FPS1000 - 12
EVALUATION
DATA

DWG: IA659-53-01		
APPD	CHK	DWG
20.05.07	20.05.07	20.05.07

NEMIC-LAMBDA LTD.

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TERMINOLOGY USED

Definition

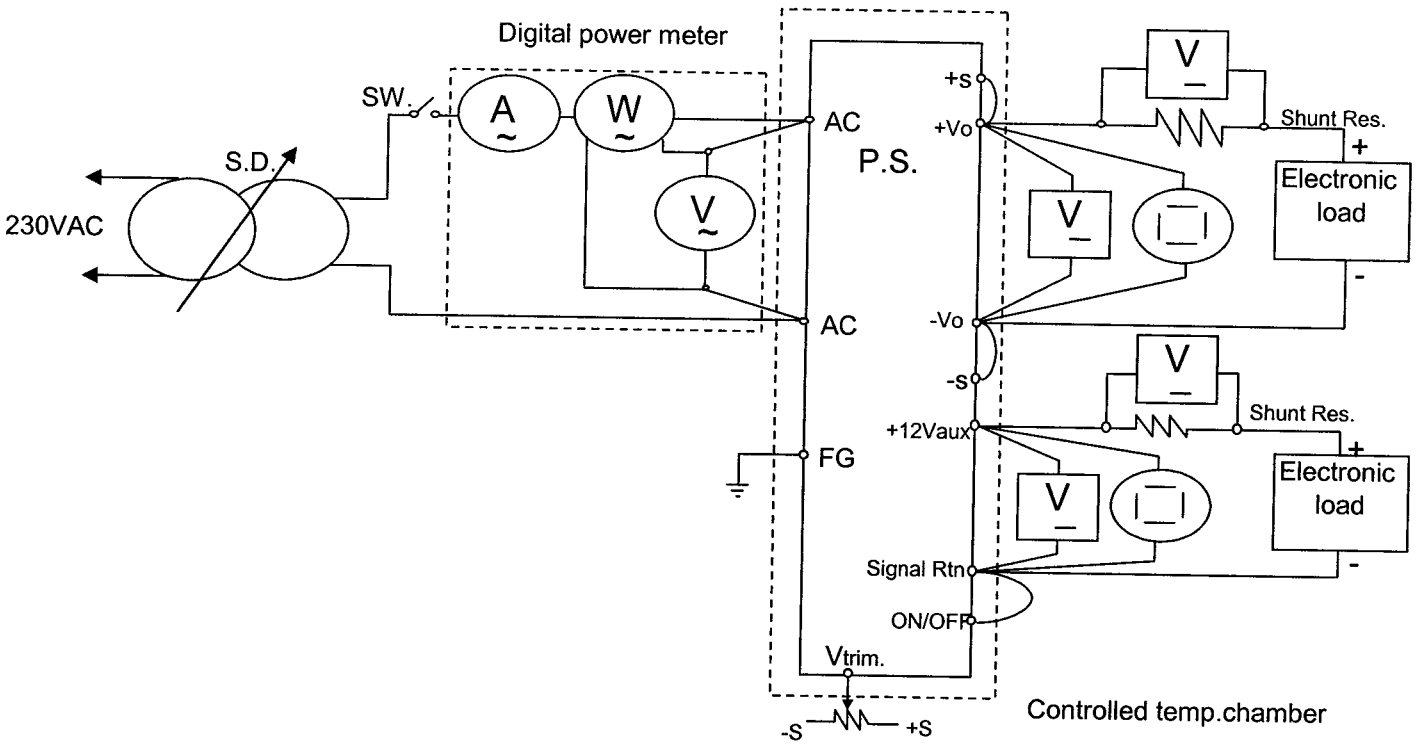
Vin	Input voltage
Vout	Output voltage
Iin	Input current
Iout	Output current
Ta	Ambient temperature

1.EVALUATION METHOD

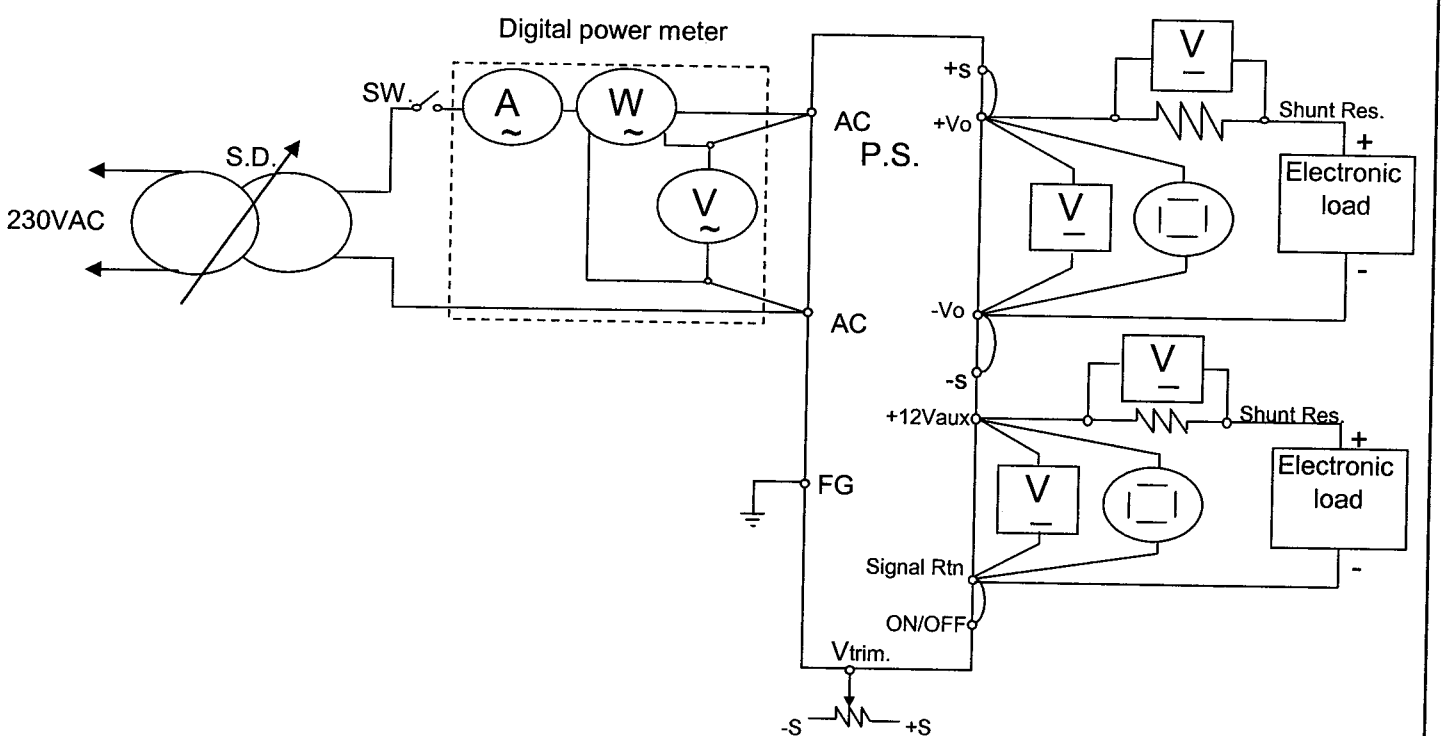
FPS1000 - 12

1-1.Circuits used for determination

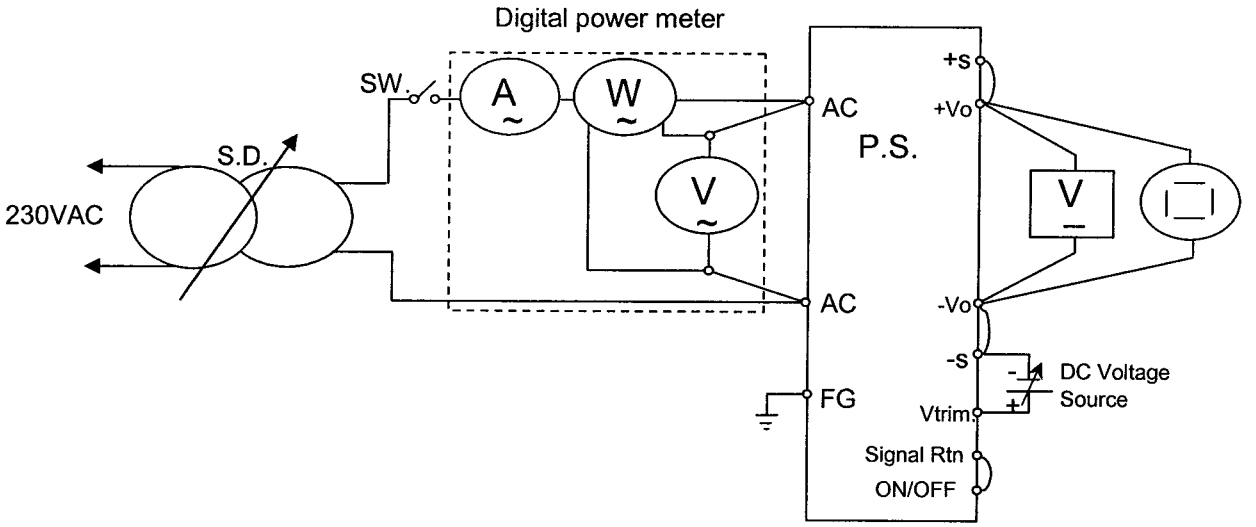
(1)Steady state data



(2) Warm up voltage drift & temperature stability

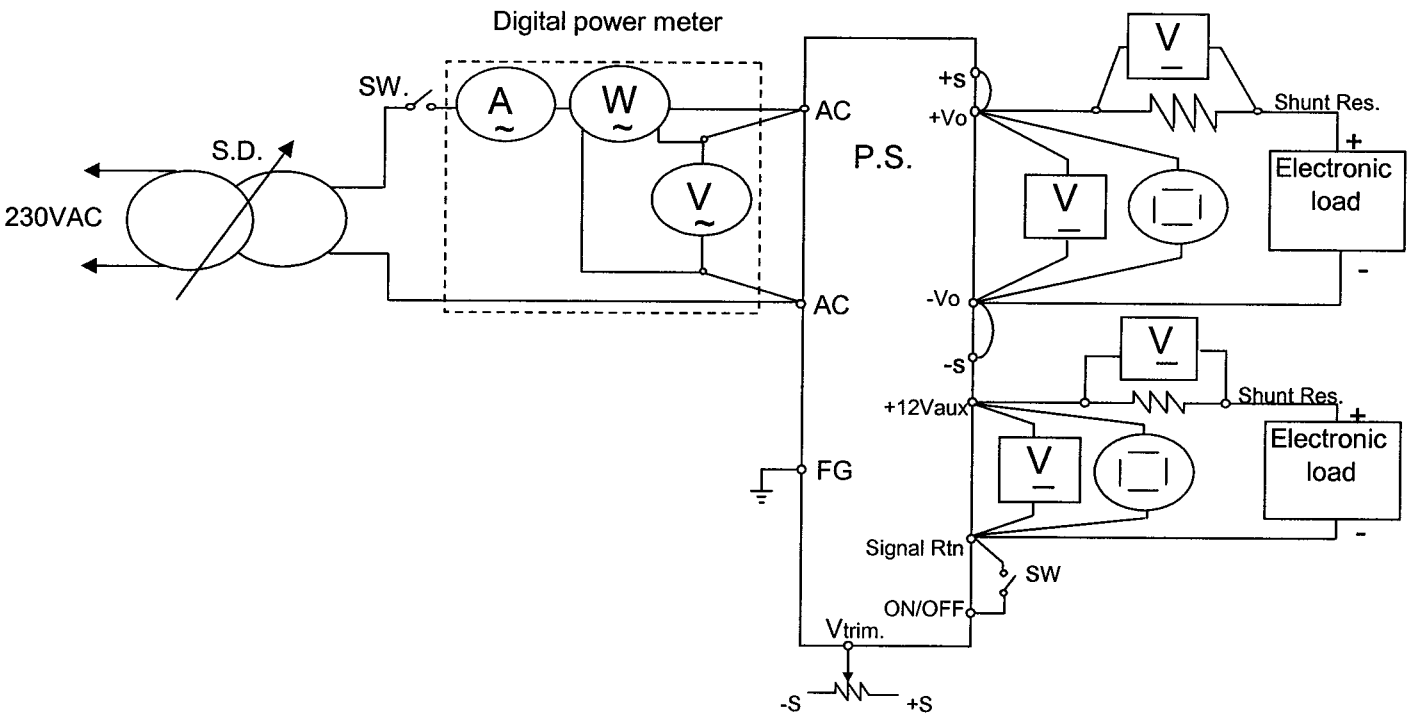


(3)Over Voltage Protection (OVP) characteristics



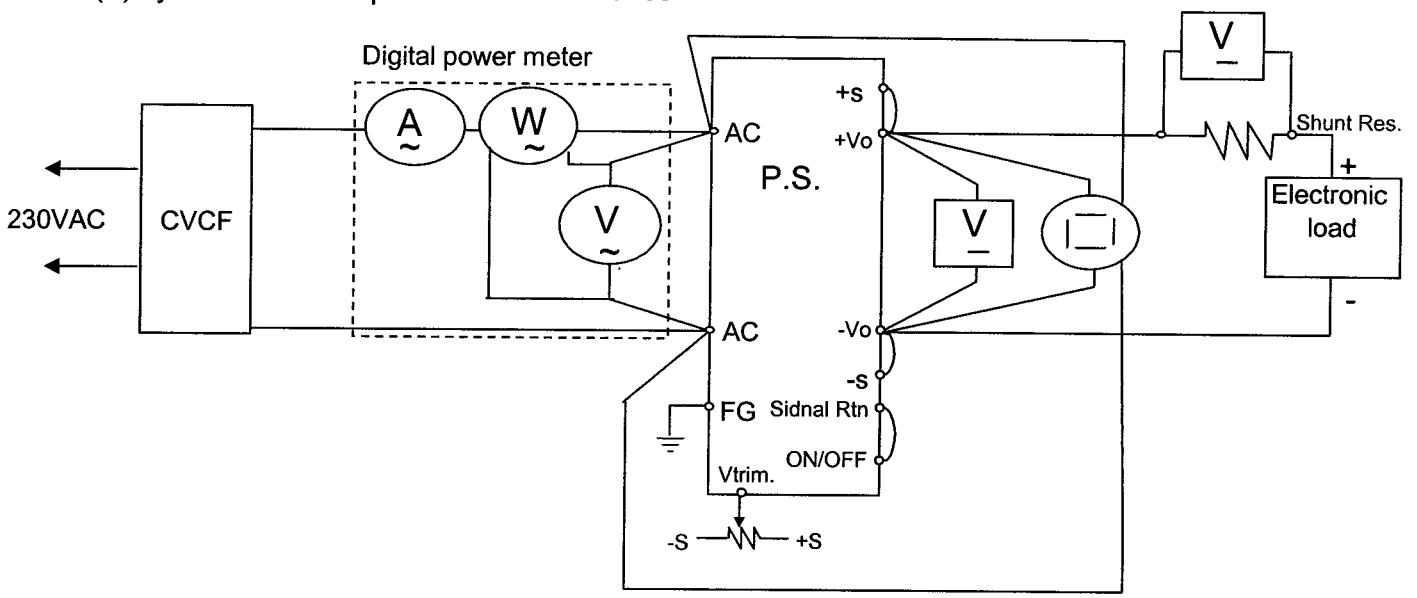
(4) Over Current Protection (OCP) characteristics
Same as steady state data

