The documentation and process conversion measures necessary to comply with this document shall be completed by 19 September 2015.

INCH-POUND

MIL-PRF-19500/441L
19 June 2015
SUPERSEDING
MIL-PRF-19500/441K
30 March 2010

PERFORMANCE SPECIFICATION SHEET

* TRANSISTOR, PNP, SILICON, POWER,
ENCAPSULATED (THROUGH HOLE AND SURFACE MOUNT), AND UNENCAPSULATED,
RADIATION HARDNESS ASSURANCE, DEVICE TYPES 2N3740 AND 2N3741
QUALITY LEVELS JAN, JANTX, JANTXV, JANS, JANHC, AND JANKC

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 power PNP silicon 2N3740 and 2N3741 transistors. Four levels of product assurance (JAN, JANTX, JANTXV, and JANS) are provided for each encapsulated device type and two levels of product assurance (JANHC and JANKC) are provided for each unencapsulated device type as specified in MIL–PRF–19500. Provisions for radiation hardness assurance (RHA) to eight radiation levels is provided for quality levels JANTXV, JANS, JANHC, and JANKC. RHA level designators “M”, “D”, “P“, “L”, “R”, “F”, “G”, and “H” are appended to the device prefix to identify devices, which have passed RHA requirements.

* 1.2 Package and die outlines. The device package for the encapsulated device type are as follows: TO-66 in accordance with figure 1 and surface mount in accordance with figure 2. The dimensions and topography for JANHC and JANKC unencapsulated die are in accordance with figure 3.

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

Types	P_T (1)			$R_{\theta JC}$ (2) T0-66 only	$R_{\theta JC}$ (2) U4 only	V_{CBO}	V_{CEO}	V_{EBO}	I_B	I_C	T_{STG} and T_J
	T_C = +25°C	T_A = +25°C	T_C = +100°C								
	W	W	W	°C/W	°C/W	V dc	V dc	V dc	A dc	A dc	°C
2N3740	25	3	14	7	6	-60	-60	-7	-2	-4	-65 to +200
2N3741	25	3	14	7	6	-80	-80	-7	-2	-4	-65 to +200

(1) See figures 4 and 5 for temperature-power derating curves.
(2) See figures 6 and 7, transient thermal impedance graphs.

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°C.

Limits	h_{FE2} (1) V_{CE} = 1 V dc I_C = 250 mA dc	h_{FE4} (1) V_{CE} = 1 V dc I_C = 1 A dc	$\|h_{fe}\|$ V_{CE} = 10 V dc I_C = 100 mA dc f = 5 MHz	$V_{CE(sat)}$[2] (1) I_C = 1.0 A dc I_B = 125 mA dc	C_{obo} V_{CB} = 10 V dc I_E = 0 100 kHz ≤ f ≤ 1 MHz	Pulse response	
						t_{on}	t_{off}
				V dc	pF	ns	µs
Min	30	10	1				
Max	120		12	-0.6	100	400	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 brand and quality level designators.

* 1.5.1.1 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: the base quality level "JAN" that uses no modifiers, "JANTX", "JANTXV", and "JANS".

* 1.5.1.2 Unencapsulated devices (die). The quality level designators for unencapsulated devices (die) that are applicable for this specification sheet from the lowest to the highest level are as follows: "JANHC" and "JANKC".

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

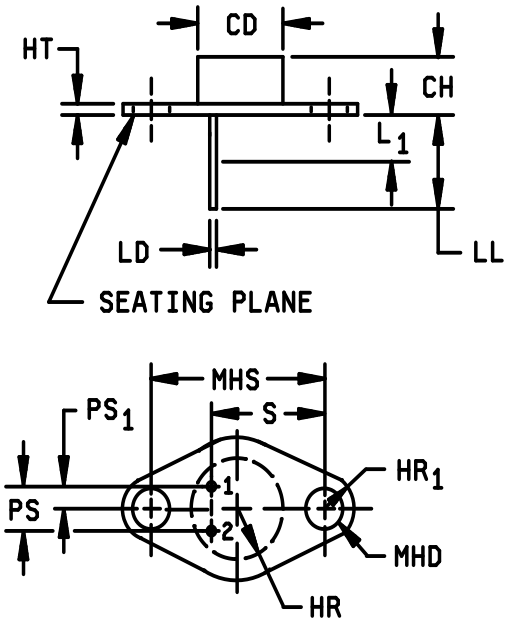
* 1.5.3.2 Second number symbols. The second number symbols for the transistors covered by this specification sheet are as follows: "3740" and "3741".

* 1.5.4 Suffix symbols. The following suffix symbols are incorporated in the PIN as applicable.

* 1.5.4.1 Following suffix symbols. The following suffix symbols are incorporated in the PIN for this specification sheet:

No Suffix	Indicates a through-hole mount package similar to a TO–66 metal can (see figure 1).
U4	Indicates a 3 pad surface mount package (see figure 2).

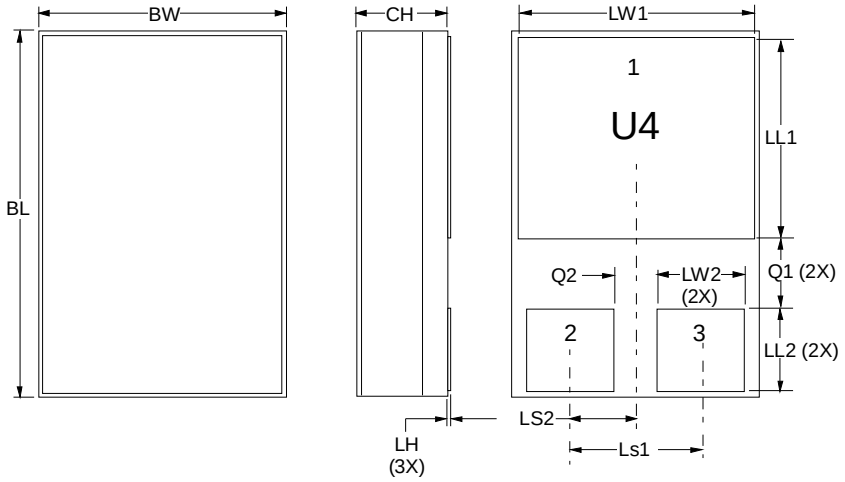
* 1.5.5 Lead finish. The lead finishes applicable to this specification sheet are listed on QPDSIS–19500.



Symbol	Dimensions				Notes	Symbol	Dimensions				Notes
	Inches		Millimeter				Inches		Millimeters		
	Min	Max	Min	Max			Min	Max	Min	Max	
CD		.620		15.75	9	LL	.360	.500	9.14	12.70	4, 8
CH	.250	.340	6.35	8.64		L_1		.050		1.27	4, 8
HT	.050	.075	1.27	1.91		MHD	.142	.152	3.61	3.86	6, 9
HR		.350		8.89		MHS	.958	.962	24.33	24.43	
HR_1	.115	.145	2.92	3.68	5	PS	.190	.210	4.83	5.33	3
LD	.028	.034	0.71	0.86	4, 8, 9	PS_1	.093	.107	2.36	2.72	3
						S	.570	.590	14.48	14.99	3

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. These dimensions should be measured at points .050 to .055 inch (1.27 to 1.40 mm) below seating plane. When gauge is not used, measurement will be made at seating plane.
4. Both terminals.
5. At both ends.
6. Two holes.
7. The collector shall be electrically connected to the case.
8. LD applies between L1 and LL. Lead diameter shall not exceed twice LD within L1.
9. In accordance with ASME Y14.5M, diameters are equivalent to ϕ symbology.
10. Lead 1 is the emitter, lead 2 is the base, collector is the case.

