HWS600

RELIABILITY DATA

信頼性データ

TDK-Lambda

A232-57-01B

I N D E X

使用記号　Terminology used

FG ・・・・・・・フレームグラウンド　Frame GND

※ 信頼性試験は、代表データであり、全ての製品は、ほぼ同等な特性を示します。
従いましてこの値は実力値とお考え願います。

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

1. MTBF計算値　　Calculated values of MTBF

(1)　部品ストレス解析法MTBF　Parts stress reliability projection MTBF

MODEL : HWS600-24

算出方法　Calculating Method

Telcordiaの部品ストレス解析法(*1)で算出されています。
故障率λ_{SS}は、それぞれの部品ごとに電気ストレスと動作温度によって決定されます。
Calculated based on parts stress reliability projection of Telcordia (*1).
Individual failure rate λ_{SS} is calculated by the electric stress and temperature rise of the each part.

*1: Telcordia document “Reliability Prediction Procedure for Electronic Equipment” (Document number SR-332,Issue3)

＜算出式＞

$$MTBF = \frac{1}{\lambda_{equip}} = \frac{1}{\pi_E \sum_{i=1}^{m} (N_i \cdot \lambda_{ssi})} \times 10^9 \text{ 時間 (hours)}$$

$$\lambda_{ssi} = \lambda_{Gi} \cdot \pi_{Qi} \cdot \pi_{Si} \cdot \pi_{Ti}$$

λ_{equip}	:全機器故障率（FITs）　Total equipment failure rate (FITs = Failures in10^9 hours)
λ_{Gi}	:i　番目の部品に対する基礎故障率　Generic failure rate for the ith part
π_{Qi}	:i　番目の部品に対する品質ファクタ　Quality factor for the ith part
π_{Si}	:i　番目の部品に対するストレスファクタ　Stress factor for the ith part
π_{Ti}	:i　番目の部品に対する温度ファクタ　Temperature factor for the ith part
m	:異なる部品の数　Number of different part types
N_i	:i　番目の部品の個数　Quantity of ith part type
π_E	:機器の環境ファクタ　Equipment environmental factor

MTBF値　MTBF values

条件　Conditions

･入力電圧 Input voltage	:　230VAC	･出力電圧、電流 Output voltage & current	:　24VDC, 27A (100%)
･環境ファクタ Environmental factor	:　GB (Ground, Benign)	・取付方法 Mounting method	:　標準取付　A : Standard mounting A

SR-332,Issue3

MTBF(Ta=25℃)　≒　1,998,996　時間　(hours)

MTBF(Ta=40℃)　≒　1,088,578　時間　(hours)

(2) 部品点数法MTBF　Part count reliability projection MTBF

MODEL : HWS600-5

算出方法　Calculating method

JEITA (RCR-9102, RCR-9102A) の部品点数法で算出されています。
それぞれの部品ごとに、部品故障率 λ_G が与えられ、各々の点数によって決定されます。
Calculated based on part count reliability projection of JEITA (RCR-9102, RCR-9102A).
Individual failure rates λ_G is given to each part and MTBF is calculated by the count of each part.

＜算出式＞

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

λ *equip* : 全機器故障率（故障数／10^6時間）
Total equipment failure rate （Failure／10^6 hours）

λ_G : *i* 番目の同属部品に対する故障率（故障数／10^6時間）
Generic failure rate for the *i*th generic part （Failure／10^6 hours）

Ni : *i* 番目の同属部品の個数
Quantity of *i*th generic part

n : 異なった同属部品のカテゴリーの数
Number of different generic part categories

π_Q : *i* 番目の同属部品に対する品質ファクタ （π_Q=1）
Generic quality factor for the *i*th generic part （π_Q=1）

MTBF値　MTBF values

G_F : 地上固定　(Ground, Fixed)

RCR-9102

MTBF ≒ 150,504 時間 (hours)
(但し、MTBFにファンは含まれておりません。)
However MTBF Calculation for FAN isn’t Included.

RCR-9102A

MTBF ≒ 82,195 時間 (hours)
(但し、MTBFにファンは含まれておりません。)
However MTBF Calculation for FAN isn’t Included.

2. 部品ディレーティング　Component derating

MODEL : HWS600-5

(1)　算出方法　Calculating method

(a)　測定条件　Conditions

・入力 Input	: 100, 200VAC	・周囲温度 Ambient temperature	: 50℃
・出力 Output	: 5V　120A(100%)	・取付方法 Mounting method	: 標準取付 (A) Standard mounting (A)

(b)　半導体　Semiconductors

ケース温度、消費電力、熱抵抗より使用状態の接合点温度を求め最大定格、接合点温度との比較を求めました。
Compared with maximum junction temperature and actual one which is calculated based on case temperature, power dissipation and thermal impedance.

(c)　IC、抵抗、コンデンサー等　IC, Resistors, Capacitors, etc.

周囲温度、使用状態、消費電力など、個々の値は設計基準内に入っています。
Ambient temperature, operating condition, power dissipation and so on are within derating criteria.

(d)　熱抵抗算出方法　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 : ディレーティングの始まるケース温度　一般に25℃
Case temperature at start point of derating ; 25℃ in general

T_a : ディレーティングの始まる周囲温度　一般に25℃
Ambient temperature at start point of derating ; 25℃ in general

T_l : ディレーティングの始まるリード温度　一般に25℃
Lead temperature at start point of derating ; 25℃ in general

$P_{c(max)}$ ($P_{ch(max)}$) : 最大コレクタ(チャネル)損失
Maximum collector(channel) dissipation

$T_{j(max)}$ ($T_{ch(max)}$) : 最大接合点温度
Maximum junction(channel) temperature

θ_{j-c} (θ_{ch-c}) : 接合点からケースまでの熱抵抗
Thermal impedance between junction(channel) and case

