CUS350M

RELIABILITY DATA

DWG No. CA820-57-01		
APPD	CHK	DWG
[signature]	Song.HF	Wang.HC
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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 : CUS350M-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.

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

λequip : 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 ≒ 108,909 (Hours)

2. Components Derating

MODEL : CUS350M-12

(1) Calculating Method

(a) Measuring method

・Mounting method : Standard mounting	・Ambient temperature : 40℃
・Input voltage : 115, 230VAC	・Output voltage & current : 12V, 29A(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

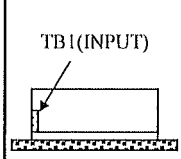
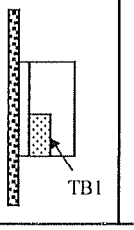
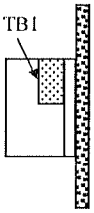
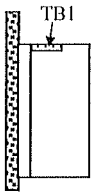
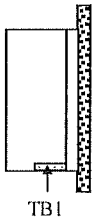
Location No.	Vin = 115VAC	Load = 100%	Ta = 40℃
BD1 D10XB60H-7000 SHINDENGEN	Tch (max) = 150 ℃ Pch= 6.225 W Tch= Tc+ ((θch-c) × Pch)= 124 ℃ D.F. = 83 %	θch-c = 1.9 ℃/W ΔTc= 72 ℃	Tc= 112 ℃
Q1 TK31E60W TOSHIBA	Tch (max) = 150 ℃ Pch= 5.449 W Tch= Tc+ ((θch-c) × Pch)= 136 ℃ D.F. = 91 %	θch-c = 0.543℃/W ΔTc= 93 ℃	Tc= 133 ℃
D1 IDH04SG60C INFINEON	Tj (max) = 175 ℃ Pd = 2.532 W Tch= Tc+ ((θj-c) × Pch)= 140 ℃ D.F. = 80 %	θj-c = 3.5℃/W ΔTc= 91 ℃	Tc= 131 ℃
Q2A TK16E60W TOSHIBA	Tj (max) = 150 ℃ Pd = 3.651 W Tj = Tc + ((θch-c) × Pd) = 117 ℃ D.F. = 78 %	θch-c = 0.962℃/W ΔTc = 73 ℃	Tc= 113 ℃
Q301 TPH2R306NH, L1Q TOSHIBA	Tj (max) = 150 ℃ Pd = 1.79W Tj = Tc + ((θch-c) × Pd) = 134 ℃ D.F. = 89 %	θch-c = 1.6℃/W ΔTc = 91 ℃	Tc= 131 ℃

Location No.	Vin = 230VAC	Load = 100%	Ta = 40℃
BD1 D10XB60H-7000 SHINDENGEN	Tch (max) = 150 ℃ Pch= 3.113 W Tch= Tc+ ((θch-c) × Pch)= 98 ℃ D.F. = 65 %	θch-c = 1.9 ℃/W ΔTc= 52 ℃	Tc= 92 ℃
Q1 TK31E60W TOSHIBA	Tch (max) = 150 ℃ Pch= 2.83 W Tch= Tc+ ((θch-c) × Pch)= 102 ℃ D.F. = 68 %	θch-c = 0.543℃/W ΔTc= 60 ℃	Tc= 100 ℃
D1 IDH04SG60C INFINEON	Tj (max) = 175 ℃ Pd = 2.532 W Tch= Tc+ ((θj-c) × Pch)= 112 ℃ D.F. = 64 %	θj-c = 3.5℃/W ΔTc= 63 ℃	Tc= 103 ℃
Q2A TK16E60W TOSHIBA	Tj (max) = 150 ℃ Pd = 3.651 W Tj = Tc + ((θch-c) × Pd) = 101 ℃ D.F. = 67 %	θch-c = 0.962℃/W ΔTc = 57 ℃	Tc= 97 ℃
Q301 TPH2R306NH, L1Q TOSHIBA	Tj (max) = 150 ℃ Pd = 1.79W Tj = Tc + ((θch-c) × Pd) = 123 ℃ D.F. = 82 %	θch-c = 1.6℃/W ΔTc = 80 ℃	Tc= 120 ℃

