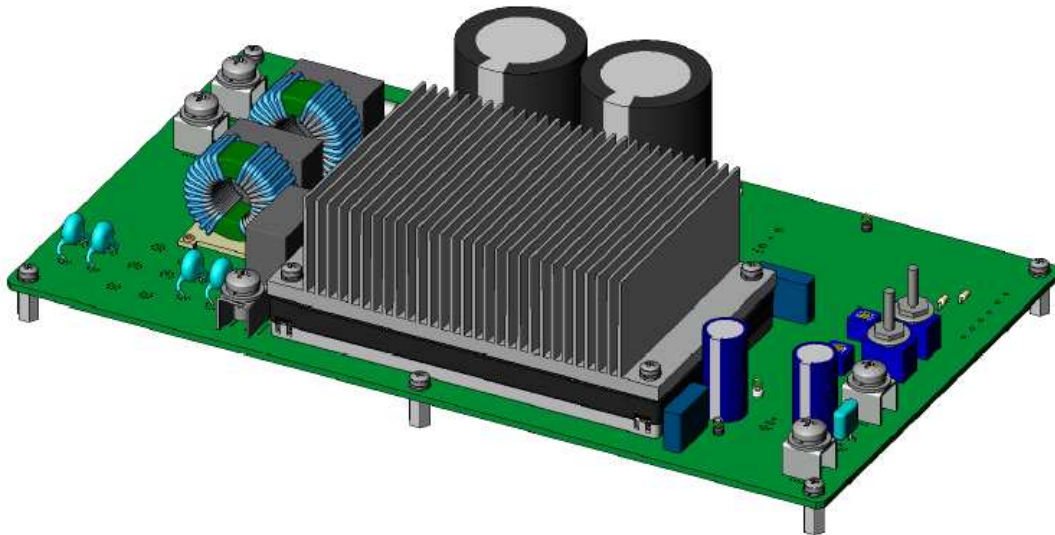


PFE500F/EB

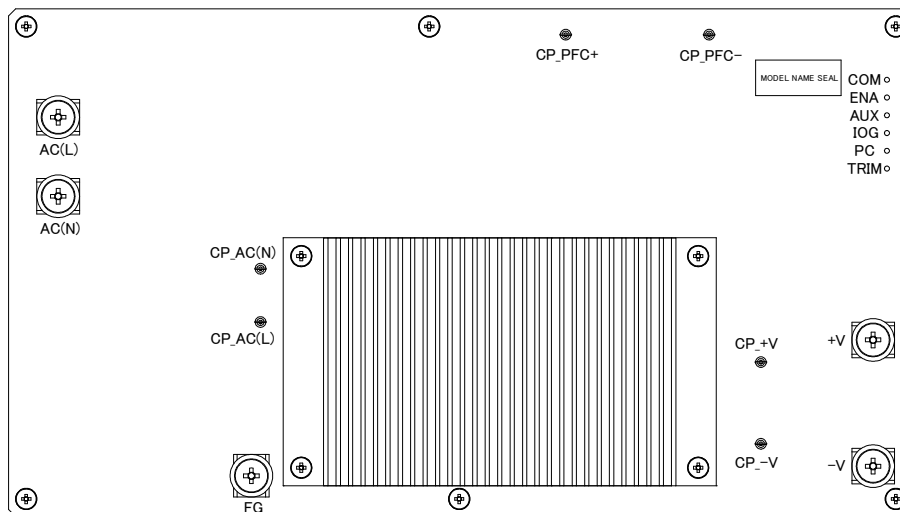
Instruction Manual and Electrical Characteristics



CAUTION

- Please do not modify or disassemble this product. You may have electric shock and product damage.
- Please do not touch this product to avoid electric shock or burn from high voltage or high temperature areas.
- Please do not use when smoke, smell, or abnormal sound is present as this might cause electric shock or fire etc.
- Please do not touch this product immediately after the main lines are cut off to avoid electric shock.
- To do work with this product, please confirm that voltage at each terminal pin has drop low.
- Note that this product is not guaranteed for case of damage or breakdown.
- When evaluating, forced cooling is necessary. Please be sure to use the fan.
- This product designing in order to evaluate electric and function date of PFE series. Note that PCB design do not consider of safety, reliability, and EMI characteristic.
- This product must not be used for equipment intended for market use.
- Electrical and function date is a reference value. Therefore, be sure to verify characteristics by actual evaluation.
- Please refer PFE500F Instruction manual also.

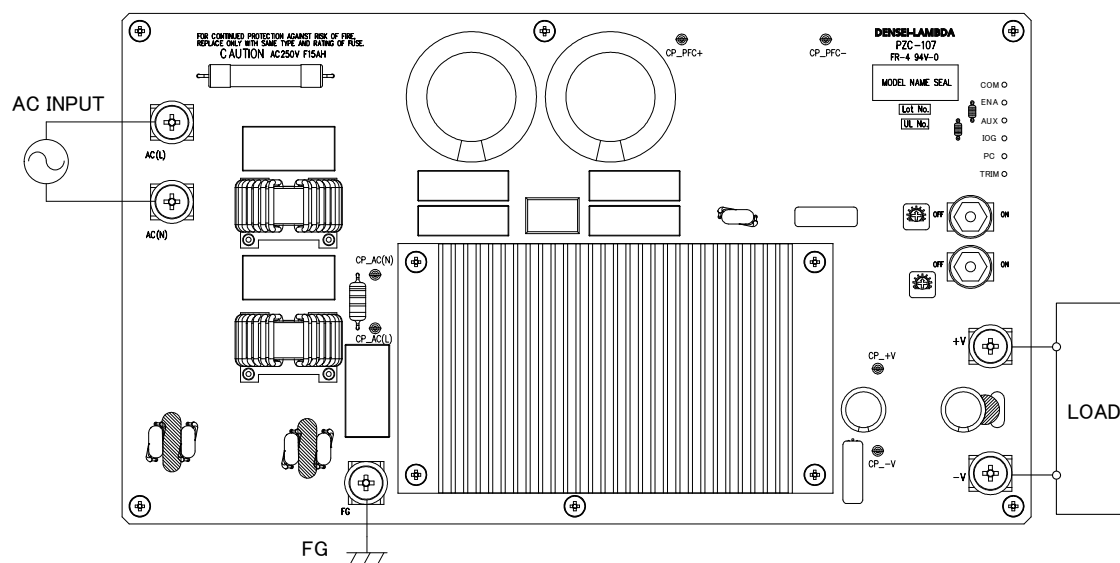
1. Terminal Explanation



- | | | | |
|-------------|-------------------------------|----------|----------------------------------|
| • AC (L) | : Input terminal live line | • CP_+V | : +V check pin |
| • AC (N) | : Input terminal neutral line | • CP_-V | : -V check pin |
| • FG | : Frame ground | • COM | : Common ground |
| • +V | : +Output terminal | • ENA | : Power on signal |
| • -V | : -Output terminal | • AUX | : Auxiliary power supply |
| • CP_AC (L) | : AC (L) check pin | • IOG | : I.O.G. signal |
| • CP_AC (N) | : AC (N) check pin | • PC | : PC signal |
| • CP_PFC+ | : +Boosted voltage check pin | • TRIM | : Output Voltage trimming signal |
| • CP_PFC- | : -Boosted voltage check pin | • ON/OFF | : ON/OFF control signal |

Note that CP_PFC+ and CP_PFC- is high voltage. (390V)

2. Terminal Connection Method



As for internal connection, refer to "4. Schematic".

3. Explanation of Function and Precautions

3.1 Input Voltage Range

Input voltage range is indicated below. Take care not apply input voltage which is out of specified range nor should a DC input voltage be applied as this would result into power module damage.

Single phase 85 to 265VAC (47 to 63Hz)

3.2 Output Voltage Adjustment Range

The output voltage can be adjusted within the range below by ON/OFF of SW202 and the adjustment of VR201 and VR202 or applying external voltage.

