

MILITARY SPECIFICATION  
TRANSISTOR, TYPES 2N2631 AND 2N2876

1. SCOPE

1.1 Description.- This specification covers the detail requirements for a silicon, NPN transistor and is in accordance with MIL-S-19500, except as otherwise specified herein.

1.2 Mechanical dimensions and outline.- See figure 1 for transistor type 2N2876 and figure 2 for transistor type 2N2631.

1.3 Absolute maximum ratings.-

V <sub>CB</sub>	V <sub>CE</sub>	V <sub>EB</sub>	I <sub>C</sub>		P <sub>C</sub>		T <sub>stg</sub> °C	T <sub>J</sub> °C
			Amp		Watts			
			2N2631	2N2876	2N2631	2N2876		
80	60	4	<u>1</u> /1.5	<u>2</u> /2.5	8.75	17.5	-65 to +200	+200

<sup>1</sup>/<sub>Derate 0.05 W/°C for T<sub>C</sub> above 25°C.</sub>

<sup>2</sup>/<sub>Derate 0.1 W/°C for T<sub>C</sub> above 25°C.</sub>

1.4 Primary electrical characteristics.-

	V <sub>CE(sat)</sub>		C <sub>obo</sub> V <sub>CB</sub> = 30v	ft	h <sub>FE</sub> I <sub>C</sub> = 300 ma	P <sub>out</sub> f = 50 mc		P <sub>out</sub> f = 150 mc	
	2N2631	2N2876				2N2631	2N2876	2N2631	2N2876
	I <sub>C</sub> = 1.5	I <sub>C</sub> = 2.5							
Units	Volts	, Volts	pf	mc		Watts	Watts	Watts	Watts
Minimum	---	---	---	150	30	7.5	10	3	3
Maximum	1.0	1.0	20	---	150	---	---	---	---

2. APPLICABLE DOCUMENT

2.1 The following documents, of the issue in effect on the date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-S-19500 - Semiconductor Devices, General Specification For

STANDARD

MILITARY

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

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity as directed by the contracting officer.)

3. REQUIREMENTS

3.1 General.- Transistors shall be in accordance with MIL-S-19500 and as specified herein.

FSC 5960

3.2 Design, construction and physical dimensions.- Transistors shall be of the design, construction and physical dimensions shown on figure 1 for transistor type 2N2876 and figure 2 for transistor type 2N2631.

3.3 Performance characteristics.- Performance characteristics shall be as specified in 4.3 and 4.4

3.4 Marking.- The transistor shall be marked with the "USN" prefix in lieu of the "JAN" prefix. The country of origin may be omitted.

#### 4. QUALITY ASSURANCE PROVISIONS

4.1 Qualification tests.- Qualification tests shall be conducted at a laboratory satisfactory to the Bureau of Ships. Qualification tests shall consist of the tests specified in 4.3 and 4.4. (Application for qualification tests shall be in accordance with "Provisions Governing Qualification" (see 6.1)).

4.2 Quality conformance inspection. Quality conformance inspection shall consist of the examinations and tests specified in 4.3 and 4.4.

4.3 Group A inspection.- Group A inspection shall consist of the examinations and tests shown in table I. A device having one or more defects shall be counted as one defective.

4.4 Group B inspection.- Group B inspection shall consist of the examinations and tests shown in table II.

4.4.1 Salt atmosphere. The markings shall be legible after the test. There shall be no evidence (when examined with no magnification) of flaking or pitting of the finish or corrosion that will interfere with the mechanical and electrical application of the device.

4.4.2 Destructive tests. Tests listed in subgroups 2, 4 and 6 are considered destructive.

4.4.3 Shock.- The shock waveform shall approximate one half-cycle of a sinewave with a rise time of  $0.5 \begin{matrix} +0.1 \\ -0 \end{matrix}$  msec and a decay time of  $0.5 \begin{matrix} +0.1 \\ -0 \end{matrix}$  msec. The acceleration of any secondary impacts shall not exceed 20 percent of each primary impact. The amplitude of any response waveform distortion shall not exceed 10 percent of the peak acceleration.

4.5 Input capacitance.- Input capacitance shall be conducted in accordance with Method 3240 of MIL-STD-750 except that the capacitor in the output circuit shall be omitted.