3. Main Components Temperature Rise △T List

MODEL : CUS350M-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	29A(100%)				

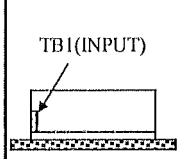
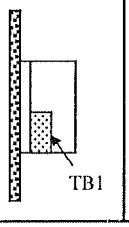
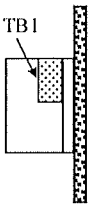
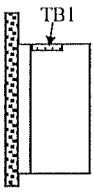
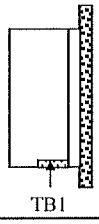
(2) Measuring Results

Output Derating		ΔT Temperature Rise (℃) Io=100 %					
		Ta=40℃	Ta=40℃	Ta=40℃	Ta=40℃	Ta=40℃	
Location No.	Part name	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E	
L1	BALUN COIL	54	61	59	70	51	
L2	BALUN COIL	52	64	57	65	52	
BD1	BRIDGE DIODE	62	72	69	71	65	
L3	CHOKE COIL	90	93	91	94	84	
Q1	MOSFET	83	90	92	93	86	
D1	S.B.D	82	89	91	91	86	
C21	E.CAP.	35	45	45	38	40	
C22	E.CAP.	53	54	57	55	53	
A104	IC	70	77	64	76	80	
Q2A	MOSFET	63	73	70	71	67	
Q2B	MOSFET	62	73	70	71	67	
L4	CHOKE COIL	79	87	83	83	79	
T2	TRANSFORMER WIRE	78	87	85	84	87	
Q301A	MOSFET	78	87	87	86	91	
Q301B	MOSFET	77	87	86	85	90	
C51	E.CAP.	46	47	50	53	60	
A103	IC	64	74	62	69	79	
PC102	PHOTO COUPLER	49	60	63	57	62	
A1	DIP IC	63	70	73	72	75	
T1	TRANSFORMER WIRE	49	56	64	55	62	

3. Main Components Temperature Rise △T List

MODEL : CUS350M-12

(1) Measuring Conditions

Mounting Method (Standard Mounting : A)	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E
					
Input Voltage	230VAC				
Output Voltage	12VDC				
Output Current	29A(100%)				

(2) Measuring Results

Output Derating		ΔT Temperature Rise (℃) Io=100 %					
		Ta=40℃	Ta=40℃	Ta=40℃	Ta=40℃	Ta=40℃	
Location No.	Part name	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E	
L1	BALUN COIL	34	40	38	47	31	
L2	BALUN COIL	34	43	37	45	32	
BD1	BRIDGE DIODE	44	52	49	51	45	
L3	CHOKE COIL	69	71	67	72	63	
Q1	MOSFET	52	57	58	60	53	
D1	S.B.D	55	61	61	63	56	
C21	E.CAP.	29	37	37	34	31	
C22	E.CAP.	40	42	44	44	39	
A104	IC	57	59	53	61	61	
Q2A	MOSFET	48	57	53	56	50	
Q2B	MOSFET	49	57	54	56	50	
L4	CHOKE COIL	68	76	71	73	66	
T2	TRANSFORMER WIRE	73	80	77	77	77	
Q301A	MOSFET	73	80	78	78	79	
Q301B	MOSFET	71	79	77	77	77	
C51	E.CAP.	46	46	45	48	52	
A103	IC	57	62	56	60	64	
PC102	PHOTO COUPLER	43	52	53	49	50	
A1	DIP IC	55	61	63	64	62	
T1	TRANSFORMER WIRE	44	51	56	50	52	

