

ELECTRICAL AND THERMAL STRESS DERATING ANALYSIS REPORT

FOR THE

SAM POWER SUPPLY

Prepared by

Sample Company

111 Foothill Blvd. Suite E-156

La Canada Flintridge, California 91011

July 2021

## TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
1.0	INTRODUCTION AND SUMMARY	1
1.1	Scope	1
1.2	Objectives	1
2.0	APPLICABLE DOCUMENTS	2
2.1	Military Documents	2
2.2	Sample Company Documents	2
3.0	DERATING STRESS ANALYSIS REQUIREMENTS	4
3.1	Derating Analysis Requirements	4
3.2	Derating Stress Calculations	4
3.3	Environmental Requirements	4
4.0	DERATING STRESS ANALYSIS	7
4.1	Method of Analysis	7
4.1.1	Junction Temperature Measure of Stress	7
4.1.2	Stress Derating Analysis Data	8
4.1.3	Stress Calculations	8
4.1.4	Stress Analysis Data Format	9
4.1.5	Stress Derating Limits	9
4.2	Stress Analysis Results	9

## TABLE OF CONTENTS

<u>Figure</u>	<u>Title</u>	<u>Page</u>
1	SAM Power Supply Functional Block Diagram	5
<u>Appendix</u>		
A	Electrical and Thermal Stress Derating Analysis Data Tabulation for the SAM Power Supply	A-1

## 1.0 INTRODUCTION AND SUMMARY

This document presents the Sample Company Electrical and Thermal Stress Derating Analysis Report performed on the SAM Power Supply. It was prepared in accordance with MIL-STD-975M, "NASA Standard Electrical, Electronic, and Electromechanical (EEE) Parts List", Appendix A, Derating Criteria.

The results of this analysis indicate that all of the SAM Power Supply parts are within the specified limits of MIL-STD-975M, Appendix A. This statement is fully supported by the parts application and derating stress data presented in the Appendix A of this report.

*This example is not a complete report. The remaining text, mathematical models and detailed appendix data tables will be provided upon the purchase of this report. Continue to scroll down to view example appendix data tables.*

## APPENDIX A

### Electrical and Thermal Stress Derating Analysis Data Tabulation for the SAM Power Supply

RELIABILITY STRESS DERATING ANALYSIS

System: SAM Power Supply

Assembly: Converter

Schematic No.: 30684941

Part Ambient Temperature, Worst Case: 55.00 Degrees Celsius

Environment: SF

Prepared By: J. Smith

Ref. Desig.	Description/ Part Number	Type/ Value	Specification	Electrical and Thermal Stress				Stress Ratio	Remarks
				Maximum Rated	Derating Factor	Derated	Actual	Actual ----- Derated	
U1	Intgrtd Ckt. 54LS00	LSTTL H FP	Mil-Std-883/ Class B-1						Quadruple 2-Input Positive-NAND Gates.
	Parameter:								
	Supply Voltage			5.50	1.00	5.50	5.00	0.9	
	Power Dissipation (Watts)			0.031	1.00	0.031	0.024	0.8	
	Input Voltage			5.50	1.00	5.50	5.00	0.9	
	Junction Temperature (°C.)			175.00	0.57	100.00	55.52	0.6	Tc = 55 °C.; θjc = 22 °C./Watt.
	Output Current (Amperes):								
	Pin 1			0.004	0.80	0.003	0.001	0.3	
	Pin 2			0.004	0.80	0.003	0.001	0.3	
	Pin 3			0.004	0.80	0.003	0.001	0.3	
	Pin 4			0.004	0.80	0.003	0.001	0.3	
U2	Intgrtd Ckt. LM139AJ	LIN BIP H DIP	Mil-Std-883/ Class B-1						Linear, Voltage Comparators.
	Parameter:								
	Supply Voltage			30.00	0.90	27.00	12.00	0.4	
	Power Dissipation (Watts)			0.800	0.75	0.600	0.057	< 0.1	
	Input Voltage			36.00	1.00	36.00	12.00	0.3	
	Junction Temperature (°C.)			150.00	0.67	100.00	56.60	0.6	Tc = 55 °C.; θjc = 28 °C./Watt.
	Output Current (Amperes):								
	Pin 1			0.010	0.80	0.008	0.006	0.8	
	Pin 2			0.010	0.80	0.008	0.006	0.8	
	Pin 3			0.010	0.80	0.008	0.006	0.8	
	Pin 4			0.010	0.80	0.008	0.001	0.1	
CR1	Diode 1N4148-1	General Purpose	Mil-S-19500/ 116 JANTX						
	Parameter:								
	Junction Temperature (°C.)			175.000	0.71	125.000	55.240	0.4	Tc = 55 °C.; θjc = 120 °C./Watt.
	PIV			100.000	0.70	70.000	40.000	0.6	Power Dissipation = .002 Watts.
	Surge Current (Amperes)			0.399	0.50	0.200	0.150	0.8	
	Forward Current (Amperes)			0.160	0.50	0.080	0.002	< 0.1	
VR1	Diode 1N4461	Zener/ Avalnch	Mil-S-19500/ 406 JANTX						Iz Derated (Amps.) = Iz Nom. + 0.5(Iz Max. - Iz Nom.) Iz Nom. = 0.1668, Iz Max. = 0.5243
	Parameter:								
	Junction Temperature (°C.)			175.000	0.71	125.000	55.850	0.4	Tc = 55 °C.; θjc = 125 °C./Watt.
	Power (Watts)			1.192	0.50	0.596	0.007	< 0.1	
	Zener Current (Amperes)			0.524	0.66	0.346	0.001	< 0.1	
Q1	Transistor 2N2222A	NPN/PNP	Mil-S-19500/ 225 JANTX						
	Parameter:								
	Junction Temperature (°C.)			150.000	0.83	125.000	55.210	0.4	Tc = 55 °C.; θjc = 70 °C./Watt.
	Power (Watts)			0.379	0.50	0.190	0.003	< 0.1	
	Voltage			50.000	0.75	37.500	25.000	0.7	
	Current (Amperes)			0.607	0.75	0.455	0.003	< 0.1	
Q2	Transistor 2N2907A	NPN/PNP	Mil-S-19500/ 291 JANTX						
	Parameter:								
	Junction Temperature (°C.)			150.000	0.83	125.000	56.411	0.5	Tc = 55 °C.; θjc = 98 °C./Watt.
	Power (Watts)			0.299	0.50	0.150	0.014	< 0.1	
	Voltage			60.000	0.75	45.000	37.000	0.8	
	Current (Amperes)			0.449	0.75	0.337	0.009	< 0.1	
R1	Resistor RCR07G102JS	1.00K Ohms	Mil-R-39008, S Insld Fxd Comp						
	Parameter:								
	Maximum Operating Temp. (°C.)			130.000	1.00	130.000	55.000	0.4	
	Power (Watts)			0.250	0.60	0.150	0.001	< 0.1	
	Voltage			15.811	0.80	12.649	1.000	< 0.1	

