

VS75E

RELIABILITY DATA

信頼性データ

| DWG No. A240-57-01A | | |
|---------------------|---------------------|---------------------|
| APPD | CHK | DWG |
| <i>Fukuda</i> | <i>U. Kondo</i> | <i>M. Hada</i> |
| <i>17. Feb. '10</i> | <i>17. Feb. '10</i> | <i>17. Feb. '10</i> |

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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 : VS75E-24

(1) 算出方法 Calculating Method

JEITA (RCR-9102, 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-9102, 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>

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

 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-9102

MTBF ≒ 558,160 時間 (Hours)

RCR-9102B

MTBF ≒ 372,725 時間 (Hours)

2. 部品ディレーティング Components Derating

MODEL : VS75E-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 | : 100VAC | ・出力電圧、電流 Output voltage & current | : 5V, 15A |

(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

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

| | |
|-------------------------|---|
| T _c | : ディレーティングの始まるケース温度 一般に25°C Case Temperature at Start Point of Derating; 25°C 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°C Lead Temperature at Start Point of Derating; 25°C in General |
| T _a ' | : ディレーティ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 |
| P _c (max) | : 最大コレクタ(チャンネル)損失 |
| (P _{ch} (max)) | Maximum Collector (channel) Dissipation |
| T _j (max) | : 最大接合点(チャンネル)温度 |
| (T _{ch} (max)) | Maximum Junction (channel) Temperature |
| θ _{j-c} | : 接合点(チャンネル)からケースまでの熱抵抗 |
| (θ _{ch-c}) | Thermal Impedance between Junction (channel) and Case |
| θ _{j-l} | : 接合点(チャンネル)からリードまでの熱抵抗 |
| (θ _{ch-l}) | Thermal Impedance between Junction (channel) and Lead |
| θ _{j-a} | : 接合点(チャンネル)から周囲までの熱抵抗 |
| (θ _{ch-a}) | Thermal Impedance between Junction (channel) and Ambient |

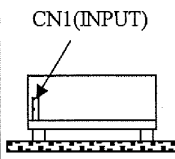
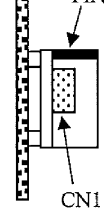
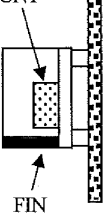
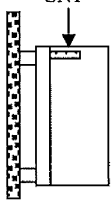
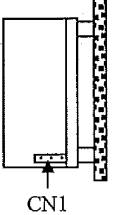
(2) 部品ディレーティング表 Component Derating List

| 部品番号 Location No. | Vin = 100VAC Load = 100% Ta = 50°C | | |
|----------------------------------|--|-------------------------------------|------------------------------------|
| Q1 2SK3561 TOSHIBA | Tch (max) = 150 °C Pch = 2.5 W Tch = Tc + ((θch-c) × Pch) = 97.8 °C D.F. = 65.2 % | θch-c = 3.125 °C/W ΔTc = 40.1 °C | Pch (max) = 40 W Tc = 90.1 °C |
| Q51 H7N0308CF RENESAS | Tch (max) = 150 °C Pch = 1.3 W Tch = Tc + ((θch-c) × Pch) = 94.1 °C D.F. = 62.7 % | θch-c = 4.17 °C/W ΔTc = 38.7 °C | Pch(max) = 30 W Tc = 88.7 °C |
| Q52 H7N0308CF RENESAS | Tch (max) = 150 °C Pch = 1.8 W Tch = Tc + ((θch-c) × Pch) = 99.1 °C D.F. = 66.0 % | θch-c = 4.17 °C/W ΔTc = 41.6 °C | Pch(max) = 30 W Tc = 91.6 °C |
| D1 D3SB60 SHINDENGEN | Tj (max) = 150 °C Pd = 3.3 W Tj = Tl + ((θj-l) × Pd) = 118.9 °C D.F. = 79.3 % | θj-l = 6.0 °C/W ΔTl = 49.1 °C | Tl = 99.1 °C |
| A101 FA3647N FUJI ELECTRIC | Tj (max) = 125 °C Pd = 86.0 mW Tj = Tc + ((θj-c) × Pd) = 92.2 °C D.F. = 73.8 % | θj-c = 72 °C/W ΔTc = 36.0 °C | Pd(max) = 300 mW Tc = 86.0 °C |
| A102 BA2903F ROHM | Tj (max) = 125 °C Pd = 4.0 mW Tj = Ta + ((θj-a) × Pd) = 83.0 °C D.F. = 66.4 % | θj-a = 160 °C/W ΔTa = 32.4 °C | Pd(max) = 622.5 mW Ta = 82.4 °C |
| PC2 PS2581L1 NEC | Tj (max) = 125 °C Pc = 2.0 mW Tj = Tc + ((θj-c) × Pc) = 87.4 °C D.F. = 69.9 % | θj-c = 150 °C/W ΔTc = 37.1 °C | Pc(max) = 150 mW Tc = 87.1 °C |

