SWS100

EVALUATION DATA

DWG No. CA731-53-01			
QA APPD	APPD	CHK	DWG
03.5.29	23-May-03	Jackson 20-May-03	Chris 20-May-03

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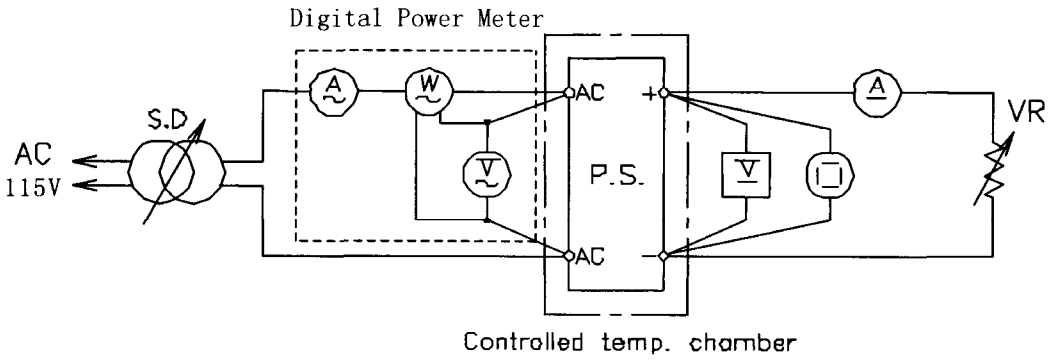
Terminology used

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

1. 1 Circuit used for determination

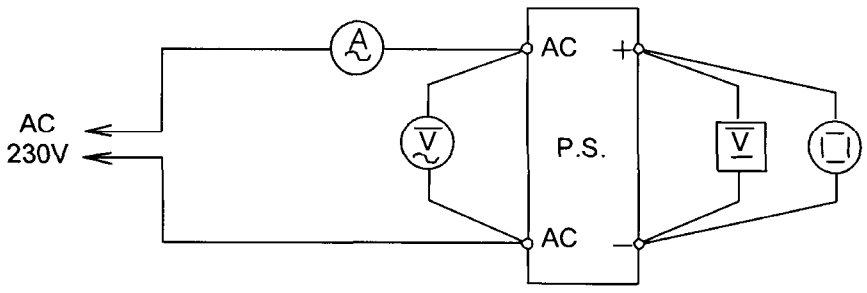
(1) Steady state data



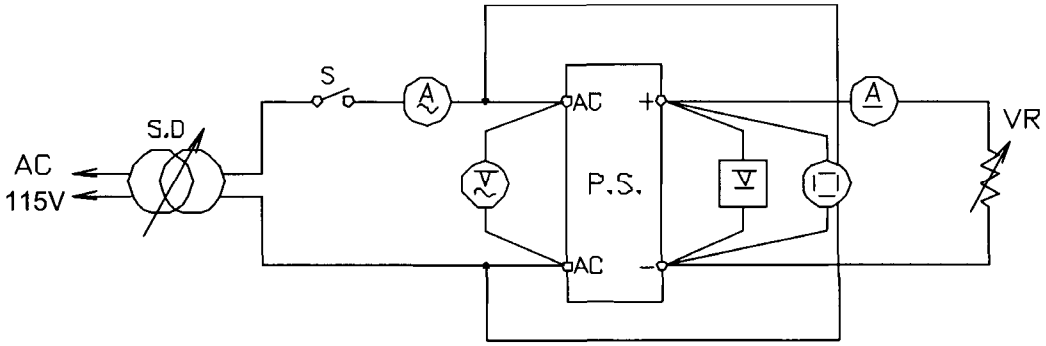
(2) Over current protection (O.C.P) characteristics

Same as steady state data.

(3) Over voltage protection (O.V.P) characteristics



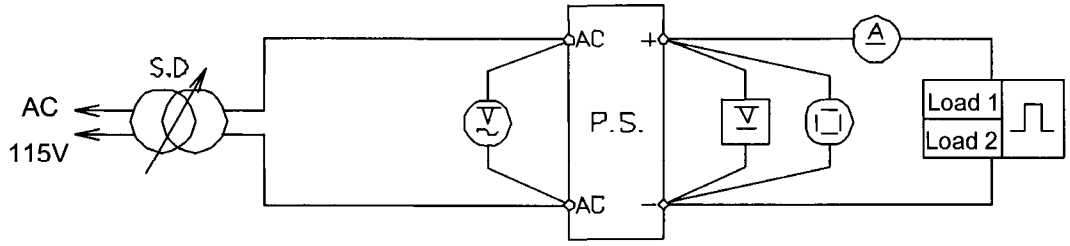
(4) Output rise characteristics



(5) Output fall characteristics

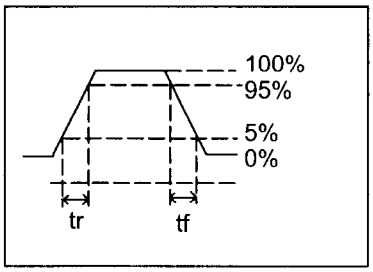
Same as output rise characteristics.

(6) Dynamic load response characteristics



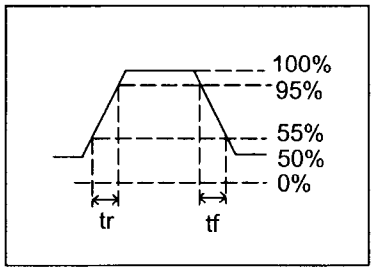
Output current waveform :

Iout 0% ⟷ 50%

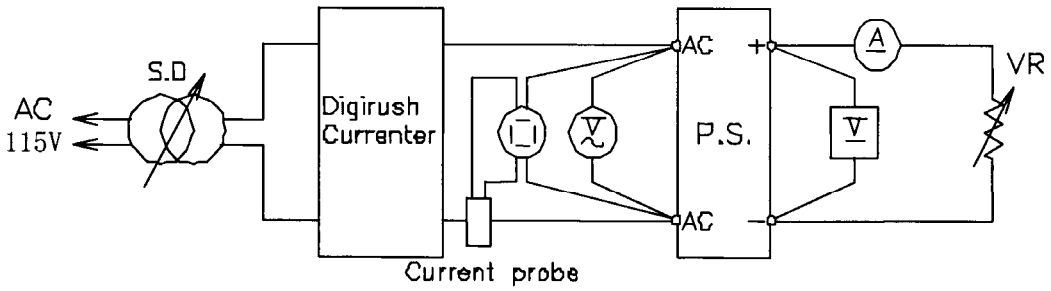


Output current waveform :

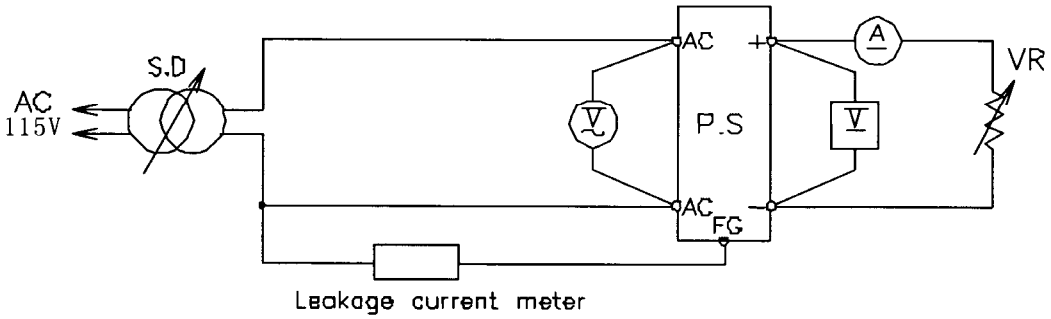
Iout 50% ⟷ 100%



(7) Inrush current characteristics



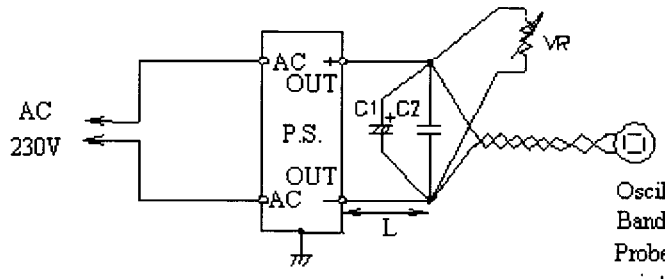
(8) Leakage current characteristics



Note : Leakage current measured through a 1k ohm resistor.
Range used : AC + DC (For SIMPSON MODEL 228)

(9) Output - ripple, noise waveform

Normal Mode

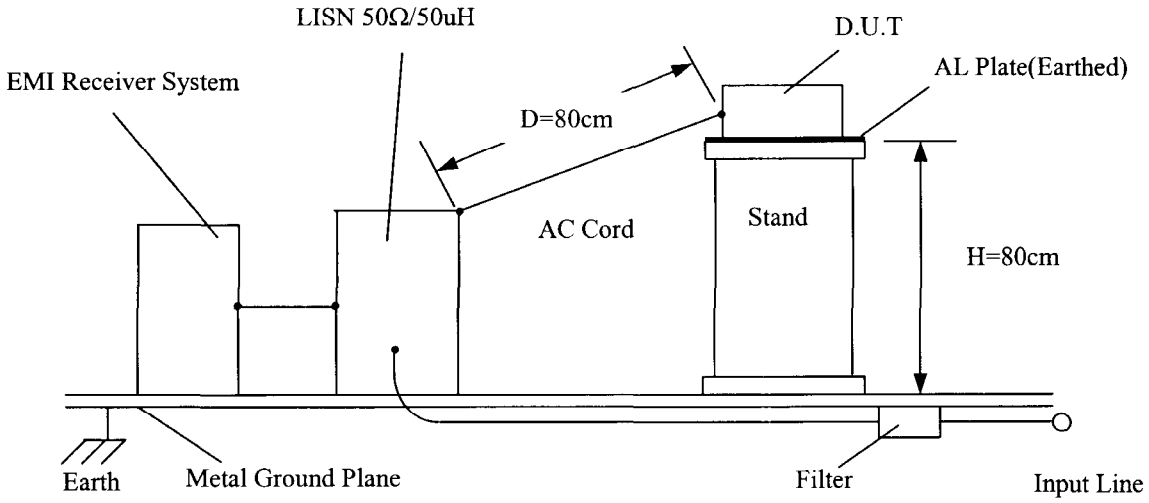


Oscilloscope
Bandwidth : 20MHz
Probe : 12inch twisted
pair terminated with C1 and C2.

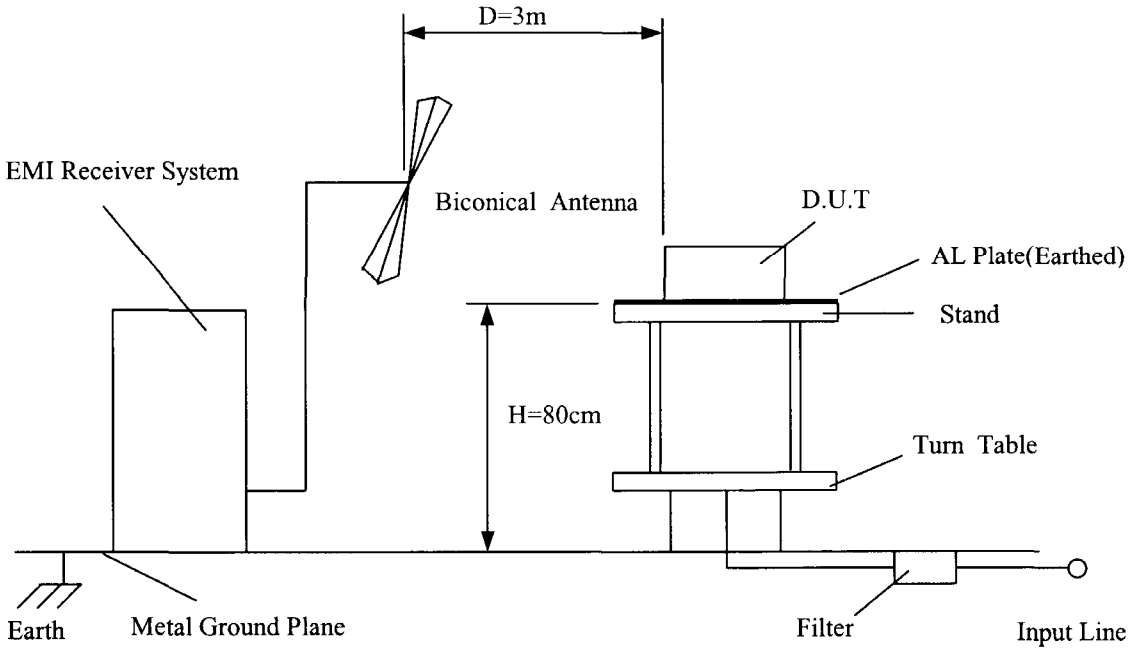
L : 150mm
C1 : 47 uF Electrolytic Capacitor
C2 : 0.1uF Film Capacitor

(10) Electro-Magnetic Interference characteristics

(a) Conducted Emission Noise



(b) Radiated Emission Noise



1.2 LIST OF EQUIPMENT USED

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	Oscilloscope	HITACHI	V-1050F
2	Digital storage oscilloscope	TEKTRONIX	TDS 540A
3	Digital volt meter	FLUKE	45
4	Digital power meter	YOKOGAWA	WT110
5	DC ampere meter	YOKOGAWA	2051
6	Dynamic dummy load	CHROMA	63030
7	Current probe/amplifier	TEKTRONIX	A6303/AM503B
8	Controlled temperature chamber	TABAI-ESPEC	SU-240
9	Leakage current meter	SIMPSON	228
10	Digirush currenter	TAKAMIZAWA CYBERNETICS	PSA-200
11	EMI receiver	HEWLETT PACKARD	HP8546A
12	LISN	EMCO	3825/2
13	Biconical antenna	EMCO	3110B

2. Characteristics

2.1 Steady state data

(1) Regulation - line and load, temperature drift

5V

1. Regulation-line and load — condition Ta : 25°C

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	line regulation	
0%	5.016V	5.015V	5.012V	5.014V	0.004V	0.080%
50%	5.008V	5.005V	5.007V	5.004V	0.004V	0.080%
100%	4.999V	4.997V	4.998V	4.997V	0.002V	0.040%
load	0.017V	0.018V	0.014V	0.017V		
regulation	0.340%	0.360%	0.280%	0.340%		

2. Temperature drift — Conditions Vin =230VAC, Iout =100%

Ta	-10°C	+25°C	+45°C	temperature stability	
Vout	4.997V	4.998V	4.994V	0.004V	0.080%

12V

1. Regulation-line and load — condition Ta : 25°C

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	line regulation	
0%	12.011V	12.013V	12.014V	12.017V	0.006V	0.050%
50%	12.003V	12.004V	12.008V	12.008V	0.005V	0.042%
100%	11.998V	11.998V	12.002V	12.002V	0.004V	0.033%
load	0.013V	0.015V	0.012V	0.015V		
regulation	0.108%	0.125%	0.100%	0.125%		

2. Temperature drift — Conditions Vin =230VAC, Iout =100%

Ta	-10°C	+25°C	+45°C	temperature stability	
Vout	12.046V	12.002V	11.998V	0.048V	0.400%

24V

1. Regulation-line and load — condition Ta : 25°C

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	line regulation	
0%	23.946V	23.956V	23.957V	23.959V	0.013V	0.054%
50%	23.942V	23.947V	23.951V	23.951V	0.009V	0.038%
100%	23.942V	23.942V	23.948V	23.947V	0.006V	0.025%
load	0.004V	0.014V	0.009V	0.012V		
regulation	0.017%	0.058%	0.038%	0.050%		

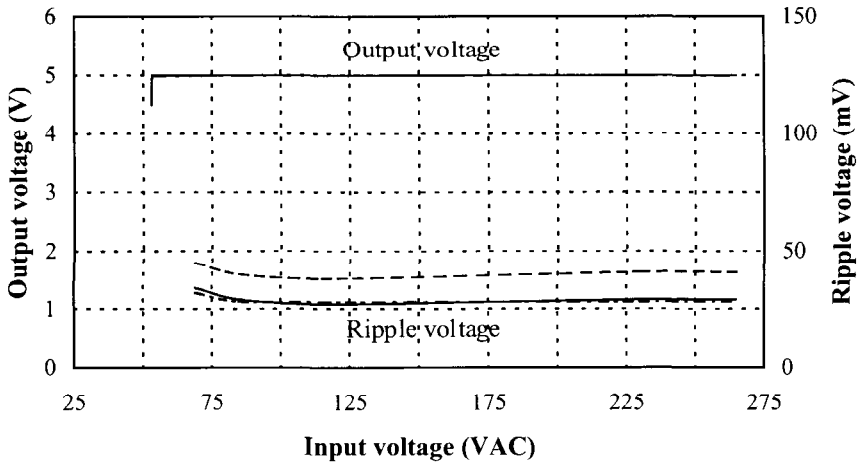
2. Temperature drift — Conditions Vin =230VAC, Iout =100%

Ta	-10°C	+25°C	+45°C	temperature stability	
Vout	24.013V	23.948V	23.886V	0.127V	0.529%

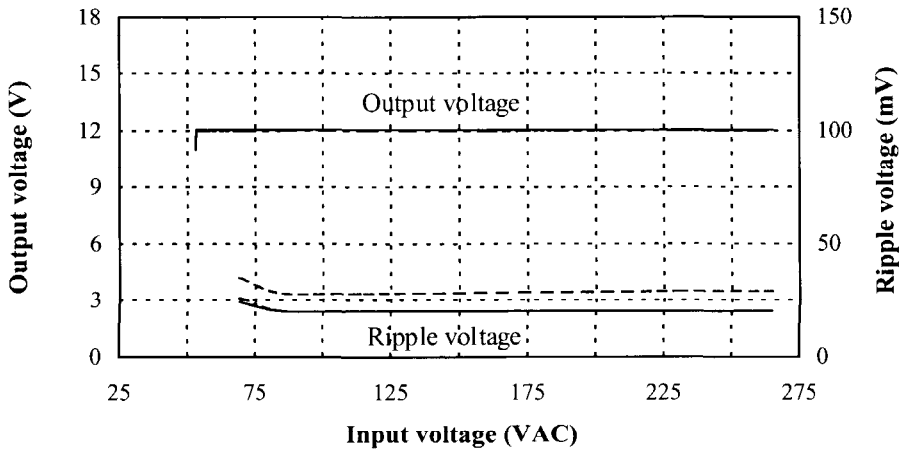
2.1 (2) Output voltage and Ripple voltage v.s. Input voltage

