PF1500B-360

EVALUATION DATA

型式データ

TDK-Lambda

CA906-53-01A

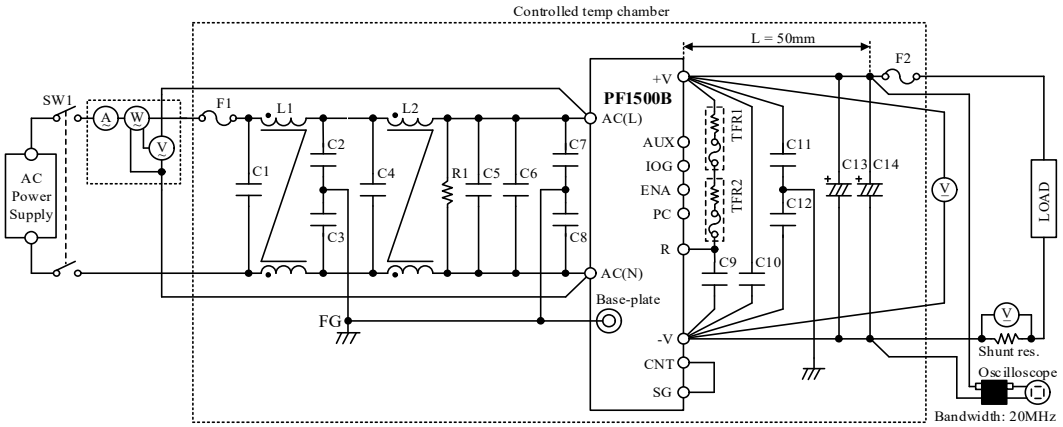
Index

使用記号 Terminology used		定義 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
f	・・・・・・・・・・	周波数	Frequency
Po	・・・・・・・・・・	出力電力	Output power
Tbp	・・・・・・・・・・	ベースプレート温度	Base-plate temperature

1. 評価方法　Evaluation Method

1.1 測定回路　Measurement Circuits

(1) 静特性 Steady state characteristics



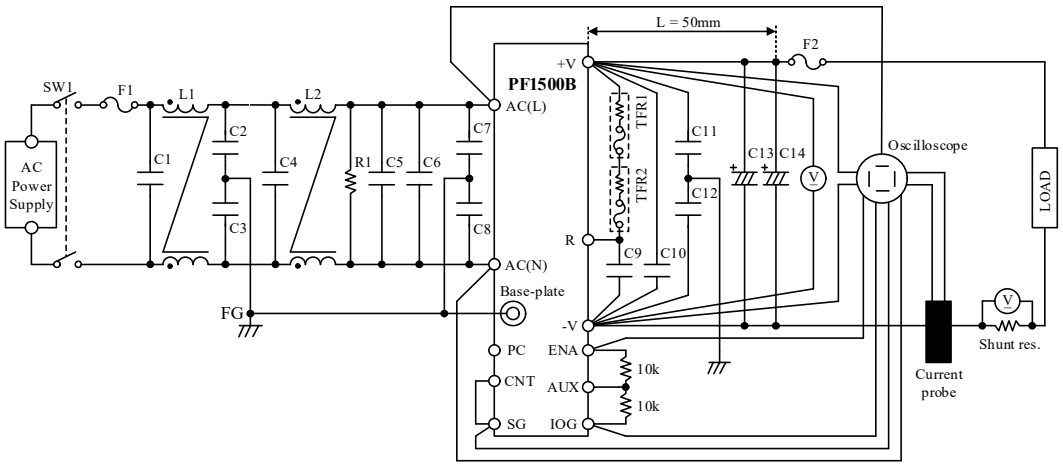
(2) 待機電力特性　Warm up voltage drift characteristics

上記(1)と同じ　Same as (1) above

(3) 電流制限特性　Current limit characteristics

上記(1)と同じ　Same as (1) above

(4) 過電圧保護特性　Over voltage protection (O.V.P.) characteristics



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

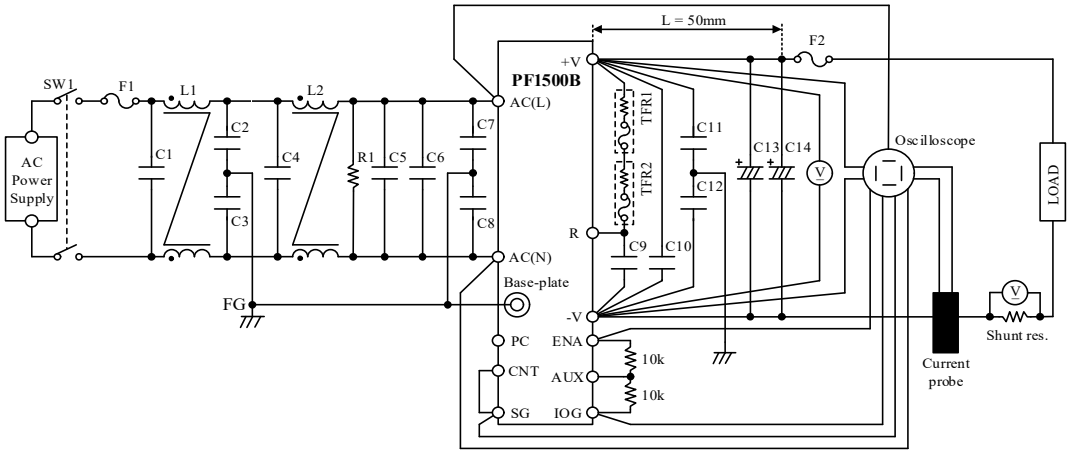
上記(4)と同じ　Same as (4) above

(6) 出力立下がり特性　Output fall characteristics

上記(4)と同じ　Same as (4) above

F1:	250VAC, 20A	C13,C14:	450VDC, 220uF×3 parallel Electrolytic Capacitor
C1,C4,C5,C6:	250VAC, 1uF Film Capacitor	L1:	4.5mH
C2,C3,C7,C8:	250VAC, 2200pF Ceramic Capacitor	L2:	2.2mH
C9,C10:	450VDC, 1uF Film Capacitor	R1:	0.5W, 470kΩ
C11,C12:	250VAC, 2200pF Ceramic Capacitor	TFR1,TFR2:	10Ω, 139°C

(7) IOG、ENA信号 対 出力電圧　IOG and ENA signals vs. output voltage



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

上記（7）と同じ　Same as (7) above

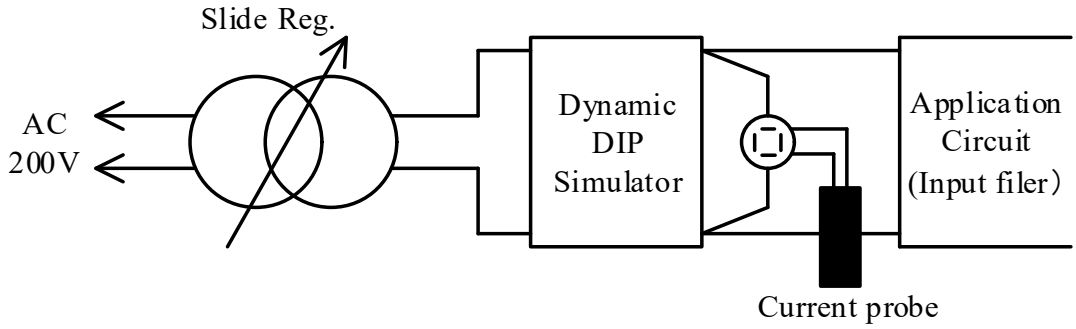
(9) 過渡応答（負荷急変）特性　Dynamic load response characteristics

上記（7）と同じ　Same as (7) above

(10) 入力電圧瞬停特性　Response to brown out characteristics

上記（7）と同じ　Same as (7) above

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

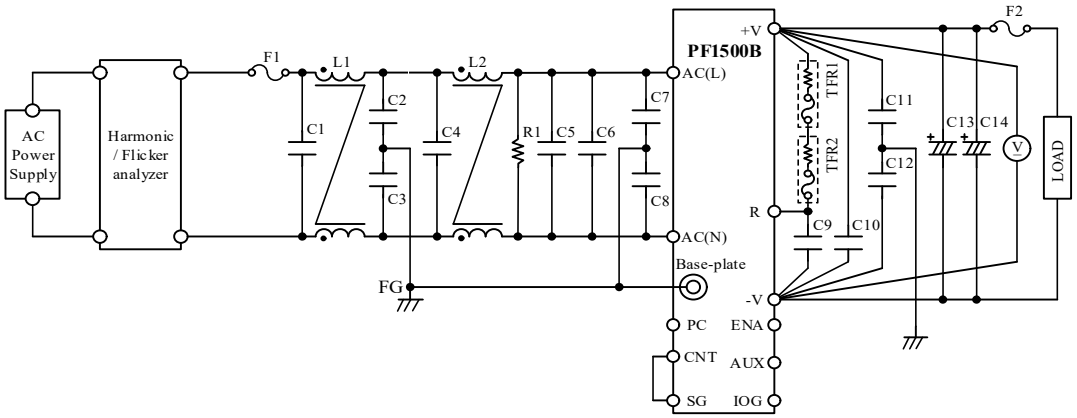


(12) 入力電流波形　Input curret waveform

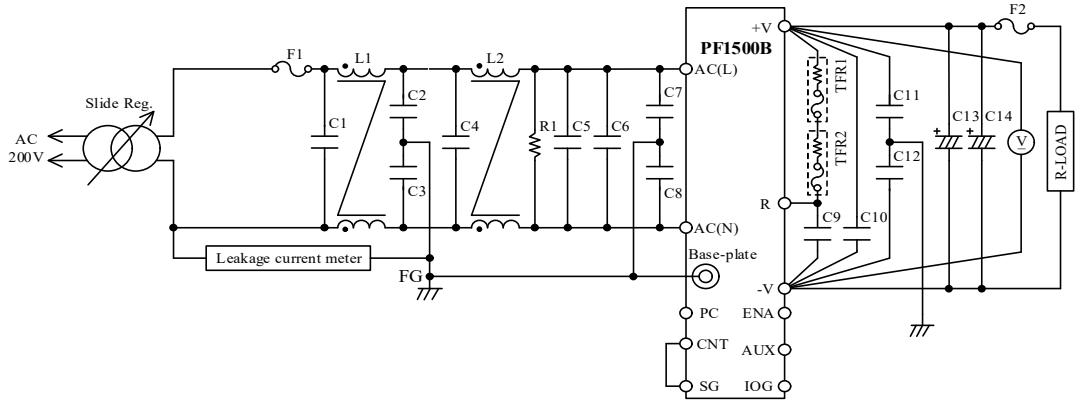
上記（7）と同じ　Same as (7) above

F1:	250VAC, 20A	C13,C14:	450VDC, 220uF×3 parallel Electrolytic Capacitor
C1,C4,C5,C6:	250VAC, 1uF Film Capacitor	L1:	4.5mH
C2,C3,C7,C8:	250VAC, 2200pF Ceramic Capacitor	L2:	2.2mH
C9,C10:	450VDC, 1uF Film Capacitor	R1:	0.5W, 470kΩ
C11,C12:	250VAC, 2200pF Ceramic Capacitor	TFR1,TFR2:	10Ω, 139°C

(13) 高調波成分、総合高調波歪率　Input current harmonics and total harmonic distortion



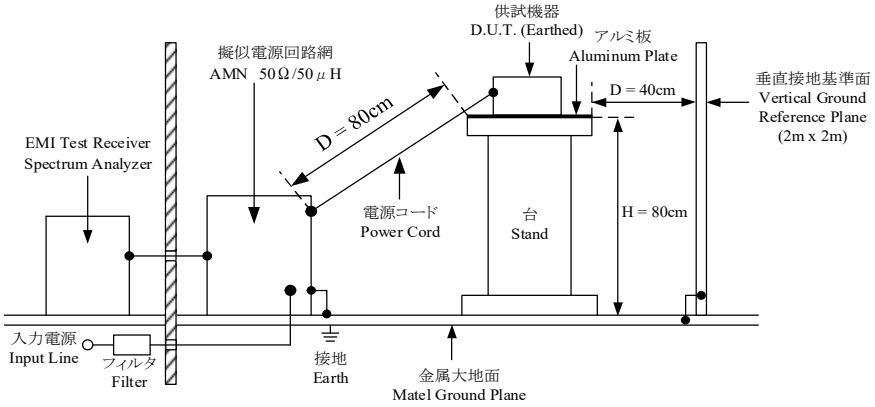
(14) リーク電流特性　Leakage current characteristics



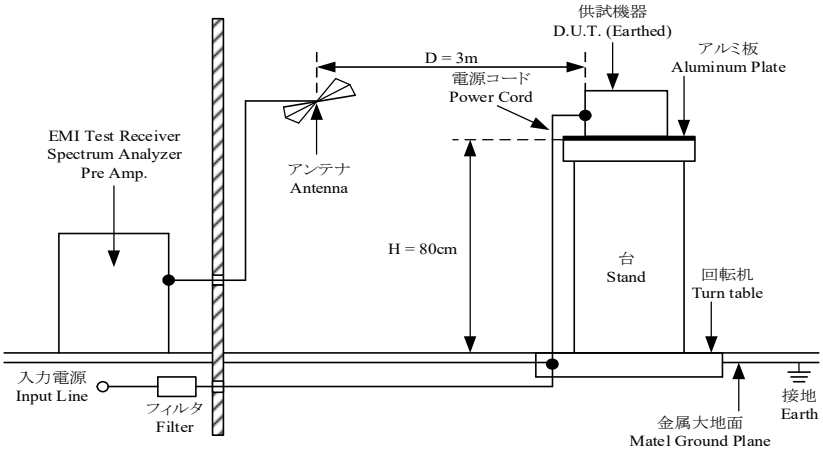
F1:	250VAC, 20A	C13,C14:	450VDC, 220uF×3 parallel Electrolytic Capacitor
C1,C4,C5,C6:	250VAC, 1uF Film Capacitor	L1:	4.5mH
C2,C3,C7,C8:	250VAC, 2200pF Ceramic Capacitor	L2:	2.2mH
C9,C10:	450VDC, 1uF Film Capacitor	R1:	0.5W, 470kΩ
C11,C12:	250VAC, 2200pF Ceramic Capacitor	TFR1,TFR2:	10Ω, 139°C

(15) EMI 特性　Electro-Magnetic Interference characteristics

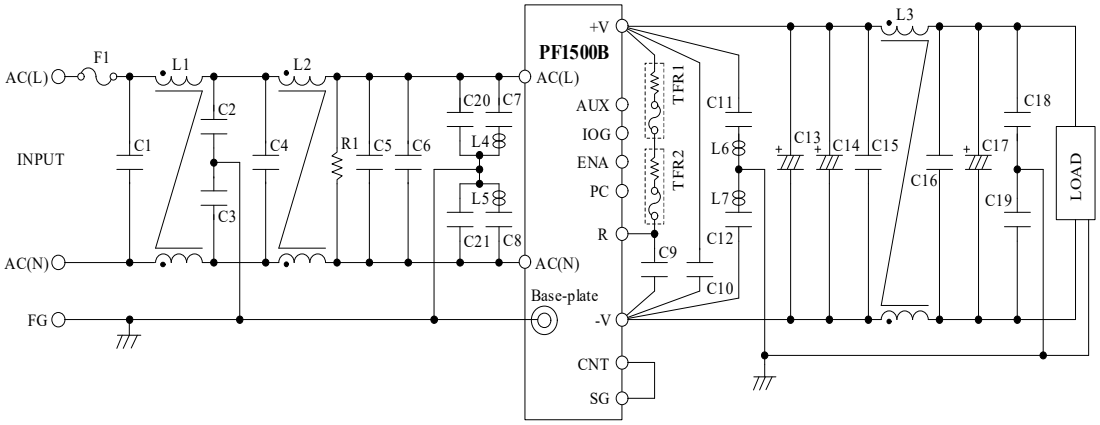
(a) 雑音端子電圧 (帰還ノイズ) Conducted Emission Noise



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



VCCI class A application system



F1:	250VAC, 20A	C18,C19:	250VAC, 2200pF Ceramic Capacitor
C1,C4,C5,C6:	250VAC, 1uF Film Capacitor	C20,C21:	250VAC, 47pF Ceramic Capacitor
C2,C3,C7,C8:	250VAC, 2200pF Ceramic Capacitor	L1:	4.5mH
C9,C10:	450VDC, 1uF Film Capacitor	L2:	2.2mH
C11,C12:	250VAC, 2200pF Ceramic Capacitor	L3:	202uH
C13,C14:	450VDC, 220uF×3 parallel Electrolytic Capacitor	L4,L5,L6,L7:	Ferrite Bead
C15,C16:	630V, 0.22uF Film Capacitor	R1:	0.5W, 470kΩ
		TFR1,TFR2:	10Ω, 139°C

*詳細な周辺パラメータ情報(参照用)

The detailed peripheral parameter information (for reference)

	SYMBOL	PRODUCT TYPE	ITEM DESCRIPTION	NOTE	MANUFACTURER
1	F1	Fuse	0324020.MXP	250VAC, 20A	LITTELFUSE
2	C1,C4,C5,C6	Cap.,Film(AC)	LE105-FX4131	250VAC, 1uF	OKAYA
3	C2,C3,C7,C8	Cap.,Ceramic(AC)	DE1E3KX222MA4BN04F	250VAC, 2200pF	MURATA
4	C9,C10	Cap.,Film	MDX22W105K-F	450V, 1uF	NTK
5	C11,C12	Cap.,Ceramic(AC)	DE1E3KX222MA4BN04F	250VAC, 2200pF	MURATA
6	C13,C14	Cap., Elect	EKHJ451VSN661MA59M	450V, 660uF	NI-CHEMI
7	C15,C16	MLCC	C3216X7R2J223KT	630V, 0.022uF x3	MURATA
8	C18,C19	Cap.,Ceramic(AC)	DE1E3KX222MA4BN04F	250VAC, 2200pF	MURATA
9	C20,C21	Cap.,Ceramic(AC)	DE11XRA470KA4BN01F	250VAC, 47pF	MURATA
10	L1	Noise Filter Coil	CV112045	4.5mH, 12A	TNC
11	L2	Noise Filter Coil	DMEGC core DMR73_ H36x23x15 : ϕ1.2 x 19T	2.2mH	TDK
12	L3	Noise Filter Coil	DMEGC core DN85H_ H31x19x13 : ϕ0.8 x 14T	0.2mH	TDK
13	L4,L5,L6,L7	Beads Core	HF57BB3.5X3X1.3		TDK
14	R1	Res.,	RK73H2BTTD1503F	0.5W 470kΩ x3	KOA
15	TFR1,TFR2	Res., Thermal Fuse	A5MC-100J	10Ω 139°C	UCHIHASHI

1.2 使用測定機器　List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	AC POWER SUPPLY	KIKUSUI	PCR2000L
2	AC POWER SUPPLY	KIKUSUI	PCR3000LE
3	DIGITAL POWER METER	YOKOGAWA ELECT.	WT310
4	DIGITAL STORAGE OSCILLOSCOPE	YOKOGAWA ELECT.	DLM2054
5	DATA ACQUISITION / SWITCH UNIT	AGILENT	34970A
6	DC ELECTRONIC LOAD	Chroma	63203A-600-210
7	CONTROLLED TEMP. CHAMBER	ESPEC CORP.	SU-662
8	LINE SUG SIMULATOR	TAKAMISAWA	PSA-210
9	CURRENT PROBE	YOKOGAWA	701933
10	HARMONIC/FLICKER ANALYZER	KIKUSUI	KHA1000
11	DUMMY LOAD	ARCOL	HS50 SERIES
12	SHUNT RESISTER	YOKOGAWA ELECT.	2215
13	EMI TEST RECEIVER/SPECTRUM ANALYZER	ROHDE & SCHWARZ	ESCI-03
14	LISN	ROHDE & SCHWARZ	ENV216
15	BROADBAND ANTENNA	SCHWARZBECK	VULB9168
16	EARTH LEAKAGE CURRENT METER	SIMPSON	228

