

MS - 12

TEST DATA

QUALITY

DRAWING No. A009-53-01		
DRAWN BY	CHECKED BY	APPROVED BY
八鳥 60.7.29	近藤 60.7.30	天代 60.8.3

 NEMIC·LAMBDA

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Terminology used

Definition

V_{in} ----- Input voltage

V_{out} ----- Output voltage

I_{in} ----- Input current

I_{out} ----- Output current

T_a ----- Temperature

MS-12

SPECIFICATIONS

A009-01-01A

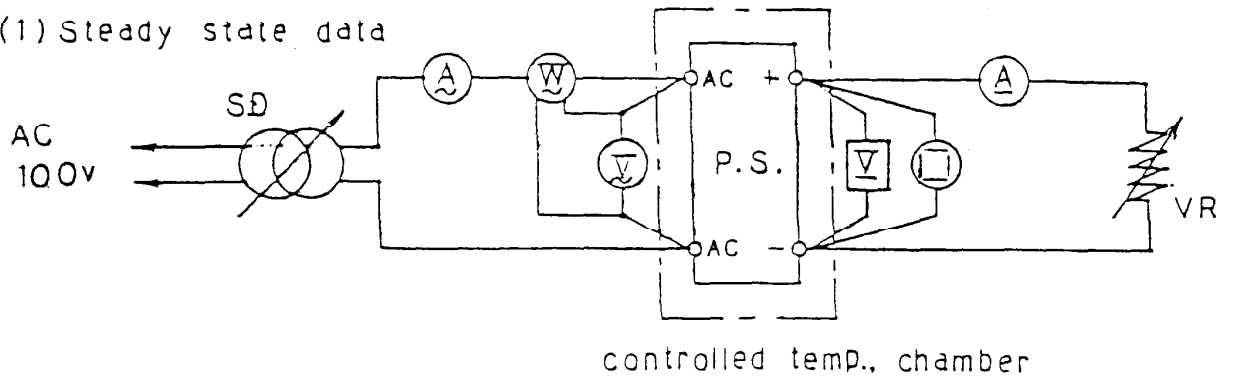
Items	Model	MS-12												
		-2	-5	6	9	-12	-15	-18	-24	-28	-48			
1	Nominal Output Voltage	V	2	5	6	9	12	15	18	24	28	48		
2	Maximum Output Current	A	30	30	26	18	15	12	10	7.5	6.5	3.8		
3	Maximum Output Power	W	60	150	156	162	180	180	180	180	182	182		
4	Efficiency (Typ) (*1)	%	69	78	78	78	81	81	83	84	85	85		
5	Input Voltage Range (*9)	-	85-132VAC (47-440Hz) or 90-165VDC											
6	Input Current (Typ) (*1)	A	1.4	3.2	3.2	3.4	3.5	3.5	3.5	3.5	3.5	3.5		
7	In-rush Current (Typ) (*2)	-	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	33.0	33.0	28.6	19.8	16.5	13.0	11.0	8.3	7.2	4.2		
			-39.0	-39.0	-33.8	-23.4	-19.5	-15.7	-13.0	-9.8	-8.5	-5.0		
13	Over Voltage Protection (*6)	V	2.7	5.75	6.9	10.5	14.0	17.5	21.0	28.0	32.7	56.2		
			-2.9	-6.25	-7.5	-11.2	-15.0	-18.7	-22.5	-30.0	-35.0	-60.0		
14	Hold-Up Time (*7)	-	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)	°C	-10 ~ +71											
20	Operating Humidity	-	30% ~ 90% RH											
21	Storage Temperature	°C	-30 ~ +85											
22	Storage Humidity	-	10% ~ 95% RH											
23	Cooling	-	Convection cooled											
24	Temperature Coefficient	-	Less than 1% at -10°C ~ +71°C											
25	Withstand Voltage	-	Input-Output, Input-Chassis...2.0kVAC Imin (20mA)											
26	Isolation Resistance	-	More than 100MΩ at 25°C and 70%RH Output-Chassis...500VDC											
27	Vibration	-	Less than 11.6m/s ²											
28	Shock	-	Less than 196.1m/s ²											
29	Weight	-	1600g											
30	Size	-	Refer to Outline Drawing											

NOTES

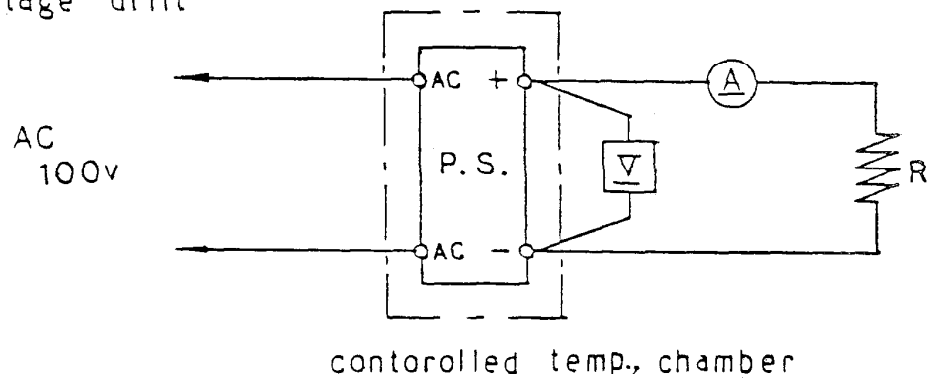
- *1 : At 100VAC & maximum output power.
- *2 : When resuming operation in less than 10 sec after power failure at no load, softstart circuit will not limit the in-rush current at turn-on.
- *3 : From 85-132VAC or 90-165VDC, constant load.
- *4 : From No load ~ Full load, constant input voltage.
- *5 : Constant current limiting with automatic recovery.
- *6 : Inverter shut-down method, manual reset.
- *7 : At 100VAC input, and output power of 150 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 temperature
-10°C... 60% , 60°C...70%
0-50°C...100% , 71°C...50% (61°C-71°C Forced air cooling)
 - ii) With respect to input voltage
85-132VAC or 110-165VDC...100%
90-110VDC... 80%

Circuits used for determination

(1) Steady state data



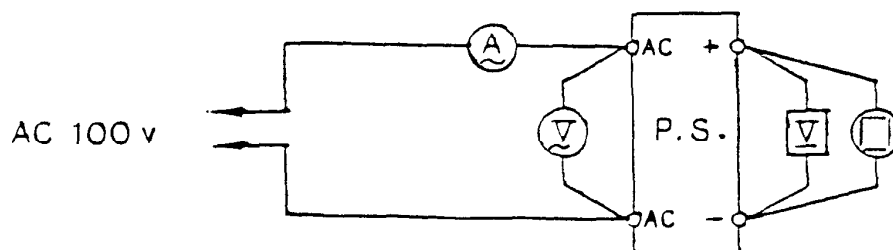
(2) Warm up voltage drift



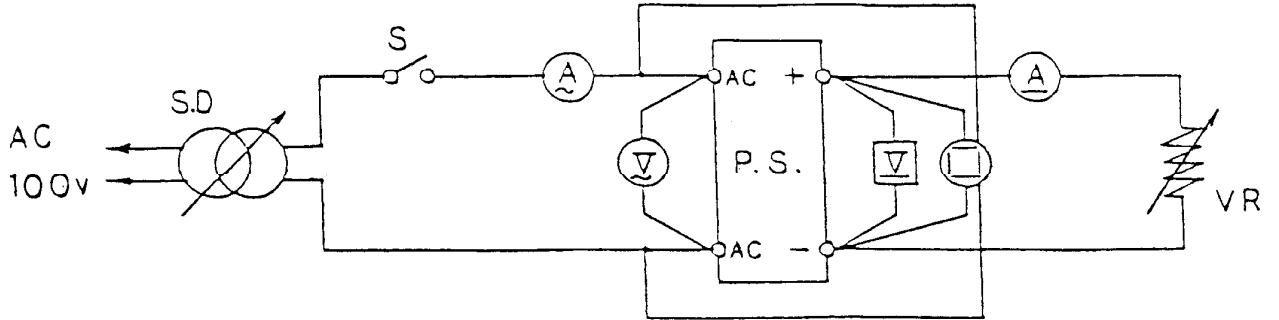
(3) Over current protection (o.c.p) characteristics

Same as steady state data.

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



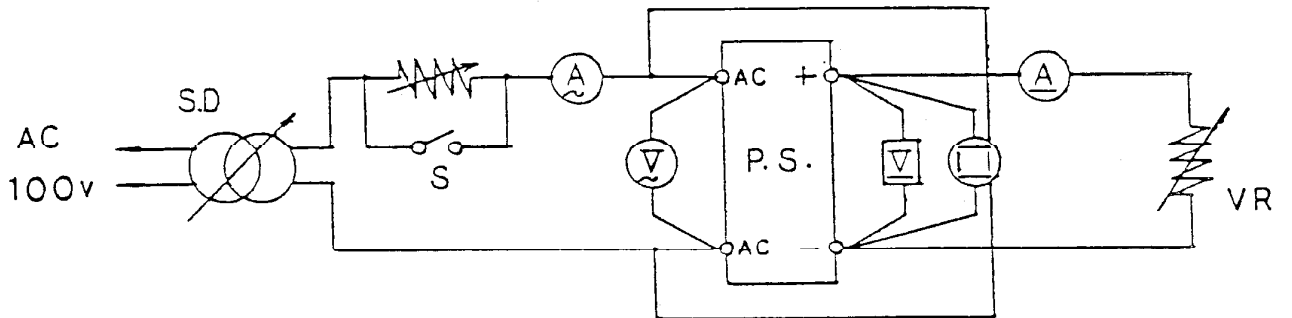
(5) Output rise characteristics



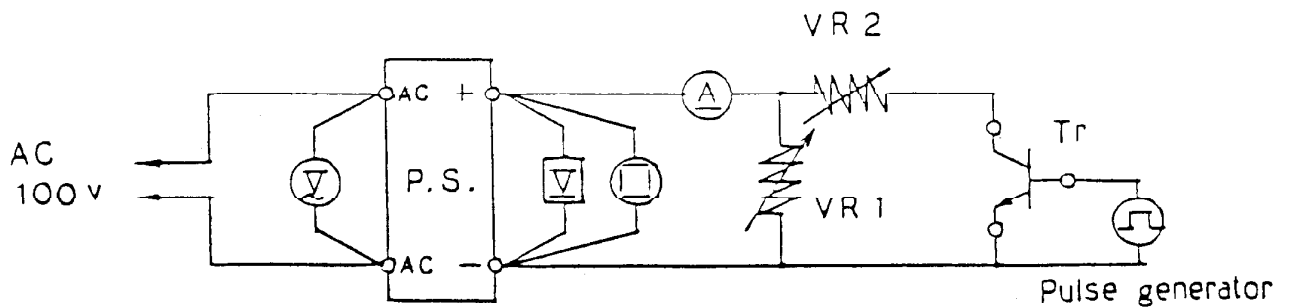
(6) Output fall characteristics

Same as output rise characteristics.

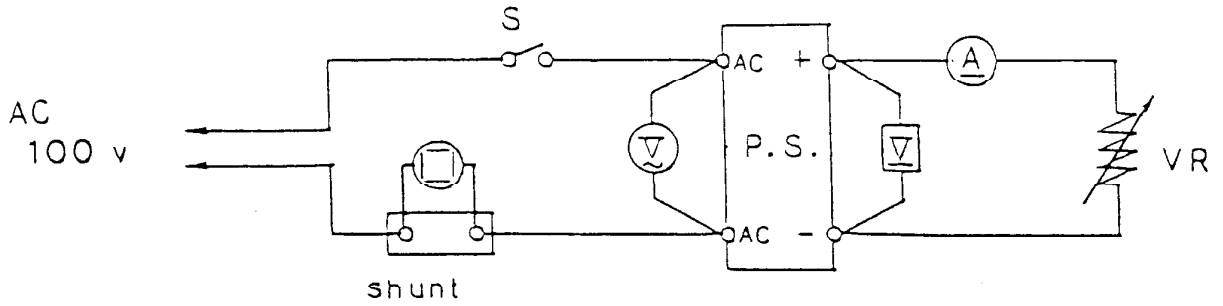
(7) Dynamic line response



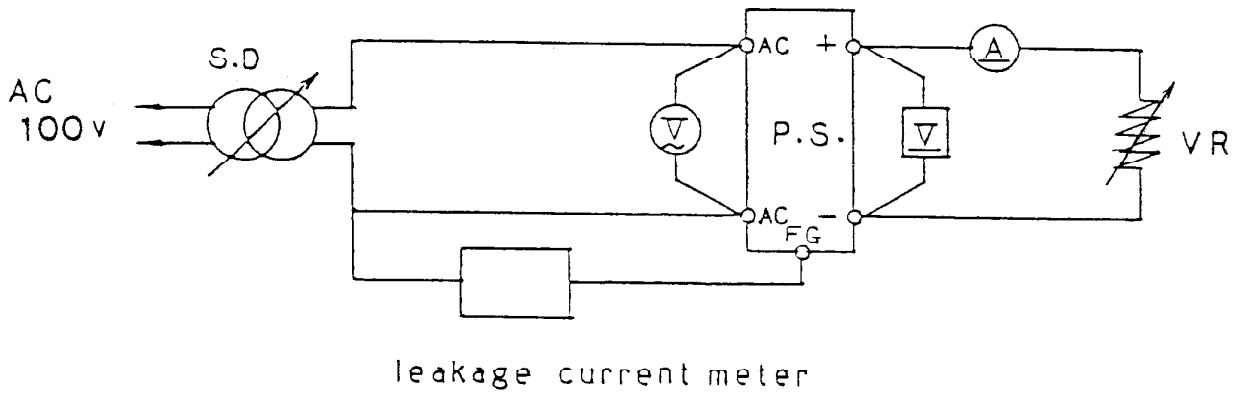
(8) Dynamic load response



(9) Inrush current characteristics

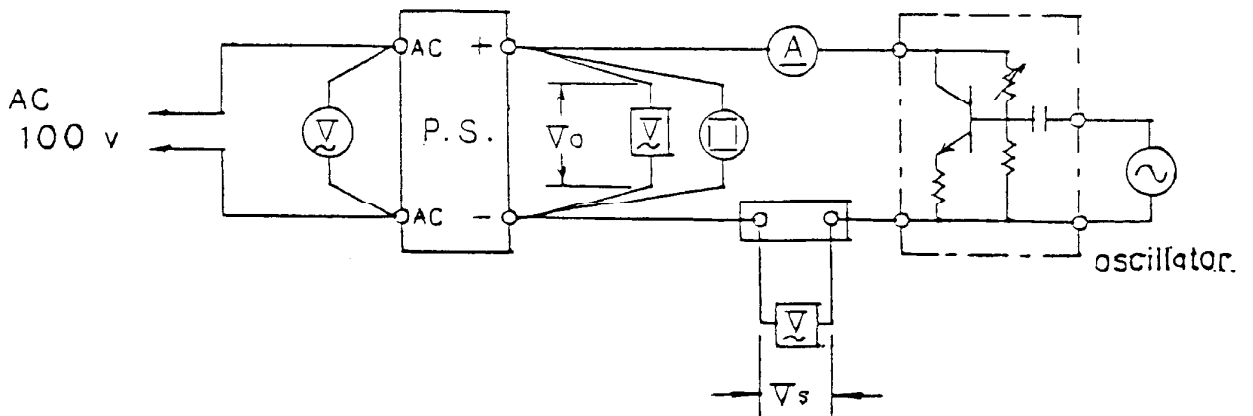


(10) Leakage current



- Note : ·Leakage current measured through a 1kΩ resistor.
- Range wed — AC + DC

(11) Output impedance



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

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.,	$44/_{11\Omega}$, $24/_{06\Omega}$
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	TABA I	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			

