

KWS15A

RELIABILITY DATA

信頼性データ

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* 試験結果は、代表データではありますが、全ての製品はほぼ同等な特性を示します。

従いまして、以下の結果は参考値とお考え願います。

Test results are typical data. Nevertheless the following results are considered to be reference data because all units have nearly the same characteristics.

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 : KWS15A-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 in 10⁹ 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 : 230VAC ・出力電圧、電流 : 24VDC, 0.7A (100%)
- Input voltage Output voltage & current
- ・環境ファクタ : GB (Ground, Benign) ・取付方法 : 標準取付 A
- Environmental factor Mounting method : Standard mounting A
- SR-332, Issue3

$$MTBF(T_a=25^\circ C) \cong \frac{8,202,502}{\text{時間 (Hours)}}$$

$$MTBF(T_a=40^\circ C) \cong \frac{3,653,665}{\text{時間 (Hours)}}$$

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

MODEL : KWS15A-24

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>

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

λ_{equip} : 全機器故障率 (故障数 / 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 ith Generic Part (Failure / 10^6 Hours)

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 ($\pi_Q=1$)

MTBF値 MTBF Values

GF : 地上、固定 (Ground, Fixed)

RCR-9102B

MTBF ≒ 498,355 時間 (Hours)

2. 部品デレーティング Components Derating

MODEL : KWS15A-5

(1) 算出方法 Calculating Method

(a) 測定方法 Measuring method

取付方法	: 標準取付 : A	周囲温度	: 45°C
Mounting method	Standard mounting : A	Ambient temperature	
入力電圧	: 100, 200VAC	出力電圧、電流	: 5VDC, 3A (100%)
Input voltage		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

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

T_c : デ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

$P_j(\max)$: 最大接合点(チャンネル)損失
($P_{ch}(\max)$) Maximum Junction (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

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

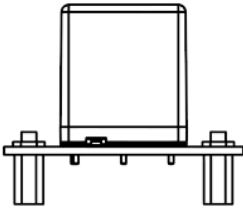
部品番号 Location No.	$V_{in} = 100VAC$	Load = 100%	$T_a = 45^{\circ}C$
Q101 IPD65R950C6 INFINEON	$T_j(\max) = 150^{\circ}C$ $P_d = 0.63 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 111.7^{\circ}C$ D.F. = 74.5 %	$\theta_{j-c} = 3.4^{\circ}C/W$ $\Delta T_c = 64.6^{\circ}C$	$T_c = 109.6^{\circ}C$
D101 ABS8 TSC	$T_j(\max) = 150^{\circ}C$ $P_d = 0.31 W$ $T_j = T_l + ((\theta_{j-l}) \times P_d) = 102.6^{\circ}C$ D.F. = 68.4 %	$\theta_{j-l} = 25^{\circ}C/W$ $\Delta T_l = 49.8^{\circ}C$	$T_l = 94.8^{\circ}C$
D102 S1JL TSC	$T_j(\max) = 175^{\circ}C$ $P_d = 0.03 W$ $T_j = T_l + ((\theta_{j-l}) \times P_d) = 102.4^{\circ}C$ D.F. = 58.5 %	$\theta_{j-l} = 25^{\circ}C/W$ $\Delta T_l = 56.6^{\circ}C$	$T_l = 101.6^{\circ}C$
D103 ES1DL TSC	$T_j(\max) = 150^{\circ}C$ $P_d = 0.07 W$ $T_j = T_l + ((\theta_{j-l}) \times P_d) = 100.7^{\circ}C$ D.F. = 67.1 %	$\theta_{j-l} = 35^{\circ}C/W$ $\Delta T_l = 53.2^{\circ}C$	$T_l = 98.2^{\circ}C$
D51 TP869C06R FUJI ELECTRIC	$T_j(\max) = 150^{\circ}C$ $P_d = 1.66 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 114.7^{\circ}C$ D.F. = 76.4 %	$\theta_{j-c} = 1.0^{\circ}C/W$ $\Delta T_c = 68.0^{\circ}C$	$T_c = 113.0^{\circ}C$
A201 TL431RN3 CYS	$T_j(\max) = 150^{\circ}C$ $P_d = 0.003 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 92.6^{\circ}C$ D.F. = 61.7 %	$\theta_{j-c} = 50^{\circ}C/W$ $\Delta T_c = 47.4^{\circ}C$	$T_c = 92.4^{\circ}C$
PC101 TLP291 TOSHIBA	$T_j(\max) = 125^{\circ}C$ $P_d = 2.69 mW$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 98.0^{\circ}C$ D.F. = 78.4 %	$\theta_{j-c} = 0.25^{\circ}C/mW$ $\Delta T_c = 52.3^{\circ}C$	$T_c = 97.3^{\circ}C$