2. 特性データ Characteristics

2.1 静特性 Steady state data

(1) 入力変動、負荷変動、温度変動 / 起動、停止電圧

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

360V Po=1008W

1. Regulation - line and load Condition Tbp : 25°C

Iout \ Vin	85VAC	115VAC	230VAC	255VAC	line regulation	
0%	361.0V	361.0V	361.1V	362.1V	1.1V	0.31%
50%	360.9V	361.0V	361.2V	361.2V	0.3V	0.07%
100%	360.8V	361.0V	361.2V	361.2V	0.5V	0.12%
load regulation	0.2V	0.1V	0.1V	0.9V		
	0.06%	0.02%	0.02%	0.24%		

2. Temperature drift Conditions Vin : 115VAC
Iout : 100%

Iout \ Vin	-40°C	+25°C	+100°C	temperature stability	
Vout	359.9V	361.0V	362.0V	2.1V	0.59%

3. Start up voltage and Drop out voltage Conditions Tbp : 25°C
Iout : 100%

Start up voltage (Vin)	76.0V
Drop out voltage (Vin)	67.0V

360V Po=1512W

1. Regulation - line and load Condition Tbp : 25°C

Iout \ Vin	170VAC	230VAC	255VAC	line regulation	
0%	361.0V	361.1V	360.6V	0.4V	0.12%
50%	361.1V	361.2V	361.2V	0.1V	0.02%
100%	361.1V	361.2V	361.3V	0.1V	0.04%
load regulation	0.1V	0.2V	0.6V		
	0.03%	0.04%	0.17%		

2. Temperature drift Conditions Vin : 230VAC
Iout : 100%

Iout \ Vin	-40°C	+25°C	+100°C	temperature stability	
Vout	360.0V	361.2V	362.3V	2.3V	0.62%

(2) 出力電圧、出力リップル電圧 対 入力電圧

Output voltage and ripple voltage vs. input voltage

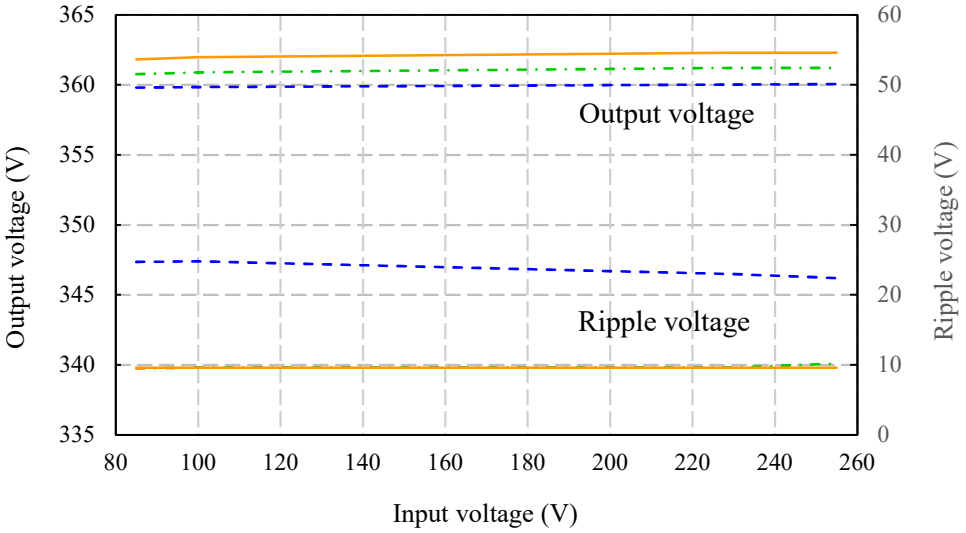
Conditions Tbp : Cout :

-40°C 1350uF

25°C 1350uF

100°C 2700uF

360V Po=1008W



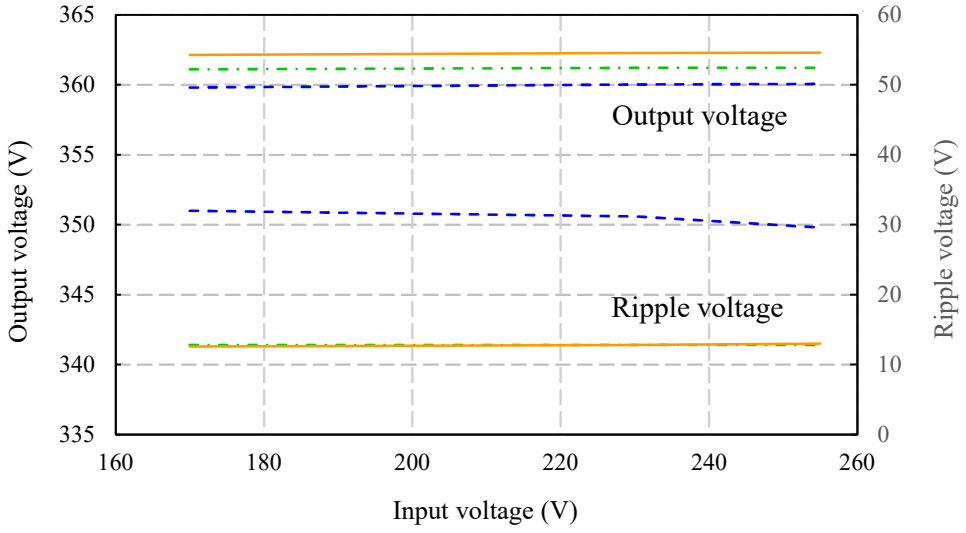
Conditions Tbp : Cout :

-40°C 1350uF

25°C 1350uF

100°C 2700uF

360V Po=1512W

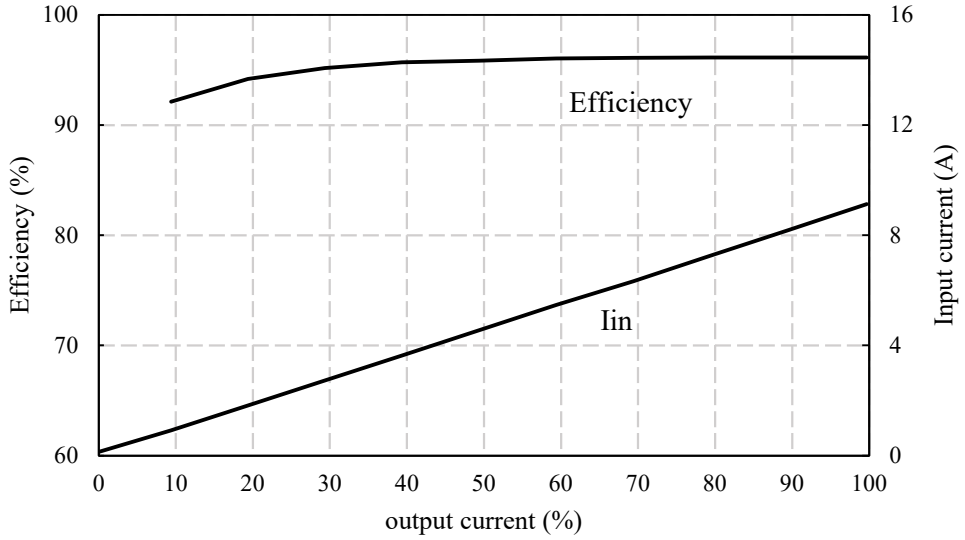


(3) 効率、入力電流 対 出力電流

Efficiency and input current vs. output current

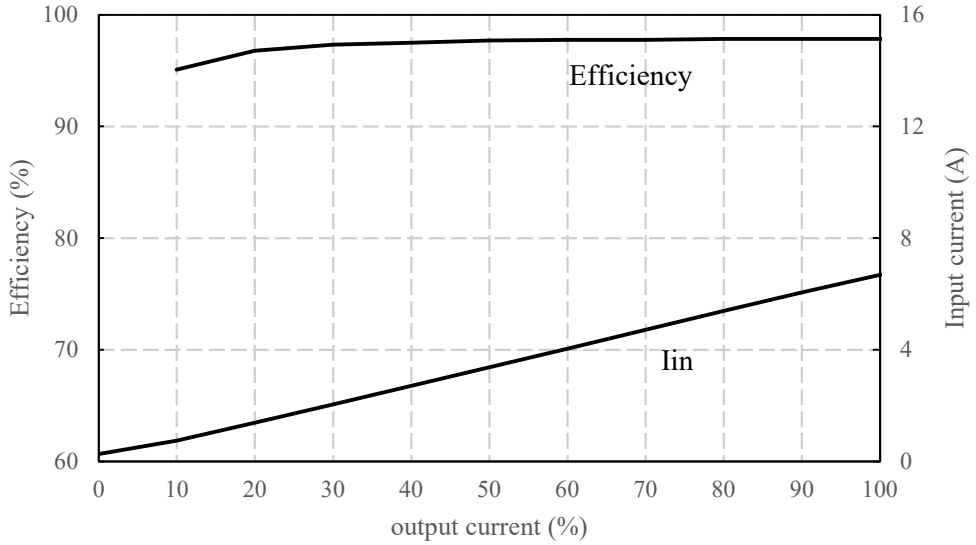
Conditions Vin : 115VAC
Iout : 100%
Tbp : 25°C

360V Po=1008W



Conditions Vin : 230VAC
Iout : 100%
Tbp : 25°C

360V Po=1512W



(4) 効率、入力電流 対 入力電圧

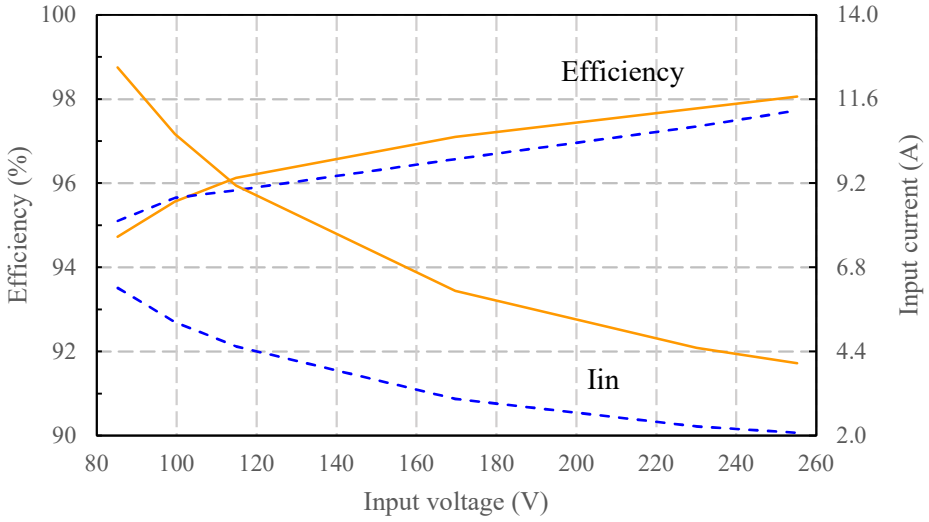
Efficiency and input current vs. input voltage

Conditions Iout : 50%

100%

Tbp : 25°C

360V Po=1008W

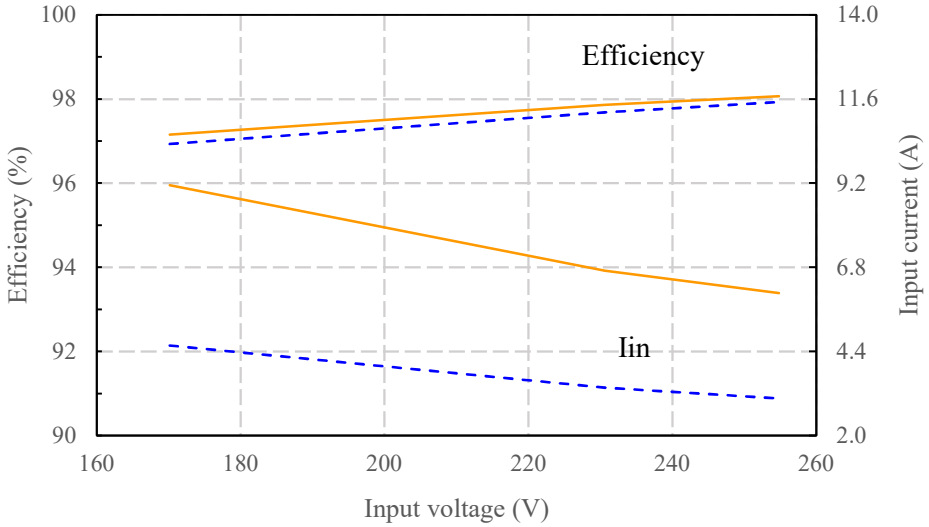


Conditions Iout : 50%

100%

Tbp : 25°C

360V Po=1512W

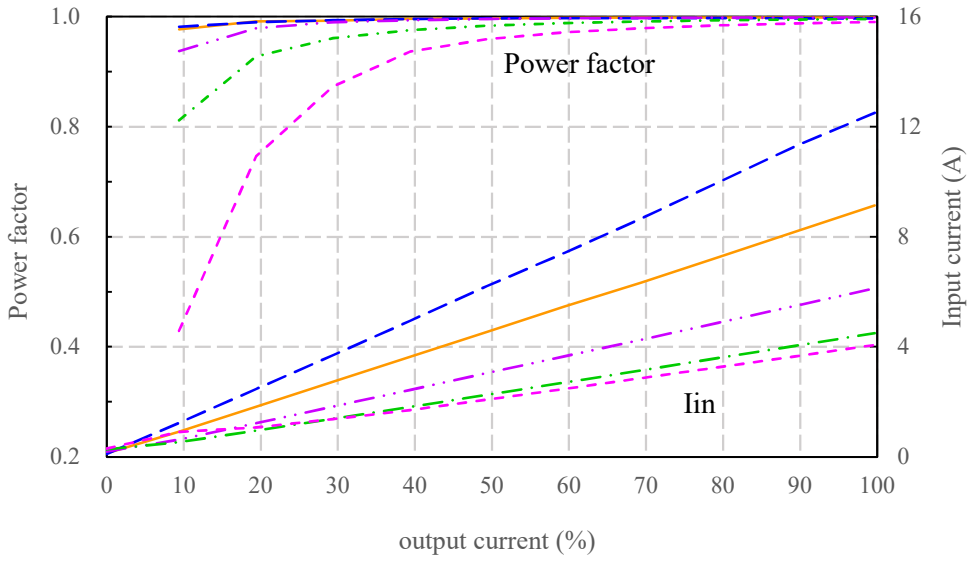


(5) 力率、入力電流 対 出力電流

Power factor and input current vs. output current

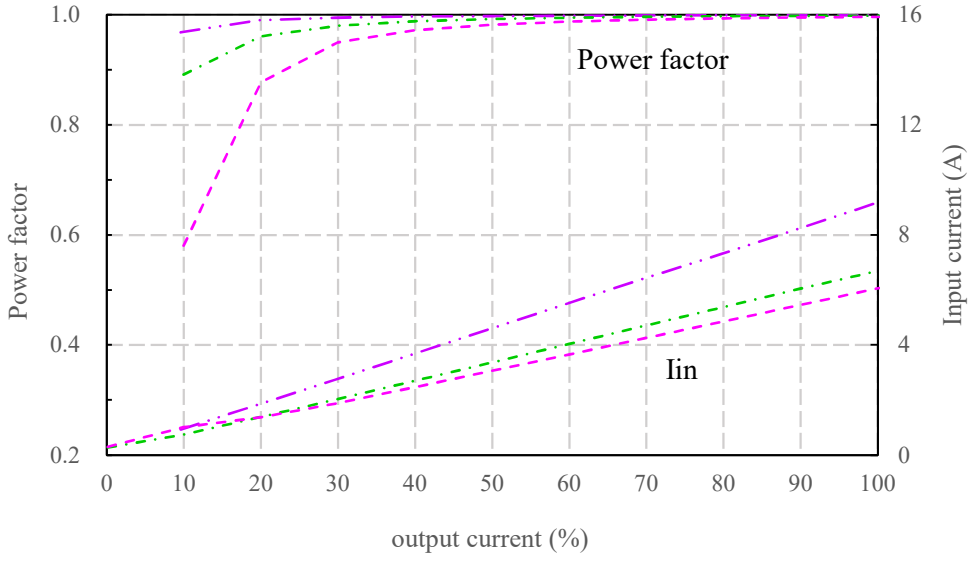
Conditions Vin : 85VAC
115VAC
170VAC
230VAC
255VAC
Tbp : 25°C

360V Po=1008W



Conditions Vin : 170VAC
230VAC
255VAC
Tbp : 25°C

360V Po=1512W



(6) 起動、停止電圧特性

Start and stop voltage characteristics

出力電圧 対 入力電圧

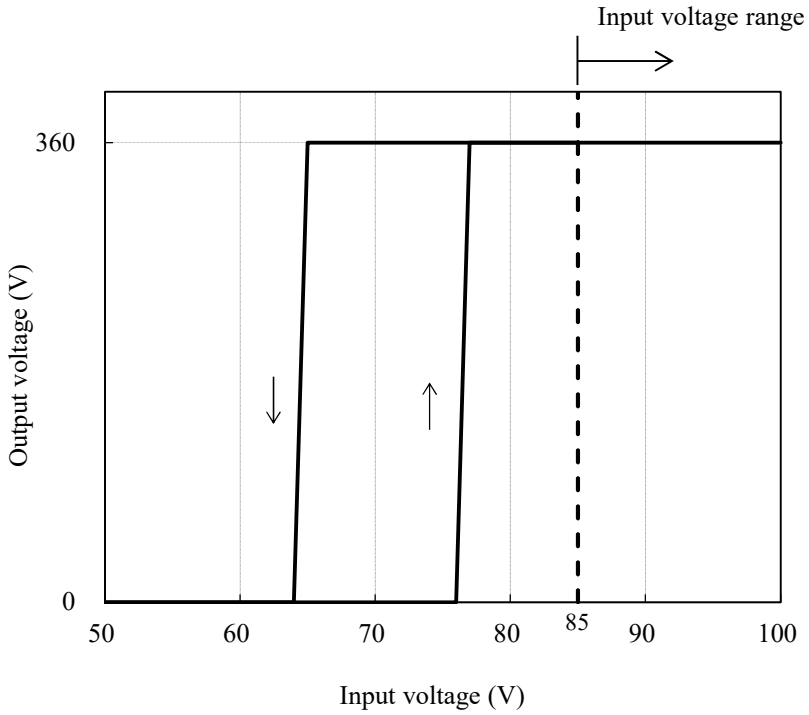
Output voltage vs. Input voltage

Condition: Io : 0%（起動時）,100%（停止時）

Tbp : 25°C

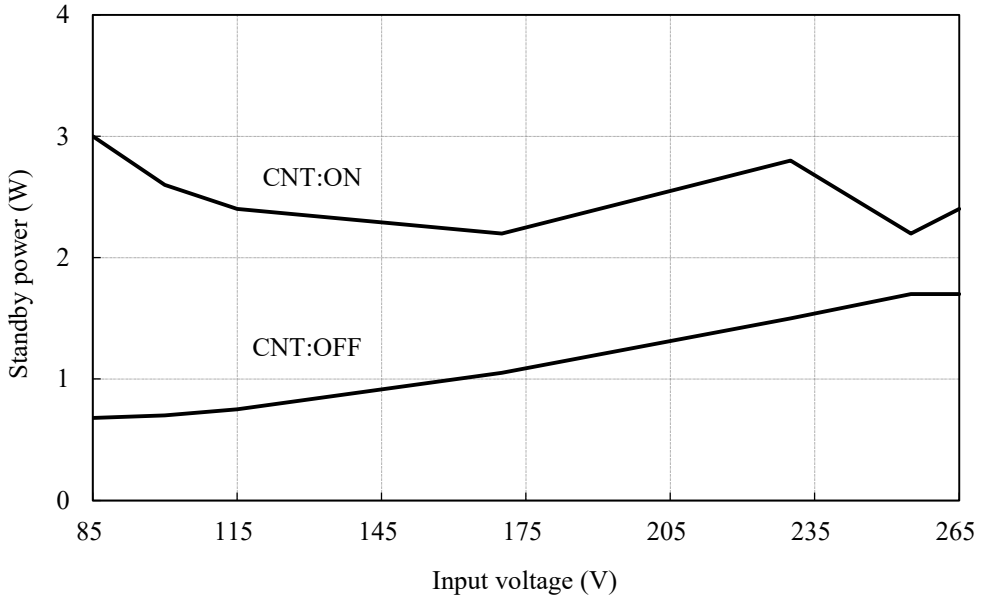
Up / down:

Tbp	25°C
start up	77.0V
shut down	64.0V



2.2 待機電力特性　Standby power characteristics

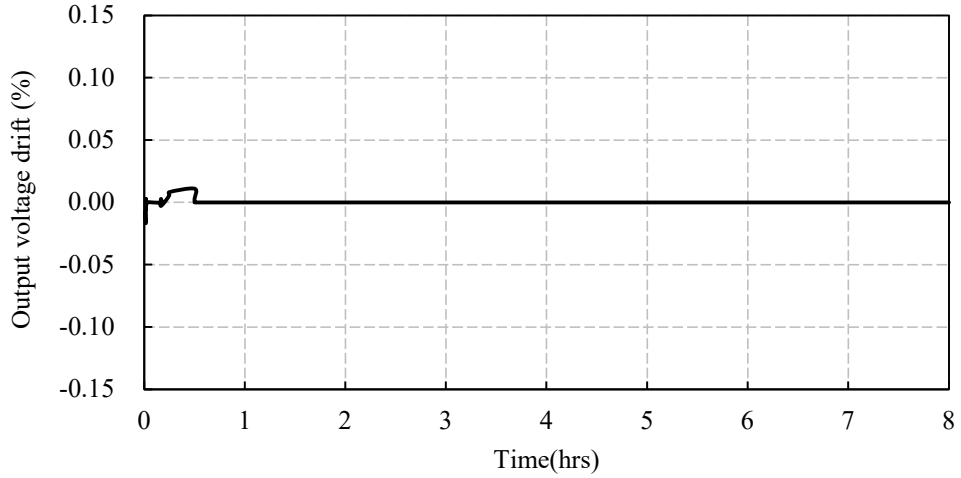
Condition　Tbp: 25°C
Iout: 0%



2.3 通電ドリフト特性　Warm up voltage drift characteristics

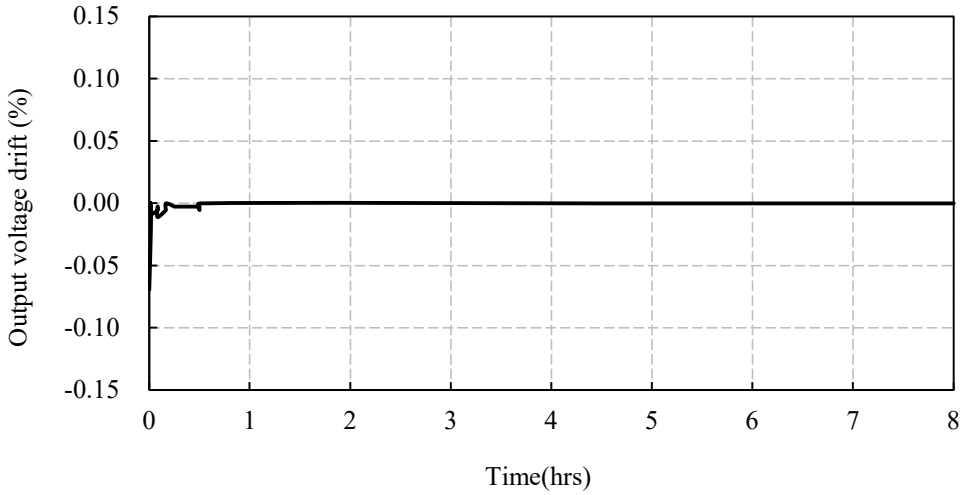
Conditions　Vin : 115VAC
Iout : 100%
Tbp : 25°C

360V　Po=1008W



Conditions　Vin : 230VAC
Iout : 100%
Tbp : 25°C

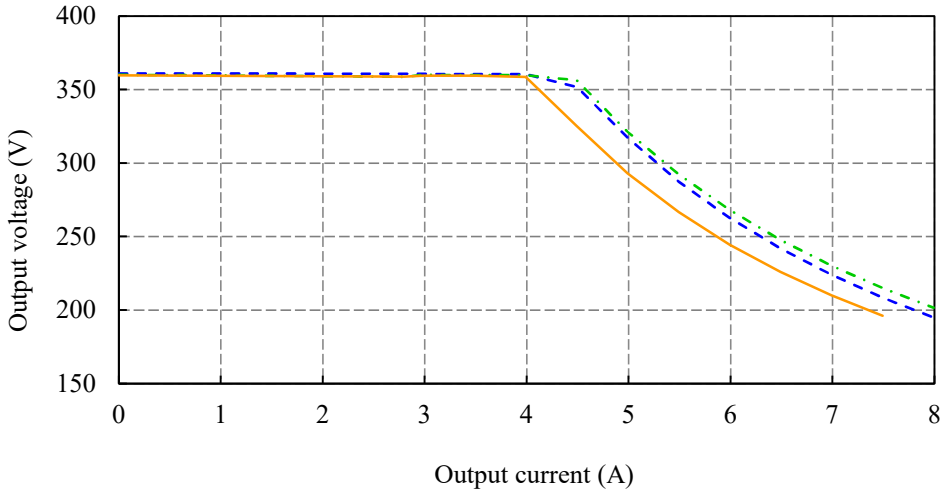
360V　Po=1512W



2.4 電流制限特性　Current limit characteristics

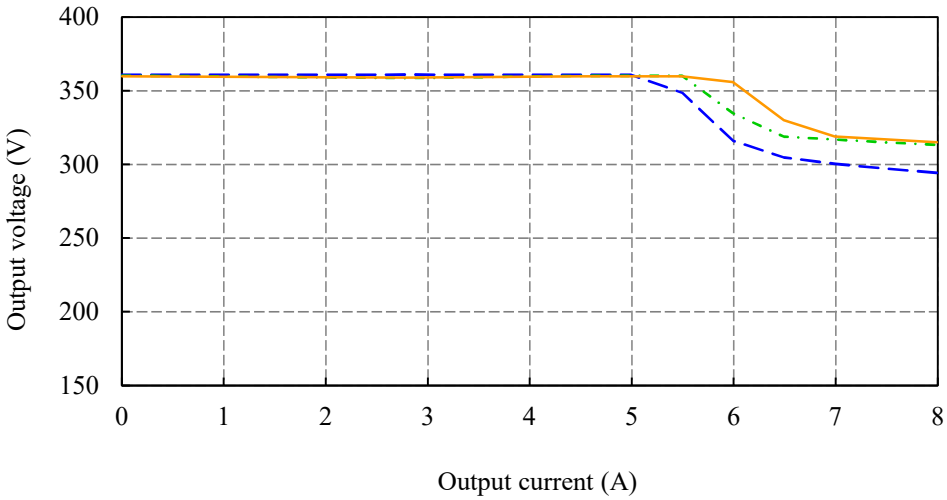
Conditions　Tbp :　-40°C
25°C
100°C
Vin : 115VAC

360V



Conditions　Tbp :　-40°C
25°C
100°C
Vin : 230VAC

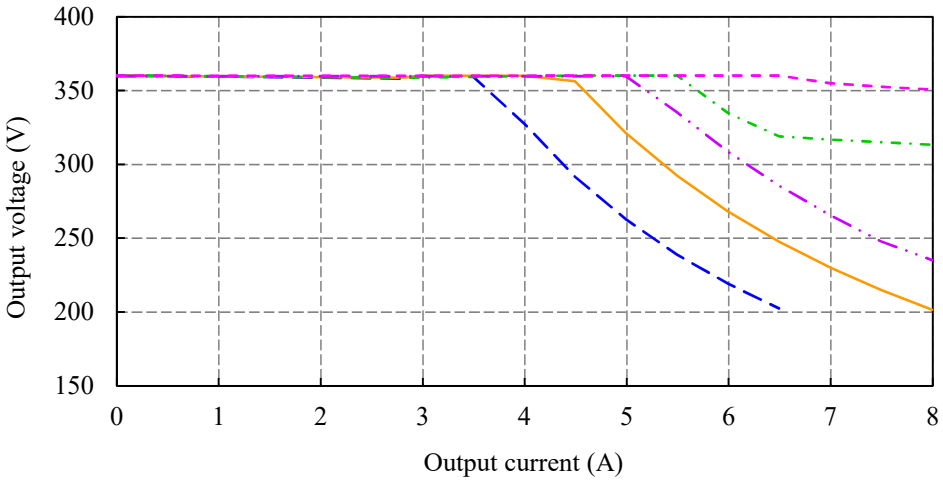
360V



2.4 電流制限特性　Current limit characteristics

Conditions Vin 85VAC
115VAC
170VAC
230VAC
255VAC
Tbp : 25°C

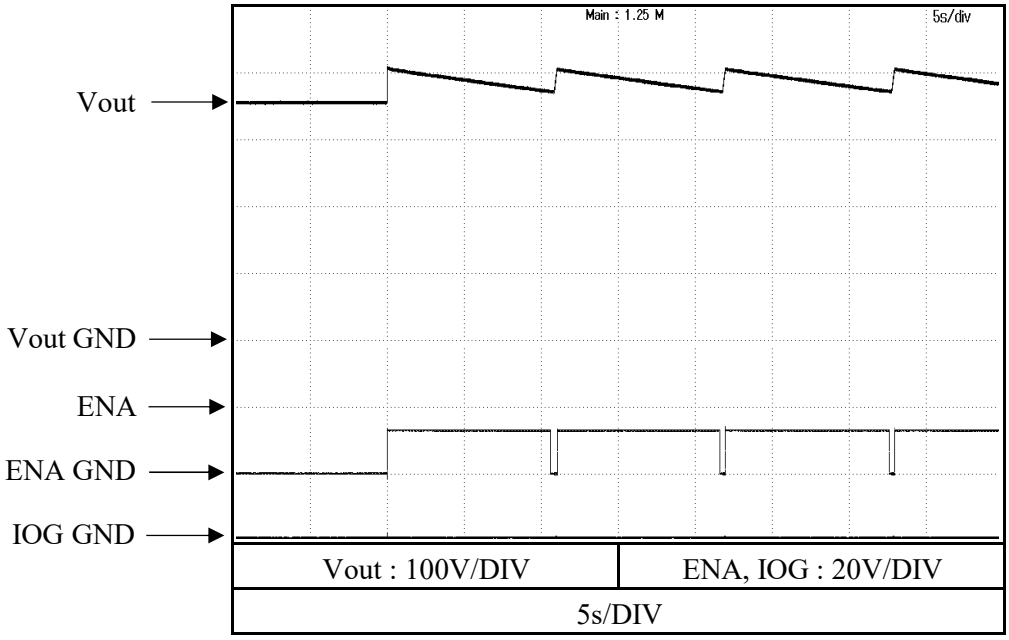
360V



2.5 過電圧保護特性　Over voltage protection (O.V.P.) characteristics

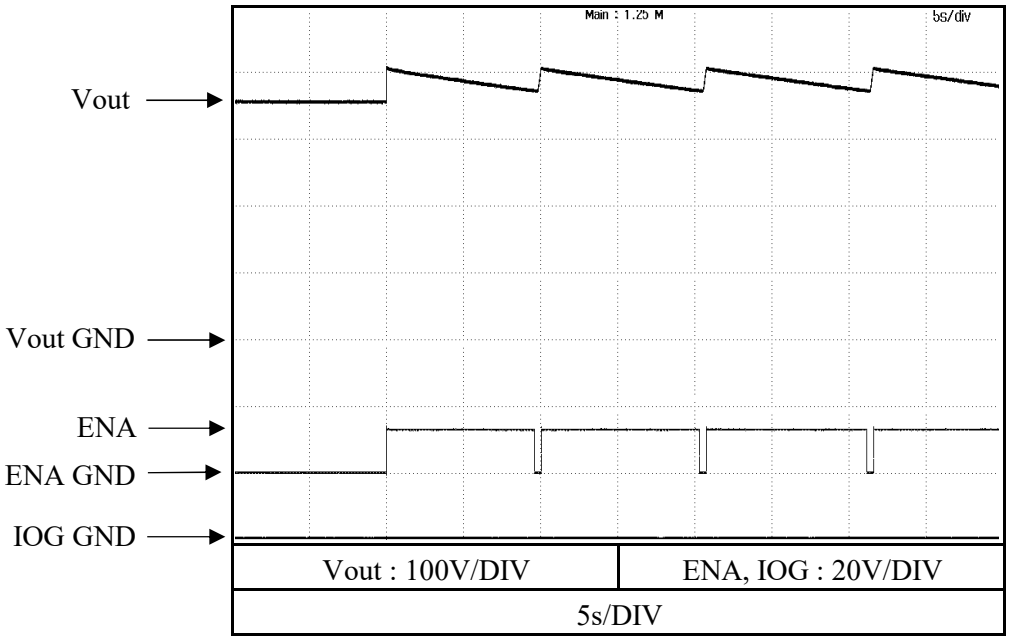
Conditions　Vin : 115VAC
Iout : 0%
Tbp : 25°C

360V



Conditions　Vin : 230VAC
Iout : 0%
Tbp : 25°C

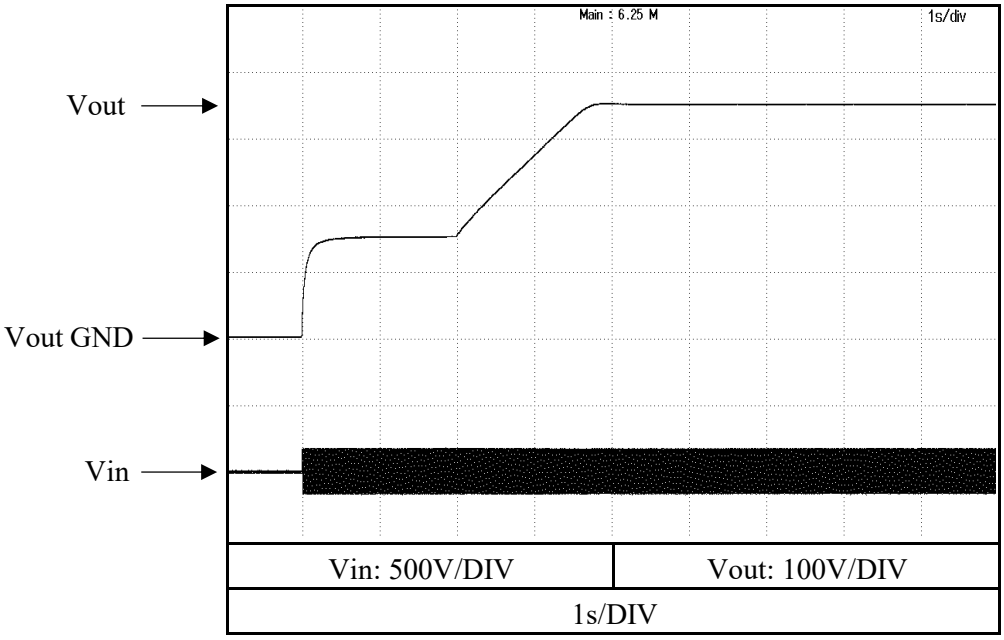
360V



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

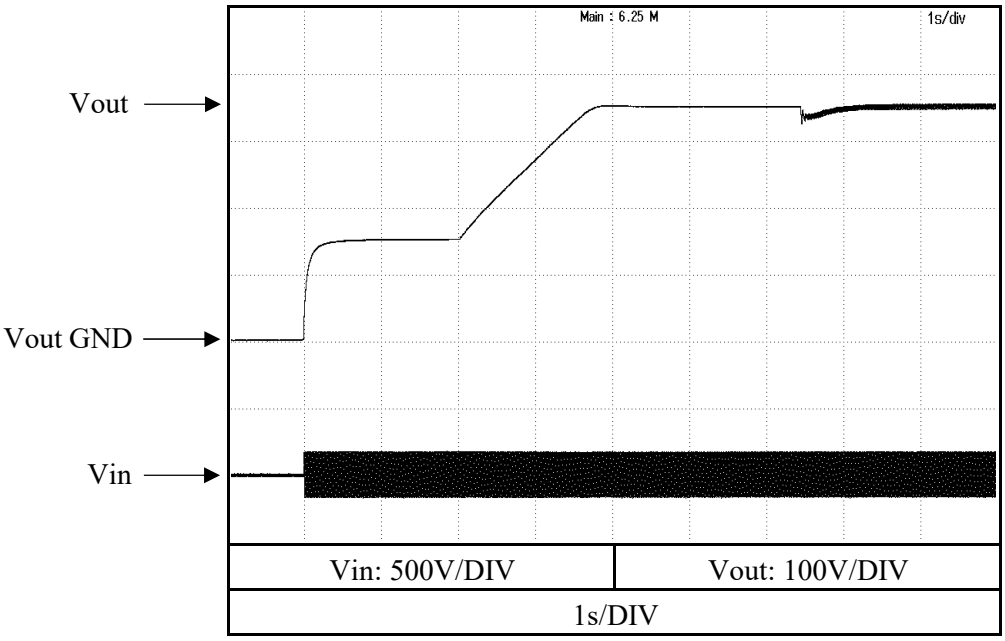
Conditions　Vin : 115VAC
Iout : 0%
Tbp : 25°C

360V　　Po=0W



Conditions　Vin : 115VAC
Iout : 100%
Tbp : 25°C

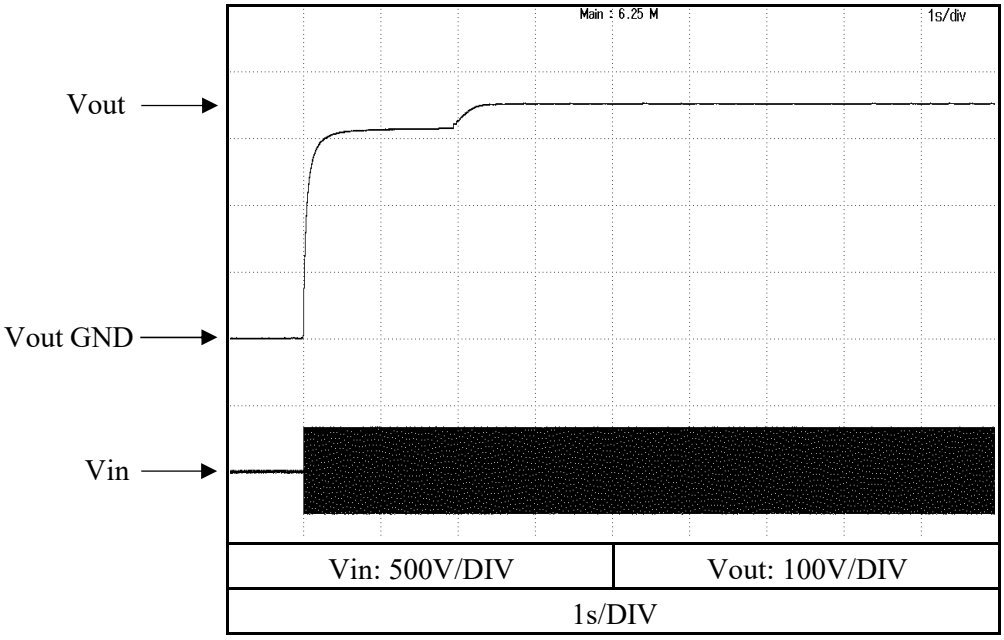
360V　　Po=1008W



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

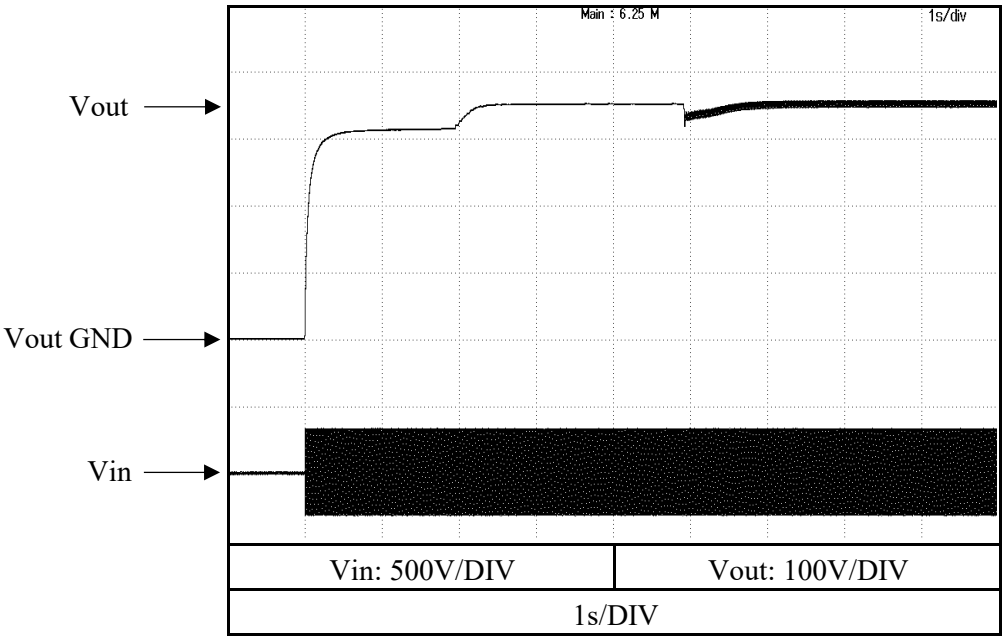
Conditions　Vin : 230VAC
Iout : 0%
Tbp : 25°C

