

ZWS100B

RELIABILITY DATA

信頼性データ

DWG No. A245-57-01		
APPD	CHK	DWG
<i>M. Watanabe</i> 9. Jun. '10	<i>H. Kawabara</i> 9. Jun. '10	<i>T. Saito</i> 9. Jun. '10

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※ 試験結果は、代表データであります。全ての製品はほぼ同等な特性を示します。
従いまして、以下の結果は実力値とお考え願います。

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. MTBF計算値 Calculated Values of MTBF

MODEL : ZWS100B-5

(1) 算出方法 Calculating Method

JEITA (RCR-9102B)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-9102B).
 Individual failure rates λ_G is given to each part and MTBF is calculated
 by the count of each part.

<算出式>

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

λ_{equip} : 全機器故障率 (故障数/10⁶時間)
 Total Equipment Failure Rate (Failure/10⁶Hours)

λ_G : i番目の同属部品に対する故障率 (故障数/10⁶時間)
 Generic Failure Rate for The ith Generic Part (Failure/10⁶Hours)

n_i : i番目の同属部品の個数
 Quantity of ith 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 ($\pi_Q=1$)
 Generic Quality Factor for The ith Generic Part ($\pi_Q=1$)

(2) MTBF値 MTBF Values

G_F : 地上固定 (Ground, Fixed)

RCR-9102B

MTBF ≒ 279,197 時間 (Hours)

2. 部品デイレートイング Components Derating

MODEL : ZWS100B-5

(1) 算出方法 Calculating Method

(a) 測定方法 Measuring method

・取付方法 Mounting method	: 標準取付 : A Standard mounting : A	・周囲温度 Ambient temperature	: 50°C
・入力電圧 Input voltage	: 100, 200VAC	・出力電圧、電流 Output voltage & current	: 5V, 20A(100%)

(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

$$\theta_{j-c} = \frac{T_j(\max) - T_c}{P_{ch}(\max)} \quad \theta_{j-a} = \frac{T_j(\max) - T_a}{P_{ch}(\max)} \quad \theta_{j-l} = \frac{T_j(\max) - T_l}{P_{ch}(\max)}$$

T_c : デイレートイングの始まるケース温度 一般に25°C
Case Temperature at Start Point of Derating; 25°C in General

T_a : デイレートイングの始まる周囲温度 一般に25°C
Ambient Temperature at Start Point of Derating; 25°C in General

T_l : デイレートイングの始まるリード温度 一般に25°C
Lead Temperature at Start Point of Derating; 25°C in General

$P_{ch}(\max)$: 最大チャネル損失
Maximum Channel Dissipation

$T_j(\max)$: 最大接合点(チャネル)温度
($T_{ch}(\max)$) Maximum Junction (channel) Temperature

θ_{j-c} : 接合点(チャネル)からケースまでの熱抵抗
(θ_{ch-c}) 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) 部品デレーティング表 Component Derating List

部品番号 Location No.	Vin = 100VAC	Load = 100%	Ta = 50°C
Q1 FMV09N90E FUJI ELECTRIC	Tch (max) = 150 °C Pch = 3.2 W Tch = Tc + ((θch-c) × Pch) = 117.7 °C D.F. = 78.5 %	θch-c = 1.471 °C/W ΔTc = 63.0 °C	Pch (max) = 85 W Tc = 113.0 °C
Q51 IPA057N08N3 G INFINEON	Tch (max) = 175 °C Pch = 2.0 W Tch = Tc + ((θch-c) × Pch) = 103.6 °C D.F. = 59.2 %	θch-c = 3.8 °C/W ΔTc = 46.0 °C	Pch (max) = 39 W Tc = 96.0 °C
Q52 IPA057N08N3 G INFINEON	Tch (max) = 175 °C Pch = 2.7 W Tch = Tc + ((θch-c) × Pch) = 106.3 °C D.F. = 60.7 %	θch-c = 3.8 °C/W ΔTc = 46.0 °C	Pch (max) = 39 W Tc = 96.0 °C
D1 D3SB60 SHINDENGEN	Tj (max) = 150 °C Pd = 3.9 W Tj = Tc + ((θj-c) × Pd) = 99.5 °C D.F. = 66.3 %	θj-c = 5.5 °C/W ΔTc = 28.0 °C	Tc = 78.0 °C
D101 S1NB60 SHINDENGEN	Tj (max) = 150 °C Pd = 11.6 mW Tj = Tl + ((θj-l) × Pd) = 81.2 °C D.F. = 54.1 %	θj-l = 15 °C/W ΔTl = 31.0 °C	Tl = 81.0 °C
SR1 BCR8PM-16LG RENESAS	Tj (max) = 150 °C Pc = 1.5 W Tj = Tc + ((θj-c) × Pc) = 110.5 °C D.F. = 73.7 %	θj-c = 4.3 °C/W ΔTc = 54.0 °C	Tc = 104.0 °C
PC101 TLP161G (LED) TOSHIBA	Tj (max) = 125 °C Pd = 7.1 mW Tj = Ta + ((θj-a) × Pd) = 96.6 °C D.F. = 77.3 %	θj-a = 500 °C/W ΔTa = 43.0 °C	Ta = 93.0 °C
PC103 PS2861B (LED) NEC	Tj (max) = 125 °C Pd = 0.9 mW Tj = Tc + ((θj-c) × Pd) = 80.3 °C D.F. = 64.2 %	θj-c = 330 °C/W ΔTc = 30.0 °C	Tc = 80.0 °C