(5) Output Rise Characteristics

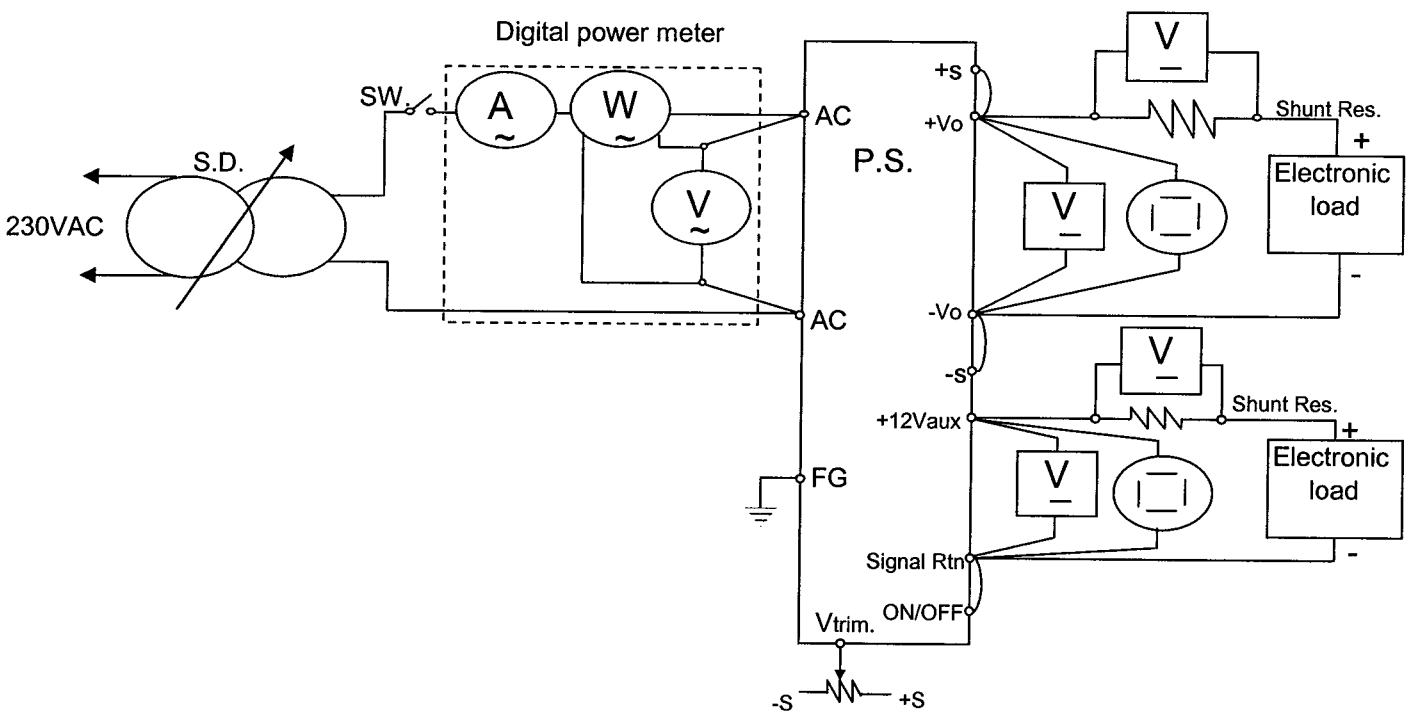


(6) Output fall characteristics
Same as output rise characteristics

(7)Dynamic line response characteristics

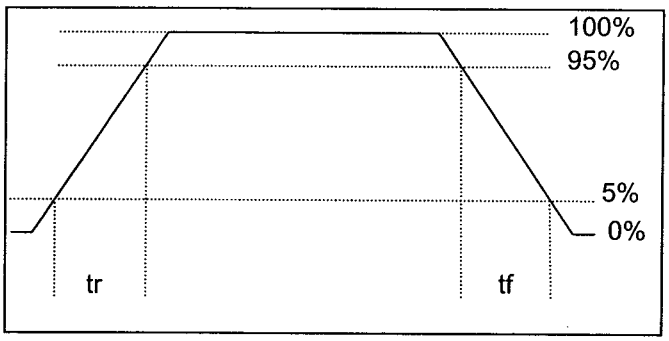


(8) Dynamic load response characteristics



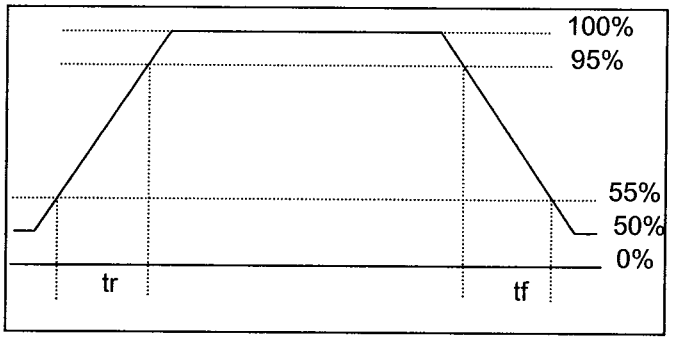
Dynamic load response characteristics

Output current waveform
Iout 0% <---> 100%



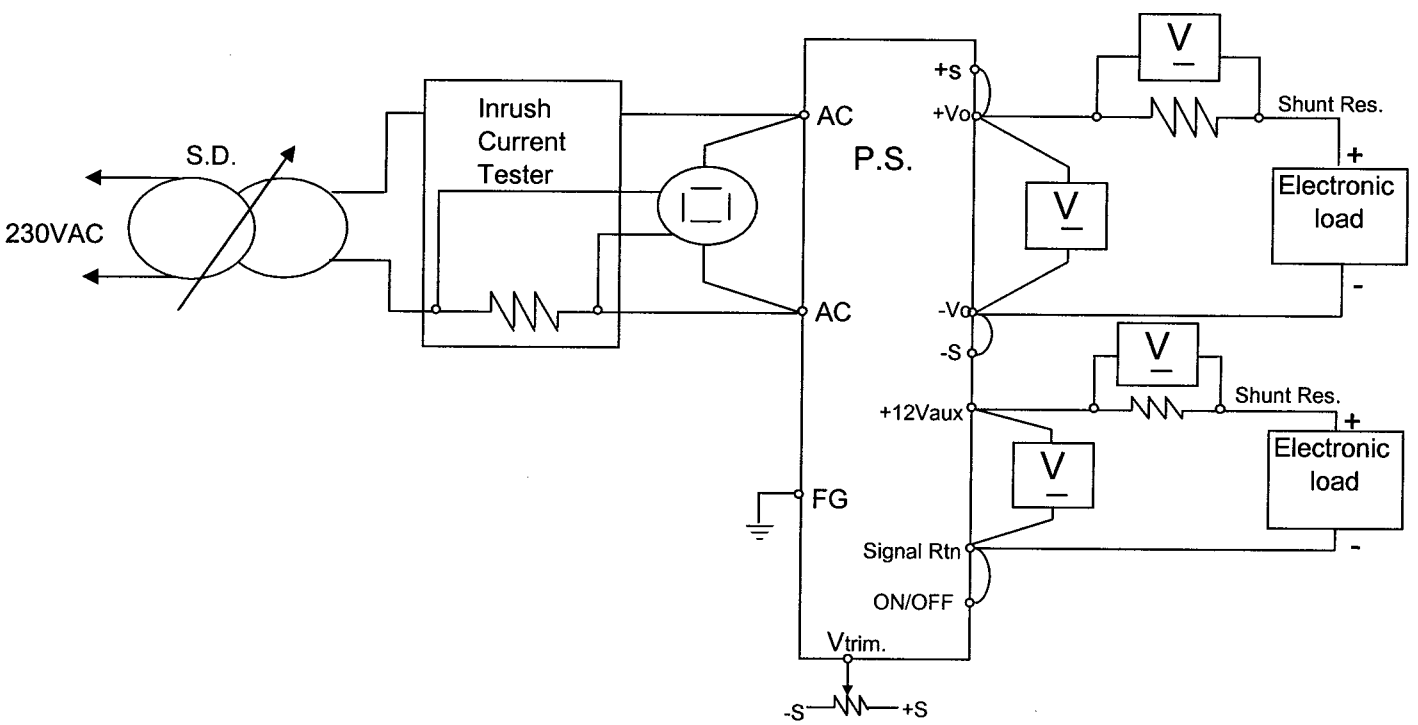
t_r = 100μs
t_f = 100μs

Output current waveform
Iout 50% <---> 100%

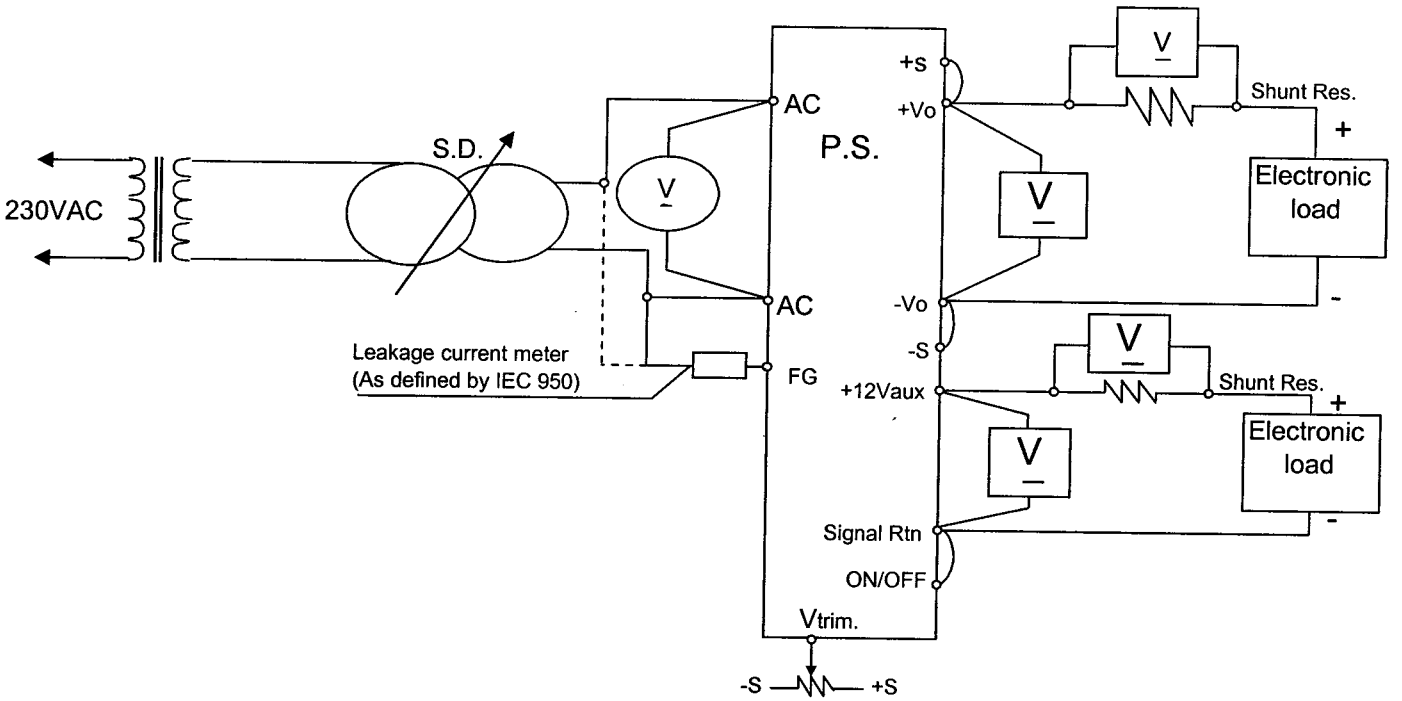


t_r = 100μs
t_f = 100μs

(9)Inrush current characteristics

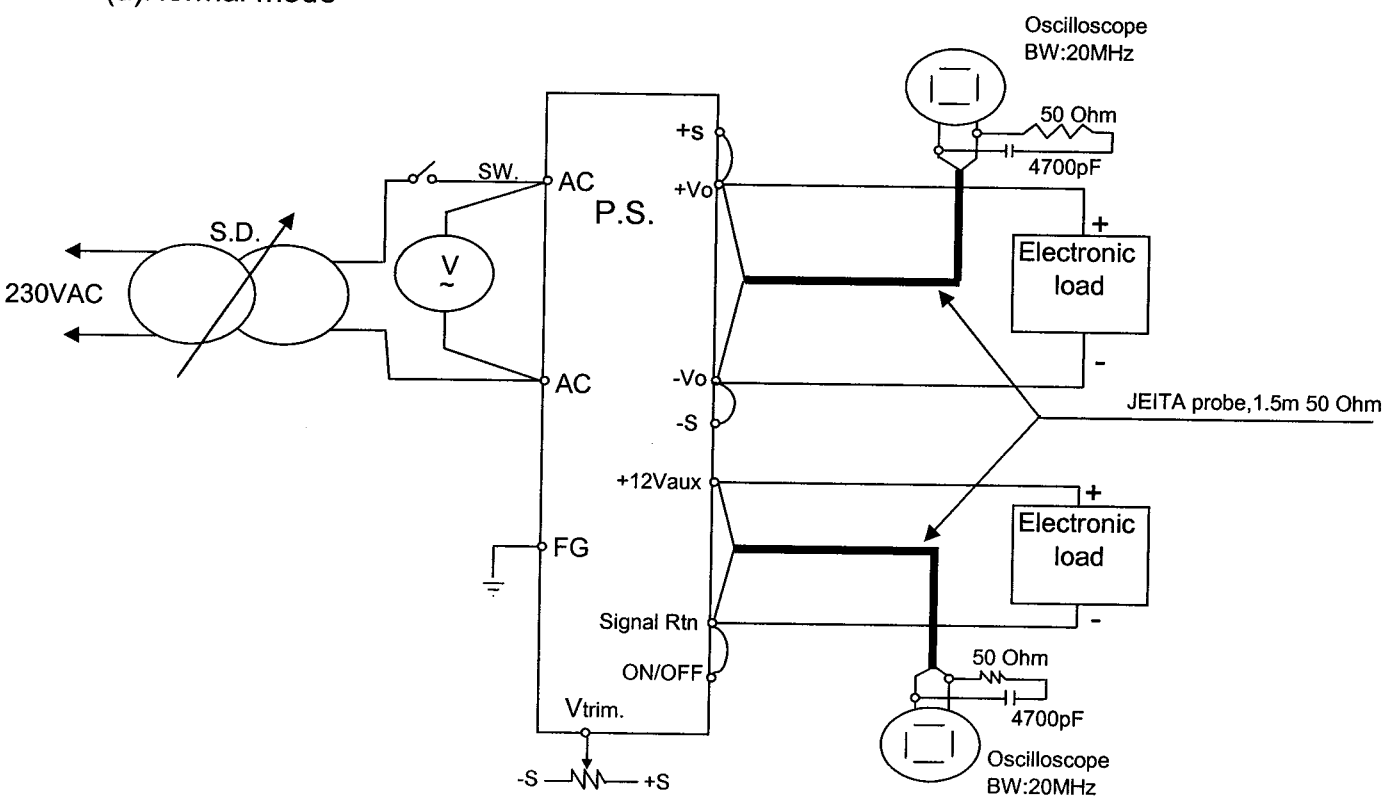


(10)Leakage current characteristics

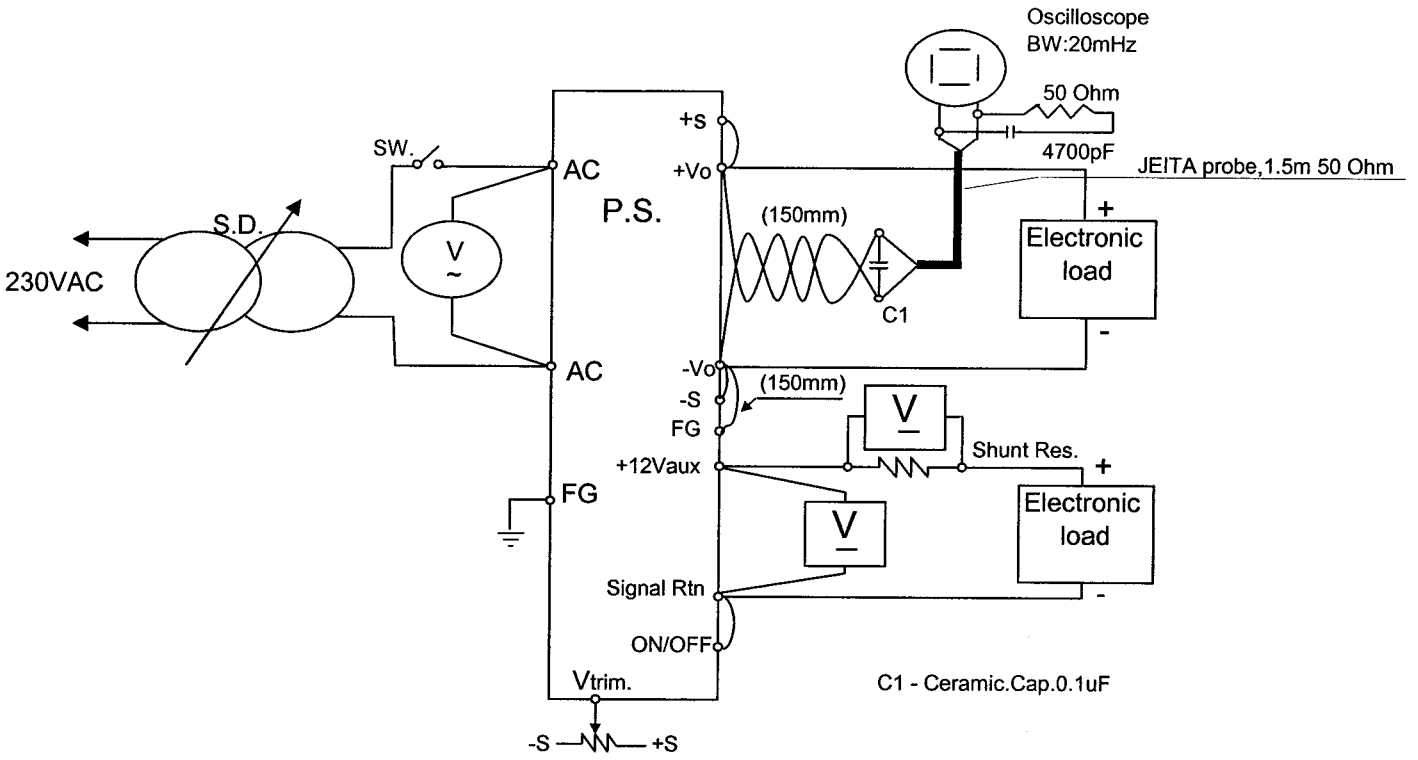


(11)Output ripple & noise waveform

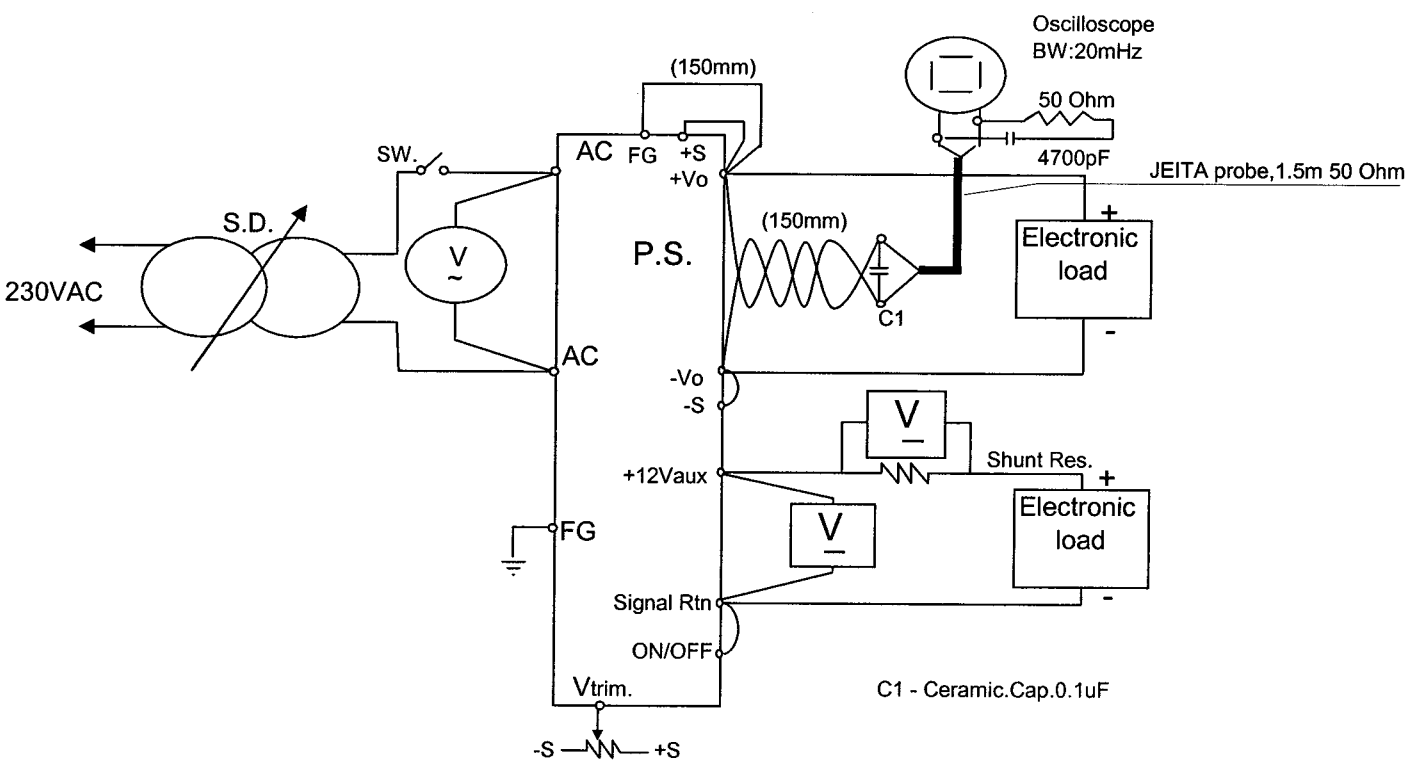
(a)Normal mode



(b)Normal and common mode to -Vo Terminal



(c)Normal and common mode to +Vo Terminal



1-2 List of equipment used

No	EQUIPMENT USED	MANUFACTURER	MODEL No.
1	Storage oscilloscope	YOKOGAWA	DL7100
2	Storage oscilloscope	YOKOGAWA	DL1540
3	Analog oscilloscope	HITACHI	V-1565
4	Digital multimeter	AGILENT	34401A
5	Digital power meter	YOKOGAWA	WT110
6	Autotransformer	VOLTAC	B15
7	Dynamic electronic load	KIKUSUI	PLZ1003W
8	Electronic DC load	TAKASAGO	FK-1000H
9	Controlled temp. chamber	THERMOTRON	SE-600-5-5
10	AC power supply (CVCF)	KIKUSUI	PCR4000L
11	Analyzing AC power supply	TAKASAGO	AA2000XG
12	Inrush current tester	TAKAMISAWA	PSA-210
13	Leakage current tester	HIOKI	3155
14	Current probe	TEKTRONIX	P6021
15	RMS voltmeter	AGILENT	3400A

2. CHARACTERISTICS

2-1. Steady state data

(1). Regulation-Line & Load,Temperature drift

Vout=10.5V

1. Regulation - Line & Load

CONDITIONS: Ta = 25°C
Iaux=0.25A

Iout\Vin	85VAC	100VAC	200VAC	230VAC	260VAC	Line Reg	
N.L.	10.515	10.515	10.515	10.514	10.514	1mV	0.010%
50%	10.498	10.498	10.497	10.497	10.497	1mV	0.010%
100%	10.500	10.500	10.499	10.499	10.498	2mV	0.020%
Load	17mV	17mV	18mV	17mV	17mV		
Reg	0.161%	0.161%	0.171%	0.161%	0.161%		

2.Temperature drift

CONDITIONS: Vin=100VAC
Io=72A
Iaux=0.25A

Ta	0°C	25°C	50°C	temp. drift		PPM/°C
Vo(V)	10.488	10.497	10.503	15mV	0.143%	28.6

Vout=12V

1. Regulation - Line & Load

CONDITIONS: Ta = 25°C
Iaux=0.25A

Iout\Vin	85VAC	100VAC	200VAC	230VAC	260VAC	Line Reg	
N.L.	12.014	12.014	12.015	12.014	12.013	2mV	0.020%
50%	12.004	12.004	12.002	12.002	12.002	2mV	0.020%
100%	12.005	12.004	12.003	12.002	12.002	3mV	0.025%
Load	9mV	10mV	13mV	12mV	11mV		
Reg	0.075%	0.083%	0.100%	0.100%	0.092%		

2.Temperature drift

CONDITIONS: Vin=100VAC
Io=72A
Iaux=0.25A

Ta	0°C	25°C	50°C	temp. drift		PPM/°C
Vo(V)	12.000	12.007	12.011	11mV	0.092%	18.3

Vout=13.2V

1. Regulation - Line & Load

CONDITIONS: Ta = 25°C
Iaux=0.25A

Iout\Vin	85VAC	100VAC	200VAC	230VAC	260VAC	Line Reg	
N.L.	13.212	13.212	13.213	13.212	13.211	2mV	0.015%
50%	13.199	13.198	13.197	13.197	13.197	2mV	0.015%
100%	13.207	13.207	13.206	13.205	13.204	3mV	0.022%
Load	13mV	14mV	16mV	15mV	14mV		
Reg	0.100%	0.106%	0.120%	0.113%	0.106%		

2.Temperature drift

CONDITIONS: Vin=100VAC
Io=57.6A
Iaux=0.25A

Ta	0°C	25°C	50°C	temp. drift		PPM/°C
Vo(V)	13.206	13.218	13.222	16mV	0.121%	24.2

Auxiliary supply

1. Regulation - Line & Load

CONDITIONS: Ta = 25°C
Vo=12V
Io=72A

Iaux\Vin	85VAC	100VAC	200VAC	230VAC	260VAC	Line Reg	
N.L.	11.752	11.750	11.749	11.746	11.742	10mV	0.080%
50%	11.673	11.672	11.670	11.668	11.665	8mV	0.070%
100%	11.627	11.627	11.626	11.624	11.622	5mV	0.042%
Load	125mV	123mV	123mV	122mV	120mV		
Reg	1.042%	1.025%	1.025%	1.017%	1.000%		

2.Temperature drift

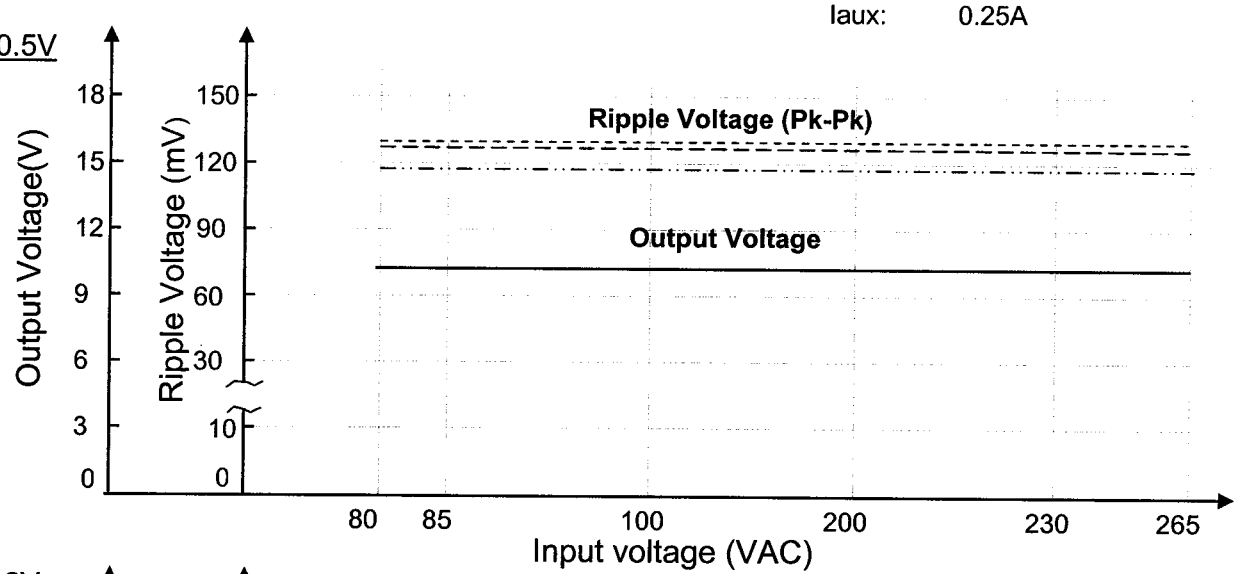
CONDITIONS: Vin=100VAC
Vo=12V
Io=72A
Iaux=0.25A

Ta	0°C	25°C	50°C	temp. drift		PPM/°C
Vaux(V)	11.506	11.606	11.693	187mV	1.56%	312

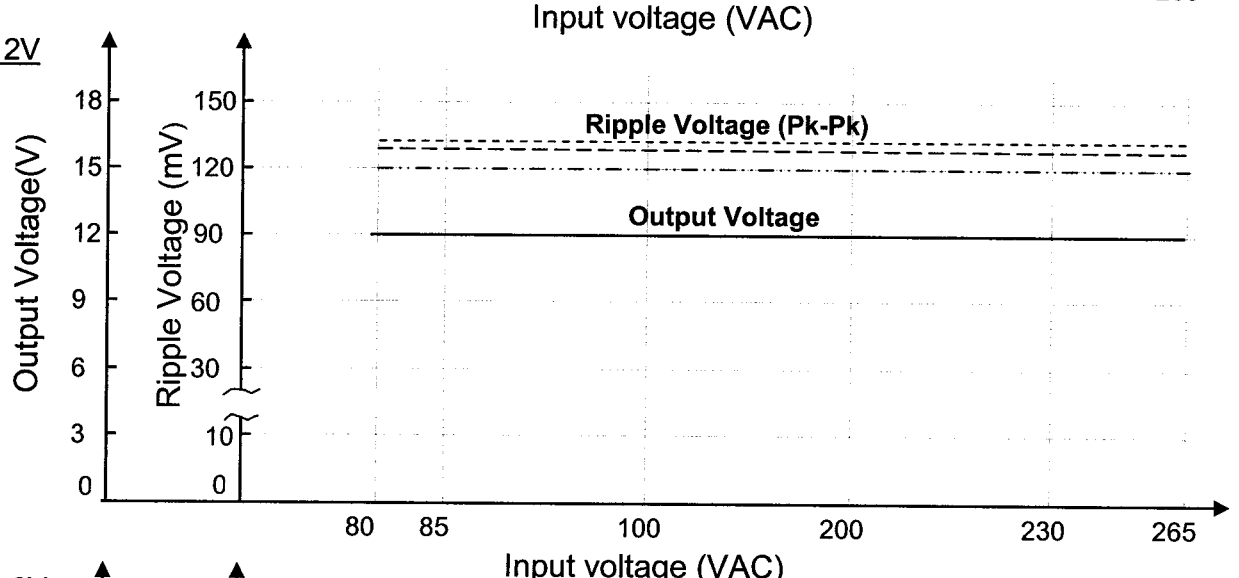
(2). Output voltage and ripple voltage v.s. input voltage

