PAH200S48-*

QUALITY TEST DATA

POWER MODULE

DRAWING NO. : PA554-53-01			
DLJ QA	NLS R&D		
APPROVED	PREPARED	CHECKED	APPROVED
	24/7/2000	24/7/00	24/7/00
DATE : 4/Sep/00	DATE ISSUE : 24 July 00		

NEMIC-LAMBDA (S) PTE LTD

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PAH200S48-*

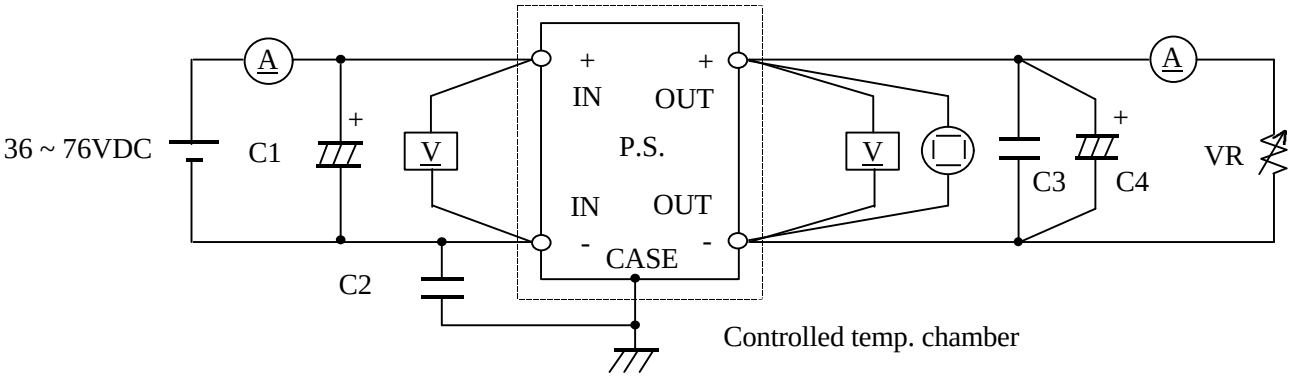
Terminology used

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



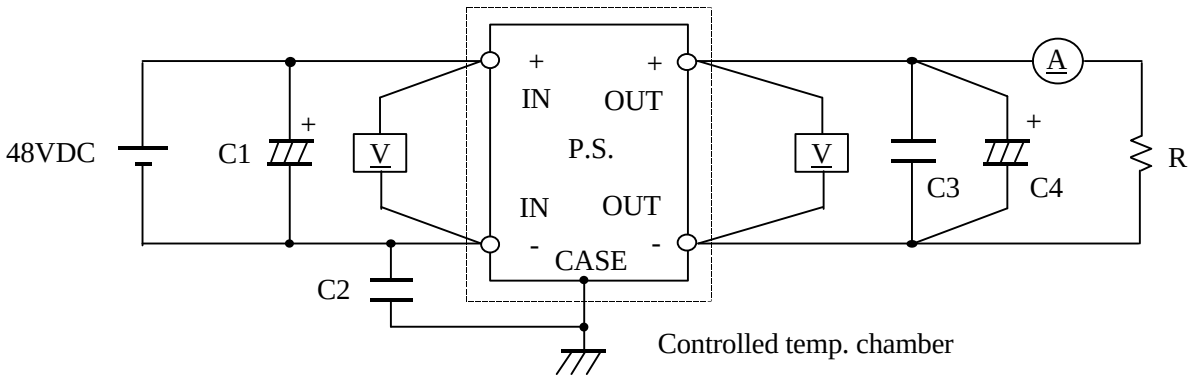
(i) Tp = -20°C ~ 100°C

C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1µF Ceramic Capacitor
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

(ii) Tp = -40°C ~ 100°C

C1 : 33µF Ceramic Capacitor or equivalent capacitor such as 100V 6.8µF x 5 pcs
C4 : 2 pieces of the above recommended value

(2) Warm up voltage drift characteristics

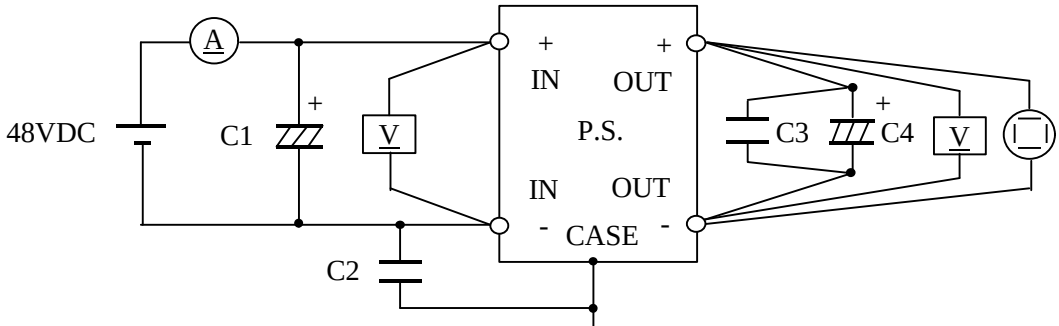


C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1µF Ceramic Capacitor
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

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

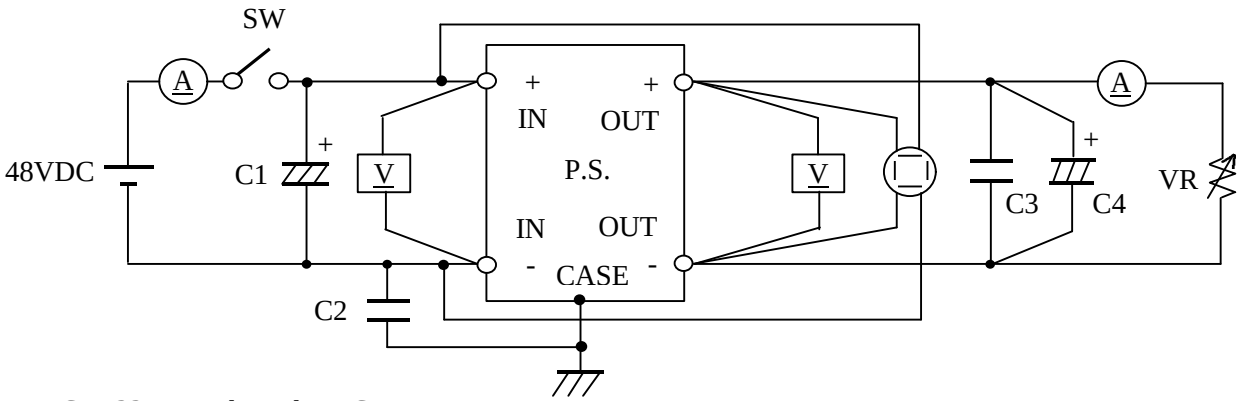
Same as steady state data

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



C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1uF Ceramic Capacitor
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

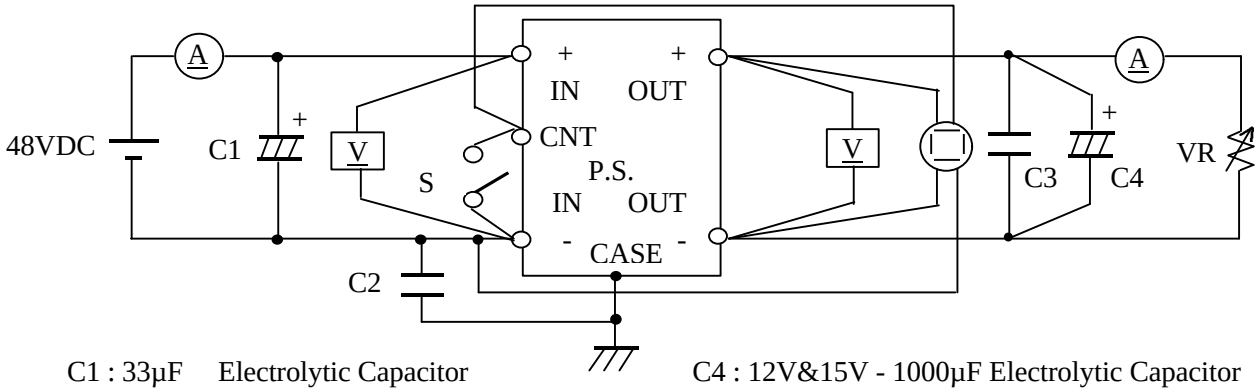
(5) Output rise characteristics



C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1µF Ceramic Capacitor
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

(6) Output fall characteristics
Same as Output rise characteristics

(7) Output rise characteristics with on/off control

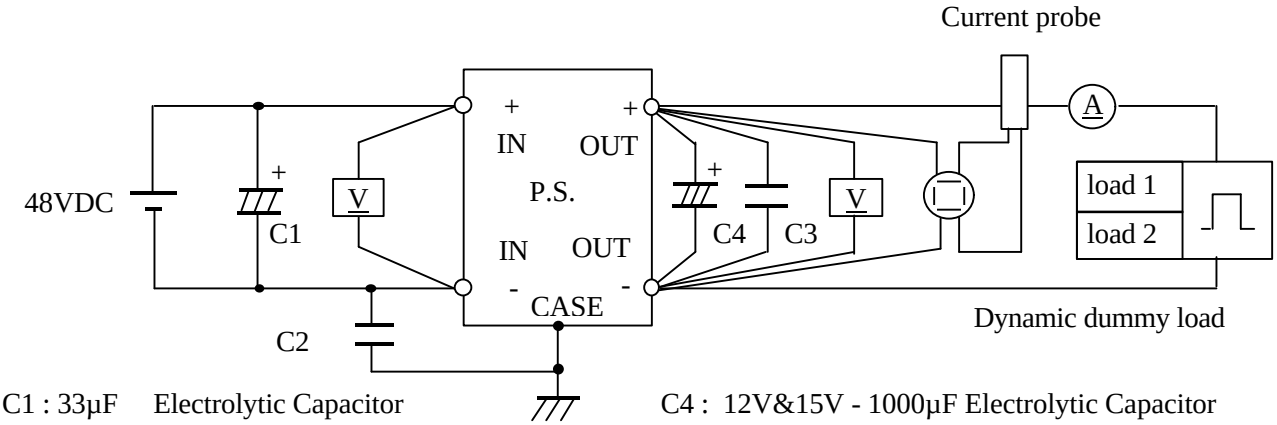


C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1µF Ceramic Capacitor
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

(8) Output fall characteristics with on/off control

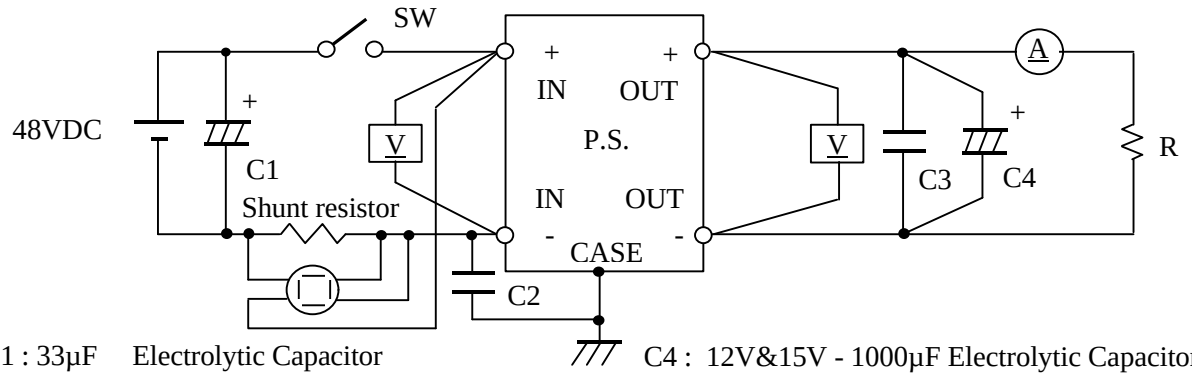
Same as Output rise characteristics with on/off control

(9) Dynamic load response characteristics



C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1µF Ceramic Capacitor
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

