

QUALITY TEST DATA

KWS5

DWG. NO.		PA766 - 53 - 01			
QA APPROVAL		R / D			
NLJ	NLS	APPROVED	CHECKED	ENGR.	DRAWN
N. Ioku	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	WILLIAM PHIA
25.6.92	17 JUN. 92	16 JUN. 92	16 JUN. 92	16 JUN. 92	15 JUNE. 92

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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

KWS5 Specifications

NEMIC-LAMBDA

PA766-01-01A

*: For delivery, contact to our sales office.

ITEMS		MODEL	KWS5-5	KWS5-12	KWS5-15
1	Nominal Output Voltage	V	5	12	15
2	Minimum Output Current	A	0	0	0
3	Maximum Output Current	A	1.0	0.45	0.35
4	Maximum Output Power	W	5.0	5.4	5.25
5	Efficiency (typ)	(*1) %	67	70	70
6	Input Voltage Range	(*2) -	85 ~ 265VAC (47~440Hz) or 110 ~ 340VDC		
7	Input Current (typ)	(*1) A	0.2A at 100VAC		
8	Inrush Current (typ)	A	15A at 100VAC, 30A at 200VAC		
9	Output Voltage Range	-	FIXED ±5% (Max)		
10	Maximum Ripple & Noise	(*3) mV	120	150	150
11	Maximum Line Regulation	(*3,*4) mV	20	48	60
12	Maximum Load Regulation	(*3,*5) mV	40	96	120
13	Maximum Temperature Drift	(*3,*6) mV	50	120	150
14	Over Current Protection	(*7) -	105% ~		
15	Over Voltage Protection	(*8) -	110% ~		
16	Parallel Operation	-	_____		
17	Series Operation	-	Possible		
18	Hold-Up Time (typ)	-	17mS at 5W, 100VAC, Ta = 25°C		
19	Operating Temperature	-	-10°C ~ +70°C (-10°C : 80%, 0~+50°C : 100%, +70°C : 25%)		
20	Operating Humidity	-	30 ~ 90%RH (No dewdrop)		
21	Storage Temperature	-	-30 ~ +85°C		
22	Storage Humidity	-	20%RH ~ 95%RH (No dewdrop)		
23	Cooling	-	Convection Cooling		
24	Withstand Voltage	-	Input-Output : 3kVAC (20mA), Input-FG : 2kVAC (20mA) Output-FG : 500VAC(100mA) for 1minute each.		
25	Isolation Resistance	-	More than 100MΩ at 25°C and 70%RH Output-FG 500VDC		
26	Vibration	-	10~55Hz, Constant Amplitude 1.65mm p-p (Max 10G), sweep 1 Minute X,Y,Z 1 hour each		
27	Shock	-	Less than 50G for 11±5mS on ± (X, Y, Z) axis each 3 times		
28	Safety	-	Approved by UL1950, CSA950, EN60950		
29	Conducted Radio Noise	(*9) -	Built to meet VCCI-Class A, FCC-class B, VDE-classB		
30	Weight	g	75g		
31	Size (WxHxD)	mm	45 x 20.5 x 55 (Refer to Outline Drawing)		

* Read Instruction manual carefully, before using the power supply unit.

= NOTES =

- *1. At 100VAC and Maximum Output Power, Ta=25C.
- *2. For cases where conformance to various safety specs (UL, CSA & TUV) are required to be described as 100-240VAC, 50/60Hz on name plate.
- *3. Please refer to Fig. A for measurement determination of line & load regulation and output ripple & noise voltage.
- *4. From 85~265VAC, constant load.
- *5. From Min load - Full load (Maximum power), constant input Voltage.
- *6. From 0~50°C, constant input voltage and load.
- *7. Current limiting with automatic recovery. Avoid to operate over load or dead short for more than 30seconds.
- *8. Over Voltage Clamping by Zener Diode.
- *9. VDE class-B with external capacitor.

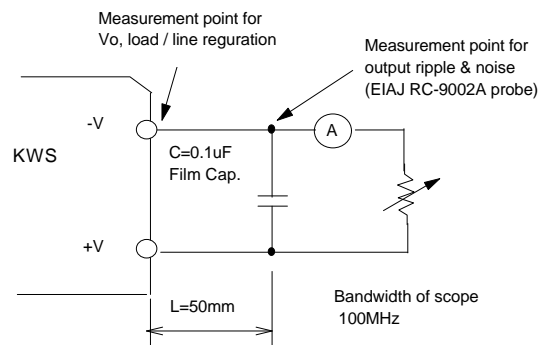
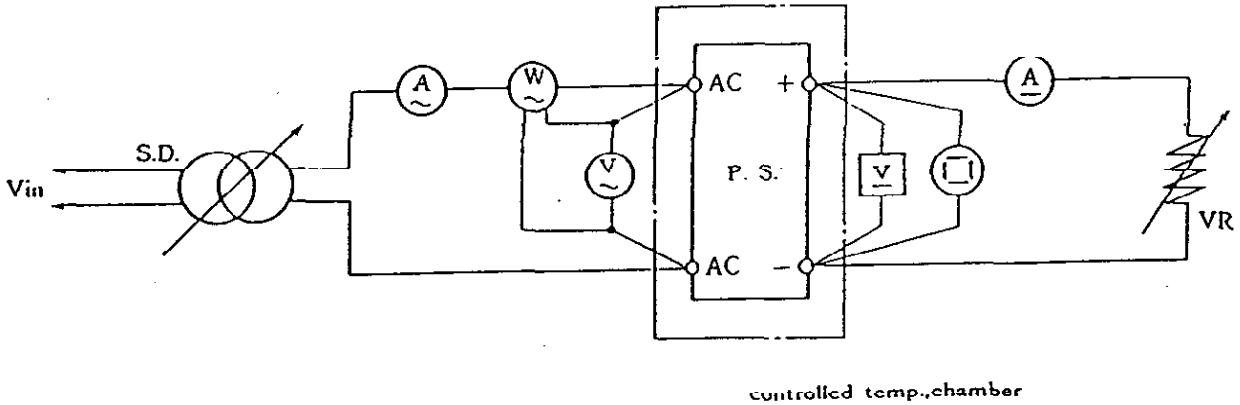


Fig.A

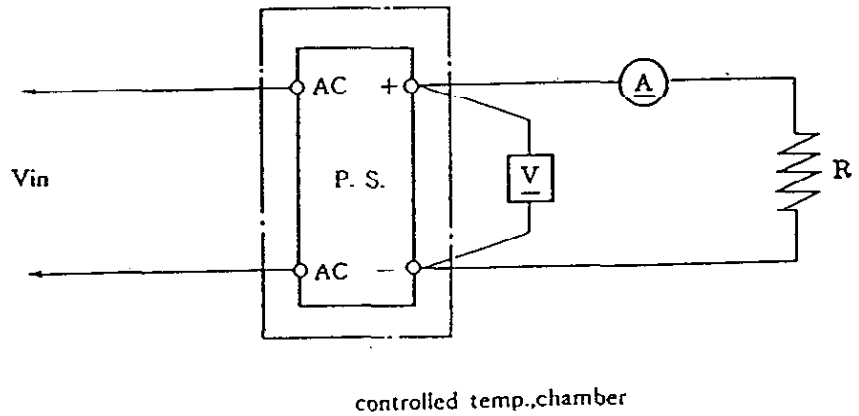
2. 評価測定方法 EVALUATION METHOD

2-1 測定回路 Circuits used for determination

(1) 静特性 Steady state data

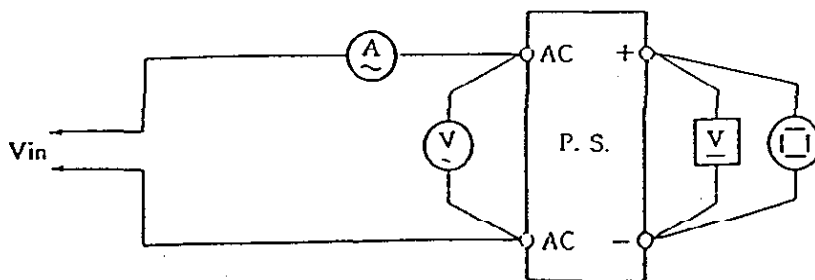


(2) 通電ドリフト特性 Warm up voltage drift characteristics

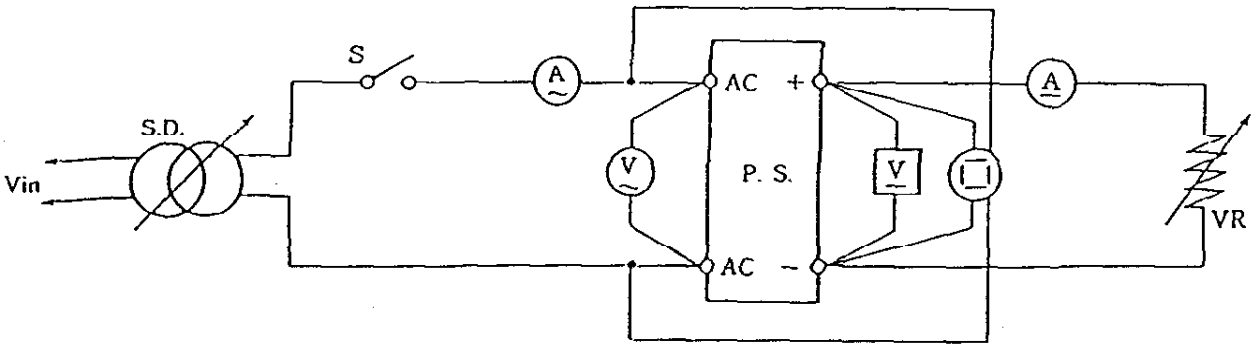


(3) 過電流保護特性 Over current protection (OCP) characteristics
Same as steady state data.

(4) 過電圧保護特性 Over voltage protection (OVP) characteristics



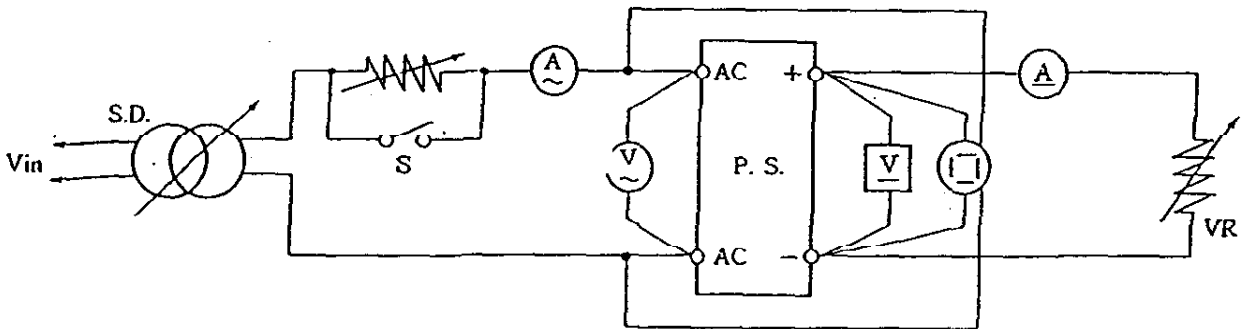
(5) 出力立上り特性 Output rise characteristics



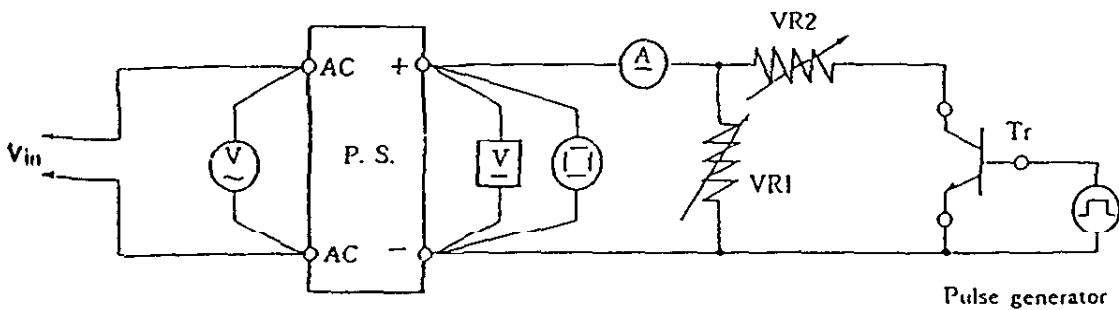
(6) 出力立下り特性 Output fall characteristics

Same as output rise characteristics.

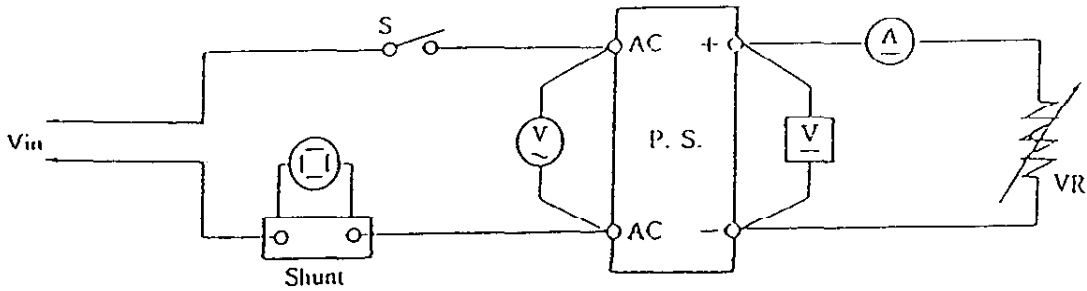
(7) 過渡応答 (入力急変) 特性 Dynamic line response characteristics



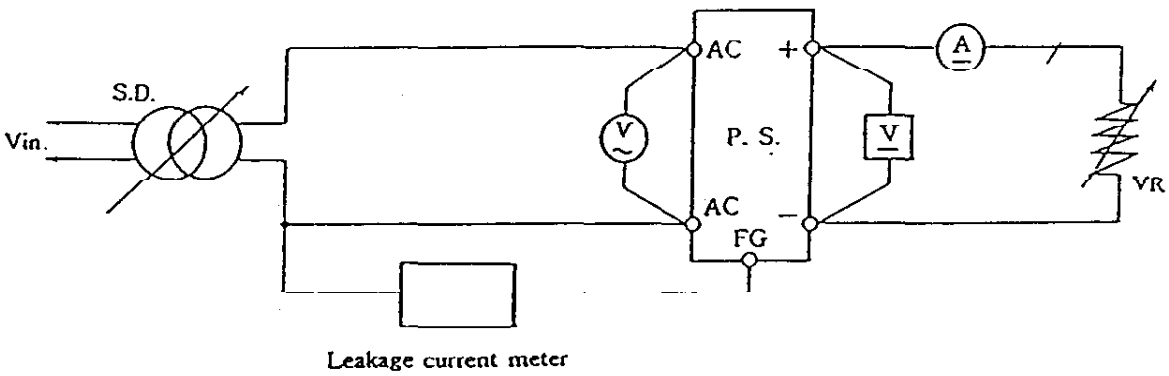
(8) 過渡応答 (負荷急変) 特性 Dynamic load response characteristics



(9) 入力サージ電流 (突入電流) 特性 Inrush current characteristics



(10) リーク電流 (漏洩電流) 特性 Leakage current characteristics

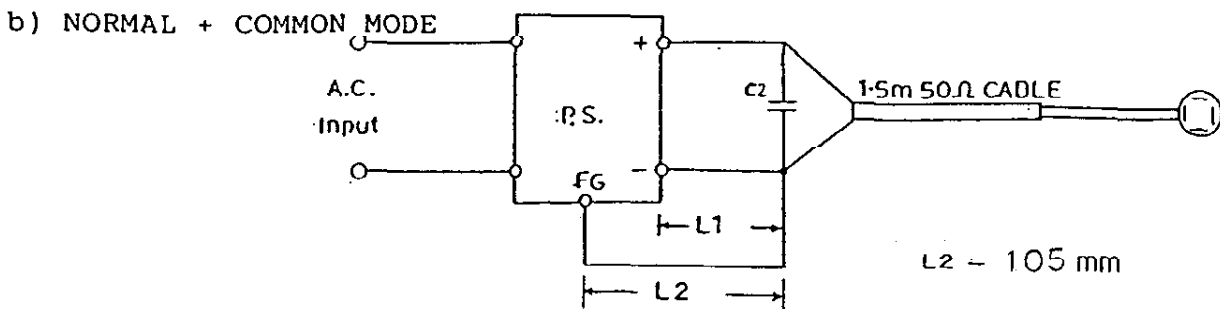
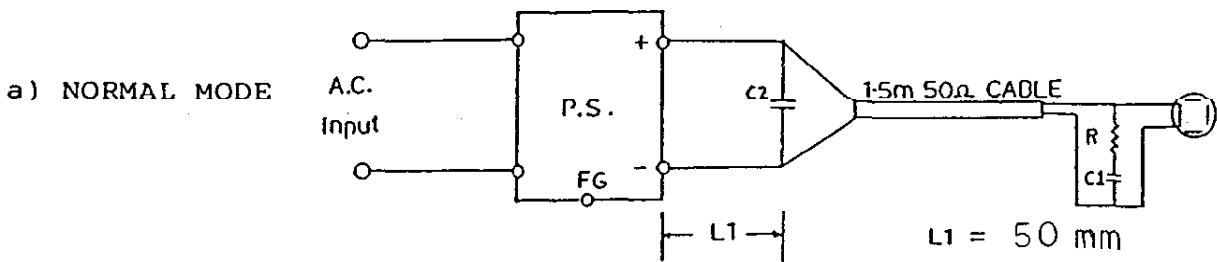


Note : Leakage current measured through a $1k\Omega$ resistor.