CONDITIONS: Ta: 0°C
25°C
50°C
Iout: 100%
Iaux: 0.25A

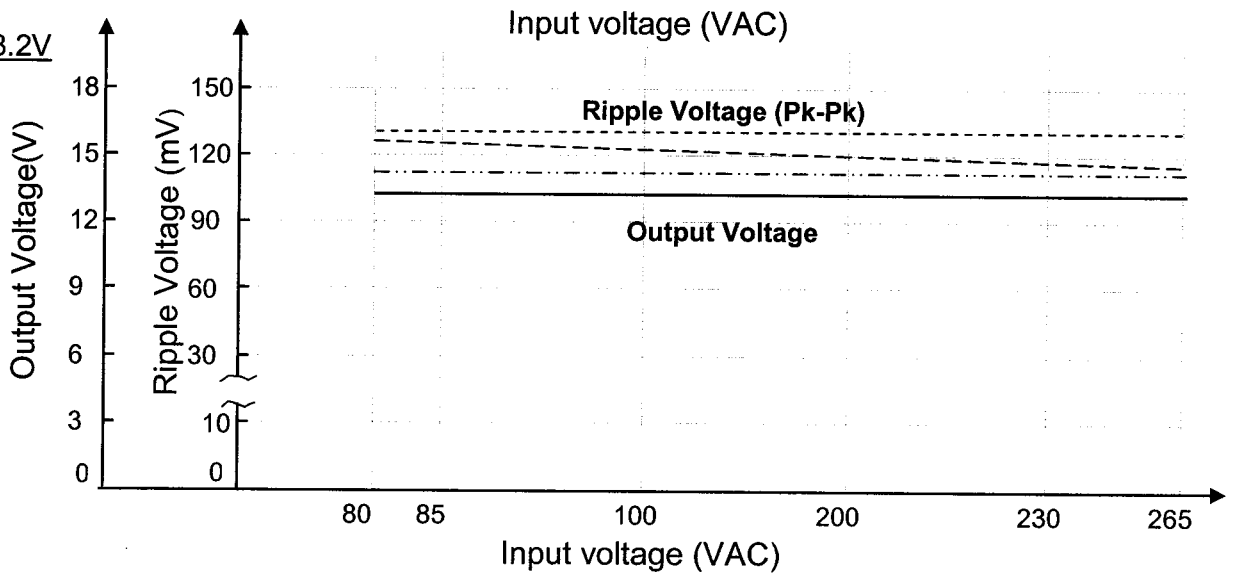
Vout=10.5V



Vout=12V

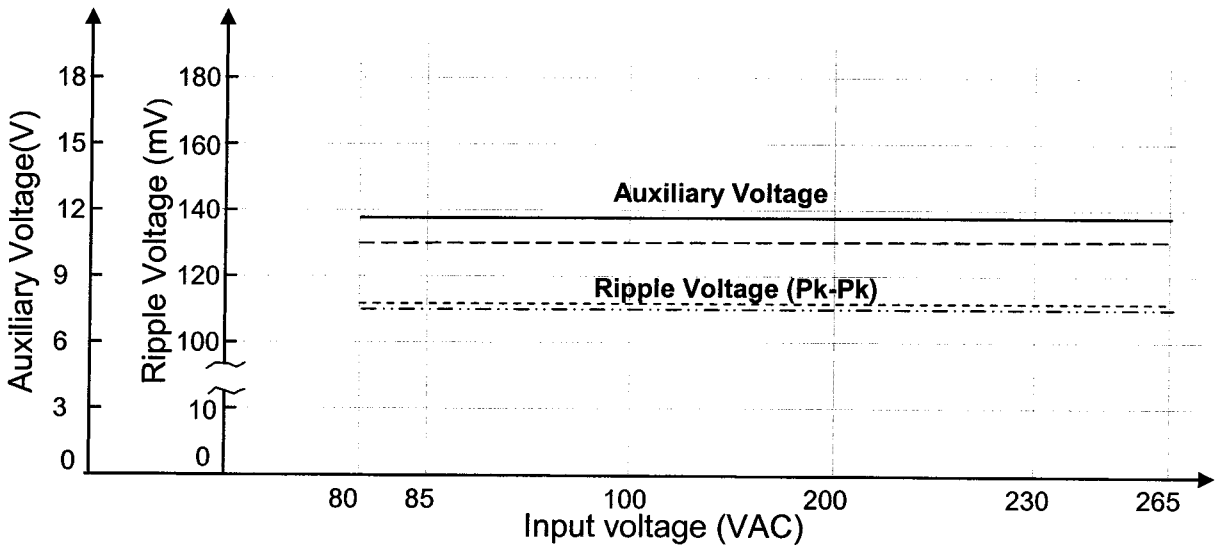


Vout=13.2V



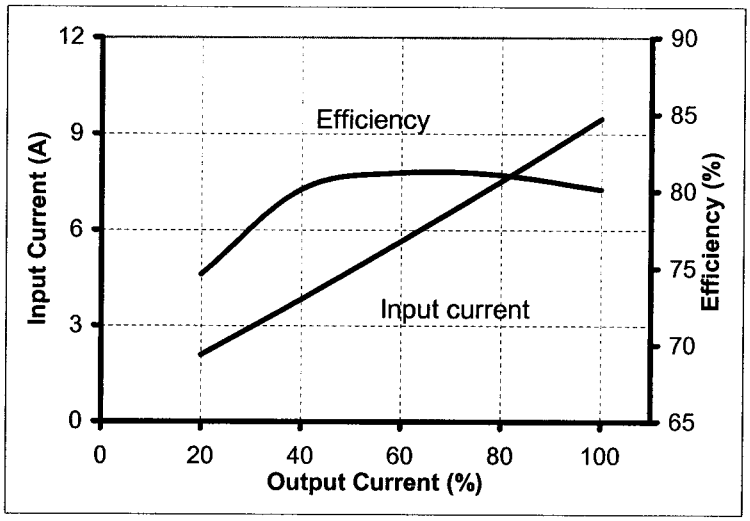
Auxiliary supply

CONDITIONS: Ta: 0°C
25°C
50°C
Vo: 12V
Iout: 72A
Iaux: 0.25A



(3) Efficiency and Input current v.s. Output current

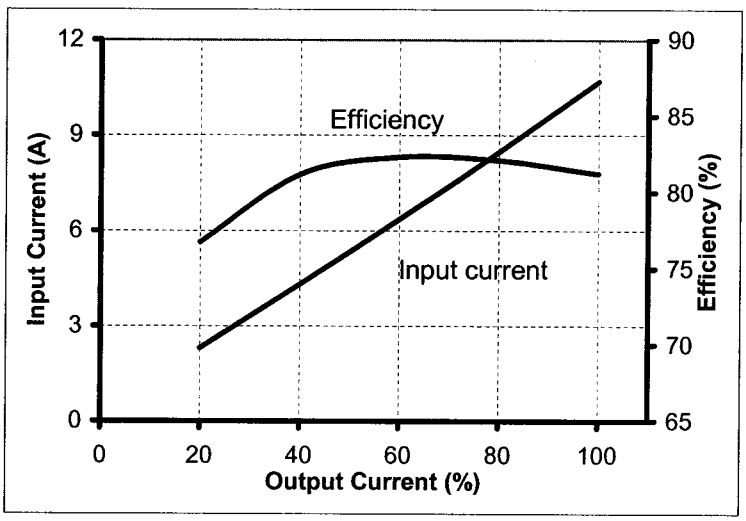
CONDITIONS: Ta:25°C
Vin:100VAC
Iaux:0.25V



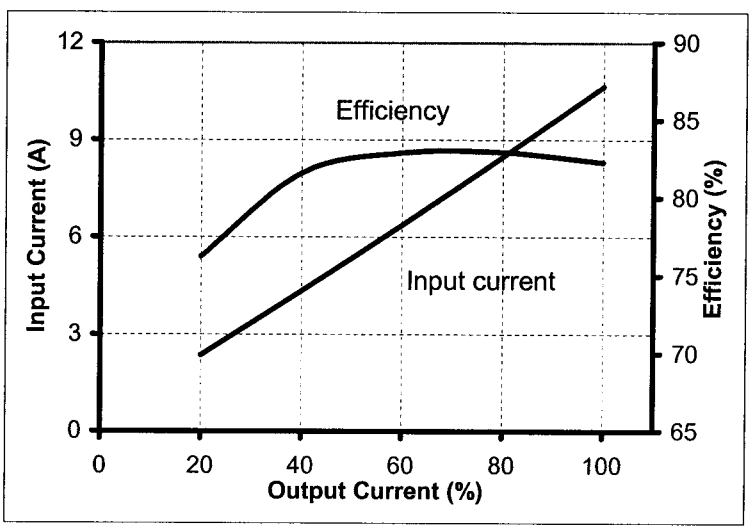
Vout=10.5V

Efficiency

Input current

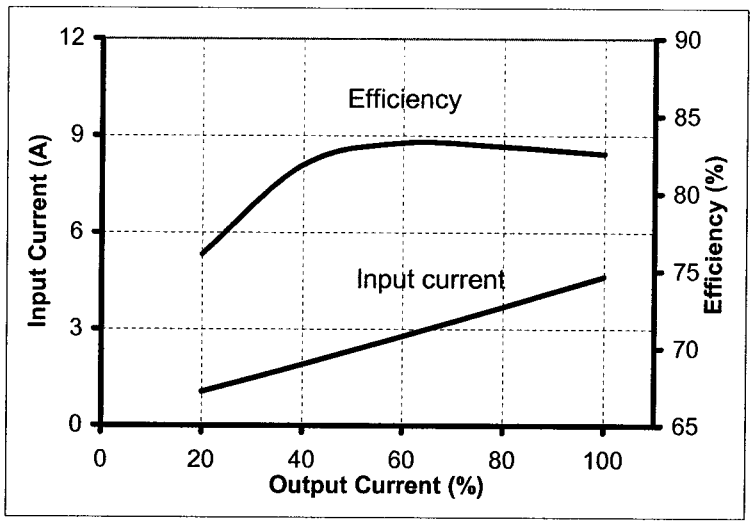


Vout=12V

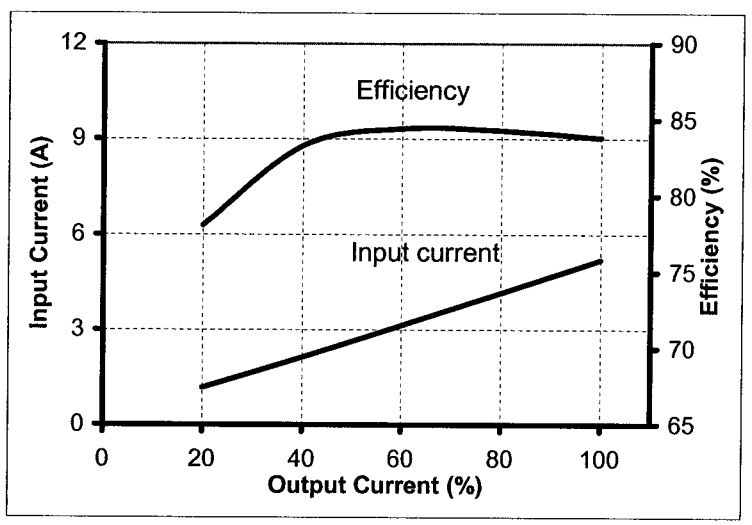


Vout=13.2V

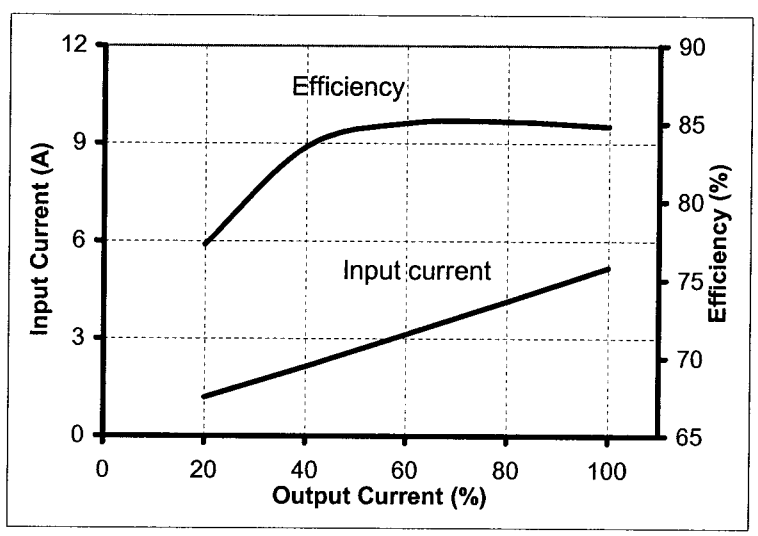
CONDITIONS: Ta:25°C
Vin:200VAC
Iaux:0.25A



Vout=10.5V



Vout=12V

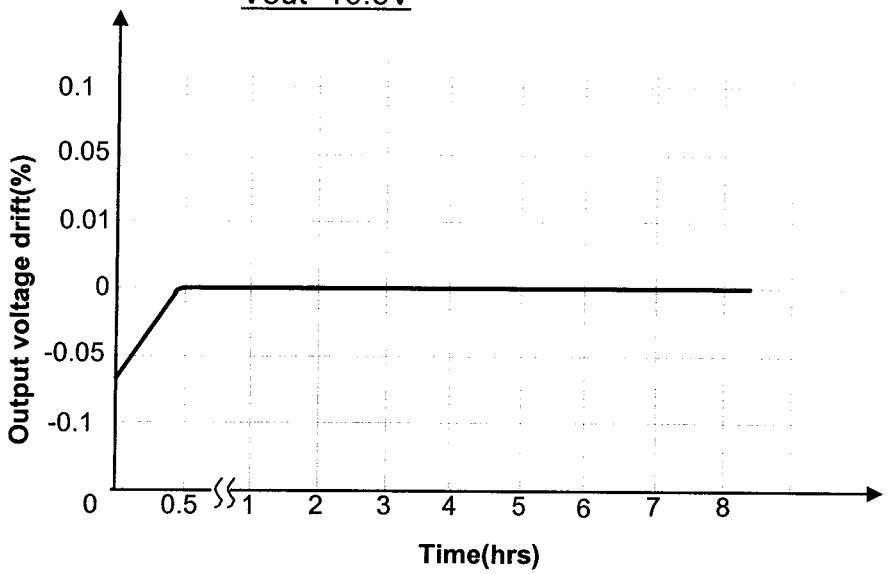


Vout=13.2V

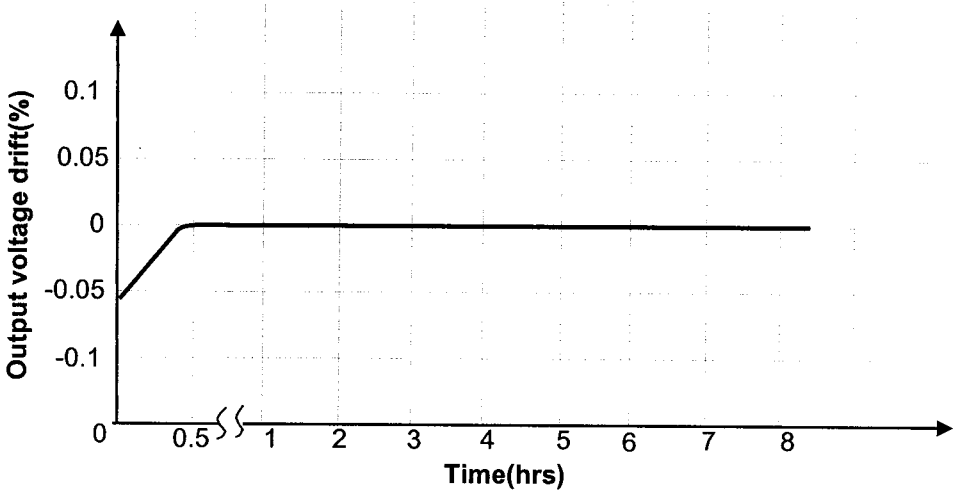
2-2. Warm up voltage drift & temperature stability

CONDITIONS: Ta=25ºC
Vin=100VAC
Io=100%
Iaux=0.25A

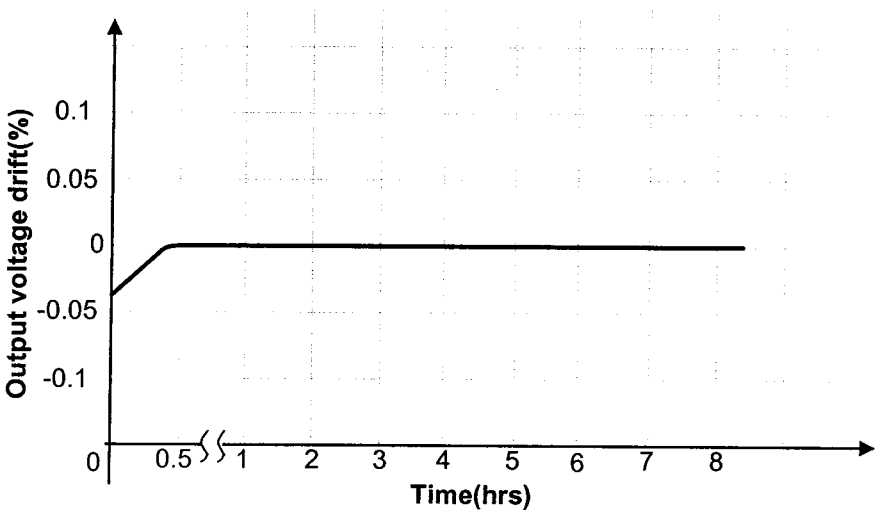
Vout=10.5V



Vout=12V

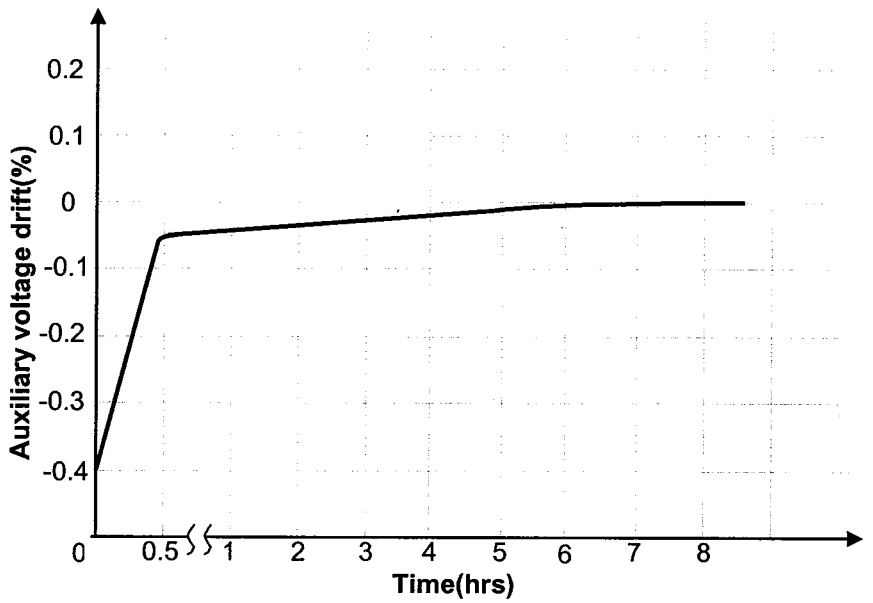


Vout=13.2V



Auxiliary supply

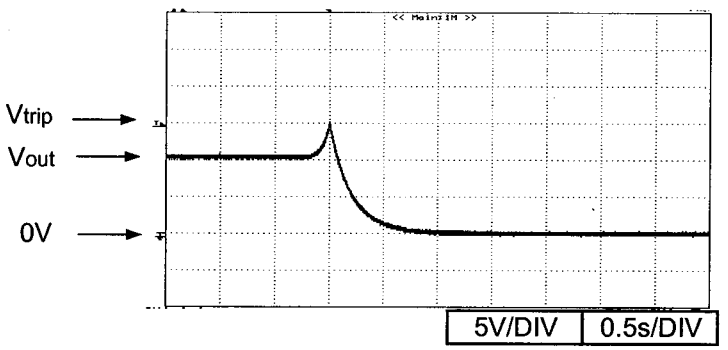
CONDITIONS: Ta=25ºC
Vin=100VAC
Vo=12V
Io=72A
Iaux=0.25A



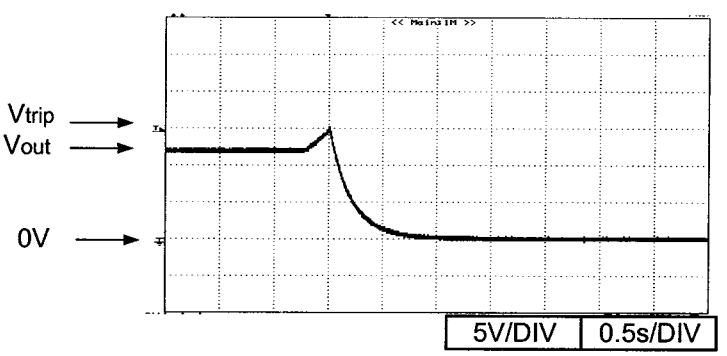
2-3. Over voltage protection (OVP) characteristics

CONDITIONS: Ta = 25°C
Vin = 100VAC
NO LOAD

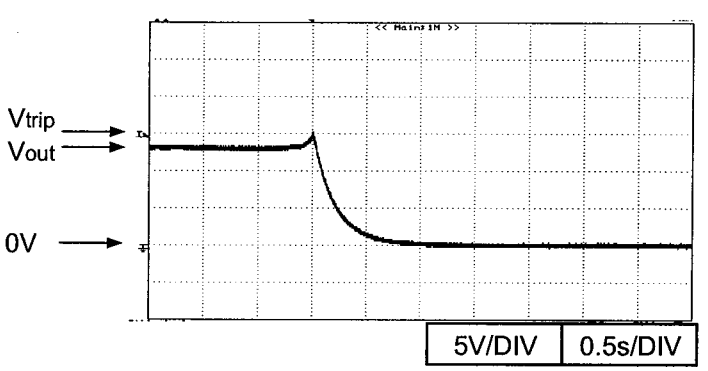
(a) Operation 10.5V to OVP



(b) Operation 12V to OVP

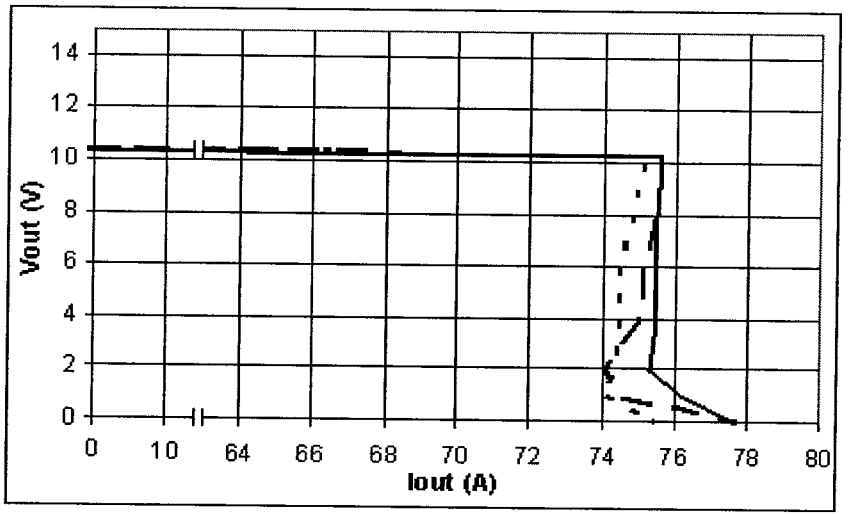


(c) Operation 13.2V to OVP

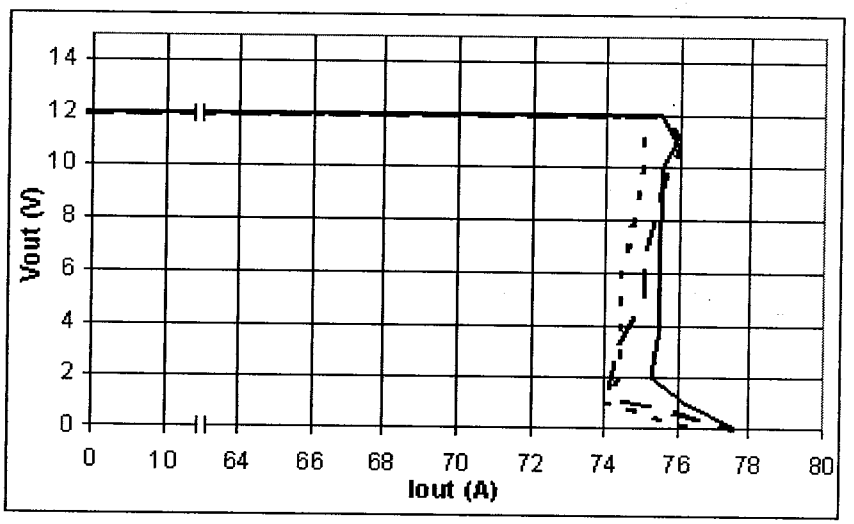


2-4. Over current protection (OCP) characteristics
(a) OCP vs ambient temperature