360V　　Po=0W



Conditions　Vin : 230VAC
Iout : 100%
Tbp : 25°C

360V　　Po=1512W

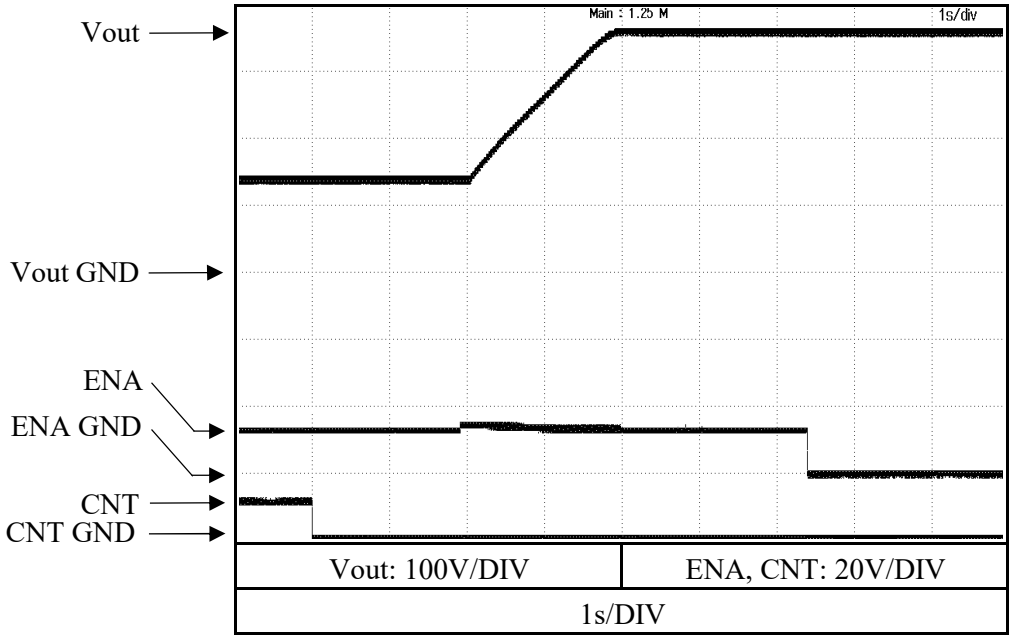


2.7 ON/OFF CONTROLによる出力立ち上がり特性

Output rise characteristics with ON/OFF CONTROL

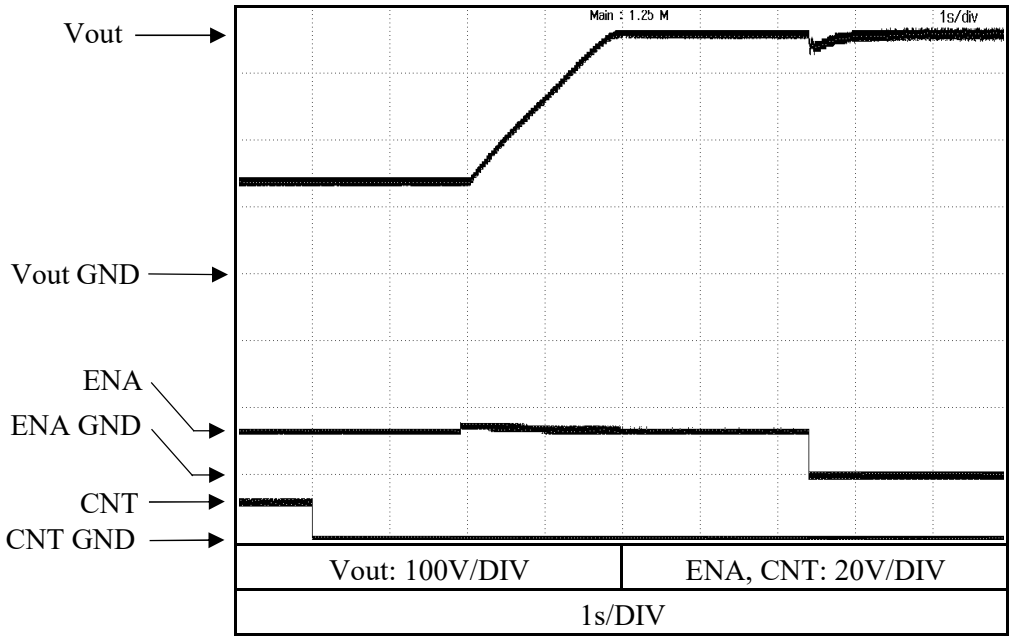
Conditions Vin : 100VAC
Iout : 0%
Tbp : 25°C

360V Po=0W



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

360V Po=1008W

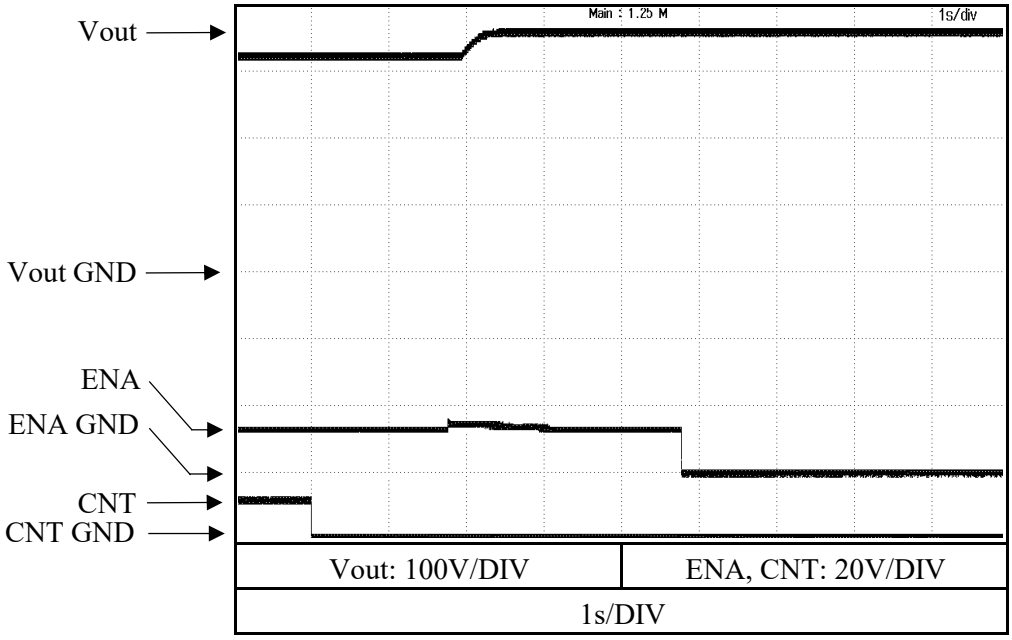


2.7 ON/OFF CONTROLによる出力立ち上がり特性

Output rise characteristics with ON/OFF CONTROL

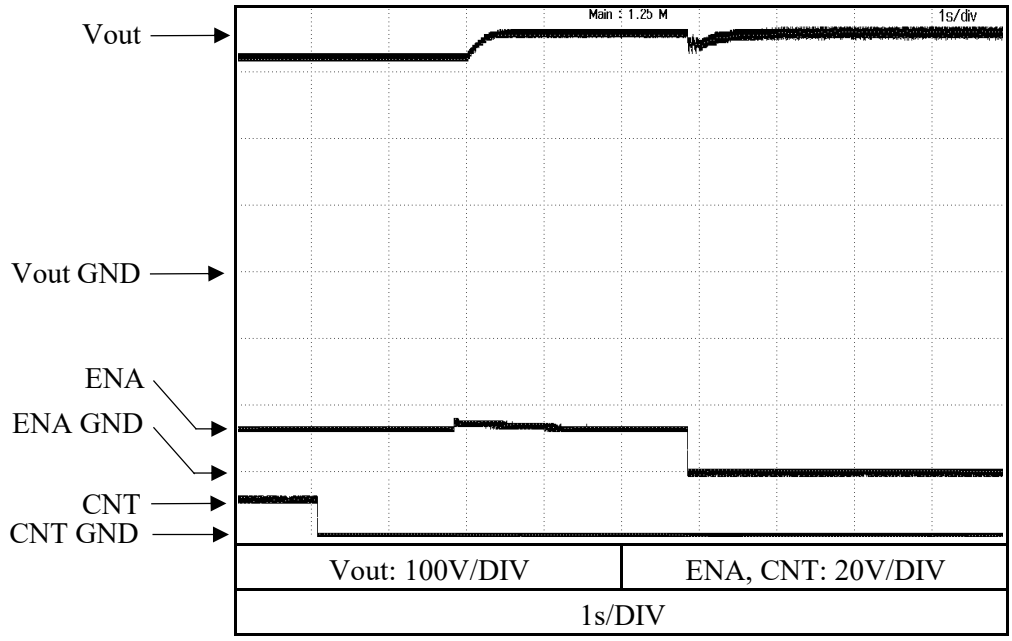
Conditions Vin : 230VAC
Iout : 0%
Tbp : 25℃

360V Po=0W



Conditions Vin : 230VAC
Iout : 100%
Tbp : 25℃

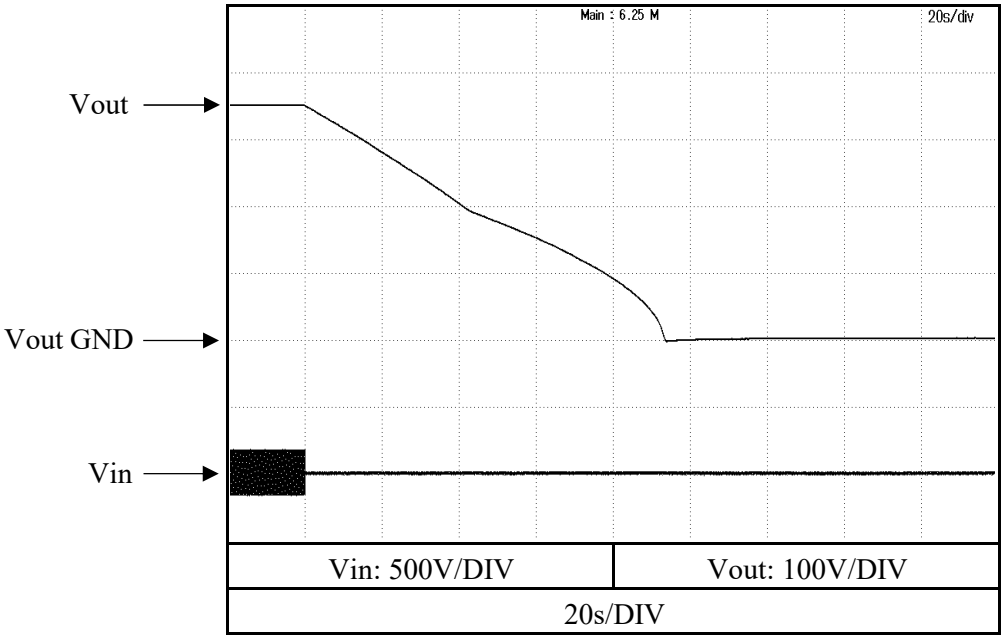
360V Po=1512W



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

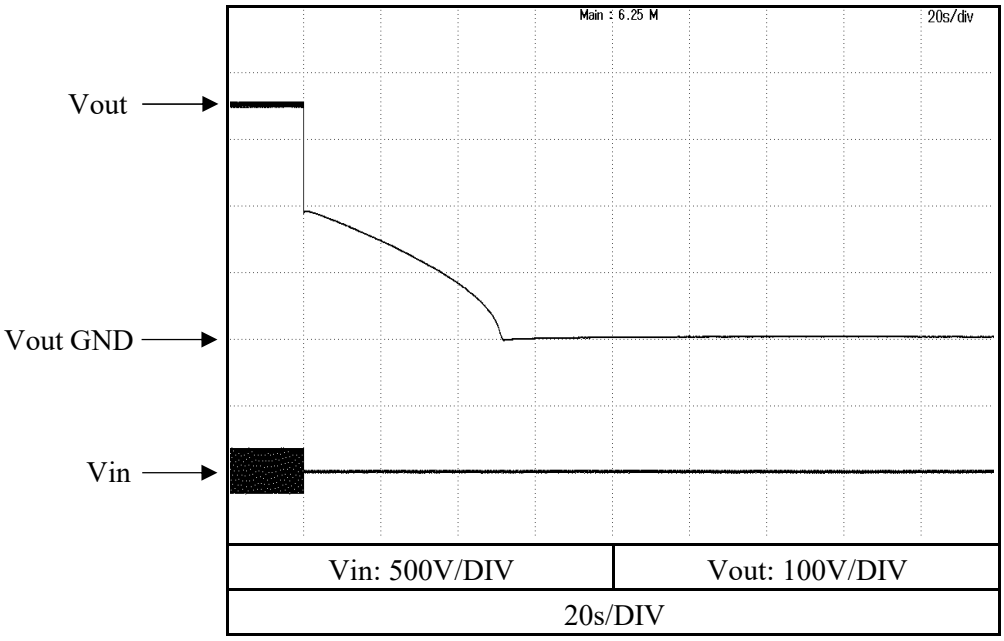
Conditions　Vin : 115VAC
Iout : 0%
Tbp : 25°C

360V　　Po=0W



Conditions　Vin : 115VAC
Iout : 100%
Tbp : 25°C

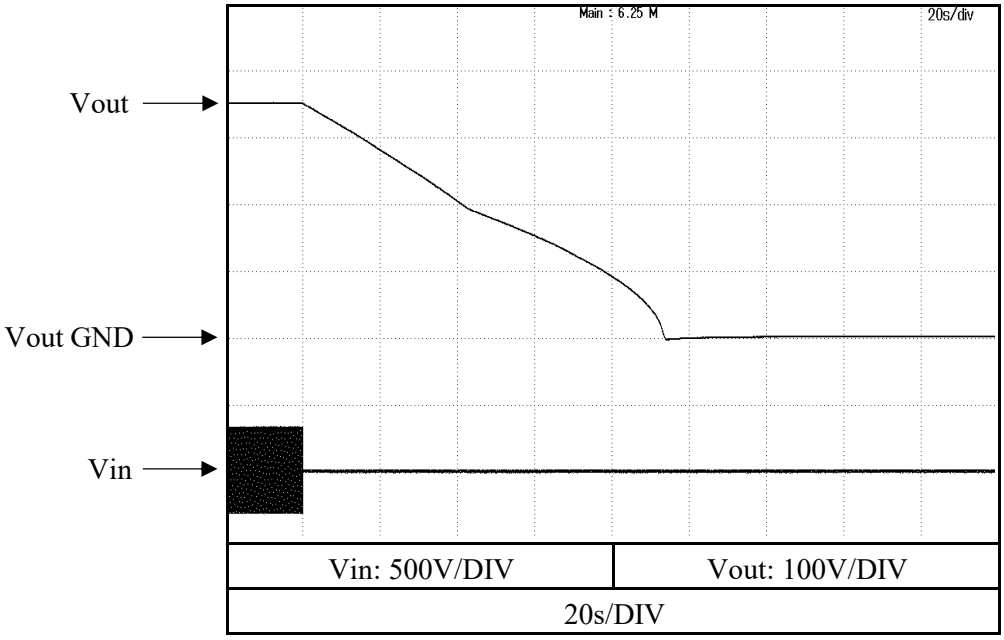
360V　　Po=1008W



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

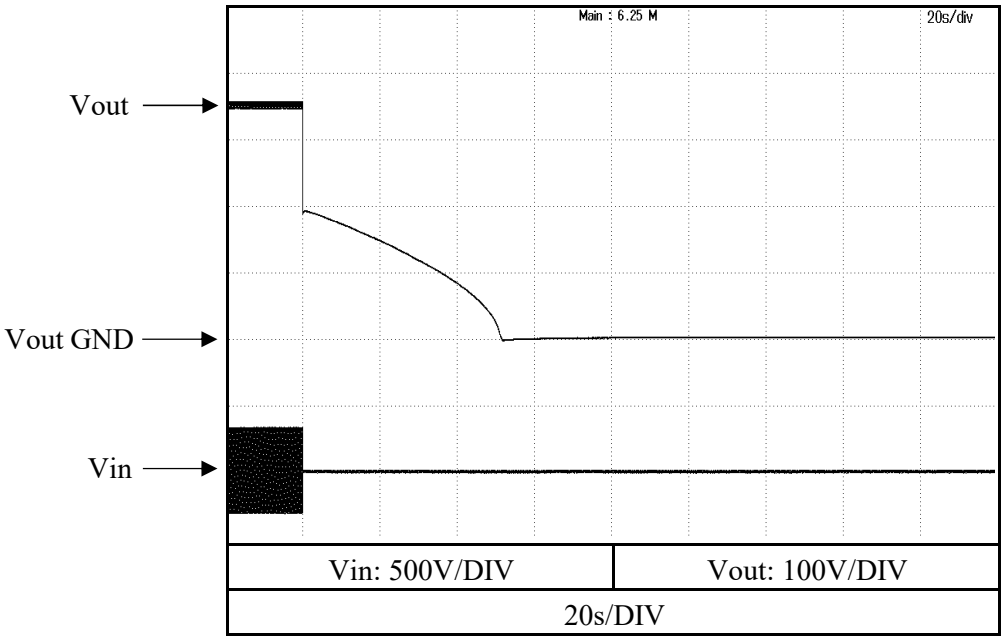
Conditions　Vin : 230VAC
Iout : 0%
Tbp : 25°C

