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4725

REPORT SUMMARY SHEET

2-769

C D E

1. COMPONENT PART NAME: Semiconductor Transistor, Switching, Silicon NPN, [redacted]

Semiconductor Device Qualification Tests, General Specification

2. PROGRAM OR WEAPON SYSTEM: Saturn

3. [redacted] NO: 11253-8-1

4. [redacted]: Evaluation

TEST COMPL.	5	2	65
REPT. COMPL.	1	3	65

7. THIS TEST (SUPERSEDES) (SUPPLEMENTS) REPORT NO:

8A. PART TYPE, SIZE, RATING, LOT, ETC.	9. VENDOR	10. VENDOR PART NO.	11. MIL/GOV. STD. NO.	12. TOTAL TESTED
1 150 w Stud Mounted	Westinghouse	2N 3432		100
2				
3				
4				

13. INTERNAL SPECS ETC. REQ'D TO UTILIZE REPT. ENCL.: X

A 50M03501A/33

B 50M03501A

SENT WITH REPORT NO.: 742.30.30.00-H1-02

14. MIL. SPECS, STDS. REFERENCED IN 13C

B MIL-S-19500

E MIL-STD-750

15A TEST OR ENVIRONMENT	C PER SPEC.	D SPEC. PARAGRAPH/METHOD/CONDITION	E TEST LEVELS, DURATION AND OTHER DETAILS	F	G
				100	8
1 Seal Leak Test	B	4.1.1	Radioactive Tracer Gas	92	2
1 Visual (Ext)	B	4.1.2	10 Power Magnification	10	0
1 Physical Dimen.	B	3.3	As per Drawing	1	0
1 Visual (Int)	B	4.1.2.2	10 Power Magnification	90	4
1-1 Group A Parameters	A	Table II	Electrical Measurements		
1-1 Operating Life	B	4.3.1	$T_C = 88°C$ $P_T = 83$ Watts Duration 2000 hours	10	0
1-1 100 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $V_{CE(sat)}$	10	0
1-1 250 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $V_{CE(sat)}$	10	0
1-1 500 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $V_{CE(sat)}$		

16. SUMMARY OF REPORT, NATURE OF FAILURES AND CORRECTIVE ACTIONS TAKEN:

S/N's 96–100 excessive leakage.

S/N's 91 and 92 illegible markings.

S/N 2 failed I_{CEX}. S/N 1 failed I_{EBO}. S/N 82 failed h_{FE}. S/N's 1 and 83 failed h_{FE}.

S/N's 6, 8, 9 and 90 were destroyed attempting to attain 150 watt dissipation.

CONTRACTOR: NASA/MSFC

Continental Test Labs, Inc.

742.30.30.00-H1-02

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Item	2a. Part Type or Range	3. Spec	4. Vendor	10. Vendor Part No.	11. [illegible]	12. [illegible]
5						
6						
7						
8						

Item	Test or Environment	C Per Spec	D Spec Paragraph/ Method/Condition	E Test Levels, Duration and Other Details	F No. Tested	G No. Failed
1-1	1000 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	10	0
1-1	1500 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	10	0
1-1	2000 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	① 9	② 1
1-2	Storage Life	B	4.3.2	T_A = +175°C Duration 2000 hours		
1-2	100 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	10	0
1-2	250 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	10	0
1-2	500 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	10	0
1-2	1000 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	10	0
1-2	1500 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	10	0
1-2	2000 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	10	0
1-3	Altitude Test	B	4.3.3	200,000 ft. altitude, I_{CBO} monitored	20	0
1-3	Moisture Resistance	B	4.3.4	MIL-STD-750, Method 1021	20	0
1-3	Post-Test End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	20	0
1-4	Solderability	B	4.3.5	MIL-STD-202C, Method 210, Condition B	20	0

H. Summary of Report, Nature of Failures and Corrective Actions Taken

① S/N 71 [illegible] upon restarting Life Test after 1500 hour End-Points.

② S/N 72 failed ΔI_{CEX}

21. Item No. 742.60.30.00-H1-04

J-769

Test or Environment	Spec	Spec Paragraph, Method Condition	Test Levels, Duration and Other Details	Qty Tested	Qty Failed
I-4 Constant Acceleration	B	4.3.6	20,000 g's 5 min. each axis	20	0 (1)
I-4 Shock	B	4.3.7	2500 g's .3 - .5 ms 5 blows each axis	20	1 (2)
I-4 Vibration	B	4.3.8	0.45" DA or 30 g's 10-2000 cps 2 - 22 min. sweeps each axis.	20	3 (3)
I-4 Post-Test End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	20	4 (3)
I-5 Power Cycling	B	4.3.9	On Time 1 min. Off Time 2 min. Temp +150°C 500 cycles	19	2 (4)
I-5 Thermal Shock	B	4.3.10	MIL-STD-750, Method 1056, Condition B	20	0
I-5 Terminal Strength	B	4.3.11	MIL-STD-750, Method 2036	20	0
I-5 Post-Test End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	17	2 (5)
S-1 Sequential Operating Life	B	4.3.1	Duration 1100 hours	4	0
S-1 100 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	(6) 3	1 (7)
S-1 250 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	3	1
S-1 500 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	(8) 2	0
S-1 1000 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	2	(7)
S-1 1100 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$		

Summary of Report, Nature of Failures and Corrective Action Taken:

(1) S/N 31 had shorts or discontinuities in excess of 50 ns.

(2) S/N's 21, 34 and 39 had shorts or discontinuities in excess of 50 ns.

(3) S/N's 32 and 58 failed ΔI_{CEX}. S/N 56 shorted. S/N's 31 and 55 failed $r_{CE(sat)}$

(4) S/N's 47 and 48 shorted after 300 cycles.

(5) S/N's 44 and 51 failed ΔI_{CEX}.

(6) S/N 52 shorted upon restarting Life Test after 100 hour End-Points.

(7) S/N 55 failed ΔI_{CEX}.

(8) Failure in test circuits caused S/N 53 to burn out.

J-769/2

5	5A PART TYPE, SIZE, RATING LOT, ETC.	VENDOR	VENDOR PART NO.	IND./GOV STD NO.
5				
6				
7				
8				

ITEM	TEST OR ENVIRONMENT	C PER SPEC	D SPEC. PARAGRAPH/ METHOD/CONDITION	E TEST LEVELS, DURATION AND OTHER DETAILS	F NO. TESTED	G NO. FAILED
5-2	Sequential Storage Life	B	4.3.2	$T_A = 175°$ C 1100 hours	4	0
5-2	100 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	4	1 (1)
5-2	750 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	4	1 (1)
5-2	500 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	4	1 (2)
5-2	1000 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$	4	1 (2)
5-2	1100 hour End-Points	A	Table IV	ΔI_{CEX} h_{FE} $r_{CE(sat)}$		

J-769/2

SUMMARY OF REPORT, NATURE OF FAILURES AND CORRECTIVE ACTIONS TAKEN:

(1) S/N 57 failed I_{CEX}.
(2) S/N 59 failed I_{CEX}.

NO. 742.60.30.03-111-04

Universal Report No. 742.60.30.00-H1-04 Originator's Report No. 11253-8-1

REPORT OF TEST ON Westinghouse 113D(2N3432) Transistors - Qualification

TEST PERFORMED BY:

CONTINENTAL TESTING LABORATORIES, INC.

TEST AUTHORIZED BY:

NASA/MSFC
Contract No. NAS8-11253

	Date	Signature
Test Initiated		
Test Completed		
Report Written By	3/30/65	Robert D. Stiles
Technician	3/30/65	Joseph F. Sands
Test Engineer	3/30/65	Robert D Stiles
Supervisor	3/30/65	Floyd C Kinney
Supervisor	4/2/65	Madison S Bryant
Government Repr.	4/2/65	L Dominick
Final Release		

TABLE OF CONTENTS

ADMINISTRATIVE DATA

1. PURPOSE OF TEST

To subject the Westinghouse 113D (2N3432) Transistors to a series of environmental and electrical tests to qualify this type for possible use in the Saturn program equipment.

2. MANUFACTURER

Westinghouse Electric Corporation

3. MANUFACTURER'S TYPE OR MODEL NO.

113D (2N3432)

4. DRAWING, SPECIFICATION OR EXHIBIT

NASA 50M03501A/33 and MIL-STD-750

5. QUANTITY OF ITEMS TESTED

100

6. DATE TEST COMPLETED

February 5, 1965

7. SECURITY CLASSIFICATION OF ITEM

Unclassified

8. TEST CONDUCTED BY

Continental Testing Laboratories, Inc.,
755 U.S. Highway 17-92, Fern Park, Florida

9. DISPOSITION OF TEST SPECIMENS

Returned to NASA/MSFC, R-ASTR-RT, Attention: Mr. J. H. Smith

LIST OF APPARATUS

1. Power Supply, Lambda, Model #71.
2. Power Supply, Hyperion, Model #A1-32-10, S/N 129-228 A/P6.
3. Transistor Test Station, Optimized Devices, Model #1500.
4. Vacuum Tube Voltmeter, Hewlett-Packard, Model #412A.
5. Vacuum Tube Voltmeter, Hewlett-Packard, Model #400H, S/N 313-22295.
6. Digital Voltmeter, Hewlett-Packard, Model #405BR.
7. Millivoltmeter, Hewlett-Packard, Model #411A.
8. Microvolt Ammeter, Hewlett-Packard, Model #425A, S/N 4859.
9. Differential Voltmeter, John Fluke, Model 803B, S/N 1736.
10. Wide Range Oscillator, Hewlett-Packard, Model #200CD, S/N 229-45217.
11. Pulse Generator, Hewlett-Packard, Model #214A, S/N 219.
12. Digital Counter, Hewlett-Packard, Model #50-5245L, S/N 335-00888.
13. Oscilloscope, Tektronix, Model #561-A, S/N 9979.
14. Potentiometer, Leeds & Northrup, Catalogue #8692, S/N 1629152.
15. Accelerometer, Endevco, Model 2215C, S/N FB-79.
16. Micrometer 1", Starrett, Model #436.
17. Sliding 6" Caliper, Starrett, Model #1025.
18. Soldering Pot, American Beauty, Catalogue #600.
19. ATC Timer, 1 second increment.
20. Tork Timer, 1 minute increment.
21. Vibration System, Ling Electronics.

LIST OF APPARATUS

22. Altitude Chamber, Consolidated Vacuum Corporation, Model #PS-40A.

23. Temperature Chambers, Continental Testing Laboratories, Inc., Models M12DR, M14DR, M16DH and M18DH.

24. Shock Machine, Continental Testing Laboratories, Inc., Model SH-5K.

25. High G Centrifuge, Continental Testing Laboratories, Inc., S/N 1028.

26. Modular Life Test Rack, Continental Testing Laboratories, Inc.

27. Discontinuity Time Monitor, Continental Testing Laboratories, Inc.

SUMMARY

DESCRIPTION OF ITEMS

The Westinghouse 113D (2N3432) (Date Code 434) is a silicon, fused, NPN, power transistor intended for use in voltage and current regulators, amplifiers, and high-power switching circuit applications.

OBJECTIVE OF TEST

To determine the capabilities and limitations of the Westinghouse 113D (2N3432) Transistors and their performance during the tests conducted as outlined in 50M03501A and 50M03501A/33 specifications.

CONCLUSIONS

The units, with limitations, met the requirements of 50M03501A specification. These units should not be utilized in the extreme environmental levels such as may be encountered in Group B Tests, Subgroup 4, of this test program which stresses the units beyond the manufacturer's specifications.

