Classification : Report	Reliability Prediction Report

Reliability Prediction Report

The details of the system are as follows :

1. Date : 2004-10-11
2. Model : SS100 v1.0
3. Quantity : 1
4. Analyst : SENA

5. Results

Name	Failure Rate	MTBF	Remark
SS100 v1.0	0.761049 Fits	1,313,976 Hours	150.00 years

* Failure Rate Unit = Failure Per Million Hour(10^6)

Standard : MIL-HDBK-217F Notice2 Failure Distribution : Exponential Operating Temperature : 25 °C Operating Stress : 50% (Voltage, Current, Power)

Reliability Prediction Report

Contents

I. Purpose

A reliability prediction is simply the analysis of parts and components in an effort to predict the rate at which an item will fail. A reliability prediction is one of the most common forms of reliability analyses. These predictions can help development engineers make decisions about component selection, stress levels and different designs.

II. Terms

1. MTBF (Mean Time Between Failure)

The average between failure occurrences. The sum of the operating time of a machine divided by the total number of failures.

2. MTTF (Mean Time To Failure)

A basic measure of system reliability for non-repairable items: The total number of life units of an item divided by the total number of failures within that population, during a particular measurement interval under stated conditions.

3. Failure

An event when machinery/equipment is not available to produce parts at specified conditions when scheduled or is not capable of producing parts or perform scheduled operations to specification. For every failure, an action is required.

4. Failure Rate

Number of failures per unit of gross operating period in terms of time, events, cycles, or number of parts.

5. Reliability

The probability that machinery/equipment can perform continuously, without failure, for a specified interval of time when operating under stated conditions.

6. Availability

A measure of the degree to which machinery/equipment is in an operable and committable state at any point in time. Specifically, the percent of time that machinery/equipment will be operable when needed.

III. Analysis Methods

1) Model : MIL-HDBK-217

This handbook contains two methods of reliability prediction such as Part Stress Analysis and part Count. These methods vary in degree of information needed to apply them

1-1) Part Stress Methods

Part Stress Analysis Methods requires a greater amount of detailed information and is applicable during the later design phase when actual hardware and circuits being designed.

1-2) Parts Count Methods

Parts Count Methods required less information, generally part quantities, quality level and the application environment. The Parts Count Methods will usally result in a more conservative estimate of system reliability than the Parts Stress Method.

1-3) equation for calculation

MIL-HDBK-217F Gate/Logic Arrays and Microprocessor Equations

$$\lambda_P = (C_1\pi_T + C_2\pi_E)\pi_Q\pi_L$$

where:

$C_1 =$	Die Complexity Failure Rate
$\pi_T =$	Temperature Factor
$C_2 =$	Package Failure Rate
$\pi_E =$	Environment Factor
$\pi_Q =$	Quality Factor
$\pi_L =$	Learning Factor

MIL-HDBK-217F Memories Equations

$$\lambda_P = (C_1\pi_T + C_2\pi_E + \lambda_{cyc})\pi_Q\pi_L$$

where:

$C_1 =$	Die Complexity Failure Rate
$\pi_T =$	Temperature Factor
$C_2 =$	Package Failure Rate
$\pi_E =$	Environment Factor
$\lambda_{cyc} =$	EEPROM Read/Write Cycling Induced Failure Rate
$\pi_Q =$	Quality Factor
$\pi_L =$	Learning Factor

MIL-HDBK-217F VHSIC/VHSIC-Like and VLSI CMOS Equations

$$\lambda_P = \lambda_{BD}\pi_{MFG}\pi_T\pi_{CD} + \lambda_{BP}\pi_E\pi_Q\pi_{PT} + \lambda_{EOS}$$

where:

λ_{BD} =	Die Base Failure Rate
π_{MFG} =	Manufacturing Process Correction Factor
π_T =	Temperature Factor
π_{CD} =	Die Complexity Correction Factor
λ_{BP} =	Package Base Failure Rate
π_E =	Environment Factor
π_Q =	Quality Factor
π_{PT} =	Package Type Correction Factor
λ_{EOS} =	Electrical Overstress Failure Rate

