

Evaluation Data

품 목	SMPS
품 명	CSF15-DE,DW
Rev. No.	A

2008 년 05 월 06 일

작 성 : 연구원 최영철

검 토 : 전 임 한상용

승 인 : 상 무 장재하



서울특별시 성동구 성수2가 3동 273-1

TEL : (02) 461-1524

FAX : (02) 463-6398

Evaluation data

1. CSF15-DD

1. Input characteristics
 - . Inrush Current Characteristics
 - . Input Current & Efficiency Characteristics
2. Output characteristics
 - . Line & Load Regulation Characteristics
 - . Dynamic Load Response Characteristics
 - . Ripple & Noise Characteristics
 - . Turn on Time Characteristics
 - . Hold up Time Characteristics
 - . Over Current Protection Characteristics
 - . Over Voltage Protection Characteristics

2. CSF15-EE

1. Input characteristics
2. Output characteristics

3. CSF15-BDW

1. Input characteristics
2. Output characteristics

4. CSF15-DDW

1. Input characteristics
2. Output characteristics

5. CSF15-EEW

1. Input characteristics
2. Output characteristics

1-1. CSF15-DD Input characteristics

(1) Oscilloscope : WAVE PRO 7000(LeCroy)

CH2 : Input voltage - ADP305 High voltage differential probe

CH3 : Input current - AP015 current probe

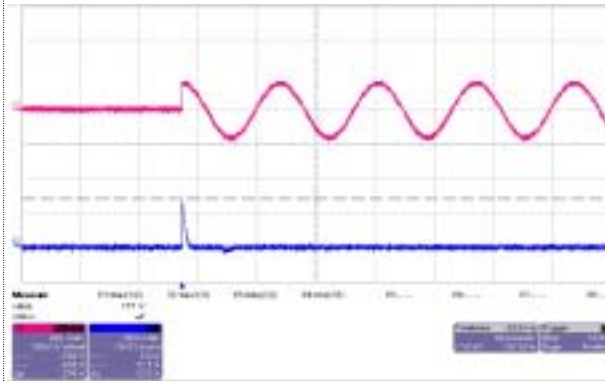
(2) Digital Multimeter : FLUKE189 (FLUKE)

(1) Inrush Current Characteristics (110V)

Vin=
110V

Io=
100%

I_{rush} = 13.7A



CH2
200V/div
10.0ms/div

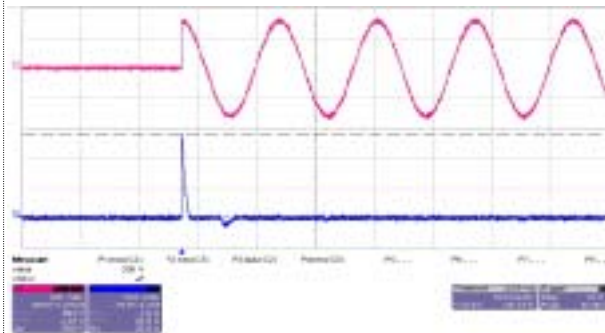
CH3
10.0A/div
10.0ms/div

(2) Inrush Current Characteristics (220V)

Vin=
220V

Io=
100%

I_{rush} = 28.0A



CH2
200V/div
10.0ms/div

CH3
10.0A/div
10.0ms/div

(3) Input Current & Efficiency Characteristics

Condition Ta : 25

Io \ Vin		85V	110V	132V	170V	220V	264V
		85V	110V	132V	170V	220V	264V
Load (min)	Input Current	0.045A	0.040A	0.038A	0.038A	0.038A	0.039A
	Efficiency	-	-	-	-	-	-
Load (50%)	Input Current	0.228A	0.188A	0.167A	0.136A	0.129A	0.115A
	Efficiency	65.9%	65.4%	65.9%	63.3%	59.6%	57.1%
Load (100%)	Input Current	0.436A	0.338A	0.287A	0.239A	0.198A	0.186A
	Efficiency	68.1%	69.9%	69.5%	69.8%	67.8%	65.0%

1-2. CSF15-DD Output characteristics

(1) Digital Multimeter : FLUKE189 (FLUKE)


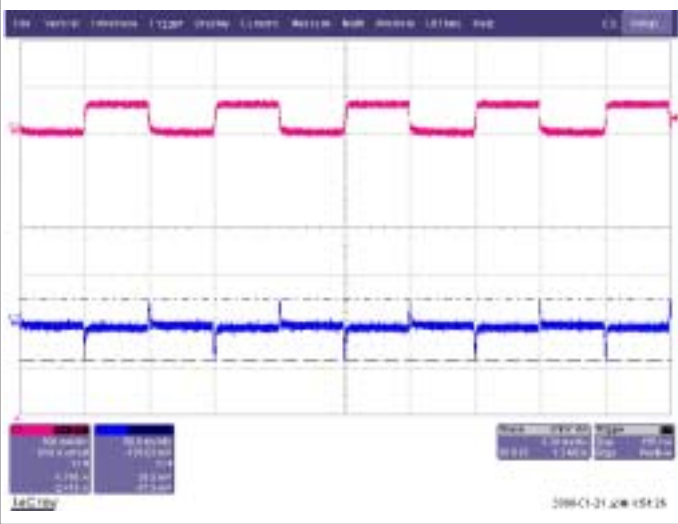
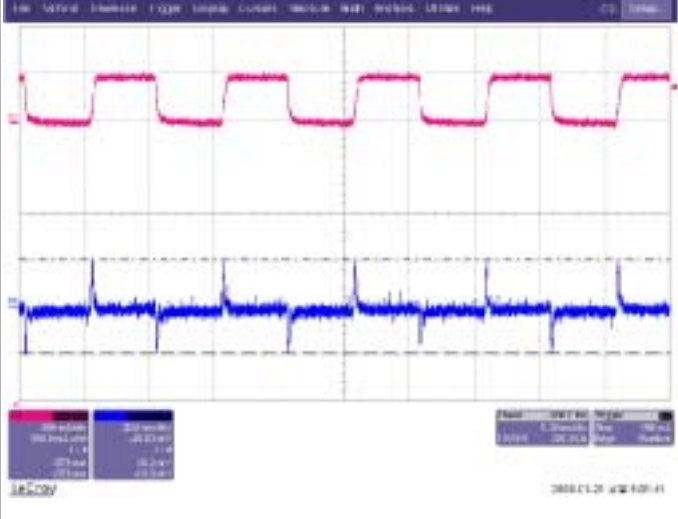
(1) Line & Load Regulation Characteristics								Condition Ta : 25
CH1								
V_{in} \ I_o	85V	110V	132V	170V	220V	264V	Line Regulation [mV]	
Load (min)	5.067V	5.067V	5.067V	5.067V	5.067V	5.067V	0mV	
Load (50%)	5.065V	5.065V	5.065V	5.064V	5.064V	5.064V	1mV	
Load (100%)	5.062V	5.062V	5.062V	5.063V	5.063V	5.063V	1mV	
Load Regulation	5mV	5mV	5mV	4mV	4mV	4mV		
CH2								
V_{in} \ I_o	85V	110V	132V	170V	220V	264V	Line Regulation [mV]	
Load (min)	12.216V	12.216V	12.216V	12.216V	12.217V	12.217V	1mV	
Load (50%)	12.209V	12.207V	12.206V	12.205V	12.205V	12.204V	5mV	
Load (100%)	12.183V	12.186V	12.187V	12.189V	12.192V	12.196V	13mV	
Load Regulation	33mV	30mV	29mV	27mV	25mV	21mV		
CH3								
V_{in} \ I_o	85V	110V	132V	170V	220V	264V	Line Regulation [mV]	
Load (min)	12.156V	12.156V	12.156V	12.156V	12.156V	12.156V	0mV	
Load (50%)	12.146V	12.144V	12.143V	12.142V	12.140V	12.139V	7mV	
Load (100%)	12.110V	12.115V	12.119V	12.121V	12.125V	12.131V	21mV	
Load Regulation	46mV	41mV	37mV	35mV	31mV	25mV		
(2) CSF15-DD Cross Regulation characteristics								Condition Ta : 25
Channel NO.	CH1		CH2		CH3			
Input Voltage								
220VAC	min%	5.051V	100%	12.161V	100%	12.075V		
	min%	5.051V	50%	12.171V	50%	12.082V		
	50%	5.050V	0%	12.182V	0%	12.101V		
	100%	5.049V	0%	12.191V	0%	12.103V		
Cross Regulation[mV]		2mV		30mV		26mV		

1-3. CSF15-DD Dynamic load response characteristics

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH2 : CURRENT WAVE FORM - AP015 Current probe

