CUS200M

RELIABILITY DATA

DWG No. CA811-57-01		
APPD	CHK	DWG
Wang YB 22-Jan-16	WangHL 22-Jan.-'16	ZhangBC 22-Jan-'16

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※ 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 : CUS200M-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.

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

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 ≒ 126,383 (Hours)

2. Components Derating

MODEL : CUS200M-12

(1) Calculating Method

(a) Measuring method

･Mounting method　:Standard mounting A	･ Ambient temperature　:50℃
･Input voltage　:115, 230VAC	･ Output voltage & current : 12V, 16.7A(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

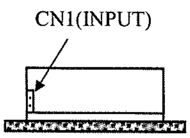
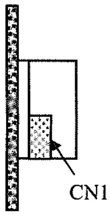
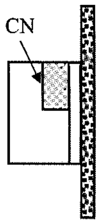
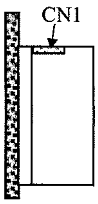
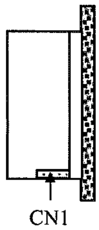
Location No.	Vin = 115VAC Vout = 12V Iout = 16.7A Ta = 50℃ Mounting : A		
D1 D10XB60H-7000 SHINDENGEN	Tch (max) = 150 ℃ Pch = 3.67 W Tch = Tc+ ((θch-c) × Pch) = 119.3 ℃ D.F. = 79.5 %	θch-c = 1.9 ℃/W ΔTc = 62.3 ℃	 Tc = 112.3 ℃
Q1 TK20A60W TOSHIBA	Tch (max) = 150 ℃ Pch = 2.8 W Tch = Tc+ ((θch-c) × Pch) = 118.4 ℃ D.F. = 78.9 %	θch-c = 2.78℃/W ΔTc = 60.6 ℃	 Tc = 110.6 ℃
D2 YG975C6R SHINDENGEN	Tj (max) = 150 ℃ Pd = 0.84 W Tch = Tc+ ((θj-c) × Pch)= 110 ℃ D.F. = 73.3 %	θj-c = 1.75℃/W ΔTc = 58.5 ℃	 Tc = 108.5 ℃
Q2A TK16E60W TOSHIBA	Tj (max) = 150 ℃ Pd = 1.07 W Tj = Tc + ((θch-c) × Pd) = 107 ℃ D.F. = 71.4 %	θch-c = 3.13℃/W ΔTc = 53.7 ℃	 Tc = 103.7 ℃
Q51A IPA032N06N3 G INFINEON	Tj (max) = 175 ℃ Pd = 0.8W Tj = Tc + ((θch-c) × Pd) = 95.3 ℃ D.F. = 54.4 %	θch-c = 3.7℃/W ΔTc = 42.3 ℃	 Tc = 108.2 ℃

Location No.	Vin = 230VAC Vout = 12V Iout = 16.7A Ta = 50℃ Mounting : A		
D1 D10XB60H-7000 SHINDENGEN	Tch (max) = 150 ℃ Pch = 1.8 W Tch = Tc+ ((θch-c) × Pch)= 9.3 ℃ D.F. = 64.9 %	θch-c = 1.9 ℃/W ΔTc = 43.9 ℃	 Tc = 93.9 ℃
Q1 TK20A60W TOSHIBA	Tch (max) = 150 ℃ Pch = 1.9 W Tch= Tc+ ((θch-c) × Pch)= 104 ℃ D.F. = 69.3 %	θch-c = 2.78℃/W ΔTc = 48.7 ℃	 Tc = 98.7 ℃
D2 YG975C6R SHINDENGEN	Tj (max) = 150 ℃ Pd = 0.84 W Tch = Tc+ ((θj-c) × Pch) = 100.2 ℃ D.F. = 66.8 %	θj-c = 1.75℃/W ΔTc = 48.7 ℃	 Tc = 98.7 ℃
Q2A TK16E60W TOSHIBA	Tj (max) = 150 ℃ Pd = 1.07 W Tj = Tc + ((θch-c) × Pd) = 95.8 ℃ D.F. = 63.9 %	θch-c = 3.13℃/W ΔTc = 42.5 ℃	 Tc = 92.5 ℃
Q51A IPA032N06N3 G INFINEON	Tj (max) = 175 ℃ Pd = 0.8W Tj = Tc + ((θch-c) × Pd) = 94.2 ℃ D.F. = 53.8 %	θch-c = 3.7℃/W ΔTc = 41.2 ℃	 Tc = 107.3 ℃