MIL-HDBK-217F GaAs MMIC and Digital Devices Equations

$$\lambda_P = (C_1\pi_T\pi_A + C_2\pi_E)\pi_L\pi_Q$$

where:

C_1 =	Die Complexity Failure Rate
π_T =	Temperature Factor
π_A =	Device Application Factor
C_2 =	Package Failure Rate
π_E =	Environment Factor
π_L =	Learning Factor
π_Q =	Quality Factor

Failure Rate(λ) = $1X10^6$ Hours

MTBF=1/λ

2) Model : Bellcore(Telcordia) TR-332

The Bellcore reliability prediction model was originally developed by AT&T Bell Labs. Bell Labs modified the equations from MIL-HDBK-217 to better represent what their equipment was experiencing in the field. The main concepts between MIL-HDBK-217 and Bellcore were very similar, but Bellcore added the ability to take into account burn-in, field, and laboratory testing. This added ability has made the Bellcore standard very popular with commercial organizations. The current version of Telcordia is Issue 1, and follows Bellcore Issue 6 in order of release. Telcordia Issue 1 was released in May 2001.
Telcordia also supports the ability to perform a parts count or part stress analysis, but in Telcordia, these different calculations are referred to as Calculation Methods. Telcordia offers ten different Calculation Methods. Each of these Methods is designed to take into account different information. This information can include stress data, burn-in data, field data, or laboratory test data.

Failure Rate(λ)= $1X10^9$ Hours (FITs)
MTBF=1/λ

Bellcore Method I – Case 1 Equations

Device Steady-State Failure rate = λ_{SSi}

$$\lambda_{SSi} = \lambda_{Gi}\pi_{Qi}\pi_{Si}\pi_{Ti}$$

where:

λ_{Gi} =	Generic steady-state failure rate for the *ith* device
π_{Qi} =	Quality Factor for the *ith* device
π_{Si} =	Stress Factor = based on 50% stress (value of 1.0)
π_{Ti} =	Temperature Factor = based on 40°C temperature (value of 1.0)

Bellcore Method I – Case 2 Equations

Same as Method 1 – Case 1 above.

Bellcore Method I – Case 3 Equations

Device Steady-State Failure rate = λ_{SSi}

$$\lambda_{\mathrm{SSi}} = \lambda_{\mathrm{Gi}}\pi_{\mathrm{Qi}}\pi_{\mathrm{Si}}\pi_{\mathrm{Ti}}$$

where:

$\lambda_{\mathrm{Gi}} =$	Generic steady-state failure rate for the *ith* device
$\pi_{\mathrm{Qi}} =$	Quality Factor for the *ith* device
$\pi_{\mathrm{Si}} =$	Stress Factor for the *ith* device
$\pi_{\mathrm{Ti}} =$	Temperature Factor for the *ith* device due to normal operating temperature during the steady state

Bellcore Method II Equations

Method II Equations are based on the same basic principles as Method I. The calculation of the Device Steady-State Failure rate (λ_{SSi}) is the same as Method I with the only difference being the possible calculation of λ_{Gi}^{*}. The basic equation is as follows:

$$\lambda_{\mathrm{SSi}} = \lambda_{\mathrm{Gi}}^{*}\pi_{\mathrm{Qi}}\pi_{\mathrm{Si}}\pi_{\mathrm{Ti}}$$

where:

$\lambda_{\mathrm{Gi}}^{*} =$	Base steady-state failure rate for the *ith* device
$\pi_{\mathrm{Qi}} =$	Quality Factor for the *ith* device
$\pi_{\mathrm{Si}} =$	Stress Factor for the *ith* device
$\pi_{\mathrm{Ti}} =$	Temperature Factor for the *ith* device due to normal operating temperature during the steady state

