EVA2400

RELIABILITY DATA

DWG No. IA754-79-01		
APPD	CHK	DWG
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27/Jun/12	27.Jun.'12	27.Jun.'12

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* Test results are reference data based on our standard measurement condition.

1. Calculated values of MTBF

EVA2400 SERIES

(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 = 19,780 (hours)

2. Components derating

EVA2400 SERIES

(1) Calculating method

(a) Measuring method

・Mounting method : Standard mounting	・Ambient temperature : 45°C
・Input voltage : 170~265VAC	・Output voltage & current: Vout: 100%, Io: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

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

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

Tc : Case temperature at start point of derating ; 25°C in General

Tl : Lead temperature at start point of derating ; 25°C in General

Pc(max) : Maximum power dissipation

Tj(max) : Maximum junction temperature

θj-a : Thermal impedance between junction (channel) and Ambient Temperature

θj-c : Thermal impedance between junction (channel) and case

θj-*l* : Thermal impedance between junction and lead

Vin = 170Vac Load = 100% Ta= 45 °C

PFC

D608,D609	Tjmax=	150	°C	θj-c =	1.0	°C/W	Pc(max)	---	W
D25XB60-7000	Pd =	14	W	⊿Tc =	62.4	°C	Tc =	107.4	°C
SHINDENGEN	Tj = Tc + (θj-c x Pd) =>			Tj =	121.4	°C	D.F. =	80.9	%
D604~D607	Tjmax=	150	°C	θj-c =	2.6	°C/W	Pc(max)	---	W
STTH806DTI	Pd =	10	W	⊿Tc =	44.1	°C	Tc =	89.1	°C
ST	Tj = Tc + (θj-c x Pd) =>			Tj =	115.1	°C	D.F. =	76.7	%
Q603,Q604,	Tjmax=	150	°C	θj-c =	0.44	°C/W	Pc(max)	284	W
Q607,Q608	Pd =	9.3	W	⊿Tc =	48.5	°C	Tc =	93.5	°C
SPW32N50C3	Tj = Tc + (θj-c x Pd) =>			Tj =	97.5	°C	D.F. =	65.0	%
INFINEON									

BIAS

A406	Tjmax=	150	°C	θj-c =	3.0	°C/W	Pc(max)	---	W
MIP0225SY	Pd =	4.3	W	⊿Tc =	29.2	°C	Tc =	74.2	°C
PANASONIC	Tj = Tc + (θj-c x Pd) =>			Tj =	87.1	°C	D.F. =	58.1	%
A407	Tjmax=	150	°C	θj-c =	4.31	°C/W	Pc(max)	15	W
KA78R15CTU	Pd =	1.6	W	⊿Tc =	49.1	°C	Tc =	94.1	°C
FAIRCHILD	Tj = Tc + (θj-c x Pd) =>			Tj =	100.9	°C	D.F. =	67.3	%
D407	Tjmax=	150	°C	θj-l =	6.5	°C/W	Pc(max)	---	W
S3L20U-5004P15	Pd =	1.6	W	⊿Tl =	53.3	°C	Tl =	98.3	°C
SHINDENGEN	Tj = Tl + (θj-l x Pd) =>			Tj =	108.7	°C	D.F. =	72.5	%
Q408,Q409	Tjmax=	150	°C	θj-c =	0.833	°C/W	Pc(max)	150	W
2SK3878(F)	Pd =	7.0	W	⊿Tc =	48.6	°C	Tc =	93.6	°C
TOSHIBA	Tj = Tc + (θj-c x Pd) =>			Tj =	99.4	°C	D.F. =	66.3	%

DC/DC

Q601~Q604	Tjmax=	150	°C	θj-c =	0.78	°C/W	Pc(max)	160	W
2SK2372-A	Pd =	18	W	⊿Tc =	65.4	°C	Tc =	110.4	°C
RENESAS	Tj = Tc + (θj-c x Pd) =>			Tj =	124.4	°C	D.F. =	82.9	%

(Model: EVA150-16)

D605~D620	Tjmax=	150	°C	θj-c =	3.5	°C/W	Pc(max)	---	W
YG911S3R	Pd =	2.4	W	⊿Tc =	33.0	°C	Tc =	78.0	°C
FUJI	Tj = Tc + (θj-c x Pd) =>			Tj =	86.4	°C	D.F. =	57.6	%

(Model: EVA300-8)