Regulation - line and load , temp. drift

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5 v

1. Regulation - line and load

Condition Ta : 25°C

Iout \ Vin	AC 85 v	AC 100 v	AC 132 v	line regulation	
0 %	5.020 v	5.020 v	5.020 v	0 mv	0 %
50 %	5.016 v	5.016 v	5.016 v	0 mv	0 %
100 %	5.013 v	5.013 v	5.013 v	0 mv	0 %
load regulation	7 mv	7 mv	7 mv		
	0.14 %	0.14 %	0.14 %		

2. Temperature drift

Conditions Vin : AC100 v
Iout : 100%

Ta	0 °C	25 °C	50 °C	Temp.stability	
Vout	4.989 v	5.013 v	5.020 v	31 mv	0.62 %

12 v

1. Regulation - line and load

Condition Ta : 25°C

Iout \ Vin	AC 85 v	AC 100 v	AC 132 v	line regulation	
0 %	12.022 v	12.022 v	12.022 v	0 mv	0 %
50 %	12.017 v	12.017 v	12.017 v	0 mv	0 %
100 %	12.013 v	12.014 v	12.014 v	1 mv	0.008 %
load regulation	9 mv	8 mv	8 mv		
	0.075 %	0.07 %	0.07 %		

2. Temperature drift

Conditions Vin : AC100 v
Iout : 100%

Ta	0 °C	25 °C	50 °C	Temp.stability	
Vout	11.958 v	12.014 v	12.031 v	73 mv	0.61 %

Regulation - line and load, temp. drift

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24 v

1. Regulation - line and load

Condition Ta : 25°C

Iout \ Vin	AC 85 v	AC 100 v	AC 132 v	line regulation	
0 %	24.09 v	24.09 v	24.09 v	0 mv	0 %
50 %	24.09 v	24.09 v	24.09 v	0 mv	0 %
100 %	24.09 v	24.09 v	24.09 v	0 mv	0 %
load regulation	0 mv	0 mv	0 mv		
	0 %	0 %	0 %		

2. Temperature drift

Conditions Vin : AC 100 v
Iout : 100 %

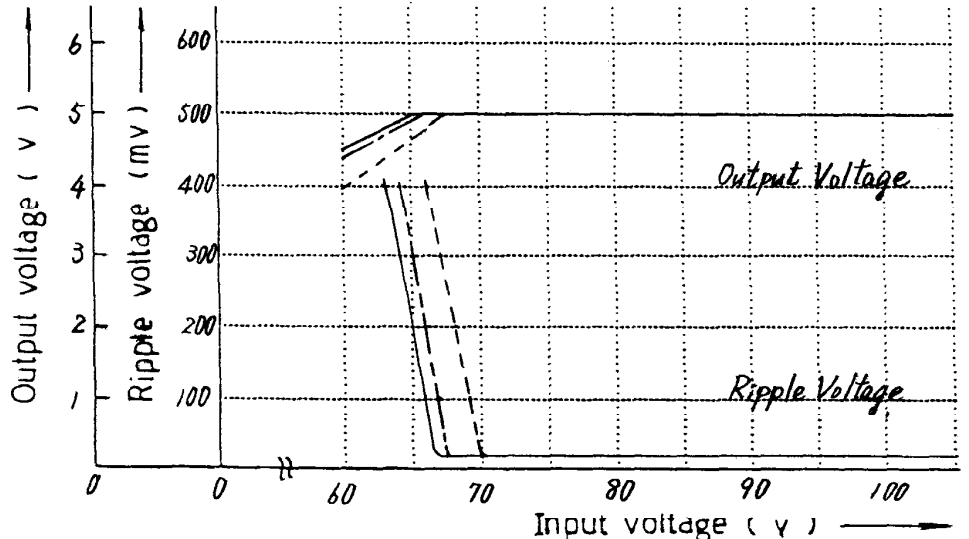
Ta	0 °C	25 °C	50 °C	Temp. stability	
Vout	23.96 v	24.09 v	24.10 v	140 mv	0.58 %

Output voltage and ripple voltage v.s. input voltage

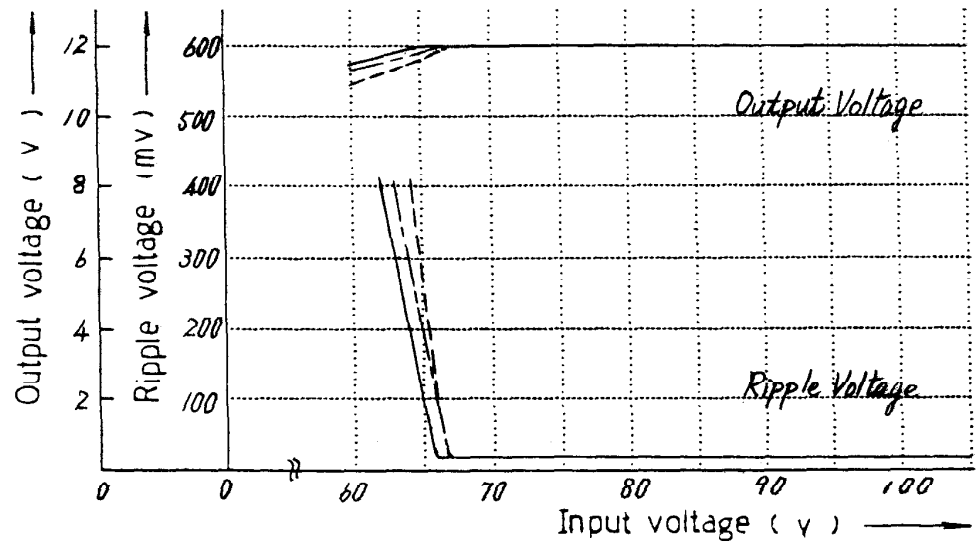
MS-12

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

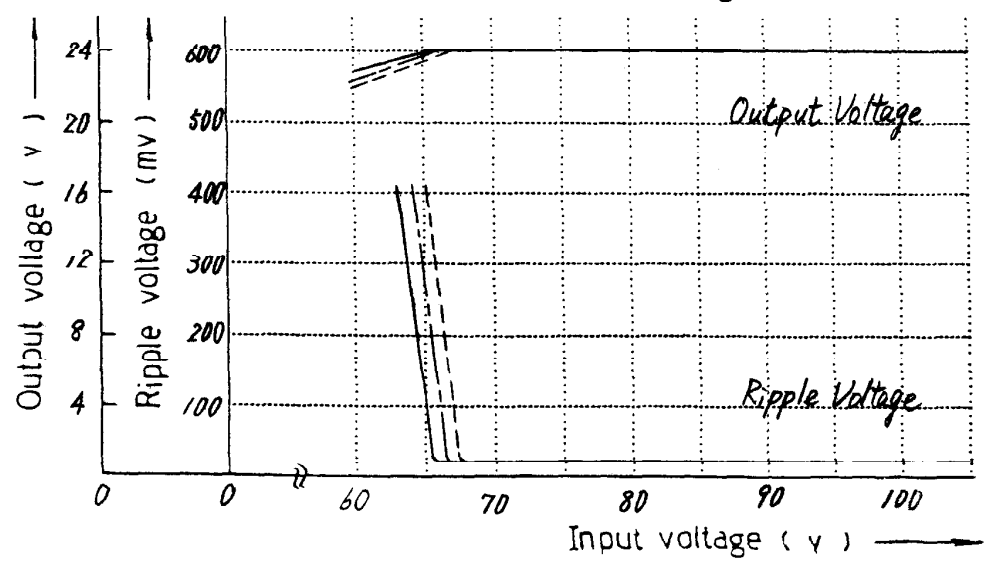
5 v



12 v



24 v



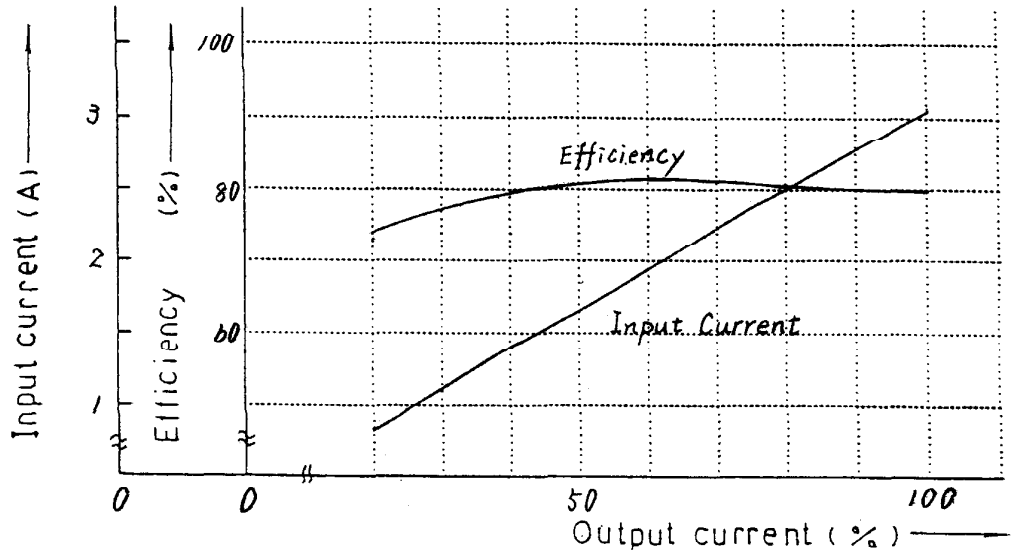
Efficiency and input current v.s. output current

