

The documentation and process conversion measures necessary to comply with this document shall be completed by 15 October 2016.

INCH-POUND

MIL-PRF-19500/773A
w/Amendment 2
15 July 2016
SUPERSEDING
MIL-PRF-19500/773A
w/Amendment 1
18 December 2015

PERFORMANCE SPECIFICATION SHEET

TRANSISTOR, DUAL NPN/PNP SILICON, DUAL TRANSISTOR, UNITIZED, NPN/PNP, SILICON, FOR LOW-POWER APPLICATIONS, TYPES M19500/773-01, QUALITY LEVELS JAN, JANTX, JANTXV, JANS, AND JANSR

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 unitized, dual transistors which contain a pair of NPN and PNP transistors in one package. Four levels of product assurance (JAN, JANTX, JANTXV, JANS) are provided for each device type as specified in [MIL-PRF-19500](#).

* 1.1.1 Polarity designation. Voltages and currents of limits and test conditions shown herein apply to the NPN transistor when not labeled. For the PNP transistor, the values are the same, but the polarity designations are the opposite.

1.2 Package outlines. The device outline for this specification sheet is a FLAT-8, in accordance with figure 1. **Error! Reference source not found.**

1.3 Maximum ratings - unless otherwise specified $T_A = +25^\circ\text{C}$.

Types	V_{CBO}	V_{CEO}	V_{EBO}	I_C	I_C	$I_{CM(1)}$	I_B	$I_{BM(1)}$
	<u>V dc</u>	<u>V dc</u>	<u>V dc</u>	<u>mA dc</u>	<u>mA dc</u>	<u>A dc</u>	<u>mA dc</u>	<u>mA dc</u>
NPN	60	60	6	800	800	4	200	400
PNP	-60	-60	-6	-800	-800	-4	-200	-400

Types	P_T $T_A = +25^\circ\text{C}$		P_T $T_C = +25^\circ\text{C}$		$R_{\theta JA}$		$R_{\theta JC}$		T_J and T_{STG}
	One section	Both sections	One section	Both sections	One section	Both sections	One section	Both sections	
	<u>W</u>	<u>W</u>	<u>W</u>	<u>W</u>	<u>°C/W</u>	<u>°C/W</u>	<u>°C/W</u>	<u>°C/W</u>	<u>°C</u>
NPN	0.8		5	7	180	125	35	25	-65 to +200
PNP	0.8	1.4	5		180		35		

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1.3 Maximum ratings - unless otherwise specified $T_A = +25^\circ\text{C}$. - Continued.

NOTES:

- (1) Collector peak current ($t_p < 5\text{ms}$)
- (2) Base peak current ($t_p < 5\text{ms}$).
- (3) See 3.3 for abbreviations.

1.4 Primary electrical characteristics. Unless otherwise specified, $T_A = +25^\circ\text{C}$ (1)

Limits	I_{CBO}	I_{EBO}	$V_{BE(on)}$	$V_{CE(sat)}^{(2)}$		$h_{FE}^{(2)}$	
	$V_{CB}=60\text{V}$	$V_{EB}=6\text{V}$	$V_{CE}=2\text{V}$ $I_C=100\text{mA}$	$I_C=0.8\text{A}$ $I_B=40\text{mA}$	$I_C=2\text{A}$ $I_B=100\text{mA}$	$I_C=100\text{mA}$ $V_{CE}=2\text{V}$	$I_C=1\text{A}$ $V_{CE}=2\text{V}$
	<u>nA</u>	<u>nA</u>	<u>mV</u>	<u>mV</u>	<u>mV</u>		
Min			600			80	160
Max	100	100	720	160 (NPN) 180 (PNP)	380 (NPN) 440 (PNP)		400

	$t_{(on)}$	$t_{(off)}$
	$V_{CC} = 10\text{ V dc}$ $I_C = 0.8\text{ A dc}$ $I_{B(on)} = 80\text{ mA}$	$V_{CC} = 10\text{ V dc}$ $I_C = 0.8\text{ A dc}$ $I_{B(off)} = -80\text{ mA}$
	ns	ns
Max NPN	175	2500
Max PNP	150	1000

- (1) For PNP type, voltage and current are negative
- (2) 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 6.4 for PIN construction example and 6.5 for a list of available PINs.

1.5.1 JAN certification mark and quality level. 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 Radiation hardness assurance (RHA) designator. The RHA levels that are applicable for this specification sheet from lowest to highest are as follows: "M", "D", "P", "L", "R", "F", "G", and "H".

