VS15C

EVALUATION DATA

DWG No. : CA710-53-01			
APPD	APPD	CHK	DWG
31.Aug.'99	10.Aug.99	Aug.10'99	Aug.06.99

INDEX

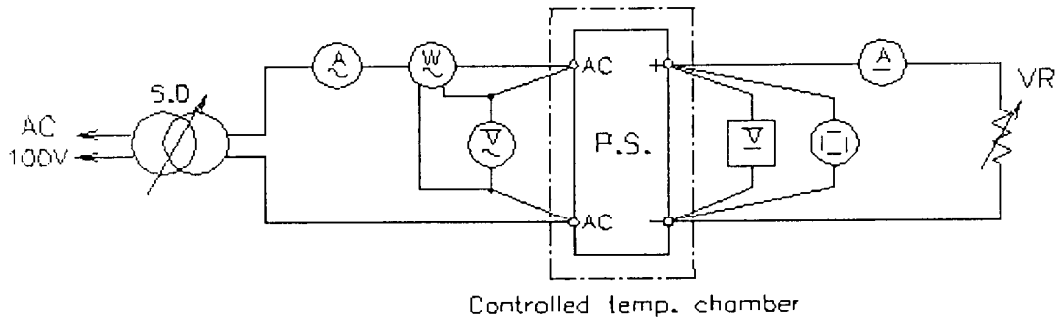
Terminology used

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

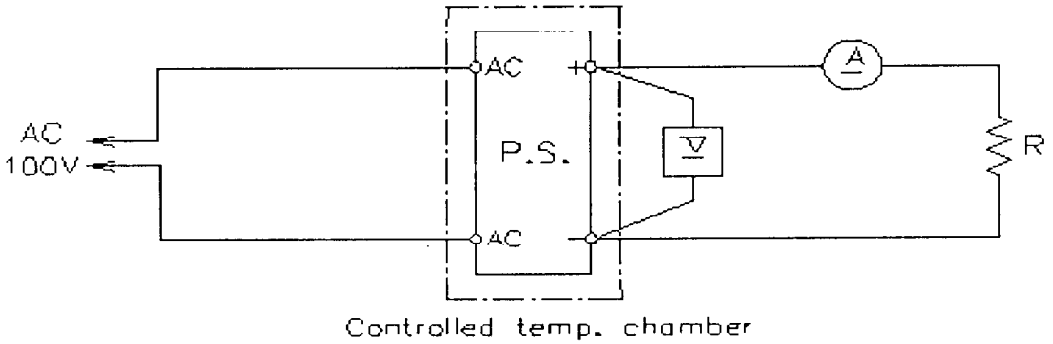
1. Evaluation Method

1.1 Circuit used for determination

(1)Steady state data



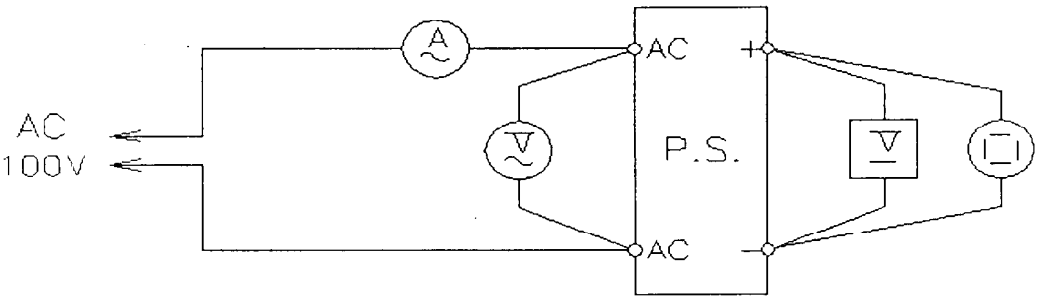
(2)Warm up voltage drift characteristics



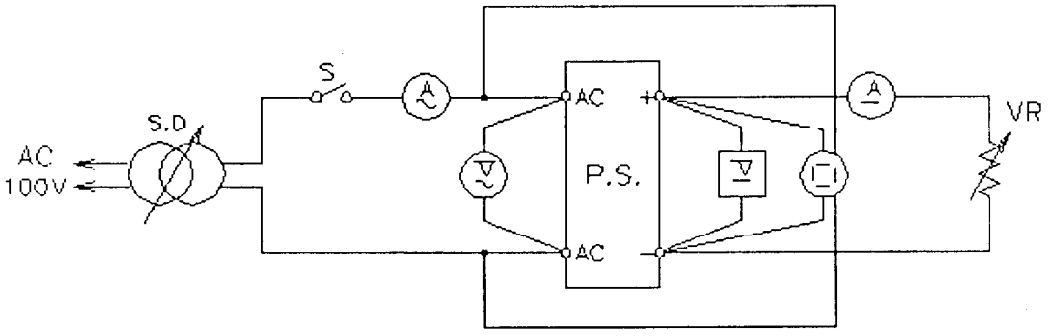
(3) Over current protection (O.C.P) characteristics

Same as Steady state data.

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



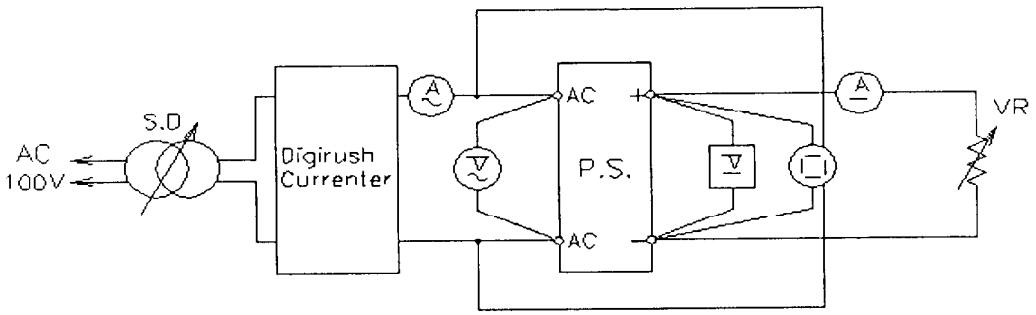
(5) Output rise characteristics



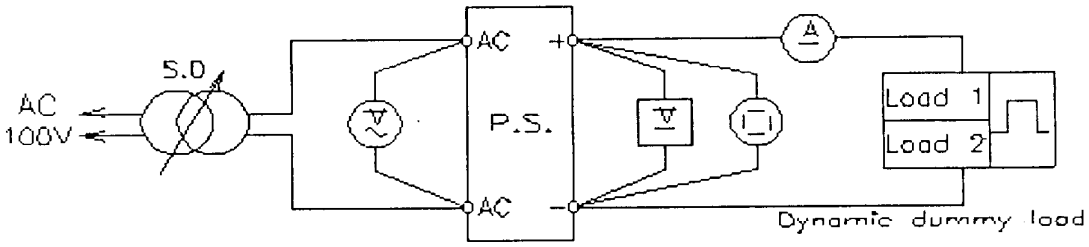
(6) Output fall characteristics

Same as output rise characteristics.

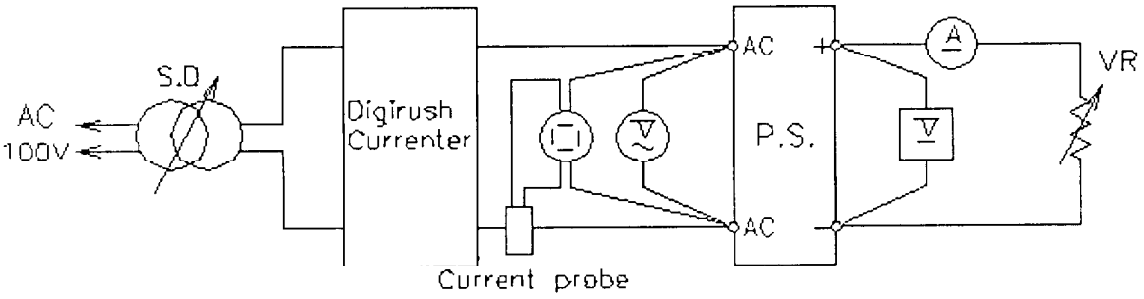
(7) Dynamic line response characteristics



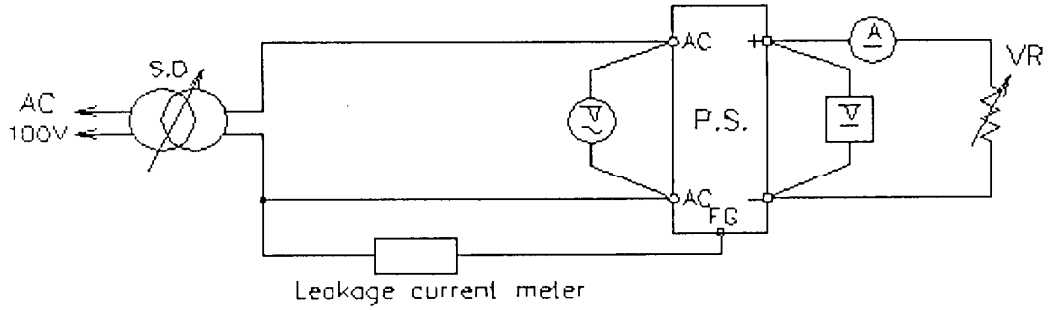
(8) Dynamic load response characteristics



(9) Inrush current characteristics

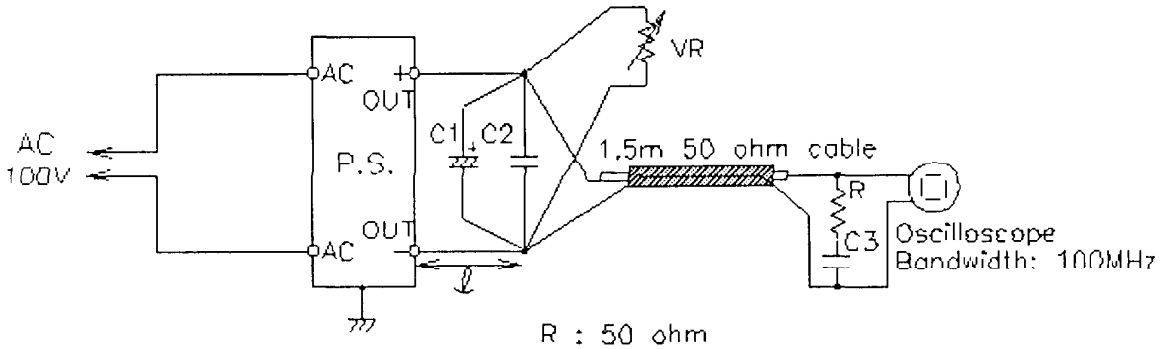


(10) Leakage current characteristics



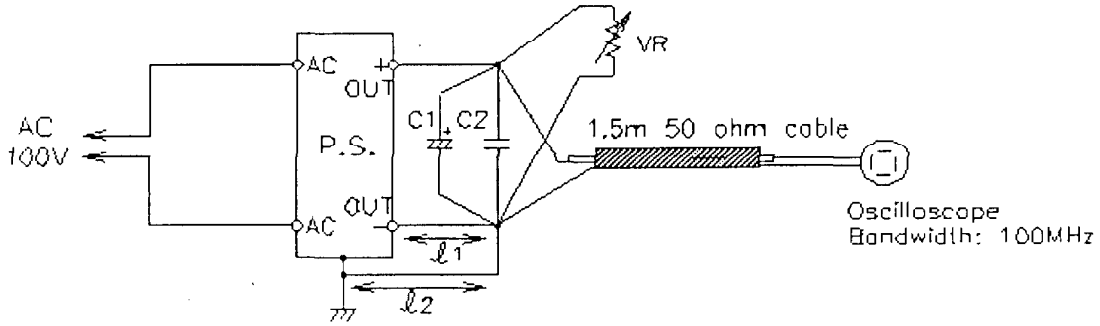
11)Output ripple and noise waveform

a)Normal Mode (EIAJ Standard RC - 9002A)



R : 50 ohm
C3: 4700P Ceramic Capacitor
ℓ : 150mm
C1: 100uF Electrolytic Capacitor
C2: 0.1uF Film Capacitor

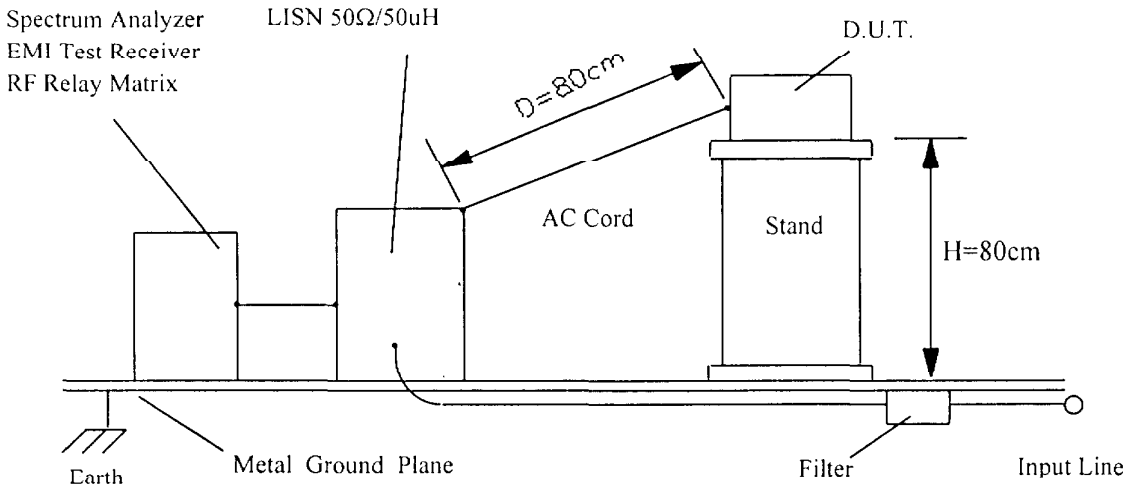
b)Normal + Common Mode



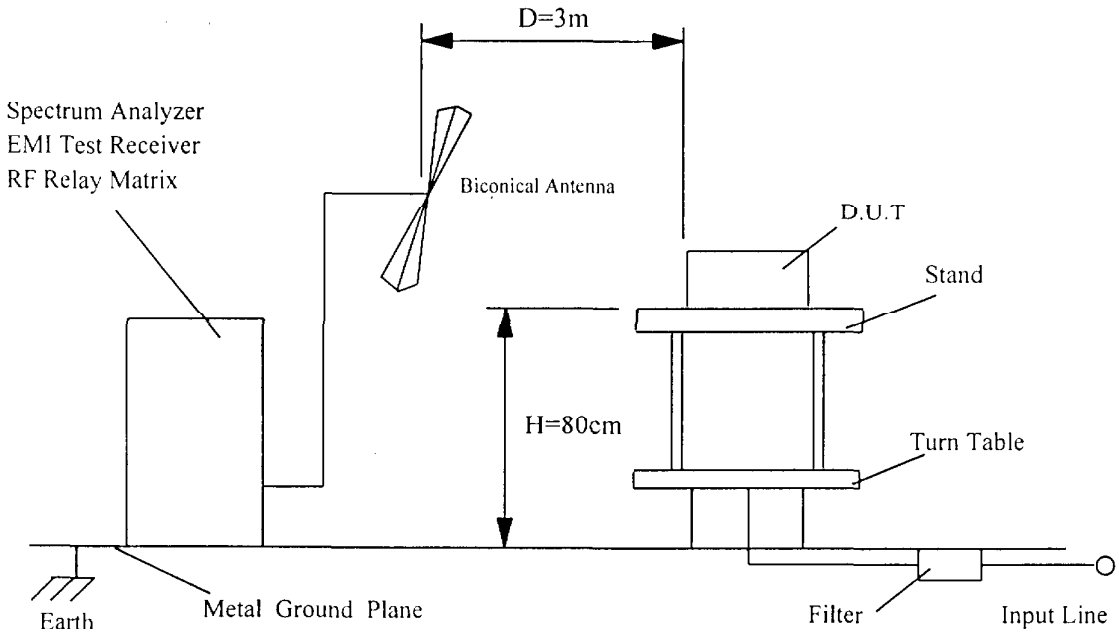
ℓ1: 150mm
ℓ2: 265mm
C1: 100uF Electrolytic Capacitor
C2: 0.1uF Film Capacitor

