

PAH75S48-*

QUALITY TEST DATA



POWER MODULE

DRAWING NO. : PA549-53-01		
NLS R&D		
PREPARED	CHECKED	APPROVED
<i>Chloe</i> 3/9/99	<i>Anna</i> 3/9/99	<i>[Signature]</i> 3/9/99
DATE ISSUE : 3/9/99		

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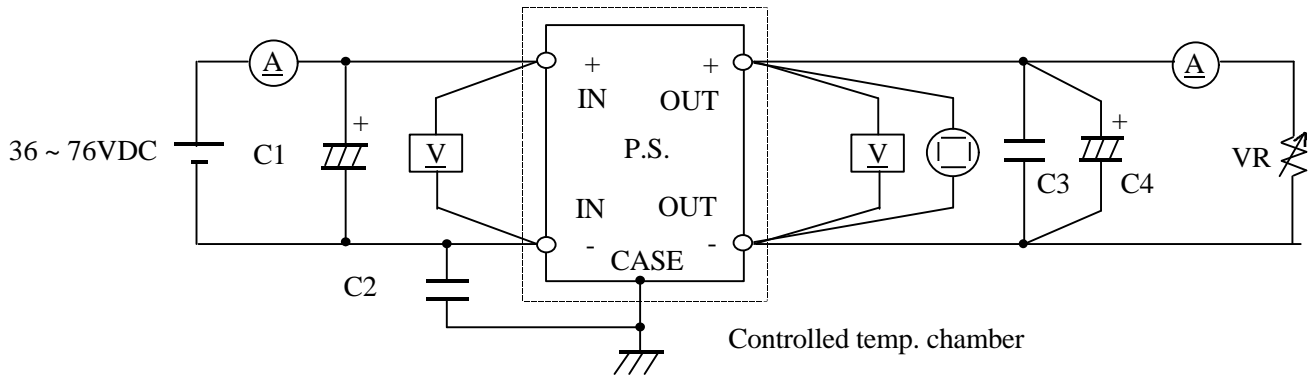
Terminology used

Vin - Input Voltage	Iout - Output Current
Vout - Output Voltage	Tp - Base-Plate Temperature
Iin - Input Current	Tr - Load Rise-Time
	Tf - Load Fall-Time

1. EVALUATION METHOD

1 - 1 Circuit used for determination

(1) Steady state data



(i) $T_p = -20^{\circ}\text{C} \sim 100^{\circ}\text{C}$

C1 : 33 μF Electrolytic Capacitor

C2 : 4700pF Ceramic Capacitor

C3 : 1 μF Ceramic Capacitor

C4 : 3.3V&5V - 2200 μF Electrolytic Capacitor

12V&15V - 470 μF Electrolytic Capacitor

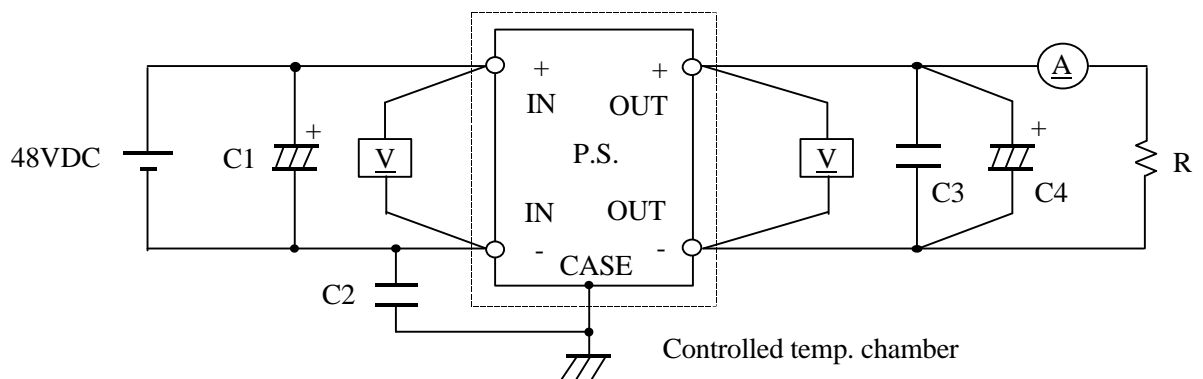
24V&28V - 220 μF Electrolytic Capacitor

(ii) $T_p = -40^{\circ}\text{C} \sim 100^{\circ}\text{C}$

C1 : 33 μF Ceramic Capacitor or equivalent capacitor such as 100V 6.8 μF x 5 pcs

C4 : 2 pieces of the above recommended value

(2) Warm up voltage drift characteristics



C1 : 33 μF Electrolytic Capacitor

C2 : 4700pF Ceramic Capacitor

C3 : 1 μF Ceramic Capacitor

C4 : 3.3V&5V - 2200 μF Electrolytic Capacitor

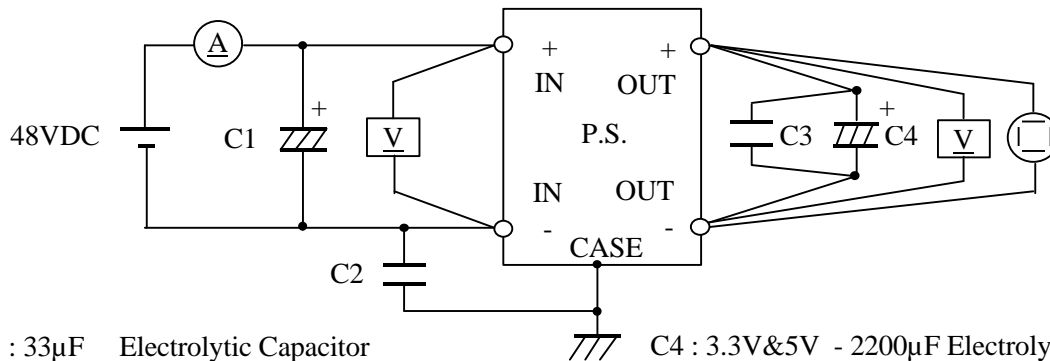
12V&15V - 470 μF Electrolytic Capacitor

24V&28V - 220 μF Electrolytic Capacitor

(3) Over current protection (O.C.P.) characteristics

Same as steady state data

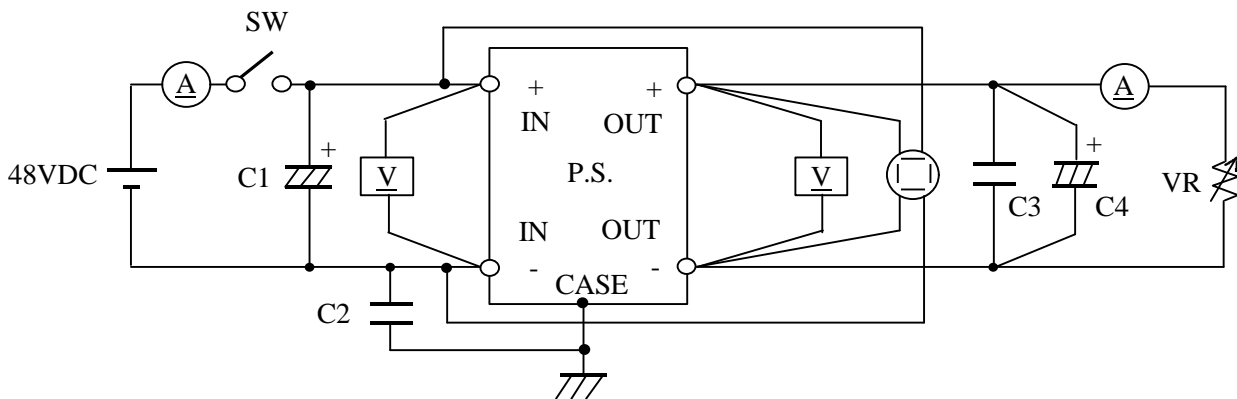
(4) Over voltage protection (O.V.P.) characteristics



C1 : 33 μ F Electrolytic Capacitor
 C2 : 4700pF Ceramic Capacitor
 C3 : 1 μ F Ceramic Capacitor

C4 : 3.3V&5V - 2200 μ F Electrolytic Capacitor
 12V&15V - 470 μ F Electrolytic Capacitor
 24V&28V - 220 μ F Electrolytic Capacitor

(5) Output rise characteristics



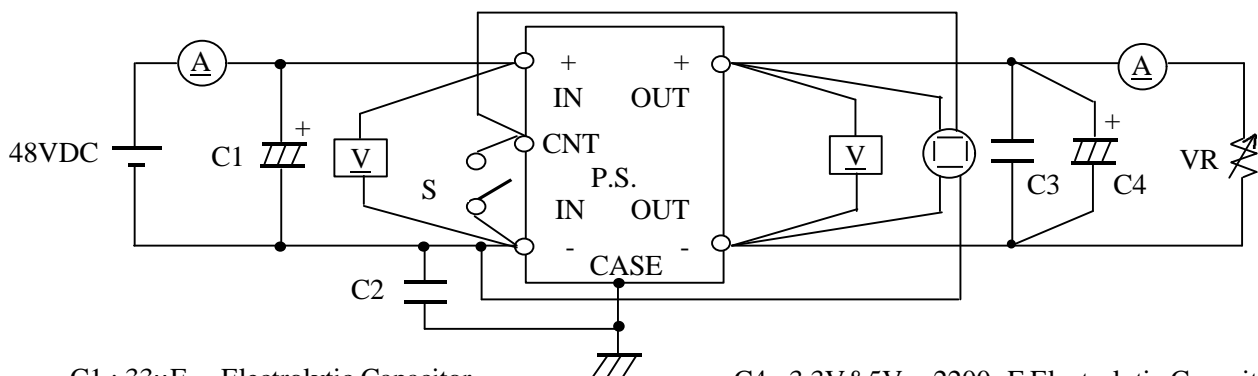
C1 : 33 μ F Electrolytic Capacitor
 C2 : 4700pF Ceramic Capacitor
 C3 : 1 μ F Ceramic Capacitor

C4 : 3.3V&5V - 2200 μ F Electrolytic Capacitor
 12V&15V - 470 μ F Electrolytic Capacitor
 24V&28V - 220 μ F Electrolytic Capacitor

(6) Output fall characteristics

Same as Output rise characteristics

(7) Output rise characteristics with on/off control

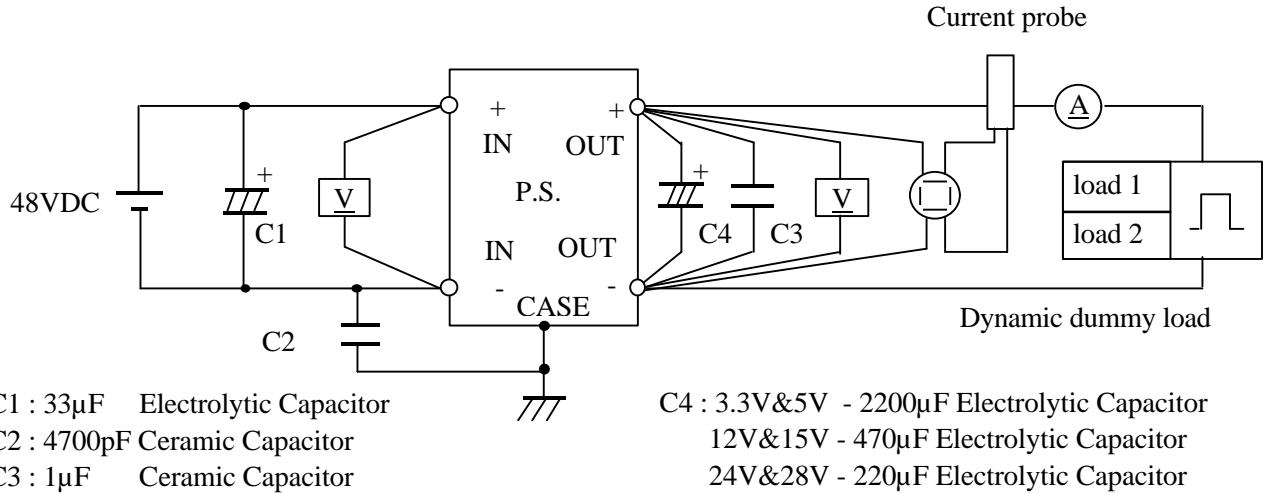


C1 : 33 μ F Electrolytic Capacitor
 C2 : 4700pF Ceramic Capacitor
 C3 : 1 μ F Ceramic Capacitor

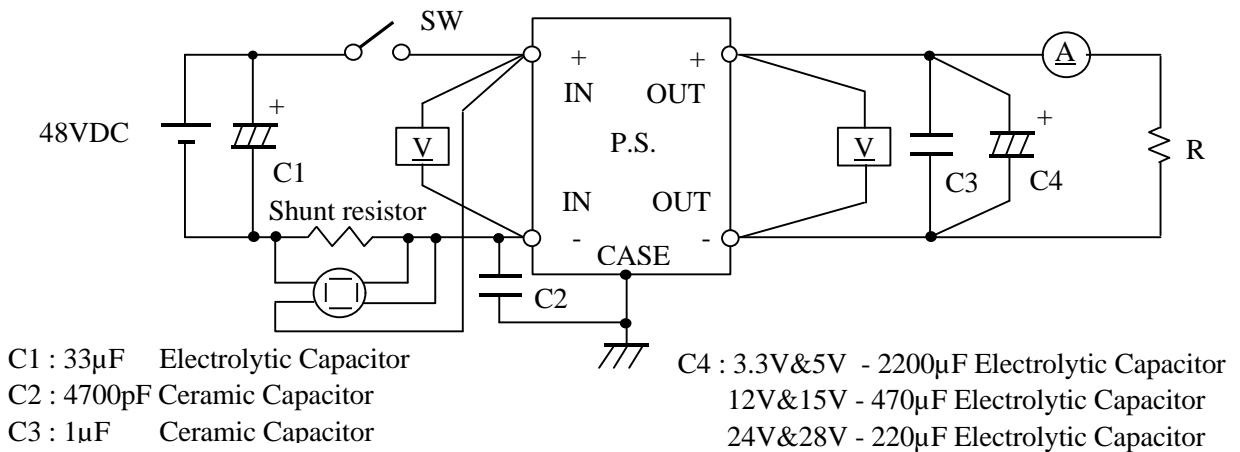
C4 : 3.3V&5V - 2200 μ F Electrolytic Capacitor
 12V&15V - 470 μ F Electrolytic Capacitor
 24V&28V - 220 μ F Electrolytic Capacitor

(8) Output fall characteristics with on/off control
 Same as Output rise characteristics with on/off control

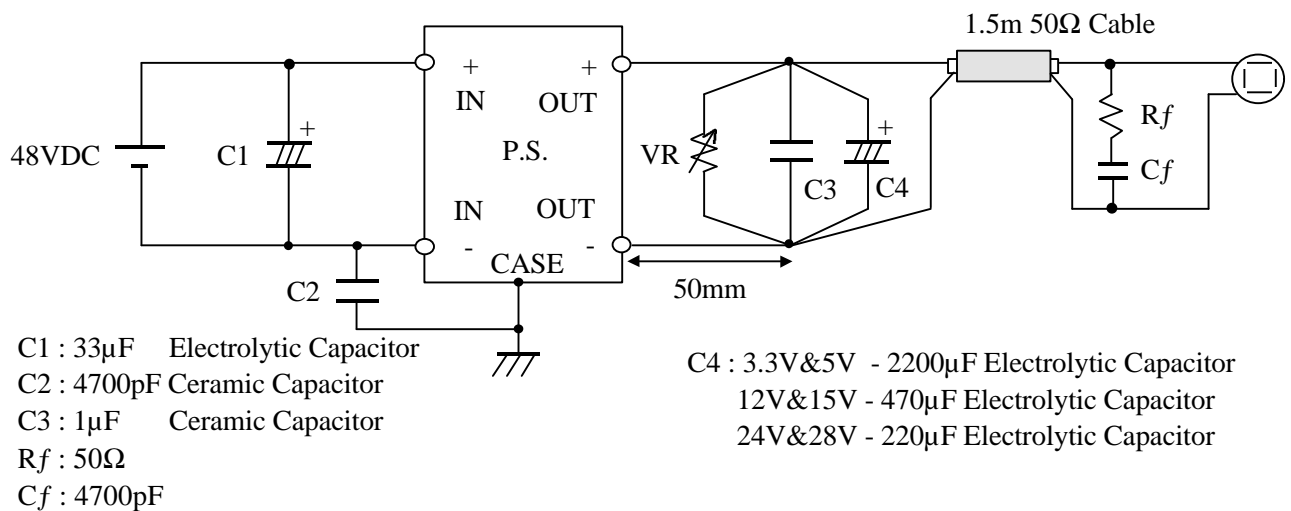
(9) Dynamic load response characteristics



