TDK-Lambda

VS100E

参考資料

SPECIFICATIONS

A241-01-01B

ITEMS \ MODEL				VS100E-3	VS100E-5	VS100E-12	VS100E-15	VS100E-24	VS100E-48
1	Nominal Output Voltage		V	3.3	5	12	15	24	48
2	Maximum Output Current		A	20	20	8.5	7.0	4.3	2.2
3	Maximum Output Power		W	66.0	100.0	102.0	105.0	103.2	105.6
4	Efficiency (Typ)	(*1)	%	80	85	85	85	86	87
5	Input Voltage Range	(*2)	-	85 - 132VAC (47 - 63Hz) or 110 - 175VDC					
6	Input Current (Typ)	(*1)	A	1.5	2.1				
7	Inrush Current (Typ)	(*1)	-	30A at Cold Start					
8	Output Voltage Range		V	2.97 - 3.63	4.5 - 5.5	10.8 - 13.2	13.5 - 16.5	21.6 - 26.4	43.2 - 52.8
9	Maximum Ripple & Noise	0≤Ta≤70°C	mV	120	120	150	150	150	200
	(*3)(*4)	-10≤Ta<0°C	mV	160	160	180	180	180	240
10	Maximum Line Regulation	(*3)(*5)	mV	20	20	48	60	96	192
11	Maximum Load Regulation	(*3)(*6)	mV	40	40	96	120	150	240
12	Temperature Coefficient	(*3)	-	Less than 0.02% / °C					
13	Over Current Protection	(*7)	A	21.0 ≤	21.0 ≤	8.92 ≤	7.35 ≤	4.51 ≤	2.31 ≤
14	Over Voltage Protection	(*8)	V	3.80 - 4.46	5.75 - 6.75	13.8 - 16.2	17.3 - 20.3	27.6 - 32.4	55.2 - 64.8
15	Hold-up Time (Typ)	(*1)	-	20ms					
16	Leakage Current	(*9)	-	Less than 0.5mA					
17	Parallel Operation		-	-					
18	Series Operation		-	Possible					
19	Operating Temperature	(*10)	-	Convection : -10 to +70°C (-10 to +50°C:100%, +60°C:70%, +70°C:20%)					
20	Operating Humidity		-	30 to 90%RH (No Condensing)					
21	Storage Temperature		-	-30 to +85°C					
22	Storage Humidity		-	10 to 95%RH (No Condensing)					
23	Cooling		-	Convection Cooling					
24	Withstand Voltage		-	Input - FG : 2kVAC (10mA), Input - Output : 2kVAC (10mA) Output - FG : 500VAC (20mA) for 1min					
25	Isolation Resistance		-	More than 100MΩ at 25°C and 70%RH Output - FG : 500VDC					
26	Vibration		-	At no operating, 10 - 55Hz (Sweep for 1min) 19.6m/s^2 Constant, X,Y,Z 1hour each.					
27	Shock		-	Less than 196.1m/s^2					
28	Safety		-	Approved by UL60950-1, CSA60950-1, EN60950-1, EN50178(OV II), Designed to meet DENAN (Section 2).					
29	Conducted Emission		-	Designed to meet EN55011/EN55022-B, FCC-B, VCCI-B					
30	Radiated Emission		-	Designed to meet EN55011/EN55022-B, FCC-B, VCCI-B					
31	Immunity		-	Designed to meet IEC61000-4-2(Level 2,3), -3(Level 3), -4(Level 3), -5(Level 2,3), -6(Level 3), -8(Level 4), -11					
32	Weight (Typ)		g	290					
33	Size (W x H x D)	(*11)	mm	62 x 29 x 155 (Refer to Outline Drawing)					

*Read instruction manual carefully, before using the power supply unit.

=NOTES=

*1. At 100VAC, Ta=25°C, nominal output voltage and maximum output power.

*2. For cases where conformance to various safety specs (UL, CSA, EN) are required, to be described as 100 - 120VAC(50/60Hz).

*3. Please refer to Fig. A for measurement of line & load regulation and ripple voltage.

*4. For start up at low ambient temperature and low input voltage, output ripple noise might not meet specification. However, there is no overshoot at start up and output ripple noise specification can be met after one second.

*5. 85 - 132VAC, constant load.

*6. No load-Full load, constant input voltage.

*7. 3.3, 5V model : Constant current limit and hiccup with automatic recovery.
12 - 48V model : Constant current limit with automatic recovery.
Avoid to operate at over load or short circuit condition for more than 30seconds.

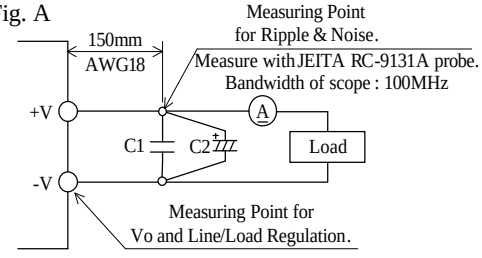
*8. OVP circuit will shut the output down, manual reset (Re power on).

*9. Measured by the each measuring method of UL, CSA, EN and DENAN(at 60Hz), Ta=25°C.

*10. Ratings
- Derating at standard mounting. Refer to output derating curve(A241-01-02_).
- When forced air cooling, refer to derating curve(A241-01-03_).
- Load (%) is percent of maximum output power or maximum output current, whichever is greater.

*11. Not include lead length on solder side.

Fig. A



C1 : Film Cap. 0.1 µF
C2 : Elec. Cap. 100 µF

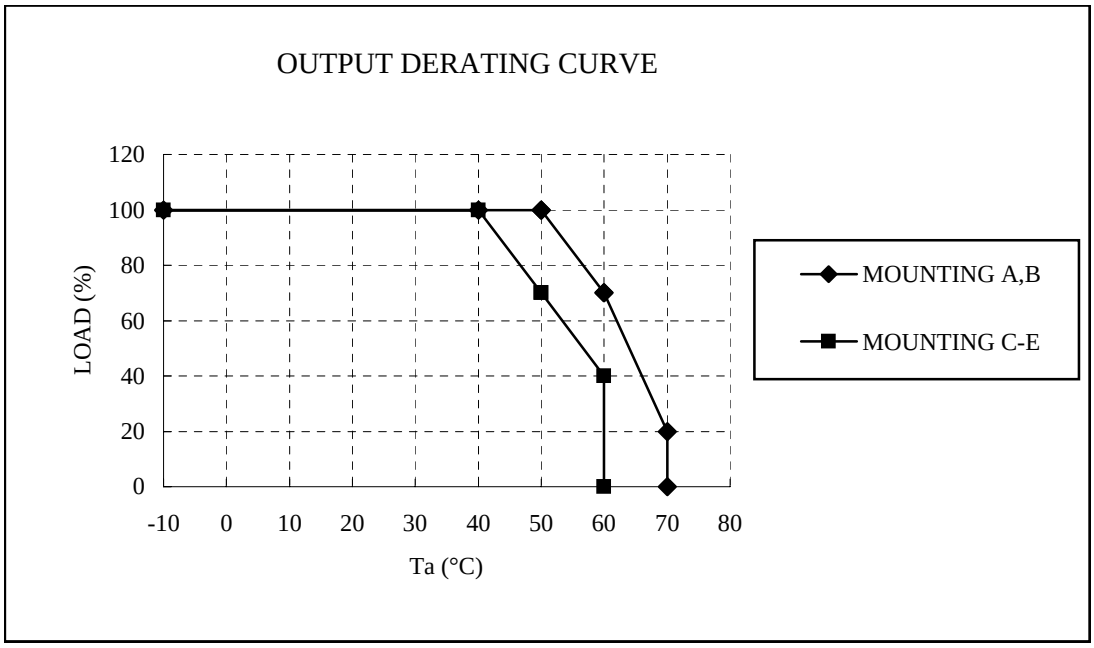
VS100E

OUTPUT DERATING

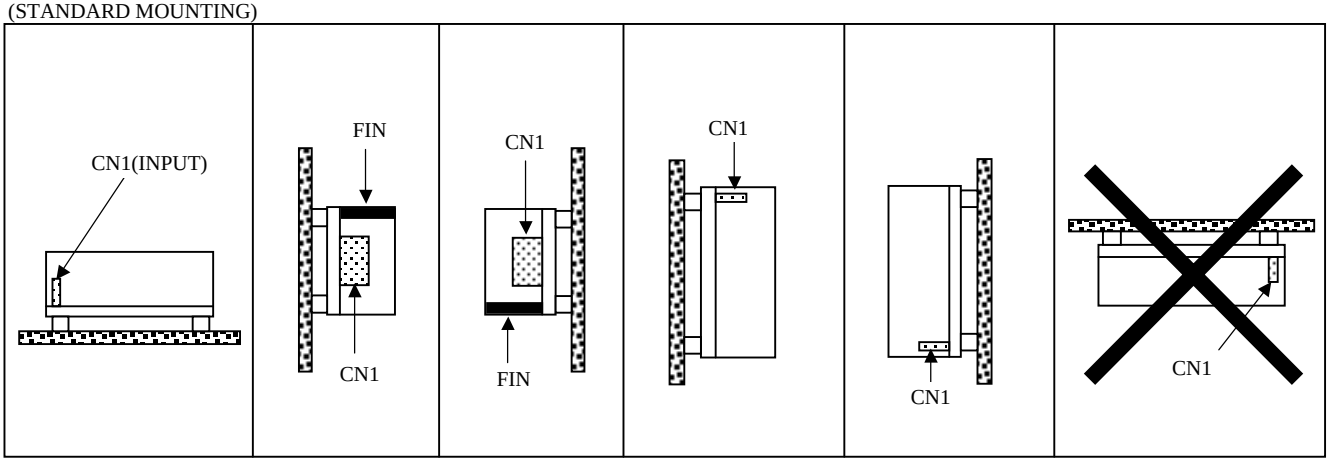
A241-01-02

*COOLING : CONVECTION COOLING

Ta (°C)	LOAD (%) MOUNTING A,B	LOAD (%) MOUNTING C-E
-10 to +40	100	100
50	100	70
60	70	40
70	20	-



MOUNTING A (STANDARD MOUNTING) | MOUNTING B | MOUNTING C | MOUNTING D | MOUNTING E | DON'T USE



VS100E

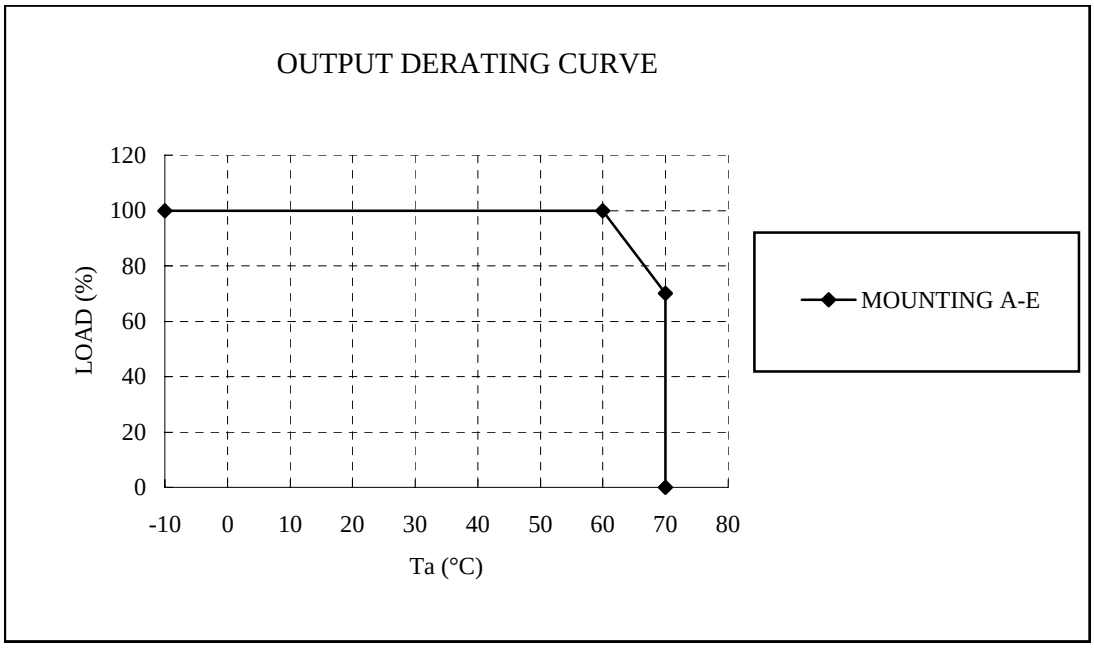
OUTPUT DERATING

A241-01-03

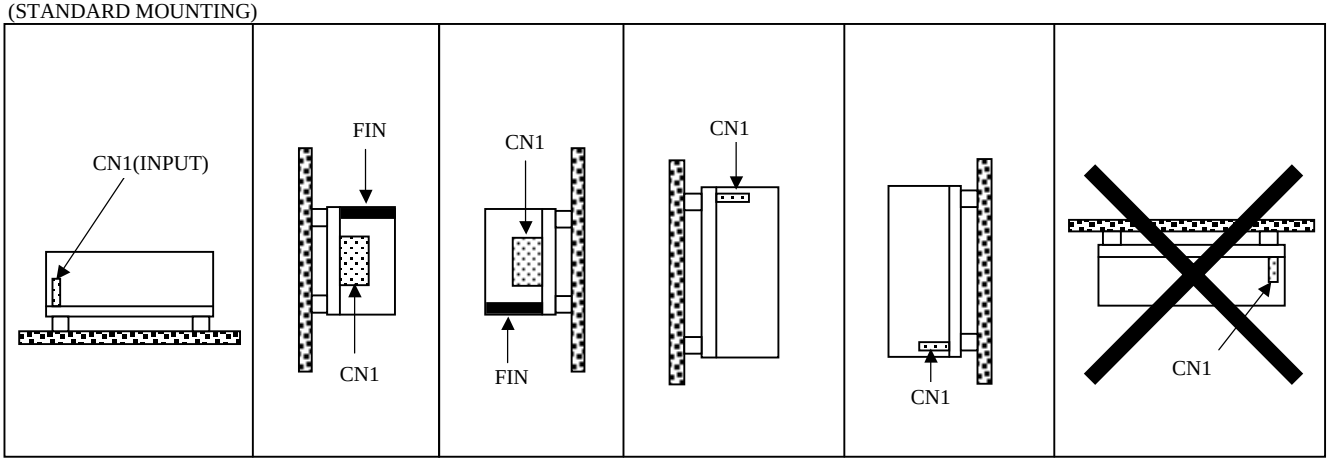
*COOLING : FORCED AIR COOLING

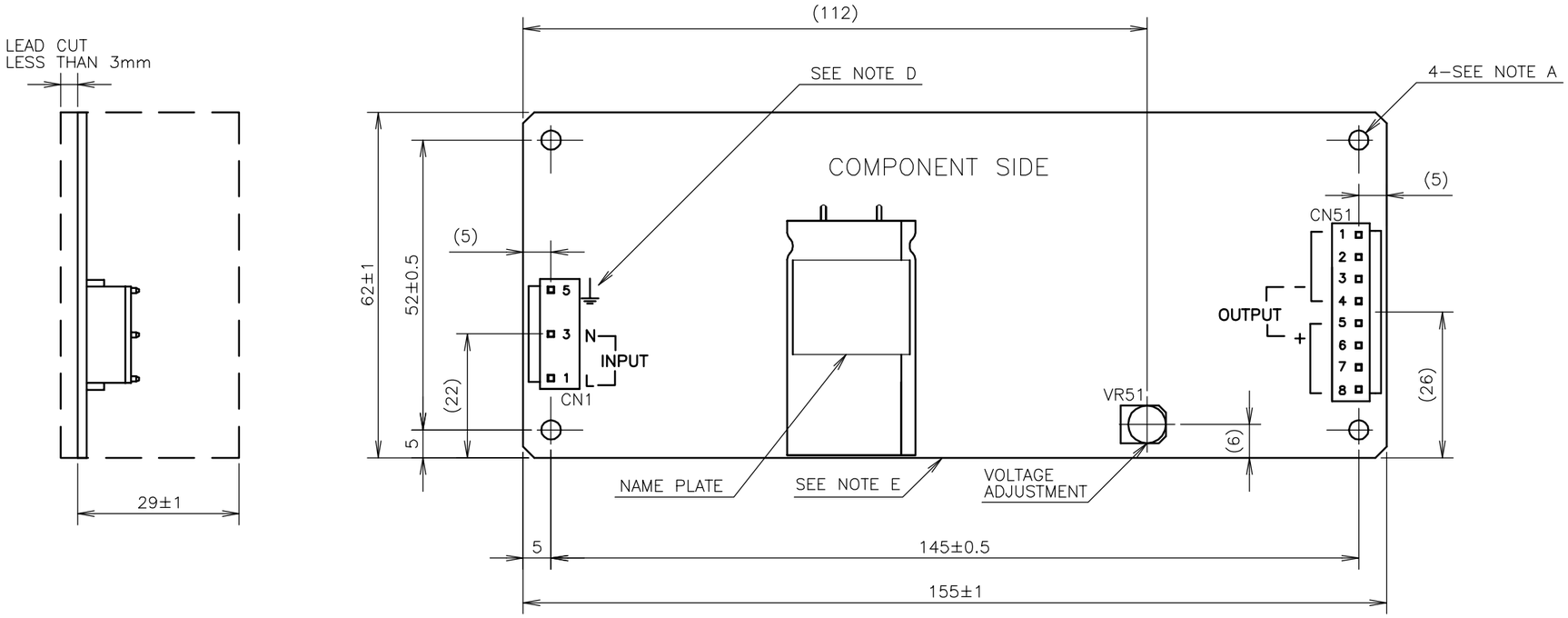
Ta (°C)	LOAD (%)
	MOUNTING A-E
-10 to +60	100
70	70

Air flow ≥ 0.5m^3/min : Air must flow through component side.



