

LWT50H

EVALUATION DATA

型式データ

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Terminology used :

	Defination
Vin	Input voltage
Vout	Output voltage
Iin	Input current
Iout	Output current
Ta	Ambient temperature

LWT50H

SPECIFICATIONS

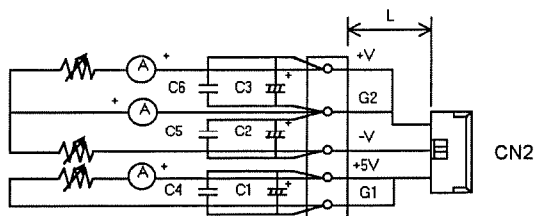
PA787-01-01B

ITEMS		MODEL	LWT50H-5FF			LWT50H-522			LWT50H-525		
1	Nominal Output Voltage	V	+5±1%	+15	-15	+5±1%	+12	-12	+5±1%	+12	-5
2	Minimum Output Current	A	1.0	0	0	1.0	0	0	1.0	0	0
3	Maximum Output Current	A	8.0	1.5	1.0	8.0	1.5	1.0	8.0	1.5	1.0
4	Maximum Output Power /CH	W	40.0	22.5	15.0	40.0	18.0	12.0	40.0	18.0	5.0
5	Total Allowable Output Power	-	50W								
6	Efficiency (Typ) (*1)	%	73			72			70		
7	Input Voltage Range (*8)	-	85-265VAC (47-440Hz) or 110-330VDC								
8	Input Current (Typ) 100/200V	-	1.2A / 0.7A								
9	In-rush Current (Typ) (*2)	-	16A at 100VAC, 32A at 200VAC								
10	Output Voltage Range	-	CH1 : (+5%, -0% max); CH2, CH3 : FIXED (±5% max)								
11	Maximum Ripple & Noise (*1)	mV	100	150	150	100	150	150	100	150	150
12	Maximum Line Regulation (*3, 7)	mV	50	150	150	50	120	120	50	120	50
13	Maximum Load Regulation (*4, 7)	mV	100	300	300	100	240	240	100	240	100
14	Over Current Protection (*5)	-	More than 105% for each channel								
15	Over Voltage Protection (*6)	-	CH1 Only ... 5.75V ~ 6.75V								
16	Hold-Up Time (Typ) (*1)	-	20ms at 100VAC								
17	Conducted EMI	-	Designed to meet VDE 0871B, FCC 20780B								
18	Safety Agency	-	Built to meet UL1950, CSA234, IEC950, EN60950, S.E.L.V.								
19	Parallel Operation	-	-								
20	Remote ON/OFF	-	-								
21	Remote Sensing	-	-								
22	Operating Temperature (*9)	-	0 ~ 60°C Convection cooled : 0 ~ 40°C...50W, 50°C...40W, 60°C...30W								
23	Operating Humidity	-	30 ~ 90% RH								
24	Storage Temperature	-	-30 ~ 85°C								
25	Storage Humidity	-	10 ~ 95% RH								
26	Cooling	-	Convection Cooled								
27	Temperature Coefficient	-	CH1...Less than 1%, CH2,CH3...less than 2% at 0 ~ 60°C								
28	Withstand Voltage	-	Input - Chassis : 2kVAC, Input-Output : 3kVAC 1min (20mA)								
29	Isolation Resistance	-	More than 100MΩ at 25°C and 70%RH Output-Chassis ... 500VDC								
30	Vibration	-	10 ~ 55Hz (sweep 1 min) Less than 19.6m/s ² X,Y,Z 1h each								
31	Shock	-	Less than 196.1m/s ²								
32	Weight	-	400g								
33	Size (WxHxD)	mm	97 x 26 x 160 (Refer to Outline Drawing)								

NOTES :

- *1 : At 100VAC and Maximum Output Power (5V 6A, CH2,CH3 total 20W).
- *2 : Typical value at cold start Ta = 25°C.
- *3 : From 85-265VAC or 110-330VDC, constant load.
- *4 : From Min output current - Max output current.
- *5 : The operation of the OCP will be given priority by the output total power at more than 53W.
- *6 : Inverter shutdown method, manual reset. (OVP circuit will shutdown all outputs).
- *7 : Please refer to Fig. A for measurement determination of line & load regulation and output ripple voltage.
- *8 : For cases where conformance to various safety specs (UL, CSA, VDE, etc.) are required, input voltage and frequency range will be 100-240VAC, 50/60Hz.
- *9 : Applies to Std. Mounting position. For other mounting position, refer to Instruction Manual.

Fig.A



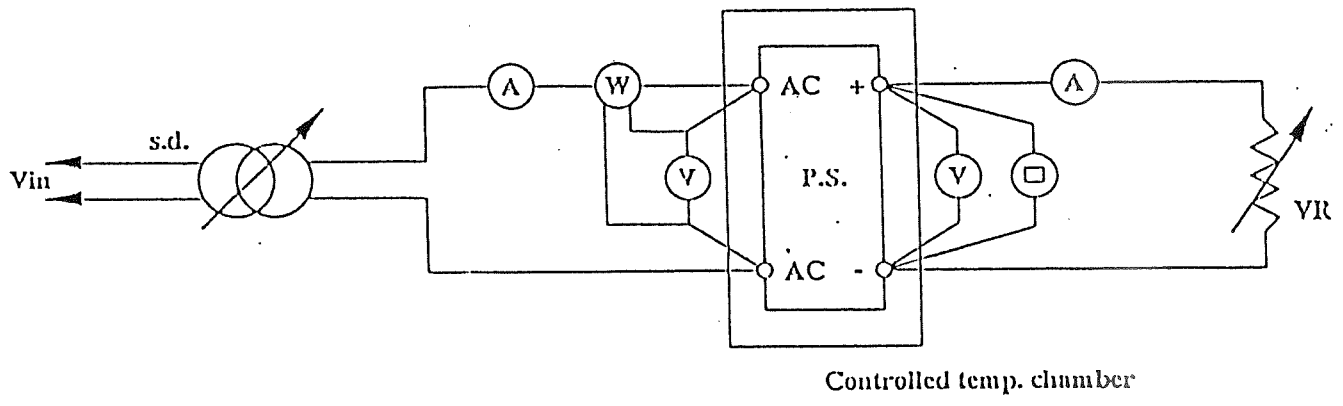
L : 120mm AWG #18 (Dual Wire)

- C1 : Elec. Cap 1000μF
- C2 : Elec. Cap 100μF
- C3 : Elec. Cap 220μF
- C4, 5, 6 : Film Cap 0.1μF
- Bandwidth of scope : 100MHz EIAJ Probe