12)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-1050
2	Digital storage oscilloscope	TEKTRONIX	TDS-540A
3	Digital volt meter	LEADER	856
4	Digital watt/current/volt meter	HIOKI	3186
5	DC ampere meter	YOKOGAWA	2051
6	Dynamic dummy load	KIKUSUI	PLZ152W
7	Current probe/amplifier	TEKTRONIX	A6303/AM503B
8	Controlled temperature chamber	TABAI-ESPEC	SU-240
9	Leakage current meter	SIMPSON	228
10	Digirush currenter	TAKAMISAWA CYBERNETICS	PSA-200

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	85V	100V	132V	Line regulation	
0%	5.020	5.019	5.017	3 mV	0.06%
50%	5.018	5.018	5.016	2 mV	0.04%
100%	5.017	5.016	5.015	2 mV	0.04%
Load	3 mV	3 mV	2 mV		
Regulation	0.06%	0.06%	0.04%		

2. Temperature drift

Conditions Vin=100Vac
Io =100%

Ta(°C)	-10°C	+25°C	+50°C	Temperature drift	
Vo(Vdc)	5.004	5.016	5.014	12 mV	0.24%

12V

1. Regulation - line and load

Condition Ta : 25°C

Iout\Vin	85V	100V	132V	Line regulation	
0%	12.021	12.018	12.012	9 mV	0.075%
50%	12.020	12.015	12.015	5 mV	0.042%
100%	12.016	12.014	12.014	2 mV	0.017%
Load	5 mV	4 mV	3 mV		
Regulation	0.042%	0.033%	0.025%		

2. Temperature drift

Conditions Vin=100Vac
Io =100%

Ta(°C)	-10°C	+25°C	+50°C	Temperature drift	
Vo(Vdc)	12.007	12.014	12.047	40 mV	0.333%

24V

1. Regulation - line and load

Condition Ta : 25°C

Iout\Vin	85V	100V	132V	Line regulation	
0%	24.062	24.064	24.053	11 mV	0.046%
50%	24.060	24.057	24.066	9 mV	0.038%
100%	24.058	24.057	24.068	11 mV	0.046%
Load	4 mV	7 mV	15 mV		
Regulation	0.017%	0.029%	0.063%		

2. Temperature drift

Conditions Vin=100Vac
Io =100%

Ta(°C)	-10°C	+25°C	+50°C	Temperature drift	
Vo(Vdc)	24.008	24.057	24.069	61 mV	0.254%

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

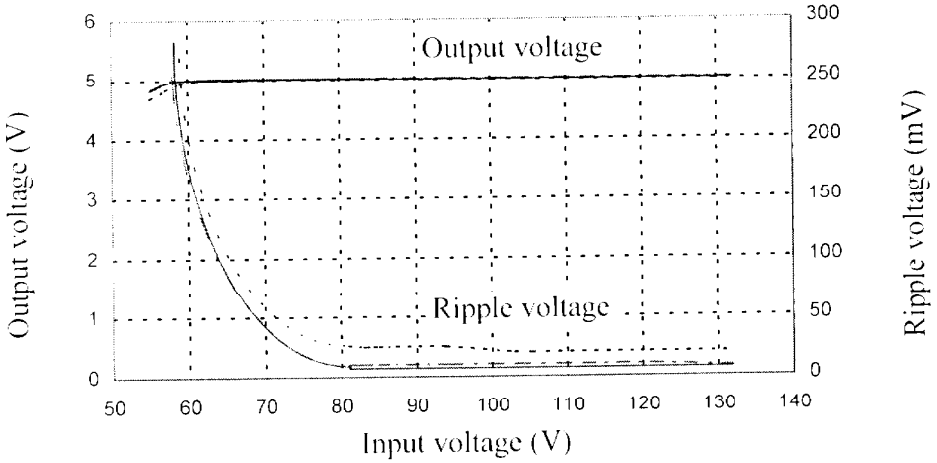
Conditions Iout : 100%

Ta : -10°C - - - - -

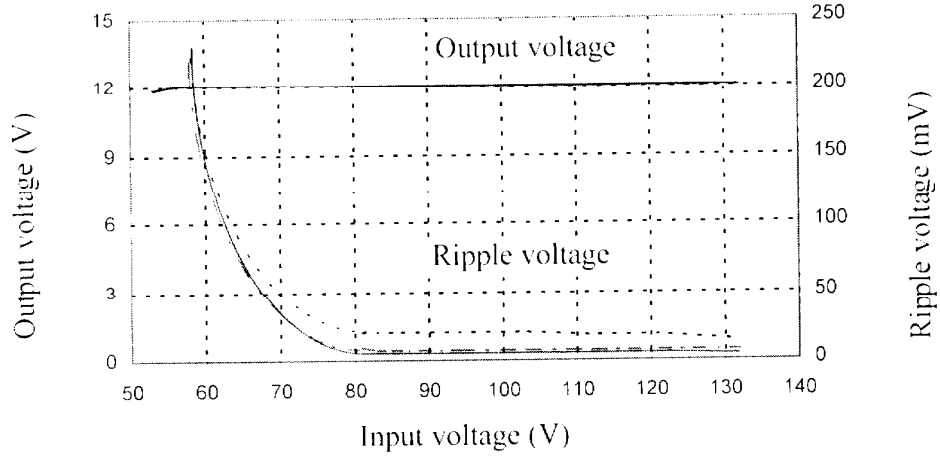
25°C — · — · —

50°C ————

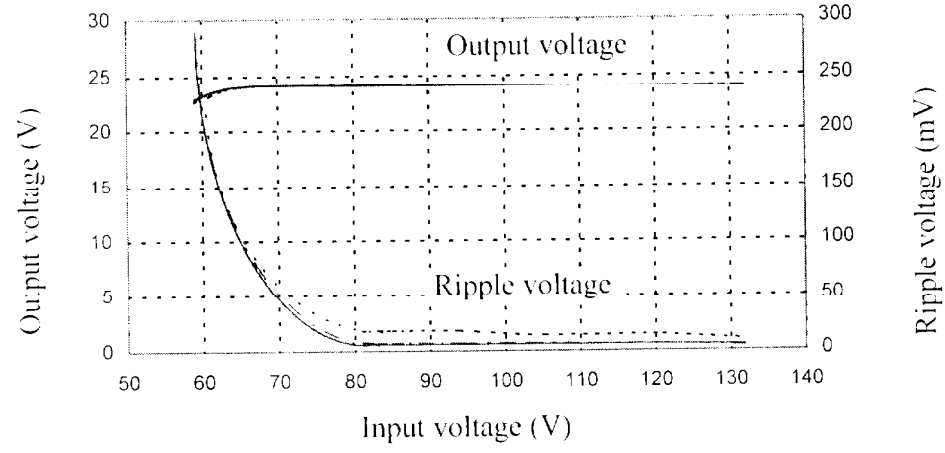
5V



12V



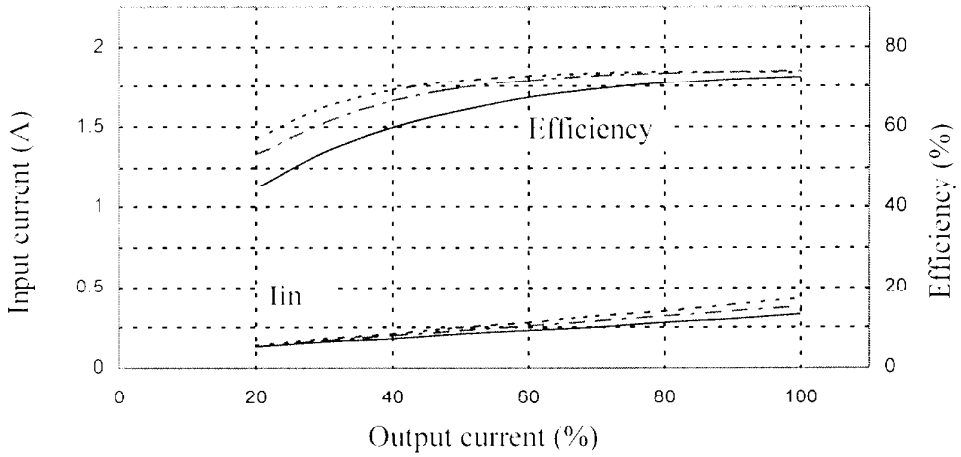
24V



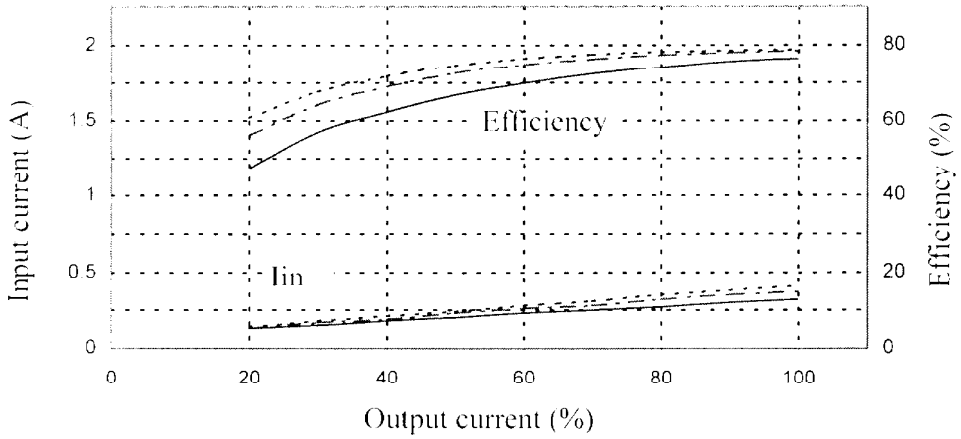
2.1. (3) Efficiency and Input current v.s. Output current

Conditions Ta : 25°C
Vin : 85Vac
100Vac
132Vac

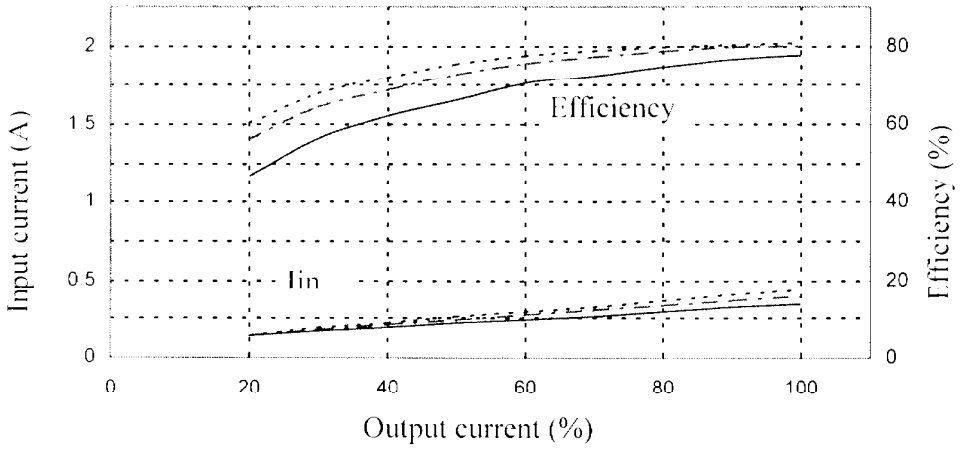
5V



12V



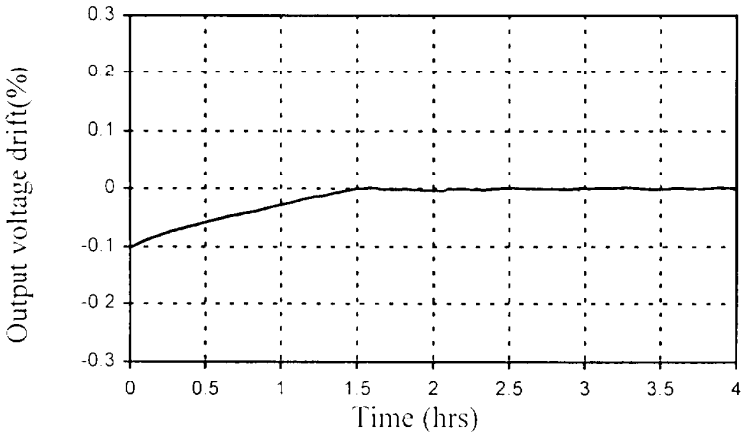
24V



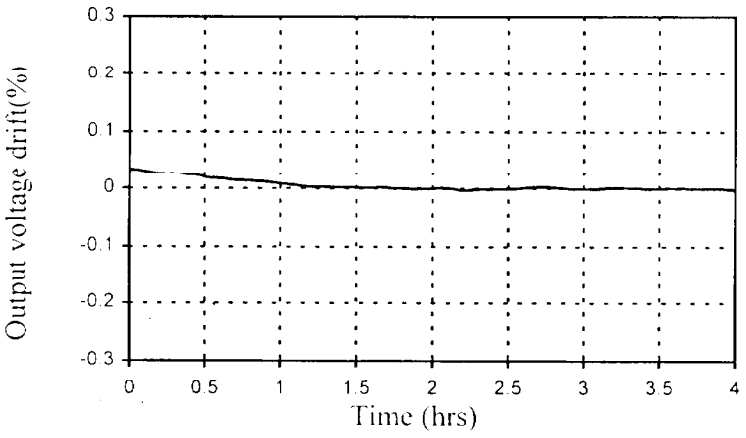
2.2 Warm up voltage drift characteristics

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

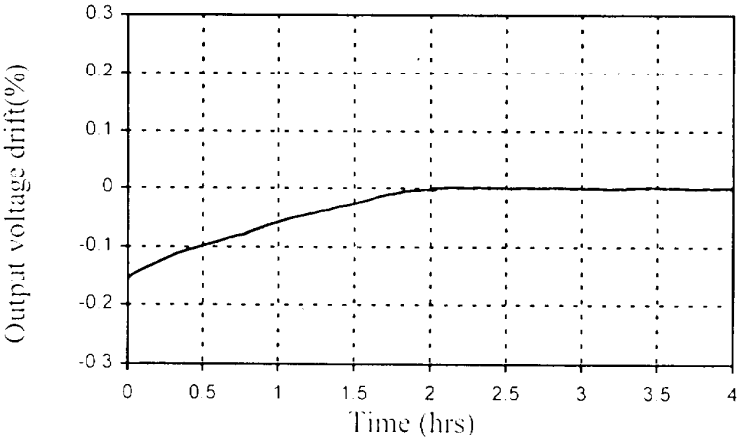
5V



12V



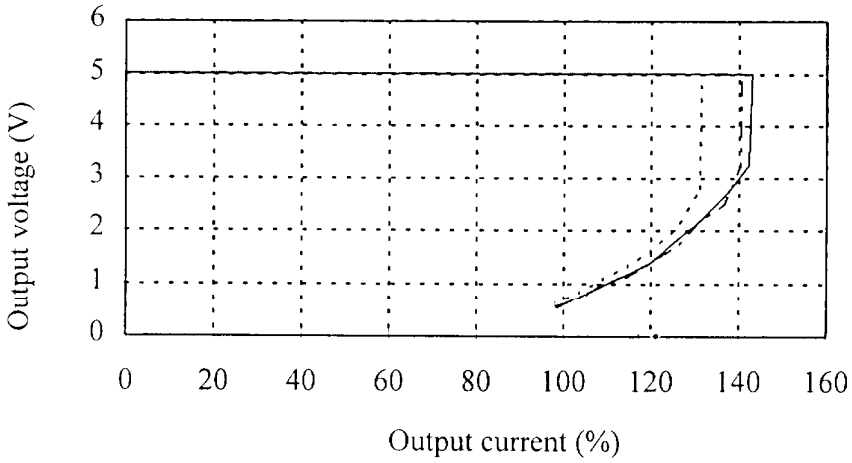
24V



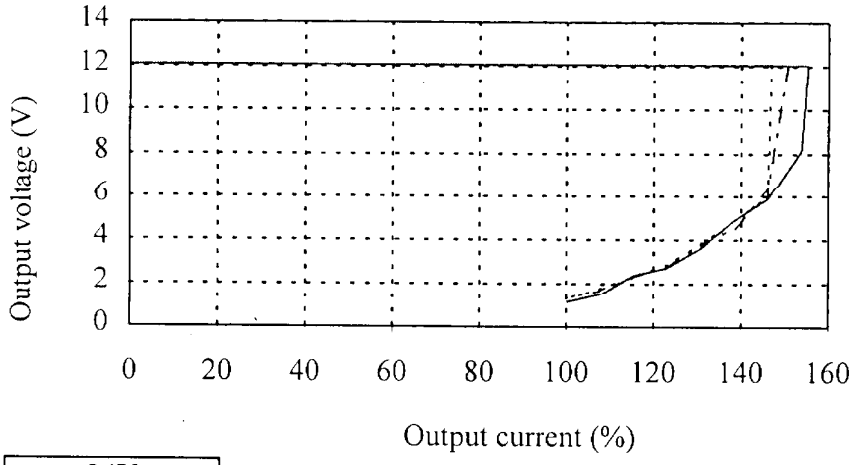
2.3 Over current protection (OCP) characteristics

