

**PFE500SA**

**EVALUATION DATA**

**型式データ**

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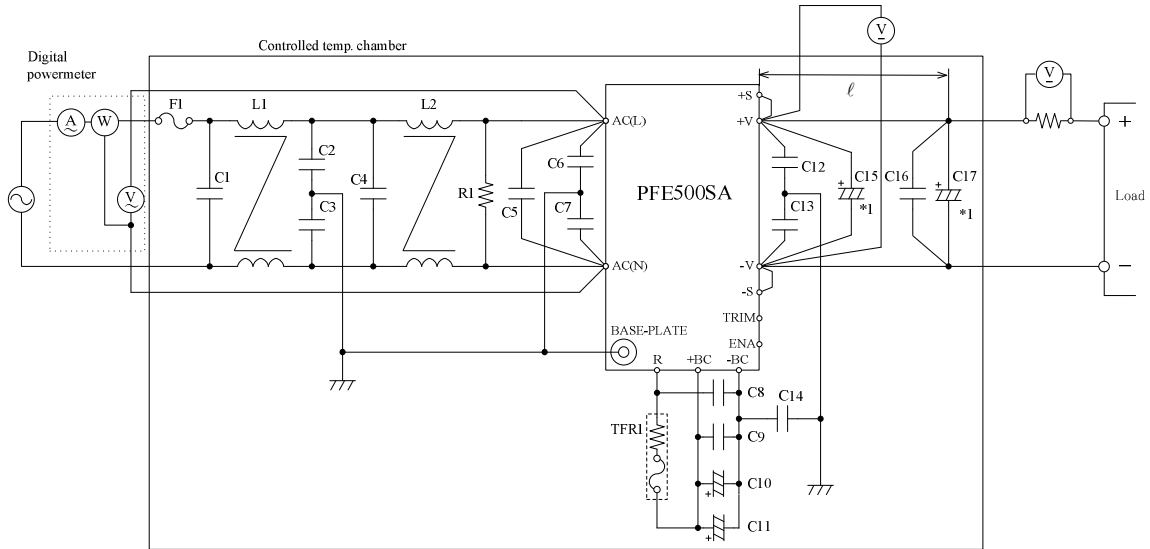
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使用記号 Terminology used

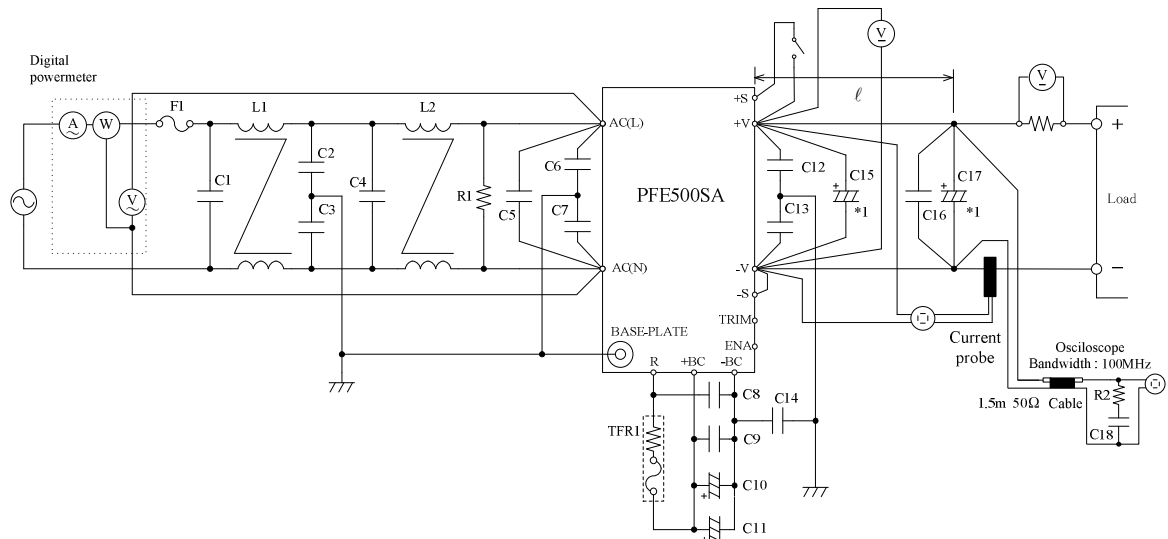
Definition		
$V_{in}$	.....	入力電圧 Input Voltage
$V_o$	.....	出力電圧 Output Voltage
$I_{in}$	.....	入力電流 Input Current
$I_o$	.....	出力電流 Output Current
$T_{bp}$	.....	ベースプレート温度 Baseplate Temperature
$T_a$	.....	周囲温度 Ambient Temperature
$f$	.....	周波数 Frequency

1. 測定方法 Evaluation Method  
 1.1 測定回路 Measurement Circuits

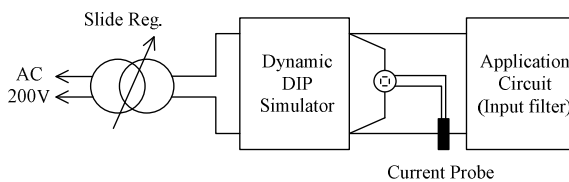
(1) 静特性 Steady state characteristics



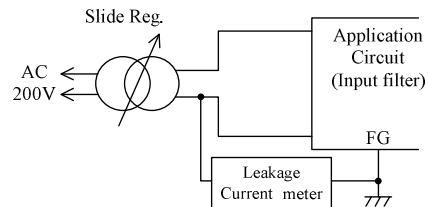
(2) 過渡応答、保護機能、出力リップル、ノイズ波形、その他  
 Dynamic, protection and Output ripple noise waveform other characteristics



Inrush current characteristics



Leakage current characteristics



- C1, C4, C5: 1uF Film Capacitor
- C2, C3: 4700pF Ceramic Capacitor
- C6, C7, C14: 1000pF Ceramic Capacitor
- C8, C9: 1uF Film Capacitor
- C10, C11: 390uF Electrolytic Capacitor
- C12, C13: 0.033uF Film Capacitor
- C16: 2.2uF Ceramic Capacitor
- C18: 4700pF Ceramic Capacitor

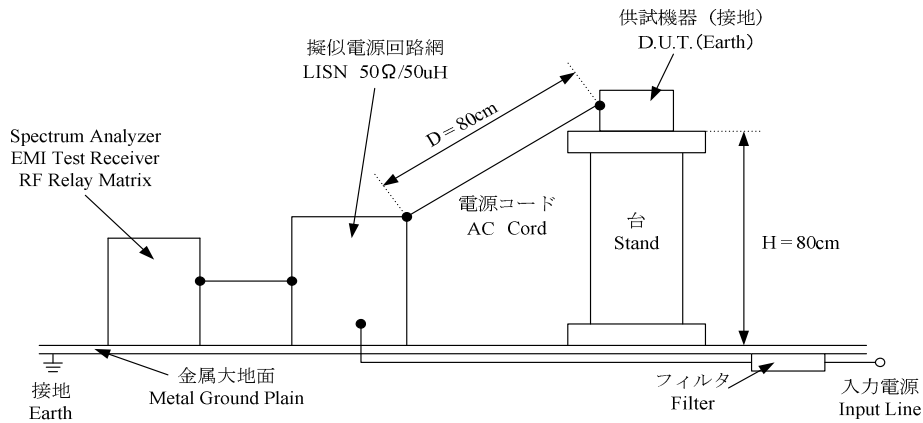
- C15, C17: 12V-1000uF Electrolytic Capacitor
- 28V- 470uF Electrolytic Capacitor
- 48V- 220uF Electrolytic Capacitor
- R1: 0.5W 470kΩ
- R2: 50Ω
- L1, L2: 6mH
- ℓ: 50mm
- TFR1: 10Ω more 139°C

==== Note ====

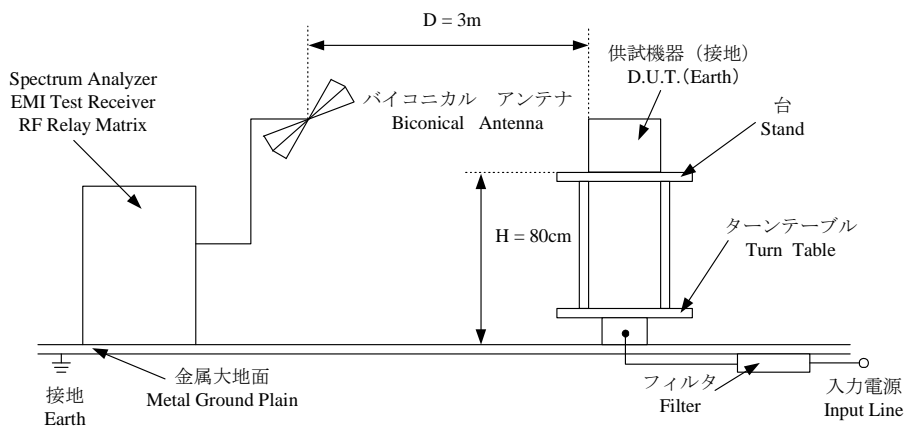
\*1: At ambient temperature less than -20°C, measurement was done using twice of the recommended capacitor above.

(3) EMI特性 Electro-Magnetic Interference characteristics

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

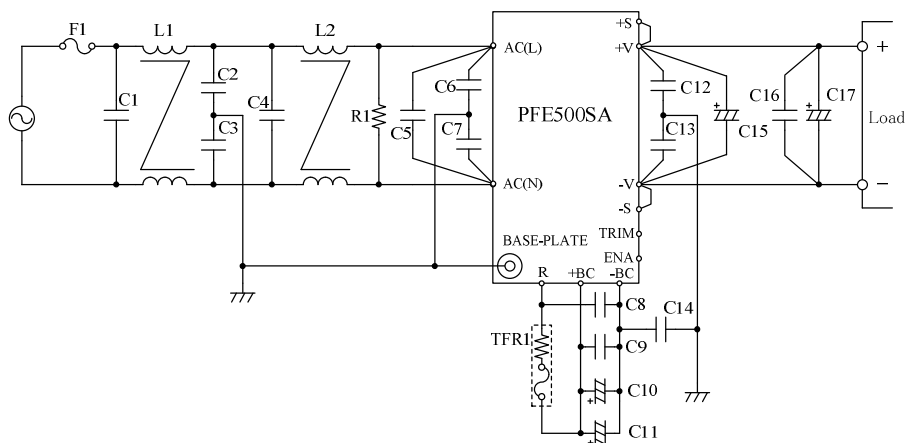


(b) 雑音電界強度(輻射ノイズ) Radiated Emission Noise



\* 入出力の線材にはシールド線を使用しました。  
 \* Shielded cable used to input and output cable.

VCCI class A対応アプリケーションシステム  
 VCCI class A application system



- |  |   |
|--|---|
| C1, C4, C5: 1uF Film Capacitor         | C15, C17: 12V-1000uF Electrolytic Capacitor |
| C2, C3: 4700pF Ceramic Capacitor       | 28V- 470uF Electrolytic Capacitor           |
| C6, C7, C14: 1000pF Ceramic Capacitor  | 48V- 220uF Electrolytic Capacitor           |
| C8, C9: 1uF Film Capacitor             | R1: 0.5W 470kΩ                              |
| C10, C11: 390uF Electrolytic Capacitor | L1, L2: 6mH                                 |
| C12, C13: 0.033uF Film Capacitor       | TFR1: 10Ω more 139°C                        |
| C16: 2.2uF Ceramic Capacitor           |   |

1.2 使用測定機器 List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	DIGITAL PHOSPHOR OSCILLOSCOPE	TEKTRONIX	TDS3012
2	DIGITAL STORAGE OSCILLOSCOPE	YOKOGAWA ELECT.	DL9040L
3	DIGITAL POWER METER	YOKOGAWA ELECT.	WT210
4	DATA ACQUISITION / SWITCH UNIT	AGILENT	34970A
5	CURRENT PROBE	YOKOGAWA ELECT.	701928
6	SHUNT RESISTER	YOKOGAWA ELECT.	2215
7	CONTROLLED TEMP. CHAMBER	ESPEC CORP.	SU-261
8	HARMONIC / FLICKER ANALYZER	KIKUSUI	KHA1000
9	EMI TEST RECEIVER / SPECTRUM ANALYZER	ROHDE & SCHWARZ	ESCI
10	PRE AMP	SONOMA	310N
11	INRUSH CURRENT METER	TAKAMISAWA	PSA-210
12	AMN	SCHWARZBECK	NNLK8121
13	ANTENNA(BICONICAL ANTENNA)	SCHWARZBECK	CBL6111D
14	DYNAMIC DUMMY LOAD	TAKASAGO	FK-1000L
15	AC POWER SUPPLY	TAKASAGO	AA-2000XG
16	SLIDE REGULATOR	MATSUNAGA	SD-2650
17	AC POWER SUPPLY	NF	ES10000S
18	DYNAMIC DUMMY LOAD	TAKASAGO	FK-600L
19	SINGLE-PHASE MASTER	NF	4420
20	REFERENCE IMPEDANCE NETWORK	NF	4150

2. 特性データ Characteristics

2.1 静特性 Steady state data

(1) 入力・負荷・温度変動 Regulation - line and load, Temperature drift

12V

1. Regulation - line and load

Condition Tbp : 25°C

Iout \ Vin	85VAC	100VAC	200VAC	265VAC	line regulation	
0%	12.008V	12.008V	12.008V	12.008V	0mV	0.000%
50%	12.004V	12.004V	12.004V	12.004V	0mV	0.000%
100%	12.003V	12.003V	12.002V	12.003V	1mV	0.008%
load regulation	5mV	5mV	6mV	5mV		
	0.042%	0.042%	0.050%	0.042%		

2. Temperature drift

Conditions Vin=100VAC

Iout=100%

Tbp	-40°C	+25°C	+85°C	temperature stability	
Vout	11.938V	12.003V	12.000V	65mV	0.542%

28V

1. Regulation - line and load

Condition Tbp : 25°C

Iout \ Vin	85VAC	100VAC	200VAC	265VAC	line regulation	
0%	28.084V	28.084V	28.084V	28.083V	1mV	0.004%
50%	28.076V	28.076V	28.076V	28.077V	1mV	0.004%
100%	28.075V	28.076V	28.076V	28.076V	1mV	0.004%
load regulation	9mV	8mV	8mV	7mV		
	0.032%	0.029%	0.029%	0.025%		

2. Temperature drift

Conditions Vin=100VAC

Iout=100%

Tbp	-40°C	+25°C	+100°C	temperature stability	
Vout	27.963V	28.076V	28.044V	113mV	0.404%

48V

1. Regulation - line and load

Condition Tbp : 25°C

Iout \ Vin	85VAC	100VAC	200VAC	265VAC	line regulation	
0%	48.180V	48.184V	48.184V	48.184V	4mV	0.008%
50%	48.163V	48.166V	48.166V	48.167V	4mV	0.008%
100%	48.163V	48.166V	48.166V	48.167V	4mV	0.008%
load regulation	17mV	18mV	18mV	17mV		
	0.035%	0.038%	0.038%	0.035%		

2. Temperature drift

Conditions Vin=100VAC

Iout=100%

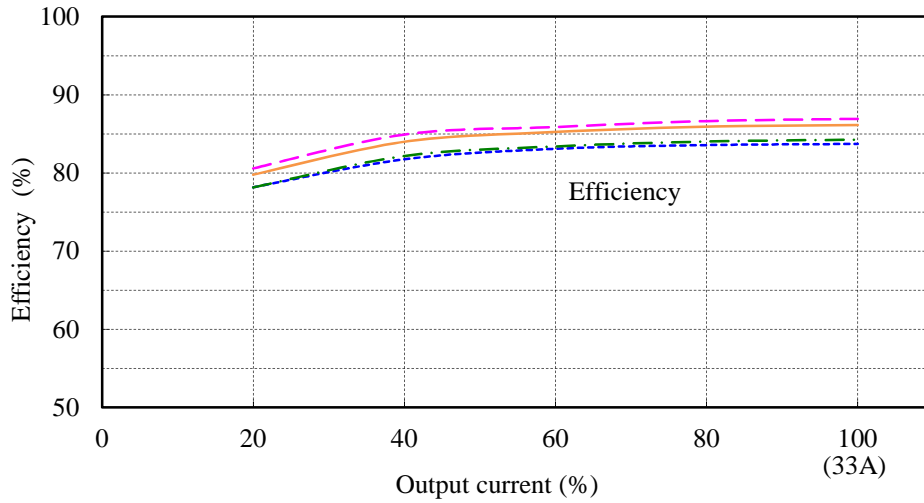
Tbp	-40°C	+25°C	+100°C	temperature stability	
Vout	47.975V	48.166V	48.164V	191mV	0.398%