3. Main Components Temperature Rise ΔT List

MODEL : CUS200M-12

(1) Measuring Conditions

Mounting Method	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E
(Standard Mounting : A)					
Input Voltage	115VAC				
Output Voltage	12VDC				
Output Current	16.7A(100%)				

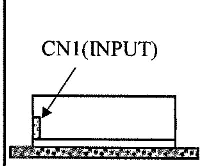
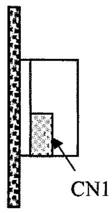
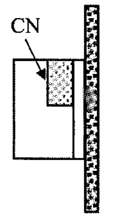
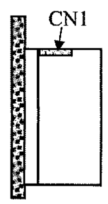
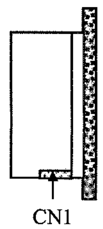
(2) Measuring Results

		ΔT Temperature Rise (℃)				
Output Derating		Io=16.7A (100 %)				
		Ta=50℃	Ta=50℃	Ta=40℃	Ta=40℃	Ta=40℃
Location No.	Part name	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E
C7	E.CAP.	40.5	34.4	44.7	43.1	41.1
C51A	E.CAP.	36.8	34.4	37.6	33	48.1
C51B	E.CAP.	38.9	36.3	34.9	33.8	50
C51C	E.CAP.	35.6	34.5	30.5	31.1	46.4
C52	E.CAP.	32.7	30.4	28.6	27.6	43.2
C61	E.CAP.	25.6	32.2	20.7	22.2	42.8
L1 WIRE	BALUN COIL	54	46.1	63.1	63.4	53.5
L2 WIRE	BALUN COIL	51.3	43.2	54.4	57.1	47.7
L3 WIRE	CHOKE COIL	44.4	35.5	38.1	55.2	36
L4 WIRE	CHOKE COIL	73.5	70.5	66.1	73.4	71.8
L5 WIRE	CHOKE COIL	53.7	51.3	48	51.9	58.1
T1 WIRE	TRANSFORMER WIRE	59.5	60.4	56.5	55.8	70.5
T2 WIRE	TRANSFORMER WIRE	38.6	46.5	33.8	38	52.2
D1	BRIDGE DIODE	62.3	56.9	57	62.8	59.1
D2	S.B.D	58.5	54.9	51	58.2	57.3
D61	S.B.D	38	44.6	34.5	36.8	56
Q1	MOSFET	60.6	56.3	53.2	60.3	59.2
Q2A	MOSFET	53.7	51.3	46.6	53.7	53.4
Q2B	MOSFET	52	49.9	45	51.7	52.2
Q51A	MOSFET	42.3	39.4	49.3	42.8	47.9
Q51B	MOSFET	42.3	38.9	49.6	43.1	46.5
PC101	PHOTO COUPLER	42.6	41.6	37.6	39.2	51.1
PC102	PHOTO COUPLER	40.1	40.8	34.9	36.8	50
PC103	PHOTO COUPLER	34.5	38.4	29.1	31.9	45.4
PC104	PHOTO COUPLER	35.9	39.1	30.9	33	46.4
A101	CHIP IC	48.6	42.1	50.4	51.3	49.9
A102	CHIP IC	52.8	48.9	47.5	50.9	55.4
A103	CHIP IC	56	55.9	50.6	53.5	61.4

3. Main Components Temperature Rise ΔT List

MODEL : CUS200M-12

(1) Measuring Conditions

	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E
Mounting Method (Standard Mounting : A)					
Input Voltage	230VAC				
Output Voltage	12VDC				
Output Current	16.7A(100%)				