Conditions Ta : 25°C
Vin : 85Vac
100Vac
132Vac

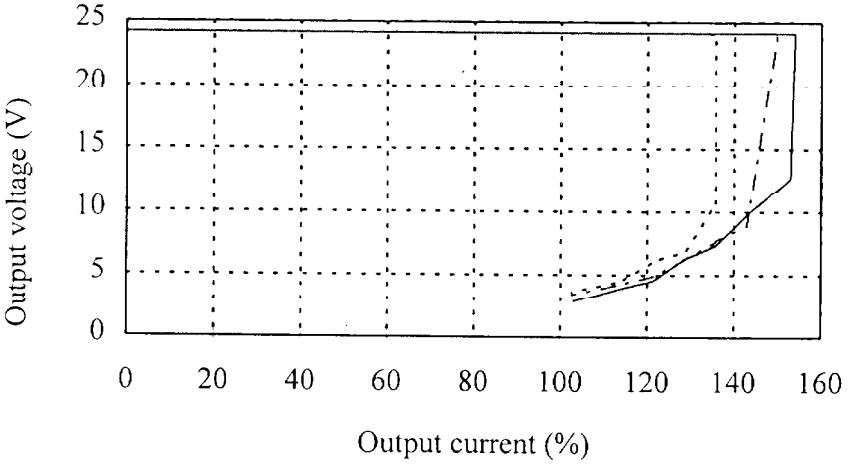
5V



12V



24V



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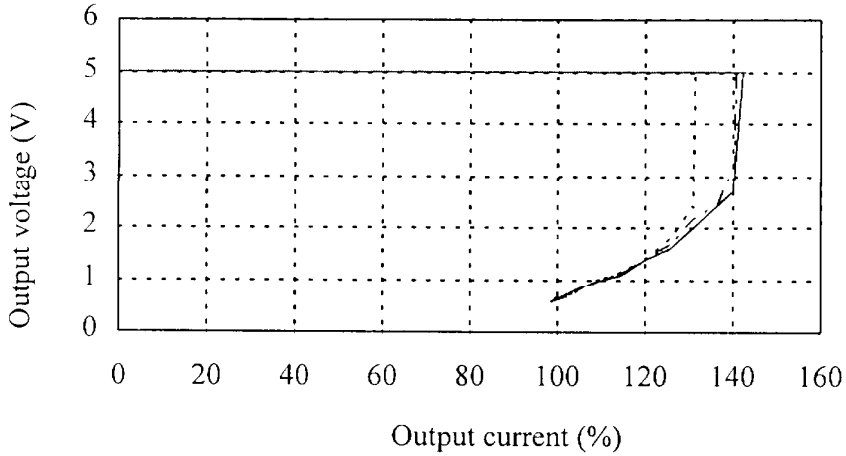
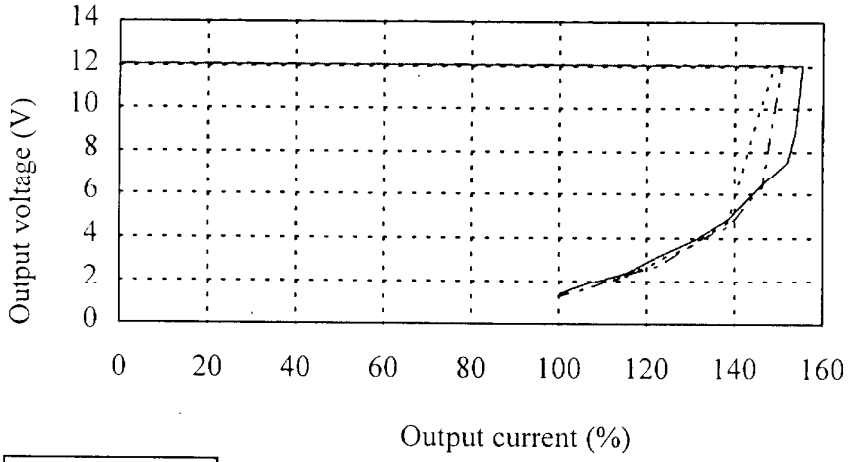
2.3 Over current protection (OCP) characteristics

Conditions Vin : 100VAC
Ta : -10°C
25°C
50°C

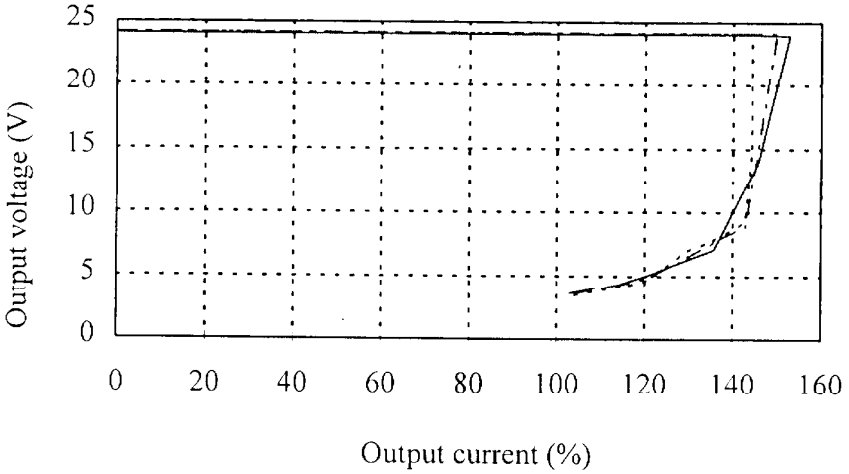
5V



12V



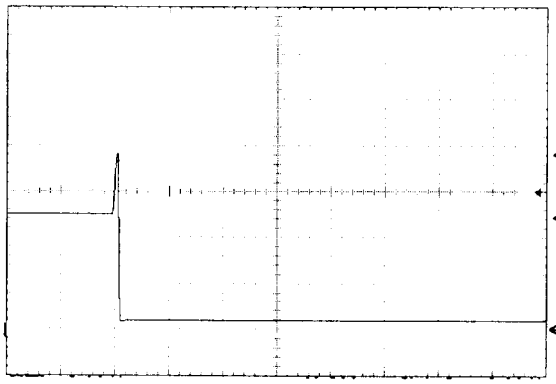
24V



2.4 Over voltage protection (OVP) characteristics

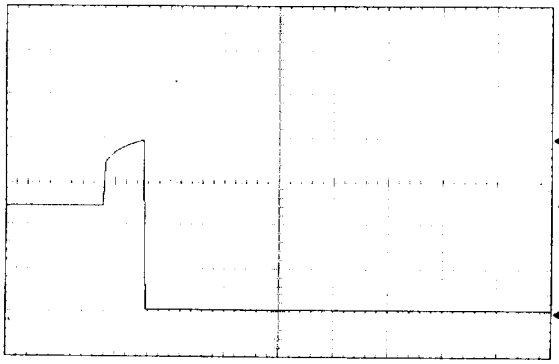
Conditions Ta : 25°C
Vin : 100Vac
Io : 0%

