MS-11

TEST DATA

QUALITY

DRAWING No. A008-53-01		
DRAWN BY	CHEKED BY	APPROVED BY
八鳥 60.5.24	渡辺 60.5.29	60.5.29

ΔNEMIC·LAMBDA

INDEX

Terminology used

Definition

Vin ----- Input voltage

Vout----- Output voltage

Iin ----- Input current

Iout ----- Output current

Ta ----- Temperature

MS－11

SPECIFICATIONS

A008-01-01 A

	Items	Model	MS-11 -2	MS-11 5	MS-11 -6	MS-11 -9	MS-11 -12	MS-11 -15	MS-11 -18	MS-11 -24	MS-11 -28	MS-11 -48
1	Nominal Output Voltage	V	2	5	6	9	12	15	18	24	28	48
2	Maximum Output Current	A	20	20	17	12	10	8	6.5	5	4	2.5
3	Maximum Output Power	W	40	100	102	108	120	120	117	120	112	120
4	Efficiency (Typ) (*1)	%	70	76	76	78	81	81	83	84	85	85
5	Input Voltage Range (*9)	—	85~132VAC (47~440Hz) or 90~165VDC									
6	Input Current (Typ) (*1)	A	0.9	2.2	2.2	2.35	2.6	2.6	2.35	2.4	2.3	2.4
7	In-rush Current (Typ) (*2)	A	30A at 100VAC									
8	Output Voltage Range	%	±10% (Typ)									
9	Maximum Ripple & Noise	mV	50	50	50	60	60	60	80	80	80	100
10	Maximum Line Regulation (*3)	mV	20	20	24	36	48	60	72	96	112	192
11	Maximum Load Regulation (*4)	mV	20	20	24	36	48	60	72	96	112	192
12	Over Current Protection (*5)	A	22.0 ~26.0	22.0 ~26.0	18.5 ~22.0	13.0 ~15.7	11.0 ~13.0	8.8 ~10.5	7.2 ~8.5	5.5 ~6.5	4.4 ~5.2	2.8 ~3.3
13	Over Voltage Protection (*6)	V	2.7 ~2.9	5.75 ~6.25	6.9 ~7.5	10.5 ~11.2	14.0 ~15.0	17.5 ~18.7	21.0 ~22.5	28.0 ~30.0	32.7 ~35.0	56.2 ~60.0
14	Hold-Up Time (*7)	ms	More than 20ms									
15	Remote Sensing	—	Possible									
16	Remote ON/OFF Control (*8)	—	Possible									
17	Parallel Operation	—	Possible									
18	Series Operation	—	Possible									
19	Operating Temperature (*9)	℃	-10 ~ +71									
20	Operating Humidity	%	30% ~ 90% RH									
21	Storage Temperature	℃	-30 ~ +85									
22	Storage Humidity	%	10% ~ 95% RH									
23	Cooling	—	Convection cooled									
24	Temperature Coefficient	%	Less than 1% at -10℃ ~ +71℃									
25	Withstand Voltage	kV	Input-Output , Input-Chassis…2.0kVAC 1min (20mA)									
26	Isolation Resistance	Ω	More than 100MΩ at 25℃ and 70%RH Output-Chassis…500VDC									
27	Vibration	—	Less than 19.6m/S²									
28	Shock	—	Less than 196.1m/S²									
29	Weight	g	930									
30	Size	—	Refer to Outline Drawing									

NOTES

*1 : At 100VAC & maximum output power.

*2 : When resuming operation in less than 8 sec after power failure at no load, softstart circuit will not limit the in-rush current at turn-on.

*3 : From 85~132VAC or 90~165VDC, constant load.

*4 : From No load ~ Full load, constant input voltage.

*5 : Constant current limiting with automatic recovery.

*6 : Inverter shut-down method, manual reset.

*7 : At 100VAC input, and output power of 100 W.

*8 : TTL compatible input :greater than 2V or open…shutdown, 0V~0.8V…power on. Supply voltage to CNT must not exceed 7V.

*9 : Ratings : Percent of maximum output current or maximum output power, Whichever is greater.

i) With respect to operating temprature

-10℃… 60% , 60℃…70%

0~50℃…100% , 71℃…50% (61℃~71℃ Forced air cooling)

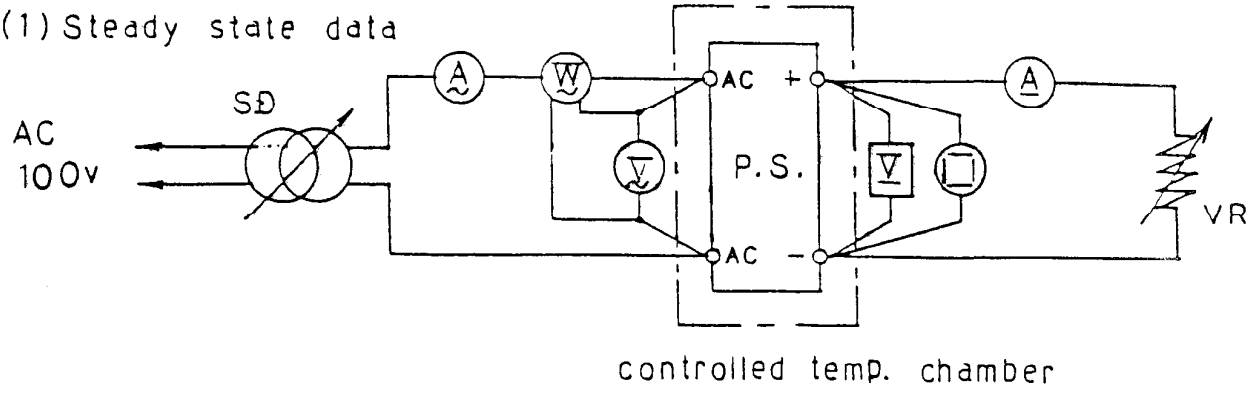
ii) With respect to input voltage

85~132VAC , 110~165VDC…100%

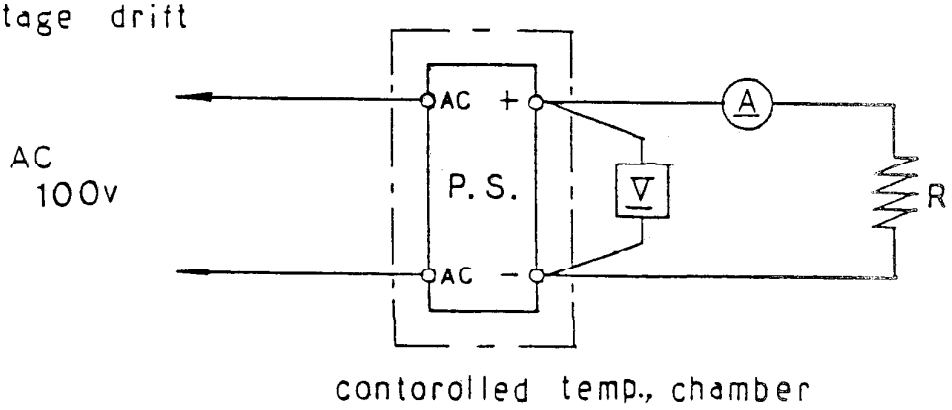
90~110VDC… 80%

Circuits used for determination

(1) Steady state data



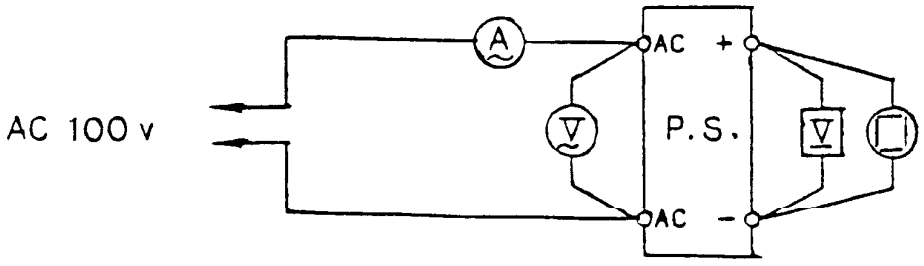
(2) Warm up voltage drift



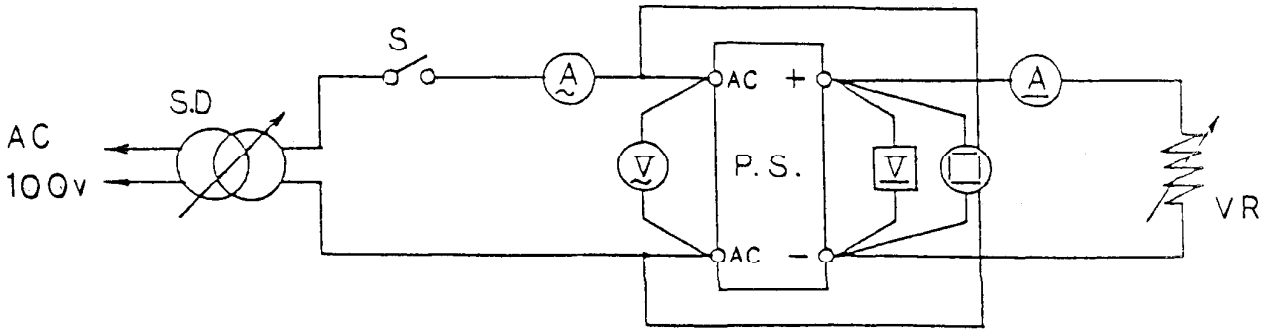
(3) Over current protection (o.c.p) characteristics

Same as steady state data

(4) Over voltage protection (o.v.p) characteristics



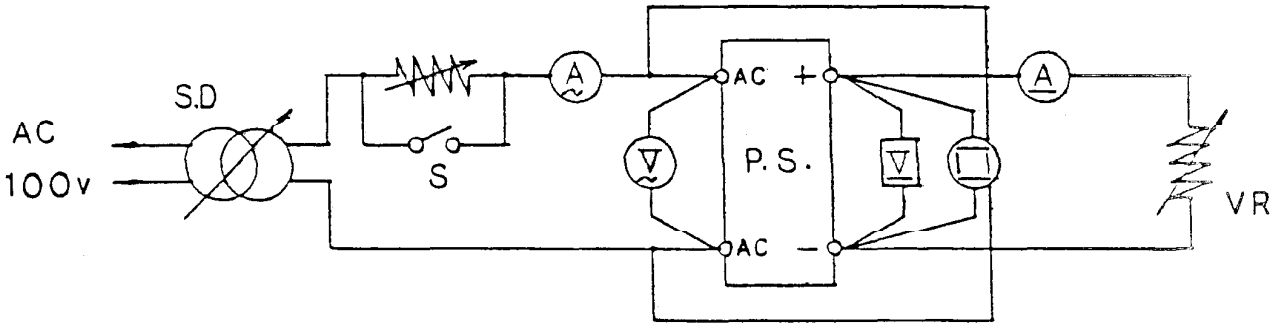
(5) Output rise characteristics



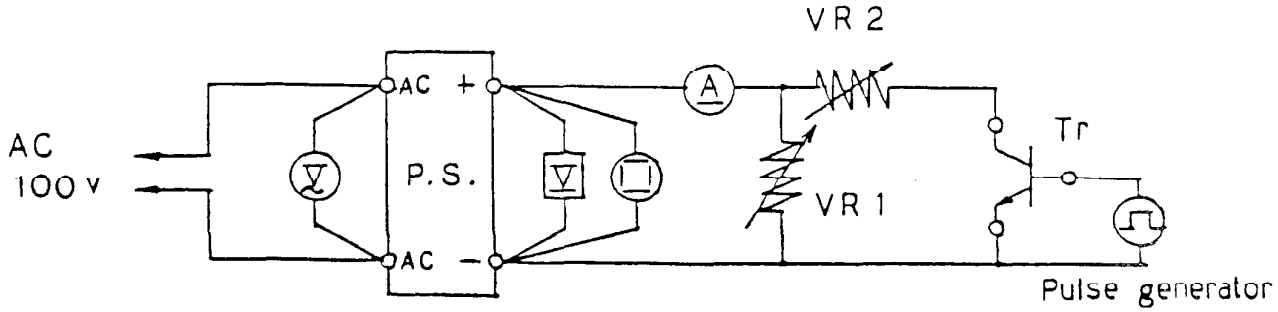
(6) Output fall characteristics

Same as output rise characteristics.

