ZWD225PAF

EVALUATION DATA

DWG No.	PA574-53-01-A	
APPD	CHK	DWG
	Leng	
07/03/14	06/03/14	6/3/14

INDEX

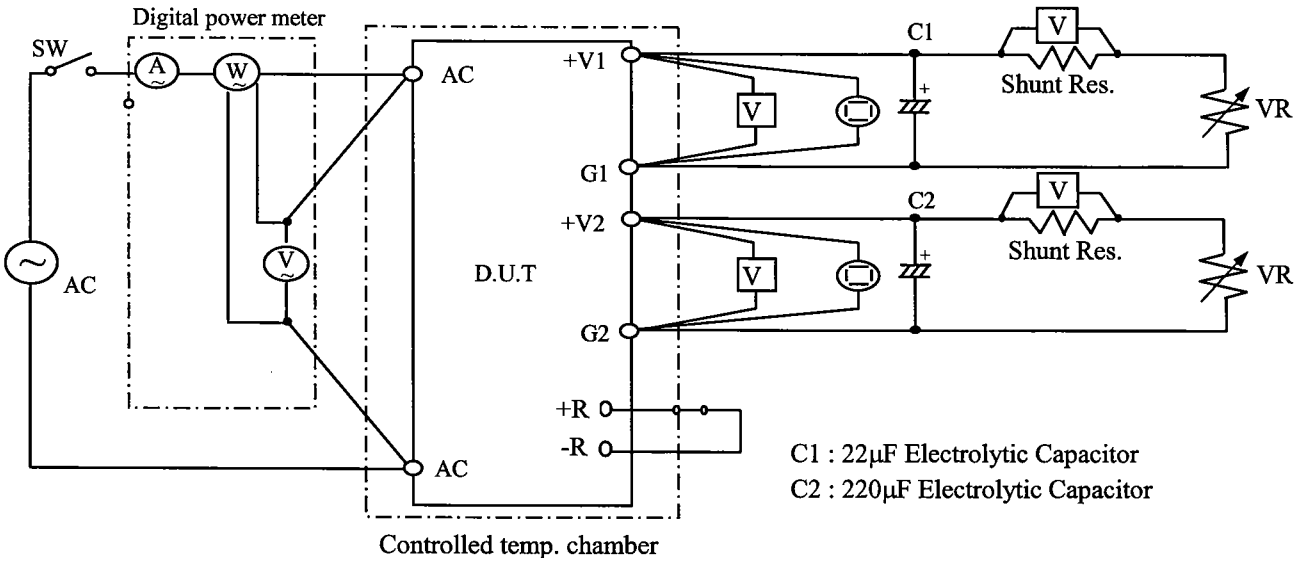
Terminology used

Vin - Input Voltage
Iin - Input Current
V1 - CH1 Output Voltage (5V)
V2 - CH2 Output Voltage (24V)
G1 - CH1 Output Voltage (GND)
G2 - CH2 Output Voltage (GND)
I1 - CH1 (5V) Output Current
I2 - CH2 (24V) Output Current
Ta - Ambient Temperature
Tr - Load Rise-Time
Tf - Load Fall-Time

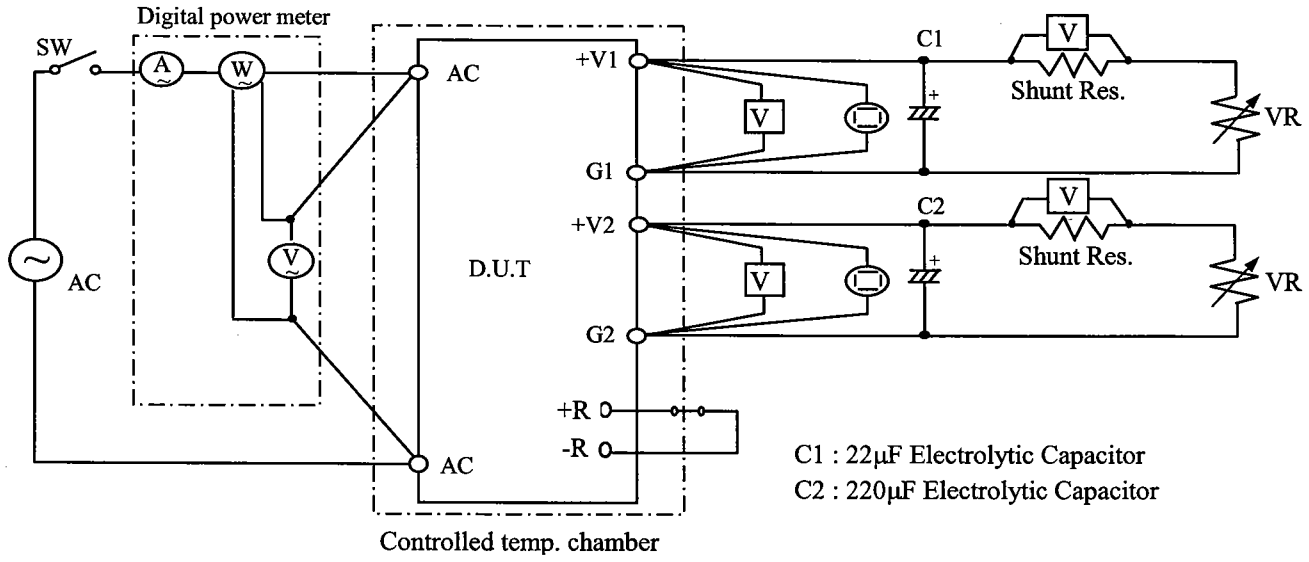
1. EVALUATION METHOD

1 - 1 Circuit used for determination

(1) Steady state data



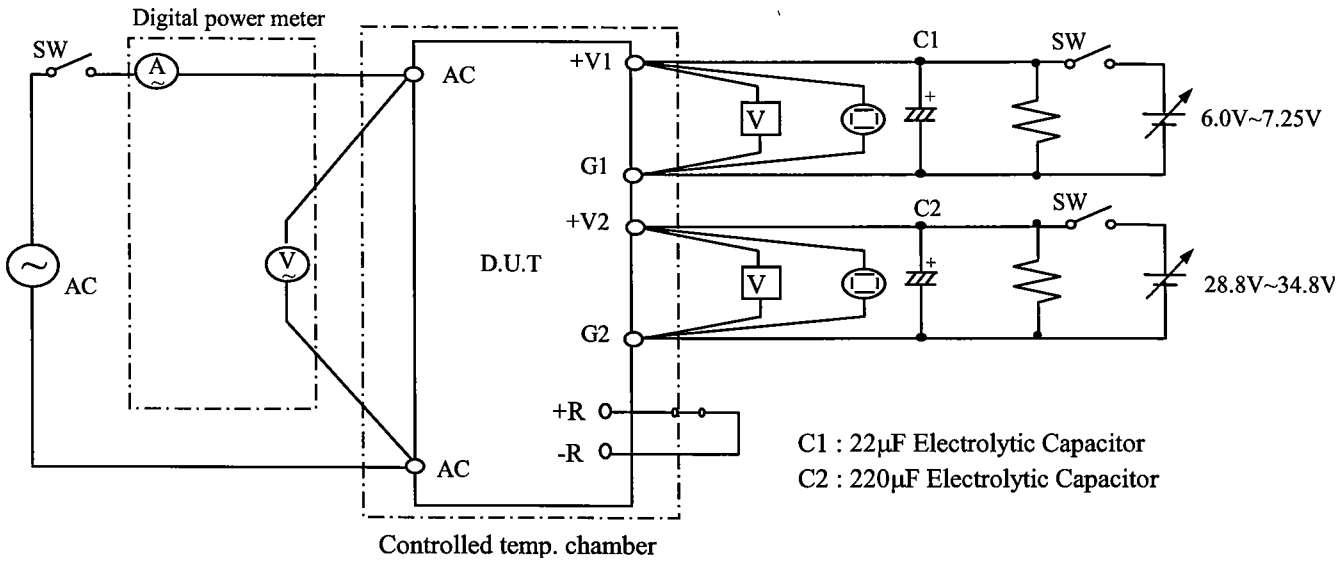
(2) Warm up voltage drift characteristics



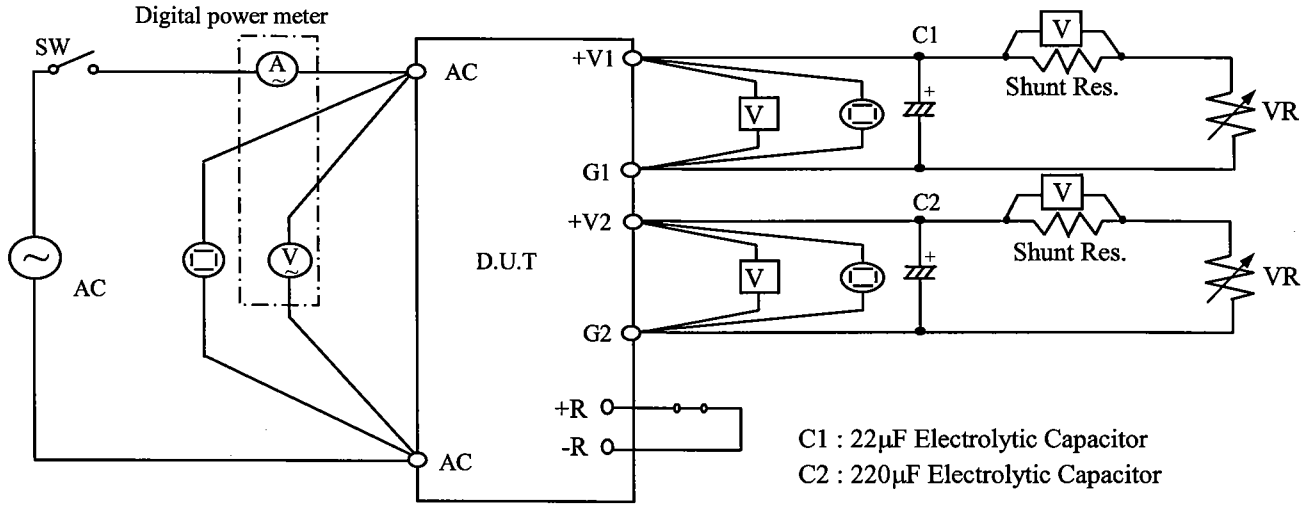
(3) Over current protection (O.C.P.) characteristics

Same as steady state data

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



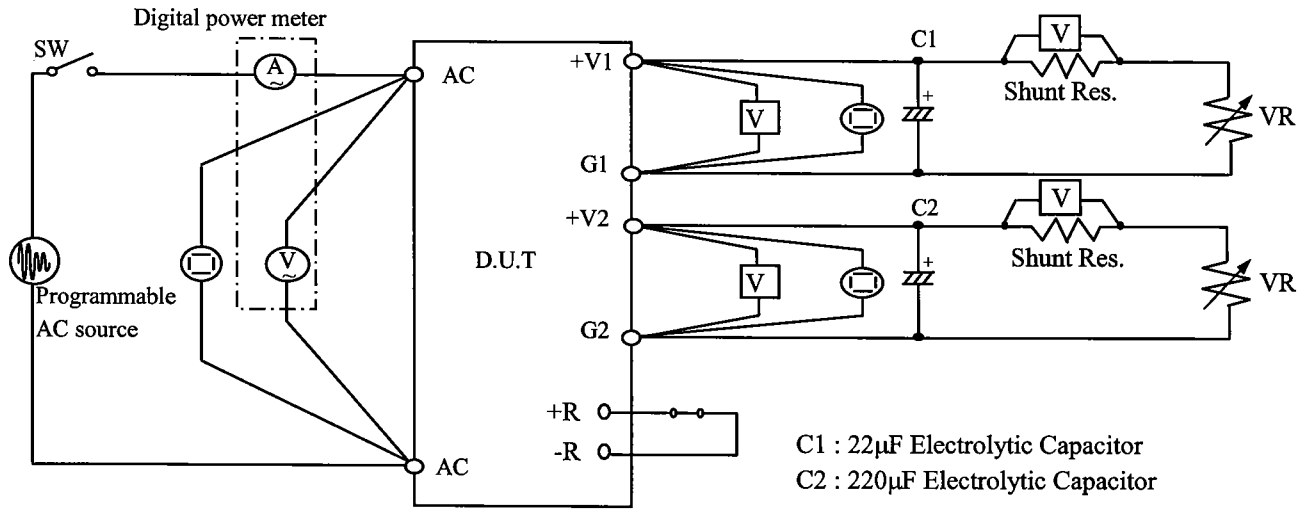
(5) Output rise characteristics



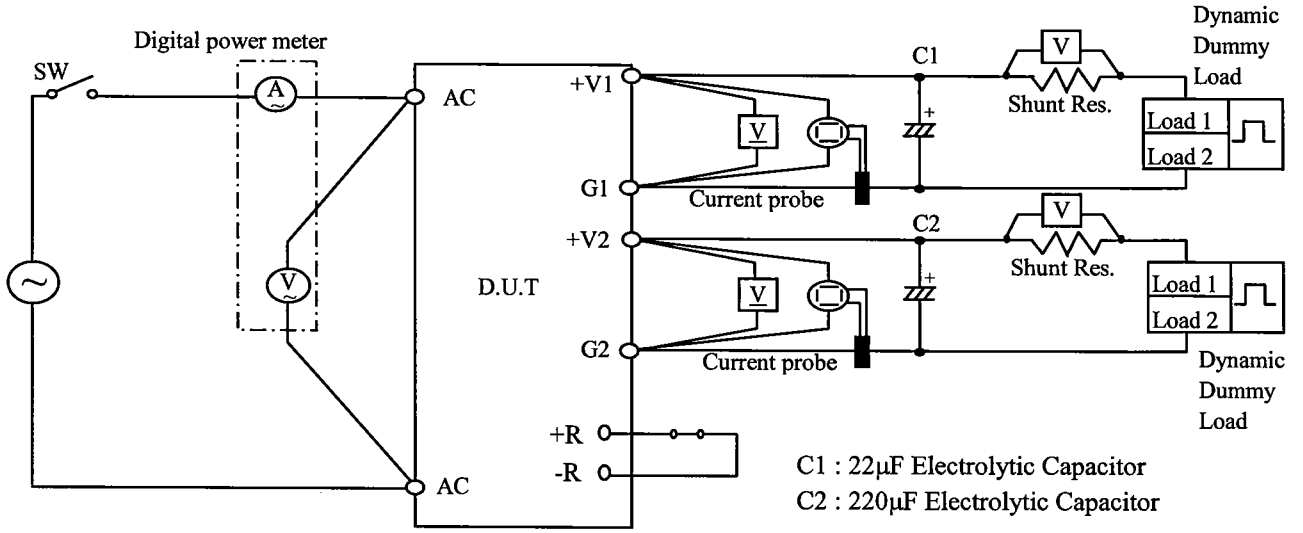
(6) Output fall characteristics

Same as Output rise characteristics

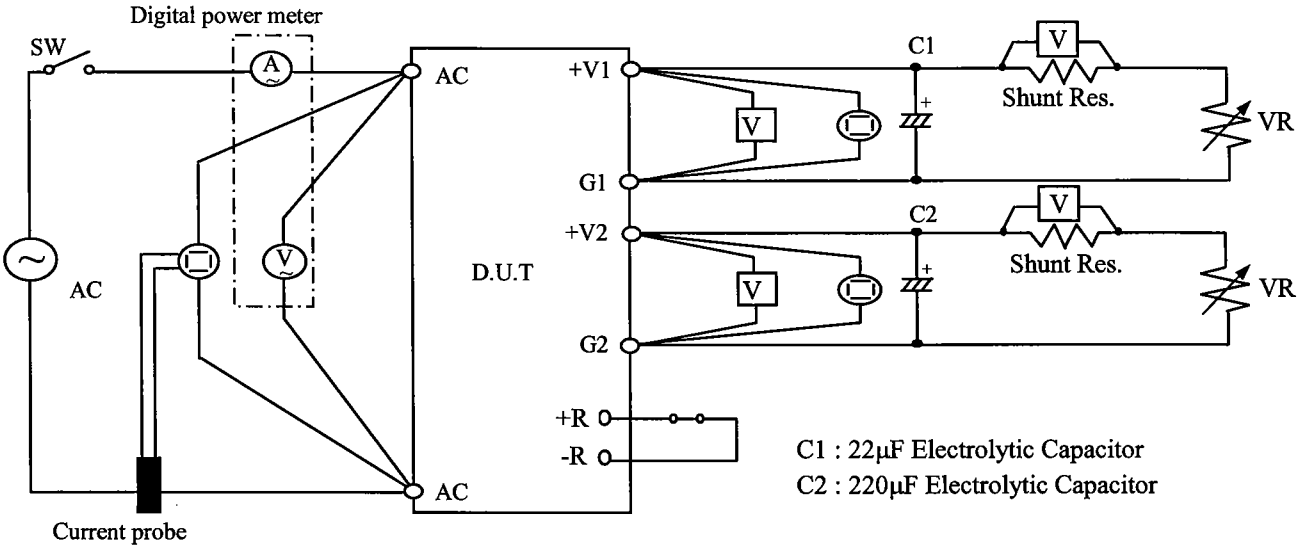
(7) Dynamic line response characteristics