5V



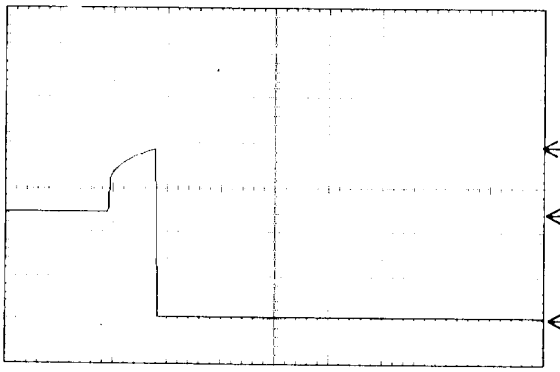
2V/DIV	200mS/DIV

12V



5V/DIV	200mS/DIV

24V

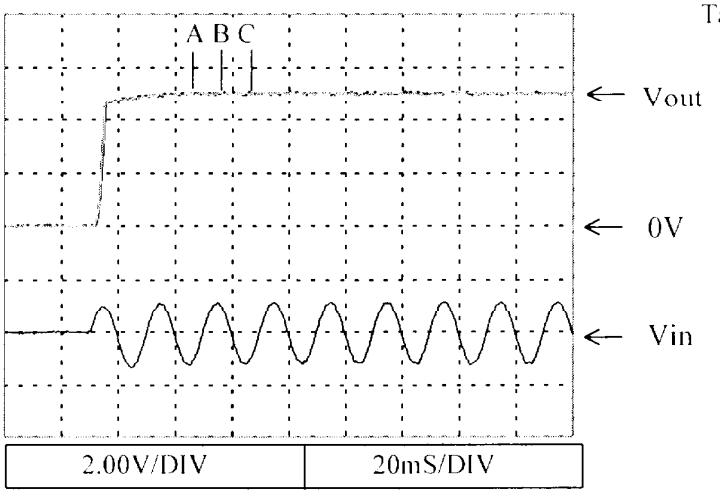


10V/DIV	200mS/DIV

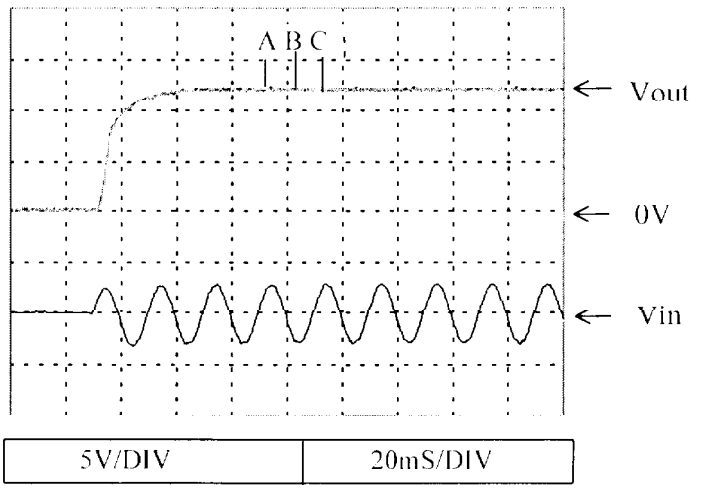
2.5 Output rise characteristics

Conditions Vin : 85Vac (A)
: 100Vac (B)
: 132Vac (C)
Iout : 0%
Ta : 25°C

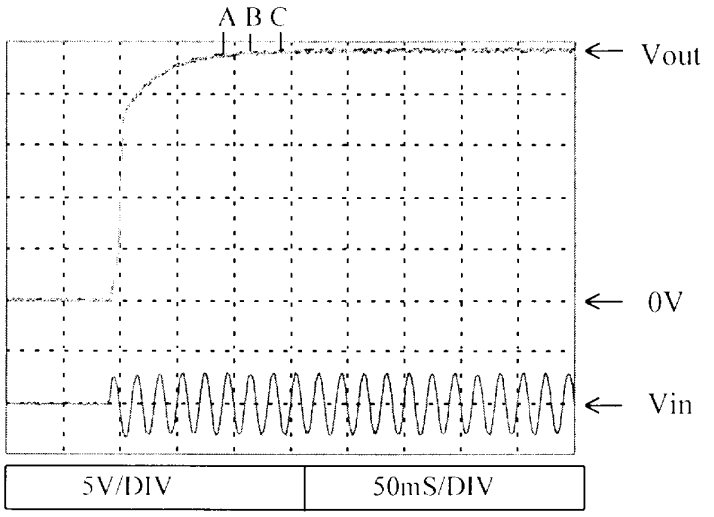
5V



12V



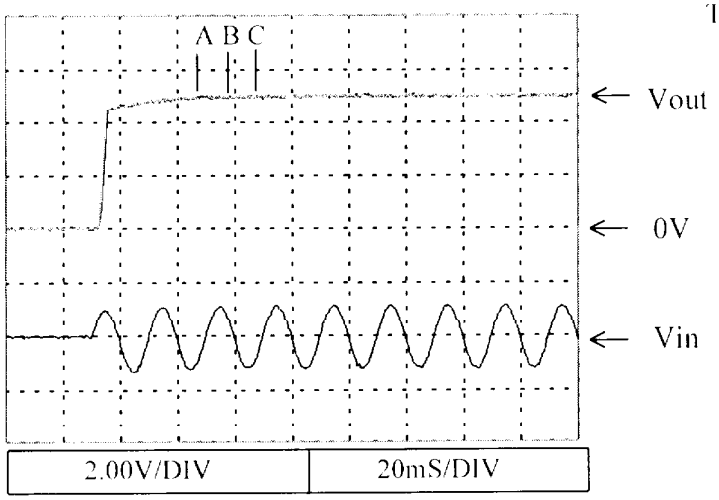
24V



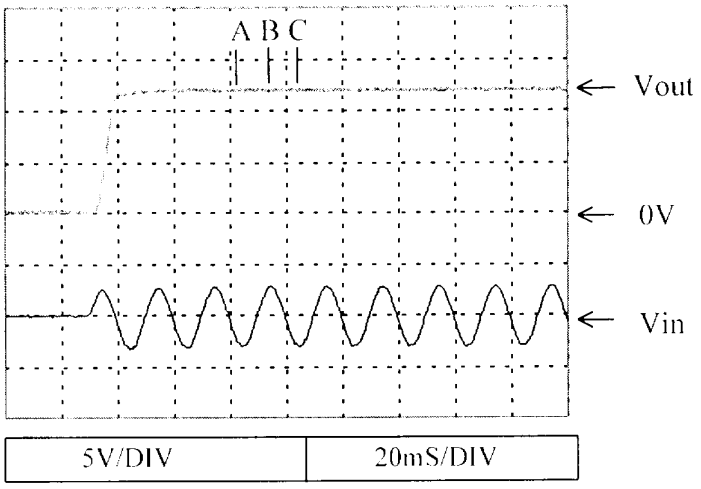
2.5 Output rise characteristics

Conditions Vin : 85Vac (A)
: 100Vac (B)
: 132Vac (C)
Iout : 100%
Ta : 25°C

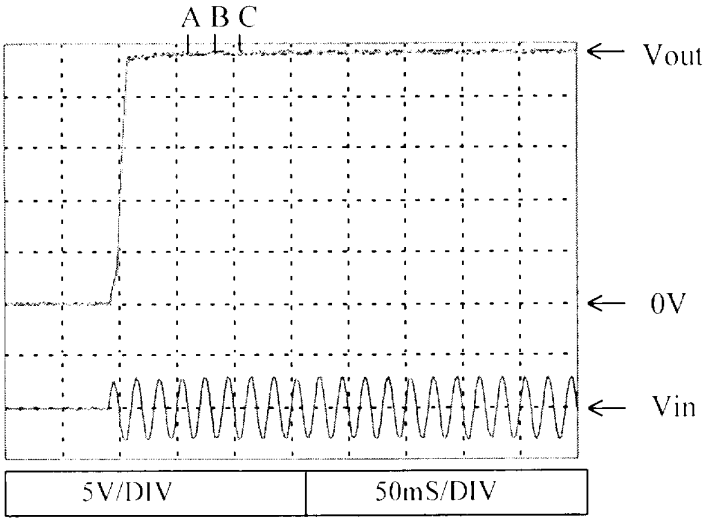
5V



12V



24V



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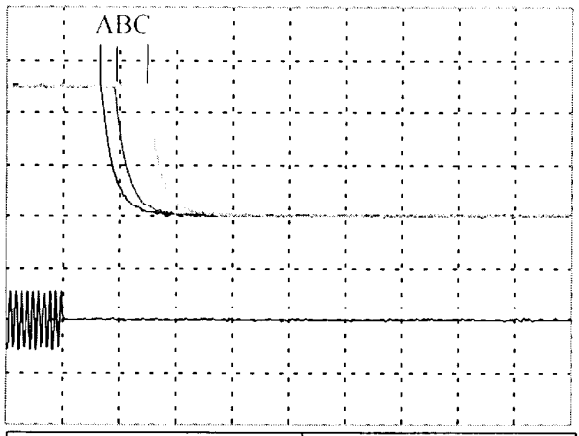
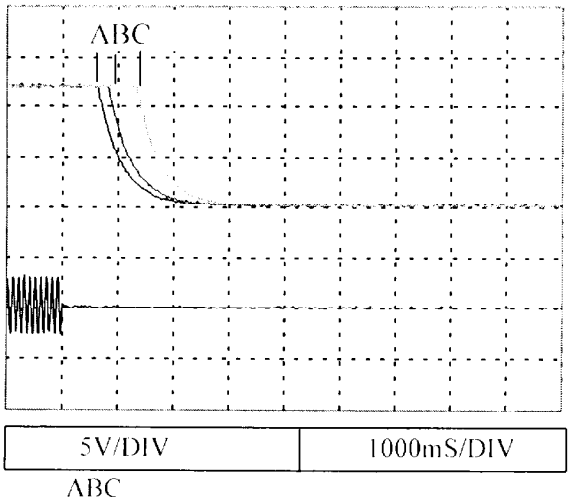
2.6 Output fall characteristics

Conditions Vin : 85Vac (A)
: 100Vac (B)
: 132Vac (C)
Iout : 0%
Ta : 25°C

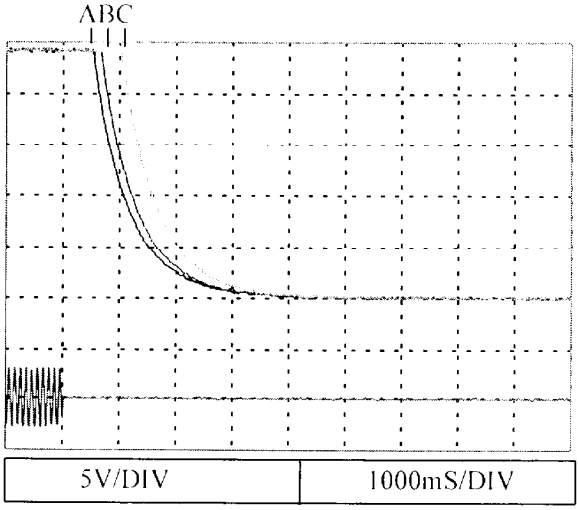
5V



12V



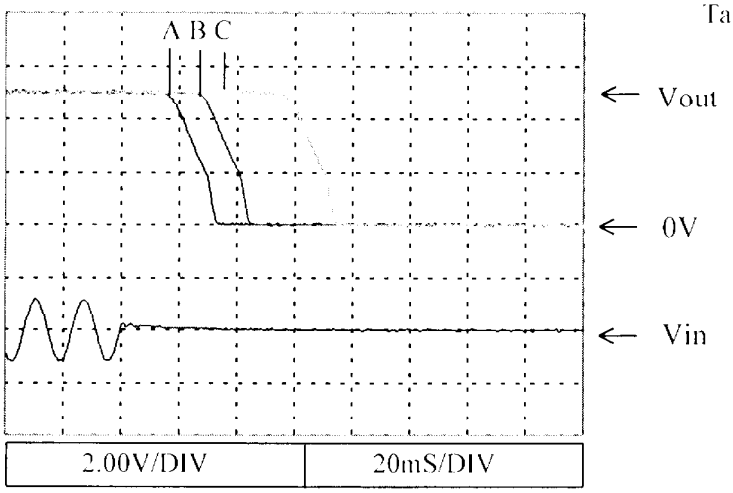
24V



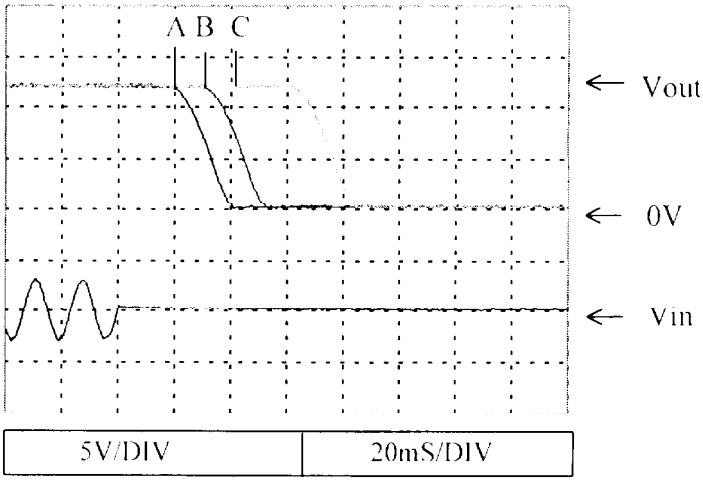
2.6 Output fall characteristics

Conditions Vin : 85Vac (A)
: 100Vac (B)
: 132Vac (C)
Iout : 100%
Ta : 25°C

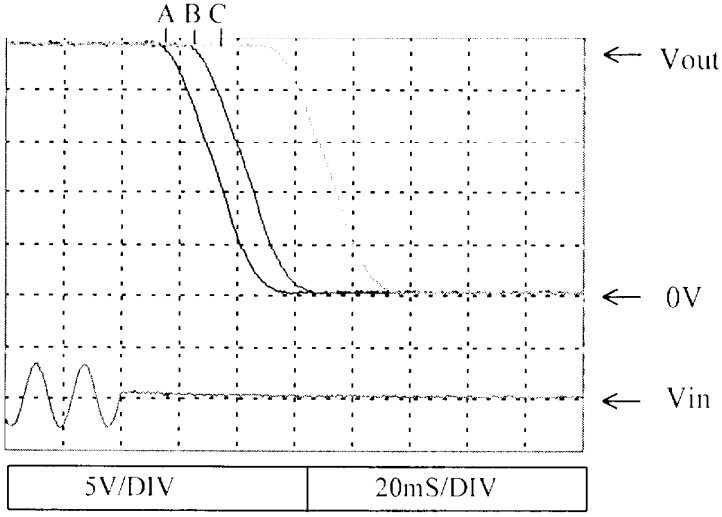
5V



12V



24V



2.7 Hold up time characteristics

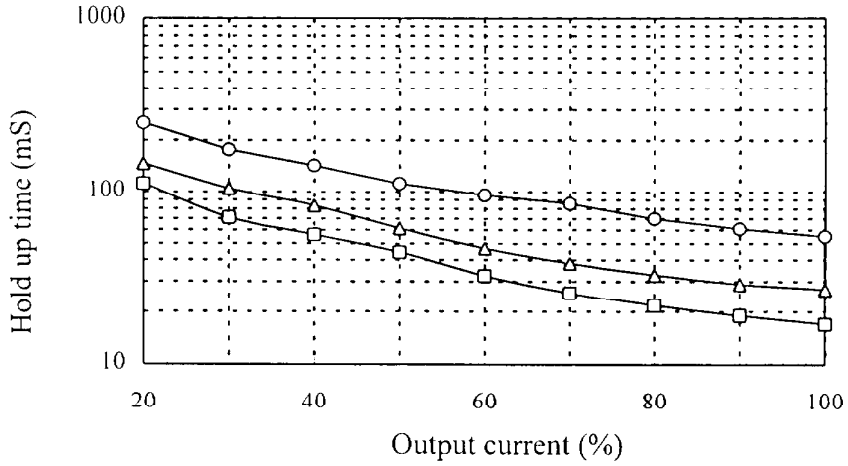
Conditions Ta : 25°C

Vin : 85Vac

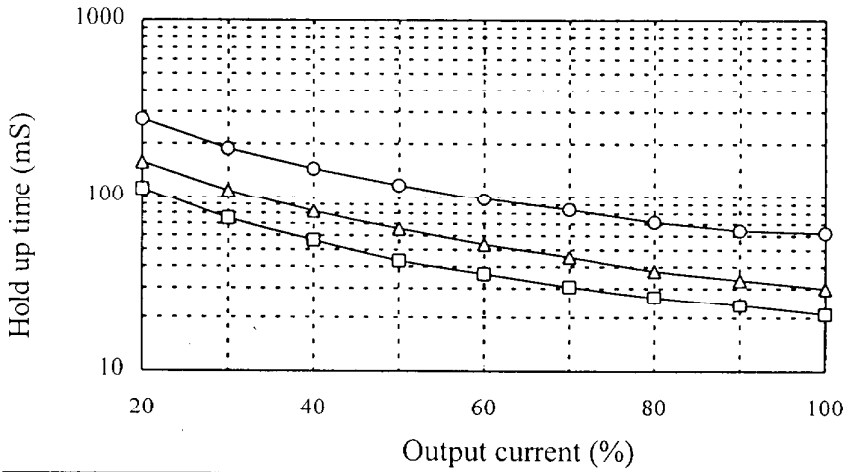
100Vac

132Vac

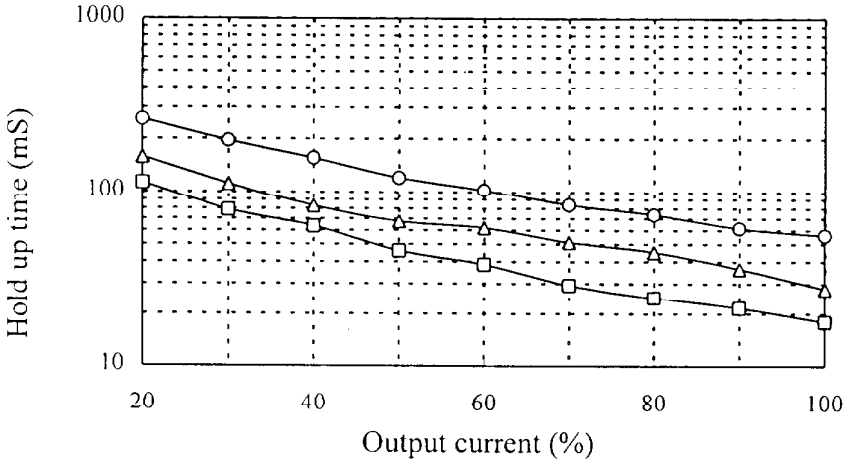
5V



12V



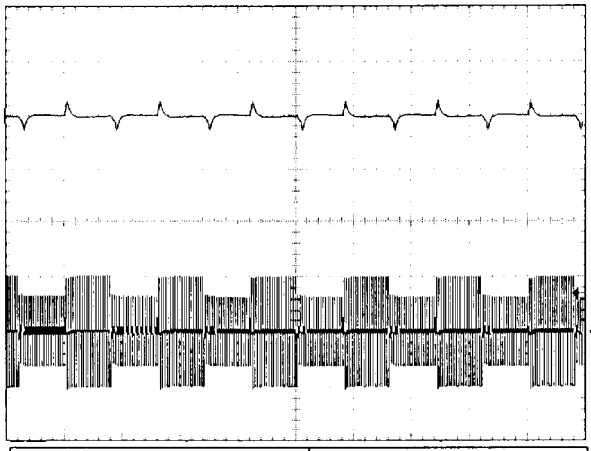
24V



2.8 Dynamic line response characteristics

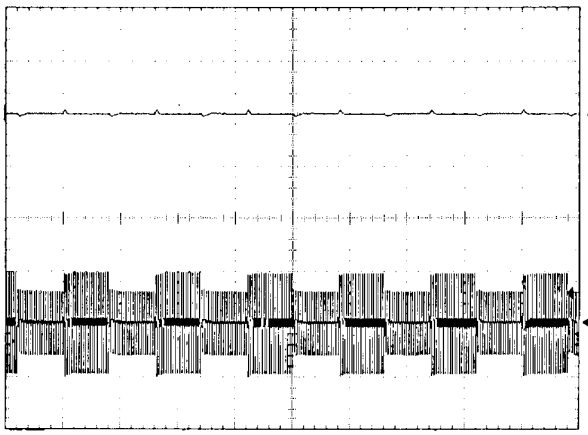
Conditions Vin : 85Vac⟷132Vac
Iout : 100%
Ta : 25°C

