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MTBF Prediction Report for TS-4900

Note: Technologic Systems Inc. assumes no liability for the use of the information provided in this report.

This report provides MTBF information for the Printed Circuit Board Assembly of the **TS-4900 Rev E02**, comprising of 347 parts using Telcordia SR-332, Issue 3, Quality Level = II, Part Count Method. (FITs = failures per billion hours).

Short Form report of per component calculation result and its contribution to the overall Failure Rate is included as an appendix.

MTBF Results:

MTBF:		3,096,340.6 hrs		FR:		322 FITs	
ENV:	GB	TEMP:	25 C	PIEL:	**6.0**	MODEL:	Serial
UCL:	90%	FR-MEAN:	267 FITs	FR-SIGMA:	42 FITs	FR-UCL:	322 FITs

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Reliability vs Time
UT-4900-SILEX-EVAL_E02_MTBF.CIR
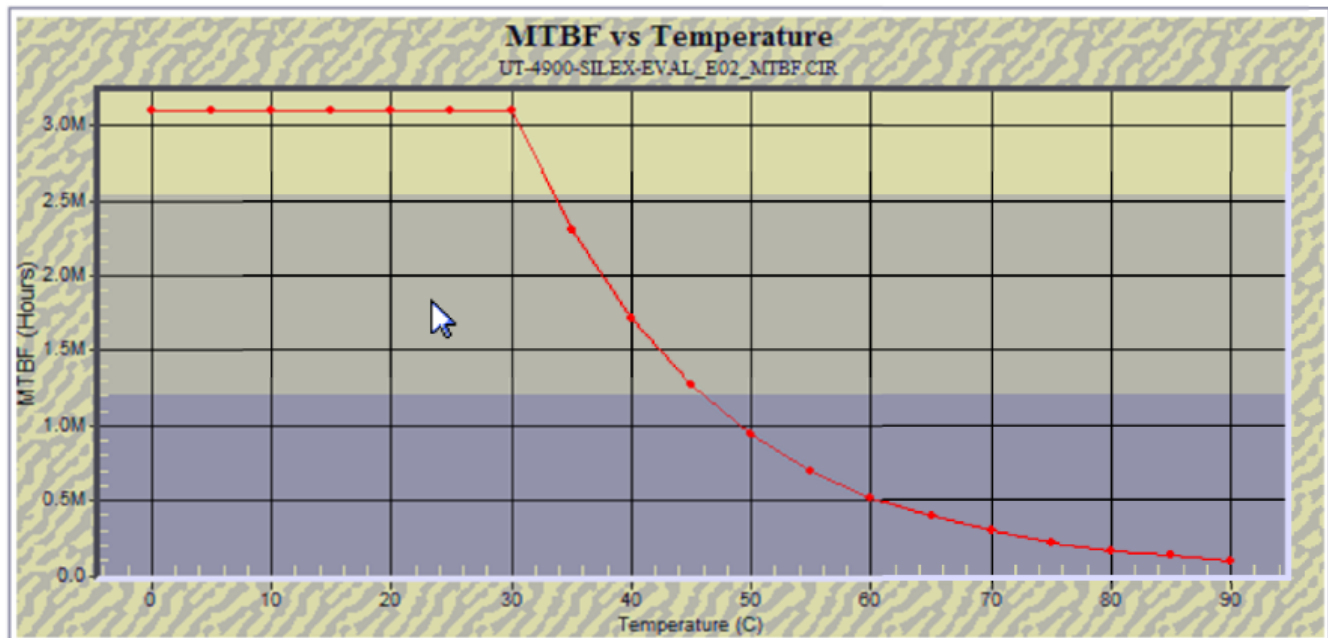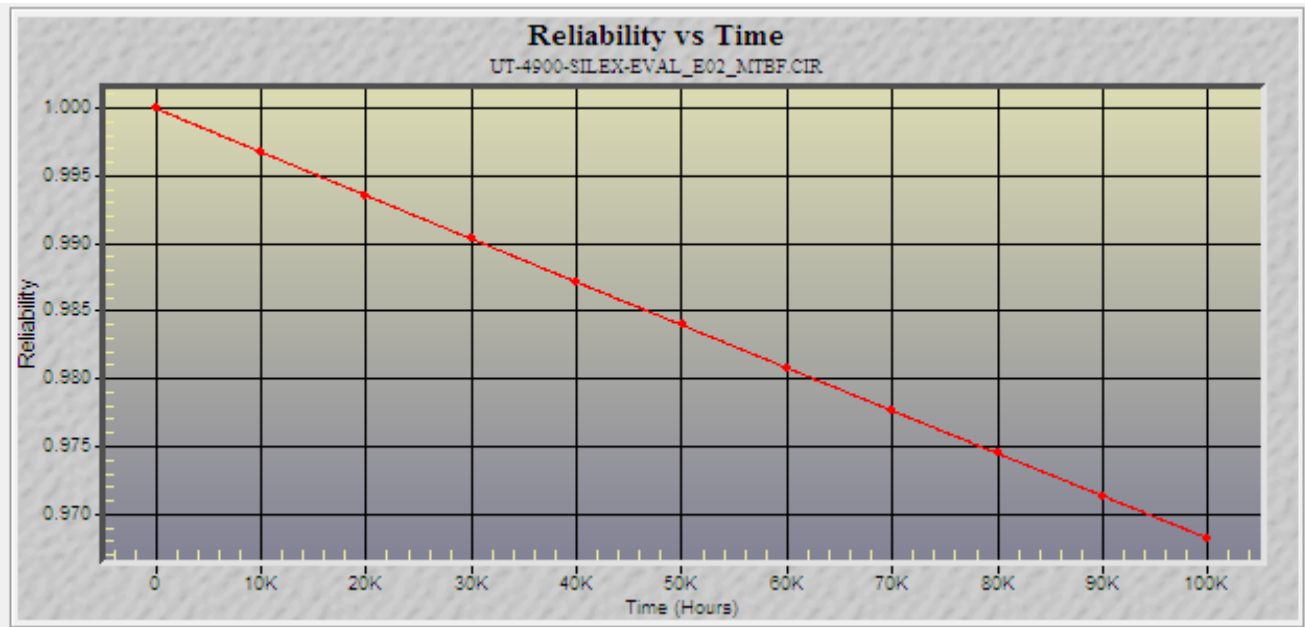
Notes:

- Reliability is the probability that the system will operate without failure for the given time.
- The time is actual device operating time, not calendar time.
- The Reliability calculation assumes replacement upon failure.
- The failure rate models used for this prediction are idealized models that predict device hardware failures, and do not include system failures that may be caused by: design errors; manufacturing process errors (eg, solder joints, wiring, assembly, etc); software failures; transient failures caused by power supply fluctionstions, external magnetic or electric fields, etc; transient failures from soft errors due to alpha particles, cosmic radiation, or charge loss; failure due to operator usage errors or abuse in the field; etc.
- Technologic Systems makes no claims regarding the accuracy of this prediction and specifically disclaims all liability for loss or damages of any kind resulting from any use of this prediction by any party.

MTBF Calculation Methodology:

The MTBF prediction calculation was performed using the RelCalc V5.1-TELC3 software, which implements the Telcordia SR-332 (Issue 3) failure rate models. It is assumed that any component failure results in a system failure (i.e., no redundancy).

The calculation was done with the following assumptions:

1. Operating internal chassis temperature=25C (assume temp across PCB is relatively constant).

2. Telcordia environment = GB. The Telcordia definition for GB is Ground, Fixed, Controlled: Vibration/Shock stresses: Low; Atmospheric variations: Low; Temperature

cycling stresses: Low; Application examples: Central office, data center, environmentally controlled vaults, environmentally controlled remote shelters, and environmentally controlled customer premise areas.

