

The documentation and process conversion measures necessary to comply with this document shall be completed by 24 May 2025.

INCH-POUND

MIL-PRF-19500/728D
w/AMENDMENT 1
24 February 2025
SUPERSEDING
MIL-PRF-19500/728D
26 September 2019

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, SWITCHING,
TYPES 2N3724, 2N3725, 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 NPN, silicon, switching transistors. Four levels of product assurance (JAN, JANTX, JANTXV, and JANS) are provided for each device type as specified in [MIL-PRF-19500](#) and two levels of product assurance (JANHC and JANKC) are provided for each unencapsulated device type. RHA level designators "M", "D", "P", "L", "R", and "F" are appended to the device prefix to identify devices which have passed RHA requirements.

1.2 Physical dimensions. The device package for the encapsulated device type is as follow: (TO-5 and TO-39) in accordance with [figure 1](#) and (UB) in accordance with [figure 2](#). The dimensions and topography for JANHC and JANKC unencapsulated die is as follows: The A version die in accordance with [figure 3](#).

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

Types	I_C <u>A dc</u>	V_{CBO} <u>V dc</u>	V_{CEO} <u>V dc</u>	V_{EBO} <u>V dc</u>	T_J and T_{STG} <u>$^{\circ}\text{C}$</u>
2N3724, L, UB	1	50	30	6.0	-65 to +200
2N3725, L, UB	1	80	50	6.0	-65 to +200

Types	P_T $T_A = +25^{\circ}\text{C}$ (1) <u>W</u>	P_T $T_C = +25^{\circ}\text{C}$ (1) <u>W</u>	P_T $T_{SP(IS)} = +25^{\circ}\text{C}$ (1) <u>W</u>	$R_{\theta JA}$ (2) (3) <u>$^{\circ}\text{C/W}$</u>	$R_{\theta JC}$ (2) (3) <u>$^{\circ}\text{C/W}$</u>	$R_{\theta JSP(IS)}$ (2) (3) <u>$^{\circ}\text{C/W}$</u>
2N3724	0.800	5	N/A	175	35	N/A
2N3725	0.800	5	N/A	175	35	N/A
2N3724L	0.800	5	N/A	175	35	N/A
2N3725L	0.800	5	N/A	175	35	N/A
2N3724UB	0.500	N/A	1.5	350	N/A	90
2N3725UB	0.500	N/A	1.5	350	N/A	90

(1) For derating, see [figure 4](#), [figure 5](#), [figure 6](#), and [figure 7](#).

(2) See [3.3](#).

(3) For thermal impedance curves, see [figure 8](#), [figure 9](#), [figure 10](#), and [figure 11](#).

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1.4 Primary electrical characteristics at $T_A = +25^\circ\text{C}$.

Types	h _{FE1} I _C = 100 mA dc V _{CE} = 1 V dc		h _{FE2} I _C = 300 mA dc V _{CE} = 1 V dc		h _{FE3} I _C = 500 mA dc V _{CE} = 1.0 V dc		/h _{FE} / f = 100 MHz V _{CE} = 10 V dc I _C = 50 mA dc		C _{obo} 100 kHz ≤ f ≤ 1 MHz V _{CB} = 10 V dc I _E = 0	
	Min	Max	Min	Max	Min	Max	Min	Max	Min pF	Max pF
2N3724, L	60	240	40		35		3.0			12
2N3724UB	60	240	40		35		3.0			12
2N3725, L	60	240	35		30		3.0			12
2N3725UB	60	240	35		30		3.0			12

Types	V _{CE(sat)2} (1) I _C = 100 mA dc I _B = 10 mA dc		V _{CE(sat)1} (1) I _C = 10 mA dc I _B = 1.0 mA dc		V _{BE(sat)1} (1) I _C = 10 mA dc I _B = 1.0 mA dc		V _{BE(sat)2} (1) I _C = 100 mA dc I _B = 10 mA dc		Switching (saturated)			
	t _{on} See figure 12		t _{off} See figure 13									
	V dc Min	V dc Max	V dc Min	V dc Max	V dc Min	V dc Max	V dc Min	V dc Max	ns Min	ns Max	ns Min	ns Max
2N3724, L, UB, 2N3725, L, UB		.2 .26		.25 .25		.76 .76		.86 .86		50 50		60 60

(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 6.4 for PIN construction example and 6.5 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".

1.5.1.2 Quality level designators for 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 for JANS quality levels are as follows: "M", "D", "P", "L", "R", and "F". For the RHA levels for TXV quality levels are as follows: "R" and "F".

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

1.5.3.1 First number and first letter symbols. The semiconductors 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 semiconductors covered by this specification sheet are as follows: "3724" and "3725".

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

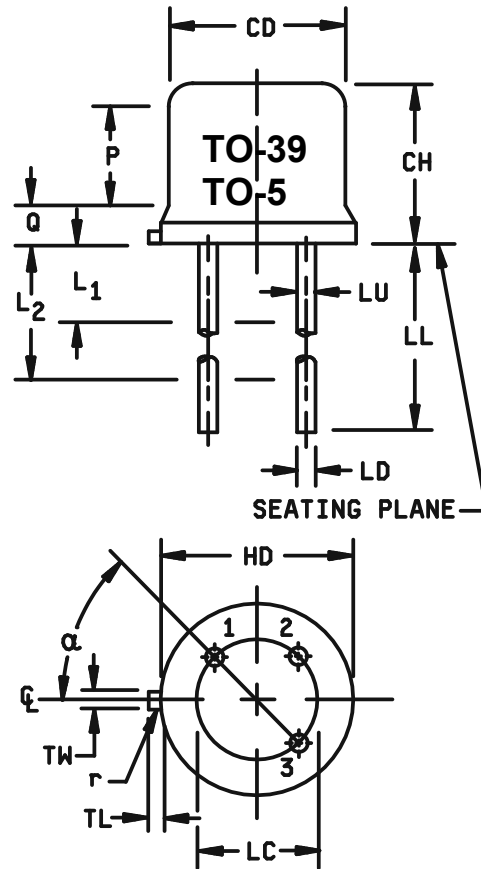
	A blank first suffix symbol indicates a 3 lead metal can package with lead dimension LL = .5 inches (12.70 mm) min and .750 inch (19.05 mm) max. (see figure 1 , TO-39).
L	Indicates a 3 lead metal can package with lead dimension LL = 1.5 inches (38.10 mm) min and 1.75 inches (44.45 mm) max. (see figure 1 , TO-5)
UB	Indicates a 4 pad surface mount package, (see figure 2)

1.5.5 Lead finish. The lead finishes applicable to this specification sheet are listed on [QML-19500](#).

1.5.6 Die identifiers for unencapsulated devices (manufacturers and critical interface identifiers). The manufacturer die identifiers that are applicable for this specification sheet is "A".

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Symbol	Dimensions				Note
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.200 TP		5.08 TP		7
LD	.016	.019	0.41	0.48	8,9
LL	See note 13				
LU	.016	.019	0.41	0.48	8,9
L ₁		.050		1.27	8,9
L ₂	.250		6.35		8,9
P	.100		2.54		7
Q		.030		0.76	5
TL	.029	.045	0.74	1.14	3,4
TW	.028	.034	0.71	0.86	3
r		.010		0.25	11
α	45° TP		45° TP		7

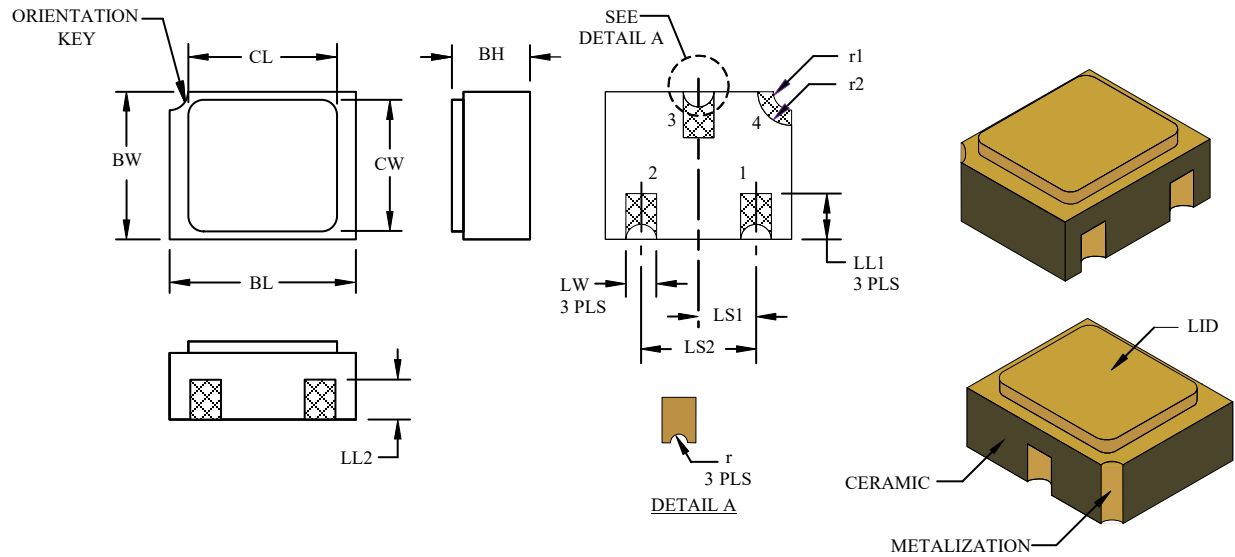


NOTES:

1. Dimensions are in inches.
2. Millimeters equivalents are given for general information only.
3. Beyond r (radius) maximum, TW shall be held for a minimum length of .011 (0.28 mm).
4. Dimension TL measured from maximum HD.
5. Body contour optional within zone defined by HD, CD, and Q.
6. CD shall not vary more than .010 inch (0.25 mm) in zone P. This zone is controlled for automatic handling.
7. Leads at gauge plane .054 +.001 -.000 inch (1.37 +0.03 -0.00 mm) below seating plane shall be within .007 inch (0.18 mm) radius of true position (TP) at maximum material condition (MMC) relative to tab at MMC.
8. Dimension LU applies between L₁ and L₂. Dimension LD applies between L₂ and LL minimum. Diameter is uncontrolled in L₁ and beyond LL minimum.
9. All three leads.
10. The collector shall be internally connected to the case.
11. Dimension r (radius) applies to both inside corners of tab.
- * 12. Lead 1 = emitter, lead 2 = base, lead 3 = collector.
13. For L suffix devices (TO-5), dimension LL = 1.5 inches (38.10 mm) min. and 1.75 inches (44.45 mm) max. For non-L suffix types (TO-39), dimension LL = .5 inch (12.70 mm) min. and .750 inch (19.05 mm) max.

