The documentation and process conversion measures necessary to comply with this document shall be completed by 25 June 2016.

INCH-POUND
MIL-PRF-19500/766B
25 March 2016
MIL-PRF-19500/766A
10 November 2014

PERFORMANCE SPECIFICATION SHEET

* TRANSISTOR, PNP, SILICON, LOW-POWER,
TYPE 2N5401, JANS, JANSR, 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 PNP silicon, low-power transistors. Four levels of product assurance (JAN, JANTX, JANTXV, and JANS) are provided for each device type as specified in MIL-PRF-19500, two levels of product assurance are provided for die.

* 1.2 Package outlines. The device packages for the (UB) in accordance with figure 1.

* 1.3 Maximum ratings unless otherwise specified T_A = +25°C.

Type	P_{T1} (1) (2) T_C = +25°C	P_{T2} (1) (2) $T_{SP(IS)}$ = +25°C	P_{T3} (1) (2) T_A = +25°C	$R_{\theta JA}$	$R_{\theta JSP(IS)}$	V_{CBO}	V_{CEO}	V_{EBO}	I_C	T_J and T_{STG}
	W	W	W	°C/W	°C/W	V dc	V dc	V dc	mA dc	°C
2N5401UB	1.2	1	0.36	280	85	-160	-150	-5	-500	-65 to +200

NOTES:
(1) For thermal impedance curve, for 2N5401, see figures 2 and 3 for T_A > +25°C.
(2) For variants with tin-lead plating, or hot solder dip lead finish, all testing, and any handling, performed at T_A > +125°C shall be carried out in a 100-percent inert atmosphere.

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.

Limits	h_{FE1} (1)	h_{FE2} (1)	h_{FE3} (1)	$\lvert h_{fe} \rvert$	$V_{BE(SAT)1}$ (1)
	V_{ce} = -5 V dc I_C = -1 mA dc	V_{ce} = -5 V dc I_C = -10 mA dc	V_{ce} = -5 V dc I_C = -50 mA dc	f = 10 MHz V_{ce} = -10 V dc I_C = -10 mA dc	I_C = -10 mA dc I_B = -1.0 mA dc
					mV dc
Min	50	60	60	5	
Max		240			1

(1) Pulsed (see 4.5.1).

* 1.5 Part or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-19500, and as specified herein. See 6.5 for PIN construction example and 6.6 for a list of available PINs.

* 1.5.1 JAN certification mark and quality level designators.

* 1.5.1.1 Quality level designators for encapsulated devices. The quality level designators for encapsulated devices that are applicable for this specification sheet from the lowest to the highest level are as follows: "JAN", "JANTX", “JANTXV”, and "JANS".

* 1.5.2 Device type. The designation system for the device types covered by this specification sheet are as follows.

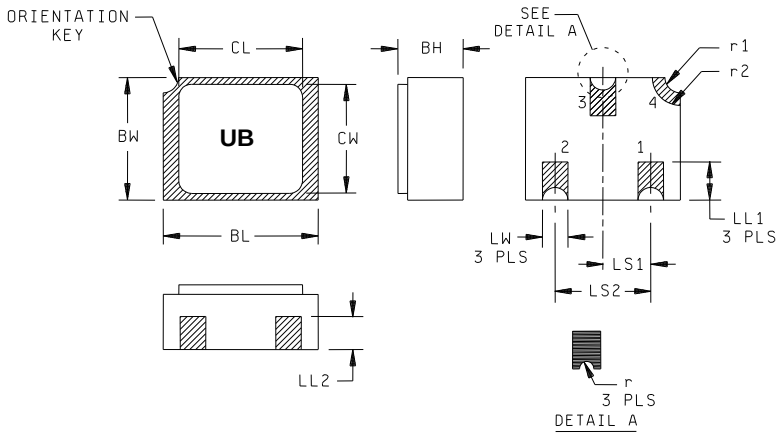
* 1.5.2.1 First number and first letter symbols. The semiconductors of this specification sheet use the first number and letter symbols "2N".