Range wed : AC + DC

$R = 50\Omega$
 $C1 = 4700pF$
 $C2 = 0.1\mu F$

11) Output-ripple, noise



2-2. 使用測定機器 List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	Oscilloscope	HITACHI DENSHI	V-1065
2	Digital storage oscilloscope	HITACHI DENSHI	VC-6041
3	Digital voltmeter	IWATSU	VDAC 7411
4	Digital watt/current/volt meter	HIOKI	3182
5	DC Ampere meter	YOKOGAWA ELECTRIC	2051
6	Autotransformer	SUPERIOR ELECTRIC	136 BT
7	Variable resistive load	IWASHITA ELECTRIC	D-5-10/16
8	Dynamic dummy load	TAKAMIZAWA CYBERNETICS KIKUSUI	PSA-150D PLZ72W, PLZ150WA
9	Digirush currenter	TAKAMIZAWA CYBERNETICS	PSA-200
10	Current Probe/Amplifier	TEKTRONIX	A6303/AM503
11	Controlled Temp. Chamber	TABAI	PL-2GM
12	Leakage current meter	YOKOGAWA ELECTRIC	3226
13	Equipment for dynamic line response	- BUILT IN-HOUSE -	

REGULATION - Line and Load, Temp. Drift

KWS 5

5V

1. Regulation - Line and Load

Condition Ta : 25°C

I _{out} \ V _{in}	AC 85 v	AC 100 v	AC 220 v	AC 265 v	Line Regulation	
0 %	5.033 v	5.033 v	5.033 v	5.032 v	1 mv	0.02 %
50 %	5.029 v	5.029 v	5.026 v	5.025 v	4 mv	0.08 %
100 %	5.025 v	5.025 v	5.022 v	5.022 v	3 mv	0.06 %
Load	8 mv	8 mv	11 mv	10 mv		
Regulation	0.16 %	0.16 %	0.22 %	0.20 %		

2. Temperature Drift

Conditions

V_{in} : AC100v

I_{out} : 100 %

Ta	0 °C	25 °C	50 °C	Temp. Stability	
V _{out}	5.023 v	5.025 v	5.027 v	4 mv	0.08 %

12V

1. Regulation - Line and Load

Condition Ta : 25°C

I _{out} \ V _{in}	AC 85 v	AC 100 v	AC 220 v	AC 265 v	Line Regulation	
0 %	11.973v	11.973 v	11.964 v	11.961 v	12 mv	0.10 %
50 %	11.969v	11.967v	11.957 v	11.954 v	15 mv	0.13 %
100 %	11.962v	11.961v	11.954 v	11.950 v	12 mv	0.10 %
Load	11 mv	12 mv	10 mv	11 mv		
Regulation	0.09 %	0.10 %	0.08 %	0.09 %		

2. Temperature Drift

Conditions

V_{in} : AC100v

I_{out} : 100 %

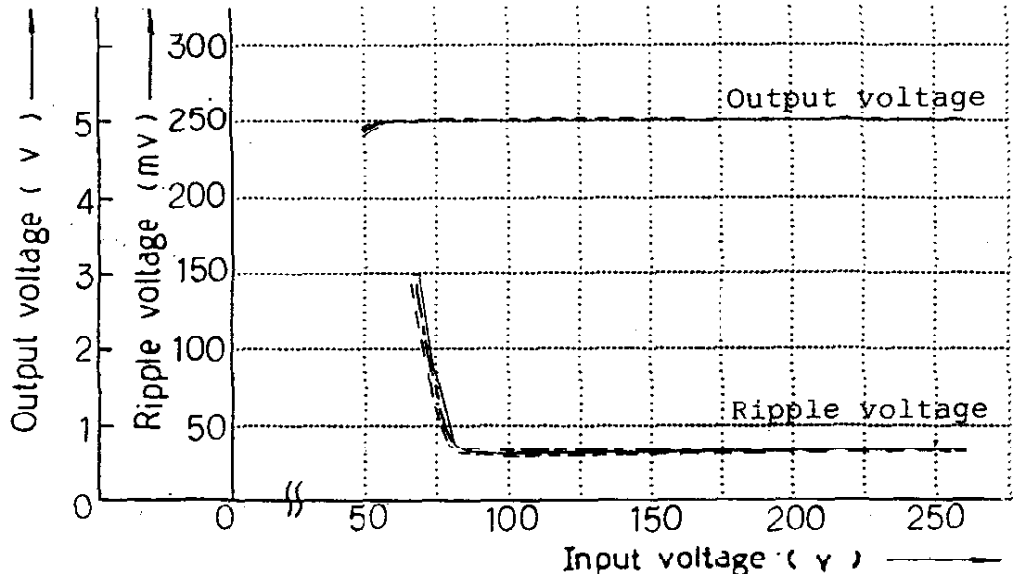
Ta	0 °C	25 °C	50 °C	Temp. Stability	
V _{out}	11.932 v	11.961 v	11.973v	41 mv	0.34 %

Output voltage and ripple voltage v.s. input voltage

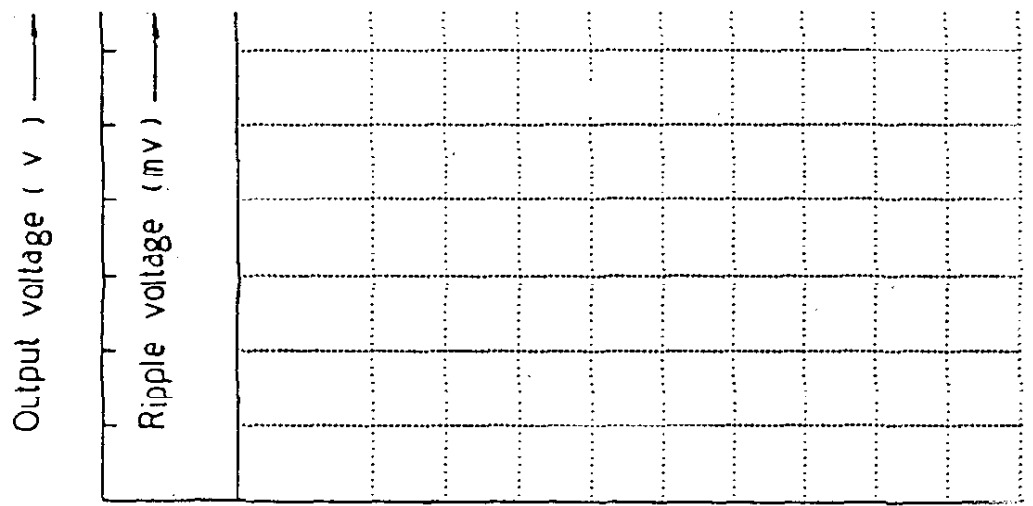
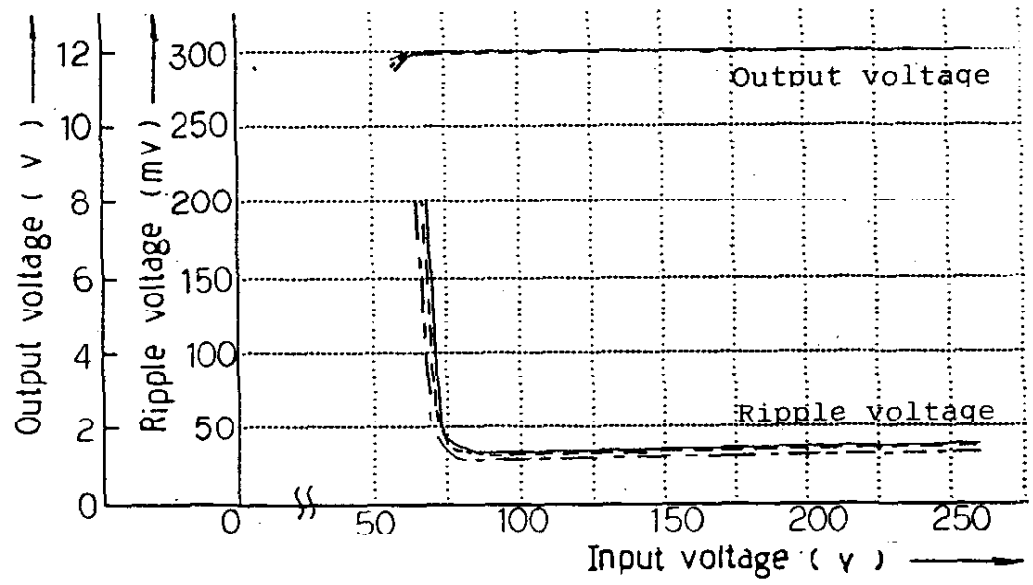
KWS 5

Conditions: I_{out}: 100%
 T_a: 0°C -----
 25°C -----
 50°C -----

5V



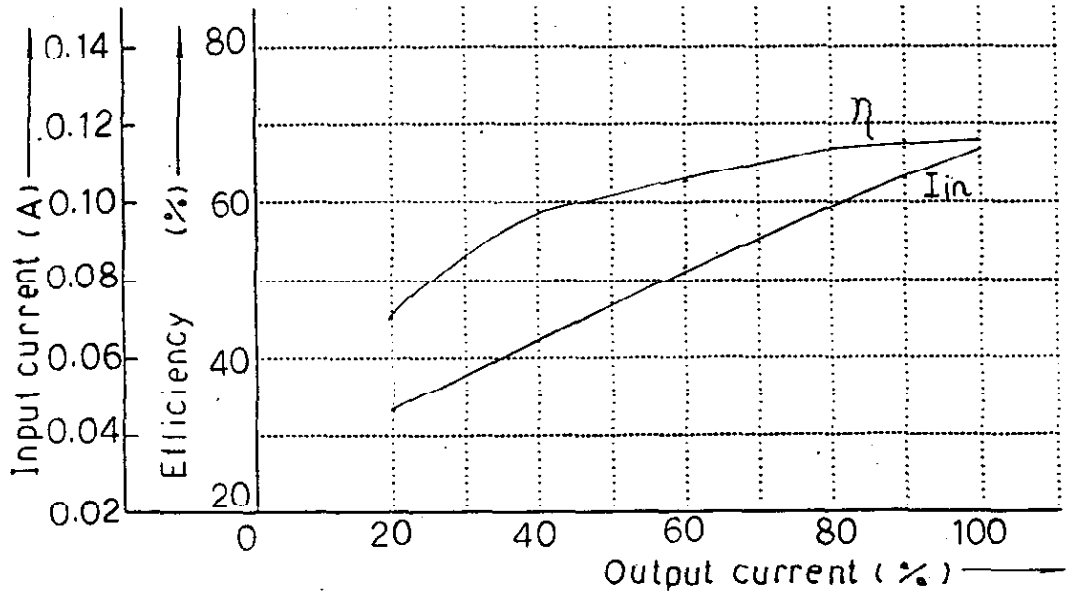
12V



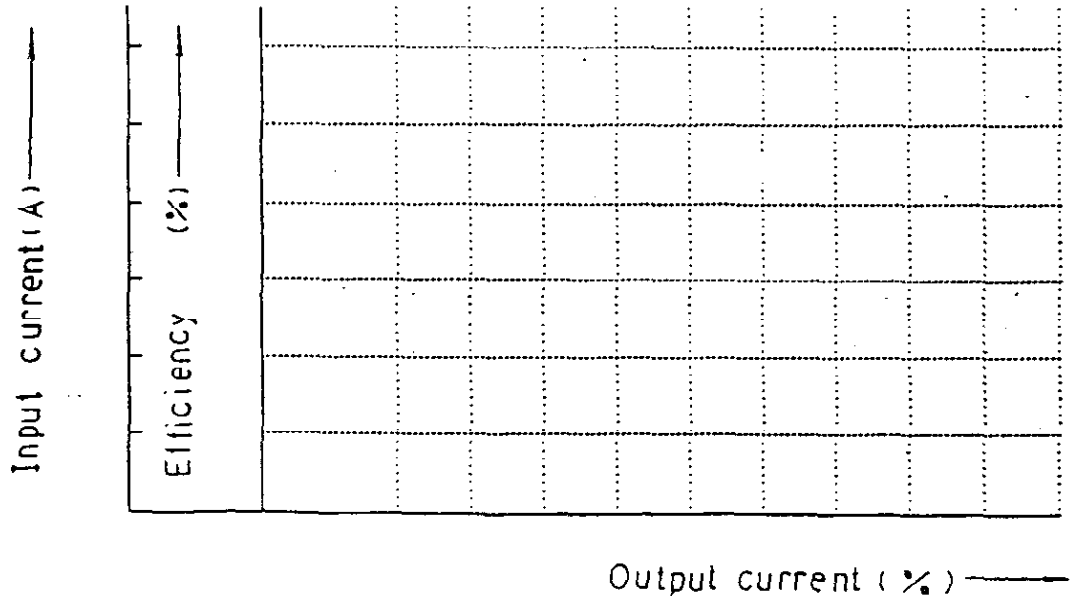
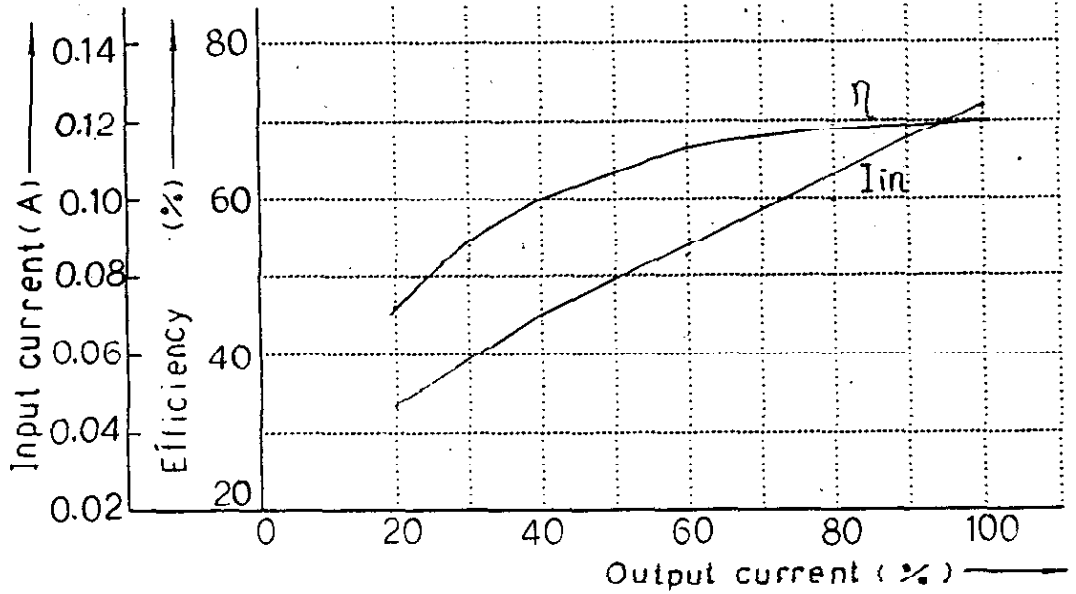
Input voltage

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

5V

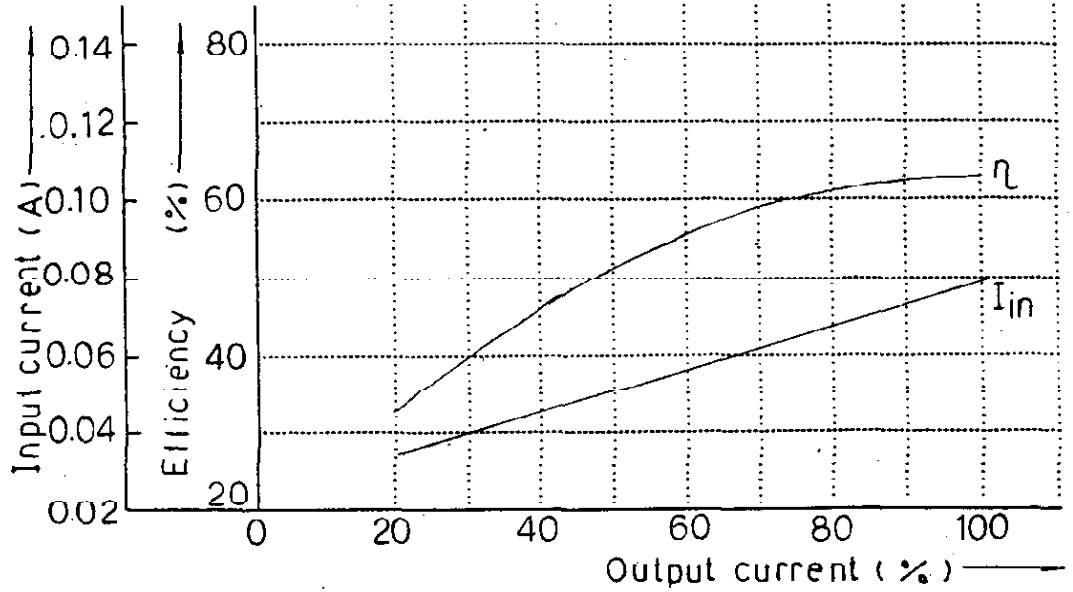


12V

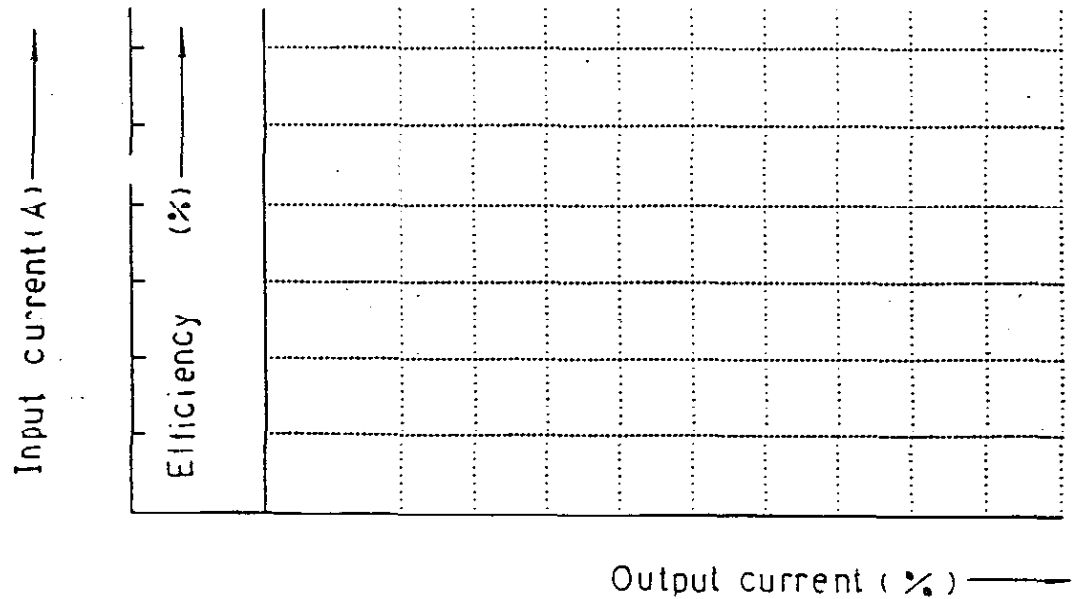
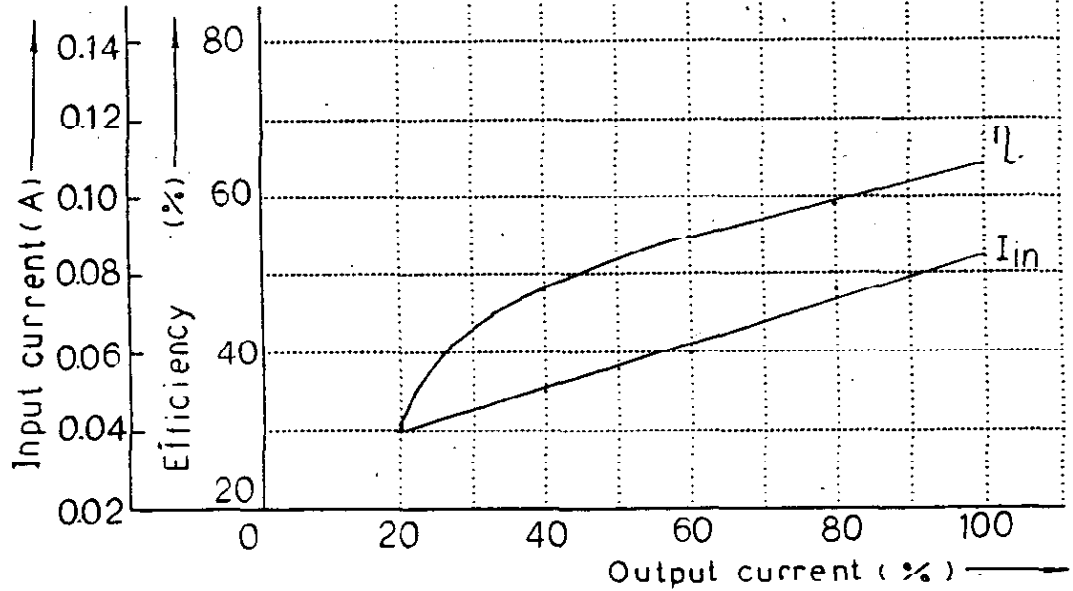


