



## CPLLEE Parts Application Analysis

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The purpose of this ATM report is to document a final Parts Application Analysis (PAA) for the flight model design of the Charged Particle Lunar Environment Experiment (CPLLEE) Subsystem.

It has been established by the results of the analysis that all electronic, electrical and electromechanical parts employed in CPLLEE have been designed to operate within the functional and environmental stress level limits prescribed for hi-rel application by Bendix document ATM 241B, Acceptable Parts List for ALSEP.

Part and assembly level failure rate data provided by this PAA study also serve as the basis for:

CPLLEE Flight Model Reliability Predictions, and

Criticality Ranking Factors Used in the CPLLEE Flight Model Failure Modes, Effects and Criticality Analyses (FMECA)

Prepared by:

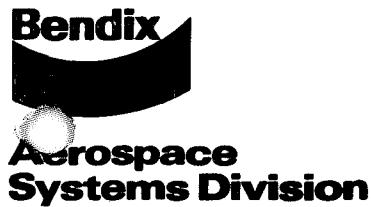
\_\_\_\_\_  
T. A. Simonds

Reviewed by:

\_\_\_\_\_  
J. Taylor  
CPLLEE Reliability P. E.

Approved by:

\_\_\_\_\_  
S. J. Ellison, Manager  
ALSEP Reliability Department



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### 1.0 Introduction

This report presents the results of the parts application analysis for the flight model CPLEE Experiment. This analysis represents an updating of previous parts application data prepared for prototype CPLEE hardware.

This analysis included the following:

- (1) Determination of part operational stress levels.
- (2) Determination of part operational temperatures.
- (3) Determination of part operational duty cycles.
- (4) Establishment of part operational failure rates on the basis of part type and information gained from items (1) thru (3) above.

### 2.0 References

1. BxA Specification AL-260000, Rev. A, Charged Particle Lunar Environment Experiment Specification (Incorporates SCN-1)
2. BxA Specification IC-314107, Rev. B, Interface Control Specification for Charged Particle Lunar Environment Experiment Subsystem for ALSEP (Incorporates SCN 1 thru 7)
3. BxA Reliability Engineering Manual, Revision A



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4. CPLLEE Engineering Drawings as listed:
  - a. BxRL Drawing No. 2166263, Rev. C - Logic Module Assembly
  - b. 2165365, Rev. G - Switchable Power Supply
  - c. 2165385, Rev. B - Low Voltage Power Supply
  - d. 2165390, Rev. G - Channeltron Power Supply No. 1
  - e. 2165395, Rev. G - Channeltron Power Supply No. 2
  - f. 2165355, Rev. D - Amplifier Module Assembly
  - g. 2167370, Rev. A - Vertical Analyzer
  - h. 2166260, Rev. E - 60° Analyzer
  - i. 2165405, Rev. C - Ancillary Module Assembly
  - j. 2166577, Rev. H - Electronic Package
  - k. 2165701, Rev. C - CPLLEE Experiment
5. BxRL letter CA-25515, CPLLEE Part Application Data (prototype design)
6. ATM-605, Failure Rate Data for ALSEP
7. MIL-HDBK-217A, Reliability Stress & Failure Rate Data For Electronic Equipment
8. ASD-R-05-64-1, Information for Reliability Prediction (General Electric)
9. HAMLIN Life Test Data on DRVT-1 Dry Reed Switches as submitted to Bendix Aerospace Systems Division on 15 September 1968.
10. ATM-241, Acceptable Parts List for ALSEP Rev. B



## CPL EE Parts Application Analysis

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### 3.0 CPL EE Configuration

The drawings listed in Reference 4 represent flight configuration for the purpose of this analysis. Later revisions have been mechanical in nature and do not affect the analysis.

### 4.0 Method of Analysis

#### 4.1 Part operational stress levels

A complete electrical stress analysis was performed on the CPL EE electronics. The results of this analysis was verified by ECAP (reference 5), in which an IBM 360 computer was utilized to determine electronic part operational DC and AC stress levels at 25°C.

#### 4.2 Part operational temperature

Component operational temperatures were extracted from BRLD Part Application Data (reference 5).

#### 4.3 Part operational Duty Cycles

Duty cycles were determined from the CPL EE Specifications (references 1 & 2) and may be summarized as follows:

TABLE 4-1 CPL EE Subassembly Operational Data Cycles

##### A. Logic Module Assembly

B101 - 50%

Remainder of Assembly - 100%

##### B. Switchable Power Supply

Switching Circuit - 50.0%

-3500V, -3500V Power Supplies - 12.5% (Includes associated secondary circuits)

350V, 35V Power Supplies - 25.0% (Includes associated secondary circuits)

Remainder of Assembly - 100.0%



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### C. Low Voltage Power Supply

Total - 50%

### D. Channeltron Power Supply No. 1

Total - 100%

### E. Channeltron Power Supply No. 2

Total - 100%

### F. Amplifier Module Assembly

Amplifier Submodules (A510-A521) - 50%

Remainder of Assembly - 100%

### G. Vertical Analyzer Assembly

Total - 50%

### H. 60° Analyzer Assembly

Total - 50%

### I. Ancillary Module Assembly

Temperature Control Circuit - Less than 1%

Dust Cover Removal Circuit - Less than 1%

Temperature Monitor Circuit - 100%

### J. Electronic Package (miscellaneous parts)

Heaters - 50%

Thermostats - 100%

### K. Structural/Mechanical Section

Dust Cover Assembly - 7.8%

Remainder of Section - 100%



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## CPLEE Parts Application Analysis

### 4.4 Part Operation Failure Rates

Failure rates were assigned utilizing the procedures and data contained in ATM 605 (reference 6) for resistors, capacitors, and semiconductors. Failure rates for other parts were assigned utilizing the data contained in references 7 thru 9.

### 5.0 Results

Tabulated PAA results are contained in Appendices A thru K of this ATM and may be summarized as follows:

#### ASSEMBLY FAILURE RATES

<u>Unit</u>	<u>Total Failure Rate</u>	<u>Appendix</u>
Logic Module Assembly	1.02431%/1000 hrs.	A
Switchable Power Supply	0.53119%/1000 hrs.	B
Low Voltage Power Supply	0.06332%/1000 hrs.	C
Channeltron Power Supply No. 1	0.15041%/1000 hrs.	D
Channeltron Power Supply No. 2	0.07366%/1000 hrs.	E
Amplifier Module Assembly	0.23561%/1000 hrs.	F
Vertical Analyzer Assembly	0.29706%/1000 hrs.	G
60° Analyzer Assembly	0.29706%/1000 hrs.	H
Ancillary Module Assembly	0.14912%/1000 hrs.	I
Electronic Package (misc. parts)	0.19500%/1000 hrs.	J
Mechanical Assembly *	1.10000%/1000 hrs.	K

\*NOTE: For reliability prediction, an "α" factor of 0.10 applies reducing this total failure rate to 0.11000 as compared with the other data so tabulated.



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HIGHEST ELECTRICAL STRESS LEVELS

<u>Unit</u>	<u>Part(s)</u>	<u>Stress Levels</u>	<u>Appendix</u>
Logic Module Assembly	R102 RT1&RT2	0.27 1.00**	A
Switchable Power Supply	C201	0.64	B
Low Voltage Power Supply	C309, C315-6, R307	0.64 0.39	C
Channeltron Power Supply #1	C1-C10(A401)	0.64	D
Channeltron Power Supply #2	C1-C10(A403)	0.64	E
Amplifier Module Assembly	C511	0.50	F
Vertical Analyzer	C601 Heater	0.75 0.86**	G
60° Analyzer	C601 Heater	0.75 0.86**	H
Ancillary Module	C706 RT207	0.58 1.00**	I
Electronic Package (misc. parts)	All parts	1.00**	J
Structural/Mechanical Section	Not applicable	---	K

\*\* These parts are designed to operate at the 100% stress level.

6.0 Conclusions

This PAA reflects that the derated parts stress levels of this experiment are good from the reliability standpoint, and that all parts are within the required operational stress levels of ATM 241 (reference 10).



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APPENDIX A

PARTS APPLICATION ANALYSIS DATA  
FOR  
LOGIC MODULE ASSEMBLY

# PARTS APPLICATION ANALYSIS

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## RESISTORS

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Logic Module Assembly

DATE: 7 October 1968  
SCHEMATIC NO: 2166263, Rev. C

(Resistors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (REF. OR MFR) DESIGNATION AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM POWER OPERATING (WATTS)	8 POWER RATIO OPERATING	9 MAXIMUM DUTY CYCLE	10 BULB AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE $\times 10^9$ HRS - 40 °C SOURCE (65 °C BELOW)	13 ENVIRONMENTAL CONDITIONS	14 SPECIAL (OPTIONS)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (8/1000 HRS)	17 TOTAL RESISTOR COUNT PER TYPE	18 TOTAL FAILURE RATE (8/1000 HRS)	
R101	RNR55C	--	20K	5	0.100	0.001	0.01	1.0	40	Register Readout(B106)	0.015	A	Lunar	1.0	0.015	1	0.015	
R102	"	"	332	"	"	0.027	0.27	"	"	"	0.016	"	"	"	0.016	1	0.016	
R103-R114	"	"	3K	"	"	0.003	0.03	"	40	Readout Sequencer (B109)	0.015	"	"	"	0.015	12	0.180	
R116	"	"	20K	"	0.100	0.001	0.01	"	"	Filter Network(B113)	0.015	"	"	"	0.015	1	0.015	
-	RC07, Type BB	Allen Bradley	5.1K	"	0.125	0.001	0.01	"	"	Register Readout(B106)	0.002	"	"	"	0.0021	0.002		
R118	RNR 55C	--	3K	"	0.100	0.003	0.03	"	"	Filter Network(B113)	0.015	"	"	"	0.015	1	0.015	
R119	RC07, Type BB	Allen Bradley	5.1K	"	0.125	0.005	0.04	"	"	"	0.002	"	"	"	0.0021	0.002		
R120	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
R121	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
R1	RC07, Type BB	Allen Bradley	5.1K	5	0.125	0.002	0.02	1.0	40	Demand Programmer (B107)	0.002	A	Lunar	1.0	0.002	1	0.002	
R2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
R1	RNR 55C	--	14K	5	0.100	0.002	0.02	1.0	40	Test Oscillator (B108)	0.015	A	Lunar	1.0	0.015	1	0.015	
R2	"	"	10K	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
R3	"	"	47	"	"	0.001	0.01	"	"	"	"	"	"	"	"	"	"	
R4	RC07, Type CB	Allen Bradley	1.5K	"	0.250	0.002	"	"	"	"	0.002	"	"	"	0.0021	0.002		
19	FAILURE RATE SOURCES (FOR COLUMN #14)								20									21
	A ATM 605	B _____								CALCULATED MTBF <u>330,000</u> HRS								TOTAL FAILURE RATE <u>0.300</u> %/1000 HRS
	C _____	D _____																

# PARTS APPLICATION ANALYSIS

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## CAPACITORS

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUBASSEMBLY: Logic Module Assembly

DATE: 7 October 1968  
SCHEMATIC NO: 2166263, Rev. C

1 CIRCUIT NUMBER	2 TYPE (MATERIAL AND CONSTRUCTION)	3 MANUFACTURER	4 CAPACITANCE VALUE mid	5 TOLERANCE	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 VOLTAGE RATIO RATED	9 MAXIMUM DUTY CYCLE	10 TEMPERATURE SWING AIR (°C)	11 CIRCUIT FUNCTION OR APPLICATION	12 13 14 15 16 17 18 19	13 BASIC FAILURE RATE (1/1000 HRS) - 100°C - 30°C - 50°C - 70°C - 85°C - 100°C - 120°C - 140°C - 160°C - 180°C - 200°C - 220°C - 240°C - 260°C - 280°C - 300°C - 320°C - 340°C - 360°C - 380°C - 400°C - 420°C - 440°C - 460°C - 480°C - 500°C - 520°C - 540°C - 560°C - 580°C - 600°C - 620°C - 640°C - 660°C - 680°C - 700°C - 720°C - 740°C - 760°C - 780°C - 800°C - 820°C - 840°C - 860°C - 880°C - 900°C - 920°C - 940°C - 960°C - 980°C - 1000°C	14 SPECIFIC (DETERIORATION) ENVIRONMENT	15 FAILURE MULTIPLIER	16 FINAL FAILURE RATE	17 TOTAL CAPACITOR COUNT	18 TOTAL FAILURE RATE (#1000 HRS)	19 Failure Rate (#1000 HRS)	
C101	CKR06C	Aerovox	0.033	10	100	3	0.03	1.0	40	Readout Sequencer (B109)	.00041A	Lunar	1.0	0.0004	2	0.0008			
C102			"	"	"	6	"	"	"	Logic Module Assembly	"	"	"	"	"	"	1	0.0004	
C103	CKR05C		"	0.001	"	200	6	"	"	Demand Programmer(B107)	"	"	"	"	"	"	"	"	
C104	"	"	"	"	"	2	"	"	"	Resistor Readout (B106)	"	"	"	"	"	"	"	"	
C105	"	"	"	"	"	3	"	"	"	Sequencer Cmd. Dcdr. (B110)	"	"	"	"	"	"	"	"	
C106	CKR06C		"	0.002	"	100	3	"	"	Demand Programmer (B107)	"	"	"	"	"	"	"	"	
C107	CKR05C		"	0.001	"	200	2	"	"	Sequence Cmd. Dcdr. (B110)	"	"	"	"	"	"	"	"	
C108	CKR06C		"	0.002	"	100	3	"	"	"	"	"	"	"	"	"	"	"	
C109	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C110										Readout Sequencer(B109)	"	"	"	"	"	"	"	"	
C113	"	"	0.033	"	"	"	"	"	"	Filter Network (B113)	.00321"	"	"	"	"	"	"	4	0.0016
C114	CSR13B	Kemet	6.8	"	6	"	0.50	"	"	"	"	"	"	"	"	"	"	"	
C115	CKR06C	Aerovox	0.022	"	100	"	0.03	"	"	"	"	"	"	"	"	"	"	"	
C117	CSR13G	Kemet	1.0	"	50	"	0.06	"	"	"	"	"	"	"	"	"	"	"	
C118	"	"	0.068	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C119	"	"	1.0	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C120	CSR13B		"	180	"	6	"	0.50	"	Demand Programmer (B111)	"	"	"	"	"	"	"	"	
C121	CKR06C	Aerovox	0.033	"	100	"	0.03	"	"	Test Oscillator (B108)	"	"	"	"	"	"	"	"	
C1, C2	"	"	0.039	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C1, C2	CKR05C		"	150pf	"	200	4	"	"	Programmer (B111)	"	"	"	"	"	"	"	"	
C3	CKR06C		"	2200pf	"	"	"	"	"	Test Oscillator (B108)	"	"	"	"	"	"	"	"	
20	FAILURE RATE SOURCES (FOR COLUMN #14)											21	CALCULATED MTBF 6,290,000 HRS						
A ATM605	B	C	D																22
																			TOTAL FAILURE RATE 0.0159 #1000 HRS

## PARTS APPLICATION ANALYSIS

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PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

**DATE:** 7 October 1968  
**SCHEMATIC NO:** 2166263, Rev. C

(Semiconductors)

## PARTS APPLICATION ANALYSIS

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(SEMICONDUCTORS) - All Flatpacks