MS-12

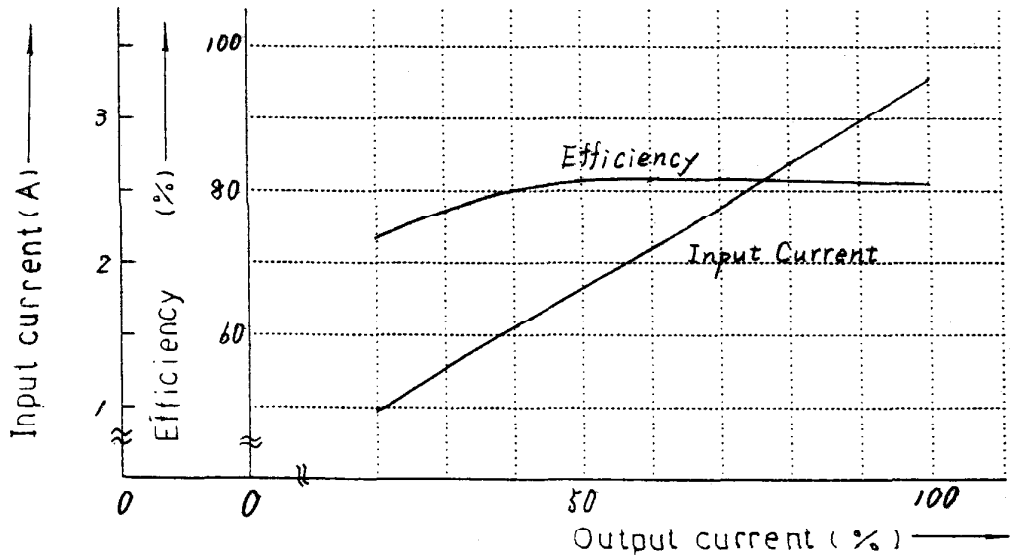
11/33

Conditions V_{in} : AC 100v
 T_a : 25°C

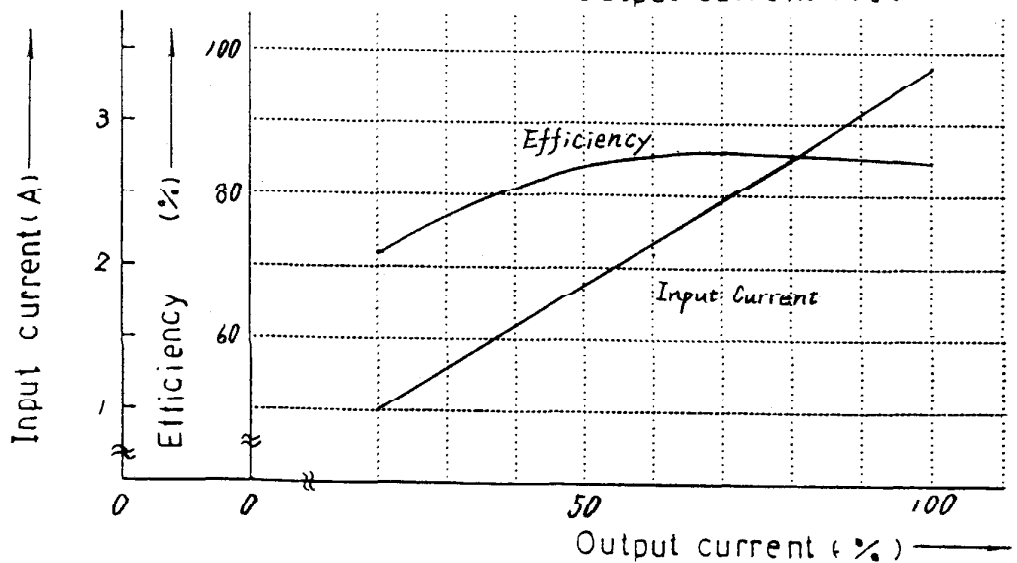
5 v



12 v



24 v

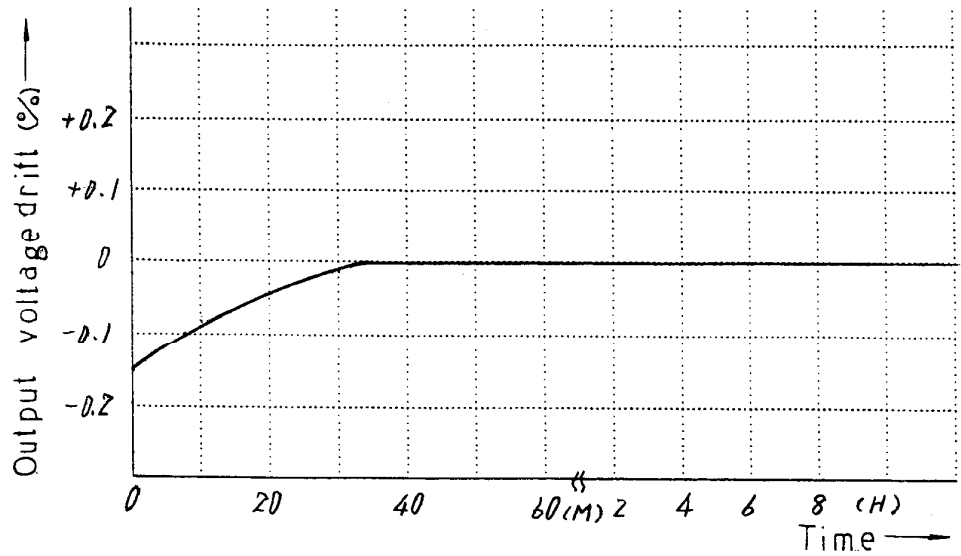


Warm up voltage drift

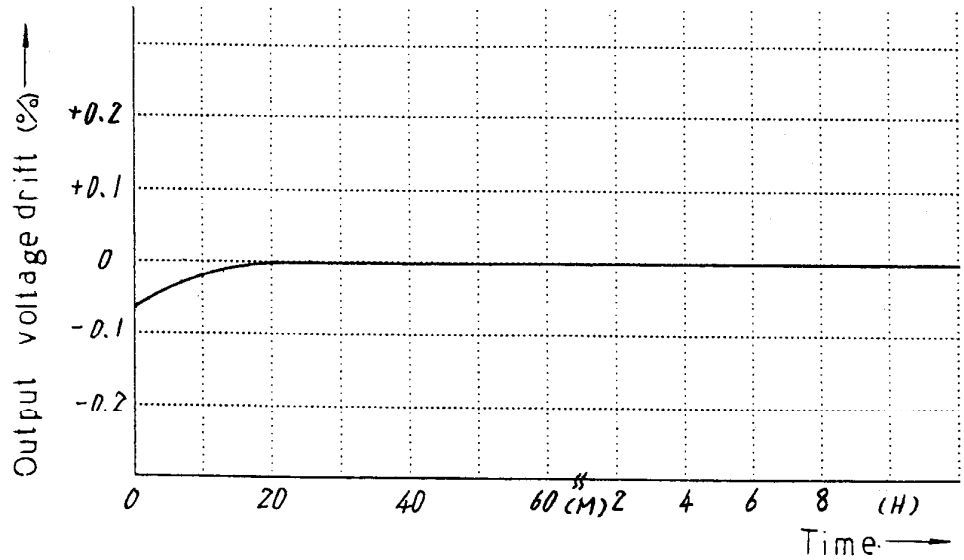
MS-12

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

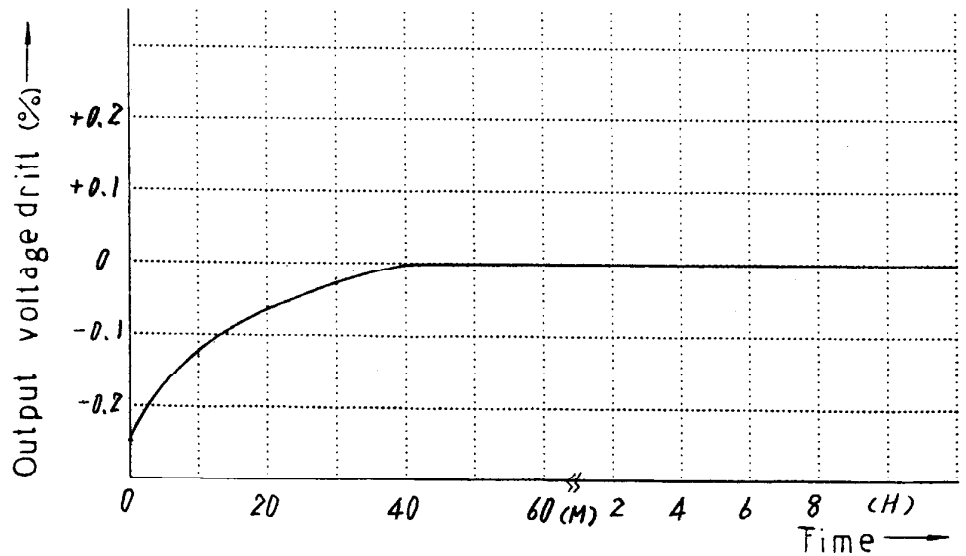
5v



12v



24v

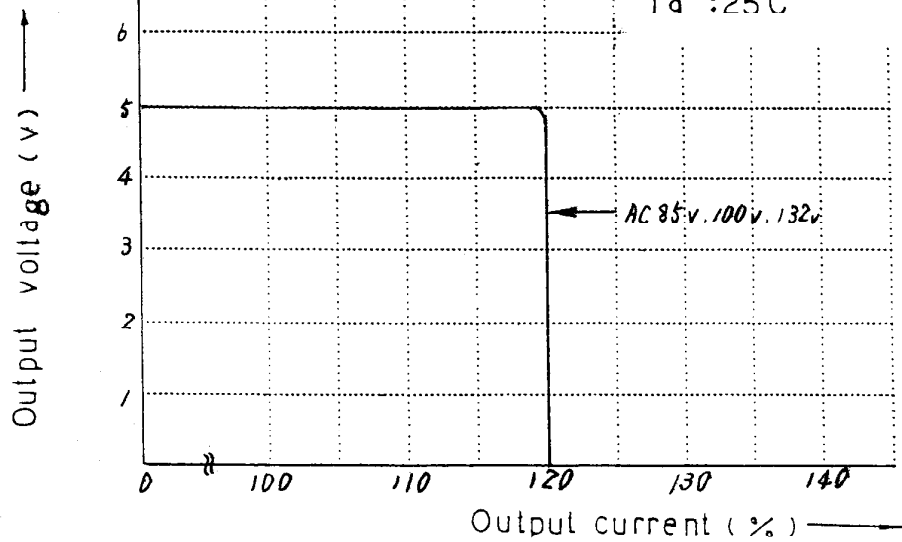


O.C.P characteristics

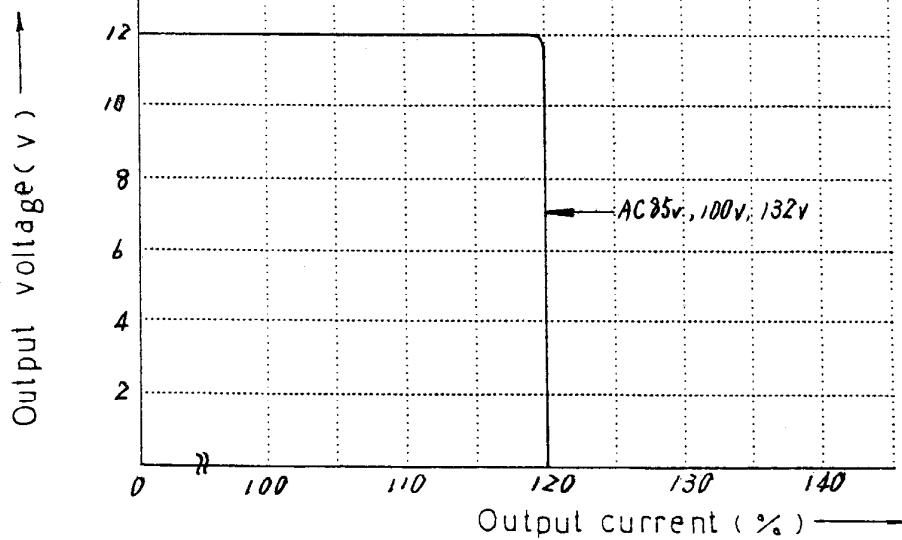
MS-12

Conditions Vin : AC 85v
AC100v
AC132v
Ta : 25°C

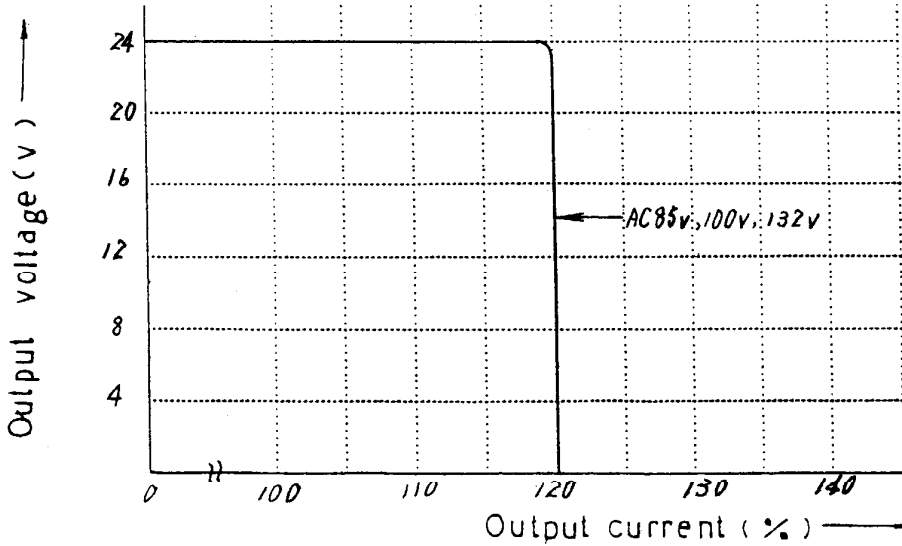
5 v



12 v



24 v

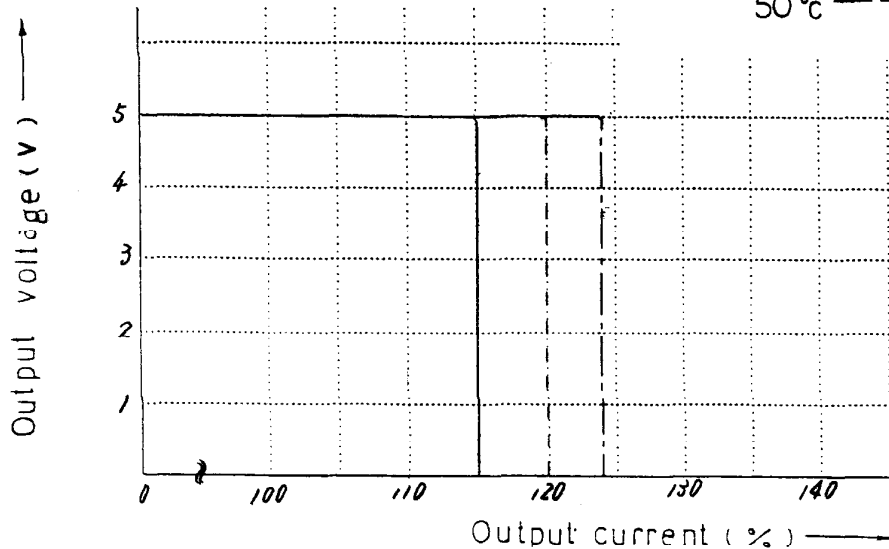


O.C.P characteristics

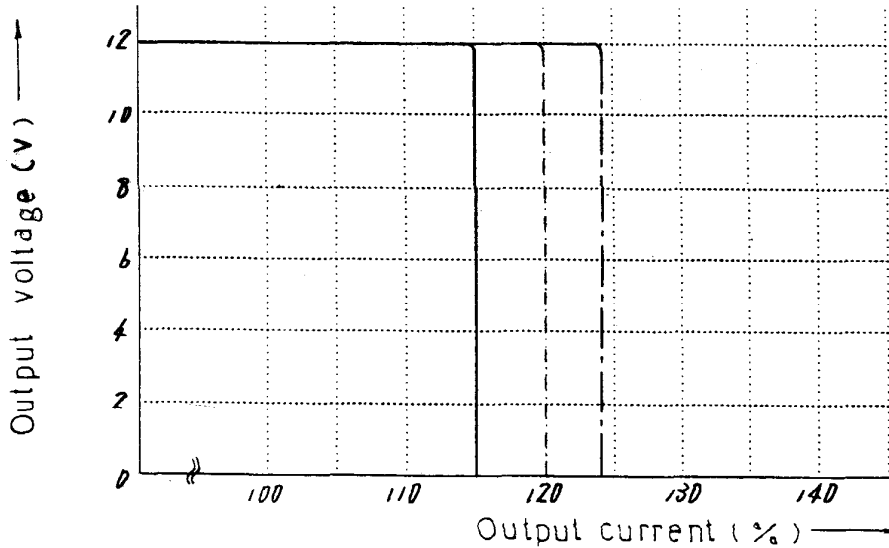
MS-12

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

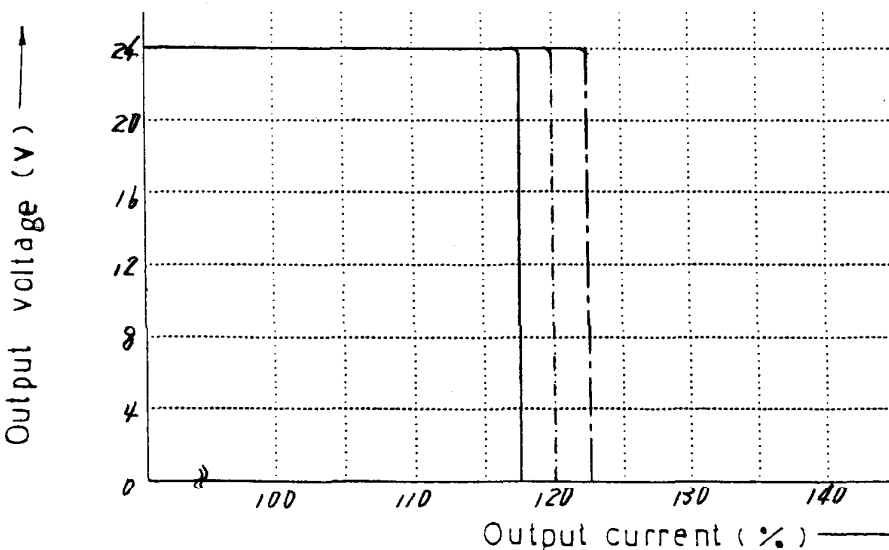
5v



12v



24v