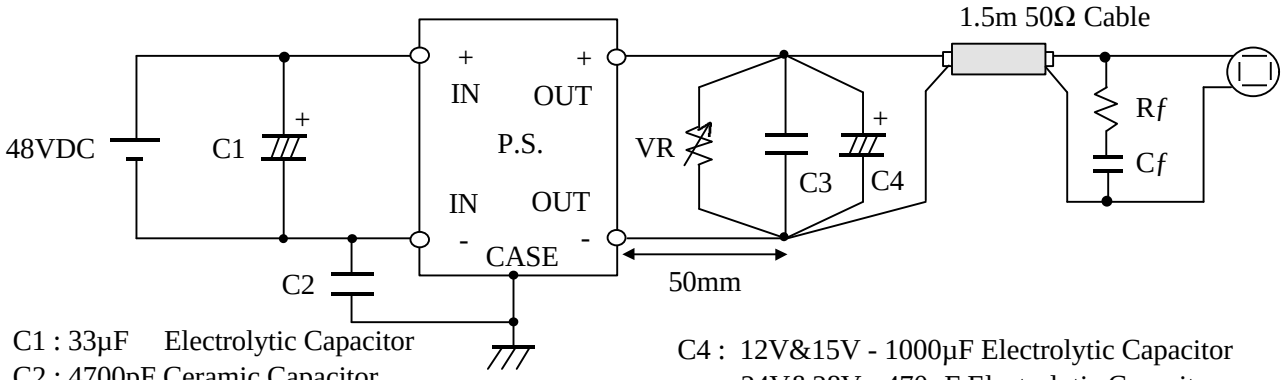
(10) Inrush current waveform



C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1µF Ceramic Capacitor
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

(11) Output-ripple , noise waveform

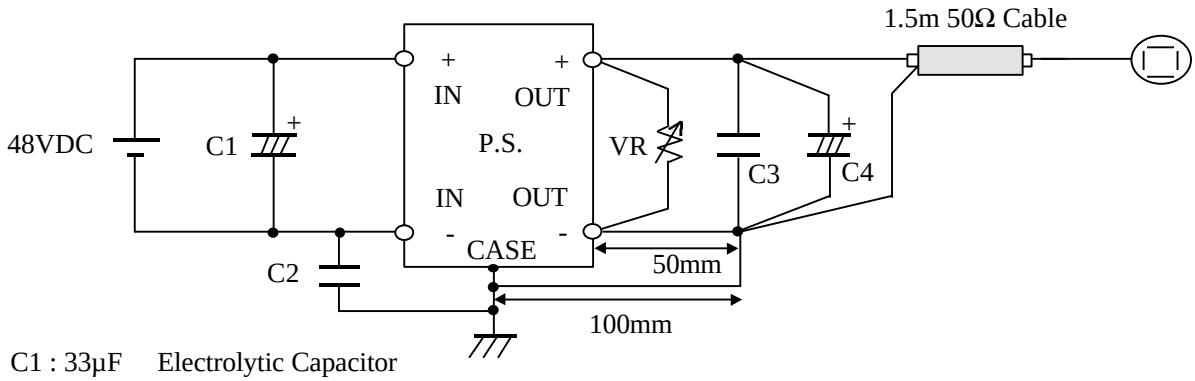
NORMAL MODE (EIAJ Standard RC-9002A)



C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1µF Ceramic Capacitor
Rƒ : 50Ω
Cƒ : 4700pF
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

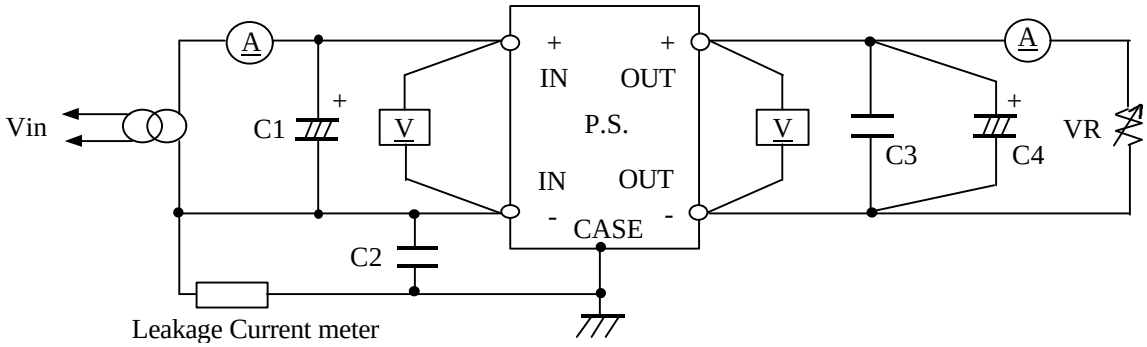
(11) Output-ripple , noise waveform

NORMAL + COMMON MODE



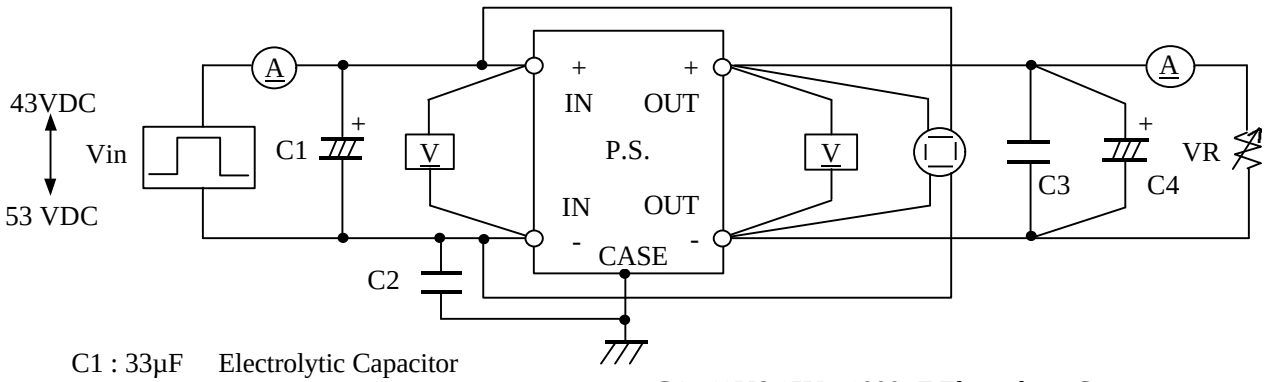
C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1µF Ceramic Capacitor
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

(12) Leakage current characteristics



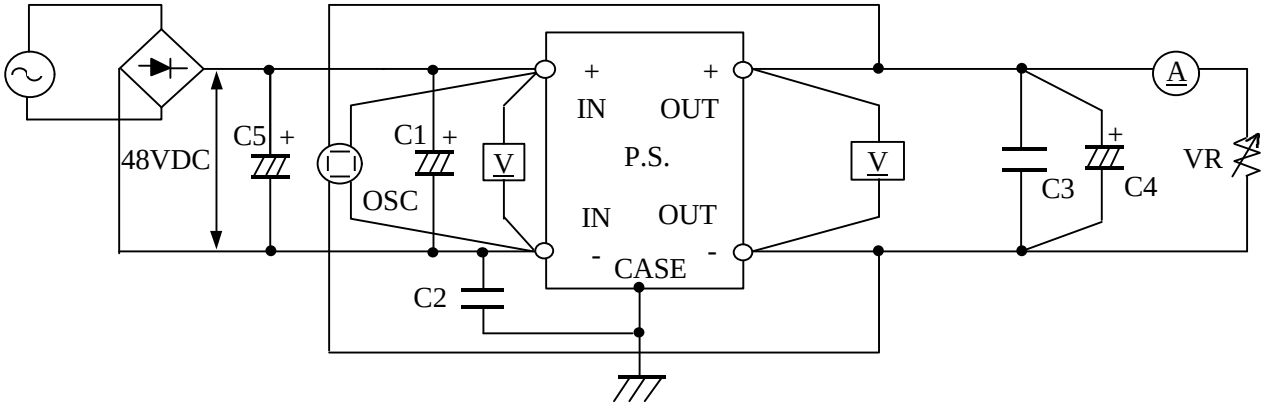
C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1µF Ceramic Capacitor
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

(13) Dynamic line characteristics



C1 : 33µF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 : 1µF Ceramic Capacitor
C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

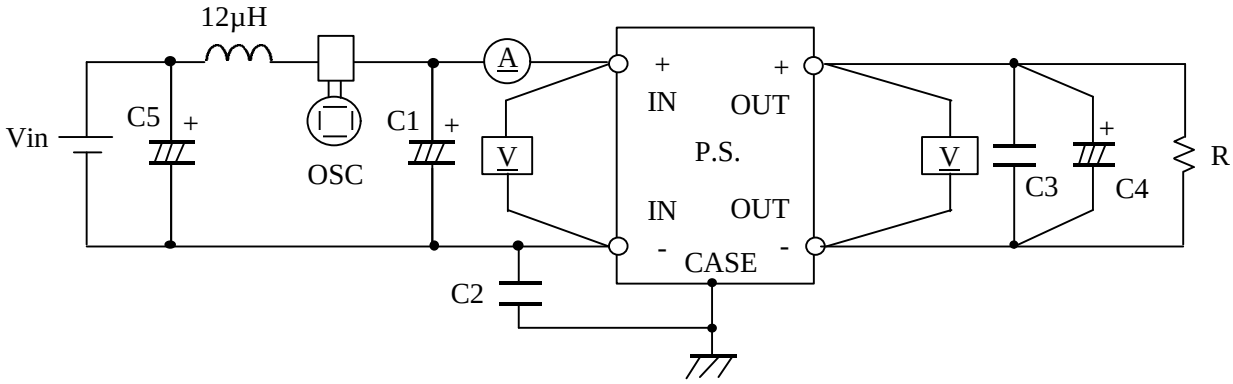
(14) AC input response characteristics



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

C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF Electrolytic Capacitor

(15) Input Reflected current characteristics



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

C4 : 12V&15V - 1000µF Electrolytic Capacitor
24V&28V - 470µF 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	44/11Ω
9	Variable resistive load	MATSUNAGA	2.4/0.6Ω
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

12 V

Regulation - Line and Load Tp = 25°C

Iout \ Vin	36 VDC	48 VDC	76 VDC	Line Regulation (mV)	
0%	12.0530	12.0540	12.0540	1.0	0.008%
50%	12.0510	12.0520	12.0520	1.0	0.008%
100%	12.0500	12.0500	12.0510	1.0	0.008%
Load Regulation (mV)	3.0	4.0	3.0		
	0.025%	0.033%	0.025%		

Temperature Drift Vin = 48VDC
Iout = 100%

Tp	-40°C	25°C	100°C	Temp. Stability	
Vout	12.030V	12.050 V	11.950 V	0.08	0.66%

24 V

Regulation - Line and Load Tp = 25°C

Iout \ Vin	36 VDC	48 VDC	76 VDC	Line Regulation (mV)	
0%	24.01	24.003	24.009	7.0	0.029%
50%	24.004	24.004	23.995	9.0	0.037%
100%	23.987	23.997	23.994	10.0	0.042%
Load Regulation (mV)	23.0	7.0	15.0		
	0.096%	0.029%	0.062%		

Temperature Drift Vin = 48VDC
Iout = 100%

Tp	-40°C	25°C	100°C	Temp. Stability	
Vout	23.977 V	23.997 V	23.879 V	0.098 V	0.41%

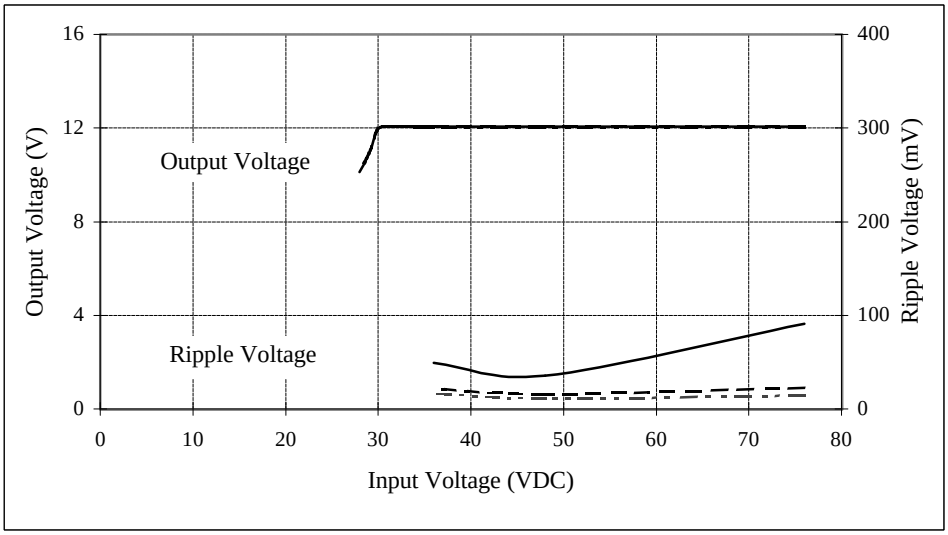
2. CHARACTERISTICS

2-1 Steady State Data

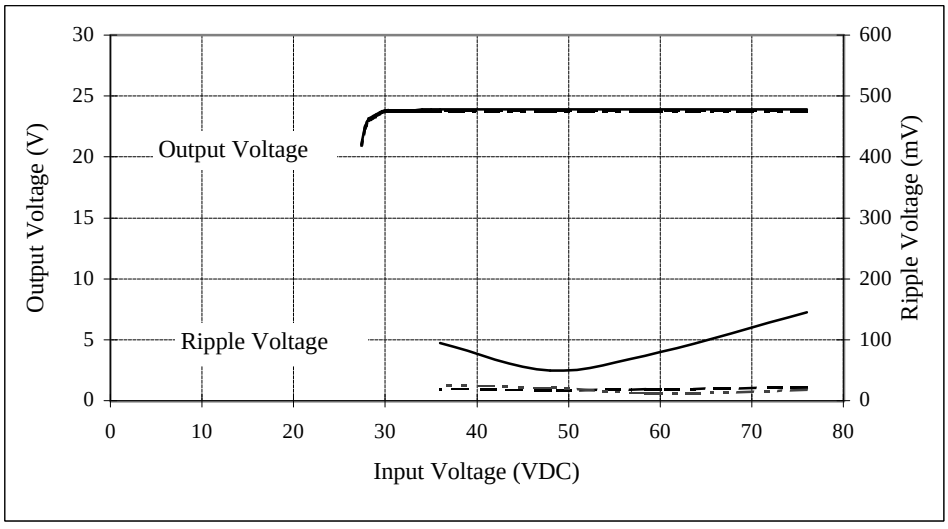
(2) Output Voltage And Ripple Voltage V.S. Input Voltage