(2) Measuring Results

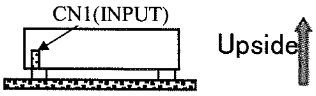
		ΔT Temperature Rise (℃)				
Output Derating		Io=16.7A (100 %)				
		Ta=50℃	Ta=50℃	Ta=40℃	Ta=40℃	Ta=40℃
Location No.	Part name	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E
C7	E.CAP.	32.9	27.7	35.8	37.1	31.1
C51A	E.CAP.	36.2	33.8	36.6	32.5	44.4
C51B	E.CAP.	38.1	35.7	34	33.1	46
C51C	E.CAP.	34.6	34	29.8	30.4	41.7
C52	E.CAP.	32.1	30.5	28.1	26.8	39.6
C61	E.CAP.	24.6	31.5	20.1	21.7	37.2
L1 WIRE	BALUN COIL	28.8	21.4	34.1	38.3	27
L2 WIRE	BALUN COIL	32.1	24.2	33.7	39.3	28
L3 WIRE	CHOKE COIL	26.7	19.5	21.8	35.7	20.3
L4 WIRE	CHOKE COIL	52.5	49.1	47.1	53.7	50.1
L5 WIRE	CHOKE COIL	48.1	44.5	42.2	47	47.8
T1 WIRE	TRANSFORMER WIRE	57	58.8	55.2	54.3	65.7
T2 WIRE	TRANSFORMER WIRE	36.2	43.1	31.6	35.9	45
D1	BRIDGE DIODE	43.9	39	39.8	46.4	40.5
D2	S.B.D	45.7	41.7	39.6	46.7	43.2
D61	S.B.D	37.3	43.3	33.9	35.9	50.3
Q1	MOSFET	48.7	43	41.8	48.7	44.9
Q2A	MOSFET	42.5	39.5	36.6	43.6	40.5
Q2B	MOSFET	41.5	38.7	35.6	42.2	39.8
Q51A	MOSFET	41.2	39	47.9	41.7	45.3
Q51B	MOSFET	41	38.4	47.7	41.8	43.8
PC101	PHOTO COUPLER	40.2	39	35.3	37.5	44.3
PC102	PHOTO COUPLER	37.8	38.2	32.7	35	43.2
PC103	PHOTO COUPLER	32.4	35.8	27.2	30.2	39.3
PC104	PHOTO COUPLER	33.8	36.5	28.8	31.3	40.1
A101	CHIP IC	42.4	36.7	43.9	47.4	41.4
A102	CHIP IC	45.9	41.8	40.8	45.4	45
A103	CHIP IC	51.2	50.8	46	49.7	53.2

