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tems Division

Parts Application Analysis - Array D  
Redundant Command Receiver

ATM 983

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DATE 26 Feb. 1971

This Parts Application Analysis was prepared by Motorola's Government Electronics Division as required under the Bendix/Motorola subcontract SC-0721 for the ALSEP program.

The ALSEP Redundant Command Receiver is a solid state receiver with active redundancy that may be used to receive either PM or PM-FM type signals. This receiver includes two identical electrically separate receivers, consisting of an rf converter, an IF and Audio Amp, and a power isolator. In addition, the redundant receiver has an rf power divider referred to as an rf coupler, and a selection circuit referred to as an audio combiner.

The purpose of the Parts Application Analysis is to determine the stress level for each part in each application and to identify any part(s) that is stressed beyond its recommended derating. In this analysis the amount of derating was determined from parts ratings at an operating temperature of 75°C, which represents the maximum temperature anticipated during 2 years of lunar surface operation.

The analysis has shown that 70% of the parts are stressed below 10% of the manufacturers rating at 75°C. Only one part exceeds a 50% stress; **Q<sub>4</sub>** in the rf converter has a VCE of 55% which presents no particular reliability problem. In conclusion, the analysis has shown that all electrical parts have been conservatively applied in the Redundant Command Receiver.

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27 August 1970

Parts Application Analysis for  
ALSEP Redundant Command Receiver  
BXA Part Number 2345147

"Preliminary - The Bendix Corporation,  
Aerospace Systems Division, Approval Pending"

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C	Motorola's Special Memorandum No. 188

## **APPLICATION**

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NEXT ASSEMBLY	USED ON	LTR	DESCRIPTION	DATE	APPROVED
			"Preliminary - The Bendix Corporation, Aerospace Systems Division Approval Pending"	8/27/70	
		A	Revised to FACI Configuration Appendix A - PAA Data Sheets - Pages 1 thru 6,8,10, 13 thru 17, 19 thru 26, 30,32,33, and 37 Appendix B - PAA Summary Sheets - Pages 1 and 2	11/30/70	

## 1.0 INTRODUCTION

The part application analysis was performed on the ALSEP Redundant Command Receiver for Bendix Aerospace Systems. The method of analysis complied with the technique and form requirements of Task 4 and Task 16 of the Reliability Program Plan for the ALSEP Redundant Command Receiver (Motorola Document Number 3875/001, Revision A, dated 30 April 30, 1970).

The analysis was performed on the design configuration as of Nov. 30, 1970.

This report is considered a final parts application analysis submitted to fulfill the requirements of the CDR.

## 2.0 REQUIREMENTS

The application of all electrical parts has been reviewed. The purpose of the analysis was to determine the degree of derating achieved for each part in each application with respect to its electrical capabilities. Part ratings were obtained from vendor data sheets. The amount of derating was determined from parts ratings at an operating temperature of 75°C, which represents the maximum temperature during the mission profile of 2 years of lunar surface operation.

The following are the recommended derating guidelines used in the analysis:

### CAPACITORS

Ceramic	- 50% Voltage
Mica	- 50% Voltage
Paper/Plastic	- 50% Voltage
Electrolytic, Wet	- 60% Voltage
Electrolytic, Solid	- 60% Voltage*

\* Requires series impedance of 3 ohms/volt

RESISTORS

Film	- 50% Power
Wirewound	- 50% Power
Composition	- 50% Power

SEMICONDUCTORS

Diodes, Si	- 50% Voltage
	- 50% Current
$T_j$	= 140°C Maximum

Transistors, Si	- 50% Voltage
	- 50% Current
$T_j$	= 140°C Maximum

TRANSFORMERS AND COILS - 15°C Rise

3.0 SUMMARY OF ANALYSIS AND CONCLUSIONS

Table I presents a summary of the part application analysis. The table shows that a majority of the parts (70%) are stressed below 10% of the manufacturer's rating at the worst case temperature of 75°C.

$Q_4$  of the RF Converter has a VCE greater than 50% of the rated VCEO.

<u>RF Converter</u>	<u>Voltage Derating</u>	<u>T<sub>j</sub></u>
$Q_4$	55%	103°C

All junction temperatures of all transistors except  $Q_4$  are now 100°C or less, and only  $Q_4$ 's voltage derating exceeds 50%. However, since the stress ratio is .55,  $Q_4$  presents no particular reliability problem area (see paragraph 5.0).

In conclusion, the Part Application Analysis has shown that all electrical parts have been conservatively applied in the Redundant Command Receiver at the maximum expected temperature for the assurance of reliable performance during the two-year lunar surface operation.

#### 4.0 ANALYSIS DETAILS

The details of the procedure used in the performance of the Part Application Analysis is contained in the following paragraphs.

The worksheets used in the completion of the PAA are contained in Appendix A. The circuit symbols appearing on these sheets correspond to the circuit symbols assigned to the parts appearing on the module drawings. The following is a list of schematics and revision letters used in the analysis:

Module	Schematic No.	Revision
IF and Audio	63-P11349B	D
RF Converter	63-P11377B	B
Power Isolator and Audio Combiner	63-P113 <del>55</del> <sup>80</sup> B	B

Electrical measurements, obtained from breadboard measurements of AC and DC voltages and currents, were used to calculate the part stresses. A derating was obtained by comparing these calculated stresses with the part ratings at a worst case temperature of 75°C. All information is recorded on the worksheets in Appendix A.

Once the electrical stress ratio was calculated, a failure rate based upon this stress ratio and an expected temperature of 45°C was assigned from Motorola R&C's Special Memorandum No. 188, contained in Appendix C, or MIL-HDBK-217A.

The following is a set of assumptions and ground rules used in this analysis:

- a) Electrical measurements were made under normal room ambient conditions and anticipated typical driving signals and loading.
- b) All connectors have been grouped with the modules in which they are assembled.
- c) All select-at-test components were assigned values that would result in the worst case stresses of circuit parts.
- d) Part ratings at 75°C were obtained from MIL specs, vendor sheets, or IRS's.
- e) Temperature rise in transformers and inductors was estimated based upon engineering judgment.
- f) All filters, integrated circuits, solid state amplifiers, and crystal oscillators were entered on the "MISC. PARTS" sheets. The parameters considered in the analysis were those considered pertinent to the reliability of the application.
- g) Screening factors were used where applicable and appear from SM-188 in the Failure Rate multiplier column of the PAA worksheets of Appendix A.

The part application analysis summary sheets appear in Appendix B. For each module, failure rates were entered and summed.

The total failure rate for each module is not the failure rate used in the reliability prediction (Motorola Report No. 038). The module failure rate was adjusted by the results of the FMECA (Motorola Report No. 035) and this value was used in the prediction.

## 5.0 CONCLUSIONS

As mentioned in paragraph 3.0,  $Q_4$  in the RF converter has a junction temperature of  $103^{\circ}\text{C}$  and a voltage stress ratio of .55. Since 55% is not greatly above the recommended 50% and since this situation presents no problem of reliability significance, no further design changes are being considered. Also,  $103^{\circ}\text{C}$  junction temperature is well below the recommended  $140^{\circ}\text{C}$ .

Table 1

Summary of Parts Application AnalysisSTRESS DERATINGS OF TRANSISTORS & DIODES (37 total)

<u>Voltage Derating (%)</u> <u>(Recommended 50% Max.)</u>	<u>Quantity</u>	<u>% of Total</u>	<u>Module</u>	<u>Remarks</u>
≤10	21	56		
>10, ≤20	2	5.4		
>20, ≤30	4	10.8		
>30, ≤40	5	13.5	$\{ Q_1$ -RF Converter	44%, $T_J = 97^\circ C$
>40, ≤50	2	5.4	$\{ Q_2$ -RF Converter	43%, $T_J = 97^\circ C$
>50, ≤60	1	2.7	$Q_4$ -RF Converter	55%, $T_J = 103^\circ C$

N/A	2	5.4	Zener Diodes
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<u>Junction Temperature</u> <u>(Recommended 140°C Max.)</u>	<u>Quantity</u>	<u>% of Total</u>	<u>Module</u>	<u>Remarks</u>
≤100°C	36	97.3		
>100, ≤140°C	1	2.7	$Q_4$ -RF Converter	$T_J = 103^\circ C$

STRESS DERATING OF PARTS OTHER THAN TRANSISTORS AND DIODES (321 total)

<u>Stress %</u>	<u>Quantity</u>	<u>% of Total</u>	<u>Module</u>	<u>Remarks</u>
≤10	231	72		
>10, ≤20	42	13.1		
>20, ≤30	9	2.8		
>30, ≤40	2	0.6	$\{ C-19$ -IF and Audio	Ceramic Max ≤50%; actual 44%
>40, ≤50	3	0.9	$\{ C-7, C8$ -Power Isolator	Elect. Max ≤60%; actual 48%
5°C	34	10.6		Inductors and Transformers

APPENDIX A

PART APPLICATION ANALYSIS  
WORKSHEETS

## CAPACITORS

PROJECT: ALSEP

ASSEMBLY: REDUNDANT COMMAND  
SUB ASSEMBLY: INTEGRATORDATE: 20 TBC  
SCHEMATIC NO: 11377B

(Capacitors)

1 CIRCUIT STABOL NUMBER	2 TYPE (MIL or MFR) CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE MFD	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE RATED	8 VOLTAGE OPERATING RATIO	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE (°C)	11 12 CIRCUIT FUNCTION OR APPLICATION	13 X <sub>0</sub> RATE OF FAILURES (8/1000 HRS) AVERAGE LIFE CYCLE SPECIFIED ENVIRONMENT (DEFINITE)	14 X <sub>1</sub> RATE OF FAILURES (8/1000 HRS) AVERAGE LIFE CYCLE SPECIFIED ENVIRONMENT (DEFINITE)	15 SPECIFIED ENVIRONMENT (DEFINITE)	16 FAILURE RATE MULTIPLIER	17 FINAL FAILURE RATE	18 TOTAL CAPACITOR COUNT	19 TOTAL FAILURE RATE (8/1000 HRS)
C1	21-P11258B		33pf	1	500	1.61.5	.01		75		.301A			.1		1	000-80
C2	21-P11258B		33pf	1	500	1.71.2	.01		75		.301A			.1		000-80	
C3	ST10251-11		100pF	-	200	1.731.15	.01		75		.6001B			-		000-80	
C4	21-P11258B		10pf	1	500	1.71.15	.01		75		.301A			.1		000-80	
C5	C1K05		1000pF	10	200	1.651.1	.06		75		7.01A			.15		000-80	
C6	C1R05		1000pF	10	200	1.721.1	.01		75		7.01A			.15		000-80	
C7	C1K05		1000pF	10	300	1.71.1	.01		75		7.01A			.15		000-80	
C8	21-P11258B		33pf	1	500	1.631.2	.02		75		.301A			.1		000-80	
C9	SKR05		1000pF	10	200	1.31.2	.03		75		7.01A			.15		000-80	
C10	C1K05		1000pF	10	200	1.631.1	.04		75		7.01A			.15		000-80	
C11	SKR05		1000pF	10	200	1.601.1	.03		75		7.01A			.15		000-80	
C12	21-P11258B		5pf	1	500	1.681.2	.02		75		.301A			.1		000-80	
C13	SKR05		1000pF	10	200	1.51.1	.06		75		7.01A			.15		000-80	
C14	C1K05		1000pF	10	200	1.601.1	.06		75		7.01A			.15		000-80	
C15	C1K05		1000pF	10	300	1.621.1	.02		75		7.01A			.15		000-80	
C16	SKR05		1000pF	10	200	1.681.1	.06		75		7.01A			.15		000-80	
C17	SKR05		1000pF	10	200	1.601.1	.01		75		7.01A			.15		000-80	
C18	ST10251-9		8-10pF	-	250	0.1.1	.01		75		.6001B			-		000-80	
C19	ECY101R		1.5pi	20	500	0.1.1	.01		75		.331A			.18		000-80	
20 FAILURE RATE SOURCES (FOR COLUMN #14)																	
A SM-188      B MIL-HDBK-217 F16, 7.6.138																	
C D																	
21 CALCULATED MTBF _____ HRS																	
22 TOTAL FAILURE RATE 013210 / 1000 HRS																	

## PARTS APPLICATION ANALYSIS

Page 10 of 13CAPACITOR

PROJECT: ALSEP

ASSEMBLY: POTENTIOMETER COMMAND

SUBASSEMBLY: CF Control Loop

DATE: 20 July 1970

SCHEMATIC NO: 111377B

(Capacitors)

1 CIRCUIT, SYMBOL NUMBER	2 TYPE DESIGNATION (INIT or AFR) CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE mfd	5 TOLERANCE%	6 MANUFACTURER'S RATED VOLTAGE	7 DC OPERATING VOLTAGE	8 VOLTAGE OPERATING RATIO: RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION APPLICATION	12 10 <sup>-3</sup> BASIC FAILURE RATE (8/1000 HRS)	13 10 <sup>-3</sup> SCTRCB (SEE SOURCE FOR USE OF CIRCUIT ENVIRONMEN-	14 10 <sup>-3</sup> SEE SOURCE FOR USE OF CIRCUIT ENVIRONMEN-	15 SPECIAL ENVIRONMENT (DEFNS)	16 FAILURE MULTIPLIER	17 FINAL FAILURE RATE	18 TOTAL CAPACITOR PART COUNT	19 TOTAL FAILURE RATE (8/1000 HRS)
C-1 ST10251-7	.8-10 PF	-	250	0 .1	.01	25			75	.601A								.000600
C-1 R-PI1258F	5PF	1	500	142 .1	.01	25			75	.301A								.000080
C-1 C-105	10PF	10	200	201 .1	.02	75			75	.701A								.001050
C-3 ECY108R	65PF	20	500	0 .1	.01	25			75	.331A								.000260
C-4 ST10251-9	.14	-	350	0 .1	.01	25			75	.601B								.000600
C-5 C-105	8.2PF	10	200	201 .1	.02	75			75	.701A								.001050
C-6 C-105	10PF	10	200	.75 .1	.01	75			75	.701A								.001050
C-7 NOT USED																		
C-8 ECY108R	12PF	5	500	10.71 .1	.03	75			75	.331A								.000260
C-9 NOT USED																		
C-10 C-105	10PF	10	200	5.30 .1	.04	75			75	.701A								.001050
C-11 C-105	10PF	10	200	10.31 .1	.06	75			75	.701A								.001050
C-12 C-105	10PF	10	200	12.81 .1	.01	75			75	.701A								.001050
C-13 C-105	10PF	10	200	1001 .1	.02	75			75	.701A								.001050
C-14 C-105	10PF	10	200	1011 .1	.03	75			75	.101A								.001050
C-15 R-PI16-65A	Joule	5	500	.661 .5	.01	75			75	.301A								.000280
C-16 C-105	10PF	10	200	201 .1	.01	75			75	.701A								.001050
C-17 ECY108	10PF	10	500	11.81 .5	.02	75			75	.331A								.000260
C-18 C-105	10PF	10	200	.73 .1	.01	75			75	.701A								.001050