Condition : Iout = 100%
Tp = -40°C
Tp = 25°C
Tp = 100°C

12 V



24 V



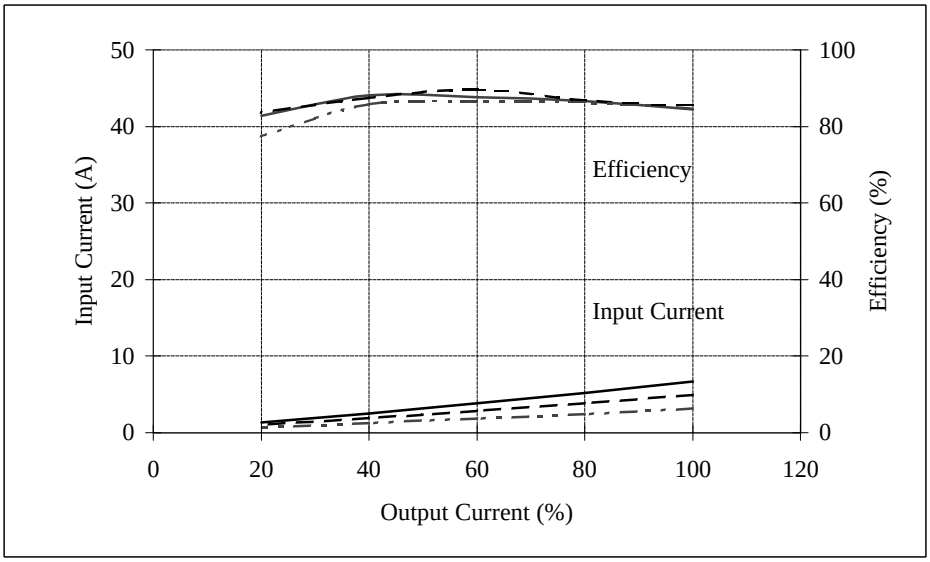
2. CHARACTERISTICS

2-1 Steady State Data

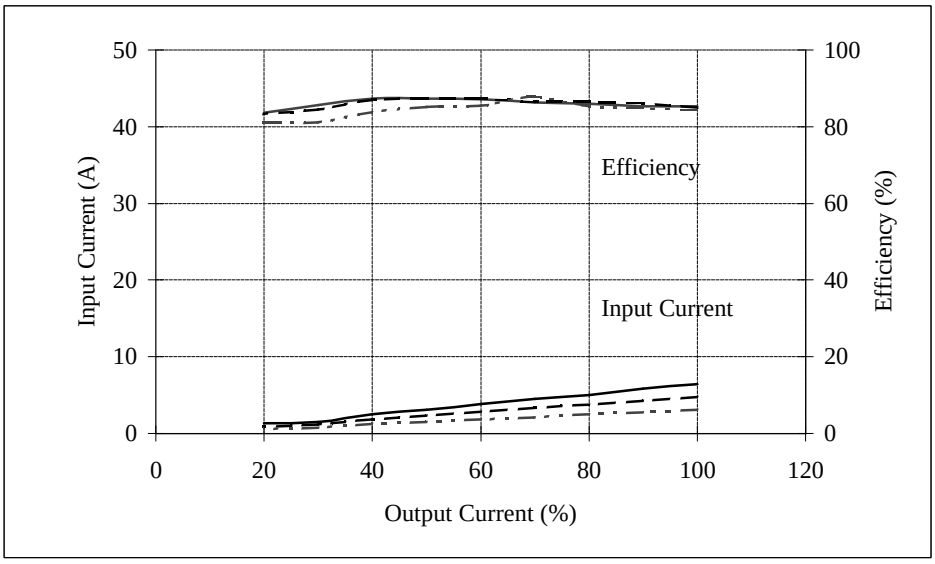
(3) Efficiency And Input Current V.S. Output Current

Condition : Vin = 36 VDC ———
= 48VDC – – – –
= 76VDC –·–·–
Tp = 25°C

12 V



24 V



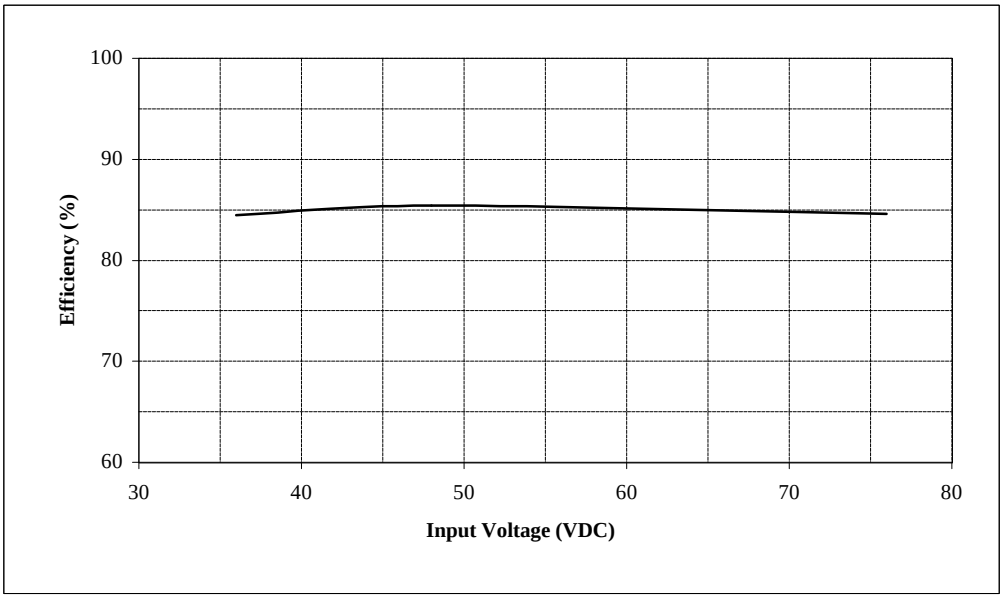
2. CHARACTERISTICS

2-1 Steady State Data

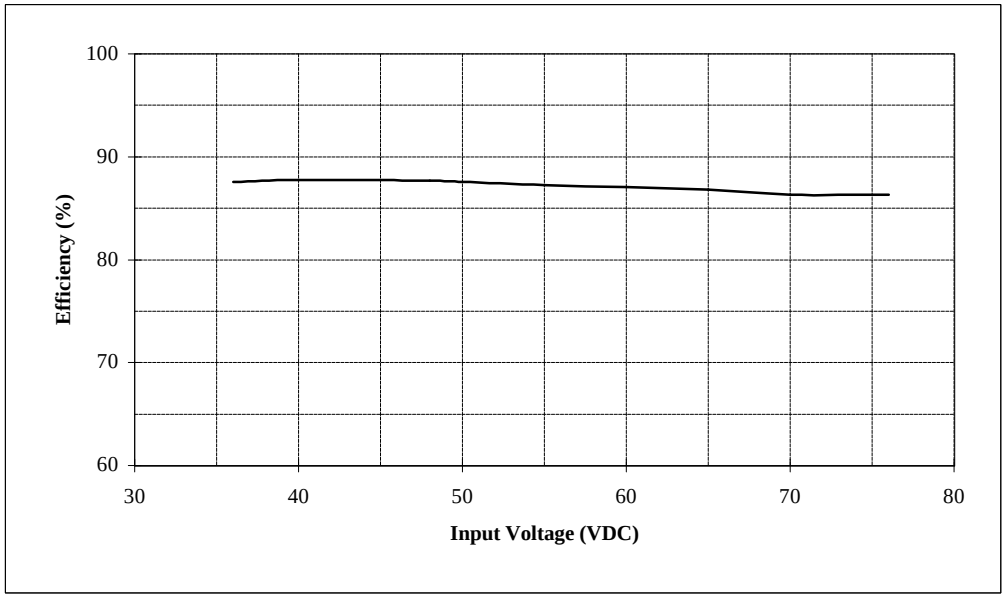
(4) Efficiency v.s. Input Voltage

Condition : Iout = 100%
Tp = 25°C

12 V



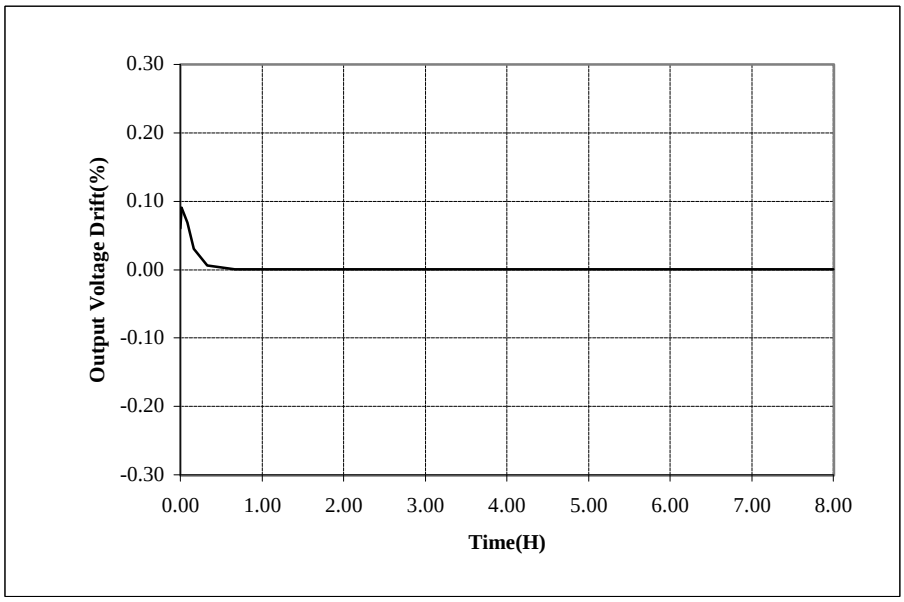
24 V



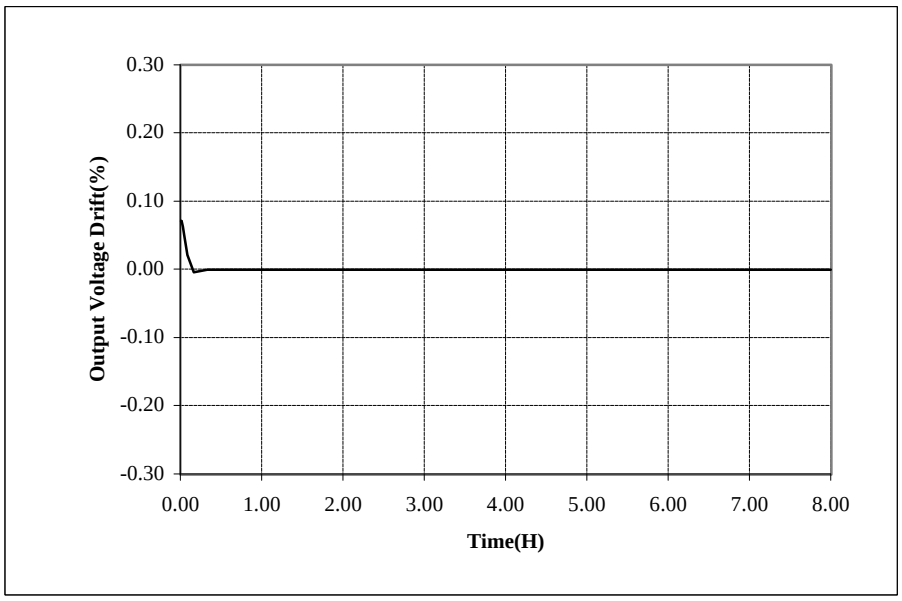
2-2 Warm Up Voltage Drift Characteristics

