The documentation and process conversion measures necessary to comply with this document shall be completed by 9 October 2002.

INCH-POUND

MIL-PRF-19500/559E
9 July 2002
SUPERSEDING
MIL-PRF-19500/559D
10 August 1998

PERFORMANCE SPECIFICATION

SEMICONDUCTOR DEVICE, UNITIZED, NPN, SILICON, SWITCHING, FOUR TRANSISTOR ARRAY TYPES 2N6989, 2N6989U, AND 2N6990, 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, switching transistors in a four independent chip array. Four levels of product assurance are provided for each device type as specified in MIL-PRF-19500.

1.2 Physical dimensions. See figures 1, 2, 3, 4 (14 pin dual-in-line, 14 pin flat package), and figure 5 (20 pin surface mount).

1.3 Maximum ratings. (1)

Type	P_T $T_A = +25°C$ (2)	V_{CBO} (3)	V_{EBO} (3)	V_{CEO} (3)	I_C (3)	T_{OP} and T_{STG}
	W	V dc	V dc	V dc	mA dc	°C
*2N6989	2.0	75	6	50	800	-65 to +200
2N6989U	1.0	75	6	50	800	-65 to +200
*2N6990	1.0	75	6	50	800	-65 to +200

(1) Maximum voltage between transistors shall be ≥ 500 V dc.
* (2) Derate linearly 11.43 mW/°C above $T_A = +25°C$ for 2N6989 and 2N6989U. Derate linearly 5.71 mW/°C above $T_A = +25°C$ for 2N6990. Ratings apply to total package.
(3) Ratings apply to each transistor in the array.

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

AMSC N/A FSC 5961

DISTRIBUTION STATEMENT A. Approved for public release; distribution is unlimited.

1.4 Primary electrical characteristics. Characteristics apply to each transistor in the array.

Limits	h_{FE2} (1) V_{CE} = 10 V dc I_C = 1.0 mA dc	h_{FE4} (1) V_{CE} = 10 V dc I_C = 150 mA dc	C_{obo} V_{CB} = 10 V dc I_E = 0 100 kHz $\leq$ f $\leq$ 1 MHz	Switching	
				t_{on} See figure 6	t_{off} See figure 7
			pF	ns	ns
Min	75	100			
Max	325	300	8	35	300

Limits	$\|h_{FE}\|$ V_{CE} = 20 V dc I_C = 20 mA dc f = 100 MHz	$V_{CE(sat)2}$ (1) I_C = 500 mA dc I_B = 50 mA dc	$V_{BE(sat)2}$ (1) I_C = 500 mA dc I_B = 50 mA dc
		V dc	V dc
Min	2.5		
Max	8.0	1.0	2.0

(1) Pulsed (see 4.5.1).

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

DEPARTMENT OF DEFENSE

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

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Document Automation and Production Services (DAPS), Building 4D (DPM-DODSSP), 700 Robbins Avenue, 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.

