

# QUALITY TEST DATA

KWS10

DWG. NO.		PA767 - 53 - 01			
QA APPROVAL		R / D			
NLJ	NLS	APPROVED	CHECKED	ENGR.	DRAWN
N. Joku	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	WILLIAM PHIA
25 JUN '92	17 JUN '92	16 JUN '92	16 JUN '92	16 JUN '92	15 JUNE '92

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#### Terminology used

##### Definition

Vin .....	Input voltage
Vout .....	Output voltage
Iin .....	Input current
Iout .....	Output current
Ta .....	Temperature

# KWS10 Specifications

NEMIC-LAMBDA

PA767-01-01A

\*: For delivery, contact to our sales office.

ITEMS		MODEL	KWS10-5	KWS10-12	KWS10-15
1	Nominal Output Voltage	V	5	12	15
2	Minimum Output Current	A	0	0	0
3	Maximum Output Current	A	2.0	0.9	0.7
4	Maximum Output Power	W	10.0	10.8	10.5
5	Efficiency (typ)	(*1) %	73	75	75
6	Input Voltage Range	(*2) -	85 ~ 265VAC ( 47~440Hz ) or 110 ~ 340VDC		
7	Input Current (typ)	(*1) A	0.3A at 100VAC		
8	Inrush Current (typ)	A	15A at 100VAC, 30A at 200VAC		
9	Output Voltage Range	-	FIXED $\pm 5\%$ (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 10W, 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 100M $\Omega$ 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 $\pm$ 5mS on $\pm$ (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	100g		
31	Size (WxHxD)	mm	45 x 20.5 x 64 (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.

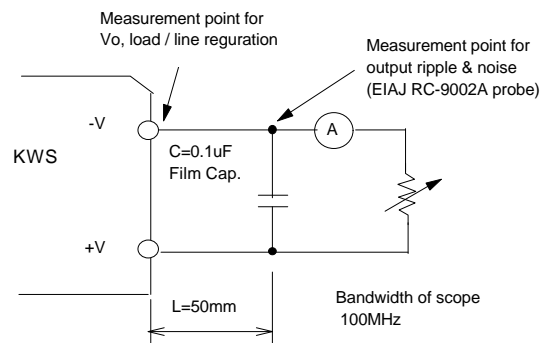
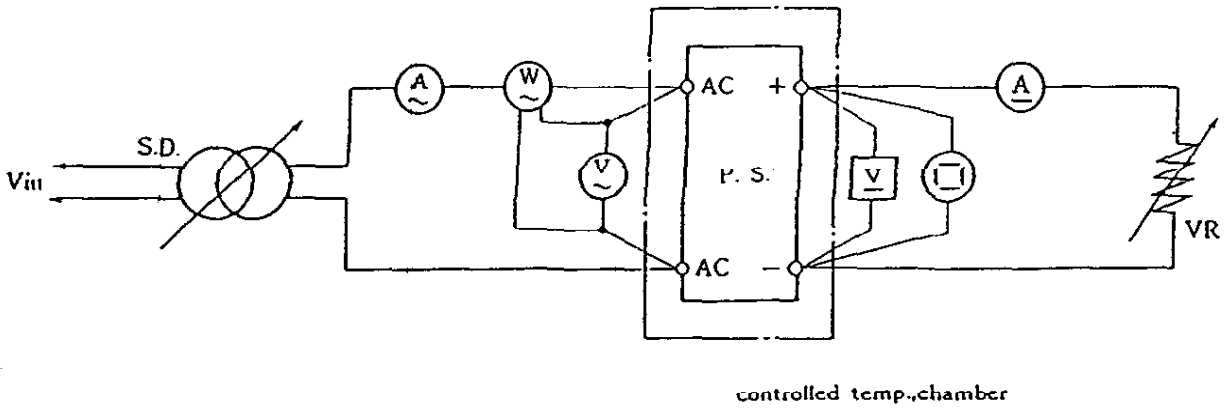


Fig.A

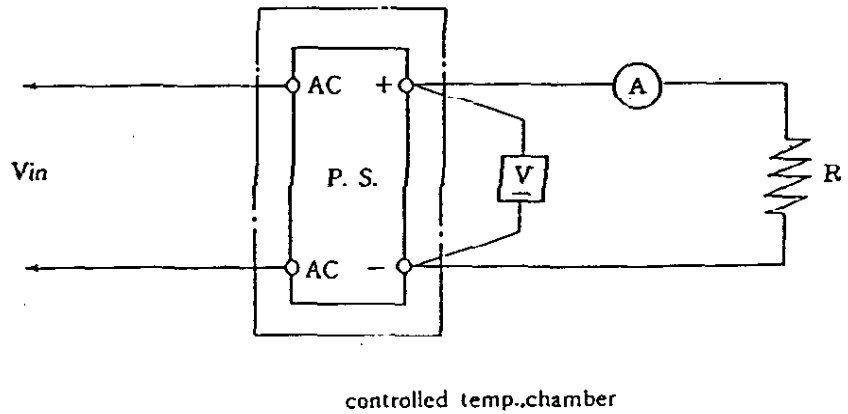
## 2. 評価測定方法 EVALUATION METHOD

### 2-1 測定回路 Circuits used for determination

(1) 静特性 Steady state data



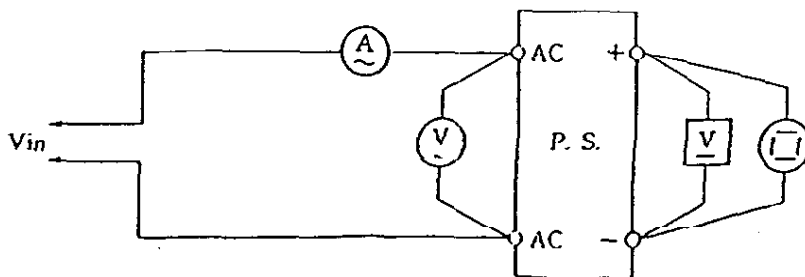
(2) 通電ドリフト特性 Warm up voltage drift characteristics



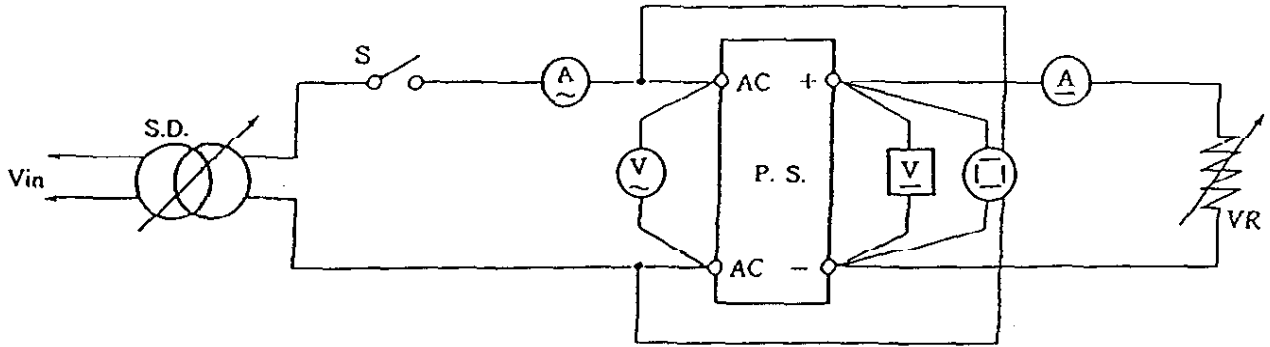
(3) 過電流保護特性 Over current protection (OCP) characteristics

Same as steady state data.

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



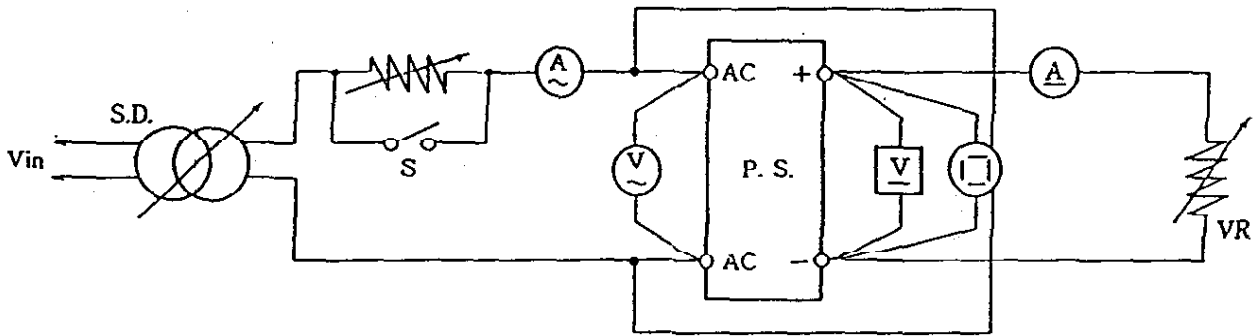
(5) 出力立上り特性 Output rise characteristics



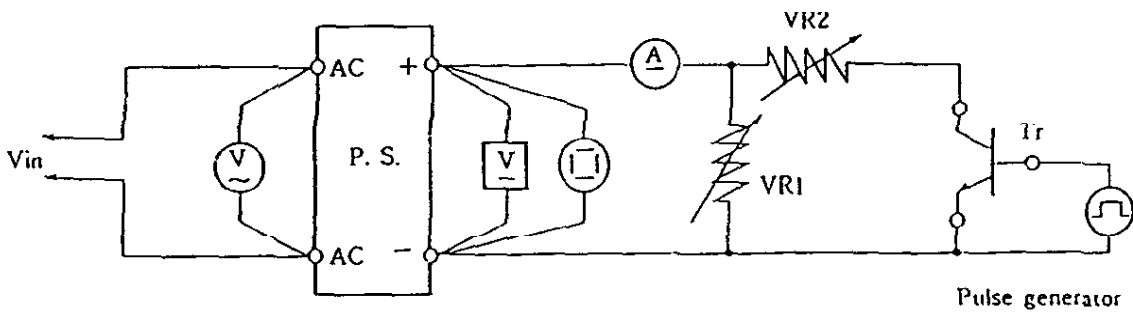
(6) 出力立下り特性 Output fall characteristics

Same as output rise characteristics.

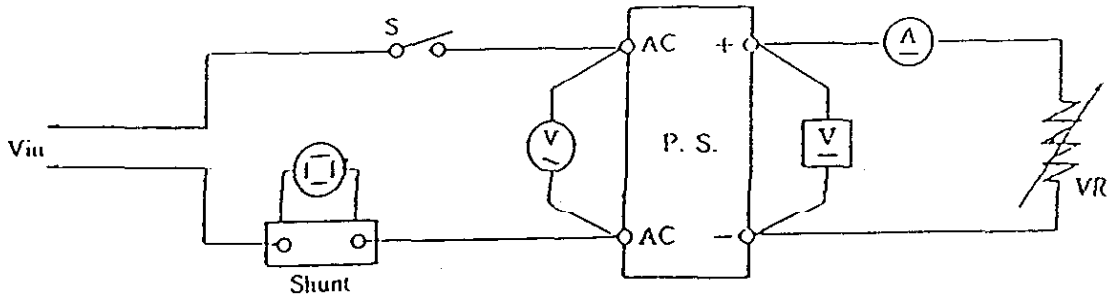
(7) 過渡応答 (入力急変) 特性 Dynamic line response characteristics



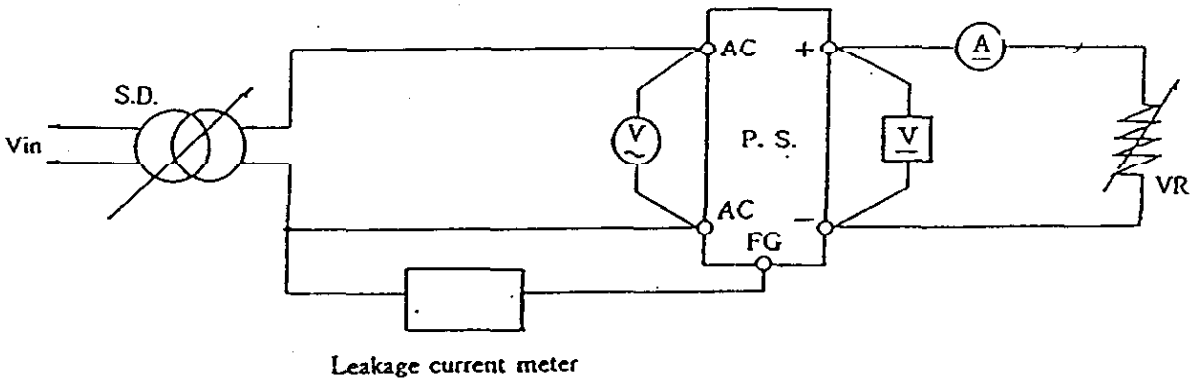
(8) 過渡応答 (負荷急変) 特性 Dynamic load response characteristics



(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

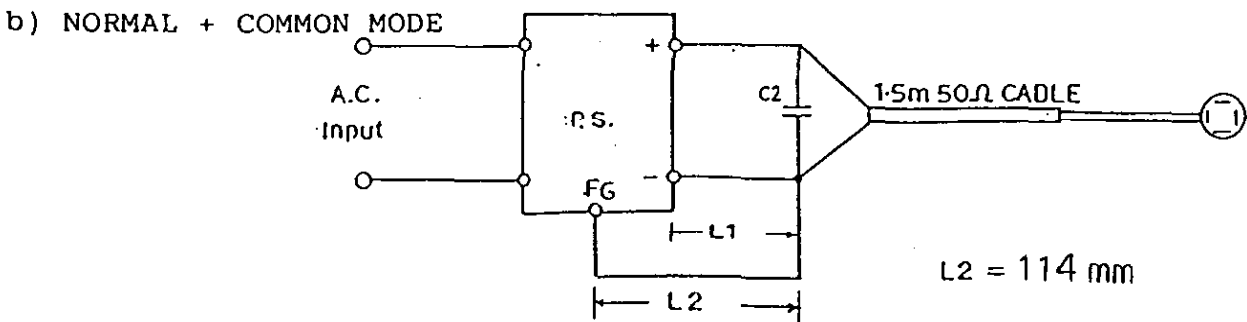
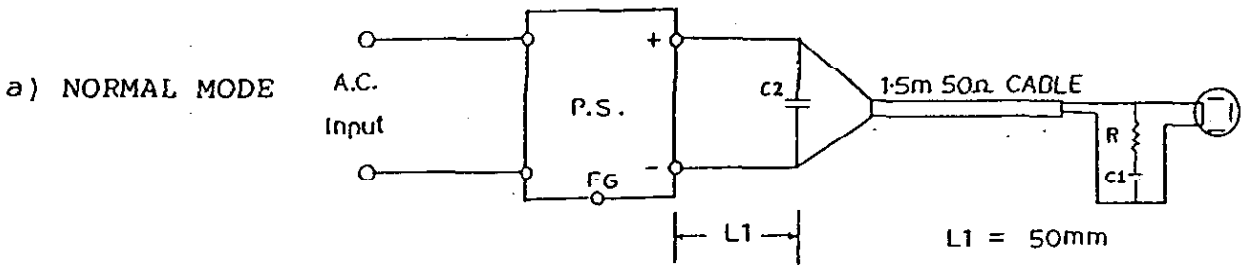


Note : Leakage current measured through a 1kΩ resistor.

Range wed : AC + DC

R = 50 Ω  
C1 = 4700pF  
C2 = 0.1μF

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-G041
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 10

5V

1. Regulation - Line and Load

Condition Ta : 25°C

Iout \ Vin	AC 85 v	AC 100 v	AC 220 v	AC 265 v	Line Regulation	
0 %	4.994v	4.994 v	4.994 v	4.994 v	0 mV	0 %
50 %	4.988v	4.988 v	4.988 v	4.988 v	0 mV	0 %
100 %	4.984v	4.984 v	4.984 v	4.984 v	0 mV	0 %
Load	10 mV	10 mV	10 mV	10 mV		
Regulation	0.20 %	0.20 %	0.20 %	0.20 %		

2. Temperature Drift

Conditions

Vin : AC100V  
Iout : 100 %

Ta	0 °C	25 °C	50 °C	Temp. Stability
Vout	4.988 v	4.984 v	4.984 v	4 mV 0.08 %

12V

1. Regulation - Line and Load

Condition Ta : 25°C

Iout \ Vin	AC 85 v	AC 100 v	AC 220 v	AC 265 v	Line Regulation	
0 %	11.964v	11.964 v	11.966 v	11.966 v	2 mV	0.02 %
50 %	11.959v	11.959 v	11.958 v	11.958 v	1 mV	0.01 %
100 %	11.955v	11.955 v	11.955 v	11.955 v	0 mV	0 %
Load	9 mV	9 mV	11 mV	11 mV		
Regulation	0.08 %	0.08 %	0.09 %	0.09 %		

2. Temperature Drift

Conditions

Vin : AC100V  
Iout : 100 %

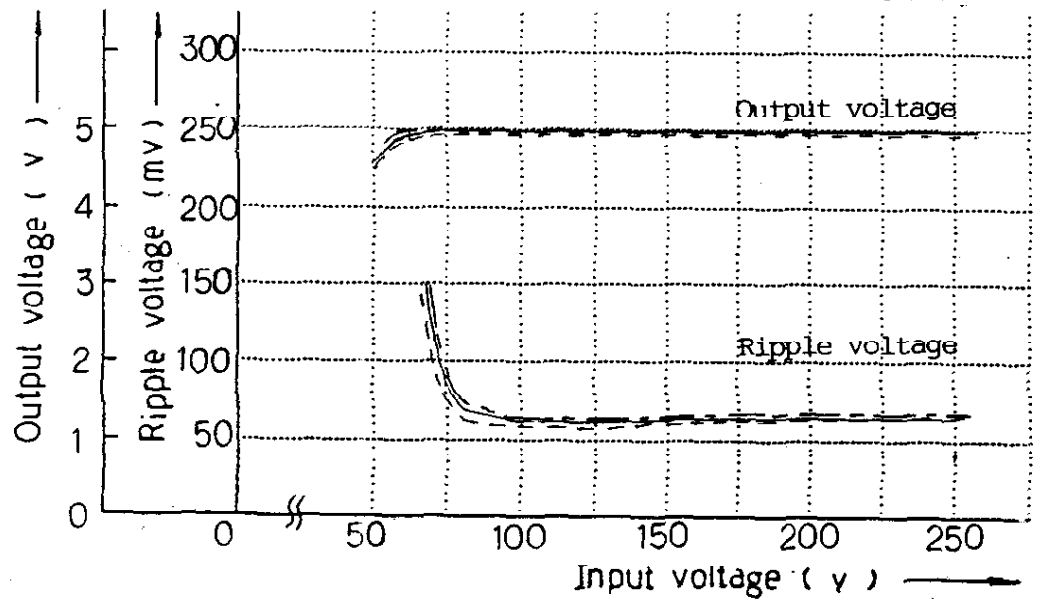
Ta	0 °C	25 °C	50 °C	Temp. Stability
Vout	11.936v	11.955v	11.959v	23 mV 0.19 %