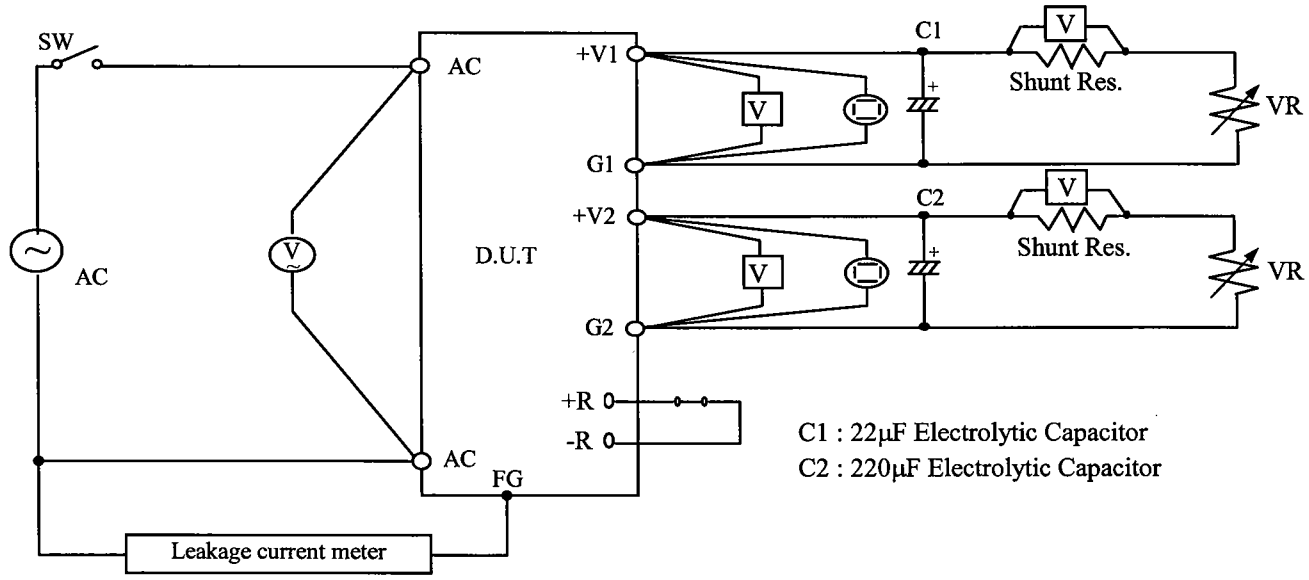
(8) Dynamic load response characteristics



(9) Inrush current characteristics

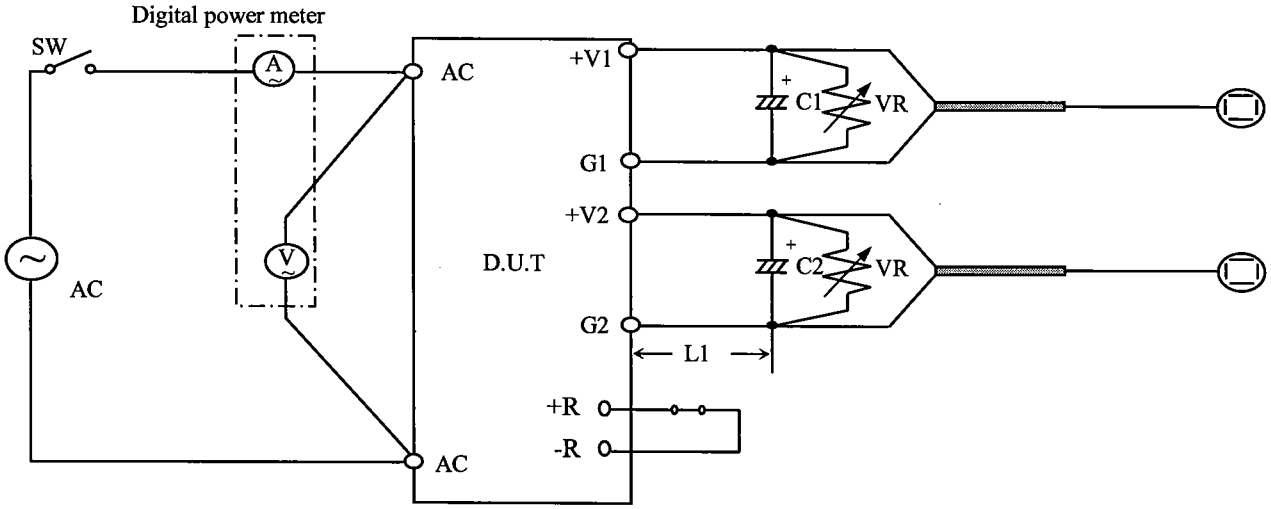


(10) Leakage current characteristics



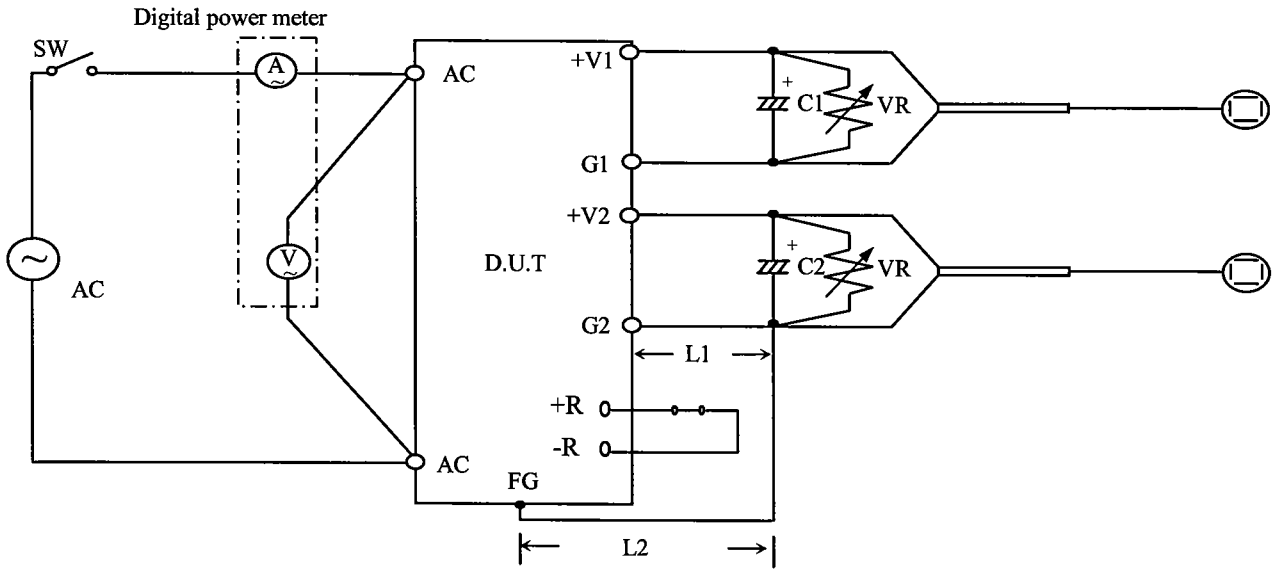
(11) Output ripple and noise waveform

a) NORMAL MODE (NORMAL PROBE), BW = 20MHz



C1 : 22μF Electrolytic Capacitor
C2 : 220μF Electrolytic Capacitor
L1 : 150mm

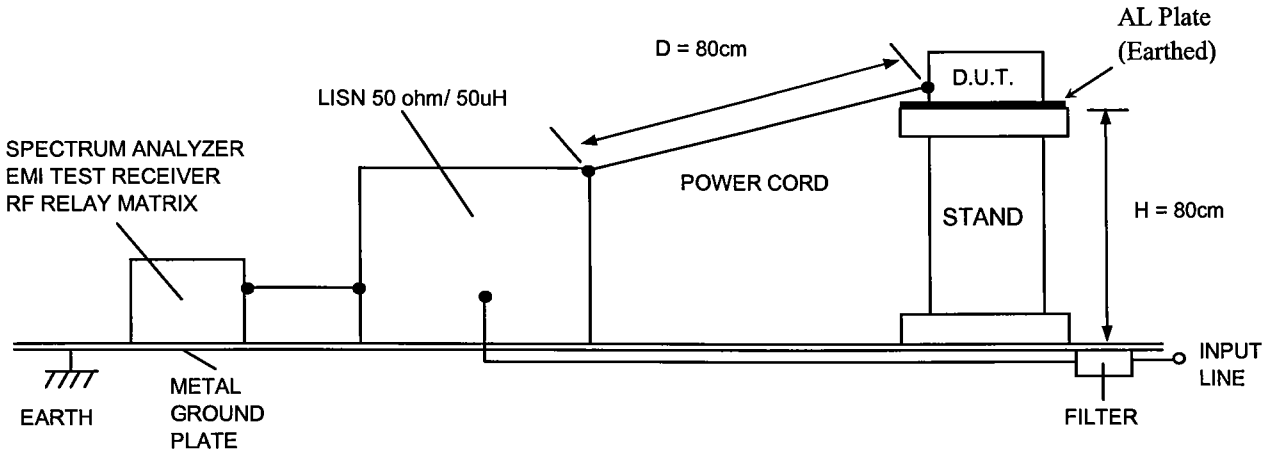
b) NORMAL + COMMON MODE (NORMAL PROBE)



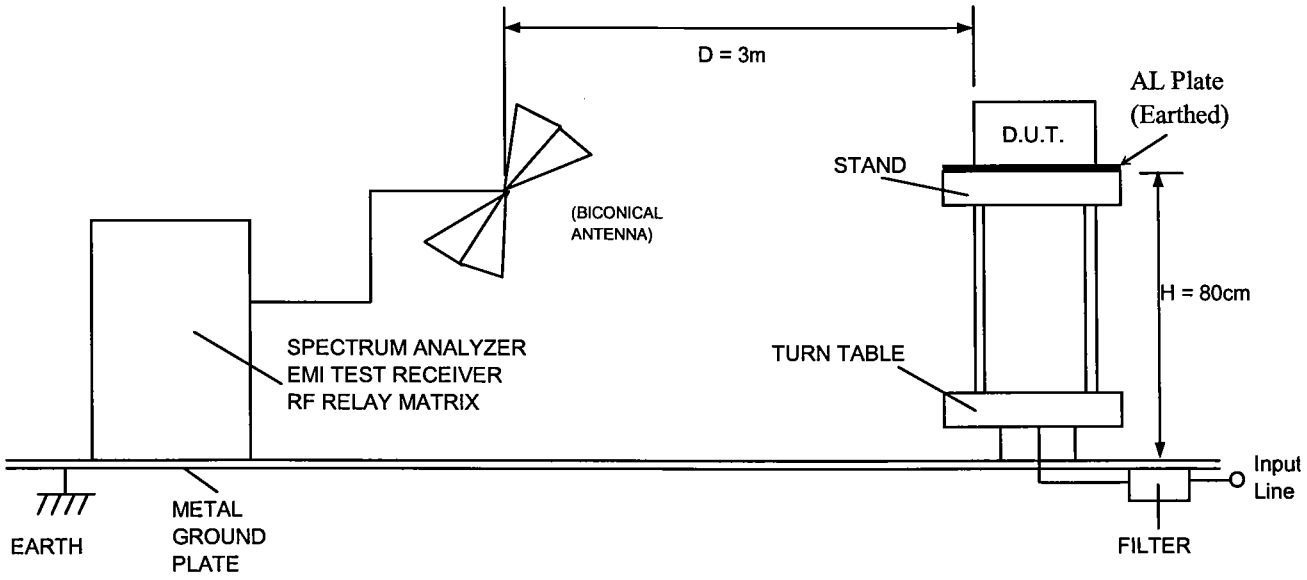
C1 : 22μF Electrolytic Capacitor
C2 : 220μF Electrolytic Capacitor
L1 : 150mm
L2: 300mm

(12) Electro-Magnetic Interference characteristics

(a) Conducted Emission Noise



(b) Radiated Emission Noise



1-2 List of equipment used

No	Description	Manufacturer	Model No.
1	Oscilloscope	IWATSU	SS-7810
3	Digital oscilloscope	YOKOGAWA ELEC.	DL1540L / DL1740
5	Digital volt meter	FLUKE	89IV , 87IV
6	Digital watt/current/volt meter	VOLTTECH HIOKI	PM3000A 3182
7	Dynamic dummy load	TAKAMISAWA CHROMA KIKUSUI	PSA-150D 363030 PLZ152WA / PLZ72W
8	Autotransformer	YOKOYAMA	B-50 10KVA
9	Controlled temp . chamber	ESPEC	PMS-P101
10	Current probe/ amplifier	TEKTRONIX	A6303/TM502A
11	Shunt resistor	YOKOGAWA	2215
12	Leakage current tester	YOKOGAWA ELEC.	3226
13	AC power source / Analyzer	KIKUSUI	PCR4000L
14	Programmable AC source	HEWLETT PACKARD	6813A

2. CHARACTERISTICS

2-1 Steady State Data

(1) Regulation - Line and Load, Temperature Drift

Conditions : Ta = 25°C
I2 = 9A

1.1 Regulation - Line and Load

V1(5V)

I1 \ Vin		85 VAC	100 VAC	132 VAC	Line Regulation	
0%		4.988	4.989	4.989	0.001	0.020%
50%		4.988	4.988	4.989	0.001	0.020%
100%		4.988	4.988	4.988	0.000	0.000%
Load	0%	0.000	-0.001	-0.001	85V ⟷	132V
Regulation	100%	0.000%	-0.020%	-0.020%		

1.2 Temperature Drift

Conditions : Vin = 100VAC
I1 = 5A
I2 = 9A

Ta	-10°C	25°C	50°C	Temp. Stability	
Vout	4.993	4.988	5.007	0.019	0.38%

1.1 Regulation - Line and Load

Conditions : Ta = 25°C
I1 = 5A

V2(24V)

I2 \ Vin		85 VAC	100 VAC	132 VAC	Line Regulation	
0%		23.992	23.992	23.993	0.001	0.004%
50%		23.978	23.978	23.978	0.000	0.000%
100%		23.974	23.974	23.975	0.001	0.004%
Load	0%	-0.018	-0.018	-0.018	85V ⟷	132V
Regulation	100%	-0.075%	-0.075%	-0.075%		

1.2 Temperature Drift

Conditions : Vin = 100VAC
I1 = 5A
I2 = 9A

Ta	-10°C	25°C	50°C	Temp. Stability	
Vout	24.001	23.974	23.951	0.050	0.21%

2. CHARACTERISTICS

2-1 Steady State Data

(1) Regulation - Line and Load, Temperature Drift

Conditions : Ta = 25°C
I2 = 9A

1.1 Regulation - Line and Load

V1(5V)

I1 \ Vin		170 VAC	200 VAC	265 VAC	Line Regulation	
0%		4.990	4.990	4.991	0.001	0.020%
50%		4.989	4.989	4.990	0.001	0.020%
100%		4.989	4.989	4.989	0.000	0.000%
Load Regulation	0%	-0.001	-0.001	-0.001	170V ⟷	265V
	100%	-0.020%	-0.020%	-0.020%		

1.2 Temperature Drift

Conditions : Vin = 200VAC
I1 = 5A
I2 = 9A

Ta	-10°C	25°C	50°C	Temp. Stability	
Vout	4.993	4.989	5.007	0.018	0.36%

1.1 Regulation - Line and Load

Conditions : Ta = 25°C
I1 = 5A

V2(24V)

I2 \ Vin		170 VAC	200 VAC	265 VAC	Line Regulation	
0%		23.990	23.991	23.991	0.001	0.004%
50%		23.977	23.978	23.978	0.001	0.004%
100%		23.973	23.974	23.974	0.001	0.004%
Load Regulation	0%	-0.017	-0.017	-0.017	170V ⟷	265V
	100%	-0.071%	-0.071%	-0.071%		