(2) 効率 対 出力電流

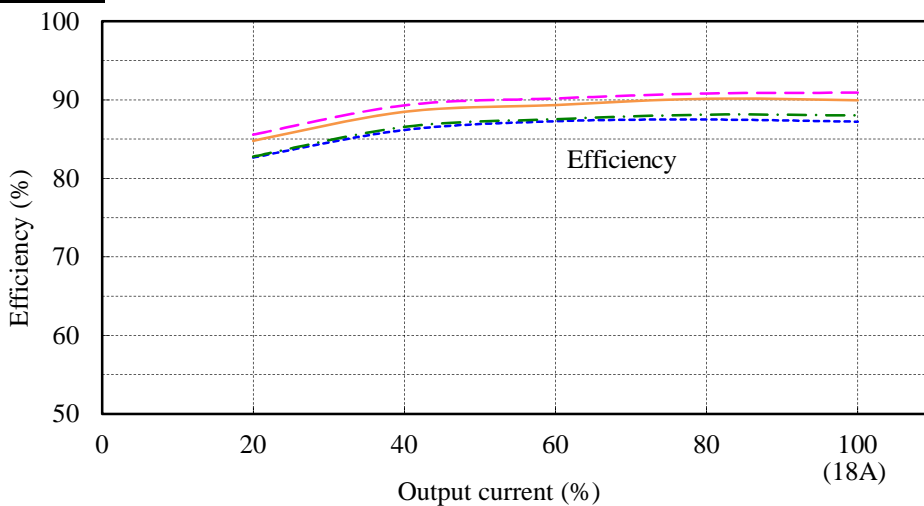
Efficiency vs. Output current

Conditions Vin : 85 VAC ---  
 : 100 VAC -.-  
 : 200 VAC —  
 : 265 VAC -.-  
 Tbp : 25 °C

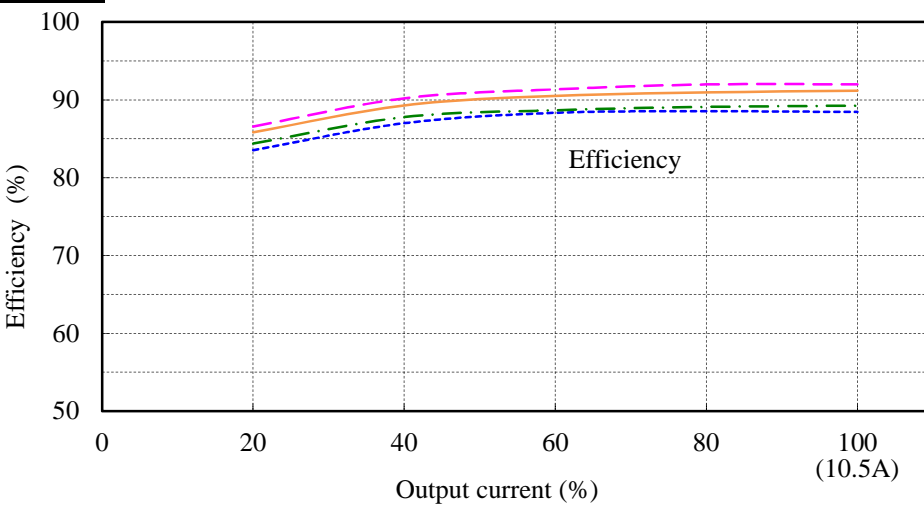
12V



28V



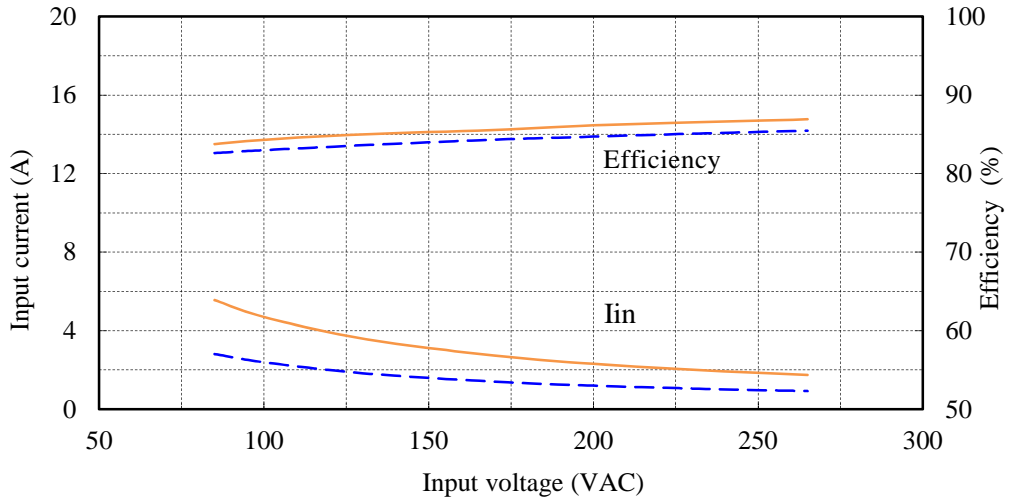
48V



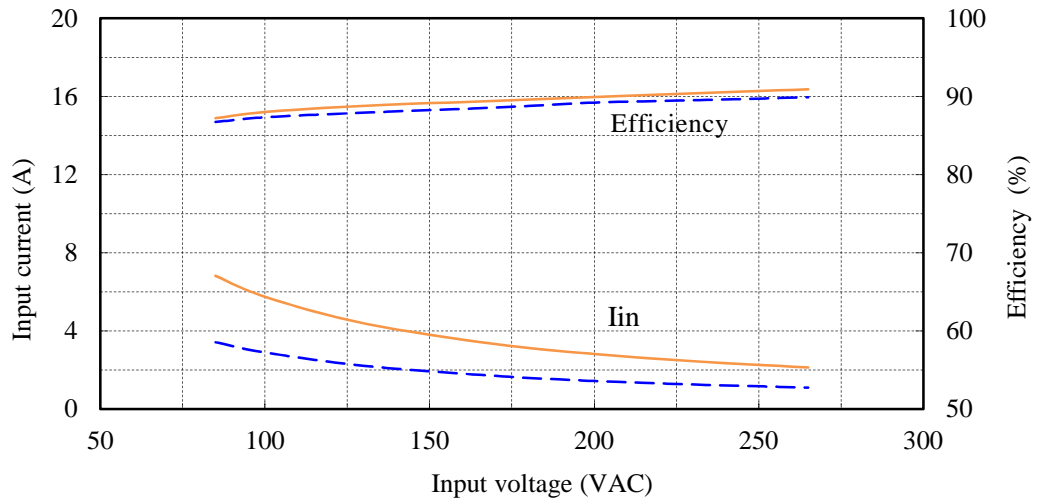
(3) 入力電流・効率 対 入力電圧  
Input current and Efficiency vs. Output current

Conditions  $I_o$  : 50 %    ---  
                  : 100 %    ———  
 $T_{bp}$  : 25 °C

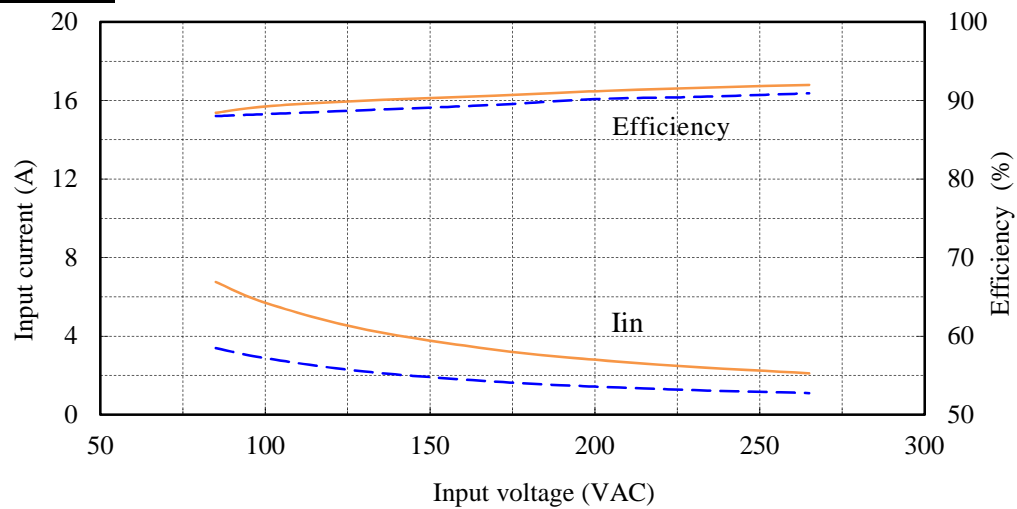
12V



28V



48V

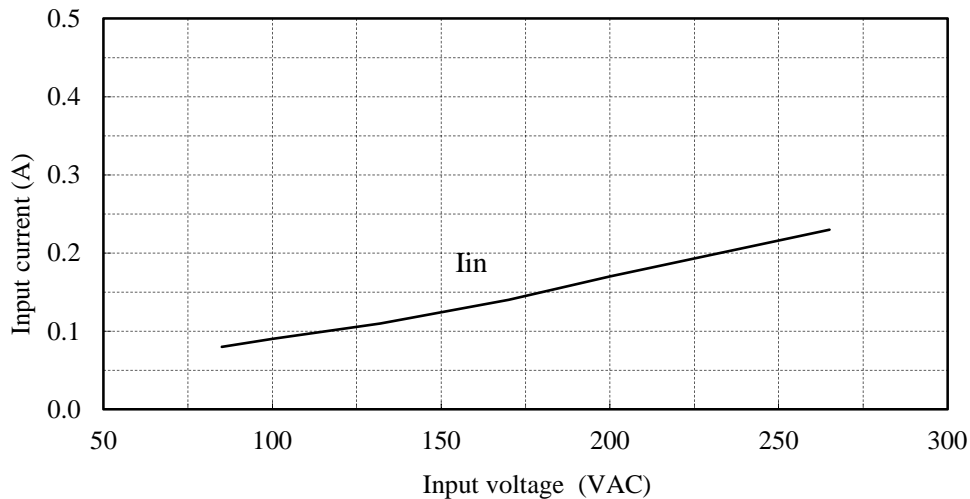




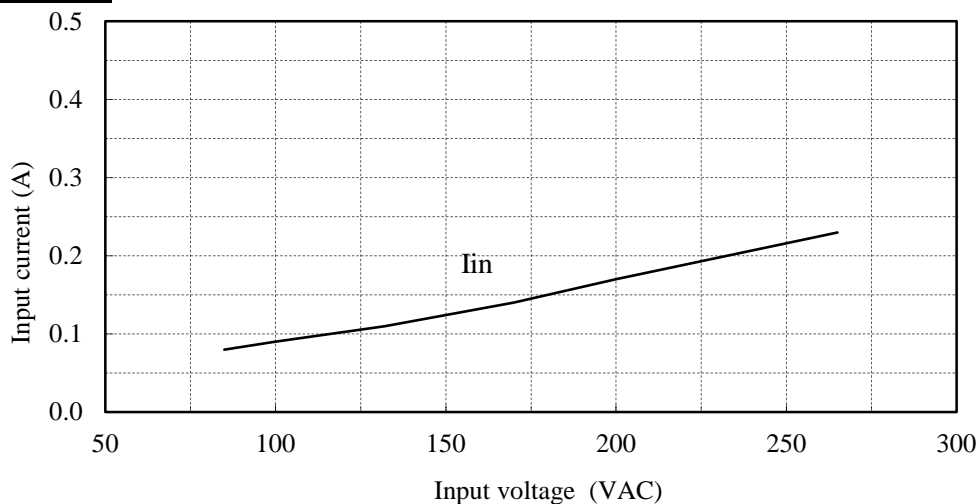
(4) 入力電流 対 入力電圧 (無負荷時)  
 Input current vs. Input voltage with No load

Conditions  $I_o$  : 0 %  
 $T_{bp}$  : 25 °C

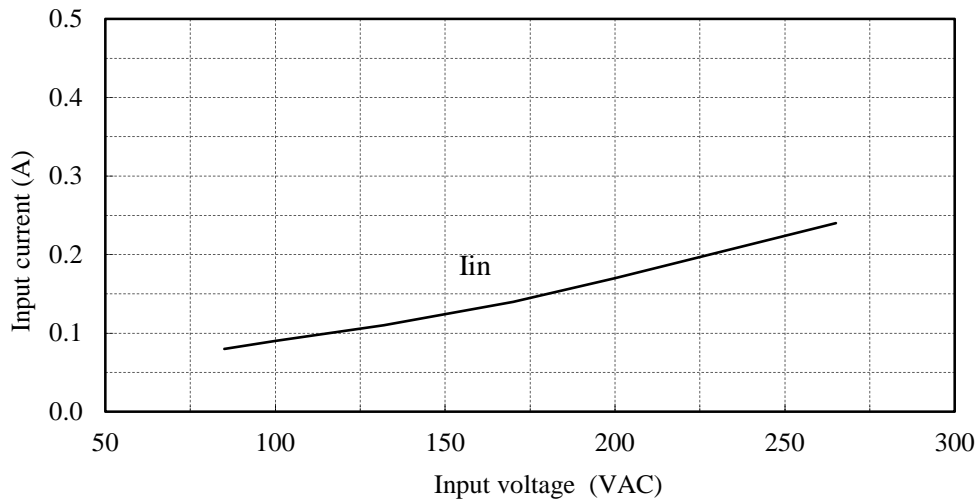
12V



28V



48V

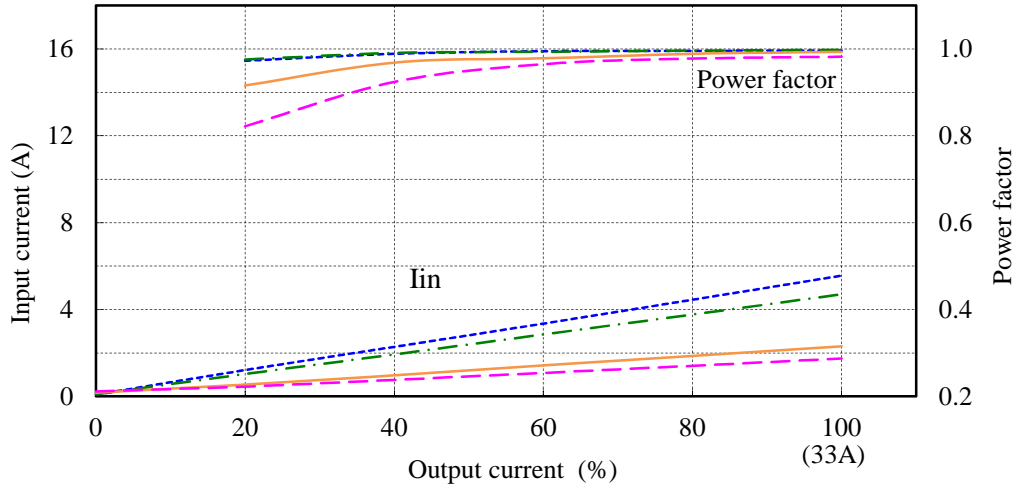


(5) 入力電流・力率 対 出力電流

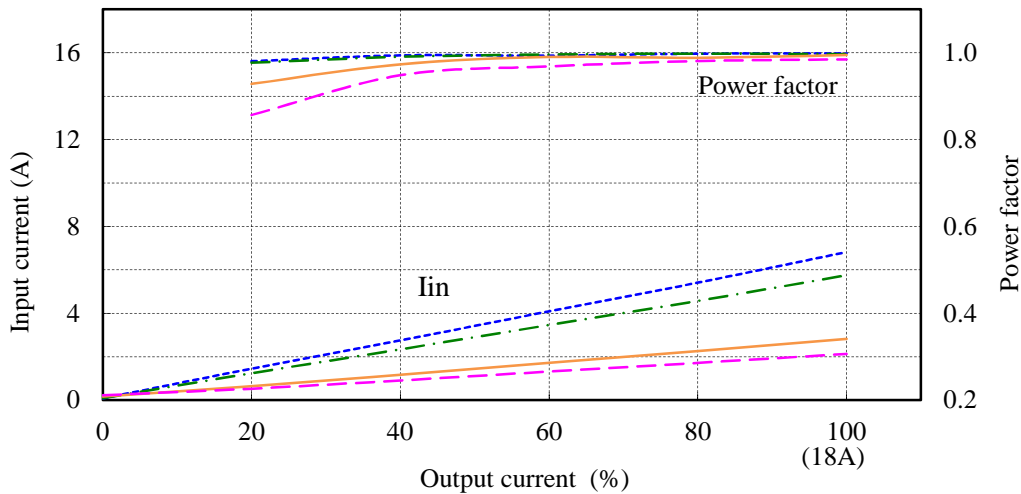
Input current and Power factor vs. Output current

Conditions Vin : 85 VAC ---  
 : 100 VAC - - -  
 : 200 VAC ---  
 : 265 VAC - - -  
 Tbp : 25 °C

