PAH75D24-5033

QUALITY
TEST DATA

POWER MODULE

DRAWING NO. : PA565-53-01			
DLJ QA	NLS R&D		
APPROVED	PREPARED	CHECKED	APPROVED
T. Murayama 20/9/'01	29/8/01	12/9/01	12/9/01
DATE :	DATE ISSUE : 12 Sept 01		

DENSEI-LAMBDA

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PAH75D24-5033

Terminology used

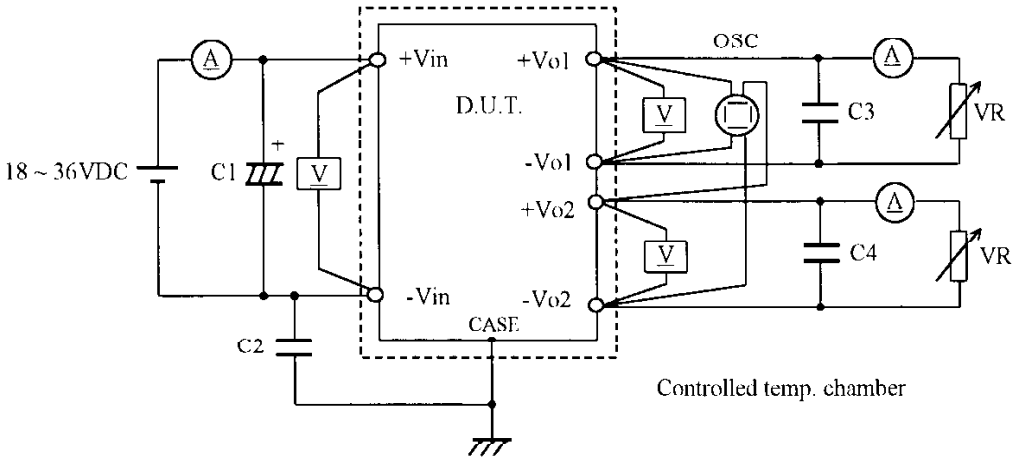
Vin -	Input Voltage	Io1 -	CH1 Output Current (5V)
Iin -	Input Current	Io2 -	CH2 Output Current (3.3V)
Vo1 -	CH1 Output Voltage (5V)	Tp -	Base-Plate Temperature
Vo2 -	CH2 Output Voltage (3.3V)	Tr-	Load Rise-Time
		Tf-	Load Fall-Time

1. EVALUATION METHOD

PAH75D24-5033

1 - 1 Circuit used for determination

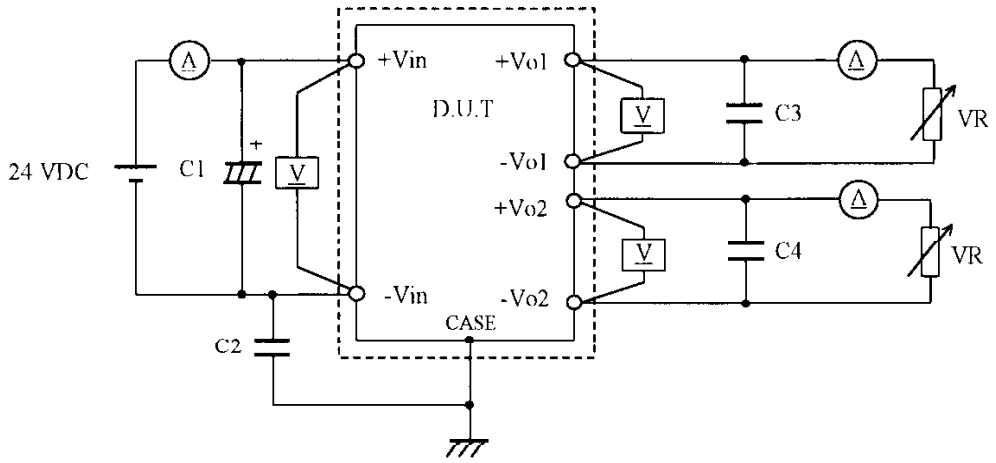
(1) Steady state data



(i) Tp = -20°C ~ 100°C
C1 : 100μF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 , C4 : 33μF Ceramic Capacitor

(ii) Tp = -40°C ~ 100°C
C1 : 33μF Ceramic Capacitor

(2) Warm up voltage drift characteristics

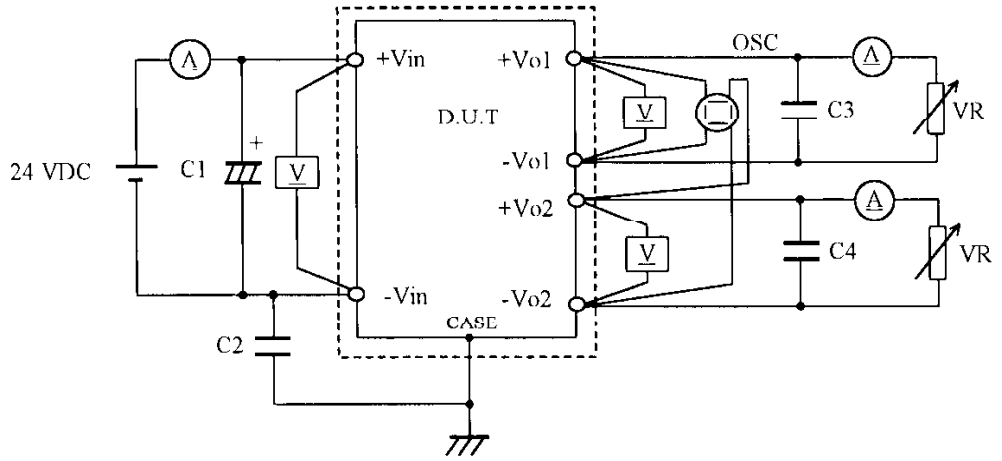


C1 : 100μF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 , C4 : 33μF Ceramic Capacitor

(3) Over current protection (O.C.P.) characteristics **PAH75D24-5033**

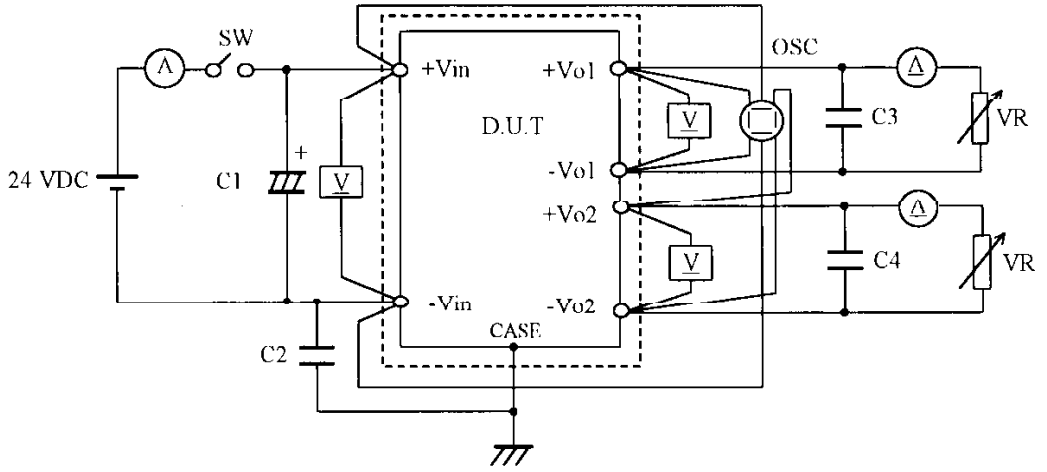
Same as steady state data

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



C1 : 100μF Electrolytic Capacitor C3 , C4 : 33μF Ceramic Capacitor
C2 : 4700pF Ceramic Capacitor

(5) Output rise characteristics

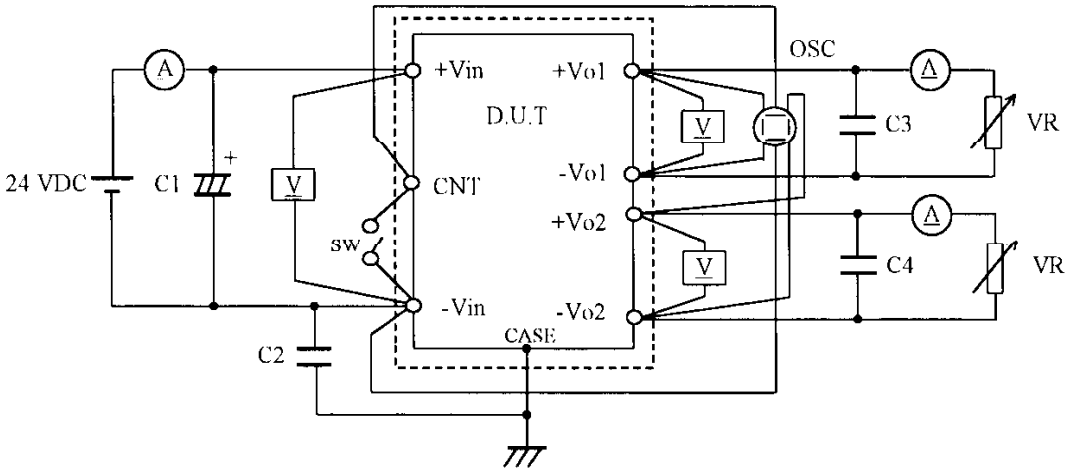


C1 : 100μF Electrolytic Capacitor C3 , C4 : 33μF Ceramic Capacitor
C2 : 4700pF Ceramic Capacitor

(6) Output fall characteristics

Same as Output rise characteristics

(7) Output rise characteristics with on/off control

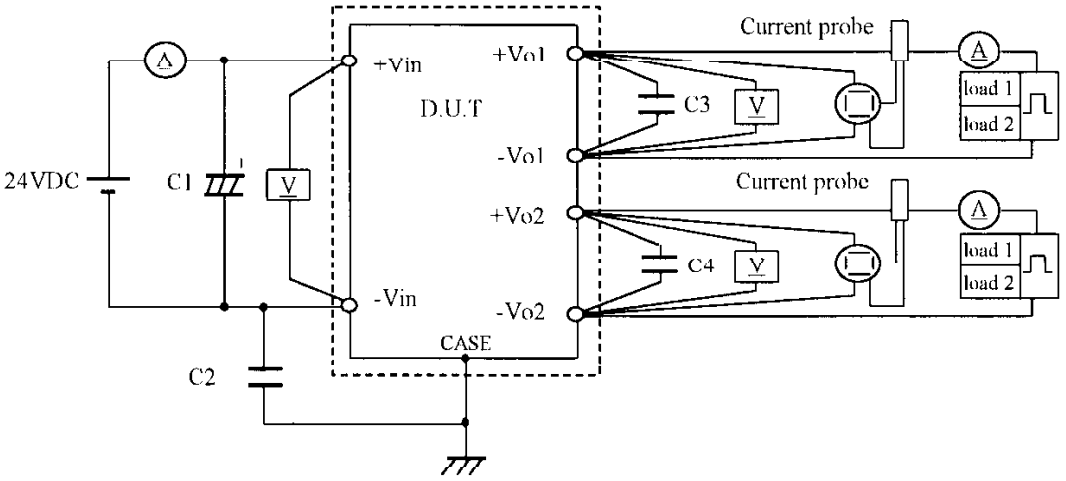


C1 : 100μF Electrolytic Capacitor C3 , C4 : 33μF Ceramic Capacitor
C2 : 4700pF Ceramic Capacitor