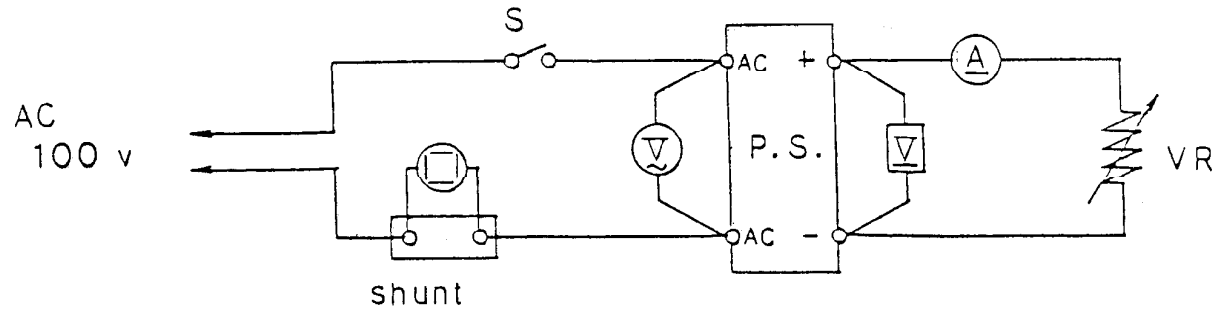
(7) Dynamic line response



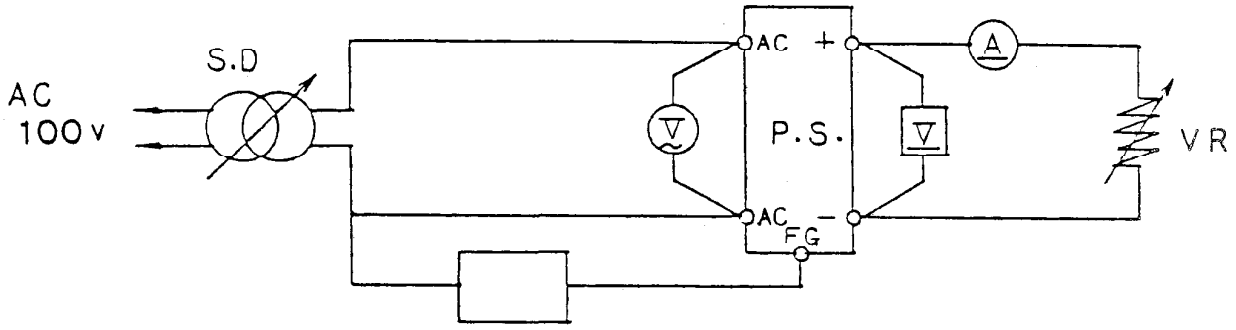
(8) Dynamic load response



(9)Inrush current characteristics



(10)Leakage current

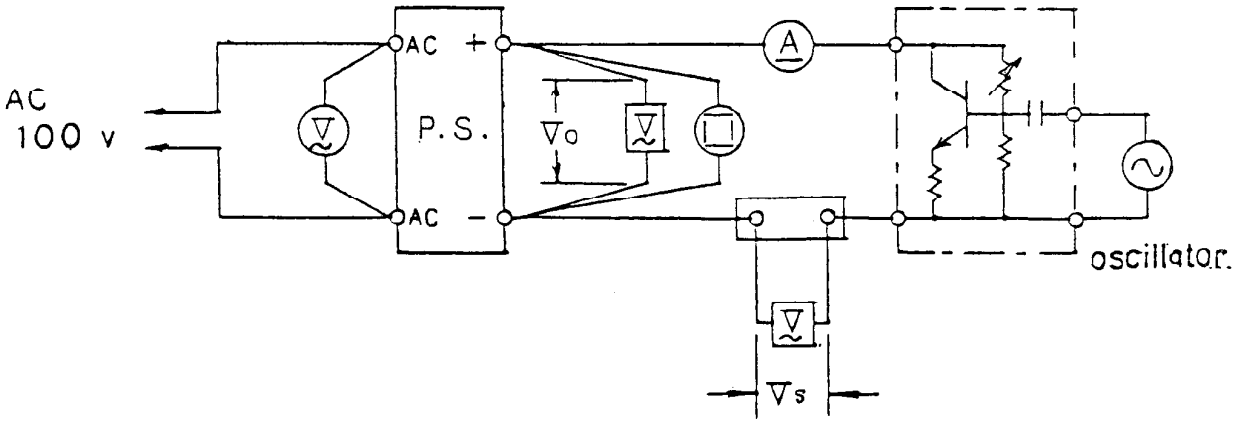


leakage current meter

Note : ·Leakage current measured through a 1kΩ resistor.

Range wed— AC + DC

(11)Output impedance



Note : Output impedance $|Z| = \frac{V_o}{V_s} \cdot R_s$ (R_s: 0.1Ω)

List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL.NO
1	Oscilloscope	HITACHI·DENSHI	V-1050F
2	Storage oscilloscope	SONY·TEKTRONIX	7633
3	Digital volt meter	A & D	5512A
4	A.C. Ampere meter	YOKOGAWA·ELEC.,	2053
5	A.C. Volt meter	〃	2052
6	A.C. Watt meter	〃	2041
7	D.C. Ampere meter	〃	2051
8	Variac	MATSUNAGA	SD-1320
9	Variable resistive load	IWASHITA·ELEC.,	44/11Ω, 24/06Ω
10	Dynamic dummy load	TAKAMIZAWA CYBERNETICS	PSA-150D
11	Digirush currenter	〃	PSA-200
12	Oscillator	NF CIRCUIT DESIGN BLOCK	CR-116
13	Controlled temp., chamber	TABAI	INP105
14	Leakage current meter	YOKOGAWA·ELEC.,	3226
15	Equipment for dynamic line response	-BUILT IN-HOUSE	———
16	Output impedance measuring equipment	〃	———
17			
18			
19			

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Regulation – line and load , temp. drift

5 v

1. Regulation – line and load Condition Ta : 25°C

Iout \ Vin	AC 85 v	AC100 v	AC132 v	line regulation	
0 %	5.013 v	5.013 v	5.013 v	0 mv	0 %
50 %	5.009 v	5.009 v	5.009 v	0 mv	0 %
100 %	5.005 v	5.005 v	5.005 v	0 mv	0 %
load regulation	8 mv	8 mv	8 mv		
	0.16 %	0.16 %	0.16 %		

2. Temperature drift Conditions Vin : AC 1 0 v
Iout: 100

Ta	0 °C	25 °C	50 °C	Temp.stability	
Vout	4.983 v	5.005 v	5.011 v	28 mv	0.56 %

12 v

1. Regulation – line and load Condition Ta : 25°C

Iout \ Vin	AC 85 v	AC100v	AC132v	line regulation	
0 %	12.013 v	12.015 v	12.016 v	3 mv	0.025%
50 %	12.012 v	12.013 v	12.013 v	1 mv	0.008%
100 %	12.010 v	12.010 v	12.011 v	1 mv	0.008 %
load regulation	3 mv	5 mv	5 mv		
	0.025%	0.04%	0.04 %		

2. Temperature drift Conditions Vin : AC 1(0 v
Iout: 100%

Ta	0 °C	25 °C	50 °C	Temp.stability	
Vout	11.967 v	12.010 v	12.025 v	58 mv	0.48 %

MS-11

Regulation – line and load , temp. drift

24 V

1. Regulation – line and load Condition Ta : 25°C

Iout \ Vin	AC 85 V	AC 100V	AC 132 V	line regulation	
0 %	24.03 V	24.02V	24.03 V	10 mv	0.04 %
50 %	24.02V	24.02 V	24.03V	10 mv	0.04 %
100 %	24.02V	24.02V	24.03V	10 mv	0.04 %
load regulation	10 mv	0 mv	0 mv		
	0.04 %	0 %	0 %		

2. Temperature drift Conditions Vin : AC 100 V
Iout : 100 %

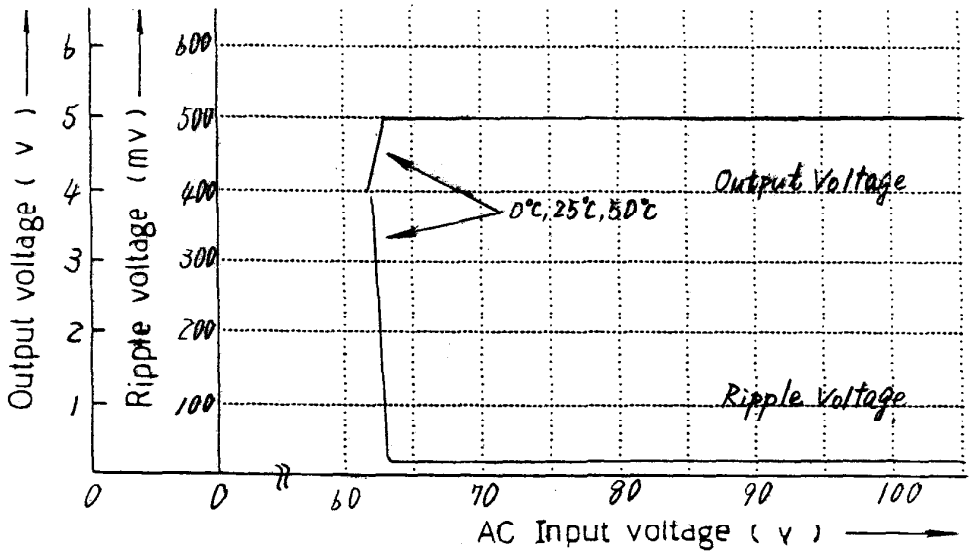
Ta	0 °C	25 °C	50 °C	Temp. stability	
Vout	23.95 V	24.02 V	24.06 V	110 mv	0.46 %

Output voltage and ripple voltage v.s. input voltage

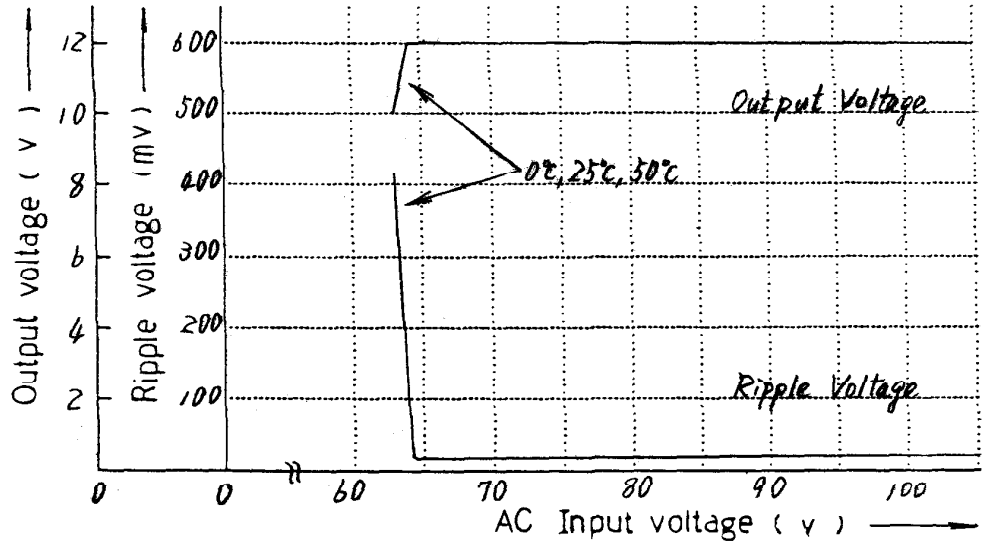
MS-11

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

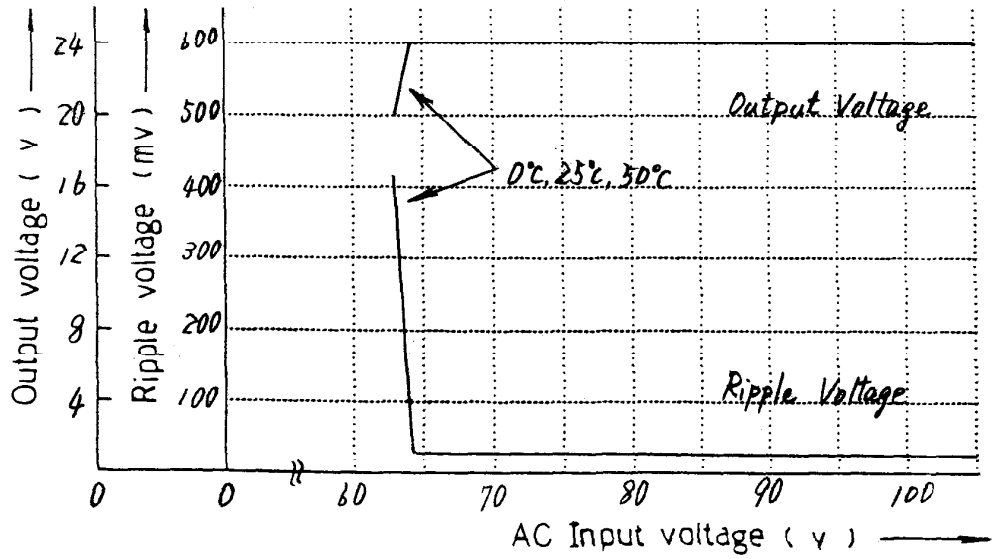
5 V



12 V



24 V



Efficiency and input current v.s. output current

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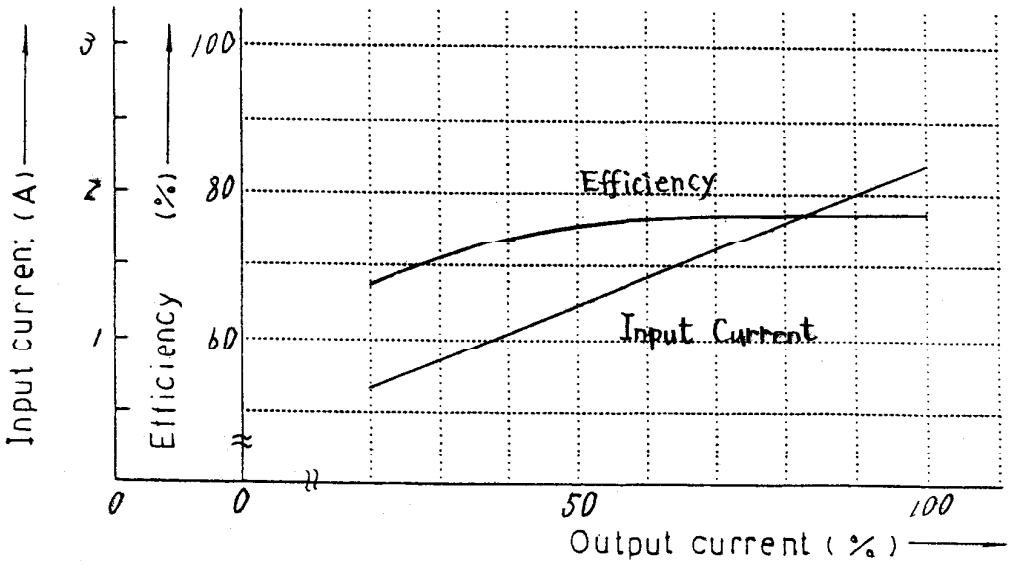
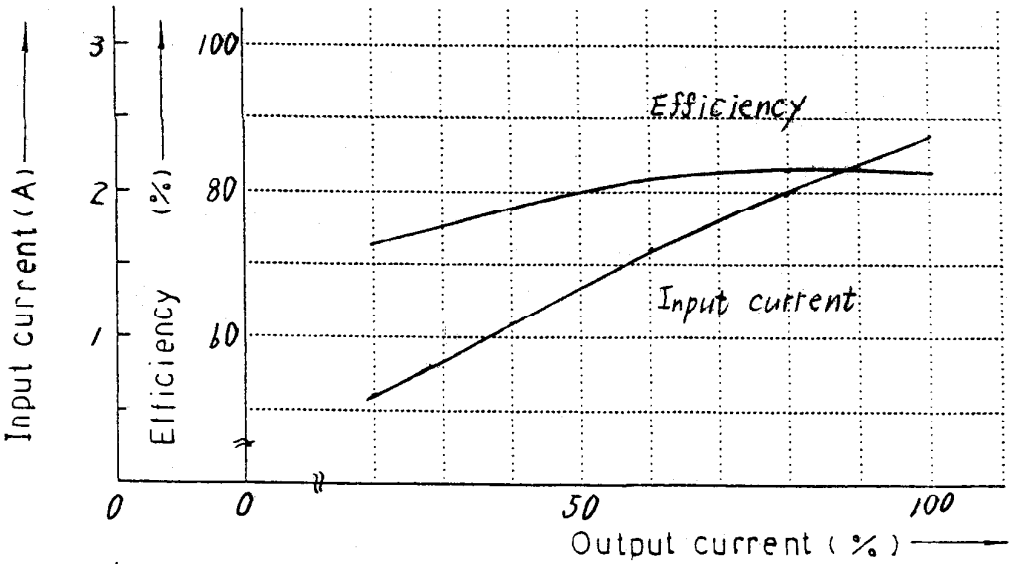
Conditions Vin : AC 100v
Ta : 25°C