θ_{j-a} : 接合点から周囲までの熱抵抗
Thermal impedance between junction and air

θ_{j-l} : 接合点からリードまでの熱抵抗
Thermal impedance between junction and lead

(2) 部品ディレーティング表 Component derating list

部品番号 Location No.	Vin = 100VAC Load = 100% Ta = 50℃
Q1-Q2 F20W60C3 SHINDENGEN	Tchmax = 150℃, θ ch-c = 0.6℃/W, Pch(max) = 75W Pch = 11.0W, Δ Tc = 34.6℃, Tc = 84.6℃ Tch = Tc + ((θ ch - c) × Pch) = 91.2℃ D.F. = 60.8%
Q31 2SK3907 TOSHIBA	Tchmax = 150℃, θ ch-c = 0.833℃/W, Pch(max) = 150W Pch = 12.5W, Δ Tc = 31.5℃, Tc = 81.5℃ Tch = Tc + ((θ ch - c) × Pch) = 91.9℃ D.F. = 61.3%
Q32 2SK3907 TOSHIBA	Tchmax = 150℃, θ ch-c = 0.833℃/W, Pch(max) = 150W Pch = 16.2W, Δ Tc = 24.5℃, Tc = 74.5℃ Tch = Tc + ((θ ch - c) × Pch) = 88.0℃ D.F. = 58.7%
Q51-Q52 SPP80N03S2L-05 INFINEON	Tchmax =175℃, θ ch-c = 0.9℃/W, Pch(max) = 167W Pch = 25.5W, Δ Tc = 50.6℃, Tc = 100.6℃ Tch = Tc + ((θ ch - c) × Pch) = 123.6℃ D.F. = 73.5%
Q53-Q56 SPP80N03S2L-05 INFINEON	Tchmax =175℃, θ ch-c = 0.9℃/W, Pch(max) = 167W Pch = 7.9W, Δ Tc = 44.1℃, Tc = 94.1℃ Tch = Tc + ((θ ch - c) × Pch) = 101.2℃ D.F. = 58.7%
Q102 2SC2873-Y TOSHIBA	Tjmax =150℃, θ j-a =250℃/W, Pc(max) = 0.5W Pc = 51.0mW, Δ Ta = 23.5℃, Ta = 73.5℃ Tj = Ta + ((θ j - a) × Pc) =86.3℃ D.F. = 57.5%
Q103 2SA1213-Y TOSHIBA	Tjmax = 150℃, θ j-a = 250℃/W, Pc(max) = 0.5W Pc = 53.0mW, Δ Ta= 23.3℃, Ta = 73.3℃ Tj = Ta + ((θ j - a) × Pc) = 86.6℃ D.F. = 57.7%
Q153 2SA1213-Y TOSHIBA	Tjmax = 150℃, θ j-a = 250℃/W, Pc(max) = 0.5W Pc = 38.9mW, Δ Ta= 32.0℃, Ta = 82.0℃ Tj = Ta + ((θ j - a) × Pc) = 91.7℃ D.F. = 61.1%
Q201 2SK2615 TOSHIBA	Tchmax =150℃, θ ch-a =250℃/W, Pch(max) = 0.5W Pch = 85.0mW, Δ Ta = 37.0℃, Ta = 87.0℃ Tch = Ta + ((θ ch - a) × Pch) = 108.3℃ D.F. = 72.2%
Q202 2SK2615 TOSHIBA	Tchmax =150℃, θ ch-a =250℃/W, Pch(max) = 0.5W Pch = 40.0mW, Δ Ta = 43.1℃, Ta = 93.1℃ Tch = Ta + ((θ ch - a) × Pch) = 103.1℃ D.F. = 68.7%
Q304 2SA1213-Y TOSHIBA	Tjmax = 150℃, θ j-a= 250℃/W, Pc(max) = 0.5W Pc = 48.0mW, Δ Ta =24.5℃, Ta = 74.5℃ Tj = Ta + ((θ j - a) × Pc) = 86.5℃ D.F. = 57.7%
Q331 2SC2712-Y TOSHIBA	Tjmax = 150℃, θ j-a= 833℃/W, Pc(max) = 150mW Pc = 59.0ｍW, Δ Ta =19.8℃, Ta = 69.8℃ Tj = Ta + ((θ j - a) × Pc) = 119.0℃ D.F. = 79.3%
D1 DX25XB60-7000 SHINDENGEN	Tjmax = 150℃, θ j-c = 1.5℃/W, Pd = 14.3W, Δ Tc = 44.0℃, Tc = 94.0℃ Tj = Tc + ((θ j - c) × Pd) = 115.5℃ D.F. = 77.0%
D2 YG967C6RSC FUJI ELEC	Tjmax = 150℃, θ j-c = 2℃/W, Pd = 14.5W, Δ Tc = 36.8℃, Tc = 86.8℃ Tj = Tc + ((θ j - c) × Pd) = 115.8℃ D.F. = 77.2%

部品番号 Location No.	Vin = 100VAC　　Load = 100%　　Ta = 50℃
D101 CRH01 TOSHIBA	Tjmax = 150℃,　θ j-l= 30℃/W, Pd = 43.3mW,　Δ Tl =21.5℃,　Tl =71.5℃ Tj = Tl + ((θ j - l) × Pd) = 72.8℃ D.F. = 48.5%
D102 CRH01 TOSHIBA	Tjmax = 150℃,　θ j-l= 30℃/W, Pd = 12.7mW,　Δ Tl =21.5℃,　Tl =71.5℃ Tj = Tl + ((θ j - l) × Pd) = 71.9℃ D.F. = 47.9%
D153 NSU03A60 NIHON INTER	Tjmax = 150℃,　θ j-l= 13℃/W, Pd = 0.2W,　Δ Tl =31.5℃,　Tl =81.5℃ Tj = Tl + ((θ j - l) × Pd) = 84.1℃ D.F. = 56.1%
D154 NSU03A60 NIHON INTER	Tjmax = 150℃,　θ j-l= 13℃/W, Pd = 0.6W,　Δ Tl =31.6℃,　Tl =81.6℃ Tj = Tl + ((θ j - l) × Pd) = 89.4℃ D.F. = 59.6%
D301 CRH01 TOSHIBA	Tjmax = 150℃,　θ j-l= 30℃/W, Pd = 0.3W,　Δ Tl =19.8℃,　Tl =69.8℃ Tj = Tl + ((θ j - l) × Pd) = 78.8℃ D.F. = 52.5%
D331 CRH01 TOSHIBA	Tjmax = 150℃,　θ j-l= 30℃/W, Pd = 0.2W,　Δ Tl =12.6℃,　Tl =62.6℃ Tj = Tl + ((θ j - l) × Pd) = 68.6℃ D.F. = 45.7%
D352 1SS184 TOSHIBA	Tjmax = 150℃,　θ j-a= 833℃/W,　P(max) = 150mW Pd =2.2mW,　Δ Ta =9.7℃,　Ta =59.7℃ Tj = Ta + ((θ j - a) × Pd) = 61.5℃ D.F. = 41.0%
D353 CRH01 TOSHIBA	Tjmax = 150℃,　θ j-l= 30℃/W, Pd = 0.2W,　Δ Tl =11.7℃,　Tl =61.7℃ Tj = Tl + ((θ j - l) × Pd) = 67.7℃ D.F. = 45.1%
PC31 PS2581L1 (LED) NEC	Tjmax = 125℃,　θ j-c = 150℃/W,　Pd(max) = 150mW Pd = 4.2mW,　Δ Tc = 12.6℃,　Tc = 62.6℃ Tj = Tc + ((θ j - c) × Pd) = 63.2℃ D.F. = 50.6%
PC31 PS2581L1 (TRANSISTOR) NEC	Tjmax = 125℃,　θ j-c = 150℃/W,　Pc(max) = 150mW Pc = 0.2mW,　Δ Tc = 12.6℃,　Tc = 62.6℃ Tj = Tc + ((θ j - c) × Pc) = 62.6℃ D.F. = 50.1%
PC52 PS2581L1 (LED) NEC	Tjmax = 125℃,　θ j-c = 150℃/W,　Pd(max) = 150mW Pd = 0.6mW,　Δ Tc = 12.0℃,　Tc = 62.0℃ Tj = Tc + ((θ j - c) × Pd) = 62.1℃ D.F. = 49.7%
PC52 PS2581L1 (TRANSISTOR) NEC	Tjmax = 125℃,　θ j-c = 150℃/W,　Pc(max) = 150mW Pc = 4.8mW,　Δ Tc = 12.0℃,　Tc = 62.0℃ Tj = Tc + ((θ j - c) × Pc) = 62.7℃ D.F. = 50.2%
PC331 PS2801-1 (LED) NEC	Tjmax = 125℃,　θ j-c =150℃/W,　Pd(max) =60mW Pd = 0.1mW,　Δ Tc = 19.0℃,　Tc = 69.0℃ Tj = Tc + ((θ j - c) × Pd) = 69.0℃ D.F. = 55.2%
PC331 PS2801-1 (TRANSISTOR) NEC	Tjmax = 125℃,　θ j-c = 150℃/W,　Pc(max) =120mW Pc = 6.7mW,　Δ Tc = 19.0℃,　Tc = 69.0℃ Tj = Tc + ((θ j - c) × Pc) = 70.0℃ D.F. = 56.0%
SR1 SF10JZ47(F) TOSHIBA	Tjmax = 125℃,　θ j-c = 3.4℃/W, Pc = 4.4W,　Δ Tc = 29.6℃,　Tc = 79.6℃ Tj = Tc + ((θ j - c) × Pc) = 94.6℃ D.F. = 75.7%

