SWS300

RELIABILITY DATA

DWG No. CA740-57-01		
APPD	CHK	DWG
13 Oct 2004	Jackson 13-Oct-04	Ryan 13-Oct-04

I N D E X

PAGE

※ The above data is typical value. As all units have nearly the same characteristics, the data to be considered as ability value.

1. CALCULATED VALUES OF MTBF

MODEL : SWS300-5

(1) Calculating method

Calculated based on part count reliability projection of JEITA (RCR-9102).

Individual failure rates λ_G is given to each part and MTBF is calculated by the count of each part.

<Formula> :

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

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

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

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)

MTBF ≒ 322,289(Hours)

However MTBF calculation for Fan isn't included.

2. COMPONENT DERATING

MODEL : SWS300-5

(1) Calculating Method

(a) Measuring Conditions

Input	:	115/230VAC	• Ambient temperature	:	50°C
Output	:	5V 55A(100%)	• Mounting method	:	Standard Mounting

(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

$$\theta_{j-c} = \frac{T_{j(max)} - T_c}{P_{c(max)}} \qquad \theta_{j-a} = \frac{T_{j(max)} - T_a}{P_{c(max)}} \qquad \theta_{j-l} = \frac{T_{j(max)} - T_l}{P_{c(max)}}$$

T_c : Case Temperature at Start Point of Derating ; 25°C in General

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

T_l : Lead Temperature at Start Point of Derating ; 25°C in General

$P_{c(max)}$ $(P_{ch(max)})$: Maximum Collector(channel) Dissipation

$T_{j(max)}$ $(T_{ch(max)})$: Maximum Junction(channel) Temperature

θ_{j-c} (θ_{ch-c}) : Thermal Impedance between Junction(channel) and Case

θ_{j-a} : Thermal Impedance between Junction and Air

θ_{j-l} : Thermal Impedance between Junction and Lead

(2) Component Derating List

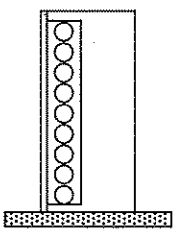
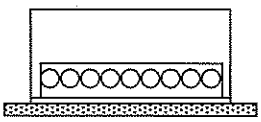
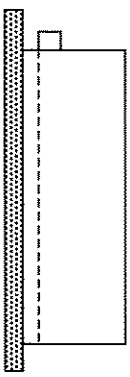
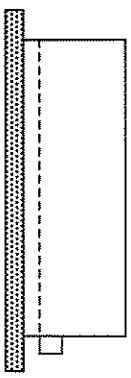
Location No.	Vin = 115VAC Load = 100% Ta = 50°C		