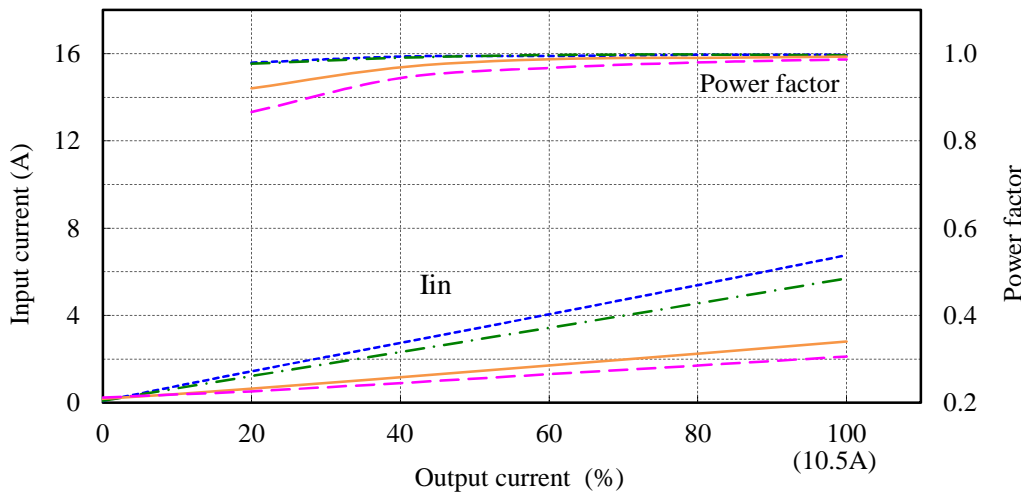
12V



28V



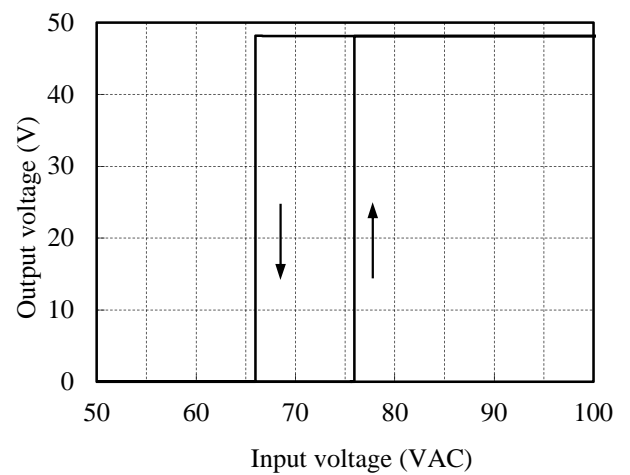
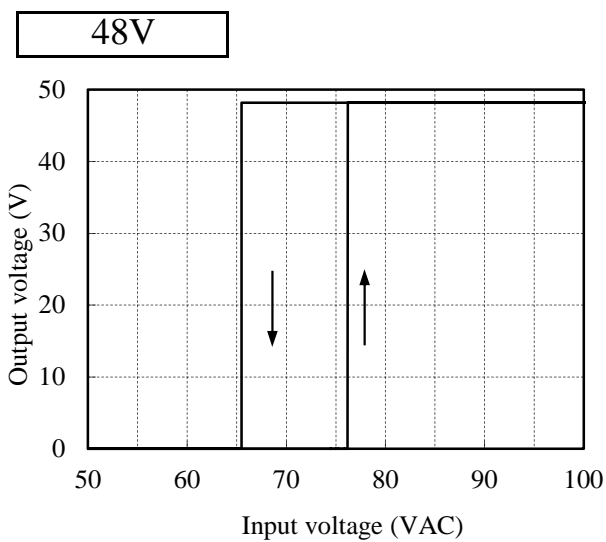
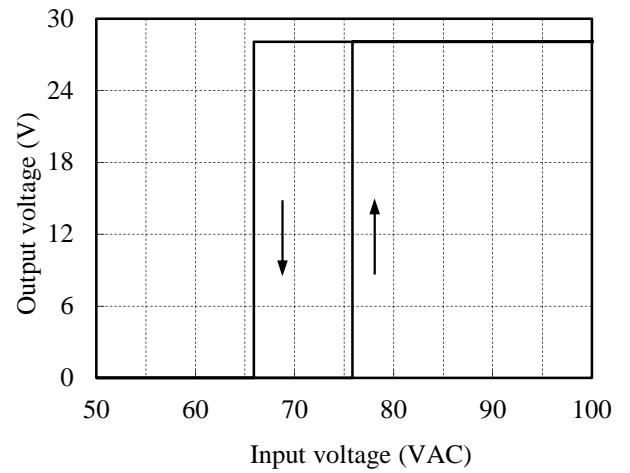
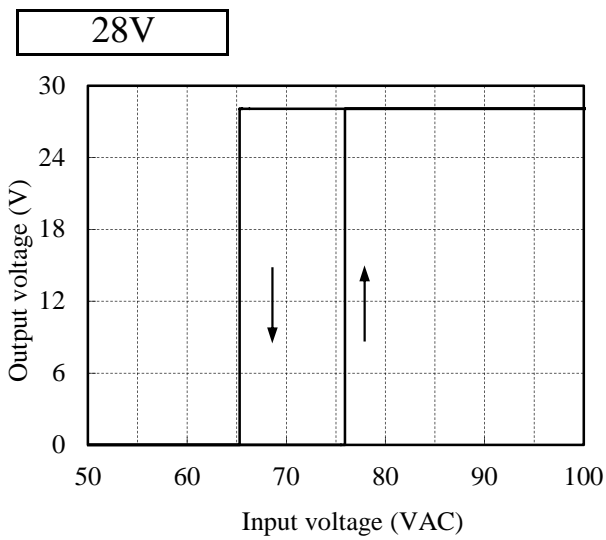
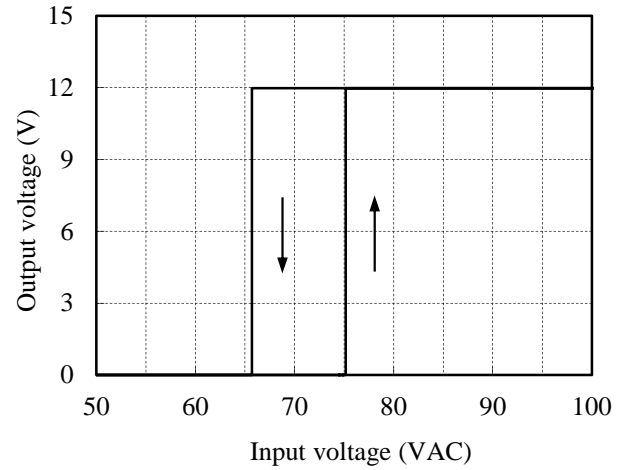
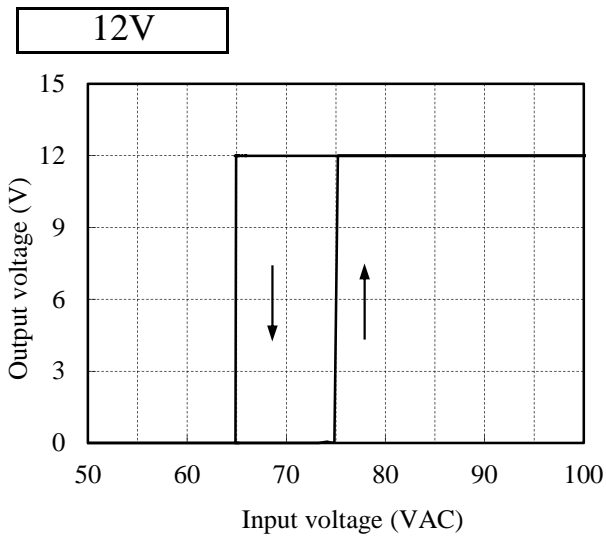
48V



## (6) 起動・停止電圧特性 Start and Stop voltage characteristics

Conditions  $I_o$  : 0 %    ———  
 $T_{bp}$  : 25 °C

Conditions  $I_o$  : 100 %    ———  
 $T_{bp}$  : 25 °C



2.2 通電ドリフト特性

Warm up voltage drift characteristics

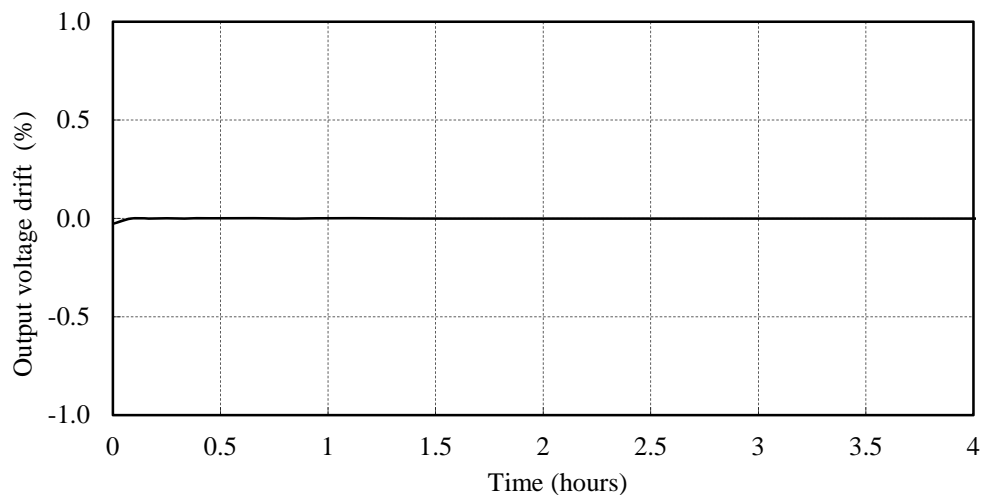
Conditions

Vin : 100 VAC

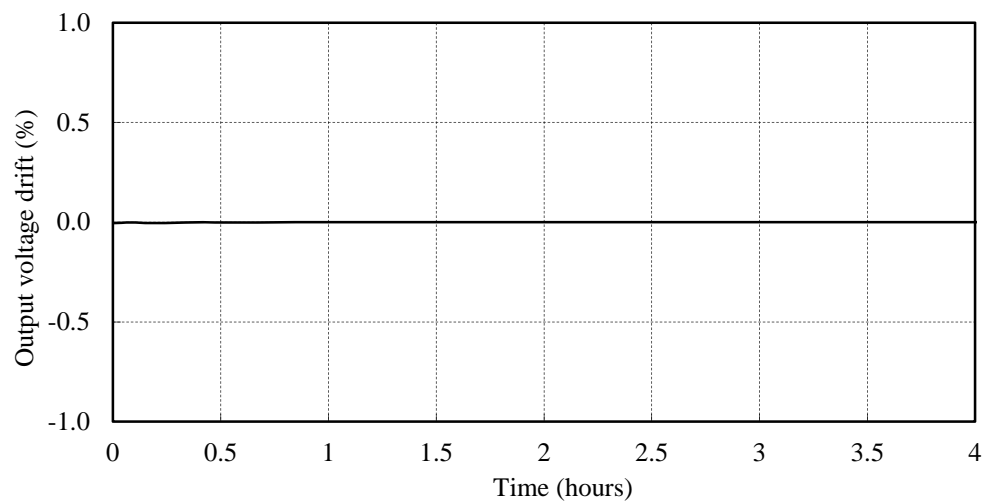
Io : 100 %

Ta : 25 °C

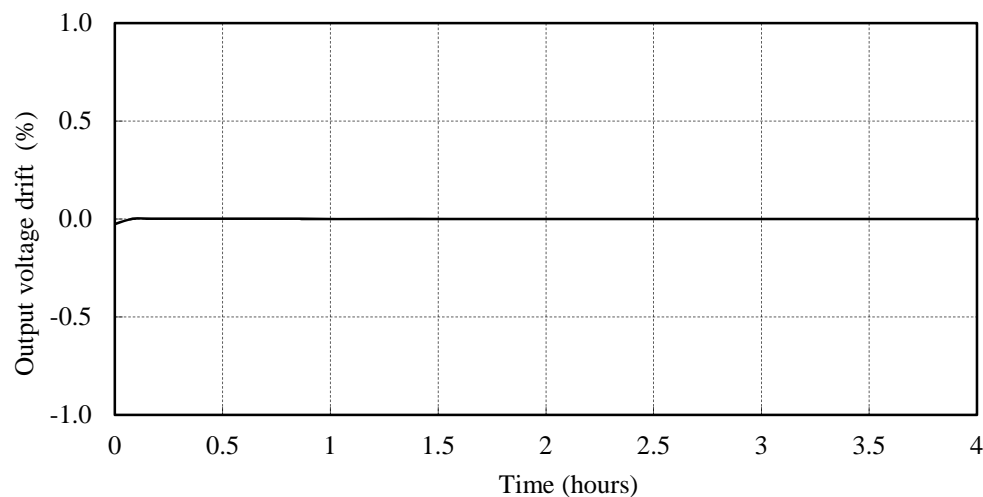
12V



28V



48V



## 2.3 過電流保護特性

Over current protection (OCP) characteristics

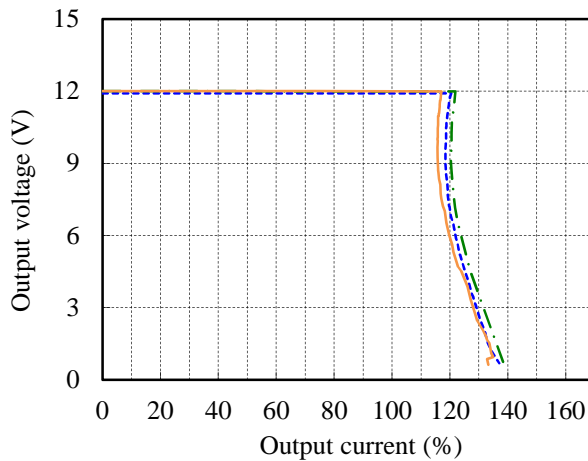
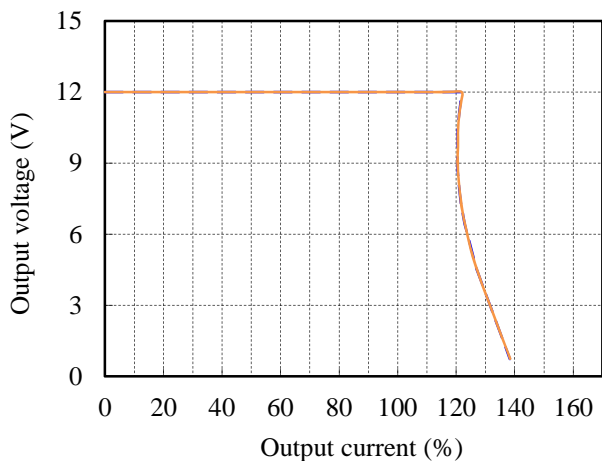
入力電圧依存性  
Input voltage dependence

Conditions Vin : 100 VAC (---)  
: 200 VAC (—)  
Tbp : 25 °C

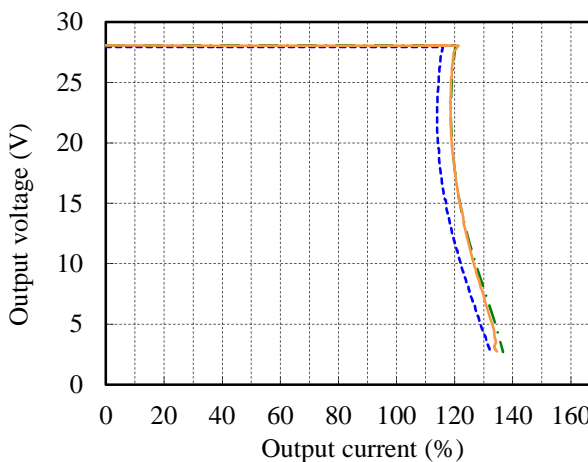
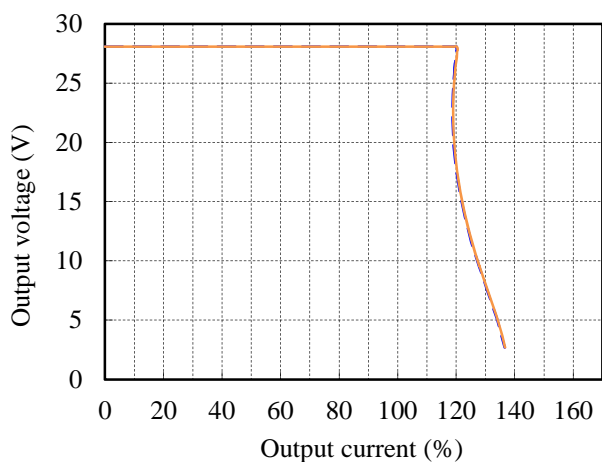
ベースプレート温度依存性  
Baseplate temperature dependence

Conditions Vin : 100 VAC  
Tbp : -40 °C (---)  
: 25 °C (---)  
: 85 °C(12V) (—)  
: 100 °C(28,48V) (—)

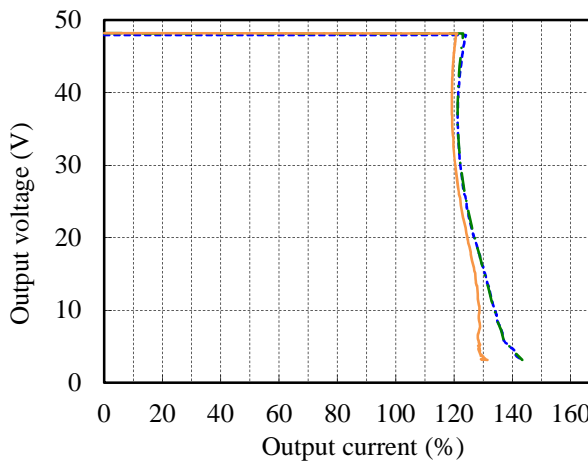
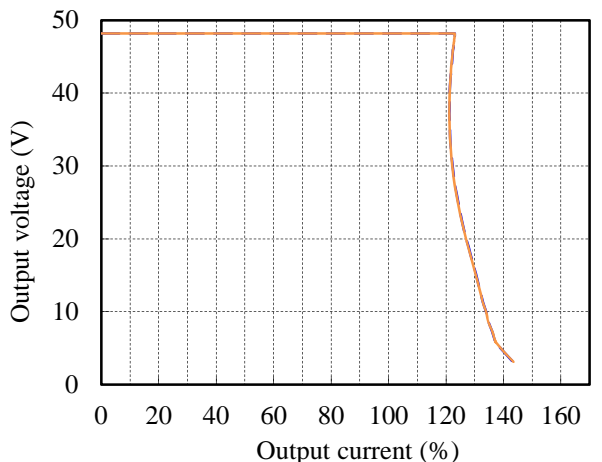
12V



