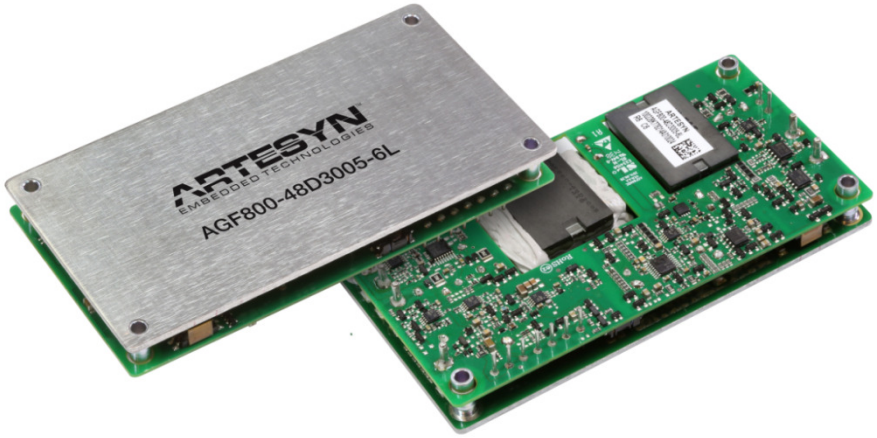
AGF800-48D3005

800 Watts

Full-brick Converter

Total Power: 800 Watts
Input Voltage: 36 to 75 Vdc
# of Outputs: Dual



Special Features

- Delivering up to 23.3A for 30V and 20A for 5V
- Ultra-high efficiency 93.5% typ.with both half load
- Wide input range: 36V ~ 75V
- Excellent thermal performance
- No minimum load requirement
- Fixed frequency operation
- RoHS 6 compliant
- Remote control function
- Remote output sense
- Trim function: 22V ~ 33V for 30V output and 3V~6V for 5V output
- Input under voltage protection
- Output over current protection
- Output over voltage protection
- Over temperature protection
- Inverter operation good for 30V output
- Industry standard full-brick pin-out outline
- With aluminum baseplate
- Pin length: 3.8mm

Safety

IEC/EN/UL 60950
CE Mark
UL/TUV
GB4943
EN55022 Class B

Product Descriptions

The AGF800-48D3005 is a dual outputs DC-DC converter with standard full-brick outline and pin configuration. It delivers up to 23.3A output current with 30V output voltage and 20A output current with 5V output voltage. Above 93.5% ultra-high efficiency and excellent thermal performance make it an ideal choice to supply power to power amplifier in telecom and datacom application. Aluminum baseplate structure makes it possible for the module to work under -40 ^{O}C ~ 100 ^{O}C baseplate temperature without air cooling.

Applications

Telecom/ Datacom

ARTESYN™
EMBEDDED TECHNOLOGIES

Model Numbers

Standard	Output Voltage	Output Current	Structure	Thread Hole	RoHS Status
AGF800-48D3005	30V	23.3A	Baseplate	Without thread	R6
	5V	20A			

Ordering information

AGF800	-	48	D	3005	-	6	L	/	M
①		②	③	④		⑤	⑥		⑦

①	Model series	AGF: high efficiency full-brick series; 800: output power 800W
②	Input voltage	48: 36V ~ 75V input range, rated input voltage 48V
③	Output channel	D: dual outputs
④	Rated output voltage	3005: 30V output and 5V output
⑤	Pin length	-6: 3.8mm
⑥	RoHS status	L: RoHS, R6
⑦	Structure	Default: non-threaded mounting hole; M: threaded mounting hole

Options

None

Electrical Specifications

Absolute Maximum Ratings

Stress in excess of those listed in the "Absolute Maximum Ratings" may cause permanent damage to the power supply. These are stress ratings only and functional operation of the unit is not implied at these or any other conditions above those given in the operational sections of this TRN. Exposure to any absolute maximum rated condition for extended periods may adversely affect the power supply's reliability.