Q1 2SK2837 TOSHIBA	Tchmax = 150 °C, Pch = 18.83W, Tch = Tc + ((θ ch-c) × Pch) = 125.3 °C D.F. = 83.5%	θ ch-c = 0.83 °C/W, Δ Tc = 59.6 °C,	Pch(max) = 150 W, Tc = 109.6 °C
Q2 2SK2611 TOSHIBA	Tchmax = 150 °C, Pch = 14.49W, Tch = Tc + ((θ ch-c) × Pch) =121.9 °C D.F. =81.3%	θ ch-c = 0.83 °C/W, Δ Tc =59.9 °C,	Pch(max) = 150 W, Tc = 109.9 °C
Q102 2SK2177-4061 SHINDENGEN	Tchmax = 150 °C, Pch = 0.03W, Tch = Tc + ((θ ch-c) × Pch) = 69.2 °C D.F. = 46.1%	θ ch-c = 12.50 °C/W, Δ Tc = 18.8°C,	Pch(max) = 10 W, Tc = 68.8 °C
D1 D10XB60H SHINDENGEN	Tjmax = 150 °C, Pd = 6.00 W, Tj = Tc + ((θ j-c) × Pd) = 115.5 °C D.F. =77.0%	θ j-c = 1.9 °C/W, Δ Tc = 54.1 °C,	Tc= 104.1 °C
D2 YG911S3R FUJI-ELE	Tjmax = 150 °C, Pd = 2.1 W, Tj = Tc + ((θ j-c) × Pd) = 111.4 °C D.F. =74.3%	θ j-c = 3.50 °C/W, Δ Tc = 54.0 °C,	Tc= 104.0 °C
D51 S60SC4M SHINDENGEN	Tjmax = 150 °C, Pd = 17.04 W, Tj = Tc + ((θ j-c) × Pd) = 103.2 °C D.F. = 68.8%	θ j-c = 0.5 °C/W, Δ Tc =44.7 °C,	Tc =94.7 °C
A101 FA5502M-TE1 FUJI-ELE	Tjmax = 150 °C, Pd = 0.09W, Tj = Tc + ((θ j-c) × Pd) =90.4 °C D.F. = 60.3%	θ j-c = 50.00 °C/W, Δ Tc =35.9 °C,	Tc= 85.9 °C
A102 M51995AFP-600C MITSUBISHI	Tjmax = 150 °C, Pd = 0.35 W, Tj = Tc + ((θ j-c) × Pd) = 107.0 °C D.F. = 71.3%	θ j-c = 40.00 °C/W, Δ Tc = 43.0°C,	Tc = 93.0 °C
A201 UPC1093T-E1 NEC	Tjmax = 150 °C, Pd = 0.03W, Tj = Ta + ((θ j-a) × Pd) =73.9°C D.F. = 49.3%	θ j-a = 315 °C/W, Δ Ta =14.4°C,	Ta= 64.4°C
PC1 TLP721F (D4-GR,M) (LED) TOSHIBA	Tjmax = 125 °C, If = 0 mA, ALLOWABLE I_F(max) = 45mA (at Ta = 61.3°C) D.F. = 0 %	ΔI_f/°C = -0.7mA /°C, Δ Ta = 11.3 °C,	I_f(max)=60mA, Ta= 61.3°C
PC1 TLP721F (D4-GR,M) (Transistor) TOSHIBA	Tjmax = 125 °C, Pd = 0 W, Tj = Ta + ((θ j-a) × Pd) =61.3 °C D.F. = 49.0 %	θ j-a = 667°C/W, Δ Ta = 11.3 °C,	Pc(max) = 150 mW, Ta= 61.3 °C
PC2 TLP721F (D4-GR,M) (LED) TOSHIBA	Tjmax = 125 °C, If = 1.2 mA, ALLOWABLE I_F(max) = 40mA (at Ta = 68.1°C) D.F. = 3.0 %	ΔI_f/°C = -0.7mA /°C, Δ Ta =18.1 °C,	I_f(max)=60mA, Ta= 68.1°C
PC2 TLP721F (D4-GR,M) (Transistor) TOSHIBA	Tjmax = 125 °C, Pd = 30 mW, Tj = Ta + ((θ j-a) × Pd) =88.1 °C D.F. = 70.5 %	θ j-a = 667°C/W, Δ Ta =18.1 °C,	Pc(max) = 150 mW, Ta= 68.1 °C