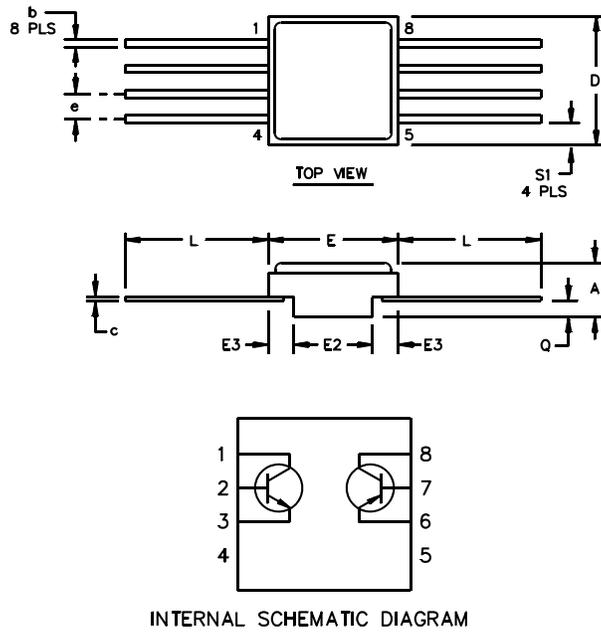
1.5.3 Device type. The designation system for the device types of transistors covered by this specification sheet are as follows.

1.5.3.1 First number. The transistors of this specification sheet use the first number "M19500".

1.5.3.2 Second number. The second number for the transistors covered by this specification sheet are "773".

* 1.5.4 Suffix numbers. The suffix number "01" is used for NPN and PNP devices.

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Ref.	DRAWING inches			DRAWING mm			NOTES
	MIN	TYP	MAX	MIN	TYP	MAX	
A	.088	.096	.104	2.24	2.44	2.64	
b	.015	.017	.019	0.38	0.43	0.48	
c	.004	.005	.006	0.10	0.13	0.16	
D	.250	.255	.260	6.35	6.48	6.61	
E	.250	.255	.260	6.35	6.48	6.61	
E2	.170	.175	.180	4.32	4.45	4.58	
E3	.035	.040	.045	0.88	1.01	1.14	
e		.050			1.27		
L	.256	-	.291	6.51	-	7.38	
Q	.026	.031	.036	0.66	0.79	0.92	
S1	.036	.044	.052	0.92	1.12	1.32	
N	08			08			

NOTES:

1. Dimensions are in inches.
2. Millimeters equivalents are given for general information only.

FIGURE 1. Physical dimensions for device type M19500/773-01 (FLAT-8).

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.

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in [MIL-PRF-19500](#), and on [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](#).

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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 [1.4](#), [1.5](#), and [table I](#).

3.7 Electrical test requirements. The electrical test requirements shall be as specified in [table I](#).

3.8 Workmanship. Dual transistor unitized, NPN/PNP, silicon, low-power 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 [table I](#), [table II](#), and [table III](#)).

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.

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4.3.1 Screening of encapsulated devices (JANS, JANTX, JANTXV levels). Screening of packaged devices 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 (see 4.3.3).	Thermal impedance (see 4.3.3).
9	I_{CBO1} , h_{FE2}	Not applicable
10	48 hours minimum	48 hours minimum
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 4.3.2	See 4.3.2
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 of table I herein.

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

4.3.2 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.

4.3.3 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). See group E, subgroup 4 herein.

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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. End-point electrical measurements shall be in accordance with [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 E-VIB (JANTX & JANTXV) of [MIL-PRF-19500](#), and as follows.

4.4.2.1 Group B inspection (JANS), table E-VIa of [MIL-PRF-19500](#).

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
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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 $T_J = +275^\circ\text{C}$ minimum. Option 2: 216 hours minimum, sample size = 45, $c = 0$; adjust T_A or P_D to achieve a $T_J = +225^\circ\text{C}$ minimum.
B6	3131	$R_{\theta JA}$ only.

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. 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 failures mode has been implemented and the devices from the wafer lot are screened to eliminate the failure mode.

<u>Step</u>	<u>Method</u>	<u>Condition</u>
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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, 48 hours minimum. $n = 45$ devices, $c = 0$.
3	1032	High-temperature life (non-operating), $t = 340$ hours $T_A = +200^\circ\text{C}$. $n = 22$, $c = 0$.

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

- 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. For JANS, samples shall be selected from each inspection lot. See [MIL-PRF-19500](#).
- 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.