RECOMMENDATIONS

It is recommended that the proposed mounting of these devices be tested thoroughly so that temperature dissipation will not overheat the junction.

Distribution of Test Samples

Tests	Sample S/N's
"A" Group Test	1 - 90
Operating Life	71, 72, 76, 78, 79, 3, 4, 5, 7 and 10
Storage Life	11 - 20
Altitude Moisture Resistance	21 - 30
Solderability Acceleration Shock Vibration	31 - 40
Power Cycling Thermal Shock Terminal Strength	41 - 50
Sequentially through all tests	61 - 70
Control Group and Spares	71 - 80
Test Set-up and Check Out	81 - 90

TABLE I

Performance Requirements

Measurement	Symbol	Condition	Min.	Max.	Units
Collector Current	I_{CEX}	$V_{BE} = -1.5$ Vdc, $V_{CE} = 200$ Vdc $T_C = +150°C$		20	mA
Emitter Current	I_{EBO}	$V_{EB} = 25$ Vdc $I_C = 0$ $T_C = +150°C$		20	mA
Saturation Resistance	$r_{CE(sat)}$	$I_C = 5.0$ A $I_B = 750$ mA $T_C = +25°C$		0.5	ohm
DC Current Gain	h_{FE}	$V_{CE} = 4$ Vdc $I_C = 5$A $T_C = +25°C$	10	18(typ)	
Beta Cutoff Frequency	f_{hfe}	$V_{CE} = 4$ Vdc $I_C = 5$A $T_C = +25°C$ I_B(AC) = 1 mA rms		30(typ)	kc

TABLE II

GROUP B TESTS

Test	Method MIL-STD-750	Condition
Subgroup 1		
Operating Life	1026	Para 4.3.1
Post-Test End-Point Measurements		Table IV of the applicable detail specification
Subgroup 2		
High Temperature Life (Storage Life)	1031	Para 4.3.2
Post-Test End-Point Measurements		Table IV of the applicable detail specification
Subgroup 3		
Altitude	1001	Para 4.3.3
Moisture Resistance	1021	Para 4.3.4
Post-Test End-Point Measurements		Table IV of the applicable detail specification
Subgroup 4		
Solderability		Para 4.3.5
Constant Acceleration	2006	Para 4.3.6
Shock	2016	Para 4.3.7
Vibration, Variable Frequency	2056	Para 4.3.8
Post-Test End-Point Measurements		Table IV of the applicable detail specification
Subgroup 5		
Power Cycling	1052	Para 4.3.9
Thermal Shock	1056	Para 4.3.10
Terminal Strength	2036	Para 4.3.11
Post-Test End-Point Measurements		Table IV of the applicable detail specification

TABLE III

Post-Test End-Point Measurements

Parameter	Symbol	Allowable Deviation	Min.	Max.
Collector Current	I_{CEX}	± 1.0 mA		
DC Current Gain	h_{FE}		10	
Saturation Resistance	$r_{CE(sat)}$			0.6 ohm

Note: The parameter measurements shall not deviate from the value obtained when tested before the environmental tests by more than the above limits.

VISUAL EXAMINATION (EXTERNAL)

The transistors were visually examined under a 10X microscope for quality of workmanship and mechanical soundness, including such factors as seals, soldering, coating, plating and product marking. Following the visual examination, ten of the samples were subjected to a physical dimensions check using standard measuring instruments, i.e., micrometers, calipers, etc., to insure that the semiconductors met the requirements of the applicable detail specification.

RESULTS

On S/N 91 the part number was illegible and on S/N 92 the manufacturer's date code was illegible.

All physical dimensions were found to be within the specified limits of the outline drawing in the detail specification, Figure 1, Dimensional Outline, Transistor 113D.

VISUAL EXAMINATION (INTERNAL)

One semiconductor device was opened and examined with a 10X microscope to determine construction.

RESULTS

These transistors are of single chip construction in planar form with the emitter diffused into the base region and the base in turn diffused into the collector region. The chip is welded to the case over the stud, while leads for the base and emitter are welded to their respective locations on the chip and connected to feed-through terminals on the case header. The transistor is constructed in annular form with a portion of the base in the center surrounded by the emitter which in turn is surrounded by the rest of the base which is surrounded by the collector. The central portion of the base and the remainder of the base ring are connected by a jumper strap. It was also noted that the emitter had a jumper strap connected at one point to another point 180° around the emitter ring. The angular alignment of the emitter and base jumper straps was approximately 90°. The axis of the emitter jumper strap which lies approximately between the emitter base lead was taken as the Z axis, while the axis of the base jumper, which lies at 90° to the emitter jumper, was taken as the X axis. The Y axis lies perpendicular to the plane of the base, and consequently perpendicular to the plane of the jumpers.

There were no apparent imperfections noted in the construction of the welds or header seals.

SEAL-LEAK TEST

The semiconductors were subjected to a Leak Test by NASA, employing a radioactive tracer gas at a pressure differential of 80 ± 5 psi.

TEST RESULTS

S/N's 93-100 failed and were retained by NASA per AEC regulations.

GROUP A TESTS

ELECTRICAL TESTS

TEST PROCEDURE

The transistors were subjected to all the electrical performance requirements as set forth in Table I of this report. The tests were performed in accordance with 50M03501A/33 and MIL-STD-750 methods were incorporated. In the case of any parameter measurement falling within the measurement accuracy of the instrument, the sample was considered within specification limits.

Because of the nature of the devices and the parameters to be measured, $V_{CE(sat)}$, h_{FE}, and f_{hfe}, the devices were securely mounted to a large heat sink so that the case temperature would be held at +25°C during the measurements. The test procedures were arranged so that the bias conditions were applied to the device for a minimum period of time.

TEST RESULTS

S/N 2 failed I_{CEX} (shorted).
S/N 1 failed I_{EBO} (shorted).
S/N 82 failed f_{hfe} (shorted).
S/N's 1 and 83 failed h_{FE}.

GROUP B TESTS

Following the Group A Electrical Tests, the test samples were broken into five subgroups. Each subgroup was subjected to the tests as outlined in Table II and End-Point measurements as outlined in the detail specifications were performed following each subgroup and at specified times during the tests of Subgroups 1 and 2.

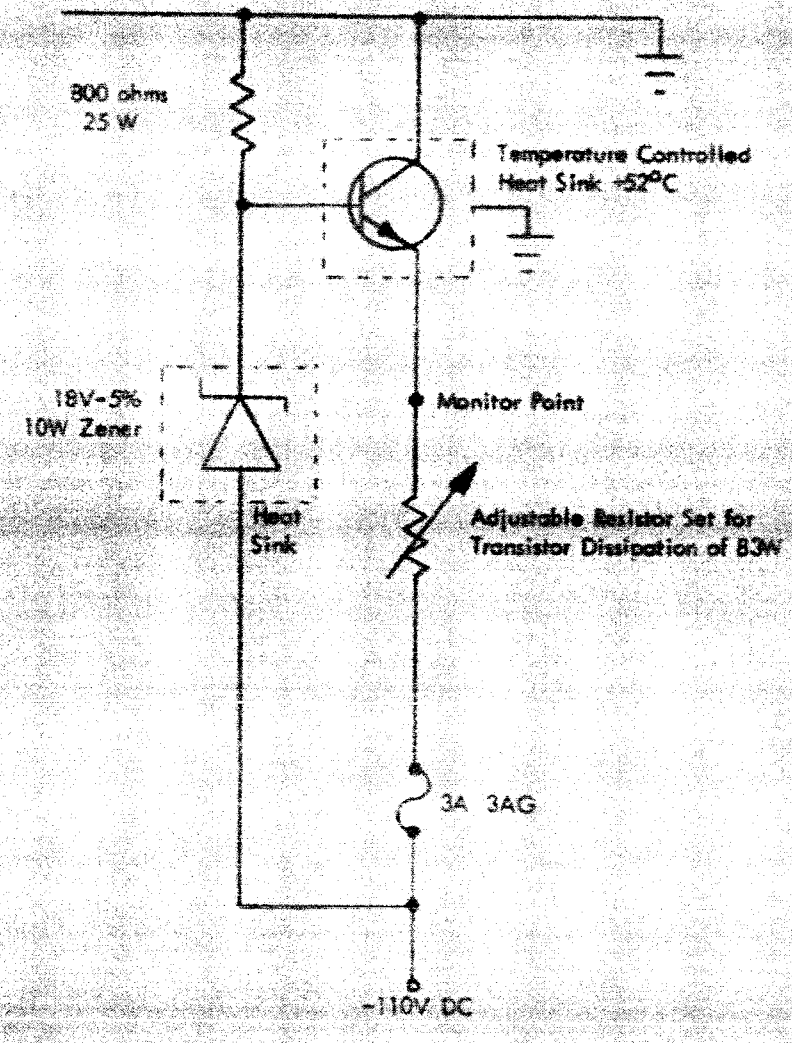

Figure 1

Operating Life Test Circuit

GROUP B TESTS

SUBGROUP 1

OPERATING LIFE TEST

TEST PROCEDURE

The test samples were subjected to 2000 hours Operating Life at case temperature of +88°C and a power dissipation of 83 watts. The units were removed from test and the End-Point measurements performed at 100, 250, 500, 1000, 1500 and 2000 hours. The circuit used during this test is shown in Figure 1.

In an attempt to establish a test condition of T_C = +37°C and P_T = 150 W, four units were destroyed, S/N's 6, 8, 9 and 90. The cause was determined to be excessive junction temperature. It was determined that the thermal resistance between the case and the heat sink could not be reduced sufficiently to maintain a case temperature of +37°C with a power dissipation of 150 watts and a sink temperature of +25°C. Consequently, the test conditions were modified so that the thermal resistance between case and sink was taken into account and the junction temperature stabilized at the maximum specified junction temperature of +150°C. This in turn resulted in a power dissipation of 83 watts.

The heat sink used to stabilize case temperature for this test consisted of a 17"x17"x1/2" aluminum plate which formed one wall of a 17"x17"x6" water tank. The water temperature was thermostatically controlled so that the sink temperature could be maintained at +52°C.

Since P_T = 83W, T_S = 52°C, T_C = 88°C, $\theta_{C-S} = \frac{88-52^\circ}{83}$ C/W = .42° C/W. The case temperature was measured by inserting a thermocouple into a .060" diameter hole drilled into the hex portion of the case. The heat sink temperature was measured with a United Electric, Model E32N, temperature controller whose sensing element was attached diagonally across the heat sink. The transistor was prepared with Dow Corning heat sink compound, and torqued to the maximum recommended value of 30 lb.-in. No insulating washers were used in the mounting. All ten devices tested were mounted on the common heat sink, and were spaced 3" from one another on a 5x5 grid pattern. When the device failures occurred during the initial test set-up at 150W, only one device at a time was mounted on the heat sink. At a power dissipation of 150W, the case temperature would rise beyond 37°C to approximately 85°C, at which time failure would occur, while the sink temperature was maintained at or near 25°C. A thermocouple surface probe was also used to measure the sink temperature adjacent to the transistor. It was found that the heat sink temperature had increased to 28°C.

OPERATING LIFE TEST
(Continued)

TEST RESULTS

S/N 71 shorted out immediately following re-installation in the life rack after the 1500 hour End-Point measurements. Examination of the End-Point data revealed no reason for the failure. S/N 71 was removed from test.

S/N 72 exceeded the limit specified for ΔI_{CEX} at the 2000 hour End-Points.

SUBGROUP 2

STORAGE LIFE TEST

TEST PROCEDURE

The semiconductors were inserted into a Storage Life Test fixture and placed in a high temperature chamber and stabilized at 175°C for a period of 2000 hours. The semiconductors were removed from the chamber at the completion of 100, 250, 500, 1000, 1500 and 2000 hours for End-Point measurements.