4. **Electrolytic Capacitor Lifetime**

MODEL : CUS200M-12

Cooling condition : Convection cooling

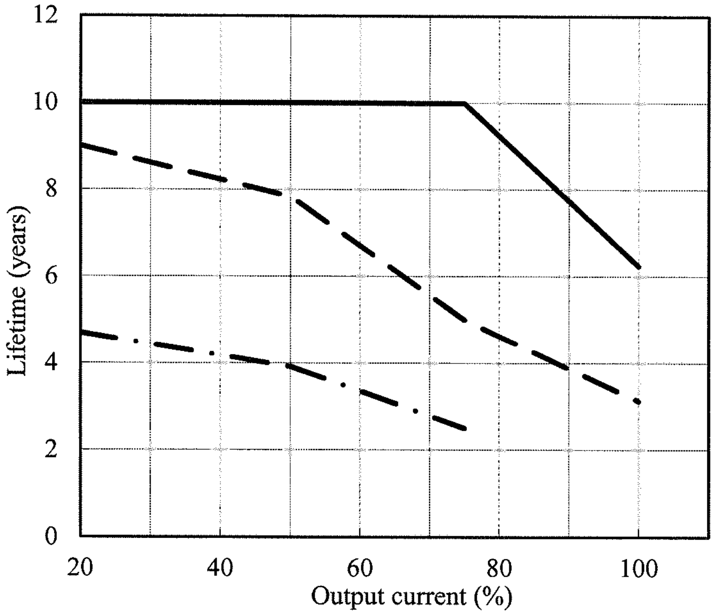
Mounting A



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

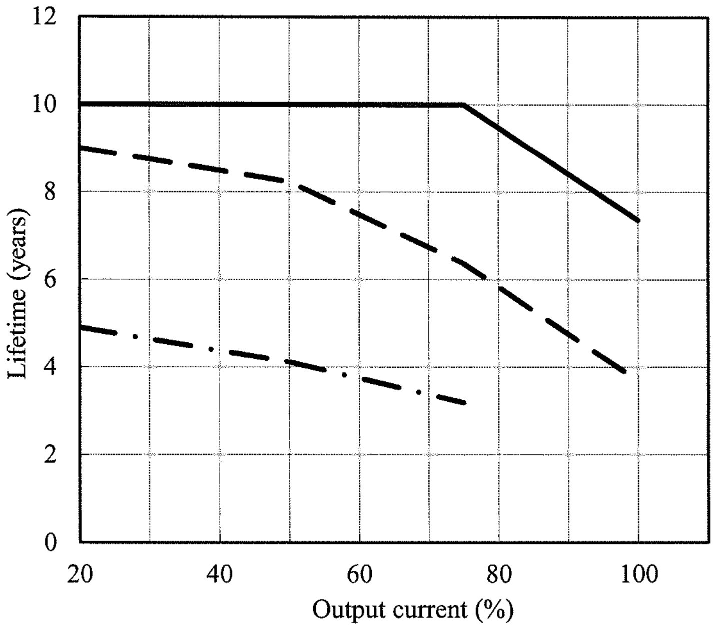
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	9.0	4.7
50	10.0	7.8	3.9
75	10.0	5.0	2.5
100	6.2	3.1	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	9.0	4.9
50	10.0	8.2	4.1
75	10.0	6.4	3.2
100	7.4	3.7	-

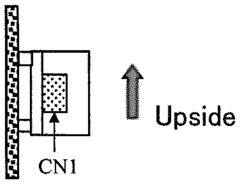


4. Electrolytic Capacitor Lifetime

MODEL : CUS200M-12

Cooling condition : Convection cooling

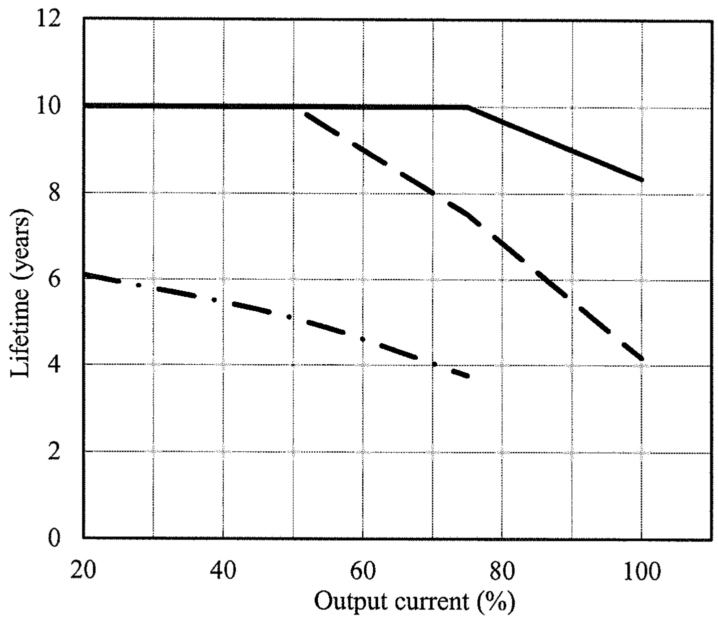
Mounting B



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

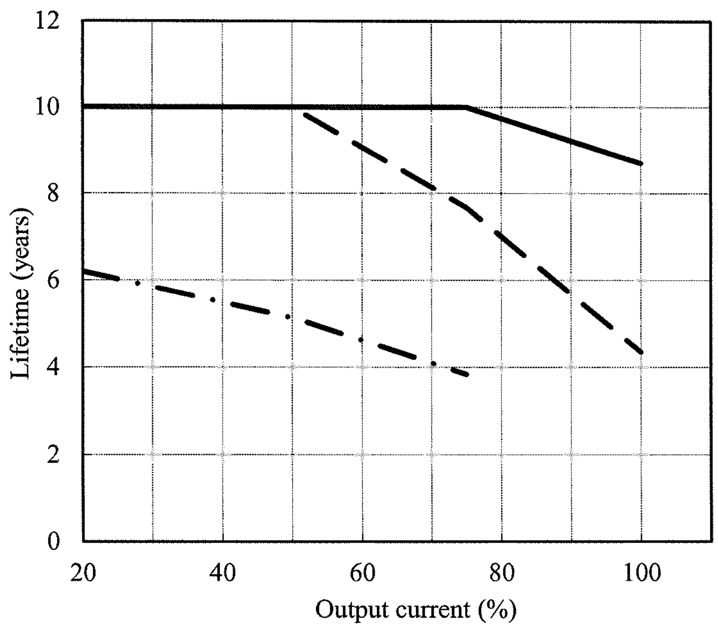
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	10.0	6.1
50	10.0	10.0	5.1
75	10.0	7.5	3.8
100	8.3	4.2	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	10.0	6.2
50	10.0	10.0	5.1
75	10.0	7.7	3.8
100	8.7	4.3	-