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

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

<u>Subgroup</u>	<u>Method</u>	<u>Condition</u>
C2	2036	Test condition E, 3 ounce weight: Three bends of 15 degrees for M19500/773-01 (22 devices, 2 leads each device).
C5	3131	$R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3 and 4.3.2).
C6	1026	1,000 hours at $V_{CB} = 10$ V dc; power shall be applied to achieve $T_J = +150^\circ\text{C}$ 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.

4.4.4 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.

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](#).

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TABLE I. Group A inspection.

Inspection <u>1/ 2/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1 3/</u>						
Visual and mechanical examination <u>4/</u>	2071					
Solderability <u>4/ 5/</u>	2026	n = 15 leads, c = 0				
Resistance to solvents <u>4/ 5/ 6/</u>	1022	n = 15 devices, c = 0				
Temp cycling <u>4/ 5/</u>	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal <u>5/</u> Fine leak Gross leak	1071	n = 22 devices, c = 0				
Electrical measurements <u>5/</u>		Table I , subgroup 2				
Bond strength <u>4/ 5/</u>	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) <u>5/</u>	2075	n = 4 devices, c = 0				
<u>Subgroup 2</u>						
Thermal impedance <u>7/</u>	3131	See 4.3.3	Z _{θJX}			°C/W
Collector to base cutoff current	3036	Bias condition D, V _{CB} = 60V dc pulsed (see 4.5.1).	I _{CB01}		100	nA dc
Emitter to base cutoff current	3061	Bias condition D, V _{EB} = 6 V dc pulsed (see 4.5.1).	I _{EBO}		100	nA dc
Breakdown voltage, collector-base	3001	Bias condition D; I _C = 100 μA dc; pulsed (see 4.5.1)	V _{(BR)CBO}	60		V dc
Breakdown voltage, collector-emitter	3011	Bias condition D; I _C = 1 mA dc; pulsed (see 4.5.1)	V _{(BR)CEO}	60		V dc

See footnotes at end of table.

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TABLE I. Group A inspection - Continued.

Inspection <u>1/ 2/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - Continued						
Breakdown voltage emitter-base	3026	Bias condition D, $I_C = 10 \mu\text{A}$ dc, pulsed (see 4.5.1)	$V_{(BR)EBO}$	6		V dc
Collector-emitter saturated voltage	3071	$I_C = 0.8 \text{ A}$ dc, $I_B = 40 \text{ mA}$ dc, pulsed (see 4.5.1)	$V_{CE(sat)1}$			
NPN					160	mV dc
PNP					180	mV dc
Collector-emitter saturated voltage	3071	$I_C = 2 \text{ A}$ dc, $I_B = 100 \text{ mA}$ dc, pulsed (see 4.5.1)	$V_{CE(sat)2}$			
NPN					380	mV dc
PNP					440	mV dc
Base-emitter voltage (non saturated)	3066	Condition B, $V_{CE} = 2\text{V}$; $I_C = 100 \text{ mA}$ dc; pulsed (see 4.5.1)	$V_{BE(ON)}$	600	720	mV dc
Forward-current transfer ratio	3076	$V_{CE} = 2 \text{ V}$ dc, $I_C = 100 \text{ mA}$ dc, pulsed (see 4.5.1)	h_{FE1}	100		
Forward-current transfer ratio	3076	$V_{CE} = 2 \text{ V}$ dc, $I_C = 1 \text{ A}$ dc, pulsed (see 4.5.1)	h_{FE2}	160	400	
<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_{CBO2}		10	μA dc
Low temperature operation		$T_A = -55^\circ\text{C}$				
Forward-current transfer ratio	3076	$V_{CE} = 2 \text{ V}$ dc, $I_C = 100 \text{ mA}$ dc, pulsed (see 4.5.1)	h_{FE1}	40		

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>						
Open circuit output capacitance	3236	$V_{CB} = 10 \text{ V dc}$, $I_E = 0$, $f = 1 \text{ MHz}$	C_{obo}			
* NPN					45	pF
PNP					60	pF
Saturated turn-on time		$I_c=0.8\text{A}$, $V_{CC}=10\text{V}$, $V_{BE(off)}=-5\text{V}$, $I_{B(on)}=-I_{B(off)}= 80\text{mA}$ (see figure 4)	t_{on} (NPN)		175	ns
Saturated turn off time			t_{off} (NPN)		2,500	ns
Saturated turn-on time		$I_c= 0.8 \text{ A}$, $V_{CC}=10\text{V}$, $V_{BE(off)}=-5\text{V}$, $I_{B(on)}=-I_{B(off)}= 80 \text{ mA}$ (see figure 5)	t_{on} (PNP)		150	ns
Saturated turn off time			t_{off} (PNP)		1,000	ns
<u>Subgroups 5, 6, and 7</u>						
Not applicable						

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

2/ For PNP transistor voltage and current are negative.