Conditions Iout : 100%
Ta : -10°C
: 25°C
: 45°C

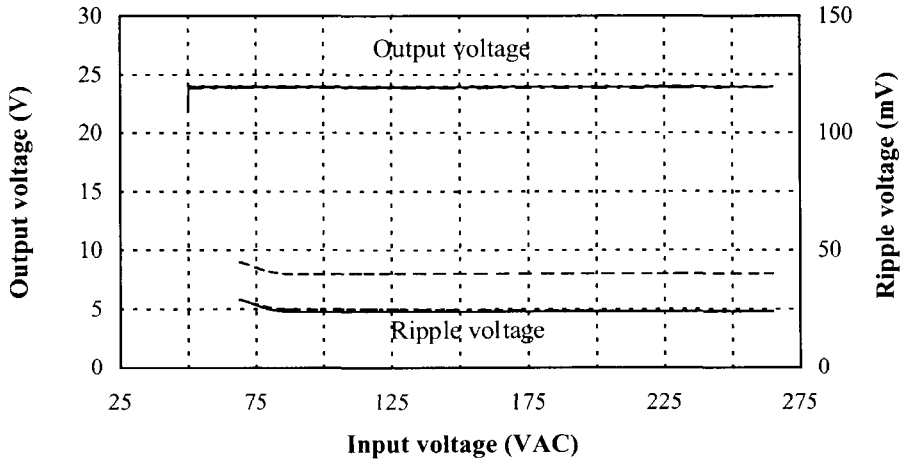
5V



12V



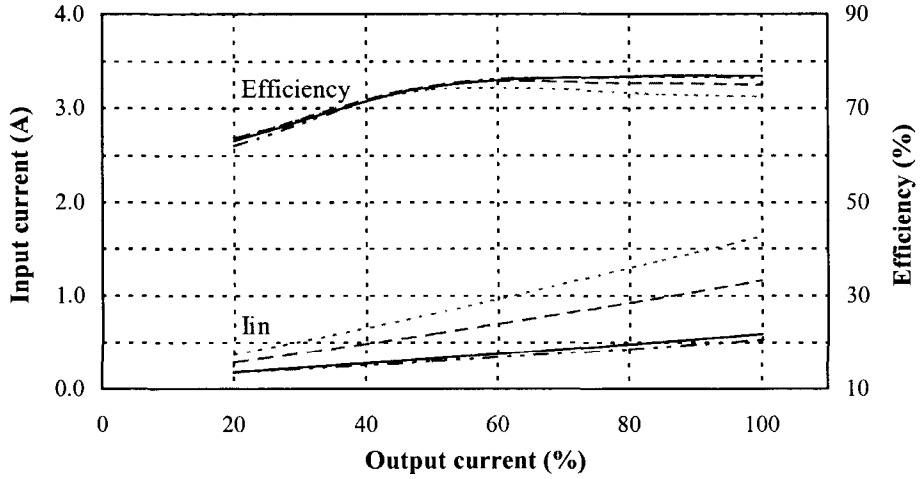
24V



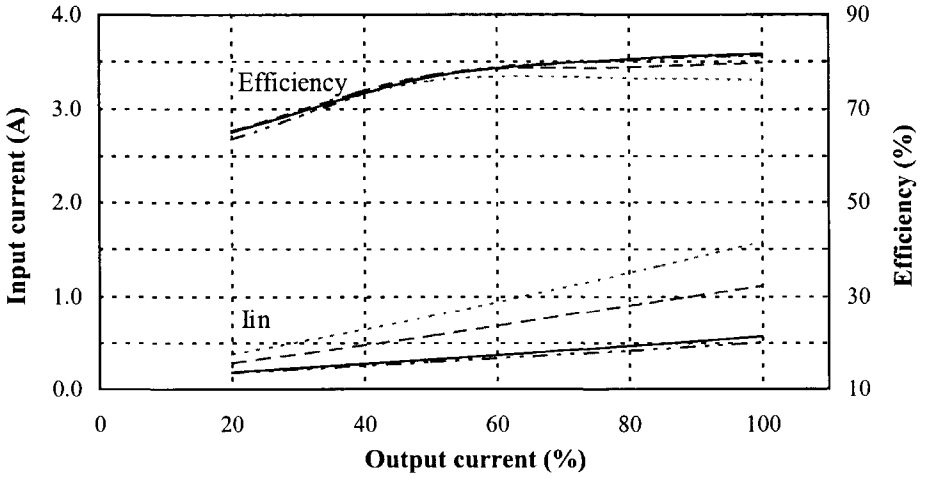
2.1 (3) Efficiency and input current v.s. Output current

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

5V



12V



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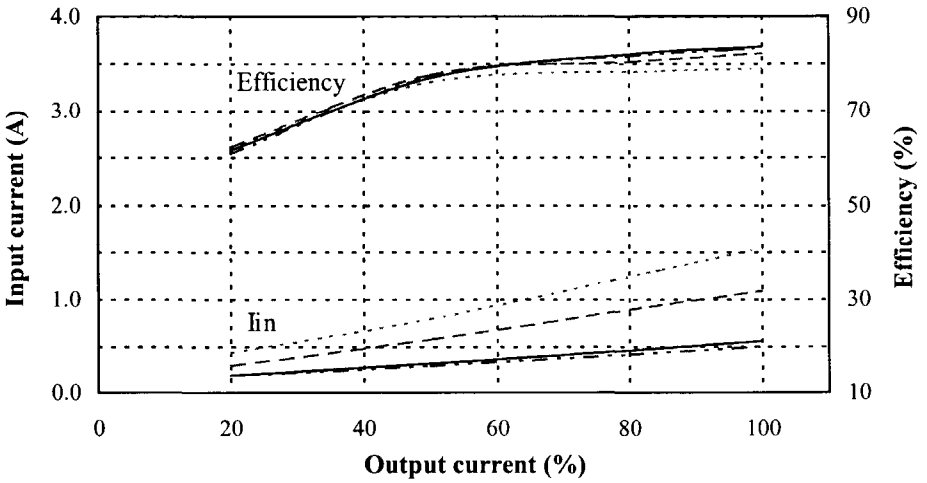
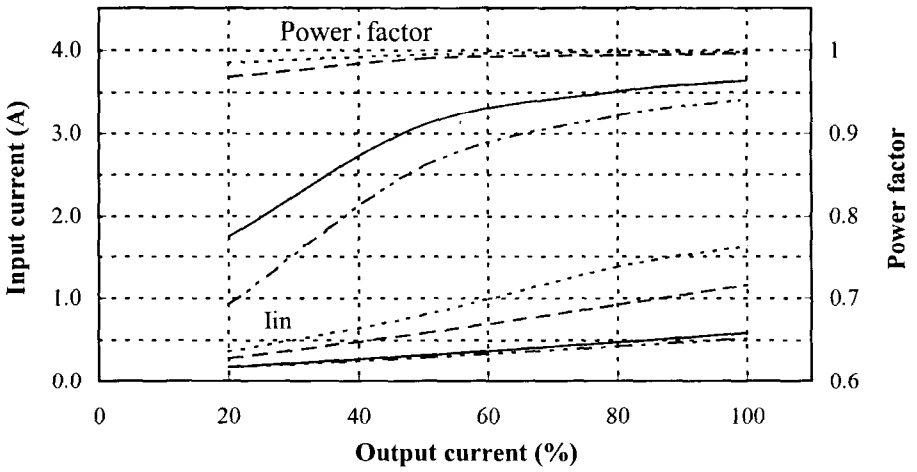


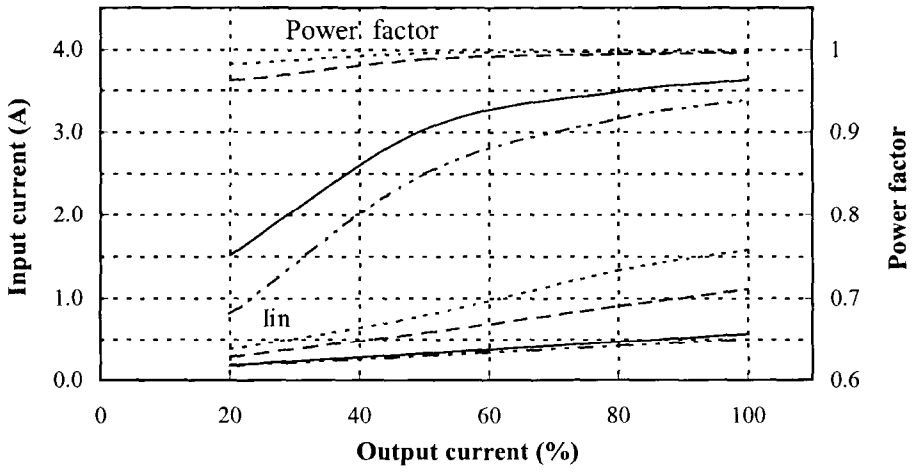
2.1 (4) Power factor and Input current v.s Output current

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

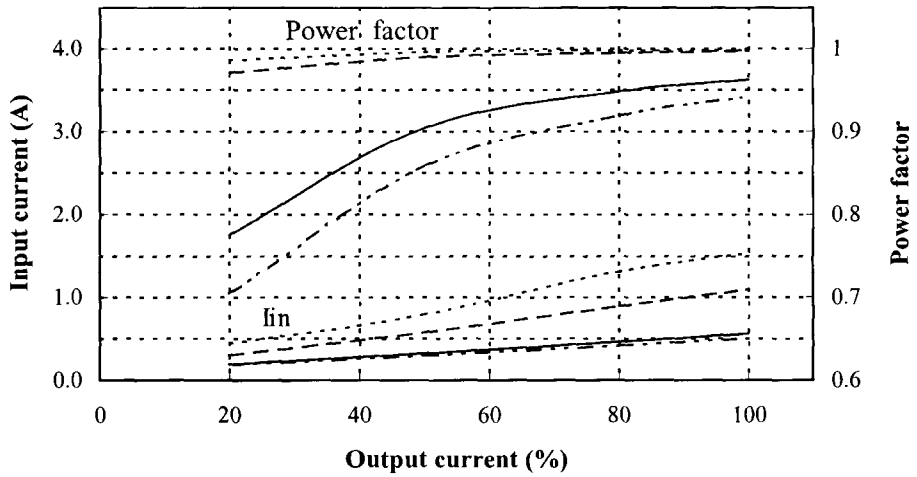
5V



12V



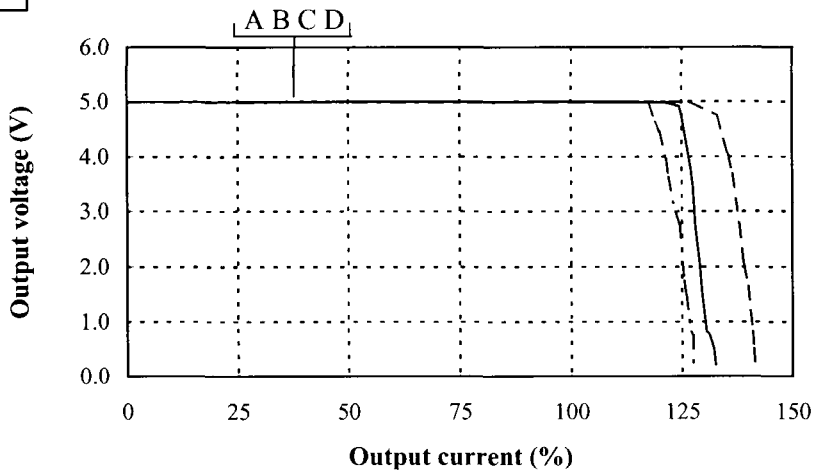
24V



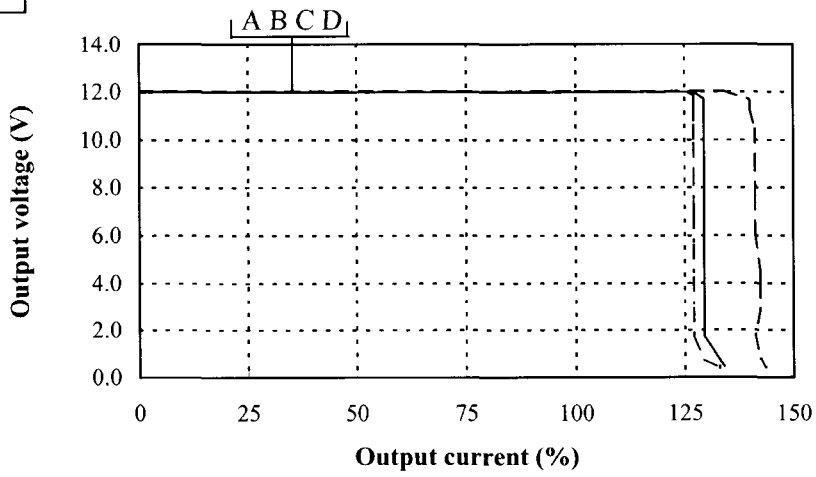
2.2 Over current protection (OCP) characteristics

Conditions Vin : 85VAC (A) Ta : -10°C
: 115VAC (B) : 25°C
: 230VAC (C) : 45°C
: 265VAC (D)

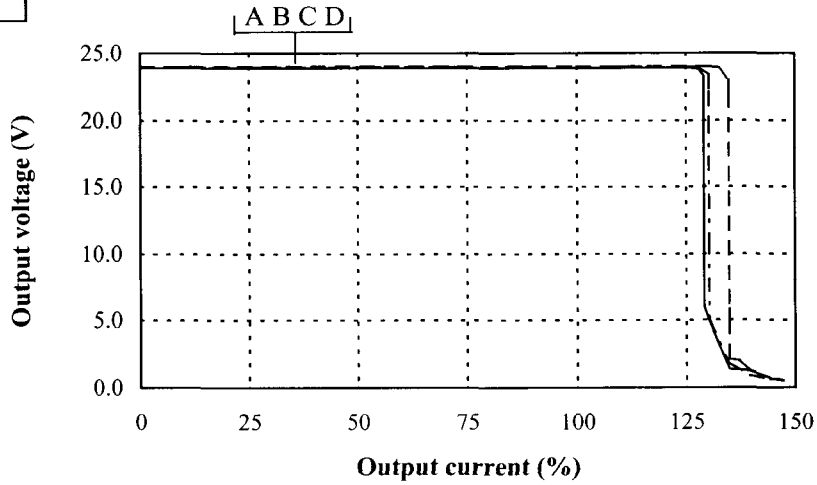
5V



12V



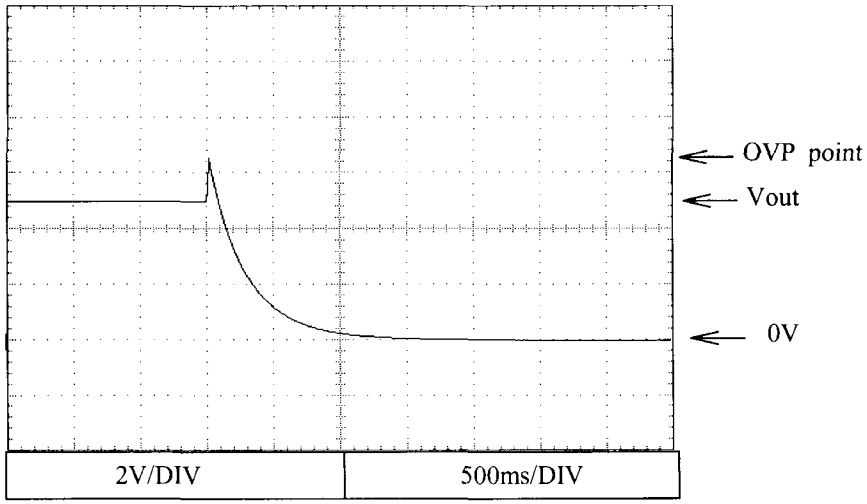
24V



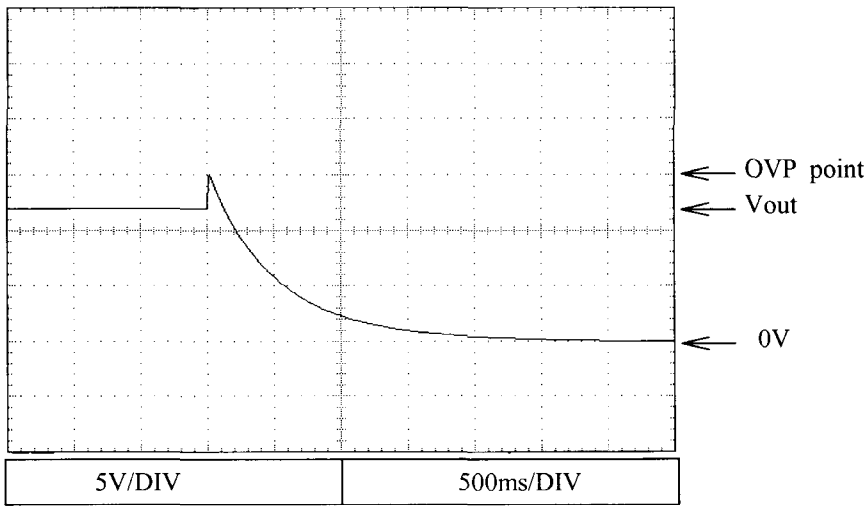
2.3 Over voltage protection (OVP) characteristics