Table 1. Absolute Maximum Ratings:

Parameter	Model	Symbol	Min	Typ	Max	Unit
Input Voltage						
Operating -Continuous	All	$V_{IN,DC}$	-	-	80	Vdc
Non-operating -100mS	All		-	-	100	Vdc
Maximum Output Power	All	$P_{O,max}$	-	-	800	W
Isolation Voltage[1]						
Input to outputs	Open frame modules		-	-	1500	Vdc
Input to baseplate	Baseplate modules		-	-	1500	Vdc
Outputs to baseplate	Baseplate modules		-	-	500	Vdc
Ambient Operating Temperature	All	T_A	-40	-	+85	^{O}C
Operating Baseplate Temperature	All	T_A	-40	-	+100	^{O}C
Storage Temperature	All	T_{STG}	-55	-	+125	^{O}C
Humidity (non-condensing)						
Operating	All		-	-	95	%
Non-operating	All		-	-	95	%

Note 1 - 1mA for 60s, slew rate of 1500V/10s

Input Specifications

Table 2. Input Specifications:

Parameter	Conditions[1]	Symbol	Min	Typ	Max	Unit
Operating Input Voltage, DC	All	$V_{IN,DC}$	36	48	75	Vdc
Turn-on Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,ON}$	33	35	36	Vdc
Turn-off Voltage Threshold	$I_O = I_{O,max}$	$V_{IN,OFF}$	31	33	35	Vdc
Lockout Voltage Hysteresis	$I_O = I_{O,max}$		1	2	-	V
Maximum Input Current ($I_O = I_{O,max}$)	$V_{IN,DC} = 36V_{DC}$	$I_{IN,max}$	-	-	30	A
No-load input current	$V_{IN,DC} = 48V_{DC}$		-	0.2	0.4	A
Standby input current	Remote OFF		-	0.02	0.1	A
Recommended Input Fuse	Fast blow external fuse recommended		-	-	40	A
Recommended External Input Capacitance	Low ESR capacitor recommended	C_{IN}	-	470	-	uF
Input Reflected Ripple Current	Through 12uH inductor		-	200	-	mA
Operating Efficiency	T_A=25 ^{O}C $I_O = I_{O,max}$ $I_O = 50\% I_{O,max}$	η	- -	92.5 93.5	- -	% %

Note 1 - Ta = 25 ^{O}C, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise noted.

Output Specifications

Table 3. Output Specifications:

Parameter	Condition[1]	Symbol	Min	Typ	Max	Unit
Factory Set Voltage	$V_{IN,DC}$ = 48V_{DC} I_O=$I_{O,max}$	V_O	29.7	30	30.3	Vdc
			4.95	5	5.05	Vdc
Output Voltage Line Regulation	All	Vo	-	0.1	0.5	%
Output Voltage Load Regulation	All	V_O(30V)	-	0.3	0.5	%
		V_O(5V)	-	0.5	1	%
Output Voltage Temperature Regulation	All	%Vo	-	-	5.6	mV/^{O}C
Output voltage trim range	All	V_O(30V)	22	-	33	V
		V_O(5V)	3	-	6	V
Total Output Voltage Range	Over sample, line, load, temperature & life	V_O(30V)	29.1	30	30.9	V
		V_O(5V)	4.85	5.0	5.15	V
Output Ripple, pk-pk	Measure with a 1uF ceramic capacitor in parallel with a 10uF tantalum capacitor, 0 to 20MHz bandwidth	V_O(30V)	-	250	-	mV_{PK-PK}
		V_O(5V)	-	100	-	mV_{PK-PK}
Operating output current range	All	I_O(30V)	0	-	23.3	A
		I_O(5V)	0	-	20	A
Output DC current-limit inception[2]	Foldback first , then Hiccup	I_O(5V/0A)	24.5	-	36	A
		I_O(30V/0 A)	21	-	44	A
V_O Load Capacitance[3]	All	C_O(30V)	820	2200	4400	uF
		C_O(5V)	330	680	4400	uF
V_O Dynamic Response Peak Deviation	V_O(30V) 25% load change 50% ~ 75% ~ 50% slew rate = 0.1A/us	$\pm V_O$	-	400	900	mV
Settling Time		T_s	-	-	500	uSec
	V_O(5V) 25% load change 50% ~ 75% ~ 50% slew rate = 0.1A/us	$\pm V_O$	-	100	250	mV
		T_s	-	-	500	uSec
Switching frequency	All	f_{SW}	260	290	320	KHz