+/-20% of the typical voltage rating

Initial setting of VR201, VR202 and SW202 are VR201=0ohm, VR202=100kohm and SW202=OFF. By increasing VR201 resistance (turn clockwise), output voltage will increase. At the SW202=ON, output voltage will decrease and decreasing VR202 resistance (tune Counter clockwise), output voltage will decrease further.

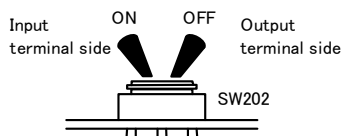


Fig.3-1 SW202 ON/OFF

3.3 Output Ripple & Noise

Measure according to description below Fig.3-2 in accordance with JEITA-9131A (Section 7.16 and 7.17). Connect and measure coaxial cable with JEITA attachment across C206 electrodes. Use 100MHz bandwidth oscilloscope or equivalent. By attaching ceramic capacitor to C207, output spike can be reduced.

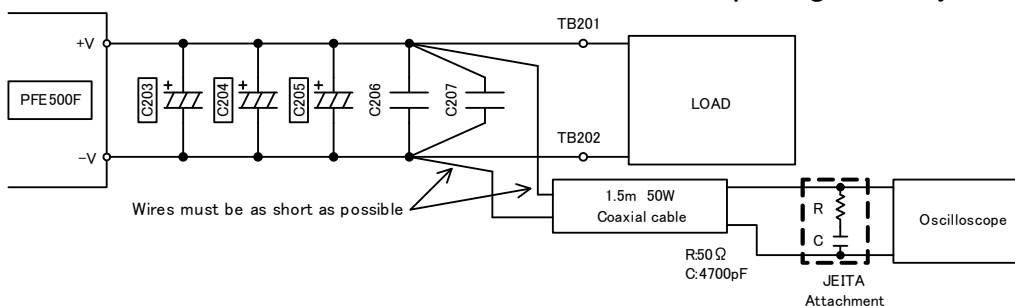


Fig.3-2 Output Ripple Voltage (including Spike Noise) Measurement Method

3.4 ON/OFF control

Without turning the input supply on and off, the output voltage can be enabled and disabled using ON/OFF of SW201. Note that a high voltage(390V) is generated in the CP_PFC+ and CP_PFC- pin even in the state of control OFF.

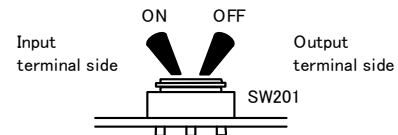


Fig.3-3 SW201 ON/OFF

3.5 Over Current Protection (OCP)

This power module has built-in OCP function. This value is set in 105% to 140% of nominal output current. Output will automatically recover when short circuit or overload condition is removed. Avoid continuous shorted condition or overload condition over 30 seconds because this might result in power module damage.

3.6 Parallel operation (PC signal)

By connecting the PC signal of each power module at the parallel operation, output current can be equally drawn from each module.

3.7 Power on signal (ENA)

This signal is located at the secondary side (output side) and it is an open drain output. Maximum sink current is 10mA and maximum applied voltage is 75V. Return line for ENA terminal is the COM terminal.

3.8 I.O.G. signal (IOG)

Normal or abnormal operation of the power module can be monitored by using the IOG terminal. This signal is LOW when inverter is normally operating and HIGH when inverter stops or when inverter is operating abnormally.

3.9 Auxiliary power supply (AUX)

AUX voltage value is within 10–14VDC. And maximum output current is 20mA. Ground for the AUX terminal is COM terminal. Avoid short circuit of AUX terminal with other terminals as this would lead to power module damage.

3.10 Operating ambient temperature

In order to evaluate safety, ambient temperature range recommends the indicated below.

0 degC to +40 degC

3.11 Cooling method

To evaluate this product, forced air cooling is required. Prepare fan and set airflow at 4m/sec as shown in Fig.3-4. Air must flow between heatsink fins.

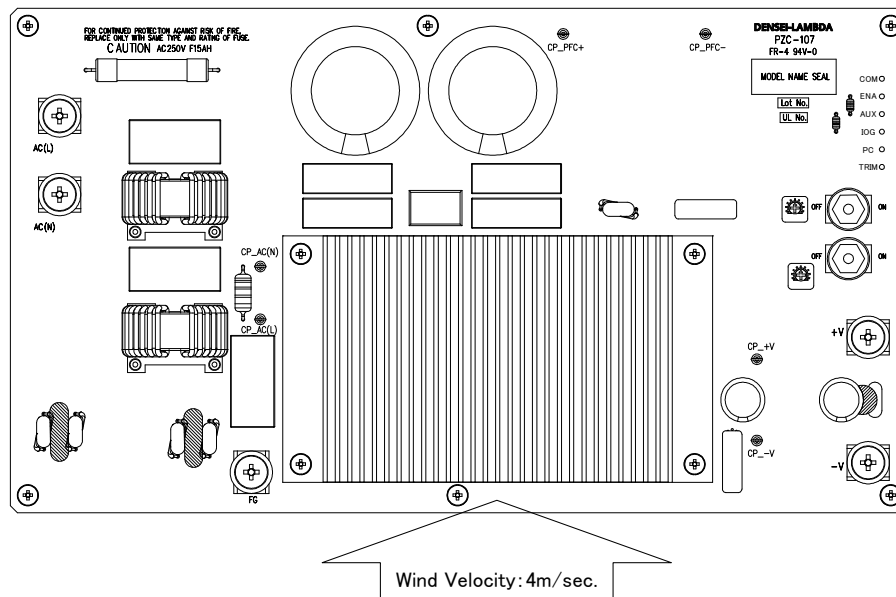
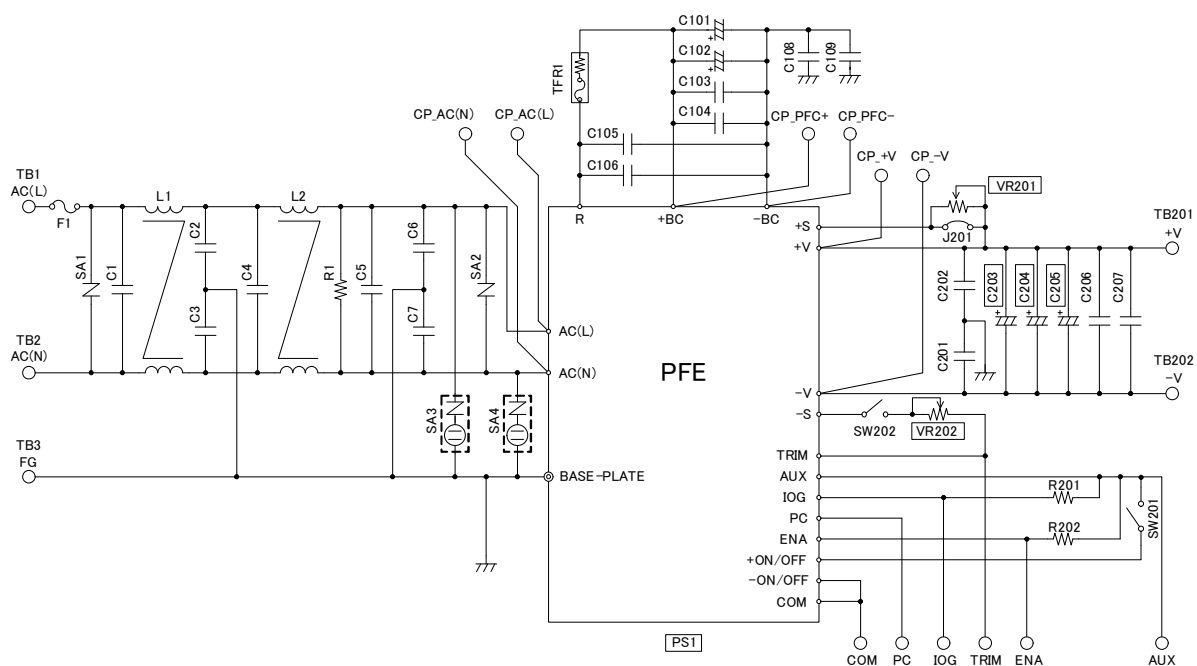
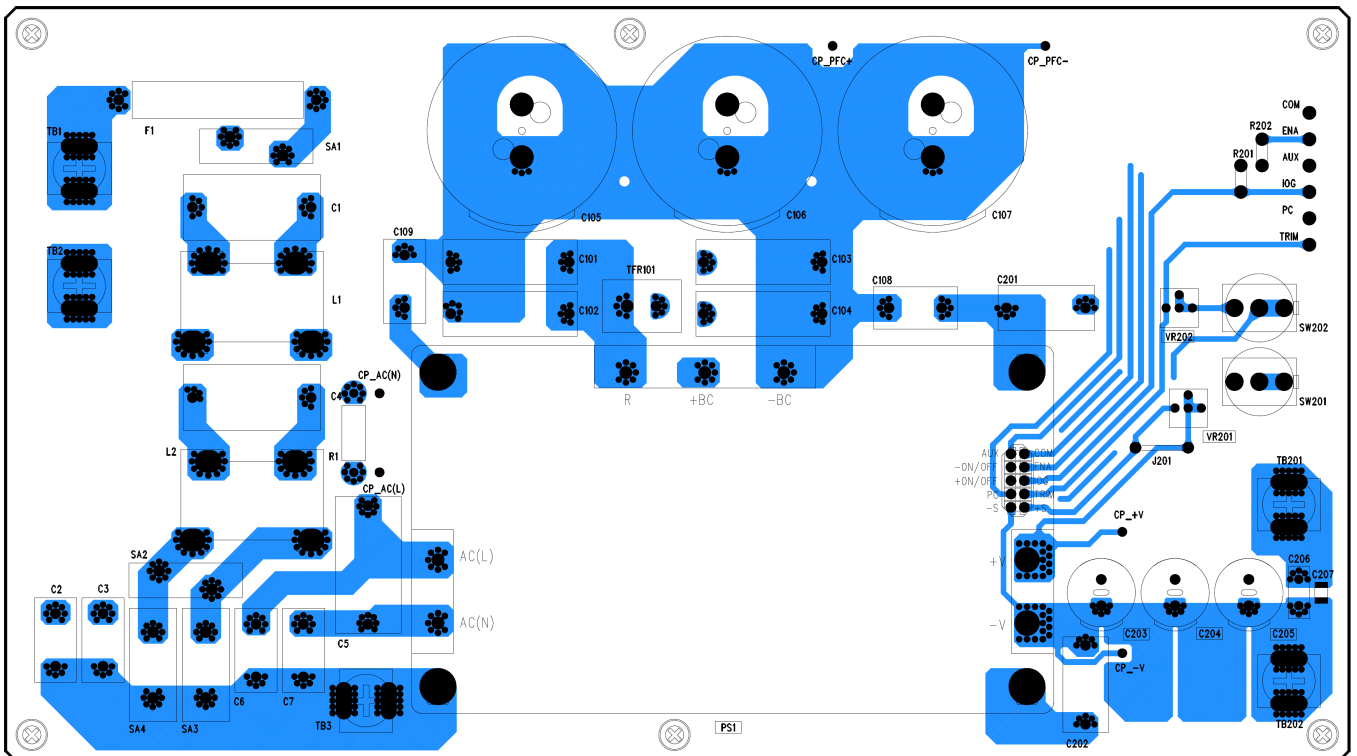