(10) Inrush current waveform

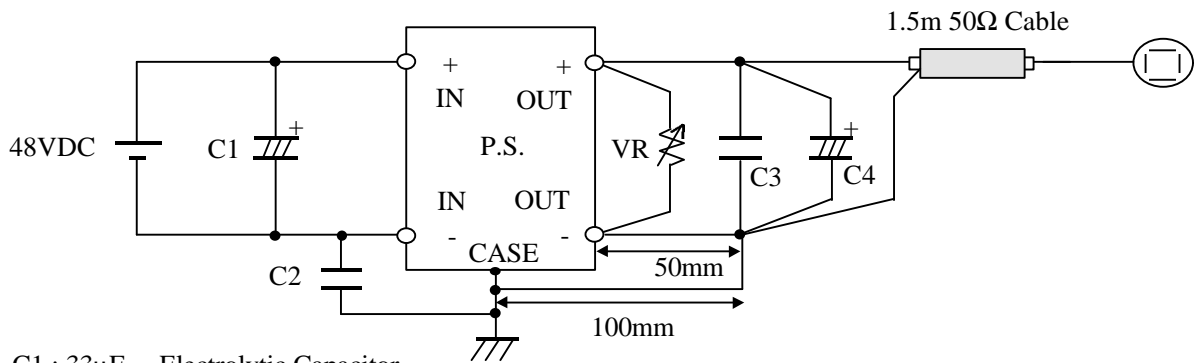


(11) Output-ripple , noise waveform
 NORMAL MODE (EIAJ Standard RC-9002A)



(11) Output-ripple , noise waveform

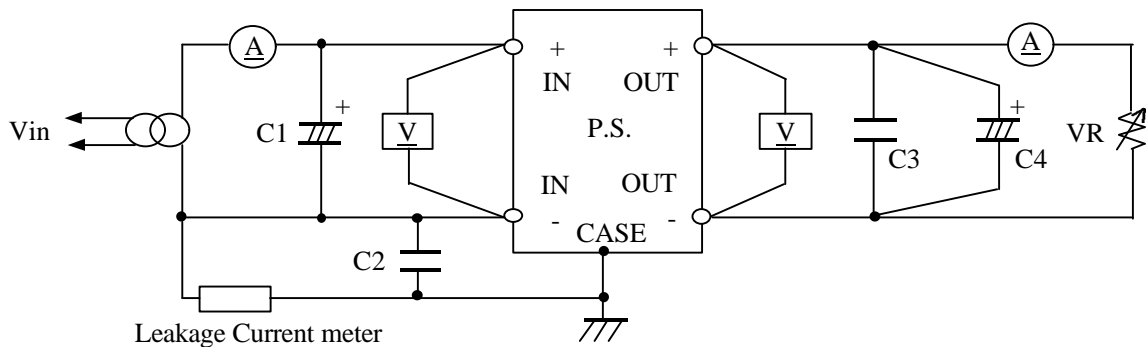
NORMAL + COMMON MODE



C1 : 33µF Electrolytic Capacitor
 C2 : 4700pF Ceramic Capacitor
 C3 : 1µF Ceramic Capacitor

C4 : 3.3V&5V - 2200µF Electrolytic Capacitor
 12V&15V - 470µF Electrolytic Capacitor
 24V&28V - 220µF Electrolytic Capacitor

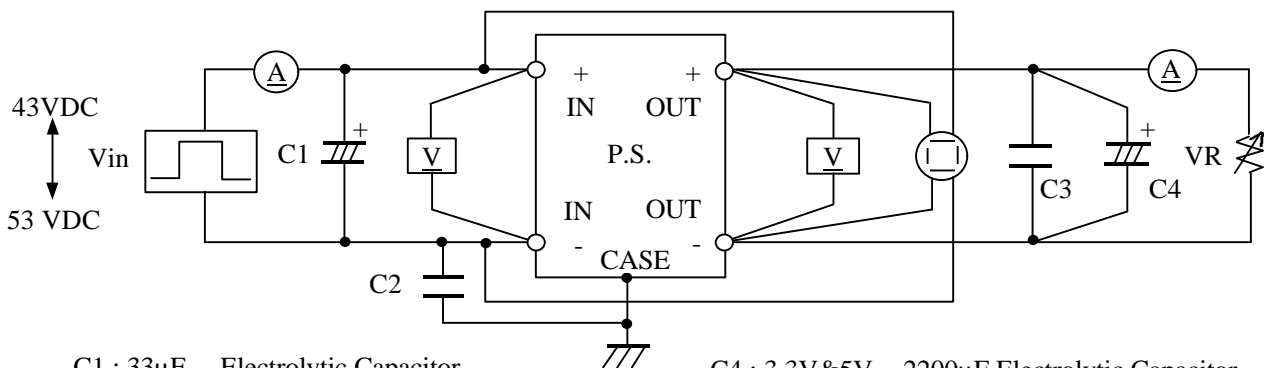
(12) Leakage current characteristics



C1 : 33µF Electrolytic Capacitor
 C2 : 4700pF Ceramic Capacitor
 C3 : 1µF Ceramic Capacitor

C4 : 3.3V&5V - 2200µF Electrolytic Capacitor
 12V&15V - 470µF Electrolytic Capacitor
 24V&28V - 220µF Electrolytic Capacitor

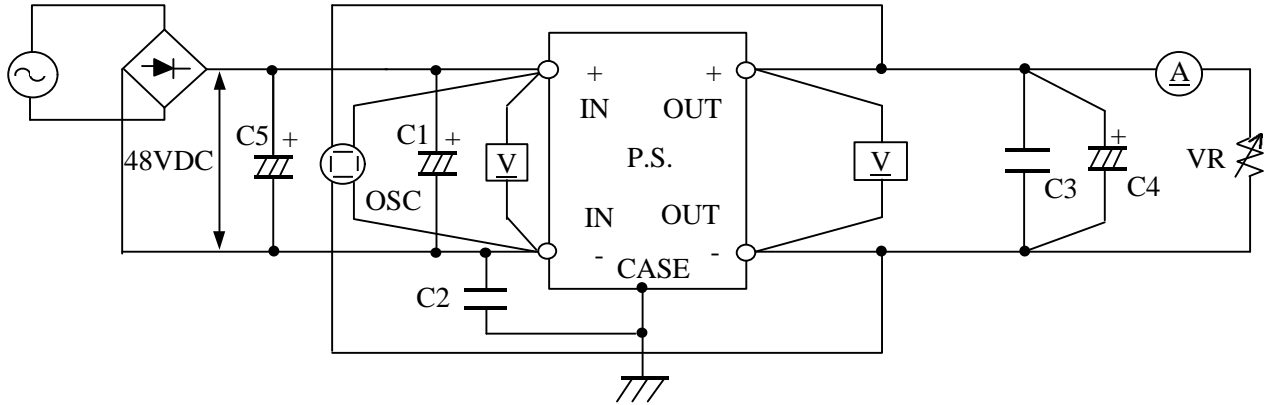
(13) Dynamic line characteristics



C1 : 33µF Electrolytic Capacitor
 C2 : 4700pF Ceramic Capacitor
 C3 : 1µF Ceramic Capacitor

C4 : 3.3V&5V - 2200µF Electrolytic Capacitor
 12V&15V - 470µF Electrolytic Capacitor
 24V&28V - 220µF Electrolytic Capacitor

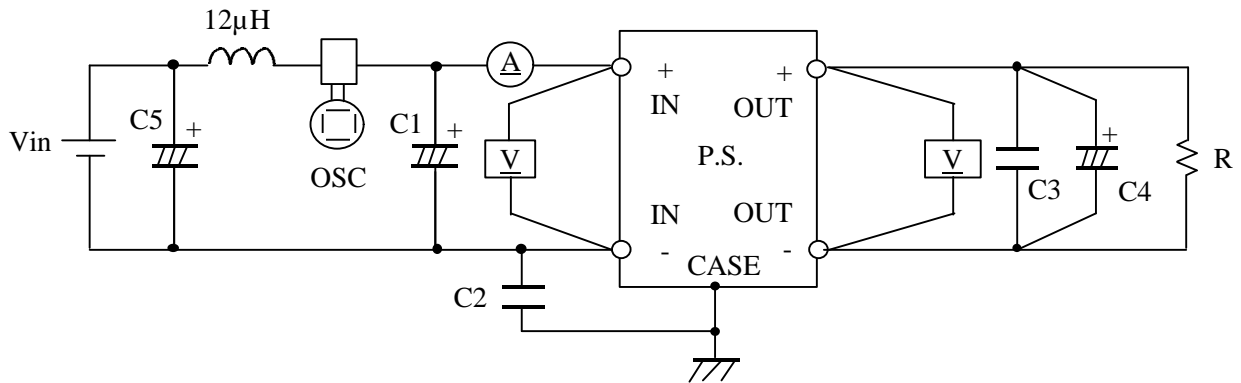
(14) AC input response characteristics



C1 : 33 μ F Electrolytic Capacitor
 C2 : 4700pF Ceramic Capacitor
 C3 : 1 μ F Ceramic Capacitor
 C5 : 560 μ F Electrolytics Capacitor

C4 : 3.3V&5V - 2200 μ F Electrolytic Capacitor
 12V&15V - 470 μ F Electrolytic Capacitor
 24V&28V - 220 μ F Electrolytic Capacitor

(15) Input Reflected current characteristics



C1 : 33 μ F Electrolytic Capacitor
 C2 : 4700pF Ceramic Capacitor
 C3 : 1 μ F Ceramic Capacitor
 C5 : 220 μ F Elerctrolytic Capacitor

C4 : 3.3V&5V - 2200 μ F Electrolytic Capacitor
 12V&15V - 470 μ F Electrolytic Capacitor
 24V&28V - 220 μ F Electrolytic Capacitor

1-2 List of equipment used

No	Description	Manufacturer	Model No.
1	Oscilloscope	TEKTRONIX	2465B
2		HITACHI	V-1050F
3	Digital oscilloscope	YEW	DL2140
4		HITACHI	VC-6041
5	Digital volt meter	IWATSU	VDAC 7411
6	DC ampere meter	YOKOGAWA ELEC.	2051
7	Dynamic dummy load	TAKAMIZAWA	PSA-150D
8	Variable resistive load	MATSUNAGA	44/11 Ω
9	Variable resistive load	MATSUNAGA	2.4/0.6 Ω
10	Controlled temp . chamber	TABAI	PL-2GM
11	Shunt resistor	KUWANO	100mV , 1A
12	Current probe amplifier	TEKTRONIX	TM503
13	Current probe	TEKTRONIX	A6303
14	AC power source / Analyzer	HEWLETT PACKARD	6813A
15	Leakage current tester	SIMPSON	229-2

2. CHARACTERISTICS

2-1 Steady State Data

(1) Regulation - Line and Load, Temperature Drift

5 V

Regulation - Line and Load Tp = 25°C

Iout \ Vin	36 VDC	48 VDC	76 VDC	Line Regulation	
	0%	5.050V	5.051V	5.051V	1 mV
50%	5.049V	5.050V	5.049V	1 mV	0.020%
100%	5.049V	5.049V	5.049V	0 mV	0.000%
Load Regulation	1 mV	2mV	2mV		
	0.020%	0.040%	0.040%		

Temperature Drift Vin = 48VDC
Iout = 100%

Tp	-40°C	25°C	100°C	Temp. Stability	
Vout	5.034V	5.056V	5.053V	22 mV	0.44%

12 V

Regulation - Line and Load Tp = 25°C

Iout \ Vin	36 VDC	48 VDC	76 VDC	Line Regulation	
	0%	12.022V	12.018V	12.017V	5 mV
50%	12.024V	12.024V	12.023V	1 mV	0.008%
100%	12.025V	12.024V	12.023V	2 mV	0.017%
Load Regulation	3 mV	6 mV	6 mV		
	0.025%	0.050%	0.050%		

Temperature Drift Vin = 48VDC
Iout = 100%

Tp	-40°C	25°C	100°C	Temp. Stability	
Vout	11.995V	12.030V	12.004V	35 mV	0.29%

24 V

Regulation - Line and Load Tp = 25°C

Iout \ Vin	36 VDC	48 VDC	76 VDC	Line Regulation	
	0%	24.009V	24.007V	24.004V	5 mV
50%	24.011V	24.011V	24.009V	2 mV	0.008%
100%	24.013V	24.011V	24.010V	3 mV	0.012%
Load Regulation	4 mV	4 mV	6 mV		
	0.017%	0.017%	0.025%		

Temperature Drift Vin = 48VDC
Iout = 100%

Tp	-40°C	25°C	100°C	Temp. Stability	
Vout	23.958V	24.028V	23.929V	99 mV	0.41%

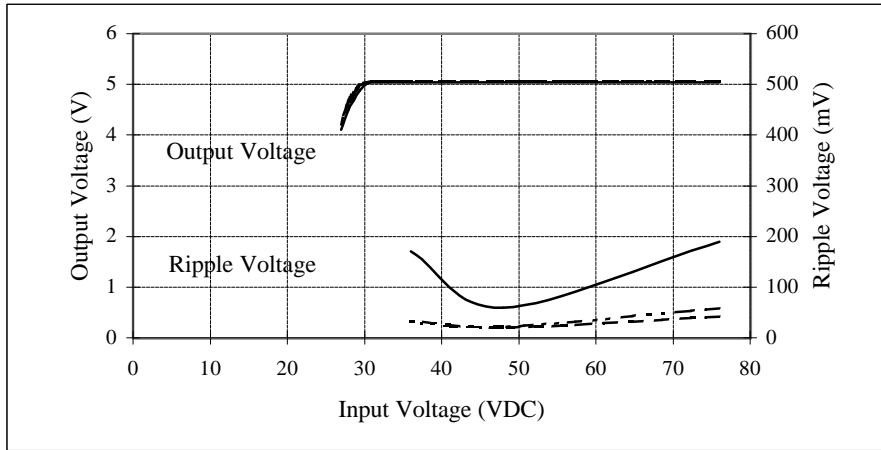
2. CHARACTERISTICS

2-1 Steady State Data

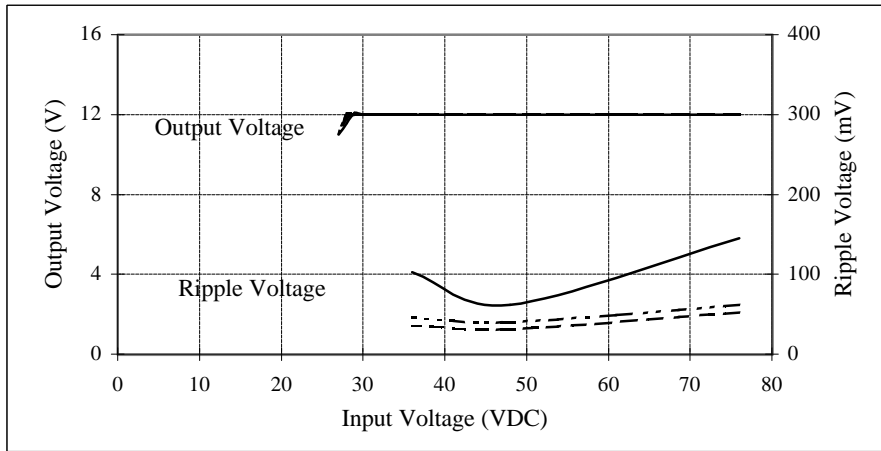
(2) Output Voltage And Ripple Voltage V.S. Input Voltage

Condition : $I_{out} = 100\%$
 $T_p = -40^\circ\text{C}$ ———
 $T_p = 25^\circ\text{C}$ - - - - -
 $T_p = 100^\circ\text{C}$ ······

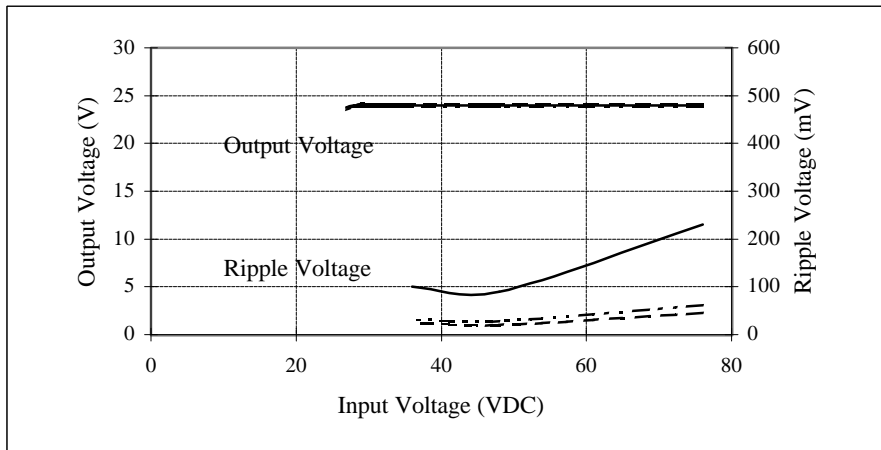
5 V



12 V



24 V



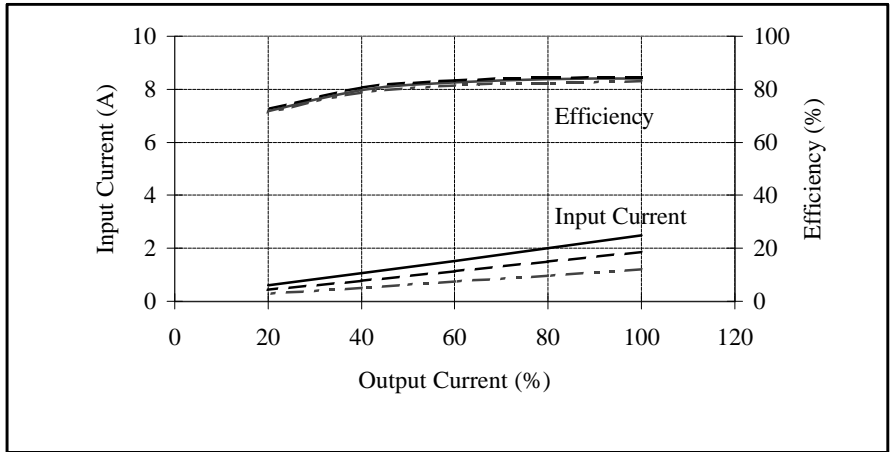
2. CHARACTERISTICS

2-1 Steady State Data

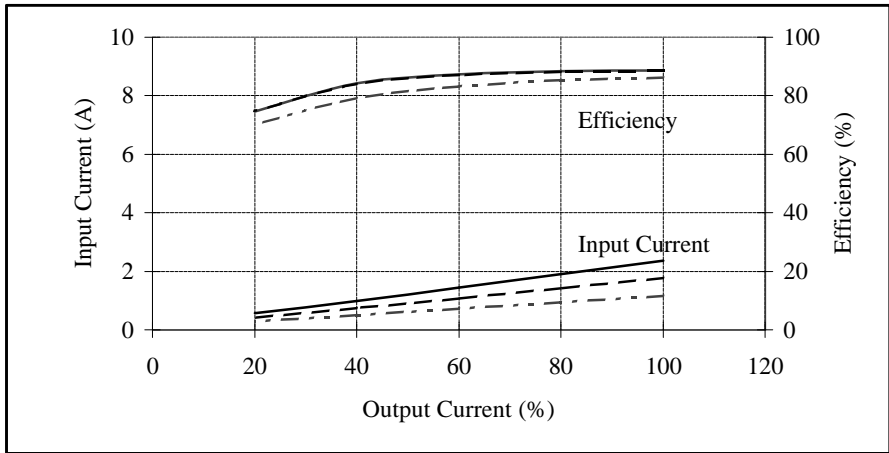
(3) Efficiency And Input Current V.S. Output Current