4. Electrolytic Capacitor Lifetime

MODEL : CUS350M-12

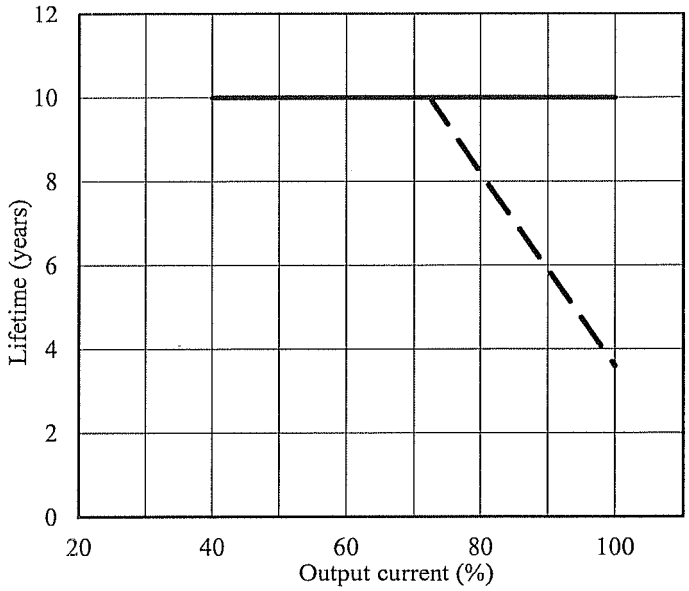
Cooling condition : Convection cooling

Mounting A

Conditions Ta 25℃ : ——
40℃ : – – –

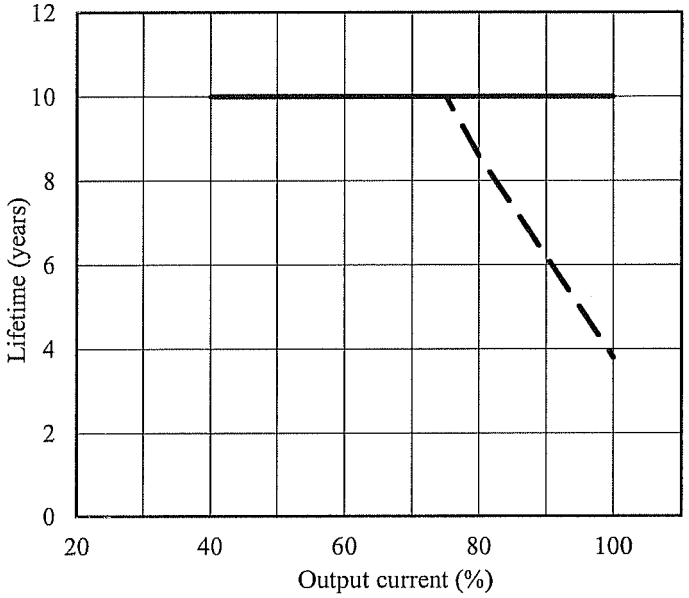
Vin=115VAC

Load (%)	Lifetime (years)	
	Ta= 25℃	Ta= 40℃
40	10.0	10.0
60	10.0	10.0
80	10.0	8.2
100	10.0	3.6



Vin=230VAC

Load (%)	Lifetime (years)	
	Ta= 25℃	Ta= 40℃
40	10.0	10.0
60	10.0	10.0
80	10.0	8.6
100	10.0	3.8