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

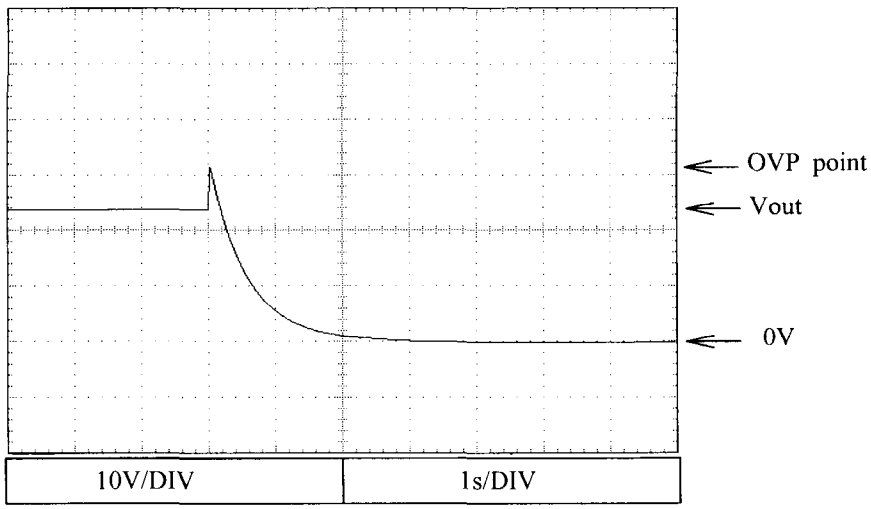
5V



12V



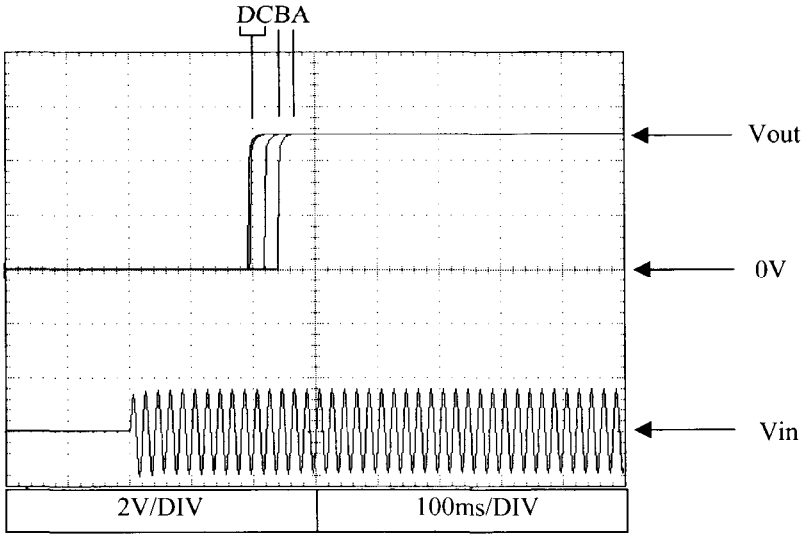
24V



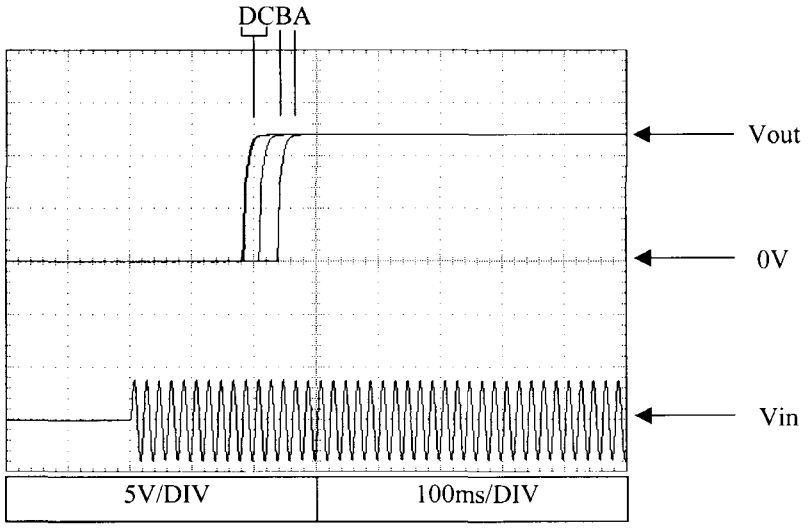
2.4 Output rise characteristics

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

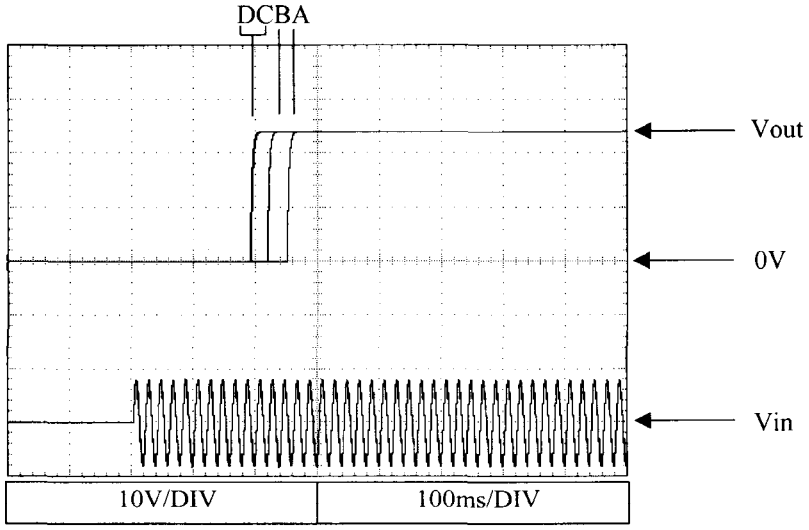
5V



12V



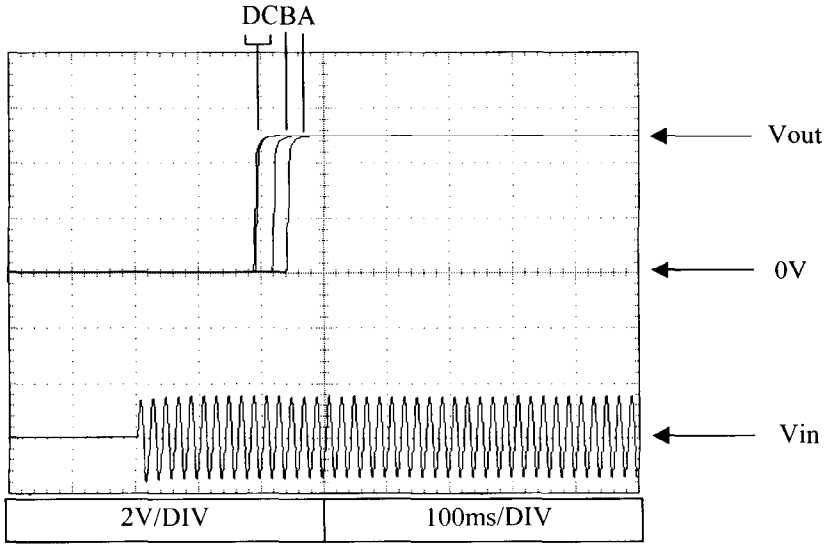
24V



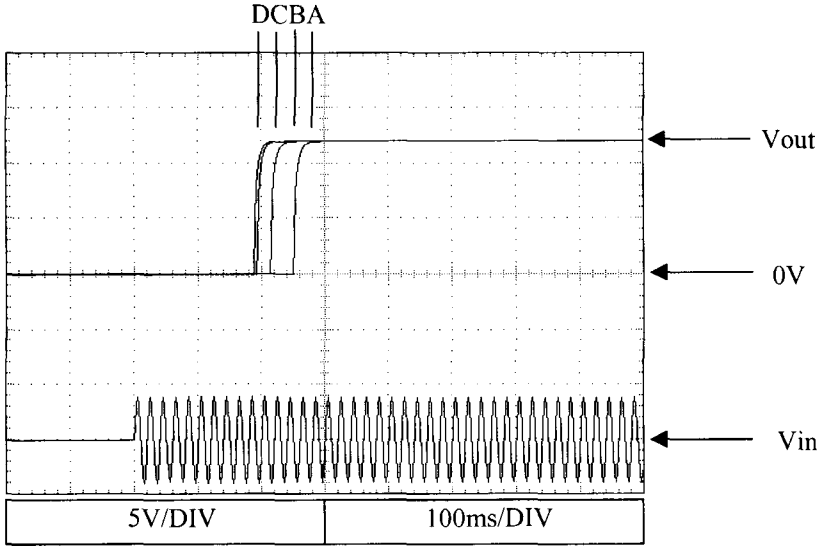
2.4 Output rise characteristics

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

5V



12V



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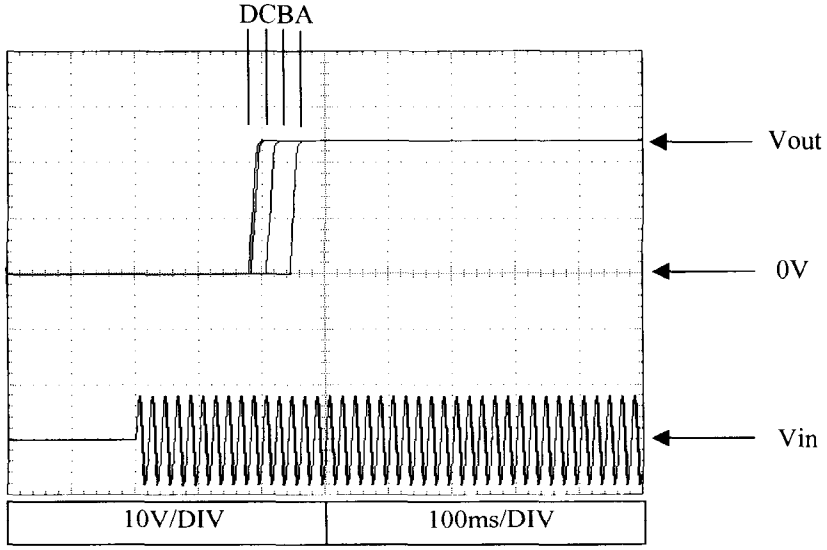
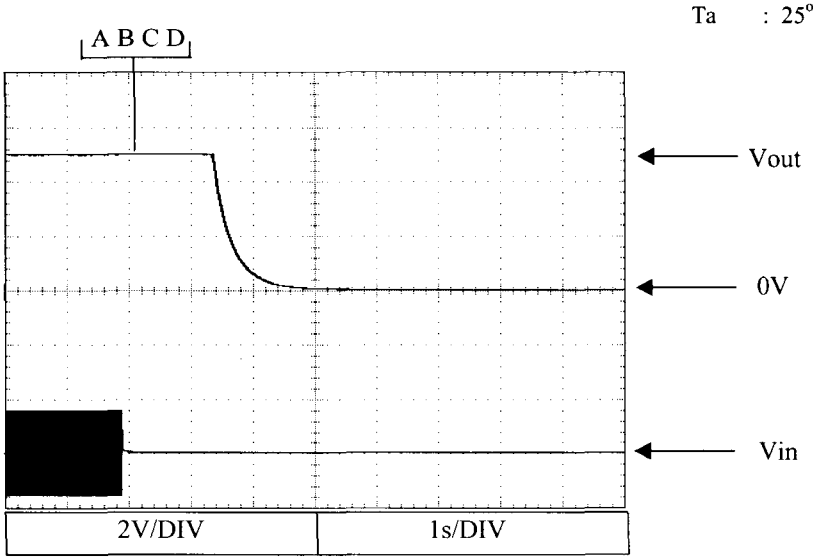


