HFE2500

EVALUATION DATA

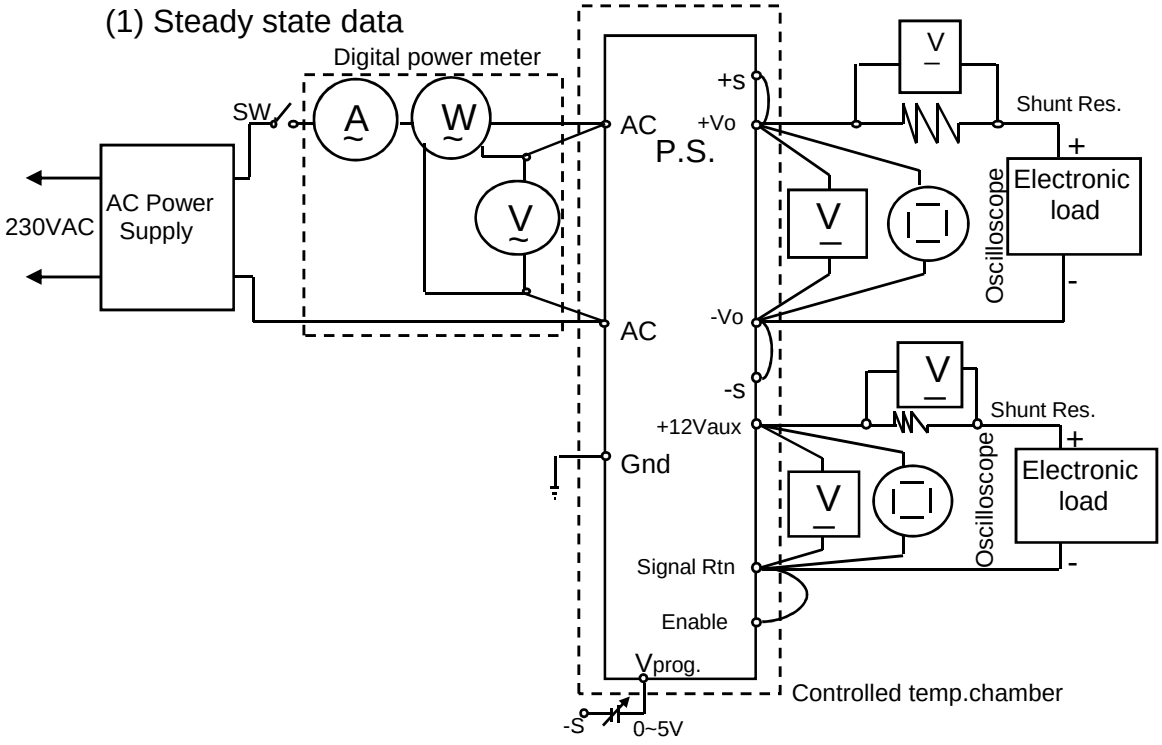
DWG. No. IA689-53-01		
APPD	CHK	DWG
Doron P. Dec-18-11	13-Dec-11	DOTAN 13.12.11

INDEX

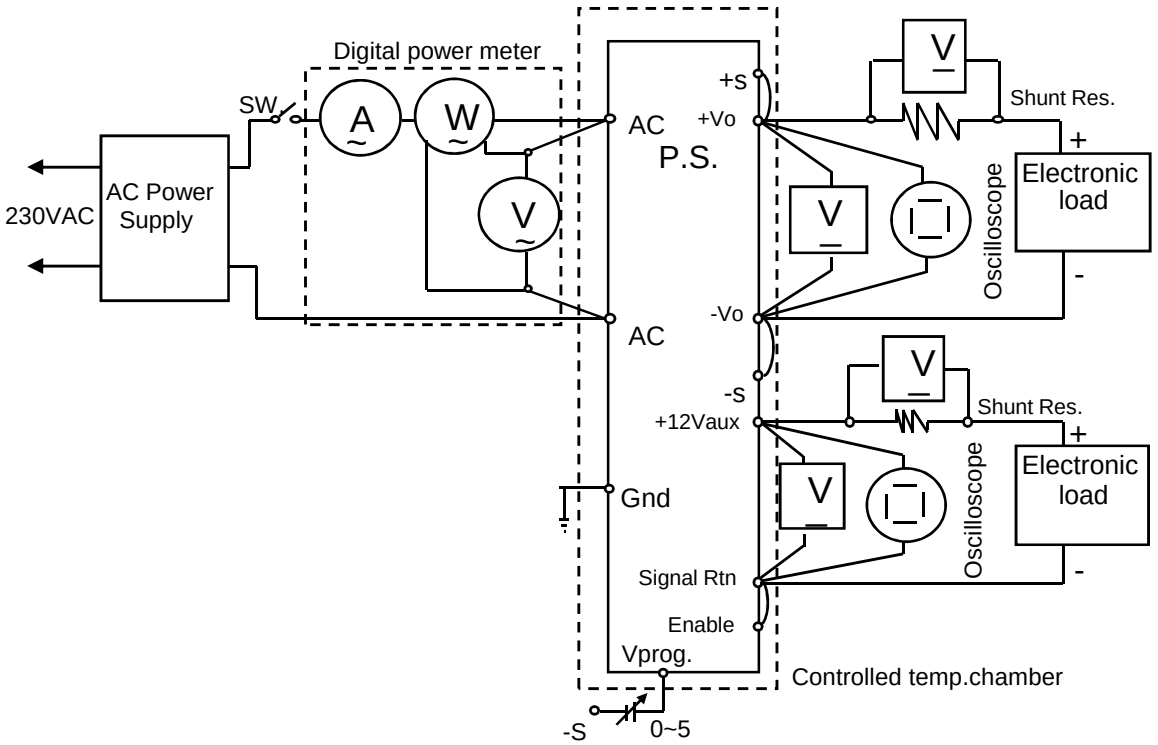
1.EVALUATION METHOD

1-1.Circuits used for determination

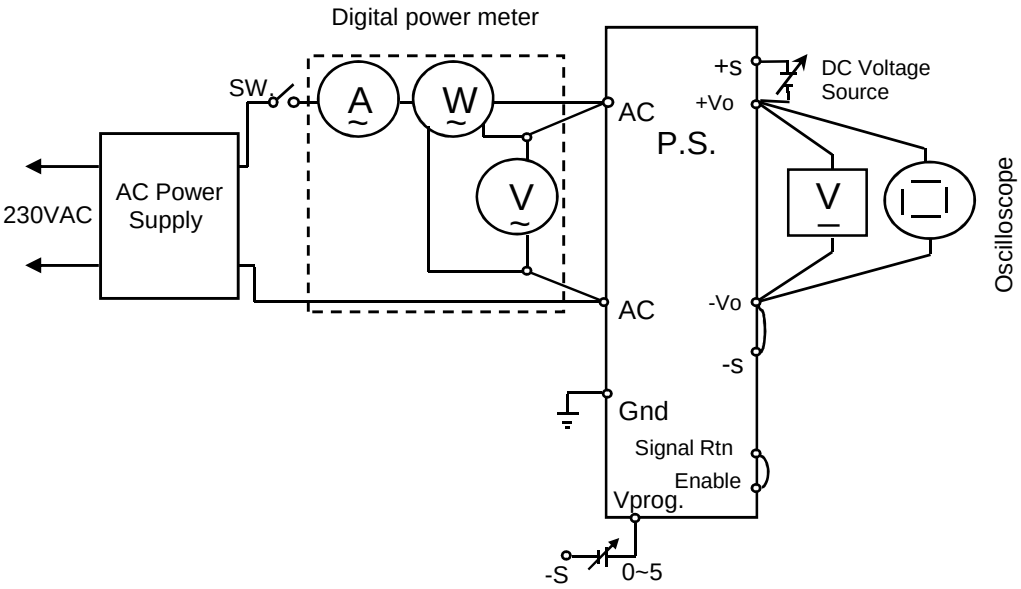
(1) Steady state data



(2) Warm up voltage drift & temperature stability



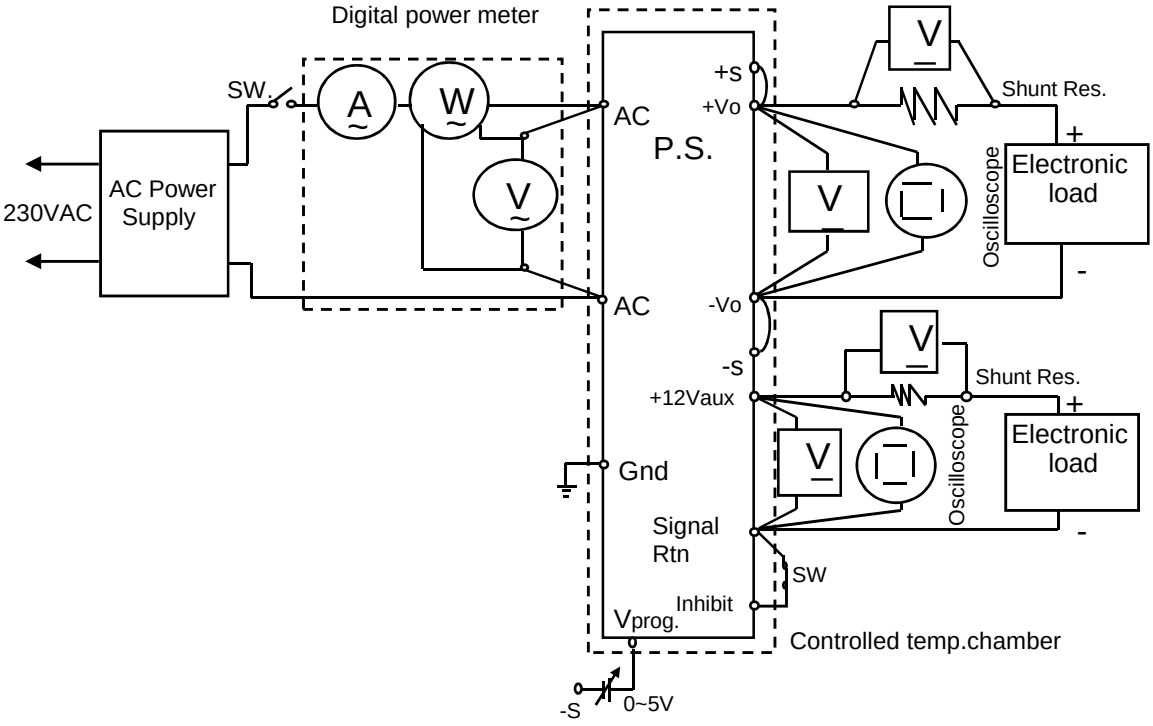
(3) Over Voltage Protection (OVP) characteristics



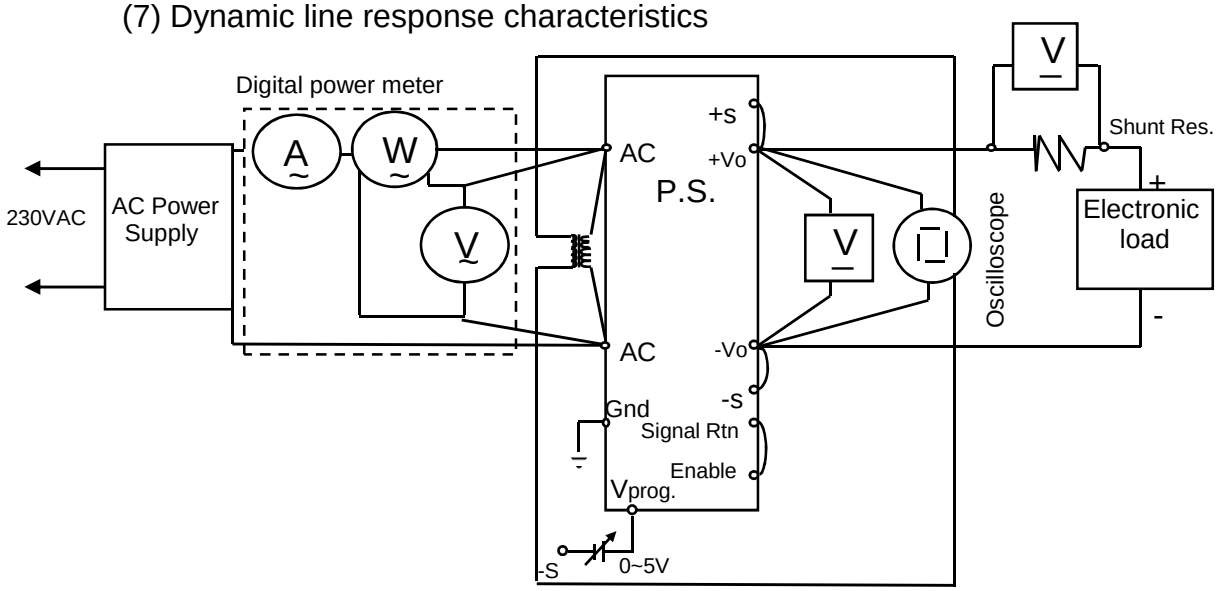
(4) Over Current Protection (OCP) characteristics

Same as item (1)

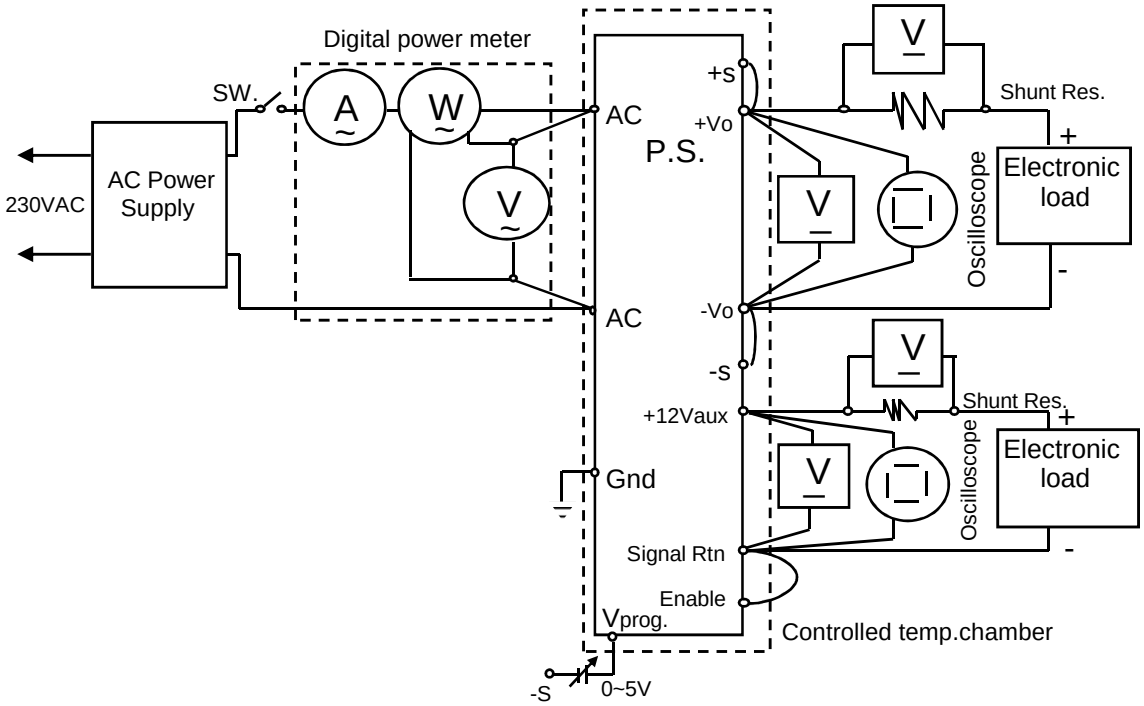
(5) (6) Output Rise & Fall Characteristics



