

# **MTBF Prediction Report**

**Model Name: WR24ACWI125MF10N(RV)**

**Customer:**

**Stage: EDVT1**

**PCB Rev.: A**

**Part List Rev.: 1**

**Spec Rev.:**

**Conclusion:**

<input checked="" type="checkbox"/>
<input type="checkbox"/>

**PASS**

**FAIL**

**Prepared By: Michael**

**Checked By: JET**

**Approved By: JAYSON**

CMTBF TEST REPORT			Test Engineer:	Michael
Model Name:	WR24ACWI125MF10N(RV)	Customer:	Test Date:	2012-10-22
Quantity:	1	Ser. No.:		
<p><b>1. Purpose:</b> Verify PSU whether or not to meet the customer CMTBF specification.</p> <p><b>2. Conditions:</b> Input: 24V AC Output: 24Vdc/0.125A Ambient: 25 degree C</p> <p><b>3. Equipment:</b> Oscilloscope: Tek3054B, AC source: HP6813A, Electronic load:Chroma6310 Multimeter: Agilent34401A, Current Probe Amplifier:Tek TM502A</p> <p><b>4. Criteria:</b> The life time of the power supply component shall exceed 200,000 hours when 24vac and maximun load at 25°C .Calculated using the formula by the MIL-HDBK-217F.</p> <p><b>5. REGISTER:</b> Details,please refer to the report content.</p> <p><b>6. Result:</b> The MTBF value meets spec..</p>				



**WR9X375LRPNKIT(RVB) CMTBF REPORT LIST  
PART LIST REV: 0A**

<b>COMPONENT</b>	<b>FAILURE RATE</b>	<b>Q'TY</b>
RESISTOR	0.06574596	15
CAPACITOR ( except electrolytic )	0.057055526	7
CAPACITOR ( electrolytic )	0.497096364	3
DIODE	0.241357222	7
ZENER DIODE	0.042711376	2
Integrated Circuits	0.162197306	1
TL431	0.198038414	1
Transistor-Power MOSFET	1.221713704	1
IC-Opto-couplers	0.087282484	1
Magnetic	0.012530251	2
TOTAL	2.58572861	40
MTBF	386,738.19	Hours
MTBF SPEC.	200,000	Hours
Conclusion	OK	

Input Voltage	NO .	Test Item	Page
		Cover,Report,Part list,and summary	1~4
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**MTBF prediction worksheet - Magnetics**

Model WR24ACWI125MF10N(RV)

Conditions: Vin=24VAC; Output Load:+24V/0.125A

Amb. : 25°C

Component description			Component specifications	Stress	Failure rate				
Ref. Design	Part No.	Type	Tcore deg.C	Tcore deg.C	$\lambda_b$	$\pi_Q$	$\pi_E$	$\pi_c$	$\lambda_p$
LF1	703-01200254(R)	C	130	44.7	0.000433272	4	1	1	0.001733086
T1	320-00972501(R)	X	130	55.1	0.002699291	4	1	1	0.010797165
TOTAL									0.012530251

**MTBF prediction worksheet - TL431s**

Model WR24ACWI125MF10N (RV)

Conditions: Vin=24VAC; Output Load: +24V/0.125A

Amb. : 25°C

Component description				Component specifications					Sress				Failure rate						
Ref. Design	Part No.	Type	Maker	Pin NO.	VKA	IK(rms)	Rth	Tj	VKA	IK(rms)	Ta	Tj(c)	C1	C2	$\pi T$	$\pi L$	$\pi Q$	$\pi E$	$\lambda p$
					V	A	degC/W	deg.C	V	A	deg.C	deg.C							
U3	270-03460001(R)	AZ431	BCD	3	36	0.1	330	150	25.6	0.002	47.5	64.396	0.01	0.001179	1.921423	1	10	0.5	0.198038
TOTAL																			0.198038

**MTBF prediction worksheet - Integrated Circuits**

Model WR24ACWI125MF10N (RV)