部品番号 Location No.	$V_{in} = 200VAC$	Load = 100%	$T_a = 45^{\circ}C$
Q101 IPD65R950C6 INFINEON	$T_j(\max) = 150^{\circ}C$ $P_d = 0.94 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 104.0^{\circ}C$ D.F. = 69.3 %	$\theta_{j-c} = 3.4^{\circ}C/W$ $\Delta T_c = 55.8^{\circ}C$	$T_c = 100.8^{\circ}C$
D101 ABS8 TSC	$T_j(\max) = 150^{\circ}C$ $P_d = 0.19 W$ $T_j = T_l + ((\theta_{j-l}) \times P_d) = 86.6^{\circ}C$ D.F. = 57.7 %	$\theta_{j-l} = 25^{\circ}C/W$ $\Delta T_l = 36.8^{\circ}C$	$T_l = 81.8^{\circ}C$
D102 S1JL TSC	$T_j(\max) = 175^{\circ}C$ $P_d = 0.022 W$ $T_j = T_l + ((\theta_{j-l}) \times P_d) = 91.7^{\circ}C$ D.F. = 52.4 %	$\theta_{j-l} = 25^{\circ}C/W$ $\Delta T_l = 46.1^{\circ}C$	$T_l = 91.1^{\circ}C$
D103 ES1DL TSC	$T_j(\max) = 150^{\circ}C$ $P_d = 0.06 W$ $T_j = T_l + ((\theta_{j-l}) \times P_d) = 92.6^{\circ}C$ D.F. = 61.7 %	$\theta_{j-l} = 35^{\circ}C/W$ $\Delta T_l = 45.5^{\circ}C$	$T_l = 90.5^{\circ}C$
D51 TP869C06R FUJI ELECTRIC	$T_j(\max) = 150^{\circ}C$ $P_d = 1.69 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 114.5^{\circ}C$ D.F. = 76.3 %	$\theta_{j-c} = 1.0^{\circ}C/W$ $\Delta T_c = 67.8^{\circ}C$	$T_c = 112.8^{\circ}C$
A201 TL431RN3 CYS	$T_j(\max) = 150^{\circ}C$ $P_d = 0.0032 W$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 89.8^{\circ}C$ D.F. = 59.9 %	$\theta_{j-c} = 50^{\circ}C/W$ $\Delta T_c = 44.6^{\circ}C$	$T_c = 89.6^{\circ}C$
PC101 TLP291 TOSHIBA	$T_j(\max) = 125^{\circ}C$ $P_d = 2.61 mW$ $T_j = T_c + ((\theta_{j-c}) \times P_d) = 93.5^{\circ}C$ D.F. = 74.8 %	$\theta_{j-c} = 0.25^{\circ}C/mW$ $\Delta T_c = 47.8^{\circ}C$	$T_c = 92.8^{\circ}C$

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

MODEL : KWS15A-5

(1) 測定条件 Measuring Conditions

取付方法 Mounting Method (標準取付 : A) (Standard Mounting : A)	Mounting A	
		
入力電圧 V_{in} Input Voltage	100VAC	200VAC
出力電圧 V_{out} Output Voltage	5VDC	
出力電流 I_{out} Output Current	100% load	

(2) 測定結果 Measuring Results

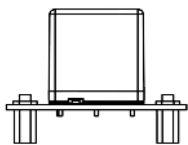
出力デレーティング Output Derating		ΔT Temperature Rise ($^{\circ}C$)	
		100VAC	200VAC
部品番号 Location No.		部品名 Part name	
		取付方向 Mounting A	
		$T_a=45^{\circ}C$	
Q101	MOS FET	64.6	55.8
D101	BRIDGE DIODE	49.8	36.8
D102	DIODE	56.6	46.1
D103	DIODE	53.2	45.5
D51	DIODE	68.0	67.8
T1	TRANS	56.4	53.5
L1	CHOKE COIL	40.6	31.0
L201	CHOKE COIL	59.8	58.2
C2	ECAP	54.8	46.7
C208	ECAP	54.1	51.3
A101	CHIP IC	61.5	52.2
A201	SHUNT REGULATOR IC	47.4	44.6
PC101	PHOTO COUPLER	52.3	47.8