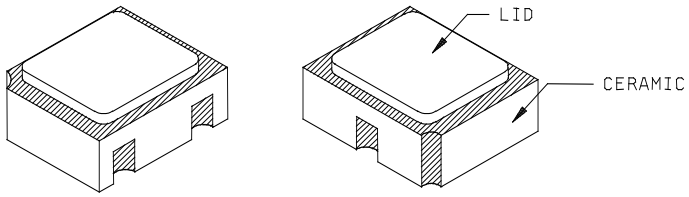
* 1.5.2.2 Second number symbols. The second number symbols for the semiconductors covered by this specification sheet are as follows: "5401".

* 1.5.3 Suffix symbols. The following suffix letters are incorporated in the PIN for this specification sheet.

UB	Indicates a surface mount 2N5401UB, (see figure 1)

* 1.5.4 Lead finish. The lead finishes applicable to this specification sheet are listed on QML-19500.





Symbol	Dimensions				Symbol	Dimensions			
	Inches		Millimeters			Inches		Millimeters	
	Min	Max	Min	Max		Min	Max	Min	Max
BH	.046	.056	1.17	1.42	LS	.071	.079	1.80	2.01
BL	.115	.128	2.92	3.25	LW	.016	.024	0.41	0.61
BW	.085	.108	2.16	2.74	r	.008 TYP		0.20 TYP	
CL		.128		3.25	r1	.012 TYP		0.30 TYP	
CW		.108		2.74	r2	.022 TYP		0.56 TYP	
LL1	.022	.038	0.56	0.96					
LL2	.017	.035	0.43	0.89					

NOTES:

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Hatched areas on package denote metallized areas.
4. Pad 1 = Base, Pad 2 = Emitter, Pad 3 = Collector, Pad 4 = Shielding connected to the lid.
5. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.

FIGURE 1. Physical dimensions, surface mount (2N5401UB).

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3 and 4 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://quicksearch.dla.mil.)

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 and as follows.

$R_{\theta JA}$	Thermal resistance junction to ambient.
$R_{\theta JC}$	Thermal resistance junction to case.
$R_{\theta JSP(IS)}$	Thermal resistance junction to solder pad (Infinite sink to PCB).
UB	Surface mount case outlines (see figure 1).

* 3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and figure 1.

3.4.1 Lead finish. Lead finish shall be solderable in accordance with 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).

3.4.2 Marking. Devices shall be marked in accordance with MIL-PRF-19500. The prefixes JAN, JANTX, JANTXV, and JANS can be abbreviated as J, JX, JV, and JS respectively. The radiation hardened designator M, D, P, L, R, F, G, or H shall immediately precede (or replace) the device “2N” identifier (depending upon degree of abbreviation required).

3.5 Radiation hardness assurance (RHA). Radiation hardness assurance requirements, PIN designators, and test levels shall be as defined in 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 as specified in table I.

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 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, 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	Measurement	
	JANS	JANTX and JANTXV levels
* (1) 3c	Thermal impedance method 3131 of MIL-STD-750. (See 4.3.2).	Thermal impedance method 3131 of MIL-STD-750. (See 4.3.2).
7	Optional.	Optional.
9	I_{CBO2}, h_{FE3}	Not applicable.
11	I_{CBO1}, h_{FE2}; ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE2} = 15 percent of initial value or 30mV whichever is greater.	I_{CBO1}, h_{FE2}
12	See 4.3.1.	See 4.3.1.
13	ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE2} = 15 percent of initial value or 30mV whichever is greater, subgroup 2 and 3 of table I herein.	ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE2} = 15 percent of initial value or 30mV whichever is greater, subgroup 2 and 3 of table I herein.
14	Required.	Required.

(1) 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 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°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).

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 MIL-PRF-19500 and table I herein.

4.4.2 Group B inspection. See 4.4.2.2 for JAN, JANTX, and JANTXV group B testing. Delta measurements shall be in accordance with 4.5.2 herein.