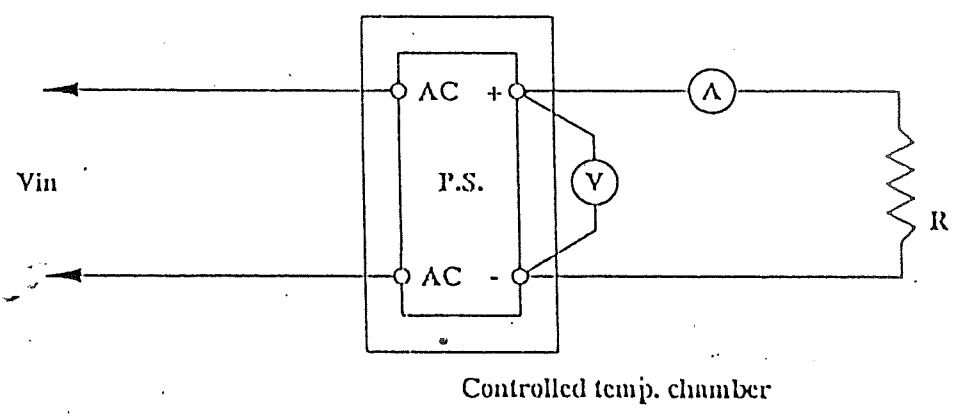
1. EVALUATION METHOD

1-1 Circuits used for determination

(1) Steady state data

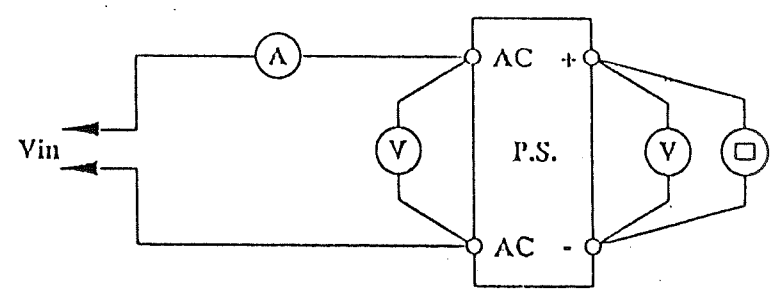


(2) Warm up voltage drift characteristics

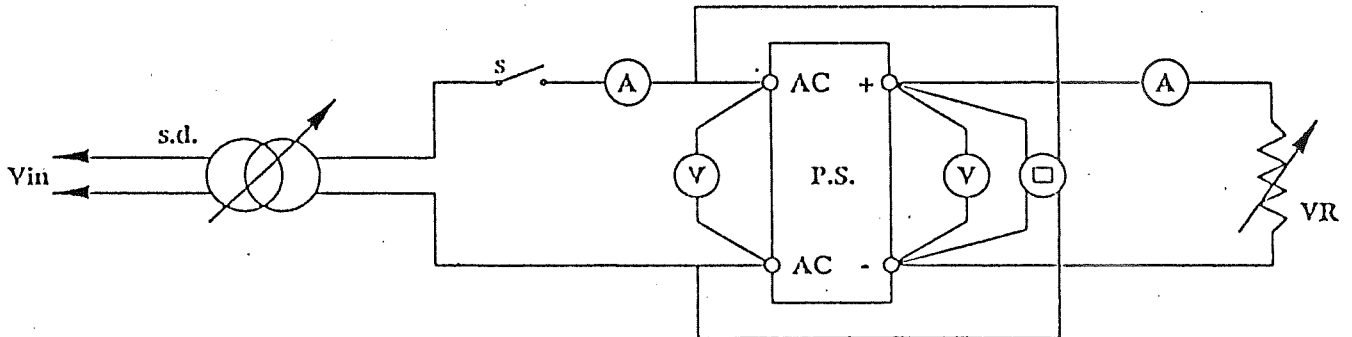


(3) Over current protection (OCP) characteristics Same as steady state data

(4) Over voltage protection (OVP) characteristics

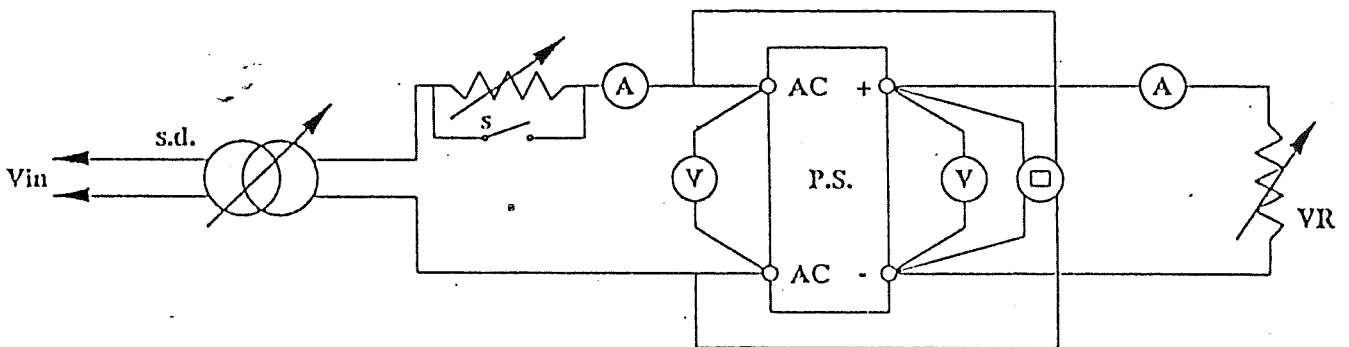


(5) Output rise characteristics

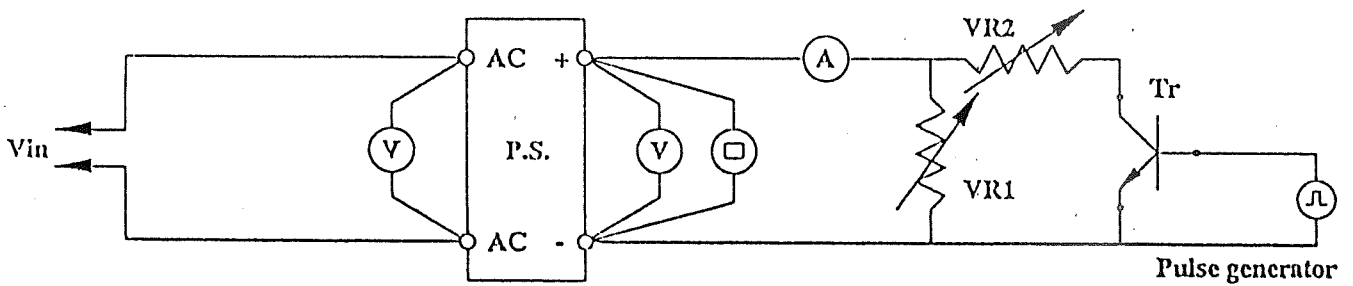


(6) Output fall characteristics
Same as Output rise characteristics

(7) Dynamic line response characteristics

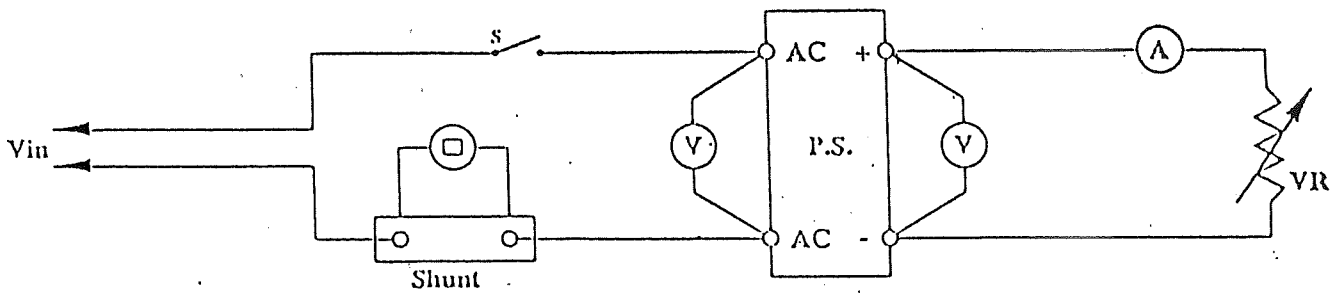


(8) Dynamic load response characteristics

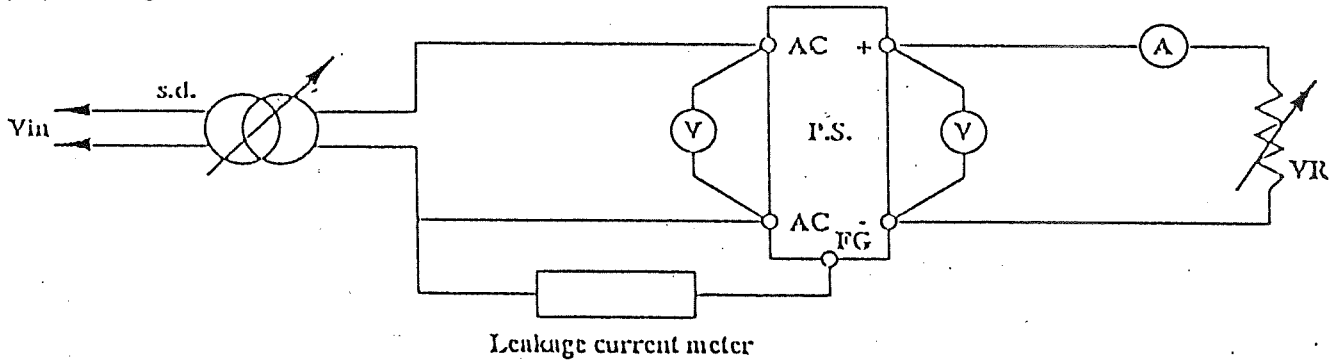


(9) Inrush current characteristics

LWT50H



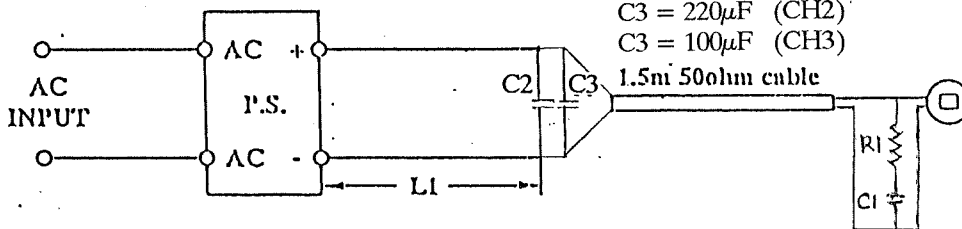
(10) Leakage current characteristics



Note : Leakage current measure through a 1K ohm resistor. Range wed : AC + DC

(11) Output-ripple, noise

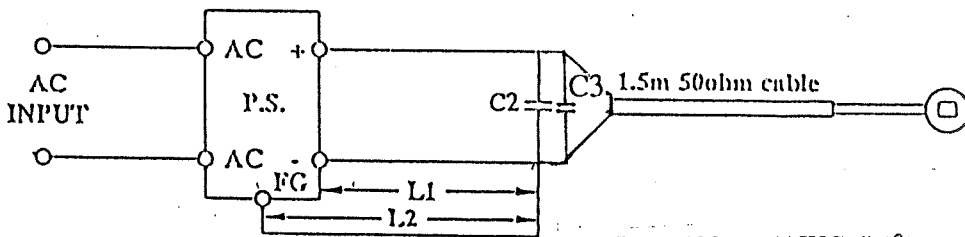
(a) Normal mode



- R1 = 50Ω
- C1 = 4700pF
- C2 = 0.1μF
- C3 = 1000μF (CH1)
- C3 = 220μF (CH2)
- C3 = 100μF (CH3)

L1 = 120mm

(b) Normal + common mode



- L1 = 120mm (AWG # 18)
- L2 = 120mm (AWG # 18)

3. List Of Equipment Used

LWT50H

NO	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1.	Oscilloscope	Iwatsu	SS-7610
2.	Digital Storage Oscilloscope	Tektronix	2432A / TDS620
3.	Digital Voltmeter	Hewlett Packard	34401A
4.	Digital Watt / Current Voltmeter	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-2150D PLZ72W, PLZ150WA
9.	Digirush Currenter	Takamizawa Cybernetics	PSA-200
10.	Current Probe / Amplifier	Tektronic	A6303 / AM503
11.	Controlled Temperature Chamber	Tabai	PL-1G
12.	Leakage Current meter	Yokogawa Electric	3226
13.	Equipment For Dynamic Line Response	-Built in - House-	-

REGULATION – Line And Load, Temp. Drift

CH1

Condition CH2 : 0.45 A
CH3 : 0.22 A
Ta : 25°C

1. Regulation – Line and Load

Iout	Vin	AC 85 V	AC 100 V	AC 220 V	AC 265 V	LINE REGULATION	
		V	V	V	V	mV	%
12.5	%	5.036 V	5.036 V	5.036 V	5.036 V	0 mV	0 %
50	%	5.021 V	5.021 V	5.021 V	5.021 V	0 mV	0 %
100	%	4.999 V	4.999 V	4.999 V	4.999 V	0 mV	0 %
LOAD REGULATION		37 mV	37 mV	37 mV	37 mV		
		0.74 %	0.74 %	0.74 %	0.74 %		

2. Temperature Drift

Conditions Vin : AC100V
Iout : CH1 : 8 A
CH2 : 0.45 A
CH3 : 0.22 A

Ta	0 °C	25 °C	40 °C	TEMP. STABILITY	
Vout	5.011 V	4.999 V	4.983 V	28 mV	0.56 %

CH2

Condition CH1 : 1 A
CH3 : 1 A
Ta : 25°C

1. Regulation – Line and Load

Iout	Vin	AC 85 V	AC 100 V	AC 220 V	AC 265 V	LINE REGULATION	
		V	V	V	V	mV	%
0	%	14.936 V	14.936 V	14.941 V	14.942 V	6 mV	0.04 %
50	%	14.924 V	14.924 V	14.927 V	14.928 V	4 mV	0.03 %
100	%	14.912 V	14.913 V	14.917 V	14.917 V	5 mV	0.03 %
LOAD REGULATION		24 mV	23 mV	24 mV	25 mV		
		0.16 %	0.15 %	0.16 %	0.17 %		

2. Temperature Drift

Conditions Vin : AC100V
Iout : CH1 : 1 A
CH2 : 1.5 A
CH3 : 1 A

Ta	0 °C	25 °C	40 °C	TEMP. STABILITY	
Vout	14.888 V	14.913 V	14.943 V	55 mV	0.37 %

REGULATION – Line And Load, Temp. Drift

CH3

Conditions Ta : 25°C

Iout = CH1 : 1A
 CH2 : 1.5A

1. Regulation – Line and Load

Iout	Vin	AC 85 V	AC 100 V	AC 220 V	AC 265 V	LINE REGULATION	
0	%	-14.914 V	-14.914 V	-14.914 V	-14.914 V	0 mV	0.00 %
50	%	-14.900 V	-14.901 V	-14.901 V	-14.901 V	1 mV	0.01 %
100	%	-14.880 V	-14.880 V	-14.882 V	-14.883 V	3 mV	0.02 %
LOAD REGULATION		34 mV	34 mV	32 mV	31 mV		
		0.23 %	0.23 %	0.21 %	0.21 %		

2. Temperature Drift

Conditions Vin : AC100V
 Iout : CH1 : 1 A
 CH2 : 1.5 A
 CH3 : 1 A

Ta	0 °C	25 °C	40 °C	TEMP. STABILITY	
Vout	-14.850 V	-14.880 V	-14.914 V	64 mV	0.43 %

LWT50H-5FF

Output Voltage And Ripple Voltage v.s Input Voltage

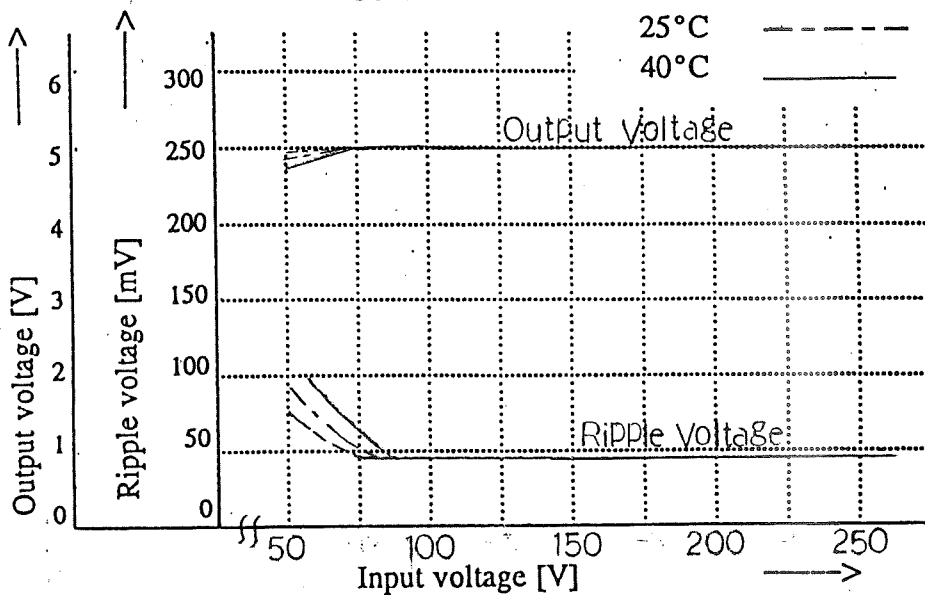
Conditions

Ta : 0°C -----
 25°C - - - - -
 40°C _____

CH1

Load conditions

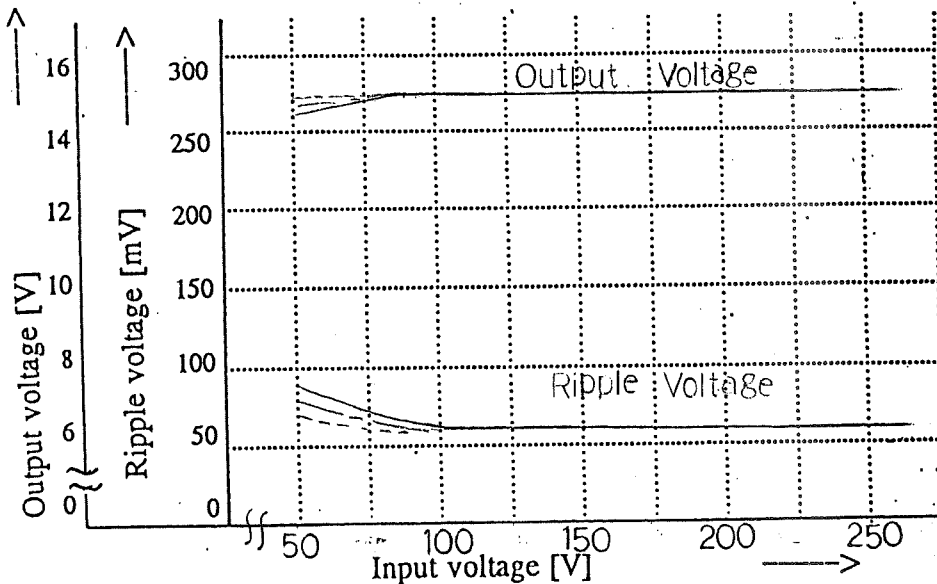
Iout = CH1 : 8A
 CH2 : 0.45A
 CH3 : 0.22A