#### 5. PREPARATION FOR DELIVERY

5.1 See MIL-S-19500.

#### 6. NOTES

6.1 The activity responsible for the qualified products list is the Bureau of Ships, Department of the Navy, Washington, D. C. 20360, and information pertaining to qualification of products may be obtained from that activity. Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification". (Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pa.)

Preparing activity:  
Navy - SH  
(Project 5960-N488(NAVY))

Table I - Group A inspection.

Examination or test	Conditions		LTPD	Symbol	Limits		Unit
	MIL-STD-750 method	Specific Conditions			Min	Max	
<u>Subgroup 1</u>			10				
Visual and mechanical examination	2071						
<u>Subgroup 2</u>			5				
Breakdown voltage, collector to base	3001 Cond. D	$I_C = 100\mu\text{A}$		$BV_{CBO}$	80	---	Vdc
Breakdown voltage, collector to emitter	3011 Cond. D	$I_C = 500\text{mA}^{1/}$		$BV_{CEO}$	60	---	Vdc
Breakdown voltage, collector to emitter	3011 Cond. A	$I_C = 100\mu\text{A}$ $V_{BE} = 1.5\text{V}$		$BV_{CEX}$	80	---	Vdc
Latch-up voltage (collector to emitter)		See figure 3		$V_{CEXL}$	60	---	Vdc
Collector to base cutoff current	3036 Cond. D	$V_{CB} = 30\text{Vdc}$		$IC_{BO}$	---	0.1	$\mu\text{Adc}$
Breakdown voltage, emitter to base	3026 Cond. D	$I_E = 100\mu\text{A}$		$BV_{EBO}$	4.0	---	Vdc
Collector saturation voltage 2N2631	3071	$I_C = 1.5\text{Adc}$ $I_B = 300\text{mAdc}$		$V_{CE}(\text{sat})$	---	1.0	Vdc
2N2876		$I_C = 2.5\text{Adc}$ $I_B = 500\text{mAdc}$		$V_{CE}(\text{sat})$	---	1.0	Vdc
Forward-current transfer ratio	3076	$I_C = 300\text{mAdc}$ $V_{CE} = 10\text{Vdc}$ $PW = 300\mu\text{sec}$ Duty cycle $\leq 2.0\%$		$h_{FE}$	30	150	
<u>Subgroup 3</u>			5				
Open circuit output capacitance	3236	$V_{CB} = 30\text{Vdc}$		$C_{obo}$	---	20	pf
Input capacitance (output open-circuited)	3240 (See 4.5)	$V_{EB} = 3\text{Vdc}$		$C_{ibo}$	---	300	pf

Table I - Group A inspection (Cont'd)

Examination or test	Conditions		LTPD	Symbol	Limits		Unit
	MIL-STD-750 method	Specific Conditions			Min	Max	
<u>Subgroup 3 (Cont'd)</u>							
Extrapolated unity gain frequency	3261	$I_C = 250\text{mA dc}$ $V_{CE} = 28\text{V dc}$ $f = 100\text{mc}$		$f_t$	150	---	mc
Power output		See figure 4 $V_{CE} = 28\text{V dc}$ $P_{in} = 1.0\text{W}$ $f = 150\text{mc}$		$P_{out}$	3.0	---	Watts
Power output 2N2631		See figure 4 $V_{CE} = 28\text{V dc}$ $P_{in} = 1.0\text{W}$ $f = 50\text{mc}$		$P_{out}$	7.5	---	Watts
2N2876		$V_{CE} = 28\text{V dc}$ $P_{in} = 2.0\text{W}$ $f = 50\text{mc}$		$P_{out}$	10.0	---	Watts