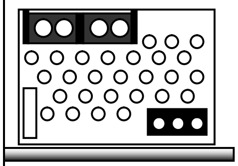
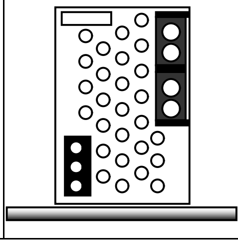
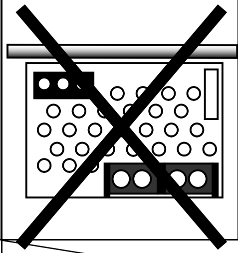
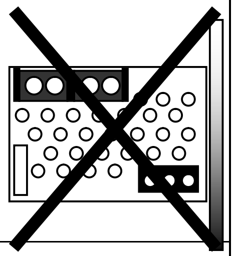
部品番号 Location No.	Vin = 200VAC Load = 100% Ta = 50℃
Q1-Q2 F20W60C3 SHINDENGEN	Tchmax = 150℃, θ ch-c = 0.6℃/W, Pch(max) = 75W Pch = 4.9W, Δ Tc = 14.1℃, Tc = 64.1℃ Tch = Tc + ((θ ch - c) × Pch) = 67.0℃ D.F. = 44.7%
Q31 2SK3907 TOSHIBA	Tchmax = 150℃, θ ch-c = 0.833℃/W, Pch(max) = 150W Pch = 12.5W, Δ Tc = 30.3℃, Tc = 80.3℃ Tch = Tc + ((θ ch - c) × Pch) = 90.7℃ D.F. = 60.5%
Q32 2SK3907 TOSHIBA	Tchmax = 150℃, θ ch-c = 0.833℃/W, Pch(max) = 150W Pch = 16.2W, Δ Tc = 23.9℃, Tc = 73.9℃ Tch = Tc + ((θ ch - c) × Pch) = 87.4℃ D.F. = 58.3%
Q51-Q52 SPP80N03S2L-05 INFINEON	Tchmax =175℃, θ ch-c = 0.9℃/W, Pch(max) = 167W Pch = 25.5W, Δ Tc = 48.3℃, Tc = 98.3℃ Tch = Tc + ((θ ch - c) × Pch) = 121.3℃ D.F. = 72.2%
Q53-Q56 SPP80N03S2L-05 INFINEON	Tchmax =175℃, θ ch-c = 0.9℃/W, Pch(max) = 167W Pch = 7.9W, Δ Tc = 42.3℃, Tc = 92.3℃ Tch = Tc + ((θ ch - c) × Pch) = 99.4℃ D.F. = 57.7%
Q102 2SC2873-Y TOSHIBA	Tjmax =150℃, θ j-a =250℃/W, Pc(max) = 0.5W Pc = 58.0mW, Δ Ta = 17.7℃, Ta = 67.7℃ Tj = Ta + ((θ j - a) × Pc) = 82.2℃ D.F. = 54.8%
Q103 2SA1213-Y TOSHIBA	Tjmax = 150℃, θ j-a = 250℃/W, Pc(max) = 0.5W Pc = 0.1W, Δ Ta= 18.5℃, Ta = 68.5℃ Tj = Ta + ((θ j - a) × Pc) = 93.5℃ D.F. = 62.3%
Q153 2SA1213-Y TOSHIBA	Tjmax = 150℃, θ j-a = 250℃/W, Pc(max) = 0.5W Pc = 38.9mW, Δ Ta= 31.1℃, Ta = 81.1℃ Tj = Ta + ((θ j - a) × Pc) = 90.8℃ D.F. = 60.6%
Q201 2SK2615 TOSHIBA	Tchmax =150℃, θ ch-a =250℃/W, Pch(max) = 0.5W Pch = 85.0mW, Δ Ta = 36.5℃, Ta = 86.5℃ Tch = Ta + ((θ ch - a) × Pch) = 107.8℃ D.F. = 71.8%
Q202 2SK2615 TOSHIBA	Tchmax =150℃, θ ch-a =250℃/W, Pch(max) = 0.5W Pch = 40.0mW, Δ Ta = 43.5℃, Ta = 93.5℃ Tch = Ta + ((θ ch - a) × Pch) = 103.5℃ D.F. = 69.0%
Q304 2SA1213-Y TOSHIBA	Tjmax = 150℃, θ j-a = 250℃/W, Pc(max) = 0.5W Pc = 48.0mW, Δ Ta = 20.8℃, Ta = 70.8℃ Tj = Ta + ((θ j - a) × Pc) = 82.8℃ D.F. = 55.2%
Q331 2SC2712-Y TOSHIBA	Tjmax = 150℃, θ j-a= 833℃/W, Pc(max) = 150mW Pc = 59.0mW, Δ Ta = 19.8℃, Ta = 69.8℃ Tj = Ta + ((θ j - a) × Pc) = 119.0℃ D.F. = 79.3%
D1 DX25XB60-7000 SHINDENGEN	Tjmax = 150℃, θ j-c = 1.5℃/W, Pd = 7.2W, Δ Tc = 19.9℃, Tc = 69.9℃ Tj = Tc + ((θ j - c) × Pd) = 80.7℃ D.F. = 53.8%
D2 YG967C6RSC FUJI ELEC	Tjmax = 150℃, θ j-c = 2℃/W, Pd = 13.9W, Δ Tc = 19.7℃, Tc = 69.7℃ Tj = Tc + ((θ j - c) × Pd) = 97.5℃ D.F. = 65.0%