部品番号 Location No.	$V_{in} = 200VAC$	Load = 100%	$T_a = 50^{\circ}C$
Q1 FMV09N90E FUJI ELECTRIC	Tch (max) = 150 °C Pch = 3.2 W Tch = Tc + ((θ_{ch-c}) × Pch) = 107.7 °C D.F. = 71.8 %	$\theta_{ch-c} = 1.471^{\circ}C/W$ $\Delta Tc = 53.0^{\circ}C$	Pch (max) = 85 W Tc = 103.0 °C
Q51 IPA057N08N3 G INFINEON	Tch (max) = 175 °C Pch = 2.0 W Tch = Tc + ((θ_{ch-c}) × Pch) = 99.6 °C D.F. = 56.9 %	$\theta_{ch-c} = 3.8^{\circ}C/W$ $\Delta Tc = 42.0^{\circ}C$	Pch (max) = 39 W Tc = 92.0 °C
Q52 IPA057N08N3 G INFINEON	Tch (max) = 175 °C Pch = 2.7 W Tch = Tc + ((θ_{ch-c}) × Pch) = 103.3 °C D.F. = 59.0 %	$\theta_{ch-c} = 3.8^{\circ}C/W$ $\Delta Tc = 43.0^{\circ}C$	Pch (max) = 39 W Tc = 93.0 °C
D1 D3SB60 SHINDENGEN	Tj (max) = 150 °C Pd = 2.2 W Tj = Tc + ((θ_{j-c}) × Pd) = 92.1 °C D.F. = 61.4 %	$\theta_{j-c} = 5.5^{\circ}C/W$ $\Delta Tc = 30.0^{\circ}C$	Tc = 80.0 °C
D101 S1NB60 SHINDENGEN	Tj (max) = 150 °C Pd = 2.2 mW Tj = Tl + ((θ_{j-l}) × Pd) = 78.1 °C D.F. = 52.1 %	$\theta_{j-l} = 15^{\circ}C/W$ $\Delta Tl = 28.0^{\circ}C$	Tl = 78.0 °C
SR1 BCR8PM-16LG RENESAS	Tj (max) = 150 °C Pc = 0.0 W Tj = Tc + ((θ_{j-c}) × Pc) = 87.0 °C D.F. = 58.0 %	$\theta_{j-c} = 4.3^{\circ}C/W$ $\Delta Tc = 37.0^{\circ}C$	Tc = 87.0 °C
PC101 TLP161G (LED) TOSHIBA	Tj (max) = 125 °C Pd = 0.0 mW Tj = Ta + ((θ_{j-a}) × Pd) = 80.0 °C D.F. = 64.0 %	$\theta_{j-a} = 500^{\circ}C/W$ $\Delta Ta = 30.0^{\circ}C$	Ta = 80.0 °C
PC103 PS2861B (LED) NEC	Tj (max) = 125 °C Pd = 0.9 mW Tj = Tc + ((θ_{j-c}) × Pd) = 73.3 °C D.F. = 58.6 %	$\theta_{j-c} = 330^{\circ}C/W$ $\Delta Tc = 23.0^{\circ}C$	Tc = 73.0 °C

3. 主要部品温度上昇値 Main Components Temperature Rise ΔT List

MODEL : ZWS100B-5

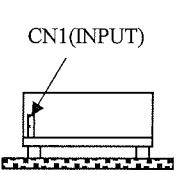
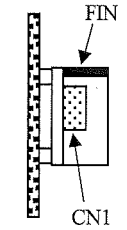
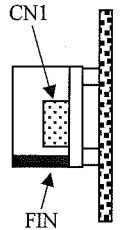
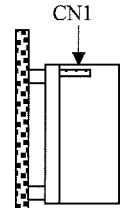
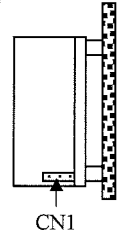
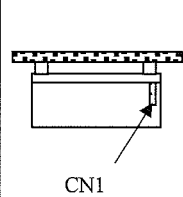
(1) 測定条件 Measuring Conditions

取付方法 Mounting Method (標準取付 : A) (Standard Mounting : A)	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E	Mounting F
入力電圧 V_{in} Input Voltage	100VAC					
出力電圧 V_o Output Voltage	5VDC					
出力電流 I_o Output Current	20A(100%)					

