ZWS150B

RELIABILITY DATA

信頼性データ

DWG No. A246-57-01		
APPD	CHK	DWG
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INDEX

PAGE

※ 試験結果は、代表データでありますが、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 : ZWS150B-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＞

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

λequip : 全機器故障率 (故障数／10^6時間)
Total Equipment Failure Rate (Failure／10^6Hours)

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 ith Generic Part (Failure／10^6Hours)

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 (π_Q=1)
Generic Quality Factor for The ith Generic Part (π_Q=1)

(2) MTBF値 MTBF Values

G_F : 地上固定 (Ground, Fixed)

RCR-9102B

MTBF ≒ 269,331 時間 (Hours)

2. 部品ディレーティング Components Derating

MODEL : ZWS150B-5

(1) 算出方法 Calculating Method

(a) 測定方法 Measuring method

・取付方法 :標準取付 : A Mounting method Standard mounting : A	・周囲温度 :50℃ Ambient temperature
・入力電圧 :100, 200VAC Input voltage	・出力電圧、電流 :5V, 30A(100%) Output voltage & current

(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

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

Tc :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

Ta :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

Tl :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

Pch(max) :最大チャネル損失
Maximum Channel Dissipation

Tj(max) :最大接合点(チャネル)温度
(Tch(max)) Maximum Junction (channel) Temperature

θj-c :接合点(チャネル)からケースまでの熱抵抗
(θch-c) Thermal Impedance between Junction (channel) and Case

θj-a :接合点から周囲までの熱抵抗
Thermal Impedance between Junction and air

θj-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

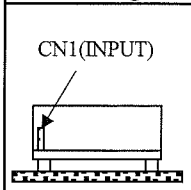
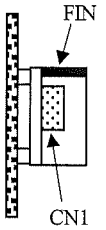
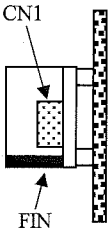
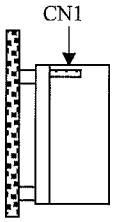
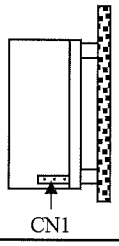
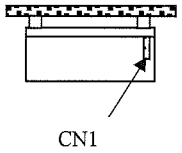
部品番号 Location No.	Vin = 100VAC	Load = 100%	Ta = 50℃
Q1 FMH09N90E FUJI ELECTRIC	Tch (max) = 150 ℃ Pch= 4.0 W Tch= Tc+ ((θch-c) × Pch)= 120.4 ℃ D.F. = 80.3 %	θch-c = 0.61 ℃/W ΔTc= 68.0 ℃	Pch (max) = 205 W Tc= 118.0 ℃
Q51 IPA057N08N3 G INFINEON	Tch (max) = 175 ℃ Pch = 4.0 W Tch = Tc + ((θch-c) × Pch) = 129.2 ℃ D.F. = 73.8 %	θch-c = 3.8 ℃/W ΔTc = 64.0 ℃	Pch (max) = 39 W Tc= 114.0 ℃
Q52 IPA057N08N3 G INFINEON	Tch (max) = 175 ℃ Pch = 1.3 W Tch = Tc + ((θch-c) × Pch) = 108.9℃ D.F. = 62.2 %	θch-c = 3.8 ℃/W ΔTc = 54.0 ℃	Pch (max) = 39 W Tc= 104.0 ℃
Q53 IPA057N08N3 G INFINEON	Tch (max) = 175 ℃ Pch = 1.3 W Tch = Tc + ((θch-c) × Pch) = 107.9℃ D.F. = 61.7 %	θch-c = 3.8 ℃/W ΔTc = 53.0 ℃	Pch (max) = 39 W Tc= 103.0 ℃
D1 D10XB60H SHINDENGEN	Tj (max) = 150 ℃ Pd = 5.6 W Tj = Tc + ((θj-c) × Pd) = 91.6 ℃ D.F. = 61.1%	θj-c = 1.9 ℃/W ΔTc = 31.0 ℃	Tc= 81.0 ℃
D101 S1NB60 SHINDENGEN	Tj (max) = 150 ℃ Pd = 11.6 mW Tj = Tl + ((θj-l) × Pd) = 83.2 ℃ D.F. = 55.5 %	θj-l = 15 ℃/W ΔTl = 33.0 ℃	Tl= 83.0 ℃
SR1 BCR8PM-16LG RENESAS	Tj (max) = 150 ℃ Pc = 2.8 W Tj = Tc + ((θj-c) × Pc) = 128.0 ℃ D.F. = 85.3 %	θj-c = 4.3 ℃/W ΔTc = 66.0 ℃	Tc= 116.0 ℃
PC101 TLP161G (LED) TOSHIBA	Tj (max) = 125 ℃ Pd = 7.1 mW Tj = Ta + ((θj-a) × Pd) = 96.6 ℃ D.F. = 77.3 %	θj-a = 500℃/W ΔTa = 43.0 ℃	Ta= 93.0 ℃
PC103 PS2861B (LED) NEC	Tj (max) = 125 ℃ Pd = 1.0 mW Tj = Tc + ((θj-c) × Pd) = 79.3 ℃ D.F. = 63.4 %	θj-c = 330℃/W ΔTc = 29.0 ℃	Tc= 79.0 ℃