Condition : $V_{in} = 36\text{ VDC}$ ———
 $= 48\text{ VDC}$ - - - -
 $= 76\text{ VDC}$ - · - · -
 $T_p = 25^\circ\text{C}$

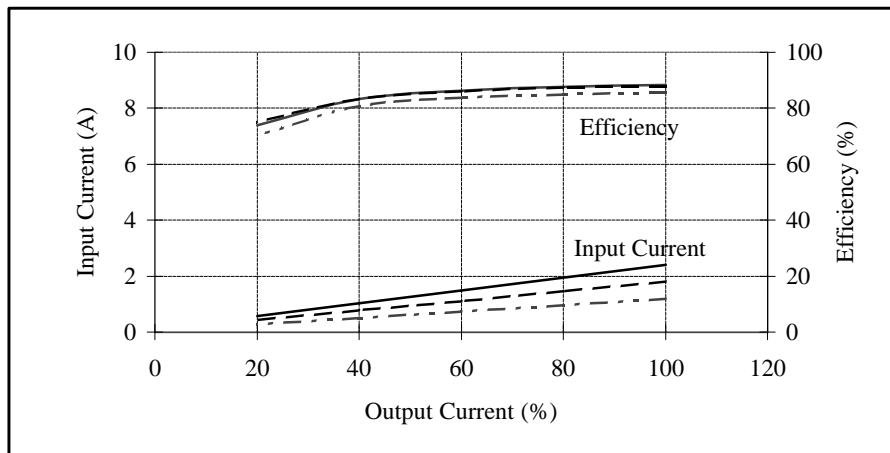
5 V



12 V



24 V



2. CHARACTERISTICS

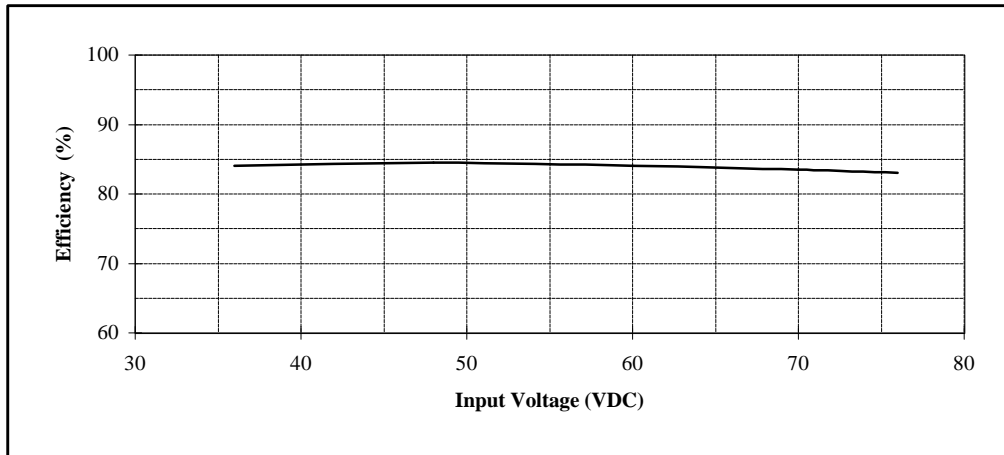
2-1 Steady State Data

(4) Efficiency v.s. Input Voltage

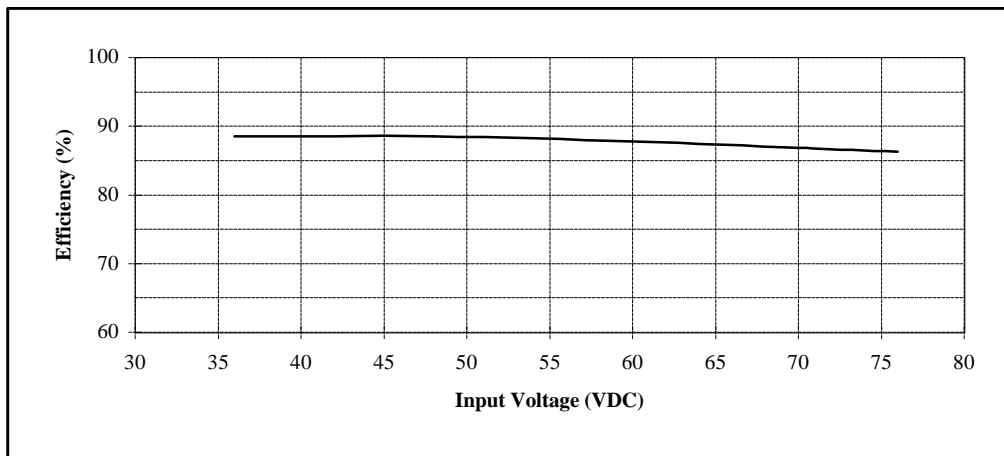
Condition : Iout = 100%

Tp = 25°C

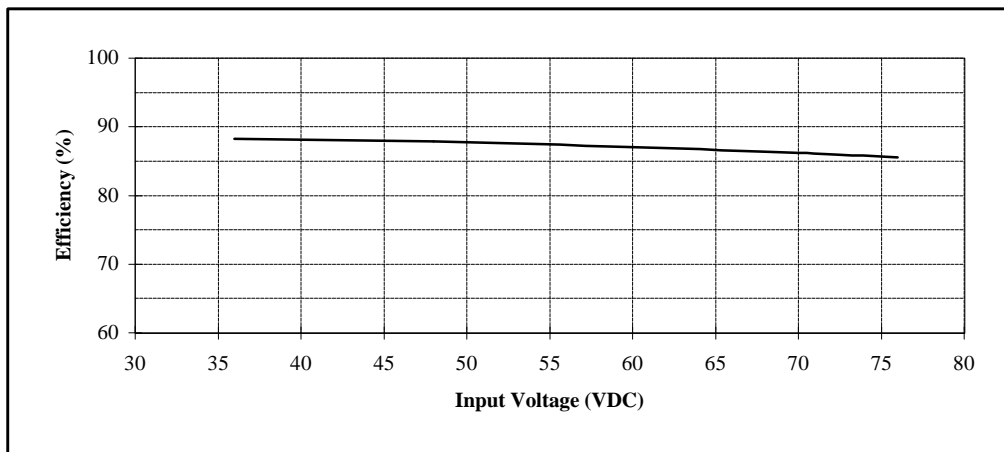
5 V



12 V



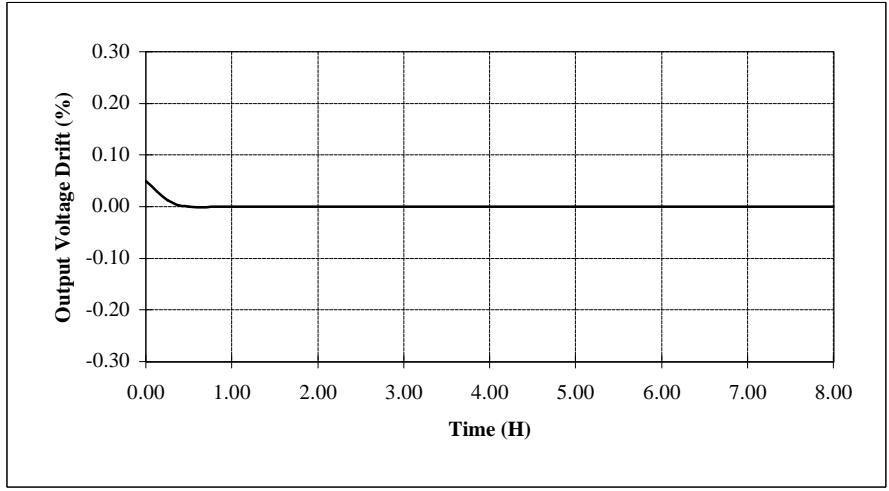
24 V



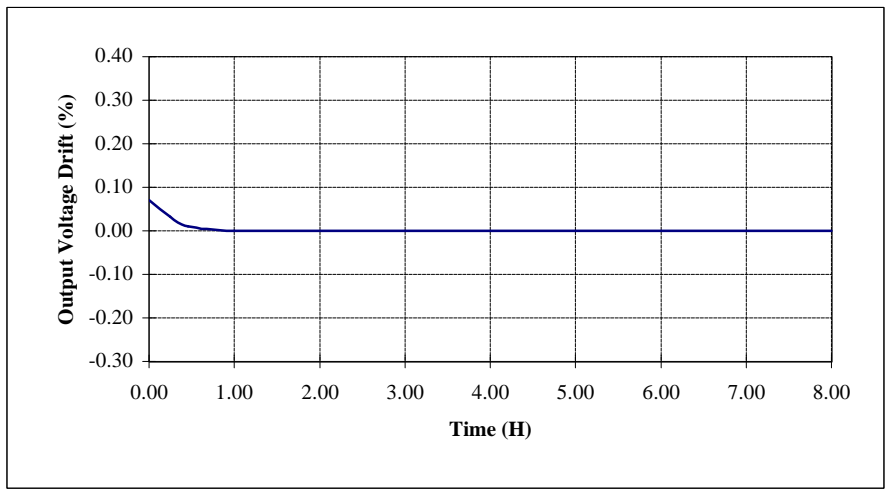
2-2 Warm Up Voltage Drift Characteristics

Condition : $V_{in} = 48 \text{ V DC}$
 $I_{out} = 100 \%$
 $T_p = 25^\circ\text{C}$

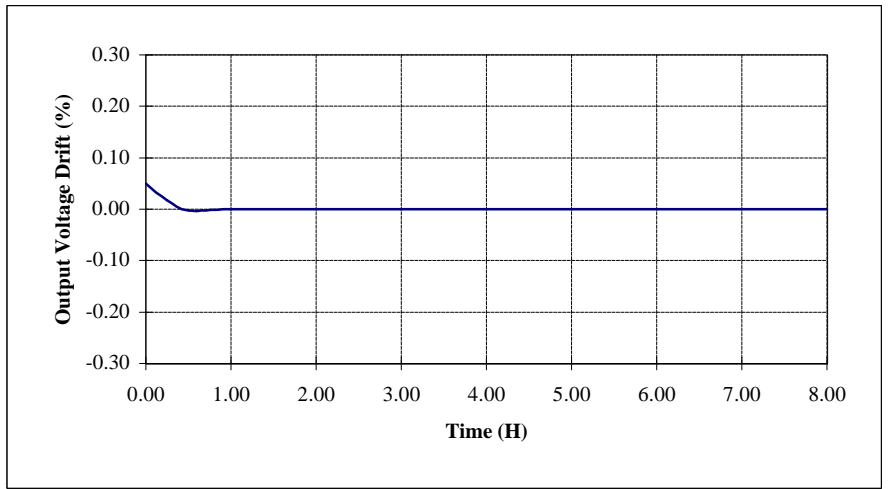
5 V



12 V



24 V

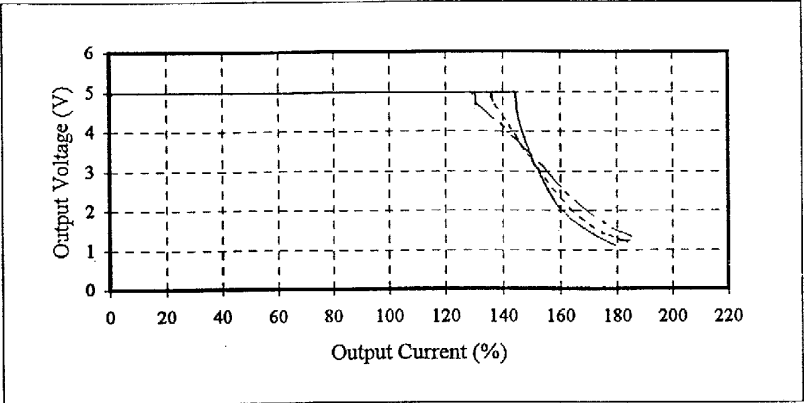


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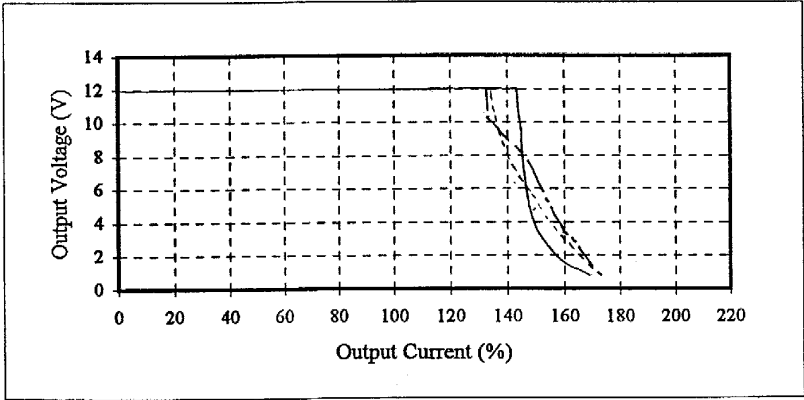
2-3 O.C.P. Charateristics

Condition : $V_{in} = 36 \text{ VDC}$ ———
 $V_{in} = 48 \text{ VDC}$ - - - - -
 $V_{in} = 76 \text{ VDC}$ - · - · -
 $T_p = 25^\circ\text{C}$

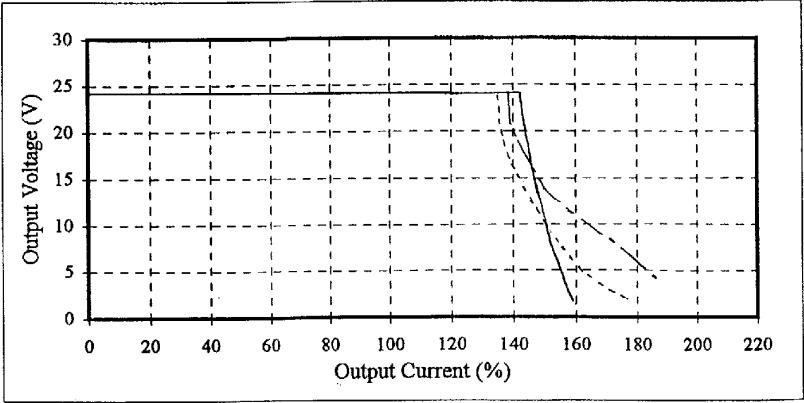
5 V



12 V



24 V

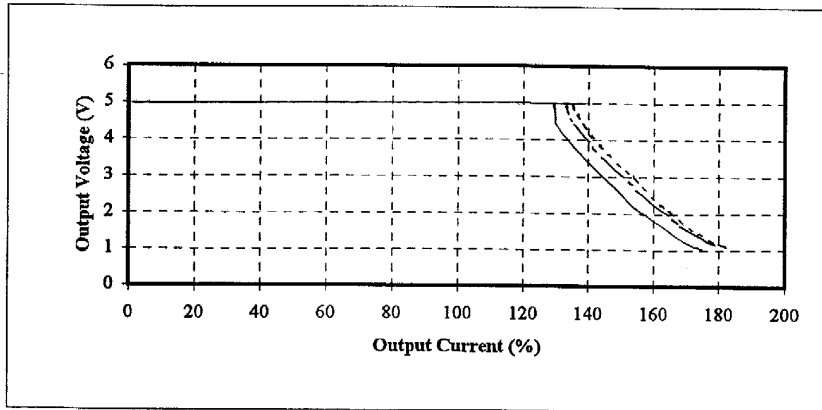


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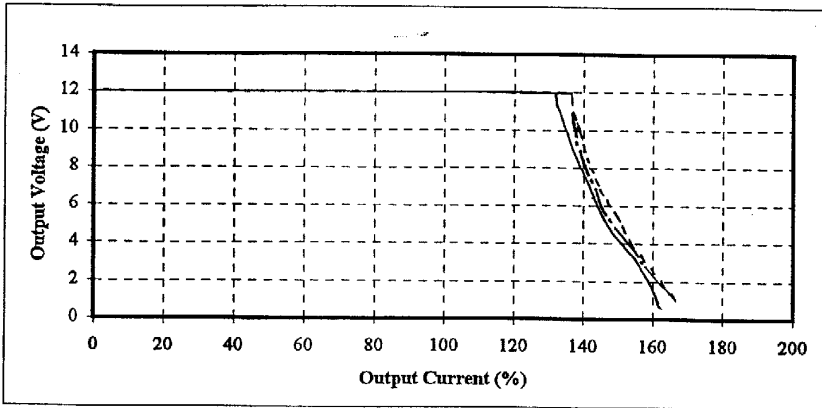
O.C.P. Characteristics