5V



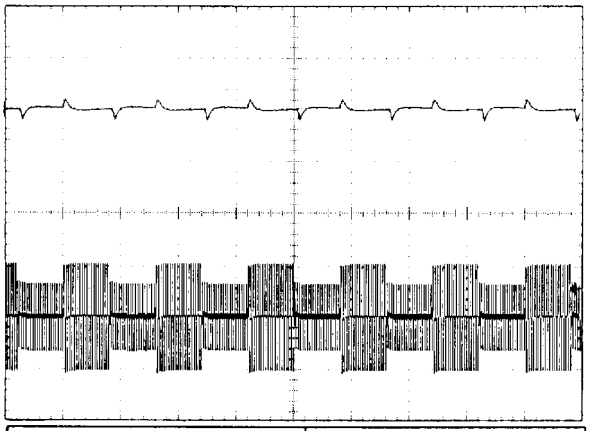
50mV/DIV | 500mS/DIV

12V



50mV/DIV | 500mS/DIV

24V

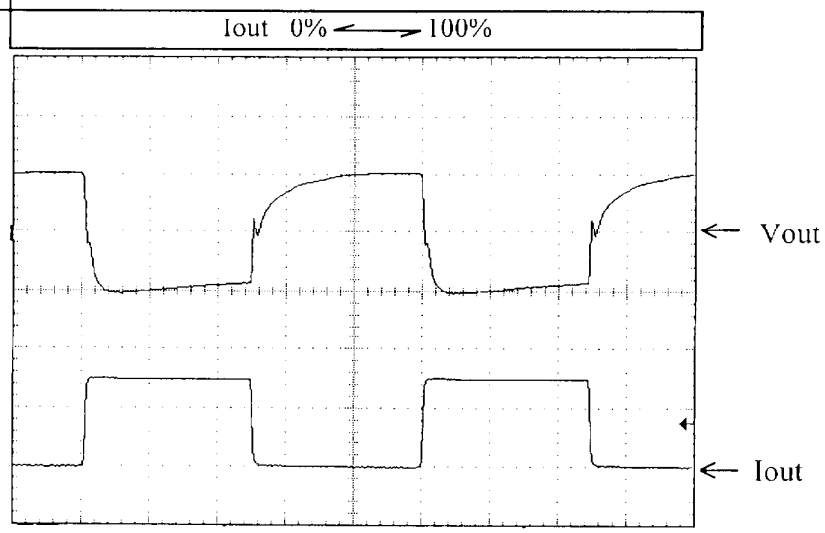


50mV/DIV | 500mS/DIV

2.9 Dynamic load response characteristics

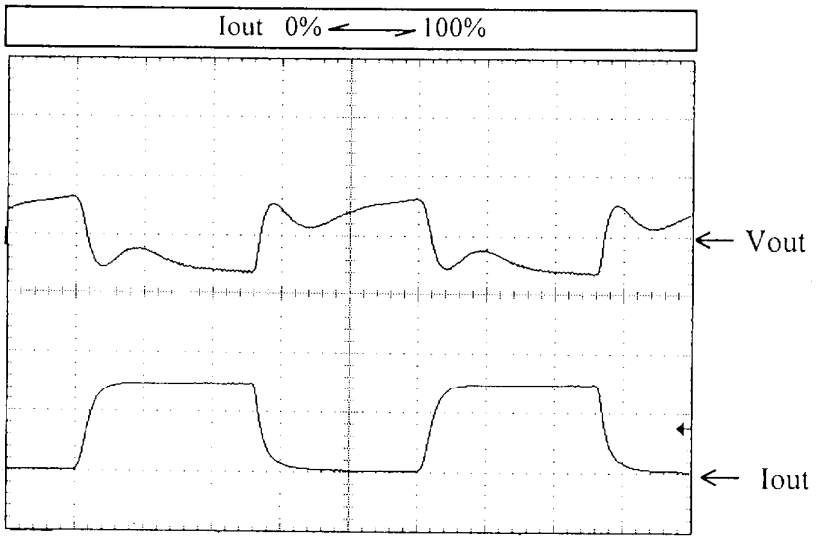
Conditions Vin : 100Vac
Ta : 25°C

5V f=100Hz



200mV/DIV	2mS/DIV
+4.2 %	-4.2 %

f=1kHz

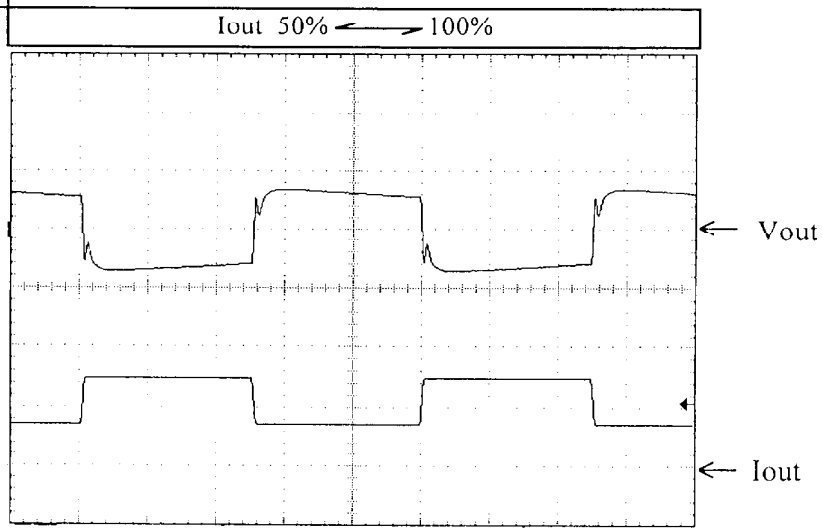


200mV/DIV	200uS/DIV
+2.6 %	-2.8 %

2.9 Dynamic load response characteristics

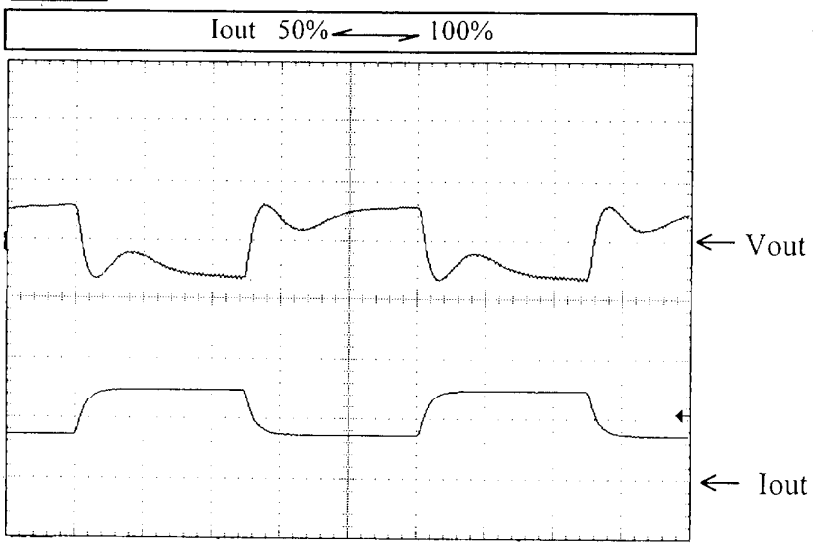
Conditions Vin : 100Vac
Ta : 25°C

5V **f=100Hz**



100mV/DIV	2mS/DIV
+1.4 %	-1.6 %

f=1kHz

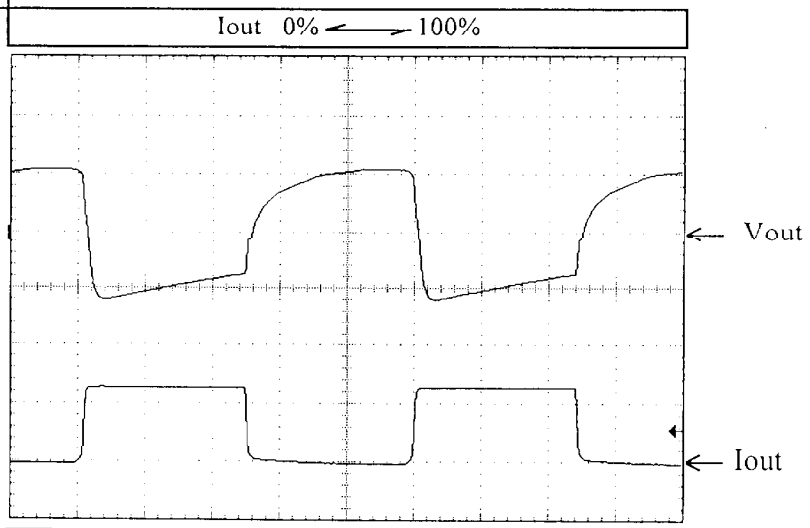


100mV/DIV	200uS/DIV
+1.2 %	-1.4 %

2.9 Dynamic load response characteristics

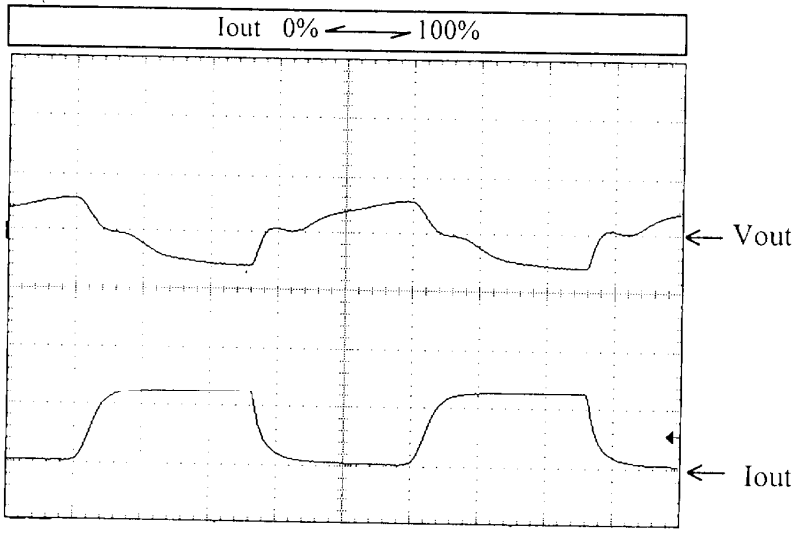
Conditions Vin : 100Vac
Ta : 25°C

12V	f=100Hz



200mV/DIV	2mS/DIV
+1.8 %	-2.0 %

f=1kHz

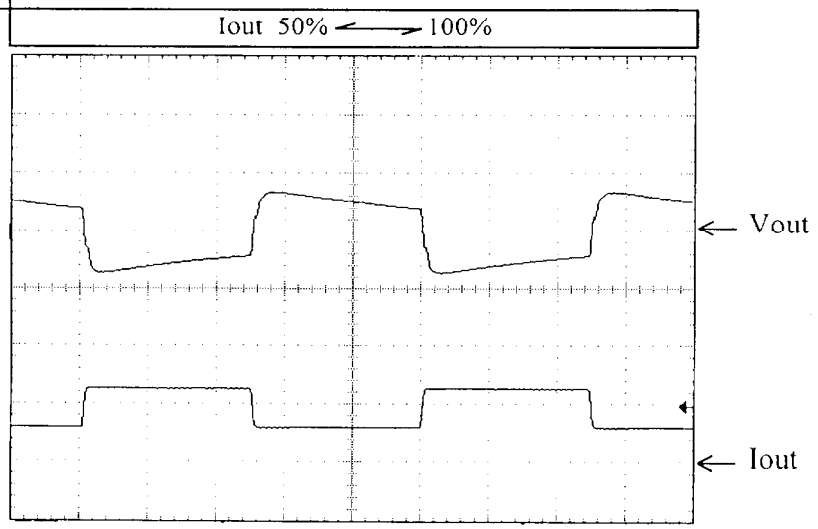


200mV/DIV	200uS/DIV
+0.9 %	-1.0 %

2.9 Dynamic load response characteristics

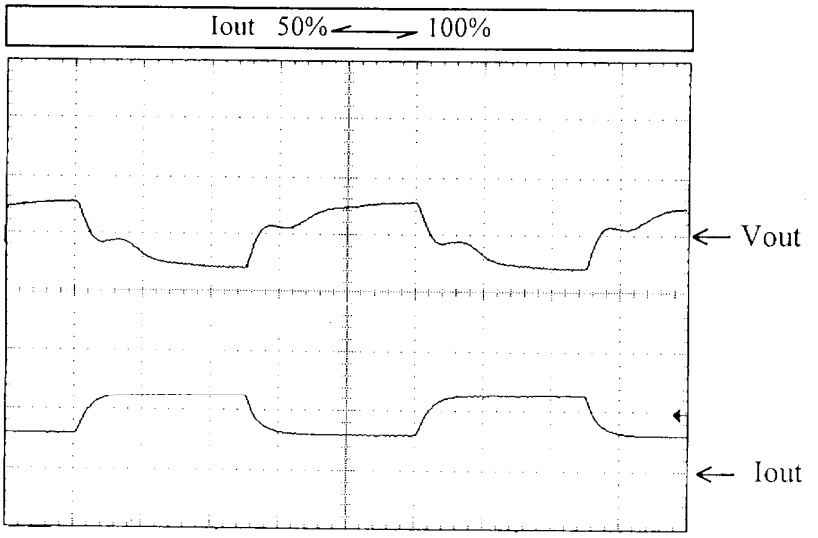
Conditions Vin : 100Vac
Ta : 25°C

12V	f=100Hz



100mV/DIV	2mS/DIV
+0.56 %	-0.63 %

f=1kHz

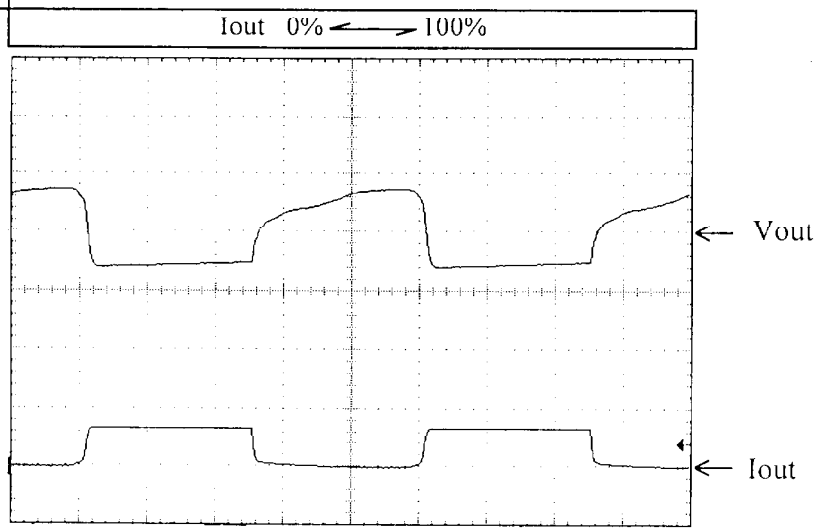


100mV/DIV	200uS/DIV
+0.46 %	-0.50 %

2.9 Dynamic load response characteristics

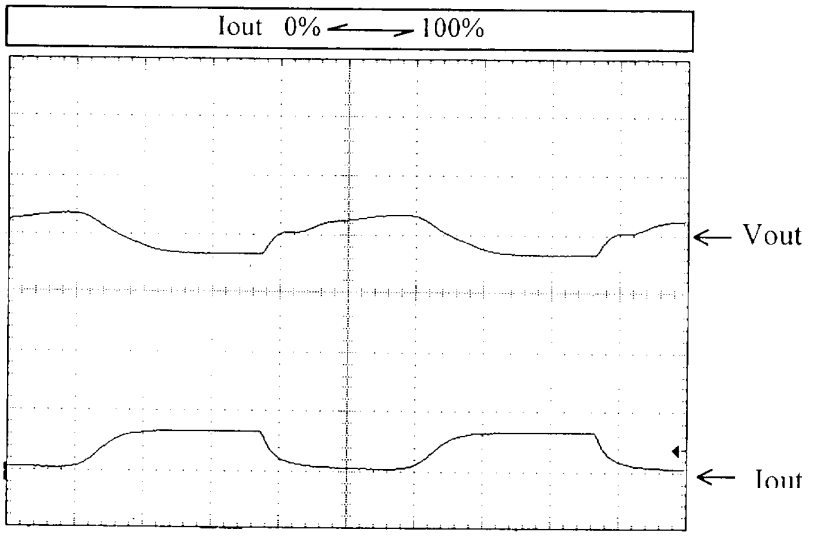
Conditions Vin : 100Vac
Ta : 25°C

24V	f=100Hz



200mV/DIV	2mS/DIV
+0.57 %	-0.50 %

f=1kHz

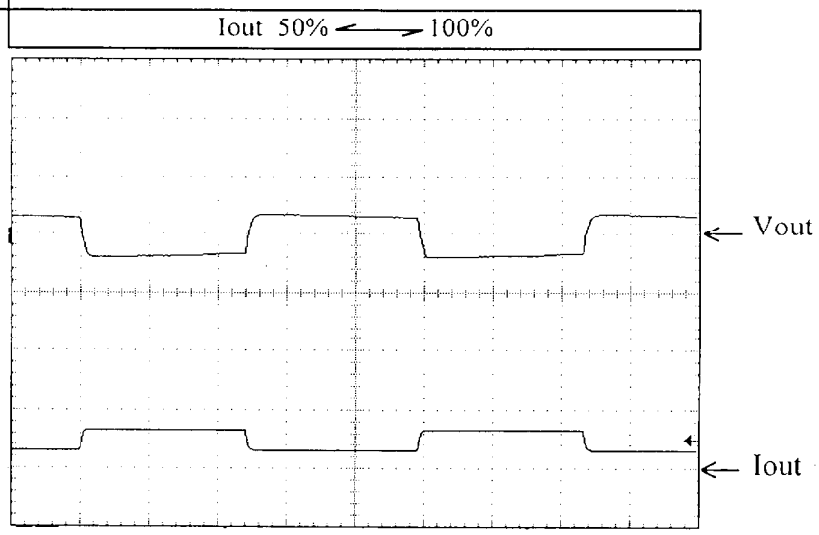


200mV/DIV	200uS/DIV
+0.34 %	-0.30 %