FAILURE RATE SOURCES (FOR COLUMN #14)

A SM-188 B MIL-HPGK-217 F16, 7.6.138

C D

CALCULATED MTBF \_\_\_\_\_ HRS

TOTAL FAILURE RATE 012040 1000 HRS

## PARTS APPLICATION ANALYSIS

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CAPACITORS

PROJECT: ALSEP

ASSEMBLY: Redundant Command  
Circuit Board

SUBASSEMBLY: RF CONVERTER

DATE: 20 July 1971

SCHEMATIC NO: 111377R

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (MIL or MIL CONSTRUCTION)	3 MANUFACTURER	4 CAPACITANCE VALUE MIL	5 TOLERANCE	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 VOLTAGEF RATIO/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE (°C)	11 CIRCUIT FUNCTION APPLICATION	12	13 X BASIC FAILURE RATE (1/1000 HRS) AT 10°C (REF. 14)	14 SPECIAL ENVIRONMENT (DETERMINED BY TEST) Failure Rate Multiplexer	15 SPECIAL ENVIRONMENT (DETERMINED BY TEST)	16 FAILURE RATE MULTIPLIER	17 FINAL FAILURE RATE	18 TOTAL FAILURES COUNT	19 TOTAL FAILURE RATE (1/1000 HRS)
C39	21-11258B	33pf	1	500	0 .1	.01	75			.30 A		.1					.000080	
C40	21-11258B	33pf	1	50	0 .1	.01	75			.30 A		.1					.000080	
C41	21-11258B	33pf	1	50	0 .1	.01	75			.30 A		.1					.000080	
C42	CKR05	1000 pf	10	300	5.48	1 .03	75			7.0 A		.15					.001050	
20	FOR USE OF RELIABILITY DEPT																	
	FAILURE RATE SOURCES (FOR COLUMN #14)																	
A	SM-188	B																
C		D																
21	CALCULATED MTBF _____ HRS																	
22	TOTAL FAILURE RATE 001290 1000 HRS																	

BS-321A

## PARTS APPLICATION ANALYSIS

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RESISTORS

PROJECT: ALSEP

ASSEMBLY: P1, P2, P3, P4, P5, P6, P7, P8, P9, P10, P11, P12, P13, P14, P15, P16, P17, P18

SUB ASSEMBLY: RF CONVTR

DATE: 20 July 1972

SCHEMATIC NO: 12-211777B

(Resistors)

1 CIRCUIT SYNTHOL NUMBER	2 TYPE (MIL or MFR) AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATT)	7 MAXIMUM OPERATING POWER (WATTS)	8 POWER RATIO/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (1/1000 HRS) AT SOURCE (SEE BELOW)	13 X10 <sup>3</sup>	14 SPECIAL ENVIRONMENTS (DEFINE)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (1/1000 HRS)	17 TOTAL FAILURE COUNT PER TYPE	18 TOTAL FAILURE RATE (1/1000 HRS)
R1 RCR056			56	5 .125 .001 .01				75		.01 A			-		.000210		
R2 RCR056			68	5 .125 .001 .01				75		.01 A			-		.000212		A
R3 RCR056			12K	5 .125 .011 .09				75		.01 A			-		.000212		A
R4 RCR056			12K	5 .125 .023 .02				75		.01 A			-		.000212		A
R5 RCR056			1.2K	5 .125 .007 .06				75		.01 A			-		.000210		A
R6 RCR056			68	5 .125 .001 .01				75		.01 A			-		.000210		A
R7 RCR056			2.2K	5 .125 .001 .01				75		.01 A			-		.000212		A
R8 RCR056			390	5 .125 .003 .02				75		.01 A			-		.000212		A
R9 RCR056			4.8K	5 .125 .005 .04				75		.01 A			-		.000212		A
R10 RCR056			10	5 .125 .001 .01				75		.01 A			-		.000210		A
R11 RCR056			47	5 .125 .001 .01				75		.01 A			-		.000210		A
R12 RCR056			1.6K	5 .125 .004 .03				75		.01 A			-		.000210		A
C13 RCR056			100	5 .125 .007 .07				75		.01 A			-		.000210		A
R14 RCR056			10	5 .125 .001 .01				75		.01 A			-		.000210		A
R15 RCR056			33K	5 .125 .001 .01				75		.01 A			-		.000210		A
R16 RCR056			18K	5 .125 .003 .02				75		.01 A			-		.000212		A
R17 RCR056			680	5 .125 .001 .01				75		.01 A			-		.000212		A
R18 RCR056			330	5 .125 .024 .19				75		.01 A			-		.000210		A

19

FAILURE RATE SOURCES (FOR COLUMN #14)

A SM-155

B \_\_\_\_\_

C \_\_\_\_\_

D \_\_\_\_\_

20

CALCULATED MTBF \_\_\_\_\_ HRS

21

TOTAL FAILURE RATE .000212 1/1000 HRS

## PARTS APPLICATION ANALYSIS

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RESISTORS

PROJECT: ALSEP

ASSEMBLY: P/N 1100-1000000

SUB ASSEMBLY: X/F Computer

DATE: 20 July 17

SCHEMATIC NO: 110-111-77B

(Resistors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (NAME OR MFR) DESIGNATION AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM OPERATING (WATTS)	8 POWER RATIO/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (8/100 HRS) $\times 10^{-3}$ SEE BELOW	13 FAILURE MULTIPLIER	14 SPECIAL ENVIRONMENT (DEFINE)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (8/1000 HRS)	17 TOTAL RESISTOR COUNT PER TYPE	18 TOTAL FAILURE RATE (8/1000 HRS)	
R19 RCR05G		2.2K 5	.125 .001 .01			75				.01 A							.000010	A
R20 RCR05G		2.2 5	.125 .007 .02			75				.01 A							.000010	A
R21 RCR05G		12K 5	.125 .004 .03			75				.01 A							.000010	A
R22 RCR05G		370 5	.125 .001 .01			75				.01 A							.000010	A
R23 RCR05G		20 5	.125 .001 .01			75				.01 A							.000010	A
R24 RCR05G		33 5	.125 .001 .01			75				.01 A							.000010	A
R25 RCR05G		18K 5	.125 .007 .06			75				.01 A							.000010	A
R26 RCR05G		8.2K 5	.125 .002 .02			75				.01 A							.000010	A
R27 NOT USED																		
R28 RCR05G		10 5	.125 .001 .01			75				.01 A							.000010	A
R29 RCF05G		560 5	.125 .011 .09			75				.01 A							.000010	A
R30 THERMISTOR 06-P14404A		1K 10	.250 .001 .01			75				- A							.015000	A
R31 RCR05G		56 5	.125 .001 .01			75				.01 A							.000010	A
R32 RCR07G		220 5	.250 .002 .02			75				.01 A							.000010	A
R33 RCR05G		- 5	.125 .010 .08			75				.01 A							.000010	A
R40 RCR05G		22K 5	.125 .001 .01			75				.01 A							.000010	A
19	FAILURE RATE SOURCES (FOR COLUMN #14)	B	C	D	20	CALCULATED MTBF	HRS	21	TOTAL FAILURE RATE	015140 .000 HRS								

## PARTS APPLICATION ANALYSIS

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## (INDUCTORS TRANSFORMERS)

PROJECT: ALSEP

ASSEMBLY: 6-14111-1007112  
RE-01212SUB ASSEMBLY: PT 6-14111-1007112DATE: 20 JUN 1973SCHEMATIC NO: 6-3-P113778

(Inductors &amp; Transformers)

1 CIRCUIT SYMBOL NUMBER	2 DESIGNATION (MIL or AFRI) CONSTRUCTION	3 MANUFACTURER	4 TYPE OF CLASS (95% BELOW)	5 WIRE SIZE, PRIMARY	6 WIRE SIZE, SECONDARY	7 INSULATION CLASS	8 VA RATING (1-H)	9 INDUCTANCE AT RATED CUR.	10 SPACIFIED CUR. MINIMUM FREQ.	11 OPERATING AMBIENT HOT SPOT (HR METHOD)	12 TEMPERATURE (°C) (HR RISE METHOD)	13 AST. ACTUAL RISE	14 OPERATING TEMP MAX.	15 ACTUAL RATED	16 PRIMARY CURRENT RATED	17 PRIMARY VOLTAGE NO. WINDINGS	18 SECONDARY WINDING NO.	19 SECONDARY VOLTAGE WINDINGS	20 INPUT READING VOLTS	21 INPUT READING AMPS (1000 HRS)	22 INPUT READING VOLTS	23 INPUT READING AMPS (1000 HRS)	24 INPUT READING VOLTS	25 INPUT READING AMPS (1000 HRS)	26 INPUT READING VOLTS	27 INPUT READING AMPS (1000 HRS)	28 INPUT READING VOLTS	29 INPUT READING AMPS (1000 HRS)	30 INPUT READING VOLTS	31 INPUT READING AMPS (1000 HRS)	32 REL. DEPT USE ONLY
L1	21-P14118A	C	-	-	125	.15	1	21	75	-	-	55	50	0.1100	1	-	-	-	-	-	-	-	-	A	.022062						
L2	24-P11417B	C	32	-	105	-	.05	110	75	-	-	55	50	0.1100	1	-	-	-	-	-	-	-	-	i	.022825						
L3	24-P14118A	C	-	-	125	.15	1.0	21	75	-	-	55	80	4	350	1	-	-	-	-	-	-	-	-	A	.022062					
L4	21-P14118A	C	-	-	125	.15	1.0	25	75	-	-	55	50	1	350	1	-	-	-	-	-	-	-	-	A	.022060					
L5	24-P11417B	C	28	-	105	-	.1	23	75	-	-	55	80	4	150	1	-	-	-	-	-	-	-	-	A	.022825					
L6	24-P14118A	C	-	-	125	.15	1.0	25	75	-	-	55	50	4	350	1	-	-	-	-	-	-	-	-	A	.022062					
L7	24-P11417B	C	28	-	105	-	.1	23	75	-	-	55	50	4	150	1	-	-	-	-	-	-	-	-	A	.022825					
L8	NOT used																														
L9	24-P11417B	C	28	-	105	-	.04	120	75	-	-	55	50	0.11	149	1	-	-	-	-	-	-	-	-	j	.022325					
L10	24-P11417B	C	28	-	105	-	.04	120	75	-	-	55	50	0.01	157	1	-	-	-	-	-	-	-	-	i	.022225					
L11	24-P14118A	C	-	-	125	.15	.15	35	75	-	-	55	80	0.01	100	1	-	-	-	-	-	-	-	-	A	.022062					
L12	24-P11417B	C	28	-	105	-	.04	22	75	-	-	55	80	0.01	151	1	-	-	-	-	-	-	-	-	A	.022825					
L13	24-P14118A	C	-	-	125	.15	2.2	22	75	-	-	55	80	0.01	352	1	-	-	-	-	-	-	-	A	.023262						
L14	24-P14118A	C	-	-	125	-15	.15	22	75	-	-	55	80	0.01	352	1	-	-	-	-	-	-	-	A	.022225						
L15	24-P11418A	C	-	-	125	.15	5.6	22	75	-	-	55	50	0.01	204	1	-	-	-	-	-	-	-	A	.022062						
L16	21-P14118A	C	-	-	125	.15	1.0	25	75	-	-	55	80	7	350	2	-	-	-	-	-	-	-	A	.022060						
L17	21-P14118A	C	-	-	125	-15	1.0	25	75	-	-	55	80	16	350	2	-	-	-	-	-	-	-	A	.022225						
L18	24-P11417B	C	28	-	105	-	.1	22	75	-	-	55	80	7	157	.5	-	-	-	-	-	-	-	A	.022825						
L19	21-P11417B	C	18	-	105	-	.015	22	75	-	-	55	80	0.1	1620	1	-	-	-	-	-	-	-	A	.022325						
28 TYPE OF CASE	29	FAILURE RATE SOURCES (FOR COLUMN 26)										30	CALCULATED MTBF _____ HRS						31	TOTAL FAILURE RATE <u>043200</u> 3,1000 HRS						A		ATM-983 Page 17 of 60			
A. HER. SEAL	B. VAC. IMP.	C. ENCAP.	D. OPEN	A. <u>SM-188</u> B. _____ C. _____ D. _____																											