部品番号 Location No.	Vin = 200VAC	Load = 100%	Ta = 50℃
Q1 FMH09N90E FUJI ELECTRIC	Tch (max) = 150 ℃ Pch= 4.0 W Tch= Tc+ ((θch-c) × Pch)= 108.4 ℃ D.F. = 72.3 %	θch-c = 0.61 ℃/W ΔTc= 56.0 ℃	Pch (max) = 205 W Tc= 106.0 ℃
Q51 IPA057N08N3 G INFINEON	Tch (max) = 175 ℃ Pch = 4.0 W Tch = Tc + ((θch-c) × Pch) = 129.2 ℃ D.F. = 73.8 %	θch-c = 3.8 ℃/W ΔTc = 64.0 ℃	Pch (max) = 39 W Tc= 114.0 ℃
Q52 IPA057N08N3 G INFINEON	Tch (max) = 175 ℃ Pch = 1.3 W Tch = Tc + ((θch-c) × Pch) = 107.9℃ D.F. = 61.7 %	θch-c = 3.8 ℃/W ΔTc = 53.0 ℃	Pch (max) = 39 W Tc= 103.0 ℃
Q53 IPA057N08N3 G INFINEON	Tch (max) = 175 ℃ Pch = 1.3 W Tch = Tc + ((θch-c) × Pch) = 107.9℃ D.F. = 61.7 %	θch-c = 3.8 ℃/W ΔTc = 53.0 ℃	Pch (max) = 39 W Tc= 103.0 ℃
D1 D10XB60H SHINDENGEN	Tj (max) = 150 ℃ Pd = 3.2 W Tj = Tc + ((θj-c) × Pd) = 92.1 ℃ D.F. = 61.4%	θj-c = 1.9 ℃/W ΔTc = 36.0 ℃	Tc= 86.0 ℃
D101 S1NB60 SHINDENGEN	Tj (max) = 150 ℃ Pd = 2.2 mW Tj = Tl + ((θj-l) × Pd) = 81.1 ℃ D.F. = 54.1 %	θj-l = 15 ℃/W ΔTl = 31.0 ℃	Tl= 81.0 ℃
SR1 BCR8PM-16LG RENESAS	Tj (max) = 150 ℃ Pc = 0.0 W Tj = Tc + ((θj-c) × Pc) = 100.0 ℃ D.F. = 66.7 %	θj-c = 4.3 ℃/W ΔTc = 50.0 ℃	Tc= 100.0 ℃
PC101 TLP161G (LED) TOSHIBA	Tj (max) = 125 ℃ Pd = 0.0 mW Tj = Ta + ((θj-a) × Pd) = 85.0 ℃ D.F. = 68.0 %	θj-a = 500℃/W ΔTa = 35.0 ℃	Ta= 85.0 ℃
PC103 PS2861B (LED) NEC	Tj (max) = 125 ℃ Pd = 1.0 mW Tj = Tc + ((θj-c) × Pd) = 77.3 ℃ D.F. = 61.8 %	θj-c = 330℃/W ΔTc = 27.0 ℃	Tc= 77.0 ℃

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

MODEL : ZWS150B-5

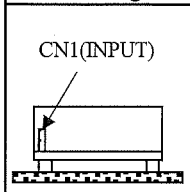
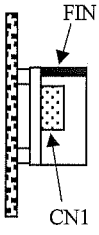
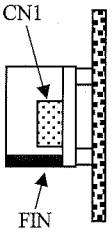
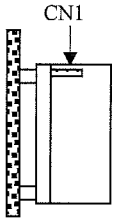
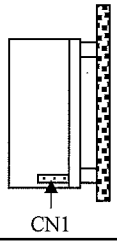
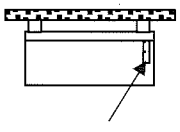
(1) 測定条件 Measuring Conditions

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 Vin Input Voltage	100VAC					
出力電圧 Vo Output Voltage	5VDC					
出力電流 Io Output Current	30A(100%)					