(7) Dynamic line response characteristics

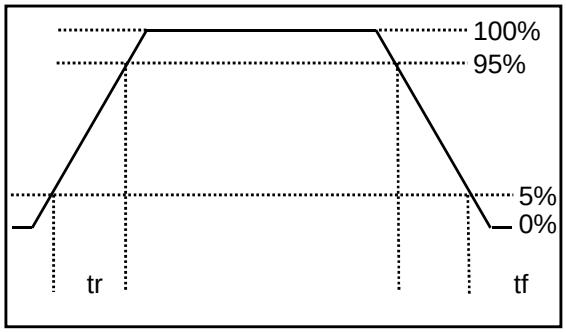


(8) Dynamic load response characteristics



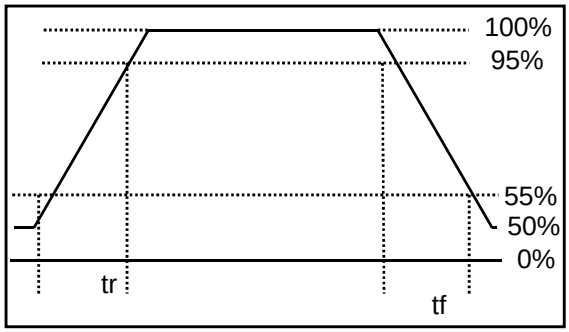
Dynamic load response characteristics

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



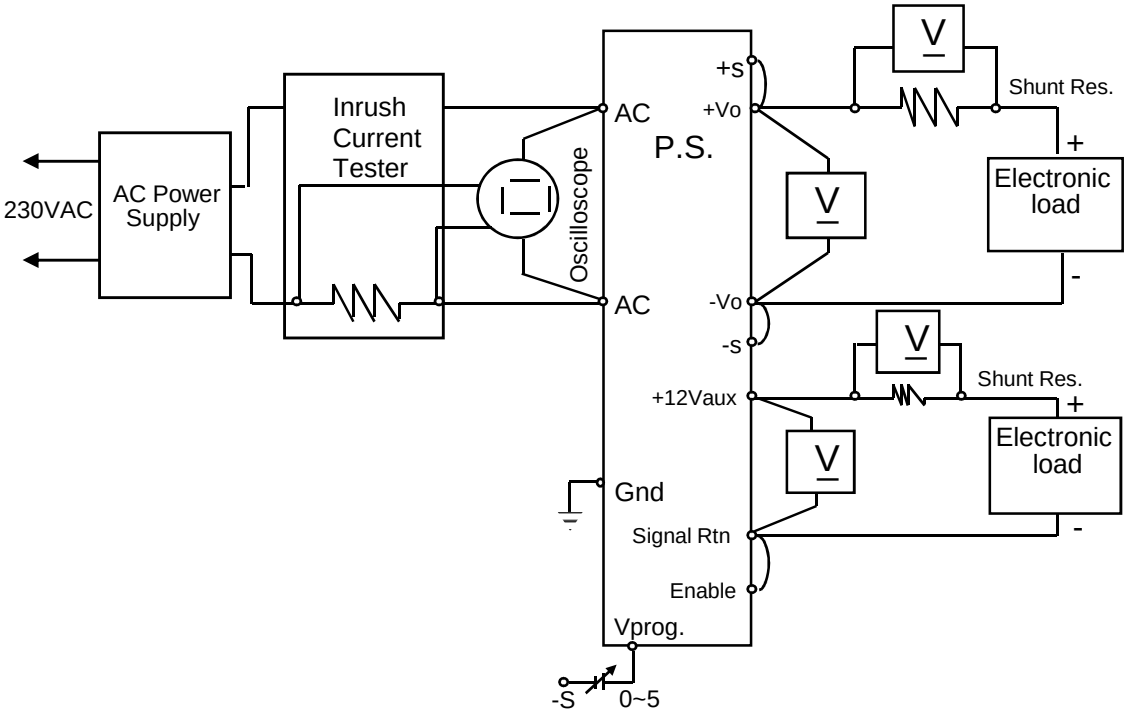
t_r = 100µs
t_f = 100µs

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

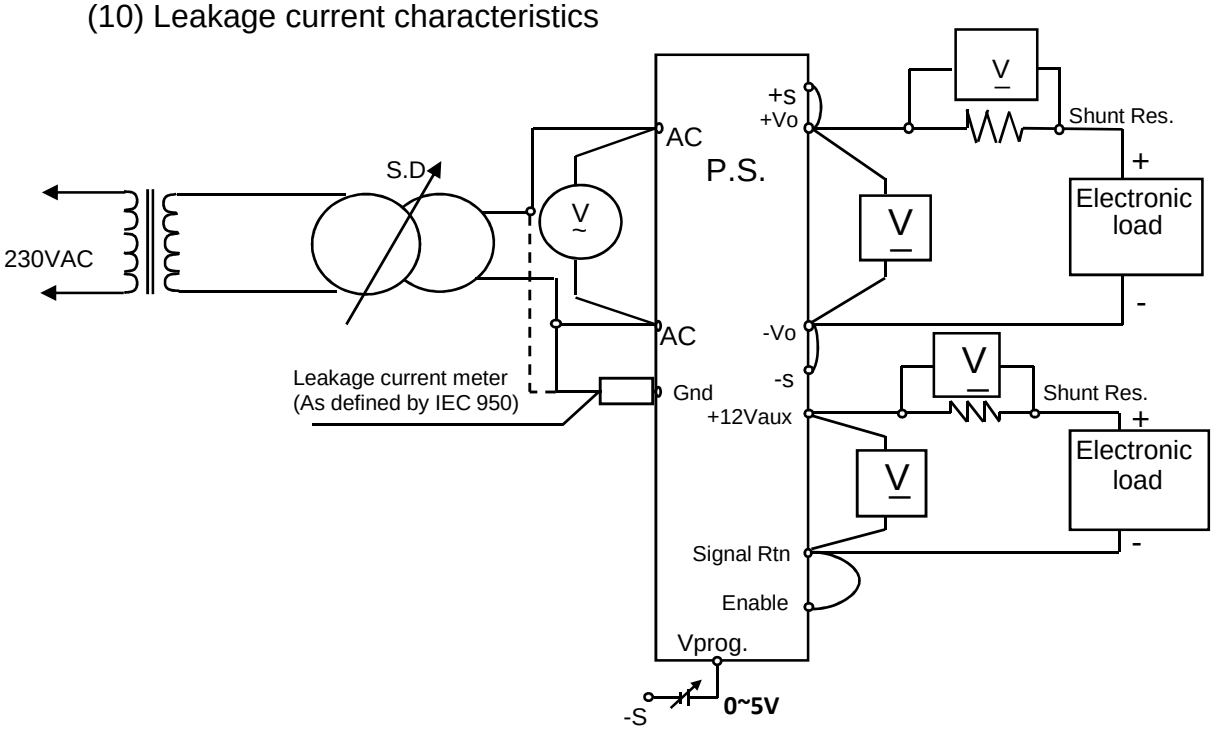


t_r = 100µs
t_f = 100µs

(9) Inrush current characteristics

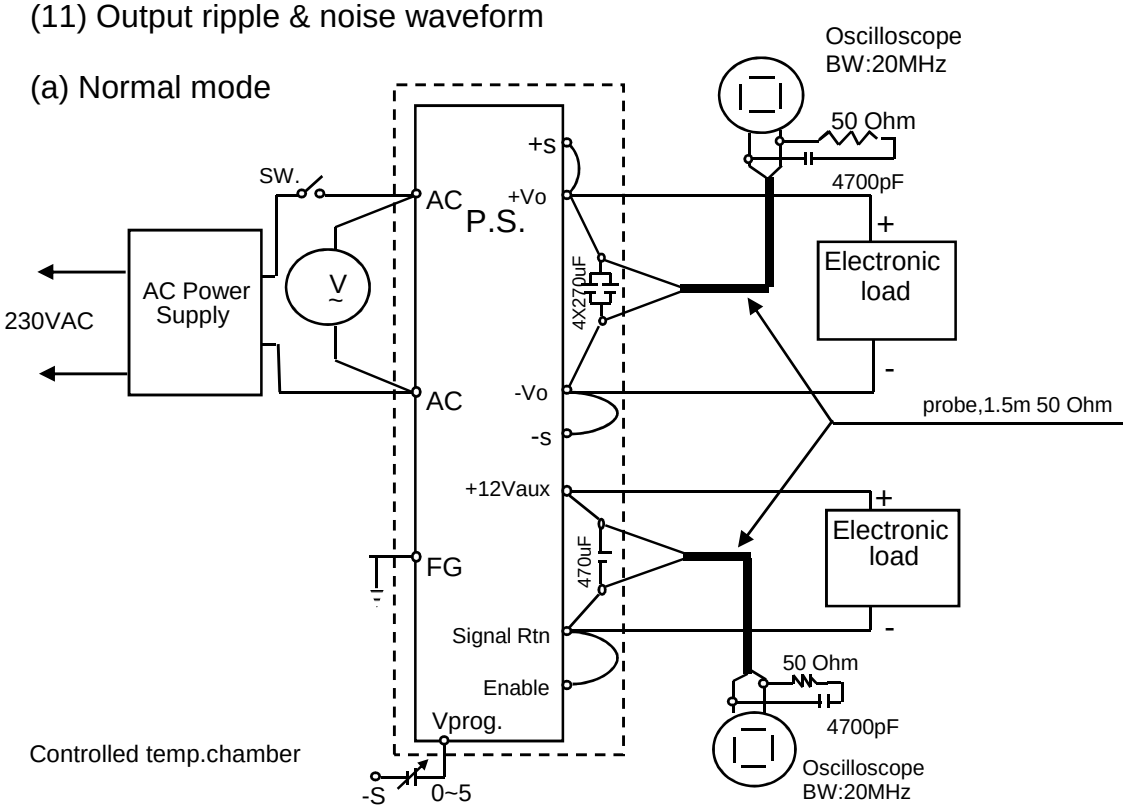


(10) Leakage current characteristics

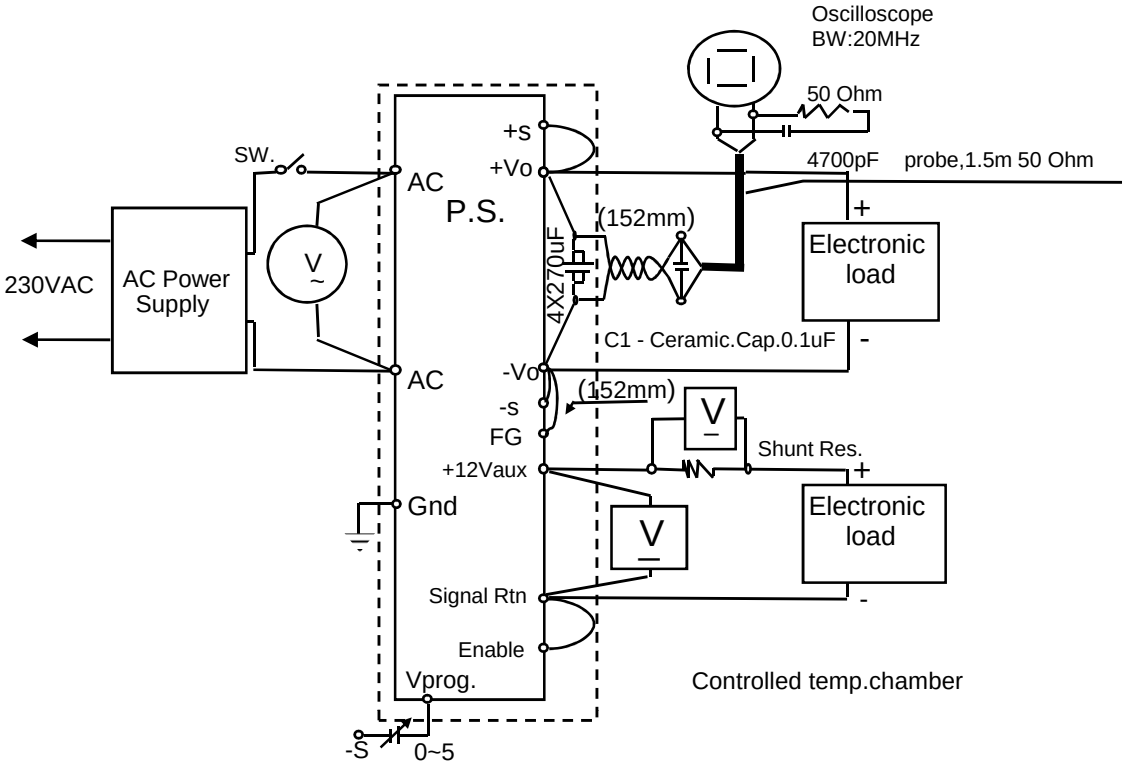


(11) Output ripple & noise waveform

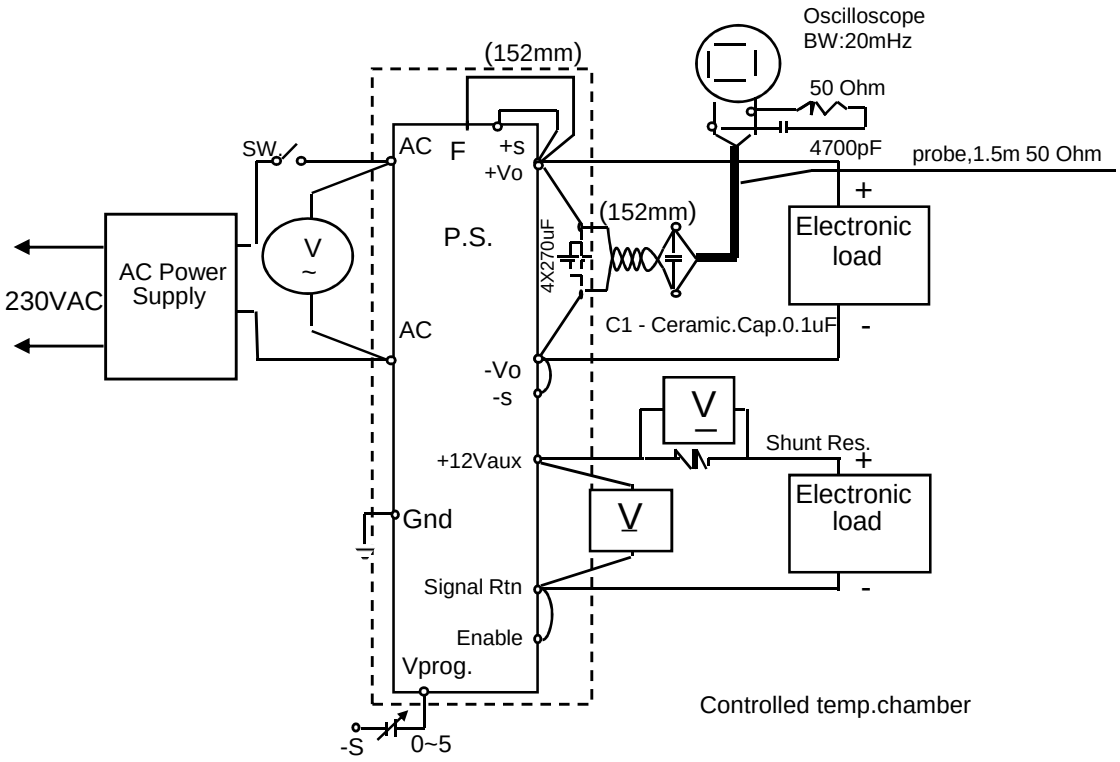
(a) Normal mode



(b) Normal and common mode -Vo Terminal grounded



(c) Normal and common mode +Vo Terminal grounded



(12) Standby current

Same as Steady state data

1.2 List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	AC POWER SUPPLY	CHROMA	6463
2	AC POWER SUPPLY	CHROMA	6590
3	CONTROLLED TEMP. CHAMBER	THERMOTRON	SE-600-5-5
4	CONTROLLED TEMP. CHAMBER	THERMOTRON	SE-600-6-6
5	CONTROLLED TEMP. CHAMBER	THERMOTRON	SM-16-3800
6	CURRENT PROBE	YOKOGAWA	701933
7	CURRENT TRANSDUCER	DANFYSIK	ULTRASTAB 867
8	DIGITAL MULTI METER (DMM)	AGILENT	3401A
9	DIGITAL OSCILLOSCOPE	YOKOGAWA	DL1740E / DL1740EL
10	DIGITAL POWER METER	YOKOGAWA	WT110
11	ELECTRONIC LOAD	CHROMA	63203
12	ELECTRONIC LOAD	CHROMA	63204
13	ELECTRONIC LOAD	CHROMA	63206
14	ELECTRONIC LOAD	H & H	ZS7060
15	ELECTRONIC LOAD	H & H	ZS7006
16	LEAKAGE CURRENT TESTER	KIKUSUI	TOS3200