## PARTS APPLICATION ANALYSIS

## (INDUCTORS &amp; TRANSFORMERS)

Page 7 of 7

PROJECT: ALSEP

ASSEMBLY: Redundant Command  
Receiver

SUB ASSEMBLY: RF CONVERTER

DATE: 20 July 1972

SCHEMATIC NO: 63-P11377B

1 (Inductors & Transformers)	2 CIRCUIT SYMBOL NUMBER	3 TYPE OF CASE (INIT. OF MFR.)	4 MANUFACTURER	CONSTRUCTION			7 WIRE SIZE, PRIMARY	8 WIRE SIZE, SECONDARY	9 INSULATION CLASS	10 VA RATING WATTS	11 IMPEDANCE AT RATED CAP MICROH	12 OPERATING AMBIENT TEMP. (AIR SURFACE)	13 TEMPERATURE (°C) RISE	14 TEST METHOD	15 EFF. ACTUAL TEMP. MAX	16 OPERATING TEMP. MAX	17 ACTUAL MA	18 RATED MA	19 PRIMARY CURRENT	20 NO. WINDINGS	21 SECONDARY WINDING NO.	22 VOLTAGE	23 WINDINGS	24 HYPOT READING	25 FAILURES - 1000 HRS (500°C)	26 FAILURES - 1000 HRS (550°C)	27 FAILURES - 1000 HRS (600°C)	28 TOTAL FAILURES - 1000 HRS
				5 TYPE OF CASE (REF. TO 20)	6 REF. SEAL	10 ATTACHED CAP																						
L20	NOT USED																											
T1	NOT USED																											
T2	24-P11417B	C	34	34	105	-	-	122	75	-	-	5	80	.01	.1	.1	.1	.1	-	-	A	.005650						
T3	24-P11417B	C	34	34	105	-	-	110	75	-	-	5	80	.01	.1	.1	.1	.1	-	-	A	.005650						
T4	24-P11417B	C	34	34	105	-	-	107	75	-	-	5	80	.01	.1	.1	.1	.1	-	-	A	.005650						
29	TYPE OF CASE	30		FAILURE RATE SOURCES (FOR COLUMN 29)							31	CALCULATED MTTF _____ HRS							32	TOTAL FAILURE RATE .016950 / 1000 HRS								
	A. REZ. SEAL			A. SN-188								B. _____								C. _____								

## PARTS APPLICATION ANALYSIS

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## (SEMICONDUCTORS)

PROJECT: ALSEP

ASSEMBLY: Radiation Hardened  
PROJECT

SUB ASSEMBLY: RF Converter

DATE: 20. July 1972

SCHEMATIC NO: 67-179377B

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU FACTUR ER	MAX. TEMP °C			AVG PWR DISSIPATION (mw)						POWER FA TIO			MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI CATION	PART SPECIAL ENVIRON MENT (Detail)	FOR RELIABILITY USE ONLY																											
						RATED AT 25°C									MAXIMUM VOLTAGES				DIODE PIV																															
			AMBIENT	ACTUAL	JUNCTION	A CT UAL	A CT UAL	A CT UAL	A CT UAL	A CT UAL	A CT UAL	ACTUAL	RATED 25°C	ACTUAL	RATED TA or TC	V <sub>CBO</sub>	V <sub>CB</sub>	V <sub>CR0</sub>	V <sub>CE</sub>	RATED	ACTUAL	RATED	ACTUAL	RATE (% 1000 HRS)	S OUR CE	F M A IL T E R	F M A IL T E R	T C O UN T A L T E R	T C O UN T A L T E R	TOTAL FAILURE RATE (% 1000 HRS)																				
L	R																																																	
1	48-P16069A		75	200	78	500	-	300	-	20	.01	.07	-	-	-	-	-	-	35	1.0				2.6 A	.02	.000052																								
2	R		75	125	20	200	-	100	-	10	.05	.10	-	-	-	-	-	-	30	1.0				12.2 A	.02	.000244																								
3	CR		75	125	30	200	-	100	-	10	.05	.10	-	-	-	-	-	-	30	1.0				3.2 A	.02	.000224																								
4	CR		75	150	71	250	-	175	-	1	.01	.01	-	-	-	-	-	-	50	0				3.2 A	.1	.000222																								
Q	TRANSISTOR, NPN																																																	
1	JAN-TX1N3069		75	175	97	200	-	143	-	25	.13	.18	30	7.32	15	6.2	-	-			507	A	.1	.000507	A																									
Q	TRANSISTOR, NPN																																																	
X	JAN-TX1N2357		75	175	97	200	-	143	-	25	.13	.18	30	5.6	15	6.4	-	-			5.3 A	.1	.000522																											
Q	TRANSISTOR, NPN																																																	
3	JAN-TX2N2357		75	175	97	200	-	143	-	25	.13	.18	30	4.4	15	5.2	-	-			5.0 A	.1	.000507																											
Q	TRANSISTOR, NPN																																																	
4	JAN-TX2N2357		75	175	103	200	-	143	-	32	.16	.22	30	5.5	15	8.1	-	-			7.16	A	.1	.000716	A																									
Q	TRANSISTOR, NPN																																																	
5	JAN-TX2N2357		75	175	79	200	-	143	-	5	.03	.04	30	4.0	15	4.7	-	-			7.62	A	.1	.000720																										
FAILURE RATE SOURCE (See Column 23)			A						B						C						D																													
NOTE: It is assumed the transient and peak power does not exceed the safe limit.																																																		
TOTAL FAILURE RATE <u>00.3980</u> %/1000 HRS.																																																		

## PARTS APPLICATION ANALYSIS

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## (SEMICONDUCTORS)

PROJECT: ALSEP

ASSEMBLY: Redundant Command Receiver

SUB ASSEMBLY: RF Converter

DATE: 20 July 1970

SCHEMATIC NO: 63-P11377B

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU FACTURER	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		FOR RELIABILITY USE ONLY										TOTAL FAILURE RATE (%)							
			RATED AT		25°C		Actual		Actual		Actual		Actual		Actual		Actual		Rated		Actual		Circuit Function or Application		Part Special Environment (Define)		Rate (1/1000 HRS)		Source Failure Rate (1/1000 HRS)		Failure Rate (1/1000 HRS)		Total Count Type		Total Failure Rate (%)	
			AMBIENT	T <sub>A</sub>	RATED	T <sub>J</sub>	ACTUAL	T <sub>A</sub>	ACTUAL	T <sub>A</sub>	ACTUAL	T <sub>A</sub>	Actual (Ambient case)	RATED T <sub>A</sub> or T <sub>C</sub>	Actual	RATED T <sub>A</sub> or T <sub>C</sub>	Actual	RATED T <sub>A</sub> or T <sub>C</sub>	Actual	RATED	V	Actual	V	Actual	V	Actual	V	Actual	V	Actual	V	Actual	V	Actual	V	
			Q6	TRANSISTOR, NPN JANTXAN2857	75	175	79	200	-	143	-	5	0.3	0.4	30	4.5	15	5.2	-	-	45°C 100°C 200°C 300°C 400°C 500°C 600°C 700°C 800°C 900°C 1000°C 1100°C 1200°C 1300°C 1400°C 1500°C 1600°C 1700°C 1800°C 1900°C 2000°C 2100°C 2200°C 2300°C 2400°C 2500°C 2600°C 2700°C 2800°C 2900°C 3000°C 3100°C 3200°C 3300°C 3400°C 3500°C 3600°C 3700°C 3800°C 3900°C 4000°C 4100°C 4200°C 4300°C 4400°C 4500°C 4600°C 4700°C 4800°C 4900°C 5000°C 5100°C 5200°C 5300°C 5400°C 5500°C 5600°C 5700°C 5800°C 5900°C 6000°C 6100°C 6200°C 6300°C 6400°C 6500°C 6600°C 6700°C 6800°C 6900°C 7000°C 7100°C 7200°C 7300°C 7400°C 7500°C 7600°C 7700°C 7800°C 7900°C 8000°C 8100°C 8200°C 8300°C 8400°C 8500°C 8600°C 8700°C 8800°C 8900°C 9000°C 9100°C 9200°C 9300°C 9400°C 9500°C 9600°C 9700°C 9800°C 9900°C 10000°C 10100°C 10200°C 10300°C 10400°C 10500°C 10600°C 10700°C 10800°C 10900°C 11000°C 11100°C 11200°C 11300°C 11400°C 11500°C 11600°C 11700°C 11800°C 11900°C 12000°C 12100°C 12200°C 12300°C 12400°C 12500°C 12600°C 12700°C 12800°C 12900°C 13000°C 13100°C 13200°C 13300°C 13400°C 13500°C 13600°C 13700°C 13800°C 13900°C 14000°C 14100°C 14200°C 14300°C 14400°C 14500°C 14600°C 14700°C 14800°C 14900°C 15000°C 15100°C 15200°C 15300°C 15400°C 15500°C 15600°C 15700°C 15800°C 15900°C 16000°C 16100°C 16200°C 16300°C 16400°C 16500°C 16600°C 16700°C 16800°C 16900°C 17000°C 17100°C 17200°C 17300°C 17400°C 17500°C 17600°C 17700°C 17800°C 17900°C 18000°C 18100°C 18200°C 18300°C 18400°C 18500°C 18600°C 18700°C 18800°C 18900°C 19000°C 19100°C 19200°C 19300°C 19400°C 19500°C 19600°C 19700°C 19800°C 19900°C 20000°C 20100°C 20200°C 20300°C 20400°C 20500°C 20600°C 20700°C 20800°C 20900°C 21000°C 21100°C 21200°C 21300°C 21400°C 21500°C 21600°C 21700°C 21800°C 21900°C 22000°C 22100°C 22200°C 22300°C 22400°C 22500°C 22600°C 22700°C 22800°C 22900°C 23000°C 23100°C 23200°C 23300°C 23400°C 23500°C 23600°C 23700°C 23800°C 23900°C 24000°C 24100°C 24200°C 24300°C 24400°C 24500°C 24600°C 24700°C 24800°C 24900°C 25000°C 25100°C 25200°C 25300°C 25400°C 25500°C 25600°C 25700°C 25800°C 25900°C 26000°C 26100°C 26200°C 26300°C 26400°C 26500°C 26600°C 26700°C 26800°C 26900°C 27000°C 27100°C 27200°C 27300°C 27400°C 27500°C 27600°C 27700°C 27800°C 27900°C 28000°C 28100°C 28200°C 28300°C 28400°C 28500°C 28600°C 28700°C 28800°C 28900°C 29000°C 29100°C 29200°C 29300°C 29400°C 29500°C 29600°C 29700°C 29800°C 29900°C 30000°C 30100°C 30200°C 30300°C 30400°C 30500°C 30600°C 30700°C 30800°C 30900°C 31000°C 31100°C 31200°C 31300°C 31400°C 31500°C 31600°C 31700°C 31800°C 31900°C 32000°C 32100°C 32200°C 32300°C 32400°C 32500°C 32600°C 32700°C 32800°C 32900°C 33000°C 33100°C 33200°C 33300°C 33400°C 33500°C 33600°C 33700°C 33800°C 33900°C 34000°C 34100°C 34200°C 34300°C 34400°C 34500°C 34600°C 34700°C 34800°C 34900°C 35000°C 35100°C 35200°C 35300°C 35400°C 35500°C 35600°C 35700°C 35800°C 35900°C 36000°C 36100°C 36200°C 36300°C 36400°C 36500°C 36600°C 36700°C 36800°C 36900°C 37000°C 37100°C 37200°C 37300°C 37400°C 37500°C 37600°C 37700°C 37800°C 37900°C 38000°C 38100°C 38200°C 38300°C 38400°C 38500°C 38600°C 38700°C 38800°C 38900°C 39000°C 39100°C 39200°C 39300°C 39400°C 39500°C 39600°C 39700°C 39800°C 39900°C 40000°C 40100°C 40200°C 40300°C 40400°C 40500°C 40600°C 40700°C 40800°C 40900°C 41000°C 41100°C 41200°C 41300°C 41400°C 41500°C 41600°C 41700°C 41800°C 41900°C 42000°C 42100°C 42200°C 42300°C 42400°C 42500°C 42600°C 42700°C 42800°C 42900°C 43000°C 43100°C 43200°C 43300°C 43400°C 43500°C 43600°C 43700°C 43800°C 43900°C 44000°C 44100°C 44200°C 44300°C 44400°C 44500°C 44600°C 44700°C 44800°C 44900°C 45000°C 45100°C 45200°C 45300°C 45400°C 45500°C 45600°C 45700°C 45800°C 45900°C 46000°C 46100°C 46200°C 46300°C 46400°C 46500°C 46600°C 46700°C 46800°C 46900°C 47000°C 47100°C 47200°C 47300°C 47400°C 47500°C 47600°C 47700°C 47800°C 47900°C 48000°C 48100°C 48200°C 48300°C 48400°C 48500°C 48600°C 48700°C 48800°C 48900°C 49000°C 49100°C 49200°C 49300°C 49400°C 49500°C 49600°C 49700°C 49800°C 49900°C 50000°C 50100°C 50200°C 50300°C 50400°C 50500°C 50600°C 50700°C 50800°C 50900°C 51000°C 51100°C 51200°C 51300°C 51400°C 51500°C 51600°C 51700°C 51800°C 51900°C 52000°C 52100°C 52200°C 52300°C 52400°C 52500°C 52600°C 52700°C 52800°C 52900°C 53000°C 53100°C 53200°C 53300°C 53400°C 53500°C 53600°C 53700°C 53800°C 53900°C 54000°C 54100°C 54200°C 54300°C 54400°C 54500°C 54600°C 54700°C 54800°C 54900°C 55000°C 55100°C 55200°C 55300°C 55400°C 55500°C 55600°C 55700°C 55800°C 55900°C 56000°C 56100°C 56200°C 56300°C 56400°C 56500°C 56600°C 56700°C 56800°C 56900°C 57000°C 57100°C 57200°C 57300°C 57400°C 57500°C 57600°C 57700°C 57800°C 57900°C 58000°C 58100°C 58200°C 58300°C 58400°C 58500°C 58600°C 58700°C 58800°C 58900°C 59000°C 59100°C 59200°C 59300°C 59400°C 59500°C 59600°C 59700°C 59800°C 59900°C 60000°C 60100°C 60200°C 60300°C 60400°C 60500°C 60600°C 60700°C 60800°C 60900°C 61000°C 61100°C 61200°C 61300°C 61400°C 61500°C 61600°C 61700°C 61800°C 61900°C 62000°C 62100°C 62200°C 62300°C 62400°C 62500°C 62600°C 62700°C 62800°C 62900°C 63000°C 63100°C 63200°C 63300°C 63400°C 63500°C 63600°C 63700°C 63800°C 63900°C 64000°C 64100°C 64200°C 64300°C 64400°C 64500°C 64600°C 64700°C 64800°C 64900°C 65000°C 65100°C 65200°C 65300°C 65400°C 65500°C 65600°C 65700°C 65800°C 65900°C 66000°C 66100°C 66200°C 66300°C 66400°C 66500°C 66600°C 66700°C 66800°C 66900°C 67000°C 67100°C 67200°C 67300°C 67400°C 67500°C 67600°C 67700°C 67800°C 67900°C 68000°C 68100°C 68200°C 68300°C 68400°C 68500°C 68600°C 68700°C 68800°C 68900°C 69000°C 69100°C 69200°C 69300°C 69400°C 69500°C 69600°C 69700°C 69800°C 69900°C 70000°C 70100°C 70200°C 70300°C 70400°C 70500°C 70600°C 70700°C 70800°C 70900°C 71000°C 71100°C 71200°C 71300°C 71400°C 71500°C 71600°C 71700°C 71800°C 71900°C 72000°C 72100°C 72200°C 72300°C 72400°C 72500°C 72600°C 72700°C 72800°C 72900°C 73000°C 73100°C 73200°C 73300°C 73400°C 73500°C 73600°C 73700°C 73800°C 73900°C 74000°C 74100°C 74200°C 74300°C 74400°C 74500°C 74600°C 74700°C 74800°C 74900°C 75000°C 75100°C 75200°C 75300°C 75400°C 75500°C 75600°C 75700°C 75800°C 75900°C 76000°C 76100°C 76200°C 76300°C 76400°C 76500°C 76600°C 76700°C 76800°C 76900°C 77000°C 77100°C 77200°C 77300°C 77400°C 77500°C 77600°C 77700°C 77800°C 77900°C 78000°C 78100°C 78200°C 78300°C 78400°C 78500°C 78600°C 78700°C 78800°C 78900°C 79000°C 79100°C 79200°C 79300°C 79400°C 79500°C 79600°C 79700°C 79800°C 79900°C 80000°C 80100°C 80200°C 80300°C 80400°C 80500°C 80600°C 80700°C 80800°C 80900°C 81000°C 81100°C 81200°C 81300°C 81400°C 81500°C 81600°C 81700°C 81800°C 81900°C 82000°C 82100°C 82200°C 82300°C 82400°C 82500°C 82600°C 82700°C 82800°C 82900°C 83000°C 83100°C 83200°C 83300°C 83400°C 83500°C 83600°C 83700°C 83800°C 83900°C 84000°C 84100°C 84200°C 84300°C 84400°C 84500°C 84600°C 84700°C 84800°C 84900°C 85000°C 85100°C 85200°C 85300°C 85400°C 85500°C 85600°C 85700°C 85800°C 85900°C 86000°C 86100°C 86200°C 86300°C 86400°C 86500°C 86600°C 86700°C 86800°C 86900°C 87000°C 87100°C 87200°C 87300°C 87400°C 87500°C 87600°C 87700°C 87800°C 87900°C 88000°C 88100°C 88200°C 88300°C 88400°C 88500°C 88600°C 88700°C 88800°C 88900°C 89000°C 89100°C 89200°C 89300°C 89400°C 89500°C 89600°C 89700°C 89800°C 89900°C 90000°C 90100°C 90200°C 90300°C 90400°C 90500°C 90600°C 90700°C 90800°C 90900°C 91000°C 91100°C 91200°C 91300°C 91400°C 91500°C 91600°C 91700°C 91800°C 91900°C 92000°C 92100°C 92200°C 92300°C 92400°C 92500°C 92600°C 92700°C 92800°C 92900°C 93000°C 93100°C 93200°C 93300°C 93400°C 93500°C 93600°C 93700°C 93800°C 93900°C 94000°C 94100°C 94200°C 94300°C 94400°C 94500°C 94600°C 94700°C 94800°C 94900°C 95000°C 95100°C 95200°C 95300°C 95400°C 95500°C 95600°C 95700°C 95800°C 95900°C 96000°C 96100°C 96200°C 96300°C 96400°C 96500°C 96600°C 96700°C 96800°C 96900°C 97000°C 97100°C 97200°C 97300°C 97400°C 97500°C 97600°C 97700°C 97800°C 97900°C 98000°C 98100°C 98200°C 98300°C 98400°C 98500°C 98600°C 98700°C 98800°C 98900°C 99000°C 99100°C 99200°C 99300°C 99400°C 99500°C 99600°C 99700°C 99800°C 99900°C 100000°C	A SM-188	C D	NOTE: It is assumed the transient and peak power does not exceed the safe limit.	TOTAL FAILURE RATE .000368 1/1000 HRS.											