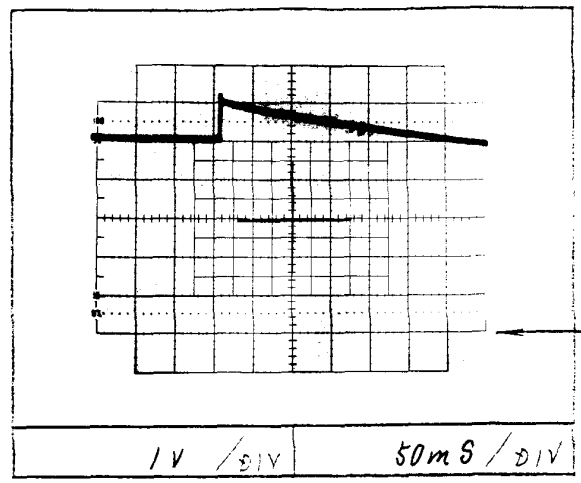


O.V.P. Characteristics

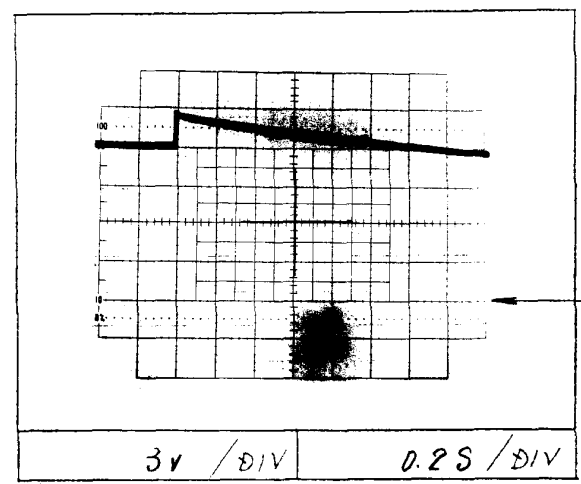
MS - 12

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

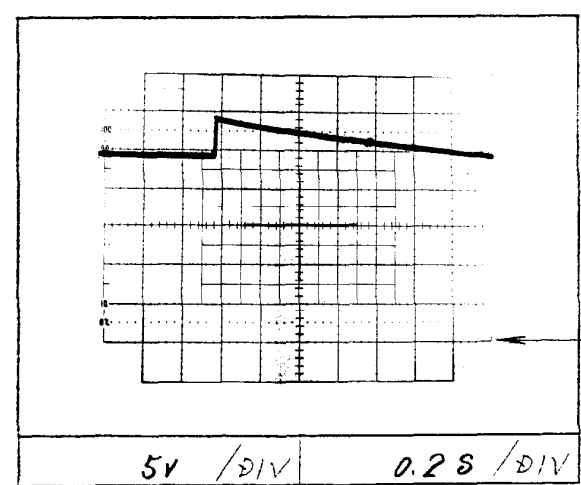
5v



12v



24v

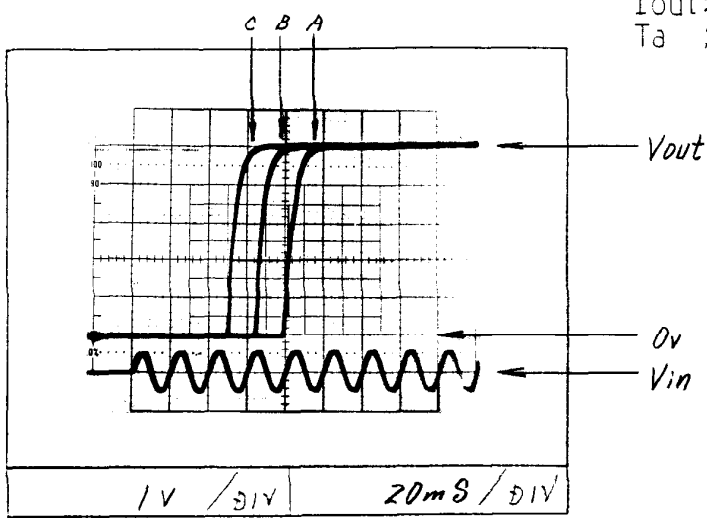


Output rise time

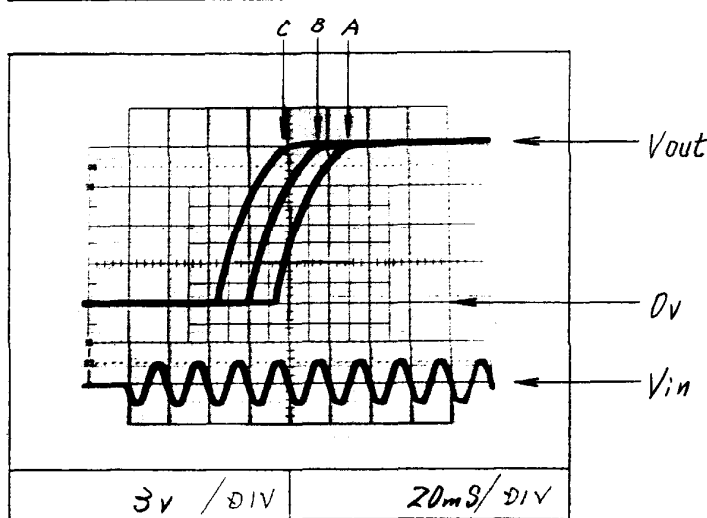
MS-12

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

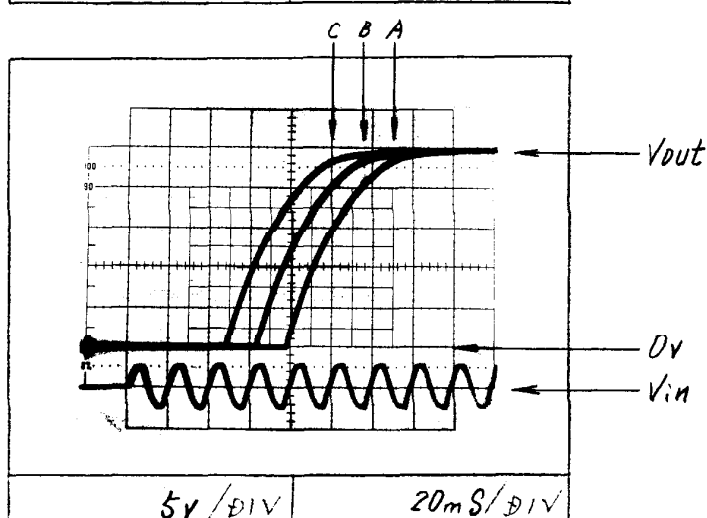
5v



12v



24v

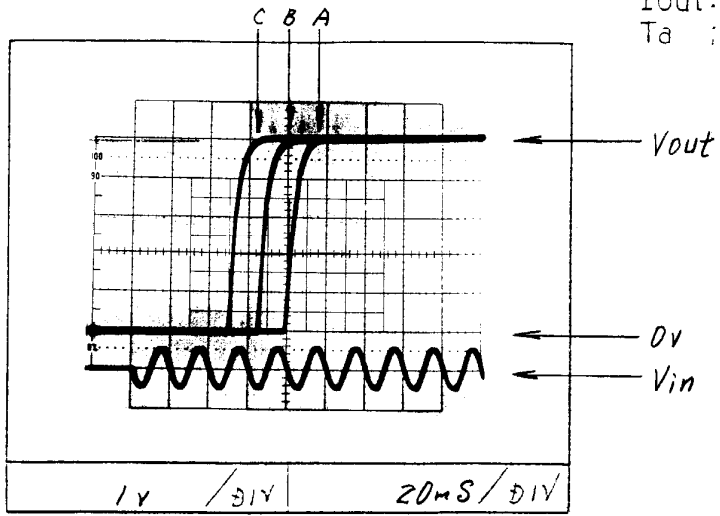


Output rise time

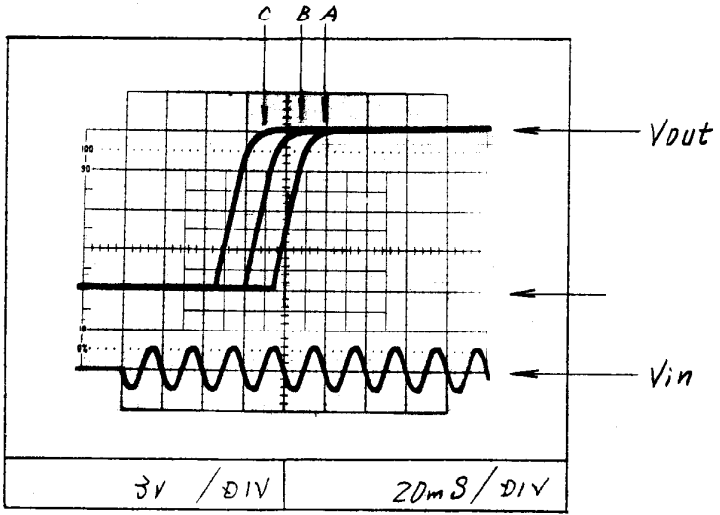
MS-12

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

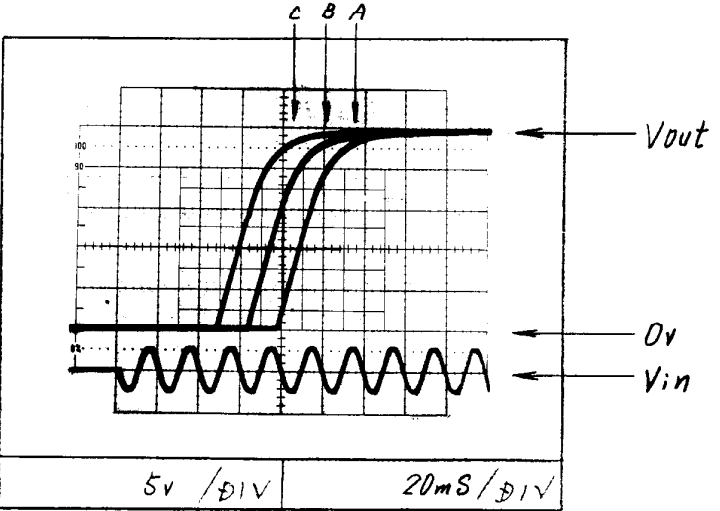
5v



12v



24v

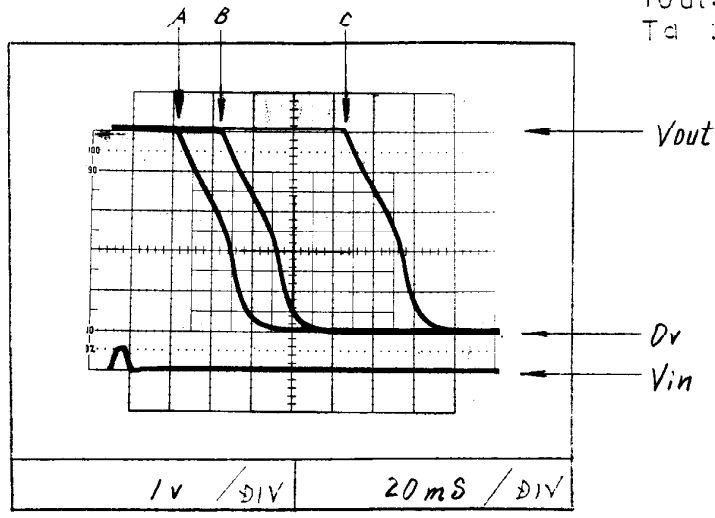


Output fall time

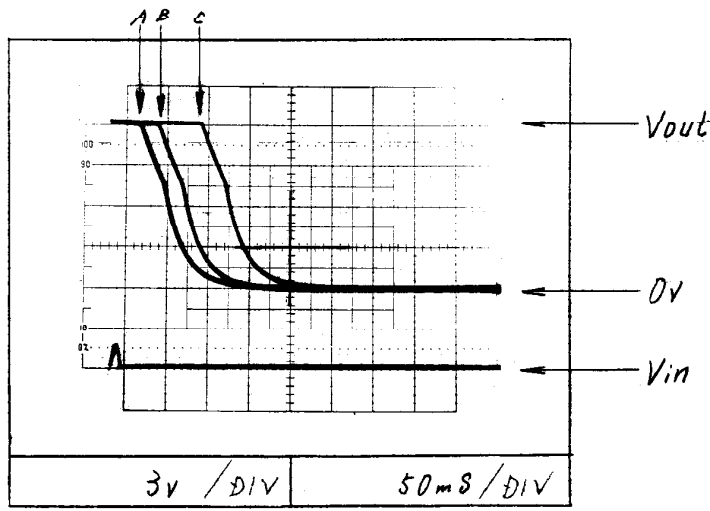
MS-12

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