MOUNTING A (STANDARD MOUNTING) | MOUNTING B | MOUNTING C | MOUNTING D | MOUNTING E | DON'T USE





CONNECTORS USED:

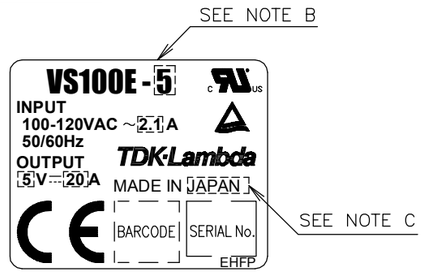
PART DESCRIPTION	PART NAME	MANUFACT.	QTY
PIN HEADER (INPUT SIDE CN1)	B3P5–VH(LF)(SN)	J.S.T.	1
PIN HEADER (OUTPUT SIDE CN51)	B8P–VH(LF)(SN)	J.S.T.	1

*OUTPUT CURRENT OF EACH CONNECTOR PIN MUST BE LESS THAN 5A.

MATCHING HOUSINGS, PINS & TOOL (NOT INCLUDED WITH THE PRODUCT):

PART DESCRIPTION	PART NAME	MANUFACT.	QTY
SOCKET HOUSING (CN1)	VHR–5N	J.S.T.	1
SOCKET HOUSING (CN51)	VHR–8N	J.S.T.	1
TERMINAL PINS	SVH–21T–P1.1	J.S.T.	11
	BVH–21T–P1.1		
HAND CRIMPING TOOL	YC–160R	J.S.T.	–

NAME PLATE



SCALE FOR NAME PLATE : 2/1

NOTES

A: 4–ø3.5 HOLES ARE FOR CUSTOMER'S CHASSIS MOUNTING HOLES. ALL MUST BE SCREWED IN ORDER TO CONFORM THE VIBRATION/EMI SPEC.

B: MODEL NAME, INPUT VOLTAGE RANGE, NOMINAL OUTPUT VOLTAGE, AND MAXIMUM OUTPUT CURRENT ARE SHOWN HERE IN ACCORDANCE WITH THE SPECIFICATIONS.

C: COUNTRY OF MANUFACTURE WILL BE SHOWN HERE.

D: ⏚ IS FOR SAFETY GROUND CONNECTION.

E: TO KEEP THE DISTANCE MORE THAN 2mm BETWEEN PCB EDGE AND CUSTOMER'S CHASSIS.

(unit : mm)

MODEL NAME	VS100E
TDK-Lambda	

A241–02–01B

VS100E

EVALUATION DATA

型式データ

DWG No. A241-53-01		
APPD	CHK	DWG
H Hatamoto	Shimamura	Komatsu
5/Dec/08	5, Dec, '08	5. Dec. '08

INDEX

使用記号 Terminology used

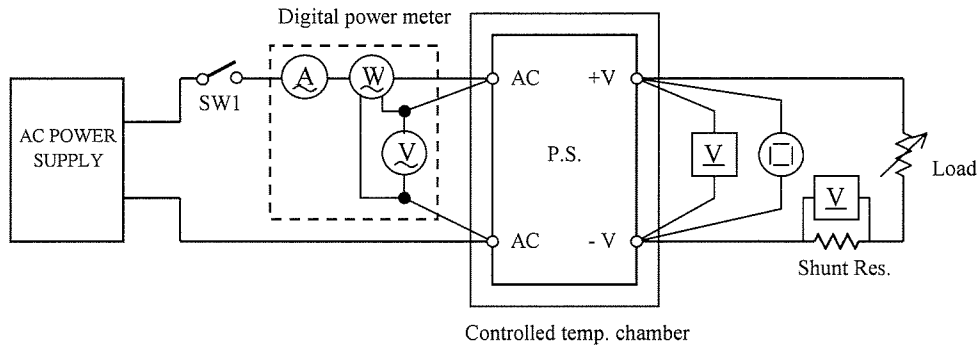
	Definition	
Vin	..... 入力電圧	Input voltage
Vout	..... 出力電圧	Output voltage
Iin	..... 入力電流	Input current
Iout	..... 出力電流	Output current
Ta	..... 周囲温度	Ambient temperature
f	..... 周波数	Frequency

1. 測定方法　**Evaluation Method**

1.1 測定回路　Circuit used for determination

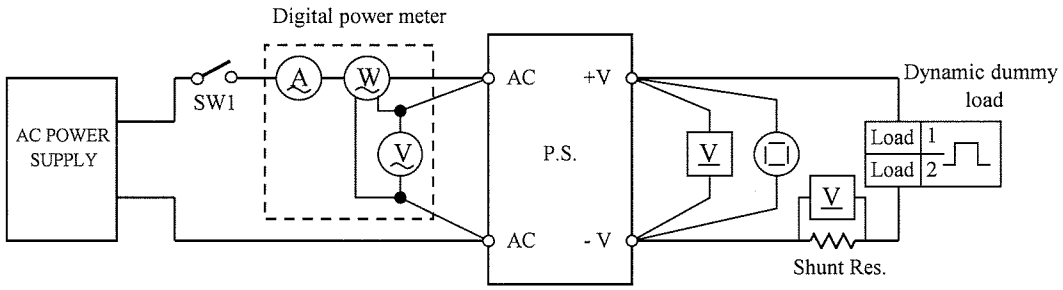
測定回路1 Circuit 1

- 静特性　Steady state data
- 過電流保護特性　Over current protection (OCP) characteristics
- 過電圧保護特性　Over voltage protection (OVP) characteristics
- 出力立ち上がり特性　Output rise characteristics
- 出力立ち下がり特性　Output fall characteristics
- 出力保持時間特性　Hold up time characteristics



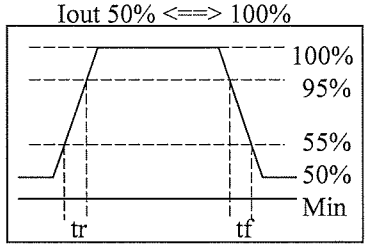
測定回路2 Circuit 2

- 過渡応答(負荷急変) 特性　Dynamic load response characteristics



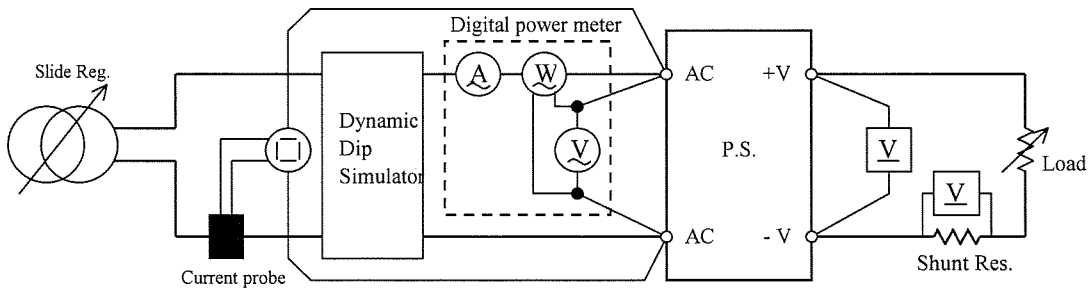
Output current waveform

Iout 50% <==> 100%



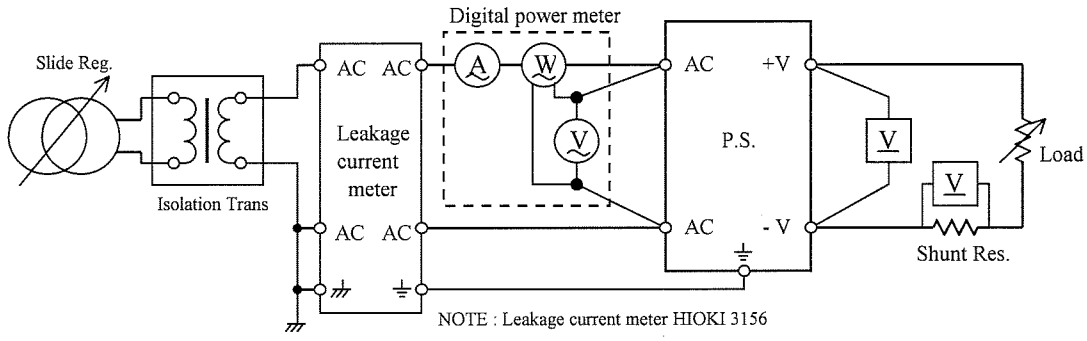
測定回路3 Circuit 3

- 入力サージ電流(突入電流)特性　Inrush current characteristics



測定回路4 Circuit 4

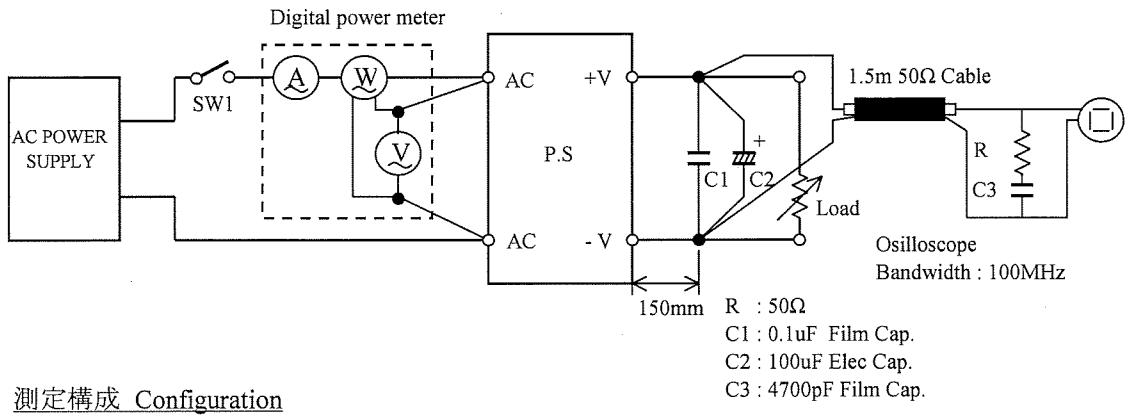
・リーク電流特性　　Leakage current characteristics



測定回路5 Circuit 5

・出力リップル、ノイズ特性　　Output ripple and noise waveform

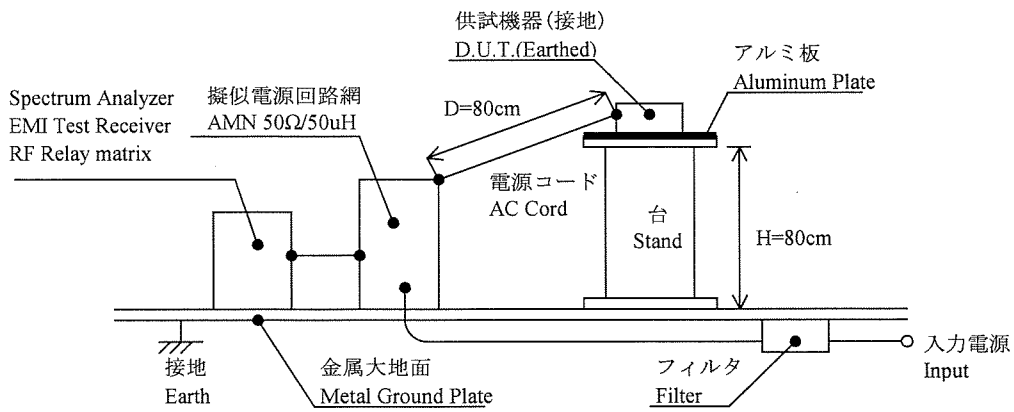
Normal Mode (JEITA Standard RC-9131A)



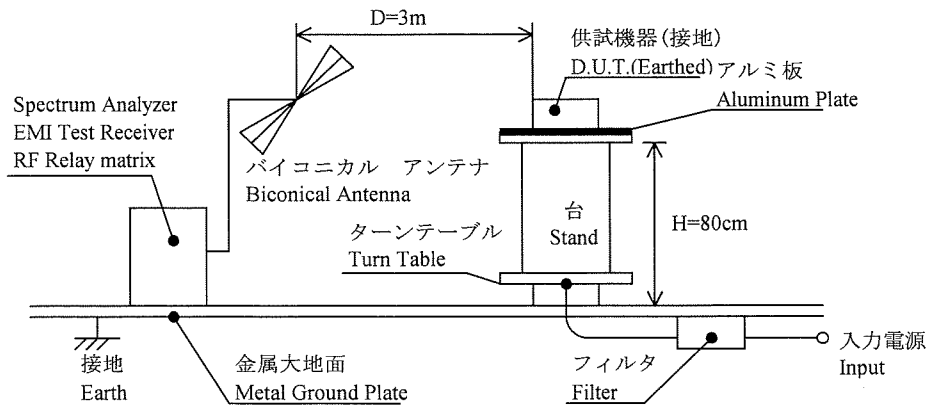
測定構成 Configuration

・ＥＭＩ特性　　Electro-Magnetic Interference characteristics

雑音端子電圧（帰還ノイズ）　　Conducted Emission Noise



雑音電界強度（輻射ノイズ）　　Radiated Emission Noise



1.2 使用測定機器　　List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	DIGITAL STORAGE OSCILLOSCOPE	TEKTRONIX	TDS3012
2	DIGITAL STORAGE OSCILLOSCOPE	YOKOGAWA ELECT.	DL1740EL/DL9040L
3	DIGITAL MULTIMETER	AGILENT	34970A
4	DIGITAL POWER METER	YOKOGAWA ELECT.	WT210
5	CURRENT PROBE/AMPLIFIER	YOKOGAWA ELECT.	701930
6	DYNAMIC DUMMY LOAD	TAKASAGO	FK-600L
7	SLIDE REGULATOR	MATSUNAGA	SD-2650
8	CVCF	TAKASAGO	AA2000XG
9	LEAKAGE CURRENT METER	HIOKI	3156
10	DYNAMIC DIP SIMULATOR	CYBERNETICS	PSA-210
11	CONTROLLED TEMP. CHAMBER	ESPEC	SU-261
12	SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSA
13	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESHS10
14	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESVS10
15	RF RELAY MATRIX	ROHDE & SCHWARZ	PSU
16	AMN	KYORITU DENSHI	KNW-242
17	ANTENA(BICONICAL ANTENA)	SCHWARZBECK	BBA9106
18	POWER HITESTER	HIOKI	3193
19	POWER HITESTER	HIOKI	9600
20	IMPEDANCE NETWORK 20A	NF	4150
21	SING PHASE MASTER	NF	4420
22	BOOSTER	NF	4421

2. 1 静特性　Steady state data

(1) 入力・負荷・温度変動／出力起動・低下電圧

Regulation - line and load, Temperature drift / Start up voltage and Drop out voltage

5V

1. Regulation - line and load　Condition　Ta :　25 ℃

Iout \ Vin	85VAC	100VAC	132VAC	line regulation	
0%	5.006V	5.007V	5.007V	1mV	0.020%
50%	5.006V	5.006V	5.007V	1mV	0.020%
100%	5.006V	5.006V	5.007V	1mV	0.020%
load	0mV	1mV	0mV		
regulation	0.000%	0.020%	0.000%		

2. Temperature drift　Conditions　Vin :　100 VAC
Iout :　100 %

Ta	-10℃	+25℃	+50℃	temperature stability	
Vout	5.006V	5.006V	5.002V	4mV	0.080%

3. Start up voltage and Drop out voltage　Conditions　Ta :　25 ℃
Iout :　100 %

Start up voltage (Vin)	70VAC
Drop out voltage (Vin)	69VAC

12V

1. Regulation - line and load　Condition　Ta :　25 ℃

Iout \ Vin	85VAC	100VAC	132VAC	line regulation	
0%	11.967V	11.967V	11.967V	0mV	0.000%
50%	11.966V	11.966V	11.966V	0mV	0.000%
100%	11.966V	11.966V	11.966V	0mV	0.000%
load	1mV	1mV	1mV		
regulation	0.008%	0.008%	0.008%		

2. Temperature drift　Conditions　Vin :　100 VAC
Iout :　100 %

Ta	-10℃	+25℃	+50℃	temperature stability	
Vout	11.979V	11.966V	11.945V	34mV	0.283%

3. Start up voltage and Drop out voltage　Conditions　Ta :　25 ℃
Iout :　100 %

Start up voltage (Vin)	69VAC
Drop out voltage (Vin)	65VAC

24V

1. Regulation - line and load　Condition　Ta :　25 ℃

Iout \ Vin	85VAC	100VAC	132VAC	line regulation	
0%	23.982V	23.982V	23.982V	0mV	0.000%
50%	23.980V	23.981V	23.981V	1mV	0.004%
100%	23.981V	23.981V	23.981V	0mV	0.000%
load	2mV	1mV	1mV		
regulation	0.008%	0.004%	0.004%		

2. Temperature drift　Conditions　Vin :　100 VAC
Iout :　100 %

Ta	-10℃	+25℃	+50℃	temperature stability	
Vout	24.005V	23.981V	23.950V	55mV	0.229%