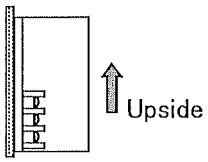


4. Electrolytic Capacitor Lifetime

MODEL : CUS350M-12

Cooling condition : Convection cooling

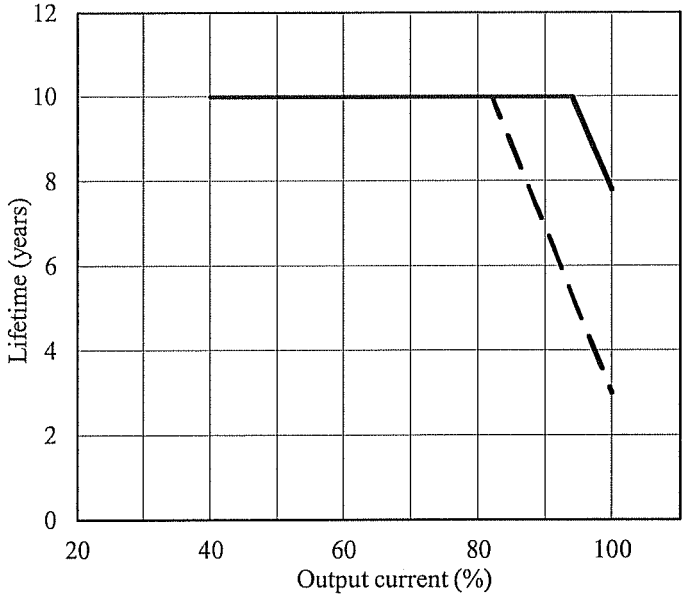
Mounting B



Conditions Ta 25℃ : ——
40℃ : – – –

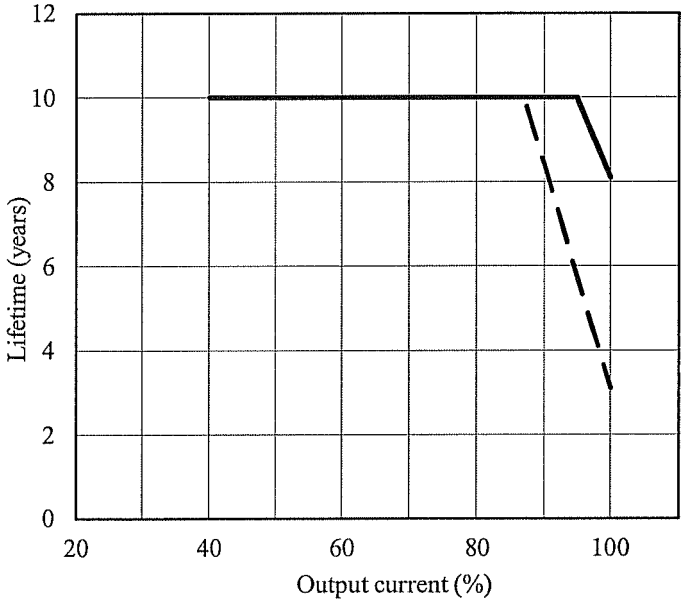
Vin=115VAC

Load (%)	Lifetime (years)	
	Ta= 25℃	Ta= 40℃
40	10.0	10.0
60	10.0	10.0
80	10.0	10.0
100	7.8	3.0



Vin=230VAC

Load (%)	Lifetime (years)	
	Ta= 25℃	Ta= 40℃
40	10.0	10.0
60	10.0	10.0
80	10.0	10.0
100	8.1	3.1