Conditions V_{in} : AC 220v
 T_a : 25°C

5V



12V

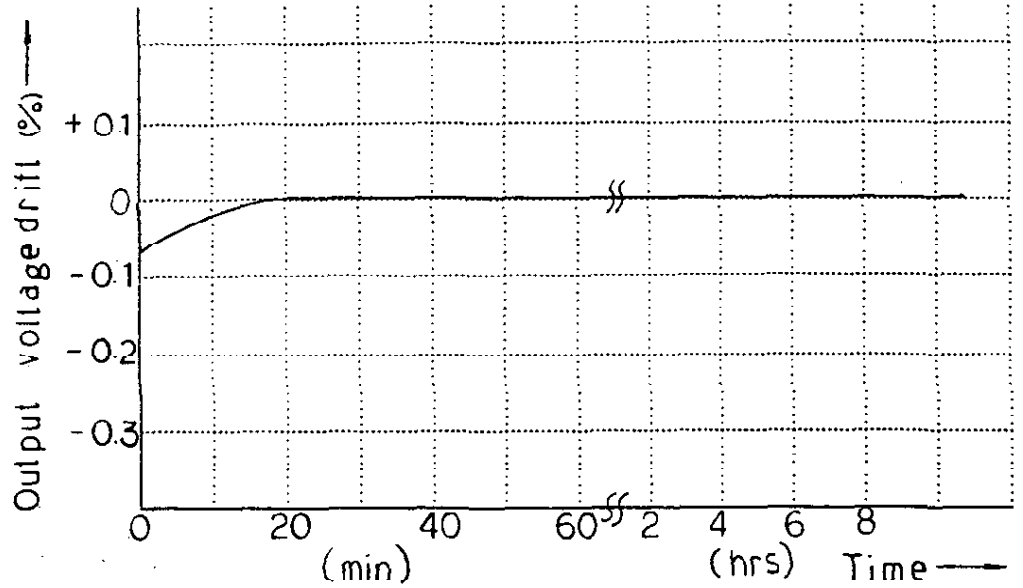


Warm up voltage drift

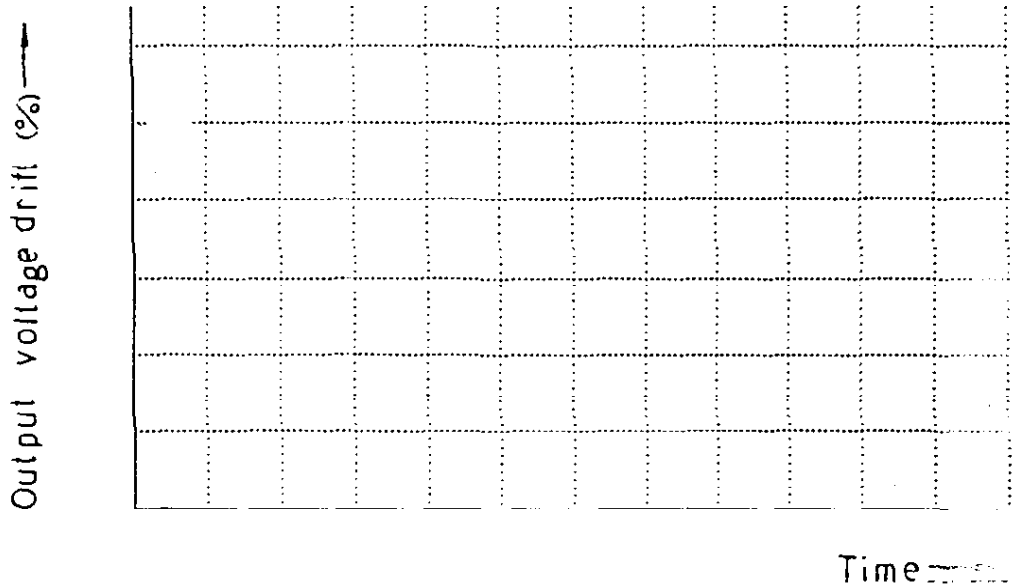
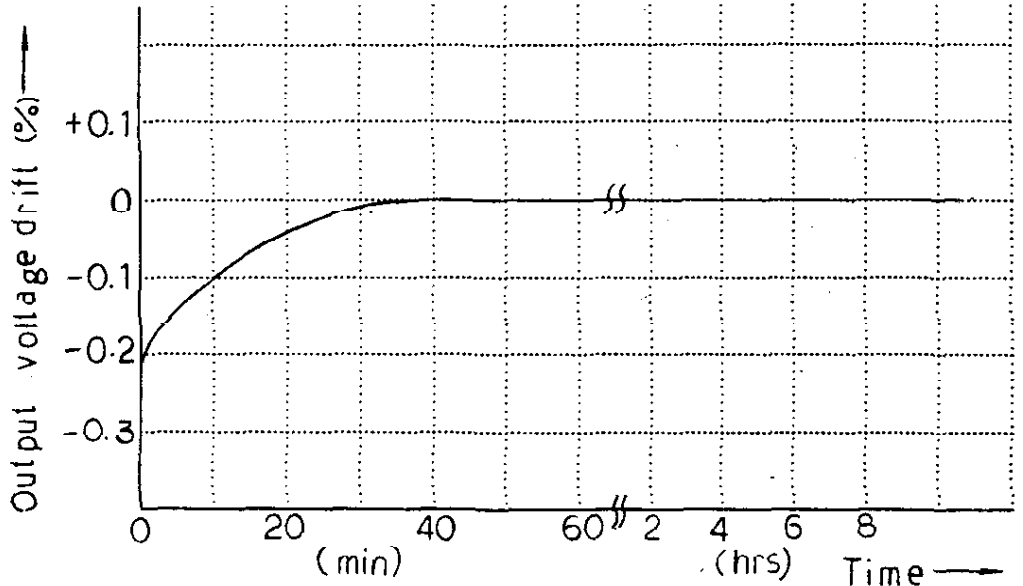
KWS 5

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

5V



12V

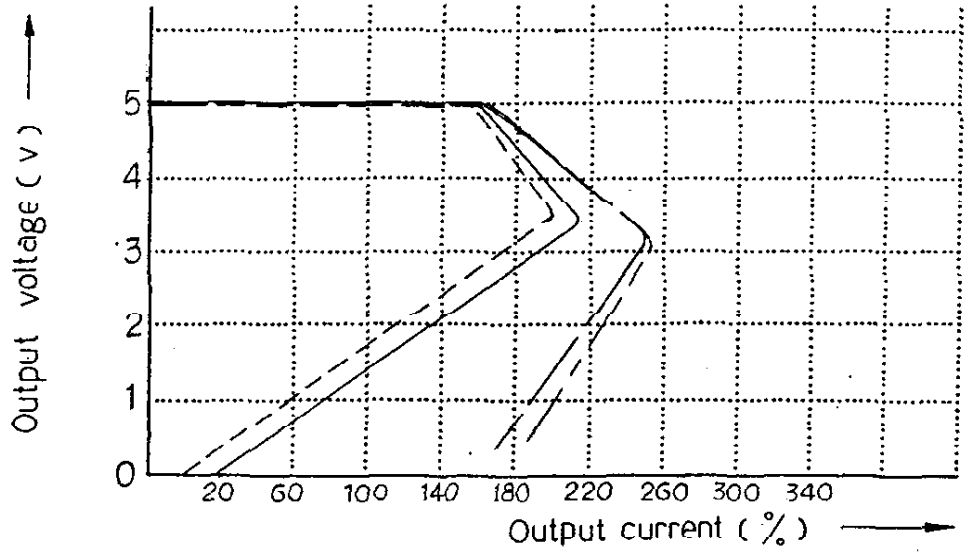


001 Characteristics

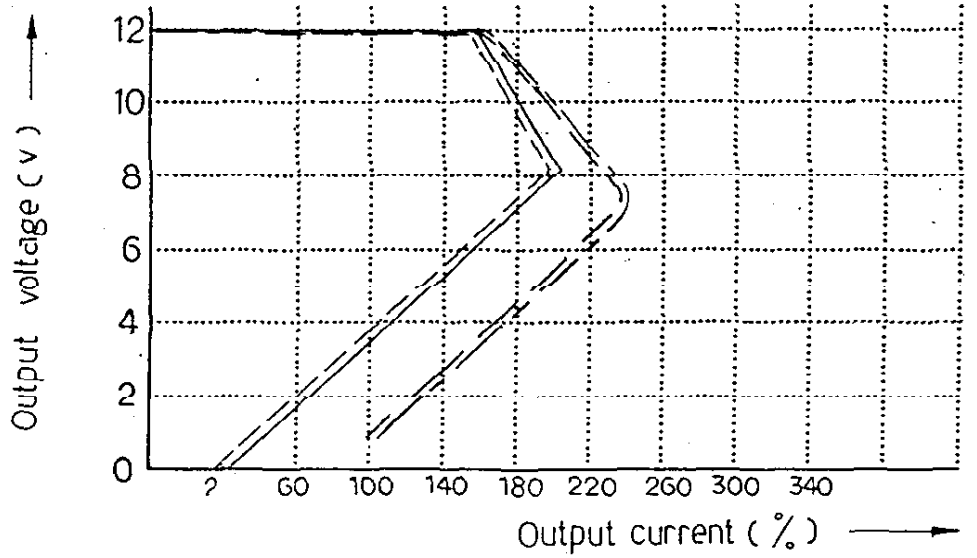
KWS 5

Conditions V_{in} : AC 85 v - - - -
 AC 100 v - - - -
 AC 220 v - - - -
 AC 265 v - - - -
 T_a : 25°C

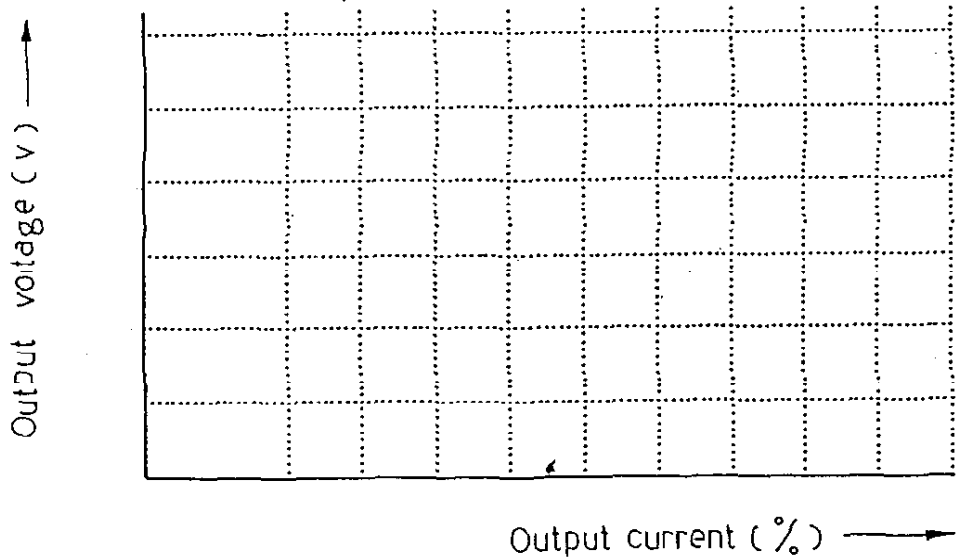
5V



12V



Blank box



O.C.P Characteristics

KWS 5

Conditions

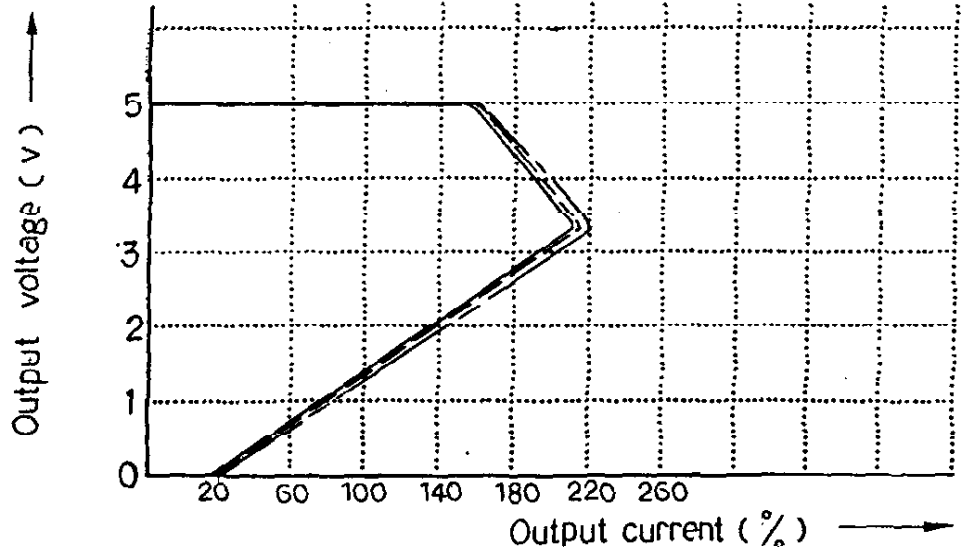
Vin : AC 100v

Ta : 0°C ———

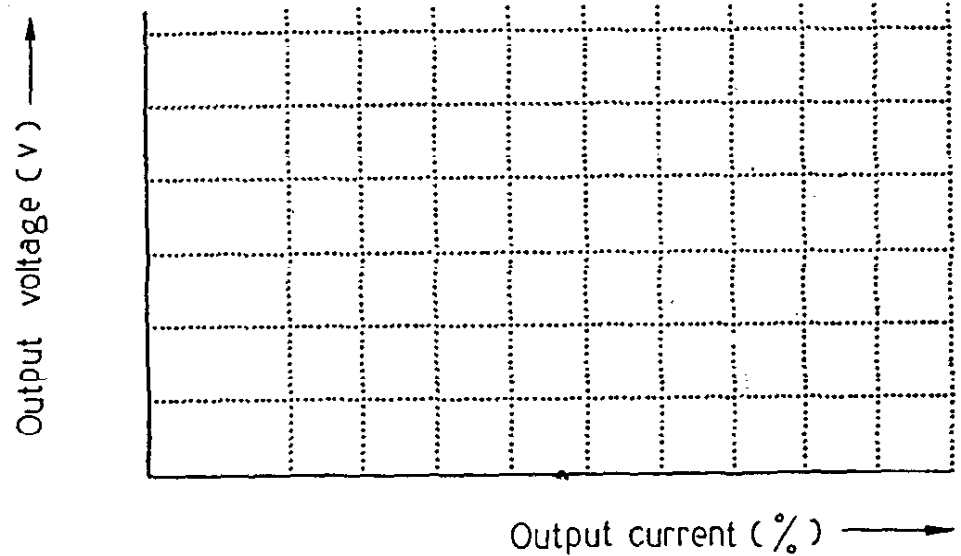
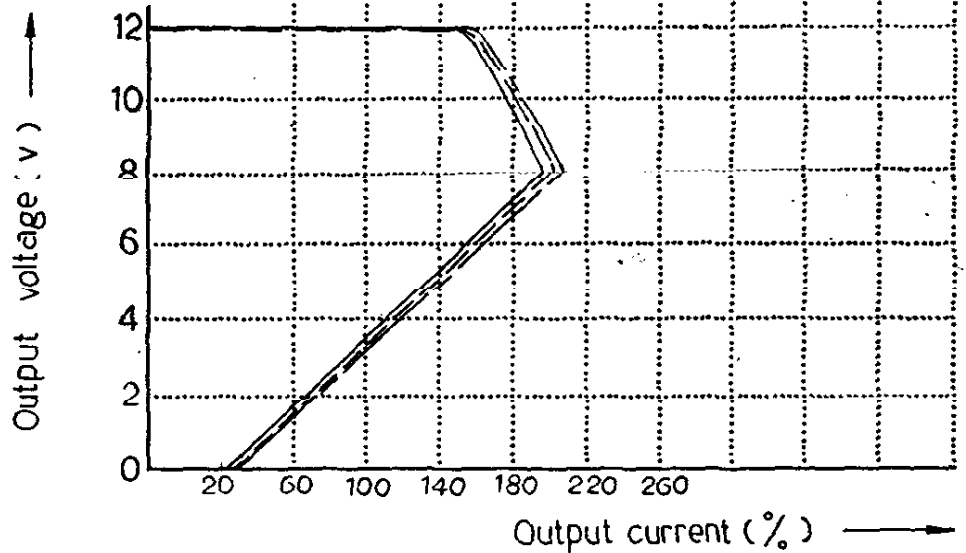
25°C - - - -

50°C - · - · -

5V



12V

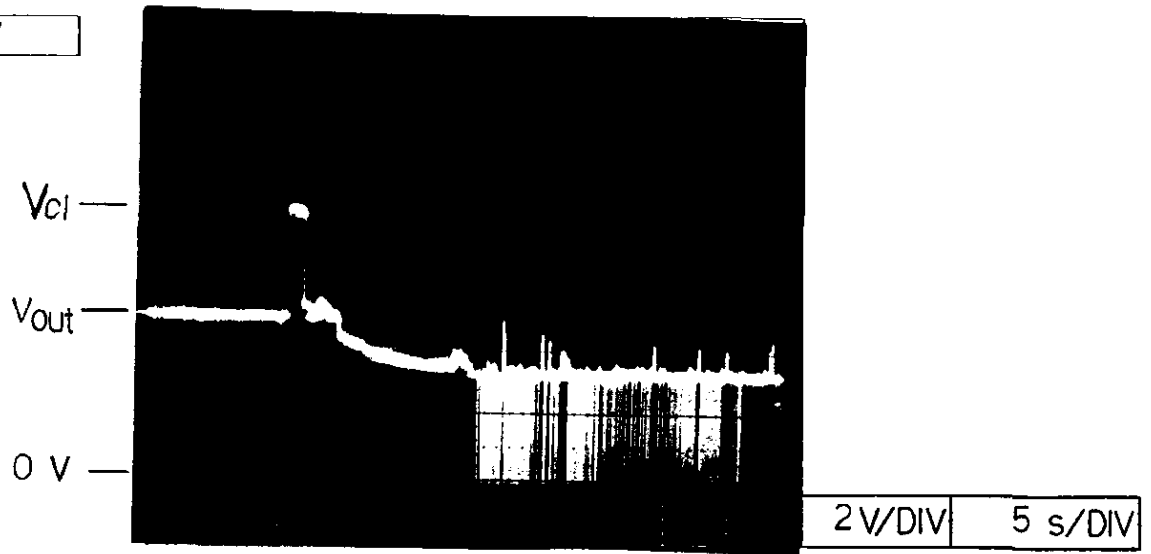


O.V.P Characteristics

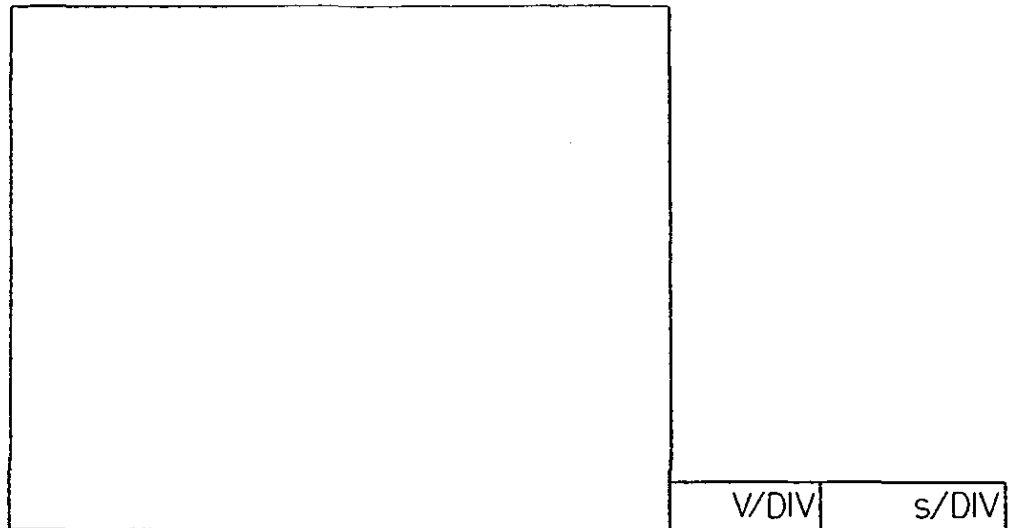
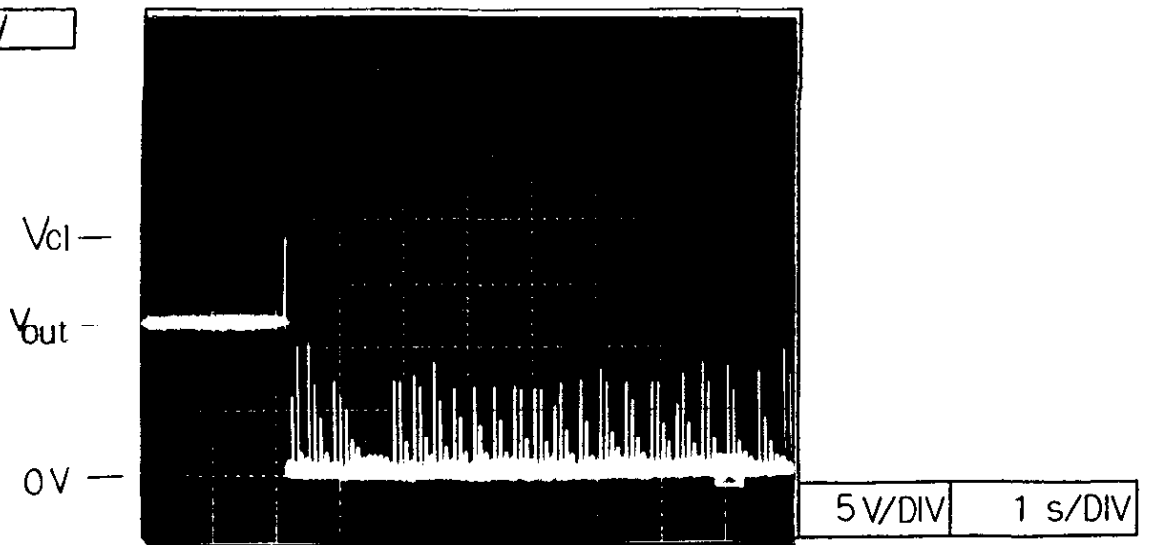
KWS 5