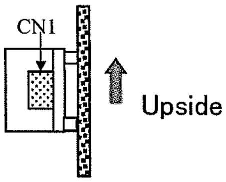


4. Electrolytic Capacitor Lifetime

MODEL : CUS200M-12

Cooling condition : Convection cooling

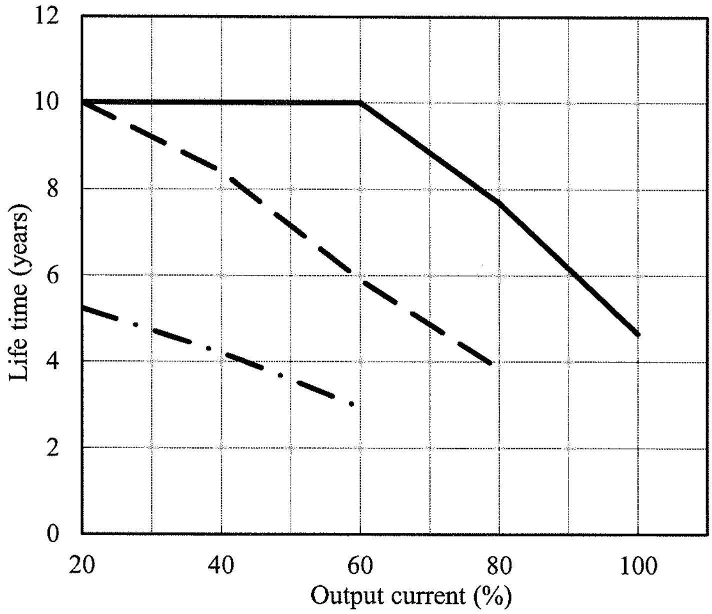
Mounting C



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

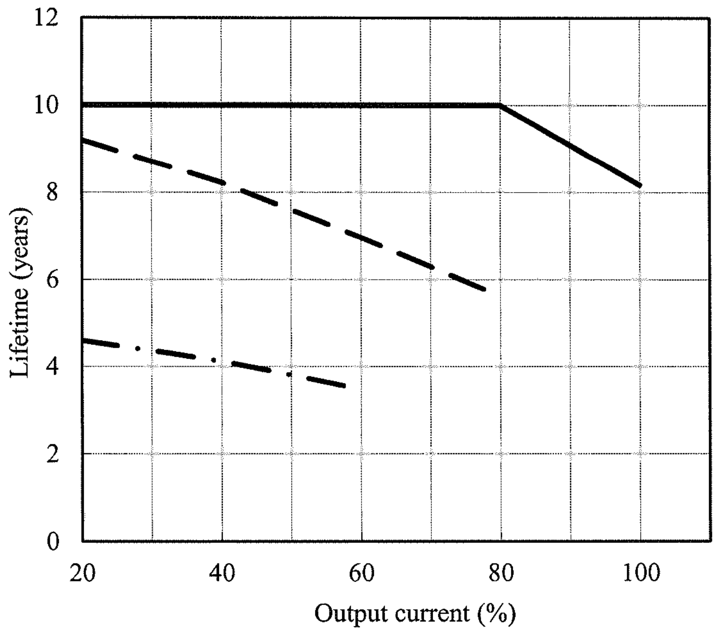
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	10.0	5.2
40	10.0	8.4	4.2
60	10.0	5.9	3.0
80	7.7	3.8	-
100	4.7	-	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	9.2	4.6
40	10.0	8.2	4.1
60	10.0	7.0	3.5
80	10.0	5.6	-
100	8.2	-	-