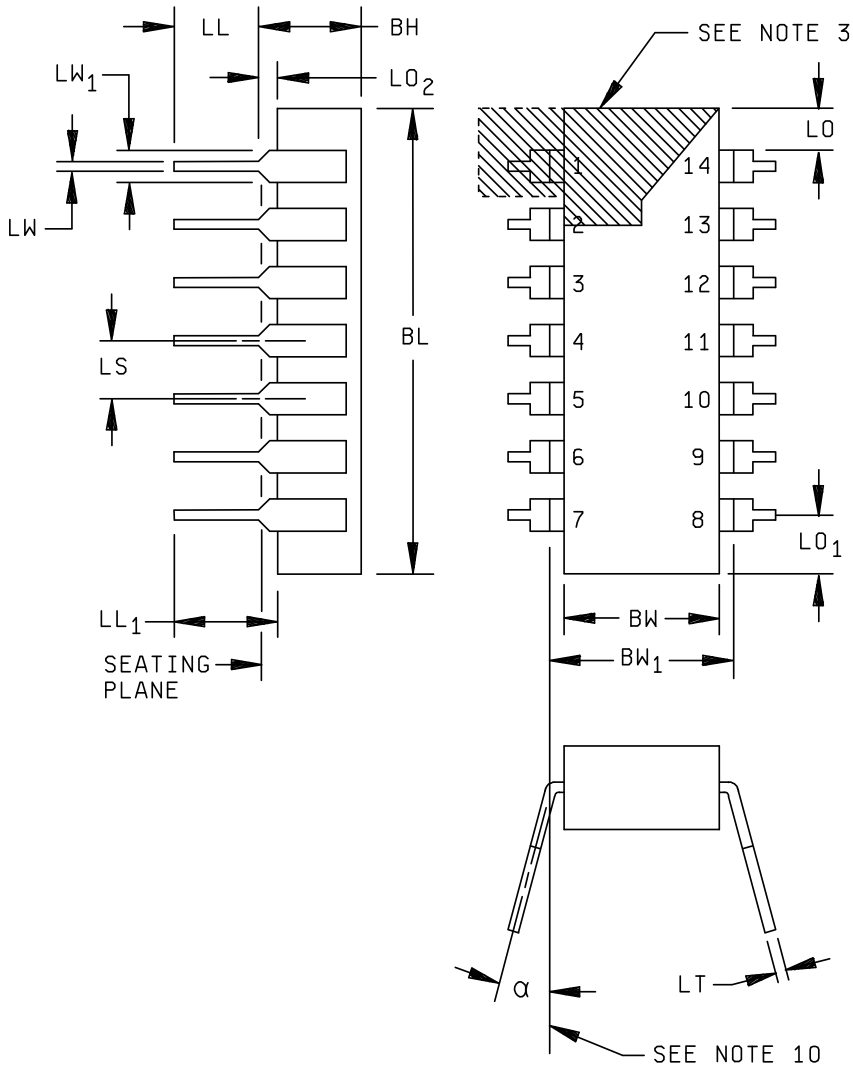


FIGURE 1. Dimensions and configuration for type 2N6989.

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
BH		.200		5.08	
LW	.014	.023	0.36	0.58	10
LW_1	.030	.070	0.76	1.78	4, 10
LT	.008	.015	0.20	0.38	10
BL		.785		19.94	6
BW	.220	.310	5.59	7.87	6
BW_1	.290	.320	7.37	8.13	9

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
LS	.100 BSC		2.54 BSC		7, 11
LL	.125	.200	3.18	5.08	
LL_1	.150		3.81		
LO	.005		0.13		8
LO_1		.098		2.49	8
LO_2	.015	.060	0.38	1.52	5
α	0°	15°	0°	15°	

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Index area: A notch or pin one identification mark shall be located adjacent to pin one and shall be located within the shaded area shown. The manufacturer's identification shall not be used as a pin one identification mark.
4. The minimum limit for dimension LW_1 may be .023 inch (0.58 mm) for leads number 1, 7, 8, and 14 only.
5. Dimension LO_2 shall be measured from the seating plane to the base plane.
6. This dimension allows for off-center lid, meniscus, and glass overrun.
7. The basic pin spacing is .100 inch (2.54 mm) between centerlines. Each pin centerline shall be located within ± .010 inch (0.25 mm) of its exact longitudinal position relative to pins 1 and 14 (see figure 6).
8. Applies to all four corners (leads number 1, 7, 8, and 14).
9. Lead center when α is 0°. BW_1 shall be measured at the centerline of the leads.
10. All leads.
11. Twelve spaces.
12. No organic or polymeric materials shall be molded to the bottom of the package to cover the leads.

FIGURE 1. Dimensions and configuration for type 2N6989 - Continued.