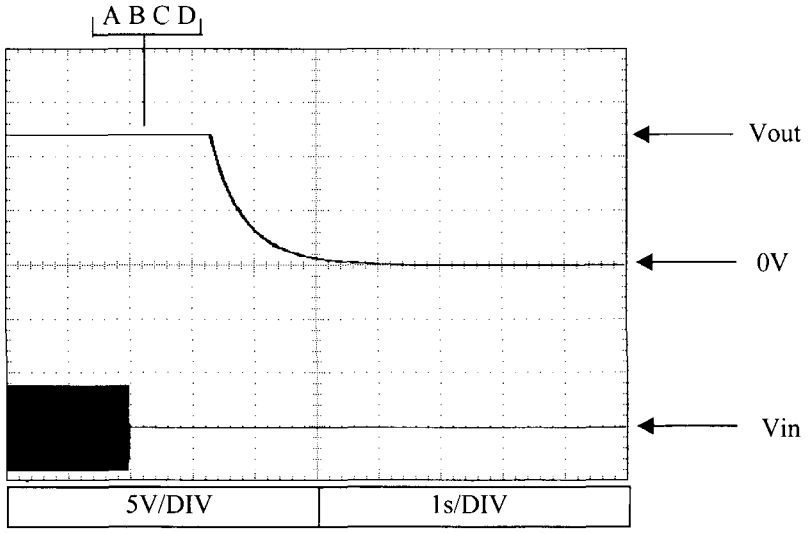
2.5 Output fall characteristics

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

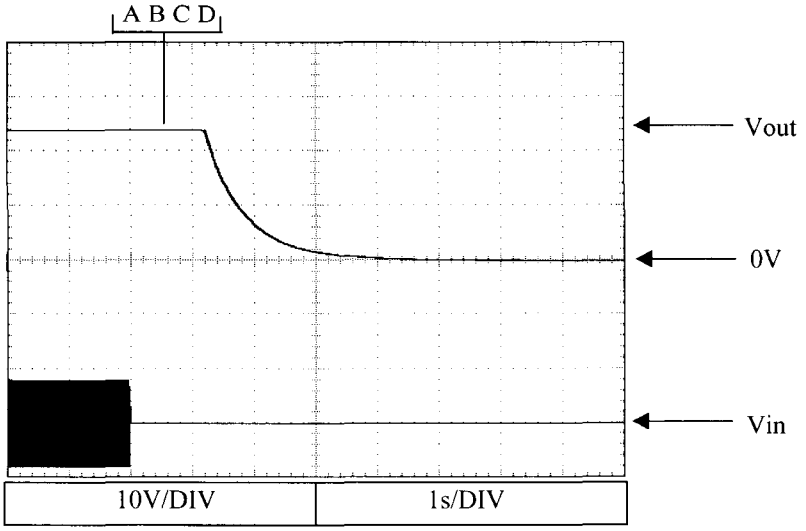
5V



12V



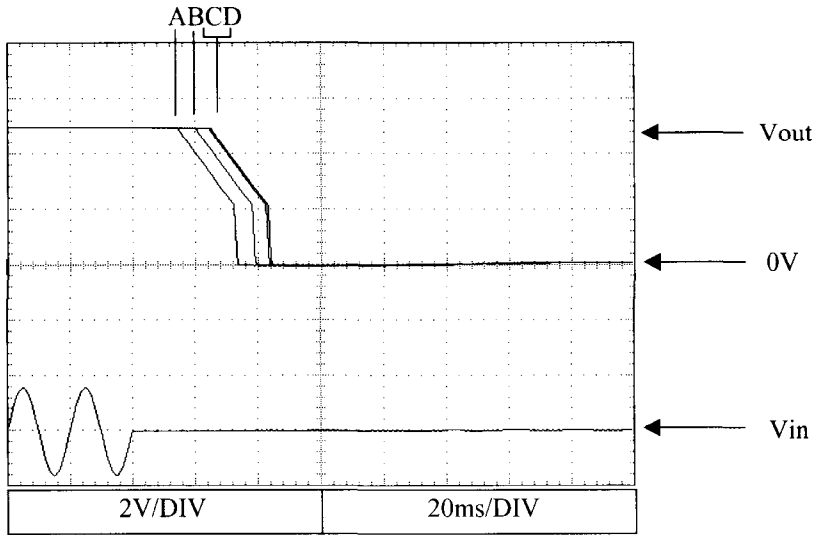
24V



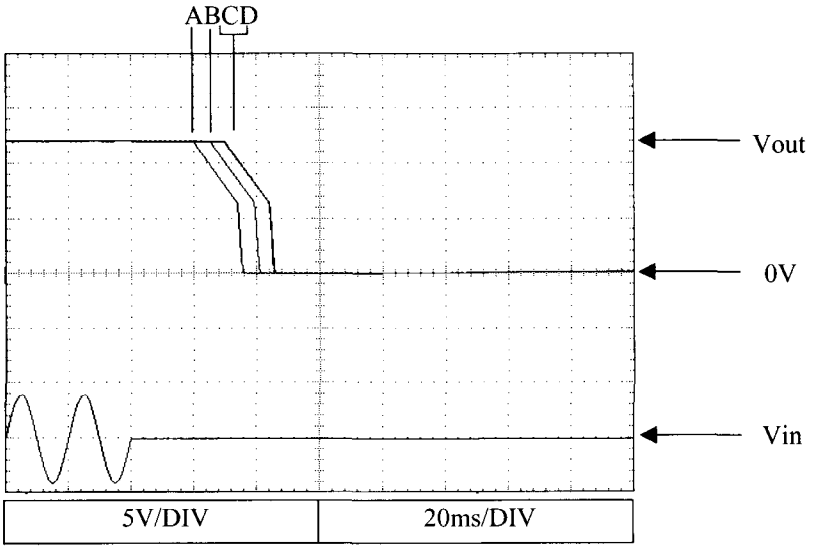
2.5 Output fall characteristics

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

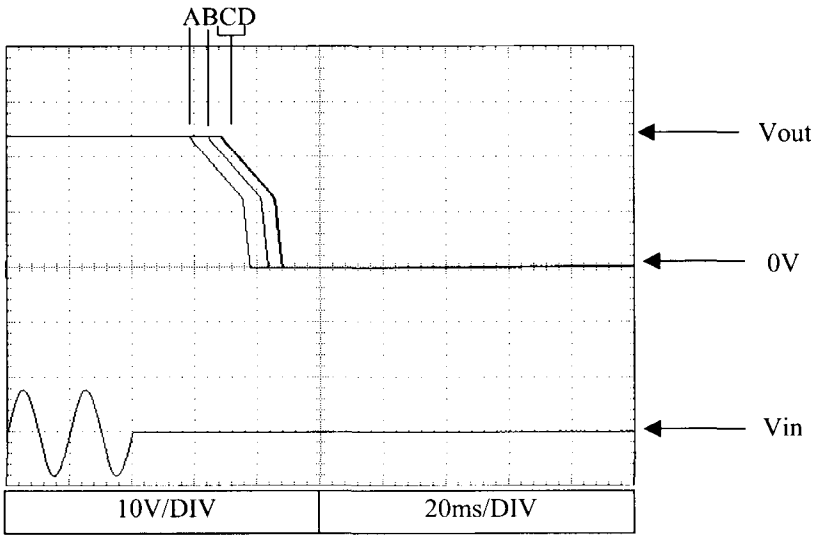
5V



12V



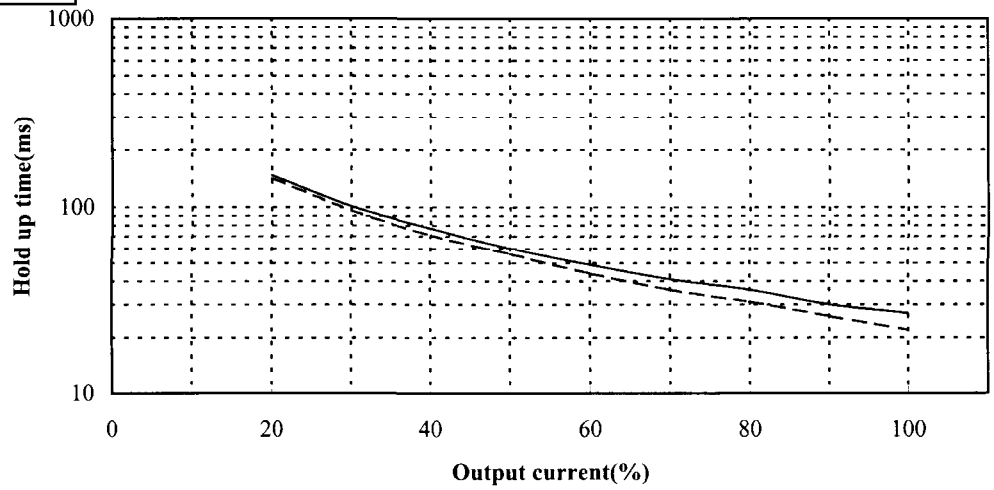
24V



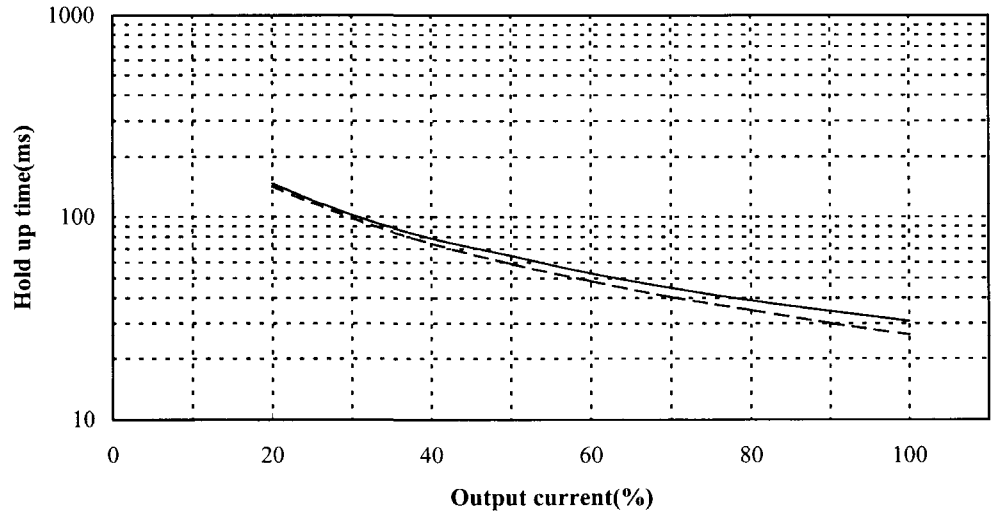
2.6 Hold up time characteristics

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

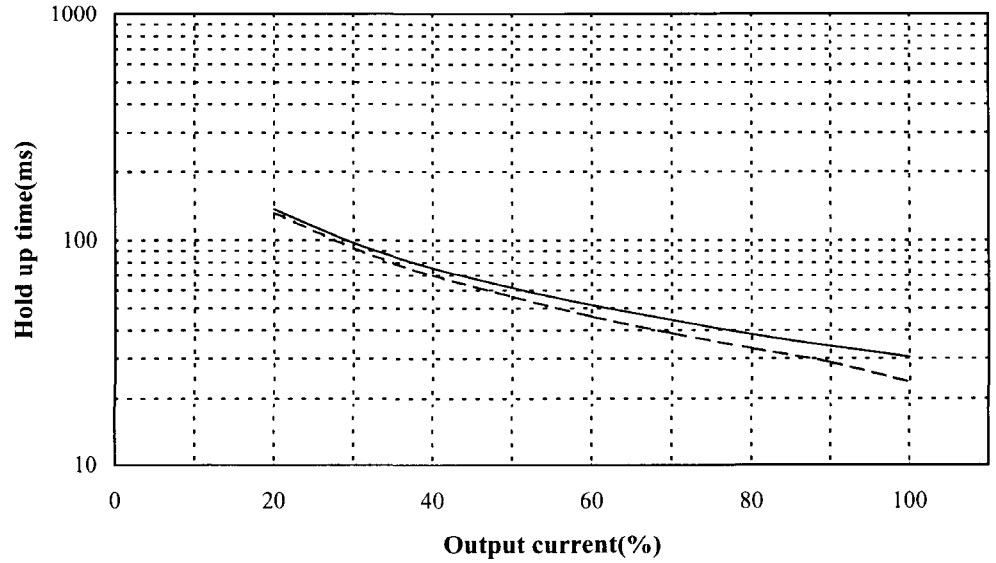
5V



12V



24V

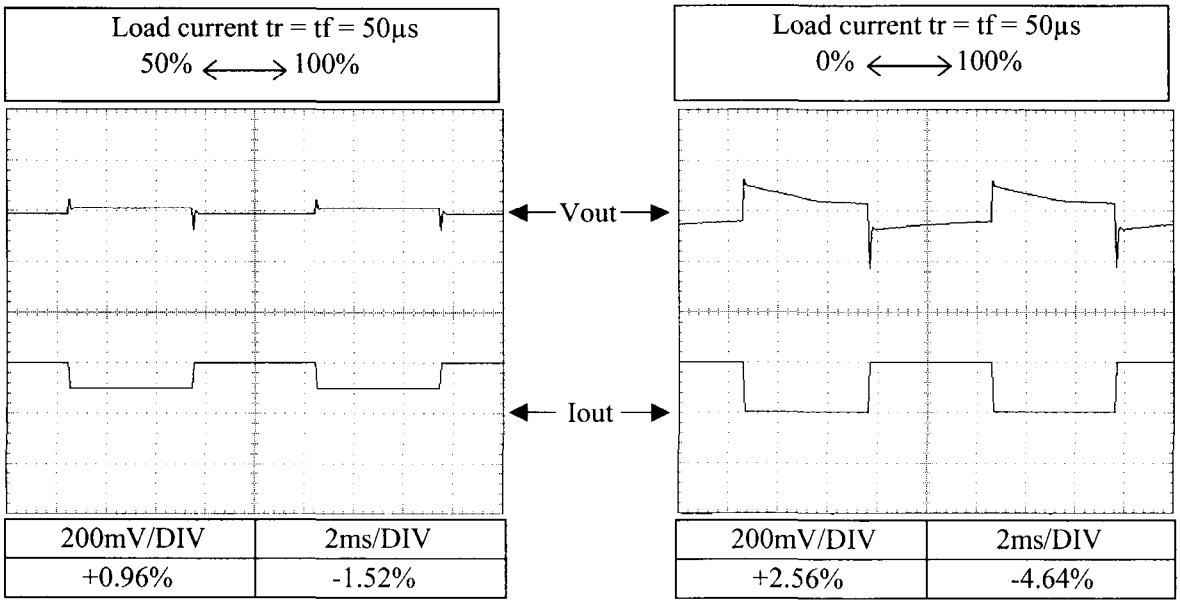


2.7 Dynamic load response characteristics

Conditions Vin : 115VAC
Ta : 25°C

5V

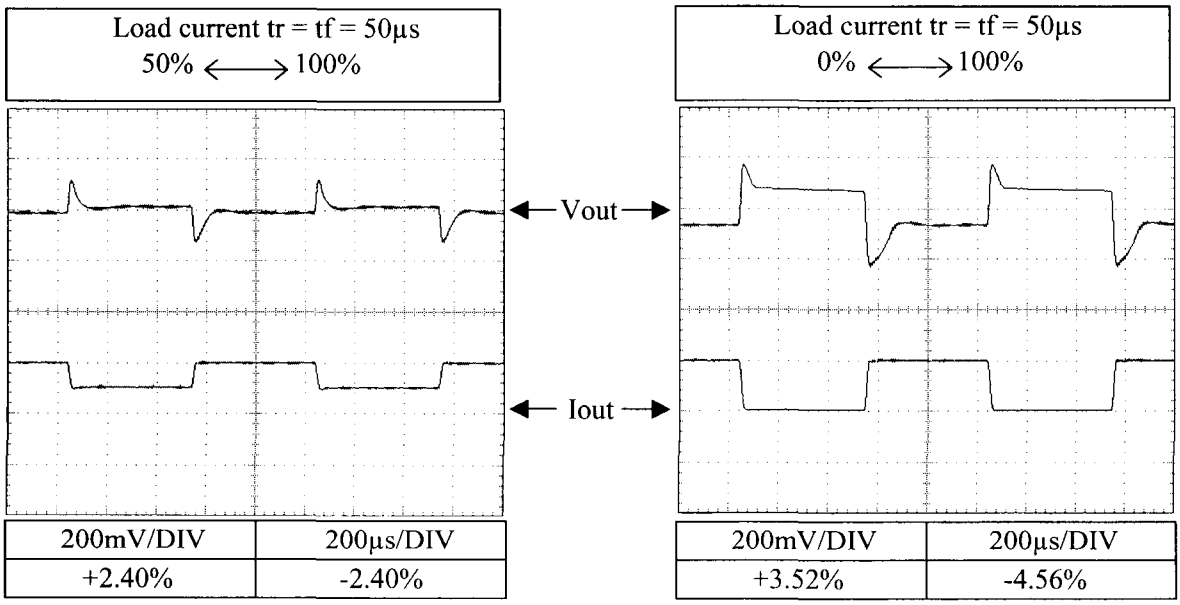
f=100Hz



200mV/DIV	2ms/DIV
+0.96%	-1.52%

200mV/DIV	2ms/DIV
+2.56%	-4.64%

f=1kHz



200mV/DIV	200µs/DIV
+2.40%	-2.40%

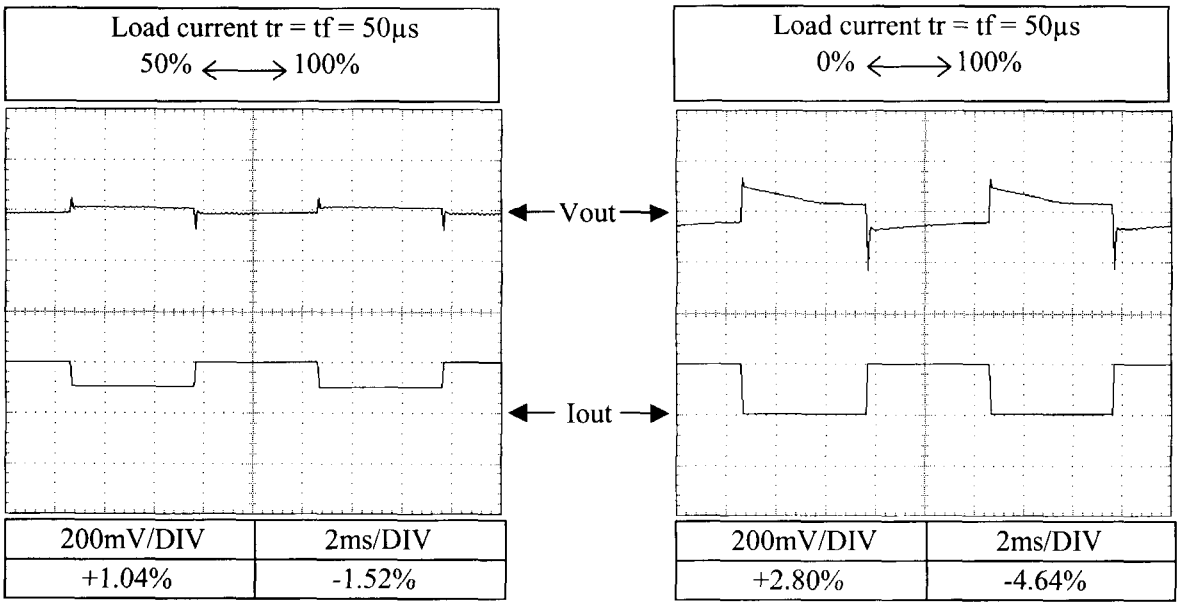
200mV/DIV	200µs/DIV
+3.52%	-4.56%

2.7 Dynamic load response characteristics

Conditions Vin : 230VAC
Ta : 25°C

5V

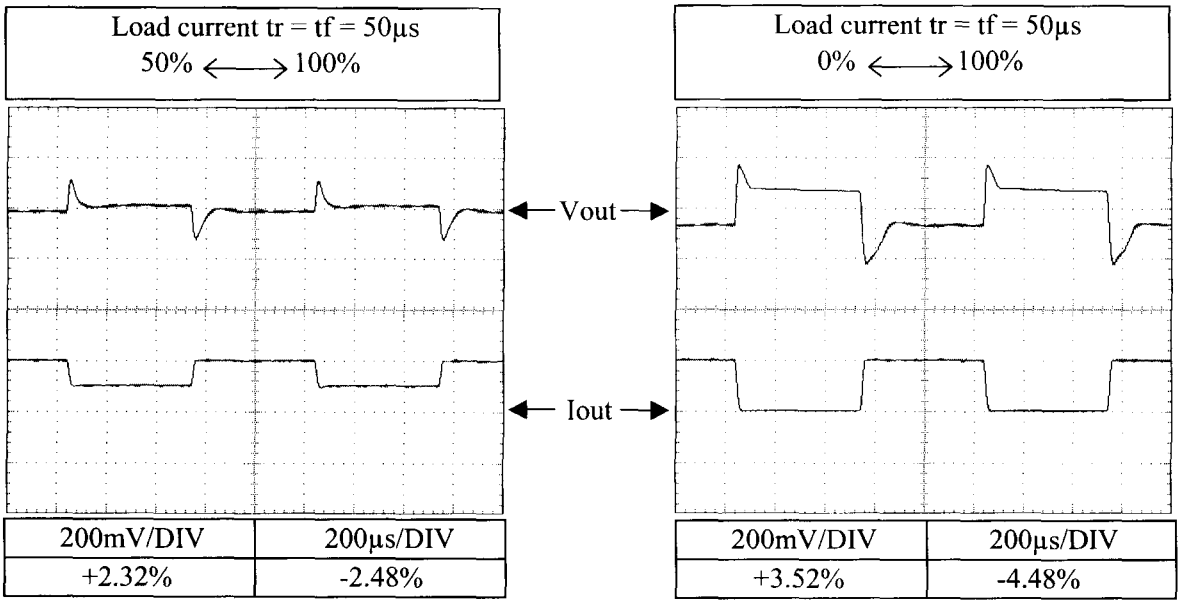
f=100Hz



200mV/DIV	2ms/DIV
+1.04%	-1.52%

200mV/DIV	2ms/DIV
+2.80%	-4.64%

f=1kHz



200mV/DIV	200µs/DIV
+2.32%	-2.48%

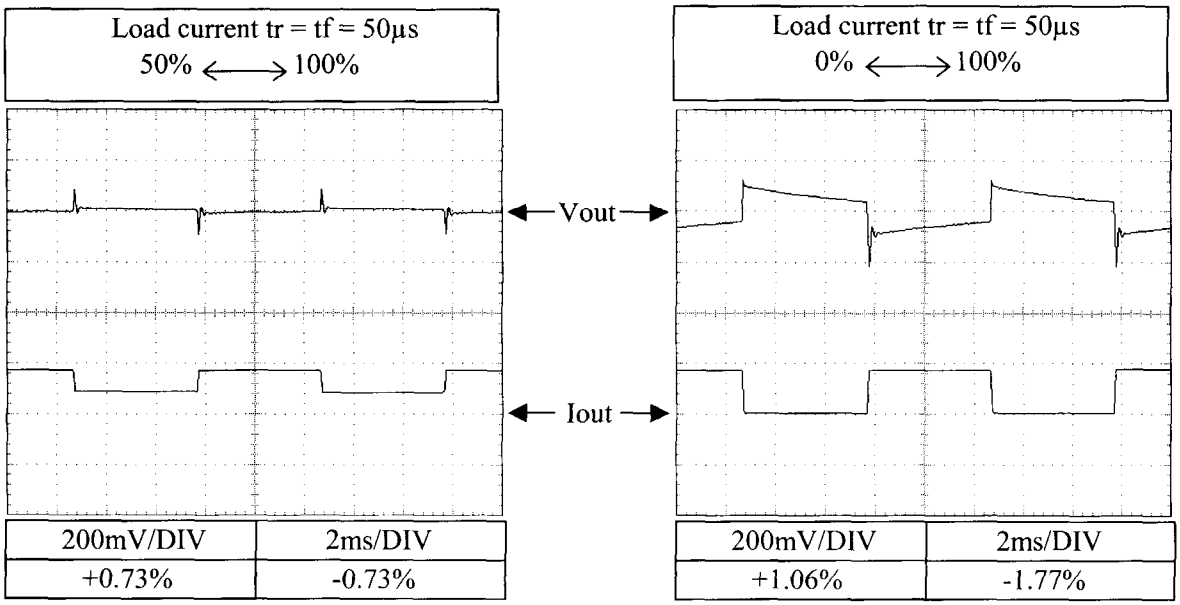
200mV/DIV	200µs/DIV
+3.52%	-4.48%

2.7 Dynamic load response characteristics

Conditions Vin : 115VAC
Ta : 25°C

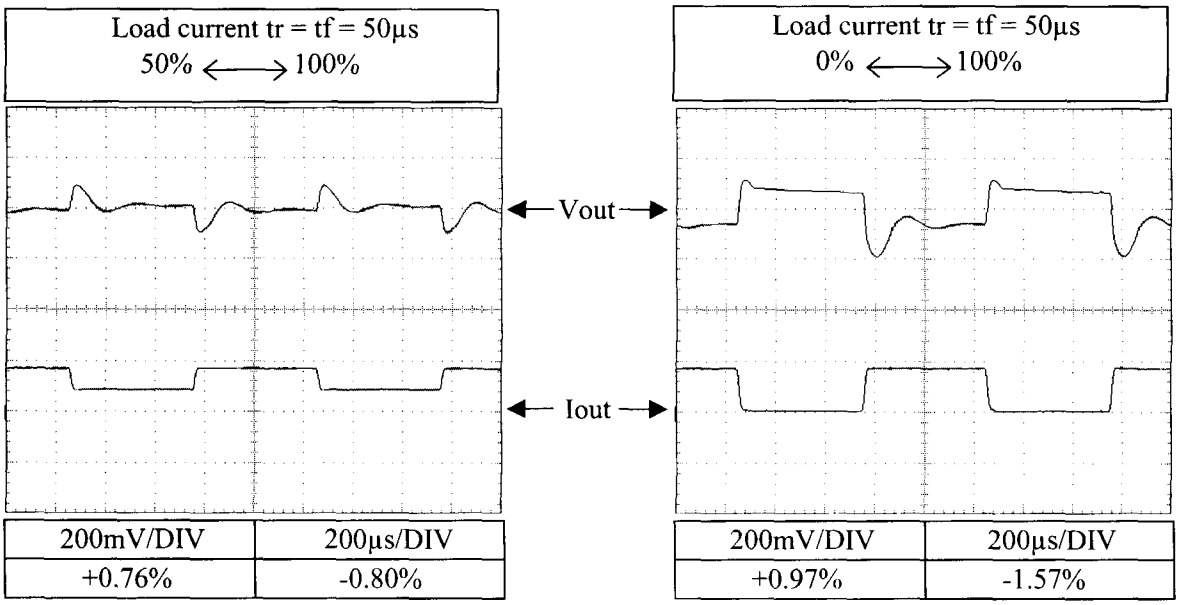
12V

f=100Hz



200mV/DIV	2ms/DIV	200mV/DIV	2ms/DIV
+0.73%	-0.73%	+1.06%	-1.77%

f=1kHz



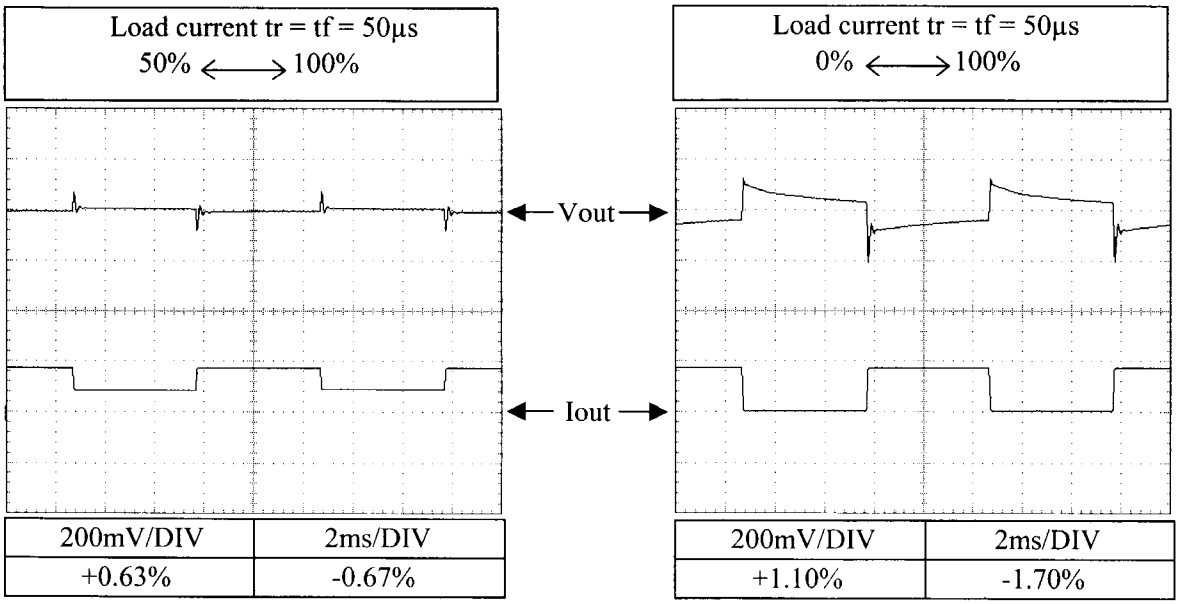
200mV/DIV	200µs/DIV	200mV/DIV	200µs/DIV
+0.76%	-0.80%	+0.97%	-1.57%