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

MODEL : VS75E-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 |
|--|---|---|---|---|---|
| |  |  |  |  |  |
| 入力電圧 Input Voltage (VAC) | 100 | | | | |
| 出力電圧 Output Voltage (VDC) | 5 | | | | |
| 出力電流 Output Current (A) | 15 | | | | |

(2) 測定結果 Measuring Results

| 出力デレーティング Output Derating (%) | | ΔT Temperature Rise ($^{\circ}\text{C}$) | | | | |
|----------------------------------|------------------|--|--------------------------|--------------------------|--------------------------|--------------------------|
| | | 100 | | | | |
| | | Ta=50 $^{\circ}\text{C}$ | Ta=50 $^{\circ}\text{C}$ | Ta=40 $^{\circ}\text{C}$ | Ta=40 $^{\circ}\text{C}$ | Ta=40 $^{\circ}\text{C}$ |
| 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 |
| Q1 | MOS FET | 40.1 | 50.4 | 47.1 | 55.0 | 52.9 |
| Q51 | MOS FET | 38.7 | 51.0 | 46.9 | 53.0 | 53.7 |
| Q52 | MOS FET | 41.6 | 52.5 | 47.9 | 52.7 | 55.5 |
| D1 | BRIDGE DIODE | 49.1 | 47.2 | 52.2 | 58.2 | 55.1 |
| A101 | CHIP SBD | 36.0 | 32.1 | 34.5 | 41.4 | 40.5 |
| A102 | CHIP IC | 32.4 | 26.2 | 33.8 | 36.8 | 36.3 |
| A201 | CHIP IC | 35.0 | 29.0 | 36.4 | 32.2 | 40.7 |
| T1 | TRANS | 43.7 | 38.2 | 45.2 | 43.9 | 47.6 |
| L1 | BALUN | 42.8 | 40.3 | 41.7 | 52.5 | 41.1 |
| L51 | CHOKE COIL | 47.3 | 44.5 | 48.4 | 46.1 | 53.9 |
| C5 | E.CAP. | 28.9 | 26.9 | 30.6 | 36.8 | 34.7 |
| C6 | E.CAP. | 25.0 | 20.3 | 28.3 | 31.1 | 31.2 |
| C7 | E.CAP. | 27.1 | 24.4 | 30.7 | 35.6 | 35.5 |
| C51 | E.CAP. | 24.8 | 20.9 | 29.5 | 22.8 | 32.6 |
| C52 | E.CAP. | 23.5 | 20.6 | 24.9 | 20.0 | 32.0 |
| PC2 | PHOTO COUPLER | 37.1 | 36.1 | 39.5 | 43.0 | 43.3 |

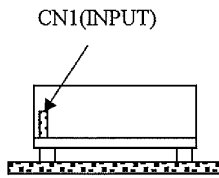
4. 電解コンデンサ推定寿命計算値 Electrolytic Capacitor Lifetime