D605~D620	Tjmax=	150	°C	θj-c =	3.0	°C/W	Pc(max)	---	W
STTH506DTI	Pd =	3.0	W	⊿Tc =	31.8	°C	Tc =	76.8	°C
ST	Tj = Tc + (θj-c x Pd) =>			Tj =	85.8	°C	D.F. =	57.2	%

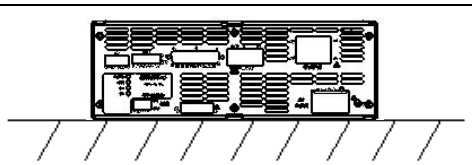
(Model: EVA600-4)

D605~D620	Tjmax=	150	°C	θj-c =	3.0	°C/W	Pc(max)	---	W
STTH506DTI	Pd =	3.0	W	⊿Tc =	30.2	°C	Tc =	75.2	°C
ST	Tj = Tc + (θj-c x Pd) =>			Tj =	84.2	°C	D.F. =	56.1	%

3. Main components temperature rise

EVA2400 SERIES

(1) Measuring conditions

Mounting method (Standard mounting)	
Input voltage (Vin)	170~265VAC
Output voltage (Vo)	100%
Output current (Io)	100%
Auxiliary output (J4 Connector)	5V,0.2A 15V,0.2A

(2) Measuring results

Output derating			ΔT Temperature rise (°C) Standard mounting		
Location No.		Part name	EVA150-16	EVA300-8	EVA600-4
INPUT	L301	COMMON CHOKE	13.0		
	L302	COMMON CHOKE	12.5		
PFC	A601	CHIP PFC IC	36.9		
	C611	ELEC. CAPACITOR	4.4		
	D604~D607	DIODE	44.1		
	D608,D609	BRIDGE DIODE	62.4		
	L603	PFC CHOKE	51.4		
	Q603,Q604,Q607,Q608	MOS FET	48.5		
BIAS	A406	TOP SWITCH	29.2		
	A407	15V LINEAR REGULATOR	49.1		
	C410	ELEC. CAPACITOR	19.5		
	C413	ELEC. CAPACITOR	28.5		
	C438	ELEC. CAPACITOR	32.0		
	C442	ELEC. CAPACITOR	31.1		
	D407	DIODE	53.3		
	PC406	OPTOCOUPLER	32.0		
	Q408,Q409	MOS FET	48.6		
	T401	TRANSFORMER	36.4		
DC/DC	C601	ELEC. CAPACITOR	8.0	7.0	9.0
	C628	ELEC. CAPACITOR	8.6	10.5	16.0
	D605~D620	DIODE	33.0	31.8	30.2
	L601	CHOKE COIL	35.6	44.3	47.2
	Q601~Q604	MOS FET	38.9	41.8	65.4
	T601	TRANSFORMER	30.5	40.5	36.9
	T602	CURRENT TRANSFORMER	6.3	11.3	9.4
	T603	TRANSFORMER	8.3	10.2	10.0
	TS601	THERMAL GUARD	35.8	36.8	47.5
OUTPUT FILTER	C87	ELEC. CAPACITOR	11.9	13.2	16.5
	L81	COMMON CHOKE	15.1	12.4	15.7

4. Electrolytic capacitors computed life

(24hours per day, 365 days operation)

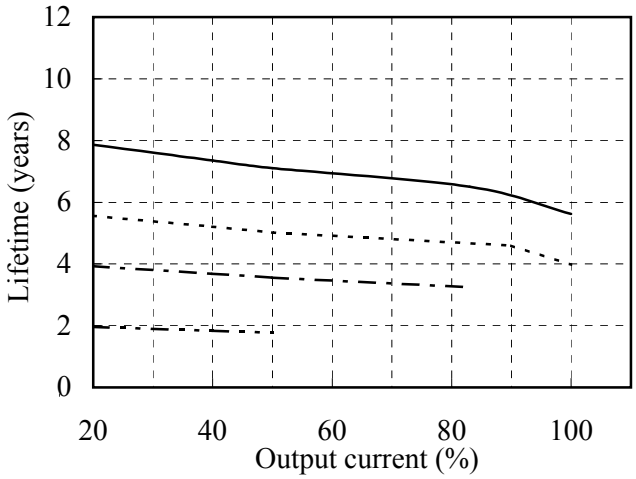
Conditions Ta 40°C : ——
45°C : - - - - -
50°C : - · - · -
60°C : — ·· —

MODEL : EVA150-16

Vin=200VAC

Auxiliary output: 5V,0.2A 15V,0.2A

Load (%)	Lifetime (years)			
	Ta= 40°C	Ta= 45°C	Ta= 50°C	Ta= 60°C
20	7.9	5.6	3.9	2.0
40	7.4	5.2	3.7	1.8
50	7.1	5.0	3.6	1.8
83	6.5	4.6	3.3	—
100	5.6	4.0	—	—

