

# PAF450F280-\*

## EVALUATION DATA

### 型式データ

DWG.NO. C176-53-01/450			
承認	承認	査閲	担当
<i>E. Takahashi</i>	<i>S. Tomida</i>	<i>M. Miyasaka</i>	<i>R. Ishizawa</i>
12. Jan '05	11. Jan '05	6. Jan '05	6. Jan '05

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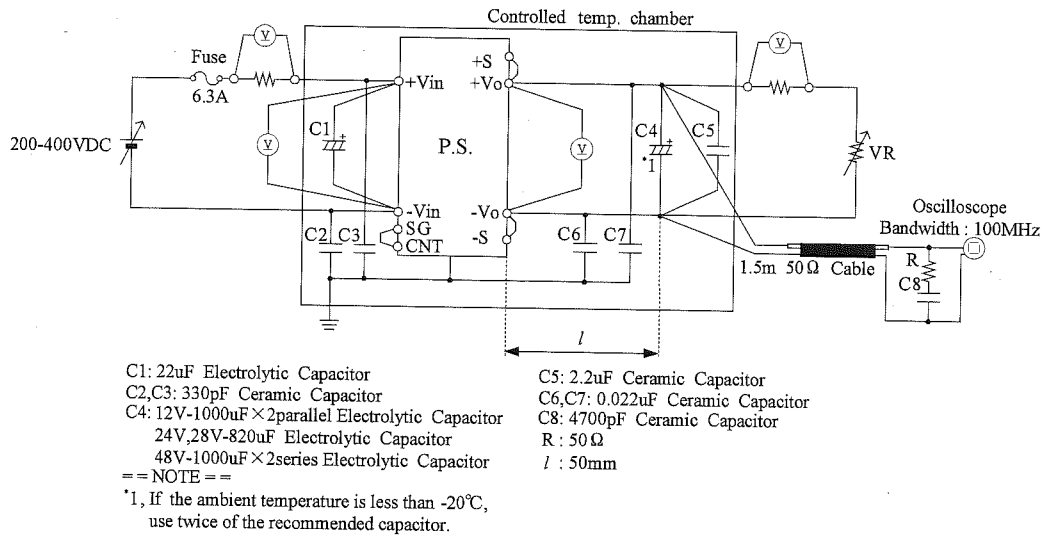
使用記号 Terminology used

	Definition	
Vin	..... 入力電圧	Input Voltage
Vout	..... 出力電圧	Output Voltage
Vcnt	..... CNT電圧	CNT Voltage
Iin	..... 入力電流	Input Current
Iout	..... 出力電流	Output Current
Tbp	..... ベースプレート温度	Baseplate Temperature
Ta	..... 周囲温度	Ambient Temperature

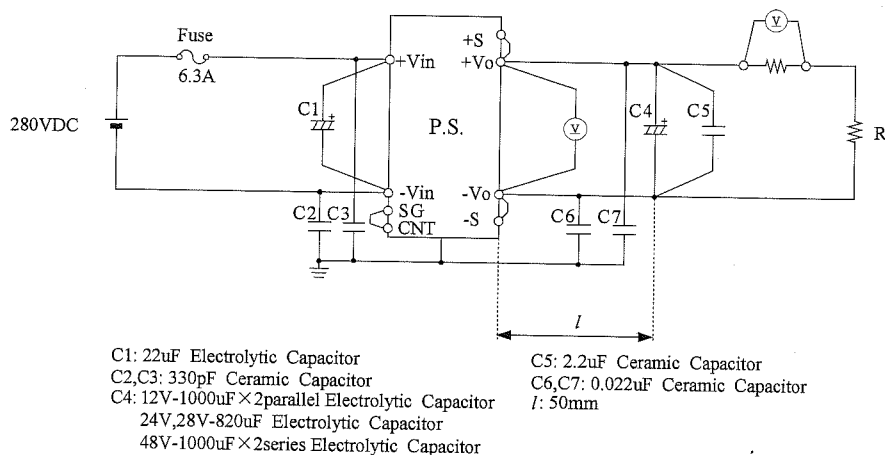
1. 測定方法 Evaluation Method

1.1 測定回路 Circuits used for determination

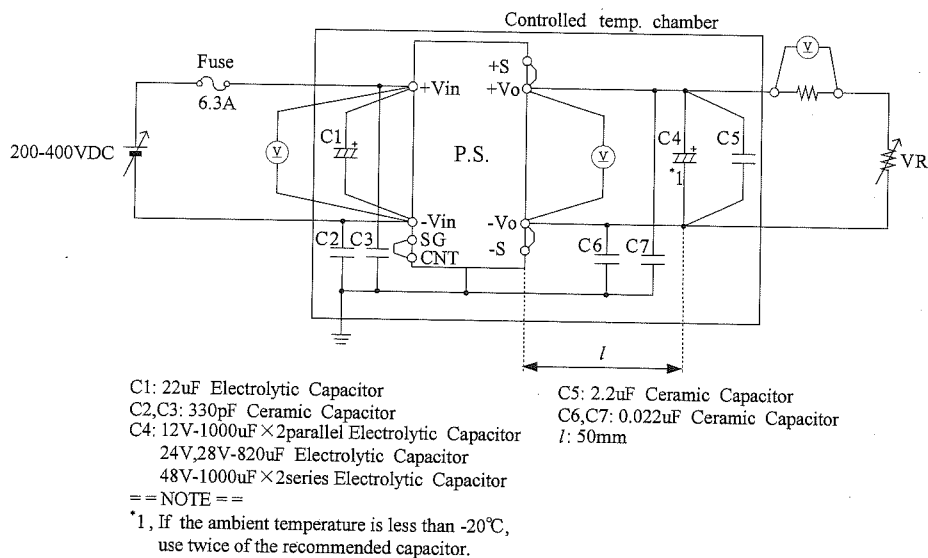
(1) 静特性 Steady state data



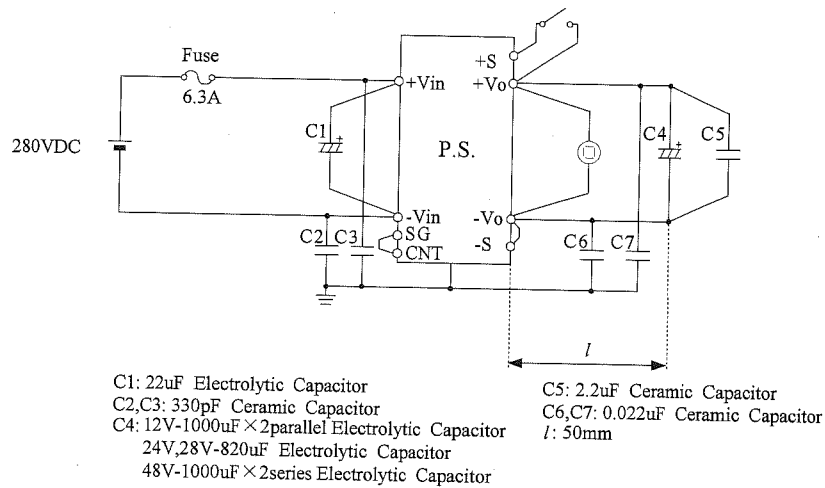
(2) 通電ドリフト特性 Warm up voltage drift characteristics



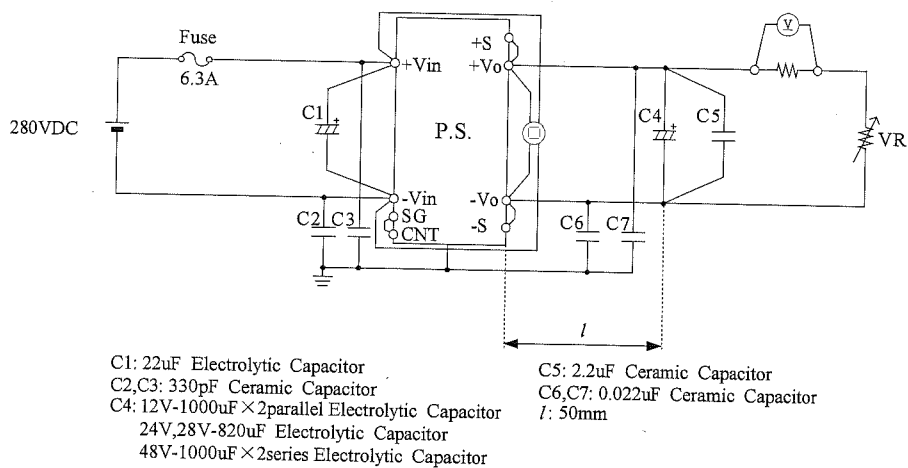
(3) 過電流保護特性 Over current protection (OCP) characteristics



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



## (5) 出力立ち上がり特性 Output rise characteristics



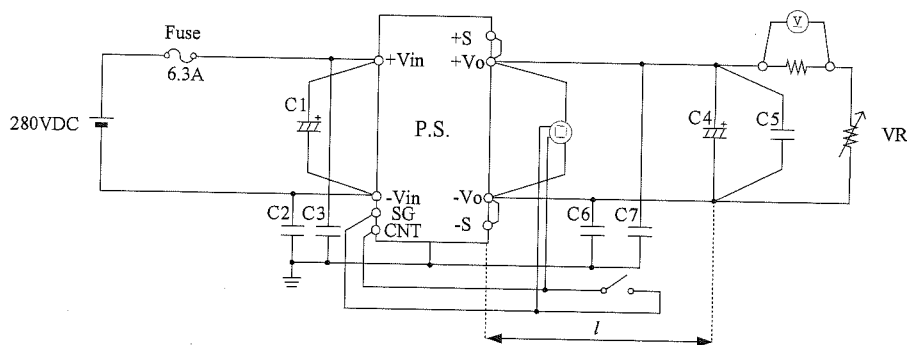
## (6) 出力立ち下がり特性 Output fall characteristics

出力立ち上がり特性と同じ

Same as output rise characteristics

(7) 出力立ち上がり特性 (ON/OFFコントロール時)

Output rise characteristics with ON/OFF CONTROL



- C1: 22uF Electrolytic Capacitor
- C2,C3: 330pF Ceramic Capacitor
- C4: 12V-1000uF × 2parallel Electrolytic Capacitor  
24V,28V-820uF Electrolytic Capacitor
- C5: 2.2uF Ceramic Capacitor
- C6,C7: 0.022uF Ceramic Capacitor
- l: 50mm

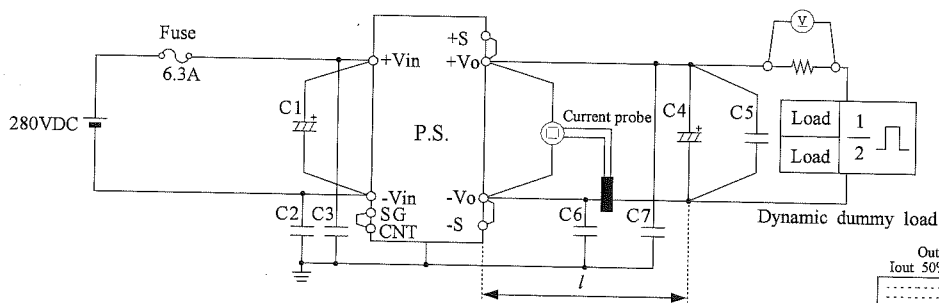
(8) 出力立ち下がり特性 (ON/OFFコントロール時)

Output fall characteristics with ON/OFF CONTROL

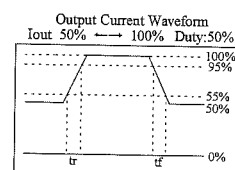
出力立ち上がり特性 (ON/OFFコントロール時) と同じ

Same as output rise characteristics with ON/OFF CONTROL

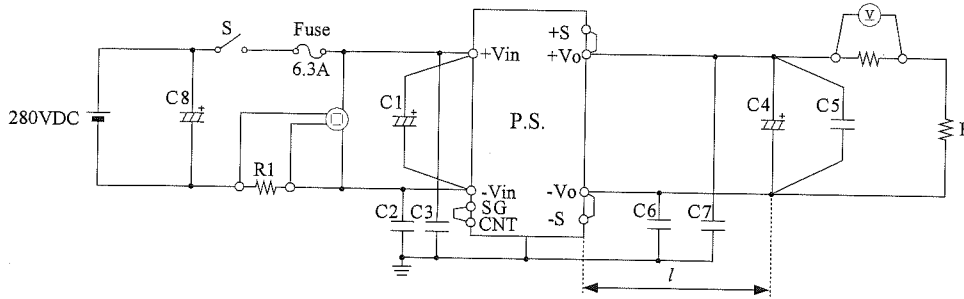
(9) 過渡応答(負荷急変)特性 Dynamic load response characteristics



- C1: 22uF Electrolytic Capacitor
- C2,C3: 330pF Ceramic Capacitor
- C4: 12V-1000uF × 2parallel Electrolytic Capacitor  
24V,28V-820uF Electrolytic Capacitor
- C5: 2.2uF Ceramic Capacitor
- C6,C7: 0.022uF Ceramic Capacitor
- l: 50mm



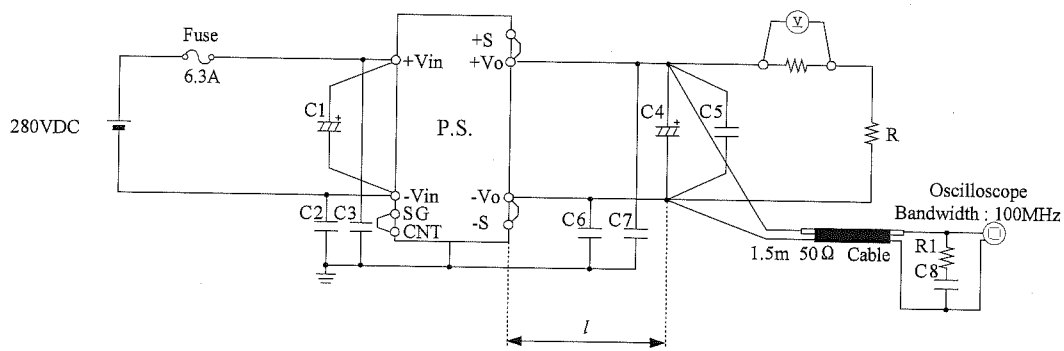
(10) 入力サージ電流 (突入電流) 特性 Inrush current characteristics



- |  |  |
|--|--|
| C1: 22 $\mu$ F Electrolytic Capacitor                        | C6,C7: 0.022 $\mu$ F Ceramic Capacitor |
| C2,C3: 330pF Ceramic Capacitor                               | C8: 450 $\mu$ F Electrolytic Capacitor |
| C4: 48V-1000 $\mu$ F $\times$ 2series Electrolytic Capacitor | R1: 0.01 $\Omega$                      |
| C5: 2.2 $\mu$ F Ceramic Capacitor                            | l: 50mm                                |

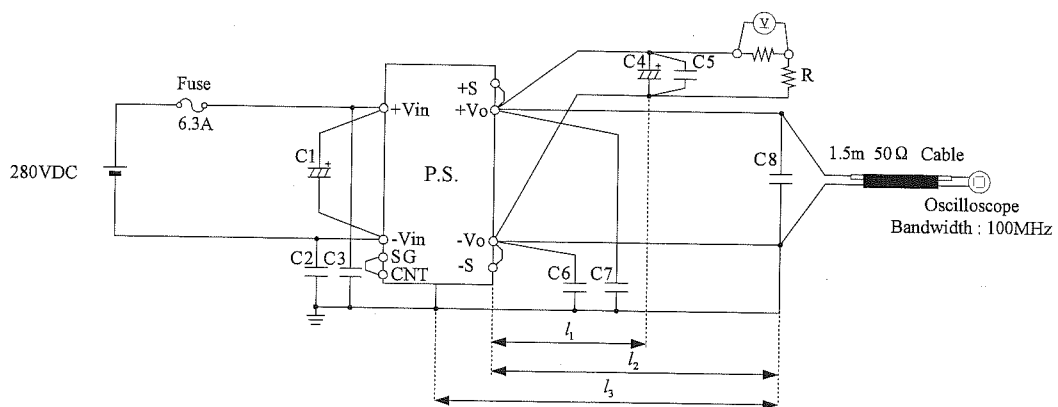
(11) 出力リップル、ノイズ波形 Output ripple and noise waveform

(a) Normal Mode



- |  |  |
|--|--|
| C1: 22 $\mu$ F Electrolytic Capacitor                          | C5: 2.2 $\mu$ F Ceramic Capacitor      |
| C2,C3: 330pF Ceramic Capacitor                                 | C6,C7: 0.022 $\mu$ F Ceramic Capacitor |
| C4: 12V-1000 $\mu$ F $\times$ 2parallel Electrolytic Capacitor | C8: 4700pF Ceramic Capacitor           |
| 24V,28V-820 $\mu$ F Electrolytic Capacitor                     | R1: 50 $\Omega$                        |
| 48V-1000 $\mu$ F $\times$ 2series Electrolytic Capacitor       | l: 50mm                                |

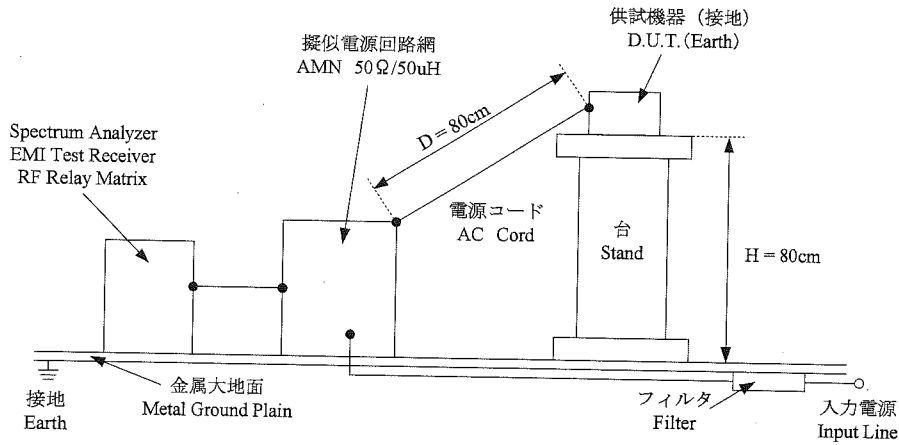
(b) Normal + Common Mode



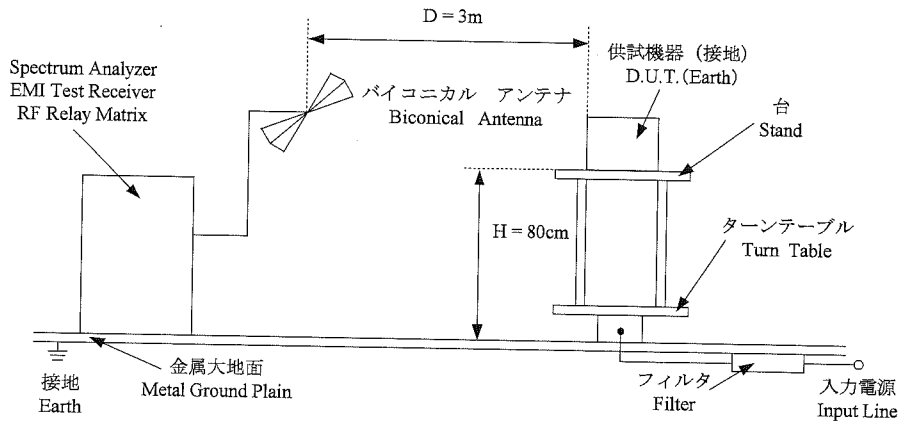
- |  |  |
|--|--|
| C1: 22 $\mu$ F Electrolytic Capacitor                          | C5: 2.2 $\mu$ F Ceramic Capacitor      |
| C2,C3: 330pF Ceramic Capacitor                                 | C6,C7: 0.022 $\mu$ F Ceramic Capacitor |
| C4: 12V-1000 $\mu$ F $\times$ 2parallel Electrolytic Capacitor | C8: 0.1 $\mu$ F Ceramic Capacitor      |
| 24V,28V-820 $\mu$ F Electrolytic Capacitor                     | l <sub>1</sub> : 50mm                  |
| 48V-1000 $\mu$ F $\times$ 2series Electrolytic Capacitor       | l <sub>2</sub> : 150mm                 |
|  | l <sub>3</sub> : 150mm                 |

(12) EMI 特性 Electro-Magnetic Interference characteristics

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

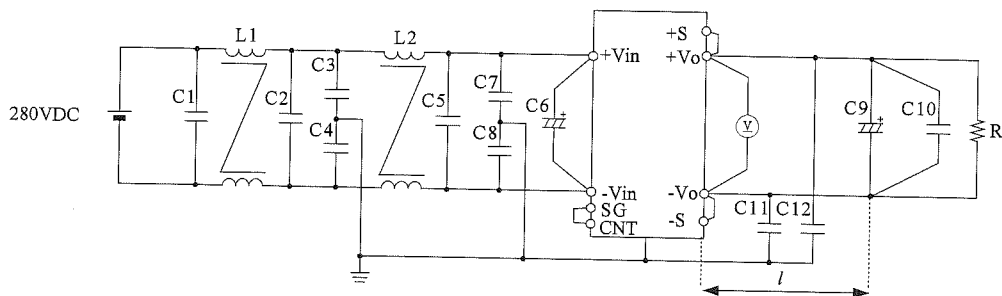


(b) 雑音電界強度 (輻射ノイズ) Radiated Emission Noise



(1) VCCI class A 対応アプリケーションシステム

VCCI class A application system



- |  |                                     |
|--|-------------------------------------|
| C1, C2, C5: 0.68uF Film Capacitor                  | C10: 2.2uF Ceramic Capacitor        |
| C3, C4, C7, C8: 680pF Ceramic Capacitor            | C11, C12: 0.022uF Ceramic Capacitor |
| C6: 22uF Electrolytic Capacitor                    | L1: 5mH                             |
| C9: 12V-1000uF × 2 parallel Electrolytic Capacitor | L2: 3.8mH                           |
| 24V, 28V-820uF Electrolytic Capacitor              | l: 50mm                             |
| 48V-1000uF × 2 series Electrolytic 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	IWATSU-LECROY	DS-4354
3	DIGITAL MULTIMETER	ADVANTEST	R6441B
4	DATA ACQUISITION / SWITCH UNIT	AGILENT	34970A
5	CURRENT PROBE	LECROY	AP015
6	SHUNT RESISTER	YOKOGAWA ELECT.	2215
7	CONTROLLED TEMP. CHAMBER	TABAI ESPEC	SU-261
8	SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSA
9	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESHS10
10	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESVS10
11	RF RELAY MATRIX	ROHDE & SCHWARZ	PSU
12	AMN	KYORITU DENSHI	KNW-408
13	ANTENNA(BICONICAL ANTENNA)	SCHWARZBECK	BBA9106
14	DYNAMIC DUMMY LOAD	TAKASAGO	FK-1000L
15	DC POWER SUPPLY	TAKASAGO	AA-2000XG