2.9 Dynamic load response characteristics

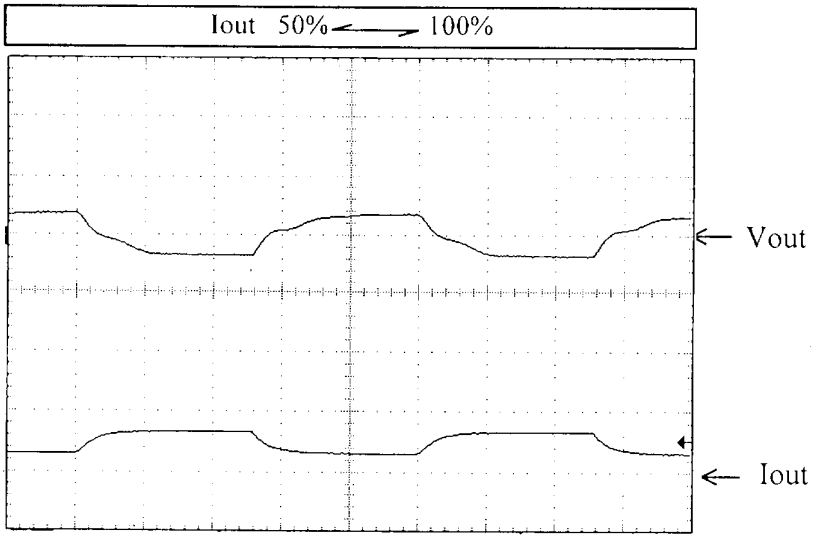
Conditions Vin : 100Vac
Ta : 25°C

24V **f=100Hz**



100mV/DIV	2mS/DIV
+0.15 %	-0.17 %

f=1kHz

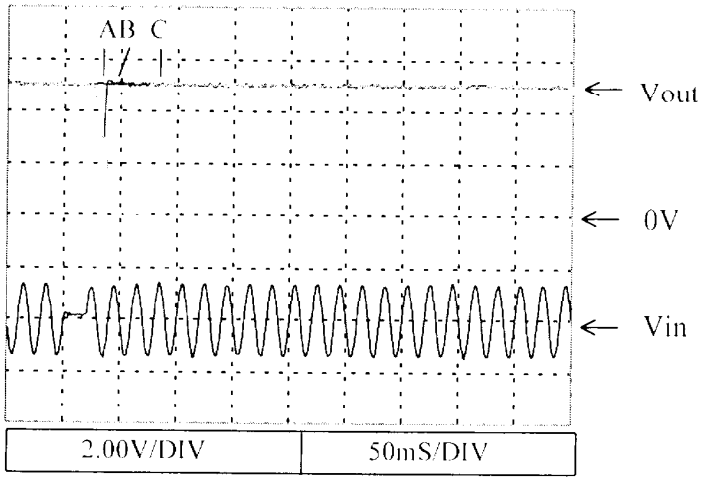


100mV/DIV	200uS/DIV
+0.16 %	-0.14 %

2.10 Response to brown out characteristics

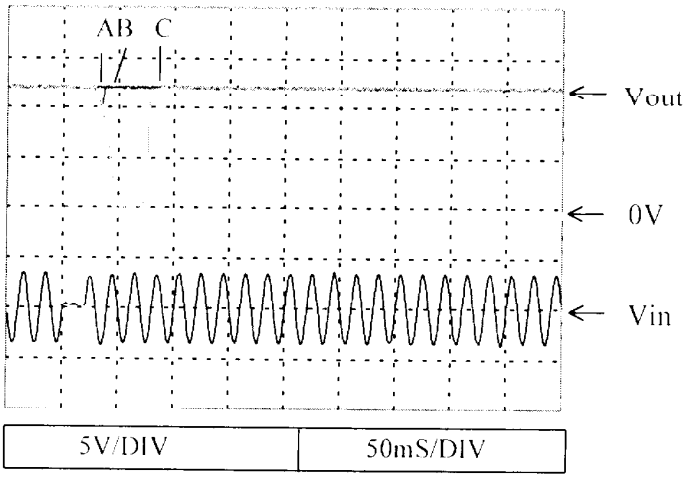
Conditions Vin : 100Vac
Iout : 100%
Ta : 25°C

5V



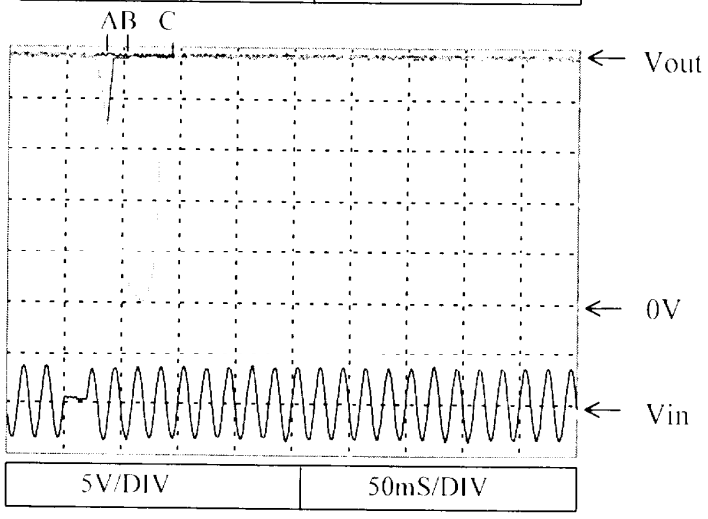
A = 20 mS
B = 35 mS
C = 70 mS

12V



A = 20 mS
B = 35 mS
C = 70 mS

24V



A = 20 mS
B = 35 mS
C = 70 mS

VS15C

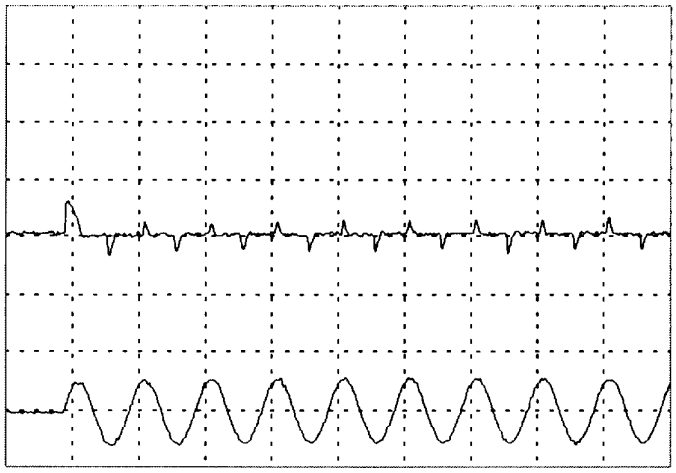
2.11 Inrush current waveform

Conditions Vin : 100Vac
Iout : 100%
Ta : 25°C

5V

Switch on phase angle of input AC voltage :

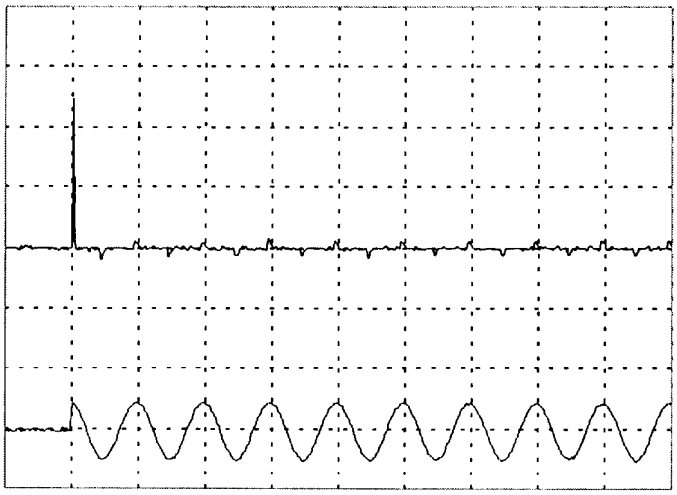
Φ=0°



5.0A/DIV	20mS/DIV

Switch on phase angle of input AC voltage :

Φ=90°



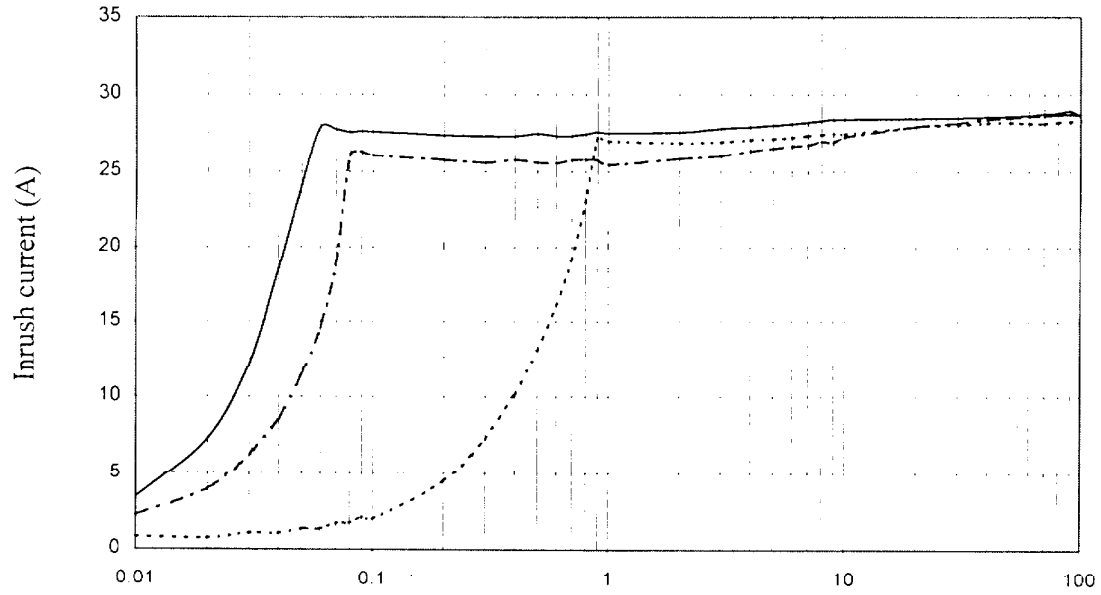
10.0A/DIV	20mS/DIV

VS15C

2.12 Inrush currentcharacteristics

Conditions Vin : 100Vac
Iout : 0% - - - - - - - - - - - -
50% — - — - — - —
100% ————————
Ta : 25°C

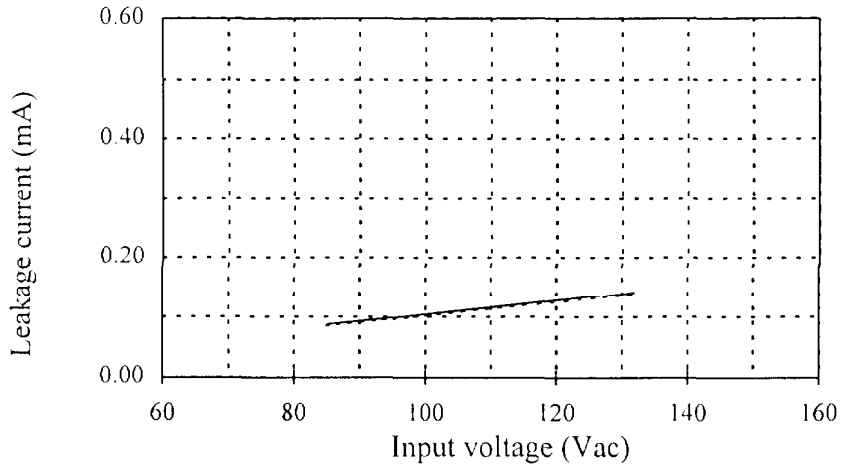
5V



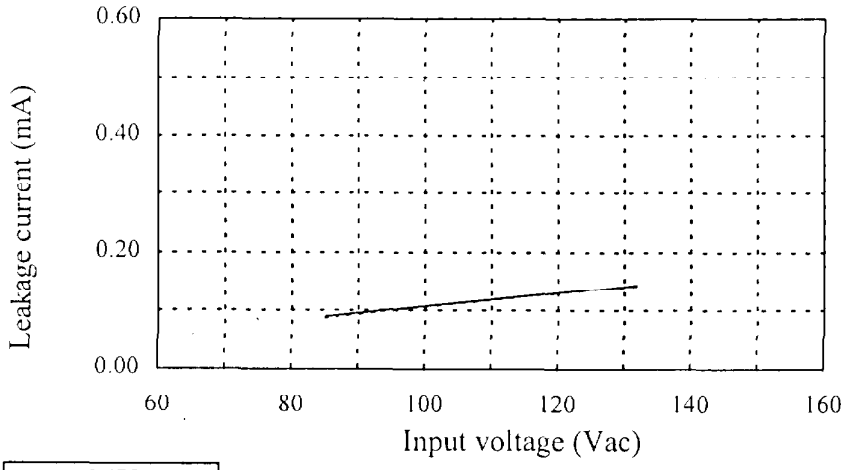
2.13 Leakage current characteristics

Conditions Ta : 25°C
Vin : 0% - - - - - - - - -
100% ————————

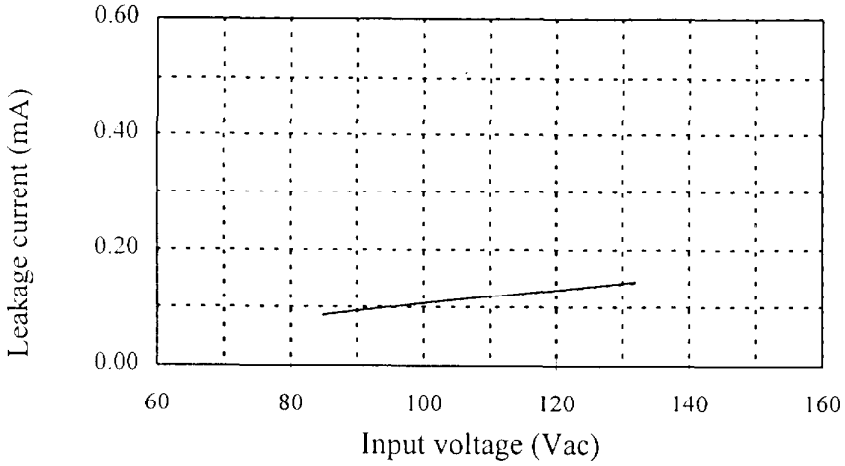
5V



12V



24V

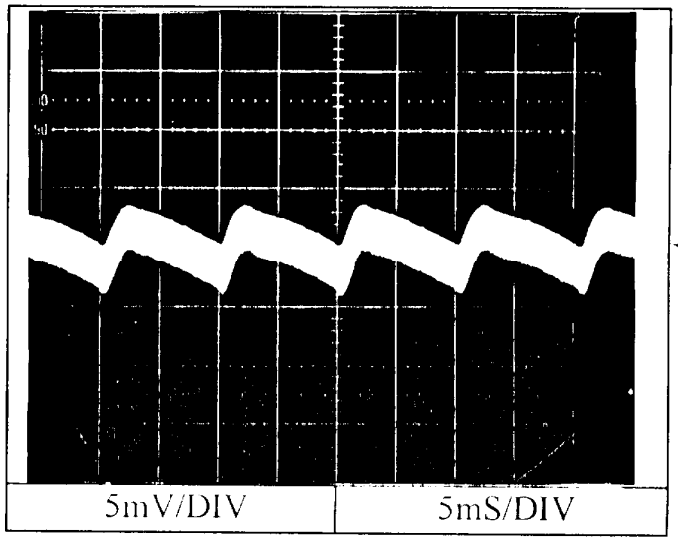


2.14 Output ripple and noise waveform

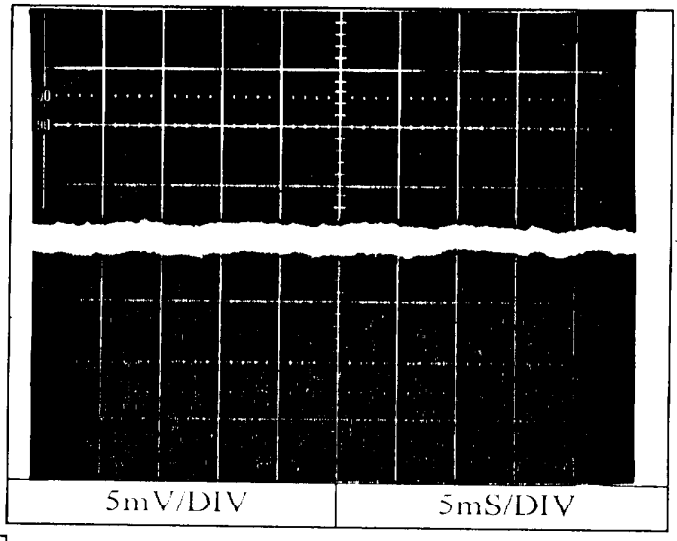
Conditions Vin : 100VAC
Iout : 100%
Ta : 25°C