2.7 Dynamic load response characteristics

Conditions Vin : 230VAC
Ta : 25°C

12V

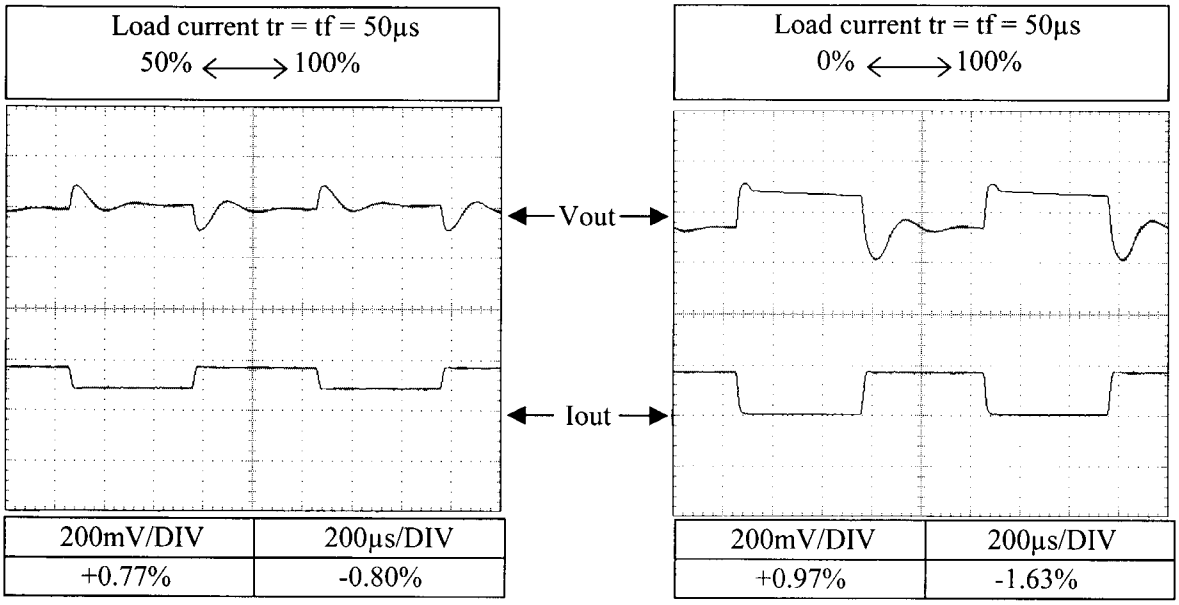
f=100Hz



200mV/DIV	2ms/DIV
+0.63%	-0.67%

200mV/DIV	2ms/DIV
+1.10%	-1.70%

f=1kHz



200mV/DIV	200µs/DIV
+0.77%	-0.80%

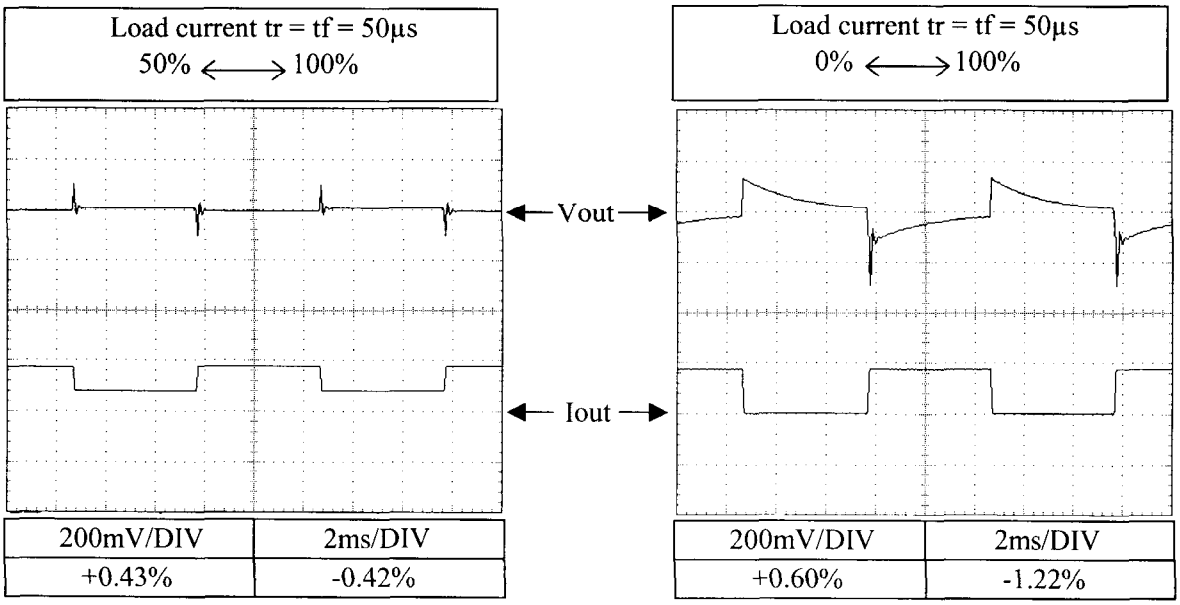
200mV/DIV	200µs/DIV
+0.97%	-1.63%

2.7 Dynamic load response characteristics

Conditions Vin : 115VAC
Ta : 25°C

24V

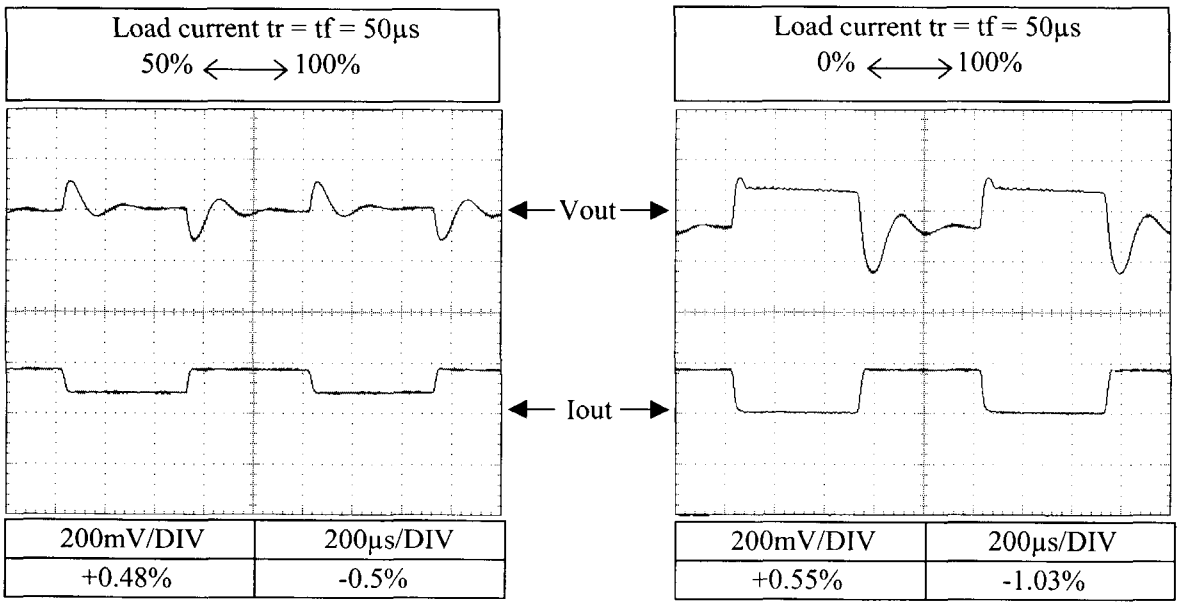
f=100Hz



200mV/DIV	2ms/DIV
+0.43%	-0.42%

200mV/DIV	2ms/DIV
+0.60%	-1.22%

f=1kHz



200mV/DIV	200µs/DIV
+0.48%	-0.5%

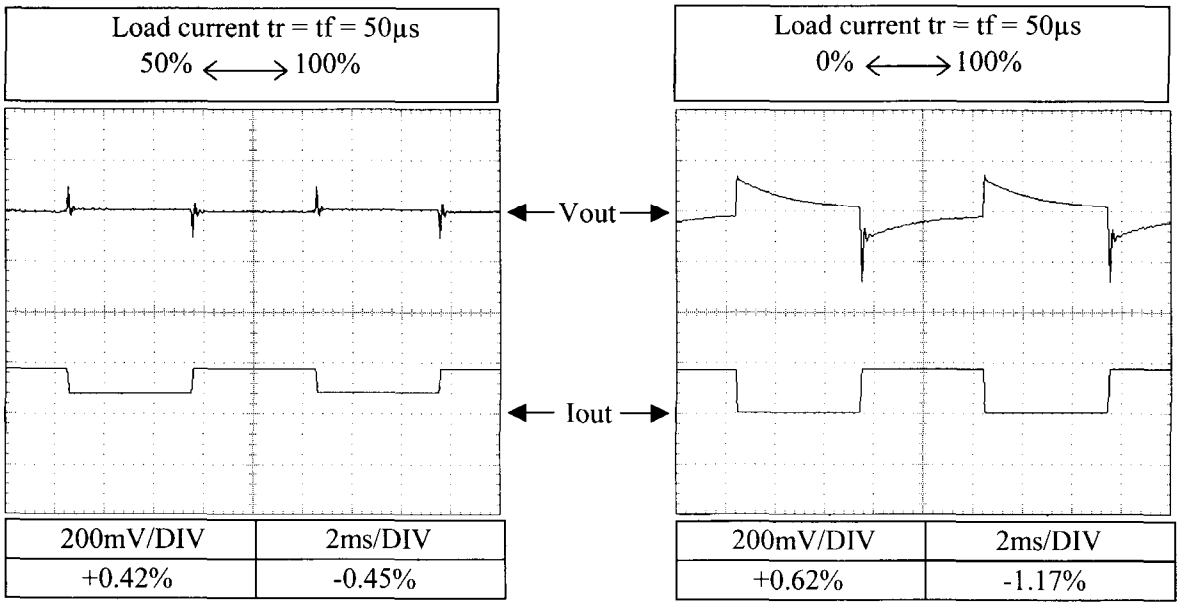
200mV/DIV	200µs/DIV
+0.55%	-1.03%

2.7 Dynamic load response characteristics

Conditions Vin : 230VAC
Ta : 25°C

24V

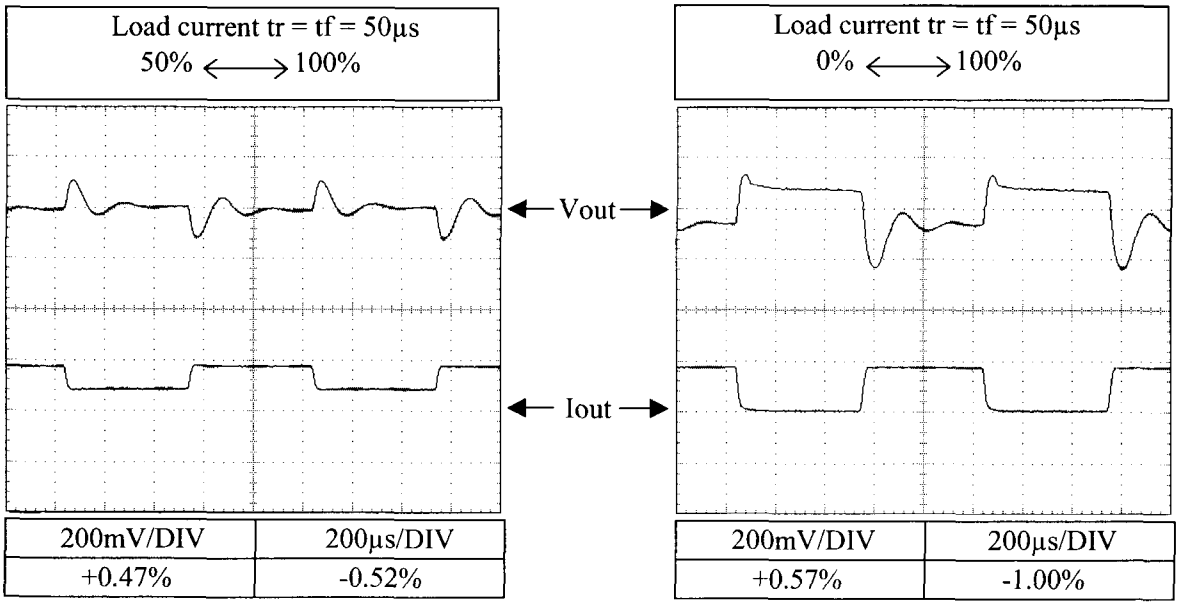
f=100Hz



200mV/DIV	2ms/DIV
+0.42%	-0.45%

200mV/DIV	2ms/DIV
+0.62%	-1.17%

f=1kHz



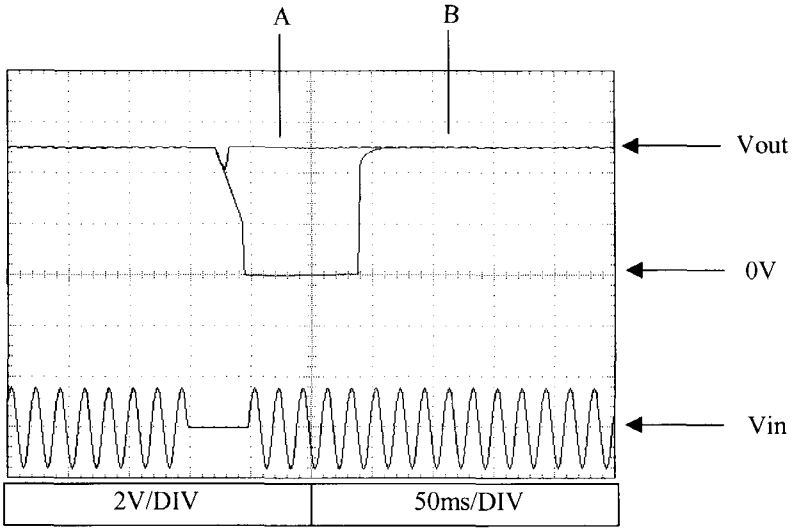
200mV/DIV	200µs/DIV
+0.47%	-0.52%

200mV/DIV	200µs/DIV
+0.57%	-1.00%

2.8 Response to brown out characteristics

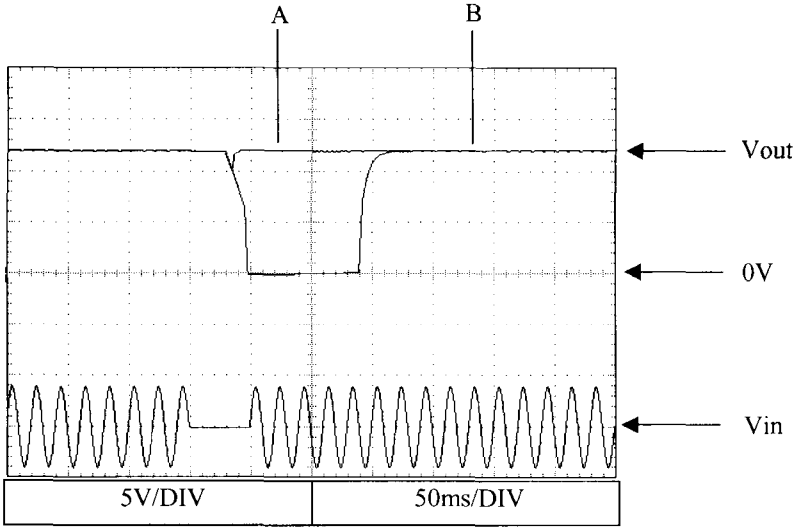
Conditions Vin : 115V
Iout : 100%
Ta : 25°C

5V



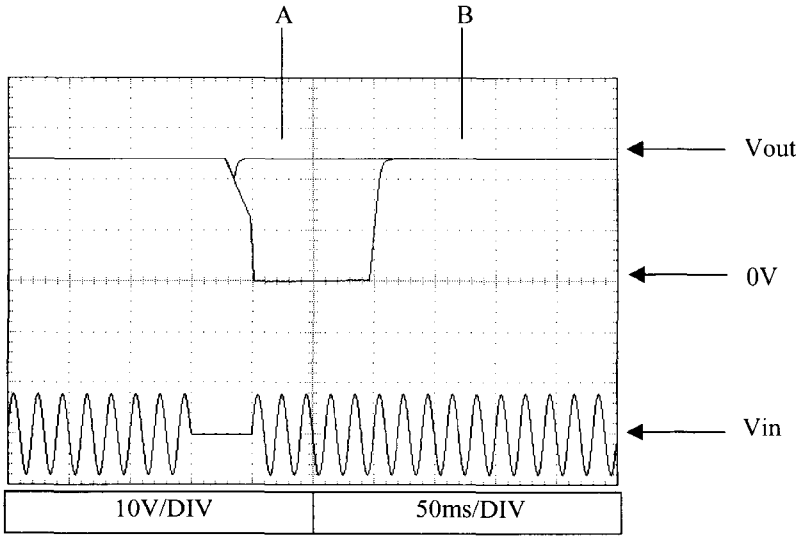
A=28ms
B=46ms

12V



A=36ms
B=47ms

24V

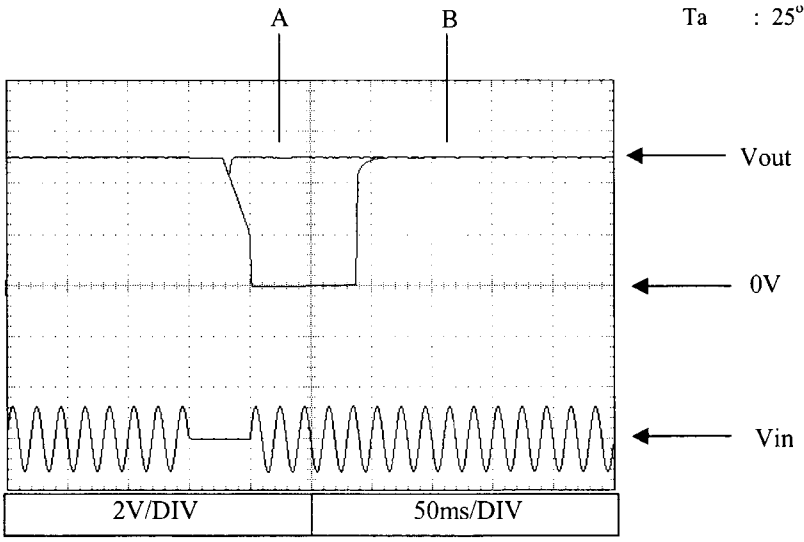


A=35ms
B=49ms

2.8 Response to brown out characteristics

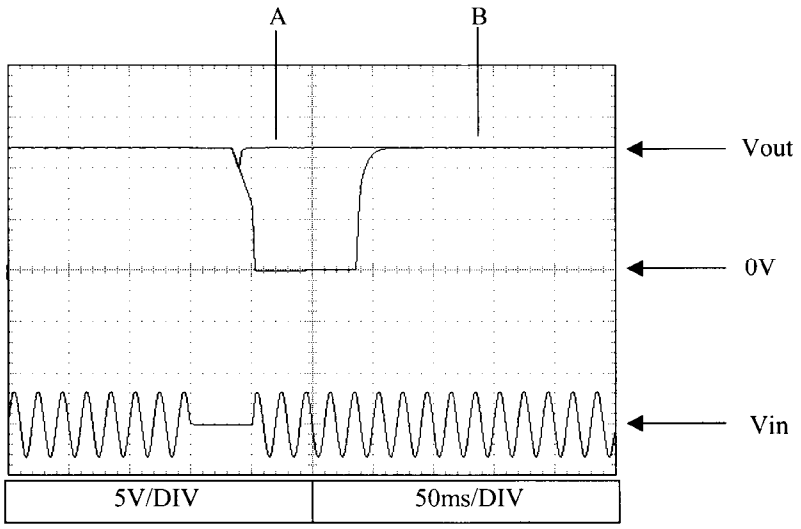
Conditions Vin : 230V
Iout : 100%
Ta : 25°C