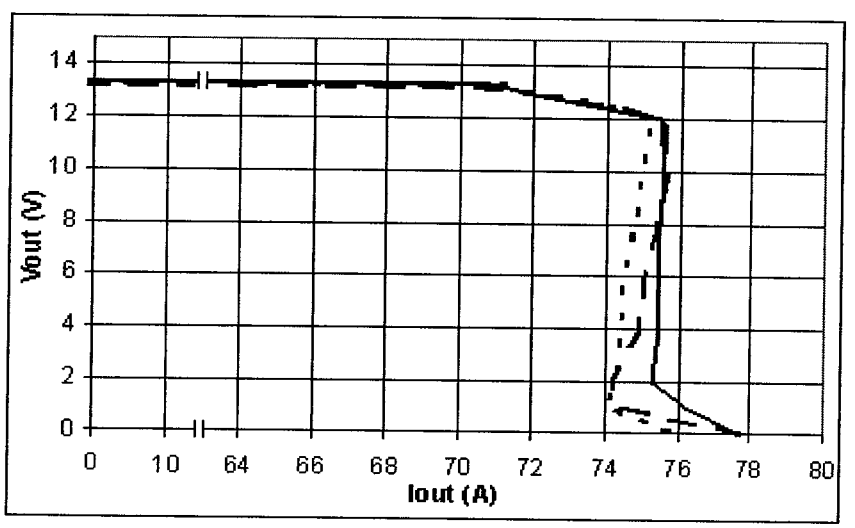
CONDITIONS: Vin=200VAC
Ta: 0°C ——————
25°C – – – – –
50°C ·····



Vout=10.5V



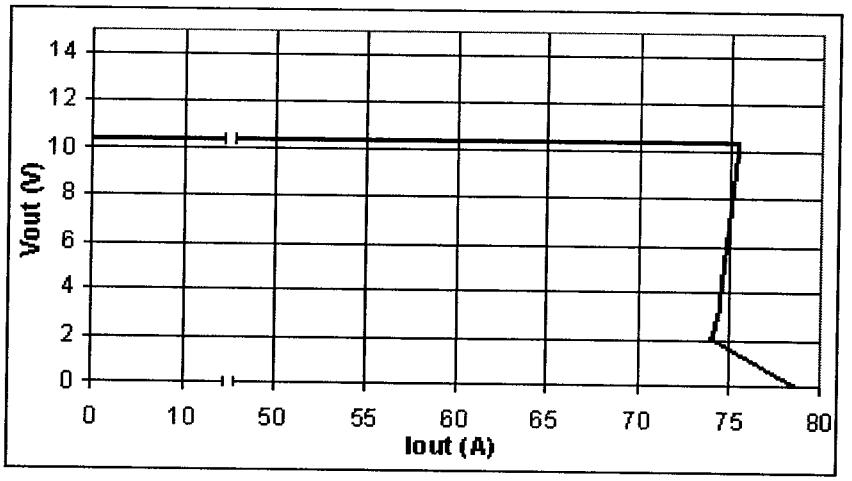
Vout=12V



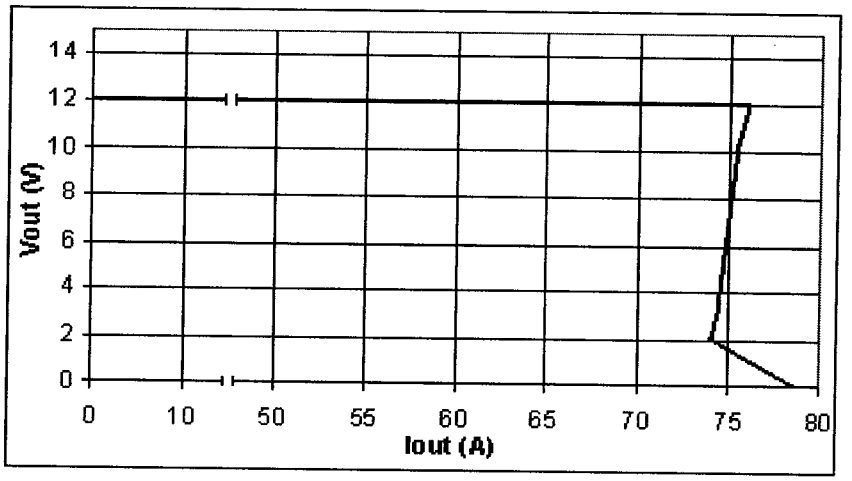
Vout=13.2V

(b) OCP vs input voltage

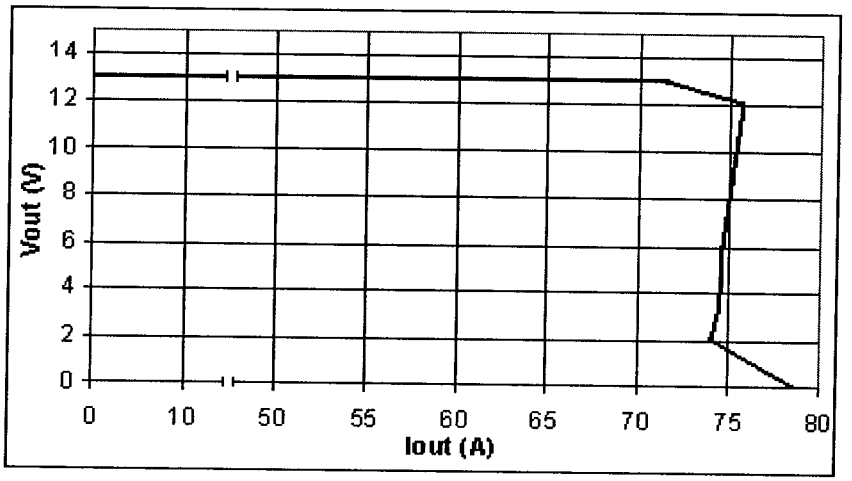
CONDITIONS:
Ta =25°C
Vin=85~265VAC



Vout=10.5V



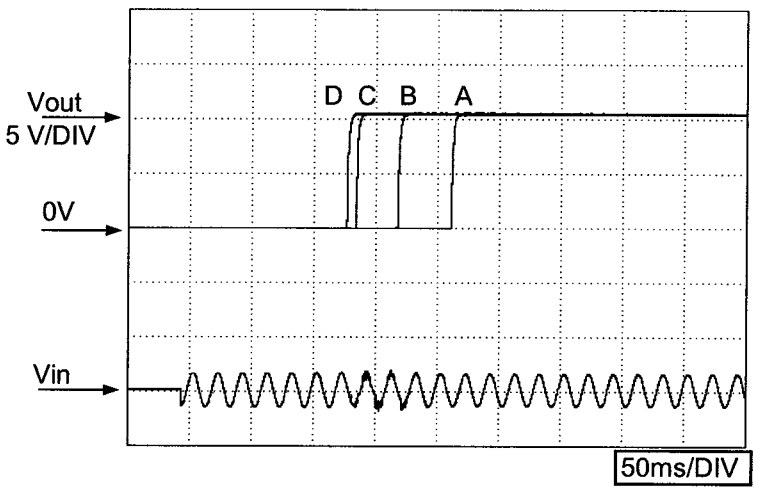
Vout=12V



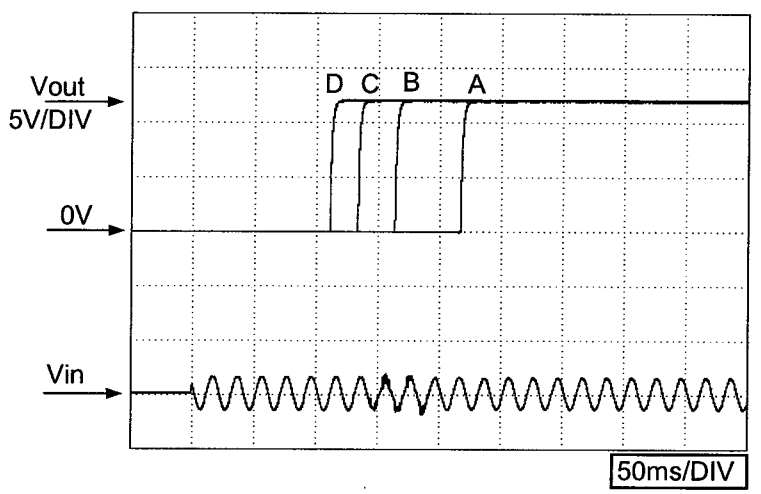
Vout=13.2V

2-5. AC ON/OFF Output Rise characteristics

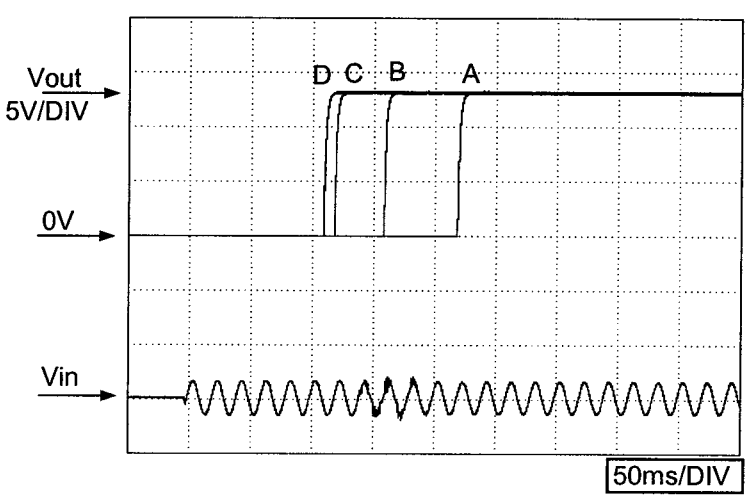
CONDITIONS: Ta=25˚C
Iout=100%
Iaux=0.25A
Vin:85VAC (A)
:100VAC (B)
:200VAC (C)
:265VAC (D)



Vout=10.5V

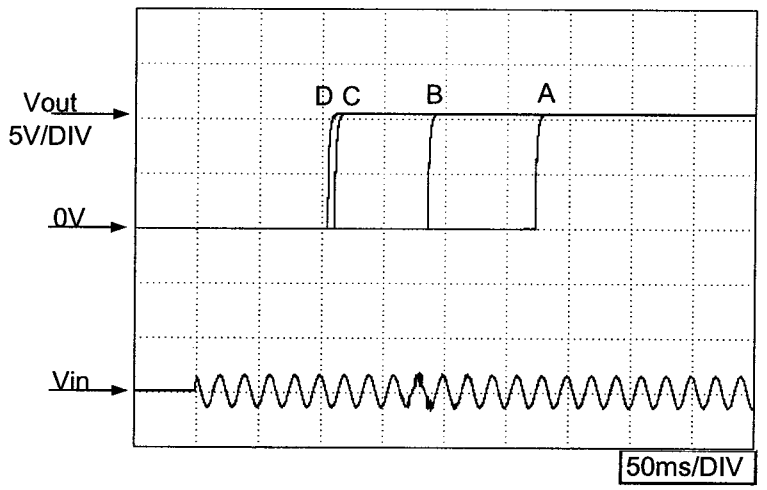


Vout=12V

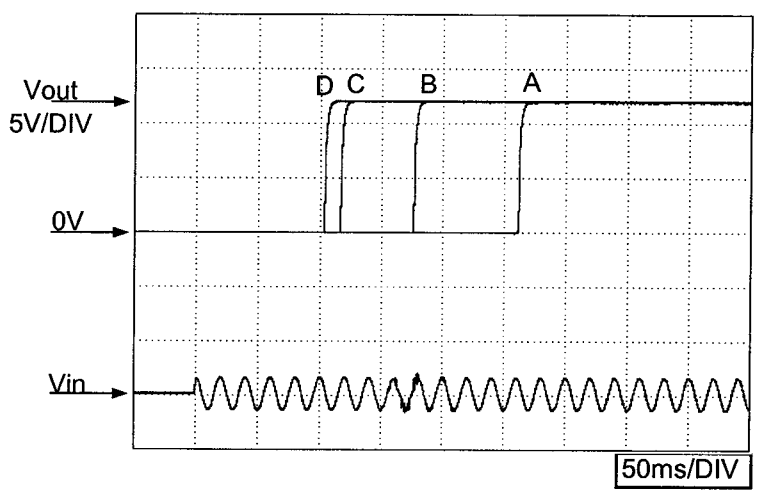


Vout=13.2V

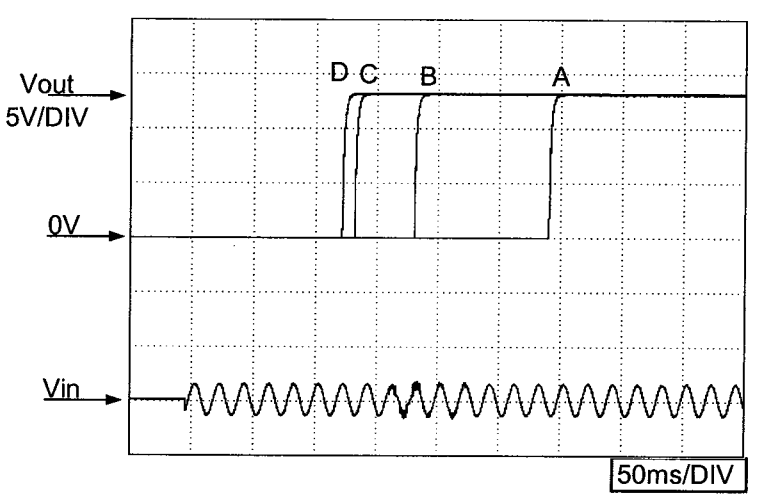
CONDITIONS: Ta=25°C
Iout=0%
Iaux=0.25A
Vin:85VAC (A)
:100VAC (B)
:200VAC (C)
:265VAC (D)



Vout=10.5V



Vout=12V

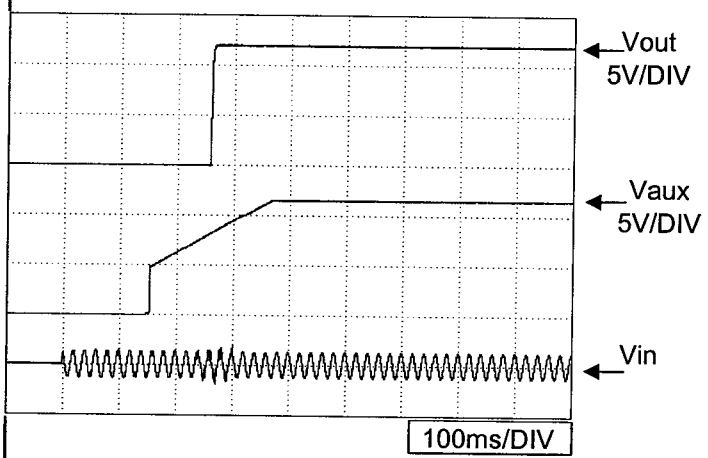


Vout=13.2V

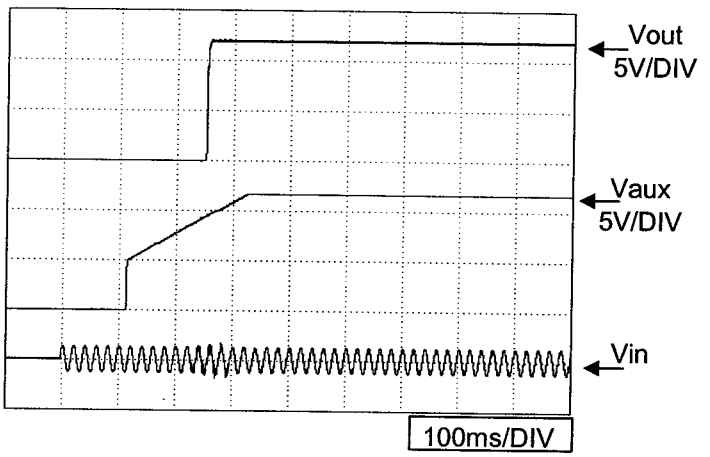
Auxiliary supply

CONDITIONS: Ta=25°C
Vin=100VAC
Vout=12V
Iout=72A

Iaux=0.25A

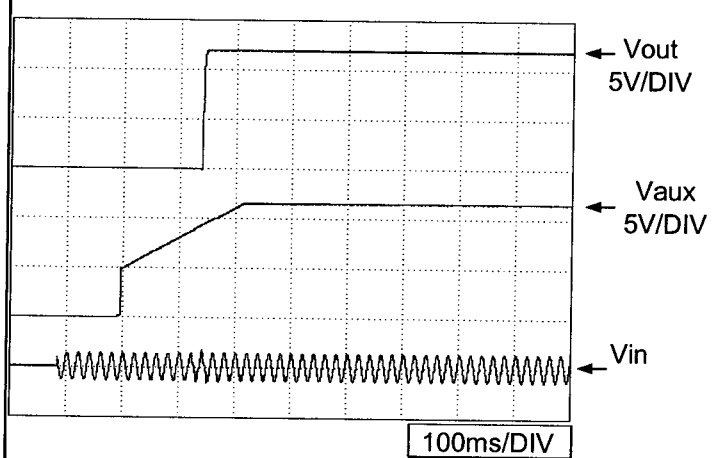


Iaux=0A

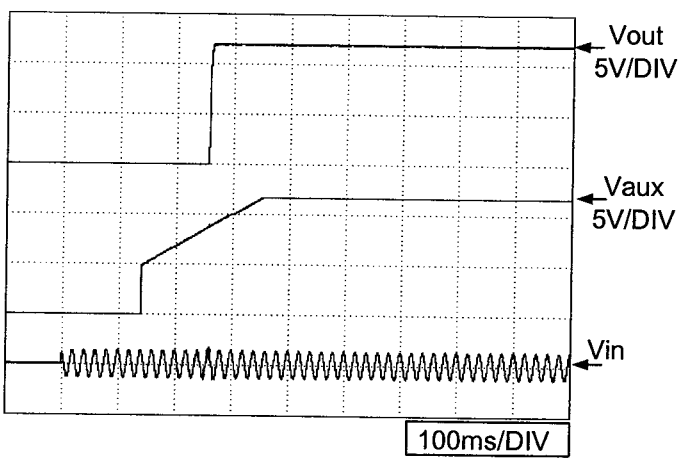


CONDITIONS: Ta=25°C
Vin=100VAC
Vout=12V
Iout=0A

Iaux=0.25A

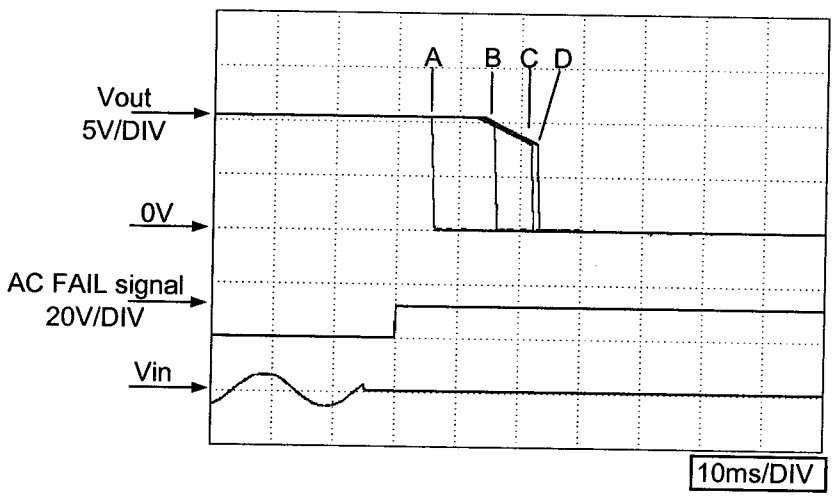


Iaux=0A

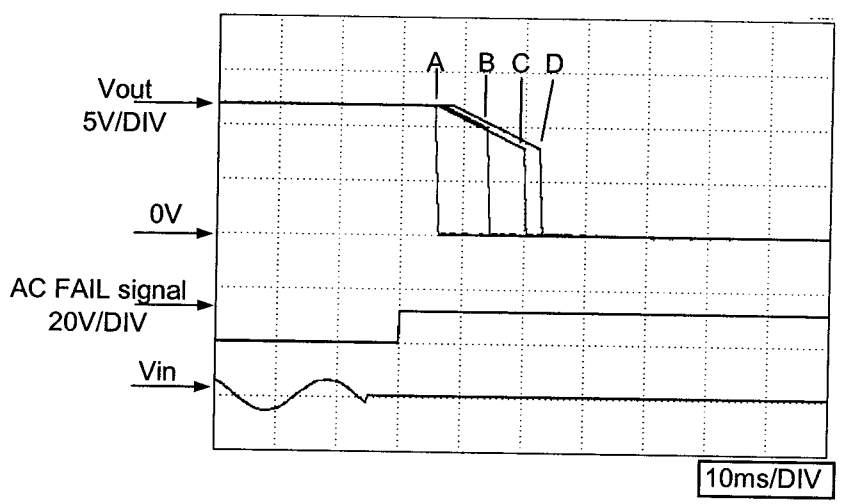


2-6. AC ON/OFF Output Fall characteristics

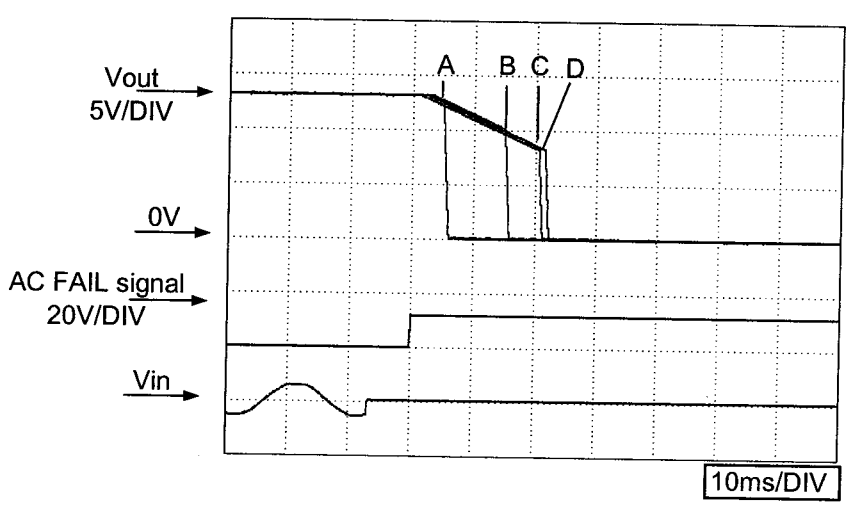
CONDITIONS: Ta=25˚C
Iout=100%
Iaux=0.25A
Vin:85VAC (A)
:100VAC (B)
:200VAC (C)
:265VAC (D)