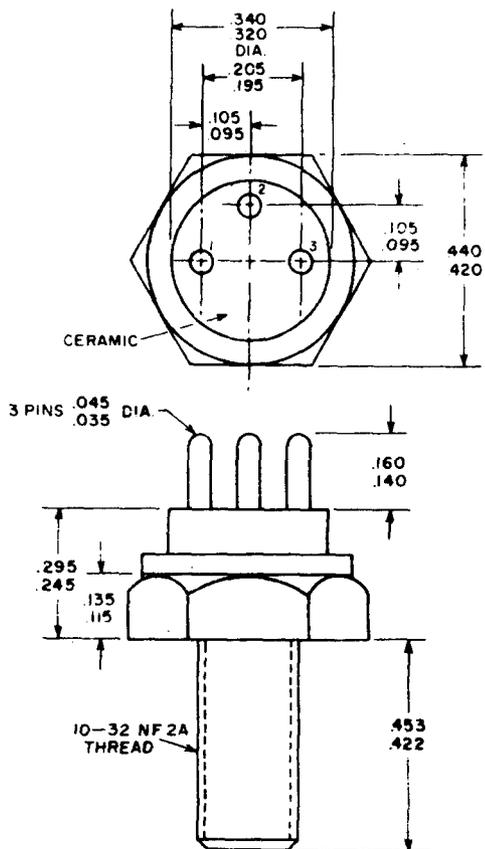
<sup>1/</sup> Pulse width  $\leq 30 \text{ usec}$ ; duty cycle  $\leq 2.0$  percent.

Table II - Group B inspection.

Examination or test	Conditions		LT PD	Symbol	Limits		Unit
	MIL-STD-750 method	Specific Conditions			Min	Max	
<u>Subgroup 1</u>			20				
Physical dimensions	2066						
<u>Subgroup 2</u>			10				
Solderability	2026						
Thermal shock (temperature cycling)	1051 Cond. C						
Thermal shock (glass strain)	1056 Cond. A						
Moisture resistance	1021						
<u>Subgroup 3</u>			10				
Shock	2016	See 4.4.3 500 G min. 1.0 msec 5 blows each orientation X <sub>1</sub> , Y <sub>1</sub> , Y <sub>2</sub> , Z <sub>1</sub>					
Vibration fatigue	2046	Nonoperating					
Vibration, variable frequency	2056						
Constant acceleration	2006	20,000 G					
<u>Subgroup 4</u>			10				
Terminal strength (lead fatigue) 2N2631 only	2036 Cond. E						
Terminal strength (tension) 2N2876 only	2036 Cond. A	Weight = 5 lbs. Time = 10 seconds each terminal					
Terminal strength (stud torque) 2N2876 only	2036 Cond. D2	Torque = 12 in. lbs. Time = 30 seconds					
<u>Subgroup 5</u>			10				
Thermal resistance (junction-to-case) 2N2631	3151			θ <sub>J-C</sub>	---	20	°C
2N2876				θ <sub>J-C</sub>	---	10	°C

Table II - Group B inspection (Cont'd)

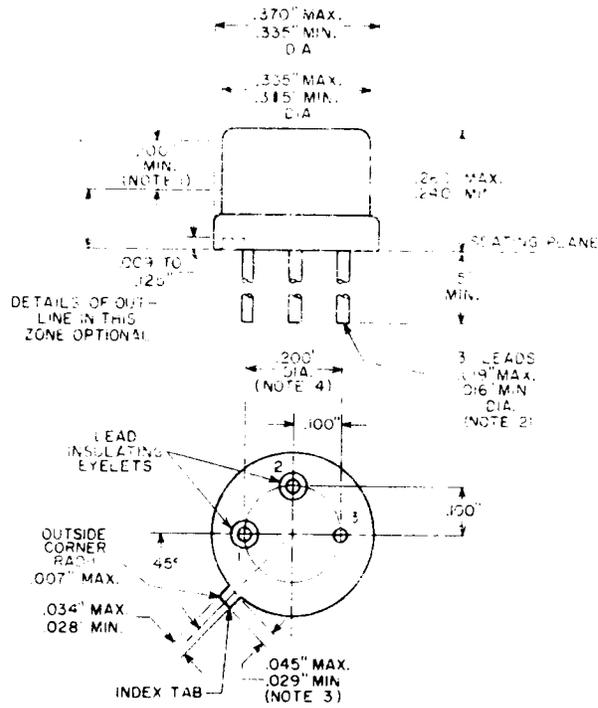
Examination or test	Conditions		LTPD	Symbol	Limits		Unit
	MIL-STD-750 method	Specific Conditions			Min	Max	
<u>Subgroup 6</u>			10				
Salt atmosphere (corrosion)	1041	See 4.4.1					
End points for subgroups 2, 3 and 6:							
Collector to base cutoff current	3036 Cond. D	V <sub>CB</sub> = 30Vdc		I <sub>CBO</sub>	---	0.1	uAdc
Power output 2N2631		See figure 4 V <sub>CE</sub> = 28Vdc P <sub>in</sub> = 1.0W f = 50mc		P <sub>out</sub>	7.5	---	Watts
2N2876		V <sub>CE</sub> = 28Vdc P <sub>in</sub> = 2.0W f = 50mc		P <sub>out</sub>	10.0	---	Watts
<u>Subgroup 7</u>			λ = 10				
High temperature life (nonoperating)	1031	T <sub>A</sub> = 200°C min.					
<u>Subgroup 8</u>			λ = 10				
Steady state operation life 2N2631	1026	T <sub>C</sub> = 100°C V <sub>CE</sub> = 28Vdc I <sub>C</sub> = 180mAdc					
2N2876		T <sub>C</sub> = 100°C V <sub>CE</sub> = 28Vdc I <sub>C</sub> = 360mAdc					
End points for subgroups 7 and 8:							
Collector to base cutoff current	3036 Cond. D	V <sub>CB</sub> = 30Vdc		I <sub>CBO</sub>	---	0.5	uAdc
Power output 2N2631		See figure 4 V <sub>CE</sub> = 28Vdc P <sub>in</sub> = 1.0W f = 50mc		P <sub>out</sub>	6.8	---	Watts
2N2876		V <sub>CE</sub> = 28Vdc P <sub>in</sub> = 2.0W f = 50mc		P <sub>out</sub>	9.0	---	Watts