MODEL : VS75E-5

空冷条件 : 自然空冷

Cooling Condition : Convection Cooling

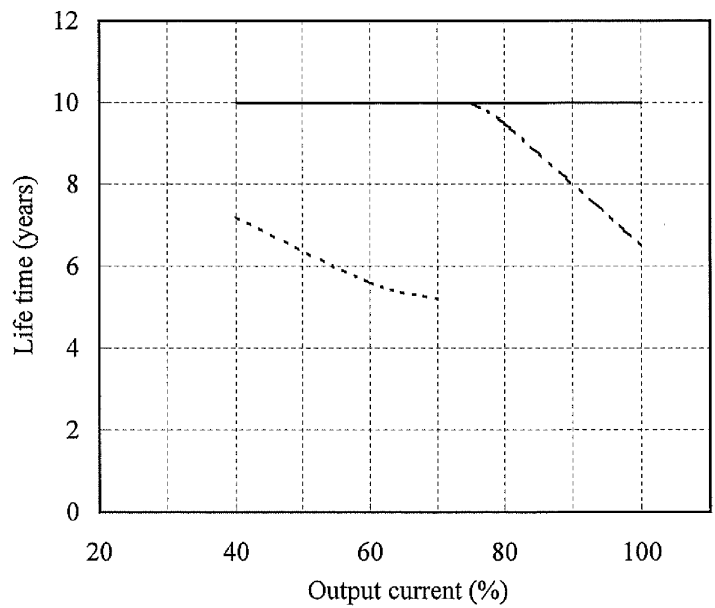
取付方向 A
Mounting A



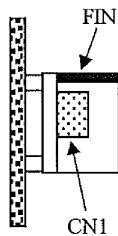
Vin=100VAC

| Load (%) | Lifetime (years) | | |
|----------|------------------|----------|----------|
| | Ta= 40°C | Ta= 50°C | Ta= 60°C |
| 40 | 10.0 | 10.0 | 7.2 |
| 60 | 10.0 | 10.0 | 5.6 |
| 80 | 10.0 | 9.5 | - |
| 100 | 10.0 | 6.5 | - |

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



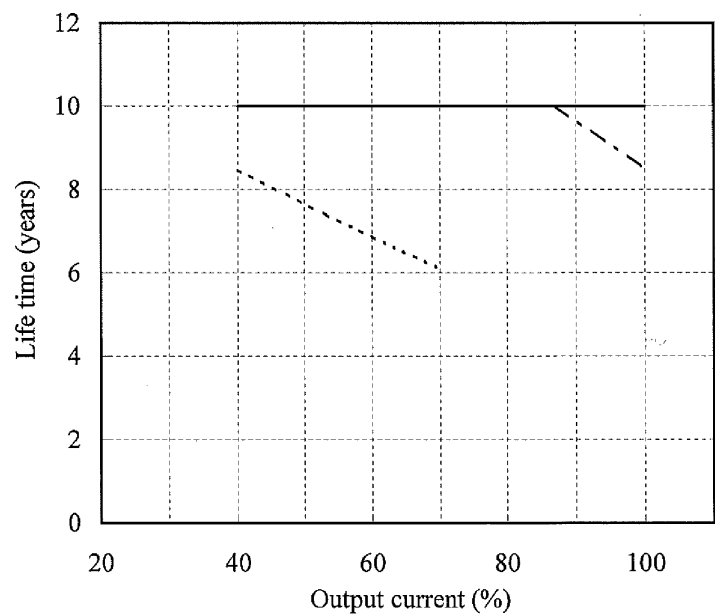
取付方向 B
Mounting B



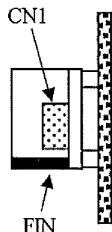
Vin=100VAC

| Load (%) | Lifetime (years) | | |
|----------|------------------|----------|----------|
| | Ta= 40°C | Ta= 50°C | Ta= 60°C |
| 40 | 10.0 | 10.0 | 8.5 |
| 60 | 10.0 | 10.0 | 6.9 |
| 80 | 10.0 | 10.0 | - |
| 100 | 10.0 | 8.5 | - |