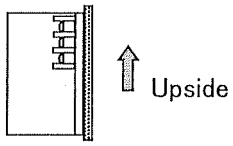


4. Electrolytic Capacitor Lifetime

MODEL : CUS350M-12

Cooling condition : Convection cooling

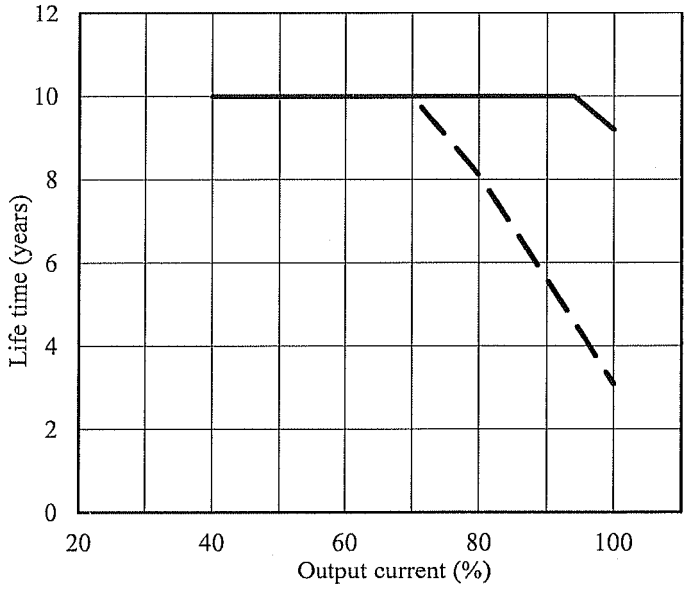
Mounting C



Conditions Ta 25℃ : ———
40℃ : – – –

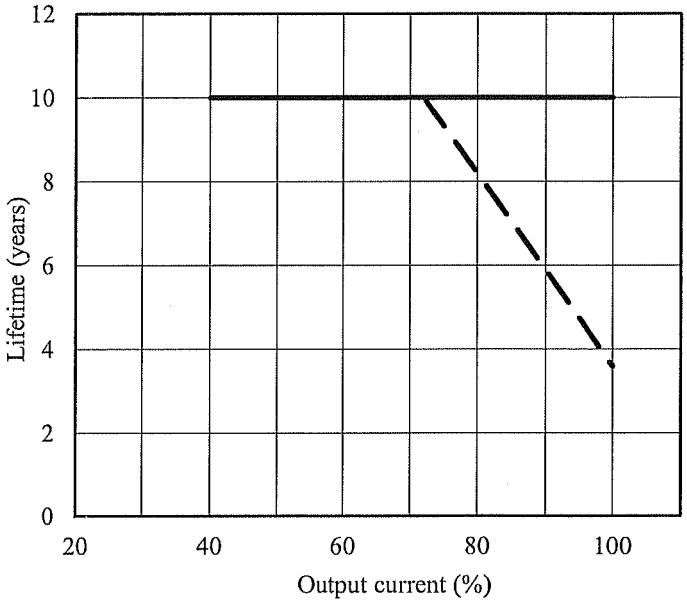
Vin=115VAC

Load (%)	Lifetime (years)	
	Ta= 25℃	Ta= 40℃
40	10.0	10.0
60	10.0	10.0
80	10.0	8.1
100	9.2	3.1



Vin=230VAC

Load (%)	Lifetime (years)	
	Ta= 25℃	Ta= 40℃
40	10.0	10.0
60	10.0	10.0
80	10.0	8.2
100	10.0	3.6