Output voltage and ripple voltage v.s. input voltage

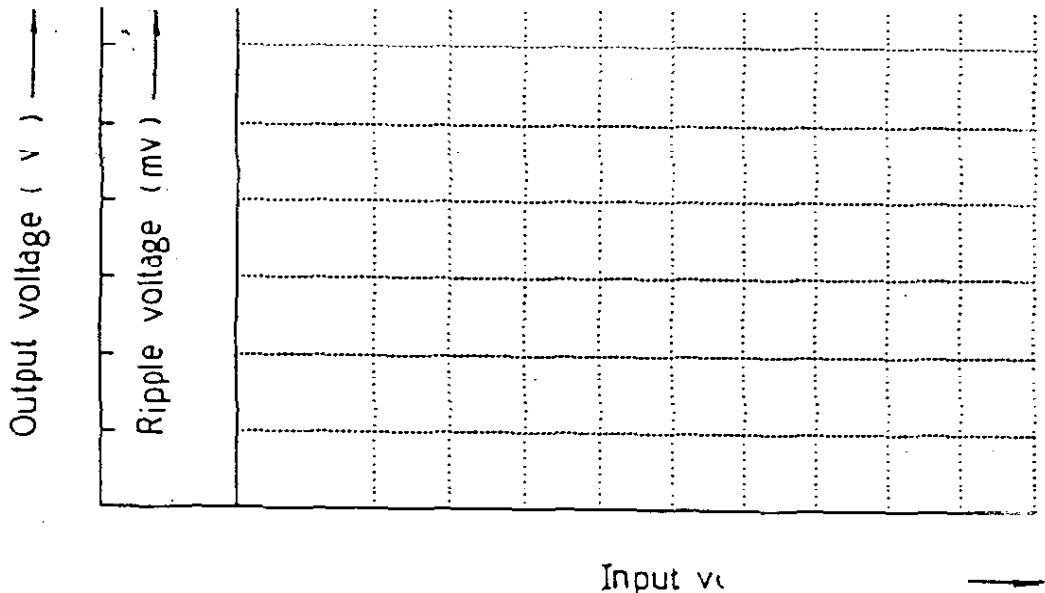
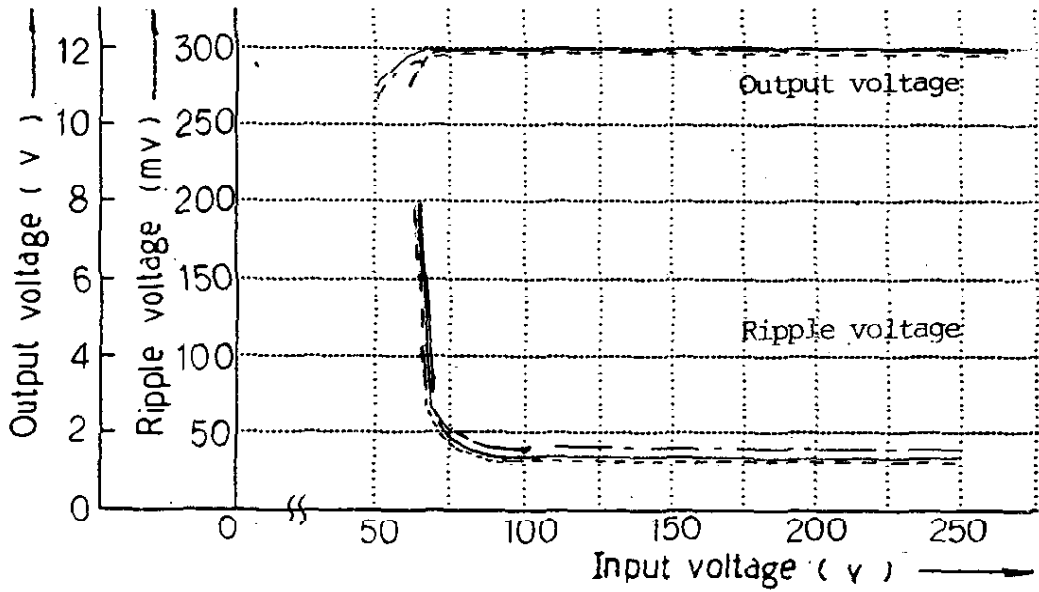
KWS 10

Conditions  $I_{out} : 100\%$   
 $T_a : 0^\circ\text{C}$  - - - -  
 $25^\circ\text{C}$  - - - -  
 $50^\circ\text{C}$  - - - -

5V

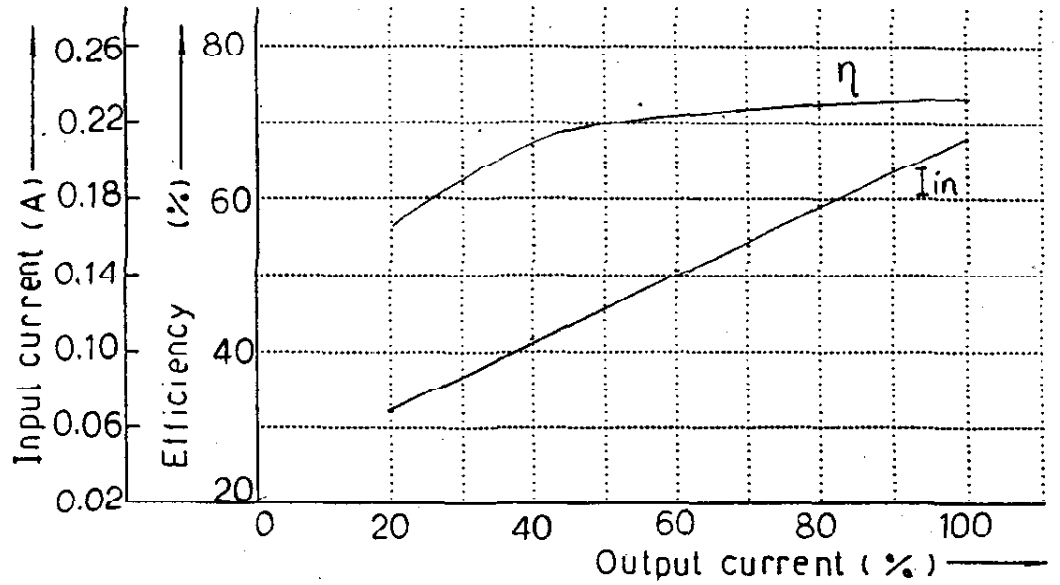


12V

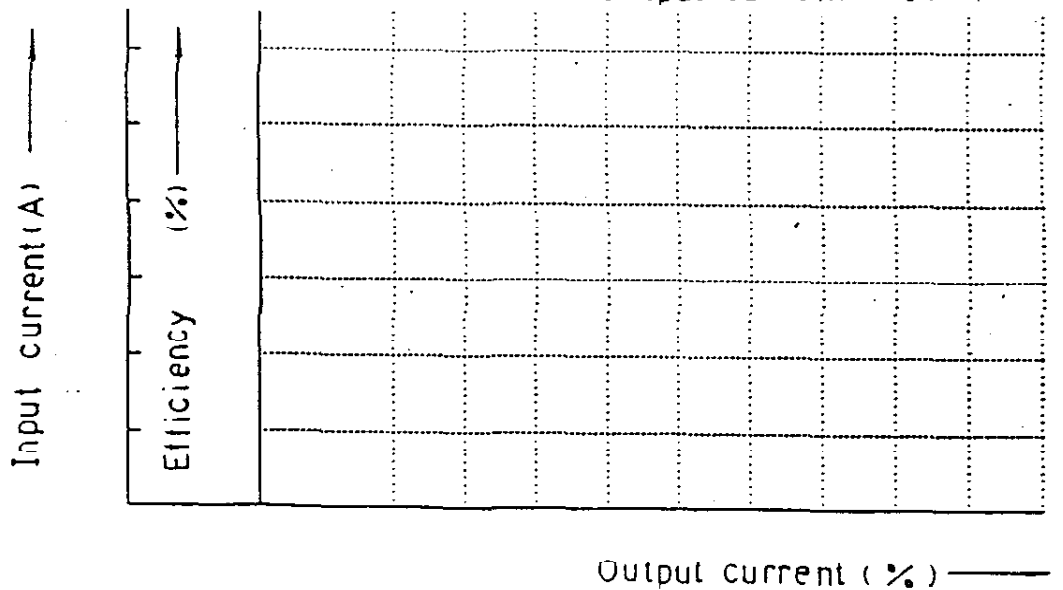
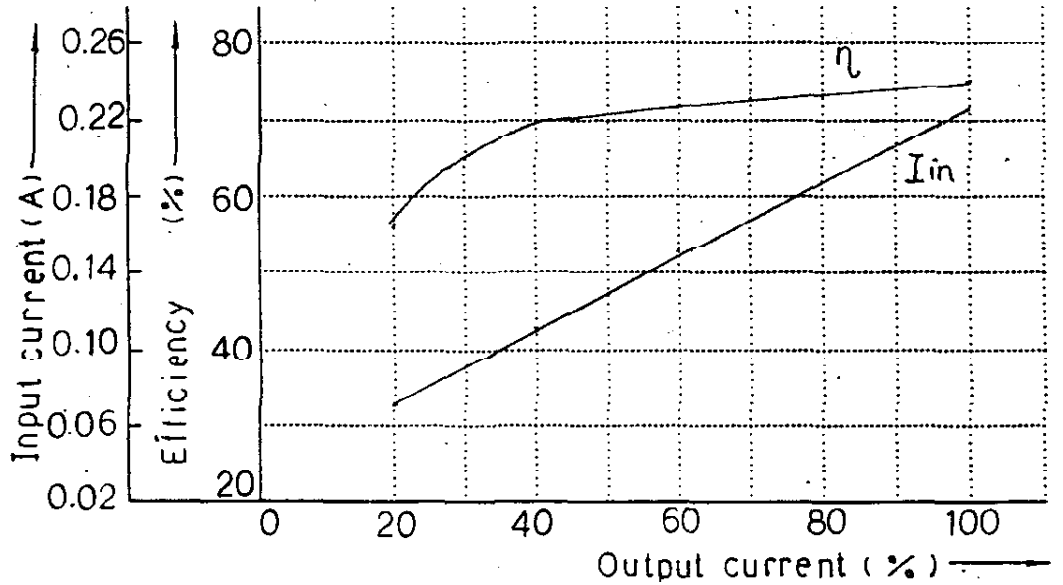


Conditions Vin : AC 100 v  
Ta : 25 °C

5V

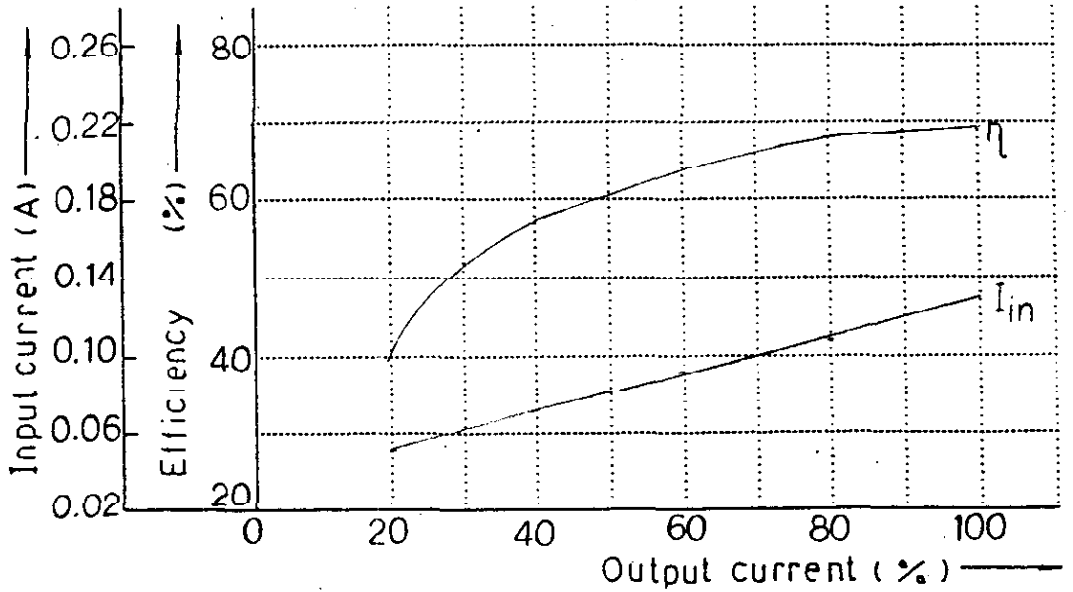


12V

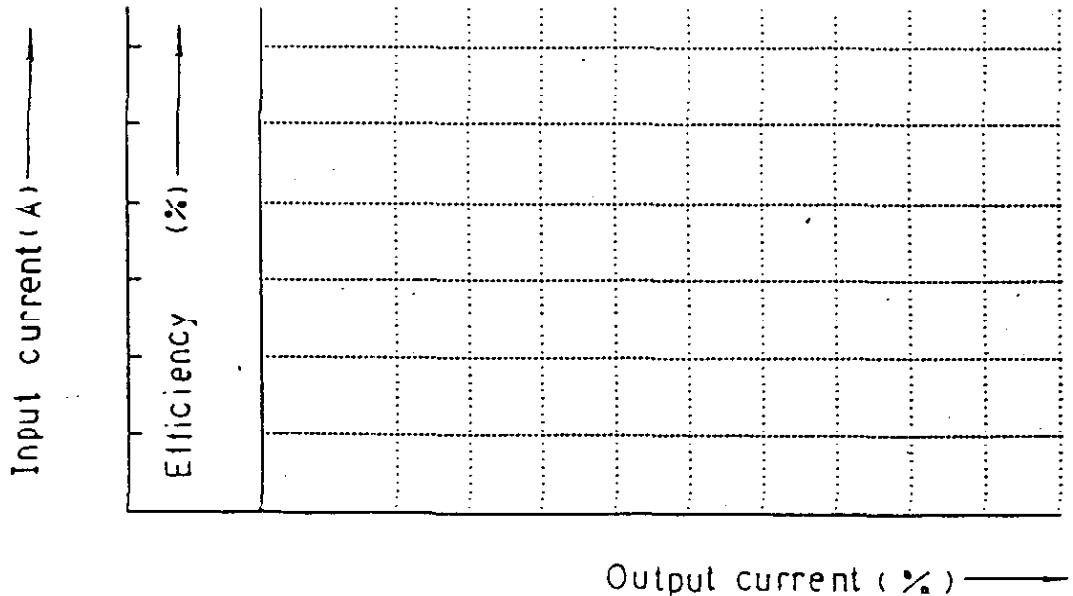
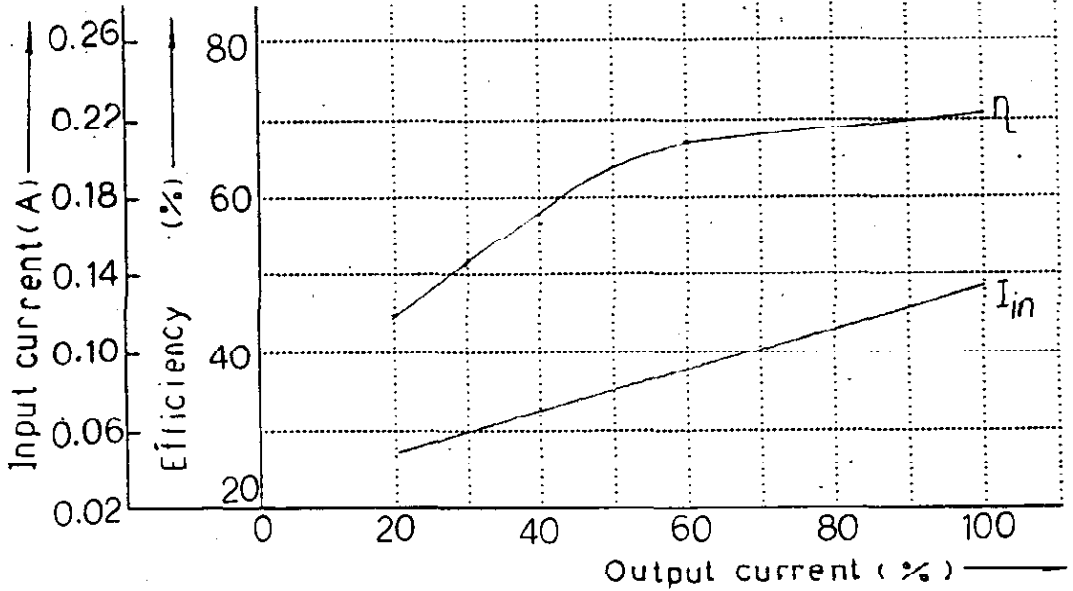