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

5V



12V



Output rise time

KWS 5

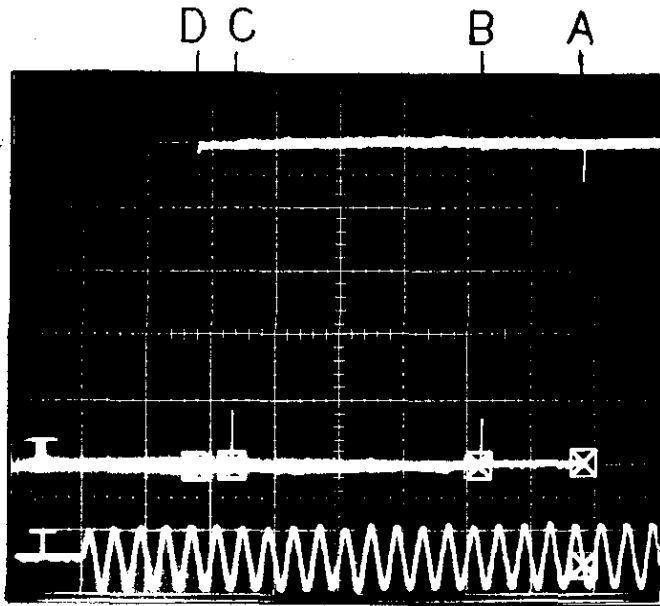
Conditions Vin: AC 85v (A)
 100v (B)
 220v (C)
 265v (D)

5V

V_{out}

0V

V_{in}



I_{out}: 0 %

T_a: 25°C

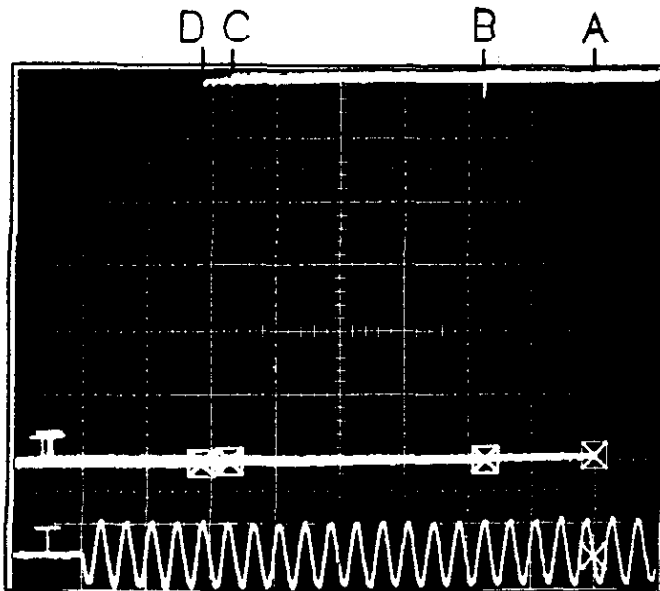
1 V/DIV 50 ms/DIV

12V

V_{out}

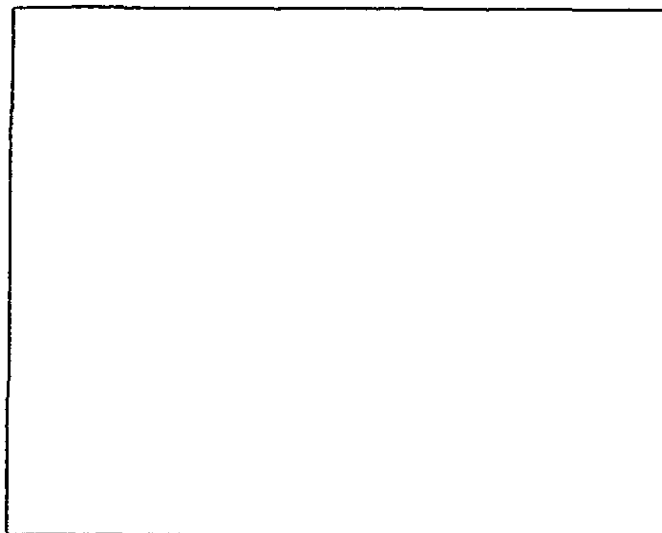
0V

V_{in}



2 V/DIV 50 ms/DIV

[Empty box]



V/DIV ms/DIV

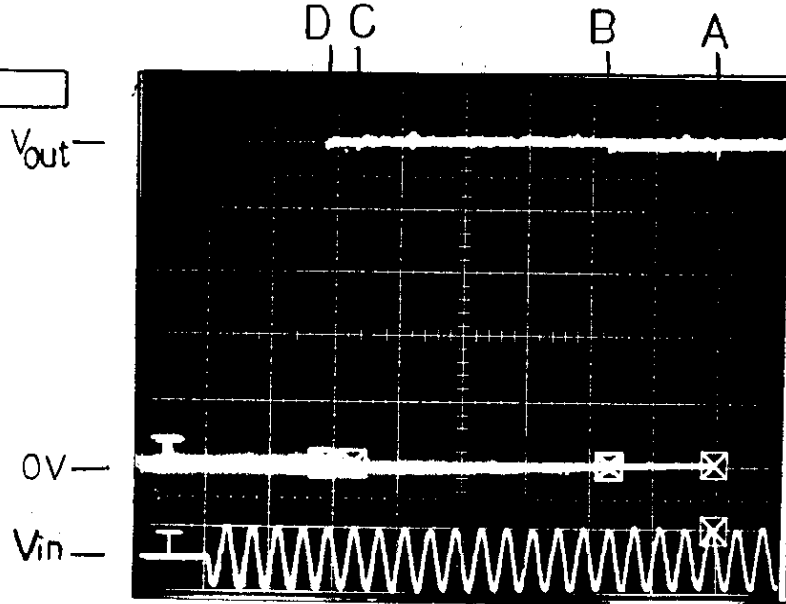
Output rise time

KWS 5

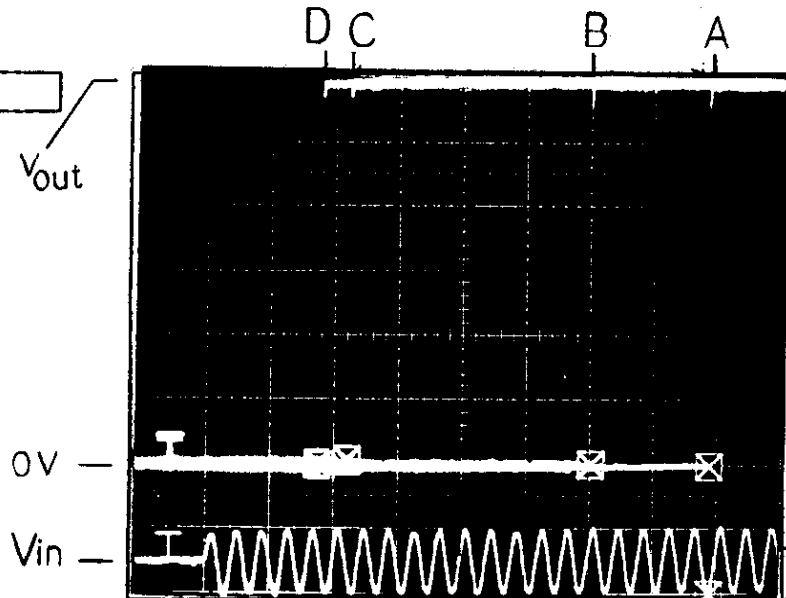
Conditions Vin: AC 85v (A)
 100v (B)
 220v (C)
 265v (D)

Iout: 100 %
 Ta: 25°C

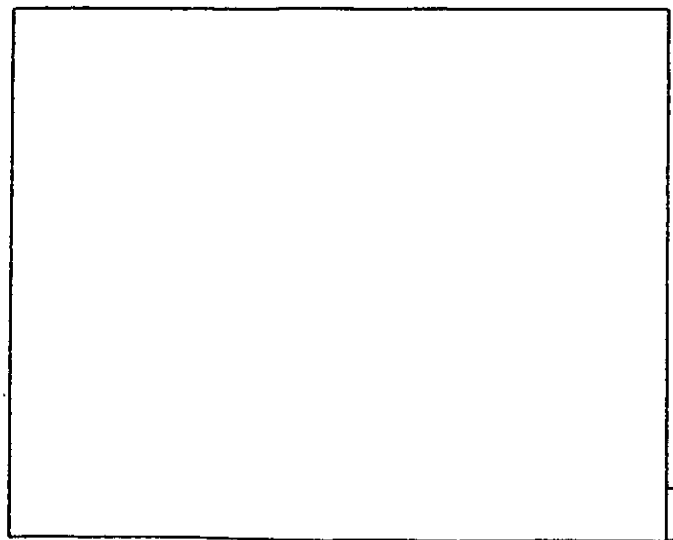
5V



12V



[Empty box]



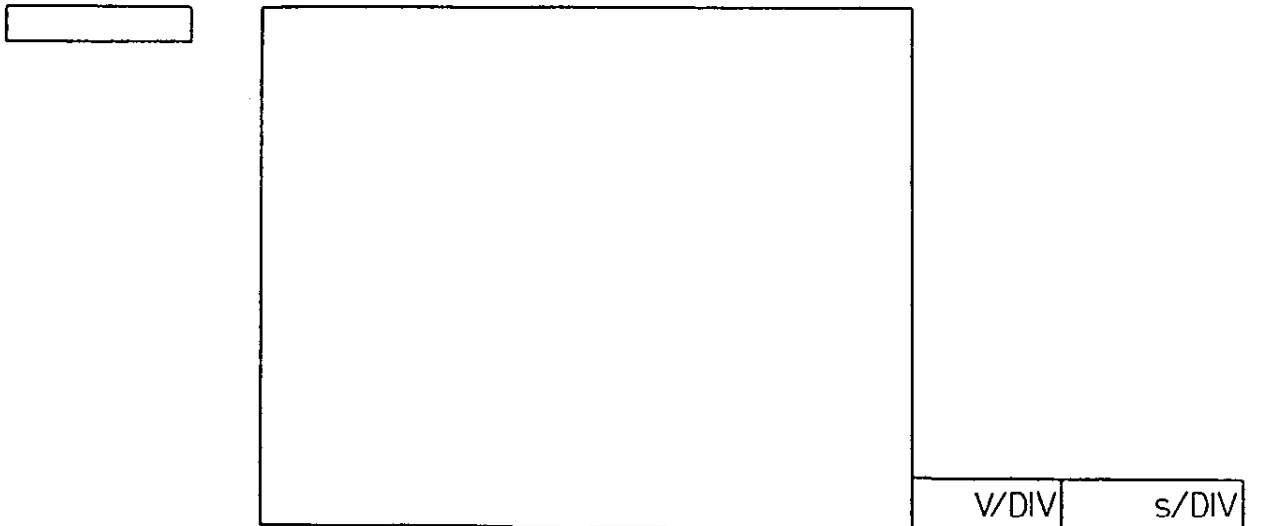
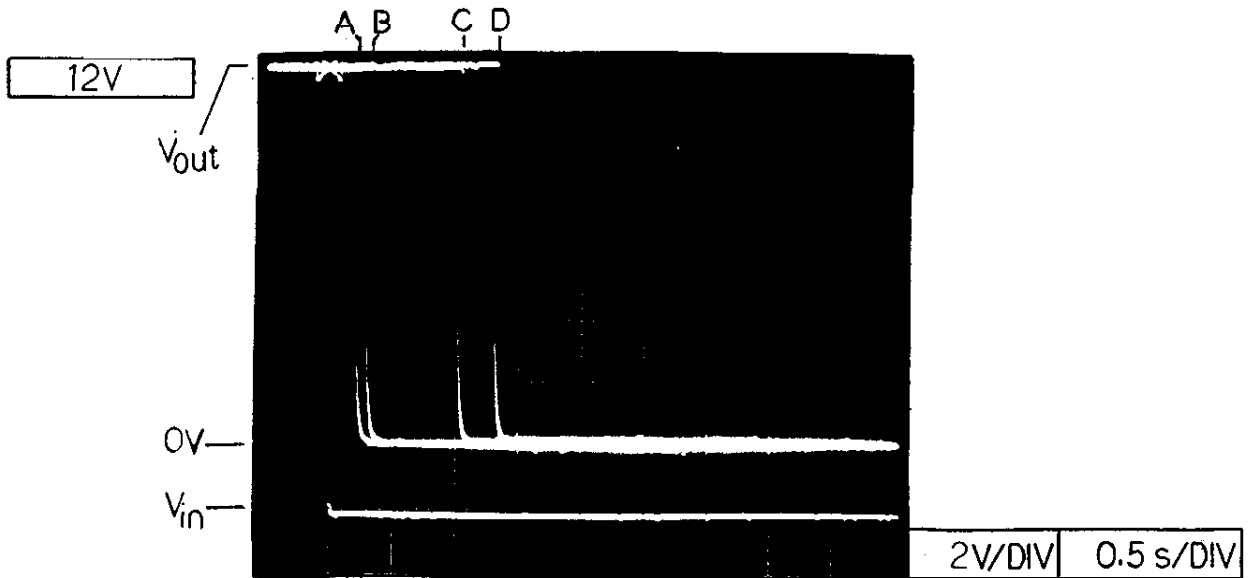
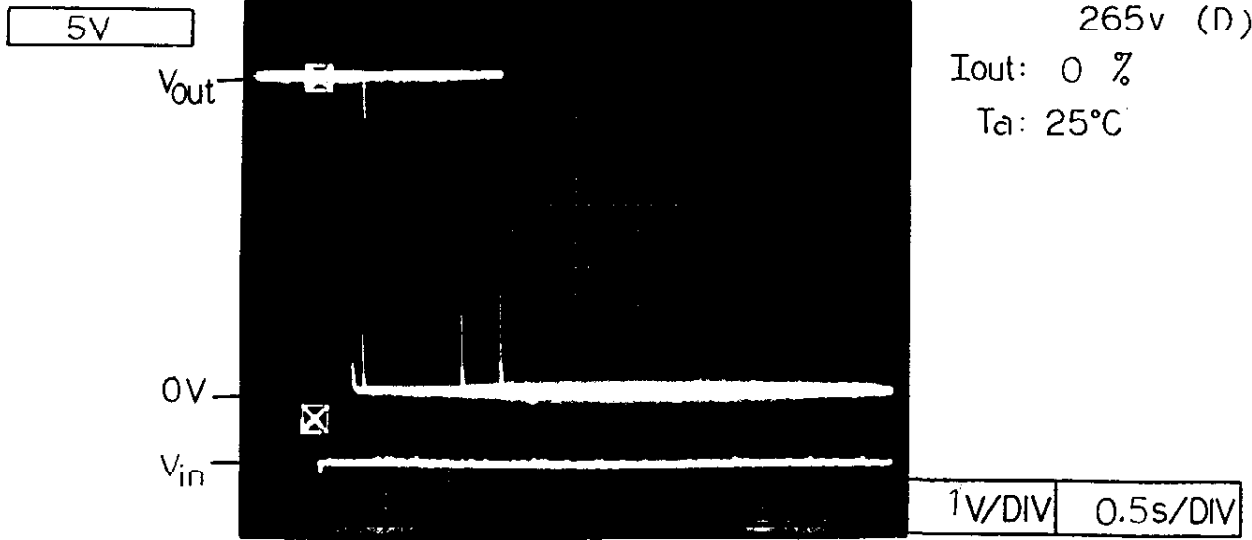
V/DIV ms/DIV

Output fall time

KWS 5

Conditions Vin: AC 85v (A)
100v (B)
220v (C)
265v (D)

Iout: 0 %
Ta: 25°C

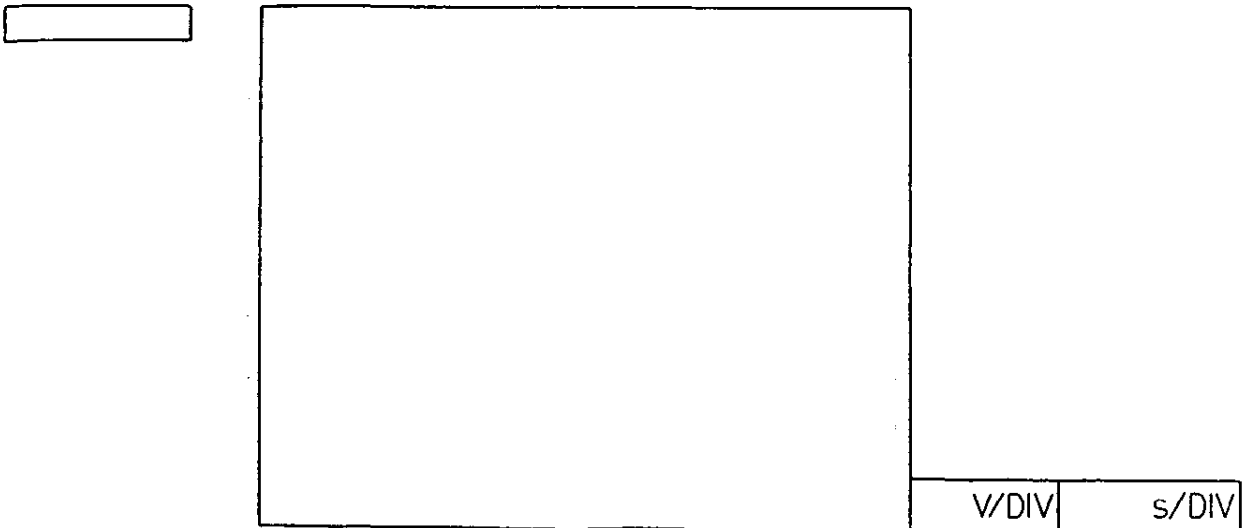
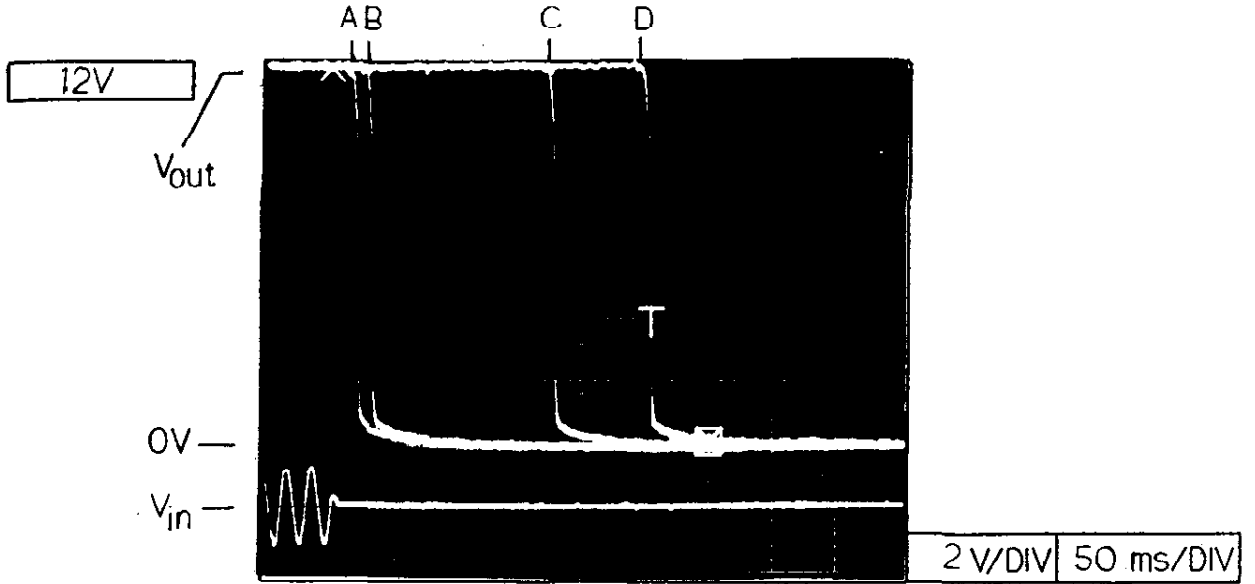
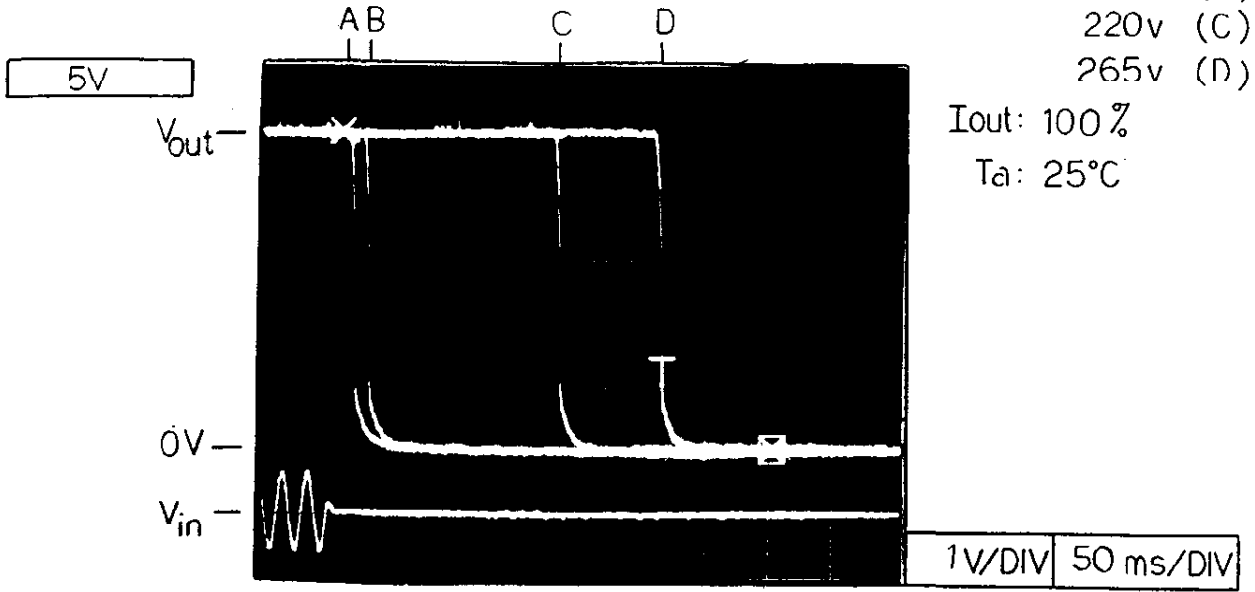