3. Start up voltage and Drop out voltage　Conditions　Ta :　25 ℃
Iout :　100 %

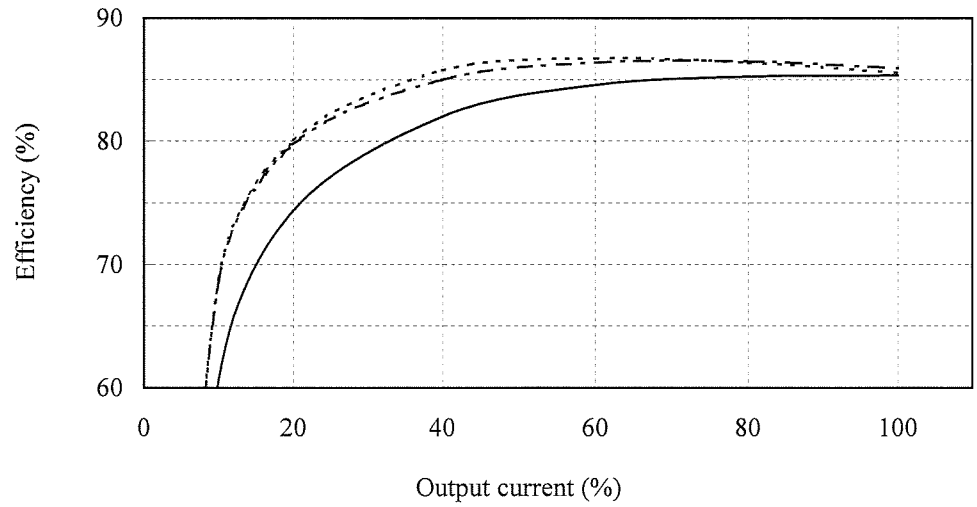
Start up voltage (Vin)	69VAC
Drop out voltage (Vin)	68VAC

(2) 効率対出力電流

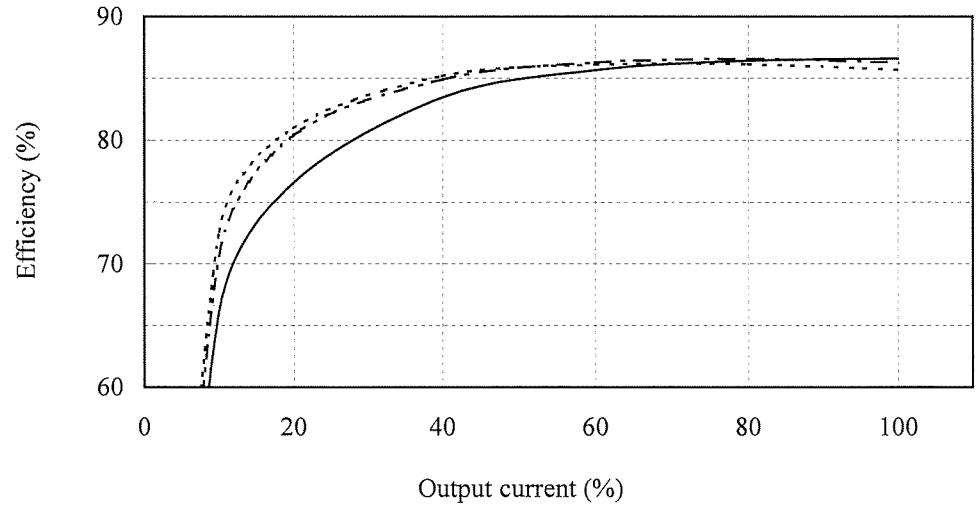
Efficiency vs. Output current

Conditions Vin : 85 VAC ------
: 100 VAC -·-·-·-
: 132 VAC ———
Ta : 25 ℃

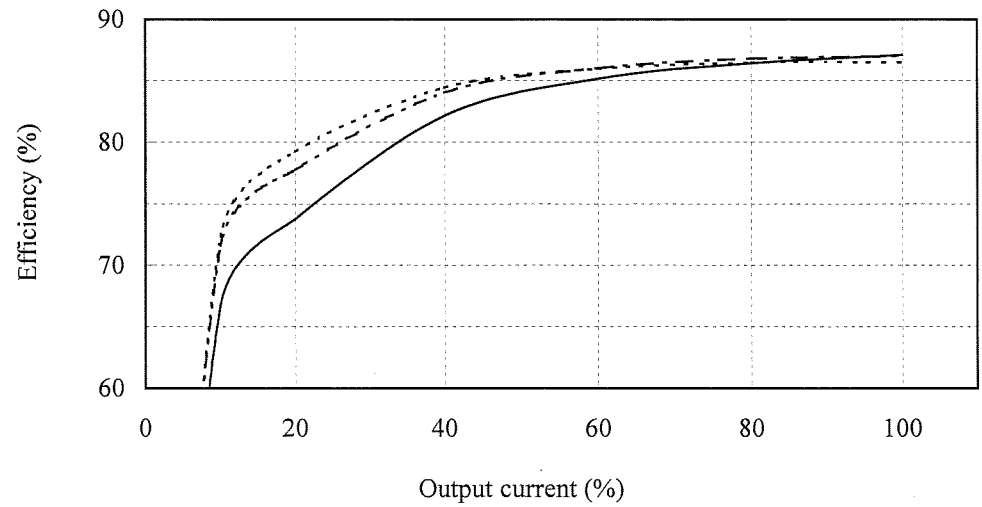
5V



12V



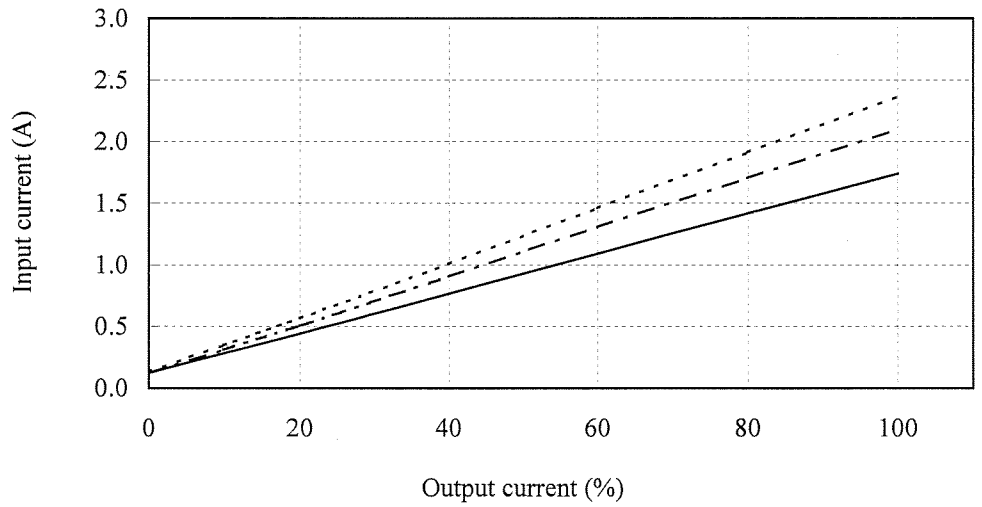
24V



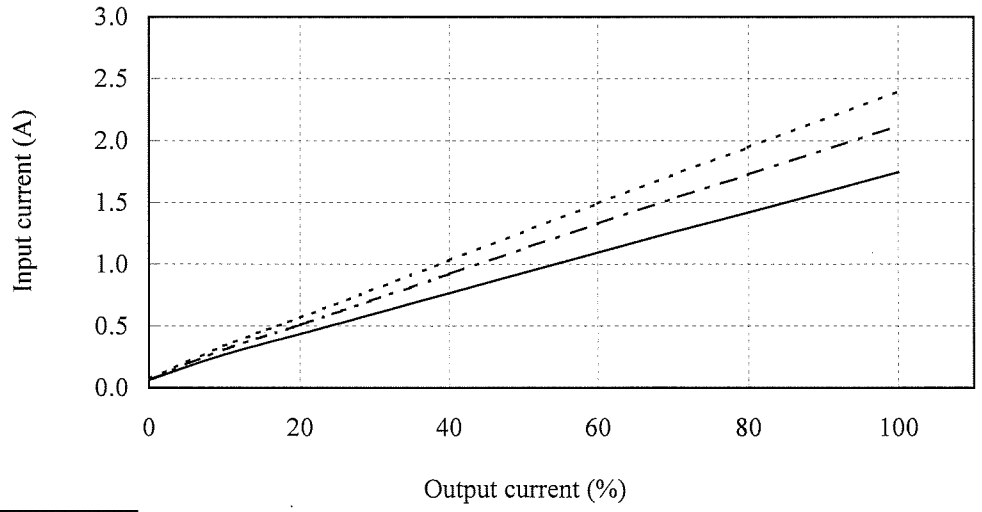
(3) 入力電流対出力電流
Input current vs. Output current

Conditions Vin : 85 VAC ------
: 100 VAC —·—·—
: 132 VAC ———
Ta : 25 ℃

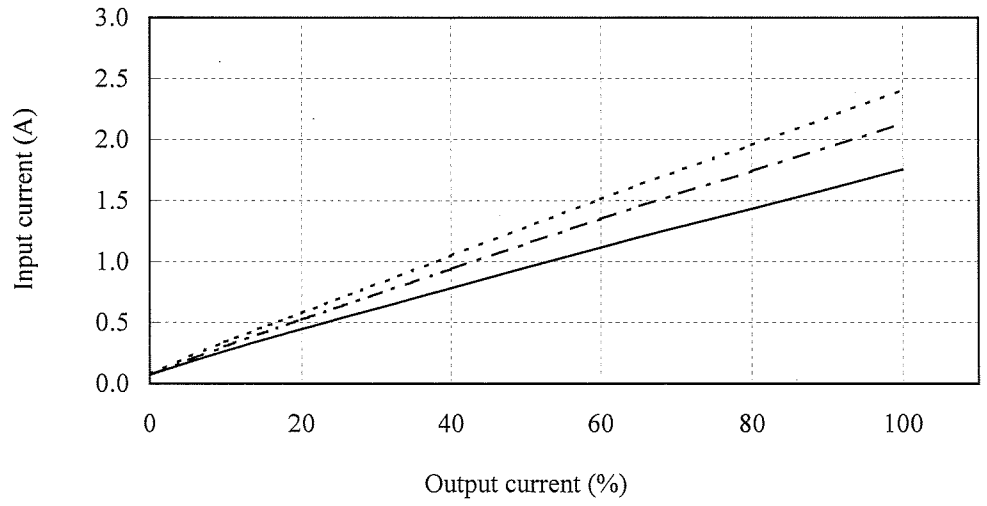
5V



12V



24V



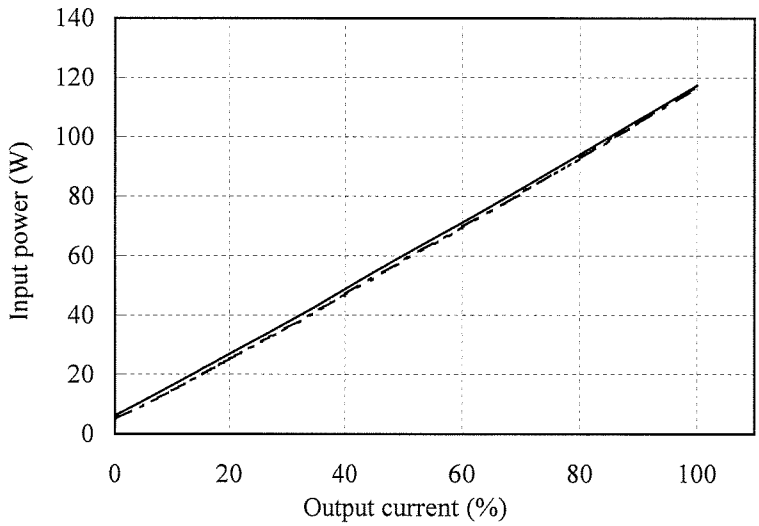
(4) 入力電力対出力電流
Low load input power vs. Output current

Conditions Vin : 85 VAC -----
: 100 VAC -·-·-
: 132 VAC ——
Ta : 25 ℃

5V

Conditions Iout : 0%

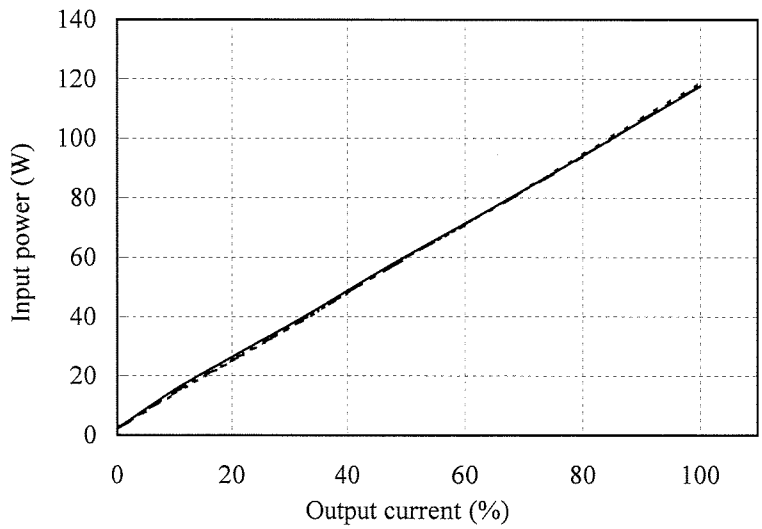
Vin	Input power
85VAC	4.8W
100VAC	4.9W
132VAC	6.3W



12V

Conditions Iout : 0%

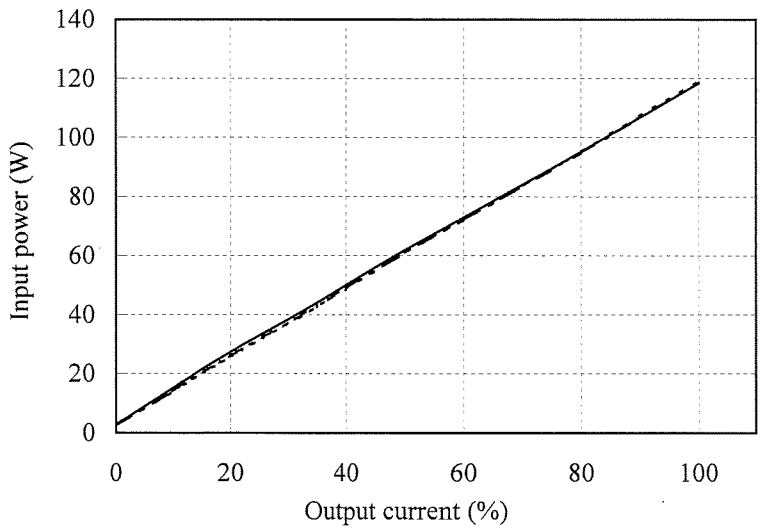
Vin	Input power
85VAC	2.3W
100VAC	2.0W
132VAC	2.5W



24V

Conditions Iout : 0%

Vin	Input power
85VAC	2.5W
100VAC	2.4W
132VAC	3.0W



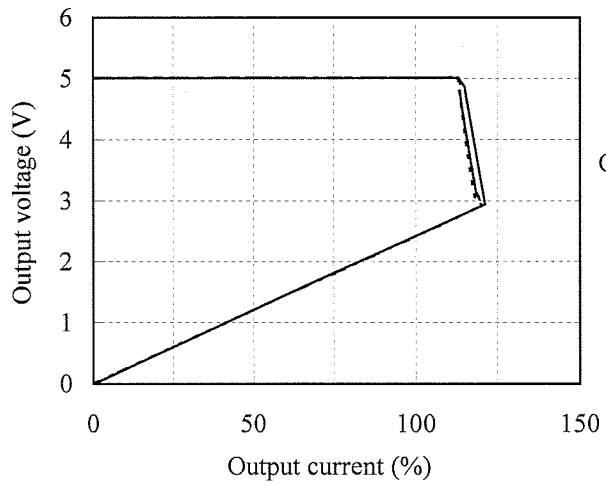
2.2 過電流保護特性
Over current protection (OCP) characteristics

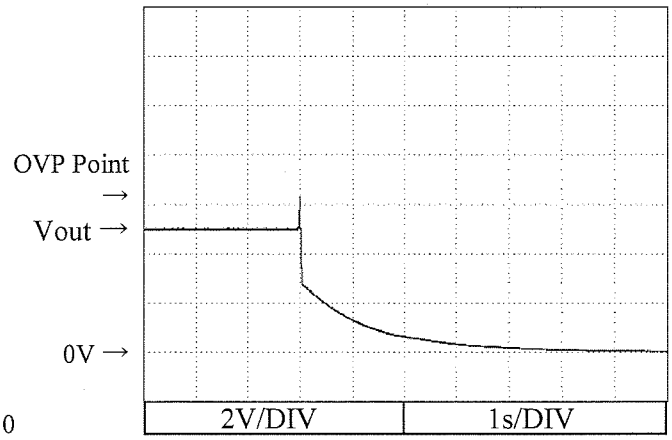
Conditions Vin : 85 VAC ------
100 VAC —·—·—
132 VAC ———
Ta : 25 ℃

2.3 過電圧保護特性
Over voltage protection (OVP) characteristics

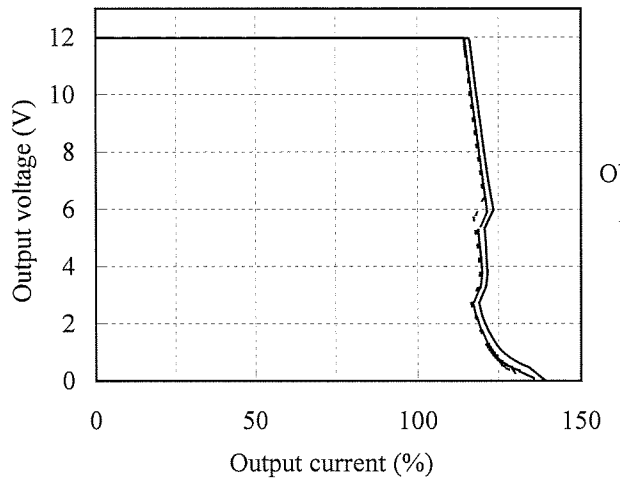
Conditions Vin : 100 VAC
Io : 0 %
Ta : 25 ℃