CH3 : VOLTAGE WAVE FORM - PP005 Passive Voltage probe

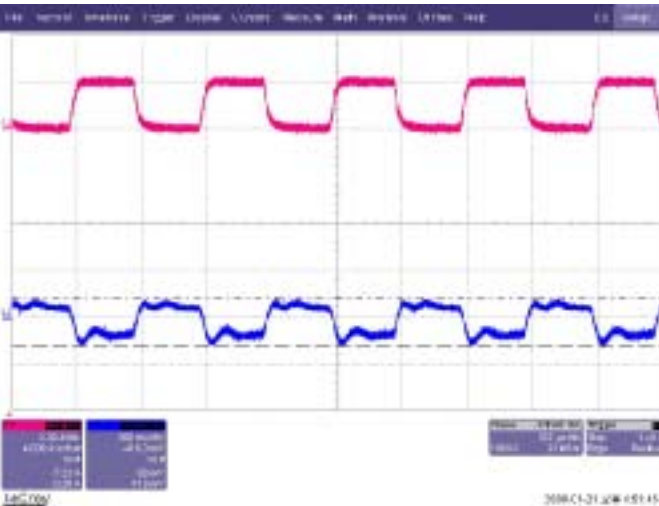
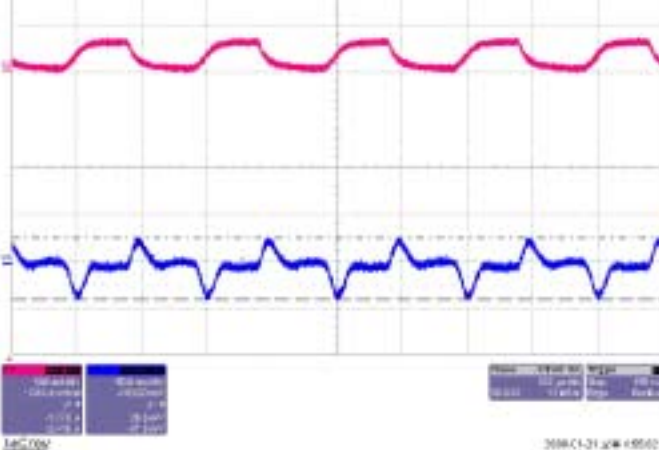
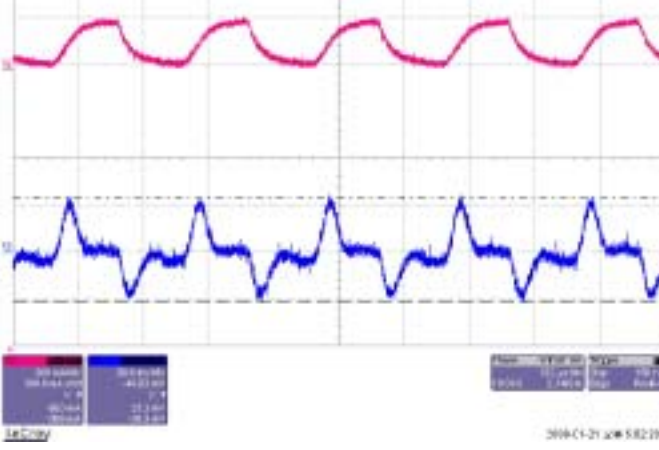
220VAC	<p>OUTPUT 5V/2A</p> <p>$I_o =$ 0~100% 100Hz</p>	<p>CH1 :</p> <p>+V_{PK}=140mV (2.8%)</p> <p>-V_{PK}=160mV (3.2%)</p>		<p>CH2 2.00A/div 5.00ms/div</p> <p>CH3 200mV/div 5.00ms/div</p>
220VAC	<p>OUTPUT 12V/0.3A</p> <p>$I_o =$ 0~100% 100Hz</p>	<p>CH2 :</p> <p>+V_{PK}=26mV (0.21%)</p> <p>-V_{PK}=38mV (0.31%)</p>		<p>CH2 500mA/div 5.00ms/div</p> <p>CH3 50.0mV/div 5.00ms/div</p>
220VAC	<p>OUTPUT 12V/0.2A</p> <p>$I_o =$ 0~100% 100Hz</p>	<p>CH3 :</p> <p>+V_{PK}=20mV (0.16%)</p> <p>-V_{PK}=19mV (0.16%)</p>		<p>CH2 200mA/div 5.00ms/div</p> <p>CH3 20.0mV/div 5.00ms/div</p>

1-4. CSF15-DD Dynamic load response characteristics

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH2 : CURRENT WAVE FORM - AP015 Current probe

CH3 : VOLTAGE WAVE FORM - PP005 Passive Voltage probe

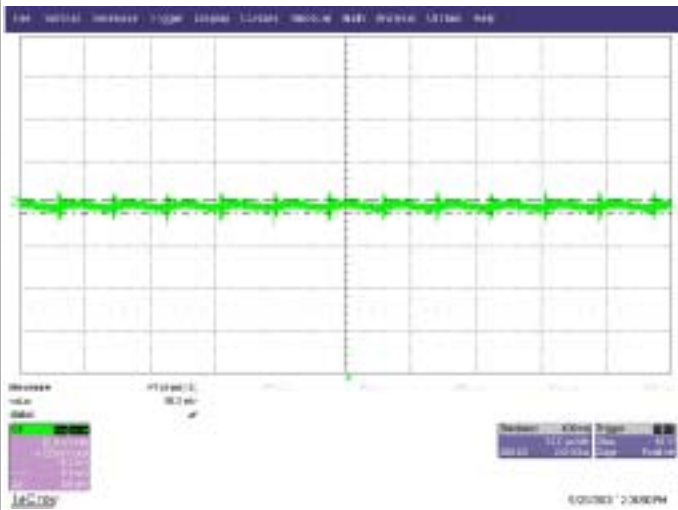
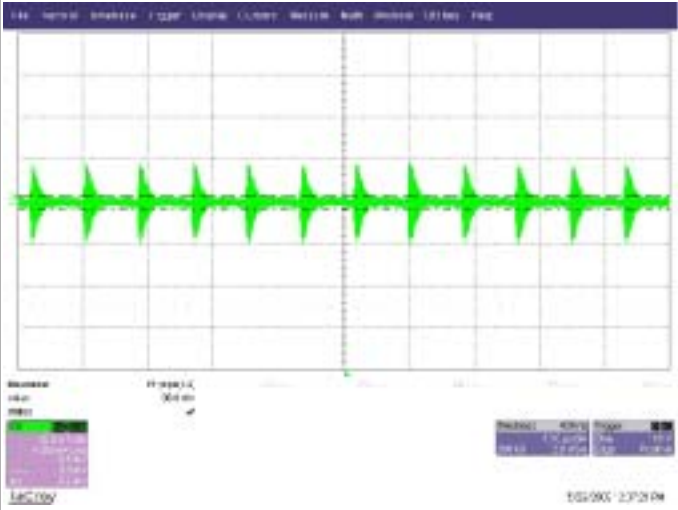
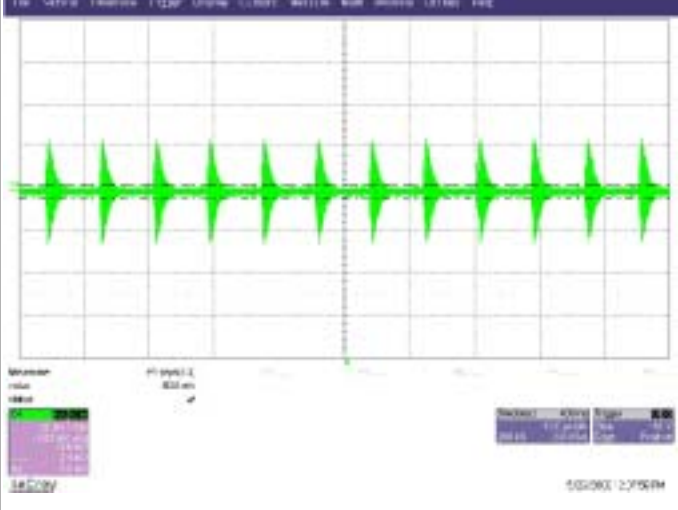
220VAC	OUTPUT 5V/2A $I_o =$ 0~100% 1KHz	CH1 : +V _{PK} =88mV (1.8%) -V _{PK} =118mV (2.4%)		CH2 2.00A/div 500us/div CH3 200mV/div 500us/div
220VAC	OUTPUT 12V/0.3A $I_o =$ 0~100% 1KHz	CH2 : +V _{PK} =27mV (0.22%) -V _{PK} =38mV (0.31%)		CH2 500mA/div 500us/div CH3 50.0mV/div 500us/div
220VAC	OUTPUT 12V/0.2A $I_o =$ 0~100% 1KHz	CH3 : +V _{PK} =23mV (0.19%) -V _{PK} =21mV (0.17%)		CH2 200mA/div 500us/div CH3 20.0mV/div 500us/div

1-5. CSF15-DD Ripple & Noise characteristics

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH4 : BNC Cable Probe(50 , 1.5m)

Band Width : 200MHz

220VAC	$I_o=100\%$	CH1 Ripple 7mV Ripple&NOISE 16mV _{p-p}		CH4 20.0mV/div 10.0us/div
220VAC	$I_o=100\%$	CH2 Ripple 6mV Ripple&NOISE 39mV _{p-p}		CH4 20.0mV/div 10.0us/div
220VAC	$I_o=100\%$	CH3 Ripple 6mV Ripple&NOISE 50mV _{p-p}		CH4 20.0mV/div 10.0us/div

1-6. CSF15-DD Output characteristics

(1) Oscilloscope : WAVE PRO 7000(LeCroy)
 CH2 : Input voltage - ADP305 High voltage differential probe
 CH4 : Output voltage - PP005A passive probe

--	--	--	--	--

(1) Turn on time characteristics

<p>$V_{in} = 100V$</p>	<p>$I_o = 100\%$</p>	<p>$t_{turn\ on} = 615ms$</p>		<p>CH4 2.00V/div 100.0ms/div</p> <p>CH2 200V/div 100.0ms/div</p>
-----------------------------------	---------------------------------	--	--	--

(2) Hold up characteristics

<p>$V_{in} = 100V$</p>	<p>$I_o = 100\%$</p>	<p>$t_{hold\ up} = 19.7ms$</p>		<p>CH4 2.00V/div 10.0ms/div</p> <p>CH2 200V/div 10.0ms/div</p>
-----------------------------------	---------------------------------	---	--	--

(3) Over Current protection characteristics

<p>$V_{in} = 220V$</p>		<p>O.C.P = 3.1A</p>		<p>X 1.00A/div 5us/div</p> <p>Y 1.00V/div 5us/div</p>
-----------------------------------	--	---------------------	--	---

(4) Over Voltage protection characteristics

<p>$V_{in} = 220V$</p>	<p>$I_o = 10\%$</p>	<p>O.V.P = 6.5V</p>		<p>CH1 2.00V/div 50.0ms/div</p>
-----------------------------------	--------------------------------	---------------------	--	---

2-1. CSF15-EE Input characteristics

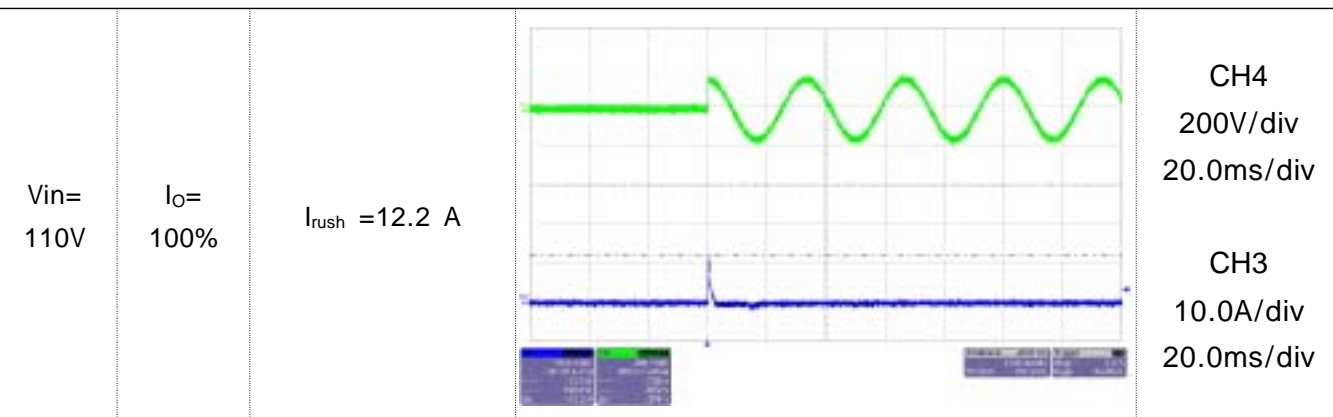
(1) Oscilloscope : WAVE PRO 7000(LeCroy)