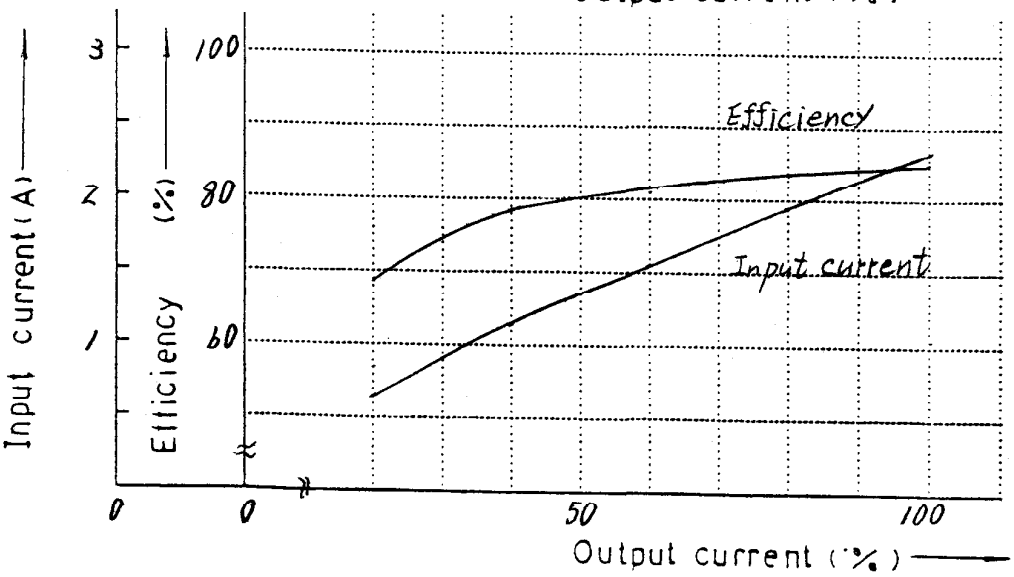
5v



12v



24v

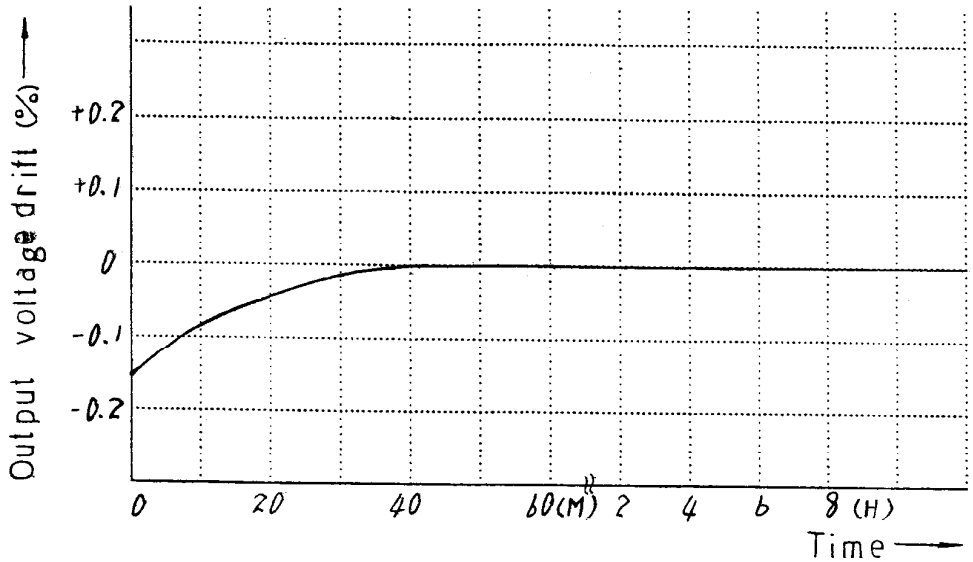


Warm up voltage drift

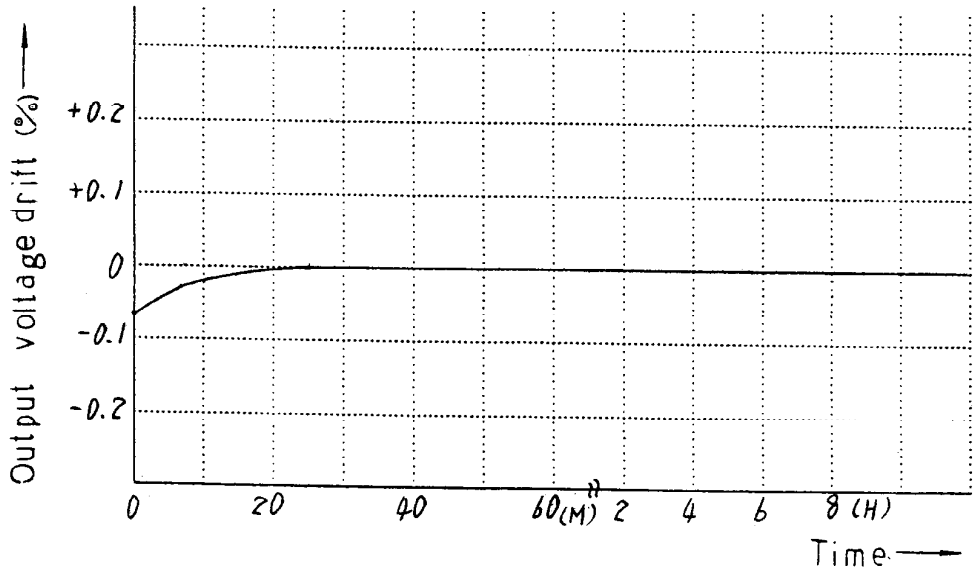
MS - 11

Conditions Vin : AC 100 v
Vout,Iout : 100%
Ta : 25°C

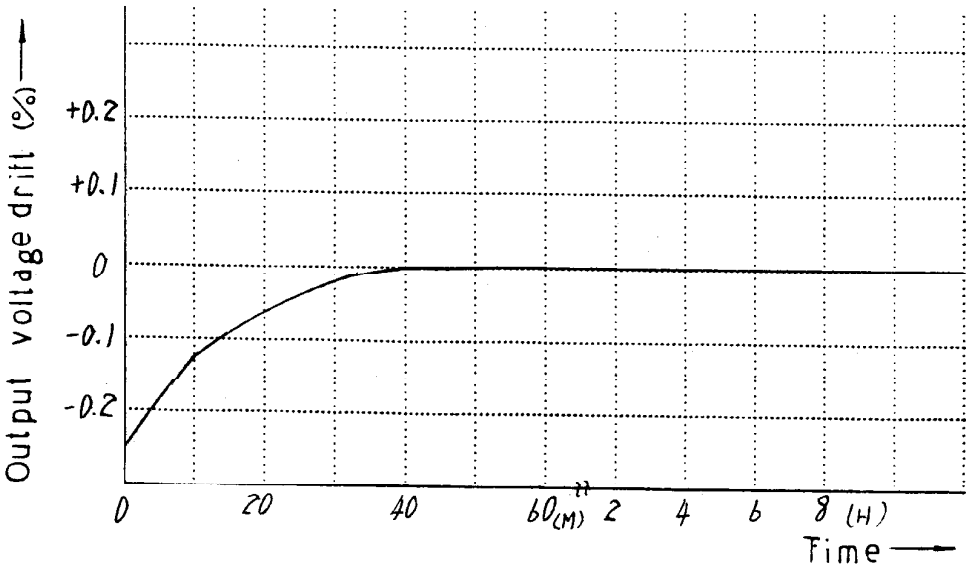
5 v



12 v



24 v

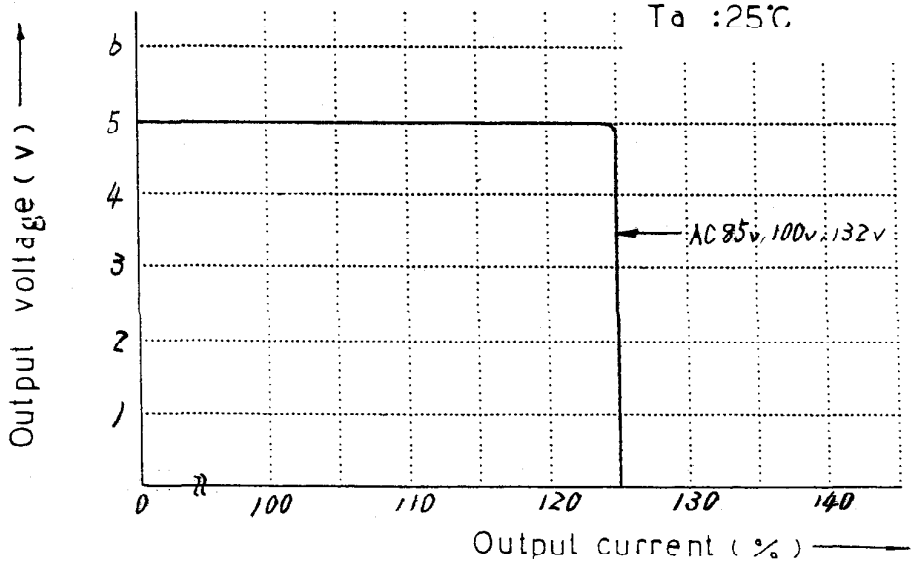


O.C.P characteristics

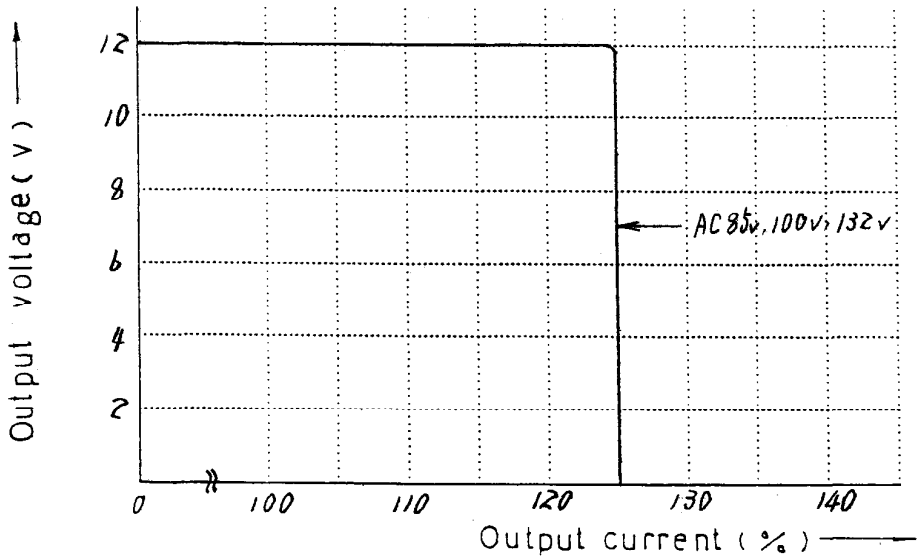
MS-11

Conditions Vin :AC 85v———
AC100v- - - - -
AC132v— - —
Ta :25℃

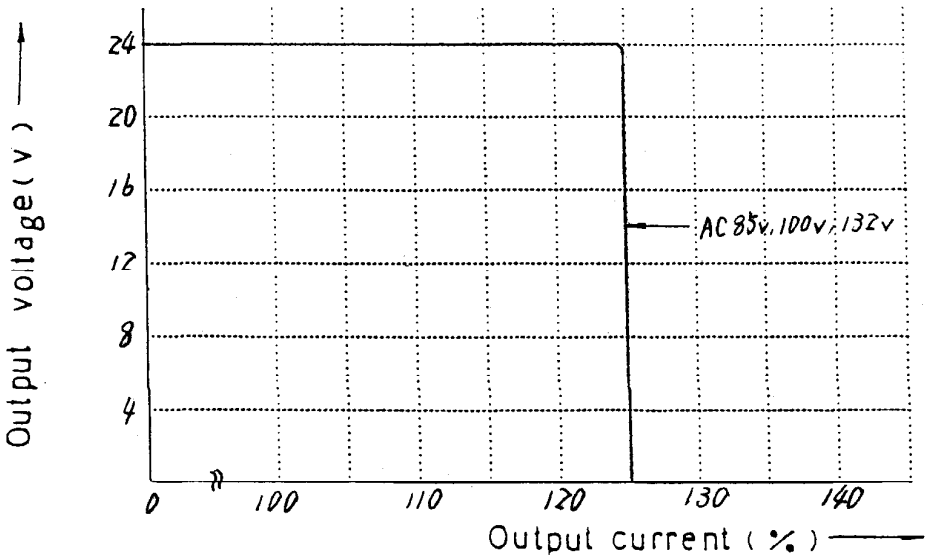
5 v



12 v



24 v

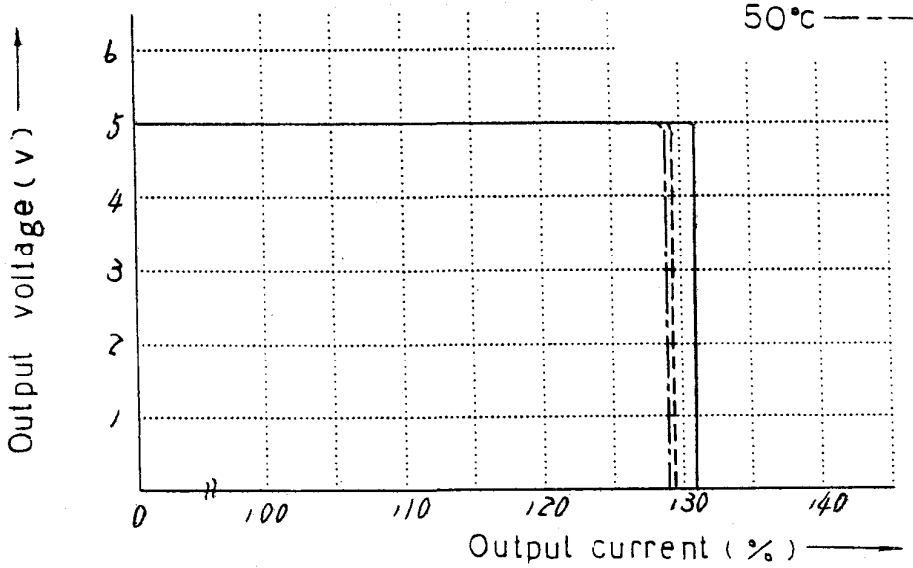


O.C.P characteristics

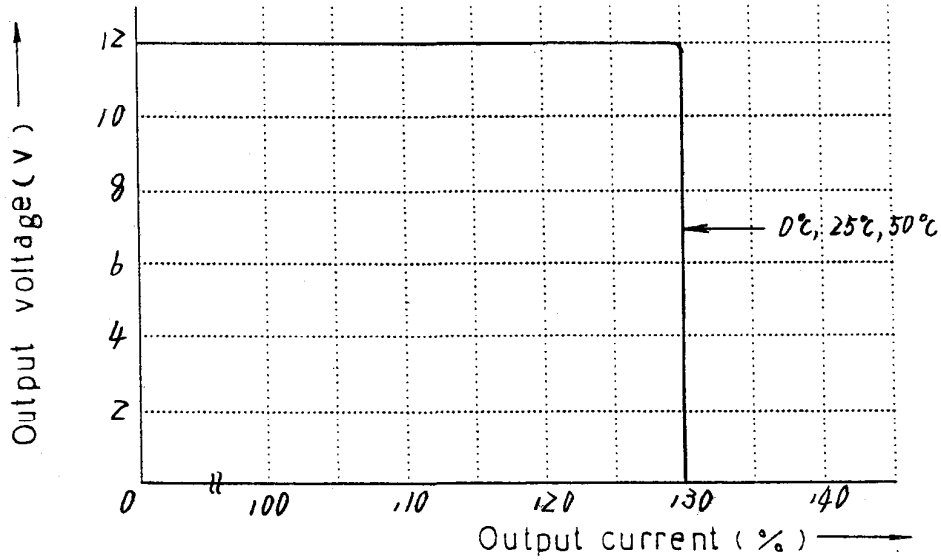
MS-11

Conditions Vin : AC 100 v