Location No.	Vin = 230VAC Load = 100% Ta = 50°C		
Q1 2SK2837 TOSHIBA	Tchmax = 150 °C, Pch = 3.57W, Tch = Tc + ((θ ch-c) × Pch) = 95.9 °C D.F. = 63.9%	θ ch-c = 0.83 °C/W, Δ Tc = 42.9 °C,	Pch(max) = 150 W, Tc = 92.9 °C
Q2 2SK2611 TOSHIBA	Tchmax = 150 °C, Pch = 14.49W, Tch = Tc + ((θ ch-c) × Pch) =113.2 °C D.F. =75.5%	θ ch-c = 0.83 °C/W, Δ Tc =51.2 °C,	Pch(max) = 150 W, Tc = 101.2 °C
Q102 2SK2177-4061 SHINDENGEN	Tchmax = 150 °C, Pch = 0.03W, Tch = Tc + ((θ ch-c) × Pch) = 60.7 °C D.F. = 40.5%	θ ch-c = 12.50 °C/W, Δ Tc = 10.3 °C,	Pch(max) = 10 W, Tc = 60.3 °C
D1 D10XB60H SHINDENGEN	Tjmax = 150 °C, Pd = 2.71 W, Tj = Tc + ((θ j-c) × Pd) = 82.6 °C D.F. =55.1%	θ j-c = 1.9 °C/W, Δ Tc = 27.5 °C,	Tc= 77.5 °C
D2 YG911S3R FUJI-ELE	Tjmax = 150 °C, Pd = 1.5 W, Tj = Tc + ((θ j-c) × Pd) = 95.4 °C D.F. =63.6%	θ j-c = 3.50 °C/W, Δ Tc = 40.1 °C,	Tc= 90.1 °C
D51 S60SC4M SHINDENGEN	Tjmax = 150 °C, Pd = 17.04 W, Tj = Tc + ((θ j-c) × Pd) = 102.5 °C D.F. = 68.3%	θ j-c = 0.5 °C/W, Δ Tc =44.0 °C,	Tc =94.0 °C
A101 FA5502M-TE1 FUJI-ELE	Tjmax = 150 °C, Pd = 0.09W, Tj = Tc + ((θ j-c) × Pd) =86.0 °C D.F. = 57.3%	θ j-c = 50.00 °C/W, Δ Tc =31.5 °C,	Tc= 81.5 °C
A102 M51995AFP-600C MITSUBISHI	Tjmax = 150 °C, Pd = 0.35 W, Tj = Tc + ((θ j-c) × Pd) = 104.7 °C D.F. = 69.8%	θ j-c = 40.00 °C/W, Δ Tc = 40.7°C,	Tc = 90.7 °C
A201 UPC1093T-E1 NEC	Tjmax = 150 °C, Pd = 0.03W, Tj = Ta + ((θ j-a) × Pd) =73.7°C D.F. = 49.1%	θ j-a = 315 °C/W, Δ Ta =14.2°C,	Ta= 64.2°C
PC1 TLP721F (D4-GR,M) (LED) TOSHIBA	Tjmax = 125 °C, If = 0 mA, ALLOWABLE I_F(max) = 45mA (at Ta = 60.6°C) D.F. = 0 %	ΔI_f/°C = -0.7mA /°C, Δ Ta = 10.6 °C,	I_f(max)=60mA, Ta= 60.6°C
PC1 TLP721F (D4-GR,M) (Transistor) TOSHIBA	Tjmax = 125 °C, Pd = 0 W, Tj = Ta + ((θ j-a) × Pd) =60.6 °C D.F. = 48.5 %	θ j-a = 667°C/W, Δ Ta = 10.6 °C,	Pc(max) = 150 mW, Ta= 60.6 °C
PC2 TLP721F (D4-GR,M) (LED) TOSHIBA	Tjmax = 125 °C, If = 1.2 mA, ALLOWABLE I_F(max) = 41mA (at Ta = 65.4°C) D.F. = 2.9 %	ΔI_f/°C = -0.7mA /°C, Δ Ta =15.4 °C,	I_f(max)=60mA, Ta= 65.4°C
PC2 TLP721F (D4-GR,M) (Transistor) TOSHIBA	Tjmax = 125 °C, Pd = 30 mW, Tj = Ta + ((θ j-a) × Pd) =85.4 °C D.F. = 68.3 %	θ j-a = 667°C/W, Δ Ta =15.4 °C,	Pc(max) = 150 mW, Ta= 65.4 °C

3. MAIN COMPONENTS TEMPERATURE RISE ΔT LIST

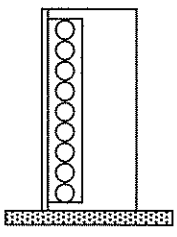
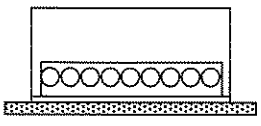
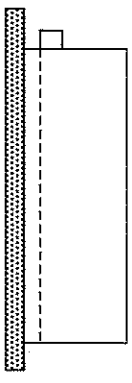
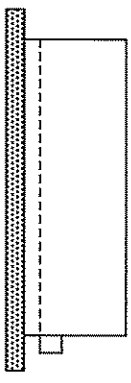
MODEL : SWS300-5

Measuring Conditions

	(A)	(B)	(C)	(D)
Mounting Method (Standard Mounting Method:(A))				
Input Voltage (VAC)	115			
Output Voltage (VDC)	5			
Output Current (A)	55			

		ΔT Temperature rise (°C)			
Output Derating (%)		100 (Ta =50°C)	100 (Ta =50°C)	100 (Ta =50°C)	100 (Ta =50°C)
Location No.	Parts Name	Mounting A	Mounting B	Mounting C	Mounting D
L1	BALUN COIL	37.8	34	36.4	32.5
L3	PFC CHOKE	28.9	27.5	34.6	26.5
L51	CHOKE COIL	42.3	38.4	44.7	38.9
T1	TRANS PULSE	36.8	34.5	38.8	33.9
A101	CHIP IC	30.3	35.9	30.7	27.6
A102	CHIP IC	36.2	43	37.5	32.9
D1	BRIDGE DIODE	52.2	54.1	56.8	50.9
Q1	MOS-FET	55.3	59.6	56.5	50.1
Q2	MOS-FET	64.8	59.9	69.2	58.1
D51	OUTPUT DIODE	39.2	44.7	45.8	40.6
C6	E. CAP.	16.2	14.8	18.1	15
C9	E. CAP.	17.5	20.7	18.9	16.4
C10	E. CAP.	24	20.7	22.3	20.9
C53	E. CAP.	14.2	10.8	14.5	9.6
C58	E. CAP.	18.9	14.8	19.6	15.8
C59	E. CAP.	16.7	11.6	17.2	12.7

