

MTBF TEST

REPORT

OF

SWITCH ADAPTER

MODEL

T1235-001

Test Type:	Parts Prediction	Standard:	MIL-HDBK-217F	Test Date:	Dec 25th 2004
Product:	SMPS	Model:		Revision:	A

1. Test Condition :

AC Line Voltage:	115 Vac	Line Frequency:	50 Hz
Temperature:	40°C	LOAD:	12V / 2.0A

2. Summary :

2.1 Microelectronic Devices (Section 5)

$$\lambda p = (C1 * \pi T + C2 * \pi E) * \pi Q * \pi L$$

$$= 0.2691209 \text{ Failures / 10 Hours}$$

2.2 Discrete Semiconductors (Section 6)

$$\lambda p = \lambda b * \pi E * \pi Q * \pi T \quad (\text{opto couple})$$

$$\lambda p = \lambda b * \pi E * \pi Q * \pi C * \pi S * \pi T \quad (\text{Diode})$$

$$\lambda p = \lambda b * \pi E * \pi Q * \pi \Lambda * \pi T \quad (\text{Si FET})$$

$$\lambda p = \lambda b * \pi E * \pi Q * \pi T \quad (\text{LED})$$

$$= 2.360913 \text{ Failures / 10 Hours}$$

2.3 Resistors (Section 9)

$$\lambda p = \lambda b * \pi E * \pi Q * \pi P * \pi S * \pi T$$

$$= 1.91362 \text{ Failures / 10 Hours}$$

2.4 Capacitors (Section 10)

$$\lambda p = \lambda b * \pi E * \pi Q * \pi sR * \pi V * \pi C * \pi T$$

$$= 3.892757 \text{ Failures / 10 Hours}$$

2.5 Inductive Devices (Section 11)

$$\lambda p = \lambda b * \pi E * \pi Q * \pi T$$

$$= 0.188657 \text{ Failures / 10 Hours}$$

2.6 Connectors (Section 15)

$$\lambda p = \lambda b * \pi E * \pi Q * \pi K * \pi T$$

$$= 0.067193 \text{ Failures / 10 Hours}$$

2.7 Interconnection Assemblies (Section 16)

$$\lambda p = \lambda b * (N1 * \pi C + N2 * (\pi E + 13)) * \pi Q * \pi E$$

$$= 0.040384 \text{ Failures / 10 Hours}$$

2.8 Fuses (Section 22)

$$\lambda p = \lambda b * \pi E$$

$$= 0.01000 \text{ Failures / 10 Hours}$$

3. Result

Total of λp (Fail/100000 Hrs)	MTBF (Hours)	RESULT
8.74	114382	Pass

APPROVED:周軍 05/01/06

董金亞 05/01/06

CHECKED:趙瑞鋒

05/01/05

PREPARED:王貴賓

2005/01/03

Microelectronic devices										Ambient: 40°C		Input: 115V ac			
Location	Part type	R(W)	TjC	Pin	πE	πQ	πT	πL	C2	C1	λP	MTBF			
IC1	IC PWM ONSEMI	0.05	70.2	8	2	2	2.8043	1	0.003	0.02	0.122754	8146362.7			
IC4	TL 431	0.002	74.0	3	2	2	3.5675	1	0.001	0.02	0.146367	6832153.0			
Total Of This Page											0.269121	3715801.9			

Discrete semiconductors Ambient: 40°C Input: 115V ac

LOCATION	PART TYPE	Vmax (V)	Base data										Measure & Calculation Data		MTBF
			πR	πA	λb	πS	πT	πC	πQ	πE	Vop	I op/ Pral	Tj (C)	λP	
D1	DIODE-FAST	100	—	—	0.0010	0.1229	4.0660	2.0	8.0	9.0	42.2	—	71.6	0.071952	13898226.7
D2	DIODE-RECT	1000	—	—	0.0010	0.0440	4.6343	2.0	8.0	9.0	276.6	—	76.7	0.029380	34037333.6
D3	1N4148	75	—	—	0.0010	0.0085	3.7980	2.0	8.0	9.0	10.56	—	69.0	0.004667	214278914.1
D4A	DIODE-SCHOTTKY	100	—	—	0.0010	0.1229	4.4953	2.0	8.0	9.0	42.2	—	75.5	0.079549	12570862.4
BD1	BRIDGE-DIODE	600	—	—	0.0010	0.0378	4.6343	2.0	8.0	9.0	155.9	—	76.7	0.025238	39623040.3
ZD1	SMD-DIODE-ZENER	15.6	—	—	0.0010	0.0006	3.9302	2.0	8.0	9.0	0.72	—	70.3	0.000321	3113113836.0
ZD4	SMD-DIODE-ZENER	15.6	—	—	0.0010	0.8232	4.3709	2.0	8.0	9.0	14.4	—	74.4	0.518152	1929936.3
SCR1	ZEBBER DIODE	—	1.0000	—	—	0.0022	4.0285	—	8.0	9.0	—	—	71.4	0.063811	15671309.9
Q1	MOS-FET	600	—	4.0	0.0120	—	2.2996	—	8.0	1.0	263.1	—	69.1	0.883035	1132458.4
IC2	PHOTO COUPLER	—	—	—	—	—	3.6650	—	5.5	6.0	—	—	73.0	0.302364	3307275.3
LED	LED	—	—	—	0.0040	—	2.8973	—	5.5	6.0	—	—	63.2	0.382446	2614751.4
Total Of This Page											2.360913	345217944.5			