RELIABILITY STRESS DERATING ANALYSIS

System: SAM Power Supply

Assembly: Converter

Schematic No.: 30684941

Part Ambient Temperature, Worst Case: 55.00 Degrees Celsius

Environment: SF

Prepared By: J. Smith

Ref. Desig.	Description/ Part Number	Type/ Value	Specification	Electrical and Thermal Stress				Stress Ratio	Remarks
				Maximum Rated	Derating Factor	Derated	Actual	Actual ----- Derated	
R2	Resistor RWR74S1210FP	121.00 Ohms	Mil-R-39007, P Power Fixed WW						
	Parameter:								
	Maximum Operating Temp. (°C.)			275.000	1.00	275.000	55.000	0.2	
	Power (Watts)			5.000	0.50	2.486	0.065	< 0.1	
	Voltage			23.074	0.80	18.459	2.804	0.2	
R3	Resistor RJR24FW501P	500.00 Ohms	Mil-R-39035, P Trimmer NonWW						
	Parameter:								
	Maximum Operating Temp. (°C.)			150.000	1.00	150.000	55.000	0.4	
	Power (Watts)			0.500	0.60	0.300	0.004	< 0.1	
	Voltage			2.230	0.80	1.784	1.414	0.8	
R4	Resistor M83401/01	50.00 Ohms	Mil-R-83401, Mil Netwrk Fxd Film						
	Parameter:								
	Maximum Operating Temp. (°C.)			125.000	1.00	125.000	55.000	0.4	
	Power (Watts)			1.750	0.60	1.050	0.800	0.8	
	Voltage			9.354	0.80	7.483	6.325	0.8	
C1	Capacitor CKR06BX104KP	100.00 nF	Mil-C-39014, P Ceramc, Gen. Pur.						
	Parameter:								
	Maximum Operating Temp. (°C.)			85.000	1.00	85.000	55.000	0.6	
	Voltage			100.00	0.60	60.00	25.00	0.4	
C2	Capacitor CMR06F471JPDP	470.00 pF	Mil-C-39001, P Mica, Dipped						
	Parameter:								
	Maximum Operating Temp. (°C.)			125.000	1.00	125.000	55.000	0.4	
	Voltage			500.00	0.50	250.00	24.00	< 0.1	
C3	Capacitor CLR73BH330KGP	33.00 uF	Mil-C-39006, P Tntlm Elctrylctc						Slug, Hermetic Construction.
	Parameter:								
	Maximum Operating Temp. (°C.)			125.000	0.88	110.000	55.000	0.5	
	Voltage			30.00	0.60	18.00	12.00	0.7	
C4	Capacitor CSR13F476KP	47.00 uF	Mil-C-39003, P Tntlm Elctrylctc						
	Parameter:								
	Maximum Operating Temp. (°C.)			125.000	0.88	110.000	55.000	0.5	
	Voltage			35.00	0.50	17.50	12.00	0.7	
T1	Transformer TF4R03GA203	Power	Mil-T-27 ,Mil Audio, Pwr, HiPwr						
	Parameter:								
	Maximum Operating Temp. (°C.)			130.00	0.81	105.000	75.000	0.7	
	Voltage			200.000	0.50	100.000	85.000	0.9	
L1	Coil CL3500GA203	Variabl	Mil-C-15305, Mil Fxd and Var, RF						
	Parameter:								
	Maximum Operating Temp. (°C.)			125.00	0.84	105.000	75.000	0.7	
	Voltage			200.000	0.50	100.000	85.000	0.9	
J1	Connector G06 Series	20 Ga.	Mil-C-24308, Mil Rack and Panel						22 Active Contacts.
	Parameter:								
	Current per Contact (Amperes)					3.700	0.400	0.1	Applied stress of less than 50 volts is negligible.