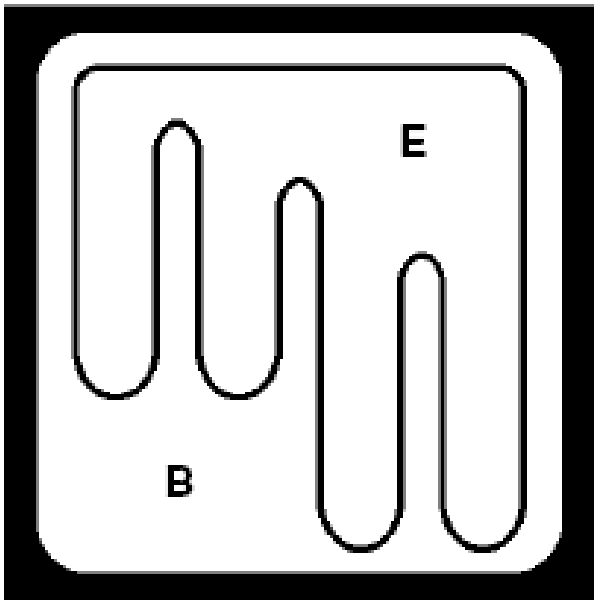
FIGURE 1. Physical dimensions, TO-66 (2N3740, 2N3741).



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
BL	.215	.225	5.46	5.72
BW	.145	.155	3.68	3.94
CH	0.049	0.075	1.24	1.91
LH		.020		0.51
LW1	.135	.145	3.43	3.68
LW2	.047	.057	1.19	1.45
LL1	.085	.125	2.16	3.17
LL2	.045	.075	1.14	1.9
LS1	0.07	.095	1.78	2.41
LS2	0.035	.048	0.890	1.21
Q1	0.03	.070	0.76	1.78
Q2	0.02	0.035	0.51	0.89
TERM 1	Collector			
TERM 2	Base			
TERM 3	Emitter			

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. In accordance with ASME Y14.5M, diameters are equivalent to ϕ symbology.

FIGURE 2. Physical dimensions and configuration (SMD.22) (2N3740U4, 2N3741U4).



C - version

NOTES:

1. Chip size: .070 x .070 inch ±.002 inch (1.78 x 1.78 mm ±.0508 mm).
2. Chip thickness: .014 ±.0015 inch (.356 ±.0381 mm) nominal.
3. Top metal: Aluminum 54,000 Å minimum, 66,000Å nominal.
4. Back metal: Al/Ti/Ni/Au 10,000Å minimum, 12,000Å nominal.
5. Backside: Collector.
6. Bonding pad: B = .028 x .016 inch (.711 x .406 mm), E = .028 x .016 inch (.711 x .406 mm).
7. Previous A and B versions of JANC die are obsolete.

FIGURE 3. Physical dimensions, JANHCC and JANKCC die.

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 (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 and physical dimensions shall be as specified in MIL–PRF–19500, and herein. The device package styles shall be as follows: TO-66, in accordance with figure 1, three pad surface mount case outline in accordance with figure 2, and unencapsulated die in accordance with figure 3 for device types JANHC and JANKC.

* 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).

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

* 3.6 Radiation hardness assurance (RHA). Radiation hardness assurance requirements and test levels shall be as defined in MIL–PRF–19500.

* 3.7 Marking.

* 3.7.1 Through hole mount packages. Marking shall be in accordance with MIL–PRF–19500.

* 3.7.2 Surface mount packages. Marking shall be in accordance with MIL–PRF–19500. The marking of the U4 package shall consists of an abbreviated part number, the date code, and the manufacturer's symbol or logo. The prefixes JAN, JANTX, JANTXV and JANS can be abbreviated as J, JX, JV and JS respectively. The "2N" prefix and the "U4" suffix can also be omitted. The radiation hardness designator shall immediately precede (or replace) the device "2N" identifier (depending upon degree of abbreviation required).

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 table I, II, and III).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL–PRF–19500 and as specified herein.

* 4.2.1 JANHC and JANKC devices. JANHC and JANKC devices are qualified in accordance with MIL–PRF–19500.

4.2.2 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 IV tests, the tests specified in table IV 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.

4.3.1 Screening of encapsulated devices (quality levels JANTX, JANTXV and JANS only). Screening of encapsulated 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 level	JANTX and JANTXV levels
(1) 3c	Thermal impedance, method 3131 of MIL–STD–750, see 4.3.1.2.	Thermal impedance, method 3131 of MIL–STD–750, see 4.3.1.2.
9	I_{CEX1} and h_{FE2}	Not applicable.
10	48 hours minimum.	48 hours minimum.
11	I_{CEX1} and h_{FE2}; ΔI_{CEX1} = 100 percent of initial value or 50 nA dc, whichever is greater, Δh_{FE2} = ± 25 percent of initial value.	I_{CEX1} and h_{FE2}
12	See 4.3.1.1	See 4.3.1.1
13	Subgroups 2 and 3 of table I herein; ΔI_{CEX1} = 100 percent of initial value or 50 nA dc; whichever is greater; Δh_{FE2} = ±25 percent of initial value.	Subgroup 2 of table I herein; ΔI_{CEX1} = 100 percent of initial value or 50 nA dc, whichever is greater; Δh_{FE2} = ±25 percent of initial value.

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

4.3.1.1 Power burn-in conditions. Power burn-in conditions are as follows: V_{CB} = -10 to -30 V dc. Power shall be applied to the device to achieve a junction temperature, T_J = +175 °C minimum and a minimum P_D = 75 percent of P_T maximum rated as defined in 1.3.

* 4.3.1.2 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}, (and V_H where appropriate). See table IV, group E, subgroup 4 herein.

* 4.3.2 Screening of unencapsulated die (JANHC and JANKC). Screening of JANHC and JANKC unencapsulated die shall be in accordance with appendix G of MIL–PRF–19500. The Burn-in duration for the JANKC level shall follow the JANS requirements; the JANHC level shall follow the JANTX requirements of MIL–PRF–19500.

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. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing of MIL–PRF–19500, and 4.4.2.1 (JANS), and 4.4.2.2 (JAN, JANTX, and JANTXV). Delta requirements shall be in accordance with table II herein.

* 4.4.2.1 Quality level JANS, table E-VIA of MIL–PRF–19500.

Subgroup	Method	Conditions
B4	1037	V_{CB} = -10 V dc, 2,000 cycles, t_{ON} = t_{OFF} = 3 minutes, $P_{D(ON)}$ = P_D max rated in accordance with 1.3; $P_{D(OFF)}$ = 0.
B5	1027	(NOTE: If a failure occurs, resubmission shall be at the test conditions of the original sample.) V_{CB} = -10 V dc, $P_D \geq$ 100 percent of maximum rated P_T (see 1.3). Option 1: 96 hours minimum sample size in accordance with table VIa of MIL–PRF–19500, 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 T_J = +225°C minimum.

* 4.4.2.2 Quality level JAN, JANTX and JANTXV, table E-VIB of MIL–PRF–19500. Separate samples may be used for each step. Delta requirements for JAN, JANTX, and JANTXV shall be after each step and shall be in accordance with table II herein.

Step	Method	Condition
1	1037	6,000 cycles, t_{ON} = t_{OFF} = 3 minutes, $P_{D(ON)}$ = P_D max rated per 1.3; $P_{D(OFF)}$ = 0. n = 45, c = 0.
2	1048	Blocking life: T_A = +150°C, V_{CB} = 80 percent of rated voltage, 48 hours min. n = 45, 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. For JANS, samples shall be selected from each inspection lot. See MIL–PRF–19500.

b. Shall be chosen from an inspection lot that has been submitted to and passed table I, subgroup 2, conformance inspection. When the final lead finish is solder or any plating prone to oxidation at high temperature, the samples for life test (subgroups B4 and B5 for JANS, and group B for JAN, JANTX, and JANTXV) may be pulled prior to the application of final lead finish.

* 4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VII of MIL–PRF–19500, and 4.4.3.1 (JANS), and 4.4.3.2 (JAN, JANTX, and JANTXV) herein for group C testing. Delta requirements shall be in accordance with table II herein.

* 4.4.3.1 -Quality level JANS, table E-VII of MIL-PRF-19500.