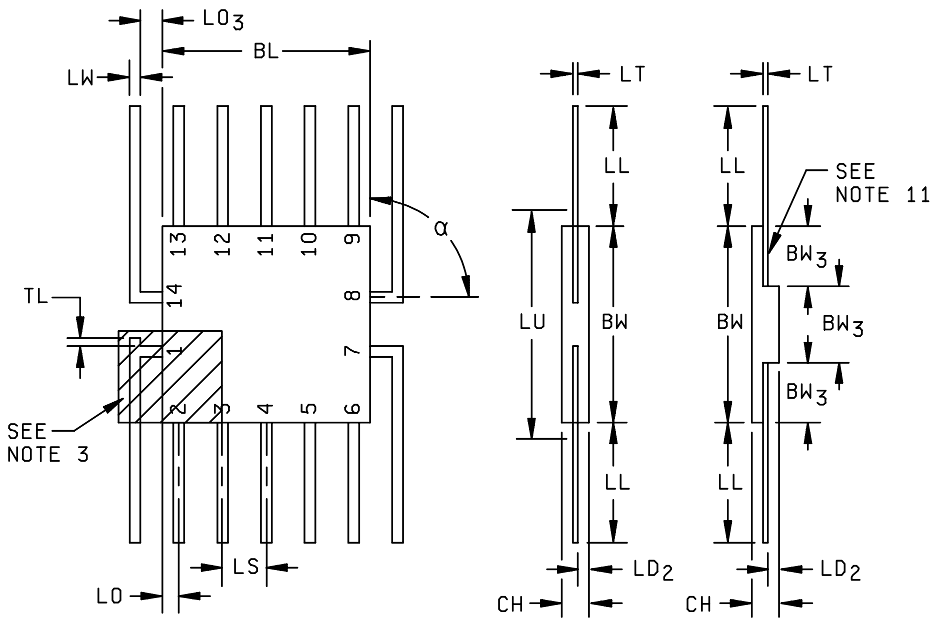


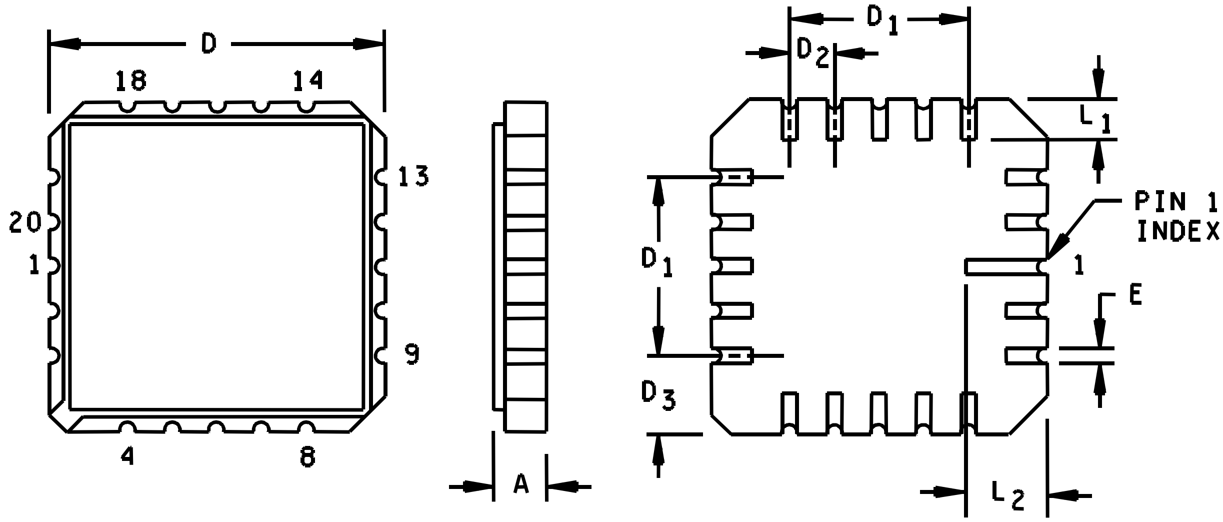
FIGURE 2. Physical dimensions for type 2N6990.