(8) Output fall characteristics with on/off control

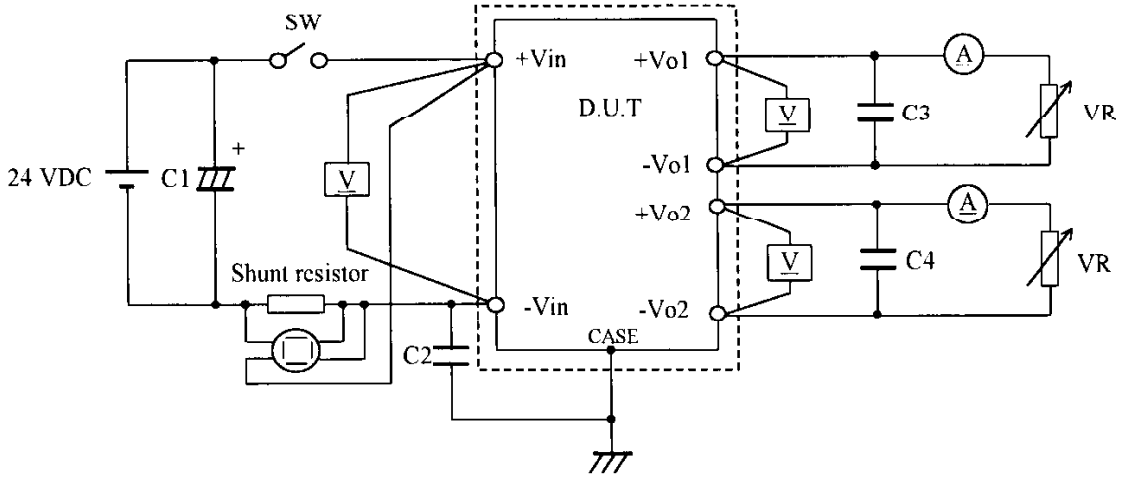
Same as Output rise characteristics with on/off control

(9) Dynamic load response characteristics



C1 : 100μF Electrolytic Capacitor C3 , C4 : 33μF Ceramic Capacitor
C2 : 4700pF Ceramic Capacitor

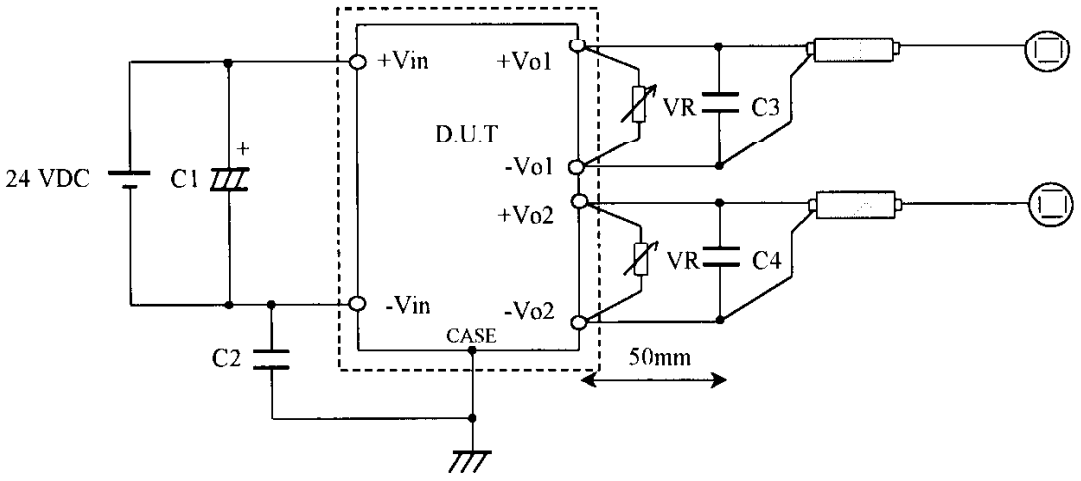
(10) Inrush current waveform



C1 : 100μF Electrolytic Capacitor C3 , C4 : 33μF Ceramic Capacitor
C2 : 4700pF Ceramic Capacitor

(11) Output-ripple , noise waveform

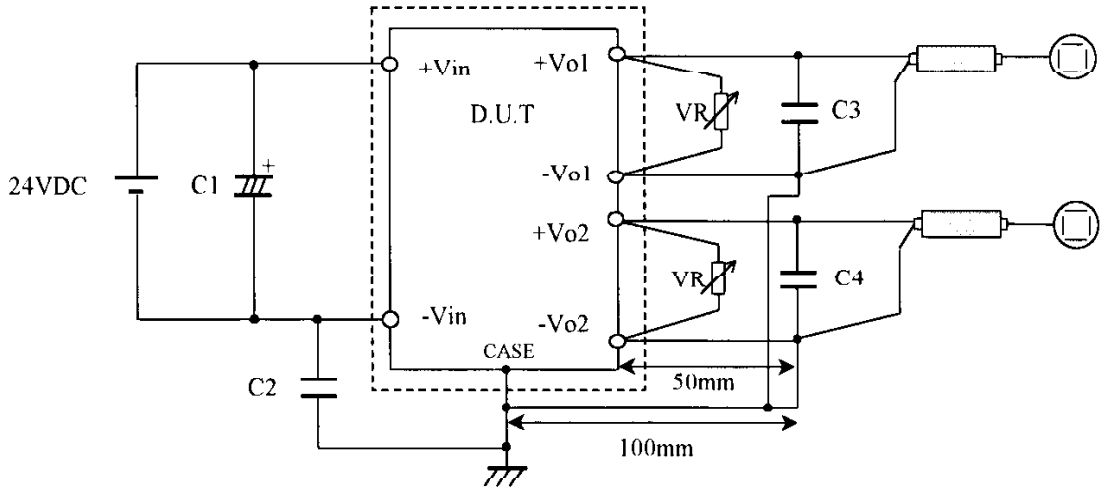
a) NORMAL MODE (NORMAL PROBE)



C1 : 100μF Electrolytic Capacitor C3 , C4 : 33μF Ceramic Capacitor
C2 : 4700pF Ceramic Capacitor

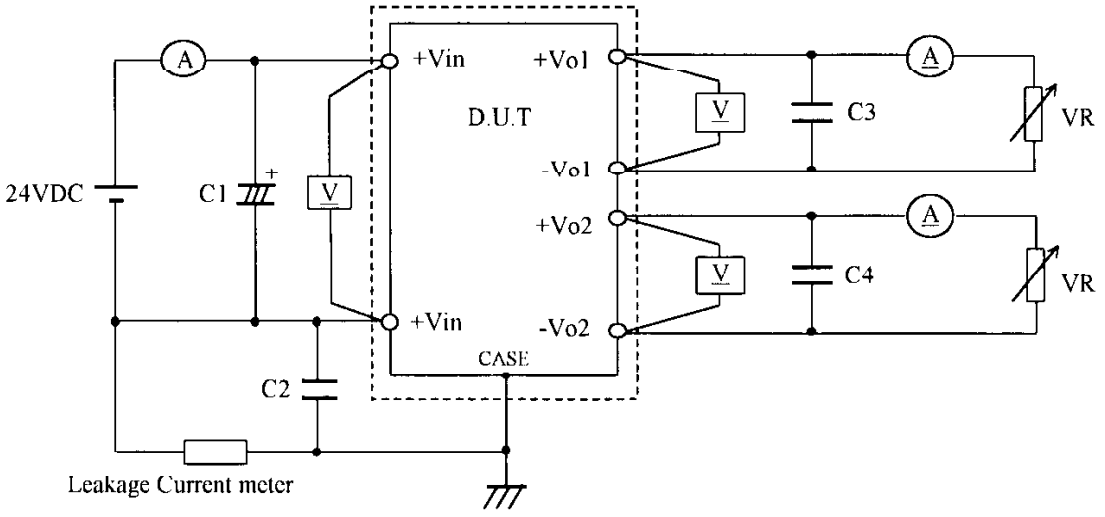
Output-ripple , noise waveform

b) NORMAL + COMMON MODE



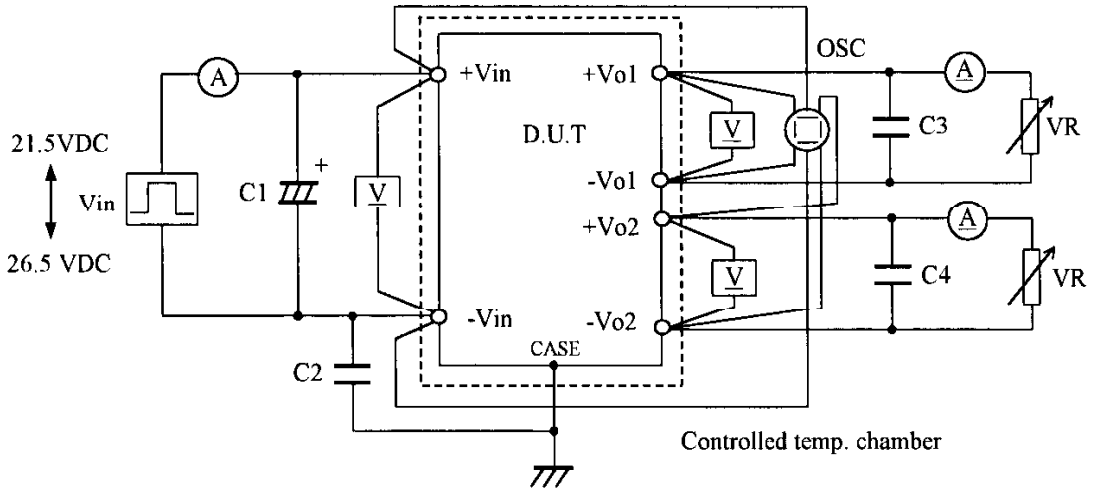
C1 : 100μF Electrolytic Capacitor C3 , C4 : 33μF Ceramic Capacitor
C2 : 4700pF Ceramic Capacitor

(12) Leakage current characteristics



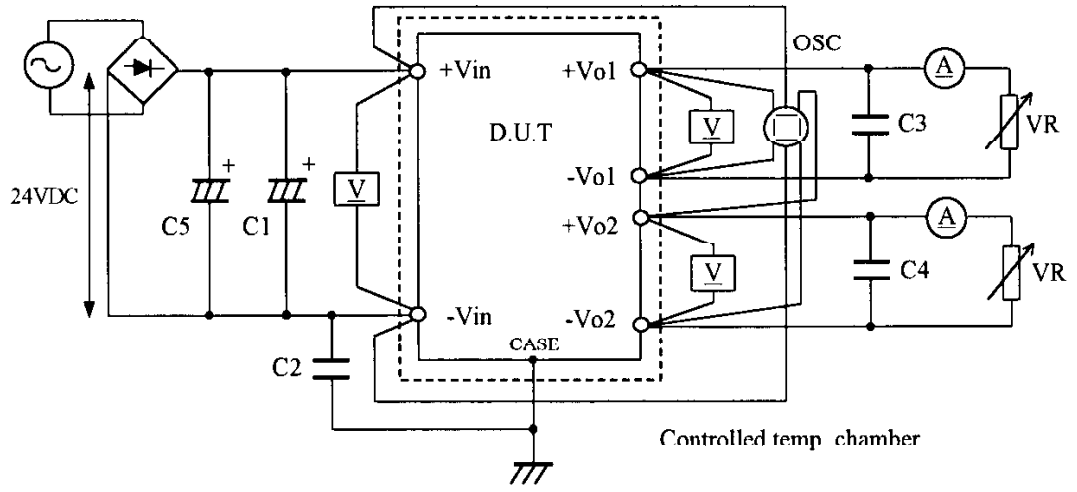
C1 : 100μF Electrolytic Capacitor C3 , C4 : 33μF Ceramic Capacitor
C2 : 4700pF Ceramic Capacitor