Conditions Vin : AC 220v  
Ta : 25°C

5V



12V

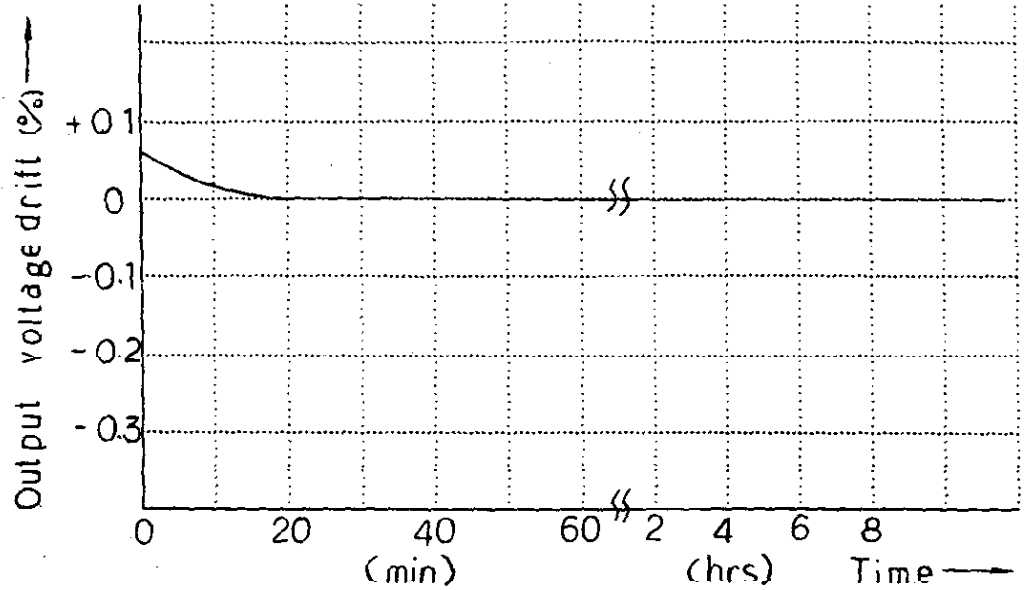


Warm up voltage drift

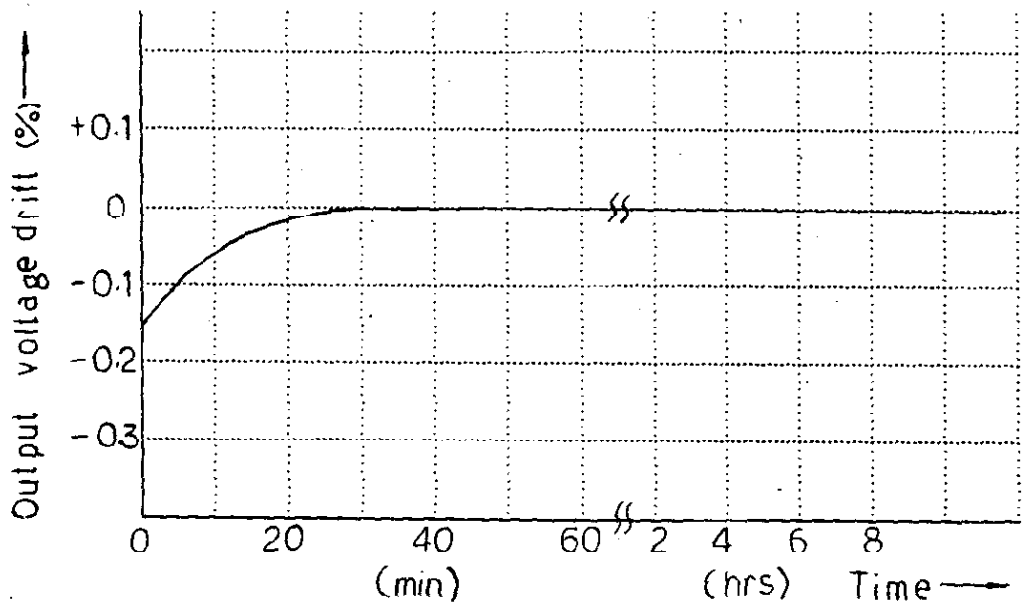
KWS 10

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

5V



12V



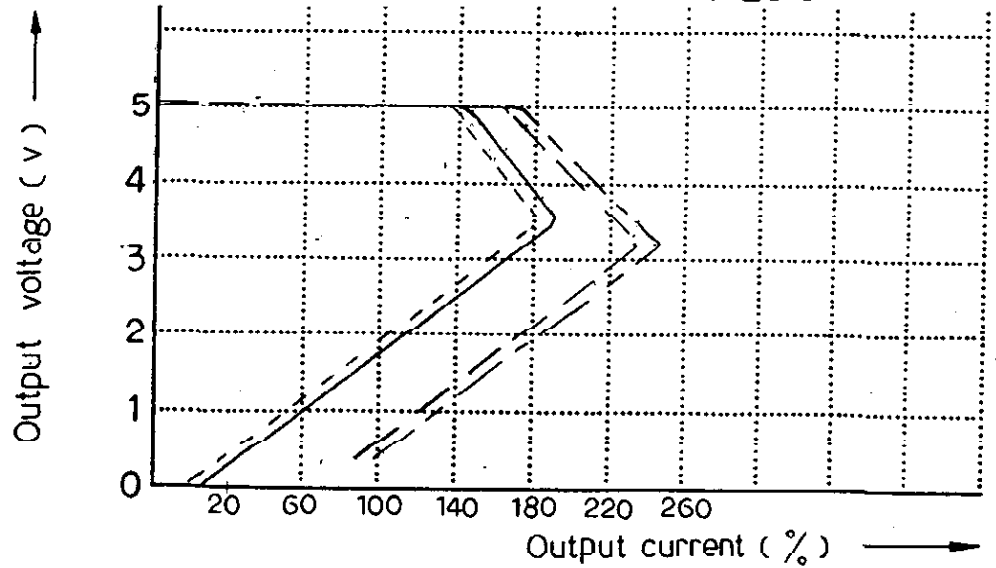
Time = 10

O.C.P Characteristics

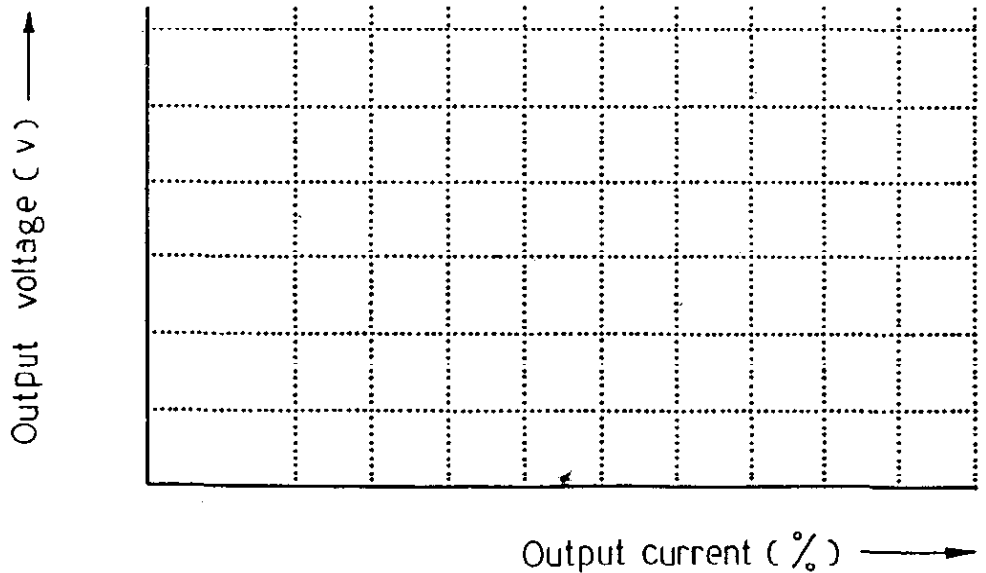
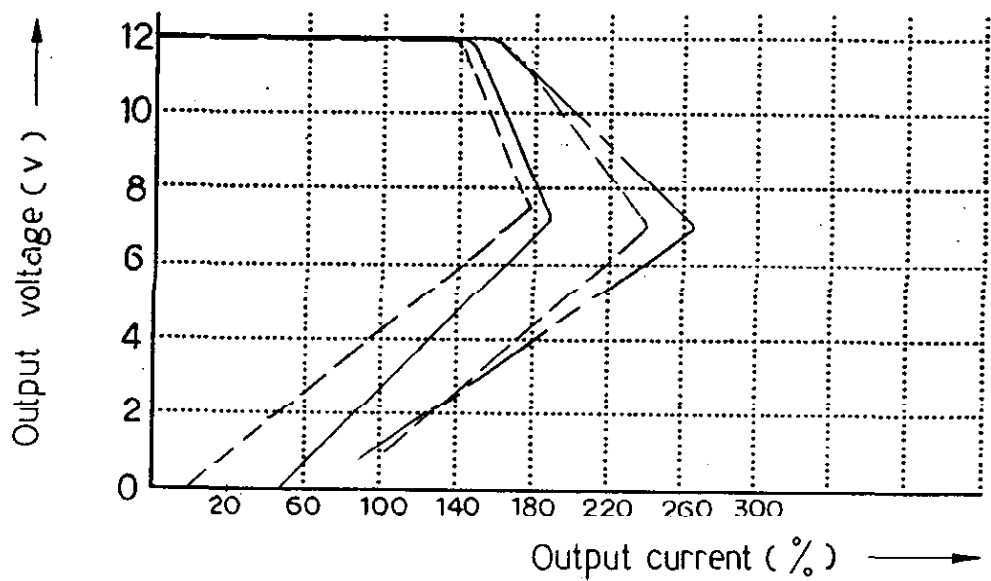
KWS 10

Conditions Vin: AC 85 v ---  
 AC 100 v ———  
 AC 220 v - - - -  
 AC 265 v - - - -  
 Ta: 25°C

5V



12V

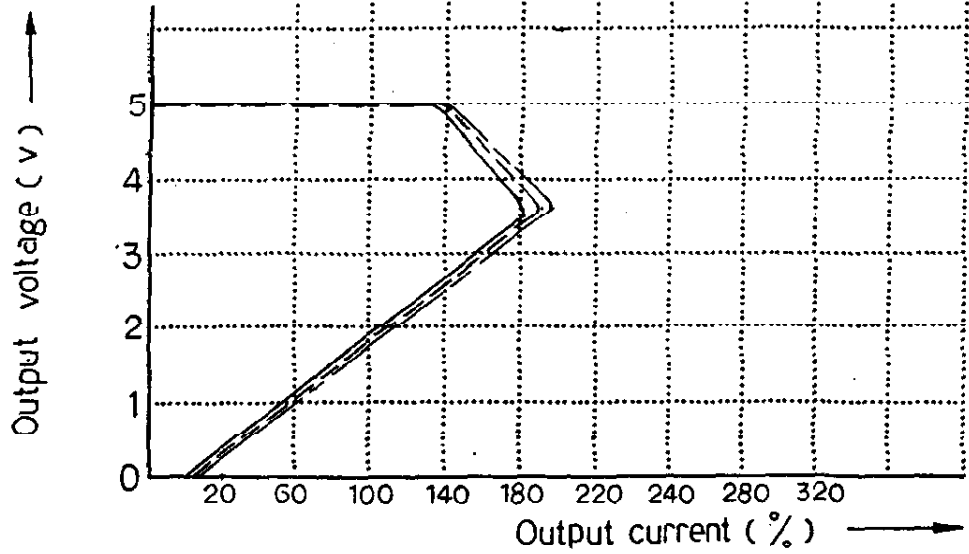


O.C.P Characteristics

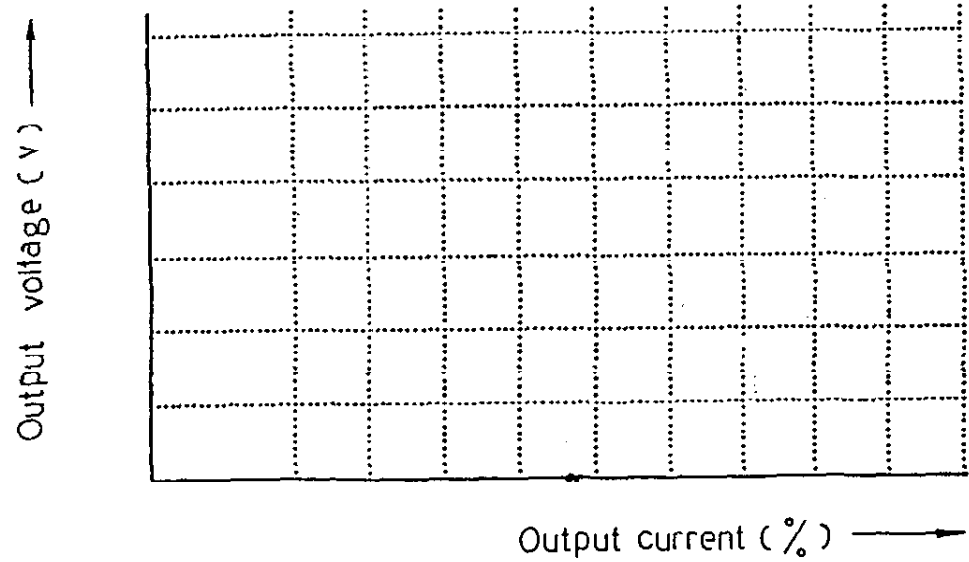
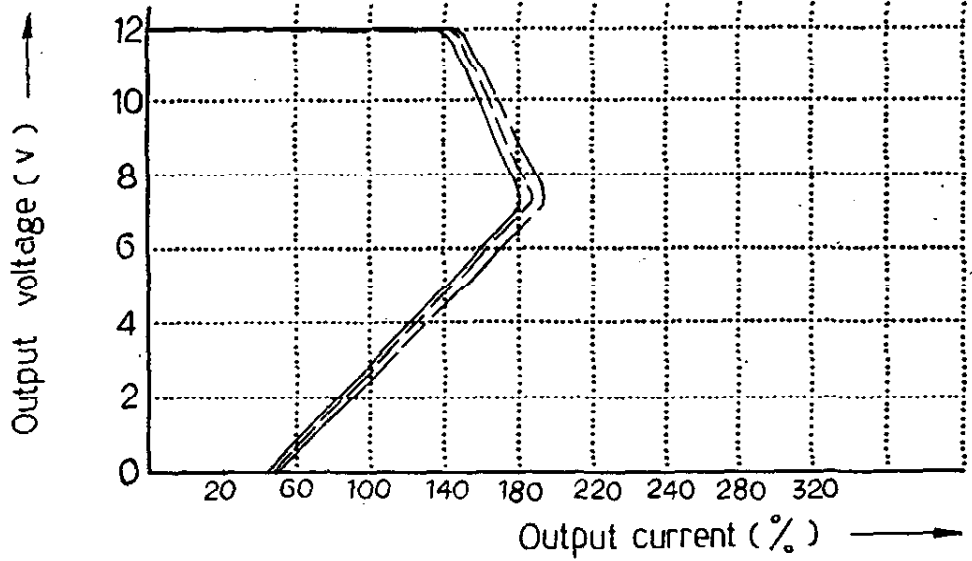
KWS 10

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

5V



12V

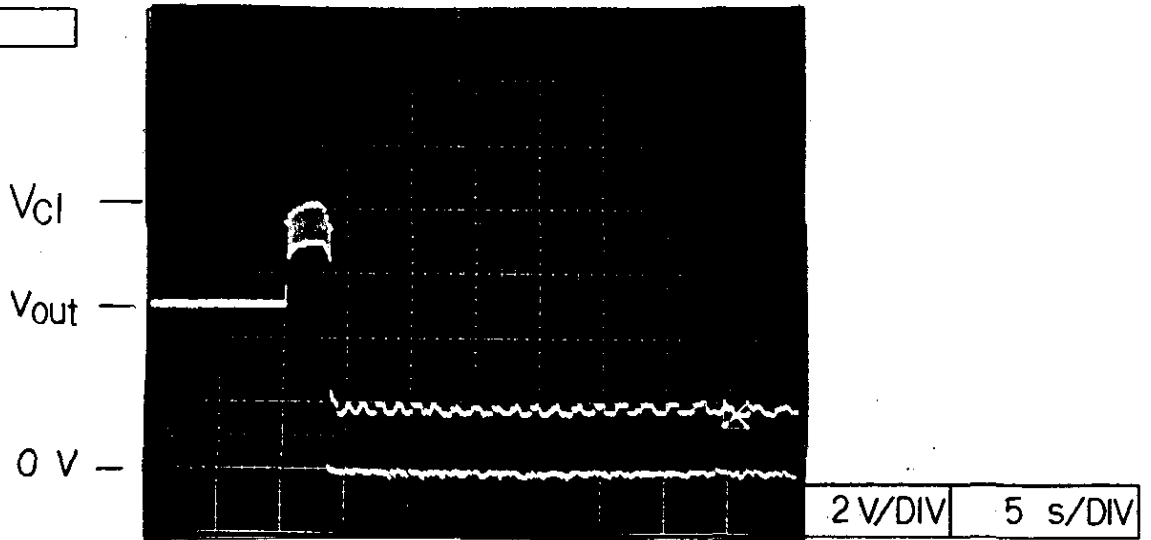


O.V.P Characteristics

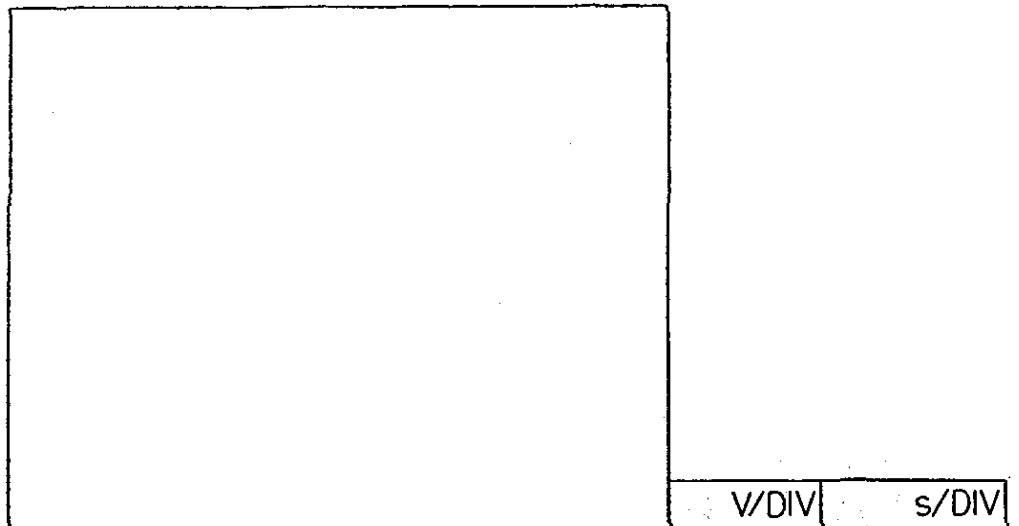
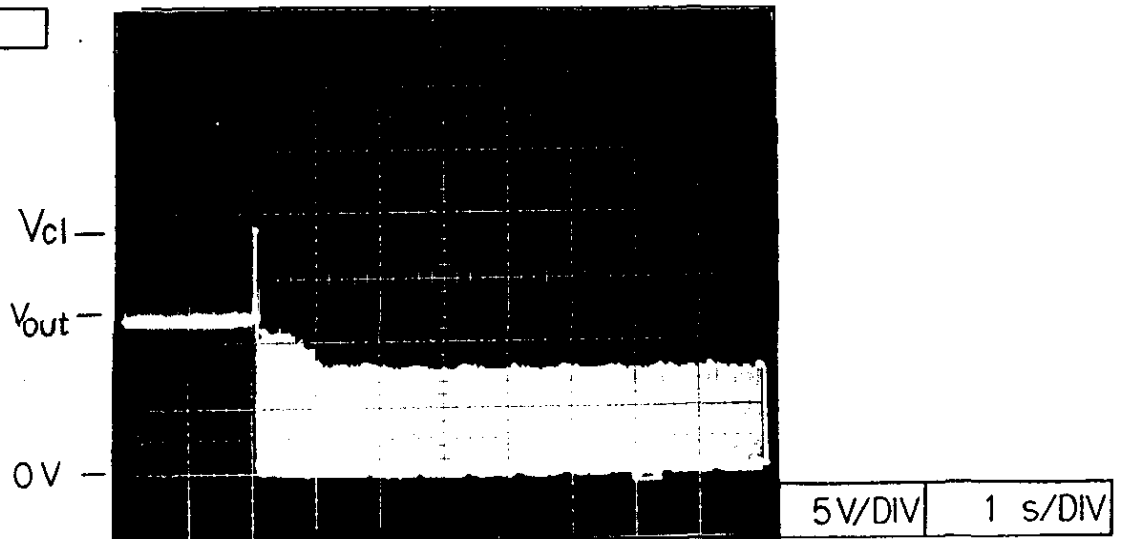
KWS 10