部品番号 Location No.	Vin = 200VAC	Load = 100%	Ta = 50℃
D101 CRH01 TOSHIBA	Tjmax = 150℃, Pd = 48.7mW, Tj = Tl + ((θ j - l) × Pd) = 72.6℃ D.F. = 48.4%	θ j-l= 30℃/W, Δ Tl = 21.1℃,	 Tl = 71.1℃
D102 CRH01 TOSHIBA	Tjmax = 150℃, Pd = 17.2mW, Tj = Tl + ((θ j - l) × Pd) = 71.6℃ D.F. = 47.7%	θ j-l= 30℃/W, Δ Tl = 21.1℃,	 Tl = 71.1℃
D153 NSU03A60 NIHON INTER	Tjmax = 150℃, Pd = 0.2W, Tj = Tl + ((θ j - l) × Pd) = 83.0℃ D.F. = 55.3%	θ j-l= 13℃/W, Δ Tl =30.4℃,	 Tl =80.4℃
D154 NSU03A60 NIHON INTER	Tjmax = 150℃, Pd = 0.6W, Tj = Tl + ((θ j - l) × Pd) = 88.3℃ D.F. = 58.9%	θ j-l= 13℃/W, Δ Tl = 30.5℃,	 Tl = 80.5℃
D301 CRH01 TOSHIBA	Tjmax = 150℃, Pd = 0.3W, Tj = Tl + ((θ j - l) × Pd) = 78.9℃ D.F. = 52.6%	θ j-l= 30℃/W, Δ Tl = 19.9℃,	 Tl = 69.9℃
D331 CRH01 TOSHIBA	Tjmax = 150℃, Pd = 0.2W, Tj = Tl + ((θ j - l) × Pd) = 68.7℃ D.F. = 45.8%	θ j-l= 30℃/W, Δ Tl = 12.7℃,	 Tl = 62.7℃
D352 1SS184 TOSHIBA	Tjmax = 150℃, Pd = 2.2mW, Tj = Ta + ((θ j - a) × Pd) = 61.6℃ D.F. = 41.1%	θ j-a= 833℃/W, Δ Ta = 9.8℃,	P(max) = 150mW Ta = 59.8℃
D353 CRH01 TOSHIBA	Tjmax = 150℃, Pd = 0.2W, Tj = Tl + ((θ j - l) × Pd) = 67.7℃ D.F. = 45.1%	θ j-l= 30℃/W, Δ Tl = 11.7℃,	 Tl = 61.7℃
PC31 PS2581L1 (LED) NEC	Tjmax = 125℃, Pd = 4.2mW, Tj = Tc + ((θ j - c) × Pd) = 63.0℃ D.F. = 50.4%	θ j-c = 150℃/W, Δ Tc = 12.4℃,	Pd(max) = 150mW Tc = 62.4℃
PC31 PS2581L1 (TRANSISTOR) NEC	Tjmax = 125℃, Pc = 0.2mW, Tj = Tc + ((θ j - c) × Pc) = 62.4℃ D.F. = 49.9%	θ j-c = 150℃/W, Δ Tc = 12.4℃,	Pc(max) = 150mW Tc = 62.4℃
PC52 PS2581L1 (LED) NEC	Tjmax = 125℃, Pd = 0.6mW, Tj = Tc + ((θ j - c) × Pd) = 62.0℃ D.F. = 49.6%	θ j-c = 150℃/W, Δ Tc = 11.9℃,	Pd(max) = 150mW Tc = 61.9℃
PC52 PS2581L1 (TRANSISTOR) NEC	Tjmax = 125℃, Pc = 4.8mW, Tj = Tc + ((θ j - c) × Pc) = 62.6℃ D.F. = 50.1%	θ j-c = 150℃/W, Δ Tc = 11.9℃,	Pc(max) = 150mW Tc = 61.9℃
PC331 PS2801-1 (LED) NEC	Tjmax = 125℃, Pd = 0.1mW, Tj = Tc + ((θ j - c) × Pd) = 64.3℃ D.F. = 51.4%	θ j-c =150℃/W, Δ Tc = 14.3℃,	Pd(max) =60mW Tc = 64.3℃
PC331 PS2801-1 (TRANSISTOR) NEC	Tjmax = 125℃, Pc = 6.7mW, Tj = Tc + ((θ j - c) × Pc) = 65.3℃ D.F. = 52.2%	θ j-c = 150℃/W, Δ Tc = 14.3℃,	Pc(max) =120mW Tc = 64.3℃
SR1 SF10JZ47(F) TOSHIBA	Tjmax = 125℃, Pc = 4.2W, Tj = Tc + ((θ j - c) × Pc) = 79.9℃ D.F. = 63.9%	θ j-c = 3.4℃/W, Δ Tc = 15.6℃,	 Tc = 65.6℃

3. 主要部品温度上昇値　　Main components temperature rise ΔT list

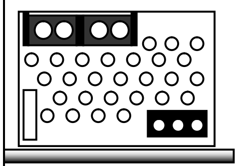
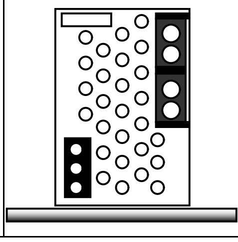
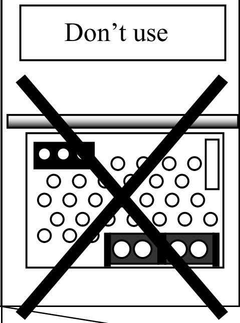
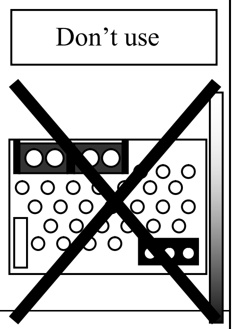
MODEL : HWS600-5

・ 測定条件　Conditions

取付方法 Mounting method (標準取付:(A)) (Standard mounting method:(A))	(A)	(B)	(C)	(D)
			Don't use 	Don't use 
入力電圧 Input voltage（VAC）	100			
出力電圧 Output voltage（VDC）	5			
出力電流 Output current（A）	120			