1.2 Temperature Drift

Conditions : Vin = 200VAC
I1 = 5A
I2 = 9A

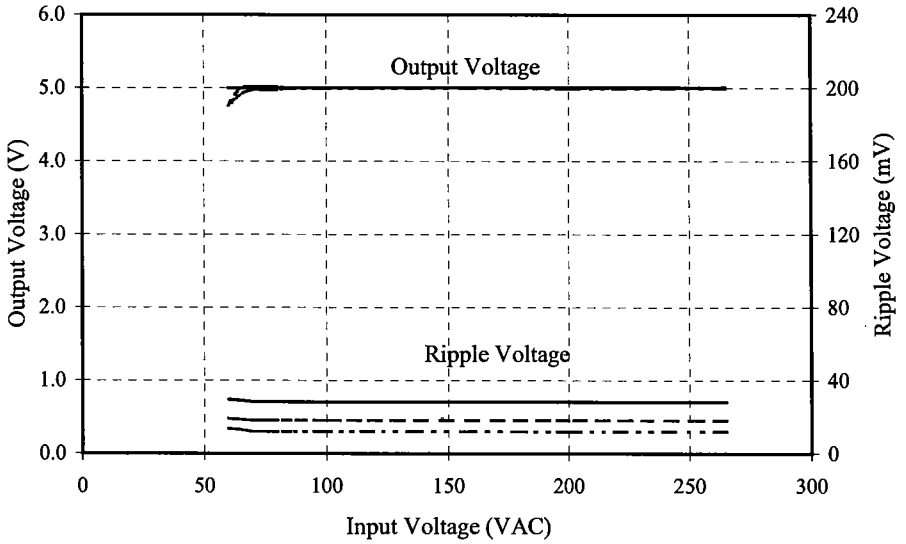
Ta	-10°C	25°C	50°C	Temp. Stability	
Vout	24.002	23.974	23.950	0.052	0.22%

2-1 Steady State Data

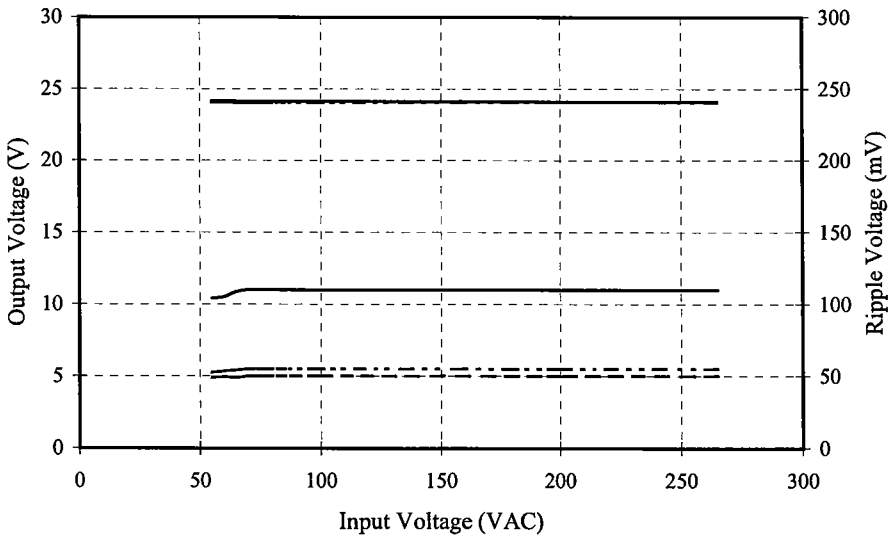
(2) Output Voltage And Ripple Voltage Vs Input Voltage

Conditions : Ta = -10°C ———
Ta = 25°C – – – –
Ta = 50°C —·—·—
Io = 100%

V1(5V)



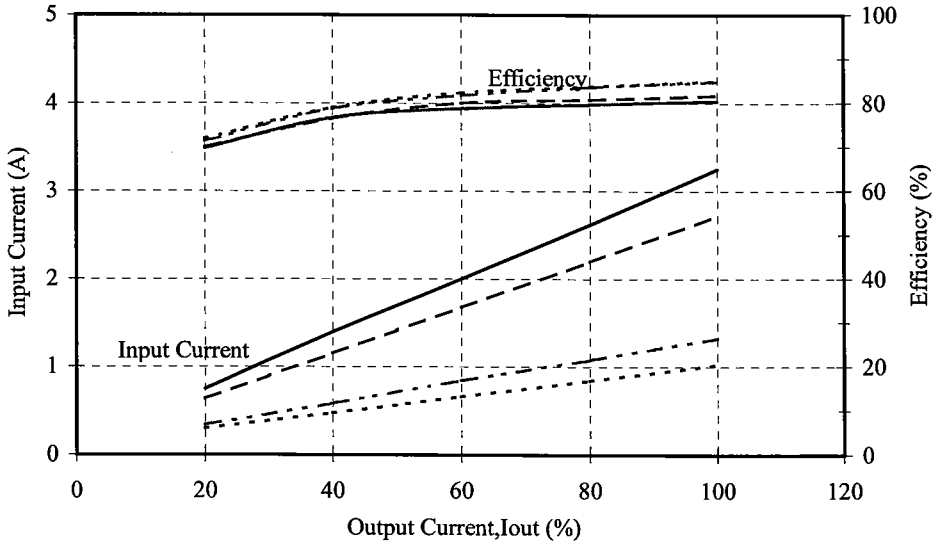
V2(24V)



2-1 Steady State Data

(3) Efficiency And Input Current Vs Output Current

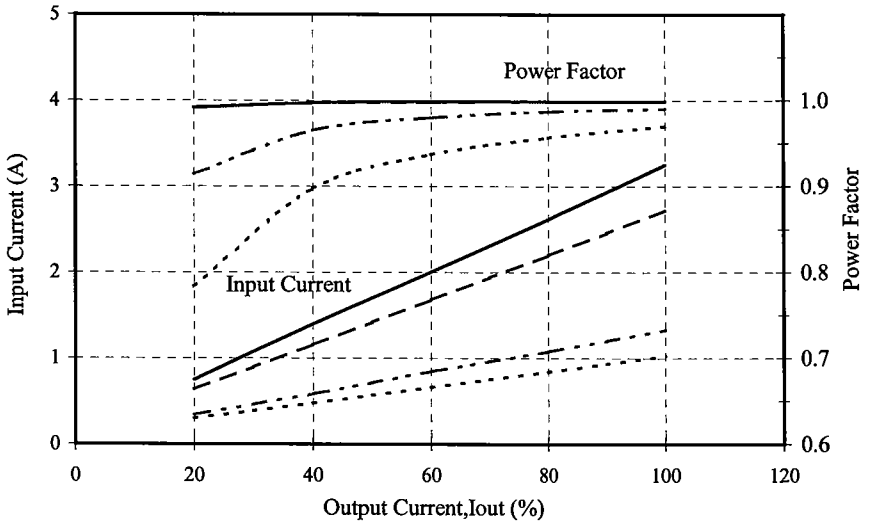
Conditions : Ta = 25°C
Vin = 85VAC ———
= 100VAC – – – –
= 200VAC —·—·—
= 265VAC ------



2-1 Steady State Data

(4) Power factor And Input Current Vs Output Current

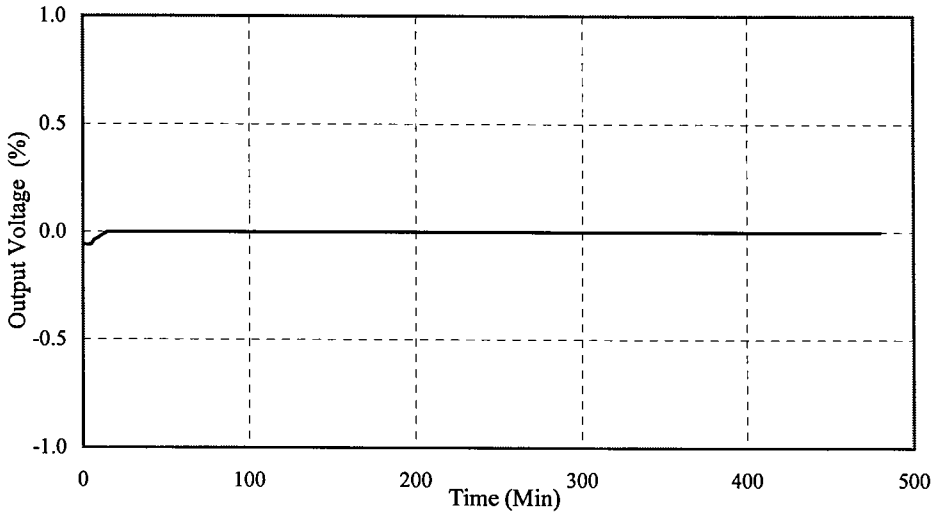
Conditions : Ta = 25°C
Vin = 85VAC
= 100VAC
= 200VAC
= 265VAC



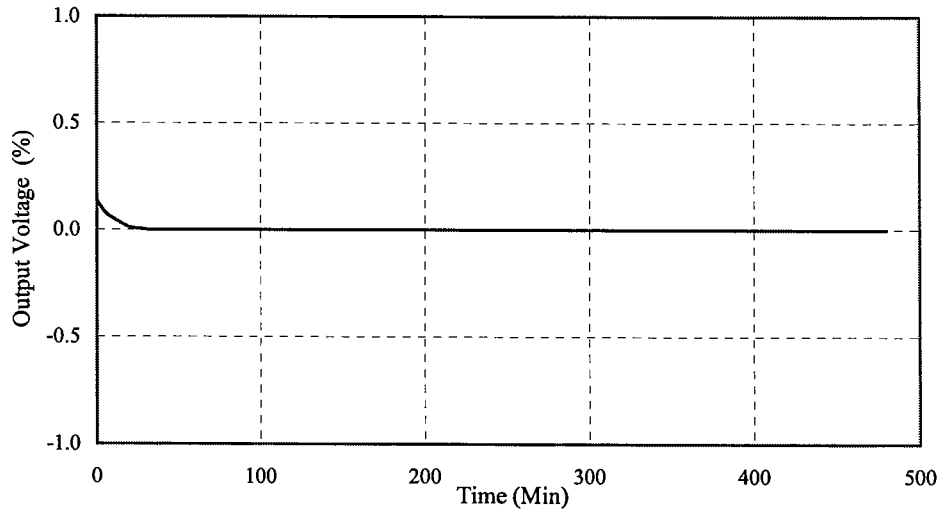
2-2 Warm Up Voltage Drift Characteristics

Conditions : Ta = 25°C
Vin = 100VAC
I1 = 5A
I2 = 8.33A

V1(5V)



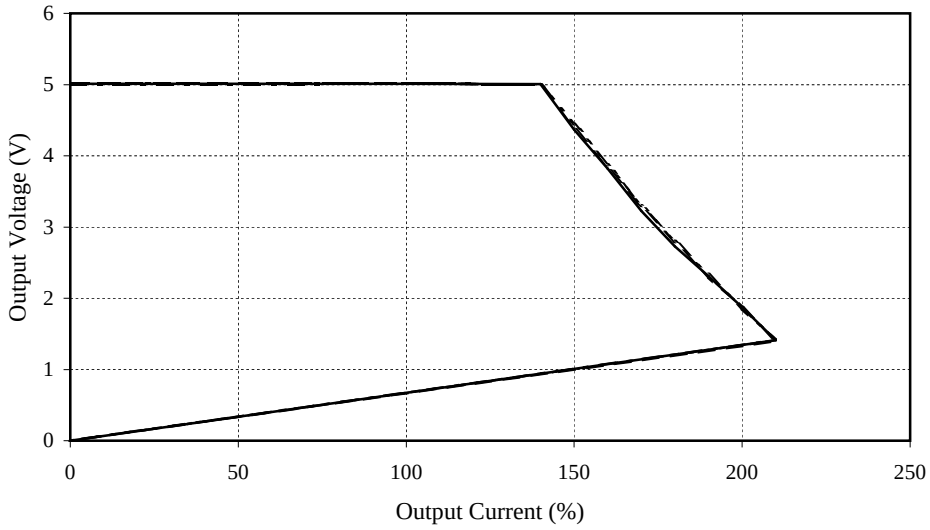
V2(24V)



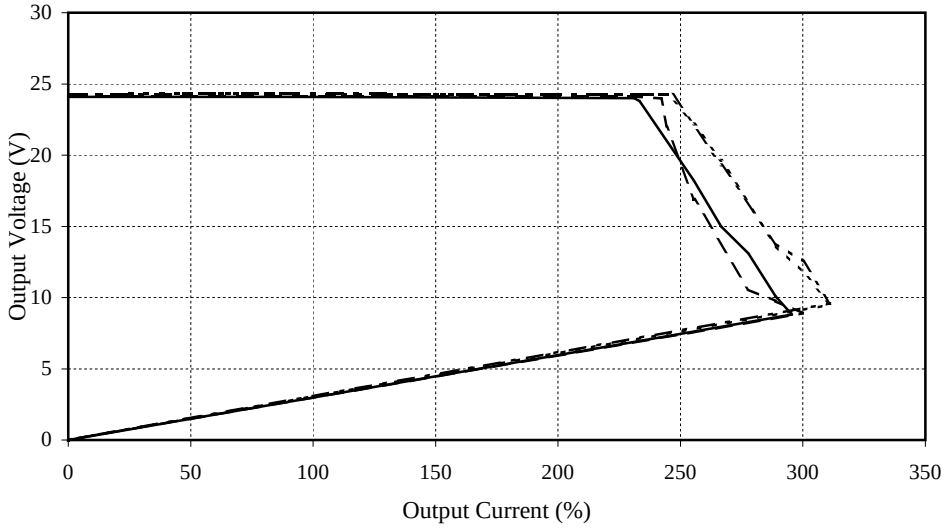
2-3 O.C.P. Characteristics

Conditions : Ta = 25°C
Vin = 85VAC ————
= 100VAC – – – – –
= 200VAC - - - - - - - -
= 265VAC –·–·–·–