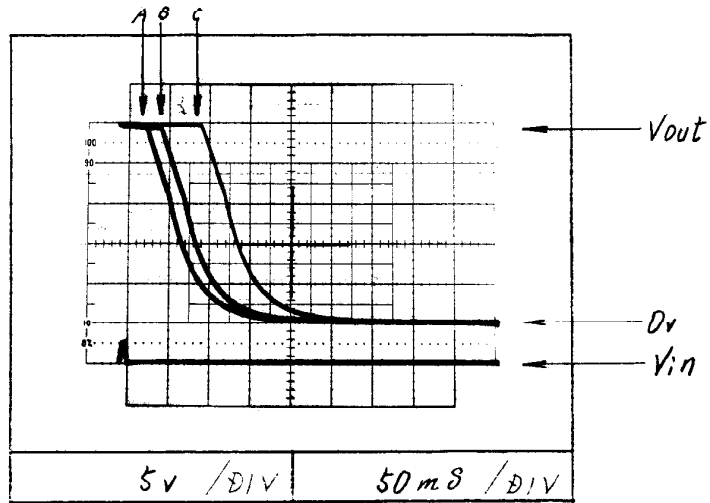
5v



12v



24v

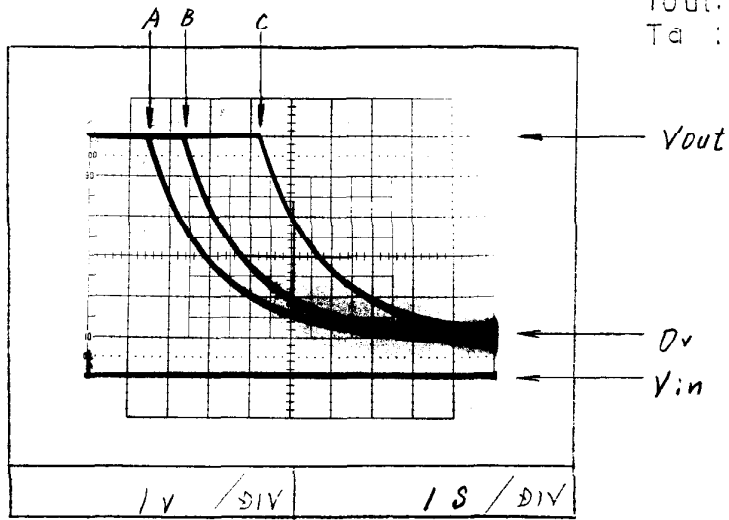


Output fall time

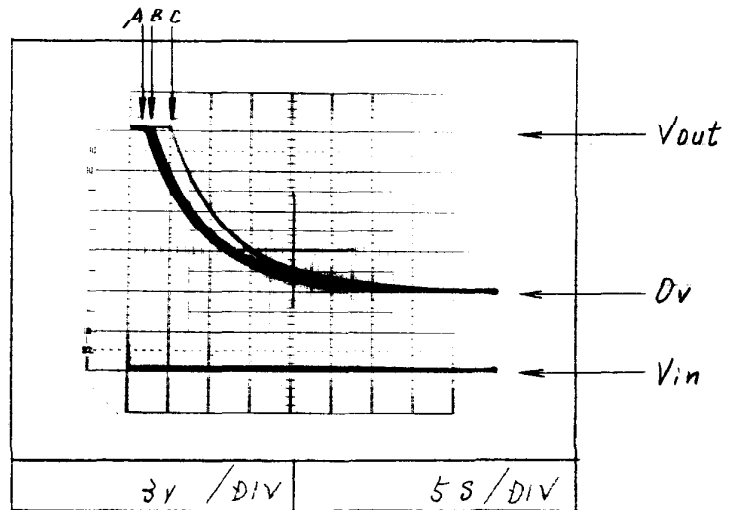
MS-12

Conditions V_{in} : A C 85v, 100v, 132v
B
 I_{out} : 0 %
 T_a : 25°C

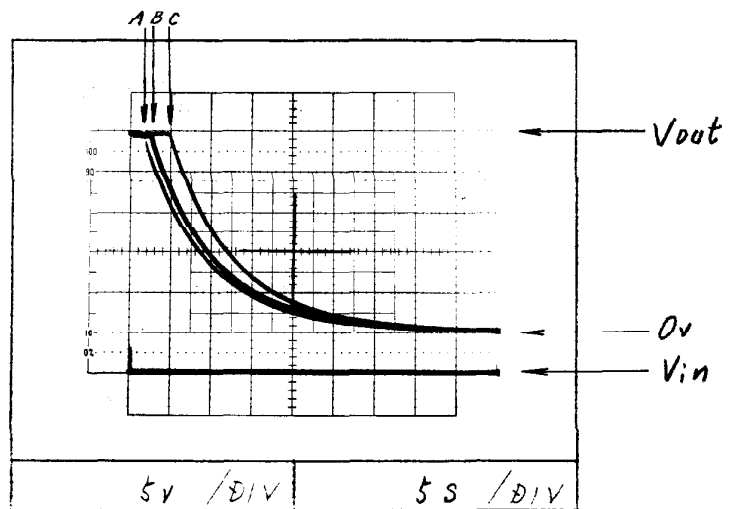
5v



12v



24v

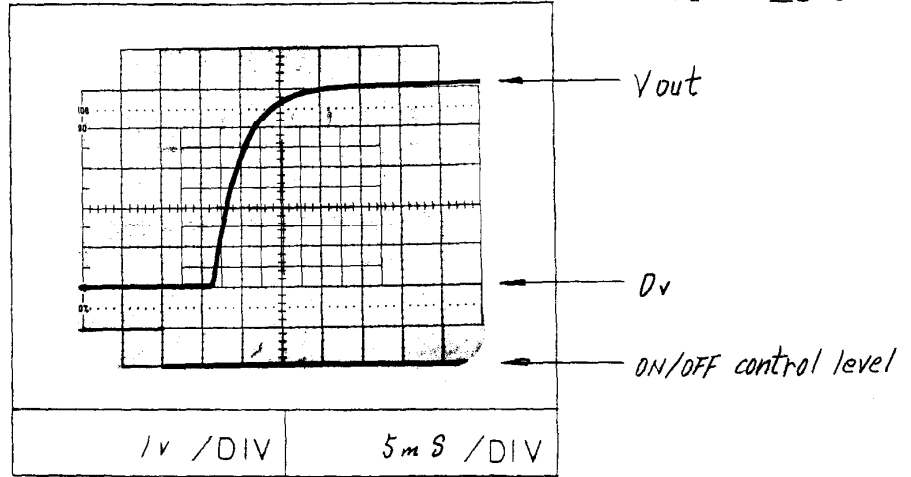


Output rise time with ON/OFF CONTROL

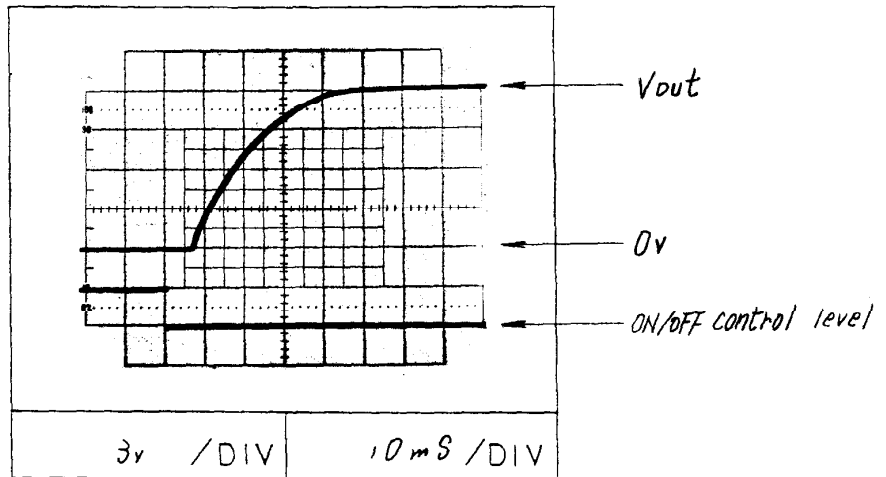
MS-12

Conditions V_{in} : AC100V
 I_{out} : 100 %
 T_a : 25°C

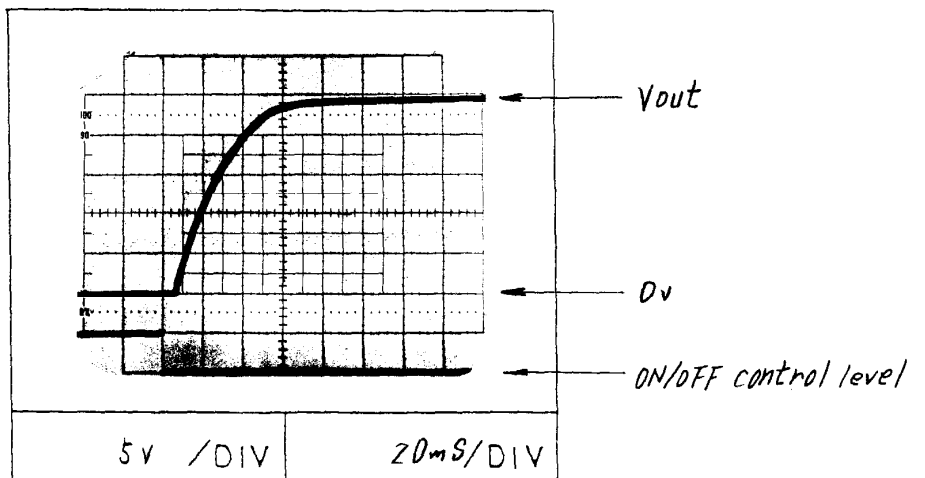
5V



12V



24V

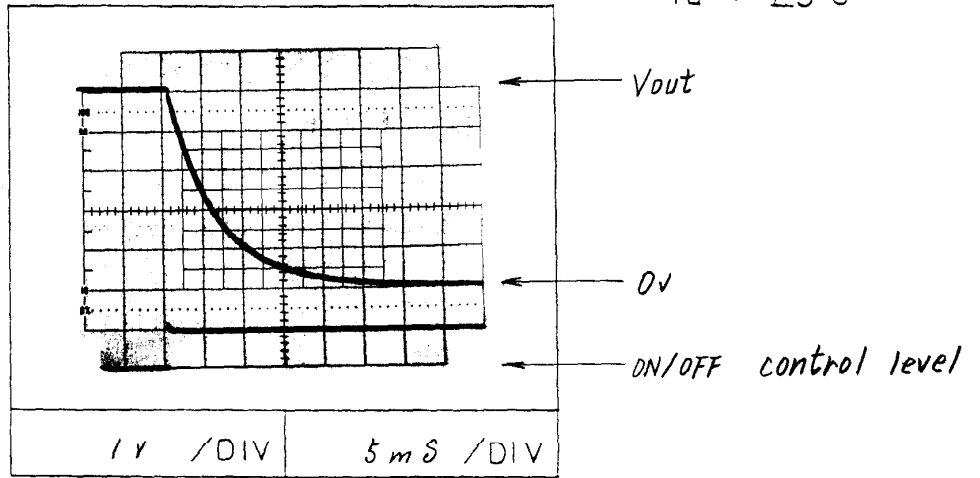


Output fall time with ON/OFF CONTROL

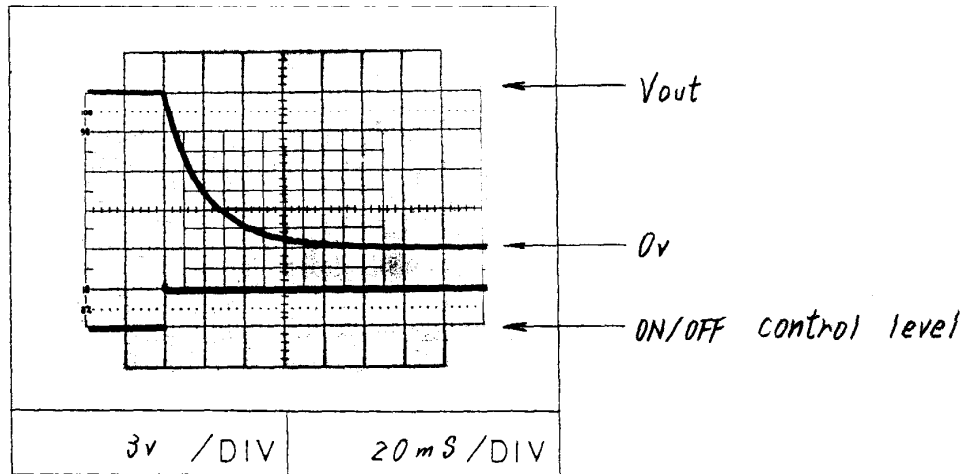
MS-12

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

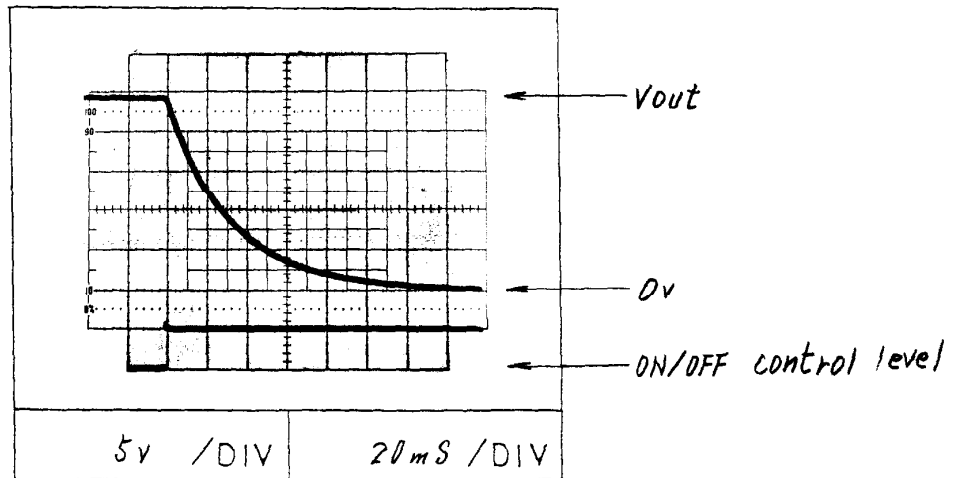
5v



12v



24v

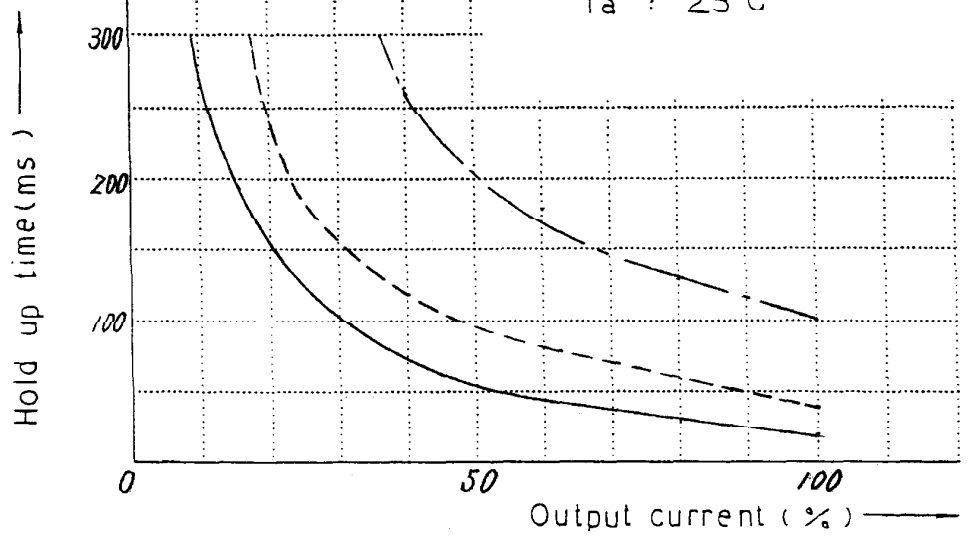


Hold up time