Subgroup	Method	Conditions
C2	2036	Test condition A, weight = 3 lbs, t = 15 s, not applicable to 2N3740U4 and 2N3741U4.
C5	3131	Thermal resistance; see 4.3.1.2, $R_{\theta JC}$ = 7°C/W for 2N3740, 2N3741; $R_{\theta JC}$ = 6°C/W for 2N3740U4, 2N3741U4.
C6	1037	6,000 cycles, $t_{ON} = t_{OFF}$ = 3 minutes, $P_{D(ON)} = P_D$ max rated in accordance with 1.3; $P_{D(OFF)} = 0$.

* 4.4.3.2 Quality levels JAN, JANTX, and JANTXV, table E-VII of MIL-PRF-19500.

Subgroup	Method	Conditions
C2	2036	Test condition A, weight = 3 lbs, t = 15 s, not applicable to 2N3740U4 and 2N3741U4.
C5	3131	Thermal resistance; see 4.3.1.2, $R_{\theta JC}$ = 7°C/W for 2N3740, 2N3741; $R_{\theta JC}$ = 6°C/W for 2N3740U4, 2N3741U4.
C6		Not applicable.

4.4.3.3 Group C inspection sample selection. Samples for subgroups in group C 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 table I tests for conformance inspection. 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 JANKC types shall include the group D tests specified in table III 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 herein), except group D, subgroup 2 may be performed separate from other subgroups. Group D inspection may also be performed ahead of the screening lot using die selected in accordance with MIL–PRF–19500 and related documents. 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 herein. Delta requirements shall be in accordance with table II herein.

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

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

4.5.2 Inspection conditions. Unless otherwise specified, all inspections shall be conducted at a case temperature of +25°C ±3°C.

TABLE I. Group A inspection.

Inspection 1/	MIL–STD–750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical 3/ examination	2071					
Solderability 3 / 4/	2026	n = 15 leads, c = 0				
Resistance to 3/ 4/ 5/ solvent	1022	n = 15 devices, c = 0				
Temp cycling 3/ 4/	1051	Test condition C, 25 cycles, n = 22 devices, c = 0				
Hermetic seal 4/	1071	n = 22 devices, c = 0				
Fine leak						
Gross leak						
Electrical measurements 4/		Table I, subgroup 2 herein				
Bond strength 3/ 4/	2037	Pre-condition T_A = +250°C at t = 24 hrs or T_A = +300°C at t = 2 hrs, n = 11 wires, c = 0				
Subgroup 2						
Thermal impedance 6/	3131	See 4.3.3	$Z_{\theta JX}$			°C/W
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = -100 mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$			
2N3740				-60		V dc
2N3741				-80		V dc
Collector to emitter cutoff current	3041	Bias condition D	I_{CEO}		-10	µA dc
2N3740		V_{CE} = -40 V dc				
2N3741		V_{CE} = -60 V dc				
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = -7 V dc	I_{EBO}		-100	nA dc
Collector to emitter cutoff current	3041	Bias condition A; V_{BE} = -1.5 V dc	I_{CEX1}		-300	nA dc
2N3740		V_{CE} = -60 V dc				
2N3741		V_{CE} = -80 V dc				
Collector to base cutoff current	3036	Bias condition D	I_{CBO}		-100	nA dc
2N3740		V_{CE} = -60 V dc				
2N374		V_{CE} = -80 V dc				

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL–STD–750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 2 -Continued.						
Base emitter voltage (non-saturated)	3066	Test condition B; V_{CE} = -1 V dc; I_C = -250 mA dc pulsed (see 4.5.1)	V_{BE}		-1	V dc
Saturation voltage and resistance	3071	I_C = -250 mA dc; I_B = -25 mA dc pulsed (see 4.5.1)	$V_{CE(sat)1}$		-0.4	V dc
Saturation voltage and resistance	3071	I_C = -1 A dc; I_B = -125 mA dc pulsed (see 4.5.1)	$V_{CE(sat)2}$		-0.6	V dc
Forward-current transfer ratio	3076	V_{CE} = -1 V dc; pulsed (see 4.5.1)				
		I_C = -100 mA dc I_C = -250 mA dc I_C = -500 mA dc I_C = -1 A dc	h_{FE1} h_{FE2} h_{FE3} h_{FE4}	40 30 20 10	120	
Forward-current transfer ratio	3076	V_{CE} = -5 V dc; I_C = -4 A dc pulsed (see 4.5.1)	h_{FE5}	3		
Subgroup 3						
High temperature operation:		T_A = +150°C				
Collector to emitter cutoff current 2N3740 2N3741	3041	Bias condition A, V_{BE} = -1.5 V dc V_{CE} = -60 V dc V_{CE} = -80 V dc	I_{CEX2}		-25	µA dc
Low temperature operation:		T_A = -55°C				
Forward-current transfer ratio	3076	V_{CE} = -1 V dc; I_C = -250 mA dc pulsed (see 4.5.1)	h_{FE6}	10		
Subgroup 4						
Small-signal short-circuit forward-current transfer ratio	3206	V_{CE} = -10 V dc; I_C = -50 mA dc; f = 1 kHz	h_{fe}	25	250	
Small-signal short-circuit forward-current transfer ratio	3306	V_{CE} = -10 V dc; I_C = -100 mA dc; f = 5 MHz	$\lvert h_{fe} \rvert$	1	12	
Open circuit output capacitance	3236	V_{CB} = -10 V dc; I_E = 0; 100 KHz ≤ f ≤ 1 MHz	C_{obo}		100	pF

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL–STD–750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 4 - Continued.						
Pulse response Turn-on time		I_C = -1 A dc; I_{B1} = -0.1 A dc (see figure 8)	t_{on}		400	ns
Turn-off time		I_C = -1 A dc; I_{B1} = I_{B2} = -0.1 A dc (see figure 8)	t_{off}		1	µs
Subgroup 5						
SOA (continuous dc)	3051	T_C = +25°C; power application time = 1 s; 1 cycle (see figure 9)				
Test 1		V_{CE} = -6.25 V dc; I_C = -4 A dc				
Test 2		V_{CE} = -20 V dc; I_C = -1.25 A dc				
Test 3		I_C = -150 mA dc				
2N3740 2N3741		V_{CE} = -50 V dc V_{CE} = -65 V dc				
SOA (clamped switching)		T_A = +25°C; V_{CC} = -15 V dc; duty cycle ≤ 5 percent, t_p = 1.5 ms (vary to obtain I_C), I_C = -4 A dc (see figures 10 and 11)				
2N3740 2N3741		Clamp voltage = -60 V dc Clamp voltage = -80 V dc				
End-point electrical measurements		See table I, subgroup 2 herein				
SOA (switching)	3053	Load condition C (unclamped inductive) (see figure 12); T_A = +25°C; duty cycle ≤ 5 percent, R_S = 0.1 Ω; t_r = t_f ≤ 500 ns; R_{BB1} = 50 Ω; V_{BB1} = 10 V dc; R_{BB2} = ∞; V_{BB2} = 0; V_{CC} ≥ -20 V dc				
Test 1		t_p = 375 µs (vary to obtain I_C); I_C = -1 A dc; L = 5 mH (min) at 1 A with maximum dc resistance of 0.5 Ω. For reference only: 2 ESSEX Stancor C-2688 (in parallel), or equivalent				

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL–STD–750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 5 - Continued.						
Test 2		t_p = 1.5 ms (vary to obtain I_C); I_C = -.25 A dc; L = 80 mH (min) at .25 A with a maximum dc resistance of 1 Ω. For reference only. ESSEX Stancor C-2691 or Triad C = 48				
SOA (clamped switching) (destructive)		T_A = +25°C; V_{CC} = -55 V dc (see figures 10 and 11); duty cycle ≤ 5 percent, t_p = 1.5 ms (vary to obtain I_C); I_C = -4 A dc				
2N3740		Clamp voltage = -60 V dc				
2N3741		Clamp voltage = -80 V dc				
End-point electrical measurements		See table I, subgroup 2 herein				
Subgroups 6 and 7						
Not applicable						

1/ For sampling plan, see MIL–PRF–19500.
2/ For resubmission of failed subgroup 1, double the sample size of the failed test or sequence of tests.
3/ Separate samples may be used.
4/ Not required for JANS.
5/ Not required for laser marked devices.
6/ This test required for the following end-point measurements only:
Group B, subgroups 3, 4, and 5 (JANS).
Group B, see 4.4.2.2 herein, after each step (JAN, JANTX, and JANTXV).
Group C, subgroup 2 and 6 for JANS and subgroup 2 only for JAN, JANTX, and JANTXV.
Group E, subgroup 1.