3/ 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.

4/ Separate samples may be used.

5/ Not required for JANS devices.

6/ Not required for laser marked devices.

7/ This test required for the following end-point measurements only:

Group B, subgroups 3, 4 and 5 (JANS).

Group B, step 1(JAN, JANTX, JANTXV).

Group C, subgroups 2 and 6.

Group E, subgroup 1.

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

Inspection <u>1/ 2/ 3/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1 4/</u>						
Neutron irradiation	1017	Neutron exposure $V_{CES} = 0$ V				
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 60$ V dc; pulsed (see 4.5.1)	I_{CBO}		200	nA dc
Emitter to base cutoff current	3061	Bias condition D; $V_{EB} = 6.0$ V dc; pulsed (see 4.5.1)	I_{EBO}		200	nA dc
Breakdown voltage, collector - base	3001	Bias condition D; $I_C = 100$ μ A dc	$V_{(BR)CBO}$	60		V dc
Breakdown voltage, collector - emitter	3011	Bias condition D; $I_C = 1$ mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	60		V dc
Breakdown voltage Emitter-base	3026	Bias condition D, $I_C = 10$ μ A dc, pulsed (see 4.5.1)	$V_{(BR)EBO}$	6		V dc
Collector – emitter saturated voltage	3071	$I_C = 0.8$ A dc; $I_B = 40$ mA dc; pulsed (see 4.5.1)	$V_{CE(sat)1}$			
NPN					184	mV dc
PNP					207	mV dc
Collector – emitter saturated voltage	3071	$I_C = 2$ A dc; $I_B = 100$ mA dc; pulsed (see 4.5.1)	$V_{CE(sat)2}$			
NPN					437	mV dc
PNP					506	mV dc
Base-emitter voltage (non saturated)	3066	Condition B, $V_{CE} = 2$ V; $I_C = 100$ mA dc; pulsed (see 4.5.1)	$V_{BE(ON)}$	600	828	mV dc
Forward-current transfer ratio	3076	$V_{CE} = 2$ V dc, $I_C = 100$ mA dc, pulsed (see 4.5.1)	$[h_{FE1}]$ <u>5/</u>	[50]		
Forward-current transfer ratio	3076	$V_{CE} = 2$ V dc, $I_C = 1$ A dc, pulsed (see 4.5.1)	$[h_{FE2}]$ <u>5/</u>	[80]	400	

See footnotes at end of table.

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

Inspection <u>1/</u> <u>2/</u> <u>3/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u>						
Steady-state total dose irradiation	1019	Gamma exposure $V_{CES} = 48\text{ V}$				
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 60\text{ V dc}$; pulsed (see 4.5.1)	I_{CBO}		200	nA dc
Emitter to base cutoff current	3061	Bias condition D; $V_{EB} = 6.0\text{ V dc}$; pulsed (see 4.5.1)	I_{EBO}		200	nA dc
Breakdown voltage, collector - base	3001	Bias condition D; $I_C = 100\text{ }\mu\text{A dc}$	$V_{(BR)CBO}$	60		V dc
Breakdown voltage, collector – emitter	3011	Bias condition D; $I_C = 1\text{ mA dc}$; pulsed (see 4.5.1)	$V_{(BR)CEO}$	60		V dc
Breakdown voltage Emitter base	3026	Bias condition D, $I_C = 10\text{ }\mu\text{A dc}$, Pulsed (see 4.5.1)	$V_{(bre)EBO}$	6		V dc
Collector – emitter saturated voltage	3071	$I_C = 0.8\text{ A dc}$; $I_B = 40\text{ mA dc}$; pulsed (see 4.5.1)	$V_{CE(sat)1}$			
NPN					184	mV dc
PNP					207	mV dc
Collector-emitter Saturated voltage	3071	$I_C = 2\text{ A dc}$, $I_B = 100\text{ ma dc}$, Pulsed (see 4.5.1)	$V_{CE(sat)2}$			
NPN					437	mV dc
PNP					506	mV dc
Base-emitter voltage (non saturated)	3066	Condition B, $V_{CE} = 2\text{ V}$; $I_C = 100\text{ mA dc}$; pulsed (see 4.5.1)	$V_{BE(ON)}$	600	828	mV dc
Forward-current transfer ratio	3076	$V_{CE} = 2\text{ V dc}$, $I_C = 100\text{ mA dc}$, pulsed (see 4.5.1)	$[h_{FE1}]$ <u>5/</u>	[50]		
Forward-current transfer ratio	3076	$V_{CE} = 2\text{ V dc}$, $I_C = 1\text{ A dc}$, pulsed (see 4.5.1)	$[h_{FE2}]$ <u>5/</u>	[80]	400	

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.