Condition : $T_p = -40^\circ\text{C}$ ———
 $T_p = 25^\circ\text{C}$ - - - - -
 $T_p = 100^\circ\text{C}$ - · - · - ·
 $V_{in} = 48 \text{ VDC}$

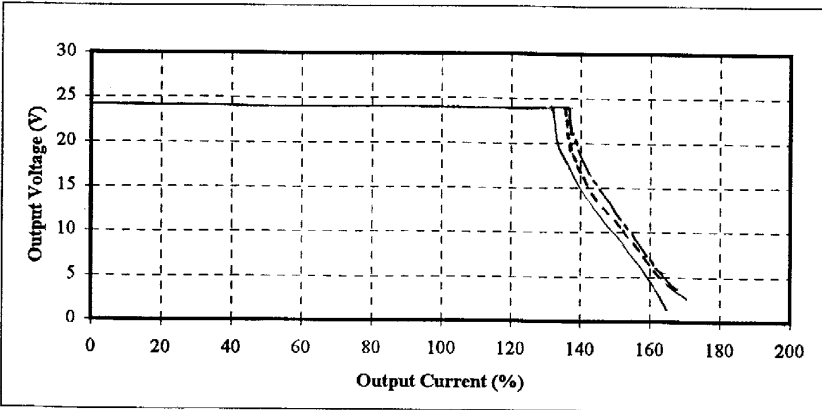
5V



12V



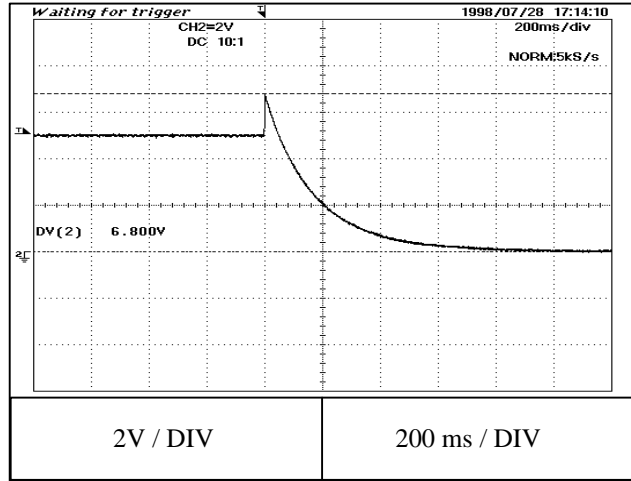
24 V



2-4 O.V.P. Characteristics

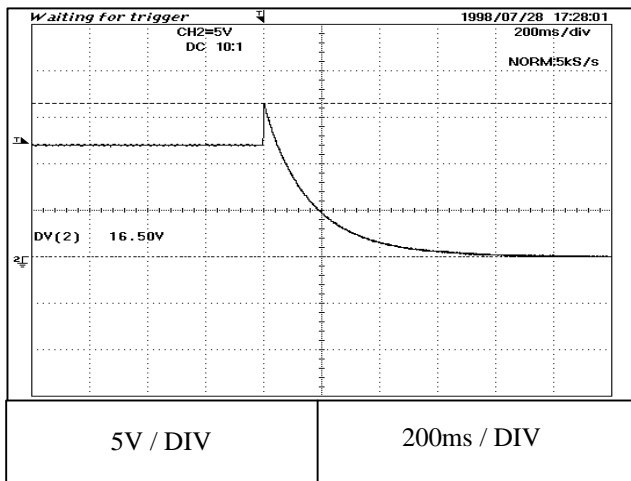
Condition : $V_{in} = 48 \text{ V DC}$
 $I_{out} = 0 \%$
 $T_p = 25^\circ\text{C}$

5 V



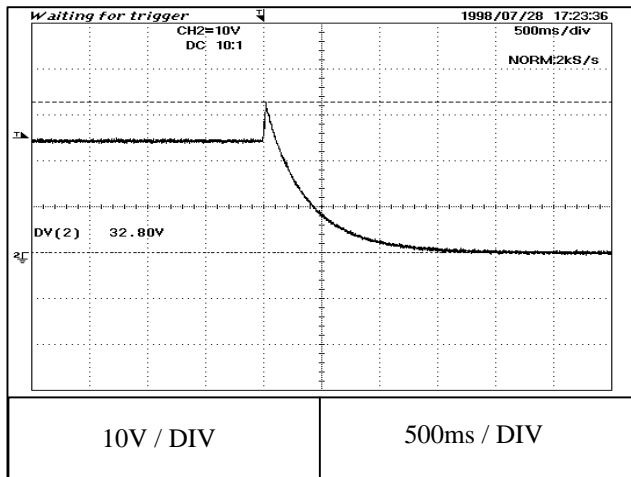
← OVP
Trip Point

12 V



← OVP
Trip Point

24 V

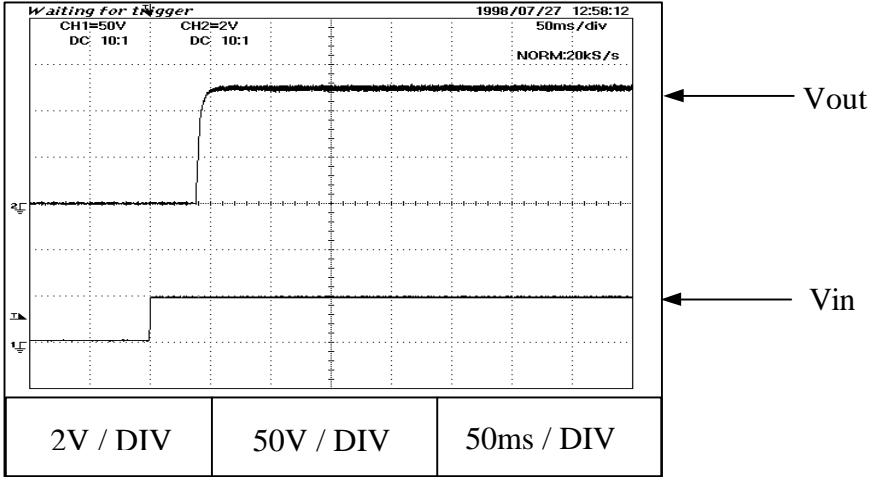


← OVP
Trip Point

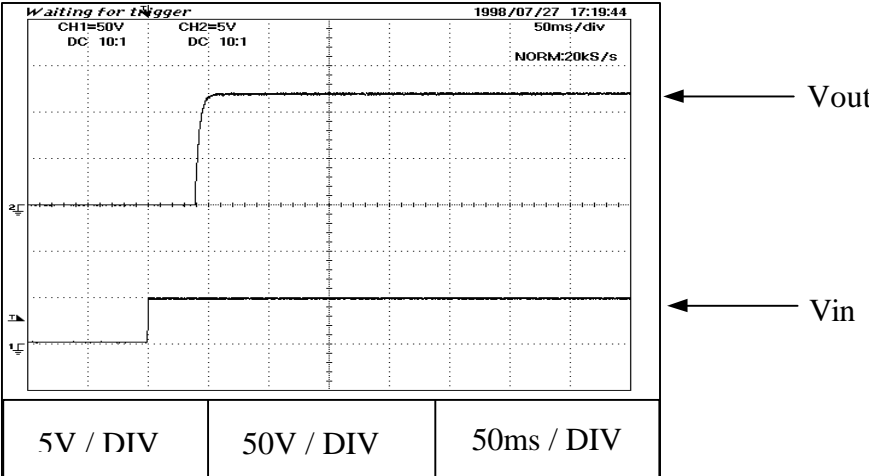
2-5 Output Rise Characteristics

Condition : $V_{in} = 48\text{ V DC}$
 $I_{out} = 0\%$
 $T_p = 25^\circ\text{C}$

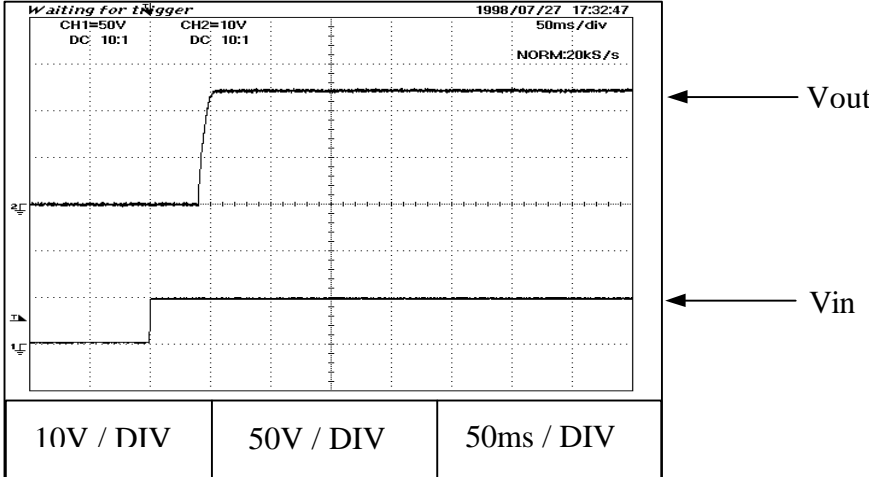
5 V



12 V



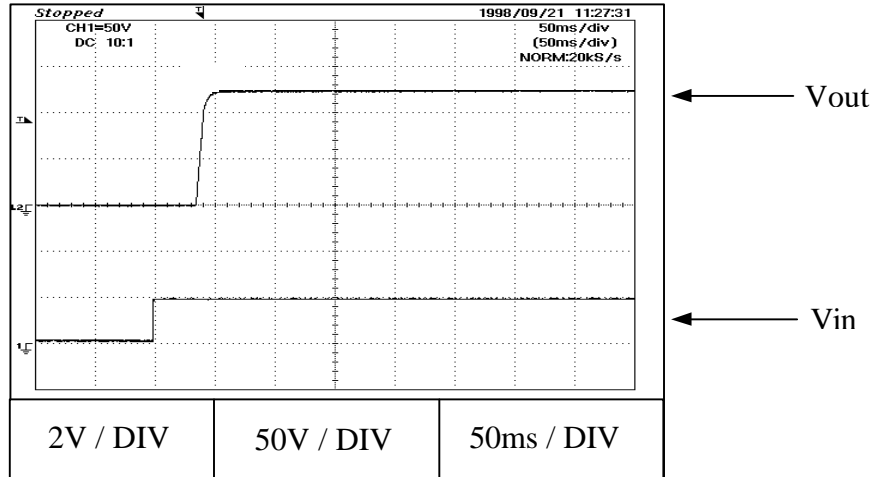
24 V



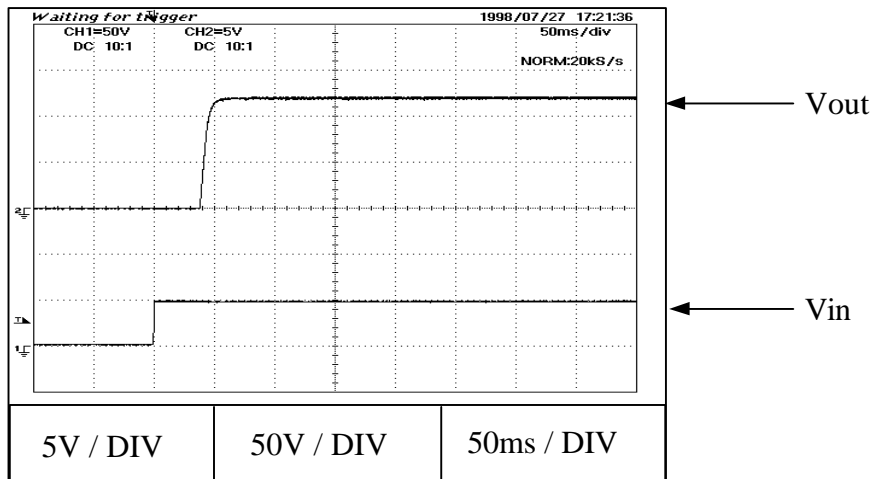
Output Rise Characteristics

Condition : $V_{in} = 48\text{ V DC}$
 $I_{out} = 100\%$
 $T_p = 25^\circ\text{C}$