CH4 : Input voltage - ADP305 High voltage differential probe

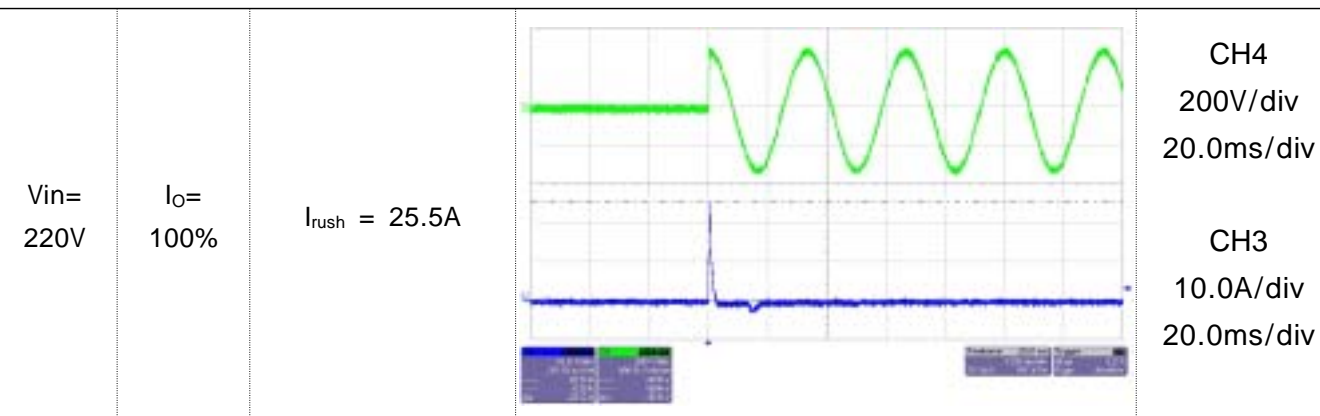
CH3 : Input current - AP015 current probe

(2) Digital Multimeter : FLUKE189 (FLUKE)

(1) Inrush Current Characteristics (110V)



(2) Inrush Current Characteristics (220V)



(3) Input Current & Efficiency Characteristics

Condition $T_a : 25$

		V_{in}						
		85V	110V	132V	170V	220V	264V	
Load (min)	Input Current	0.054A	0.048A	0.046A	0.045A	0.047A	0.048A	
	Efficiency	-	-	-	-	-	-	
Load (50%)	Input Current	0.241A	0.200A	0.170A	0.149A	0.132A	0.121A	
	Efficiency	65.7%	65.1%	65.6%	64.1%	60.6%	57.8%	
Load (100%)	Input Current	0.460A	0.356A	0.306A	0.249A	0.209A	0.195A	
	Efficiency	68.6%	70.3%	70.7%	70.0%	68.4%	66.3%	

2-2. CSF15-EE Output characteristics

(1) Digital Multimeter : FLUKE189 (FLUKE)

(1) Line & Load Regulation Characteristics								Condition Ta : 25
$V_{in} \backslash I_o$	85V	110V	132V	170V	220V	264V	Line Regulation [mV]	
Load (min)	5.019V	5.021V	5.021V	5.022V	5.022V	5.022V	3mV	
Load (50%)	5.023V	5.022V	5.022V	5.022V	5.022V	5.022V	1mV	
Load (100%)	5.022V	5.022V	5.022V	5.022V	5.022V	5.022V	0mV	
Load Regulation	4mV	1mV	1mV	0mV	0mV	0mV		
$V_{in} \backslash I_o$	85V	110V	132V	170V	220V	264V	Line Regulation [mV]	
Load (min)	15.072V	15.072V	15.073V	15.072V	15.072V	15.072V	1mV	
Load (50%)	15.056V	15.057V	15.058V	15.059V	15.060V	15.061V	5mV	
Load (100%)	15.041V	15.039V	15.036V	15.033V	15.032V	15.030V	11mV	
Load Regulation	31mV	33mV	37mV	39mV	40mV	42mV		
$V_{in} \backslash I_o$	85V	110V	132V	170V	220V	264V	Line Regulation [mV]	
Load (min)	15.129V	15.129V	15.128V	15.128V	15.128V	15.128V	1mV	
Load (50%)	15.119V	15.119V	15.120V	15.121V	15.122V	15.124V	5mV	
Load (100%)	15.113V	15.110V	15.108V	15.107V	15.106V	15.104V	9mV	
Load Regulation	16mV	19mV	20mV	21mV	22mV	24mV		
(2) CSF15-EE Cross Regulation characteristics								
Channel NO.	CH1		CH2		CH3			
Input Voltage								
220VAC	min%	5.133V	100%	15.028V	100%	15.112V		
	min%	5.134V	50%	15.031V	50%	15.115V		
	50%	5.133V	0%	15.042V	0%	15.121V		
	100%	5.132V	0%	15.047V	0%	15.119V		
Cross Regulation[mV]		2mV		19mV		9mV		




2-3. CSF15-EE Dynamic load response characteristics

< >

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH2 : CURRENT WAVE FORM - AP015 Current probe

CH3 : VOLTAGE WAVE FORM - PP005 Passive Voltage probe

220VAC	<p>OUTPUT 5V/2A</p> <p>$I_o =$ 0~100% 100Hz</p>	<p>CH1 :</p> <p>+V_{PK}=158mV (3.2%)</p> <p>-V_{PK}=156mV (3.1%)</p>		<p>CH2 2.00A/div 5.00ms/div</p> <p>CH3 200mV/div 5.00ms/div</p>
220VAC	<p>OUTPUT 15V/0.3A</p> <p>$I_o =$ 0~100% 100Hz</p>	<p>CH2 :</p> <p>+V_{PK}=31mV (0.20%)</p> <p>-V_{PK}=37mV (0.24%)</p>		<p>CH2 500mA/div 5.00ms/div</p> <p>CH3 50.0mV/div 5.00ms/div</p>
220VAC	<p>$I_o =$ 0~100% 100Hz</p>	<p>CH3 :</p> <p>+V_{PK}=17mV (0.11%)</p> <p>-V_{PK}=19mV (0.12%)</p>		<p>CH2 200mA/div 5.00ms/div</p> <p>CH3 20.0mV/div 5.00ms/div</p>

2-4. CSF15-EE Dynamic load response characteristics

< >

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH2 : CURRENT WAVE FORM - AP015 Current probe

CH3 : VOLTAGE WAVE FORM - PP005 Passive Voltage probe

220VAC	<p>OUTPUT 5V/2A</p> <p>$I_o =$ 0~100% 1KHz</p>	<p>CH1 :</p> <p>+V_{PK}=78mV (1.6%)</p> <p>-V_{PK}=128mV (2.6%)</p>		<p>CH2 2.00A/div 500us/div</p> <p>CH3 200mV/div 500us/div</p>
220VAC	<p>OUTPUT 15V/0.3A</p> <p>$I_o =$ 0~100% 1KHz</p>	<p>CH2 :</p> <p>+V_{PK}=32mV (0.21%)</p> <p>-V_{PK}=42mV (0.28%)</p>		<p>CH2 500mA/div 500us/div</p> <p>CH3 50.0mV/div 500us/div</p>
220VAC	<p>OUTPUT 15V/0.2A</p> <p>$I_o =$ 0~100% 1KHz</p>	<p>CH3 :</p> <p>+V_{PK}=19mV (0.12%)</p> <p>-V_{PK}=21mV (0.14%)</p>		<p>CH2 200mA/div 500us/div</p> <p>CH3 20.0mV/div 500us/div</p>

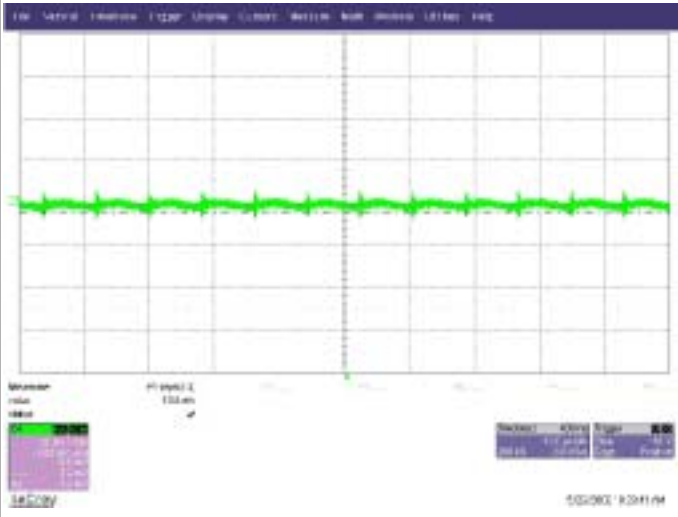
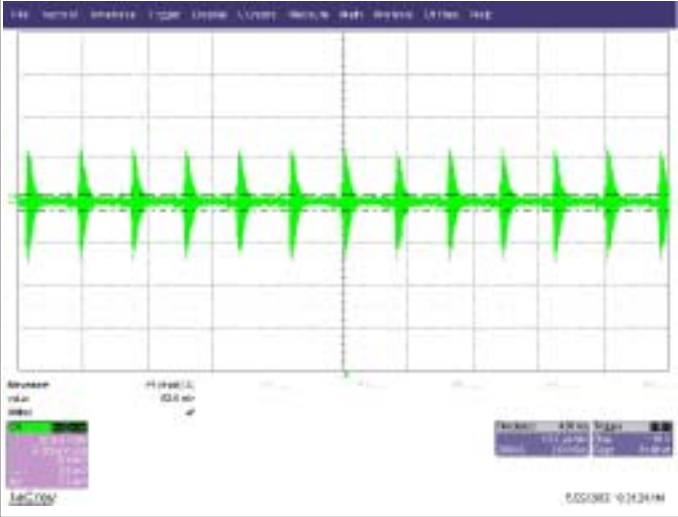
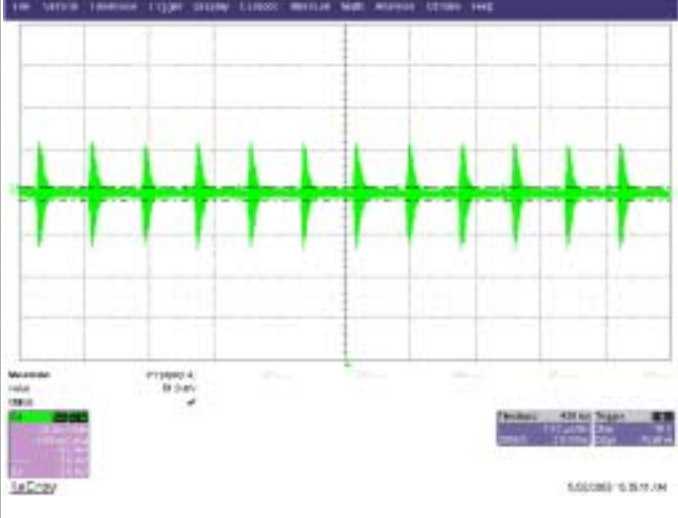
2-5. CSF15-EE Ripple & Noise characteristics