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

MODEL : KWS15A

空冷条件: 自然空冷 Cooling condition: Convection cooling

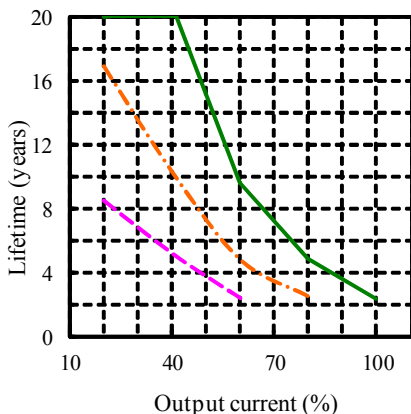
取付方向 A
Mounting A



5V

Vin = 100VAC

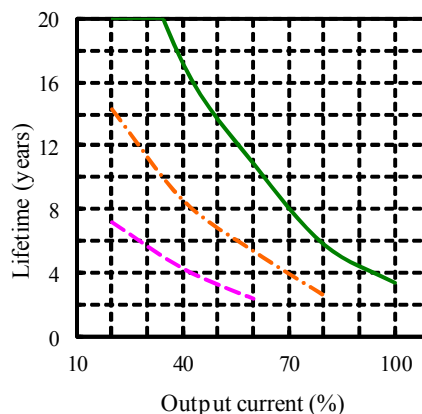
Load	Ta	Lifetime (years)		
		40°C	50°C	60°C
20%		20.0	16.9	8.5
40%		20.0	10.3	5.2
60%		9.6	4.8	2.4
80%		4.9	2.5	-
100%		2.3	-	-



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

Vin = 200VAC

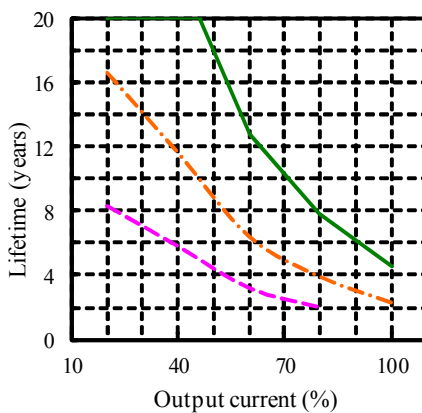
Load	Ta	Lifetime (years)		
		40°C	50°C	60°C
20%		20.0	14.3	7.2
40%		17.2	8.6	4.3
60%		10.9	5.4	2.4
80%		5.8	2.6	-
100%		3.4	-	-



24V

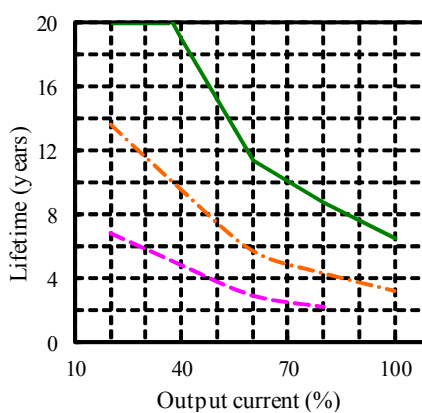
Vin = 100VAC

Load	Ta	Lifetime (years)		
		40°C	50°C	60°C
20%		20.0	16.6	8.3
40%		20.0	11.6	5.8
60%		12.8	6.4	3.2
80%		7.8	3.9	2.0
100%		4.5	2.3	-



Vin = 200VAC

Load	Ta	Lifetime (years)		
		40°C	50°C	60°C
20%		20.0	13.6	6.8
40%		19.0	9.5	4.8
60%		11.4	5.7	2.9
80%		8.7	4.3	2.2
100%		6.5	3.2	-



上記推定寿命は、弊社計算方法により算出した値であり、封口ゴムの劣化等の影響を含めておりません。
The lifetime is calculated based on our method and doesn't include the seal rubber degradation effect etc.