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

**DATE:** 7 October 1968  
**SCHEMATIC NO:** 2166263, Rev.

## (Semiconductors)

## PARTS APPLICATION ANALYSIS

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**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

**DATE:** 7 October 1968  
**SCHEMATIC NO:** 2166263, Rev. C

## PARTS APPLICATION ANALYSIS

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**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

**DATE:** 7 October 1968  
**SCHEMATIC NO:** 2166263, Rev.

(Semiconductors)

## PARTS APPLICATION ANALYSIS

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**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

DATE: 7 October 1968

SCHEMATIC NO: 2166263, Rev. C

(Semiconductors)

## PARTS APPLICATION ANALYSIS

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**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

**DATE:** 7 October 1968  
**SCHEMATIC NO:** 2166263. Rev.

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**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

DATE: 7 October 1968  
SCHEMATIC NO: 2166263, Rev. C

(Semiconductors)

## PARTS APPLICATION ANALYSIS

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**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

**DATE:** 7 October 1968  
**SCHEMATIC NO:** 2166263 E

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(SEMICONDUCTORS) - All Flatpacks

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Logic Module Assembly

DATE: 7 October 1968  
SCHEMATIC NO:2166263, Rev. C

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU FAC TUR ER	ACT UAL	ACT UAL	JUNC TION	ACT UAL	CASE	MAX. TEMP °C			AVG PWR DISSIPATION (mw)			POWER RATIO		MAXIMUM VOLTAGES			DIODE PIV		FOR RELIABILITY USE ONLY							
											RATED AT			25°C		ACTUAL		ACTUAL		V <sub>CBO</sub>	V <sub>CB</sub>	V <sub>CBO</sub>	V <sub>CE</sub>	RATE (%/ 1000 HRS)	S O C E	F U R C E	F A L T I P A T E R	T O U N L T A N L T
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		
-	SNR 511	Texas Instr.	40	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	B109	Lunar	002	A	1	0.0012	1	0.0012	
-	SNR 514	"	"	"	"	2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	6	0.0072
-	SNR 516	"	"	"	"	5	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	3	0.0036
-	SNR 1730	"	"	"	"	15	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	0.0012
-	SNR 1731	"	"	"	"	2.5	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	1	0.0012
-	SNR 5101	"	"	"	"	3	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	7	0.0084
<sup>28</sup> FAILURE RATE SOURCE (See Column 23)								<sup>29</sup> NOTE: It is assumed the transient and peak power does not exceed the safe limit.								<sup>30</sup> TOTAL FAILURE RATE <u>0.0228</u> %/1000 HRS.												
<sup>A</sup> ATM 605				<sup>C</sup> _____				<sup>B</sup> _____				<sup>D</sup> _____																

PCB#A

BS-321A

## PARTS APPLICATION ANALYSIS

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PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

DATE: 7 October 1968  
SCHEMATIC NO: 2166263, Rev. C

## PARTS APPLICATION ANALYSIS

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**PROJECT: ALSEE**

## ASSEMBLY: CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

DATE: 7 October 1968

SCHEMATIC NO: 2166263, Rev. C

## (Semiconductors)

## PARTS APPLICATION ANALYSIS (CONNECTORS)

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PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

## **SUB ASSEMBLY: Logic Module Assembly**

**DATE:** 7 October 1968  
**SCHEMATIC NO:** 2166263, Rev. C

### (Connectors)

## PARTS APPLICATION ANALYSIS

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**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Logic Module Assembly

**DATE:** 7 October 1968  
**SCHEMATIC NO:** 2166263, Rev. C

(Misc. Parts)



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**APPENDIX B**

**PARTS APPLICATION ANALYSIS DATA  
FOR  
SWITCHABLE POWER SUPPLY**

# PARTS APPLICATION ANALYSIS

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## RESISTORS

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUB ASSEMBLY:** Switchable Power Supply

**DATE:** 4 October 1968  
**SCHEMATIC NO:** 2165365, Rev. G

(Resistors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (BALL or MFR) DESIGNATION AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM OPERATING POWER (WATTS)	8 POWER RATIO/ OPERATING RATED	9 MAXIMUM DUTY CYCLE	10 BULK/JA TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATES (%/1000 HRS) - 4 SOURCE - 1 SOURCE (SEE BELOW)	13 SPECIAL ENVIRONMENT'S (DEFINE)	14 FAILURE RATE MULTIPLIER	15 FINAL FAILURE RATES (%/1000 HRS)	16 TOTAL RESISTOR COUNT PER TYPE	17 TOTAL FAILURE RATES (%/1000 HRS)	
R201	RC07, Type CB	Allen Bradley	1.8K	5	0.25	2.5 mw	0.01	0.50	40	Switching Circuit	.002	A	Lunar	1.0	.002	1	0.002
R202	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R203	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R204	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R205	"	"	"	"	"	30 mw	0.12	"	"	"	"	"	"	"	"	"	"
R206	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R207	"	"	27K	"	"	25 mw	0.10	1.00	"	"	"	"	"	"	"	"	"
R208	"	"	"	"	"	2.5 mw	0.01	.125	"	+3500 v	"	"	"	"	"	"	"
R209	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R210	"	"	160K 300K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R211	"	"	2.2K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R212	"	"	100K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R213	"	"	220K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R214	"	"	27K	"	"	"	"	"	"	-3600 v	"	"	"	"	"	"	"
R215	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R216	"	"	160K 300K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R217	"	"	2.2K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R218	"	"	100K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
<b>19</b> <b>FAILURE RATE SOURCES (FOR COLUMN #14)</b> A ATM 605      B _____ C _____      D _____										<b>20</b> <b>CALCULATED MTBF _____ HRS</b> See Page 2				<b>21</b> <b>TOTAL FAILURE RATE _____ %/1000 HRS</b> See Page 2			

FORM 9501  
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# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix B

## RESISTORS

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968  
SCHEMATIC NO: 2165365, Rev. G

(Resistors)

1 CIRCUIT SYMBOL NUMBER	2 TYPICAL DESIGNATION AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 OPERATING POWER (WATTS)	8 POWER RATIO/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (%/100 HRS) - 27°C (50°F) BELOW		13 SPECIAL (DEFINITE)	14 FAILURE RATE MULTIPLIER	15 FINAL FAILURE RATE (%/100 HRS)	16 TOTAL FAILURE COUNT PER TIME	17 TOTAL FAILURE RATE (%/100 HRS)	
											12 - 27°C (50°F) BELOW	13 SPECIAL (DEFINITE)						
R219	RC07, Type CB	Allen Bradley	220K	5 . 250	2.5 mw	0.01	125	40	-3500 v Circuit	.002	A	Lunar	1.0	.002	1	0.002		
R220	"	"	27K	"	"	"	0.25	"	350 v	"	"	"	"	"	"	"		
R221	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
R222	"	"	300K 620K	"	"	"	"	"	"	"	"	"	"	"	"	"		
R223	"	"	4.7K	"	"	"	"	"	"	"	"	"	"	"	"	"		
R224	"	"	100K	"	"	"	"	"	"	"	"	"	"	"	"	"		
R225	"	"	220K	"	"	"	"	"	"	"	"	"	"	"	"	"		
R226	"	"	27K	"	"	"	"	"	35 v	"	"	"	"	"	"	"		
R227	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
R228	"	"	300K 620K	"	"	"	"	"	"	"	"	"	"	"	"	"		
R229	"	"	2.7K	"	"	"	"	"	"	"	"	"	"	"	"	"		
R230	"	"	100K	"	"	"	"	"	"	"	"	"	"	"	"	"		
R231	"	"	220K	"	"	"	"	"	"	"	"	"	"	"	"	"		
R232	"	"	47K	"	"	"	1.00	"	Housekeeping	"	"	"	"	"	"	"		
R233	RC07, Type BB	"	20M	" . 125	1.2 mw	" 0.50	"	Secondary	"	"	"	"	"	"	5	0.010		
R234	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
19 FAILURE RATE SOURCES (FOR COLUMN #14)												20 CALCULATED MTBF <u>1,190,000</u> HRS		21 TOTAL FAILURE RATE <u>0.084</u> %/1000 HRS				
A <u>ATM 605</u> B _____												CALCULATED MTBF <u>1,190,000</u> HRS		TOTAL FAILURE RATE <u>0.084</u> %/1000 HRS				
C _____ D _____																		

FORM 6051

BS-321A

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix B

## RESISTORS

PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968  
SCHEMATIC NO: 2165365, Rev. G

1 CIRCUIT STABOL NUMBER	2 TYPE (MIL or MFR) AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 OPERATING POWER (WATTS)	8 POWER RATIO/ OPERATING RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION APPLICATION	12 BASIC FAILURE RATE (%/1000 HRS) - AT 85°C (SEE BELOW)	13 TIME OF EXPOSURE TO LARGE AMPLITUDE ENVIRONMENT	14 SPECIAL ENVIRONMENTAL (OPTIONAL)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (%/1000 HRS)	17 TOTAL FAILURE COUNT PER TPS	18 TOTAL FAILURE RATE (%/1000 HRS)
R1	RC07, Type CB	Allen Bradley	2.4 14	5	0.25	2.5 mw	0.01	0.50	40	Submodule A203	.0021	A	Lunar	1.0	.002	1	0.002
R2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R3	Wirewound, HVBW	Victoreen	100 21	"	3.00	0.03	"	1.00	"	"	"	"	"	"	"	"	"
R4	RC07, Type CB	Allen Bradley	1.2 14	"	0.25	2.5 mw	"	0.50	"	"	"	"	"	"	"	"	"
R6	"	"	2.4 21	"	"	"	"	1.00	"	"	"	"	"	"	"	"	"
R7	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R8	"	"	22 21	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R9	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
19	FAILURE RATE SOURCES (FOR COLUMN #14)								20	CALCULATED MTBF <u>5,560,000</u> HRS							
	A <u>ATM 605</u>	B _____	C _____	D _____													
	21	TOTAL FAILURE RATE <u>0.018</u> %/1000 HRS															

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BS-321A

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix B

## CAPACITORS

PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

SUBASSEMBLY: Switchable Power Supply

DATE: 4 October 1968

SCHEMATIC NO: 2165365, Rev. G

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE DESIGNATION (MIL or MFR) CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE END	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 VOLTAGE RATING OPERATING RATIO <sup>a</sup>	9 RATED DUTY CYCLE	10 MAXIMUM BULK AIR TEMPERATURE (°C)	11 CIRCUIT FUNCTION OR APPLICATION	12 13 14 15 16 17 18 19	13 14 15 16 17 18 19	13 14 15 16 17 18 19				
											DC PEAK PEAK	PEAK VOLTAGE	OPERATING RATIO	RATED DUTY CYCLE	BASIC FAIL. RATE X 10 <sup>6</sup> /HR AT 100°C SUS. BLD.	EXTRAPOL. FAIL. RATE MULTIPLIER	FINAL FAIL. RATE
C201	CSR13	Kemet	18	10	50	32	- 0.64	1.00	40	Switching Circuit	.004	A	Lunar	1.0	.004	1	0.004
C202	"	"	"	"	"	5.4	" 0.27	0.50	"	"	.001	"	"	"	.001	"	0.001
C203	"	"	"	"	"	"	" 0.27	"	"	"	"	"	"	"	"	"	"
C204	"	"	"	"	"	4	" 0.08	.125	"	+3500 v	".0005	"	"	"	.0005	"	0.0005
C205	CKR06	Aerovox	.047	"	100	1	" 0.07	"	"	"	.0004	"	"	"	.0004	"	0.0004
C206	"	"	.01	"	"	7	" 0.07	"	"	"	"	"	"	"	"	"	"
C207	CSR13	Kemet	1	"	50	3.5	" 0.07	"	"	-3500 v	".005	"	"	"	.005	"	0.005
C208	CKR06	Aerovox	.047	"	100	1	" 0.01	"	"	"	.0004	"	"	"	.0004	"	0.0004
C209	"	"	.01	"	"	7	" 0.07	"	"	"	"	"	"	"	"	"	"
C210	CSR13	Kemet	.1	"	75	7.5	" 0.10	0.25	"	350 v	".005	"	"	"	.005	"	0.005
C211	CKR06	Aerovox	.047	"	100	2	" 0.02	"	"	"	.0004	"	"	"	.0004	"	0.0004
C212	"	"	.0022	"	200	6	" 0.03	"	"	"	"	"	"	"	"	"	"
C213	CSR13	Kemet	.1	"	75	3.75	" 0.05	"	"	35 v	".005	"	"	"	.005	"	0.005
C214	CKR06	Aerovox	.047	"	100	1	" 0.01	"	"	"	.0004	"	"	"	.0004	"	0.0004
C215	CKR05	"	.001	"	"	8	" 0.08	1.00	"	"	"	"	"	"	"	"	"
C216	CSR13	Kemet	2.7	"	15	5	" 0.33	0.50	"	Housekeeping	".001	"	"	"	.001	"	0.001
C217	"	"	1	"	50	3.5	" 0.07	.125	"	+3500 v	".005	"	"	"	.005	"	0.005
C218	"	"	1	"	"	"	"	"	"	-3500 v	".005	"	"	"	"	"	"
C219	Ceramic, TCDN 220	Aerovox	56 pf	"	500	10	" 0.02	"	"	Secondary	".0004	"	"	"	.0004	"	0.0004
20	FAILURE RATE SOURCES (FOR COLUMN #14)								21	CALCULATED MTBF _____ HRS				TOTAL FAILURE RATE _____ X 1000 HRS			
	A	ATM 605	B														
	C		D														

BS-321A

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix B

## CAPACITORS

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUBASSEMBLY: Switchable Power Supply

DATE: 4 October 1968  
SCHEMATIC NO: 2165365, Rev. G

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (MU OR $\mu$ PF) DESIGNATION CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE mfd	5 TOLERANCE	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 VOLTAGE RATIO/ RATING	9 MAXIMUM DUTY CYCLE	10 MAXIMUM BULK AIR TEMPERATURE (°C)	11 CIRCUIT FUNCTION OR APPLICATION	12 13 14 15 16 17 18 19	BASIC FAILURE RATE (51000 HRS) AT 20°C (50% LOAD)	14 SOURCE (50% BELOW SPECIFIED ENVIRONMENT)	15 FAILURE MULTIPLIER	16 FINAL FAILURE RATE	17 TOTAL CAPACITOR COUNT PER TTSP	18 TOTAL FAILURE RATE (51000 HRS)	
C220	Ceramic, TCDN 220	Aerovox	56 pf	10	500	90	-	0.18	0.25	40	Secondary Circuit	.0004	A	Lunar, 1.0	0.0004	1	0.0004	
C221	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C222	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C223	"	"	"	"	"	"	10	0.02	"	"	"	"	"	"	"	"	"	
C224	"	"	"	"	"	"	90	0.18	"	"	"	"	"	"	"	"	"	
C225	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C226	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C1	Ceramic, HVD-6	Aerovox	56 pf	10	6KV	420	3KV	0.07	0.50	40	Submodule A201	.0004	A	Lunar, 1.0	0.0004	1	0.0004	
C2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C1	Ceramic, HVD-6	Aerovox	50 pf	10	6KV	420	3KV	0.07	0.50	40	Submodule A202	.0004	A	Lunar, 1.0	0.0004	1	0.004	
C2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C1	Ceramic, HVD-4	Aerovox	25 pf	10	6KV	540	3KV	0.09	0.50	40	Submodule A203	.0004	A	Lunar, 1.0	0.0004	1	0.0004	
C2	"	"	"	"	"	"	1020	0.17	"	"	"	"	"	"	"	"	"	
C3	"	"	"	"	"	"	540	0.09	1.00	"	"	"	"	"	"	"	"	
20	FAILURE RATE SOURCES (FOR COLUMN #14)										21	CALCULATED MTBF <u>2,400,000 HRS</u>				TOTAL FAILURE RATE <u>0.0417</u> $\times$ 1000 HRS		
	A <u>ATM 605</u>	B _____	C _____	D _____														