Output fall time

KWS 5

Conditions Vin: AC 85v (A)
100v (B)
220v (C)
265v (D)

Iout: 100%
Ta: 25°C

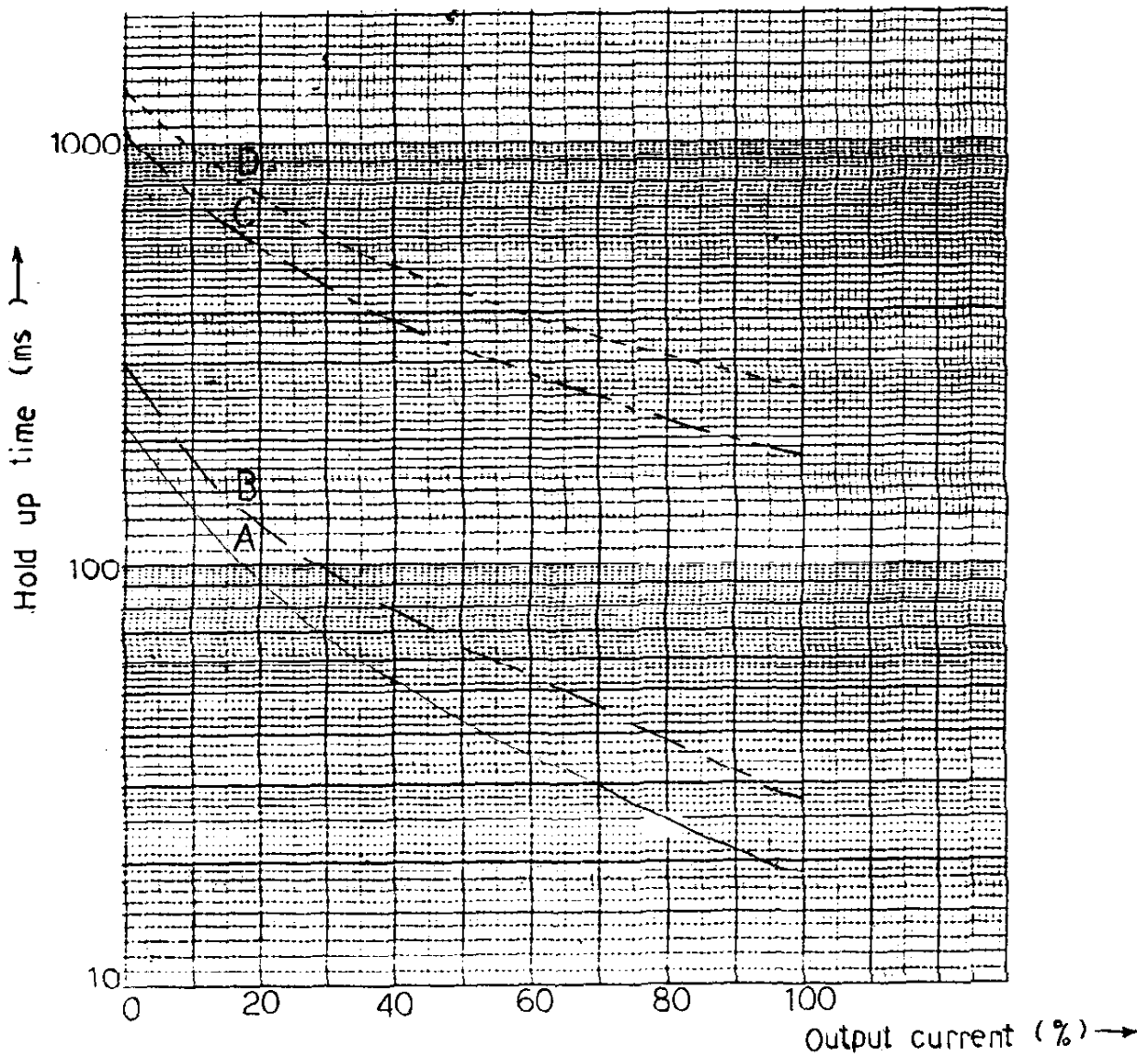


Hold up time

KWS 5

5V

Condition Vin : AC 85v ——— A
AC 100v - - - - B
AC 220v - - - - C
AC 265v ····· D
Ta : 25°C

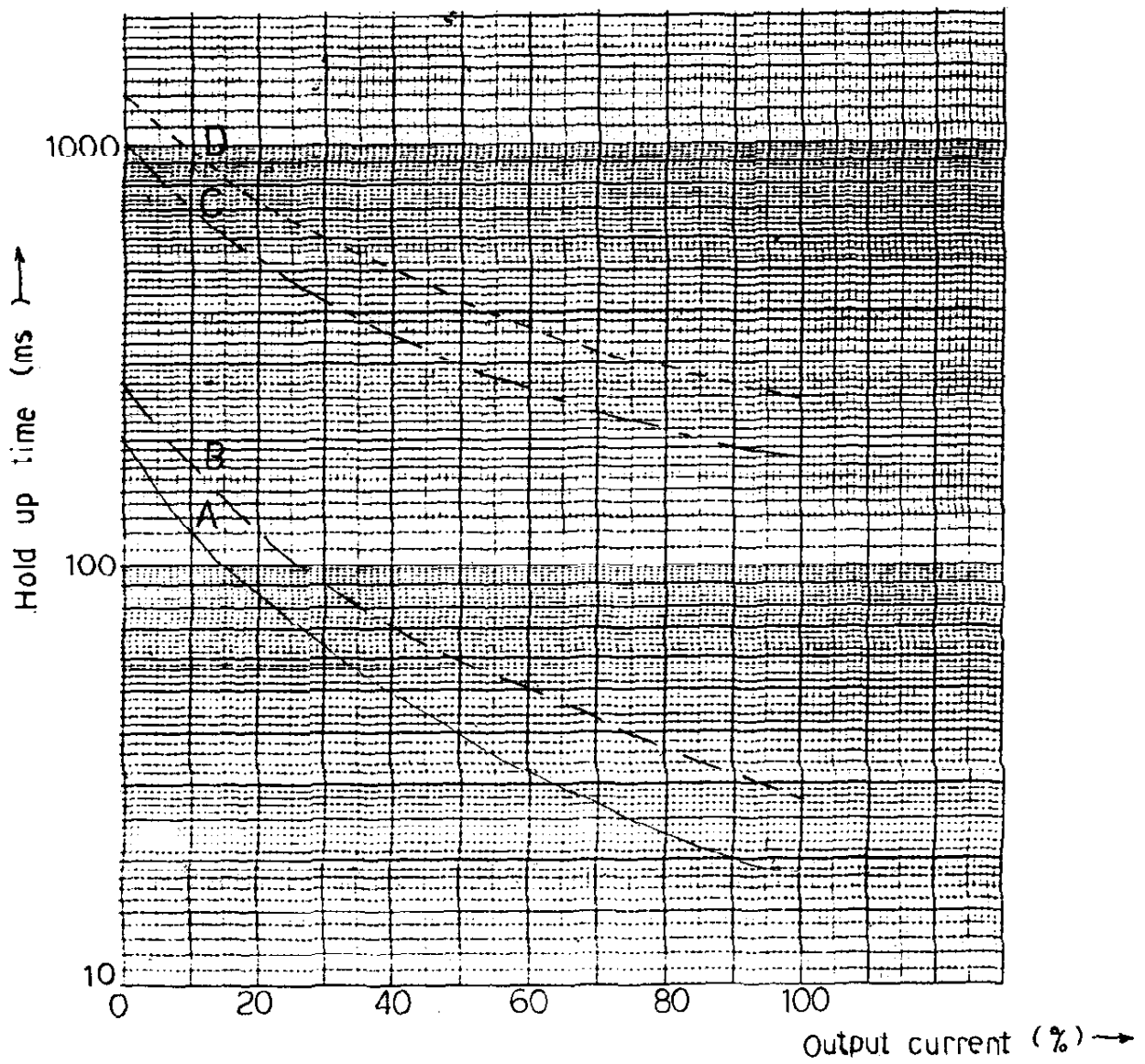


Hold up time

KWS 5

12V

Condition Vin : AC 85v — A
AC 100v - - - B
AC 220v - - - C
AC 265v ····· D
Ta : 25°C



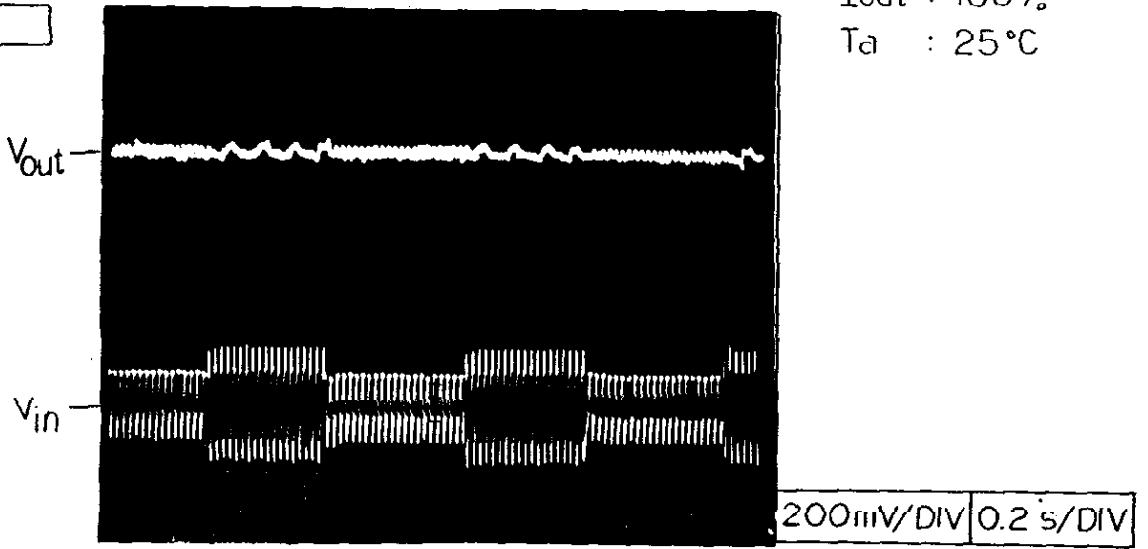
Dynamic line response

KWS 5

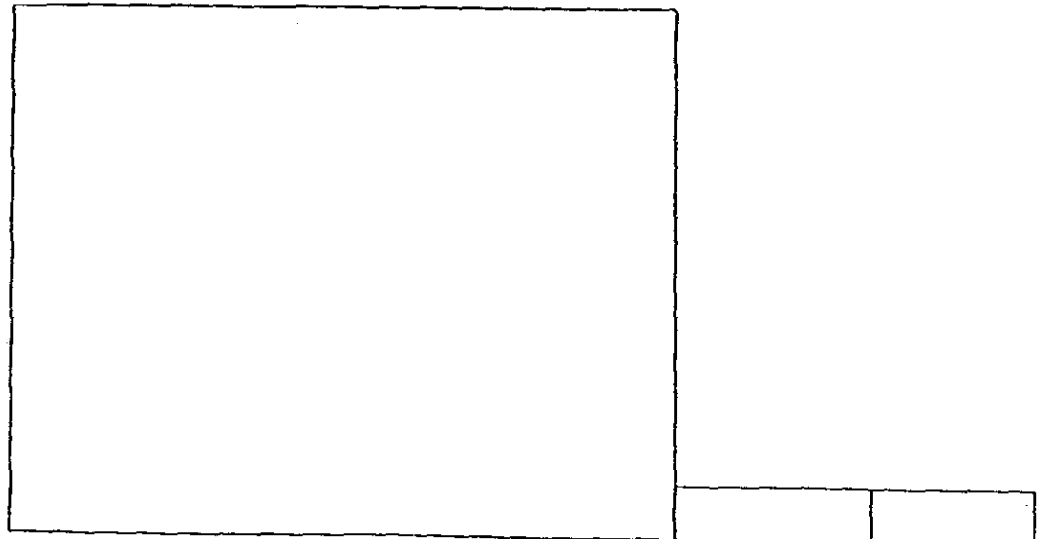
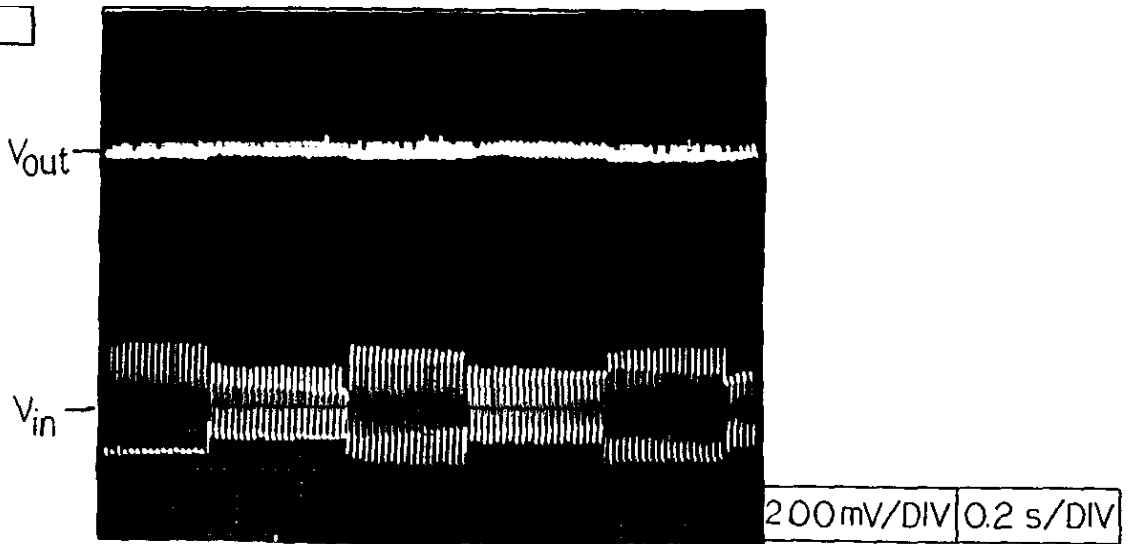
Vin : AC 85 v \rightleftharpoons AC 132 v

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

5V



12V



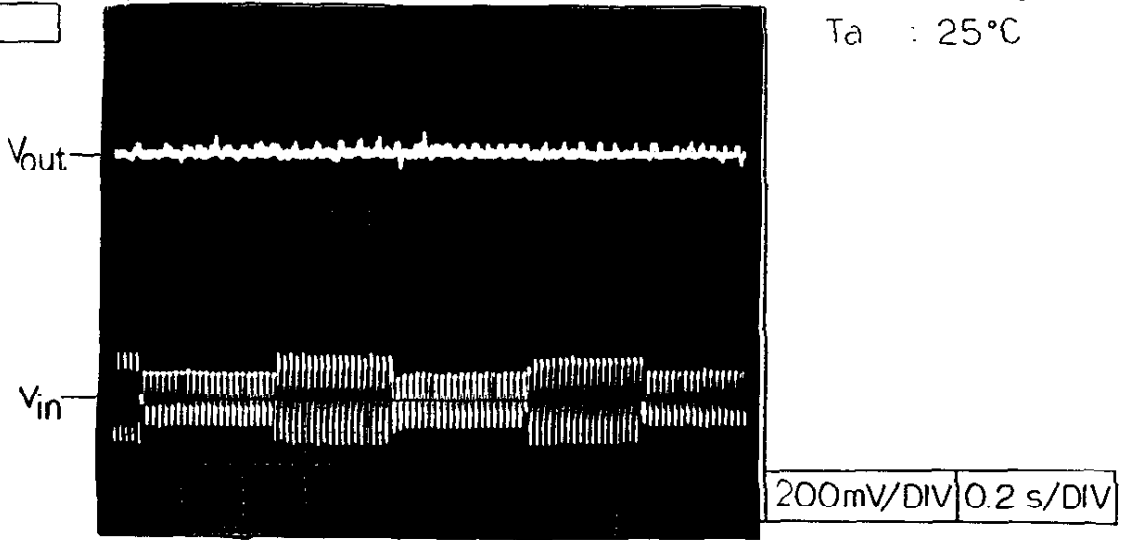
Dynamic line response

KWS 5

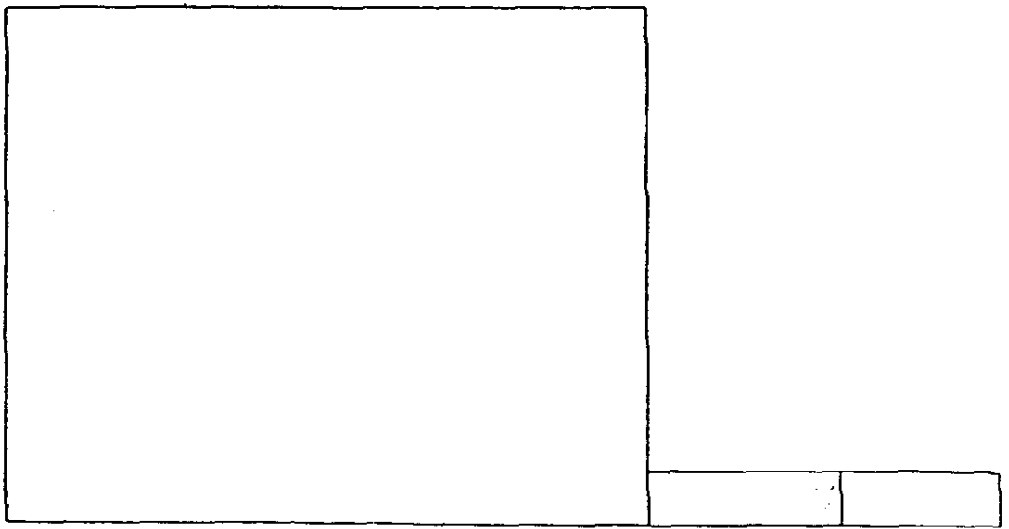
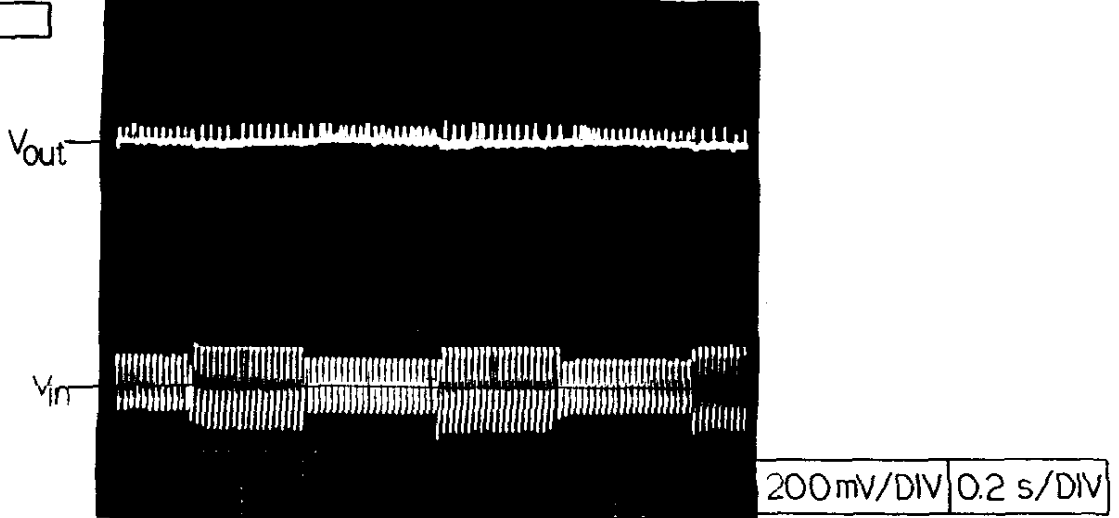
Vin : AC170v \rightleftharpoons AC265v