TEST RESULTS

All units were within the specified limits.

SUBGROUP 3

ALTITUDE TEST

TEST PROCEDURE

The semiconductors were placed in an altitude chamber and the pressure was reduced to an equivalent of 200,000 feet of altitude. After the chamber had attained this altitude, measurement of I_{CBO} of the test samples was performed. The chamber was then returned to ambient pressure and measurement of I_{CBO} of the test samples was again performed.

TEST RESULTS

All samples were within the specified limits.

SUBGROUP 3
(Continued)

MOISTURE RESISTANCE TEST

TEST PROCEDURE

The semiconductors were placed in a moisture resistance chamber and subjected to ten humidity cycles per MIL-STD-750, Method 1021.

Upon completion of the test, the specimens were removed from the chamber and visually examined for evidence of damage as a result of the test, and Post-Test End-Point measurements were performed.

TEST RESULTS

All samples were within the specified limits.

SUBGROUP 4

SOLDERABILITY TEST

TEST PROCEDURE

The semiconductor terminals were immersed in Kester Soldering Flux, Formula #1544, to within 1/4" of the body of the devices. After this process, the units were immediately immersed in solder composed of 60 parts tin and 40 parts lead as specified in MIL-STD-202B, Method 210, Test Condition B.

TEST RESULTS

The units showed no evidence of physical damage, and solder covered more than 90% of the leads.

CONSTANT ACCELERATION TEST

TEST PROCEDURE

The semiconductors were mounted in a centrifuge and subjected to a constant acceleration of 20,000 g's for five minutes in each direction of the three mutually perpendicular axes. Following the Acceleration Test, the devices were visually examined for evidence of damage as a result of the test.

TEST RESULTS

The units showed no evidence of damage.

SUBGROUP 4
(Continued)

SHOCK TEST

TEST PROCEDURE

The semiconductors were mounted on a shock machine and subjected to five blows in each direction of the three mutually perpendicular axes. Each blow had an amplitude of 3500 g's in a half-sine waveform and a duration of 0.3 to 0.5 milliseconds. The semiconductors were energized during this test and the emitter potential was monitored to determine if there were any discontinuities or shorts of a duration greater than 50 nanoseconds, as outlined in the general specification. Following the Shock Test, the devices were visually examined for damage.

TEST RESULTS

S/N 31 indicated a discontinuity or short exceeding 50 nanoseconds during the second blow in the Y axis.

VIBRATION, VARIABLE FREQUENCY

TEST PROCEDURE

The semiconductors were inserted in a test fixture which, in turn, was mounted on the table of the vibration exciter. The units were then subjected to vibration in the frequency range of 10 to 3000 cycles and return to 10 cycles in a time duration of 22 minutes. A vibration level of 30 g's or .45" DA was maintained, whichever was the lesser. The units were subjected to two sweeps as described above, along each of the three major axes.

The devices were energized during this test, and emitter potential was monitored to determine if there were any discontinuities or shorts with a duration greater than 50 nanoseconds, as outlined in the general specification.

Following the Vibration Test, the units were visually examined for damage, and Post-Test End-Point measurements were performed.

TEST RESULTS

Vibration:

Discontinuities or shorts were indicated as follows: S/N 31 in X and Y axis. S/N 34 in Y and Z axis. S/N 39 in X, Y and Z axis.

SUBGROUP 4
(Continued)

VIBRATION, VARIABLE FREQUENCY

TEST RESULTS (Continued)

End-Points:

S/N's 32 and 58 failed ΔI_{CEX}. (shorted)
S/N 58 shorted.
S/N's 31 and 55 failed $r_{CE(sat)}$

SUBGROUP 5

POWER CYCLING TEST

TEST PROCEDURE

The semiconductors were subjected to a Power Cycling Test under the following conditions:

The "Power-On" portion of the cycle was long enough to allow the semiconductor case temperature to reach +150°C ± 5°C. The "Power-Off" portion of the cycle was long enough to permit the case temperature to drop within ± 5°C of the ambient temperature. This cycle was repeated for a total of 500 cycles.

TEST RESULTS

S/N's 47 and 48 failed (shorted) after about 300 cycles.

THERMAL SHOCK TEST

TEST PROCEDURE

The semiconductors were subjected to five cycles of thermal shock, these conditions being five minutes at 100°C, alternated by five minutes at 0°C as per MIL-STD-750, Method 1056, Condition B.

TEST RESULTS

No physical damage was observed as a result of this test.

SUBGROUP 5
(Continued)

TERMINAL STRENGTH TEST

TEST PROCEDURE

Each semiconductor was subjected to a Terminal Strength Test with a 5 pound load for a 15 second duration, as specified in MIL-STD-750, Method 2036, Condition A.

At the conclusion of the test, the units were examined for evidence of damage, and Post-Test End-Point measurements were performed.

TEST RESULTS

No damage was noted as a result of the Terminal Strength Test.

During the Post-Test End-Point measurements, S/N's 44 and 51 failed ΔI_{CEX}. (Shorted)

SEQUENTIAL TESTS

TEST PROCEDURE

Ten samples (S/N's 5. through 60) were placed in all of the tests of Subgroups 3, 4 and 5 in order. Following the End-Point measurements for Subgroup 5, half of this group was placed in Operating Life Test and the remaining half was placed in Storage Life.

End-Point measurements were performed on both groups at 100, 250, 500, 1000 and 1100 hours.

TEST RESULTS

Operating Life: S/N 55 failed ΔI_{CEX} at 250, 500 and 1100 hour End-Points.
S/N 52 failed upon restart after 100 hour End-Points.

Storage Life: S/N 57 failed ΔI_{CEX} at 250 and 500 hour End-Points.
S/N 59 failed ΔI_{CEX} at 1000 and 1100 hour End-Points.

ENCLOSURE 1

SUMMARY SHEET #1

Item: Transistors Contr: NASA Date Completed 2/5/65 No. of Samples 100 Sample Nos.

Spec: 30M03501A/33 Mfr: Westinghouse Mfr's Type 2N3432 (113D) Date Test Began 11/3/64 From 1 to 100

Test No.	Test Grp	Sample Nos.	Proc Para.	Data Page	Test Conditions	Specification Limits Max unless otherwise specified	Measured Values Min	Measured Values Max	No. Samples Tested	No. Samples Passed	REMARKS
1	A	1-100	4.2.2	2-10	Seal Leak Test	Atmospheric cc/sec in excess of 1×10^{-9} cc/sec.			100	92	S/N 93-100 out
2	A	1-92	4.2.1.	2-10	Visual Exam (Ext)	As per spec.			92	90	S/N 91, 92 out
3	A	1-10	3.3	1	Physical Dimensions	As per spec.			10	10	
4	A	1-90	4.1.3	2-10	Collector Current I_{CEX} $V_{BE} = -1.5$ Vdc $V_{CE} = 200$ Vdc $T_C = +150°C$	Max. 20 mA	.035 mA	200 mA+	90	89	S/N 2 out S/N 2 not used in rest of summary.
5	A	1, 3-90	4.1.3	2-10	Emitter Current I_{EBO} $V_{EB} = 25$ Vdc $I_C = 0$ $T_C = +150°C$	Max. 20 mA	.0146mA	200 mA+	89	88	S/N 1 out
6	A	1, 3-90	4.1.3	2-10	Saturation Resistance $r_{CE(sat)}$ $I_B = 750$ mA $I_C = 5A$ $T_C = +25°C$	Max. 0.5 ohms	.054 ohms	.174 ohms	89	89	
7	A	1, 3-90	4.1.3	2-10	Beta Cutoff Freq f_{hfe} $V_{CE} = 4$ Vdc $I_C = 5A$ $T_C = +25°C$ $I_n(AC) = 1$ mA rms	Max. 30 kc (typ)	0 kc	87 kc	89	88	S/N 82 shorted
8	A	1, 3-81, 83-90	4.1.4	2-10	DC Current Gain h_{FE} $V_{CE} = 4$ Vdc $I_C = 5A$ $T_C = +25°C$	Min. 10 Max. 19 (typ)	7	32	88	86	S/N 1, 83 out
9	A	73	4.2.1.2		Visual Exam (Int)	Opened S/N 73 to determine construction			1	1	

SUMMARY SHEET # 2

Item: Transistors Contr: NASA Date Completed 2/5/65 No. of Samples 100 Sample Nos.:

Spec: 50M03501A/33 Mfr: Westinghouse Mfr's Type 2N3432 (113D) Date Test Began 11/3/64 From 1 to 100

Test No.	Test Grp	Sample Nos.	Proc. Para.	Data Page	Test Conditions	Specification Limits Max unless otherwise specified	Measured Values Min	Measured Values Max	No. Samples Tested	No. Samples Passed	REMARKS
10	B Sub Grp 1	71,72, 3,4,5, 76,7, 78,79, 10	4.3.1		Operating Life MIL-STD-750 Method 1026 T_C = +190°F P_t = 83W Duration 2000 ±48 hs						S/N 6,8,9,90 failed during test set-up.
			Table IV	11	100 hr End-Points Collector Current ΔI_{CEX} V_{BE} = 1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	Allow. Dev. ± 1.0 mA	.015mA	.451mA	10	10	
					DC Current Gain h_{FE} V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	Min. 10	12	20	10	10	
					Saturation Resistance $r_{CE(sat)}$ I_C = 5A I_B = 750 mA T_C = +25°C	Max. .5 ohm	.068 ohms	.16 ohms	10	10	
				12	250 hr End-Points ΔI_{CEX} h_{FE} $r_{CE(sat)}$	Allow. Dev. ± 1.0 mA Min. 10 Max. .5 ohm	.03mA 14 .068 ohms	.60mA 25 .16 ohms	10 10 10	10 10 10	
				13	500 hr End-Points ΔI_{CEX} h_{FE} $r_{CE(sat)}$	Allow. Dev. ± 1.0 mA Min. 10 Max. .5 ohm	.003mA 12 .072 ohms	.701mA 20 .17 ohms	10 10 10	10 10 10	

SUMMARY SHEET #3

Item Transistors Contr NASA Date Completed 2/5/65 No. of Samples 100 Sample Nos.:

Spec. 50M03501A/33 Mfr: Westinghouse Mfr's Type 2N3432(113D) Date Test Began 11/3/64 From 1 to 100

Test No.	Test Grp	Sample Nos.	Proc Para.	Data Page	Test Conditions	Specification Limits Max unless otherwise specified	Measured Values Min	Measured Values Max	No. Samples Tested	No. Samples Passed	REMARKS
10	B Sub Grp 1	71,72, 3,4,5, 76,7, 78,79, 10	Table IV	14	1000 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	000mA	.851mA	10	10	
					h_{FE}	Min. 10	14	24	10	10	
					$r_{CE(sat)}$	Max .5 ohms	.074 ohms	.144 ohms	10	10	
				15	1500 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.002mA	.751mA	10	10	
					h_{FE}	Min 10	13	23	10	10	
					$r_{CE(sat)}$	Max .5 ohms	.070 ohms	.156 ohms	10	10	
											SN 71 shorted on restart
				16	2000 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.04mA	1.3mA	9	8	S/N 72 out
					h_{FE}	Min 10	14	25	9	9	
					$r_{CE(sat)}$	Max .5 ohms	.074 ohms	.168 ohms	9	9	
11	B Sub Grp 2	11-20	4.3.2		High Temp Life (Storage Life) MIL-STD-750 Method 1031 T_A = +175°C Duration 2000 hrs ± 48 hrs.						
			Table IV	17	100 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.015mA	.34mA	10	10	
					h_{FE}	Min 10	15	30	10	10	
					$r_{CE(sat)}$	Max .5 ohms	.07 ohms	.11 ohms	10	10	
				18	230 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.002mA	.26mA	10	10	
					h_{FE}	Min 10	14	22	10	10	
					$r_{CE(sat)}$	Max .5 ohms	.072 ohms	.122 ohms	10	10	
				19	500 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.01mA	.185mA	10	10	
					h_{FE}	Min. 10	13	20	10	10	
					$r_{CE(sat)}$	Max .5 ohms	.074 ohms	.11 ohms	10	10	