Resistor

Ambient: 40°C

Input: 115V ac

LOCATION	PARTS TYPE	Resistance (ohm)	Pate (W)	Basic Data						Measure & Calculation Data			MTBF (Hours)	
				λ_b	π_T	π_P	π_s	π_Q	π_E	Top (C)	Vop (V)	Pd (W)		λ_P
R1A	RES-SMD	549000	0.25	0.0037	1.531	0.136	0.729	10	16	72.2	57.5	0.006	0.089990	11112291.4
R1B	RES-SMD	549000	0.25	0.0037	1.526	0.136	0.729	10	16	71.8	57.5	0.006	0.089710	11147016.0
R2A	RES SMD	200000	0.25	0.0037	1.622	0.141	0.731	10	16	79.8	36.15	0.007	0.098662	10135596.0
R2B	RES SMD	200000	0.25	0.0037	1.620	0.141	0.731	10	16	79.6	36.15	0.007	0.098515	10150736.0
R2C	RES SMD	200000	0.25	0.0037	1.621	0.141	0.731	10	16	79.7	36.15	0.007	0.098589	10143161.0
R2D	RES SMD	200000	0.25	0.0037	1.622	0.141	0.731	10	16	79.8	36.15	0.007	0.098662	10135596.0
R5	SMD CHIP-RES	10000	0.25	0.0037	1.574	0.013	0.710	10	16	75.8	0.373	0.000	0.008445	118414446.7
R3	SMD C.F-RES	47	0.25	0.0037	1.484	0.146	0.733	10	16	68.2	0.58	0.007	0.093739	10667914.5
R4	SMD C.F-RES	220	0.25	0.0037	1.569	0.166	0.742	10	16	75.4	1.48	0.010	0.114181	8758030.6
R6	RES-SMD-CHIP	1000	0.25	0.0037	1.586	0.003	0.710	10	16	76.8	0.016	0.000	0.001791	558271511.2
R7-1	RES-SMD-CHIP	10	0.25	0.0037	1.586	0.163	0.740	10	16	76.8	0.309	0.010	0.113332	8823614.1
R2E	RES SMD	15	0.25	0.0037	1.605	0.202	0.764	10	16	78.4	0.498	0.017	0.146537	6824235.2
R2F	RES SMD	15	0.25	0.0037	1.599	0.202	0.764	10	16	77.9	0.498	0.017	0.145986	6849974.1
R8	SMD C.F-RES	22	0.25	0.0037	1.614	0.214	0.772	10	16	79.1	0.649	0.019	0.157783	6337807.9
R10	SMD-CHIP-RES	5600	0.25	0.0037	1.529	0.214	0.773	10	16	72	10.37	0.019	0.149662	6681706.3
R11	RES-SMD CHIP	18000	0.25	0.0037	1.512	0.130	0.727	10	16	70.6	9.79	0.005	0.084444	11842111.9
R9	RES-SMD-CHIP	1000	0.25	0.0037	1.530	0.046	0.711	10	16	72.1	0.617	0.000	0.029881	3346316.1
R7	RES-METAL	1	2	0.0037	1.526	0.400	0.748	10	16	71.8	0.309	0.095	0.270520	3696578.6
R24	SMD-CHIP-RES	4700	0.125	0.0037	1.489	0.037	0.711	10	16	68.7	1.00	0.000	0.023191	43120937.3
Total of This Page										68.7	1.00	0.000	1.913621	522569.5