FIGURE 1. Physical dimensions for 2N3724 and 2N3725 (TO-5 and TO-39).

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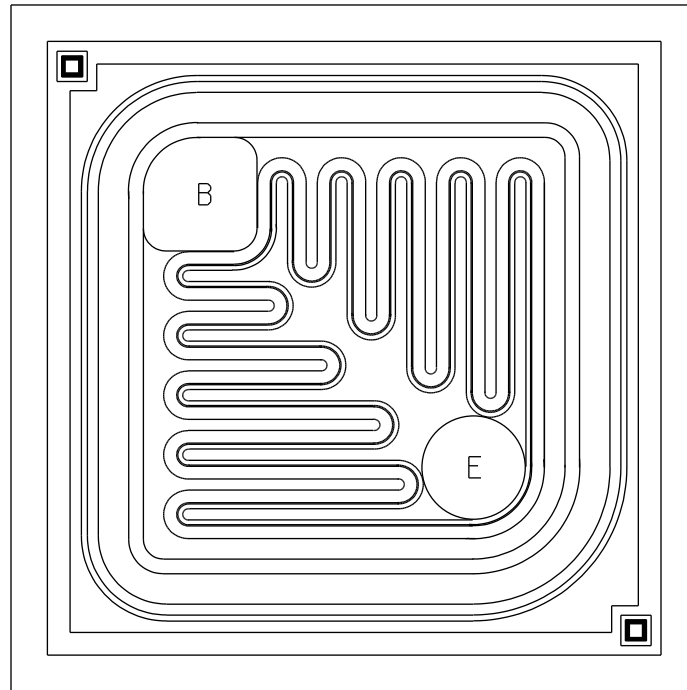
Symbol	Dimensions				Note	Symbol	Dimensions				Note
	Inches		Millimeters				Inches		Millimeters		
	Min	Max	Min	Max			Min	Max	Min	Max	
BH	.046	.056	1.17	1.42		LS ₁	.035	.039	0.89	0.99	
BL	.115	.128	2.92	3.25		LS ₂	.071	.079	1.80	2.01	
BW	.085	.108	2.16	2.74		LW	.016	.024	0.41	0.61	
CL	.115	.128	2.92	3.25		r		.008		0.20	
CW	.085	.108	2.16	2.74		r1		.012		0.31	
LL1	.022	.038	0.56	0.97		r2		.022		0.56	
LL2	.017	.035	0.43	0.89							

NOTES:

1. Dimensions are in inches.
2. Millimeters equivalents 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.

* FIGURE 2. Physical dimensions, surface mount 2N3724UB and 2N3725UB (UB version).

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NOTES:

- * 1. Die size: .025 x .025 inch $\pm$.002 inch (0.635 mm x 0.635 mm $\pm$.0508 mm).
- 2. Die thickness: .010 $\pm$.0015 inch (0.254 mm $\pm$ 0.0381 mm).
- 3. Base bonding pad: .004 x .004 inch (0.1016 mm x 0.1016 mm).
- 4. Emitter bonding pad: .004 x .004 inch (0.1016 mm x 0.1016 mm).
- 5. Back metal: Gold, 5,000 Å.
- 6. Top metal: Aluminum, 15,000Å minimum, 18,000 Å nominal.
- 7. Back side: Collector.
- 8. Glassivation: Si₃N₄, 8,000 Å nominal.

FIGURE 3. JANHC and JANKC die dimensions.

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 <https://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.

PCB	Printed circuit board.
R _{θJA}	Thermal resistance junction to ambient.
R _{θJC}	Thermal resistance junction to case.
R _{θJSP(1S)}	Thermal resistance junction to solder pads (infinite sink mount to PCB).

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in **MIL-PRF-19500**, and on figure 1, figure 2, and figure 3 herein.

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 Radiation hardness assurance (RHA). Radiation hardness assurance requirements, PIN designators, and test levels shall be as defined in **MIL-PRF-19500**.

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3.6 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in paragraph 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 Marking. Marking shall be in accordance with MIL-PRF-19500, except for the UB suffix package. Marking on the UB package shall consist of an abbreviated part number, the date code, and the manufacturers 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 "UB" suffix can also be omitted. The radiation hardened designator M, D, P, L, R, or F shall immediately precede (or replace) the device "2N" identifier (depending upon degree of abbreviation required).

3.9 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, and table 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.

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* 4.3 Screening (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with table E-IV 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	Measurements for JANS level	Measurements for JANTX and JANTXV levels
2	Optional	Optional
3a 3b 3c	Required Not applicable Thermal impedance (transient), method 3131 of MIL-STD-750 (1)	Required Not applicable Thermal impedance (transient), method 3131 of MIL-STD-750 (1)
4	Required	Optional
5	Required	Not applicable
8	Required	Not required
9	I _{CBO1} , h _{FE1}	Not applicable
10	48 hours minimum	48 hours minimum
11	I _{CBO1} ; h _{FE1} ; ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE1} = ± 15 percent	I _{CBO1} ; h _{FE1}
12	See 4.3.2	See 4.3.2
13	Subgroups 2 and 3 of table I herein; ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE1} = ± 15 percent	Subgroup 2 of table I herein; ΔI_{CBO1} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE1} = ± 15 percent
15	Required	Not required
16	Required	Not required

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

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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, T_A ambient rated as defined in 1.3. With approval of the qualifying activity and preparing activity, alternate burn-in criteria (hours, bias conditions, T_J , and mounting conditions) may be used 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_{MD} (and V_C where appropriate). The thermal impedance limit used in screen 3c shall comply with the thermal impedance graph on figure 8, figure 9, figure 10, and figure 11 (less than or equal to the curve value at the same t_H time) and/or shall be less than the process determined statistical maximum limit as outlined in method 3131.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein. If alternate screening is being performed in accordance with MIL-PRF-19500, a sample of screened devices shall be submitted to and pass the requirements of table I, subgroup 1, and 2 inspection only (table E-VIB, group B, subgroup 1 is not required to be performed again if group B has already been satisfied in accordance with 4.4.2).

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 tests and conditions specified for subgroup testing in table E-VIA (JANS) of MIL-PRF-19500 and 4.4.2.1. Delta requirements only apply to subgroups B4 and B5. See 4.4.2.2 for JAN, JANTX, and JANTXV group B testing. Delta requirements for JAN, JANTX, and JANTXV shall be after each step in 4.4.2.2 and shall be in accordance with table I, subgroup 2 and 4.5.3 herein.

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

Subgroup	Method	Condition
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B4	1037	$V_{CB} = 10$ V dc.
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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.)
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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.

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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 failure 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>
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 (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 test 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 requirements shall be in accordance with [table I](#), subgroup 2 and [4.5.3](#) herein; delta requirements only apply to subgroup C6.

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; (not applicable for UB devices).
C5	3131	$R_{\theta JA}$ and $R_{\theta JC}$ only, as applicable (see 1.3) and applied thermal impedance curves.
C6	1026	1,000 hours, $V_{CB} = 10$ V dc, power and ambient temperature shall be applied to the device to achieve $T_J = +150^\circ\text{C}$ minimum, and minimum power dissipation of 75 percent of max rated P_T (see 1.3 herein); $n = 45$, $c = 0$. The sample size may be increased and the test time decreased so 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.

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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 for UB devices.
C5	3131	R _{θJA} and R _{θJC} only, as applicable (see 1.3) and applied thermal impedance curves.
C6		Not applicable.

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

4.4.4 Group D inspection. Conformance inspection for hardness assured JANS 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](#) 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 in [table III](#) herein. Delta measurements shall be in accordance with the applicable steps of [4.5.3](#).

4.5 Method 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 Input capacitance. This test shall be conducted in accordance with method 3240 of [MIL-STD-750](#), except the output capacitor shall be omitted.

4.5.3 Delta requirements. Delta requirements 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} = 40 V dc	ΔI _{CB01} (1)	100 percent of initial value or 8 nA dc, whichever is greater.	
2	Forward current transfer ratio	3076	V _{CE} = 1 V dc; I _C = 100 mA dc; pulsed see 4.5.1	Δh _{FE1} (1)	±25 percent change from initial reading.	

(1) Devices which exceed the [table I](#) limits for this test shall not be accepted.

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* 4.5.4 Displacement damage characterization. For RHA devices, each supplier shall perform a displacement damage characterization. The characterization shall demonstrate exposure versus data and does not indicate pass or fail criteria. The exposure shall be conducted in accordance with method 1017 of [MIL-STD-750](#). The following details shall apply:

- a. Samples may be taken from any wafer of the qualification lot.
- b. As a minimum, testing shall be at $2E+12$ n/cm² plus two additional fluence levels chosen by the manufacturer.
- c. If the device degrades less than 5 percent of the specification at the highest fluence level, a single data point may be sufficient.

Alternate package options may be substituted for characterization. The displacement damage characterization data shall be made available from the manufacturer.

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TABLE I. Group A inspection.

Inspection <u>1</u> /	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 <u>2</u> /						
Visual and mechanical Examination <u>3</u> /	2071	n = 45 devices, c = 0				
Solderability <u>3</u> / <u>4</u> /	2026	n = 15 leads, c = 0				
Resistance to solvents <u>3</u> / <u>4</u> / <u>5</u> /	1022	n = 15 devices, c = 0				
Temp cycling <u>3</u> / <u>4</u> /	1051	Test condition C, 25 cycles. n = 22 devices, c = 0				
Hermetic seal <u>4</u> / <u>6</u> / Fine leak Gross leak	1071	n = 22 devices, c = 0				
Electrical measurements <u>4</u> /		Table I, subgroup 2				
Bond strength <u>3</u> / <u>4</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>4</u> /	2075	n = 4 devices, c = 0				
Subgroup 2						
Thermal impedance <u>7</u> /	3131	See 4.3.3	Z _{θJX}			°C/W
Collector to base cutoff current	3036	Condition D. V _{CB} = 40 V dc, I _E = 0 mA dc	I _{CBO1}		100	nA dc
Emitter to base cutoff current	3061	Condition D. V _{(BR)EBO} = 4 V dc	I _{EBO}		10	nA dc
Collector to base cutoff current	3036	Bias condition D; I _E = 0 mA dc	I _{CBO2}			
2N3724, L, 2N3724UB 2N3725, L, 2N3725UB		V _{CB} = 50 V dc V _{CB} = 80 V dc			10 10	μA dc μA dc
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	V _{CE} = 1 V dc; I _C = 100 mA dc	h _{FE1}	60	240	
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	V _{CE} = 1.0 V dc; I _C = 300 mA dc	h _{FE2}	40 35		
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	V _{CE} = 1.0 V dc; I _C = 500 mA dc	h _{FE3}	35 30		

See footnotes at end of table.