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
CH	.030	.115	0.76	2.92	
LW	.010	.019	0.25	0.48	7
TL	.003	.006	0.08	0.15	7
BL		.280		7.11	5
BW	.240	.260	6.10	6.60	
LU		.290		7.37	5
BW_2	.125		3.18		

Symbol	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
BW_3	.030		0.76		
LS	.050 BSC		1.27 BSC		6, 8
LT	.003	.006	0.076	0.152	12
LL	.250	.370	6.35	9.40	
LD_2	.005	.040	0.13	1.02	4
LO	.005		0.13		9, 10
LO_3	.004		`0.10		13
α	30°	90°	30°	90°	14

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Index area: A notch or pin one identification mark shall be located adjacent to pin one and shall be located within the shaded area shown. The manufacturer's identification shall not be used as a pin one identification mark. Alternatively, a tab (dim TL) may be used to identify pin one.
4. Dimension LD_2 shall be measured at the point of exit of the lead from the body.
5. This dimension allows for off-center lid, meniscus, and glass overrun.
6. The basic pin spacing is .050 inch (1.25 mm) between centerlines. Each pin centerline shall be located within $\pm$ .005 inch (0.13 mm) of its exact longitudinal position relative to pins 1 and 14.
7. All leads: Increase maximum limit by .003 inch (0.08 mm) measured at the center of the flat when the lead finish is solder.
8. Twelve spaces.
9. Applies to all four corners (leads number 2, 6, 9, and 13).
10. Dimension LO may be .000 inch (0.00 mm if leads number 2, 6, 9, and 13) bend toward the cavity of the package within one lead width from the point of entry of the lead into the body or if the leads are brazed to the metallized ceramic body.
11. No organic or polymeric materials shall be molded to the bottom of the package to cover the leads.
12. Optional, see note 1. If a pin one identification mark is used in addition to this tab, the minimum limit of dimension TL does not apply.
13. Applies to leads number 1, 7, 8, and 14.
14. Lead configuration is optional within dimension BW except dimensions LW and LT apply.

FIGURE 2. Physical dimensions for type 2N6990 - Continued.



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	.063	.075	1.60	1.90
D	.345	.355	8.76	9.02
D_1	.195	.205	4.95	5.21
D_2	.050 TYP		1.27 TYP	
D_3	.070	.080	1.76	2.03
E	.025 REF		0.64 REF	
L_1	* .050 REF for pins 2 through 20		* 1.27 REF for pins 2 through 20	
L_2	.080	.090	2.03	2.28

NOTES:
1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Unless otherwise specified, tolerance is ±.005 inch (0.13 mm)

FIGURE 3. Physical dimensions for type 2N6989U.

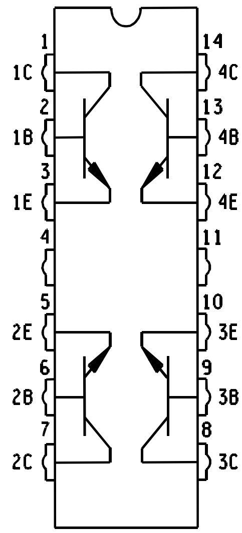


FIGURE 4. Schematic and terminal connections for type 2N6989 and 2N6990.

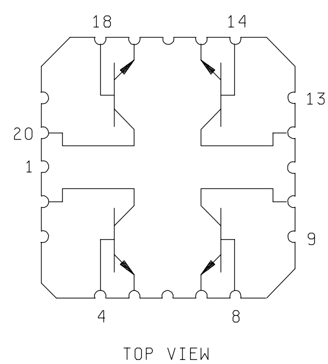


FIGURE 5. Schematic and terminal connections for type 2N6989U.

3. REQUIREMENTS

3.1 General. The requirements for acquiring the product described herein shall consist of this document and MIL-PRF-19500.

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 manufacturer's 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 and as follows.

3.4 Interface and physical dimensions. Interface and physical dimensions shall be as specified in MIL-PRF-19500, and on figures 1, 2, 3, 4, and 5.

3.4.1 Lead finish. Lead finish shall be solderable in accordance with MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition document (see 6.2).

3.4.2 Schematic and terminal connections. The schematic and terminal connections shall be as shown on figure 4 (for flat package and dual-in-line) and on figure 5 (for leadless chip carrier).