(2) 測定結果 Measuring Results

出力デレーティング Output Derating		ΔT Temperature Rise ($^{\circ}C$)					
		$I_o=100\%$					
		$T_a=50^{\circ}C$	$T_a=50^{\circ}C$	$T_a=50^{\circ}C$	$T_a=40^{\circ}C$	$T_a=50^{\circ}C$	$T_a=40^{\circ}C$
部品番号 Location No.	部品名 Part name	取付方向 Mounting A	取付方向 Mounting B	取付方向 Mounting C	取付方向 Mounting D	取付方向 Mounting E	取付方向 Mounting F
Q1	MOS FET	63	62	68	71	68	76
Q51	MOS FET	46	49	50	51	52	57
Q52	MOS FET	46	51	52	51	55	59
D1	BRIDGE DIODE	28	28	31	36	29	38
D101	BRIDGE DIODE	31	32	34	42	34	46
SR1	TRIAC	54	52	59	62	59	66
A101	CHIP IC	33	39	34	42	37	52
A102	CHIP IC	36	28	43	34	33	44
A201	CHIP IC	30	24	38	27	30	40
T1	TRANS	50	48	52	54	57	61
L1	BALUN	35	29	36	46	35	40
L51	CHOKE COIL	42	38	48	43	51	52
C6	E.CAP.	27	19	32	30	25	31
C7	E.CAP.	28	21	37	32	29	33
C8	E.CAP.	32	24	35	38	29	36
C9	E.CAP.	36	28	40	41	34	43
C10	E.CAP.	25	18	37	25	23	32
C51	E.CAP.	26	20	33	24	28	31
C52	E.CAP.	22	19	32	21	28	30
PC101	PHOTO COUPLER	43	40	44	49	42	54
PC103	PHOTO COUPLER	30	22	38	28	28	40

(1) 測定条件 Measuring Conditions

取付方法 Mounting Method (標準取付 : A) (Standard Mounting : A)	Mounting A	Mounting B	Mounting C	Mounting D	Mounting E	Mounting F
	     	CN1(INPUT)	FIN CN1	CN1 FIN	CN1	CN1
入力電圧 V_{in} Input Voltage	200VAC					
出力電圧 V_o Output Voltage	5VDC					
出力電流 I_o Output Current	20A(100%)					

(2) 測定結果 Measuring Results

出力デレーティング Output Derating		ΔT Temperature Rise ($^{\circ}C$)					
		$I_o=100\%$					
		$T_a=50^{\circ}C$	$T_a=50^{\circ}C$	$T_a=50^{\circ}C$	$T_a=40^{\circ}C$	$T_a=50^{\circ}C$	$T_a=40^{\circ}C$
部品番号 Location No.	部品名 Part name	取付方向 Mounting A	取付方向 Mounting B	取付方向 Mounting C	取付方向 Mounting D	取付方向 Mounting E	取付方向 Mounting F
Q1	MOS FET	53	53	58	61	55	65
Q51	MOS FET	42	49	50	49	51	57
Q52	MOS FET	43	51	52	51	54	59
D1	BRIDGE DIODE	30	33	34	37	33	40
D101	BRIDGE DIODE	28	30	31	36	31	41
SR1	TRIAC	37	37	43	46	40	50
A101	CHIP IC	26	32	28	35	30	43
A102	CHIP IC	29	25	40	33	30	41
A201	CHIP IC	24	23	38	27	31	40
T1	TRANS	44	45	50	49	51	57
L1	BALUN	26	21	31	34	25	31
L51	CHOKE COIL	36	37	48	42	51	52
C6	E.CAP.	20	16	27	25	20	26
C7	E.CAP.	21	18	33	30	25	28
C8	E.CAP.	24	20	29	31	23	31
C9	E.CAP.	27	23	33	33	27	36
C10	E.CAP.	21	17	33	24	21	29
C51	E.CAP.	22	20	33	24	27	31
C52	E.CAP.	18	19	31	21	28	29
PC101	PHOTO COUPLER	30	29	34	39	32	42
PC103	PHOTO COUPLER	23	21	36	26	27	38

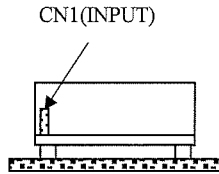
4. 電解コンデンサ推定寿命計算値 Electrolytic Capacitor Lifetime