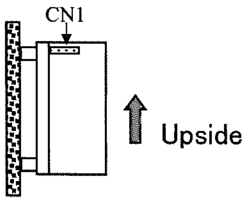


4. Electrolytic Capacitor Lifetime

MODEL : CUS200M-12

Cooling condition : Convection cooling

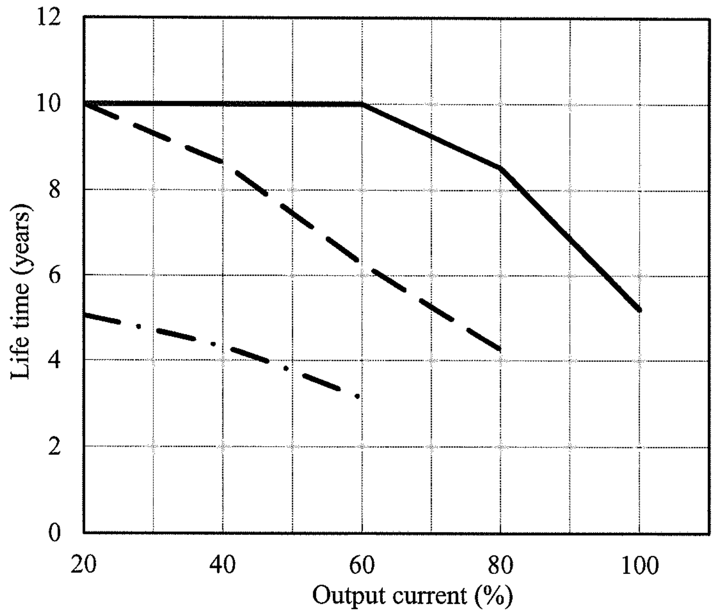
Mounting D



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

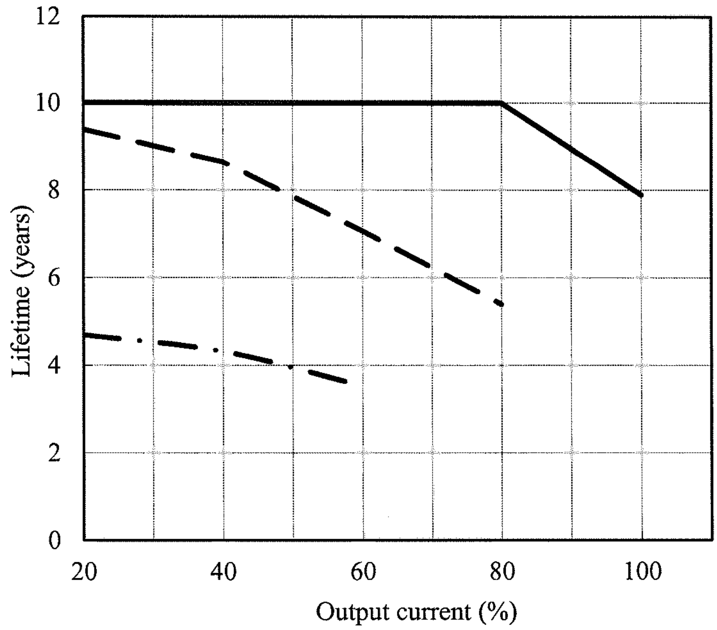
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	10.0	5.1
40	10.0	8.6	4.3
60	10.0	6.3	3.1
80	8.5	4.3	-
100	5.2	-	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	9.4	4.7
40	10.0	8.6	4.3
60	10.0	7.1	3.5
80	10.0	5.4	-
100	7.9	-	-