The basis for the calculation of λ^*_{Gi} is outlined below for each different case:

Bellcore Method II – Case L1 Equations

If $T_1 \le 10{,}000$, then:

$$\lambda^*_{\mathrm{Gi}} = [2 + \mathrm{n}] \;/\; [(2/\lambda_{\mathrm{Gi}}) + (4 \times 10^{-6})\mathrm{N}_0(\mathrm{T}_1)^{0.25}\pi_{\mathrm{Q}}]$$

If $T_1 > 10{,}000$, then:

$$\lambda^*_{\mathrm{Gi}} = [2 + \mathrm{n}] \;/\; [(2/\lambda_{\mathrm{Gi}}) + ((3 \times 10^{-5}) + (\mathrm{T}_1 \times 10^{-9}))\mathrm{N}_0\pi_{\mathrm{Q}}]$$

where:

$n =$	The number of failures in the laboratory test
$\lambda_{\mathrm{Gi}} =$	Generic steady-state failure rate for the *ith* device
$\mathrm{N}_0 =$	Number of devices on test
$\mathrm{T}_1 =$	Effective time on test in hours
$\pi_{\mathrm{Q}} =$	Device Quality Factor

Bellcore Method II – Case L2 Equations

If $T_1 \le 10{,}000$, then:

$$\lambda^*_{\mathrm{Gi}} = [2 + \mathrm{n}] / [(2/\lambda_{\mathrm{G}}) + (4 \times 10^{-6})\mathrm{N}_0(\mathrm{T}_1)^{0.25}]$$

If $T_1 > 10{,}000$, then:

$$\lambda^*_{\mathrm{Gi}} = [2 + \mathrm{n}] \;/\; [(2/\lambda_{\mathrm{G}}) + ((3 \times 10^{-5}) + (\mathrm{T}_1 \times 10^{-9}))\mathrm{N}_0]$$

where:

$n =$	The number of failures in the laboratory test
$\lambda_{\mathrm{G}} =$	Generic failure rate
$\mathrm{N}_0 =$	Number of units on test
$\mathrm{T}_1 =$	Effective time on test in hours

Bellcore Method II – Case L3 Equations

$$\lambda_{Gi}^{*} = [2 + n] \; / \; [(2/\lambda_{Gi}) + (4 \times 10^{-6}) N_0 W \pi_Q]$$

where:

$n =$	The number of failures in the laboratory test
$\lambda_{Gi} =$	Generic steady-state failure rate for the *ith* device
$N_0 =$	Number of devices on test
$\pi_Q =$	Device Quality Factor
$W =$	Special time factor

If $T_1 + T_e \leq 10{,}000$, then: $W = (T_1 + T_e)^{0.25} - T_e^{0.25}$

If $T_1 + T_e > 10{,}000 \geq T_e$, then:

$$W = ((T_1 + T_e)/4000) + 7.5 - T_e^{0.25}$$

If $T_e > 10{,}000$, then: $W = T_1 / 4000$

where:

$T_1 =$	The effective time on test
$T_e =$	Total effective burn-in time for devices as defined: $T_e = A_{b,d} t_{b,d}$ where: $A_{b,d}$ = temperature acceleration factor due to device burn-in $t_{b,d}$ = device burn-in time (hours)
$N_0 =$	Number of devices on test
$\pi_Q =$	Device Quality Factor
$W =$	Special time factor

Bellcore Method II – Case L4 Equations

$$\lambda^*_{Gi} = [2 + n] \ / \ [(2/\lambda_{Gi}) + (4 \times 10^{-6})N_0 W]$$

where:

$n =$	The number of failures in the laboratory
$\lambda_{Gi} =$	Generic steady-state failure rate for the
$N_0 =$	Number of devices on test
$W =$	Special time factor

If $T_1 + T_e \le 10{,}000$, then: $W = (T_1 + T_e)^{0.25} - T_e^{0.25}$

If $T_1 + T_e > 10{,}000 \ge T_e$, then:

$$W = ((T_1 + T_e)/4000) + 7.5 - T_e^{0.25}$$

If $T_e > 10{,}000$, then: $W = T_1 / 4000$

where:

W = Special time factor

Bellcore Method III Equations

Due to the complexity and detail of the calculations for Method III, the equations have not been included for reference here. Refer to the Bellcore "Reliability Prediction Procedure for Electronic Equipment" for all details regarding Method III equations.