## PARTS APPLICATION ANALYSIS

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(MISC. PARTS)

**PROJECT: ALSEP**

ASSEMBLY: Redundant Receiver Command

SUB ASSEMBLY: RF CONVERTER

DATE: 20 July 1970

SCHEMATIC NO: 63-P11377A

(Misc. Parts)

## PARTS APPLICATION ANALYSIS

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## (MISC. PARTS)

PROJECT: ALSEP

ASSEMBLY: Redundant Control  
Resource

SUB ASSEMBLY: RF CONVERTER

DATE: 20 July 1970

SCHEMATIC NO: 63-P13776

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CSC, MIL OR MILSPEC) and CONSTRUCTION	MANUFACTURER	AMBIENT TEMPERATURE RANGE °C		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY				
			MAX RATED	MID RATED	RATED MW	USE MW			BASIC FAILURE RATE (%) / 1000 HOURS	S O U R E	PART SPECIAL ENVIRONMENT (DESIGNED)	FAILURE RATE (%) / 1000 HOURS	TOTAL FAILURE RATE (%) / 1000 HOURS
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Y1	CRYSTAL, QUARTZ 52-16063A		85	75	10	.5			0.5	A		-	.00050
15	FAILURE RATE SOURCES (FOR COLUMN 11)				16	CALCULATED BY THE _____ HOURS				17	TOTAL FAILURE RATE _____ %/1000 HOURS		
A. <u>DOT 50-1606</u>	B. <u> </u>	C. <u> </u>	D. <u>MIL-STD-217 Chart XVII</u>										

# PARTS APPLIED TO ION ANALYSIS

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**(MISC. PARTS)**

**PROJECT: ALSEP**

ASSEMBLY: Redundant Command Receiver

SUB ASSEMBLY: RF CONVERTER

**DATE:** 20 July 1977  
**SCHEMATIC NO:** 63-P11377B

(Misc. Parts)

## PARTS APPLICATION ANALYSIS

Page 13 of 13

(CONNECTORS)

PROJECT: ALSEP

ASSEMBLY: REDUNDANT Command

SUB ASSEMBLY: RF CONVERTER

DATE: 20 July 1970

SCHEMATIC NO: S-P11327B

(Connectors)

CIRCUIT, REF. DESIGN- NATION	TYPE DESIGNATION (C&C, MIL OR MFR)  AND CONSTRUCTION	MANU- FACTUR- ER	PINS												NO. OF INSER- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC FA- ILURE RATE 1/1000 Hours (See 24)	SOUR- CES OF F.R.	F.R. MODI- FIER	TOTAL FAIL- URE RATE (%/1000 Hours)					
			NUMBER		CURRENT			VOLTAGE																	
			TOTAL	ACTIVE	RATED AMP. mA	MAX. mA	MIN.	RATED	ACTUAL	TO GND	TRANSIENT	STEADY STATE	SURGE	14	15	16	17								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22				
J1	55-032-0000		1	1	2	1	-	400	.1	-	-	-	75	-	-	-		1.0	A	-	.001				
J2	50-050-2214		1	1	2	2	-	400	.1	-	-	-	75	TEFLON	-	-		1.0	A	-	.001				
23	REQUIRED LIFE HOURS	24	FAILURE RATE SOURCES (FOR COLUMN 20)							25	CALCULATED MTBF _____ HOURS				26	TOTAL FAILURE RATE _____ 1/1000 HOURS									
			A	MOT. SM-188							B														
			C								D														

TOTAL MODULE FAILURE RATE  
.112445 1/1000 HRS. A

(BS-321A)

## PARTS APPLICATION ANALYSIS

Page 1 of 16CAPACITORS

PROJECT: ALSEP

ASSEMBLY: REDUNDANT COMMAND  
KINETIC ENERGY

SUBASSEMBLY: 1P AND A4010

DATE: 20 JULY 1972

SCHEMATIC NO: 62-P11347B

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE DESIGNATION (NAME OF MFR) CONSTRUCTION	3 MANUFACTURER	4 CAPACITIVE VALUE MFN	5 TOLERANCE	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 VOLTAGE RATIO, OPERATING/ RATED	9 DUTY CYCLE	10 MANUFACTURER'S AIR TEMPERATURE	11 BULK AIR TEMPERATURE (°C)	12 CIRCUIT FUNCTION OR APPLICATION	13 BASIC FAILURE RATE (8/1000 HRS) AT 25°C SEE REQS	14 SPECIAL ENVIRONMENT (DEFINITE)	15 FAILURE MULTIPLIER	16 FINAL FAILURE RATE	17 TOTAL CAPACITOR COUNT PER TYPE	18 TOTAL FAILURE RATE (8/1000 HRS)
C1 CSR 13G		15PF	10 50 11.3 11.28		75						1.4 B	Level P			.001400	A	
C2 NOT USED																A	
C3 NOT USED																A	
C4 CKR06		.1uf	10 100 11.3 11.12								7.0 1A		.15		.001095		
C5 CKR06		.01uf	20 200 5.6 11.16.03								7.0 1A		.15		.001050		
C6 CKR05		.001	10 200 5.6 11.11.03								7.0 1A		.15		.001050		
C7 CKR05		33PF	10 200 11.3 14.0 .08								7.0 1A		.15		.001050		
C8 21-P11257B		1.0	20 50 11.3 11.23								7.1 1A		.15		.001365		
C9 CKR05		—	10 200 5.6 11.16.03								7.0 1A		.15		.001050		
C10 CKR06		.0022	10 200 6.1.2 .04								7.0 1A		.15		.001050		
C11 CKR06		.0022	10 200 6.1.2 .04								7.0 1A		.15		.001050		
C12 CKR05		120PF	10 200 6.1.2 .04								7.0 1A		.15		.001050		
C13 21-P11258B		15P	1 500 6.1.11.01								30 1A	FOR REVIEW	.1		.0000050		
C14 CKR06		.1	10 100 5.7 14.0 .10								7.0 1A		.15		.001050		
C15 21-P11257B		1.0	20 50 6.2 11.13								7.4 1A		.15		.001110		
C16 CKR06		—	10 100 7.0 16.0 .13 .50								7.0 1A		.15		.001050		
C17 21-P11257B		.170PF	1 1.1 7.0 16.0 .13 .50								7.0 1A		.15		.001050		
C18 CKR06		.11	2 50 7.8 11.16 .16								7.7 1A		.15		.001110		
C19 21-P11257B		.0018	5 25 6.0 5.0 .44 .50								8.9 1A		.15		.001335		
20																	
21																	
22																	
FAILURE RATE SOURCES (FOR COLUMN #14)																	
A SM-188      B MTL-HDRK-217A																	
C D																	
CALCULATED MTBF _____ HRS																	
TOTAL FAILURE RATE 018.070 X 1000 HRS																	

BS-321A

## PARTS APPLICATION ANALYSIS

Page 2 of 16CAPACITORS

PROJECT: ALSEP

ASSEMBLY: F. INSTRUMENT COMMAND  
RECEIVERSUBASSEMBLY: IF AND AudioDATE: 30 July 1970SCHEMATIC NO: 1-11347B

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (NAME OF MFR) DESIGNATION CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE MFD	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 VOLTCYC/F OPERATING RATIO/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE [°C]	11 12	13 CIRCUIT FUNCTION APPLICATION	14 X 10 <sup>-3</sup> BASIC FAILURE RATE (3/1000 HRS) AT 40°C SINGLE REVERSE POLARITY	15 SPECIAL ENVIRONMENT (DEFNED)	16 FAILURE RATE MULTIPLIER	17 FINAL FAILURE RATE	18 TOTAL CAPACITOR PER TYPE	19 TOTAL FAILURE RATE (3/1000 HRS)
C200	21-P11258B	22uf	1	100	0	1.16	.01		75		.30A		.1		.000080	A	
C201	21-P11258B	9.1pf	1	500	0	1.03	.01				.30A		.1		.000080	A	
C22	21-P11257B	1.0	20	50	5.8	1.1	.12				7.3A		.15		.001085		
C23	21-P11257B	1nf	20	50	4.	1.1	.09				7.0A		.15		.001050		
C24	21-P11257B	1nf	20	50	4.	1.1	.09				7.0A		.15		.001050		
C25	21-P11257B	.001	5	50	4.2	2.0	.13				7.5A		.15		.001085		
C26	21-P11257B	1.0	20	50	11.3	1	.23				7.1A		.15		.001365		
C27	21-P11257B	1.0	20	50	4.0	4.0	.16				7.9A		.15		.001185		
C28	21-P11257B	1.0	20	50	5.5	1.4	.12				7.3A		.15		.001075		
C202	21-P11258B	22	1	100		1.19	.01				.30A		.1		.000080		
C203	21-P11258B	7.5	1	500		1.05	.01				.30A		.1		.000080		
C31	CKR06	23uf	10	200	6.0	4.0	.05				7.0A		.15		.001050		
C32	CKR06	22uf	10	20	6.0	4.0	.05				7.0A		.15		.001050		
C204	21-P11258B	22	1	100		1.14	.01				.30A		.1		.000080	A	
C205	21-P11258B	7.5pf	1	500		1.05	.01				.30A		.1		.000080	A	
C206	21-P11258B	22	1	100		1.14	.01				.30A		.1		.000080	A	
C36	21-P11258B	33nf	1	500	4.5	3.0	.02				.30A		.1		.000080		
C37	21-P11257B	1.0	20	50	11.3	1	.23				9.1A		.15		.001365		
C207	21-P11258B	9.1pf	1	500		1.06	.01	V			.30A		.1		.000080	A	
20	FAILURE RATE SOURCES (FOR COLUMN #14)										CALCULATED MTBF _____ HRS		TOTAL FAILURE RATE .512152 1000 HRS				
A	S1 - 1.52	B															
C		D															