(2) 測定結果 Measuring Results

出力ディレーティング Output Derating		ΔT Temperature Rise (℃) Io=100 %					
		Ta=50℃	Ta=40℃	Ta=40℃	Ta=30℃	Ta=50℃	Ta=30℃
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	68	63	79	81	72	90
Q51	MOS FET	64	73	73	75	73	89
Q52	MOS FET	54	57	61	60	62	72
Q53	MOS FET	53	58	60	61	63	75
D1	BRIDGE DIODE	31	37	40	48	37	55
D101	BRIDGE DIODE	33	41	41	51	38	62
SR1	TRIAC	66	62	75	79	69	87
A101	CHIP IC	34	48	42	55	43	66
A102	CHIP IC	38	28	50	34	37	55
A201	CHIP IC	30	19	34	23	35	43
T1	TRANS	60	64	69	72	76	86
L1	BALUN	46	40	51	66	45	66
L51	CHOKE COIL	50	46	53	50	64	68
C6	E.CAP.	29	23	38	34	30	41
C7	E.CAP.	30	23	42	32	31	42
C8	E.CAP.	35	26	43	42	32	49
C9	E.CAP.	40	32	48	45	39	53
C10	E.CAP.	30	18	41	24	27	42
C51	E.CAP.	27	23	32	28	37	41
C52	E.CAP.	29	22	30	25	38	39
PC101	PHOTO COUPLER	43	48	49	58	47	65
PC103	PHOTO COUPLER	29	16	38	21	30	45

(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 Vin Input Voltage	200VAC					
出力電圧 Vo Output Voltage	5VDC					
出力電流 Io Output Current	30A(100%)					

(2) 測定結果 Measuring Results

出力ディレーティング Output Derating		ΔT Temperature Rise (℃) Io=100 %					
		Ta=50℃	Ta=40℃	Ta=40℃	Ta=30℃	Ta=50℃	Ta=30℃
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	56	51	65	67	59	75
Q51	MOS FET	64	71	71	73	72	87
Q52	MOS FET	53	57	60	59	62	72
Q53	MOS FET	53	58	60	60	63	74
D1	BRIDGE DIODE	36	42	46	51	43	58
D101	BRIDGE DIODE	31	38	40	48	38	57
SR1	TRIAC	50	44	57	60	51	68
A101	CHIP IC	30	41	39	50	41	59
A102	CHIP IC	35	26	47	30	33	52
A201	CHIP IC	29	19	34	22	33	42
T1	TRANS	58	61	66	68	71	82
L1	BALUN	30	24	38	45	29	47
L51	CHOKE COIL	49	45	53	49	62	67
C6	E.CAP.	25	19	32	27	25	35
C7	E.CAP.	25	19	35	25	26	36
C8	E.CAP.	29	21	36	34	26	41
C9	E.CAP.	33	26	40	36	32	45
C10	E.CAP.	27	16	38	21	24	39
C51	E.CAP.	27	22	32	26	37	41
C52	E.CAP.	29	21	30	24	39	37
PC101	PHOTO COUPLER	35	35	43	50	42	57
PC103	PHOTO COUPLER	27	15	37	19	28	44

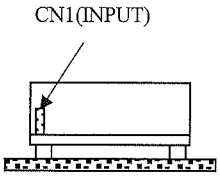
4. 電解コンデンサ推定寿命計算値　Electrolytic Capacitor Lifetime