SUMMARY SHEET # 4

Item: Transistors Contr: NASA Date Completed 2/5/65 No. of Samples 100 Sample Nos

Spec: 50M0350/A/33 Mfr: Westinghouse Mfr's Type 2N3432(113D) Date Test Began 11/3/64 From 1 to 100

Test No.	Test Grp	Sample Nos.	Proc Para.	Data Page	Test Conditions	Specification Limits Max unless otherwise specified	Measured Values Min	Measured Values Max	No. Samples Tested	No. Samples Passed	REMARKS
11	B Sub Grp 2	11-20	Table IV	20	1000 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.045mA	.245mA	10	10	
					h_{FE}	Min. 10	14	23	10	10	
					$r_{CE(sat)}$	Max. .5 ohms	.074ohms	.104ohms	10	10	
				21	1500 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.06mA	.36mA	10	10	
					h_{FE}	Min. 10	13	20	10	10	
					$r_{CE(sat)}$	Max. .5 ohms	.07 ohms	.108ohms	10	10	
				22	2000 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.08mA	.46mA	10	10	
					h_{FE}	Min. 10	15	22	10	10	
					$r_{CE(sat)}$	Max. .5 ohms	.072ohms	.116ohms	10	10	
12	B Sub Grp 3	21-30 51-60	4.3.3		Altitude Test 200,000 ft. MIL-STD-750 Method 1001 I_{CBO} V_{CB} = 200V/dc I_E = 0	Ambient (20mA Max) At altitude (20mA Max) Post Altitude (20mA Max)	.023mA .022mA .023mA	.4mA .4mA .4mA	20 20 20	20 20 20	
13	B Sub Grp 3	21-30 51-60	4.3.4		Moisture Resistance MIL-STD-750 Method 1021	10 Cycles			20	20	
14	B Sub Grp 3	21-30 51-60	Table IV	23-24	Post-Test End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.008mA	.76mA	20	20	
					h_{FE}	Min. 10	14	27	20	20	
					$r_{CE(sat)}$	Max. .5 ohms	.058ohms	.126ohms	20	20	
15	B Sub Grp 3	31-40 51-60	4.3.5		Solderability MIL-STD-202C Method 210 Condition B	90% of surface to be covered with smooth bright film of solder.			20	20	

SUMMARY SHEET # 5

Item: Transistors Contr: NASA Date Completed 2/3/65 No. of Samples 100 Sample Nos.:

Spec: 50M03501A/33 Mfr: Westinghouse Mfr's Type 2N3432(113D) Date Test Began 11/3/64 From 1 to 100

Test No.	Test Grp	Sample Nos.	Proc Para.	Data Page	Test Conditions	Specification Limits Max unless otherwise specified	Measured Values Min	Measured Values Max	No. Samples Tested	No. Samples Passed	REMARKS
16	B Sub Grp 4	31-40 51-60	4.3.6		Constant Accel. 20,000 g's, 5 min. XYZ axes MIL-STD-750 Method 2006				20	20	
17	B Sub Grp 4	31-40 51-60	4.3.7		Shock MIL-STD-750 Method 2016 3500 g's .3-.5 ms 5 blows XYZ axes	Max. 50 nanoseconds			20	19	S/N 31 exceeded 50 ns.
18	B Sub Grp 4	31-40 51-60	4.3.8		Vibration Var. Freq. 0.45" DA or 30 g's 10-3000 cps. 2-22 min. sweeps XYZ axes MIL-STD-750 Method 2056	Max. 50 nanoseconds			20	17	S/N 31,34,39 exceeded 50ns
19			Table IV	25-26	Post-Test End-Points ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.000mA	200mA	20	18	S/N 32 out S/N 58 shorted
					h_{FE}	Min. 10	13	27	20	20	
					$r_{CE(sat)}$	Max. .5 ohms	.068 ohms	3 ohms	20	18	S/N 31,55 out
20	B Sub Grp 5	41-50 51-57 59-60	4.3.9		Power Cycling MIL-STD-750 Method 1052 On Time 1 min. Off Time 2 min. Temp +150°C 500 cycles				19	17	S/N 47,48 shorted

SUMMARY SHEET # 6

Item: Transistors Contr: NASA Date Completed 2/5/65 No. of Samples 100 Sample Nos.

Spec: 50M03501A/33 Mfr: Westinghouse Mfr's Type 2N3432(1130) Date Test Began 11/3/64 From 1 to 100

Test No.	Test Grp	Sample Nos.	Proc Para.	Data Page	Test Conditions	Specification Limits Max unless otherwise specified	Measured Values Min	Measured Values Max	No. Samples Tested	No. Samples Passed	REMARKS
21	B Sub Grp 5	41-50 51-60	4.3.10		Thermal Shock MIL-STD-750 Method 1056 Condition B +100°C 5 min. 0°C 5 min. 5 Cycles				20	20	
22	B Sub Grp 5	41-50	4.3.11		Terminal Strength MIL-STD-750 Method 2036 5 lb. for 15 sec. on each lead.				20	20	
23	B	41-46 49-50 51-57 59-60	Table IV	27-28	Post-Test End-Points ΔI_{CEX} h_{FE} $r_{CE(sat)}$	Allow. Dev. ± 1.0 mA Min 10 Max .5 ohms	.000mA 10 .054 ohms	200mA 22 .152 ohms	17 17 17	15 17 17	S/N 44, 51 out
24	B	52-55	4.3.1		Operating Life Seq. MIL-STD-750 Method 1026 T_C = 88°C P_T = 83W						
25	B	52-55	Table IV	29	100 hr End-Points ΔI_{CEX} h_{FE} $r_{CE(sat)}$	Allow. Dev. ± 1.0 mA Min 10 Max .5 ohms	.02mA 17 .054 ohms	.50mA 28 .09 ohms	4 4 4	4 4 4	SN 52 shorted on restart
				30	250 hr End-Points ΔI_{CEX} h_{FE} $r_{CE(sat)}$	Allow. Dev. ± 1.0 mA Min 10 Max .5 ohms	.02mA 16 .052 ohms	1.3mA 28 .108ohms	3 3 3	2 3 3	S/N 55 out

SUMMARY SHEET #7

Item: Transistors Contr: NASA Date Completed 2/5/65 No. of Samples 100 Sample Nos.:

Spec: 50M03501A/33 Mfr: Westinghouse Mfr's Type 2N3432(113D) Date Test Began 11/3/64 From 1 to 100

Test No.	Test Grp	Sample Nos.	Proc. Para.	Data Page	Test Conditions	Specification Limits Max unless otherwise specified	Measured Values Min	Measured Values Max	No. Samples Tested	No. Samples Passed	REMARKS
25	B	53-55	Table IV	31	500 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.045mA	1.4mA	3	2	S/N 55 out
					h_{FE}	Min 10	14	20	3	3	
					$r_{CE(sat)}$	Max .5 ohms	.054 ohms	.104ohms	3	3	
											SN 53 shorted on restart
		54-55		32	1000 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.1mA	1.0mA	2	2	
					h_{FE}	Min 10	18	26	2	2	
					$r_{CE(sat)}$	Max .5 ohms	.06 ohms	.122 ohms	2	2	
				33	1100 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.01mA	1.4mA	2	1	S/N 55 out
					h_{FE}	Min 10	17	26	2	2	
					$r_{CE(sat)}$	Max .5 ohms	.058 ohms	.120 ohms	2	2	
26	B	56, 57, 59, 60	4.3.2		Storage Life Seq. MIL-STD-750 Method 1031						
			Table IV	29	100 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.068mA	.94mA	4	4	
					h_{FE}	Min 10	16	23	4	4	
					$r_{CE(sat)}$	Max .5 ohms	.074 ohms	.098 ohms	4	4	
				30	250 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.038mA	1.14mA	4	3	S/N 57 out
					h_{FE}	Min 10	16	21	4	4	
					$r_{CE(sat)}$	Max .5 ohms	.074 ohms	.098 ohms	4	4	
				31	500 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.013mA	1.14mA	4	3	S/N 57 out
					h_{FE}	Min 10	14	17	4	4	
					$r_{CE(sat)}$	Max .5 ohms	.072 ohms	.102 ohms	4	4	
				32	1000 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.06mA	2.34mA	4	3	S/N 59 out
					h_{FE}	Min 10	14	21	4	4	
					$r_{CE(sat)}$	Max .5 ohms	.08 ohms	.11 ohms	4	4	

SUMMARY SHEET # 8

Item Transistors Contr NASA Date Completed 2/5/65 No. of Samples 100 Sample Nos.:

Spec: 50M03501A/33 Mfr: Westinghouse Mfr's Type 2N3432(113D) Date Test Began 11/3/64 From 1 to 100

Test No.	Test Grp	Sample Nos.	Proc Para.	Data Page	Test Conditions	Specification Limit Max unless otherwise specified	Measured Values Min	Measured Values Max	No. Samples Tested	No. Samples Passed	REMARKS
26	B	56,57 59,60	Table IV	33	Storage Life Seq. 1100 hr End-Points						
					ΔI_{CEX}	Allow. Dev. ± 1.0 mA	.03mA	2.44mA	4	3	S/N 59 out
					h_{FE}	Min. 10	15	19	4	4	
					$r_{CE(sat)}$	Max. .5 ohms	.082 ohms	.112 ohms	4	4	

ENCLOSURE 2

CONTINENTAL TESTING LABORATORIES, INC.

Job No. [illegible] Spec. [illegible]

Manufacturer [illegible] Test Program [illegible] Ref. Spec. [illegible]

Transistor Type [illegible] Report No. 11253-8-1 Test [illegible]

Test Typ.	Test	Date	Parameter Measurement and Test Condition	Sym-bol	Transistor Serial Number 1	2	3	4	5	6	7	8	9	10	Range Min	Max	Limits Min	Max	Units
A	[illegible]	[illegible]	PHYSICAL DIMENSIONS																
			HEX WIDTH		←	←	←	←	←	←	←	←	←	←					
			HEX HEIGHT		←	←	←	←	←	←	←	←	←	←					
			CASE HEIGHT		←	←	←	←	←	←	←	←	←	←					
			CASE WIDTH		←	←	←	←	-	←	←	←	←	←					
			LEAD LENGTH		←	←	←	←	←	←	←	←	←	←					
			LEAD WIDTH		←	←	←	←	←	←	←	←	←	←					
			BOLT LENGTH		←	←	←	←	←	←	←	←	←	←					
			BOLT WIDTH		←	←	←	←	←	←	←	←	←	←					
			HOLE DIAMETER		←	←	←	←	←	←	←	←	←	←					
			FLANGE WIDTH		←	←	←	←	←	←	←	←	←	←					

CONTINENTAL TESTING LABORATORIES, INC.