Condition : Vin = 48 V DC
Iout = 100 %
Tp = 25°C

12 V



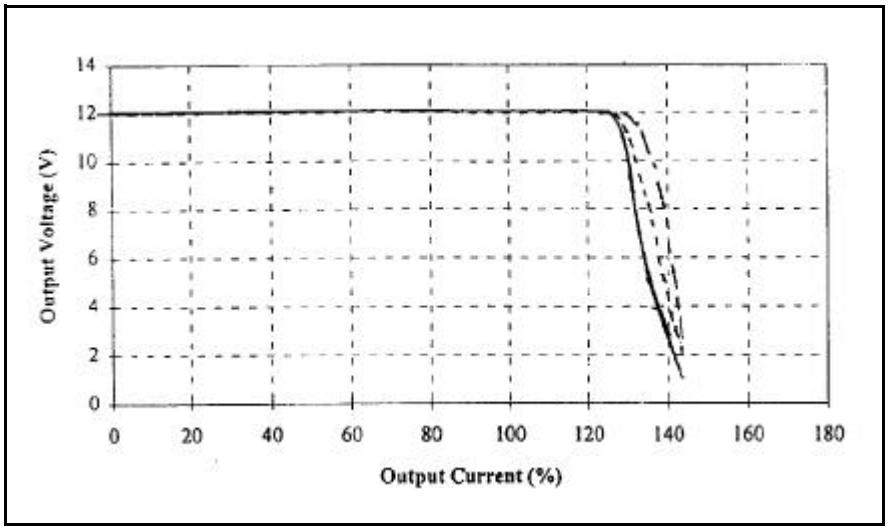
24 V



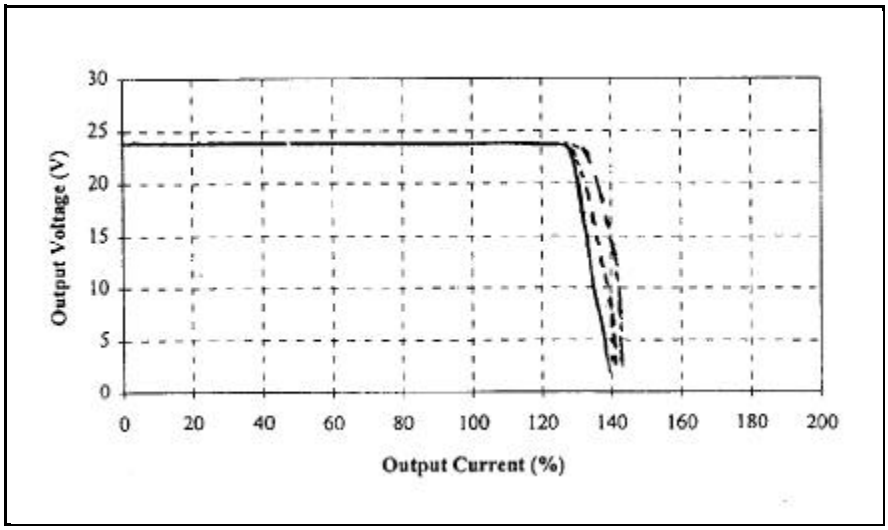
2-3 O.C.P. Charateristics

Condition : Vin = 36 VDC ————
Vin = 48 VDC ---------
Vin = 76 VDC —·—·—·—·-
Tp = 25°C

12 V



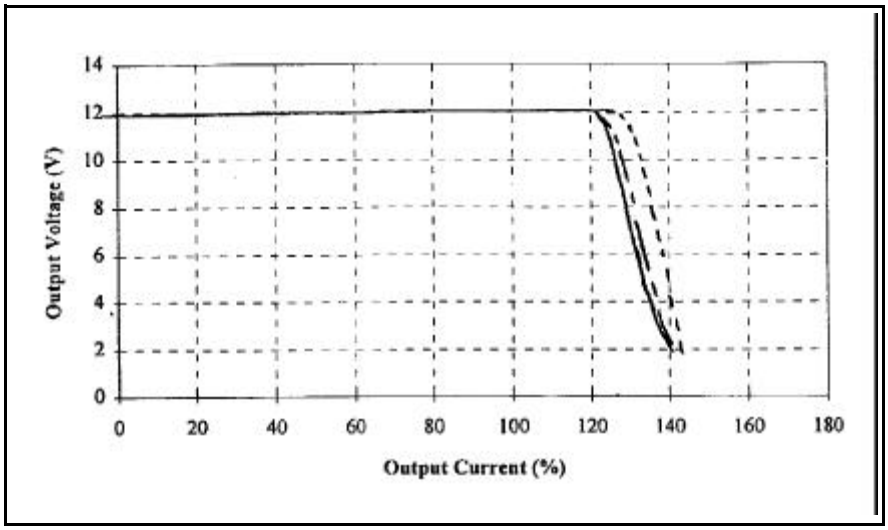
24V



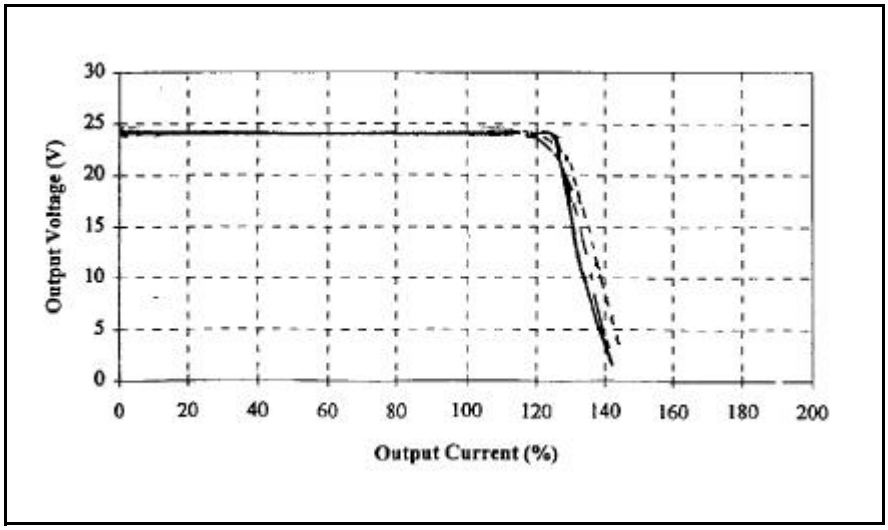
O.C.P. Charateristics

Condition : Tp = -40°C ————
Tp = 25°C - - - - - - - - -
Tp = 100°C —·—·—·—·—
Vin = 48 VDC

12V



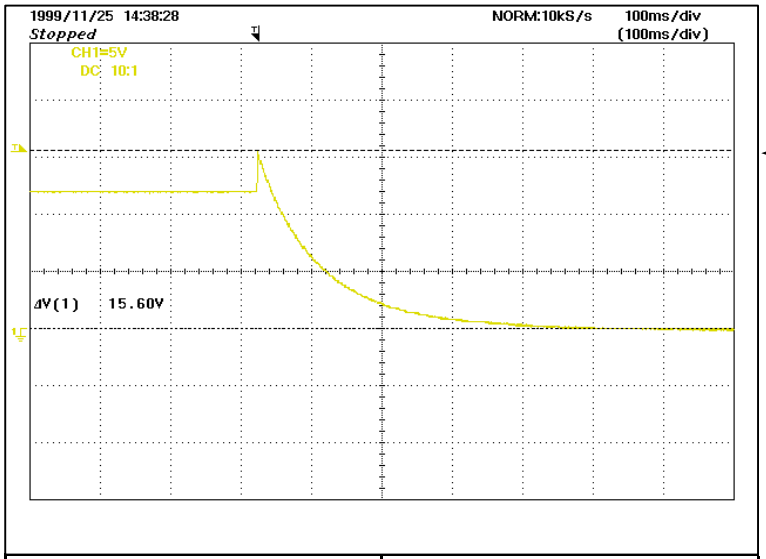
24V



2-4 O.V.P. Characteristics

Condition : Vin = 48 V DC
Iout = 0 %
Tp = 25°C

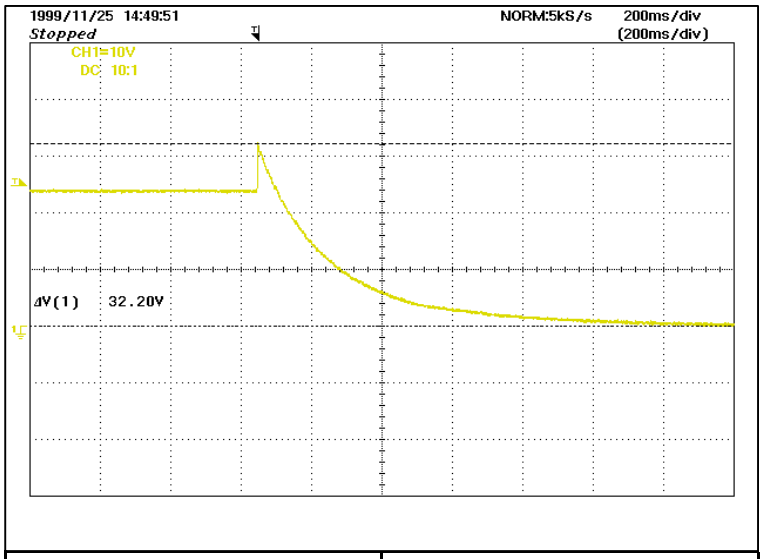
12 V



OVP
Trip Point

5V/DIV	100ms/DIV

24 V



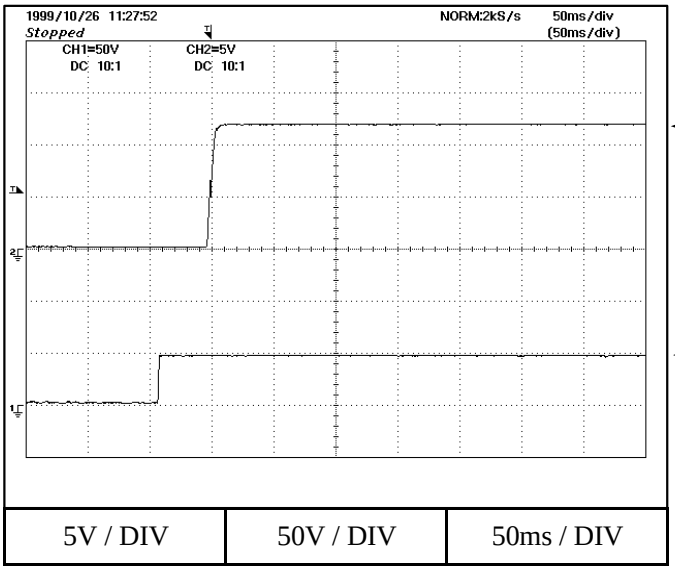
OVP
Trip Point

10V/DIV	200ms/DIV

2-5 Output Rise Characteristics

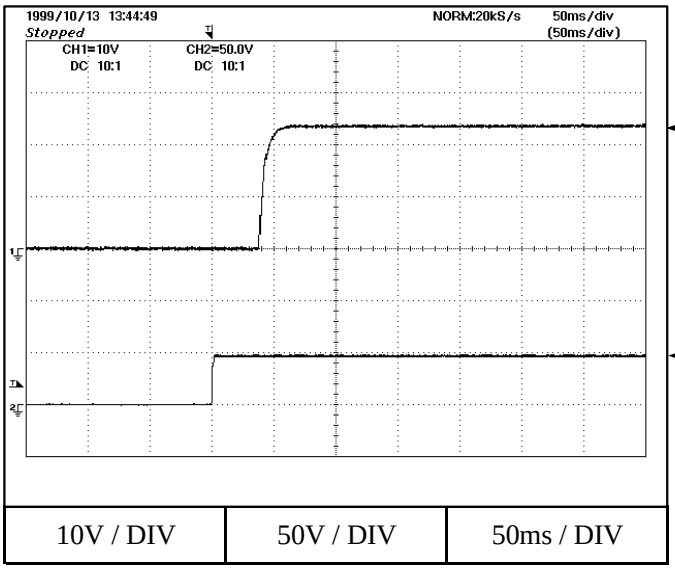
Condition : Vin = 48 V DC
Iout = 0 %
Tp = 25°C