MODEL : ZWS150B-5

空冷条件：自然空冷

Cooling condition : Convection cooling

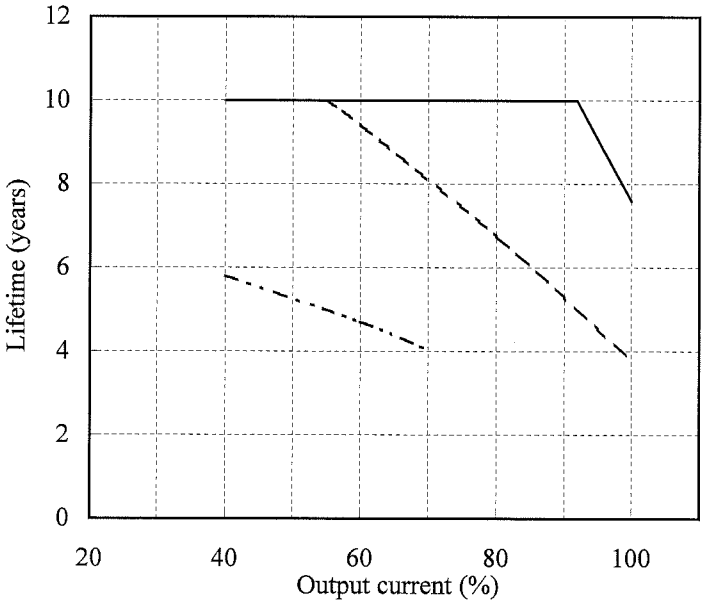
取付方向 A
Mounting A



Conditions　Ta　40℃ : ——
50℃ : – – –
60℃ : —··—

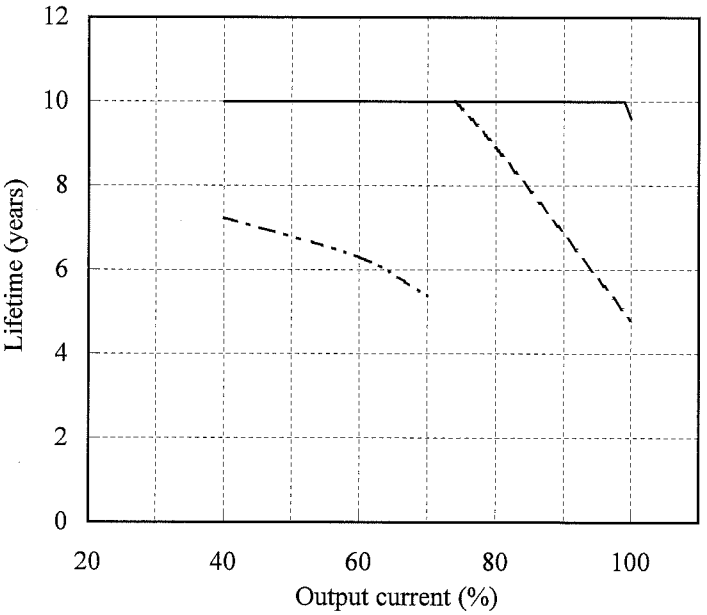
Vin=100VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
40	10.0	10.0	5.8
60	10.0	9.4	4.7
80	10.0	6.7	-
100	7.6	3.8	-

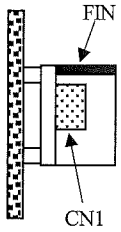


Vin=200VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
40	10.0	10.0	7.2
60	10.0	10.0	6.3
80	10.0	8.9	-
100	9.6	4.8	-



