CUS150M1

RELIABILITY DATA

TDK-LAMBDA

INDEX

※ Test results are typical data. Nevertheless the following results are considered to be actual capability data because all units have nearly the same characteristics.

1. Calculated Values of MTBF

MODEL : CUS150M1-12

(1) Calculating Method

Calculated based on part count reliability projection of JEITA (RCR-9102B).
Individual failure rates λ_G is given to each part and MTBF is calculated
by the count of each part.

$$MTBF = \frac{1}{\lambda_{equip}} = \frac{1}{\sum_{i=1}^{n} n_i \left(\lambda_G \pi_Q\right)_i} \times 10^6 \quad \text{(Hours)}$$

λ_{equip} : Total Equipment Failure Rate (Failure／10^6Hours)

λ_G : Generic Failure Rate for The ith Generic Part (Failure／10^6Hours)

n_i : Quantity of ith Generic Part

n : Number of Different Generic Part Categories

π_Q : Generic Quality Factor for The ith Generic Part (π_Q=1)

(2) MTBF Values

G_F : Ground, Fixed

RCR-9102B

MTBF ≒ 145,065 (Hours)

2. Components Derating

MODEL : CUS150M1-12

(1) Calculating Method

(a) Measuring method

・Mounting method :Standard mounting A	・Ambient temperature :50℃
・Input voltage :115, 230VAC	・Output voltage & current :12V, 12.5A(100%)

(b) Semiconductors

Compared with maximum junction temperature and actual one which is calculated based on case temperature, power dissipation and thermal impedance.

(c) IC, Resistors, Capacitors, etc.

Ambient temperature, operating condition, power dissipation and so on are within derating criteria.

(d) Calculating method of thermal impedance

$$\theta j-c=\frac{Tj(max)-Tc}{Pch(max)} \qquad \theta j-a=\frac{Tj(max)-Ta}{Pch(max)} \qquad \theta j-l=\frac{Tj(max)-Tl}{Pch(max)}$$

Tc : Case Temperature at Start Point of Derating; 25℃ in General

Ta : Ambient Temperature at Start Point of Derating; 25℃ in General

Tl : Lead Temperature at Start Point of Derating; 25℃ in General

Pch(max) : Maximum Channel Dissipation

Tj(max) (Tch(max)) : Maximum Junction (channel) Temperature

θj-c (θch-c) : Thermal Impedance between Junction (channel) and Case

θj-a : Thermal Impedance between Junction and air

θj-l : Thermal Impedance between Junction and Lead

(2) Component Derating List

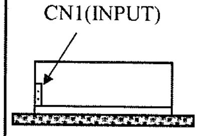
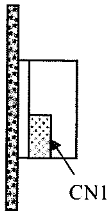
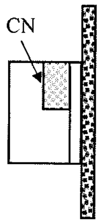
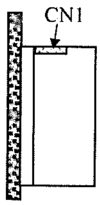
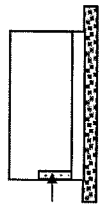
Location No.	Vin = 115VAC Vout = 12V Iout = 12.5A Ta = 50℃ Mounting : A
D1 D10XB60H-7000 SHINDENGEN	Tch (max) = 150 ℃ θch-c = 1.9 ℃/W Pch = 3.01 W ΔTc = 64.6 ℃ Tc = 114.6 ℃ Tch = Tc+ ((θch-c) × Pch) = 120.3 ℃ D.F. = 80.2 %
Q1 TK16A60W TOSHIBA	Tch (max) = 150 ℃ θch-c = 3.13℃/W Pch = 2.6 W ΔTc = 65.2 ℃ Tc = 115.2 ℃ Tch = Tc+ ((θch-c) × Pch) = 123.3 ℃ D.F. = 82.2 %
D2 YG975C6R SHINDENGEN	Tj (max) = 150 ℃ θj-c = 1.75℃/W Pd = 0.6 W ΔTc = 64.3 ℃ Tc = 114.3 ℃ Tch = Tc+ ((θj-c) × Pch)= 115.4 ℃ D.F. = 76.9 %
Q2A TK7A60W TOSHIBA	Tj (max) = 150 ℃ θch-c = 4.17℃/W Pd = 0.8 W ΔTc = 61.3 ℃ Tc = 111.3 ℃ Tj = Tc + ((θch-c) × Pd) = 114.6 ℃ D.F. = 76.4 %
Q51A TK58A06N1 TOSHIBA	Tj (max) = 150 ℃ θch-c = 3.57℃/W Pd = 0.45W ΔTc = 46.5 ℃ Tc = 108.2 ℃ Tj = Tc + ((θch-c) × Pd) = 98.1 ℃ D.F. = 56.1 %