28V



48V



2.4 過電圧保護特性

Over voltage protection (OVP) characteristics

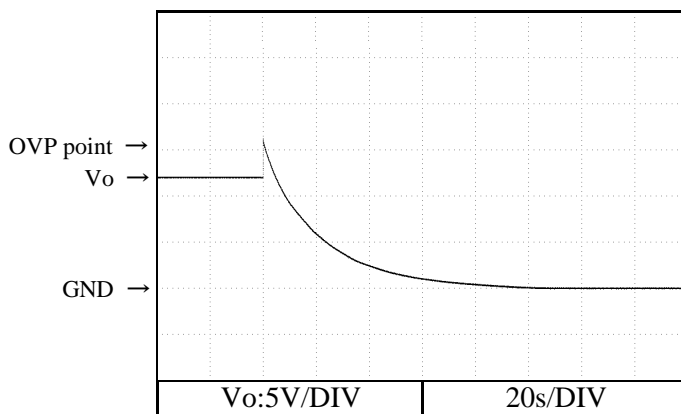
Conditions

Vin : 100 VAC

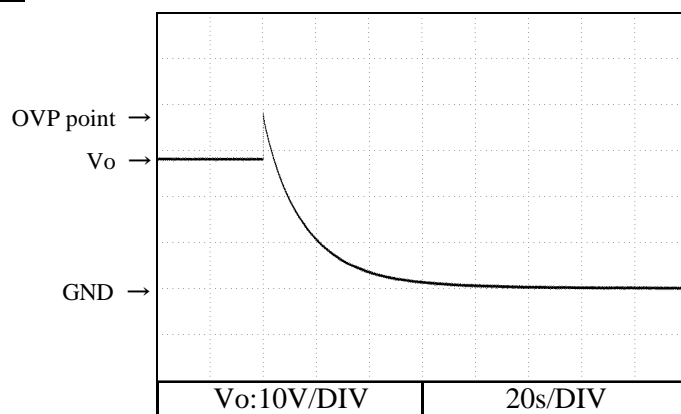
Io : 0 %

Tbp : 25 °C

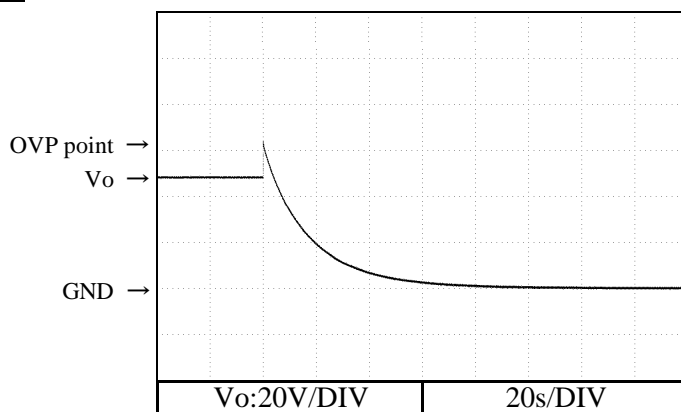
**12V**



**28V**



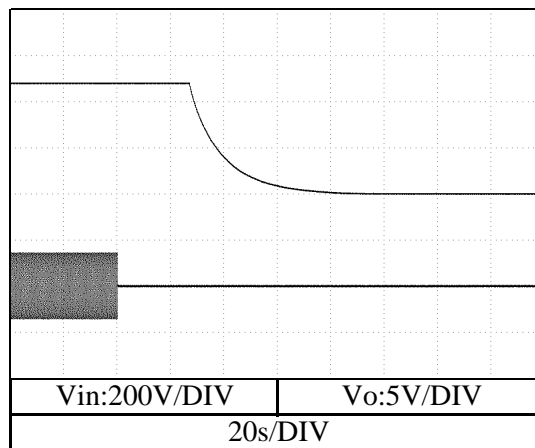
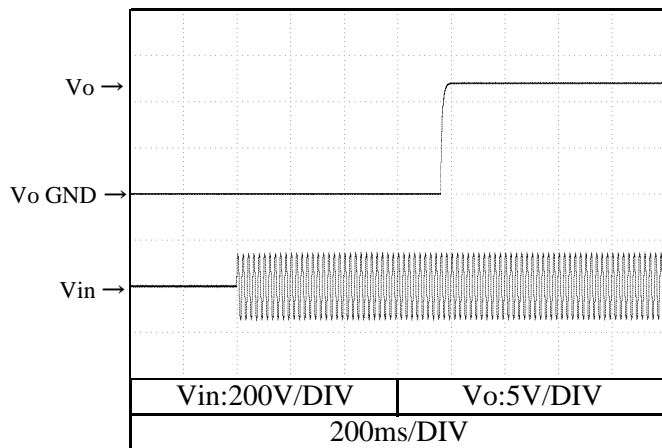
**48V**



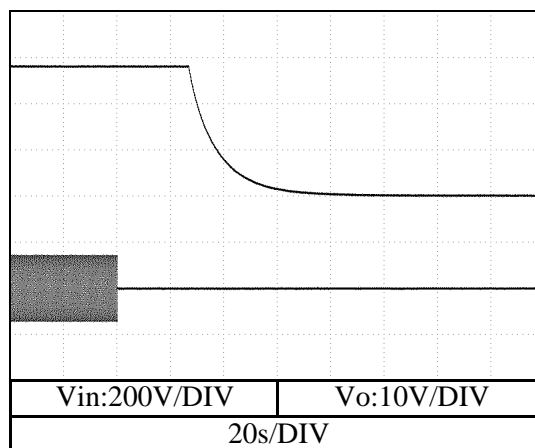
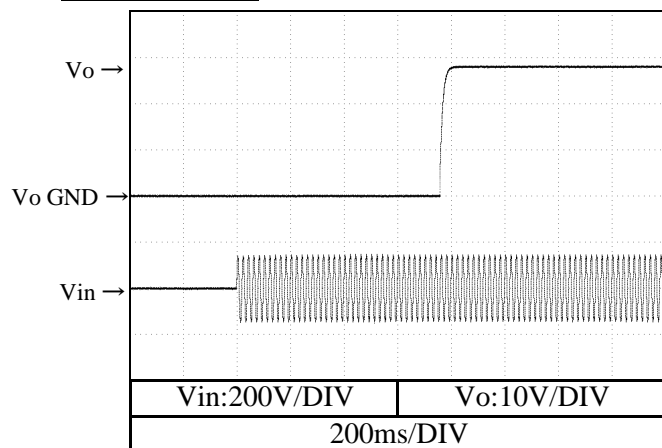
## 2.5 出力立ち上がり、立ち下り特性 Output rise , fall characteristics

Conditions Vin : 100 VAC  
Io : 0 %  
Tbp : 25 °C

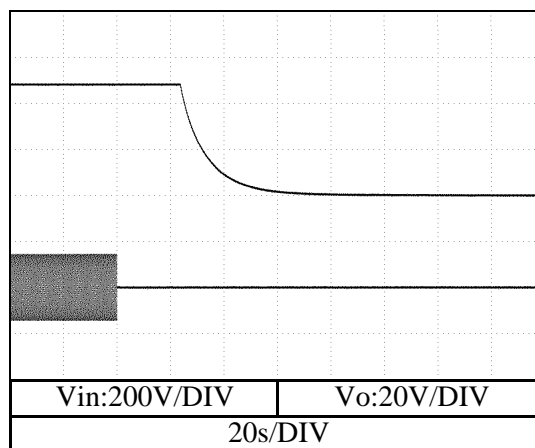
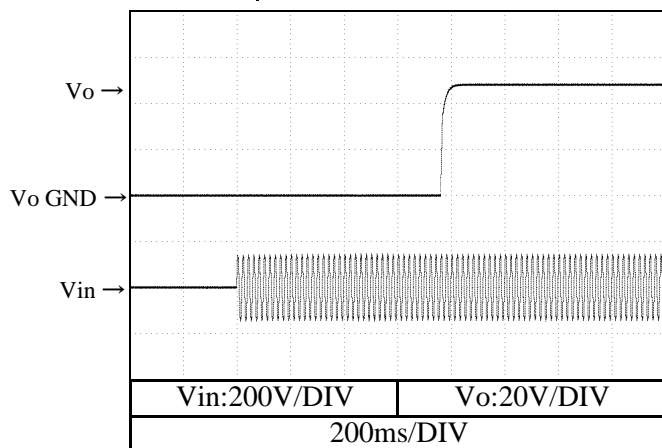
12V



28V



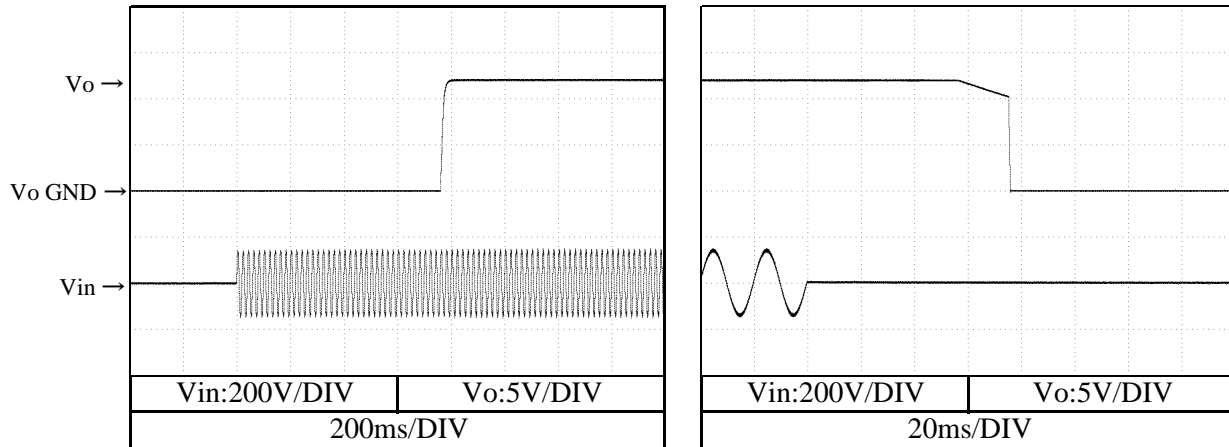
48V



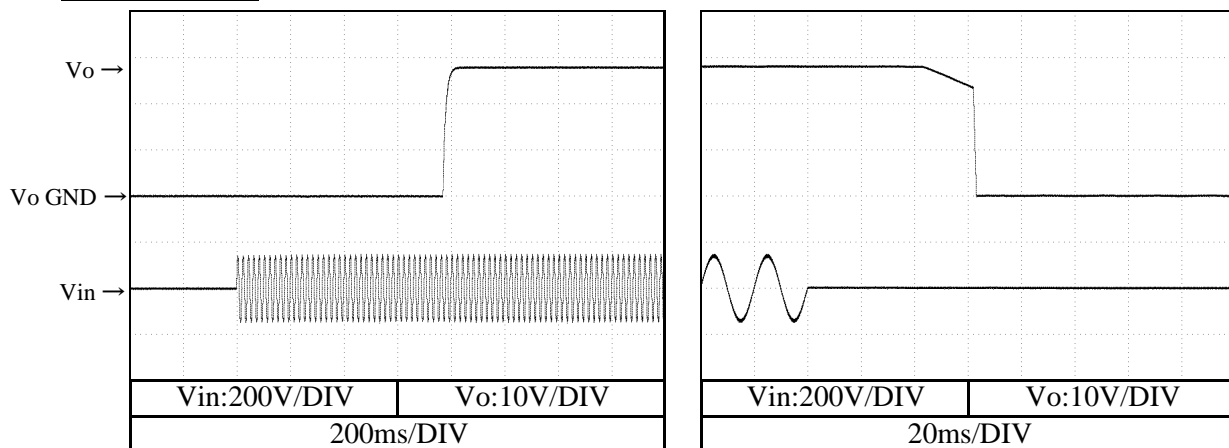
## 2.5 出力立ち上がり、立ち下り特性 Output rise , fall characteristics

Conditions     $V_{in}$  : 100 VAC  
 $I_o$  : 100 %  
 $T_{bp}$  : 25 °C

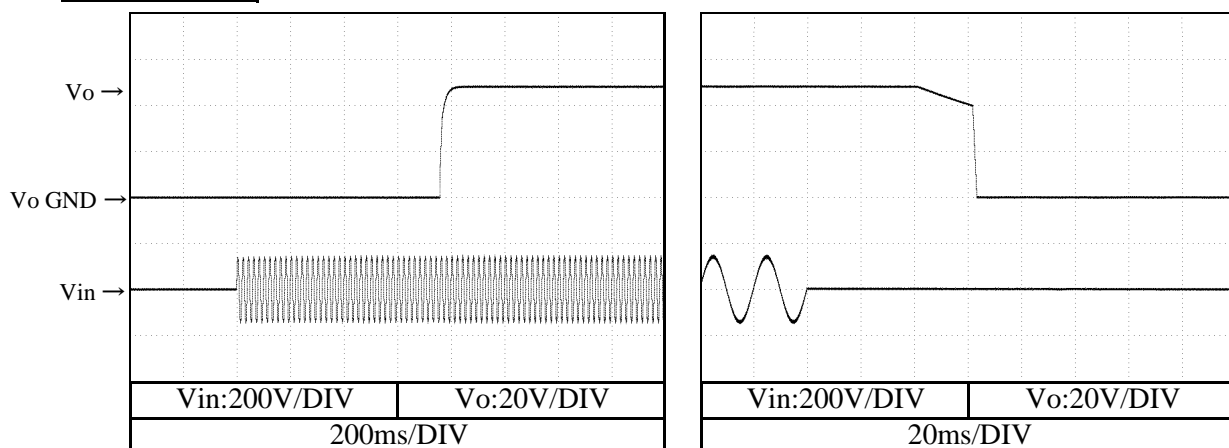
**12V**



**28V**



**48V**

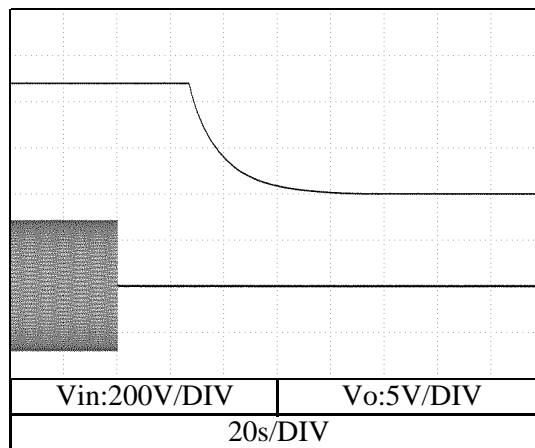
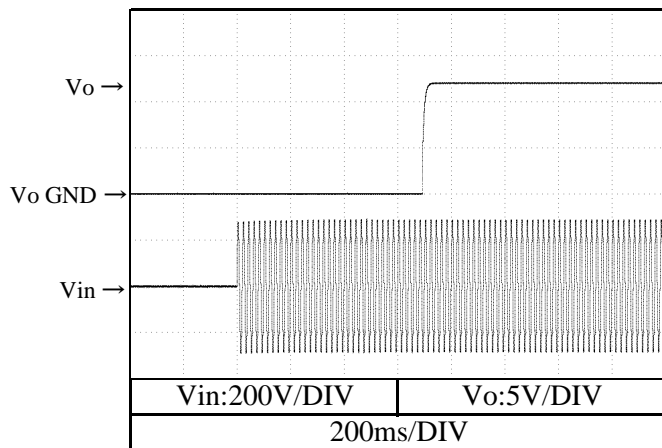




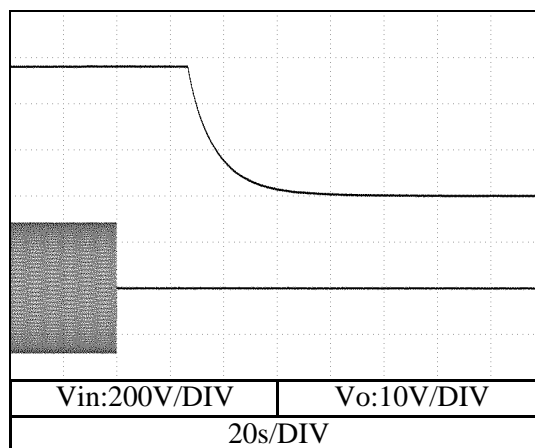
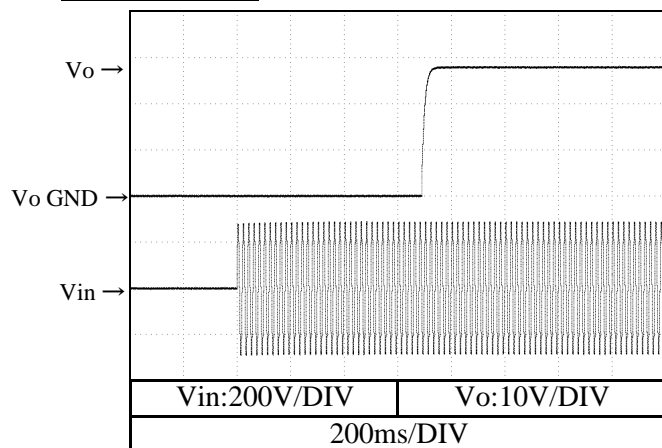
## 2.5 出力立ち上がり、立ち下り特性 Output rise , fall characteristics

