circ\text{C}$ for 96 hours; $P_T = 4 \text{ W}$ at $T_A = +100^\circ\text{C}$ or adjusted as required by the chosen T_A to give an average lot $T_J = +225^\circ\text{C}$. Marking legibility requirement shall not apply.

4.4.2.2 Quality levels JAN, JANTX, and JANTXV (table E–VIB of MIL–PRF–19500).

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
B3	1037	$V_{CB} \geq 10 \text{ V dc}$; ΔT_J between cycles $\geq 100^\circ\text{C}$; $t_{on} = t_{off} \geq 1 \text{ minute}$ for 2,000 cycles. No heat sink or forced air cooling on the device shall be permitted.
B6	1032	$T_A = +200^\circ\text{C}$.

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. Delta requirements shall be in accordance with the applicable step of 4.6 herein.

<u>Subgroup</u>	<u>Method</u>	<u>Conditions</u>
C2	1056	Test condition B.
C2	2036	Test condition A, weight = 10 lbs (4.54 Kg), application time = 15 seconds.
C5	3131	See 4.3.1, $R_{\theta JC} = 1.5^\circ\text{C/W}$.
C6	1037	$V_{CB} \geq 10 \text{ V dc}$; ΔT_J between cycles $\geq 100^\circ\text{C}$; $t_{on} = t_{off} \geq 1 \text{ minute}$ for 6,000 cycles. No heat sink or forced air cooling on the device shall be permitted.

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 pulse response measurement shall be as specified in section 4 of [MIL-STD-750](#).

4.6 Delta requirements. The requirements for delta measurements for groups B, C, and E shall be as specified below. (1) (2) (3) (4)

Step	Inspection	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1	Forward-current transfer ratio	3076	$V_{CE} = 2.0 \text{ V dc};$ $I_C = 3.0 \text{ A dc};$ pulsed (see 4.5.1)	Δh_{FE2} (5)	± 25 percent change from initial value		
2	Saturation voltage, collector to emitter	3071	$I_C = 5 \text{ A dc};$ $I_B = 0.5 \text{ A dc};$ pulsed (see 4.5.1)	$\Delta V_{CE(SAT)1}$ (5)	± 50 percent change from initial value		

- (1) The delta measurements for group B, quality level JANS, shall be as follows:
 - a. In addition to the measurements specified for subgroup 4 of table E-VIA of [MIL-PRF-19500](#), the measurements of step 1 shall also be taken.
 - b. In addition to the measurements specified for subgroup 5 of table E-VIA of [MIL-PRF-19500](#), the measurements of steps 1 and 2 shall also be taken.
- (2) The delta measurements for group B, quality levels JAN, JANTX and JANTXV shall be as follows:
 - a. In addition to the measurements specified for subgroup 3 of table E-VIB of [MIL-PRF-19500](#), the measurements of steps 1 shall also be taken.
 - b. In addition to the measurements specified for subgroup 6 of table E-VIB of [MIL-PRF-19500](#), the measurements of step 1 shall also be taken.
- (3) The delta measurements for group C shall be as follows:
 - a. In addition to the measurements specified for subgroup 6 of table E-VII of [MIL-PRF-19500](#), the measurements of all steps shall also be taken for JANS.
 - b. In addition to the measurements specified for subgroup 6 of table E-VII of [MIL-PRF-19500](#), the measurements of step 1 shall also be taken for JAN, JANTX, and JANTXV.
- (4) The delta measurements for group E, all quality levels, shall be as follows: In addition to the measurements specified for subgroups 1 and 2 of table E-IX of [MIL-PRF-19500](#), the measurements of steps 1 and 2 shall also be taken.
- (5) Devices which exceed the [table I](#) (group A) limits for this test shall not be acceptable.

TABLE I. Group A inspection.