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

5v



12v



Dynamic load response

KWS 5

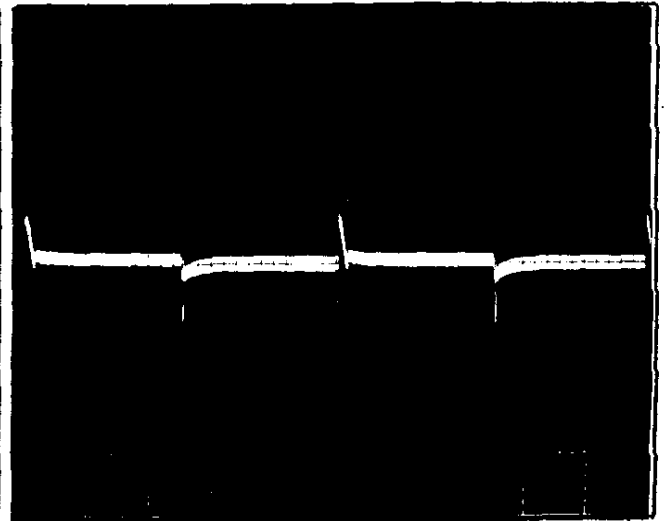
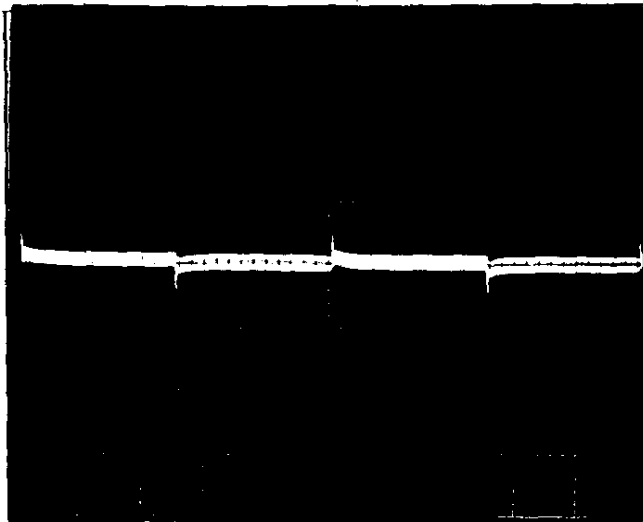
Conditions V_{in} : AC 100 V
 T_a : 25 °C

5V

I_{out} 50 \leftrightarrow 100% $f=100\text{Hz}$

I_{out} 0 \leftrightarrow 100% $f=100\text{Hz}$

V_{out}



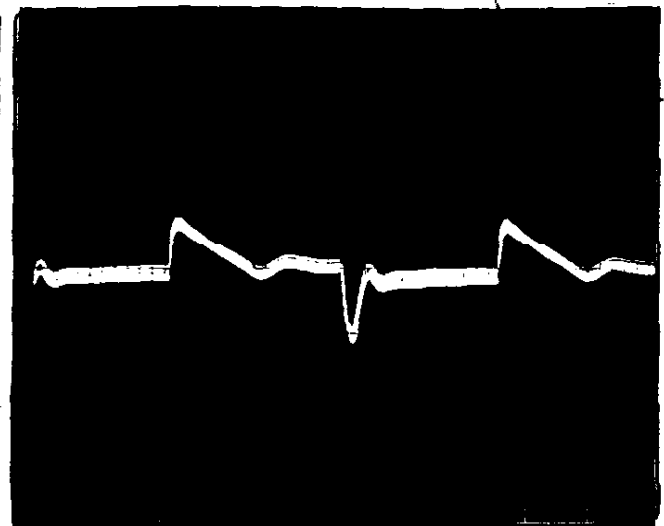
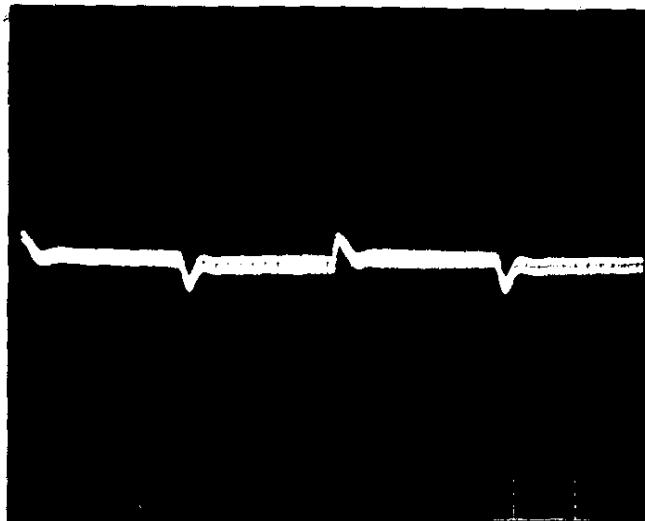
200mV / DIV	2mS / DIV
+2.0%	-1.6%

200mV / DIV	2mS / DIV
+3.2%	-3.8%

I_{out} 50 \leftrightarrow 100% $f=1\text{kHz}$

I_{out} 0 \leftrightarrow 100% $f=1\text{kHz}$

V_{out}



200mV / DIV	0.2mS / DIV
+2.4%	-2.0%

200mV / DIV	0.2mS / DIV
+3.6%	-4.8%

Dynamic load response

KWS 5

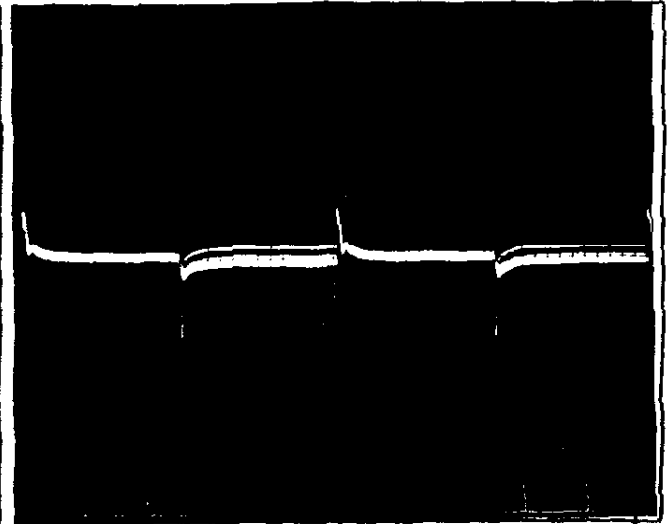
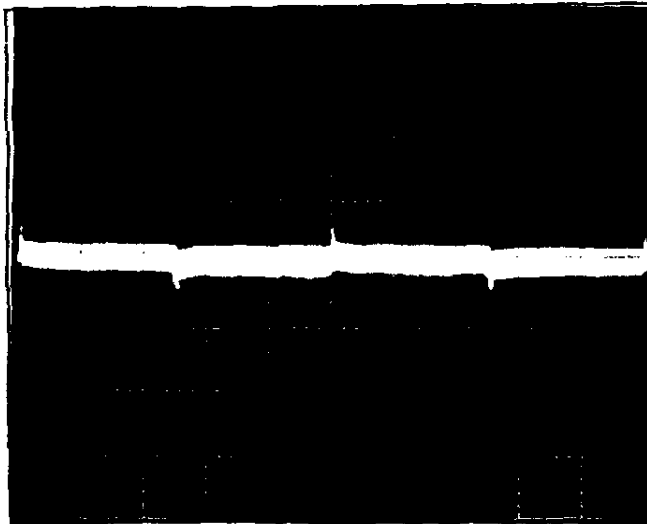
Conditions Vin: AC 220 V
Td: 25 °C

5V

Iout 50 ↔ 100% f=100Hz

Iout 0 ↔ 100% f=100Hz

Vout-



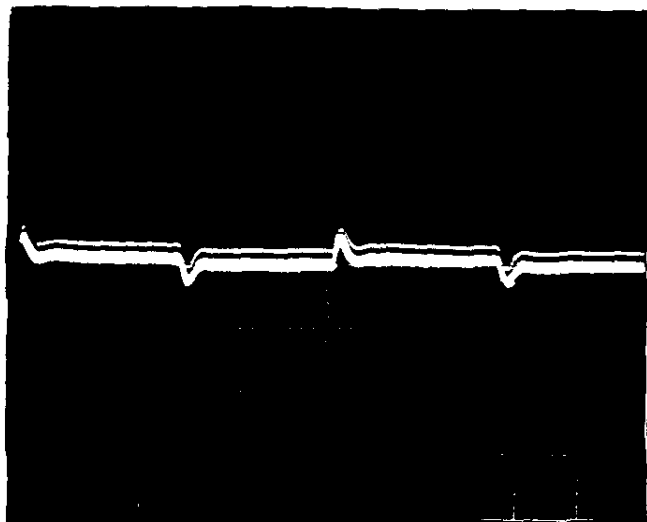
200mV / DIV	2mS / DIV
+2.4%	-1.6%

200mV / DIV	2mS / DIV
+3.2%	-4.8%

Iout 50 ↔ 100% f=1kHz

Iout 0 ↔ 100% f=1kHz

Vout-



200mV / DIV	0.2mS / DIV
+2.4%	-1.6%

200mV / DIV	0.2mS / DIV
+3.2%	-4.8%

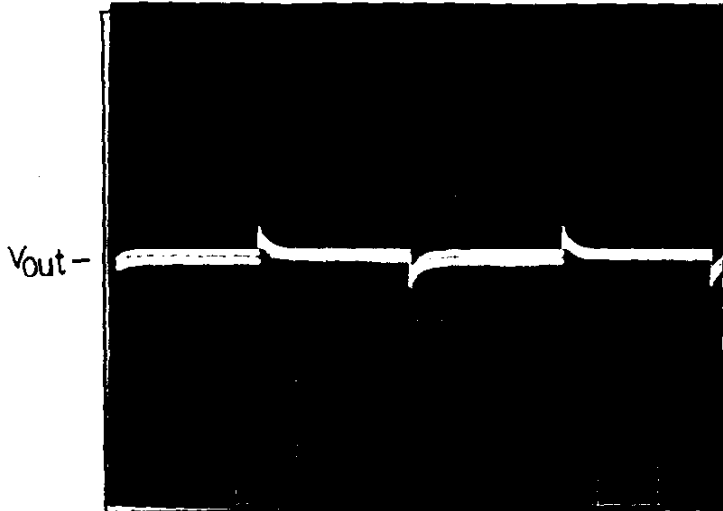
Dynamic load response

KWS 5

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

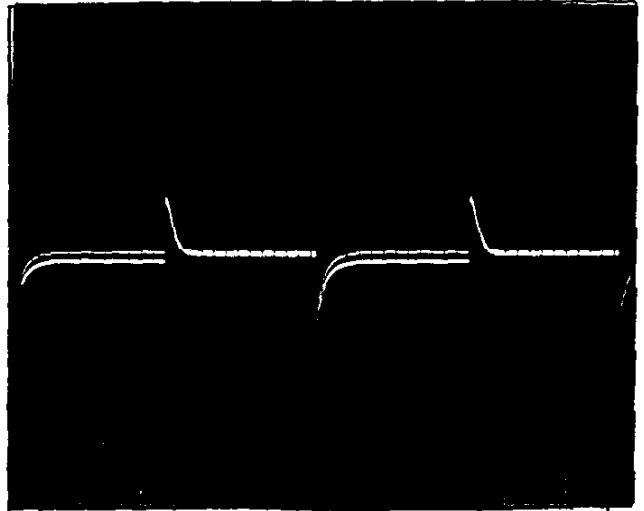
12V

I_{out} 50 \leftrightarrow 100% $f=100\text{Hz}$



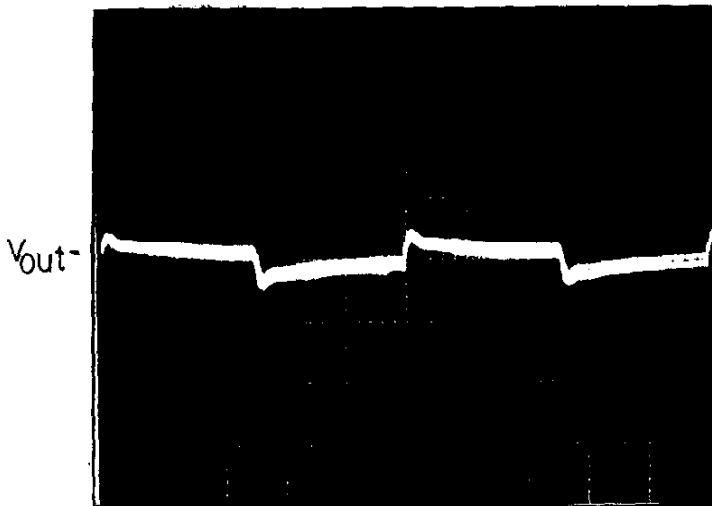
200mV / DIV	2mS / DIV
+1.0%	-0.8%

I_{out} 0 \leftrightarrow 100% $f=100\text{Hz}$



200mV / DIV	2mS / DIV
+1.7%	-2.0%

I_{out} 50 \leftrightarrow 100% $f=1\text{kHz}$



200mV / DIV	0.2mS / DIV
+0.8%	-0.8%

I_{out} 0 \leftrightarrow 100% $f=1\text{kHz}$



200mV / DIV	0.2mS / DIV
+1.5%	-2.0%

Dynamic load response

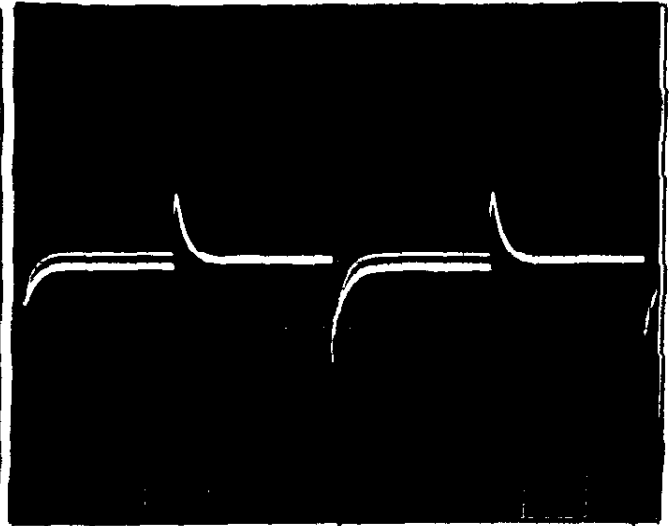
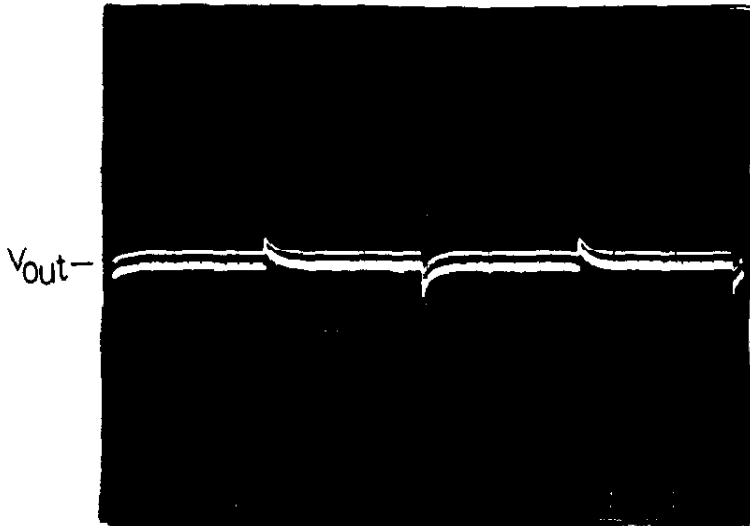
KWS 5

Conditions Vin: AC 220 V
Ta: 25 °C

12V

Iout 50 ↔ 100% f=100Hz

Iout 0 ↔ 100% f=100Hz

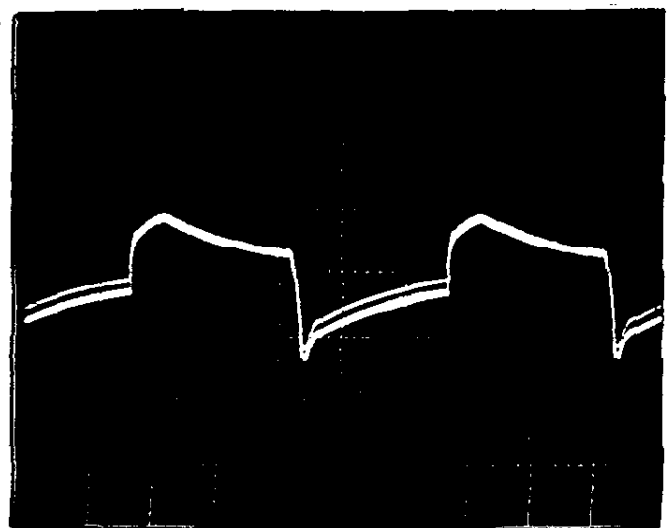
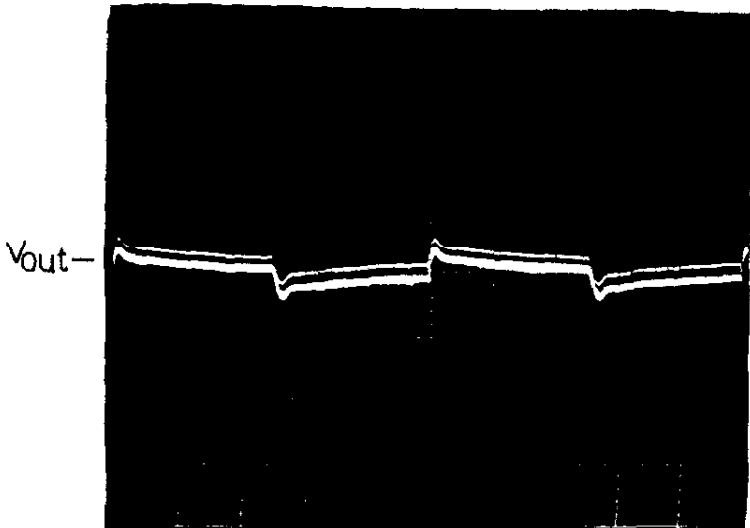