Ta : 0 °C ——
25 °C - - - -
50 °C — — —

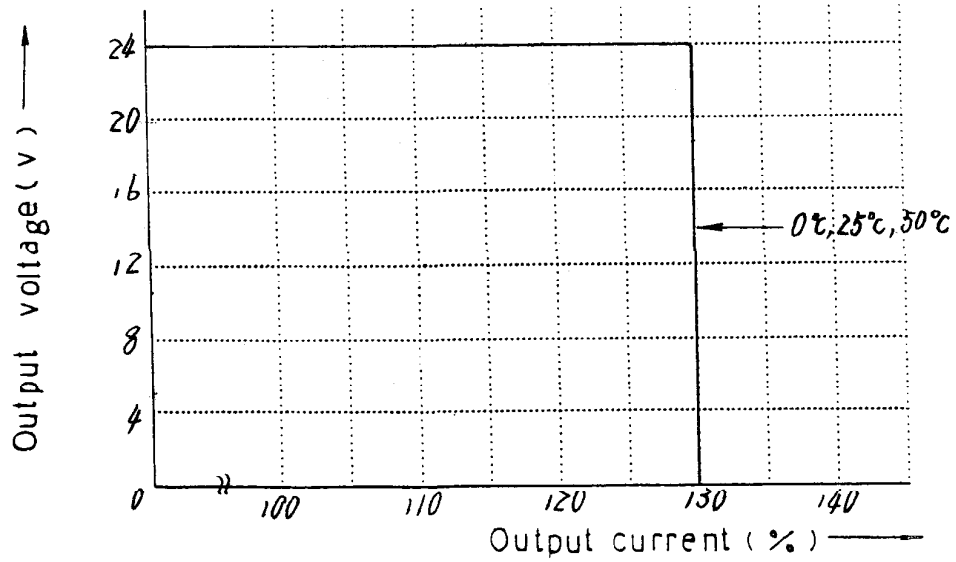
5V



12V



24V

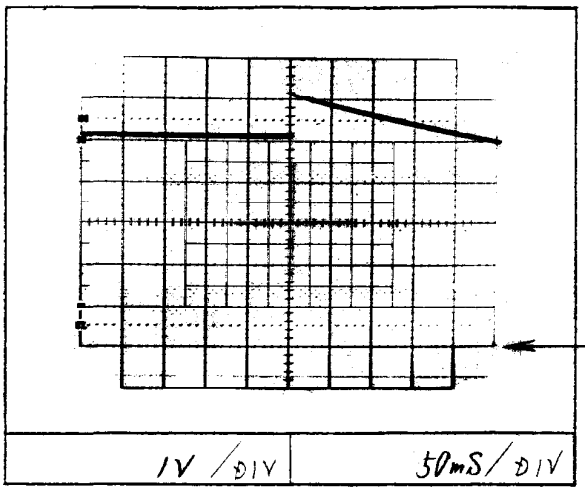


O.V.P. Characteristics

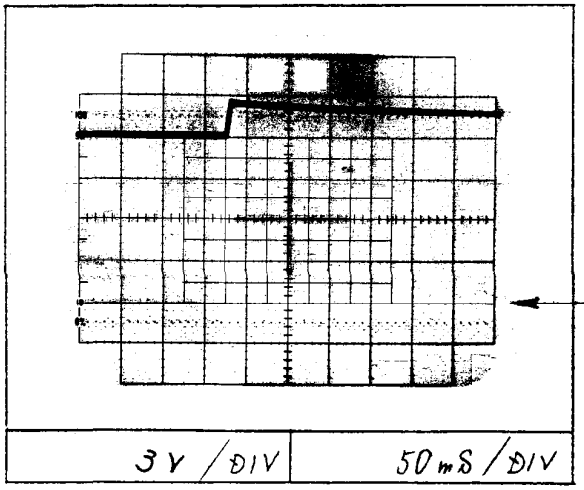
MS-11

Conditions Vin : AC100v
Iout : 0%
Ta : 25°C

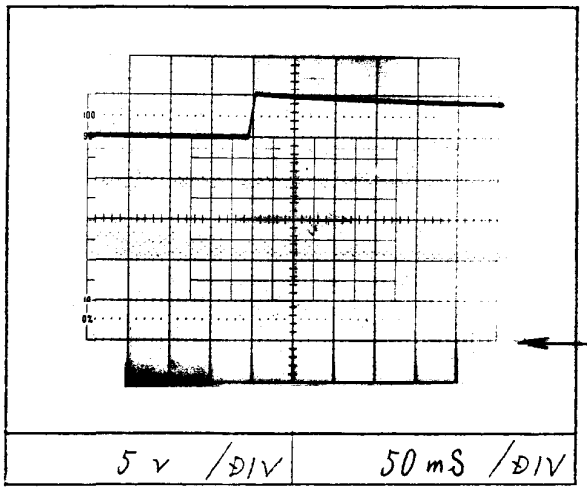
5 v



12 v



24 v

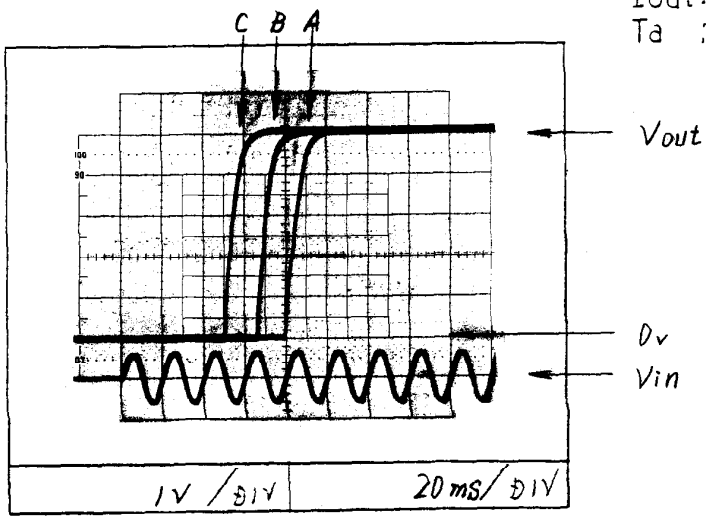


MS-11

Output rise time

A B C
Conditions Vin: AC 85v, 100v, 132v
Iout: 100 %
Ta : 25°C

5v



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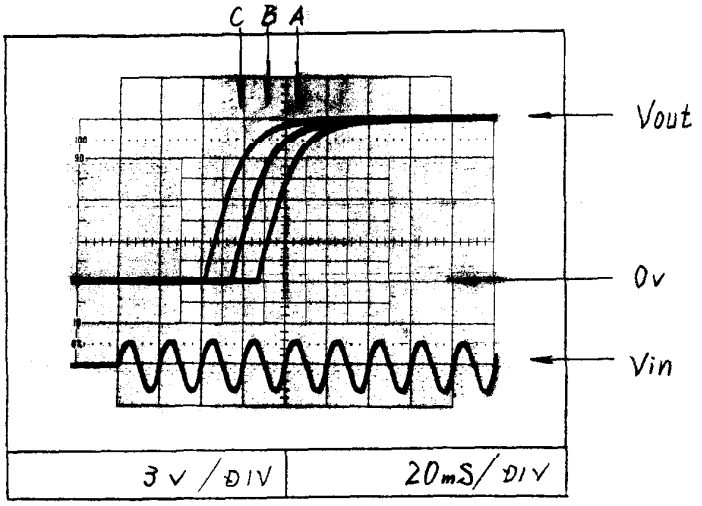

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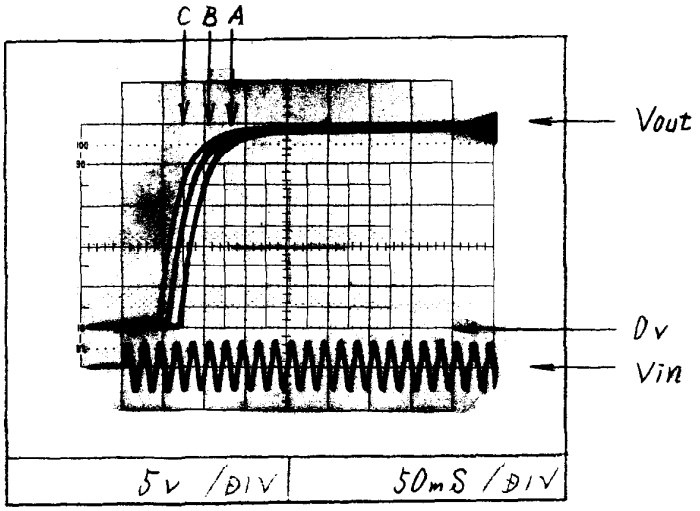