Inspection <u>1</u> /	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u> Visual and mechanical examination	2071					
<u>Subgroup 2</u> Thermal impedance <u>2</u> /	3131	See 4.3.1	$Z_{\theta JX}$			°C/W
Breakdown voltage, collector to emitter 2N3715 2N3716	3011	Bias condition D, $I_C = 10$ mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	60 80		V dc V dc
Collector-base cutoff current 2N3715 2N3716	3036	Bias condition D $V_{CB} = 80$ V dc $V_{CB} = 100$ V dc	I_{CBO}		10 10	μ A dc μ A dc
Emitter-base cutoff current	3061	Bias condition D; $V_{EB} = 7$ V dc	I_{EBO}		1.0	mA dc
Collector to emitter cutoff current 2N3715 2N3716	3041	Bias condition A, $V_{BE} = 1.5$ V dc $V_{CE} = 60$ V dc $V_{CE} = 80$ V dc	I_{CEX1}		10 10	μ A dc μ A dc
Collector to emitter cutoff current 2N3715 2N3716	3041	Bias condition C $V_{CE} = 60$ V dc $V_{CE} = 80$ V dc	I_{CES1}		10 10	μ A dc μ A dc
Base emitter voltage (saturated)	3066	Test condition A; $I_C = 5$ A dc; $I_B = 0.5$ A dc; pulsed (see 4.5.1);	$V_{BE(SAT)1}$		1.5	V dc
Base emitter voltage (saturated)	3066	Test condition A; $I_C = 10$ A dc; $I_B = 2$ A dc; pulsed (see 4.5.1);	$V_{BE(SAT)2}$		3.0	V dc
Saturation voltage; collector to emitter	3071	$I_C = 5$ A dc; $I_B = 0.5$ A dc pulsed (see 4.5.1)	$V_{CE(SAT)1}$		1.0	V dc
Saturation voltage; collector to emitter	3071	$I_C = 10$ A dc; $I_B = 2$ A dc pulsed (see 4.5.1)	$V_{CE(SAT)2}$		2.5	V dc
Forward-current transfer ratio	3076	$V_{CE} = 2.0$ V dc; $I_C = 1.0$ A dc; pulsed (see 4.5.1)	h_{FE1}	50	150	
Forward-current transfer ratio	3076	$V_{CE} = 2.0$ V dc; $I_C = 3.0$ A dc; pulsed (see 4.5.1)	h_{FE2}	30	120	

See footnote at end of table.

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	$V_{CE} = 2.0 \text{ V dc}; I_C = 5 \text{ A dc};$ pulsed (see 4.5.1)	h_{FE3}	10		
Forward-current transfer ratio	3076	$V_{CE} = 4.0 \text{ V dc}; I_C = 10 \text{ A dc};$ pulsed (see 4.5.1)	h_{FE4}	5		
<u>Subgroup 3</u>						
High temperature operation:		$T_A = +150^\circ\text{C}$				
Collector to emitter cutoff current 2N3715 2N3716	3041	Bias condition C $V_{CE} = 50 \text{ V dc}$ $V_{CE} = 70 \text{ V dc}$	I_{CES2}		5.0 5.0	mA dc mA dc
Low temperature operation:		$T_A = -55^\circ\text{C}$				
Forward-current transfer ratio	3076	$V_{CE} = 2.0 \text{ V dc}; I_C = 3.0 \text{ A dc};$ pulsed (see 4.5.1)	h_{FE5}	12		
<u>Subgroup 4</u>						
Pulse response:	3251	Test condition A, except test circuit and pulse requirement in accordance with figure 4				
Pulse delay time			t_d		0.2	μs
Pulse rise time			t_r		1.3	μs
Pulse storage time			t_s		1.2	μs
Pulse fall time			t_f		1.2	μs
Small-signal short-circuit forward-current transfer ratio	3206	$V_{CE} = 10 \text{ V dc}; I_C = 0.5 \text{ A dc};$ $f = 1 \text{ kHz}$	h_{fe}	30	300	
Magnitude of small-signal, short-circuit forward-current transfer ratio	3306	$V_{CE} = 10 \text{ V dc}; I_C = 0.5 \text{ A dc};$ $f = 1 \text{ MHz}$	$ h_{fe} $	4.0	20	
Open circuit output capacitance	3236	$V_{CB} = 10 \text{ V dc}; I_E = 0; f = 1 \text{ MHz}$	C_{obo}		500	pF

See footnote at end of table.

TABLE I. Group A inspection – Continued.