MODEL : ZWS100B-5

空冷条件 : 自然空冷

Cooling condition : Convection cooling

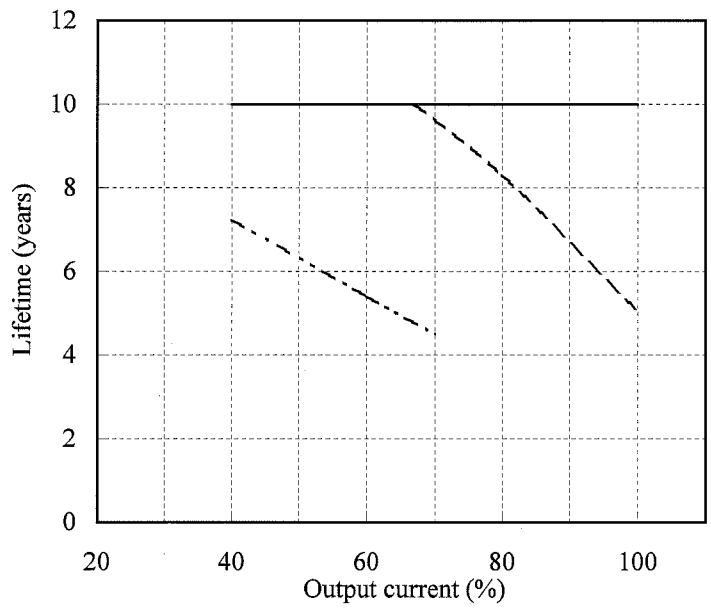
取付方向 A
Mounting A



Vin=100VAC

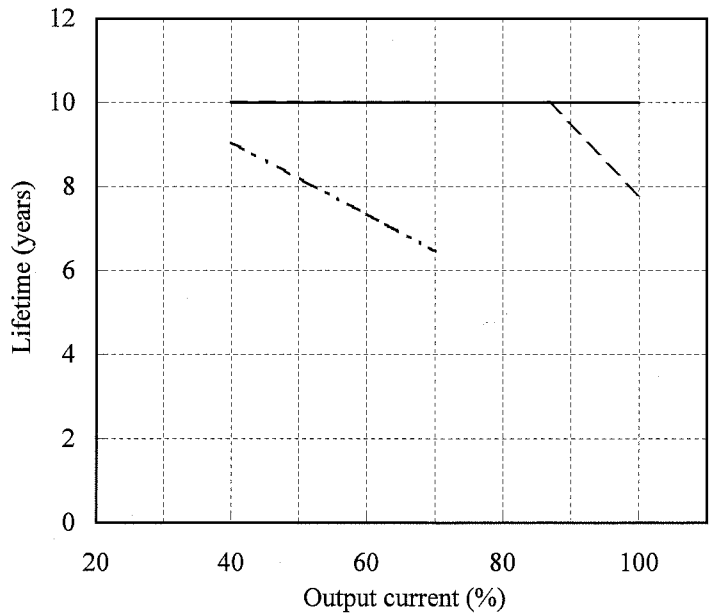
Load (%)	Lifetime (years)		
	Ta= 40°C	Ta= 50°C	Ta= 60°C
40	10.0	10.0	7.2
60	10.0	10.0	5.4
80	10.0	8.3	-
100	10.0	5.1	-

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

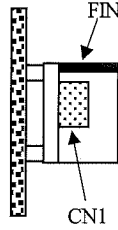


Vin=200VAC

Load (%)	Lifetime (years)		
	Ta= 40°C	Ta= 50°C	Ta= 60°C
40	10.0	10.0	9.0
60	10.0	10.0	7.3
80	10.0	10.0	-
100	10.0	7.8	-



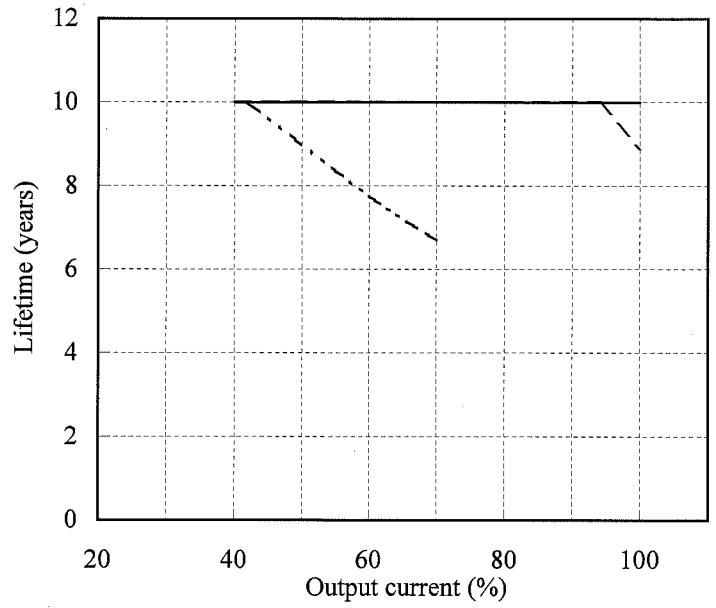
取付方向 B
Mounting B



Vin=100VAC

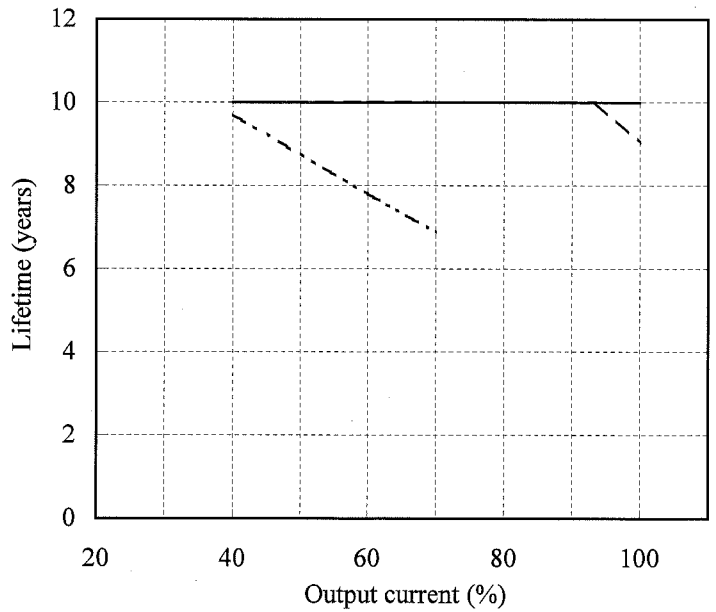
Load (%)	Lifetime (years)		
	Ta=40°C	Ta=50°C	Ta=60°C
40	10.0	10.0	10.0
60	10.0	10.0	7.7
80	10.0	10.0	-
100	10.0	8.9	-