CH2

Load conditions

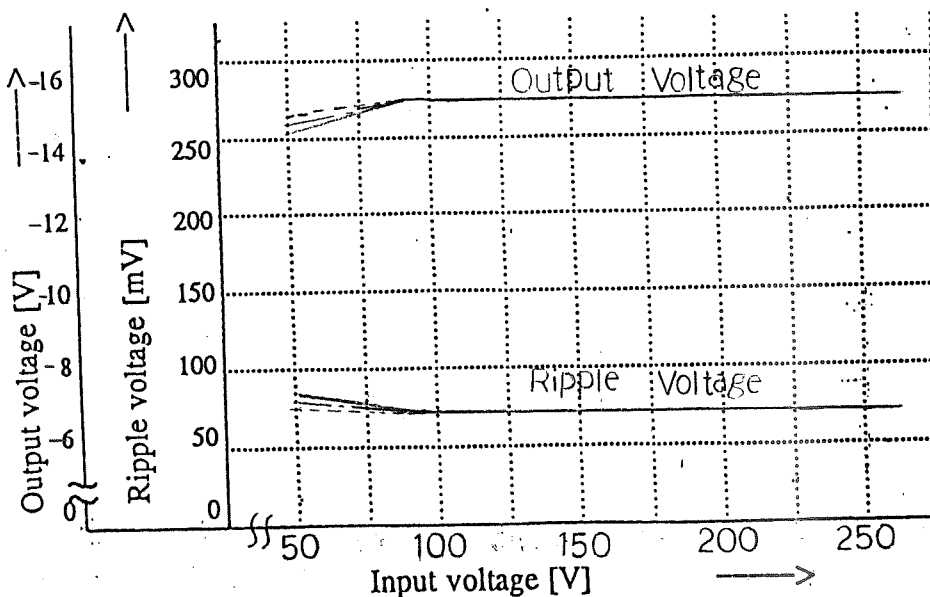
Iout = CH1 : 1A
 CH2 : 1.5A
 CH3 : 1A



CH3

Load conditions

Iout = CH1 : 1A
 CH2 : 1.5A
 CH3 : 1A



LWT50H-5FF

Efficiency And Input Current v.s Output Current

Conditions

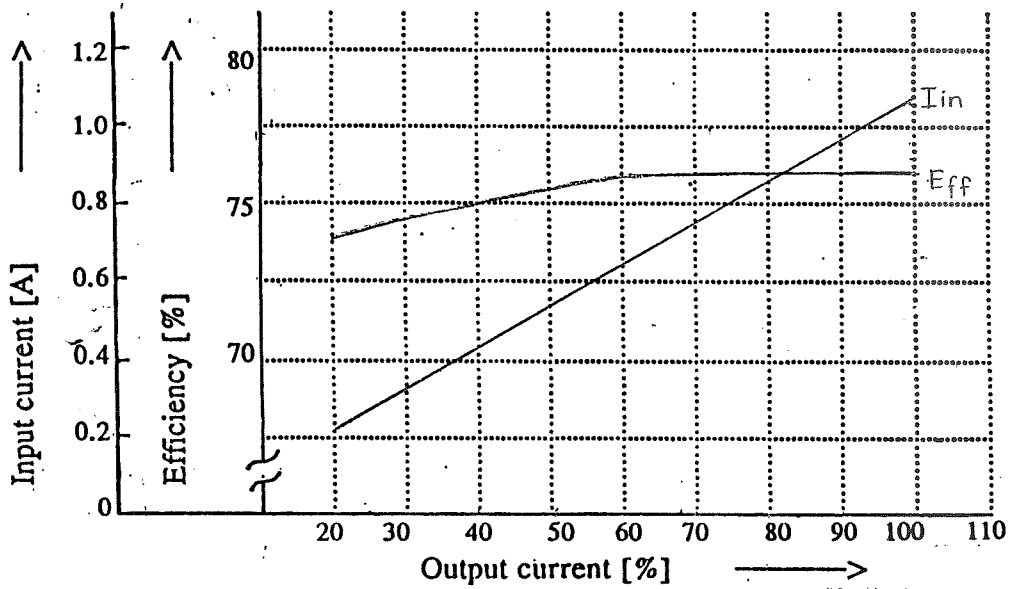
Vin : AC100V

Ta : 25°C

CH1 : 6A

100% = CH2 : 0.8A

CH3 : 0.53A

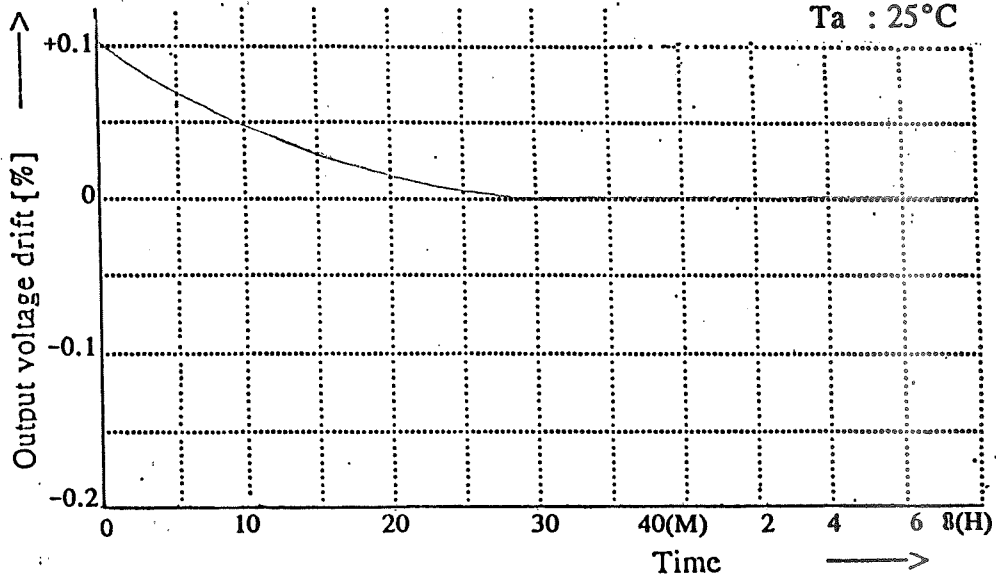


Warm Up Voltage Drift

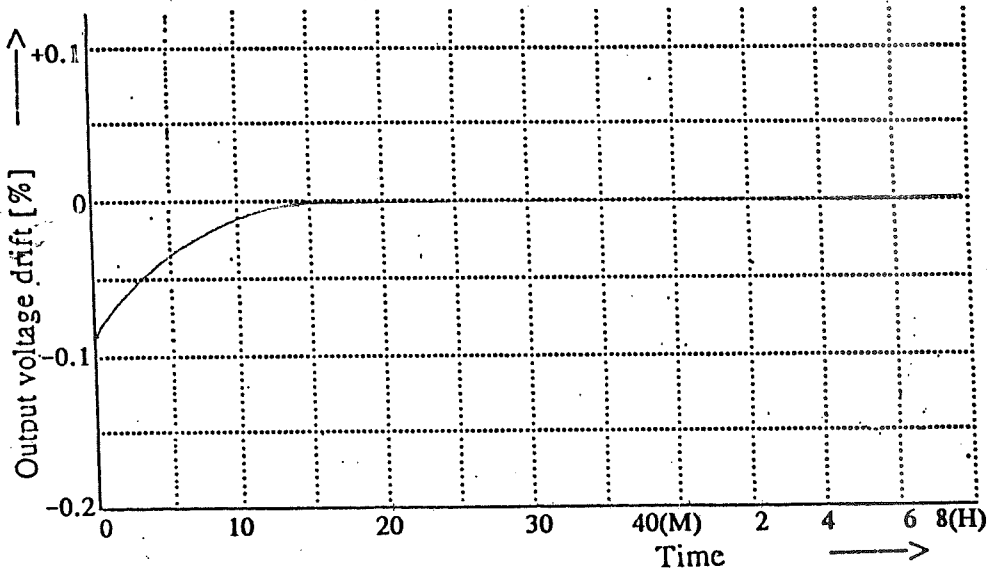
LWT50H-5FF

Conditions Vin : AC100V
Iout : 100%
Ta : 25°C

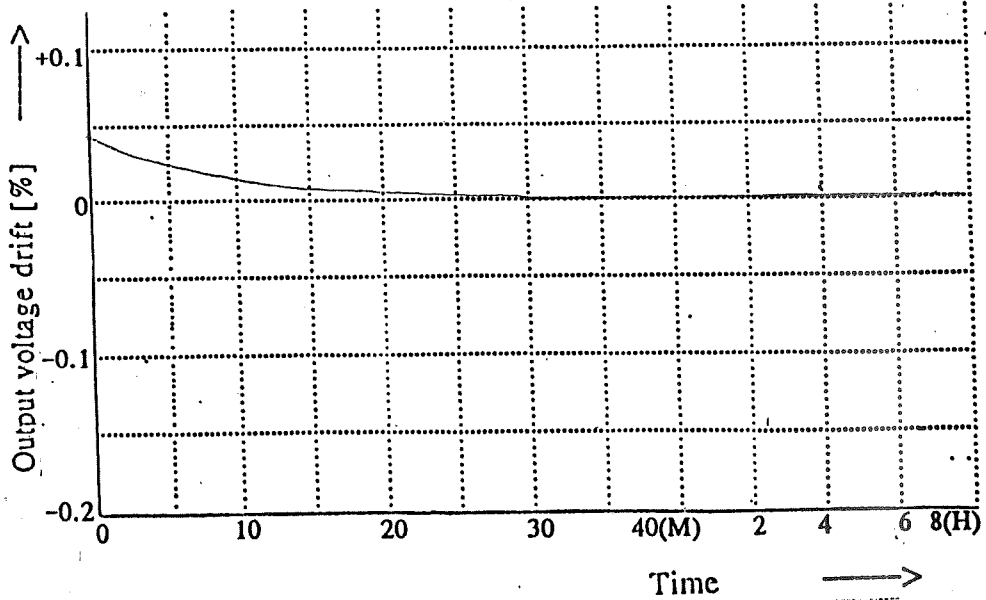
CH1



CH2



CH3



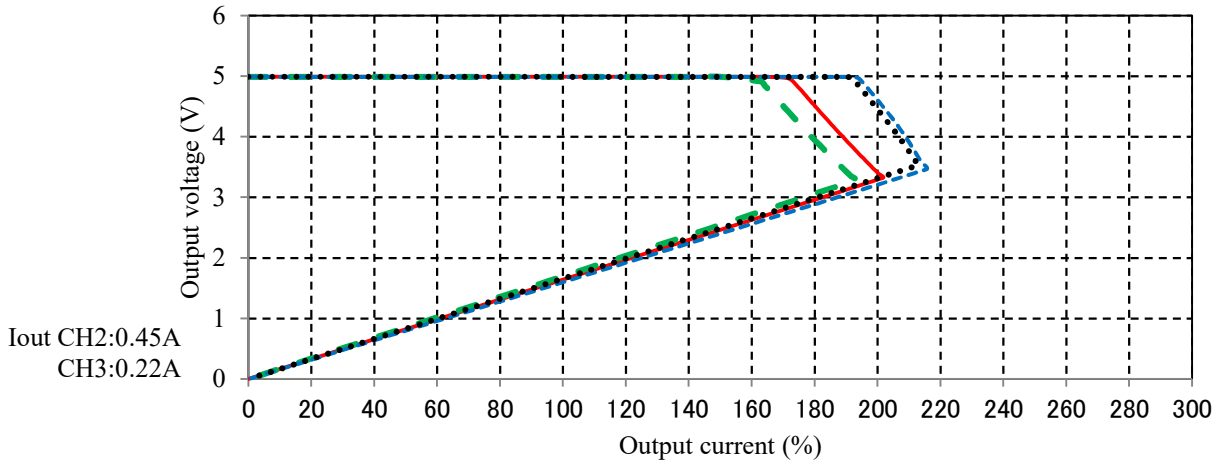
2-3. 過電流保護特性

Over current protection (OCP) characteristics

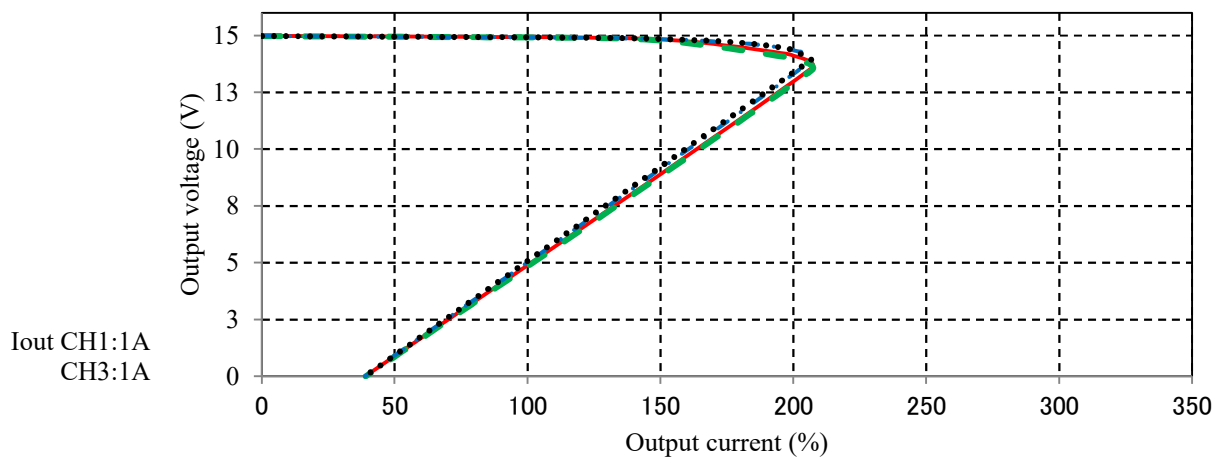
Conditions Ta : 25°C

V_{in} : AC85V
 AC100V
 AC220V
 AC265V

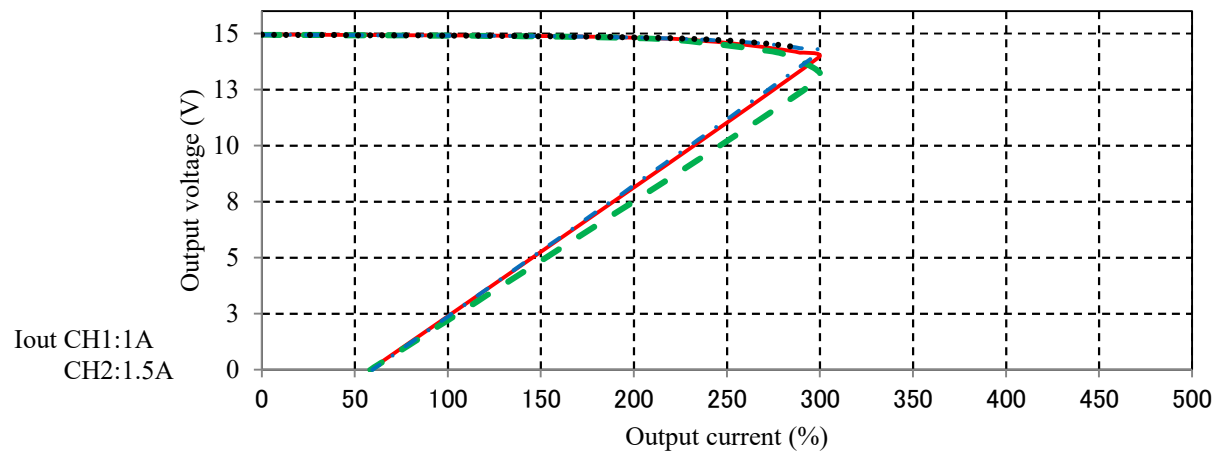
1CH



2CH



3CH



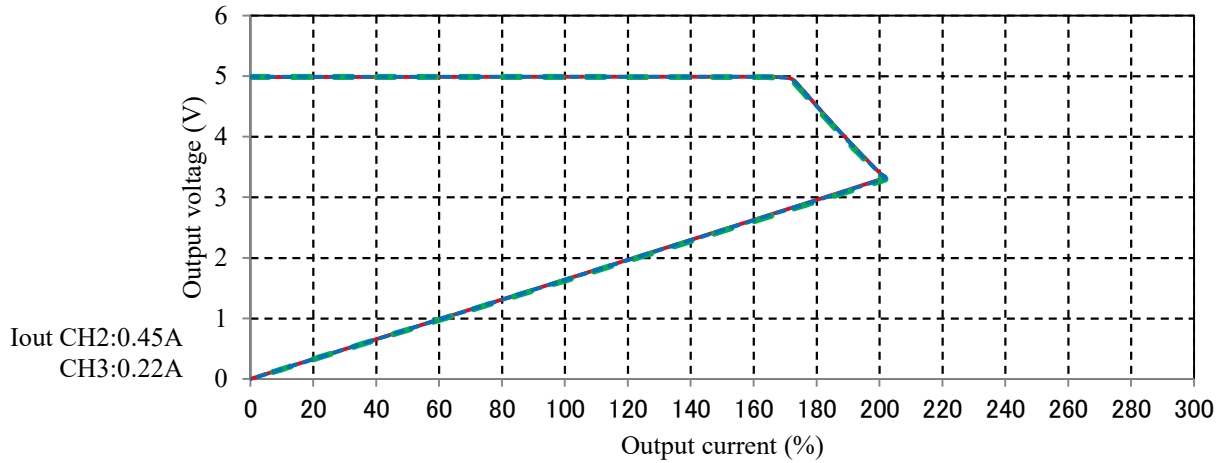
2-3. 過電流保護特性