2. Characteristics

2.1 Steady state data

(1) Regulation - line and load, Temperature drift, Start-up voltage and Drop out voltage

12V

1. Regulation - line and load

Conditions $I_{AUX.}$: 0.5 A
Ta : 25 °C

Iout \ Vin	85VAC	115VAC	132VAC	Line Regulation	
0%	12.001V	12.001V	12.001V	0mV	0.00%
50%	12.002V	12.002V	12.002V	0mV	0.00%
100%	12.002V	12.004V	12.004V	2mV	0.02%
Load Regulation	1mV	3mV	3mV		
	0.01%	0.03%	0.03%		

Iout \ Vin	170VAC	230VAC	265VAC	Line Regulation	
0%	12.001V	12.001V	12.001V	0mV	0.00%
50%	12.004V	12.004V	12.004V	0mV	0.00%
100%	11.999V	12.000V	12.000V	1mV	0.01%
Load Regulation	5mV	4mV	4mV		
	0.04%	0.03%	0.03%		

* Note: Load at 85VAC is derated according to specification

2. Temperature drift

Conditions Vin : 230 VAC
Iout : 100 %
$I_{AUX.}$: 0.5 A

Ta	-10°C	25°C	50°C	Temp. Stability		
Vout	11.997V	12.012V	12.006V	0.015V	0.13%	15.63ppm

(1) Regulation - line and load, Temperature drift, Start-up voltage and Drop out voltage

24V

1. Regulation - line and load

Conditions $I_{AUX.}$: 0.5 A
Ta : 25 °C

Iout \ Vin	85VAC	115VAC	132VAC	Line Regulation	
0%	24.000V	24.000V	24.000V	0mV	0.00%
50%	24.007V	24.008V	24.008V	1mV	0.00%
100%	24.006V	24.004V	24.004V	2mV	0.01%
Load Regulation	7mV	8mV	8mV		
	0.03%	0.03%	0.03%		

Iout \ Vin	170VAC	230VAC	265VAC	Line Regulation	
0%	24.002V	24.002V	24.003V	1mV	0.00%
50%	24.002V	24.003V	24.003V	1mV	0.00%
100%	23.999V	23.999V	23.999V	0mV	0.00%
Load Regulation	3mV	4mV	4mV		
	0.01%	0.02%	0.02%		

* Note: Load at 85VAC is derated according to specification

2. Temperature drift

Conditions Vin : 230 VAC
Iout : 100 %
$I_{AUX.}$: 0.5 A

Ta	-10°C	25°C	50°C	Temp. Stability		
Vout	24.010V	23.975V	23.901V	0.109V	0.45%	57ppm

(1) Regulation - line and load, Temperature drift, Start-up voltage and Drop out voltage

48V

1. Regulation - line and load

Conditions $I_{AUX.}$: 0.5 A
Ta : 25 °C

Iout \ Vin	85VAC	115VAC	132VAC	Line Regulation	
0%	48.013V	48.013V	48.013V	0mV	0.00%
50%	48.020V	48.017V	48.017V	3mV	0.01%
100%	48.009V	48.005V	48.005V	4mV	0.01%
Load Regulation	11mV	12mV	12mV		
	0.02%	0.03%	0.03%		

Iout \ Vin	170VAC	230VAC	265VAC	Line Regulation	
0%	48.013V	48.013V	48.013V	0mV	0.00%
50%	48.011V	48.011V	48.011V	0mV	0.00%
100%	47.986V	47.985V	47.985V	1mV	0.00%
Load Regulation	27mV	28mV	28mV		
	0.06%	0.06%	0.06%		

* Note: Load at 85VAC is derated according to specification

2. Temperature drift

Conditions Vin : 230 VAC
Iout : 100 %
$I_{AUX.}$: 0.5 A

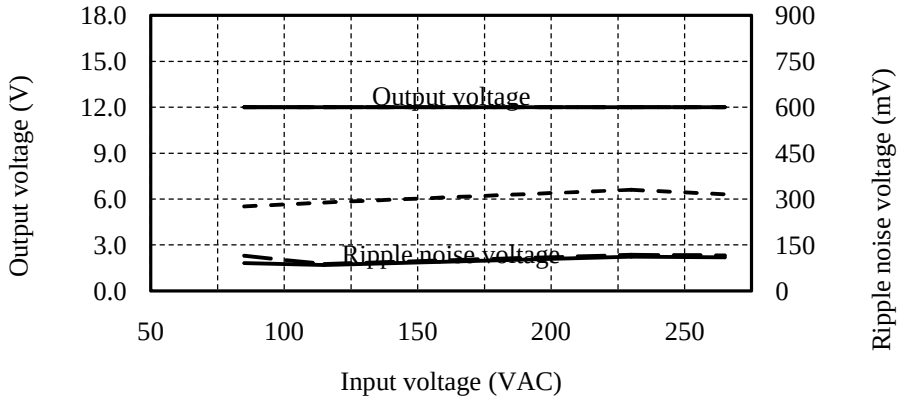
Ta	-10°C	25°C	50°C	Temp. Stability		
Vout	47.918V	47.953V	47.876V	0.077V	0.16%	20ppm

2.1 Steady state data

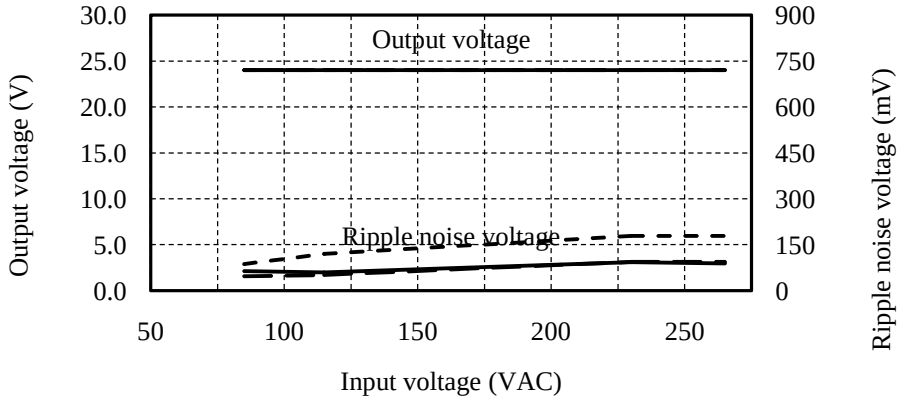
(2) Output voltage and Ripple noise voltage vs. Input voltage

Conditions Iout : 100 %
Ta : -10 °C
: 25 °C
: 50 °C

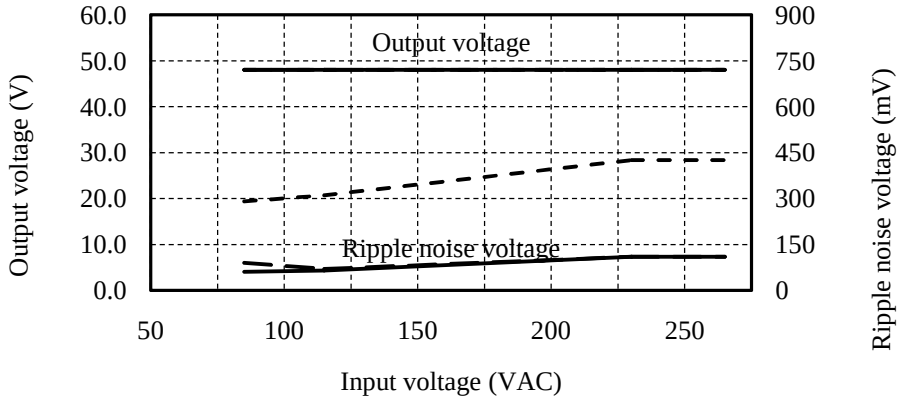
12V



24V



48V

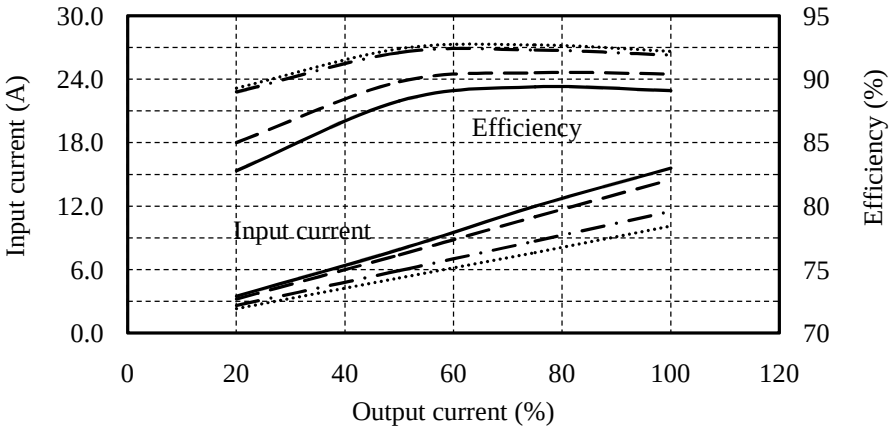


2.1 Steady state data

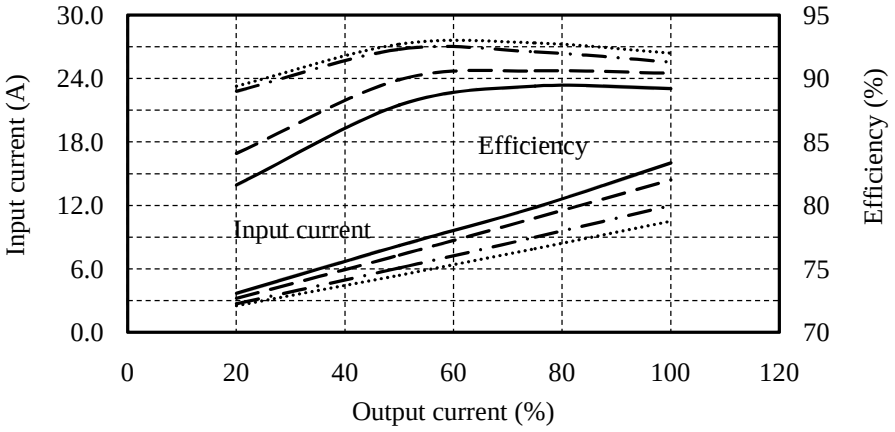
(3) Efficiency and Input current vs. Output current

Conditions Vin : 85 VAC
: 115 VAC
: 230 VAC
: 265 VAC
Ta : 25 °C

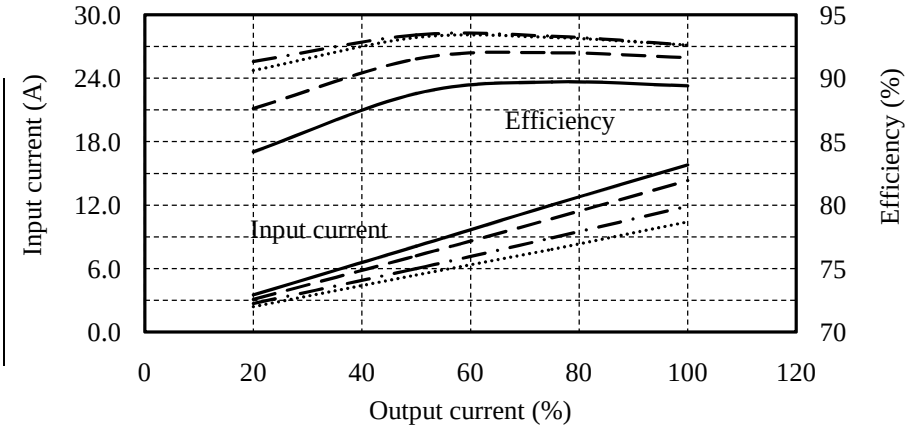
12V



24V



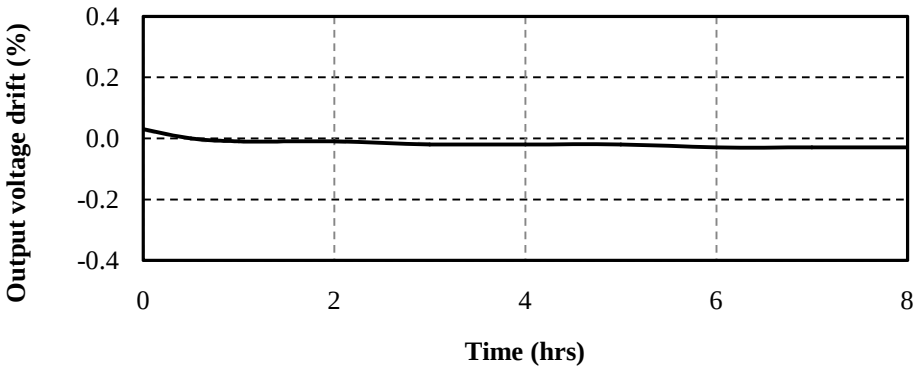
48V



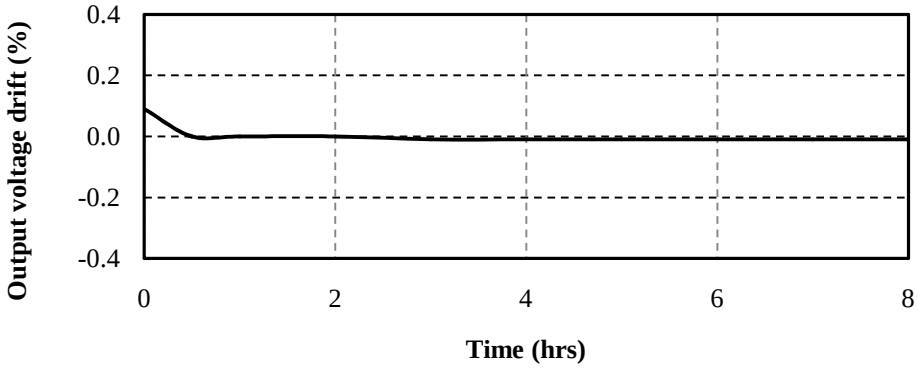
2.2 Warm up voltage drift characteristics