Conditions: Vin=24VAC; Output Load:+24V/0.125A

Amb. : 25°C

Component description				Component specifications					Sress				Failure rate						
Ref. Design	Part No.	Type	Maker	Pin NO.	VCC(max)	Ic (rms)	Rth	Tj	VCC(peak)	Ic(rms)	Ta	Tj(c)	C1	C2	$\pi T$	$\pi L$	$\pi Q$	$\pi E$	$\lambda p$
					V	A	deg.C/W	deg.C	V	A	deg.C	deg.C							
U2	260-08080001(R)	PWM	ON-BRIGHT	8	30	0.01	200	150	13.7	0.003	52	60.22	0.01	0.0034	1.4519	1	10	0.5	0.162197306
TOTAL																			0.162197306



**Component stress analysis worksheet - IC-Opto-couplers**

Model WR24ACWI125MF10N (RV)

Conditions: Vin=24VAC; Output Load:+24V/0.125A

Amb. : 25°C

Component description				Component specifications					Worse case stress in application								Failure rate				
Ref. Design	Part No.	Type	Maker	P/Pc	R/Vce(max)	I/F/lce(rms)	Rth	Tj	V/R/Vce(max)	I/F/lce(rms)	P/Pc	Ta	Tj	πT	λb	πQ	πE	λp			
				W	V	A	deg.C/W	deg.C	Vpeak(V)	Ratio	Irms(A)	Ratio	W	Ratio	deg.C	deg.C					
U1	251-03000002(R)	PHO	LITEON	0.07	6	0.05	400	100	1.3	0.21667	0.002	0.04	0.0026	0.04	48	49.04	2.011531	0.0055	8	1	0.088507
				0.15	35	0.05	425	100	2.5	0.07143	0.002	0.04	0.0050	0.03	48	50.13	1.955855	0.0055	8	1	0.086058
TOTAL																					0.087282



**MTBF prediction worksheet - Zener Diodes**

Model WR24ACWI125MF10N(RV)

Conditions: Vin=24VAC; Output Load:+24V/0.125A

Amb. : 25°C

Component description			Component specifications					Stress				Failure rate						
Ref. Desig.	Part No.	Maker	Vz	Iz	Pd	Rth	Tj	Vz	Iz(rms)	Ta	Tj(c)	λb	πE	πQ	πt	πs	πc	λp
			V	I	W	deg.C/W	deg. C	V	A	deg.C	deg.C							
ZD1	211-01770008(R)	PANJIT	27	0.019	0.5	300	175	24.34	0.002	47	61.604	0.002	1	5.5	2.02721	1	1	0.022299
ZD2	211-02307001(R)	PANJIT	27	0.005	0.4	325	150	12.86	0.003	44	56.539	0.002	1	5.5	1.85564	1	1	0.020412
TOTAL																		0.042711

**MTBF prediction worksheet - Diodes**

Model WR24ACWI125MF10N (RV)