5V



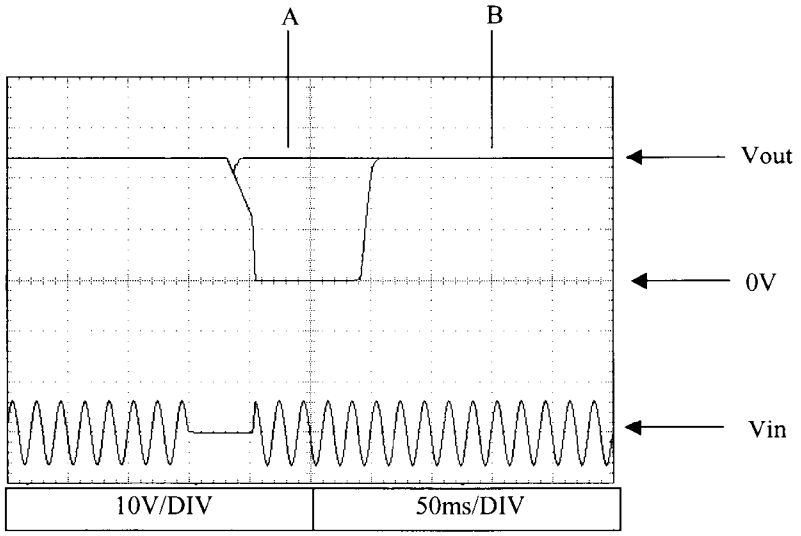
A=34ms
B=51ms

12V



A=40ms
B=52ms

24V



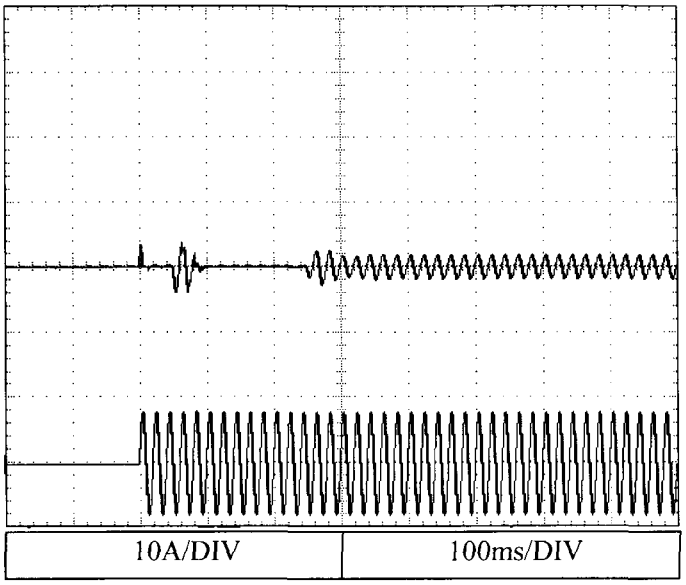
A=38ms
B=54ms

2.9 Inrush current waveform

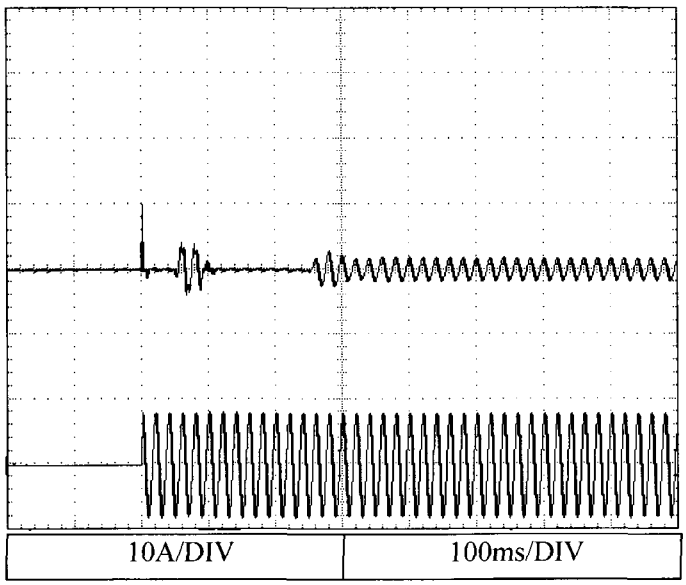
Conditions Vin : 115VAC
Iout : 100%
Ta : 25°C

5V

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



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

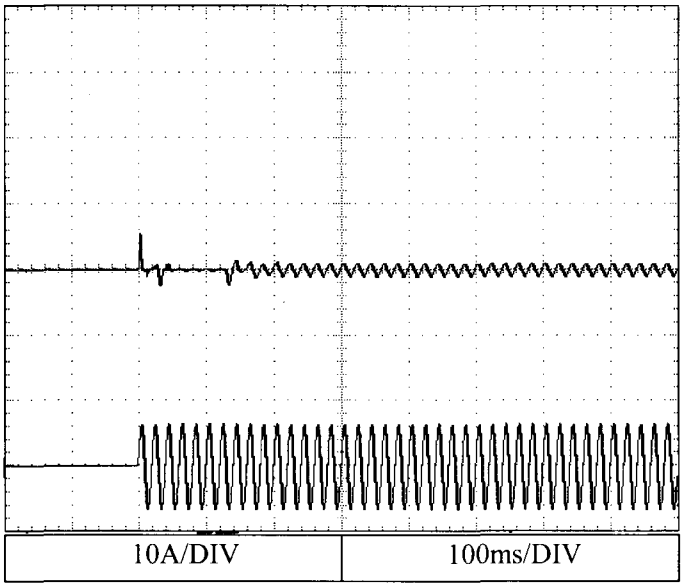


2.9 Inrush current waveform

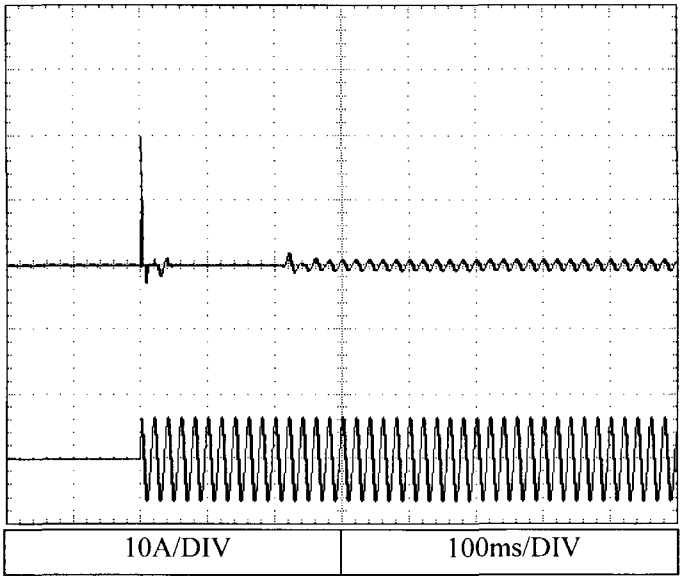
Conditions Vin : 230VAC
Iout : 100%
Ta : 25°C

5V

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



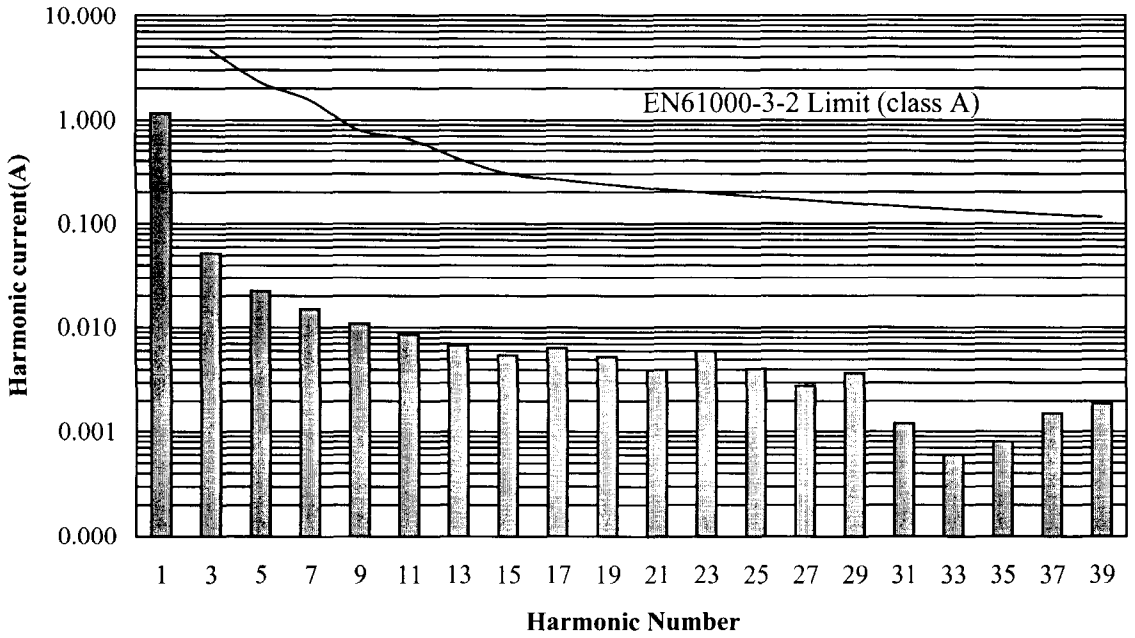
Switch on phase angle of input AC voltage
$\phi=90^{\circ}$



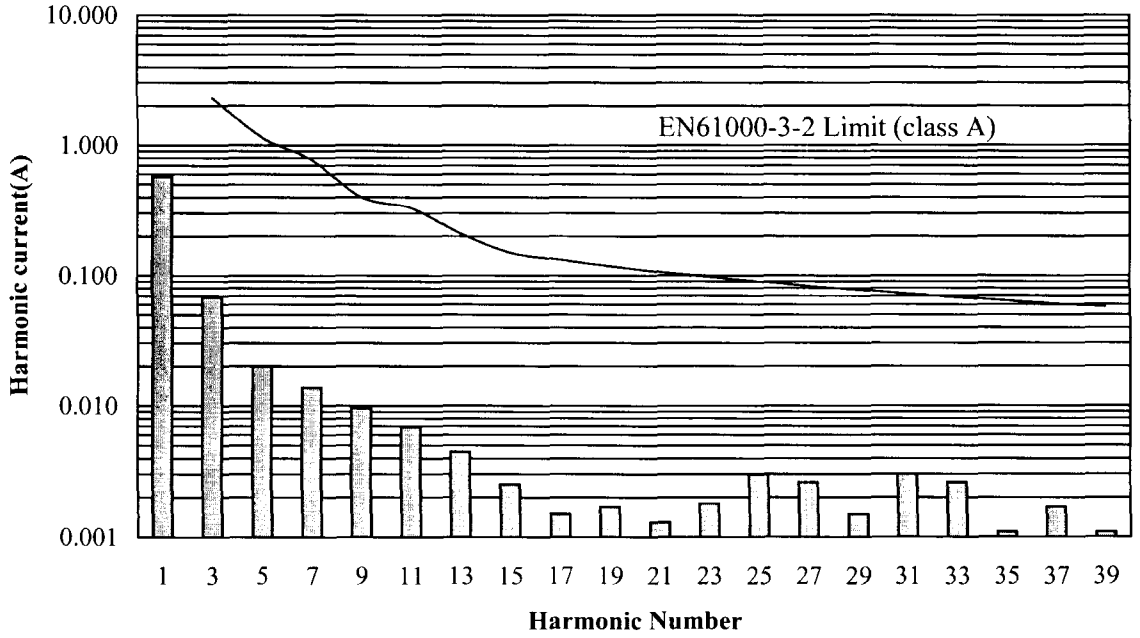
2.10 Input current harmonics

5V

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



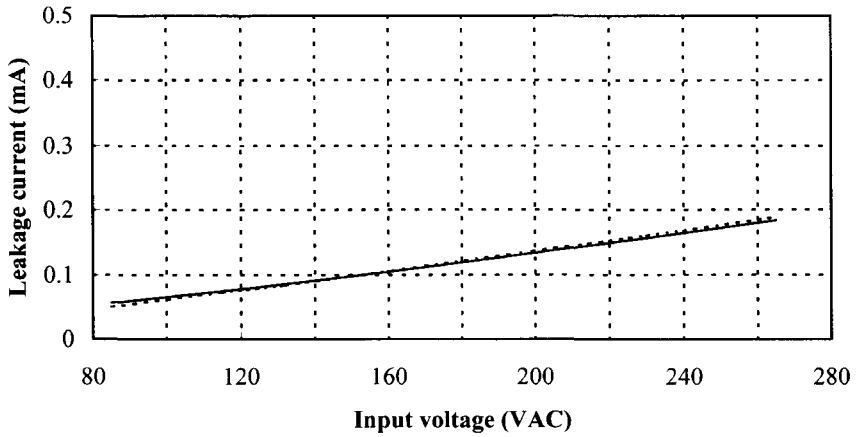
Conditions Vin : 230VAC
Iout : 100%
Ta : 25°C



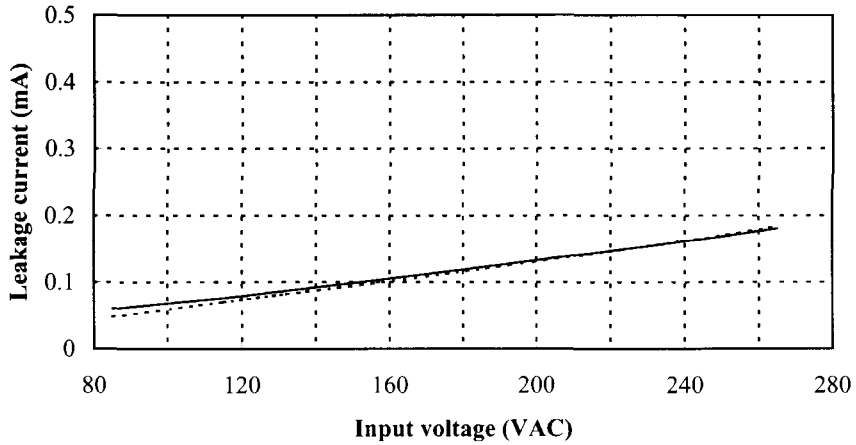
2.11 Leakage current characteristics

Conditions Iout : 0% ----------
: 100% ——————
Ta : 25°C
f : 50Hz
Equipment used : MODEL 228 (Simpson)

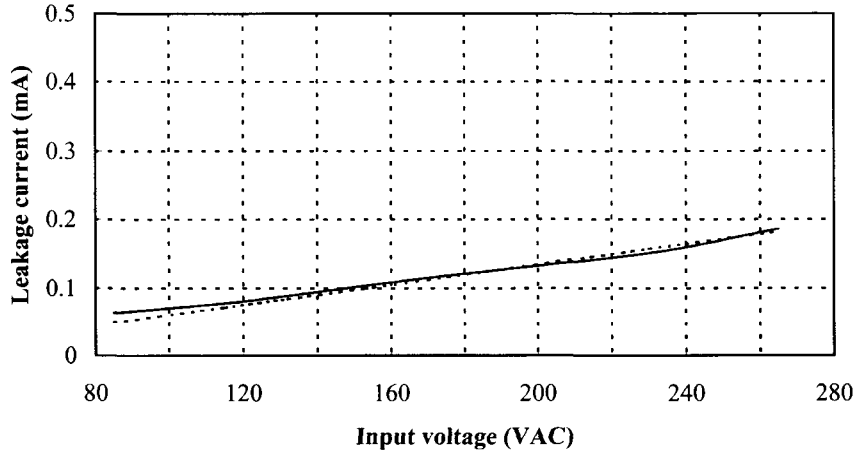
5V



12V



24V

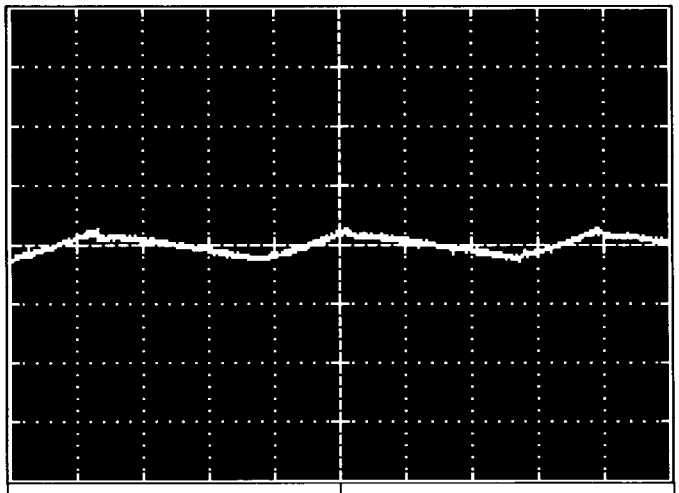


2.12 Output ripple and noise waveform

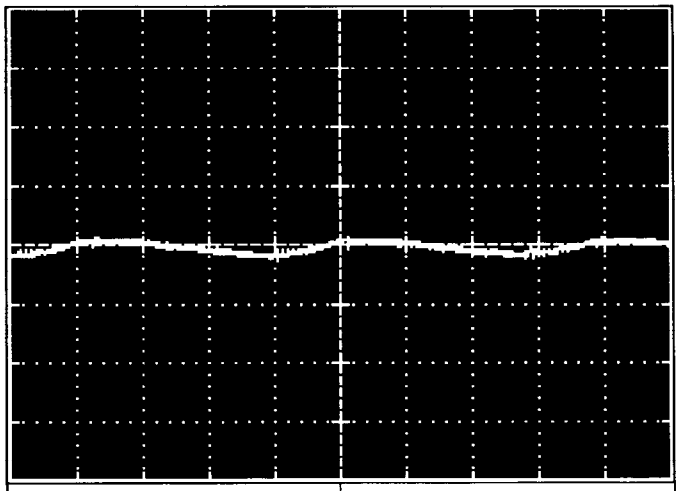
Conditions Vin : 230VAC
Iout : 100%
Ta : 25°C