Capacitor

Ambient: 40°C

Input: 115V ac

LOCATION	PARTS TYPE	Tmax (C)	Vmax (V)	C (uF)	Basic Data						Measure & Calculation Data				MTBF			
					λb	πT	πC	πV	πsr	πQ	πE	Ta (C)	VOP (V)	S		λP		
CX1	X-Cap	100	275	0.22	0.00051	1.883	0.873	1.164	1.3	3	10	61.2	115	0.418	0.038051	26280190.5		
CY1	Y-Cap	100	250	0.0033	0.00051	1.848	0.598	1.003	1.3	3	10	60.0	47.48	0.190	0.022045	45360735.1		
CY3	Y-Cap	100	250	0.001	0.00051	1.903	0.537	1.000	1.3	3	10	61.9	1.81	0.007	0.020331	49186307.8		
C1	E-Cap	105	400	68	0.00018	7.601	2.639	1.083	1.3	3	10	77.1	146	0.365	0.152569	6554420.1		
C2	CAP-CERAMIC	85	1000	0.0022	0.00200	6.209	0.577	1.002	1.3	3	10	71.1	76.6	0.077	0.279806	3573900.8		
C3	E-Cap	105	50	22	0.00018	7.476	2.036	1.012	1.3	3	10	76.6	12.32	0.246	0.108101	9250615.3		
C4	SMD-CAP CER	125	50	0.1	0.00200	6.969	0.813	1.069	1.3	3	10	74.5	12.32	0.246	0.472473	2116525.0		
C5	CERAMIC-CAP	125	50	0.001	0.00200	5.636	0.537	1.048	1.3	3	10	68.3	10.94	0.219	0.247540	4039744.0		
C13	SMD-CAP CER	125	50	0.1	0.00200	6.784	0.813	1.021	1.3	3	10	73.7	8.23	0.165	0.438991	2277948.6		
C6	CAP CER	125	100	0.00047	0.00200	5.917	0.172	1.191	1.3	3	10	69.7	43.1	0.431	0.094359	1059797.5		
C7	E-Cap	105	16	1000	0.00018	6.167	4.898	4.581	1.3	3	10	70.9	12.39	0.774	0.971304	1029544.0		
C8	E-Cap	105	16	1000	0.00018	6.104	4.898	4.581	1.3	3	10	70.6	12.39	0.774	0.961339	1040215.7		
C9	E-Cap	105	25	100	0.00018	5.199	1.514	1.554	1.3	3	10	66.0	12.32	0.493	0.085847	11648637.0		
Total of This Page																	3.892757	256887.3

connector

Ambient: 40°C

Input: 115V ac

LOCATION	PARTS TYPE	PIN NO.	Basic Data						Measure & Calculation Data				MTBF (Hours)					
			λb	πT	πK	πQ	πE	Ta (C)	πT (C)	To (C)	λP							
AC Inlet	2 PIN	2	0.0036	1.5785	4	2	1	51.8	0.4290	52.2290	0.045460	21997410.6						
DC Outlet	2 Wire	2	0.00700	1.5524	1	2	1	50.5	0.6482	51.1482	0.021734	46011882.7						
Total of This Page																	0.067193	68009243.3

Inductive		Ambient: 40°C		Input: 115V ac		Basic Data		Measure & Calculation Data		MTBF (hours)
LOCATION	PARTS TYPE	INSULATION CLASS	TMAX (C)	λ b	π T	π Q	π E	Ths (C)	λ P	
L1	INDUCTOR	.....	120	0.00003	1.7671	3	6	71	0.000954	1047981342.5
L2	INDUCTOR	.....	120	0.00003	1.5182	3	6	57.4	0.000820	1219792239.7
L3	INDUCTOR	.....	120	0.00003	1.5841	3	6	61.1	0.000855	1169006369.9
LF1	INDUCTOR	.....	120	0.00003	1.7937	3	6	72.4	0.000969	1032431276.3
T1	TRANSFORMER	.....	120	0.00540	1.9039	3	6	78.1	0.185059	5403682.8
Total of This Page									0.188657	4474614911.3

PCB		Ambient: 40°C		Input: 115V ac		Basic Data		Measure & Calculation Data		MTBF (Hours)										
LOCA-TION	PARTS TYPE	λ b	π C	π Q&T	π E	CR	π LC	as	acc	N1	N2	d	h	Trise	Nf	asMT	LC	ECF	λ P / λ smt	MTBF (Hours)
PCB	PTH	0.000017	1	2	2	....	....	....	....	30	26	....	....	....	....	....	....	....	0.026792	37324574.5
PCB	PTH	....	....	7	....	0.08	1	7	6	....	....	1240	30	10	1355785.3	16922316.2	87600.0	0.23	0.013592	73575287.7
Total of This Page										0.040384	24762576.4									