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TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - Continued						
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	$V_{CE} = 5 \text{ V dc}; I_C = 1 \text{ A dc};$ pulsed (see 4.5.1)	h_{FE4}	30 25		
Forward-current transfer ratio	3076	$V_{CE} = 1 \text{ V dc}; I_C = 10 \text{ mA dc};$ pulsed (see 4.5.1)	h_{FE5}	30		
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	$V_{CE} = 2 \text{ V dc}; I_C = 800 \text{ mA dc};$ pulsed (see 4.5.1)	h_{FE6}	25 20		
Collector-emitter saturation voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 10 \text{ mA dc}; I_B = 1.0 \text{ mA dc};$ pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.25 0.25	V dc V dc
Collector-emitter saturation voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 100 \text{ mA dc}; I_B = 10 \text{ mA dc};$ pulsed (see 4.5.1)	$V_{CE(sat)2}$		0.2 0.26	V dc V dc
Collector-emitter saturation voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 300 \text{ mA dc}; I_B = 30 \text{ mA dc};$ pulsed (see 4.5.1)	$V_{CE(sat)3}$		0.32 0.4	V dc V dc
Collector-emitter saturation voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 500 \text{ mA dc}; I_B = 50 \text{ mA dc};$ pulsed (see 4.5.1)	$V_{CE(sat)4}$		0.42 0.52	V dc V dc
Collector-emitter saturation voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 800 \text{ mA dc}; I_B = 80 \text{ mA dc};$ pulsed (see 4.5.1)	$V_{CE(sat)5}$		0.65 0.8	V dc V dc
Collector-emitter saturation voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 1 \text{ A dc}; I_B = 100 \text{ mA dc};$ pulsed (see 4.5.1)	$V_{CE(sat)6}$		0.75 0.95	V dc V dc
Base-emitter saturation voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3066	Test condition A; $I_C = 10 \text{ mA dc};$ $I_B = 1 \text{ mA dc};$ pulsed (see 4.5.1)	$V_{BE(sat)1}$		0.76 0.76	V dc V dc

See footnotes at end of table.

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TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - Continued						
Base-emitter saturation voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3066	Test condition A; I _C = 100 mA dc; I _B = 10 mA dc; pulsed (see 4.5.1)	V _{BE(sat)2}		0.86 0.86	V dc V dc
Base-emitter saturation voltage	3066	Test condition A; I _C = 300 mA dc; I _B = 30 mA dc; pulsed (see 4.5.1)	V _{BE(sat)3}		1.1	V dc
Base-emitter saturation voltage	3066	Test condition A; I _C = 500 mA dc; I _B = 50 mA dc; pulsed (see 4.5.1)	V _{BE(sat)4}	.8	1.1	V dc
Base-emitter saturation voltage	3066	Test condition A; I _C = 800 mA dc; I _B = 80 mA dc; pulsed (see 4.5.1)	V _{BE(sat)5}		1.5	V dc
Base-emitter saturation voltage	3066	Test condition A; I _C = 1 A dc; I _B = 100 mA dc; pulsed (see 4.5.1)	V _{BE(sat)6}		1.7	V dc
<u>Subgroup 3</u>						
High temperature operation		T _A = +150°C				
Collector to base cutoff current 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3036	Bias condition D; V _{CB} = 80 V dc for 2N3725 V _{CB} = 50 V dc for 2N3724	I _{CBO3}		120 120	μA dc μA dc
Low temperature operation		T _A = -55°C				
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	V _{CE} = 2 V dc; I _C = 800 mA dc	h _{FE7}	15 10		
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	V _{CE} = 5 V dc, I _C = 1 A dc	h _{FE8}	15 10		

See footnotes at end of table.

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w/AMENDMENT 1

TABLE I. Group A inspection - Continued.

Inspection 1/ <u>Subgroup 4</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Magnitude of small-signal short-circuit forward current transfer ratio	3306	$V_{CE} = 10 \text{ V dc}; I_C = 50 \text{ mA dc}; f = 100 \text{ MHz}$	$ h_{fe} $	3.0		
Open circuit output capacitance	3236	$V_{CB} = 10 \text{ V dc}; I_E = 0; 100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	C_{obo}		12	pF
Input capacitance (output open-circuited)	3240	$V_{EB} = -0.5 \text{ V dc}; I_C = 0; 100 \text{ kHz} \leq f \leq 1 \text{ MHz}$	C_{ibo}		55	pF
Switching time Turn-on delay time	3251	$V_{CC} = 30 \text{ V dc}, I_{CS} = 500 \text{ mA dc}, I_{B1} = 50 \text{ mA dc}, V_{BE(off)} = -2.0\text{-V dc.}$ See figure 12.				
2N3724, L, 2N3724UB 2N3725, L, 2N3725UB			t_{on}		50	ns
Turn-off time		$I_C = 500 \text{ mA dc}, I_{B1} = 50 \text{ mA dc}, I_{B2} = -50 \text{ mA dc.}$ See figure 13.	t_{off}		60	ns
<u>Subgroup 5</u>		$T_A = +25^\circ\text{C}$				
Safe operating area	3051	$t_p = 10 \text{ ms, (For TO-5 and TO-39 see figures 14 ad 15)}$ (For UB see figures 16 and 17)				
<u>Test 1</u>						
2N3724 2N3724L 2N3725, 2N3725L		$V_{ce} = 7\text{V}, I_c = .8 \text{ A}$				
2N3724UB and 2N3725UB		$V_{ce} = 11\text{V}, I_c = .5 \text{ A}$				
<u>Test 2</u>						
2N3724 2N3724L 2N3725, 2N3725L 2N3724UB and 2N3725UB		$V_{ce} = 20 \text{ V}, I_c = .25 \text{ A}$				
<u>Test 3</u>						
2N3724 2N3724L, 2N3724UB		$V_{ce} = 30 \text{ V}, I_c = .11 \text{ A}$				
2N3725, 2N3725L 2N3725UB		$V_{ce} = 50 \text{ V}, I_c = .04 \text{ A}$				

See footnotes at end of table.

MIL-PRF-19500/728D
w/AMENDMENT 1

TABLE I. Group A inspection - Continued.

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 6</u>						
Not required						

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

2/ For resubmission of failed in [table I](#), subgroup 1, 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/ Separate samples may be used.

4/ Not required for JANS devices.

5/ Not required for laser marked devices.

6/ This hermetic seal test is an end-point to temp cycling in addition to electrical measurements.

7/ For end-point measurements, this test is required for the following subgroups:

Group B, step 1 of [4.4.2.2](#) herein (JAN, JANTX, and JANTXV).

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

Group C, subgroup 2 and 6.

Group E, subgroup 1 and 2.

MIL-PRF-19500/728D
w/AMENDMENT 1

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

Inspection 1/ <u>Subgroup 1</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Neutron irradiation	1017	Neutron exposure $V_{CES} = 0$ V				
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 40$ Vdc, $I_E = 0$ mA dc	I_{CB01}		200	η A dc
Emitter to base cutoff current	3061	Bias condition D; $V_{(BR)EBO} = 4$ V dc	I_{EBO}		20	η A dc
Collector to base cutoff current	3036	Bias condition D; $I_E = 0$ mA dc	I_{CB02}			
2N3724, L, 2N3724UB		$V_{CB} = 50$ Vdc			20	μ A dc
2N3725, L, 2N3725UB		$V_{CB} = 80$ Vdc			20	μ A dc
Forward-current transfer ratio	3076	$V_{CE} = 1$ V dc, $I_C = 100$ mA dc	h_{FE1}	[30]	240	
Forward-current transfer ratio	3076	$V_{CE} = 1$ V dc, $I_C = 300$ mA dc	h_{FE2}			
2N3724, L, 2N3724UB				[20]		
2N3725, L, 2N3725UB				[17.5]		
Forward-current transfer ratio	3076	$V_{CE} = 1$ V dc, $I_C = 500$ mA dc	h_{FE3}			
2N3724, L, 2N3724UB				[17.5]		
2N3725, L, 2N3725UB				[15]		
Forward-current transfer ratio	3076	$V_{CE} = 5$ V dc, $I_C = 1.0$ A dc; pulsed (see 4.5.1)	h_{FE4}			
2N3724, L, 2N3724UB				[15]		
2N3725, L, 2N3725UB				[12.5]		
Forward-current transfer ratio	3076	$V_{CE} = 1$ V dc, $I_C = 10$ mA dc; pulsed (see 4.5.1)	h_{FE5}	[15]		
Forward-current transfer ratio	3076	$V_{CE} = 2$ V dc, $I_C = 800$ mA dc; pulsed (see 4.5.1)	h_{FE6}			
2N3724, L, 2N3724UB				[12.5]		
2N3725, L, 2N3725UB				[10]		
Collector-emitter saturated voltage	3071	$I_C = 10$ mA dc, $I_B = 1.0$ mA dc, pulsed (see 4.5.1)	$V_{CE(sat)1}$			
2N3724, L, 2N3724UB					0.29	V dc
2N3725, L, 2N3725UB					0.29	V dc
Collector-emitter saturated voltage	3071	$I_C = 100$ mA dc, $I_B = 10$ mA dc, pulsed (see 4.5.1)	$V_{CE(sat)2}$			
2N3724, L, 2N3724UB					0.23	V dc
2N3725, L, 2N3725UB					0.30	V dc

See footnotes at end of table.