Measuring Conditions

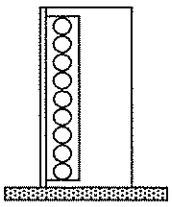
	(A)	(B)	(C)	(D)
Mounting Method (Standard Mounting Method:(A))				
Input Voltage (VAC)	230			
Output Voltage (VDC)	5			
Output Current (A)	55			

		ΔT Temperature rise (°C)			
Output Derating (%)		100 (Ta =50°C)	100 (Ta =50°C)	100 (Ta =50°C)	100 (Ta =50°C)
Location No.	Parts Name	Mounting A	Mounting B	Mounting C	Mounting D
L1	BALUN COIL	13.3	10.9	12.6	9.7
L3	PFC CHOKE	16.9	15.7	20.7	15.7
L51	CHOKE COIL	42.1	36.9	44.6	38.9
T1	TRANS PULSE	35.1	32.4	37	32.7
A101	CHIP IC	26.8	31.5	28.3	25.1
A102	CHIP IC	34.7	40.7	36.5	32.2
D1	BRIDGE DIODE	26.2	27.5	29.9	25.5
Q1	MOS-FET	38.8	42.9	40.4	35.3
Q2	MOS-FET	52.3	51.2	57	47.3
D51	OUTPUT DIODE	38.6	44	45.1	40.1
C6	E. CAP.	10.9	9.6	12.1	9.8
C9	E. CAP.	12.5	13.5	14.5	12
C10	E. CAP.	22	17.4	20.4	19.5
C53	E. CAP.	13.5	9.8	13.8	9.2
C58	E. CAP.	18.8	13.4	18.7	15.7
C59	E. CAP.	16	10.4	15.8	12.3

4. ELECTROLYTIC CAPACITOR LIFETIME

MODEL: SWS300-5

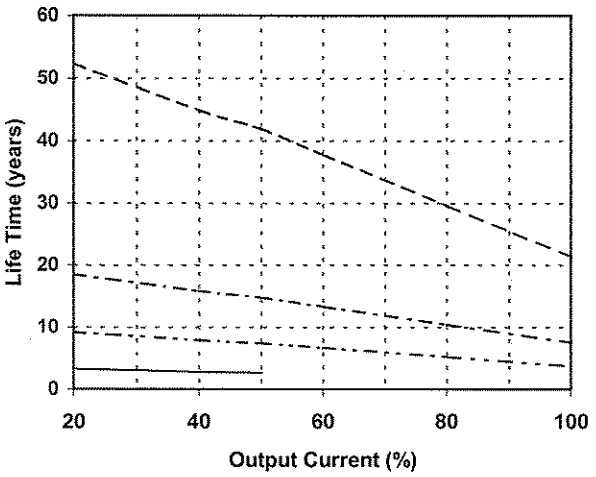
Mounting A



Ta = 25°C ———
Ta = 40°C —·—·—
Ta = 50°C —··—··—
Ta = 65°C ———

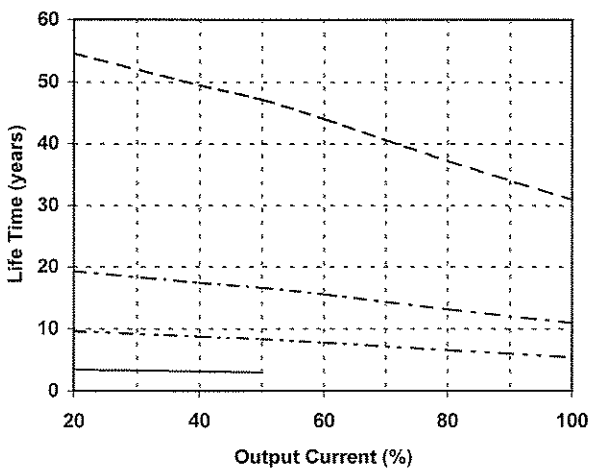
Vin = 115VAC

Load (%)	Life Time (years)			
	Ta = 25°C	Ta = 40°C	Ta = 50°C	Ta = 65°C
20	52.3	18.5	9.2	3.3
40	44.9	15.9	7.9	2.8
50	41.9	14.8	7.4	2.6
60	37.8	13.4	6.7	---
80	29.6	10.5	5.2	---
100	21.4	7.6	3.8	---