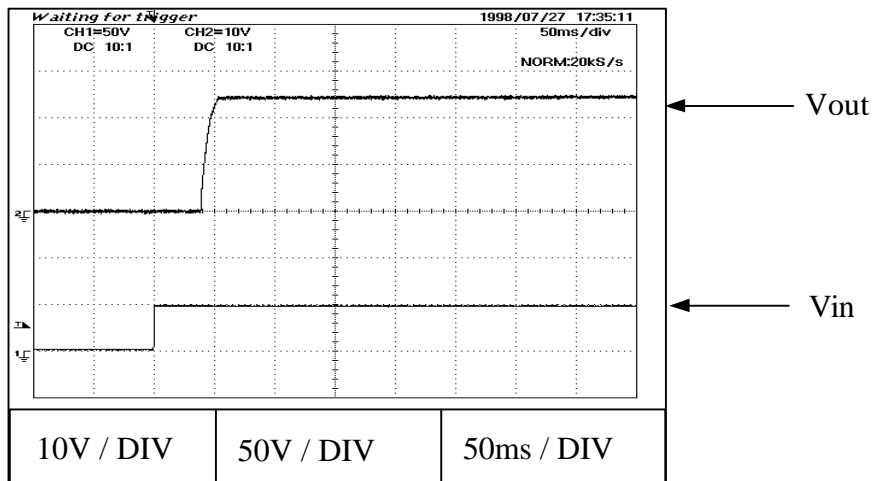
5 V



12 V



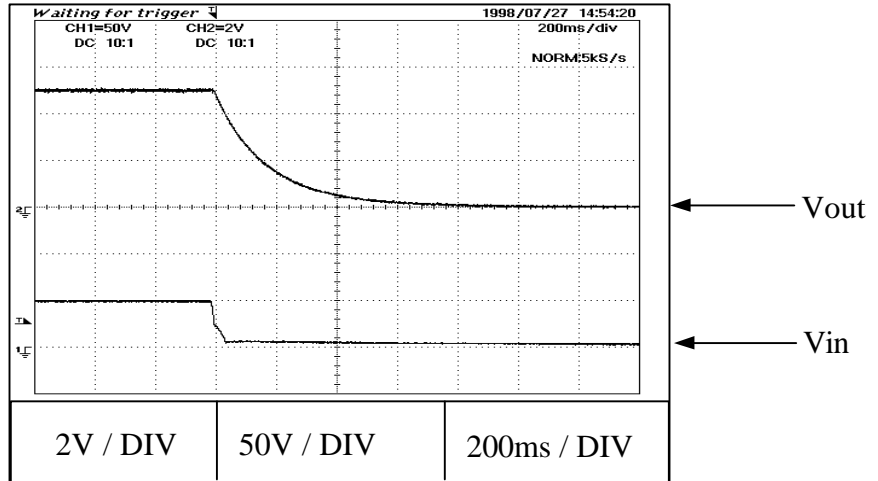
24 V



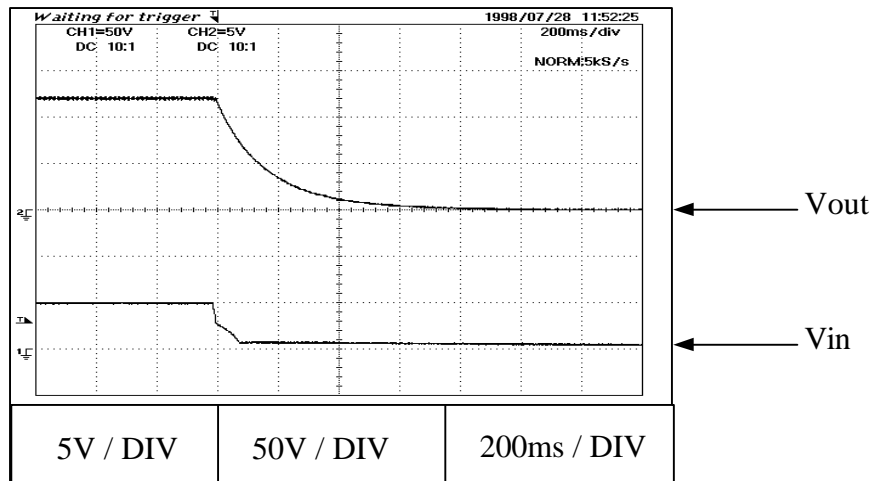
2-6 Output Fall Characteristics

Condition : $V_{in} = 48\text{ V DC}$
 $I_{out} = 0\%$
 $T_p = 25^\circ\text{C}$

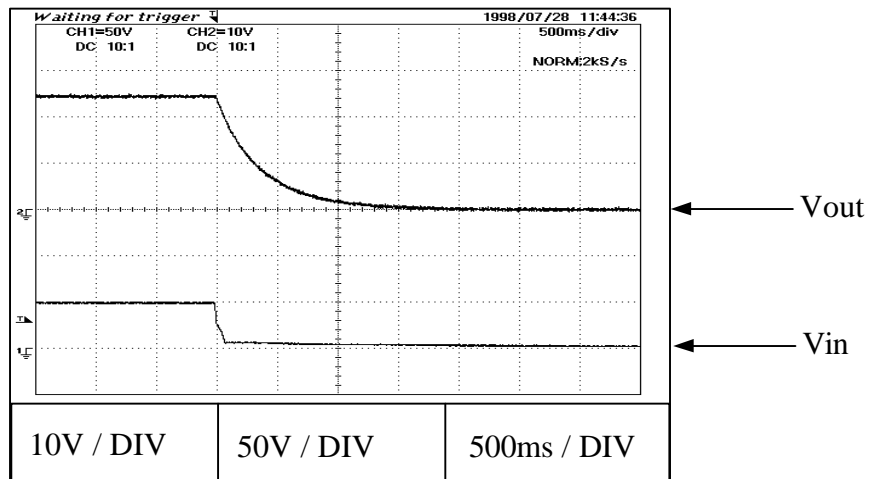
5 V



12 V



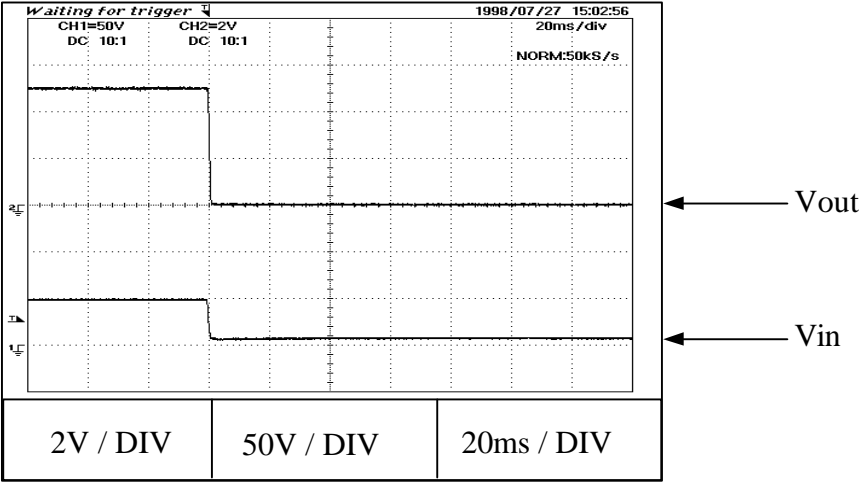
24 V



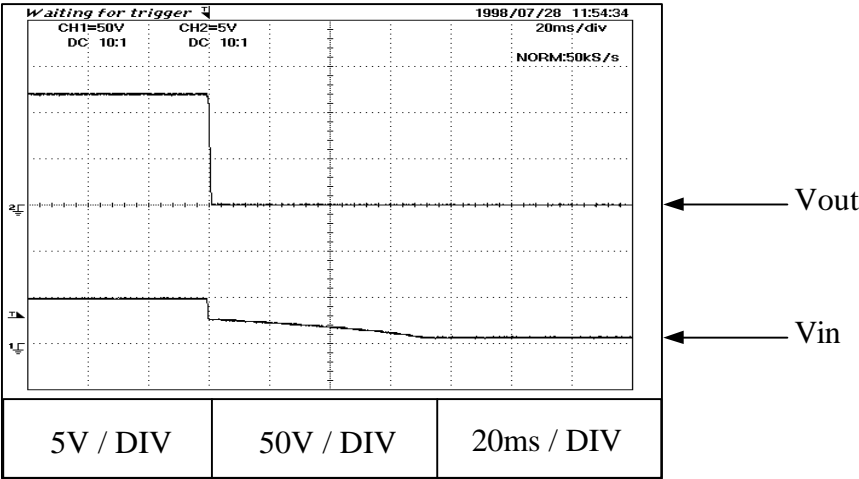
Output Fall Characteristics

Condition : $V_{in} = 48\text{ V DC}$
 $I_{out} = 100\%$
 $T_p = 25^\circ\text{C}$

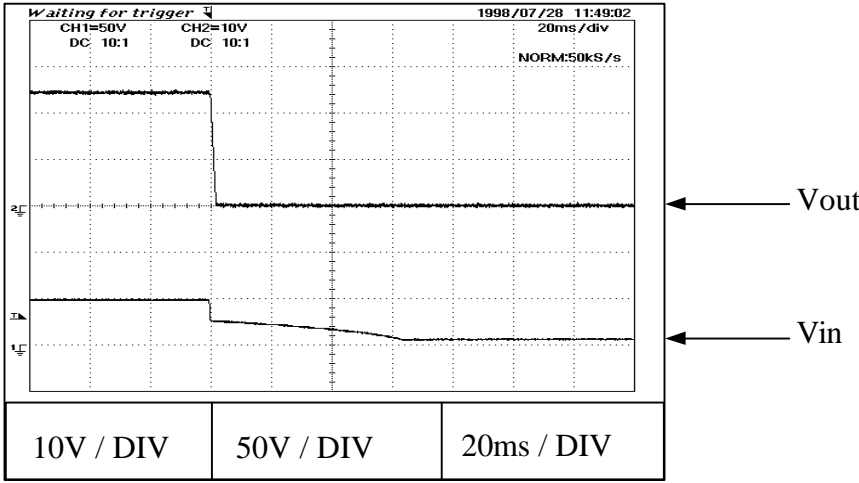
5 V



12 V



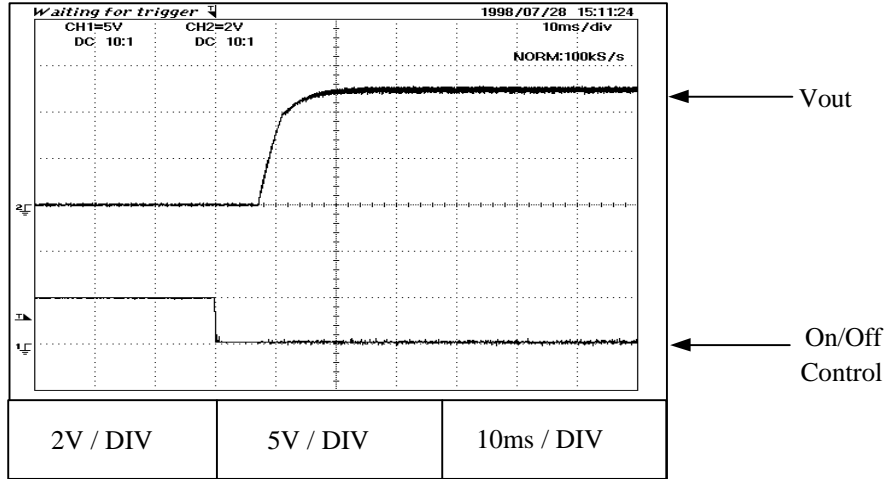
24 V



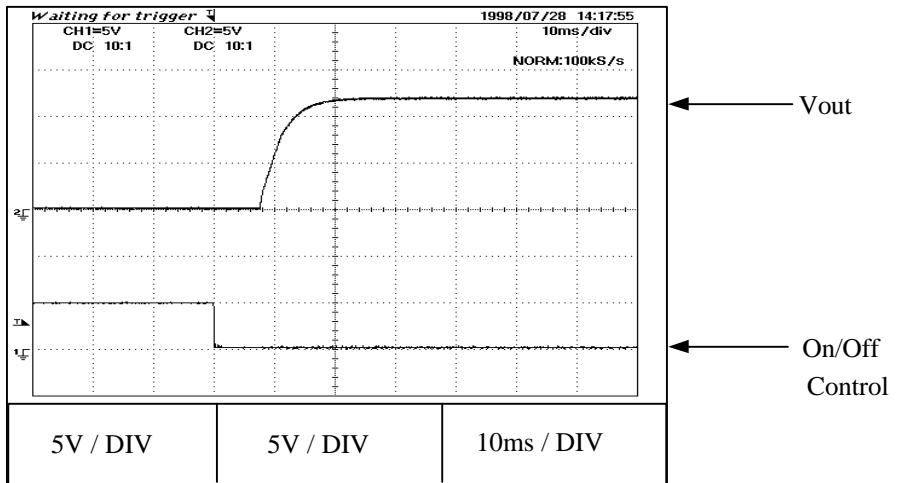
2-7 Output Rise With On/Off Characteristics
(Negative logic)

Condition : $V_{in} = 48 \text{ V DC}$
 $I_{out} = 0 \%$
 $T_p = 25^\circ\text{C}$

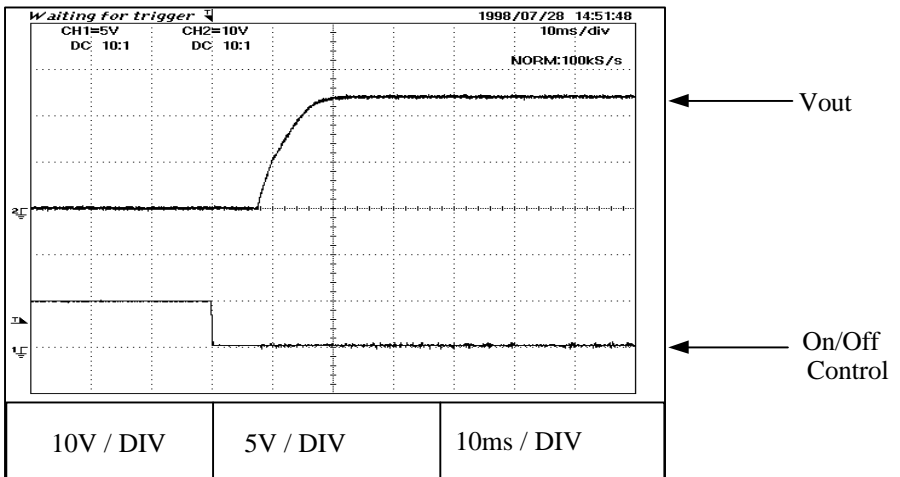
5 V



12 V



24 V

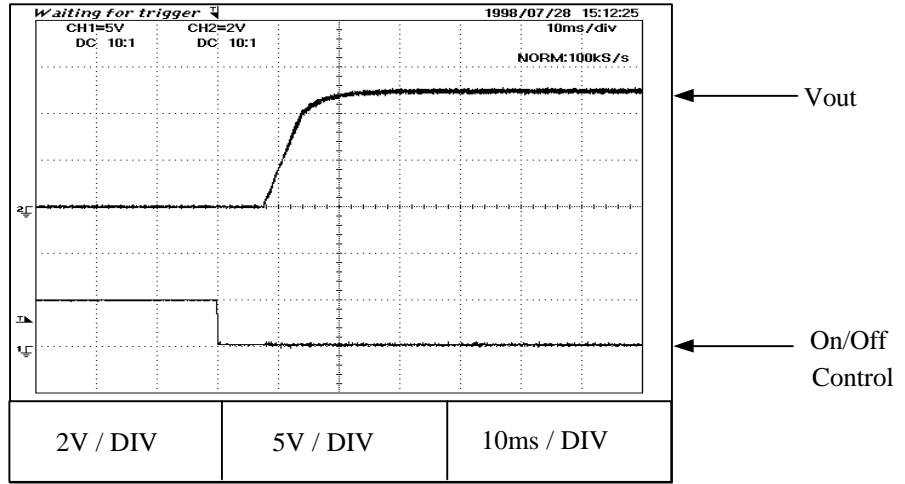


Output Rise With On/Off Characteristics

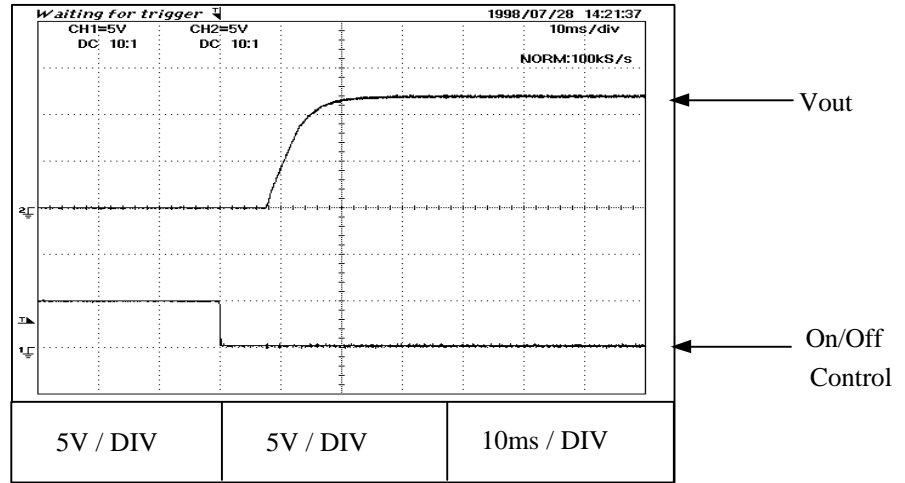
(Negative logic)

Condition : $V_{in} = 48 \text{ V DC}$
 $I_{out} = 100 \%$
 $T_p = 25^\circ\text{C}$

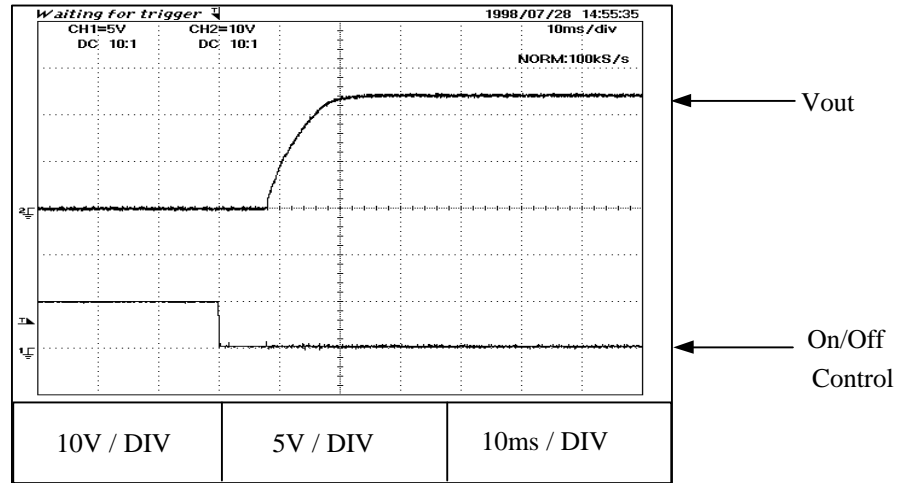
5 V



12 V



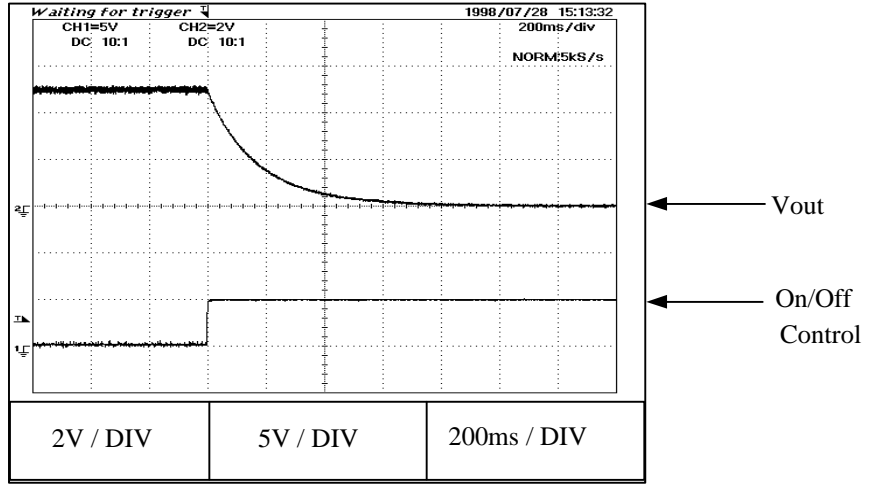
24 V



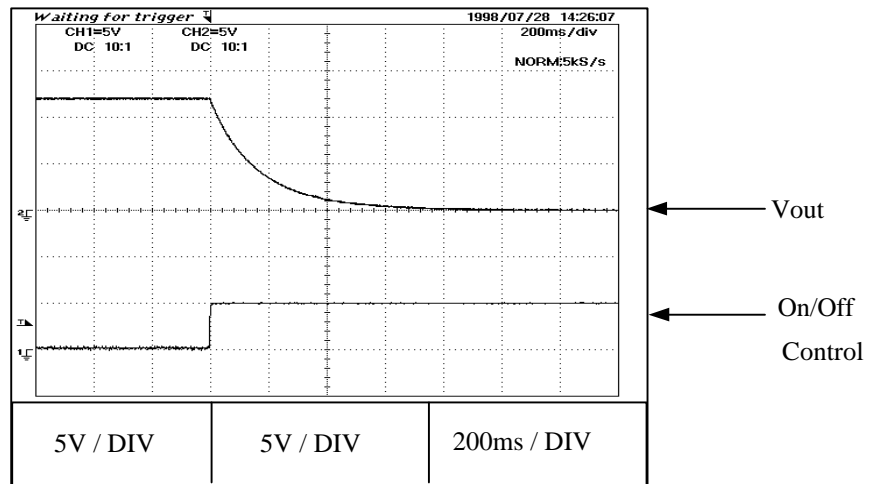
2-8 Output Fall With On/Off Characteristics
(Negative logic)