MIL-PRF-19500/728D
w/AMENDMENT 1

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

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 1</u> - Continued.						
Collector-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 300 \text{ mA dc}$, $I_B = 30 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{CE(sat)3}$		0.37 0.46	V dc V dc
Collector-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 500 \text{ mA dc}$, $I_B = 50 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{CE(sat)4}$		0.48 0.60	V dc V dc
Collector-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 800 \text{ mA dc}$, $I_B = 80 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{CE(sat)5}$		0.75 0.92	V dc V dc
Collector-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 1.0 \text{ A dc}$, $I_B = 100 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{CE(sat)6}$		0.86 1.09	V dc V dc
Base-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3066	Test condition A, $I_C = 10 \text{ mA dc}$, $I_B = 1 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{BE(sat)1}$		0.87 0.87	V dc V dc
Base-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3066	Test condition A, $I_C = 100 \text{ mA dc}$, $I_B = 10 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{BE(sat)2}$		0.99 0.99	V dc V dc
Base-emitter saturated voltage	3066	Test condition A, $I_C = 300 \text{ mA dc}$, $I_B = 30 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{BE(sat)3}$		1.27	V dc
Base-emitter saturated voltage	3066	Test condition A, $I_C = 500 \text{ mA dc}$, $I_B = 50 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{BE(sat)4}$	0.8	1.27	V dc
Base-emitter saturated voltage	3066	Test condition A, $I_C = 800 \text{ mA dc}$, $I_B = 80 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{BE(sat)5}$		1.73	V dc
Base-emitter saturated voltage	3066	Test condition A, $I_C = 1.0 \text{ A dc}$, $I_B = 100 \text{ mA dc}$, pulsed (see 4.5.1)	$V_{BE(sat)6}$		1.96	V dc

See footnote at end of table.

MIL-PRF-19500/728D
w/AMENDMENT 1

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

Inspection 1/ <u>Subgroup 2</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Steady-state total dose irradiation 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	1019	Condition A. Gamma exposure $V_{ECS} = 24$ V Gamma exposure $V_{ECS} = 40$ V				
Collector to base cutoff current	3036	Bias condition D; $V_{CB} = 40$ Vdc, $I_E = 0$ mA dc	I_{CB01}		200	η A dc
Emitter to base cutoff current	3061	Bias condition D; $V_{(BR)EBO} = 4$ V dc	I_{EBO}		20	η A dc
Collector to base cutoff current 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3036	Bias condition D; $I_E = 0$ mA dc $V_{CB} = 50$ Vdc $V_{CB} = 80$ Vdc	I_{CB02}		20 20	μ A dc μ A dc
Forward-current transfer ratio	3076	$V_{CE} = 1$ V dc, $I_C = 100$ mA dc	h_{FE1}	[30]	240	
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	$V_{CE} = 1$ V dc, $I_C = 300$ mA dc	h_{FE2}	[20] [17.5]		
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	$V_{CE} = 1$ V dc, $I_C = 500$ mA dc	h_{FE3}	[17.5] [15]		
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	$V_{CE} = 5$ V dc, $I_C = 1.0$ A dc; pulsed (see 4.5.1)	h_{FE4}	[15] [12.5]		
Forward-current transfer ratio	3076	$V_{CE} = 1$ V dc, $I_C = 10$ mA dc; pulsed (see 4.5.1)	h_{FE5}	[15]		
Forward-current transfer ratio 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3076	$V_{CE} = 2$ V dc, $I_C = 800$ mA dc; pulsed (see 4.5.1)	h_{FE6}	[12.5] [10]		
Collector-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 10$ mA dc, $I_B = 1.0$ mA dc, pulsed (see 4.5.1)	$V_{CE(sat)1}$		0.29 0.29	V dc V dc
Collector-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	$I_C = 100$ mA dc, $I_B = 10$ mA dc, pulsed (see 4.5.1)	$V_{CE(sat)2}$		0.23 0.30	V dc V dc

See footnotes at end of table.

MIL-PRF-19500/728D
w/AMENDMENT 1

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

Inspection <u>1/</u>	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
<u>Subgroup 2</u> - Continued.						
Collector-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	I _C = 300 mA dc, I _B = 30 mA dc, pulsed (see 4.5.1)	V _{CE(sat)3}		0.37 0.46	V dc V dc
Collector-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	I _C = 500 mA dc, I _B = 50 mA dc, pulsed (see 4.5.1)	V _{CE(sat)4}		0.48 0.60	V dc V dc
Collector-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	I _C = 800 mA dc, I _B = 80 mA dc, pulsed (see 4.5.1)	V _{CE(sat)5}		0.75 0.92	V dc V dc
Collector-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3071	I _C = 1.0 A dc, I _B = 100 mA dc, pulsed (see 4.5.1)	V _{CE(sat)6}		0.86 1.09	V dc V dc
Base-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3066	Test condition A, I _C = 10 mA dc, I _B = 1 mA dc, pulsed (see 4.5.1)	V _{BE(sat)1}		0.87 0.87	V dc V dc
Base-emitter saturated voltage 2N3724, L, 2N3724UB 2N3725, L, 2N3725UB	3066	Test condition A, I _C = 100 mA dc, I _B = 10 mA dc, pulsed (see 4.5.1)	V _{BE(sat)2}		0.99 0.99	V dc V dc
Base-emitter saturated voltage	3066	Test condition A, I _C = 300 mA dc, I _B = 30 mA dc, pulsed (see 4.5.1)	V _{BE(sat)3}		1.27	V dc
Base-emitter saturated voltage	3066	Test condition A, I _C = 500 mA dc, I _B = 50 mA dc, pulsed (see 4.5.1)	V _{BE(sat)4}	0.8	1.27	V dc
Base-emitter saturated voltage	3066	Test condition A, I _C = 800 mA dc, I _B = 80 mA dc, pulsed (see 4.5.1)	V _{BE(sat)5}		1.73	V dc
Base-emitter saturated voltage	3066	Test condition A, I _C = 1.0 A dc, I _B = 100 mA dc, pulsed (see 4.5.1)	V _{BE(sat)6}		1.96	V dc

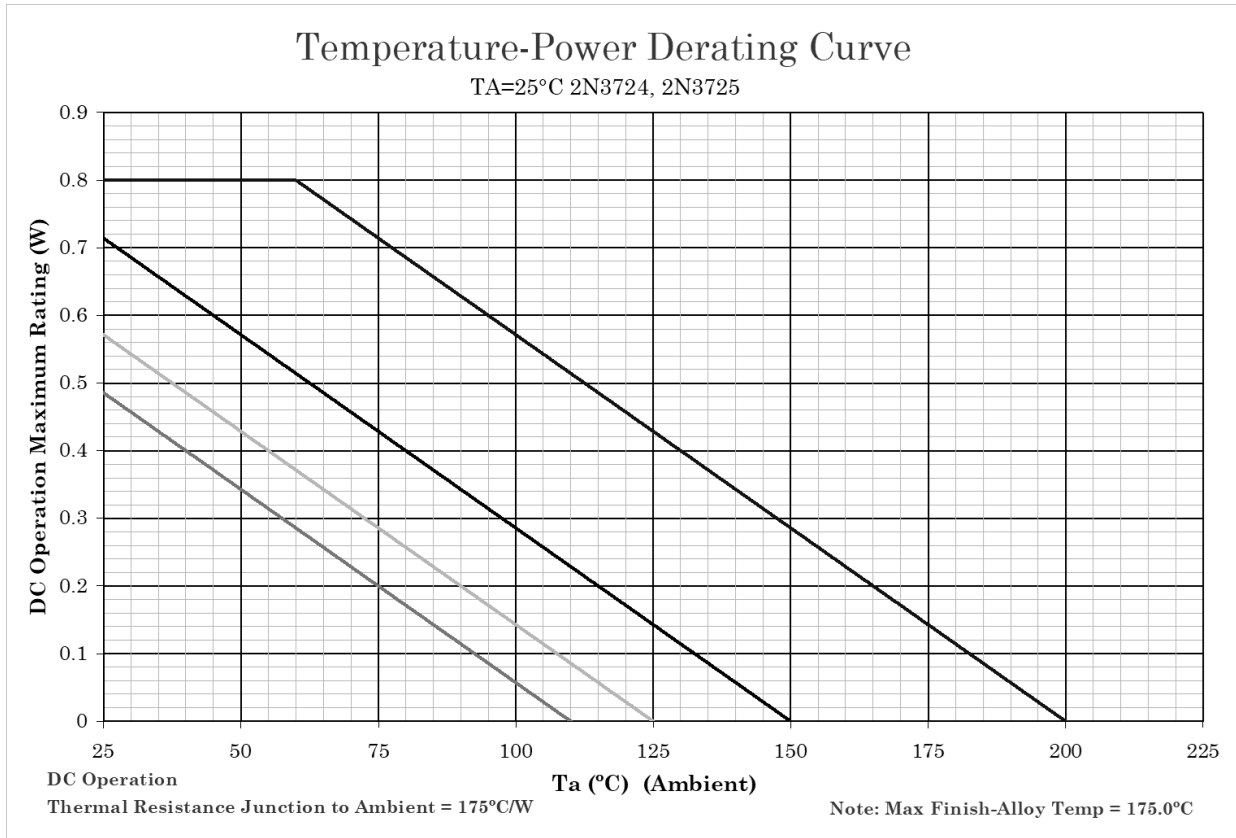
1/ For sampling plan see MIL-PRF-19500.