(13) Dynamic line characteristics



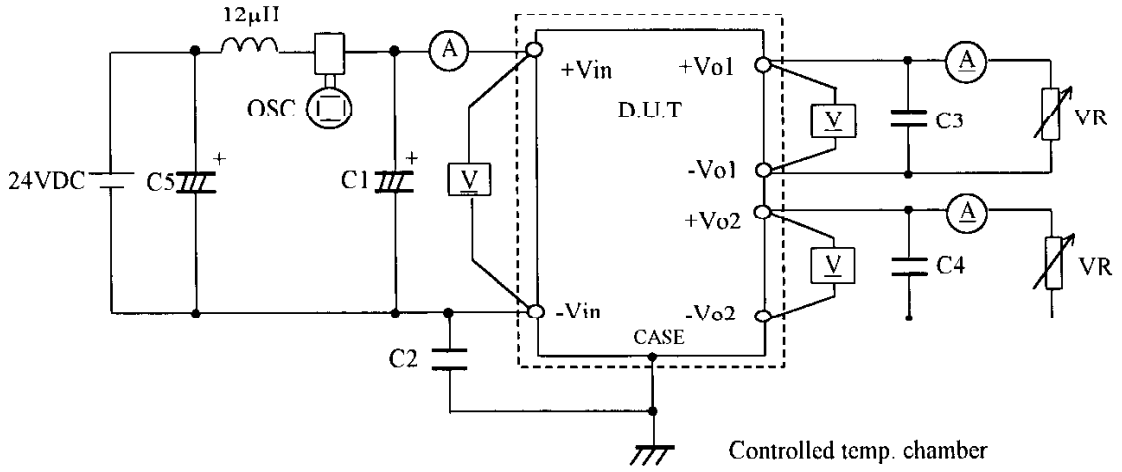
C1 : 100μF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 , C4 : 33μF Ceramic Capacitor

(14) AC input response characteristics



C1 : 100μF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 , C4 : 33μF Ceramic Capacitor
C5 : 15000μF Electrolytic Capactor

(15) Input Reflected current characteristics



C1 : 100μF Electrolytic Capacitor
C2 : 4700pF Ceramic Capacitor
C3 , C4 : 33μF Ceramic Capacitor
C5 : 220μF Electrolytic Capacitor

1-2 List of equipment used

No	Description	Manufacturer	Model No.
1	Oscilloscope	TEKTRONIX	2465B
2		IWATSU	SS-7810
3	Digital oscilloscope	YOKOGAWA ELEC.	DL1540CL
4		YOKOGAWA ELEC.	DL1200A
5	Digital volt meter	IWATSU	VDAC 7411
6	Dynamic dummy load	TAKAMIZAWA	PSA-150D
7	Controlled temp . chamber	TABAI	PL-2GM
8	Shunt resistor	KUWANO	100mV , 1A
9	Current probe amplifier	TEKTRONIX	TM503
10	Current probe	TEKTRONIX	A6303
11	AC power source / Analyzer	SCHAFFNER	NSG1007
12		HEWLETT PACKARD	8904A
13	Leakage current tester	SIMPSON	229-2

2. CHARACTERISTICS

2-1 Steady State Data

(1) Regulation - Line and Load, Temperature Drift

Tp = 25°C

Vo1 (5V)

Iout \ Vin		18 VDC	24 VDC	36 VDC	Line Regulation			
0%		5.022V	5.022V	5.022V	0.00V	0.00%	0.000V	0.00%
50%		5.013V	5.013V	5.013V	0.000V	0.00%	0.000V	0.00%
100%		5.005V	5.005V	5.005V	0.000V	0.00%	0.000V	0.00%
Load Regulation	0% ↕ 50%	0.009V	0.009V	0.009V	18V ⟷ 24V		24V ⟷ 36V	
		0.18%	0.18%	0.18%				
	50% ↕ 100%	-0.008V	-0.008V	-0.008V				
		-0.16%	-0.16%	-0.16%				

Tp = 25°C

Vo2 (3.3V)

Iout \ Vin		18 VDC	24 VDC	36 VDC	Line Regulation			
0%		3.309V	3.310V	3.310V	-0.001V	-0.12%	0.000V	0.00%
50%		3.300V	3.300V	3.302V	-0.001V	-0.03%	0.002V	0.06%
100%		3.292V	3.293V	3.294V	0.001V	0.03%	0.000V	0.00%
Load Regulation	0% ↕ 50%	0.009V	0.010V	0.008V	18V ⟷ 24V		24V ⟷ 36V	
		0.27%	0.30%	0.24%				
	50% ↕ 100%	-0.008V	-0.007V	-0.008V				
		-0.24%	-0.21%	-0.24%				

Temperature Drift

Condition : Vin = 24VDC
Io1 = 7.5A
Io2 = 7.5A

Vout \ Tp	-40°C	25°C	100°C	Temp. Stability	
Vo1 (5v)	4.992V	5.013V	5.015V	0.023V	0.46%
Vo2 (3.3V)	3.308V	3.300V	3.270V	0.038V	1.15%

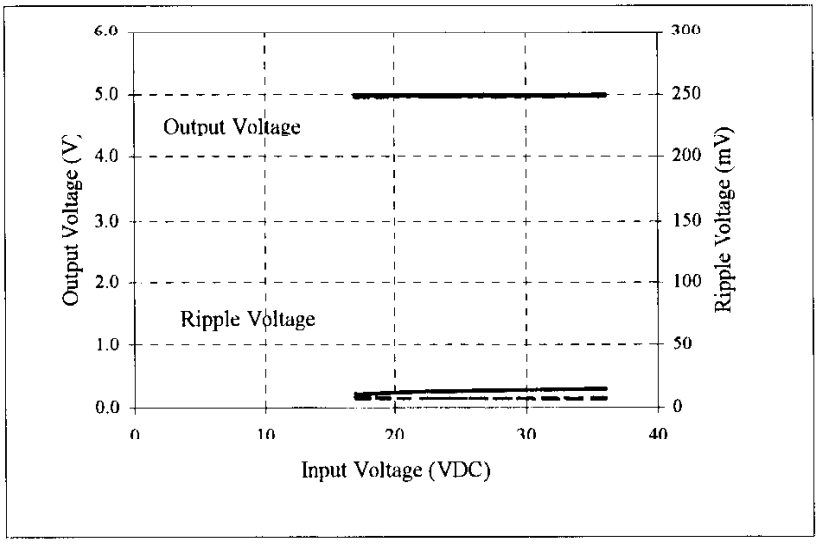
2. CHARACTERISTICS

2-1 Steady State Data

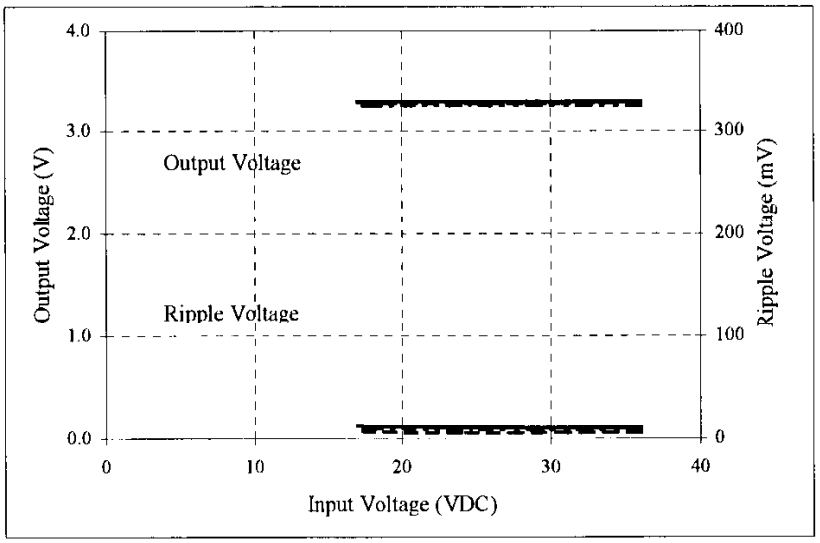
(2) Output Voltage And Ripple Voltage V.S. Input Voltage

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

Vo1(5V)
Io1 = 15A
Io2 = 0A



Vo2(3.3V)
Io1 = 0A
Io2 = 15A



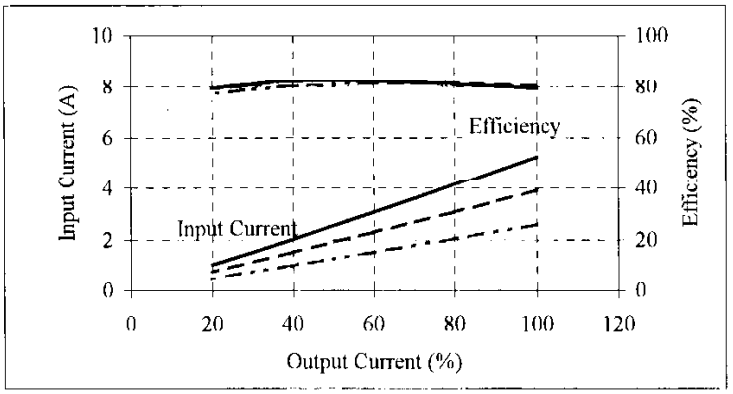
2. CHARACTERISTICS

2-1 Steady State Data

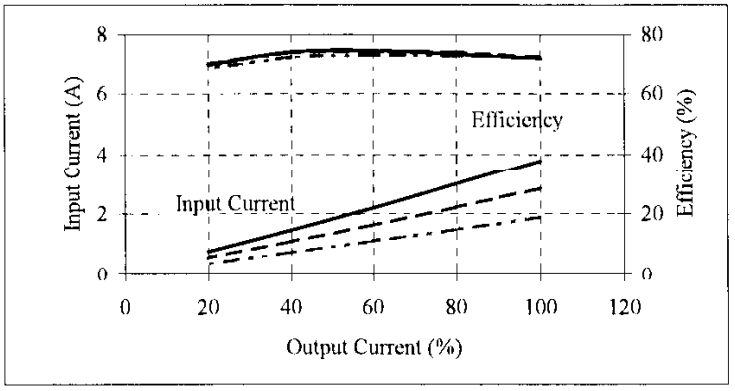
(3) Efficiency And Input Current V.S. Output Current