Over current protection (OCP) characteristics

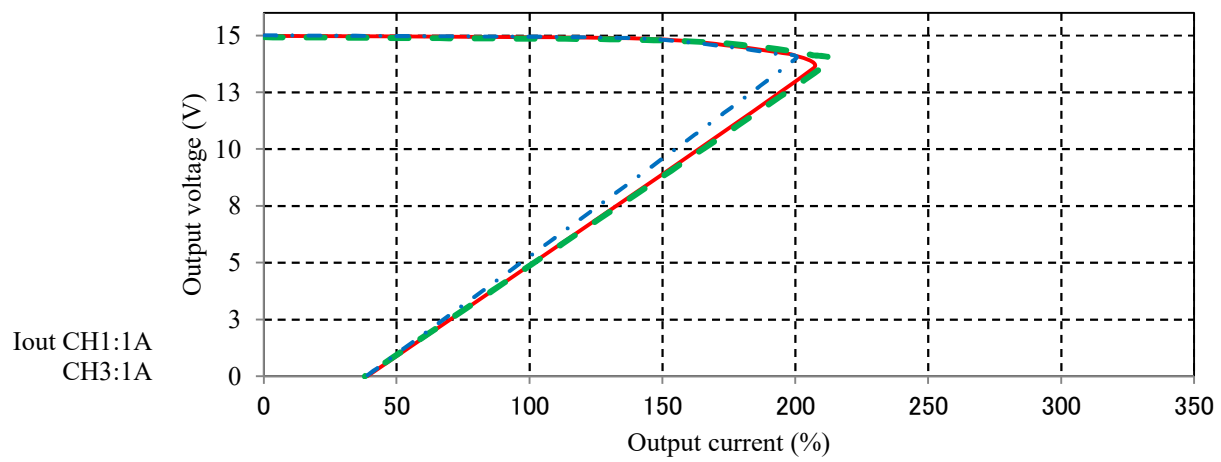
Conditions V_{in} : 100 VAC

Ta : 0 °C ---
 25 °C ---
 40 °C -.-

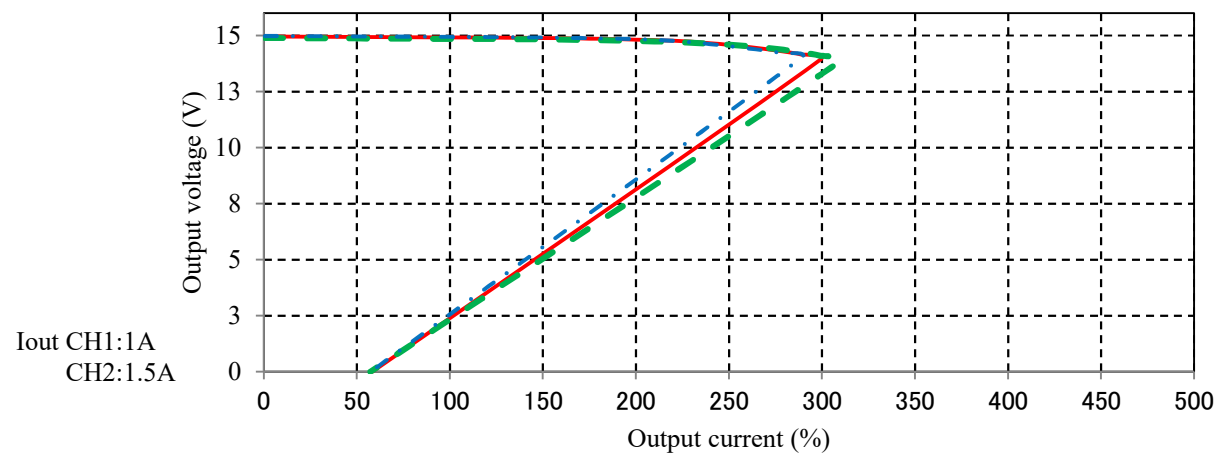
1CH



2CH



3CH



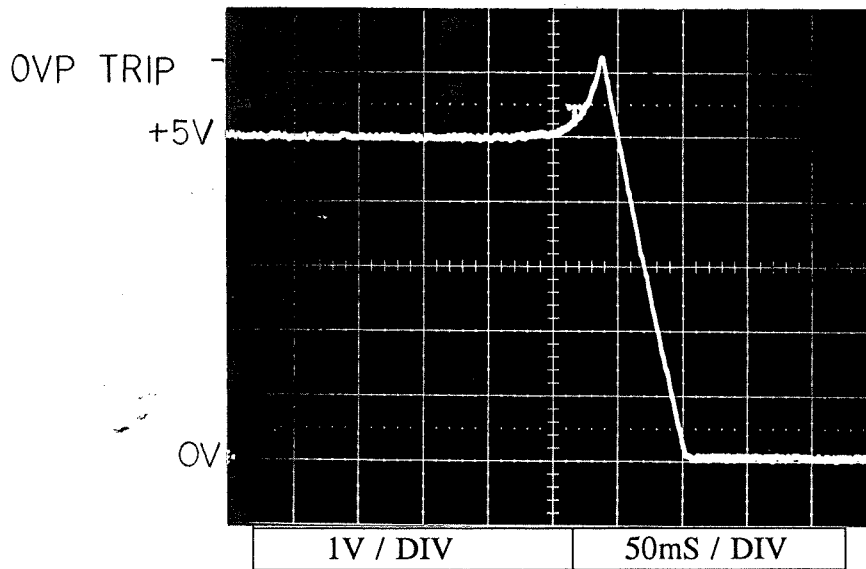
LWT50H-5FF

OVP Characteristics

Conditions

I_{out} : MIN
CH1 : 1.0A
CH2 : 0A
CH3 : 0A

CH1: +5V

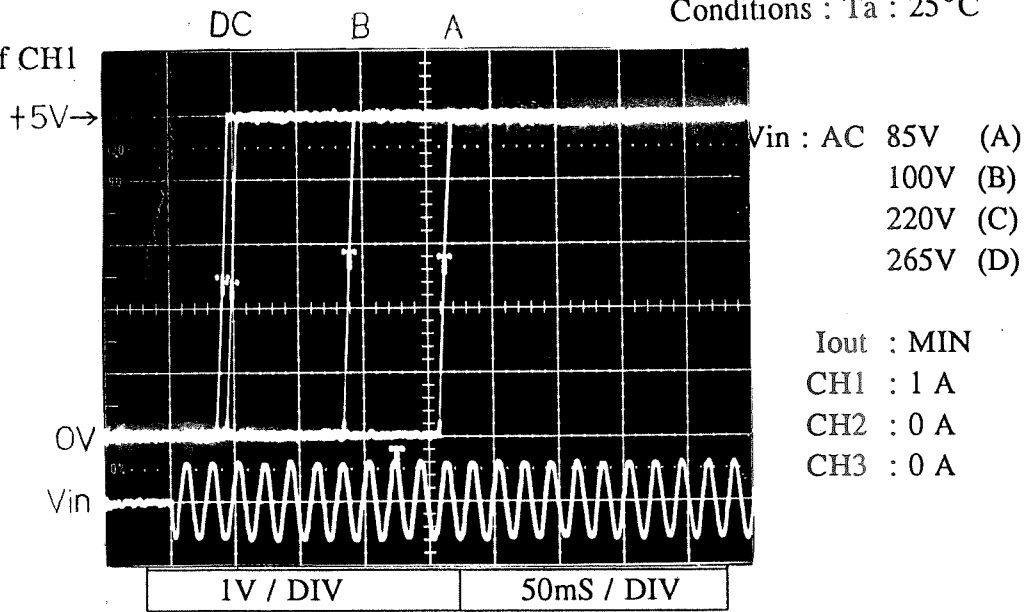


Output Rise Time

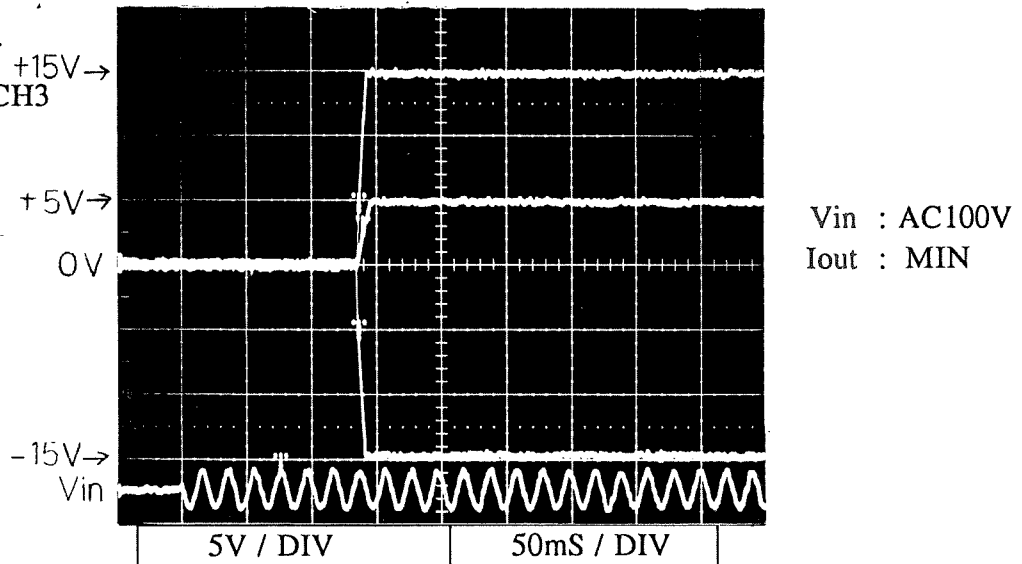
LWT50H-5FF

Conditions : Ta : 25°C

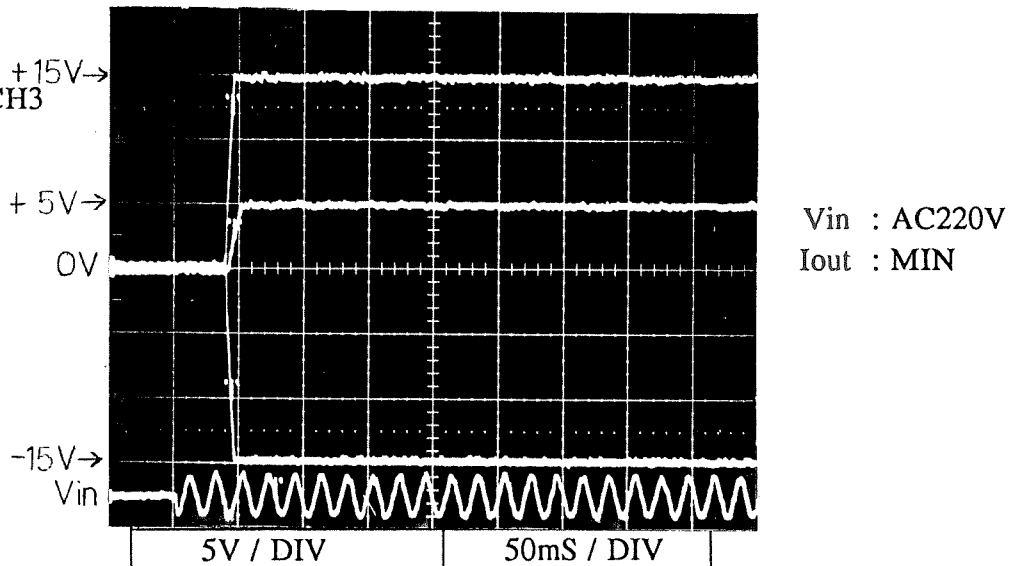
Waveform of CH1



Waveform of CH1, CH2, CH3



Waveform of CH1, CH2, CH3

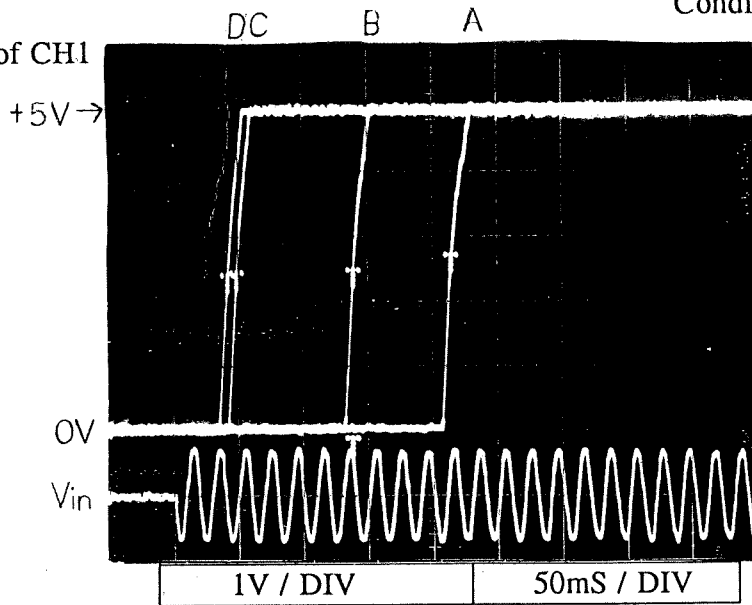


Output Rise Time

LWT50H-5FF

Conditions : Ta : 25°C

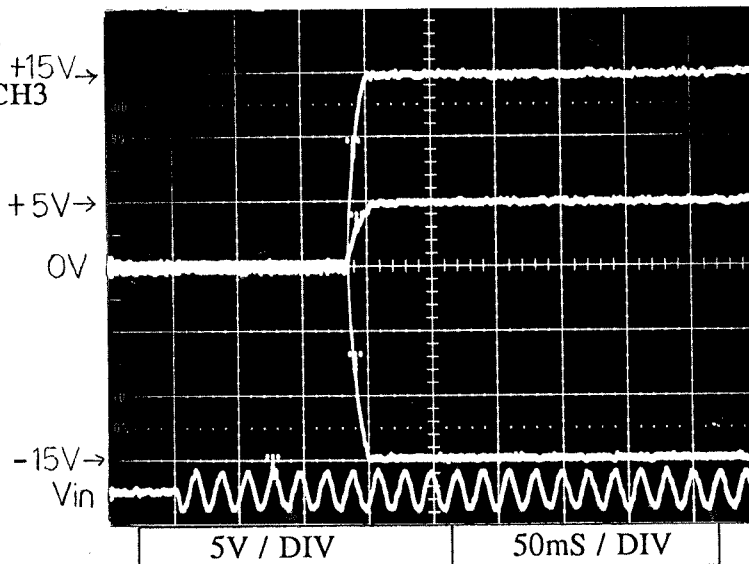
Waveform of CH1



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

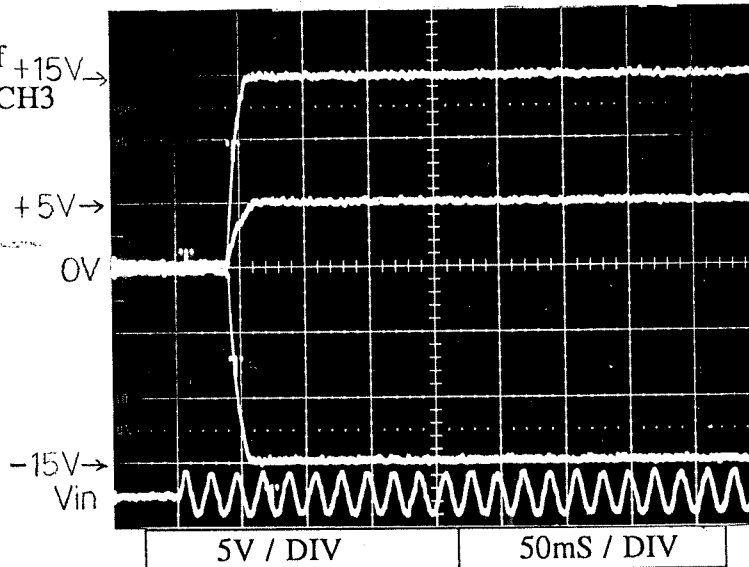
Iout : 100%
CH1 : 6 A
CH2 : 0.8 A
CH3 : 0.53 A