3. Each part's operating current/voltage/power stress = 50%.

4. Each IC or semiconductor part's operating power = typical data sheet value.

5. Calculate using the 90% UCL (Upper confidence Level) Telcordia Issue 3 model.

6. Each part's Telcordia Quality Level = II.

Note: The Telcordia SR-332 (Issue 3) definition for Quality Level = II:

A. steps must have been taken to ensure that the components are compatible with the design application and manufacturing process;
B. an effective feedback and corrective action program must be in place to identify and resolve problems quickly in manufacturing and in the field;
C. purchase specifications must explicitly identify important characteristics (electrical, mechanical, thermal and environmental) and acceptable quality levels (i.e., AQLs, Defects Per Million [DPMs], etc.) for lot control;
D. devices and device manufacturers must be qualified and identified on approved parts/manufacturers lists (device qualification must include appropriate life and endurance tests);
E. lot-to-lot controls, either by the equipment manufacturer or the device manufacturer, must be in place at adequate AQLs/DPMs to ensure consistent quality.

Where possible, manufacturer failure rate data was used. Where this data was not specifically available, data for similar parts was substituted and a correction factor (CF) was adjusted to provide a more conservative estimate and a more realistic value.

Appendix: Short Form Report

PartType	Qty	RefDes	TotalFR	%FR
IC,Logic	1	U19	1.03945	0.39
IC,Logic	1	U11	1.03945	0.39
IC,GateArray/PAL	1	U17	13.3469	4.99
IC,GateArray/PAL	1	U15	19.9955	7.48
IC,GateArray/PAL	1	U16	33.0068	12.35

IC,GateArray/PAL	2	U5-6	3.81341	1.43
IC,GateArray/PAL	1	U13	6.67347	2.5
IC,GateArray/PAL	3	U7-9	20.0204	7.49
IC,Micro	1	U4	30	11.23
IC,RAM	4	U22-25	31.8545	11.92
IC,ROM/PROM	1	U18	9.41366	3.52
IC,ROM/PROM	1	U12	38.569	14.43
IC,Linear	2	U20-21	9.88947	3.7
Transistor	2	Q2-3	5.25673	1.97
Transistor	2	Q6-7	5.25673	1.97
Diode	1	D5	0.25214	0.09
Diode	3	D2-4	1.51284	0.57
Resistor	6	RN1-6	0.625659	0.23
Resistor	4	R32-33,R37-38	0.266357	0.1
Resistor	2	R92-93	0.133179	0.05
Resistor	6	R44-49	0.399536	0.15
Resistor	4	R83-86	0.266357	0.1
Resistor	2	R70-71	0.133179	0.05
Resistor	3	R23-25	0.199768	0.07
Resistor	1	RN9	0.104276	0.04
Resistor	2	R78-79	0.133179	0.05
Resistor	6	R11-16	0.399536	0.15

Resistor	3	R80-82	0.199768	0.07
Resistor	4	R73-76	0.266357	0.1
Resistor	7	R60-66	0.466125	0.17
Resistor	1	R35	0.066589	0.02
Resistor	2	R88-89	0.133179	0.05
Resistor	6	R26-31	0.399536	0.15
Resistor	2	R95-96	0.133179	0.05
Resistor	4	R40-43	0.266357	0.1
Resistor	2	R68-69	0.133179	0.05
Capacitor	8	C52-59	0.752537	0.28
Capacitor	3	C60-62	0.282201	0.11
Capacitor	4	C43-46	0.376269	0.14
Capacitor	27	C200-226	2.53981	0.95
Capacitor	93	C300-392	8.74825	3.27
Capacitor	1	C65	0.094067	0.04
Capacitor	83	C107-189	7.80757	2.92
Capacitor	4	C94-97	0.376269	0.14
Capacitor	7	C80-86	0.65847	0.25
Inductive	2	L1-2	0.399536	0.15
Inductive	1	L4	0.199768	0.07
Inductive	1	L3	0.199768	0.07
Inductive	11	FB2-12	0.915602	0.34

Connector	1	CN3	0.637584	0.24
Connector	2	CN1-2	3.67837	1.38
QuartzCrystal	1	Y2	1.9618	0.73
QuartzCrystal	1	Y1	1.9618	0.73
Miscellaneous	1	K1	0.000011	0
Miscellaneous	1	PCB_4900_E	0	0