4.4.2.1 Group B inspection (JANS), table E-VIA of MIL-PRF-19500.

	Subgroup	Method	Condition
*	B4	1037	V_{CB} = -10 V dc, adjust device current, or power, to achieve a minimum ΔT_J of +100°C.
*	B5	1027	V_{CB} = -10 V dc; $P_D \geq$ 100 percent of maximum rated P_T (see 1.3). (NOTE: If a failure occurs, resubmission shall be at the test conditions of the original sample.) Option 1: 96 hours minimum sample size in accordance with MIL-PRF-19500, table E-VIA, adjust T_A or P_D to achieve T_J = +275°C minimum. Option 2: 216 hours minimum, sample size = 45, c = 0; adjust T_A or P_D to achieve a T_J = +225°C minimum.

4.4.2.2 Group B inspection, (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.

	Step	Method	Condition
*	1	1026	Steady-state 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.

4.4.2.3 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.

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 tests and conditions specified for subgroup testing in table E-VII of MIL-PRF-19500, and in 4.4.3.1 (JANS) and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Delta measurements shall be in accordance with 4.5.2 herein.

4.4.3.1 Group C inspection (JANS), table E-VII of MIL-PRF-19500.

	Subgroup	Method	Condition
	C2	2036	Test condition E (not applicable to the 2N5401UB).
	C5	3131	$R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3 and 4.3.2) and in accordance with thermal impedance curves.
*	C6	1026	1,000 hours at V_{CB} = -10 V dc; power shall be applied to achieve T_J = +150°C minimum and a minimum of P_D = 75 percent of maximum rated P_T as defined in 1.3 n = 45, 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.

4.4.3.2 Group C inspection (JAN, JANTX, and JANTXV), table E-VII of MIL-PRF-19500.

Subgroup	Method	Condition
C2	2036	Test condition E (not applicable to the 2N5401UB).
C5	3131	$R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3 and 4.3.2) and in accordance with thermal impedance curves.
C6	1026	Not applicable.

4.4.3.3 Group C sample selection. Samples selected from group C inspection shall be chosen at random from any lot containing the intended package type and lead finish procured to the same specification which is submitted to and passes group A tests 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 group 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 D inspection. Conformance inspection for hardness assured JANS and JANTXV types shall include the group D tests specified in table II herein. These tests shall be performed as required in accordance with MIL-PRF-19500 and method 1019 of MIL-STD-750, for total ionizing dose or method 1017 of MIL-STD-750 for neutron fluence as applicable (see 6.2.e herein), except group D, subgroup 2 may be performed separate from other subgroups. Alternate package options may also be substituted for the testing provided there is no adverse effect to the fluence profile.

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

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 measurements. Delta measurements 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} = -120 V dc	ΔI_{CBO1}	±100 percent of initial value or 5 nA dc, whichever is greater	
2.	Forward current transfer ratio	3076	V_{CE} = -5 V dc, I_C = -10 mA dc	ΔH_{FE2}	±15 percent of initial value	
3.	Collector-emitter saturation voltage	3071	I_C = -50 mA dc, I_B = -5 mA dc	$\Delta V_{CE(sat)2}$	±15percent or 30 mV whichever is greater	

* TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical inspection 3/	2071	n = 45 devices, c = 0				
Solderability 4/	2026	n = 15 leads, c = 0				
Resistance to solvents 3/ 4/	1022	n = 15 devices, c = 0				
Temp cycling 4/	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal 4/ 5/ Fine leak Gross leak	1071	n = 22 devices, c = 0				
Electrical measurements 4/		Table I, subgroup 2				
Bond strength 4/	2037	Precondition T_A = +250°C at t = 24 hours or T_A = +300°C at t = 2 hours, n = 11 wires, c = 0				
Decap internal visual (design verification) 4/	2075	n = 4 devices, c = 0				
Subgroup 2						
Thermal impedance	3131	See 4.3.2	$Z_{\theta JX}$			°C/W
Collector to base cutoff current	3036	Bias condition D, V_{CB} = -120 V dc pulsed (see 4.5.1)	I_{CBO1}		-50	nA dc
Emitter to base cutoff current	3061	Bias condition D, V_{EB} = -3 V dc pulsed (see 4.5.1)	I_{EBO1}		-50	nA dc
Breakdown voltage, collector-base	3001	Bias condition D; I_C = -100 μA dc; pulsed (see 4.5.1)	$V_{(BR)CBO}$	-160		V dc
Breakdown voltage, collector-emitter	3011	Bias condition D; I_C = -1 mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	-150		V dc
Breakdown voltage emitter-base	3026	Bias condition D, I_C = -10 μA dc, pulsed (see 4.5.1)	$V_{(BR)EBO}$	-5		V 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	V_{CE} = -5 V dc, I_C = -1 mA dc, pulsed (see 4.5.1)	h_{FE1}	50		
Forward-current transfer ratio	3076	V_{CE} = -5 V dc, I_C = -10 mA dc, pulsed (see 4.5.1)	h_{FE2}	60	240	
Forward-current transfer ratio	3076	V_{CE} = -5 V dc, I_C = -50 mA dc, pulsed (see 4.5.1)	h_{FE3}	60		
Collector-emitter saturated voltage	3071	I_C = -10 mA dc, I_B = -1 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)1}$		-200	mV dc
Collector-emitter saturated voltage	3071	I_C = -50 mA dc, I_B = -5 mA dc, pulsed (see 4.5.1)	$V_{CE(sat)2}$		-500	mV dc
Base-emitter saturated voltage	3066	Test condition A, I_C = -10 mA dc, I_B = -1 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)1}$		-1	V dc
Base-emitter saturated voltage	3066	Test condition A, I_C = -50 mA dc, I_B = -5 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)2}$		-1	V dc
Subgroup 3						
High temperature operation:		T_A = +150°C				
Collector to base cutoff current	3036	Bias condition D, V_{CB} = -120 V dc Tamb = 150 (+0 -5)°C	I_{CBO2}		-50	µA dc
Low temperature operation		T_A = -55°C				
Forward-current transfer ratio	3076	V_{CE} = -5 V dc, I_C = -10 mA dc, pulsed (see 4.5.1)	h_{FE4}	20		
Subgroup 4						
Small signal short circuit forward current transfer ratio	3206	V_{CE} = 10 V dc, f = 10 MHz, I_C = 10 mA dc:	h_{fe}	5		
Open circuit output capacitance	3236	V_{CB} = -10 V dc, I_E = 0, f = 1 MHz	C_{obo}		6	pF
Subgroups 5, 6, and 7						
Not appicable						

1/ For sampling plan see MIL-PRF-19500.
2/ For resubmission of failed test in subgroup 1 of table I, 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/ Not required for laser marked devices.
4/ Not required for JANS devices
5/ This hermetic seal test is an end-point to temp-cycling in addition to electrical measurements.

* TABLE II. Group D inspection and end-point limits.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1 4/						
Neutron irradiation	1017	Neutron exposure V_{CES} = 0 V				
Collector to base cutoff current	3036	Bias condition D; V_{CB} = -120 V dc; pulsed (see 4.5.1	I_{CBO1}		-100	nA dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = -3.0 V dc; pulsed (see 4.5.1)	I_{EBO1}		-100	nA dc
Breakdown voltage, collector-base	3001	Bias condition D; I_C = -100 μA dc;	$V_{(BR)CBO}$	-160		V dc
Breakdown voltage, collector-emitter	3011	Bias condition D; I_C = -1 mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	-150		V dc
Breakdown voltage emitter-base	3026	Bias condition D, I_C = -10 μA dc, pulsed (see 4.5.1)	$V_{(BR)EBO}$	-5		V dc
Forward-current transfer ratio	3076	V_{CE} = -5 V dc, I_C = -1 mA dc, pulsed (see 4.5.1)	[h_{FE1}] 5/			
M thru H	1019			[25]		
Forward-current transfer ratio	3076	V_{CE} = -5 V dc, I_C = -10 mA dc, pulsed (see 4.5.1)	[h_{FE2}] 5/			
M thru H	1019			[30]	240	
Forward-current transfer ratio	3076	V_{CE} = -5 V dc, I_C = -50 mA dc, pulsed (see 4.5.1)	[h_{FE3}] 5/			
M thru H	1019			[30]		
Collector–emitter saturated voltage	3071	I_C = -10 mA dc; I_B = -1 mA dc; pulsed (see 4.5.1)	$V_{CE(sat)1}$		-230	V dc
Collector–emitter saturated voltage	3071	I_C = -50 mA dc; I_B = -5 mA dc; pulsed (see 4.5.1)	$V_{CE(sat)2}$		-575	V dc
Base-emitter saturated voltage	3066	Test condition A; I_C = -10 mA dc; I_B = -1 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)1}$		-1.15	V dc
Base-emitter saturated voltage	3066	Test condition A; I_C = -50 mA dc; I_B = -5 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)2}$		-1.15	V dc

See footnotes at end of table.