Waveform of CH1, CH2, CH3



Vin : AC100V
Iout : 100%

Waveform of CH1, CH2, CH3



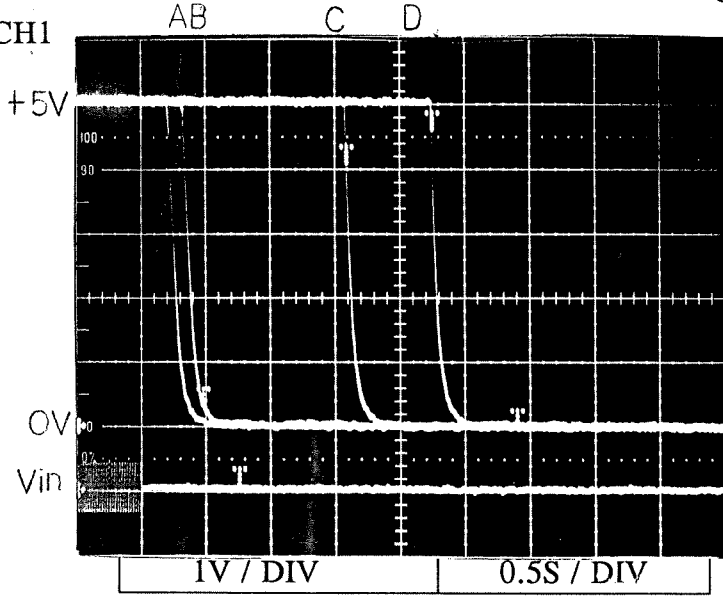
Vin : AC220V
Iout : 100%

Output Fall Time

LWT50H-5FF

Conditions : Ta : 25°C

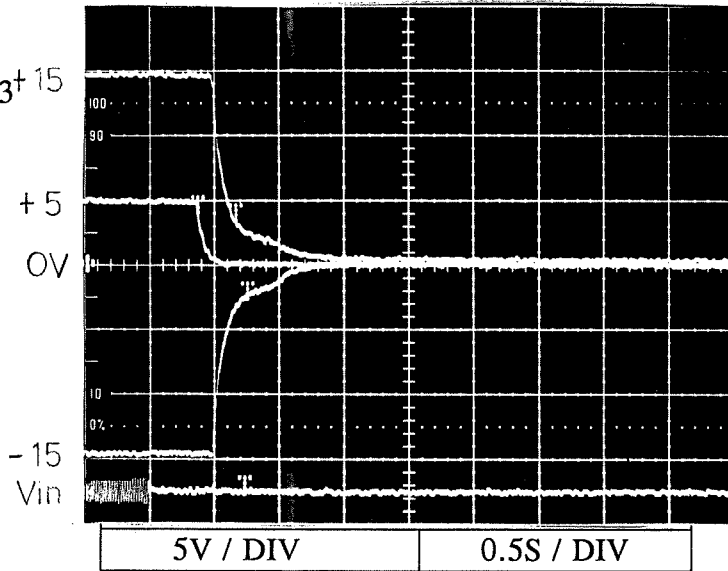
Waveform of CH1



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

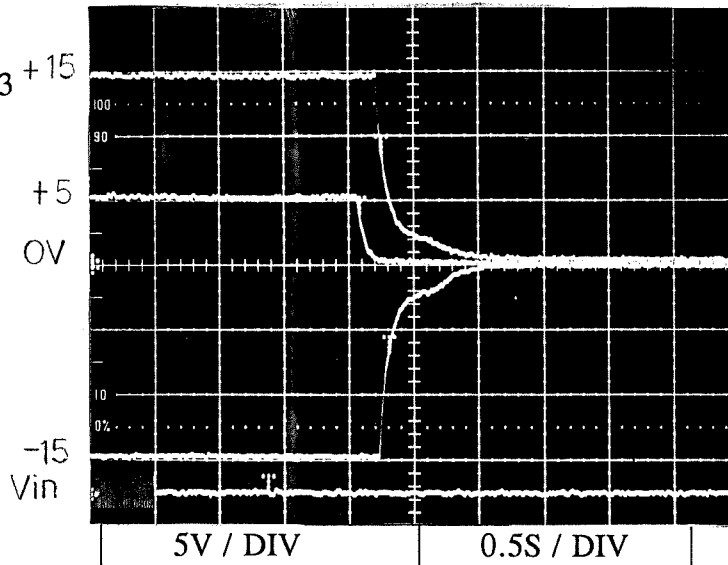
Iout : MIN
CH1 : 1 A
CH2 : 0 A
CH3 : 0 A

Waveform of CH1, CH2, CH3⁺15



Vin : AC100V
Iout : MIN

Waveform of CH1, CH2, CH3⁺15



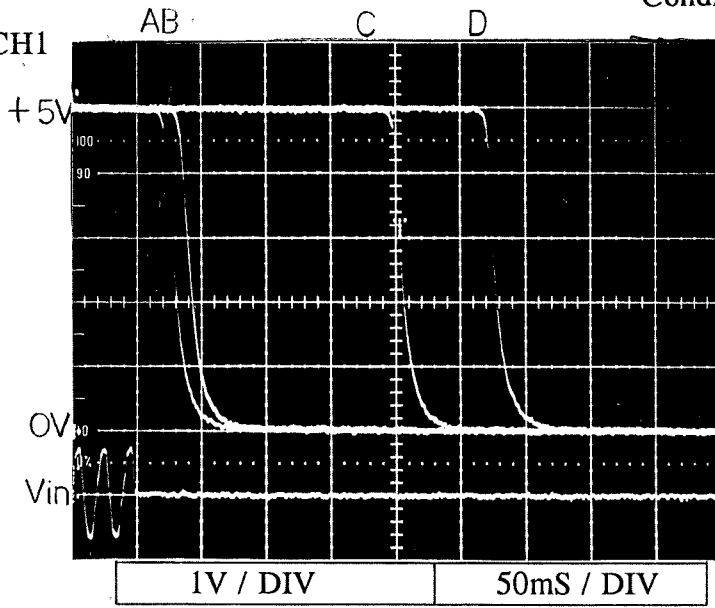
Vin : AC220V
Iout : MIN

Output Fall Time

LWT50H-5FF

Conditions : Ta : 25°C

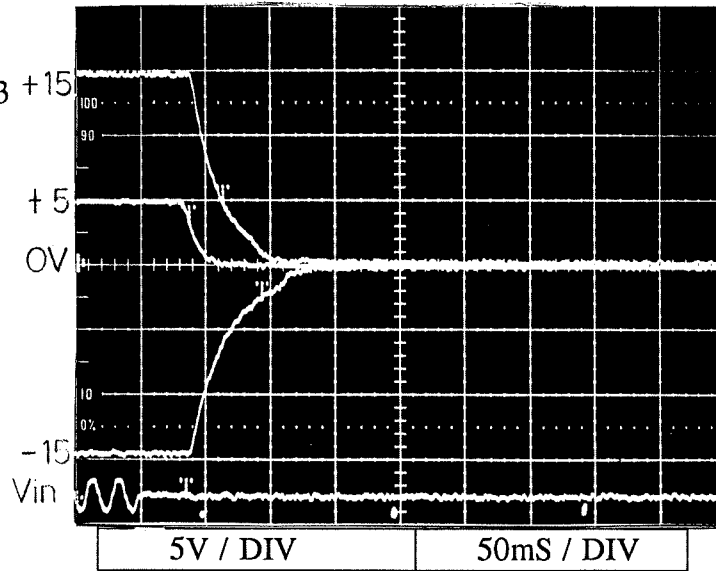
Waveform of CH1



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

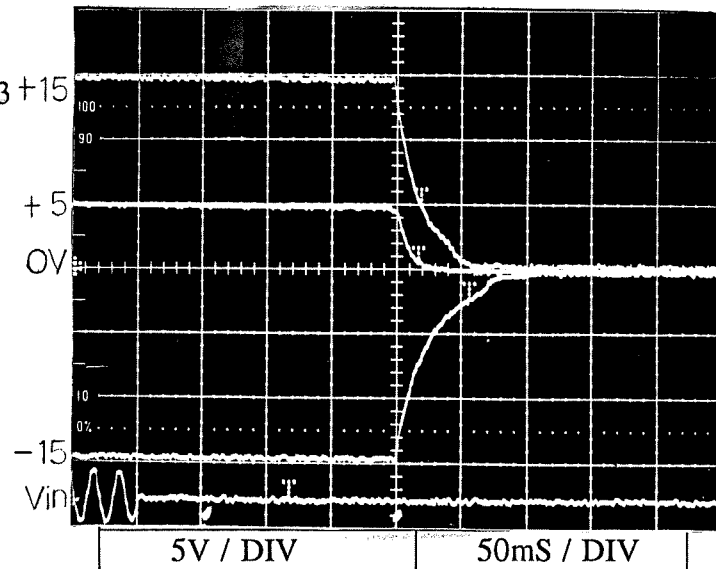
Iout : 100%
CH1 : 6 A
CH2 : 0.8 A
CH3 : 0.53 A

Waveform of CH1, CH2, CH3



Vin : AC100V
Iout : 100%

Waveform of CH1, CH2, CH3



Vin : AC220V
Iout : 100%

LWT50H-5FF

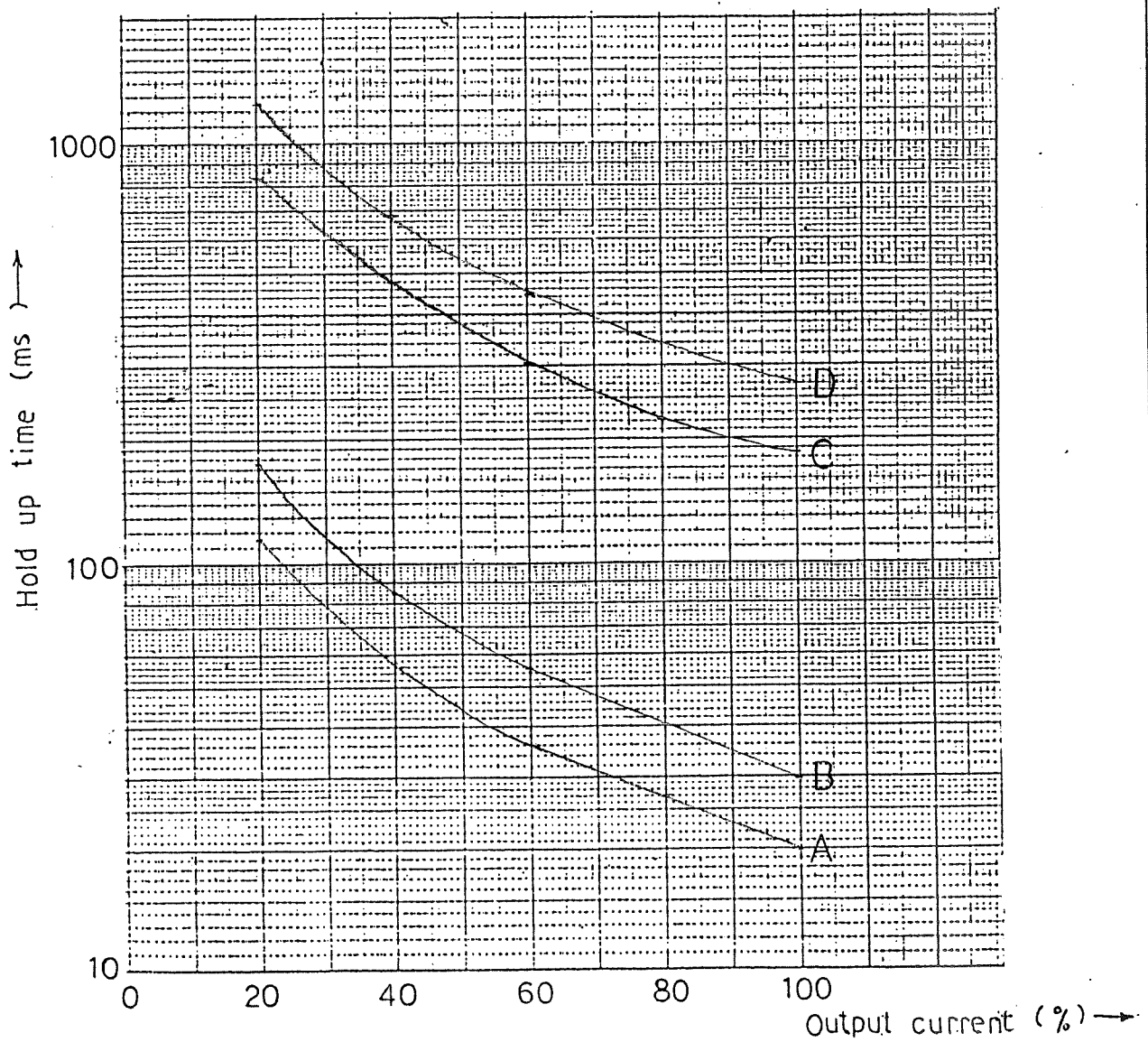
Hold Up Time

Conditions

Vin : AC85V — (A)
AC100V — (B)
AC220V — (C)
AC265V — (D)