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



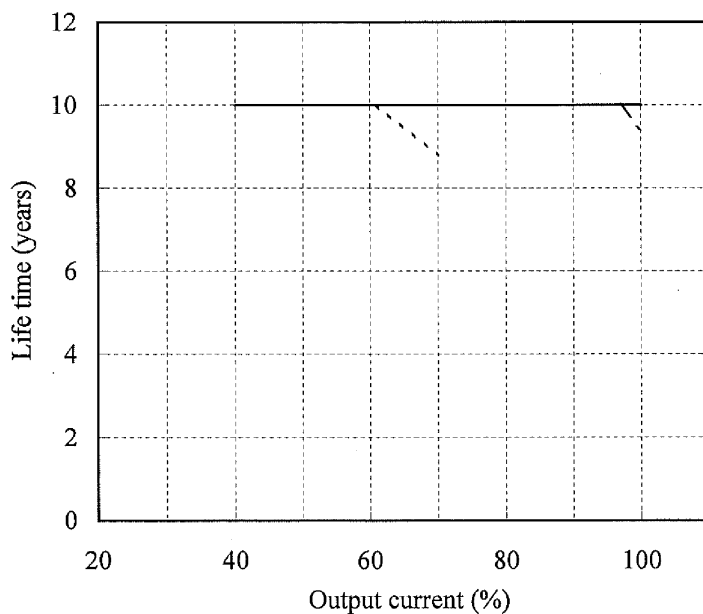
取付方向 C
Mounting C



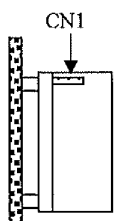
Vin=100VAC

| Load (%) | Lifetime (years) | | |
|----------|------------------|----------|----------|
| | Ta= 30°C | Ta= 40°C | Ta= 50°C |
| 40 | 10.0 | 10.0 | 10.0 |
| 60 | 10.0 | 10.0 | 10.0 |
| 80 | 10.0 | 10.0 | - |
| 100 | 10.0 | 9.4 | - |

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



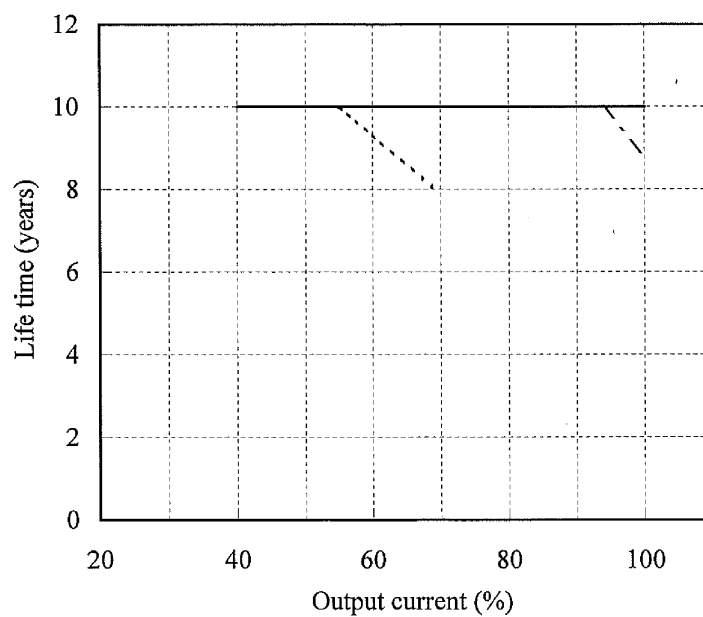
取付方向 D
Mounting D



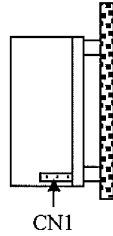
Vin=100VAC

| Load (%) | Lifetime (years) | | |
|----------|------------------|----------|----------|
| | Ta= 30°C | Ta= 40°C | Ta= 50°C |
| 40 | 10.0 | 10.0 | 10.0 |
| 60 | 10.0 | 10.0 | 9.3 |
| 80 | 10.0 | 10.0 | - |
| 100 | 10.0 | 8.8 | - |