Job No. CTN-8   Spec. 50M03501A/33

Manufacturer Westinghouse   Test Program NASA   Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D)   Report No. 11253-B-1   Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	1	2	3	4	5	6	7	8	9	10	Range Min	Range Max	Limits Min	Limits Max	Units
			Seal Leak Test															10^{-7}	cc/sec
		[illegible]	Visual Examination a. Seals b. Soldering c. Coating d. Plating e. Welds f. Product Marking		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
			Performance Requirements																
	[illegible]	11/24	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°	I_{CEX}	9.8	* Short	.47	.315	.94	.34	.11	.15	.20	.035	.035	3.4		20	mA
	[illegible]	11/24	Emitter Current V_{EB} = 25 Vdc I_C = 0 T_C = +150°C	I_{EBO}	* Short	1.35	.76	.84	.05	.97	.303	.02	.98	.54	.02	1.8		20	mA
	[illegible]	11/1/64	Saturation Resistance I_B = 750 mA T_C = +25°C I_C = 5.0 A	$r_{CE(sat)}$	.098	.098	.08	.09	.08	.049	.084	.084	.088	.174	.049	.174		0.3	ohm
	[illegible]	11/24	Beta Cutoff Frequency	hfe	37	* 0	24	46	30	8	43	26	19	40	0	46		30 (typ)	kc
	[illegible]	11/12/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	* 7	32	15	16	20	18	18	22	15	16			10	18 (typ)	

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[redacted]

Job No. C114-8 — CONTINENTAL TESTING LABORATORIES, INC. — Spec. 50M03501A/33

Manufacturer: Westinghouse — Test Program: NASA — Ref. Spec.: MIL-STD-750

Transistor Type: 2N3432 (1130) — Report No.: 11253-8-1 — Test:

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 11	12	13	14	15	16	17	18	19	20	Range Min	Range Max	Limits Min	Limits Max	Units
A			Seal Leak Test															1x10⁻⁸	cc/sec
		11/26	Visual Examination a. Seals b. Soldering c. Coating d. Plating e. Welds f. Product Marking		*	*	*	*	*	*	*	*	*	*					
			Performance Requirements																
			Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°	I_{CEX}	1.2	.5	.3	.5	.5	.2	.25	.5	.2	.25		1.4		20	mA
			Emitter Current V_{EB} = 25 Vdc I_C = 0 T_C = +150°C	I_{EBO}	1.1	.45	.3	.102	.0845	.2	2.1	1.2	.22	2.42	.1	.3		20	mA
			Saturation Resistance I_B = 750 mA T_C = +25°C I_C = 5.0 A	$r_{CE(sat)}$	.098	.098	.098	.094	.122	.082	.084	.072	.088	.070	.07	.1		0.5	ohm
		11/26	Beta Cutoff Frequency	h_{fe}	46	45	42	41	34	38	31	30	29	27	25	45		30 (typ)	kc
		11/10/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	18	16	16	19	22	20	22	16	14	20	14	32	10	18 (typ)	

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CTL-8 | CONTINENTAL TESTING LABORATORIES, INC. | Spec. 50M03501A/33

Manufacturer Westinghouse | Test Program NASA | Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (1130) | Report No. 11253-8-4 | Test

Parameter Measurement and Test Condition	Symbol	21	22	23	24	25	26	27	28	29	30	Range Min	Range Max	Limits Min	Limits Max	Units
Seal Leak Test															1×10^{-8}	cc/sec
Visual Examination a. Seals b. Soldering c. Coating d. Plating e. Welds f. Product Marking																
Performance Requirements Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°	I_{CEX}	[illegible]	.145	[illegible]	.14	.285	.274	.29	.10	.15	.229	.10	[illegible]		20	mA
Emitter Current V_{EB} = 25 Vdc I_C = 0 T_C = +150°C	I_{EBO}	.40	.13	.26	.22	.27	9.1	1.4	2.6	1.5	.025	[illegible]	[illegible]		20	mA
Saturation Resistance I_B = 750 mA T_C = +25°C I_C = 5.0 A	$r_{CE(sat)}$	.083	.078	.087	.63	.10	.054	.103	.136	.066	.10	[illegible]	[illegible]		0.5	ohm
Beta Cutoff Frequency	f_{hfe}	38	45	34	30	53	33	50	58	37	39		[illegible]		30 (typ)	kc
DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	17	18	26	18	14	20	14	16	16	17	14	[illegible]	10	18 (typ)	

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Job No. CIN-8 CONTINENTAL TESTING LABORATORIES, INC. Spec. 50M03501A/33

Manufacturer Westinghouse Test Program NASA Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) Report No. 11253-8-2 Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	31	32	33	34	35	36	37	38	39	40	Range Min	Range Max	Limits Min	Limits Max	Units
A			Seal Leak Test															1x10⁻⁷	cc/sec
		[illegible]	Visual Examination a. Seals b. Soldering c. Coating d. Plating e. Welds f. Product Marking		-	-	-	-	-	-	-	-	-	-					
			Performance Requirements																
	[illegible]	[illegible]	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°	I_{CEX}	.21	.65	.12	.10	.48	.025	.32	.34	.18	.0045	.025	.65		20	mA
	[illegible]	[illegible]	Emitter Current V_{EB} = 25 Vdc I_C = 0 T_C = +150°C	I_{EBO}	1.30	1.42	5.28	1.3	.172	4.8	1.45	1.84	.0195	.68	.0195	5.28		20	mA
	[illegible]	11/9/64	Saturation Resistance I_B = 750 mA T_C = +25°C I_C = 5.0 A	r_{CE} (sat)	.116	.094	.086	.162	.086	.078	.119	.116	.072	.014	[illegible]	.116		0.5	ohm
	[illegible]	[illegible]	Beta Cutoff Frequency	f_{hfe}	41	31	24	69	87	38	33	71	36	31	24	87		30 (typ)	kc
	[illegible]	11/10/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	14	13	17	18	14	17	12	16	19	20	12	20	10	18 (typ)	

[illegible]

Job No. CTN-8 CONTINENTAL TESTING LABORATORIES, INC. Spec. 50M03501A/33

Manufacturer Westinghouse Test Program NASA Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) Report No. 11253-8-2 Test

Insp. Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	41	42	43	44	45	46	47	48	49	50	Range Min	Range Max	Limits Min	Limits Max	Units
A			Seal Leak Test															5x10[illegible]	cc/sec
		11/4/64	Visual Examination a. Seals b. Soldering c. Coating d. Plating e. Welds f. Product Marking		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
			Performance Requirements																
		11/4/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°	ICEX	.72	.20	.245	1.5	.053	.094	.072	.20	.62	.096	.053	1.5		20	mA
		11/4/64	Emitter Current V_{EB} = 25 Vdc I_C = 0 T_C = +150°C	IEBO	6.2	.121	1.1	.047	.5	.0882	.80	.57	.57	.055	.047	6.2		20	mA
	[illegible]	11/4/64	Saturation Resistance I_B = 750 mA T_C = +25°C I_C = 5.0 A	rCE (sat)	.084	.096	.096	.102	.058	.086	.118	.082	.08	.070	.058	.118		0.5	ohm
	[illegible]	11/4/64	Beta Cutoff Frequency	hfe	42	34	35	37	36	33	33	57	31	33	31	57		30 (typ)	kc
	[illegible]	11/10/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	hFE	16	14	18	20	18	20	16	15	22	20	14	22	10	18 (typ)	

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CONTINENTAL TESTING LABORATORIES, INC.

Job No. CTN-6 | Test Program NASA | Spec. 50M03901A/CJ

Manufacturer Westinghouse | Report No. 11253-8-1 | Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) | Test

Test Grp.	Tech.	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 51	52	53	54	55	56	57	58	59	60	Range Min	Max	Limits Min	Max	Units
A			Seal Leak Test															1×10^{-7}	cc/sec
		11/1/64	Visual Examination a. Seals b. Soldering c. Coating d. Plating e. Welds f. Product Marking		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
			Performance Requirements																
			Collector Current $V_{BE} = -1.5$ Vdc $V_{CE} = 200$ Vdc $T_C = +150°$	I_{CEX}	1.35	.39	.80	.24	1.10	.12	.35	.28	.16	.13	.13	1.35		20	mA
			Emitter Current $V_{EB} = 25$ Vdc $I_C = 0$ $T_C = +150°C$	I_{EBO}	.18	.286	.43	.042	.198	.52	.182	.531	.740	.0146	.0146	.72		20	mA
			Saturation Resistance $I_B = 250$ mA $T_C = +25°C$ $I_C = 5.0$ A	$r_{CE(sat)}$	.072	.070	.072	.114	.228	.090	.098	.098	.084	.088	.032	.114		0.5	ohms
		11/2/64	Beta Cutoff Frequency	$\|h_{fe}\|$	29	37	32	55	29	44	33	27	39	37	28	55		30 (typ)	kc
		11/9/64	DC Current Gain $V_{CE} = 4$ Vdc $I_C = 5A$ $T_C = +25°C$	h_{FE}	18	19	21	16	25	20	14	16	18	17	14	25	10	18 (typ)	
		11/10/64																	

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Job No. CTN-8 — CONTINENTAL TESTING LABORATORIES, INC. — Spec. 50M03501A/33

Manufacturer Westinghouse — Test Program NASA — Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) — Report No. 11253-8-2 — Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 61	62	63	64	65	66	67	68	69	70	Range Min	Range Max	Limits Min	Limits Max	Units
A			Seal Leak Test															1x10⁻⁸	cc/sec
		11/1/64	Visual Examination a. Seals b. Soldering c. Coating d. Plating e. Welds f. Product Marking		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
			Performance Requirements																
		11/2/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°	I_{CEX}	.37	.235	.12	.0385	.123	.045	1.06	.124	.118	.035				20	mA
		11/2/64	Emitter Current V_{EB} = 25 Vdc I_C = 0 T_C = +150°C	I_{EBO}	.83	.618	.305	.0945	.0115	.329	1.18	.297	1.55	1.40				20	mA
		11/3/64	Saturation Resistance I_B = 750 mA T_C = +25°C I_C = 5.0 A	$r_{CE(sat)}$	.092	.092	.068	.092	.094	.072	.074	.088	.126	.090				0.5	ohm
		11/4/64	Beta Cutoff Frequency	h_{fe}	34	34	29	34	30	30	36	28	32	28	24	74		30 (typ)	kc
		11/10/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	17	15	21	20	14	23	15	21	18	16	14	23	10	18 (typ)	

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CTN-8 | CONTINENTAL TESTING LABORATORIES, INC. | Spec. 50M03901A/33

Manufacturer Westinghouse | Test Program NASA | Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) | Report No. 11253-8-1 | Test

Date	Parameter Measurement and Test Condition	Symbol	71	72	73	74	75	76	77	78	79	80	Range Min	Range Max	Limits Min	Limits Max	Unit
	Seal Leak Test														1x10[illegible]	cc/sec
[illegible]	Visual Examination a. Seals b. Soldering c. Coating d. Plating e. Welds f. Product Marking		•	•	•	•	•	•	•	•	•	•					
	Performance Requirements Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°	I_{CEX}	.179	9.70	.195	.187	.132	.249	.207	.08	.165	.095	.08	9.7		20	mA
	Emitter Current V_{EB} = 25 Vdc I_C = 0 T_C = +150°C	I_{EBO}	.253	1.59	.239	1.54	1.85	.480	.171	.086	9.06	.069	.069	9.06		20	mA
	Saturation Resistance I_B = 750 mA T_C = +25°C I_C = 5.0 A	r_{CE} (sat)	.094	.111	.098	.088	.096	.078	.052	.10	.111	.078	[illegible]	[illegible]		0.5	ohm
	Beta Cutoff Frequency	f_{hfe}	72	40	28	36	31	41	34	36	37	27	27	41		30 (typ)	kc
	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	19	13	14	17	18	20	21	17	14	16	13	21	10	18 (typ)	

Job No. CIN-8 CONTINENTAL TESTING LABORATORIES, INC. Spec. 50M03501A/33

Manufacturer Westinghouse Test Program NASA Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (1130) Report No. 11253-8-2 Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	81	82	83	84	85	86	87	88	89	90	Range Min	Range Max	Limits Min	Limits Max	Units
A			Seal Leak Test															1x10^-8	cc/sec
			Visual Examination a. Seals b. Soldering c. Coating d. Plating e. Welds f. Product Marking		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
			Performance Requirements Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°	I_{CEX}	.10	.347	.383	.10	.333	.301	.165	8.70	.0945	.0745	.0745	8.7		20	mA
			Emitter Current V_{EB} = 25 Vdc I_C = 0 T_C = +150°C	I_{EBO}	.10	.019	.252	.330	.360	.175	.158	[illegible]	.040	.440	[illegible]	[illegible]		20	mA
			Saturation Resistance I_B = 750 mA T_C = +25°C I_C = 5.0 A	$r_{CE(sat)}$	.148	.012	.082	.088	.074	.111	.094	.08	.054	.044	[illegible]	[illegible]		0.5	ohm
			Beta Cutoff Frequency	f_{hfe}	34	*C	49	40	36	38	34	30	30	39	08	[illegible]		30 (typ)	kc
			DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	14	*5 SHATTERED	*8	15	20	15	17	17	26	16		[illegible]	10	19 (typ)	

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CONTINENTAL TESTING LABORATORIES, INC.