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

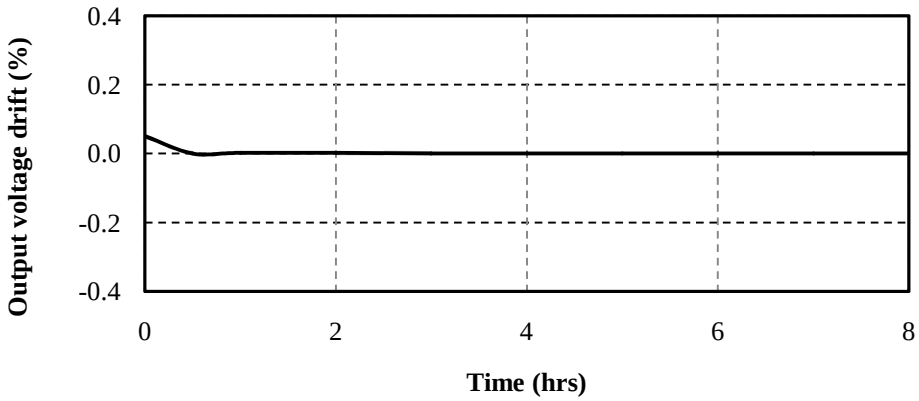
12V



24V



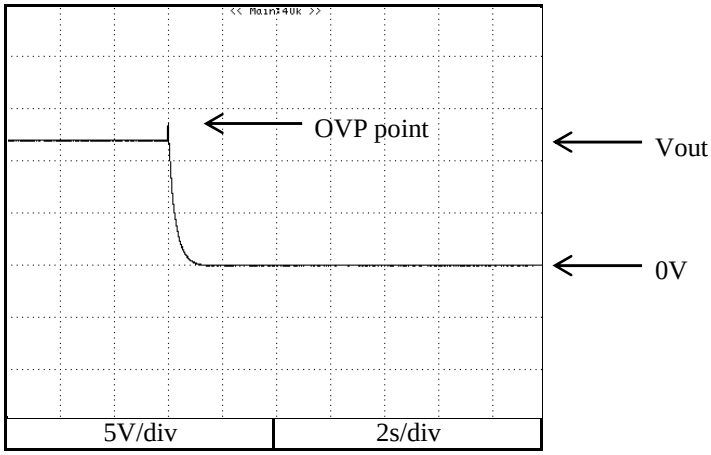
48V



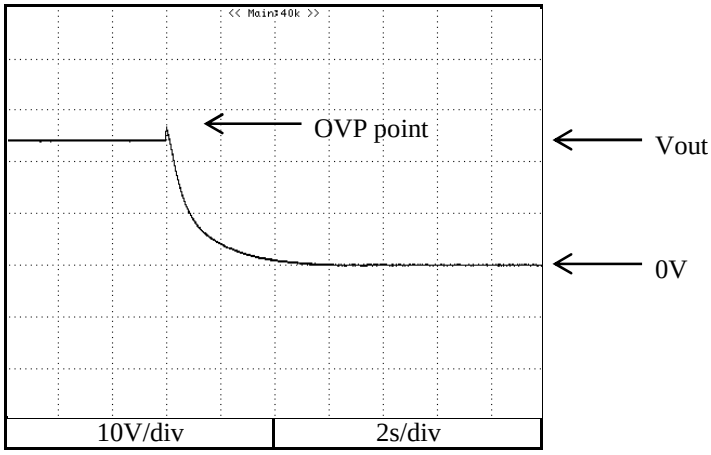
2.3 Over voltage protection (OVP) characteristics

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

12V



24V



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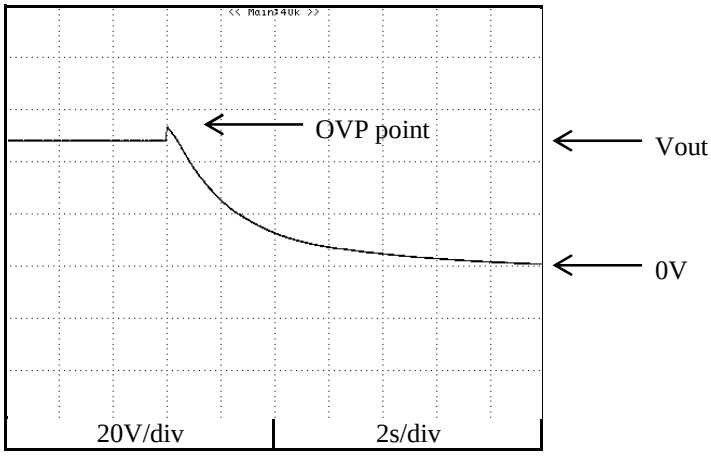
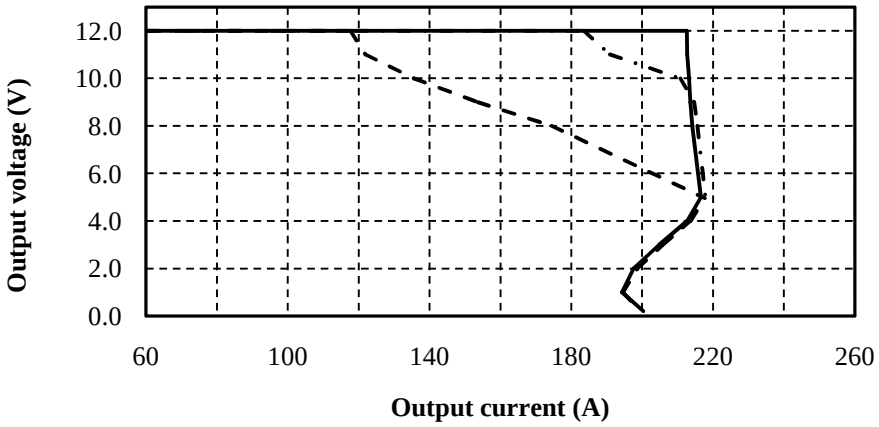


2.4 Over current protection (OCP) characteristics

Conditions Vin : 85 VAC
: 115 VAC
: 230 VAC
Ta : 25 °C

12V



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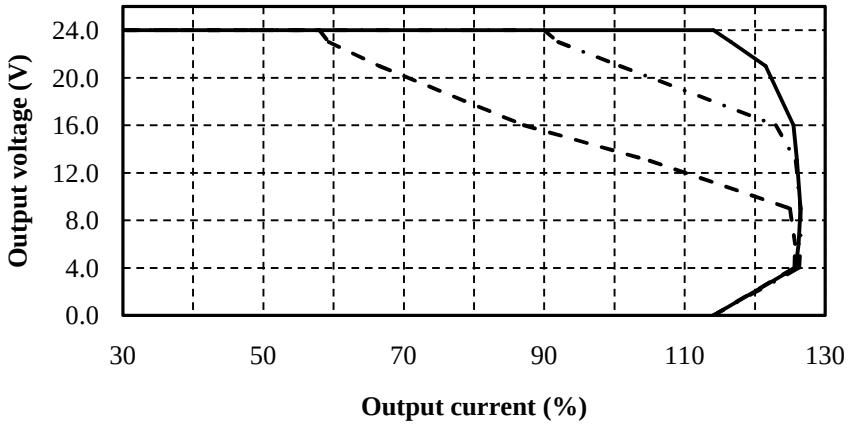

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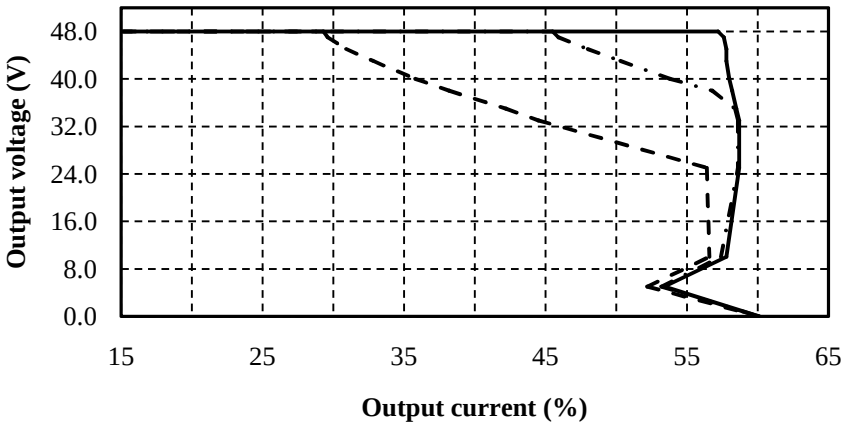
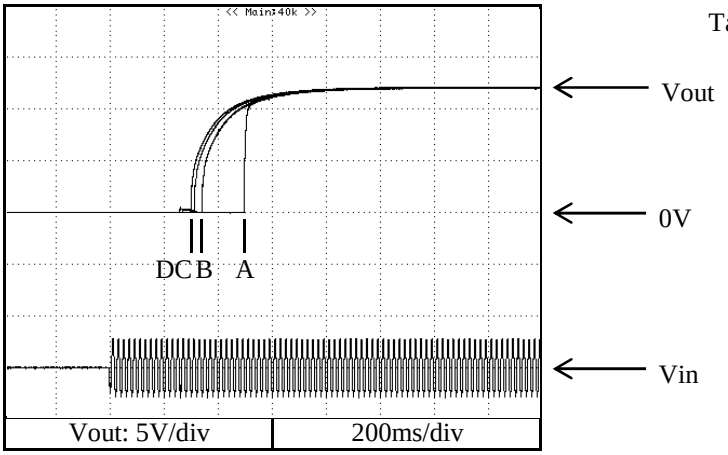


2.5 Output rise characteristics

Conditions Vin : 85 VAC (A)
: 115 VAC (B)
: 230 VAC (C)
: 265 VAC (D)
Iout : 0 %
Ta : 25 °C

12V



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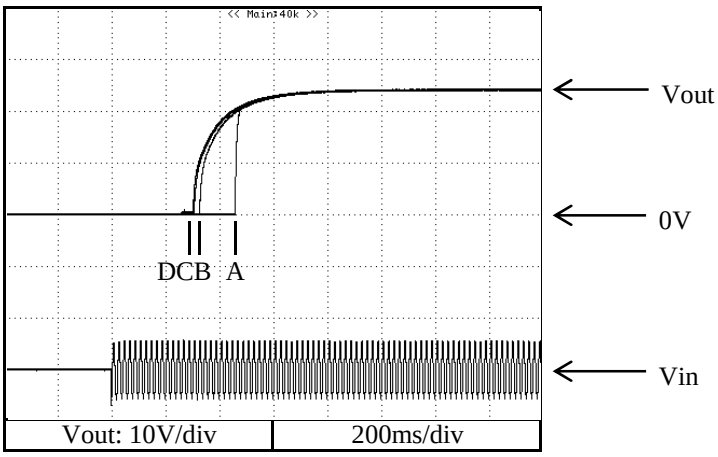

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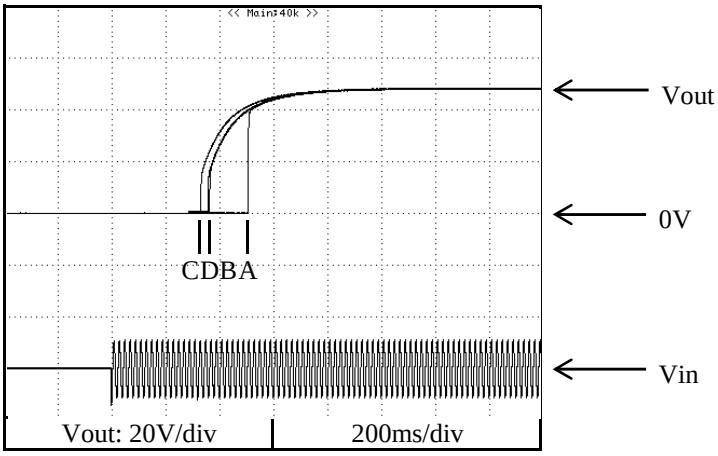
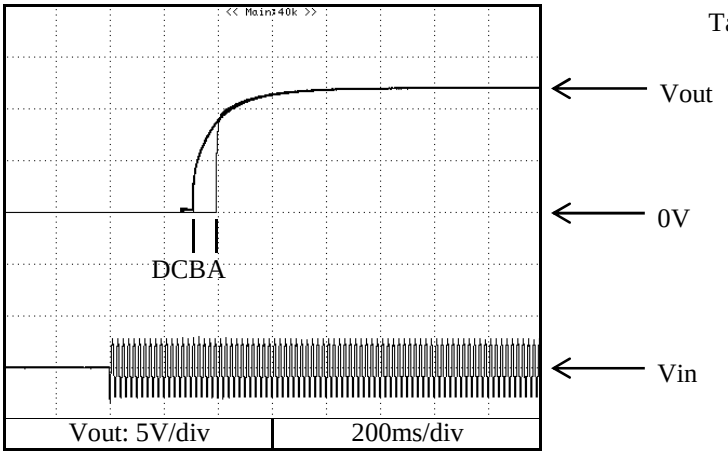


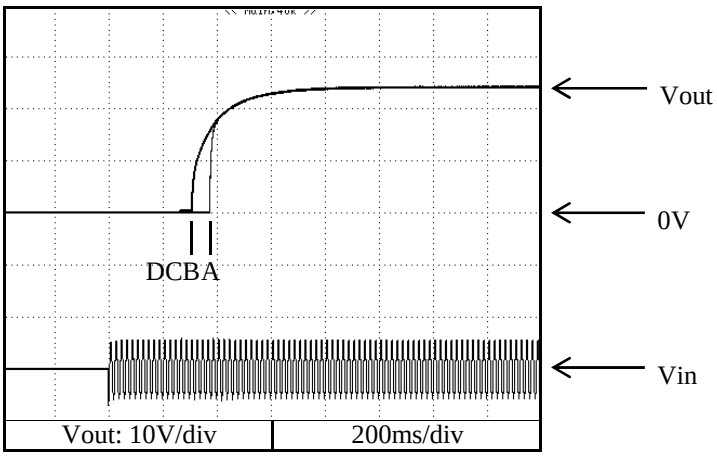
2.5 Output rise characteristics

Conditions Vin : 85 VAC (A)
: 115 VAC (B)
: 230 VAC (C)
: 265 VAC (D)
Iout : 100 %
Ta : 25 °C

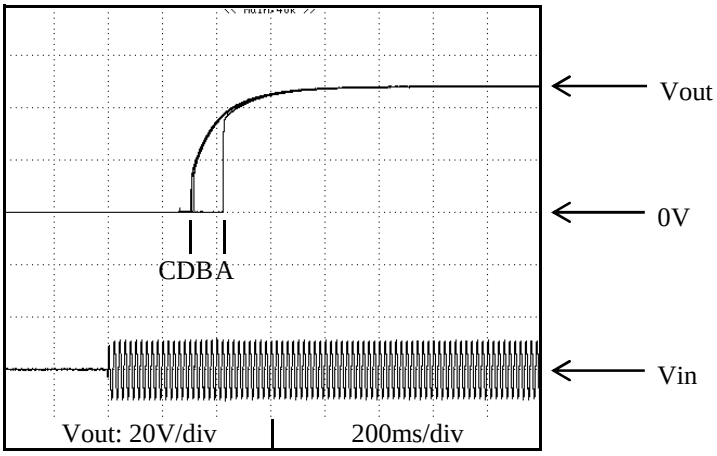
12V



24V



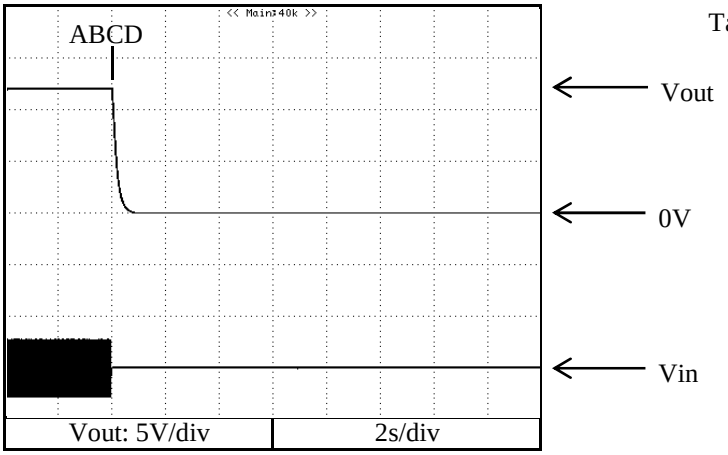
48V



2.6 Output fall characteristics

Conditions Vin : 85 VAC (A)
: 115 VAC (B)
: 230 VAC (C)
: 265 VAC (D)
Iout : 0 %
Ta : 25 °C