Location No.	Vin = 230VAC Vout = 12V Iout = 12.5A Ta = 50℃ Mounting : A
D1 D10XB60H-7000 SHINDENGEN	Tch (max) = 150 ℃ θch-c = 1.9 ℃/W Pch = 1.5 W ΔTc = 52.6 ℃ Tc = 102.6 ℃ Tch = Tc+ ((θch-c) × Pch)= 105.5 ℃ D.F. = 70.3 %
Q1 TK16A60W TOSHIBA	Tch (max) = 150 ℃ θch-c = 3.13℃/W Pch = 1.6 W ΔTc = 57.8 ℃ Tc = 107.8 ℃ Tch= Tc+ ((θch-c) × Pch)= 112.8 ℃ D.F. = 75.2 %
D2 YG975C6R SHINDENGEN	Tj (max) = 150 ℃ θj-c = 1.75℃/W Pd = 0.6 W ΔTc = 55.4 ℃ Tc = 105.4 ℃ Tch = Tc+ ((θj-c) × Pch) = 106.5 ℃ D.F. = 71.0 %
Q2A TK7A60W TOSHIBA	Tj (max) = 150 ℃ θch-c = 4.17℃/W Pd = 0.8 W ΔTc = 53.2 ℃ Tc = 92.5 ℃ Tj = Tc + ((θch-c) × Pd) = 106.5 ℃ D.F. = 71.0 %
Q51A TK58A06N1 TOSHIBA	Tj (max) = 150 ℃ θch-c = 3.57℃/W Pd = 0.45W ΔTc = 45.6 ℃ Tc = 107.3 ℃ Tj = Tc + ((θch-c) × Pd) = 97.2 ℃ D.F. = 55.6 %

3. Main Components Temperature Rise △T List

MODEL : CUS150M1-12

(1) Measuring Conditions

Mounting Method (Standard Mounting : A)	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E
					
Input Voltage	115VAC				
Output Voltage	12VDC				
Output Current	12.5A(100%)				

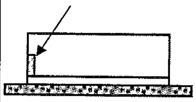
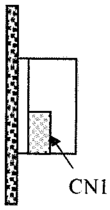
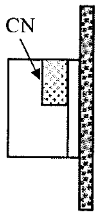
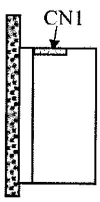
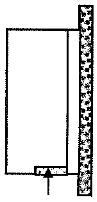
(2) Measuring Results

Output Derating		ΔT Temperature Rise (℃) Io=12.5A (100 %)				
		Ta=50℃	Ta=50℃	Ta=50℃	Ta=40℃	Ta=50℃
Location No.	Part name	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E
C7	E.CAP.	41.4	36.3	46.7	42.4	42.1
C51B	E.CAP.	40.7	39.5	34.5	36.4	41.4
C51C	E.CAP.	35.9	37.8	28.9	31.1	38.3
C52	E.CAP.	34.6	34.5	28.9	30.1	36.5
L1 WIRE	BALUN COIL	39.7	30.4	49.7	44	35.4
L2 WIRE	BALUN COIL	43.3	32.3	50.5	45.6	37.9
L3 WIRE	CHOKE COIL	42.3	38.9	42.7	54.7	41.9
L4 WIRE	CHOKE COIL	70	71.7	64.6	71	70.5
L5 WIRE	CHOKE COIL	47.4	44	44.5	43.4	53.5
T1 WIRE	TRANSFORMER WIRE	56.6	53.6	52.1	52	53.5
T2 WIRE	TRANSFORMER WIRE	26.6	39.3	23.6	24.4	44.3
D1	BRIDGE DIODE	64.6	61.4	62.8	64.9	64.6
D2	S.B.D	64.3	64.1	61.5	63.9	68.1
D61	S.B.D	25.6	37.6	21.5	24.3	40.3
Q1	MOSFET	65.2	64.6	62.3	64.5	68.2
Q2A	MOSFET	61.3	62.8	58.6	61.1	66.3
Q2B	MOSFET	58.9	60.8	56.2	57.9	64.3
Q51A	MOSFET	43.8	40.7	45.8	40	43.4
Q51B	MOSFET	46.5	42.8	48.5	42.8	44.8
PC101	PHOTO COUPLER	41.5	43.6	35.1	35.1	49.2
PC102	PHOTO COUPLER	37.5	42.7	30.9	31.4	49.3
PC104	PHOTO COUPLER	30	40.6	24.1	25.2	47
A101	CHIP IC	46.8	37.3	50.9	43.1	41.5
A102	CHIP IC	51.9	51.4	47.9	47.4	59
A103	CHIP IC	45.3	39.9	40.7	41.8	46.1

3. Main Components Temperature Rise △T List

MODEL : CUS150M1-12

(1) Measuring Conditions

Mounting Method	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E
Mounting Method (Standard Mounting : A)					
Input Voltage	230VAC				
Output Voltage	12VDC				
Output Current	12.5A(100%)				