360V　　Po=0W



Conditions　Vin : 230VAC
Iout : 100%
Tbp : 25°C

360V　　Po=1512W

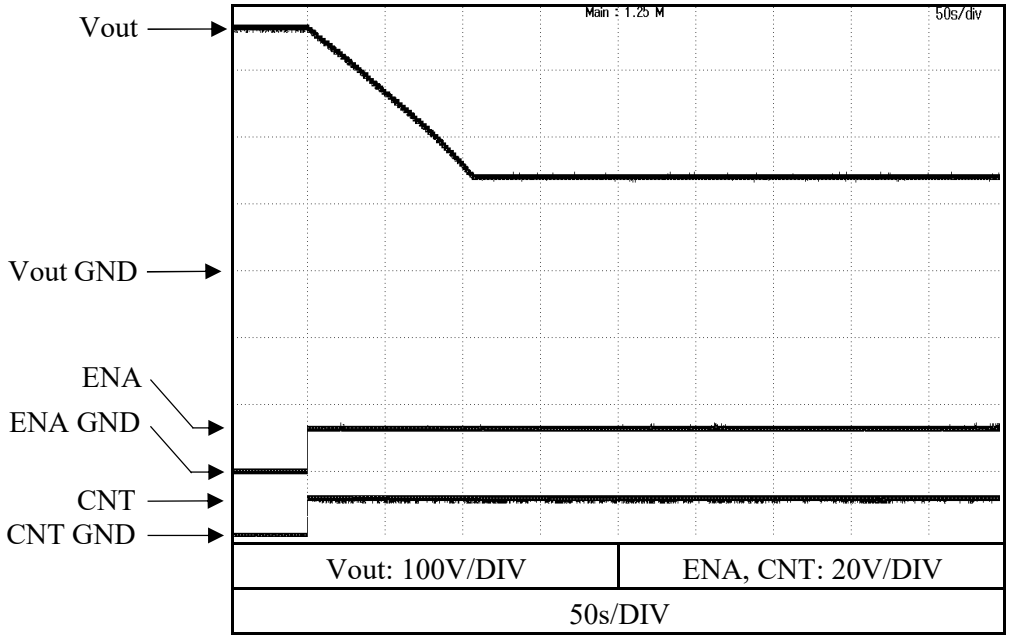


2.9 ON/OFF CONTROLによる出力立ち下がり特性

Output fall characteristics with ON/OFF CONTROL

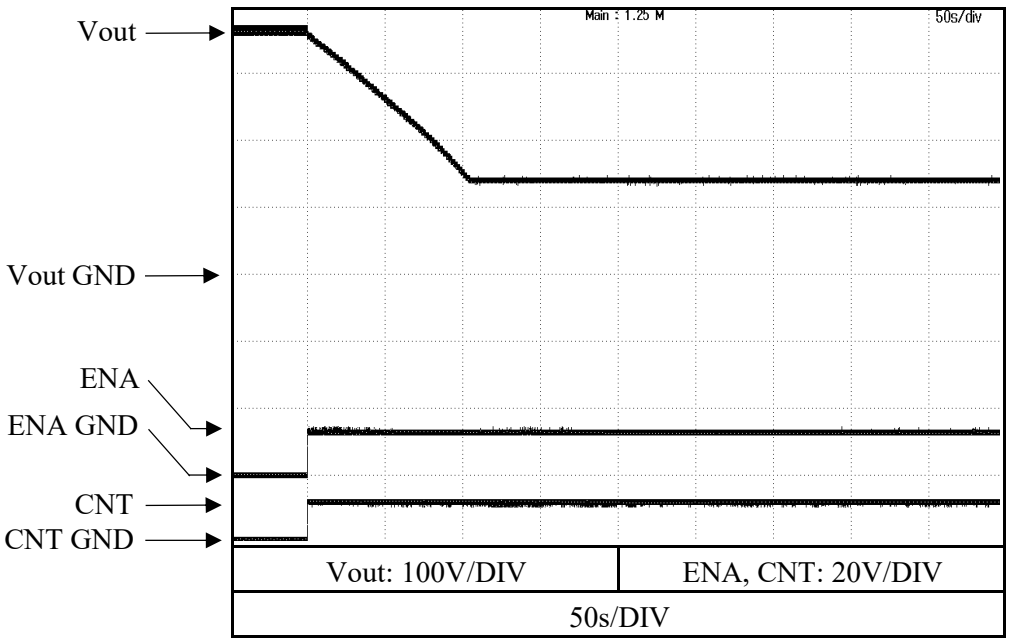
Conditions Vin : 100VAC
Iout : 0%
Tbp : 25°C

360V Po=0W



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

360V Po=1008W

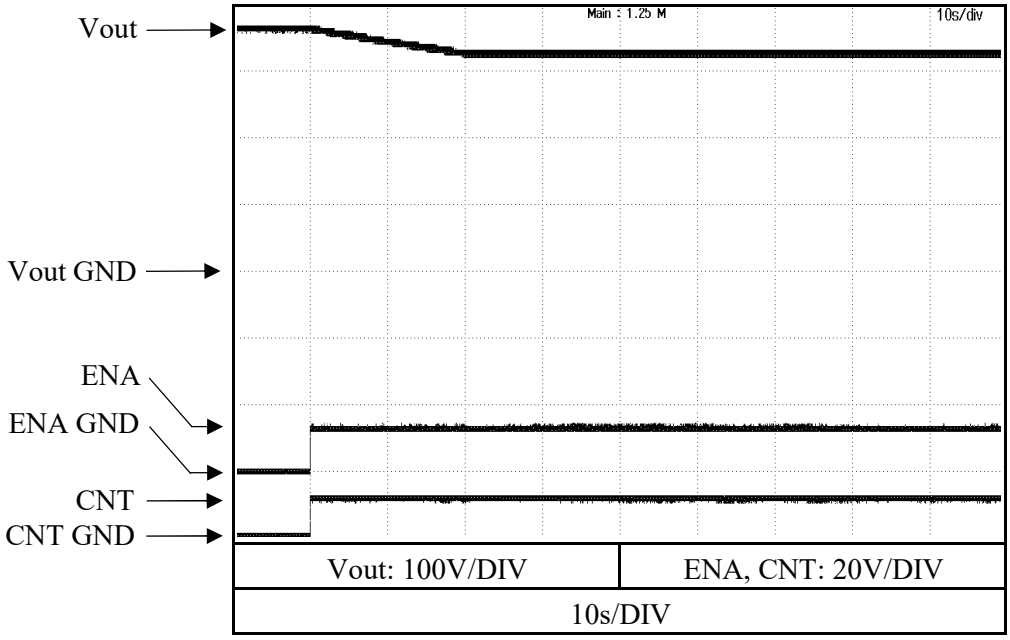


2.9 ON/OFF CONTROLによる出力立ち下がり特性

Output fall characteristics with ON/OFF CONTROL

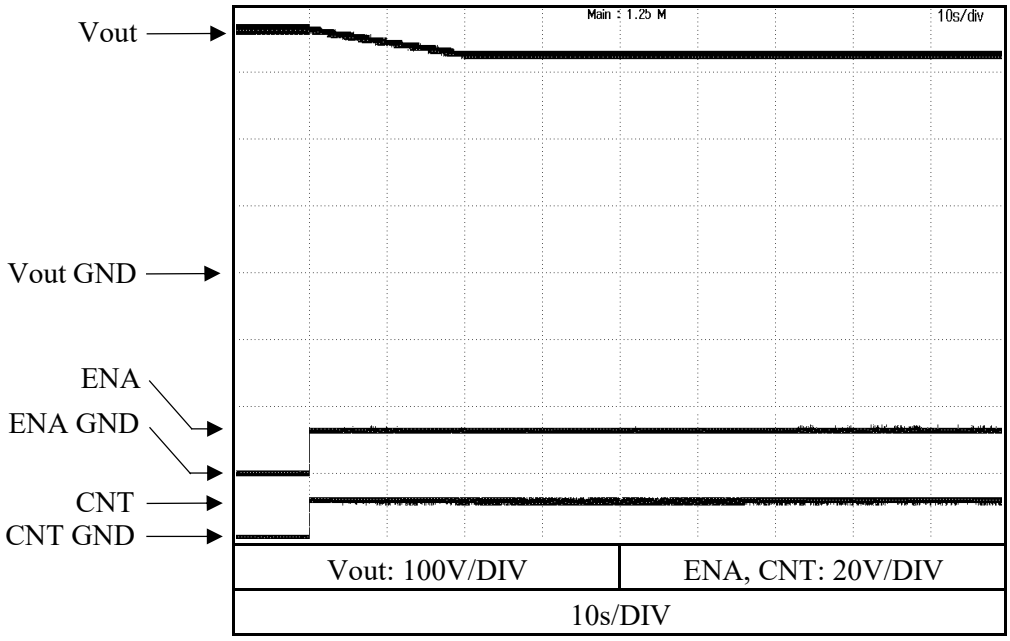
Conditions Vin : 230VAC
Iout : 0%
Tbp : 25°C

360V Po=0W



Conditions Vin : 230VAC
Iout : 100%
Tbp : 25°C

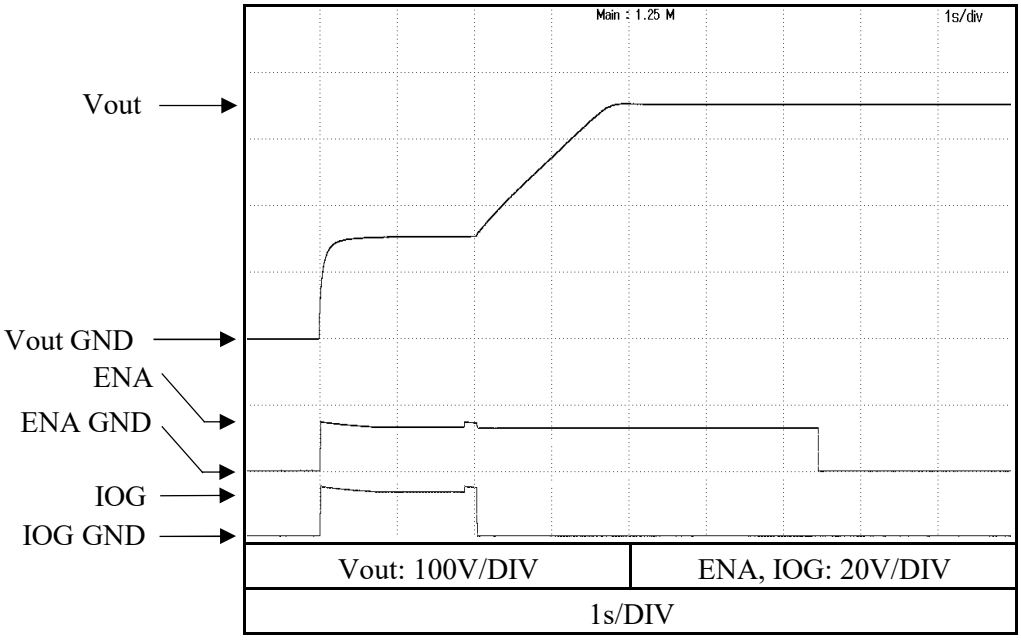
360V Po=1512W



2.10 IOG、ENA信号 対 出力電圧　IOG and ENA signals vs. output voltage

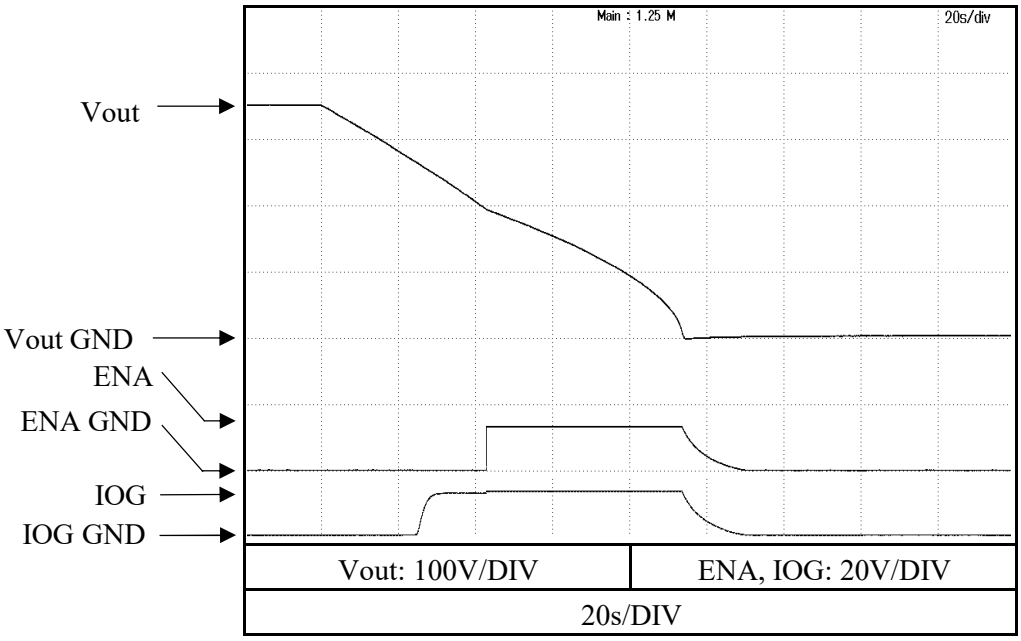
Conditions　Vin : 115VAC
Iout : 0%
Tbp : 25°C

360V　　Po=0W　(A) Rise



Conditions　Vin : 115VAC
Iout : 0%
Tbp : 25°C

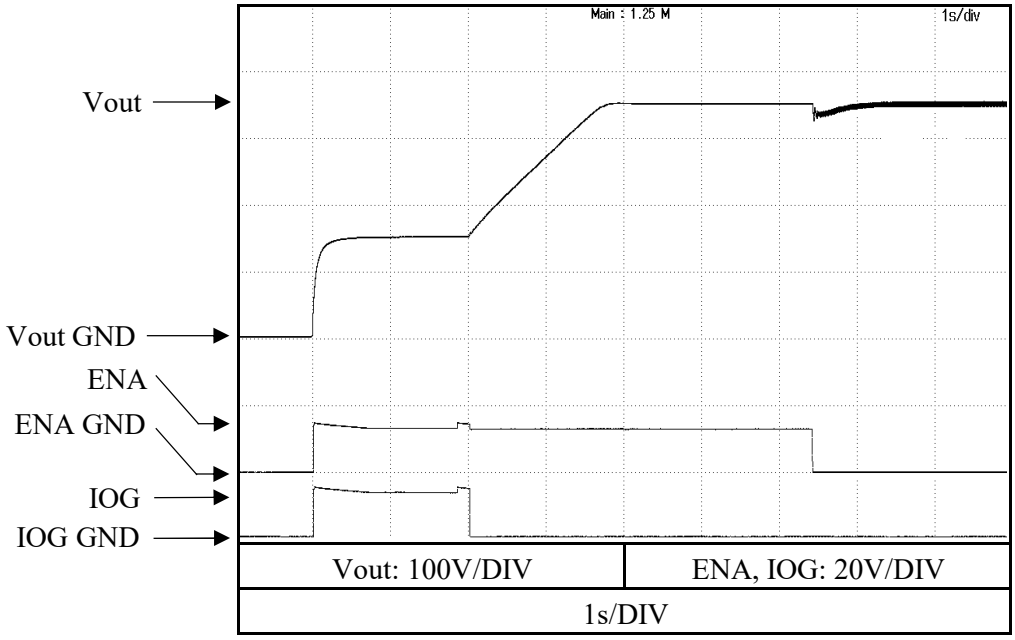
360V　　Po=0W　(B) fall



2.10 IOG、ENA信号 対 出力電圧　IOG and ENA signals vs. output voltage

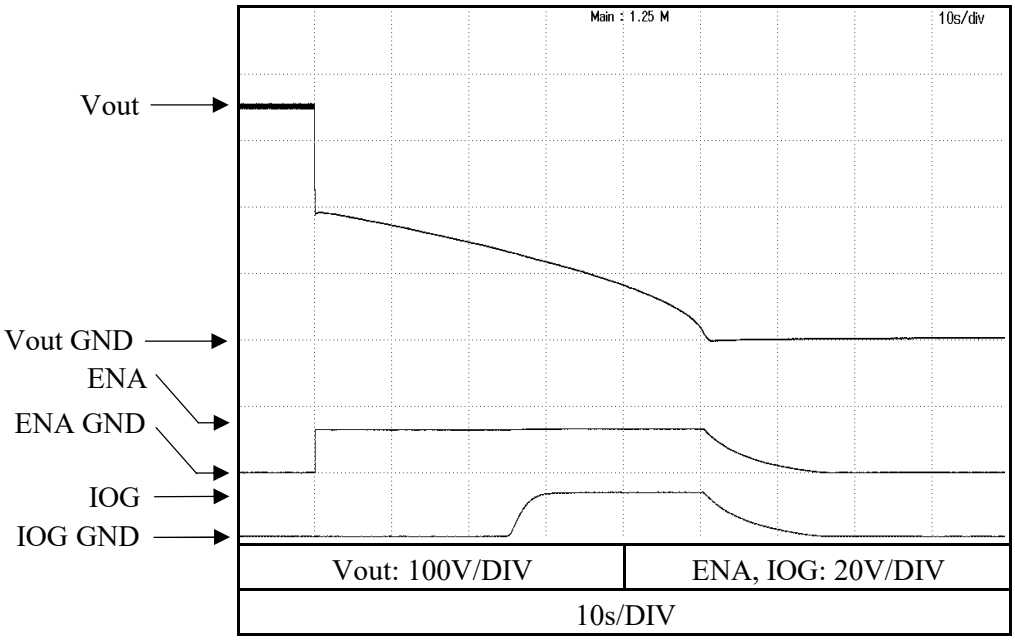
Conditions　Vin : 115VAC
Iout : 100%
Tbp : 25°C

360V　　Po=1008W　(A) Rise



Conditions　Vin : 115VAC
Iout : 100%
Tbp : 25°C

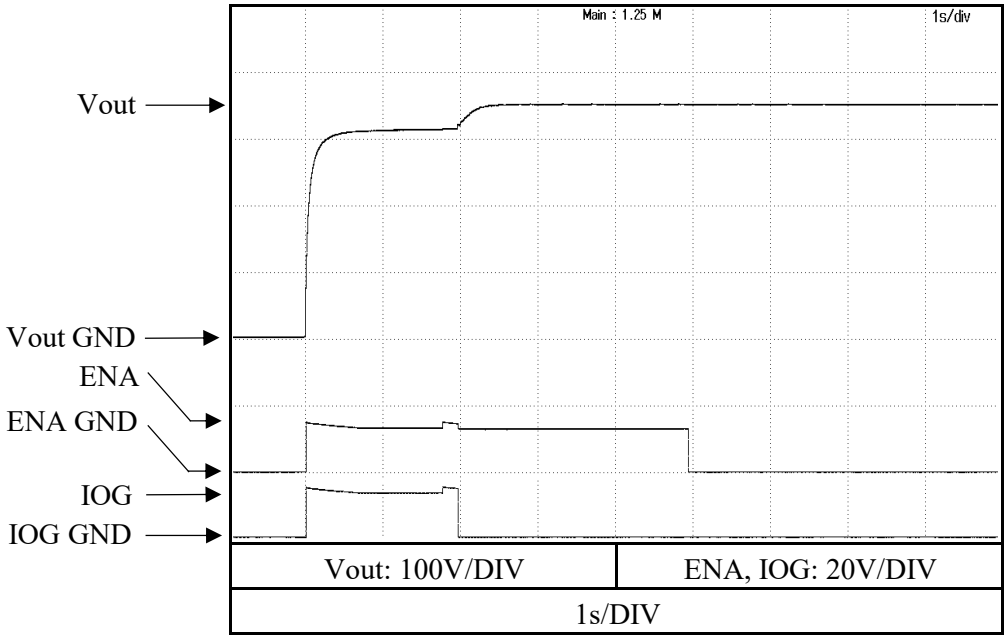
360V　　Po=1008W　(B) fall



2.10 IOG、ENA信号 対 出力電圧　IOG and ENA signals vs. output voltage

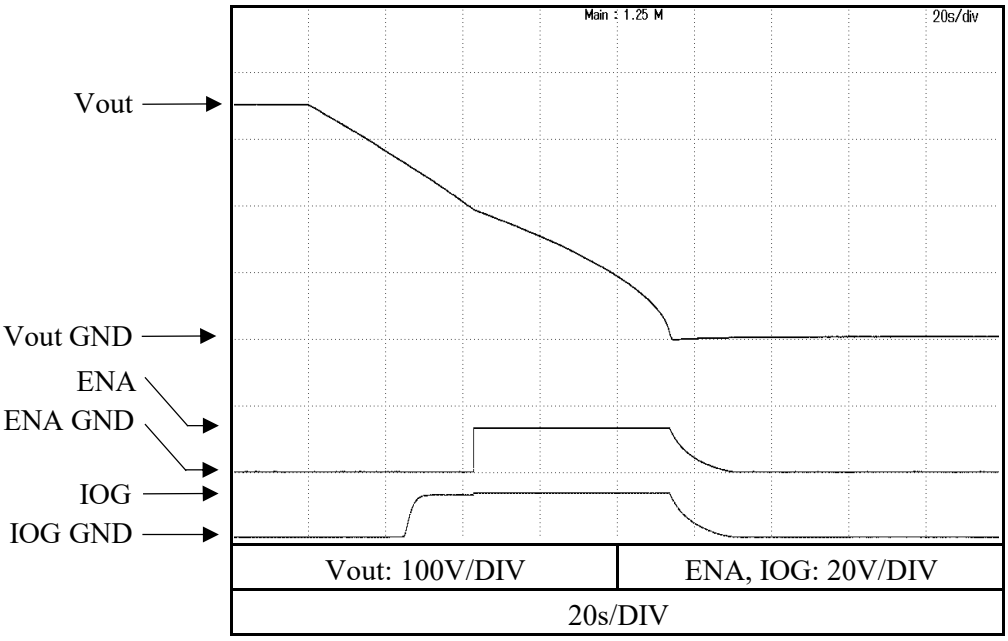
Conditions　Vin : 230VAC
Iout : 0%
Tbp : 25°C