Fuse		Ambient: 40°C		Input: 115V ac		Base data		Calculation data		MTBF (Hours)
LOCATION	PARTS TYPE	λ b	π E	λ P	π E	λ P	π E	λ P	π E	MTBF (Hours)
FI	T2A1250VAC	0.01	1.0	0.01	1.0	0.01	1.0	0.01	1.0	100000000
Total of this page										100000000

Temperature rise test**Test equipment:**

NO	Instrument	Manufacturer & type NO
1	Ac source	special power system MODEL: YF-6010
2	Dc load	Chroma 6314 Dc electronic load
3	Power meter	Zentech 2100 digital power meter
4	Hybrid recorder	YOKOGAWA DR130
5	CONST. TEMP&HUMI.TEST CHAMBER	CTH 060HV

Tests Conditions:

Ambient temp: 40 °C
Thermal couple test on the hottest points
Output: 12VDC/2.0A
Input: 90VAC/115VAC/230VAC/264VAC

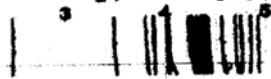
Test result: pass

16	16.1°C	17	17.9°C	18	18.8°C
19	19.0°C	20	42.9°C		

Jan. 02. 05 15:51 MANUAL

01	80.0°C	02	52.2°C	03	57.0°C
04	68.0°C	05	70.2°C	06	63.4°C
07	69.0°C	08	65.8°C	09	65.8°C
10	67.2°C	11	64.3°C	12	56.8°C
13	60.0°C	14	70.7°C	15	73.5°C
16	64.2°C	17	65.4°C	18	63.0°C
19	72.4°C	20	37.0°C		

U.D.
04CH



input = 26VAC 100.0°C

Jan. 02. 05 15:30 MANUAL

01	61.4°C	02	52.7°C	03	58.2°C
04	68.0°C	05	70.6°C	06	64.0°C
07	65.6°C	08	66.5°C	09	66.0°C
10	61.5°C	11	65.5°C	12	57.4°C
13	60.2°C	14	71.0°C	15	73.7°C
16	64.0°C	17	65.0°C	18	63.0°C
19	72.4°C	20	37.1°C		

60.8°C
59.0°C
63.7°C
62.6°C
2500/h
02 15:00
03CH



input = 23VAC
output = 12VDC / 2A 100.0°C

Jan. 02. 05 14:42 MANUAL

10	01	9	70.0°C	7	05	6	74.5°C	4	00	3	61.5°C	1	0
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NO	Location	Part type	Measured temperatures (°C)				Calculated temperatures		
			40 °C				Top	Trat	Top/Trat
			90VAC (°C)	115VAC (°C)	230VAC (°C)	264VAC (°C)	Top max (°C)	Max rating (°C)	De-rating (%)
1	L1	INDCTOR	79.5	71.0	61.4	60.0	79.5	130	61.15%
2	L2	INDCTOR	63.8	57.4	52.7	52.2	63.8	130	49.08%
3	CY3	Y-CAP	68.4	61.9	58.2	57.8	68.4	100	68.40%
4	BD1	BRIDGE-DIODE	85.8	76.7	68.8	68.0	85.8	150	57.20%
5	LF1	INDCTOR	84.8	76.3	70.6	70.2	84.8	130	65.23%
6	D3	DIODE-SW	76.6	69.0	64.5	63.4	76.6	125	61.28%
7	IC1	IC	77.6	70.2	65.6	64.8	77.6	125	62.08%
8	C2	CAP-CERAMIC	78.4	71.1	66.5	65.8	78.4	125	62.72%
9	D1	DIODE-FAST	79.5	71.6	66.6	65.8	79.5	150	53.00%
10	Q1	MOS-FET	77.0	69.1	64.5	63.2	77.0	150	51.33%
11	R7	RES-METAL	80.5	71.8	65.5	64.3	80.5	125	64.40%
12	CY1	Y-CAP	66.0	60.0	57.4	56.8	66.0	100	66.00%
13	L3	INDCTOR	66.2	61.1	60.2	60.0	66.2	130	50.92%
14	IC2	PHOTO COUPLER	79.0	73.0	71.0	70.7	79.0	125	63.20%
15	D4A	DIODE-SCHOTTKY	81.0	75.5	73.7	73.5	81.0	150	54.00%
16	R1A	RES-SMD	72.2	66.9	64.6	64.2	72.2	125	57.76%
17	C5	CERAMIC-CAP	74.2	68.3	65.8	65.5	74.2	125	59.36%
18	R3	SMD C.F-RES	75.4	68.2	63.9	63.3	75.4	125	60.32%
19	T	X'FMR	78.1	72.2	72.4	72.4	78.1	130	60.08%
20	Ambient temp								