V1(5V)
I2= 8.33A



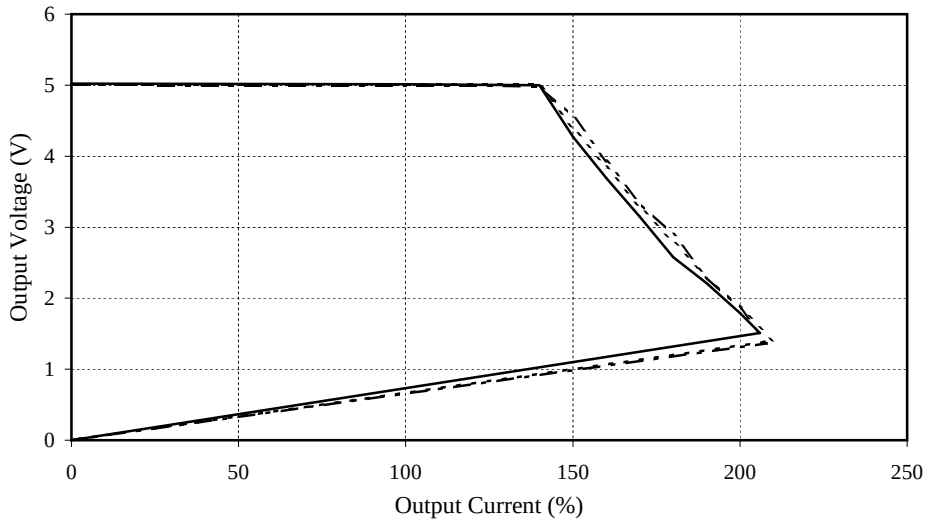
V2(24V)
I1 = 1.8A



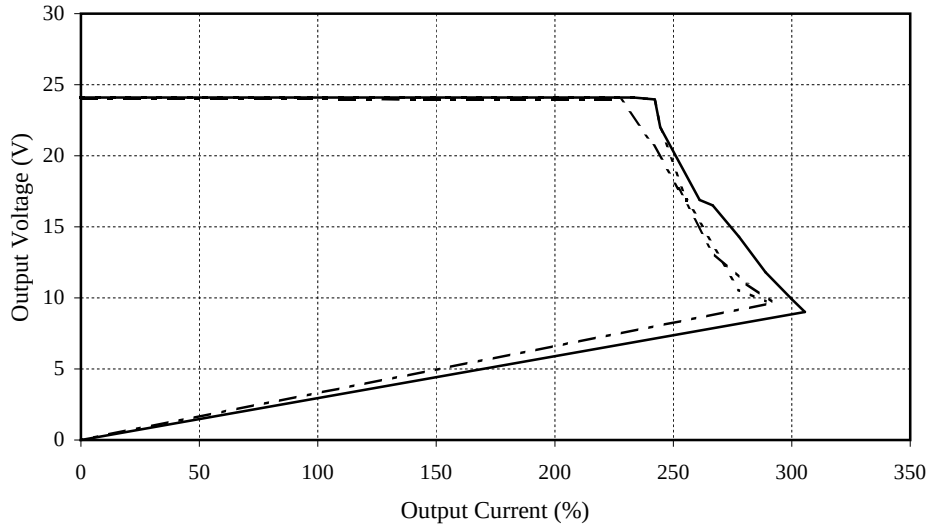
2-3 O.C.P. Characteristics

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

V1(5V)
I2= 8.33A



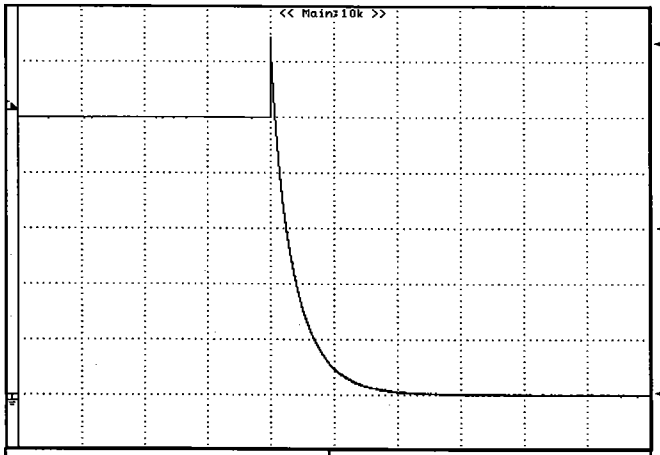
V2(24V)
I1 = 1.8A



2.4 O.V.P. Characteristics

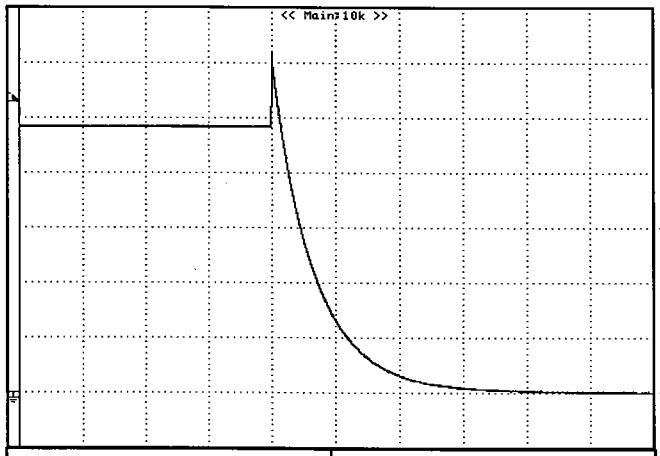
Conditions : Ta = 25°C
Vin = 100VAC
I1 = 0A
I2 = 0A

V1(5V)



V1 (5V)	Time Base
1V / DIV	2s / DIV
OVP Trip Point : 130%	

V2(24V)

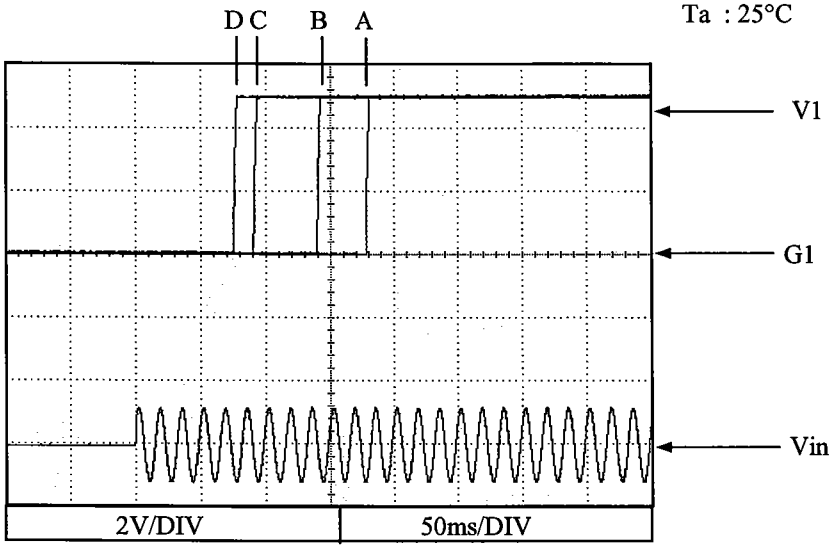


V2 (24V)	Time Base
5V / DIV	2s / DIV
OVP Trip Point : 129%	

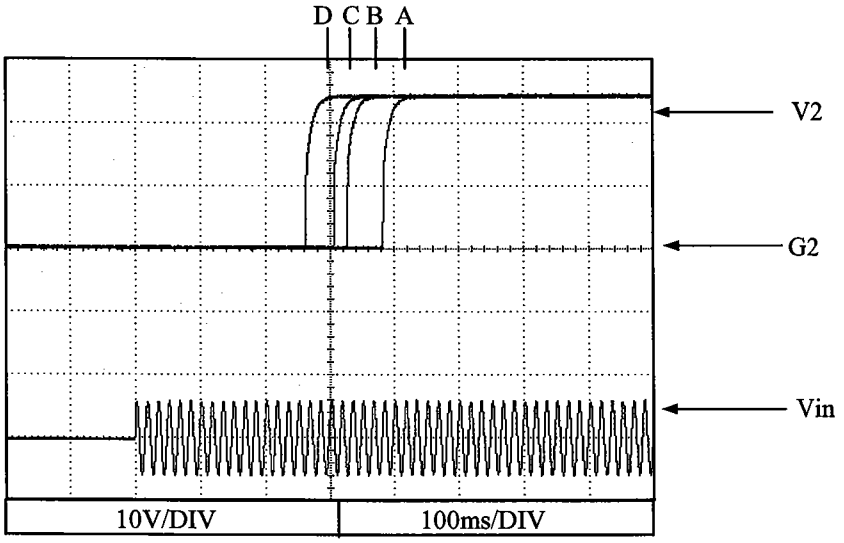
2-5 Output Rise Characteristics

Conditions Vin : 85VAC(A)
Vin : 100VAC(B)
Vin : 200VAC(C)
Vin : 265VAC(D)
I1 : 0A
I2 : 0A
Ta : 25°C

V1(5V)



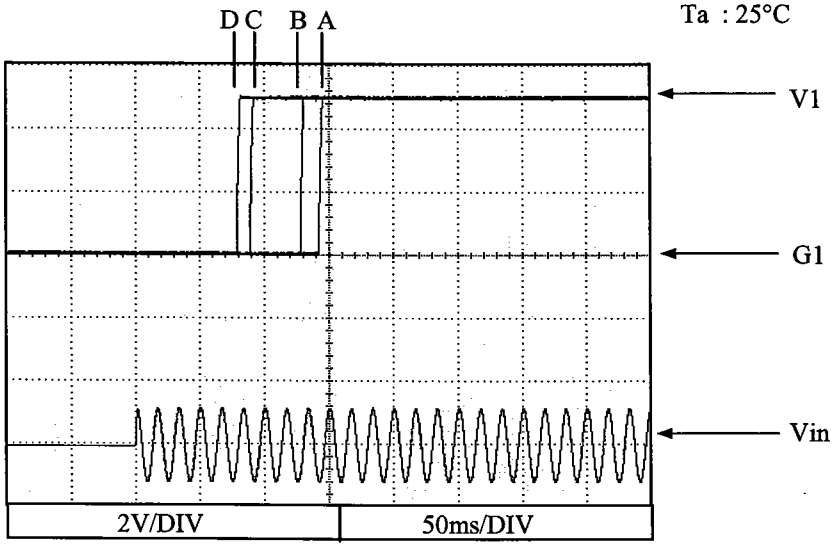
V2(24V)



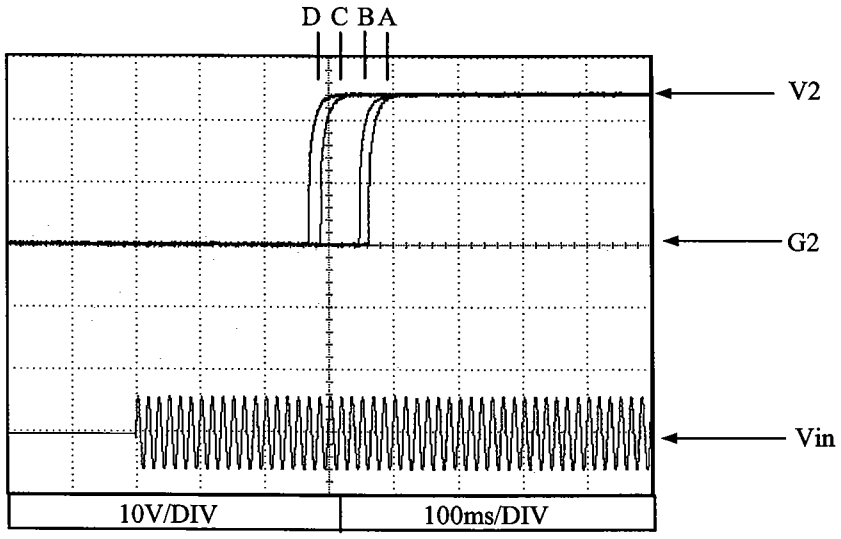
2-5 Output Rise Characteristics

Conditions
Vin : 85VAC(A)
Vin : 100VAC(B)
Vin : 200VAC(C)
Vin : 265VAC(D)
I1 : 5A
I2 : 9A
Ta : 25°C

V1(5V)



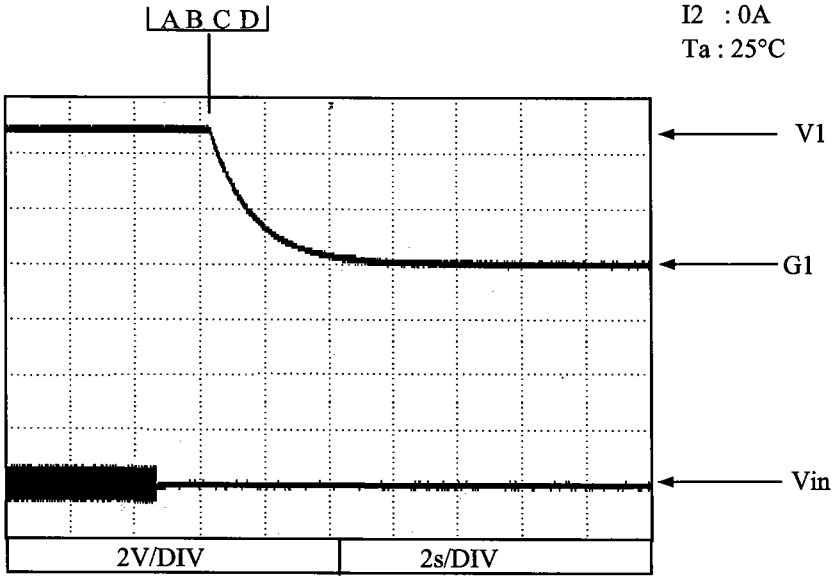
V2(24V)



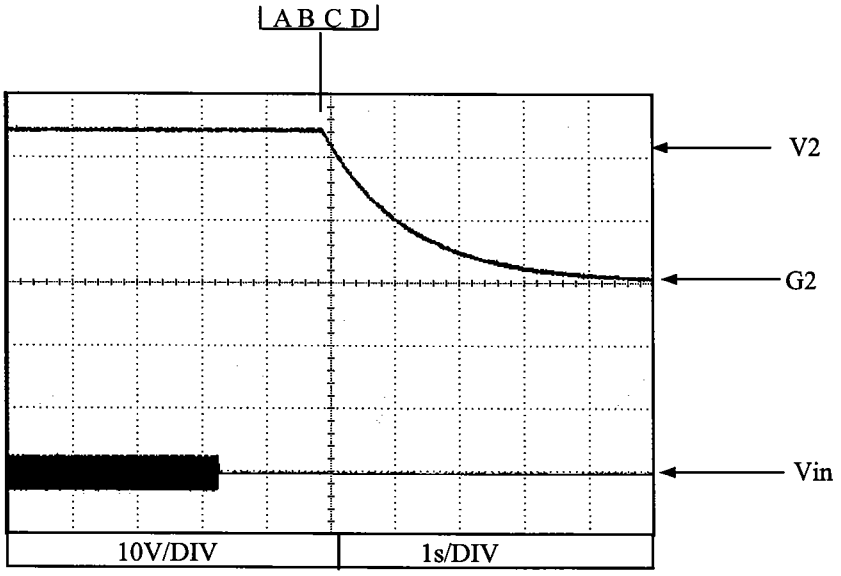
2-6 Output Fall Characteristics

Conditions : Vin : 85VAC(A)
Vin : 100VAC(B)
Vin : 200VAC(C)
Vin : 265VAC(D)
I1 : 0A
I2 : 0A
Ta : 25°C

V1(5V)



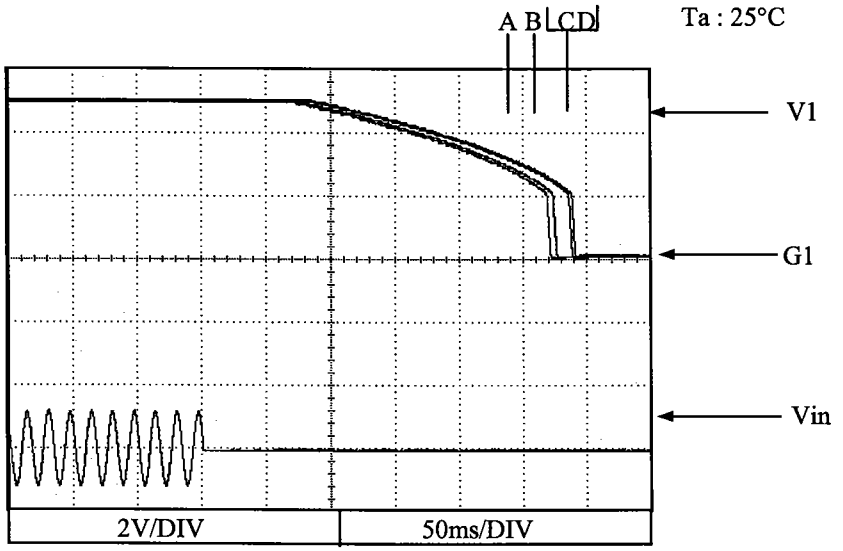
V2(24V)



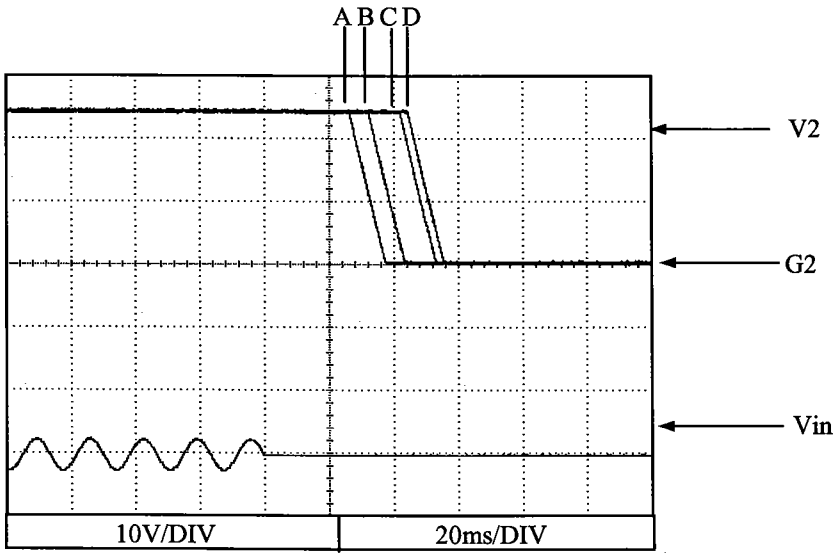
2-6 Output Fall Characteristics

Conditions Vin : 85VAC(A)
Vin : 100VAC(B)
Vin : 200VAC(C)
Vin : 265VAC(D)
I1 : 5A
I2 : 9A
Ta : 25°C

V1(5V)