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

5V



12V





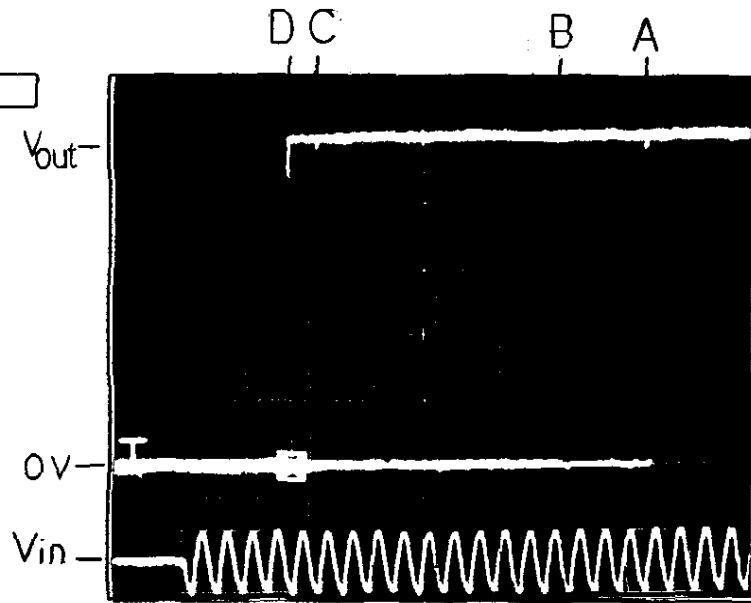
Output rise time

KWS 10

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

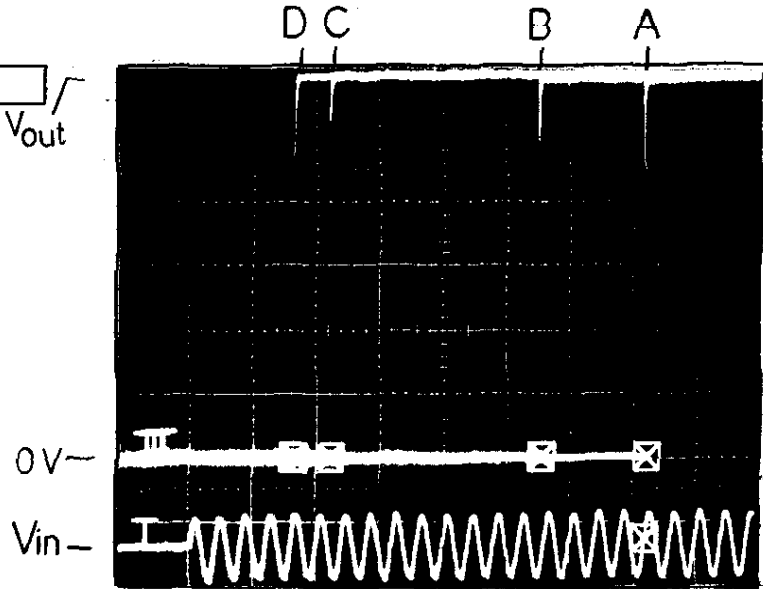
Iout: 0 %  
Ta: 25°C

5V

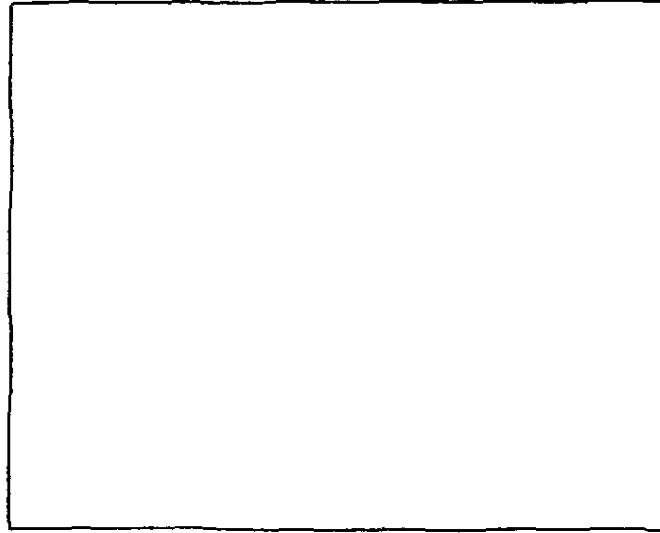


1 V/DIV 50 ms/DIV

12V



2 V/DIV 50 ms/DIV



V/DIV ms/DIV

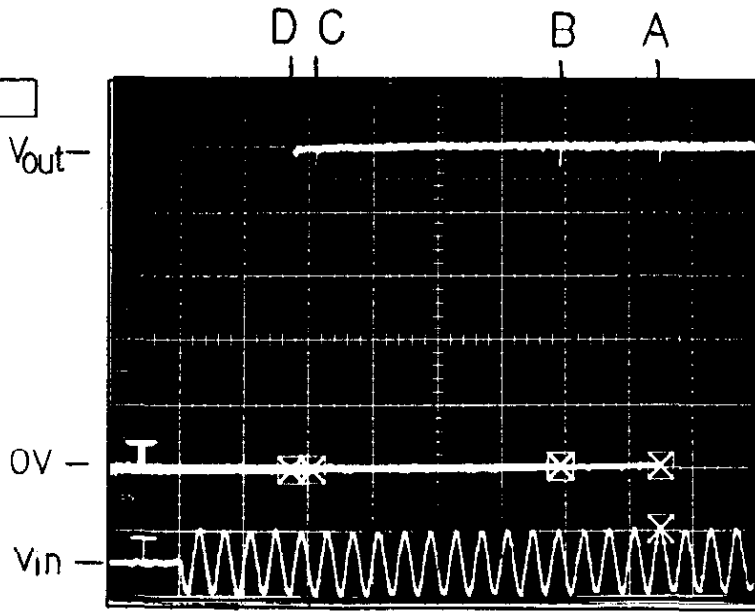
Output rise time

KWS 10

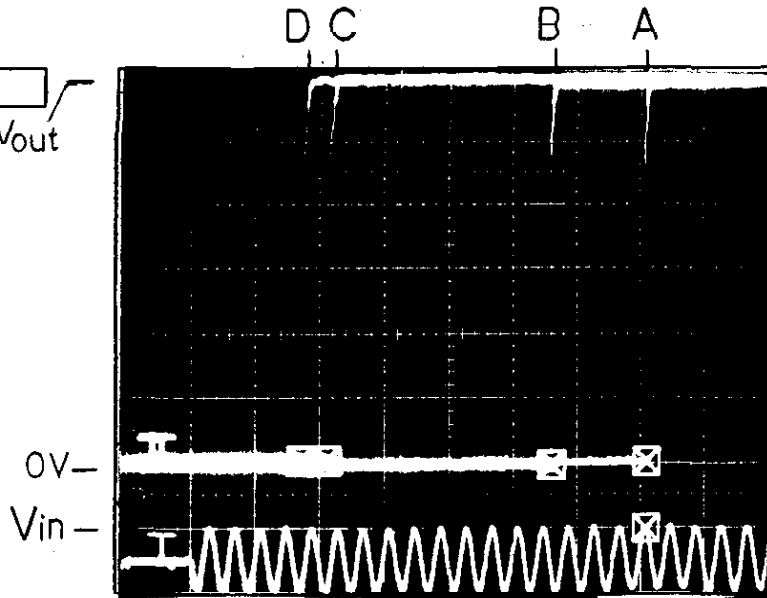
Conditions Vin: AC 85v (A)  
 100v (B)  
 220v (C)  
 265v (D)

Iout: 100 %  
 Ta: 25°C

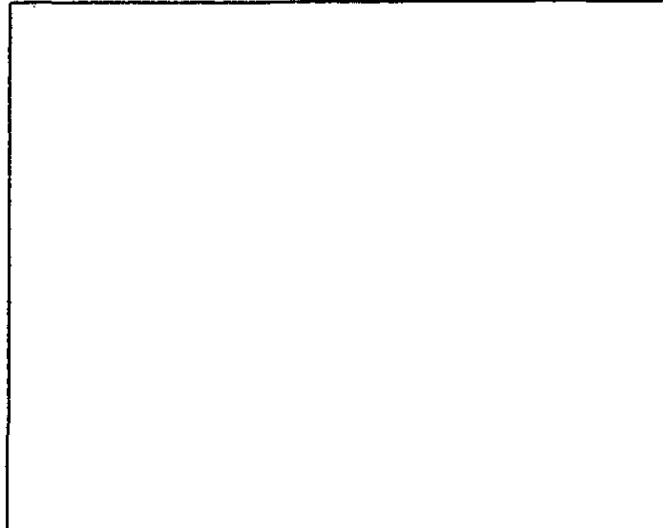
5V



12V



[Empty box]



V/DIV ms/DIV

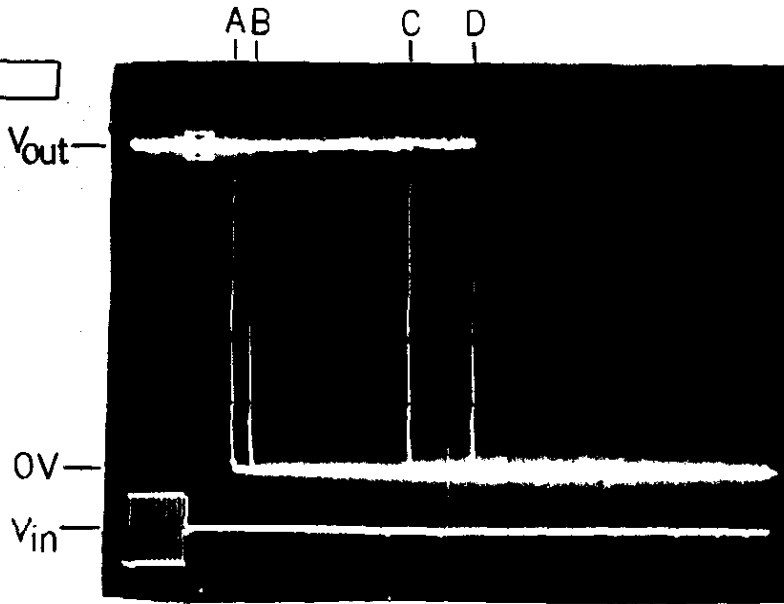
Output fall time

KWS 10

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

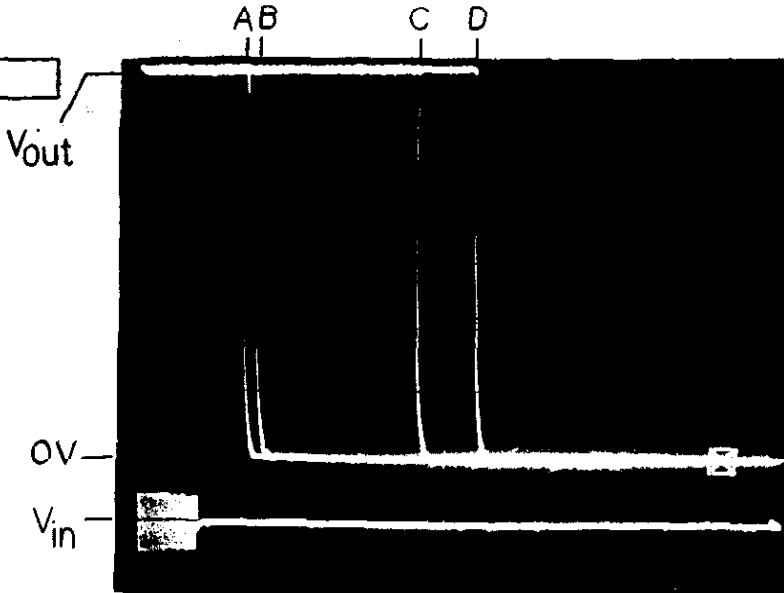
Iout: 0 %  
Ta: 25°C

5V

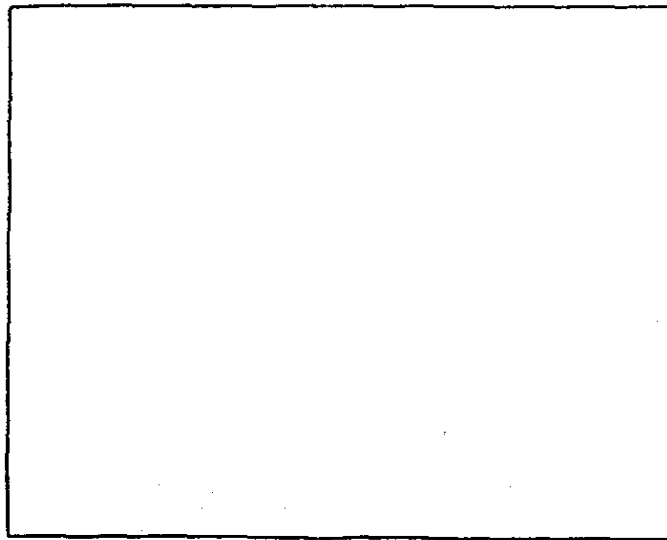


1 V/DIV 0.5 s/DIV

12V



2 V/DIV 0.5 s/DIV



V/DIV s/DIV

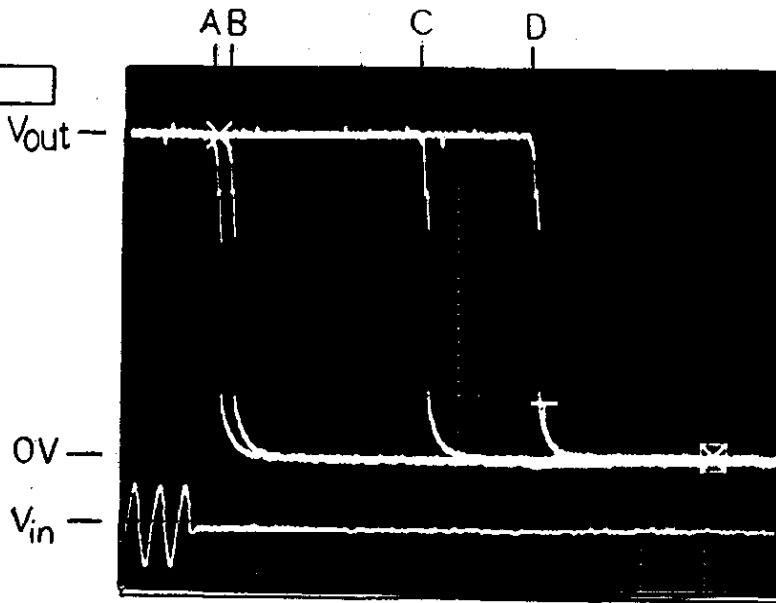
Output fall time

KWS 10

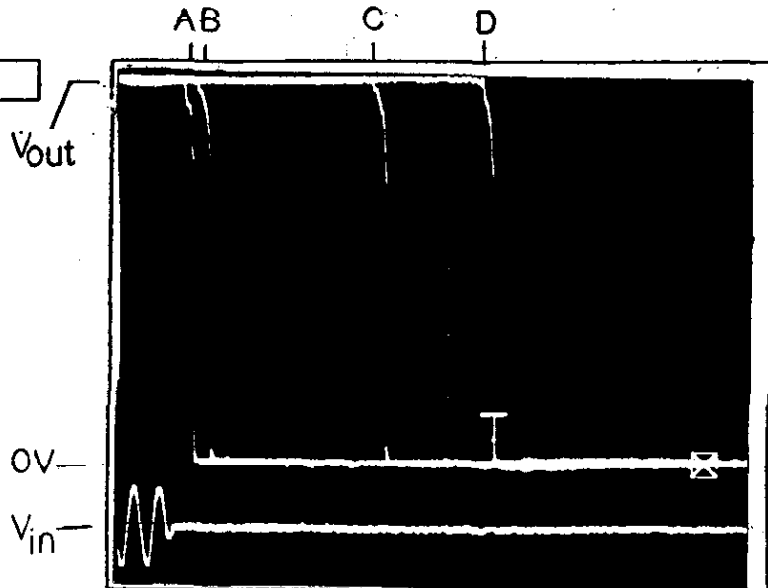
Conditions Vin: AC 85v (A)  
100v (B)  
220v (C)  
265v (D)

Iout: 100 %  
Ta: 25°C

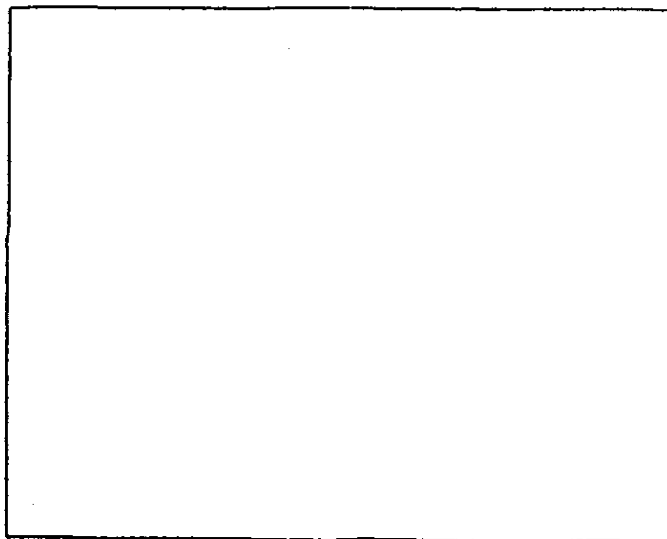
5V



12V



[Empty box]