12 V



5V / DIV	50V / DIV	50ms / DIV

24 V

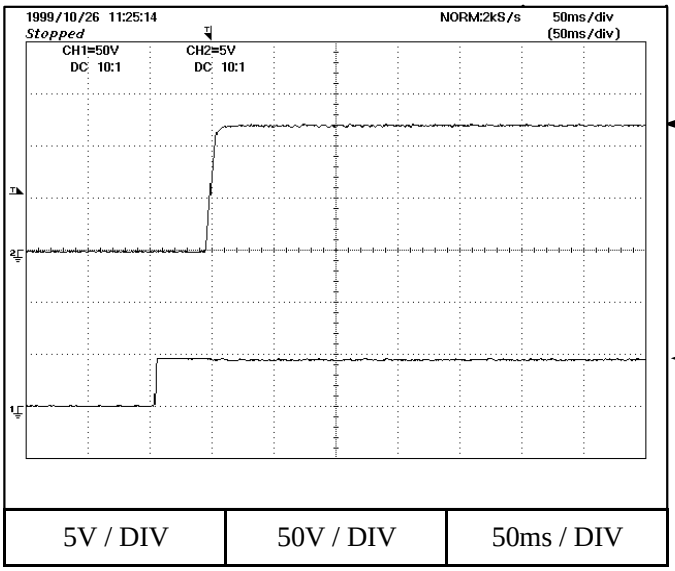


10V / DIV	50V / DIV	50ms / DIV

Output Rise Characteristics

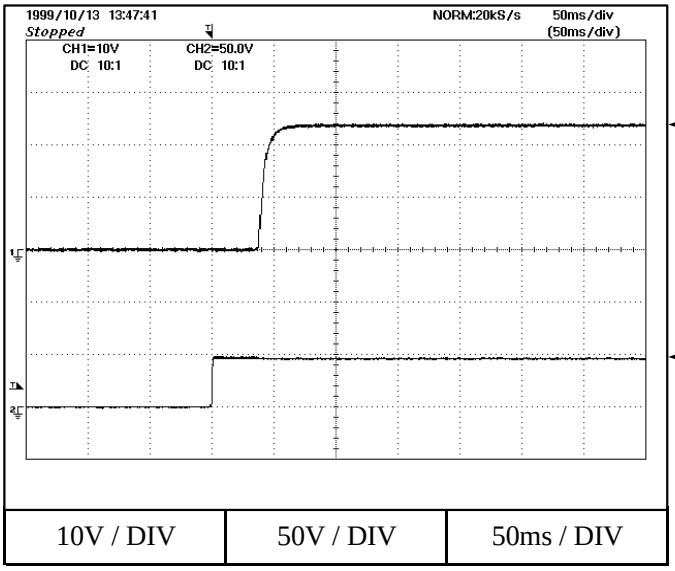
Condition : Vin = 48 V DC
Iout = 100 %
Tp = 25°C

12 V



5V / DIV	50V / DIV	50ms / DIV

24 V

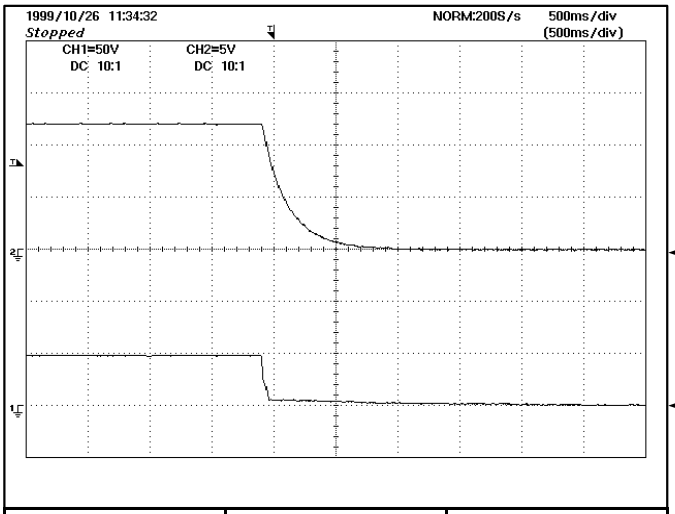


10V / DIV	50V / DIV	50ms / DIV

2-6 Output Fall Characteristics

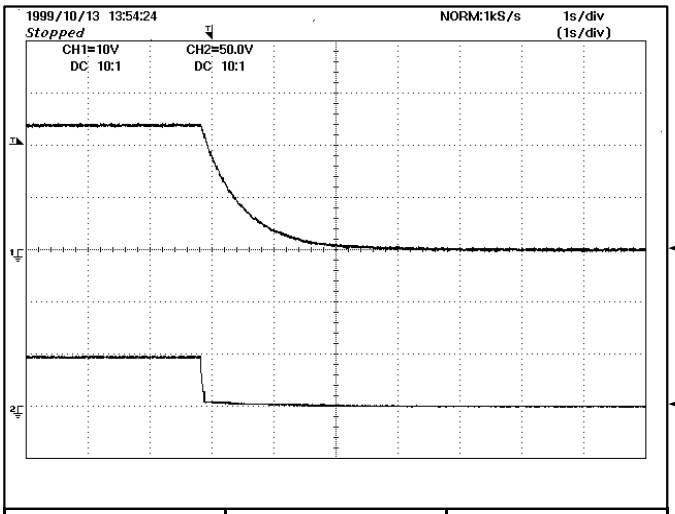
Condition : Vin = 48 V DC
Iout = 0 %
Tp = 25°C

12 V



5V / DIV	50V / DIV	500ms / DIV

24 V

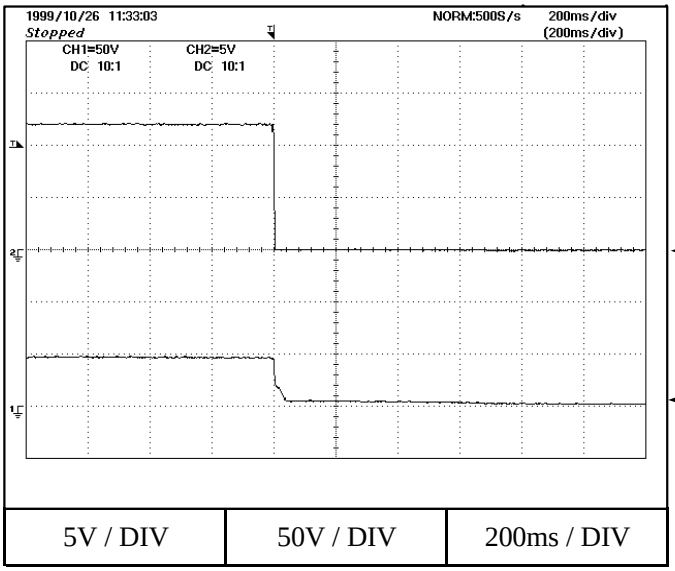


10V / DIV	50V / DIV	1s / DIV

Output Fall Characteristics

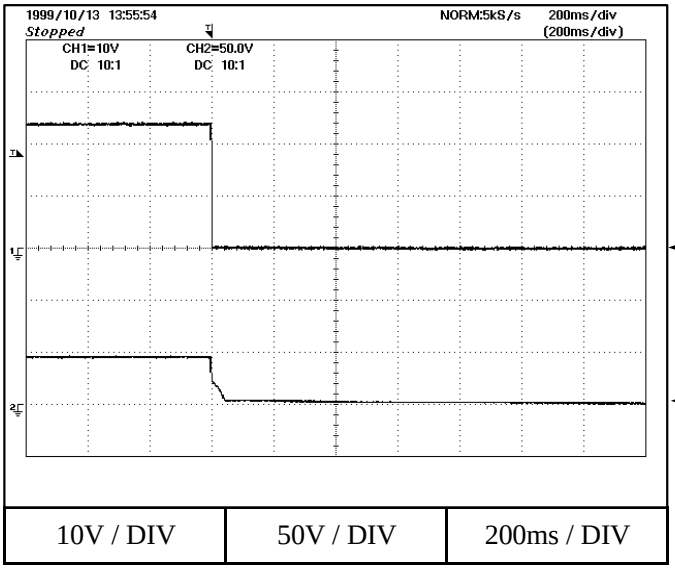
Condition : Vin = 48 V DC
Iout = 100 %
Tp = 25°C

12 V



5V / DIV	50V / DIV	200ms / DIV

24 V



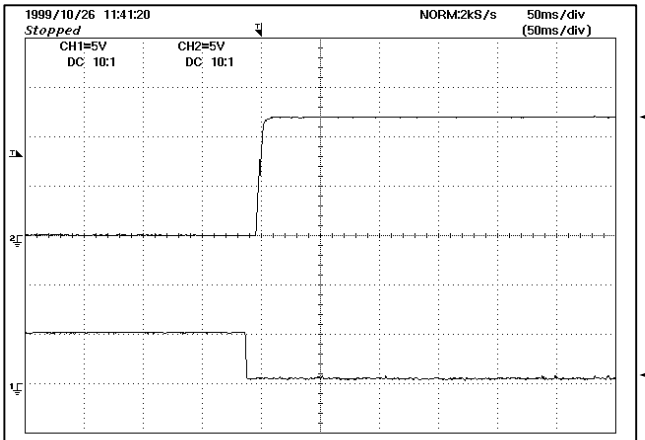
10V / DIV	50V / DIV	200ms / DIV

2-7 Output Rise With On/Off Characteristics

(Negative logic)

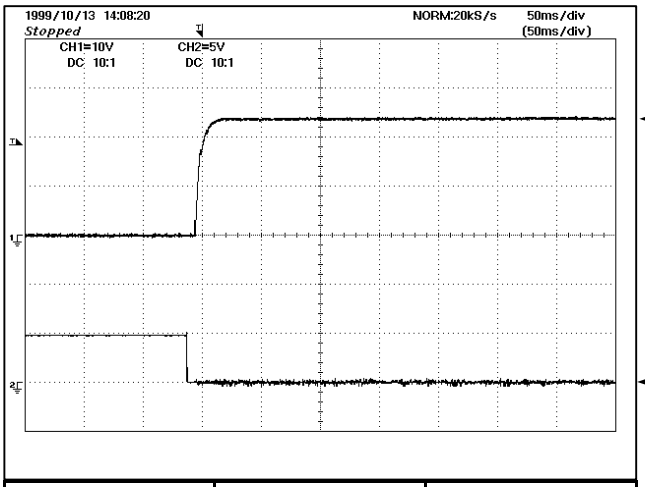
Condition : Vin = 48 V DC
Iout = 0 %
Tp = 25°C

12 V



5V / DIV	5V / DIV	50ms / DIV

24 V



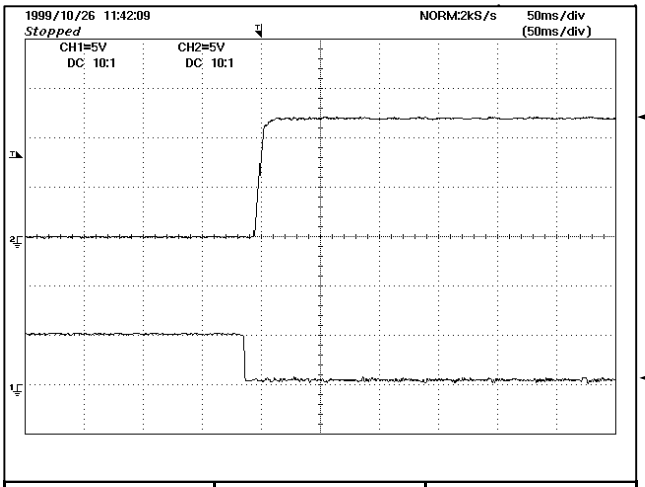
10V / DIV	5V / DIV	50ms / DIV

Output Rise With On/Off Characteristics

(Negative logic)