Vout=10.5V

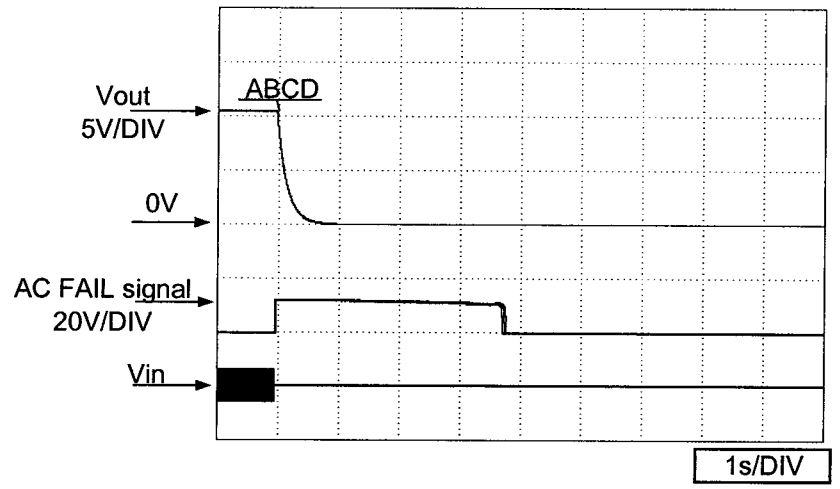


Vout=12V

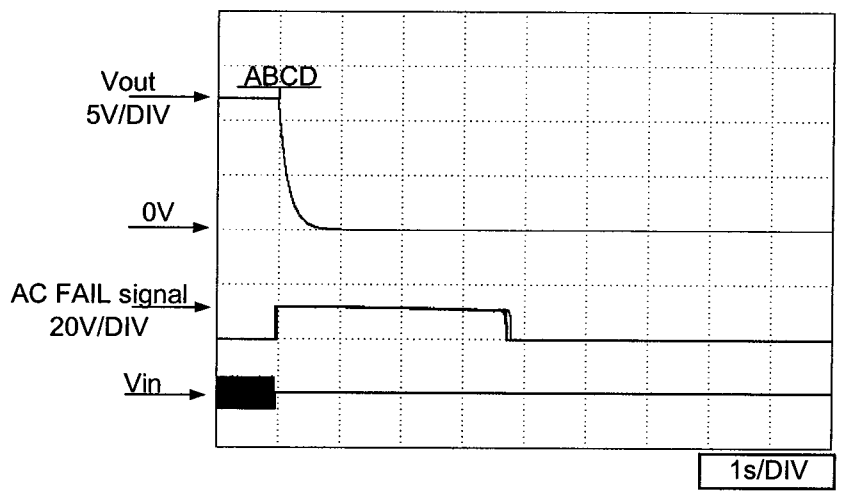


Vout=13.2V

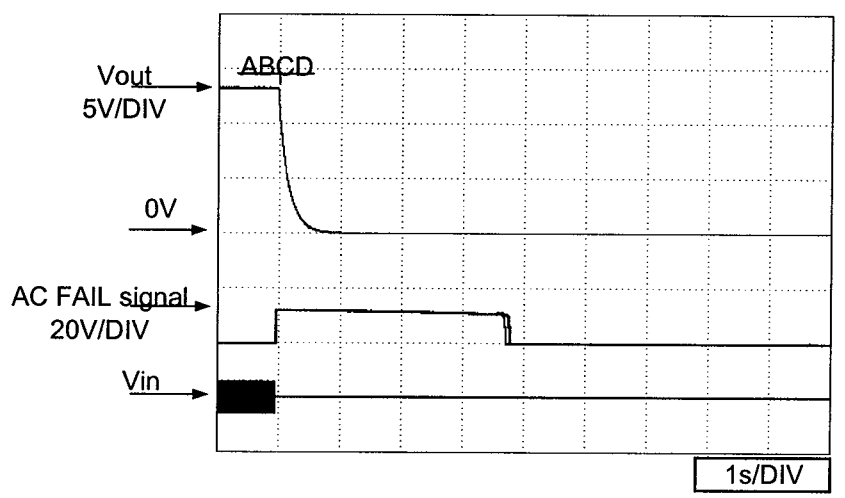
CONDITIONS: Ta=25˚C
Iout=0%
Iaux=0.25A
Vin:85VAC (A)
:100VAC (B)
:200VAC (C)
:265VAC (D)



Vout=10.5V



Vout=12V

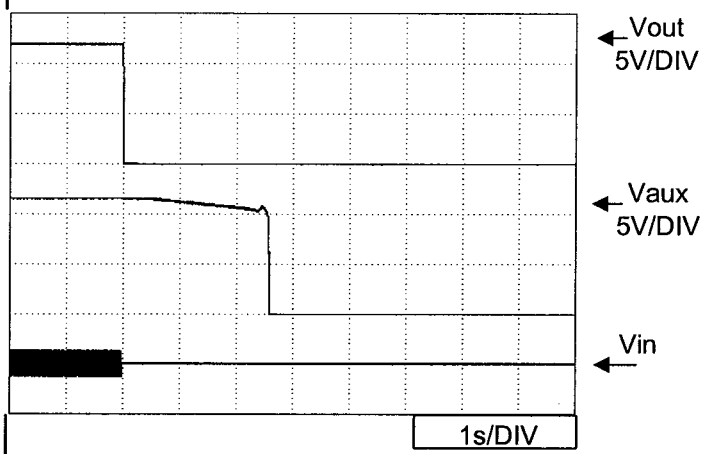


Vout=13.2V

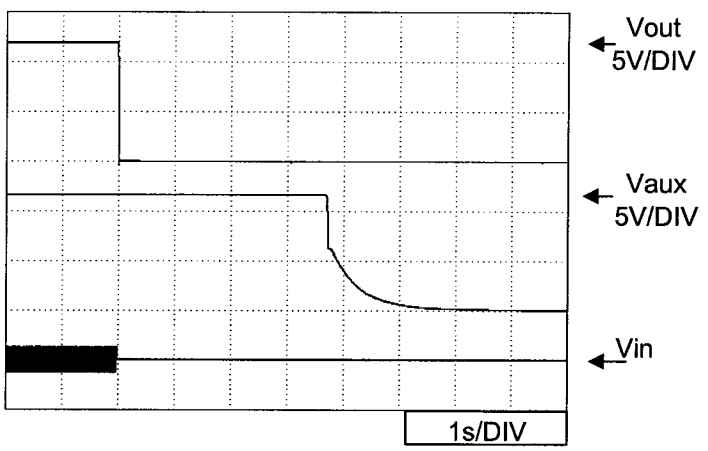
Auxiliary supply

CONDITIONS: Ta=25˚C
Vin=100VAC
Vout=12V
Iout=72A

Iaux=0.25A

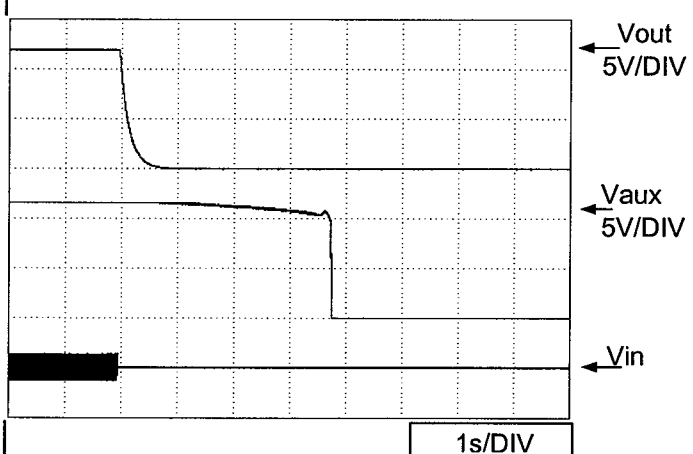


Iaux=0A

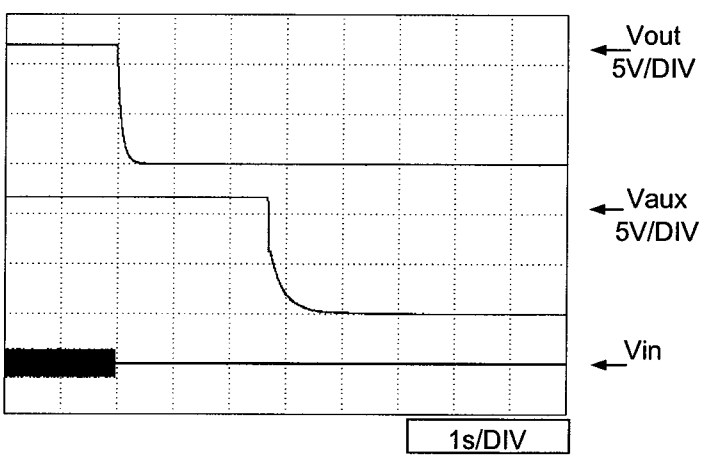


CONDITIONS: Ta=25˚C
Vin=100VAC
Vout=12V
Iout=0A

Iaux=0.25A

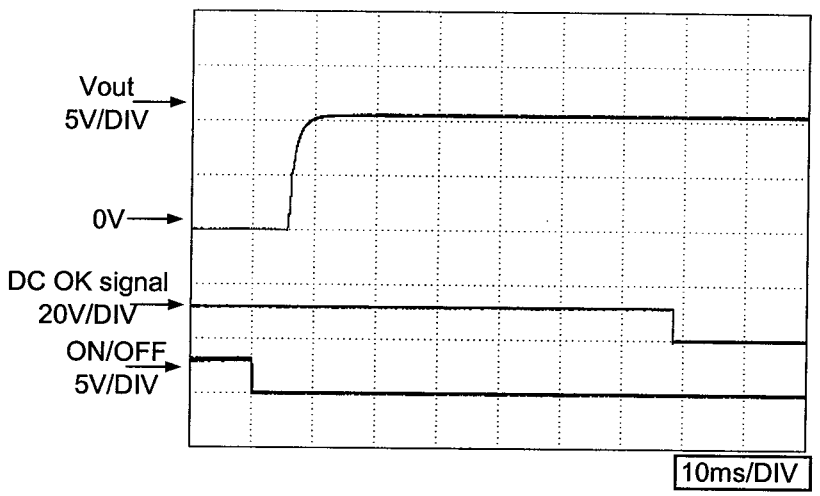


Iaux=0A

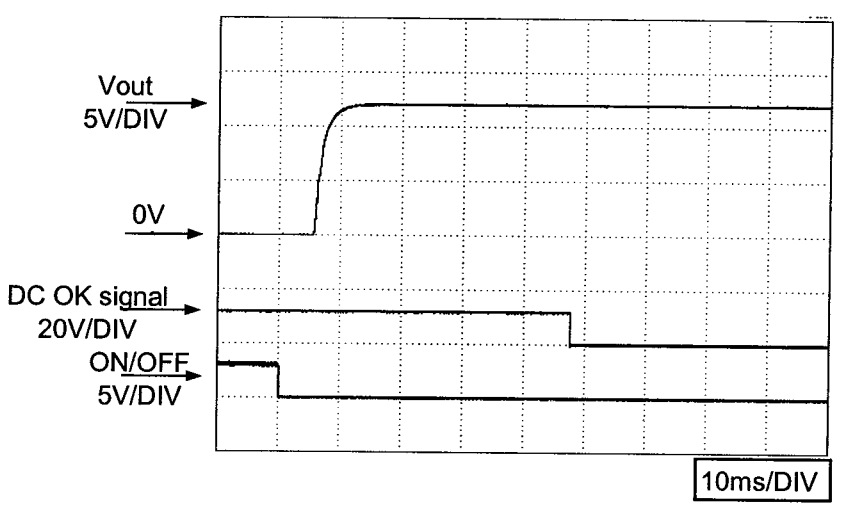


2-7. ON/OFF Control Output Rise characteristics

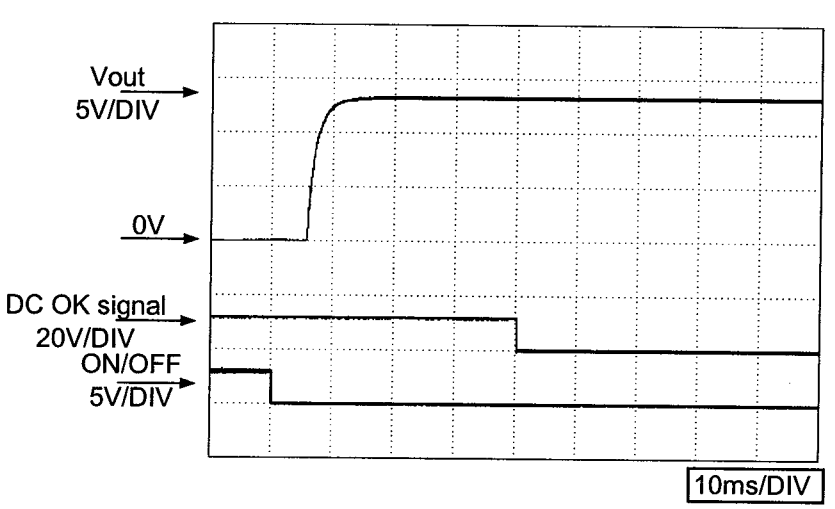
CONDITIONS: Ta=25°C
Iout=100%
Iaux=0.25A
Vin:100VAC



Vout=10.5V

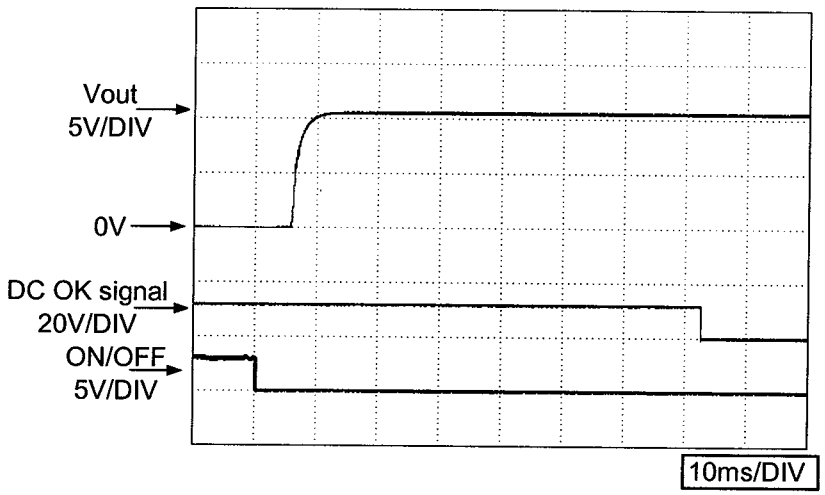


Vout=12V

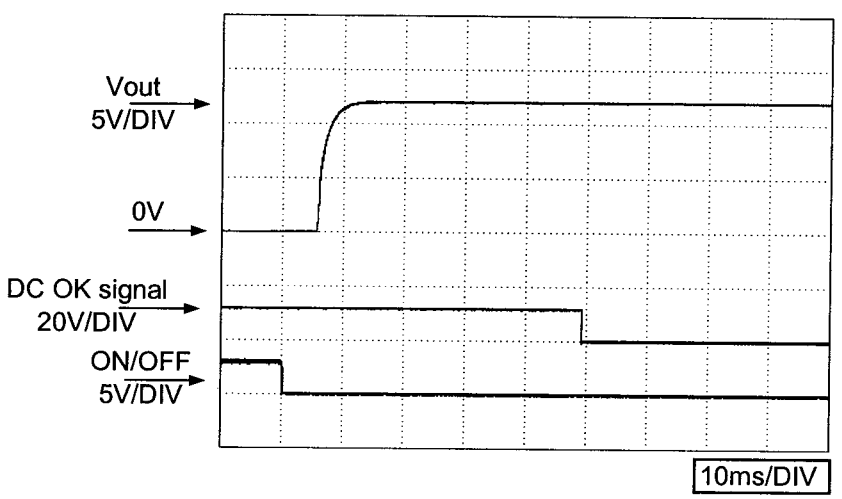


Vout=13.2V

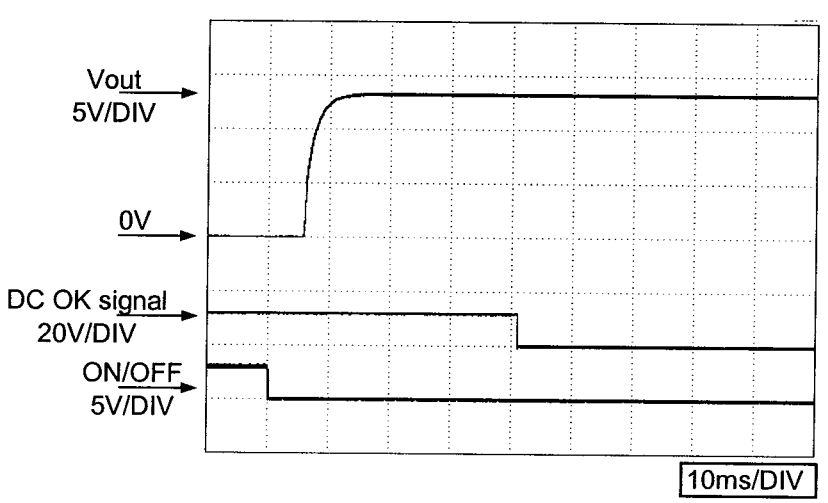
CONDITIONS: Ta=25˚C
Iout=0%
Iaux=0.25A
Vin:100VAC



Vout=10.5V



Vout=12V

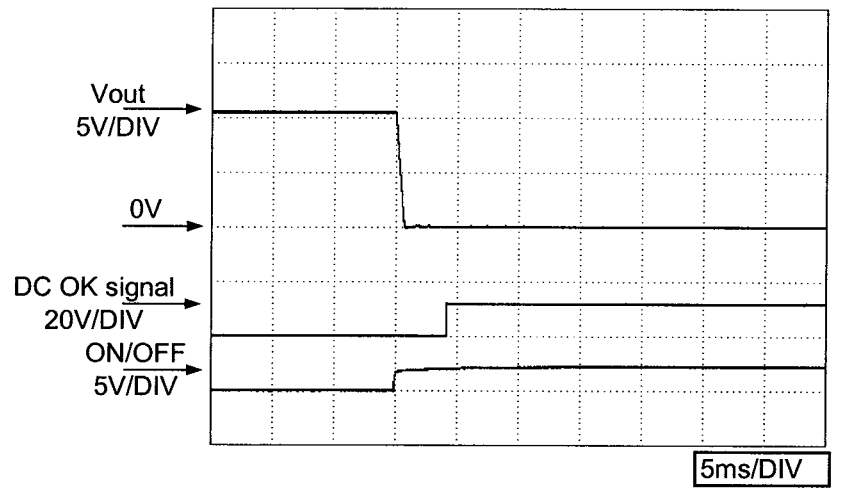


Vout=13.2V

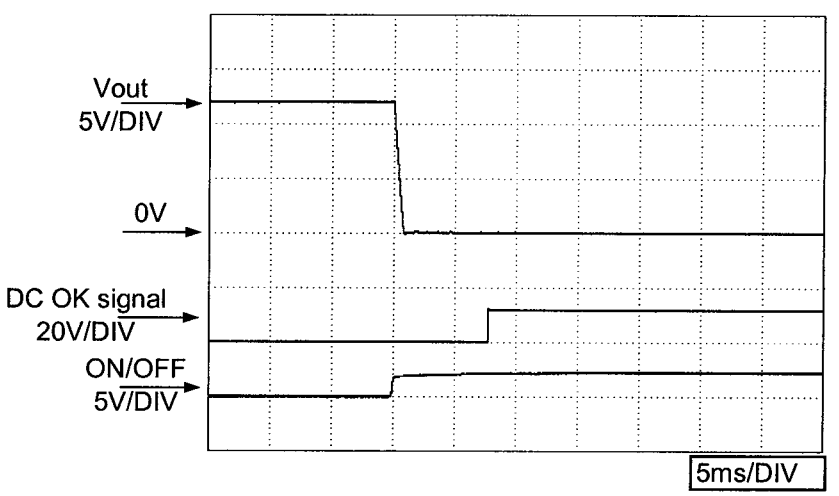
2-8. ON/OFF Control Output Fall characteristics

CONDITIONS:

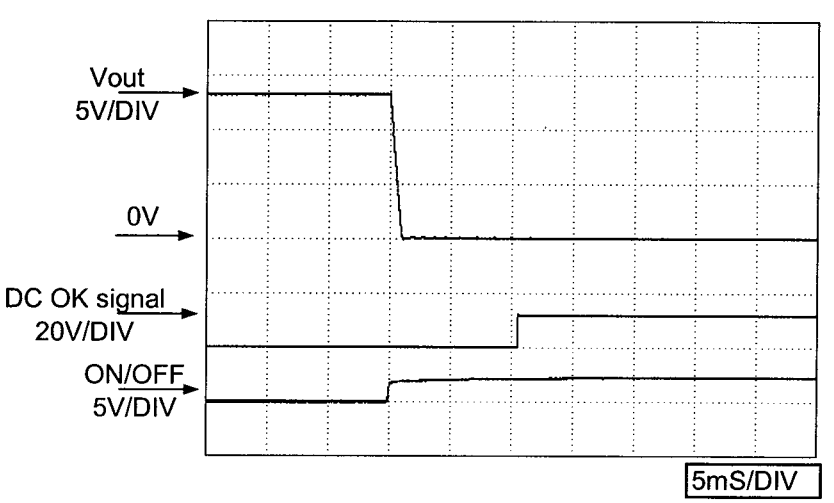
Ta=25°C
Iout=100%
Iaux=0.25A
Vin:100VAC



Vout=10.5V

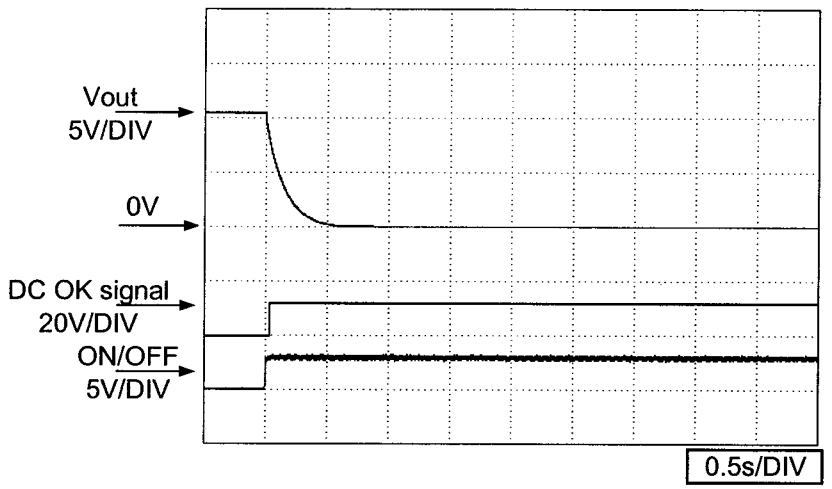


Vout=12V

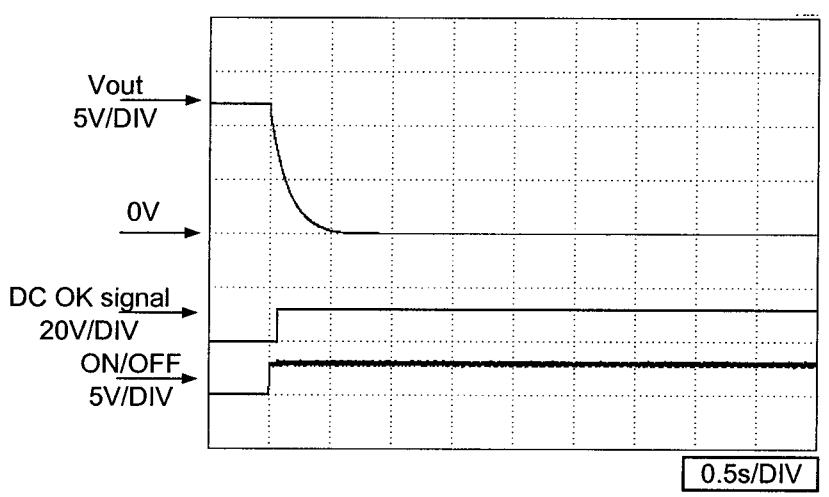


Vout=13.2V

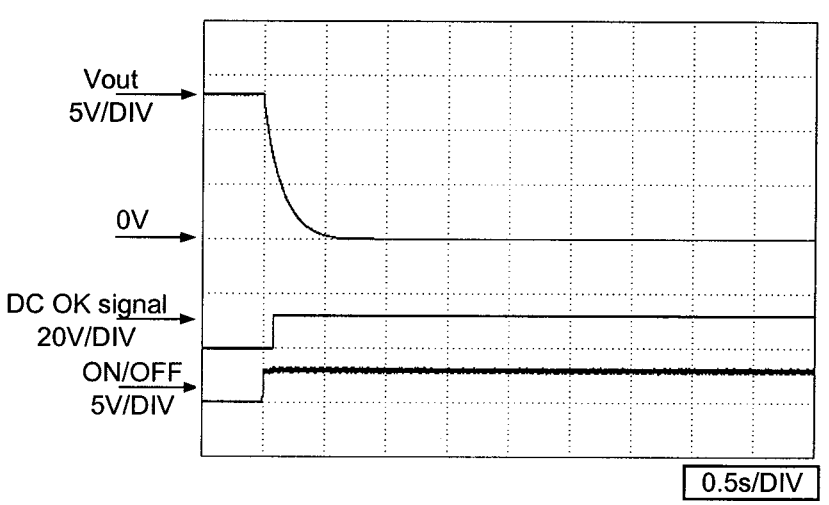
CONDITIONS: Ta=25°C
Iout=0%
Iaux=0.25A
Vin:100VAC