Condition : $V_{in} = 48 \text{ V DC}$
 $I_{out} = 0 \%$
 $T_p = 25^\circ\text{C}$

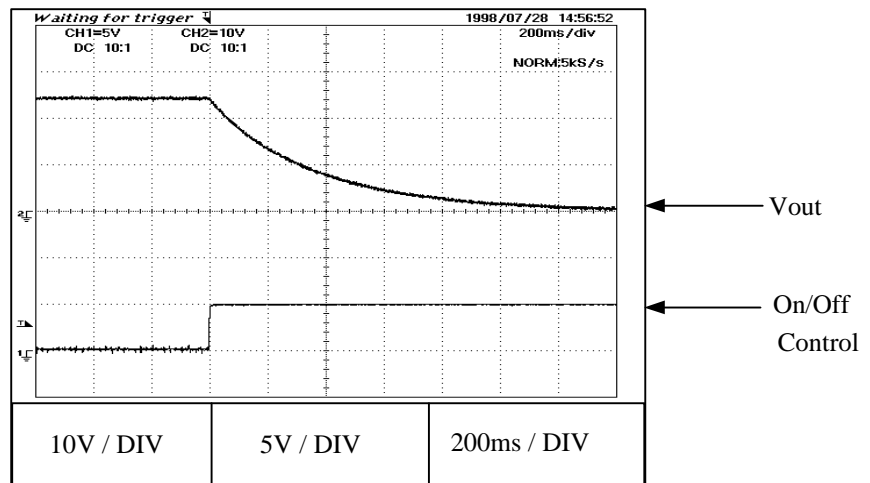
5 V



12 V



24 V



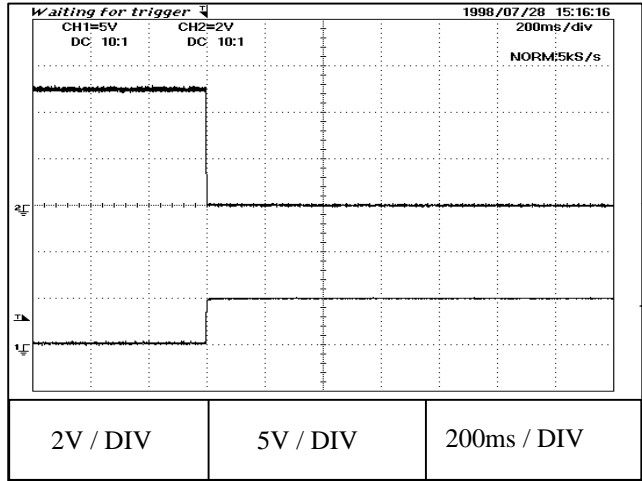
PAH75S48-*

Output Fall With On/Off Characteristics

(Negative logic)

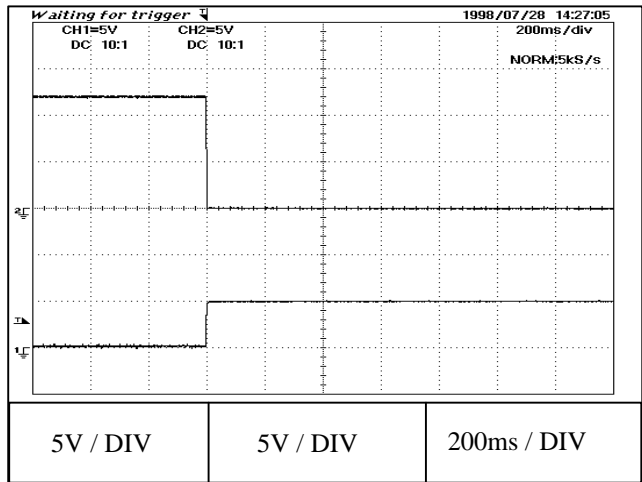
Condition : $V_{in} = 48 \text{ V DC}$
 $I_{out} = 100 \%$
 $T_p = 25^\circ\text{C}$

5 V



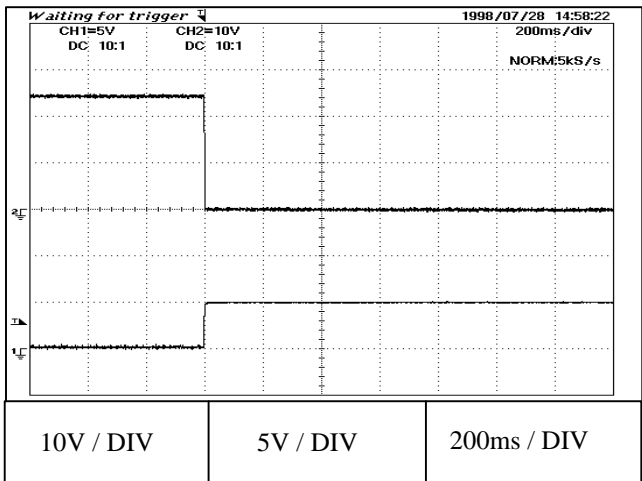
← Vout
 ← On/Off Control

12 V



← Vout
 ← On/Off Control

24 V

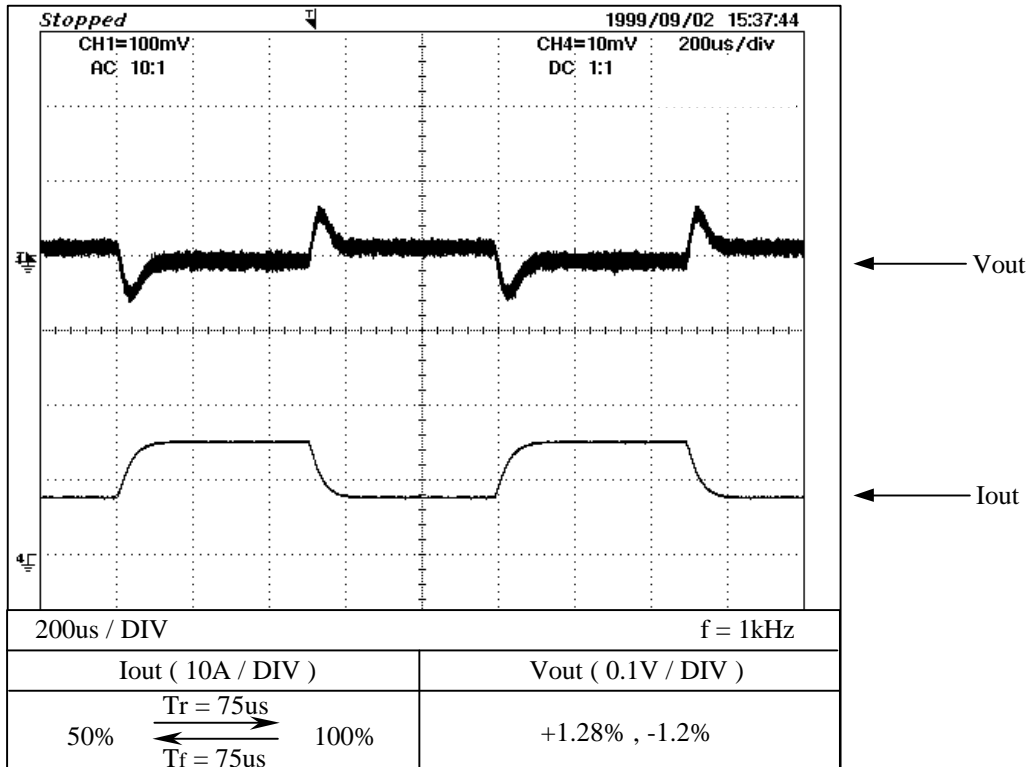
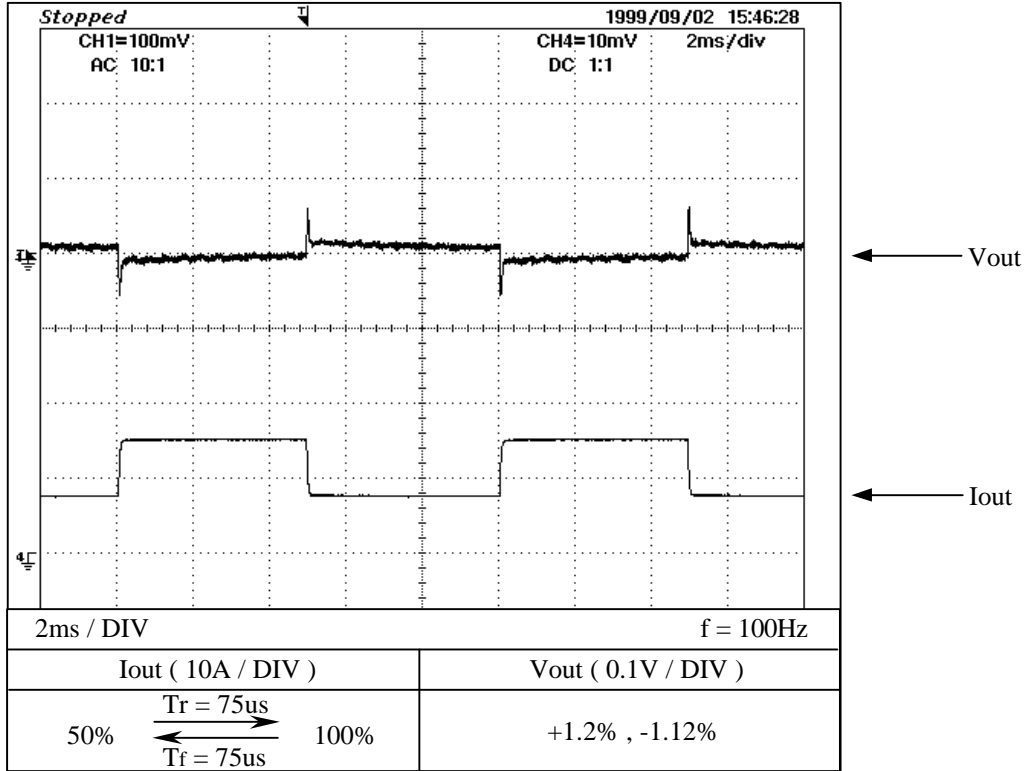


← Vout
 ← On/Off Control

2-9 Dynamic Load Response Characteristics

Condition : $V_{in} = 48 \text{ VDC}$
 $T_p = 25^\circ\text{C}$

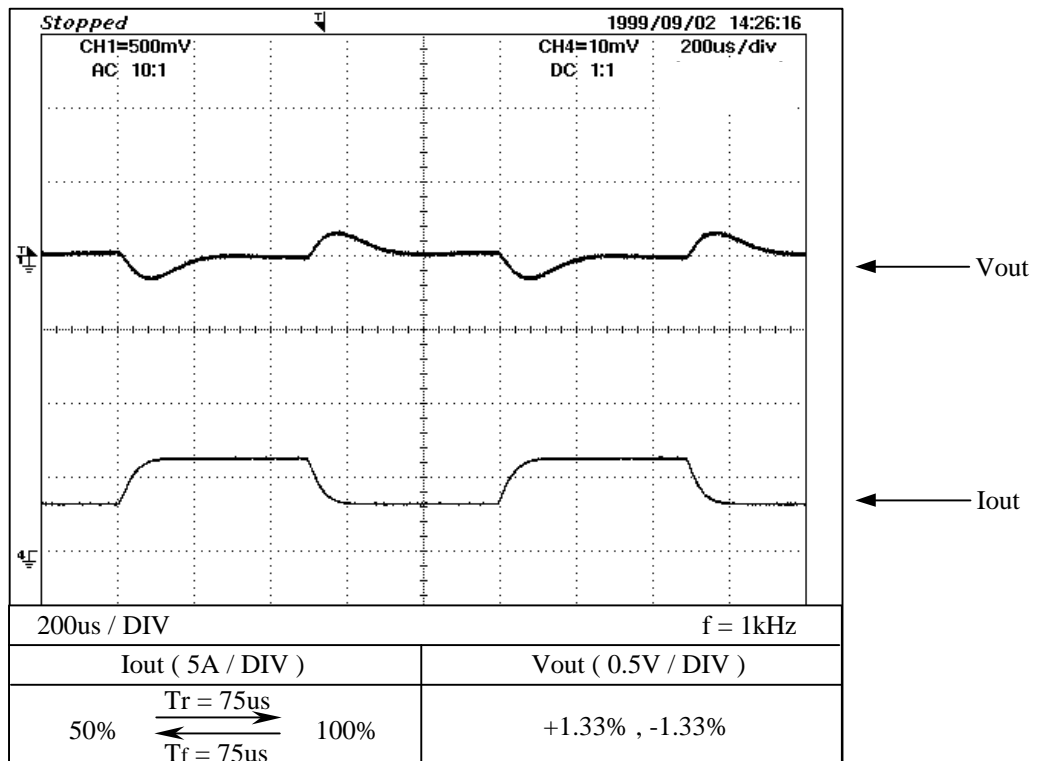
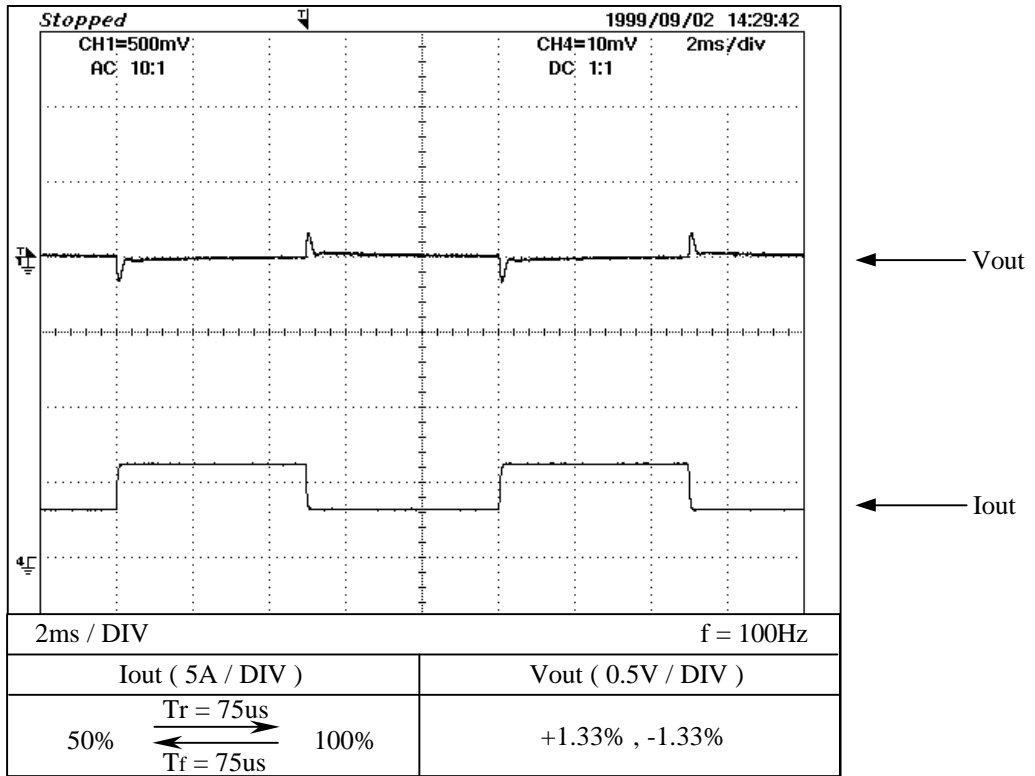
5 V