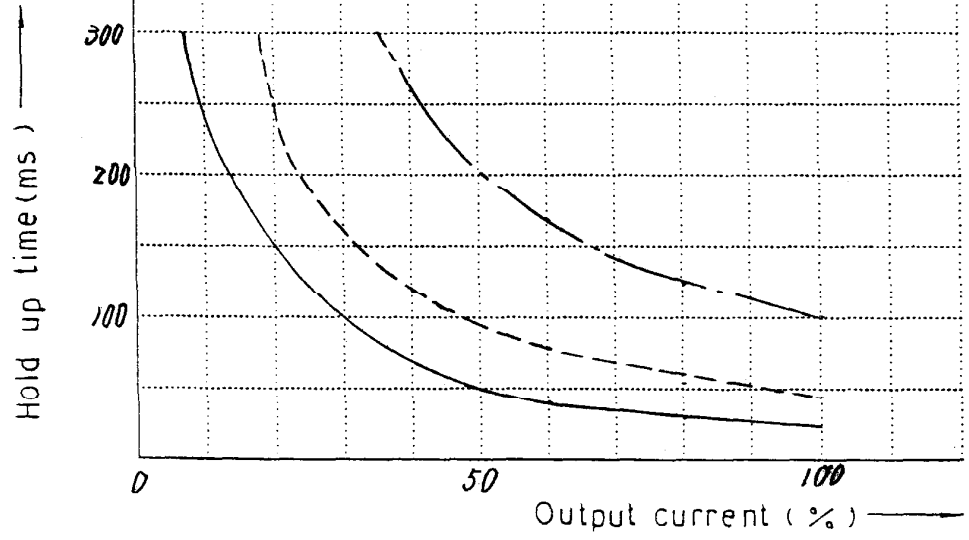
MS-12

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

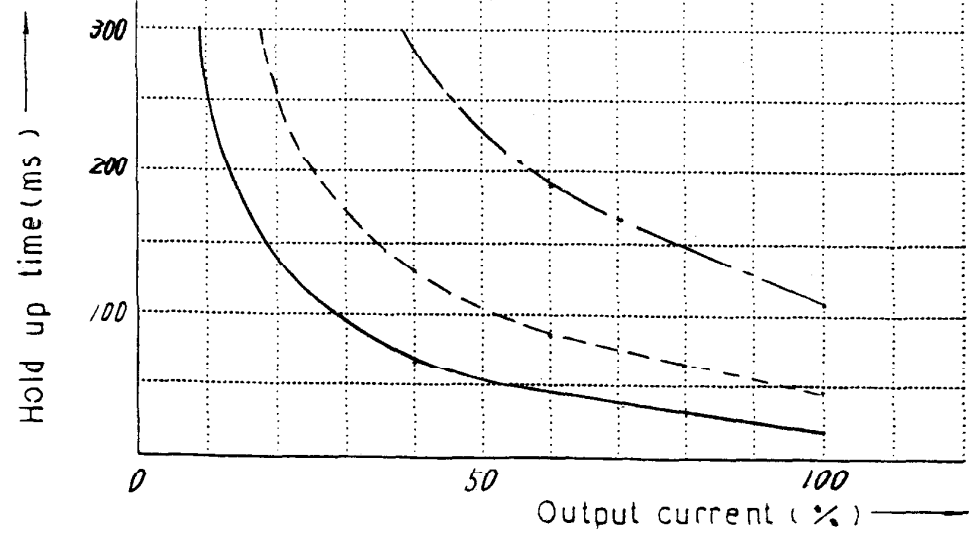
5v



12v



24v



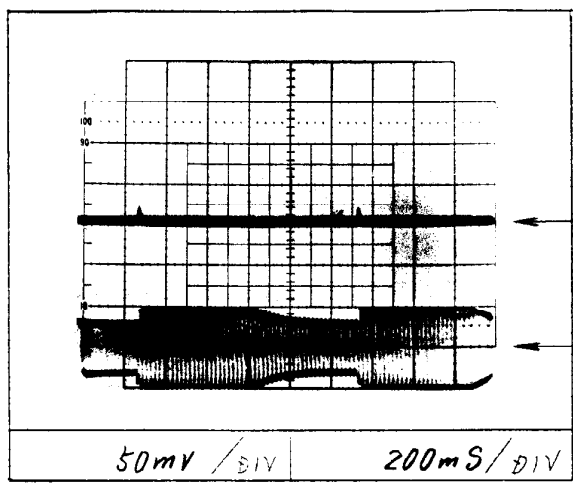
Dynamic line — Response

MS - 12

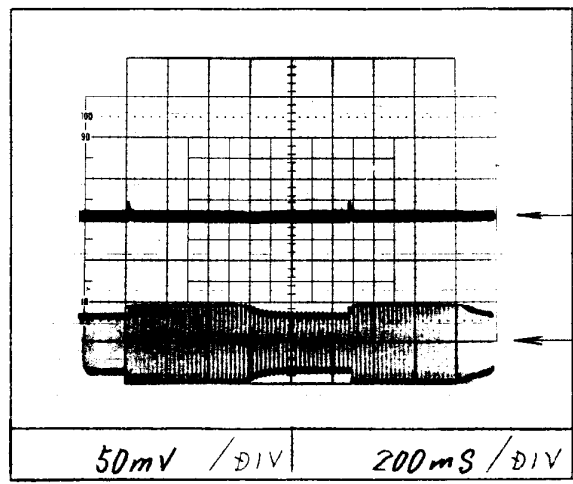
Vin : AC85v \rightleftharpoons AC132v

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

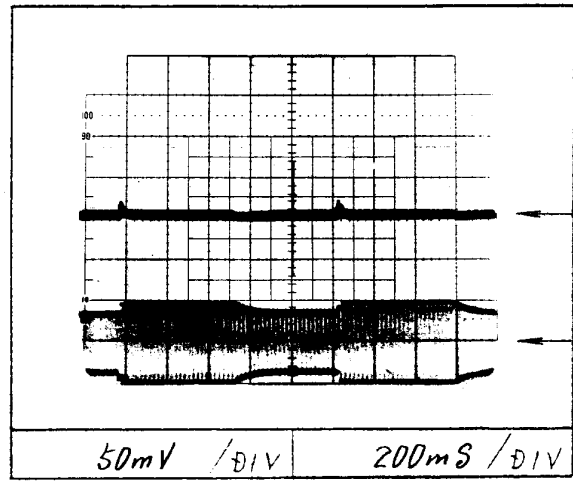
5v



12v



24v

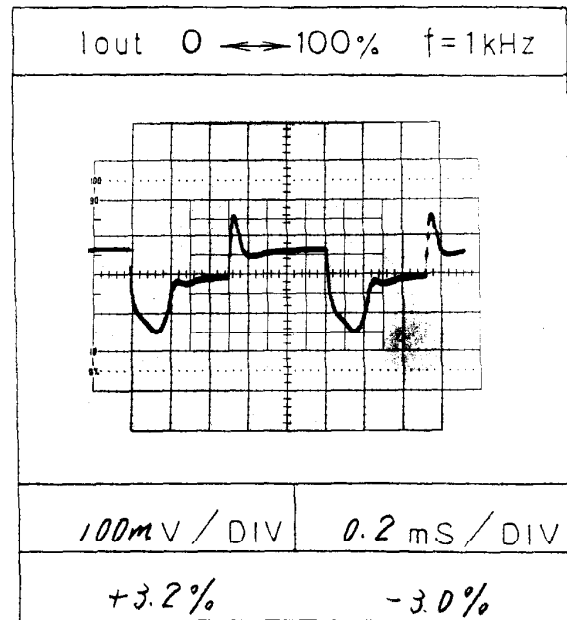
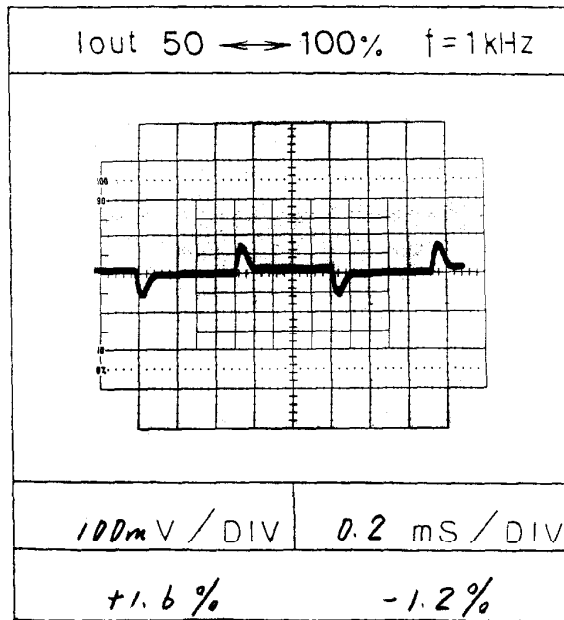
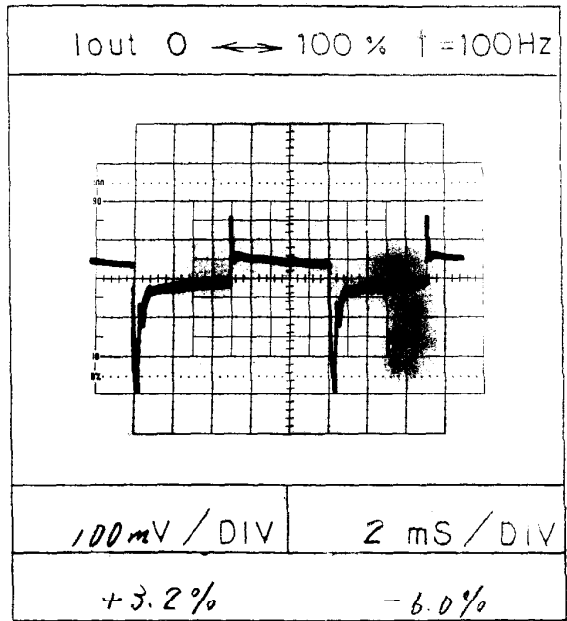
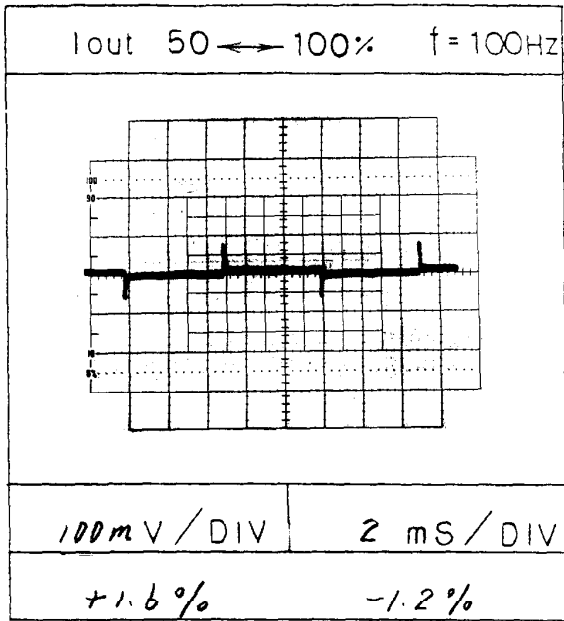


Dynamic load response

MS-12

Conditions Vin: AC 100 V
Ta: 25 °C

5 V

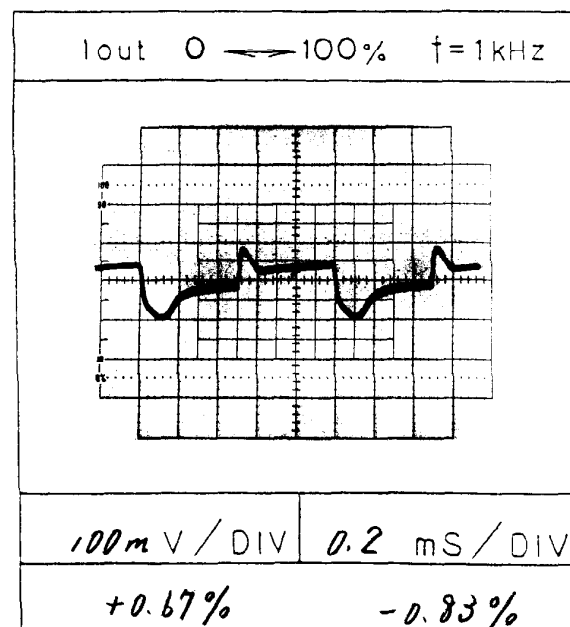
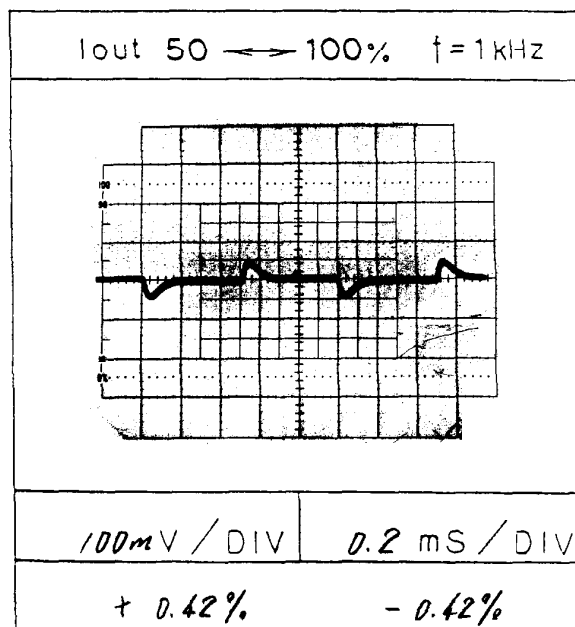
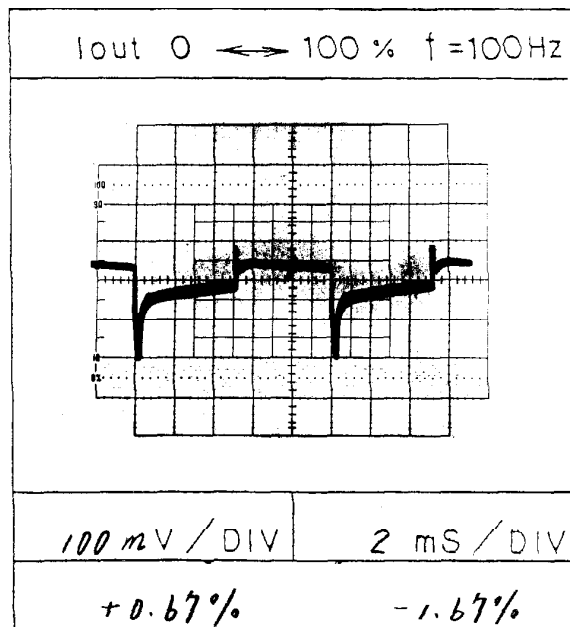
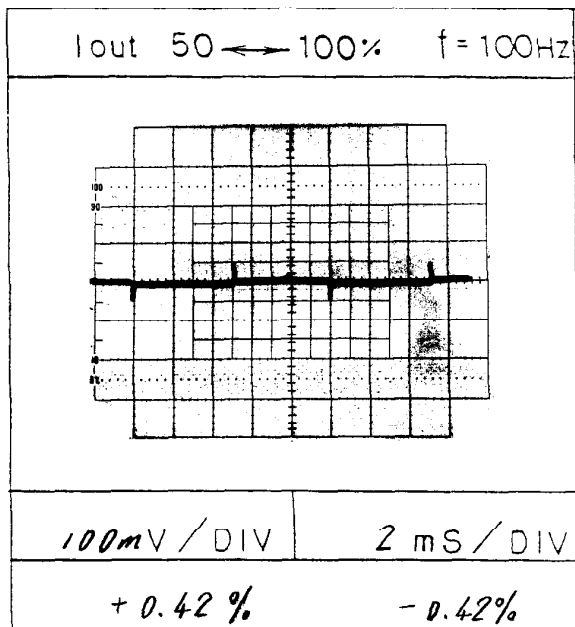