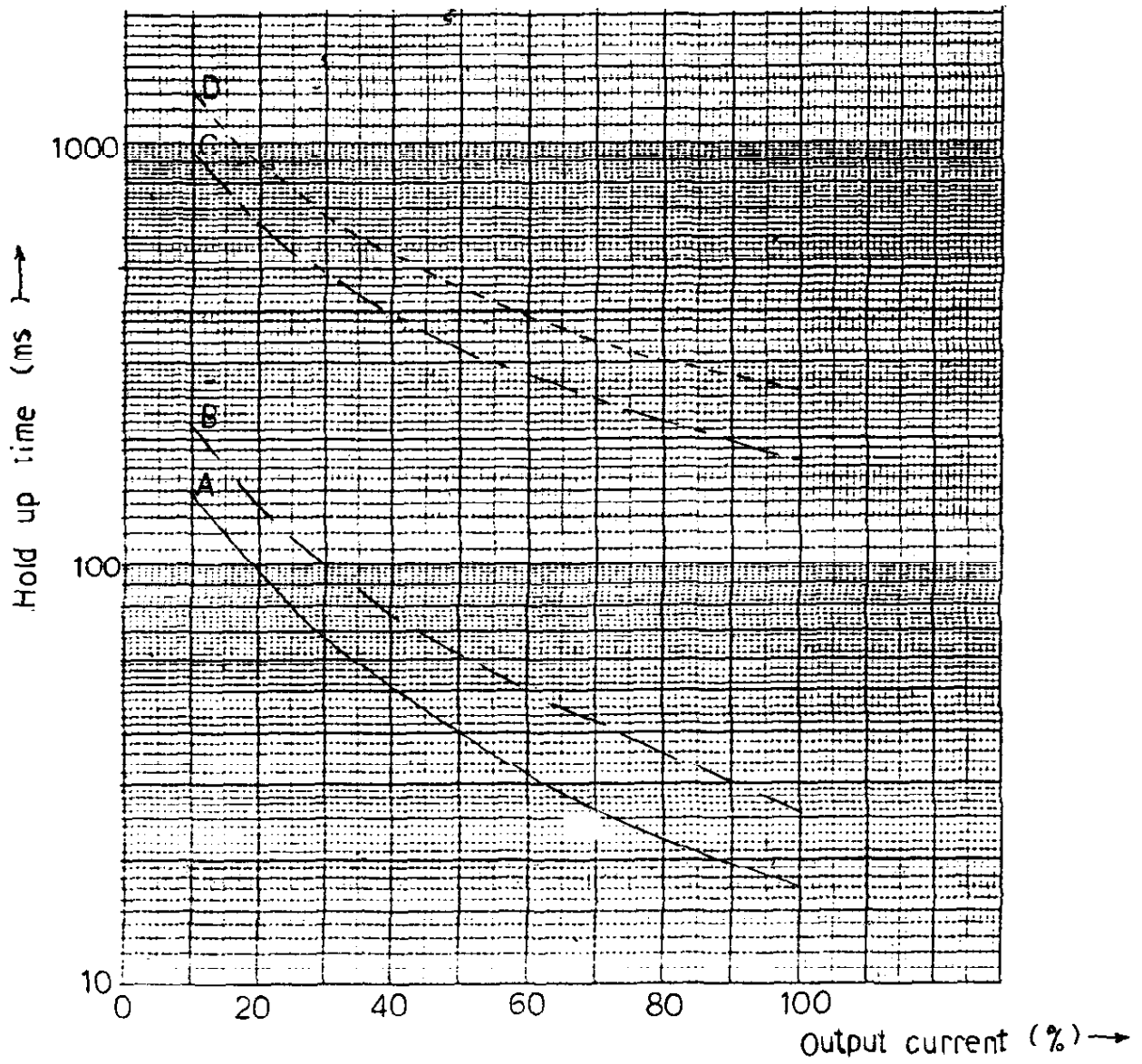
[Empty box] V/DIV s/DIV

Hold up time

KWS 10

5V

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

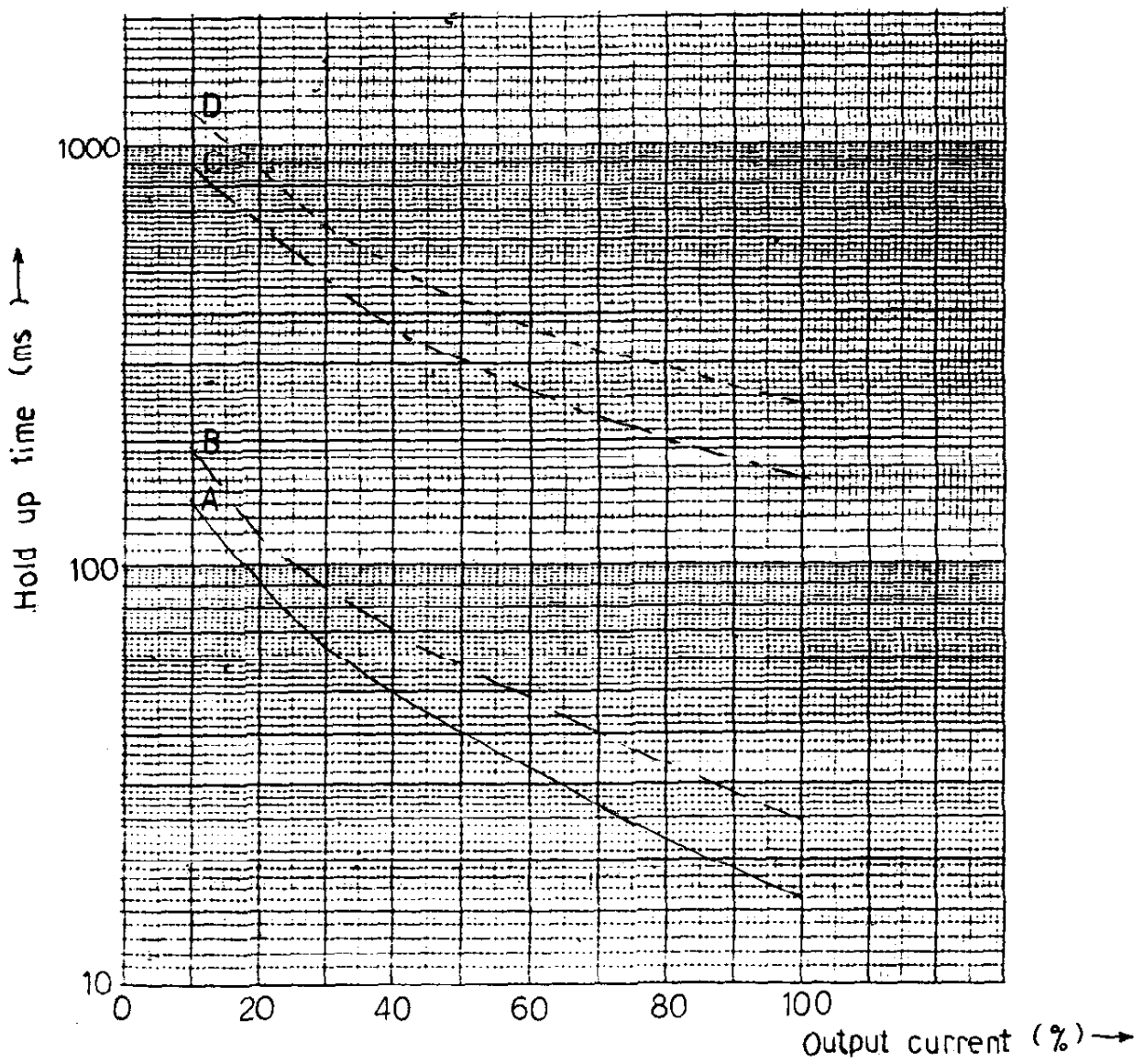


Hold up time \_\_\_\_\_

KWS 10

12V

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



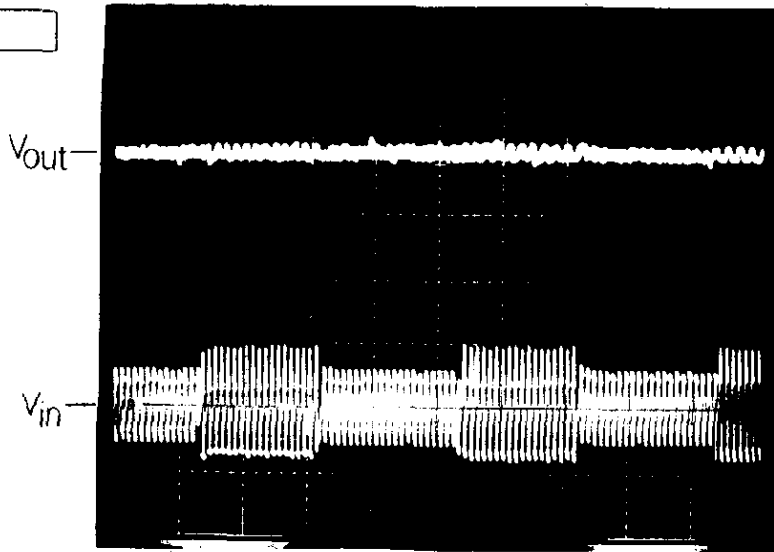
Dynamic line response

KWS 10

Vin : AC 85 v  $\rightleftharpoons$  AC 132 v

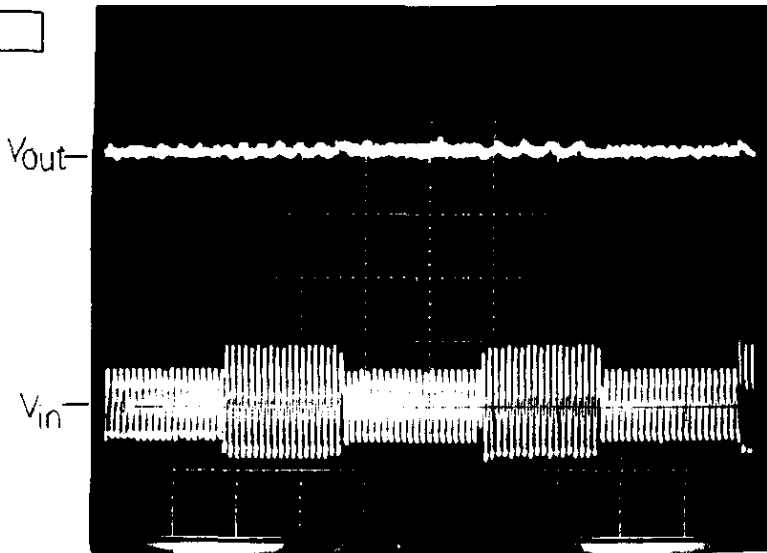
Conditions  
Vout : Rated  
Iout : 100%  
Ta : 25°C

5V

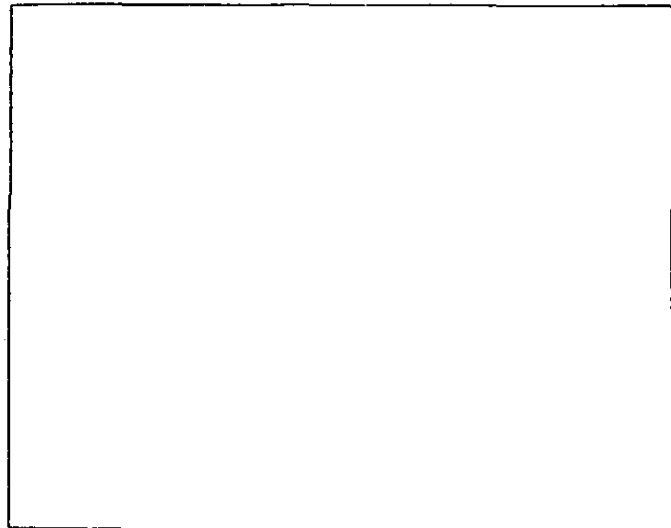


200mV/DIV 0.2 s/DIV

12V



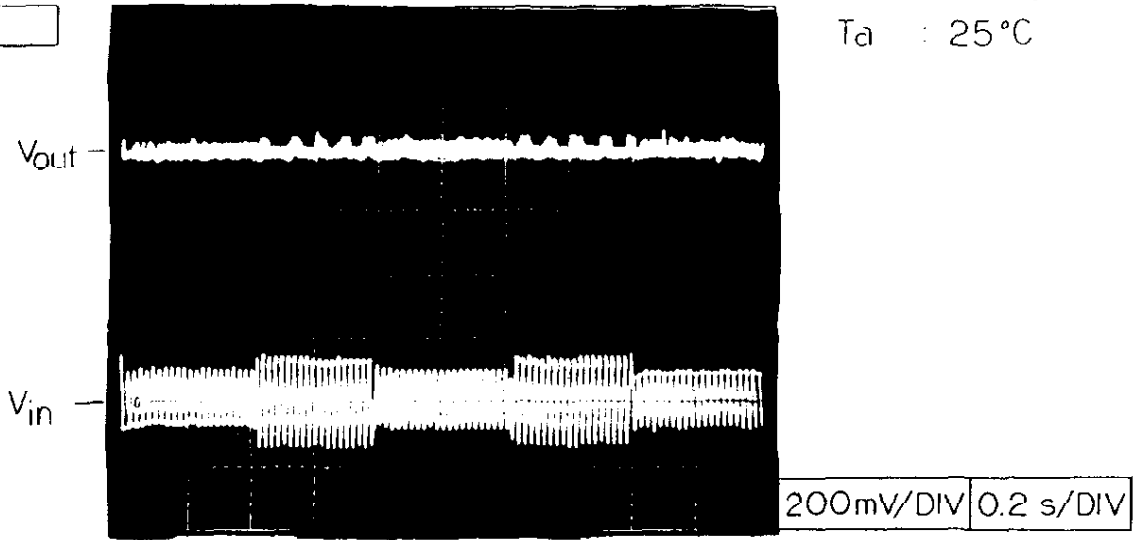
200mV/DIV 0.2 s/DIV



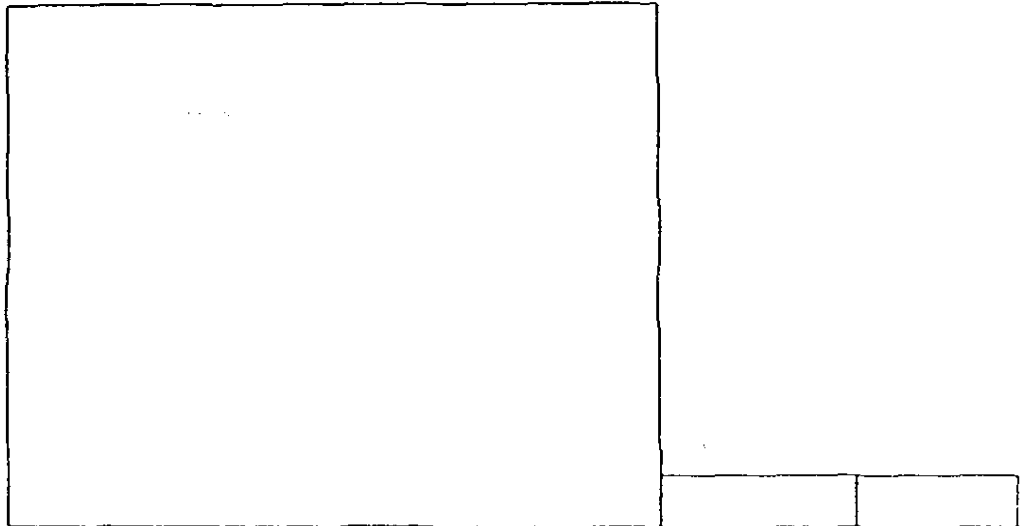
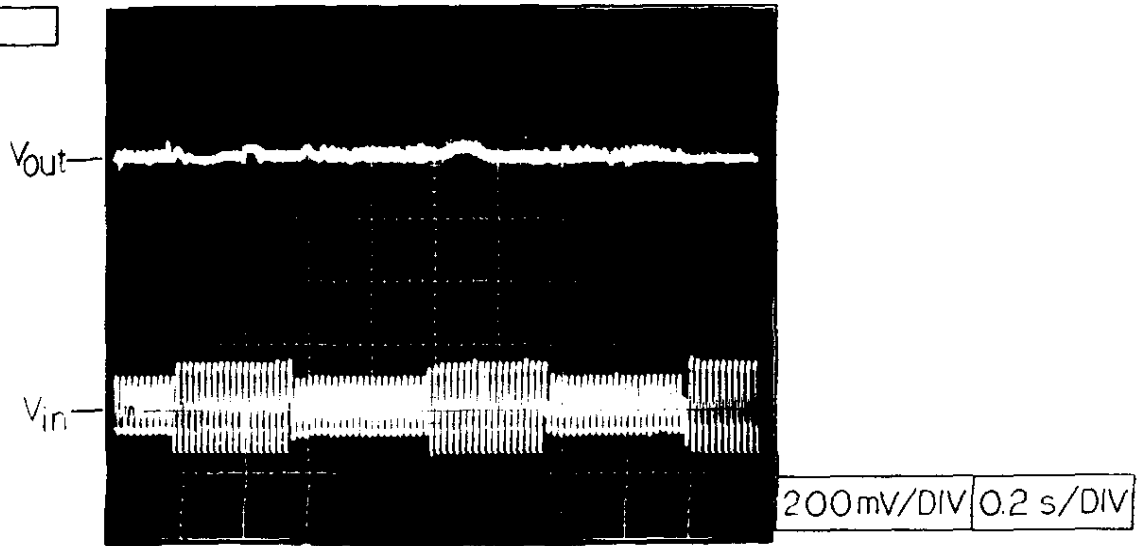
Vin : AC170v  $\rightleftharpoons$  AC265v

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

5v



12v





Dynamic load response

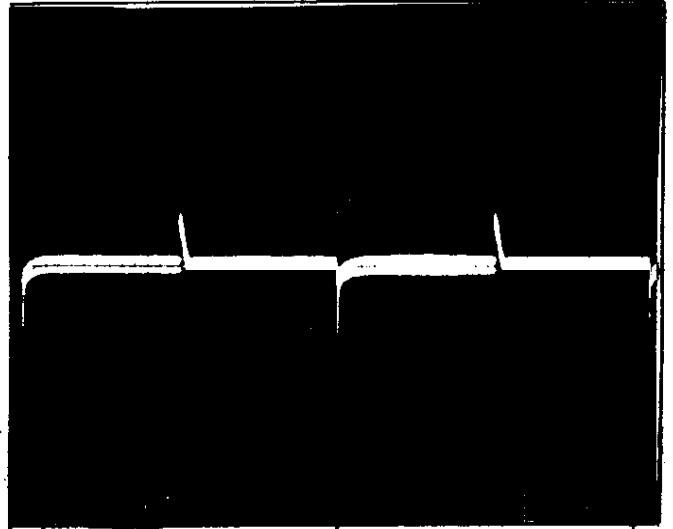
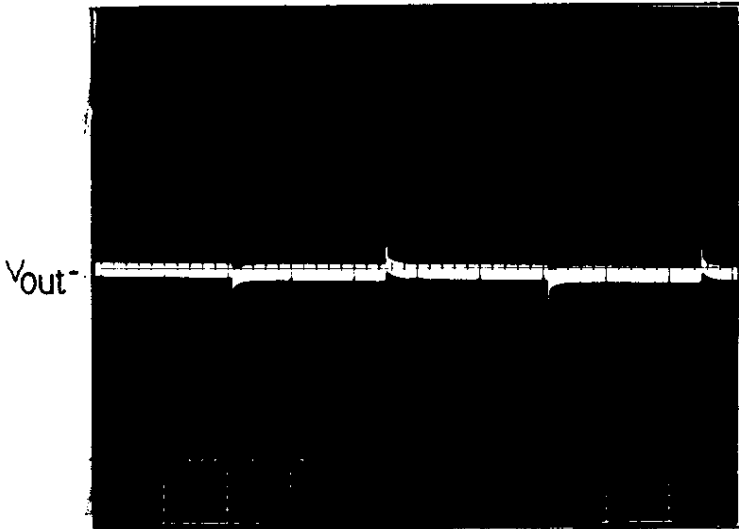
KWS 10

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%  $f=100\text{Hz}$

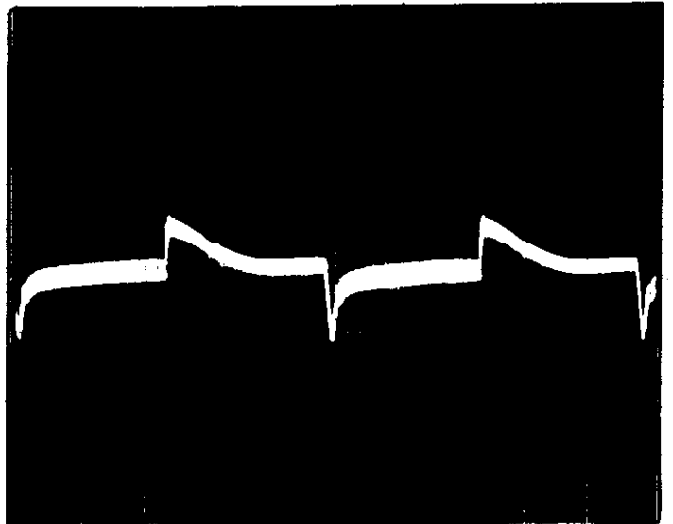
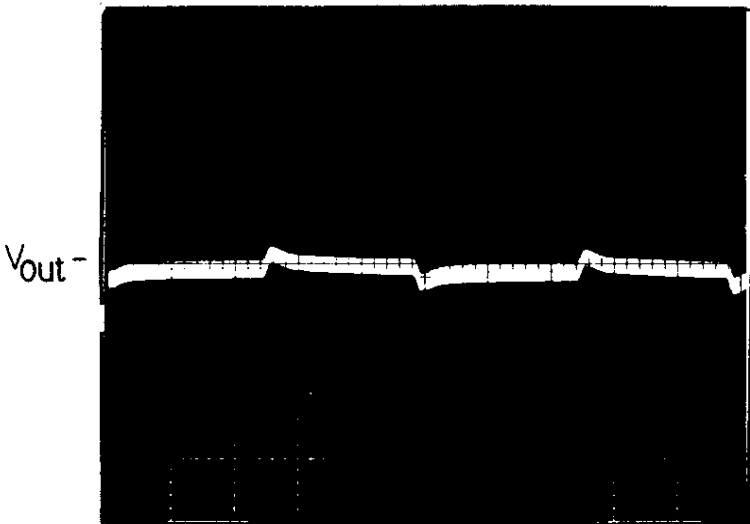