MIL-PRF-19500/728D
w/AMENDMENT 1

* 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 and 4.5.3 herein.	
<u>Subgroup 2</u>			45 devices c = 0
Intermittent life	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 and 4.5.3 herein.	
<u>Subgroup 4</u>			15 devices, c = 0
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). $R_{\theta JA}$, $R_{\theta JC}$ only.	
Thermal impedance curves		See MIL-PRF-19500 , table E-IX, group E, subgroup 4.	
<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.	
<u>Subgroup 12</u>			
Neutron Irradiation	1017	See 4.5.4	

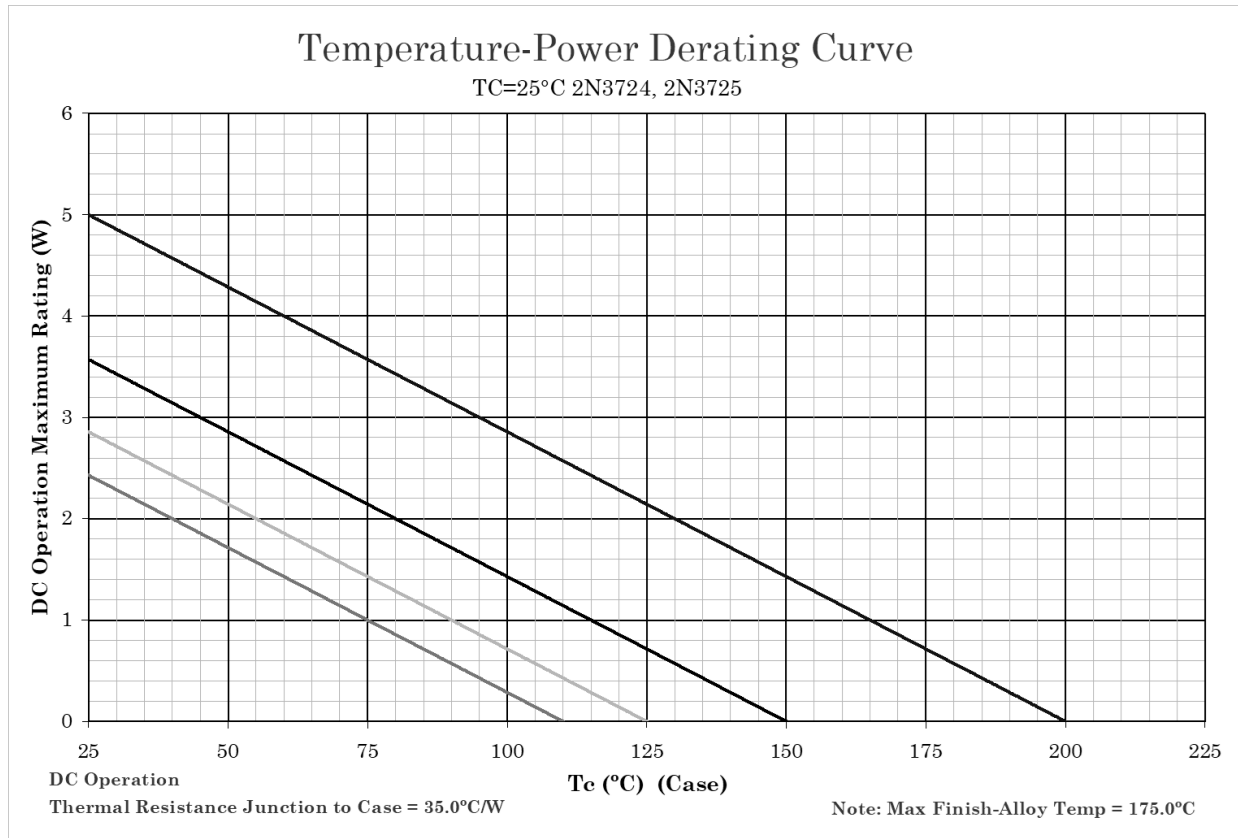
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NOTES:

1. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature ($T_J \leq 200^\circ\text{C}$) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at $T_J \leq 150^\circ\text{C}$, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at $T_J \leq 125^\circ\text{C}$, and 110°C to show power rating where most users want to limit T_J in their application.

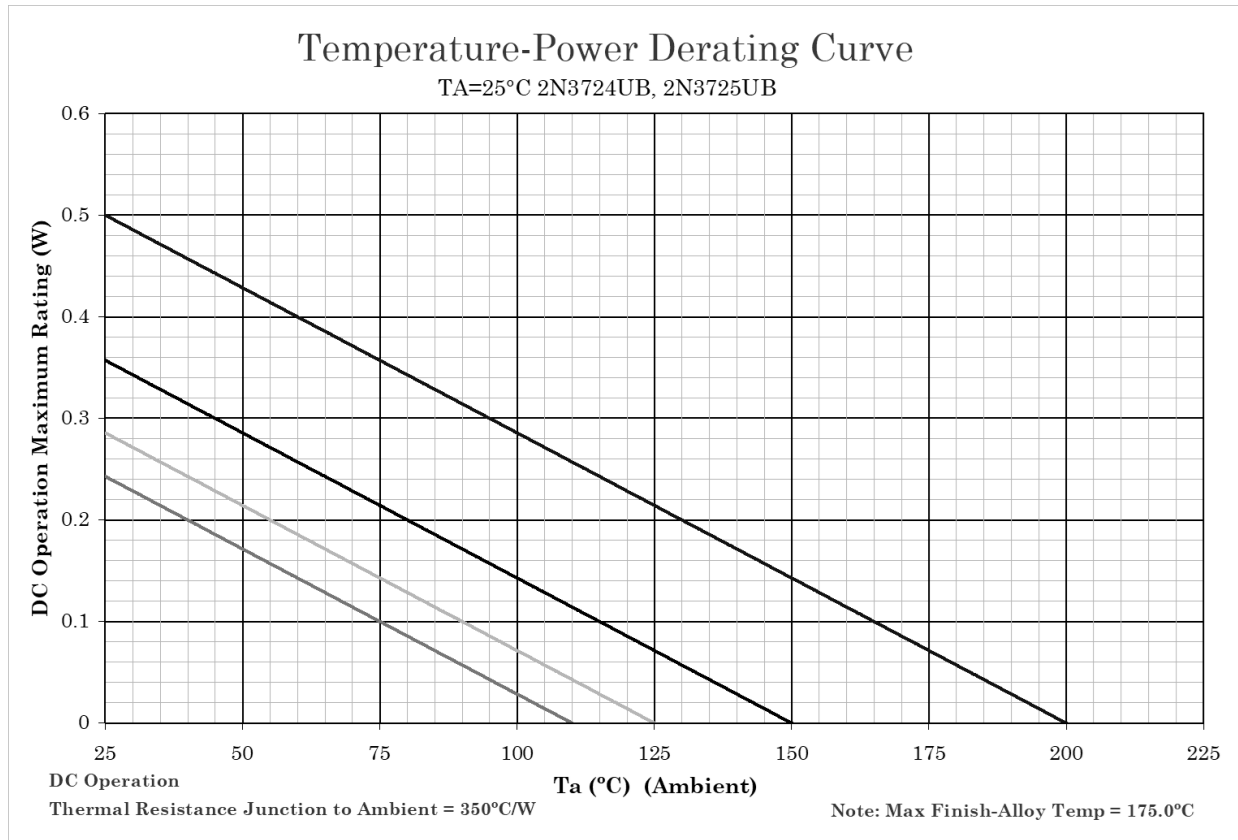
FIGURE 4. Derating for 2N3724 and 2N3725 ($R_{\theta JA}$) .125 inch (3.175 mm) PCB (TO-5 and TO-39).



NOTES:

1. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature ($T_J \leq 200^\circ\text{C}$) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at $T_J \leq 150^\circ\text{C}$, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at $T_J \leq 125^\circ\text{C}$, and 110°C to show power rating where most users want to limit T_J in their application.

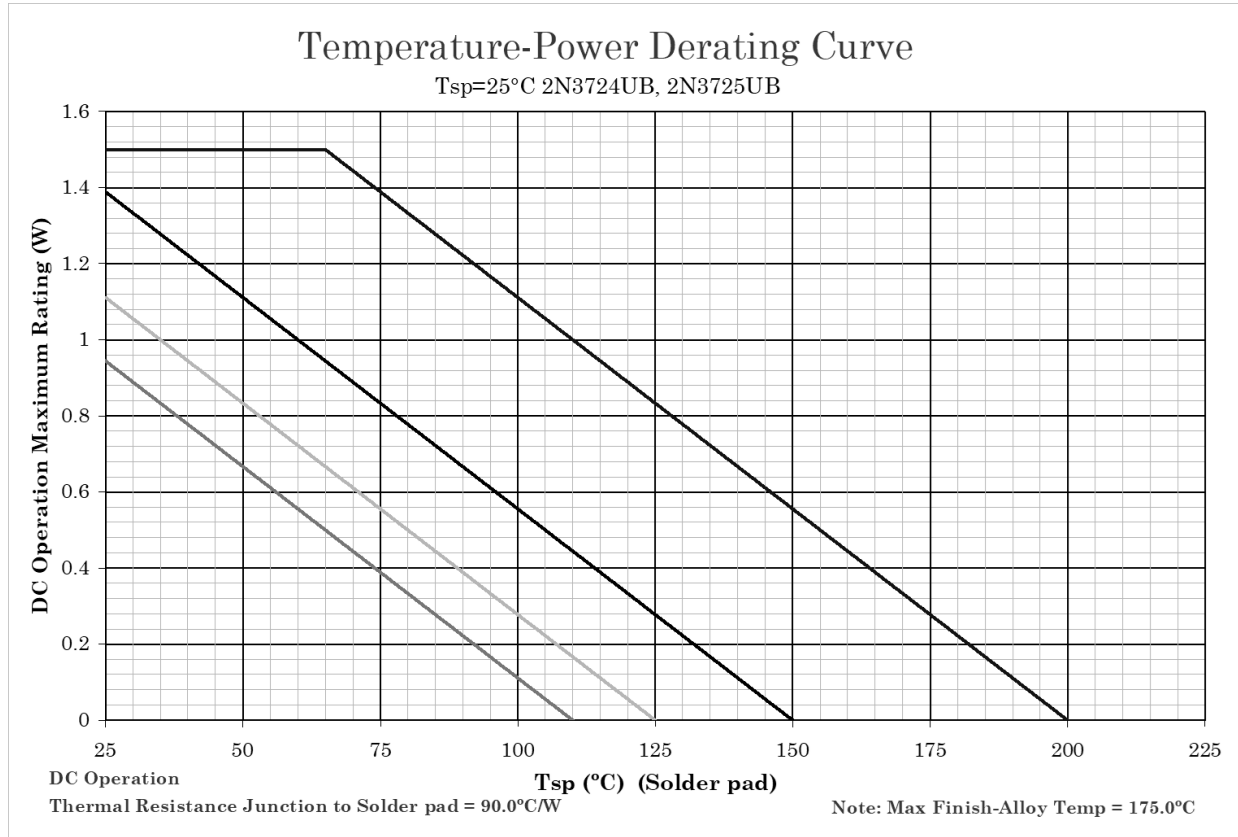
FIGURE 5. Derating for 2N3724 and 2N3725 ($R_{\theta JC}$), (TO-5 and TO-39).