Dynamic load response

MS - 12

Conditions Vin: AC 100 V
Ta: 25 °C

12 V

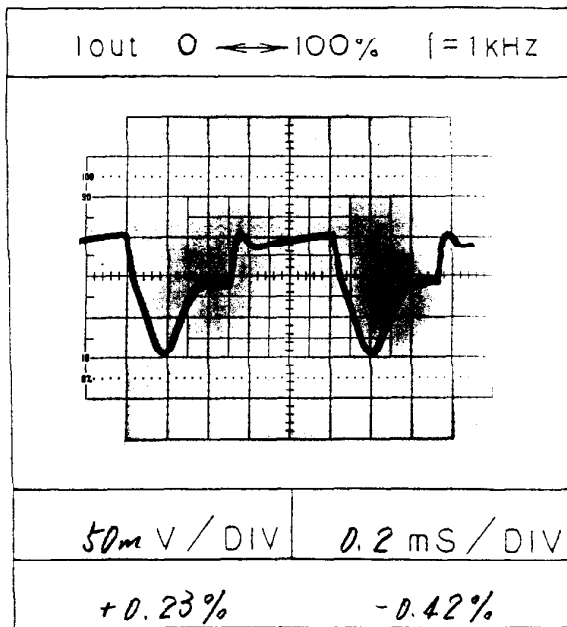
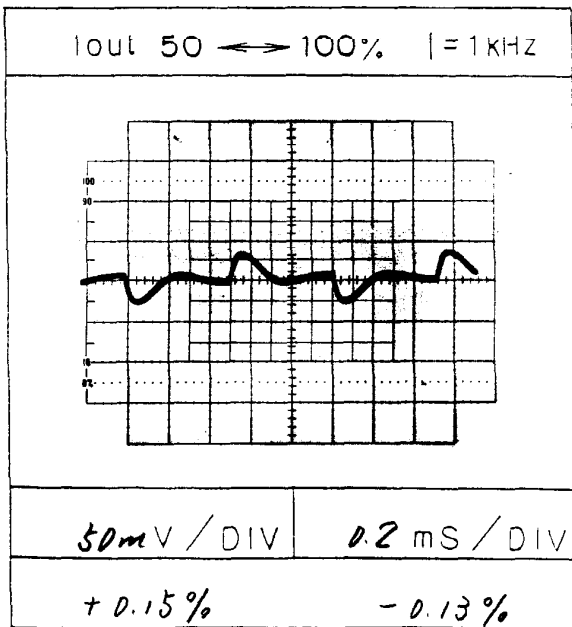
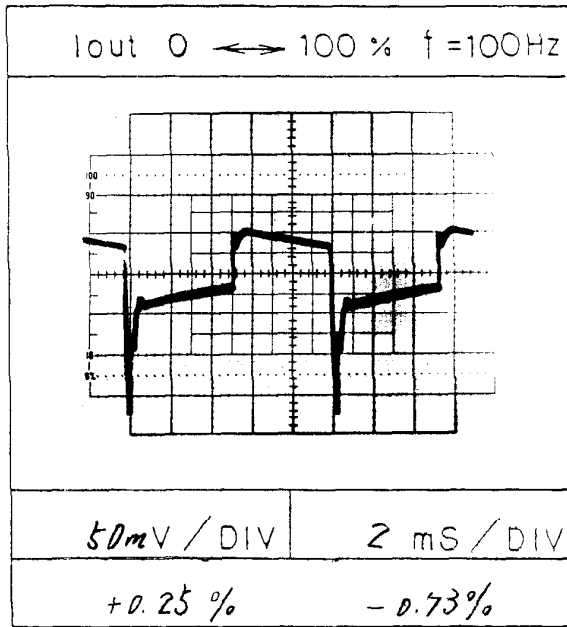
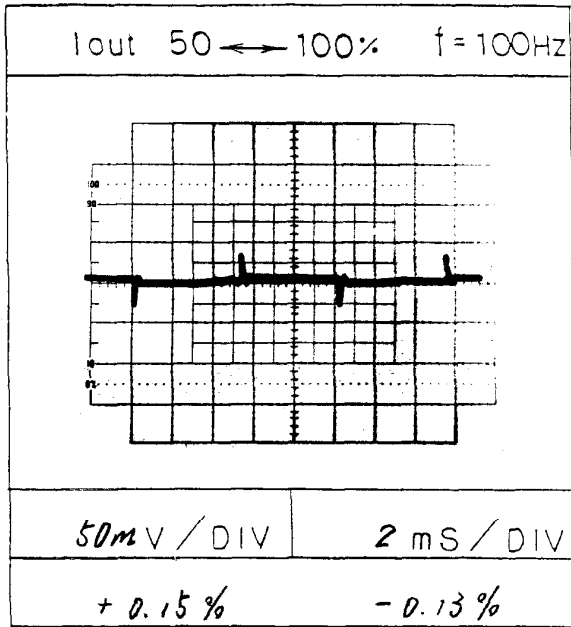


Dynamic load response

MS-12

Conditions Vin: AC 100 V
Ta: 25 °C

24 V



Response to brown out

MS-12

Conditions Vin: AC 100v

Iout: 100%

Ta: 25°C

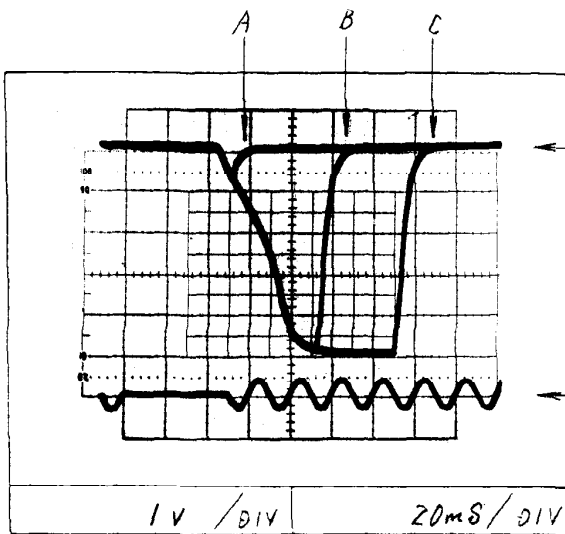
Brown out time

A: 50 ms

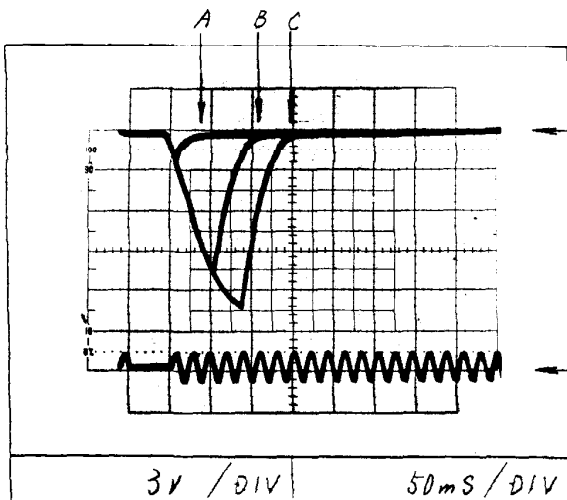
B: 80 ms

C: 110 ms

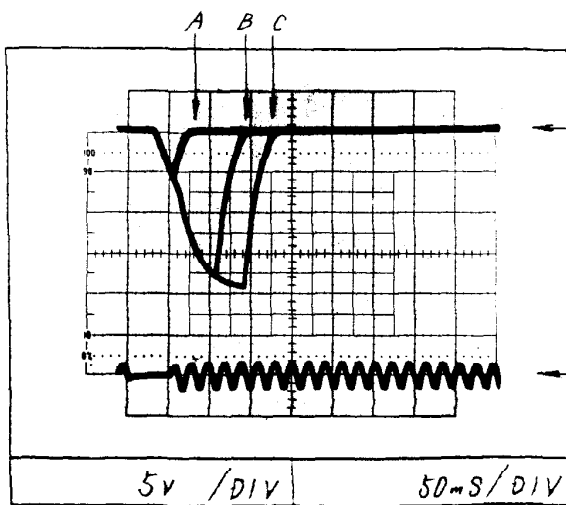
5v



12v



24v



Inrush current characteristics

MS-12

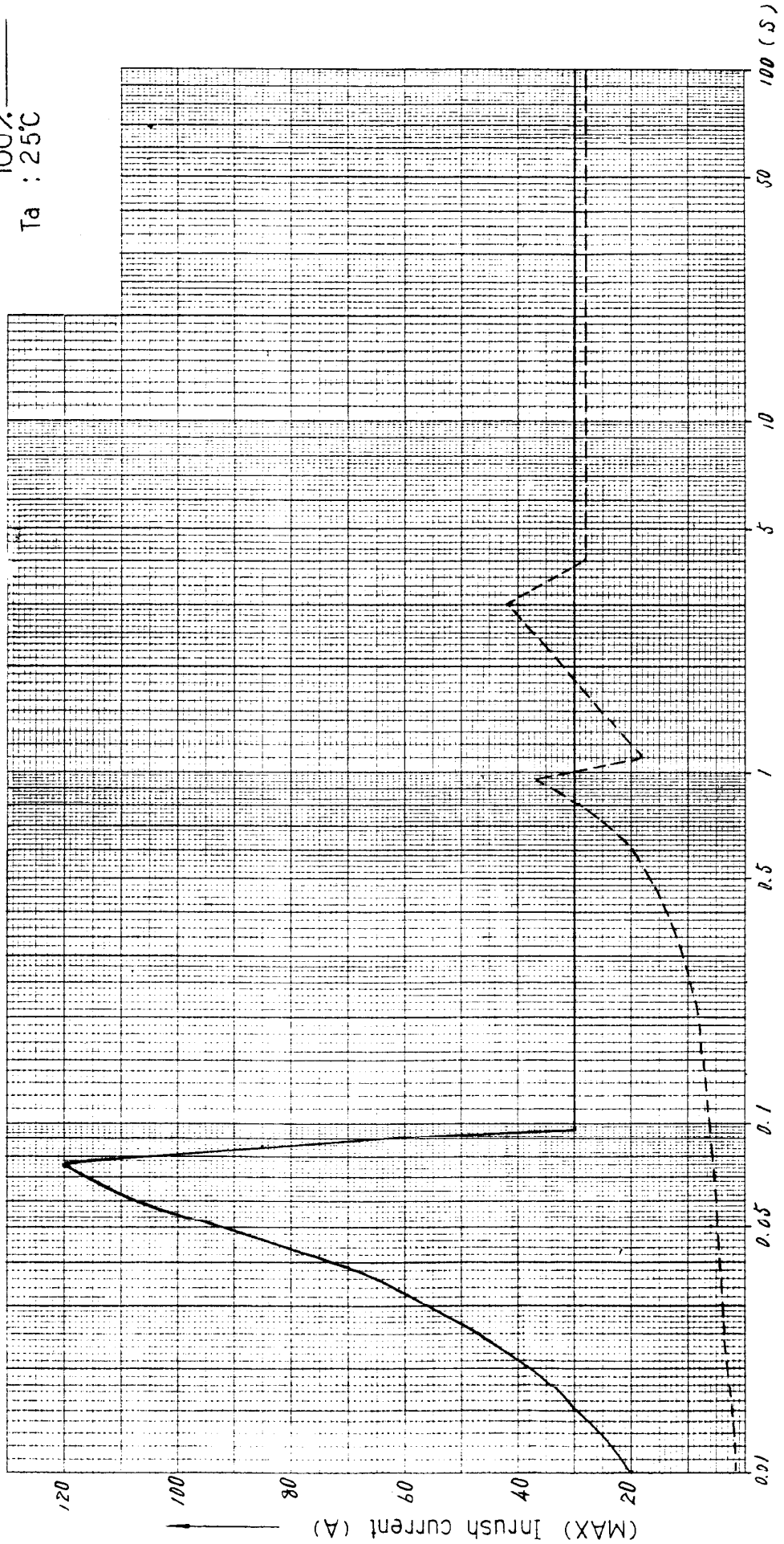
Conditions

Vin : AC100 v

Iout : 0% -----

100% -----

Ta : 25°C -----



△ NEMIC LAMBDA

Brown out time →

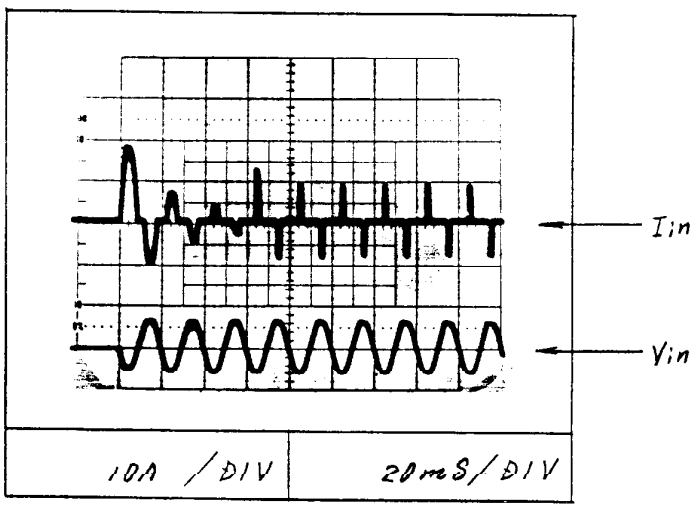
Inrush current wavetome

MS-12

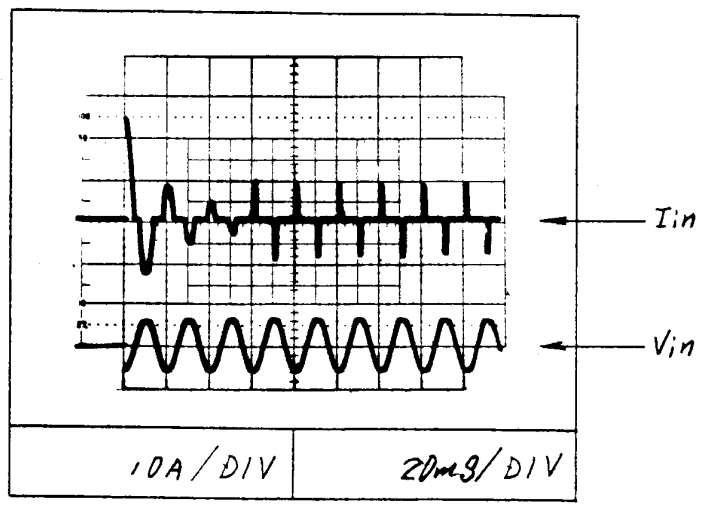
Conditions Vin : AC100 v
Iout : 100 %
Ta : 25 °C