		ΔT temperature rise (℃)			
出力ディレーティング Output derating		Io = 100% Ta = 50℃		Io = 50% Ta = 70℃	
部品番号 Location No.	部品名 Parts name	取付方向 Mounting A	取付方向 Mounting B	取付方向 Mounting A	取付方向 Mounting B
L1	BALUN COIL	14.9	13.6	4.8	3.0
L2	BALUN COIL	9.1	7.9	0.8	1.1
L3	CHOKE COIL	24.1	22.4	10.8	10.0
L51	CHOKE COIL	40.9	40.6	9.9	10.0
T21	TRANS PULSE	10.5	7.5	2.6	2.5
T31	TRANS PULSE	17.4	15.2	6.6	6.3
T32	TRANS PULSE	44.6	43.4	13.1	12.8
D1	BRIDGE DIODE	44.0	41.3	14.4	15.2
D2	LLD	36.8	39.0	16.2	16.9
Q1-Q2	MOS FET	34.6	33.7	10.0	10.1
Q31	MOS FET	31.5	28.7	15.3	15.8
Q32	MOS FET	24.5	23.0	10.5	10.5
Q51-Q52	MOS FET	50.6	48.2	14.1	13.8
Q53-Q56	MOS FET	44.1	41.6	12.1	11.4
A102	CHIP IC	13.2	12.6	7.5	7.8
A152	CHIP IC	19.5	20.2	14.3	14.8
A351	CHIP IC	14.7	13.3	11.7	12.7
C9	E. CAP.	6.1	5.0	1.5	2.0
C13	E. CAP.	9.8	10.0	3.0	3.4
C12	E. CAP.	7.3	6.3	2.6	3.0
C35	E. CAP.	14.6	12.1	5.3	5.1
C51	E. CAP.	8.4	6.6	4.1	3.8
C52	E. CAP.	7.1	5.3	2.1	1.8
C53	E. CAP.	9.5	8.0	2.5	2.4
C54	E. CAP.	6.2	4.6	1.6	1.4

・ 測定条件　Conditions

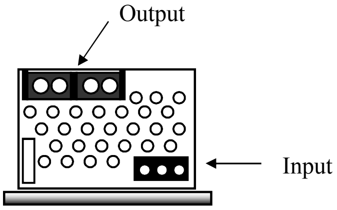
取付方法 Mounting method (標準取付:(A)) (Standard mounting method:(A))	(A)	(B)	(C)	(D)
				
入力電圧 Input voltage（VAC）	200			
出力電圧 Output voltage（VDC）	5			
出力電流 Output current（A）	120			

		ΔT temperature rise (℃)			
出力ディレーティング Output derating		Io = 100% Ta = 50℃		Io = 50% Ta = 70℃	
部品番号 Location No.	部品名 Parts name	取付方向 Mounting A	取付方向 Mounting B	取付方向 Mounting A	取付方向 Mounting B
L1	BALUN COIL	4.5	3.0	2.4	1.2
L2	BALUN COIL	2.1	0.9	0.1	0.4
L3	CHOKE COIL	17.7	16.3	10.4	9.7
L51	CHOKE COIL	40.7	40.4	10.1	10.1
T21	TRANS PULSE	10.1	7.2	3.0	2.9
T31	TRANS PULSE	16.3	13.9	6.5	6.0
T32	TRANS PULSE	43.8	42.8	13.1	12.6
D1	BRIDGE DIODE	19.9	17.7	6.7	7.1
D2	LLD	19.7	20.6	10.0	10.4
Q1-Q2	MOS FET	14.1	13.5	4.7	4.7
Q31	MOS FET	30.3	28.5	15.6	16.1
Q32	MOS FET	23.9	22.5	10.7	10.5
Q51-Q52	MOS FET	48.3	46.7	14.1	13.7
Q53-Q53	MOS FET	42.3	40.4	12.2	11.4
A102	CHIP IC	11.5	10.6	7.3	7.2
A152	CHIP IC	19.2	19.8	14.4	14.5
A351	CHIP IC	14.4	12.7	11.6	12.5
C9	E. CAP.	4.9	3.6	1.3	1.9
C13	E. CAP.	8.0	7.8	2.8	3.2
C12	E. CAP.	5.8	4.8	2.4	2.8
C35	E. CAP.	13.9	11.4	5.2	4.9
C51	E. CAP.	8.2	6.7	4.2	3.7
C52	E. CAP.	7.1	5.4	2.2	1.8
C53	E. CAP.	9.3	8.1	2.5	2.3
C54	E. CAP.	6.3	4.8	1.7	1.5