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

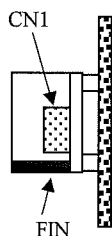


Vin=200VAC

Load (%)	Lifetime (years)		
	Ta=40°C	Ta=50°C	Ta=60°C
40	10.0	10.0	9.7
60	10.0	10.0	7.8
80	10.0	10.0	-
100	10.0	9.0	-



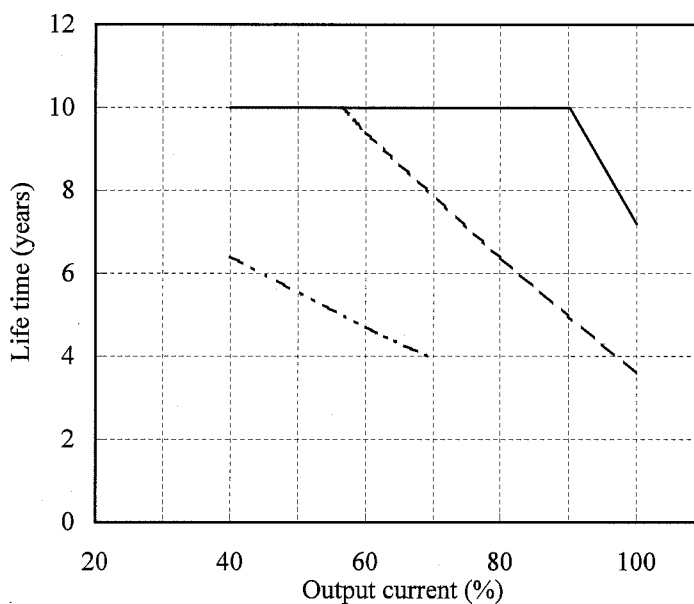
取付方向 C
Mounting C



Vin=100VAC

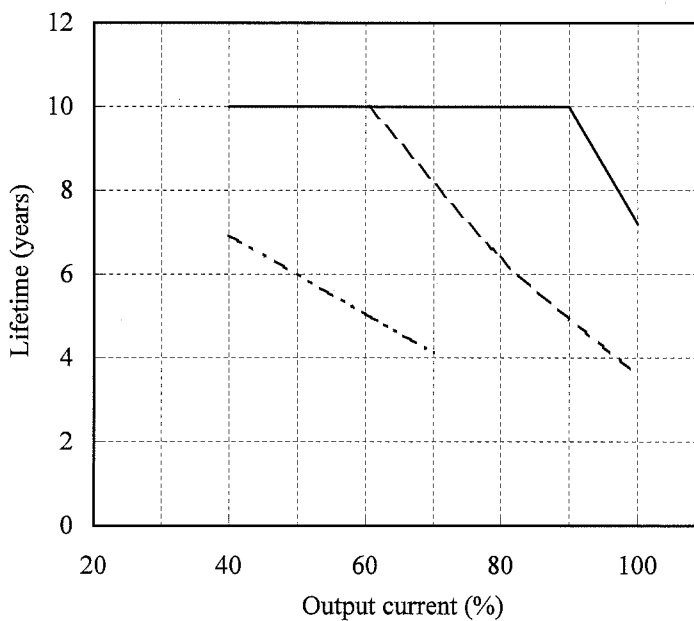
Load (%)	Lifetime (years)		
	Ta= 40°C	Ta= 50°C	Ta= 60°C
40	10.0	10.0	6.4
60	10.0	9.4	4.7
80	10.0	6.4	-
100	7.2	3.6	-

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

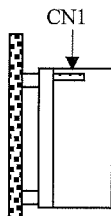


Vin=200VAC

Load (%)	Lifetime (years)		
	Ta= 40°C	Ta= 50°C	Ta= 60°C
40	10.0	10.0	6.9
60	10.0	10.0	5.1
80	10.0	6.4	-
100	7.2	3.6	-