(2) Measuring Results

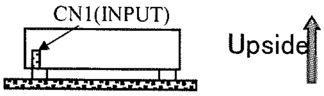
Output Derating		ΔT Temperature Rise (℃) Io=12.5A (100 %)				
		Ta=50℃	Ta=50℃	Ta=50℃	Ta=40℃	Ta=50℃
Location No.	Part name	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E
C7	E.CAP.	37	31.3	40.8	38.1	34.8
C51B	E.CAP.	40.9	38.9	34	35.7	39.7
C51C	E.CAP.	35.3	37.1	28.4	30.5	36.3
C52	E.CAP.	34	34	28.4	29.4	34.8
L1 WIRE	BALUN COIL	25.7	18	33.8	31	21.2
L2 WIRE	BALUN COIL	31.9	22.4	37.8	35.4	26.9
L3 WIRE	CHOKE COIL	28.8	26.1	28.5	39.7	27.8
L4 WIRE	CHOKE COIL	54.6	56.4	50.2	56.4	54.4
L5 WIRE	CHOKE COIL	43.7	40.4	40.9	40.3	47.2
T1 WIRE	TRANSFORMER WIRE	55.5	52.5	51.3	51.3	51.2
T2 WIRE	TRANSFORMER WIRE	24.8	37.2	21.9	22.9	38.8
D1	BRIDGE DIODE	51.6	49.5	50	52.6	50.5
D2	S.B.D	55.4	55.5	53.1	55.9	57.2
D61	S.B.D	24.9	36.6	20.8	23.8	36.8
Q1	MOSFET	57.8	56.7	55.3	59.1	58.7
Q2A	MOSFET	53.2	54.4	50.9	53.8	56
Q2B	MOSFET	51.4	53.1	49.1	51.2	54.6
Q51A	MOSFET	43	40.1	44.8	39	41.9
Q51B	MOSFET	45.6	42.1	47.3	41.8	43.1
PC101	PHOTO COUPLER	39.6	41.8	33.6	33.8	44.2
PC102	PHOTO COUPLER	35.5	40.6	29.3	30.1	43.7
PC104	PHOTO COUPLER	28.3	38.5	22.9	23.9	41.4
A101	CHIP IC	41.7	33.2	45.4	39.1	35.6
A102	CHIP IC	46.4	46	43	43.5	50.5
A103	CHIP IC	40.8	35.2	38.2	38.8	40.4