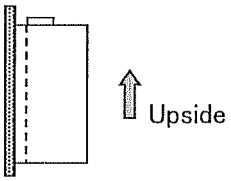


4. Electrolytic Capacitor Lifetime

MODEL : CUS350M-12

Cooling condition : Convection cooling

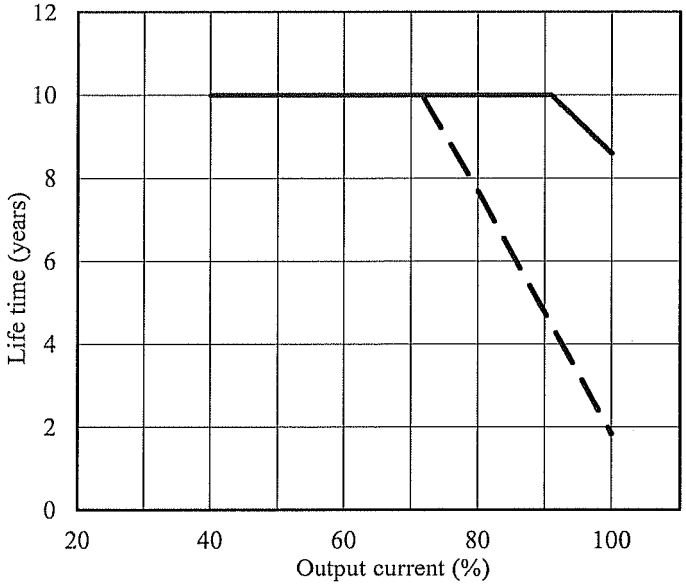
Mounting D



Conditions Ta 25℃ : ——
40℃ : – – –

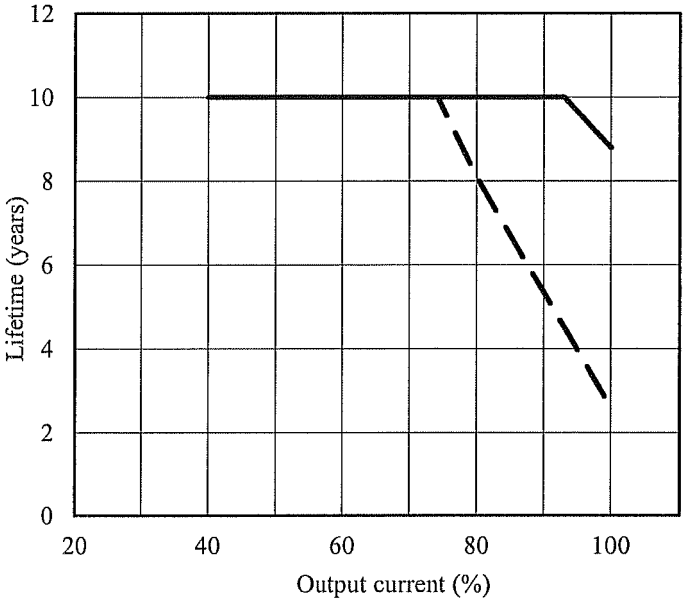
Vin=115VAC

Load (%)	Lifetime (years)	
	Ta= 25℃	Ta= 40℃
40	10.0	10.0
60	10.0	10.0
80	10.0	7.7
100	8.6	1.8



Vin=230VAC

Load (%)	Lifetime (years)	
	Ta= 25℃	Ta= 40℃
40	10.0	10.0
60	10.0	10.0
80	10.0	8.1
100	8.8	2.6

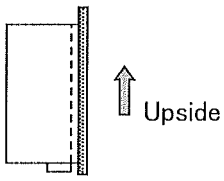


4. Electrolytic Capacitor Lifetime

MODEL : CUS350M-12

Cooling condition : Convection cooling

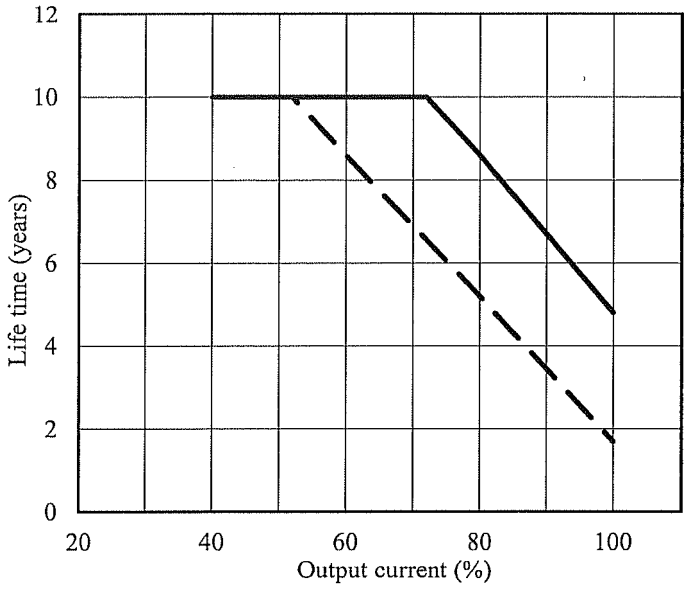
Mounting E



Conditions Ta 25℃ : ——
40℃ : — — —

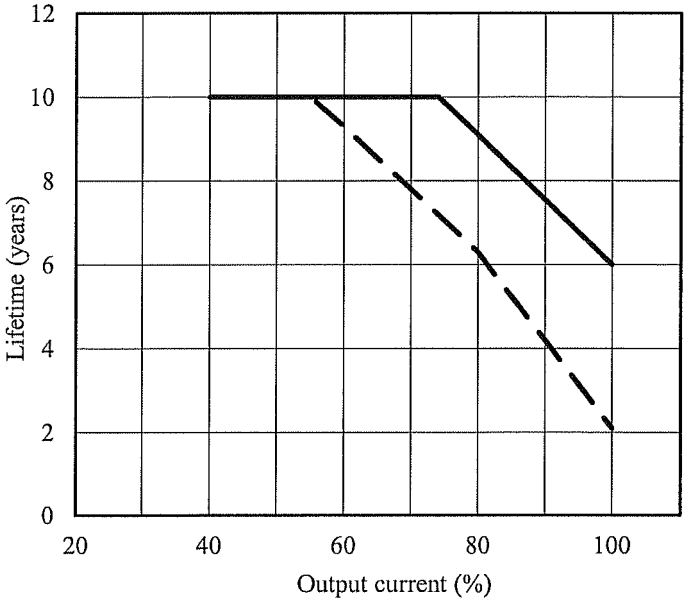
Vin=115VAC

Load (%)	Lifetime (years)	
	Ta= 25℃	Ta= 40℃
40	10.0	10.0
60	10.0	8.6
80	8.6	5.2
100	4.8	1.7