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

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

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).

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 associated specification that did not request the performance of table II, the tests specified in table II herein must be performed by the first inspection lot processed to this revision to maintain qualification.

4.3 Screening (JANS, JANTX, and JANTXV levels only). Screening shall be in accordance with table 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 (see table IV of MIL-PRF-19500)	Measurement	
	JANS level	JANTX and JANTXV levels
*3c	Thermal impedance, method 3131 of MIL-STD-750.	Thermal impedance, method 3131 of MIL-STD-750.
9	I_{CBO2}, h_{FE4}	Not applicable.
10	48 hours minimum.	48 hours minimum.
11	I_{CBO2}; h_{FE4}; ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater. Δh_{FE4} = $\underline{+}$15 percent.	I_{CBO2}; h_{FE4}
12	See 4.3.1 240 hours minimum.	See 4.3.1 80 hours minimum.
13	Subgroups 2 and 3 of table I herein; ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE4} = $\underline{+}$15 percent.	Subgroup 2 of table I herein; ΔI_{CBO2} = 100 percent of initial value or 5 nA dc, whichever is greater; Δh_{FE4} = $\underline{+}$15 percent.

* 4.3.1 Power burn-in conditions. Power burn-in conditions are as follows: V_{CB} = 10 V dc. Power shall be applied to achieve T_J = +135°C minimum using a minimum P_D = 75 percent of P_T maximum rated as defined in 1.3.

4.3.2 Thermal impedance ($Z_{\theta JX}$ measurements). The $Z_{\theta JX}$ measurements shall be performed in accordance with MIL-STD-750, Method 3131.

a. I_M measurement current---------------5 mA.

b. I_H forward heating current ------------200 mA (min).

c. t_H heating time --------------------------25 - 30 ms.

d. t_{md} measurement delay time -------60 µs max.

e. V_{CE} collector-emitter voltage -------10 V dc minimum

The maximum limit for $Z_{\theta JX}$ under these test conditions are $Z_{\theta JX}$ (max) = 72°C/W.

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 group A1 and A2 inspection only (table VIb, group B, subgroup 1 is not required to be performed again if group B has already been satisfied per 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 conditions specified for subgroup testing in table VIa (JANS) of MIL-PRF-19500 and 4.4.2.1. Electrical measurements (end-points) and delta requirements shall be in accordance with group A, subgroup 2 and 4.5.5 herein. See 4.4.2.2 for JAN, JANTX, and JANTXV group B testing. Electrical measurements (end-points) and delta requirements for JAN, JANTX, and JANTXV shall be after each step in 4.4.2.2 and shall be in accordance with group A, subgroup 2 and 4.5.5 herein.

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

	Subgroup	Method	Condition
*	B4	1037	V_{CB} = 10 - 30 V dc; T_J = +150°C, 2,000 cycles. No heat sink or forced-air cooling on devices shall be permitted.
*	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 Group B inspection, (JAN, JANTX, and JANTXV). 1/

Step	Method	Condition
1	1039	Steady-state life: Test condition B, 340 hours, V_{CB} = 10 -30 V dc, T_J = +150°C min. No heat sink or forced-air cooling on the devices shall be permitted. n = 45 devices, c = 0.
2	1039	The steady-state life test of step 1 shall be extended to 1,000 hrs for each die design. Samples shall be selected from a wafer lot every twelve months of wafer production. Group B, step 2 shall not be required more than once for any single wafer lot. n = 45, c = 0.
3	1032	High-temperature life (non-operating), t = 340 hours, T_A = +200°C. n = 22, c = 0.

* 4.4.3 Group C inspection, Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table 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. Electrical measurements (end-points) and delta requirements shall be in accordance with group A, subgroup 2 and 4.5.5 herein, delta parameters apply to subgroup C6.

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

Subgroup	Method	Condition
C2	2036	Test condition E, 3 ounce weight; three bends of 15 degrees for 2N6990; three bends for 2N6989; not applicable to 2N6989U.
C6	1026	1,000 hours at V_{CB} = 10 V dc; T_J = +150°C min. No heat sink or forced-air cooling on device shall be permitted.