Conditions Vin : 200 VAC  
Io : 0 %  
Tbp : 25 °C

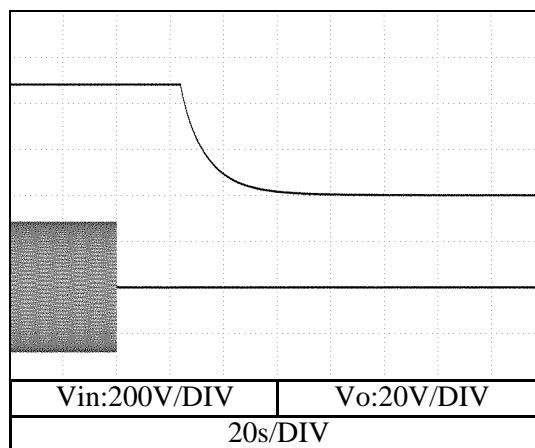
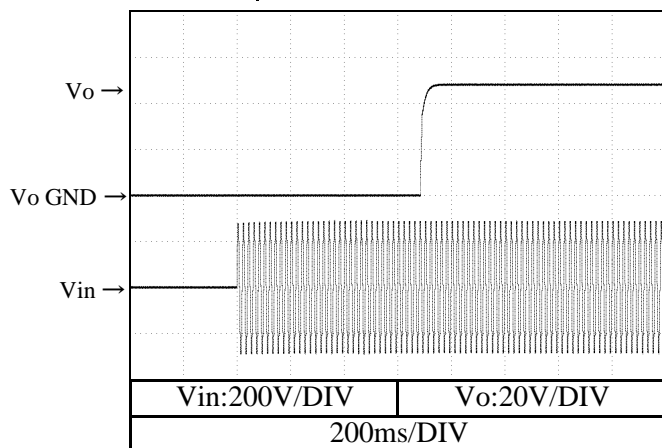
12V



28V



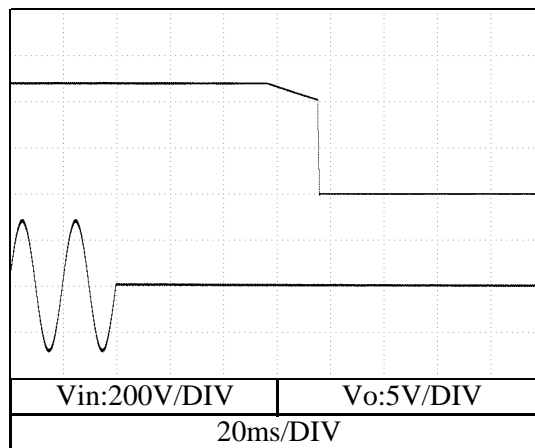
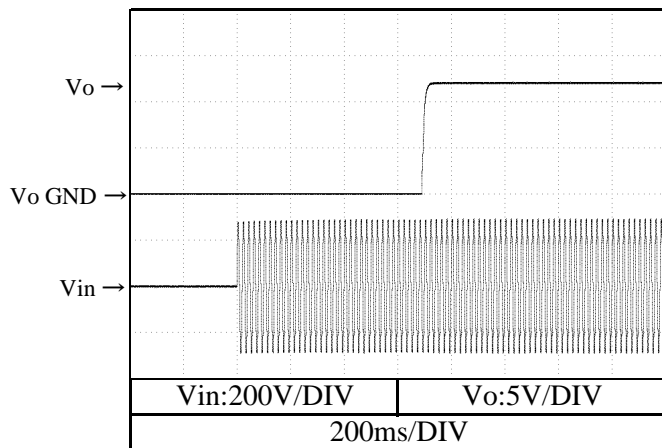
48V



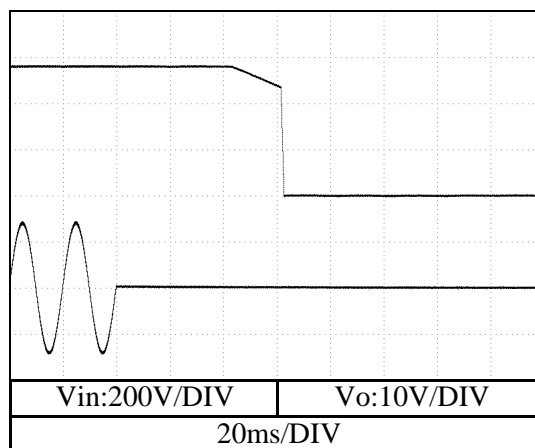
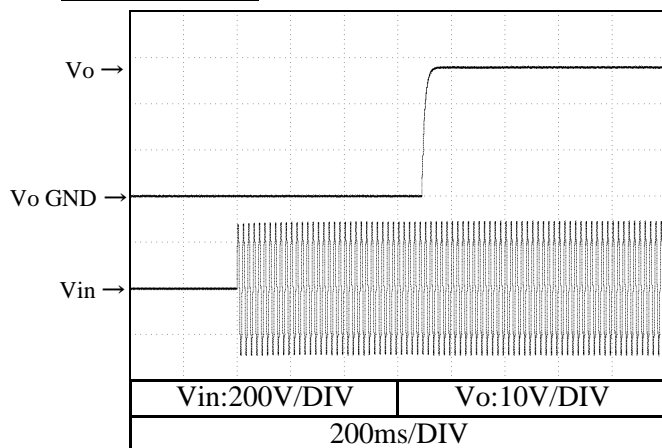
## 2.5 出力立ち上がり、立ち下り特性 Output rise , fall characteristics

Conditions Vin : 200 VAC  
Io : 100 %  
Tbp : 25 °C

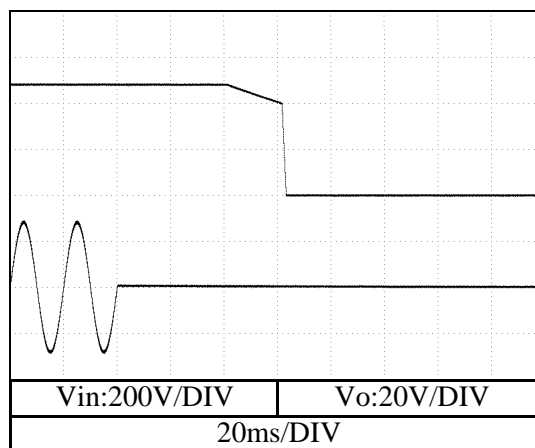
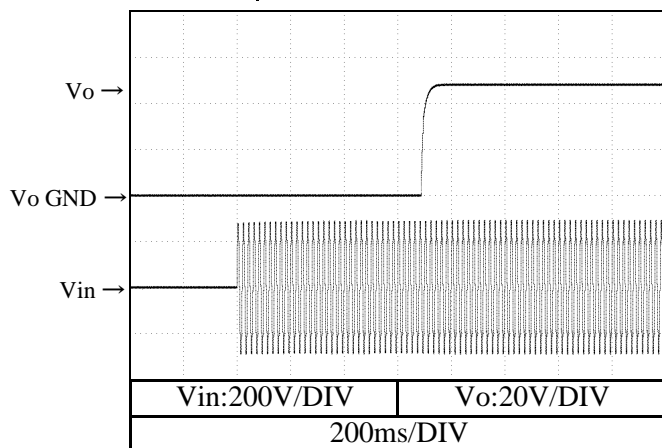
12V



28V



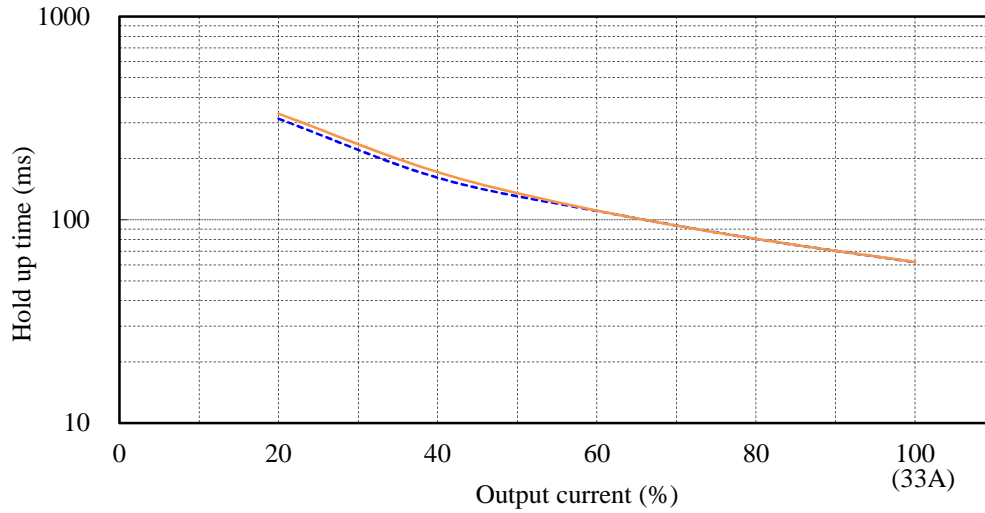
48V



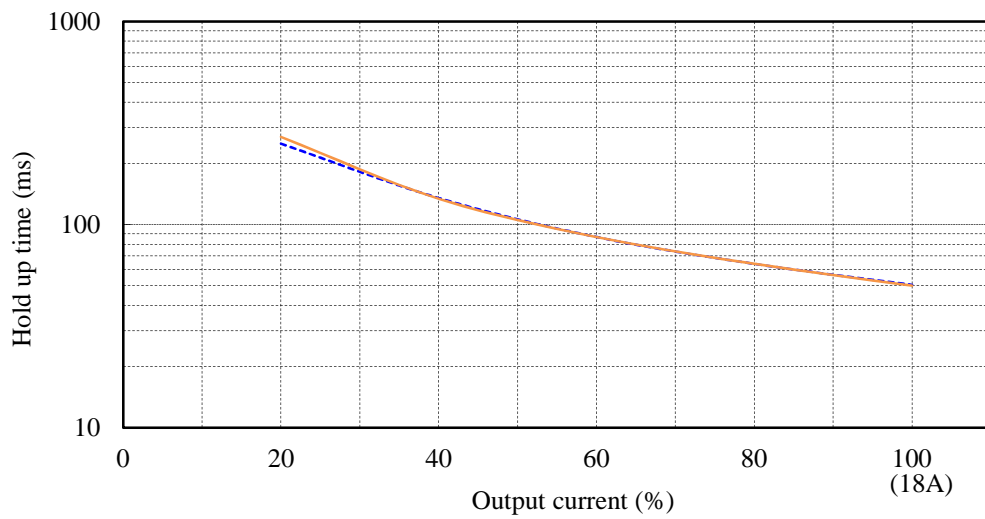
2.6 出力電圧保持時間特性  
Hold up time characteristics

Conditions Vin : 100 VAC ---  
: 200 VAC ---  
Tbp : 25 °C

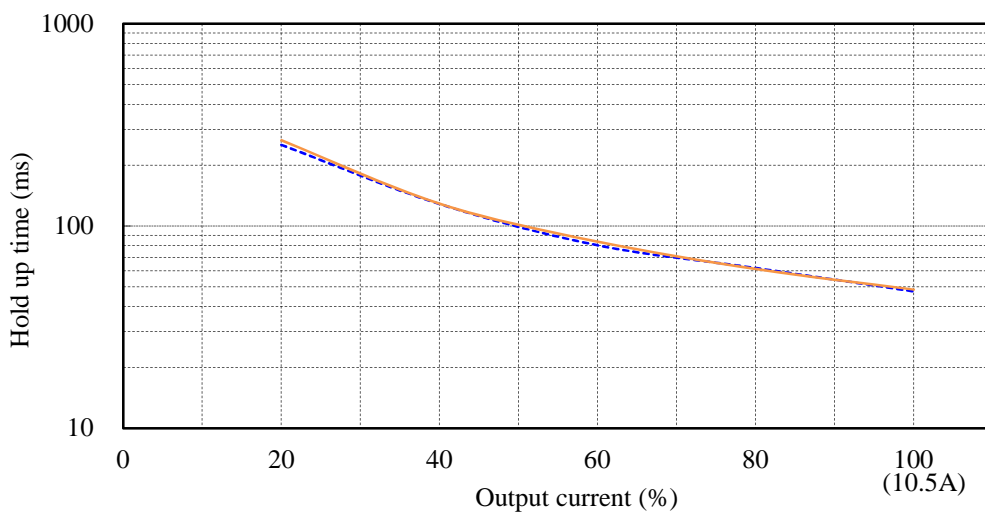
12V



28V

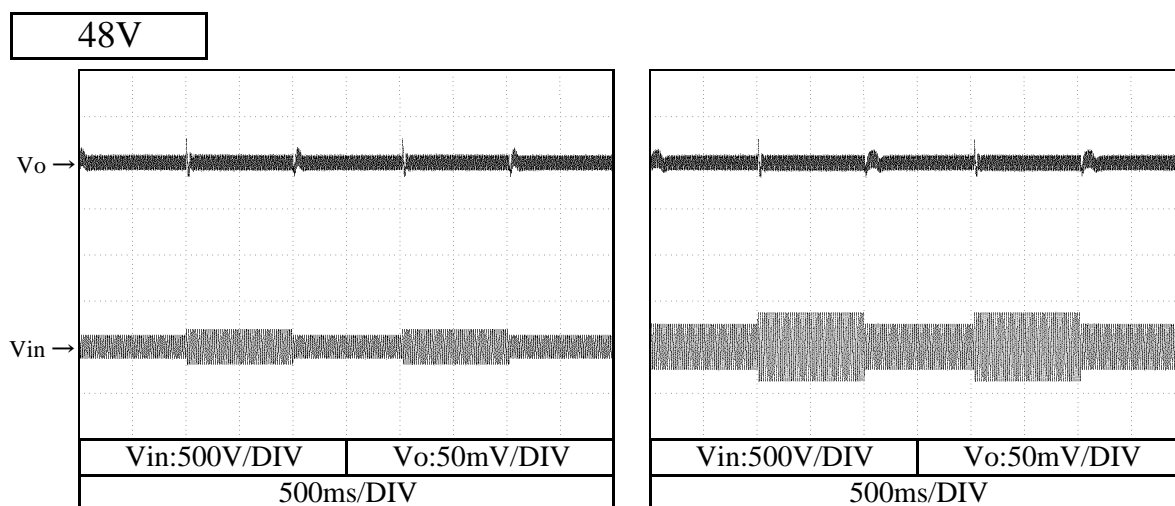
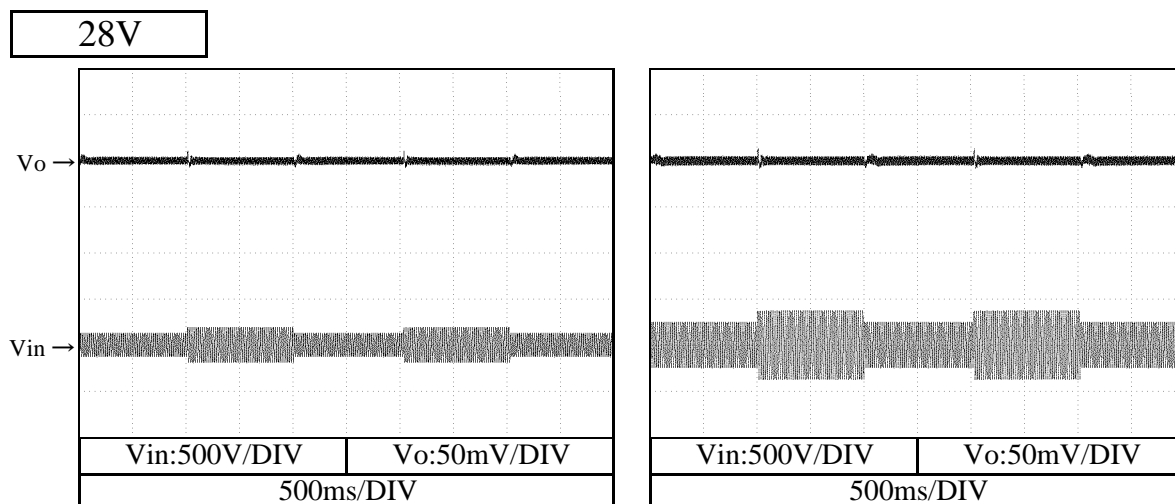
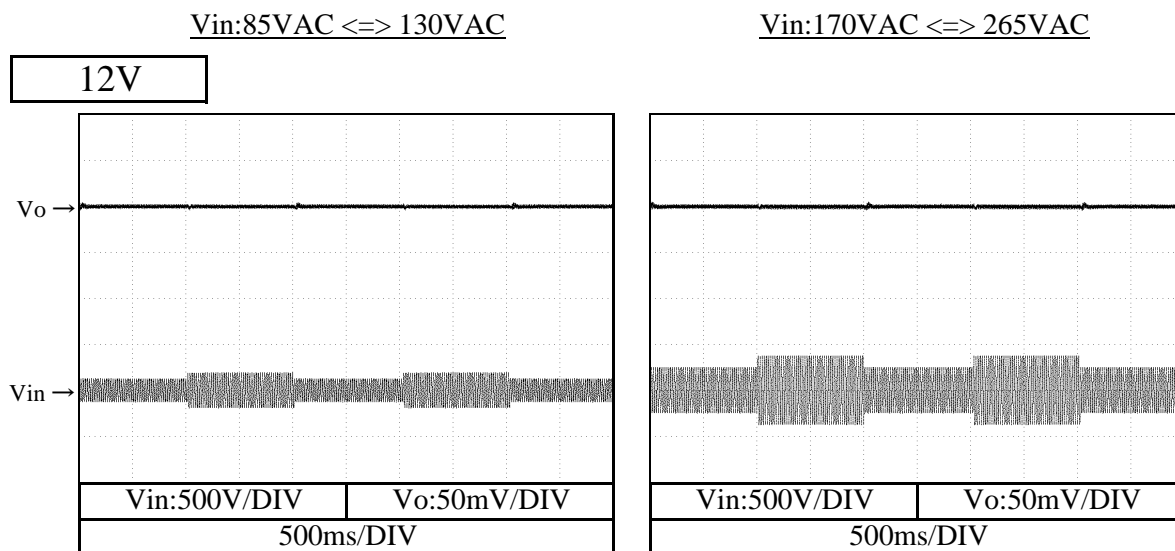