PARTS APPLICATION ANALYSIS

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ATM-798, Appendix B

(SEMICONDUCTORS)

PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968  
SCHEMATIC NO: 2165365, Rev. G

(Semiconductors)

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 APPLICATION (Define)	FOR RELIABILITY USE ONLY											
					RATED AT			25°C		ACTUAL 25°C (Amb or case in)		ACTUAL RATED T <sub>A</sub> or T <sub>C</sub>		V <sub>CBO</sub>	V <sub>CB</sub>	V <sub>CEO</sub>	V <sub>CE</sub>	RATE D	RATE D	RATE D	RATE D	SPECI AL ENVIRON MENT (See below)	F R A L R ATE TYPE	M U L T I P L I T A L R ATE TYPE	T O T A L R ATE TYPE	C O U N T	TOTAL FAILURE RATE (%/1000 HRS)
			TA	T <sub>J</sub>	T <sub>C</sub>	AMBIENT	CASE	TA	T <sub>C</sub>	AC TUE AL	AC TUE AL	ACT UAL	ACT UAL	ACT UAL	ACT UAL	ACT UAL	ACT UAL	ACT UAL	ACT UAL	ACT UAL	ACT UAL	ACT UAL	ACT UAL	ACT UAL			
Q201	2N760A, NPN	Raytheon	40	200	-	500	1.8w	"	"	5	0.01	-	60	5	60	2	-	-	Switching Circuit	Lunar	.001	A	1.0	.001	1	.001	
Q202	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	2	"	"	"	"	"	"	"	"	"	"	
Q203	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	2	"	"	"	-3500V Circuit	"	"	"	"	"	"	"
Q204	2N3799, PNP	Motorola	"	"	"	360	1.2w	"	"	3.6	"	"	"	"	"	"	2	"	"	"	"	"	".006	"	".006	"	.006
Q205	2N2484, NPN	Fairchild	"	"	"	360	1.2w	"	"	2.9	0.08	"	"	"	"	"	2	"	"	"	"	"	".001	"	".001	"	.001
Q206	2N30574, NPN	"	"	"	"	400	5.0w	"	"	4	0.01	"	140	7	80	23	"	"	"	"	"	"	"	"	"	"	"
Q207	2N760A, NPN	Raytheon	"	"	"	500	1.8w	"	"	5	"	"	60	5	60	2	"	"	+3500V Circuit	"	"	"	"	"	"	"	"
Q208	2N3799A, PNP	Motorola	"	"	"	360	1.2w	"	"	3.6	"	"	"	"	"	"	2	"	"	"	"	"	".006	"	".006	"	.006
Q209	2N2484, NPN	Fairchild	"	"	"	360	1.2w	"	"	29	0.08	"	"	"	"	"	2	"	"	"	"	"	".001	"	".001	"	.001
<sup>28</sup> FAILURE RATE SOURCE (See Column 23)						<sup>29</sup> NOTE: It is assumed the transient and peak power does not exceed the safe limit.						<sup>30</sup> TOTAL FAILURE RATE _____ %/1000 HRS.															
A ATM 605						C _____						D _____															

9249A

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# PARTS APPLICATION ANALYSIS

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## (SEMICONDUCTORS)

ATM-798, Appendix B

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Switchable Power Supply

**DATE:** 4 October 1968  
**SCHEMATIC NO:** 2165365, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E R E S T R	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		FOR RELIABILITY USE ONLY								
			A M B I C T U R E R E S T R	A C T U R E R E S T R	J U N C A C T U R E R E S T R	RATED AT			A M B I C T U R E R E S T R	A M B I C T U R E R E S T R	A M B I C T U R E R E S T R	A M B I C T U R E R E S T R	ACTUAL 25°C RATED TA or TC (Ambient case) 12	ACTUAL 25°C RATED TA or TC 13	ACTUAL 25°C RATED TA or TC 14	V <sub>CBO</sub> R A C T E D	V <sub>CB</sub> A C T E D	V <sub>CBO</sub> R A C T E D	V <sub>CE</sub> R A C T E D	R A C T E D	A C T U R E R E S T R	S O U R C E (See below)	F M I A L T I P R A L E R (See below)	T C O U N T A L T I P R A L E R (See below)	TOTAL FAILURE RATE (%/1000 HRS)		
Q210	2N3057A, NPN	Fairchild	40	200	-	400	5.0w	-	-	4	0.01	-	140	7	80	23	-	-	+3500V Circuit	Lunar	0.001	A	1.0	.001	1	.001	
Q211	2N760A, NPN	Raytheon	"	"	"	500	1.8w	"	"	5	"	"	60	5	60	2	"	"	350V Circuit	"	"	"	"	"	"	"	"
Q212	2N3799, PNP	Motorola	"	"	"	360	1.2w	"	"	3.6	"	"	"	"	"	"	"	"	"	"	"	"	"	.006	"	".006	".006
Q213	2N2484, NPN	Fairchild	"	"	"	360	1.2w	"	"	57.6	0.16	"	"	"	"	"	"	"	"	"	"	"	".002	"	".002	".002	
Q214	2N3057A, NPN	"	"	"	"	400	5.0w	"	"	4	0.01	"	140	7	80	23	"	"	"	"	"	"	"	.001	"	".001	".001
Q215	2N760A, NPN	Raytheon	"	"	"	500	1.8w	"	"	5	"	"	60	5	60	2	"	"	35V Circuit	"	"	"	"	"	"	"	"
Q216	2N3799, PNP	Motorola	"	"	"	360	1.2w	"	"	3.6	"	"	"	"	"	"	"	"	"	"	"	"	".006	"	".006	".006	
Q217	2N2484, NPN	Fairchild	"	"	"	360	1.2w	"	"	57.6	0.16	"	"	"	"	"	"	"	"	"	"	"	".002	"	".002	".002	
Q218	2N3057A, NPN	"	"	"	"	400	5.0w	"	"	4	0.01	"	140	7	80	23	"	"	"	"	"	"	"	.001	"	".001	".001
<sup>28</sup> FAILURE RATE SOURCE (See Column 23)			A ATM 605			C			NOTE: It is assumed the transient and peak power does not exceed the safe limit.			D						<sup>29</sup> TOTAL FAILURE RATE 0.040 %/1000 HRS.			<sup>30</sup>						

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# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix B

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968  
SCHEMATIC NO: 2165365, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU FAC TUR E ACT URE NT R	MAX. TEMP °C			AVG PWR DISSIPATION (mw)			POWER RATIO			MAXIMUM VOLTAGES			DIODE PIV			CIRCUIT FUNCTION or APPLICATION (Define)	FOR RELIABILITY USE ONLY										
			A M B I C T U E N T R	A C T U E N T R	J U N U S E	RATED AT			25°C			ACTUAL RATED 25°C			ACTUAL RATED TA or TC			V <sub>CBO</sub> R A C T U E D			V <sub>CB</sub> A C T U E D			V <sub>CEO</sub> R A C T U E D					
						HOT SPOT T <sub>A</sub>			T <sub>J</sub>			T <sub>C</sub>			T <sub>A</sub>			V <sub>CB</sub>			V <sub>CEO</sub>			V <sub>CE</sub>					
						T <sub>A</sub>	T <sub>J</sub>	T <sub>C</sub>	T <sub>A</sub>	T <sub>J</sub>	T <sub>C</sub>	T <sub>A</sub>	T <sub>J</sub>	T <sub>C</sub>	V <sub>CB</sub>	V <sub>CB</sub>	V <sub>CB</sub>	V <sub>CEO</sub>	V <sub>CEO</sub>	V <sub>CEO</sub>	V <sub>CE</sub>	V <sub>CE</sub>	V <sub>CE</sub>	V <sub>CE</sub>					
CR 201	Reference MC7103	MICRO S/C	40	200	-	250	-	-	-	-	-	2.5	0.01	-	-	-	-	-	1KV	10V	House- keeping Circuit	Lunar	0.001	A	1.0	0.001	1	0.001	
CR 202	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 203	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 204	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 205	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 206	"	"	"	"	"	"	"	"	"	"	"	80	0.32	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 207	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 208	"	"	"	"	"	"	"	"	"	"	"	2.5	0.01	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 209	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
<sup>28</sup> FAILURE RATE SOURCE (See Column 23)						<sup>29</sup> NOTE: It is assumed the transient and peak power does not exceed the safe limit.						<sup>30</sup> TOTAL FAILURE RATE _____ %/1000 HRS.																	
P249A						BS-321A																							

## PARTS APPLICATION ANALYSIS (SEMICONDUCTORS)

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ATM-798, Appendix B

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUB ASSEMBLY:** Switchable Power Supply

**DATE:** 4 October 1968  
**SCHEMATIC NO:** 2165365, Rev. G

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix B

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968  
SCHEMATIC NO: 2165365, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	M A N U F A C T U R E S R	A M B I C T U R E S R	A C T U R E S T A N T	J U N C T U A N T	C C A C T U A N T	C C A C T U A N T	A G T U A L	AVG PWR DISSIPATION (mw)			POWER RATIO		MAXIMUM VOLTAGES				DIODE PIN		CIRCUIT FUNCTION or APPLI- CATION (Define)	PART SPECIAL ENVIRON- MENT (See below)	FOR RELIABILITY USE ONLY											
									RATED AT			25°C		ACTUAL RATED 25°C		ACTUAL RATED TA or TC		V <sub>CBO</sub>	V <sub>CB</sub>	V <sub>CEO</sub>	V <sub>CE</sub>	R A T E D	A C T U A L	R A T E D	A C T U A L	S O R C E	F U R C T	M I L I P A L	F N I L R A L	T O U T R A L	C O O L T U N A L	T C O O L T U N A L	TOTAL FAILURE RATE (%/1000 HRS)
									1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21				
CR1	Reference MC7101	Micro S/C	40	200	-	250	-	-	-	7.5	.03	-	-	-	-	-	-	6KV	3.5 KV	A201 Sub-Module	Lunar	001	A	1.0	001	1	0.001						
CR2	"	"	"	"	"	"	"	"	"	2.5	.01	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
CR3	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
CR1	Reference MC7101	Micro S/C	40	200	-	250	-	-	-	7.5	.03	-	-	-	-	-	-	6KV	3.5 KV	A202 Sub-Module	Lunar	001	A	1.0	001	1	0.001						
CR2	"	"	"	"	"	"	"	"	"	2.5	.01	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
CR3	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"				
<sup>28</sup> FAILURE RATE SOURCE (See Column 23)										<sup>29</sup> NOTE: It is assumed the transient and peak power does not exceed the safe limit.										<sup>30</sup> TOTAL FAILURE RATE <u>0.006</u> %/1000 HRS.													
A ATM 605										B D																							

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## PARTS APPLICATION ANALYSIS

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### (INDUCTORS & TRANSFORMERS)

ATM-798, Appendix B

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUB ASSEMBLY:** Switchable Power Supply

**DATE:** 4 October 1968  
**SCHEMATIC NO:** 2165365 Rev. G

1 (Inductors & Transformers)	2 CIRCUIT SYMBOL	3 MANUFACTURER	4 TYPE OF CASE (MIL or AFR)	5 CONSTRUCTION	6 WIRE SIZE PRIMARY	7 WIRE SIZE SECONDARY	8 INSULATION CLASS	9 VA RATING	10 PROXIMITY CUR. SPECIFIED PREO	11 MISCELLANEOUS	12 OPERATING AMBIENT (NOT SPOT SURFACES)	13 TEST (OR METHOD)	14 RATED TEMP.	15 RATED TEMP. MAX.	16 OPERATING MAX. ACTUAL	17 RATED CURRENT	18 PRIMARY VOLTAGE	19 SECONDARY NO. WINDINGS	20 VOLTS	21 WINDINGS	22 HYPOT READING	23 VOLTS	24 WINDINGS	25 BASIC FAILURE RATE - A 1000 HRS	26 SOURCE ISE BELOW	27 TOTAL FAILURE RATE (1/1000 HRS)	REL. DEPT USE ONLY			
T201	Power, 2165929	BxRL	C	47	47	C	0.8 mva	-	- - -	40	-	-	15	55	2.65.0 ma ma	60	8756-7	35	-	-	.017	B	0.017							
T202	" , 2165925	"	"	"	"	"	" 4 mva	"	" " "	"	"	"	"	"	1.53.4 ma ma	"	"	350	"	" "	"	B	"							
T1	Power, 2166537	BxRL	C	44	47	C	30.0	-	- - -	40	-	-	15	55	5.03 ma ma	60	8K6-7	350	-	-	.017	B	0.017							
T2	" , "	"	"	"	"	"	30.0	"	" " "	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	.017	B	0.017	
L201	Power, 2165926	BxRL	C	38	-	-	0.06	"	" " "	"	"	"	"	"	10.60 ma ma	27	-	-	-	-	.017	B	0.017							
28	TYPE OF CASE	29	FAILURE RATE SOURCES (FOR COLUMN #28)				30	CALCULATED MTBF				31	TOTAL FAILURE RATE				1,180,000 HRS				0.085 1/1000 HRS									
A. HER. SEAL	A. ATM 605	B. VAC. IMP.	B. MIL-HDBK-217A	C. ENCAP.	C. _____	D. OPEN	D. _____																							

END FORM 9248

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# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix B

## (RELAYS)

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968  
SCHEMATIC NO: 2165365, Rev. G

(Relays)

CIRCUIT REFER- ENCE DESIG- NATION	TYPE DESIGNATION (CEC, MIL OR MPR)  AND CONSTRUCTION	MANUFACTURER	CONTACT LOAD						NUMBER OF POLES	RELAY COIL						B A I L U R F C U C R E R M O D I F I E R	F. R.	TOTAL FAILURE RATE (%/1000 HOURS)				
			RATED		ACTUAL					TYPE OF LOAD	T O T A L A L V E	A C T U L E D	MAX. P O P E R.	MAX. P O P E R.	MIN. P O P E R.	RATE OF OPERA- TIONS PER HOUR OR SECOND	REQ'D LIFE OPERA- TIONS	MISCELLA- NEOUS REMARKS				
			V O L T A G E	C U R R E N T	STADY STATE	PEAK STATE	STADY STATE	SURGE														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
K1	Reed Relay (DRV-T-1)	Hamlin	5KV	10ma	-	3KV	0.1 ma	-	Resistance	1	1	-	-	-	-	275 / hr.	2,409	Xo = 2116,000 cycles	058	D	1.0	0.058
K2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	0.058
24	DEVICE AVERAGE AMBIENT TEMPERATURE °C	40	FAILURE RATE SOURCES (FOR COLUMN NO. 21)						CALCULATED MTBF <u>862,000</u> HOURS						TOTAL FAILURE RATE <u>0.116</u> 3/1000 HRS							
25	A	ATM 605	B	MIL-HDBK-217A	C	ASD-R-05-6A-1(G E.)	Vendor Data	26	27													