RDF 2000

RDF 2000 is the new version of the CNET UTEC80810 reliability prediction standard that covers most of the same components as MIL-HDBK-217. The models take into account power on/off cycling as well as temperature cycling and are very complex with predictions for integrated circuits requiring information on equipment outside ambient and print circuit ambient temperatures, type of technology, number of transistors, year of manufacture, junction temperature, working time ratio, storage time ratio, thermal expansion characteristics, number of thermal cycles, thermal amplitude of variation, application of the device, as well as per transistor, technology related and package related base failure rates. As this standard becomes more widely used it could become the international successor to the US MIL-HDBK-217

NPRD-95 data

NPRD-95 data provides failure rates for a wide variety of items, including mechanical and electromechanical parts and assemblies. The document provides detailed failure rate data on over 25,000 parts for numerous part categories grouped by environment and quality level. Because the data does not include time-to-failure, the document is forced to report average failure rates to account for both defects and wearout. Cumulatively, the database represents approximately 2.5 trillion part hours and 387,000 failures accumulated from the early 1970's through 1994. The environments addressed include the same ones covered by MIL-HDBK-217; however, data is often very limited for some environments and specific part types. For these cases, it then becomes necessary to use the "rolled up" estimates provided, which make use of all data available for a broader class of parts and environments. Although the data book approach is generally thought to be less desirable, it remains an economical means of estimating "ballpark" reliability for mechanical components.

Reliability Prediction Report

Part Number	SS100 V1.0
Date	2004 10, 11
Environment	GB, GC
Temperature	25

MIL-HDBK-217FN2

Failure Rate	0.761049
MTBF	1,313,976

Assembly Name	Part Number	Ref Des	Qty	Failure Rate	MTBF	Reliability
SS100 V1.0	SS100 V1.0	SS100 V1.0	1.00	0.761049	1,313,976	.9999

Reliability Prediction Report

Part Number	SS100 V1.0
Date	2004 10, 11
Environment	GB, GC
Temperature	25

MIL-HDBK-217FN2

Failure Rate	0.761049
MTBF	1,313,976

Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
XPC855TZP50D4	CPU,PBGA357,Stepping D4	Integrated Circuit	C1: 0.140000 C2: 0.015045 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 2.000000 Pi T: 0.597863 Model Failure Rate: 0.182446	1.00	.18	5,481,062.96
SX-6	Crystal,25.000Mhz, ±30ppm, SMD	Miscellaneous	Lambda B: 0.027256 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.000000 Model Failure Rate: 0.027256	1.00	.03	36,688,541.36
SCO-103	Oscillator,5.000Mhz, ±30ppm, SMD	Other	Model Failure Rate: 0.062560	1.00	.06	15,984,750.49
HY57V281620HCT-H	Dram Memory,SDRAM 16MB, TSOP54	Integrated Circuit	C1: 0.010000 C2: 0.010235 Lambda Cyc: 0.000000 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 2.000000 Pi T: 0.100000 Model Failure Rate: 0.012235	2.00	.02	40,866,299.43
AM29DL640G-90EI	Flash Memory,8MB, TSOP48	Integrated Circuit	C1: 0.006800 C2: 0.015045 Lambda Cyc: 0.000000 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 10.000000 Pi T: 0.100000 Model Failure Rate: 0.082023	1.00	.08	12,191,646.29

Reliability Prediction Report

Part Number	SS100 V1.0		
Date	2004 10, 11	MIL-HDBK-217FN2	
Environment	GB, GC	Failure Rate	0.761049
Temperature	25	MTBF	1,313,976

Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
LXT972ALC A4	IC-Custom,Ethernet Tranceiver, LQFP64	Integrated Circuit	C1: 0.002500 C2: 0.005593 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 2.000000 Pi T: 0.100000 Model Failure Rate: 0.006093	1.00	6.09e-003	164,135,671.12
LM1117MPX-3.3	IC-Regulator,Dropout Regulator, 800mA, SOT223	Integrated Circuit	C1: 0.010000 C2: 0.004841 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 2.000000 Pi T: 0.100000 Model Failure Rate: 0.006841	1.00	6.84e-003	146,167,639.98
MAX708TCUA	IC-Reset,Voltage monitor,SOIC8	Integrated Circuit	C1: 0.010000 C2: 0.004841 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 2.000000 Pi T: 0.100000 Model Failure Rate: 0.006841	1.00	6.84e-003	146,167,639.98

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Part Number	SS100 V1.0
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MIL-HDBK-217FN2

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Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
AT24C01A-10SC-2.7	EEprom Serial,1Kbit, SOIC8	Integrated Circuit	C1: 0.000850 C2: 0.002645 Lambda Cyc: 0.003194 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 1.000000 Pi T: 0.100000 Model Failure Rate: 0.004602	1.00	4.60e-003	217,318,634.10
SP3243ECA	IC-RS232, SSOP28	Integrated Circuit	C1: 0.010000 C2: 0.010235 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 1.000000 Pi T: 0.100000 Model Failure Rate: 0.006118	1.00	6.12e-003	163,465,197.70
SP3485CN	IC-RS485, SOIC8	Integrated Circuit	C1: 0.010000 C2: 0.010235 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 1.000000 Pi T: 0.100000 Model Failure Rate: 0.006118	2.00	.01	81,732,598.85

Reliability Prediction Report

Part Number SS100 V1.0
Date 2004 10, 11
Environment GB, GC
Temperature 25

MIL-HDBK-217FN2
Failure Rate 0.761049
MTBF 1,313,976

Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
74LCX16244MTD	IC-TTL,Buffer, TSSOP48	Integrated Circuit	C1: 0.002500 C2: 0.018319 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 2.000000 Pi T: 0.100000 Model Failure Rate: 0.018819	1.00	.02	53,138,166.81
74LCX14MTC	IC-TTL,Inverter, TSSOP14	Integrated Circuit	C1: 0.002500 C2: 0.006225 Pi E: 0.500000 Pi FY: 4.000000 Pi L: 1.000000 Pi Q: 2.000000 Pi T: 0.100000 Model Failure Rate: 0.006725	1.00	6.72e-003	148,704,772.40
SMDA15C-8.TB	IC	Semiconductor	Lambda B: 0.001300 Pi C: 1.000000 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.000000 Pi S: 1.000000 Pi T: 1.000000 Model Failure Rate: 0.001300	1.00	1.30e-003	769,230,769.23
BL-R5132B	LED Diode 2x5x7mm, Red, DIP	Semiconductor	Lambda B: 0.000230 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.000000 Pi T: 1.000000 Model Failure Rate: 0.000230	1.00	2.30e-004	4,347,826,086.96