TABLE II. Group B, C, and E delta measurements. 1/ 2/ 3/ 4/

Step	Inspection	MIL–STD–750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Collector to emitter cutoff current 2N3740 2N3741	3041	Bias condition A; V_{BE} = -1.5 V dc V_{CE} = -60 V dc V_{CE} = -80 V dc	ΔI_{CEX1}			100 percent of initial value or 50 nA dc, whichever is greater.
2.	Forward-current transfer ratio	3076	V_{CE} = -1 V dc; I_C = -250 mA dc; pulsed (see 4.5.1)	Δh_{FE2}			±25 percent change from initial reading.
3.	Saturation voltage and resistance	3071	I_C = -250 mA dc; I_B = -25 mA dc; pulsed (see 4.5.1)	$\Delta V_{CE(sat)1}$			50 mV dc change from initial value.

1/ The delta measurements for table E-VIA (JANS) of MIL–PRF–19500 are as follows:
   a. Subgroup 4, see table II, step 3.
   b. Subgroup 5, see table II, steps 1, 2, and 3.

2/ The delta measurements for 4.4.2.2, group B (JAN, JANTX, and JANTXV) of MIL–PRF–19500 are after each step in 4.4.2.2, see table II, steps 1, 2, and 3.

3/ The delta measurements for table E-VII of MIL–PRF–19500 are as follows: Subgroup 6, see table II, steps 1 and 2 (JANS only).

4/ The delta measurements for table E-IX (all quality levels) of MIL–PRF–19500 are as follows: Subgroup 1, see table II, step 2; subgroup 2, see table II, steps 1 and 2.

TABLE III. Group D inspection.

Inspection 1/ 2/ 3/	MIL–STD–750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1 4/						
Neutron irradiation	1017	Neutron exposure Vces = 0 V				
Breakdown voltage, collector to emitter 2N3740 2N374	3011	Bias condition D; I_C = -100 mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	 -60 -80		 V dc V dc
Collector to emitter cutoff current 2N3740 2N3741	3041	Bias condition D V_{CE} = -40 V dc V_{CE} = -60 V dc	I_{CEO}		-20	µA dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = -7 V dc	I_{EBO}		-200	nA dc
Collector to emitter cutoff current 2N3740 2N3741	3041	Bias condition A; V_{BE} = -1.5 V dc V_{CE} = -60 V dc V_{CE} = -80 V dc	I_{CEX1}		-600	nA dc
Collector to base cutoff current	3036	Bias condition D	I_{CBO}		-200	nA dc
.Base emitter voltage (nonsaturated)	3066	Test condition B; V_{CE} = -1 V dc; I_C = -250 mA dc pulsed (see 4.5.1)	V_{BE}		-2	V dc
Saturation voltage and resistance	3071	I_C = -250 mA dc; I_B = -25 mA dc pulsed (see 4.5.1)	$V_{CE(sat)1}$		-0.46	V dc
Saturation voltage and resistance	3071	I_C = -1 A dc; I_B = -125 mA dc pulsed (see 4.5.1)	$V_{CE(sat)2}$		-0.69	V dc
Forward-current transfer ratio	3076	V_{CE} = -1 V dc; pulsed (see 4.5.1)				
		I_C = -100 mA dc I_C = -250 mA dc I_C = -500 mA dc I_C = -1 A dc	[h_{FE1}] 5/ [h_{FE2}] 5/ [h_{FE3}] 5/ [h_{FE4}] 5/	[20] [15] [10] [5]	120	
Forward-current transfer ratio 2N3740 2N3741	3076	V_{CE} = -5 V dc; I_C = -4 A dc pulsed (see 4.5.1) V_{CE} = -60 V dc V_{CE} = -80 V dc	[h_{FE5}] 5/	[1.5]		

See footnotes at end of table.

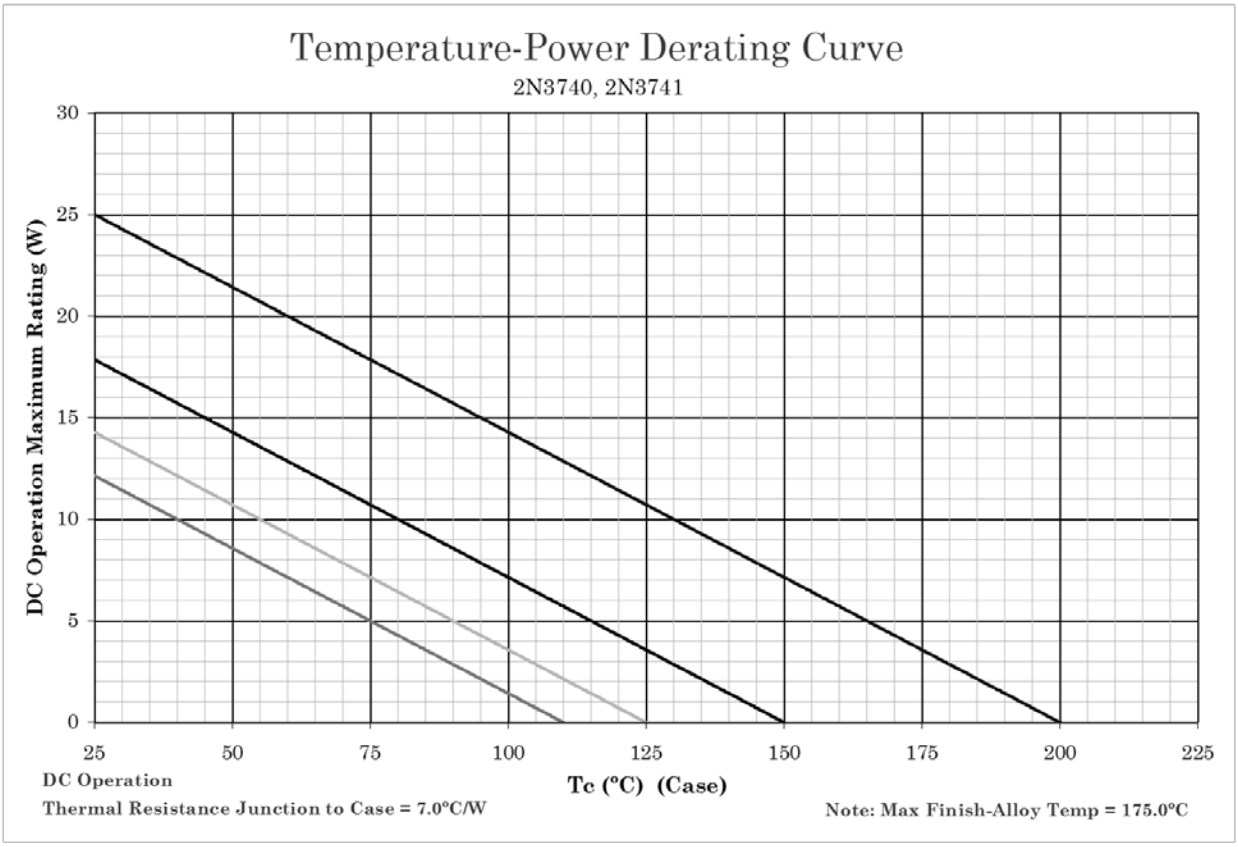
* TABLE III. Group D inspection - Continued.