Fig.3-4 Forced air cooling method

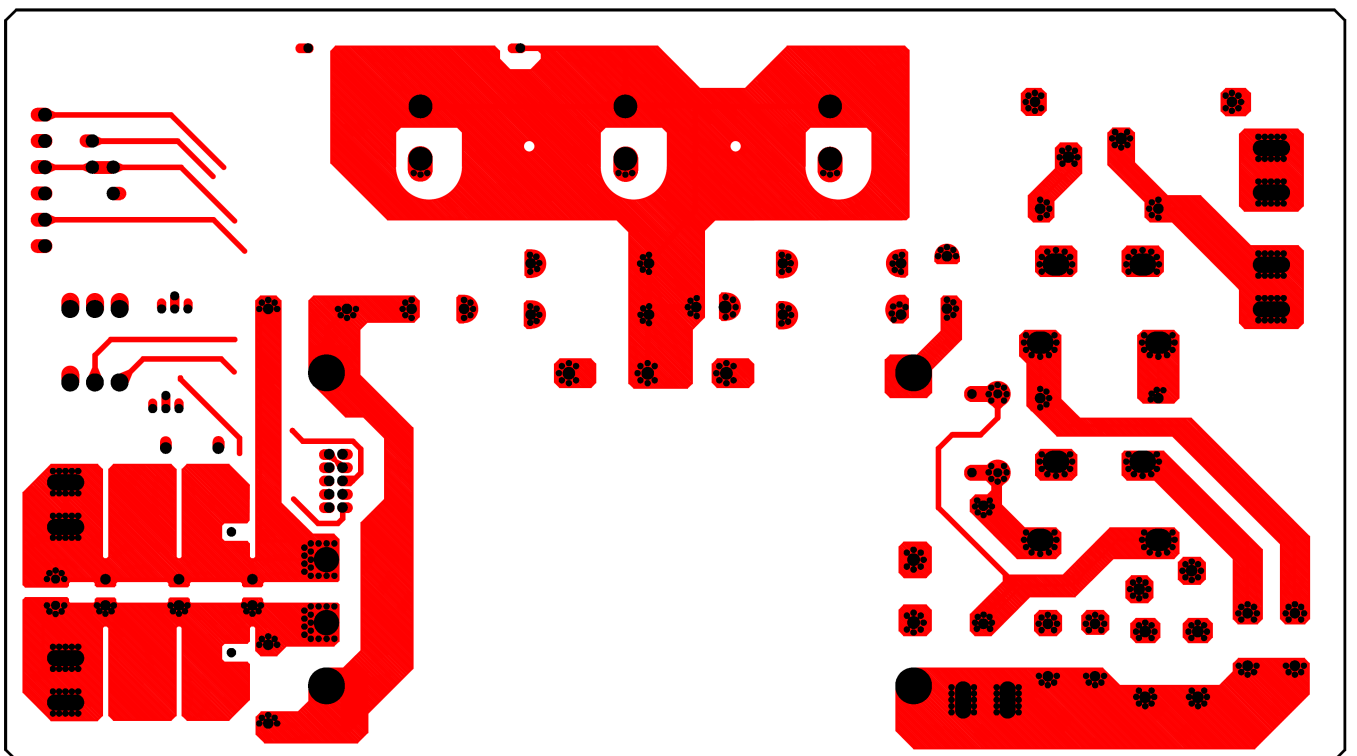
4. Schematic



5. PCB Layout



Components side



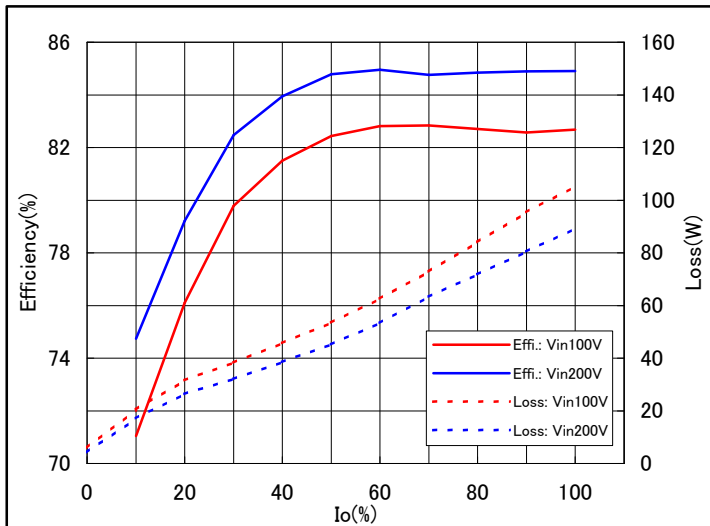
Solder side

6. Components List

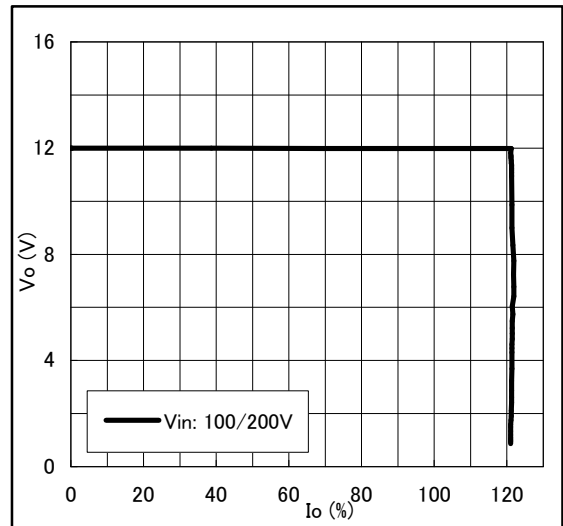
COMMON				UNIQUE			
SYMBOL	PRODUCT TYPE	NOTE 1	NOTE 2	SYMBOL	PRODUCT TYPE	NOTE 1	NOTE 2
PS1	Ref.unique list			= 12V =			
C1	Cap., Film	AC250V	1	PS1	PFE500F-12 HFP		
C2	Cap., Ceramic	AC250V	2200p	C203	Cap., Elect	25V	1000
C3	Cap., Ceramic	AC250V	2200p	C204	No need		
C4	Cap., Film	AC250V	1	C205	Cap., Elect	25V	1000
C5	Cap., Film	AC250V	1				
C6	Cap., Ceramic	AC250V	2200p	VR201	Res., Variable	1/2W	10k
C7	Cap., Ceramic	AC250V	2200p	VR202	Res., Variable	1/2W	100k
C101	Cap., Film	450V	0.47				
C102	Cap., Film	450V	0.47				
C103	Cap., Film	450V	0.47				
C104	Cap., Film	450V	0.47				
C105	Cap., Elect	450V	390				
C106	Cap., Elect	450V	390				
C107	No Need						
C108	Cap., Ceramic	AC250V	2200p				
C109	No Need						
G201	Cap., Film	AC250V	0.033				
G202	Cap., Film	AC250V	0.033				
C203	Ref.unique list			= 28V =			
C204	Ref.unique list			PS1	PFE500F-28 HFP		
C205	Ref.unique list			C203	Cap., Elect	50V	470
C206	MLCC	100V	2.2	C204	No need		