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MIL-HDBK-217FN2

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Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
BL-R2132B	LED Diode 2x5x7mm, Green, DIP	Semiconductor	Lambda B: 0.000230 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.000000 Pi T: 1.000000 Model Failure Rate: 0.000230	2.00	4.60e-004	2,173,913,043.48
BL-R3132B	LED Diode 2x5x7mm, Yellow, DIP	Semiconductor	Lambda B: 0.000230 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.000000 Pi T: 1.000000 Model Failure Rate: 0.000230	2.00	4.60e-004	2,173,913,043.48
SAM5280 / BYCOLOR	LED Diode 2x5x7mm, 2color Red/Green, DIP	Semiconductor	Lambda B: 0.000230 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.000000 Pi T: 1.000000 Model Failure Rate: 0.000230	1.00	2.30e-004	4,347,826,086.96
LED HOLDER	LED Holder 7mm, 2pin holder	Other	Model Failure Rate: 0.000800	5.00	4.00e-003	250,000,000.00
LED HOLDER	LED Holder 5mm, 2pin holder	Other	Model Failure Rate: 0.000800	1.00	8.00e-004	1,250,000,000.00
CM1608K-301T02	SMD Bead 1608, Bead, 300?	Inductor	Lambda B: 0.000030 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.000000 Pi T: 1.000000 Model Failure Rate: 0.000030	8.00	2.40e-004	4,166,666,666.67
CM1608K-601T02	SMD Bead 1608, Bead, 600?	Inductor	Lambda B: 0.000030 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.000000 Pi T: 1.000000 Model Failure Rate: 0.000030	3.00	9.00e-005	11,111,111,111.11

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MIL-HDBK-217FN2
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MTBF 1,313,976

Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
CM1608K-102T02	SMD Bead 1608, Bead, 1?	Inductor	Lambda B: 0.000030 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.000000 Pi T: 1.000000 Model Failure Rate: 0.000030	7.00	2.10e-004	4,761,904,761.90
10? , 6.3V	SMD Capacitor 10? , 6.3V, 3216(A) Tantal	Capacitor	Lambda B: 0.000400 Pi C: 1.698244 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.001015 Model Failure Rate: 0.001020	9.00	9.18e-003	108,934,557.23
10? , 10V	SMD Capacitor 10? , 10V, 3216(A) Tantal	Capacitor	Lambda B: 0.000400 Pi C: 1.698244 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.001015 Model Failure Rate: 0.001020	1.00	1.02e-003	980,411,015.05

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MIL-HDBK-217FN2

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Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
100? , 16V	SMD Capacitor 100? , 16V, 7343(D) Tantal	Capacitor	Lambda B: 0.000400 Pi C: 2.884032 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.001015 Model Failure Rate: 0.001732	1.00	1.73e-003	577,308,805.85
0.01?	SMD Capacitor 1608, 0.01? , 16V	Capacitor	Lambda B: 0.002000 Pi C: 0.660693 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.296296 Model Failure Rate: 0.002569	15.00	.04	25,946,764.31
0.1?	SMD Capacitor 1608, 0.1? , 16V	Capacitor	Lambda B: 0.002000 Pi C: 0.812831 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.296296 Model Failure Rate: 0.003161	29.00	.09	10,908,787.12

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MIL-HDBK-217FN2
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Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
10?	SMD Capacitor 1608, 10? , 50V	Capacitor	Lambda B: 0.002000 Pi C: 0.354813 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.296296 Model Failure Rate: 0.001380	1.00	1.38e-003	724,727,039.47
18?	SMD Capacitor 1608, 18? , 50V	Capacitor	Lambda B: 0.002000 Pi C: 0.374089 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.296296 Model Failure Rate: 0.001455	2.00	2.91e-003	343,692,412.02
20?	SMD Capacitor 1608, 20? , 50V	Capacitor	Lambda B: 0.002000 Pi C: 0.377653 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.296296 Model Failure Rate: 0.001469	1.00	1.47e-003	680,897,540.55

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MIL-HDBK-217FN2
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Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
33?	SMD Capacitor 1608, 33? , 50V	Capacitor	Lambda B: 0.002000 Pi C: 0.395063 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.296296 Model Failure Rate: 0.001536	8.00	.01	81,361,364.51
270?	SMD Capacitor 1608, 270? , 50V	Capacitor	Lambda B: 0.002000 Pi C: 0.477334 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.296296 Model Failure Rate: 0.001856	2.00	3.71e-003	269,352,946.45
0.001?	Capacitor Surge 0.001? , 2KV, DIP 7.5mm	Capacitor	Lambda B: 0.002000 Pi C: 0.537032 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.500000 Pi SR: 1.000000 Pi T: 1.000000 Pi V: 1.296296 Model Failure Rate: 0.002088	1.00	2.09e-003	478,822,404.52