12V



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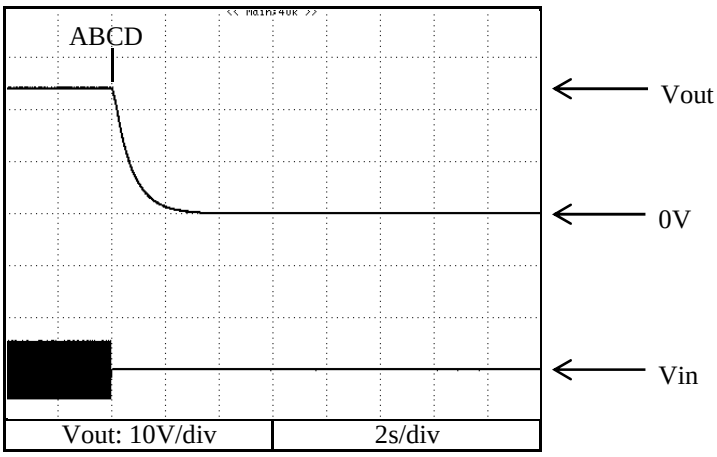
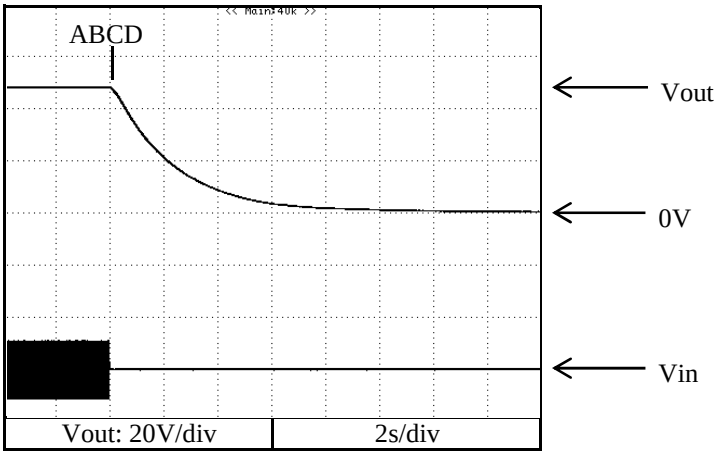


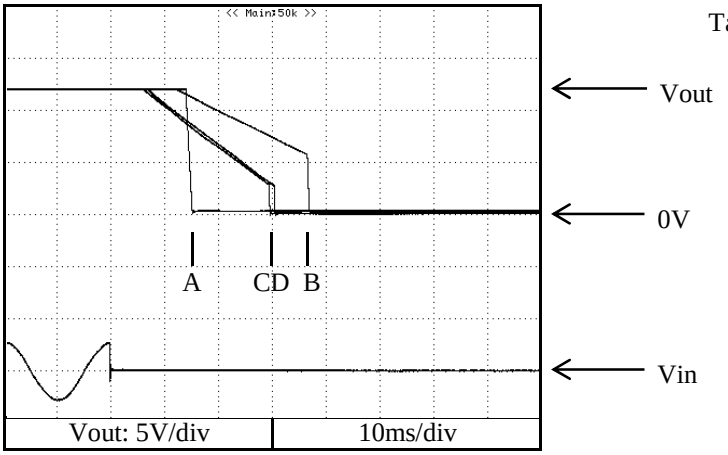
48V



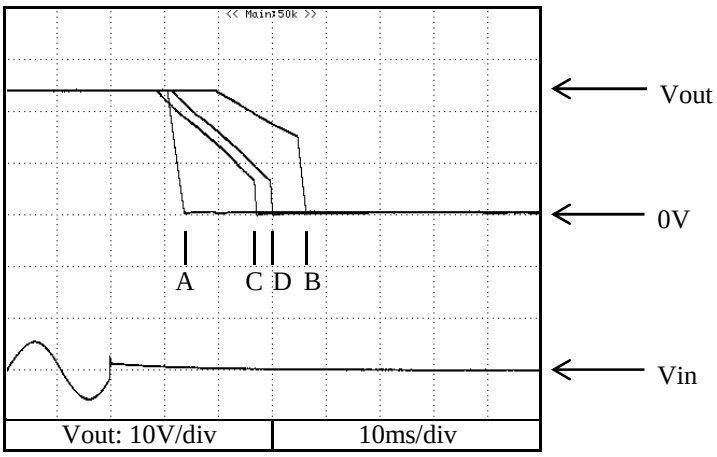
2.6 Output fall characteristics

Conditions Vin : 85 VAC (A)
: 115 VAC (B)
: 230 VAC (C)
: 265 VAC (D)
Iout : 100 %
Ta : 25 °C

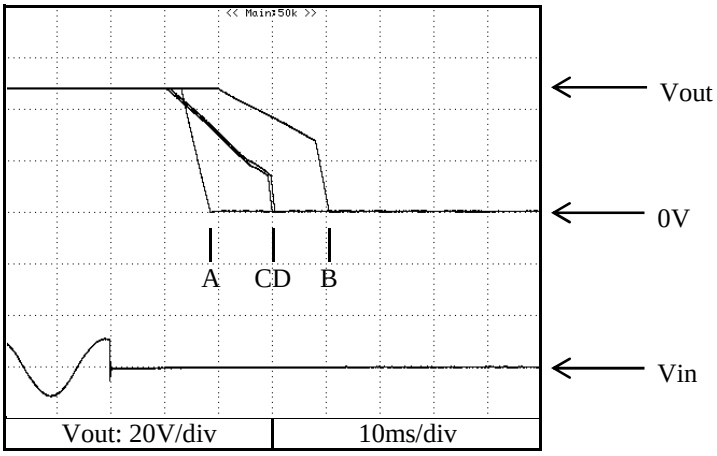
12V



24V



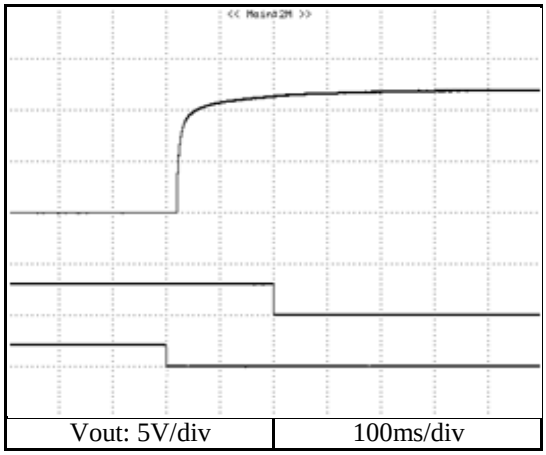
48V



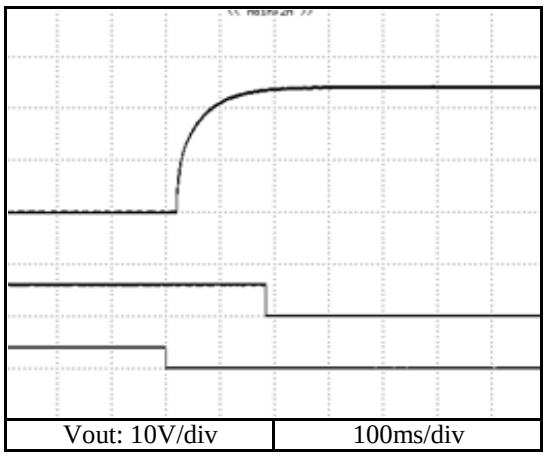
2.7 Output rise characteristics with ON/OFF CONTROL

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

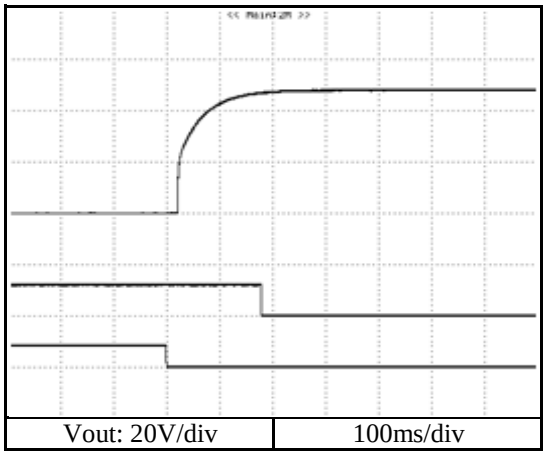
12V



24V



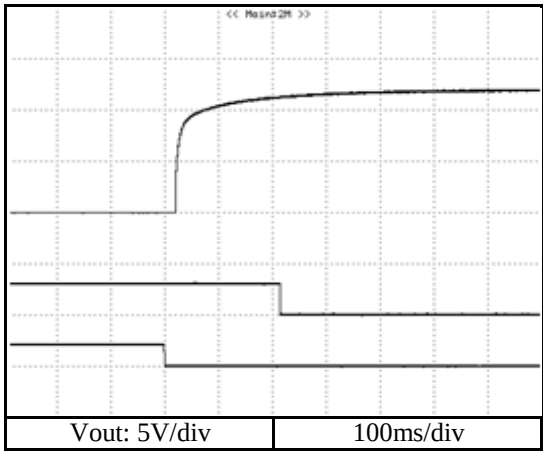
48V



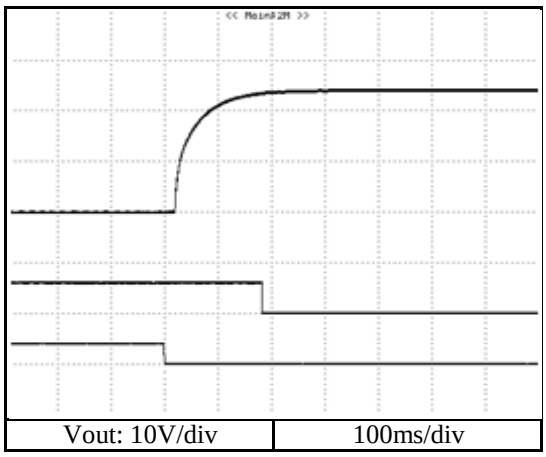
2.7 Output rise characteristics with ON/OFF CONTROL

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

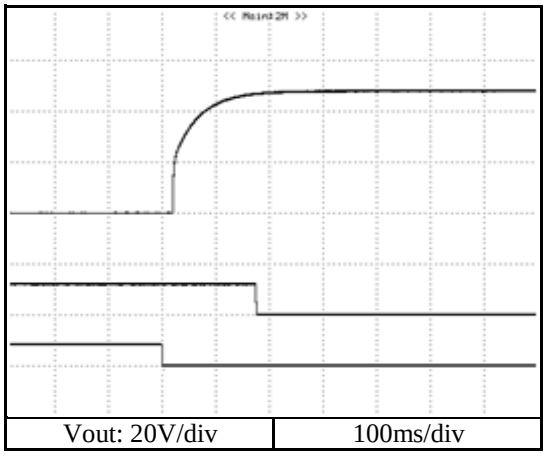
12V



24V



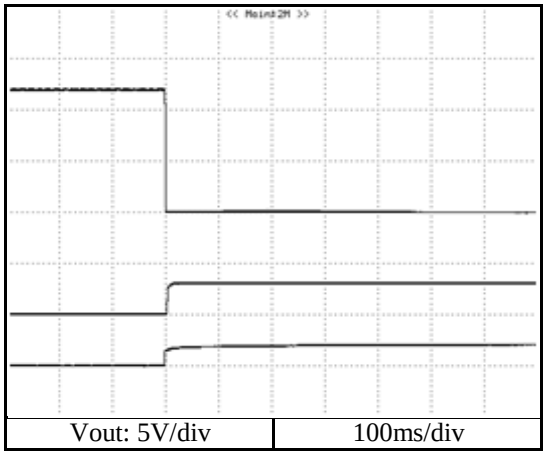
48V



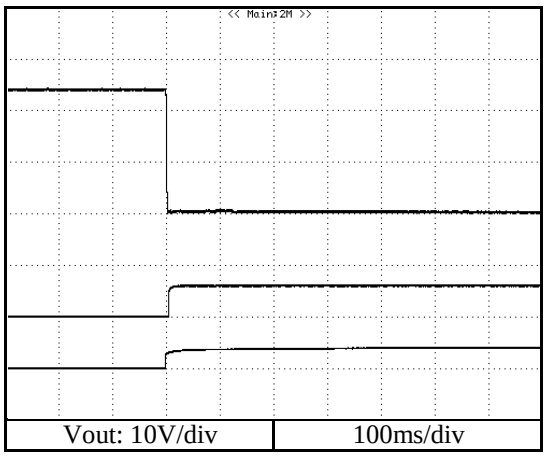
2.8 Output fall characteristics with ON/OFF CONTROL

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

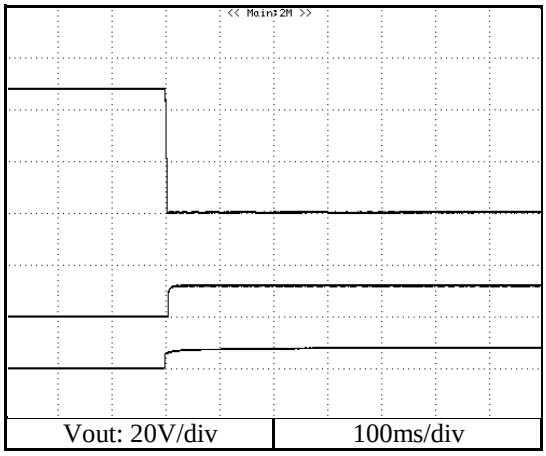
12V



24V



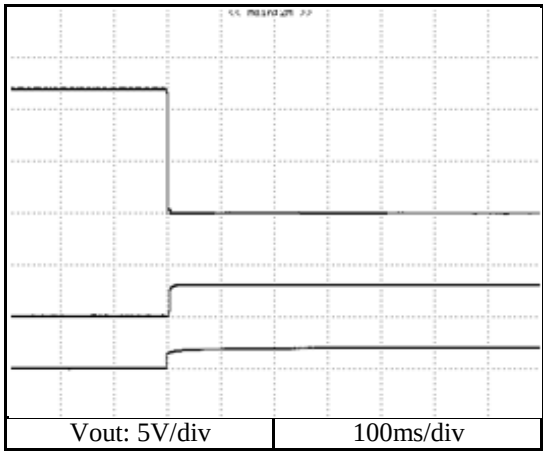
48V



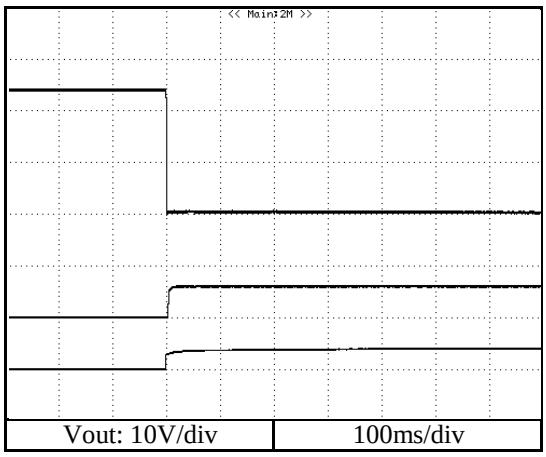
2.8 Output fall characteristics with ON/OFF CONTROL