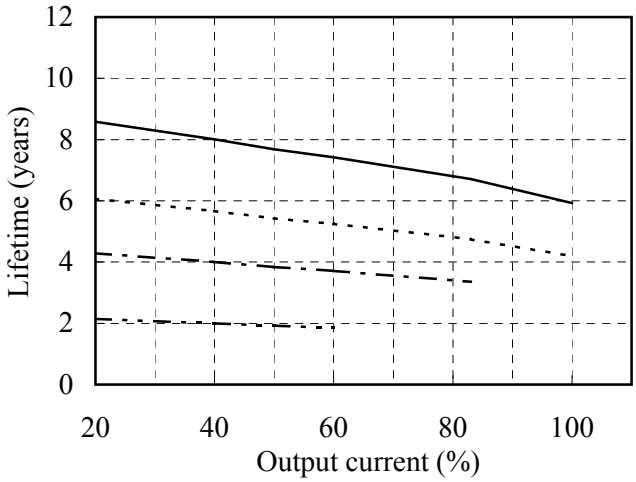


MODEL : EVA300-8

Vin=200VAC

Auxiliary output: 5V,0.2A 15V,0.2A

Load (%)	Lifetime (years)			
	Ta= 40°C	Ta= 45°C	Ta= 50°C	Ta= 60°C
20	8.6	6.1	4.3	2.1
40	8.0	5.7	4.0	2.0
50	7.7	5.4	3.8	1.9
83	6.7	4.7	3.4	—
100	5.9	4.2	—	—

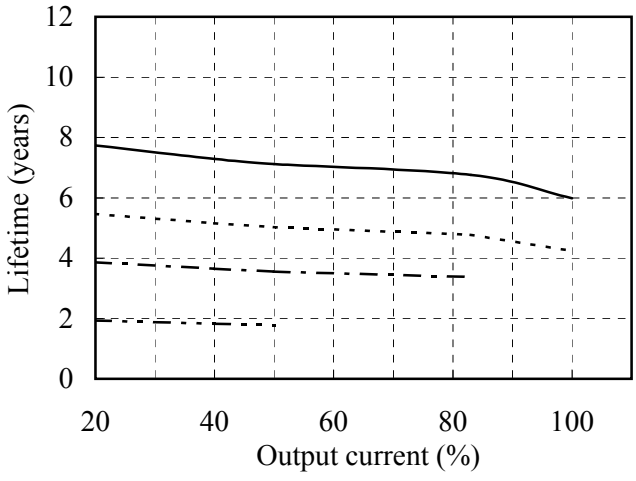


MODEL : EVA600-4

Vin=200VAC

Auxiliary output: 5V,0.2A 15V,0.2A

Load (%)	Lifetime (years)			
	Ta= 40°C	Ta= 45°C	Ta= 50°C	Ta= 60°C
20	7.7	5.5	3.9	1.9
40	7.3	5.2	3.6	1.8
50	7.1	5.0	3.6	1.8
83	6.8	4.8	3.4	—
100	6.0	4.2	—	—



5. Abnormal test

EVA2400 SERIES

(1) Test conditions

Input : 230VAC
Vout: 100%, Iout: 100%
Ta: 25°C

(2) Test results

PFC (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		No output	No change	Others	
1	Q604	D-S	●								●			●			
2		G-S	●												●		
3		D-G	●							●	●			●			Da: Q604,Q606,ZD601, R651~R654
4		D		●											●		
5		S		●											●		
6		G		●						●	●			●			Da: Q604
7	D604	A-K	●							●	●			●			Da: Q604
8		A		●											●		
9	D605	A-K	●							●	●			●			Da: Q603
10		A		●											●		
11	D601	A-K	●												●		
12		A		●											●		
13	L601		●												●		
14				●											●		
15	L605		●							●	●			●			Da: Q603,604
16				●											●		
17	R626			●												●	Output voltage decrease
18	C619		●								●			●			
19				●											●		
20	D608	1-2	●								●			●			
21		2-4	●								●			●			
22	D609	1-2	●								●			●			
23		2-4	●								●			●			
24	D603	A-K	●							●				●			Da: R613~R616
25	D610	A-K	●							●	●			●			Da: R613~616, Q603,Q604,Q607,Q608
26		A		●											●		
27	D613	A-K	●												●		
28		A		●											●		