Job No. CIN-8

Manufacturer Westinghouse

Transistor Type 2N3432 (113D)

Test Program NASA

Report No. 11253-8-2

Spec. 50M03501A/33

Ref. Spec. MIL-STD-750

Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	71	72	3	4	5	76	7	78	79	10	Range Min	Range Max	Limits Min	Limits Max	Units
A	JJP	11/23/64	LIFE (OPERATING) 100 hr	Δ I_{CEX}	.038	.10	.045	.035	.04	.051	.03	.31	.015	.07	.015	.31			mA
B			Post-Test End-Points																
B	JJP	11/23/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.91	.26	.09	.155	.30	.71	.44	.49	.14	.145	.14	.91	Allowable Deviation ±1 mA		mA
B	JJP	11/23/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	19	12	14	15	20	19	14	15	12	16	12	20			
B	JJP	11/23/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	[illegible]	.102	.080	.090	.070	.069	.082	.100	.104	.110	.069	.11		0.6	ohm

[B]

Job No. CTN-8 — CONTINENTAL TESTING LABORATORIES, INC. — Spec. 50M30[illegible]

Manufacturer Westinghouse — Test Program NASA — Ref. Spec. [illegible]

Transistor Type 2N3432 (113D) — Report No. 11253-8-2 — Test

Test Type	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 71	72	3	4	5	76	7	78	79	10	Range Min	Range Max	Limits Min	Limits Max	Units
I	JAP	11/19/64	OPERATING LIFE 250 MA																
				ΔI_{CEX}	.012	.60	.23	.035	.09	.201	.03	.32	.185	.040					μa
B			Post-Test End-Points																
	JAP	12/10/64	Collector Current V_{BE} = -1.5 Vdc, V_{CE} = 200 Vdc, T_C = +150°C	I_{CEX}	.11	2.1	.25	.24	.15	.45	.08	.40	.35	.12	.35	2.0		Allowable Deviation: ±1 mA	mA
	JAP	12/10/64	DC Current Gain V_{CE} = 4 Vdc, I_C = 5A, T_C = +25°C	h_{FE}	21	14	17	18	25	21	16	17	14	18	15	25			
	JAP	12/10/64	Saturation Resistance I_C = 5.0 A, I_B = 750 mA, T_C = +25°C	r_{CE} (sat)	.088	.100	.080	.090	.074	.068	.084	.100	.100	.160	.069	.160		0.6	ohm

CONTINENTAL TESTING LABORATORIES, INC.

Job No. CIN-8 Spec. 50M03501A/33

Manufacturer Westinghouse Test Program NASA Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) Report No. 11253-8-2 Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 71	72	3	4	5	76	7	78	79	10	Range Min	Range Max	Limits Min	Limits Max	Units
B	JJJ	12/10/64	500 hr. OPERATING LIFE																
				ΔI_{CEX}	.003	.20	.02	.125	.03	.34	.04	.54	.445	.035	.003	.111			
B			Post-Test End-Points																
	JJJ	12/10/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.175	2.5	.45	.49	.23	.95	.15	.64	.61	.21	.15	2.5		Allowable Deviation ± 1 mA	
B	JJJ	12/10/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	17	12	14	45	20	19	14	14	12	14	12	36			
B	JJJ	12/10/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.086	.108	.082	.094	.078	.079	.090	.116	.110	.130	.078	.126		0.6	ohm
B3																			

Job No. CIN-8 CONTINENTAL TESTING LABORATORIES, INC. Spec. 50M03501A/33

Manufacturer Westinghouse Test Program NASA Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) Report No. 11253-8-1 Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	71	72	3	4	5	76	7	78	79	10	Range Min	Range Max	Limits Min	Limits Max	Units
B	[illegible]	12/31/64	1000 HR. OPERATING LIFE																
				Δ [illegible]	.007	[illegible]	[illegible]	[illegible]	[illegible]	.557	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	
B			Post-Test End-Points																
			Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.165	2.7	.44	[illegible]	[illegible]	1.10	[illegible]	[illegible]	[illegible]	.51	[illegible]	[illegible]	Allowable Deviation ±1 mA		
			DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	21	14	16	17	24	21	15	17	14	20	14	24			
			Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.052	[illegible]	.080	[illegible]	.076	.074	.088	.108	.096	.144	.074	.144		0.6	ohm

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Job No. CIN-8 CONTINENTAL TESTING LABORATORIES, INC. Spec. 50M0350lA/33

Manufacturer Westinghouse Test Program NASA Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) Report No. 11253-8-2 Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number										Range		Limits		Units
					71	72	3	4	5	26	2	23	22	1	Min	Max	Min	Max	
A	[illegible]	1/22/65	1500 HOUR OPERATING LIFE																
				Δ I_{CEX}	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	.11	[illegible]	[illegible]	[illegible]	[illegible]			
B			Post-Test End-Points																
	[illegible]	1/22/65	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.17	[illegible]	[illegible]	[illegible]	[illegible]	1.1	.19	[illegible]	[illegible]	[illegible]	.17	[illegible]	Allowable Deviation ±1 mA		
	[illegible]	1/26/65	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	20		16			17	15	[illegible]	15	17	13	23			
115		1/22/65	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	[illegible]	[illegible]				[illegible]	[illegible]	[illegible]	.152	[illegible]	[illegible]	.152		0.6	ohm

Job No. CIN-8 — CONTINENTAL TESTING LABORATORIES, INC. — Spec. 50M03501A, 33

Manufacturer Westinghouse — Test Program NASA — Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) — Report No. 11253-8-F — Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number										Range		Limits		
					72	3	4	5	6	7	8	9	10		Min	Max	Min	Max	Reg'd
				Δ I_{CEX}	1.3	.30	.65	.70	.55	.07	.18	.65	.60		.07	1.00			
B			Post-Test End-Points																
			Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	4.8	.21	.40	.70	1.1	.15	.76	.75	.60		.13	.9	Allowable Deviation ±1 mA		
			DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	16	15	17	25	21	12	5	14	22		10				
			Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.120	.100	.100	.070	.070	.090	.106	.110	.120		.074	.112		0.6	ohms
11b																			

CONTINENTAL TESTING LABORATORIES, INC.

Job No. CIN-8
Manufacturer Westinghouse
Transistor Type 2N3432 (113D)

Test Program NASA
Report No. 11253-8-2

Spec. 50M03501A/33
Ref. Spec. MIL-STD-750
Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	11	12	13	14	15	16	17	18	19	20	Range Min	Range Max	Limits Min	Limits Max	Units
B	GW	11/23/64	STORAGE LIFE 100 hr																
				Δ I_{cex}	.09	.05	.07	.07	.093	.015	.215	.34	.30	.255	[illegible]	[illegible]			
B			Post-Test End-Points																
B	GW	11/23/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	1.55	.41	.90	.31	.185	.245	.44	.90	.45	.52	[illegible]	[illegible]	Allowable Deviation ±1 mA		
B	GW	11/23/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	16	15	15	17	20	19	20	15	30	18	[illegible]				
B	GW	11/23/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.080	.090	.110	.071	.071	.082	.082	.071	.086	.070	[illegible]	[illegible]		0.6	ohm

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Job No. CT-8 CONTINENTAL TESTING LABORATORIES, INC. Spec. 50M03501A/35

Manufacturer Westinghouse Test Program NASA Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (130) Report No. 11253-6-1 Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	11	12	13	14	15	16	17	18	19	20	Range Min	Range Max	Limits Min	Limits Max	Units
B	[illegible]	11/30/64	STORAGE LIFE 250 hr																
				Δ ICEX	.26	.06	.01	.05	.002	.13	.015	.01	.005	.005	[illegible]	[illegible]			
B			Post-Test End-Points																
	[illegible]	12/1/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	1.2	.30	.62	.17	.09	.13	.21	.55	.21	.26	.05	[illegible]	Allowable Deviation ±1 mA		
	[illegible]	12/1/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	18	17	17	20	22	20	21	16	14	20	14	[illegible]			
	[illegible]	12/1/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.084	.100	.182	.076	.072	.084	.098	.074	.088	.072	.072	[illegible]		0.6	ohm

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Job No. CTN-8 — CONTINENTAL TESTING LABORATORIES, INC. — Spec. 50M03501A/33

Manufacturer Westinghouse — Test Program NASA — Ref. Spec. MIL-STD-750

Transistor Type 2N3402 (1130) — Report No. 11203-8-1 — Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 11	12	13	14	15	16	17	18	19	20	Range Min	Range Max	Limits Min	Limits Max	Units
B	JHD	12/10/64	500 hrs. STORAGE LIFE																
				ΔI_{CEX}	.02	.08	-.02	.03	.068	.01	.185	.18	.035	.065	.01	.185			
b			Post-Test End-Points																
B	JHD	12/10/64	Collector Current V_{BE} = -1.5 Vdc, V_{CE} = 200 Vdc, T_C = +150°C	I_{CEX}	1.40	.46	.24	.27	.16	.25	.91	.26	.99	.33	.16	1	Allowable Deviation ±1 mA		
B	JHD	12/10/64	DC Current Gain V_{CE} = 4 Vdc, I_C = 5A, T_C = +25°C	h_{FE}	16	15	15	17	30	18	19	15	13	18	13	25			
B	JHD	12/10/64	Saturation Resistance I_C = 5.0 A, I_B = 750 mA, T_C = +25°C	$r_{CE(sat)}$	.088	.103	.110	.080	.074	.084	.098	.078	.094	.074	.074	.11		0.6	ohm

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Job No. CTN-8 CONTINENTAL TESTING LABORATORIES, INC. Spec. 50M03501A/33

Manufacturer Westinghouse Test Program NASA Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) Report No. 11253-8-P Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	11	12	13	14	15	16	17	18	19	20	Range Min	Range Max	Limits Min	Limits Max	Unit
B	SW	12/31/64	1000 Hour STORAGE LIFE																
				Δ I_{CEX}	.16	.11	.07	.07	.118	.07	.265	.23	.1	.046	.045	.265		1	
B			Post-Test End-Points																
			Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	1.3	.47	.74	.31	.91	.37	.41	.79	.38	.31	.31	1.3	Allowable Deviation ±1 mA		
			DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	18	16	16	26	21	22	23	17	14	19	14	26			
	SW	1/4/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	r_{CE} (sat)	.088	.100	.104	.075	.076	.082	.100	.078	.092	.074	.074	.104		0.6	ohm

AC

Job No. CTN-8 — CONTINENTAL TESTING LABORATORIES, INC. — Spec. 50M03501A 33

Manufacturer Westinghouse — Test Program NASA — Ref. Spec. MIL-STD 750

Transistor Type 2N3432 (113D) — Report No. 11253-8 F — Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 11	12	13	14	15	16	17	18	19	20	Range Min	Range Max	Limits Min	Limits Max	Units
B	JH	1-22-65	1500 HOUR STORAGE LIFE																
				ΔI_{CEX}	.34	.09	.14	.16	.113	.06	.345	.22	.185	.075	.06	.4			
B			Post-Test End-Points																
			Collector Current V_{BE} = -1.5 Vdc, V_{CE} = 200 Vdc, T_C = +150°C	I_{CEX}	1.1	.45	.31	.5	.21	.32	.07	.70	.33	.34	.31	1.1		Allowable Deviation +1 mA	
			DC Current Gain V_{CE} = 4 Vdc, I_C = 5A, T_C = +25°C	h_{FE}	14	16	14	17	26	18	19	14	13	17	13	26			
			Saturation Resistance I_C = 5.0 A, I_B = 750 mA, T_C = +25°C	$r_{CE(sat)}$	.053	.065	.05	.074	.034	.088	.102	.074	.090	.070	.070	.102		0.6	ohm

CONTINENTAL TESTING LABORATORIES, INC.