48V



2.7 過渡応答 (入力急変) 特性  
Dynamic line response characteristics

Conditions  $I_o : 100\%$   
 $T_{bp} : 25\text{ }^\circ\text{C}$

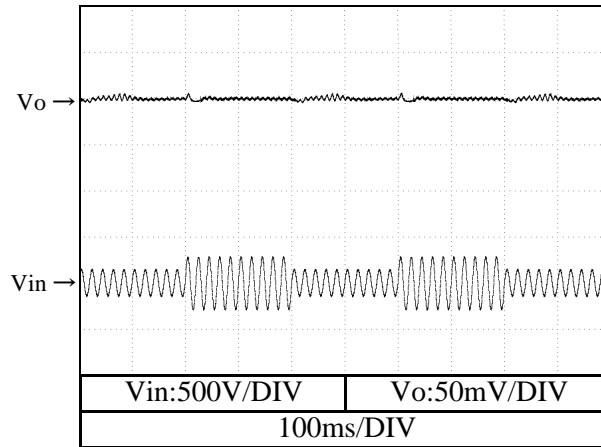


2.7 過渡応答 (入力急変) 特性  
Dynamic line response characteristics

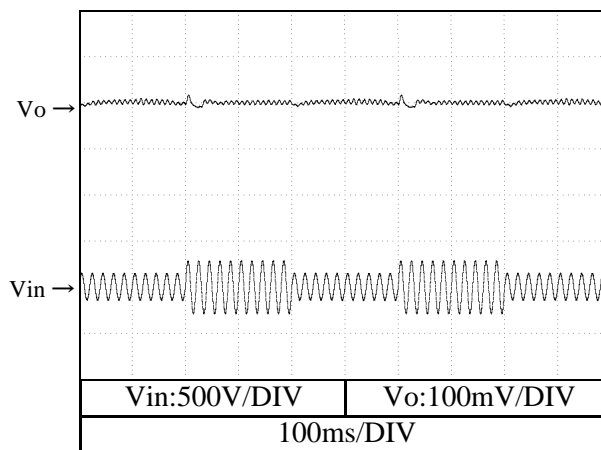
Conditions  $I_o$  : 100 %  
 $T_{bp}$  : 25 °C

Vin:100VAC <=> 200VAC

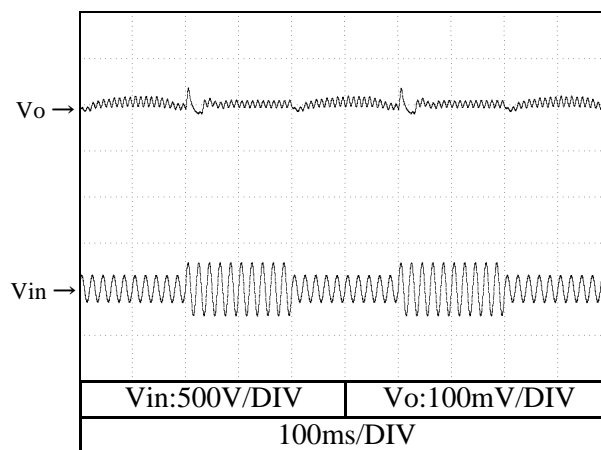
12V



28V



48V



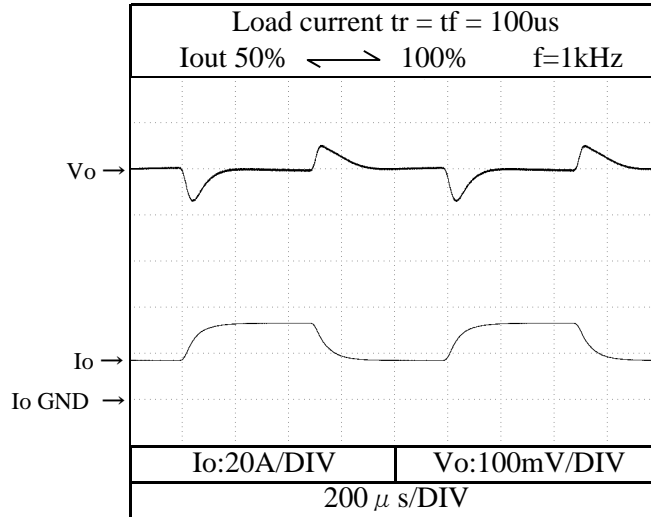
Note: This test follows SEMI F47-0200.

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

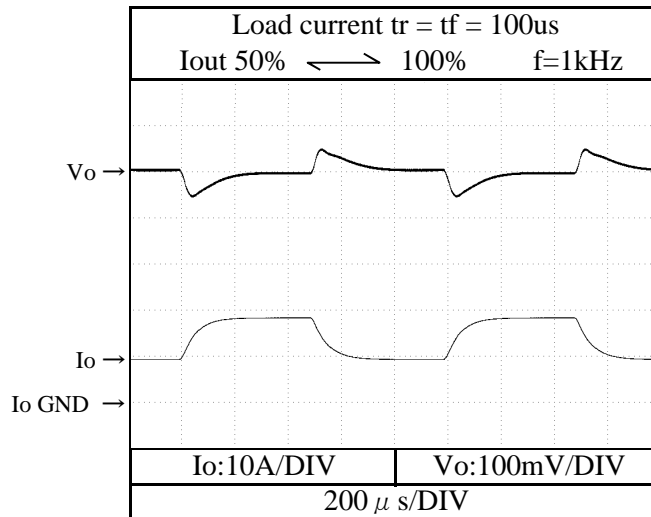
Conditions

Vin : 100 VAC  
Tbp : 25 °C

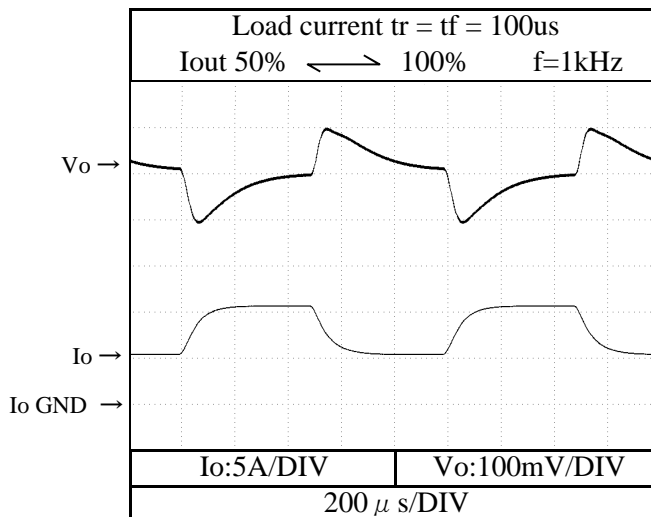
**12V**



**28V**



**48V**



2.9 入力電圧瞬停特性

Response to brownout characteristics

Conditions

$I_o$  : 100 %

$T_{bp}$  : 25 °C

瞬停時間 Interruption time

A : 出力電圧が低下なし Output voltage does not drop.

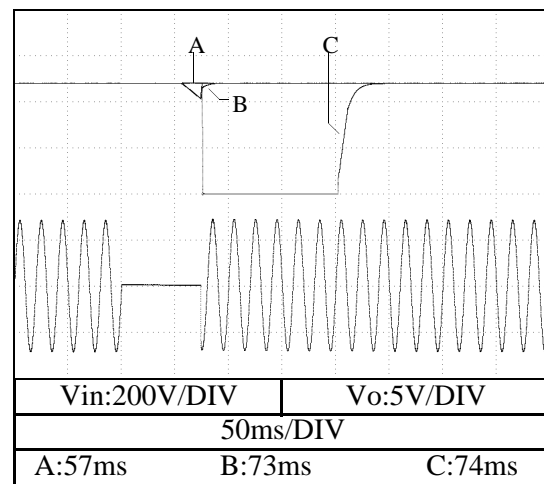
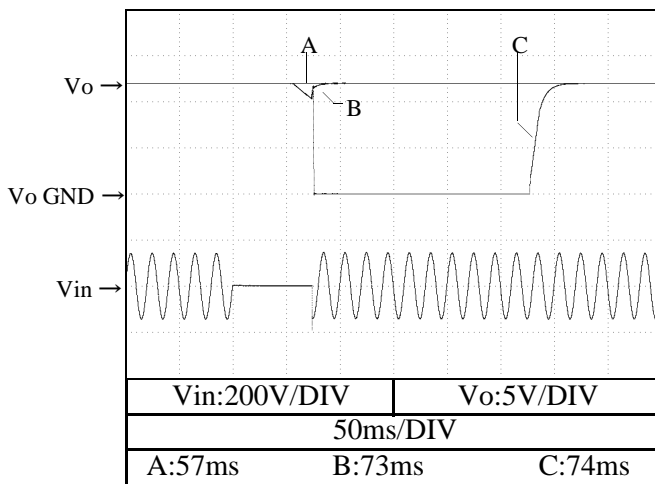
B : 出力電圧の低下が0Vまでいかない Output voltage drop down not reaching 0V.

C : 出力電圧が0Vまで低下 Output voltage drops until 0V.

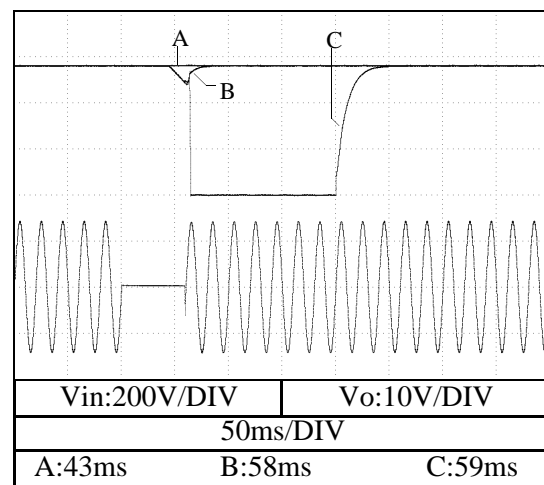
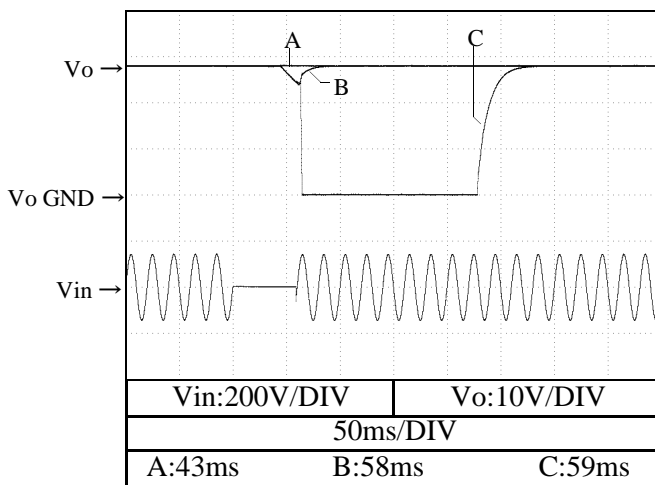
$V_{in}$  : 100VAC

$V_{in}$  : 200VAC

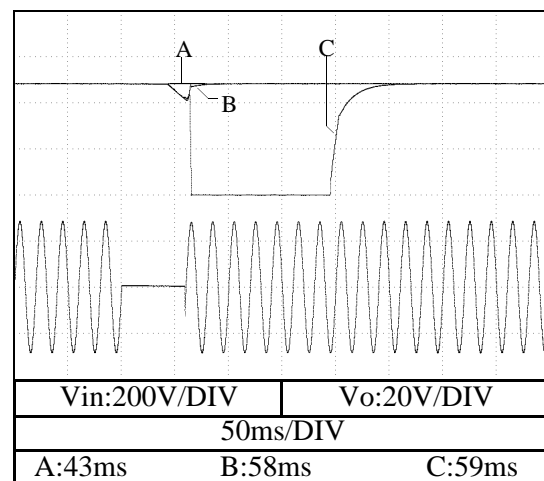
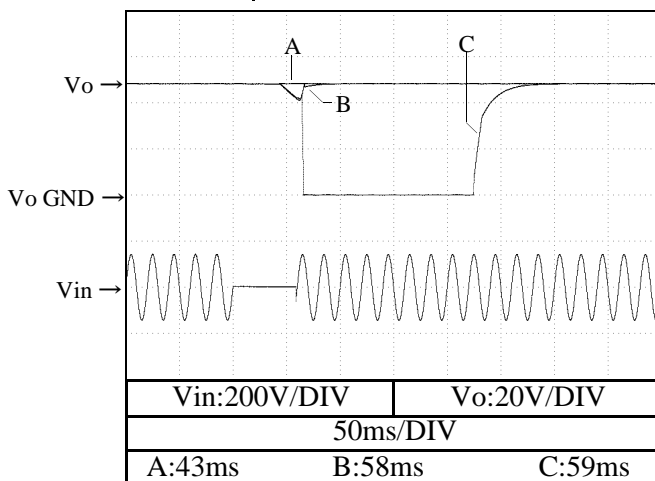
12V



28V



48V

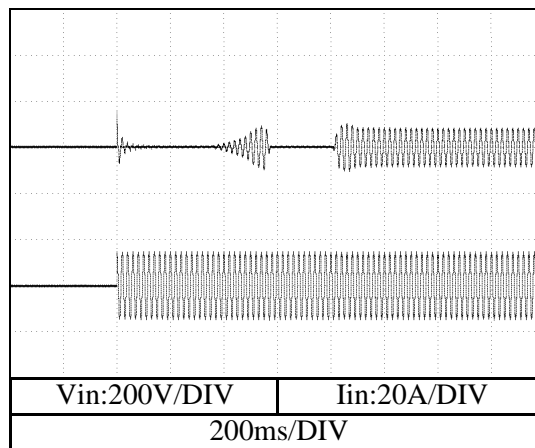
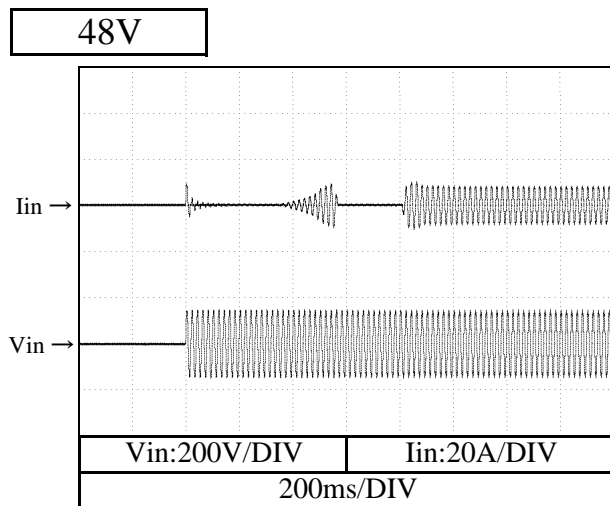
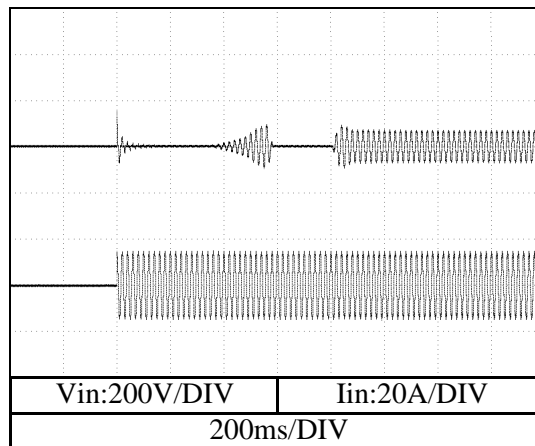
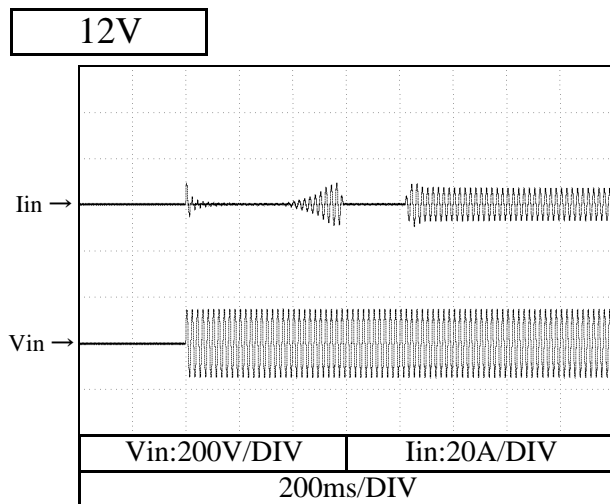