C207	No Need			C205	Cap., Elect	50V	470
R1	Res., Metal	1/2W	470k				
R201	Res., Metal	1/4W	10k	VR201	Res., Variable	1/2W	20k
R202	Res., Metal	1/4W	10k	VR202	Res., Variable	1/2W	100k
TFR101	Res., Thermal Fuse	1.6W	10 /139degC				
SA1	No need						
SA2	No need						
SA3	No need						
SA4	No need						
L1	BALUN COIL	6mH					
L2	BALUN COIL	6mH					
F1	Fuse	AC250V	15A	= 48V =			
SW201	Switch			PS1	PFE500F-48 HFP		
J201	No Need			C203	Cap., Elect	100V	220
TB1	Terminal	40A		C204	No need		
TB2	Terminal	41A		C205	Cap., Elect	100V	220
TB3	Terminal	42A					
TB201	Terminal	43A		VR201	Res., Variable	1/2W	50k
TB202	Terminal	44A		VR202	Res., Variable	1/2W	100k
GP_AC(L)	Check Pin						
CP_AC(N)	Check Pin						
CP_PFC+	Check Pin						
CP_PFC-	Check Pin						
CP_+V	Check Pin						
CP_-V	Check Pin						

7. PFE500F-12/EB Electrical Characteristics Data

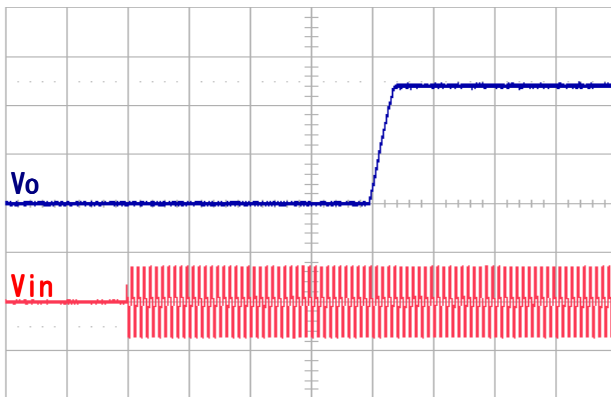
7.1 Efficiency characteristics



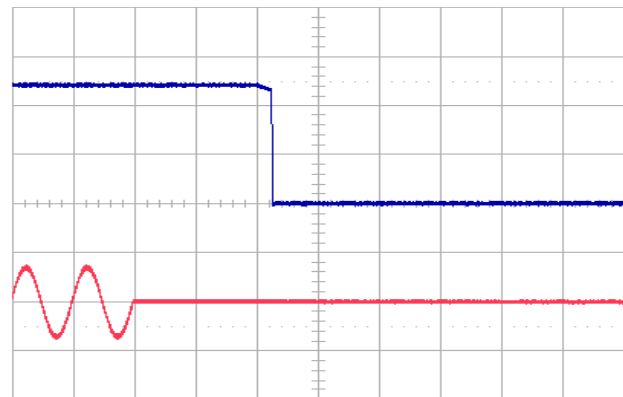
7.2 Over Current Protection



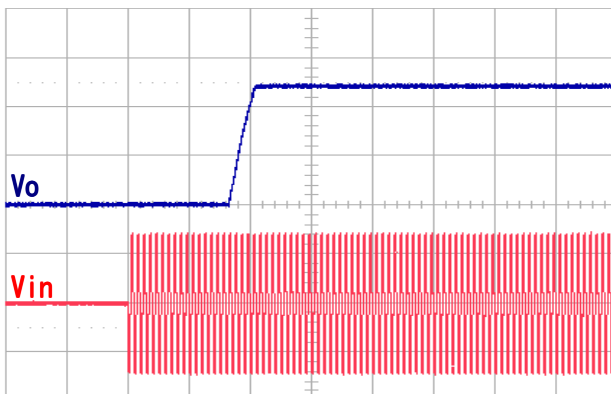
7.3 Output rise, fall Characteristics



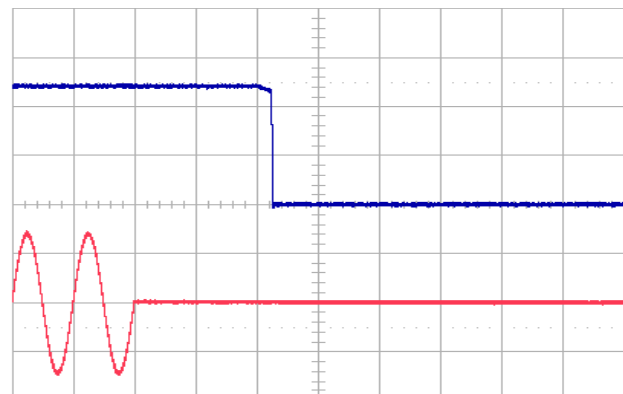
Vin: 100V AC I_o : 100%
Vo: 5V/DIV Vin: 200V/DIV Time: 200ms/DIV