Inspection 1/ 2/ 3/	MIL–STD–750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 2						
Total dose irradiation 2N3740 2N3741	1019	Gamma exposure Vces = -48V Vces = -64V				
Breakdown voltage, collector to emitter 2N3740 2N3741	3011	Bias condition D; I_C = -100 mA dc; pulsed (see 4.5.1)	$V_{(BR)CEO}$	 -60 -80		 V dc V dc
Collector to emitter cutoff current 2N3740 2N3741	3041	Bias condition D V_{CE} = -40 V dc V_{CE} = -60 V dc	I_{CEO}		-20	μA dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = -7 V dc	I_{EBO}		-200	nA dc
Collector to emitter cutoff current 2N3740 2N3741	3041	Bias condition A; V_{BE} = -1.5 V dc V_{CE} = -60 V dc V_{CE} = -80 V dc	I_{CEX1}		-600	nA dc
Collector to base cutoff current	3036	Bias condition D	I_{CBO}		-200	nA dc
Base emitter voltage (nonsaturated)	3066	Test condition B; V_{CE} = -1 V dc; I_C = -250 mA dc pulsed (see 4.5.1)	V_{BE}		-2	V dc
Saturation voltage and resistance	3071	I_C = -250 mA dc; I_B = -25 mA dc pulsed (see 4.5.1)	$V_{CE(sat)1}$		-0.46	V dc
Saturation voltage and resistance	3071	I_C = -1 A dc; I_B = -125 mA dc pulsed (see 4.5.1)	$V_{CE(sat)2}$		-0.69	V dc
Forward-current transfer ratio	3076	V_{CE} = -1 V dc; pulsed (see 4.5.1)				
		I_C = -100 mA dc I_C = -250 mA dc I_C = -500 mA dc I_C = -1 A dc	[h_{FE1}] 5/ [h_{FE2}] 5/ [h_{FE3}] 5/ [h_{FE4}] 5/	[20] [15] [10] [5]	120	
Forward-current transfer ratio 2N3740 2N3741	3076	V_{CE} = -5 V dc; I_C = -4 A dc pulsed (see 4.5.1) V_{CE} = -60 V dc V_{CE} = -80 V dc	[h_{FE5}] 5/	[1.5]		

1/ Tests to be performed on all devices receiving radiation exposure.
2/ For sampling plan, see MIL–PRF–19500.
3/ Electrical characteristics apply to all device types 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 that [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 IV. Group E inspection (all quality levels) - for qualification or re-qualification only.

Inspection	MIL–STD–750		Sample plan
	Method	Conditions	
Subgroup 1			45 devices c = 0
Temperature cycling (air to air)	1051	Test condition C, 500 cycles.	
Hermetic seal Fine leak Gross leak	1071		
Electrical measurements		See table I, subgroup 2 and table II herein.	
Subgroup 2			45 devices c = 0
Blocking life	1048	T_A = +150°C, V_{CB} = 80 percent of rated voltage, t = 1,000 hours.	
Electrical measurements		See table I, subgroup 2 and table II herein.	
Subgroup 4			Sample size N/A
Thermal impedance curves		See MIL–PRF–19500.	
Subgroup 8			45 devices c = 0
Reverse stability	1033	Condition B.	

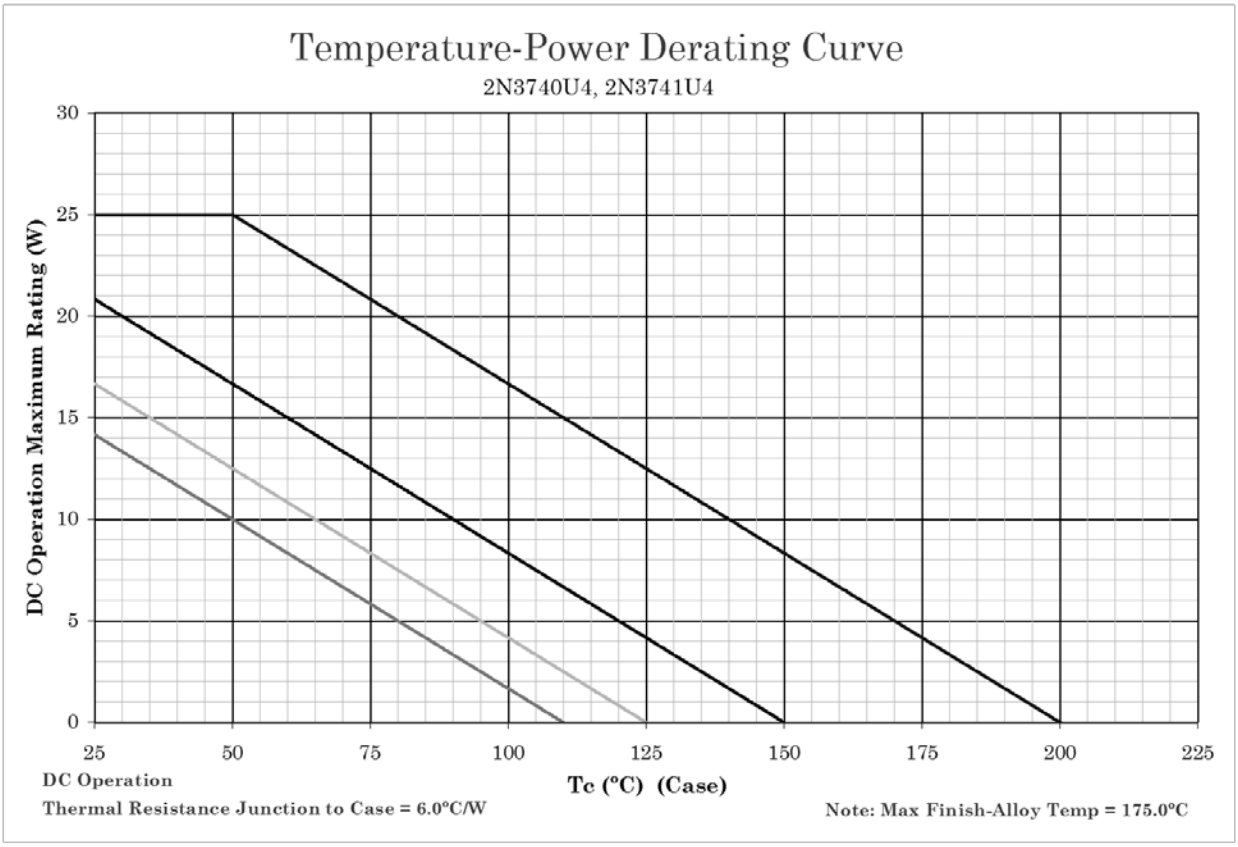


$R_{\theta JC}$ = 7°C/W

NOTES:

1. All devices are capable of operating at ≤ 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 ≤ +200°C) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at T_J ≤ +150°C where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at T_J ≤ +125°C and +110°C to show power rating where most users want to limit T_J in their application.

FIGURE 4. Temperature-power derating graph (2N3740, 2N3741, TO-66).



$R_{\theta JC}$ = 6°C/W

NOTES:

1. All devices are capable of operating at ≤ 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 ≤ +200°C) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at T_J ≤ +150°C where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at T_J ≤ +125°C and +110°C to show power rating where most users want to limit T_J in their application.

FIGURE 5. Temperature-power derating graph (2N3740U4, 2N3741U4).