200 mV / DIV	2 mS / DIV
+ 2.0 %	- 2.8 %

200 mV / DIV	2 mS / DIV
+ 3.4 %	- 4.4 %

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

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



200 mV / DIV	0.2 mS / DIV
+ 1.2 %	- 1.6 %

200 mV / DIV	0.2 mS / DIV
+ 3.4 %	- 4.8 %

Dynamic load response

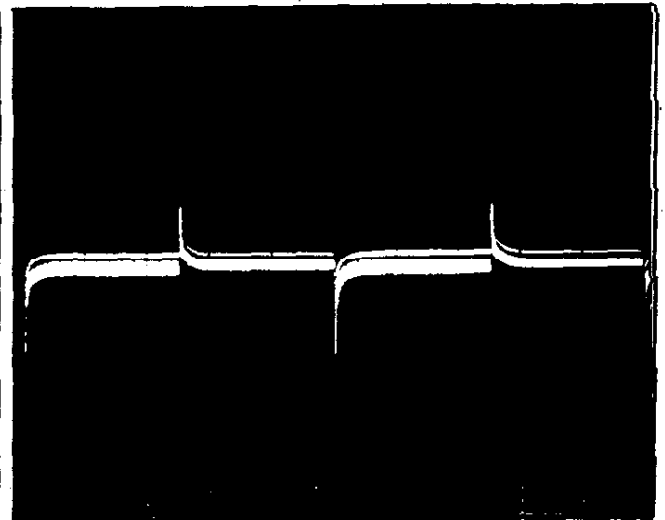
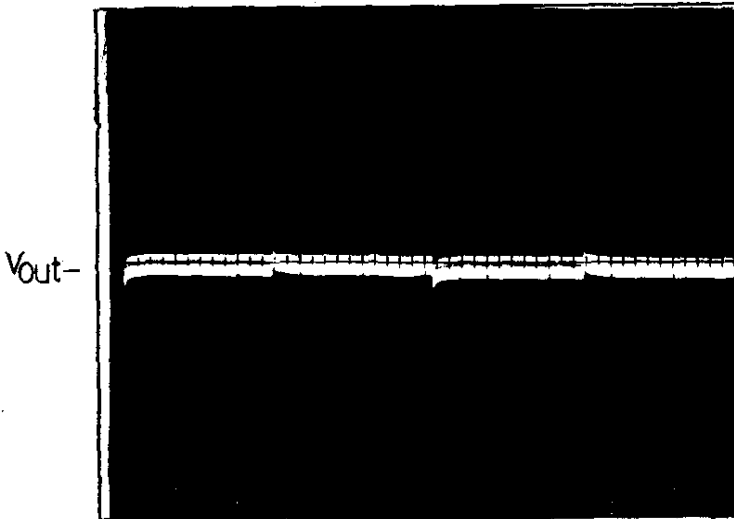
KWS 10

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

5V

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

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

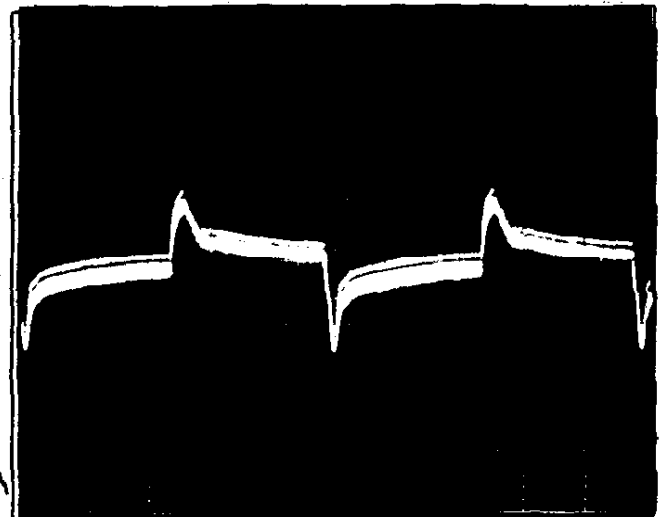
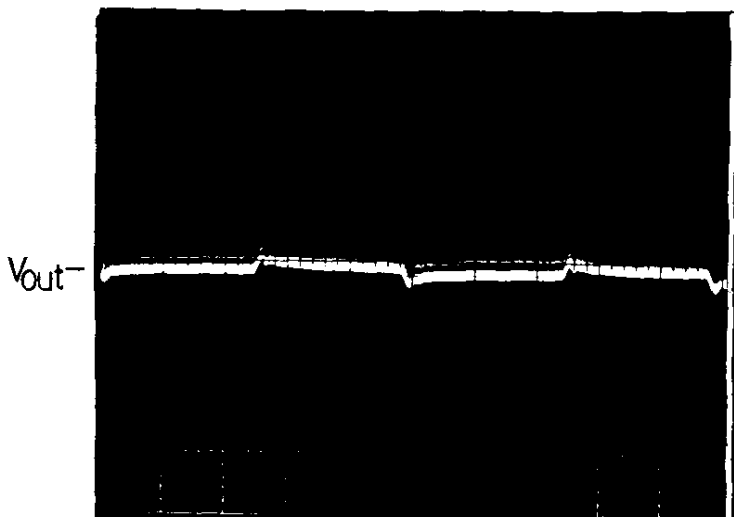


200 mV / DIV	2 mS / DIV
+1.2%	-1.6%

200 mV / DIV	2 mS / DIV
+4.0%	-5.6%

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

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



200 mV / DIV	0.2 mS / DIV
+1.2%	-1.6%

200 mV / DIV	0.2 mS / DIV
+4.8%	-5.8%

Dynamic load response

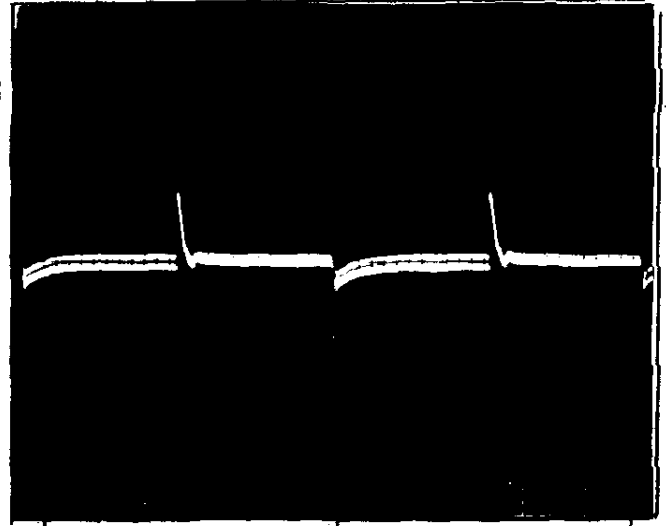
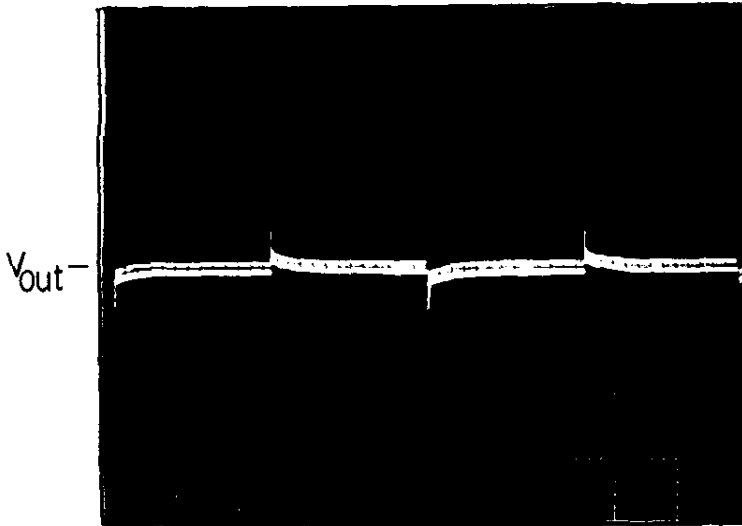
KWS 10

Conditions Vin: AC 100 V  
Ta: 25 °C

12V

Iout 50 ↔ 100% f=100Hz

Iout 0 ↔ 100% f=100Hz

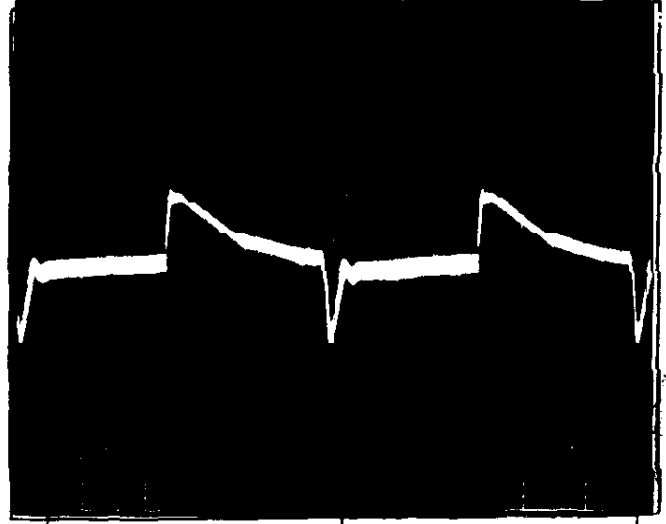
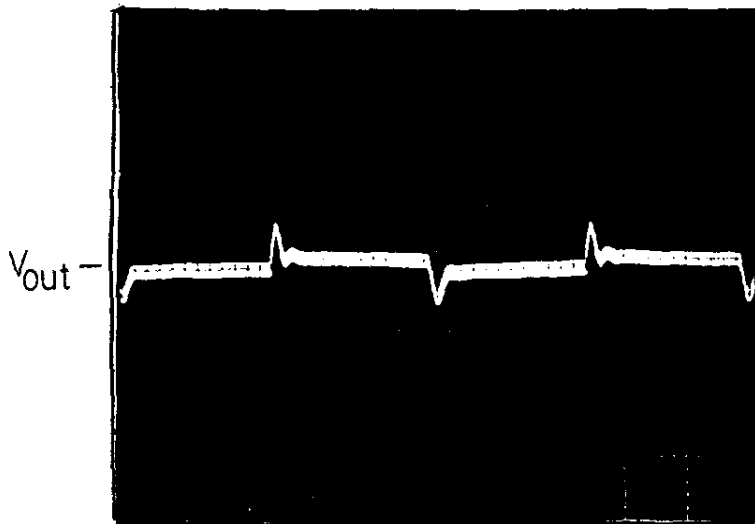


200 mV / DIV	2 ms / DIV
+1.3 %	-1.1 %

200 mV / DIV	2 ms / DIV
+2.0 %	-2.4 %

Iout 50 ↔ 100% f=1kHz

Iout 0 ↔ 100% f=1kHz



200 mV / DIV	0.2 ms / DIV
+1.2 %	-1.0 %

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

Dynamic load response

KWS 10

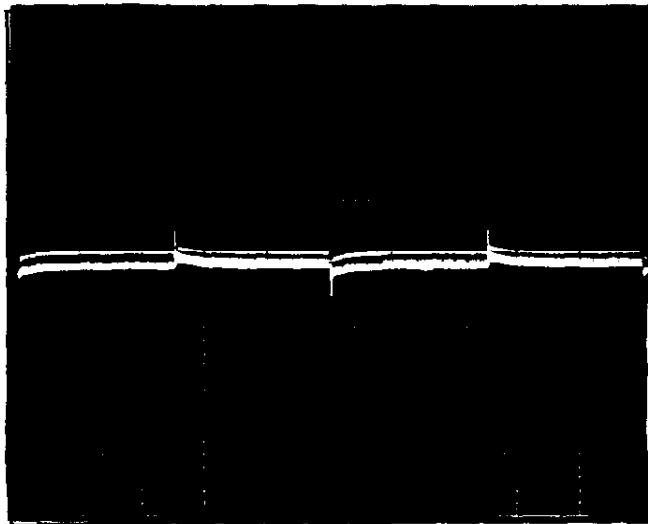
Conditions  $V_{in}$ : AC 220 V  
 $T_a$ : 25 °C

12V

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

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

$V_{out}$



200 mV / DIV    2 mS / DIV

+1.2%    -1.0%

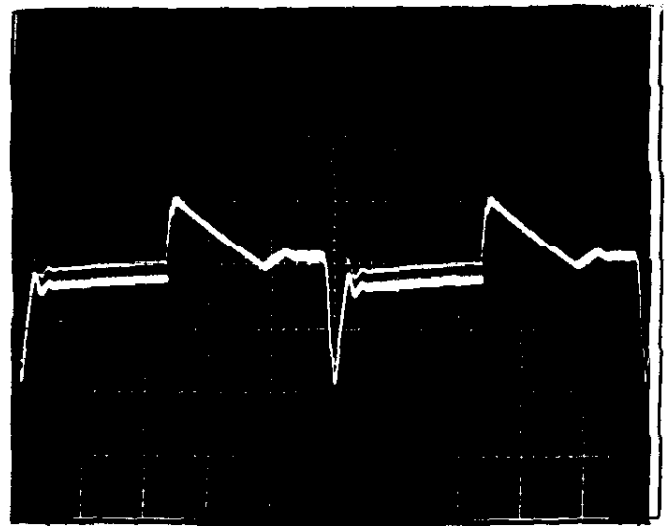
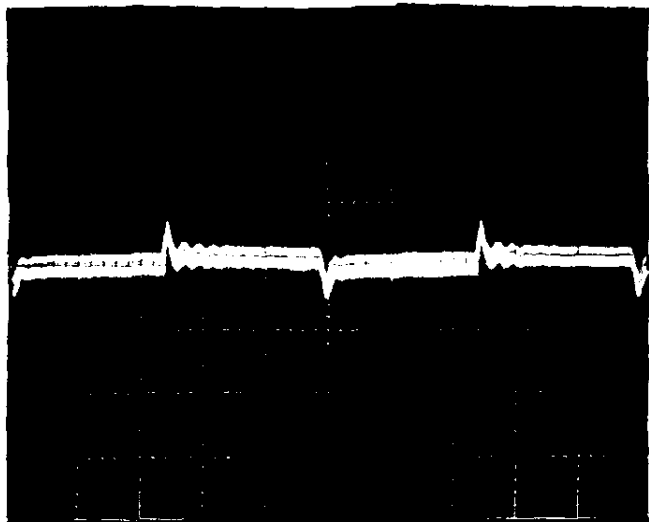
200 mV / DIV    2 mS / DIV