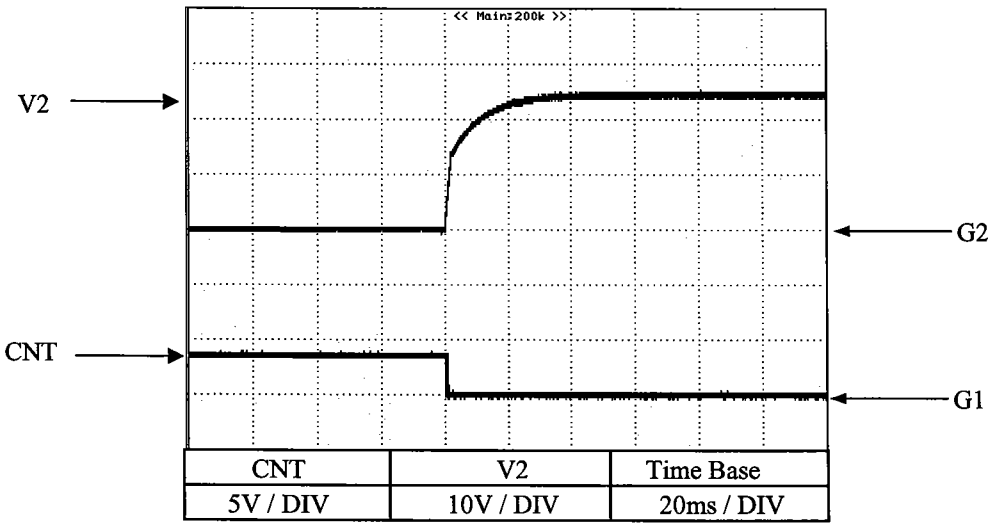


V2(24V)



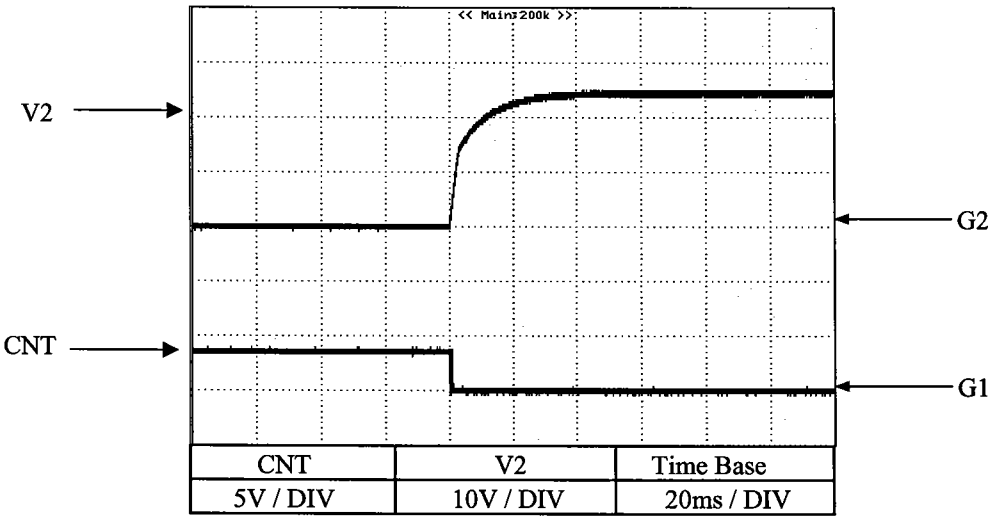
2.7 Output rise characteristics with ON_OFF Control

Conditions : Ta = 25°C
I2 = 0A
Vin = 100 VAC



CNT	V2	Time Base
5V / DIV	10V / DIV	20ms / DIV

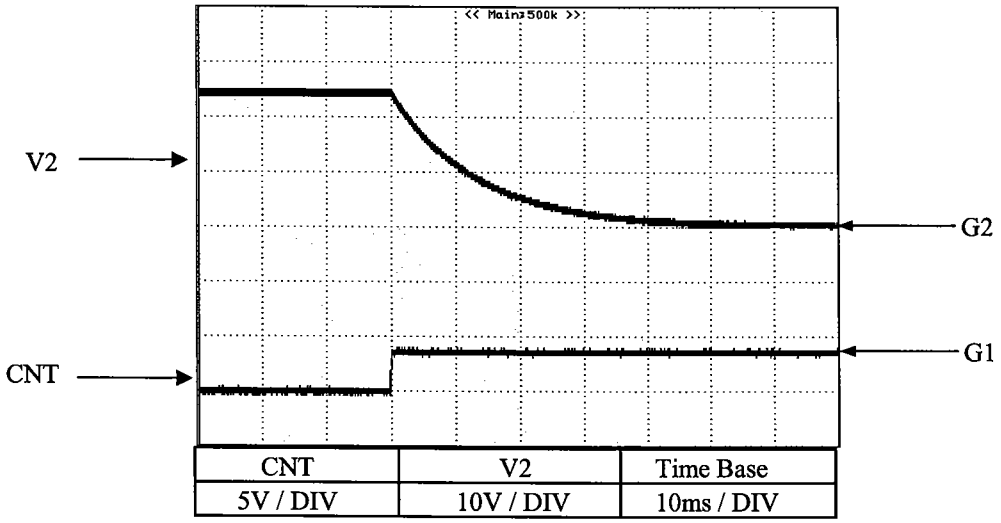
Conditions : Ta = 25°C
I2 = 9A
Vin = 100 VAC



CNT	V2	Time Base
5V / DIV	10V / DIV	20ms / DIV

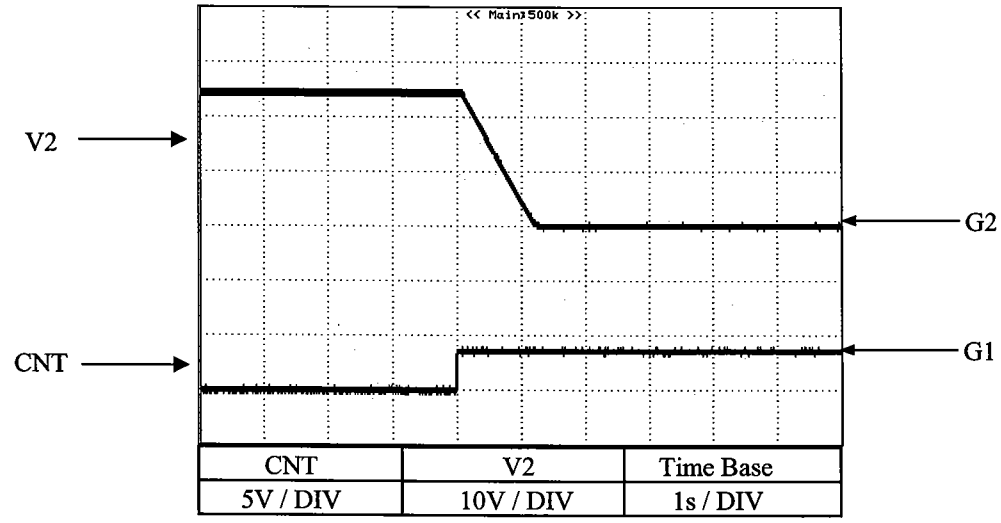
2.8 Output fall characteristics with ON_OFF Control

Conditions : Ta = 25°C
I2 = 0A
Vin = 100 VAC



CNT	V2	Time Base
5V / DIV	10V / DIV	10ms / DIV

Conditions : Ta = 25°C
I2 = 9A
Vin = 100 VAC

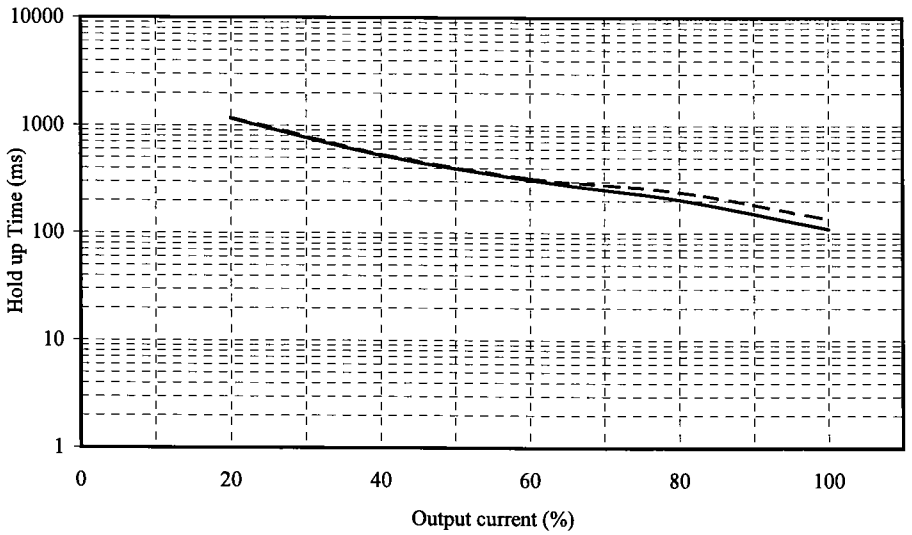


CNT	V2	Time Base
5V / DIV	10V / DIV	1s / DIV

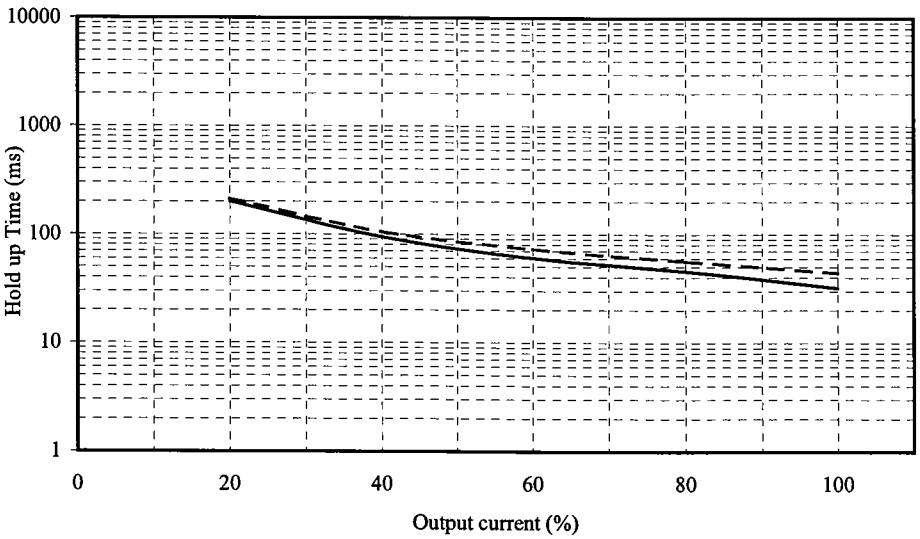
2-9 Hold Up Time Characteristics

Conditions : Ta = 25°C
Vin = 100VAC ———
= 200VAC – – – –

V1(5V)



V2(24V)

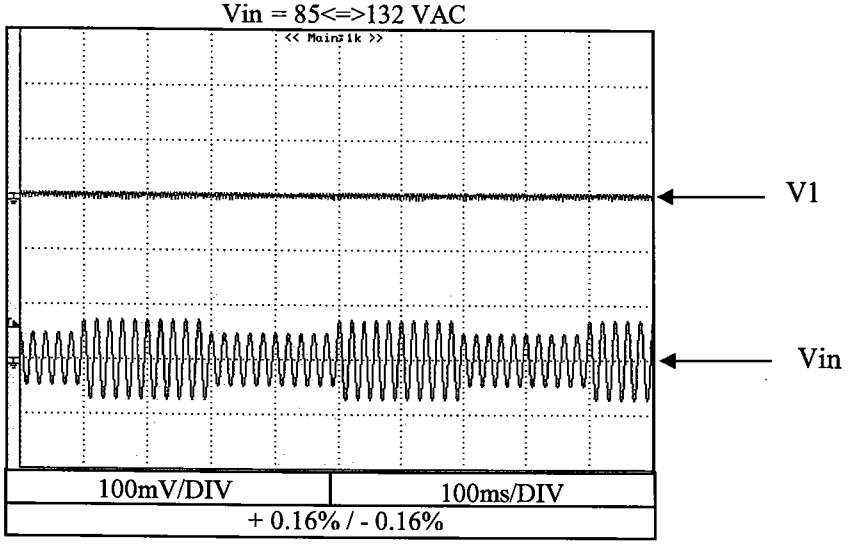


2-10 Dynamic Line Response Characteristics

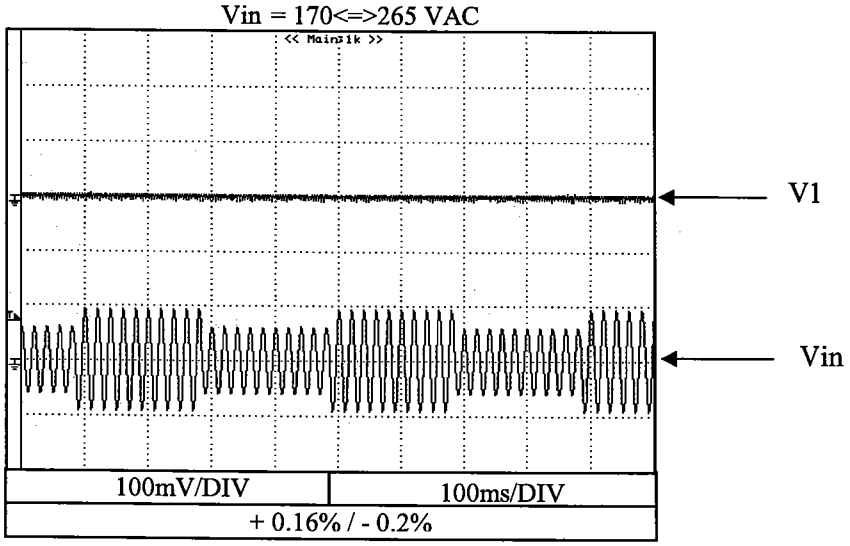
Conditions : Ta = 25°C
I1 = 5A
I2 = 9A

V1(5V)

Vin = 85<=>132 VAC



Vin = 170<=>265 VAC

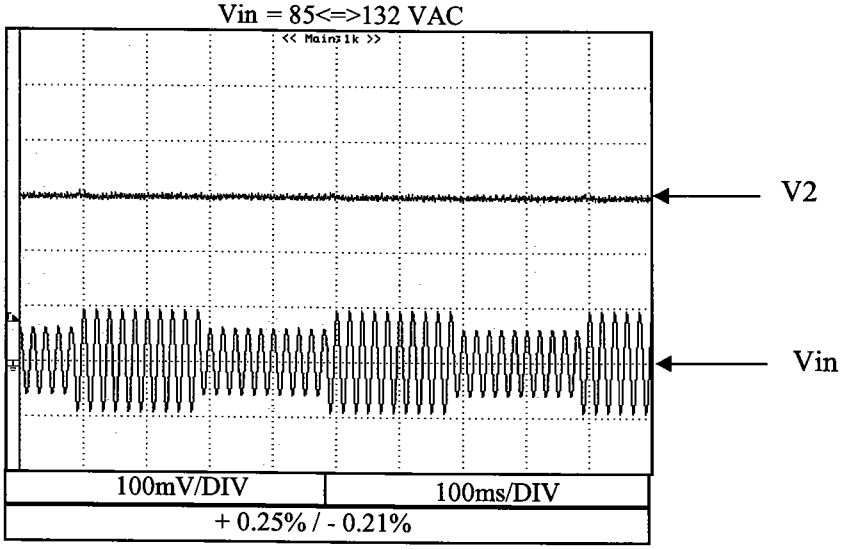


2-10 Dynamic Line Response Characteristics

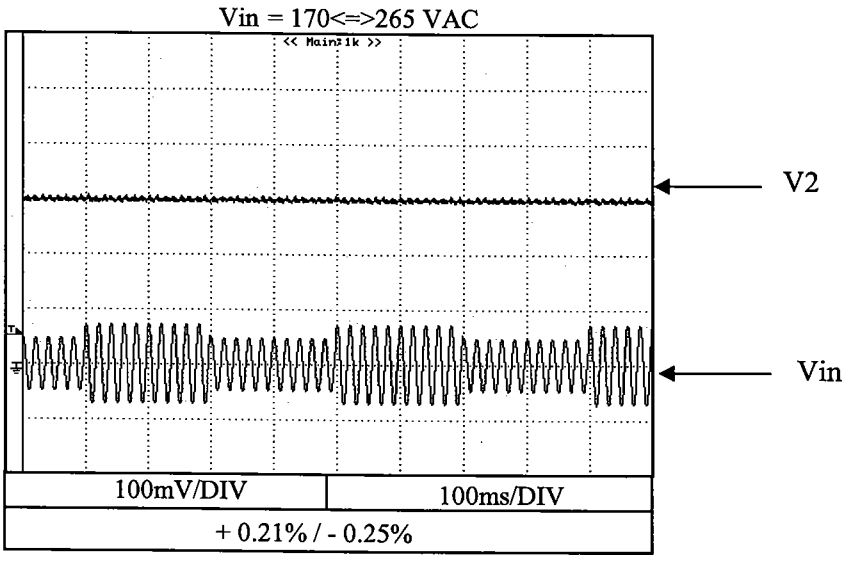
Conditions : Ta = 25°C
I1 = 5A
I2 = 9A

V2(24V)