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

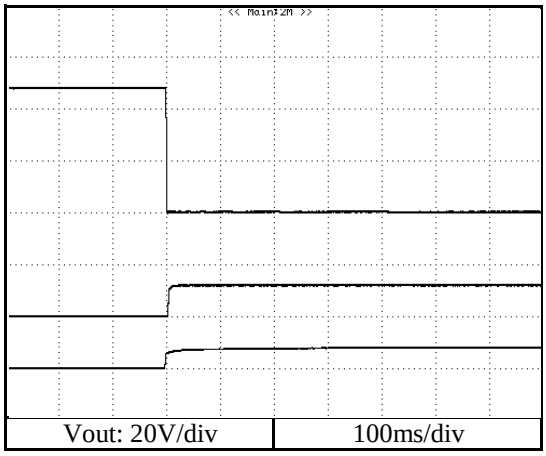
12V



24V



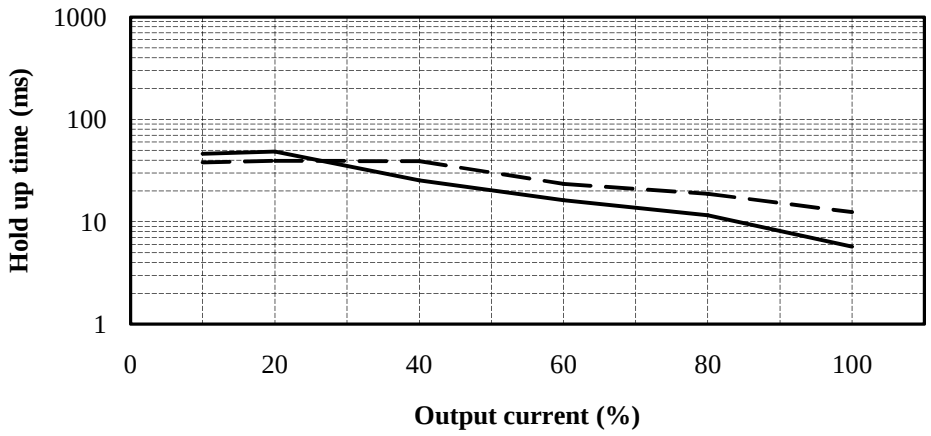
48V



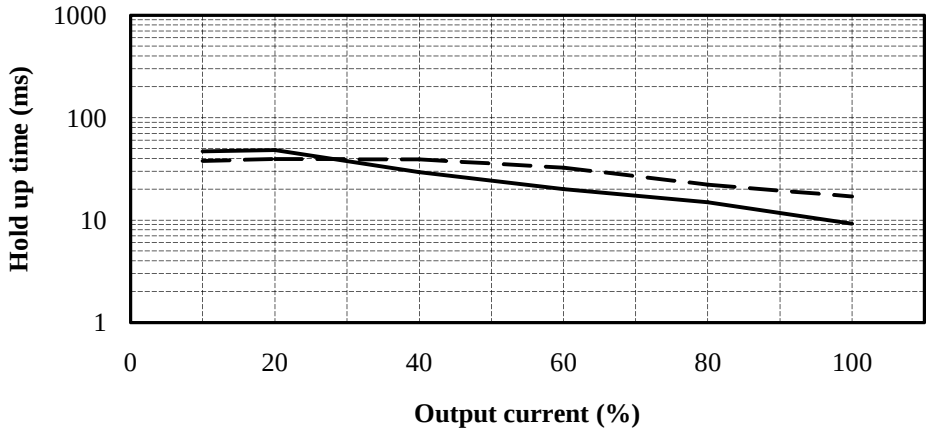
2.9 Hold up time characteristics

Conditions Vin : 115 VAC - - - - - -
: 230 VAC ——
Ta : 25 °C

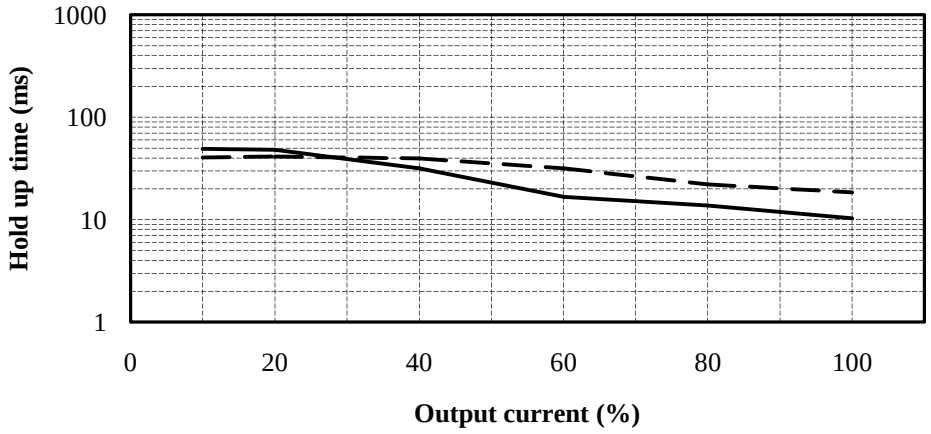
12V



24V



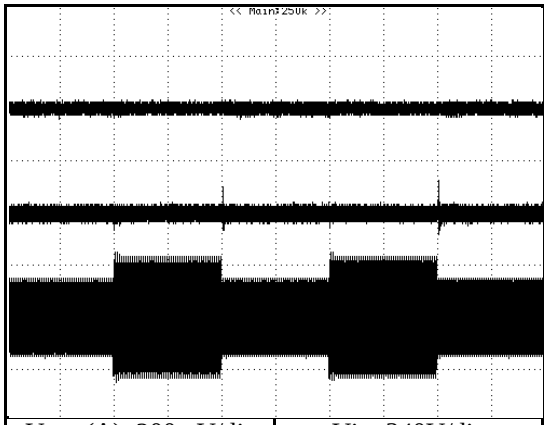
48V



2.10 Dynamic line response characteristics

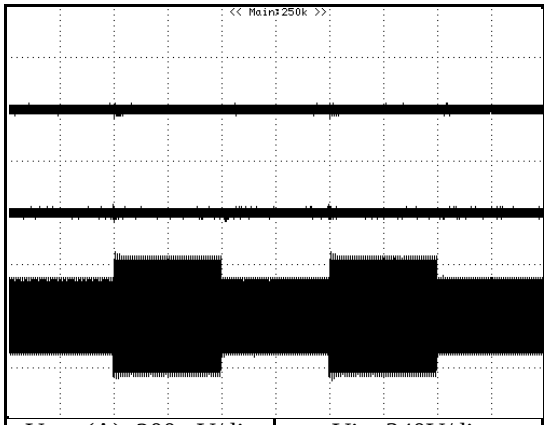
Conditions Vin : 85 VAC ↔ 132 VAC (A)
: 170 VAC ↔ 265 VAC (B)
Iout : 100 %
Ta : 25 °C

12V



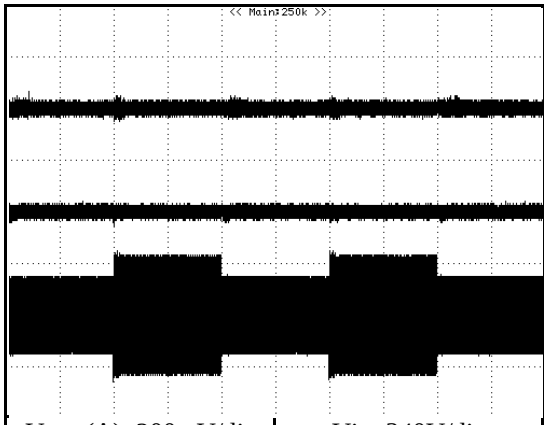
Vout (A): 200mV/div	Vin: 340V/div
Vout (B): 200mV/div	500ms/div

24V



Vout (A): 200mV/div	Vin: 340V/div
Vout (B): 200mV/div	500ms/div

48V



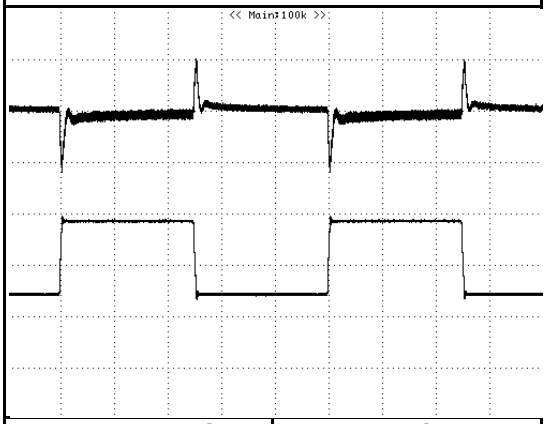
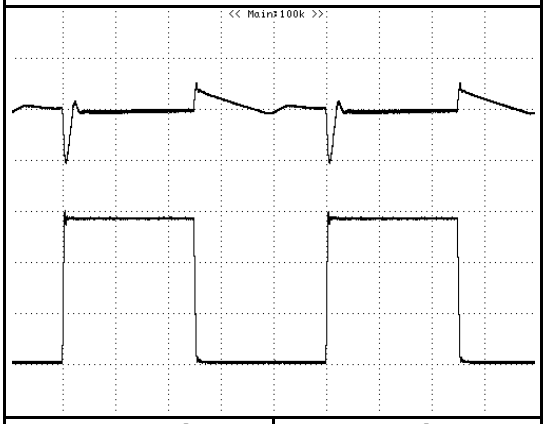
Vout (A): 200mV/div	Vin: 340V/div
Vout (B): 200mV/div	500ms/div

2.11 Dynamic load response characteristics

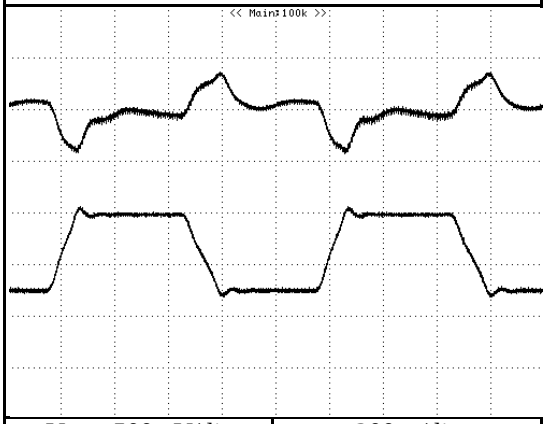
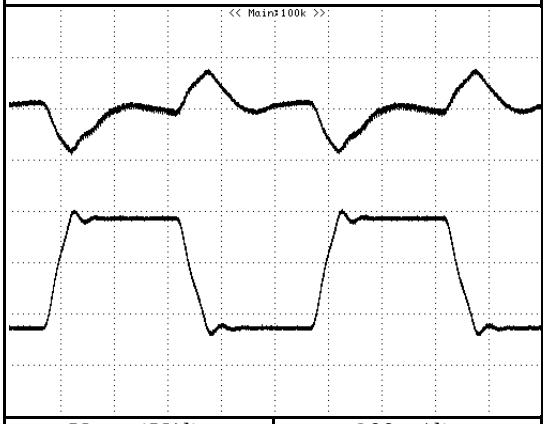
Conditions Vin : 230 VAC
Ta : 25 °C

12V

f=100Hz

Iout: 50% ↔ 100%		Iout: 1% ↔ 100%	
			
Vout: 500mV/div	2ms/div	Vout: 2V/div	2ms/div
+4.28%	-4.96%	+8.70%	-17.73%

f=1kHz

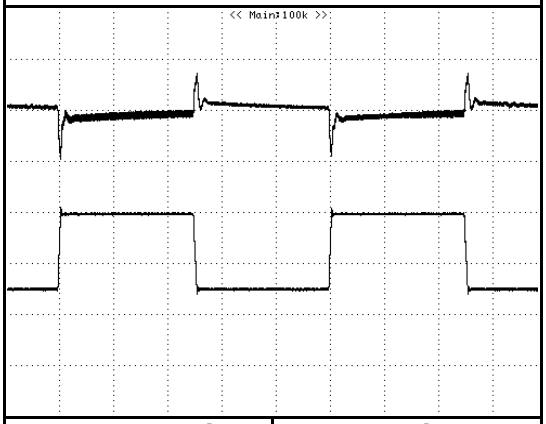
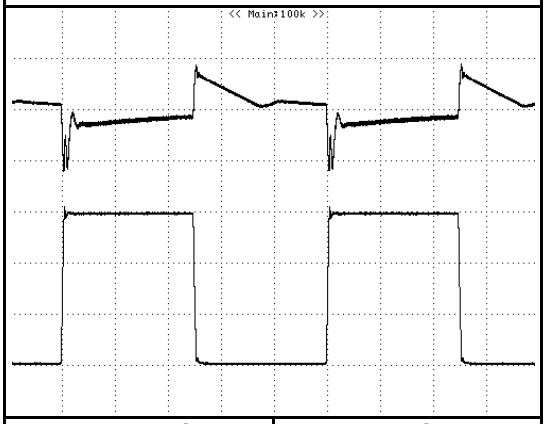
Iout: 50% ↔ 100%		Iout: 25% ↔ 100%	
			
Vout: 500mV/div	200µs/div	Vout: 1V/div	200µs/div
+3.06%	-3.60%	+6.33%	-7.51%

2.11 Dynamic load response characteristics

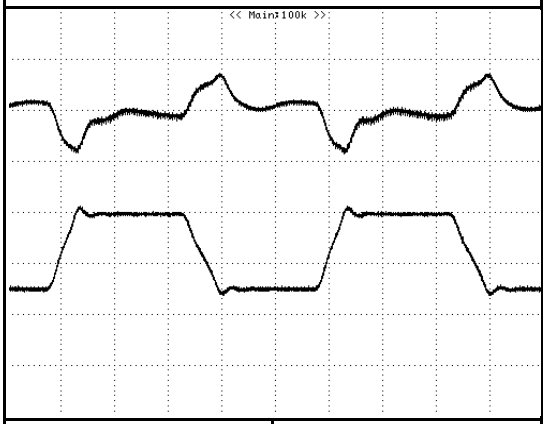
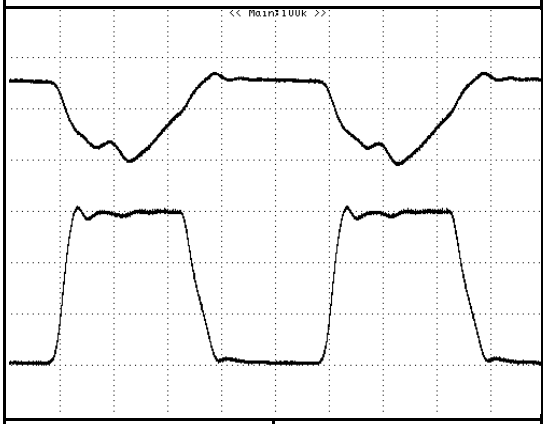
Conditions Vin : 230 VAC
Ta : 25 °C