360V　　Po=0W　(A) Rise



Conditions　Vin : 230VAC
Iout : 0%
Tbp : 25°C

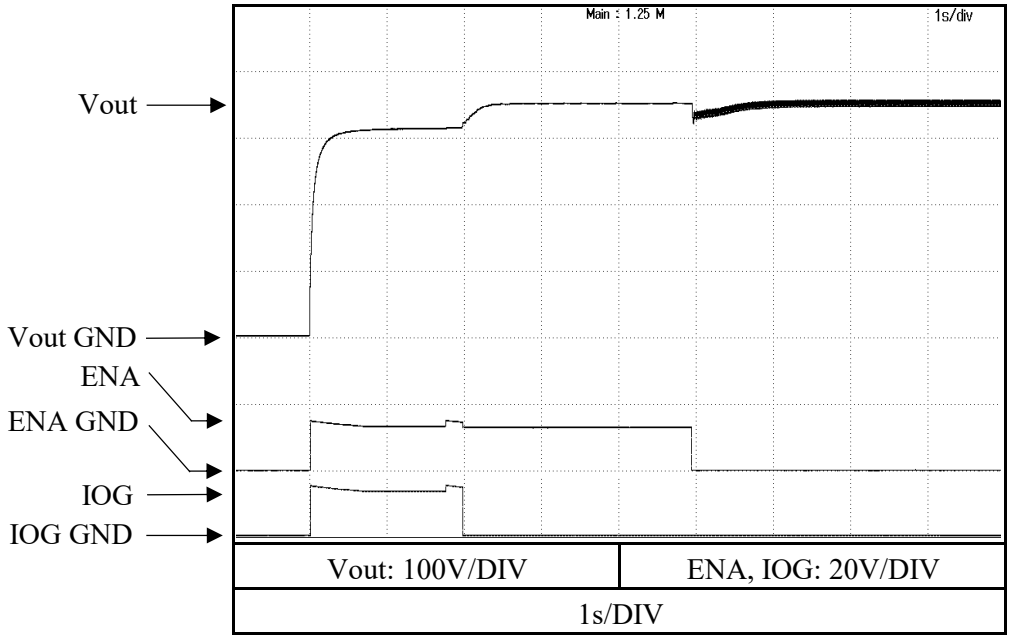
360V　　Po=0W　(B) fall



2.10 IOG、ENA信号 対 出力電圧　IOG and ENA signals vs. output voltage

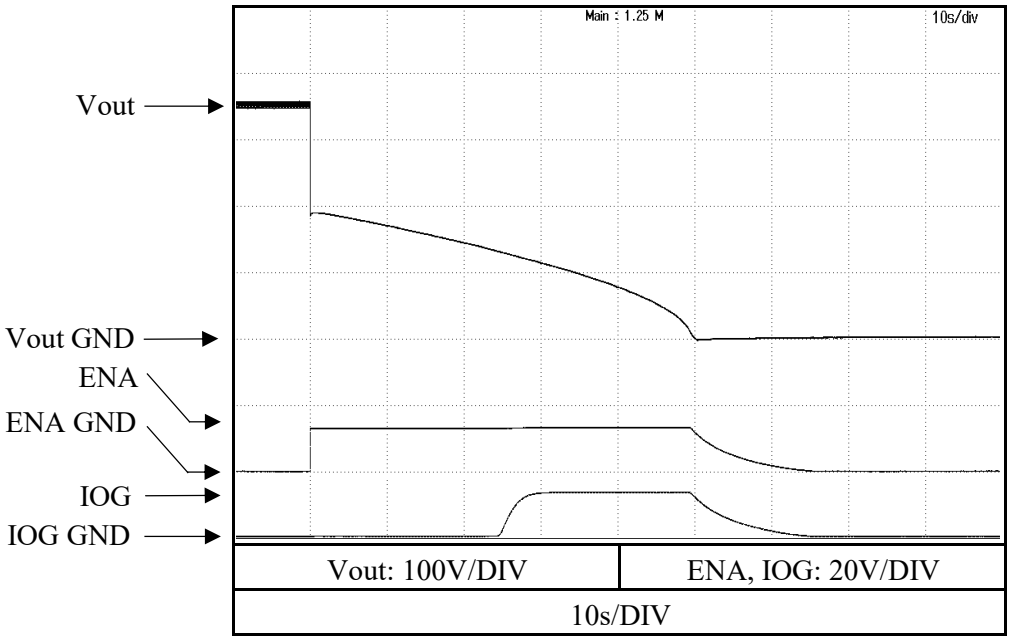
Conditions　Vin : 230VAC
Iout : 100%
Tbp : 25°C

360V　Po=1512W　(A) Rise



Conditions　Vin : 230VAC
Iout : 100%
Tbp : 25°C

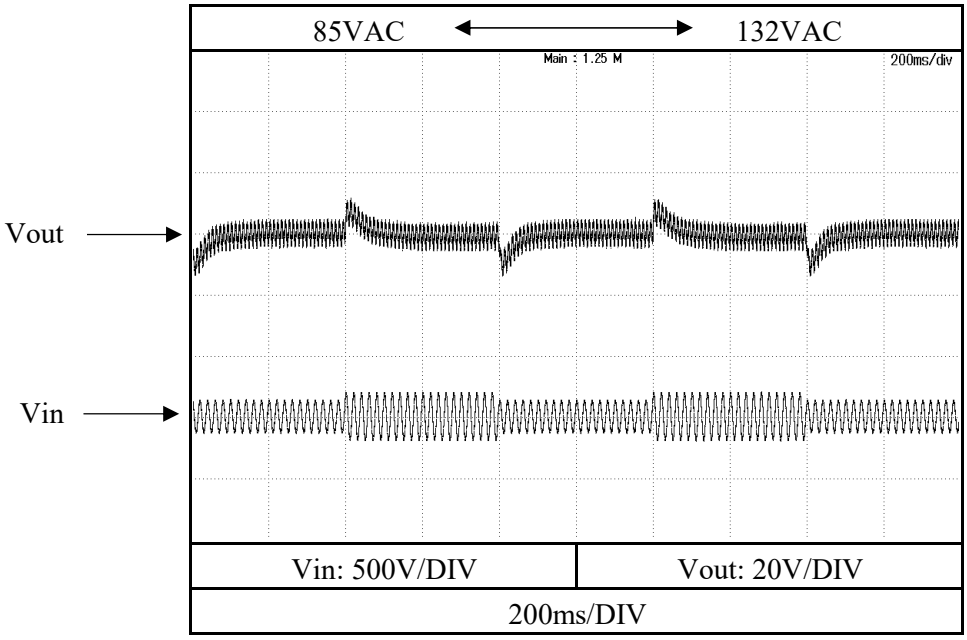
360V　Po=1512W　(B) fall



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

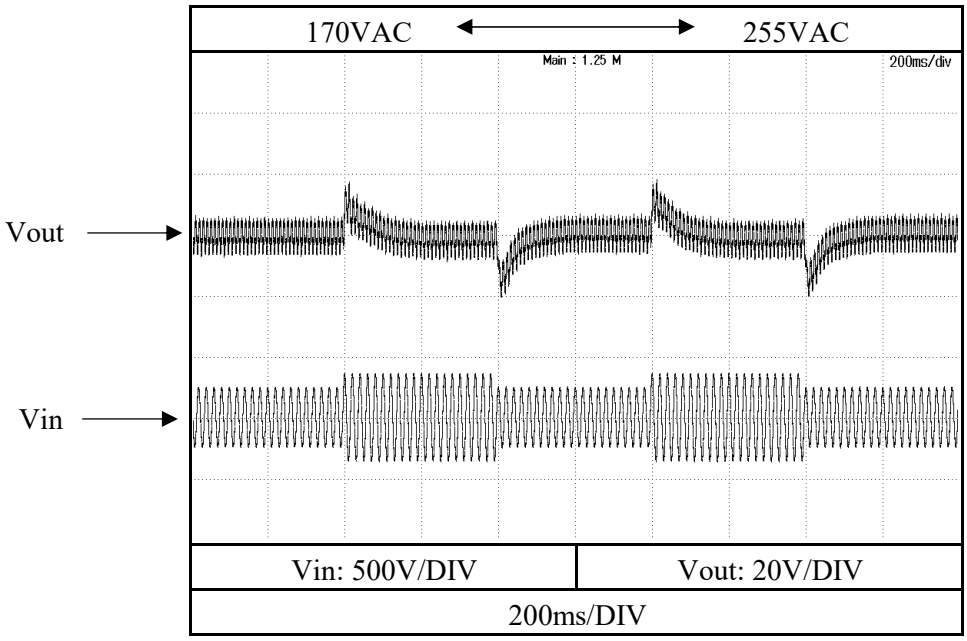
Conditions　Iout : 100%
Tbp : 25°C

360V　　Po=1008W



Conditions　Iout : 100%
Tbp : 25°C

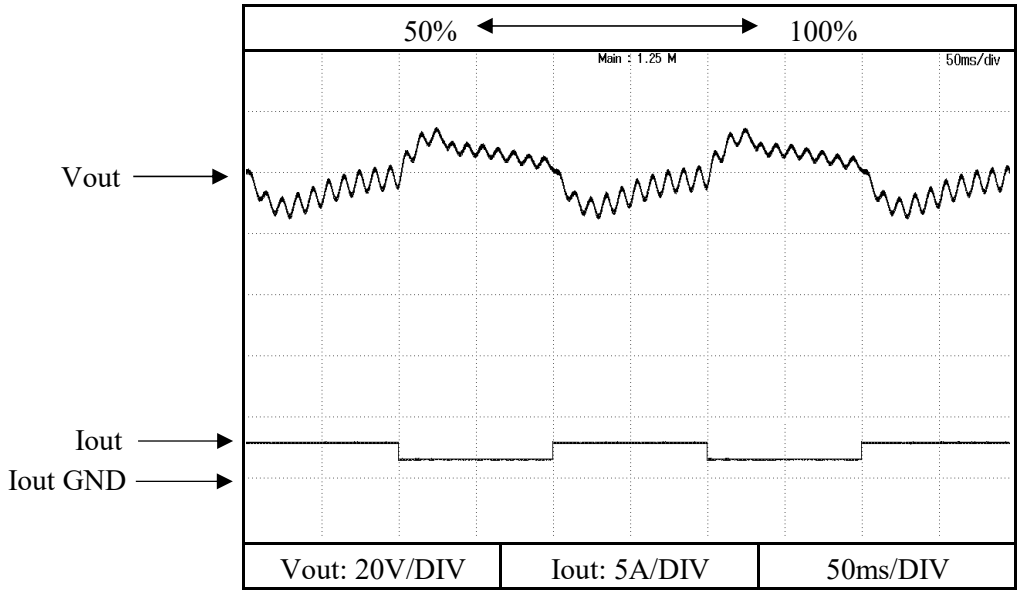
360V　　Po=1512W



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

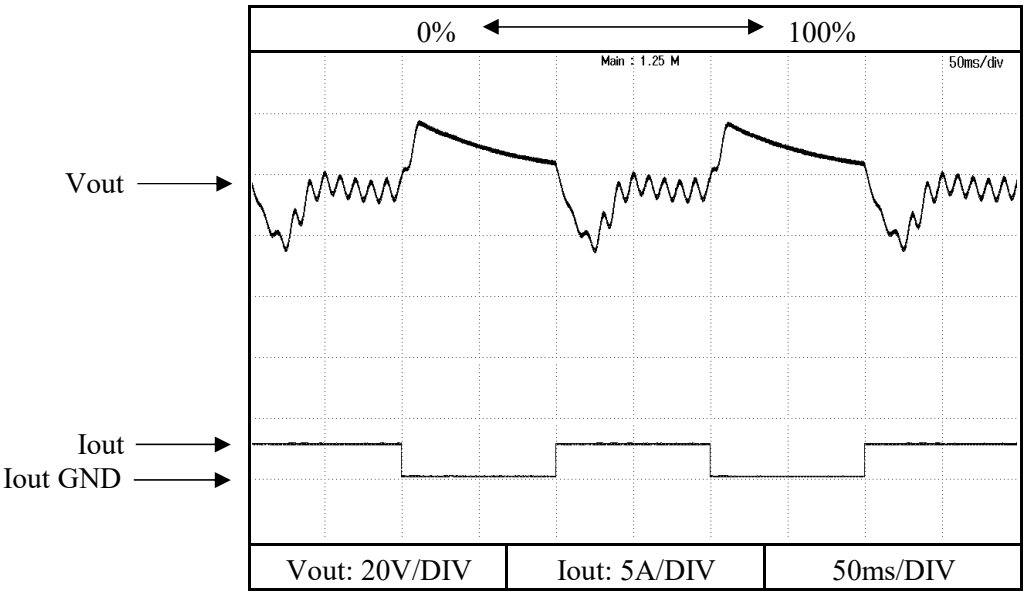
Conditions　Vin : 115VAC
Tbp : 25°C
f : 5Hz

360V　　Po=1512W



Conditions　Vin : 115VAC
Tbp : 25°C
f : 5Hz

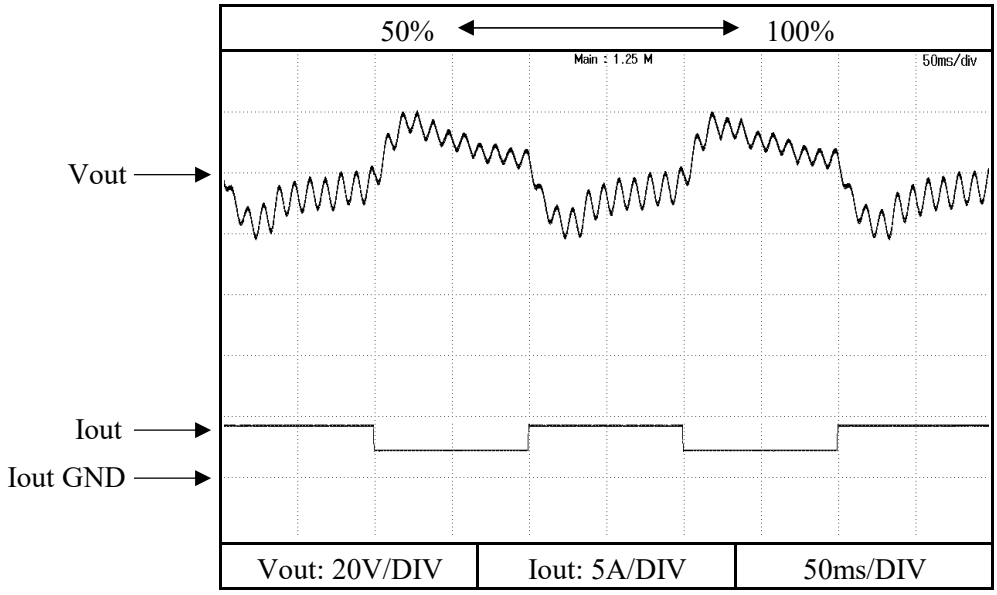
360V　　Po=1512W



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

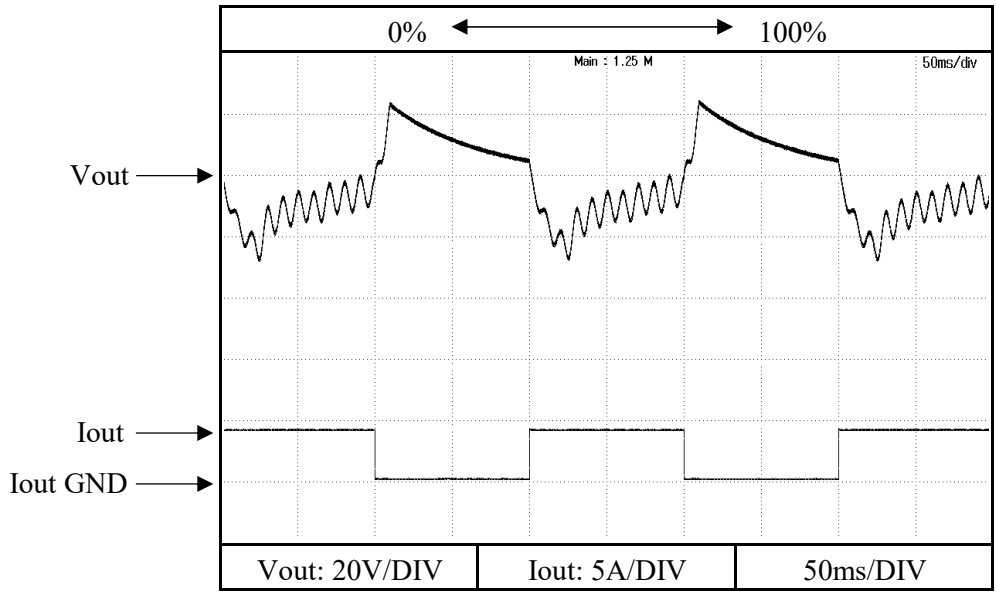
Conditions　Vin : 230VAC
Tbp : 25°C
f : 5Hz

360V　　Po=1512W



Conditions　Vin : 230VAC
Tbp : 25°C
f : 5Hz

360V　　Po=1512W



2.13 入力電圧瞬停特性　Response to brown out characteristics

瞬停時間 Interrupition time

A : 出力電圧が10%~15%低下 Output voltage drops 10%~15% of typical voltage.

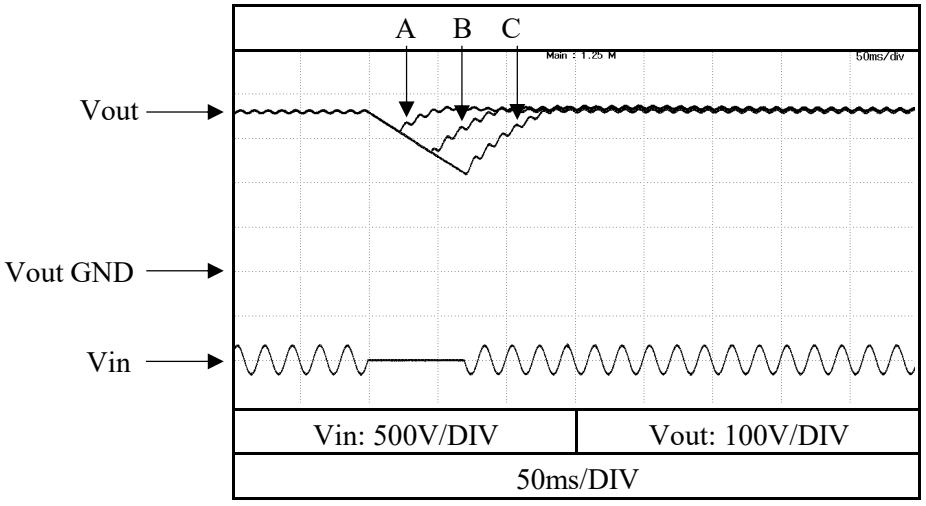
B : 出力電圧が20%~40%低下 Output voltage drops 20%~40% of typical voltage.