## 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	200VDC	280VDC	400VDC	line regulation	
0%	12.001V	12.002V	12.001V	1mV	0.008%
50%	12.001V	12.001V	12.001V	0mV	0.000%
100%	12.000V	12.001V	12.001V	1mV	0.008%
load regulation	1mV	1mV	0mV		
	0.008%	0.008%	0.000%		

## 2. Temperature drift

Conditions Vin : 280VDC

Iout : 100%

Tbp	-40°C	25°C	100°C	temperature drift	
Vout	11.925V	12.001V	12.009V	84mV	0.700%

24V

## 1. Regulation - line and load

Condition Tbp : 25°C

Iout \ Vin	200VDC	280VDC	400VDC	line regulation	
0%	24.079V	24.079V	24.078V	1mV	0.004%
50%	24.079V	24.079V	24.079V	0mV	0.000%
100%	24.078V	24.078V	24.079V	1mV	0.004%
load regulation	1mV	1mV	1mV		
	0.004%	0.004%	0.004%		

## 2. Temperature drift

Conditions Vin : 280VDC

Iout : 100%

Tbp	-40°C	25°C	100°C	temperature drift	
Vout	23.947V	24.078V	24.086V	139mV	0.580%

## (1) 入力・負荷・温度変動

Regulation - line and load, temperature drift

28V

## 1. Regulation - line and load

Condition Tbp : 25°C

Iout \ Vin	200VDC	280VDC	400VDC	line regulation	
0%	28.084V	28.084V	28.084V	0mV	0.000%
50%	28.084V	28.084V	28.084V	0mV	0.000%
100%	28.084V	28.085V	28.085V	1mV	0.004%
load regulation	0mV	1mV	1mV		
	0.000%	0.004%	0.004%		

## 2. Temperature drift

Conditions Vin : 280VDC

Iout : 100%

Tbp	-40°C	25°C	100°C	temperature drift	
Vout	27.958V	28.085V	28.095V	137mV	0.488%

48V

## 1. Regulation - line and load

Condition Tbp : 25°C

Iout \ Vin	200VDC	280VDC	400VDC	line regulation	
0%	47.942V	47.943V	47.941V	2mV	0.004%
50%	47.942V	47.943V	47.942V	1mV	0.002%
100%	47.942V	47.943V	47.941V	2mV	0.004%
load regulation	0mV	0mV	1mV		
	0.000%	0.000%	0.002%		

## 2. Temperature drift

Conditions Vin : 280VDC

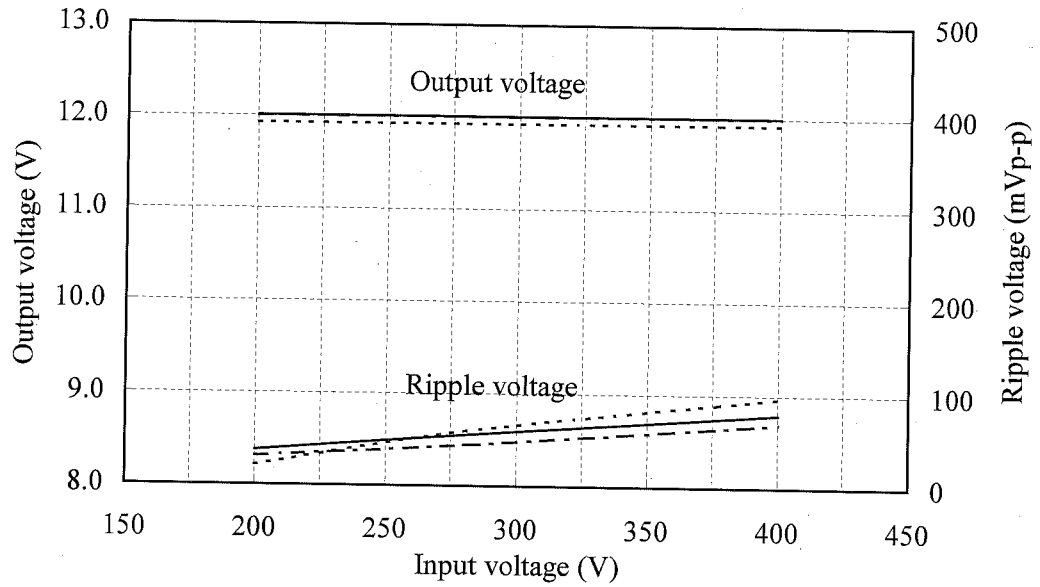
Iout : 100%

Tbp	-40°C	25°C	100°C	temperature drift	
Vout	47.776V	47.943V	47.969V	193mV	0.402%

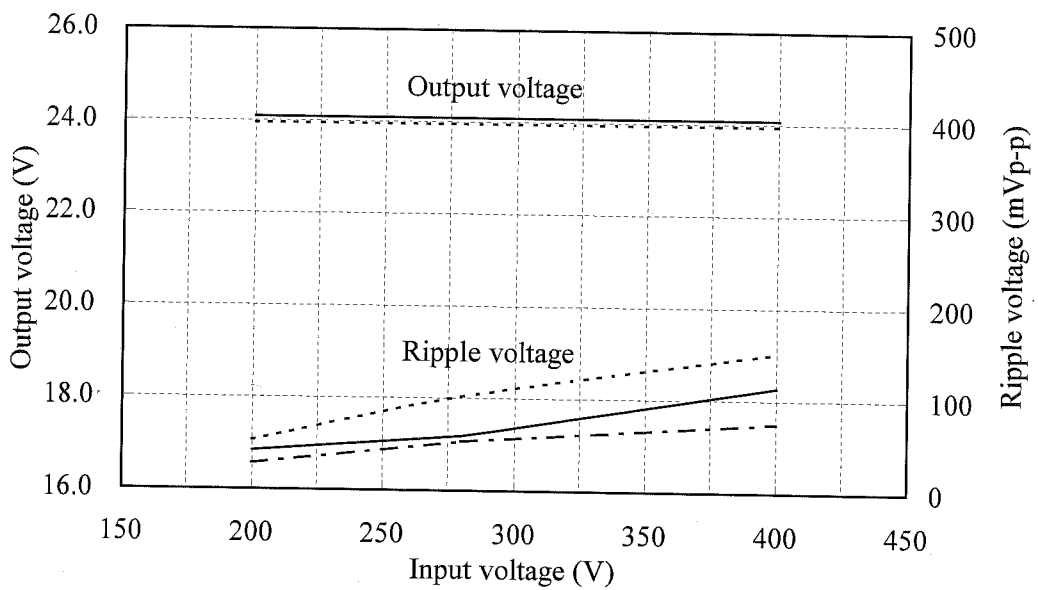
2.1 (2) 出力電圧・リップル電圧対入力電圧  
Output voltage and Ripple voltage v.s. Input voltage

Conditions Iout : 100 %  
Tbp : -40 °C -----  
          : 25 °C       - · - · -  
          : 100 °C      —————

12V



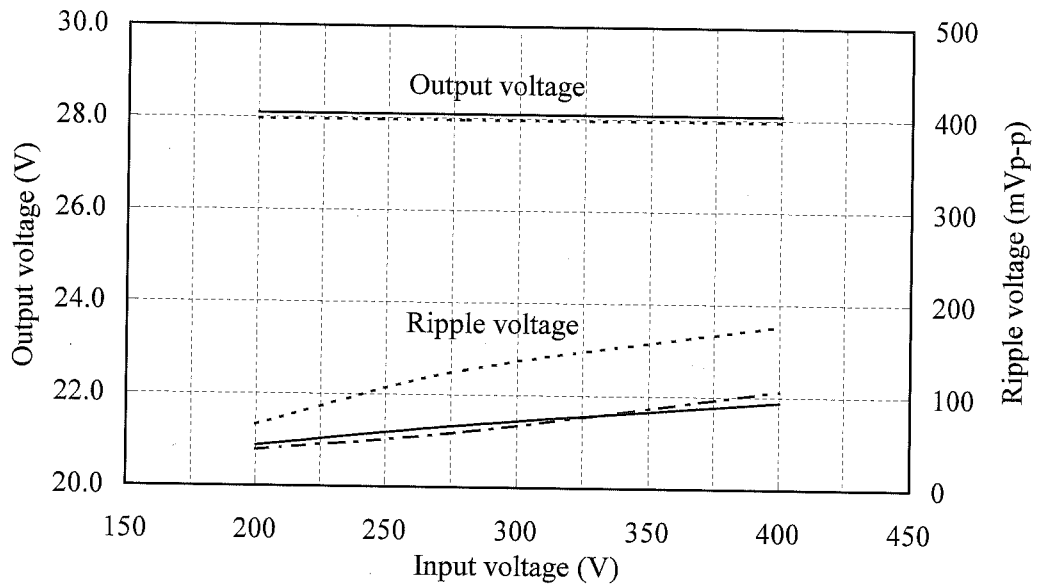
24V



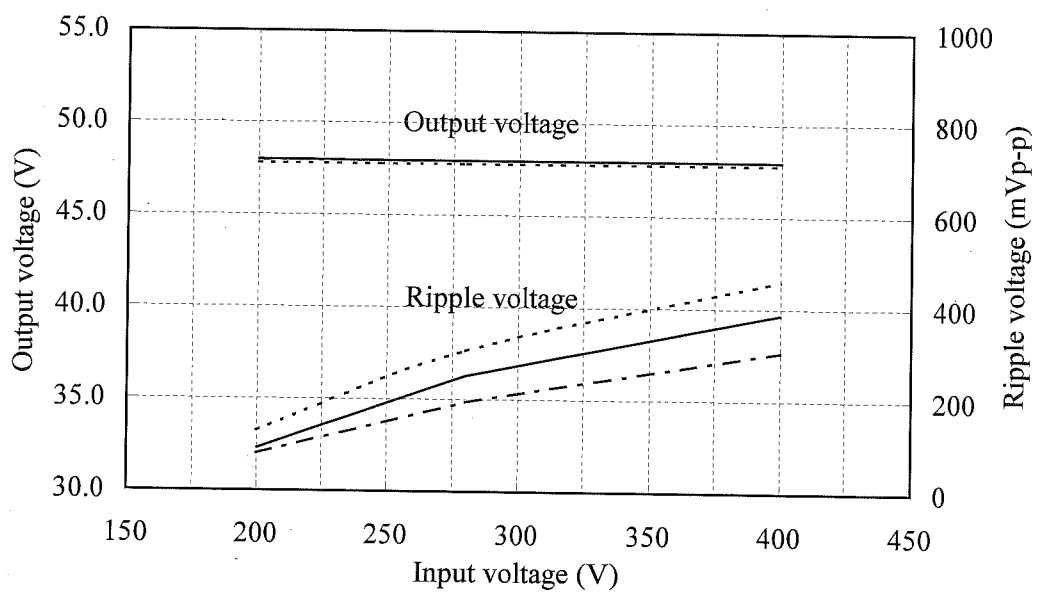
2.1 (2) 出力電圧・リップル電圧対入力電圧  
Output voltage and Ripple voltage v.s. Input voltage

Conditions Iout : 100 %  
Tbp : -40 °C -----  
          : 25 °C       - · - · -  
          : 100 °C      —————

28V



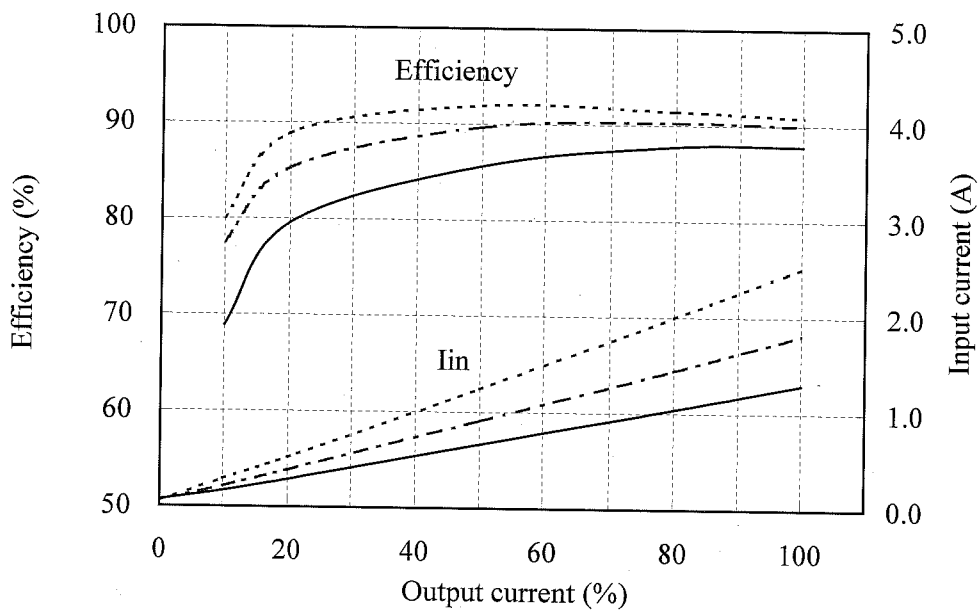
48V



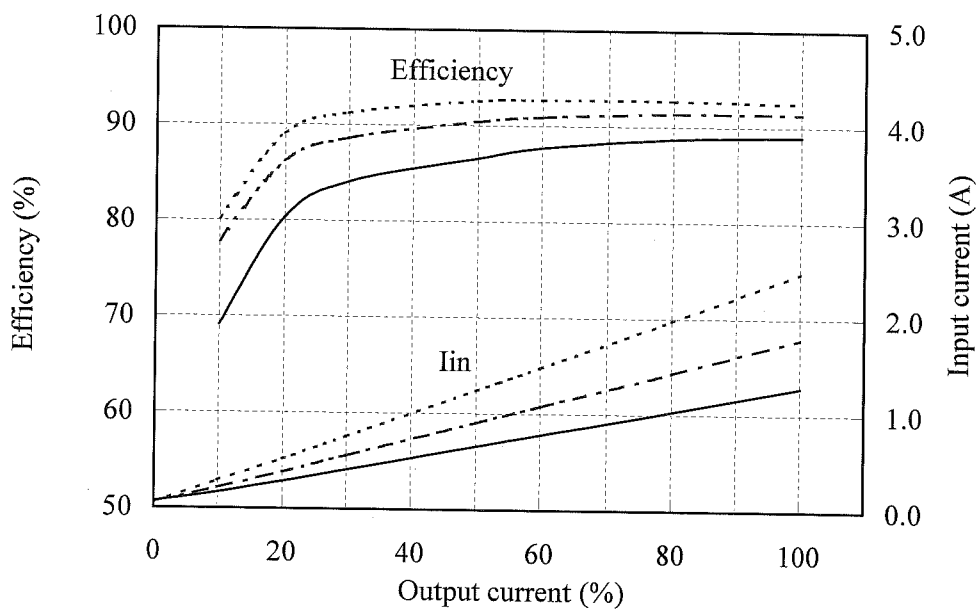
2.1 (3) 効率・入力電流対出力電流  
Efficiency and Input current v.s. Output current

Conditions  $V_{in}$  : 200 VDC -----  
                   : 280 VDC - - - - -  
                   : 400 VDC ————  
 $T_{bp}$  : 25 °C

12V



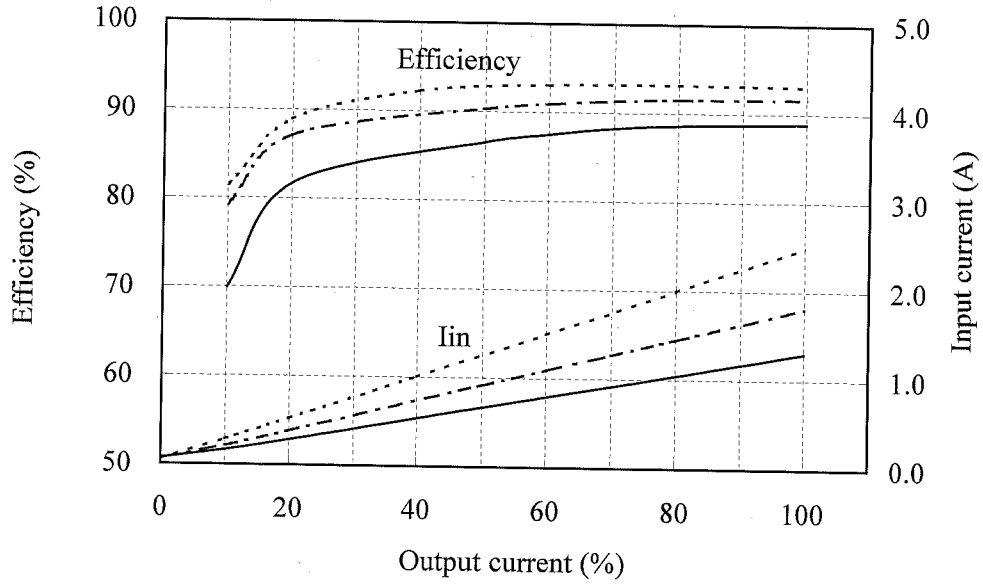
24V



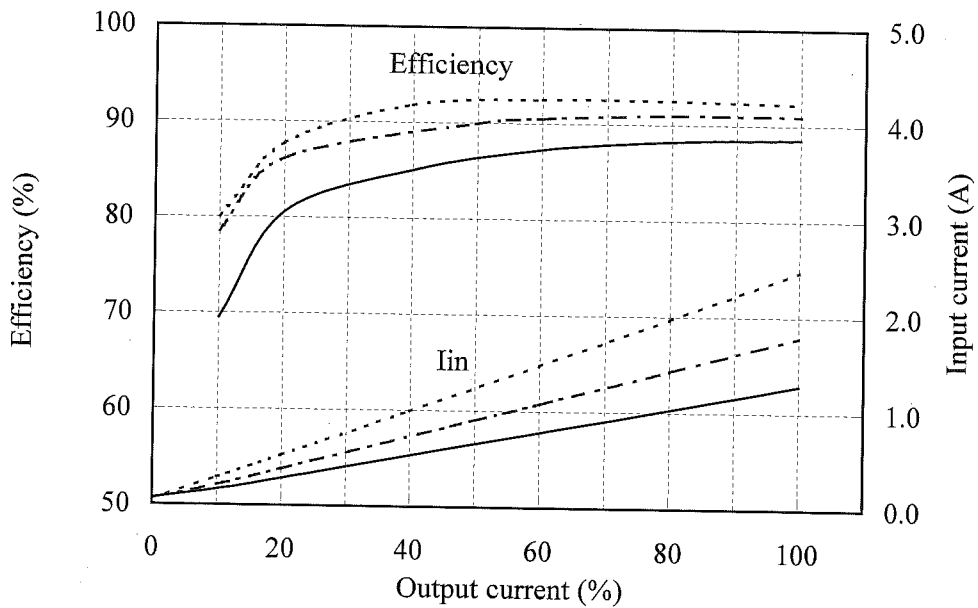
2.1 (3) 効率・入力電流対出力電流  
Efficiency and Input current v.s. Output current

Conditions  $V_{in}$  : 200 VDC -----  
                   : 280 VDC - - - - -  
                   : 400 VDC \_\_\_\_\_  
 $T_{bp}$  : 25 °C

28V



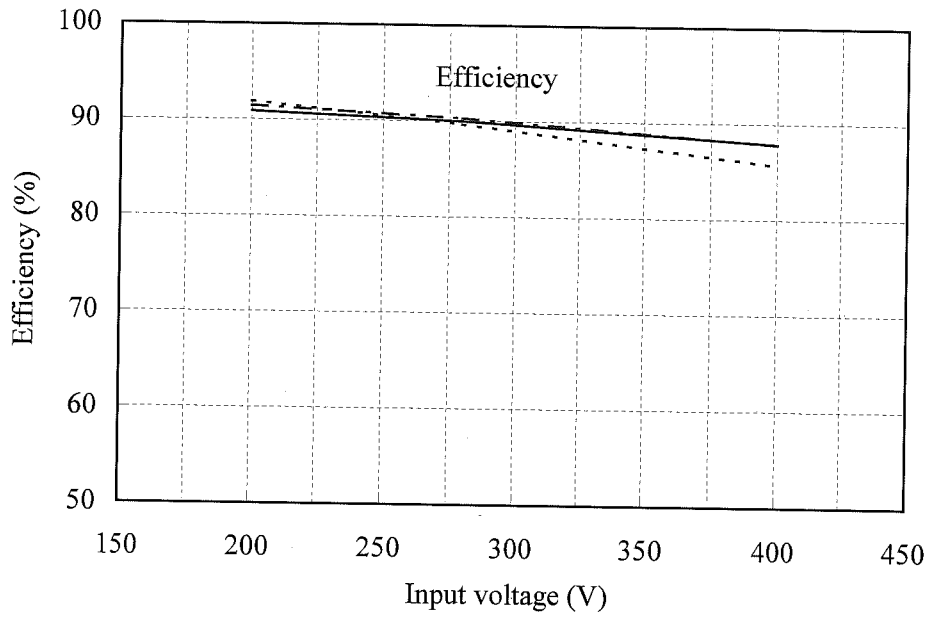
48V



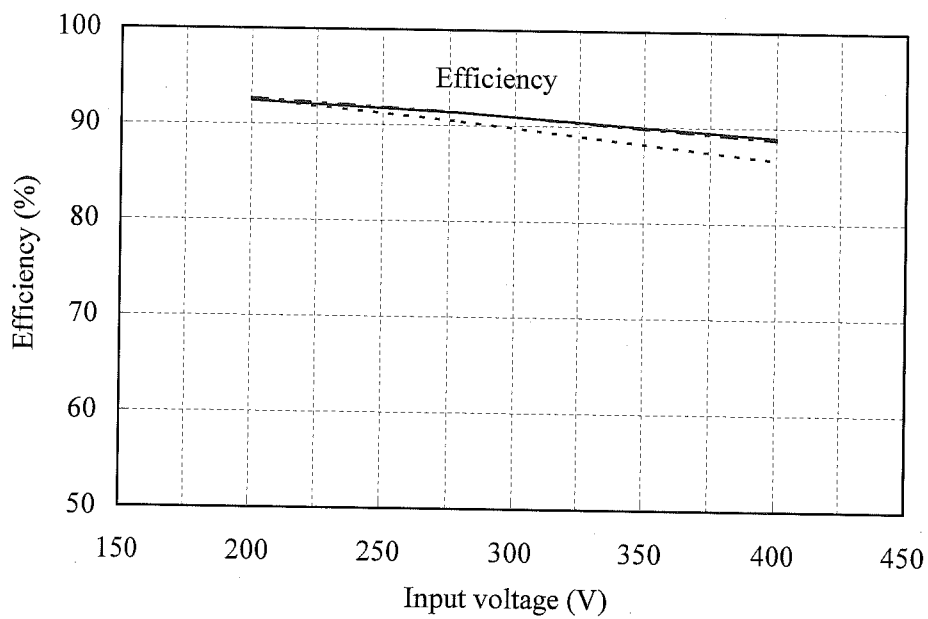
2.1 (4) 効率対入力電圧  
Efficiency v.s. Input voltage