5. アブノーマル試験 Abnormal Test

MODEL : KWS15A-5

(1) 試験条件 Test Conditions

Input : 265VAC Output : 5V, 100% load Ta : 25°C

(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	g	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	C2		<input type="radio"/>							<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: D101	
2			<input type="radio"/>								<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: A101,Q101
3	C50		<input type="radio"/>													<input type="radio"/>	EMI worsen	
4			<input type="radio"/>													<input type="radio"/>	EMI worsen	
5	C208		<input type="radio"/>											<input type="radio"/>				
6			<input type="radio"/>													<input type="radio"/>	Output ripple increase	
7	D101	AC-AC	<input type="radio"/>								<input type="radio"/>			<input type="radio"/>				
8		AC-DC	<input type="radio"/>							<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: D101	
9		DC-DC	<input type="radio"/>								<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: D101
10		AC	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>			
11	DC	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>				
12	D102	A-K	<input type="radio"/>							<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: Q101	
13		A/K	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>			
14	D51	A-K	<input type="radio"/>										<input type="radio"/>	<input type="radio"/>			Hiccup	
15		A/K	<input type="radio"/>	<input type="radio"/>										<input type="radio"/>				
16	Q101	D-S	<input type="radio"/>							<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: D101, Z102	
17		D-G	<input type="radio"/>							<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: D101, Z102, Q101	
18		G-S	<input type="radio"/>											<input type="radio"/>				
19		D	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>			
20		S	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>			
21	G	<input type="radio"/>	<input type="radio"/>							<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: D101	
22	A101	1-2	<input type="radio"/>											<input type="radio"/>				
23		2-3	<input type="radio"/>											<input type="radio"/>				
24		3-4	<input type="radio"/>											<input type="radio"/>				
25		5-6	<input type="radio"/>												<input type="radio"/>			
26		6-7	<input type="radio"/>												<input type="radio"/>			
27		7-8	<input type="radio"/>												<input type="radio"/>			
28		1	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>			
29		2	<input type="radio"/>	<input type="radio"/>									<input type="radio"/>				<input type="radio"/>	Hiccup
30		3	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>			
31		4	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>			
32		5	<input type="radio"/>	<input type="radio"/>												<input type="radio"/>	<input type="radio"/>	Can not restart
33		6	<input type="radio"/>	<input type="radio"/>												<input type="radio"/>		
34		7	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>			
35		8	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>			
36		T1	1-2	<input type="radio"/>													<input type="radio"/>	Hiccup
37	3-4		<input type="radio"/>							<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: D101	
38	4-5		<input type="radio"/>							<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: D101	
39	3-5		<input type="radio"/>							<input type="radio"/>	<input type="radio"/>			<input type="radio"/>			Da: D101, Q101	
40	6,7-8,9		<input type="radio"/>												<input type="radio"/>			
41	1		<input type="radio"/>	<input type="radio"/>													<input type="radio"/>	Hiccup
42	3/5	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>				
43	6/7	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>				
44	L1	1-2	<input type="radio"/>								<input type="radio"/>			<input type="radio"/>				
45		3-4	<input type="radio"/>								<input type="radio"/>			<input type="radio"/>				
46		1/2	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>			
47	3/4	<input type="radio"/>	<input type="radio"/>											<input type="radio"/>				