4. 電解コンデンサ推定寿命計算値　　Electrolytic capacitor lifetime

MODEL : HWS600-5

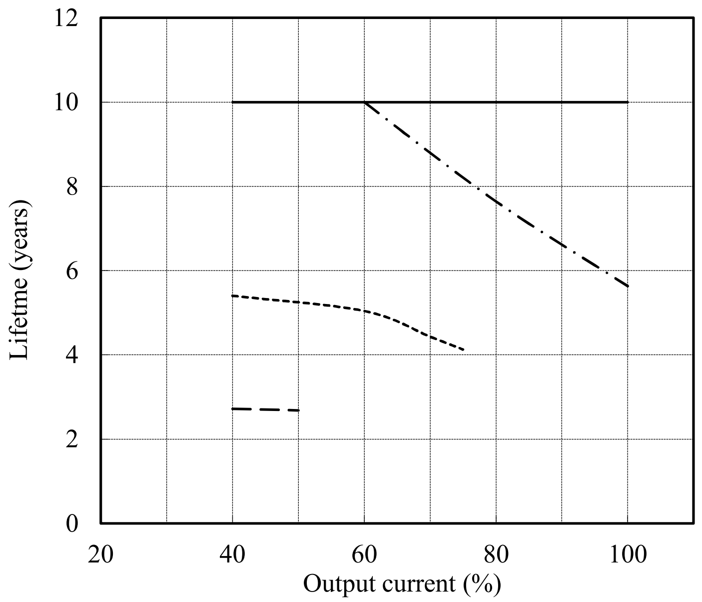
取付方向 A
Mounting A



Conditions　Ta　40℃ : ——
50℃ : —·—·
60℃ : - - - -
70℃ : — — —

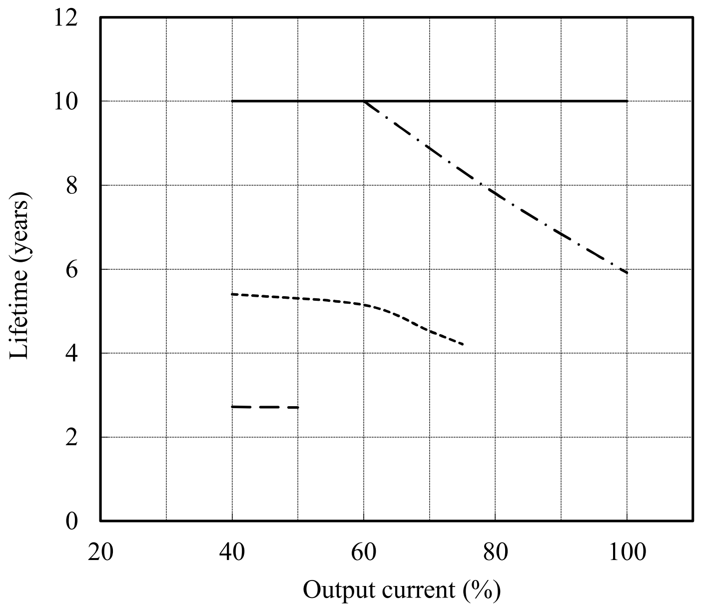
Vin=100VAC

Load (%)	Lifetime (years)			
	Ta=40℃	Ta=50℃	Ta=60℃	Ta=70℃
40	10.0	10.0	5.4	2.7
60	10.0	10.0	5.0	-
80	10.0	7.6	-	-
100	10.0	5.6	-	-



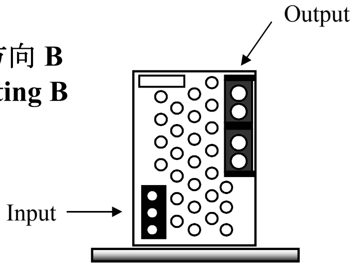
Vin=200VAC

Load (%)	Lifetime (years)			
	Ta=40℃	Ta=50℃	Ta=60℃	Ta=70℃
40	10.0	10.0	5.4	2.7
60	10.0	10.0	5.1	-
80	10.0	7.8	-	-
100	10.0	5.9	-	-



MODEL : HWS600-5

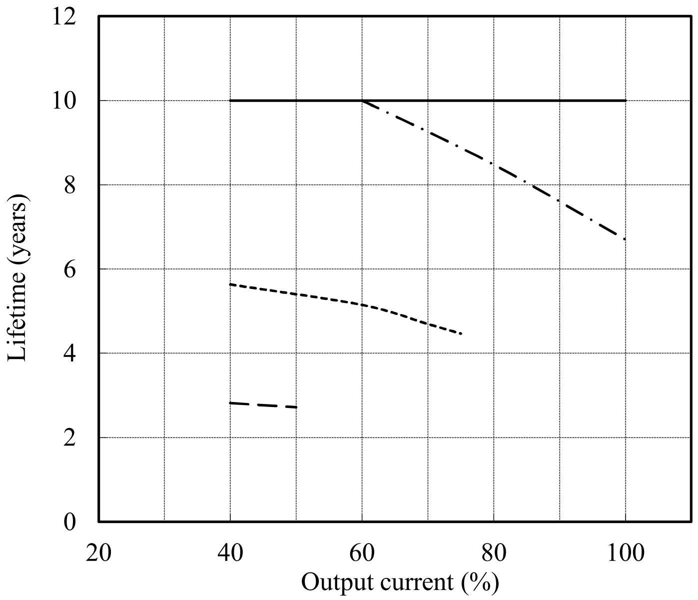
取付方向 B
Mounting B



Conditions Ta 40℃ : ———
50℃ : —·—·
60℃ : - - - -
70℃ : — — —

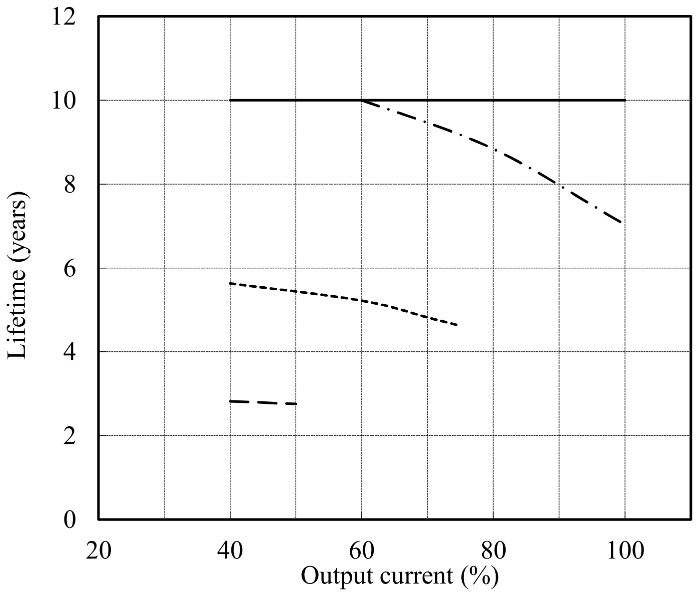
Vin=100VAC

Load (%)	Lifetime (years)			
	Ta= 40℃	Ta= 50℃	Ta= 60℃	Ta= 70℃
40	10.0	10.0	5.6	2.8
60	10.0	10.0	5.1	-
80	10.0	8.5	-	-
100	10.0	6.7	-	-



Vin=200VAC

Load (%)	Lifetime (years)			
	Ta= 40℃	Ta= 50℃	Ta= 60℃	Ta= 70℃
40	10.0	10.0	5.6	2.8
60	10.0	10.0	5.2	-
80	10.0	8.8	-	-
100	10.0	7.0	-	-



5. アブノーマル試験　Abnormal test

MODEL : HWS600-24

(1) 試験条件　Conditions

Input : 200VAC　Output : 24V　27A　 Ta : 25℃ 70%RH

(2) 試験結果　Test result

(Da : Damaged)

No.	試験箇所 Test position 部品No. Location No.	試験箇所 Test position 試験端子 Test point	試験モード Test mode ショート Short	試験モード Test mode オープン Open	① 発火 Fire	② 発煙 Smoke	③ 破裂 Burst	④ 異臭 Smell	⑤ 発熱 Red hot	⑥ 破損 Damaged	⑦ ヒューズ断 Fuse blown	⑧ OVP	⑨ OCP	⑩ 出力断 No output	⑪ 変化なし No change	⑫ その他 Others	記事 Note
1	Q1	D-S	○								○			○			FUSE:F1
2	Q1	D-G	○							○	○			○			FUSE:F1 Da: Q1,Q2,R106,R107
3	Q1	G-S	○												○		
4	Q1	D		○											○		
5	Q1	S		○											○		
6	Q1	G		○						○	○			○			FUSE:F1 Da: Q1
7	Q2	D-S	○							○	○			○			FUSE:F1
8	Q2	D-G	○							○	○			○			FUSE:F1 Da: Q1,Q2,R108,R109
9	Q2	G-S	○												○		
10	Q2	D		○											○		
11	Q2	S		○											○		
12	Q2	G		○						○	○			○			FUSE:F1 Da: Q2
13	Q31	D-S	○							○	○			○			FUSE:F21 Da: Q32,D153
14	Q31	D-G	○							○	○			○			FUSE:F21 Da: Q32,D153,Z151
15	Q31	G-S	○											○			
16	Q31	D		○										○			
17	Q31	S		○										○			
18	Q31	G		○						○	○			○			FUSE:F21 Da: Q32,D153
19	Q32	D-S	○							○	○			○			FUSE:F21 Da: Q31,D152
20	Q32	D-G	○							○	○			○			FUSE:F21 Da: Q31,D152,Z152
21	Q32	G-S	○											○			
22	Q32	D		○										○			
23	Q32	S		○										○			
24	Q32	G		○						○	○			○			FUSE:F21 Da: Q31,D152