Condition : Vin = 18 VDC ——
= 24VDC - - - -
= 36VDC -·-·-·
Tp = 25°C

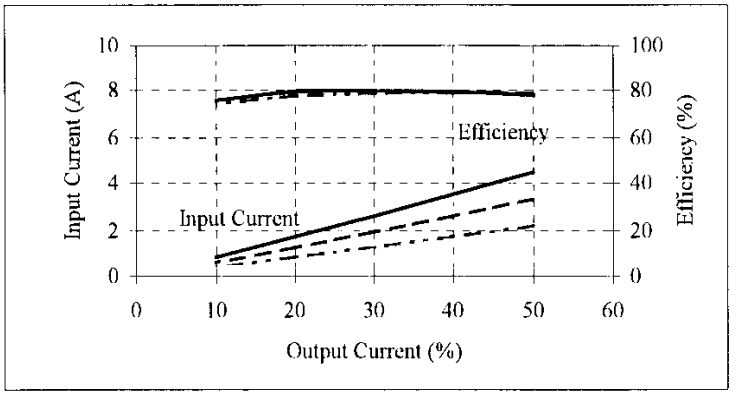
Io1 = 3 ~ 15A
Io2= 0A



Io1 = 0A
Io2 = 3 ~ 15A



Io1 = 1.5 ~ 7.5A
Io2 = 1.5 ~ 7.5A

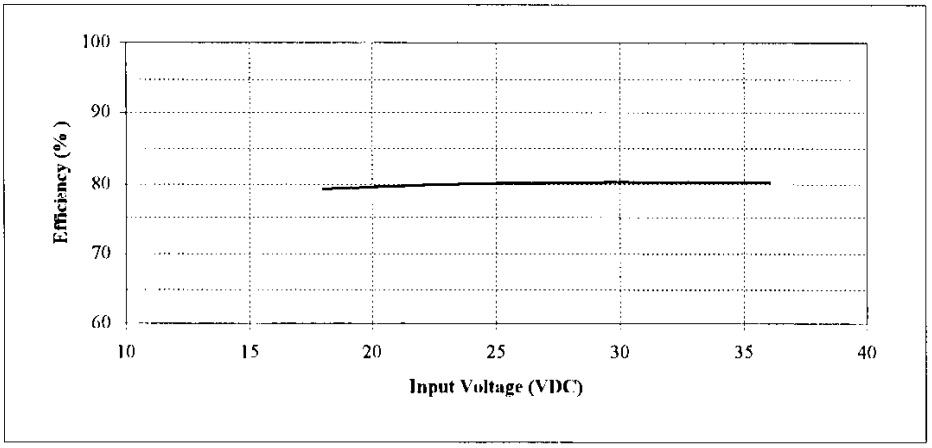


2. CHARACTERISTICS

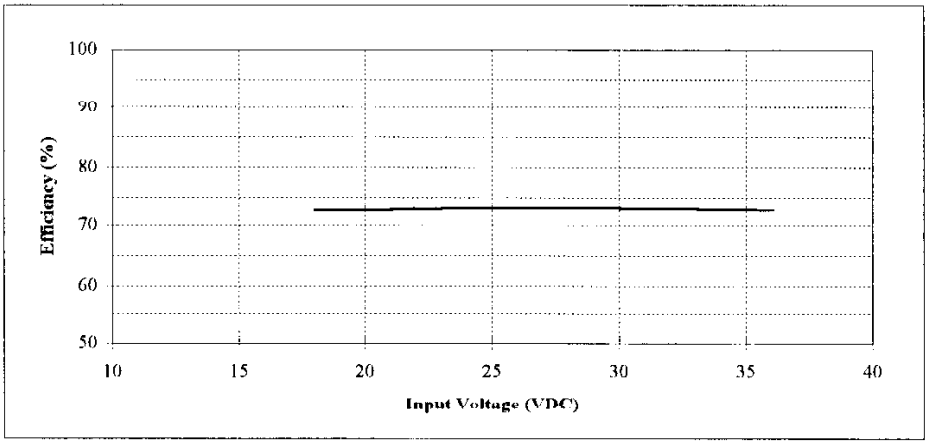
2-1 Steady State Data

(4) Efficiency v.s. Input Voltage Tp = 25°C

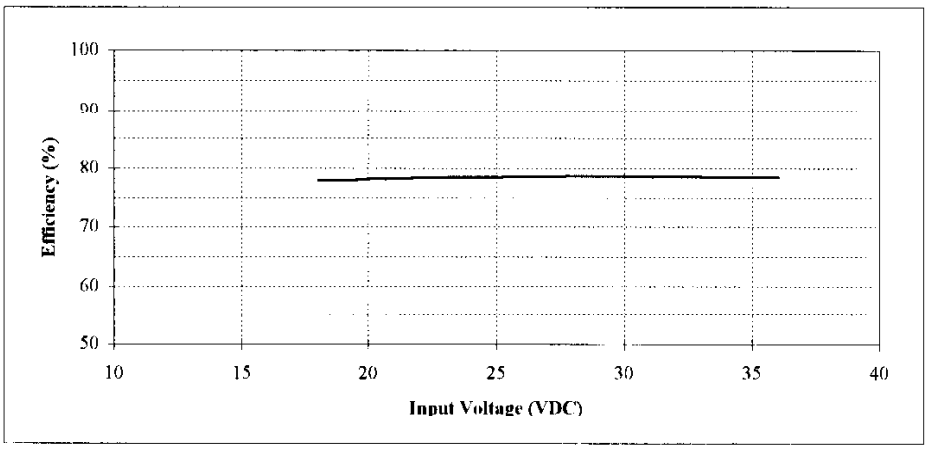
Io1= 15A
Io2 = 0A



Io1 = 0A
Io2 = 15A



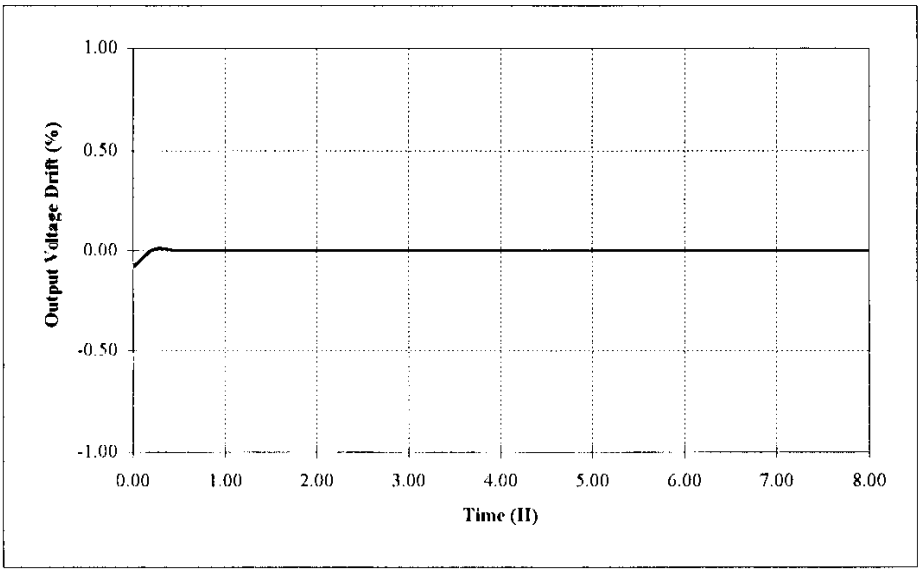
Io1 = 7.5A
Io2 = 7.5A



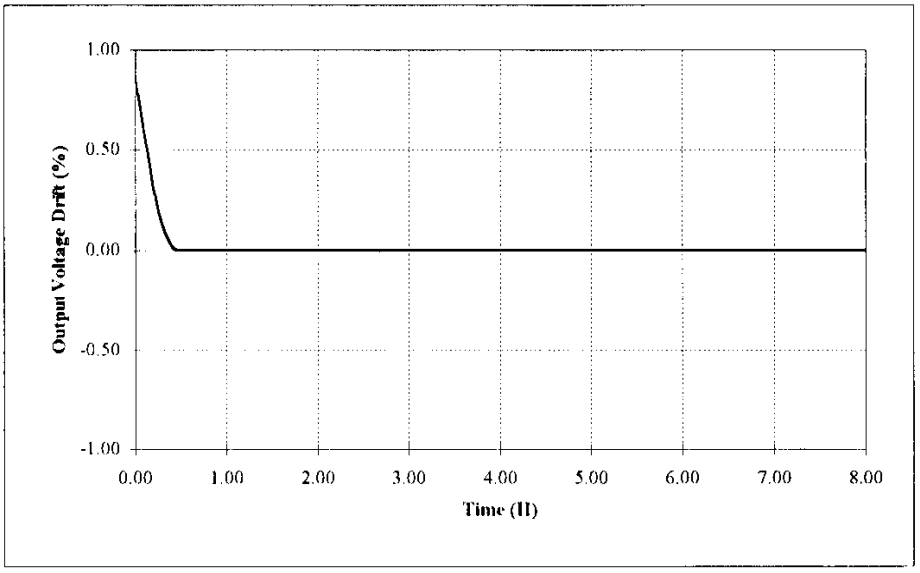
2-2 Warm Up Voltage Drift Characteristics

Condition : Vin = 24 V DC
Io1 = 7.5A
Io2 = 7.5A

Vo1 (5V)



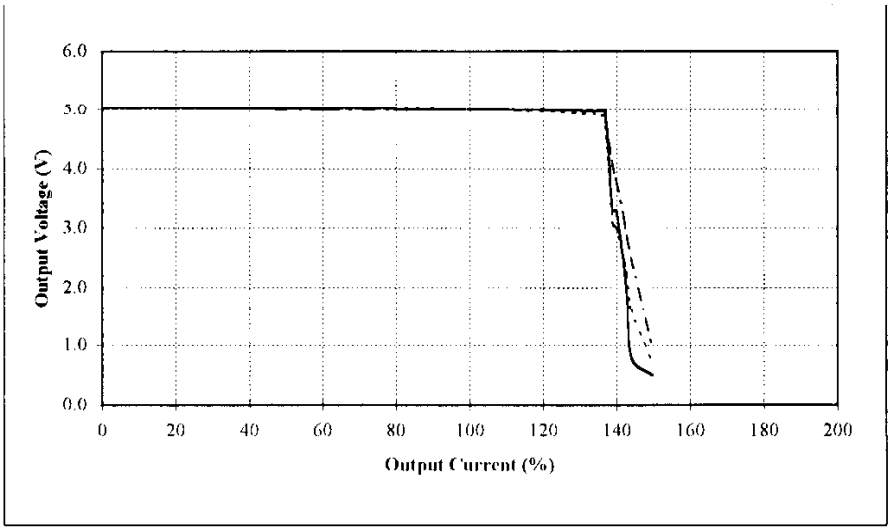
Vo2 (3.3V)