Conditions: Vin=24VAC; Output Load:+24V/0.125A

Amb. : 25°C

Component description			Component specifications							Stress					Failure Rate						
Ref.Design	Part No.	Type	Maker	Vr	If, ave.	Vf	Rth	Tj rated	K	Vr,peak	Vr,ratio	If,ave	Ta	Tj(c)	λb	πE	πQ	πt	πs	πc	λp
				V	A	V	deg.C/W	deg.C		V		A	deg.C	deg.C							
D1	205-01227001(R)	BRG	PSI	70	2	0.85	15	150	1	26.2	0.374	0.072	49.1	50.02	0.005	1	5.5	2.233	0.09	1	0.00564
D2	205-01227001(R)	BRG	PSI	70	2	0.85	15	150	1	27.6	0.394	0.072	50.1	51.02	0.005	1	5.5	2.3	0.1	1	0.00659
D3	205-01227001(R)	BRG	PSI	70	2	0.85	15	150	1	27.6	0.394	0.072	49.8	50.72	0.005	1	5.5	2.2797	0.1	1	0.00653
D4	205-01227001(R)	BRG	PSI	70	2	0.85	15	150	1	26.2	0.374	0.072	50.5	51.42	0.005	1	5.5	2.3272	0.09	1	0.00588
D5	207-01270001(R)	FR	PANJIT	420	1	1.7	35	150	1	36	0.086	0.005	51.7	52	0.069	1	5.5	2.367	0.05	1	0.04851
D7	206-00800001(R)	FR	PANJIT	140	3	0.95	20	150	1	72	0.514	0.128	47.1	49.53	0.069	1	5.5	2.2011	0.2	1	0.16599
D8	218-01700002(R)	SCHOTTKY	PANJIT	200	0.2	2	350	150	1	37.6	0.188	0.003	51.8	53.9	0.003	1	5.5	2.5018	0.05	1	0.00223
TOTAL																					0.24136

**MTBF prediction worksheet - Capacitors, except electrolytic**

Model WR24ACWI125MF10N (RV)

Conditions: Vin=24VAC; Output Load: +24V/0.125A

Amb. : 25°C

Component description				Component specifications			Stress			Failure rate				
Ref. Design	Part No.	Type	Maker	Cap. uF	Vmax rated V	temp. rated deg C	Tc deg.C	V V	V ratio	$\pi_{cv}$	$\lambda_b$	$\pi_Q$	$\pi_E$	$\lambda_p$
CX1	125-08088155(R)	MPF	UTX	0.15	275	125	46.8	24.4	0.08873	1.521086	0.000687	3	1	0.0031366
CY1	122-13021223(R)	DIS	SUCCESS	0.0022	250	125	45.3	24	0.096	0.955983	0.000754	3	1	0.0021619
C2	120-29131003(R)	MON	TDK	0.001	500	125	50.3	33.6	0.0672	0.876564	0.000748	3	1	0.0019682
C10	120-27091003(R)	MON	TDK	0.001	200	125	49	65.2	0.326	0.876564	0.001684	3	1	0.0044278
C11	120-26094702(R)	MON	TDK	0.00047	50	125	50	39.2	0.784	0.806705	0.013939	3	1	0.0337329
C6	120-26071202(R)	MON	TDK	0.00012	50	125	48	0.91	0.0182	0.694215	0.000736	3	1	0.0015319
C9	120-26071005(R)	MON	TDK	0.1	50	125	46	19.4	0.388	1.454735	0.002313	3	1	0.0100962
TOTAL														0.0570555



**MTBF prediction worksheet - Capacitors, electrolytic**

Model WR24ACWI125MF10N(RV)

Conditions: Vin=24VAC; Output Load: +24V/0.125A

Amb. : 25°C

Component description				Component specifications						Stress			Failure rate				
Ref.Design	Part No.	Type	Maker	Cap. (uF)	Vmax	Ripple current	F	T	Temp.	Tc	V	Vratio	πcv	λb	πQ	πE	λp
										deg.C	Vmax						
C1	123-47111688@	ELE	SAMXON	680	63	0.922	1 1.4	2.2	105	50.7	24.4	0.387	1.0998	0.0388	3	1	0.12796
C3	123-51091398(R)	ELE	SAMXON	390	35	1.05	1	2.44	105	47	26.4	0.754	0.9951	0.103	3	1	0.307394
C7	123-14041227(R)	ELE	SAMXON	22	50	0.079	1	2.44	105	53.9	13.7	0.274	0.5931	0.0347	3	1	0.061742
TOTAL																	0.497096



**MTBF prediction worksheet - Transistor-Power MOSFET**

Model WR24ACWI125MF10N(RV)