Vin = 230VAC

Load (%)	Life Time (years)			
	Ta = 25°C	Ta = 40°C	Ta = 50°C	Ta = 65°C
20	54.5	19.3	9.6	3.4
40	49.5	17.5	8.7	3.1
50	47.1	16.7	8.3	2.9
60	44.0	15.6	7.8	---
80	37.2	13.2	6.6	---
100	30.9	10.9	5.5	---



Formula:

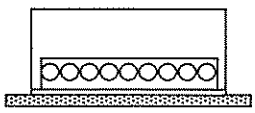
1. For 105°C Elect. capacitor
   $L = Lo * 2^{(105-\Delta T-Ta)/10} / (8 * 365)$ (years)

2. For 85°C Elect. capacitor
   $L = Lo * 2^{(85-\Delta T-Ta)/10} / (8 * 365)$ (years)

Where:
- L —— Elec. Capacitor computed life (8 hours per day , 365 days operation)
- Lo —— Guarantee life for Elec. capacitor
- Ta —— Ambient temperature
- ΔT —— Temperature rise of Elec. capacitor

MODEL: **SWS300-5**

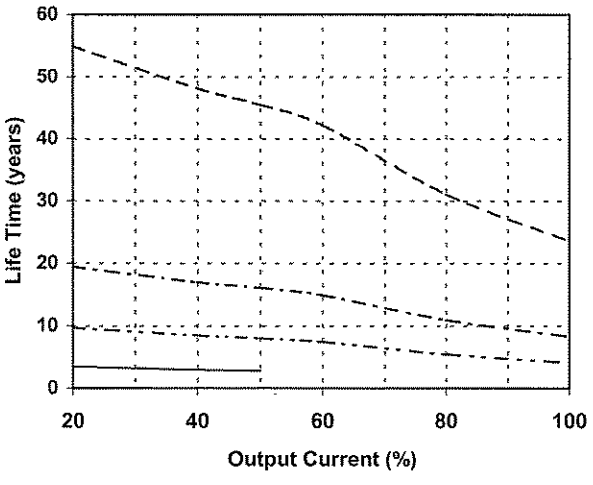
Mounting B



Ta = 25°C
Ta = 40°C
Ta = 50°C
Ta = 65°C

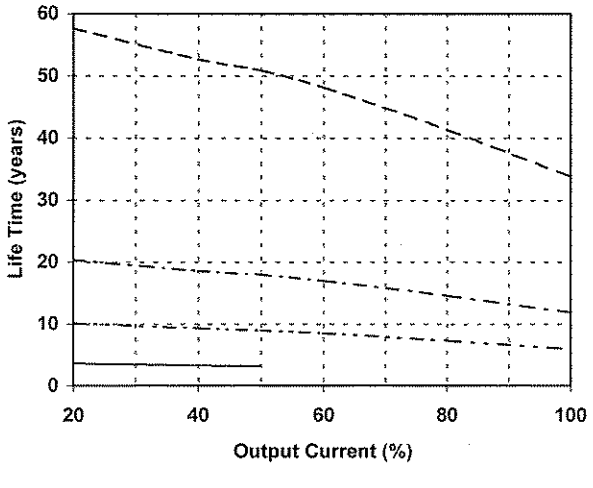
Vin = 115VAC

Load (%)	Life Time (years)			
	Ta = 25°C	Ta = 40°C	Ta = 50°C	Ta = 65°C
20	54.9	19.4	9.7	3.4
40	48.1	17.0	8.5	3.0
50	45.5	16.1	8.1	2.8
60	42.2	14.9	7.5	----
80	31.1	11.0	5.5	----
100	23.6	8.3	4.2	----



Vin = 230VAC

Load (%)	Life Time (years)			
	Ta = 25°C	Ta = 40°C	Ta = 50°C	Ta = 65°C
20	57.6	20.4	10.2	3.6
40	52.7	18.6	9.3	3.3
50	50.9	18.0	9.0	3.2
60	48.1	17.0	8.5	----
80	41.3	14.6	7.3	----
100	33.8	12.0	6.0	----