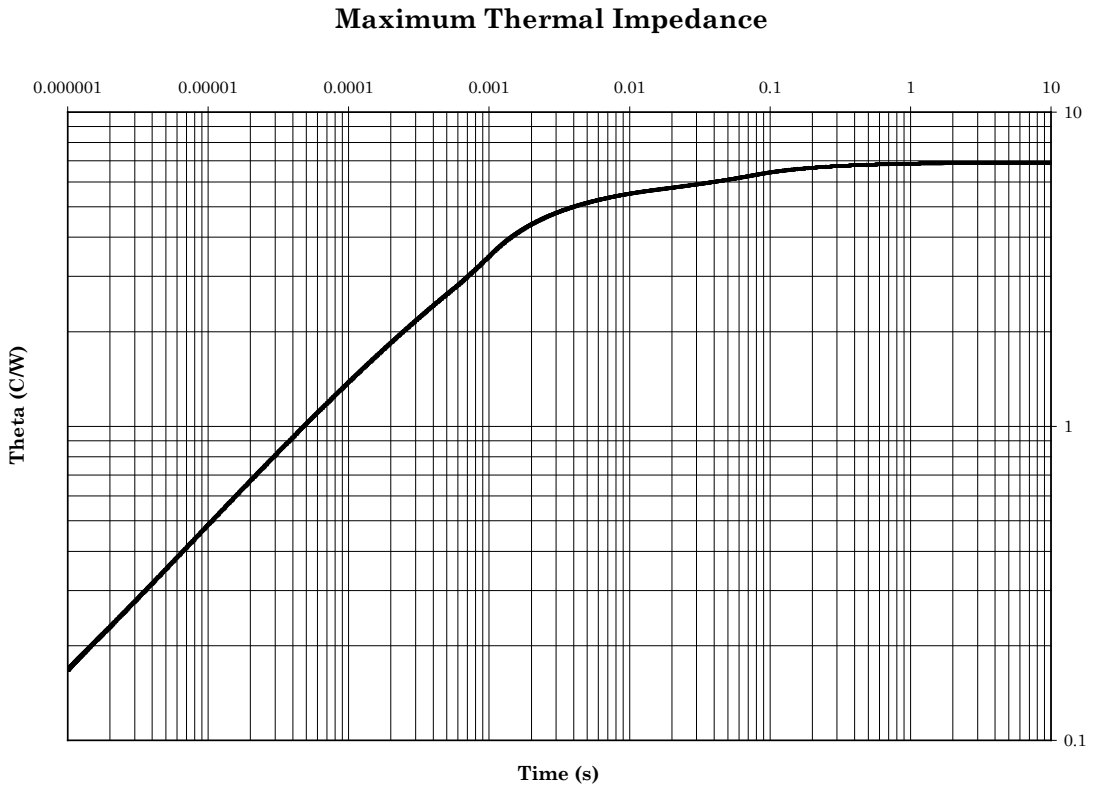


FIGURE 6. Transient thermal impedance graph (2N3740 and 2N3741).

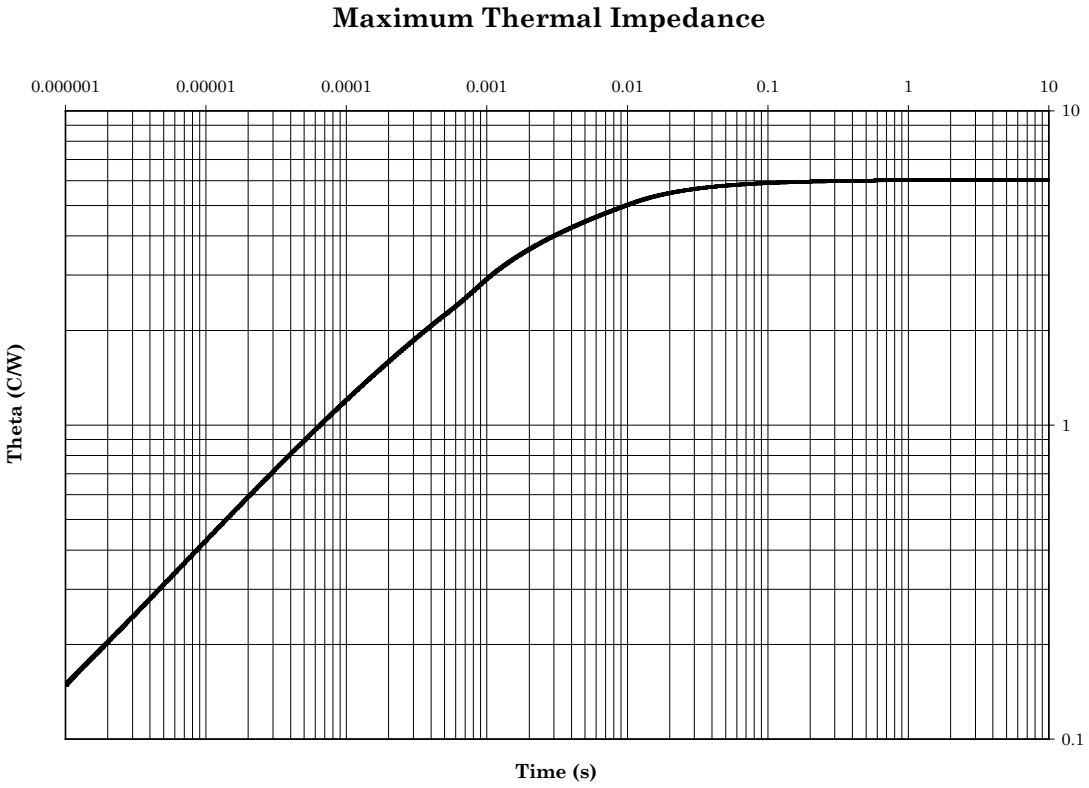
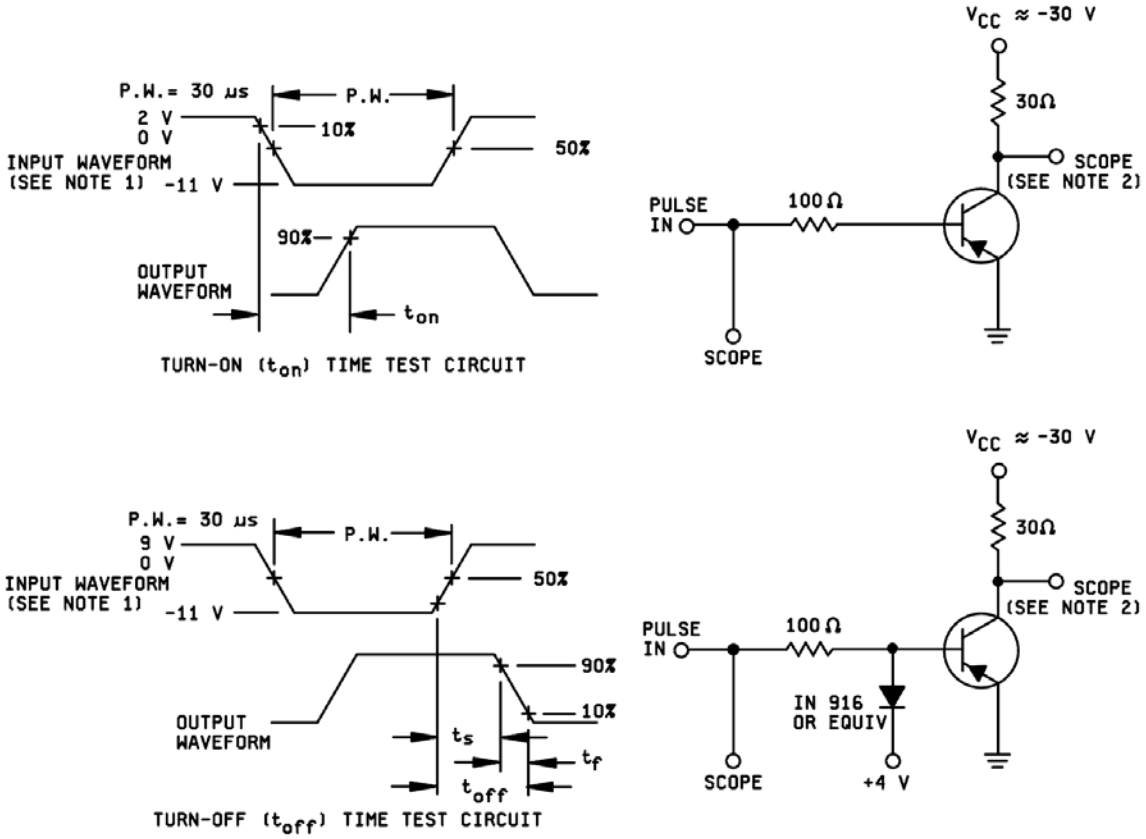


FIGURE 7. Transient thermal impedance graph (2N3740U4 and 2N3741U4).