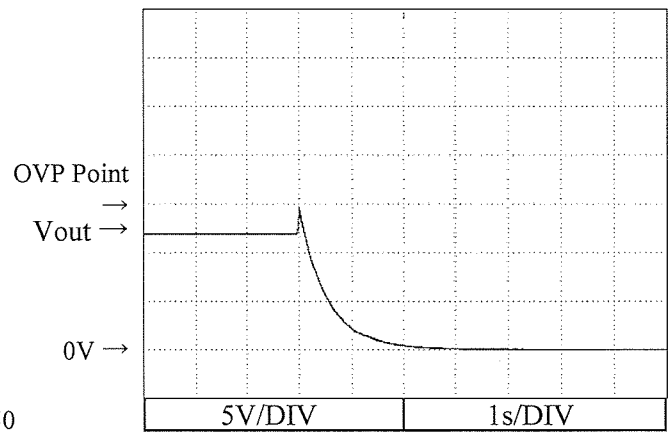
5V



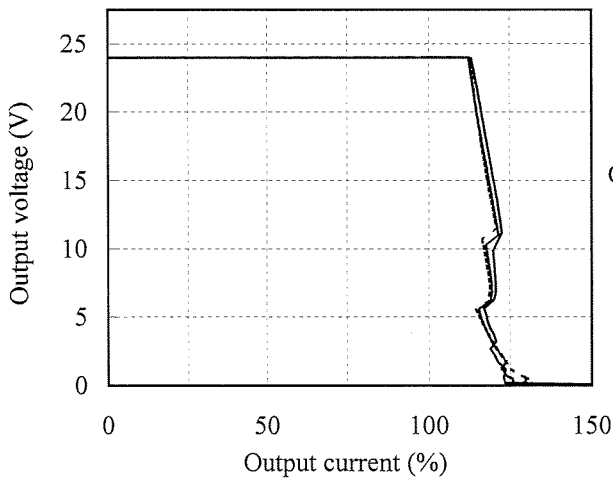


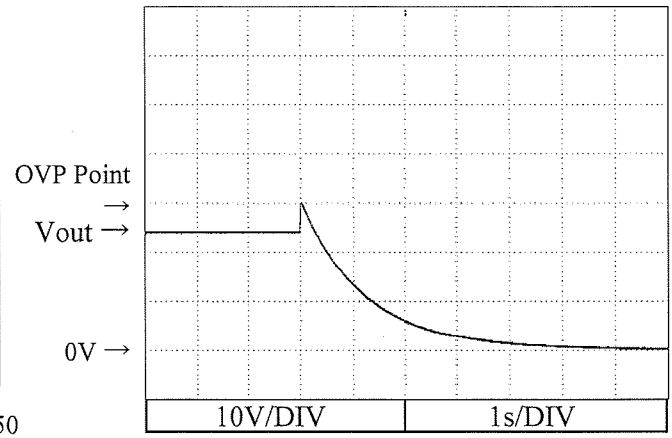
12V





24V

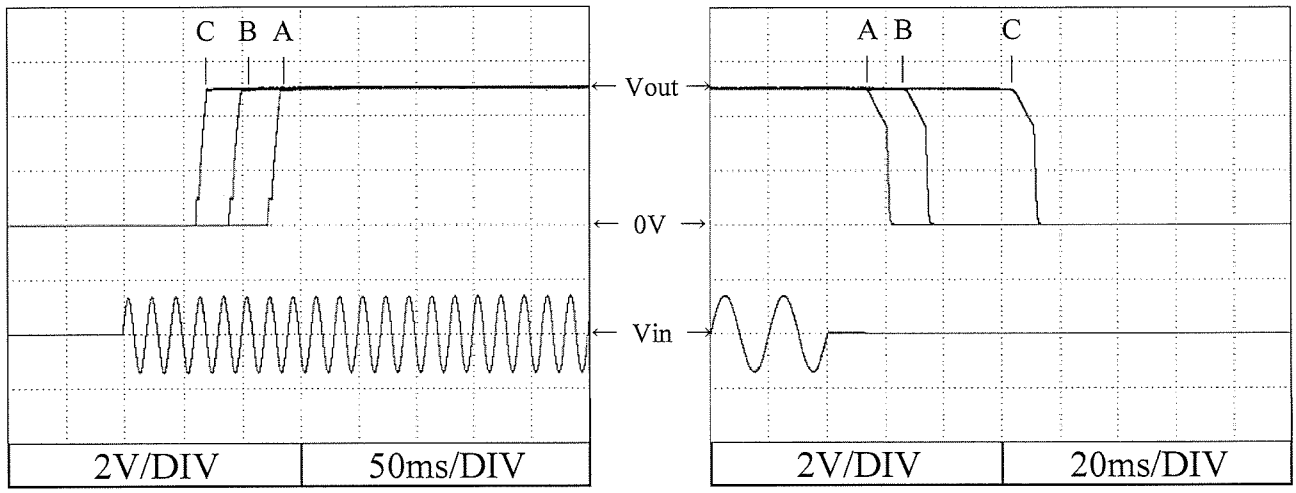




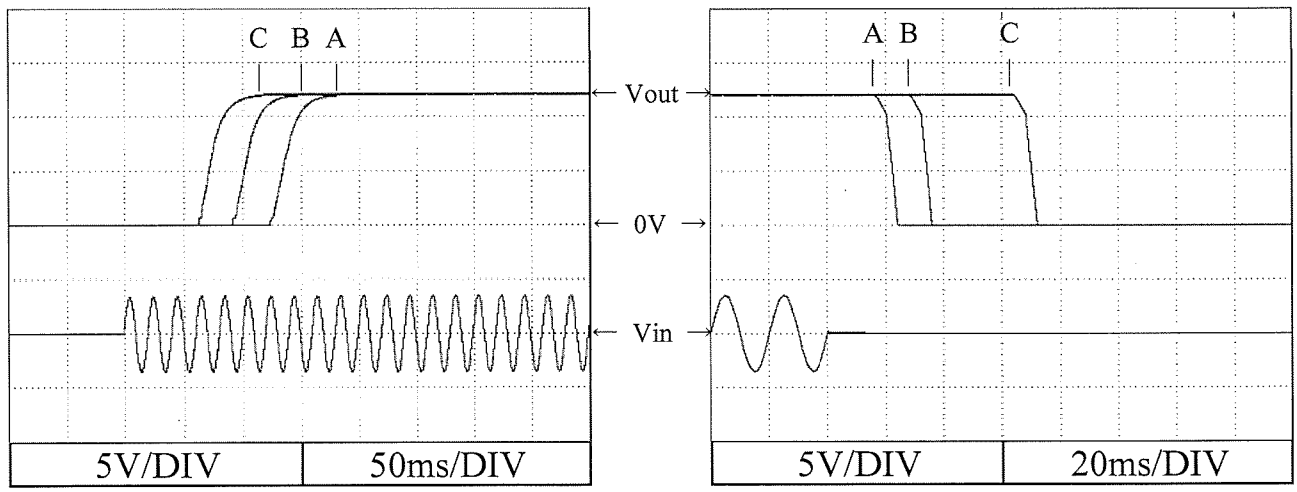
2.4 出力立ち上がり特性、出力立ち下がり特性
Output rise characteristics, Output fall characteristics

Conditions Vin : 85 VAC (A)
100 VAC (B)
132 VAC (C)
Iout : 100 %
Ta : 25 ℃

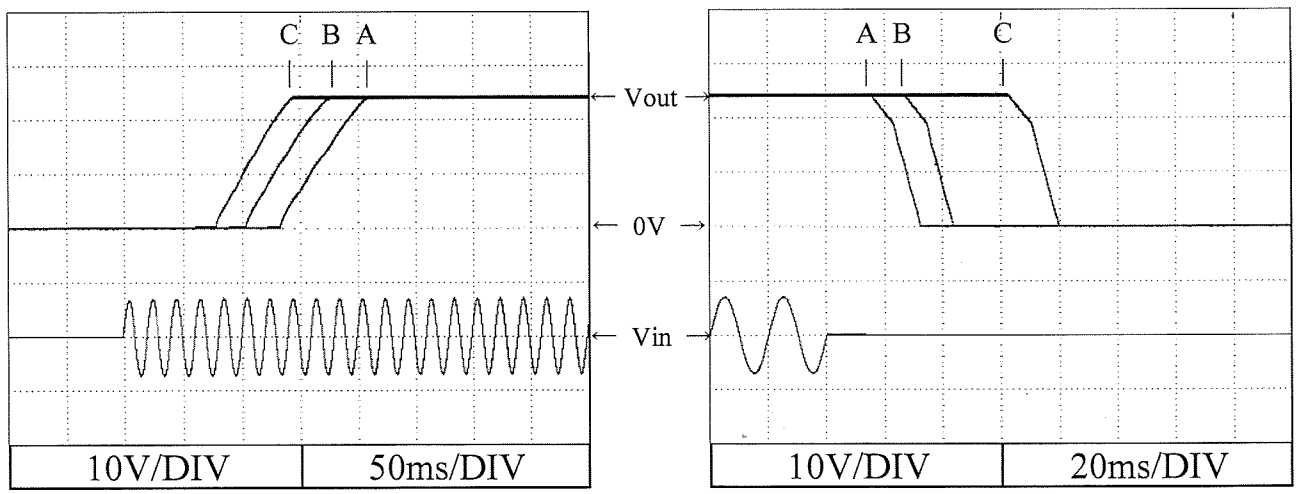
5V



12V



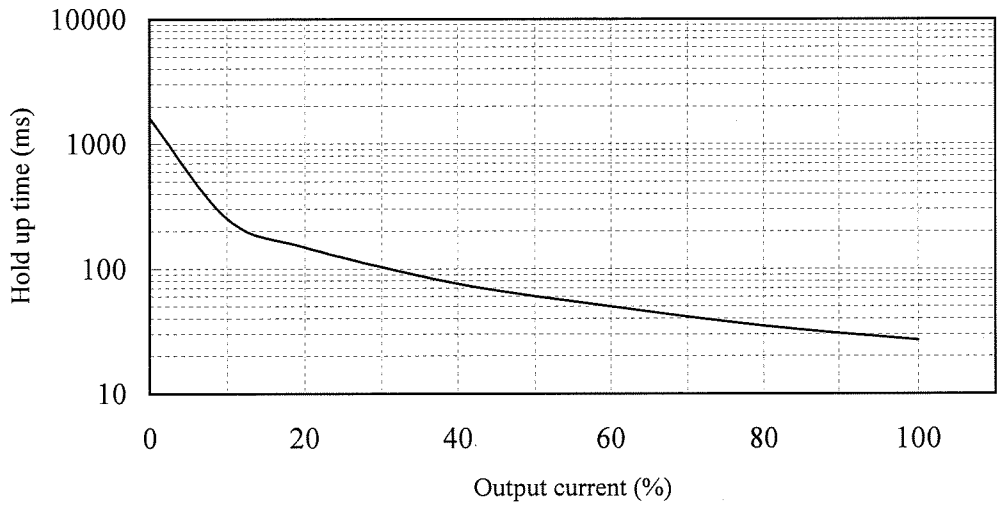
24V



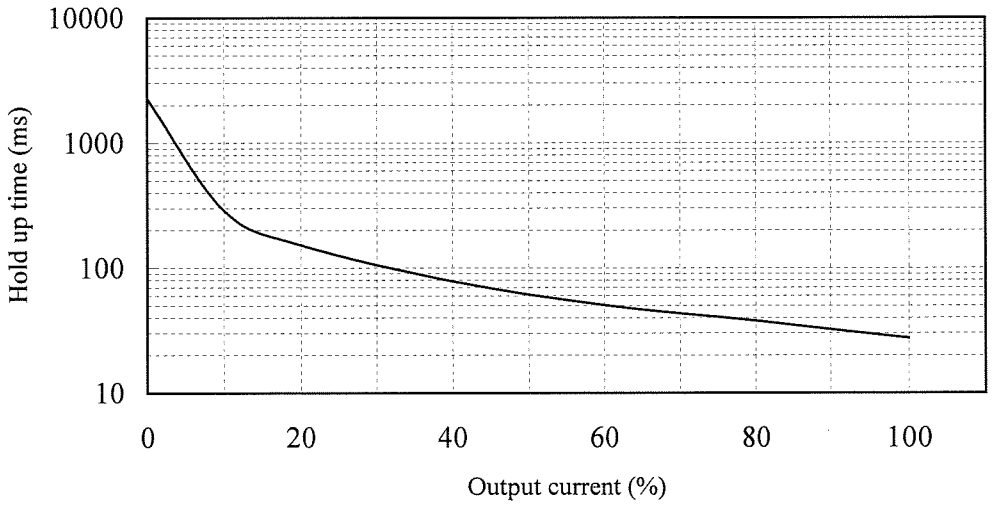
2.5 出力保持時間特性
Hold up time characteristics