NORMAL MODE

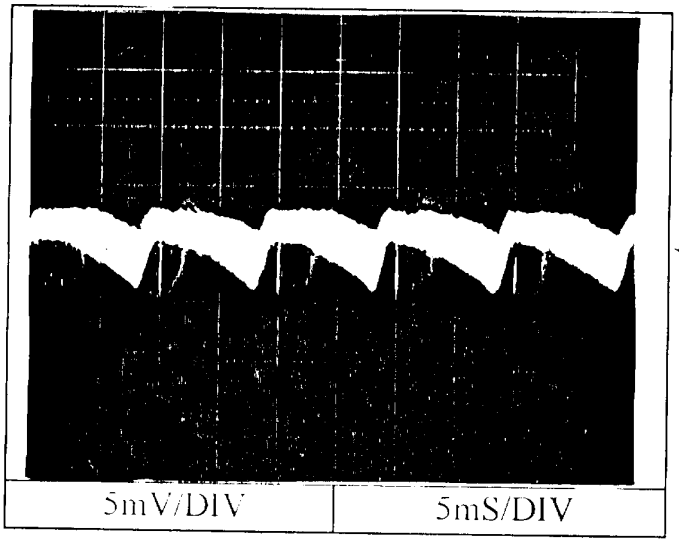
5V



12V



24V

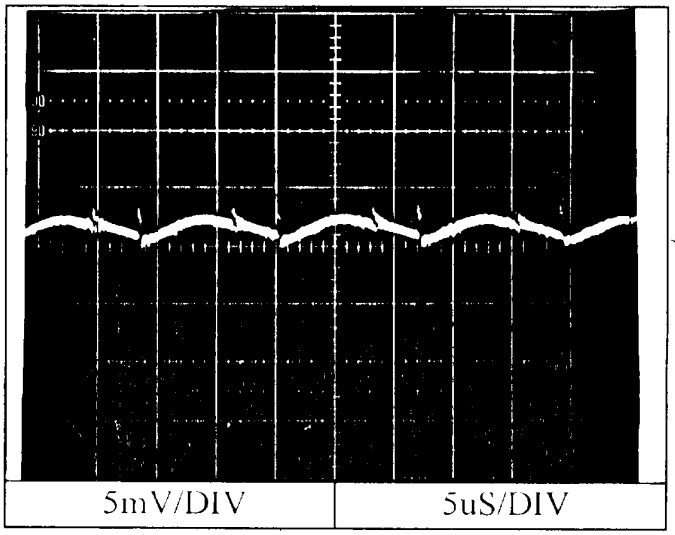


2.14 Output ripple and noise waveform

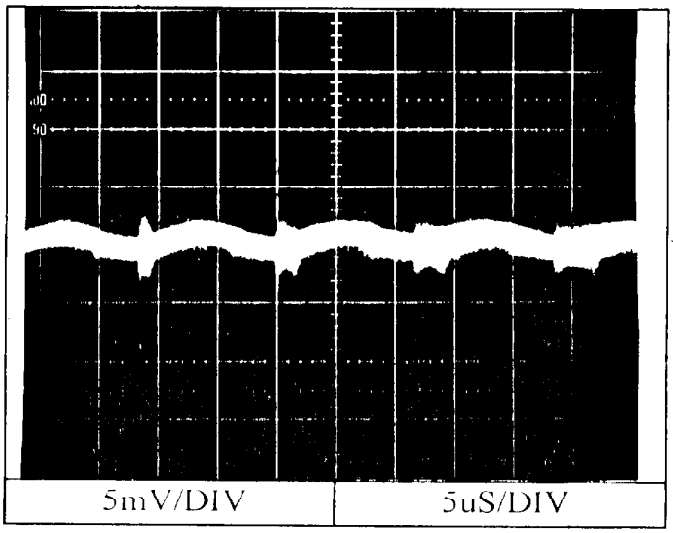
Conditions Vin : 100VAC
Iout : 100%
Ta : 25°C

NORMAL MODE

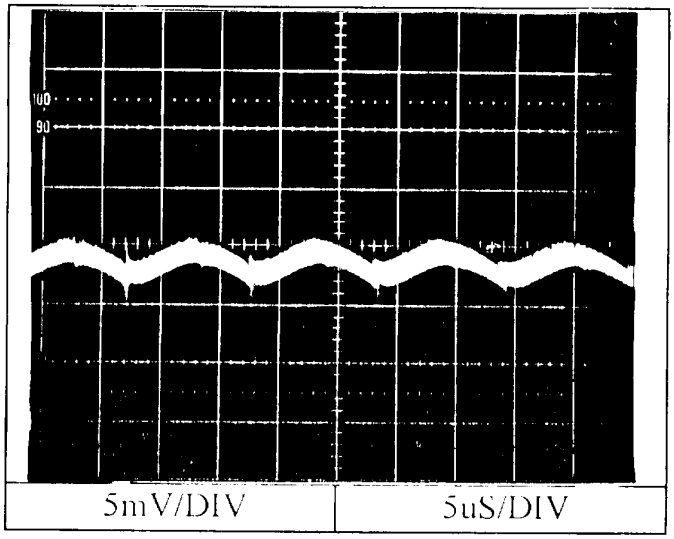
5V



12V



24V

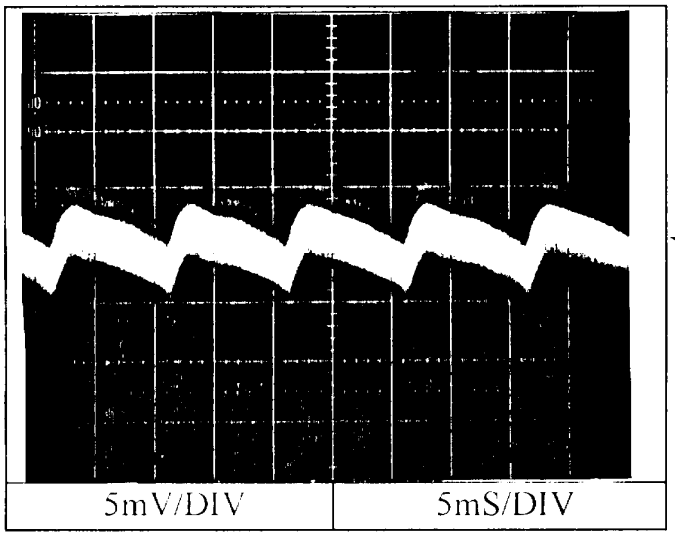


2.14 Output ripple and noise waveform

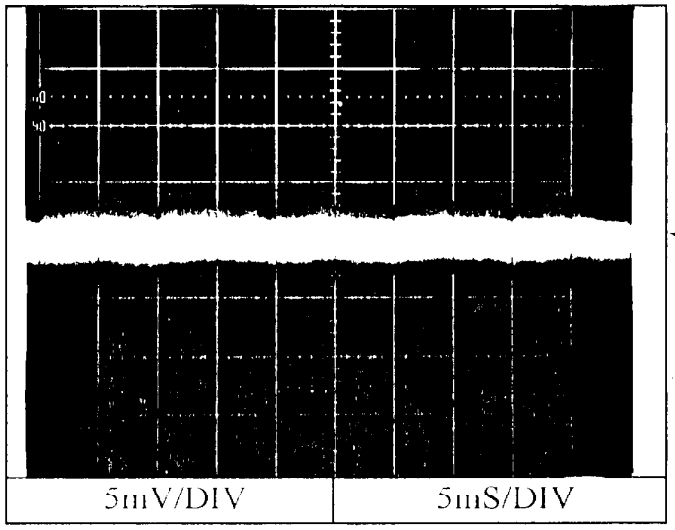
Conditions Vin : 100VAC
Iout : 100%
Ta : 25°C

NORMAL + COMMON MODE

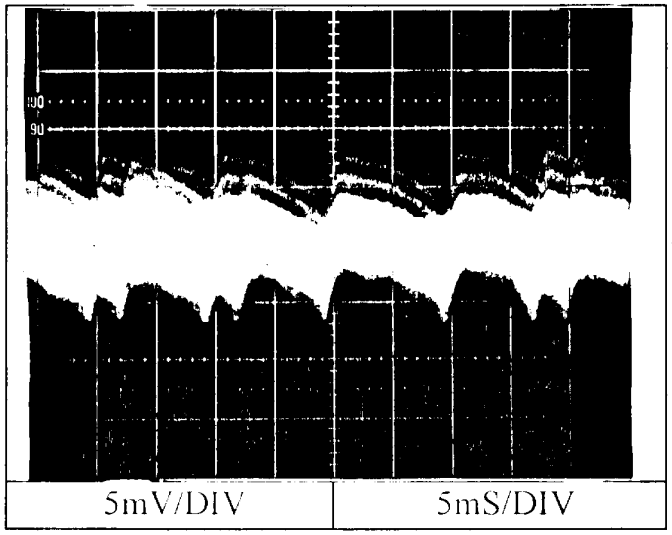
5V



12V



24V

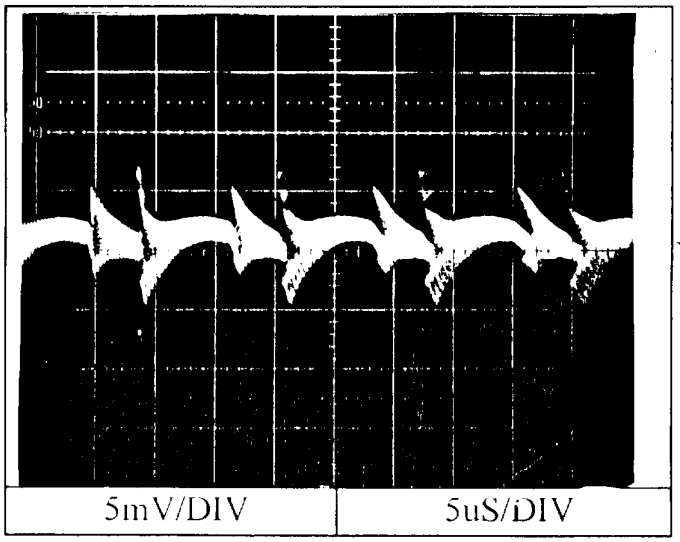


2.14 Output ripple and noise waveform

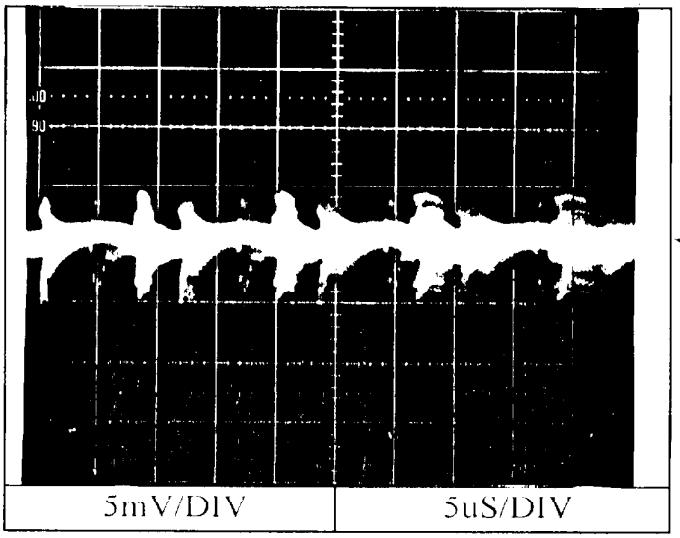
Conditions Vin : 100VAC
Iout : 100%
Ta : 25°C

NORMAL + COMMON MODE

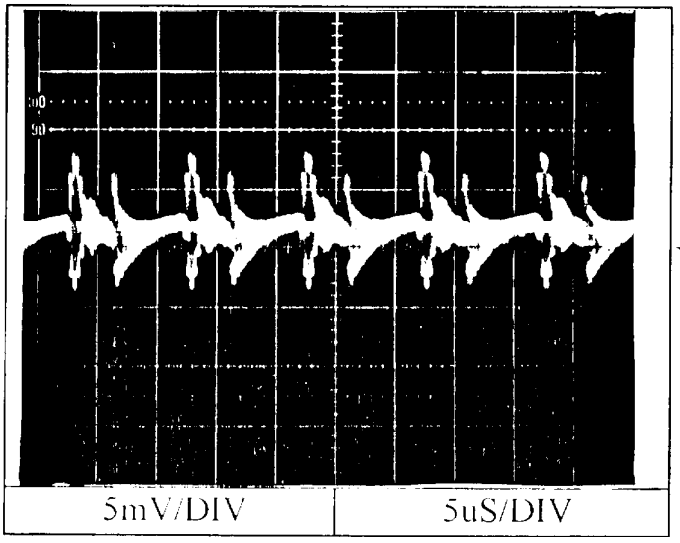
5V



12V



24V



2.15 Electro-Magnetic Interference characteristics

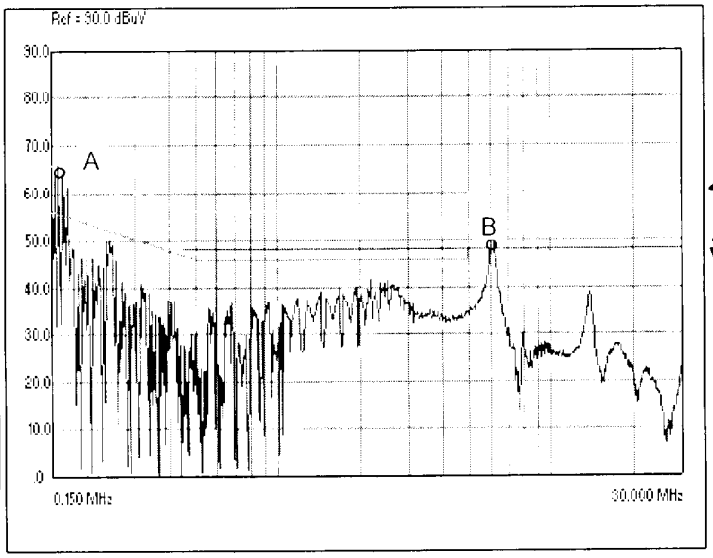
Conditions Vin : 100Vac
Iout : 100%
Ta : 25°C

Conducted Emission

5V

Ref.	Point A (166.0kHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	65.20	61.3
AV	55.20	47.6

Ref.	Point B (6.11MHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	60.00	45.7
AV	50.00	33.7