Conditions: Vin=24VAC; Output Load:+24V/0.125A

Amb. : 25°C

Component description				Component specifications							Stress				Failure rate					
Ref. Design	Part No.	Type	Maker	Pd rated	Vds rated	Id rated	Vgs rated	Rth	Rdc(on)	Tj rated	Id(rms)	Pd	Tc	Tj(c)	πT	λb	πA	πQ	πE	λp
				W	V	A	V	deg.C/W	Ohm	deg.C	A	W	deg.C	deg.C						
Q1	226-04217002(R)	M	IPS	250	200	40	20	60	0.065	175	0.16	0	56.3	56.4	1.851	0.012	10	5.5	1	1.221714
TOTAL																				1.221714

**MTBF prediction worksheet - Resistors**

Model WR24ACWI125MF10N(RV)

Conditions: Vin=24VAC; Output Load:+24V/0.125A

Amb. : 25°C

Component description				Component specifications					Stress				Failure Rate				
Ref. Design	Part No.	Type	Maker	Resistance	Power	V rms rated	temp.	K	Tc	Vrms	Power actual	Watt ratio	πR	λb	πQ	πE	λp
				Ohm	W	V	deg.C		deg.C	V	W						
R1	100-08053305(R)	R.CF	VIKMG	330000	0.125	150	155	1.00	43.2	5.8	0.0001	0.00	1.10	0.000807	5.00	1.00	0.004439819
R2	100-08018664(R)	R.CF	VIKMG	86600	0.125	150	155	1.00	49.4	8.74	0.0009	0.01	1.00	0.000859	5.00	1.00	0.004293984
R8	100-08054701(R)	R.CF	VIKMG	47	0.125	150	155	1.00	51.1	0.05	0.0001	0.00	1.00	0.000865	5.00	1.00	0.004324673
R10	100-06011303(R)	R.CF	VIKMG	1000	0.1	50	155	1.00	49.6	0.026	0.0000	0.00	1.00	0.000853	5.00	1.00	0.004265879
R7	100-06011001(R)	R.CF	VIKMG	10	0.1	50	155	1.00	51.1	0.093	0.0009	0.01	1.00	0.000873	5.00	1.00	0.004367100
R11	100-06011005(R)	R.CF	VIKMG	100000	0.1	50	155	1.00	50	1.828	0.0000	0.00	1.10	0.000857	5.00	1.00	0.004710827
R15	100-12054701(R)	R.CF	VIKMG	47	0.25	200	155	1.00	49.3	0.2	0.0009	0.00	1.00	0.000854	5.00	1.00	0.004271740
R23	100-12052404(R)	R.CF	VIKMG	24000	0.25	200	155	1.00	48.8	24.34	0.0247	0.10	1.00	0.000952	5.00	1.00	0.004758795
R21	100-06052202(R)	R.CF	VIKMG	220	0.1	50	155	1.00	49.2	0.268	0.0003	0.00	1.00	0.000853	5.00	1.00	0.004267277
R14	100-06014703(R)	R.CF	VIKMG	4700	0.1	50	155	1.00	46.8	1.066	0.0002	0.00	1.00	0.000835	5.00	1.00	0.004173894
R16	100-06014703(R)	R.CF	VIKMG	4700	0.1	50	155	1.00	47.6	1.16	0.0003	0.00	1.00	0.000841	5.00	1.00	0.004205590
R17	100-06014124(R)	R.CF	VIKMG	41200	0.1	50	155	1.00	47.5	20.98	0.0107	0.11	1.00	0.000949	5.00	1.00	0.004747397
R18	100-06014643(R)	R.CF	VIKMG	46400	0.1	50	155	1.00	47.8	2.398	0.0001	0.00	1.00	0.000841	5.00	1.00	0.004204971
R3	102-32052204(R)	R.MF	VIKMG	22000	2	350	155	1.00	51.7	10.46	0.0050	0.00	1.00	0.000872	5.00	1.00	0.004358226
R12	102-33016209(R)	R.MF	VIKMG	0.062	3	350	155	1.00	51.9	0.01	0.0016	0.00	1.00	0.000871	5.00	1.00	0.004355791
TOTAL																	0.065745964