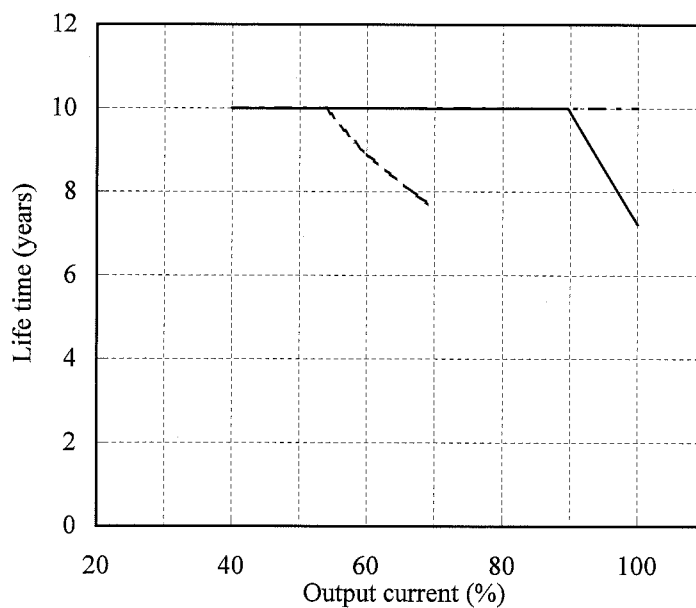
取付方向 D
Mounting D



Vin=100VAC

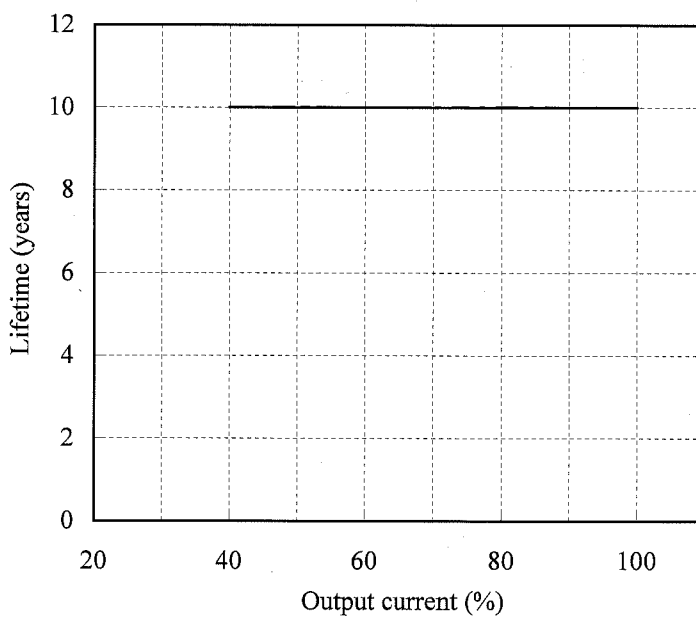
Load (%)	Lifetime (years)		
	Ta= 30°C	Ta= 40°C	Ta= 50°C
40	10.0	10.0	10.0
60	10.0	10.0	8.9
80	10.0	10.0	-
100	10.0	7.2	-

Conditions Ta 30°C : - · - · -
40°C : ———
50°C : - - - -

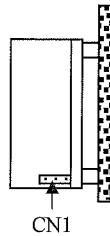


Vin=200VAC

Load (%)	Lifetime (years)		
	Ta= 30°C	Ta= 40°C	Ta= 50°C
40	10.0	10.0	10.0
60	10.0	10.0	10.0
80	10.0	10.0	-
100	10.0	10.0	-



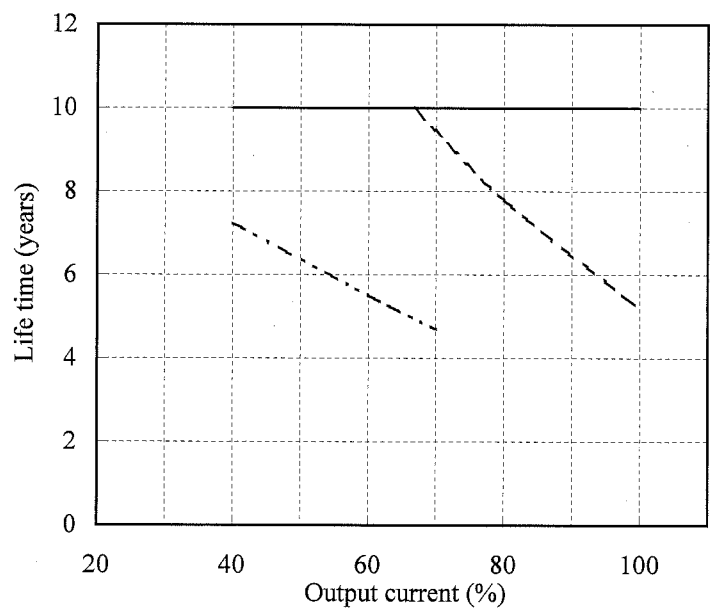
取付方向 E
Mounting E



Vin=100VAC

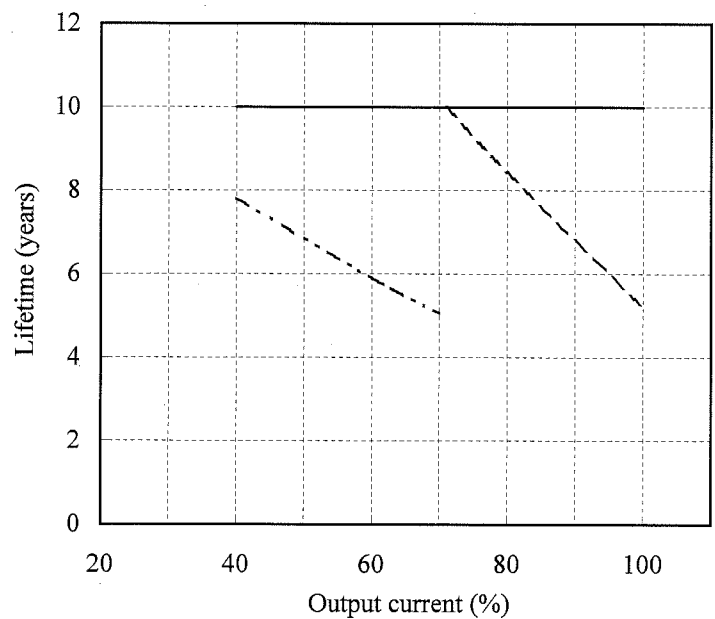
Load (%)	Lifetime (years)		
	Ta=40°C	Ta=50°C	Ta=60°C
40	10.0	10.0	7.2
60	10.0	10.0	5.5
80	10.0	7.8	-
100	10.0	5.2	-