Conditions Iout : 50 % -----  
 : 80 % - - - - -  
 : 100 % ————  
 Tbp : 25 °C

12V



24V

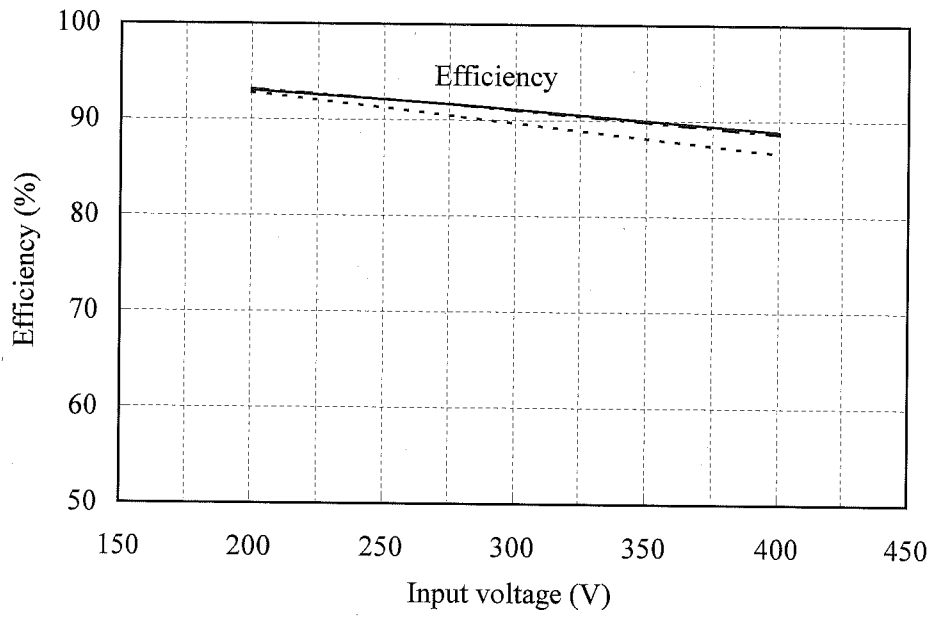




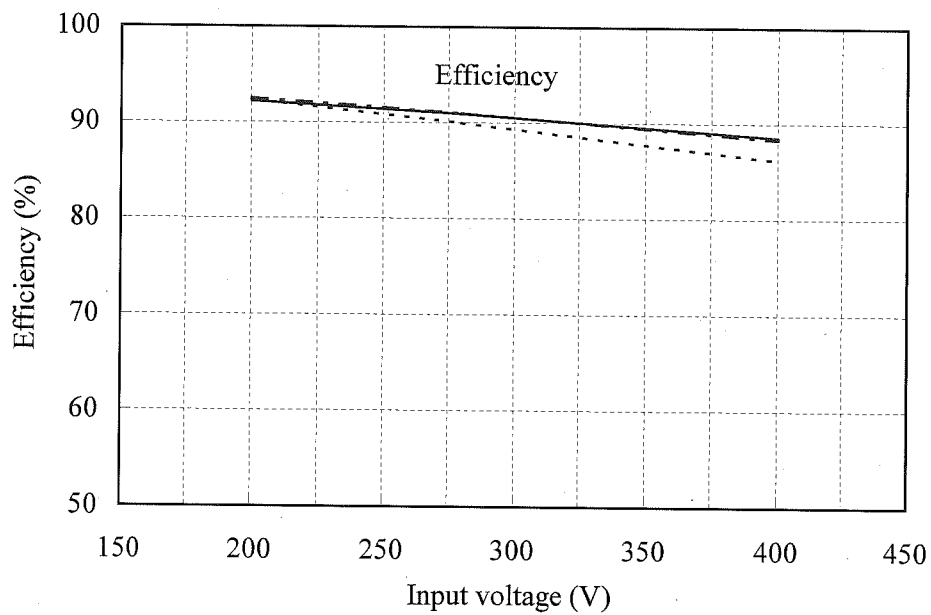
2.1 (4) 効率対入力電圧  
Efficiency v.s. Input voltage

Conditions Iout : 50 % -----  
 : 80 % - - - - -  
 : 100 % \_\_\_\_\_  
 Tbp : 25 °C

28V



48V



2.1 (5) 効率対ベースプレート温度  
Efficiency v.s. Baseplate temperature

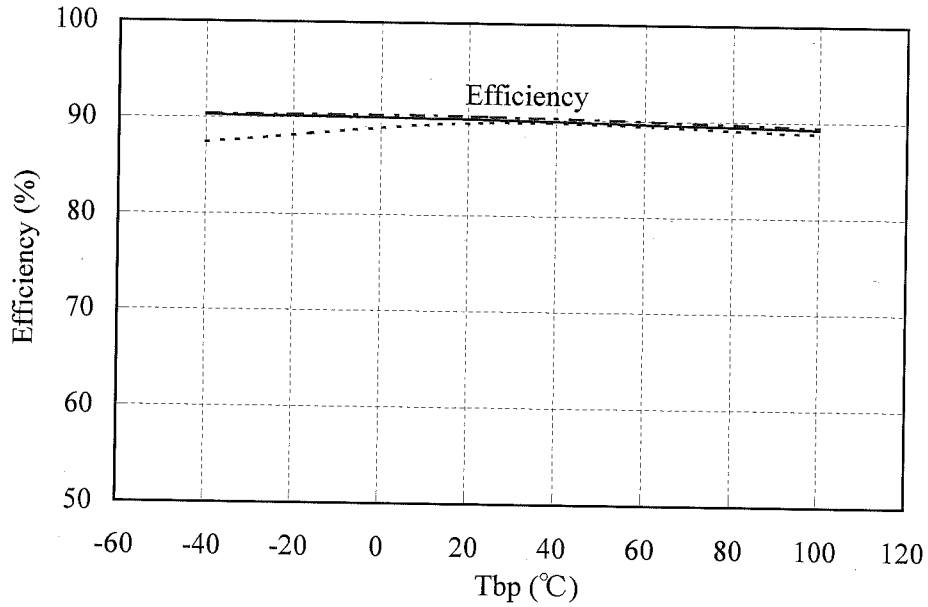
Conditions Vin : 280 VDC

Iout : 50 % -----

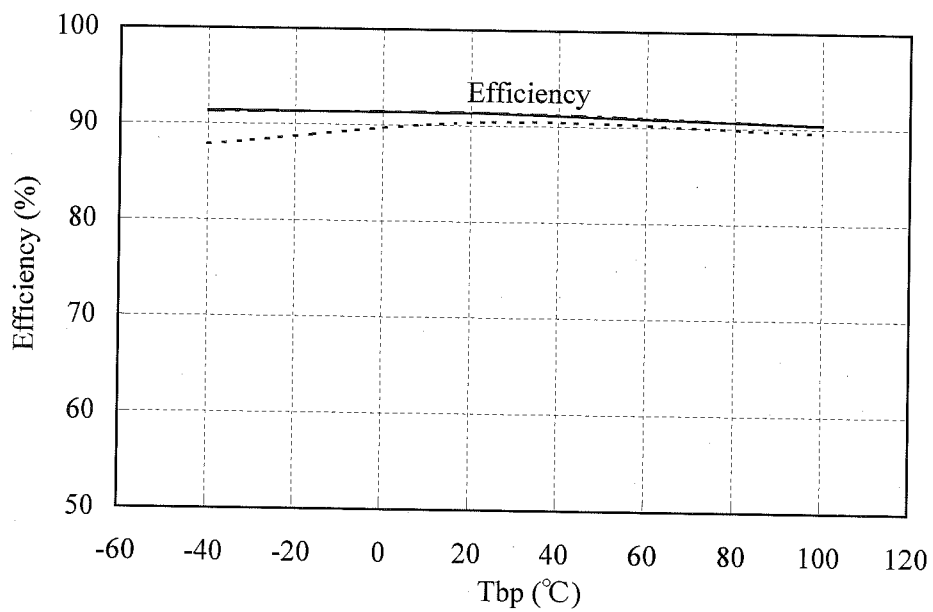
: 80 % - - - - -

: 100 % ————

12V



24V

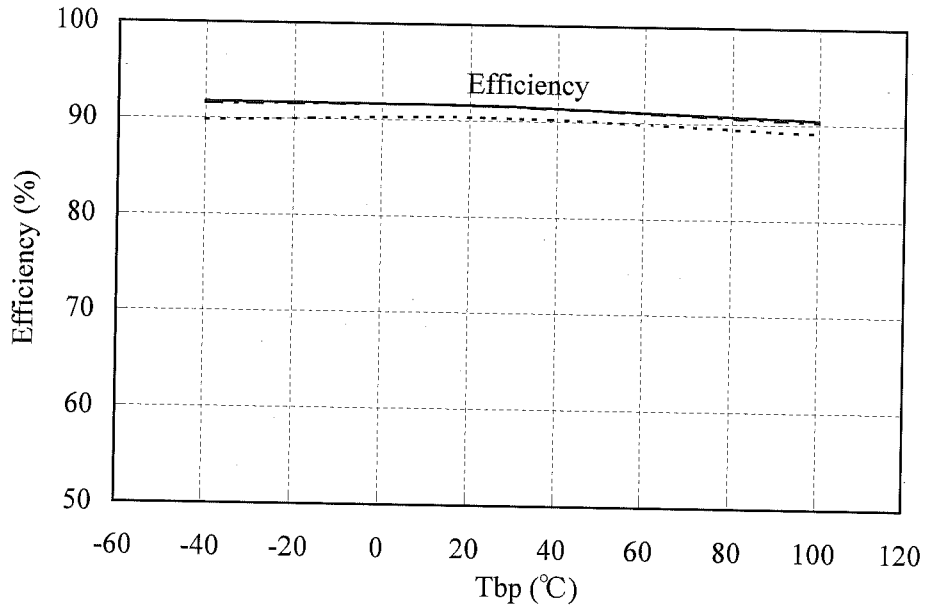


2.1 (5) 効率対ベースプレート温度  
Efficiency v.s. Baseplate temperature

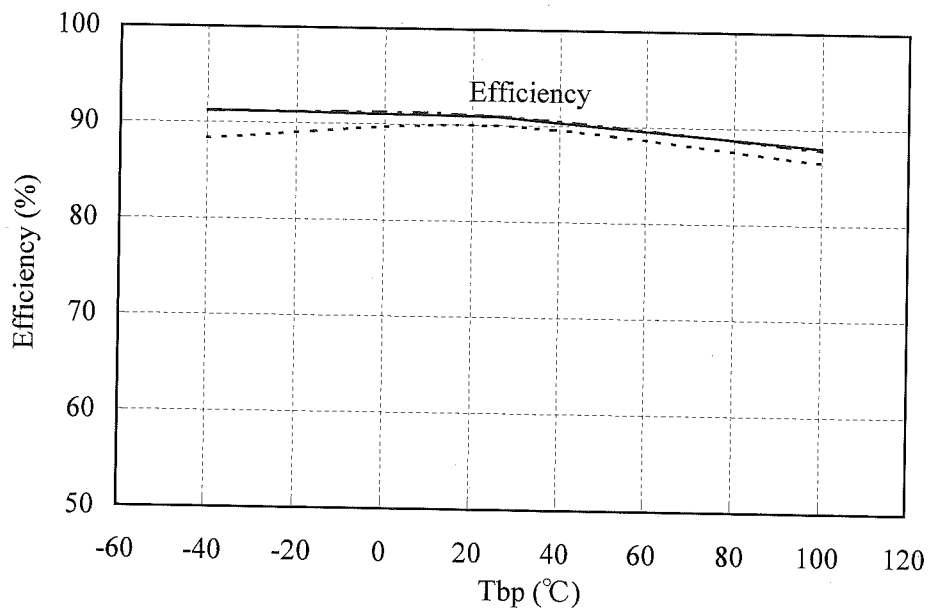
Conditions Vin : 280 VDC

Iout : 50 % -----  
: 80 % - - - - -  
: 100 % ————

28V



48V



2.2 通電ドリフト特性

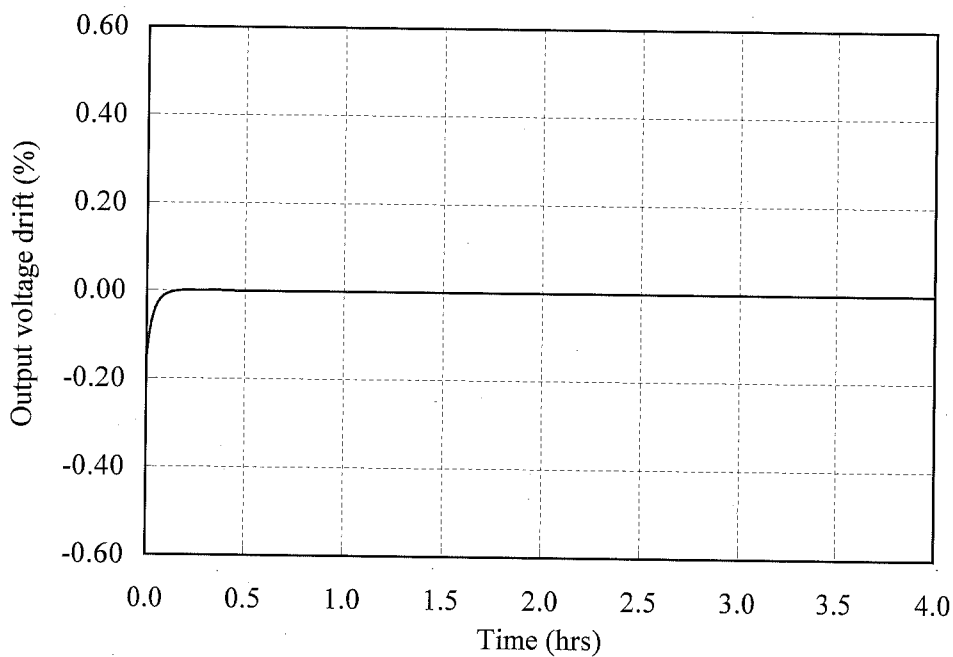
Warm up voltage drift characteristics

Conditions  $V_{in}$  : 280 VDC

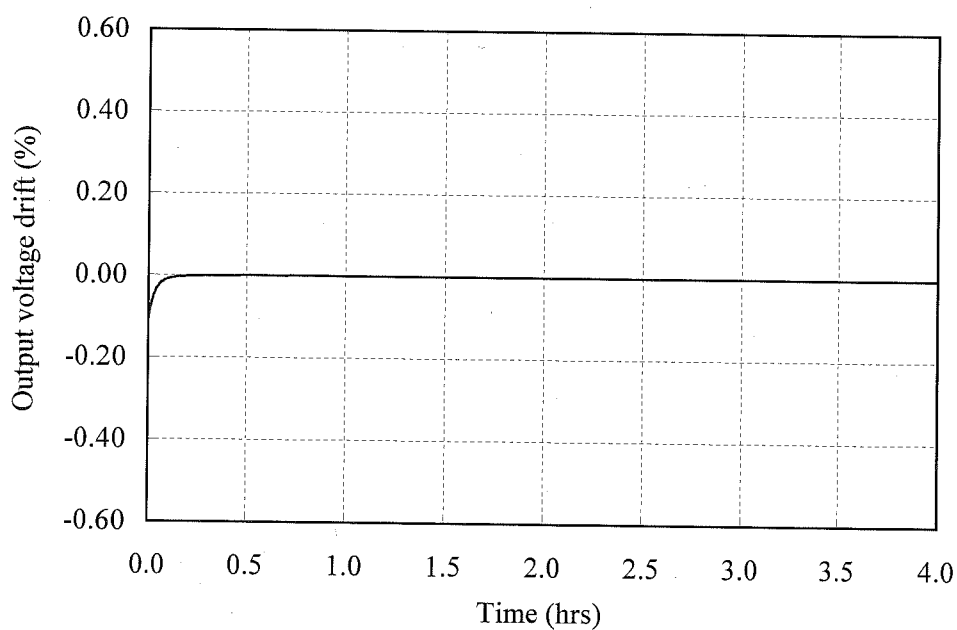
$I_{out}$  : 100 %

$T_a$  : 25 °C

12V



24V

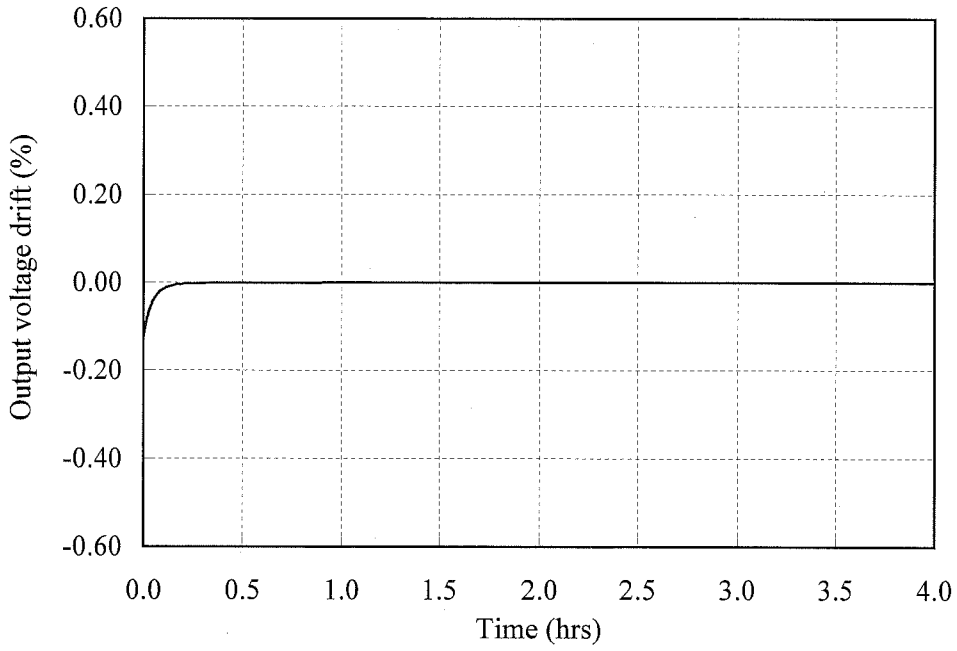


2.2 通電ドリフト特性

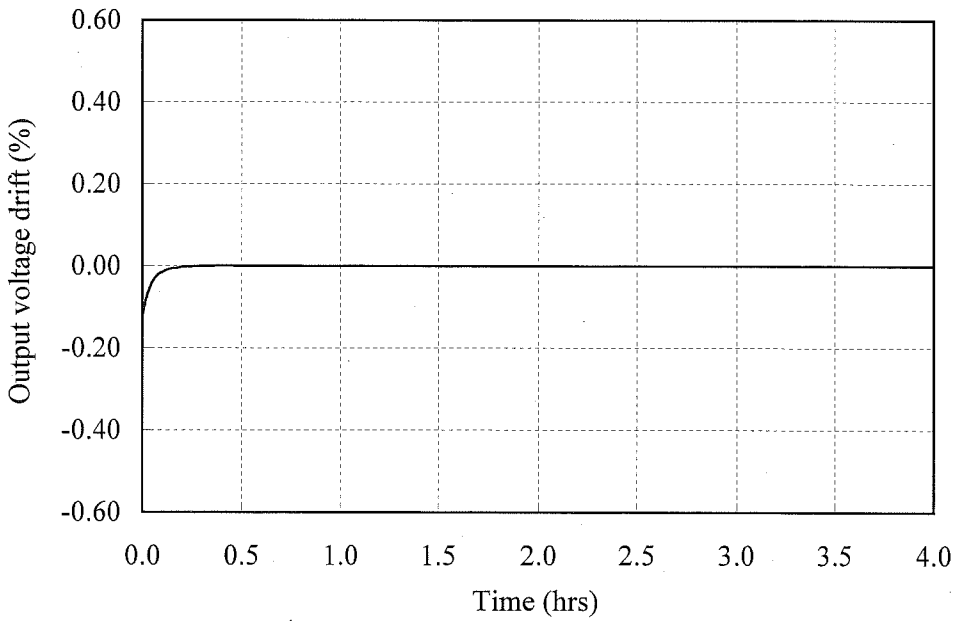
Warm up voltage drift characteristics

Conditions Vin : 280 VDC  
Iout : 100 %  
Ta : 25 °C

28V



48V

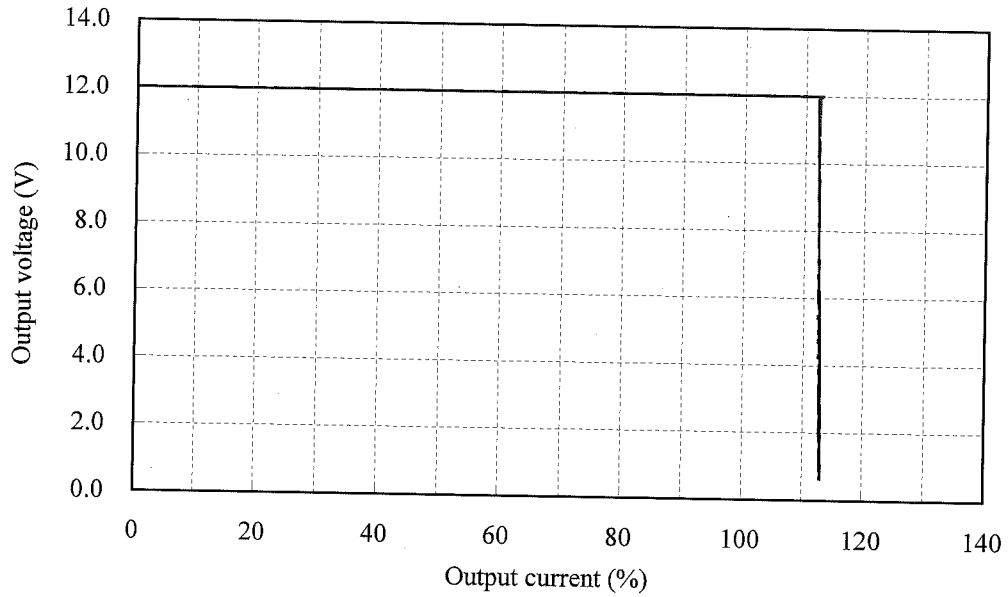


2.3 過電流保護特性

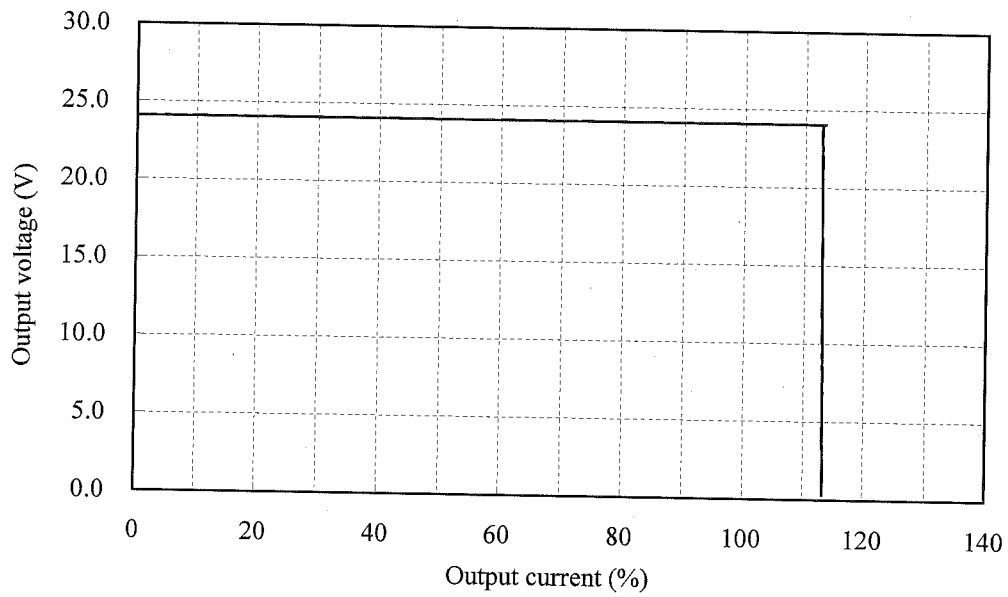
Over current protection (OCP) characteristics