(2) Test results

DC/DC (600V) (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		No output	No change	Others	
29	Q603	D-S	●							●	●			●			Da: Q601,Q602,Q604,Q609, Q611,R605,R620
30		G-S	●							●	●			●			Da: Q601,Q602,Q604, Q609~Q611,R605,R620, R610,R612
31		G-D	●							●	●			●			Da: Q601~Q604,Q609~Q611, R612,R615
32		D		●						●	●			●			Da: Q601,Q603,Q604, R615,R620
33		S		●						●	●			●			Da: Q601~Q604,R615
34		G		●						●	●			●			Da: Q601~Q604,Q609,Q611, R605,R620,R610
35	D611	A-K	●												●		
36		A		●												●	Output voltage decrease
37	D601	A-K	●							●	●			●			Da: Q601~Q604,Q609~Q612, R605,R610, R615,R620
38		A		●						●	●			●			Da: Q601~Q604,Q609~Q612, R605,R610,R615,R620
39	Q605	C-E	●												●		
40	D617	A-K	●												●		
41		A		●											●		
42	C627	+/-	●									●		●			
43				●											●		
44	L601		●							●	●			●			Da: Q601~Q603,D605,D607, D614,D616,R605,R615
45				●						●	●			●			Da: Q601~Q604,R605,R620
46	T603	14		●						●	●			●			Da: Q601,Q603,Q604,Q609, Q611,Q612,R605,R616, R615,R620,D624
47	T601	8-10		●						●	●			●			Da: Q601~Q604,R605,R620
48	C601	+/-	●								●			●			
49				●											●		

6. Vibration test

EVA2400 SERIES

(1) Vibration test class

Frequency variable endurance test

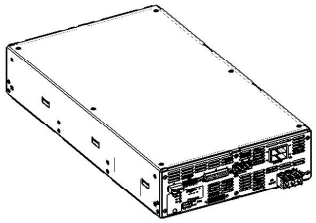
(2) Equipment used

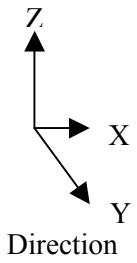
EMIC CORP ・Controller : F-400-BM-E47 ・Vibrator : 905-FN

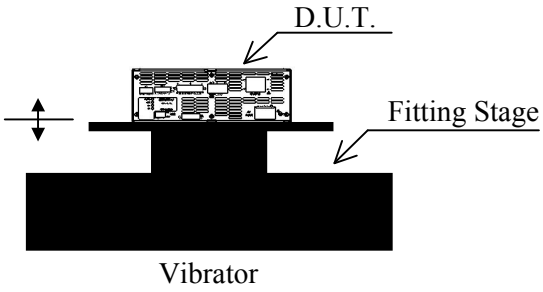
(3) Test conditions

・Sweep frequency	: 10~500Hz	・Direction	: X, Y, Z
・Sweep time	: 10min	・Sweep count	: 1 hour each
・Acceleration	: Constant 10.2m/s^2 (1.04G)		

(4) Test method







(5) Acceptable conditions

1. Not to be broken

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

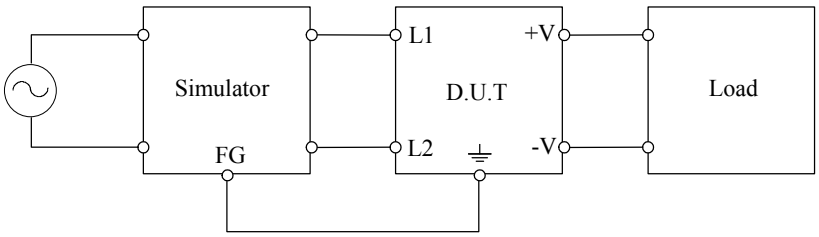
(6) Test results

OK

7. Noise simulate test

EVA2400 SERIES

(1) Test circuit and equipment



Simulator : INS-4320(A) (Noise Laboratory Co.,LTD)

(2) Test conditions

・Input voltage	: 200VAC	・Noise level	: 0~2kV
・Output voltage	: Rated	・Phase	: 0~360 deg
・Output current	: 0, 100%	・Polarity	: +, -
・Ambient temperature	: 25°C	・Mode	: Common and 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 abnormalites

(4) Test results

Common			
Test voltage (kV)	EVA150-16	EVA300-8	EVA600-4
2	PASS	PASS	PASS

Normal			
Test voltage (kV)	EVA150-16	EVA300-8	EVA600-4
2	PASS	PASS	PASS