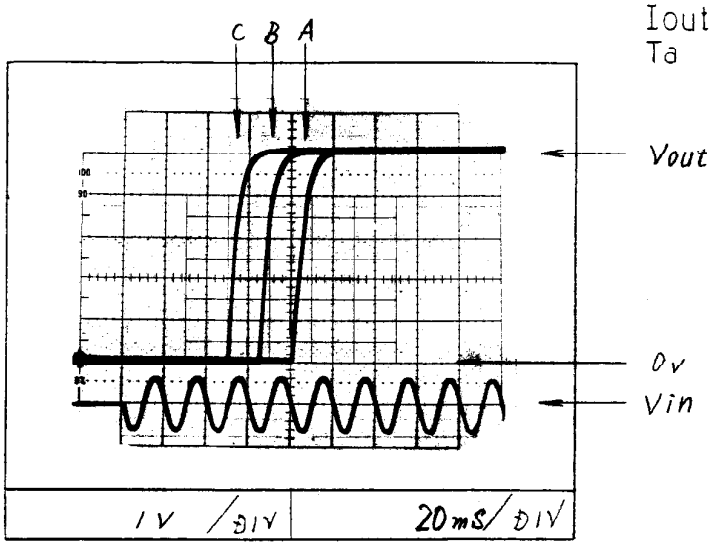
Output rise time

MS-11

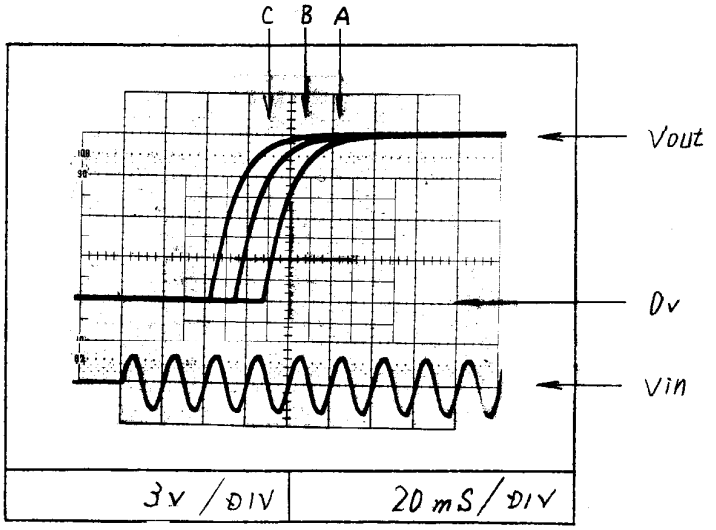
A B C

Conditions Vin: AC 85v, 100v, 132v
Iout: 0 %
Ta : 25°C

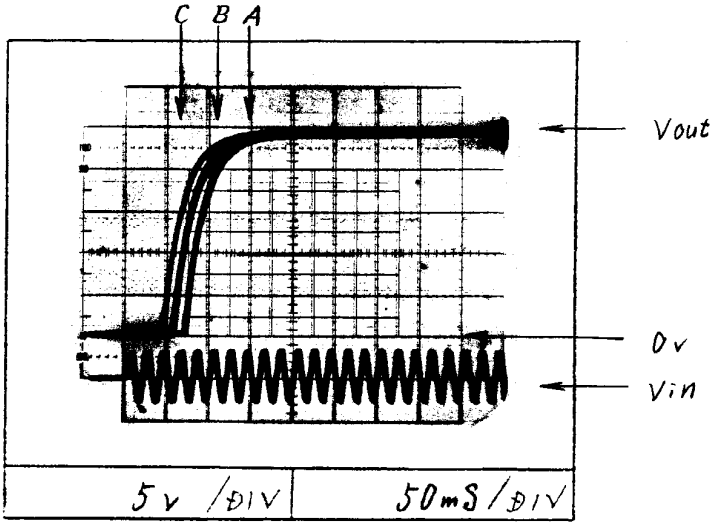
5v



12v



24v

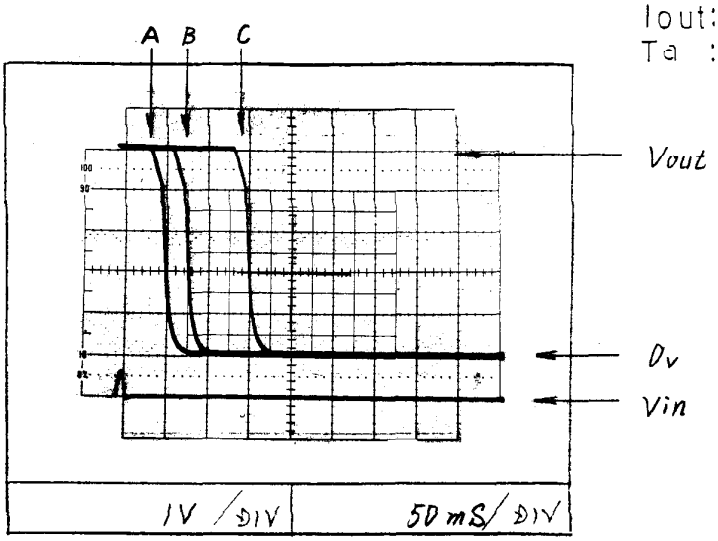


Output fall time

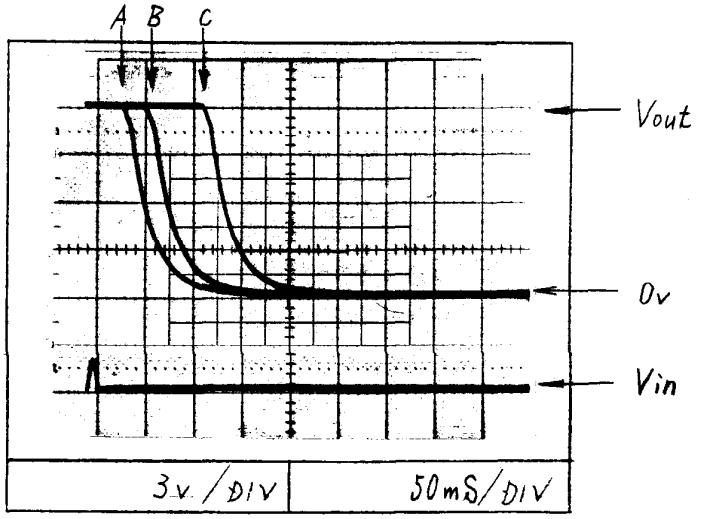
MS-11

Conditions Vin : AC85v, 100v, 132v (A B C)
Iout: 100 %
Ta : 25°C

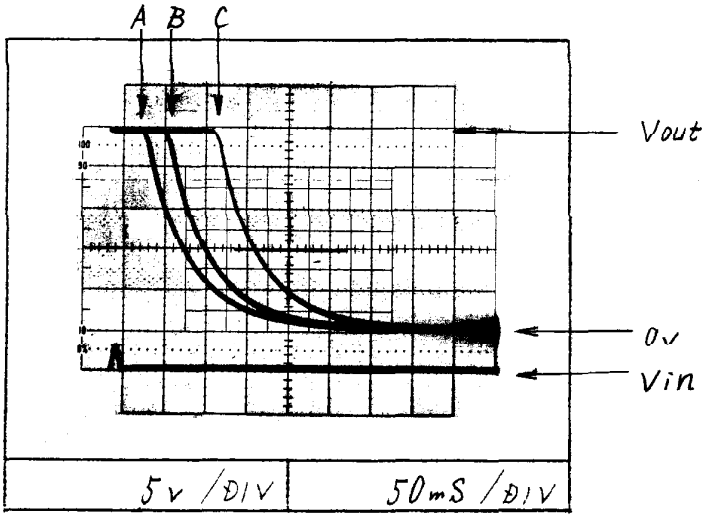
5 v



12 v



24 v

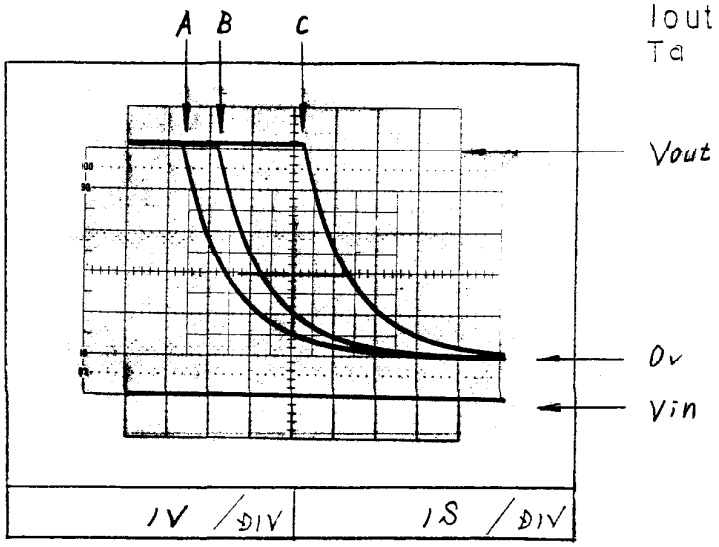


Output fall time

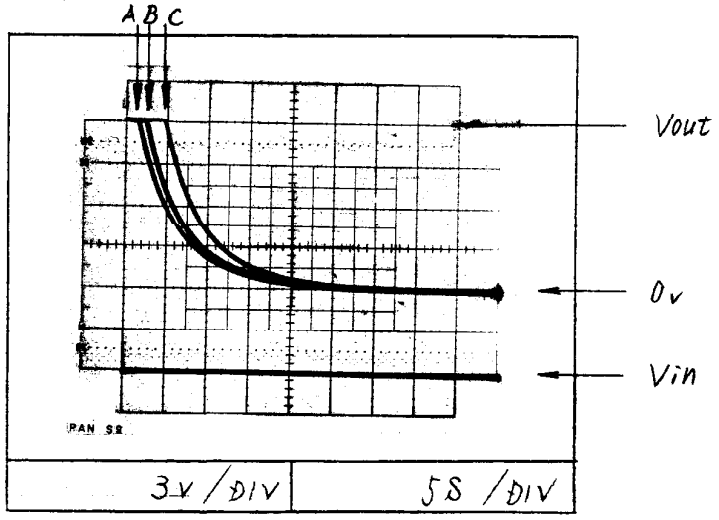
MS-11

Conditions Vin : AC85v, 100v, 132v (A B C)
Iout: 0 %
Ta : 25°C

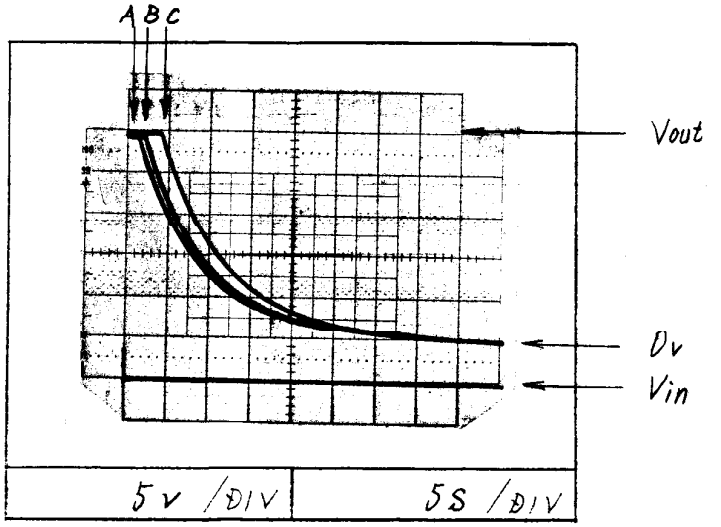
5 V



12 V