NOTES:

1. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature ($T_J \leq 200^\circ\text{C}$) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at $T_J \leq 150^\circ\text{C}$, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at $T_J \leq, 125^\circ\text{C}$, and 110°C to show power rating where most users want to limit T_J in their application.

* FIGURE 6. Derating for 2N3724UB and 2N3725UB ($R_{\theta JA}$).

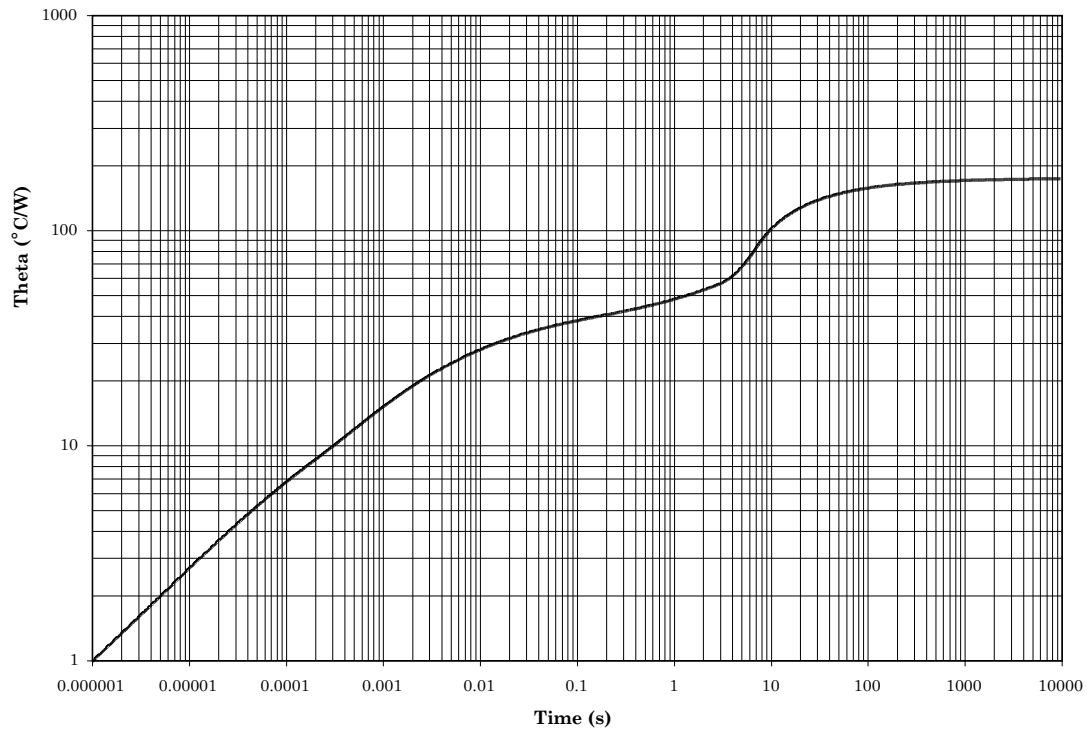


NOTES:

1. All devices are capable of operating at $\leq T_J$ specified on this curve. Any parallel line to this curve will intersect the appropriate power for the desired maximum T_J allowed.
2. Derate design curve constrained by the maximum junction temperature ($T_J \leq 200^\circ\text{C}$) and power rating specified. (See 1.3 herein.)
3. Derate design curve chosen at $T_J \leq 150^\circ\text{C}$, where the maximum temperature of electrical test is performed.
4. Derate design curves chosen at $T_J \leq, 125^\circ\text{C}$, and 110°C to show power rating where most users want to limit T_J in their application.

FIGURE 7. Derating for 2N3724UB and 2N3725UB ($R_{\theta JSP}$).

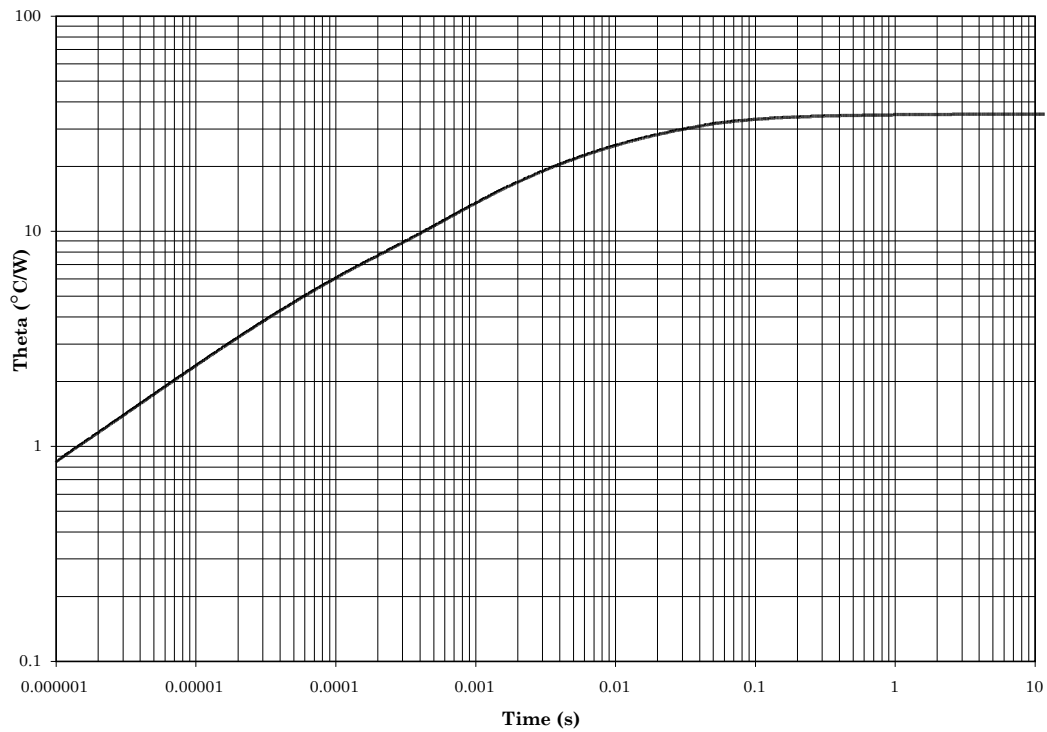
Maximum Thermal Impedance



Ambient free air cooled $T_A = +25^{\circ}\text{C}$, 800mW, Thermal Resistance $R_{\theta JA} = 175^{\circ}\text{C/W}$.

FIGURE 8. Thermal impedance graph ($R_{\theta JA}$) for 2N3724 and 2N3725 (TO-5 and TO-39).

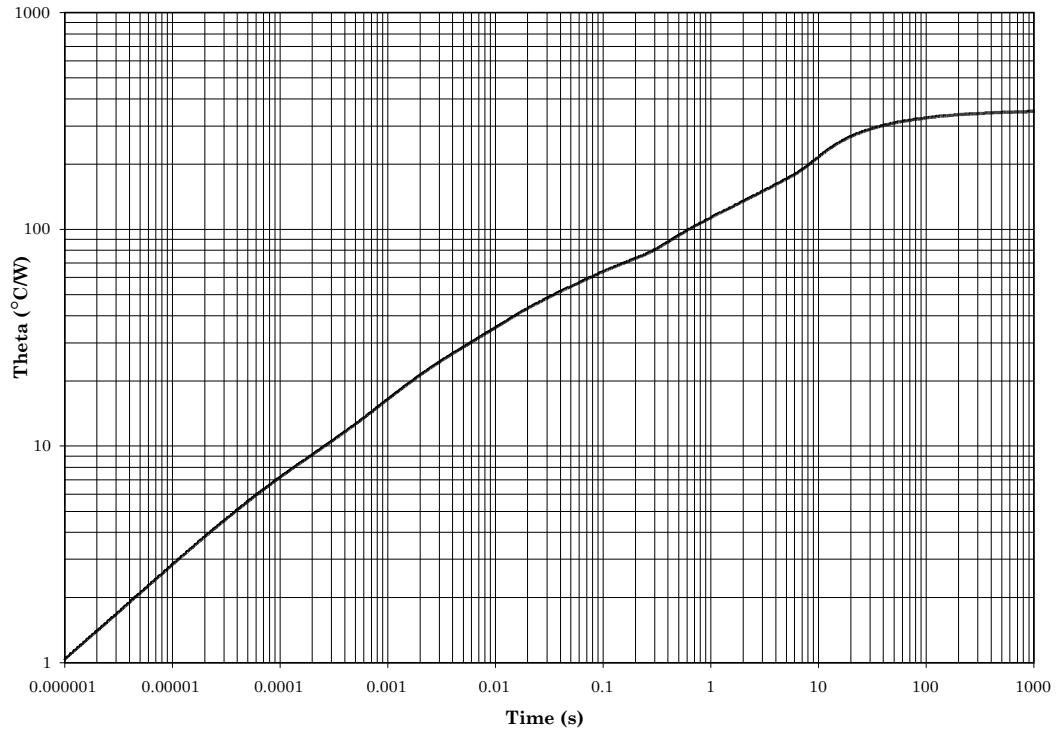
Maximum Thermal Impedance



Ambient Case Mounted $T_C = +25^{\circ}\text{C}$, Thermal resistance $R_{\theta JC} = 35^{\circ}\text{C/W}$.

FIGURE 9. Thermal impedance graph ($R_{\theta JC}$) for 2N3724 and 2N3725 (TO-5 and TO-39).