Formula:

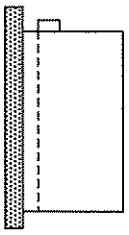
1. For 105°C Elect. capacitor
   $L = Lo * 2^{(105-\Delta T-Ta)/10} / (8 * 365)$ (years)

2. For 85°C Elect. capacitor
   $L = Lo * 2^{(85-\Delta T-Ta)/10} / (8 * 365)$ (years)

Where:
- L —— Elec. Capacitor computed life (8 hours per day , 365 days operation)
- Lo —— Guarantee life for Elec. capacitor
- Ta —— Ambient temperature
- ΔT —— Temperature rise of Elec. capacitor

MODEL: **SWS300-5**

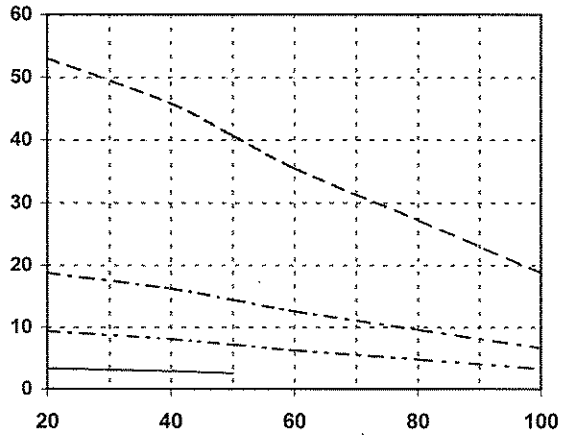
Mounting C



Ta = 25°C ——————
Ta = 40°C —·—·—·—
Ta = 50°C —··—··—
Ta = 65°C ————————

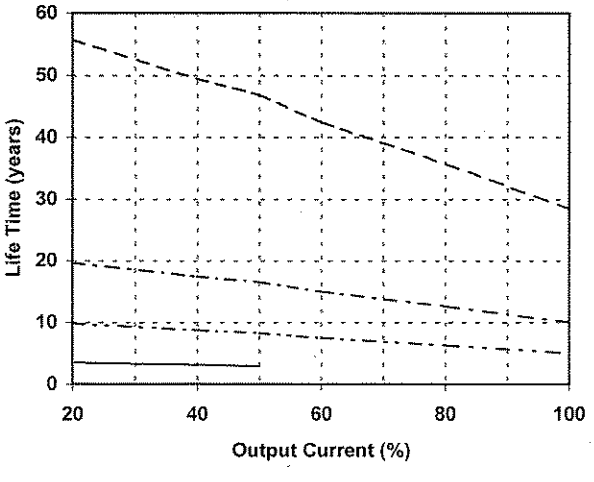
Vin = 115VAC

Load (%)	Life Time (years)			
	Ta = 25°C	Ta = 40°C	Ta = 50°C	Ta = 65°C
20	53.0	18.8	9.4	3.3
40	45.9	16.2	8.1	2.9
50	40.8	14.4	7.2	2.5
60	35.5	12.5	6.3	---
80	27.3	9.6	4.8	---
100	18.8	6.6	3.3	---



Vin = 230VAC

Load (%)	Life Time (years)			
	Ta = 25°C	Ta = 40°C	Ta = 50°C	Ta = 65°C
20	55.7	19.7	9.8	3.5
40	49.5	17.5	8.7	3.1
50	46.8	16.6	8.3	2.9
60	42.5	15.0	7.5	---
80	35.7	12.6	6.3	---
100	28.4	10.0	5.0	---



Formula:

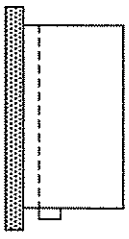
1. For 105°C Elect. capacitor
   $L = Lo * 2^{(105-\Delta T-Ta)/10} / (8 * 365)$ (years)

2. For 85°C Elect. capacitor
   $L = Lo * 2^{(85-\Delta T-Ta)/10} / (8 * 365)$ (years)

Where:
- L —— Elec. Capacitor computed life (8 hours per day , 365 days operation)
- Lo —— Guarantee life for Elec. capacitor
- Ta —— Ambient temperature
- ΔT —— Temperature rise of Elec. capacitor