24 V

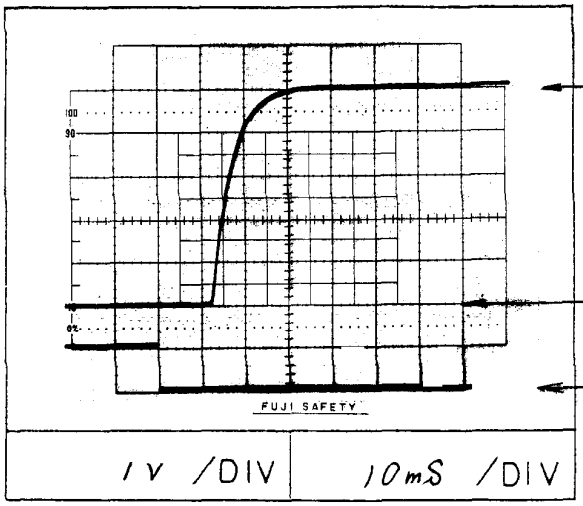


Output rise time with ON/OFF CONTROL

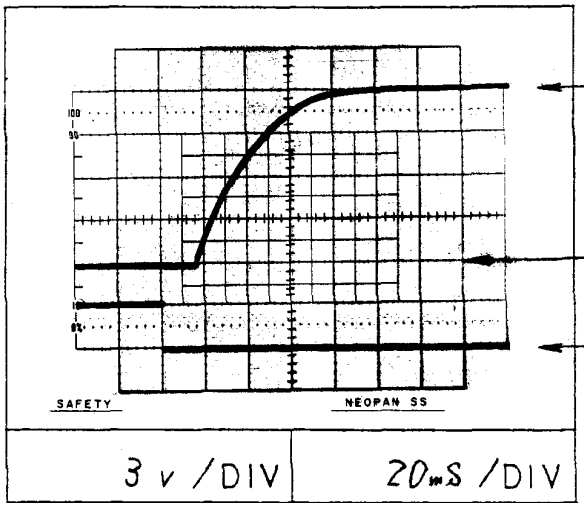
MS-11

Conditions Vin : AC100v
Iout : 100%
Ta : 25°C

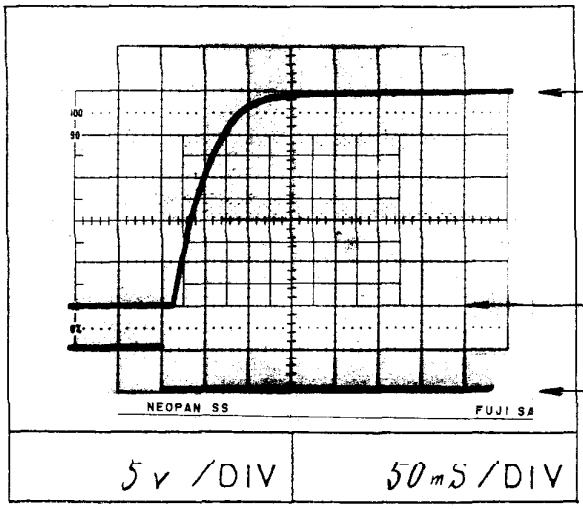
5v



12v



24v

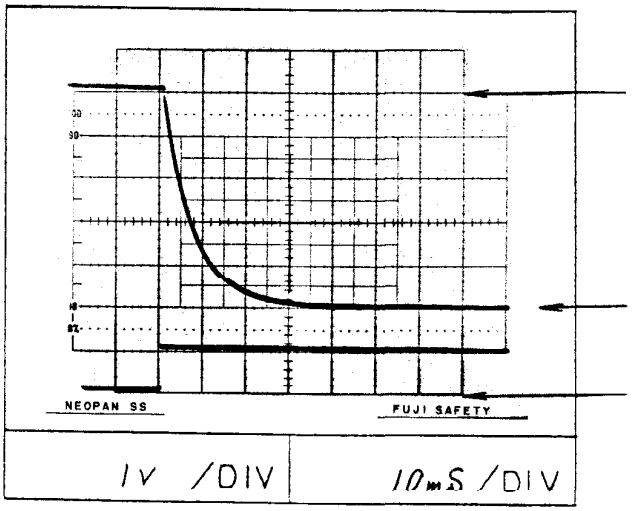


Output fall time with ON/OFF CONTROL

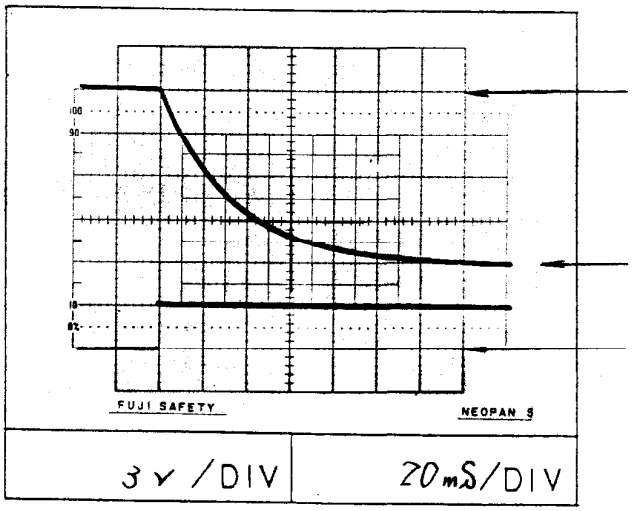
MS-11

Conditions Vin : AC 100v
Iout : 100%
Ta : 25°C

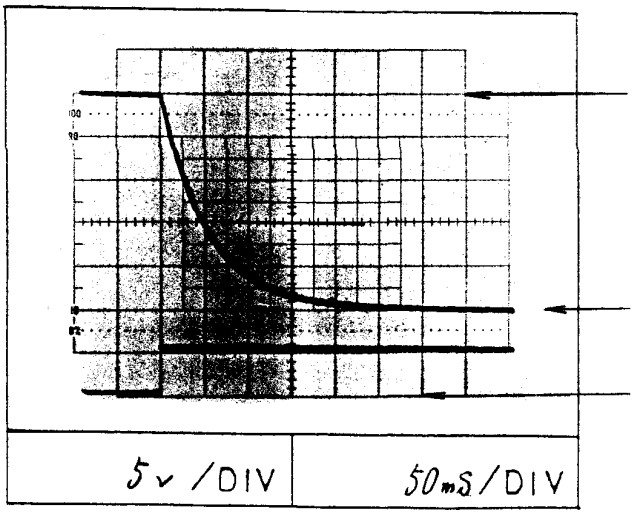
5v



12v



24v

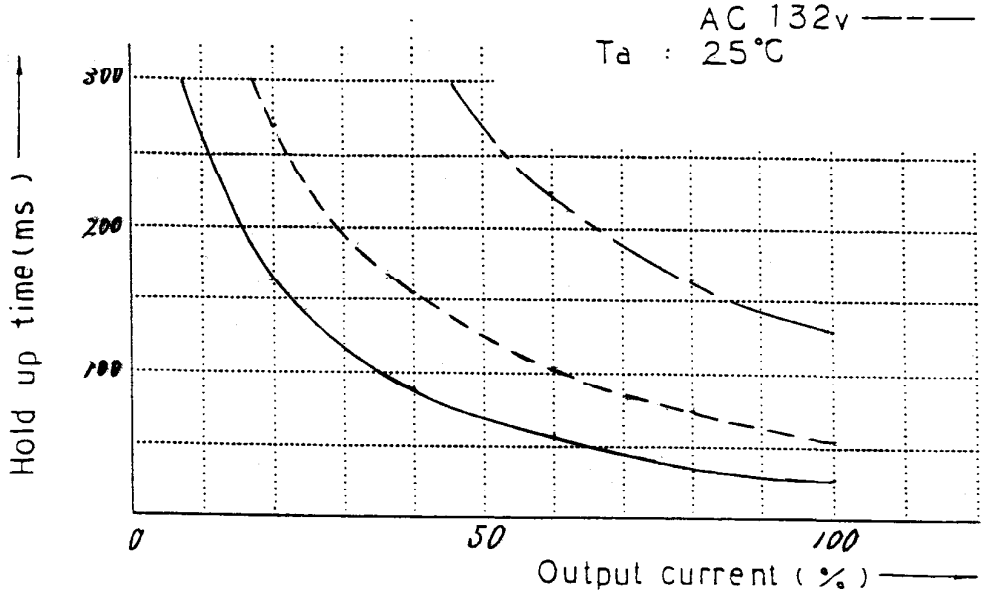


Hold up time

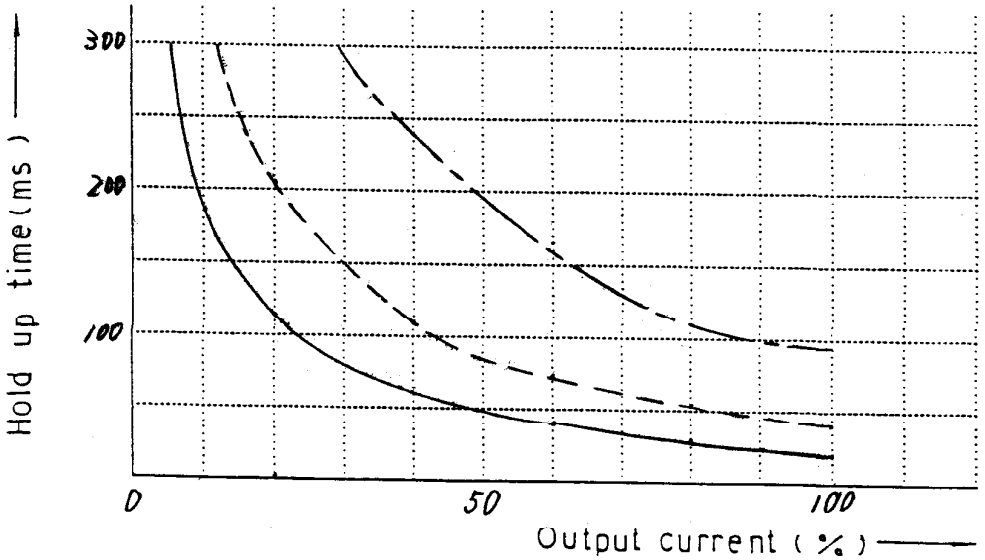
MS - 11

Conditions Vin : AC 85v ——
AC 100v - - - -
AC 132v — — —
Ta : 25°C

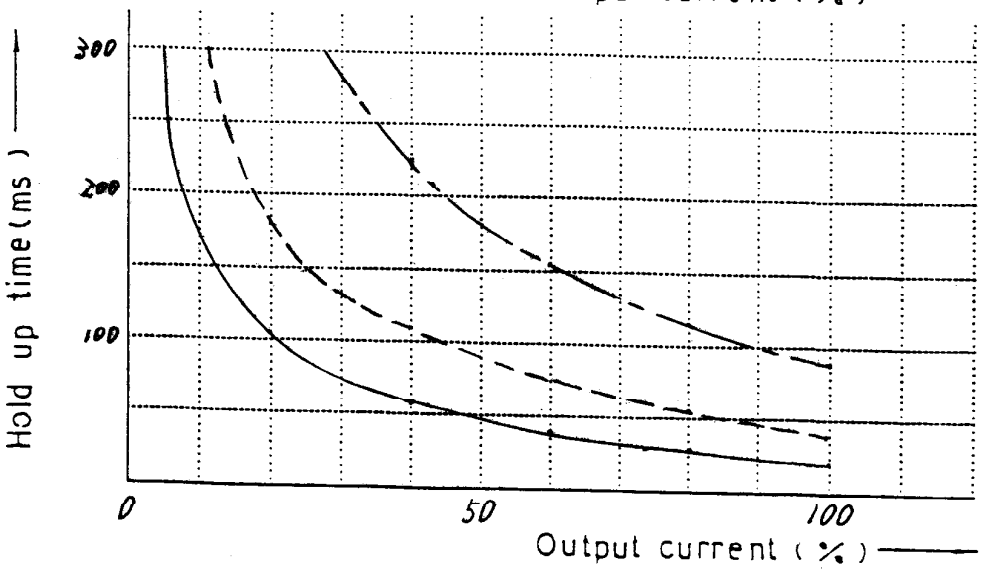
5 v.