NOTES:

1. The rise time (t_r) of the applied pulse shall be ≤ 20 ns; duty cycle ≤ 2 percent; generator source impedance shall be 50 Ω.
2. Output sampling oscilloscope: $Z_{in} \geq 100$ kΩ; $C_{in} \leq 12$ pF; rise time ≤ 2 ns.

FIGURE 8. Pulse response test circuits.

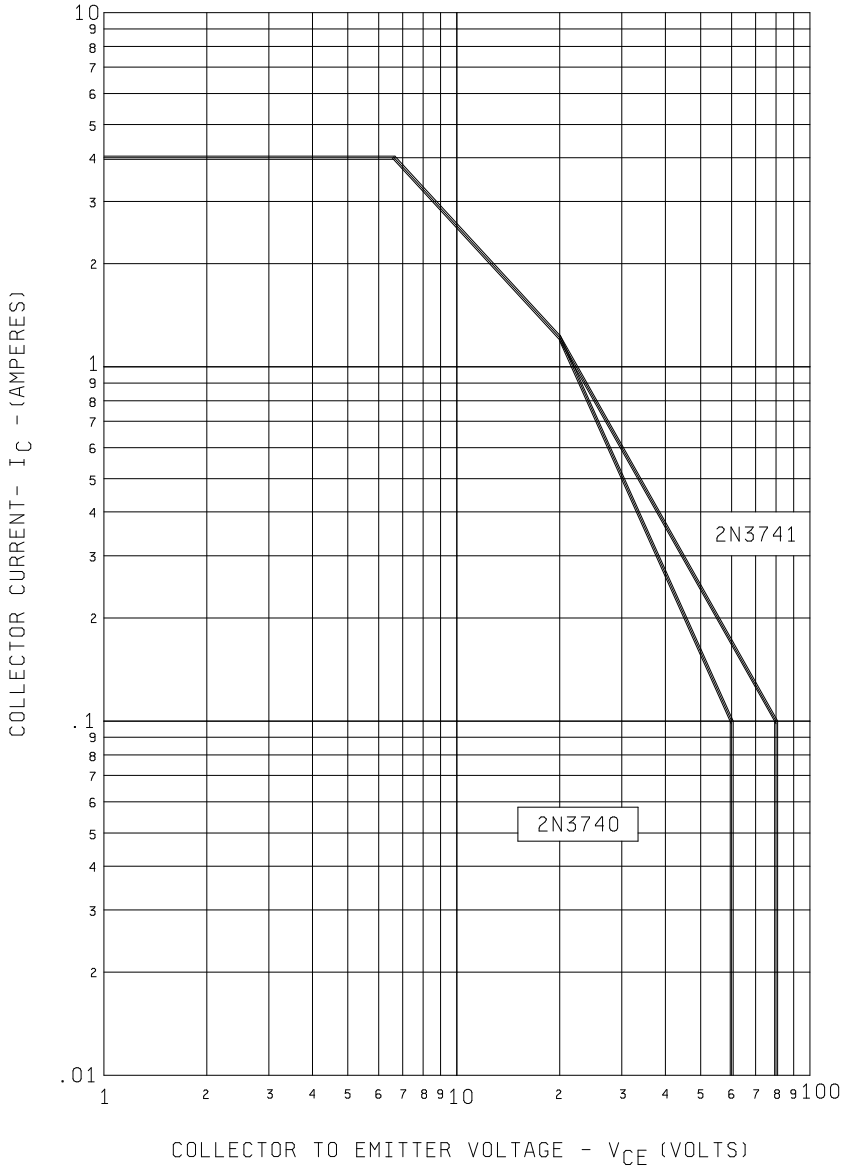
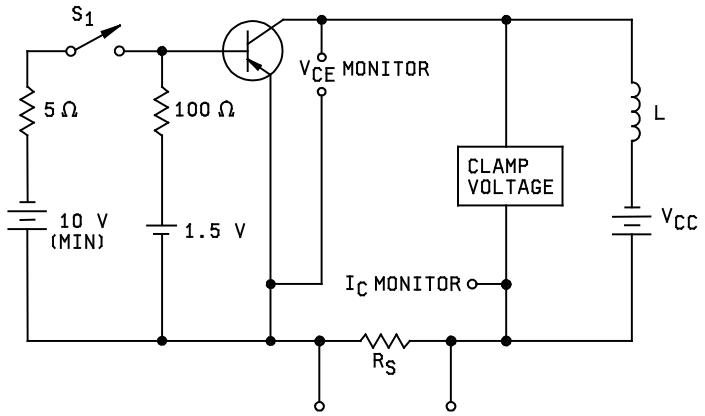


FIGURE 9. Maximum SOA graph (continuous dc, all devices).



$R_S \leq .1\Omega$ 12W; 1 percent tolerance maximum (noninductive).

L = 5 mH at 4 A with a maximum dc resistance of 0.5 Ω.
Reference only: 2 ESSEX Stancor C-2688 (in parallel),
or equivalent.

Procedure

1. With switch S_1 closed, set the specified test conditions.
2. Open S_1. Device fails if the clamp voltage is not reached.
3. Perform specified end-point tests.

FIGURE 10. Clamped inductive sweep test circuit.

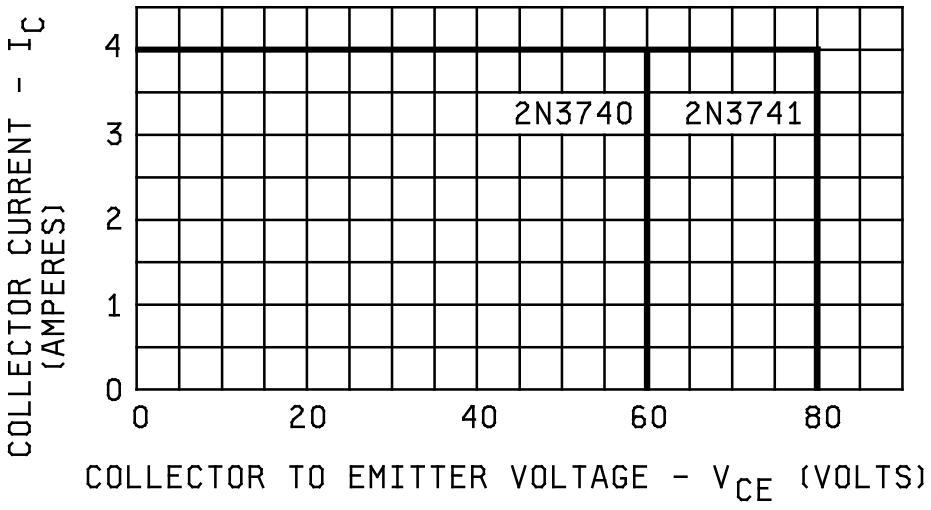


FIGURE 11. SOA for switching between saturation and cutoff (clamped inductive load, all devices).