Conditions  $V_{in}$  : 200 VDC -----  
 : 280 VDC - - - - -  
 : 400 VDC ————  
 $T_{bp}$  : 25 °C

12V



24V

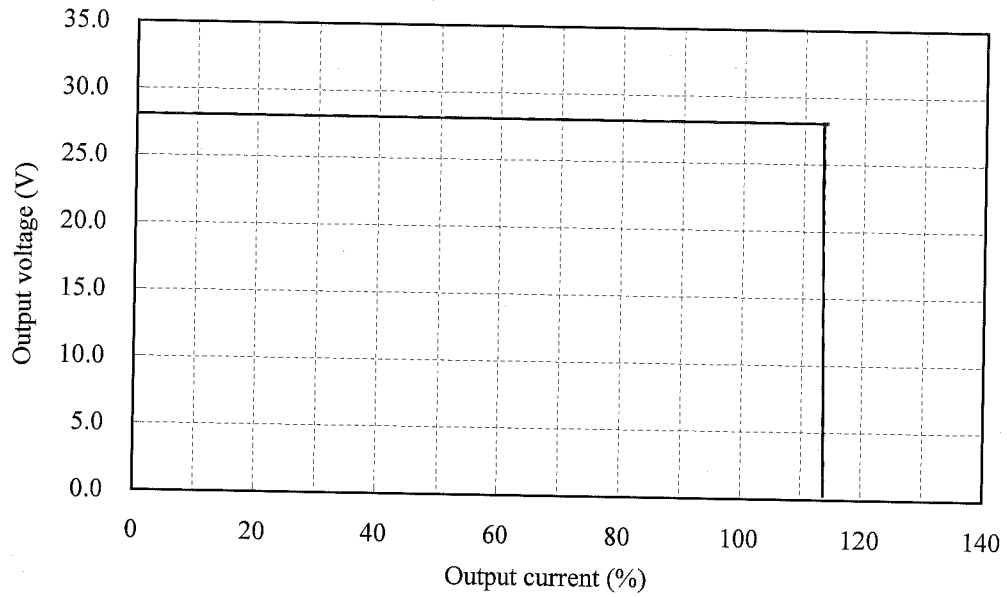


2.3 過電流保護特性

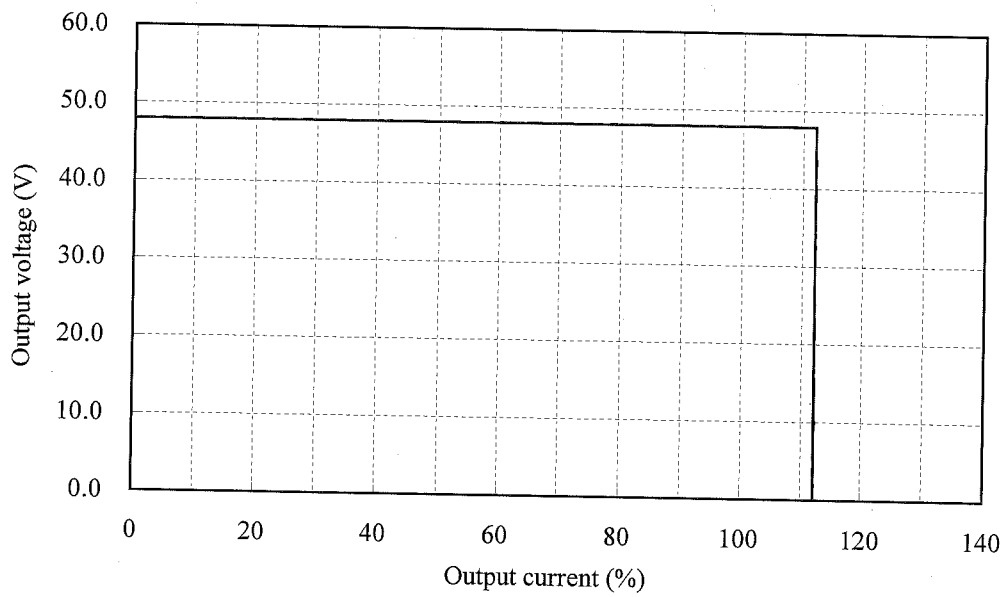
Over current protection (OCP) characteristics

Conditions  $V_{in}$  : 200 VDC -----  
 : 280 VDC -----  
 : 400 VDC -----  
 $T_{bp}$  : 25 °C

28V



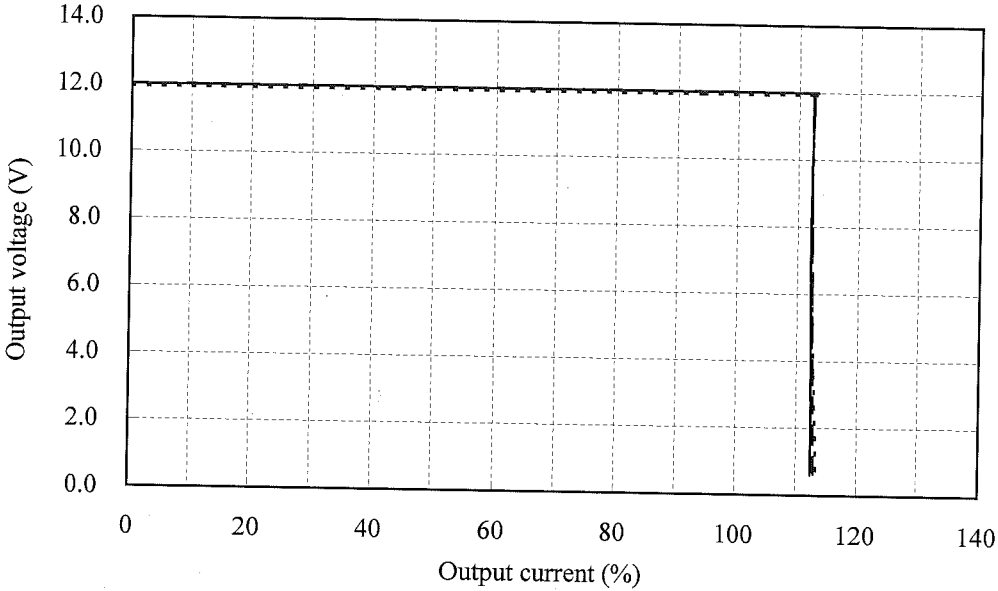
48V



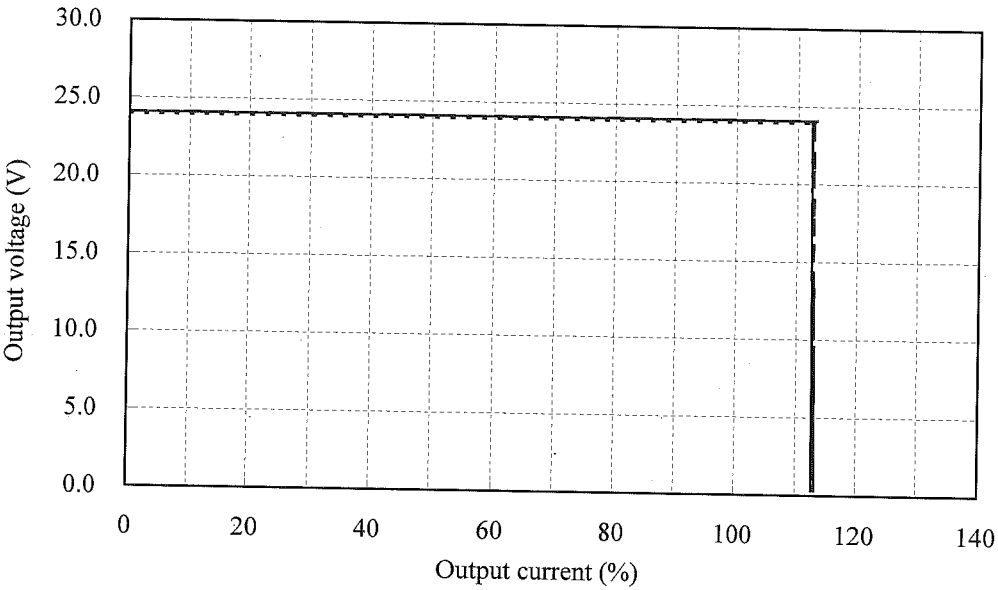
2.3 過電流保護特性  
Over current protection (OCP) characteristics

Conditions  $V_{in}$  : 280 VDC  
 $T_{bp}$  : -40 °C -----  
          : 25 °C -----  
          : 100 °C -----

12V



24V





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

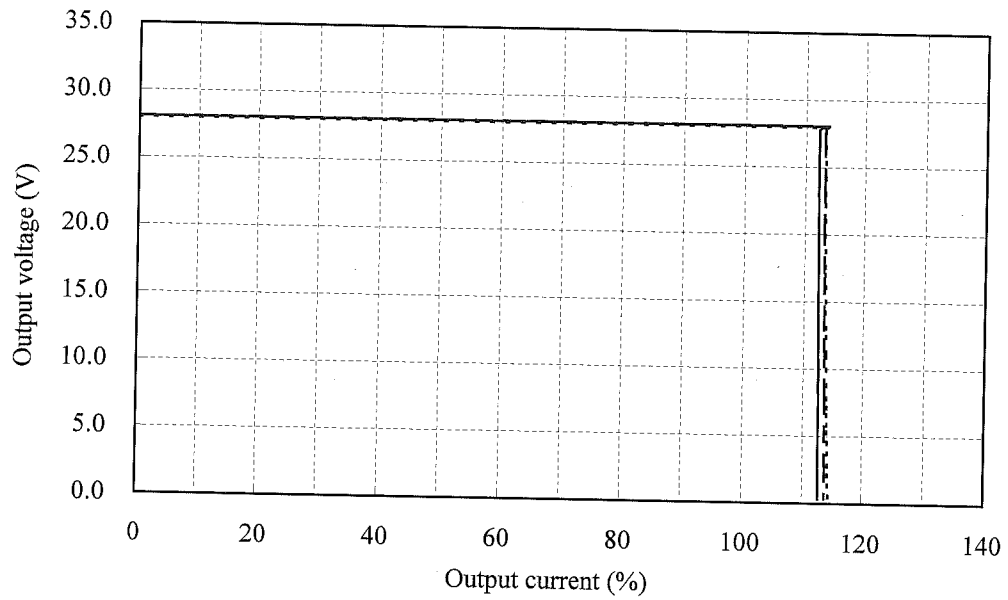
Conditions  $V_{in}$  : 280 VDC

$T_{bp}$  : -40 °C -----

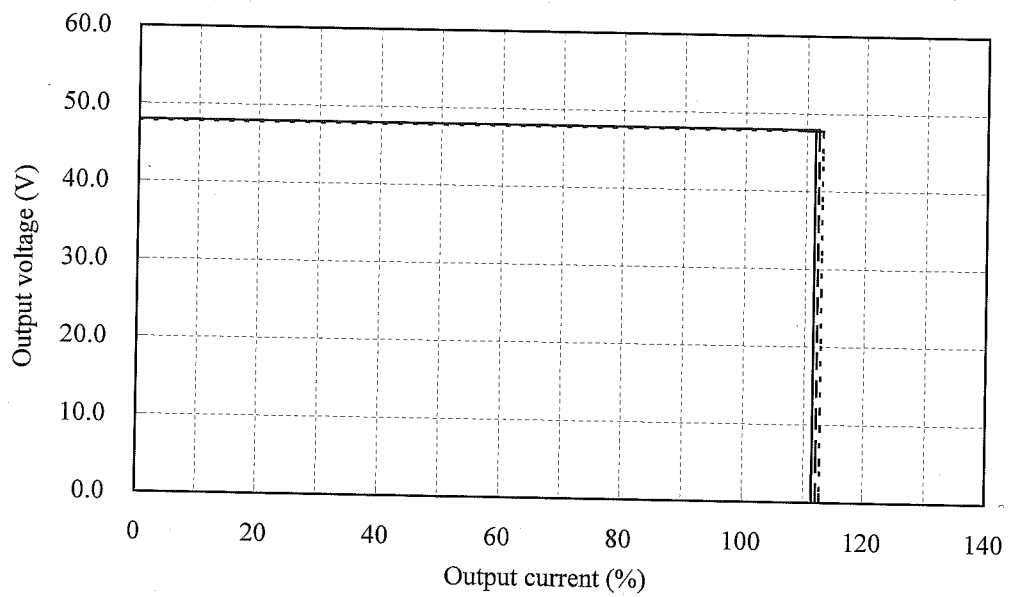
: 25 °C -----

: 100 °C -----

28V



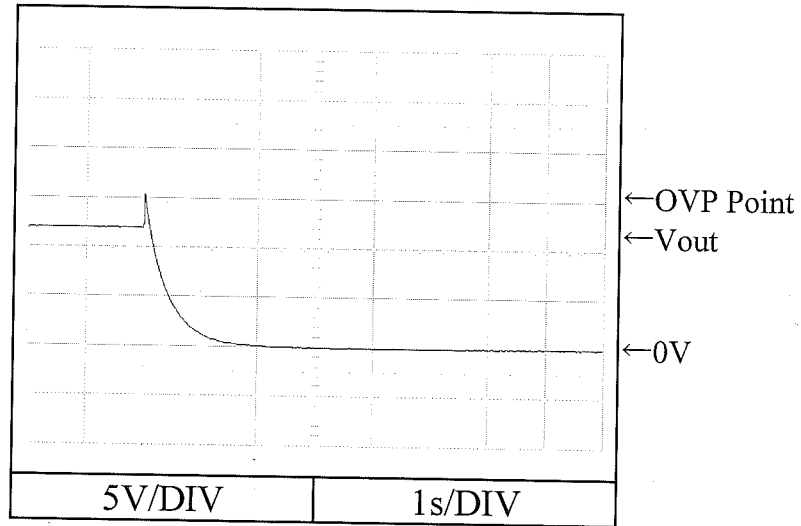
48V



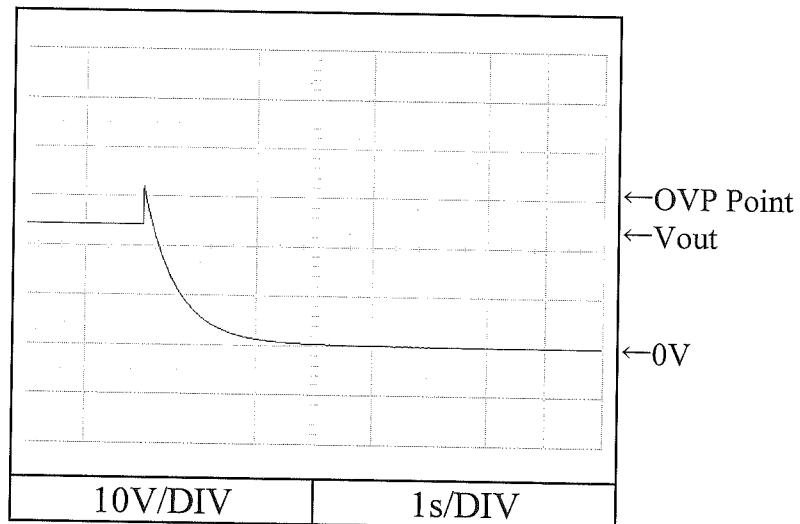
2.4 過電圧保護特性  
Over voltage protection (OVP) characteristics

Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 0 %  
 $T_{bp}$  : 25 °C

12V



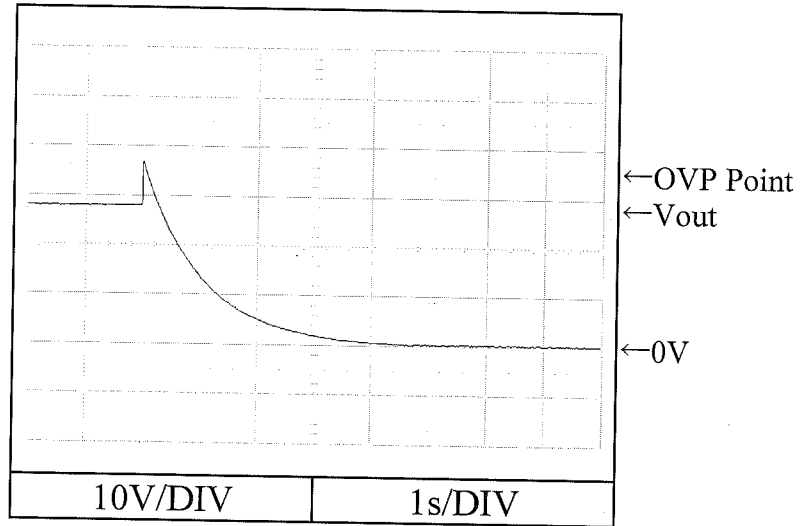
24V



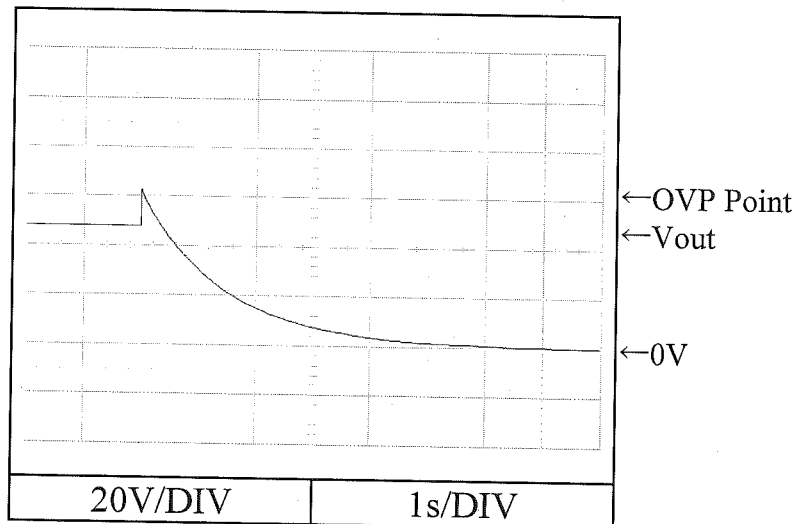
2.4 過電圧保護特性  
Over voltage protection (OVP) characteristics

Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 0 %  
 $T_{bp}$  : 25 °C

28V



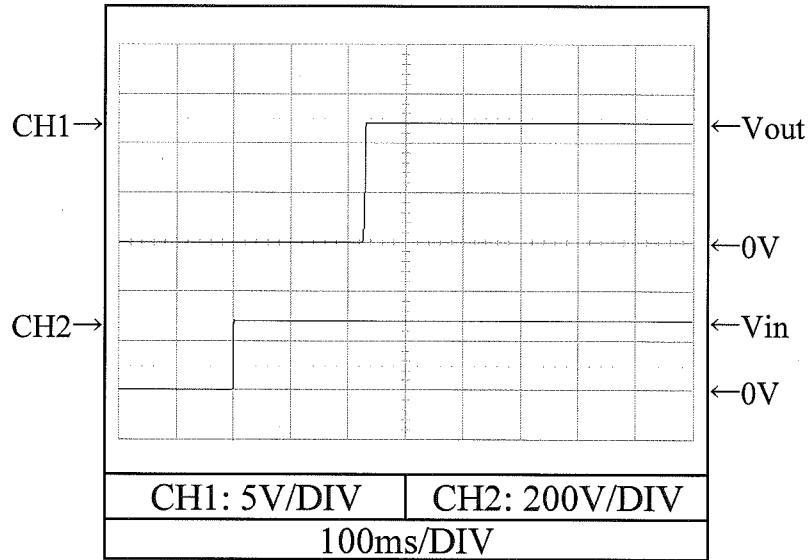
48V



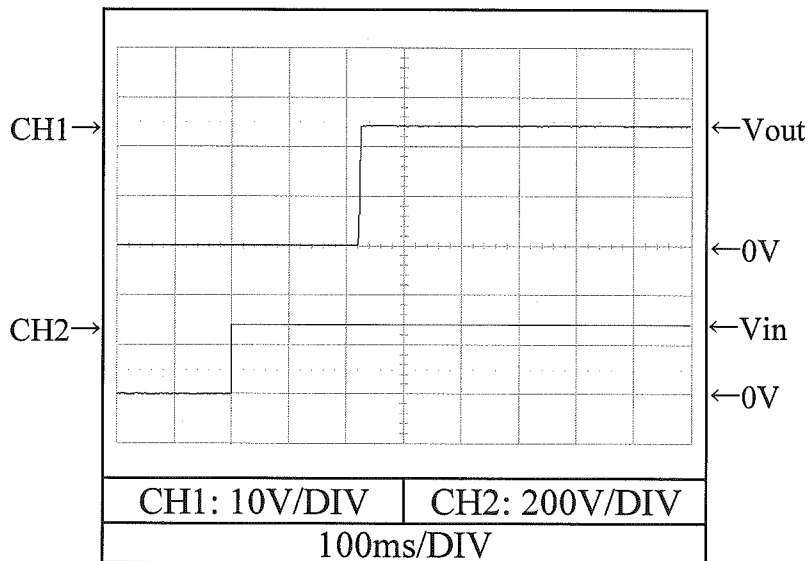
2.5 出力立ち上がり特性  
Output rise characteristics