12v



24 v



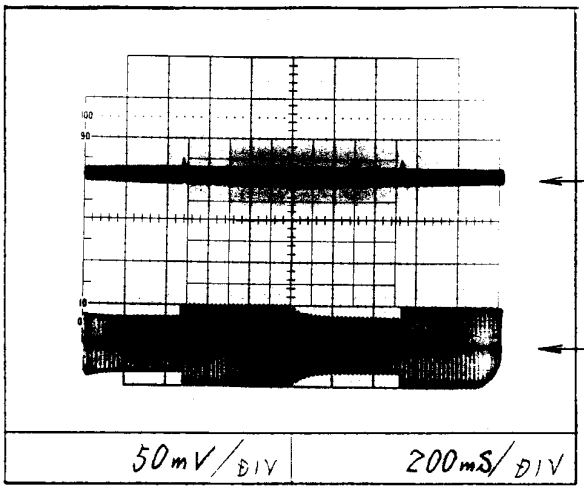
Dynamic line response

MS-11

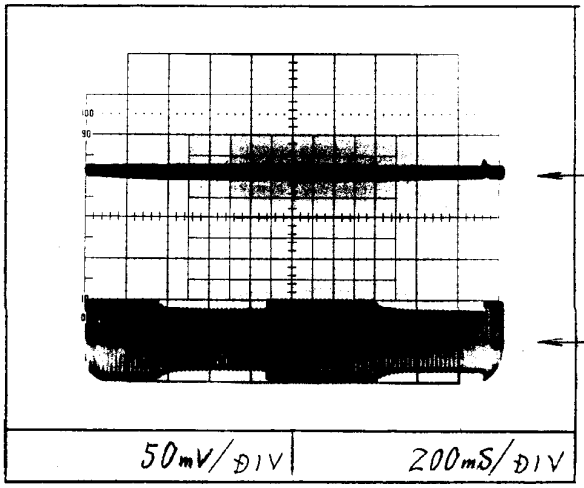
Vin : AC85v ⇄ AC132v

Conditions
Vout: Rated
Iout: 100%
Ta : 25°C

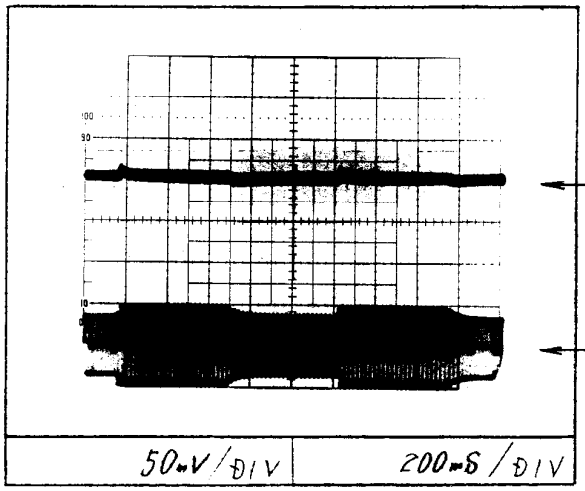
5v



12v



24v



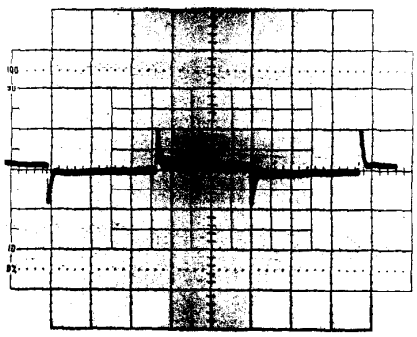
Dynamic load response

MS-11

Conditions Vin : AC 100 V
Ta : 25 °C

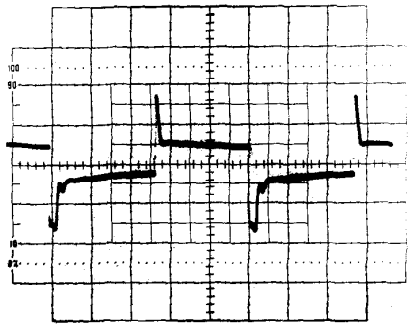
5 V

Iout 50 ⟷ 100% f = 100Hz



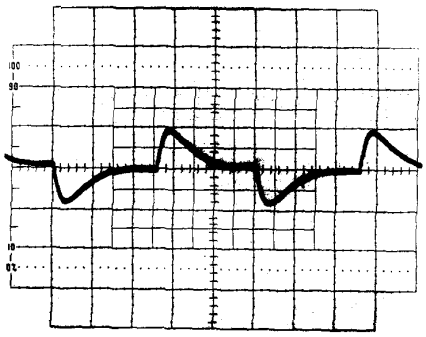
200mV / DIV	2 mS / DIV
+4.0 %	−3.8 %

Iout 0 ⟷ 100 % f = 100Hz



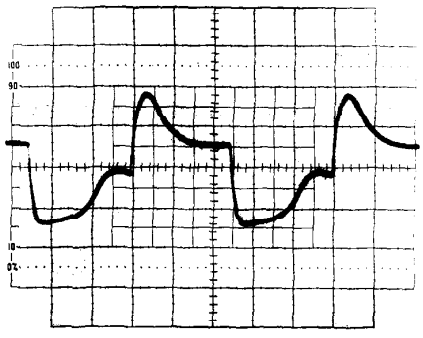
200mV / DIV	2 mS / DIV
+6.8 %	−7 %

Iout 50 ⟷ 100% f = 1kHz



200 mV / DIV	0.2 mS / DIV
+4.0 %	−3.6 %

Iout 0 ⟷ 100% f = 1kHz



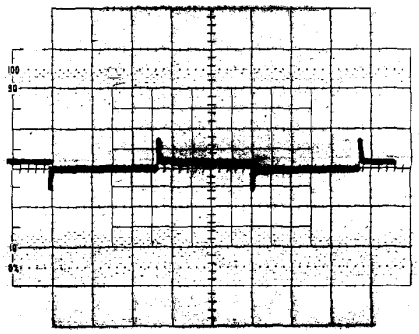
200 mV / DIV	0.2 mS / DIV
+7.6 %	−5.6 %

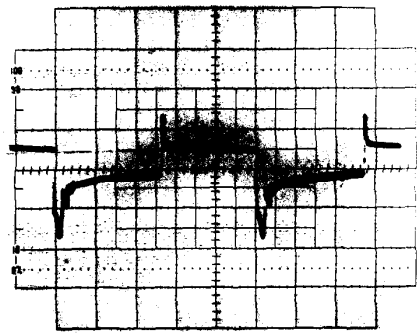
Dynamic load response

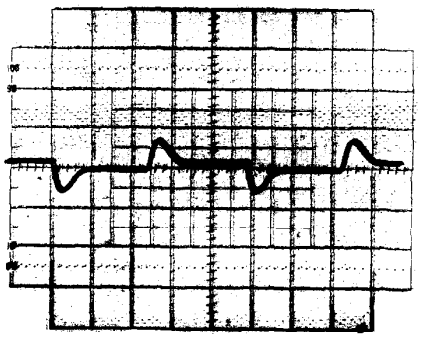
MS-11

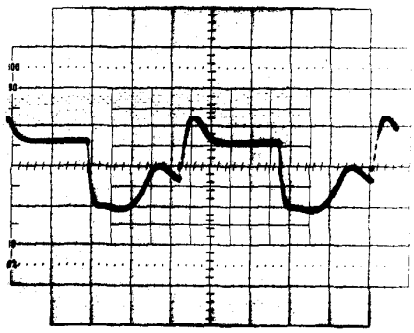
Conditions Vin : AC 100 V
Ta : 25 °C

12 V

Iout 50 ⟷ 100% f = 100Hz	
	
100mV / DIV	2 mS / DIV
+0.67 %	-0.5 %

Iout 0 ⟷ 100 % f = 100Hz	
	
100mV / DIV	2 mS / DIV
+ 1.2 %	- 1.4 %

Iout 50 ⟷ 100% f = 1kHz	
	
100 mV / DIV	0.2 mS / DIV
+ 0.58 %	-0.5 %

Iout 0 ⟷ 100% f = 1kHz	
	
100mV / DIV	0.2 mS / DIV
+ 1.1 %	- 1.0 %

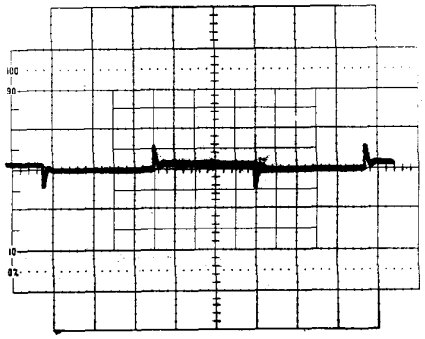
Dynamic load response

MS-11

Conditions Vin : AC 100 V
Ta : 25 °C

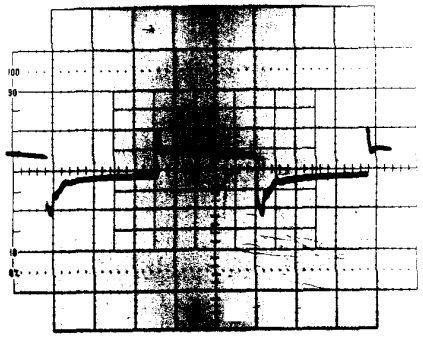
24 V

Iout 50 ⟷ 100% f = 100Hz



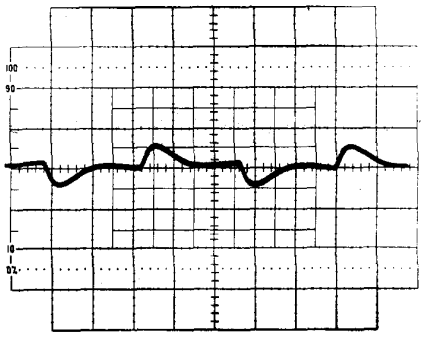
100mV / DIV	2 mS / DIV
+ 0.25 %	− 0.21 %

Iout 0 ⟷ 100 % f = 100Hz



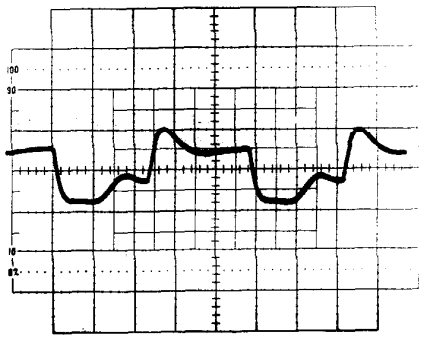
100mV / DIV	2 mS / DIV
+ 0.42 %	− 0.5 %

Iout 50 ⟷ 100% f = 1kHz



100 mV / DIV	0.2 mS / DIV
+ 0.25 %	− 0.17 %

Iout 0 ⟷ 100% f = 1kHz



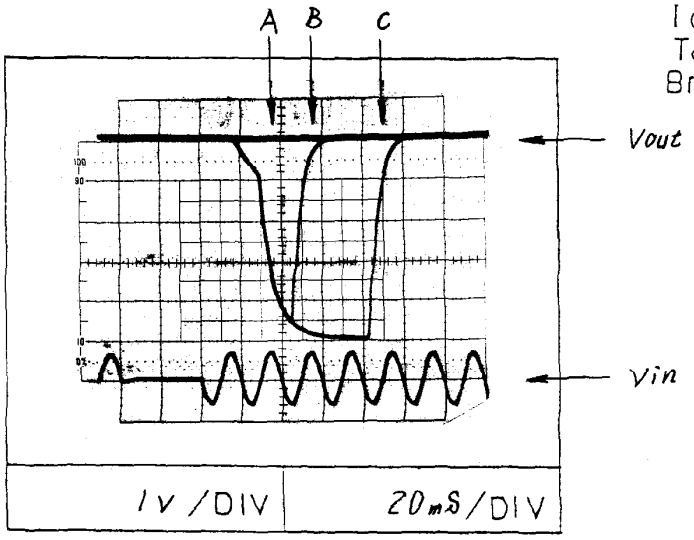
100mV / DIV	0.2 mS / DIV
+ 0.42 %	− 0.33 %

Response to brown out

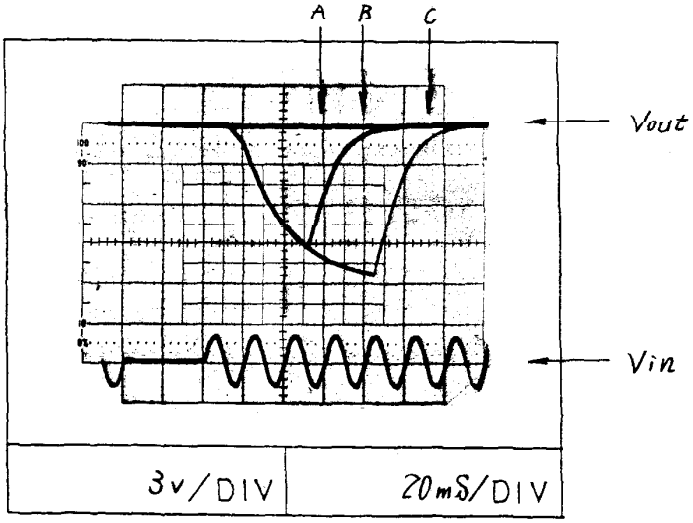
MS-11

Conditions Vin : AC 100v
Iout: 100%
Ta : 25°C
Brow out time
A : 40ms
B : 70ms
C : 100ms

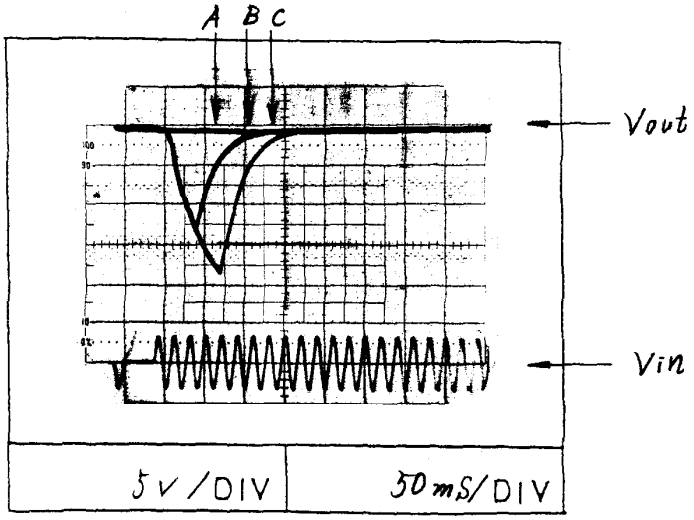
5 V



12 V



24 V

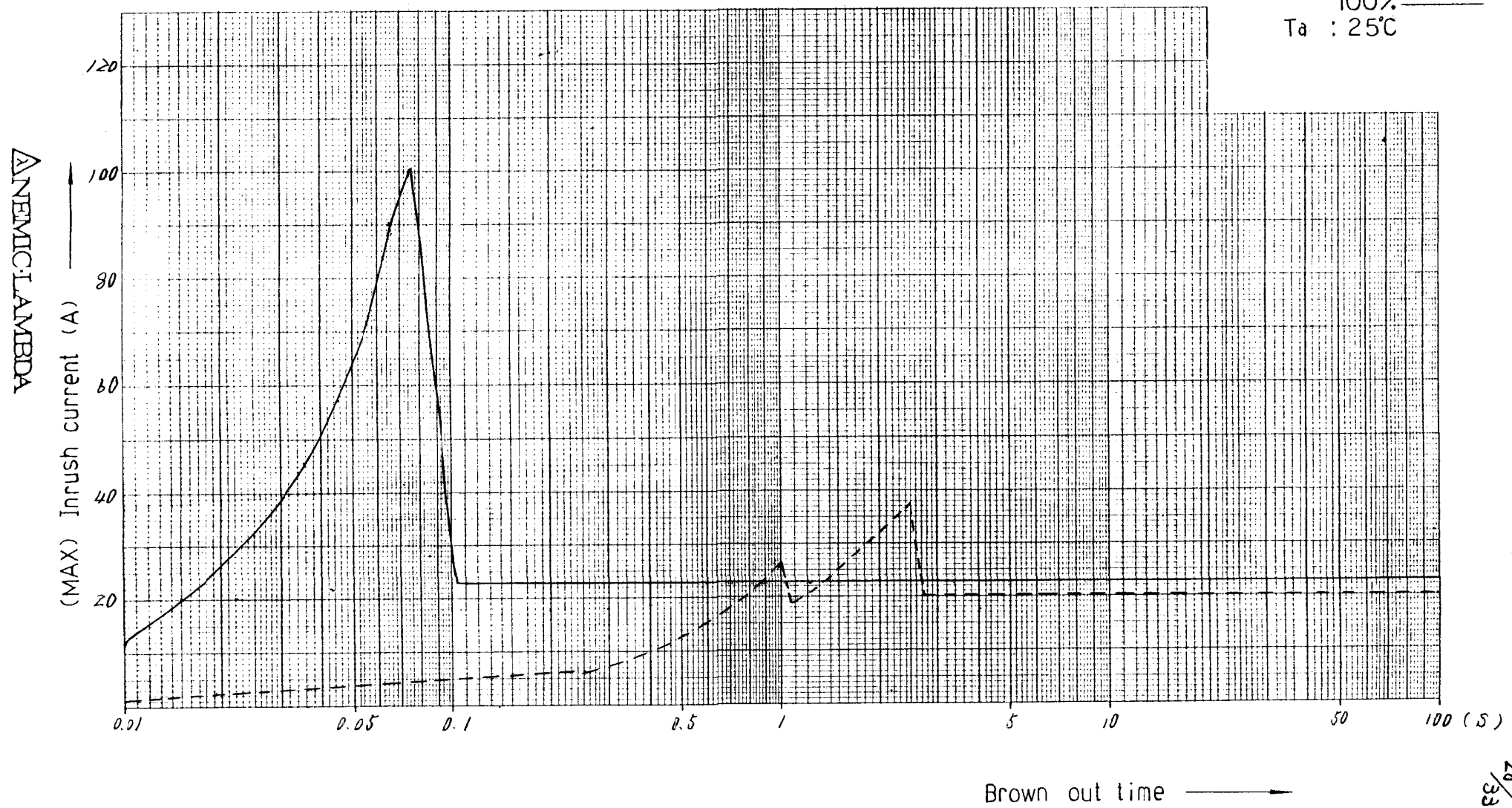


Inrush current characteristics

MS - 11

5 V .

Conditions Vin :AC 100 v
Iout : 0%------
100%——
Ta : 25℃



Inrush current wavefome

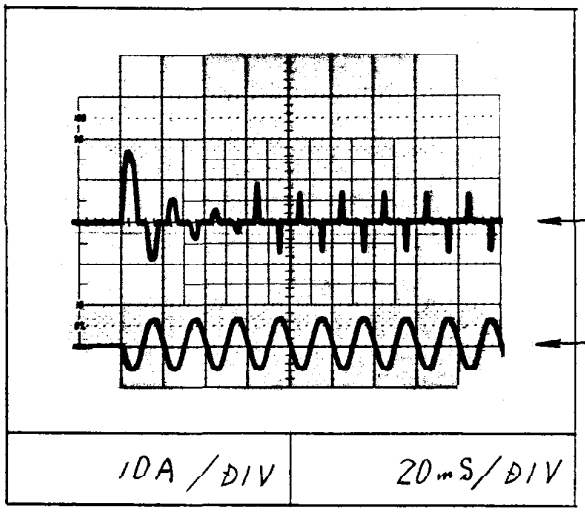
MS-11

Conditions Vin : AC100 v
Iout : 100 %
Ta : 25 ℃

5 v

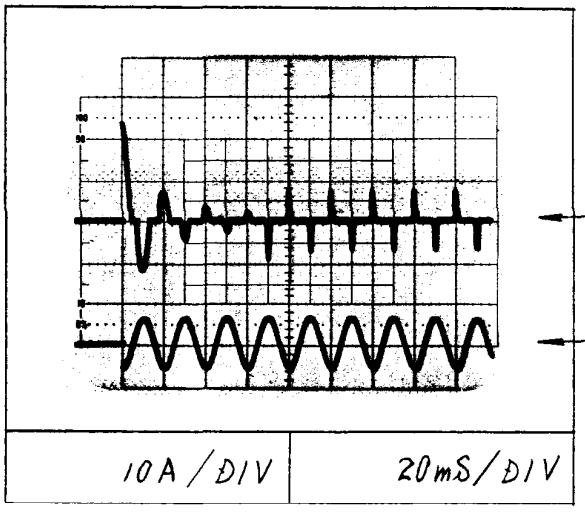
Switch in phase angle
of input AC voltage