No.	試験箇所 Test position 部品No. Location No.	試験端子 Test point	試験モード Test mode ショート Short	オープン Open	① 発火 Fire	② 発煙 Smoke	③ 破裂 Burst	④ 異臭 Smell	⑤ 発熱 Red hot	⑥ 破損 Damaged	⑦ ヒューズ断 Fuse blown	⑧ OVP	⑨ OCP	⑩ 出力断 No output	⑪ 変化なし No change	⑫ その他 Others	記事 Note
25	C13		○							○	○			○			FUSE:F1 Da:Q1,R135
26	T21	1-2	○											○			
27		3-4	○											○			
28		5-6	○											○			
29		7-8	○											○			
30		1		○										○			
31		3		○										○			
32		5		○										○			
33		7		○										○			
34	T32	1-2	○											○			
35		5-6	○											○			
36		1		○										○			
37		5		○										○			
38	D1	DC-DC	○							○	○			○			FUSE:F1 Da:D1
39		AC-"+"	○								○			○			FUSE:F1
40	D2		○							○	○			○			FUSE:F1 Da: Q1,D2
41				○						○	○			○			FUSE:F1 Da: Q1
42	D153		○							○	○			○			FUSE:F21 Da: Q32
43				○											○		
44	D154		○							○	○			○			FUSE:F21 Da: Q31
45				○											○		
46	D51		○											○			
47				○											○		
48	D53		○											○			
49				○											○		
50	Q151	D-S	○											○			
51		D-G	○											○			
52		G-S	○											○			
53		D		○										○			
54		S		○										○			
55		G		○										○			
56	Q152	C-E	○											○			
57		B-E	○													○	入力電力増加 Input power increase
58		B-C	○											○			
59		C		○										○			
60		E		○						○	○			○			FUSE:F21 Da: Q32,D153,Z152
61		B		○						○	○			○			FUSE:F21 Da: Q32,D153,Z152

No.	試験箇所 Test position 部品No. Location No.	試験端子 Test point	試験モード Test mode ショート Short	オープン Open	① 発火 Fire	② 発煙 Smoke	③ 破裂 Burst	④ 異臭 Smell	⑤ 発熱 Red hot	⑥ 破損 Damaged	⑦ ヒューズ断 Fuse blown	⑧ OVP	⑨ OCP	⑩ 出力断 No output	⑪ 変化なし No change	⑫ その他 Others	記事 Note
62	Q153	C-E	○											○			
63		B-E	○													○	入力電力増加 Input power increase
64		B-C	○											○			
65		C		○												○	入力電力増加 Input power increase
66		E		○						○	○			○			FUSE:F21 Da: Q31,D154,Z151
67		B		○						○	○			○			FUSE:F21 Da: Q31,D154,Z151
68	A351	D-S	○								○			○			FUSE:F22
69		CON-S	○											○			
70		CON-D	○							○	○			○			FUSE:F22 Da:R351,R352,Z351, D352,A351
71		D		○										○			
72		S		○										○			
73		CON		○										○			
74	Z352		○											○			
75				○											○		
76	SR1		○												○		
77			○												○		
78			○											○			
79				○						○	○			○			FUSE:F1 Da: Q1,TFR1,TFR2
80				○						○	○			○			FUSE:F1 Da: Q1,TFR1,TFR2
81				○						○	○			○			FUSE:F1 Da: Q1,TFR1,TFR2

6. 振動試験　Vibration test

MODEL : HWS600-24

(1)　振動試験種類　Vibration test class

掃引振動数耐久試験　Frequency variable endurance test

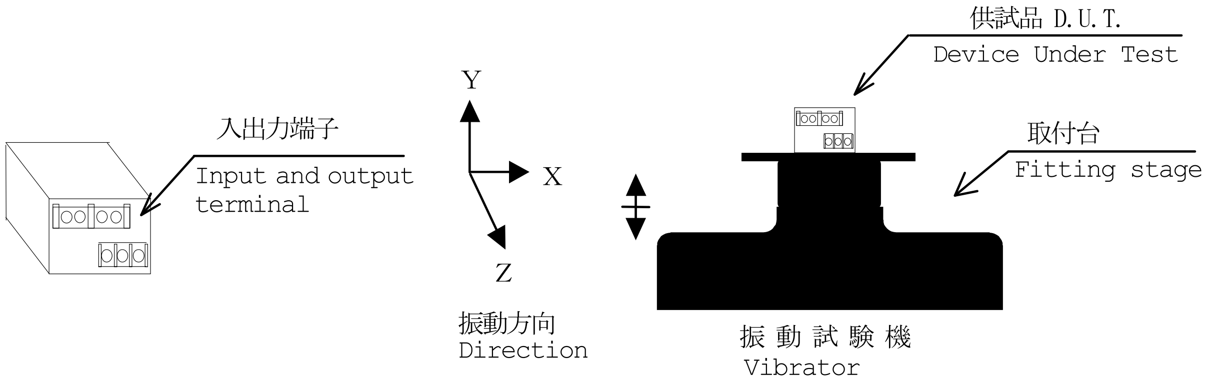
(2)　使用振動試験装置　Equipment used

・EMIC (株)製　EMIC CORP.　・制御部 Controller　: F-400-BM-DCS-7800　・加振部 Vibrator　: 905-FN

(3)　試験条件　Test conditions

・周波数範囲 Sweep frequency	10～55Hz
・掃引時間 Sweep time	1.0分間 1.0min.
・加速度 Acceleration	一定 19.6m/s^2 (2G) Constant
・振幅方向 Direction	X, Y, Z
・試験時間 Test time	各方向共 1 時間 1 hour each