## PARTS APPLICATION ANALYSIS

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## CAPACITÉ

**PROJECT: ALSEP**

ASSEMBLY: Rockwood Command Project

SUBASSEMBLY: IF and Audio

DATE: 20 July 1773

SCHEMATIC NO: 63-PII347B

### (Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (NAME OF MFR) AND CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE mfd	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE	7 DC OPERATING VOLTAGE	8 VOLTAGE OPERATING/ RATED	9 DUTY CYCLE	10 MAXIMUM DUTY CYCLE	11 BULK AIR TEMPERATURE (°C)	12 CIRCUIT FUNCTION OR APPLICATION	13 X10 <sup>-3</sup> BASIC FAILURE RATE (3,100 HRS) SEE LATER TCRCA	14 X10 <sup>-3</sup> TOTAL FAILURE RATE (3,100 HRS) SEE LATER TCRCA	15 SPECIAL (ENVIRON- MENTAL) FAILURE MULTIPLIER	16 FINAL FAILURE RATE	17 TOTAL CAPACITOR COUNT PER TYPE	18 TOTAL FAILURE RATE (3,100 HRS)
C208	21-P1125PB	.	220pf	1	100	0	1.0	.01		75		.30 A		.1	.		.000080
C209	21-P1125PB	.	47pf	1	500	4.0	13.0	.02				.30 A		.1			.000080
C41	CKR05		100 <sup>2</sup> pf	10	200	6.0	0	.04				7.0 A		.15			.001050
C42	CKR05		100 <sup>2</sup> pf	10	200	11.1		.06				7.0 A		.15			.001050
C43	CKR05		100 <sup>2</sup> pf	10	200	2.0		.01				7.0 A		.15			.001050
C44	21-P11257B		0.1 uf	20	50	3.5		.07				7.0 A		.15			.001050
C45	CKR05		220 pf	1	200	1.0	13.0	.02				7.0 A		.15			.001050
C46	CKR05		100 <sup>2</sup> pf	10	100	11.0		.11				7.0 A		.15			.001050
C47	CKR05		100 <sup>2</sup> pf	10	200	4.0		.02				7.0 A		.15			.001050
C48	CKR05		100 <sup>2</sup> pf	10	200	2.0		.01				7.0 A		.15			.001050
C49	21-P11257B		1 <sup>2</sup> pf	5	30	6.0	14.0	.20				8.5 A		.15			.001275
C50	21-P11257B		1.0	20	50	11.3		.23				9.1 A		.15			.001365
C51	CKR05		330 pf	10	200	6.0	14.0	.05				7.0 A		.15			.001050
C52	21-P11257B		100 <sup>2</sup> pf	5	25	6.0	14.0	.40				12.7 A		.15			.001705
C53	21-P11257B		31 <sup>2</sup> pf	5	25	6.0	14.0	.40				12.7 A		.15			.001705
C54	21-P11257B		1.0	5	5	6.2	12	.13				7.5 A		.15			.001125
C55	NOT USED																
C56	CKR05		100 <sup>2</sup> pf	10	200	9.0		.05				7.0 A		.15			.001050
C57	CKR05		100 <sup>2</sup> pf	10	200	1.0	10	.01	V			7.0 A		.15			.001050

BS-321A

CAPACITORS

PROJECT: ALSEP

ASSEMBLY: COMMAND  
REdundantSUBASSEMBLY: IF AND AudioDATE: 20 JULY 17, 75SCHEMATIC NO: 63-P11347B

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE DESIGNATION (MIL OR MFR) AND CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE MFD	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 VOLTAGE RATIO	9 DUTY CYCLE	10 BUCK AIR TEMPERATURE (°C)	11 CIRCUIT FUNCTION OR APPLICATION	12 X10 <sup>-3</sup> 13 BASIC FAILURE RATE (#/1000 HRS)	14 TECHNICAL SPECIALTY (S.E.D./C)	15 ENVIRONMENTAL DEFINITION	16 FAILURE RATE MULTIPLIER	17 FINAL FAILURE RATE	18 TOTAL CAPACITOR COUNT PER TYPE	19 TOTAL FAILURE RATE (#/1000 HRS)
C53	CKR06		.022	10	100	6.21.2	.07		75		7.0 A		.15				.021050
C55	21-P11257B		1.0	20	50	11.31	.23				7.0 A		.15				.221365
C60	CKR05		10 <sup>2</sup>	10	200	8.110	.05				7.0 A		.15				.021050
C61	CKR05		10 <sup>2</sup>	10	200	5.010	.03				7.0 A		.15				.021050
C62	CKR05		10 <sup>2</sup>	10	200	11.010	.06				7.0 A		.15				.021050
C63	21-P11258B		51pf	1	100	0 135	.04				30 A		.1				.000050
C64	21-P11258B		56 <sup>2</sup>	1	100	0 135	.04				30 A		.1				.000080
C65	CKR06		0.1	10	100	11.010	.11				7.0 A		.15				.021050
C66	ST10251-11		8-10 <sup>2</sup>		200	0 13.5	.02				.60 B		-				.000600
C67	CKR05		56pt	10	200	1.0 13.5	.03				7.0 A		.15				.021050
C68	CKR05		56pt	10	200	1.0 13.5	.03				7.0 A		.15				.021050
C69	ECY105R		5.1pf	5	500	2.0 1.25	.01				.33 A		.18				.000060
C70	ST10251-11		8-16 <sup>2</sup>		200	0 13.5	.02				.60 B		-				.000600
C71	ECY105R		5.1pf	5	500	2.0 1.25	.01				.33 A		.18				.000060
C72	CKR05		270pf	10	200	2.0 1.25	.02				7.0 A		.15				.021050
C73	CKR05		.001	10	200	9.510	.05				7.0 A		.15				.021050
C74	NOT USED																
C75	CKR06		.1uf	10	200	6.0 1.10	.04				7.0 A		.15				.021050
C76	NOT USED																

20

21

22

FAILURE RATE SOURCES (FOR COLUMN #14)

A SM-168 D MLK-HDBK-217 F18.7.6.13BC  D 

CALCULATED MTBF \_\_\_\_\_ HRS

TOTAL FAILURE RATE 013360 #/1000 HRS

# PARTS APPLICATION ANALYSIS

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## CAPACITORS

PROJECT: ALSEP

ASSEMBLY: Redundant Command Receivers SUBASSEMBLY: IF AND Audio

DATE: 20 JULY 1970

SCHEMATIC NO: 63-P11349B

## PARTS APPLICATION ANALYSIS

Page 16RESISTORS

PROJECT: ALSEP

ASSEMBLY: Rubber Command  
PC BoardSUB ASSEMBLY: IF AND And 1/2DATE: 20 July 1972SCHEMATIC NO: 2-1211-2478

(Resistors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (ML or MFR) DESIGNATION AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM POWER (WATTS)	8 POWER RATIO RATED	9 MAXIMUM DUTY CYCLE	10 PULS AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 X10 <sup>-3</sup> BASIC FAILURE RATE (1/1000 HRS)	13 SOURCE USE BELOW	14 SPECIAL ENVIRONMENTS (DEFINITIONS)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (1/1000 HRS)	17 TOTAL RESISTOR COUNT PER TYPE	18 TOTAL FAILURE RATE (1/1000 HRS)
R1	RCF25G	.	10K	5 .125	.012	.10		95		.01 A				-		.000010	
R2	RCR25G		33K	5 .125	.001	.01				.01 A				-		.000010	
R3	RCF25G		3.9K	5 .125	.001	.01				.01 A				-		.000010	
R4	RCR05G		470K	5 .125	.001	.01				.01 A				-		.000010	
R5	RCR05G		221	5 .125	.001	.01				.01 A				-		.000010	
R6	RCR05G		52K	5 .125	.001	.01				.01 A				-		.000010	
R7	RCF25G		56K	5 .125	.001	.01				.01 A				-		.000010	
R8	RCF25G		3.3K	5 .125	.003	.03				.01 A				-		.000010	
R9	RCR05G		470K	5 .125	.001	.01				.01 A				-		.000010	
S10	RCR05G		8.2K	5 .125	.011	.09				.01 A				-		.000010	
R11	RCR05G		10K	5 .125	.001	.07				.01 A				-		.000010	
R12	RCR05G		680	5 .125	.024	.20				.01 A				-		.000010	
R13	R-R05G		1.0E	5 .125	.011	.09				.01 A				-		.000010	
R14	RCR05G		680	5 .125	.001	.01				.01 A				-		.000010	
R15	R-R05G		56K	5 .125	.001	.01				.01 A				-		.000010	
R16	RCF25G		2.8K	5 .125	.001	.01				.01 A				-		.000010	
R17	RCR05G		1K	5 .125	.001	.01				.01 A				-		.000010	
R18	R11F55C		237K	1 .1	.001	.01	V			265 A				.0031		.000083	

FAILURE RATE SOURCES (FOR COLUMN #14)

A SN1-188      B   
C       D 

CALCULATED MTBF \_\_\_\_\_ HRS

TOTAL FAILURE RATE 000253 1/1000 HRS

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## PARTS APPLICATION ANALYSIS

Page 7 of 16RESISTORS

PROJECT: ALSEP

ASSEMBLY: Instrument CommsSUB ASSEMBLY: IF AND ADDDATE: 20 JULY 1973SCHEMATIC NO: 1-11-172

(Resistors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (NAME OF MFR) AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM OPERATING (WATTS)	8 POWER RATIO OPERATING/ RATED	9 MAXIMUM DUTY CYCLE	10 RTA AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 X10 <sup>-3</sup> BASIC FAILURE RATE (3 1000 HRS) AT SOURCE (50°F BELOW)	13 14 SPECIAL ENVIRONMENTS	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (3 1000 HRS)	17 TOTAL FAILURE COUNT PER TYPE	18 TOTAL FAILURE RATE (3 1000 HRS)
R17	RCR05G	•	56K	5	.125	.001	.01	75		.01 A					~22210	A
R22	RCR05G		56K	5	.125	.001	.01	1		.01 A					~22210	
R21	RCR05G		47K	5	.125	.001	.01			.01 A					~22210	
R22	RCR05G		1MΩ	5	.125	.001	.01			.01 A					~22210	
R23	RCR05G		1MΩ	5	.125	.001	.01			.01 A					~22210	
R24	RCR05G		15K	5	.125	.008	.07			.01 A					.000010	A
R25	RNP55C		5.1K	1	.1	.001	.01			26.5 A					.00003	
R26	RNP55C		17K	1	.1	.001	.01			26.5 A					.00003	
R27	RCR05G		—	5	.125	.001	.01			.01 A					~22210	
R28	RNP55C		10K	1	.1	.001	.01			26.5 A					.00003	
R27	RCR05G		56K	5	.125	.001	.01			.01 A					~22210	
R30	RNP55C		200K	1	.125	.001	.01			26.5 A					.00003	
R31	RCR05G		220	5	.125	.001	.01			.01 A					~22210	
R32	RCR05G		100	5	.125	.001	.01			.01 A					~22210	
R33	RCR05G		10K	5	.125	.003	.03			.01 A					.000010	A
R34	RCR05G		820K	5	.125	.001	.01			.01 A					~22210	A
R35	RCR05G		—	5	.125	.006	.05			.01 A					~22210	
R36	RCR05G		560	5	.125	.029	.24	▼		.01 A					~22210	A
19	FAILURE RATE SOURCES (FOR COLUMN 14)									20	CALCULATED MTBF _____ HRS	21	TOTAL FAILURE RATE .000472 3/1000 HRS			
A	SIM-185	B								C	D					

FUSE DATA

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## PARTS APPLICATION ANALYSIS

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RESISTORS

PROJECT: ALSEP

ASSEMBLY: Instrument Computer  
IF AND AudioSUB ASSEMBLY: IF AND AudioDATE: 22 July 1972SCHEMATIC NO: 111-1178