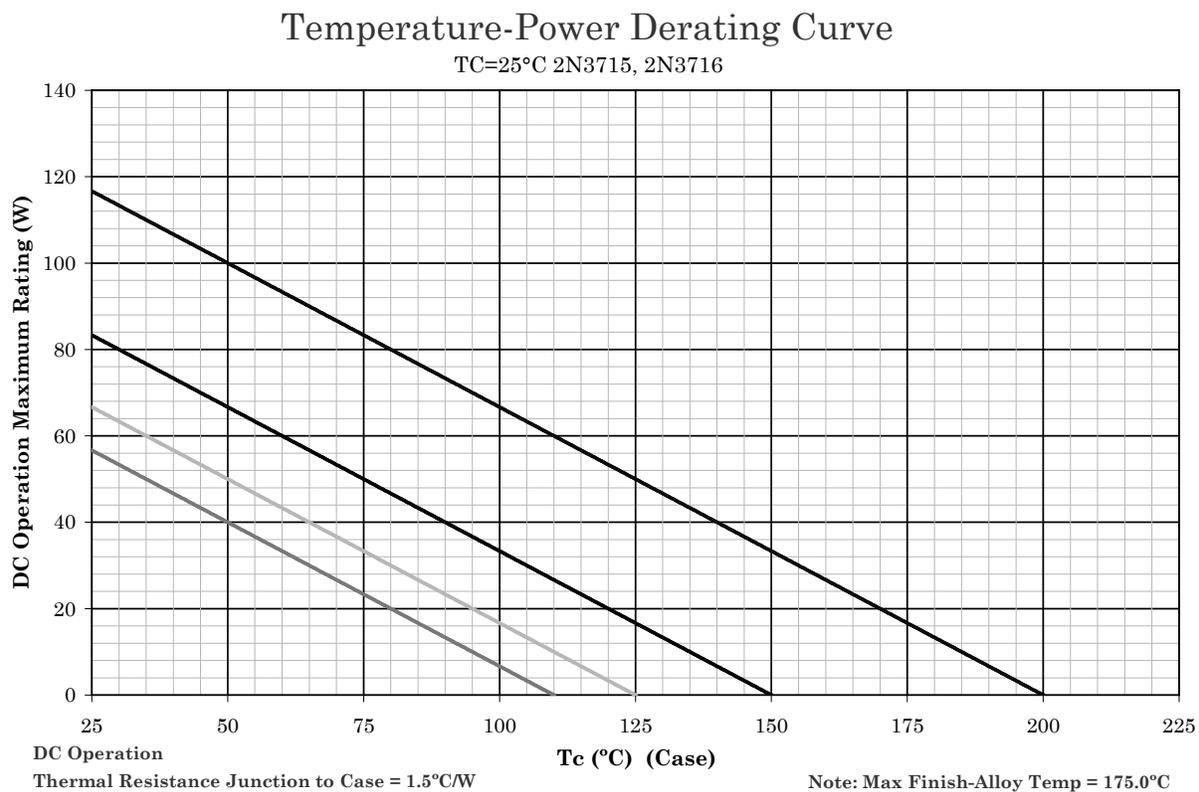
Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 5</u>						
Safe operating area (continuous dc)	3051	$T_C = +25^\circ\text{C}$; $t \geq 1$ s; 1 cycle; (see figure 5)				
Test 1		$V_{CE} = 15$ V dc; $I_C = 10$ A dc				
Test 2		$V_{CE} = 40$ V dc; $I_C = 3.75$ A dc				
Test 3 2N3715 2N3716		$V_{CE} = 55$ V dc; $I_C = 0.9$ A dc $V_{CE} = 65$ V dc; $I_C = 0.9$ A dc				
Safe operating area (switching) (clamped inductive)	3053	$T_A = +25^\circ\text{C}$; $I_C = 10$ A dc; $V_{CC} = 15$ V dc; (see figures 6 and 7)				
2N3715 2N3716		Clamp voltage = 60 V dc Clamp voltage = 80 V dc				
Test 1		t_p approximately 1.0 ms (vary to obtain I_C); $R_{BB1} = 5\Omega$; $V_{BB1} = 8$ V dc; $R_{BB2} = 4\Omega$; $V_{BB2} = 0$; $V_{CC} = 15$ V dc; $I_C = 5$ A dc; $L = 4$ mH; $Q \geq 100$ at 1 kHz; .05 ohms, 20 A dc; (Stanford Miller CK-20 or equivalent)				
Test 2	t_p approximately 2.2 ms (vary to obtain I_C); $R_{BB1} = 5\Omega$; $V_{BB1} = 8$ V dc; $R_{BB2} = 4\Omega$; $V_{BB2} = 0$; $V_{CC} = 15$ V dc; $I_C = 2.2$ A dc; $L = 20$ mH; $Q \geq 6,000$ at 10 kHz; 0.22 ohms, 12.5 A dc; (two Stancor C-2688 in series or equivalent)					
Electrical measurements		See subgroup 2 of this table				
<u>Subgroups 6 and 7</u>						
Not applicable						