Vin = 85<=>132 VAC



Vin = 170<=>265 VAC

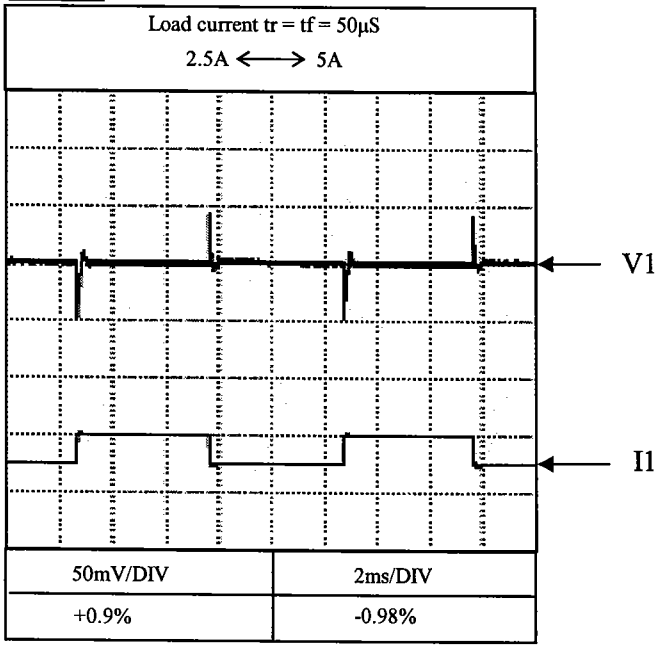


2-11 Dynamic Load Response Characteristics

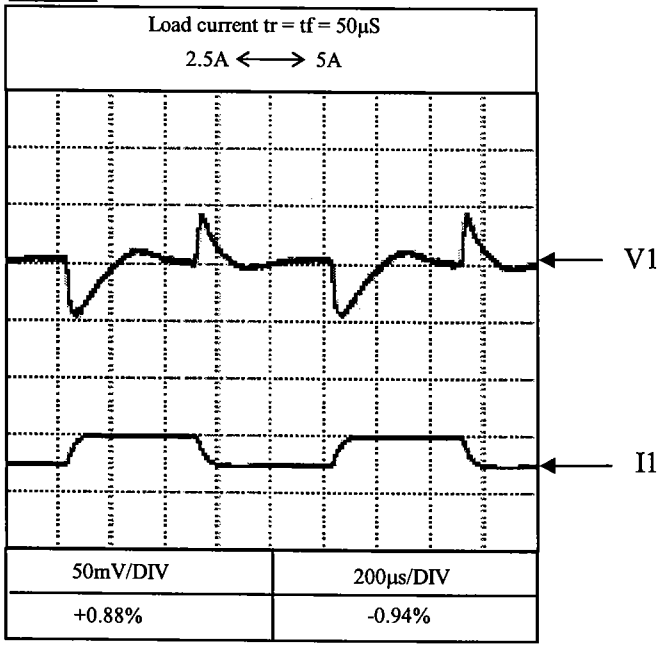
Conditions : Vin = 100VAC
Ta = 25°C
I2 = 9A

V1(5V)

f=100Hz



f=1KHz

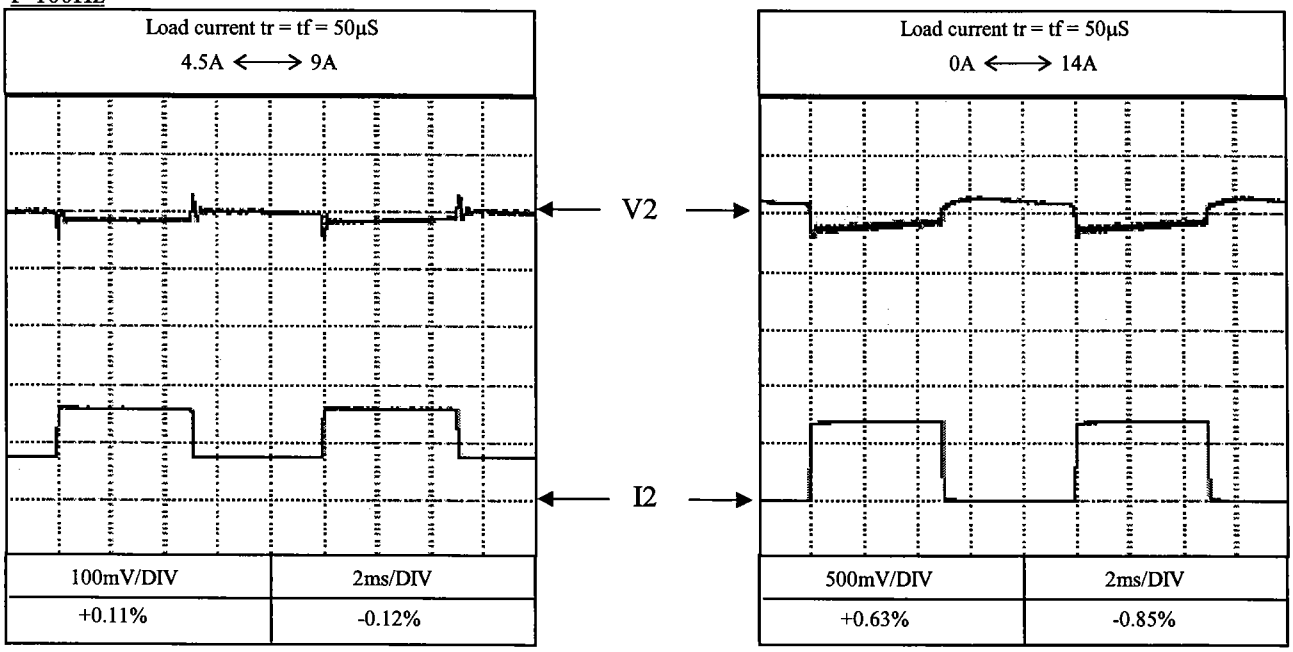


2-11 Dynamic Load Response Characteristics

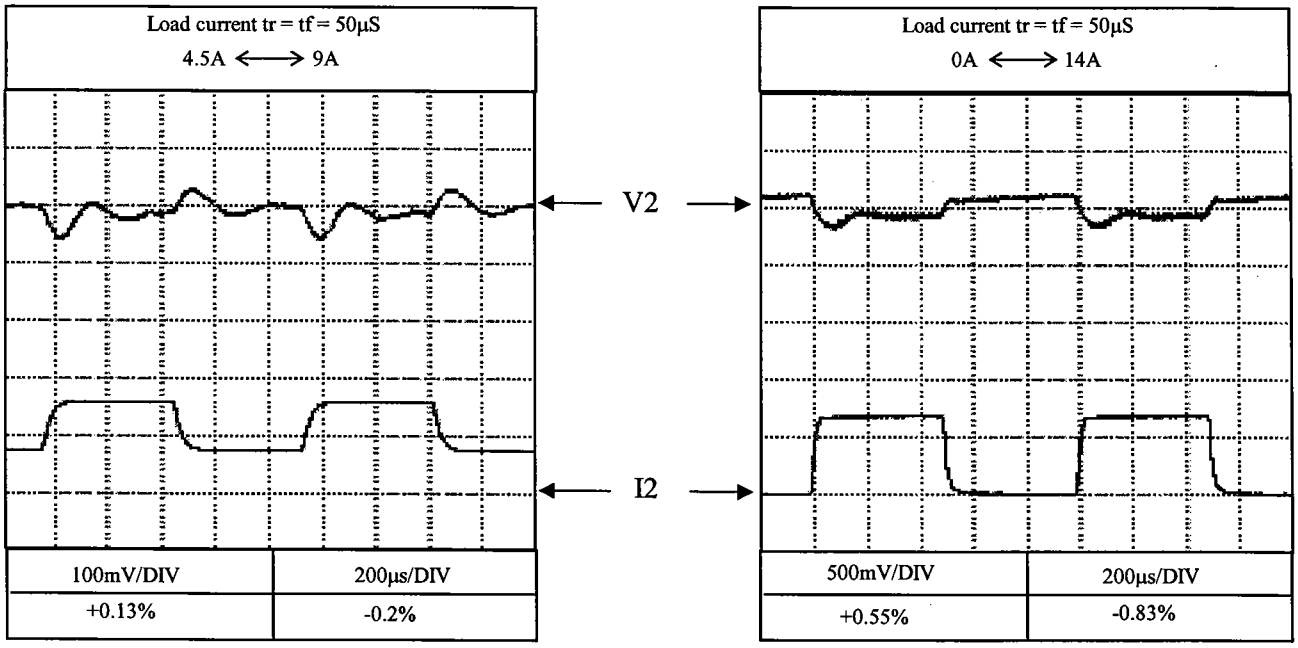
Conditions : Vin = 100VAC
Ta = 25°C
I1 = 5A

V2(24V)

f=100Hz



f=1KHz

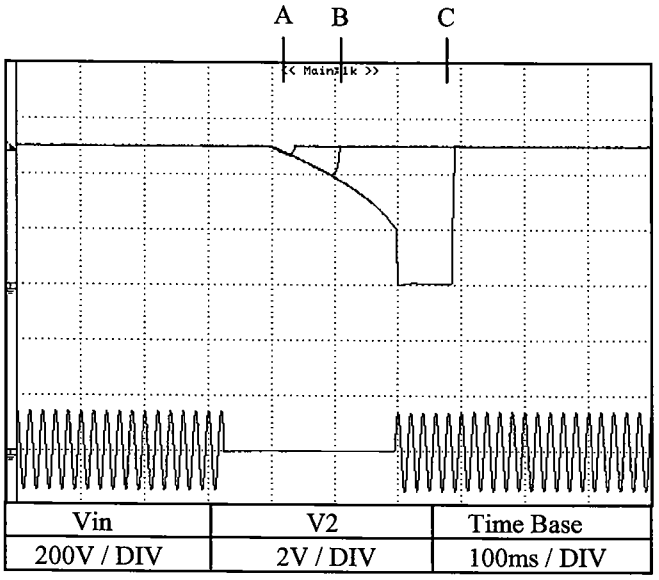


2-12 Response to brown out characteristics

Conditions : Ta = 25°C
Vin = 100VAC
I1 = 5A
I2 = 8.33A

V1(5V)

A = 110ms
B = 130ms
C = 272 ms

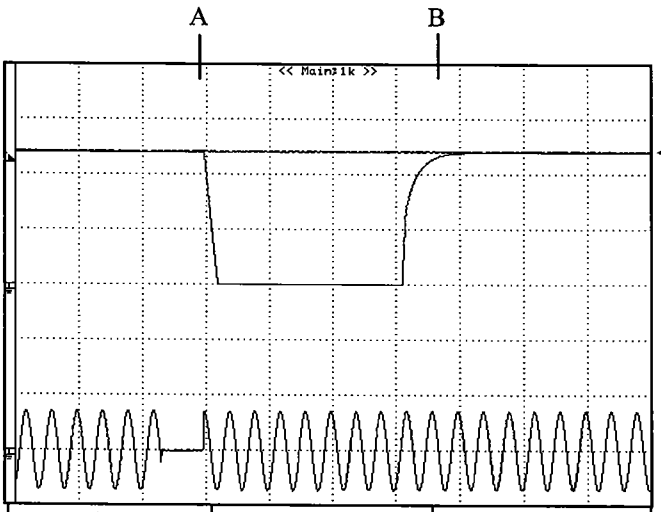


Vin	V2	Time Base
200V / DIV	2V / DIV	100ms / DIV

Conditions : Ta = 25°C
Vin = 100VAC
I1 = 1.8A
I2 = 9A

V2(24V)

A = 32ms
B = 33ms



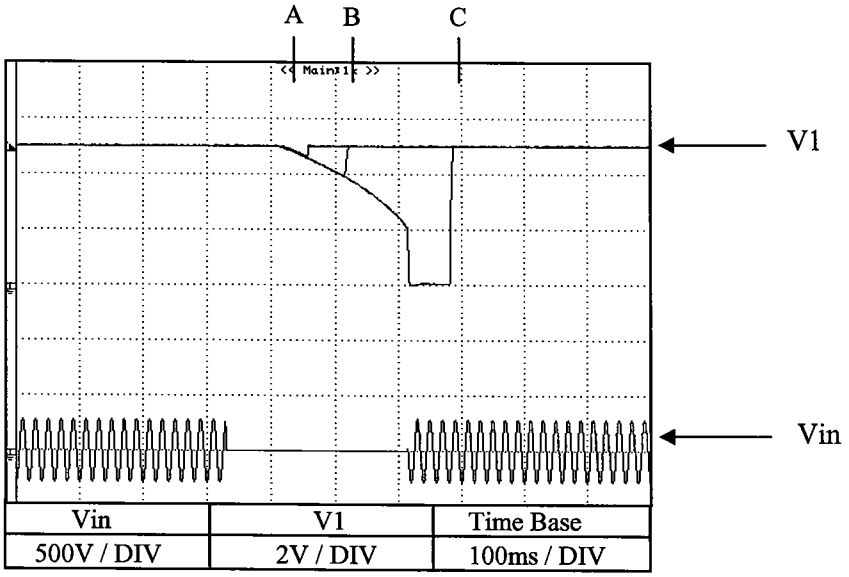
Vin	V2	Time Base
200V / DIV	10V / DIV	50ms / DIV

2-12 Response to brown out characteristics

Conditions : Ta = 25°C
Vin = 200VAC
I1 = 5A
I2 = 8.33A

V1(5V)

A = 143ms
B = 180ms
C = 275ms

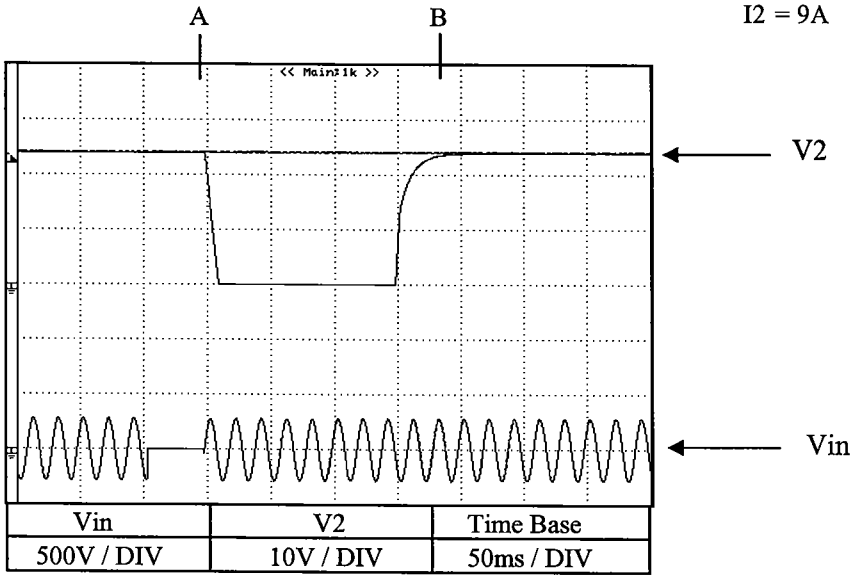


Vin	V1	Time Base
500V / DIV	2V / DIV	100ms / DIV

Conditions : Ta = 25°C
Vin = 100VAC
I1 = 1.8A
I2 = 9A

V2(24V)

A = 43ms
B = 44 ms

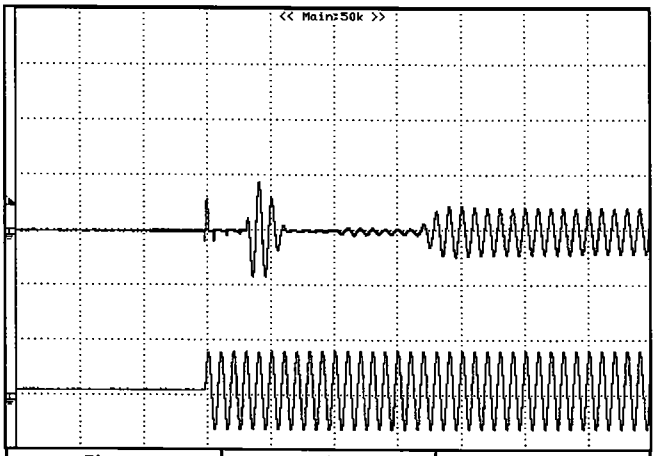


Vin	V2	Time Base
500V / DIV	10V / DIV	50ms / DIV

2-13 Inrush Current Waveform

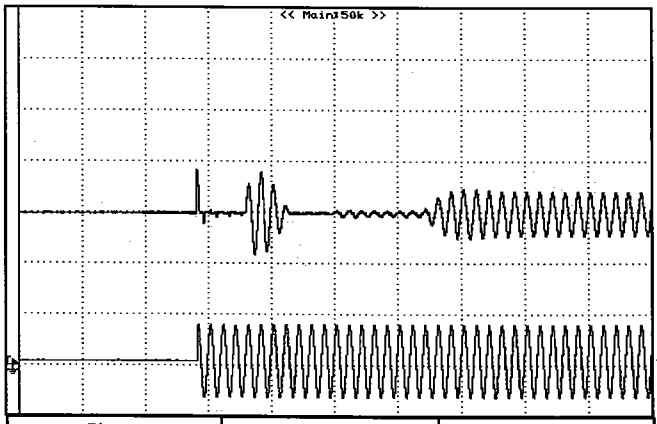
Conditions : Ta = 25°C
Vin = 100VAC
I1 = 5A
I2 = 8.33A