(Resistors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (NAME OF MFR) DESIGNATION AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM OPERATING (WATTS)	8 POWER RATIO/ OPERATING/ RATED	9 AUTOMATIC DUTY CYCLE	10 SULK AIR TEMPERATURE C	11 CIRCUIT FUNCTION OR APPLICATION	12 X10 <sup>-3</sup> RATE AT 3.1000 HRS BASIC FAILURE RATE AT 3.1000 HRS (SEE BELOW FOR USE OF RELIABILITY DEPT SOURCES)	13 X10 <sup>-3</sup> RATE AT 3.1000 HRS FAILURE RATE AT 3.1000 HRS (SEE BELOW FOR USE OF RELIABILITY DEPT SOURCES)	14 SPECIAL ENVIRONMENTAL CONDITIONS	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (R./1000 HRS)	17 TOTAL FAILURE COUNT PER TYPE	18 TOTAL FAILURE RATE (R./1000 HRS)
R37	RCR05G		360	5	.125	.029	.24		75		.01 A			-		.00010	A
R38	RCR05G		15K	5	.125	.011	.09				.01 A			-		.00010	A
R39	RCR05G		56K	5	.125	.001	.01				.01 A			-		.000010	
R40	RNR55C		56.2K	1	.1	.001	.01				26.5 A			.0031		.000023	
R41	RNR55C		56.2K	1	.1	.001	.01				26.5 A			.0031		.000023	
R42	RNR55C		-	5	.125	.001	.01				.01 A			-		.000010	
R43	RCR05G		560K	5	.125	.001	.01				.01 A			-		.000010	A
R44	RNR55C		29.8K	1	.1	.001	.01				26.5 A			.0031		.000023	
R45	RNR55C		47.2K	1	.1	.001	.01				26.5 A			.0031		.000023	
R46	RCR05G		100	5	.125	.013	.11				.01 A			-		.000010	A
R47	CNF55C		47.5K	1	.100	.001	.01				26.5 A			.0031		.000023	
R48	RNR55C		56.2K	1	.100	.031	.01				26.5 A			.0031		.000023	
R49	RNR55C		11K	1	.1	.002	.02				26.5 A			.0031		.000023	A
R50	RNR55C		8.25K	1	.1	.001	.01				26.5 A			.0031		.000023	A
R51	RNR55C		499	1	.1	.001	.01				26.5 A			.0031		.000023	A
R52	CNR57C		220K	1	.125	.001	.01				26.5 A			.0031		.000023	A
R53	RCR05G		22K	5	.125	.001	.01				.01 A			-		.000010	A
R54	RCR05G		3.9K	5	.125	.002	.02	V			.01 A			-		.000010	A

FAILURE RATE SOURCES (FOR COLUMN #16)

A SDI-188  
B \_\_\_\_\_  
C \_\_\_\_\_  
D \_\_\_\_\_

20

CALCULATED MTBF \_\_\_\_\_ HRS

21

TOTAL FAILURE RATE \_\_\_\_\_ 1/1000 HRS

1/1000 HRS

## PARTS APPLICATION ANALYSIS

Page 7 of 16RESISTORS

PROJECT: ALSEP

ASSEMBLY: Instrument Control  
PowerSUB ASSEMBLY: IT AND AudioDATE: 22 July 1972SCHEMATIC NO: 17-13

(Resistors)

1 CIRCUIT STATION NUMBER	2 TYPE (NAME OF MFR) DESIGNATION AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM OPERATING POWER (WATTS)	8 POWER RATIO/ RATED	9 MAXIMUM DUTY CYCLE	10 FOLK AIR TEMPERATURE C	11 CIRCUIT FUNCTION OR APPLICATION	12 X10 <sup>-3</sup> RATE OF FAILURE AT 100°C (SEE SOURCE 1 BELOW)	13 X10 <sup>-3</sup> RATE OF FAILURE AT 100°C (SEE SOURCE 1 BELOW)	14 SPECIAL ENVIRONMENTS (DEFINE)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (8/1000 HRS)	17 TOTAL FAILURE COUNT PER TYPE	18 TOTAL FAILURE RATE (8/1000 HRS)
R55	RNR55C		0.61K	1	.100	.001	.01		75		26.5	1		.0031		.000023	
R56	RNR57C		133K	1	.125	.001	.01				26.5	1		.0031		.000023	A
R57	RNR56G		10	5	.15	.013	.11				.01	1	A			.000010	A
R58	RNR55C		21.5K	1	.1	.001	.01				26.5	1	A	.0031		.000083	A
R59	RNR55C		21.5K	1	.1	.001	.01				26.5	1	A	.0031		.000083	A
R60	RNR57C		133K	1	.125	.001	.01				26.5	1	A	.0031		.000023	
R61	RCR05G		10K	5	.125	.001	.01				.01	1	A			.000010	
R62	RCR05G		22K	5	.1	.001	.01				.01	1	A			.000010	
R63	RNR55C		10K	1	.100	.021	.01				26.5	1	A	.0031		.000023	A
R64	RCR05G		22K	5	.125	.001	.01				.01	1	A			.000010	A
R65	RCR05G		56K	5	.125	.001	.01				.01	1	A			.000010	
R66	RCR05G		47K	5	.125	.001	.01				.01	1	A			.000010	
R67	RCR05G		56K	5	.125	.001	.01				.21	1	A			.000010	
R68	RCR05G		100	5	.125	.001	.01				.01	1	A			.000010	
R69	RCR05G		820K	5	.125	.001	.01				.01	1	A			.000010	A
R70	RCR05G		82K	5	.125	.001	.01				.01	1	A			.000010	A
R71	RCR05G		150	5	.125	.024	.20				.01	1	A			.000010	A
R72	RCR05G		5.6K	5	.125	.001	.01		Y		.01	1	A			.000010	A

FAILURE RATE SOURCES (FOR COLUMN #14)

A SIN-158 B   
C  D 

20

CALCULATED MTBF \_\_\_\_\_ HRS

21

TOTAL FAILURE RATE

1/1000 HRS

.000618

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# PARTS APPLIED ON ANALYSIS

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## **RESISTORS**

**PROJECT: ALSEP**

# ASSEMBLY : REDUNDANT COMMAND RECEIVER

SUB ASSEMBLY: IF AND AUDIO

DATE: 23 NOVEMBER 1970  
SCHEMATIC NO: 63-PII.3498

**FAILURE RATE SOURCES (FOR COLUMN #16)**

Sm-188      B \_\_\_\_\_  
C \_\_\_\_\_ D \_\_\_\_\_

**CALCULATED MTBF** \_\_\_\_\_ HRS

TOTAL FAILURE RATE .000030 %/1000 HRS

## PARTS APPLICATION ANALYSIS

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## (INDUCTORS, TRANSFORMERS)

PROJECT: ALSEP

ASSEMBLY: REDUNDANT COMMAND  
RECEIVER

SUB ASSEMBLY: I.F. AND AUDIO

DATE: 5 JULY 1973

SCHEMATIC NO: C3-P11349B

(Inductors &amp; Transformers)

1 CIRCUIT NUMBER	2 TYPE DESIGNATION (MIL or MFR) CONSTRUCTION	3 MANUFACTURER	CONSTRUCTION			8 VA RATING	9 INDUCTANCE AT RATED SPECIFIED CUR.	10 SPECIFIED FREQ.	11 Miscellaneous OPERATING AMBIENT TEMPERATURE (HOT SPOT SURFACE)	12 TEMPERATURE (°C)			14 EST. ACTUAL RISE (4R METHOD)	15 OPERATING TEMP MAX	16 ACTUAL MAX	17 PRIMARY RATED CURRENT	18 PRIMARY VOLTAGE	19 NO. WINDINGS	20 SECONDARY			24 HYPOT READING	25 FAIL. AT 1000 HRS (SEE BELOW)	26 FAIL. AT 1000 HRS (SEE BELOW)	27 TOTAL FAIL. RATE (P/1000 HRS)			
			4 TYPE OF CASE (DEG OF CASE B BELOW)	5 WIRE SIZE PRIMARY	6 WIRE SIZE SECONDARY					12 TEMP. RISE	13 EST. ACTUAL RISE	15 OPERATING TEMP MAX							21 VOLTS	22 WINDING NO.	23 WINDINGS							
L1	NOT USED																											
L20	24-P11420B	C	30	125	1.0/10.7	75	5	80	2.100	.14															A	.002060	A	
L21		C	30	125	1.0/10.7	75	5	80	1.5	100	.10														A	.002060	A	
L22		C	30	125	1.0/10.7	75	5	80	1.5	100	.10														A	.002060	A	
L23	↓	C	30	125	1.0/10.7	75	5	80	.9	100	.06														A	.002060	A	
L6	24-P12630B	C	40	125	3.7/7.3	75	5	80	.1	9.6	.26														A	.009120		
T1	24-P11420B	C	30	36	105	-10.7	75	5	80	-100	.07	1	1	.06											A	.005650		
T2					105	-10.7	75	5	80	-100	.04	1	1	.03										A	.005650			
T3					105	-10.7	75	5	80	-100	.70	1	1	3.5										A	.005650			
T4					105	-10.7	75	5	80	-100	.70	1	1	3.5										A	.005650			
TR0					105	-10.7	75	5	80	1.6	100	.03	1	1	.12									A	.005650			
T6	↓		↓	↓	105	-10.7	75	5	80	2.5	100	.70	2	1.2	.70									A	.005650			
26 TYPE OF CASE	28	FAILURE RATE SOURCES (FOR COLUMN #26)										30	CALCULATED MTBF _____ HRS			31	TOTAL FAILURE RATE .046760 3/1000 HRS					COL-TATT Page 20						
A. HER. SEAL		A. SM-188																										
B. VAC. IMP.		B.																										
C. ENCAP.		C.																										
D. OPEN		D.																										

## PARTS APPLICATION ANALYSIS

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## (SEMICONDUCTORS)

PROJECT: ALSEP

ASSEMBLY: REDUNDANT COMMAND  
REF ID: F

SUB ASSEMBLY: IF AND AUDIO

DATE: 20 July 1973  
SCHEMATIC NO: G-3-P11249B

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MAX. TEMP °C			AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI- CATION	FOR RELIABILITY USE ONLY								
					RATED AT																							
		AMB IENT		ACT UAL	R ATED	J UNCTION AL	A CT UAL	C ASE	T A N T	A CT UAL	A CT UAL	C ASE	T C	A CT UAL	C ASE DETER MINANT (Amb. or case)	R ATED DETER MINANT 10	V CBO	V CB	V CEO	V CE	R ATED	A CT UAL	S OURCE (See below)	F A IL U R A L T E R	F T O U L A N T E R	C O U L A N T E R	TOTAL FAIL URE RATE (\$/1000 HRS)	
CR1	DIODE, TX IN3064	75	150	76	250		175		.80	.01	.01																	
CR2	DIODE, TX IN3064	75	150	76	250		175		.30	.01	.01																	
CR3	DIODE, TX IN3064	75	150	76	250		175		.150	.01	.01																	
CR4	DIODE, 48-P11266B	75	150	100	250		150		50.	.20	.34																	
CR5	DIODE, 48-P11266B	75	150	100	250		150		50.	.20	.34																	
CR6	DIODE, 48-P11266B	75	150	100	250		150		50.	.20	.34																	
CR7	DIODE, 48-P11266B	75	150	100	250		150		50.	.20	.34																	
VR1	DIODE, Zener TX IN755A	75	175	81	400		266		15.	.04	.06																	
CR9	DIODE, TX IN3064	75	150	76	250		175		.15	.01	.01																	
FAILURE RATE SOURCE (See Column 23)										NOTE: It is assumed the transient and peak power does not exceed the safe limit.										TOTAL FAILURE RATE ..								
A SDI-158										TOTAL FAILURE RATE ..										TOTAL FAILURE RATE ..								
B																												

## PARTS APPLICATION ANALYSIS

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## (SEMICONDUCTORS)

PROJECT: ALSEP

ASSEMBLY: REDUNDANT COMMAND  
RECEIVER

SUB ASSEMBLY: IF AND AVOID

DATE: 20 JULY 1970SCHEMATIC NO: C3-P11349B

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU FACTUR ER	MAX. TEMP °C			AVG PWR DISSIPATION (mw)						POWER RATIO			MAXIMUM VOLTAGES						DIODE PIV	CIRCUIT FUNCTION or APPLI CATION	FOR RELIABILITY USE ONLY											
						RATED AT																												
			25°C		AMBIENT		CASE		ACTUAL		AMBIENT		CASE		ACTUAL		ACTUAL		RATED		ACTUAL		RATED		ACTUAL		PART SPECIAL ENVIRON MENT (Define)			RATE (%) 1000 HRS		FAULT MULTIPL ICAT ION RATE (%) 1000 HRS		T C OUNT
	TRANSISTOR, PNP																																	
Q1A	2N3049		75	175	77	250	-	166	-	1.8	.01	.02	25	1.0	20	.3																10.0	A .04	.000424
Q1B			75	175	76	250	-	166	-	.8	.01	.01	25	1.0	20	.3																10.4	A .04	.000416
	TRANSISTOR, NPN																																	
Q2	TX 2N2222A		75	175	79	500	-	333	-	13	.03	.04	75	6,	50	5.8																7.80	A .1	.000750
	TRANSISTOR, PNP																																	
Q3A	2N3049		75	175	78	250	-	166	-	4.	.02	.03	25	7.	20	7.																5.74	A .04	.000230
Q3B			75	175	78	250	-	166	-	4.	.02	.03	25	7.	20	7.																7.74	A .04	.000230
	TRANSISTOR, NPN																																	
Q4	TX 2N930		75	175	77	300	-	200	-	3.	.01	.02	60	3.	45	3.															3.50	A .1	.0000930	
	TRANSISTOR, NPN																																	
Q5	TX 2N2222A		75	175	89	500	-	333	-	45	.09	.14	75	1.5	50	1.5															7.9	A .1	.0008790	
* FAILURE RATE SOURCE (See Column 23)												NOTE: It is assumed the transient and peak power does not exceed the safe limit.												.003750 TOTAL FAILURE RATE						.6/1000 HRS.				
A SM-199												B												C						D				

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## PARTS APPLICATION ANALYSIS

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## (MISC. PARTS)