6. 振動試験 Vibration Test

MODEL : KWS15A

(1) 振動試験種類 Vibration Test Class

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

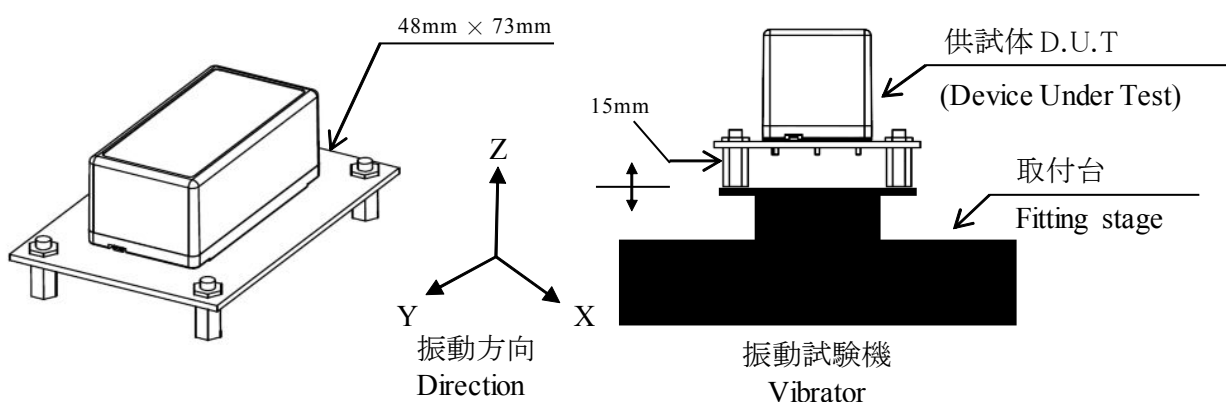
(2) 使用振動試験装置 Equipment Used

SHINKEN (株) 製 G14-701
SHINKEN CORP.

(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 |
| ・ 振幅
Amplitude | : 一定 1.65mm _{p-p} (Max. 10G)
Constant | | |

(4) 試験方法 Test Method



(5) 判定条件 Acceptable Conditions

1. 破損しない事
Not to be broken.
2. 試験後の出力に異常がない事
No abnormal output after test.

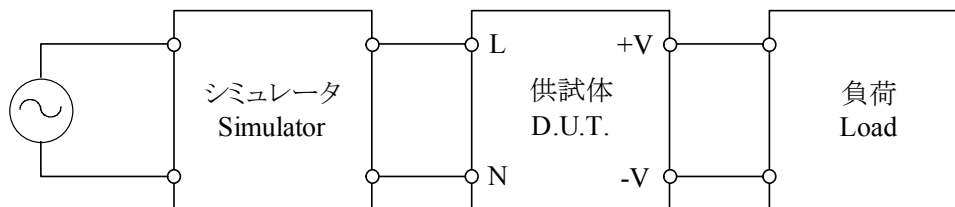
(6) 試験結果 Test Results

合格 OK

7. ノイズシミュレート試験 Noise Simulate Test

MODEL : KWS15A

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



Equipment Used (Noise simulator)

ノイズ研究所製 INS-410

Noise Laboratory Co.,LTD

(2) 試験条件 Test Conditions

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

(3) 判定条件 Acceptable Conditions

1. 試験中、5%を超える出力電圧の変動のない事
The regulation of output voltage must not exceed 5% of initial value during test.
2. 試験後の出力電圧は初期値から変動していない事
The output voltage must be within the regulation of specification after the test.
3. 発煙・発火のない事
Smoke and fire are not allowed.

(4) 試験結果 Test Results

合格 OK

8. 熱衝撃試験 Thermal Shock Test

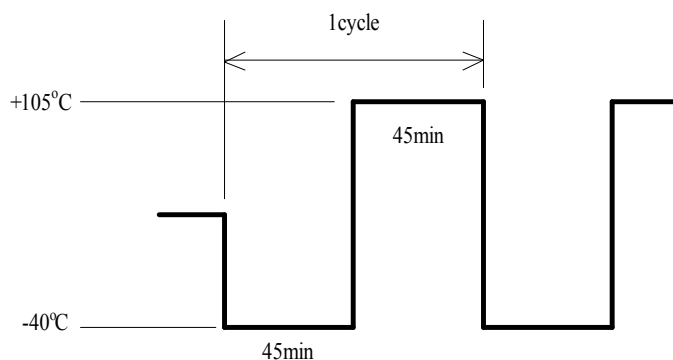
MODEL : KWS15A

(1) 使用冷熱衝撃装置 Equipment Used (Thermal Shock Chamber)

ESPEC 製 TSE-11-A
ESPEC CORP.

(2) 試験条件 Test Conditions

- ・ 電源周囲温度 : -40°C ⇔ 105°C
Ambient Temperature
- ・ 試験時間 : 図参照
Test Time Refer to Dwg.
- ・ 試験サイクル : 276 サイクル
Test Cycle 276 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。276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. 276 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

試験後の出力に異常がない事
No abnormal output after test.

(5) 試験結果 Test Results

合格 OK