Switch on phase angle
of input AC voltage
$\phi = 0°$



Iin	Vin	Time Base
10A / DIV	200V / DIV	100ms / DIV

Switch on phase angle
of input AC voltage
$\phi = 90°$

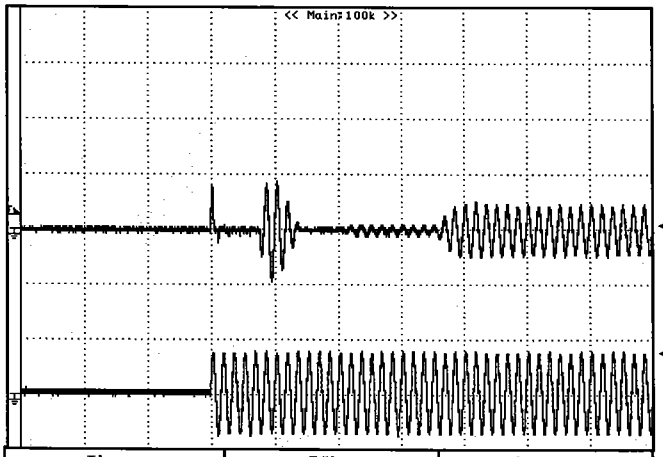


Iin	Vin	Time Base
10A / DIV	200V / DIV	100ms / DIV

2-13 Inrush Current Waveform

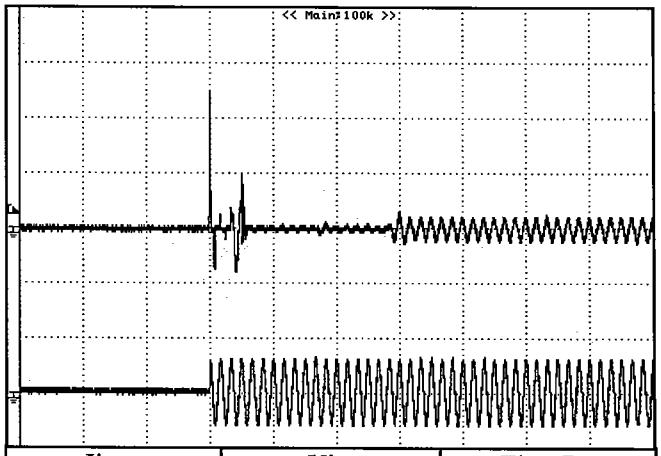
Conditions : Ta = 25°C
Vin = 200VAC
I1 = 5A
I2 = 8.33A

Switch on phase angle
of input AC voltage
$\phi = 0°$



Iin	Vin	Time Base
10A / DIV	500V / DIV	100ms / DIV

Switch on phase angle
of input AC voltage
$\phi = 90°$



Iin	Vin	Time Base
10A / DIV	500V / DIV	100ms / DIV

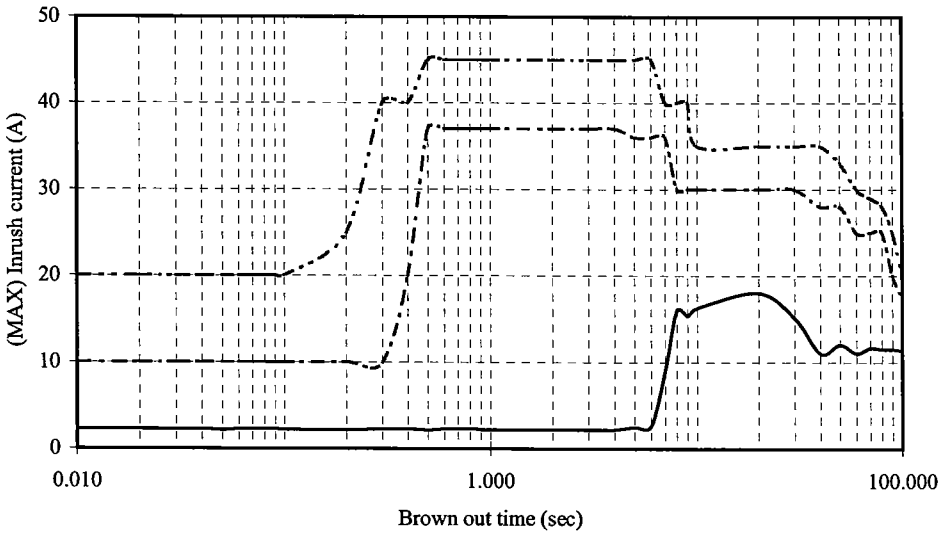
2-14 Inrush Current Characteristics

Condition : Ta = 25°C
I1 = 0A
I2 = 0A

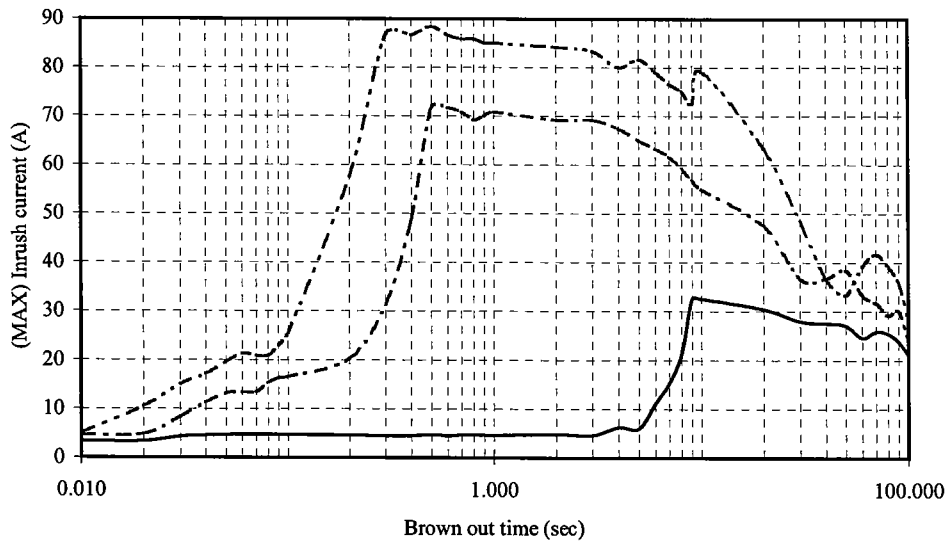
I1 = 2.5A
I2 = 4.165A

I1 = 5A
I2 = 8.33A

Vin = 100VAC



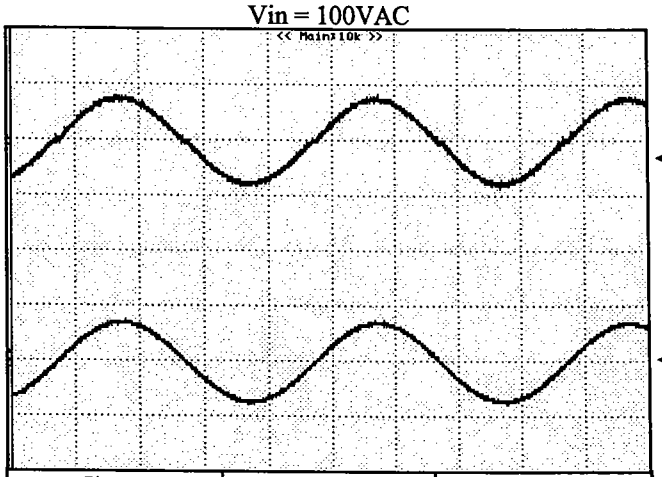
Vin = 200VAC



2-15 Input current Waveform

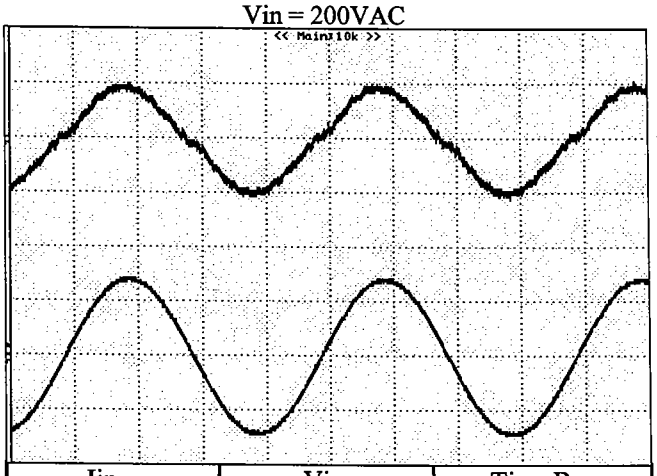
Conditions : Ta = 25°C
I1 = 5A
I2 = 8.33A

Vin = 100VAC



Iin	Vin	Time Base
5A / DIV	200V / DIV	5ms / DIV

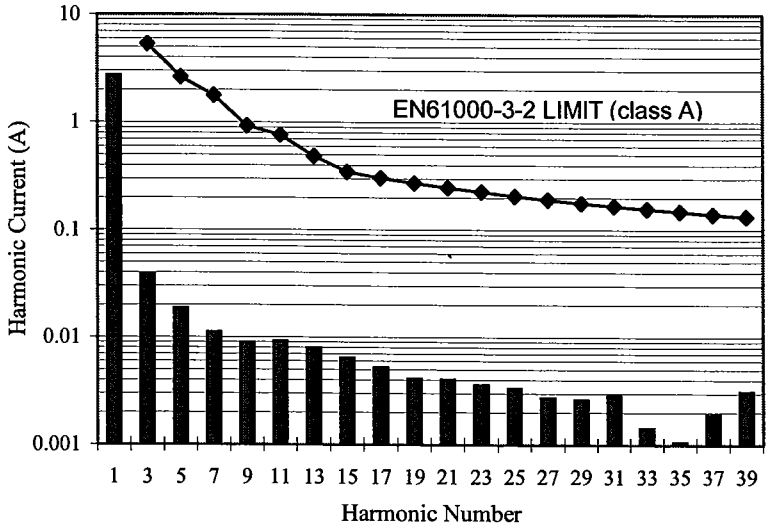
Vin = 200VAC



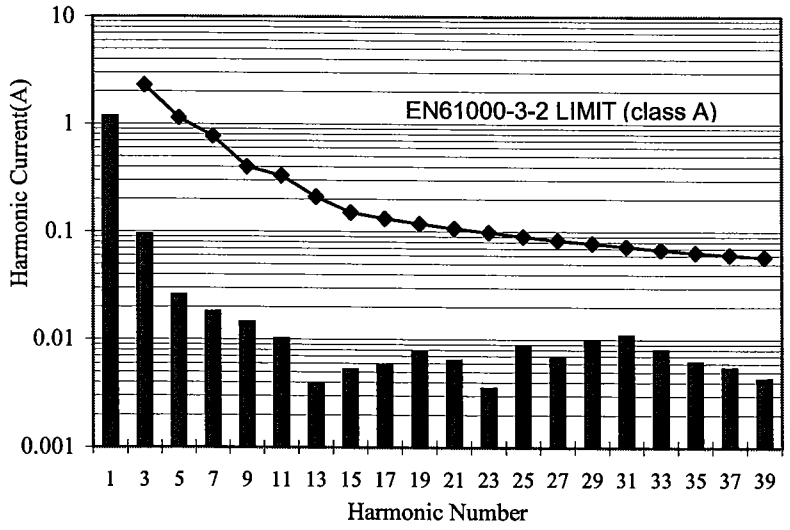
Iin	Vin	Time Base
2A / DIV	200V / DIV	5ms / DIV

2-16 Input Current Harmonics

Conditions : Ta = 25°C
Vin = 100VAC
I1 = 5A
I2 = 8.33A



Conditions : Ta = 25°C
Vin = 230VAC
I1 = 5A
I2 = 8.33A

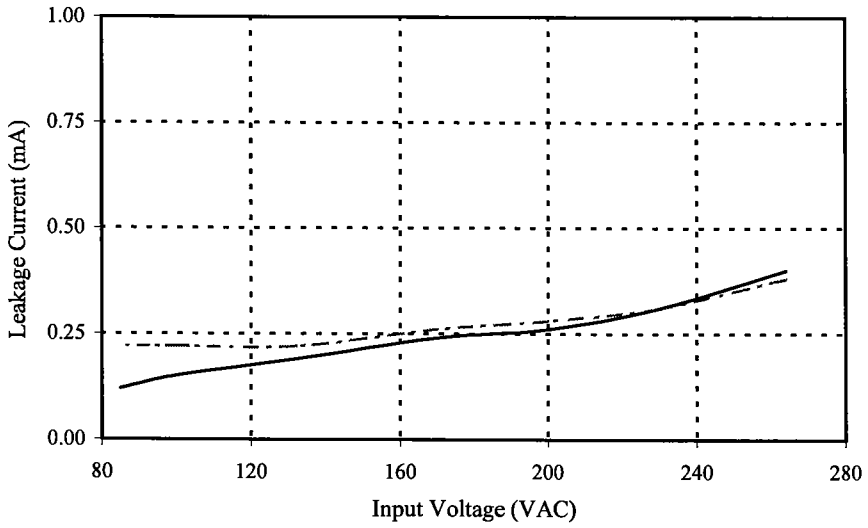


2-17 Leakage Current Characteristics

Conditions :

I1 = 0A
I2 = 0A

I1 = 5A
I2 = 5.21A
Ta = 25°C
Vin = 85VAC ~ 265VAC
f = 50Hz

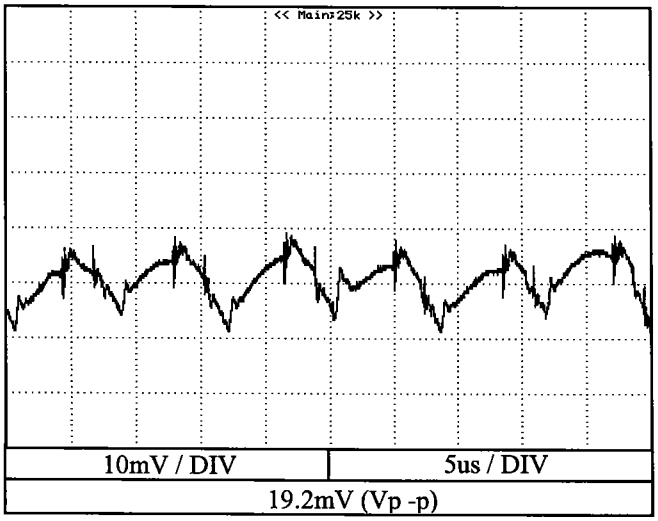


2-18 Output Ripple And Noise Waveform

Conditions : Ta = 25°C
Vin = 100VAC
I1 = 5A
I2 = 8.33A

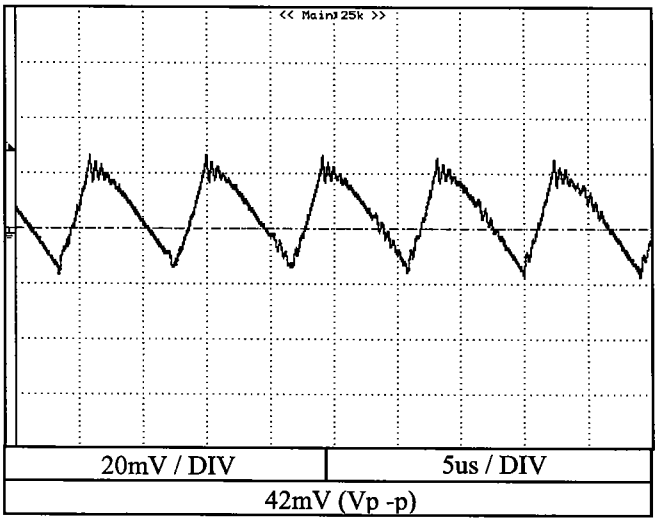
NORMAL MODE

V1(5V)



Conditions : Ta = 25°C
Vin = 100VAC
I1 = 1.8A
I2 = 9A

V2(24V)