PROJECT: ALSEP  
 ASSEMBLY: REDUNDANT COMMAND  
 RECEIVER

SUB ASSEMBLY: IF AND AUDIO

DATE: 20 JULY 1970  
 SCHEMATIC NO: 63-P11349B

(MISC. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CSC, MIL OR MFR) and CONSTRUCTION	MANUFACTURER	AMBIENT TEMPERATURE °C		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	TIME TO FAILURE (S/1000 HOURS)	BASIC FAILURE RATE (%)	SUSC E	PART SPECIAL ENVIRONMENT (DEFIRE)	FAIL-URE RATE (MULTIPLIER)	TOTAL FAILURE RATE (S/1000 HOURS)
			MAX RATED	ACT.	RATED	USE								
AR1	45F 7715312		125	75	500	28		COMPLEXITY FACTOR = 172	15.36	A			.1	.001536
AR2	51-P16073A		125	75	500	30			= 81	9.72	A		.05	.000486
AR3	USB 7741312		125	75	500	10			= 92	10.40	A		.1	.001040
AR4	45G 7741312		125	75	500	10			= 92	10.40	A		.1	.001040
AR5	USB 7741312		125	75	500	10			= 92	10.40	A		.1	.001040
AR6	45G 7741312		125	75	500	10			= 92	10.40	A		.1	.001040
15	FAILURE RATE SOURCES (FOR COLUMN 13)			16	CALCULATED MTTF _____ HOURS			17	TOTAL FAILURE RATE _____ S/1000 HOURS					
A.	NOT 59-188			B.				C.				D.	BB 200 217 Chart KEY	

DOD FORM 1000

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# PARTS APPRAISAL ANALYSIS

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**(MISC. PARTS)**

**PROJECT: ALSEP**

ASSEMBLY: REDUNDANT COMMAND RECEIVER

SUB ASSEMBLY: IF AND AUDI

**DATE:** 20 July 1970  
**SCHEMATIC NO:** C3-P11349B

(Misc. Parts)

## PARTS APPLICATION ANALYSIS

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## (MISC. PARTS)

PROJECT: ALSEP  
 ASSEMBLY: REDUNDANT COMMAND  
 RECEIVER

SUB ASSEMBLY: IF AND AUDIO

DATE: 20 JULY 1970  
 SCHEMATIC NO: G3-P11349B

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CSC, MIL, OR DFRG) and CONSTRUCTION	MANUFACTURER	AMBIENT TEMPERATURE RANGE °C		ELECTRICAL STRESS VOLTAGE		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY			
			MAX RATED	TEMP ACT.	RATED	USE			BASIC FAILURE RATE (1/1000 HOURS)	SPECIAL ENVIRONMENT (REFERENCE)	FAILURE RATE	TOTAL FAILURE RATE (1/1000 HOURS)
FL1	25-P14433A		125	75	100	11.3			7.3	A	.5	.00365
FL2	25-P14433A		125	75	100	12.			7.3	A	.5	.00365
FL3	25-P14433A		125	75	100	5.			7.0	A	.5	.00350
FL4	25-P14433A		125	75	100	10.5			7.2	A	.5	.00360
FL5	25-P14433A		125	75	100	5.5			7.6	A	.5	.00350
15	FAILURE RATE SOURCES (FOR COLUMN 11)		16	CALCULATED MTTF _____ HOURS		17	TOTAL FAILURE RATE _____ 1/1000 HOURS					
A.	MOT. SM-188	B.										
C.		D.	BB 524 217 Chart ENV									

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## (CONNECTORS)

PROJECT: ALSEP

ASSEMBLY: Redundant Command

SUB ASSEMBLY: IF AND AUDIO

DATE: 20 JULY 1970

SCHEMATIC NO: E-PII 349B

(Connectors)

CIRCUIT, REF. DESIGN- ATION	TYPE DESIGNATION (C&C, MIL OR MFR)  AND CONSTRUCTION	MANU- FACTURER	PINS												NO. OF INSER- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC F.A.I. LURE RATE 1000 Hours See 24	SOUR- CE OF F.R.	F.R. MODIFI- ER	TOTAL FAIL- URE RATE (%/1000 Hours)							
			NUMBER			CURRENT			VOLTAGE																		
			TOTAL	ACTIVE	RATED	MAX.	MIN.	RATED	ACTUAL	TC 5K/D	BETWEEN PINS	TRANSIENT	STEADY STATE	SURGE													
1	2	3	4	5	6	7mA	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22						
J1	RF, 50-047-0000		1	1	2A	14	-	400	1	-	-	-	75	KE101	-	-			1.0	A	.001						
23	24	FAILURE RATE SOURCES (FOR COLUMN 20)										25	CALCULATED MTBF _____ HOURS				26	TOTAL FAILURE RATE _____ %/1000 HOURS									
		A	MOT. SM-188																								
		C	B																								
		D																									

TOTAL MODULE FAILURE RATE

154011 %/1000 HRS A

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# PARTS APPLIED TO ION ANALYSIS

Page 1

6

## **CAPACITORS**

**PROJECT: ALSEP**

ASSEMBLY: Redundant Command Receiver SUBASSEMBLY: AUDIO COMBINER PWR 150

**DATE:** 20 July 1970

SCHEMATIC NO: 63-PII356A

## PARTS APPLICATION ANALYSIS

Page 6RESISTORS

PROJECT: ALSEP

ASSEMBLY: Instrument ComponentsSUB ASSEMBLY: AUDIO COMBINER / PWR ISODATE: 20 JULY 1970SCHEMATIC NO: 62-F11776R

(Resistors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE DESIGNATION (QML or MTR) AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	6 OPERATING POWER (WATTS)	8 POWER RATIO OPERATING/RATED	9 MAXIMUM DUTY CYCLE	10 WILK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (8/1000 HRS) - AF SOURCE (SEE BELOW)	13 13	14 SPECIAL ENVIRONMENTAL (DEFINITE)	15 FAILURE RATE MULTIPLIER	15 FINAL FAILURE RATE (8/1000 HRS)	17 TOTAL RESISTOR COUNT PER TYPE	18 TOTAL FAILURE RATE (8/1000 HRS)
R1 C2P05G			100	5	.125	.002	.016	1.0	75	.01 A							.000010
R2 C2P05G			18K	5	.125	.001	.008	1.0	75	.01 A							.000010
R3 C2P05G			18K	5	.125	.001	.008	1.0	75	.01 A							.000010
R4 RCP05G			10	5	.125	.002	.016	1.0	75	.01 A							.000010
R5 RCP05G			1.5K	5	.125	.002	.016	1.0	75	.01 A							.000010
R6 RCP05G			17K	5	.125	.001	.008	1.0	75	.01 A							.000010
R7 RCP05G			12K	5	.125	.001	.008	1.0	75	.01 A							.000010
R8 RCP05G			18K	5	.125	.001	.008	1.0	75	.01 A							.000010
R9 RCP05G			18K	5	.125	.001	.008	1.0	75	.01 A							.000010
R10 RCP05G			15K	5	.125	.001	.008	1.0	75	.01 A							.000010
R11 RCP05G			56K	5	.125	.001	.008	1.0	75	.01 A							.000010
R12 C2P05G			33K	5	.125	.001	.008	1.0	75	.01 A							.000010
R13 C2P05G			10K	10	.500	.002	.032	1.0	75	- A							.015000
R14 C2P05G			33K	5	.125	.001	.008	1.0	75	.01 A							.000010
R15 C2P05G			33K	5	.125	.001	.008	1.0	75	.01 A							.000010
R16 C2P05G			33K	5	.125	.001	.008	1.0	75	.01 A							.000010
R17 RCP05G			18K	5	.125	.001	.008	1.0	75	.01 A							.000010
R18 RCP05G			43K	5	.125	.001	.008	1.0	75	.01 A							.000010

FAILURE RATE SOURCES (FOR COLUMN #14)

A SM-188      B \_\_\_\_\_  
C \_\_\_\_\_      D \_\_\_\_\_

CALCULATED MTBF \_\_\_\_\_ HRS

TOTAL FAILURE RATE .015170 8/1000 HRS

# PARTS APPENDIX ANALYSIS

Page

of 6

## **RESISTORS**

**PROJECT: ALSEP**

## ASSEMBLY:

SUB ASSEMBLY: AUDIM COMA / PWR 150

DATE: 20 JULY 1970

SCHEMATIC NO: 65-PLA-111B

# PARTS APPLICATION ANALYSIS

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## (SEMICONDUCTORS)

**PROJECT:** ALSEP

**ASSEMBLY:** Polymer Command  
Reiever
**SUB ASSEMBLY:** Auto Combiner / PWR 130
**DATE:** 20 July 1970
**SCHEMATIC NO:** 63-P11356B
*(Semiconductors)*

CIR SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU FACTURER	MAX. TEMP °C			AVG PWR DISSIPATION (mw)			POWER RATIO			MAXIMUM VOLTAGES			DIODE PIV			CIRCUIT FUNCTION or APPLICATION (Delete)	FOR RELIABILITY USE ONLY							
			RATED AT			25°C			ACTUAL			RATED 85°C ACTUAL TA or TC			V <sub>CBO</sub> RATED			V <sub>CB</sub> ACTUAL			V <sub>CEO</sub> RATED			V <sub>CE</sub> ACTUAL		
			AMBIENT TA	ACTUAL T <sub>A</sub>	RATED T <sub>J</sub>	JUNC TION TEMP T <sub>J</sub>	AMBIENT TA	CASE T <sub>C</sub>	ACTUAL T <sub>A</sub>	ACTUAL CASE T <sub>C</sub>	ACTUAL T <sub>A</sub>	AMBIENT T <sub>A</sub>	RATED T <sub>A</sub>	ACTUAL T <sub>A</sub>	AMBIENT T <sub>A</sub>	RATED T <sub>A</sub>	ACTUAL T <sub>A</sub>	AMBIENT T <sub>A</sub>	RATED T <sub>A</sub>	ACTUAL T <sub>A</sub>	AMBIENT T <sub>A</sub>	RATED T <sub>A</sub>	ACTUAL T <sub>A</sub>			
Q1	TRANSISTOR, NPN JAN-TX-2N2222A		75	175	96	500	-	333	-	70	.14	.21	75	0.5	50	1.0	-	-	8.9	A .1					.000890	
Q2	TRANSISTOR, NPN JAN-TX-2N2222A		75	175	96	500	-	333	-	70	.14	.21	75	0.5	50	1.0	-	-	8.9	A .1					.000890	
Q3	TRANSISTOR, PNP JAN-TX-2N2907A		75	200	75	400	-	286	-	1.2	.001	.001	60	0.1	60	0.3	-	-	2.5	A .1					.000950	
Q4	TRANSISTOR, PNP JAN-TX-2N2907A		75	200	91	400	-	286	-	35	.088	.122	60	1.5	60	3.0	-	-	11.4	A .1					.001140	
Q5	TRANSISTOR, PNP JAN-TX-2N2907A		75	200	91	400	-	286	-	35	.088	.122	60	1.5	60	3.0	-	-	11.4	A .1					.001140	
Q6	TRANSISTOR, NPN JAN-TX-2N2222A		75	175	75	500	-	333	-	1.0	.002	.003	75	3.0	50	0.3	-	-	5.6	A .1					.000566	
Q7	TRANSISTOR, NPN JAN-TX-2N2222A		75	175	75	500	-	333	-	1.0	.002	.003	75	3.0	50	0.3	-	-	5.6	A .1					.000566	
Q8	TRANSISTOR, NPN JAN-TX-2N2222A		75	175	75	500	-	333	-	1.0	.002	.003	75	3.0	50	0.3	-	-	5.6	A .1					.000566	
Q9	TRANSISTOR, NPN JAN-TX-2N2222A		75	175	75	500	-	333	-	1.0	.002	.003	75	1.5	50	2.0	-	-	5.97	A .1					.000597	

FAILURE RATE SOURCE (See Column 20)

 a SM-198

 b  c  d 

NOTE: It is assumed the transient and peak power does not exceed the safe limit.

 TOTAL FAILURE RATE .007305 %/1000 HRS.

PARTS APPLICATION ANALYSIS

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(SEMICONDUCTORS)

PROJECT: ALSEP

ASSEMBLY: AUDIO CHANNEL / PWR 150  
SUB ASSEMBLY: AUDIO CHANNEL / PWR 150

DATE: 20 July 1970  
SCHEMATIC NO: 63-P113563

(Semiconductors)

CIRCUIT NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU- FACTURER	MAX. TEMP °C			AVG PWR DISSIPATION (mw)						POWER RATIO			MAXIMUM VOLTAGES				DIODE PIV		FOR RELIABILITY USE ONLY									
						RATED AT																								
			AMBIENT	ACTUAL	RATED	JUNCTION	ACTUAL	AMBIENT	AMBIENT	ACTUAL	CASE	AMBIENT	ACTUAL	AMBIENT	ACTUAL	AMBIENT	ACTUAL	V <sub>CE0</sub>	V <sub>CB</sub>	V <sub>CEO</sub>	V <sub>CE</sub>	RATED	ACTUAL	RATED	ACTUAL	SOURCE	Fault	Fault	Total	Total
G10	TRANSISTOR, NPN JANTX 222-2		75	175	95	500	-	333	-	1.0		.002	.003	75	15	50	2.0	-	-										5.97 A .1	.000597
CA1	JANTX IN3064		75	150	75	250	-	175	-	.7		.003	.004	-	-	-	-	75	0									3.14 A .1	.000314	
CR2	JANTX 1.3-64		75	50	75	21	-	175	-	.7		.003	.004	-	-	-	-	75	0									3.14 A .1	.000314	
VR1	JANTX IN753A		75	175	96	400	-	320	-	3.1		.008	.010	-	-	-	-	V <sub>Z</sub> =6.2	6.2	6.2									1.16 A .1	.000446
FAILURE RATE SOURCE (See Column 23)			A SP-162			B C			D			NOTE: It is assumed the transient and peak power does not exceed the safe limit.						TOTAL FAILURE RATE .001671 %/1000 HRS.												