< >

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH4 : BNC Cable Probe(50 , 1.5m)

Band Width : 200MHz

220VAC	$I_o=100\%$	CH1 Ripple 6mV Ripple&NOISE 14mV _{p-p}		CH4 20.0mV/div 10.0us/div
220VAC	$I_o=100\%$	CH2 Ripple 7mV Ripple&NOISE 54mV _{p-p}		CH4 20.0mV/div 10.0us/div
220VAC	$I_o=100\%$	CH3 Ripple 7mV Ripple&NOISE 52mV _{p-p}		CH4 20.0mV/div 10.0us/div

2-6. CSF15-EE Output characteristics

(1) Oscilloscope : WAVE PRO 7000(LeCroy)

CH1 : Output voltage - PP005A passive probe

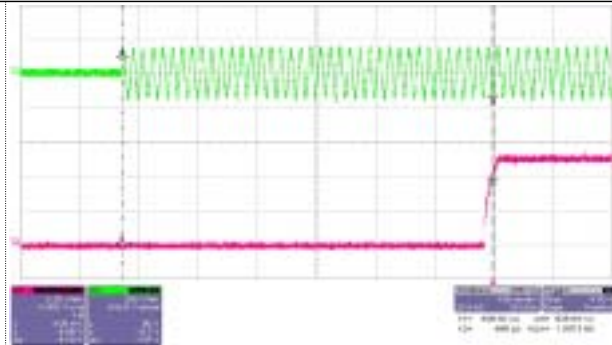
CH2 : Input voltage - ADP305 High voltage differential probe

(1) Turn on time characteristics

$V_{in} =$
100V

$I_o =$
100%

$t_{turn\ on} = 626ms$



CH2
2.00V/div
100.0ms/div

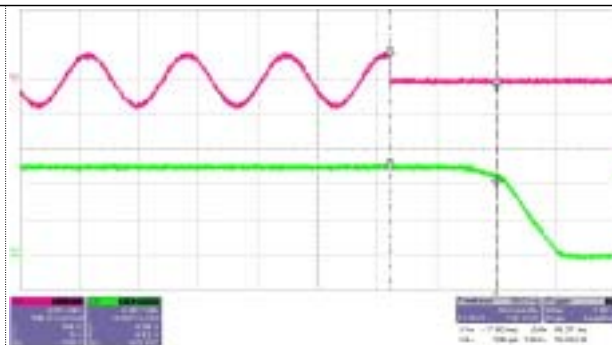
CH4
200V/div
100.0ms/div

(2) Hold up characteristics

$V_{in} =$
100V

$I_o =$
100%

$t_{hold\ up} = 18.0ms$



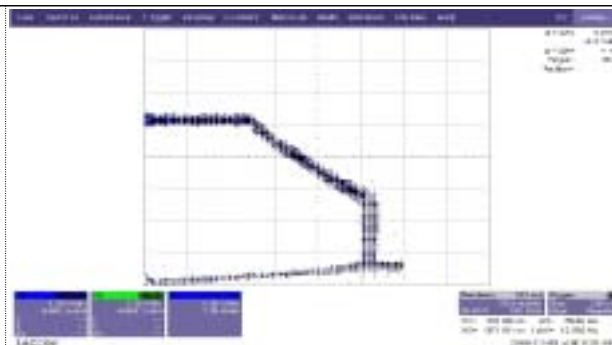
CH4
2.00V/div
10.0ms/div

CH2
200V/div
10.0ms/div

(3) Over Current protection characteristics

$V_{in} =$
220V

O.C.P = 3.0A



X
0.5A/div
5us/div

Y
2.0V/div
5us/div

(4) Over Voltage protection characteristics

$V_{in} =$
220V

$I_o =$
10%

O.V.P = 6.5V



CH4
2.00V/div
20.0ms/div

3-1. CSF15-BDW Input characteristics

(1) Oscilloscope : WAVE PRO 7000(LeCroy)

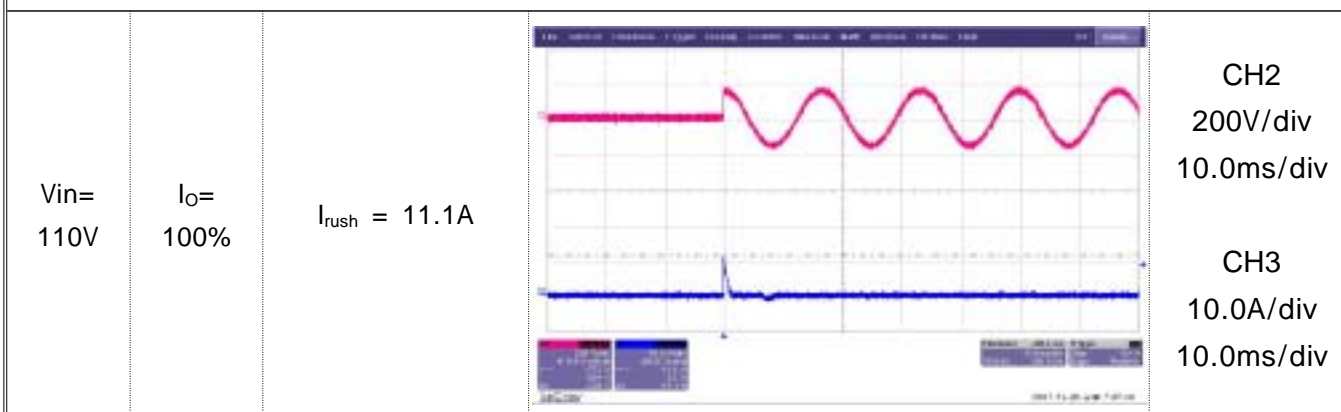
CH2 : Input line voltage - ADP305 High voltage differential probe

CH3 : Input line current - AP015 current probe

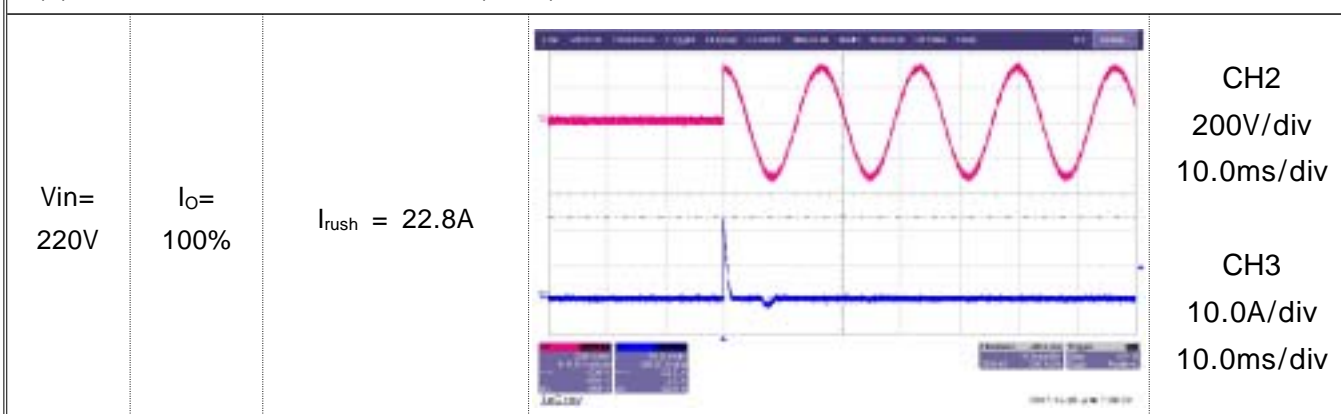
(2) Digital Multimeter : FLUKE189 (FLUKE)

--	--	--	--	--

(1) Inrush Current Characteristics (110V)



(2) Inrush Current Characteristics (220V)



(3) Input Current & Efficiency Characteristics

		Condition $T_a : 25$						
		V_{in}	85V	110V	132V	170V	220V	264V
I_o								
Load (min)	Input Current		0.053A	0.046A	0.044A	0.042A	0.043A	0.043A
	Efficiency		-	-	-	-	-	-
Load (50%)	Input Current		0.231A	0.189A	0.170A	0.140A	0.125A	0.115A
	Efficiency		64.3%	63.6%	64.0%	61.8%	58.3%	55.5%
Load (100%)	Input Current		0.433A	0.337A	0.294A	0.236A	0.202A	0.184A
	Efficiency		67.1%	68.5%	68.0%	68.0%	66.3%	64.2%

3-2. CSF15-BDW Output characteristics

(1) Digital Multimeter : FLUKE189 (FLUKE)

(1) Line & Load Regulation Characteristics								Condition Ta : 25
CH1								
I_o \ Vin	85V	110V	132V	170V	220V	264V	Line Regulation [mV]	
Load (min)	5.103V	5.103V	5.103V	5.102V	5.102V	5.102V	1mV	
Load (50%)	5.100V	5.101V	5.101V	5.101V	5.101V	5.101V	1mV	
Load (100%)	5.099V	5.099V	5.098V	5.098V	5.098V	5.097V	2mV	
Load Regulation [mV]	4mV	4mV	5mV	4mV	4mV	5mV		
CH2								
I_o \ Vin	85V	110V	132V	170V	220V	264V	Line Regulation [mV]	
Load (min)	12.305V	12.306V	12.310V	12.310V	12.310V	12.310V	5mV	
Load (50%)	12.289V	12.290V	12.291V	12.293V	12.295V	12.300V	11mV	
Load (100%)	12.272V	12.263V	12.259V	12.257V	12.256V	12.253V	19mV	
Load Regulation [mV]	33mV	43mV	41mV	53mV	54mV	57mV		
(2) CSF15-DD Cross Regulation characteristics								Condition Ta : 25
Channel NO.	CH1			CH2				
Input Voltage								
220VAC	min%	5.087V	100%	12.115V				
	min%	5.087V	50%	12.122V				
	50%	5.086V	0%	12.133V				
	100%	5.085V	0%	12.135V				
Cross Regulation[mV]		2mV		20mV				