6/ For PNP transistor voltage and current are negative

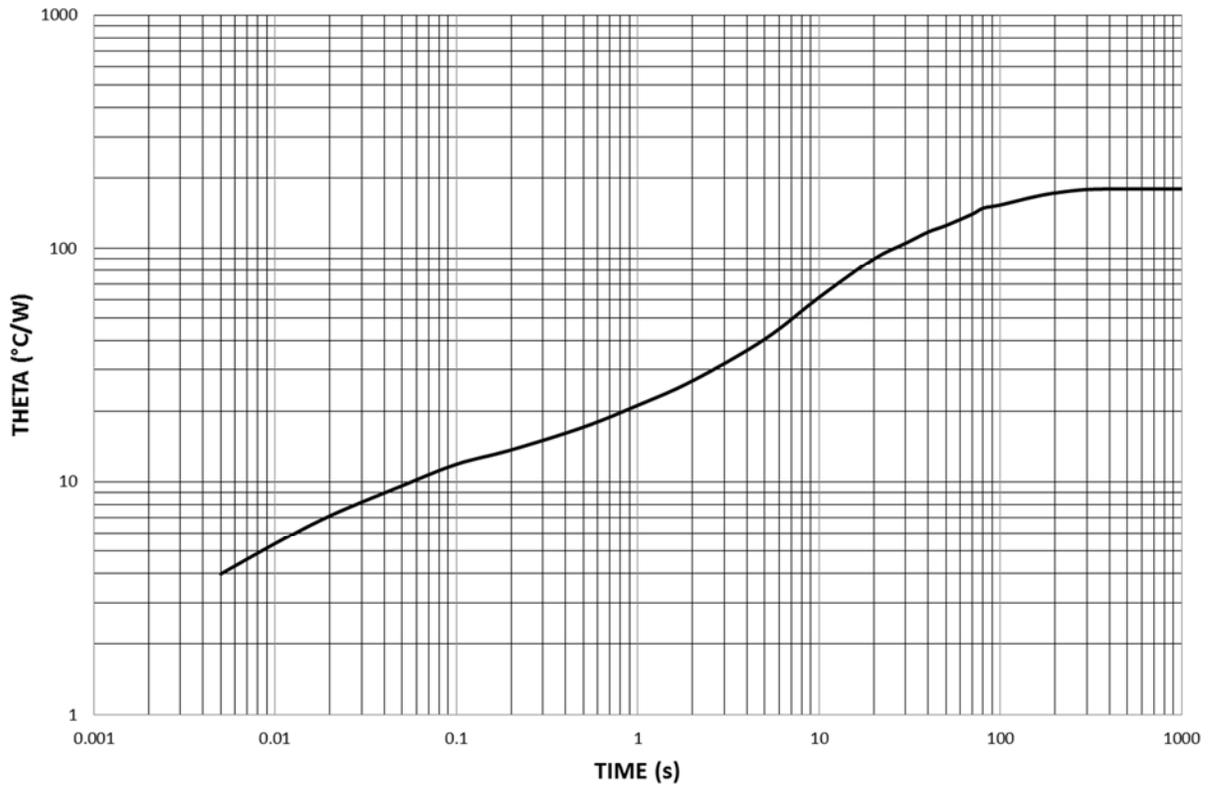
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TABLE III. Group E inspection (all quality levels) - for qualification or re-qualification only.

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
<u>Subgroup 1</u>			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.	
<u>Subgroup 2</u>			45 devices, c = 0
Intermittent life <u>1/</u>	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 table I , subgroup 2 herein.	
<u>Subgroup 4</u>			
Thermal impedance curves.		See MIL-PRF-19500 .	Sample size N/A
<u>Subgroup 5</u>			
Not applicable			
<u>Subgroup 6</u>			11 devices
ESD	1020		
<u>Subgroup 8</u>			45 devices c = 0
Reverse stability	1033	Condition B.	

1/ For PNP voltage and current are negative.