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

2/ This test required for the following end-point measurements only:
Group B, subgroups 3, 4, and 5 (JANS).
Group B, subgroups 2 and 3 (JAN, JANTX, and JANTXV).
Group C, subgroup 2 and 6.
Group E, subgroup 1.

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

Inspection	MIL-STD-750		Qualification sample plan
	Method	Conditions	
<u>Subgroup 1</u>			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C.	
Hermetic seal	1071		
Fine leak			
Gross leak			
Electrical measurements		See table I , subgroup 2 and 4.6 herein.	
<u>Subgroup 2</u>			45 devices c = 0
Blocking life	1048	Test temperature = +125°C; V _{CB} = 80 percent of rated voltage; t = 1,000 hours.	
Electrical measurements		See table I , subgroup 2 and 4.6 herein.	
<u>Subgroup 4</u>			Sample size N/A
Thermal impedance curves		See MIL-PRF-19500 .	
<u>Subgroup 6</u>			11 devices
Electrostatic discharge sensitivity classification	1020	See MIL-PRF-19500 .	
<u>Subgroup 8</u>			45 devices c = 0
Reverse voltage leakage stability	1033	Condition B for devices < 400 V.	

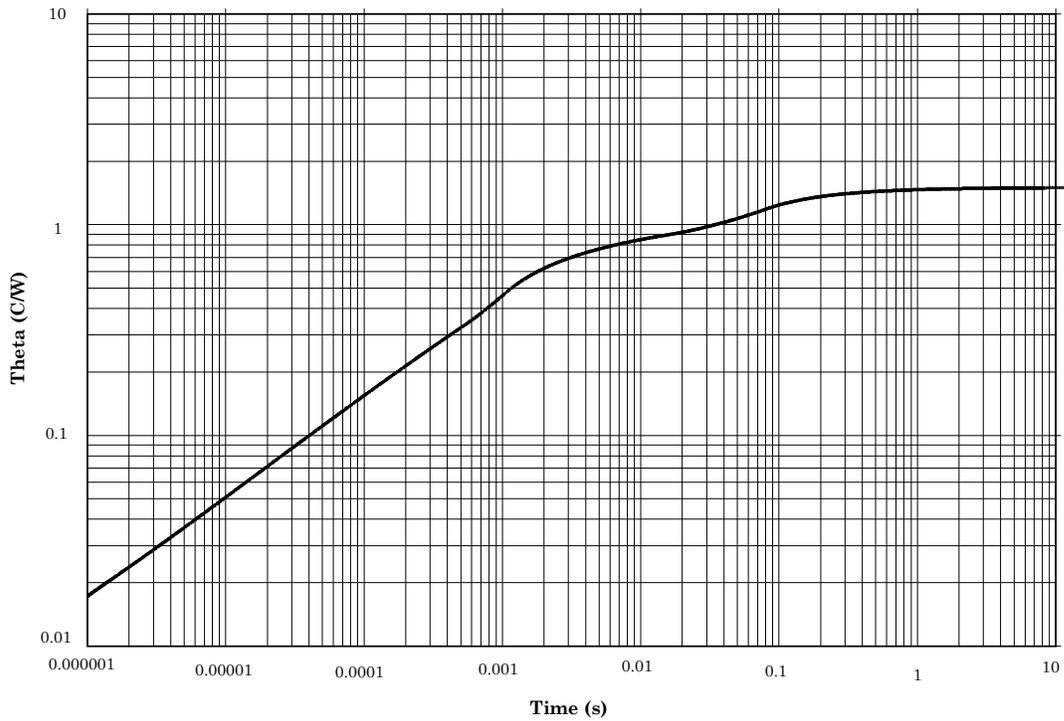


NOTES:

1. 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.