1/ Separate samples may be used for each step. In the event of a group B failure, the manufacturer may pull a new sample at double size from either the failed assembly lot or from another assembly lot from the same wafer lot. If the new “assembly lot” option is exercised, the failed assembly lot shall be scrapped.

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

Subgroup	Method	Condition
C2	2036	Test condition E, 3 ounce weight; three bends of 15 degrees for 2N6990; three bends for 2N6989; not applicable to 2N6989U.
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 group A tests for conformance inspection. 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 E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in appendix E, table IX of MIL-PRF-19500 and as specified herein. Electrical measurements (end-points) and delta measurements shall be in accordance with the applicable steps of table II and table I, group A, subgroup 2 herein; except, $Z_{\theta JX}$ need not be performed.

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 Independent transistor inspections. Inspections shall be performed on each transistor in the array.

4.5.4 Transistor-to-transistor resistance. The leads of each transistor shall be shorted together for this test. The resistance shall be measured between each transistor in the array.

4.5.5 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} = 60 V dc.	ΔI_{CB02} 1/	100 percent of initial value or 8 nA dc, whichever is greater.	
2	Forward current transfer ratio.	3076	V_{CE} = 10 V dc; I_C = 150 mA dc; pulsed see 4.5.1.	Δh_{FE4} 1/	25 percent change from initial reading.	

1/ Devices which exceed the group A limits for this test shall not be accepted.

TABLE I. Group A inspection

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 1 2/						
Visual and mechanical 3/ examination	2071	n = 45 devices, c = 0.				
Solderability 3/ 4/	2026	n = 15 leads, c = 0.				
Resistance to solvents 3/ 4/ 5/	1022	n = 15 devices, c = 0.				
Temp cycling 3/ 4/	1051	Test condition C, 25 cycles. n = 22 devices, c = 0.				
Heremetic seal 4/	1071	n = 22 devices, c = 0.				
Fine leak Gross leak						
Electrical measurements 4/		Group A, subgroup 2.				
Bond strength 3/ 4/	2037	Precondition T_A = +250°C at t = 24 hrs or T_A = +300°C at t = 2 hrs n = 11 wires, c = 0.				
Decap internal visual design verification 4/	2075	n = 4, c = 0.				
Subgroup 2						
Collector to base cutoff current	3036	Bias condition D; V_{CB} = 75 V dc I_C = 10 µA dc.	I_{CBO1}		10	µA dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = 6 V dc I_E = 10 µA dc.	I_{EBO1}		10	µA dc
Breakdown voltage, collector to emitter	3011	Bias condition D; I_C = 10 mA dc; pulsed (see 4.5.1).	$V_{(BR)CEO}$	50		V dc
Collector to base cutoff Current	3036	Bias condition D; V_{CB} = 60 V dc.	I_{CBO2}		10	nA dc
Emitter to base cutoff current	3061	Bias condition D; V_{EB} = 4 V dc.	I_{EBO2}		10	nA dc
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 0.1 mA dc.	h_{FE1}	50		
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 1.0 mA dc.	h_{FE2}	75	325	
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 10 mA dc.	h_{FE3}	100		