200mV / DIV	2mS / DIV
+1.0%	-0.8%

200mV / DIV	2mS / DIV
+1.8%	-2.7%

Iout 50 ↔ 100% f=1kHz

Iout 0 ↔ 100% f=1kHz



200mV / DIV	0.2mS / DIV
+1.0%	-0.8%

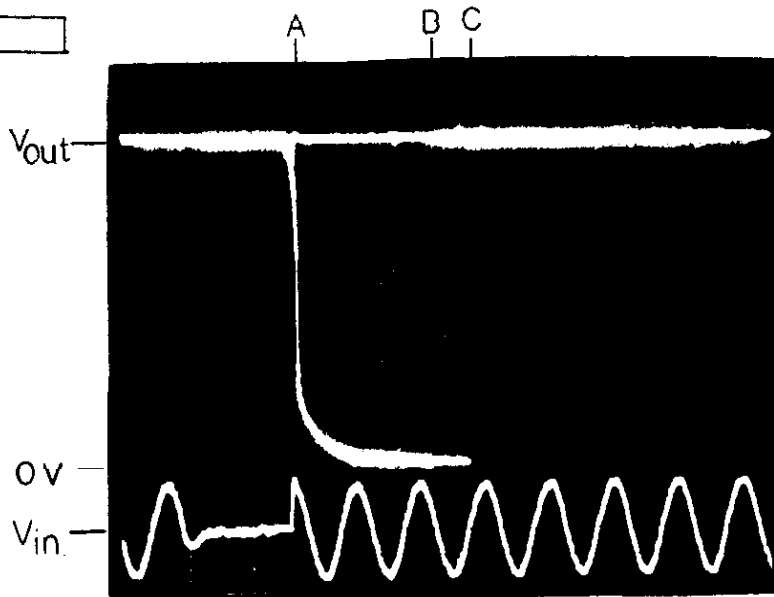
200mV / DIV	0.2mS / DIV
+1.5%	-2.3%

Response to brown out

KWS 5

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

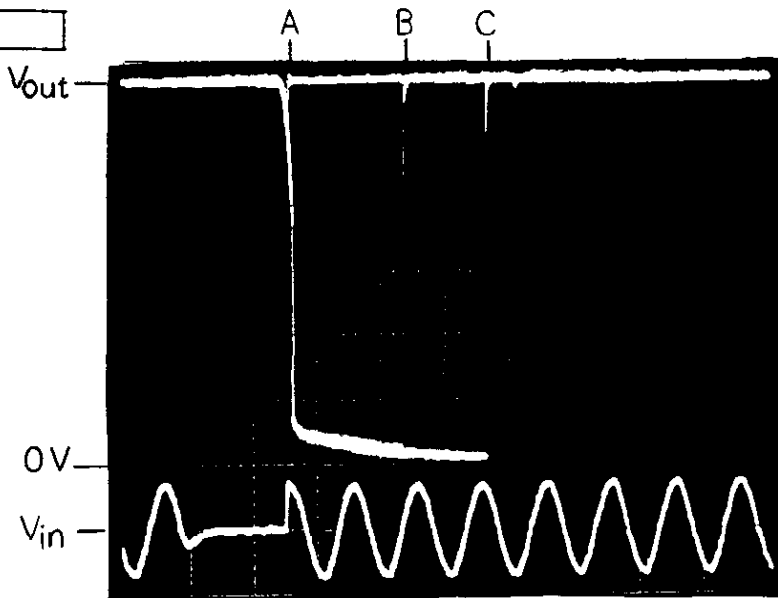
5V



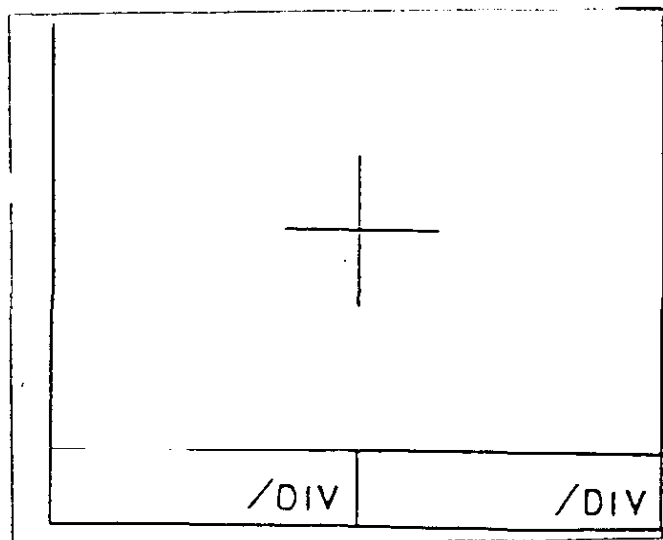
Brown out time :

- A : 34 ms
- B : 36 ms
- C : 46 ms

12V



- A : 33 ms
- B : 35 ms
- C : 51 ms



- A : ms
- B : ms
- C : ms

Response to brown out

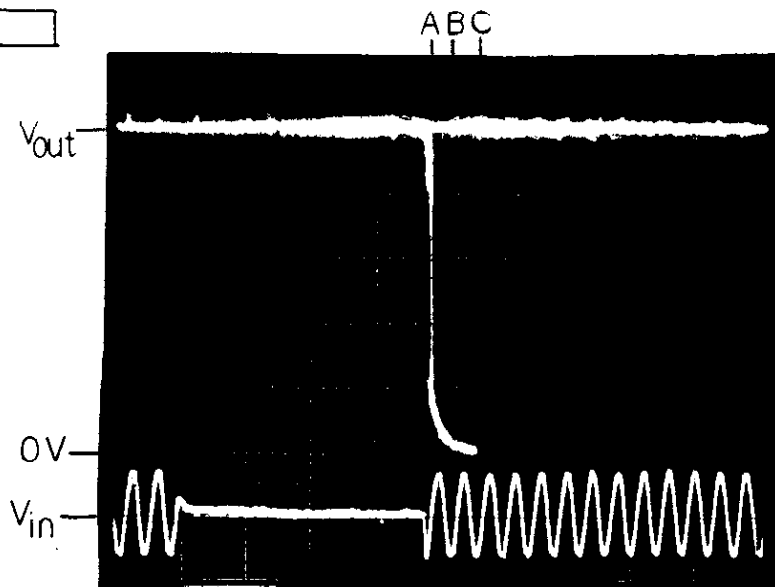
KWS 5

Conditions V_{in} : AC 220V

I_{out} : 100%

T_a : 25°C

5V



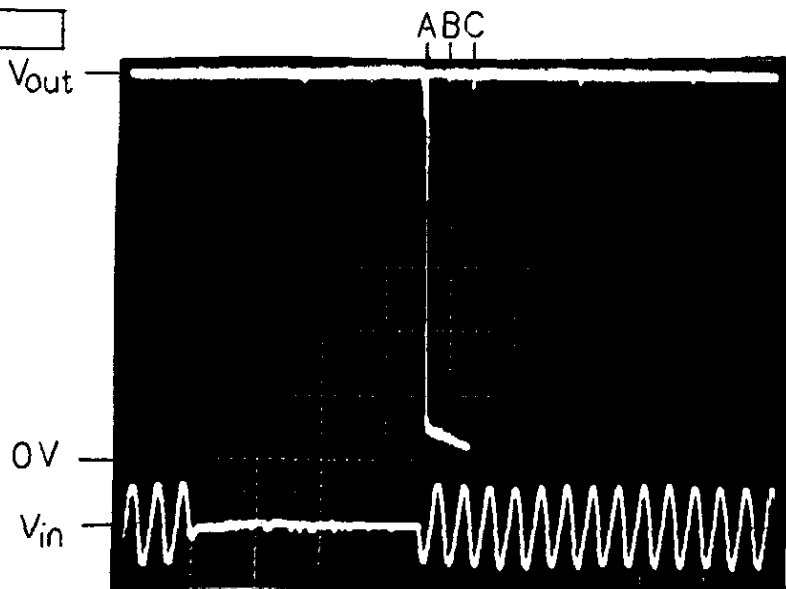
Brown out time :

A : 194 ms

B : 196 ms

C : 216 ms

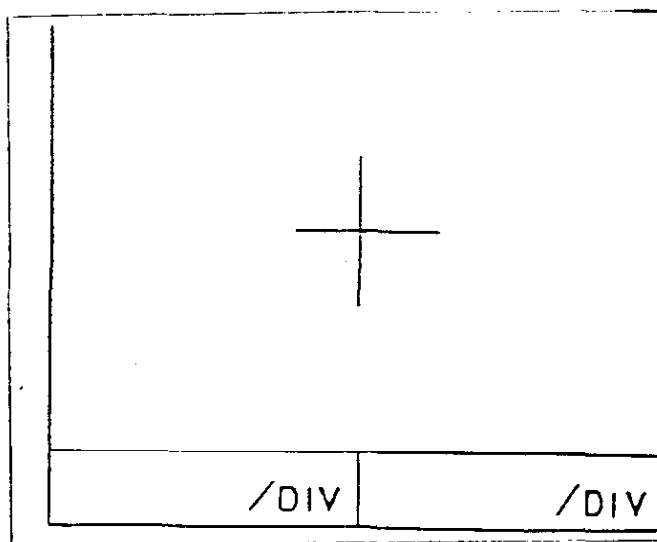
12V



A : 180 ms

B : 184 ms

C : 200 ms



A : ms

B : ms

C : ms

Inrush Current Characteristics

KWS 5

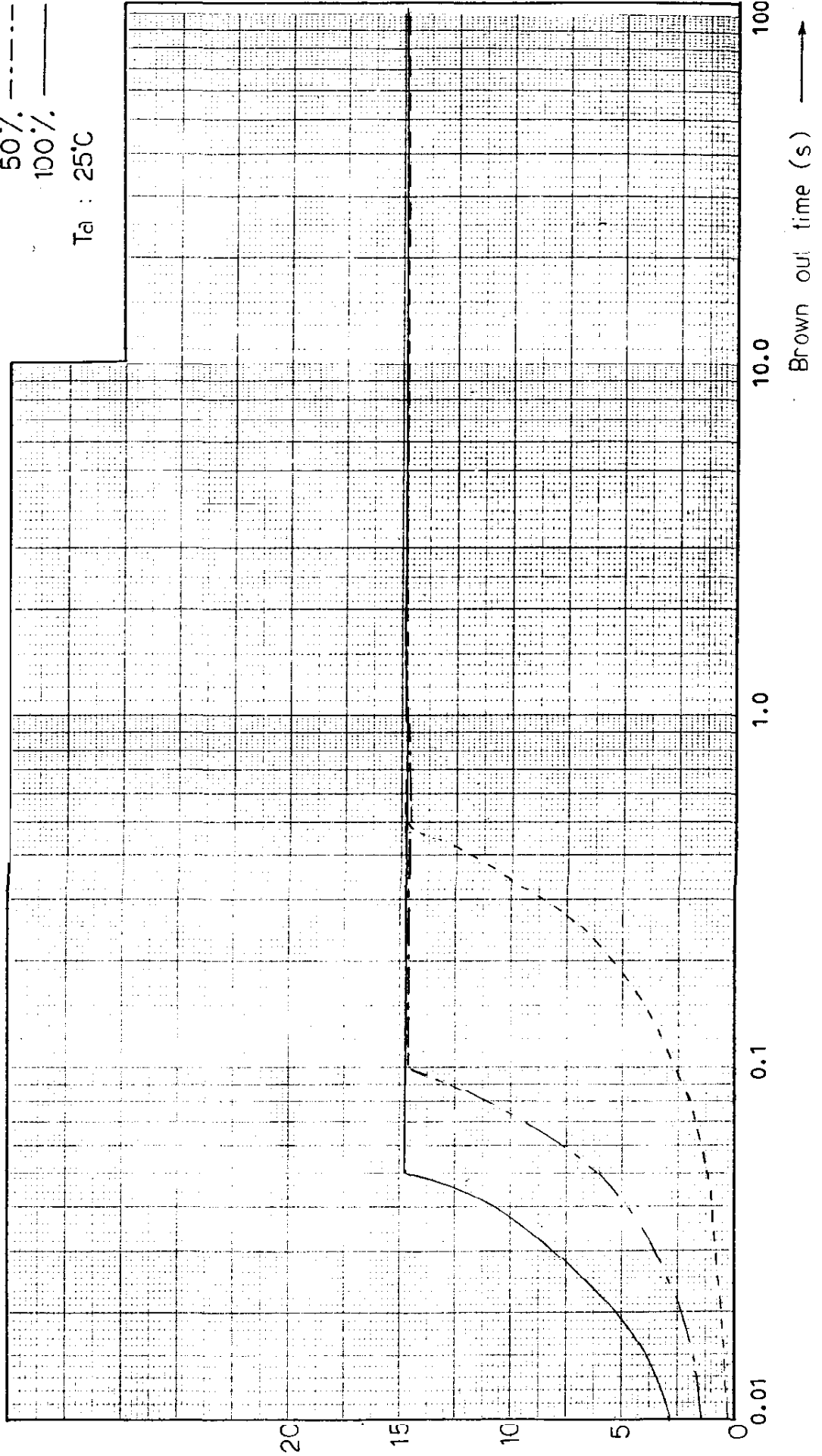
V_{in} : AC100V

I_{out} : 0% -----

50% -----

100% -----

T_a : 25°C



← (Max) Inrush Current (A)
△ NEMIC-LAMBDA

Inrush Current Characteristics

KWS 5

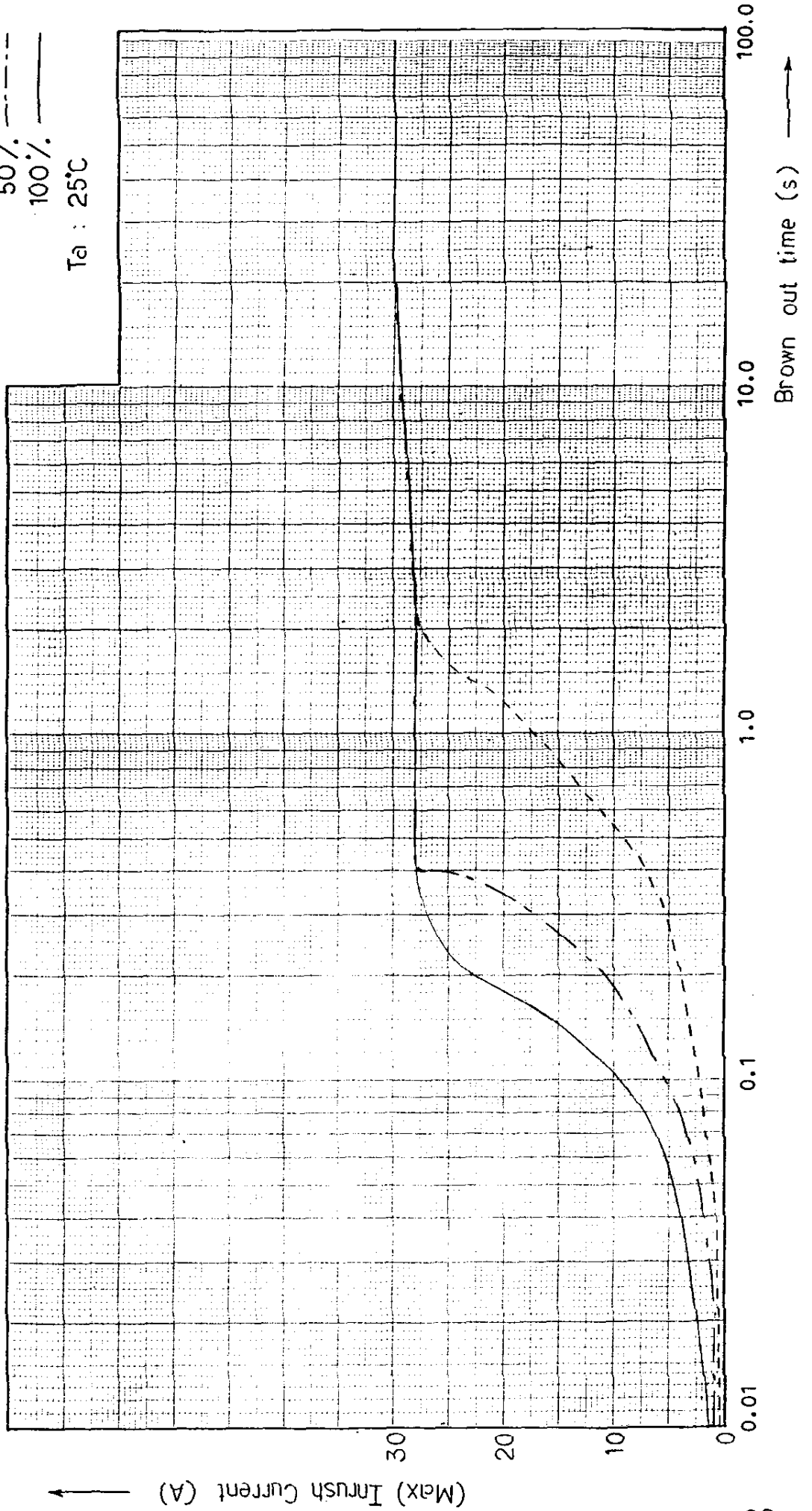
V_{in} : AC 230V

I_{out} : 0%

50%

100%

T_a : 25°C



(Max) Inrush Current (A) ←

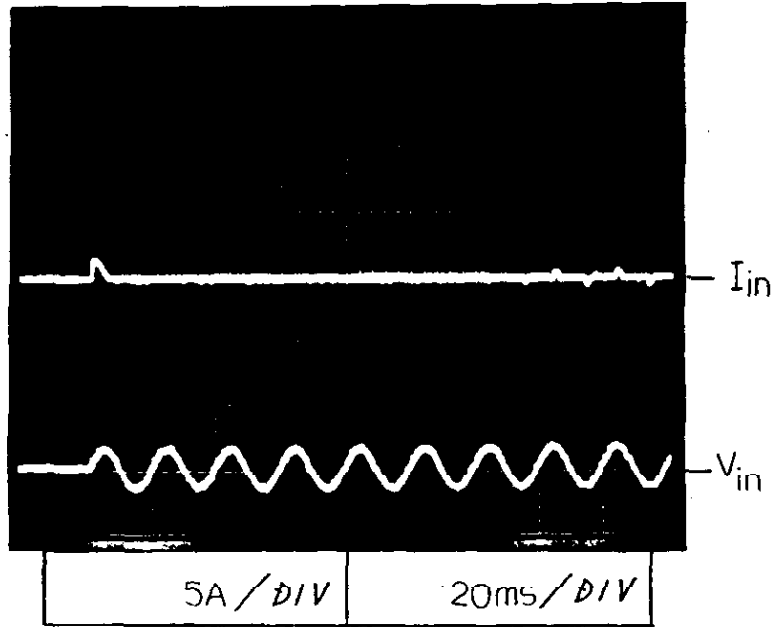
→ Brown out time (s)