## NOTES:

1. The pin spacing permits insertion in any socket having a pin-circle diameter of 0.200 inch and contacts which will accommodate pins having a diameter of 0.035 inch minimum, 0.045 inch maximum.
2. The torque applied to a 10-32 hex nut assembled on the thread during installation should not exceed 12 inch-pounds.
3. This device may be operated in any position.

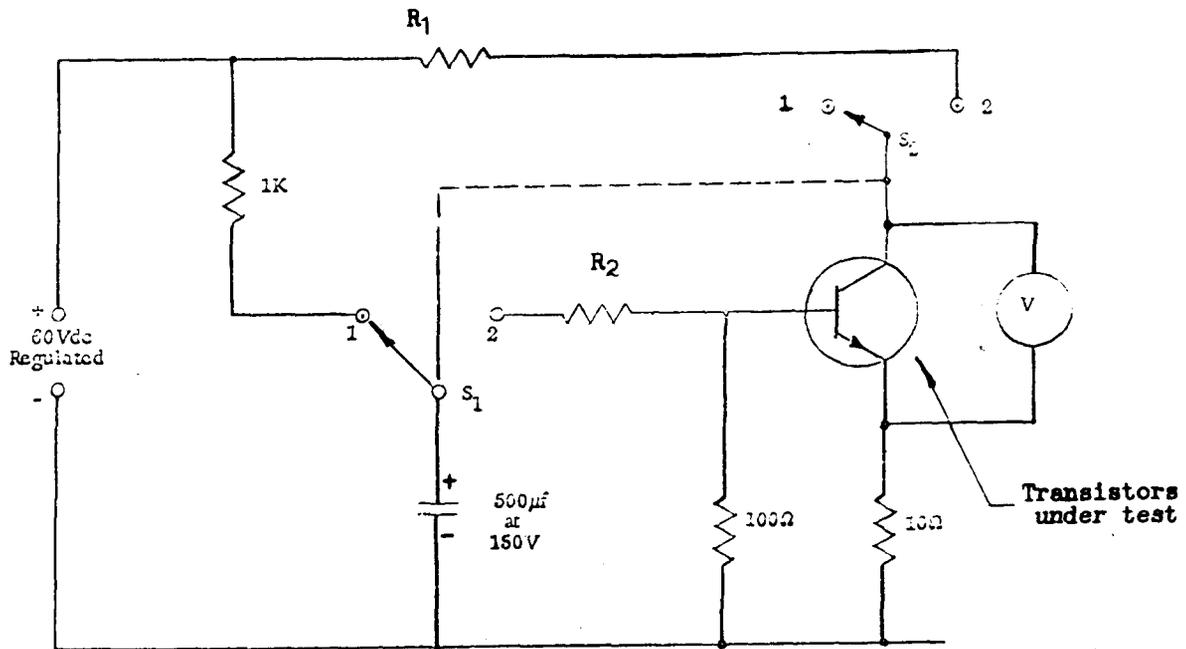
Figure 1 - Mechanical dimensions and outline of type 2N2876.