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PARTS APPLICATION ANALYSIS

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(CONNECTORS)

ATM-798, Appendix B

PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968  
SCHEMATIC NO: 2165365, Rev. G

(Connectors)

CIRCUIT, REF. DESIG- NATION	TYPE DESIGNATION (CEC, MIL OR MFR)  AND CONSTRUCTION	MANU- FACTUR- ER	PINS												NO. OF MISCELLA- NEOUS REMARKS	BASIC F. A. I. L. U. R. E. R. E. F.R. F.R. F.R. F.R. F.R. F.R. F.R. F.R.	S O U R C E O F F.R. F.R. F.R. F.R. F.R. F.R. F.R. F.R.	F.R. M OD IFI ER	TOTAL FAILURE RATE (%/1000 Hours)						
			NUMBER			CURRENT		VOLTAGE																	
			TOTAL	ACTIVE	RATED	MAX.	MIN.	RATED	ACTUAL	TRANSIENT	STEADY- STATE	ACROSS THE CONTACT	SURGE												
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22				
-	Terminals 2031A-4	USECO	1	1	-	-	-	-	-	-	-	-	40	Brass Spring	1	Used on A201, A202	.001	B	4	0.004					
-	Terminals 2031B-4	"	1	1	-	-	-	-	-	-	-	-	"	"	"	1	3 used in A203	.001	B	17	0.017				
-	Terminals 3231-2	Cambion	1	1	-	-	-	-	-	-	-	-	"	"	"	1	10 used in Assembly	.001	B	10	0.010				
23	REQUIRED LIFE HOURS	24	FAILURE RATE SOURCES (FOR COLUMN 20)						25	CALCULATED MTBF HOURS						26	TOTAL FAILURE RATE %/1000 HOURS								
			A ATM 605	B MIL-HDBK-2174	C	D																			

DOD 9213

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## PARTS APPLICATION ANALYSIS

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### (MISC. PARTS)

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Switchable Power Supply

DATE: 4 October 1968  
SCHEMATIC NO: 2165365, Rev. G

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MPR) and CONSTRUCTION	MANUFACTURER NUMBER	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY					
			MAX	MIN	RATED	USE			BASIC FAILURE RATE (%/1000 HOURS) at $25^{\circ}\text{C}$ (SEE #15)	S O U R C E	PART SPECIAL ENVIRONMENT (DEFINE)	FAIL- URE RATE	TOTAL FAILURE RATE (%/1000 HOURS)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
-	High voltage cable Assembly, 2171389	BxRL	-	-	-	-	25%	High Voltage Line	0.0475	C	Lunar	1.0	0.0475	
15	FAILURE RATE SOURCES (FOR COLUMN 11)				16	CALCULATED MTBF <sup>2</sup> , 100,000 HOURS				17	TOTAL FAILURE RATE <u>0.0475</u> %/1000 HOURS			
A.	ATM 605	B.	MIL-HDBK-217A	C.	ASD-R-05-64-1 (GE)	D.	MIL Std 217 Chart XXIV							

DOD Form 925B

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CPL EE Parts Application Analysis

NO.	REV. NO.
ATM-798	
PAGE _____	OF _____
DATE 10/10/68	

APPENDIX C

PARTS APPLICATION ANALYSIS DATA  
FOR  
LOW VOLTAGE POWER SUPPLY

# PARTS APPLICATION ANALYSIS

Page 1 of 8

ATM-798, Appendix C

## CAPACITORS

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUBASSEMBLY:** Low Voltage Power Supply

**DATE:** 27 September 1968  
**SCHEMATIC NO:** 2165385, Rev. E

1 CIRCUIT NUMBER	2 TYPE (REL or MFR) DESIGNATION CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE Value E&I	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE DC PEAK	7 OPERATING VOLTAGE DC PEAK	8 VOLTAGE RATIO, RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMP. [°C]	11 CIRCUIT FUNCTION OR APPLICATION	FOR USE OF RELIABILITY DATA						
											13 BASIC FAILURE RATE (3,1000 HRS)	14 SF FOR DOWN TO 1000 HRS	15 ENVIRONMENTAL FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE	17 TOTAL CAPACITOR PER TYPE	18 TOTAL FAILURE RATE	19 TOTAL FAILURE RATE (3,1000 HRS)
C301	CSR13	Kemet	1.0	20	50	29	0.57	0.50	40°	Regulator Circuit	0.0051	A	Lunar	1.0	0.005	1	0.005
C302	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C303	"	"	18.0	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C304	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C305	CKR06	Aerovox	0.01	"	100	"	"	"	"	"	Oscillator	"	0.0011	"	"	"	0.001
C306	CSR13	Kemet	180.0	"	6	3	"	0.50	"	"	+3V	"	0.0031	"	"	"	0.003
C307	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C308	"	"	39.0	"	10	6	"	0.60	"	"	-16V	"	0.0061	"	"	0.006	"
C309	"	"	1.0	"	50	32	"	0.64	"	"	"	"	0.0091	"	"	0.009	"
C310	"	"	3.9	"	"	"	"	"	"	"	+32V	"	"	"	"	"	"
C311	"	"	18.0	"	"	27	"	0.54	"	"	+27V	"	0.0011	"	"	0.001	"
C312	CKR06	Aerovox	0.1	"	"	3	"	0.06	"	"	+3V	"	0.0004	"	"	"	0.004
C313	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
C314	"	"	"	"	"	6	"	0.12	"	"	+6V	"	"	"	"	"	"
C315	"	"	"	"	"	32	"	0.64	"	"	-16V	"	0.0011	"	"	0.001	"
C316	"	"	"	"	"	"	"	"	"	"	+32V	"	"	"	"	"	"
C317	"	"	"	"	"	27	"	0.54	"	"	+27V	"	"	"	"	"	"
C318	CSR13	Kemet	6.8	"	6	3	"	0.50	"	"	-3V	"	0.0031	"	"	0.003	"

20

FAILURE RATE SOURCES (FOR COLUMN #14)

A ATM-605      B \_\_\_\_\_  
 C \_\_\_\_\_      D \_\_\_\_\_

21

CALCULATED MTBF 1,690,000 HRS

22

TOTAL FAILURE RATE 0.0592  $\times 10^6$  HRS

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix C

## RESISTORS

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUB ASSEMBLY:** Low Voltage Power Supply

**DATE:** 27 September 1968  
**SCHEMATIC NO:** 2165385, Rev. E

(Resistors)

1 CIRCUIT NUMBER	2 TYPE (MIL or MIL DESIGNATION AND CONSTRUCTION)	3 MANUFACTURER	4 RESISTANCE VALUE (OMEGA)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 OPERATING POWER (WATTS)	8 POWER RATIO/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (3/1000 HRS) - 40°C SOURCES (SEE BELOW)	13 - 20°C SOURCES (SEE BELOW)	14 SPECIAL ENVIRONMENTAL (DEFINITION)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (3/1000 HRS)	17 TOTAL RESISTOR COUNT PER TPS	18 TOTAL FAILURE RATE (3/1000 HRS)		
R301	RC07	Allen Bradley	3.3K	5	0.25	—	0.01	0.5	40°	Regulator Circuit	0.0021	A	Lunar	1.0	0.002	1	0.002		
R302	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
R303	"	"	300	"	"	0.01	0.03	"	"	"	"	"	"	"	"	"	"		
R304	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
R305	"	"	27K	"	"	0.03	0.13	1.0	"	Oscillator	"	"	"	"	"	"	"		
R307	"	"	47	"	"	0.10	0.39	0.5	"	+3V	"	"	"	"	"	"	"		
R308	"	"	"	"	"	0.02	0.10	"	"	"	"	"	"	"	"	"	"		
R309	"	"	300	"	"	0.03	0.12	1.0	"	Oscillator	"	"	"	"	"	"	"		
R310	"	"	10K	"	"	0.02	0.08	0.5	"	-16V	"	"	"	"	"	"	"		
R311	"	"	12K	"	"	0.03	0.11	"	"	"	"	"	"	"	"	"	"		
19.	FAILURE RATE SOURCES (FOR COLUMN #14)										20.	CALCULATED MTE: 5,000,000 HRS						21.	
A	ATM-605	B											C	D	TOTAL FAILURE RATE 0.020 %/1000 HRS				

FORM 0231

BS-321A

## PARTS APPLICATION ANALYSIS (SEMICONDUCTORS)

ATM-798, Appendix C

ATM-798, Appendix C

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

## SUB ASSEMBLY: Low Voltage Power Supply

**DATE:** 27 September 1968

SCHEMATIC NO: 2165385, Rev. E

PARTS APPLICATION ANALYSIS  
 (SEMICONDUCTORS)

Page 4 of 8

ATM-798, Appendix C

PROJECT: ALSEP  
 ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Low Voltage Power Supply

DATE: 27 September 1968  
 SCHEMATIC NO: 2165385, Rev. E

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MAX. TEMP °C	AVG PWR DISSIPATION (mw)			POWER RATIO			MAXIMUM VOLTAGES			DIODE PIV			CIRCUIT FUNCTION or APPLICATION (Define)	FOR RELIABILITY USE ONLY																
			RATED AT			25°C			ACTUAL			V <sub>CBO</sub>			V <sub>CB</sub>			V <sub>CBO</sub>			RATED			AC T U A L			RATED			AC T U A L		
			M	A	C	A	C	A	M	C	A	M	C	A	M	C	A	M	C	A	M	C	A	M	C	A	M	C	A	M	C	
CR 301	Diode, Silicon Reference, MC7102	Micro-S.C.	40	200	—	250	—	—	2.5	0.01	—	—	—	—	—	—	—	—	—	50	29	—	Regulator Circuit	Lunar	0.001	0.001	0.001	0.001	0.001	0.001		
CR 302	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
CR 303	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
CR 304	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
CR 305	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
CR 306	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
CR 307	Diode, Zener TC30A50A	Solid-tron	"	"	"	5W	"	"	"	50	"	"	"	"	"	"	"	"	"	30	—	"	"	"	0.004	"	"	0.004	"	"	0.004	
CR 308	Diode, Silicon Reference, MC7102	Micro-S.C.	"	"	"	250	"	"	"	2.5	"	"	"	"	"	"	"	"	"	50	29	Oscillator Circuit	"	"	0.001	"	"	0.001	"	"	0.001	
CR 309	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
<sup>28</sup> FAILURE RATE SOURCE (See Column 23)			<sup>29</sup> NOTE: It is assumed the transient and peak power does not exceed the safe limit.			<sup>30</sup> TOTAL FAILURE RATE See page 6 %/1000 HRS.																										
<sup>28</sup> ATM-605			<sup>29</sup> ATM-605			<sup>30</sup> ATM-605																										

## PARTS APPLICATION ANALYSIS (SEMICONDUCTORS)

Page 5 of 8  
ATM-798, Appendix C

ATM-798, Appendix C

PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

## **SUB ASSEMBLY: Low Voltage Power Supply**

DATE: 27 September 1968  
SCHEMATIC NO: 2165385, Rev. E

## PARTS APPLICATION ANALYSIS

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ATM-798, Appendix C

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY: Low Voltage Power Supply**

DATE: 27 September 1968  
SCHEMATIC NO: 2165385, Rev.

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU FACT UR ER	MAX. TEMP °C		AVG PWR DISSIPATION (mw)						POWER RATIO		MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLI CATION  (See below)	FOR RELIABILITY USE ONLY									
			A M B A C T U E N T	A C T U E D	J U N C T I O N	C A S E	A C T U E N T	V CBO	V CB	V CEO	V CE	R A T E D	R A T E D	R A T E D	R A T E D	F A U L T I P R A T E R	M F A U L T I P R A T E R	T C O U L A N T P E R	TOTAL FAIL URE RATE (%/1000 HRS)										
			RATED AT				25°C				ACTUAL				ACTUAL RATED 25°C		ACTUAL RATED TA or TC		ACTUAL		ACTUAL		ACTUAL		ACTUAL		ACTUAL		
			TA	TJ	TC	TA	TA	TA	TC	TA	TA	TA	TC	TA	TC	TA	V	V	V	V	V	V	V	V	V	V	V		
CR 320	Diode, Zener UZ806	Uni-trode	40	175	—	5W	—	—	—	50	0.01	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—		
CR 321	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 322	Diode, Zener UZ833	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
CR 323	Diode, Zener UZ808	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
				</																									

PARTS APPLICATION ANALYSIS

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(INDUCTORS & TRANSFORMERS)

ATM-798, Appendix C

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Low Voltage Power Supply

DATE: 27 September 1968  
SCHEMATIC NO: 2165385, Rev. E

CIRCUIT NUMBER	TYPE OF CASE (SEE BELOW)	MANUFACTURER	CONSTRUCTION	VA RATING	NO. OF COILS AT RATED CUR.	SPECIFIED FREQ.	MISCELLANEOUS OPERATING CONDITIONS	TEMPERATURE (°C)	PRIMARY CURRENT	SECONDARY	REL. DEPT USE ONLY																	
											WIRE SIZE PRIMARY	WIRE SIZE SECONDARY	INSULATION CLASS	AMBIENT HOT SPOT SURFACE (AIR METHOD)	EST. ACTUAL RISE	OPERATING TEMP MAX.	ACTUAL	RATED	PRIMARY VOLTAGE	NO. WINDINGS	VOLTS	BASIC FAILURE RATE (1/100 HRS)	AVERAGE FAILURE RATE (1/100 HRS)	TOTAL FAILURE RATE (1/100 HRS)				
L301	MIL-T-27	BxRL	C	—	27	C	5.8	400	—	—	40	—	—	15	15	55	100	20	39	23	—	29	—	—	0.017	B	0.017	
T301	"	"	"	38/30	32	"	17.3	"	"	"	"	"	"	"	"	"	"	"	"	"	54 + 3V	5.4	"	"	"	"	"	"
"	"	"	"	"	32	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	71 + 6V	7.1	"	"	"	"	"	"
"	"	"	"	"	38	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	320 + 32V	32.0	"	"	"	"	"	"
"	"	"	"	"	36	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	275 - 16V	27.5	"	"	"	"	"	"
"	"	"	"	"	33	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	41 - 3V	4.1	"	"	"	"	"	"
28	TYPE OF CASE	29	FAILURE RATE SOURCES (FOR COLUMN #28)				30	CALCULATED MTBF <u>2,940,000</u> HRS				31	TOTAL FAILURE RATE <u>0.034</u> 1/1000 HRS															
	A. HER. SEAL B. VAC. IMP. C. ENCAP. D. OPEN		A. ATM-605 B. MIL-HDBK-217A					C. D.																				