Inrush current waveform

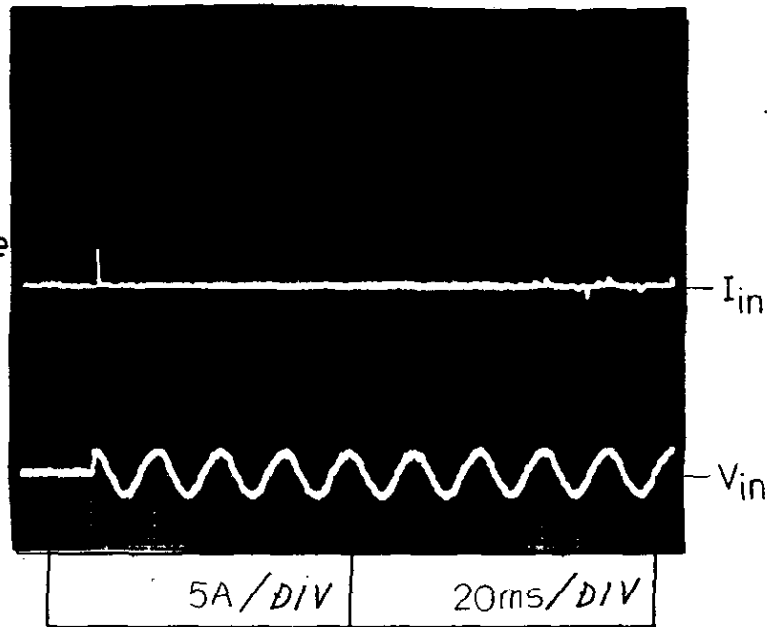
KWS 5

Conditions V_{in} : AC100 v
 I_{out} : 100 %
 T_a : 25 °C

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



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

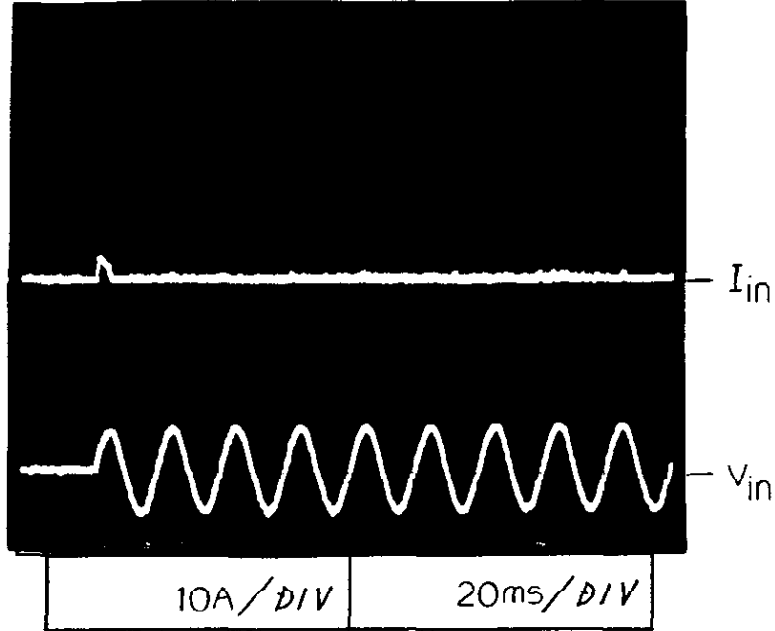


Inrush current waveform

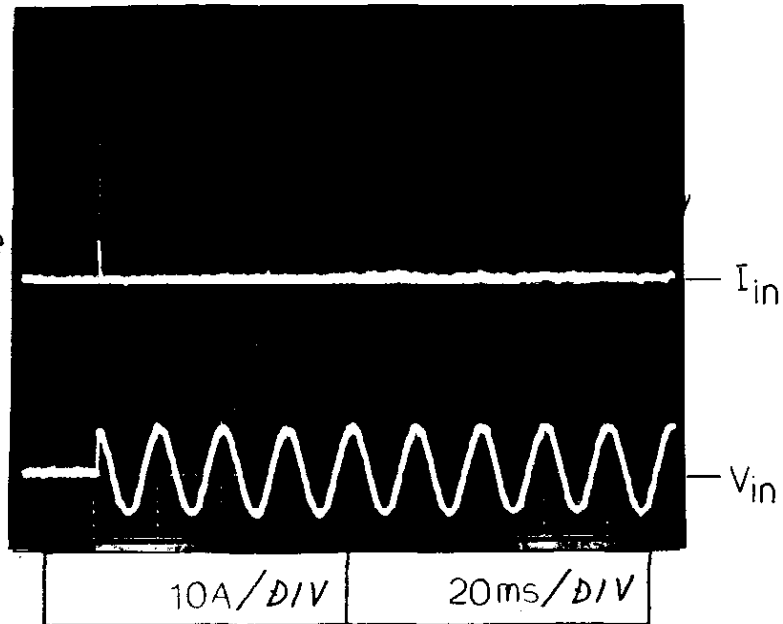
KWS 5

Conditions V_{in} : AC 230 v
 I_{out} : 100 %
 T_a : 25 °C

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



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

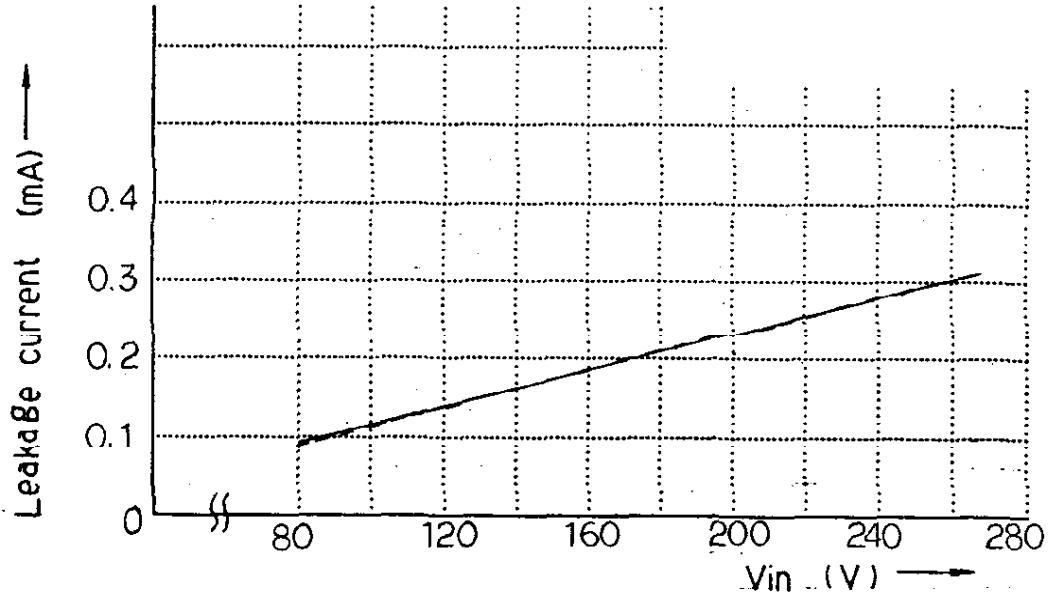


Leakage current

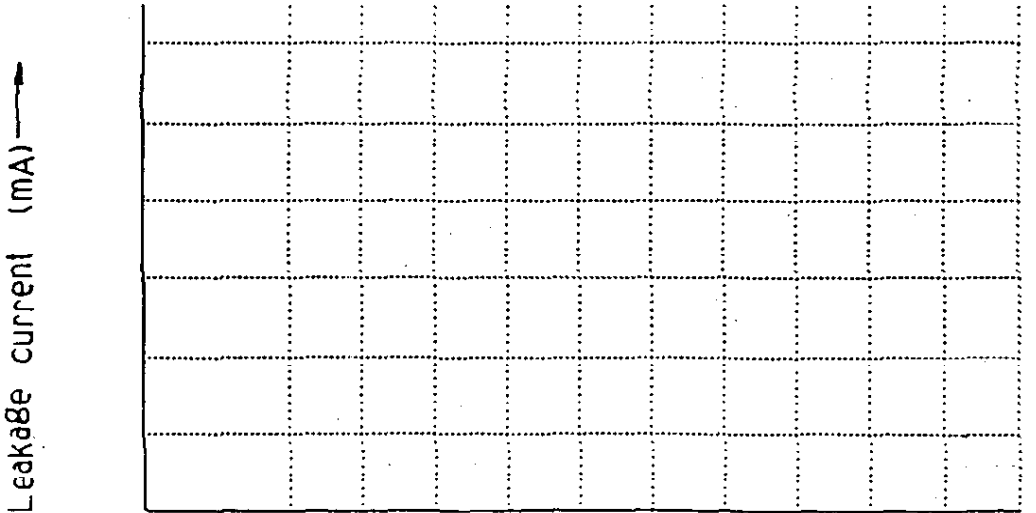
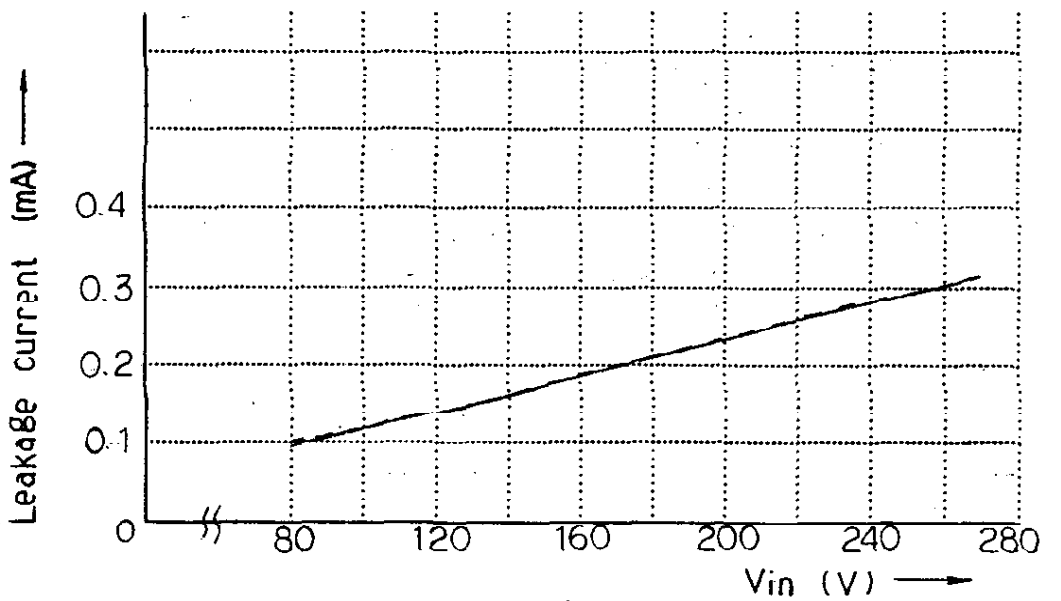
KWS 5

Conditions $I_{out} : 100\%$ —
 0% - - -
 $T_a : 25^\circ C$

5V



12V



OUTPUT-RIPPLE, NOISE

KWS 5

Conditions

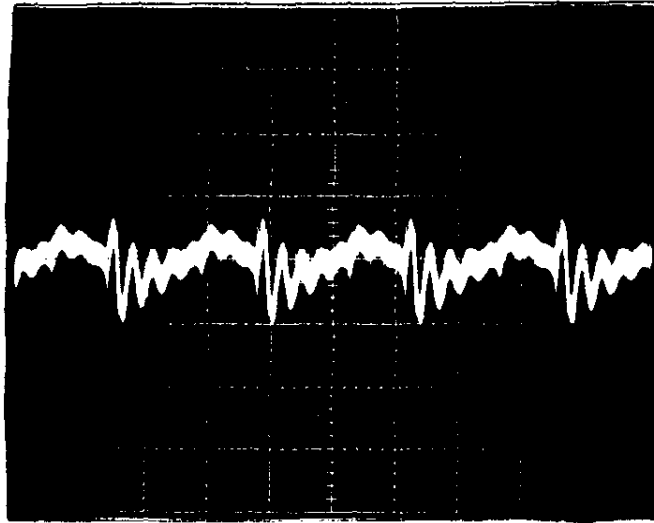
Vin: AC 100 v

Iout: 100%

Ta: 25°C

NORMAL MODE

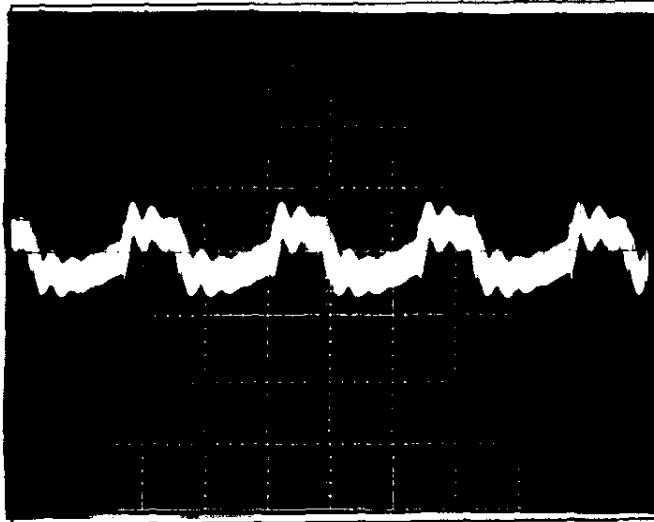
5V



20mV/DIV

2 μs/DIV

12V



20mV/DIV

2 μs/DIV

mV/DIV

μs/DIV

OUTPUT-RIPPLE, NOISE

KWS 5

Conditions

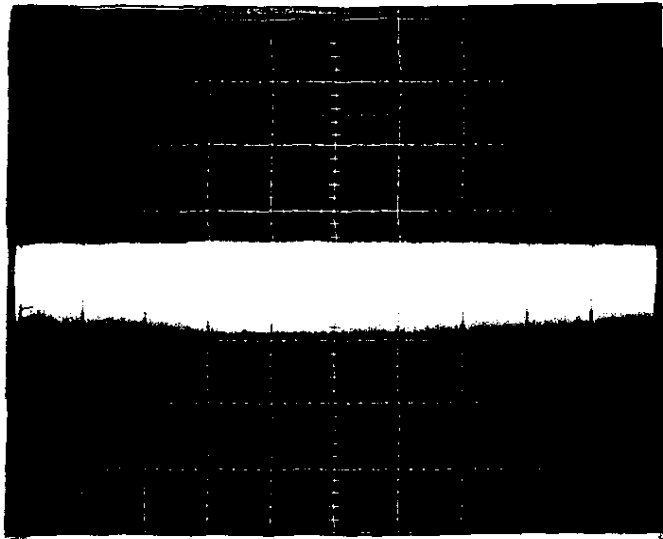
Vin: AC 100v

Iout: 100%

Ta: 25°C

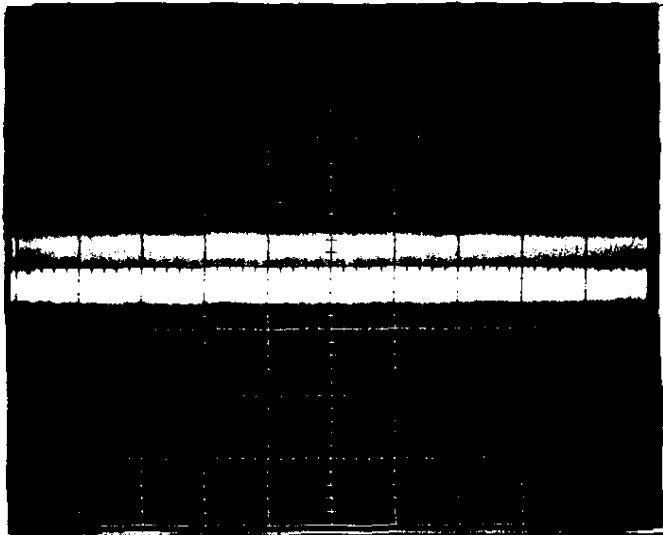
NORMAL MODE

5V

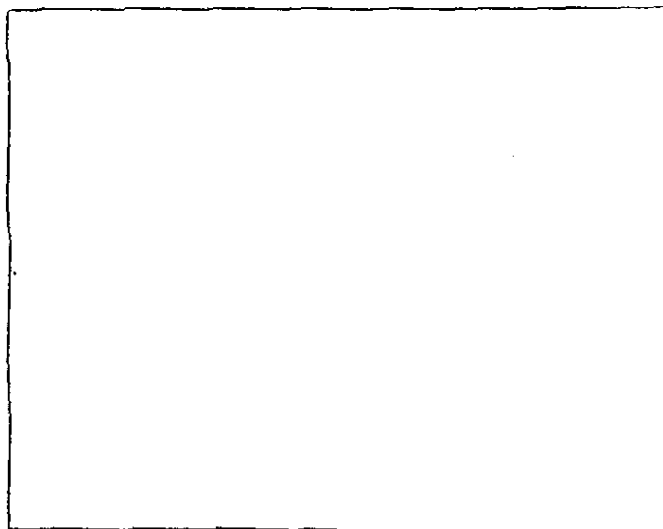


20mV/DIV | 5ms/DIV

12V



20mV/DIV | 5ms/DIV



mV/DIV | μ s/DIV

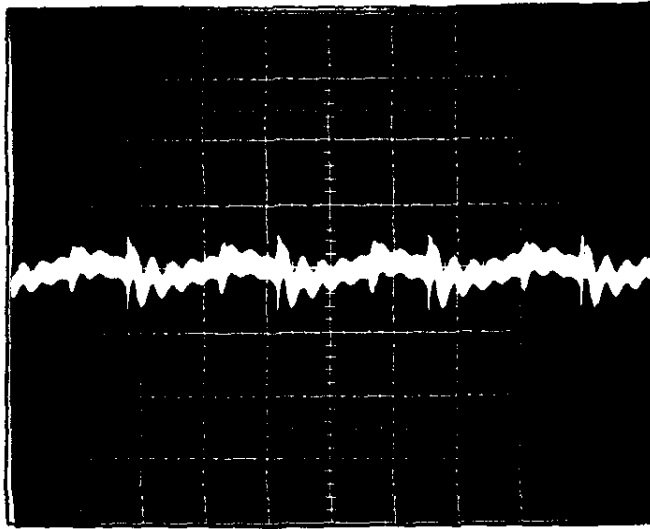
OUTPUT-RIPPLE, NOISE

KWS 5

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

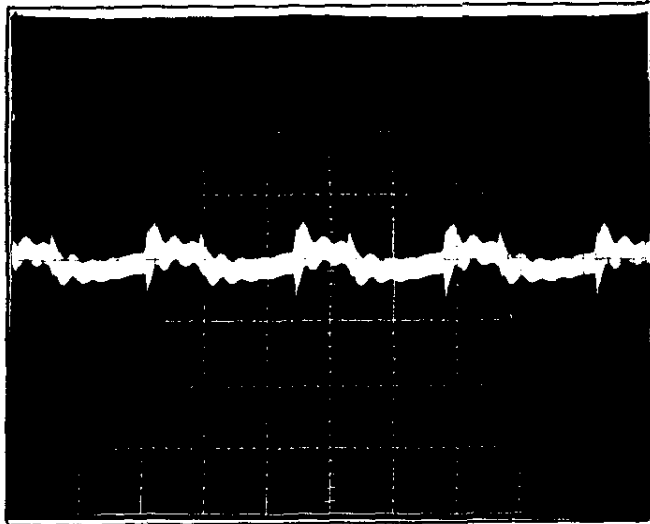
COMMON + NORMAL MODE

5V

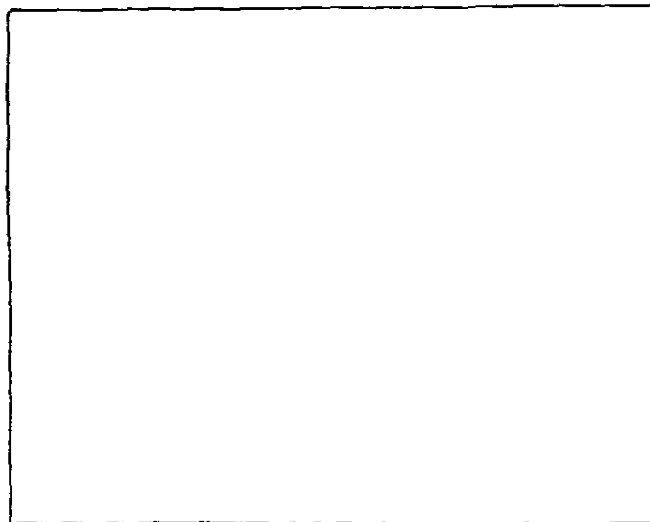


50mV/DIV | 2 μ s/DIV

12V



50mV/DIV | 2 μ s/DIV



mV/DIV | μ s/DIV

OUTPUT-RIPPLE, NOISE

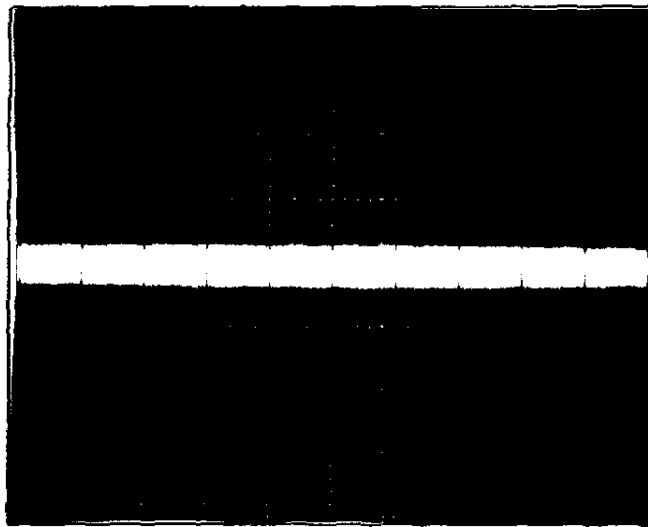
KWS 5

Conditions

Vin: AC 100 v
Iout: 100 %
Ta: 25°C

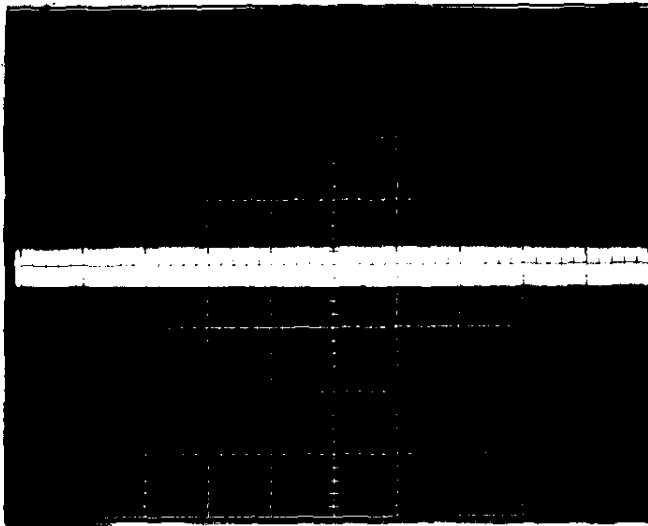
COMMON + NORMAL MODE

5V

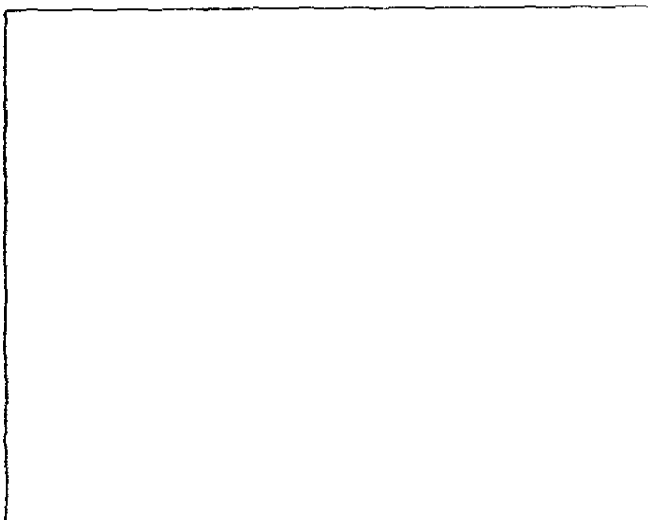


50 mV/DIV | 5 ms/DIV

12V



50 mV/DIV | 5 ms/DIV



mV/DIV | μ s/DIV