MODEL: **SWS300-5**

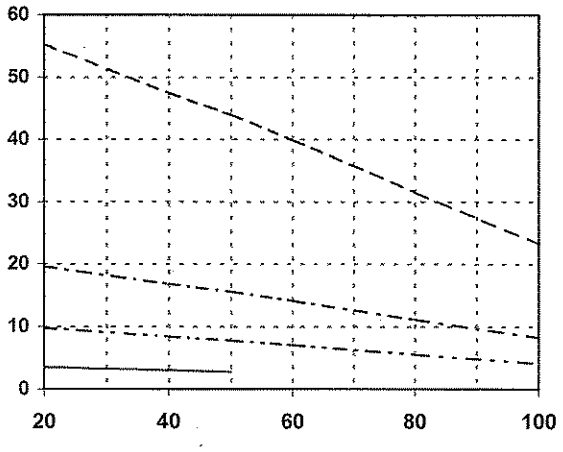
Mounting D



Ta = 25°C ------
Ta = 40°C -·-·-·-
Ta = 50°C -··-··-
Ta = 65°C ——————

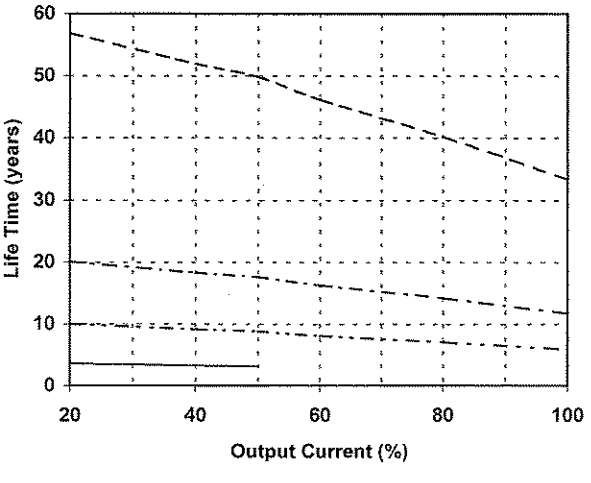
Vin = 115VAC

Load (%)	Life Time (years)			
	Ta = 25°C	Ta = 40°C	Ta = 50°C	Ta = 65°C
20	55.3	19.5	9.8	3.5
40	47.5	16.8	8.4	3.0
50	44.0	15.6	7.8	2.7
60	39.9	14.1	7.1	---
80	31.5	11.2	5.6	---
100	23.2	8.2	4.1	---



Vin = 230VAC

Load (%)	Life Time (years)			
	Ta = 25°C	Ta = 40°C	Ta = 50°C	Ta = 65°C
20	56.8	20.1	10.0	3.6
40	51.9	18.4	9.2	3.2
50	49.8	17.6	8.8	3.1
60	46.2	16.3	8.2	---
80	40.2	14.2	7.1	---
100	33.3	11.8	5.9	---



Formula:

1. For 105°C Elect. capacitor
   $L = Lo * 2^{(105-\Delta T-Ta)/10} / (8 * 365)$ (years)

2. For 85°C Elect. capacitor
   $L = Lo * 2^{(85-\Delta T-Ta)/10} / (8 * 365)$ (years)

Where:
- L —— Elec. Capacitor computed life (8 hours per day , 365 days operation)
- Lo —— Guarantee life for Elec. capacitor
- Ta —— Ambient temperature
- ΔT —— Temperature rise of Elec. capacitor