Dynamic Load Response Characteristics

Condition : $V_{in} = 48 \text{ VDC}$
 $T_p = 25^\circ\text{C}$

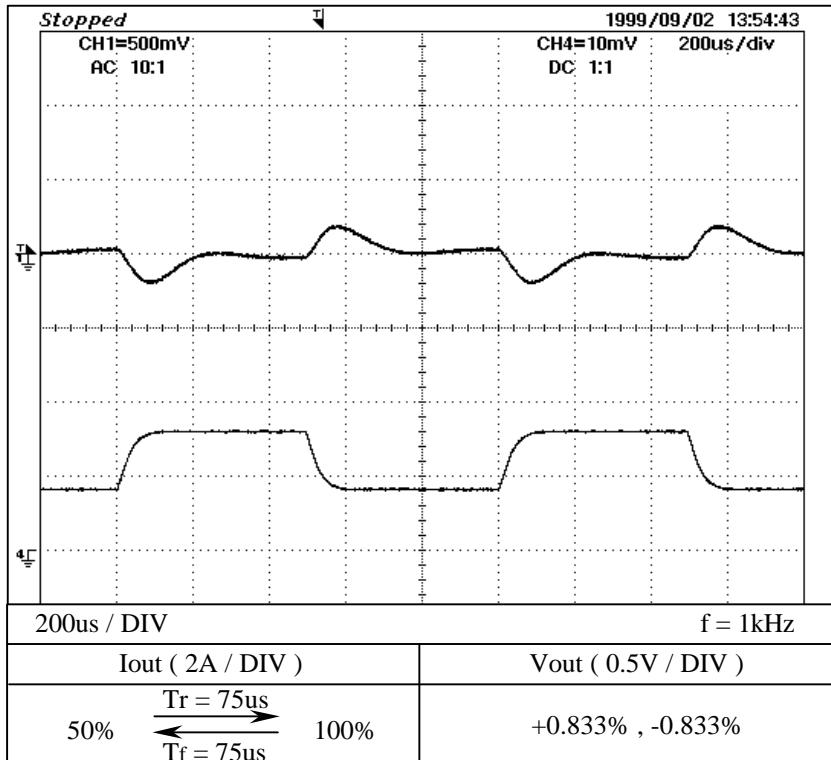
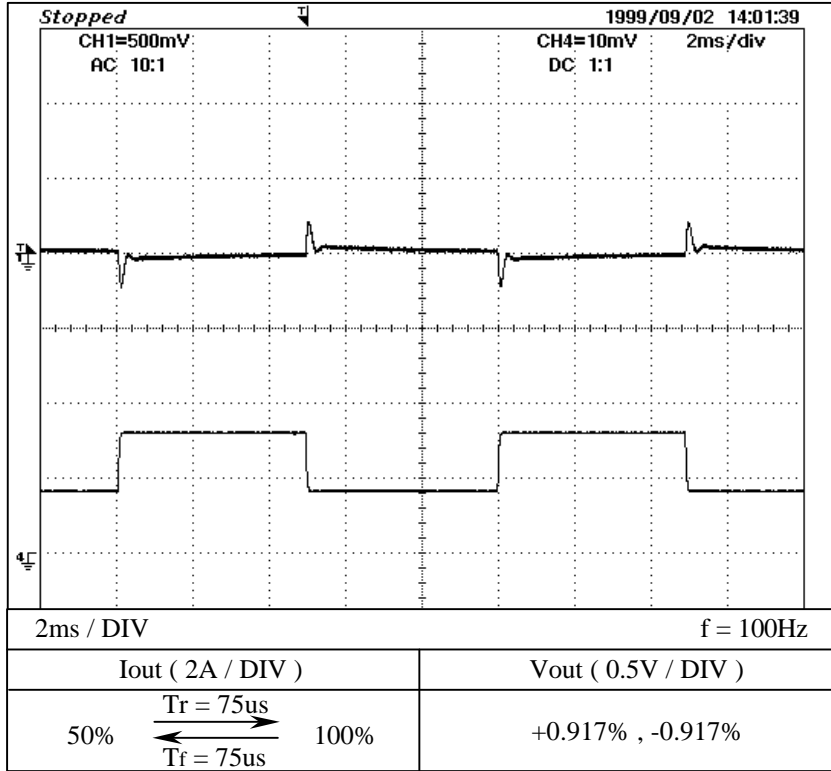
12 V



Dynamic Load Response Characteristics

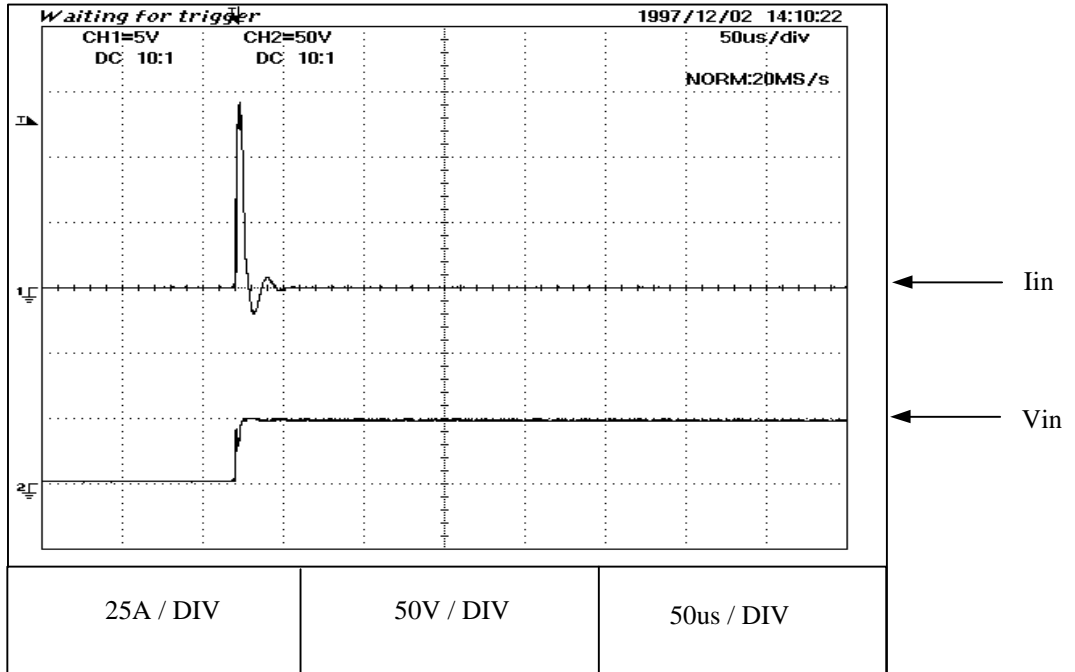
Condition : $V_{in} = 48 \text{ VDC}$
 $T_p = 25^\circ\text{C}$

24 V



2-10 Inrush Current Waveform

Condition : $V_{in} = 48 \text{ V DC}$
 $I_{out} = 100 \%$
 $T_p = 25^\circ\text{C}$

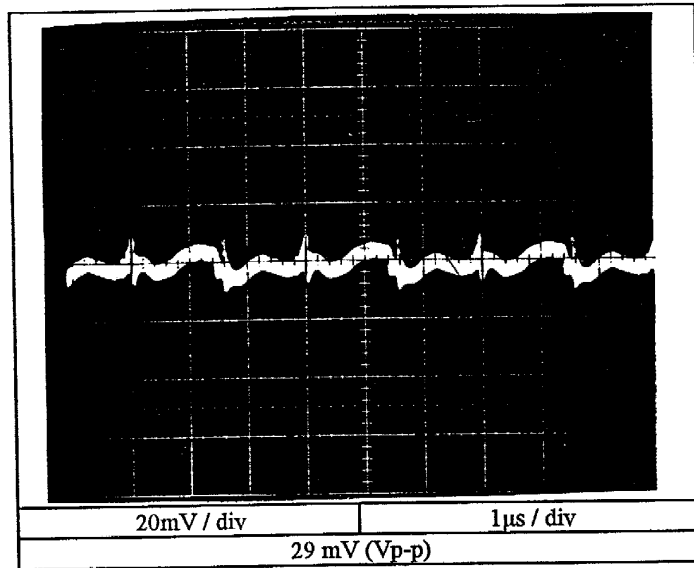


2-11 Output - Ripple & Noise Waveform

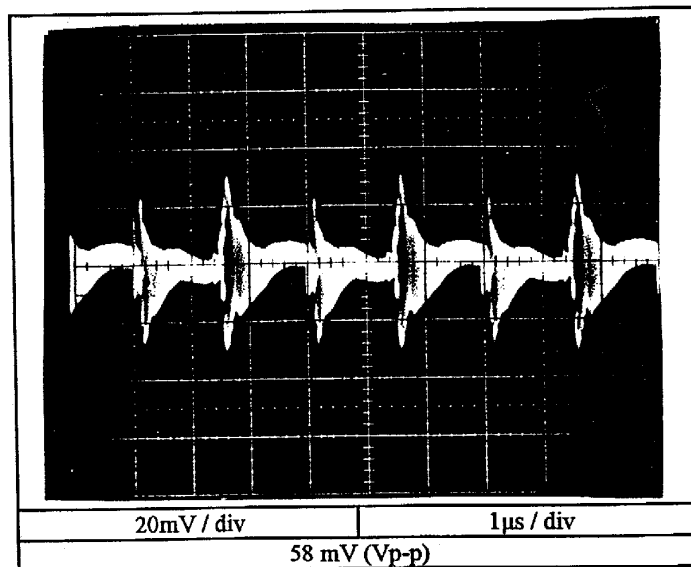
Condition : $V_{in} = 48V DC$
 $I_{out} = 100\%$
 $T_p = 25^{\circ}C$

5 V

NORMAL MODE



NORMAL + COMMON MODE



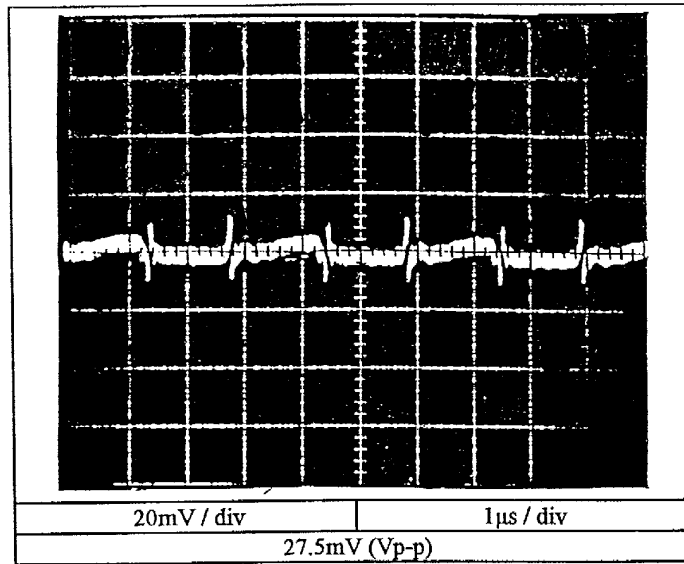
PAH75S48-*

Output - Ripple & Noise Waveform

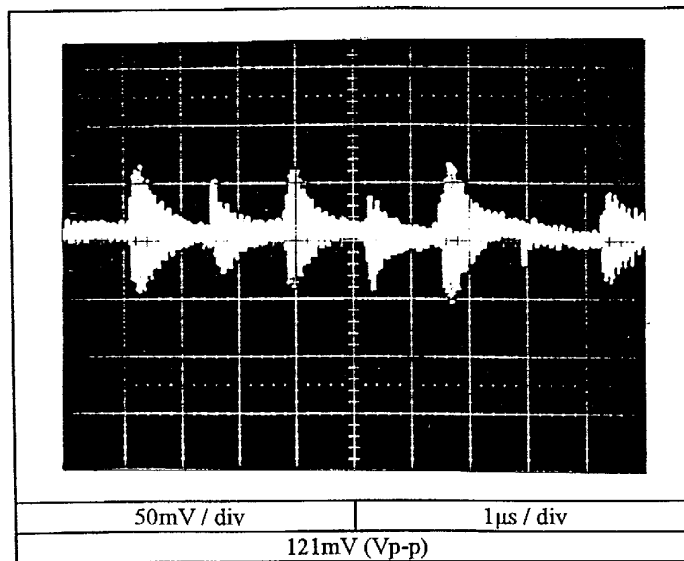
Condition : $V_{in} = 48V DC$
 $I_{out} = 100\%$
 $T_p = 25^{\circ}C$

12 V

NORMAL MODE



NORMAL + COMMON MODE



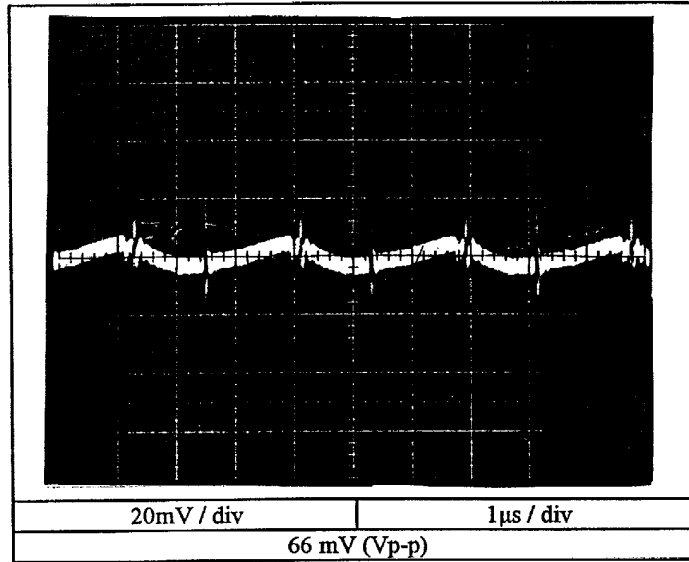
PAH75S48-*

Output - Ripple & Noise Waveform

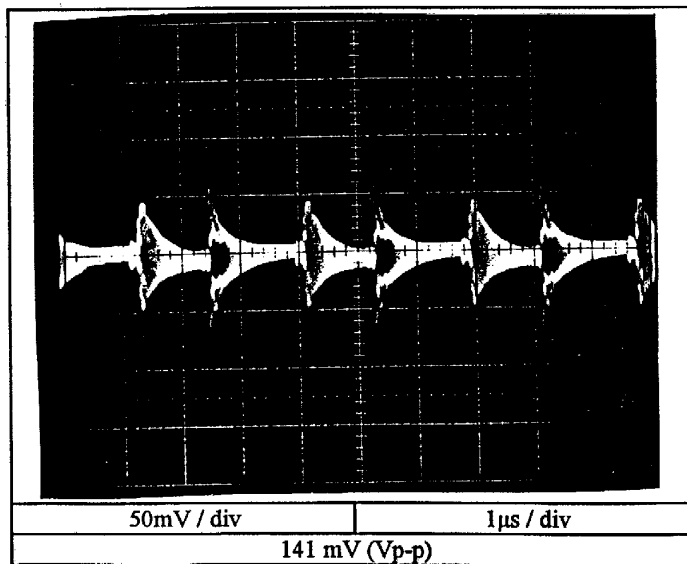
Condition : $V_{in} = 48V DC$
 $I_{out} = 100\%$
 $T_p = 25^{\circ}C$