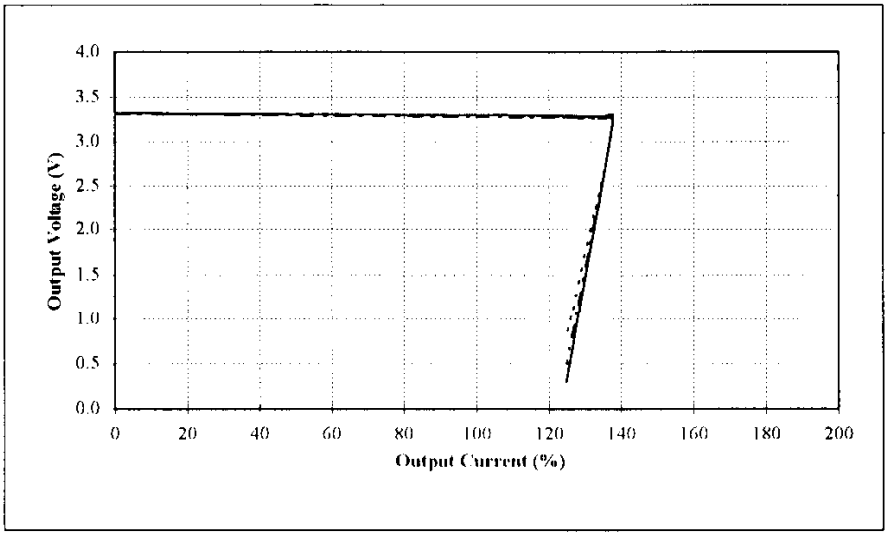
2-3 O.C.P. Charateristics

Condition : Vin = 18 VDC ————
Vin = 24 VDC ---------
Vin = 36 VDC —·—·—·—
Tp = 25°C

5 V
Io2=0A



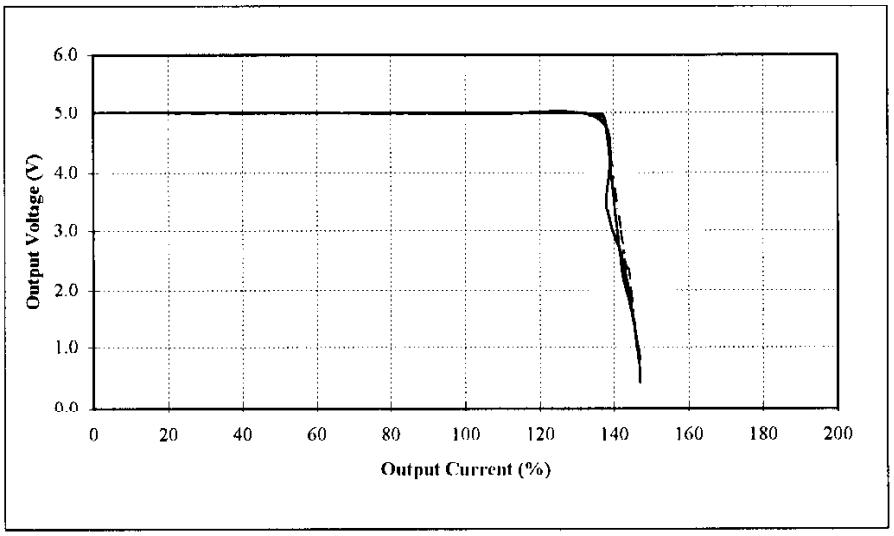
3.3 V
Io1=5A



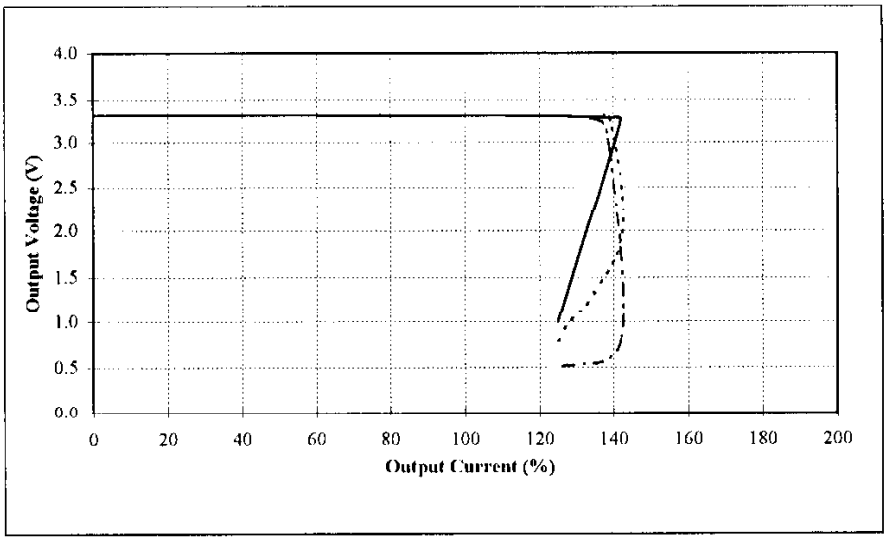
2-3 O.C.P. Charateristics

Condition : Tp = -40°C ————
Tp = 25°C - - - - - - - -
Tp = 100°C —·—·—·—
Vin = 24V

5 V
Io2=0A



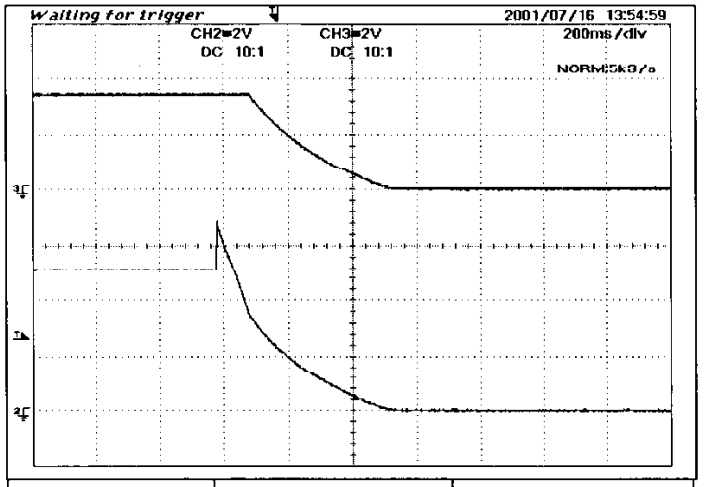
3.3 V
Io1=5A



2-4 O.V.P. Characteristics

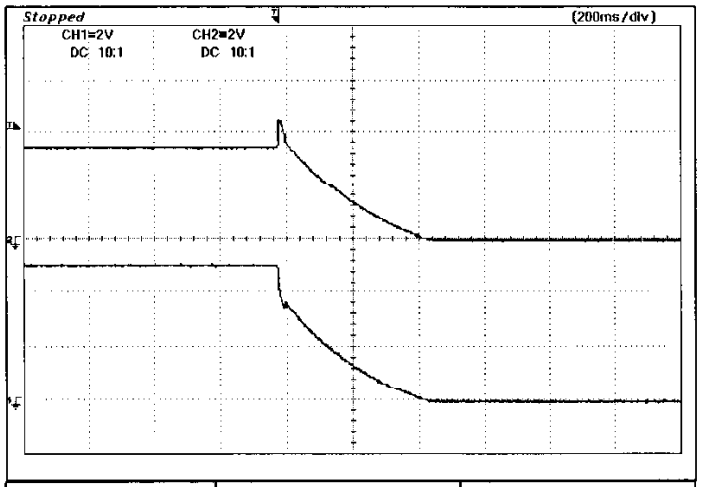
Condition : Vin =24VDC
Io1 = 0A
Io2 = 0A
Tp = 25°C

Vo1 (5V) OVP



Vo1 (5V)	Vo2 (3.3V)	Time Base
2V / DIV	2V / DIV	200ms / DIV
OVP Trip Point : 136.46%		

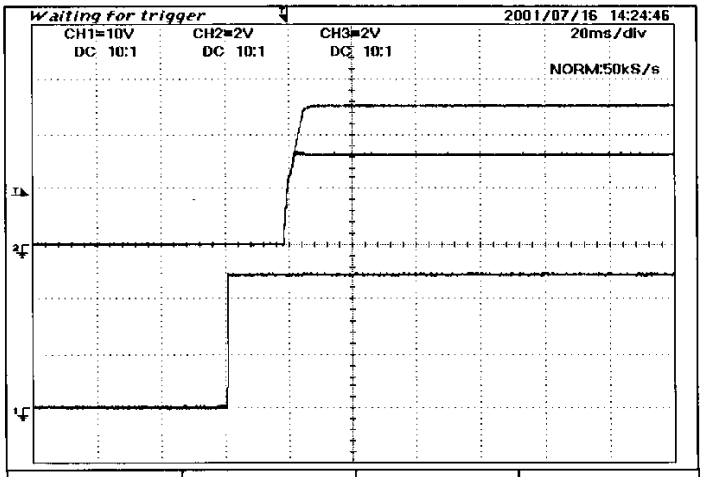
Vo2 (3.3V) OVP



Vo1 (5V)	Vo2 (3.3V)	Time Base
2V / DIV	2V / DIV	200ms / DIV
OVP Trip Point : 133.33%		

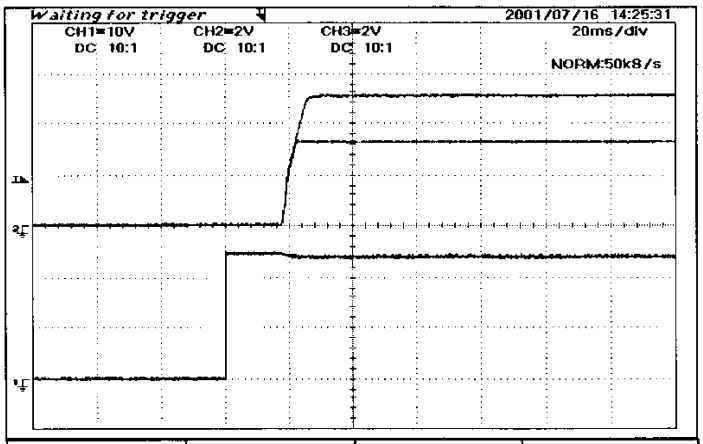
2-5 Output Rise Characteristics

Condition : Vin =24VDC
Io1 = 0A
Io2 = 0A
Tp = 25°C



Vin	Vo1 (5V)	Vo2 (3.3V)	Time Base
10V / DIV	2V / DIV	2V / DIV	20ms / DIV

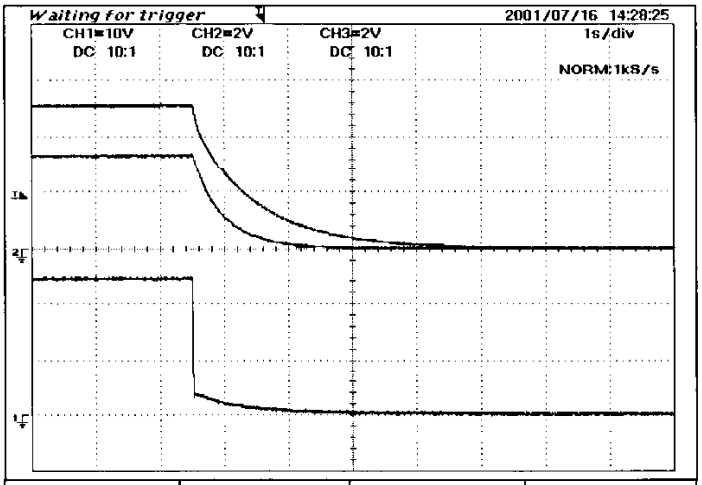
Condition : Vin =24VDC
Io1 = 7.5A
Io2 = 7.5A
Tp = 25°C