24V

f=100Hz

Iout: 50% ↔ 100%		←Vout→	Iout: 0% ↔ 100%	
		← Iout →		
Vout: 500mV/div	2ms/div		Vout: 1V/div	2ms/div
+1.53%	-1.99%		+3.75%	-5.01%

f=1kHz

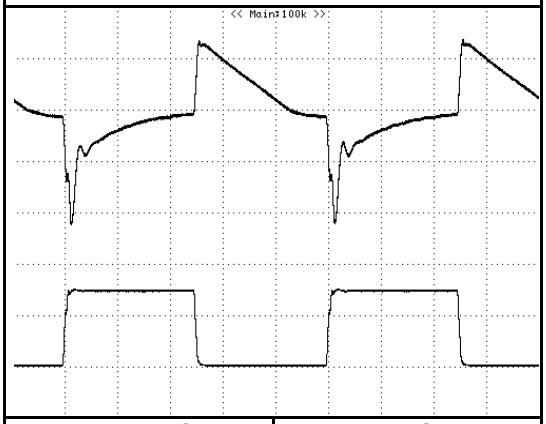
Iout: 50% ↔ 100%		←Vout→	Iout: 0% ↔ 100%	
		← Iout →		
Vout: 500mV/div	200µs/div		Vout: 2V/div	200µs/div
+1.53%	-1.80%		+5.90%	-9.25%

2.11 Dynamic load response characteristics

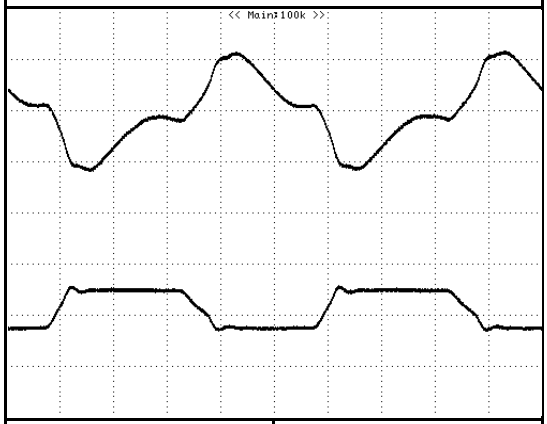
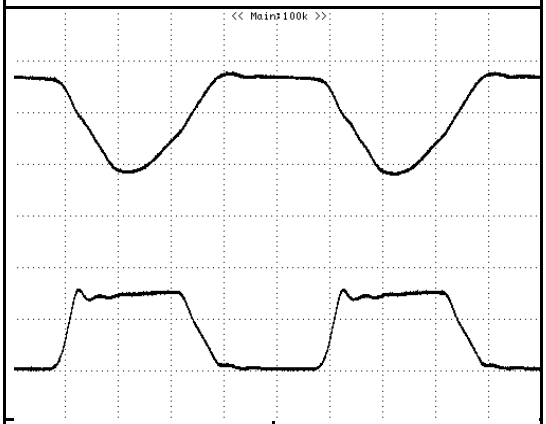
Conditions Vin : 230 VAC
Ta : 25 °C

48V

f=100Hz

Iout: 50% ↔ 100%		Iout: 0% ↔ 100%	
			
Vout: 500mV/div	2ms/div	Vout: 1V/div	2ms/div
+1.51%	-1.56%	+2.85%	-4.64%

f=1kHz

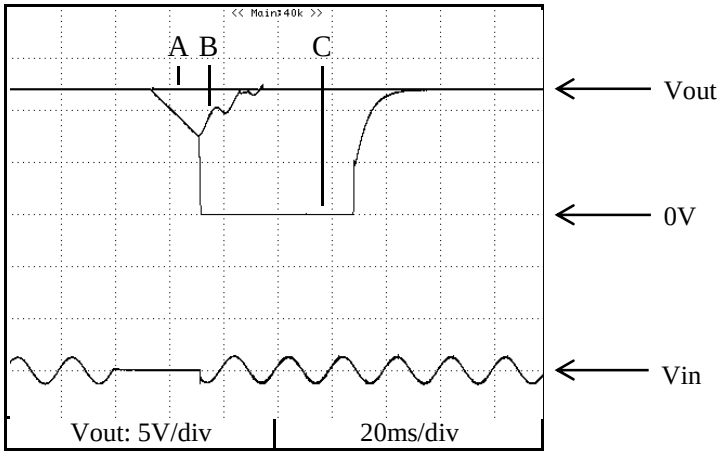
Iout: 50% ↔ 100%		Iout: 0% ↔ 100%	
			
Vout: 500mV/div	200µs/div	Vout: 2V/div	200µs/div
+1.20%	-1.24%	+3.26%	-5.06%

2.12 Response to brown out characteristics

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

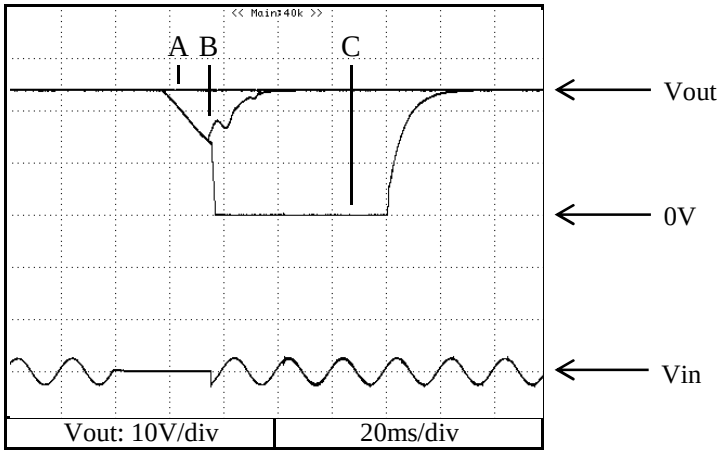
12V

A = 14ms
B = 31ms
C = 32ms



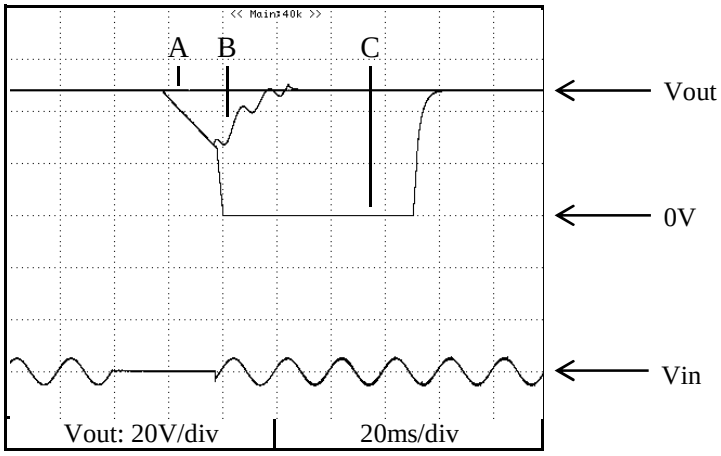
24V

A = 16ms
B = 35ms
C = 36ms



48V

A = 16ms
B = 37ms
C = 38ms

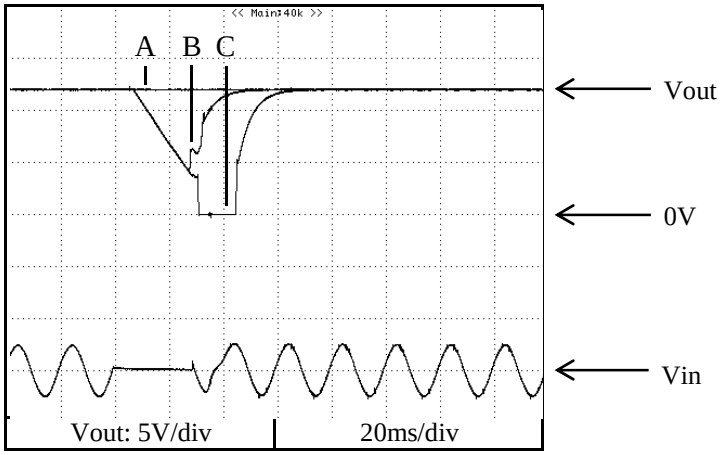


2.12 Response to brown out characteristics

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

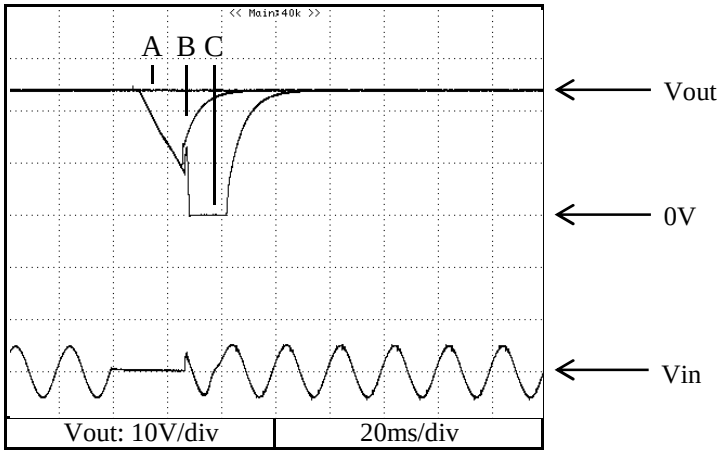
12V

A = 6ms
B = 28ms
C = 29ms



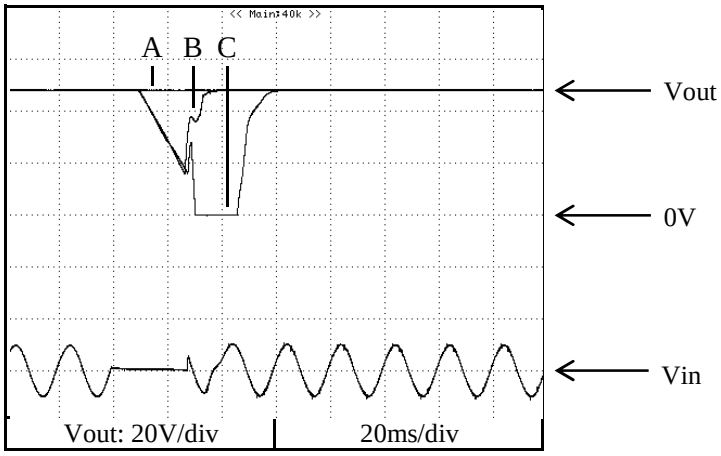
24V

A = 8ms
B = 26ms
C = 27ms



48V

A = 8ms
B = 27ms
C = 28ms



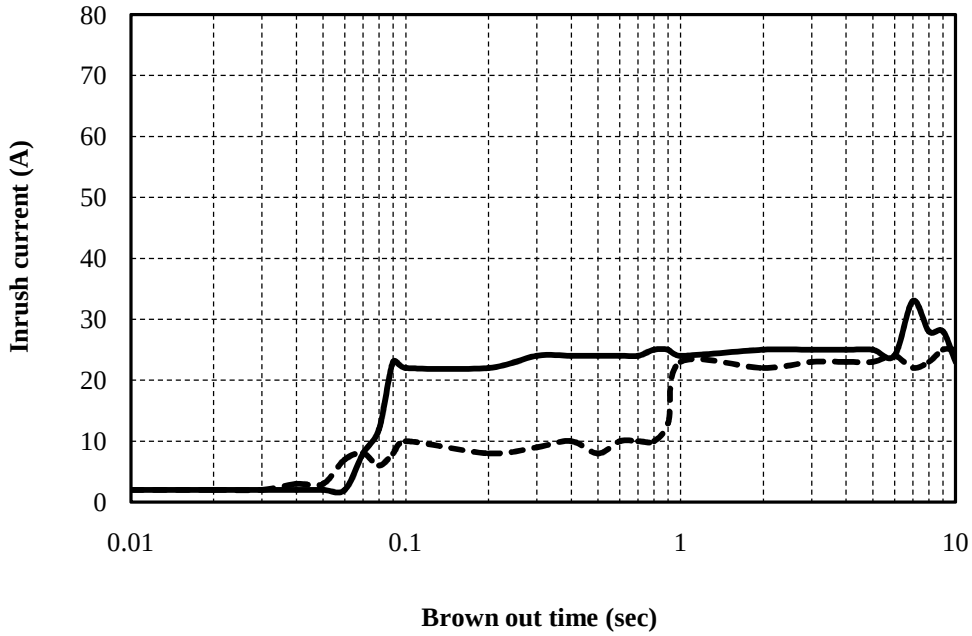
2.13 Inrush current characteristics

Conditions Iout : 115V ----
230V ——

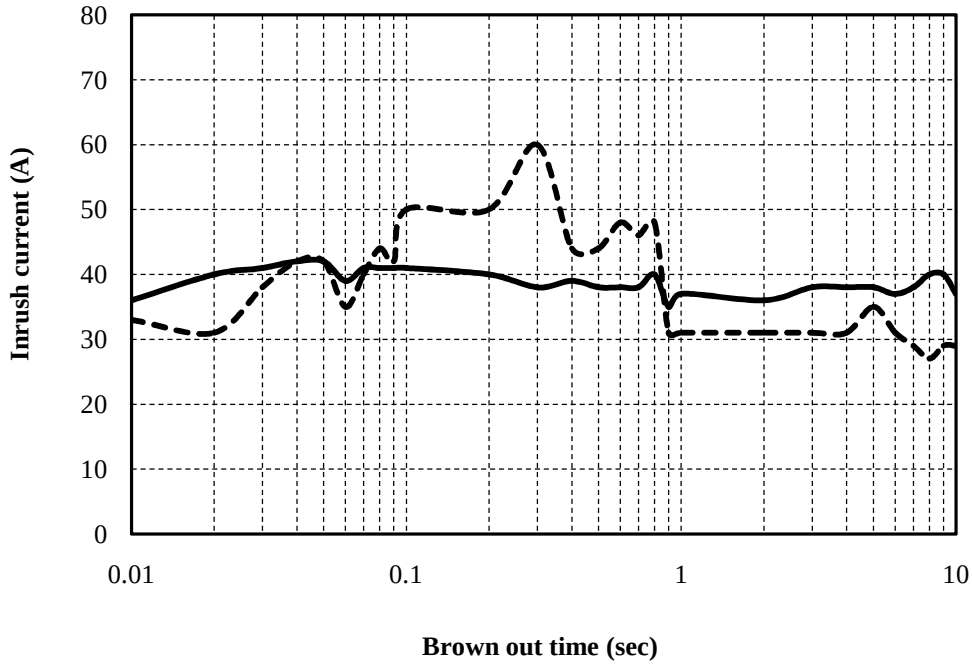
Ta : 25 °C

12V

Iout = 0%



Iout =100%

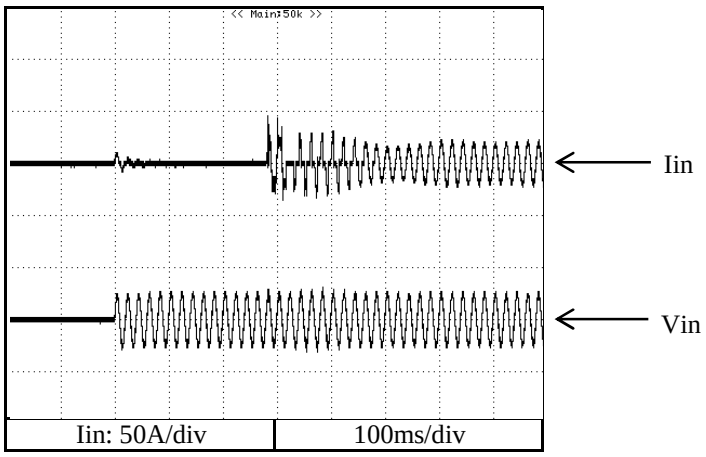


2.14 Inrush current waveform

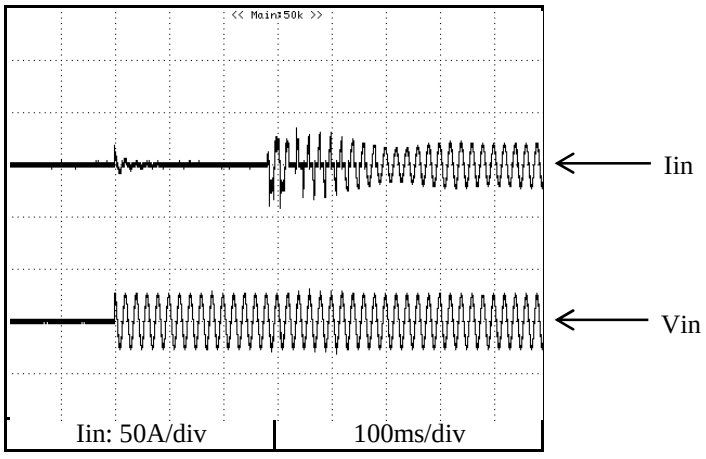
Conditions Vin : 115 VAC
Iout : 100 %
Ta : 25 °C