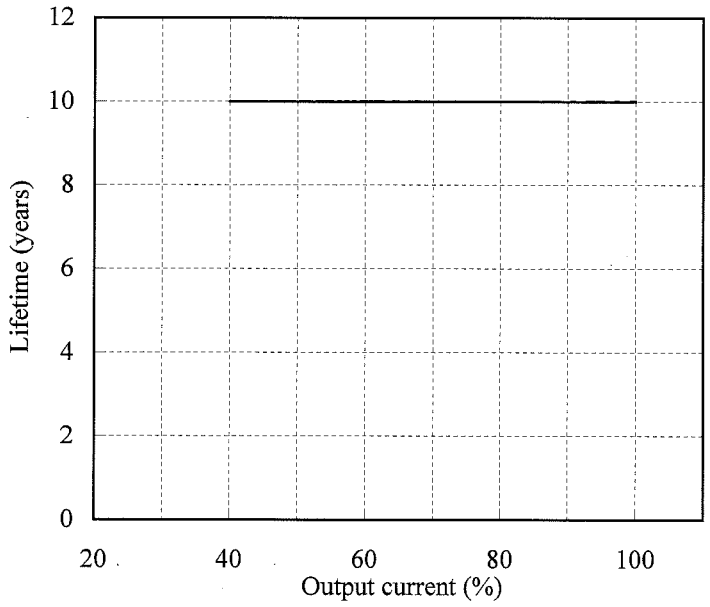
取付方向 B
Mounting B



Conditions Ta 30℃ : —·—·
40℃ : ——
50℃ : — — —

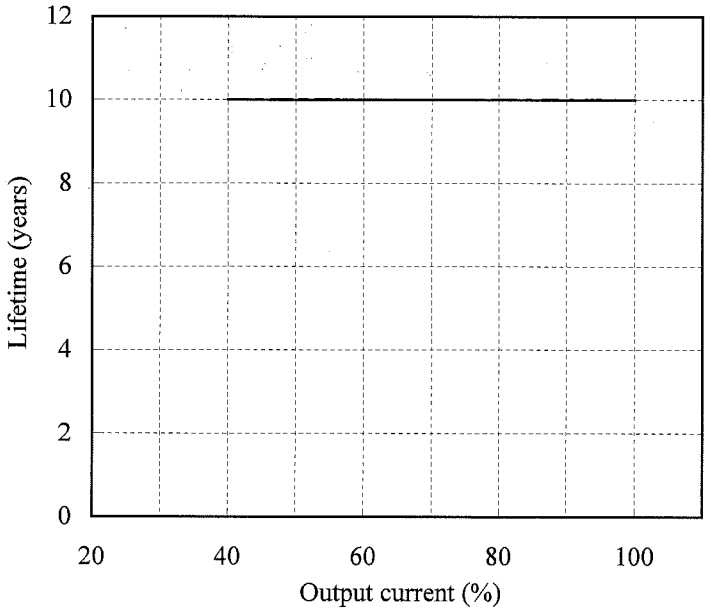
Vin=100VAC

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

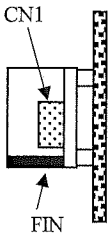


Vin=200VAC

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



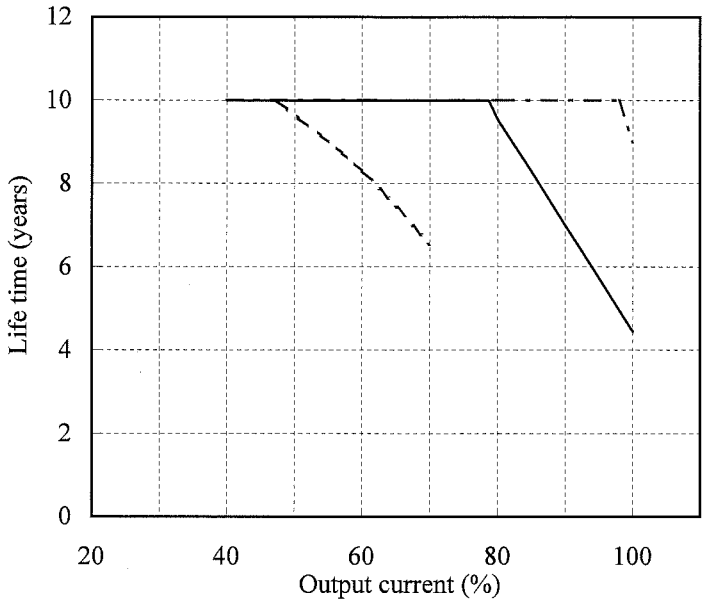
取付方向 C
Mounting C



Vin=100VAC

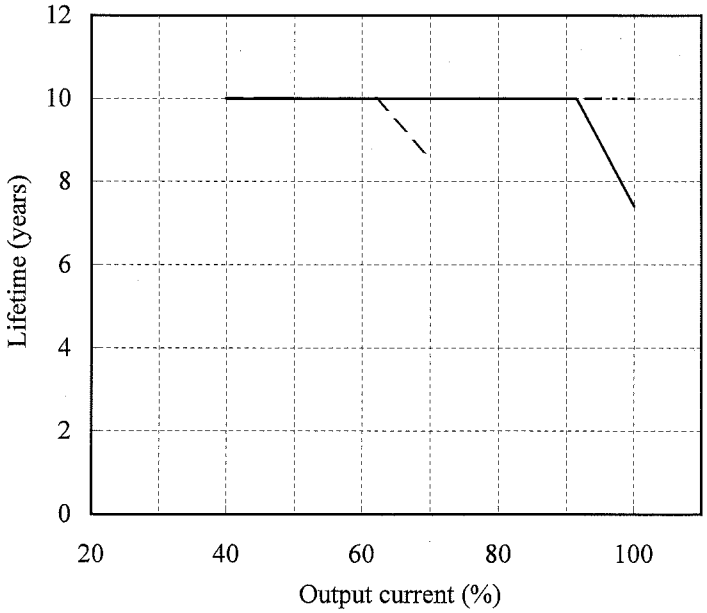
Load (%)	Lifetime (years)		
	Ta= 30℃	Ta= 40℃	Ta= 50℃
40	10.0	10.0	10.0
60	10.0	10.0	8.3
80	10.0	9.5	-
100	9.0	4.5	-

Conditions Ta 30℃ : —·—·
40℃ : ——
50℃ : — — —

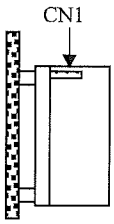


Vin=200VAC

Load (%)	Lifetime (years)		
	Ta= 30℃	Ta= 40℃	Ta= 50℃
40	10.0	10.0	10.0
60	10.0	10.0	10.0
80	10.0	10.0	-
100	10.0	7.4	-