Conditions Vin : 280 VDC  
Iout : 0 %  
Tbp : 25 °C

12V



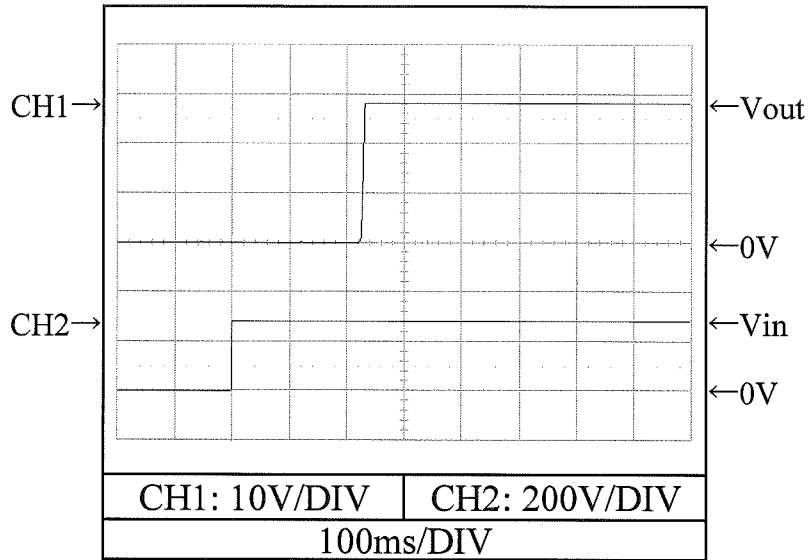
24V



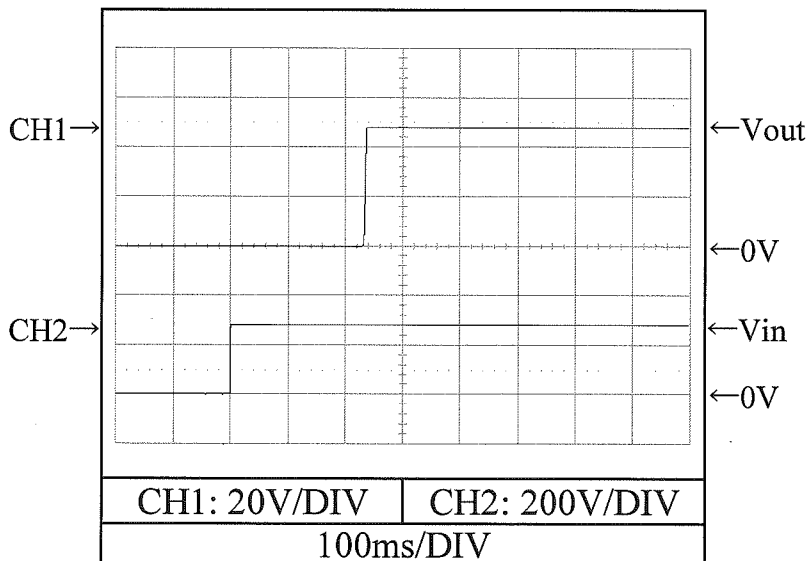
2.5 出力立ち上がり特性  
Output rise characteristics

Conditions Vin : 280 VDC  
Iout : 0 %  
Tbp : 25 °C

28V



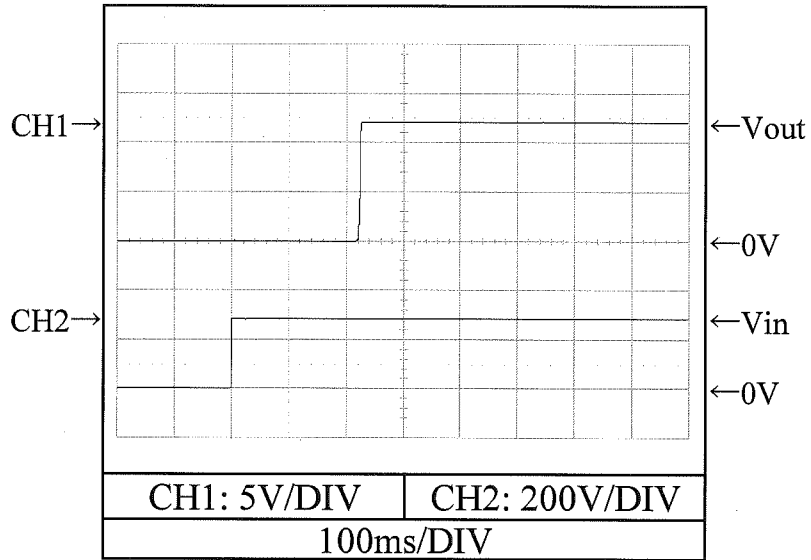
48V



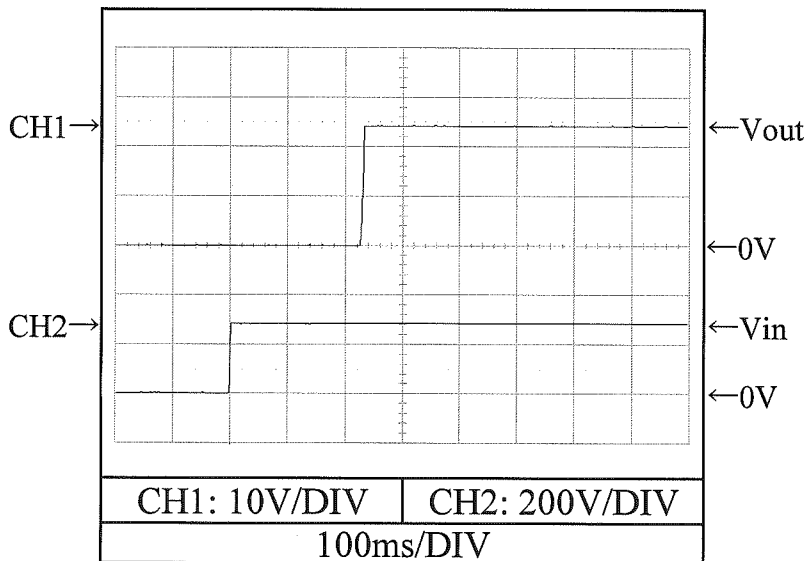
2.5 出力立ち上がり特性  
Output rise characteristics

Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 100 %  
 $T_{bp}$  : 25 °C

12V



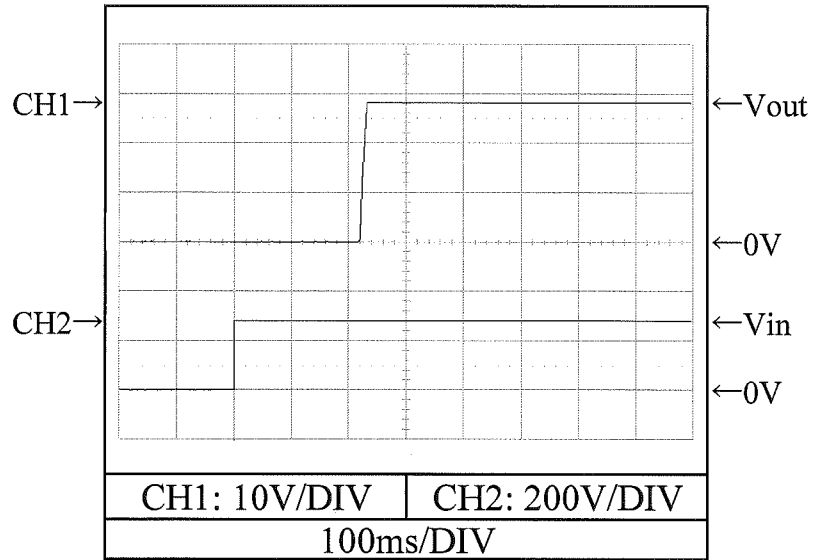
24V



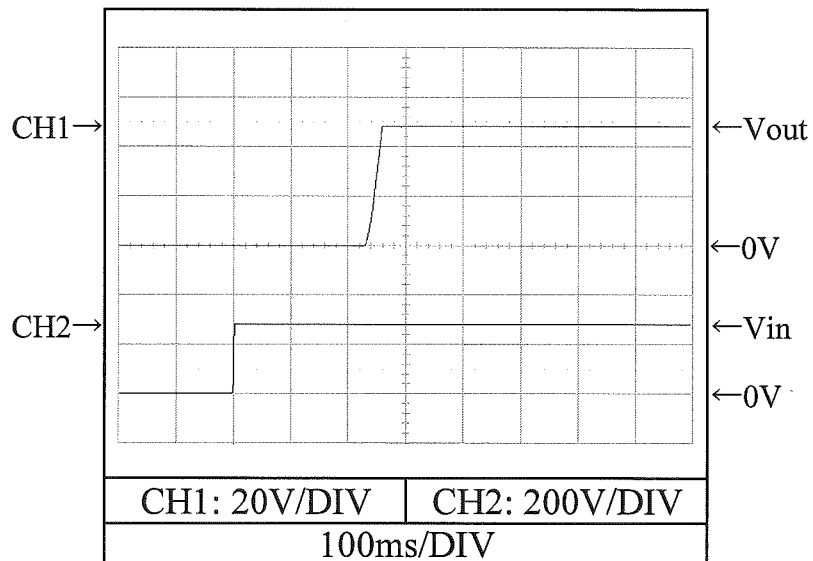
2.5 出力立ち上がり特性  
Output rise characteristics

Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 100 %  
 $T_{bp}$  : 25 °C

28V



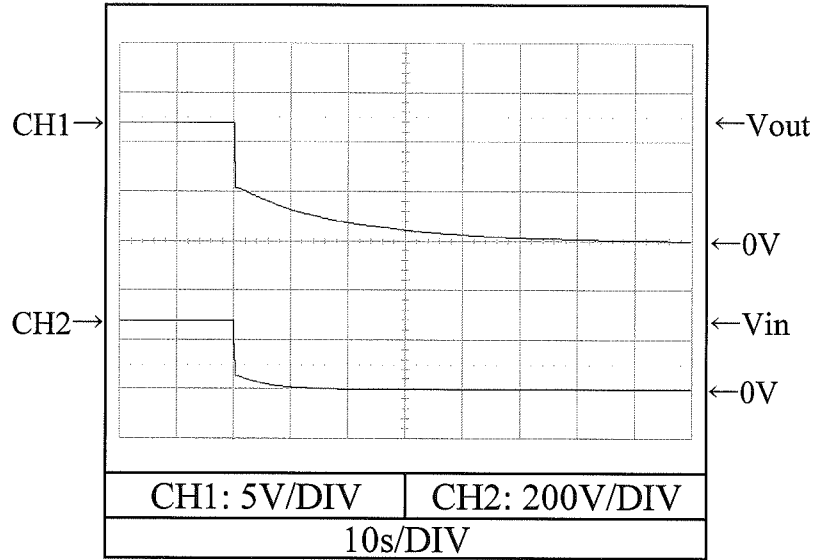
48V



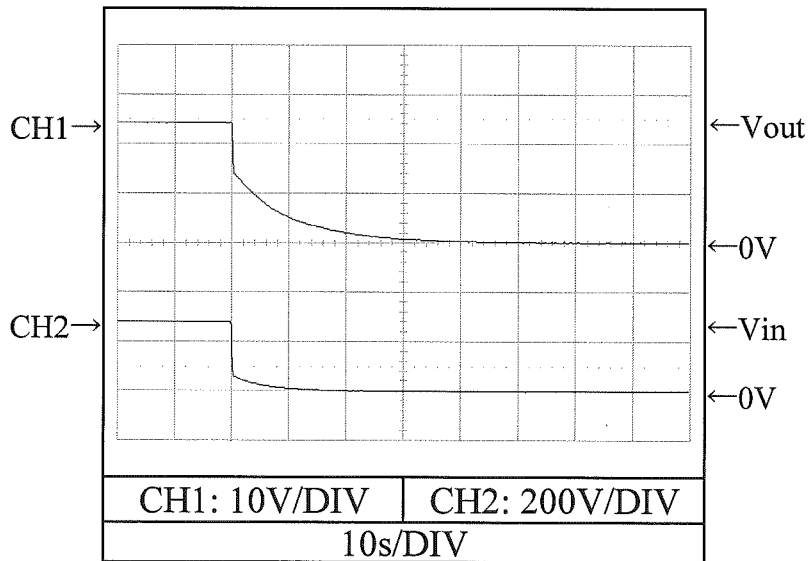
2.6 出力立ち下がり特性  
Output fall characteristics

Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 0 %  
 $T_{bp}$  : 25 °C

12V



24V

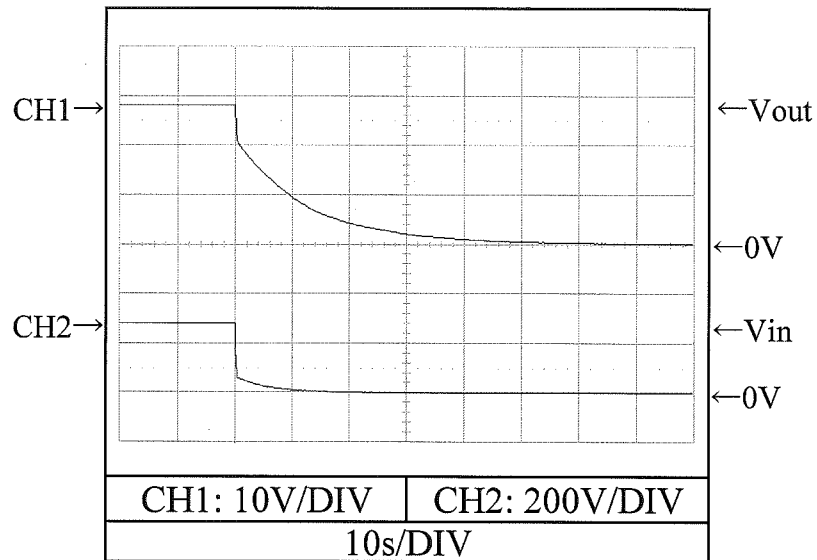




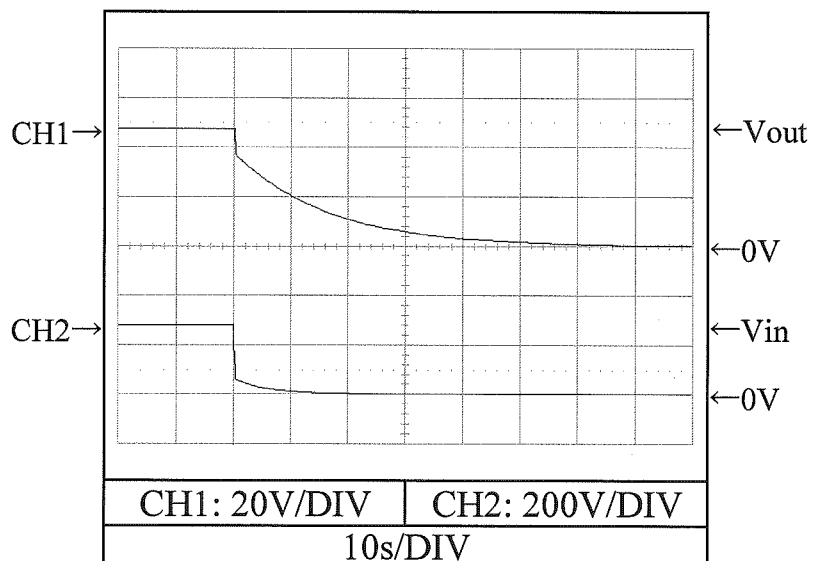
2.6 出力立ち下がり特性  
Output fall characteristics

Conditions Vin : 280 VDC  
Iout : 0 %  
Tbp : 25 °C

28V



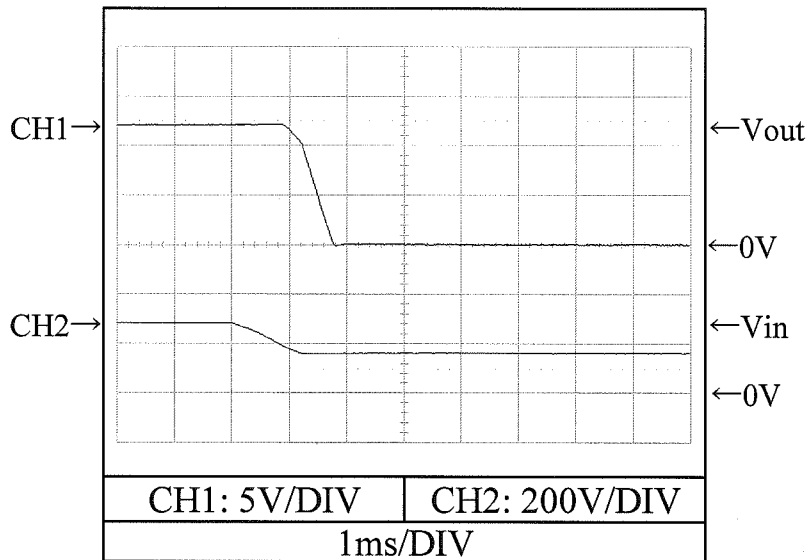
48V



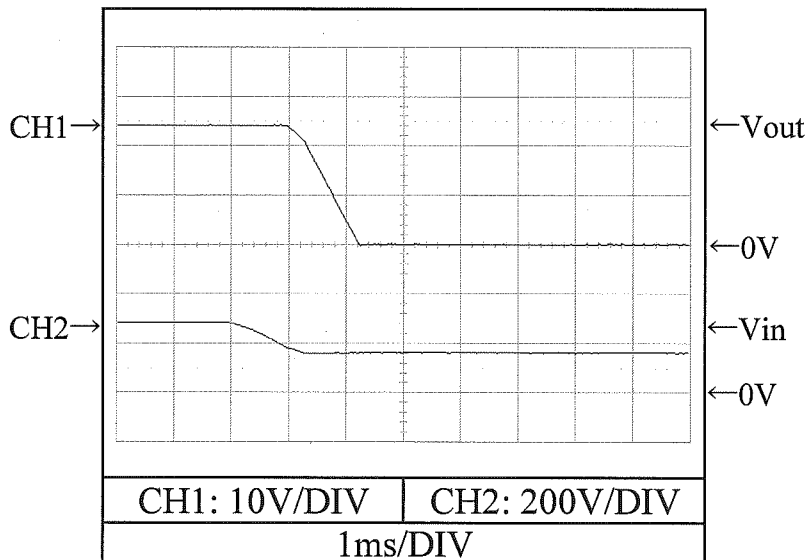
2.6 出力立ち下がり特性  
Output fall characteristics

Conditions Vin : 280 VDC  
Iout : 100 %  
Tbp : 25 °C

12V



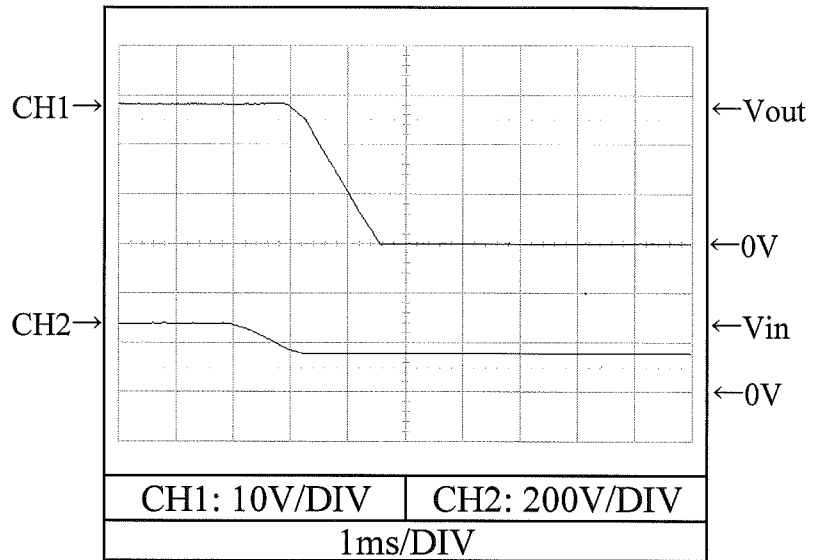
24V



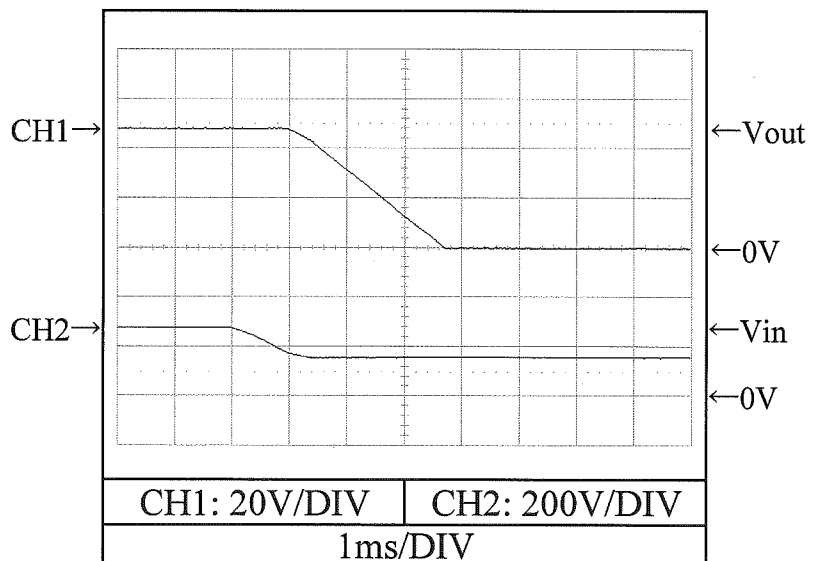
2.6 出力立ち下がり特性  
Output fall characteristics

Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 100 %  
 $T_{bp}$  : 25 °C

28V



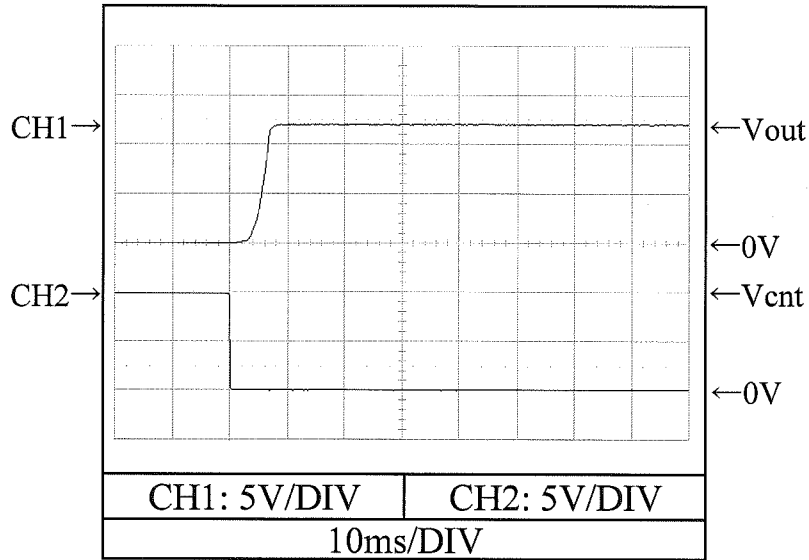
48V



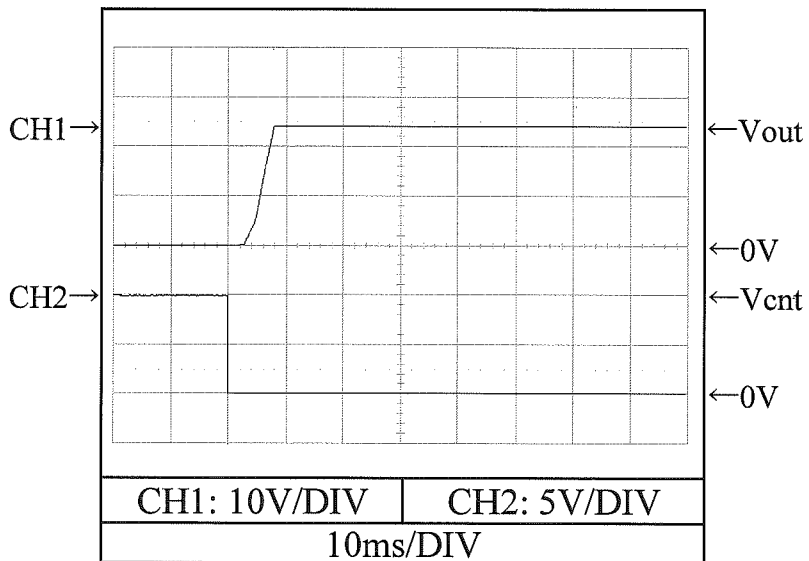
2.7 出力立ち上がり特性 (ON/OFFコントロール時)  
Output rise characteristics with ON/OFF CONTROL

Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 0 %  
 $T_{bp}$  : 25 °C

12V



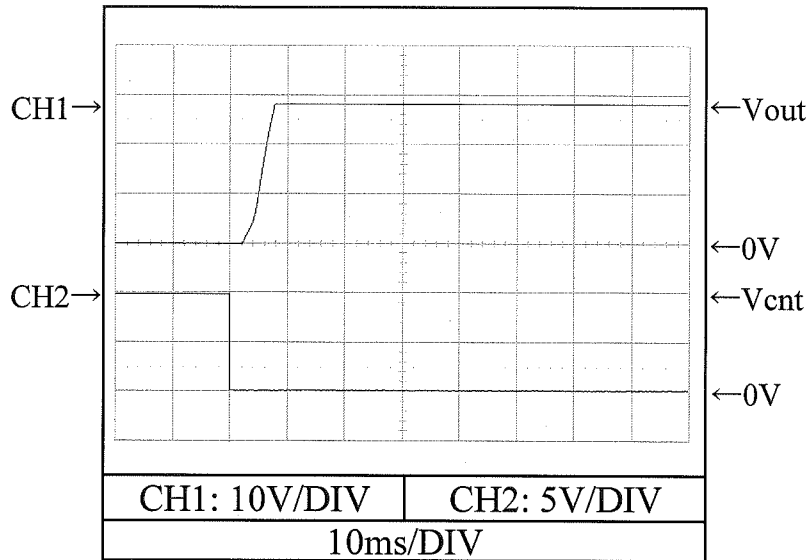
24V



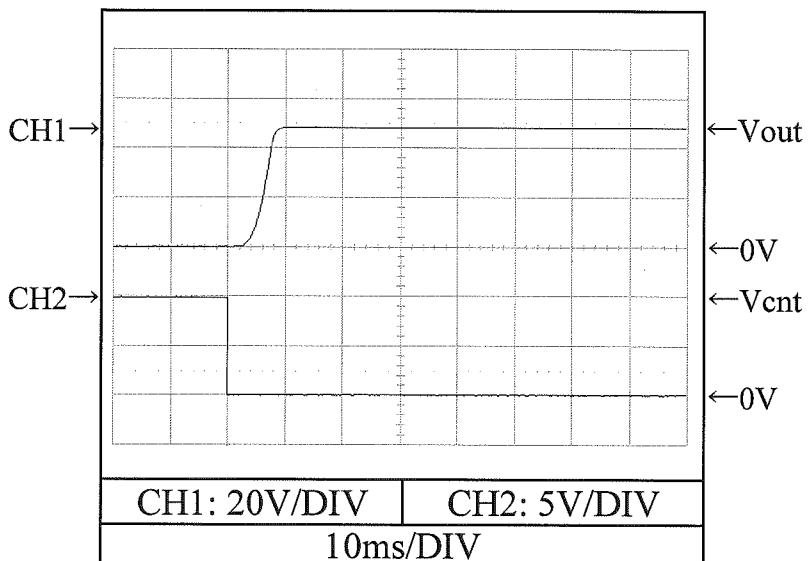
2.7 出力立ち上がり特性 (ON/OFFコントロール時)  
Output rise characteristics with ON/OFF CONTROL

Conditions Vin : 280 VDC  
Iout : 0 %  
Tbp : 25 °C

28V



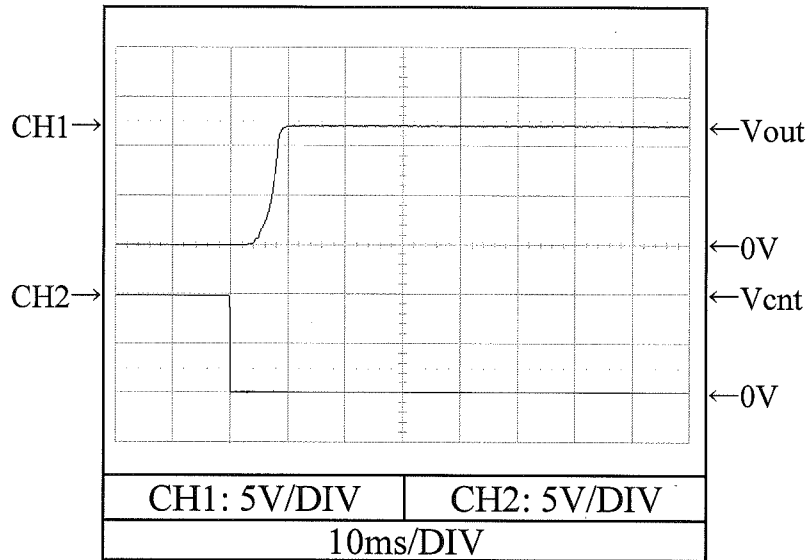
48V



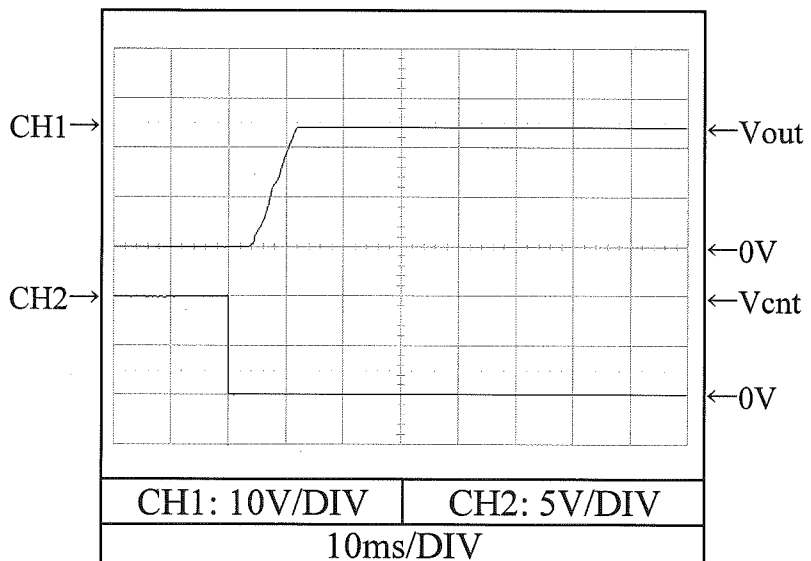
2.7 出力立ち上がり特性 (ON/OFFコントロール時)  
Output rise characteristics with ON/OFF CONTROL

Conditions Vin : 280 VDC  
Iout : 100 %  
Tbp : 25 °C

12V



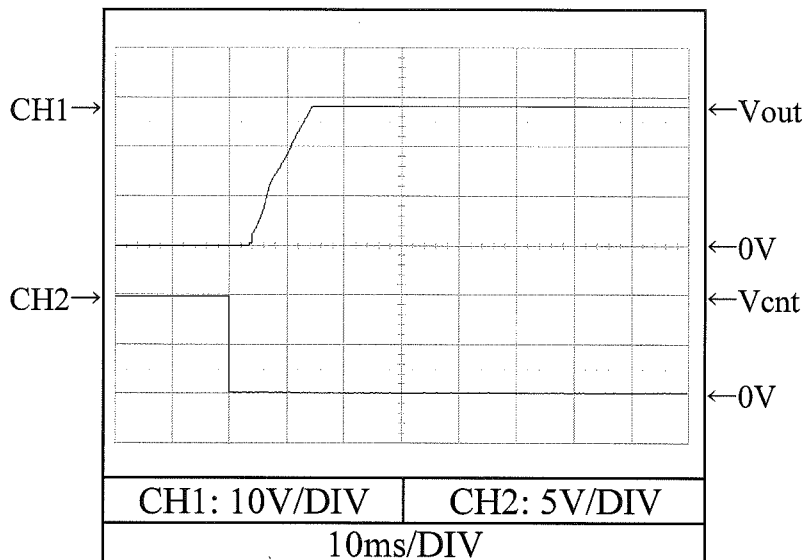
24V



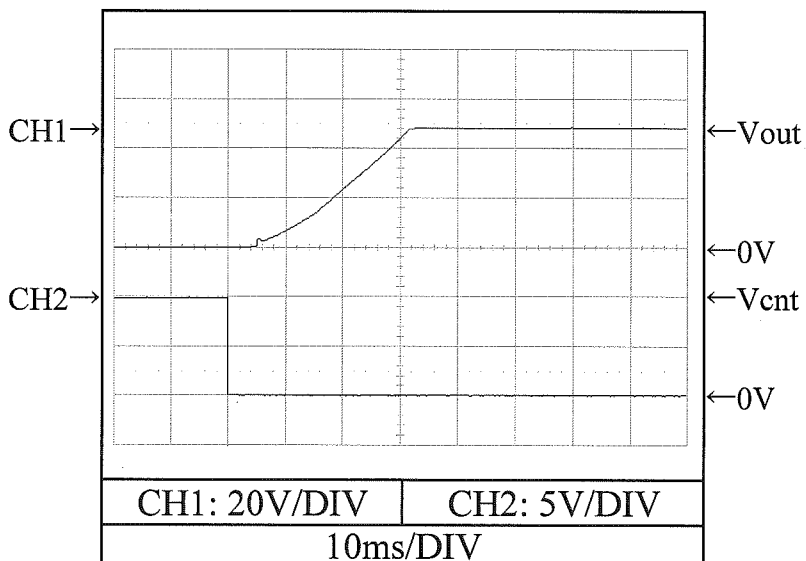
2.7 出力立ち上がり特性 (ON/OFFコントロール時)  
Output rise characteristics with ON/OFF CONTROL

Conditions Vin : 280 VDC  
Iout : 100 %  
Tbp : 25 °C

28V



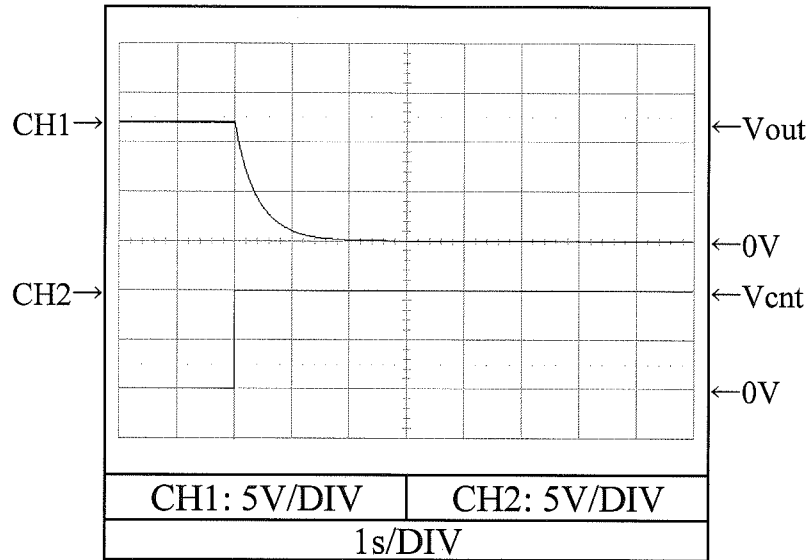
48V



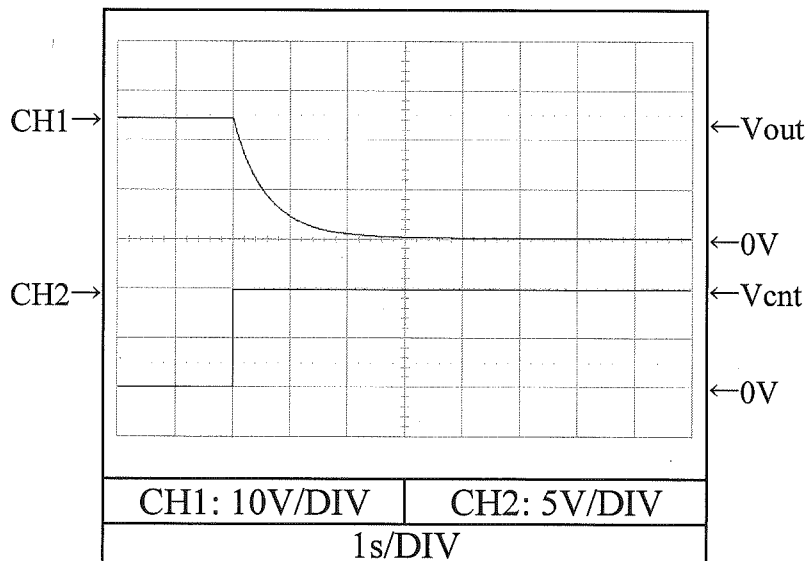
2.8 出力立ち下がり特性 (ON/OFFコントロール時)  
Output fall characteristics with ON/OFF CONTROL

Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 0 %  
 $T_{bp}$  : 25 °C

12V



24V

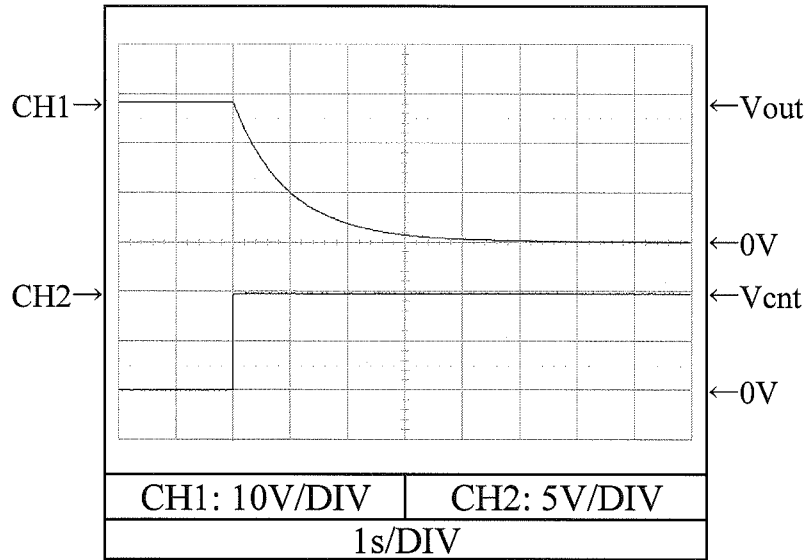




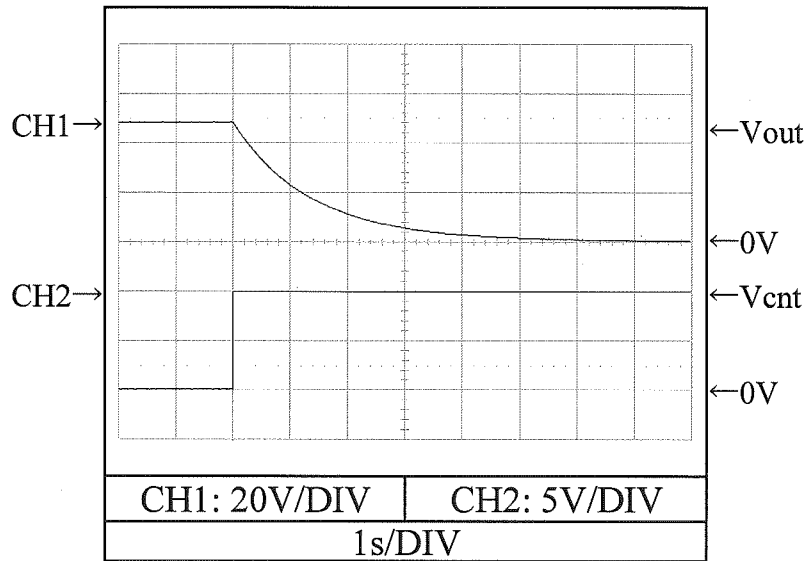
2.8 出力立ち下がり特性 (ON/OFFコントロール時)  
Output fall characteristics with ON/OFF CONTROL

Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 0 %  
 $T_{bp}$  : 25 °C

28V



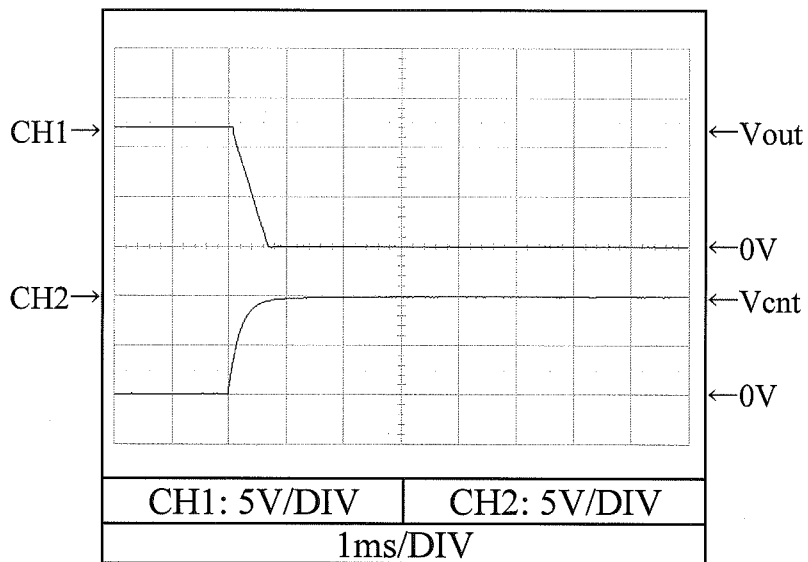
48V



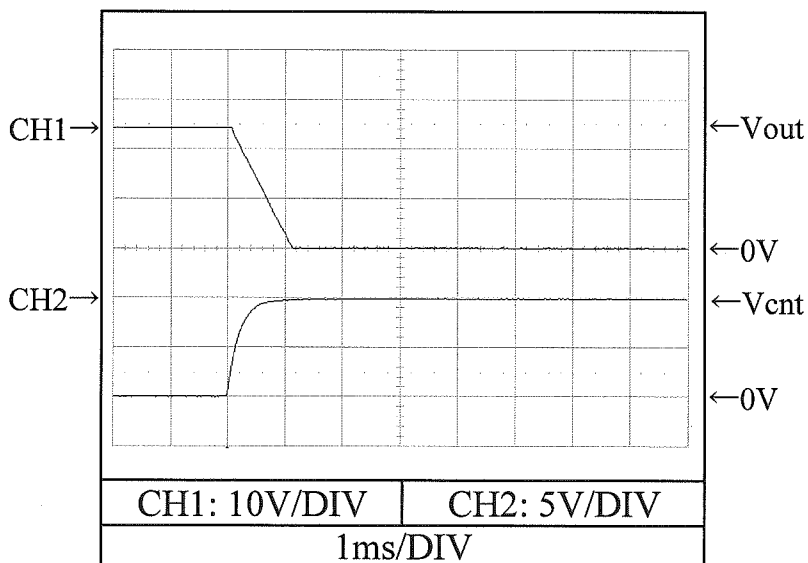
2.8 出力立ち下がり特性 (ON/OFFコントロール時)  
Output fall characteristics with ON/OFF CONTROL

Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 100 %  
 $T_{bp}$  : 25 °C

12V



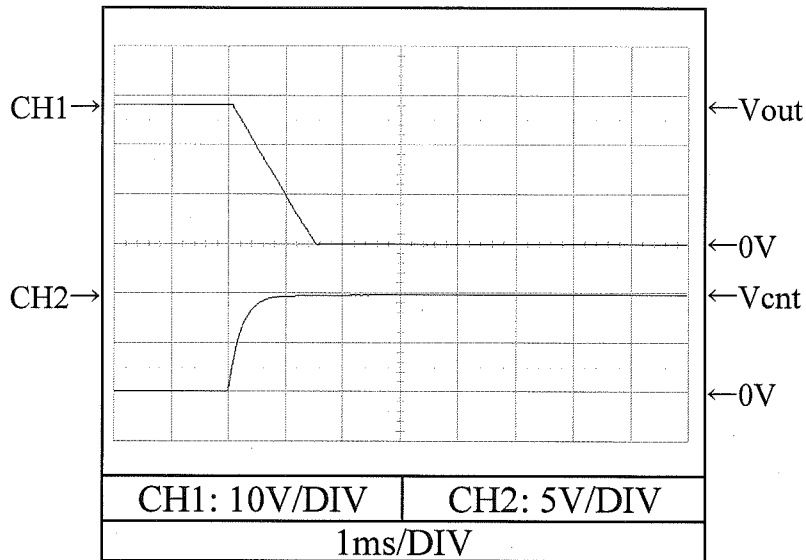
24V



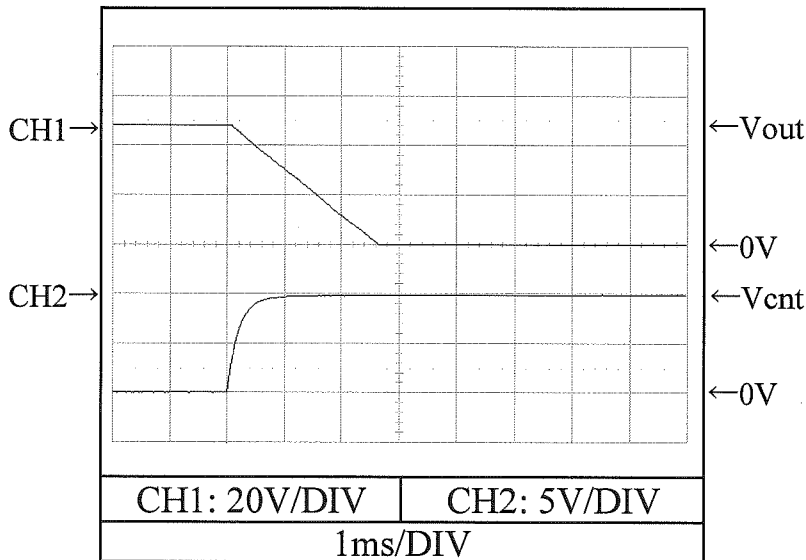
2.8 出力立ち下がり特性 (ON/OFFコントロール時)  
Output fall characteristics with ON/OFF CONTROL