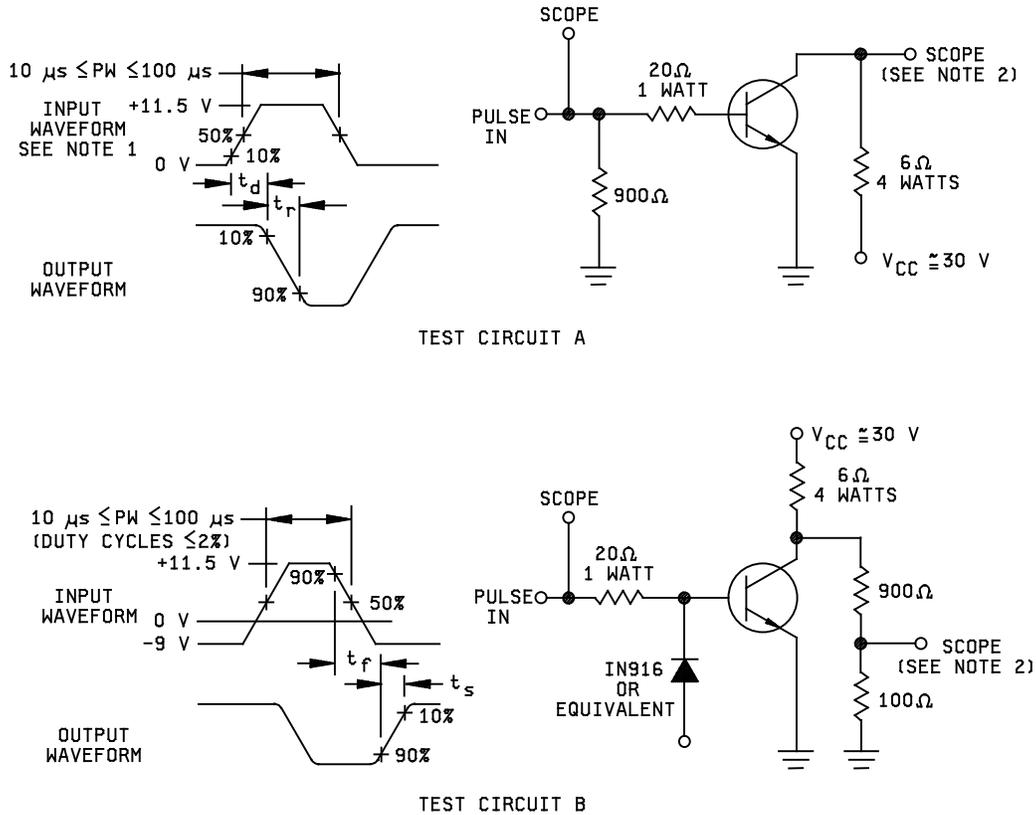
FIGURE 2. Temperature-power derating graphs for device types 2N3715 and 2N3716.

Maximum Thermal Impedance



$T_C = +25C$. Thermal resistance = $1.5^{\circ}C/W$.

FIGURE 3. Transient thermal impedance graph for device types 2N3715 and 2N3716.



NOTES:

1. The input waveform is supplied by a pulse generator with the following characteristics: $t_r \leq 20.0 \text{ ns}$, $t_f \leq 1 \mu s$, $10 \mu s \leq PW \leq 100 \mu s$, $Z_{OUT} = 50 \Omega$, duty cycle ≤ 2 percent.
2. Output waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 5 \text{ ns}$, $Z_{IN} \geq 100 \text{ k}\Omega$, $C_{IN} \leq 12 \text{ pF}$.
3. Test circuit A for t_d and t_r ; test circuit B for t_s and t_f .

FIGURE 4. Pulse response test circuits.