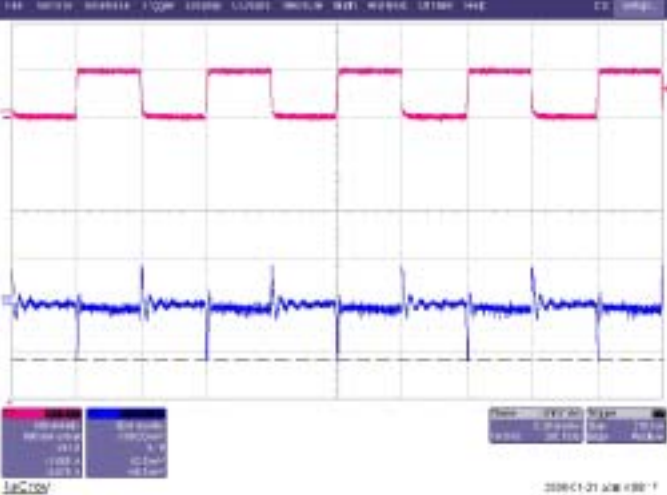
3-3. CSF15-BDW Dynamic load response characteristics

< >

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH2 : CURRENT WAVE FORM - AP015 Current probe

CH3 : VOLTAGE WAVE FORM - PP005 Passive Voltage probe

<p>220VAC</p>	<p>OUTPUT 5V/2A</p> <p>$I_o =$ 0~100% 100Hz</p>	<p>CH1 :</p> <p>+V_{PK}=136mV (2.7%)</p> <p>-V_{PK}=152mV (3.0%)</p>		<p>CH2 2.00A/div 5.00ms/div</p> <p>CH3 200mV/div 5.00ms/div</p>
<p>220VAC</p>	<p>OUTPUT 12V/0.5A</p> <p>$I_o =$ 0~100% 100Hz</p>	<p>CH2 :</p> <p>+V_{PK}=43mV (0.35%)</p> <p>-V_{PK}=59mV (0.49%)</p>		<p>CH2 500mA/div 5.00ms/div</p> <p>CH3 50.0mV/div 5.00ms/div</p>


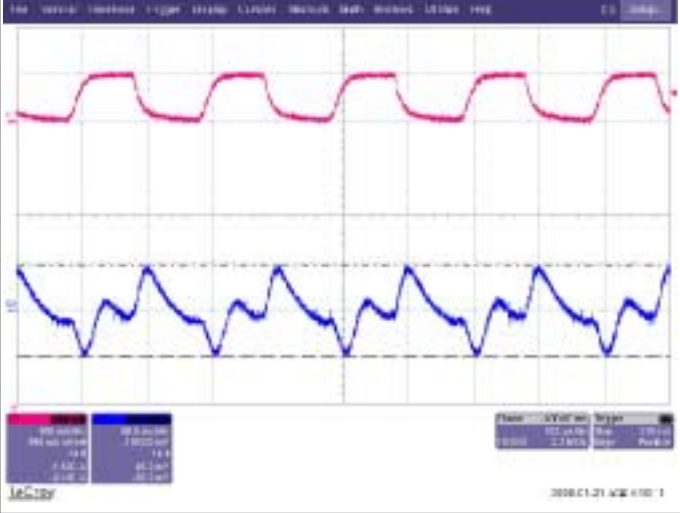
3-4. CSF15-BDW Dynamic load response characteristics

< >

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH2 : CURRENT WAVE FORM - AP015 Current probe

CH3 : VOLTAGE WAVE FORM - PP005 Passive Voltage probe

220VAC	OUTPUT 5V/2A $I_o =$ 0~100% 1KHz	CH1 : $+V_{PK} = 98mV$ (1.9%) $-V_{PK} = 108mV$ (2.1%)		CH2 2.00A/div 500us/div CH3 200mV/div 500us/div
220VAC	OUTPUT 12V/0.5A $I_o =$ 0~100% 1KHz	CH2 : $+V_{PK} = 46mV$ (0.38%) $-V_{PK} = 50mV$ (0.41%)		CH2 500mA/div 500us/div CH3 50.0mV/div 500us/div

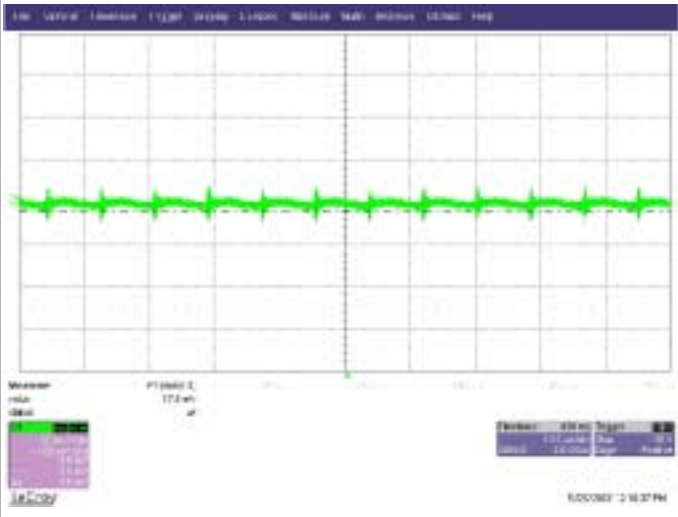
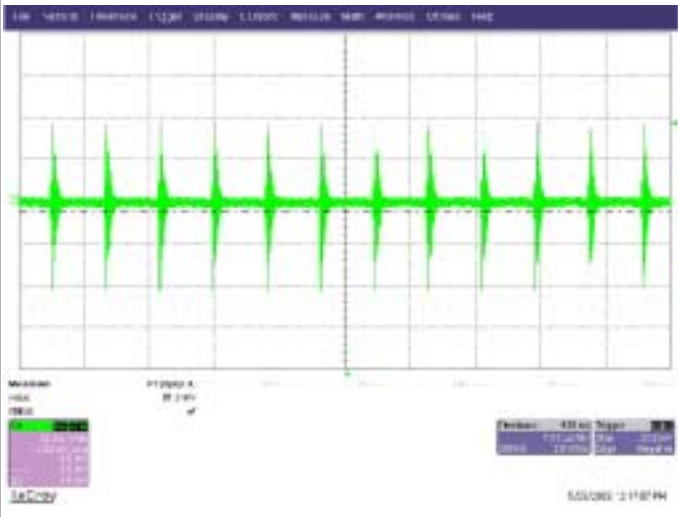
3-5. CSF15-BDW Ripple & Noise characteristics

< >

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH4 : BNC Cable Probe(50 Ω , 1.5m)

Band Width : 200MHz

220VAC	$I_o=100\%$	CH1 Ripple 7mV Ripple&NOISE 18mV _{p-p}		CH4 20.0mV/div 10.0us/div
220VAC	$I_o=100\%$	CH2 Ripple 7mV Ripple&NOISE 81mV _{p-p}		CH4 20.0mV/div 10.0us/div

3-6. CSF15-BDW Output characteristics

(1) Oscilloscope : WAVE PRO 7000(LeCroy)

CH4 : Output voltage - PP005A passive probe

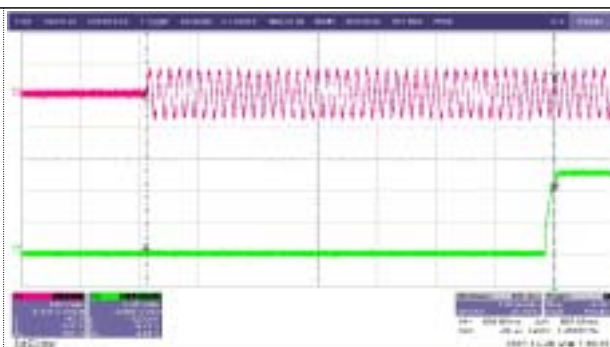
CH2 : Input voltage - ADP305 High voltage differential probe