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



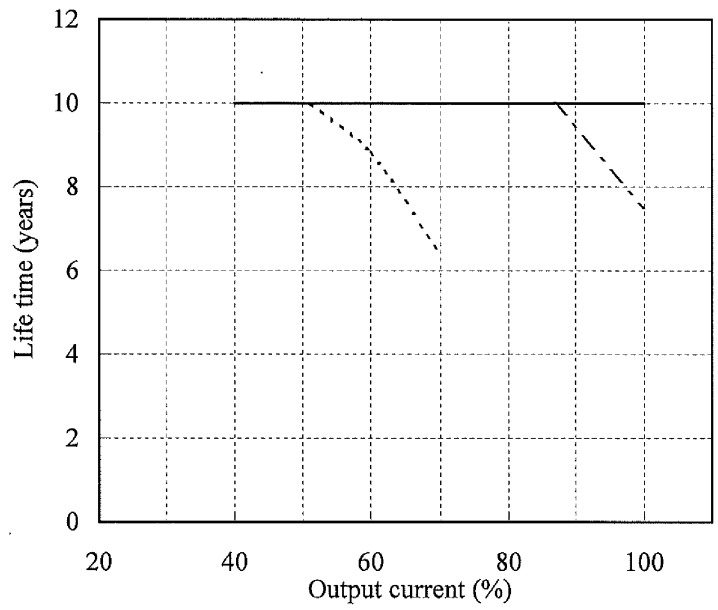
取付方向 E
Mounting E



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 | 8.8 |
| 80 | 10.0 | 10.0 | - |
| 100 | 10.0 | 7.5 | - |

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



5. アブノーマル試験 Abnormal Test

MODEL : VS75E-5

(1) 試験条件 Test Conditions

Input : 132VAC Output : Rating Ta : R.T.

(2) 試験結果 Test Results

(Da : Damaged)

| No. | Test position | | Test mode | | Test result | | | | | | | | | | | | | Note |
|-----|---------------|------------|-----------|------|-------------|-------|-------|-------|---------|---------|------------|--------|--------|-----------|-----------|--------|-----------------------------------|-------------------|
| | Location No. | Test point | Short | Open | a | b | c | d | e | f | gg | h | I | j | k | l | | |
| | | | | | Fire | Smoke | Burst | Smell | Red hot | Damaged | Fuse blown | O.V.P. | O.C.P. | No output | No change | Others | | |
| 1 | Q1 | D-S | ○ | | | | | | | ○ | ○ | | | ○ | | | Da : D101 | |
| 2 | | D-G | ○ | | | | | | | ○ | ○ | | | ○ | | | Da : Q1,D101 | |
| 3 | | G-S | ○ | | | | | | | | | | | ○ | | | | |
| 4 | | D | | ○ | | | | | | | | | | | ○ | | | |
| 5 | | S | | ○ | | | | | | | | | | | ○ | | | |
| 6 | | G | | ○ | | | | | | | ○ | ○ | | | ○ | | | Da : Q1,D101,R106 |
| 7 | Q51 | D-S | ○ | | | | | | | | | | ○ | | | | | |
| 8 | | D-G | ○ | | | | | | | | | | ○ | | | | | |
| 9 | | G-S | ○ | | | | | | | ○ | | | | | | ○ | Da : R201 Input power increase | |
| 10 | | D | | ○ | | | | | | | | | | ○ | | | | |
| 11 | | S | | ○ | | | | | | | | | | ○ | | | | |
| 12 | | G | | ○ | | | | | | | | | | | | ○ | | |
| 13 | Q52 | D-S | ○ | | | | | | | | | | ○ | | | | | |
| 14 | | D-G | ○ | | | | | | | | | | ○ | | | | | |
| 15 | | G-S | ○ | | | | | | | ○ | | | | | | ○ | Da : R206 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 | T1 | 1-6 | ○ | | | | | | | | | | | ○ | | | | |
| 23 | | 3-4 | ○ | | | | | | | | | | | ○ | | | | |
| 24 | | 7-8 | ○ | | | | | | | | | | | ○ | | | | |
| 25 | | 10-11 | ○ | | | | | | | | | | | ○ | | | | |
| 26 | | 1 | | ○ | | | | | | | | | | | ○ | | | |
| 27 | | 3 | | ○ | | | | | | | | | | | ○ | | | |
| 28 | | 7 | | ○ | | | | | | | | | | | | | ○ Input voltage increase | |
| 29 | | 9 (10) | | ○ | | | | | | | | | | | ○ | | | |