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

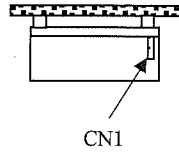


Vin=200VAC

Load (%)	Lifetime (years)		
	Ta=40°C	Ta=50°C	Ta=60°C
40	10.0	10.0	7.8
60	10.0	10.0	5.9
80	10.0	8.4	-
100	10.0	5.2	-



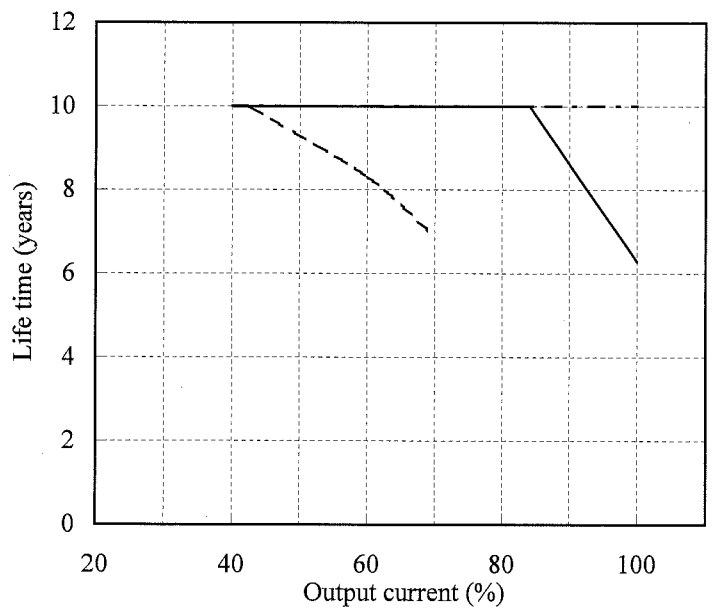
取付方向 F
Mounting F



Conditions Ta 30°C : - · - · -
40°C : ———
50°C : - - - -

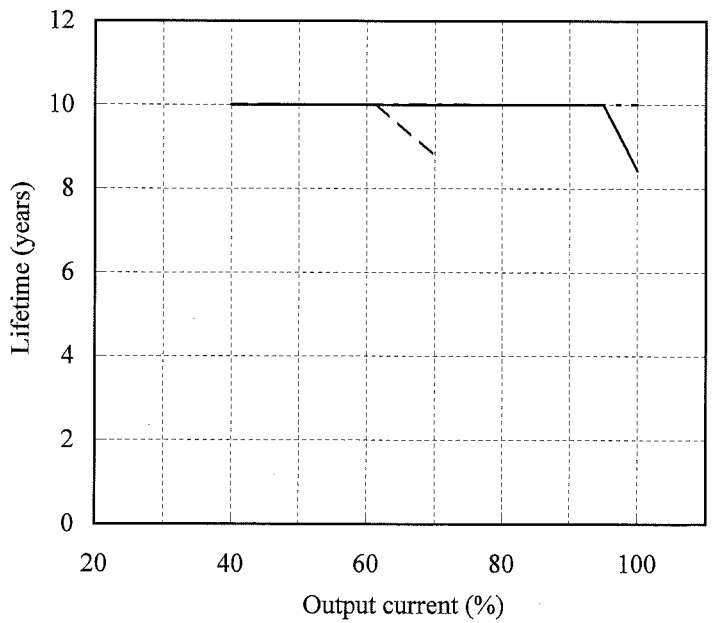
V_{in}=100VAC

Load (%)	Lifetime (years)		
	Ta=30°C	Ta=40°C	Ta=50°C
40	10.0	10.0	10.0
60	10.0	10.0	8.3
80	10.0	10.0	-
100	10.0	6.3	-



V_{in}=200VAC

Load (%)	Lifetime (years)		
	Ta=30°C	Ta=40°C	Ta=50°C
40	10.0	10.0	10.0
60	10.0	10.0	10.0
80	10.0	10.0	-
100	10.0	8.4	-



5. アブノーマル試験 Abnormal Test

MODEL :ZWS100B-5

(1) 試験条件 Test Conditions

Input : 230VAC Output : 5V, 20A Ta : 25°C

(2) 試験結果 Test Results

(Da : Damaged)

No.	Test position		Test mode		Test result											記事 Note	
	部品No. Location No.	試験端子 Test point	ショート Short	オープン Open	a	b	c	d	e	f	g	h	I	j	k		l
					発火 Fire	発煙 Smoke	破裂 Burst	異臭 Smell	赤熱 Red hot	破損 Damaged	ヒューズ断 Fuse blown	OVP	OCP	出力断 No output	変化なし No change		その他 Others
1	Q1	D-S	○											○			
2		D-G	○							○	○			○			Da : Q1
3		G-S	○											○			
4		D		○										○			
5		S		○										○			
6		G		○						○	○			○			Da : Q1
7	Q51	D-S	○										○	○			
8		D-G	○											○			
9		G-S	○													○	Input power increase
10		D		○										○			
11		S		○										○			
12		G		○												○	Input power increase
13	Q52	D-S	○											○			
14		D-G	○											○			
15		G-S	○													○	Input power increase
16		D		○										○			
17		S		○										○			
18		G		○												○	Input power increase
19	D1	AC-AC	○								○			○			
20		DC-DC	○								○			○			
21		AC-DC	○								○			○			
22		AC		○										○			
23		DC		○										○			
24		T1	5-6	○											○		
25	7-8		○											○			
26	10-11		○										○	○			
27	1			○										○			
28	5			○										○			
29	7			○												○	Input power increase
30		9		○											○		
31	SR1	T1-T2	○							○			○	○			Da:C6,C7,C8,C9
32		T1-G	○												○		
33		T2-G	○							○			○	○			Da:C6,C7,C8,C9
34		T1		○											○		
35		T2		○											○		
36		G		○											○		
37	C6	-	○											○			
38		-		○											○		