Vin: 100V AC I_o : 100%
Vo: 5V/DIV Vin: 200V/DIV Time: 20ms/DIV

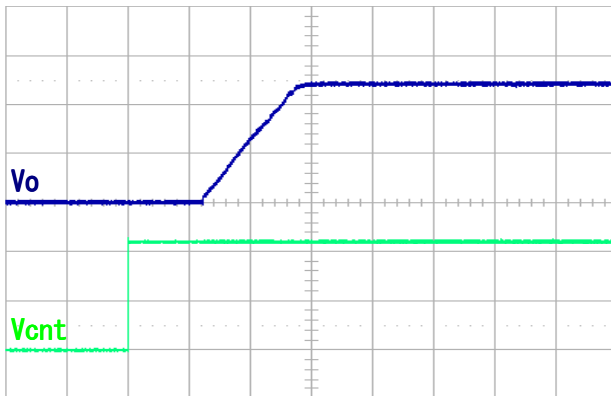


Vin: 200V AC I_o : 100%
Vo: 5V/DIV Vin: 200V/DIV Time: 200ms/DIV

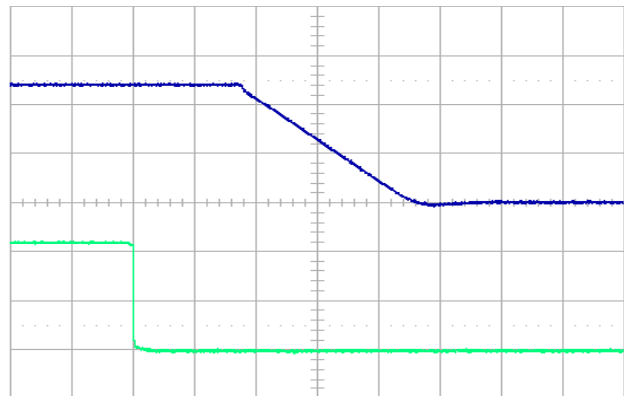


Vin: 200V AC I_o : 100%
Vo: 5V/DIV Vin: 200V/DIV Time: 20ms/DIV

7.4 Output rise, fall Characteristics (ON/OFF control)

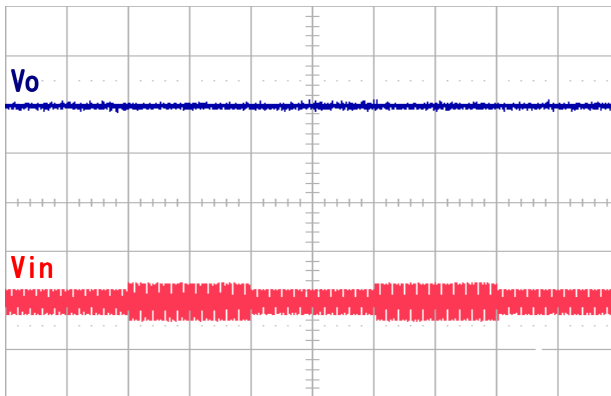


Vin: 100/200V AC Io: 100%
Vo: 5V/DIV Vcnt: 5V/DIV Time: 50ms/DIV

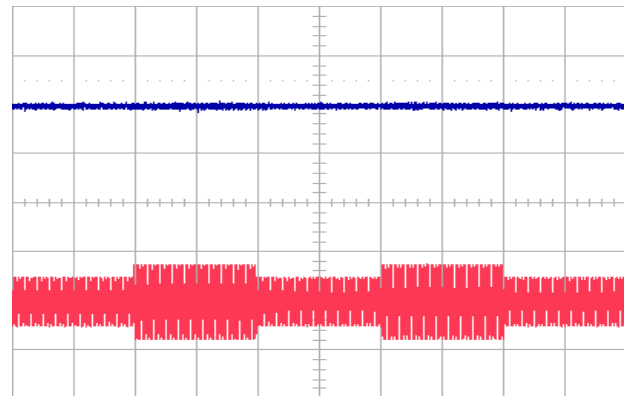


Vin: 100/200V AC Io: 100%
Vo: 5V/DIV Vcnt: 5V/DIV Time: 200us/DIV

7.5 Dynamic Line Response Characteristics

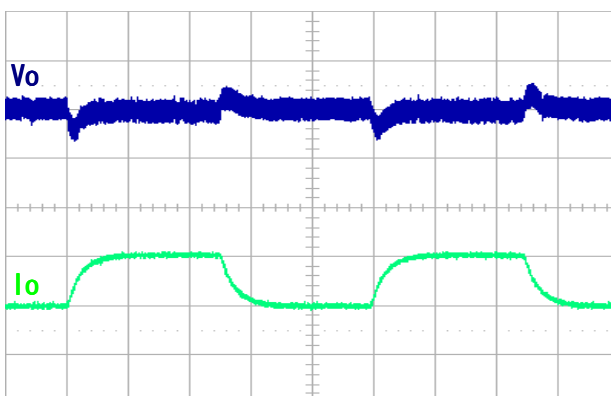


Vin: 85V⇔130VAC Io: 100%
Vo: 50mV/DIV Vin: 500V/DIV Time: 500ms/DIV



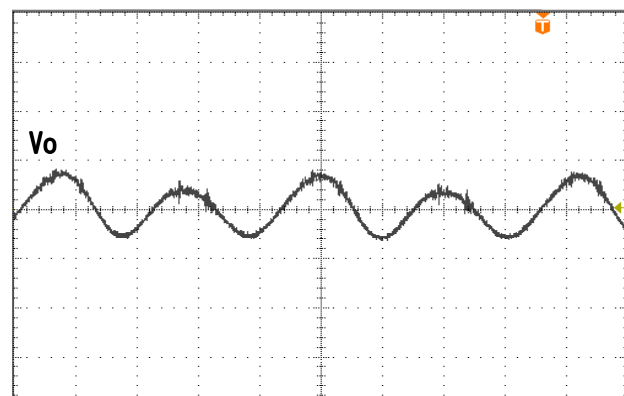
Vin: 170V⇔265VAC Io: 100%
Vo: 50mV/DIV Vin: 500V/DIV Time: 500ms/DIV

7.6 Dynamic Load Response Characteristics



Vin: 100/200V AC Io: 50%⇔100% Tr,Tf: 100us
Vo: 100mV/DIV Io: 20A/DIV Time: 200us/DIV

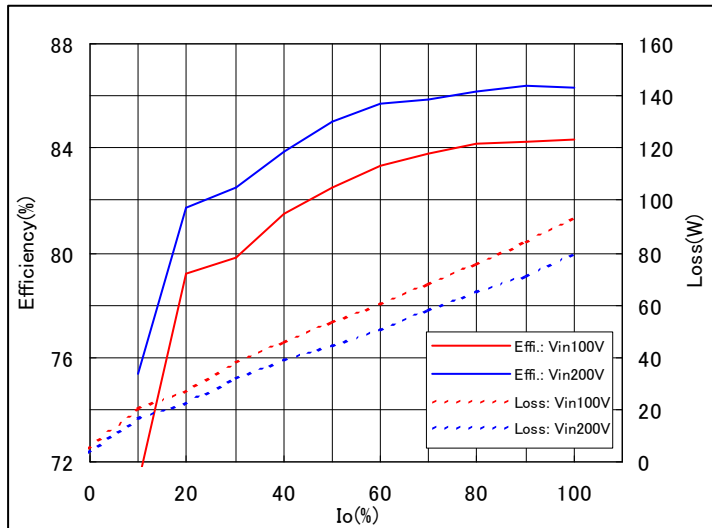
7.7 Output Ripple & Noise



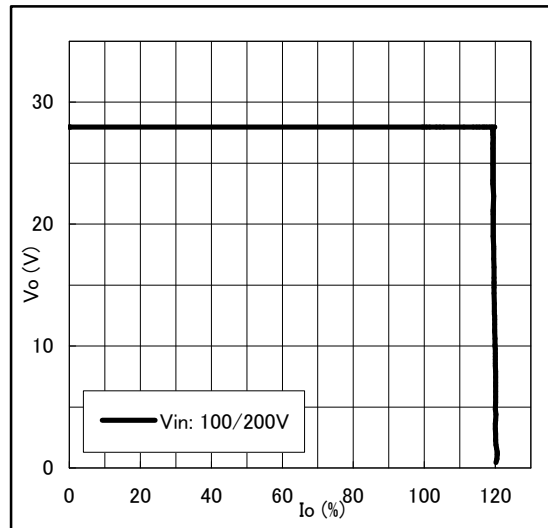
Vin: 100/200V AC Io: 100%
Vo: 20mV/DIV Time: 1us/DIV