Conditions Vin : 280 VDC  
Iout : 100 %  
Tbp : 25 °C

28V



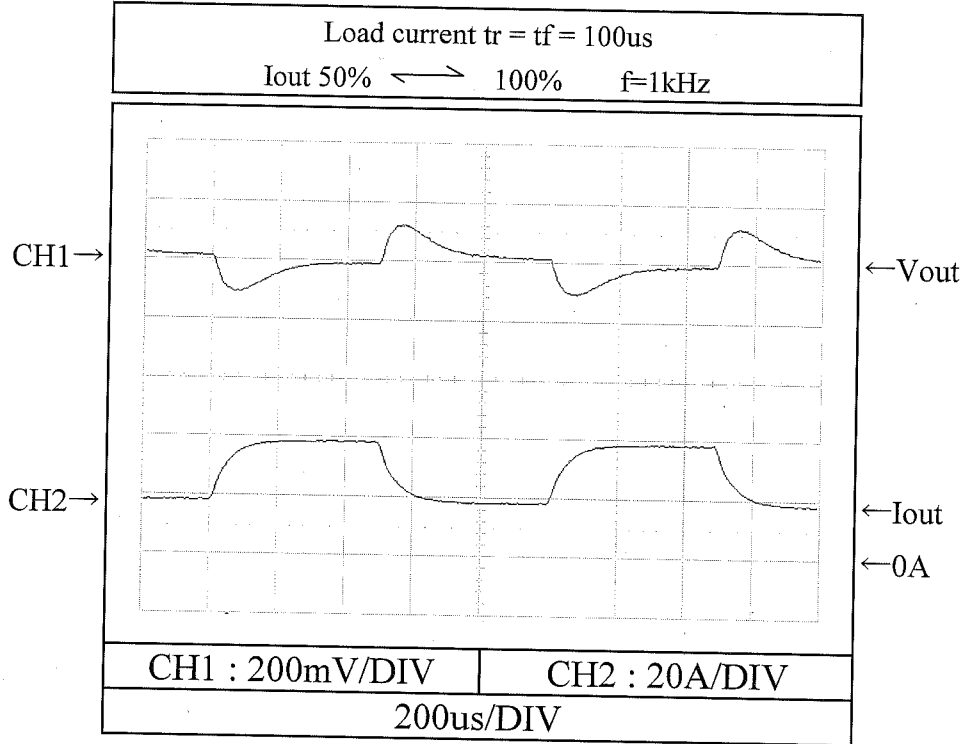
48V



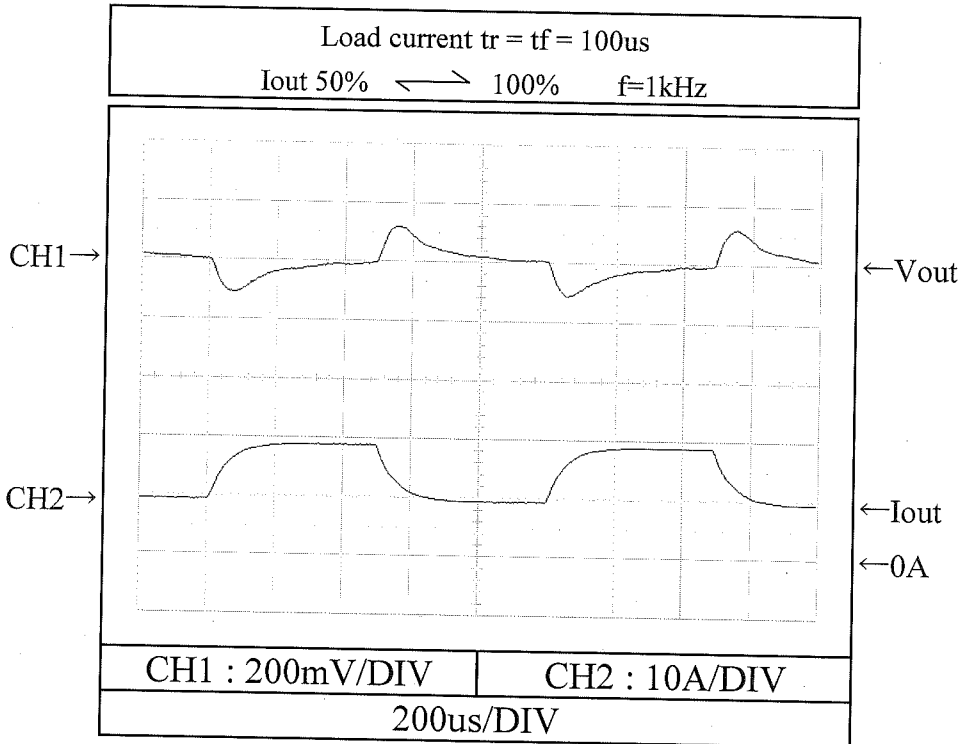
2.9 過渡応答 (負荷急変) 特性  
Dynamic load response characteristics

Conditions  $V_{in}$  : 280 VDC  
 $T_{bp}$  : 25 °C

12V



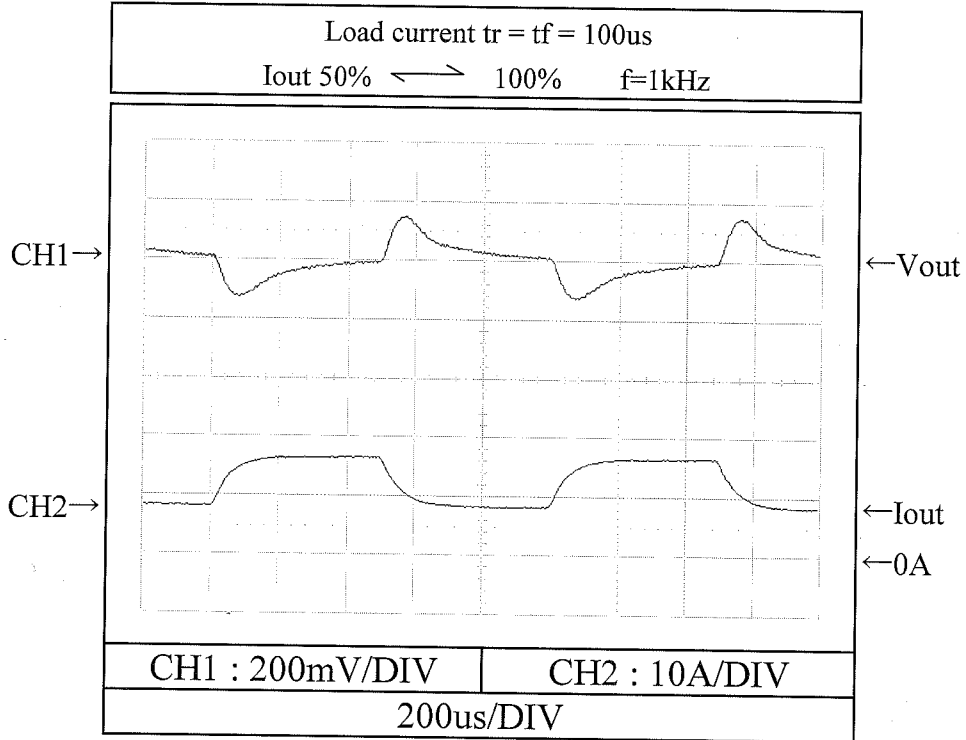
24V



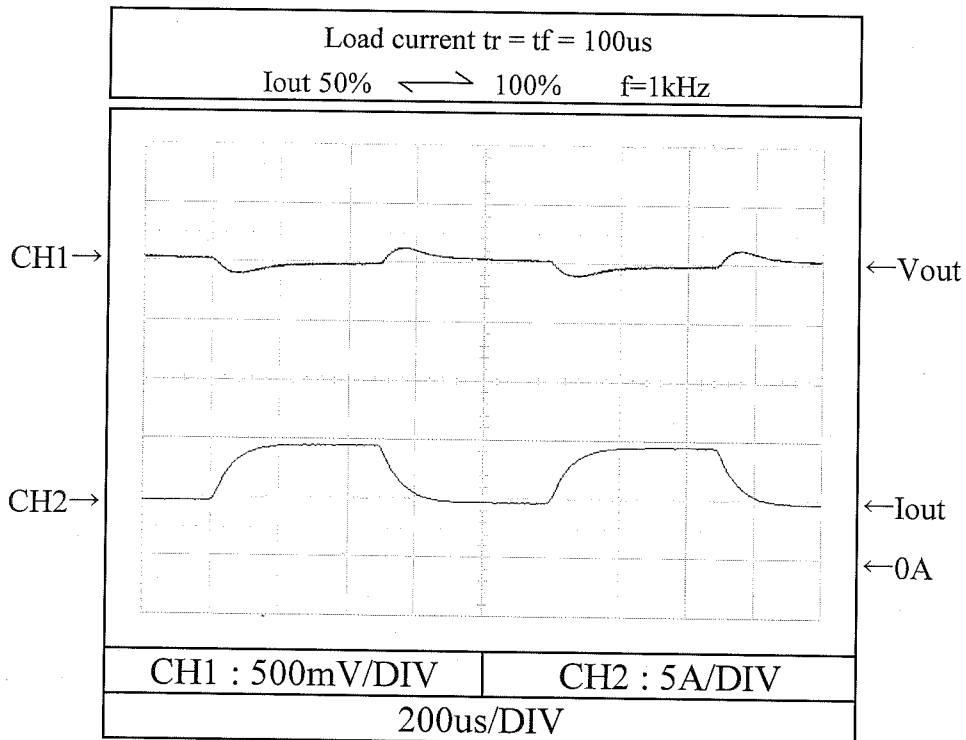
2.9 過渡応答 (負荷急変) 特性  
Dynamic load response characteristics

Conditions Vin : 280 VDC  
Tbp : 25 °C

28V



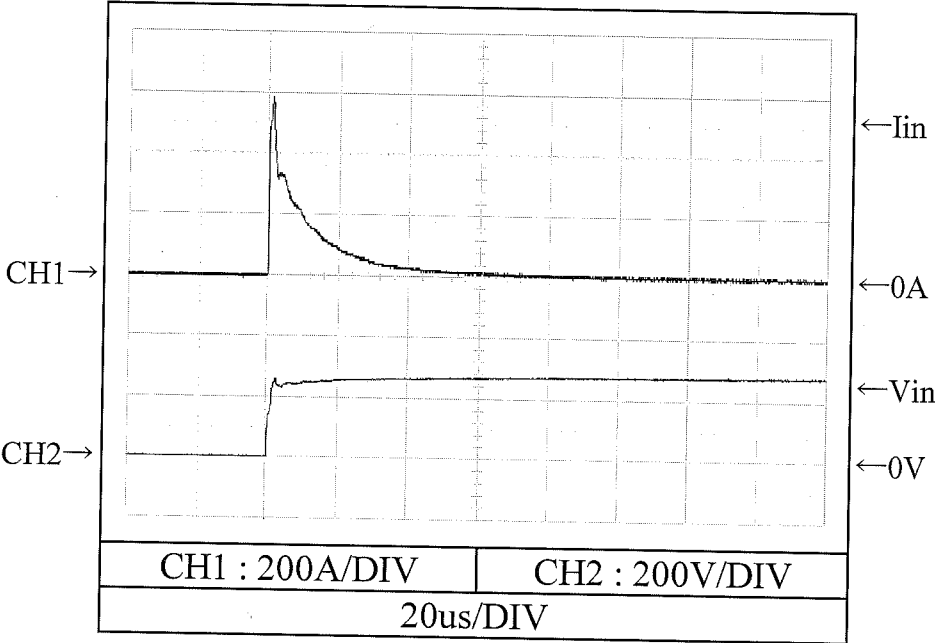
48V



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

Conditions Vin : 280 VDC  
Iout : 100 %  
Tbp : 25 °C

48V

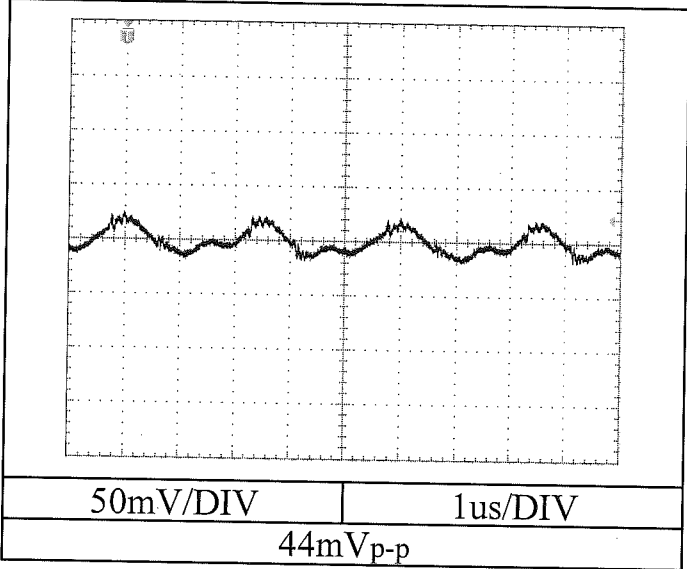


2.11 出力リップル、ノイズ波形  
Output ripple and noise waveform

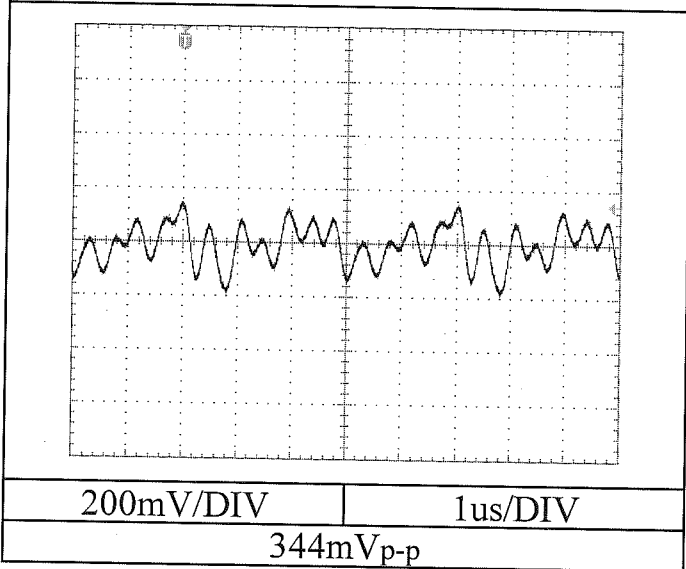
Conditions Vin : 280 VDC  
Iout : 100 %  
Tbp : 25 °C

12V

Normal mode



Normal + common mode

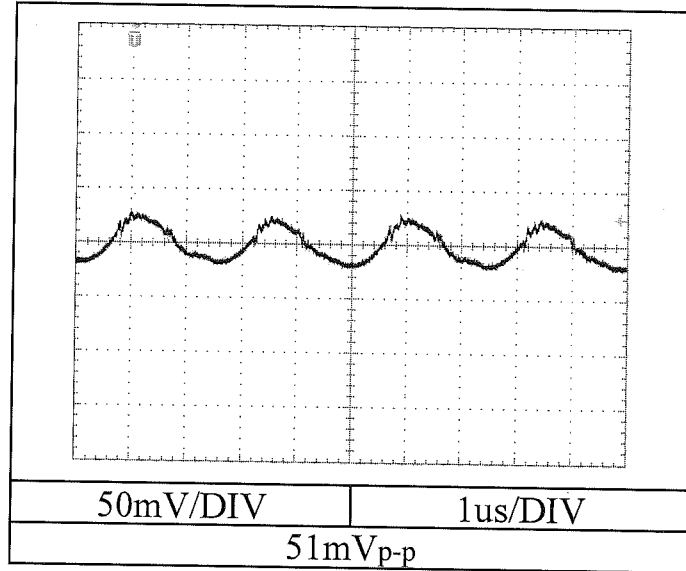


2.11 出力リップル、ノイズ波形  
Output ripple and noise waveform

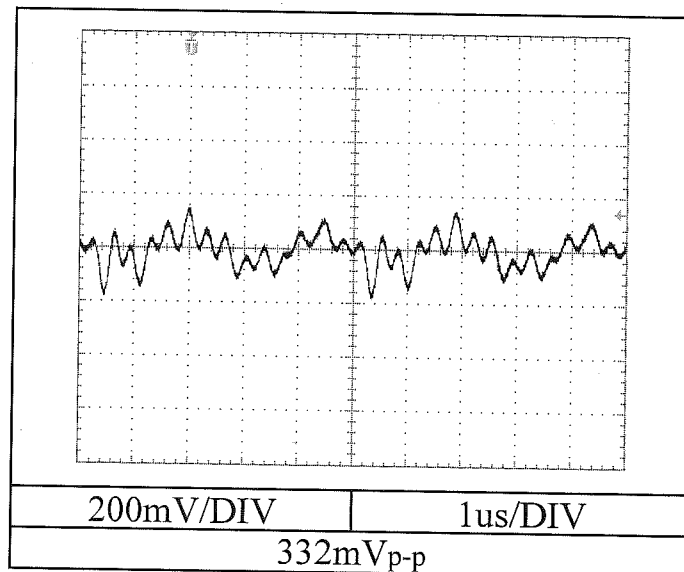
Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 100 %  
 $T_{bp}$  : 25 °C

24V

Normal mode



Normal + common mode



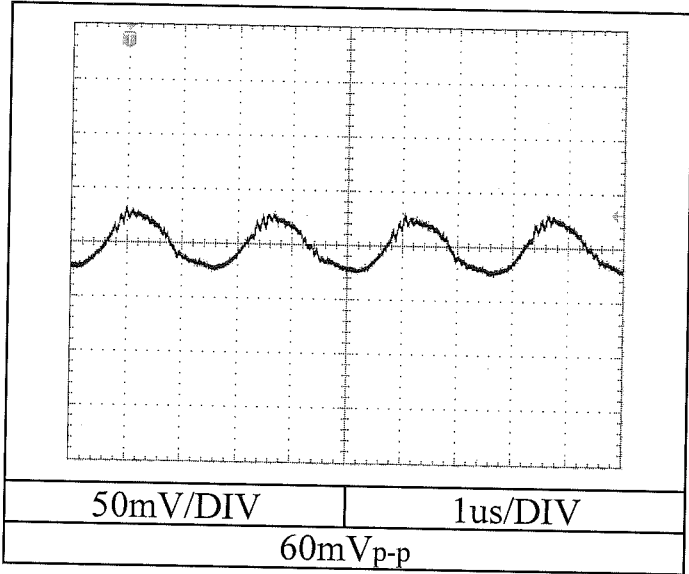


2.11 出力リップル、ノイズ波形  
Output ripple and noise waveform

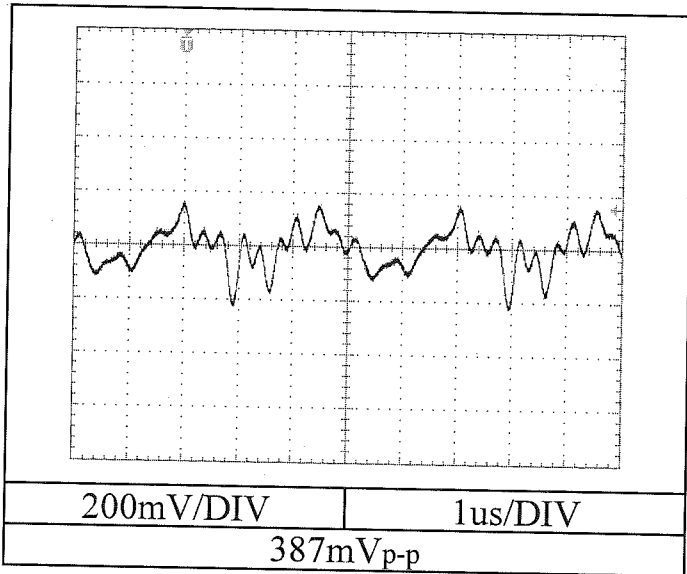
Conditions Vin : 280 VDC  
Iout : 100 %  
Tbp : 25 °C

28V

Normal mode



Normal + common mode

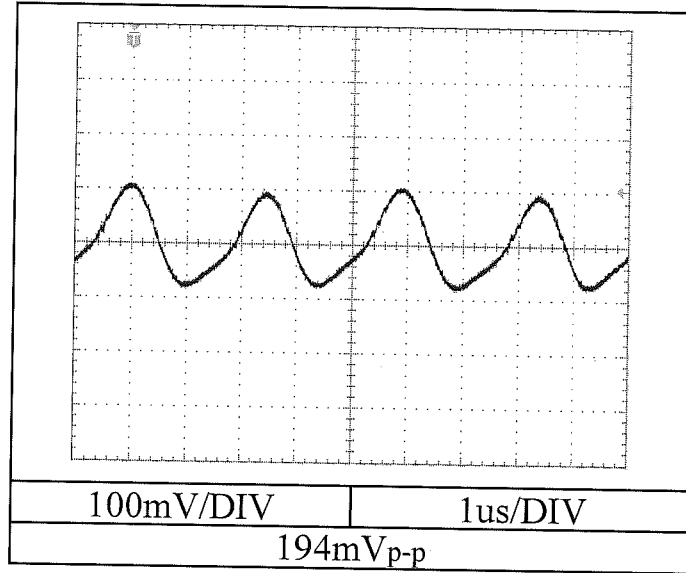


2.11 出力リップル、ノイズ波形  
Output ripple and noise waveform

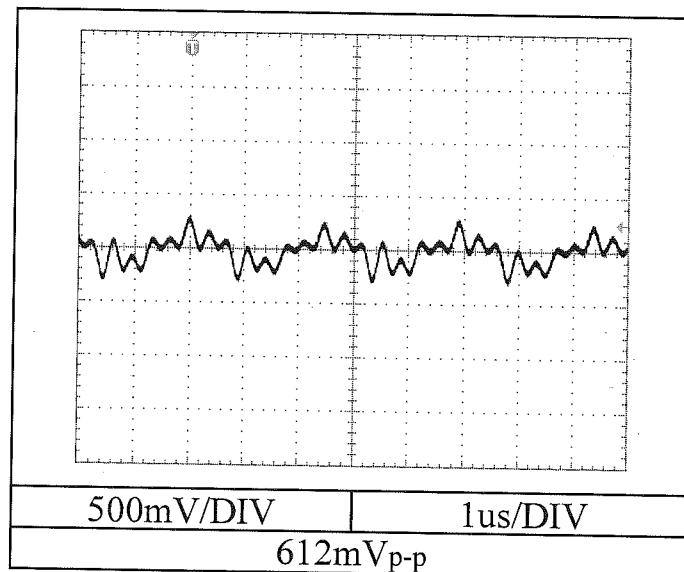
Conditions  $V_{in}$  : 280 VDC  
 $I_{out}$  : 100 %  
 $T_{bp}$  : 25 °C

48V

Normal mode



Normal + common mode



2.12 EMI特性

Electro-Magnetic Interference characteristics

(a) 雑音端子電圧 (帰還ノイズ)