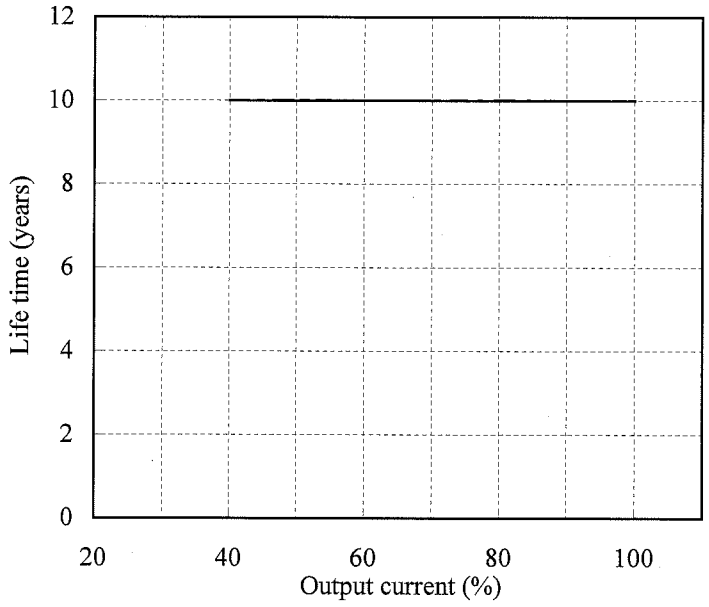
取付方向 D
Mounting D



Vin=100VAC

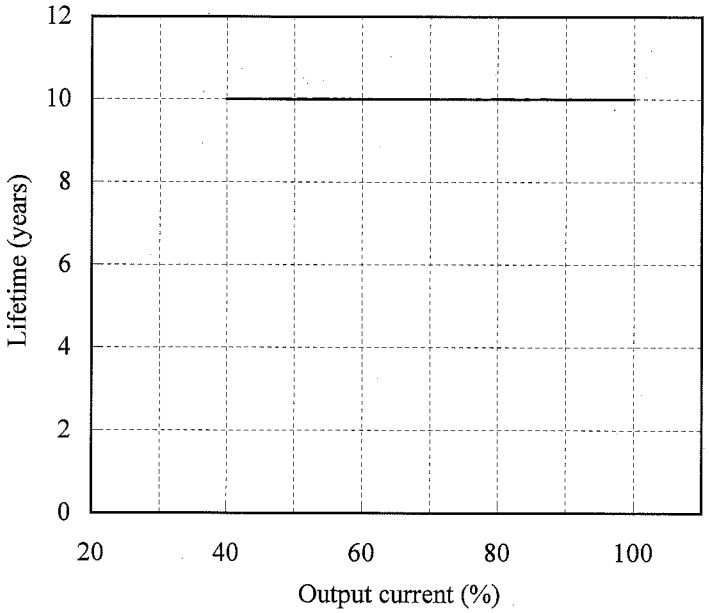
Load (%)	Lifetime (years)		
	Ta= 20℃	Ta= 30℃	Ta= 40℃
40	10.0	10.0	10.0
60	10.0	10.0	10.0
80	10.0	10.0	-
100	10.0	10.0	-

Conditions Ta 20℃ : - - - - -
30℃ : — · — ·
40℃ : ——

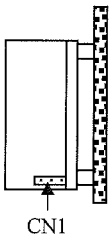


Vin=200VAC

Load (%)	Lifetime (years)		
	Ta= 20℃	Ta= 30℃	Ta= 40℃
40	10.0	10.0	10.0
60	10.0	10.0	10.0
80	10.0	10.0	-
100	10.0	10.0	-