5. VIBRATION TEST

MODEL : SWS300-5

(1) Vibration Test Class

Frequency Variable Endurance Test

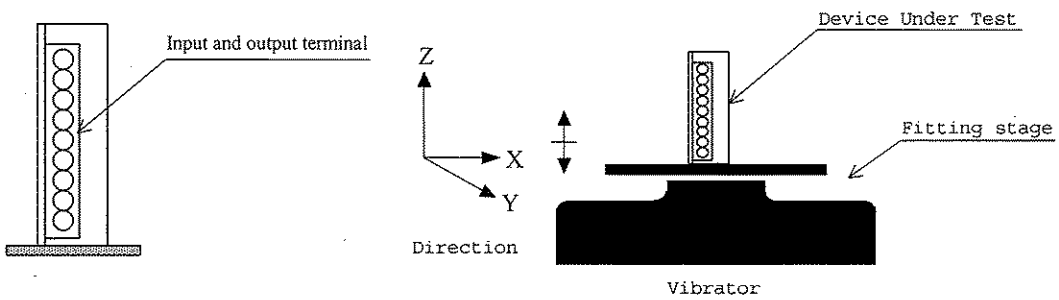
(2) Equipment Used

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

(3) Test Conditions

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

(4) Test Method



(5) Test Results

O K

Vin : 115VAC

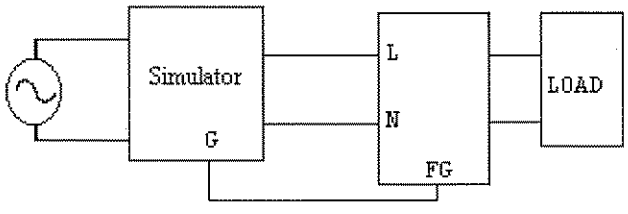
Iout : 100%

Check item		Output Voltage (V)	Ripple Voltage (mVp-p)	D.U.T.State
Before Test		4.998	85	———
After Test	X	4.997	85	O.K.
	Y	4.997	87	O.K.
	Z	4.997	87	O.K.

6. NOISE SIMULATE TEST

MODEL : SWS300-5 , 24

(1) Test Circuit And Equipment



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

(2) Test Conditions

• Input Voltage	:	115, 230VAC	• Noise Level	:	0V~2.0kV
• Output Voltage	:	Rated	• Phase Shift	:	0° ~ 360°
• Output Current	:	0%, 100%	• Polarity	:	+ , −
• Ambient Temperature	:	25°C	• Mode	:	Normal Common
• Pulse Width	:	50ns ~ 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 Result

O K

7. FAN LIFE EXPECTANCY

MODEL : SWS300

(1) Part name

AFB0512HHB (DELTA)

(2) Life expectancy

The data shows fan life expectancy for fan only by manufacture (90% survival rate).
Fig 1 shows measuring point of fan exhaust temperature.

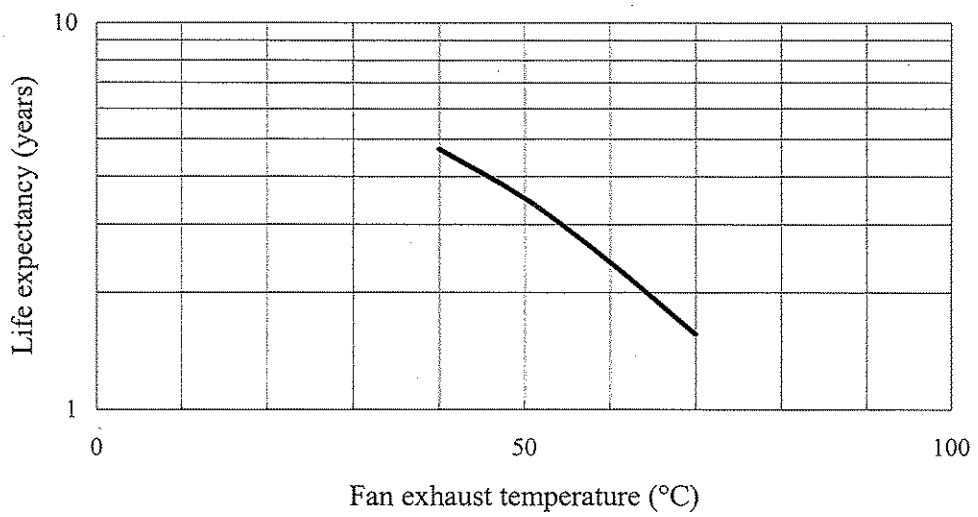
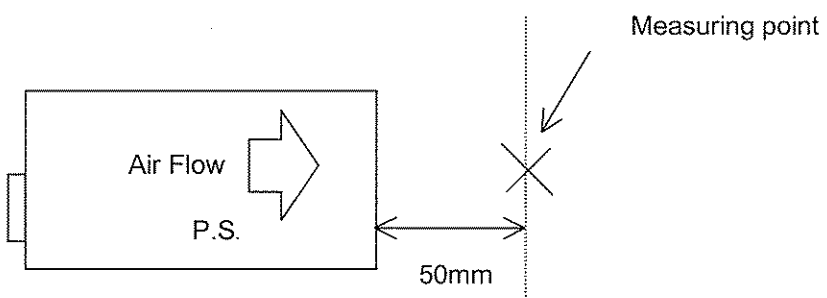


Fig 1. Measuring point of fan exhaust temperature.



1 Year = 365 Days × 24 Hours/Day
= 8760 Hours