Condition : Vin = 48 V DC
Iout = 100 %
Tp = 25°C

12 V

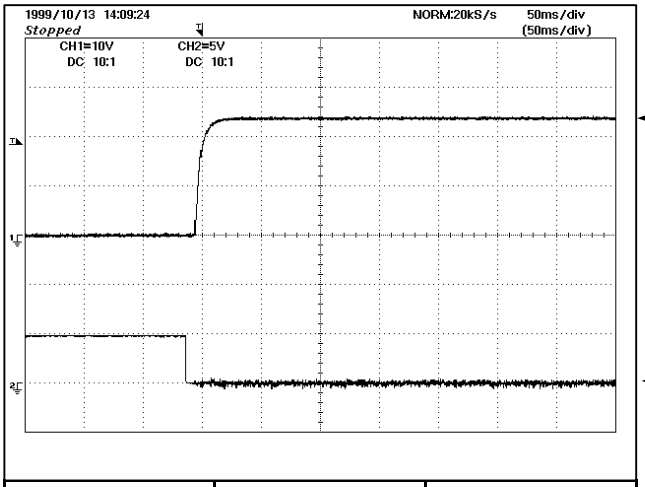


Vout

On/Off Control

5V / DIV	5V / DIV	50ms / DIV

24 V



Vout

On/Off Control

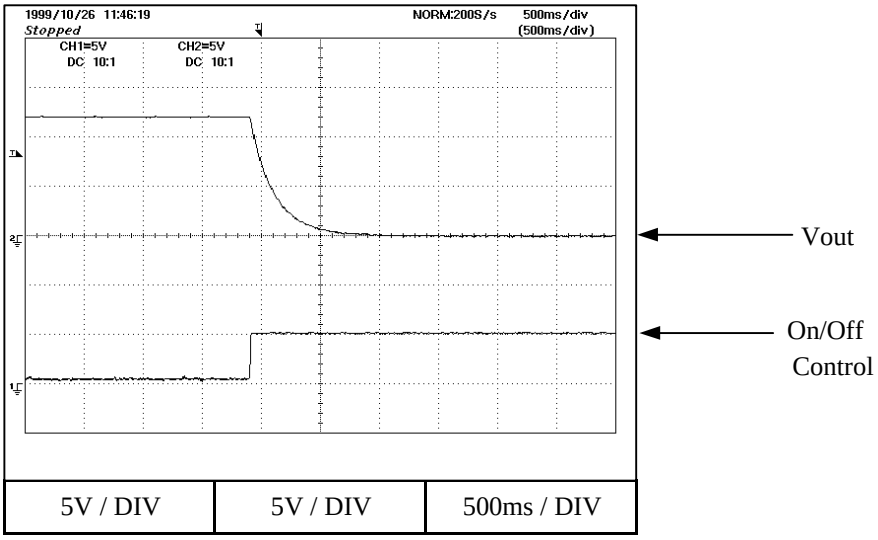
10V / DIV	5V / DIV	50ms / DIV

2-8 Output Fall With On/Off Characteristics

(Negative logic)

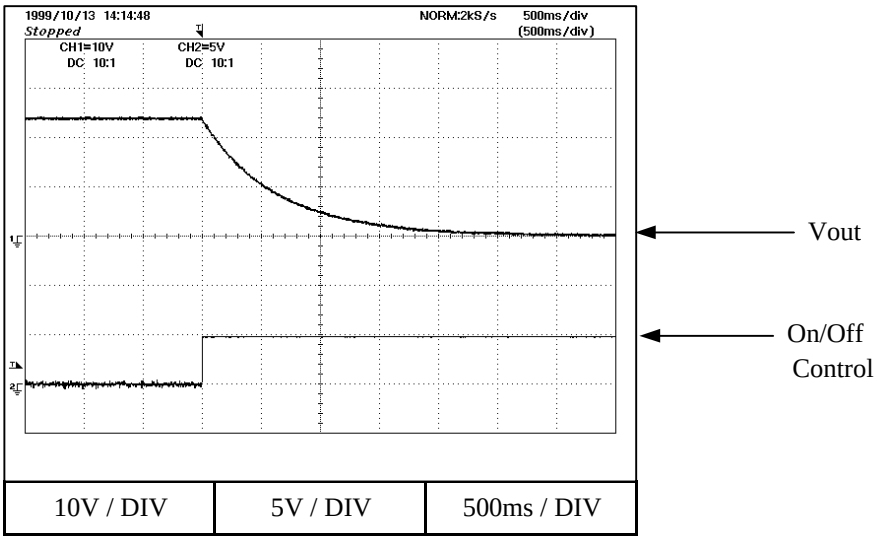
Condition : Vin = 48 V DC
Iout = 0 %
Tp = 25°C

12 V



5V / DIV	5V / DIV	500ms / DIV

24 V



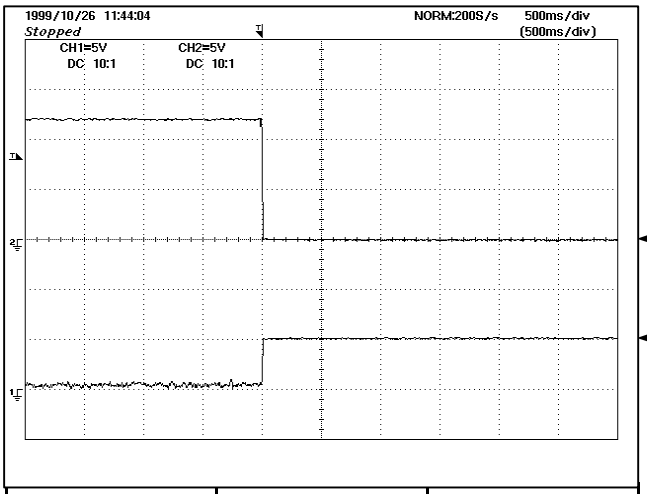
10V / DIV	5V / DIV	500ms / DIV

Output Fall With On/Off Characteristics

(Negative logic)

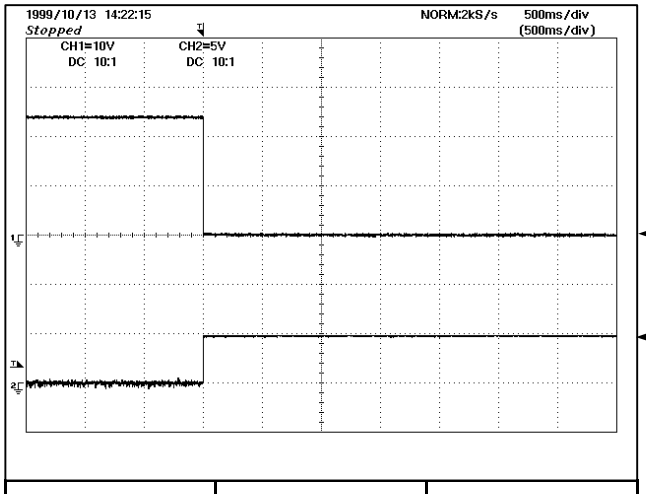
Condition : Vin = 48 V DC
Iout = 100 %
Tp = 25°C

12 V



5V / DIV	5V / DIV	500ms / DIV

24 V

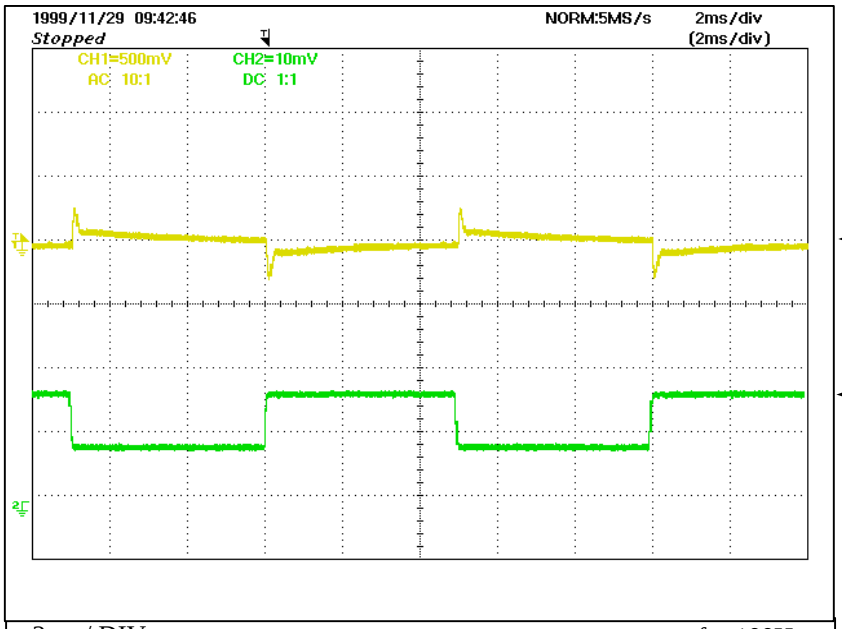


10V / DIV	5V / DIV	500ms / DIV

2-9 Dynamic Load Response Characteristics

Condition : Vin = 48 VDC
Tp = 25°C

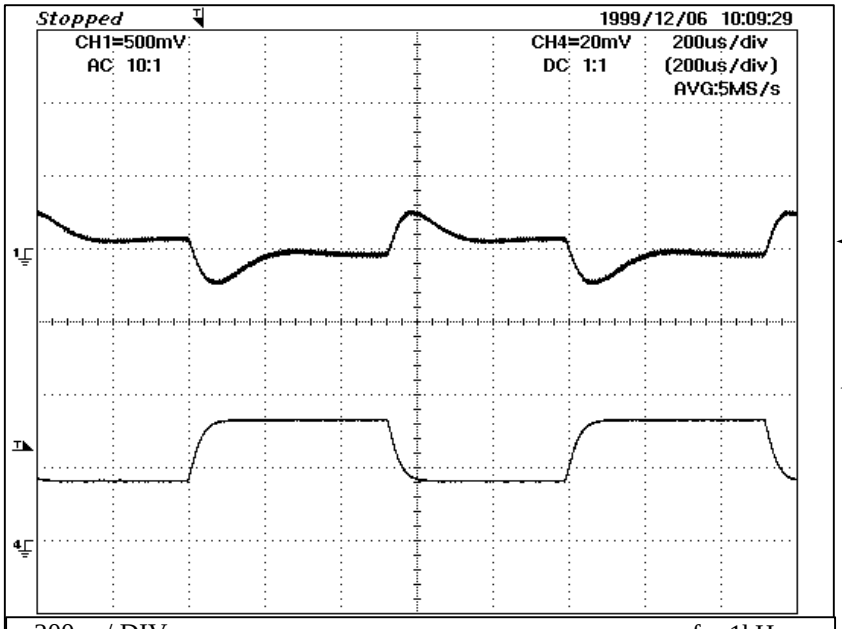
12 V



Vout

Iout

2ms / DIV	f = 100Hz
Iout (10A / DIV)	Vout (0.5V / DIV)
50% Tr = 75us / Tf = 75us 100%	+2.1 % , -2.5 %



Vout

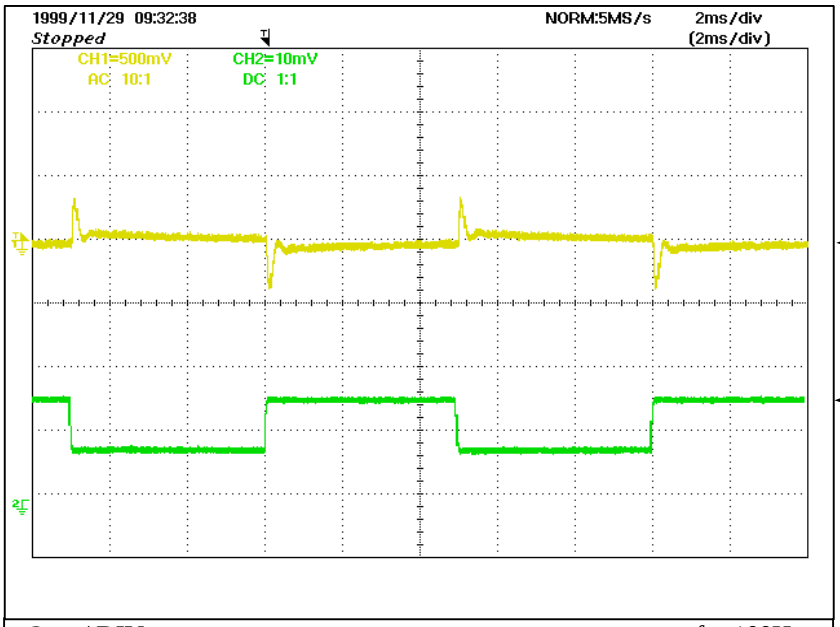
Iout

200us / DIV	f = 1kHz
Iout (10A / DIV)	Vout (0.5V / DIV)
50% Tr = 75us / Tf = 75us 100%	+2.1% , -2.5%