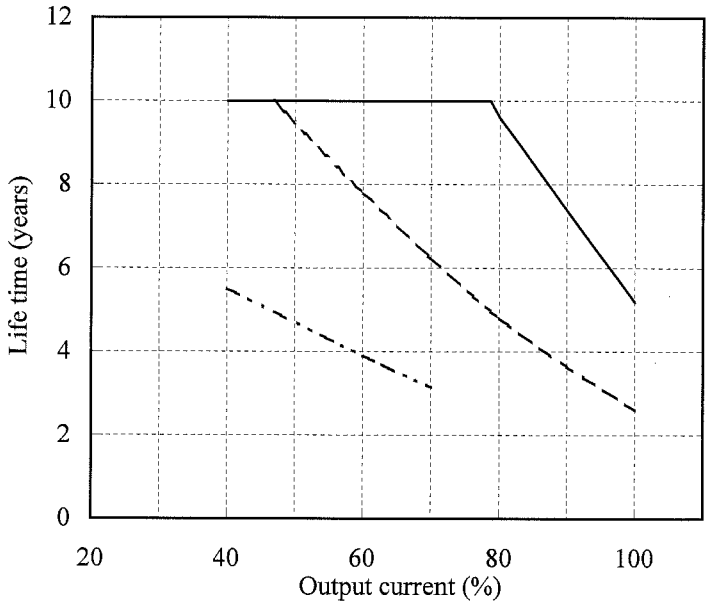
取付方向 E
Mounting E



Vin=100VAC

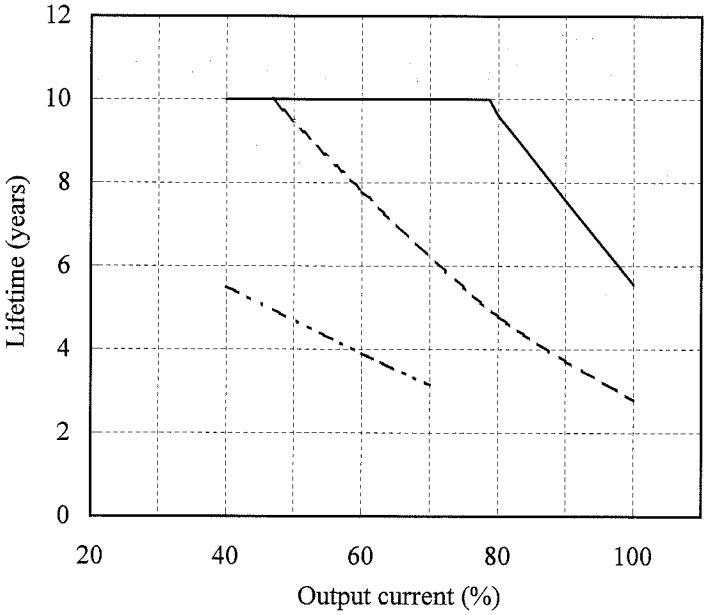
Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
40	10.0	10.0	5.5
60	10.0	7.8	3.9
80	9.6	4.8	-
100	5.2	2.6	-

Conditions Ta 40℃ : ——
50℃ : – – –
60℃ : —··—

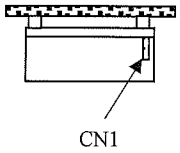


Vin=200VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
40	10.0	10.0	5.5
60	10.0	7.8	3.9
80	9.6	4.8	-
100	5.6	2.8	-