* TABLE II. Group D inspection and end-point limits - Continued.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 2						
Steady-state total dose irradiation	1019	Gamma exposure V_{CES} = 120 V				
Collector to base cutoff current	3036	Bias condition D; V_{CB} = -120 V dc; pulsed (see 4.5.1)	I_{CBO1}		-100	µA dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = -7.0 V dc; pulsed (see 4.5.1)	I_{EBO1}		-100	µA dc
Breakdown voltage, collector-base	3001	Bias condition D; I_C = -100 µA dc; pulsed (see 4.5.1)	$V_{(BR)CBO}$	-160		V dc
Breakdown voltage, collector-emitter	3011	Bias condition D; I_C = -1 mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	-150		V dc
Breakdown voltage emitter-base	3026	Bias condition D, I_C = -10 µA dc, pulsed (see 4.5.1)	$V_{(BR)EBO}$	-5		V dc
Forward-current transfer ratio	3076	V_{CE} = -5 V dc, I_C = -1 mA dc, pulsed (see 4.5.1)	$[h_{FE1}]$ 5/			
M thru H	1019			[25]		
Forward-current transfer ratio	3076	V_{CE} = -5 V dc, I_C = -10 mA dc, pulsed (see 4.5.1)	$[h_{FE2}]$ 5/			
M thru H	1019			[30]	240	
Forward-current transfer ratio	3076	V_{CE} = -5 V dc, I_C = -50 mA dc, pulsed (see 4.5.1)	$[h_{FE3}]$ 5/			
M thru H	1019			[30]		
Collector–emitter saturated voltage	3071	I_C = -10 mA dc; I_B = -1 mA dc; pulsed (see 4.5.1)	$V_{CE(sat)1}$		-230	V dc
Collector–emitter saturated voltage	3071	I_C = -50 mA dc; I_B = -5 mA dc; pulsed (see 4.5.1)	$V_{CE(sat)2}$		-575	V dc
Base-emitter saturated voltage	3066	Test condition A; I_C = -10 mA dc; I_B = -1 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)1}$		-1.15	V dc
Base-emitter saturated voltage	3066	Test condition A; I_C = -50 mA dc; I_B = -5 mA dc, pulsed (see 4.5.1)	$V_{BE(sat)2}$		-1.15	V dc

1/ Tests to be performed on all devices receiving radiation exposure.
2/ For sampling plan, see MIL-PRF-19500.
3/ Electrical characteristics apply to the corresponding UB suffix version unless otherwise noted.
4/ See 6.2.e herein.
5/ See method 1019 of MIL-STD-750, for how to determine $[h_{FE}]$ by first calculating the delta ($1/h_{FE}$) from the pre- and post-radiation h_{FE}. Notice the $[h_{FE}]$ is not the same as h_{FE} and cannot be measured directly. The $[h_{FE}]$ value can never exceed the pre-radiation minimum h_{FE} that it is based upon.

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

Inspection	MIL-STD-750		Qualification
	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 herein.	
Subgroup 2			45 devices c = 0
Intermittent life	1037	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 table I, subgroup 2 herein.	
Subgroup 4			
Thermal resistance	3131	$R_{\theta JSP(IS)}$ can be calculated but shall be measured once in the same package with a similar die size to confirm calculations (may apply to multiple specification sheets).	15 devices, c = 0
Thermal impedance curves.		See MIL-PRF-19500, table E-IX, group E, subgroup 4.	Sample size N/A
Subgroup 5			
Not applicable			
Subgroup 6			11 devices
ESD	1020		
Subgroup 8			45 devices c = 0
Reverse stability	1033	Condition B.	