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## PARTS APPLICATION ANALYSIS

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## (INDUCTORS &amp; TRANSFORMERS)

PROJECT: ALSEP

ASSEMBLY: Sub AssemblySUB ASSEMBLY: Mu Consumer / PWR 150DATE: 20 July 1985SCHEMATIC NO: 63-P117565

(Inductors &amp; Transformers)

CIRCUIT NUMBER	TYPE DESCRIPTION AND CONSTRUCTION	MANUFACTURER	CONSTRUCTION		VA RATING AT RATED CURR.	INDUCTANCE AT RATED CURR. MH/MH	SPECIFIED FREQ. MH/MHZ	MISCELLANEOUS	OPERATING TEMP (°C)	TEMPERATURE (°C)	PRIMARY CURRENT RATED MA/MA	SECONDARY CURRENT RATED MA/MA	PRIMARY VOLTAGE NO. WINDINGS VOLTS	SECONDARY VOLTAGE WINDINGS VOLTS	HIPOUT READING	BASIC FAILURE RATE - 1000 HRS - SOURCE SEE BELOW	TOTAL FAILURE RATE - 1000 HRS - SEE BELOW					
			TYPE OF CASE (SEE BELOW)	SIZE OF CASE (SEE BELOW)					OPERATING AMBIENT (SURFACE) AIR METHOD	EST. ACTUAL OPERATING TEMP MAX.												
L1	24-P14448A	C	-	-	125	.15	2.2	.79	75	-	-	5	80	70	550	.04	-	-	-	-	A .002060	
L2	24-P14449A	C	-	-	125	.15	2.2	.79	75	-	-	5	80	70	550	.04	-	-	-	-	A .002060	
26	TYPE OF CASE	28	FAILURE RATE SOURCES (FOR COLUMN 26)															30	31	CALCULATED MTBF _____ HRS		
A. HER. SEAL	B. VAC. SEP.	C. ENCAP.	D. OPEN	a. <u>5M-.182</u>	b. <u>  </u>	c. <u>  </u>	d. <u>  </u>	TOTAL FAILURE RATE .004120 1/1000 HRS														
TOTAL MODULE FAILURE RATE .0555167 1/1000 HRS.																						

## PARTS APPLICATION ANALYSIS

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# RESISTORS

PROJECT: ALSEP

## ASSEMBLY : REPDYANT COMMAND REC

SUB ASSEMBLY: RF COUPLING

DATE: 20 July 1970

SCHEMATIC NO: 44-14143-B

**FAILURE RATE SOURCES (FOR COLUMN #16)**

A SM-188 B \_\_\_\_\_  
C \_\_\_\_\_ D \_\_\_\_\_

**CALCULATED MTBF** \_\_\_\_\_ HR

TOTAL FAILURE RATE ~~0.000012~~ 8/1000 HRS

## PARTS AND APPLICATION ANALYSIS

Page 2

## (CONNECTORS)

PROJECT: ALSEP

ASSEMBLY: REDUNDANT COMMAND  
RCUR

SUB ASSEMBLY: RF COUPLING

DATE: 20 July 1990

SCHEMATIC NO: 63-P11356B

(Connectors)

CIRCUIT, REF. DESIGNATION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	MANUFACTURER	PINS															NO. OF OPER- ATIONS DURING LIFE	MISCELLANEOUS REMARKS	CLASSIC F. E. L. I. R. X.	SOURCES OF F.R.	F.R. MODIFIES	TOTAL FAILURE RATE (%/1000 Hours)			
			NUMBER		CURRENT		VOLTAGE																			
			TOTAL	ACTIVE	RATED	MAX.	MIN.	RATED	ACTUAL	TO GRD	BE- TWEEN PINS	ACROSS THE CONTACT	STEADY- STATE	TRANSI- ENT	SURGE	10	11	12	13	14	15	16				
J102	RECEPTACLE OSM-215	SPECTRA	1	1	2A	1	-	200	.1	-	-	-	-	75	Teflon	-	-	-	-	-	-	-	1.0 A	-	.0015	
P1	RF COUPLING 50-024-5000		1	1	2A	1	-	400	.1	-	-	-	-	75	Teflon	-	-	-	-	-	-	-	1.0 A	-	.001	
P1	RF COUPLING 50-024-50300		1	1	2A	1	-	400	.1	-	-	-	-	75	Teflon	-	-	-	-	-	-	-	1.0 A	-	.001	
23	REQUIRED LIFE HOURS	24	FAILURE RATE SOURCES (FOR COLUMN 29)															25	CALCULATED MTBF _____ HOURS				26	TOTAL FAILURE RATE _____ %/1000 HOURS		
	A	MST. SM-188	B	C	D																					

TOTAL MODULE FAILURE RATE

.003510 7.1000 HRS

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## PARTS APPLICATION ANALYSIS

Page 2 of 2

## (MISC. PARTS)

PROJECT: ALSEP

ASSEMBLY: Redundant Command RevR

SUB ASSEMBLY: Housing Assy.

DATE: 20 July 1970

SCHEMATIC NO: 63-P11356B

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MIL-R) and CONSTRUCTION	MANUFACTURER	AMBIENT TEMPERATURE RANGE °C				ELECTRICAL STRESS	PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE CECLT				
			MAX RATED	MIN ACT.	RATED V	USE V				BASIC FAILURE RATE (%/1000 HOURS)	SPECIFIC ENVIRONMENT (DEFINITION)	FAILURE RATE (%/1000 HOURS)	TOTAL FAILURE RATE (%/1000 HOURS)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
FL1	25-P14433A407		125	75	100	105				7.2 A		.5	.0036	
FL2	25-P14433A407				100	5.5				7.0 A		.5	.0035	
FL3	25-P14433A407				100	10.5				7.2 A		.5	.0036	
FL4	25-P14433A407				100	0				7.0 A		.5	.0035	
FL5	25-P14433A407				100	5.5				7.0 A		.5	.0035	
FL6	25-P14433A407				100	5.0				7.0 A		.5	.0035	
FL7	25-P14433A407				100	5.0				7.0 A		.5	.0035	
FL8	25-P14433A407				100	11.5				7.3 A		.5	.00365	
FL9	25-P14433A407		↓	↓	100	11.5				7.3 A		.5	.00365	
15 FAILURE RATE SOURCES (FOR COLUMN 11)														
A. MOT. SP9-188					B.									
C.					D.									
16 CALCULATED MTBF HOURS														
17 TOTAL FAILURE RATE 3/1000 HOURS														

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## PARTS APPLICATION ANALYSIS

Page \_\_\_\_\_ of \_\_\_\_

(MISC. PARTS)

**PROJECT: ALSEP**

ASSEMBLY: REDUNDANT Command  
REVB

SUB ASSEMBLY: Housing Assy

DATE: 20 July 1970  
SCHEMATIC NO: 62-011256-R

(Misc. Parts)

TOTAL MODULE FAILURE RATE  
.039307. / 1000 HRS.

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## PARTS APPLICATION ANALYSIS

Page 1

## (CONNECTORS)

PROJECT: ALSEP

ASSEMBLY: Redundant Command Receiver SUB ASSEMBLY: INTER CONNECTION PLATE

DATE: 20 July 1970

SCHEMATIC NO: 63-P113563

(Connectors)

CIRCUIT, REV. DESIGNA- TION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	MANU- FACTURER	PINS												AMBI- ENT TEMP °C	INSERT MATERIAL	GUIDE	NO. OF INSET- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	CRIM- P F A I G L U O R E X /	SOU- RCE OF F.R.	F.R. MODIFI- ER	TOTAL FAILURE RATE (1/1000 Hours)									
			NUMBER		CURRENT			VOLTAGE																								
			TOTAL	ACTIVE	RATED	ACTUAL	MAX.	MIN.	RATED	ACROSS THE CONTACT	STEADY STATE	TRANSIENT	TO 6RD	SURGE																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24									
J1	WST0038M	HUGHES	38	34	3A	35	-	490	12	-	-	-	75	Glass filled diallyl	yes	-					1.0 A	-	.04080									
W-P1	50-024-5000		1	1	2A	14	-	400	1	-	-	-	75	TEFLON		-	-				1.0 A	-	.0010									
W-P2	50-024-5000		1	1	2A	2	-	400	.1	-	-	-	75	TEFLON		-					1.0 A	-	.0010									
W-P1	50-024-5000		1	1	2A	14	-	400	1	-	-	-	75	TEFLON		-					1.0 A	-	.0010									
W-P2	50-024-5000		1	1	2A	2	-	400	.1	-	-	-	75	TEFLON		-					1.0 A	-	.0010									
23	REQUIRED LIFE HOURS	24	FAILURE RATE SOURCES (FOR COLUMN 25)				25	CALCULATED MTBF _____ HOURS				26	TOTAL MODULE FAILURE RATE _____ 1/1000 HOURS											.04480								
		A	MOT. SM-188					B						C	D																	

See also

(BS-321A)

APPENDIX B

PART APPLICATION ANALYSIS  
SUMMARY

REVISION A

PARTS APPLICATION ANALYSIS  
SUMMARY

OBJECT: ALSEP  
 ASSEMBLY: REDUNDANT SUB ASSEMBLY: IF & AUDIO  
COMMAND RECEIVER

DATE: \_\_\_\_\_  
 SCHEMATIC NO: 63 -  
P11349B

DEVICE TYPE	TOTAL NO. USED	TOTAL FAILURE RATE	COMMENTS
CAPACITORS FILTERS	79 5	.071745 .01790	
RESISTORS	73	.002263	
DIODES	9	.002227	
TRANSISTORS INTEGRATED CKTS.	5 11	.003750 .008866	
RELAYS			
TRANSFORMERS	6	.033906	
CONNECTORS	1	.0010	
COILS & CHOKES	5	.012360	

TOTAL ASSEMBLY FAILURE RATE .154011 %/1000 HOURSMEAN-TIME-TO-FAILURE 649,304 HOURSMISSION SUCCESS PROBABILITY .9733

PARTS APPLICATION ANALYSIS  
SUMMARYPROJECT: ALSEP

DATE:

ASSEMBLY: REDUNDANT SUB ASSEMBLY: RF CONVERTER SCHEMATIC NO: 63 -  
COMMAND RECEIVER P11377B

DEVICE TYPE	TOTAL NO. USED	TOTAL FAILURE RATE	COMMENTS
CAPACITORS FILTER	40 1	.026540 .00370	
RESISTORS	33	.015320	
DIODES	4	.000860	
TRANSISTORS INTEGRATED CKTS	6 1	.002988 .000387	
RELAYS CRYSTAL	1	.00050	
TRANSFORMERS	3	.016950	
CONNECTORS	2	.0020	
COILS & CHOKES	19	.043200	

TOTAL ASSEMBLY FAILURE RATE .112445 %/1000 HOURSMEAN-TIME-TO-FAILURE 889,323 HOURSMISSION SUCCESS PROBABILITY .9805

**PARTS APPLICATION ANALYSIS**  
**SUMMARY**

PROJECT: ALSEPASSEMBLY: REDUNDANT SUB ASSEMBLY: RF COUPLER  
COMMAND RECEIVER

DATE:

SCHEMATIC NO: 63 -P11356B

DEVICE TYPE	TOTAL NO. USED	TOTAL FAILURE RATE	COMMENTS
CAPACITORS			
RESISTORS	1	.000010	
DIODES			
TRANSISTORS			
RELAYS			
TRANSFORMERS			
CONNECTORS	3	.00350	
COILS & CHOKES			

TOTAL ASSEMBLY FAILURE RATE .00351 %/1000 HOURSMEAN-TIME-TO-FAILURE 28,490,028 HOURSMISSION SUCCESS PROBABILITY .9994

**PARTS APPLICATION ANALYSIS  
SUMMARY**PROJECT: ALSEP

DATE:

ASSEMBLY: REDUNDANT SUB ASSEMBLY: AUDIO COMBINER SCHEMATIC NO: C3-  
COMMAND RECEIVER POWER ISOLATOR P11356B

DEVICE TYPE	TOTAL NO. USED	TOTAL FAILURE RATE	COMMENTS
CAPACITORS	8	.027160	
RESISTORS	27	.015260	
DIODES	3	.001074	
TRANSISTORS	10	.007902	
RELAYS			
TRANSFORMERS			
CONNECTORS			
COILS & CHOKES	2	.004120	

TOTAL ASSEMBLY FAILURE RATE .055516 %/1000 HOURSMEAN-TIME-TO-FAILURE 1,801,283 HOURSMISSION SUCCESS PROBABILITY .9903

PARTS APPLICATION ANALYSIS  
SUMMARY

PROJECT: ALSEP

DATE:

ASSEMBLY: REDUNDANT SUB ASSEMBLY: INTER CONNECTION  
COMMAND RECEIVERSCHEMATIC NO: 63 -P11356B

DEVICE TYPE	TOTAL NO. USED	TOTAL FAILURE RATE	COMMENTS
CAPACITORS			
RESISTORS			
DIODES			
TRANSISTORS			
RELAYS			
CABLES	4	.0040	
TRANSFORMERS			
CONNECTORS	1	.04080	
COILS & CHOKES			

TOTAL ASSEMBLY FAILURE RATE .04480 %/1000 HOURSMEAN-TIME-TO-FAILURE 2,232,143 HOURSMISSION SUCCESS PROBABILITY .9922

**PARTS APPLICATION ANALYSIS  
SUMMARY**

PROJECT: ALSEPASSEMBLY: REDUNDANT SUB ASSEMBLY: HOUSING  
COMMAND RECEIVER

DATE:

SCHEMATIC NO: 63-P1135C1B

DEVICE TYPE	TOTAL NO. USED	TOTAL FAILURE RATE	COMMENTS
CAPACITORS <u>FILTERS</u>	11	.03930	
RESISTORS			
DIODES			
TRANSISTORS			
RELAYS			
TRANSFORMERS			
CONNECTORS			
COILS & CHOKES			

TOTAL ASSEMBLY FAILURE RATE .03930 %/1000 HOURSMEAN-TIME-TO-FAILURE 2,544,529 HOURSMISSION SUCCESS PROBABILITY .9931

APPENDIX C

Motorola's Special Memorandum No. 188

APPENDIX C IN ON FILE WITH THE ORIGINAL  
MOTOROLA DOCUMENT 3875/040