$\phi = 0°$



Switch in phase angle
of input AC voltage

$\phi = 90°$

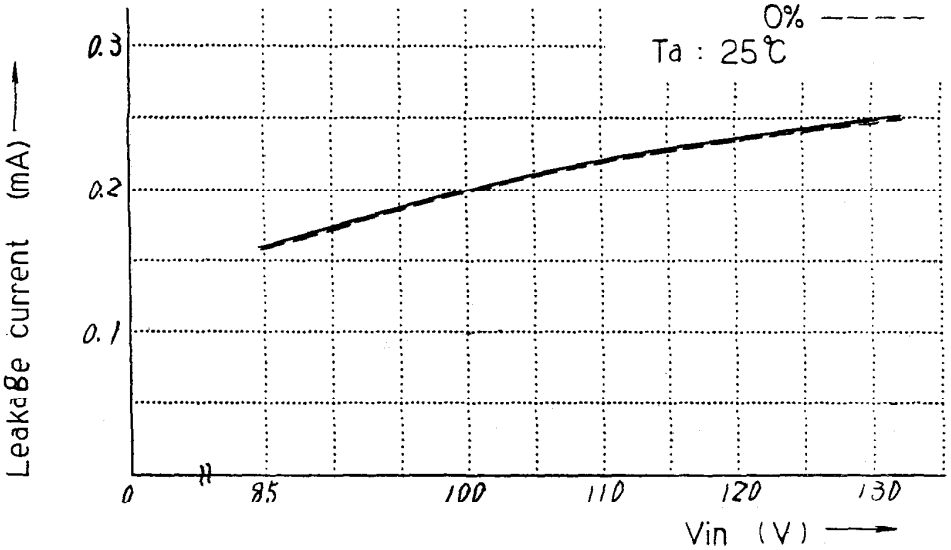


MS-11

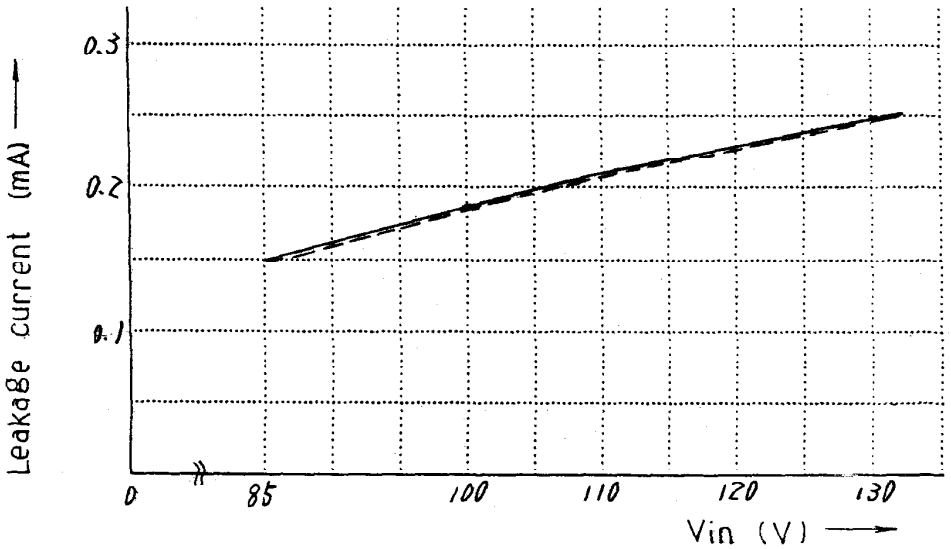
Leakage current

Conditions FG – ACG SHORT
Vin : (AC) or DC
Iout : 100% ——
0% - - - -
Ta : 25℃

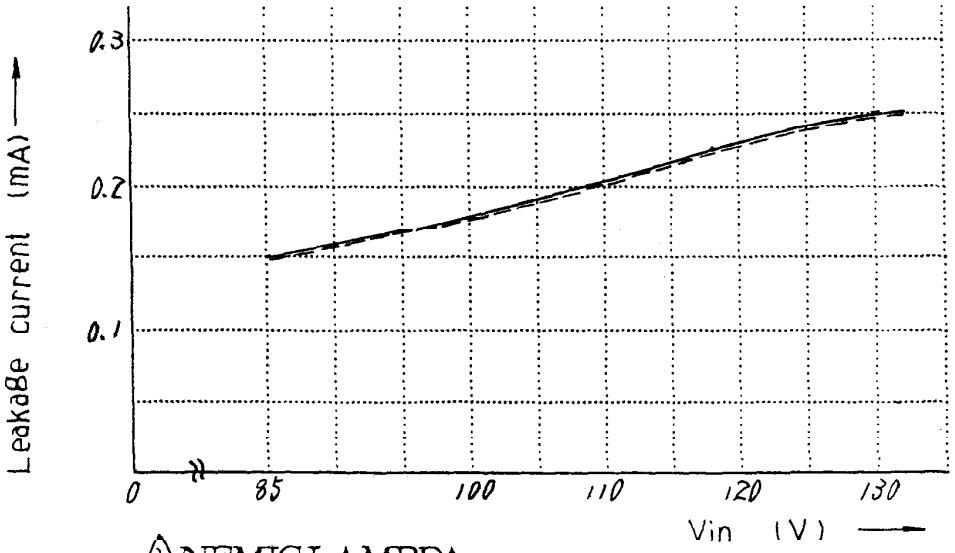
5 V



12 V



24 V

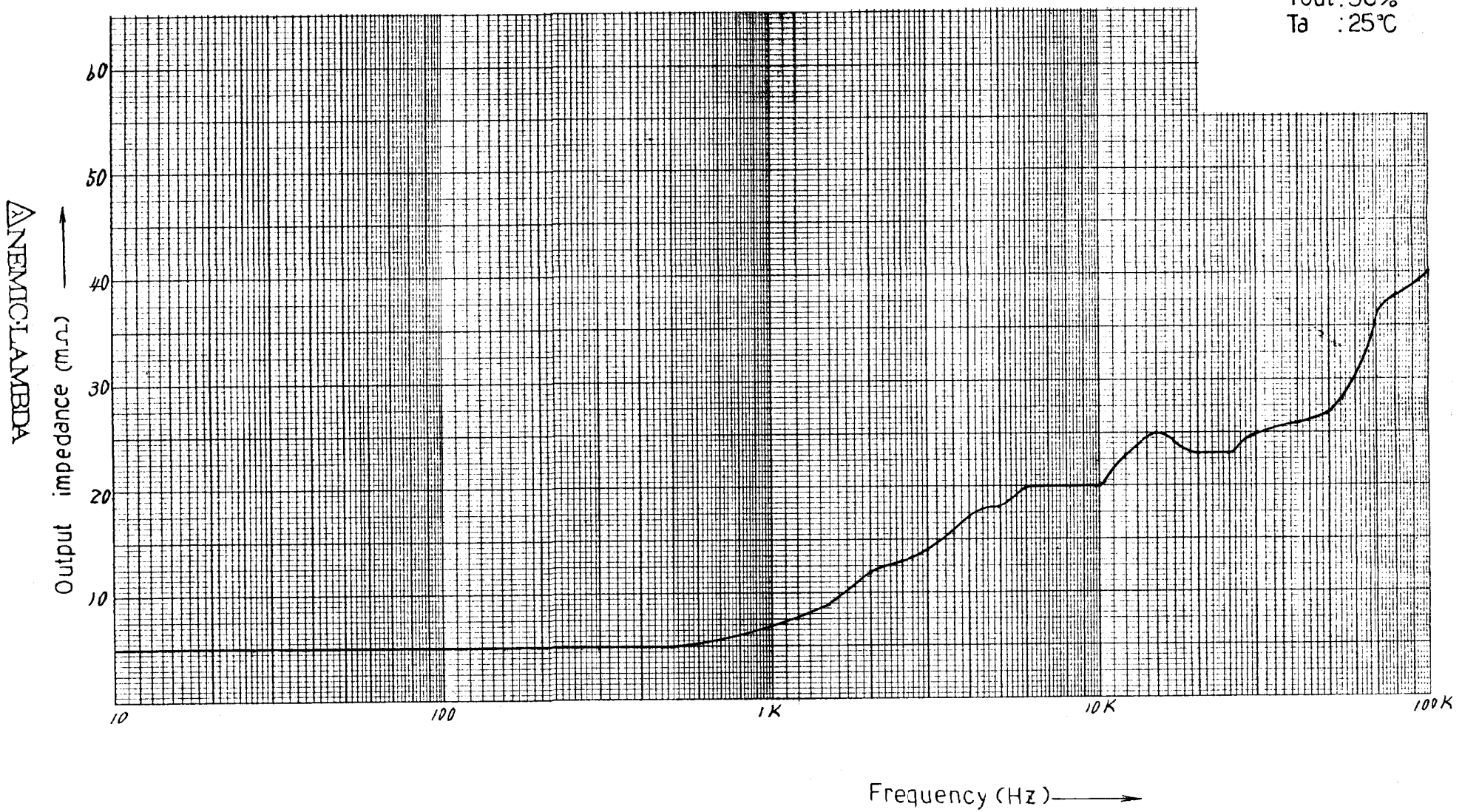


MS-11

Output impedance — Frequency

5 V

Conditions Vin : AC100V
Iout : 50%
Ta : 25°C

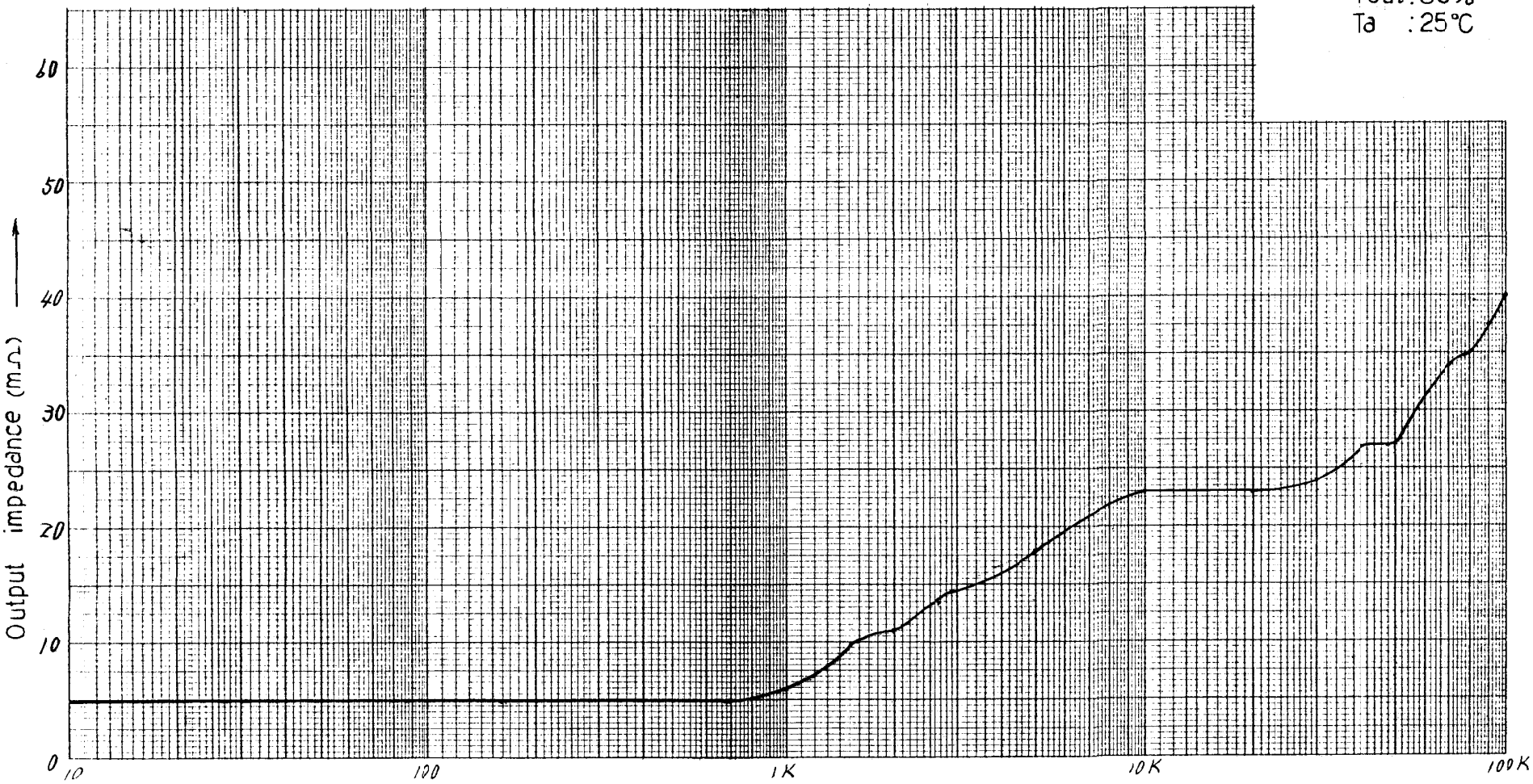


MS-11

Output impedance — Frequency

12 V

Conditions Vin : AC100V
Iout : 50%
Ta : 25°C



NEMIC-LAMBDA

MS-11

Output impedance — Frequency

24 V

Conditions Vin : AC100V
Iout : 50%
Ta : 25°C