(1) Turn on time characteristics

$V_{in} =$
V

$I_o =$
100%

$t_{turn\ on} = 687ms$



CH4
2.00V/div
100.0ms/div

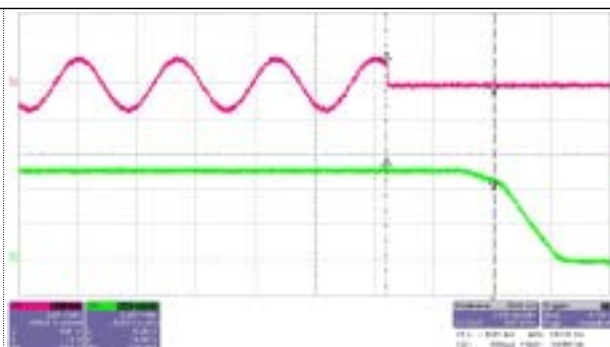
CH2
200V/div
100.0ms/div

(2) Hold up characteristics

$V_{in} =$
100V

$I_o =$
100%

$t_{hold\ up} = 18.2ms$



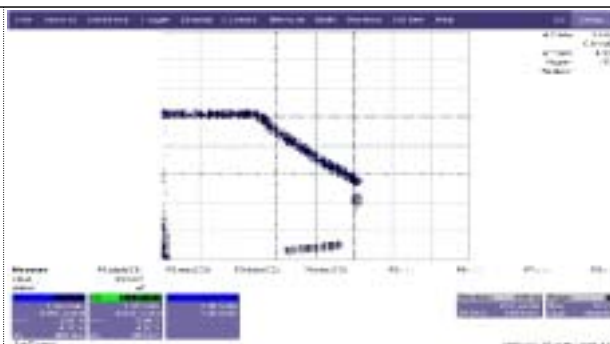
CH4
2.00V/div
10.0ms/div

CH2
200V/div
10.0ms/div

(3) Over Current protection characteristics

$V_{in} =$
220V

O.C.P = 3.1A



X
0.5A/div
10us/div

Y
2.0V/div
10us/div

(4) Over Voltage protection characteristics

$V_{in} =$
220V

$I_o =$
10%

O.V.P = 6.5V



CH4
2.00V/div
20.0ms/div

4-1. CSF15-DDW Input characteristics

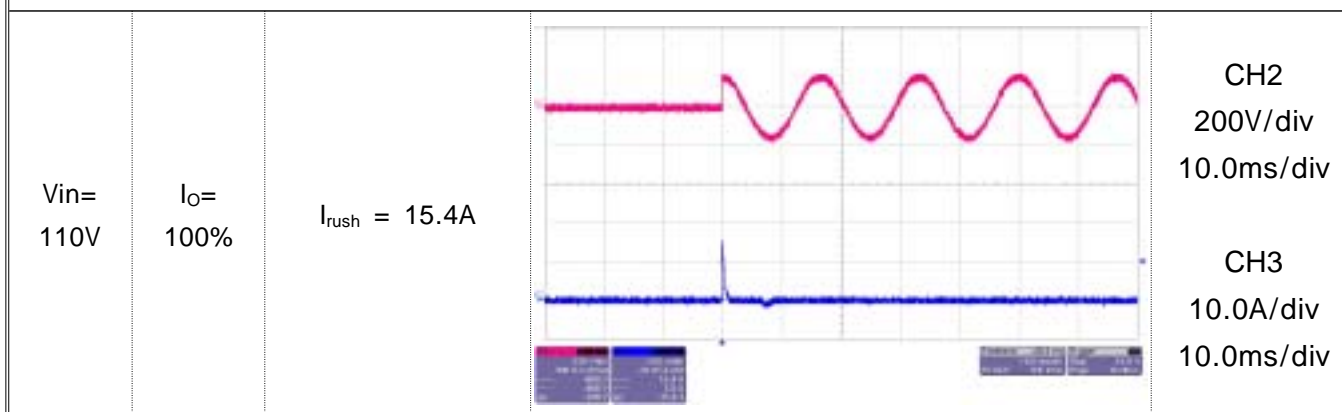
(1) Oscilloscope : WAVE PRO 7000(LeCroy)

CH2 : Input voltage - ADP305 High voltage differential probe

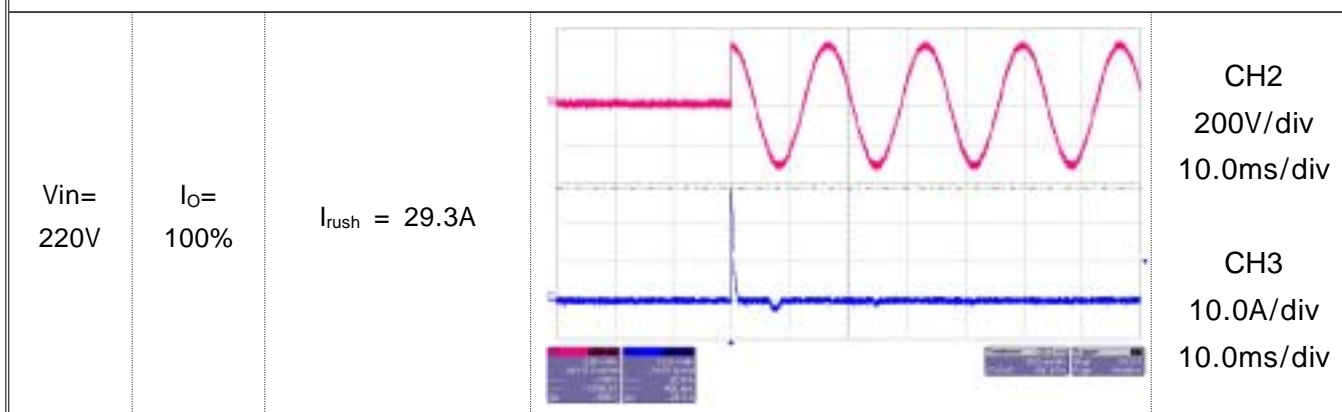
CH3 : Input current - AP015 current probe

(2) Digital Multimeter : FLUKE189 (FLUKE)

(1) Inrush Current Characteristics (110V)



(2) Inrush Current Characteristics (220V)



(3) Input Current & Efficiency Characteristics

		Condition $T_a : 25$						
		V_{in}	85V	110V	132V	170V	220V	264V
I_o								
Load (min)	Input Current		0.069A	0.059A	0.052A	0.053A	0.054A	0.055A
	Efficiency		-	-	-	-	-	-
Load (50%)	Input Current		0.235A	0.185A	0.167A	0.146A	0.130A	0.116A
	Efficiency		65.7%	66.0%	66.3%	63.0%	59.8%	57.4%
Load (100%)	Input Current		0.439A	0.352A	0.299A	0.239A	0.205A	0.188A
	Efficiency		69.3%	70.8%	70.5%	71.1%	68.5%	65.8%

4-2. CSF15-DDW Output characteristics

(1) Digital Multimeter : FLUKE189 (FLUKE)

(1) Line & Load Regulation Characteristics								Condition Ta : 25
CH1								
Input Voltage Load	85V	110V	132V	170V	220V	264V	Line Regulation [mV]	
Io=min% (0.1A)	12.077V	12.076V	12.075V	12.075V	12.075V	12.075V	2mV	
Io=50% (0.35A)	12.072V	12.073V	12.072V	12.073V	12.073V	12.073V	1mV	
Io=100% (0.7A)	12.069V	12.068V	12.068V	12.067V	12.067V	12.066V	3mV	
Load Regulation [mV]	8mV	8mV	7mV	8mV	8mV	9mV		
CH2								
Input Voltage Load	85V	110V	132V	170V	220V	264V	Line Regulation [mV]	
Io=0% (0A)	12.264V	12.264V	12.263V	12.263V	12.263V	12.264V	1mV	
Io=50% (0.35A)	12.245V	12.245V	12.246V	12.247V	12.248V	12.250V	5mV	
Io=100% (0.7A)	12.224V	12.223V	12.220V	12.218V	12.216V	12.215V	27mV	
Load Regulation [mV]	42mV	41mV	43mV	45mV	47mV	49mV		
(2) CSF15-DDW Cross Regulation characteristics								Condition Ta : 25
Channel NO.	CH1			CH2				
Input Voltage								
220VAC	min%	12.055V	100%	12.205V				
	min%	12.062V	50%	12.222V				
	50%	12.053V	0%	12.227V				
	100%	12.063V	0%	12.241V				
Cross Regulation[mV]	10mV			36mV				



4-3. CSF15-DDW Dynamic load response characteristics

< >

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH2 : CURRENT WAVE FORM - AP015 Current probe

CH3 : VOLTAGE WAVE FORM - PP005 Passive Voltage probe

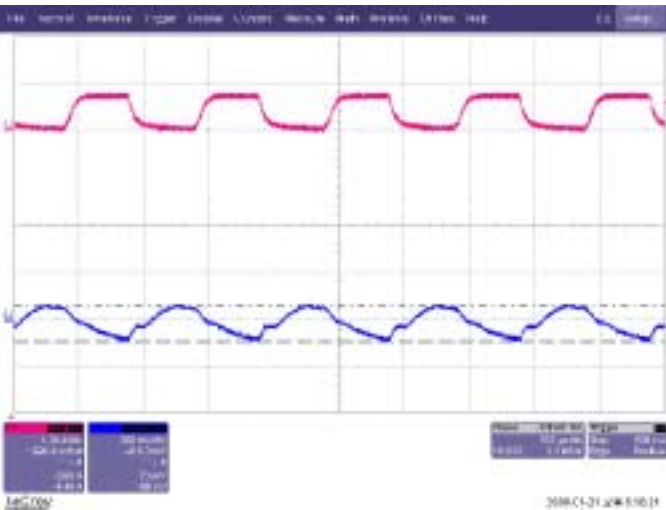
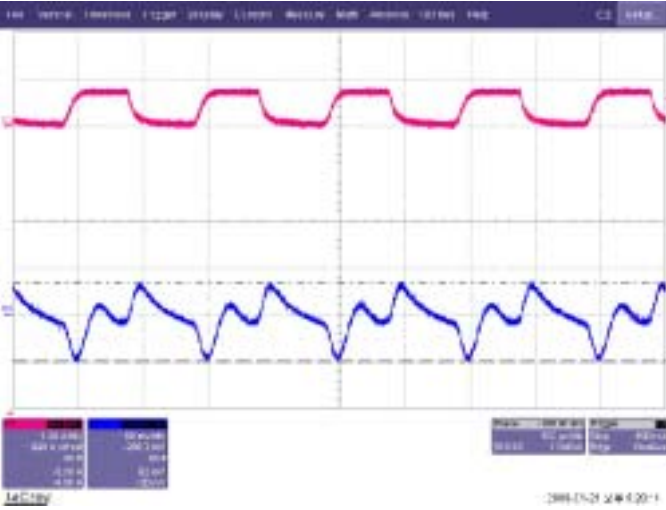
220VAC	OUTPUT 12V/0.7A $I_o =$ 0~100% 100Hz	CH1 : +V _{PK} =255mV (2.1%) -V _{PK} =395mV (3.3%)		CH2 1.00A/div 5.00ms/div CH3 500mV/div 5.00ms/div
220VAC	OUTPUT 12V/0.7A $I_o =$ 0~100% 100Hz	CH2 : +V _{PK} =58mV (0.48%) -V _{PK} =85mV (0.71%)		CH2 1.00A/div 5.00ms/div CH3 100mV/div 5.00ms/div

4-4. CSF15-DDW Dynamic load response characteristics

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH2 : CURRENT WAVE FORM - AP015 Current probe