24 V

NORMAL MODE



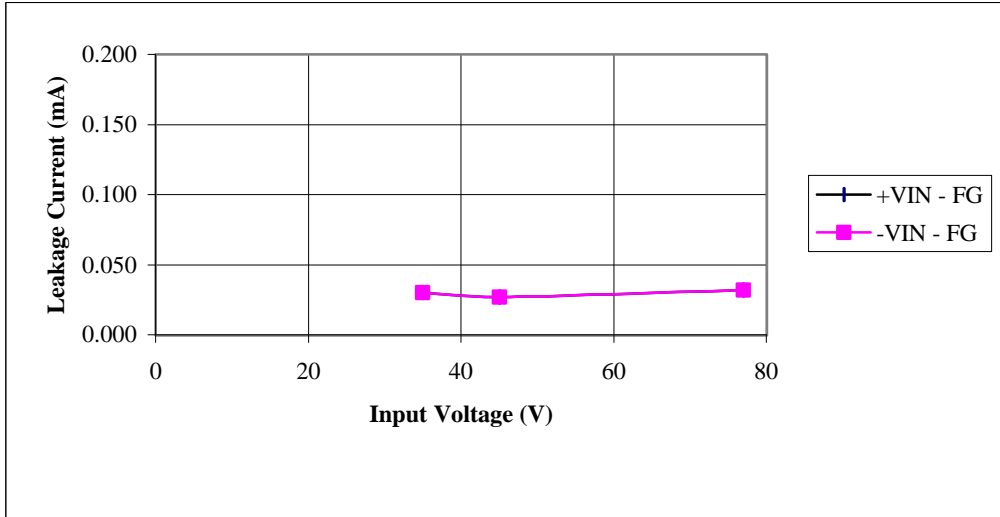
NORMAL + COMMON MODE



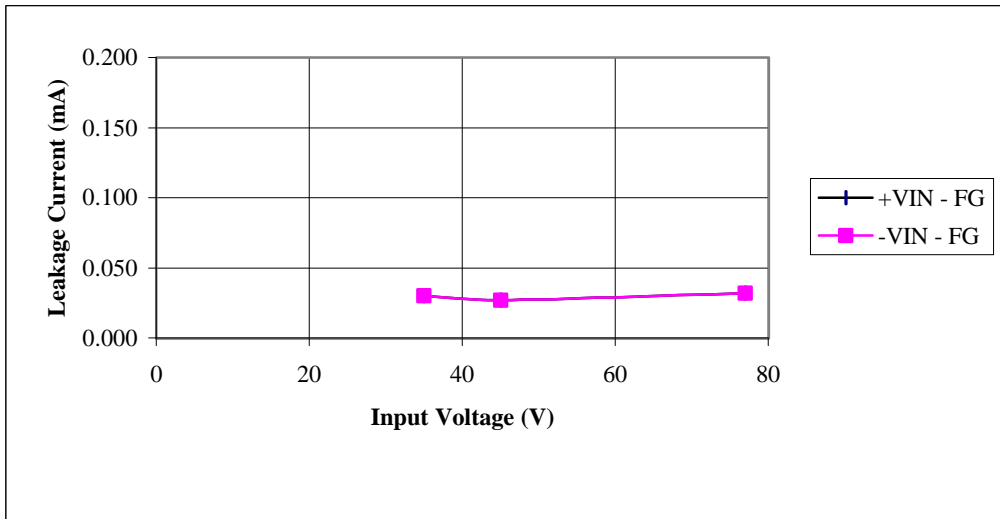
2-12 Leakage Current Characteristics

Condition : Iout = 100%
Tp= 25°C

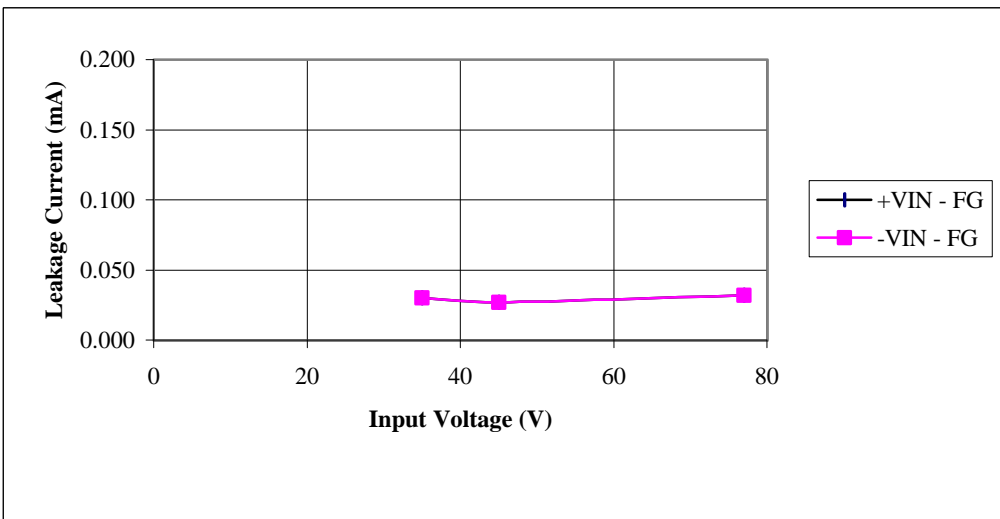
5V



12V



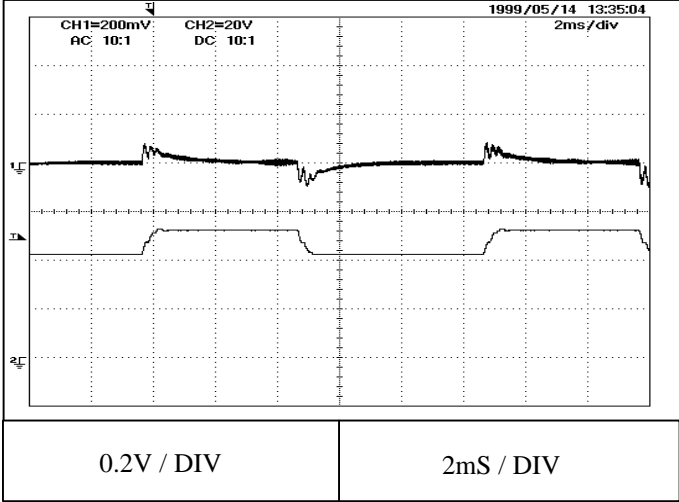
24V



2-13 Dynamic Line Response Characteristics

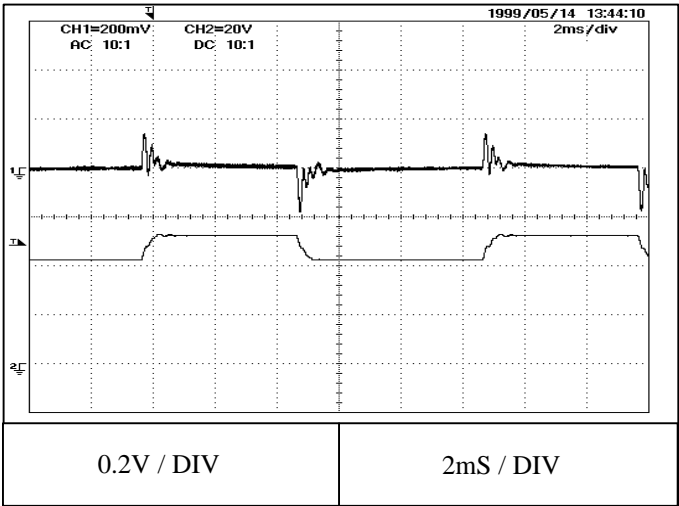
Condition : $V_{in} = 43 \rightleftharpoons 53VDC$
 $I_{out} = 100\%$
 $T_p = 25^{\circ}C$

5 V



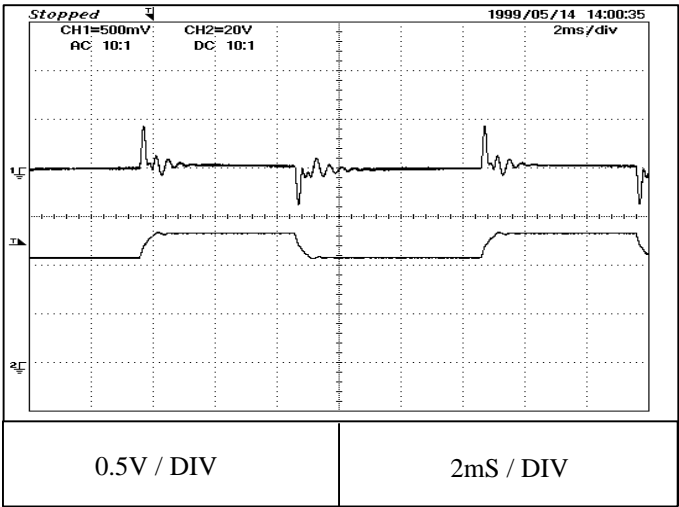
← Vout
← Vin

12 V



← Vout
← Vin

24 V

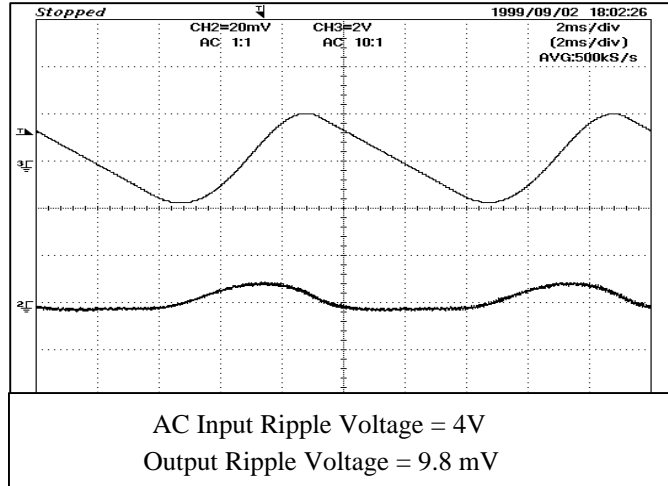


← Vout
← Vin

2-14 AC Input Response

Condition : $V_{in} = 48 \text{ VDC}$
 $I_{out} = 100\%$
 $T_p = 25^\circ\text{C}$

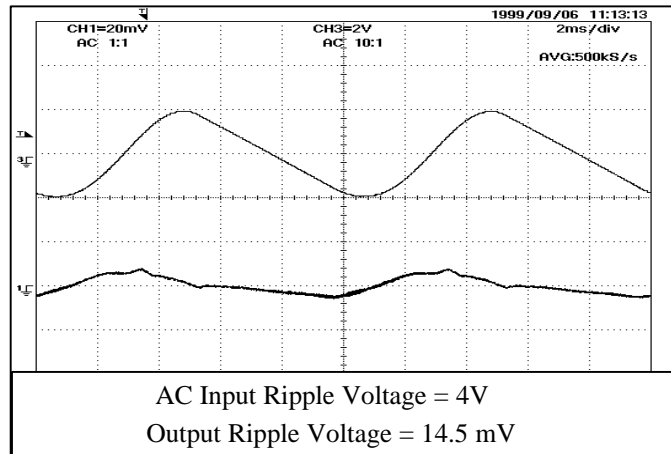
5V



Input Waveform

Output Waveform

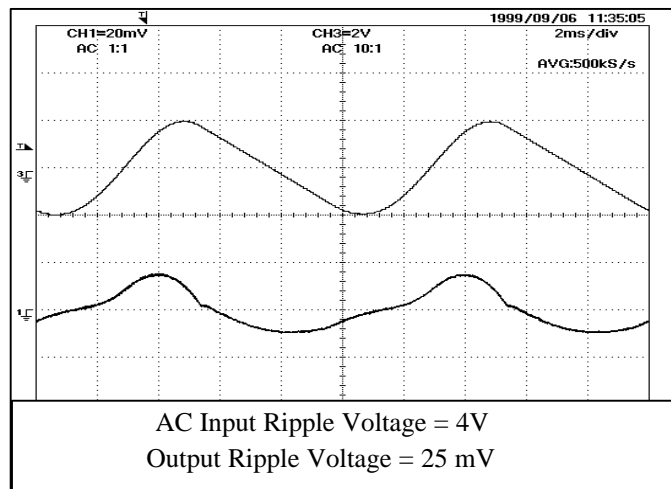
12V



Input Waveform

Output Waveform

24V



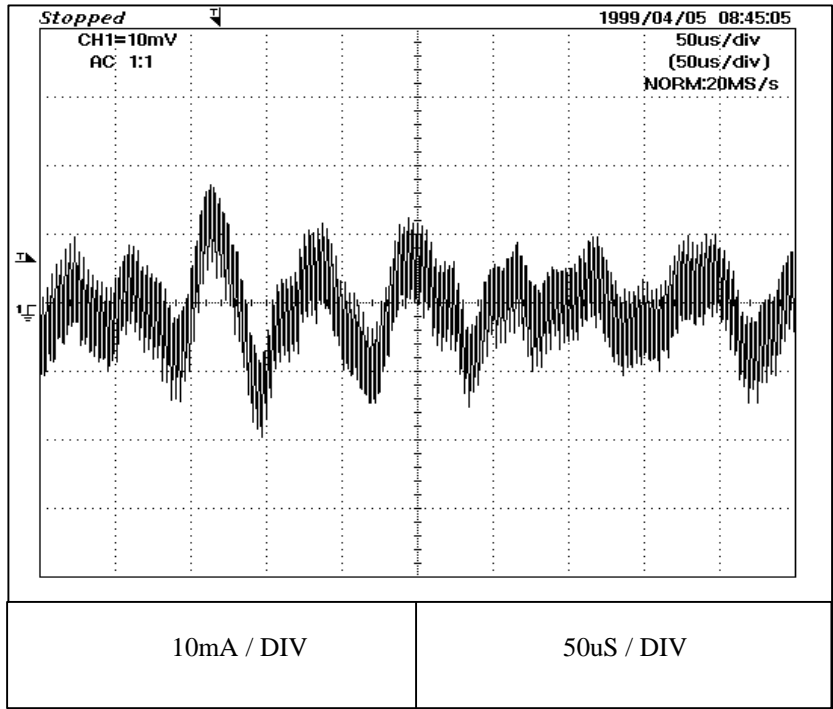
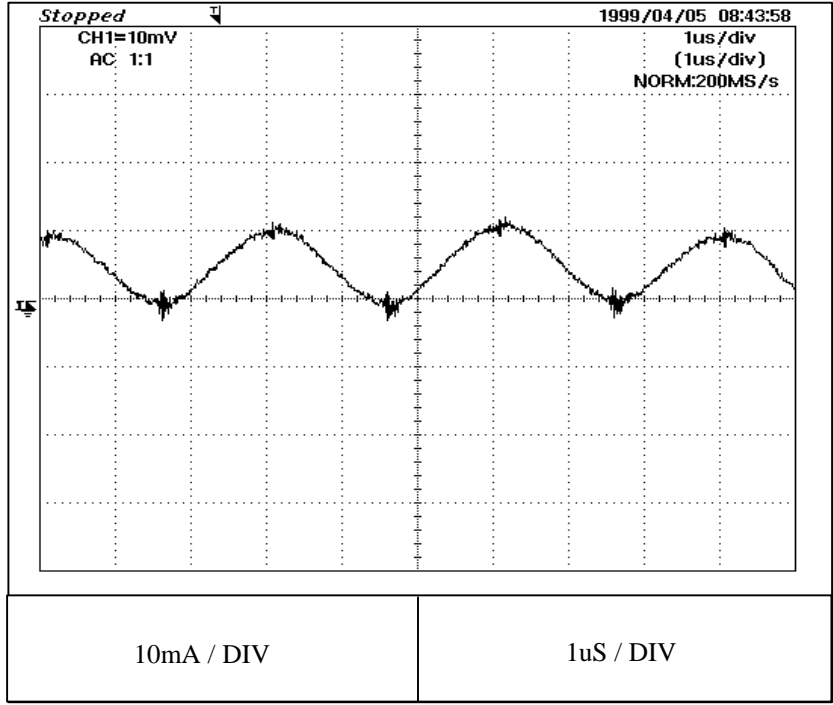
Input Waveform

Output Waveform

2-15 INPUT REFLECTED CURRENT

Condition : $V_{in} = 48 \text{ VDC}$
 $I_{out} = 100\%$
 $T_p = 25^\circ\text{C}$

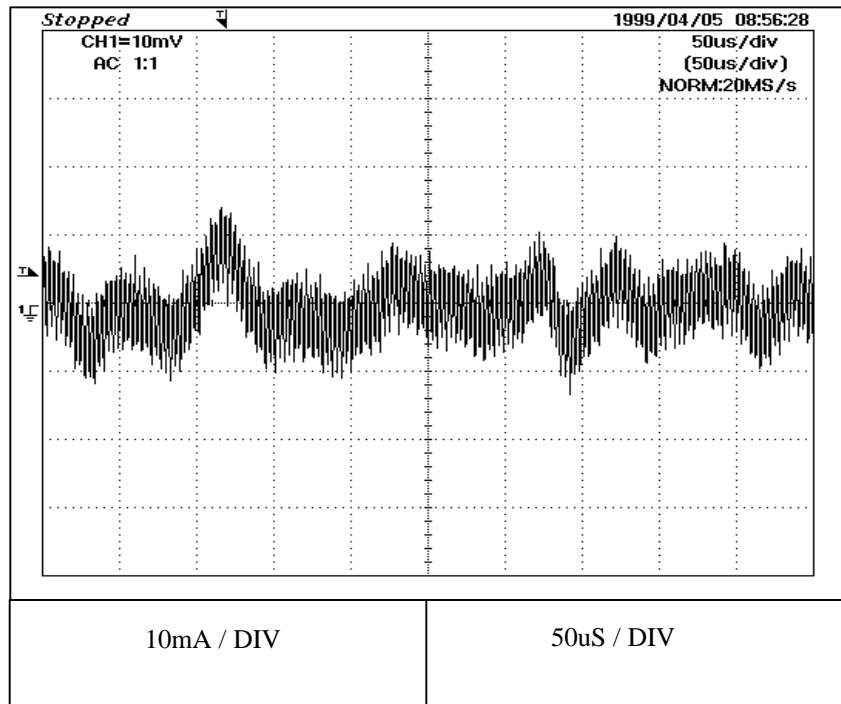
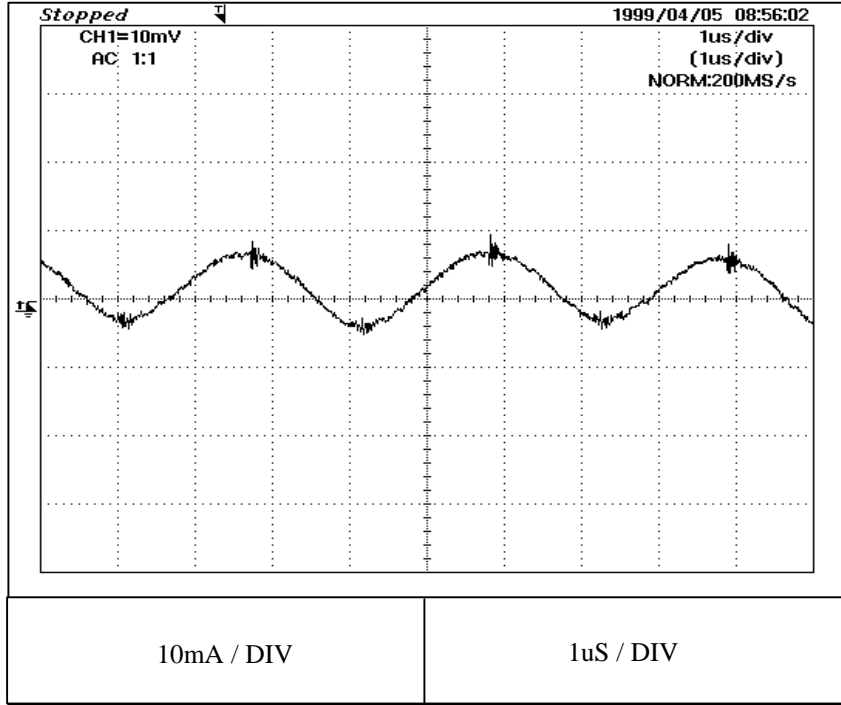
5 V



2-15 INPUT REFLECTED CURRENT

Condition : $V_{in} = 48 \text{ VDC}$
 $I_{out} = 100\%$
 $T_p = 25^\circ\text{C}$

12 V



2-15 INPUT REFLECTED CURRENT

Condition Vin = 48 VDC
Iout = 100%
Tp = 25°C

24 V