Job No. CIN-8 | Test Program NASA | Spec. 50M03501A/33

Manufacturer Westinghouse | Report No. 11253-B-? | Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (1130) | Test

Test Seq.	Tech	Date	Parameter Measurement and Test Condition	Symbol	11	12	13	14	15	16	17	18	19	20	Range Min	Range Max	Limits Min	Limits Max	Units
[illegible]	[illegible]	3/5/65	2000 Hour End Points STORAGE LIFE																
				Δ I_{CEX}	.46	.12	.14	.08	.115	.09	.955	.93	.115	.09	[illegible]	[illegible]			
B			Post-Test End-Points														Allowable Deviation ±[illegible] mA		
		[illegible]/65	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	1.0	.48	.19	.32	.21	.35	.48	.79	.33	.36	[illegible]	[illegible]			
		[illegible]/65	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	17	16	15	26	21	21	2?	16	15	26	15	[illegible]			
																		0.6	ohm
	[illegible]	3/5/65	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.0?5	.1?4	.112	[illegible]	.078	.082	.104	.07?	.07?	.07?	[illegible]	.114			

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CONTINENTAL TESTING LABORATORIES, INC.

Job No. CIN-8 | Spec. 50M03501A/03

Manufacturer Westinghouse | Test Program NASA | Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (1130) | Report No. 11253-8-F | Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 51	52	53	54	55	56	57	58	59	60	Range Min	Range Max	Limits Min	Limits Max	Units
B	JWJ	11/30/64	MOISTURE RESISTANCE CONTAINS 5 GROUPS SUBGP B																
				ΔI_{CEX}	.35	.02	.01	.01	.70	.08	.04	.05	.02	.03					
B			Post-Test End-Points																
	JWJ	11/30/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.70	.97	.21	.91	.40	.18	.90	.97	.14	.18				Allowable Deviation ±5 nA	
	JWJ	11/30/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	18	19	19	16	23	20	14	17	20	19	14	23			
23	JWJ	11/30/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.072	.070	.078	.114	.062	.092	.086	.088	.086	.088	.063	.114		0.6 ohm	

CONTINENTAL TESTING LABORATORIES, INC.

Job No. CTI-8 Spec. 50M03501A/33

Manufacturer Westinghouse Test Program NASA Ref. Spec. MIL-STD-750

Transistor Type 2N5432 (1130) Report No. 11253-B-7 Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	21	22	23	24	25	26	27	28	29	30	Range Min	Range Max	Limits Min	Limits Max	Units
6	[illegible]	11/29/66	Moisture Resistance [illegible]																
				I_{CEX}	.76	.090	.32	.07	.065	.044	.14	.01	.04	.107	.01	.7			mA
8			Post-Test End-Points																
	[illegible]	11/30/66	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.09	.075	.60	.07	.22	.93	.75	.11	.11	.12	.07	.1?	Allowable Deviation ±1 mA		
	[illegible]	11/30/66	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	18	18	22	19	15	20	14	17	16	17	14	22			
	[illegible]	11/30/66	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.068	.075	.080	.078	.102	.058	.100	.126	.066	.100	.058	.126		0.6	ohms

Job No. CTN-B

CONTINENTAL TESTING LABORATORIES, INC.

Spec. 50M03501A/33

Manufacturer Westinghouse

Test Program NASA

Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D)

Report No. 11253-8-7

Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	51	52	53	54	55	56	57	58	59	60	Range Min	Range Max	Limits Min	Limits Max	Units
b	RDD	12/2/64	ACCEL, SHOCK, VIBRATION (CONTROL GROUP) SUB GP4																
				Δ I_{CEX}	.35	.04	.00	.03	.45	.08	.24	200.*	.07	.11	[illegible]	[illegible]			
B			Post-Test End-Points																
	RDD	12/2/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	1.0	.25	.20	.25	.45	.24	.41	200 * SHORTED	.23	.24	.2	1.0	Allowable Deviation ±1 mA		
	RDD	12/2/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	17	19	22	17	27	21	15	17	19	18	15	27			
	RDD	12/2/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	r_{CE} (sat)	.086	.072	.084	.116	* 3.0	.092	.096	.102	.088	.086	.072	3.0		0.6	ohm

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Job No. CTN-8

CONTINENTAL TESTING LABORATORIES, INC.

Spec. 50M03501A/33

Manufacturer Westinghouse

Test Program NASA

Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (1130)

Report No. 11253-8-7

Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	31	32	33	34	35	36	37	38	39	40	Range Min	Range Max	Limits Min	Limits Max	Units
B	[illegible]	12/7/64	[illegible] SUB GROUP 4																
				Δ I_{CEX}	.15	[illegible]	.09	.25	.17	.005	.284	[illegible]	.271	.1055	[illegible]	[illegible]			
B			Post-Test End-Points																
	[illegible]	12/7/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.	* Smashed	.21	.35	.65	.10	.52	.66	.40	.15	[illegible]	[illegible]	Allowable Deviation ±1 mA		
		12/7/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	13	13	19	19	14	18	13	17	20	21	[illegible]	[illegible]			
	[illegible]	12/7/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	* 3.6	.102	.088	.102	.086	.076	.116	.120	.072	.068	[illegible]	[illegible]		0.6	ohm

Job No. CIN-8	CONTINENTAL TESTING LABORATORIES, INC.	Spec. 50M03501A/30		
Manufacturer Westinghouse	Test Program NASA	Ref. Spec. MIL-STD-750		
Transistor Type 2N3432 (113D)	Report No. 11253-8-2	Test		

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	51	52	53	54	55	56	57	58	59	60	Range Min	Range Max	Limits Min	Limits Max	Units
P	JBP	12/14/64	POWER CYCLE, THERMAL SHOCK CONTROL GROUP SUBSEQ. TESTS	Δ I_{CEX}	200.*	.15	.08	.000	.000	.002	.02	SHOCK-VIBRATION	.04	.09	.00	.28			n.a
B			Post-Test End-Points																
	JBP	12/14/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	* Rec. Shorts	.14	.12	.22	1.1	.17	.84	SHORTED 0~	.12	.22	.12	1.1	Allowable Deviation ±10 mA		
	JBP	12/14/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	10	20	22	17	16	22	16		20	20	10	22			
	JBP	12/14/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.152	.068	.080	.110	.116	.086	.092	[illegible]	.084	.083	.068	.152		0.6	ohm

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CONTINENTAL TESTING LABORATORIES, INC.

Job No. CIN-8

Spec. 50M02501A/33

Manufacturer Westinghouse

Test Program NASA

Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D)

Report No. 11253-8-9

Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 41	42	43	44	45	46	47	48	49	50	Range Min	Range Max	Limits Min	Limits Max	Units
B	[illegible]	12/14/64	Power Cycle, Thermal Shock, Sub Group 5	Δ I_{CEX}	.14	.05	.025	1.7*	.007	.026	Shorted on power cycle	Shorted on power cycle	.03	.154	.007	1.7			μA
B			Post-Test End-Points																
	[illegible]	12/14/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.58	.15	.17	3.4	.06	.12			.65	.45	.06	3.4	Allowable Deviation ±1 mA		
	[illegible]	12/19/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	18	16	20	21	17	19			22	22	16	22			
	[illegible]	12/19/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE (sat)}$	.082	.054	.096	.096	.068	.084	—	—	.092	.070	.054	.096		0.6	ohm

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Job No. CIN-8 — CONTINENTAL TESTING LABORATORIES, INC. — Spec. 50M03501A/33

Manufacturer Westinghouse — Test Program NASA — Ref. Spec. MIL-STD-750

Transistor Type 2N2432 (113D) — Report No. 11253-8-7 — Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	52	53	54	55	56	57	59	60			Range Min	Range Max	Limits Min	Limits Max	Unit
[illegible]	[illegible]	[illegible]	100 HR END POINTS (SEQUENTIAL) OPERATING LIFE ARE 52, 53, 54, 55 STORAGE LIFE ARE 56, 57, 59, 60																
				Δ I_{CEX}	.02	.06	.07	.60	.068	.94	.24	.32			[illegible]			1	[illegible]
B			Post-Test End-Points																
	[illegible]	[illegible]	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.31	.26	.15	1.7	.94	1.8	.40	.45			[illegible]	[illegible]	Allowable Deviation ±1 mA		
	[illegible]	[illegible]	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	24	24	17	28	23	16	20	17			16				
	[illegible]	[illegible]	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	r_{CE} (sat)	.060	.08	.090	.054	.083	.098	.082	.074			[illegible]	[illegible]		0.6	ohm

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Job No. CIN-8 — CONTINENTAL TESTING LABORATORIES, INC. — Spec. 50M03501A/33

Manufacturer Westinghouse — Test Program NASA — Ref. Spec. MIL-STD-750

Transistor Type 2N3402 (1130) — Report No. 11253-8-? — Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 53	54	55	56	57	59	60				Range Min	Range Max	Limits Min	Limits Max	Unit
B	JW	12/30/64	250 HR 6-0 POINT (SEQUENTIAL) OPERATING LIFE NAS, 53, 54, 55 STORAGE LIFE NAS, 56, 57, 59, 60																
				ΔI_{CEX}	.02	.09	* 1.3	.038	* 1.14	.21	.33				.02	1		1	%
A			Post-Test End-Points																
B	JW	12/30/64	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.32	.13	3.4	.21	3.0	.17	.44				.13	2.5	Allowable Deviation ±1 mA		
B	JW	12/30/64	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	23	14	28	21	11	20	17				14	24			
B	JW	12/30/64	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.048	.108	.052	.080	.098	.088	.074				.053	11		0.6	ohm
130																			

Job No. CTN-8 — CONTINENTAL TESTING LABORATORIES, INC. — Spec. 50M03501A/33

Manufacturer Westinghouse — Test Program NASA — Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (113D) — Report No. 11253-8-2 — Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	53	54	55	56	57	59	60				Range Min	Range Max	Limits Min	Limits Max	Units
F	[illegible]	1/8/65	500 HR. END POINTS (SEQUENTIAL) OPERATING LIFE REL. 53, 54, 55 STORAGE LIFE REL. 56, 57, 59, 60	Δ I_{CEX}	.045	.11	1.40*	.013	1.14*	.17	.34				.013	1.4		1.	[illegible]
B			Post-Test End-Points																
F	[illegible]	1/8/65	Collector Current V_{BE} = -1.5 Vdc, V_{CE} = 200 Vdc, T_C = +150°C	I_{CEX}	.155	.11	2.5	.185	2.0	.32	.43				.11	2.5	Allowable Deviation ±1 mA		
I	[illegible]	1/8/65	DC Current Gain V_{CE} = 4 Vdc, I_C = 5A, T_C = +25°C	h_{FE}	20	14	20	17	14	16	16				14	20			
F	[illegible]	1/8/65	Saturation Resistance I_C = 5.0 A, I_B = 750 mA, T_C = +25°C	$r_{CE(sat)}$	.070	.104	.054	.094	.109	.088	.079				.054	.104		0.6	ohm

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CONTINENTAL TESTING LABORATORIES, INC.