Vout=10.5V



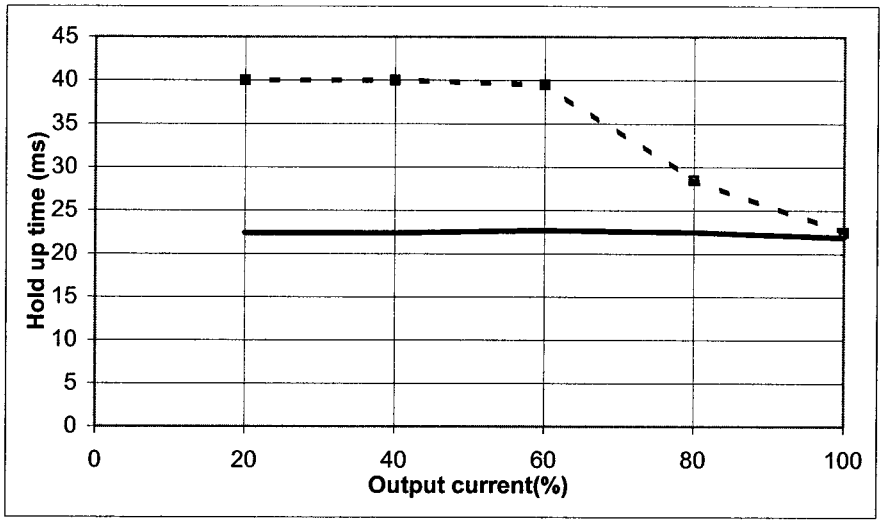
Vout=12V



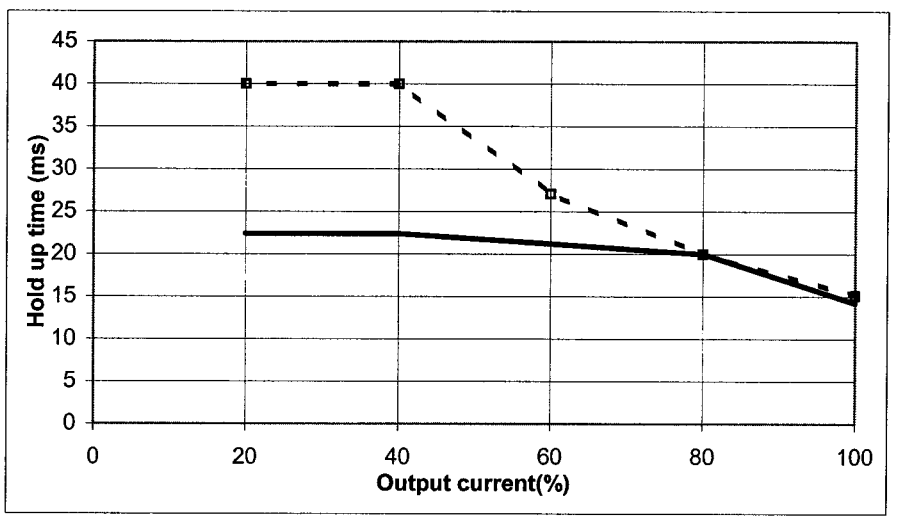
Vout=13.2V

2-9. Hold up time characteristics

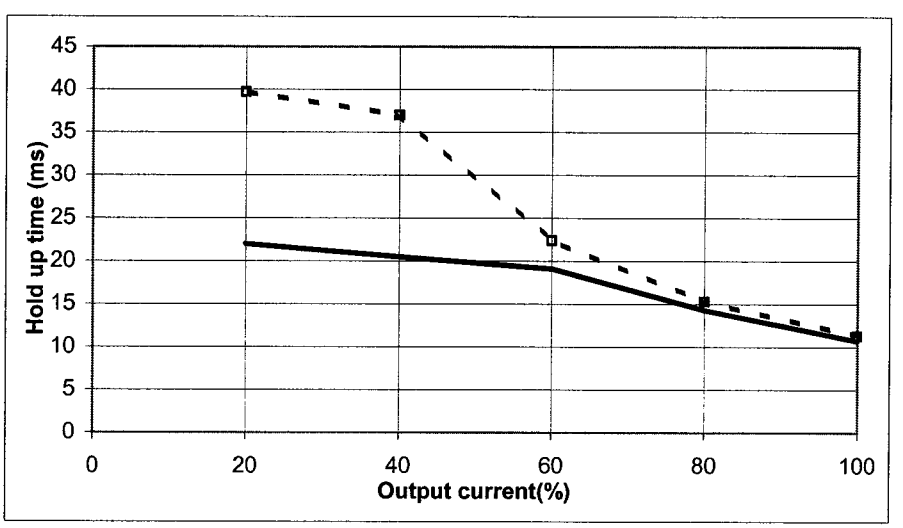
CONDITIONS: Ta=25˚C
AC 100 V ——
AC 200 V - - -



Vout=10.5V



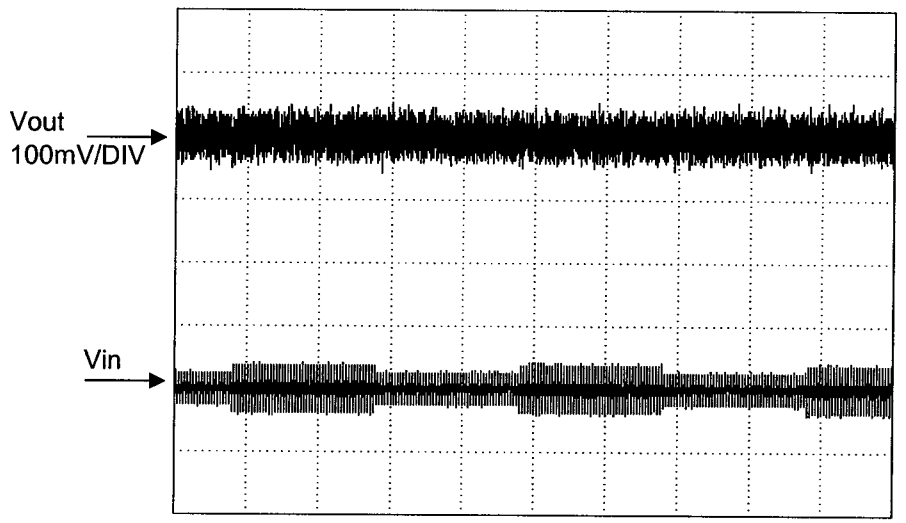
Vout=12V



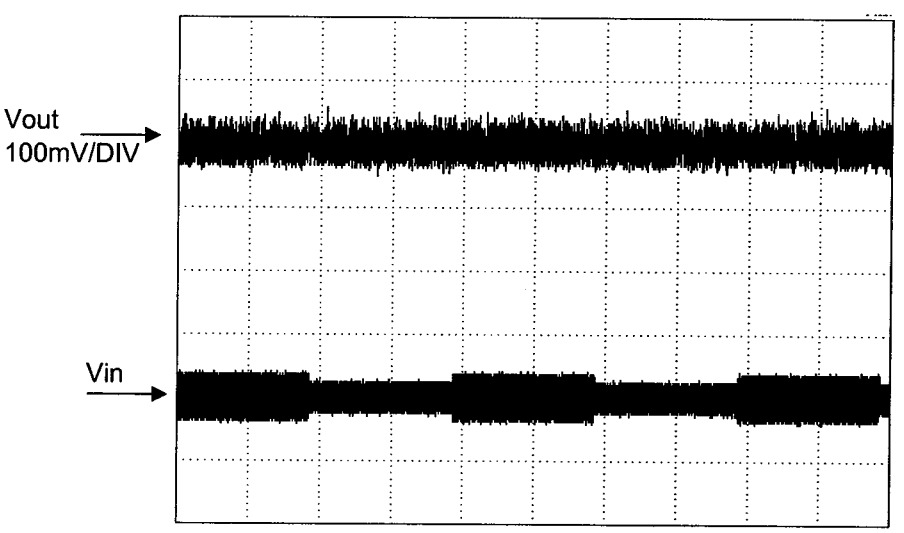
Vout=13.2V

2-10. Dynamic line response characteristics

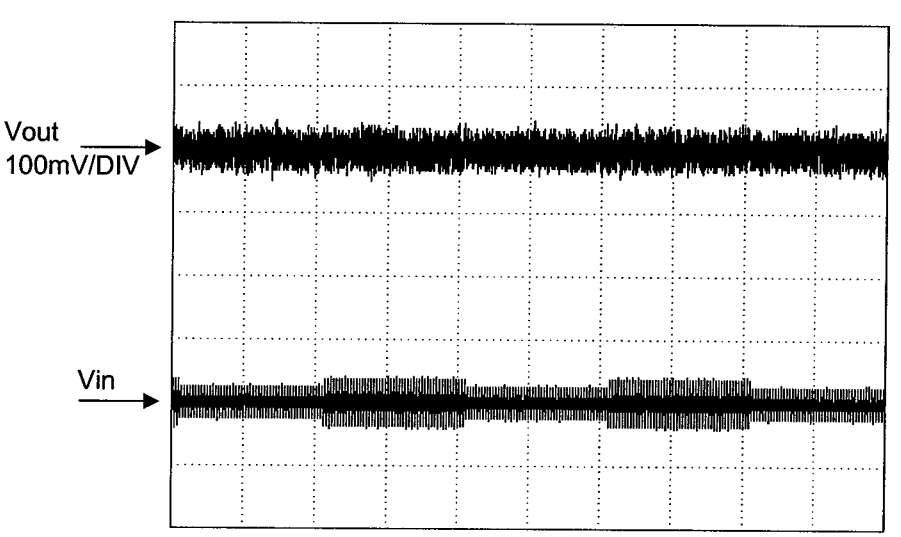
CONDITIONS: Ta:25°C
Vin: 85 ⇄ 132 VAC



Vout=10.5V
Iout=72A

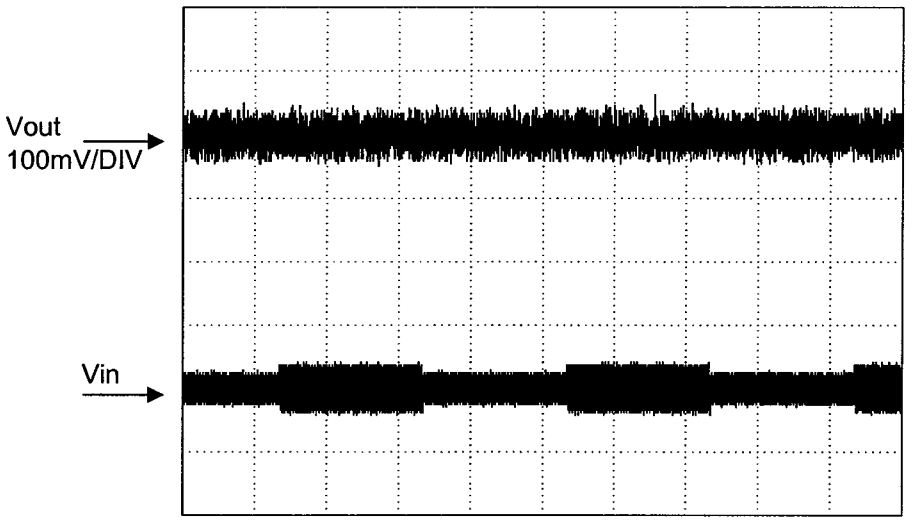


Vout=12V
Iout=72A

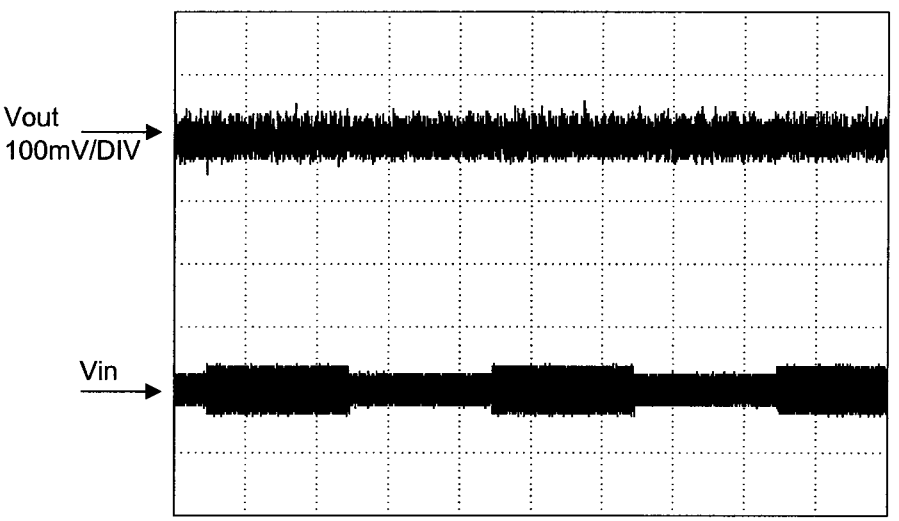


Vout=13.2V
Iout=66A

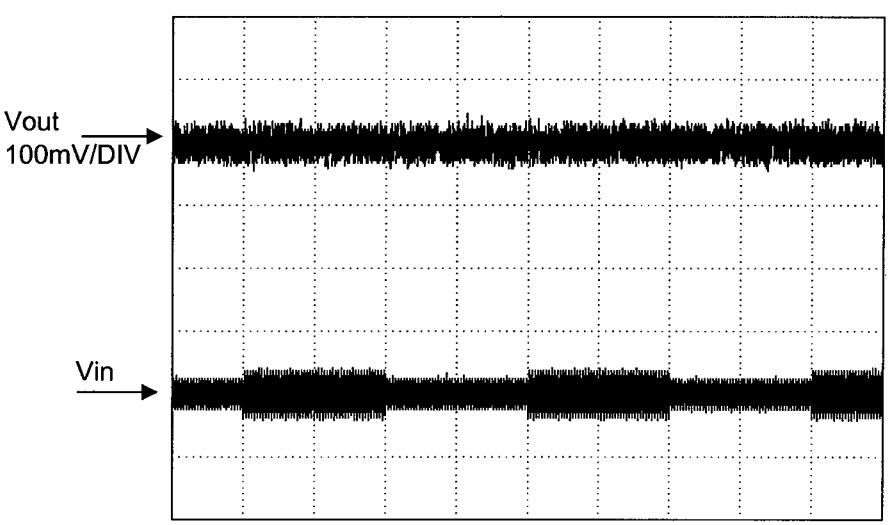
CONDITIONS: Ta: 25°C
Vin:170 ⇆ 265VAC



Vout=10.5V
Iout=72A



Vout=12V
Iout=72A



Vout=13.2V
Iout=66A

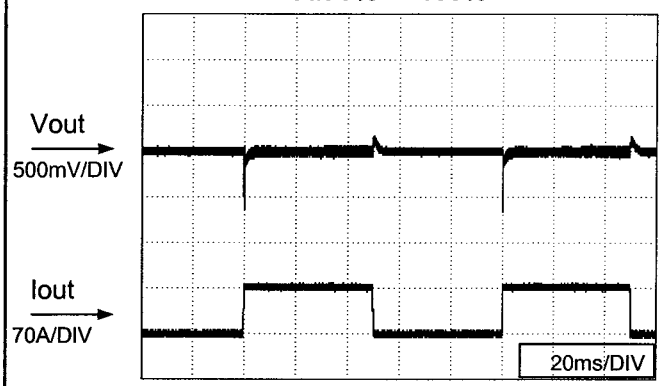
2-11. Dynamic load response characteristics

a) Vout= 10.5V

Ta=25°C
Vin=100VAC

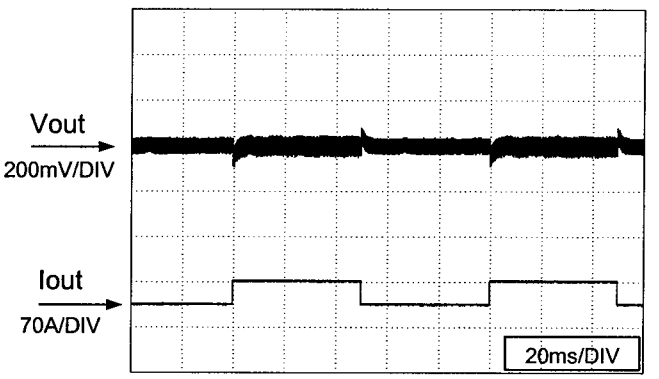
f:10 Hz

Iout 0% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.95 \\ -5.7 \end{matrix} \%$$

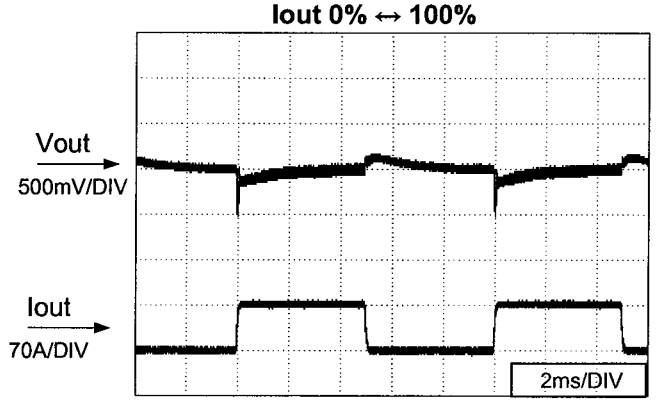
Iout 50% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.47 \\ -0.47 \end{matrix} \%$$

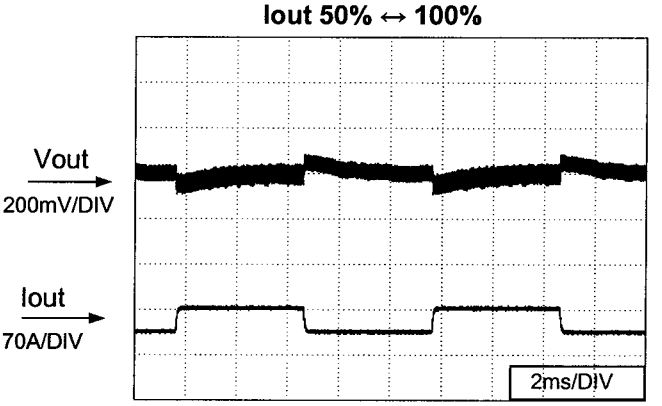
f:100 Hz

Iout 0% ↔ 100%



$$\Delta V_O : \begin{matrix} +1.42 \\ -4.76 \end{matrix} \%$$

Iout 50% ↔ 100%



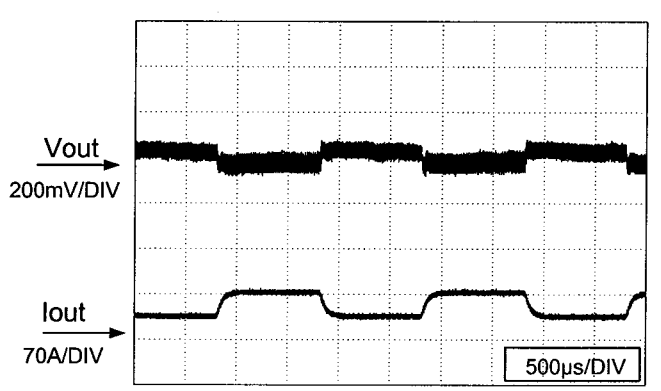
$$\Delta V_O : \begin{matrix} +0.47 \\ -0.47 \end{matrix} \%$$

f:500 Hz

Iout 0% ↔ 100%

$$\Delta V_O : \begin{matrix} +0.95 \\ -4.28 \end{matrix} \%$$

Iout 50% ↔ 100%



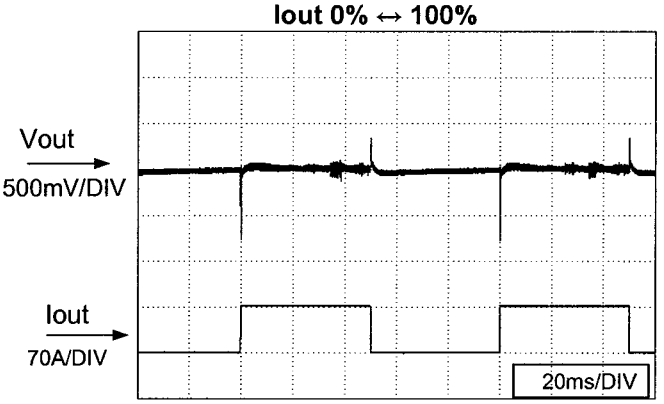
$$\Delta V_O : \begin{matrix} +0.47 \\ -0.47 \end{matrix} \%$$

b) Vout= 12V

Ta=25°C
Vin=100VAC

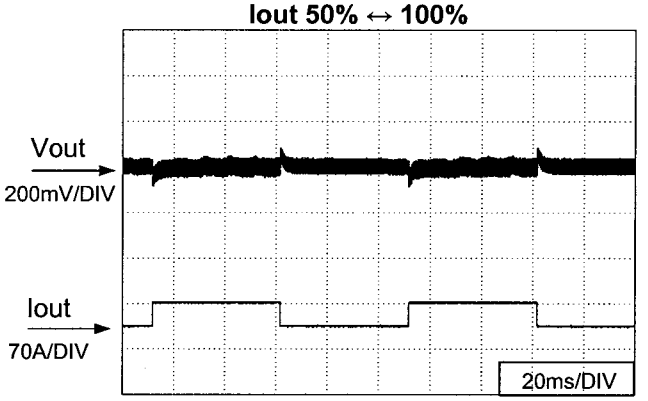
f:10 Hz

Iout 0% ↔ 100%



$$\Delta V_O = \begin{matrix} +2.5 \\ -5.8 \end{matrix} \%$$

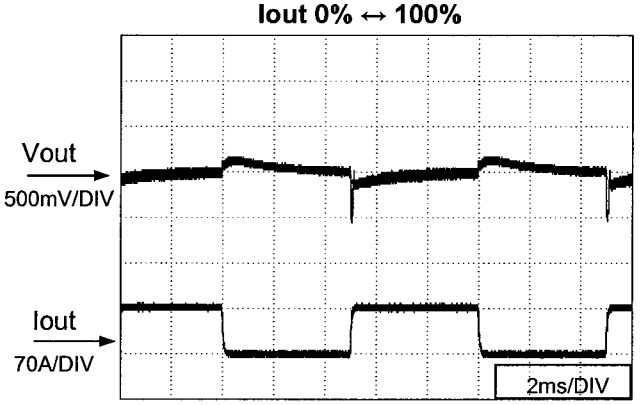
Iout 50% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.42 \\ -0.42 \end{matrix} \%$$