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroup 2 - Continued						
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 150 mA dc; pulsed (see 4.5.1).	h_{FE4}	100	300	
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 500 mA dc; pulsed see 4.5.1.	h_{FE5}	30		
Collector-emitter saturation voltage	3071	I_C = 150 mA dc; I_B = 15 mA dc pulsed (see 4.5.1).	$V_{CE(sat)1}$		0.3	V dc
Collector-emitter saturation voltage	3071	I_C = 500 mA dc; I_B = 50 mA dc; pulsed (see 4.5.1).	$V_{CE(sat)2}$		1.0	V dc
Base-emitter saturation voltage	3066	Test condition A; I_C = 150 mA dc; I_B = 15 mA dc; pulsed (see 4.5.1).	$V_{BE(sat)1}$	0.6	1.2	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).	$V_{BE(sat)2}$		2.0	V dc
Subgroup 3						
High temperature operation		T_A = +150°C				
Collector to base cutoff current	3036	Bias condition D;V_{CB} = 60 V dc.	I_{CBO3}		10	μA dc
Low temperature operation		T_A = -55°C.				
Forward-current transfer ratio	3076	V_{CE} = 10 V dc; I_C = 10 mA dc.	h_{FE6}	35		
Subgroup 4						
Small-signal short-circuit forward current transfer ratio	3206	V_{CE} = 10 V dc; I_C = 1 mA dc; f = 1 kHz.	h_{fe}	50		
Magnitude of small-signal short-circuit forward current transfer ratio	3306	V_{CE} = 10 V dc; I_C = 20 mA dc; f = 100 MHz.	$\|h_{fe}\|$	2.5	10.0	
Open circuit Output capacitance	3236	V_{CB} = 10 V dc; I_E = 0; 100 kHz $\leq$ f $\leq$ 1 MHz.	C_{obo}		8	pF
Input capacitance (output open-circuited)	3240	V_{EB} = 0.5 V dc; I_C = 0; 100 kHz $\leq$ f $\leq$ 1 MHz (see 4.5.2).	C_{ibo}		25	pF
Turn-on time		(See figure 6)	t_{on}		35	ns
Turn-off time		(See figure 7)	t_{off}		300	ns
Transistor-to-transistor resistance		$\| V_{T-T} \|$ = 500 V dc; see 4.5.4.	R_{T-T}	10^{10}		Ω

See footnotes at end of table.

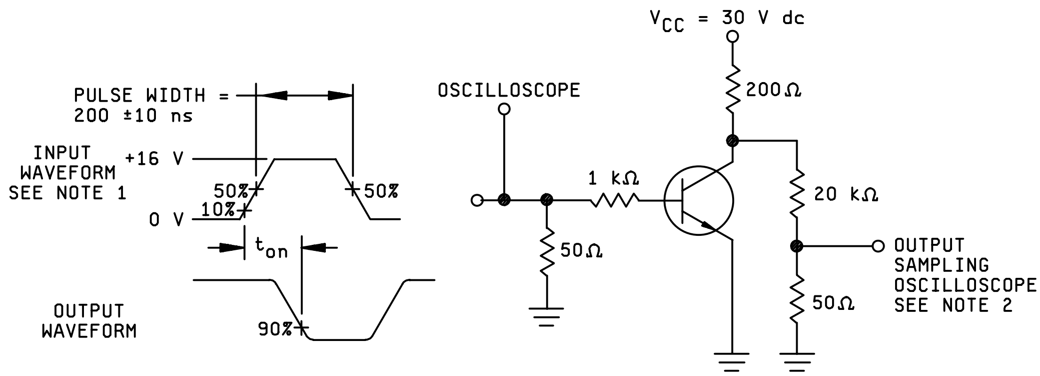
TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limit		Unit
	Method	Conditions		Min	Max	
Subgroups 5 and 6						
Not applicable						

1/ For sampling plan see MIL-PRF-19500.
2/ For resubmission of failed subgroup A1, double the sample size of the failed test or sequence of tests. A failure in group A, 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.

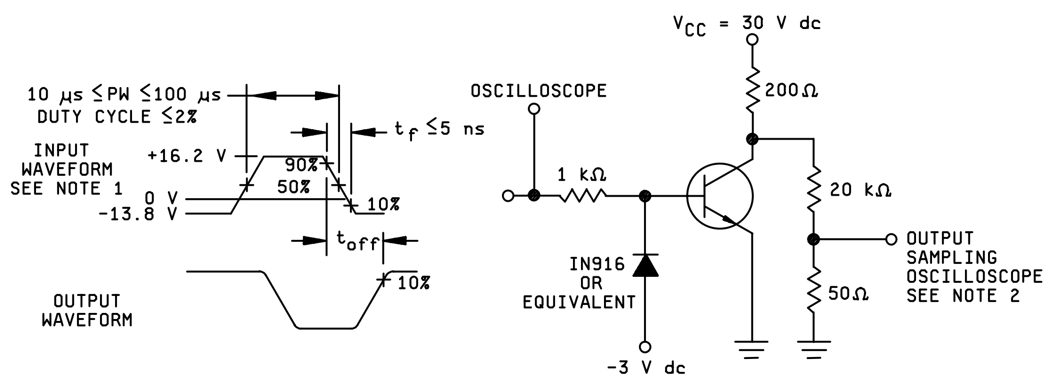
TABLE II. Group E inspection (all quality levels) - for qualification only.