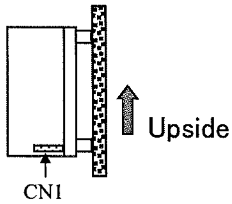


4. Electrolytic Capacitor Lifetime

MODEL : CUS200M-12

Cooling condition : Convection cooling

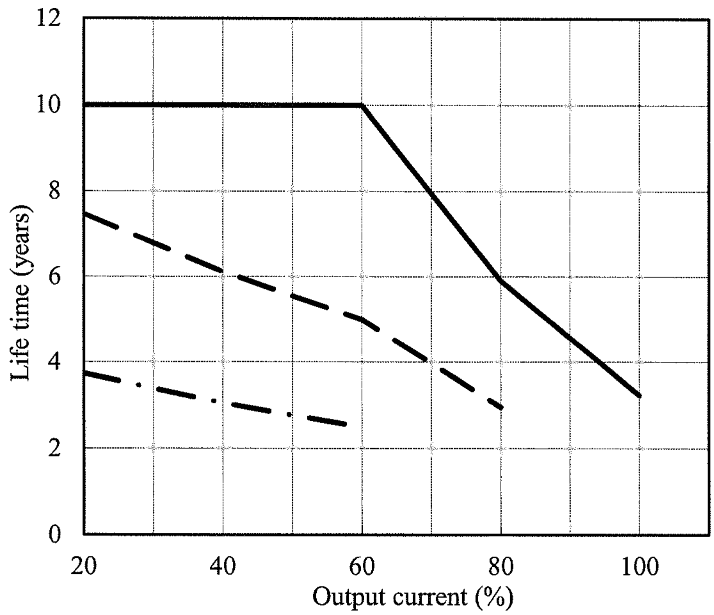
Mounting E



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

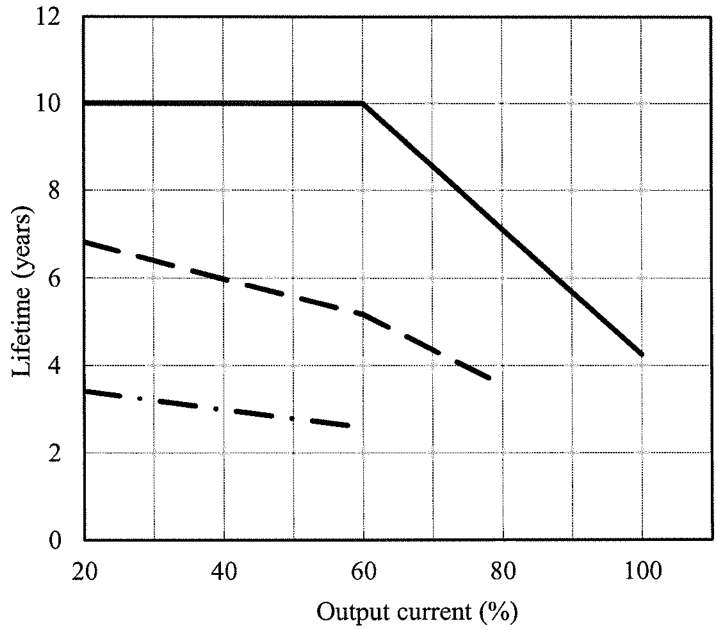
Vin=115VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	7.5	3.7
40	10.0	6.1	3.1
60	10.0	5.0	2.5
80	5.9	3.0	-
100	3.2	-	-



Vin=230VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
20	10.0	6.8	3.4
40	10.0	6.0	3.0
60	10.0	5.2	2.6
80	7.1	3.6	-
100	4.3	-	-



5. Abnormal Test

MODEL :CUS200M-12

(1) Test Conditions
Input : 230VAC Output : 12V, 16.7A 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
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 :CUS200M-12

(1) Test Conditions

Input : 230VAC   Output : 12V, 16.7A   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
11	Q2A	d		○										○			
		s		○						○				○		○	Da: Q2A, A102
		g		○										○			
		d~s	○							○	○			○		○	Da: Q2B
		g~s	○											○			
		g~d	○							○	○			○		○	Da: Q2A, Q2B
12	Q2B	d		○										○			
		s		○										○			
		g		○										○			
		d~s	○							○	○			○		○	Da: Q2A
		g~s	○											○			
		g~d	○							○	○			○		○	Da: Q2A, Q2B
13	L5		○													○	Output Ripple voltge increase
				○										○			
14	C8		○							○	○			○		○	Da: Q2A, Q2B
				○										○			
15	T2	1		○										○			
		2		○										○			
		3		○										○		○	Standby power hiccup
		4		○										○		○	Standby power hiccup
		6		○						○				○		○	Da: A103
		7		○						○				○		○	Da: A103
		1~2	○											○		○	Standby power OCP
		2~3	○							○				○		○	Da: R173
		3~4	○											○		○	Standby power OCP
		6~7	○											○		○	Standby power OCP
16	D61		○											○		○	Standby power OCP
				○						○				○		○	Da: A103
17	C61		○											○		○	Standby power OCP
				○												○	Ripple of Standby power increase
18	D107		○											○		○	Standby power OCP
				○											○		
19	D109		○											○		○	Standby power hiccup
				○										○		○	Standby power hiccup
20	C7		○								○			○		○	Da : Z101
				○						○	○			○		○	Da : Q2A and Q2B