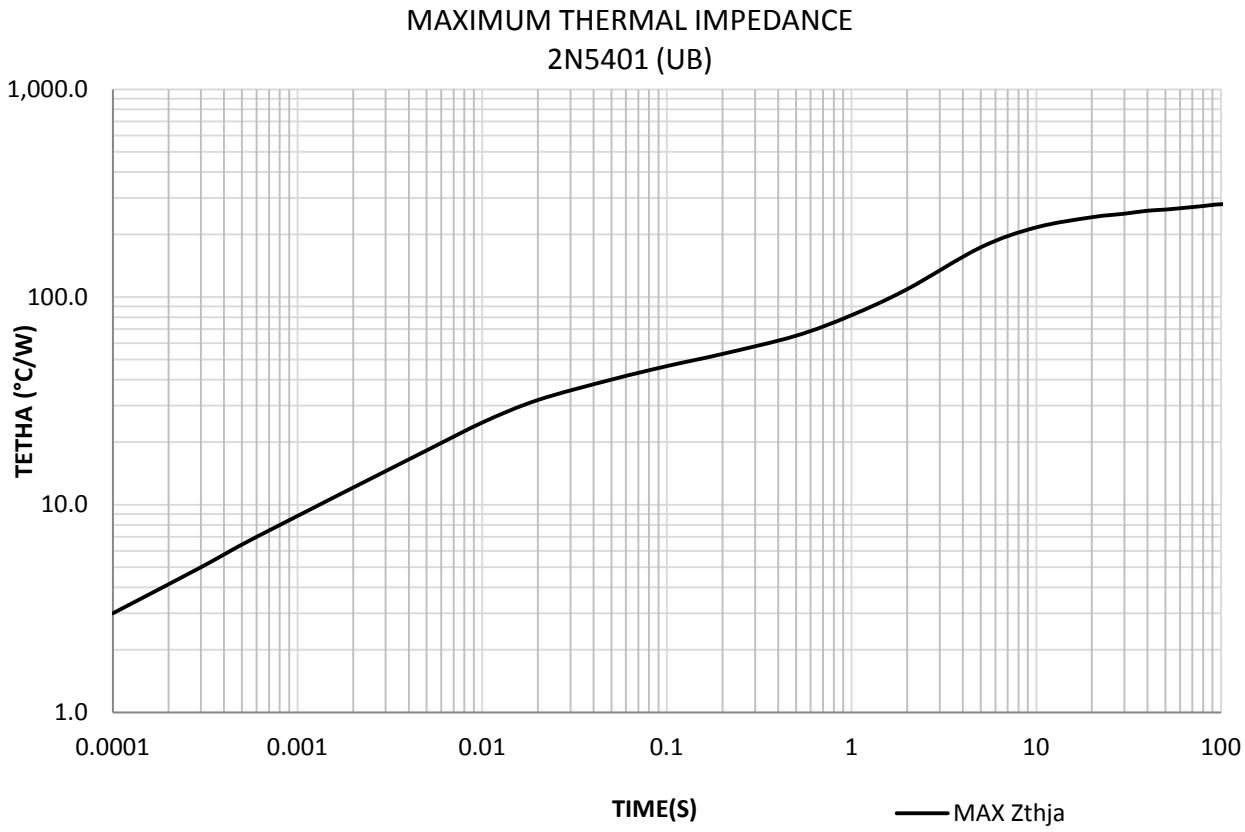


FIGURE 2. Thermal impedance graph ($R_{\theta JA}$) for 2N5401 (UB).