Vin	Vo1 (5V)	Vo2 (3.3V)	Time Base
10V / DIV	2V / DIV	2V / DIV	20ms / DIV

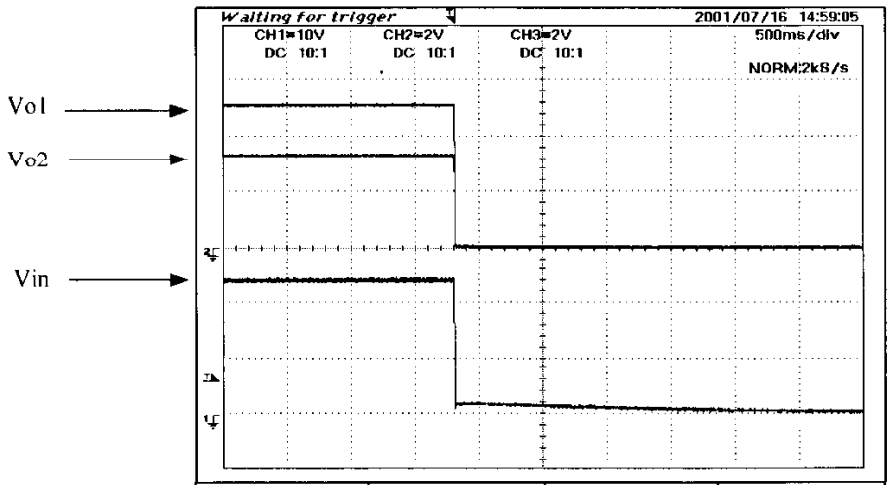
2-6 Output Fall Characteristics

Condition : Vin =24VDC
Io1 = 0A
Io2 = 0A
Tp = 25°C



Vin	Vo1 (5V)	Vo2 (3.3V)	Time Base
10V / DIV	2V / DIV	2V / DIV	1s / DIV

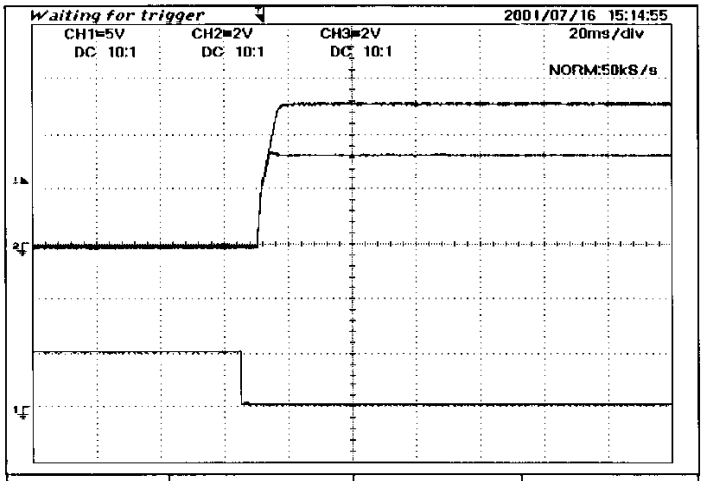
Condition : Vin =24VDC
Io1 = 7.5A
Io2 = 7.5A
Tp = 25°C



Vin	Vo1 (5V)	Vo2 (3.3V)	Time Base
10V / DIV	2V / DIV	2V / DIV	500ms / DIV

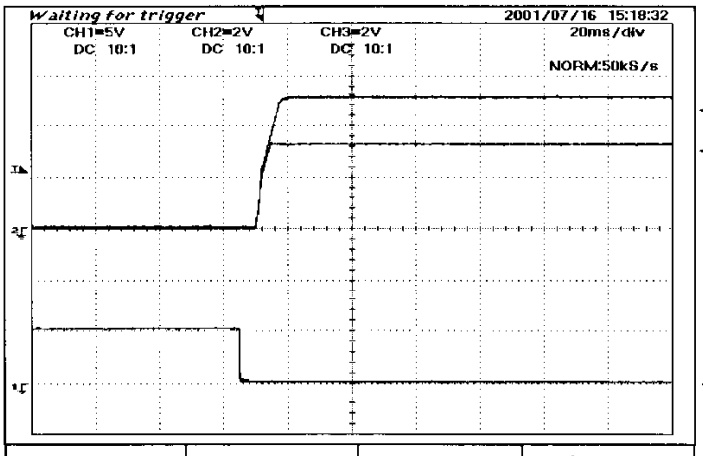
2-7 Output Rise With On/Off Characteristics

Condition : Vin =24VDC
Io1 = 0A
Io2 = 0A
Tp = 25°C



CNT	Vo1 (5V)	Vo2 (3.3V)	Time Base
5V / DIV	2V / DIV	2V / DIV	20ms / DIV

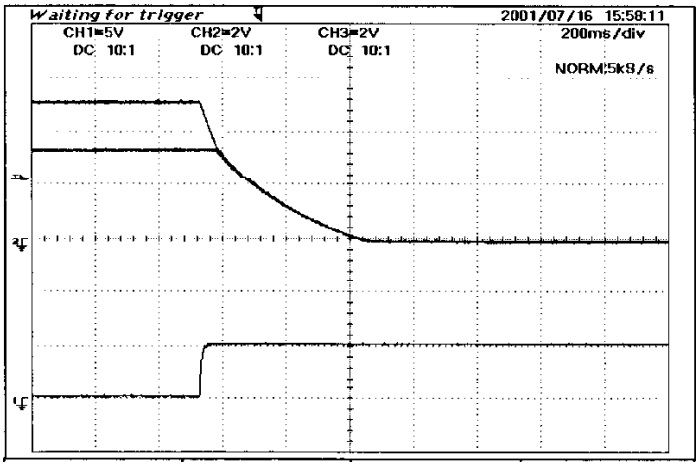
Condition : Vin =24VDC
Io1= 7.5A
Io2= 7.5A
Tp = 25°C



CNT	Vo1 (5V)	Vo2 (3.3V)	Time Base
5V / DIV	2V / DIV	2V / DIV	20ms / DIV

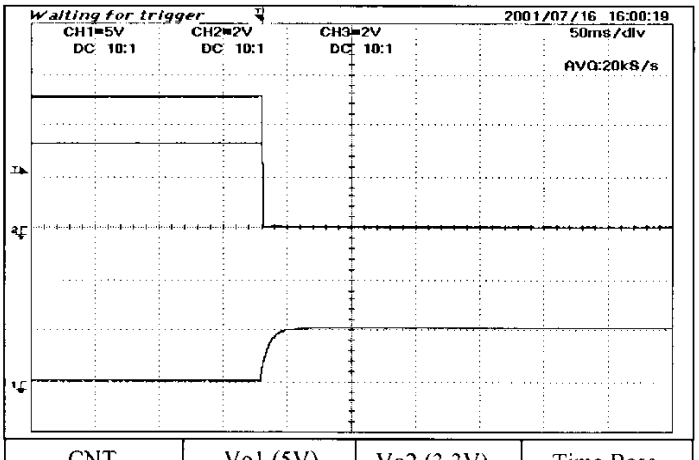
2-8 Output Fall With On/Off Characteristics

Condition : Vin =24VDC
Io1 = 0A
Io2 = 0A
Tp = 25°C



CNT	Vo1 (5V)	Vo2 (3.3V)	Time Base
5V / DIV	2V / DIV	2V / DIV	200ms / DIV

Condition : Vin =24VDC
Io1 = 7.5A
Io2 = 7.5A
Tp = 25°C

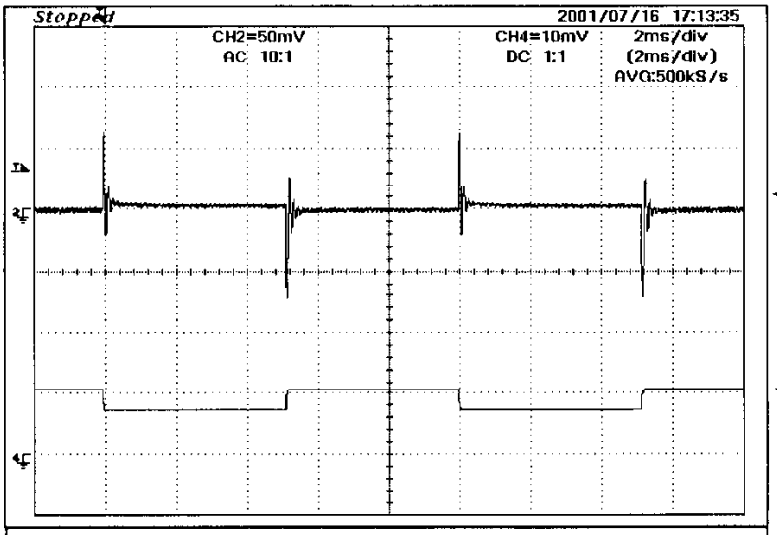


CNT	Vo1 (5V)	Vo2 (3.3V)	Time Base
5V / DIV	2V / DIV	2V / DIV	50ms / DIV

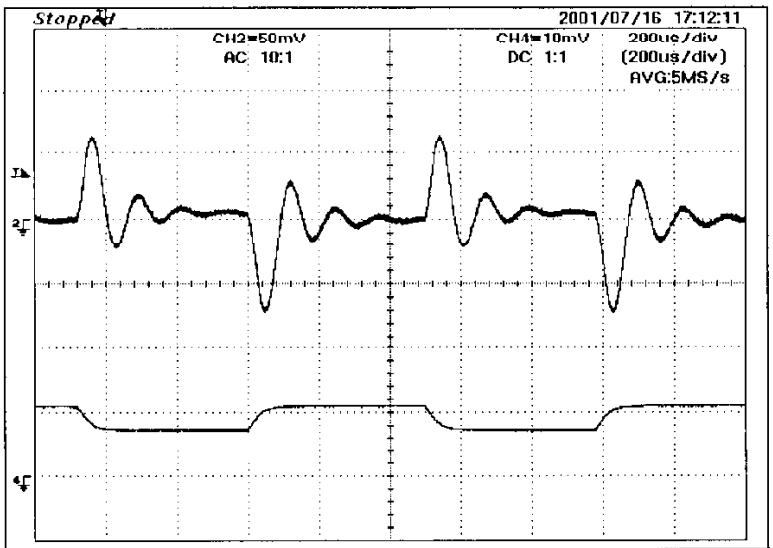
2-9 Dynamic Load Response Characteristics

Condition : Vin = 24VDC
Io2 = 0A
Tp = 25°C

Vo1 (5 V)



2ms / DIV	f = 100Hz
Io1 (10A / DIV)	Vo1 (50mV / DIV)
50% Tr = 75us / Tf = 75us 75%	+1.26% , -1.46%