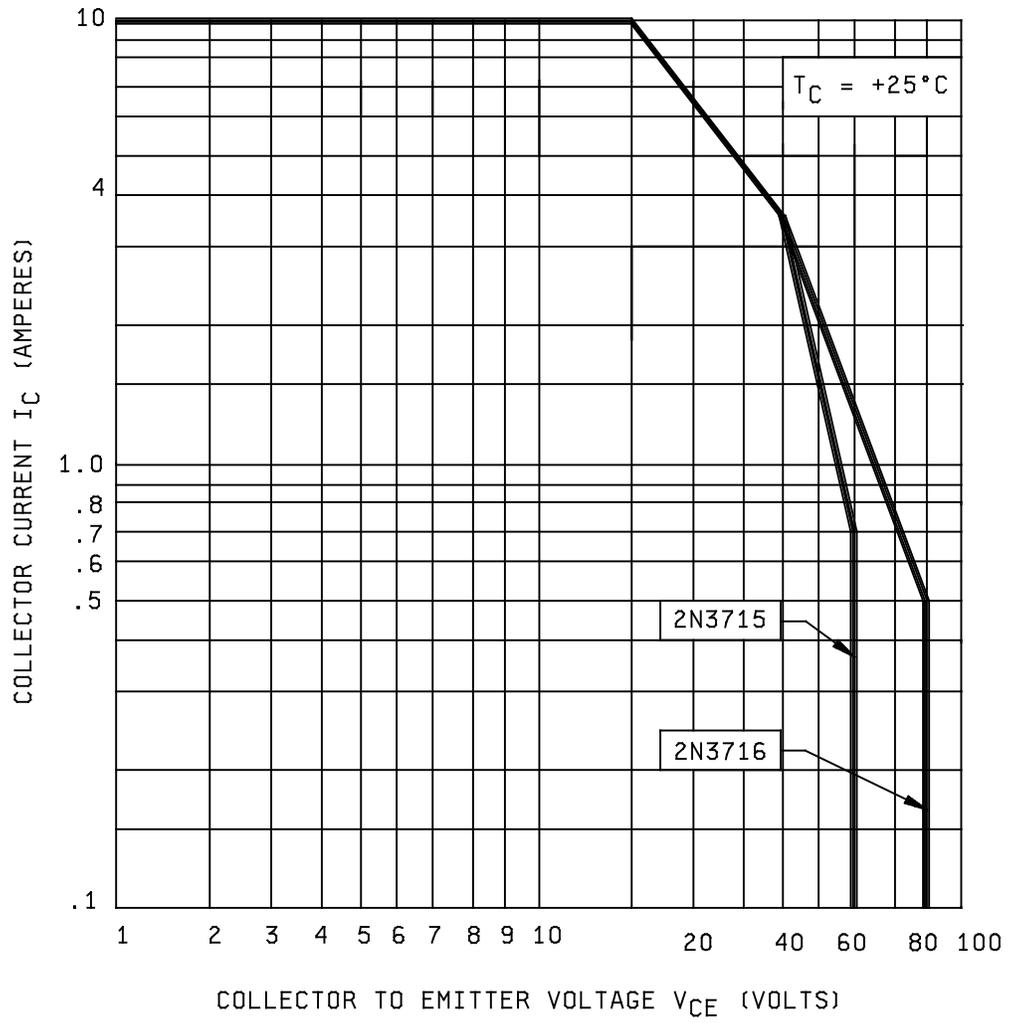


FIGURE 5. Maximum safe operating graph (dc).