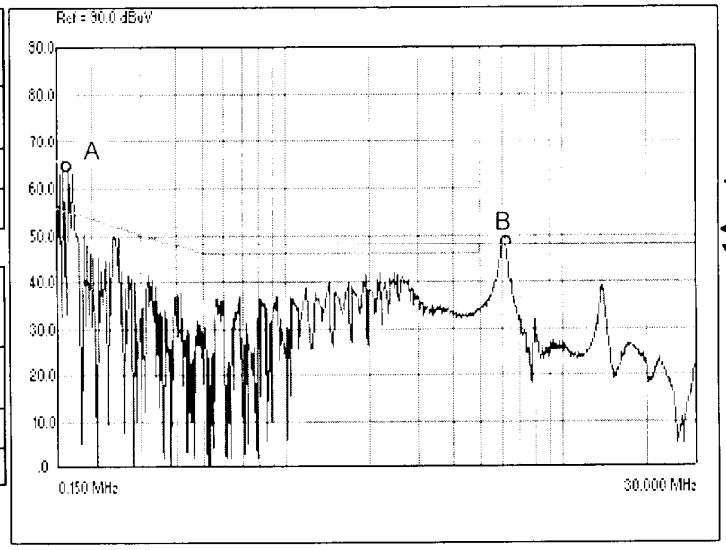


Phase : L

5V

Ref.	Point A (160.0kHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	65.50	62.6
AV	55.50	44.5

Ref.	Point B (6.13MHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	60.00	45.9
AV	50.00	33.8



Phase : N

VS15C

2.15 Electro Magnetic Interference characteristics

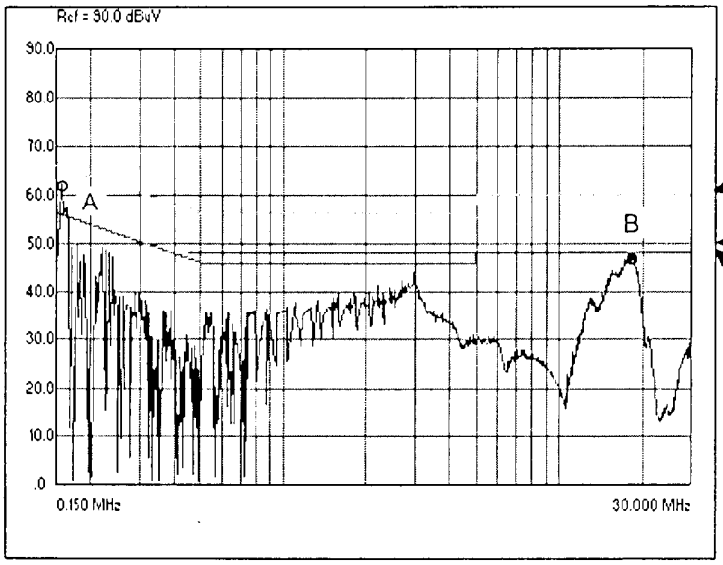
Conditions Vin : 100Vac
Iout : 100%
Ta : 25°C

Conducted Emission

12V

Ref.	Point A (156.6kHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	65.68	61.1
AV	55.68	45.0

Ref.	Point B (17.76MHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	60.00	42.7
AV	50.00	33.5

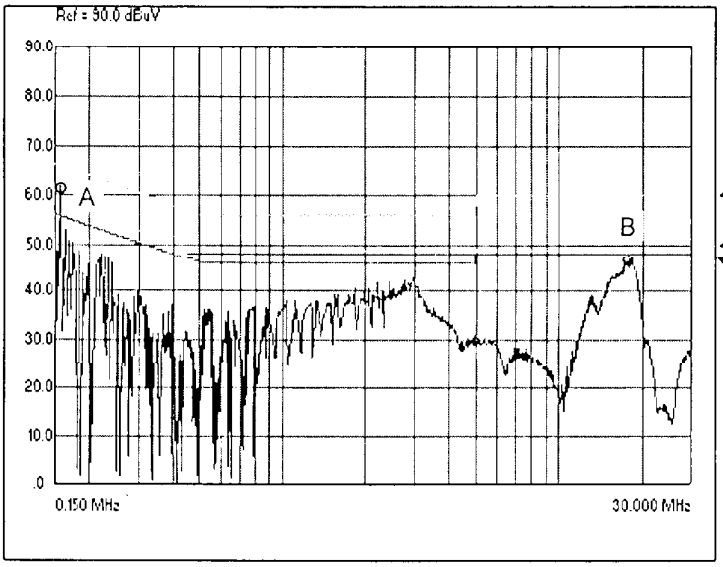


Phase : L

12V

Ref.	Point A (150.1kHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	66.00	61.4
AV	56.00	44.2

Ref.	Point B (17.78MHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	60.00	41.4
AV	50.00	32.3



Phase : N

VS15C

2.15 Electro Magnetic Interference characteristics

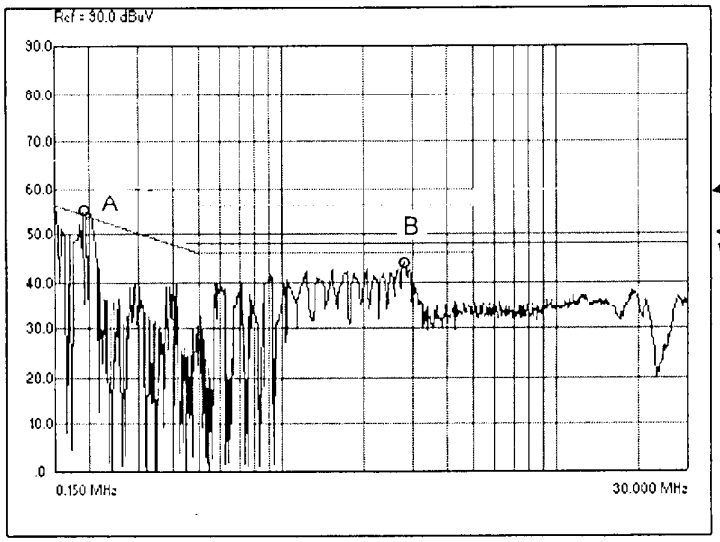
Conditions Vin : 100Vac
Iout : 100%
Ta : 25°C

Conducted Emission

24V

Ref.	Point A (189.3kHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	64.08	54.5
AV	54.08	34.2

Ref.	Point B (2.80MHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	56.00	42.0
AV	46.00	23.3

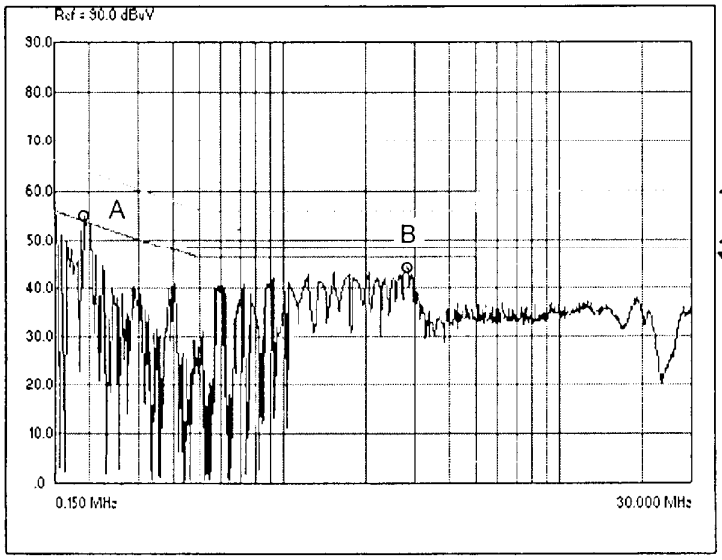


Phase : L

24V

Ref.	Point A (189.7kHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	64.06	53.8
AV	54.06	34.2

Ref.	Point B (2.80MHz)	
Data	Limit (dBuV)	Measure (dBuV)
QP	56.00	42.0
AV	46.00	23.8



Phase : N

VS15C

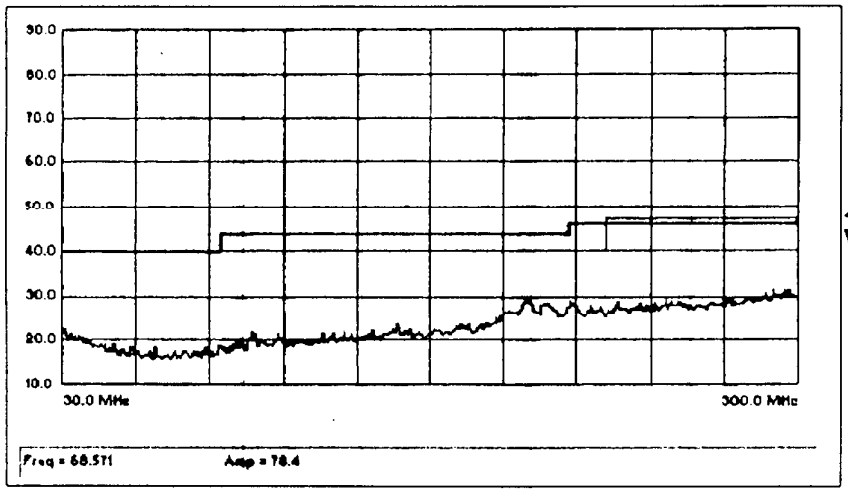
2.15 Electro Magnetic Interference characteristics

Conditions Vin : 100Vac
Iout : 100%
Ta : 25°C

Radiated Emission Noise

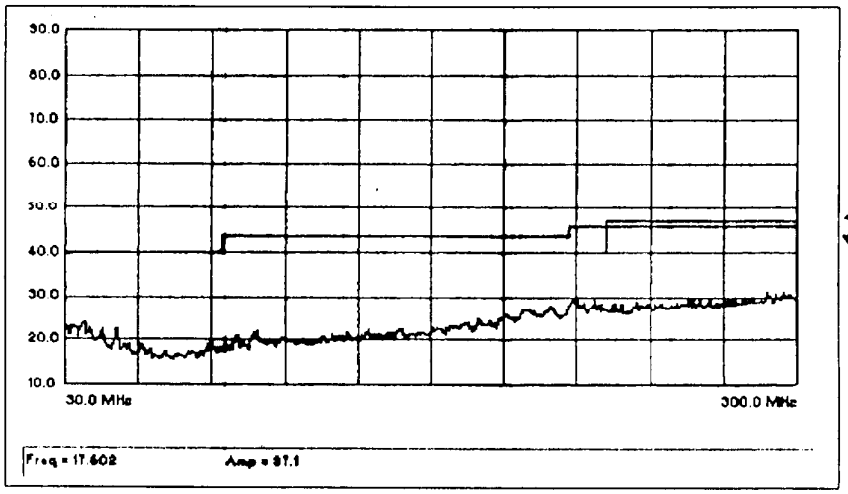
5V

HORIZONTAL :



5V

VERTICAL :



VS15C

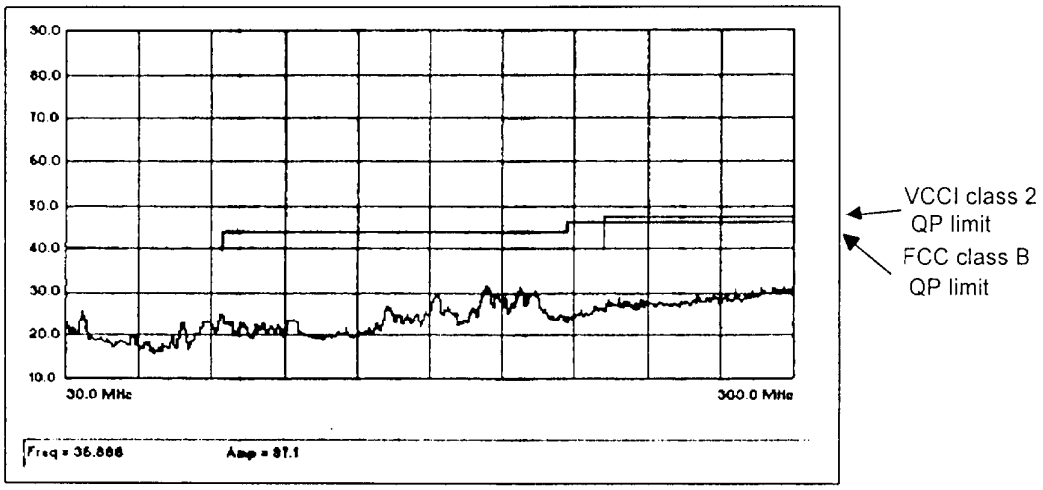
2.15 Electro Magnetic Interference characteristics

Conditions Vin : 100Vac
Iout : 100%
Ta : 25°C

Radiated Emission Noise

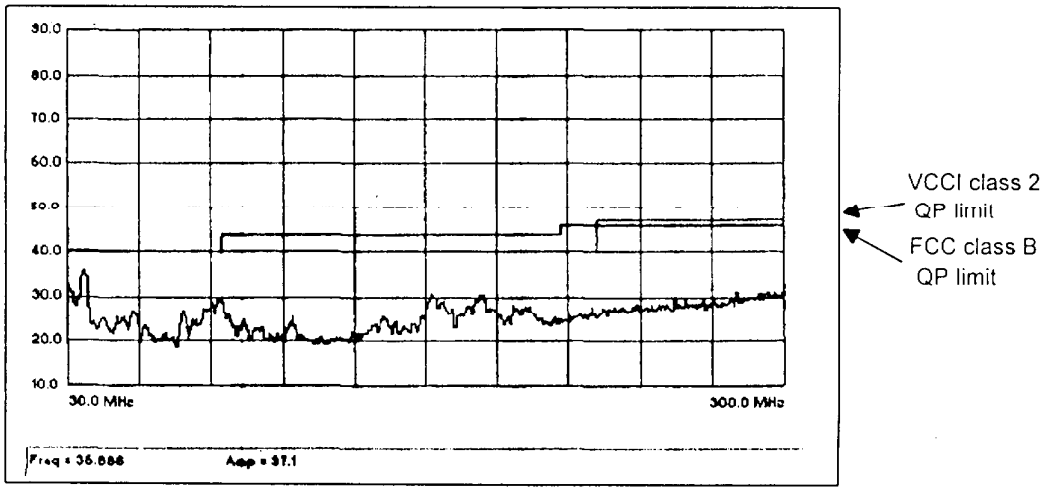
12V

HORIZONTAL :



12V

VERTICAL :



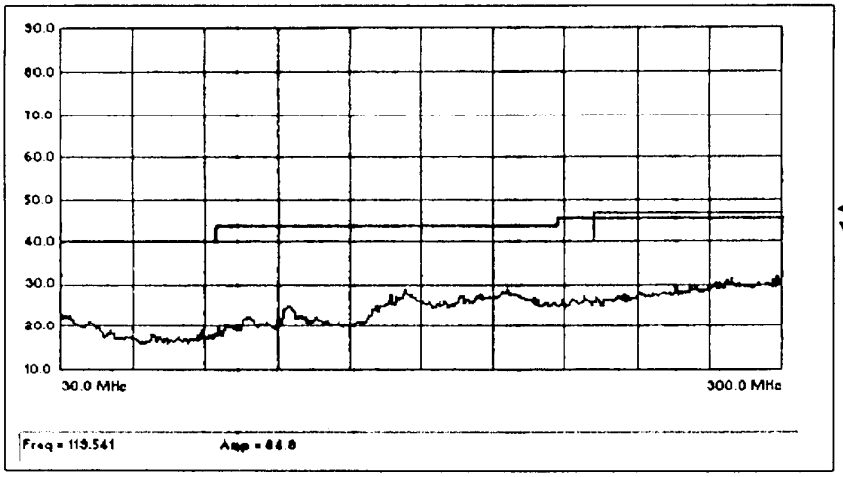
2.15 Electro Magnetic Interference characteristics

Conditions Vin : 100Vac
Iout : 100%
Ta : 25°C

Radiated Emission Noise

24V

HORIZONTAL :



24V

VERTICAL :