4. Electrolytic Capacitor Lifetime

MODEL : CUS150M1-12

Cooling condition : Convection cooling

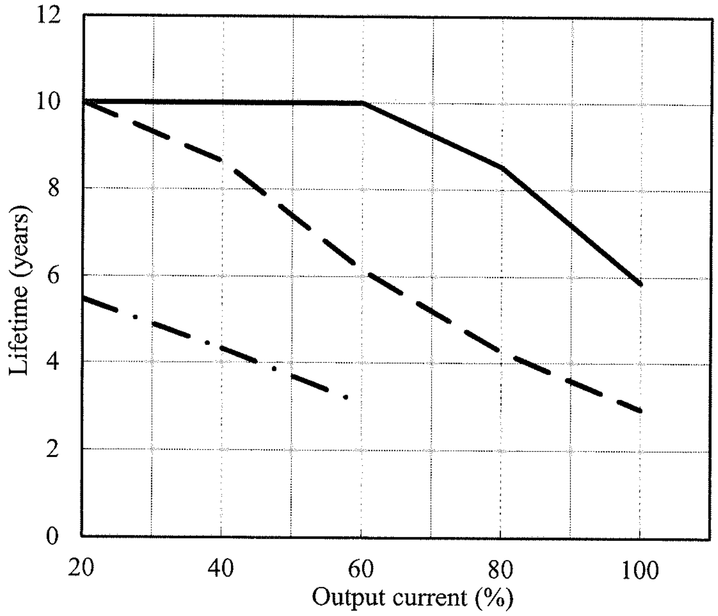
Mounting A



Conditions Ta 40℃ : ———
50℃ : – – –
60℃ : –·–·

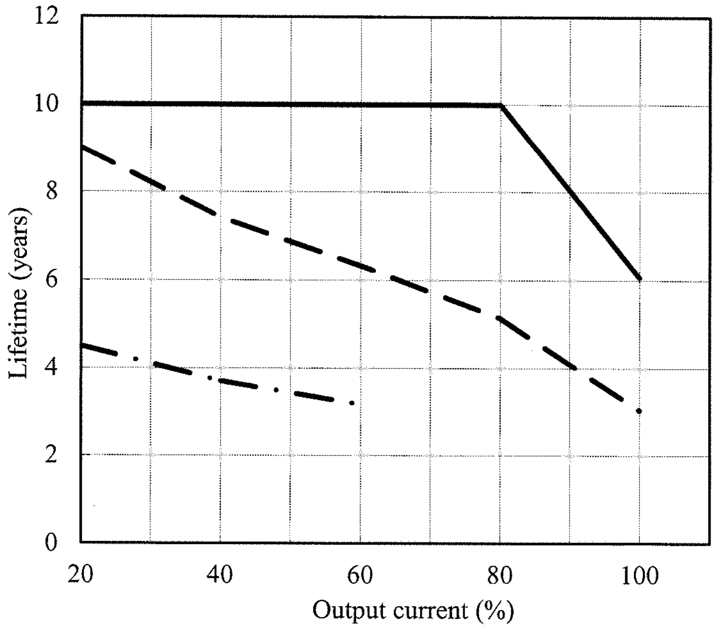
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta=40℃	Ta=50℃	Ta=60℃
20	10.0	10.0	5.5
40	10.0	8.6	4.3
60	10.0	6.2	3.1
80	8.5	4.3	-
100	5.9	2.9	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta=40℃	Ta=50℃	Ta=60℃
20	10.0	9.0	4.5
40	10.0	7.4	3.7
60	10.0	6.3	3.2
80	10.0	5.1	-
100	6.1	3.0	-

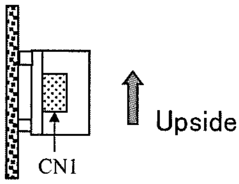


4. Electrolytic Capacitor Lifetime

MODEL : CUS150M1-12

Cooling condition : Convection cooling

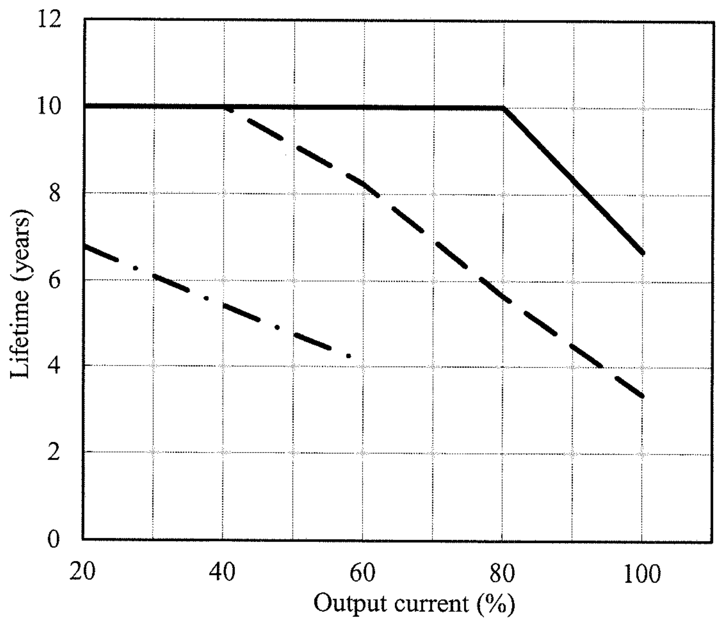
Mounting B



Conditions Ta 40℃ : ——— 50℃ : – – – 60℃ : –·–·

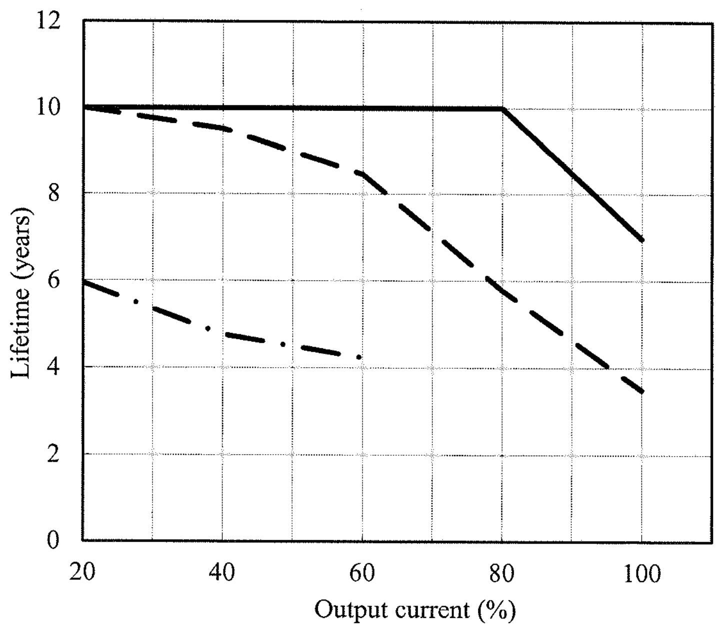
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	10.0	6.8
40	10.0	10.0	5.4
60	10.0	8.2	4.1
80	10.0	5.7	-
100	6.7	3.3	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	10.0	5.9
40	10.0	9.5	4.8
60	10.0	8.5	4.2
80	10.0	5.8	-
100	7.0	3.5	-