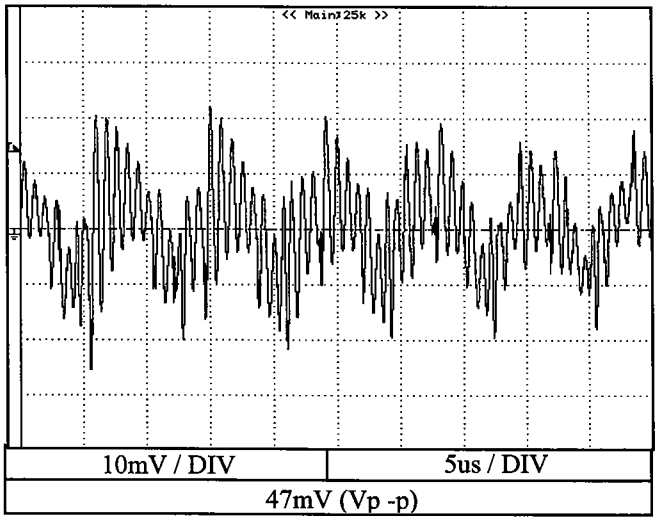


2-18 Output Ripple And Noise Waveform

Conditions : Ta = 25°C
Vin = 100VAC
I1 = 5A
I2 = 8.33A

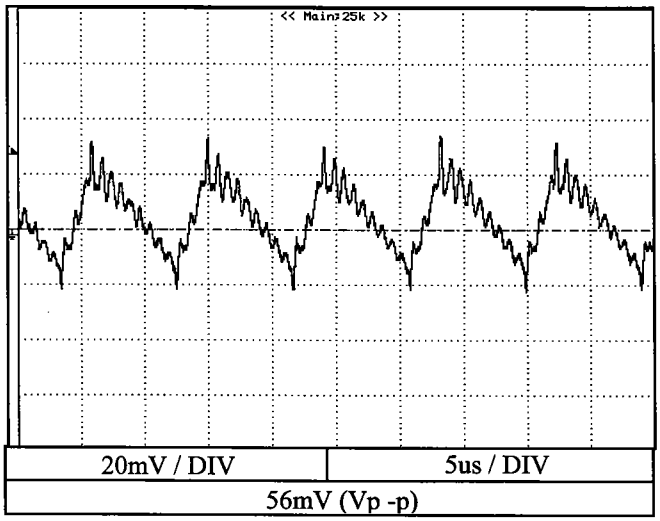
COMMON + NORMAL MODE

V1(5V)



Conditions : Ta = 25°C
Vin = 100VAC
I1 = 1.8A
I2 = 9A

V2(24V)

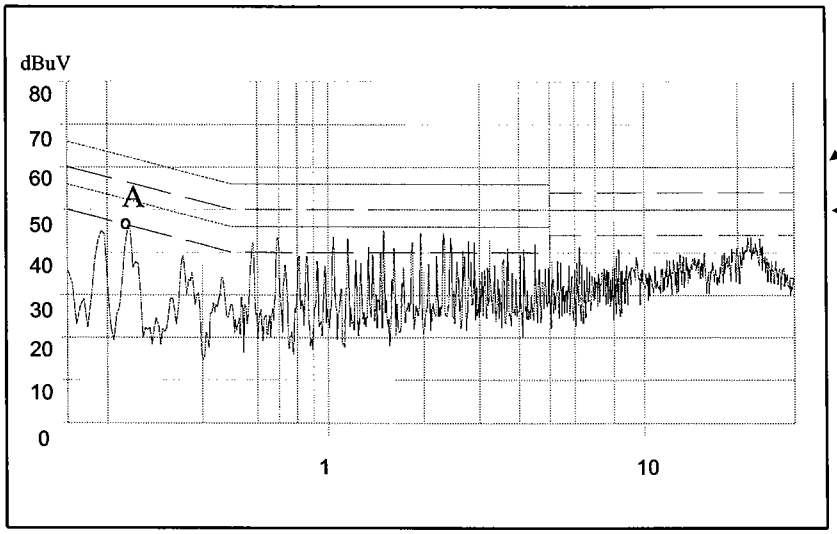


2-19 Electro-Magnetic Interference Characteristics

(a) Conducted Emission

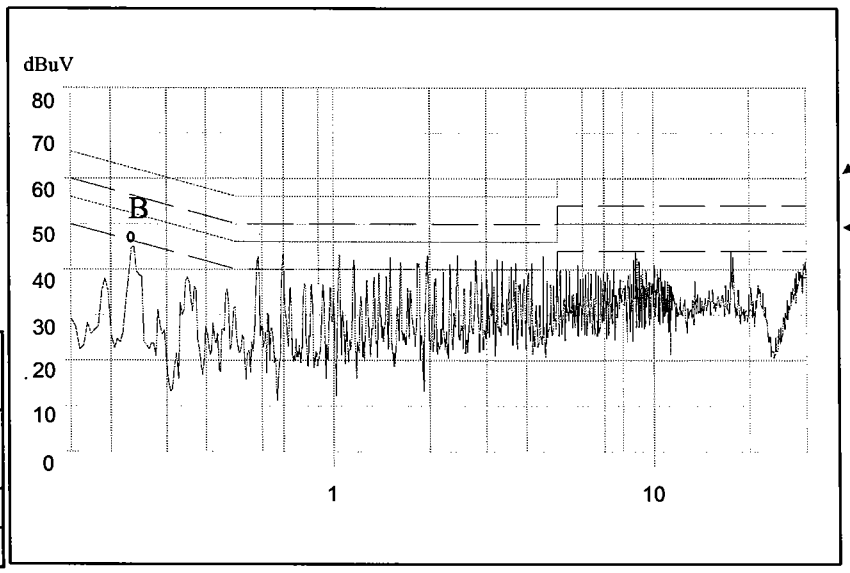
Condition : Vin = 100VAC
I1 = 5A
I2 = 8.33A
Ta = 25°C

	Point A (0.23MHz)	
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	63	46
AV	53	45.6



Phase : L

	Point B (0.228MHz)	
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	63	44.4
AV	53	43.9



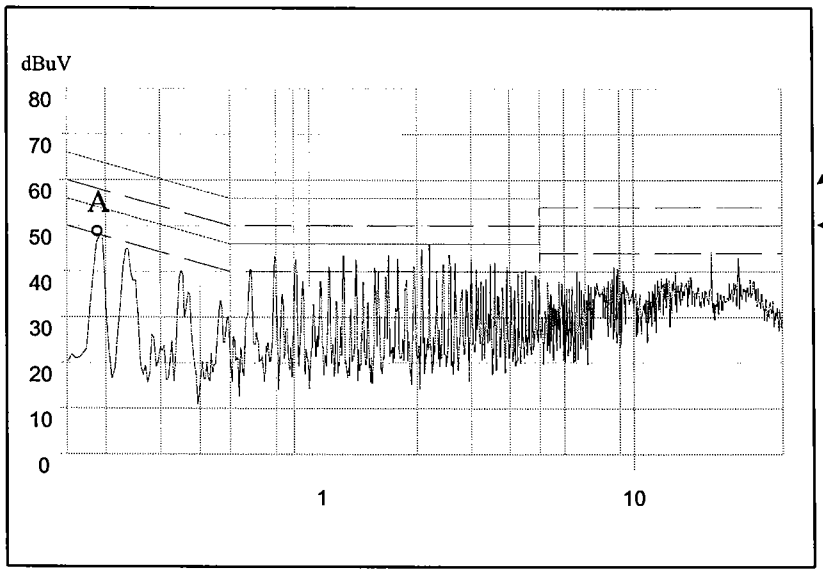
Phase : N

2-19 Electro-Magnetic Interference Characteristics

(a) Conducted Emission

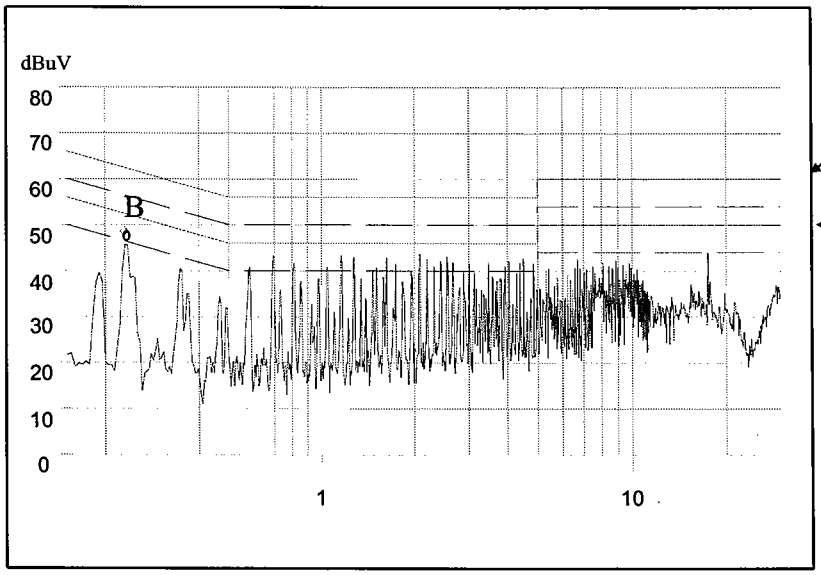
Condition : Vin = 230VAC
I1 = 5A
I2 = 8.33A
Ta = 25°C

Ref. Data	Point A (0.188MHz) V (dBuV)	Measure (dBuV)
QP	64	48.3
AV	54	46.3



Phase : L

Ref. Data	Point B (0.23MHz) Limit (dBuV)	Measure (dBuV)
QP	63	46
AV	53	45.7



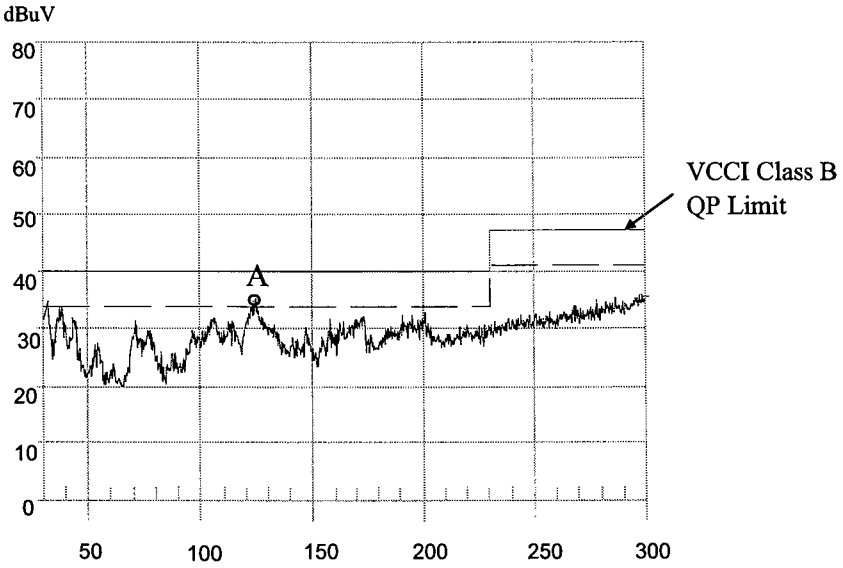
Phase : N

2-19 Electro-Magnetic Interference Characteristics

b) Radiated Emission

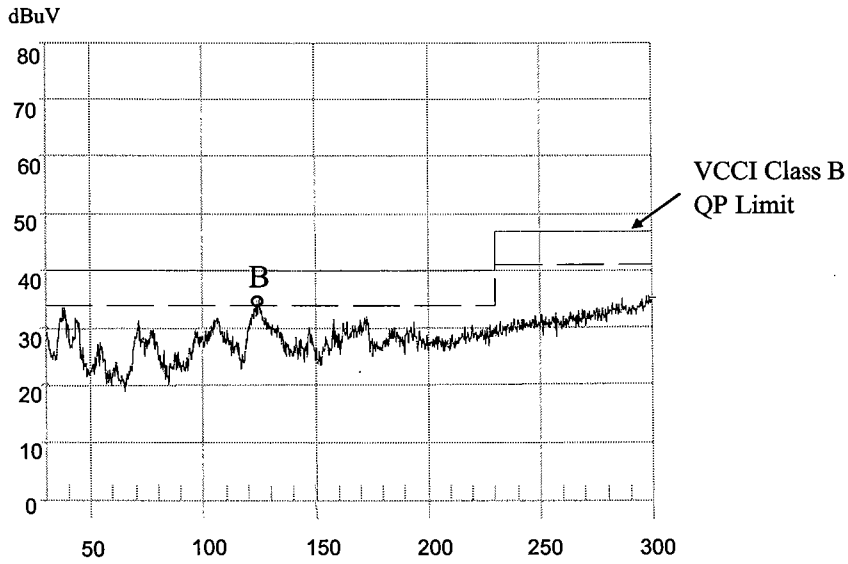
Condition : Vin = 100VAC
I1 = 5A
I2 = 8.33A
Ta = 25°C

HORIZONTAL :



Point A (125MHz)	
Limit (dBuV)	Measure (dBuV)
40	29.8

VERTICAL :



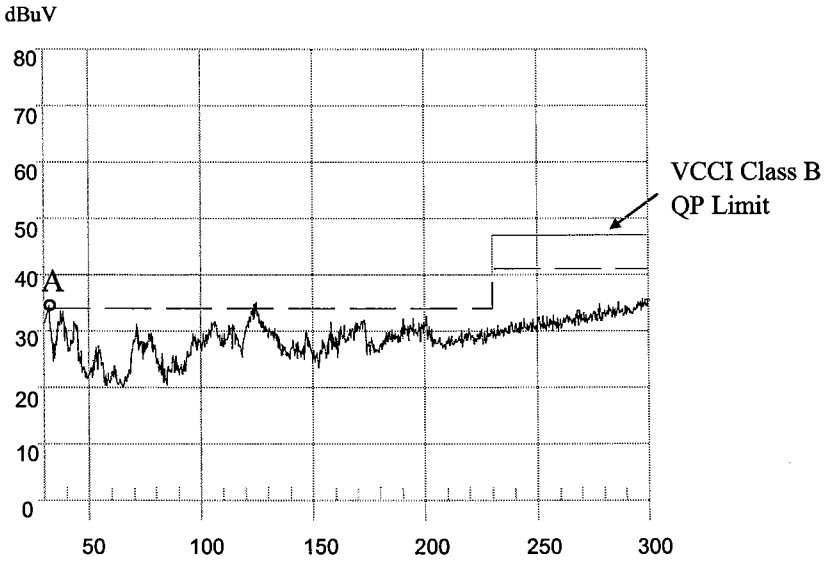
Point B (126MHz)	
Limit (dBuV)	Measure (dBuV)
40	31.0

2-19 Electro-Magnetic Interference Characteristics

b) Radiated Emission

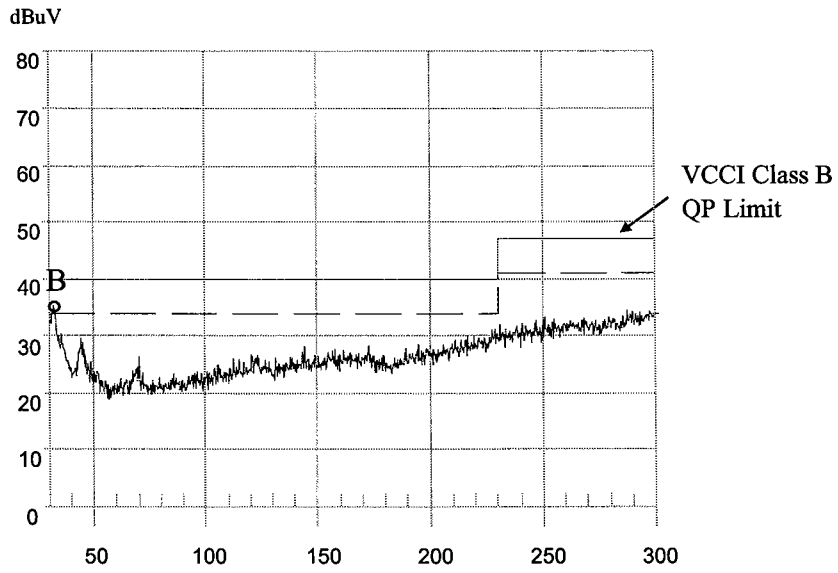
Condition : Vin = 230VAC
I1 = 5A
I2 = 8.33A
Ta = 25°C

HORIZONTAL :



Point A (32MHz)	
Limit (dBuV)	Measure (dBuV)
40	26.3

VERTICAL :



Point B (32.5MHz)	
Limit (dBuV)	Measure (dBuV)
40	31