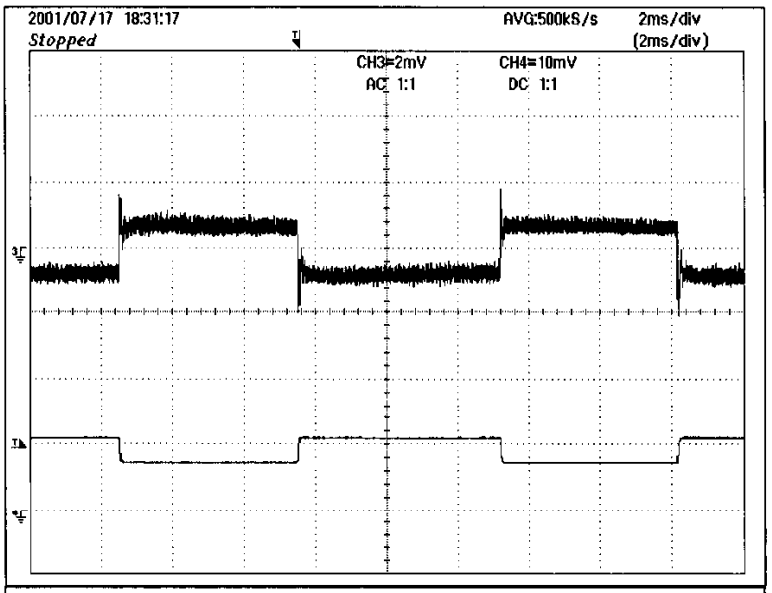


200us / DIV	f = 1kHz
Io1 (10A / DIV)	Vo1 (50mV / DIV)
50% Tr = 75us / Tf = 75us 75%	+1.26% , -1.47%

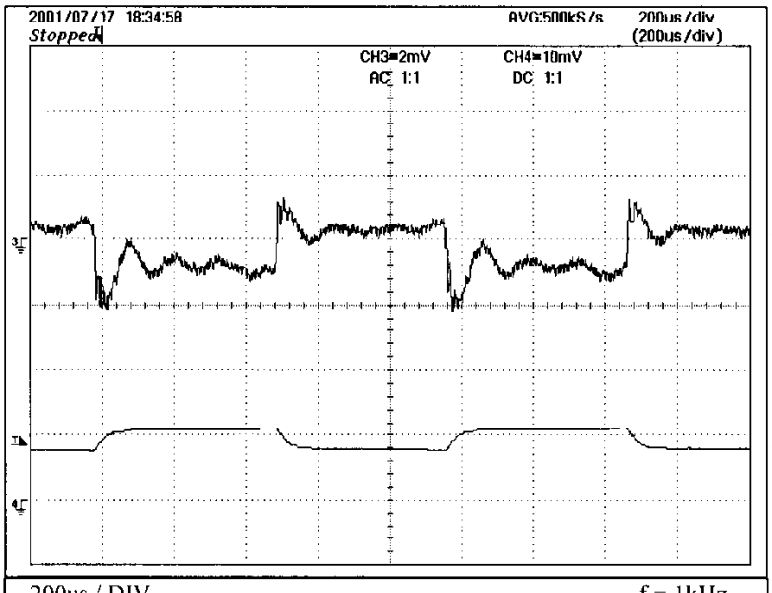
Dynamic Load Response Characteristics

Condition : Vin = 24VDC
Io1 = 0A
Tp = 25°C

Vo2 (3.3 V)



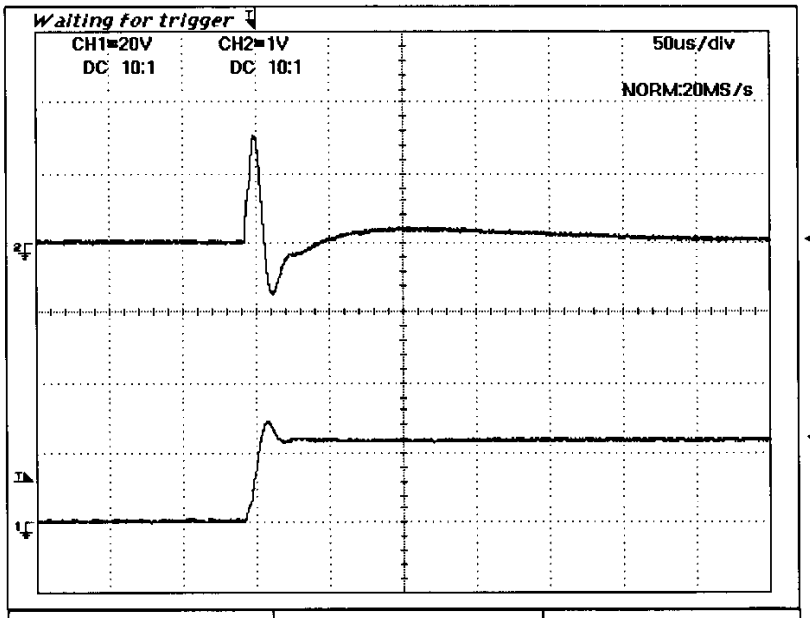
2ms / DIV		f = 100Hz
Io2 (10A / DIV)		Vo2 (2mV / DIV)
50%	Tr = 75us / Tf = 75us	75%	+0.07% , -0.04%



200us / DIV		f = 1kHz
Io2 (10A / DIV)		Vo2 (2mV / DIV)
50%	Tr = 75us / Tf = 75us	75%	+0.07% , -0.08%

2-10 Inrush Current Waveform

Condition : Vin = 24 V DC
Io1 = 5A
Io2 = 15A
Tp = 25°C



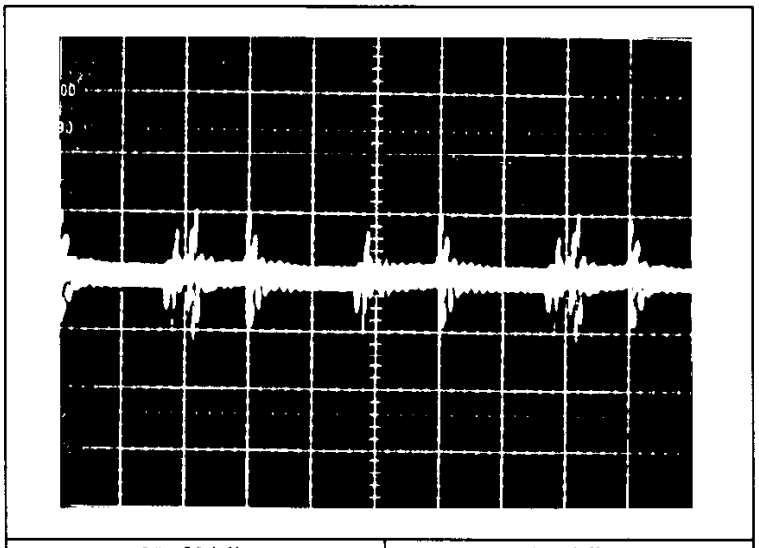
Iin	Vin	Time Base
10A / DIV	20V / DIV	50us / DIV

2-11 Output - Ripple & Noise Waveform

Condition : Vin = 24V DC
Io1 = 15A
Io2 = 0A
Tp = 25°C

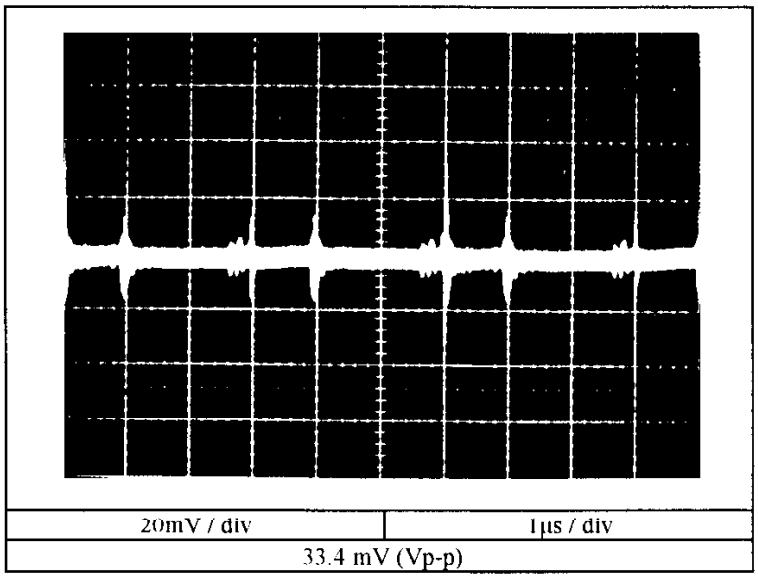
Vo1 (5V)

NORMAL MODE



20mV / div	1μs / div
46 mV (Vp-p)	

NORMAL + COMMON MODE



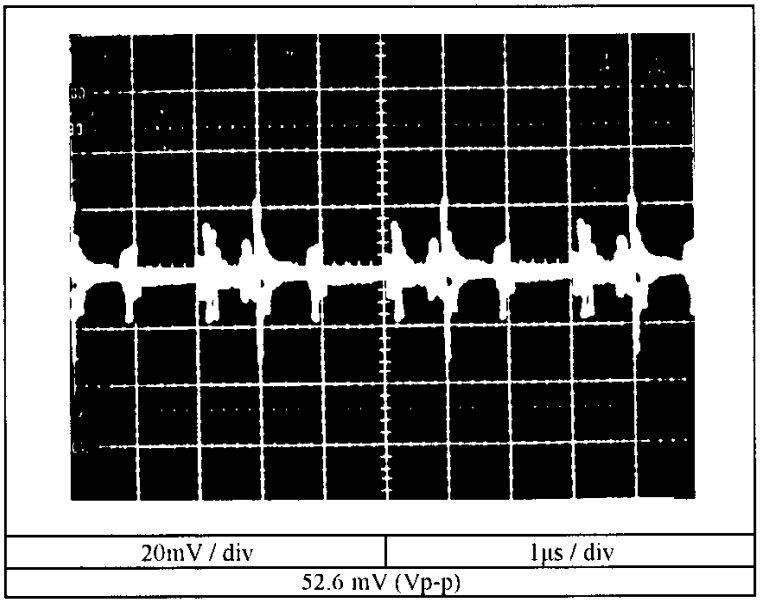
20mV / div	1μs / div
33.4 mV (Vp-p)	

Output - Ripple & Noise Waveform

Condition : Vin = 24V DC
Io1 = 0A
Io2 = 15A
Tp = 25°C

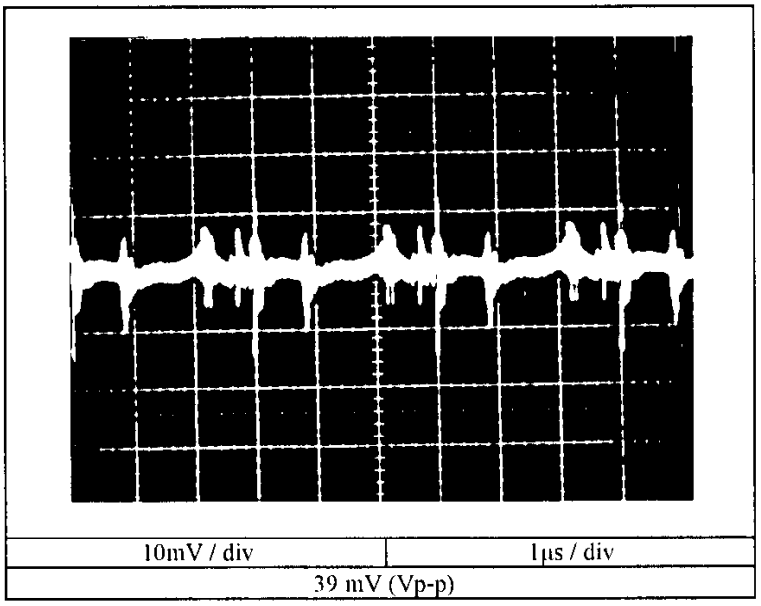
Vo2 (3.3V)