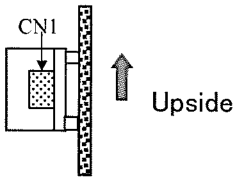


4. Electrolytic Capacitor Lifetime

MODEL : CUS150M1-12

Cooling condition : Convection cooling

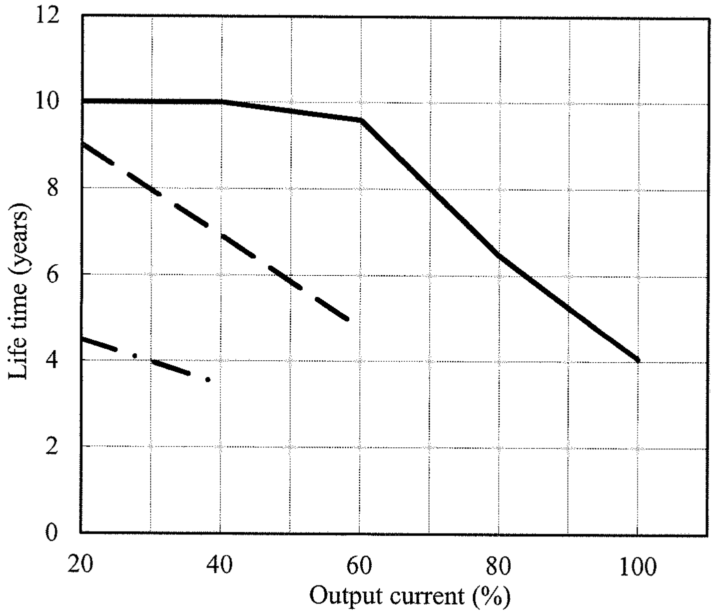
Mounting C



Conditions Ta 40℃ : ———
50℃ : – – –
60℃ : —·—·

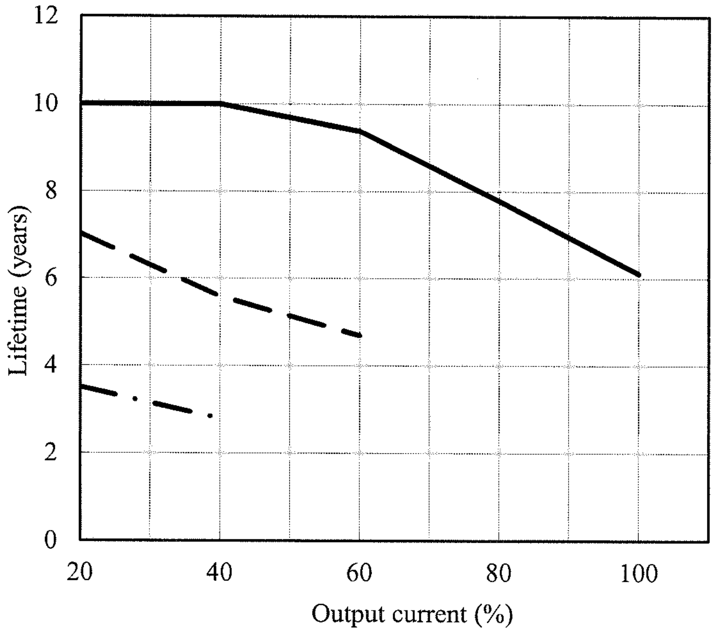
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	9.0	4.5
40	10.0	6.9	3.5
60	9.6	4.8	-
80	6.5	-	-
100	4.1	-	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	7.0	3.5
40	10.0	5.6	2.8
60	9.4	4.7	-
80	7.8	-	-
100	6.1	-	-