+2.0%    -3.1%

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

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

$V_{out}$



200 mV / DIV    0.2 mS / DIV

+1.3%    -1.2%

200 mV / DIV    0.2 mS / DIV

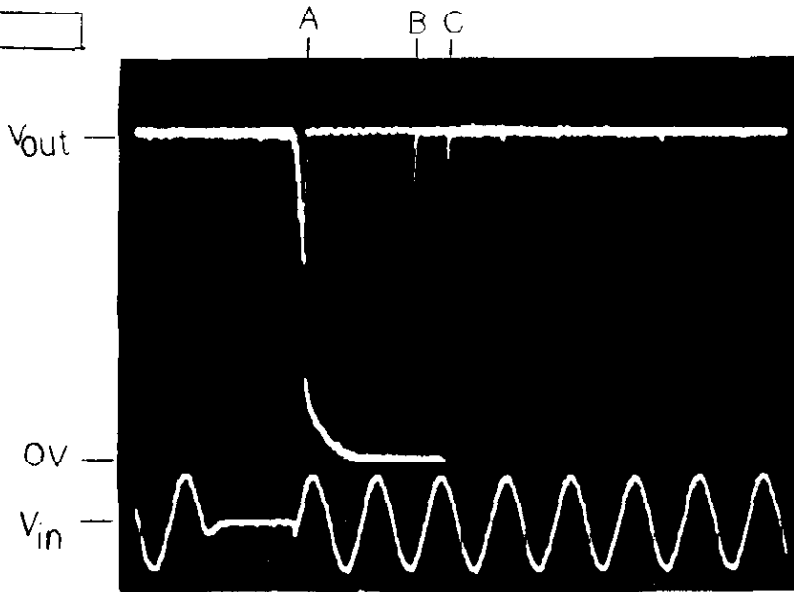
+2.0%    -3.2%

Response to brown out

KWS 10

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

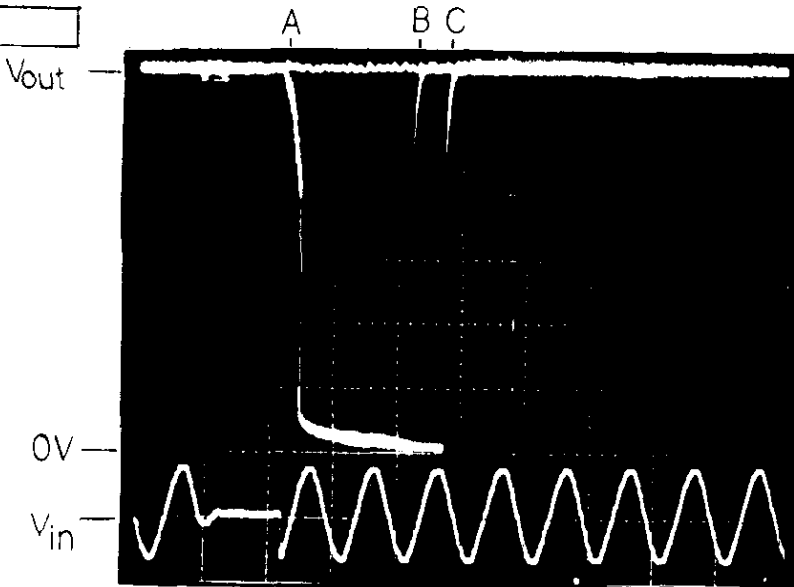
5V



Brown out time :  
A : 29 ms  
B : 33 ms  
C : 43 ms

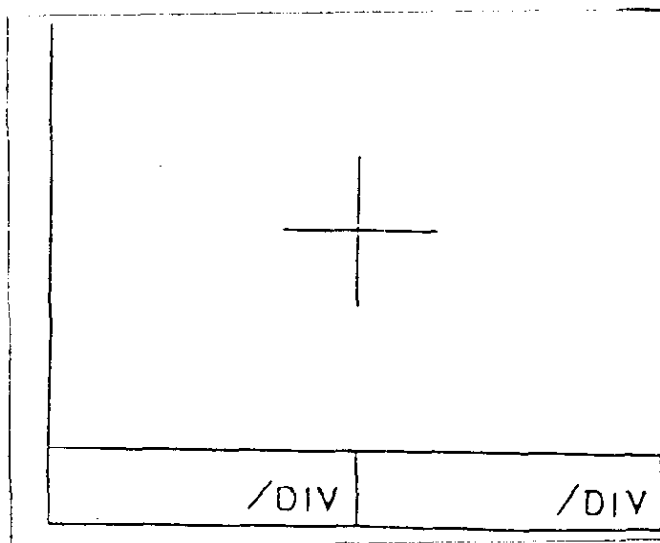
1 V/DIV 20ms/DIV

12V



A : 26 ms  
B : 32 ms  
C : 42 ms

2 V/DIV 20ms/DIV



A : ms  
B : ms  
C : ms

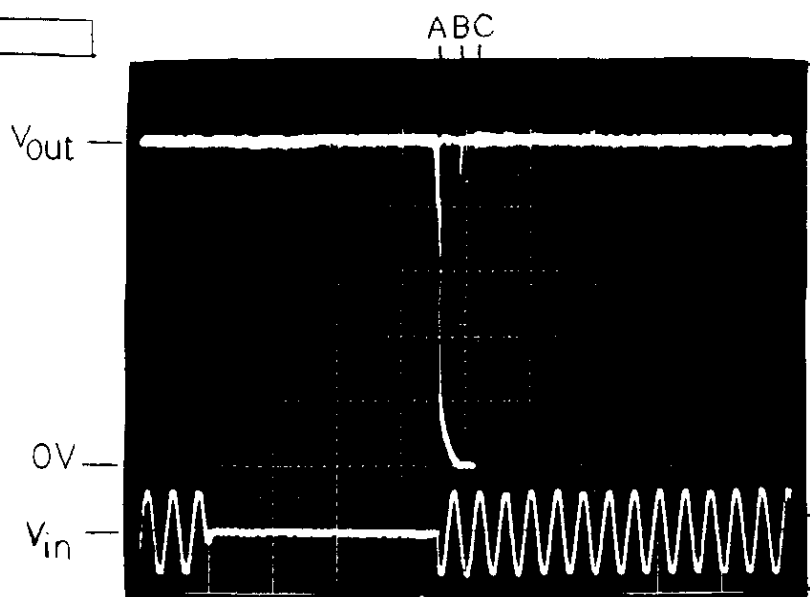
/DIV /DIV /DIV /DIV

Response to brown out

KWS 10

Conditions  $V_{in}$ : AC 220V  
 $I_{out}$ : 100%  
 $T_a$ : 25°C

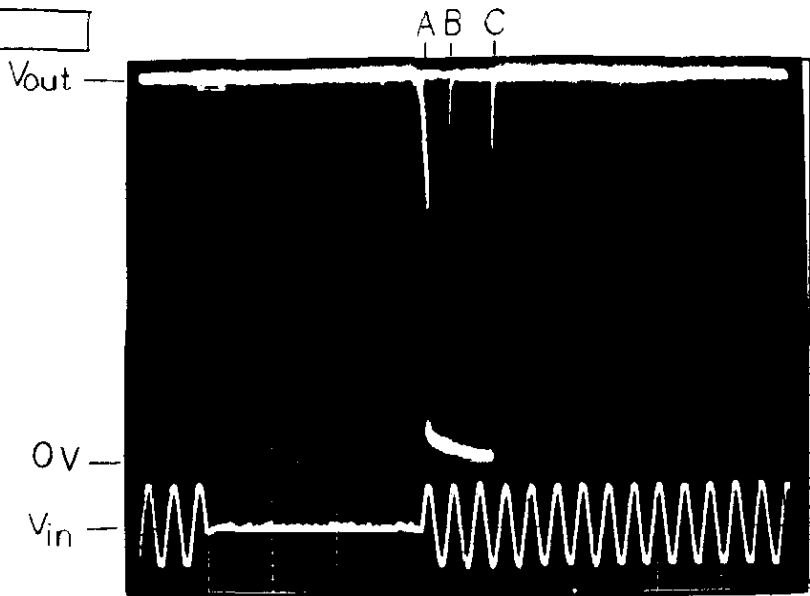
5V



Brown out time:  
 A : 182ms  
 B : 185ms  
 C : 196ms

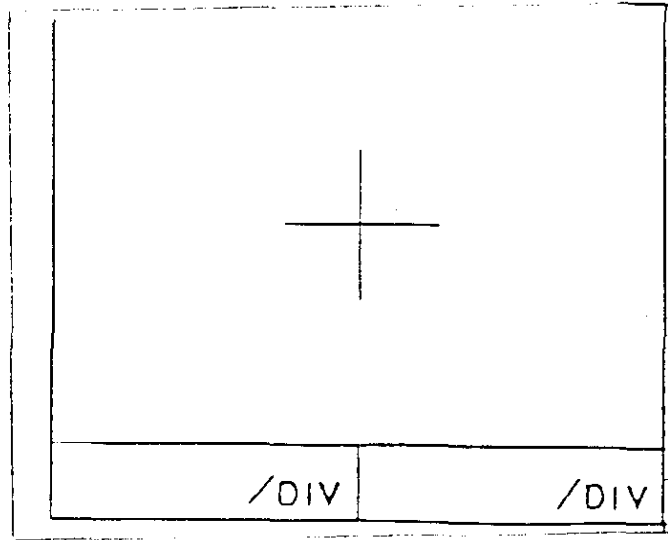
1V / DIV | 50ms / DIV

12V



A : 169ms  
 B : 176ms  
 C : 210ms

2V / DIV | 50ms / DIV



A : ms  
 B : ms  
 C : ms

KWS 10

Vin : AC 100v

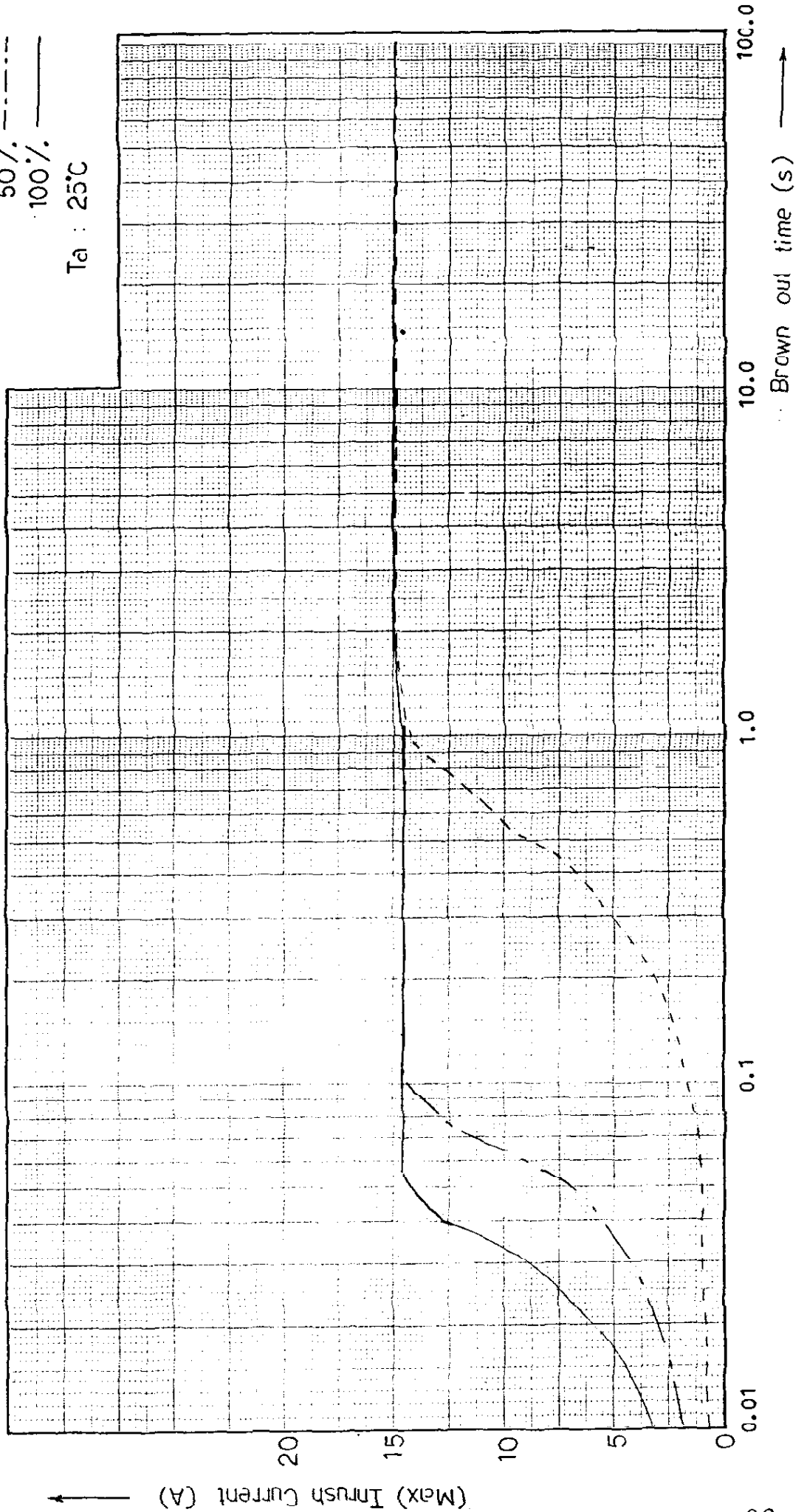
Iout : 0% - - - -

50% - - - -

100% - - - -

Ta : 25°C

Inrush Current Characteristics



Inrush Current Characteristics

KWS 10

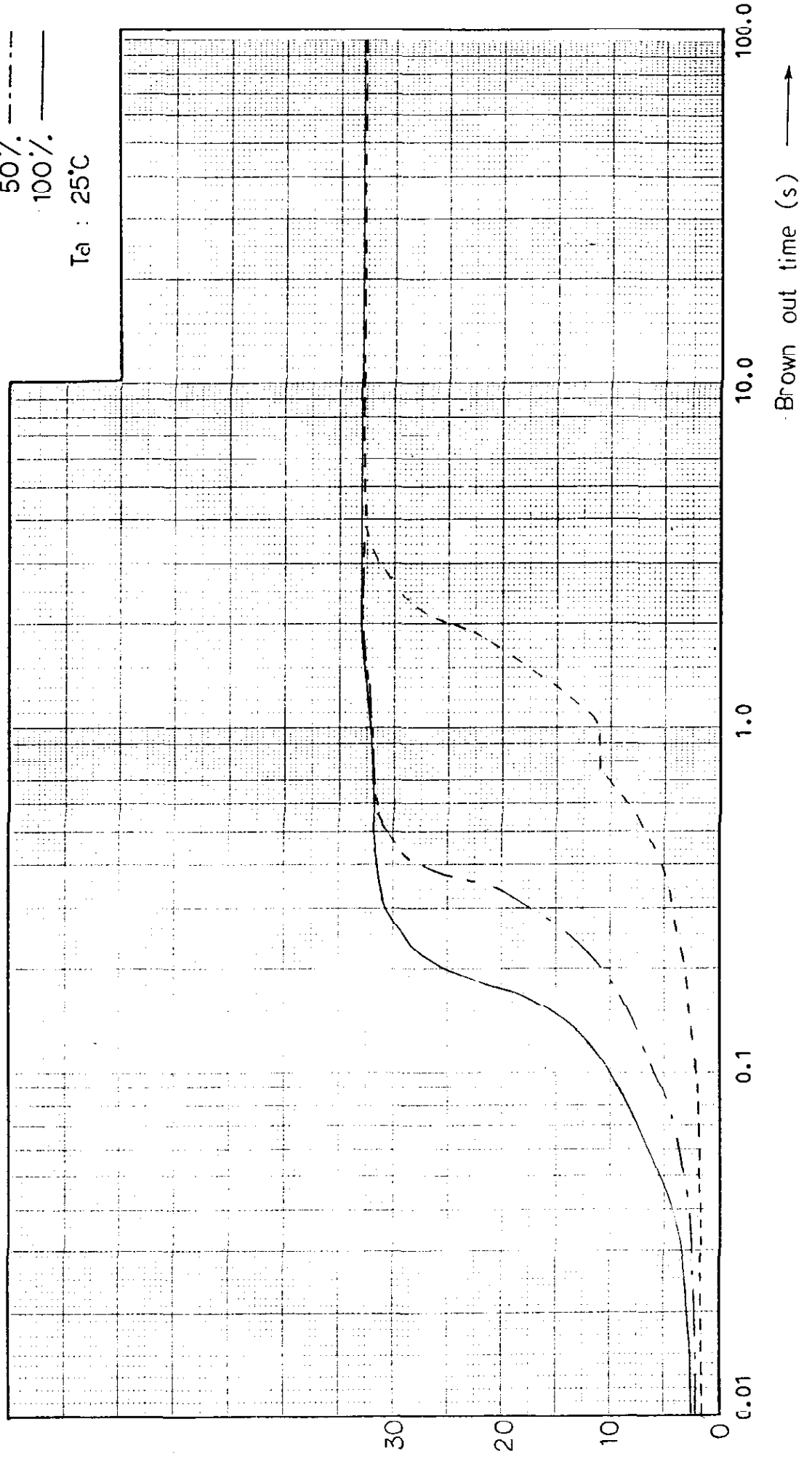
Vin : AC 230V

Iout : 0% -----

50% - - - - -

100% \_\_\_\_\_

Ta : 25°C



(Max) Inrush Current (A) ←



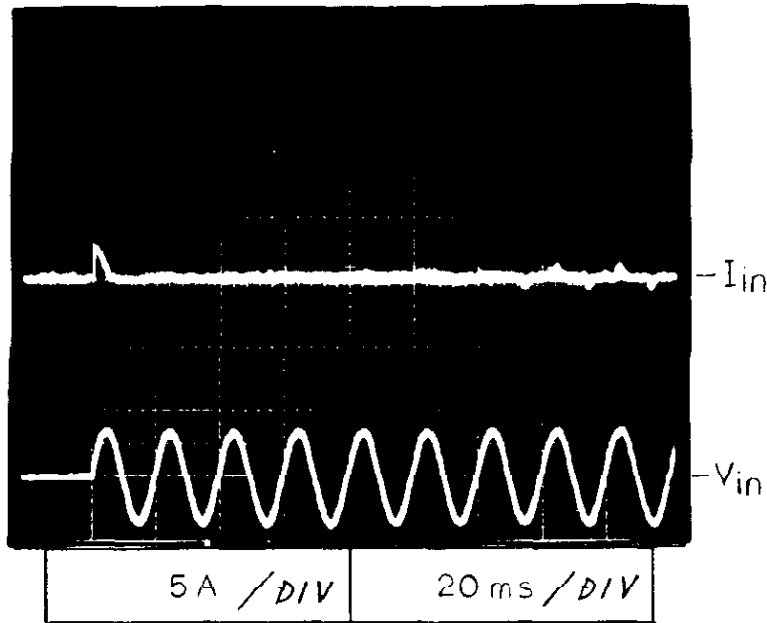


Inrush current waveform

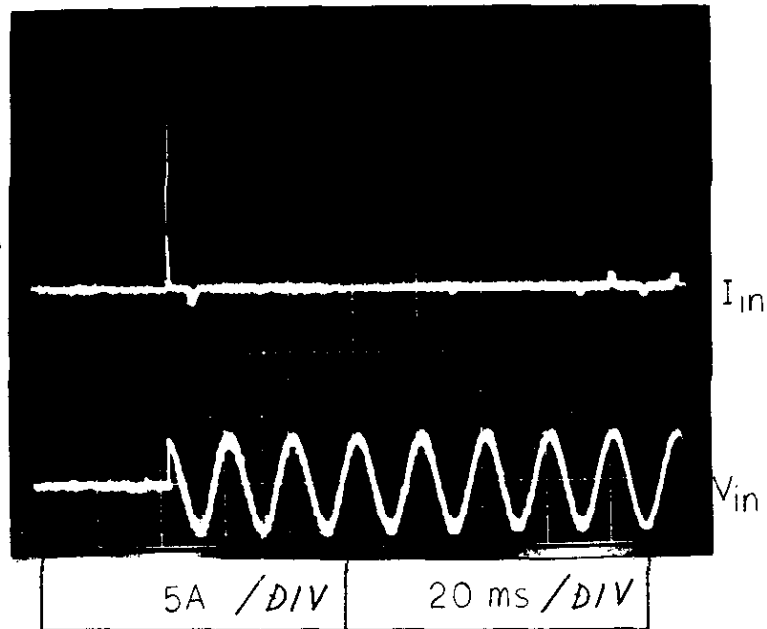
KWS 10

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

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



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

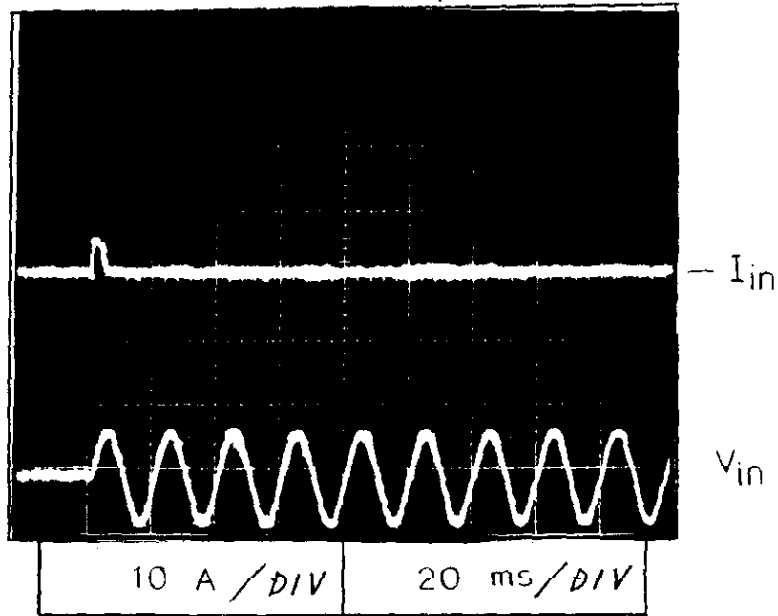