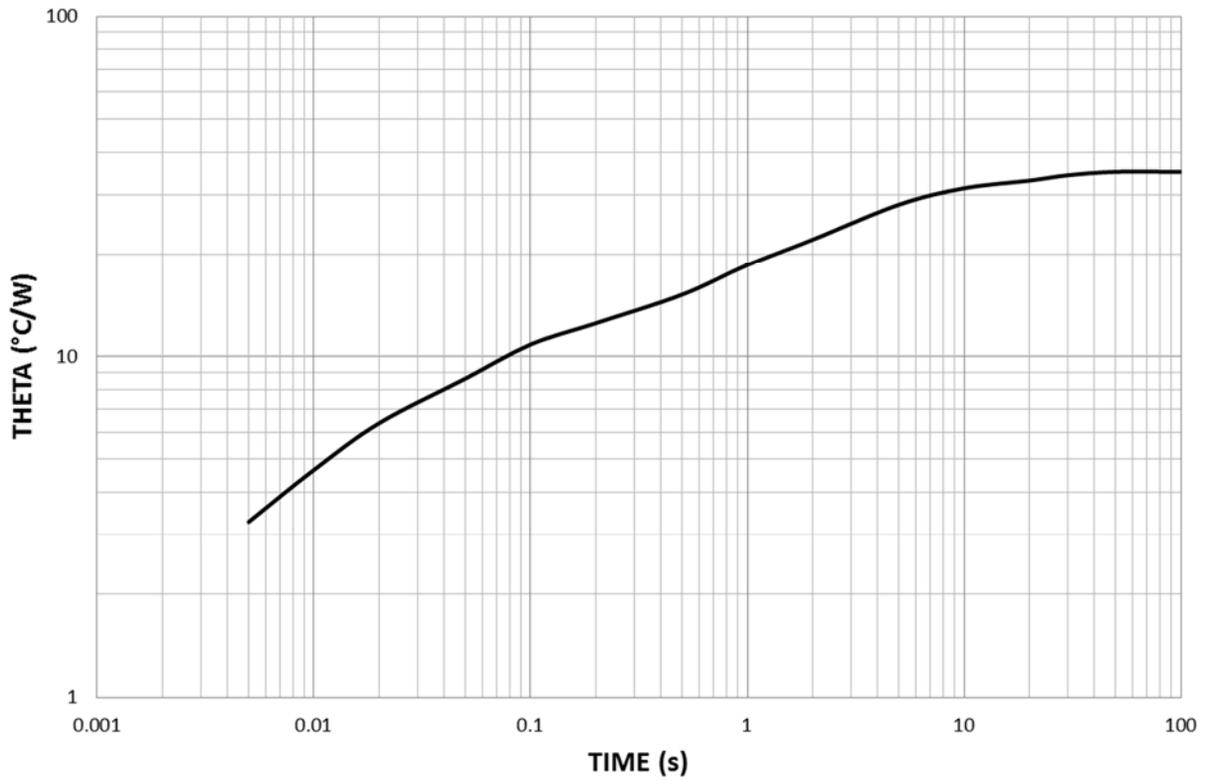
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Thermal impedance M19500/773-01, FP8 package (Socket mount)
Thermal resistance = 180°C/W one side, 125°C/W both sides operating in parallel

FIGURE 2. Thermal impedance graph ($R_{\theta JA}$) for M19500/773-01 (FP8) NPN PNP one section

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Thermal impedance M19500/773-01, FP8 package (Heat sink mount)
Thermal resistance = 35°C/W one side, 25°C/W both sides operating in parallel

FIGURE 3. Thermal impedance graph ($R_{\theta JC}$) for M19500/773-01 (FP8) one section