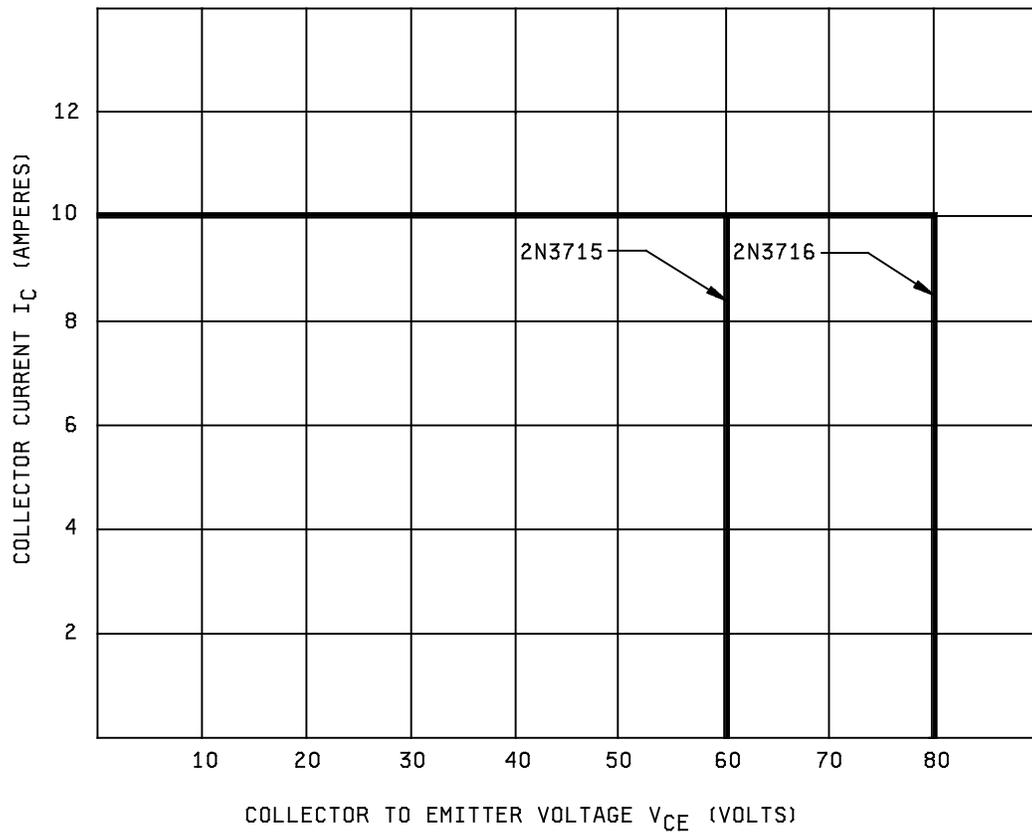
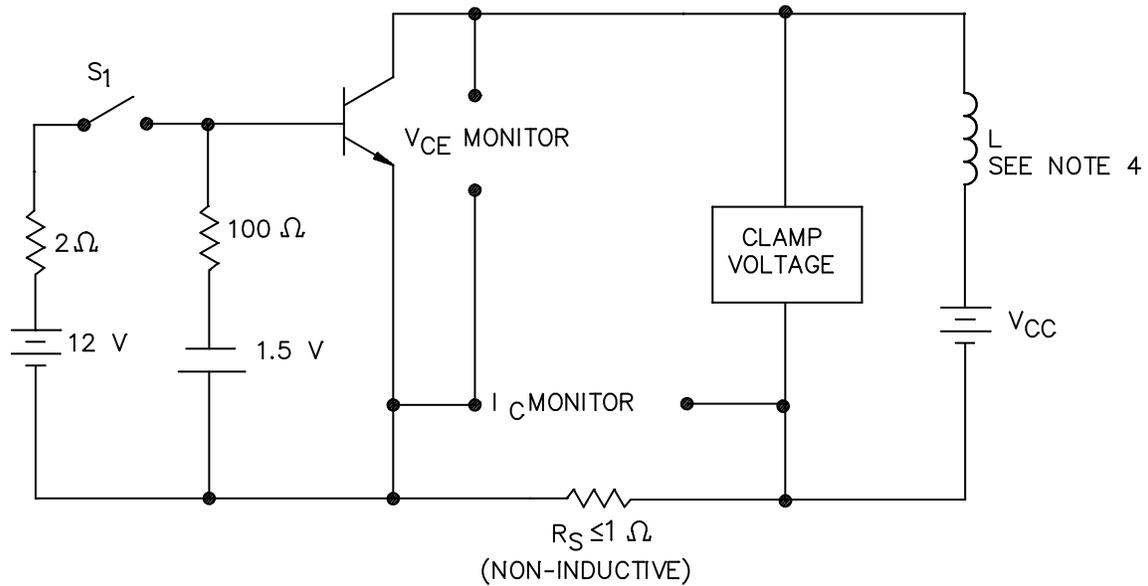


FIGURE 6. Safe operating area for switching between saturation and cutoff (clamped inductive load).

Procedure:

1. With switch S_1 closed, set the specified test conditions.
2. Open S_1 . Device fails if clamp voltage not reached.
3. Perform specified end-point tests.
4. $L = 4.0 \text{ mH}$, 0.05Ω , 20 A , $Q \geq 100$ at 1 kHz , (Sanford Miller CK-20 or equivalent).

FIGURE 7. Clamp inductive sweep 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. 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 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 Interchangeability information. MIL-PRF-19500/622 is a TO-254 package version of MIL-PRF-19500/408, which is a TO-204AA (formerly TO-3) package version. The military 2N7368 contains the same die as the military 2N3716. The MIL-PRF-19500/622 is preferred over the MIL-PRF-19500/408 whenever interchangeability is not a problem.

6.5 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

Preparing activity:
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Review activities:

Army – AR, AV, MI
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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.dla.mil>.