6. 振動試験 Vibration Test

MODEL : ZWS100B-5

(1) 振動試験種類 Vibration Test Class

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

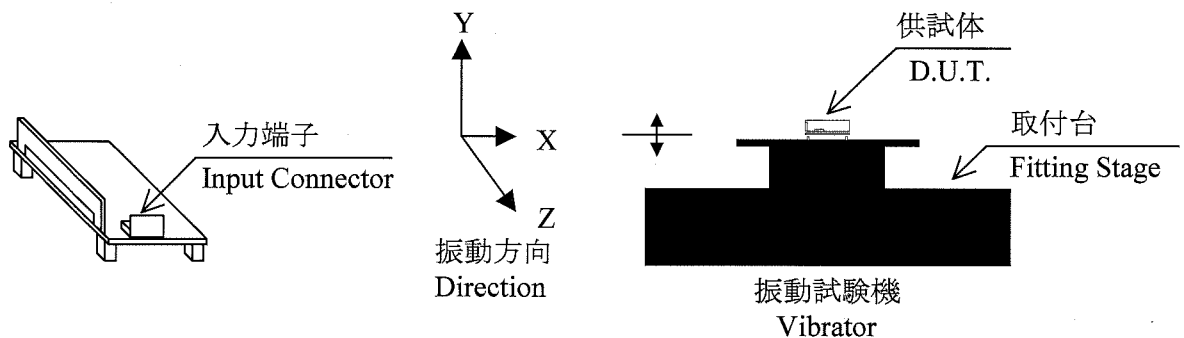
(2) 使用振動試験装置 Equipment Used

EMIC (株) 製
EMIC CORP・制御部 : F-400-BM-E47
Controller・加振部 : 905-FN
Vibrator

(3) 試験条件 Test Conditions

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

(4) 試験方法 Test Method



(5) 判定条件 Acceptable Conditions

1. 破壊しない事
Not to be broken
2. 試験後の特性は初期値から変動していない事
Characteristic to be within regulation specification after the test.

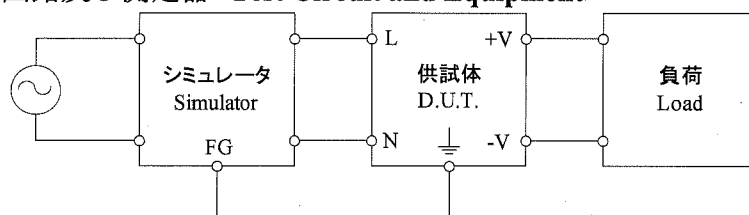
(6) 試験結果 Test Results

合格 OK

7. ノイズシミュレート試験 Noise Simulate Test

MODEL : ZWS100B-5

(1) 試験回路及び測定器 Test Circuit and Equipment



シミュレータ : INS-4320(A) (ノイズ研究所)
 Simulator : (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	: 0~2kV
・出力電圧 Output Voltage	: 定格 Rated	・位相 Phase	: 0~360 deg
・出力電流 Output current	: 0, 100%	・極性 Polarity	: +, -
・周囲温度 Ambient temperature	: 25°C	・印加モード Mode	: コモン、ノーマル Common, Normal
・パルス幅 Pulse width	: 50~1000ns	・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 Results

合格 OK

8. 熱衝撃試験 Thermal Shock Test

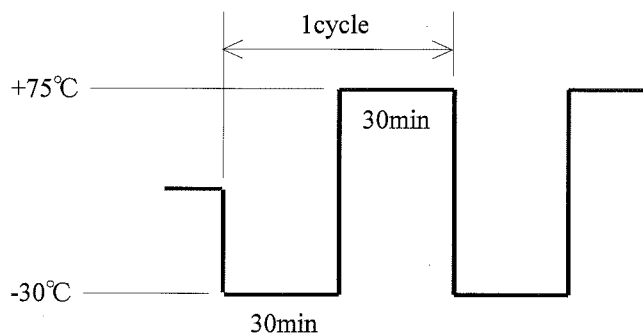
MODEL : ZWS100B-5

(1) 使用計測器 Equipment Used

TSA-70H-W : ESPEC

(2) 試験条件 Test Conditions

- ・電源周囲温度 : -30°C ⇔ 75°C +75°C
Ambient Temperature
- ・試験時間 : 図参照
Test Time Refer to Dwg.
- ・試験サイクル : 100 サイクル
Test Cycle 100 Cycles
- ・非動作
Not Operating



(3) 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.

(4) 判定条件 Acceptable Conditions

1. 破壊しない事
Not to be broken
2. 試験後の特性は初期値から変動していない事
Characteristic to be within regulation specification after the test.

(5) 試験結果 Test Results

合格 OK