2.10 入力サージ電流（突入電流）特性  
Inrush current characteristics

Conditions Vin : 100 VAC  
Io : 100 %  
Tbp : 25 °C

Switch on phase angle  
of input AC voltage  $\phi = 0^\circ$

Switch on phase angle  
of input AC voltage  $\phi = 90^\circ$



Note : 28V is same as characteristics of 48V

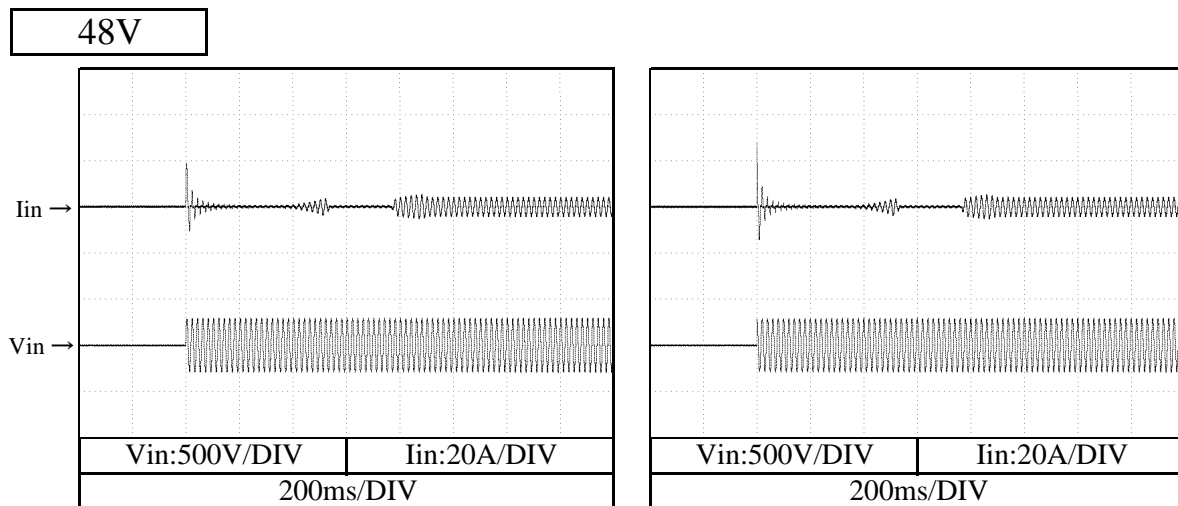
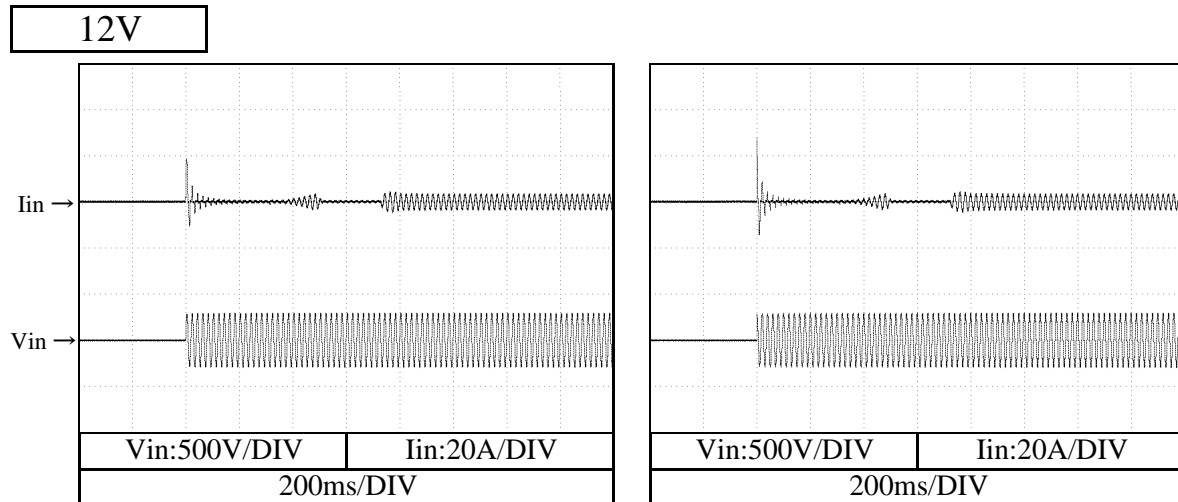


## 2.10 入力サージ電流（突入電流）特性 Inrush current characteristics

Conditions Vin : 200 VAC  
Io : 100 %  
Tbp : 25 °C

Switch on phase angle  
of input AC voltage  $\phi = 0^\circ$

Switch on phase angle  
of input AC voltage  $\phi = 90^\circ$



Note : 28V is same as characteristics of 48V

2.11 瞬停突入電流特性

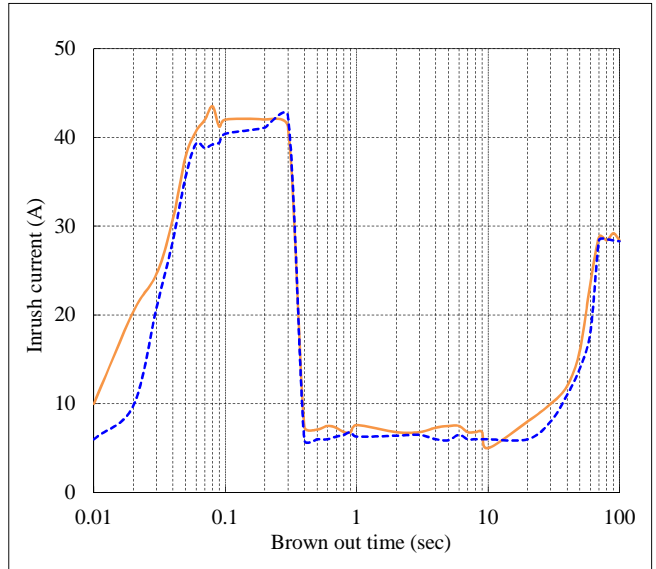
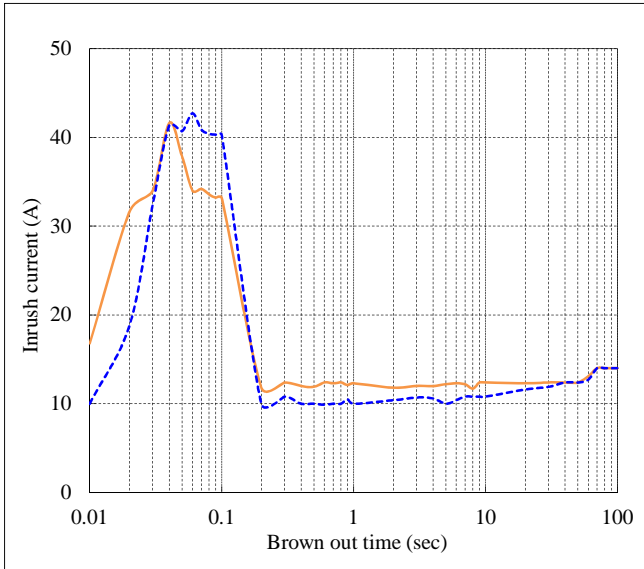
Brown of Inrush current characteristics

Conditions I<sub>o</sub> : 50 %    ---  
                   : 100 %    —  
                   T<sub>bp</sub> : 25 °C

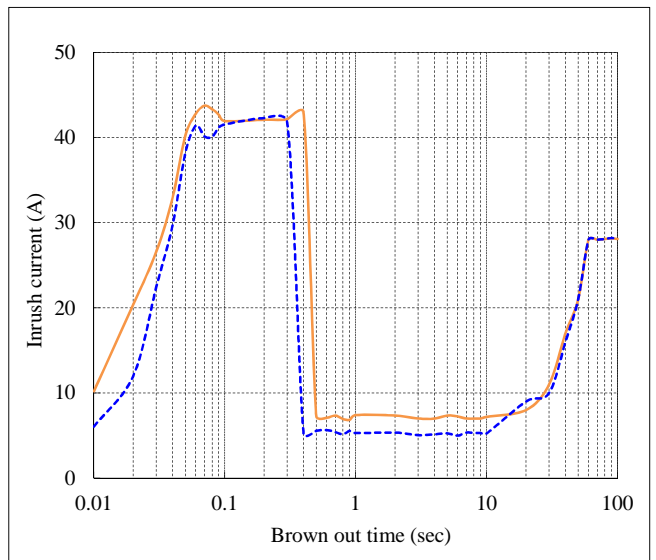
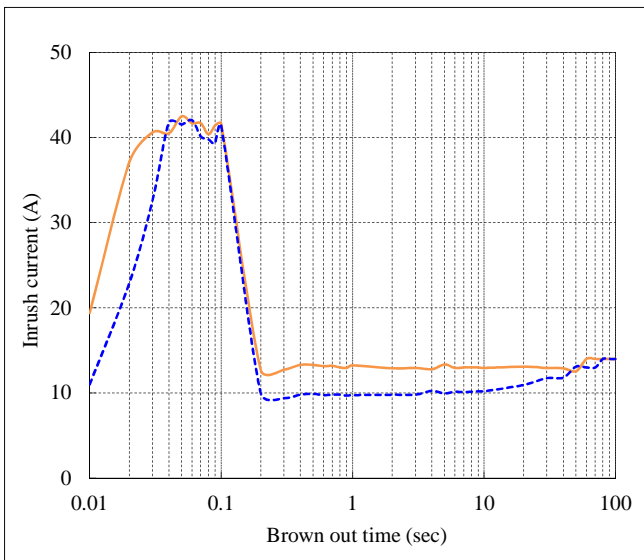
Vin:100VAC

Vin:200VAC

12V



48V



Note : Above data includes secondary inrush current.  
           : 28V is same as characteristics of 48V

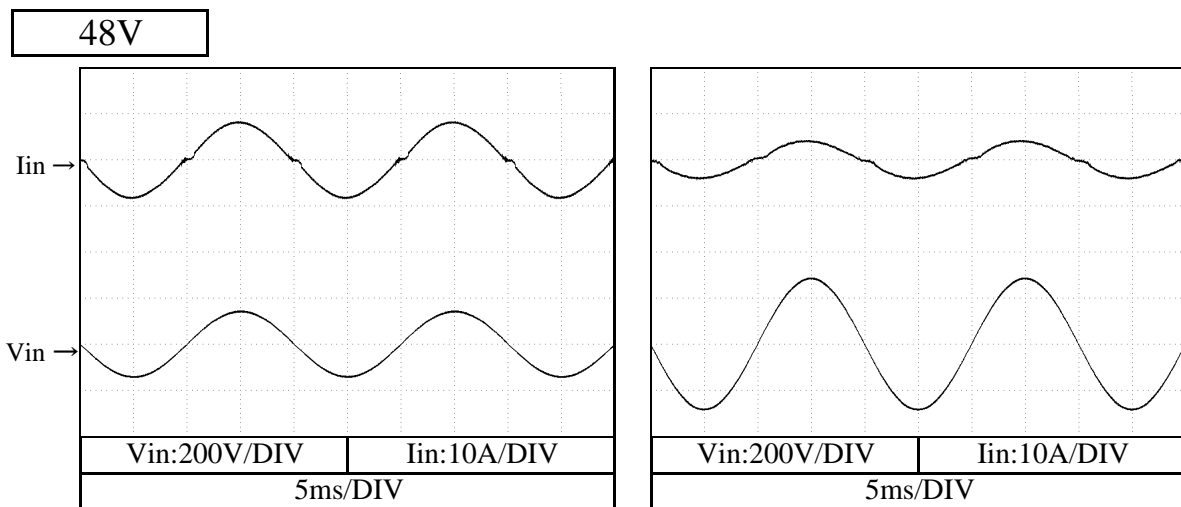
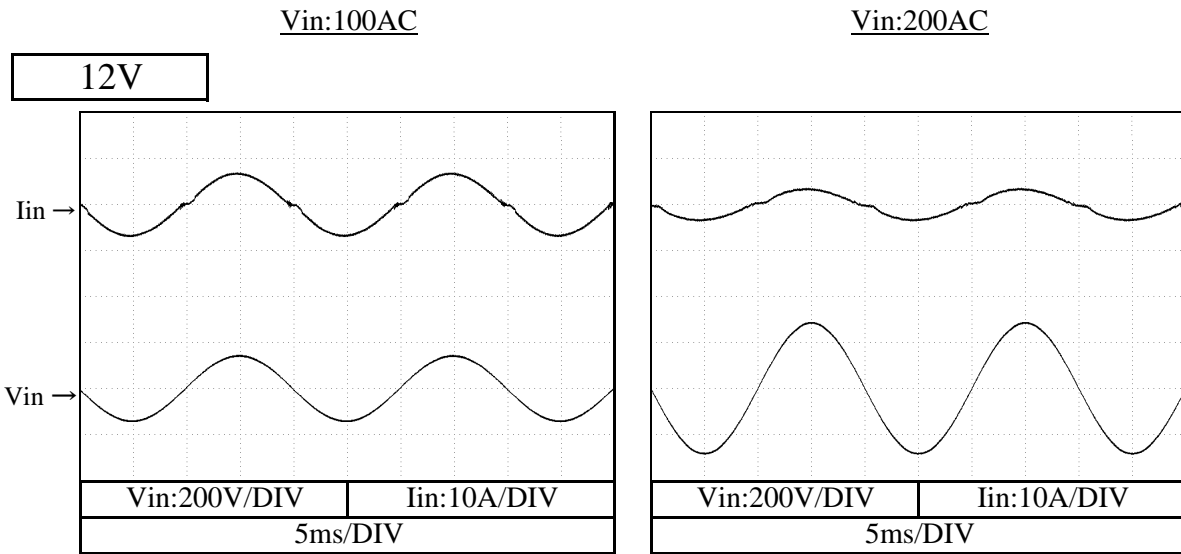
2.12 入力電流波形

Input current waveform

Conditions

$I_o : 100\%$

$T_{bp} : 25\text{ }^\circ\text{C}$



Note : 28V is same as characteristics of 48V

2.13 高調波成分

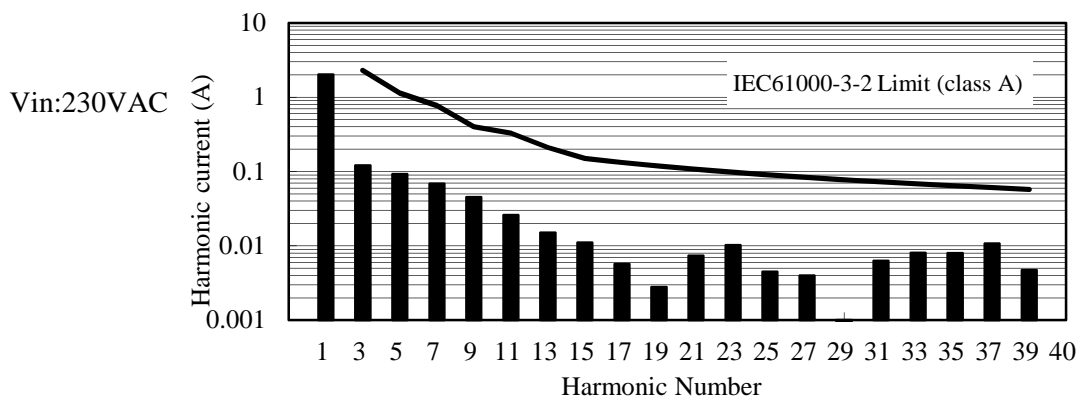
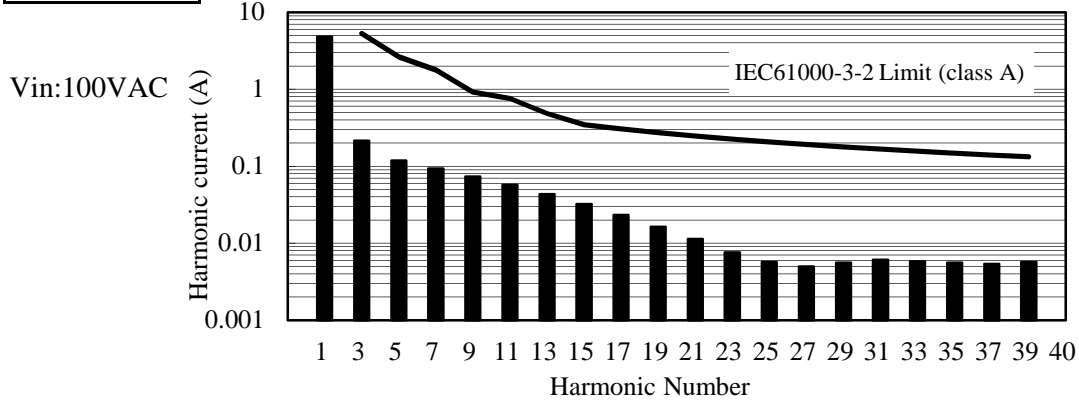
Input current harmonics