Conditions Vin : 100 VAC
Ta : 25 ℃

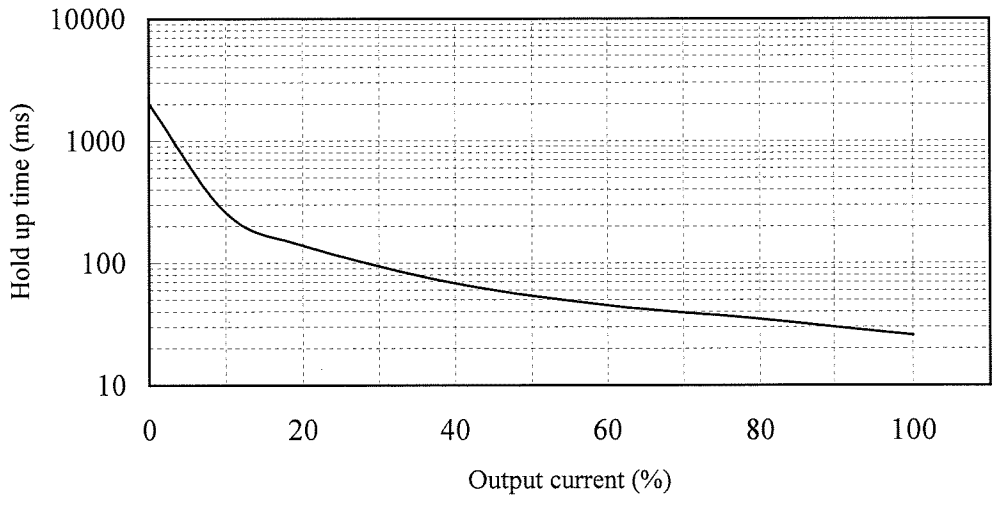
5V



12V



24V



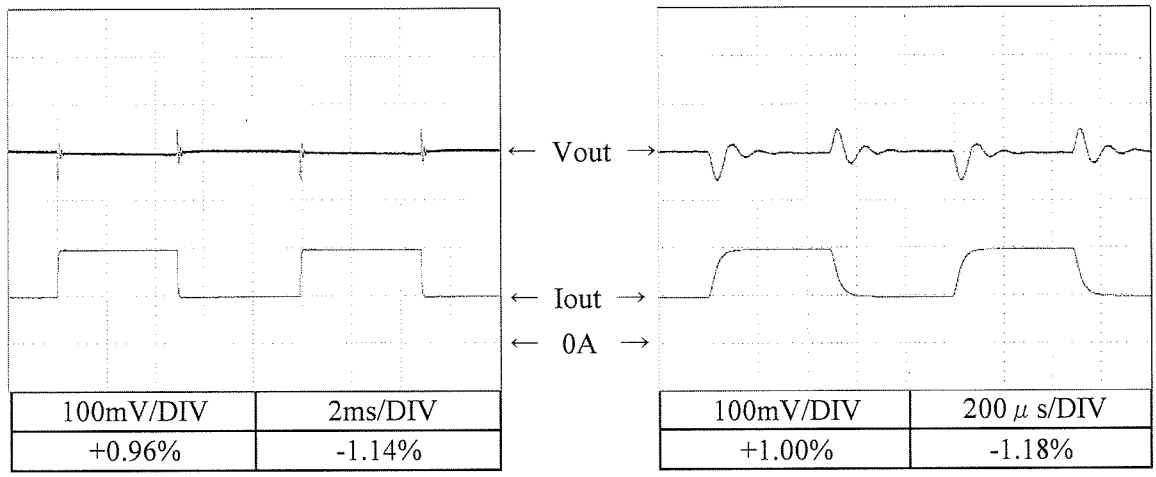
2.6 過渡応答（負荷急変）特性

Dynamic load response characteristics

Conditions Vin : 100 VAC
Io : 50 % ⟷ 100 %
(tr = tf = 50us)
Ta : 25 ℃

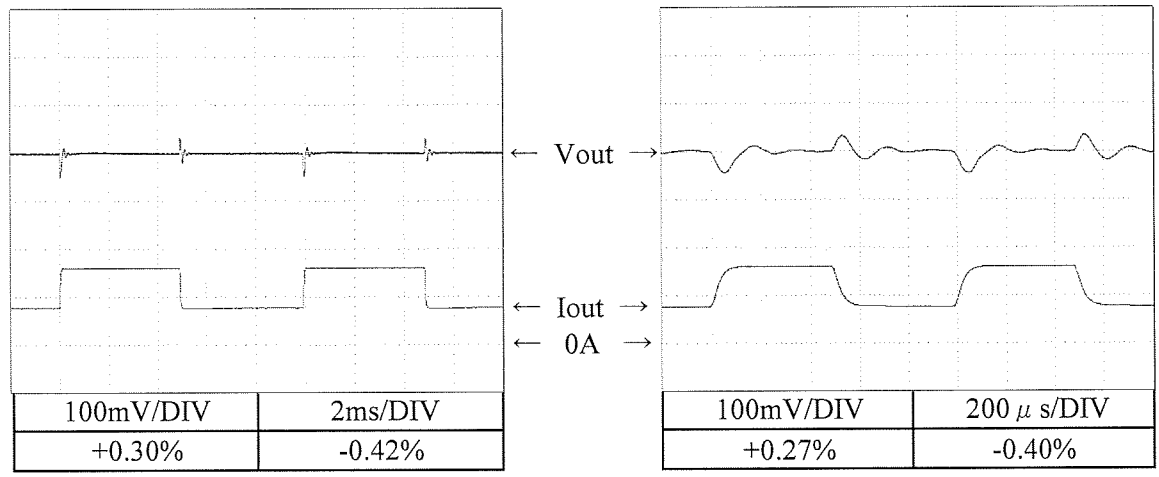
f = 100Hz　　f = 1kHz

5V



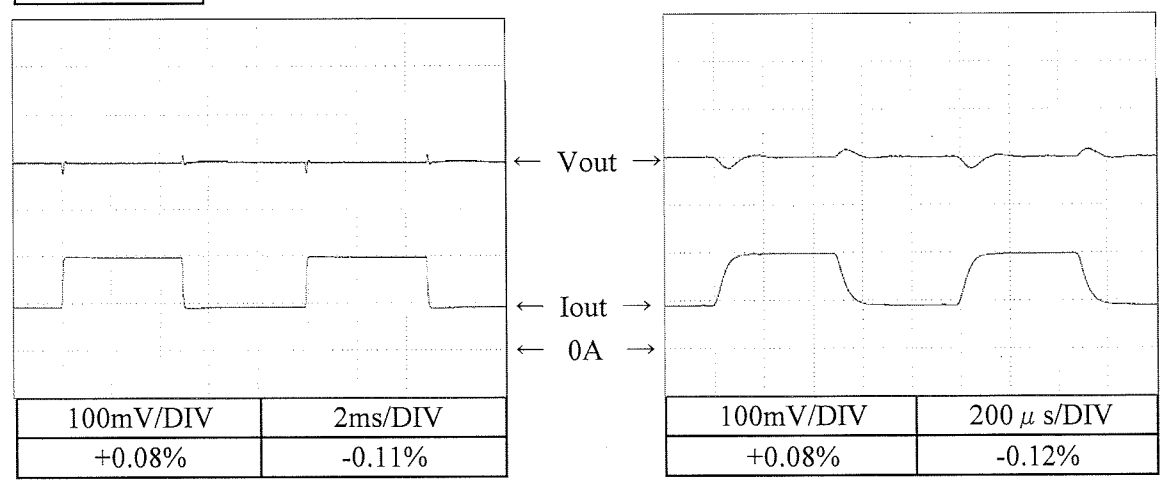
100mV/DIV	2ms/DIV	100mV/DIV	200 μ s/DIV
+0.96%	-1.14%	+1.00%	-1.18%

12V



100mV/DIV	2ms/DIV	100mV/DIV	200 μ s/DIV
+0.30%	-0.42%	+0.27%	-0.40%

24V



100mV/DIV	2ms/DIV	100mV/DIV	200 μ s/DIV
+0.08%	-0.11%	+0.08%	-0.12%

2.7 入力電圧瞬停特性

Response to brown out characteristics

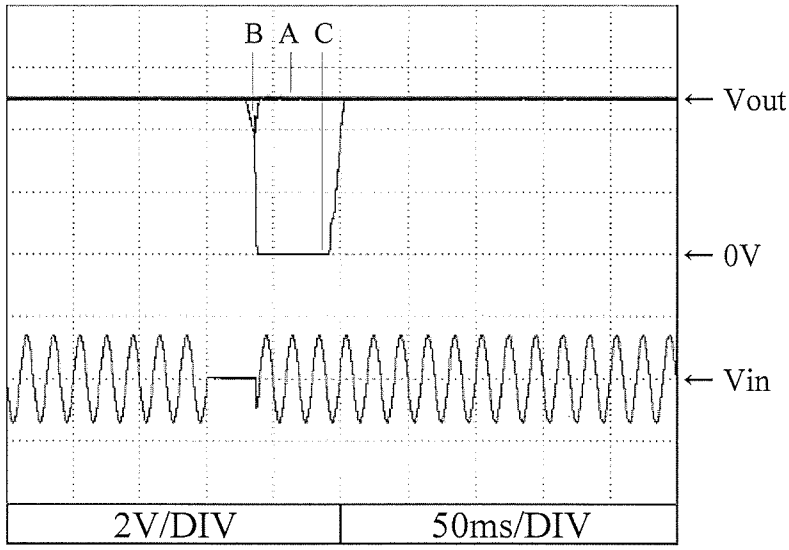
Conditions Vin : 100 VAC
Iout : 100 %
Ta : 25 ℃

5V

A = 27ms

B = 36ms

C = 37ms

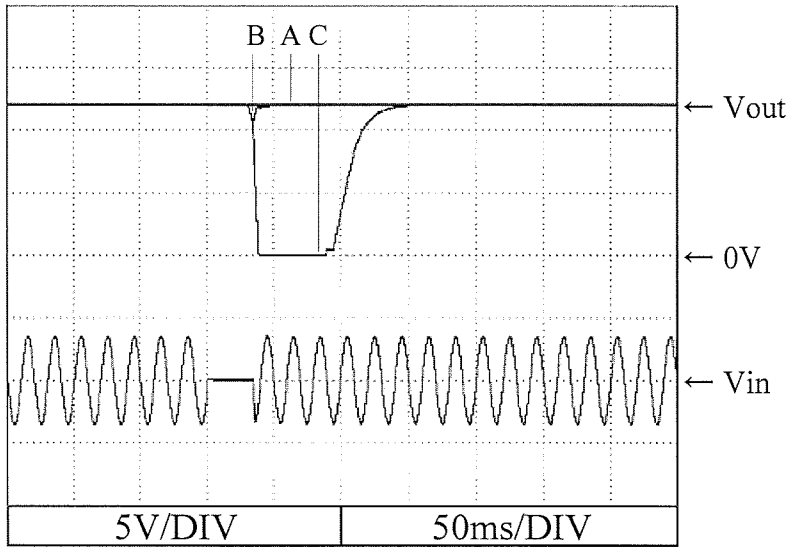


12V

A = 27ms

B = 34ms

C = 35ms

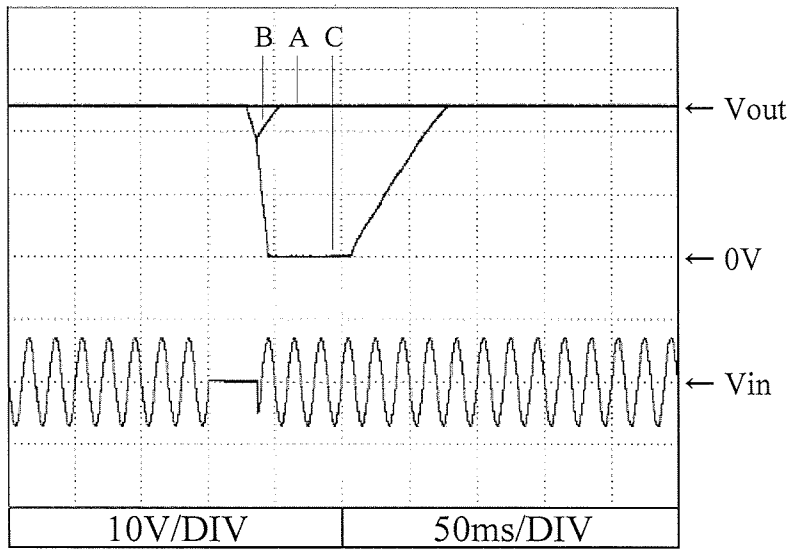


24V

A = 27ms

B = 36ms

C = 37ms

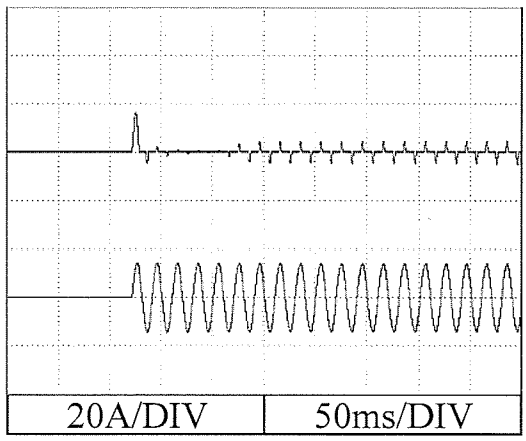


2.8 入力サージ電流（突入電流）特性
Inrush current waveform

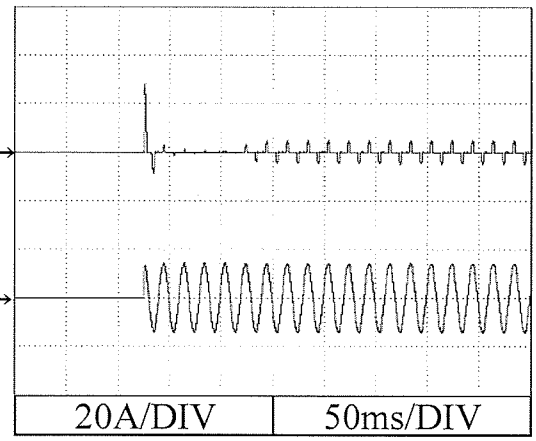
Conditions Vin : 100 VAC
Iout : 100 %
Ta : 25 ℃

5V

Switch on phase angle of input AC voltage
ϕ = 0°



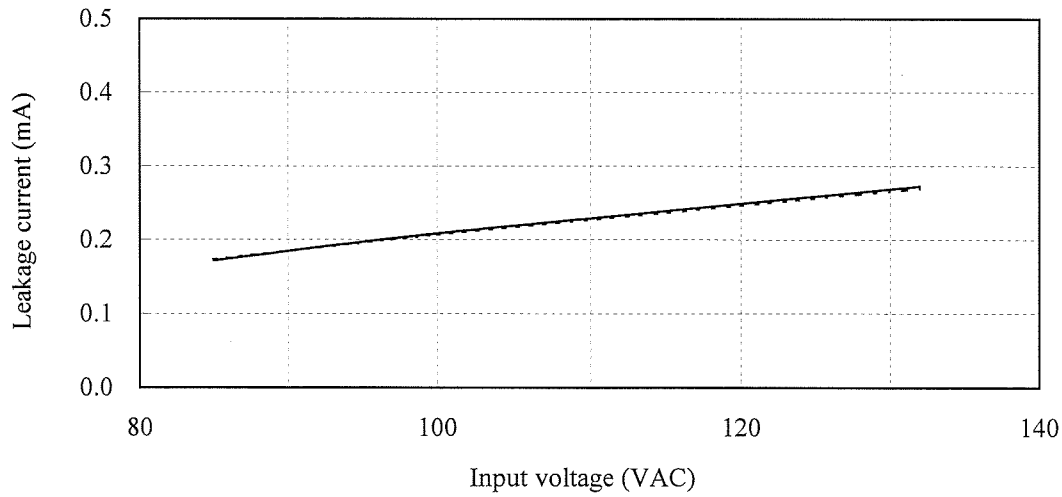
Switch on phase angle of input AC voltage
ϕ = 90°



2.9 リーク電流特性
Leakage current characteristics

Conditions Iout : 0 % ------
100 % ——
Ta : 25 ℃
f : 50 Hz
Equipment used : 3156 (HIOKI)

5V

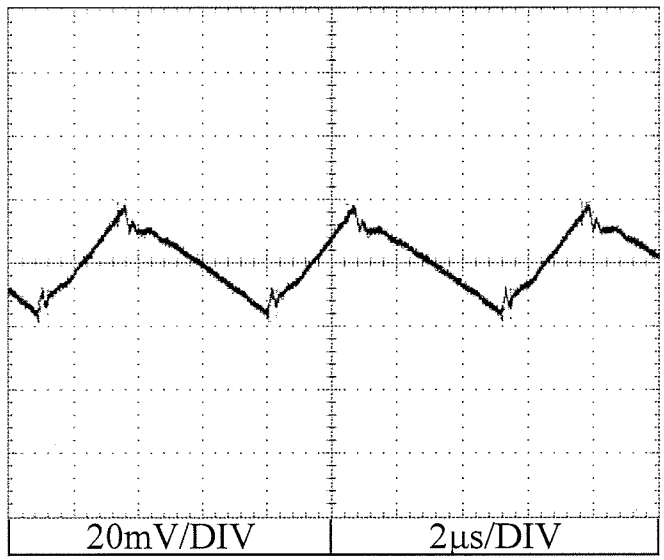


2. 10 出力リップル、ノイズ波形
Output ripple and noise waveform

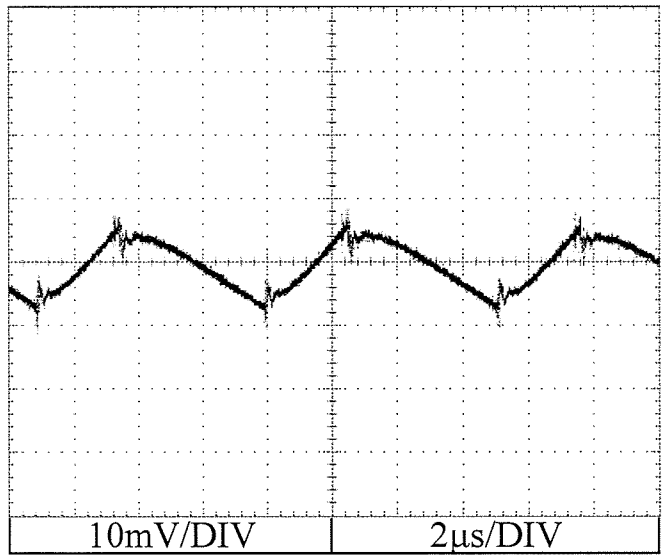
Conditions Vin : 100 VAC
Iout : 100 %
Ta : 25 ℃

NORMAL MODE

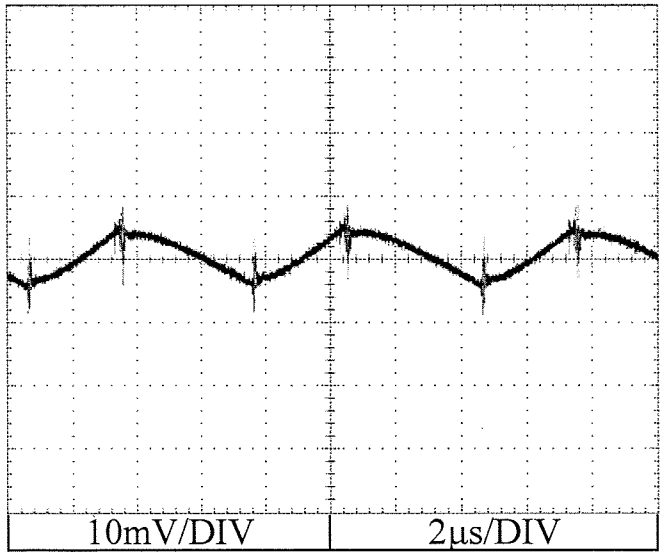
5V



12V



24V



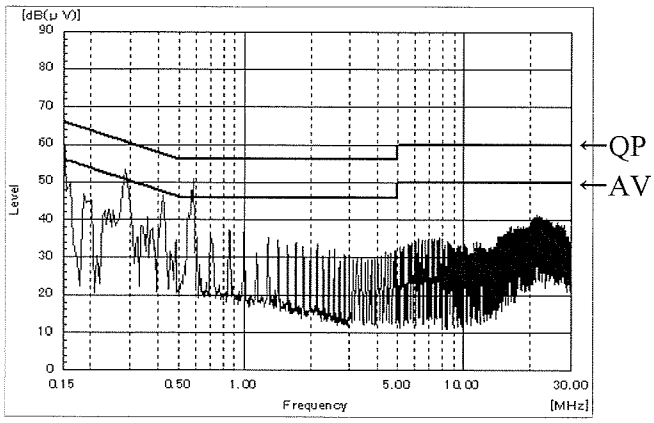
2.11 ＥＭＩ特性
Electro-Magnetic Interference characteristics