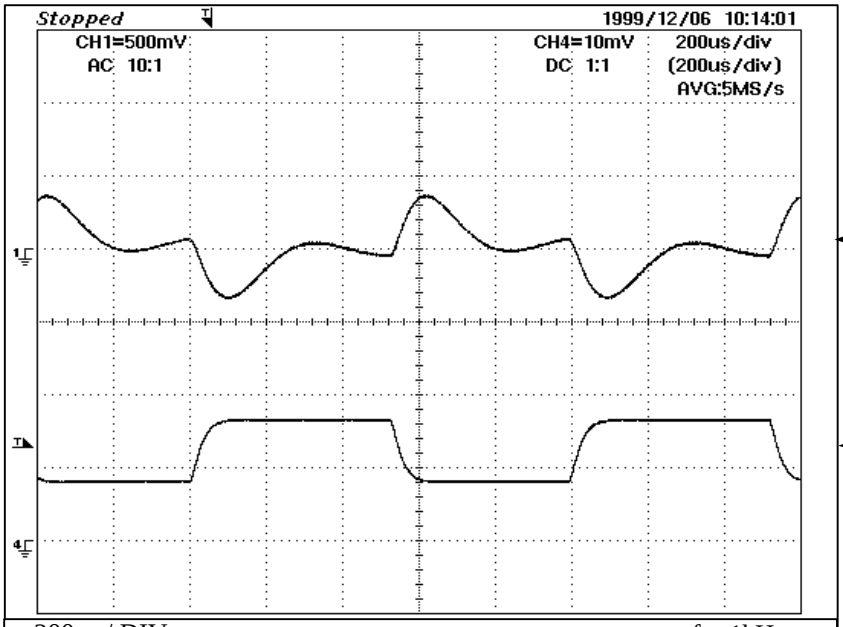
Dynamic Load Response Characteristics

Condition : Vin = 48 VDC
Tp = 25°C

24 V



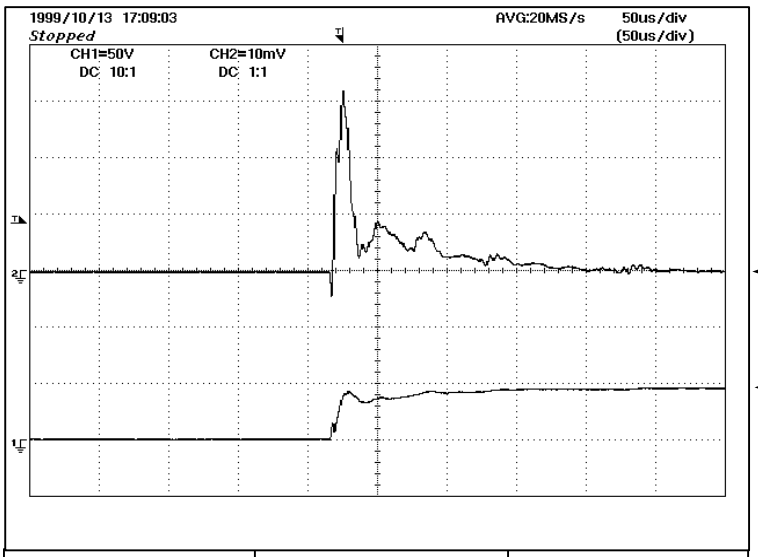
2ms / DIV	f = 100Hz
Iout (5A / DIV)	Vout (0.5V / DIV)
50% ⇄ (Tr = 75us, Tf = 75us) 100%	+1.46 % , -1.60 %



200us / DIV	f = 1kHz
Iout (5A / DIV)	Vout (0.5V / DIV)
50% ⇄ (Tr = 75us, Tf = 75us) 100%	+1.45% , -1.66%

2-10 Inrush Current Waveform

Condition : Vin = 48 V DC
Iout = 100 %
Tp = 25°C



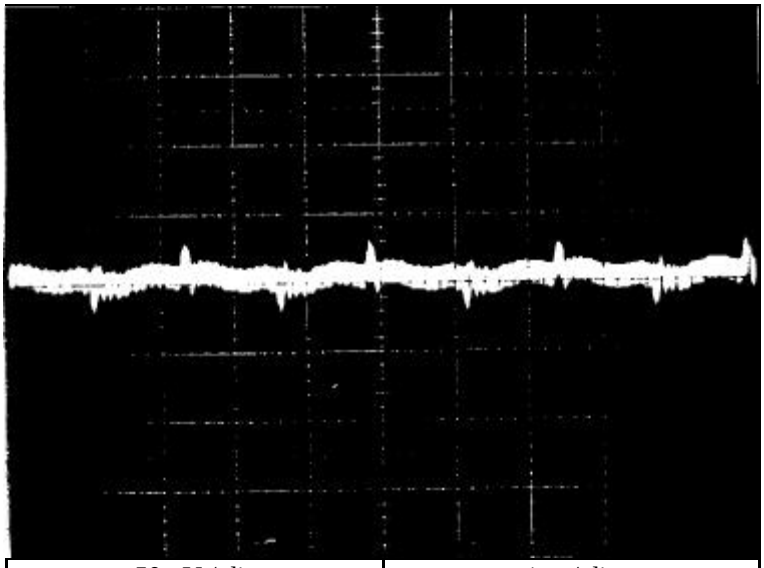
20A / DIV	50V / DIV	50us / DIV

2-11 Output - Ripple & Noise Waveform

Condition : Vin = 48V DC
Iout = 100%
Tp = 25°C

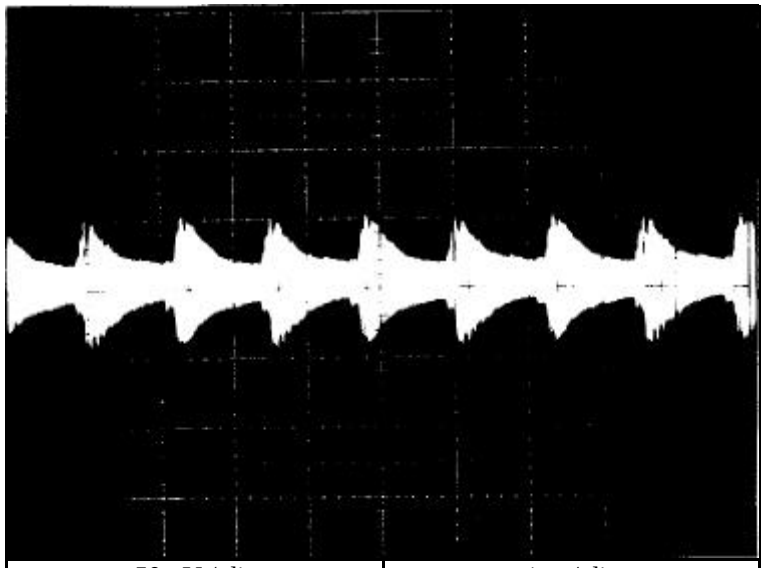
12 V

NORMAL MODE



50mV / div	1µs / div
50 mV (Vp-p)	

NORMAL + COMMON MODE



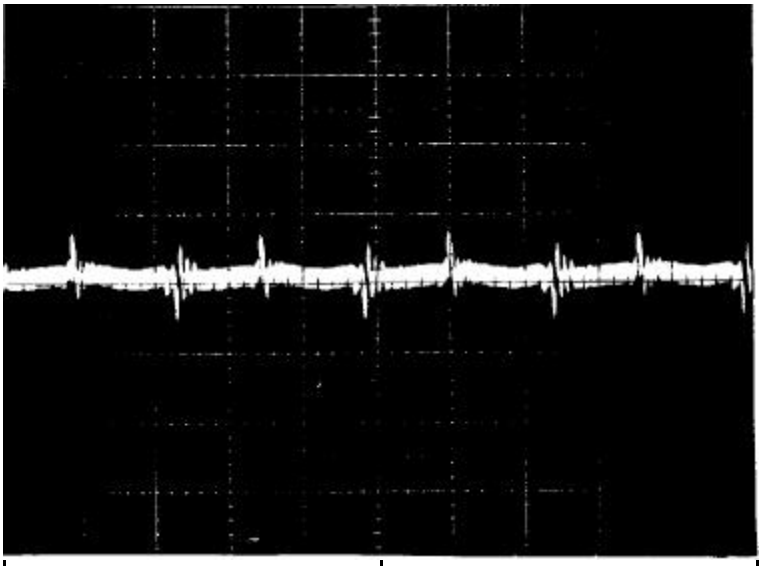
50mV / div	1µs / div
105 mV (Vp-p)	

Output - Ripple & Noise Waveform

Condition : Vin = 48V DC
Iout = 100%
Tp = 25°C

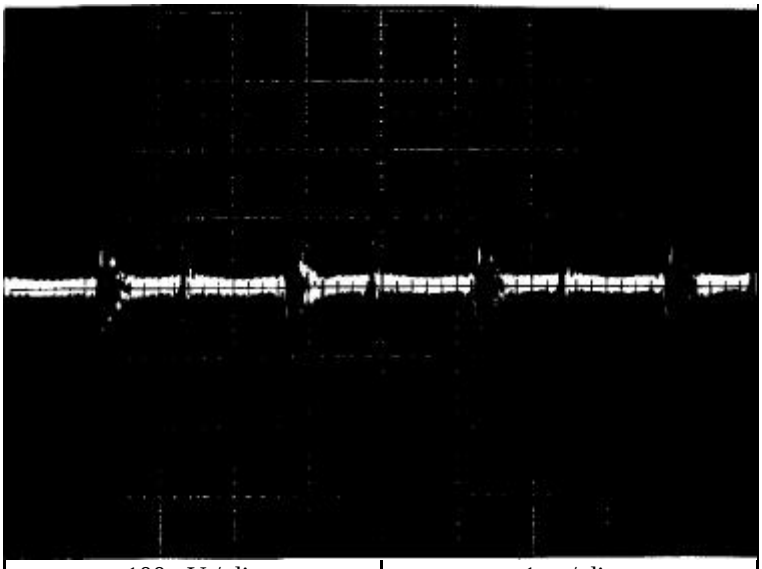
24 V

NORMAL MODE



50mV / div	1µs / div
88 mV (Vp-p)	

NORMAL + COMMON MODE

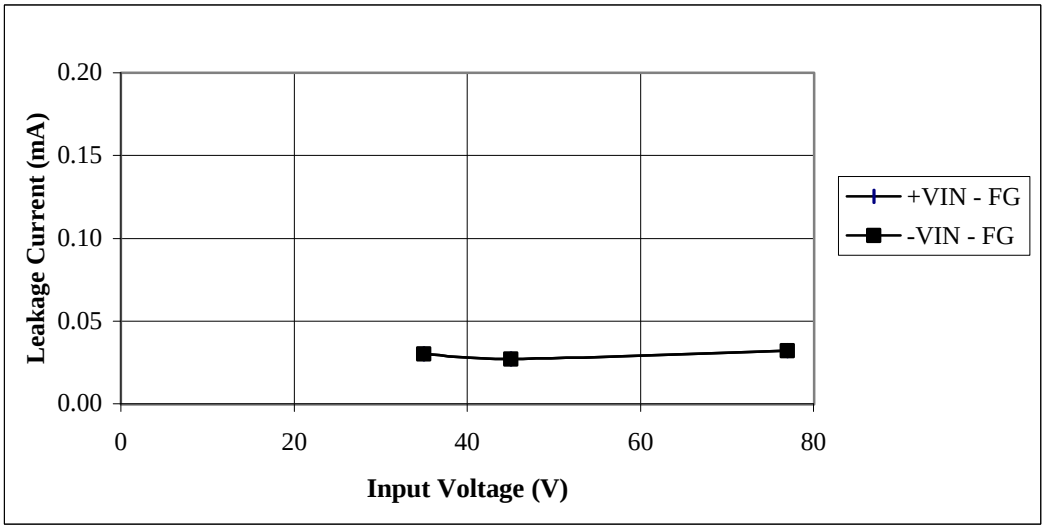


100mV / div	1µs / div
154 mV (Vp-p)	