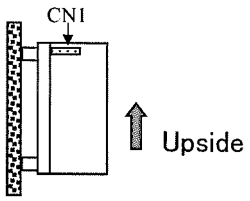


4. Electrolytic Capacitor Lifetime

MODEL : CUS150M1-12

Cooling condition : Convection cooling

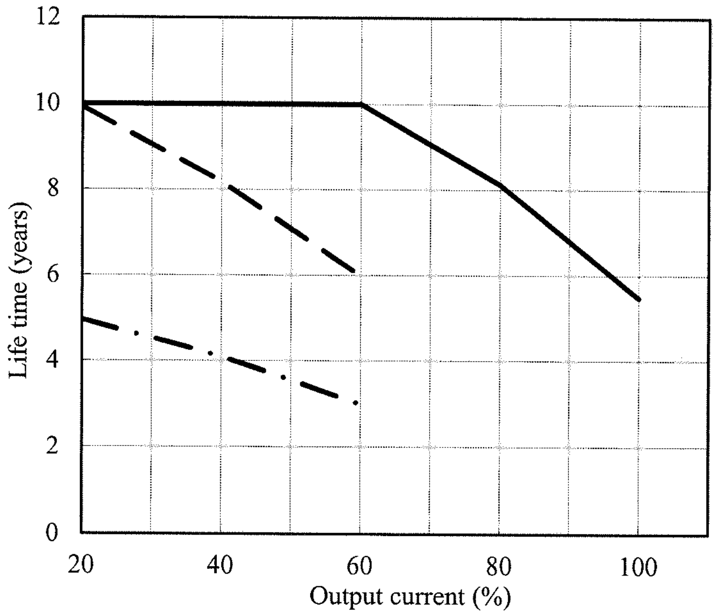
Mounting D



Conditions Ta 40℃ : ———
50℃ : – – –
60℃ : –·–·

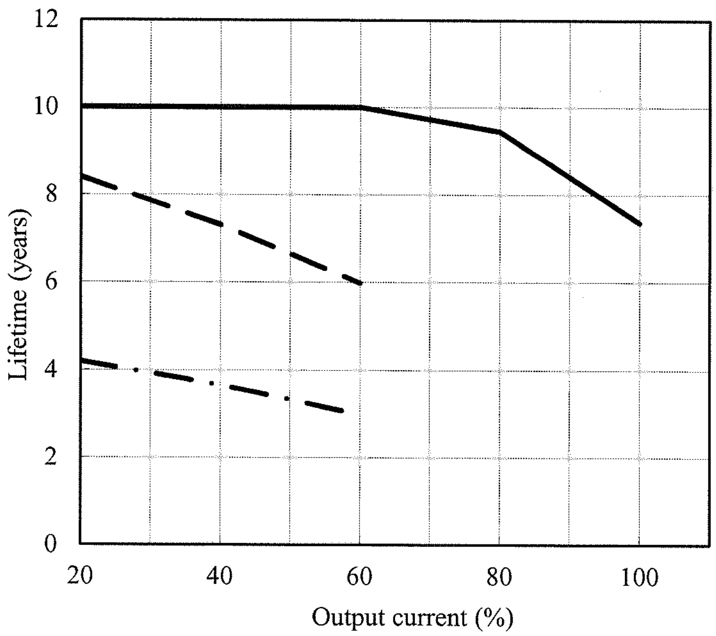
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta=40℃	Ta=50℃	Ta=60℃
20	10.0	9.9	5.0
40	10.0	8.2	4.1
60	10.0	6.0	3.0
80	8.1	-	-
100	5.5	-	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta=40℃	Ta=50℃	Ta=60℃
20	10.0	8.4	4.2
40	10.0	7.3	3.7
60	10.0	6.0	3.0
80	9.5	-	-
100	7.4	-	-