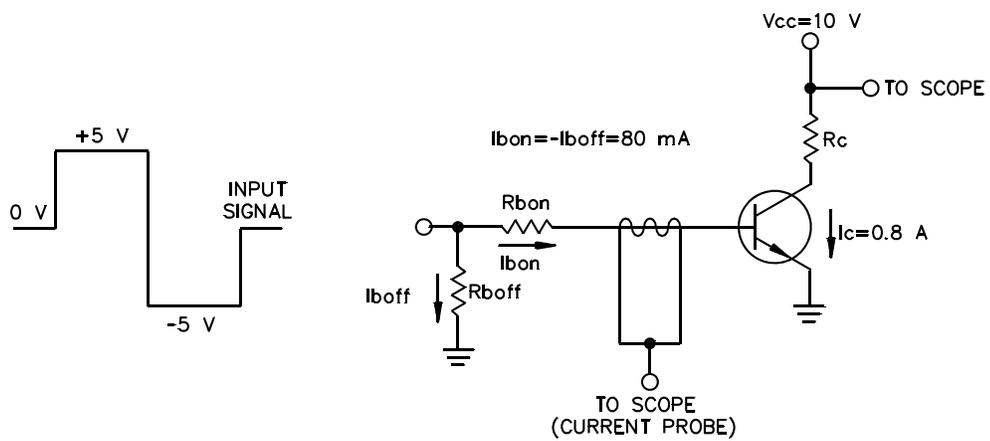
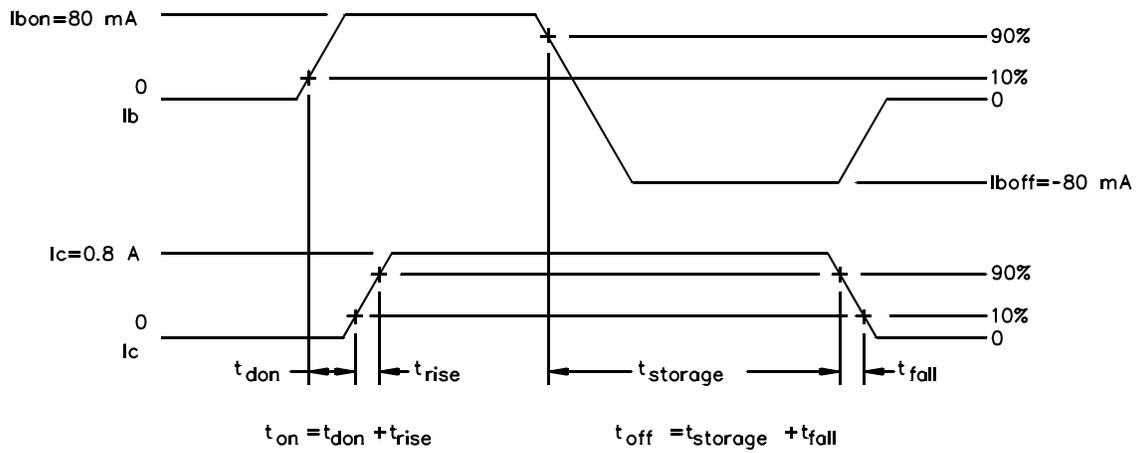
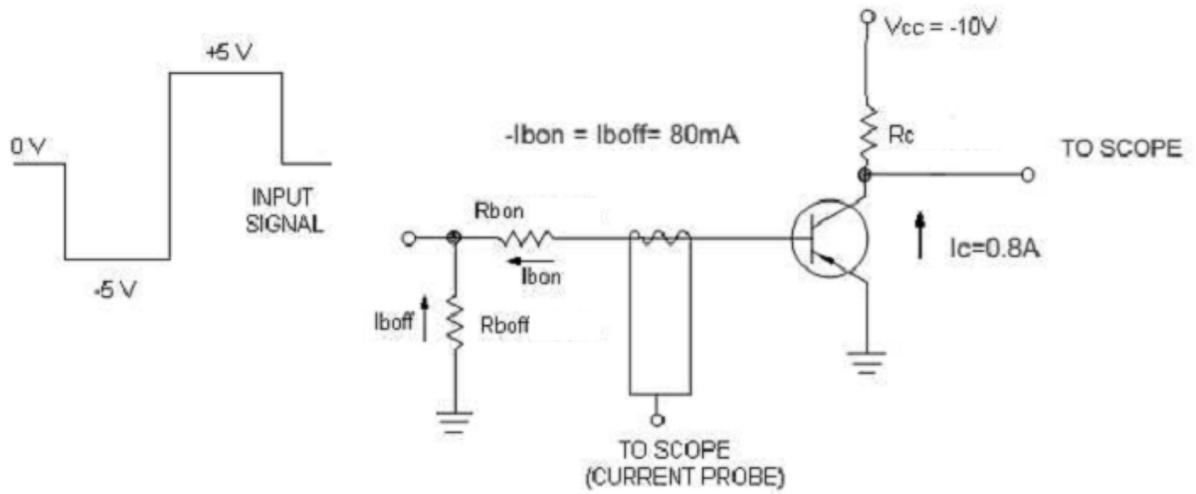
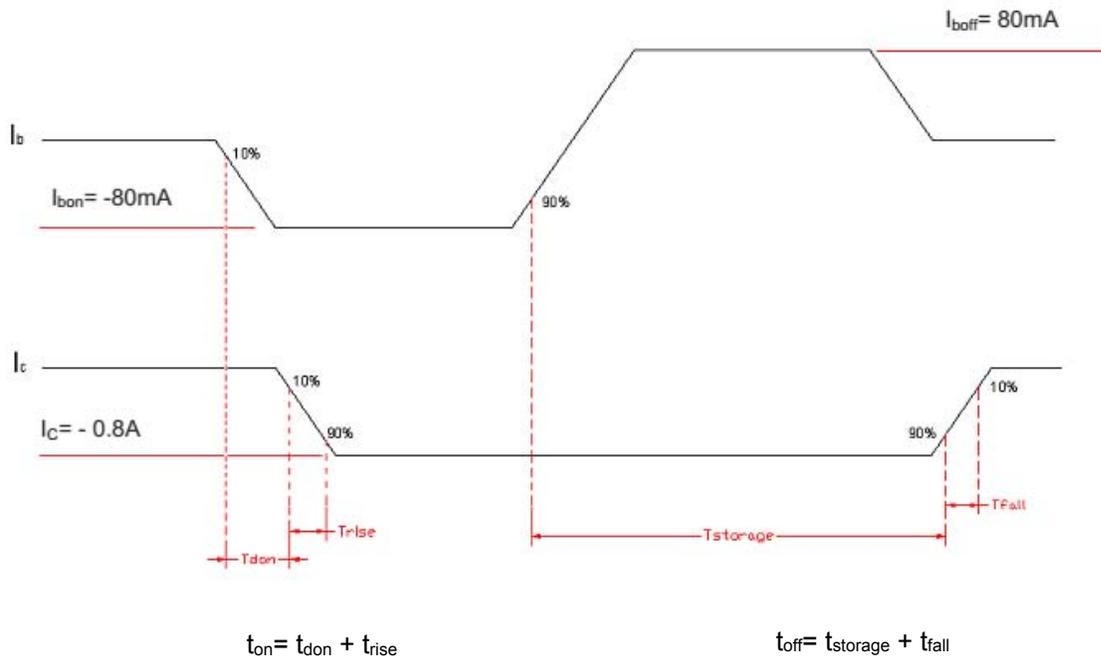