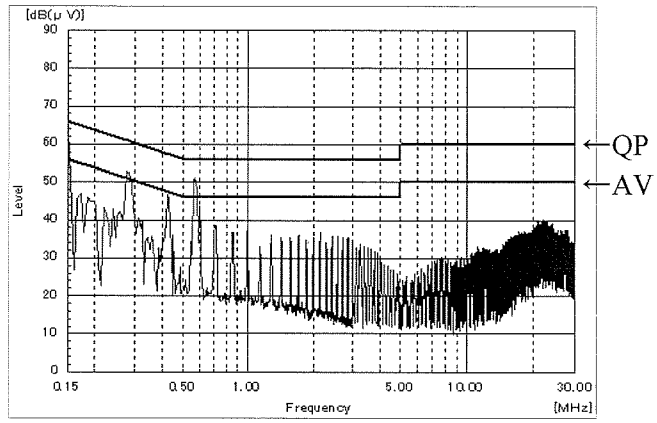
雑音端子電圧
Conducted Emission

Conditions　Vin :　100 VAC
Io :　100 %

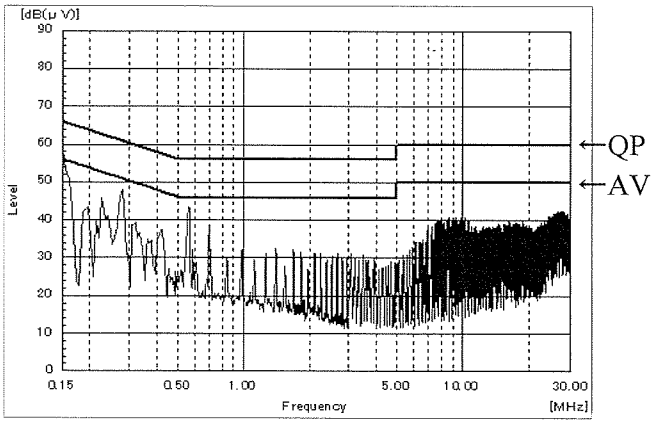
Phase : N　　Phase : L

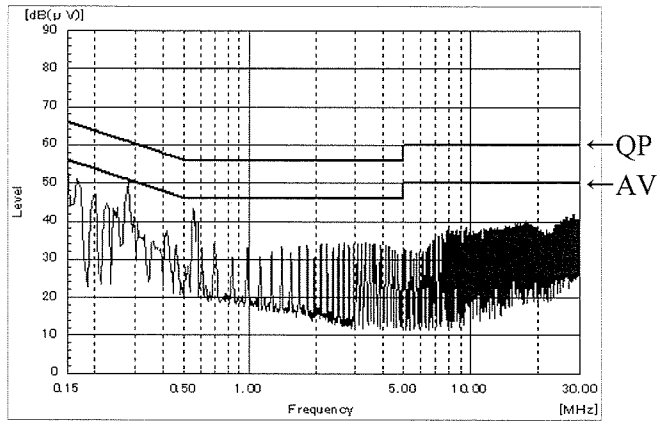
5V



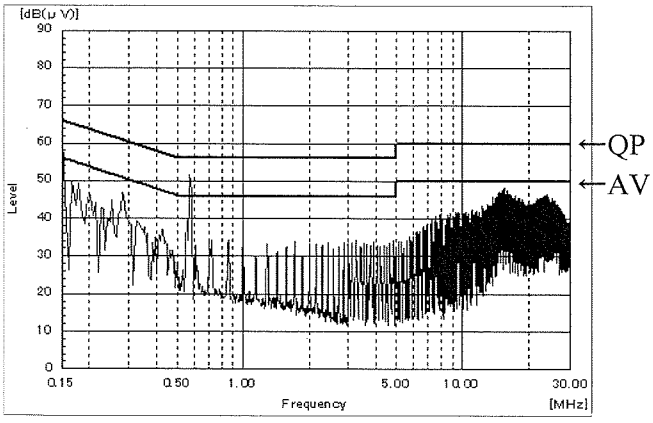


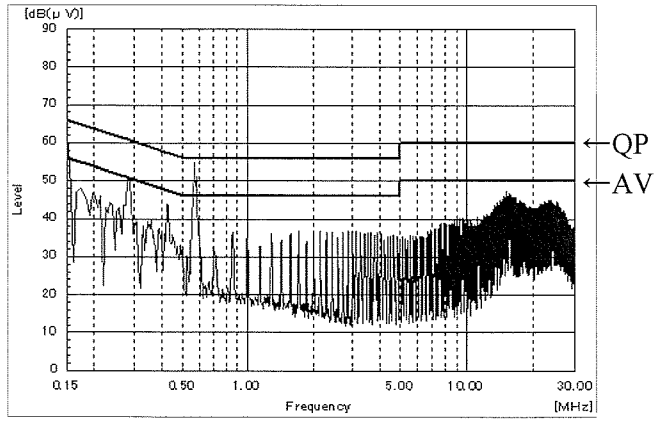
12V





24V





EN55011-B,EN55022-Bの限界値はVCCI class Bの限界値と同じ
Limit of EN55011-B,EN55022-B are same as its VCCI class B.

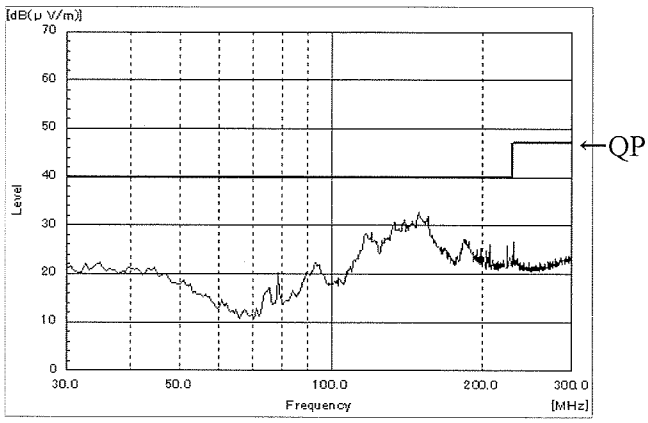
表示はピーク値です。
Indication is peak values.

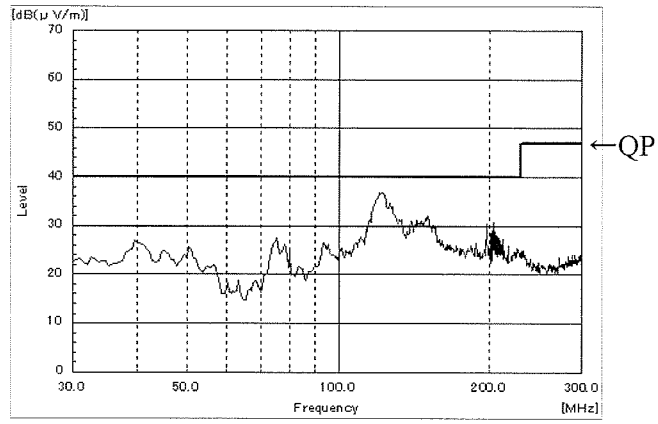
雑音電界強度
Radiated Emission

Conditions Vin : 100 VAC
Io : 100 %

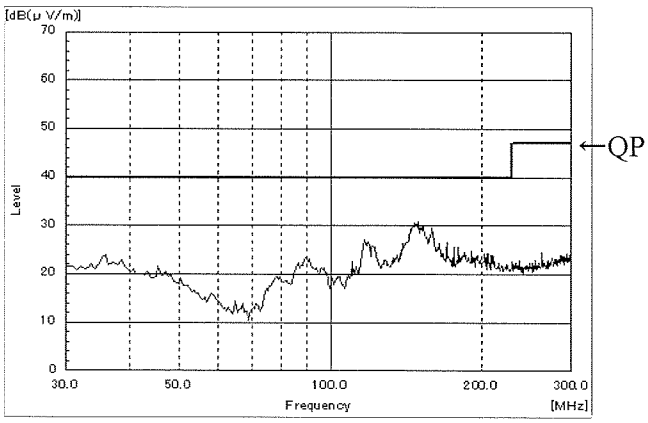
HORIZONTAL VERTICAL

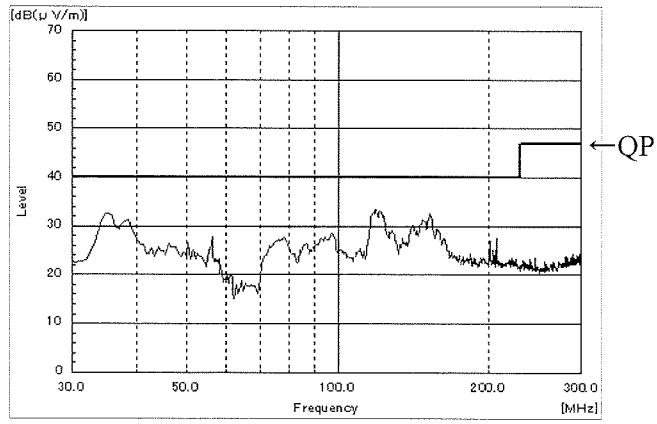
5V



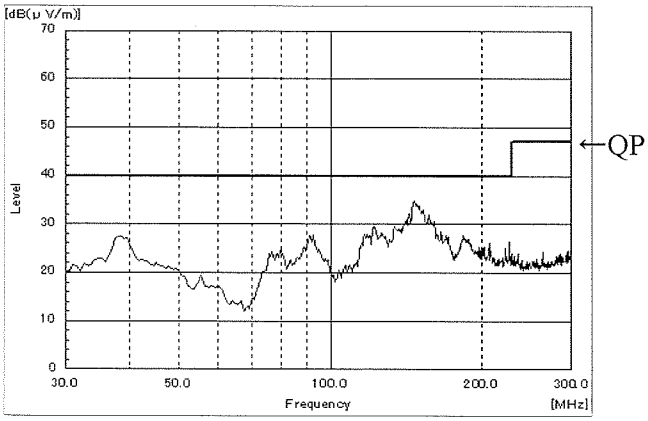


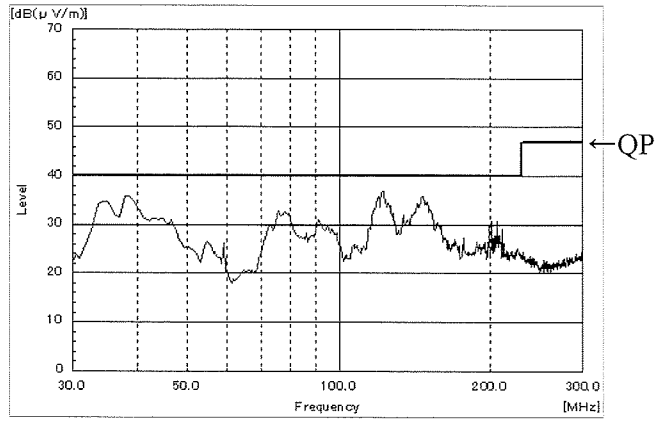
12V





24V





EN55011-B,EN55022-Bの限界値はVCCI class Bの限界値と同じ
Limit of EN55011-B,EN55022-B are same as its VCCI class B.

表示はピーク値です。
Indication is peak values.

VS100E

RELIABILITY DATA

信頼性データ

DWG No. A241-57-01		
APPD	CHK	DWG
H.Matsumoto	Y.Noguchi	Shimamune
5/Dec/'08	5.Dec.'08	5.Dec,'08

INDEX

※ 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 : VS100E-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＞

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

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)

Ni : 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-9102

MTBF ≒ 557,942 時間 (Hours)

RCR-9102B

MTBF ≒ 370,200 時間 (Hours)

2. 部品ディレーティング Components Derating

MODEL : VS100E-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 :100VAC Input voltage	・出力電圧、電流 :5V,20A 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

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

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
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
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
Pc(max) :最大コレクタ(チャネル)損失
(Pch(max)) Maximum Collector (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-l :接合点(チャネル)からリードまでの熱抵抗
(θch-l) Thermal Impedance between Junction (channel) and Lead
θj-a :接合点(チャネル)から周囲までの熱抵抗
(θch-a) Thermal Impedance between Junction (channel) and Ambient

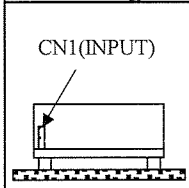
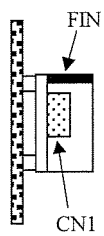
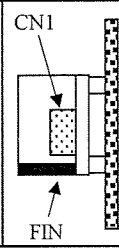
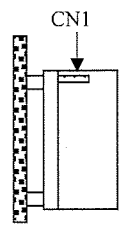
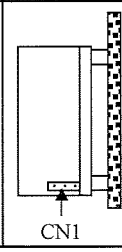
(2) 部品ディレーティング表 Component Derating List

部品番号 Location No.	Vin = 100VAC	Load = 100%	Ta = 50℃
Q1 FMP16N50E FUJI ELECTRIC	Tch (max) = 150 ℃ Pch= 2.5 W Tch= T c+ ((θch-c) × Pch)= 114.3 ℃ D.F. = 76.2 %	θch-c = 0.56 ℃/W ΔTc= 62.9 ℃	Pch (max) = 225 W Tc= 112.9 ℃
Q51 H7N0308CF RENESAS	Tch (max) = 150 ℃ Pch = 1.5 W Tch = Tc + ((θch-c) × Pch) = 118.0 ℃ D.F. = 78.7 %	θch-c = 4.17 ℃/W ΔTc = 61.6 ℃	Pch (max) = 30 W Tc= 111.6 ℃
Q52 H7N0308CF RENESAS	Tch (max) = 150 ℃ Pch = 0.6 W Tch = Tc + ((θch-c) × Pch) = 110.9 ℃ D.F. = 73.9 %	θch-c = 4.17 ℃/W ΔTc = 58.3 ℃	Pch (max) = 30 W Tc= 108.3 ℃
D1 D3SB60 SHINDENGEN	Tj (max) = 150 ℃ Pd = 4.4 W Tj = Tc + ((θj-c) × Pd) = 121.9 ℃ D.F. = 81.3 %	θj-c = 5.5 ℃/W ΔTc = 47.7 ℃	Tc= 97.7 ℃
D52 YG838C03R FUJI ELECTRIC	Tj (max) = 150 ℃ Pd = 1.7 W Tj = Tc + ((θj-c) × Pd) = 112.3 ℃ D.F. = 74.9 %	θj-c = 2.0 ℃/W ΔTc = 58.9 ℃	Tc= 108.9 ℃
A101 FA3647N FUJI ELECTRIC	Tj (max) = 125 ℃ Pd = 86.0 mW Tj = Tc + ((θj-c) × Pd) = 79.0 ℃ D.F. = 52.7 %	θj-c = 72 ℃/W ΔTc = 22.8 ℃	Pd (max) = 300 mW Tc= 72.8 ℃
A102 BA2903F ROHM	Tj (max) = 125 ℃ Pd = 4.0 mW Tj = Ta + ((θj-a) × Pd) = 78.3 ℃ D.F. = 52.2 %	θj-a = 160 ℃/W ΔTa = 27.7 ℃	Pd (max) = 622.5 mW Ta= 77.7 ℃
PC2 PS2581L1 NEC	Tj (max) = 125 ℃ Pd = 2.0 mW Tj = Tc + ((θj-c) × Pd) = 70.2 ℃ D.F. = 56.2 %	θj-c = 150℃/W ΔTc = 19.9 ℃	Pd (max)= 150 mW Tc= 69.9 ℃

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

MODEL : VS100E-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)	20				

(2) 測定結果 Measuring Results

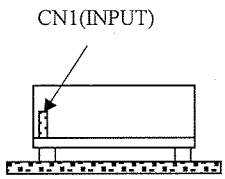
		ΔT Temperature Rise (℃)				
出力ディレーティング Output Derating (%)		100				
		Ta=50℃	Ta=50℃	Ta=40℃	Ta=40℃	Ta=40℃
部品番号 Location No.	部品名 Part name	取付方向 Mounting A	取付方向 Mounting B	取付方向 Mounting C	取付方向 Mounting D	取付方向 Mounting E
Q1	MOS FET	62.9	60.4	51.0	61.9	61.5
Q51	MOS FET	61.6	60.0	57.8	57.4	61.7
Q52	MOS FET	58.3	56.3	54.6	53.9	59.9
D52	SBD	58.9	57.2	55.6	54.5	60.3
D1	BRIDGE DIODE	47.7	49.8	46.1	50.2	46.8
A101	CHIP IC	22.8	21.2	37.4	29.7	31.0
A102	CHIP IC	27.7	25.2	36.7	34.5	33.8
A201	CHIP IC	19.6	18.5	34.8	23.1	30.8
T1	TRANS	45.4	41.7	48.2	45.2	48.0
L1	BALUN	37.5	38.7	37.3	43.4	35.0
L51	CHOKE COIL	41.7	40.5	47.4	42.0	51.1
C5	E.CAP.	26.7	23.7	30.2	31.8	25.6
C6	E.CAP.	17.6	16.3	30.8	25.2	22.6
C51	E.CAP.	40.4	33.3	40.8	34.7	45.7
C52	E.CAP.	28.3	24.8	36.1	29.2	38.3
PC2	PHOTO COUPLER	19.9	19.4	38.4	27.1	30.5

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

MODEL : VS100E-5

空冷条件：自然空冷
Cooling Condition : Convection Cooling

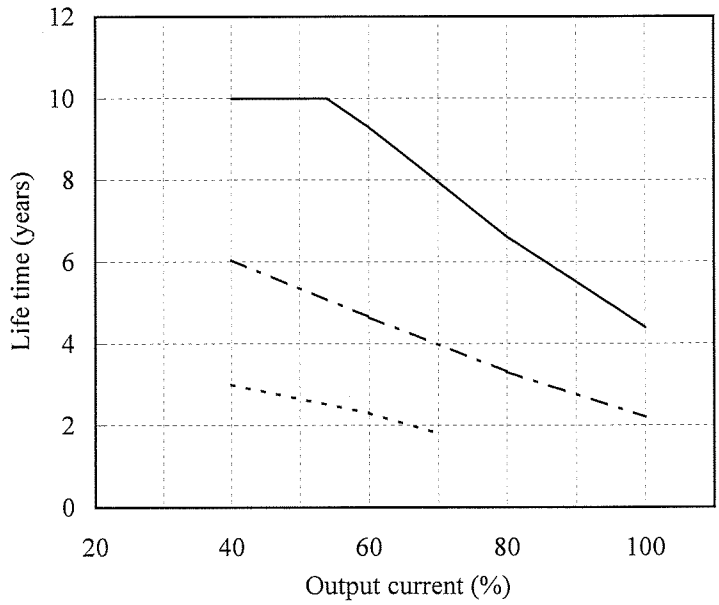
取付方向 A
Mounting A



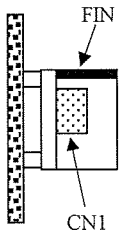
Vin=100VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
40	10.0	6.0	3.0
60	9.3	4.6	2.3
80	6.6	3.3	-
100	4.4	2.2	-