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PARTS APPLICATION ANALYSIS  
 (CONNECTORS)

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ATM-798, Appendix C

PROJECT: ALSEP  
 ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Low Voltage Power Supply

DATE: 27 September 1968  
 SCHEMATIC NO: 2165385, Rev. E

(Connectors)

CIRCUIT, REF. DESIGN- NATION	TYPE DESIGNATION (CEC, MIL OR MFR)  AND CONSTRUCTION	MANU- FACTUR- ER	PINS																NO. OF INSER- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC FAIL- URE RATE (1/1000 Hours) <small>(See 24)</small>	SOUR- CE OF F.R.	MOD- IFI- ER	F.R.	TOTAL FAILURE RATE (%/1000 Hours)			
			NUMBER		CURRENT			VOLTAGE						AMBI- ENT TEMP °C	INSERT- MATL	GUIDE												
			TOTAL	ACTIVE	RATED	ACTUAL	MAX.	MIN.	RATED	ACTUAL	BETWEEN PINS	ACROSS THE CONTACT	STEADY STATE	TRANSI- ENT	SURGE	14	15	16										
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22							
—	Jack-Non Std. Pt.	Cambion	1	1	—	—	—	—	—	—	—	—	40	Brass	Spring	1	Stress level less than 0.1	0.	0.001	B	1.0	0.001						
23	REQUIRED LIFE HOURS	24	FAILURE RATE SOURCES (FOR COLUMN 20)						25	CALCULATED MTBF <u>3,230,000</u> HOURS						26	TOTAL FAILURE RATE <u>0.031%</u> / 1000 HOURS											
			A <u>ATM-605</u>	B <u>      </u>	C <u>      </u>	D <u>      </u>																						

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**Aerospace  
Systems Division**

**CPLLEE Parts Application Analysis**

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ATM-798	
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**APPENDIX D**

**PARTS APPLICATION ANALYSIS DATA  
FOR  
CHANNELTRON POWER SUPPLY NO. 1**

# PARTS APPLICATION ANALYSIS

Page 1 of 7

ATM-798, Appendix D

## RESISTORS

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUB ASSEMBLY:** Channeltron Power Supply No. 1

**DATE:** 1 October 1968  
**SCHEMATIC NO:** 2165390, Rev. G

(Resistors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (NAME OR MARK) DESIGNATOR AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE (OMES)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM OPERATING POWER (WATTS)	8 POWER RATIO/ RATING	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (%/1000 HRS) - AT SOURCE (50°C BELOW)	13 ENVIRONMENTAL (DEFINITIONS)	14 - FAILURE RATE MULTIPLIER	15 FINAL FAILURE RATE (%/1000 HRS)	16 TOTAL RESISTOR COUNT PER TYPE	17 TOTAL FAILURE RATE (%/1000 HRS)	
R401	RNR57	Mepco	18- 35K	5	0.125	7.50	0.06	1.00	40	Input Circuit	0.015 A	Lunar	1.0	0.015	1	0.015	
R402	"	Allen Bradley	154K	"	"	2.50	0.02	"	"	Transient Suppressor (A406)	"	"	"	"	"	"	
R403	RC07	Allen Bradley	100K	"	0.250	1.25	0.01	"	"	Input Circuit	0.002 "	"	"	"	0.002	"	
R404	"	"	4.7K	"	"	"	"	1.00	"	Switching Circuit	"	"	"	"	"	"	
R405	"	"	10K	"	"	2.50	0.02	"	"	"	"	"	"	"	"	"	
R406	"	"	220- 360K	"	"	1.25	0.01	"	"	"	"	"	"	"	"	"	
R407	"	"	1.6K	"	"	2.50	0.02	"	"	"	"	"	"	"	"	"	
R408	"	"	1.2K	"	"	1.25	0.01	1.00	"	Oscillator	"	"	"	"	"	"	
R409	"	"	1.6K	"	"	"	"	"	"	"	"	"	"	"	"	"	
R410	"	"	1.2K	"	"	3.75	0.03	"	"	+3V	"	"	"	"	"	"	
R415	"	"	5.6K	"	"	1.25	0.02	"	"	Housekeeping	"	"	"	"	"	"	
R416	"	"	75K	"	"	11.25	0.09	"	"	Switching	"	"	"	"	"	"	
R417	"	"	0- 150K	"	"	1.25	0.01	"	"	Input	"	"	"	"	"	"	
R1	Comp., Type BB	Allen Bradley	1.0M	5	0.125	1.25	0.01	1.00	40	Filter Assembly (A402)	0.002 A	Lunar	1.0	0.002	1	0.002	
R2	"	"	10K	"	"	"	"	"	"	"	"	"	"	"	"	"	
R3	"	"	1.0M	"	"	"	"	"	"	"	"	"	"	"	"	"	
19	FAILURE RATE SOURCES (FOR COLUMN #14)										20	CALCULATED MTBF <u>1,720,000</u> HRS				21	TOTAL FAILURE RATE <u>0.058</u> %/1000 HRS
A	ATM-605	B															
C		D															

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix D

## CAPACITORS

PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

SUBASSEMBLY: Channeltron Power Supply No. 1

DATE: 1 October 1968  
SCHEMATIC NO: 2165390, Rev. G.

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (MIL. OR MTR) CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE mfd	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE DC PAC	7 OPERATING VOLTAGE DC PAC	8 VOLTAGE OPERATING/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE (C)	11 CIRCUIT FUNCTION OR APPLICATION	12 13 BASIC FAILURE RATE A 1000 HRS SOURCES FOR USE OF RELIABILITY DEPT	14 15 ENVIRONMENT (OPENING) FAILURE RATE B 1000 HRS SOURCES FOR USE OF RELIABILITY DEPT	16 MULTIPLIER FAILURE RATE C 1000 HRS	17 FINAL FAILURE RATE D 1000 HRS	18 TOTAL CAPACITOR COUNT E 1000 HRS	19 TOTAL FAILURE RATE F 1000 HRS	
C401	CSR13	Kemet	1.0	10	50	21	0.42	1.0	40	Input Circuit	0.002 A	Lunar 1.0	0.002	1	0.002		
C402	CKR05CW	Aerovox	0.001	"	200	20	"	0.10	"	"	0.004 "	"	"	0.0004	"	0.0004	
C403	CKR06CW	"	0.01	"	100	21	"	0.21	"	"	"	"	"	"	"	"	
C404	CSR13	Kemet	4.7	"	10	5.5	"	0.55	"	"	Housekeeping Circuit	0.005 "	"	"	0.005	"	0.005
C405	"	"	1.0	"	50	25	"	0.50	"	"	Transient Suppressor (A406)	0.003 "	"	"	0.003	"	0.003
C410	"	"	3.9	"	"	37	"	0.54	0.01	"	Switching Circuit	0.005 "	"	"	0.005	"	0.005
C1-C10	Ceramic, 3P46106	American Lava	1224 pf	10	1KV	640	-	0.64	1.0	40	Voltage Multiplier (A401)	0.001 A	Lunar 1.0	0.001	10	0.010	
C1-C4	Ceramic, HVD-6	Aerovox	0.003	10	6KV	342	-	0.57	1.0	40	Filler Assembly (A402)	0.008 A	Lunar 1.0	0.008	4	0.0032	
20	FAILURE RATE SOURCES (FOR COLUMN #14)										21	CALCULATED MTBF 3,450,000 HRS				22	TOTAL FAILURE RATE 0.029 1000 HRS
A	ATM-605	B															
C		D															

## PARTS APPLICATION ANALYSIS (SEMICONDUCTORS)

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ATM-798, Appendix D

PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

**DATE:** 1 October 1968

SUB ASSEMBLY: Channeltron Power Supply No. 1 SCHEMATIC NO: 2165390, Rev. G

## PARTS APPLICATION ANALYSIS (SEMICONDUCTORS)

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ATM-798, Appendix D

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

SUB ASSEMBLY: Channeltron Supply Power No. DATE: 1 October 1968  
1SCHEMATIC NO: 2165390, Rev. G

PARTS APPLICATION ANALYSIS  
 (INDUCTORS & TRANSFORMERS)

Page 5 of 7

ATM-798, Appendix D

PROJECT: ALSEP  
 ASSEMBLY: CPLEE Experiment

DATE: 1 October 1968  
 SUB ASSEMBLY: Channeltron Power Supply No. 1 SCHEMATIC NO: 2165390, Rev. G

(Inductors & Transformers)	1 CIRCUIT SYMBOL / NUMBER	2 DESIGNATION (MI AND FR) CONSTRUCTION	3 MANUFACTURER	CONSTRUCTION			8 VA RATING	9 INDUCTANCE	10 SPACIFIED PREG	11 MISCCELLANEOUS	TEMPERATURE (°C)			19 PRIMARY CURRENT	20 PRIMARY VOLTAGES	21 NO. WINDINGS	22 VOLTAGE	23 WINDINGS	24 HIPOT READING	25 BASIC FAILURE RATE AT 3000°C SOURCE	26 TOTAL FAILURE RATE AT 3000°C SOURCE	27 TOTAL FAILURE RATE (41000 HRS)	28 REL. DEPT USE ONLY		
				4 TYPE OF CASE (SIS BELOW)	5 WIRE SIZE PRIMARY	6 WIRE SIZE SECONDARY					12 OPERATING AMBIENT (SURFACE)	13 (or METHOD)	14 EST. ACTUAL RISE	15 TEMP MAX.	16 OPERATING	17 ACTUAL	18 RATED								
T401	MIL-T-27	BxRL	C	47	44	C	0.8	-	-	40	0	15	55	0.23	1.0	28.3	66	1	3.6	-	-	0.017	B	0.0017	
				"	"	50	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			
28	TYPE OF CASE	29	FAILURE RATE SOURCES (FOR COLUMN #26)						30	CALCULATED MTBF <u>5,880,000</u> HRS						31	TOTAL FAILURE RATE <u>0.017</u> 1/1000 HRS								
	A. HER. SEAL		A. ATM-605 B. MIL-HDBK-217A																						
	B. VAC. IMP.		C. ENCAP.							D. OPEN															

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## PARTS APPLICATION ANALYSIS

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ATM-798, Appendix D

**PROJECT:** ALSEP  
**ASSEMBLY:** CPL 11 Experiment

SUB ASSEMBLY: Channeltron Power Supply No.1 SCHEMATIC NO: 2165390, Rev. G

DATE: 1 October 1968

**SCHEMATIC NO:** 2165390, Rev. G

PARTS APPLICATION ANALYSIS  
 (CONNECTORS)

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ATM-798, Appendix D

PROJECT: ALSEP  
 ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Channeltron Power Supply No. 1

DATE: 1 October 1968  
 SCHEMATIC NO: 2165390, Rev G

(Connectors)

CIRCUIT, REF. DESIGN- NATION	TYPE DESIGNATION (CEC, MIL OR MFR)  AND CONSTRUCTION	MANU- FACTURER	PINS														NO. OF INSER- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC FAIL- URE RATE (\$/1000 Hours) (See 24)	SOUR- CE OF F.R.	MOD- IFI- ER	F.R.	TOTAL FAILURE RATE (\$/1000 Hours)							
			NUMBER			CURRENT			VOLTAGE					AMBI- ENT TEMP °C	INSERT MATL	GUIDE														
			TOTAL	ACTIVE	RATED	ACTUAL	MAX.	MIN.	RATED	ACTUAL	TRANS- IENT	STEADY STATE	SURGE																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22									
E401	Connector, Plug																													
E409	3231-1	Cambion	1	1	—	—	—	—	—	—	—	—	—	40	Spr- Brass ing	1		0.	001	C	1.0	0.009								
E410	Terminal, Insulated																													
	2031A-4	USECO	1	1	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	0.00005							
E423	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“							
23	REQUIRED LIFE HOURS	24	FAILURE RATE SOURCES (FOR COLUMN 20)												25	CALCULATED MTBF <u>11,000,000</u> HOURS				26	TOTAL FAILURE RATE <u>0.0094</u> /1000 HOURS									
			ATM-605 cASD-R-05-64-1(G.E.) <sub>d</sub>																											

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**Aerospace  
Systems Division**

CPL EE Parts Application Analysis

NO.	REV. NO.
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**APPENDIX E**

**PARTS APPLICATION ANALYSIS DATA  
FOR  
CHANNELTRON POWER SUPPLY NO. 2**

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix E

## RESISTORS

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUB ASSEMBLY:** Channeltron Power Supply No.2

**DATE:** 2 October 1968  
**SCHEMATIC NO:** 2165395 Rev. G

1 CIRCUIT SYMBOL NUMBER	2 TYPE (NAME OR MFR) AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE VALUE/ (OMES)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM POWER (WATTS)	8 POWER RATIO/ RATED	9 MAXIMUM DUTY CYCLE	10 BREAKDOWN TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (%/1000 HRS) - 15°C (SEE BELOW)	13 SPECIAL ENVIRONMENT'S (DEFINE)	14 FAILURE RATE MULTIPLIER	15 FINAL FAILURE RATE (%/1000 HRS)	16 TOTAL RESISTOR COUNT PER TYPE	17 TOTAL FAILURE RATE (%/1000 HRS)			
R411	RC07	Allen Bradley	230K 360K	5	250	2.5	0.01	1.0	40	Oscillator Circuit	0.001 A	Lunar	1.0	0.002	1	0.002			
R412	"	"	1.6K	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
R413	"	"	1.2K	"	"	7.5	0.03	"	"	+3V	"	"	"	"	"	"	"		
R414	"	"	5.6K	"	"	2.5	0.01	"	"	Housekeeping Circuit	"	"	"	"	"	"	"		
R1	RC07	Allen Bradley	1.0M	5	125	1.25	0.01	1.0	40	Filter Assembly (A404)	0.002 A	Lunar	1.0	0.002	1	0.002			
R2	"	"	10K	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
R3	"	"	1.0M	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
R1	RC07	Allen Bradley	5.1K	5	125	3.75	0.03	1.0	40	Buffer & Inverter (A405)	0.002 A	Lunar	1.0	0.002	1	0.002			
R2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
19	FAILURE RATE SOURCES (FOR COLUMN #14)								20	CALCULATED MTBF <u>5,650,000</u> HRS				21	TOTAL FAILURE RATE <u>0.018</u> %/1000 HRS				
A	ATM-605	B									C	D							

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix E

## CAPACITORS

PROJECT: ALSEP

ASSEMBLY: CPLEE Experiment

SUBASSEMBLY: Channeltron Power Supply No. 2

DATE: 2 October 1968

SCHEMATIC NO: 2165395, Rev. G

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (AGL or AFR) CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE mFD	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 OPERATING RATED VOLTAGE TO GND	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE (°C)	11 CIRCUIT APPLICATION	12 CIRCUIT FUNCTION OR APPLICATION	13 BASE FAILURE RATE (2100 HRS) A SOURCES FOR USE OF RELIABILITY DATA	14 ENVIRONMENT OR OPERATION CONDITIONS OR SOURCE FOR USE OF RELIABILITY DATA	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE	17 CAPACITOR COUNT PSR TIPS	18 TOTAL FAILURE RATE PSR TIPS	19 TOTAL FAILURE RATE (2100 HRS)
C405	CKR05	Aerovox	0.01	10	200	2	-	0.10	1.0	40	Oscillator Circuit	0.0004'A	Lunar	1.0	0.0004	1	0.0004	
C406	CKR06	"	0.001	"	100	2.1	"	0.21	"	"	"	"	"	"	"	"	"	
C407	CKR13	Kemet	4.7	"	10	5.5	"	0.55	"	"	Housekeeping	0.0043	"	"	0.0043	"	0.0043	
C408	CKR06	"	0.002	"	200	6	"	0.03	"	"	+3V	0.0004	"	"	0.0004	"	0.0004	
C409	"	Aerovox	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C1-C10	Ceramic, 3P46106	American Lava	1244pf	10	1KV	6.4	-	0.64	1.0	40	Voltage Multiplier	(A403) 0.0012'A	Lunar	1.0	0.0013	10	0.0120	
C1-C4	Ceramic, HVD-6	Aerovox	0.003	10	6KV	3.5	KV	-	0.57	1.0	40	Filter Assembly(A404)	0.0008'A	Lunar	1.0	0.0008	4	0.0032
C1	CSR13	Kemet	1.0	10	50	5.5	-	0.11	1.0	40	Buffer & Inverter	(A405) 0.0005'A	Lunar	1.0	0.0005	1	0.0005	
C2	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	
C3	CKR06	Aerovox	0.1	"	100	3	"	0.03	"	"	"	0.0004'A	Lunar	"	0.0004	"	0.0004	
20	FAILURE RATE SOURCES (FOR COLUMN #14)										21	CALCULATED MTBF <u>4,440,000</u> HRS				22	TOTAL FAILURE RATE <u>0.0225</u> $\pm$ 1000 HRS	
	A <u>ATM-605</u> B _____																	
	C _____ D _____																	