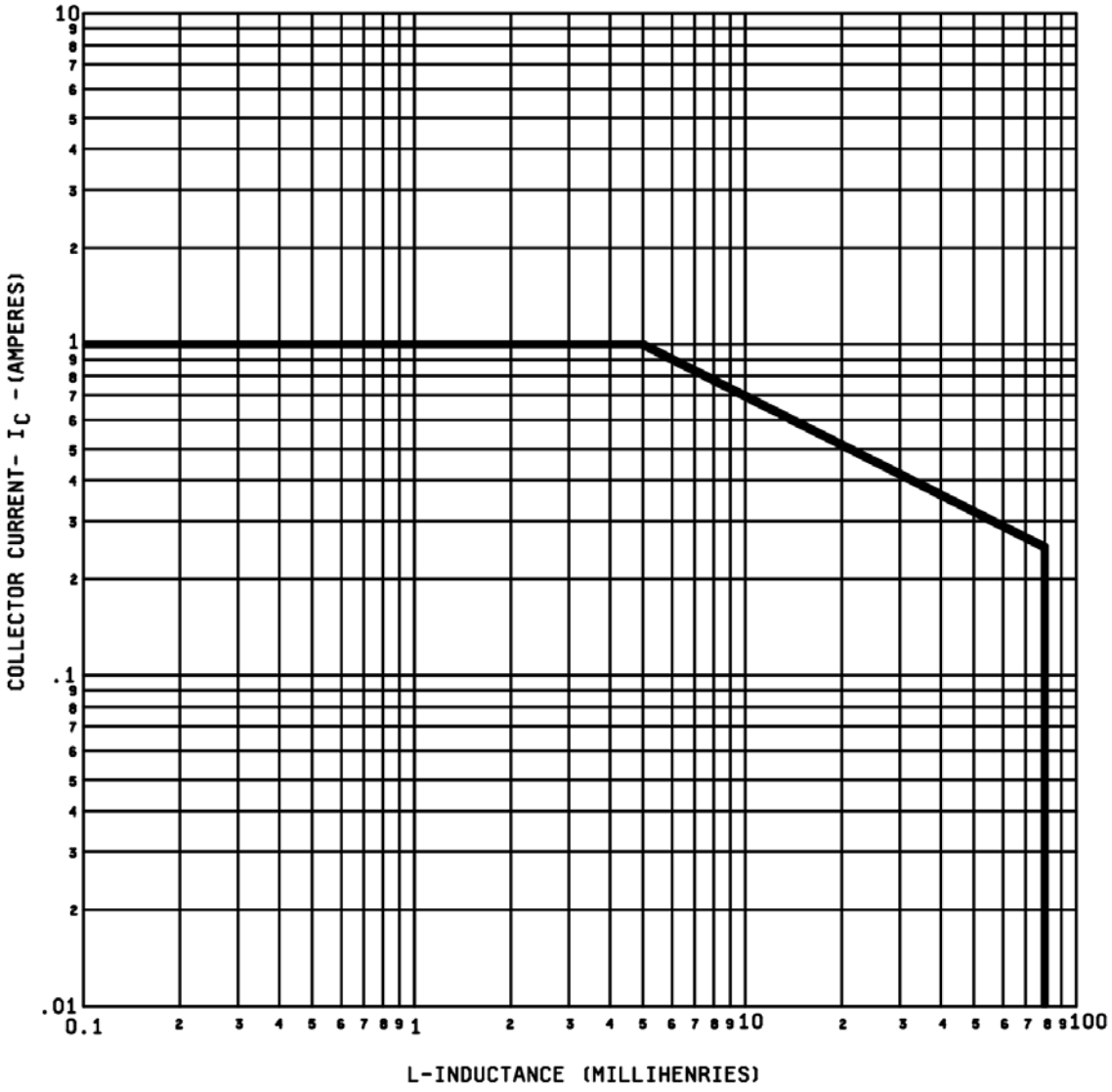


FIGURE 12. Safe operating area for switching between saturation and cutoff (unclamped inductive load).

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 and 6.5).

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

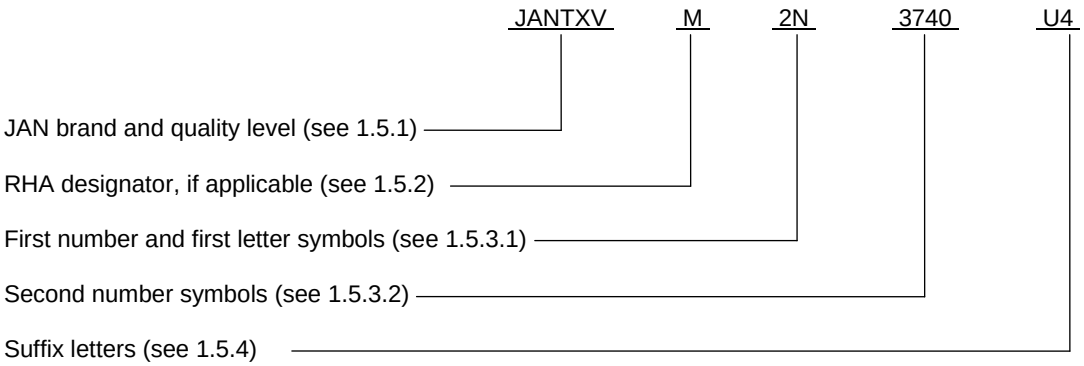
* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention 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 Suppliers of JANHC and JANKC die. The qualified JANHC and JANKC suppliers with the applicable letter version (example, JANHCC3740) will be identified on the QPDSIS. The previous die versions A and B are no longer available.

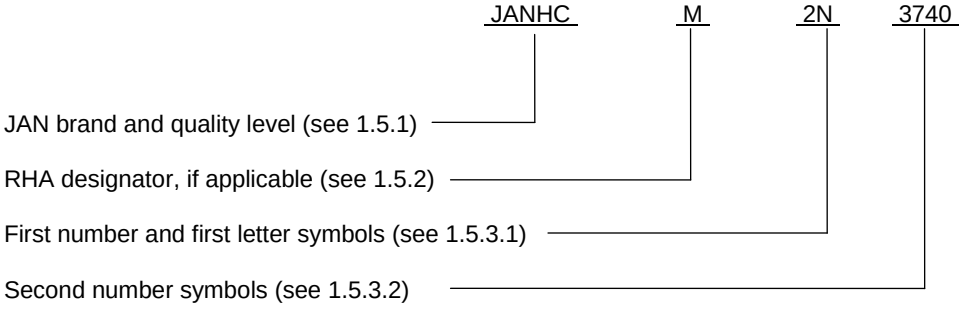
JANC ordering information	
PIN	Manufacturer
	43611
2N3740	JANHCC2N3740
2N3740	JANKCC2N3740
2N3741	JANHCC2N3741
2N3741	JANKCC2N3741

* 6.5 PIN construction examples.

* 6.5.1 Encapsulated devices. The PIN for encapsulated devices are constructed using the following form:



* 6.5.2 Un-encapsulated devices. The PINs for unencapsulated devices are constructed using the following form.



* 6.6 List of PINs.

* 6.6.1 Encapsulated devices. The following is a list of possible PINs available for encapsulated devices covered by this specification sheet.

PINs for devices of the base quality level	PINs for devices of the “TX” quality level	PINs for devices of the “TXV” quality level	PINs for devices of the “TXV” quality level with RHA (1)
JAN2N3740	JANTX2N3740	JANTXV2N3740	JANTXV#2N3740
JAN2N3740U4	JANTX2N3740U4	JANTXV2N3740U4	JANTXV#2N3740U4
JAN2N3741	JANTX2N3741	JANTXV2N3741	JANTXV#2N3741
JAN2N3741U4	JANTX2N3741U4	JANTXV2N3741U4	JANTXV#2N3741U4

PINs for devices of the “S” quality level	PINs for devices of the “S” quality leve with RHA (1)l
JANS2N3740	JANS#2N3740
JANS2N3740U4	JANS#2N3740U4
JANS2N3741	JANS#2N3741
JANS2N3741U4	JANS#2N3741U4

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

* 6.6.2 Unencapsulated devices. The following is a list of possible PINs available for unencapsulated devices covered by this specification sheet.

JANHCC#2N3740	JANHCC#2N3741
JANKCC#2N3740	JANKCC#2N3741

(1) The number sign (#) represents one of eight RHA d esignators available (“M”, “D”, “P”, “L”, “R”, “F”, “G”, or “H”).

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 last previous issue.

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

Review activities:
Army - AR, AV, MI, SM
Navy - AS, MC
Air Force - 19, 71, 99

Preparing activity:
DLA - CC

(Project 5961-2015-062)

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/.