5 v

Switch in phase angle
of input AC voltage
 $\phi = 0^\circ$



Switch in phase angle
of input AC voltage
 $\phi = 90^\circ$

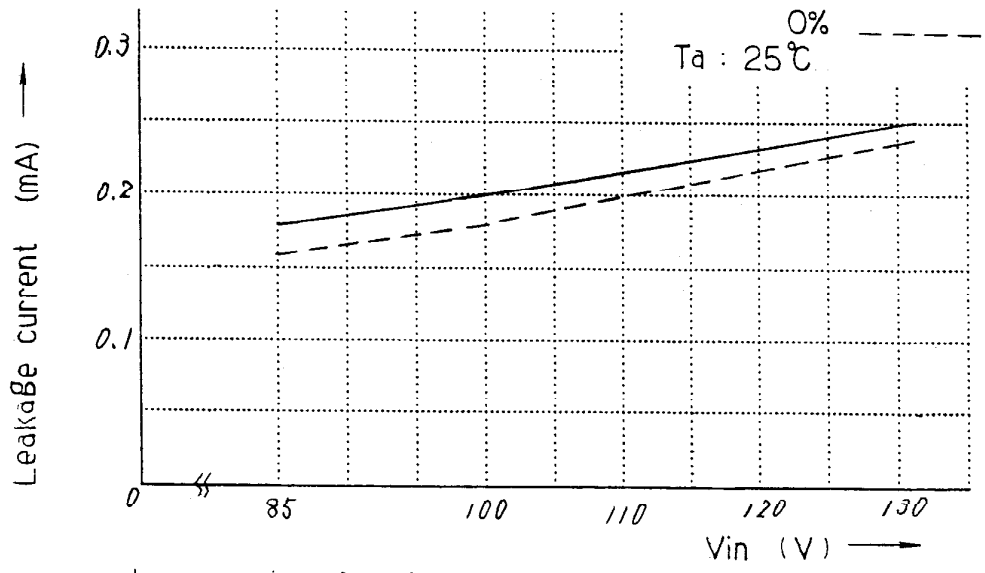


Leakage current

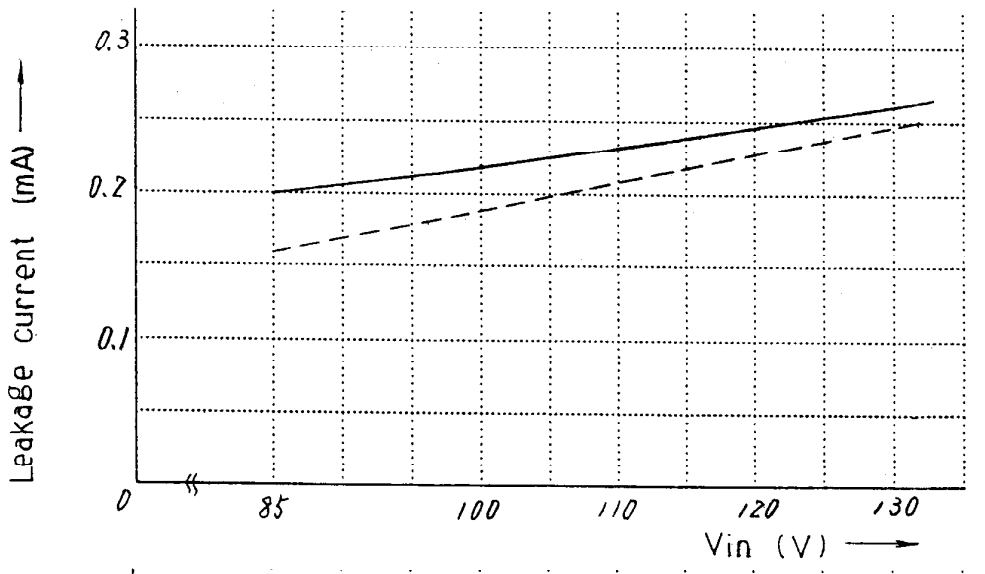
MS - 12

Conditions FG - ACG SHORT
Vin : AC or DC
Iout : 100%
0%
Ta : 25°C

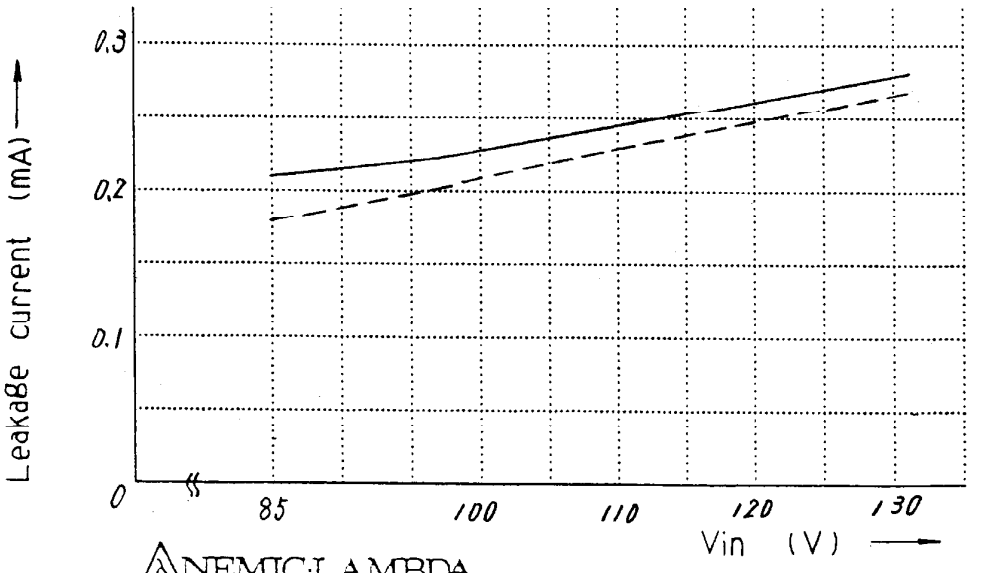
5 V



12 v



24 v

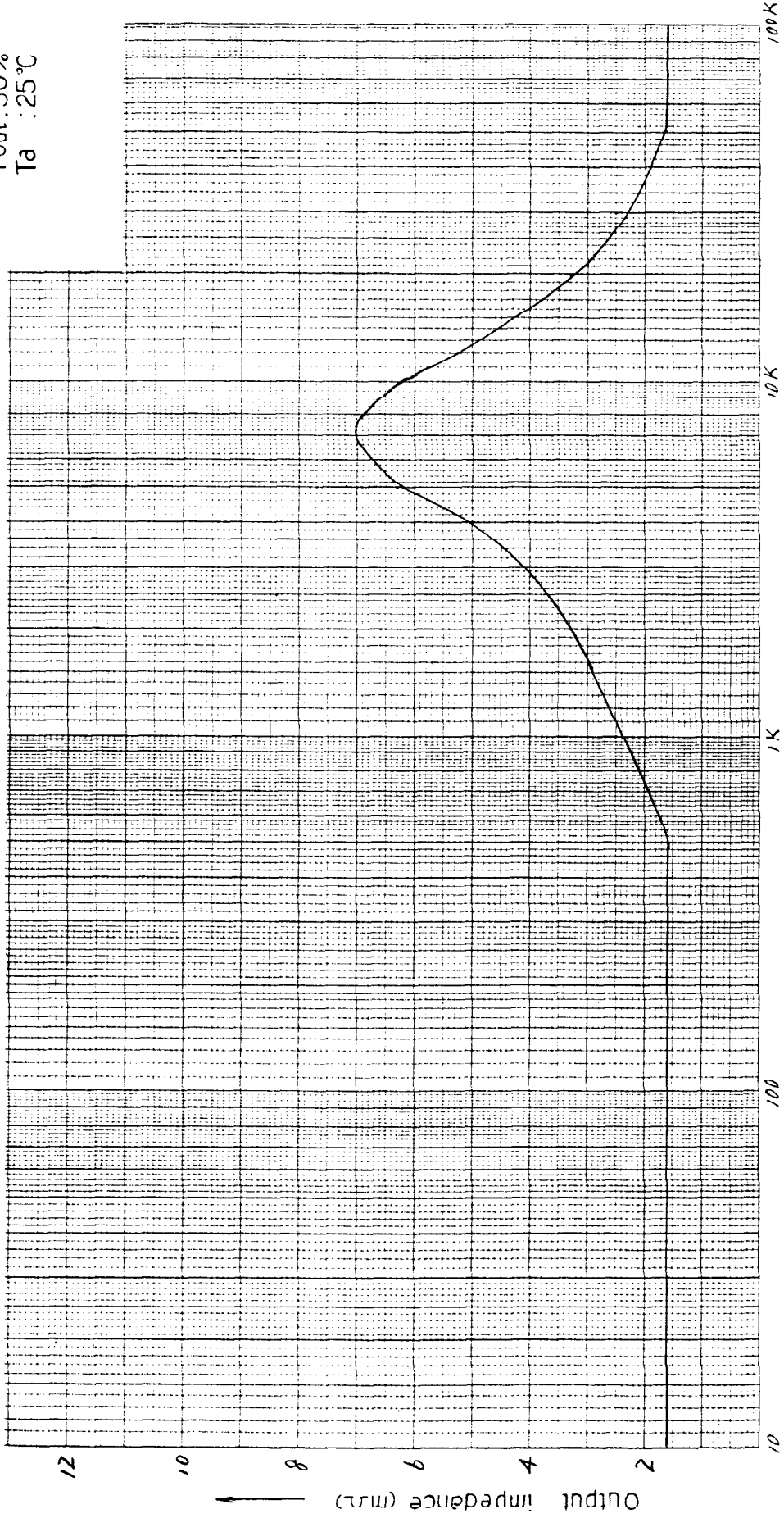


MS-12

Output impedance — Frequency

5 V

Conditions
V_{in} : AC100V
I_{out} : 50%
T_a : 25°C



△NEMICLAMBDA

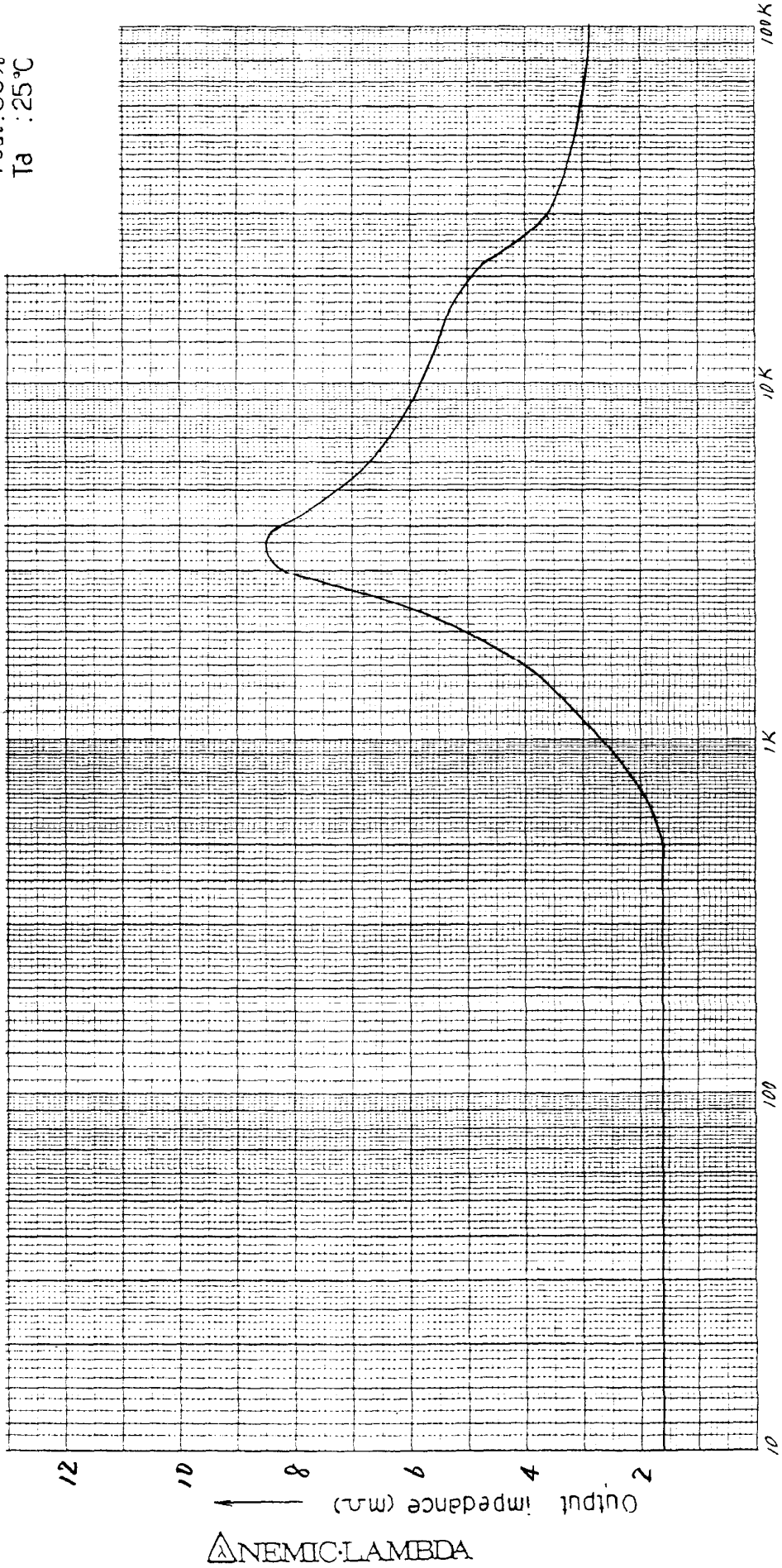
Frequency (Hz) →

MS - 12

Output impedance - Frequency

12 V

Conditions
V_{in} : AC100V
I_{out} : 50%
T_a : 25°C



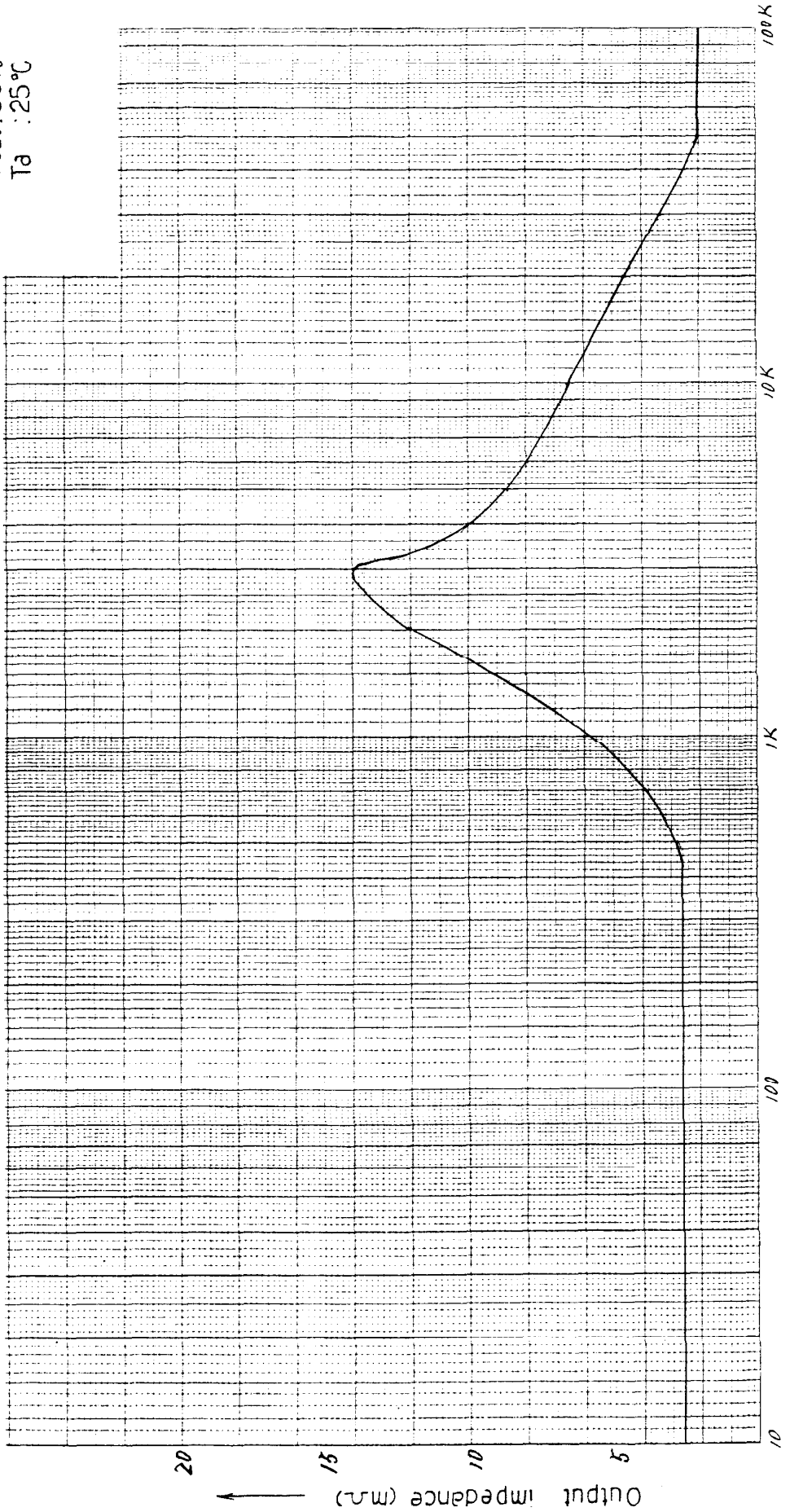
Frequency (Hz) →

MS-12

Output impedance — Frequency

24 V

Conditions
V_{in} : AC100V
I_{out} : 50%
T_a : 25°C



△NEMIC·LAMBDA

Frequency (Hz) →

24
30