6. 振動試験 Vibration Test

MODEL : VS75E-5

(1) 振動試験種類 Vibration Test Class

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

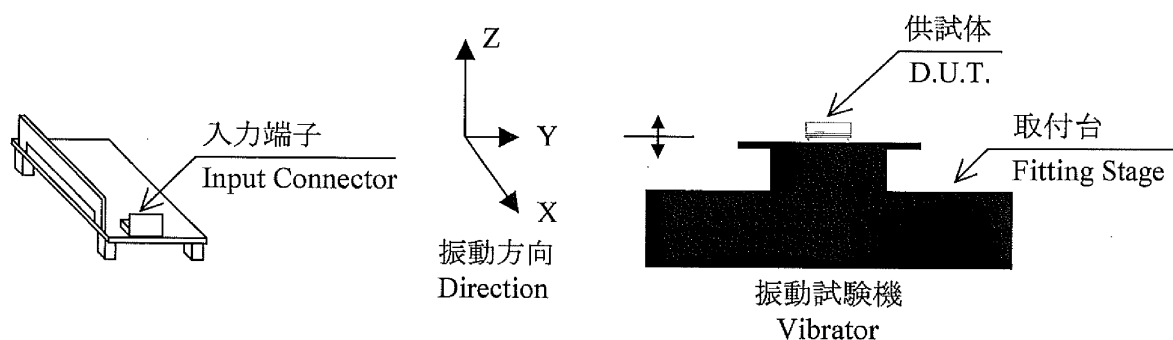
(2) 使用振動試験装置 Equipment Used

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 | : 1.0min | ・試験時間 Sweep count | : 各方向共 1時間 1 hour each |
| ・加速度 Acceleration | : Constant 19.6m/s^2 (2G) | | |

(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.

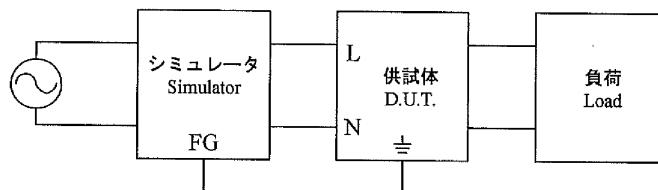
(6) 試験結果 Test Results

合格 OK

7. ノイズシミュレート試験 Noise Simulate Test

MODEL : VS75E-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 : INS-4320(A) (Noise Laboratory Co.,LTD)

(2) 試験条件 Test Conditions

| | | | |
|------------------------------|---------------|--------------------------|------------------------------|
| ・入力電圧 Input voltage | : 100VAC | ・ノイズ電圧 Noise level | : 0V~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

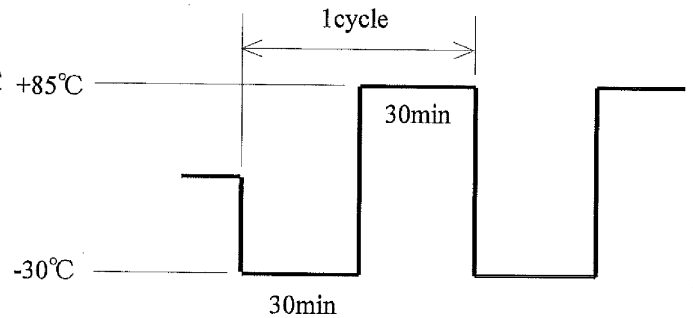
MODEL : VS75E-5

(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 ⇔ 85°C +85°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