7. PFE500F-28/EB Electrical Characteristics Data

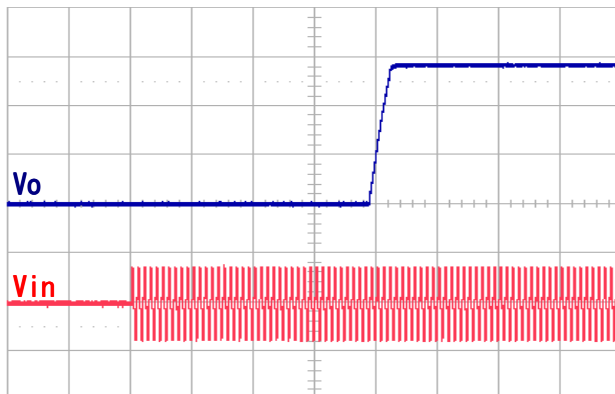
7.1 Efficiency characteristics



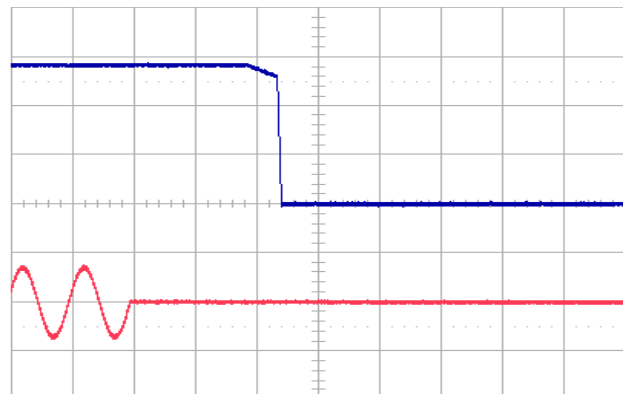
7.2 Over Current Protection



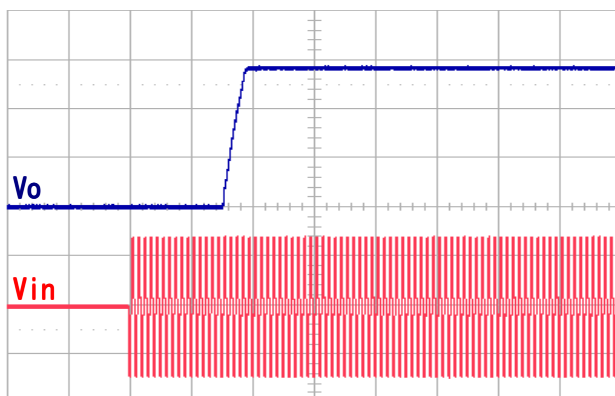
7.3 Output rise, fall Characteristics



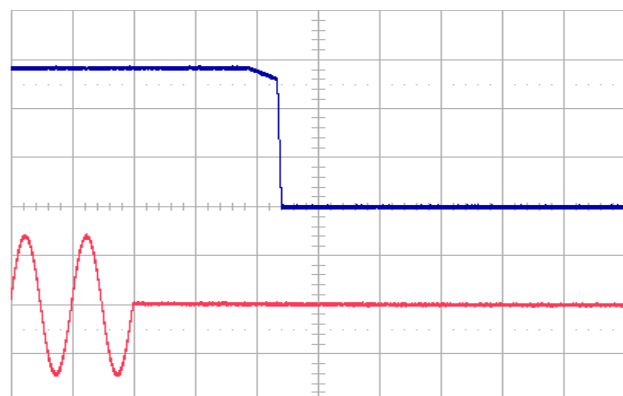
$V_{in}: 100V$ AC $I_o: 100%$
 $V_o: 10V/DIV$ $V_{in}: 200V/DIV$ $Time: 200ms/DIV$



$V_{in}: 100V$ AC $I_o: 100%$
 $V_o: 10V/DIV$ $V_{in}: 200V/DIV$ $Time: 20ms/DIV$

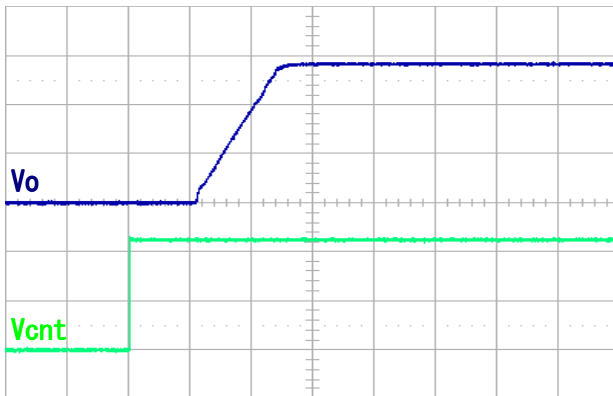


$V_{in}: 200V$ AC $I_o: 100%$
 $V_o: 10V/DIV$ $V_{in}: 200V/DIV$ $Time: 200ms/DIV$

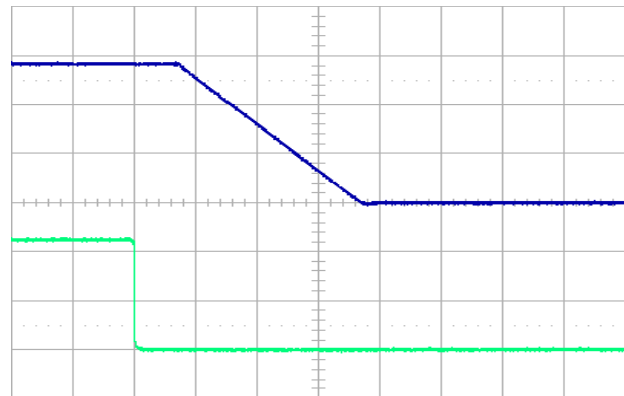


$V_{in}: 200V$ AC $I_o: 100%$
 $V_o: 10V/DIV$ $V_{in}: 200V/DIV$ $Time: 20ms/DIV$