PARTS APPLICATION ANALYSIS  
 (SEMICONDUCTORS)

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ATM-798, Appendix E

PROJECT: ALSEP  
 ASSEMBLY: CPLLE Experiment

DATE: 1 October 1968  
 SUB ASSEMBLY: Channeltron Power Supply No.2 SCHEMATIC NO: 2165395, Rev. G

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU FACT ACT TURE R	AC R ATE D	J UN CT ION AL	MAX. TEMP °C		AVG PWR DISSIPATION (mw)			POWER RATIO		MAXIMUM VOLTAGES			DIODE PIV		FOR RELIABILITY USE ONLY													
							RATED AT			25°C		AC T U E N T A L E N T A L			ACTUAL RATED TA or TC (Amb. or case)		ACTUAL RATED TA or TC		V <sub>BO</sub>	V <sub>CB</sub>	V <sub>CEO</sub>	V <sub>CE</sub>	R <sub>A</sub>	A <sub>C</sub>	R <sub>T</sub>	A <sub>C</sub>	F <sub>M</sub>	F <sub>A</sub>	F <sub>T</sub>	T <sub>C</sub>
1	2	3	4	5	T <sub>A</sub>	T <sub>J</sub>	T <sub>C</sub>	T <sub>A</sub>	T <sub>C</sub>	T <sub>A</sub>	T <sub>C</sub>	T <sub>A</sub>	T <sub>C</sub>	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27		
Q406	2N3057A, NPN	Fair-Child	40	200	—	400	2.8W	25	100	32	0.18	—	140	—	7.0	—	—	—	Oscil- lator Circuit	Lunar	0.001	A	1.0	001	1	0.0010				
CR1-CR10	Reference MC7103	Micro-S.C.	40	200	—	250	—	25	—	7.5	0.03	—	—	—	—	—	50	39	Voltage Multipli- er(A403)	Lunar	0.0012	A	1.0	0012	0.0120					
A3, A7	2N3048	Texas Instr	40	200	—	350	—	25	—	21	0.06	—	—	—	—	—	—	—	Buffer & Inverter (A405)	Lunar	0.0012	A	1.0	0012	2	0.0024				
A4, A6	SNR513B	" " " "	"	"	10	" "	" "	"	0.1	0.01	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	2	0.0024		
A5	SNR516B	" " " "	"	"	10	" "	" "	"	2.9	0.29	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	1	0.0012			
28 FAILURE RATE SOURCE (See Column 23)					29					NOTE: It is assumed the transient and peak power does not exceed the safe limit.										30 TOTAL FAILURE RATE <u>0.0190</u> %/1000 HRS.										
A ATM-605 C					B					NOTE: It is assumed the transient and peak power does not exceed the safe limit.										TOTAL FAILURE RATE <u>0.0190</u> %/1000 HRS.										

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# PARTS APPLICATION ANALYSIS

## (INDUCTORS & TRANSFORMERS)

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ATM-798, Appendix E

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Channeltron Power Supply No.2      **DATE:** 1 October 1968  
**SCHEMATIC NO.:** 2165395, Rev. G

## PARTS APPLICATION ANALYSIS

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ATM-798, Appendix E

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

SUB ASSEMBLY: Channeltron Power Supply No. 2

**DATE:** 1 October 1968  
**SCHEMATIC NO:** 2165395, Rev. G

CIRCUIT, REF. DESIGN- NATION	TYPE DESIGNATION (CEC, MIL OR MFR)  AND CONSTRUCTION	MANU- FACTUR- ER	PINS												AMBI- ENT TEMP °C	INSERT- MATL	GUIDE	NO. OF INSER- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	SOURCE	F.R.	TOTAL FAILURE RATE (%/1000 Hours)									
			NUMBER			CURRENT			VOLTAGE																						
			TOTAL	ACTIVE	RATED	MAX.	MIN.	RATED	BETWEEN PINS	ACROSS THE CONTACT	TRANSIENT	STEADY STATE	SURGE																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22										
E411-	Plug, Jack																														
E420	3231-3	Cambion	1	1	—	—	—	—	—	—	—	—	—	40	Spr- Brassing	1	—	0.001	B	1.0	0.010										
(NOTE: TOTAL FAILURE RATE BASED ON ALL 10 CONNECTORS.)																															
23	24		FAILURE RATE SOURCES (FOR COLUMN 20)												25	CALCULATED MTBF 10,000 HOURS															
REQUIRED LIFE HOURS		A ATM-605		B MIL-HDBK-217A		C		D										26		TOTAL FAILURE RATE 0.010 %/1000 HOURS											



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**APPENDIX F**

**PARTS APPLICATION ANALYSIS DATA  
FOR  
AMPLIFIER MODULE ASSEMBLY**

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix F

## RESISTORS

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Amplifier Module Assembly

**DATE:** 2 October 1968  
**SCHEMATIC NO:** 2165355, Rev. D

Resistors

1 CIRCUIT SYMBOL NUMBER	2 TYPE (MATERIAL 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 BUCK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (%/1000 HRS) - 4% (100°C) - 1% (50°C)	13 FAILURE SOURCES (SEE BELOW)	14 SPECIAL ENVIRONMENT (DEFINITE)	15 FAILURE RATE (%/1000 HRS) - MULTIPLEX	16 FAILURE RATE (%/1000 HRS)	17 TOTAL RESISTOR COUNT PER TYPE	18 TOTAL FAILURE RATE (%/1000 HRS)
R501	RC07	Allen Bradley	200	5	0.25	2.5 mw	0.01	0.50	40	Amplifier Submodules	0.0021 A	FOR USE OF RELIABILITY DEPT	Lunar	1.0	0.002	12	0.024
R502	"	"	36K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R503	"	"	3.3K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R504	"	"	10K	"	"	7.5 mw	0.03	"	"	"	"	"	"	"	"	"	"
R505	"	"	13K	"	"	9 mw	0.06	"	"	"	"	"	"	"	"	"	"
R506	"	"	3.3K	"	"	0.275	0.11	"	"	"	"	"	"	"	"	"	"
R510	RC07	Allen Bradley	2.7	5	0.25	2.5 mw	0.01	1.00	40	Amplifier Assembly	0.0021 A	FOR USE OF RELIABILITY DEPT	Lunar	1.0	0.002	1	0.002
R511	"	"	8.2	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R512	RC07	Allen Bradley	15	5	0.25	2.5 mw	0.01	1.00	40	Filter Network(A522)	0.0021 A	FOR USE OF RELIABILITY DEPT	Lunar	1.0	0.002	1	0.002
R513	"	"	100	"	"	"	"	"	"	"	"	"	"	"	"	"	"
19	FAILURE RATE SOURCES (FOR COLUMN #14)										20	CALCULATED MTBF <u>660,000</u> HRS					
	A <u>ATM-605</u>	B _____	C _____	D _____													TOTAL FAILURE RATE <u>0.152</u> %/1000 HRS

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## PARTS APPLICATION ANALYSIS

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ATM-798, Appendix F

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUBASSEMBLY:** Amplifier Module Assembly

**DATE:** 2 October 1968  
**SCHEMATIC NO:** 2165355, Rev. D

## PARTS APPLICATION ANALYSIS (SEMICONDUCTORS)

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ATM-798, Appendix F

PROJECT: ALSEP  
ASSEMBLY: CPLER Experiment

**SUB ASSEMBLY:** Amplifier Module Assembly

**DATE:** 2 October 1968  
**SCHEMATIC NO:** 2165355, Rev. I

(Semiconductors)

PARTS APPLICATION ANALYSIS  
 (CONNECTORS)

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ATM-798, Appendix F

PROJECT: ALSEP  
 ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Amplifier Module Assembly

DATE: 2 October 1968  
 SCHEMATIC NO: 2165355, Rev. D

(Connectors)

CIRCUIT, REF. DESIGN- NATION	TYPE DESIGNATION (CEC, MIL OR MFR)  AND CONSTRUCTION	MANU- FACTURER	PINS												AMBI- ENT TEMP °C	INSERT MATL	GUIDE	NO. OF INSER- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC FAIL- URE RATE (\$/1000 Hours) See 24)	SOUR- CE OF F.R.	MOD- IFI- ER	F.R.	TOTAL FAIL- URE RATE (%/1000 Hours)										
			NUMBER			CURRENT			VOLTAGE																									
			TOTAL	ACTIVE	RATED	ACTUAL	MAX.	MIN.	RATED	ACTUAL	BETWEEN PINS	ACROSS THE CONTACT	TRANSIENT	STEADY STATE	SURGE																			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22													
—	Terminals	Cambion	1	1	—	—	—	—	—	—	—	—	40	Brass	Spring	1	—	0.	001	B	1.0	0.031												
(TOTAL FAILURE RATE REFLECTS THE 31 TERMINALS USED IN THIS ASSEMBLY )																																		
23	REQUIRED LIFE HOURS	24	FAILURE RATE SOURCES (FOR COLUMN 20)						25	CALCULATED MTBF 2,220,000 HOURS						26	TOTAL FAILURE RATE 0.031 \$/1000 HOURS																	
		A ATM-605      B MIL-HDBK-217A																																
		C _____ D _____																																

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**APPENDIX G**

**PARTS APPLICATION ANALYSIS DATA  
FOR  
VERTICAL ANALYZER**

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix G

## RESISTORS

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Vertical Analyzer (NO. 1-A)

DATE: 2 October 1968  
SCHEMATIC NO: 2167370, Rev. A

(Resistors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE (NAME AND CONSTRUCTION)	3 MANUFACTURER	4 RESISTANCE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	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 - AT 100°C (@ 10 <sup>-9</sup> HRS) SOURCES (@ BELOW)	13 SPECIAL ENVIRONMENT (DATA)	14 - FAILURE MULTIPLIER	15 FINAL FAILURE RATE (@ 1000 HRS)	16 TOTAL FAILURE COUNT PER TYPE	17 TOTAL RESISTOR TYPE	18 TOTAL FAILURE RATE (@ 1000 HRS)
R601	RC07	Allen Bradley	1M	5	0.25	2.5 mw	0.01	0.50	40	Pre-amp Assembly	0.0021 A	Lunar	1.0	0.002	6	0.012	
R602	"	"	30K	"	"	0.01	0.04	"	"	"	"	"	"	"	"	"	
R603	"	"	43K	"	"	2.5 mw	0.41	"	"	"	"	"	"	"	"	"	
R604	"	"	4.3K	"	"	"	"	"	"	"	"	"	"	"	"	"	
R605	"	"	100	"	"	0.02	0.08	"	"	"	"	"	"	"	"	"	
—	"	"	3.9K	"	"	0.215	0.86	"	"	Heater	"	0.0131 "	"	"	0.013	1	0.013
19	FAILURE RATE SOURCES (FOR COLUMN #14)										20	CALCULATED MTBF <u>1,370,000</u> HRS					21
A	ATM-605	B	C	D													TOTAL FAILURE RATE <u>0.073</u> %/1000 HRS

# PARTS APPLICATION ANALYSIS

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ATM-798, Appendix G

## CAPACITORS

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUBASSEMBLY:** Vertical Analyzer (NO 1-A)

**DATE:** 2 October 1968  
**SCHEMATIC NO:** 2167370, Rev. A

(Capacitors)

1 CIRCUIT NUMBER	2 TYPE (MATERIAL AND CONSTRUCTION)	3 MANUFACTURER	4 CAPACITANCE VALUE mfd	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 PEAK VOLTAGE	9 OPERATING RATIO, R <sub>OP</sub> /R <sub>TD</sub>	10 MAXIMUM DUTY CYCLE	11 BULK AIR TEMPERATURE (C)	12 CIRCUIT FUNCTION OR APPLICATION	13 BASIC RATE A 10 <sup>-3</sup> /1000 HRS	14 SOURCE(S) FOR USE OF RELIABILITY DEPT	15 SPECIAL (DEFINITION)	16 FAILURE RATE MULTIPLIER	17 FINAL FAILURE RATE	18 TOTAL COUNT PER TYPE	19 TOTAL FAILURE RATE (10 <sup>-3</sup> HRS)	
C601A	Mica, M106R	Minitan	10	10	6	3	—	0.50	0.50	40	Analyzer Assembly	0.0030	A	Lunar	1.0	0.0020	1	0.0020	
C601	Ceramic	Farad Corp.	560pf	"	4KV	—	13K	0.75	"	"	Pre-amp	0.0017	"	"	"	0.0017	6	0.0102	
C602	Ceramic, SC-1	MUCON	1pf	"	50	—	16	0.12	"	"	"	0.0044	"	"	"	0.0004	"	0.0024	
20	FAILURE RATE SOURCES (FOR COLUMN #14)								21	CALCULATED MTBF <u>6,850,000</u> HRS								22	TOTAL FAILURE RATE <u>0.0146</u> $\times 10^3$ HRS
	A <u>ATM-605</u>	B <u>          </u>	C <u>          </u>	D <u>          </u>															

## PARTS APPLICATION ANALYSIS (SEMICONDUCTORS)

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ATM-798, Appendix G

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUB ASSEMBLY: Vertical Analyzer (NO. 1-A)**

DATE: 2 October 1968  
SCHEMATIC NO: 2167370, Rev. A

# PARTS APPLICATION ANALYSIS

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## (MISC. PARTS)

ATM-798, Appendix G

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUB ASSEMBLY:** Vertical Analyzer (NO. 1-A)

**DATE:** 2 October 1968  
**SCHEMATIC NO:** 2167370, Rev. A

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION	MANU- FACTUR- ER	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY					
			MAX	MIN	RATED	USE			BASIC FAILURE RATE (%/1000 HOURS)	SO U R C E at -20°C #15	PART SPECIAL ENVIRONMENT (DEFINE)	FAIL- URE RATE MULTI- PLIER	TOTAL FAIL- URE RATE (%/1000 HOURS)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
—	Channeltron	BxRL	--	--	--	--	0.50	Preamp. Assemblies (6)	0.016	C	Lunar	1.0	0.096	
"	Collector Rod 2166256	"	"	"	"	"	"	Analyzer Assembly	0.036	"	"	"	0.036	
"	Collector Rod 2166257	"	"	"	"	"	"	"	"	"	"	"	"	
"	Deflection Holder 2120176	"	"	"	"	"	"	"	"	"	"	"	0.105	
"	Ultra-Violet Trap 2165631	"	"	"	"	"	"	0.50 for 120 hrs.	"	"	"	"	"	
									0.105	"	"	"	"	
15	FAILURE RATE SOURCES (FOR COLUMN 11)				A. ATM-605	B. MIL-HDBK-217A	16	CALCULATED MTBF 324,000 HOURS				17	TOTAL FAILURE RATE 0.309/1000 HOURS	
					c. ASD-R-05-64-1	d. Mil Std 217 Chart XHV								