Vin=230VAC

Load (%)	Lifetime (years)	
	Ta= 25℃	Ta= 40℃
40	10.0	10.0
60	10.0	9.3
80	9.1	6.3
100	6.0	2.1



5. Abnormal Test

MODEL :CUS350M-12

(1) Test Conditions

Input : 230VAC Output : 12V, 29A 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	A103	1-2	O												O		
2		2-3	O											O			
3		3-4	O											O			DC-DC Latch
4		4-5	O												O		
5		5-6	O										O				
6		6-7	O										O				
7		7-8	O											O			
8		9-10	O												O		
9		10-11	O											O			
10		11-12	O							O	O			O			Da:F1,F2,Q2A,Q2B
11		14-4	O											O			Da:A103
12		14-8	O											O			Da:A103, Z102
13		14-15	O											O			
14		15-16	O								O			O			Da:F1,F2,Q2,Q3
15		1		O											O		
16		2		O											O		
17		3		O										O			
18		4		O										O			
19		5		O												O	Output hiccup
20		6		O										O			
21		7		O										O			
22		8		O											O		
23		10		O										O			
24		11		O										O			
25		12		O										O			
26		14		O										O			
27		15		O										O			
28		16		O										O			
29	A104	1-2	O													O	PF=0.6
30		2-3	O													O	PF=0.6
31		3-4	O											O			PFC off
32		5-6	O							O				O			Da:A104
33		6-7	O							O				O			Da:A104
34		7-8	O							O	O			O			Da:F1,F2,Q1
35		2		O												O	PF=0.6
36		3		O												O	PF=0.6
37		5		O												O	PF=0.6
38		6		O										O			PFC off

5. Abnormal Test

MODEL :CUS350M-12

(1) Test Conditions

Input : 230VAC Output : 12V, 29A Ta : 25℃

(2) Test Results

(Da : Damaged)

No.	Test position		Test mode		Test result												Note
					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	
39	A1	1-2	O													O	Output hiccup
40		2-3	O											O			
41		2-4	O							O				O			Da:R129,A1,PC101
42		3-4	O							O				O			Da:R129,A1
43		7-8	O											O			
44		1		O											O		
45		2		O										O			Auxpower OVP
46		3		O										O			
47		4,5,6		O											O		
48		7		O										O			
49		8		O										O			
50	PC101	1-2	O											O			Auxpower OVP
51		3-4	O											O			
52		1		O										O			Auxpower OVP
53		3		O										O			Auxpower OVP
54	PC102	1-2	O									O					
55		3-4	O													O	Output hiccup
56		1		O								O					
57		3		O								O					
58	PC104	1-2	O											O			
59		3-4	O												O		
60		1		O										O			
61		3		O										O			
62	BD1	AC-AC	O								O			O			Da: F1A, F1B
63		AC-DC	O								O			O			Da: F1A, F1B
64		DC-DC	O								O			O			Da: F1A, F1B
65		AC		O										O			
66		DC		O										O			
67	D1	K,A	O							O	O			O			Da:F1,F2,Q1
68		K,A		O						O	O			O			Da:F1,F2,Q1
69	Q1	G-S	O											O			
70		G-D	O							O	O			O			Da:F1A,F1B,Q1
71		D-S	O							O	O			O			Da:F1A,F1B
72		G		O						O	O			O			Da:F1A,F1B,Q1
73		D		O										O			
74		S		O										O			
75	C7		O							O	O			O			Da:F1A,F1B,Q2A,Q2B
76				O										O			