Iout : 100%
CH1 : 6A
CH2 : 0.8A
CH3 : 0.53A
Ta : 25°C

CH1



Dynamic Line Response

LWT50H-5FF

Conditions

Vout : Rated

Iout : 100%

Ta : 25°C

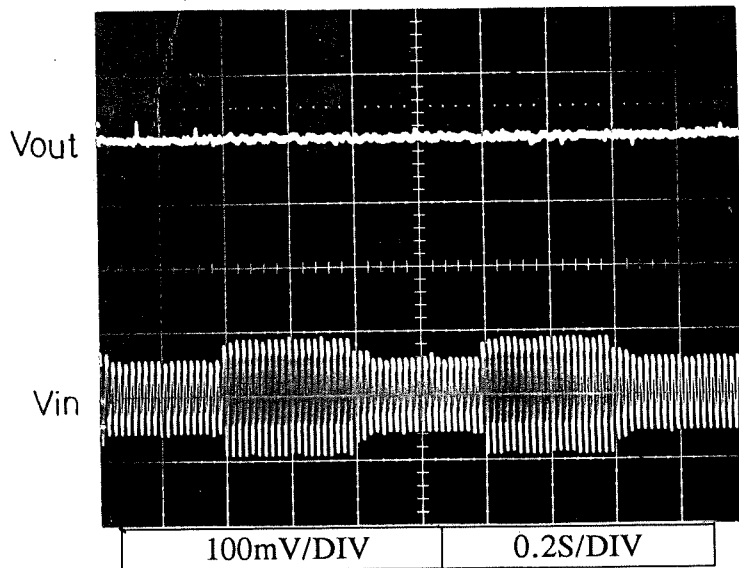
CH1 : 8A

CH2 : 0.45A

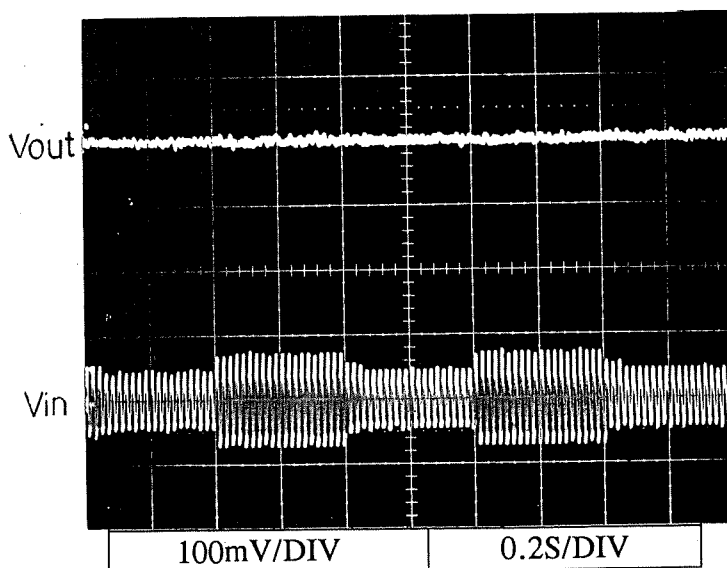
CH3 : 0.22A

Vin : AC85V \rightleftharpoons AC132V

CH1



Vin : AC170V \rightleftharpoons AC265V



Dynamic Line Response

LWT50H-5FF

Conditions

Vout : Rated

Iout : 100%

Ta : 25°C

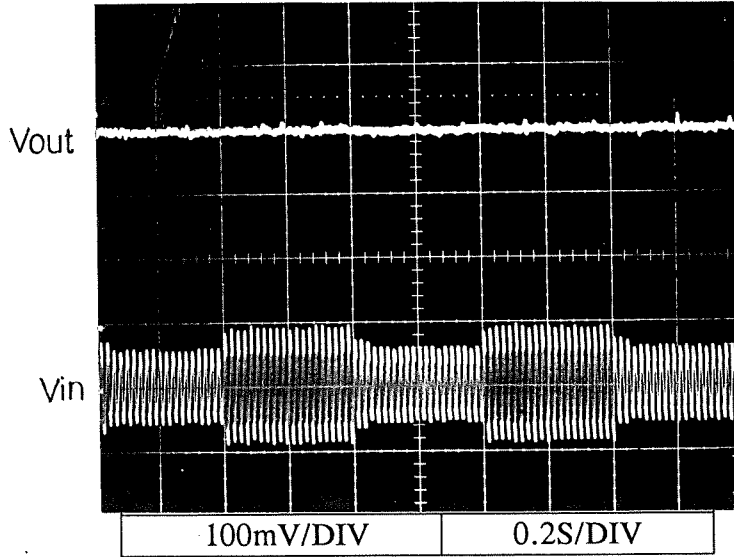
CH1 : 1A

CH2 : 1.5A

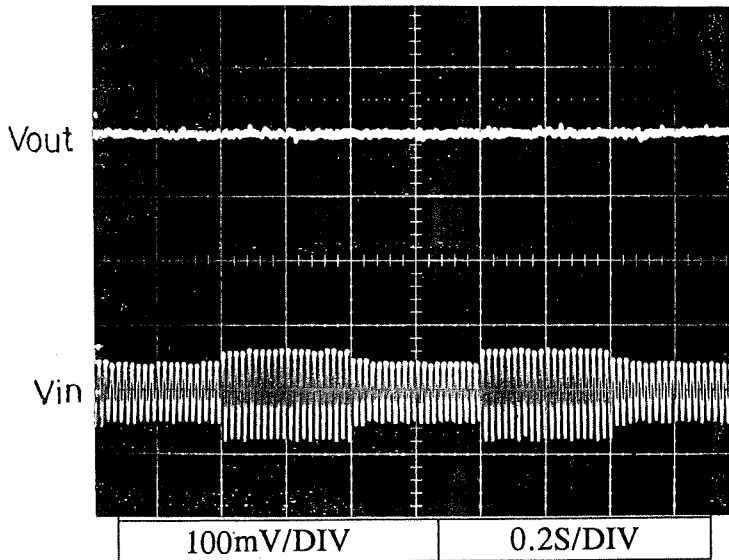
CH3 : 1A

CH2

Vin : AC85V \rightleftharpoons AC132V



Vin : AC170V \rightleftharpoons AC265V



Dynamic Line Response

LWT50H-5FF

Conditions

Vout : Rated

Iout : 100%

Ta : 25°C

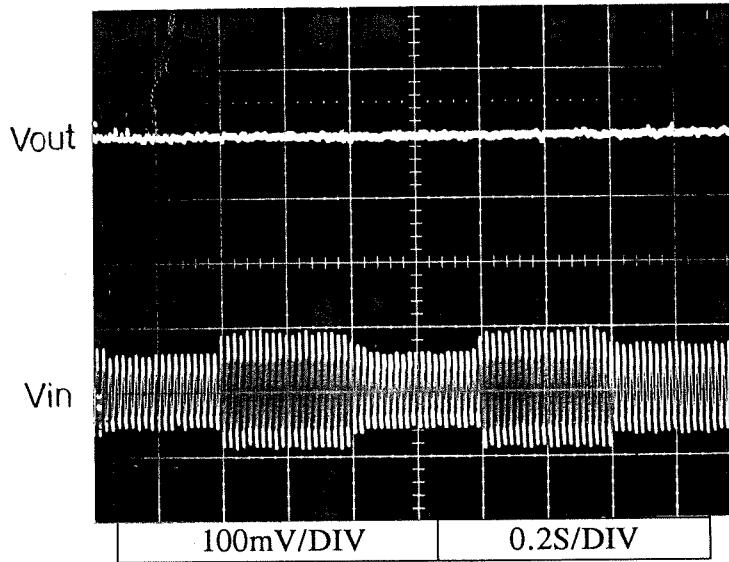
CH1 : 1A

CH2 : 1.5A

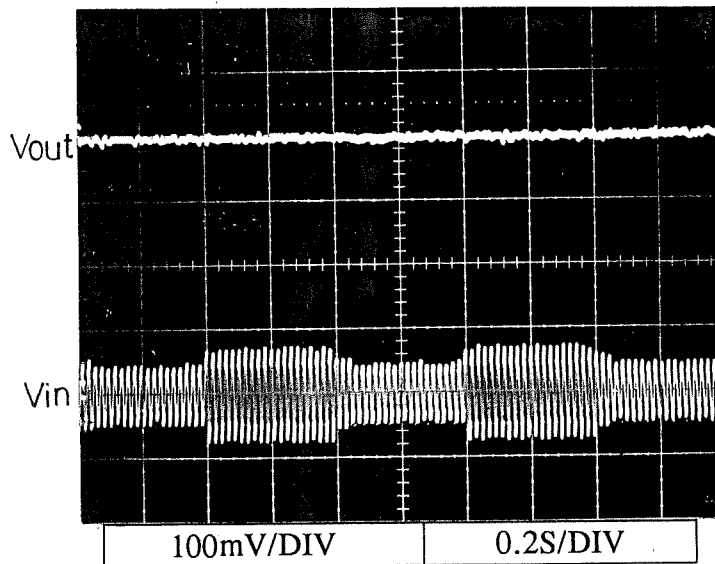
CH3 : 1A

CH3

Vin : AC85V \rightleftharpoons AC132V



Vin : AC170V \rightleftharpoons AC265V



Dynamic Load Response

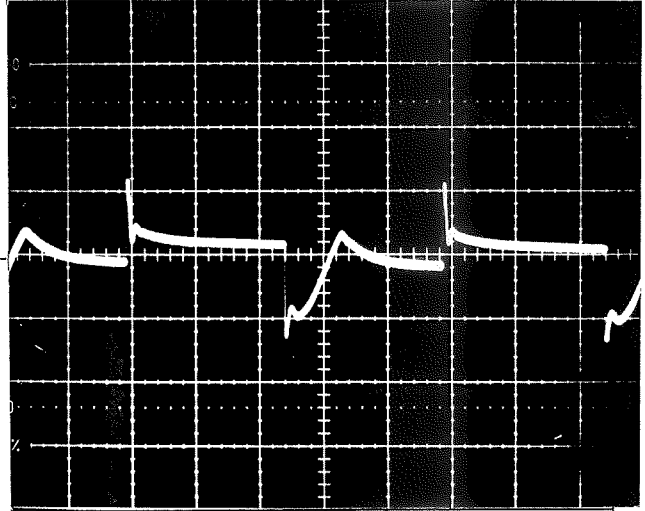
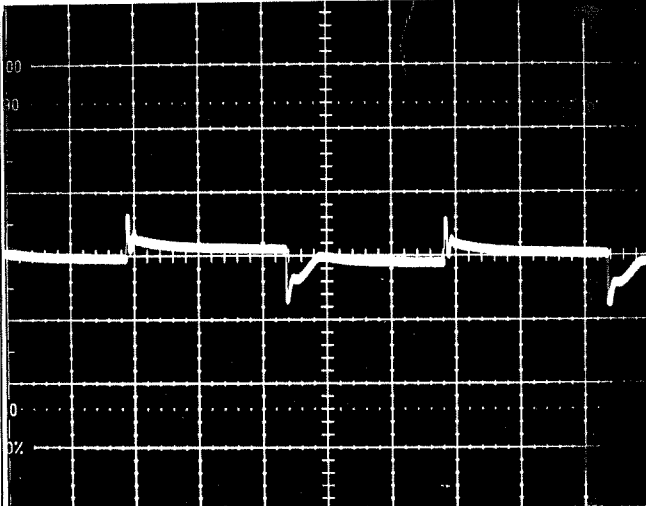
LWT50H-5FF

Conditions Vin : AC100V
Ta : 25°C
Iout : CH2 : 0.45A
CH3 : 0.22A

CH1: 5V

Iout 50% \longleftrightarrow 100% f = 100Hz

Iout 12.5% \longleftrightarrow 100% f = 100Hz



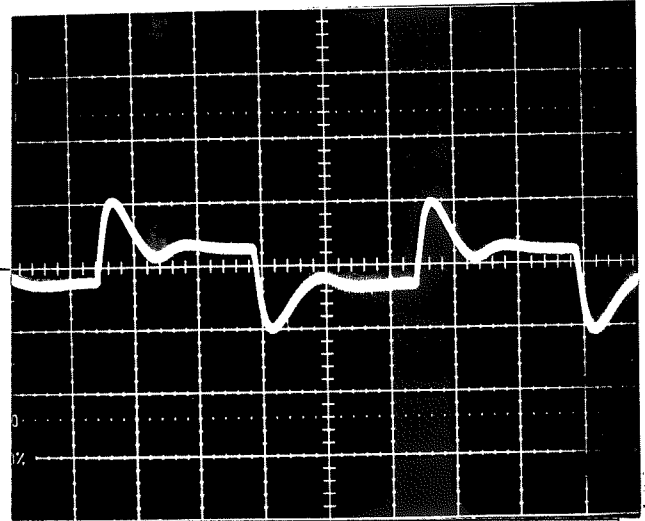
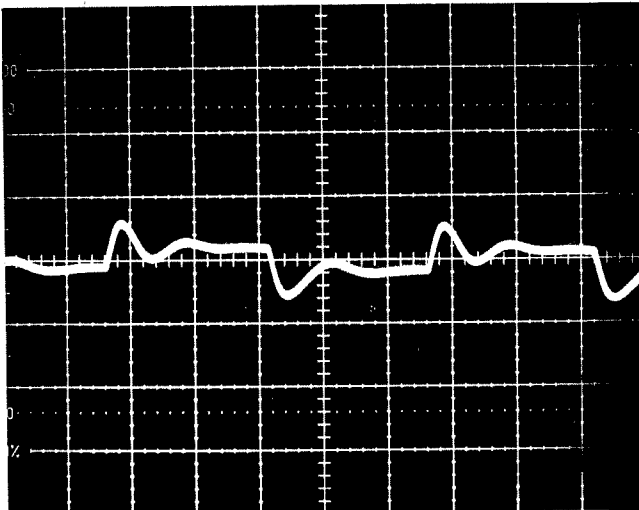
100mV/DIV	2 ms/DIV
-1.5%	+1.5%

100mV/DIV	2 ms/DIV
-2.4%	+2.4%

Vout

Iout 50% \longleftrightarrow 100% f = 1KHz

Iout 12.5% \longleftrightarrow 100% f = 1KHz



100mV/DIV	0.2 ms/DIV
-1.2%	+1.2%

100mV/DIV	0.2 ms/DIV
-2.0%	+2.0%

Vout

Dynamic Load Response

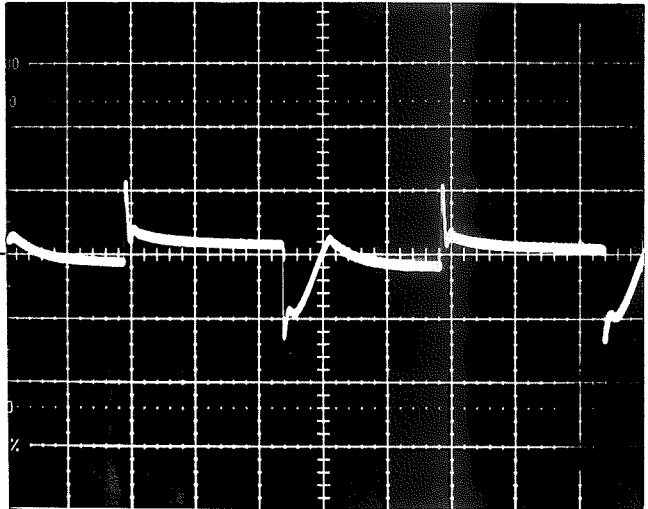
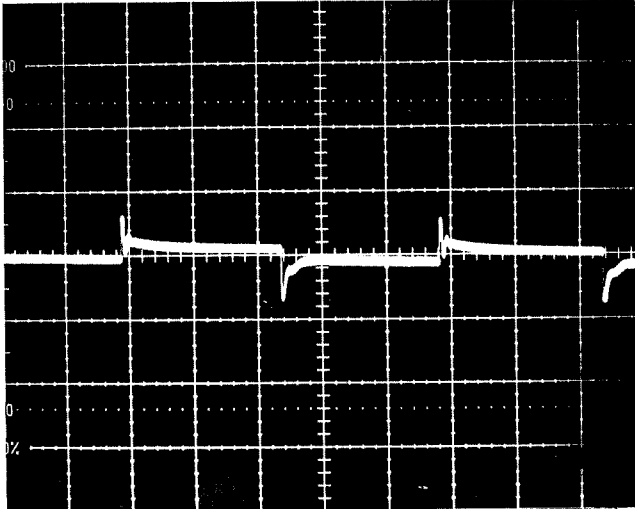
LWT50H-5FF

Conditions Vin : AC220V
Ta : 25°C
Iout : CH2 : 0.45A
CH3 : 0.22A

CH1: 5V

Iout 50% \longleftrightarrow 100% $f = 100\text{Hz}$

Iout 12.5% \longleftrightarrow 100% $f = 100\text{Hz}$



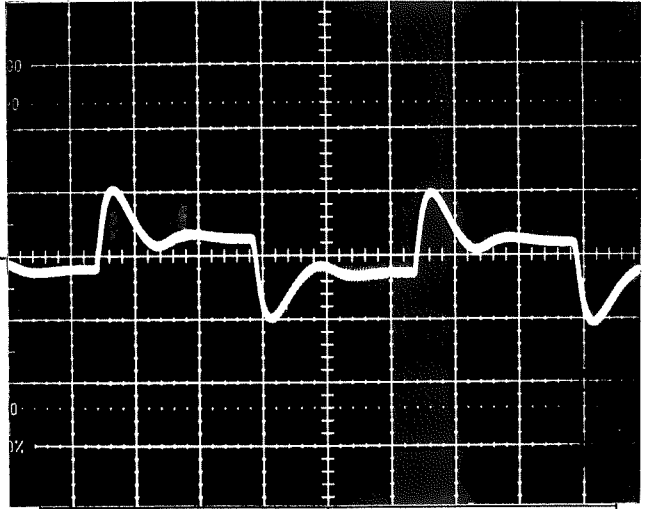
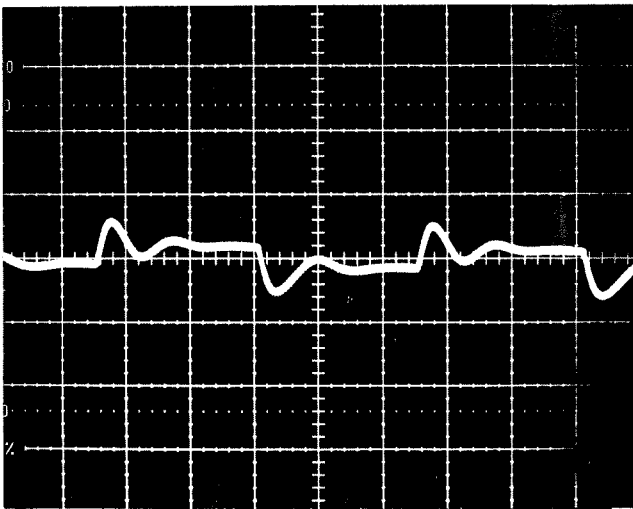
100mV/DIV	2 ms/DIV
-1.5%	+1.5%