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**C P L E E Parts Application Analysis**

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**APPENDIX H**

**PARTS APPLICATION ANALYSIS DATA  
FOR  
 $60^\circ$  ANALYZER**

# PARTS APPLICATION ANALYSIS

Page 1 of 4

ATM-798, Appendix H

## RESISTORS

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**DATE:** 2 October 1968  
**SUB ASSEMBLY:** 60° Analyzer Assembly(No. 2-B) **SCHEMATIC NO:** 2166260, Rev. E

(Resistors)

1 CIRCUIT NUMBER	2 TYPE (NAME AND CONSTRUCTION)	3 MANUFACTURER	4 RESISTANCE (OHMS)	5 TOLERANCE (%)	6 POWER RATING (WATTS)	7 MAXIMUM POWER (WATTS)	8 POWER RATIO/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATES (E10-9/HRS) - AT - 50°C - 65°C - 85°C - 100°C - 125°C - 150°C - 175°C - 200°C - 225°C - 250°C - 275°C - 300°C - 325°C - 350°C - 375°C - 400°C - 425°C - 450°C - 475°C - 500°C - 525°C - 550°C - 575°C - 600°C - 625°C - 650°C - 675°C - 700°C - 725°C - 750°C - 775°C - 800°C - 825°C - 850°C - 875°C - 900°C - 925°C - 950°C - 975°C - 1000°C - 1025°C - 1050°C - 1075°C - 1100°C - 1125°C - 1150°C - 1175°C - 1200°C - 1225°C - 1250°C - 1275°C - 1300°C - 1325°C - 1350°C - 1375°C - 1400°C - 1425°C - 1450°C - 1475°C - 1500°C - 1525°C - 1550°C - 1575°C - 1600°C - 1625°C - 1650°C - 1675°C - 1700°C - 1725°C - 1750°C - 1775°C - 1800°C - 1825°C - 1850°C - 1875°C - 1900°C - 1925°C - 1950°C - 1975°C - 2000°C - 2025°C - 2050°C - 2075°C - 2100°C - 2125°C - 2150°C - 2175°C - 2200°C - 2225°C - 2250°C - 2275°C - 2300°C - 2325°C - 2350°C - 2375°C - 2400°C - 2425°C - 2450°C - 2475°C - 2500°C - 2525°C - 2550°C - 2575°C - 2600°C - 2625°C - 2650°C - 2675°C - 2700°C - 2725°C - 2750°C - 2775°C - 2800°C - 2825°C - 2850°C - 2875°C - 2900°C - 2925°C - 2950°C - 2975°C - 3000°C - 3025°C - 3050°C - 3075°C - 3100°C - 3125°C - 3150°C - 3175°C - 3200°C - 3225°C - 3250°C - 3275°C - 3300°C - 3325°C - 3350°C - 3375°C - 3400°C - 3425°C - 3450°C - 3475°C - 3500°C - 3525°C - 3550°C - 3575°C - 3600°C - 3625°C - 3650°C - 3675°C - 3700°C - 3725°C - 3750°C - 3775°C - 3800°C - 3825°C - 3850°C - 3875°C - 3900°C - 3925°C - 3950°C - 3975°C - 4000°C - 4025°C - 4050°C - 4075°C - 4100°C - 4125°C - 4150°C - 4175°C - 4200°C - 4225°C - 4250°C - 4275°C - 4300°C - 4325°C - 4350°C - 4375°C - 4400°C - 4425°C - 4450°C - 4475°C - 4500°C - 4525°C - 4550°C - 4575°C - 4600°C - 4625°C - 4650°C - 4675°C - 4700°C - 4725°C - 4750°C - 4775°C - 4800°C - 4825°C - 4850°C - 4875°C - 4900°C - 4925°C - 4950°C - 4975°C - 5000°C - 5025°C - 5050°C - 5075°C - 5100°C - 5125°C - 5150°C - 5175°C - 5200°C - 5225°C - 5250°C - 5275°C - 5300°C - 5325°C - 5350°C - 5375°C - 5400°C - 5425°C - 5450°C - 5475°C - 5500°C - 5525°C - 5550°C - 5575°C - 5600°C - 5625°C - 5650°C - 5675°C - 5700°C - 5725°C - 5750°C - 5775°C - 5800°C - 5825°C - 5850°C - 5875°C - 5900°C - 5925°C - 5950°C - 5975°C - 6000°C - 6025°C - 6050°C - 6075°C - 6100°C - 6125°C - 6150°C - 6175°C - 6200°C - 6225°C - 6250°C - 6275°C - 6300°C - 6325°C - 6350°C - 6375°C - 6400°C - 6425°C - 6450°C - 6475°C - 6500°C - 6525°C - 6550°C - 6575°C - 6600°C - 6625°C - 6650°C - 6675°C - 6700°C - 6725°C - 6750°C - 6775°C - 6800°C - 6825°C - 6850°C - 6875°C - 6900°C - 6925°C - 6950°C - 6975°C - 7000°C - 7025°C - 7050°C - 7075°C - 7100°C - 7125°C - 7150°C - 7175°C - 7200°C - 7225°C - 7250°C - 7275°C - 7300°C - 7325°C - 7350°C - 7375°C - 7400°C - 7425°C - 7450°C - 7475°C - 7500°C - 7525°C - 7550°C - 7575°C - 7600°C - 7625°C - 7650°C - 7675°C - 7700°C - 7725°C - 7750°C - 7775°C - 7800°C - 7825°C - 7850°C - 7875°C - 7900°C - 7925°C - 7950°C - 7975°C - 8000°C - 8025°C - 8050°C - 8075°C - 8100°C - 8125°C - 8150°C - 8175°C - 8200°C - 8225°C - 8250°C - 8275°C - 8300°C - 8325°C - 8350°C - 8375°C - 8400°C - 8425°C - 8450°C - 8475°C - 8500°C - 8525°C - 8550°C - 8575°C - 8600°C - 8625°C - 8650°C - 8675°C - 8700°C - 8725°C - 8750°C - 8775°C - 8800°C - 8825°C - 8850°C - 8875°C - 8900°C - 8925°C - 8950°C - 8975°C - 9000°C - 9025°C - 9050°C - 9075°C - 9100°C - 9125°C - 9150°C - 9175°C - 9200°C - 9225°C - 9250°C - 9275°C - 9300°C - 9325°C - 9350°C - 9375°C - 9400°C - 9425°C - 9450°C - 9475°C - 9500°C - 9525°C - 9550°C - 9575°C - 9600°C - 9625°C - 9650°C - 9675°C - 9700°C - 9725°C - 9750°C - 9775°C - 9800°C - 9825°C - 9850°C - 9875°C - 9900°C - 9925°C - 9950°C - 9975°C - 10000°C - 10025°C - 10050°C - 10075°C - 10100°C - 10125°C - 10150°C - 10175°C - 10200°C - 10225°C - 10250°C - 10275°C - 10300°C - 10325°C - 10350°C - 10375°C - 10400°C - 10425°C - 10450°C - 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# PARTS APPLICATION ANALYSIS

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## CAPACITORS

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUBASSEMBLY:** 60° Analyzer Assembly(No. 2-B)

**DATE:** 2 October 1968  
**SCHEMATIC NO:** 2166260, Rev. E

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 DESIGNATOR (MIL. AND MFR.)	3 MANUFACTURER	4 CAPACITANCE VALUE mfd	5 TOLERANCE %	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 VOLTAGE RATING/ RATED VOLTAGE	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE (°C)	11 CIRCUIT FUNCTION OR APPLICATION	12 13 14 15 16 17 18 19	BASIC FAILURE RATE (1000 HRS) - USE BELOW - USE BELOW	SPECIAL (OFFERED) FAILURE RATE MULTIPLIER	FINAL FAILURE RATE	TOTAL CAPACITOR COUNT	TOTAL FAILURE RATE (8/1000 HRS)	
C601A	Mica, M106R	Minitan	10	10	6	3	—	0.50	1.0	40	Analyzer Assembly	0.0020 A	Lunar	1.0	0.0020	1	0.0020
C601	Ceramic	Farad Corp.	560pf	"	4KV	—	3K	0.75	"	"	Pre-Amp.	0.0017	"	"	0.0017	6	0.0102
C602	Ceramic, SC-1	MUCON	1pf	"	50	6	0.12	"	"	"	"	0.0004	"	"	0.0004	"	0.0024
20	FAILURE RATE SOURCES (FOR COLUMN #14)										21	CALCULATED MTBF <u>6,850,000</u> HRS				22	TOTAL FAILURE RATE <u>0.0146</u> X 1000 HRS
A	ATM-605	B	C	D													

# PARTS APPLICATION ANALYSIS

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## (SEMICONDUCTORS)

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**DATE:** 2 October 1968  
**SUB ASSEMBLY:** 60° Analyzer Assembly (No. 2-B)  
**SCHEMATIC NO:** 2166260, Rev. E

(Semiconductors)

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANU FAC TUR ER	MAX. TEMP °C			AVG PWR DISSIPATION (mw)			POWER RATIO			MAXIMUM VOLTAGES				DIODE PIV		FOR RELIABILITY USE ONLY															
						RATED AT									ACTUAL			ACTUAL 25°C		ACTUAL		ACTUAL		CIRCUIT FUNCTION		PART SPECIAL ENVIRON- MENT (Define)		RATE (%/ 1000 HRS)		S F M F T C O U I L N I A T U N T		TOTAL FAILURE RATE (%/1000 HRS)	
			AMBIENT	ACTUAL	RATED	JUNCTION	ACTUAL	CASE	AMB	CASE	ACTUAL	AMB	CASE	ACTUAL	AMB or case)	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	ACTUAL	RC	RELATIVE	TEMPERATURE	PER TYPE	PER 1000 HRS)	21	22	23	24	25	26
Q601	EK2484, NPN	Texas Inst.	25	200	—	175	—	—	—	—	21	0.12	—	—	—	—	—	—	—	—	—	—	Preamp Assem- bly	Lunar	0.001	A	1.0001	6	0.006				
CR 601	Reference MC7100	Mic- ro-S.C.	25	200	—	125	—	—	—	—	1.25	0.01	—	—	—	—	—	—	—	—	—	—	Preamp Luna	0.001	A	1.0001	6	0.006					
CR 602	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"		
28 FAILURE RATE SOURCE (See Column 23)			29			NOTE: It is assumed the transient and peak power does not exceed the safe limit.			30			TOTAL FAILURE RATE <u>0.018</u> %/1000 HRS.																					

PS404

BS-321A

# PARTS APPLICATION ANALYSIS

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## (MISC. PARTS)

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUB ASSEMBLY:** 60° Analyzer Assembly(No. 2-B)

**DATE:** 2 October 1968  
**SCHEMATIC NO:** 2166260, Rev. E

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION	MANUFACTURER	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY					
			MAX	MIN	RATED	USE			BASIC FAILURE RATE (%/1000 HOURS) at $-\frac{1}{2}^{\circ}\text{C}$	8 U R C (SEE #15)	9	10	11	12
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
—	Channeltron	BxRL	—	—	—	—	0.50	Preamp Assemblies (6)	0.016	C	Lunar	1.0	0.096	
"	Collector Rod 2166256	"	"	"	"	"	"	Analyzer Assembly	0.036	"	"	"	"	0.036
"	Collector Rod 2166257	"	"	"	"	"	"	"	"	"	"	"	"	"
"	Deflection Holder 2170176	"	"	"	"	"	"	"	"	"	"	"	"	"
"	Ultra-Violet Trap 2165631	"	"	"	"	"	0.50 for 120 hrs	"	0.105	"	"	"	"	0.105
15	FAILURE RATE SOURCES (FOR COLUMN 11)				16				17				0.309	
	A. ATM-605				B. MIL-HDBK-217A				C. ASD-R-05-64-1(G.E.)				TOTAL FAILURE RATE <u>3/1000 HOURS</u>	
	D. MIL Std 217 Chart XXIV				CALCULATED MTBF <u>324,000 HOURS</u>									

DOD Form 9258

BS-321A



**Aerospace  
Systems Division**

CPL EE Parts Application Analysis

NO.	REV. NO.
ATM-798	
PAGE	OF
DATE 10/10/68	

APPENDIX I

PARTS APPLICATION ANALYSIS DATA  
FOR  
ANCILLARY MODULE ASSEMBLY

# PARTS APPLICATION ANALYSIS

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## RESISTORS

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLLE Experiment

**SUB ASSEMBLY:** Ancillary Module Assembly

**DATE:** 30 September 1968  
**SCHEMATIC NO:** 2165405, Rev. C

(Resistors)

1 CIRCUIT NUMBER	2 TYPE (QIN or MFR) AND CONSTRUCTION	3 MANUFACTURER	4 RESISTANCE (OMAS)	5 TOLERANCE	6 POWER (WATT'S)	7 MAXIMUM POWER (WATT'S)	8 POWER RATIO/ RATED	9 MAXIMUM DUTY CYCLE	10 BULK AIR TEMPERATURE °C	11 CIRCUIT FUNCTION OR APPLICATION	12 BASIC FAILURE RATE (10 <sup>-6</sup> /HRS) - A1 (25°C SEE BELOW)	13 ENVIRONMENTAL CONDITIONS (BEFORE)	14 ENVIRONMENTAL CONDITIONS (BEFORE)	15 FAILURE RATE MULTIPLIER	16 FINAL FAILURE RATE (10 <sup>-6</sup> /HRS)	17 TOTAL RESISTOR COUNT PER TYPE	18 TOTAL FAILURE RATE (10 <sup>-6</sup> /HRS)
R701	RNR55C	—	4.02K	1.0	0.1	1	0.01	0.01	40	Temperature Control	0.015	A	Lunar	1.0	0.015	1	0.015
R702	"	"	2.80K	"	"	3	0.03	"	"	"	"	"	"	"	"	"	"
R703	"	"	2.10K	"	"	"	0.01	"	"	"	"	"	"	"	"	"	"
R704	"	"	4.02K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R705	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R706	"	"	2.80K	"	"	3	0.03	"	"	"	"	"	"	"	"	"	"
R707	"	"	2.10K	"	"	1	0.01	"	"	"	"	"	"	"	"	"	"
R708	"	"	4.02K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R712	"	"	7.5K	"	"	9	0.09	"	"	"	"	"	"	"	"	"	"
R713	"	"	10K	"	"	1	0.01	"	"	"	"	"	"	"	"	"	"
R721	"	"	22.1K	"	"	"	"	"	"	Dust Cover Removal	"	"	"	"	"	"	"
R722	"	"	10K	"	"	3	0.03	"	"	"	"	"	"	"	"	"	"
R723	"	"	49.9K	"	"	2	0.02	"	"	"	"	"	"	"	"	"	"
R724	RWR69G	"	4.0	"	2.5	50	"	"	"	"	0.001	"	"	"	0.001	"	0.001
R731	RNR55C	"	10K	"	0.1	41	0.41	1.00	"	Temperature Monitor	0.015	"	"	"	0.015	"	0.015
R732	"	"	2.80K	"	"	1	0.01	"	"	"	"	"	"	"	"	"	"
R733	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
R734	"	"	10K	"	"	"	"	"	"	"	"	"	"	"	"	"	"
19	FAILURE RATE SOURCES (FOR COLUMN #14)								20	CALCULATED MTBF _____ HRS						TOTAL FAILURE RATE _____ %/1000 HRS	
	A ATM-605	B	C	D													