NORMAL MODE

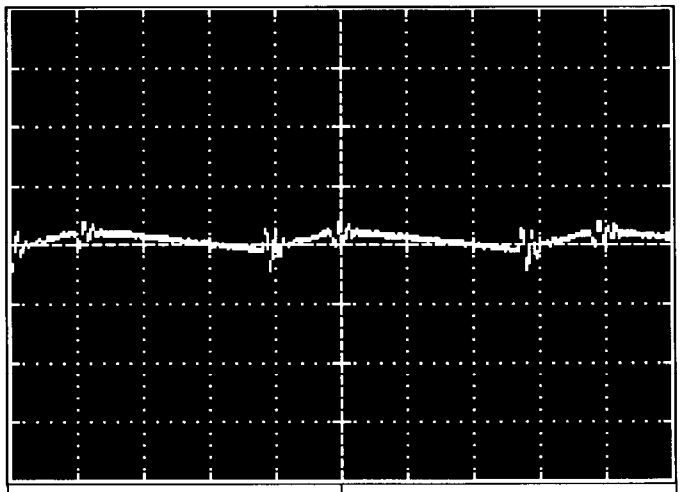
5V



12V



24V

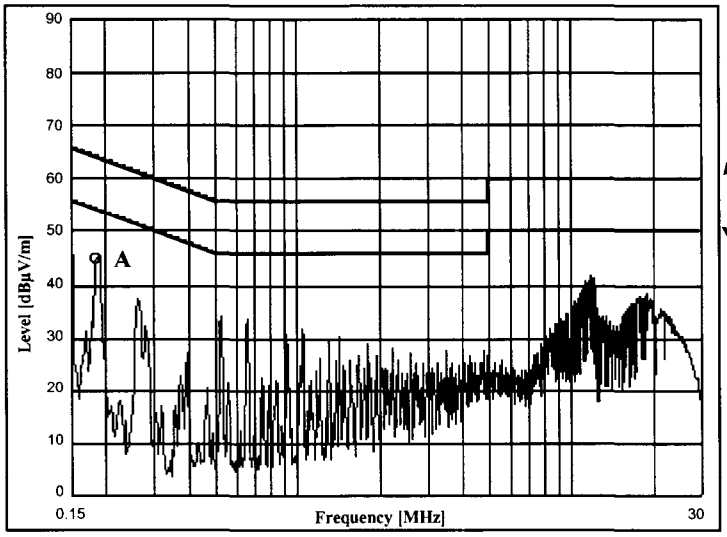


2.13 Electro-Magnetic Interference characteristics

Conducted Emission

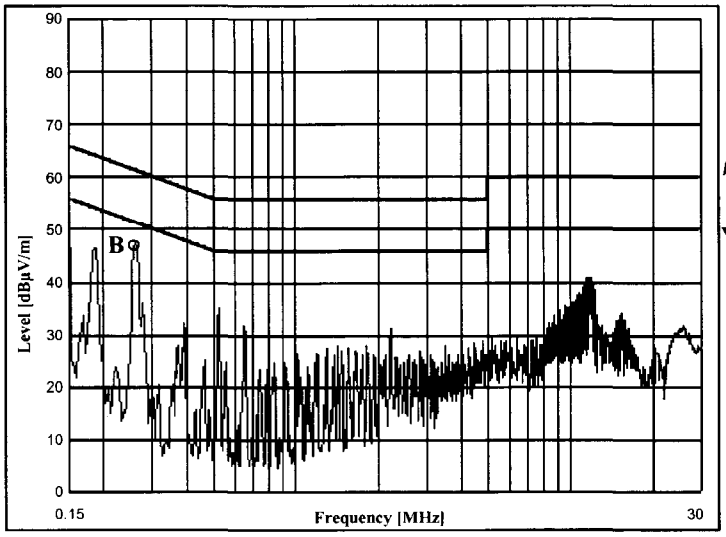
Conditions
Vin : 115VAC
Iout : 100%

5V



Phase : L

Ref. / Data	Point A (0.19MHz) Limit (dBμV)	Measure (dBμV)
QP	64.2	45.2
AV	54.2	40.9



Phase : N

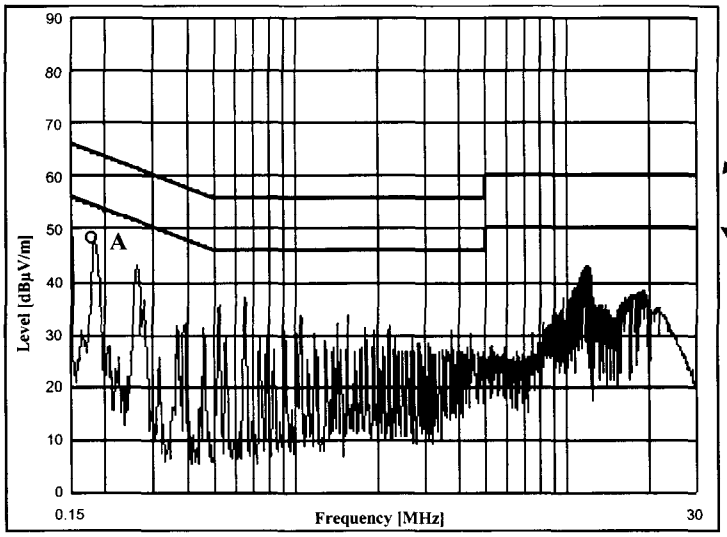
Ref. / Data	Point B (0.26MHz) Limit (dBμV)	Measure (dBμV)
QP	61.5	47.7
AV	51.5	47.7

2.13 Electro-Magnetic Interference characteristics

Conducted Emission

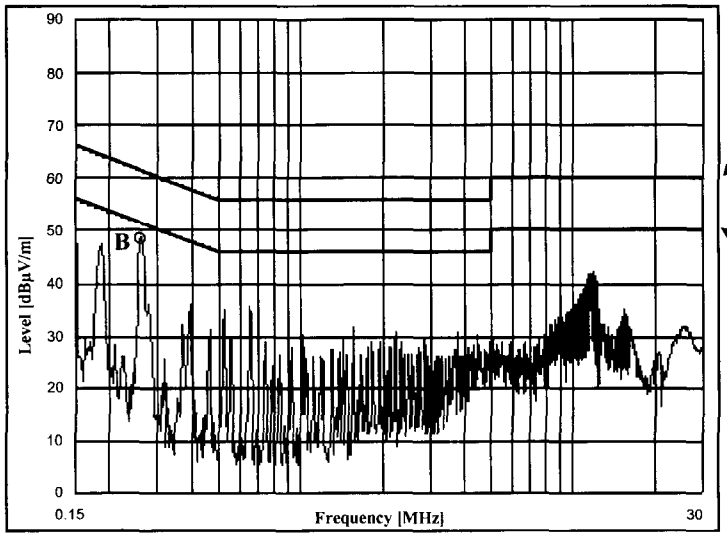
Conditions
Vin : 230VAC
Iout : 100%

5V



Phase : L

Ref. / Data	Point A (0.19MHz) Limit (dBμV)	Measure (dBμV)
QP	64.2	47.2
AV	54.2	42.8



Phase : N

Ref. / Data	Point B (0.26MHz) Limit (dBμV)	Measure (dBμV)
QP	61.5	48.3
AV	51.5	48.2

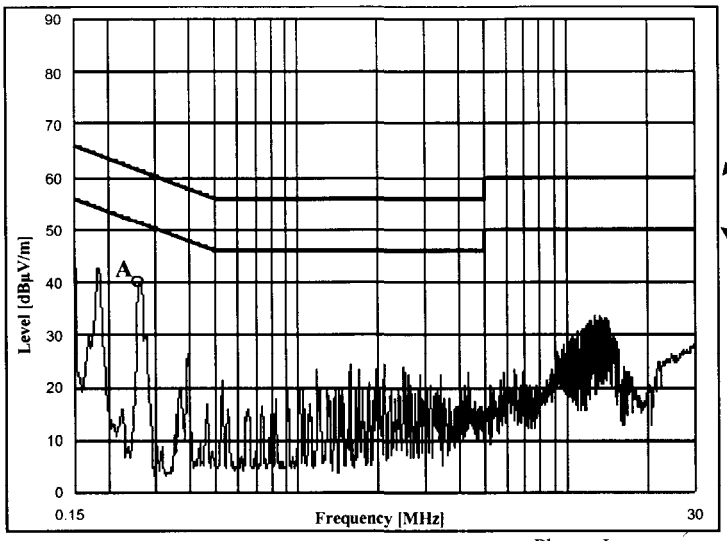
2.13 Electro-Magnetic Interference characteristics

Conducted Emission

Conditions
Vin : 115VAC
Iout : 100%

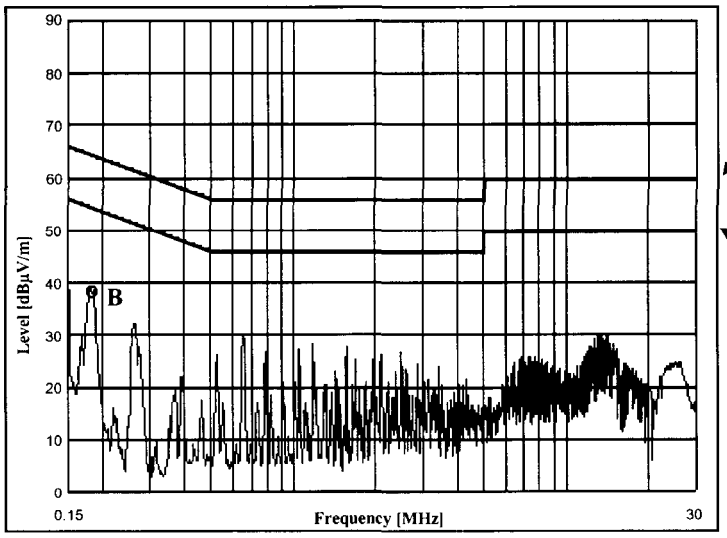
12V

Ref. / Data	Point A (0.26MHz) Limit (dBμV)	Measure (dBμV)
QP	61.5	39.7
AV	51.5	37.9



Phase : L

Ref. / Data	Point B (0.18MHz) Limit (dBμV)	Measure (dBμV)
QP	64.4	37.7
AV	54.4	36.4



Phase : N

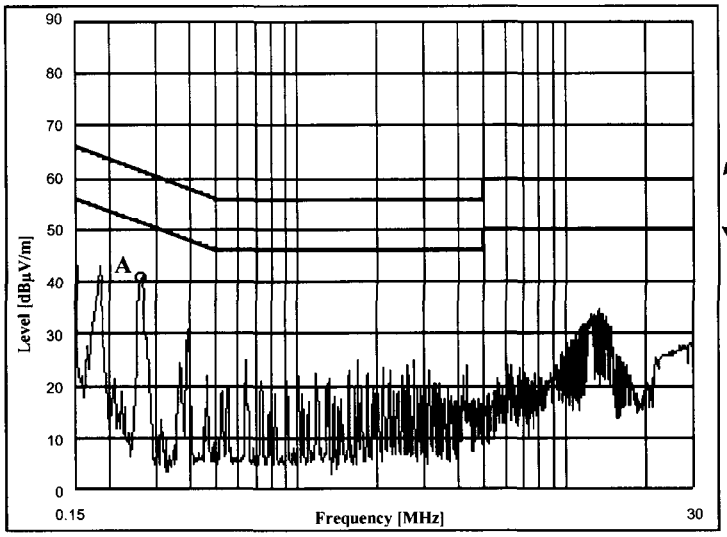
2.13 Electro-Magnetic Interference characteristics

Conducted Emission

Conditions
Vin : 230VAC
Iout : 100%

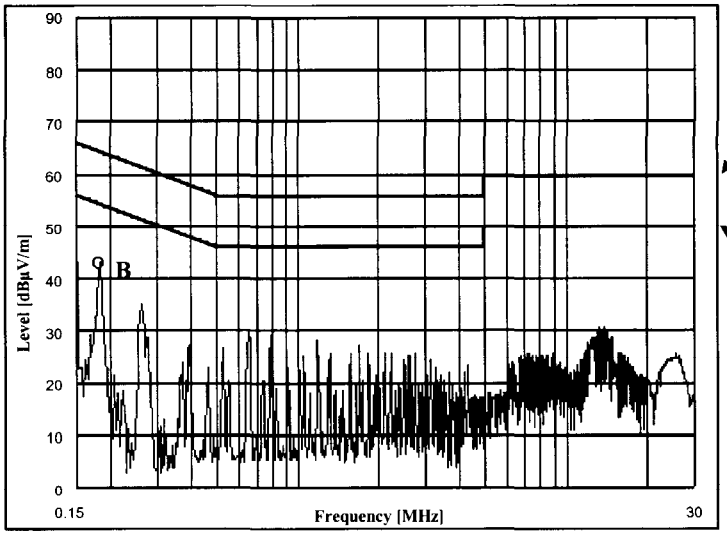
12V

Ref. / Data	Point A (0.26MHz) Limit (dBμV)	Measure (dBμV)
QP	61.5	39.4
AV	51.5	38.9



Phase : L

Ref. / Data	Point B (0.18MHz) Limit (dBμV)	Measure (dBμV)
QP	64.4	41.7
AV	54.4	38.9



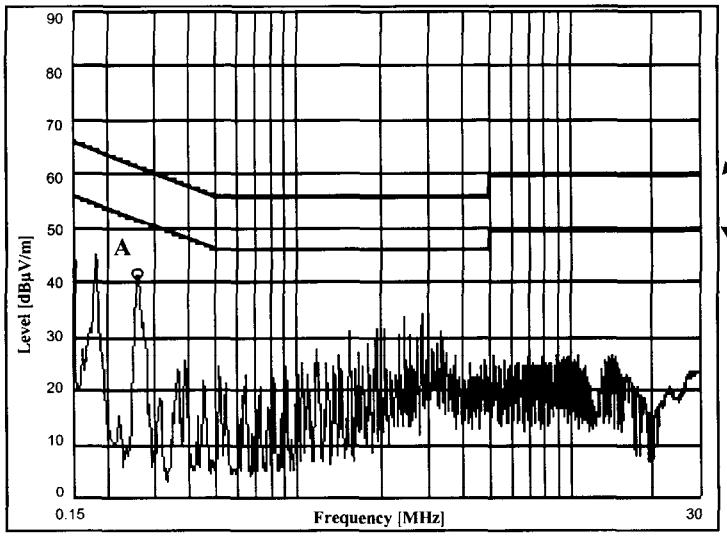
Phase : N

2.13 Electro-Magnetic Interference characteristics

Conducted Emission

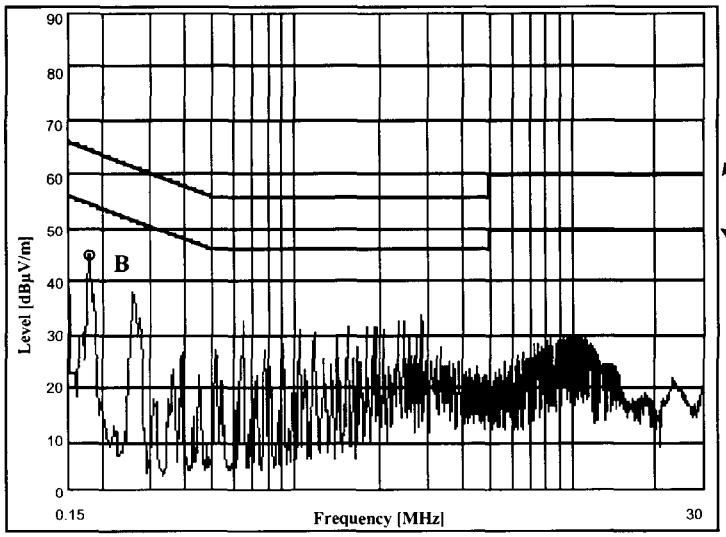
Conditions
Vin : 115VAC
Iout : 100%

24V



Phase : L

Ref. / Data	Point A (0.26MHz) Limit (dBμV)	Measure (dBμV)
QP	61.5	41.7
AV	51.5	40.2



Phase : N

Ref. / Data	Point B (0.18MHz) Limit (dBμV)	Measure (dBμV)
QP	64.4	44.1
AV	54.4	34.0

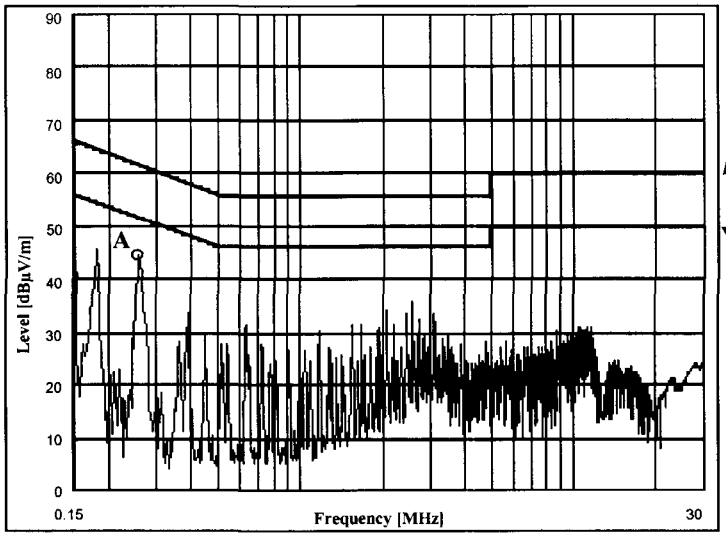
2.13 Electro-Magnetic Interference characteristics