C4 1# ZD1 2# R4 3# R5 4# ZD5 5# R6 6#
 R7-1 7# R2A-R2D 8# R2E-R2F 9# R9 10# R10 11#
 R13 12# IC4 13# R8 14# C1 15# C3 17#
 C8 18# C9 19# C7 15# Ambient temp 20#

Jan. 02. 05 21:33 MANUAL

01	68.6°C	02	67.9°C	03	69.8°C
04	70.7°C	05	68.9°C	06	72.0°C
07	70.3°C	08	76.1°C	09	75.2°C
10	68.8°C	11	70.6°C	12	70.1°C
13	72.6°C	14	77.9°C	15	69.4°C
16	70.8°C	17	70.8°C	18	69.1°C
19	64.3°C	20	45.3°C	10	

input: 280VAC



Jan. 02. 05 21:05 MANUAL

01	69.1°C	02	68.4°C	03	70.4°C
04	71.1°C	05	69.4°C	06	72.4°C
07	71.0°C	08	76.2°C	09	75.4°C
10	68.9°C	11	70.4°C	12	70.2°C
13	72.5°C	14	77.8°C	15	69.0°C
16	71.0°C	17	70.8°C	18	69.1°C
19	64.3°C	20	45.3°C		

input: 120VDC/2A



Jan. 02. 05 19:57 MANUAL

01	74.5°C	02	73.7°C	03	75.4°C
04	75.8°C	05	74.4°C	06	78.8°C
07	76.8°C	08	79.8°C	09	78.4°C
10	70.8°C	11	72.0°C	12	71.9°C
13	74.0°C	14	79.1°C	15	70.9°C
16	77.1°C	17	76.6°C	18	70.6°C
19	66.0°C	20	45.4°C		

input: 150VAC



Jan. 02. 05 19:01 MANUAL

01	78.3°C	02	77.2°C	03	79.3°C
04	79.4°C	05	78.2°C	06	80.5°C
07	81.4°C	08	82.9°C	09	81.6°C
10	72.6°C	11	73.6°C	12	73.8°C
13	75.8°C	14	80.6°C	15	72.4°C
16	81.4°C	17	80.8°C	18	72.1°C
19	67.5°C	20	45.4°C		

input: 150VAC



NO	Location	Part type	Measured temperatures (°C)				Calculated temperatures		
			40 °C				Top	Trat	Top/Trat
			90VAC (°C)	115VAC (°C)	230VAC (°C)	264VAC (°C)	Top max (°C)	Max rating (°C)	De-rating (%)
1	C4	SMD-CAP CER	78.3	74.5	69.1	68.6	78.3	125	62.64%
2	ZD1	SMD-ZENER DIODE	77.2	73.7	68.4	67.9	77.2	125	61.76%
3	R4	SMD C.F-RES	79.3	75.4	70.4	69.8	79.3	125	63.44%
4	R5	SMD CHIP-RES	79.4	75.8	71.1	70.7	79.4	125	63.52%
5	ZD4	SMD-ZENER DIODE	78.2	74.4	69.4	68.9	78.2	125	62.56%
6	R6	RES-SMD-CHIP	80.5	76.8	72.4	72.0	80.5	125	64.40%
7	R7-1	RES-SMD-CHIP	81.4	76.8	71.0	70.3	81.4	125	65.12%
8	R2A	SMD RES	82.9	79.8	76.2	76.1	82.9	125	66.32%
9	R2E	SMD RES	81.6	78.4	75.4	75.2	81.6	125	65.28%
10	R11	RES-SMD CHIP	72.6	70.6	68.9	68.8	72.6	125	58.08%
11	R10	SMD-CHIP-RES	73.6	72.0	70.4	70.6	73.6	125	58.88%
12	R13	RES-SMD CHIP	73.8	71.9	70.2	70.1	73.8	125	59.04%
13	IC4	SMD REG.TAP TL431	75.8	74.0	72.5	72.6	75.8	125	60.64%
14	R8	SMD C.F-RES	80.6	79.1	77.8	77.9	80.6	125	64.48%
15	C1	E-CAP	72.4	70.9	69.3	69.4	72.4	105	68.95%
16	C3	E-CAP	81.4	77.1	71.0	70.8	81.4	105	77.52%
17	C8	E-CAP	80.8	76.6	70.6	70.2	80.8	105	76.95%
18	C9	E-CAP	72.1	70.6	69.1	69.1	72.1	105	68.67%
19	C7	E-CAP	67.5	66.0	64.3	64.3	67.5	105	64.29%
20	Ambient temp								