## PARTS APPLICATION ANALYSIS

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PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

## **SUB ASSEMBLY: Ancillary Module Assembly**

DATE: 30 September 1968  
SCHEMATIC NO: 2165405, Rev. C

# PARTS APPLICATION ANALYSIS

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## CAPACITORS

PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUBASSEMBLY: Ancillary Module Assembly

DATE: 30 September 1968  
SCHEMATIC NO: 2165405, Rev. C

(Capacitors)

1 CIRCUIT SYMBOL NUMBER	2 TYPE [AU or MFR] DESIGN CONSTRUCTION	3 MANUFACTURER	4 CAPACITANCE VALUE mfd	5 TOLERANCE	6 MANUFACTURER'S RATED VOLTAGE	7 OPERATING VOLTAGE	8 VOLTAGE RATIO/ OPERATING/ RATED	9 DUTY CYCLE	10 MAXIMUM TEMPERATURE °C	11 BULK AIR TEMPERATURE °C	12 CIRCUIT FUNCTION OR APPLICATION	13 BASIC FAILURE RATE @ 1000 HRS - 14 FAILURE RATE SOURCES 15 ENVIRONMENTAL (DEFINE)	16 FAILURE RATE MULTIPLIER	17 FINAL FAILURE RATE	18 TOTAL COUNT PER TTIA	19 TOTAL FAILURE RATE (@1000 HRS)				
C701	CKR06CW	Aerovox	0.002	10	200	6	-	0.03	0.01	40	Temperature Control	0.0005 A	Lunar	1.0	0.0002	1	0.0002			
C702	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			
C703	CSR13BG	Kemet	18	"	50	27	"	0.54	"	"	"	0.0040 "	"	"	0.0040	"	0.0040			
C704	(Radial M106 lead)	Comp., Inc.	10	20	6	0.9	"	0.15	"	"	"	0.0005 "	"	"	0.0005	"	0.0005			
C705	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"			
C706	CSR13BG	Kemet	"	10	50	29	"	0.58	"	"	"	0.0050 "	"	"	0.0050	"	0.0050			
C721	CKR06CW	Aerovox	0.002	"	200	6	"	0.03	"	"	Dust Cover Removal	0.0002 "	"	"	0.0002	"	0.0002			
C722	(Radial M106 lead)	Comp., Inc.	10	20	6	0.9	"	0.15	"	"	"	"	"	"	"	"	"			
20	FAILURE RATE SOURCES (FOR COLUMN #14)											CALCULATED MTBF <u>9,260,000</u> HRS								
A	ATM-605	B												21	TOTAL FAILURE RATE <u>0.0108</u> ± 1000 HRS					
C		D												22						

## PARTS APPLICATION ANALYSIS

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ATM-798, Appendix I

PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

SUB ASSEMBLY: Ancillary Module Assembly

DATE: 30 September 1968  
SCHEMATIC NO: 2165405, Rev. C

CKT SYM NO.	TYPE DESIGNATION, SEMICONDUCTOR, POLARITY	MANUFACTURER	AMBIENT TEMPERATURE	MAX. TEMP °C				AVG PWR DISSIPATION (mw)					POWER RATIO			MAXIMUM VOLTAGES				DIODE PIV		CIRCUIT FUNCTION or APPLICATION (Define)  (See below)	FOR RELIABILITY USE ONLY																
				RATED AT				25°C					ACTUAL			MAXIMUM		VOLTAGES		DIODE PIV			PART SPECIAL ENVIRON- MENT (Define)	RATE (%/ 1000 HRS)	SOUL- RCB RATE (%/ 1000 HRS)	FATIGUE FAIL- URE LIFE TEST PER TYPE	TOTAL FAILURE RATE (%/ 1000 HRS)												
				ACTUAL	JUNC. THERM.	ACTUAL	CASE	AC CUR-	M	A MBI-	C ASE	AC CUR-	M	A MBI-	C ASE	ACTUAL	RATED 25°C	ACTUAL	RATED TA or TC	V <sub>CB</sub>	V <sub>CB</sub>	V <sub>CEO</sub>	V <sub>CE</sub>	RATE	ACTUAL														
				HOT SPOT	TA	s <sub>TJ</sub>	TC	AMB	CASE	COMBI	TAUENT	AMB	CASE	COMBI	TAUENT	TC	Amb. or case	12	13	14	V	15	V	16	V	17	V	18	V	19	V	20	21						
Q701	2N2912, PNP	Texas Instr	40	200	—	300	1.0W	25	200	3	0.01	—	25	0.51	20	5.5	—	—	Temp. Control	Lunar	0.003 A	1	0.003	1	0.003	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.				
Q702	2N2222A, NPN	" "	" "	" "	500	1.8W	"	175	5	" "	"	75	0.90	40	"	" "	"	"	"	"	"	"	"	"	"	"	"	"	"	"	0.001 "	"	0.001 "	0.001					
Q703	2N2907A, PNP	" "	" "	" "	400	" "	" "	4	" "	"	"	60	1.40	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	0.003 "	"	0.003 "	0.003					
Q704	2N2912, PNP	" "	" "	" "	300	1.0W	"	"	3	" "	"	25	0.51	20	"	" "	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
Q705	2N2222A, NPN	" "	" "	" "	500	1.8W	"	"	5	" "	"	75	0.90	40	"	" "	"	"	"	"	"	"	"	"	"	"	"	"	"	"	0.001 "	"	0.001 "	0.001					
Q706	2N2907A, PNP	" "	" "	" "	400	" "	" "	4	" "	"	"	60	1.40	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	0.003 "	"	0.003 "	0.003					
Q721	2N744, NPN	" "	" "	" "	300	1.0W	"	"	3	" "	"	20	0.80	12	"	" "	"	"	"	Dust Cover Removal	"	"	"	"	"	"	"	"	"	0.001 "	"	0.001 "	0.001						
Q722	" "	" "	" "	" "	" "	" "	" "	6	0.02	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	0.	0.	0.	0.	
Q723	2N2907A, PNP	" "	" "	" "	400	1.8W	"	"	36	0.09	"	75	1.40	40	"	" "	"	"	"	"	"	"	"	"	"	"	"	"	"	0.003 "	"	0.003 "	0.003						
28 FAILURE RATE SOURCE (See Column 23)				29				NOTE: It is assumed the transient and peak power does not exceed the safe limit.																30 TOTAL FAILURE RATE _____ %/1000 HRS.															
A ATM-605				C				NOTE: It is assumed the transient and peak power does not exceed the safe limit.																TOTAL FAILURE RATE _____ %/1000 HRS.															
B				D				NOTE: It is assumed the transient and peak power does not exceed the safe limit.																TOTAL FAILURE RATE _____ %/1000 HRS.															

## PARTS APPLICATION ANALYSIS

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ATM-798, Appendix I

PROJECT: ALSEP

ASSEMBLY: CPIEE Experiment

**SUB ASSEMBLY:** Ancillary Module Assembly

**DATE:** 30 September 1968

SCHEMATIC NO: 2165405, Rev. C

## PARTS APPLICATION ANALYSIS (SEMICONDUCTORS)

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PROJECT: ALSEP  
ASSEMBLY: CPLEE Experiment

**SUB ASSEMBLY:** Ancillary Module Assembly

DATE: 30 September 1968  
SCHEMATIC NO: 2165405, Rev. C

## PARTS APPLICATION ANALYSIS

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PROJECT: ALSEP  
ASSEMBLY: CPLLE Experiment

SUB ASSEMBLY: Ancillary Module Assembly

DATE: 30 September 1968  
SCHEMATIC NO: 21065405, Rev. C

(Relays)

## PARTS APPLICATION ANALYSIS

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ATM-798, Appendix I

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

## **SUB ASSEMBLY: Ancillary Module Assembly**

**DATE:** 30 September 1968  
**SCHEMATIC NO:** 21065405

SCHEMATIC NO: 21065405, Rev. C

### (Connectors)

CIRCUIT, REF. DESIGN- NATION	TYPE DESIGNATION (CEC, MIL OR MFR) AND CONSTRUCTION	M A N U F A C T U R E R	PINS												AMBI- ENT TEMP °C	INSERT MATL	GUIDE	NO. OF INSER- TIONS DURING LIFE	MISCELLA- NEOUS REMARKS	BASIC F A I L U R E R ATE %/1000 Hours (See 24)	S O U R C E O F F.R.	F.R.	TOTAL FAILURE RATE (%/1000 Hours)								
			NUMBER			CURRENT			VOLTAGE																						
			TOTAL	ACTIVE	RATED	MAX.	MIN.	RATED	ACTUAL	BETWEEN PINS	ACROSS THE CONTACT	TRANSIENT	STEADY STATE	SURGE																	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22										
—	Terminals, 3231-1	Cambion	1	1	—	—	—	—	—	—	—	—	—	40	Spr- Brass ing	1	Lunar	.0004	B	.0004											
(THERE ARE 22 OF THESE IN THE ASSEMBLY)																															
23	24	FAILURE RATE SOURCES (FOR COLUMN 20)												25	CALCULATED MTBF _____ HOURS												26				
REQUIRED LIFE HOURS		A ATM-605		B MIL-HDBK-217A		CALCULATED MTBF _____ HOURS												TOTAL FAILURE RATE _____ /1000 HOURS		0.0088											
C		D																													

## PARTS APPLICATION ANALYSIS

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### (MISC. PARTS)

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Ancillary Module Assembly

**DATE:** 30 September 1968  
**SCHEMATIC NO:** 2165405, Rev. C

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION	MANUFACTURER	TEMPERATURE RANGE				ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY				
			MAX		MIN		RATED	USE			BASIC FAILURE RATE (%/1000 HOURS)	O	U	R	C
			1	2	3	4	5	6	7	8	9	10	11	12	E
RT 207	Thermistor, Bead GB42JM4	Fenwell	250	-50	55	0.55	MW	MW	100%	Temperature Monitor	0.060	C	Lunar	1.0	0.060
—	Squib 15E166	Atlas	—	—	2.5W	2.5W	1 operation	Dust Cover Removal	—	—	0.100	C	“	1.0	0.100
—	“	“	“	“	“	“	“	“	“	“	“	“	“	“	“
15	FAILURE RATE SOURCES (FOR COLUMN 11)				16	CALCULATED MTBF _____ HOURS				17	TOTAL FAILURE RATE _____ %/1000 HOURS				0.260
	A. ATM-605	B. MIL-HBDK-217A	c. ASD-R-05-64-1(G, E.)	d. MIL Std 217 Chart XIXV											

DDO Form 925B

BS-321A

**Bendix**

**Aerospace  
Systems Division**

CPLLEE Parts Application Analysis

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**APPENDIX J**

**PARTS APPLICATION ANALYSIS DATA  
FOR  
ELECTRONIC PACKAGE (MISCELLANEOUS PARTS)**

# PARTS APPLICATION ANALYSIS

Page 1 of 1

ATM-798, Appendix J

## (MISC. PARTS)

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

Electronic Package  
**SUB ASSEMBLY:** (Miscellaneous Parts)

**DATE:** 8 October 1968  
**SCHEMATIC NO:** 2166597, Rev. H.

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION	MANUFACTURER	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY				
			MAX	MIN	RATED	USE			BASIC FAILURE RATE (%) / 1000 HOURS	O R C E	PART SPECIAL ENVIRONMENT (DEFINE)	FAIL-URE RATE MULTIPLIER	TOTAL FAILURE RATE (%) / 1000 HOURS
			4	5	6	7			8	9	10	11	12
—	Electrofilm Heater (2106258)	BxRL	—	—	—	—	50%	Double Compartment Assembly (2167060)	0.07	C	Lunar	0.5	0.035
II	II	II	II	II	II	II	II	II	II	II	II	II	II
II	Electrofilm Heater (2160259)	II	II	II	II	II	II	Single Compartment Assembly (2167050)	II	II	II	II	II
II	Thermostat & Bracket (2169814)	II	II	II	II	II	II	Double Compartment Assembly (2167060)	0.03	II	II	1.0	0.030
II	Dual Thermostat & Bracket (2169837)	II	II	II	II	II	II	II	0.06	II	II	II	0.060
15	FAILURE RATE SOURCES (FOR COLUMN 11)				16	CALCULATED MTBF <u>130,000</u> HOURS				17	TOTAL FAILURE RATE <u>0.195</u> %/1000 HOURS		
	A. ATM-605	B. MIL-HDBK-217A											
	C. ASD-R-05-64-1(G.E.)	D. MIL-STD 217 Chart XXIV											

ORD Form 9258

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CPLLEE Parts Application Analysis

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#### APPENDIX K

#### PARTS APPLICATION ANALYSIS DATA FOR STRUCTURAL/MECHANICAL SECTION

# PARTS APPLICATION ANALYSIS

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## (MISC. PARTS)

**PROJECT:** ALSEP  
**ASSEMBLY:** CPLEE Experiment

**SUB ASSEMBLY:** Structural/ Mechanical Section

**DATE:** 10 October 1968  
**SCHEMATIC NO:** 2165701, Rev. C

(Misc. Parts)

CIRCUIT SYMBOL NUMBER	TYPE DESIGNATION (CEC, MIL OR MFR) and CONSTRUCTION	MANUFACTURER	TEMPERATURE RANGE		ELECTRICAL STRESS		PERCENT DUTY CYCLE	MAJOR CHARACTERISTICS and APPLICATION	FOR RELIABILITY USE ONLY					
			MAX	MIN	RATED	USE			BASIC FAILURE RATE (%/1000 HOURS) at - °C (SEE #15)	8 FAILURE RATE (%/1000 HOURS) at + °C (SEE #15)	PART SPECIAL ENVIRONMENT (DEFINE)	FAIL- URE RATE MULTI- PLIER	TOTAL FAILURE RATE (%/1000 HOURS)	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	Mechanical Structure (2165707)	BxRL	-	-	-	-	100%	Housing and Assembly of Experiment	.1100	"	Lunar	1.0	0.1100	
	Dust Cover Assy. (2167322)	"	"	"	"	"	7.8%	Maximum Usage on Moon is 120 hours	.1100	"	"	.078	0.0860	
	Leveling/orienta- tion Support Function (2166021, 2165605)	"	"	"	"	"	100%	Leveling & Orientation of Experiment.	.8565	"	"	1.0	0.8565	
	Cable Assembly (2331505)	"	"	"	"	"	100%	Power junction from central Station to experiments.	.0475	"	"	1.0	0.0475	
15	FAILURE RATE SOURCES (FOR COLUMN 11)							16	CALCULATED MTBF <u>91,000 HOURS</u>			17	TOTAL FAILURE RATE <u>1.109/1000 HOURS</u>	
	A. <u>ATM 605</u>	B. <u>MIL-HDBK-217A</u>	C. <u>ASD-R-05-6A-1(G. E.)</u>	D. <u>Mil Std 217 Chart XXIV</u>										

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