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Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
8.2MH	Power Inductor 8.2mH, DIP 5mm	Inductor	Lambda B: 0.000030 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 1.000000 Pi T: 1.000000 Model Failure Rate: 0.000030	1.00	3.00e-005	33,333,333,333.33
LL4148	SMD Diode Switching 100V, MiniMELF	Semiconductor	Lambda B: 0.001000 Pi C: 1.000000 Pi E: 1.000000 Pi FY: 4.000000 Pi Q: 5.500000 Pi S: 0.420328 Pi T: 1.000000 Model Failure Rate: 0.002312	1.00	2.31e-003	432,562,705.86
0?	SMD Resistor 1608, 0? , 5%, 1/16W	Resistor	Lambda B: 0.003700 Pi E: 1.000000 Pi FY: 4.000000 Pi P: 0.017509 Pi Q: 1.000000 Pi S: 0.710000 Pi T: 1.000000 Model Failure Rate: 4.59962E-5	3.00	1.38e-004	7,246,968,143.39
100?	SMD Resistor 1608, 100? , 5%, 1/16W	Resistor	Lambda B: 0.003700 Pi E: 1.000000 Pi FY: 4.000000 Pi P: 0.017509 Pi Q: 1.000000 Pi S: 0.710000 Pi T: 1.000000 Model Failure Rate: 4.59962E-5	1.00	4.60e-005	21,740,904,430.16

Reliability Prediction Report

Part Number	SS100 V1.0
Date	2004 10, 11
Environment	GB, GC
Temperature	25

MIL-HDBK-217FN2

Failure Rate	0.761049
MTBF	1,313,976

Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
10?	SMD Resistor 1608, 10? , 5%, 1/16W	Resistor	Lambda B: 0.003700 Pi E: 1.000000 Pi FY: 4.000000 Pi P: 0.017509 Pi Q: 1.000000 Pi S: 0.710000 Pi T: 1.000000 Model Failure Rate: 4.59962E-5	40.00	1.84e-003	543,522,610.75
1?	SMD Resistor 1608, 1? , 5%, 1/16W	Resistor	Lambda B: 0.003700 Pi E: 1.000000 Pi FY: 4.000000 Pi P: 0.042980 Pi Q: 1.000000 Pi S: 0.710001 Pi T: 1.000000 Model Failure Rate: 1.12907E-4	13.00	1.47e-003	681,292,962.41
22.1?	SMD Resistor 1608, 22.1? , 1%, 1/16W	Resistor	Lambda B: 0.003700 Pi E: 1.000000 Pi FY: 4.000000 Pi P: 0.009370 Pi Q: 1.000000 Pi S: 0.710000 Pi T: 1.000000 Model Failure Rate: 2.46152E-5	1.00	2.46e-005	40,625,348,297.21
220?	SMD Resistor 1608, 220? , 5%, 1/16W	Resistor	Lambda B: 0.003700 Pi E: 1.000000 Pi FY: 4.000000 Pi P: 0.017509 Pi Q: 1.000000 Pi S: 0.710000 Pi T: 1.000000 Model Failure Rate: 4.59962E-5	7.00	3.22e-004	3,105,843,490.02