NORMAL MODE



20mV / div	1μs / div
52.6 mV (Vp-p)	

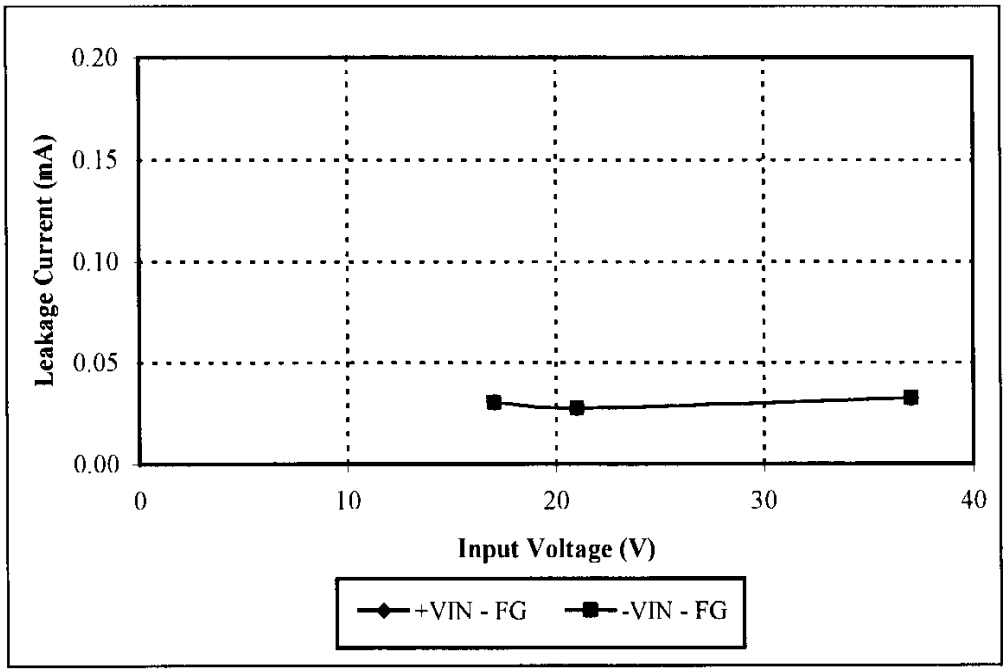
NORMAL + COMMON MODE



10mV / div	1μs / div
39 mV (Vp-p)	

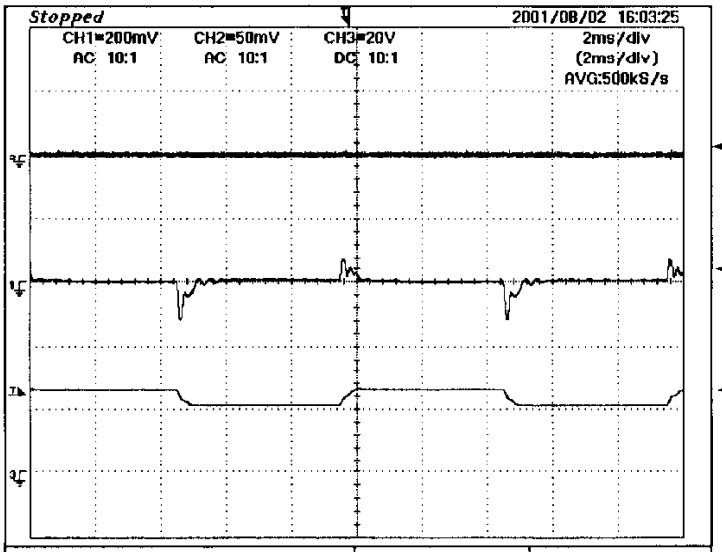
2-12 Leakage Current Characteristics

Condition : Io1 = 7.5A
Io2= 7.5A
Tp= 25°C

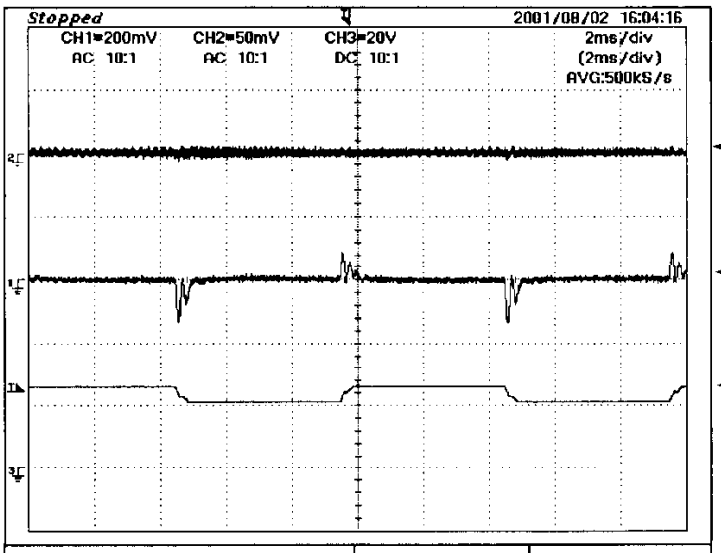


2-13 Dynamic Line Response Characteristics

Condition : Vin = 21.5 <=> 26.5 VDC
Tp = 25°C



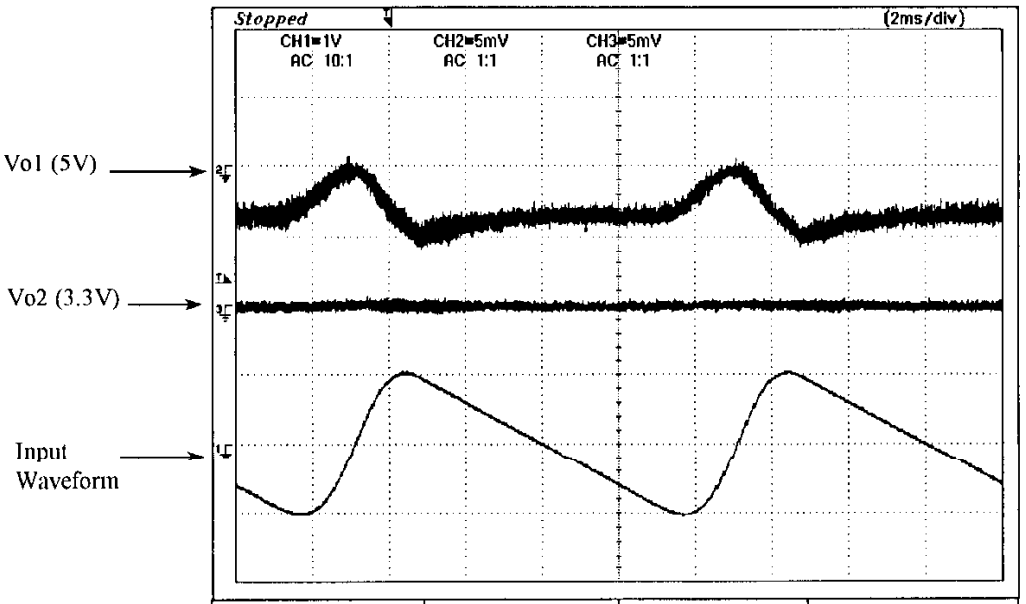
2ms / DIV	Vo1 (5V)	Vo2 (3.3V)
LOAD : Io1 = 15A ; Io2 = 0A	200mV / DIV	50mV / DIV



2ms / DIV	Vo1 (5V)	Vo2 (3.3V)
LOAD : Io1 = 0A ; Io2 = 15A	200mV / DIV	50mV / DIV

2-14 AC Input Response

Condition : Vin = 24 VDC
Io1 = 5A
Io2 = 15A
Tp= 25°C

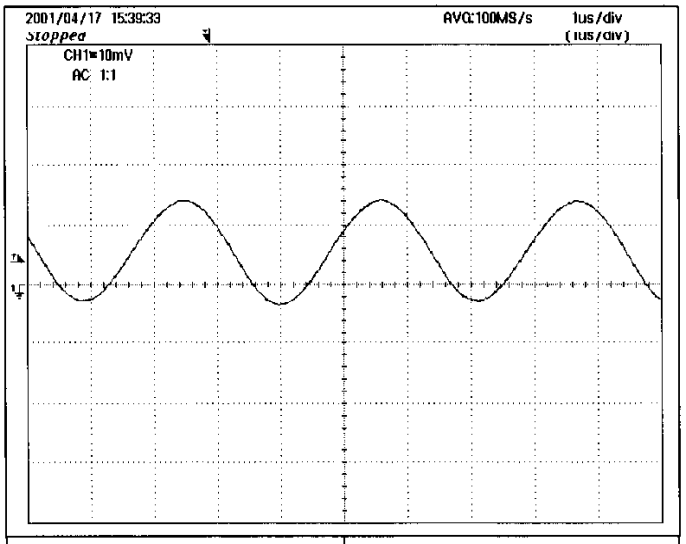


Vin	Vo1 (5V)	Vo2 (3.3V)	Time Base
1V / DIV	5mV / DIV	5mV / DIV	2ms / DIV

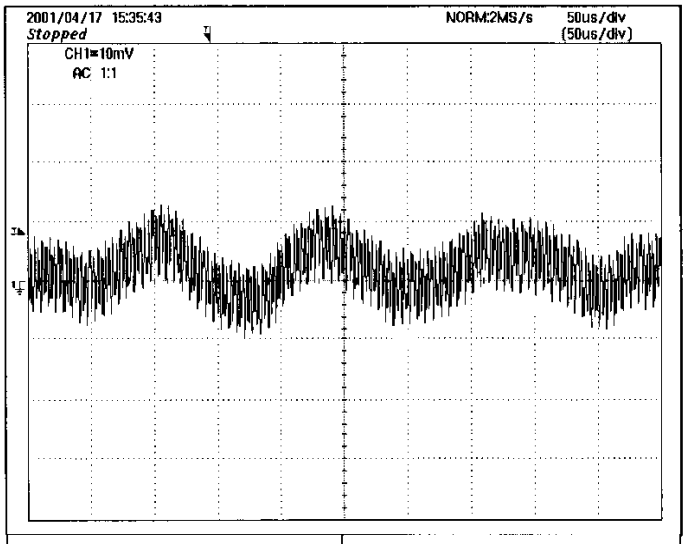
AC Input Ripple Voltage = 2V
Output Ripple Voltage = 5.2mV

2-15 INPUT REFLECTED CURRENT

Condition : Vin = 24 VDC
Io1 = 7.5A
Io2 = 7.5A
Tp= 25°C



Iin	Time Base
20mA / DIV	1us / DIV



Iin	Time Base
20mA / DIV	50us / DIV