C : 製品が再起動に至らない範囲における最大の出力電圧低下

Output voltage drops maximum but PF1500B doesn't restart.

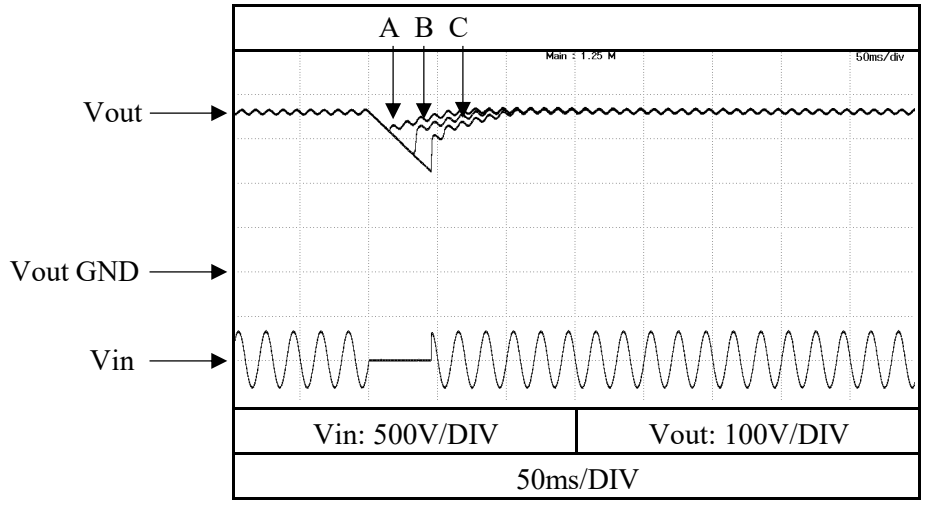
Conditions　Vin : 100VAC
Tbp : 25℃
Brown out time
A : 23ms
B : 46ms
C : 70ms