CH3 : VOLTAGE WAVE FORM - PP005 Passive Voltage probe

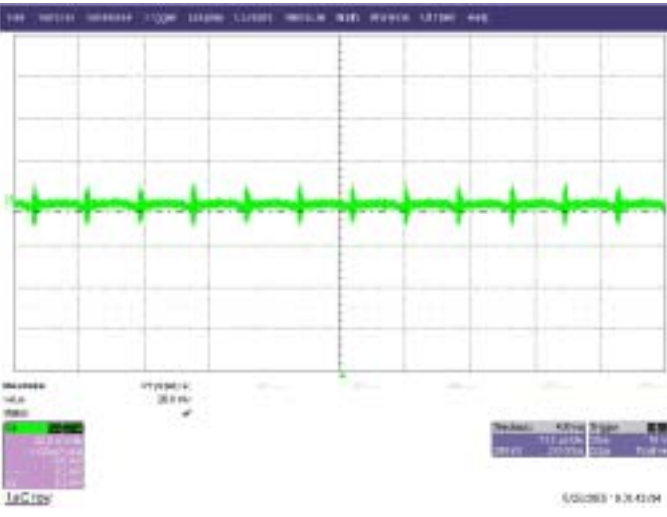
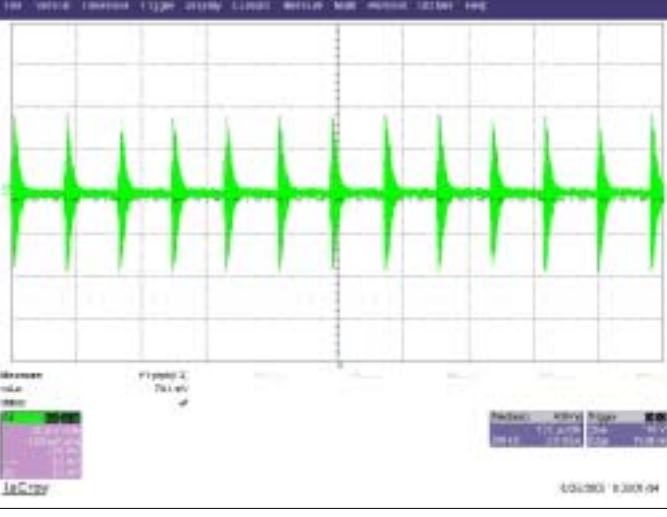
220VAC	OUTPUT 12V/0.7A $I_o =$ 0~100% 1KHz	CH1 : +V _{PK} =70mV (0.58%) -V _{PK} =88mV (0.73%)		CH2 1.00A/div 500us/div CH3 200mV/div 500us/div
220VAC	OUTPUT 12V/0.7A $I_o =$ 0~100% 1KHz	CH2 : +V _{PK} =69mV (0.57%) -V _{PK} =99mV (0.82%)		CH2 1.00A/div 500us/div CH3 100mV/div 500us/div

4-5. CSF15-DDW Ripple & Noise characteristics

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH4 : BNC Cable Probe(50 , 1.5m)

Band Width : 200MHz

220VAC	$I_o=100\%$	CH1 Ripple 6mV Ripple&NOISE 20mV _{p-p}		CH4 20.0mV/div 10.0us/div
220VAC	$I_o=100\%$	CH2 Ripple 6mV Ripple&NOISE 75mV _{p-p}		CH4 20.0mV/div 10.0us/div

4-6. CSF15-DDW Output characteristics

(1) Oscilloscope : WAVE PRO 7000(LeCroy)

CH1 : Output voltage - PP005A passive probe

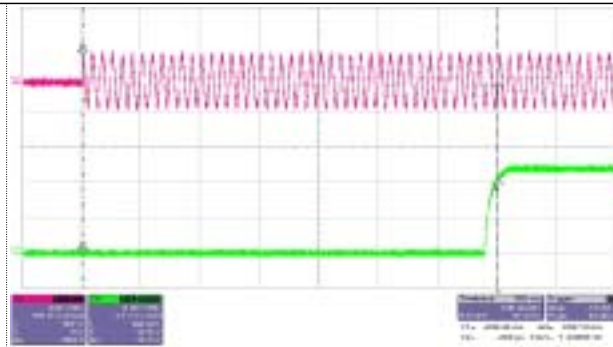
CH2 : Input voltage - ADP305 High voltage differential probe

(1) Turn on time characteristics

$V_{in} =$
100V

$I_o =$
100%

$t_{turn\ on} = 695ms$



CH4
5.00V/div
100.0ms/div

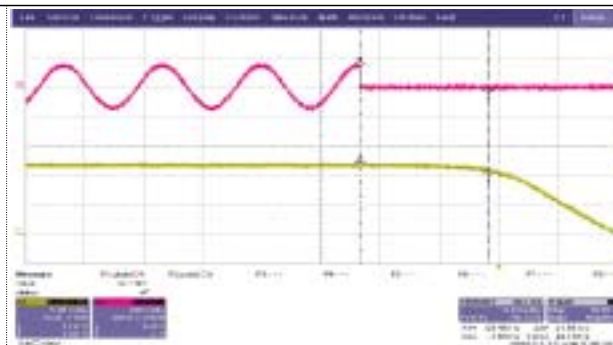
CH2
200V/div
100.0ms/div

(2) Hold up characteristics

$V_{in} =$
100V

$I_o =$
100%

$t_{hold\ up} = 21.6ms$



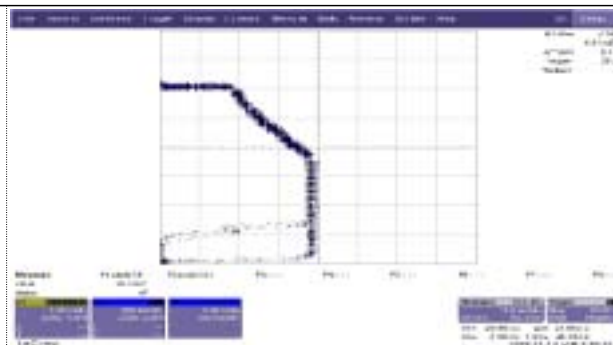
CH1
5.00V/div
10.0ms/div

CH2
200V/div
10.0ms/div

(3) Over Current protection characteristics

$V_{in} =$
220V

O.C.P = 1.15A



X
0.2A/div
10us/div

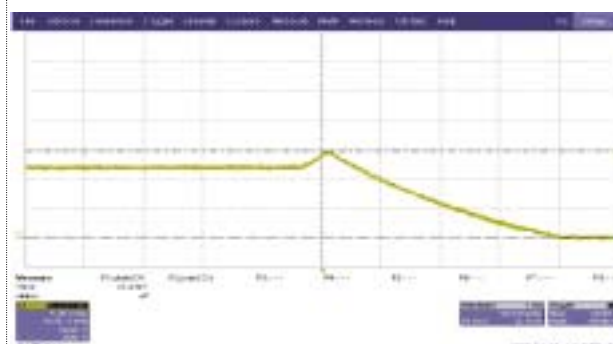
Y
5.0V/div
10us/div

(4) Over Voltage protection characteristics

$V_{in} =$
220V

$I_o =$
10%

O.V.P = 14.0V



CH1
5.00V/div
50.0ms/div

5-1. CSF15-EEW Input characteristics

(1) Oscilloscope : WAVE PRO 7000(LeCroy)

CH3 : Input voltage - ADP305 High voltage differential probe

CH4 : Input current - AP015 current probe

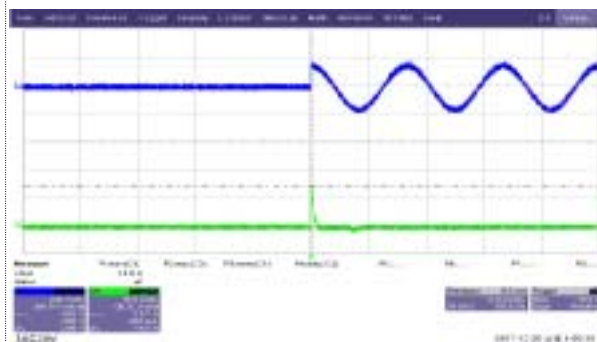
(2) Digital Multimeter : FLUKE189 (FLUKE)

(1) Inrush Current Characteristics (110V)

V_{in} =
110V

I_o =
100%

$I_{rush} = 14.0A$



CH3
200V/div
10.0ms/div

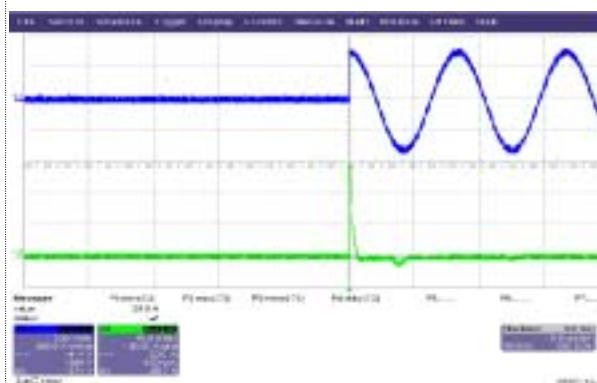
CH4
10.0A/div
10.0ms/div

(2) Inrush Current Characteristics (220V)

V_{in} =
220V

I_o =
100%

$I_{rush} = 28.7A$



CH3
200V/div
10.0ms/div

CH4
10.0A/div
10.0ms/div

(3) Input Current & Efficiency Characteristics

Condition $T_a : 25$

V_{in}		V_{in}					
		85V	110V	132V	170V	220V	264V
Load (min)	Input Current	0.071A	0.062A	0.059A	0.055A	0.053A	0.053A
	Efficiency	-	-	-	-	-	-
Load (50%)	Input Current	0.205A	0.167A	0.147A	0.126A	0.115A	0.107A
	Efficiency	67.3%	66.2%	66.1%	65.0%	60.3%	56.2%
Load (100%)	Input Current	0.374A	0.296A	0.257A	0.211A	0.178A	0.166A
	Efficiency	70.9%	72.2%	71.5%	71.2%	69.5%	66.7%

5-2. CSF15-EEW Output characteristics

(1) Digital Multimeter : FLUKE189 (FLUKE)

--	--	--	--	--

(1) Line & Load Regulation Characteristics

Condition Ta : 25

CH1

Input Voltage Load	85V	110V	132V	170V	220V	264V	Line Regulation [mV]
Io=min% (0.1A)	15.039V	15.038V	15.040V	15.042V	15.042V	15.043V	5mV
Io=50% (0.25A)	15.046V	15.046V	15.046V	15.045V	15.044V	15.044V	2mV
Io=100% (0.5A)	15.045V	15.046V	15.047V	15.047V	15.046V	15.047V	2mV
Load Regulation [mV]	7mV	8mV	7mV	5mV	4mV	4mV	

CH2

Input Voltage Load	85V	110V	132V	170V	220V	264V	Line Regulation [mV]
Io=min% (0.1A)	14.901V	14.902V	14.901V	14.901V	14.902V	14.902V	1mV
Io=50% (0.25A)	14.890V	14.892V	14.890V	14.891V	14.892V	14.892V	2mV
Io=100% (0.5A)	14.880V	14.877V	14.873V	14.871V	14.871V	14.869V	11mV
Load Regulation [mV]	21mV	25mV	28mV	30mV	31mV	33mV	