(4)　試験方法　Test method



(5)　試験結果　Test results

合　格　　O　K

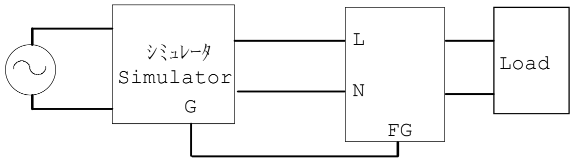
入力電圧 Vin:100VAC
出力電流 Io:100%

測定確認項目 Check item		出力電圧 (V) Output voltage	リップルノイズ (mVp-p) Ripple noise	機構・実装状態 D.U.T.State
試験前 Before test		24.015	125	――――
試験後 After test	X	24.009	123	異常なし OK
	Y	24.012	112	異常なし OK
	Z	24.013	118	異常なし OK

7. ノイズシミュレート試験　Noise simulate test

MODEL : HWS600-24

(1)　試験回路及び測定器　Test circuit and equipment



ｼﾐｭﾚｰﾀｰ Simulator	:	INS-4320（ﾉｲｽﾞ研究所） Noise Laboratory Co.,LTD

(2)　試験条件　Test conditions

・入力電圧 Input voltage	:	100,230VAC	・ノイズ電圧 Noise level	:	0V～2kV
・出力電圧 Output voltage	:	定格 Rated	・位相 Phase shift	:	0°～360°
・出力電流 Output current	:	0%,100%	・極性 Polarity	:	＋,－
・周囲温度 Ambient temperature	:	25℃	・印加モード Mode	:	Normal Common
・パルス幅 Pulse width	:	50ns～1000ns	・トリガ選択 Trigger select	:	Line

(3)　判定条件　Acceptable conditions

1.破壊しない事	Not to be broken.
2.出力がダウンしない事	Not to be shut down output.
3.その他異常のない事	No other out of orders.

(4)　試験結果　Test result

合　格　　**O　K**

8. 熱衝撃試験　Thermal shock test

MODEL : HWS600-24

(1)　使用計測器　Equipment used

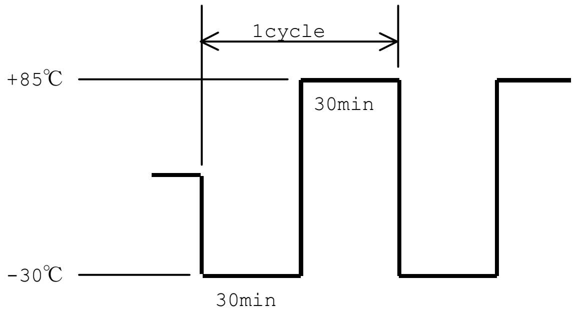
THERMAL SHOCK CHAMBER TSV-40 (TABAI ESPEC CORP.)

(2)　供試品台数　The number of D.U.T.(Device Under Test)

1　台 (units)

(3)　試験条件　Test conditions

- 電源周囲温度 Ambient temperature　:　-30℃ ⟷ 85℃
- 試験時間 Test time　:　図参照 Refer to Dwg.
- 試験サイクル Test cycle　:　100 サイクル 100 cycles
- 非動作 Not operating



(4)　試験方法　Test method

初期測定の後、供試品を試験槽に入れ、上記サイクルで試験を行う。100サイクル後に、供試品を常温常湿下に1時間放置し、出力に異常がない事を確認する。

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. 100 cycles later, leave it for 1 hour at the room temperature, then check if there is no abnormal output.

(5)　試験結果　Test results

合　格　　O　K

入力電圧 Vin:100VAC / 出力電流 Io:100%			24V From		24V To	
リップル電圧 Ripple voltage		mVp-p	32		31	
スパイクノイズ Spike noise		mVp-p	125		124	
入力変動 Line regulation	MIN	V	24.014	0mV	24.069	1mV
	MAX	V	24.014		24.070	
負荷変動 Load regulation	0%	V	24.015	1mV	24.069	1mV
	100%	V	24.014		24.070	
効率 Efficiency	Pin	W	769.9	84.2%	770.1	84.4%
	Vout	V	24.014		24.070	
	Iout	A	27.0		27.0	
半田状態・その他 Solder condition・etc.			――――		異常なし OK	

9. FAN期待寿命　　Fan life expectancy

MODEL : HWS600

(1)　使用製品名　Part name
9A0812G4D031 (SANYO DENKI CO.)

(2)　期待寿命　Life expectancy
メーカーによるファン単体の期待寿命データを示す（残存率９０％）。
また、ファン排気温度測定個所は、fig　１.に示す。

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

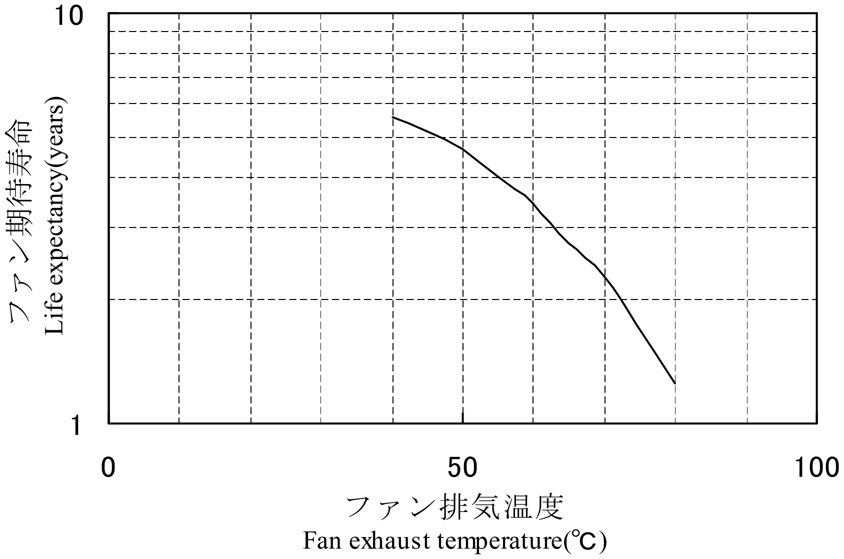
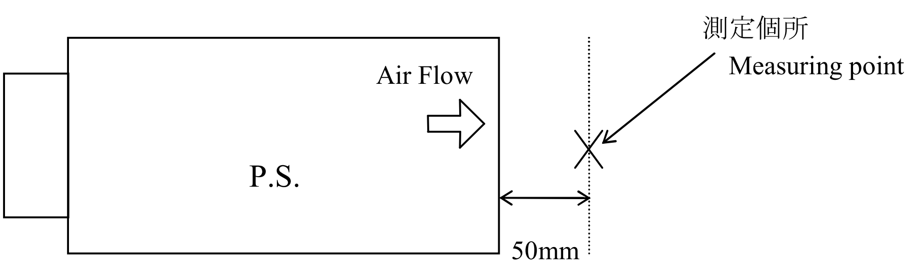


fig　１．ファン排気温度測定個所
Measuring point of fan exhaust temperature.



※電源の吸排気温度差はIo=100%で約8℃です。
The difference between the intake temperature and the exhaust temperature of the power supply is about 8℃ at Io=100%.