Conducted Emission

Conditions
Vin : 230VAC
Iout : 100%

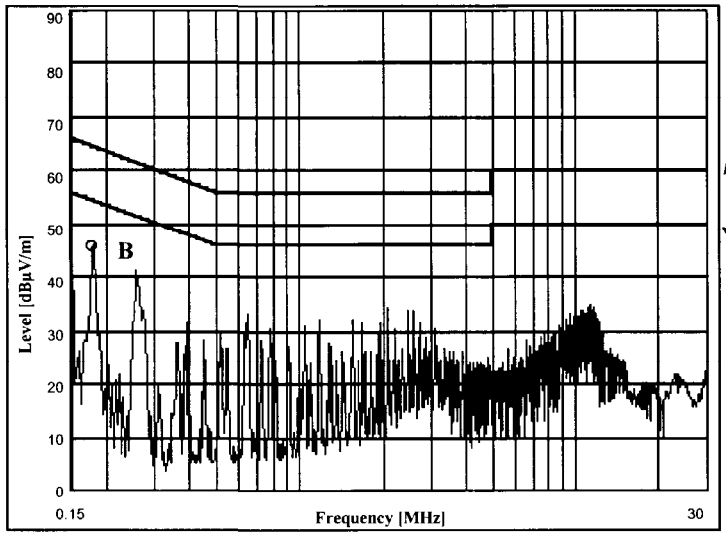
24V

Ref. / Data	Point A (0.26MHz) Limit (dBμV)	Measure (dBμV)
QP	61.5	43.5
AV	51.5	42.4



Phase : L

Ref. / Data	Point B (0.18MHz) Limit (dBμV)	Measure (dBμV)
QP	64.4	42.9
AV	54.4	38.8



Phase : N

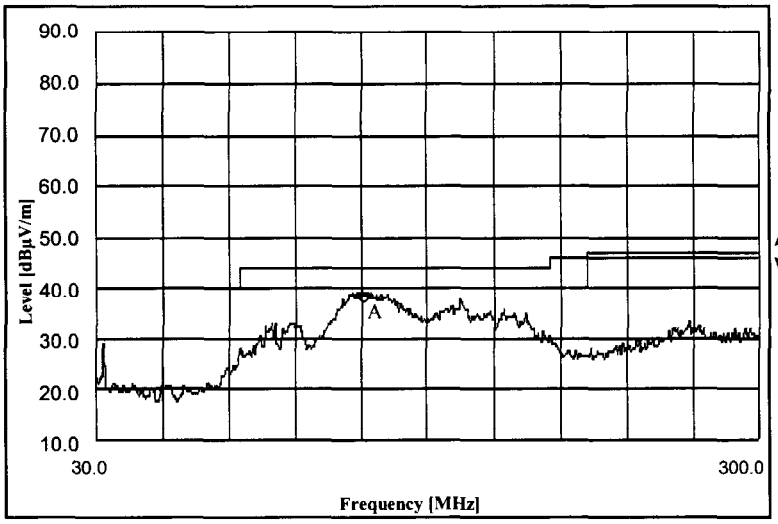
2.13 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 115VAC
Iout : 100%

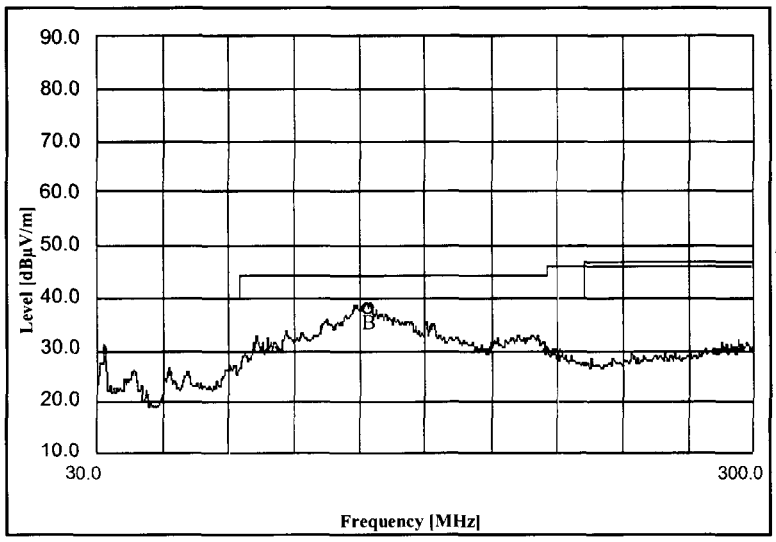
5V

HORIZONTAL:



Point A (138.8MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	38.6

VERTICAL:



Point B (140.2MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	38.5

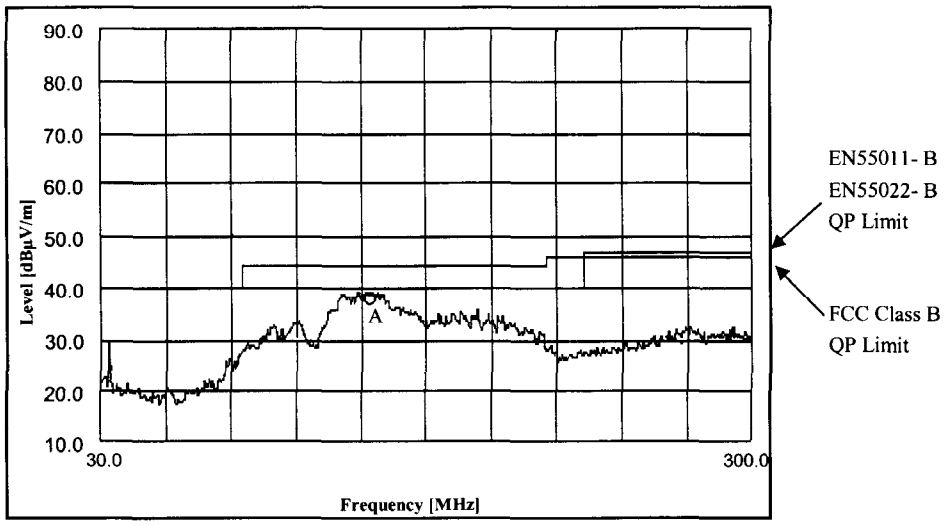
2.13 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 230VAC
Iout : 100%

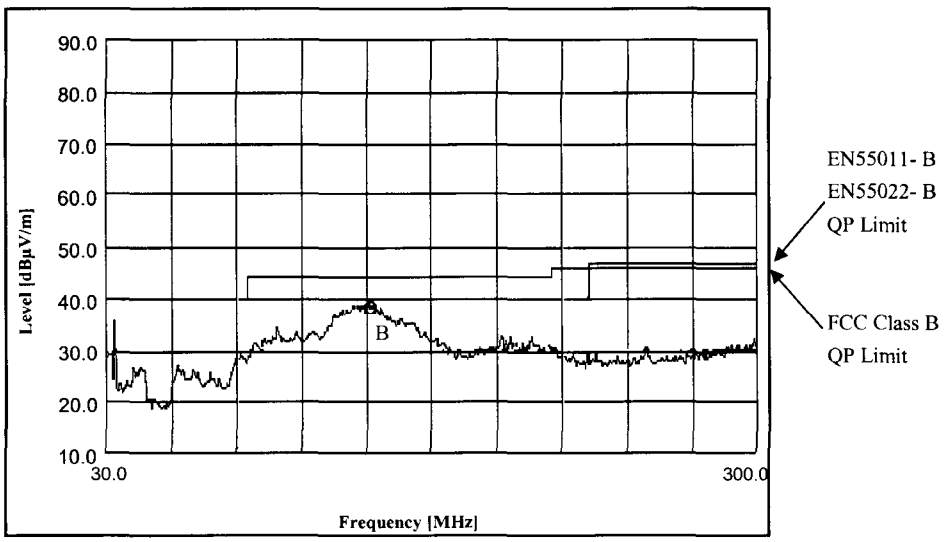
5V

HORIZONTAL:



Point A (142.4MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	38.9

VERTICAL:



Point B (142.1MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	38.3

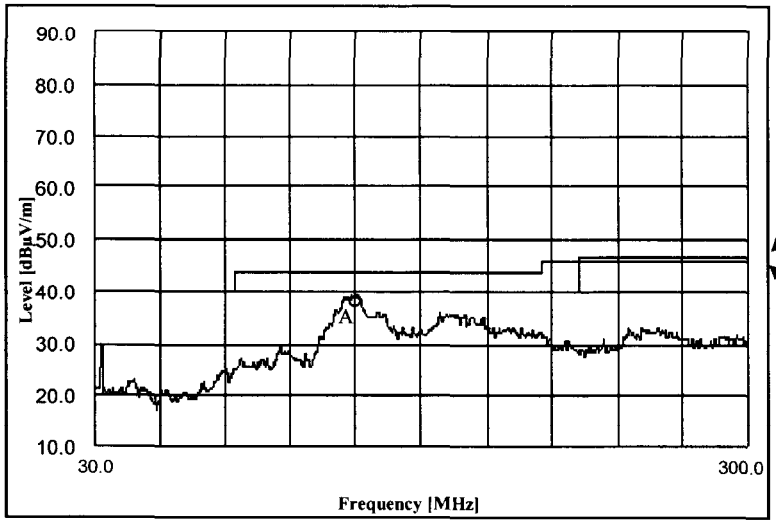
2.13 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 115VAC
Iout : 100%

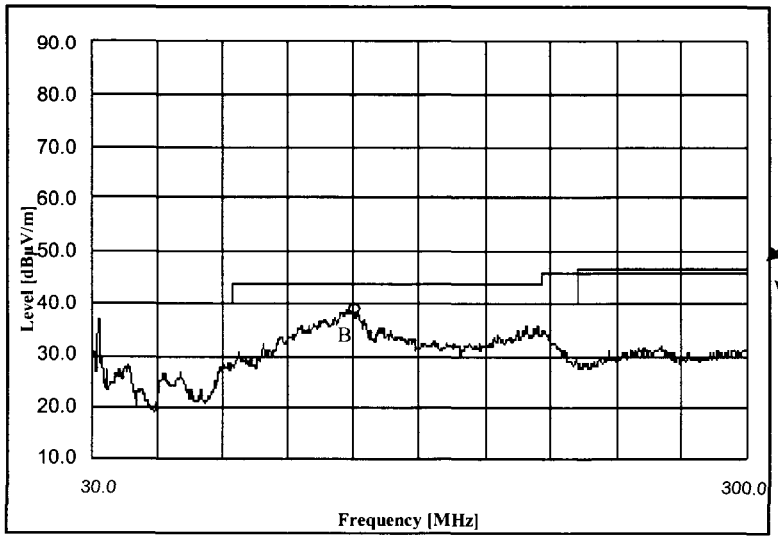
12V

HORIZONTAL:



Point A (138.8MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	38.2

VERTICAL:



Point B (138.9MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	37.8

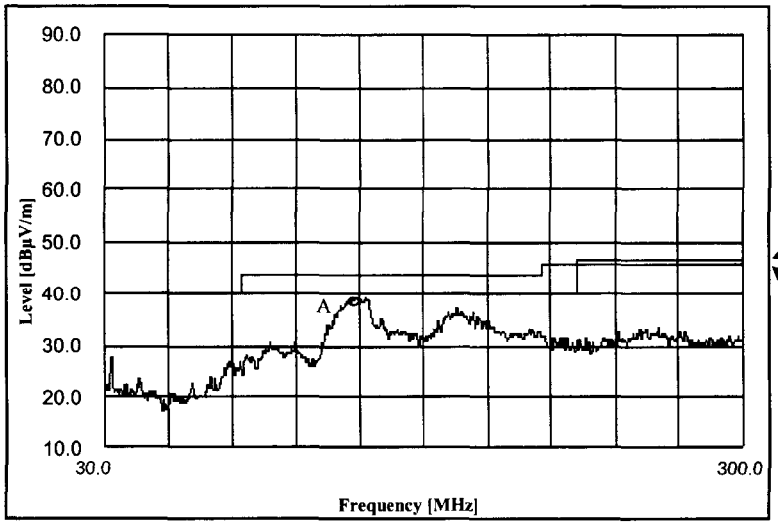
2.13 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 230VAC
Iout : 100%

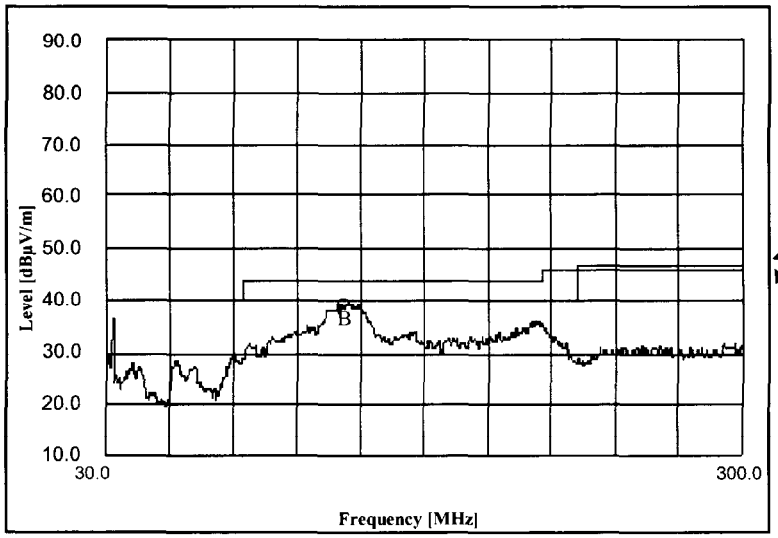
12V

HORIZONTAL:



Point A (137.5MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	37.9

VERTICAL:



Point B (134.8MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	36.1

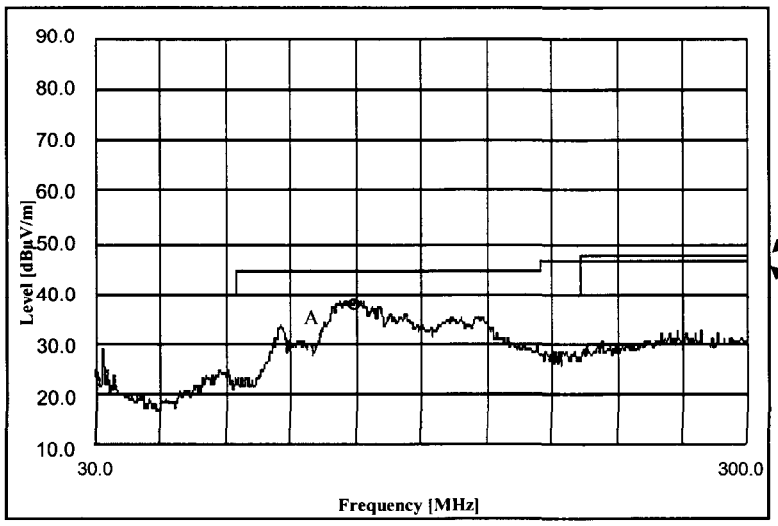
2.13 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 115VAC
Iout : 100%

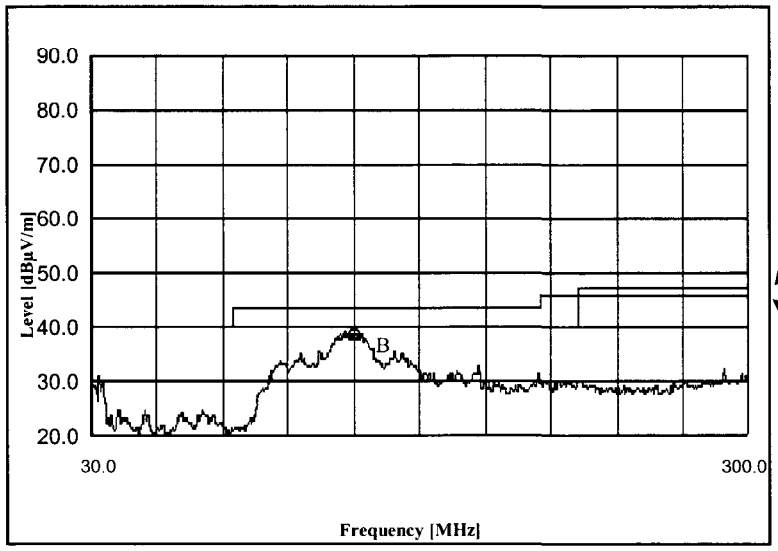
24V

HORIZONTAL:



Point A (138.8MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	38.2

VERTICAL:



Point B (138.9MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	37.8

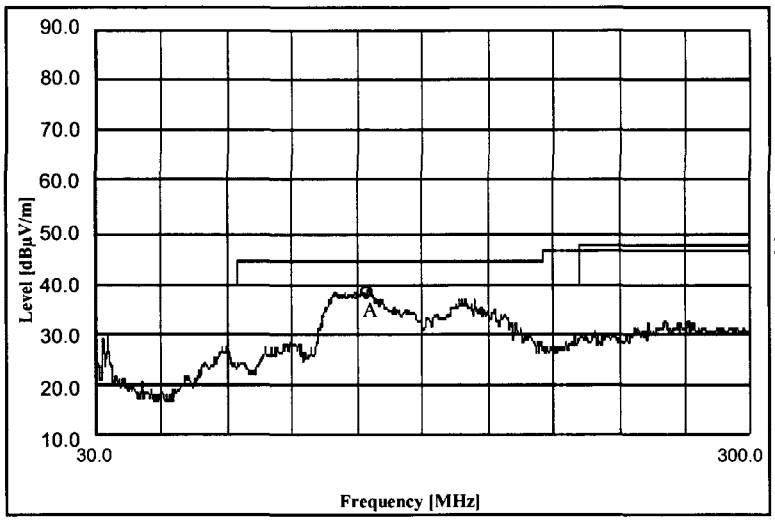
2.13 Electro-Magnetic Interference characteristics

Radiated Emission

Conditions
Vin : 230VAC
Iout : 100%

24V

HORIZONTAL:

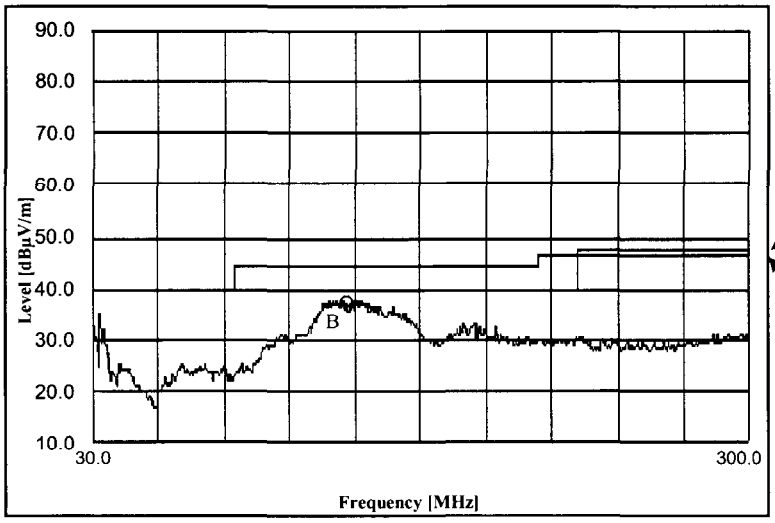


EN55011- B
EN55022- B
QP Limit

FCC Class B
QP Limit

Point A (139.4MHz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	38.4

VERTICAL:



EN55011- B
EN55022- B
QP Limit

FCC Class B
QP Limit

Point B (135.9Hz)	
Limit (dBµV/m)	Measure (dBµV/m)
40.0	39.1