7.4 Output rise, fall Characteristics (ON/OFF control)

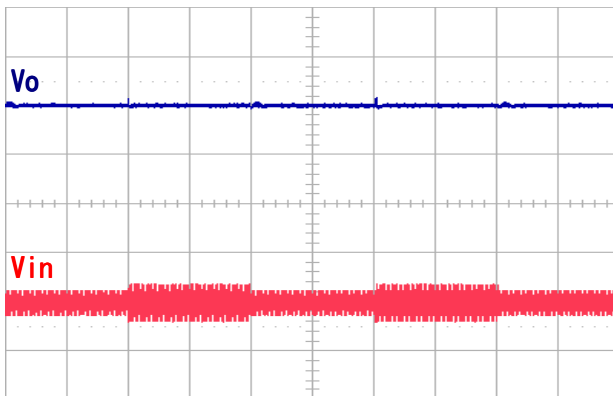


Vin: 100/200V AC Io: 100%
Vo: 10V/DIV Vcnt: 5V/DIV Time: 50ms/DIV

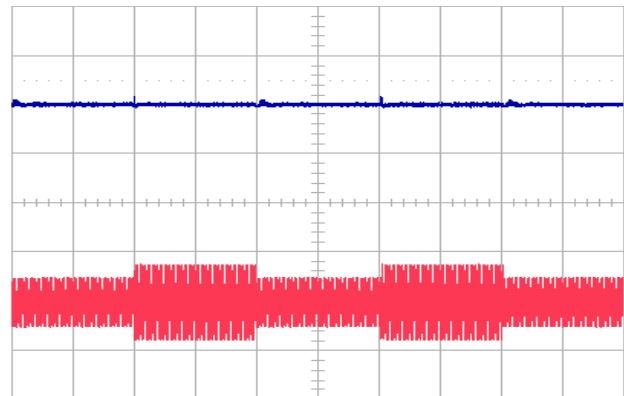


Vin: 100/200V AC Io: 100%
Vo: 10V/DIV Vcnt: 5V/DIV Time: 200us/DIV

7.5 Dynamic Line Response Characteristics

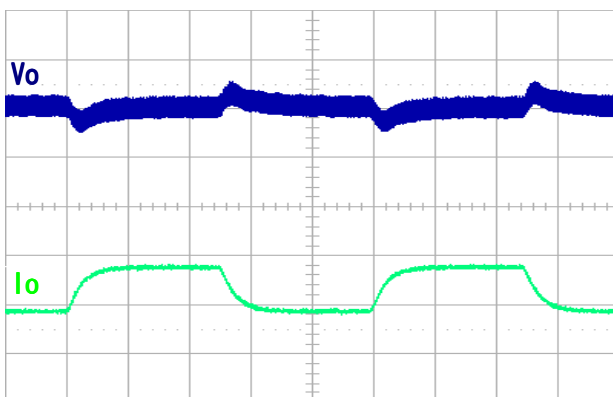


Vin: 85V⇔130VAC Io: 100%
Vo: 50mV/DIV Vin: 500V/DIV Time: 500ms/DIV



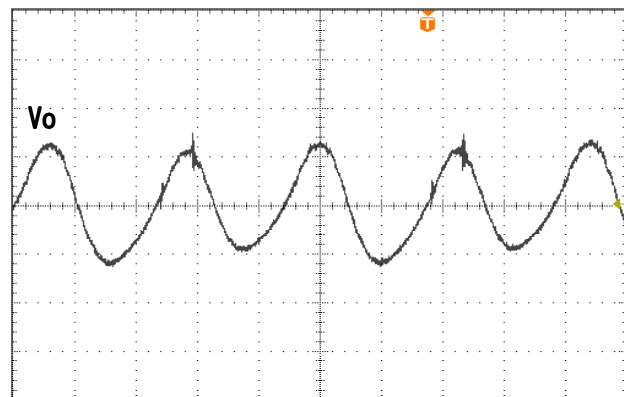
Vin: 170V⇔265VAC Io: 100%
Vo: 50mV/DIV Vin: 500V/DIV Time: 500ms/DIV

7.6 Dynamic Load Response Characteristics



Vin: 100/200V AC Io: 50%⇔100% Tr, Tf: 100us
Vo: 200mV/DIV Io: 10A/DIV Time: 200us/DIV

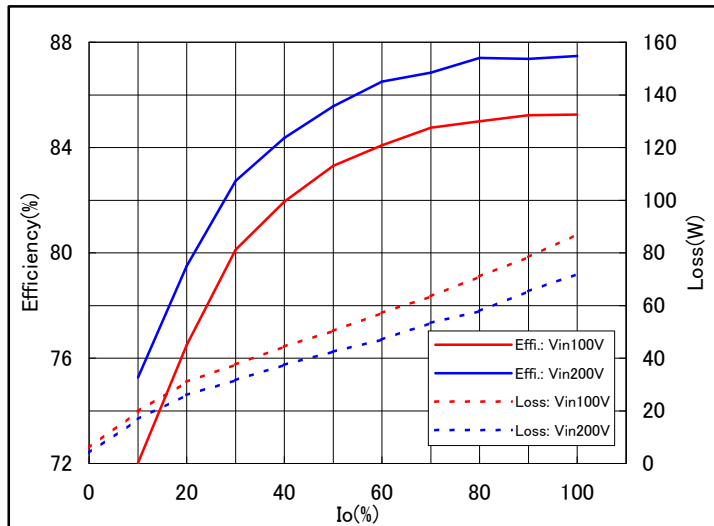
7.7 Output Ripple & Noise



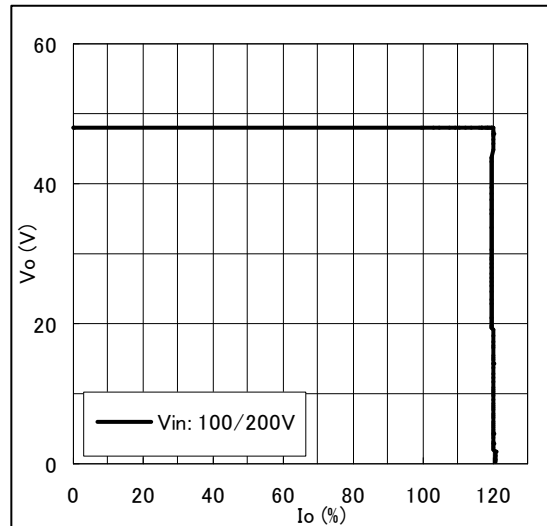
Vin: 100/200V AC Io: 100%
Vo: 20mV/DIV Time: 1us/DIV