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



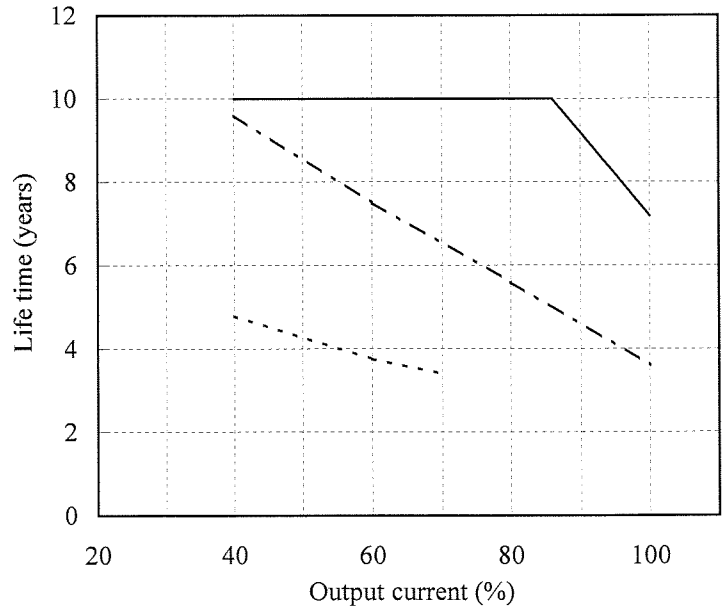
取付方向 B
Mounting B



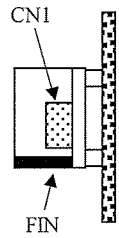
Vin=100VAC

Load (%)	Lifetime (years)		
	Ta= 40℃	Ta= 50℃	Ta= 60℃
40	10.0	9.6	4.8
60	10.0	7.5	3.7
80	10.0	5.6	-
100	7.2	3.6	-

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

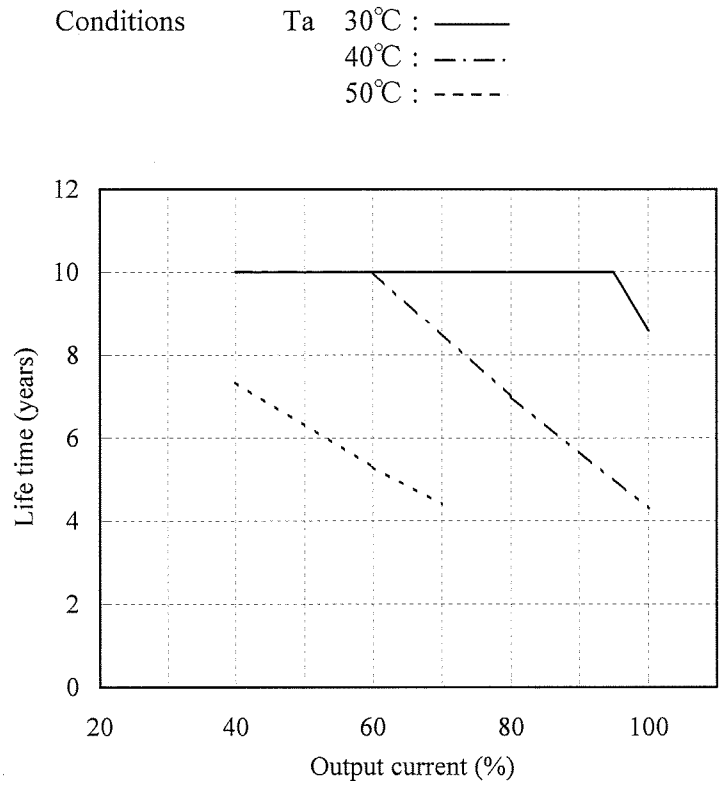


取付方向 C
Mounting C

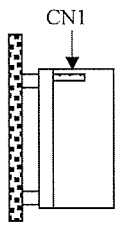


Vin=100VAC

Load (%)	Lifetime (years)		
	Ta= 30℃	Ta= 40℃	Ta= 50℃
40	10.0	10.0	7.3
60	10.0	10.0	5.3
80	10.0	7.0	-
100	8.6	4.3	-

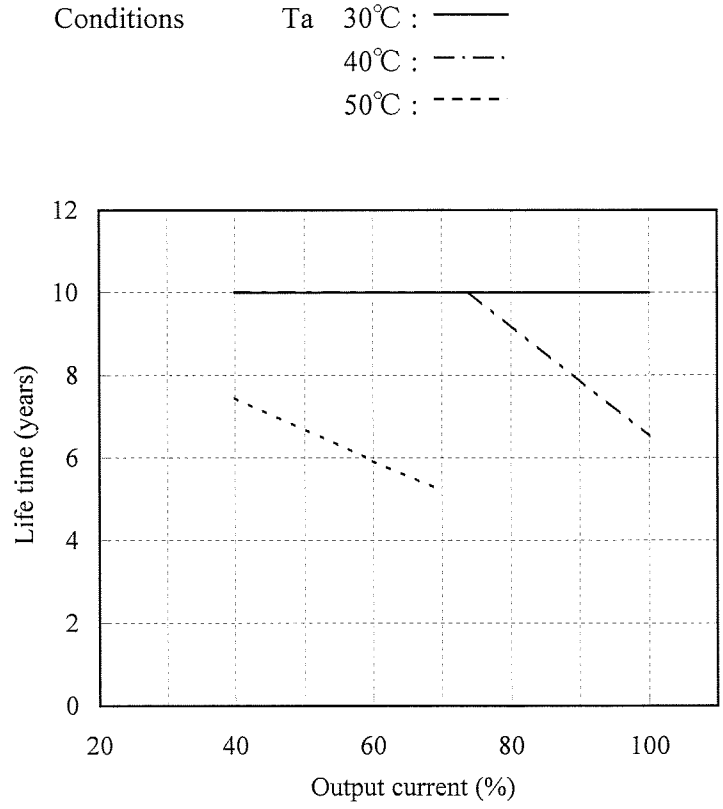


取付方向 D
Mounting D

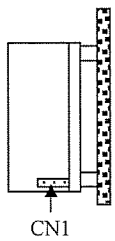


Vin=100VAC

Load (%)	Lifetime (years)		
	Ta= 30℃	Ta= 40℃	Ta= 50℃
40	10.0	10.0	7.4
60	10.0	10.0	5.9
80	10.0	9.1	-
100	10.0	6.5	-



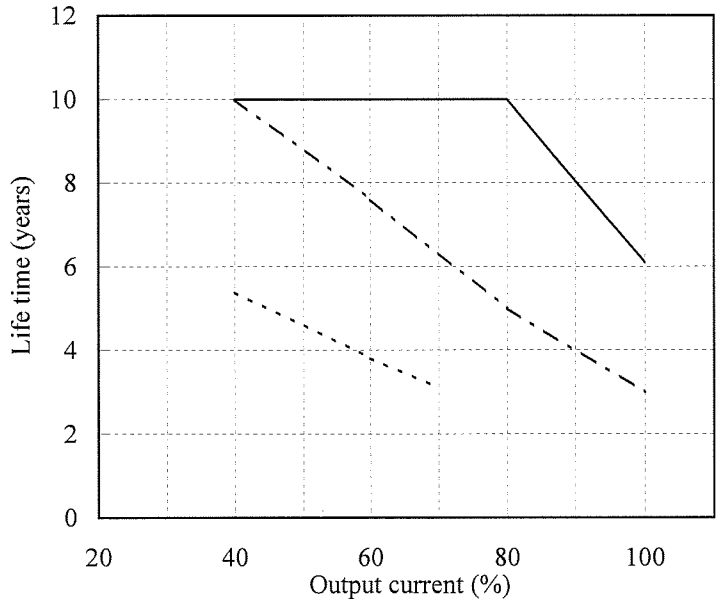
取付方向 E
Mounting E



Vin=100VAC

Load (%)	Lifetime (years)		
	Ta= 30℃	Ta= 40℃	Ta= 50℃
40	10.0	10.0	5.4
60	10.0	7.6	3.8
80	10.0	5.0	-
100	6.1	3.0	-

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



5. アブノーマル試験 **Abnormal Test**

MODEL : VS100E-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												
					a	b	c	d	e	f	g	h	I	j	k	l	
	Location No.	Test point	Short	Open	Fire	Smoke	Burst	Smell	Red hot	Damaged	Fuse blown	O.V.P.	O.C.P.	No output	No change	Others	Note
1	Q1	D-S	○							○	○			○			Da :D101, D102, R111, R112
2		D-G	○							○	○			○			Da :Q1, D101, D102, R111, R112, Q103, A101
3		G-S	○											○			
4		D		○										○			
5		S		○										○			
6		G		○						○	○			○			Da : Q1, D101, D102, R111, R112
7	Q51	D-S	○										○				
8		D-G	○										○				
9		G-S	○							○						○	Da : R201 Input power increase
10		D		○						○	○			○			Da : Q1, D101, D102, R111, R112
11		S		○						○	○			○			Da : D101, D102, R111, R112
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	D52	A-K	○										○				
23		A		○												○	Input power increase
24		K		○												○	Input power increase
25	T1	1-3	○											○			
26		5-6	○											○			
27		7-8	○											○			
28		9-11	○										○				
29		1		○										○			
30		5		○										○			
31		7		○												○	Input voltage increase
32		9 (10)		○										○			

6. 振動試験 Vibration Test

MODEL : VS100E-5

(1) 振動試験種類 Vibration Test Class

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

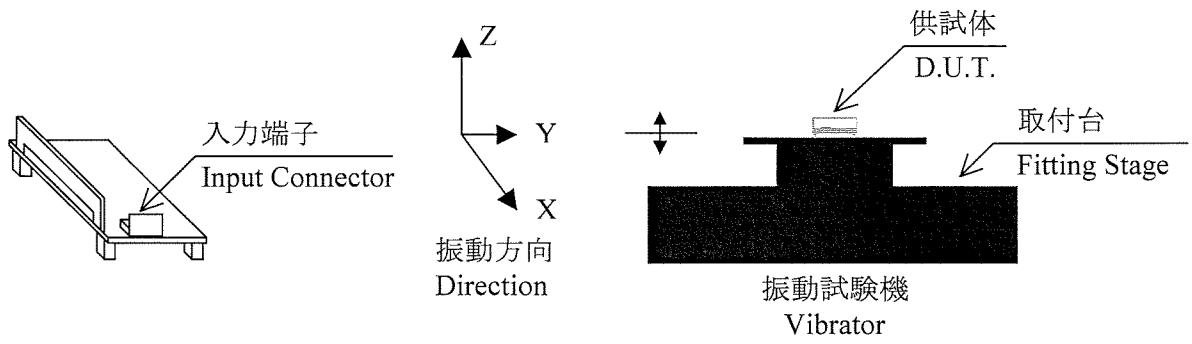
(2) 使用振動試験装置 Equipment Used

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	: 1.0min	・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.

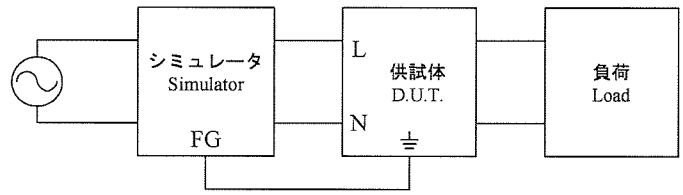
(6) 試験結果 Test Results

合格 **OK**

7. ノイズシミュレート試験 Noise Simulate Test

MODEL : VS100E-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℃	・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

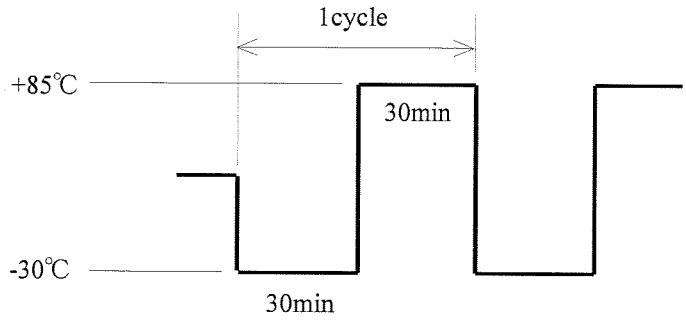
MODEL : VS100E-5

(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℃ ⇔ 85℃
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

VS100E

TEST DATA
IEC61000 SERIES

テストデータ
IEC61000シリーズ

DWG No. A241-58-01		
APPD	CHK	DWG
H.Matsumoto	Y.Noguchi	Shimamune
2/Dec/'08	2.Dec.'08	2,Dec,'08

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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. 静電気放電イミュニティ試験
Electrostatic Discharge Immunity Test (IEC61000-4-2)

MODEL : VS100E

(1) 使用計測器 Equipment Used

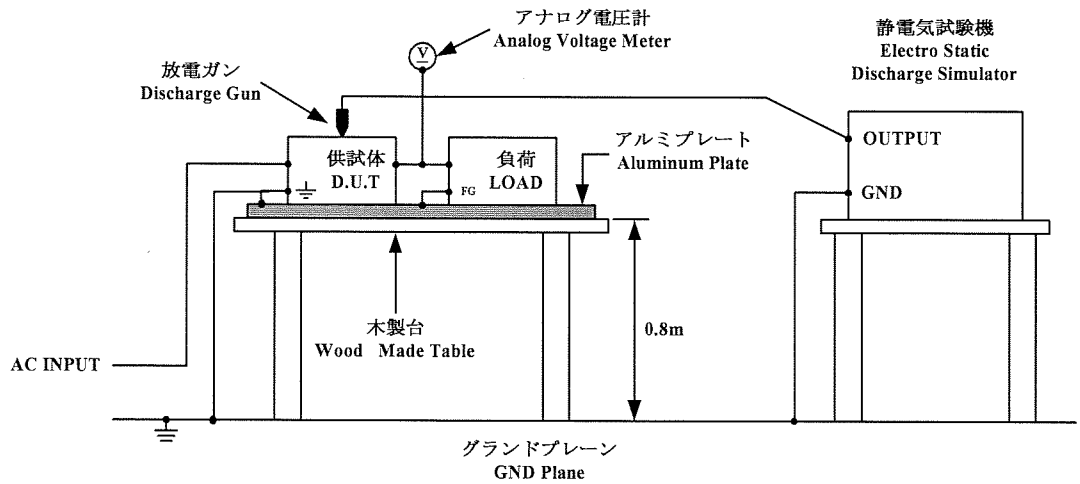
静電気試験機 Electro Static Discharge Simulator	:NSG435 (SCHAFFNER)		
放電抵抗 Discharge Resistance	:330Ω	静電容量 Capacity	:150pF

(2) 試験条件 Test Conditions

・入力電圧 Input Voltage	:100VAC	・出力電圧 Output Voltage	:定格 Rated
・出力電流 Output Current	:100%	・極性 Polarity	:+,−
・試験回数 Test Times	:10回 10 times	・放電間隔 Discharge Interval	:＞1秒 ＞1 second
・周囲温度 Ambient Temperature	:25℃		

(3) 試験方法及び印加箇所 Test Method and Device Test Point

接触放電 :⏚、ネジ止め部
Contact Discharge ⏚, Screw
気中放電 :入出力端子、⏚、ネジ止め部
Air Discharge Input and output terminal, ⏚, Screw



(4) 判定条件 Acceptable Conditions

1. 試験中の出力電圧変動は初期値(試験前)の±5%を限度とする事。
Output voltage regulation not to exceed ±5% of initial (before test) 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。
Output voltage to be within regulation specification after the test.
3. 1、2共に発煙／発火及び出力ダウンなき事。
Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) 試験結果 Test Result

Contact Discharge (kV)	VS100E-5	VS100E-24	Air Discharge(kV)	VS100E-5	VS100E-24
2	PASS	PASS	2	PASS	PASS
4	PASS	PASS	4	PASS	PASS
			8	PASS	PASS

2. 放射性無線周波数電磁界イミュニティ試験
Radiated Radio-Frequency Electromagnetic Field Immunity Test (IEC61000-4-3)

MODEL : VS100E

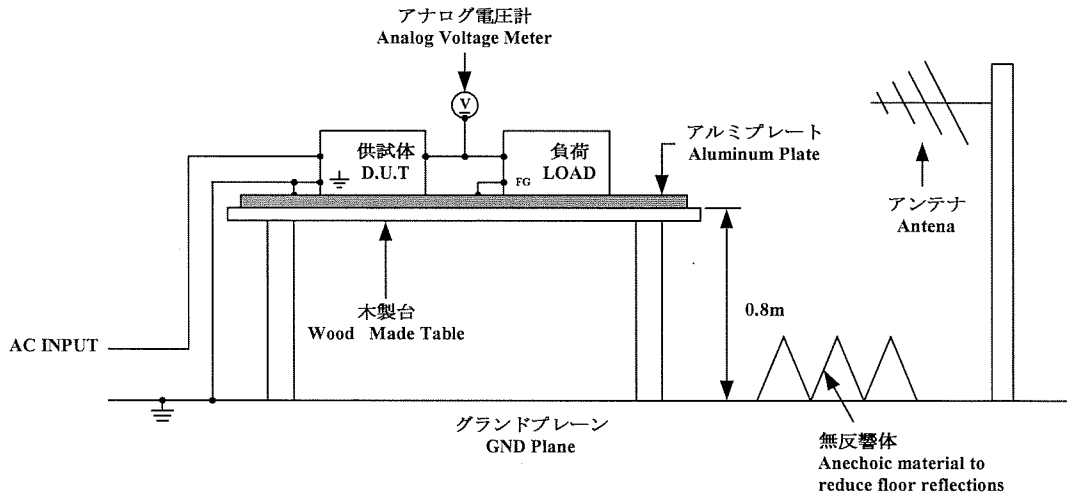
(1) 使用計測器 Equipment Used

シグナルジェネレータ Signal Generator	:8648C (Hewlett Packard)
パワーアンプシステム Power Amplifier System	:AK500-200 (Kalmus)
パワーリフレクションメーター Power Reflection Meter	:NRT (Rohde & Schwarz)
パワーヘッド Power Head	:NAP-Z6 (Rohde & Schwarz)
バイログアンテナ Bilog Antenna	:CBL6140 (Chase)