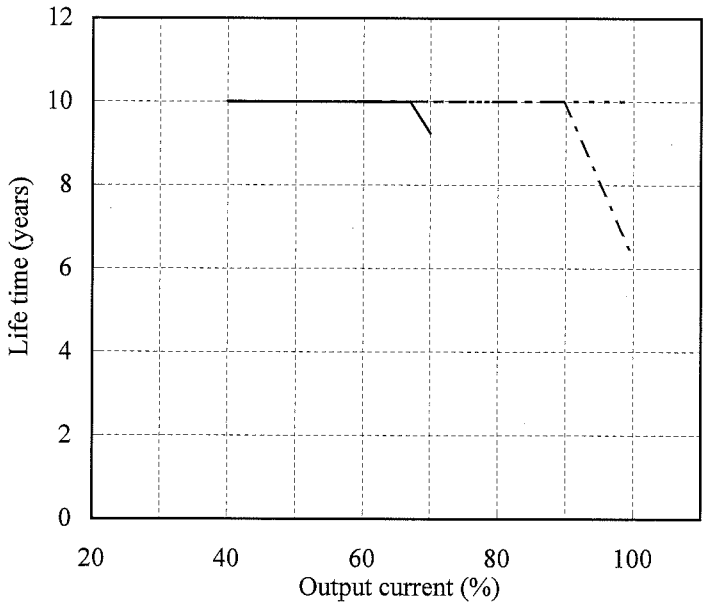
取付方向 F
Mounting F



Conditions Ta 20℃ : - - - - -
30℃ : — · — ·
40℃ : ——

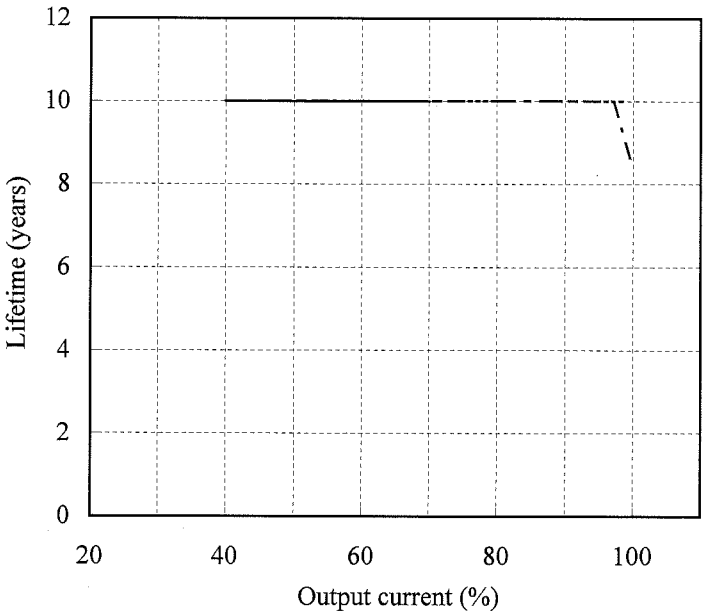
Vin=100VAC

Load (%)	Lifetime (years)		
	Ta= 20℃	Ta= 30℃	Ta= 40℃
40	10.0	10.0	10.0
60	10.0	10.0	10.0
80	10.0	10.0	-
100	10.0	6.3	-



Vin=200VAC

Load (%)	Lifetime (years)		
	Ta= 20℃	Ta= 30℃	Ta= 40℃
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 :ZWS150B-5

(1) 試験条件 Test Conditions

Input : 230VAC Output : 5V, 30A Ta : 25℃

(2) 試験結果 Test Results

(Da : Damaged)

No.	Test position		Test mode		Test result												
					a	b	c	d	e	f	g	h	I	j	k	l	
	部品No. Location No.	試験端子 Test point	ショート Short	オープン Open	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	記事 Note
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		○												○	Input power increase
17		S		○												○	Input power increase
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 : ZWS150B-5

(1) 振動試験種類 Vibration Test Class

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

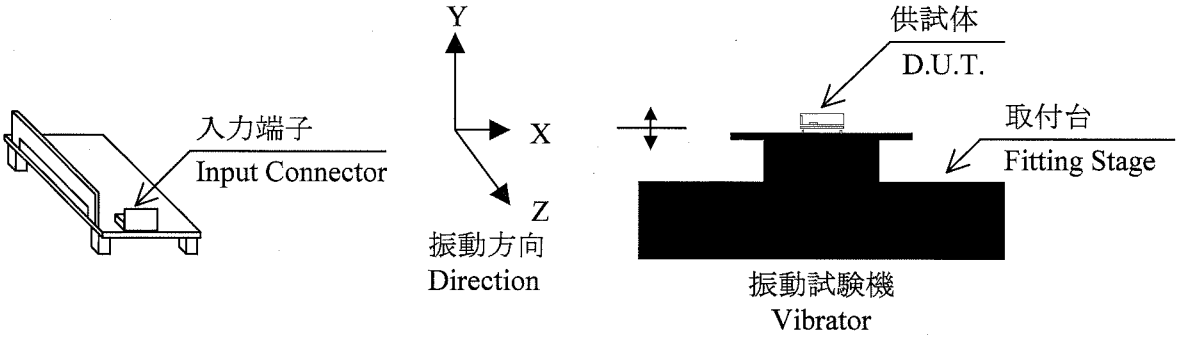
(2) 使用振動試験装置 Equipment Used

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

(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.

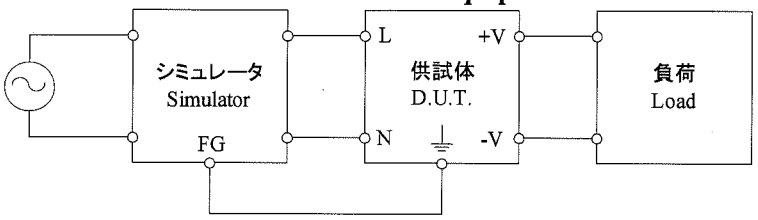
(6) 試験結果 Test Results

合格 **OK**

7. ノイズシミュレート試験 Noise Simulate Test

MODEL : ZWS150B-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℃	・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

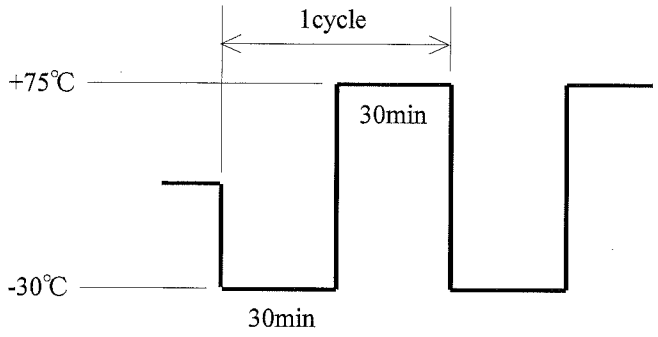
MODEL : ZWS150B-5

(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℃ ⇔ 75℃
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**