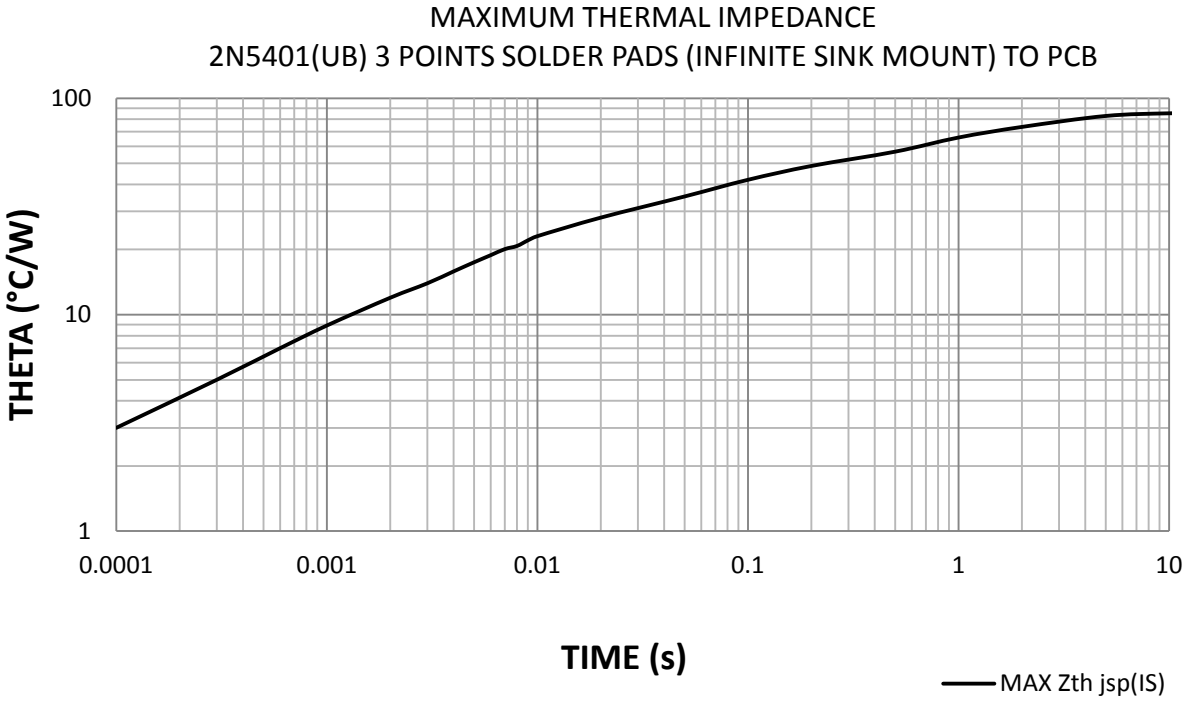


FIGURE 3. Thermal impedance graph ($R_{\theta JSP}$) for 2N5401 (UB).

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).

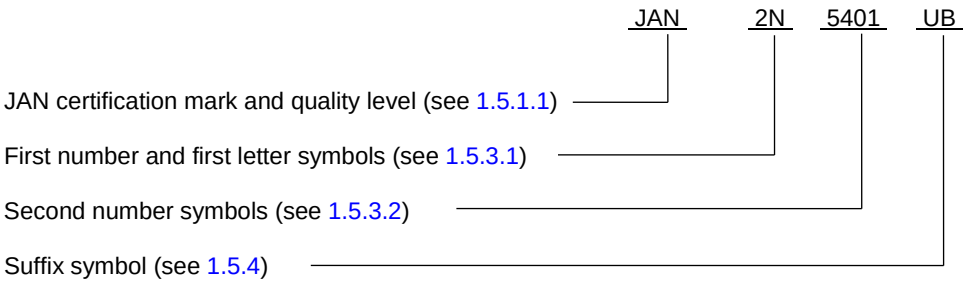
d. The complete PIN, see 1.5, 6.4 and 6.5.

e. For acquisition of RHA designed devices, table II, subgroup 1 testing of group D is optional. If subgroup 1 testing is desired, it must be specified in the contract.

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 PIN construction example.

* 6.4.1 Encapsulated devices. The PINs for encapsulated devices are constructed using the following form.



* 6.5 List of PINs.

6.5.1 PINs for encapsulated devices. The following is a list of possible PINs for encapsulated devices available on this specification sheet.

PINs for type 2N5401			
JAN2N5401UB	JANTX2N5401UB	JANTXV2N5401UB	JANS#2N5401UB

* (1) The number sign (#) represent one of eight RHA designators available (M, D, P, L, R, F, G, or H). The PIN is also available without a RHA designator.

6.6 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 previous issue.

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

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

Preparing activity:
DLA - CC

(Project 5961-2016-034)

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.