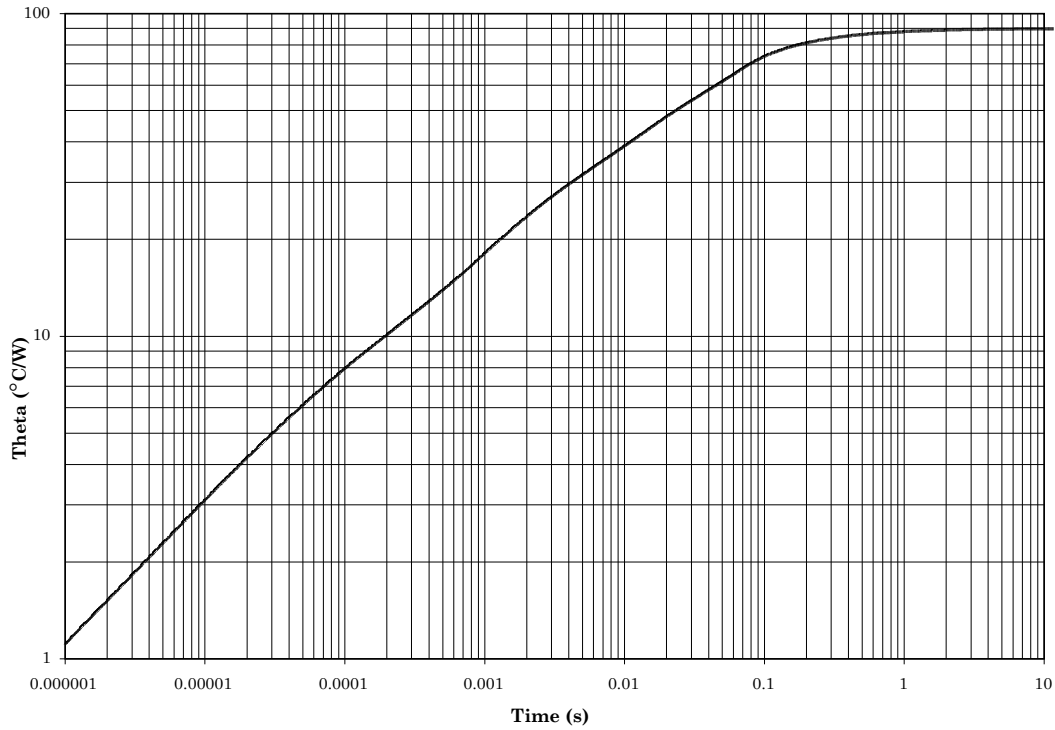
Maximum Thermal Impedance



Mounted to minimal copper clad PCB at $T_A = +25^\circ\text{C}$ (no heat sinking except air). Thermal resistance $R_{\theta JA} = 350^\circ\text{C/W}$

FIGURE 10. Thermal impedance graph ($R_{\theta JA}$) for 2N3724UB and 2N3725UB (UB).

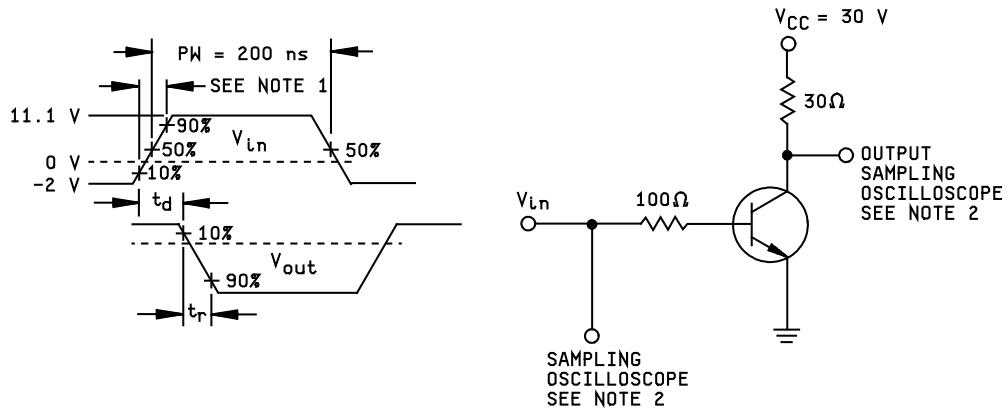
Maximum Thermal Impedance



Solder mounted to very heavy copper clad PCB at $T_{\theta JSP(IS)} = +25^{\circ}\text{C}$. Thermal Resistance $R_{\theta JSP(IS)} = 90^{\circ}\text{C/W}$

FIGURE 11. Thermal impedance graph ($R_{\theta JSP(IS)}$) for 2N3724UB and 2N3725UB (UB).

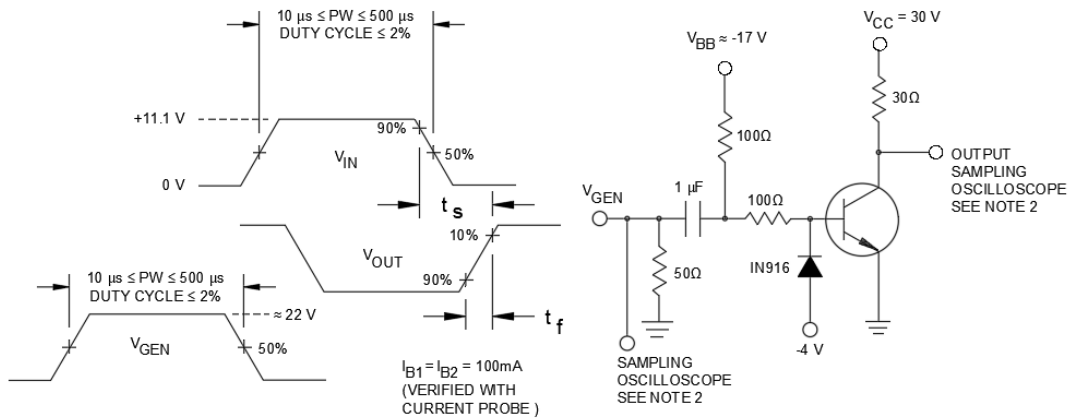
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NOTES:

1. The rise time (t_r) of the applied pulse shall be $\leq 0.1 \text{ ns}$, duty cycle ≤ 2 percent, and the generator source impedance shall be 50Ω .
2. Sampling oscilloscope: $Z_{in} \geq 100 \text{ k}\Omega$, $C_{in} \leq 12 \text{ pF}$, rise time $\leq 5 \text{ ns}$.

FIGURE 12. Test circuit and waveforms for measuring turn-on.



NOTES:

1. The rise time (t_r) of the applied pulse shall be $\leq 0.1 \text{ ns}$, duty cycle ≤ 2 percent, and the generator source impedance shall be 50Ω .
2. Sampling oscilloscope: $Z_{in} \geq 100 \text{ k}\Omega$, $C_{in} \leq 12 \text{ pF}$, rise time $\leq 5 \text{ ns}$.

* FIGURE 13. Test circuit and waveforms for measuring turn-off.

SOA Power Curve - Safe Design $T_j = 200^\circ\text{C}$ Rating

2N3725, ss728 TO-39 at $T_a = 25^\circ\text{C}$

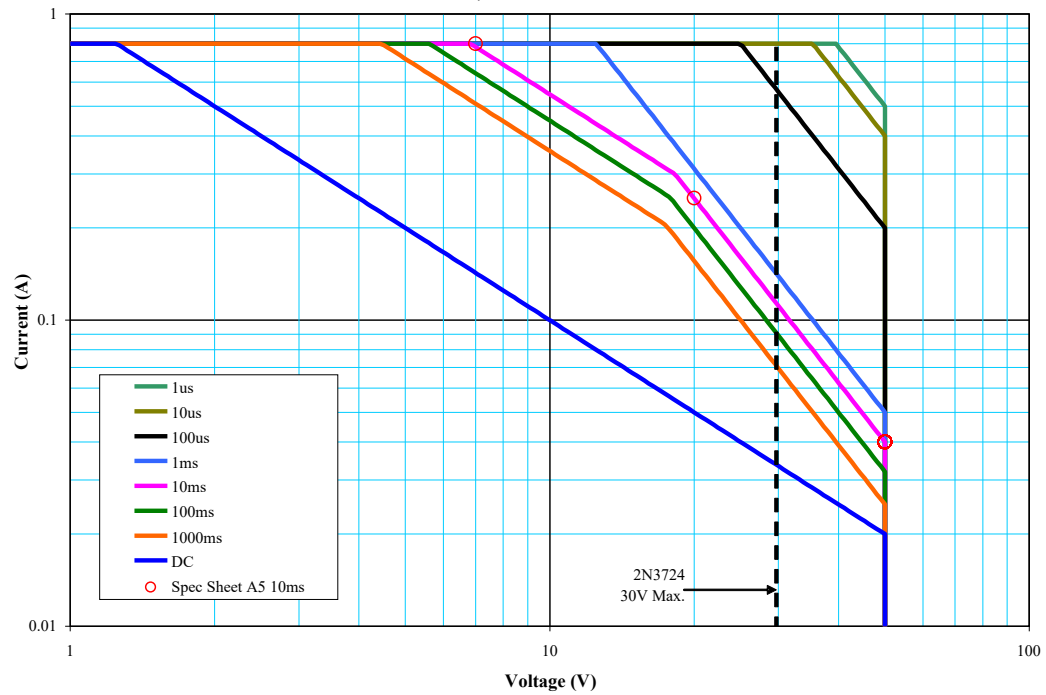


FIGURE 14. Maximum safe operating area.

SOA Power Curve - Safe Design $T_j = 200^\circ\text{C}$ Rating

2N3725, ss728 TO-39 at $T_c = 25^\circ\text{C}$

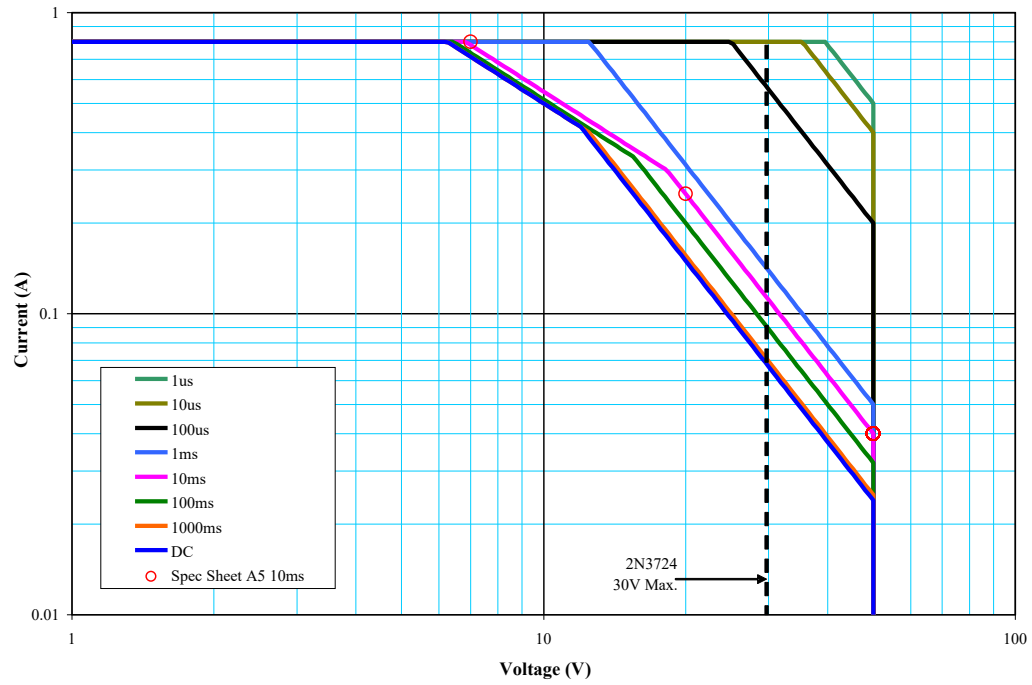


FIGURE 15. Maximum safe operating area.