**NOTES:**

1. This zone is controlled for automatic handling. The variation in actual diameter within the zone shall not exceed 0.010 inch.
2. The specified lead diameter applies in the zone between 0.050 and 0.250 inch from the seating plane. Between 0.250 and 1.5 inches, a maximum of 0.021 diameter is held. Outside of these zones the lead diameter is not controlled.
3. Measured from maximum diameter of the actual device.
4. Leads having maximum diameter (0.019 inch) measured in gauging plane of  $0.054 \begin{smallmatrix} +0.001 \\ -0.000 \end{smallmatrix}$  inch below the seating plane of the device shall be within 0.007 inch of their true locations relative to a maximum-width tab.

Figure 2 - Mechanical dimensions and outline of type 2N2631.



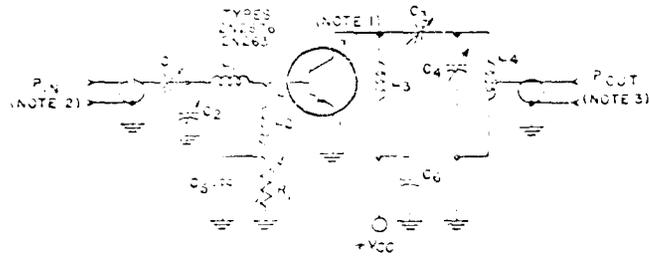
Type	R <sub>1</sub>	R <sub>2</sub>
2N2631	90 ohms	1000 ohms
2N2876	40 ohms	500 ohms

Test method:

1. With switches S<sub>1</sub> and S<sub>2</sub> in position 1, insert transistor into test socket.
2. Move switches S<sub>1</sub> and S<sub>2</sub> to position 2.
  - (a) Meter V should rise from zero to 60 volts for good transistors.
  - (b) Meter V reading less than 60 volts indicates defective transistor.

Note: S<sub>1</sub> and S<sub>2</sub> = SP - DT Micro-switch.

Figure 3 - Latch-up voltage (collector to emitter) test circuit.



	<u>For 50mc operation</u>	<u>For 150mc operation</u>
C <sub>1</sub> , C <sub>2</sub> , C <sub>3</sub> , C <sub>4</sub> :	8-60 pf	4-40 pf
C <sub>5</sub> , C <sub>6</sub> :	0.005 uf	0.005 uf
L <sub>1</sub> :	8 turns No. 16 wire, 3 8 inch inside diameter by 9 16 inch long	1 turn No. 16 wire, 1 4 inch inside diameter by 3 16 inch long
L <sub>2</sub> :	Ferrite choke, Z = 750 ohms ± 20 percent	Ferrite choke, Z = 750 ohms ± 20 percent
L <sub>3</sub> :	10 uh	1.5 uh
L <sub>4</sub> :	7 turns No. 14 wire, 1 2 inch inside diameter by 7 8 inch long. Tap 2 turns from ground end.	3 turns No. 14 wire, 3 8 inch inside diameter by 3 4 inch long. Tap 1-1 2 turns from ground end.
R <sub>1</sub> :	5000 ohms	50 ohms

NOTES:

1. Collector grounded to case in type 2N2631; see terminal diagram.
2. Generator impedance = 50 ohms.
3. Load impedance = 50 ohms.

Figure 4 - Circuit of unneutralized amplifier used to measure power output of types 2N2630 and 2N2631.

**SPECIFICATION ANALYSIS SHEET**

Form Approved  
Budget Bureau No. 119-R004

**INSTRUCTIONS**

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).

SPECIFICATION

ORGANIZATION (Of submitter)	CITY AND STATE
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CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT \$
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MATERIAL PROCURED UNDER A

DIRECT GOVERNMENT CONTRACT       SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?  
A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?  
 YES       NO IF "YES", IN WHAT WAY?

4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)

SUBMITTED BY (Printed or typed name and activity)	DATE
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