Reliability Prediction Report

Part Number	SS100 V1.0
Date	2004 10, 11
Environment	GB, GC
Temperature	25

MIL-HDBK-217FN2

Failure Rate	0.761049
MTBF	1,313,976

Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
22?	SMD Resistor 1608, 22? , 5%, 1/16W	Resistor	Lambda B: 0.003700 Pi E: 1.000000 Pi FY: 4.000000 Pi P: 0.017509 Pi Q: 1.000000 Pi S: 0.710000 Pi T: 1.000000 Model Failure Rate: 4.59962E-5	4.00	1.84e-004	5,435,226,107.54
4.7?	SMD Resistor 1608, 4.7? , 5%, 1/16W	Resistor	Lambda B: 0.003700 Pi E: 1.000000 Pi FY: 4.000000 Pi P: 0.017509 Pi Q: 1.000000 Pi S: 0.710000 Pi T: 1.000000 Model Failure Rate: 4.59962E-5	5.00	2.30e-004	4,348,180,886.03
49.9?	SMD Resistor 1608, 49.9? , 1%, 1/16W	Resistor	Lambda B: 0.003700 Pi E: 1.000000 Pi FY: 4.000000 Pi P: 0.009370 Pi Q: 1.000000 Pi S: 0.710000 Pi T: 1.000000 Model Failure Rate: 2.46152E-5	5.00	1.23e-004	8,125,069,659.44
SOCKET-JUMPER	Socket-Jumper 1x4pin, DIP 2.54mm, male	Other	Model Failure Rate: 0.009319	1.00	9.32e-003	107,302,000.00
SOCKET-JUMPER	Socket-Jumper 2x5pin, DIP 2.54mm	Other	Model Failure Rate: 0.009319	1.00	9.32e-003	107,302,000.00
5569-02A2	Socket-Jack Power Jack	Other	Model Failure Rate: 0.004576	1.00	4.58e-003	218,551,700.00

Reliability Prediction Report

Part Number	SS100 V1.0		
Date	2004 10, 11	MIL-HDBK-217FN2	
Environment	GB, GC	Failure Rate	0.761049
Temperature	25	MTBF	1,313,976

Part Number	Description	Category	Pi Factors	Qty	Failure Rate	MTBF
STP-1236A	Switch Push Tact Switch, DIP, Right Angle	Switching Device	Lambda B: 0.100000 Pi C: 1.000000 Pi E: 1.000000 Pi FY: 4.000000 Pi L: 1.003914 Pi Q: 1.000000 Model Failure Rate: 0.100391	1.00	.10	9,961,013.69
BSI-10H	Switch Slide Slide Switch, DIP, Right Angle	Other	Model Failure Rate: 0.004635	1.00	4.64e-003	215,748,531.48
RS-232 CONN	RS-232 Conn D-sub 9pin, Male	Other	Model Failure Rate: 4.74492E-4	1.00	4.74e-004	2,107,515,946.13
XFATM6 COMBO	RJ-45 Combo RJ45, 8pin, shield + magnetic	Other	Model Failure Rate: 0.004576	1.00	4.58e-003	218,551,700.00

Percentage Summary

Part Type	Quantity	% Quantity	Failure Rate	% Failure Rate
IC, Logic	3.00	1.47	0.031636	4.16
IC, Memory	4.00	1.96	0.111095	14.60
IC, Microproc	1.00	0.49	0.182446	23.97
IC, Linear	5.00	2.45	0.032035	4.21
Diode	2.00	0.98	0.003612	0.47
Opto-elec	6.00	2.94	0.001380	0.18
Res, Fixed	79.00	38.73	0.004375	0.57
Cap, Fixed	70.00	34.31	0.165992	21.81
Ind, Coil	19.00	9.31	0.000570	0.07
Switch	1.00	0.49	0.100391	13.19
Crystal	1.00	0.49	0.027256	3.58
NPRD Part	13.00	6.37	0.100259	13.17

First Year Dropout

Month	Failure Rate	Expected # of Failures	Avg. Cumulative Failure Rate
1	5.419014	0.000016	21.676041
2	3.222165	0.000019	12.888649
3	2.377275	0.000021	9.509089
4	1.915911	0.000022	7.663635
5	1.620663	0.000024	6.482646
6	1.413536	0.000025	5.654137
7	1.259206	0.000026	5.036818
8	1.139207	0.000027	4.556824
9	1.042890	0.000027	4.171554
10	0.963652	0.000028	3.854603
11	0.897172	0.000029	3.588684
12	0.840494	0.000029	3.361969