100mV/DIV	2 ms/DIV
-2.4%	+2.4%

Vout

Iout 50% \longleftrightarrow 100% $f = 1\text{KHz}$

Iout 12.5% \longleftrightarrow 100% $f = 1\text{KHz}$



100mV/DIV	0.2 ms/DIV
-1.2%	+1.2%

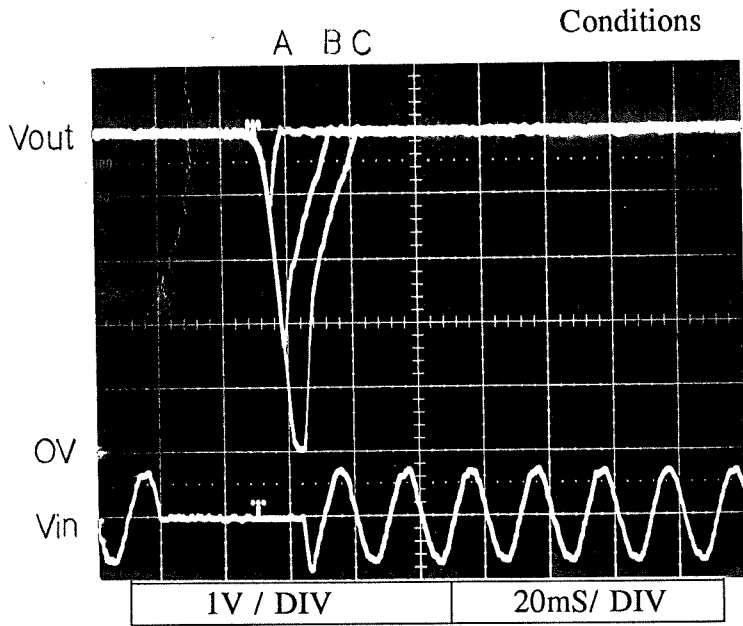
100mV/DIV	0.2 ms/DIV
-2.0%	+2.0%

Vout

Response To Brown Out

LWT50H-5FF

CH1: +5V

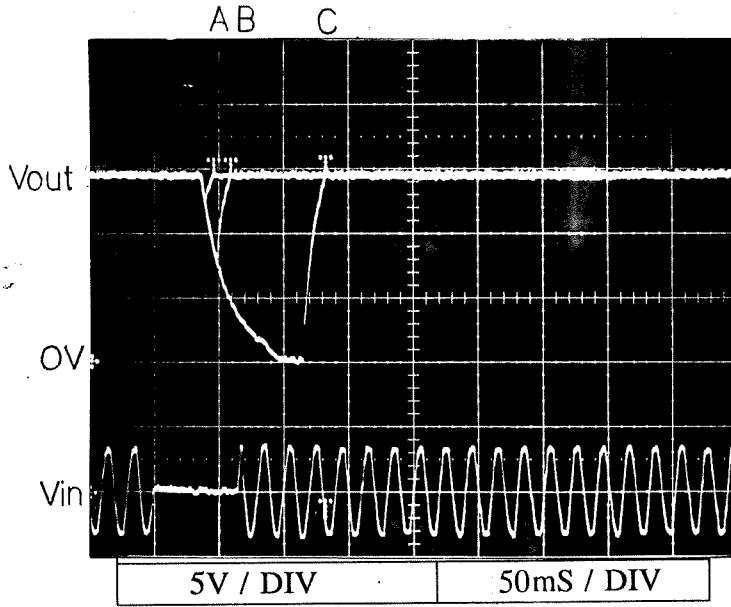


Conditions

Ta : 25°C
 Vin : AC 100 V
 Iout : 100%
 CH1 : 6 A
 CH2 : 0.8 A
 CH3 : 0.53 A

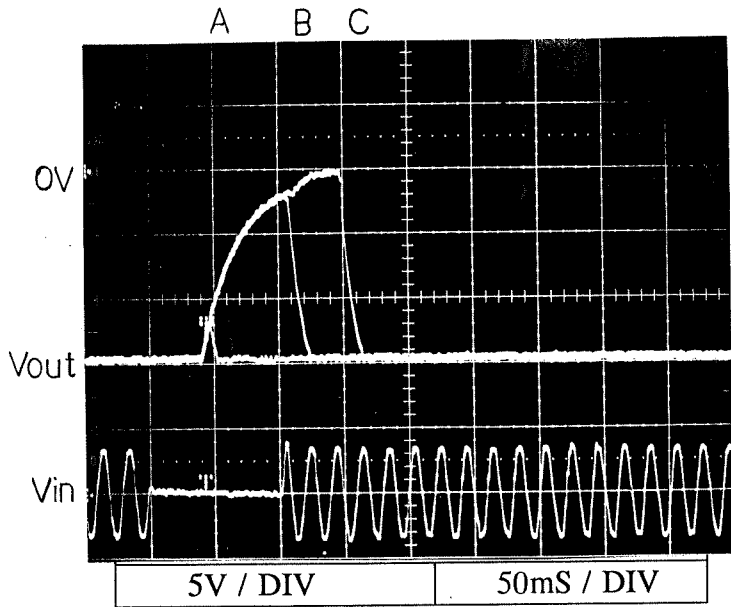
Brown Out Time
 A - 34mS
 B - 38mS
 C - 44mS

CH2: +15V



Brown Out Time
 A - 37mS
 B - 45mS
 C - 65mS

CH3: -15V

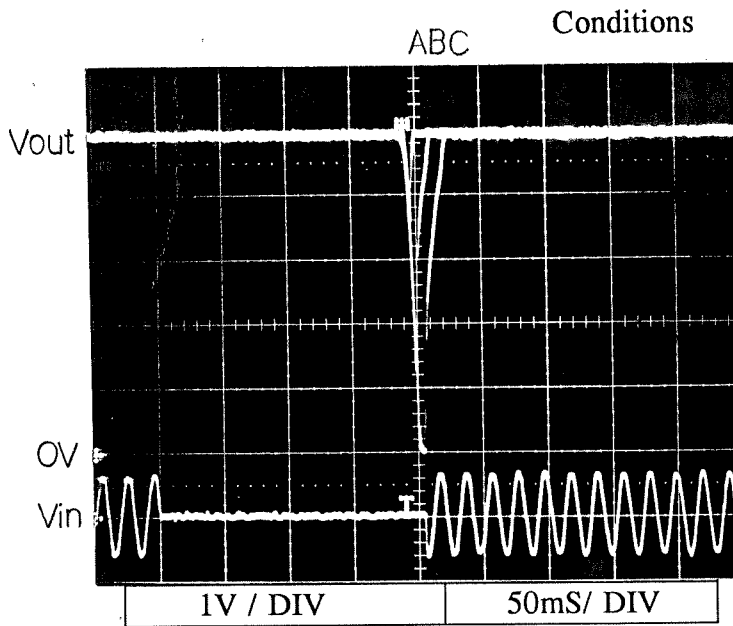


Brown Out Time
 A - 39mS
 B - 47mS
 C - 103mS

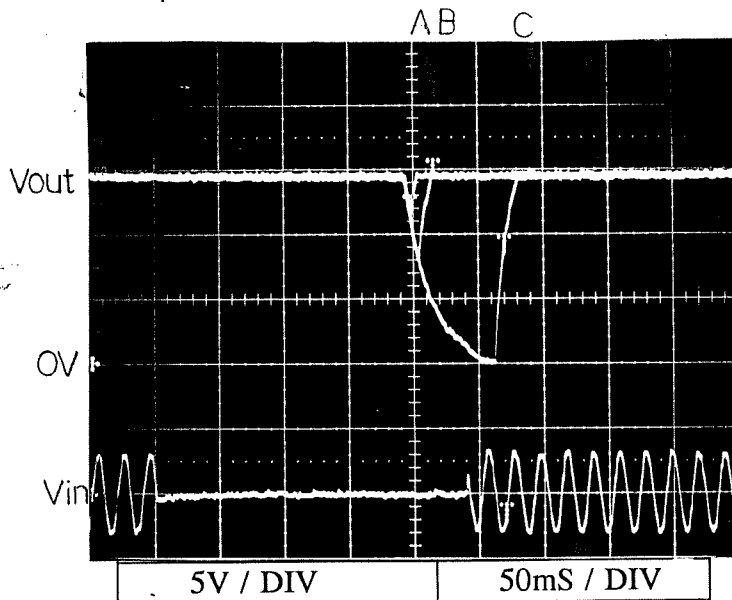
Response To Brown Out

LWT50H-5FF

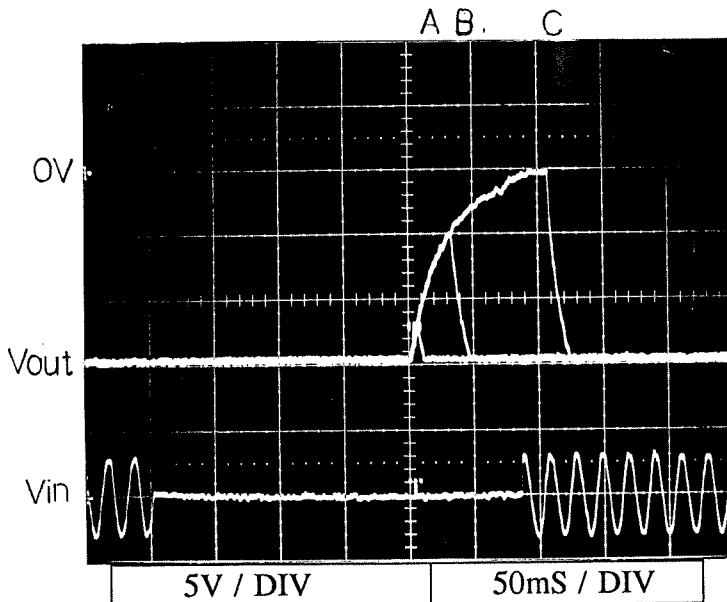
CH1: +5V



CH2: +15V



CH3: -15V

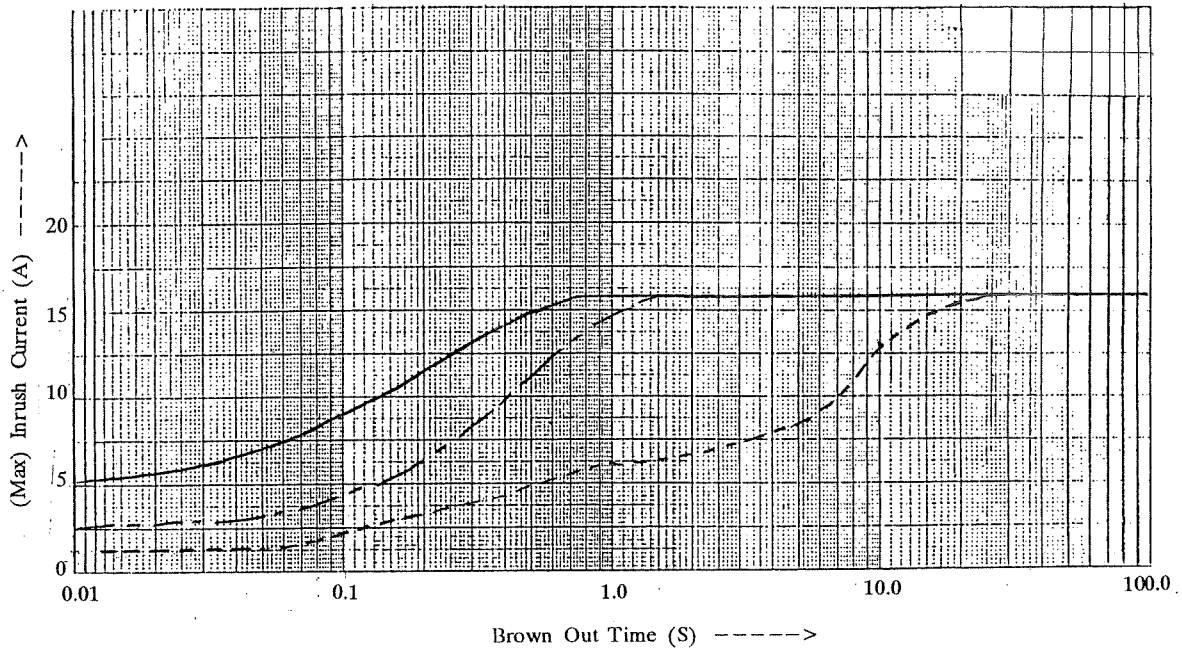


Inrush Current Characteristic

LWT50H-5FF

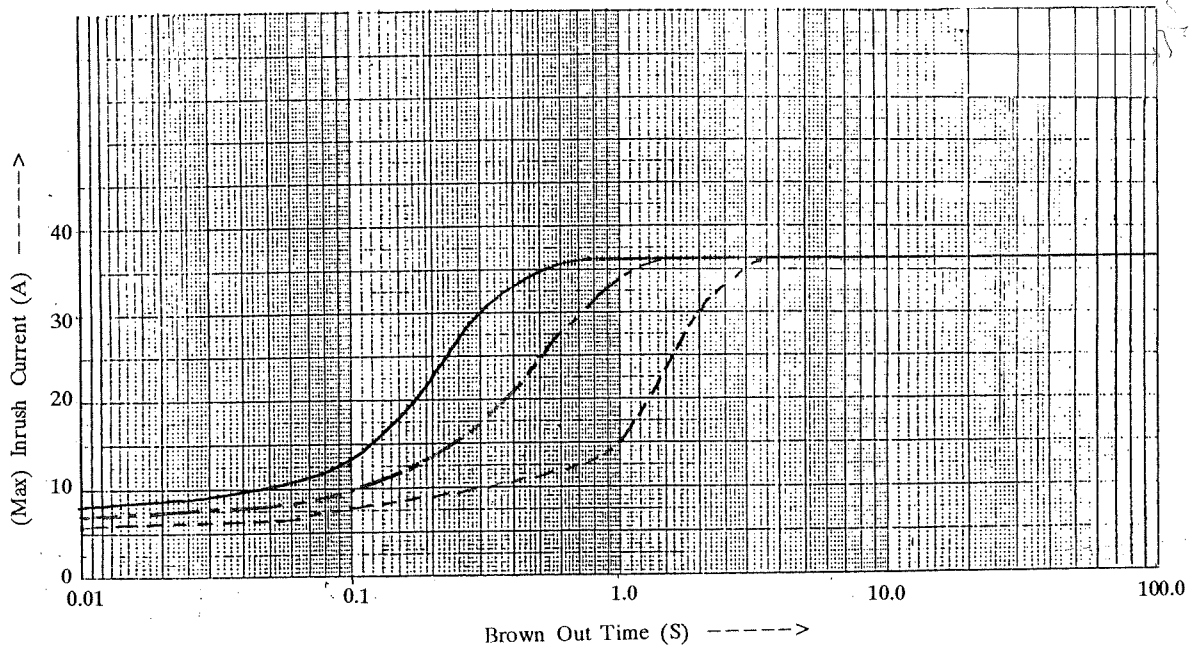
Conditions

Vin : AC100V
 Iout : 12.5% - - - - -
 50% - - - - -
 100% - - - - -
 Ta : 25°C - - - - -