Conditions

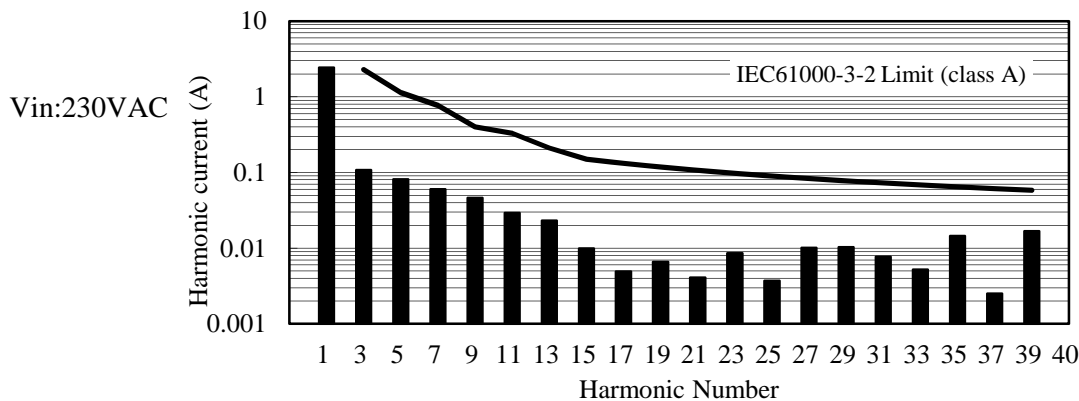
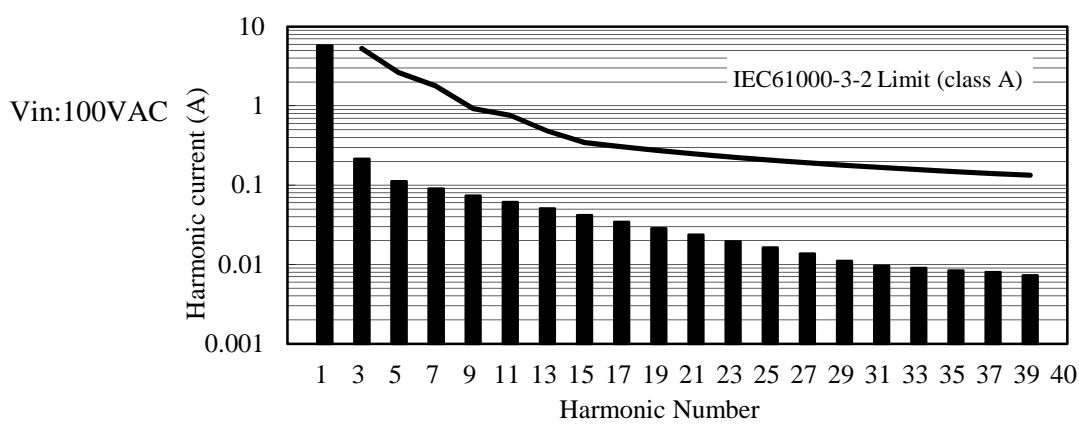
I<sub>o</sub> : 100 %

T<sub>bp</sub> : 25 °C

12V



48V



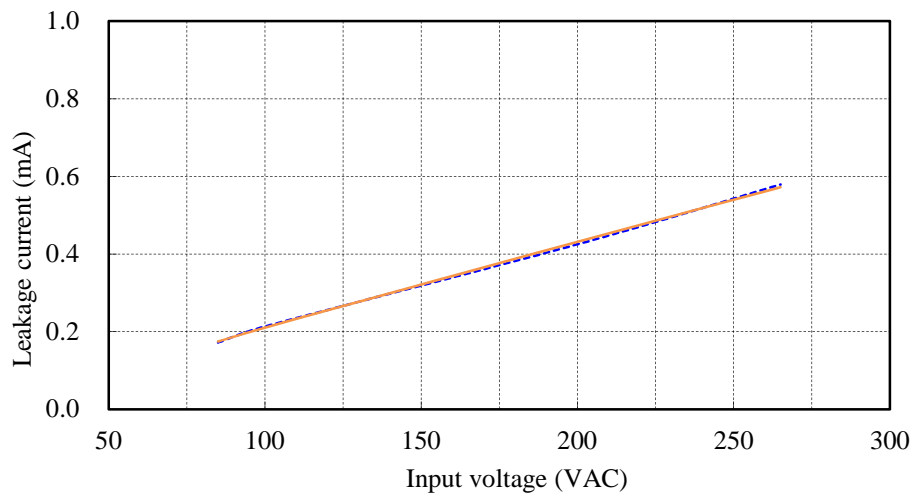
Note : 28V is same as characteristics of 48V

2.14 リーク電流特性

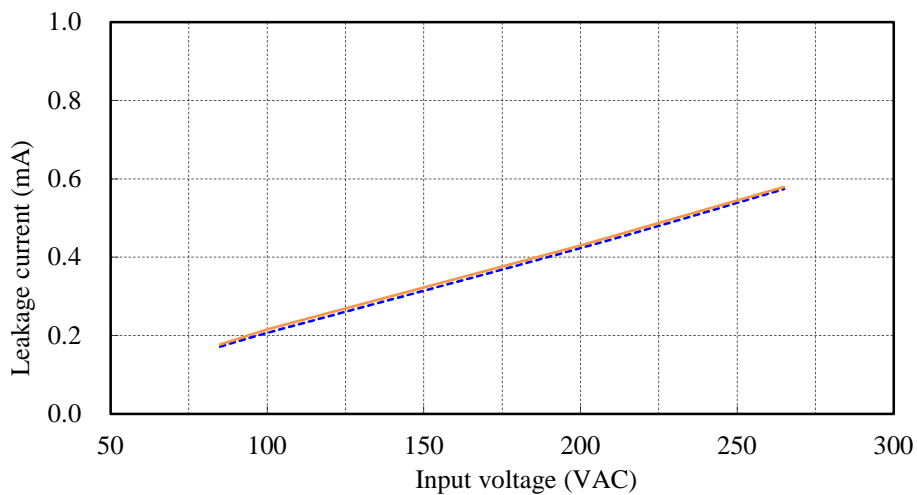
Leakage current characteristics

Conditions I<sub>o</sub> : 0 %     - - - - -  
                   : 100 %    —————  
                   T<sub>bp</sub> : 25 °C  
                   f : 50 Hz  
 Equipment used : MODEL 229-2  
   (Simpson)

12V



48V



Note : 28V is same as characteristics of 48V

2.15 出力リップル、ノイズ波形  
Output ripple and noise waveform

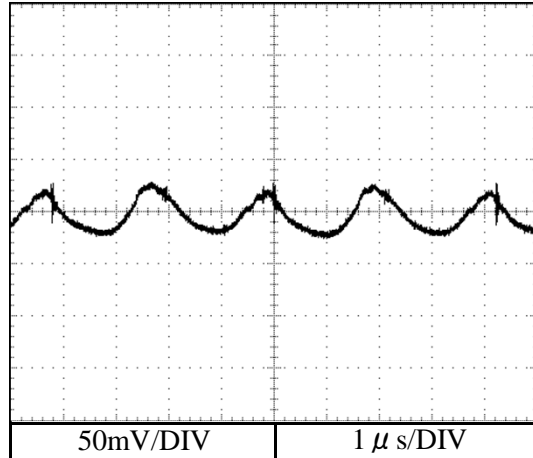
Conditions

Vin : 100 VAC

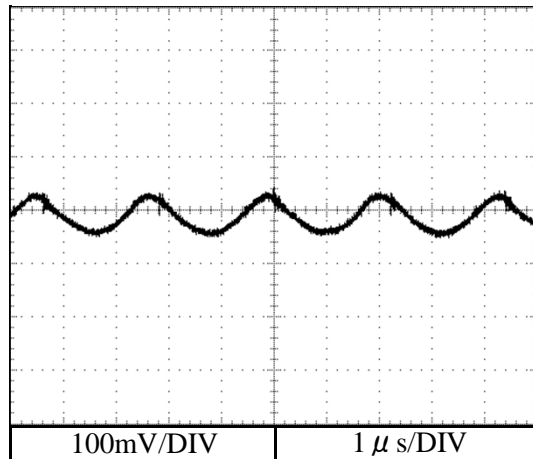
Io : 100 %

Tbp : 25 °C

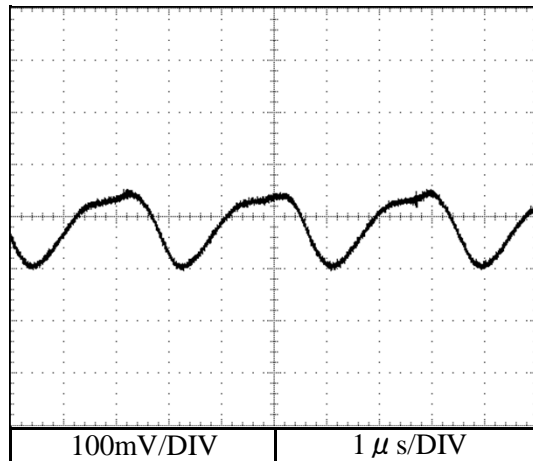
12V



28V



48V



2.16 EMI特性

Electro-Magnetic Interference characteristics

(a) 雑音端子電圧 (帰還ノイズ)

Conducted Emission

Conditions

Vin : 100 VAC

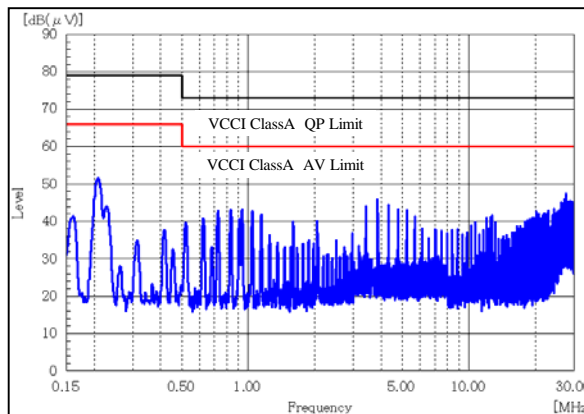
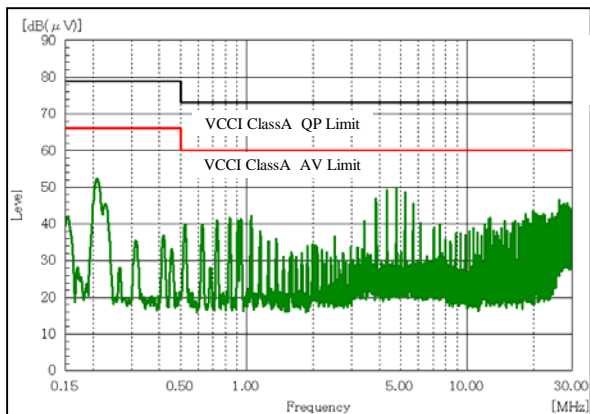
Io : 100 %

Tbp : 25 °C

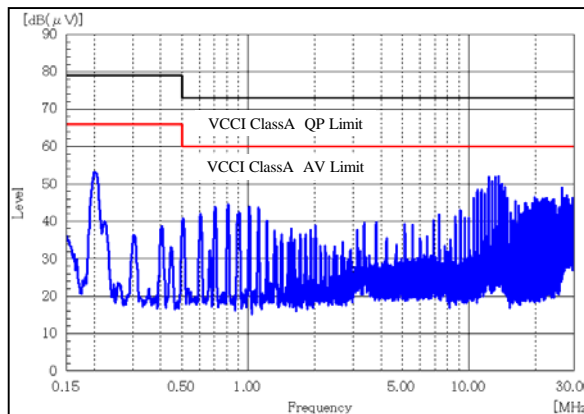
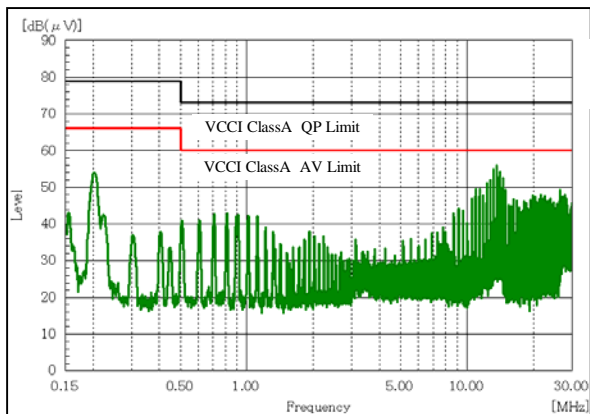
Phase:N

Phase:L

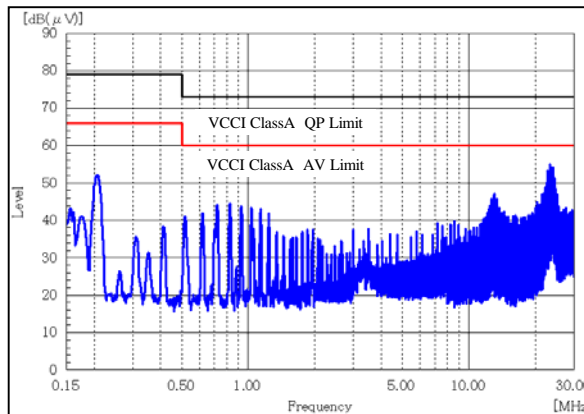
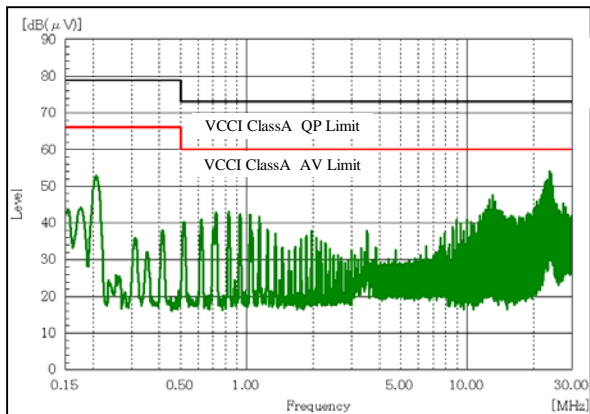
12V



28V



48V



2.16 EMI特性

Electro-Magnetic Interference characteristics

(b) 雑音電界強度 (輻射ノイズ)

Radiated Emission

Conditions

Vin : 100 VAC

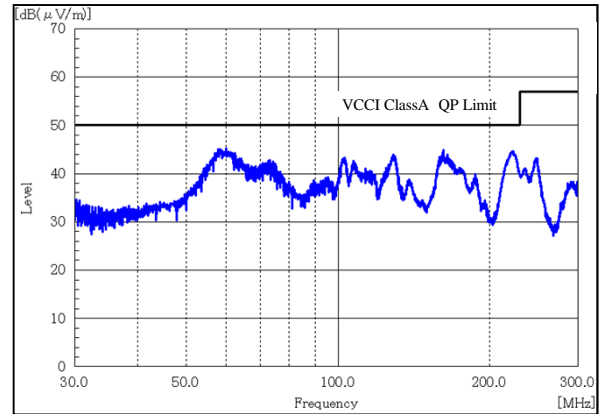
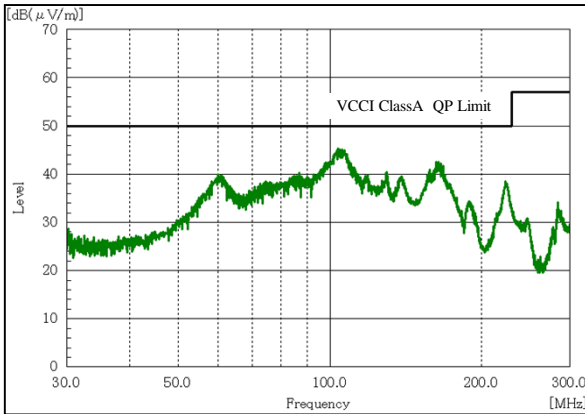
Io : 100 %

Tbp : 25 °C

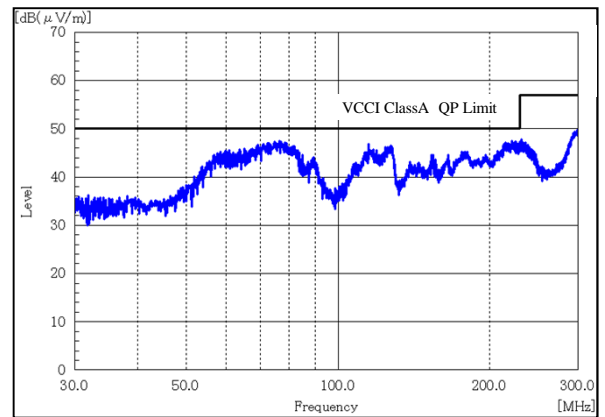
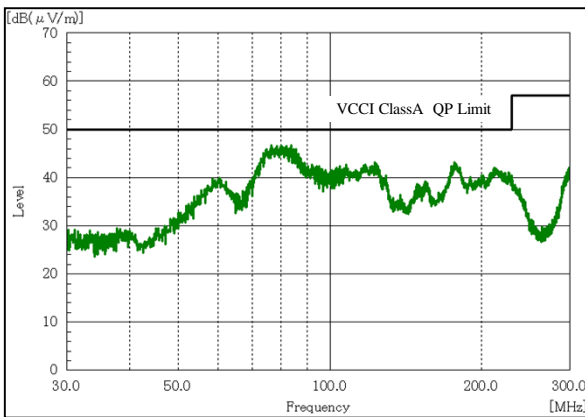
HORIZONTAL

VERTICAL

12V



28V



48V