Inspection	MIL-STD-750		Qualification
	Method	Conditions	
Subgroup 1			
Temperature cycling (air to air)	1051	Test condition C, 500 cycles.	45 devices c = 0
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See group A, subgroup 2 and 4.5.5 herein.	
Subgroup 2			
*Intermittent life	1037	V_{CB} = 10 - 30 V dc, 6,000 cycles.	45 devices c = 0
Electrical measurements		See group A, subgroup 2 and 4.5.5 herein.	
*Subgroup 3, 4, 5, 6 and 7			
Not applicable			
*Subgroup 8			45 devices c = 0
Reverse stability	1033	Condition A for devices $\geq$ 400 V dc. Condition B for devices < 400 V dc.	



NOTES:
1 The rise time (t_r) and fall time (t_f) of the applied pulse shall be each ≤ 2.0 ns; duty cycle ≤ 2 percent; generator source impedance shall be 50 Ω.
2. Output sampling oscilloscope: Z_{in} ≥ 100 kΩ; C_{in} ≤ 12 pF; rise time ≤ 5.0 ns.

FIGURE 6. Saturated turn-on switching time test circuit.



NOTES:
1. The rise time (t_r) and fall time (t_f) of the applied pulse shall be each ≤ 2.0 ns; duty cycle ≤ 2 percent; generator source impedance shall be 50 Ω.
2. Output sampling oscilloscope: Z_{in} ≥ 100 kΩ; C_{in} ≤ 12 pF; rise time ≤ 5.0 ns.

FIGURE 7. Saturated turn-off switching time test circuit.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When actual packaging of materiel 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 Point's packaging activity within the Military Department or Defense Agency, or within the Military Department's System Command. 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.)

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

6.2 Acquisition requirements. Acquisition documents must specify the following:

a. Title, number, and date of this specification.

b. Issue of DoDISS to be cited in the solicitation, and if required, the specific issue of individual documents referenced (see 2.2.1).

c. Packaging requirements (see 5.1).

d. Lead finish (see 3.4.1).

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) 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 Defense Supply Center, Columbus, ATTN: DSCC/VQE, P.O. Box 3990, Columbus, OH 43216-5000.

6.4 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 - 11
DLA - CC

Preparing activity:
DLA - CC

(Project 5961-2507)

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

NOTE: This form may not be used to request copies of documents, nor to request waivers, or clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

I RECOMMEND A CHANGE:	1. DOCUMENT NUMBER MIL-PRF-19500/559E	2. DOCUMENT DATE 9 July 2002

3. **DOCUMENT TITLE** SEMICONDUCTOR DEVICE, UNITIZED, NPN, SILICON, SWITCHING, FOUR TRANSISTOR ARRAY TYPES 2N6989, 2N6989U, AND 2N6990, 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

8. PREPARING ACTIVITY

a. Point of Contact Alan Barone	b. TELEPHONE Commercial: 614-692-0510 DSN: 850-0510 FAX: 614-692-6939 EMAIL: alan.barone@dscc.dla.mil
c. ADDRESS Defense Supply Center Columbus ATTN: DSCC-VAC P.O. Box 3990 Columbus, OH 43216-5000	IF YOU DO NOT RECEIVE A REPLY WITHIN 45 DAYS, CONTACT: Defense Standardization Program Office (DLSC-LM) 8725 John J. Kingman, Suite 2533 Fort Belvoir, VA 22060-6221 Telephone (703) 767-6888 DSN 427-6888