Conditions

Vin : AC230V
 Iout : 12.5% - - - - -
 50% - - - - -
 100% - - - - -
 Ta : 25°C - - - - -



Inrush Current Waveform

LWT50H-5FF

Conditions

Vin : AC100V

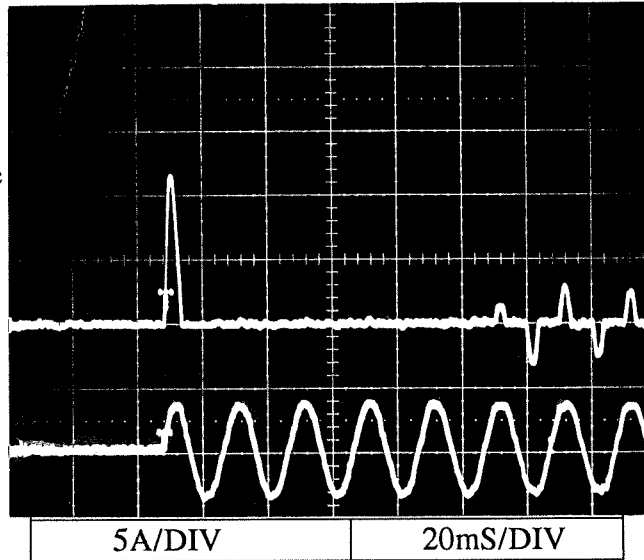
Iout : 100%

Ta : 25°C

100% : CH1 : 6A
CH2 : 0.8A
CH3 : 0.53A

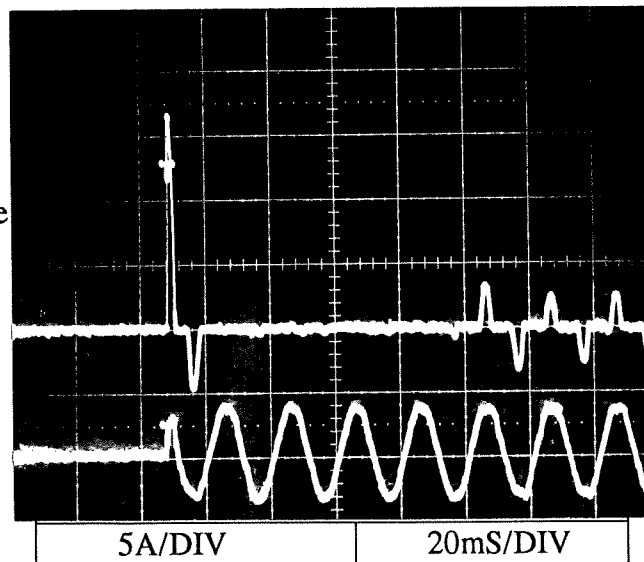
Switch in phase angle
of input AC voltage

$\phi = 0^\circ$



Switch in phase angle
of input AC voltage

$\phi = 90^\circ$



Inrush Current Waveform

LWT50H-5FF

Conditions

Vin : 230VAC

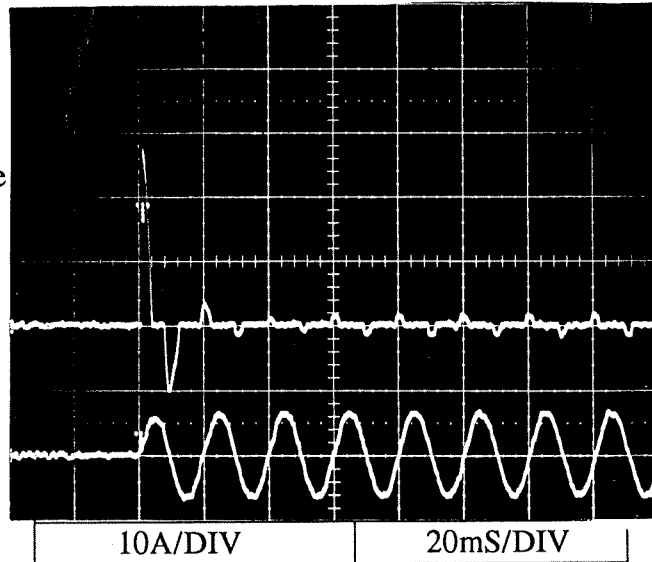
Iout : 100%

Ta : 25°C

100% : CH1 : 6A
CH2 : 0.8A
CH3 : 0.53A

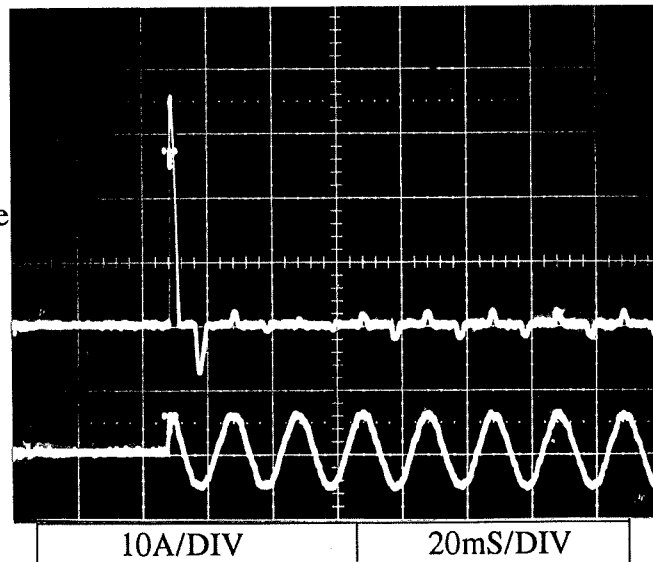
Switch in phase angle
of input AC voltage

$\phi = 0^\circ$



Switch in phase angle
of input AC voltage

$\phi = 90^\circ$



LWT50H-5FF

Leakage Current

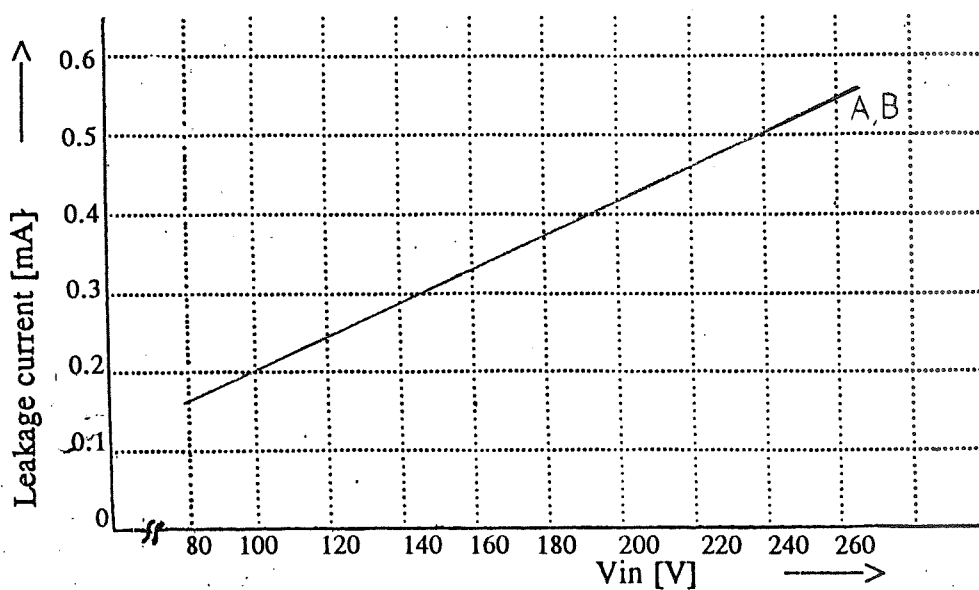
Conditions

Vin : AC85-265V

Iout : 100% _____ (A)

MIN _____ (B)

Ta : 25°C



OUTPUT-RIPPLE, NOISE

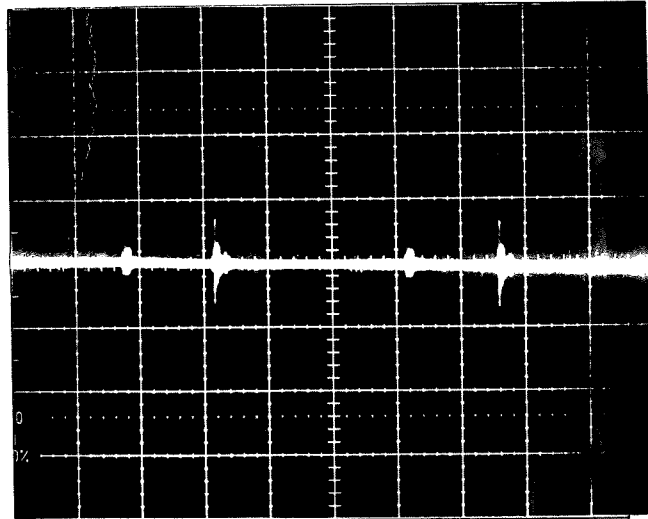
LWT50H-5FF

NORMAL MODE

Conditions

Vin : AC100V
Iout : 100 %
Ta : 25°C

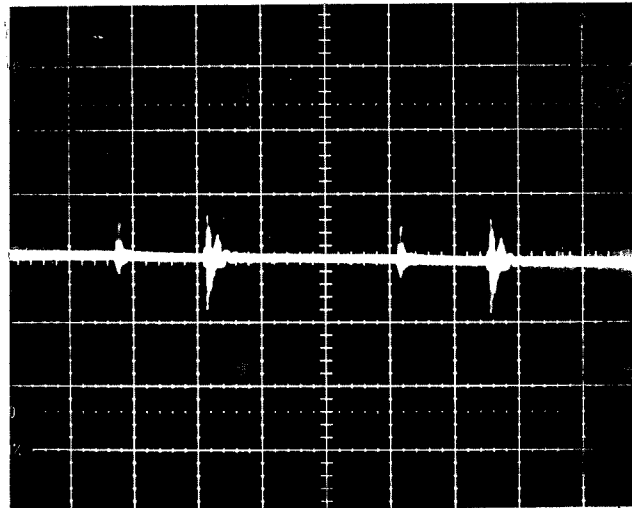
CH1



50mV / DIV

2μS / DIV

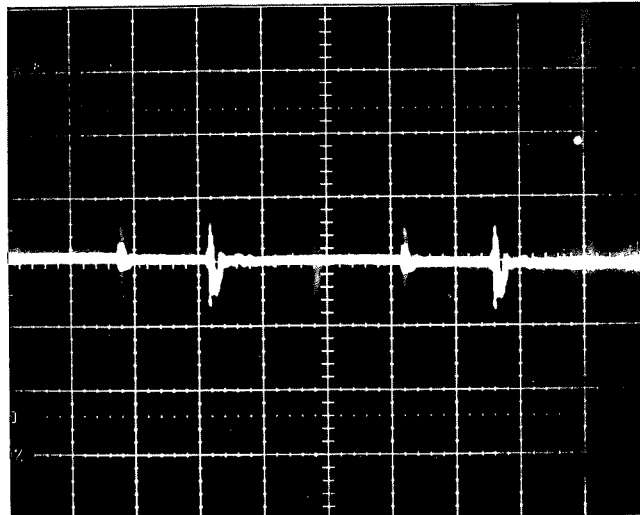
CH2



50mV / DIV

2μS / DIV

CH3



50mV / DIV

2μS / DIV

OUTPUT-RIPPLE, NOISE

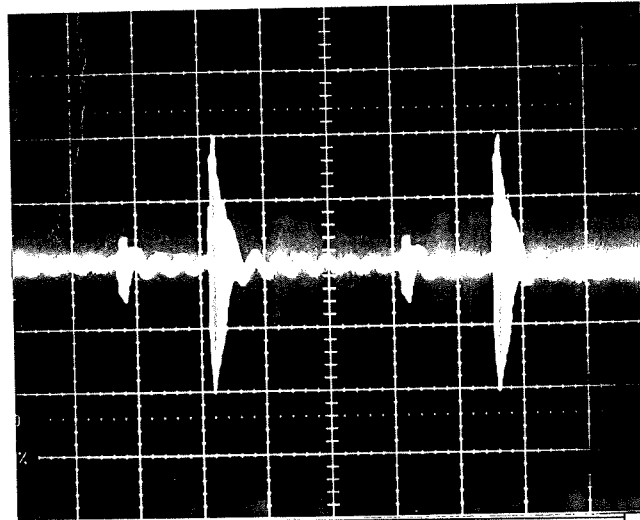
LWT50H-5FF

COMMON + NORMAL MODE

Conditions

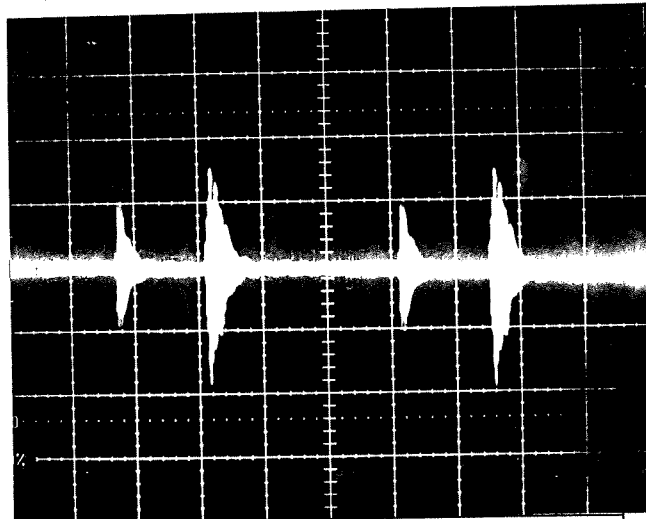
Vin : AC100V
Iout : 100 %
Ta : 25°C

CH1



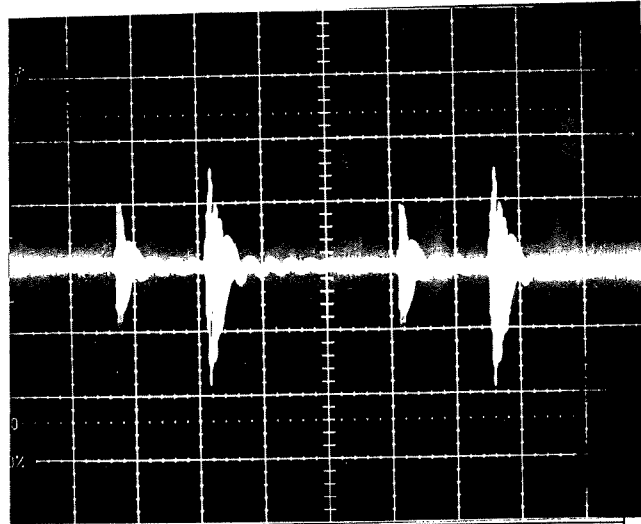
50mV / DIV 2μS / DIV

CH2



50mV / DIV 2μS / DIV

CH3



50mV / DIV 2μS / DIV