Inrush current waveform

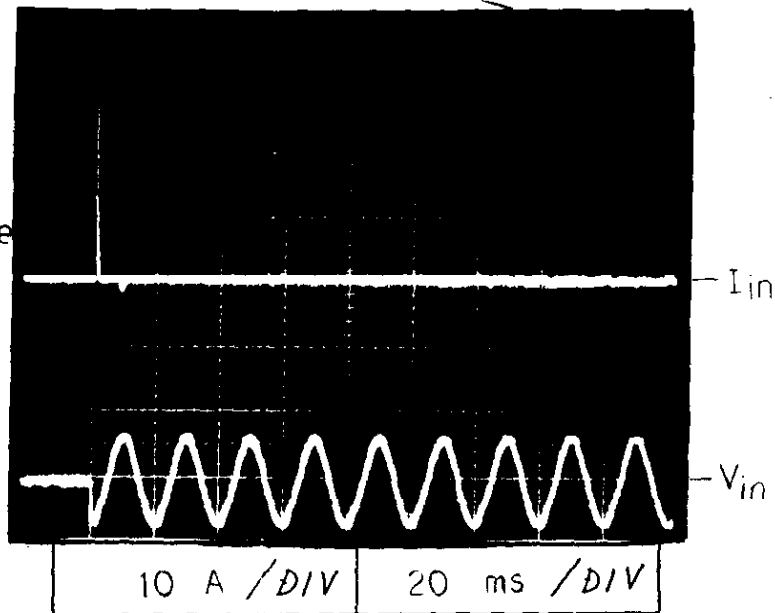
KWS 10

Conditions Vin : AC 230 v  
Iout : 100 %  
Ta : 25 °C

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



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

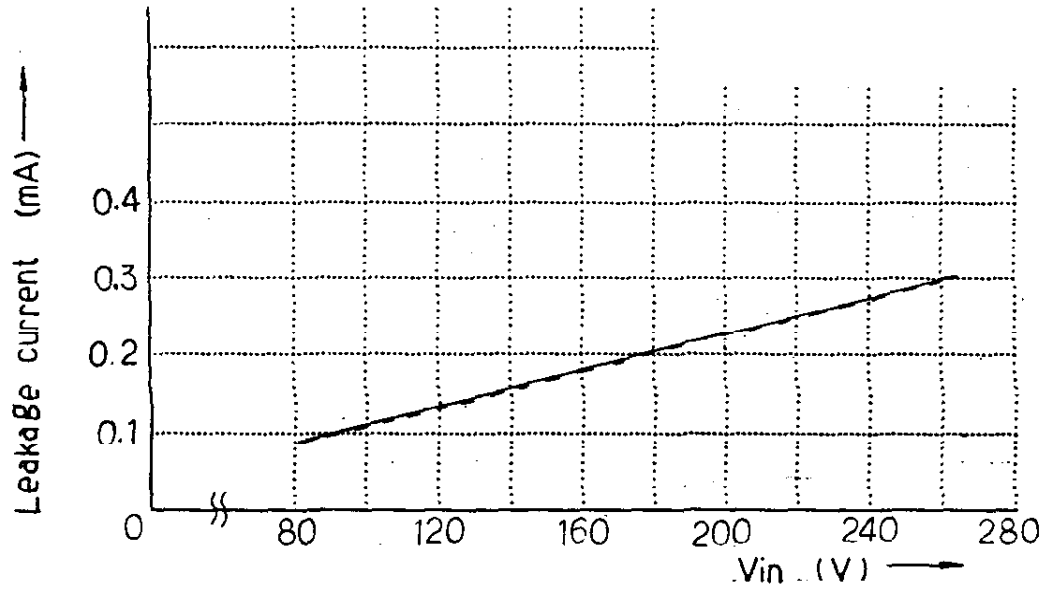


Leakage current

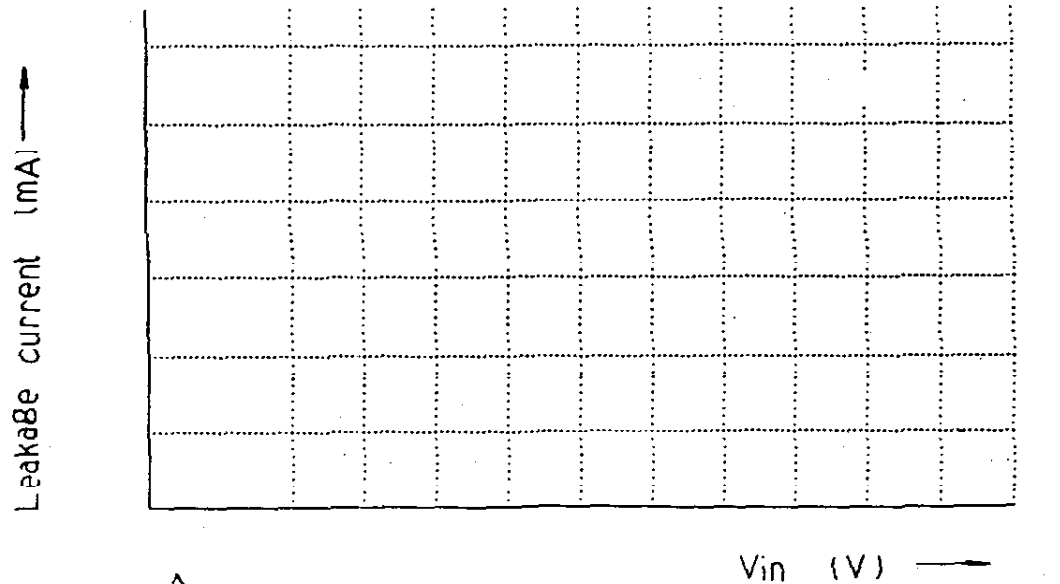
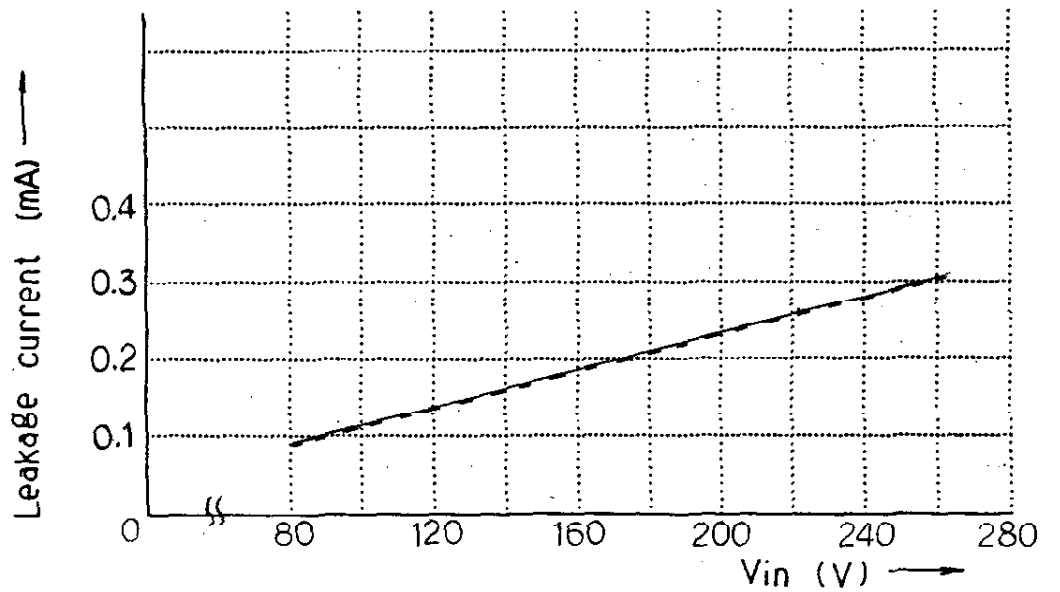
KWS 10

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

5V



12V



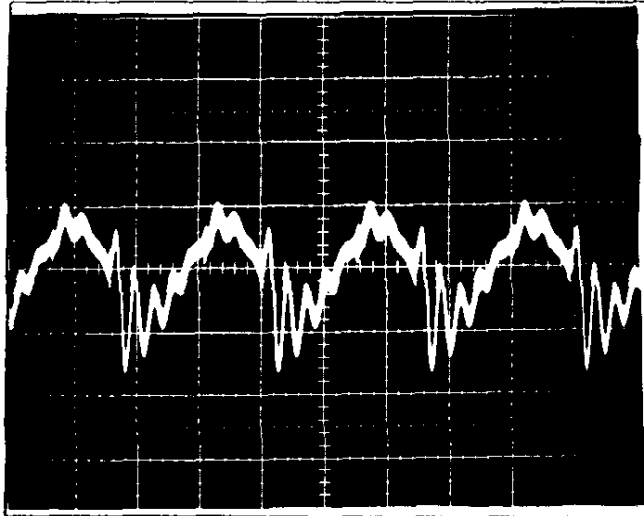
OUTPUT-RIPPLE, NOISE

KWS 10

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

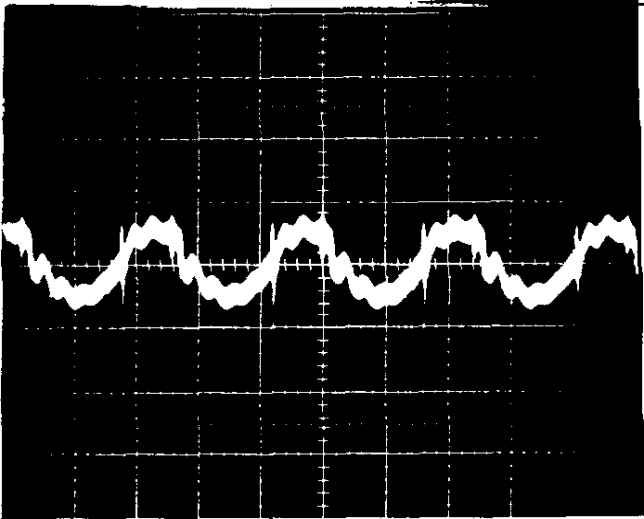
NORMAL MODE

5V

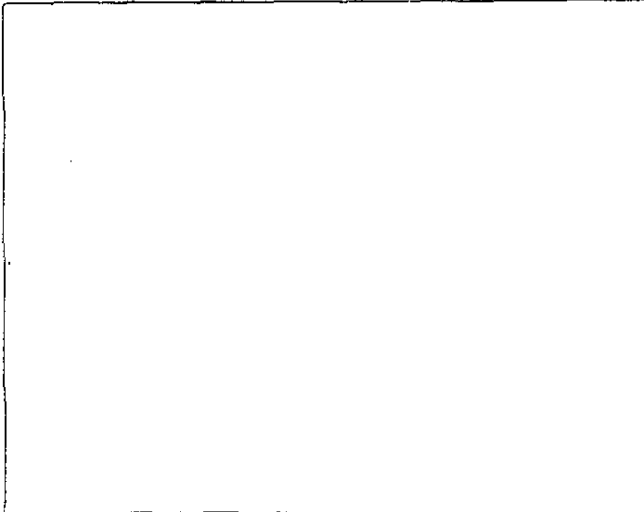


20 mV/DIV 2 μs/DIV

12V



20 mV/DIV 2 μs/DIV



mV/DIV μs/DIV

OUTPUT-RIPPLE, NOISE

KWS 10

Conditions

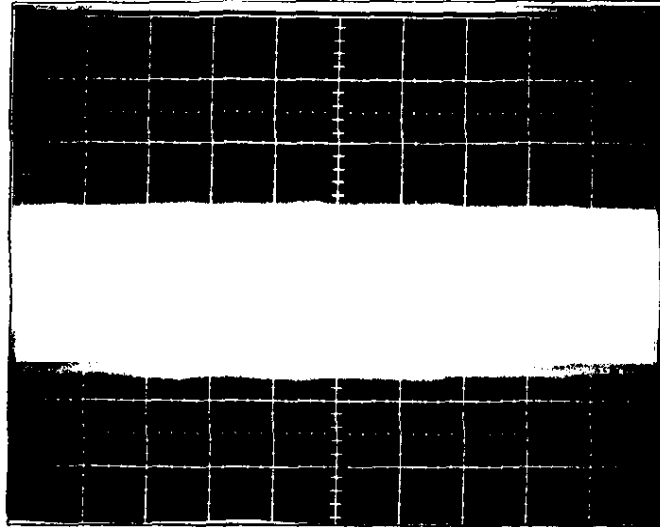
Vin: AC 100 v

Iout: 100 %

Ta: 25°C

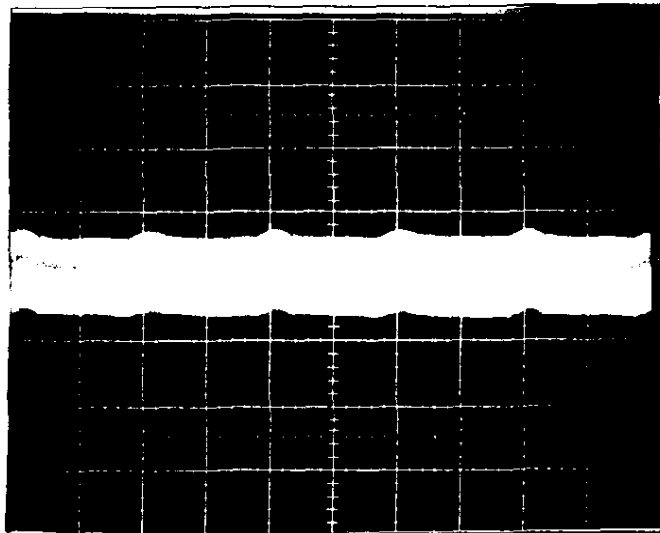
NORMAL MODE

5V

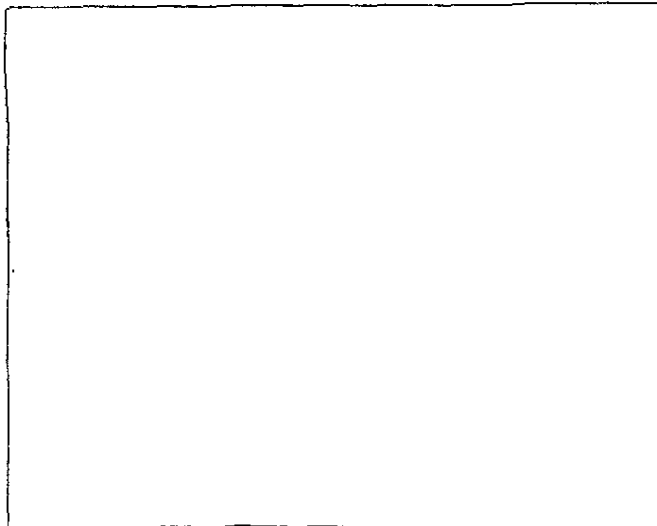


20 mV/DIV | 5 ms/DIV

12V



20 mV/DIV | 5 ms/DIV



mV/DIV |  $\mu$ s/DIV

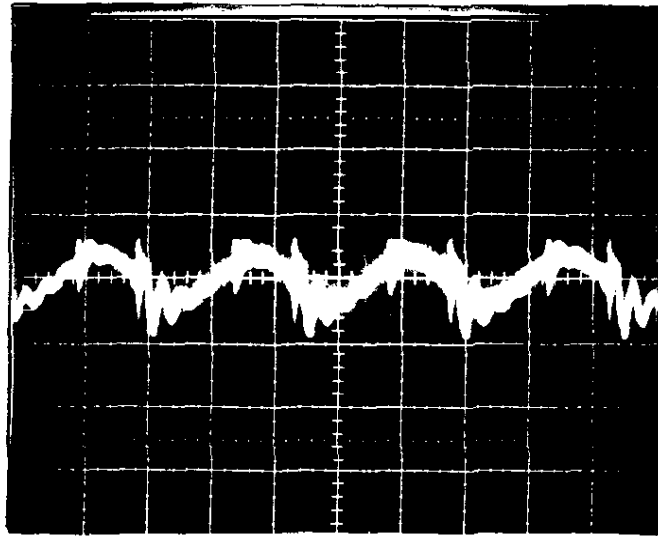
OUTPUT-RIPPLE, NOISE

KWS 10

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

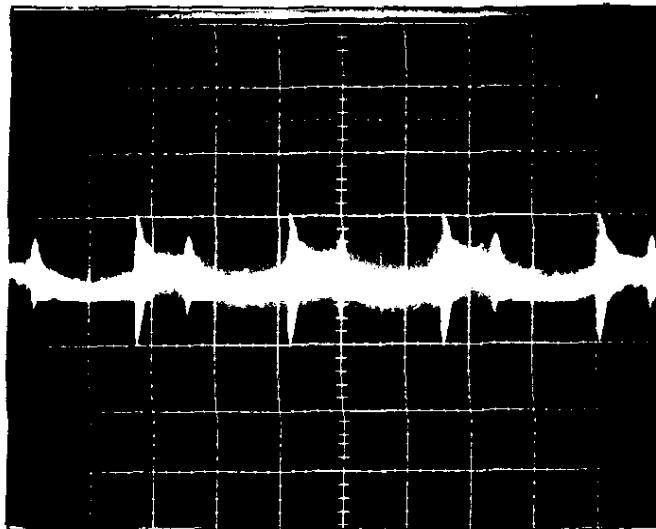
COMMON + NORMAL MODE

5V

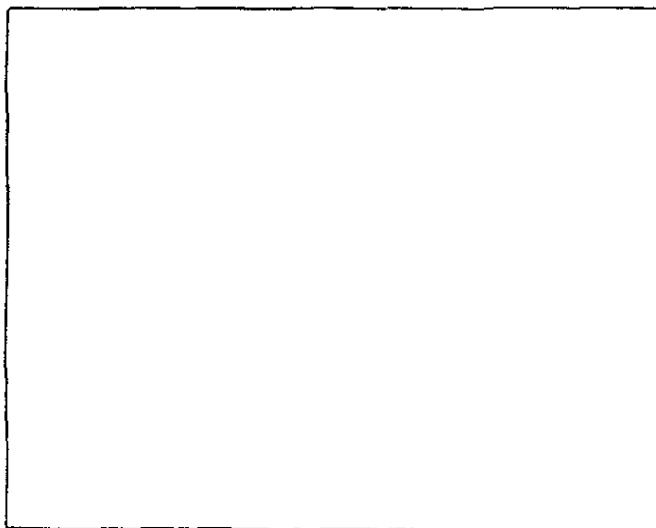


50 mV/DIV 2  $\mu$ s/DIV

12V



50 mV/DIV 2  $\mu$ s/DIV



mV/DIV  $\mu$ s/DIV

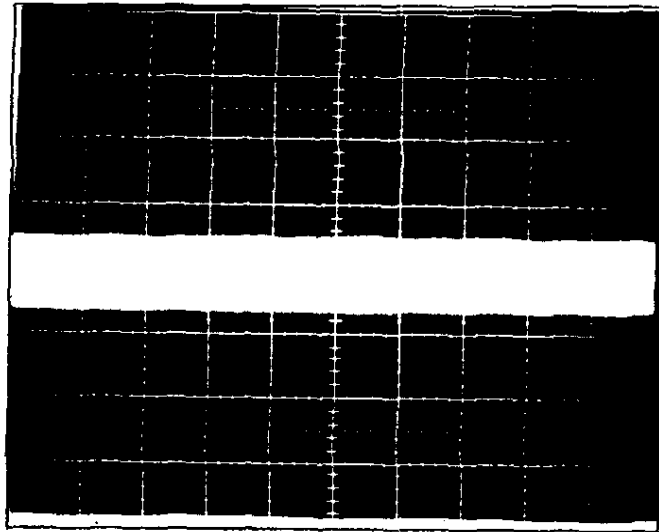
OUTPUT-RIPPLE, NOISE

KWS 10

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

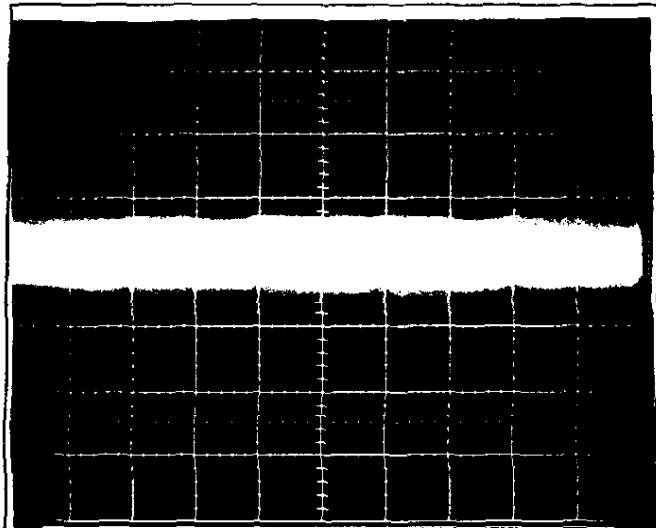
COMMON + NORMAL MODE

5V

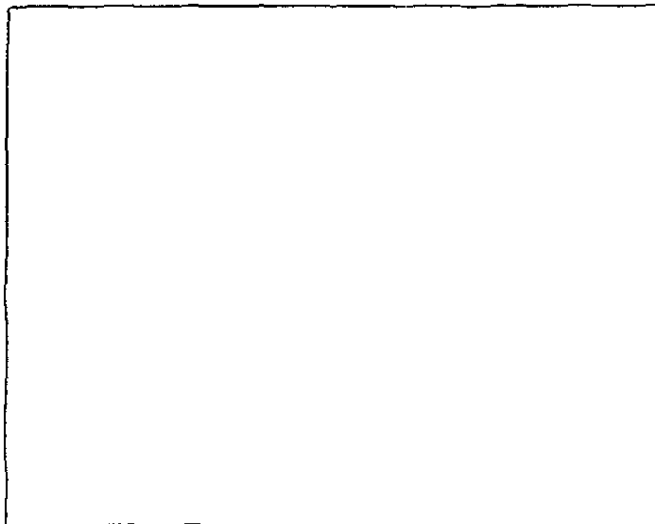


50 mV/DIV 5 ms/DIV

12V



50 mV/DIV 5 ms/DIV



mV/DIV  $\mu$ s/DIV