(2) CSF15-EEW Cross Regulation characteristics

Condition Ta : 25

Channel NO.	CH1		CH2	
Input Voltage				
220VAC	min%	15.075V	100%	15.152V
	min%	15.076V	50%	15.171V
	50%	15.078V	0%	15.175V
	100%	15.079V	0%	15.176V
Cross Regulation[mV]		4mV		24mV

4-3. CSF15-EEW Dynamic load response characteristics

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

CH2 : CURRENT WAVE FORM - AP015 Current probe

CH3 : VOLTAGE WAVE FORM - PP005 Passive Voltage probe

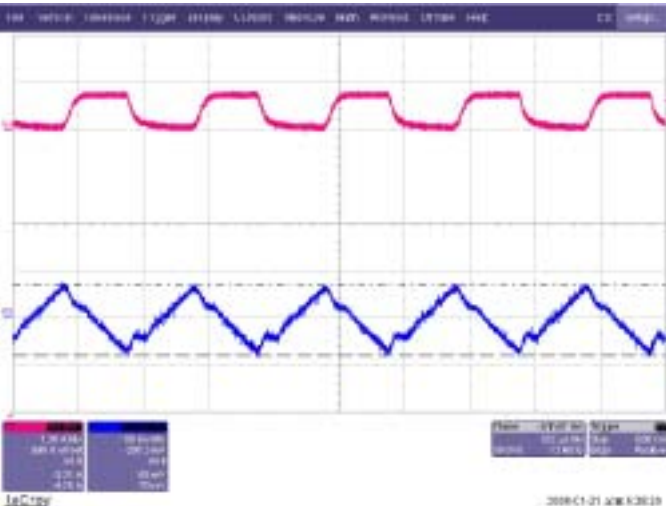
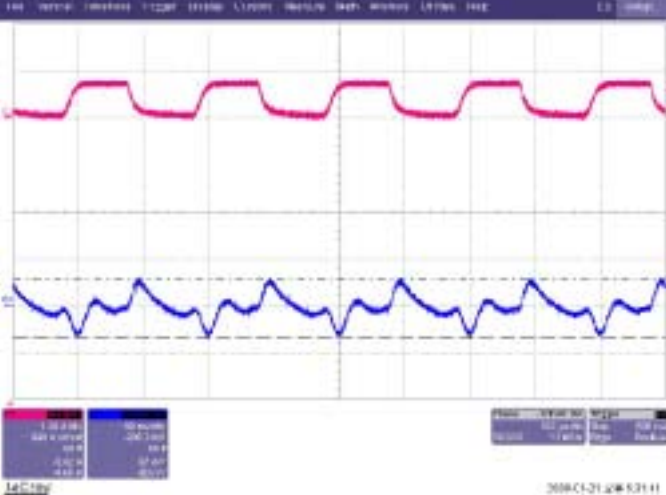
220VAC	OUTPUT 15V/0.5A $I_o =$ 0~100% 100Hz	CH1 : +V _{PK} =530mV (3.5%) -V _{PK} =580mV (3.8%)		CH2 1.00A/div 5.00ms/div CH3 1.00V/div 5.00ms/div
220VAC	OUTPUT 15V/0.5A $I_o =$ 0~100% 100Hz	CH2 : +V _{PK} =54mV (0.36%) -V _{PK} =81mV (0.54%)		CH2 1.00A/div 5.00ms/div CH3 100mV/div 5.00ms/div

5-4. CSF15-EEW Dynamic load response characteristics

(1) Oscilloscope : WAVEPRO 7000(LeCroy)

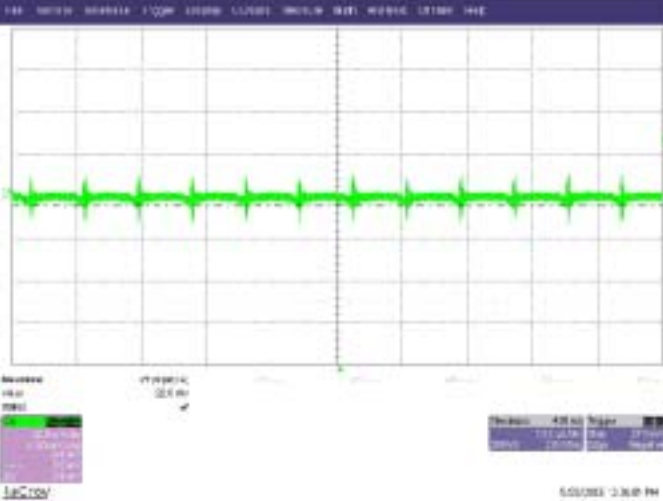
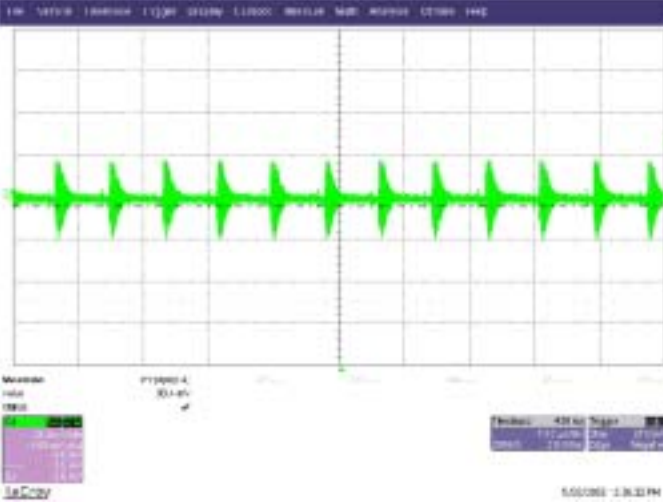
CH2 : CURRENT WAVE FORM - AP015 Current probe

CH3 : VOLTAGE WAVE FORM - PP005 Passive Voltage probe

220VAC	OUTPUT 15V/0.5A $I_o =$ 0~100% 1KHz	CH1 : +V _{PK} =68mV (0.45%) -V _{PK} =70mV (0.46%)		CH2 1.00A/div 500us/div CH3 100mV/div 500us/div
220VAC	OUTPUT 15V/0.5A $I_o =$ 0~100% 1KHz	CH2 : +V _{PK} =57mV (0.38%) -60mV (0.40%)		CH2 1.00A/div 500us/div CH3 100mV/div 500us/div

5-5. CSF15-EEW Ripple & Noise characteristics

(1) Oscilloscope : WAVEPRO 7000(LeCroy)
 CH4 : BNC Cable Probe(50 , 1.5m)
 Band Width : 200MHz

220VAC	$I_o=100\%$	CH1 Ripple 7mV Ripple&NOISE 22mV _{p-p}		CH4 20.0mV/div 10.0us/div
220VAC	$I_o=100\%$	CH2 Ripple 7mV Ripple&NOISE 30mV _{p-p}		CH4 20.0mV/div 10.0us/div

5-6. CSF15-EEW Output characteristics

(1) Oscilloscope : WAVE PRO 7000(LeCroy)

CH1 : Output voltage - PP005A passive probe

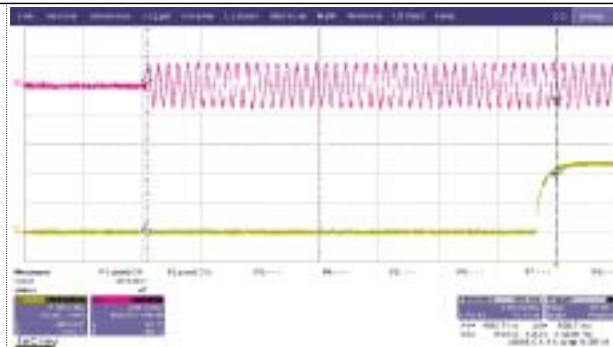
CH2 : Input voltage - ADP305 High voltage differential probe

(1) Turn on time characteristics

$V_{in} =$
100V

$I_o =$
100%

$t_{turn\ on} = 692ms$



CH1
5.00V/div
100.0ms/div

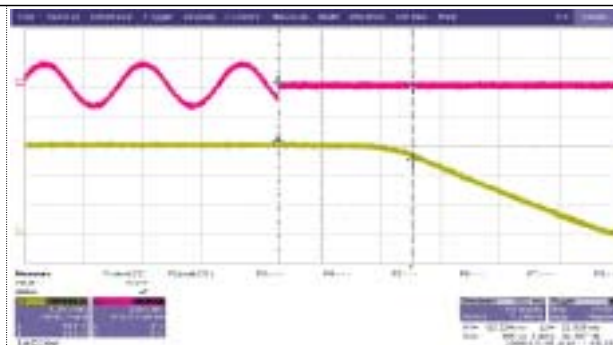
CH2
200V/div
100.0ms/div

(2) Hold up characteristics

$V_{in} =$
100V

$I_o =$
100%

$t_{hold\ up} = 22.5ms$



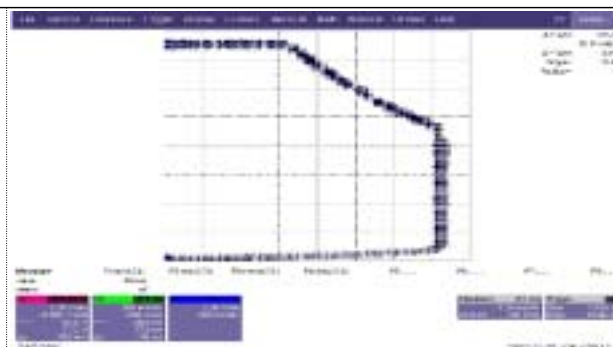
CH1
5.00V/div
10.0ms/div

CH2
200V/div
10.0ms/div

(3) Over Current protection characteristics

$V_{in} =$
220V

O.C.P = 0.8A



X
0.2A/div
5us/div

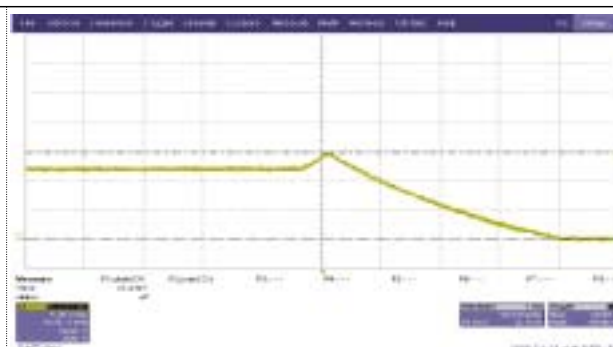
Y
5V/div
5us/div

(4) Over Voltage protection characteristics

$V_{in} =$
220V

$I_o =$
10%

O.V.P = 18.3V



CH1
5.00V/div
50.0ms/div