Job No. CIN-8

Spec. 50M03501A, 33

Manufacturer Westinghouse

Test Program NASA

Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (1130)

Report No. 11253-8-2

Test

Test Req.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number 54	55	56	57	59	60					Range Min	Range Max	Limits Min	Limits Max	Units
[illegible]	[illegible]	[illegible]	1000 H.P. (-1 Burn) (Sequential) Operating Life S/N 54, 55 Storage Life S/N 56, 57, 59, 60																
				Δ I_{CEX}	.10	1.0	.318	.530	9.34 *	.06					.06	3.[illegible]			
6			Post-Test End-Points																
[illegible]	[illegible]	[illegible]	Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.12	2.1	.39	.34	2.5	.19					.12	3.[illegible]	Allowable Deviation ±1 mA		
[illegible]	[illegible]	[illegible]	DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	18	26	19	14	20	21					14	26			
[illegible]	[illegible]	[illegible]	Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.122	.066	.090	.110	.099	.080					.06	.122		0.6	ohm

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Job No. CIN-8 — CONTINENTAL TESTING LABORATORIES, INC. — Spec. 50M03501A/33

Manufacturer Westinghouse — Test Program NASA — Ref. Spec. MIL-STD-750

Transistor Type 2N3432 (1120) — Report No. 11253-8-2 — Test

Test Grp.	Tech	Date	Parameter Measurement and Test Condition	Symbol	Transistor Serial Number						Range Min.	Range Max.	Limits Min	Limits Max	Limits Units
					54	55	56	57	58	60					
			1000 HOUR END POINTS (SEQUENTIALS) OPERATING LIFE Nos 54, 55 STORAGE LIFE Nos 56, 57, 58, 60 FINAL END POINT												
			Δ	I_{CEX}	.01	1.4	.158	.45	3.64	.08			.01	2.	
II			Post-Test End-Points												
			Collector Current V_{BE} = -1.5 Vdc V_{CE} = 200 Vdc T_C = +150°C	I_{CEX}	.21	9.5	.550	.011	3.6	.21			.21	0.6	Allowable Deviation ±1 mA
			DC Current Gain V_{CE} = 4 Vdc I_C = 5A T_C = +25°C	h_{FE}	17	26	19	15	15	17			15	26	
			Saturation Resistance I_C = 5.0 A I_B = 750 mA T_C = +25°C	$r_{CE(sat)}$	.136	.058	.082	.093	.112	.061			.058	.1	0.6 ohm

ENCLOSURE 3

C WOMACO RD NUX YOUNGWOOD PENN 6 440P EDT

FLOYD C KINNEY, CONTINENTAL TESTING LABORATORIES

FERN PARK FLORIDA

COPY E P BARBARO WESTINGHOUSE HUNTSVILLE & FLOYD C KINNEY CONTINENTAL TESTING LAB ORLANDO FLORIDA. WESTINGHOUSE 1130 /2N3432/ TRANSISTORS QUALIFICATION SHOULD QUALITY CONCLUSION IN SUMMARY ON PAGE 4 TO NOTE THAT GROUP B TESTS SUB GROUP 4 LIMITS EXCEEDED LIMITS GUARANTEED BY WESTINGHOUSE AND ALSO SHOCK LEVEL OF 3500 EXCEEDS VALUE ON MSFC STD S-SPEC IN ALL OTHER RESPECTS REPORT IS ACCEPTABLE THANK YOU FOR SENDING COPY OF REPORT TO US IF I CAN BE OF FURTHER SERVICE PLEASE LET ME KNOW

LUTHER HARRISON WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA

USE 8½" FORMS ARE VERTICAL (AUGUST 1960)

APPLICATION		PART NO.	NF
NEXT ASSY	USED ON		

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL

SEMICONDUCTOR DEVICE 113D, (2N3432)

DETAIL TEST SPECIFICATION FOR

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS DECIMALS ANGLES	ORIGINAL DATE OF DRAWING 7-31-64	SEMICONDUCTOR DEVICE 113D, DETAIL TEST SPECIFICATION FOR	GEORGE C. MARSHALL SPACE FLIGHT CENTER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HUNTSVILLE, ALABAMA
MATERIAL	DRAFTSMAN / CHECKER		
HEAT TREATMENT	TRACER / CHECKER		
FINAL PROTECTIVE FINISH	ENGINEER / ENGINEER		
	SUBMITTED		
	APPROVED	SCALE	SIZE A — DWG NO. 50M03501A-01
		UNIT WT	SHEET 1 OF 9

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL

1. SCOPE

1.1 Description. - This specification covers the electrical and environmental detail test requirements for silicon, fused, NPN, power transistor, Part Number 113D, intended for use in voltage and current regulators, amplifiers, and high-power switching circuit applications.

2. APPLICABLE DOCUMENTS

2.1 The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issue and revision in effect on the date of testing shall apply.

SPECIFICATIONS

50M03501A — Semiconductor Devices, General Test Specification for

3. REQUIREMENTS

3.1 Requirements. - Requirements shall be in accordance with Specification 50M03501A and as specified herein.

3.2 Design and Construction. - Semiconductors shall be of the design construction, and physical dimensions specified on figure 1.

3.3 Maximum Ratings. - The maximum ratings shall be as specified in table I.

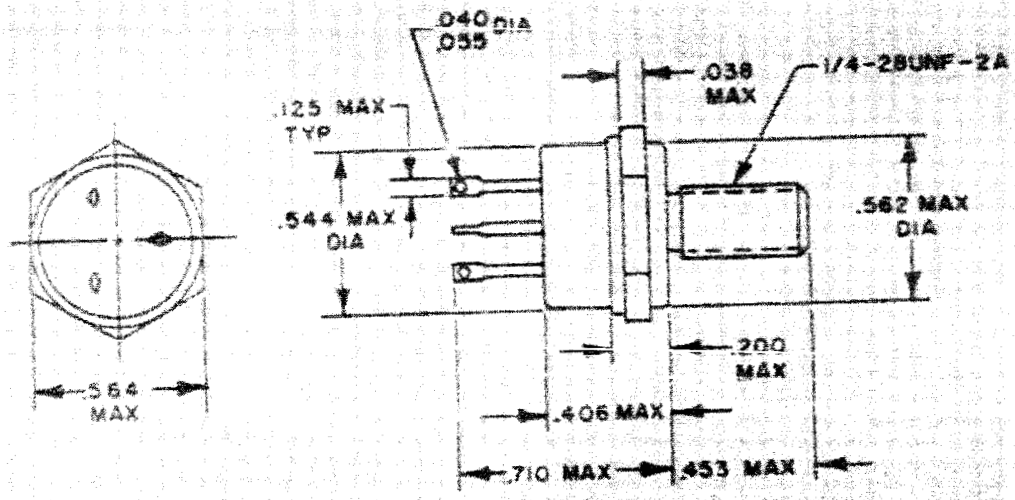
3.4 Performance Requirements. - Performance requirements shall be as specified in table II.

4. EXAMINATIONS AND TESTS

4.1 Test Values and Conditions. - Table III shall be used in conjunction with the examinations and tests contained in section 4 of Specification 50M03501A.

4.2 Post-Test End-Point Measurements. - Post-test end-point measurements shall be made as specified in table IV.

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL



NOTES:

1. ANGULAR ORIENTATION AND SHAPE OF TERMINALS NOT DEFINED.

2. RECOMMENDED STUD MOUNTING TORQUE: DRY, 20 - 30 INCH LB.; LUBRICATED, 12 - 18 INCH LB.

Figure 1. Dimensional Outline, Transistor 113D

CODE IDENT NO	DWG SIZE	51M03501A/13
	A	SHEET 3

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL

Table I. Maximum Ratings

Measurement	Symbol	Rating
Current		
Collector Current	I_C	7.5 A
Base Current	I_B	5.0 A
Emitter Current	I_E	7.5 A
Dissipation		
Total Device Dissipation, $T_C = +37^\circ$ C	P_T	150 W
Temperature		
Junction Temperature	T_J	+150° C
Storage Temperature Range	T_{stg}	-65° C to +150° C
Thermal Resistance		
Junction to Case	Θ_{JC}	0.75 C°/W
Voltage		
Collector-to-Emitter	V_{CE}	200 Vdc
Emitter-to-Base	V_{EB}	25 Vdc
Collector-to-Base	V_{CB}	*

*V_{CB} can be equal to or greater than V_{CE}.

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL

Table II. Performance Requirements

Measurement	Symbol	Condition	Min	Max	Units
Collector Current	I_{CEX}	V_{BE} = -1.5 Vdc, V_{CE} = 200 Vdc, T_C = +150°		20	mA
Emitter Current	I_{EBO}	V_{EB} = 25 Vdc, I_C = 0, T_C = +150° C		20	mA
Saturation Resistance	$r_{CE(sat)}$	I_C = 5.0 A, I_B = 750 mA, T_C = +25° C		0.5	ohm
DC Current Gain	h_{FE}	V_{CE} = 4 Vdc, I_C = 5A, T_C = +25° C	10	18 (typ)	
Beta Cutoff Frequency	f_{hfe}	V_{CE} = 4 V dc I_C = 5 A I_C(AC) = 1m A dc T_c = 25°C		30 (typ)	kc

Table III. Test Values and Conditions

Test	Condition	General Specification Reference
Gas Method	Pressure differential = 80 ± 5 psi	Para. 4.2.2.1
Terminal Strength (Condition E)	5.0 ± 0.5 pounds applied to each lead for three 90 ± 5 degree arcs to the case	Para. 4.3.11
Operating Life	T_C = +37° C, P_T = 150 W, Duration of test = 2,000 ± 48 hr	Para. 4.3.1

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL

Table III. Test Values and Conditions (Continued)

Test	Condition	General Specification Reference
High-Temperature Life	Temperature = +150° C, Duration of test = 2,000 hr	Para. 4.3.2
Power Cycling	Case temperature = +150° C, V_{CE} = 20 V, i_C = 7.5 A	Para. 4.3.9

Table IV. Post-Test End-Point Measurements

Parameter	Symbol	Allowable Deviation	Min	Max
Collector Current	I_{CEX}	±1.0 mA		
DC Current Gain	h_{FE}		10	
Saturation Resistance	$r_{CE(sat)}$			0.6 ohm

Note: The parameter measurements shall not deviate from the value obtained when tested before the environmental tests by more than the above limits.

5. NOTES

5.1 The notes specified in Specification 50M03501A are applicable to this specification.

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