SOA Power Curve - Safe Design $T_j = 200^\circ\text{C}$ Rating

2N3725UB, ss728 LCC3 UB at $T_{sp} = 25^\circ\text{C}$

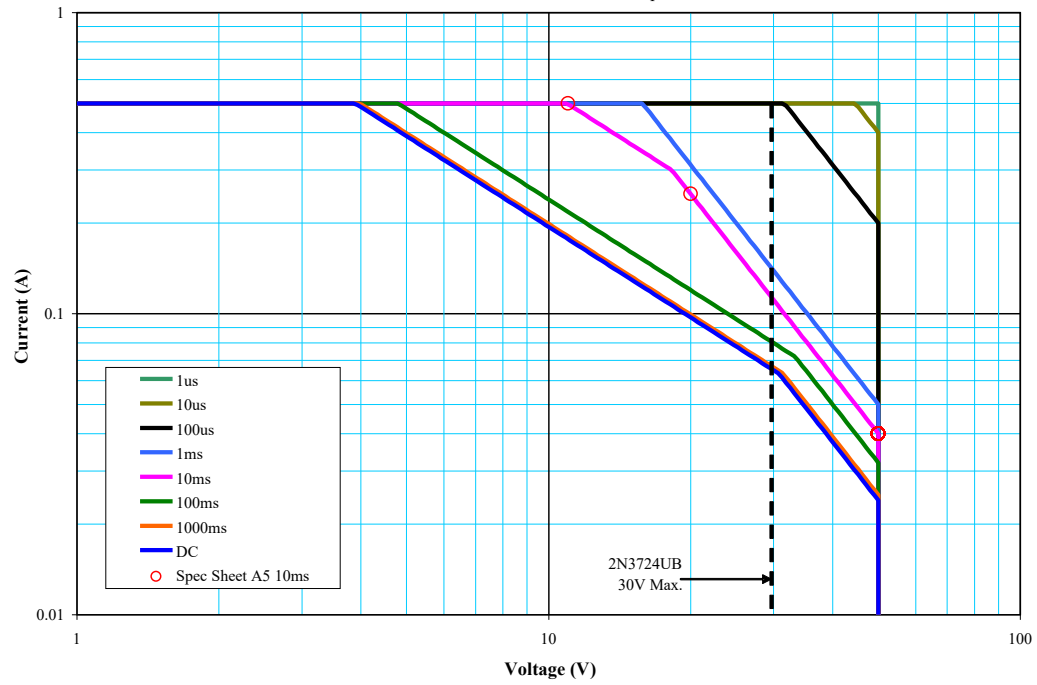


FIGURE 16. Maximum safe operating area.

SOA Power Curve - Safe Design $T_j = 200^\circ\text{C}$ Rating

2N3725UB, LCC3 UB on FR4 PCB, ss728 at $T_a = 25^\circ\text{C}$

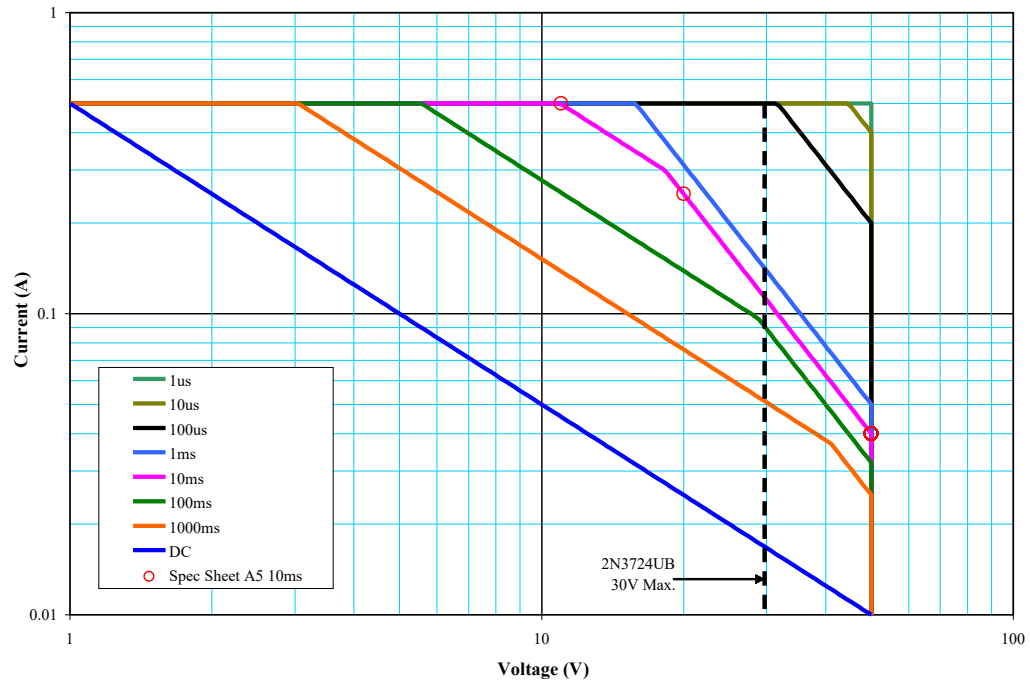


FIGURE 17. Maximum safe operating area.

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.

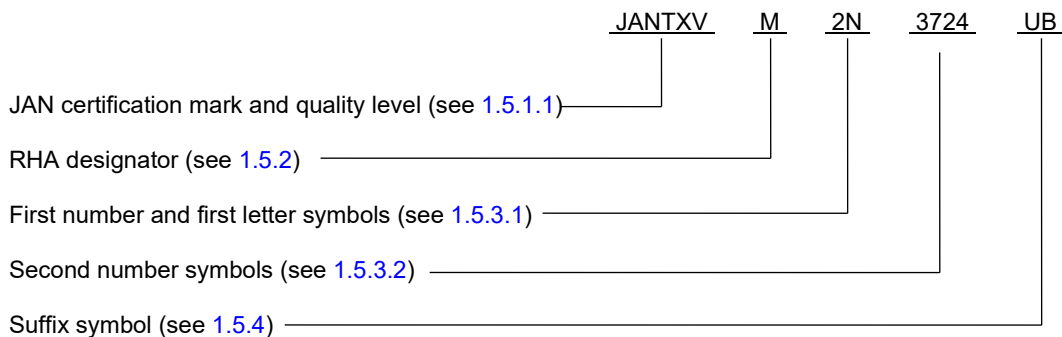
6.2 Acquisition requirements. Acquisition documents should specify the following:

- 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 1.5 and 6.4.
- e. For acquisition of RHA designed devices, [Table II](#), subgroup 1 testing of Group D is optional. If subgroup 1 testing is desired, it should 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://qpldocs.dla.mil>.

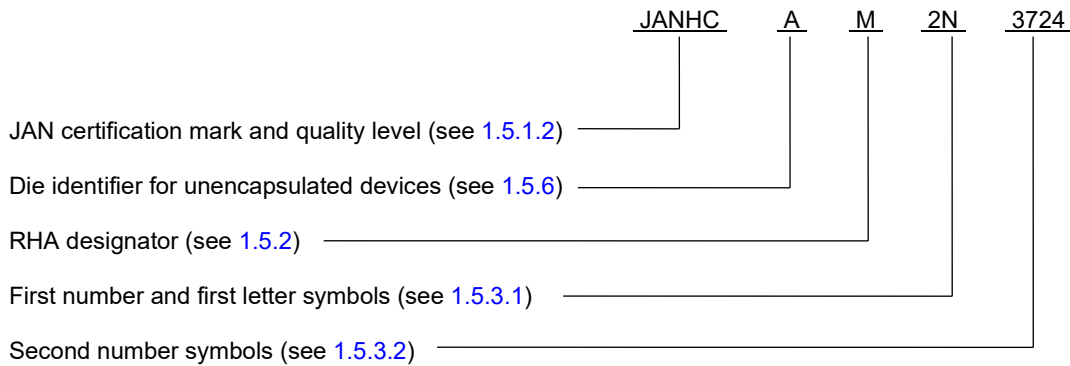
6.4 PIN construction example.

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



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6.4.2 Unencapsulated devices. The PINs for un-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.

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

PINs for types 2N3724 and 2N3725.			
JAN2N3724 JAN2N3724L JAN2N3724UB	JANTX2N3724 JANTX2N3724L JANTX2N3724UB	JANTXV2N3724 JANTXV2N3724L JANTXV2N3724UB	JANS2N3724 JANS2N3724L JANS2N3724UB
JAN2N3725 JAN2N3725L JAN2N3725UB	JANTX2N3725 JANTX2N3725L JANTX2N3725UB	JANTXV2N3725 JANTXV2N3725L JANTXV2N3725UB	JANS2N3725 JANS2N3725L JANS2N3725UB

6.5.2 List of PINs and suppliers for unencapsulated devices. The following is a list of possible PINs for unencapsulated devices available on this specification sheet.

Die ordering information (1)	
PIN	Manufacturer
	43611
2N3724	JANHCA#2N3724 JANKCA#2N3724
2N3725	JANHCA#2N3725 JANKCA#2N3725

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

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* 6.6 Amendment notations. The margins of this specification are marked with asterisks to indicate modifications generated by this amendment. 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 - SH
Air Force - 85
NASA - NA
DLA - CC

Preparing activity:
DLA - CC

(Project 5961-2024-105)

Review activities:

Air Force - 19

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>.