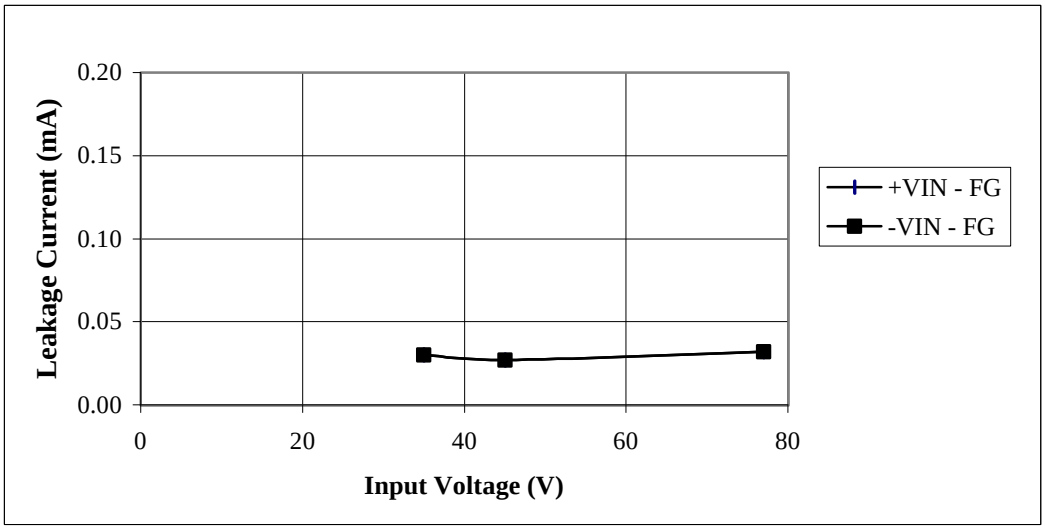
2-12 Leakage Current Characteristics

Condition : Iout = 100%
Tp= 25°C

12V



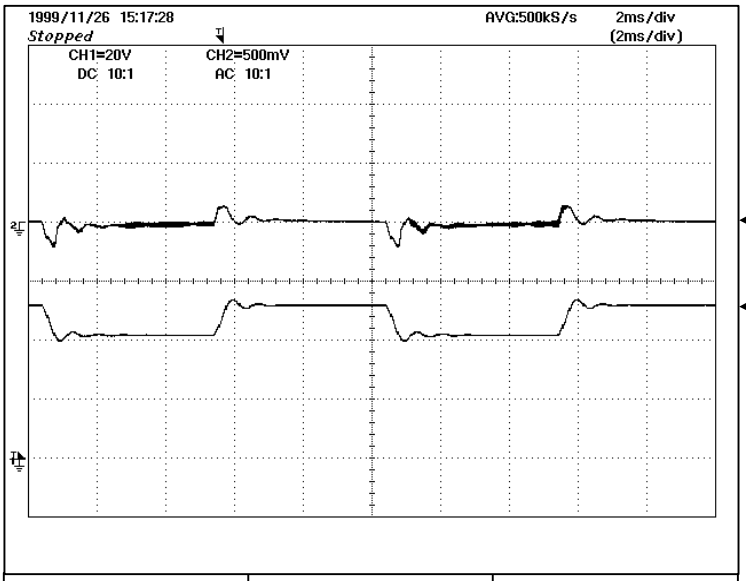
24V



2-13 Dynamic Line Response Characteristics

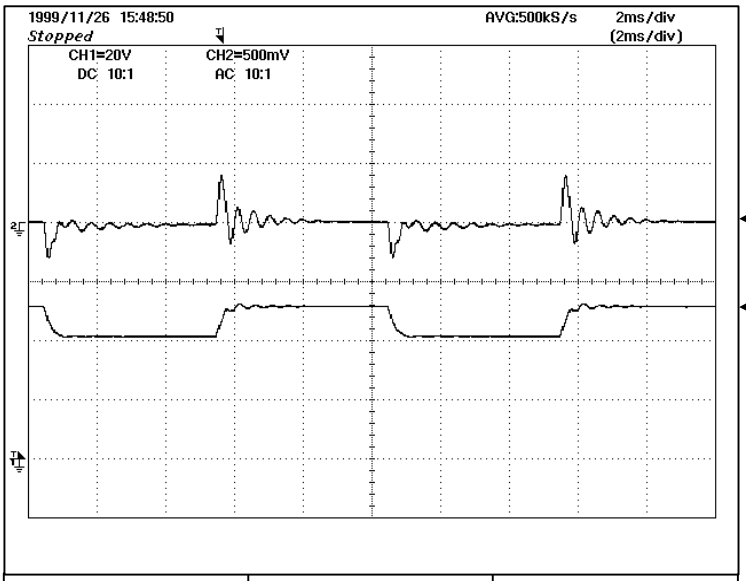
Condition Vin = 43 <=> 53VDC
Iout = 100%
Tp= 25°C

12 V



0.5V / DIV	20V / DIV	2mS / DIV

24 V

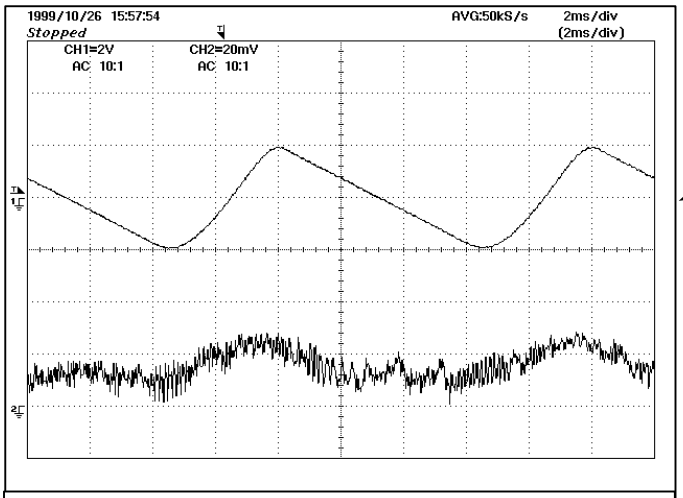


0.5V / DIV	20V / DIV	2mS / DIV

2-14 AC Input Response

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

12V

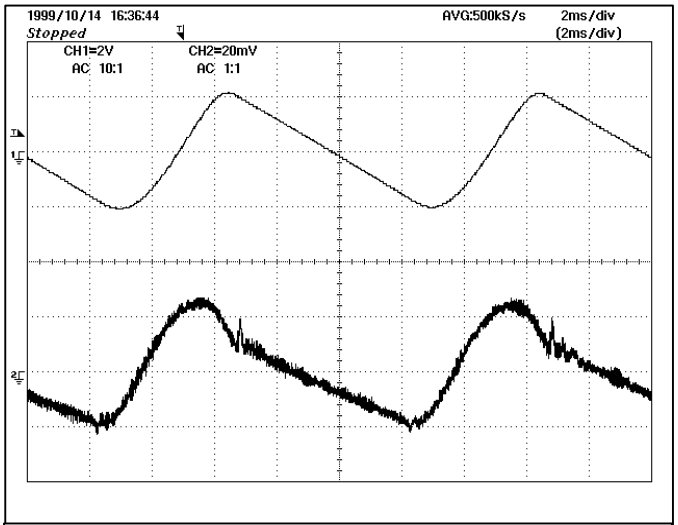


Input Waveform

Output Waveform

AC Input Ripple Voltage = 4V
Output Ripple Voltage = 22.8 mV

24V



Input Waveform

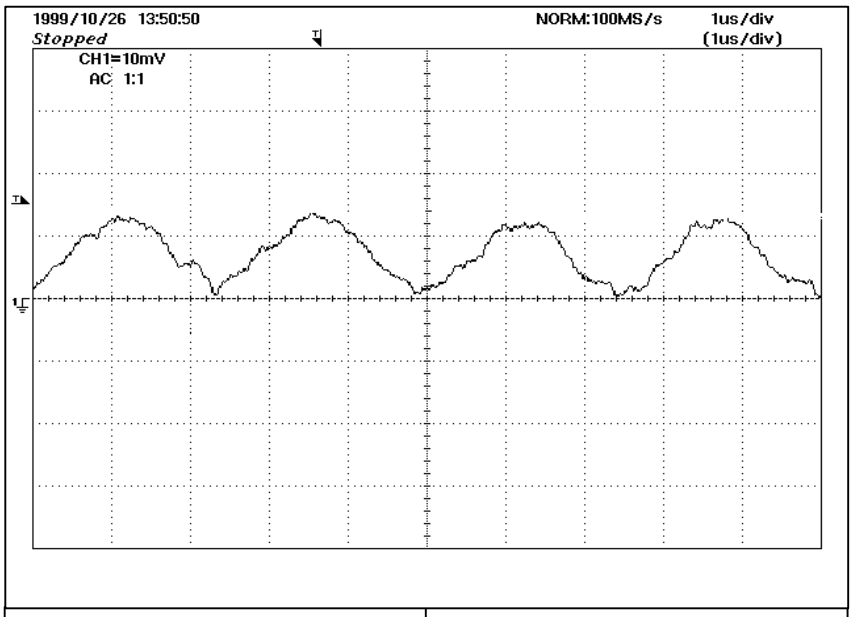
Output Waveform

AC Input Ripple Voltage = 4V
Output Ripple Voltage = 44.4 mV

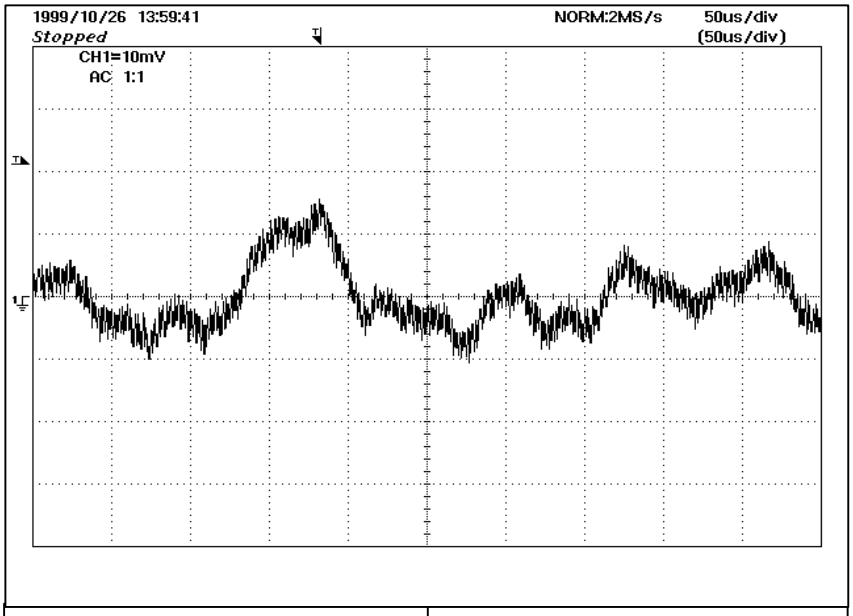
2-15 INPUT REFLECTED CURRENT

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

12 V



10mA / DIV	1us / DIV

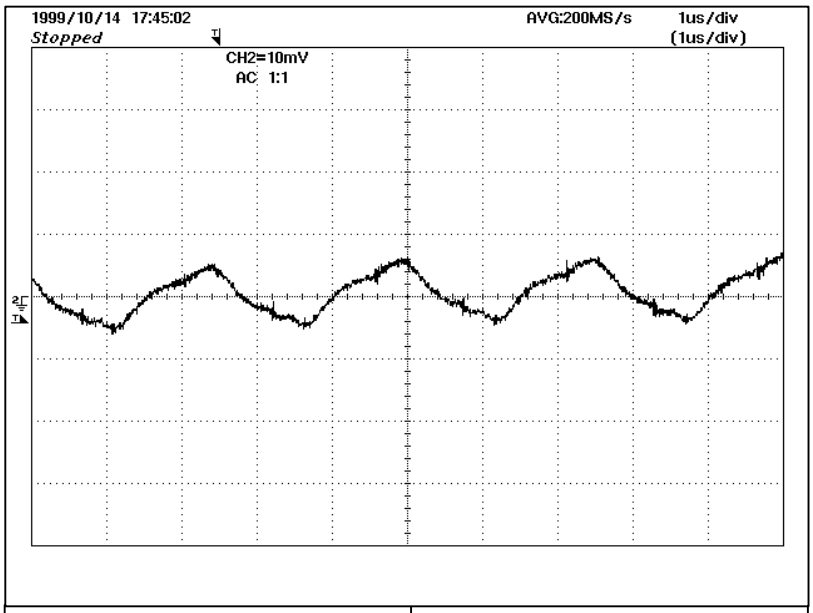


10mA / DIV	50us / DIV

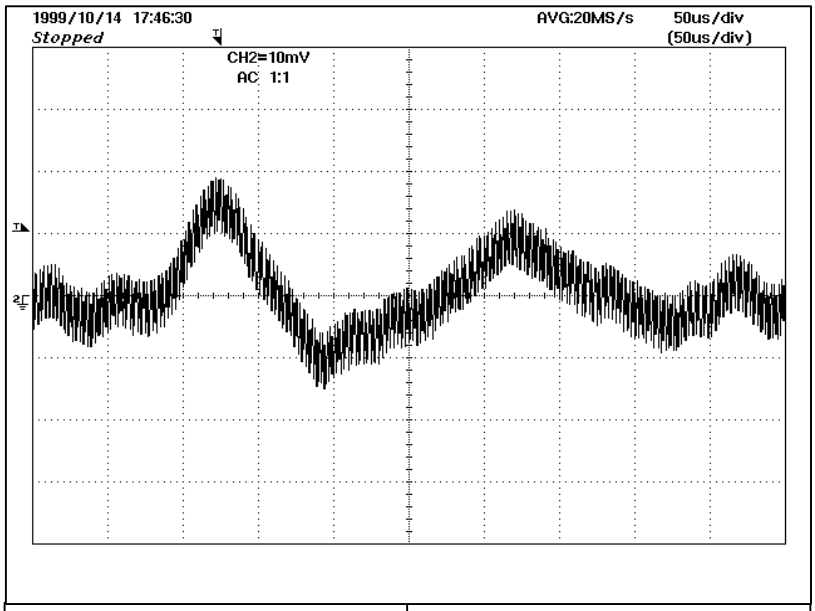
2-15 INPUT REFLECTED CURRENT

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

24 V



10mA / DIV	1us / DIV



10mA / DIV	50us / DIV