(2) 試験条件 Test Conditions

・入力電圧 Input Voltage	:100VAC	・出力電圧 Output Voltage	:定格 Rated
・出力電流 Output Current	:100%	・振幅変調 Amplitude Modulated	:80%, 1kHz
・電磁界周波数 Electromagnetic Frequency	:80～1000MHz	・周囲温度 Ambient Temperature	:25℃
・偏波 Wave Angle	:水平、垂直 Horizontal and Vertical	・距離 Distance	:3.0m
・スイープコンディション Sweep Condition	:1.0%ステップ、2.8秒保持 1.0%Step Up, 2.8 Seconds Hold		
・試験方向 Test Angle	:上下、左右、前後 Top/Bottom, Both Sides, Front/Back		

(3) 試験方法 Test Method



(4) 判定条件 Acceptable Conditions

1. 試験中の出力電圧変動は初期値(試験前)の±5%を限度とする事。
   Output voltage regulation not to exceed ±5% of initial (before test) 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。
   Output voltage to be within regulation specification after the test.
3. 1、2共に発煙／発火及び出力ダウンなき事。
   Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) 試験結果 Test Result

Radiation Field Strength (V/m)	VS100E-5	VS100E-24
1	PASS	PASS
3	PASS	PASS
10	PASS	PASS

3. 電気的ファーストトランジェントバーストイミュニティ試験
Electrical Fast Transient / Burst Immunity Test (IEC61000-4-4)

MODEL : VS100E

(1) 使用計測器 Equipment Used

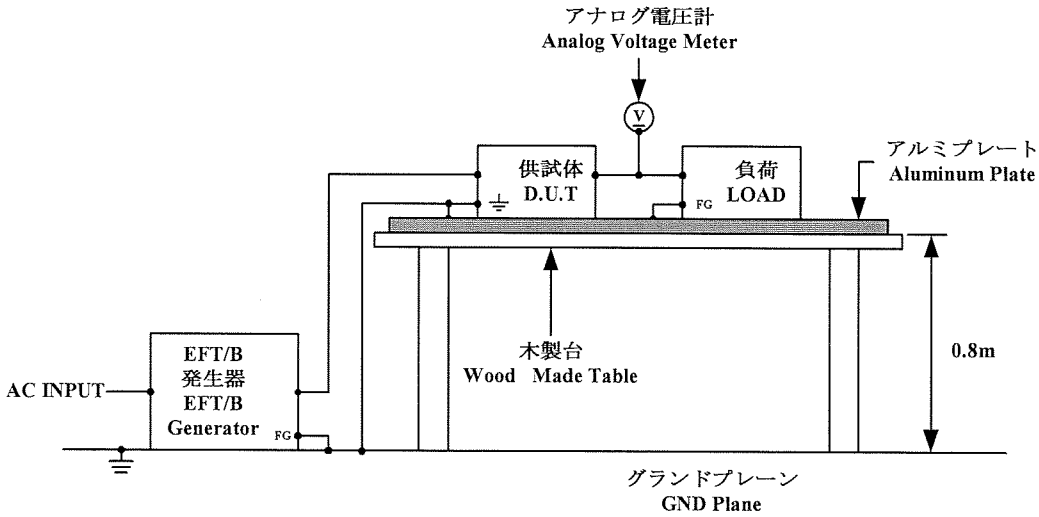
EFT/B発生器 :NSG2025(SCHAFFNER)
EFT/B Generator

(2) 試験条件 Test Conditions

・入力電圧 Input Voltage	:100VAC	・出力電圧 Output Voltage	:定格 Rated
・出力電流 Output Current	:100%	・試験時間 Test Time	:1分間 1 minute
・極性 Polarity	:+,−	・周囲温度 Ambient Temperature	:25℃
・試験回数 Number of Tests	:3回 3 times		

(3) 試験方法及び印加箇所 Test Method and Device Test Point

(N, L, ⏚), (N, L), (N), (L), (⏚)に印加
Apply to (N, L, ⏚), (N, L), (N), (L), (⏚).



(4) 判定条件 Acceptable Conditions

1. 試験中の出力電圧変動は初期値(試験前)の±5%を限度とする事。
Output voltage regulation not to exceed ±5% of initial (before test) 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。
Output voltage to be within output voltage regulation specification after the test.
3. 1、2共に発煙／発火及び出力ダウンなき事。
Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) 試験結果 Test Result

Test Voltage (kV)	Repetition Rate (kHz)	VS100E-5	VS100E-24
0.5	5	PASS	PASS
1	5	PASS	PASS
2	5	PASS	PASS

4. サージイミュニティ試験
Surge Immunity Test (IEC61000-4-5)

MODEL : VS100E

(1) 使用計測器 Equipment Used

サージ発生器 :LSS-15AX (Noiseken)
Surge Generator

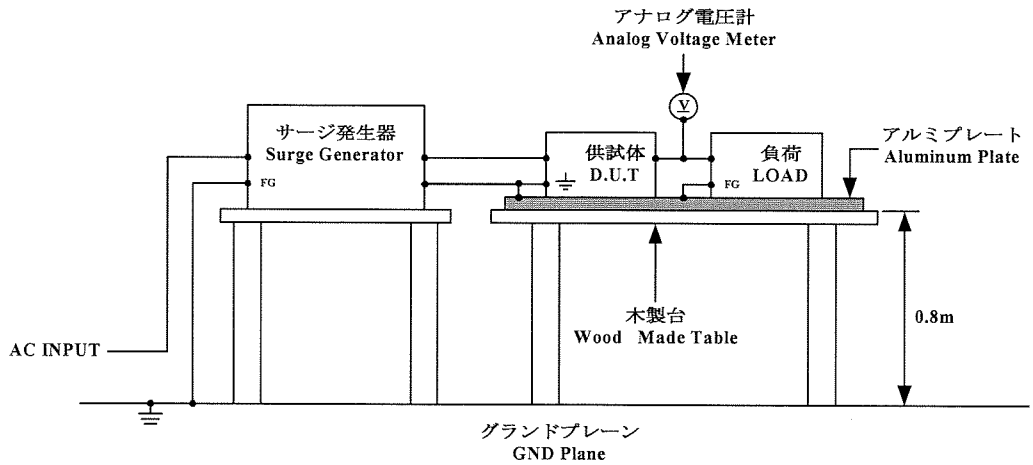
結合インピーダンス	:コモン	12Ω	結合コンデンサ	:コモン	9μF
Coupling Impedance	Common		Coupling Capacitance	Common	
	ノーマル	2Ω		ノーマル	18μF
	Normal			Normal	

(2) 試験条件 Test Conditions

・入力電圧 Input Voltage	:100VAC	・出力電圧 Output Voltage	:定格 Rated
・出力電流 Output Current	:0, 100%	・試験回数 Test times	:3回 3 times
・極性 Polarity	:＋,－	・モード Mode	:コモン、ノーマル Common, Normal
・位相 Phase	:0, 90 deg	・周囲温度 Ambient Temperature	:25℃

(3) 試験方法及び印加箇所 Test Method and Device Test Points

コモンモード (N-⏚, L-⏚) 及びノーマルモード (N-L) に印加
Apply to Common mode (N-⏚, L-⏚) and Normal mode (N-L).



(4) 判定条件 Acceptable Conditions

1. 試験中の出力電圧変動は初期値(試験前)の±5%を限度とする事。
Output voltage regulation not to exceed ±5% of initial (before test) 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。
Output voltage to be within regulation specification after the test.
3. 1、2共に発煙／発火及び出力ダウンなき事。
Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) 試験結果 Test Result

Common			Normal		
Test Voltage (kV)	VS100E-5	VS100E-24	Test Voltage (kV)	VS100E-5	VS100E-24
0.5	PASS	PASS	0.5	PASS	PASS
1	PASS	PASS	1	PASS	PASS
2	PASS	PASS			

5. 伝導性無線周波数電磁界イミュニティ試験
Conducted Disturbances Induced by Radio-Frequency Field Immunity Test (IEC61000-4-6)

MODEL : VS100E

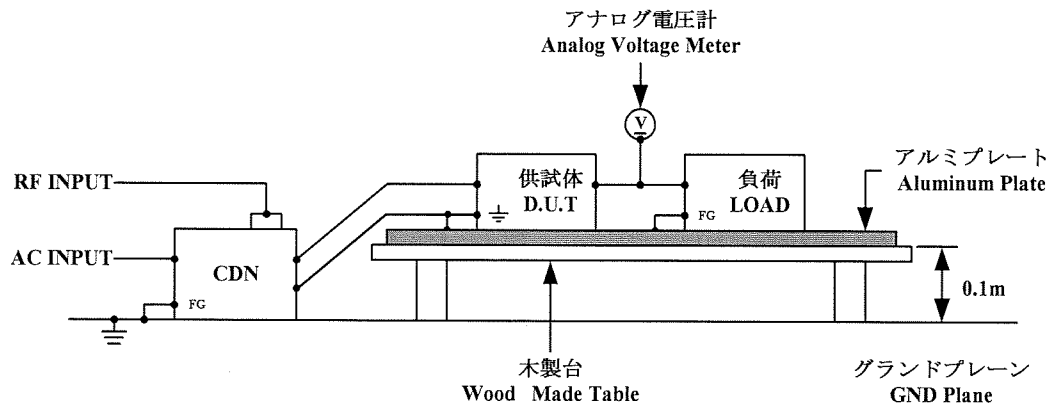
(1) 使用計測器 Equipment Used

RF パワーアンプ RF POWER AMPLIFIER	: 116FC (Kalmus)
シグナルジェネレータ SIGNAL GENERATOR	: SMG (ROHDE&SCHWARZ)
結合／減結合ネットワーク COUPLING DE-COUPLING NETWORK (CDN)	: TCDN-801-M3-25 (TOYO Corporation)

(2) 試験条件 Test Conditions

・入力電圧 Input Voltage	:100VAC	・出力電圧 Output Voltage	:定格 Rated
・出力電流 Output Current	:100%	・電磁界周波数 Electromagnetic Frequency	:150kHz～80MHz
・周囲温度 Ambient Temperature	:25℃		
・スイープ・コンディション Sweep Condition	:1.0%ステップ、2.8秒保持 1.0%Step Up, 2.8 Seconds Hold		

(3) 試験方法 Test Method



(4) 判定条件 Acceptable Conditions
1. 試験中の出力電圧変動は初期値(試験前)の±5%を限度とする事。
   Output voltage regulation not to exceed ±5% of initial (before test) 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。
   Output voltage to be within regulation specification after the test.
3. 1、2共に発煙／発火及び出力ダウンなき事。
   Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) 試験結果 Test Result

Voltage Level (V)	VS100E-5	VS100E-24
1	PASS	PASS
3	PASS	PASS
10	PASS	PASS

6. 電力周波数磁界イミュニティ試験
Power Frequency Magnetic Field Immunity Test (IEC61000-4-8)

MODEL : VS100E

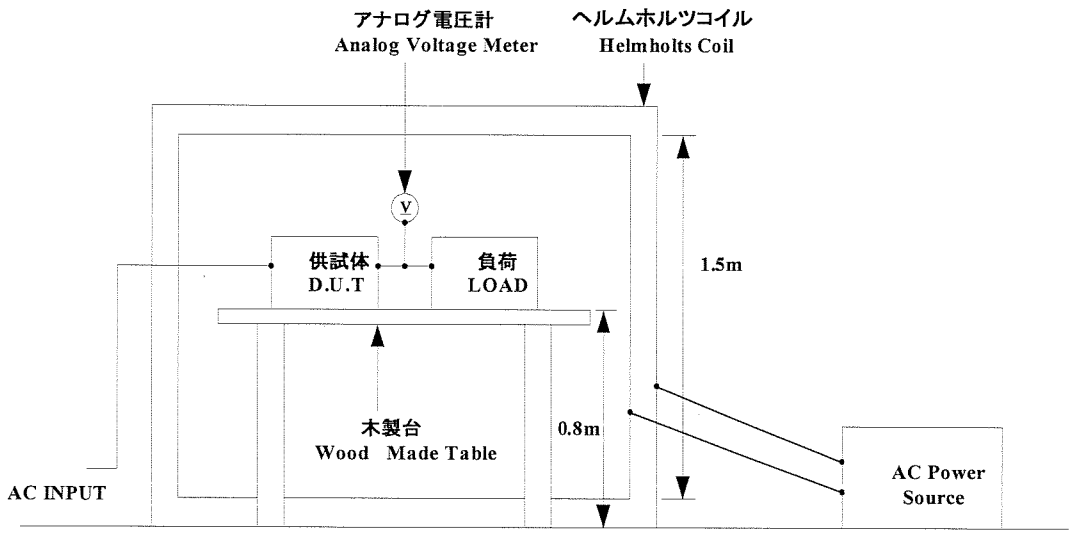
(1) 使用計測器 Equipment Used

ACパワーソース AC Power Source	:AA2000XG(Takasago)
ヘルムホルツコイル Helmholts Coil	:HHS5215 (Spulen)

(2) 試験条件 Test Conditions

・入力電圧 Input Voltage	:100VAC	・出力電圧 Output Voltage	:定格 Rated
・出力電流 Output Current	:100%	・印加磁界周波数 Magnetic Frequency	:50Hz
・試験時間 Test Time	:10秒以上(各方向) More than 10sec(Each direction)	・印加方向 Direction	:X, Y, Z
・周囲温度 Ambient Temperature	:25℃		

(3) 試験方法及び印加箇所 Test Method and Device Test Point



(4) 判定条件 Acceptable Conditions

1. 試験中の出力電圧変動は初期値(試験前)の±5%を限度とする事。
   Output voltage regulation not to exceed ±5% of initial (before test) 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。
   Output voltage to be within regulation specification after the test.
3. 1、2共に発煙／発火及び出力ダウンなき事。
   Along with 1 and 2, without the occurrence of smoke and fire, as well as no output failure.

(5) 試験結果 Test Result

Magnetic Field Strength (A/m)	VS100E-5	VS100E-24
1	PASS	PASS
3	PASS	PASS
10	PASS	PASS
30	PASS	PASS

7. 電圧ディップ、瞬停イミュニティ試験
Voltage Dips, Short Interruptions Immunity Test (IEC61000-4-11)

MODEL : VS100E

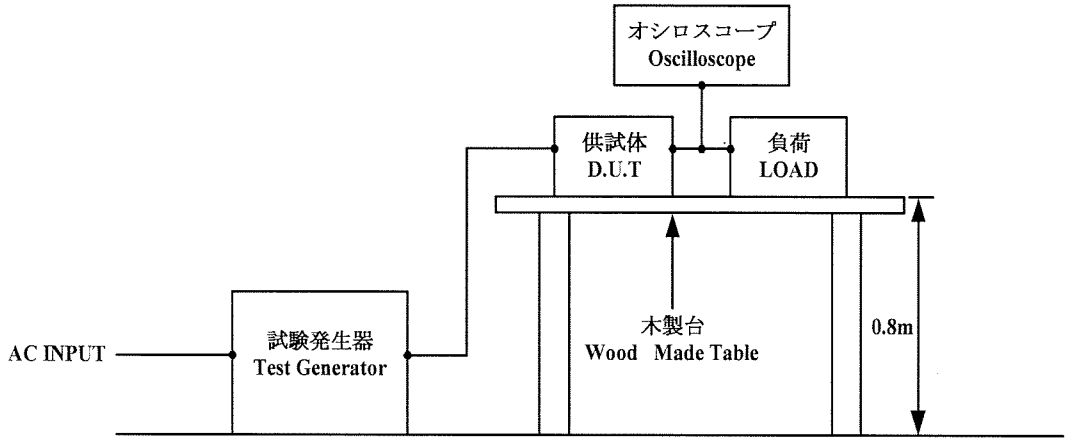
(1) 使用計測器 Equipment Used

試験発生器 :AA2000XG(Takasago)
Test Generator

(2) 試験条件 Test Conditions

・入力電圧 Input Voltage	:100VAC	・出力電圧 Output Voltage	:定格 Rated
・出力電流 Output Current	:100%	・周囲温度 Ambient Temperature	:25℃
・試験回数 Number of Tests	:3回 3 times	・試験間隔 Test interval	:10秒以上 More than 10sec

(3) 試験方法及び印加箇所 Test Method and Device Test Point



(4) 判定条件 Acceptable Conditions

1. 試験後の出力電圧は初期値から変動していない事。
Output voltage to be within output voltage regulation specification after the test.
2. 発煙／発火なき事。
Smoke and fire do not occur.

(5) 試験結果 Test Result

Test Level	Dip rate	Continue Time	VS100E-5	VS100E-24
70%	30%	500ms	PASS	PASS
40%	60%	200ms	PASS	PASS
0%	100%	10ms	PASS	PASS
0%	100%	20ms	PASS	PASS
0%	100%	5000ms	PASS	PASS