5. Abnormal Test

MODEL :CUS350M-12

(1) Test Conditions

Input : 230VAC Output : 12V, 29A 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
77	Q2A,Q2B	G-S	O											O			
78		G-D	O							O	O			O			Da:F1A,F1B,Q2A,Q2B
79		D-S	O							O	O			O			Da:F1A,F1B,Q2A,Q2B
80		G		O						O	O			O			Da:F1A,F1B,Q2A,Q2B
81		D		O										O			
82		S		O										O			
83	Q301A, Q301B	G-S	O													O	Input power increase 5W
84		G-D	O										O				
85		D-S	O										O				
86		G		O									O				
87		D		O										O			
88		S		O										O			
89	L3	1-2	O							O	O			O			Da:F1A,F1B,Q1
90		1-3	O							O						O	Da:R185,R186
91		3-4	O							O	O			O			Da:F1A,F1B,Q1
92		1,2		O												O	Input power increase 1W
93		3,4		O										O			
94	L4	1-2	O										O				
95		1,2		O										O			
96	T1	1-2	O											O			
97		2-3	O											O			Da:R129
98		3-5	O											O			Da:R129
99		6-7	O											O			Auxpower OCP
100		7-8	O											O			Auxpower OCP
101		1,2		O										O			
102		3,5		O										O			
103		6		O										O			
104		7		O										O			
105		8		O										O			
106	T2	1-2	O										O				
107		3-4	O										O				
108		4-5	O										O				
109		1,2		O										O			
110		3		O										O			
111		4		O										O			
112		5		O										O			

6. Vibration Test

MODEL : CUS350M-12

(1) Vibration Test Class

Frequency variable endurance test

(2) Equipment Used

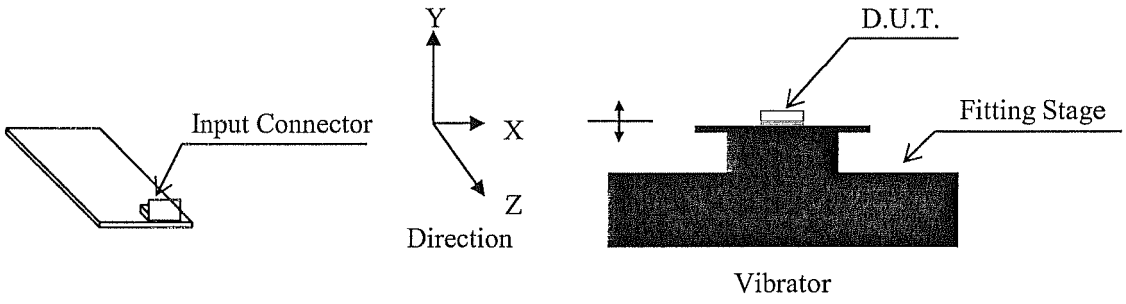
・Controller : DP550 DP CORP USA

・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.

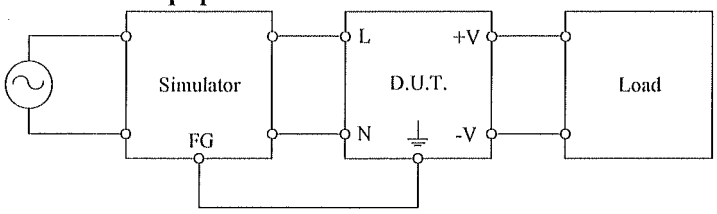
(6) Test Results

OK

7. Noise Simulate Test

MODEL : CUS350M-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 : CUS350M-12

(1) Equipment Used

TSA-101S-W : ESPEC

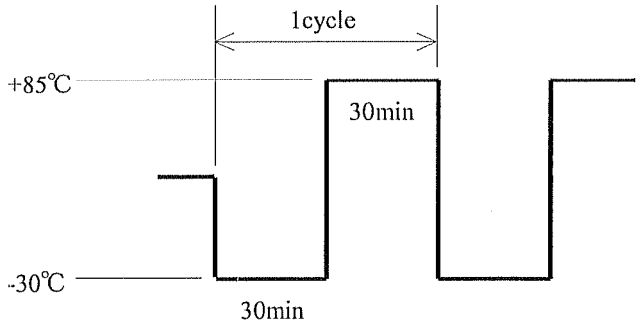
(2) Test Conditions

・Ambient Temperature : -30℃ ⇔ 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