FIGURE 4. Both sides: Saturated turn-on/turn off time test circuit-NPN



* FIGURE 5. Saturated turn-on/turn off time test circuit-PNP

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:

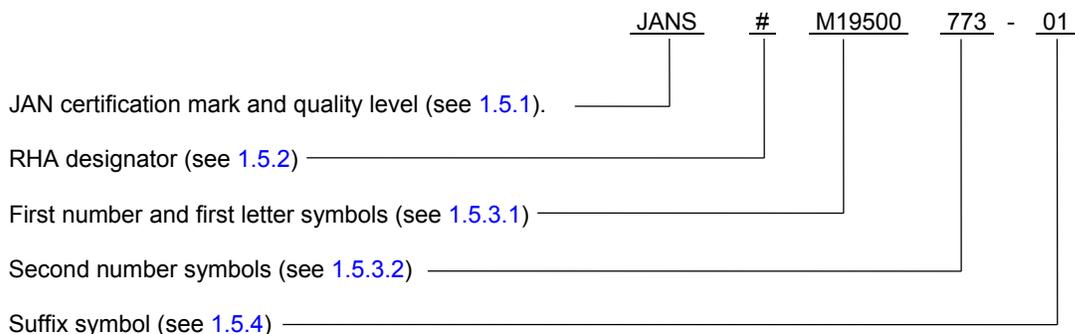
- a. Title, number, and date of this specification.
- b. Packaging requirements (see 5.1).
- c. Lead finish (see 3.4.1).
- d. The complete Part or Identifying Number (PIN), see 6.4.1.
- e. For acquisition of RHA designed devices, table II, subgroup 1 testing of group D is optional. If subgroup 1 testing 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>.

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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. The following is a list of possible PINs available on this specification sheet.

PINS for types M19500/773-01
JANM19500/773-01
JANTXM19500/773-01
JANTXVM19500/773-01
JANSM19500/773-01
JANS#M19500/773-01

(1) The number sign (#) represent one of eight RHA designators available (M, D, P, L, R, F, G, or H).

6.6 Request for new types and configurations. Requests for new device types or configurations for inclusions in this specification sheet should be submitted to: DLA Land and Maritime, ATTN: VAC, Post Office Box 3990, Columbus, OH 43218-3990 or by electronic mail at Semiconductor@dla.mil or by facsimile (614) 693-1642 or DSN 850-6939.

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6.7 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
DLA - CC

Preparing activity:
DLA - CC

(Project 5961-2016-071)

Review activities:
Army - AR, MI, SM
Navy - AS, MC
Air Force - 19, 71, 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>.