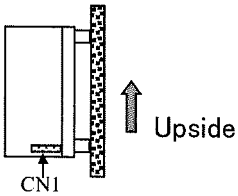


4. Electrolytic Capacitor Lifetime

MODEL : CUS150M1-12

Cooling condition : Convection cooling

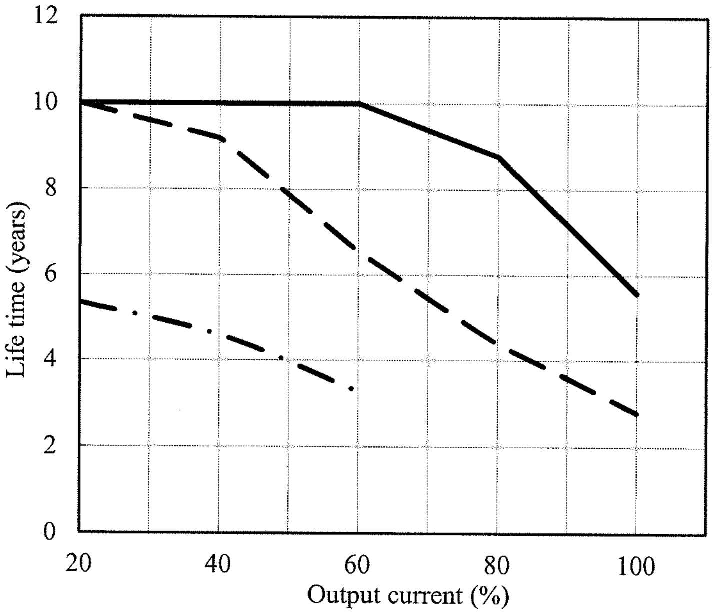
Mounting E



Conditions Ta 40℃ : ——
50℃ : – – –
60℃ : –·–·

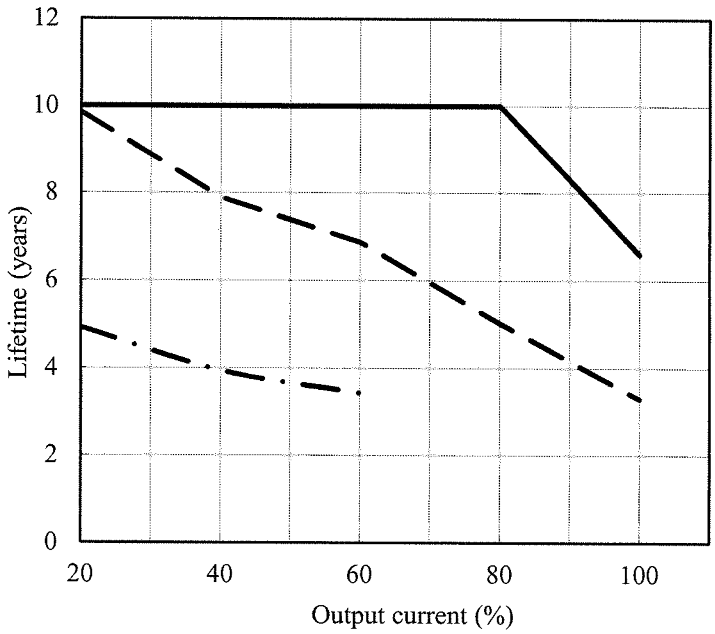
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	10.0	5.4
40	10.0	9.2	4.6
60	10.0	6.5	3.3
80	8.8	4.4	-
100	5.6	2.8	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	9.9	4.9
40	10.0	7.9	3.9
60	10.0	6.9	3.4
80	10.0	5.0	-
100	6.6	3.3	-



5. **Abnormal Test**

MODEL :CUS150M1-12

(1) Test Conditions
Input : 230VAC Output : 12V, 12.5A Ta : 25℃

(2) Test Results

(Da : Damaged)

No.	Test position: Location No.	Test position: Test point	Test mode: Short	Test mode: Open	Test result: a Fire	b Smoke	c Burst	d Smell	e Red hot	f Damaged	g Fuse blown	h OVP	I OCP	j No output	k No change	l Others	Note
1	C1		○								○			○			
				○											○		
2	L1	1~3	○												○		
		1~3		○										○			
		2~4	○												○		
		2~4		○										○			
		1~2	○								○			○			
3	L2	1~3	○												○		
		1~3		○										○			
		2~4	○												○		
		2~4		○										○			
		1~2	○								○			○			
4	C4		○								○			○			
				○											○		
5	L3		○												○		
				○										○			
6	D1	AC~AC	○								○						
		AC~DC	○								○						
		DC~DC	○								○						
		AC		○										○			
		DC+		○										○			
		DC-		○										○			
7	C6		○								○			○			
				○						○	○			○		○	Da : Q1 and Z101
8	L4	1~2	○							○	○			○		○	Da : Q1 and Z101
		1~2		○										○			
		3~4	○													○	Input power increase, audio noise
		3~4		○						○				○		○	Da : L4
9	Q1	d		○										○			
		s		○										○			
		g		○										○			
		d~s	○							○	○			○		○	Da : Z101
		g~s	○											○			
		g~d	○							○	○			○		○	Da : A101, Q1 and Z101
10	D2		○							○	○			○		○	Da : Q1 and Z101
				○						○	○			○		○	Da : Q1 and Z101

5. Abnormal Test

MODEL :CUS150M1-12

(1) Test Conditions

Input : 230VAC   Output : 12V, 12.5A   Ta : 25℃

(2) Test Results

(Da : Damaged)

No.	Test position		Test mode		Test result												
	Location No.	Test point	Short	Open	a Fire	b Smoke	c Burst	d Smell	e Red hot	f Damaged	g Fuse blown	h OVP	I OCP	j No output	k No change	l Others	Note
11	Q2A	d		O										O			
		s		O						O				O		O	Da: Q2A, A102
		g		O										O			
		d~s	O							O	O			O		O	Da: Q2B
		g~s	O											O			
		g~d	O							O	O			O		O	Da: Q2A, Q2B
12	Q2B	d		O										O			
		s		O										O			
		g		O										O			
		d~s	O							O	O			O		O	Da: Q2A
		g~s	O											O			
		g~d	O							O	O			O		O	Da: Q2A, Q2B
13	L5		O													O	Output Ripple voltge increase
				O										O			
14	C8		O							O	O			O		O	Da: Q2A, Q2B
				O										O			
15	T2	1		O										O			
		2		O										O			
		3		O										O			
		4		O										O			
		6		O						O				O		O	Da: A103
		7		O						O				O		O	Da: A103
		1~2	O											O			
		2~3	O							O				O		O	Da: R173
		3~4	O											O			
		6~7	O											O			
16	D61		O											O			
				O						O				O		O	Da: A103
17	D101		O							O				O			Da : Q1 and Z101
				O											O		
18	D107		O													O	Input power increase
				O											O		
19	D109		O											O			
				O										O			
20	C7		O								O			O		O	Da : Z101
				O						O	O			O		O	Da : Q2A and Q2B

5. Abnormal Test

MODEL :CUS150M1-12

(1) Test Conditions

Input : 230VAC Output : 12V, 12.5A Ta : 25℃

(2) Test Results

(Da : Damaged)

No.	Test position		Test mode		Test result												
					a	b	c	d	e	f	g	h	I	j	k	l	
	Location No.	Test point	Short	Open	Fire	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	OVP	OCP	No output	No change	Others	Note
21	D108		○												○		
				○										○			
22	Q51A	d		○									○	○			
		s		○									○	○			
		g		○									○	○			
		d~s	○										○	○			
		g~s	○													○	Input power Increase
		g~d	○										○	○			
23	Q51B	d		○									○	○			
		s		○									○	○			
		g		○									○	○			
		d~s	○										○	○			
		g~s	○													○	Input power Increase
		g~d	○										○	○			
24	T1	2		○										○			
		4		○										○			
		7		○											○		
		8		○											○		
		A		○									○	○			
		B		○									○	○			
		11		○											○		
		12		○											○		
		2~4	○										○	○			
		7,8~A	○										○	○			
		B~11,12	○										○	○			
25	C51B		○										○	○			
				○												○	Output ripple increase
26	C51C		○										○	○			
				○												○	Output ripple increase
27	C52		○										○	○			
				○												○	Output ripple increase

6. Vibration Test

MODEL : CUS150M1-12

(1) Vibration Test Class

Frequency variable endurance test

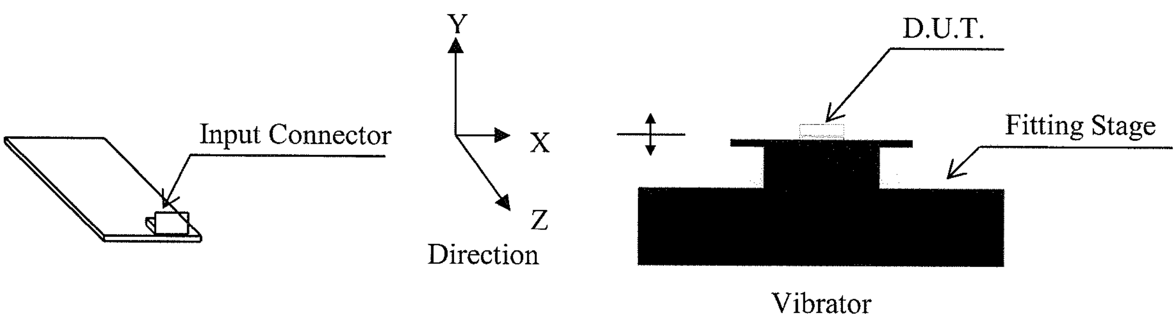
(2) Equipment Used

- Controller : DP550
  DP CORP USA
- Vibrator : V870
  LDS CORP. UK

(3) Test Conditions

- Sweep frequency : 10～55Hz
- Direction : X, Y, Z
- Sweep time : 1.0min
- Sweep count : 1 hour each
- Acceleration : Constant 19.6m/s^2 (2G)

(4) Test Method



(5) Acceptable Conditions

1. Not to be broken

2. Characteristic to be within regulation specification after the test.

(6) Test Results

OK

8. Thermal Shock Test

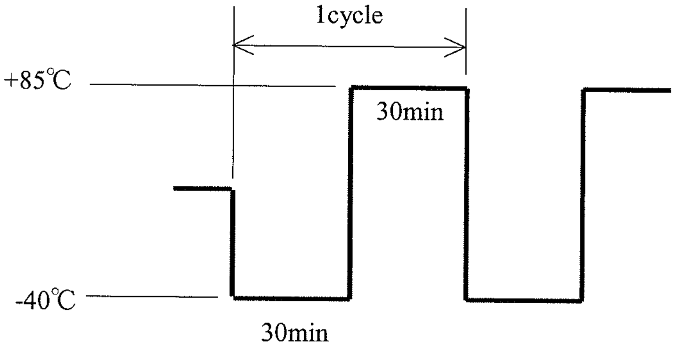
MODEL : CUS150M1-12

(1) Equipment Used

TSA-101S-W : ESPEC

(2) Test Conditions

- ・Ambient Temperature : -40℃ ⇔ 85℃
- ・Test Time : Refer to Dwg.
- ・Test Cycle : 200 Cycles
- ・No Operating



(3) Test Method

Before testing, check if there is no abnormal output, then put the D.U.T. in testing chamber, and test it according to the above cycle. 200 cycles later, leave it for 1 hour at the room temperature , then check if there is no abnormal output.

(4) Acceptable Conditions

1. Not to be broken

2. Characteristic to be within regulation specification after the test.

(5) Test Results

OK