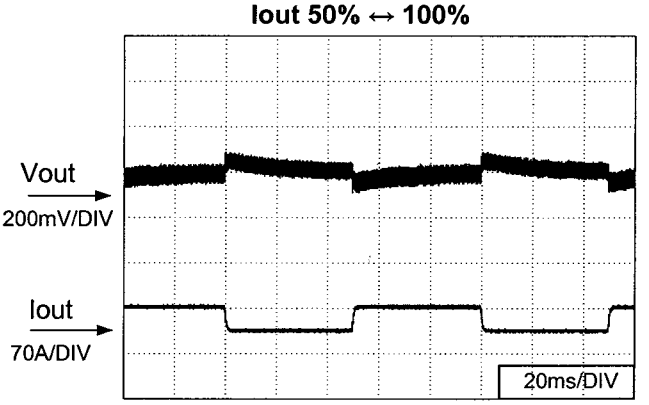
f:100 Hz

Iout 0% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.83 \\ -4.58 \end{matrix} \%$$

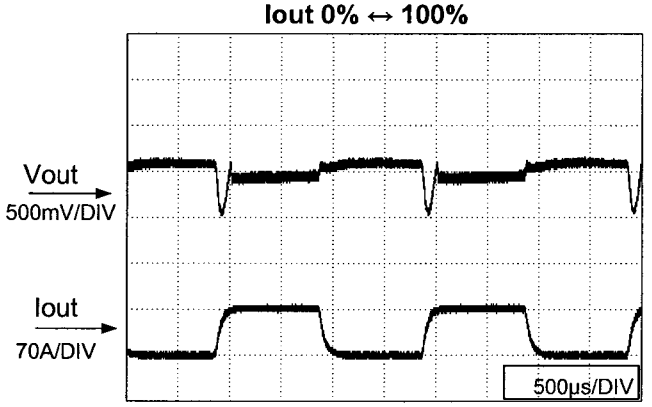
Iout 50% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.42 \\ -0.42 \end{matrix} \%$$

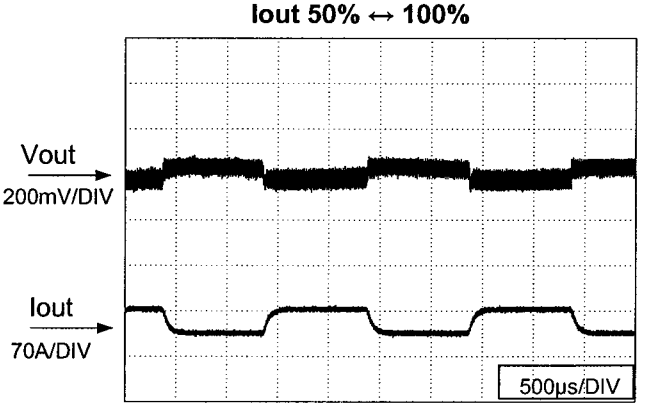
f:500 Hz

Iout 0% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.83 \\ -4.1 \end{matrix} \%$$

Iout 50% ↔ 100%



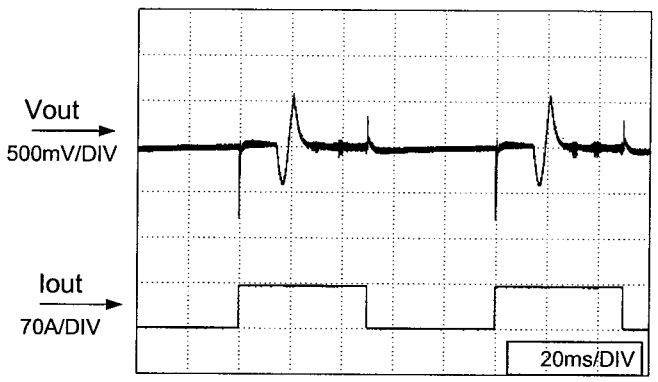
$$\Delta V_O = \begin{matrix} +0.42 \\ -0.42 \end{matrix} \%$$

c) Vout= 13.2V

Ta=25°C
Vin=100VAC

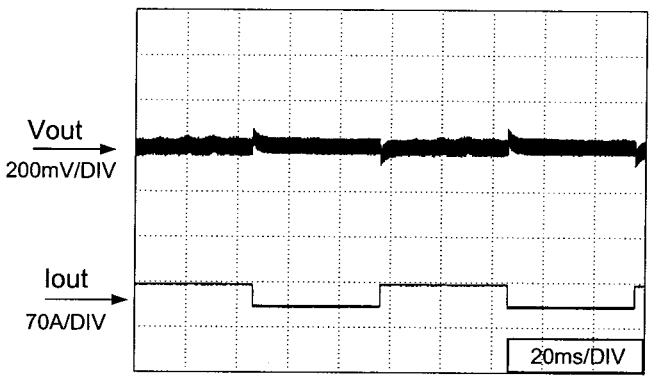
f:10 Hz

Iout 0% ↔ 100%



$$\Delta V_O = \begin{matrix} +4.5 \\ -5.8 \end{matrix} \%$$

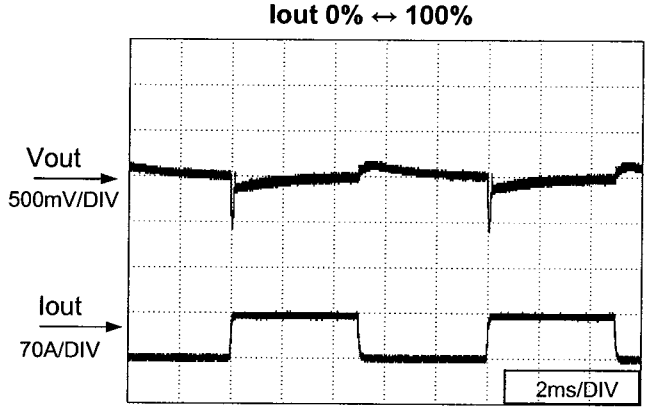
Iout 50% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.38 \\ -0.38 \end{matrix} \%$$

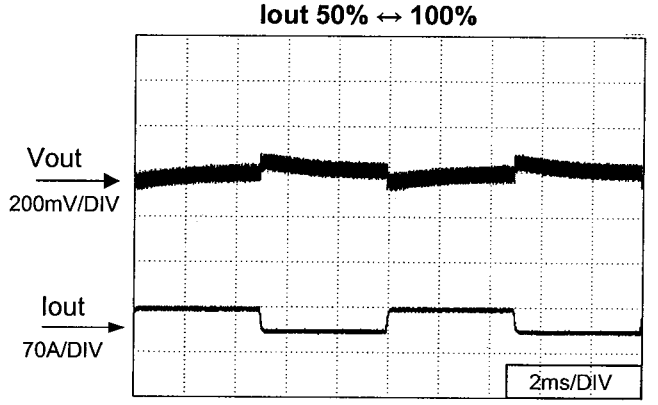
f:100 Hz

Iout 0% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.78 \\ -3.78 \end{matrix} \%$$

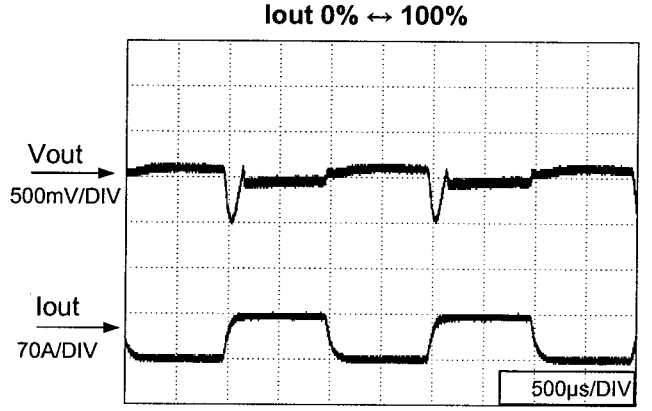
Iout 50% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.38 \\ -0.38 \end{matrix} \%$$

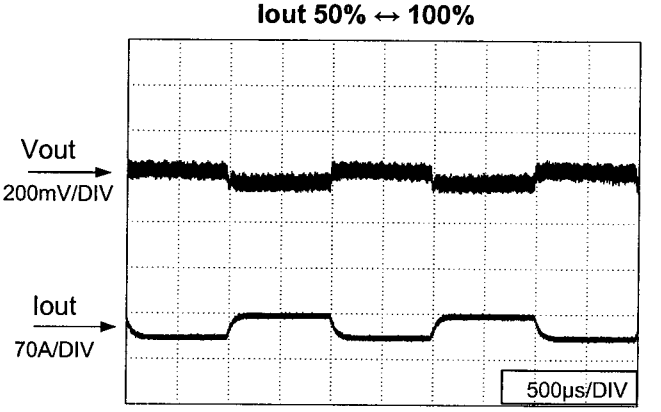
f:500 Hz

Iout 0% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.78 \\ -3.78 \end{matrix} \%$$

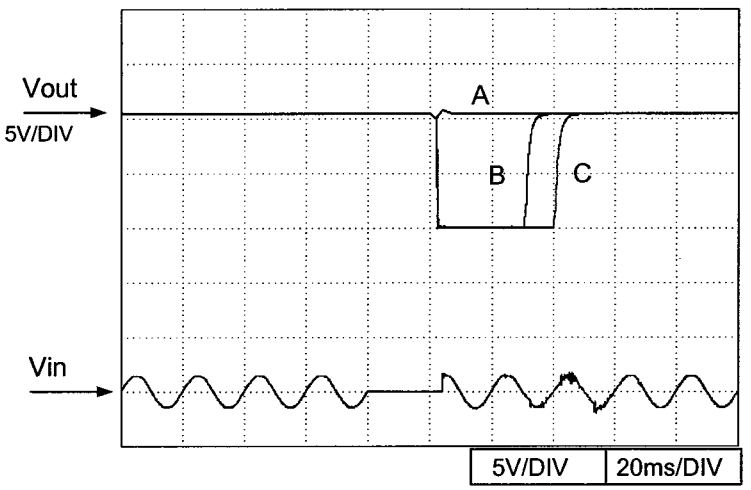
Iout 50% ↔ 100%



$$\Delta V_O = \begin{matrix} +0.38 \\ -0.38 \end{matrix} \%$$

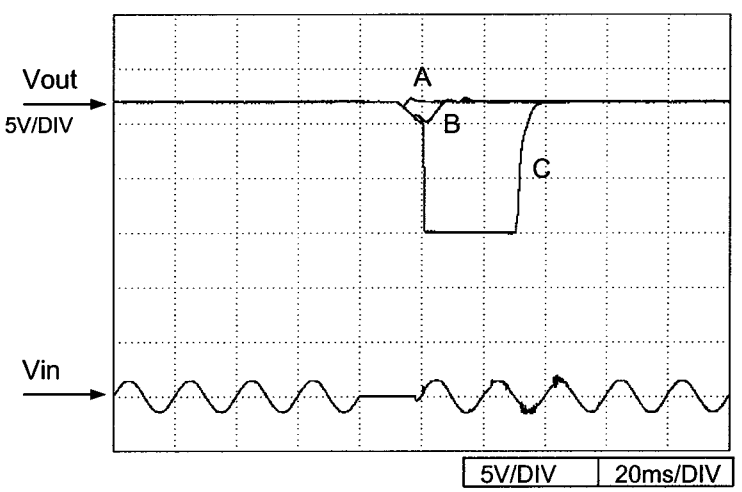
2-12. Response to Brown-out characteristics

CONDITIONS: Ta:25°C
Vin:100VAC
Iout:100%



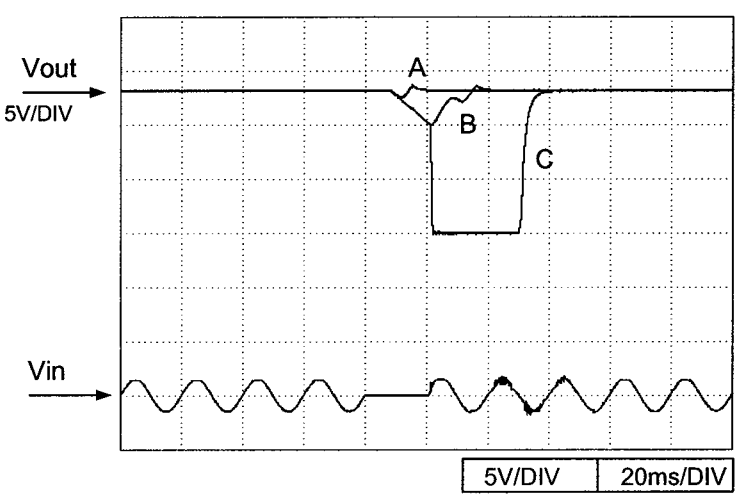
Vout=10.5V

Brown-out time:
A: 21msec
B: 22msec
C: 23msec



Vout=12V

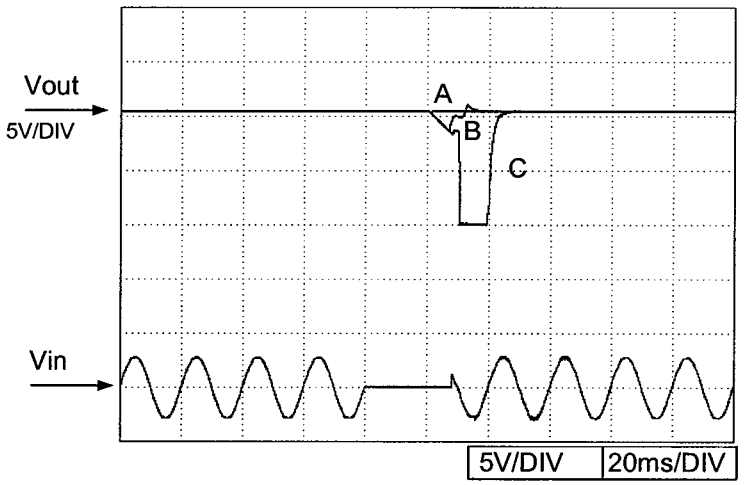
Brown-out time:
A: 15msec
B: 17msec
C: 21msec



Vout=13.2V

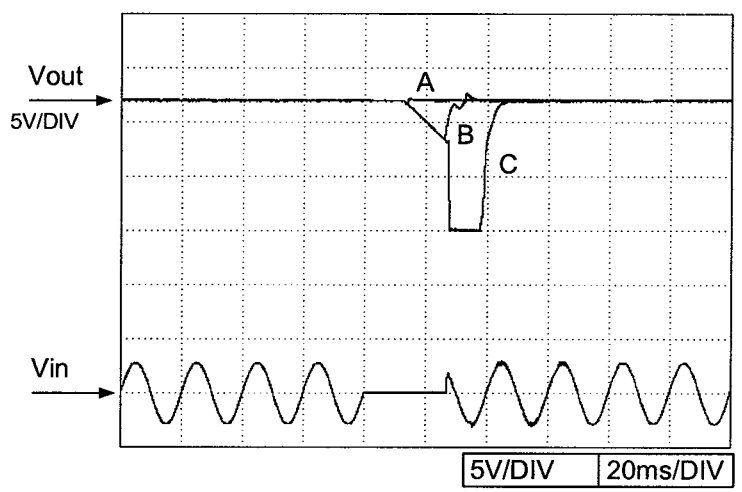
Brown-out time:
A: 8msec
B: 20msec
C: 22msec

CONDITIONS: Ta:25°C
Vin:200VAC
Iout:100%



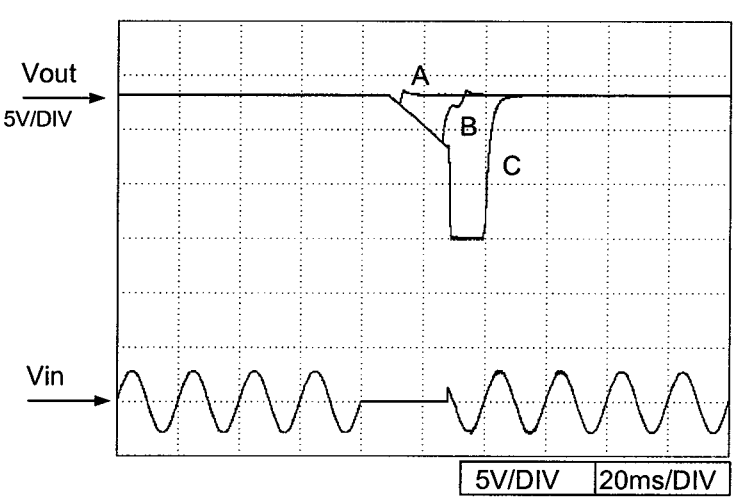
Vout=10.5V

Brown-out time:
A: 21msec
B: 27msec
C: 28msec



Vout=12V

Brown-out time:
A: 17msec
B: 26msec
C: 27msec

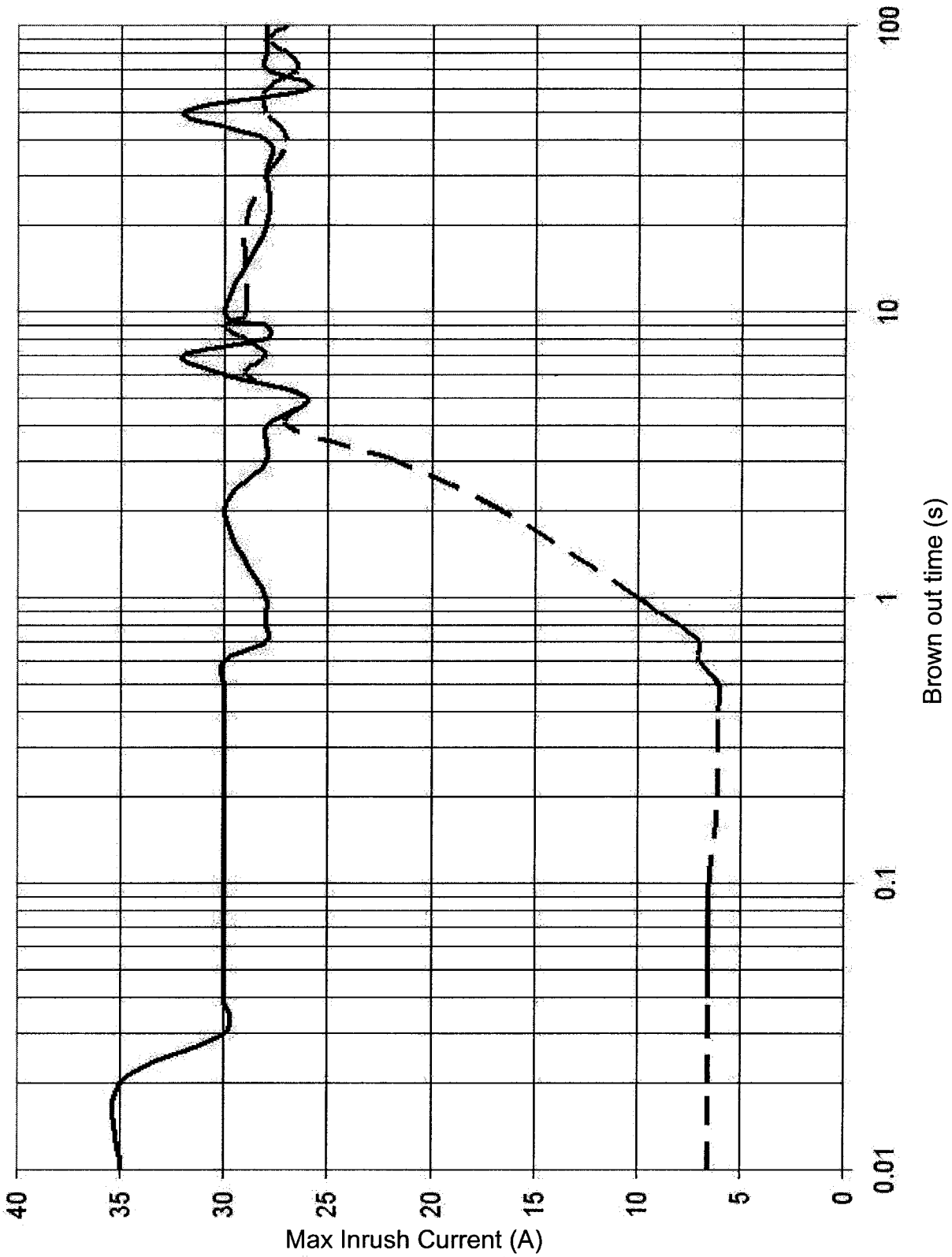


Vout=13.2V

Brown-out time:
A: 12msec
B: 26msec
C: 28msec

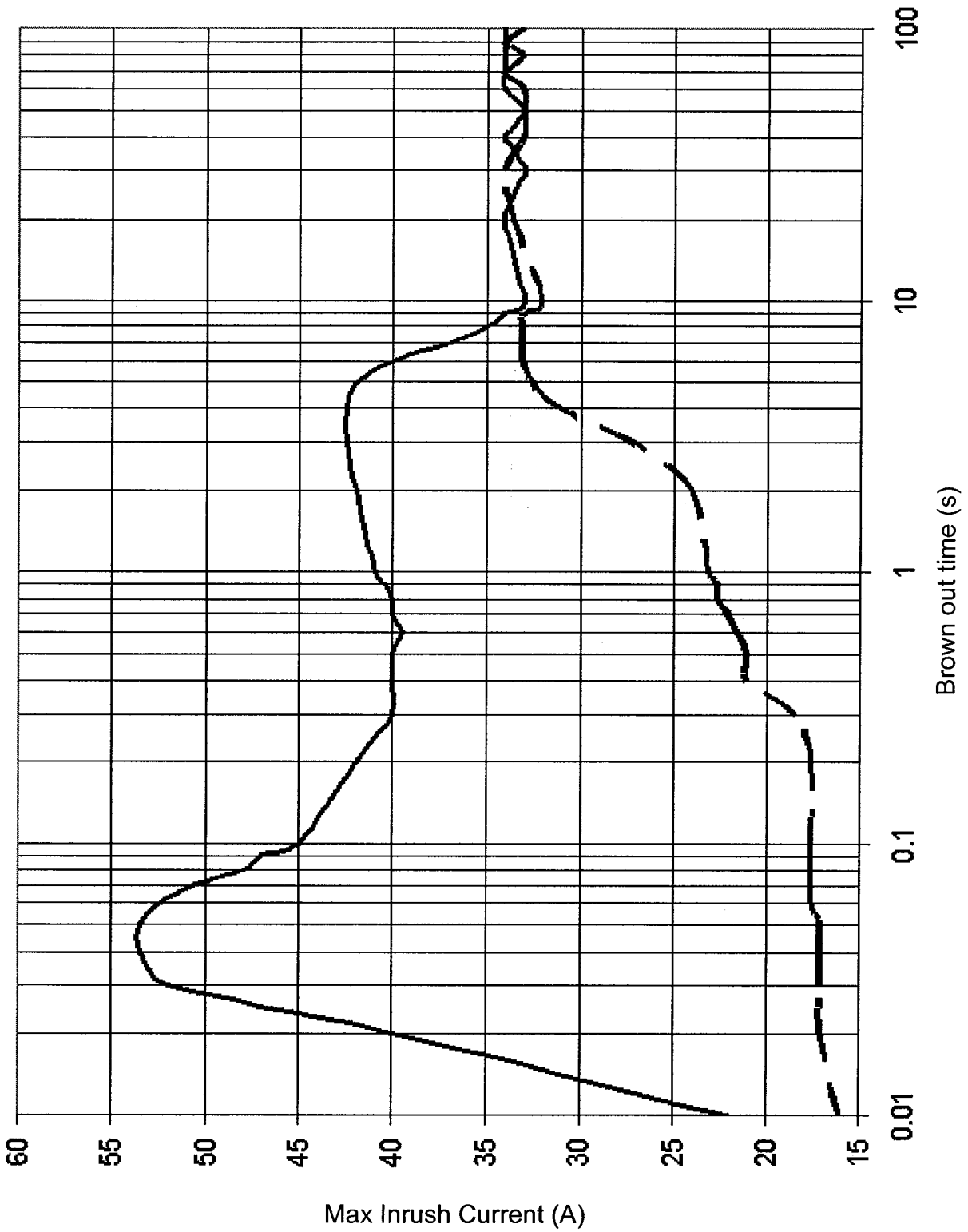
2-13. Inrush current characteristics

CONDITIONS: Ta:25°C
Vin:100VAC
Vout:12V
Iout:100% ——
Iout:0% - - - - -



CONDITIONS:

Ta:25°C
Vin:200VAC
Vout:12V
Iout:100% ——
Iout:0% - - - - -

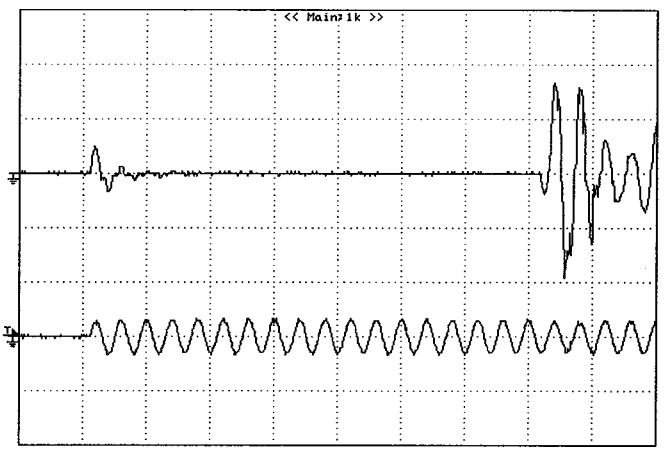


2-14. Inrush current waveform

CONDITIONS: Ta: 25°C
Vin: 100VAC
Vout: 12V
Iout: 72A

switch on phase angel of input AC voltage

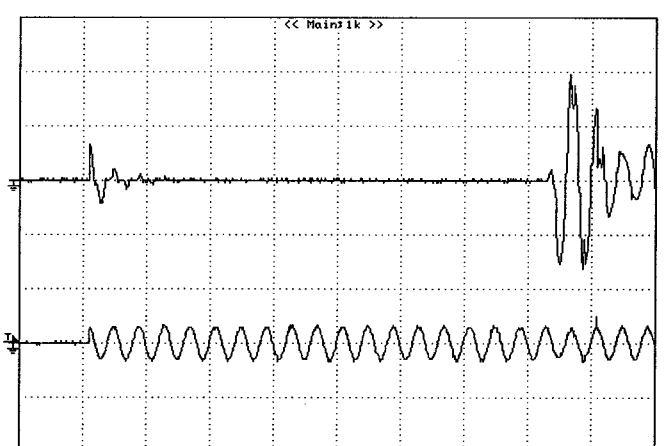
Ø=0°



20A/DIV	50ms/DIV

switch on phase angel of input AC voltage

Ø=90°



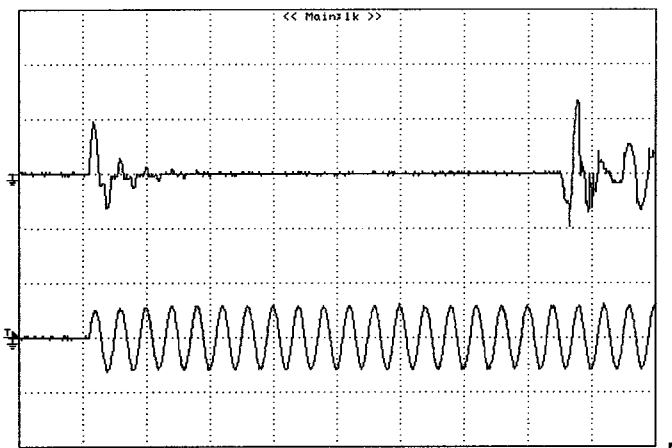
20A/DIV	50ms/DIV

CONDITIONS:

Ta: 25°C
Vin: 200VAC
Vout: 12V
Iout: 72A

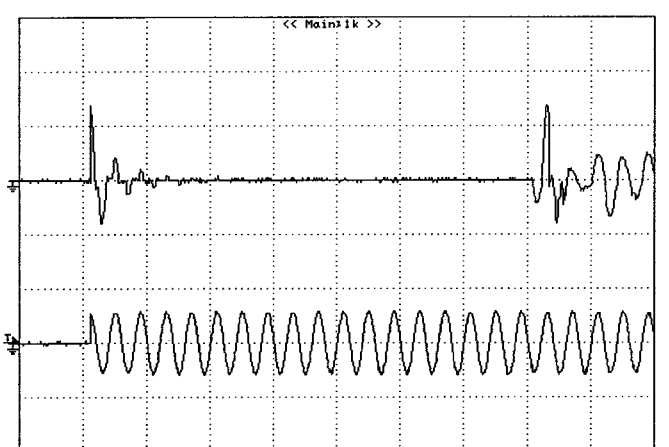
switch on phase angel of input AC voltage

Ø=0°



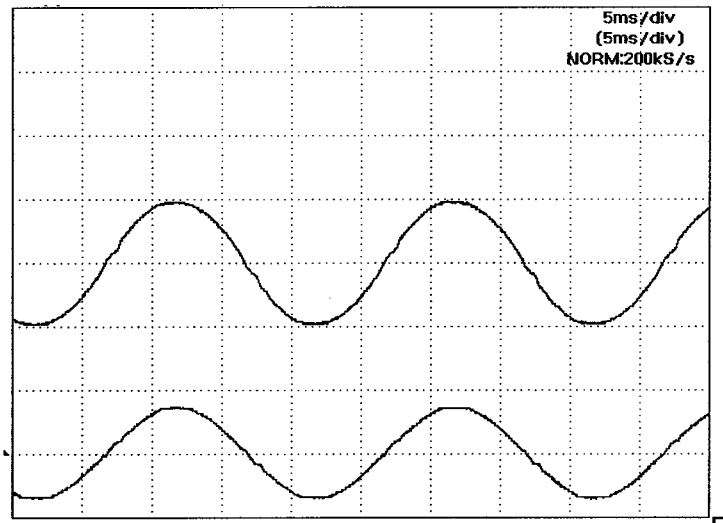
switch on phase angel of input AC voltage

Ø=90°

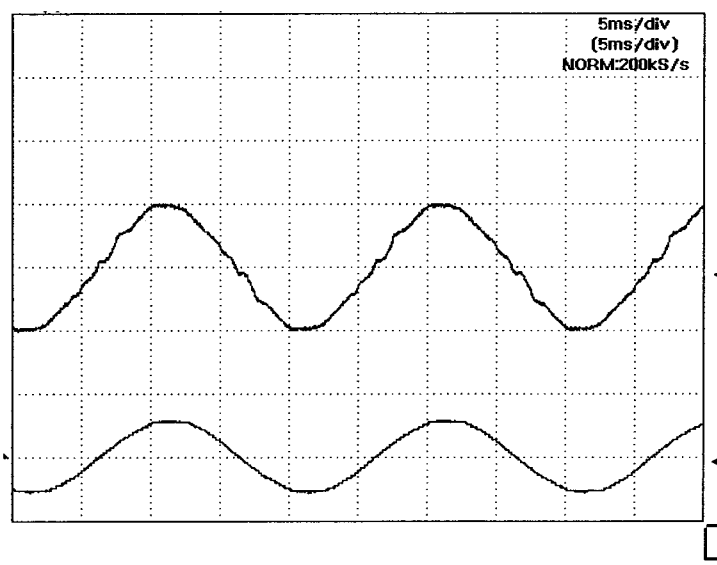


2-15. Input current waveform

CONDITIONS: Ta: 25°C
Vin: 100VAC
Vout: 12V
Iout: 72A



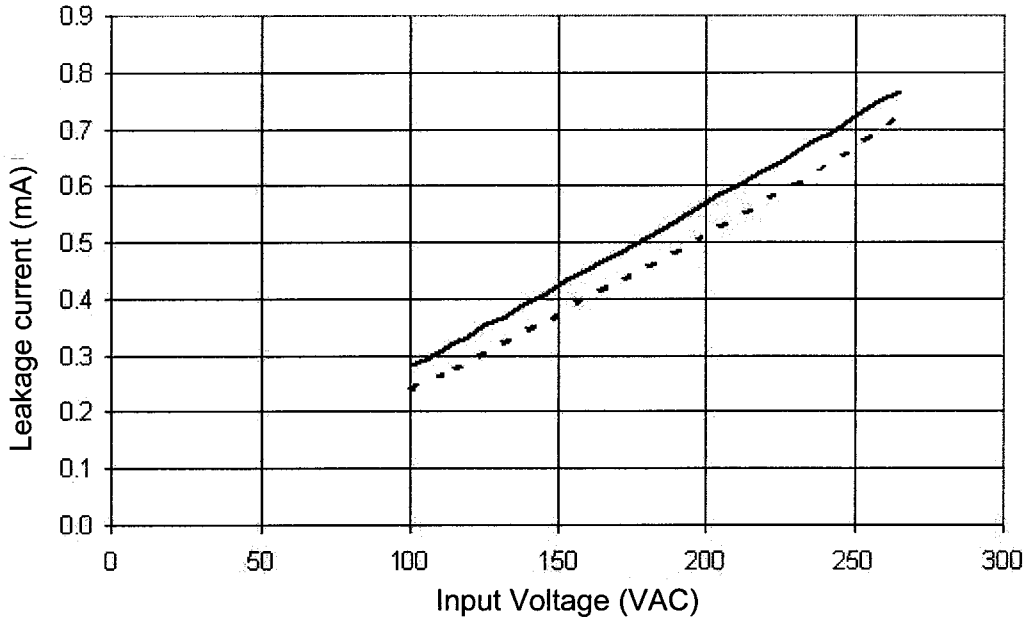
CONDITIONS: Ta: 25°C
Vin: 200VAC
Vout: 12V
Iout: 72A



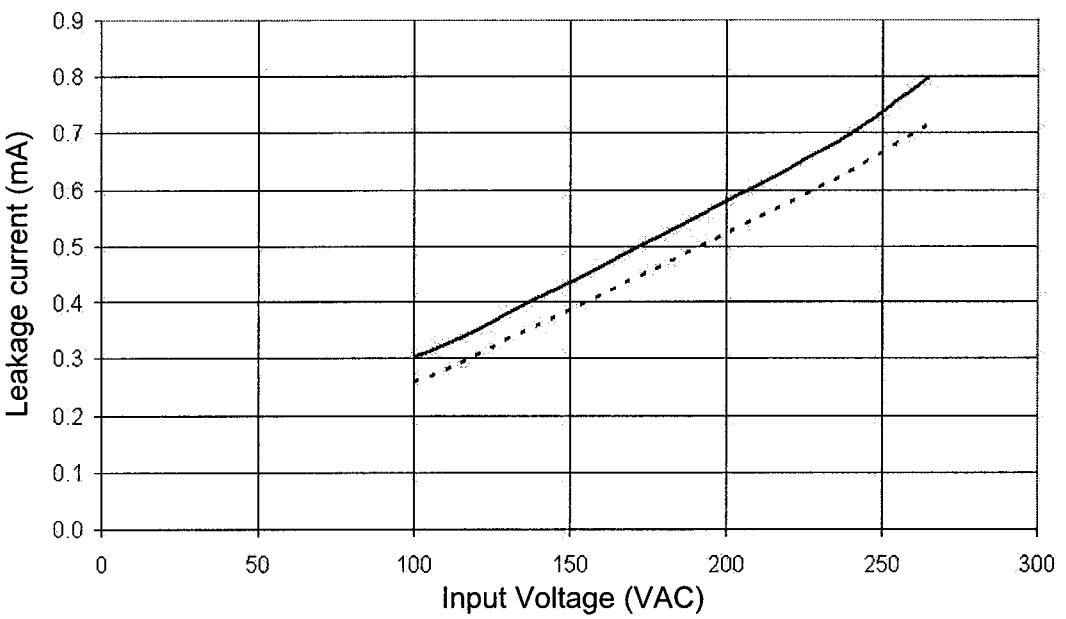
2-16. Leakage current characteristics

CONDITIONS: Ta=25˚C
Vout: 12V
Iout: 72A ——
0% .....

LINE-GND.



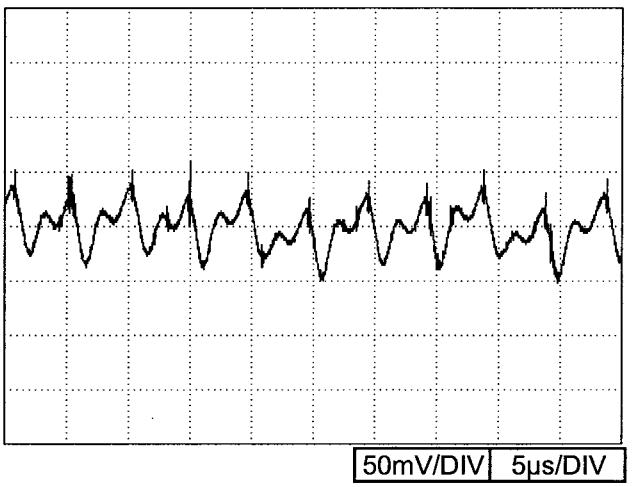
NEUTRAL-GND



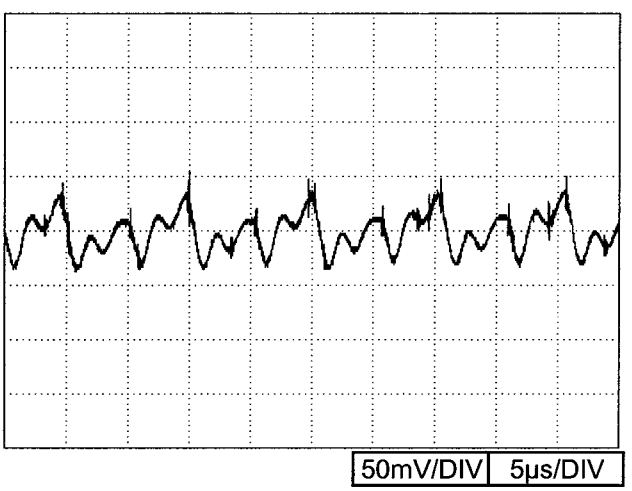
2-17. Output ripple & noise waveforms

NORMAL MODE

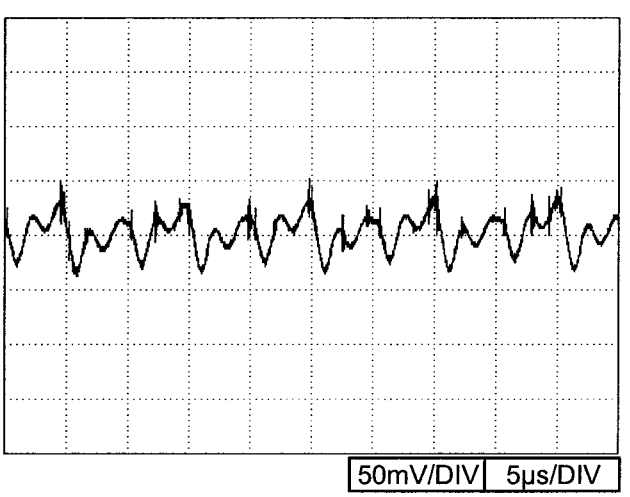
CONDITIONS: Ta = 25°C
Vin=100VAC
Iout=100%



Vout=10.5V



Vout=12V

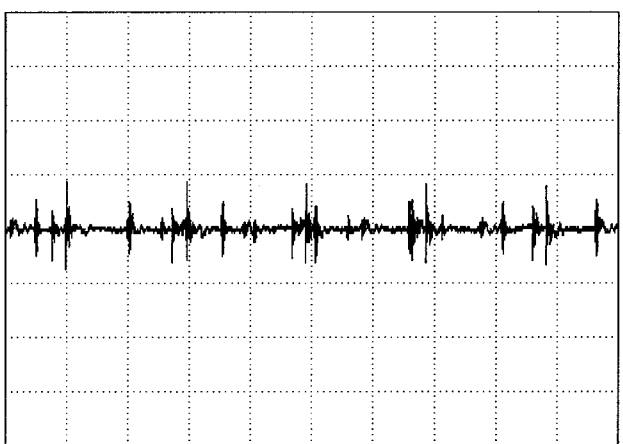


Vout=13.2V

NORMAL MODE

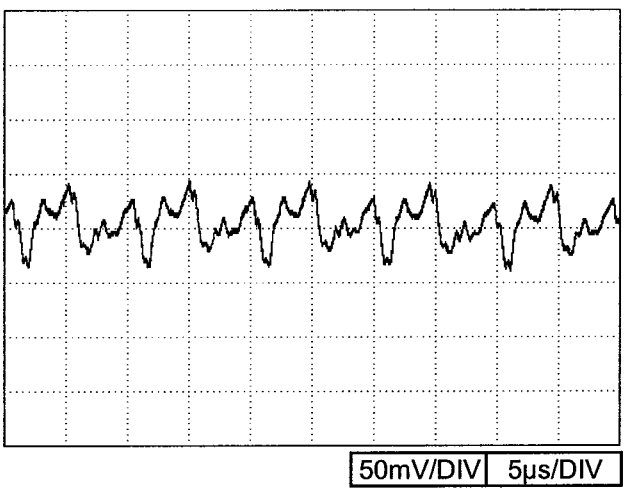
CONDITIONS: Ta=25°C
Vin=100VAC
Vo=12V
Io=72A
Iaux=0.25A

Auxiliary supply

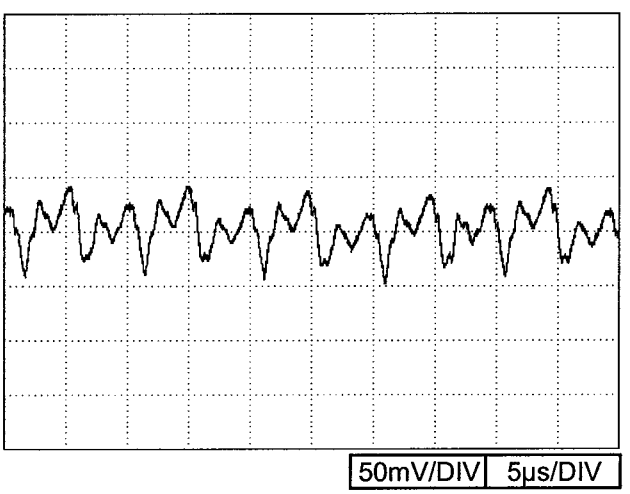


NORMAL AND COMMON MODE +Vo TERMINAL

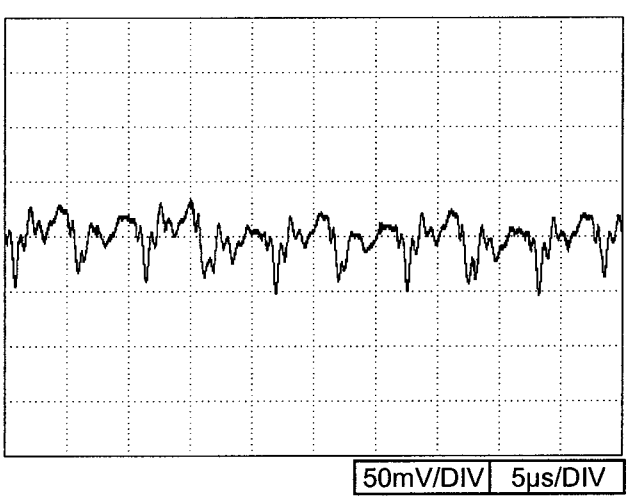
CONDITIONS: Ta = 25°C
Vin=100VAC
Iout=100%



Vout=10.5V



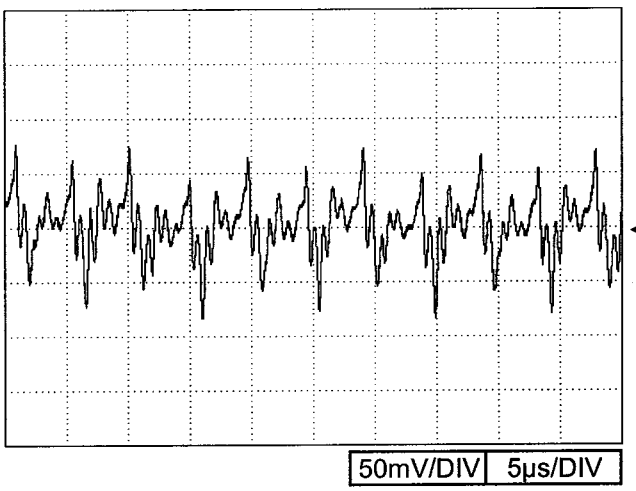
Vout=12V



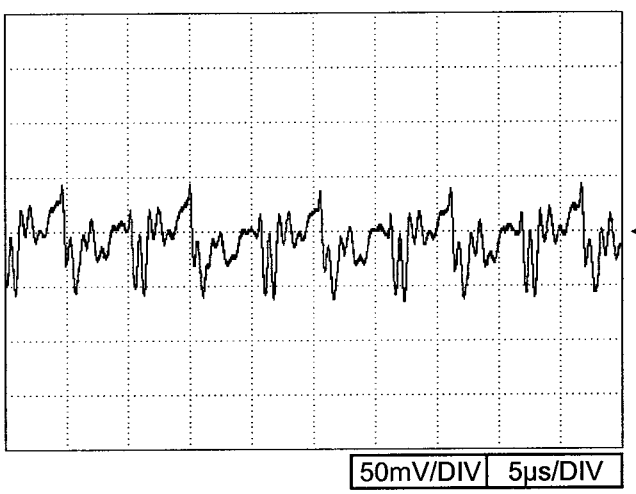
Vout=13.2V

NORMAL AND COMMON MODE -Vo TERMINAL

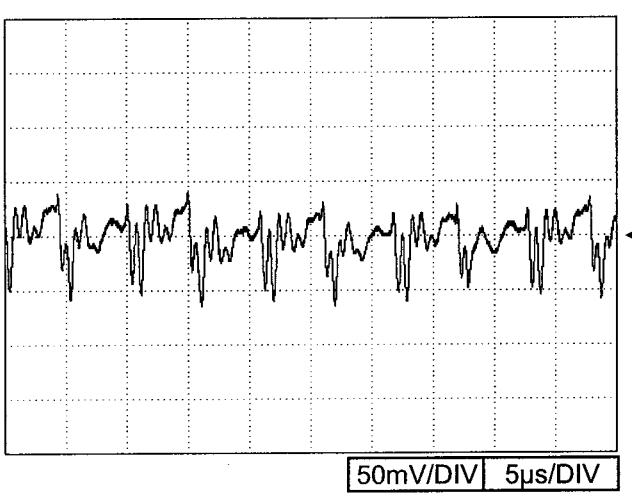
CONDITIONS: Ta = 25°C
Vin=100VAC
Iout=100%



Vout=10.5V



Vout=12V



Vout=13.2V