360V　Po=1008W



Conditions　Vin : 230VAC
Tbp : 25℃
Brown out time
A : 15ms
B : 30ms
C : 45ms

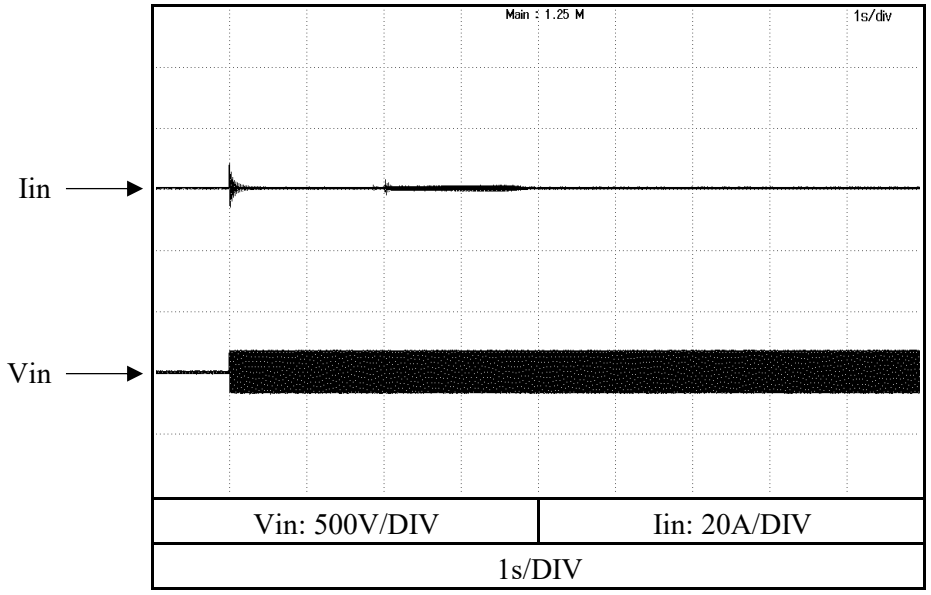
360V　Po=1512W



2.14 入力サージ電流(突入電流)波形　Inrush current waveform

Conditions　Vin : 115VAC
Tbp : 25°C

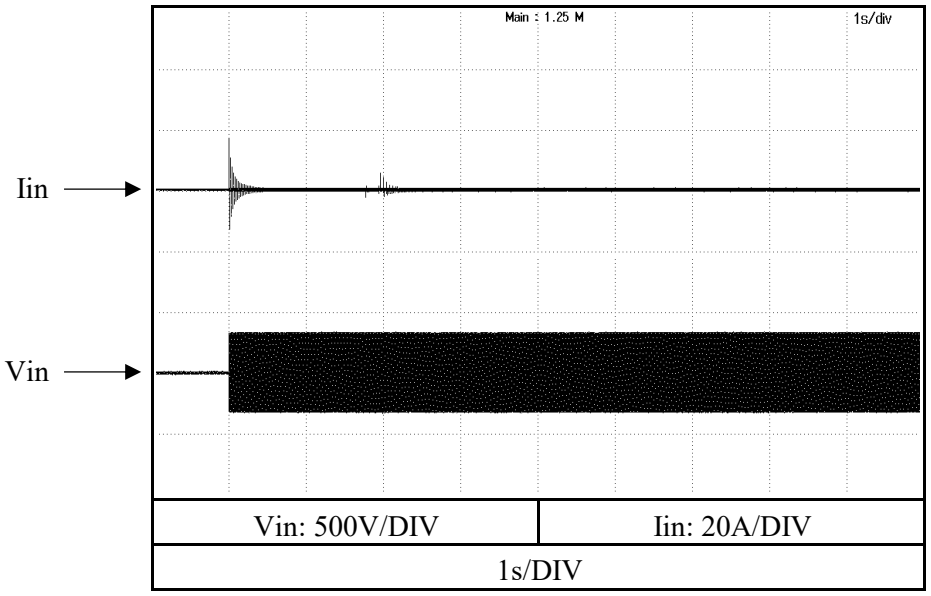
360V　　Po=1008W



入力AC電圧の位相角の切り替え＝0°
Switch in phase angle of input AC voltage=0°

Conditions　Vin : 230VAC
Tbp : 25°C

360V　　Po=1512W

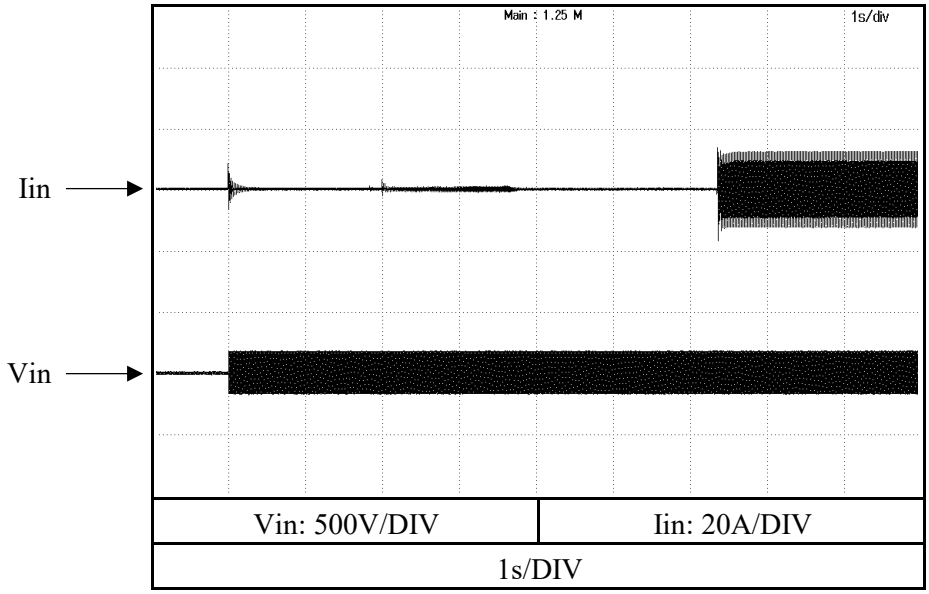


入力AC電圧の位相角の切り替え＝0°
Switch in phase angle of input AC voltage=0°

2.14 入力サージ電流(突入電流)波形　Inrush current waveform

Conditions　Vin : 115VAC
Tbp : 25°C

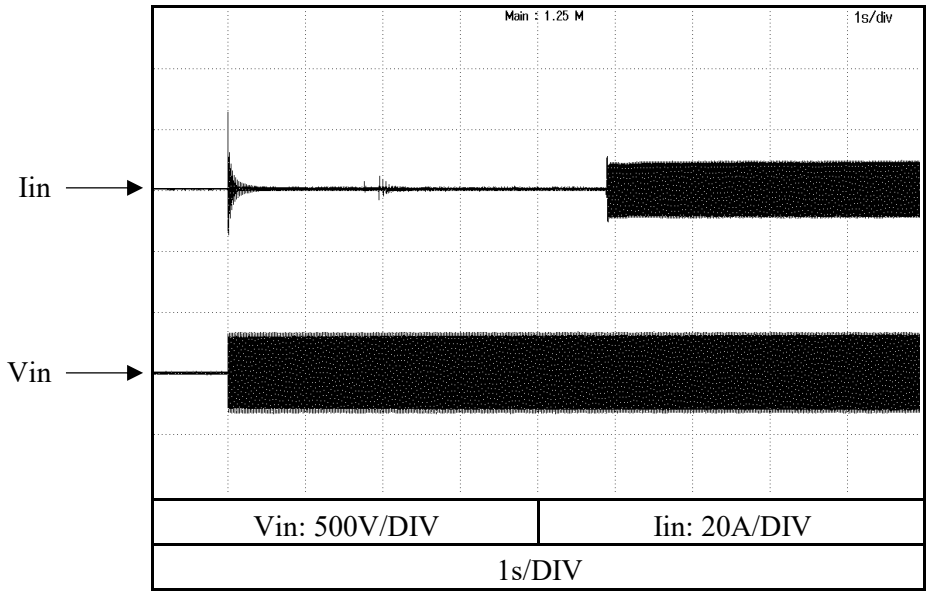
360V　　Po=1008W



入力AC電圧の位相角の切り替え＝90°
Switch in phase angle of input AC voltage=90°

Conditions　Vin : 230VAC
Tbp : 25°C

360V　　Po=1512W

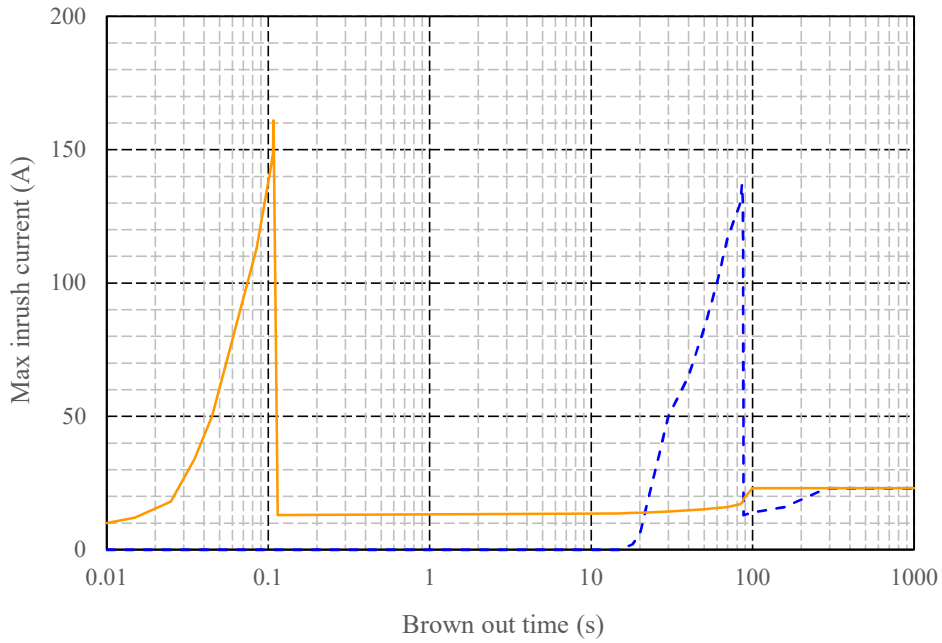


入力AC電圧の位相角の切り替え＝90°
Switch in phase angle of input AC voltage=90°

2.15 瞬停時突入電流特性　Inrush current characteristics at brown out

Conditions　Vin : 240VAC
Cout : 2700uF
Iout :　0%
100%
Tbp : 25°C

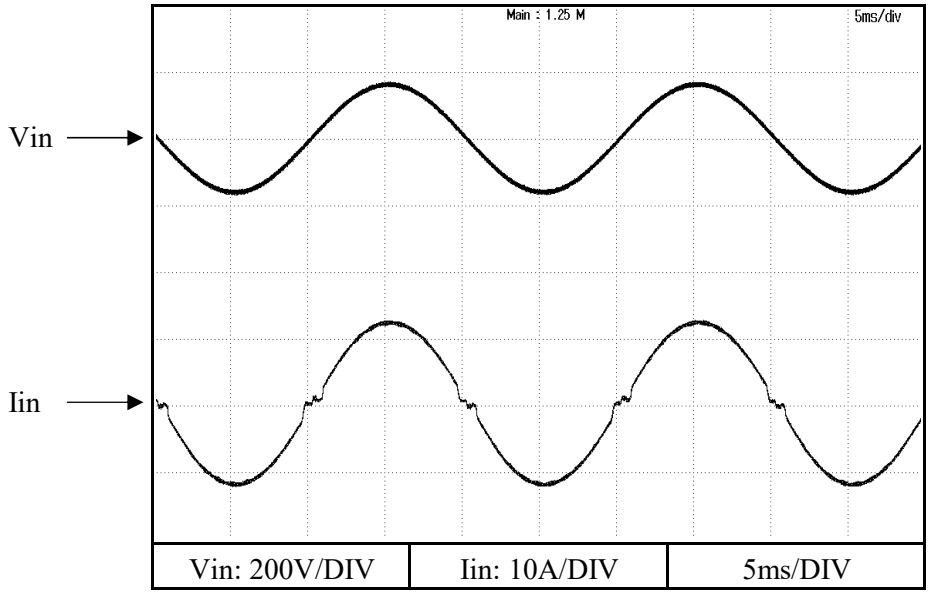
360V



2.16 入力電流波形　Input current waveform

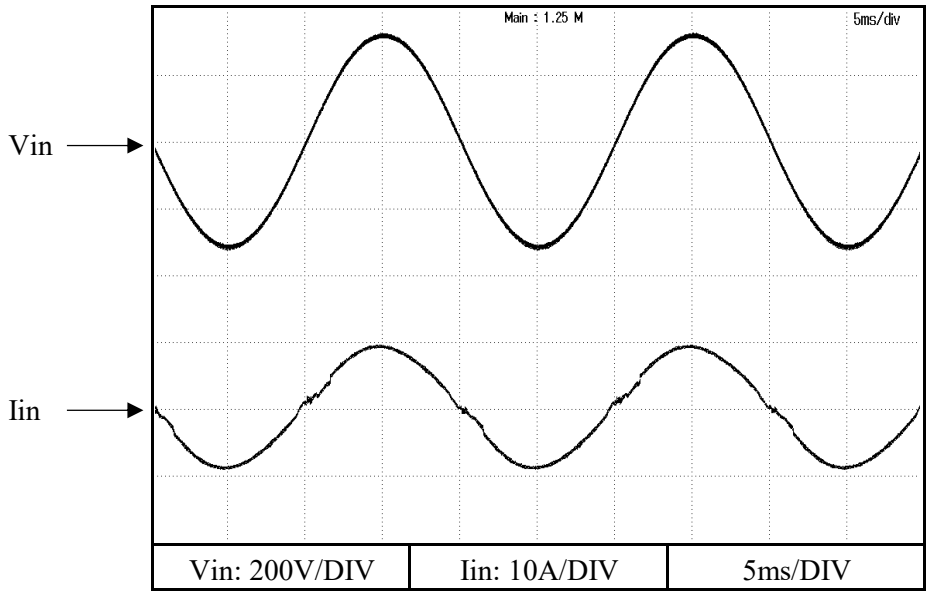
Conditions　Vin : 115VAC
Tbp : 25°C

360V　　Po=1008W



Conditions　Vin : 230VAC
Tbp : 25°C

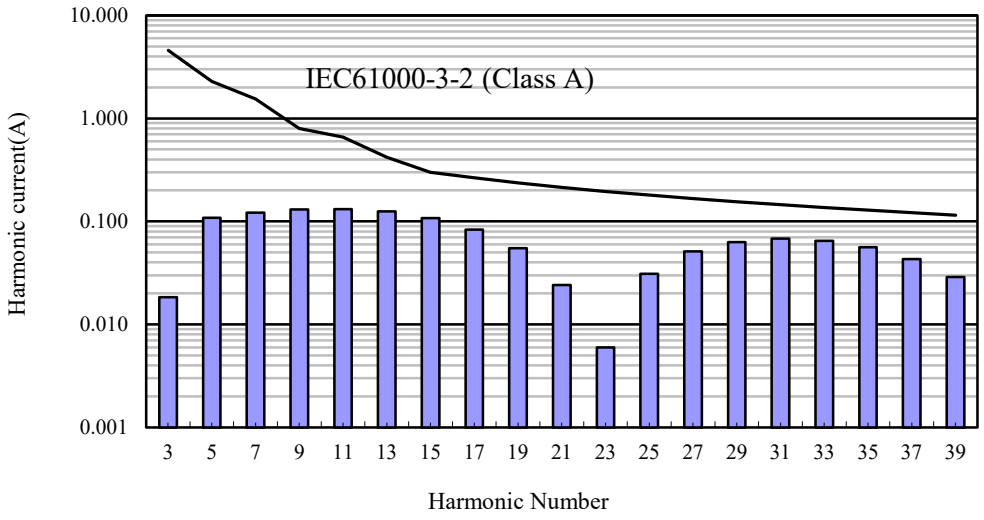
360V　　Po=1512W



2.17 高調波成分　Input current harmonics

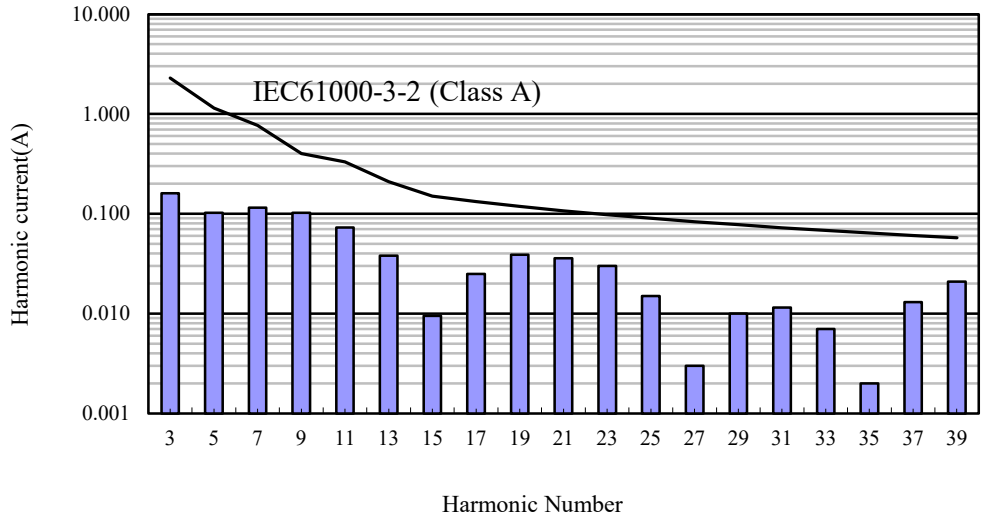
Conditions　Vin : 115VAC
Tbp : 25°C

360V　　Po=1008W



Conditions　Vin : 230VAC
Tbp : 25°C

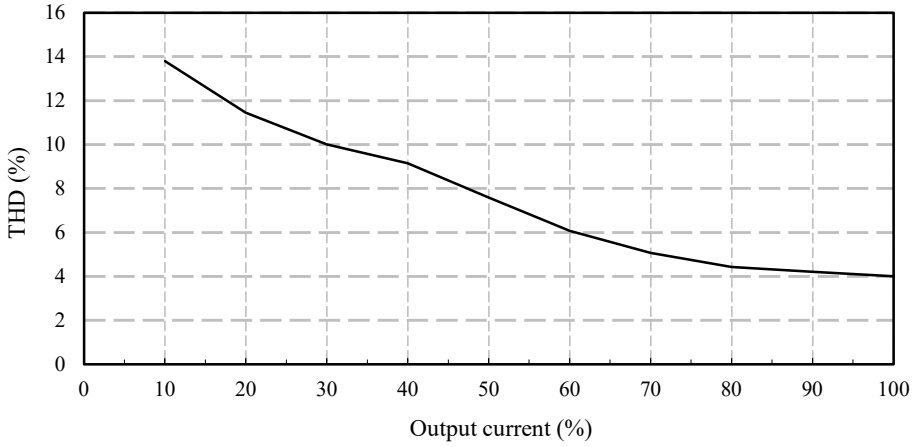
360V　　Po=1512W



2.18 総合高調波歪率　Total harmonic distortion characteristics

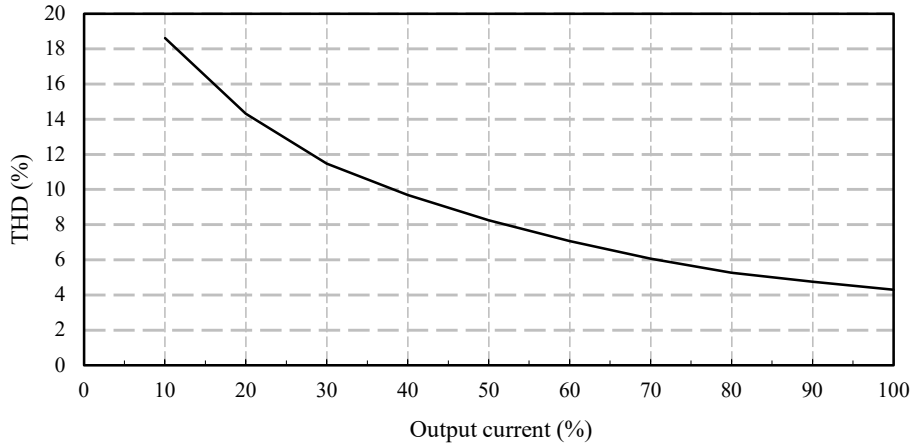
Conditions　Vin : 115VAC
Tbp : 25℃

360V　　Po=1008W



Conditions　Vin : 230VAC
Tbp : 25℃

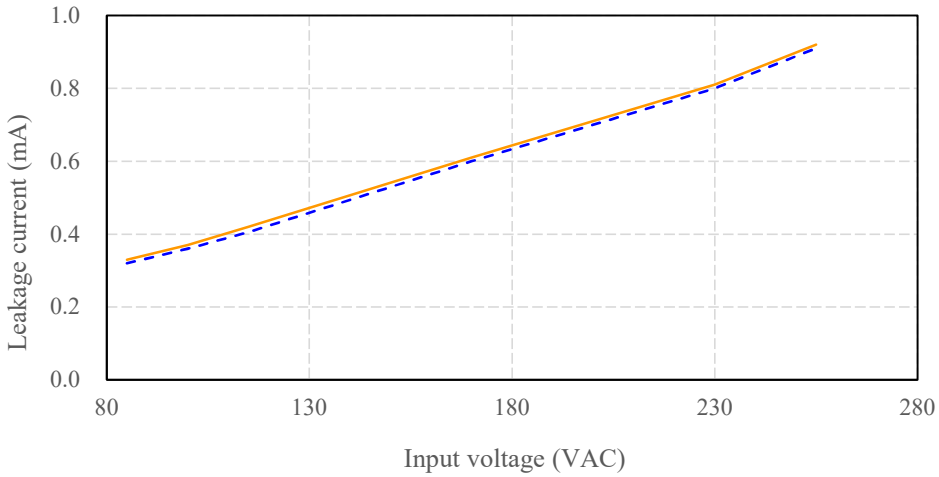
360V　　Po=1512W



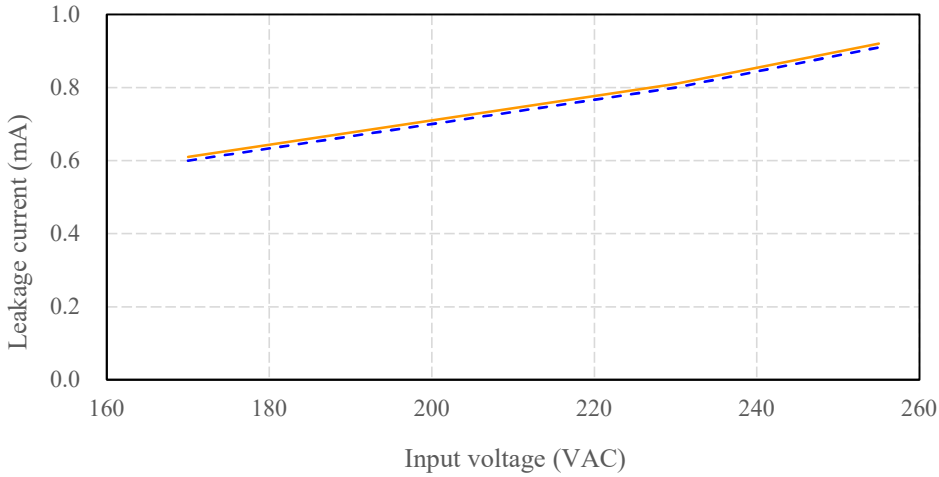
2.19 リーク電流特性　Leakage current characteristics

Conditions　Iout : 0%
Iout : 100%
Tbp : 25°C
f　: 50Hz

360V　　Po=1008W



360V　　Po=1512W



2.20 EMI特性　Electro-Magnetic Interference characteristics

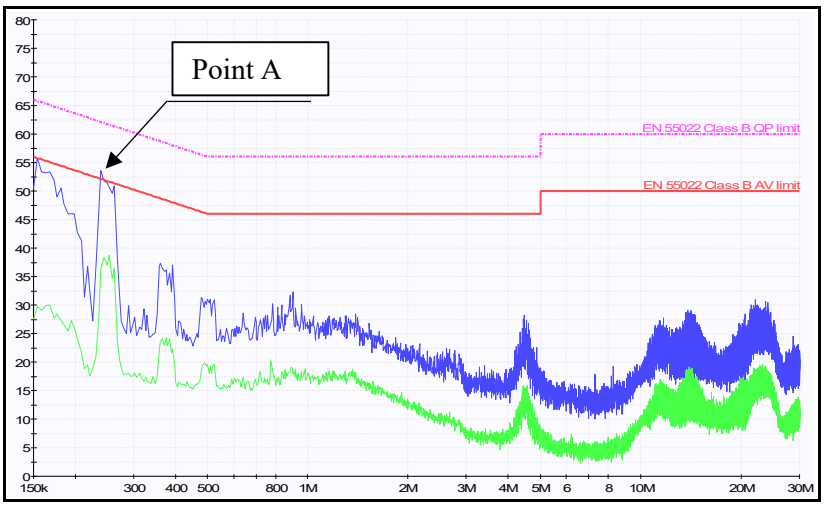
Conditions　Vin : 115VAC
Iout : 100%
Tbp : 25°C
f　: 50Hz

(1) 雑音端子電圧　Conducted Emission

360V　　Po=1008W

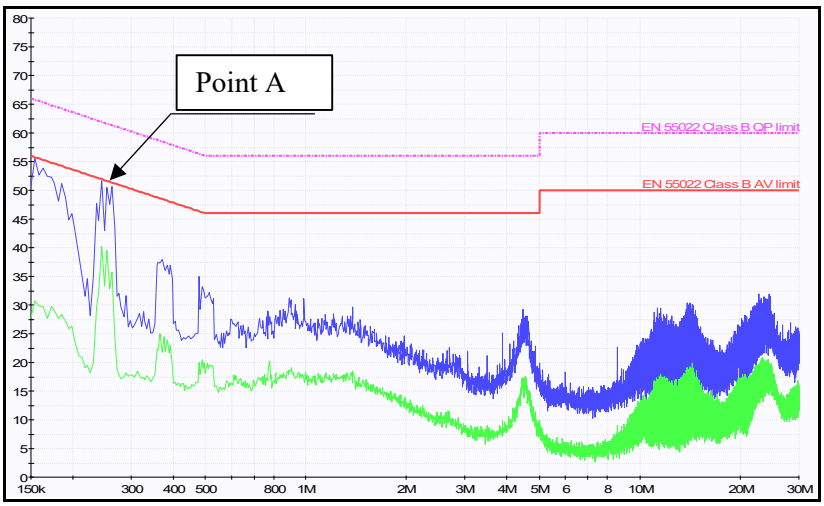
Phase : L

Ref. Data	Point A (0.24MHz) Limit (dBuV)	Measure (dBuV)
QP	62.0	53.5
AV	52.0	38.8



Phase : N

Ref. Data	Point A (0.24MHz) Limit (dBuV)	Measure (dBuV)
QP	62.0	52.5
AV	52.0	40.0



VCCI-B, FCC-Bの限界値は、EN55032 class Bと同じです。
Limit of VCCI-B, FCC-B are same as its EN55032 class B.

2.20 EMI特性　Electro-Magnetic Interference characteristics

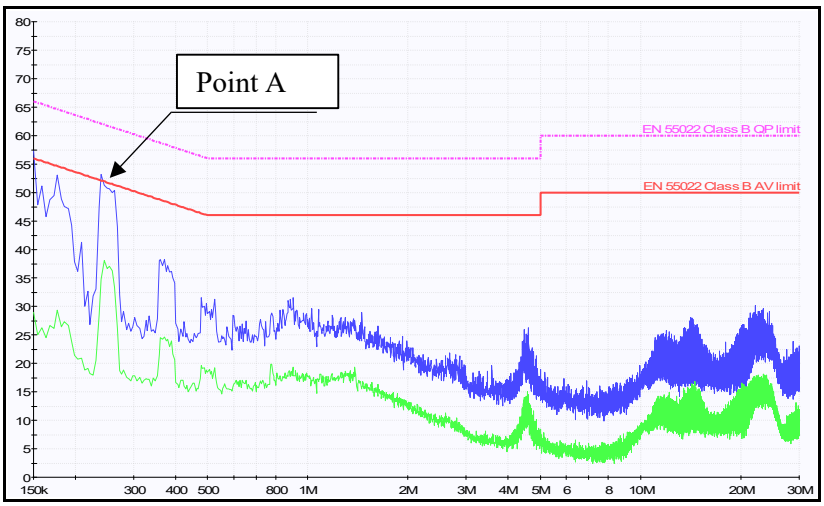
Conditions　Vin : 230VAC
Iout : 100%
Tbp : 25°C
f　: 50Hz

(1) 雑音端子電圧　Conducted Emission

360V　　Po=1512W

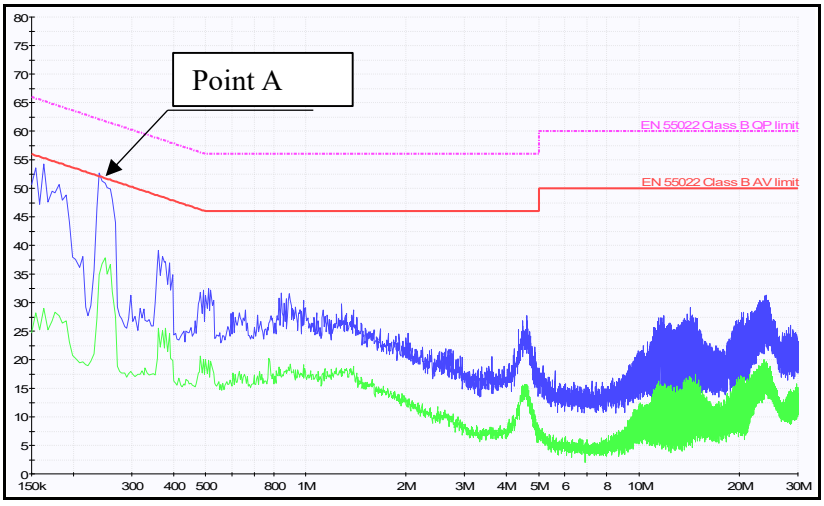
Phase : L

Ref. Data	Point A (0.24MHz) Limit (dBuV)	Measure (dBuV)
QP	62.0	53.0
AV	52.0	38.0



Phase : N

Ref. Data	Point A (0.24MHz) Limit (dBuV)	Measure (dBuV)
QP	62.0	53.0
AV	52.0	37.5



VCCI-B, FCC-Bの限界値は、EN55032 class Bと同じです。
Limit of VCCI-B, FCC-B are same as its EN55032 class B.

2.20 EMI特性　Electro-Magnetic Interference characteristics

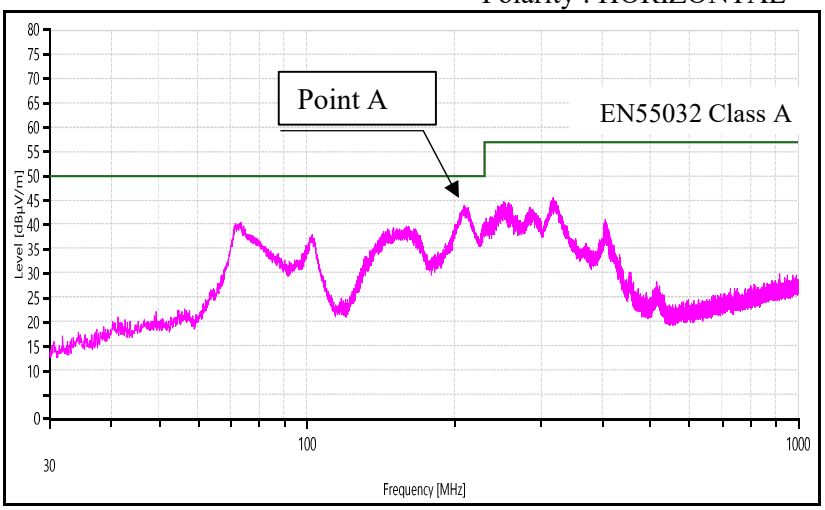
Conditions　Vin : 115VAC
Iout : 100%
Tbp : 25°C
f　: 50Hz

(1) 雑音電界強度　Radiated Emission

360V　　Po=1008W

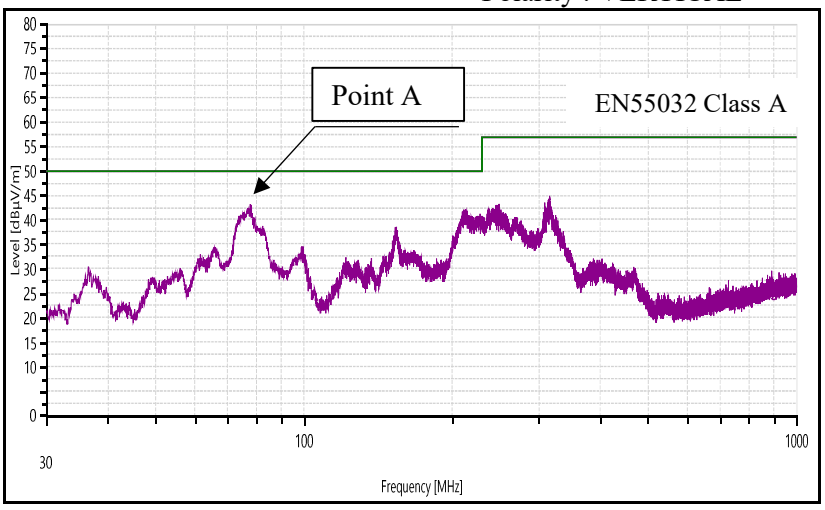
Polarity : HORIZONTAL

Ref. Data	Point A (210MHz) Limit (dBuV)	Measure (dBuV)
QP	50.0	44.0



Polarity : VERTICAL

Ref. Data	Point A (78MHz) Limit (dBuV)	Measure (dBuV)
QP	50.0	44.0



VCCI-A, FCC-Aの限界値は、EN55032 class Aと同じです。
Limit of VCCI-A, FCC-A are same as its EN55032 class A.

2.20 EMI特性　Electro-Magnetic Interference characteristics

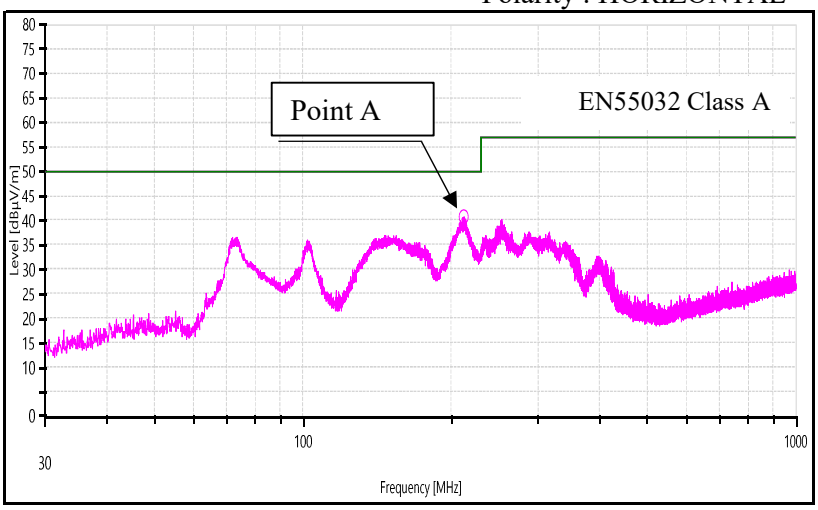
Conditions　Vin : 230VAC
Iout : 100%
Tbp : 25°C
f　: 50Hz

(1) 雑音電界強度　Radiated Emission

360V　　Po=1512W

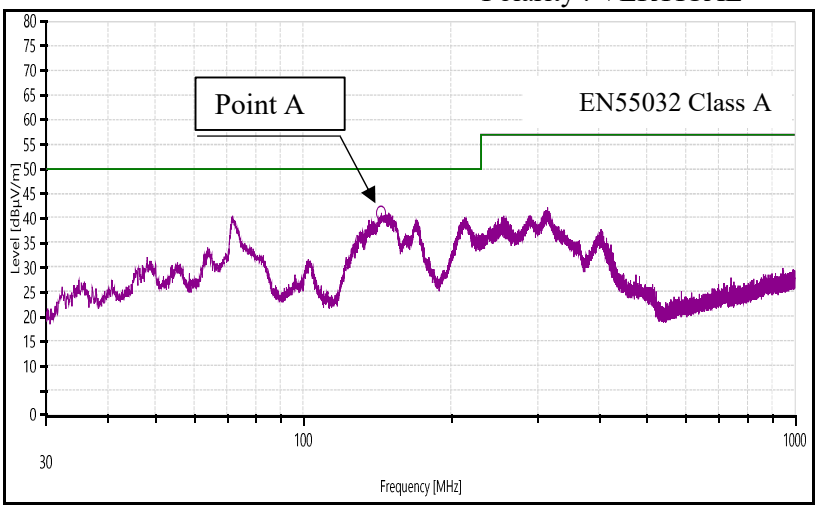
Polarity : HORIZONTAL

Ref. Data	Point A (210MHz) Limit (dBuV)	Measure (dBuV)
QP	50.0	40.7



Polarity : VERTICAL

Ref. Data	Point A (144MHz) Limit (dBuV)	Measure (dBuV)
QP	50.0	41.1



VCCI-A, FCC-Aの限界値は、EN55032 class Aと同じです。
Limit of VCCI-A, FCC-A are same as its EN55032 class A.