5. Abnormal Test

MODEL :CUS200M-12

(1) Test Conditions

Input : 230VAC Output : 12V, 16.7A 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
21	D108		O												O		
				O										O		O	Standby power hiccup
22	Q51A	d		O									O	O			
		s		O									O	O			
		g		O									O	O			
		d~s	O										O	O			
		g~s	O													O	Input power Increase
		g~d	O										O	O			
23	Q51B	d		O									O	O			
		s		O									O	O			
		g		O									O	O			
		d~s	O										O	O			
		g~s	O													O	Input power Increase
		g~d	O										O	O			
24	T1	2		O										O			
		4		O										O			
		7		O											O		
		8		O											O		
		A		O									O	O			
		B		O									O	O			
		11		O											O		
		12		O											O		
		2~4	O										O	O			
		7,8~A	O										O	O			
		B~11,12	O										O	O			
25	C51A		O										O	O			
				O												O	Output ripple increase
26	C51B		O										O	O			
				O												O	Output ripple increase
27	C51C		O										O	O			
				O												O	Output ripple increase
28	C52		O										O	O			
				O												O	Output ripple increase

6. Vibration Test

MODEL : CUS200M-12

(1) Vibration Test Class

Frequency variable endurance test

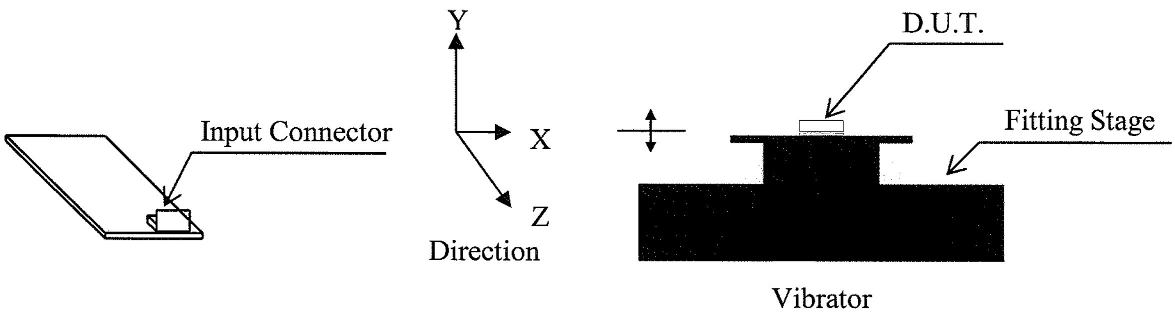
(2) Equipment Used

- 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.

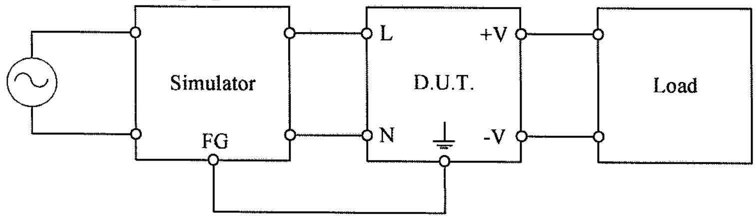
(6) Test Results

OK

7. Noise Simulate Test

MODEL : CUS200M-12

(1) Test Circuit and Equipment



Simulator :INS-400L (Noise Laboratory Co.,LTD)

(2) Test Conditions

• Input voltage	: 115, 230VAC	• Noise level	: 0～2kV
•Output Voltage	: Rated	•Phase	: 0～360 deg
•Output current	: 0, 100%	•Polarity	: +,−
•Ambient temperature	: 25℃	•Mode	: Common, Normal
•Pulse width	: 50～1000ns	• Trigger select	: Line

(3) Acceptable Conditions

1. Not to be broken
2. Not to be shut down output
3. No other out of orders

(4) Test Results

OK

8. Thermal Shock Test

MODEL : CUS200M-12

(1) Equipment Used

TSA-101S-W : ESPEC

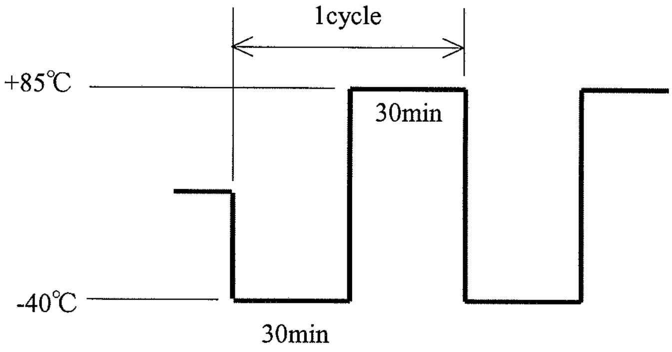
(2) Test Conditions

・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