7. PFE500F-48/EB Electrical Characteristics Data

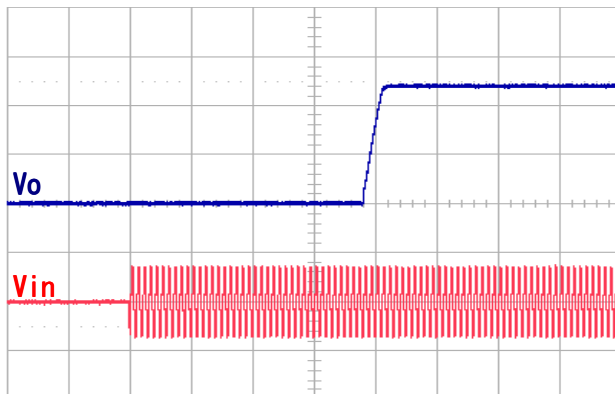
7.1 Efficiency characteristics



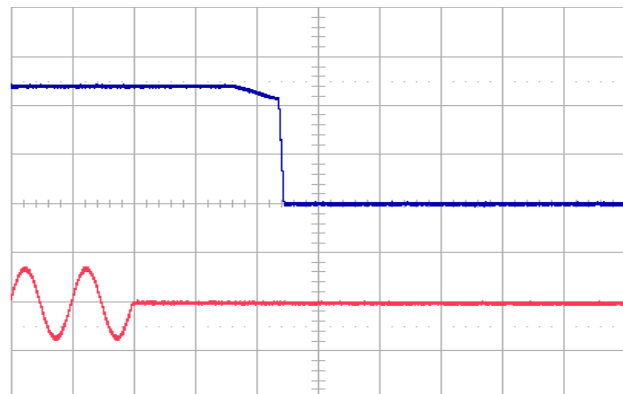
7.2 Over Current Protection



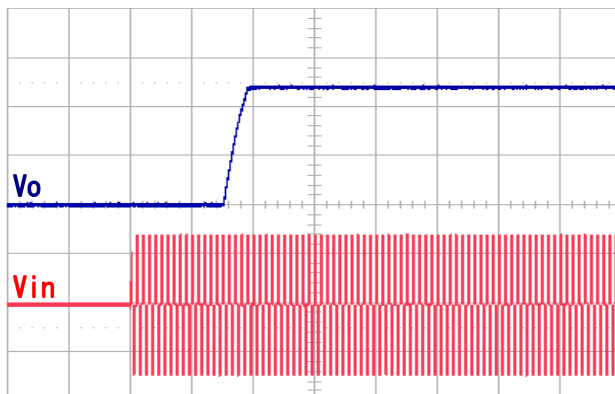
7.3 Output rise, fall Characteristics



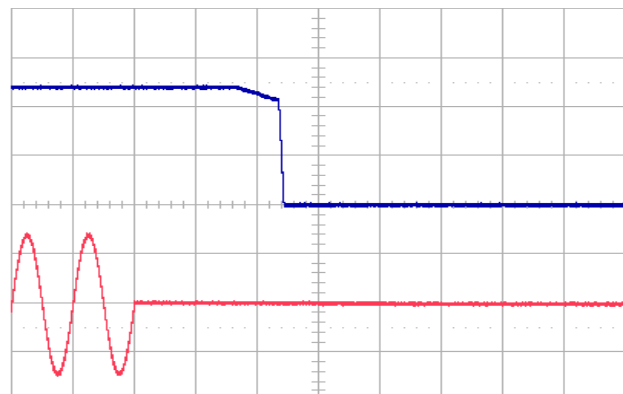
V_{in} : 100V AC I_o : 100%
 V_o : 20V/DIV V_{in} : 200V/DIV Time: 200ms/DIV



V_{in} : 100V AC I_o : 100%
 V_o : 20V/DIV V_{in} : 200V/DIV Time: 20ms/DIV

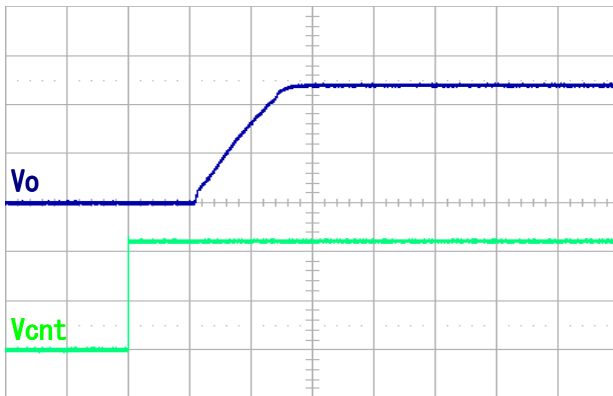


V_{in} : 200V AC I_o : 100%
 V_o : 20V/DIV V_{in} : 200V/DIV Time: 200ms/DIV

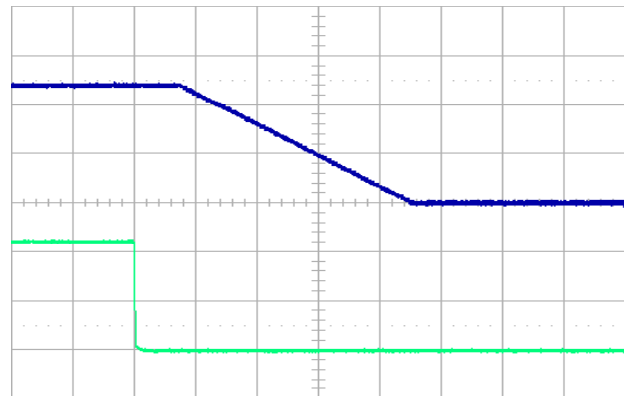


V_{in} : 200V AC I_o : 100%
 V_o : 20V/DIV V_{in} : 200V/DIV Time: 20ms/DIV

7.4 Output rise, fall Characteristics (ON/OFF control)

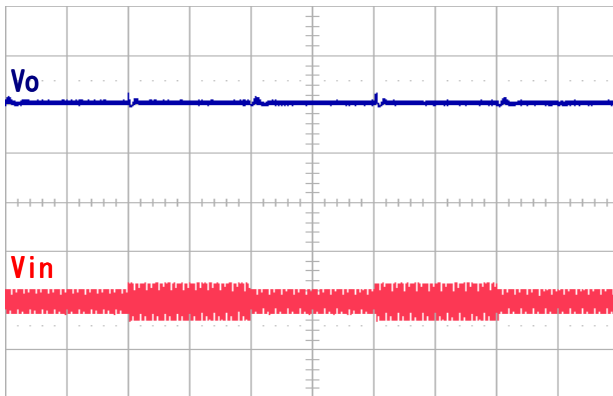


Vin: 100/200V AC Io: 100%
Vo: 20V/DIV Vcnt: 5V/DIV Time: 50ms/DIV

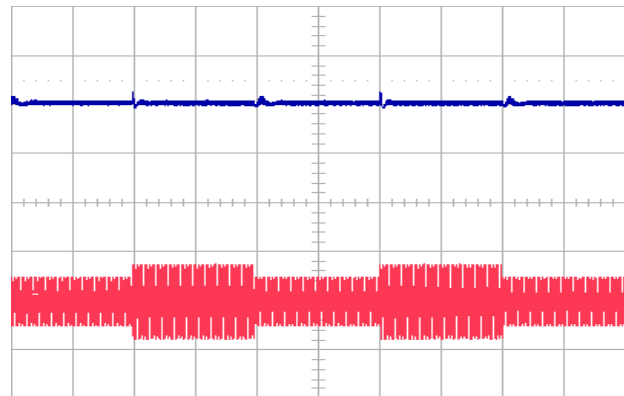


Vin: 100/200V AC Io: 100%
Vo: 20V/DIV Vcnt: 5V/DIV Time: 200us/DIV

7.5 Dynamic Line Response Characteristics

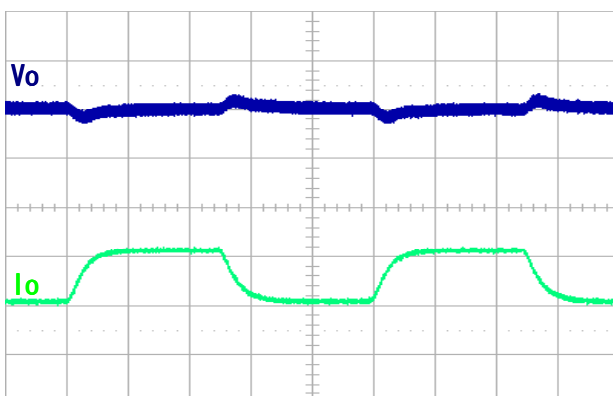


Vin: 85V⇔130VAC Io: 100%
Vo: 50mV/DIV Vin: 500V/DIV Time: 500ms/DIV



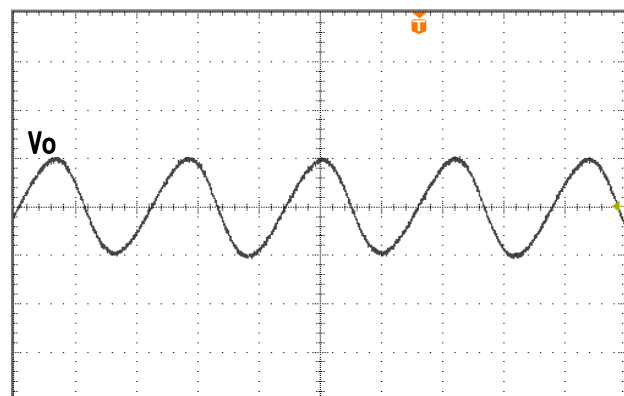
Vin: 170V⇔265VAC Io: 100%
Vo: 50mV/DIV Vin: 500V/DIV Time: 500ms/DIV

7.6 Dynamic Load Response Characteristics



Vin: 100/200V AC Io: 50%⇔100% Tr,Tf: 100us
Vo: 500mV/DIV Io: 5A/DIV Time: 200us/DIV

7.7 Output Ripple & Noise



Vin: 100/200V AC Io: 100%
Vo: 50mV/DIV Time: 1us/DIV