Conducted Emission

(1) VCCI class A 対応アプリケーションシステム

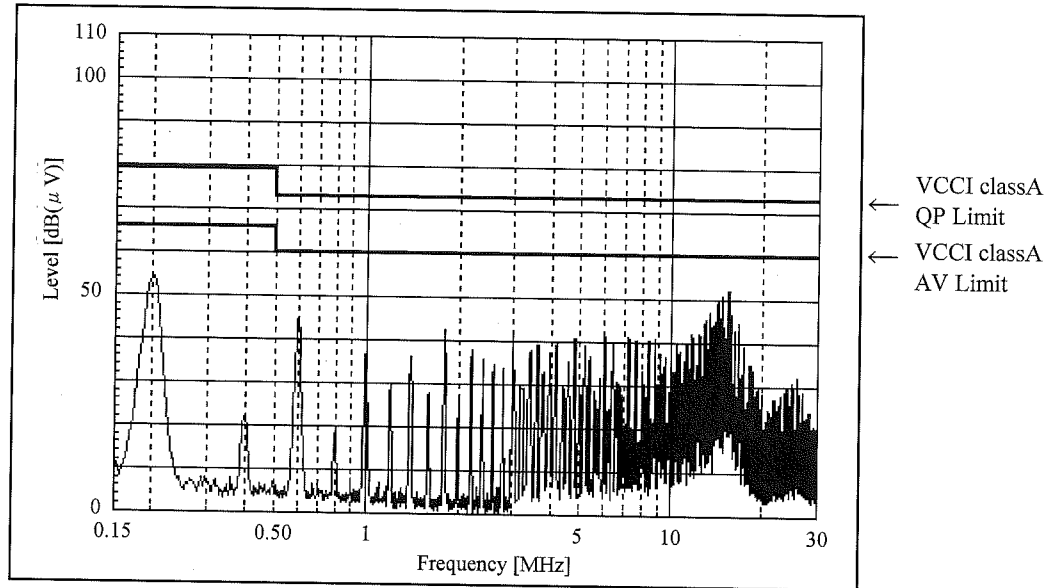
VCCI class A application system

Conditions Vin : 280 VDC

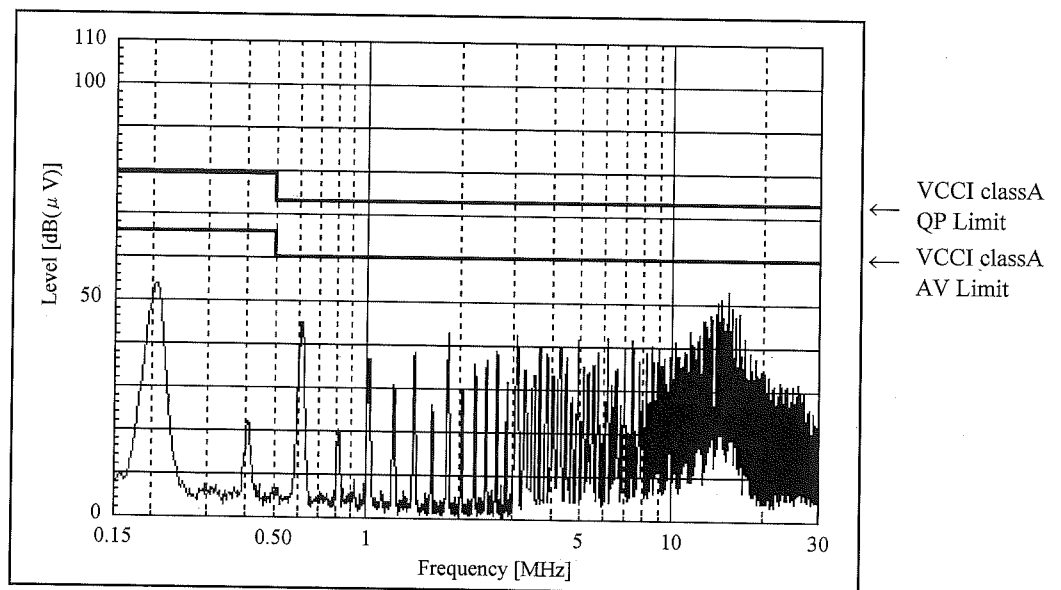
Iout : 100 %

Tbp : 25 °C

12V



24V



2.12 EMI特性

Electro-Magnetic Interference characteristics

(a) 雑音端子電圧 (帰還ノイズ)

Conducted Emission

(1) VCCI class A 対応アプリケーションシステム

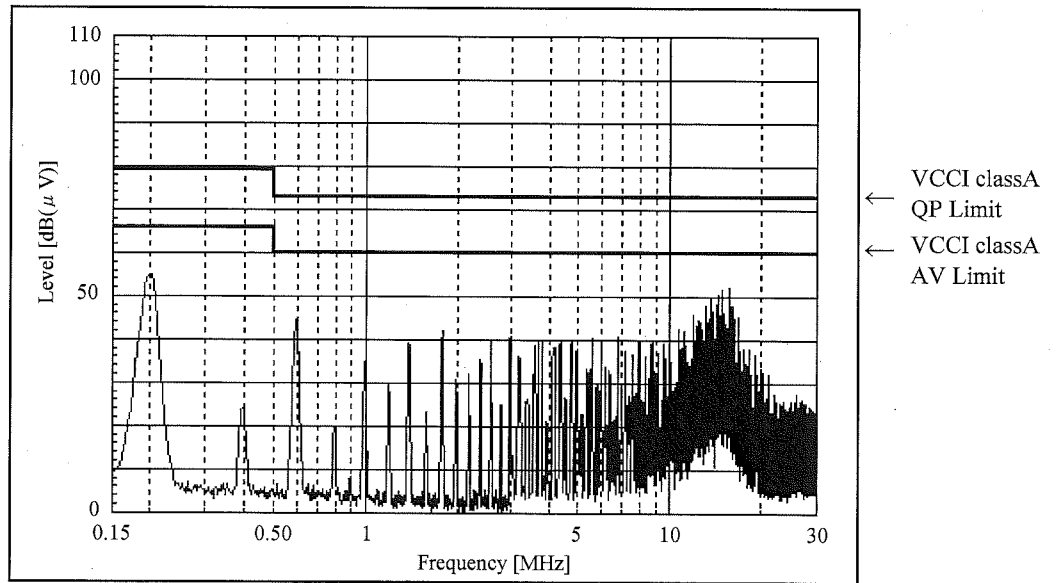
VCCI class A application system

Conditions Vin : 280 VDC

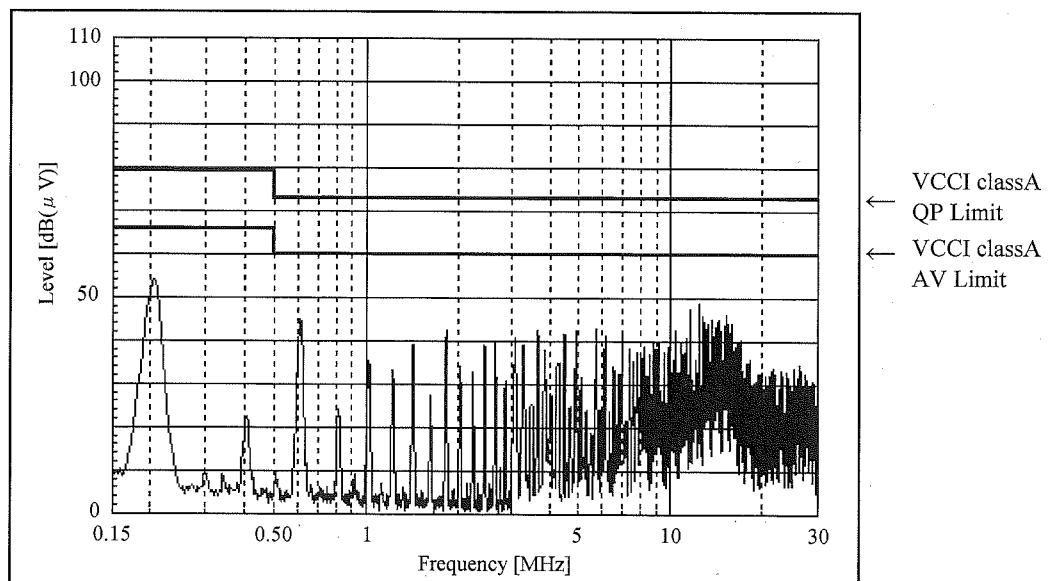
Iout : 100 %

Tbp : 25 °C

28V



48V



2.12 EMI特性

Electro-Magnetic Interference characteristics

(b) 雑音電界強度 (輻射ノイズ)

Radiated Emission

(1) VCCI class A 対応アプリケーションシステム

VCCI class A application system

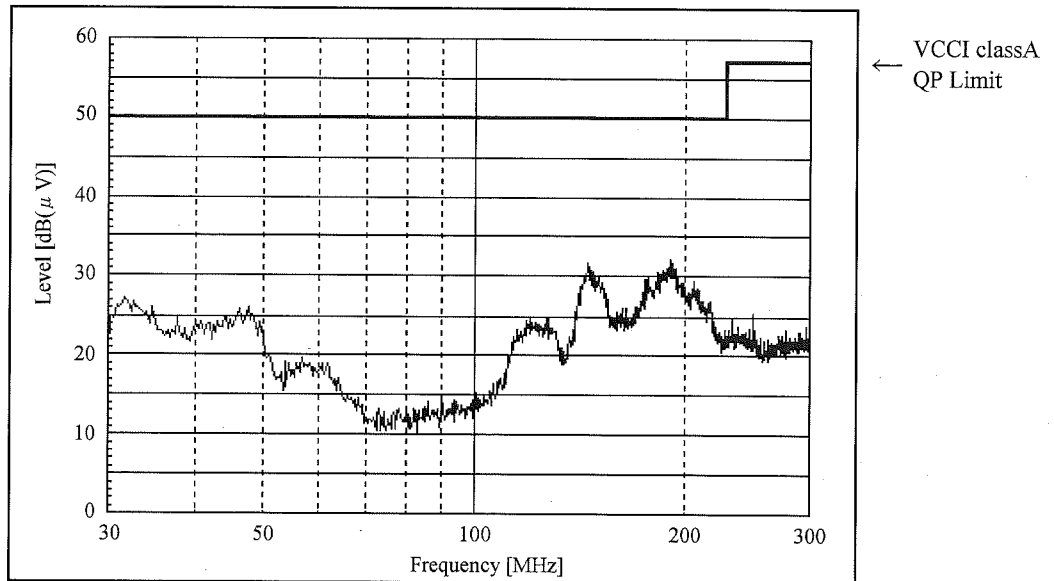
Conditions Vin : 280 VDC

Iout : 100 %

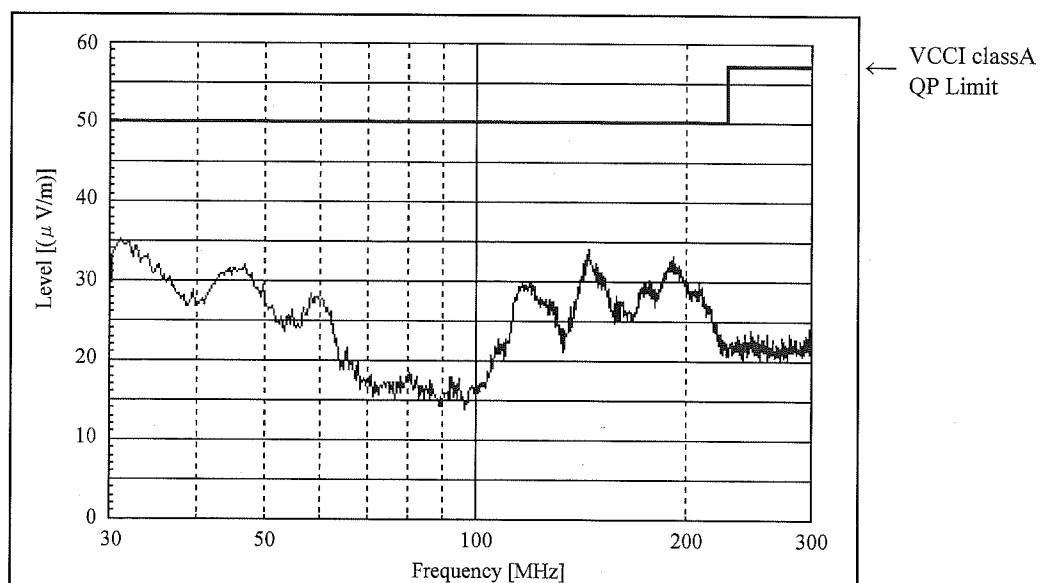
Tbp : 25 °C

12V

HORIZONTAL:



VERTICAL:



2.12 EMI特性

Electro-Magnetic Interference characteristics

(b) 雑音電界強度 (輻射ノイズ)

Radiated Emission

(1) VCCI class A 対応アプリケーションシステム

VCCI class A application system

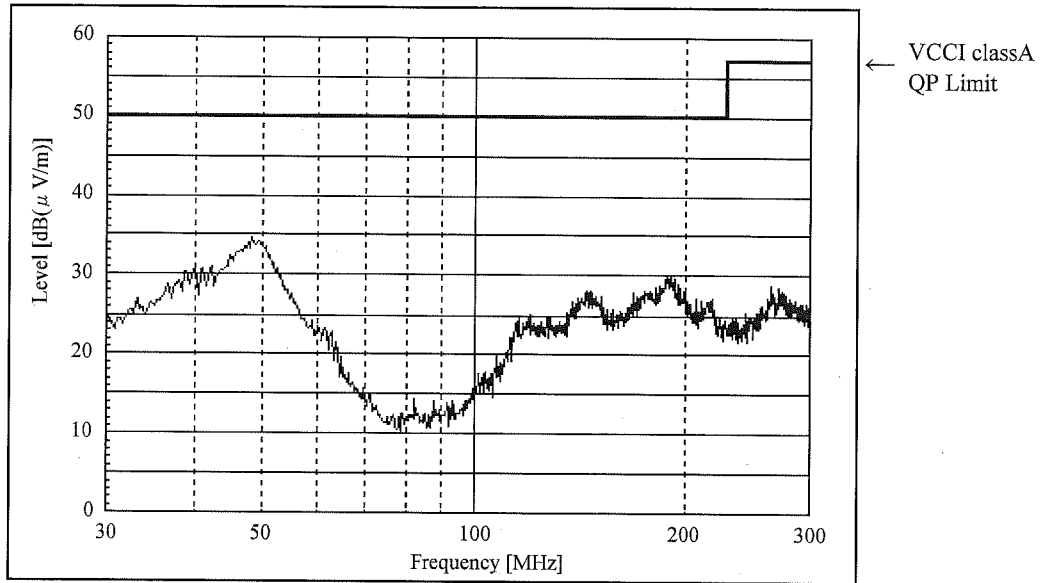
Conditions Vin : 280 VDC

Iout : 100 %

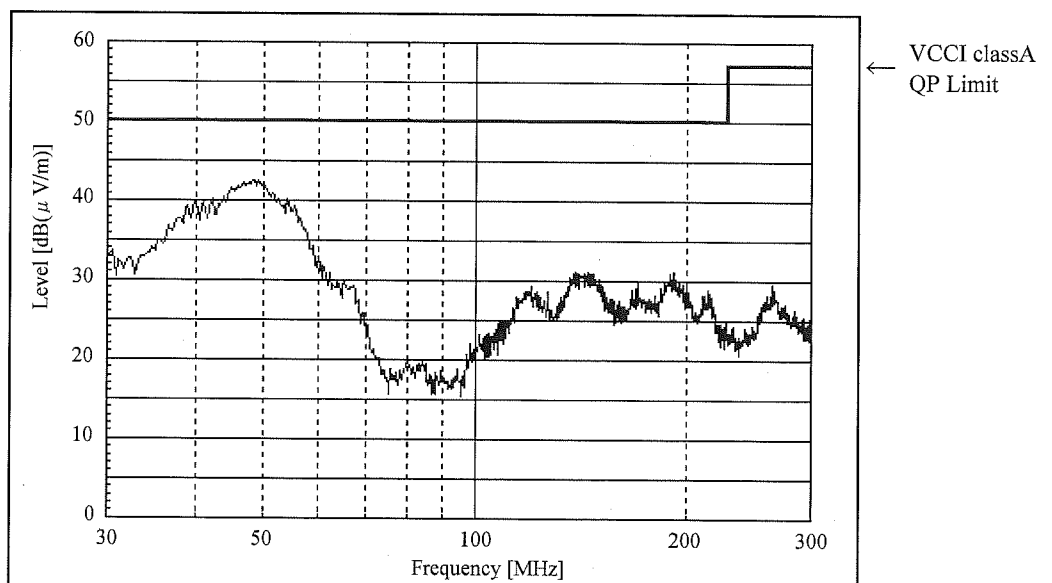
Tbp : 25 °C

24V

HORIZONTAL:



VERTICAL:



2.12 EMI特性

Electro-Magnetic Interference characteristics

(b) 雑音電界強度 (輻射ノイズ)

Radiated Emission

(1) VCCI class A 対応アプリケーションシステム

VCCI class A application system

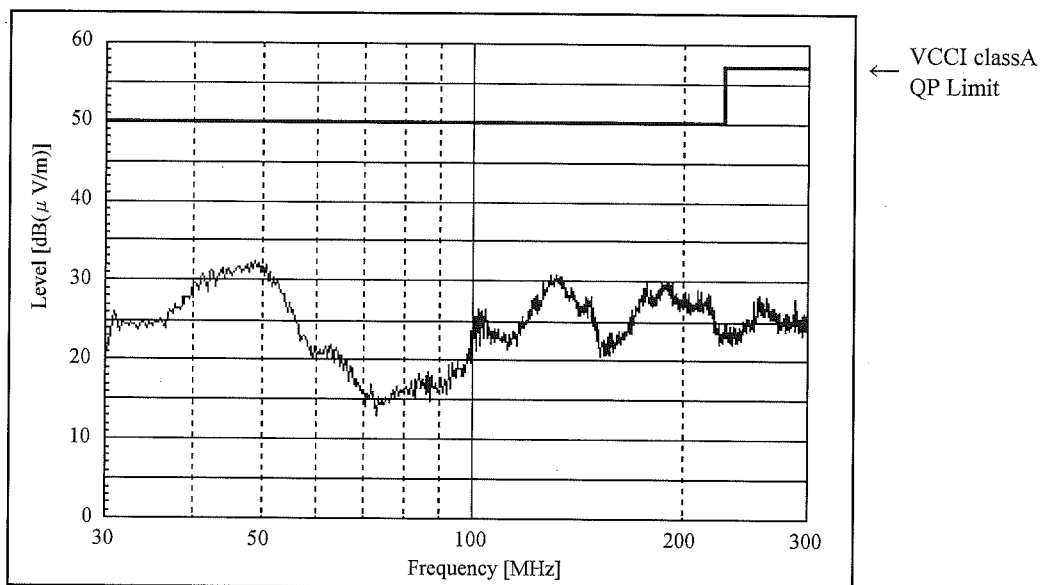
Conditions Vin : 280 VDC

Iout : 100 %

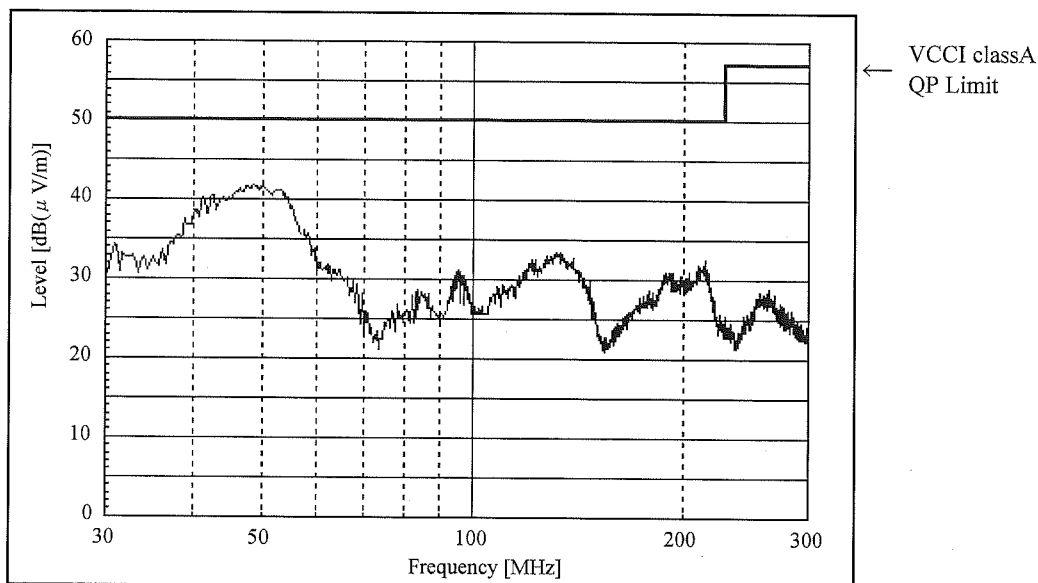
Tbp : 25 °C

28V

HORIZONTAL:



VERTICAL:



2.12 EMI特性

Electro-Magnetic Interference characteristics

(b) 雑音電界強度 (輻射ノイズ)

Radiated Emission

(1) VCCI class A 対応アプリケーションシステム

VCCI class A application system

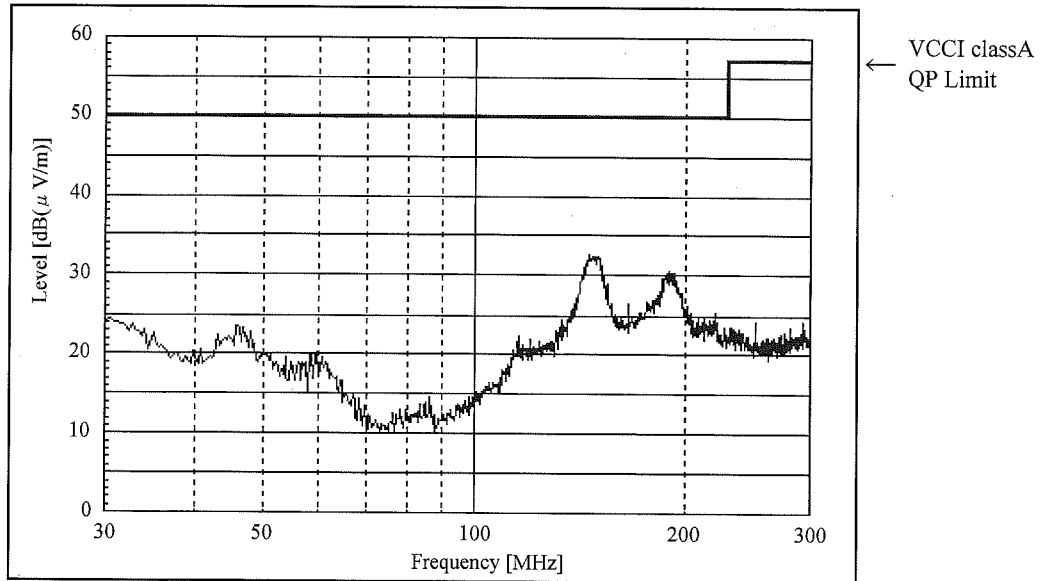
Conditions Vin : 280 VDC

Iout : 100 %

Tbp : 25 °C

48V

HORIZONTAL:



VERTICAL:

