The documentation and process conversion measures necessary to comply with this revision shall be completed by 25 April 1998

INCH-POUND

MIL-PRF-19500/455C
25 January 1998
SUPERSEDING
MIL-S-19500/455B
19 January 1988

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, POWER SWITCHING
TYPES 2N5664, 2N5665, 2N5666, 2N5666S, 2N5667, AND 2N5667S
JAN, JANTX, JANTXV, AND JANS

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for NPN, silicon, power transistors for use in high-speed power-switching applications. Four levels of product assurance are provided for each encapsulated device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (TO-66) and figure 2 (TO-5).

1.3 Maximum ratings.

Type	P_T T_A = +25°C	P_T T_A = +100°C	V_{CBO}	V_{CEO}	V_{EBO}	I_C	I_B	T_{stg} and T_{op}
	W	W	V dc	V dc	V dc	A dc	A dc	°C
2N5664	2.5 1/	30 3/	250	200	6	5	1	-65 to +200
2N5665	2.5 1/	30 3/	400	300	6	5	1	-65 to +200
2N5666, S	1.2 2	15 4/	250	200	6	5	1	-65 to +200
2N5667, S	1.2 2/	15 4/	400	300	6	5	1	-65 to +200

1/ Derate linearly 14.3 mW/°C for T_A > + 25°C.

2/ Derate linearly 6.9 mW/°C for T_A > + 25°C.

3/ Derate linearly 300 mW/°C for T_C > + 100°C .

4/ Derate linearly 150 mW/°C for T_C > +100°C .

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, Columbus, OH 43216-5000, by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

1.4 Primary electrical characteristics at T_A = 25°C.

Limits	h_{FE} V_{CE} = 5 V I_C = 1 A		$\|h_{fe}\|$ V_{CE} = 5 V I_C = 0.5 A dc f = 10 MHz	$V_{BE(sat)}$ I_C = 3 A dc 1/	$V_{CE(sat)}$ I_C = 3 A dc 1/	Pulse response		
						t_{on} I_C = 1 A dc	t_{off} I_C = 1 A dc	
	2N5665 2N5667, S	2N5664 2N5666, S					2N5664 2N5666, S	2N5665 2N5667, S
				V dc	V dc	µ s	µ s	µ s
Min	25	40	2.0					
Max	75	120	7.0	1.2	0.4	0.25	1.5	2.0

1/ I_B = 0.3 A dc for 2N5664, 2N5666, 2N5666S; I_B = 0.6 A dc for 2N5665, 2N5667, 2N5667S.

Type	$R_{\theta JC}$
	°C/W (max)
2N5664, 2N5665	3.3
2N5666, 2N5667	6.7
2N5666S, 2N5667S	6.7

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 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 listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation (see 6.2).

SPECIFICATION

DEPARTMENT OF DEFENSE

MIL-PRF-19500 - Semiconductor Devices, General Specification for.

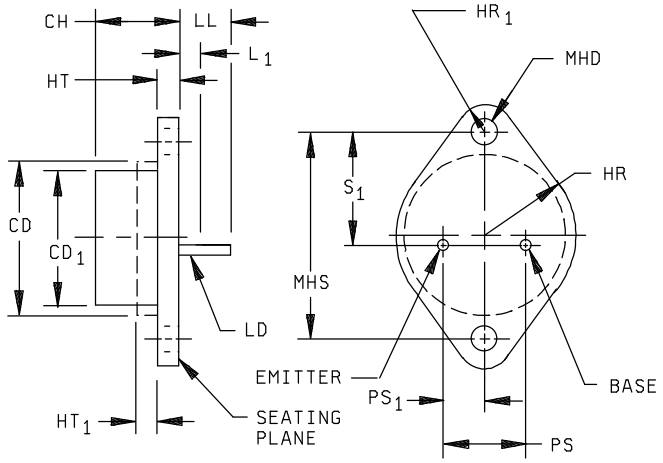
STANDARD

MILITARY

MIL-STD-750 - Test Methods for Semiconductor Devices.

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

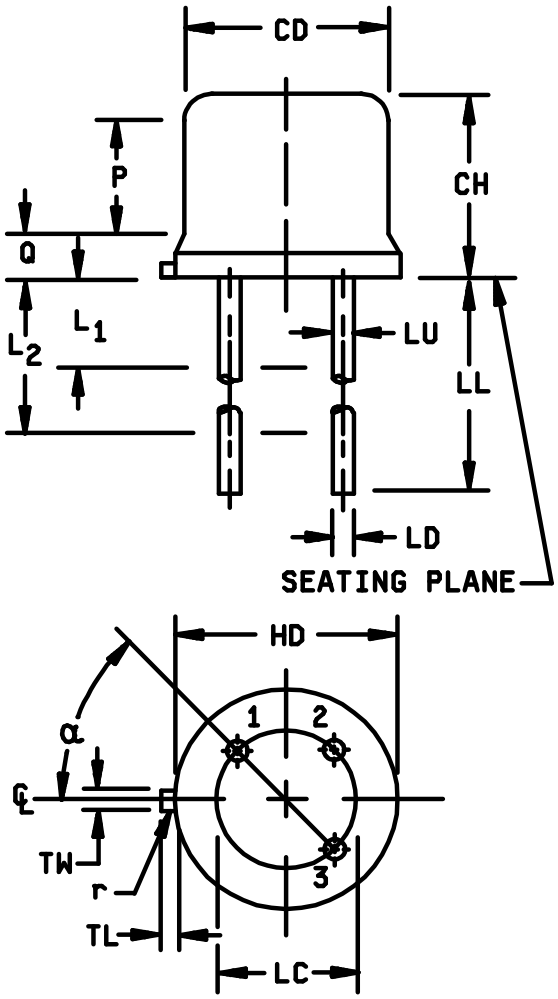
2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein (except for related associated specifications or specification sheets), the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	- - -	.620	- - -	15.75	3
CD_1	.470	.500	11.94	12.70	
CH	.250	.340	6.35	8.64	3
HR	- - -	.350	- - -	8.89	6
HR_1	.115	.145	2.92	3.68	
HT	.050	.075	1.27	1.91	3
HT_1	- - -	.050	- - -	1.27	3
LD	.028	.034	.711	.863	5, 9
LL	.360	.500	9.14	12.70	5, 9
L_1	- - -	.050	- - -	1.27	4
MHD	.142	.152	3.62	3.86	7
MHS	.958	.962	24.33	24.43	
PS	.190	.210	4.83	5.33	4
PS_1	.093	.107	2.36	2.72	4
S_1	.570	.590	14.48	14.99	

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Body contour is optional within zone defined by LD AND CD.
4. These dimensions should be measured at points .050 inch (1.27 mm) to .055 inch (1.40 mm) below seating plane. When gauge is not used, measurement will be made at seating plane.
5. Both terminals.
6. At both ends.
7. Two holes.
8. The collector shall be electrically connected to the case.
9. LD applies between L_1 and LL. Diameter is uncontrolled in L_1.

FIGURE 1. Physical dimensions of transistor types 2N5664 and 2N5665.

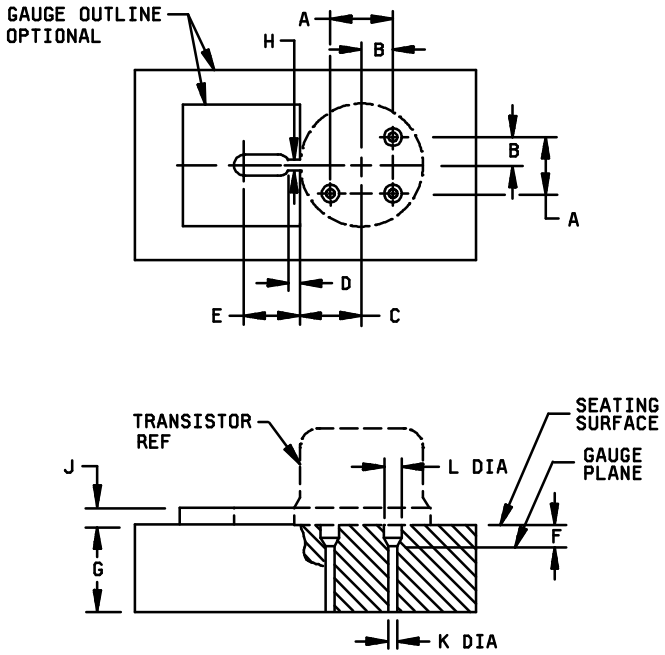


Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CD	.305	.335	7.75	8.51	
CH	.240	.260	6.10	6.60	
HD	.335	.370	8.51	9.40	
LC	.1414 Nom		3.59 Nom		6
LD	.016	.021	0.41	0.53	3
LL	See notes 13 and 14				
L_1	- - -	.050	- - -	1.27	10
LU	.016	.019	0.41	0.48	4
P	.100	- - -	2.54	- - -	5
Q					6
r	- - -	.007	- - -	0.18	
TL	.029	.045	0.74	1.14	
TW	0.28	.034	0.71	0.86	

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Measured in the zone beyond .250 inches (6.35 mm) from the seating plane.
4. Measured in the zone .050 inches (1.27 mm) and .250 inches (6.35 mm) from the seating plane.
5. Variations on dimension CD in this zone shall not exceed .010 inches (0.25 mm).
6. Outline in this zone is not controlled.
7. When measured in a gauging plane .054 inches +.001, -.000 (1.37 mm +.03, -.00) below the seating plane of the transistor, maximum diameter leads shall be within .007 inches (.18 mm) of their true location relative to a maximum width tab. Smaller diameter leads shall fall within the outline of the maximum diameter lead tolerance. Figure 3 shows the preferred measured method.
8. The collector shall be electrically connected to the case.
9. Measured from the maximum diameter of the actual device.
10. All three leads
11. Diameter of leads in this zone is not controlled.
12. Lead 1 - Emitter; lead 2 - Base, lead 3 - Collector.
13. For transistor types 2N5666 and 2N5667, LL is 1.500 inches (38.1 mm) minimum and 1.75 inches (44.45 mm) maximum.
14. For transistor types 2N5666S and 2N5667S, LL is .500 inches (12.7 mm) minimum and .75 inches (19.05 mm) maximum.

FIGURE 2. Physical dimensions of transistor types 2N5666, 2N5666S, 2N5667 and 2N5667S.

Ltr	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.1409	.1419	3.579	3.604
B	.0702	.0712	1.783	1.809
C	.182	.199	4.62	5.05
D	.009	.011	0.23	0.28
E	.125 Nom		3.18 Nom	
F	.054	.055	1.37	1.40
G	.372	.378	9.45	9.60
H	.0350	.0355	0.889	0.902
J	.150 Nom		3.81 Nom	
K	.0325	.0335	0.826	0.851
L	.0595	.0605	1.511	1.537



NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. The following gauging procedures shall be used: The use of a pin straightener prior to insertion in the gauge is permissible. The device being measured shall be inserted until its seating plane is .125 inch (3.18 mm) +.010 inch (0.254 mm) from the seating surface of the gauge. A spacer may be used to obtain the .125 inch (3.18 mm) distance from the gauge seat prior to force application. A force of 8 **"**.5 ounces shall then be applied parallel and symmetrical to the device's cylindrical axis. When examined visually after the force application (the force need not be removed) the seating plane of the device shall be seated against the gauge.
4. The location of the tab locator, within the limits of dimension C, will be determined by the tab and flange dimension of the device being checked.

FIGURE 3. Gauge for lead and tab location for device types 2N5666, 2N5666S, 2N5667 and 2N5667S.

3. REQUIREMENTS

3.1 Qualification. Devices furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list before contract award (see 4.2 and 6.3).

3.2 Associated specification. The individual item performance requirements shall be in accordance with MIL-PRF-19500, and as specified herein.

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500 and herein.

3.4 Interface requirements and physical dimensions. The interface requirements and physical dimensions shall be as specified in MIL-PRF-19500 and on figures 1 and 2 herein.

3.4.1 Lead finish. Lead finish shall be solderable in accordance with MIL-PRF-19500. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500.

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

3.7 Electrical test requirements. The electrical test requirements shall be the subgroups specified in 4.4.2 and 4.4.3 herein.

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).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500.

4.3 Screening (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with MIL-PRF-19500 (Appendix E, table IV), and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see appendix E, table IV of MIL-PRF-19500	Measurement	
	JANS level	JANTX and JANTXV levels
9	I_{CES1} and h_{FE2}	I_{CES1}
11	ΔI_{CES1} and h_{FE2}; ΔI_{CES1} = 100 percent of initial value or 10 nA dc, whichever is greater; Δh_{FE2} = ± 15 percent	I_{CES1} and h_{FE2}; ΔI_{CES1} = 100 percent of initial value or 20 nA dc, whichever is greater.
12	See 4.3.1	See 4.3.1
13	Subgroup 2 of table I herein; ΔI_{CES1} = +100 percent of initial value or 10 nA dc, whichever is greater. Δh_{FE2} = ± 15 percent	Subgroup 2 of table I herein; ΔI_{CES1} = +100 percent of initial value or 20 nA dc, whichever is greater. Δh_{FE2} = ± 25 percent

4.3.1 Power burn-in conditions. Power burn-in conditions are as follows:

T_J = + 187.5 ± 12.5°C, V_{CE} = 100 V dc, $T_A \leq$ + 100°C.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with appendix E, table V of MIL-PRF-19500 and table I herein. Endpoint electrical measurements shall be in accordance with the applicable steps of table II herein

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with conditions specified for the subgroup testing in appendix E, table VIa (JANS) and table VIb (JAN, JANTX, and JANTXV) of MIL-PRF-19500, and as follows. Electrical measurements (end points) and delta requirements shall be in accordance with the applicable steps of table II herein.

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

Subgroup	Method	Condition
B4	1037	V_{CB} = 30 V dc minimum, P_T = 1.2 W (TO-5),. P_T = 2.5 W (TO-66) minimum, T_A = +25°C ± 3°C; t_{on} = t_{off} = 3 minutes minimum for 2,000 cycles. No heat sink or forced-air cooling on devices shall be permitted.
B5	1027	See 4.5.4.
B6	3131	See 4.5.2.

4.4.2.2 Group B inspection, appendix E, table VIb (JANTX and JANTXV) of MIL-PRF-19500.

Subgroup	Method	Condition
B3	1027	T_J = +187.5°C ± 12.5°C, V_{CE} = 100 ± 5 V dc; T_A = ≤ +100°C.
B5	3131	See 4.5.2.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table VII of MIL-PRF-19500 and as follows. Electrical measurements (endpoints) and delta requirements shall be in accordance with the applicable steps of Table II herein.

Subgroup	Method	Condition
C2	2036	Terminal strength (tension) 2N5664 and 2N5665 only: Test condition A, weight = 3 pounds, application time = 15 seconds. Terminal strength (lead fatigue) 2N5666, 2N5666S, 2N5667 and 2N5667S: Test condition E.
C6	1027	2N5664, 2N5666 and 2N5666S, T_C = +100 °C; P_T = 30 W; V_{CE} = 30 V dc. 2N5665, 2N5667 and 2N5667S, T_A = +25°C; P_T = 1.2 W; V_{CE} = 40 V.

4.5 Methods of examination and test. Methods of examination and test shall be as specified in the appropriate tables and as follows:

4.5.1 Pulse measurements. Conditions for pulse measurements shall be as specified in Section 4 of MIL-STD-750.

4.5.2 Thermal resistance. Thermal resistance measurements shall be conducted in accordance with method 3131 of MIL-STD-750. The following details shall apply:

a. Collector current magnitude during power application:

   2N5664 and 2N5665, 0.833 A dc.

   2N5666, 2N5666S, 2N5667 and 2N5667S, 0.41 A dc.

b. Collector to emitter voltage magnitude shall be 20 V dc.

c. Reference temperature measuring point shall be the case.

d. Reference temperature measuring point shall be 25°C ≤ T_R ≤ 75°C and recorded before the test is started.

e. Mounting arrangement shall be with heat sink to header.

f. Maximum limit of $R_{\theta JC}$: 2N5664 and 2N5665 shall be 3.3°C/W; 2N5666, 2N5666S, 2N5667 and 2N5667S shall be 6.7°C/W.

4.5.3 Inspection conditions. Unless otherwise specified herein, all inspections shall be conducted at a case temperature (T_C) of 25°C.

4.5.4 Group B accelerated life test. This test shall be conducted using one of the three options listed herein (a, b, or c) with the following conditions applying to all options: V_{CB} = 30 V dc, 96 hours minimum, T_J = +275°C.

a. T_A = +150°C, maximum.

b. P_T = 2.5 W (TO-66); P_T = 1.2 W (TO-5), T_A = +112°C or P_T adjusted to give a lot average of T_J = +275°C.

c. T_A = +25°C +3 °C with P_T adjusted to give a lot average of T_J = +275°C.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 1						
Visual and mechanical inspection	2071					
Subgroup 2						
Breakdown voltage collector to emitter	3011	Bias condition B; I_C = 10 mA dc pulsed (see 4.5.1), R_1 = 100Ω	$V_{(BR)CER}$			V dc
2N5664, 2N5666, 2N5666S				250		
2N5665, 2N5667, 2N5667S				400		
Breakdown voltage emitter to base	3026	Bias condition D, I_E = 10 μA dc; pulsed (see 4.5.1)	$V_{(BR)EBO}$	6		V dc
Collector to emitter cutoff current	3041	Bias condition C	I_{CES1}		0.2	μA dc
2N5664, 2N5666, 2N5666S		V_{CE} = 200 V dc				
2N5665, 2N5667, 2N5667S		V_{CE} = 300 V dc				
Collector to base cutoff current	3036	Bias condition D	I_{CBO}			μA dc
2N5664, 2N5666, Sn5666S		V_{CB} = 200 V dc			0.1	μA dc
2N5664, 2N5666, 2N5666S		V_{CB} = 250 V dc			1.0	mA dc
2N5665, 2N5667, 2N5667S		V_{CB} = 300 V dc			0.1	μA dc
2N5665, 2N5667, 2N5667S		V_{CB} = 400 V dc			1.0	mA dc
Forward-current transfer ratio	3076	V_{CE} = 2 V dc, I_C = 0.5 A dc pulsed (see 4.5.1)	h_{FE1}			
2N5664, 2N5666, 2N5666S				40		
2N5665, 2N5667, 2N5667S				25		
Forward-current transfer ratio	3076	V_{CE} = 5 V dc, I_C = 1.0 A dc pulsed (see 4.5.1)	h_{FE2}			
2N5664, 2N5666, 2N5666S				40	120	
2N5665, 2N5667, 2N5667S				25	75	
Forward-current transfer ratio	3076	V_{CE} = 5 V dc, I_C = 3.0 A dc	h_{FE3}			
2N5664, 2N5666, 2N5666S				15		
2N5665, 2N5667, 2N5667S				10		

See footnote 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						
Forward-current transfer ratio	3076	V_{CE} = 5 V dc, I_C = 5 A dc pulsed (see 4.5.1)	h_{FE4}	5		
Collector-emitter saturation voltage	3071	I_C = 3.0 A dc,	$V_{CE(sat)1}$		0.4	V dc
2N5664, 2N5666, 2N2666S		I_B = 0.3 A dc, pulsed (see 4.5.1)				
2N5665, 2N2667, 2N5667S		I_B = 0.6 A dc, pulsed (see 4.5.1)				
Collector-emitter saturation voltage	3071	I_C = 5 A dc, I_B = 1 A dc pulsed (see 4.5.1)	$V_{CE(sat)2}$ 2/		1.0	V dc
Base-emitter saturation voltage	3066	Test condition A, I_C = 3.0 A dc,	$V_{BE(sat)1}$ 2/		1.2	V dc
2N5664, 2N5666, 2N2666S		I_B = 0.3 A dc, pulsed (see 4.5.1)				
2N5665, 2N2667, 2N5667S		I_B = 0.6 A dc, pulsed (see 4.5.1)				
Base-emitter saturation voltage	3066	Test condition A, I_C = 5 A dc, I_B = 1 A dc, pulsed (see 4.5.1)	$V_{BE(sat)2}$		1.5	V dc
Subgroup 3						
High-temperature operation:		T_A = + 150°C				
Collector to emitter cutoff current	3041	Bias condition C	I_{CES2}		100	µA dc
2N5664, 2N5666, 2N2666S		V_{CE} = 200 V dc				
2N5665, 2N2667, 2N5667S		V_{CE} = 300 V dc				
Low-temperature operation		T_A = -55°C				
Forward-current transfer ratio	3076	V_{CE} = 5 V dc, I_C = 1.0 A dc pulsed (see 4.5.1)	h_{FE5}			
2N5664, 2N5666, 2N2666S				15		
2N5665, 2N2667, 2N5667S				10		

See footnote at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Conditions		Min	Max	
Subgroup 4						
Magnitude of common-emitter, small-signal short-circuit, forward-current, transfer ratio	3306	V_{CE} = 5 V dc, I_C = 0.5 A dc f = 10 MHz	$\lvert h_{fe} \rvert$	2.0	7.0	
Open-circuit output capacitance	3236	V_{CB} = 10 V dc, 100 ≤ f ≤ 1 MHz	C_{obo}		120	pF
Switching time						
Turn-on time		Test condition A; I_C = 1.0 A dc, V_{CC} = 100 V dc	t_{on}		0.25	µs
2N5664, 2N5666, 2N5666S 2N5665, 2N5667, 2N5667S		See figure 4 See figure 5				
Turn-off time		Test condition A; I_C = 1.0 A dc, V_{CC} = 100 V dc	t_{off}			µs
2N5664, 2N5666, 2N5666S 2N5665, 2N5667, 2N5667S		See figure 4 See figure 5			1.5 2.0	
Subgroup 5						
Safe operating area (continuous dc) (for types 2N5664 and 2N5665 only)	3051	T_C = + 100°C, t ≥ 1 s, 1 cycle; $t_r + t_f$ = 10 µs (se figure 6)				
Test #1 2N5664 and 2N5665		V_{CE} = 6 V dc, I_C = 5 A dc				
Test #2 2N5664 and 2N5665		V_{CE} = 40 V dc, I_C = 0.75 A dc				
Test #3 2N5664		V_{CE} = 200 V dc, I_C = 43 mA dc				
Test #4 2N5665		V_{CE} = 300 V dc, I_C = 21 mA dc				

See footnote 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						
Safe operating area (continuous dc) (for types 2N5666, 2N5666S, 2N5667, and 2N5667S	3051	T_C = + 100°C, t ≥ 1 s, 1 cycle; $t_r + t_f$ = 10 μs (see figure 7)				
Test #1 2N5666, 2N5666S, 2N5667, and 2N5667S		V_{CE} = 3.0 V dc, I_C = 5 A dc				
Test #2 2N5666, 2N5666S, 2N5667, and 2N5667S		V_{CE} = 37.5 V dc, I_C = 0.4 A dc				
Test #3 2N5666 and 2N5666S		V_{CE} = 200 V dc, I_C = 27 mA dc				
Test #4 2N5667 and 2N5667S		V_{CE} = 300 V dc, I_C = 14 mA dc				
Safe operating area (switching)	3053	Load condition B (clamped inductive load) (see figure 8); T_C = + 100°C, $t_r + t_f \leq$ 10 μs, duty cycle ≤ 2 percent; t_p = 4 ms; R_S = 0.5 Ω, R_{BB1} = 50 Ω, V_{BB1} = 50 V dc R_{BB2} = 50 Ω, V_{BB2} = -4 V dc I_C = 5 A dc, V_{CC} = 50 V dc $R_L \leq$ 2.5 Ω, L = 40 mH (Triad C-48U or equivalent)				
2N5664 2N5666 and 2N5666S		Clamp voltage = 200 +0, -5 V dc				
2N5665 2N5667 and 2N5667S		Clamp voltage = 300 +0, -5 V dc				
End-point electrical measurements		See table II, steps 1 and 4				
Subgroups 6 and 7						
Not applicable						

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

TABLE II. Groups B and C electrical measurements. 3/ 4/ 5/

Steps	Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
		Method	Conditions		Min	Max	
1.	Collector to emitter cutoff current	3041	Bias condition C	I_{CES1}			
	2N5664 2N5666, 2N5666S		V_{CE} = 200 V dc			0.2	μA dc
	2N5665 2N5667, 2N5667S		V_{CE} = 300 V dc			0.2	μA dc
2.	Collector to emitter voltage (saturated)	3071	I_C = 5 A dc; I_B = 1 A dc (pulsed, see 4.5.1) 2/	$V_{CE(sat)2}$		1.0	V dc
3.	Base to emitter saturation voltage	3066	Test condition A, I_C = 5 A dc I_B = 1 A dc, pulsed (see 4.5.1) 2/	$V_{BE(sat)2}$		1.5	V dc
4.	Forward-current transfer ratio	3076	V_{CE} = 5 V dc, I_C = 1.0 A dc pulsed (see 4.5.1)	h_{FE2}			
	2N5664 2N5666, 2N5666S				40	120	
	2N5665 2N5667, 2N5667S				25	75	
5.	Collector to emitter cutoff current	3041	Base condition C	ΔI_{CES1}	100 percent of initial value or 20 nA dc, whichever is greater.		
	2N5664 2N5666, 2N5666S		V_{CE} = 200 V dc				
	2N5665 2N5667, 2N5667S		V_{CE} = 300 V dc				
6.	Forward-current transfer ratio	3076	V_{CE} = 5 V dc, I_C = 1.0 A dc pulsed (see 4.5.1)	Δh_{FE2} 2/	± 25 percent change from initial reading.		

1/ See MIL-PRF-19500 for sampling plan.

2/ Measured at less than 0.125 in (3.175 mm) from case.

3/ The electrical measurements for appendix E, table VIa (JANS) of MIL-PRF-19500 are as follows:

a. Subgroup 3, see table II herein, steps 1, 2, 3, and 4.

b. Subgroup 4, see table II herein, steps 1, 2, 3, and 4.

c. Subgroup 5, see table II herein, steps 1, 2, 3, and 4.

TABLE II. Groups B and C electrical measurements - Continued.

4/ The electrical measurements for appendix E, table VIb (JANTX and JANTXV) of MIL-PRF-19500 are as follows:

a. Subgroup 2, see table II herein, steps 1 and 3.

b. Subgroup 3, see table II herein, steps 1, 2, 3, 4, 5, and 6.

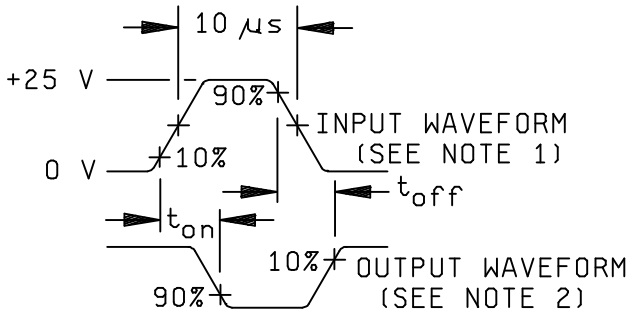
c. Subgroup 6, see table II herein, steps 1, 4, 5, and 6.

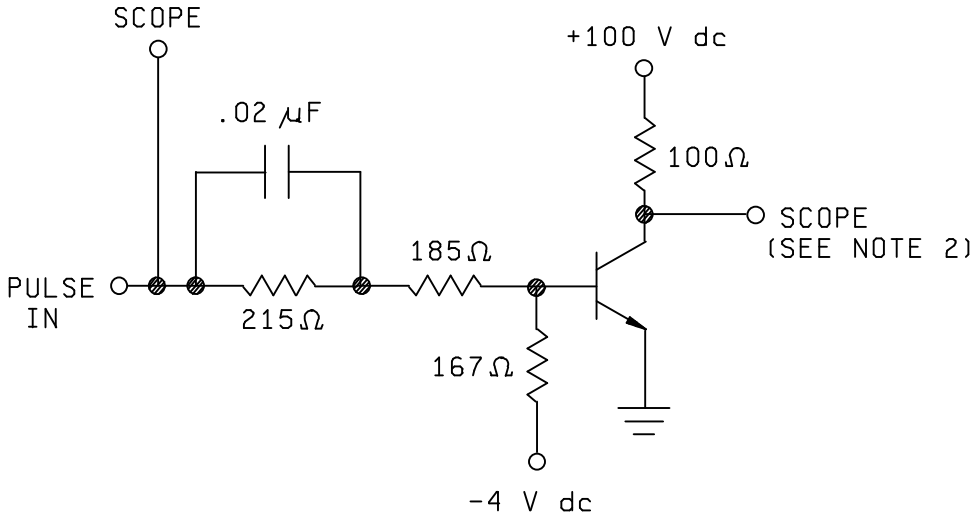
5/ The electrical measurements for appendix E, table VII of MIL-PRF-19500 are as follows:

a. Subgroup 2, see table II herein, steps 1, 2, and 4.

b. Subgroup 3, see table II herein, steps 1, 2, and 4.

c. Subgroup 6, see table II herein, steps 1, 2, 3, 4, 5, and 6.

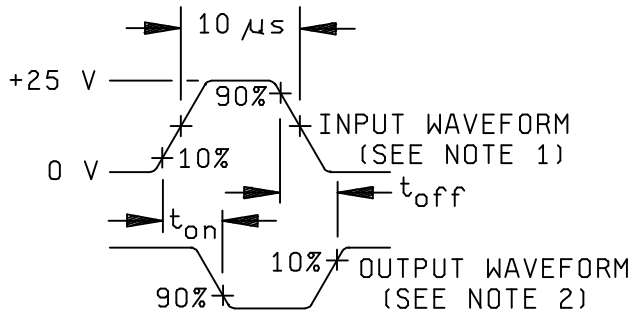


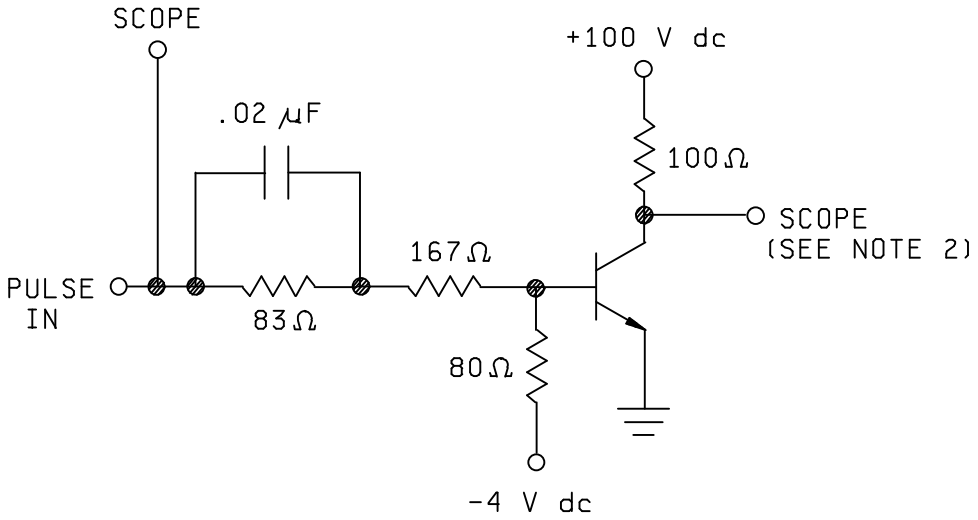


NOTES:

1. The input waveform is supplied by a pulse generator with the following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, Z_{out} = 50 ohm, PW = 10 µs, duty cycle ≤ 2 percent.
2. Output waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $Z_{in} \geq 10$ M Ω, $C_{in} \leq 11.5$ pF.
3. Resistors shall be noninductive types.
4. The dc power supplies may require additional bypassing in order to minimize ringing.
5. The input pulse voltages and supply voltages (-4 V dc and + 100 V dc) are nominal and shall be adjusted to obtain $I_{B1} = -I_{B2} = 30$ mA and $I_C = 1$ A.
6. An equivalent circuit may be used.
7. 0.02 µF capacitor may be removed during voltage adjustments.

FIGURE 4. Pulse response test circuit for types 2N5664, 2N5666 and 2N5666S.





NOTES:

1. The input waveform is supplied by a pulse generator with the following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, $Z_{out} = 50$ ohm, PW = 10 µs, duty cycle ≤ 2 percent.
2. Output waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $Z_{in} \geq 10$ MΩ, $C_{in} \leq 11.5$ pF.
3. Resistors shall be noninductive types.
4. The dc power supplies may require additional bypassing in order to minimize ringing.
5. The input pulse voltages and supply voltages (-4 V dc and + 100 V dc) are nominal and shall be adjusted to obtain $I_{B1} = -I_{B2} = 50$ mA and $I_C = 1$ A.
6. An equivalent circuit may be used.
7. 0.02 µF capacitor may be removed during voltage adjustments.

FIGURE 5. Pulse response test circuit for types 2N5665, 2N5667 and 2N5667S.

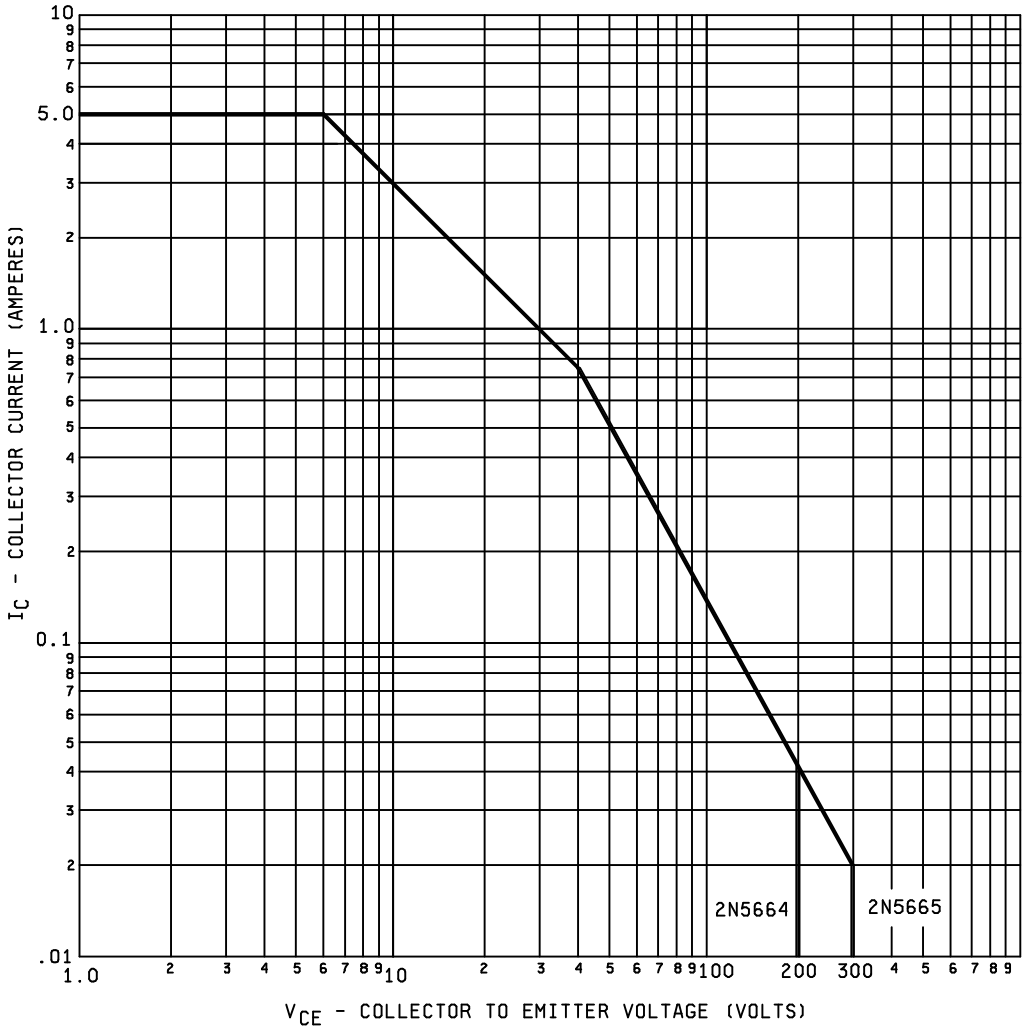


FIGURE 6. Maximum safe operating graph (continuous dc) for types 2N5664 and 2N5665.

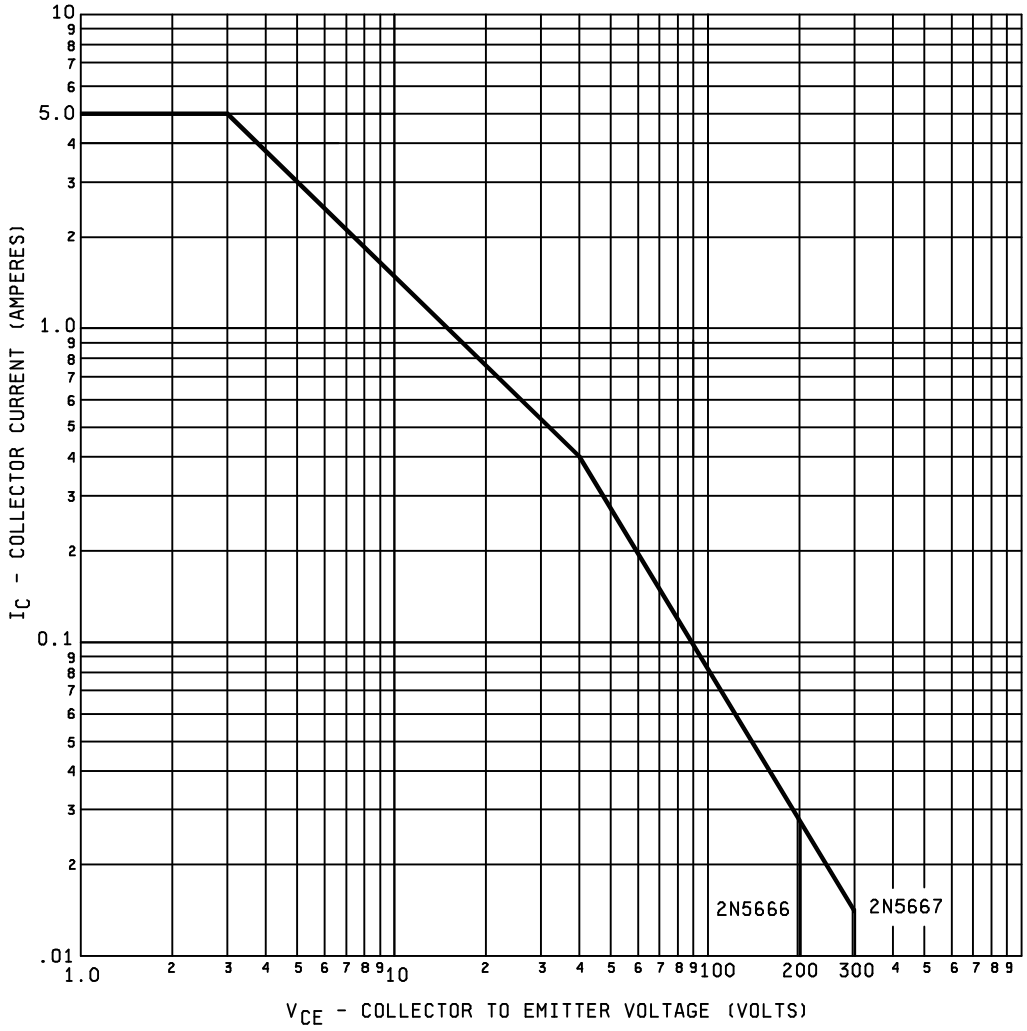


FIGURE 7. Maximum safe operating graph (continuous dc) for types 2N5666, 2N5666S, 2N5667, and 2N5667S.

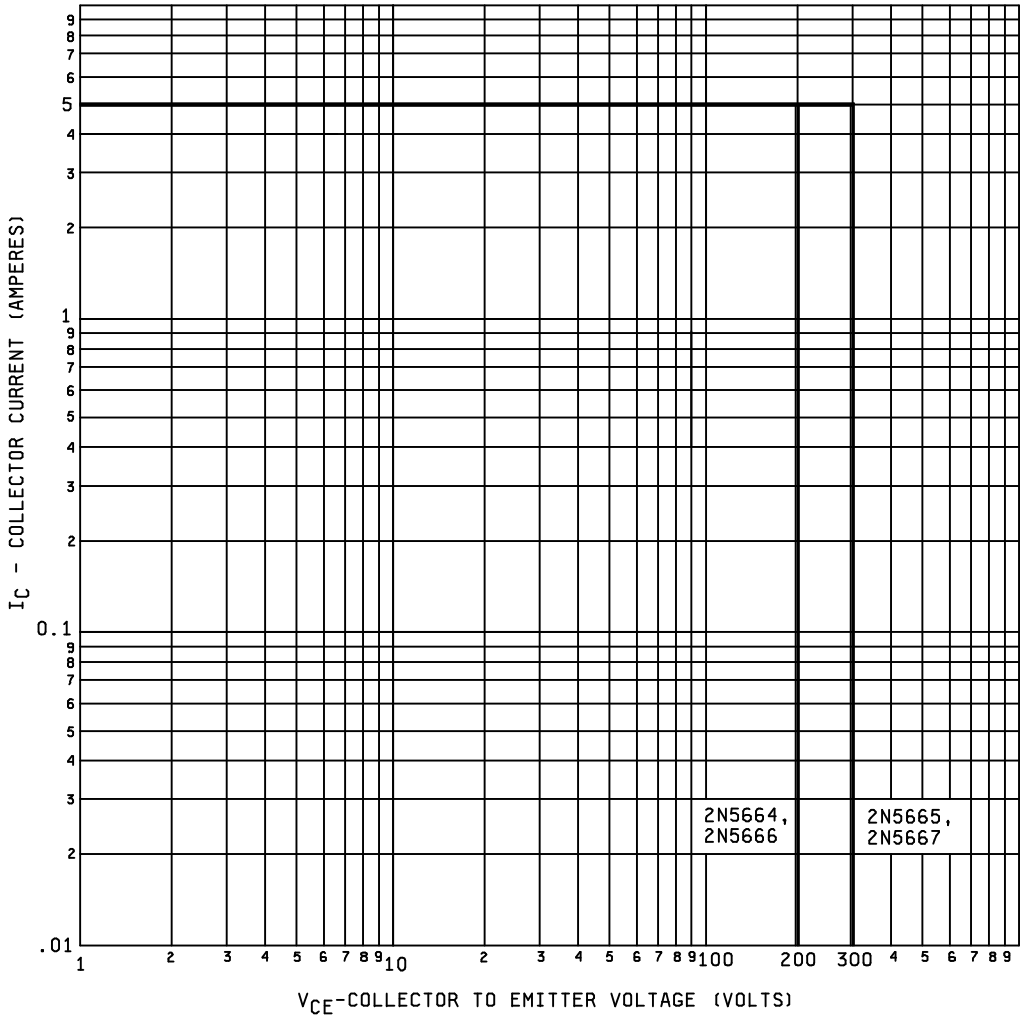


FIGURE 8. Safe operating area for switching between saturation and cutoff (clamped inductive load).

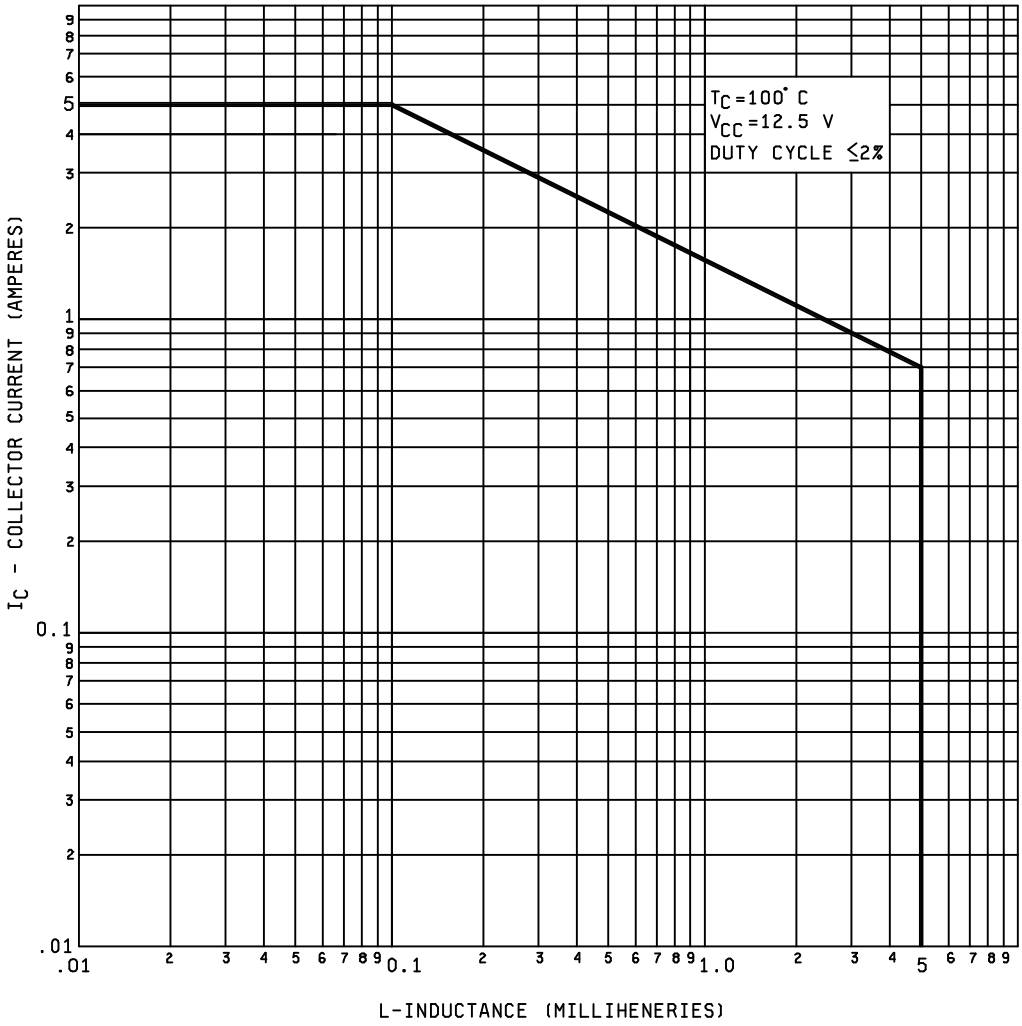


FIGURE 9. Safe operating area for switching between saturation and cutoff (unclamped inductive load).

5. PACKAGING

5.1 Packaging. Packaging shall prevent mechanical damage of the devices during shipping and handling and shall not be detrimental to the device. When actual packaging of material is to be performed by DoD personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the Inventory Control Points' packaging activity within the Military Department or Defense Agency, or within the Military Departments' System Command. Packaging data retrieval is available from the managing Military Departments' or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

5.2 Marking. Unless otherwise specified (see 6.2), marking shall be in accordance with MIL-STD-129.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Notes. The notes specified in MIL-PRF-19500 are applicable to this specification.

6.2 Acquisition requirements. See MIL- PRF-19500.

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 Products List QPL No.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 purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Columbus, ATTN: DSCC-VQE, 3990 East Broad Street, Columbus, OH 43216-5000.

6.4 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

Custodians:
Army - CR
Navy - EC
Air Force - 17

Preparing activity:
DLA - CC

(Project 5961-1917)

Review activities:
Army - AR, MI
Navy - AS, CG, MC
Air Force - 13, 19, 85, 99

STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

INSTRUCTIONS

1. The preparing activity must complete blocks 1, 2, 3, and 8. In block 1, both the document number and revision letter should be given.

2. The submitter of this form must complete blocks 4, 5, 6, and 7.

3. The preparing activity must provide a reply within 30 days from receipt of the form.

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I RECOMMEND A CHANGE:	**1. DOCUMENT NUMBER** MIL-PRF-19500/455C	**2. DOCUMENT DATE (YYMMDD)** 980125

3. DOCUMENT TITLE SEMICONDUCTOR DEVICE, TRANSISTOR, NPN, SILICON, POWER SWITCHING TYPES 2N5664, 2N5665, 2N5666, 2N5666S, 2N5667 AND 2N5667S JAN, JANTX, JANTXV AND JANS

4. NATURE OF CHANGE (Identify paragraph number and include proposed rewrite, if possible. Attach extra sheets as needed.)

5. REASON FOR RECOMMENDATION

6. SUBMITTER		
a. NAME (Last, First, Middle initial)	b. ORGANIZATION	
c. ADDRESS (Include Zip Code)	d. TELEPHONE (Include Area Code) Commercial DSN FAX EMAIL	7. DATE SUBMITTED (YYMMDD)

8. PREPARING ACTIVITY				
a. Point of contact:Alan Barone	b. TELEPHONE Commercial	DSN	FAX	EMAIL
	614-692-0510	850-0510	614-692-6939	alan_barone@dscc.dla.mil
c. ADDRESS: Defense Supply Center Columbus, ATTN: DSCC-VAT, 3990 East Broad Street, Columbus, OH 43216-5000	**IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT:** Defense Quality and Standardization Office 5203 Leesburg Pike, Suite 1403, Falls Church, VA 22041-3466 Telephone (703) 756-2340 AUTOVON 289-2340			