12V

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



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

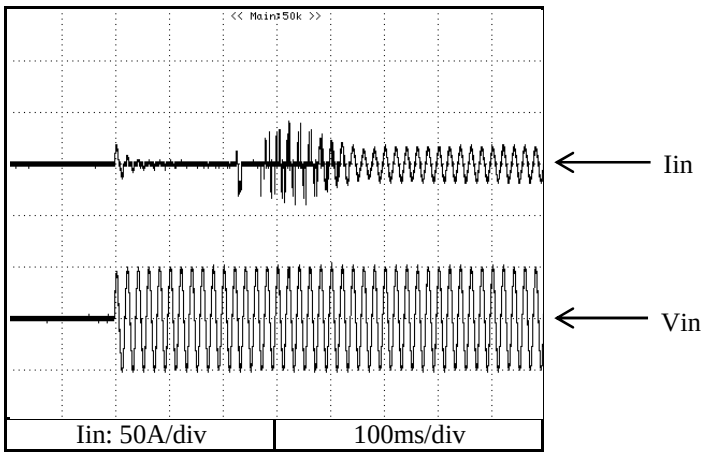


2.14 Inrush current waveform

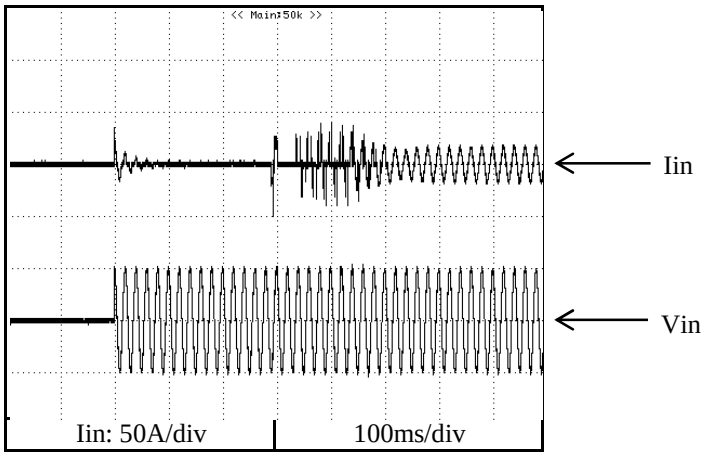
Conditions Vin : 230 VAC
Iout : 100 %
Ta : 25 °C

12V

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



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

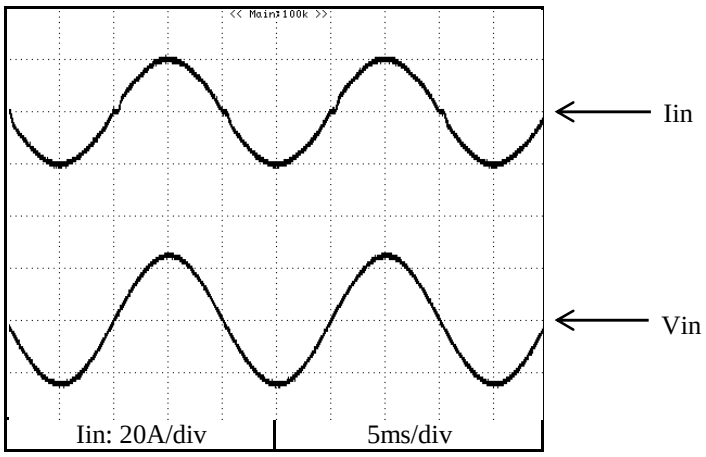


2.15 Input current waveform

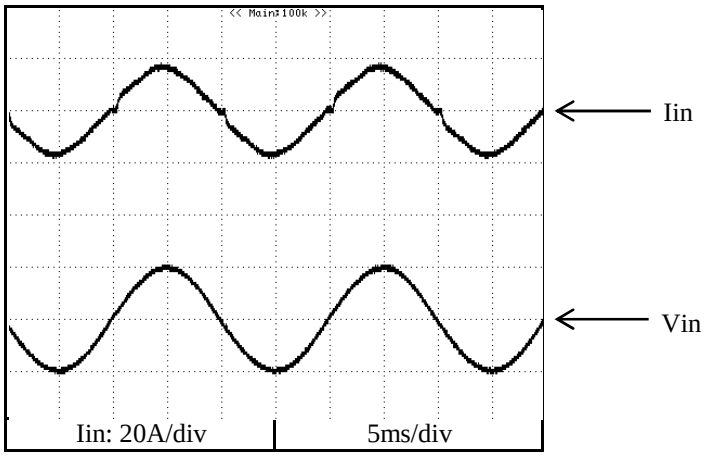
Conditions Iout : 100 %
Ta : 25 °C

12V

Vin = 115VAC



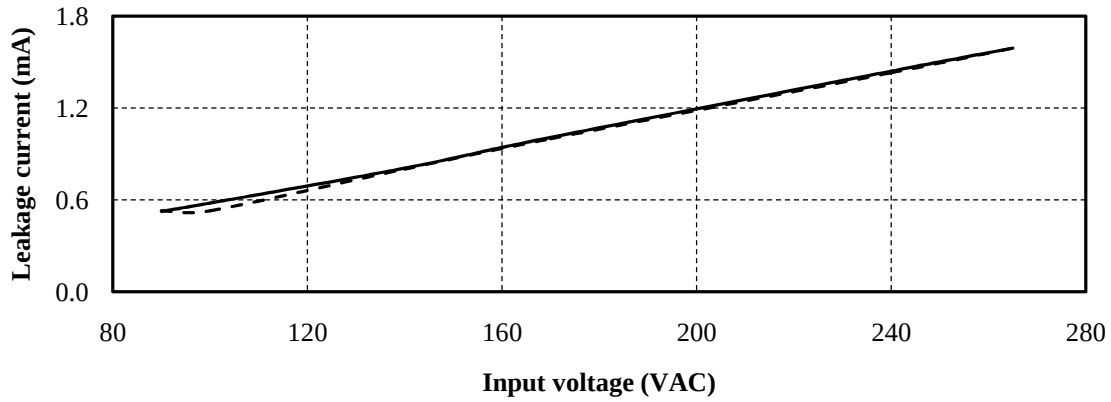
Vin = 230VAC



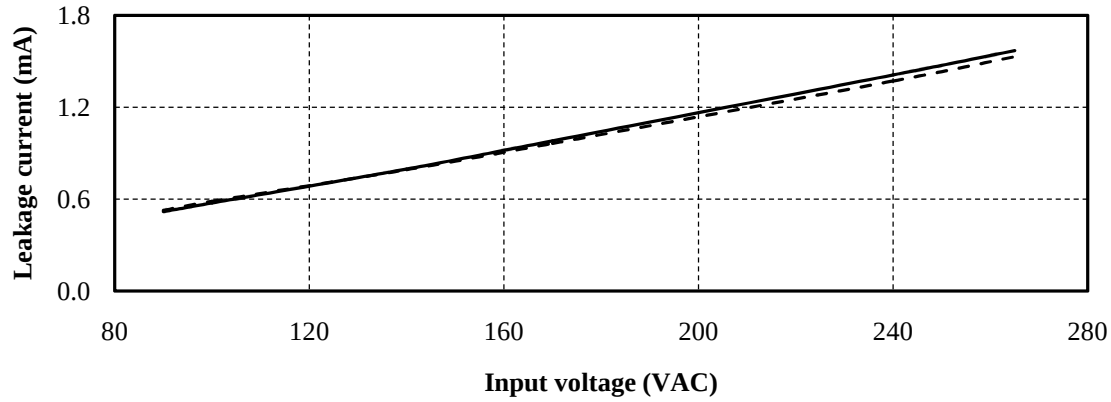
2.16 Leakage current characteristics

Conditions Iout : 0 % (- - - -)
: 100 % (——)
Ta : 25 °C
f : 60 Hz

12V



48V

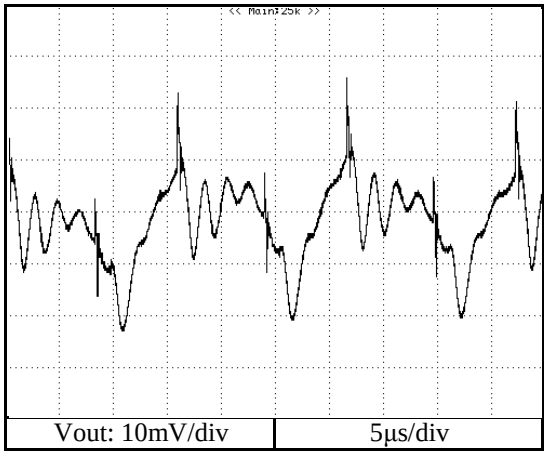


2.17 Output ripple and noise waveform

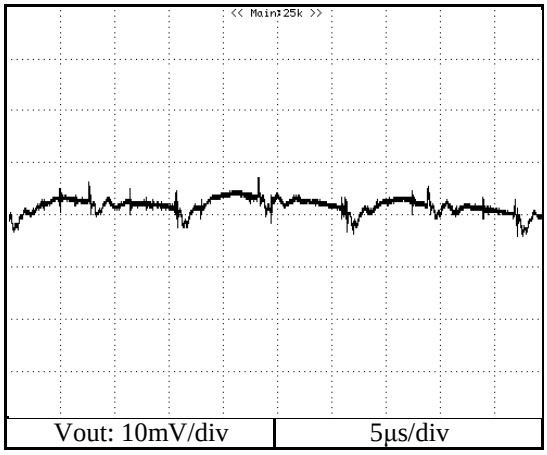
Conditions Vin : 115 VAC
Iout : 100 %
Ta : 25 °C

NORMAL MODE

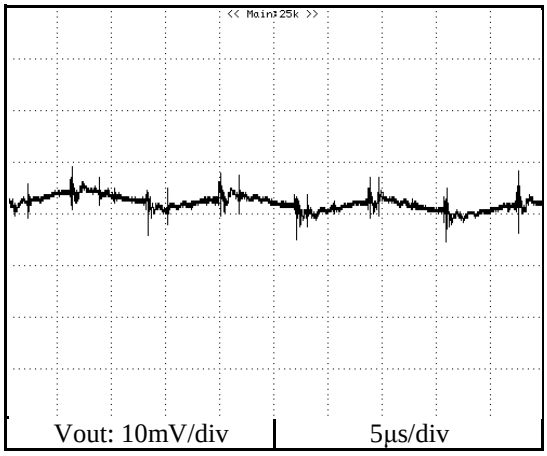
12V



24V



48V

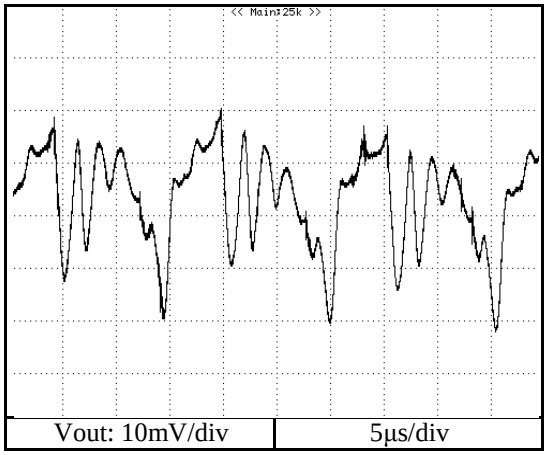


2.17 Output ripple and noise waveform

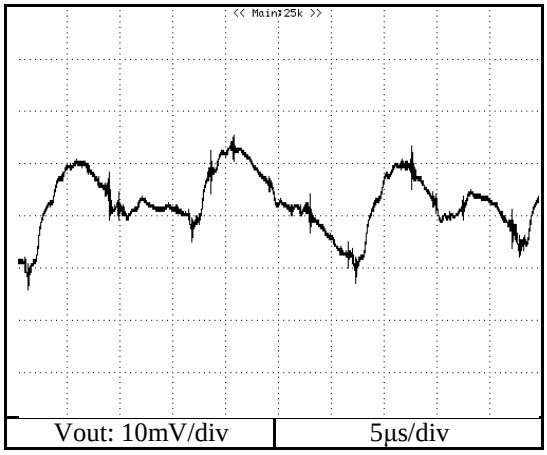
Conditions Vin : 115 VAC
Iout : 100 %
Ta : 25 °C

NORMAL + COMMON MODE

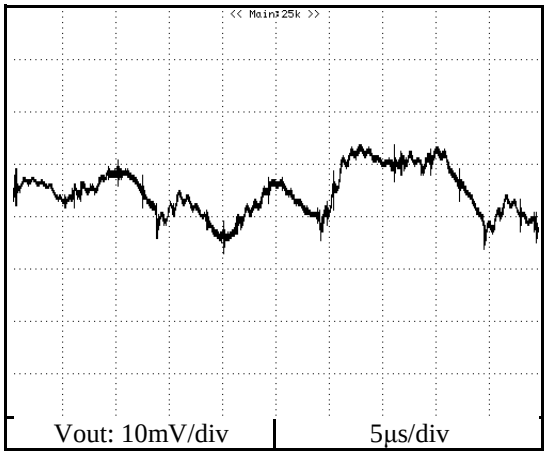
12V



24V



48V

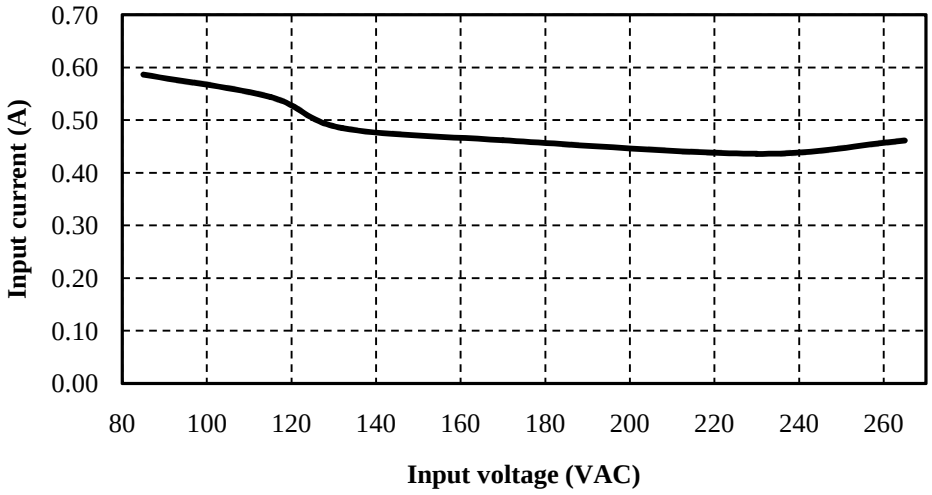


2.18 Standby current

Condition Ta : 25 °C

12V

Iout = 0%



Remote control OFF