Note 1 - Ta = 25 ^{O}C, airflow rate = 400 LFM, Vin = 48Vdc, nominal Vout unless otherwise noted.
Note 2 - Hiccup: auto-restart when over-current condition is removed.
Note 3 - High frequency and low ESR is recommended.

Output Specifications

Table 3. Output Specifications, con't:

Parameter		Condition[1]	Symbol	Min	Typ	Max	Unit
Turn-on transient	Rise time	$I_O = I_{max}$ (30V)	T_{rise}	-	200	-	mS
		$I_O = I_{max}$ (5V)	T_{rise}	-	20	-	mS
	Turn-on delay time	$I_O = I_{max}$ (30V)	$T_{turn-on}$	-	350	-	mS
	Output voltage overshoot	$I_O = 0$	$\%V_O$	-	0	5	Vo
Output voltage remote sense range		All (for both outputs)		-	-	0.3	V
Remote ON/OFF control		All		1.5	-	5	mA
Output over-voltage protection[4]		All (30V)	Vo	35	-	40	V
		All (5V)	Vo	6.5	-	8	V
Over-temperature shutdown[5]		All	^OC	105	110	130	^OC
Over-temperature hysteresis		All	^OC	5	-	-	^OC
MTBF		Telcordia SR-332-2006; 80% load, 300LFM, 40 ^OC T_A		-	2.8	-	10^6 h

Note 4 - Hiccup: auto-restart when over-voltage condition is removed.
Note 5 - Auto recovery.

AGF800-48D3005 Performance Curves

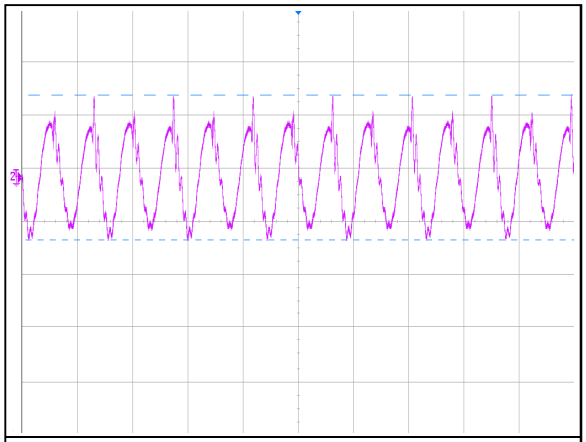


Figure 1: AGF800-48D3005 Ripple and Noise Measurement For 30V

Ch 1: Vo (100mV/div)

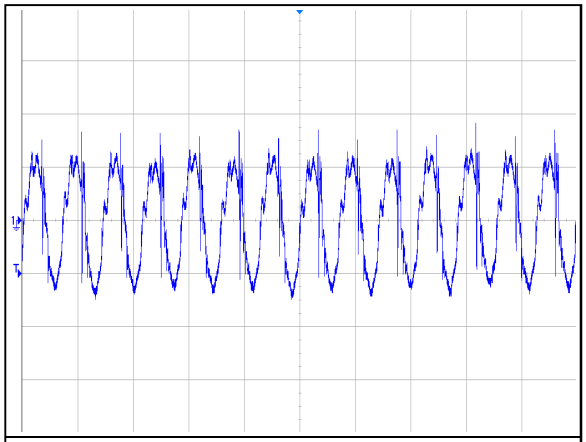


Figure 2: AGF800-48D3005 Ripple and Noise Measurement For 5V

Ch 1: Vo (20mV/div)

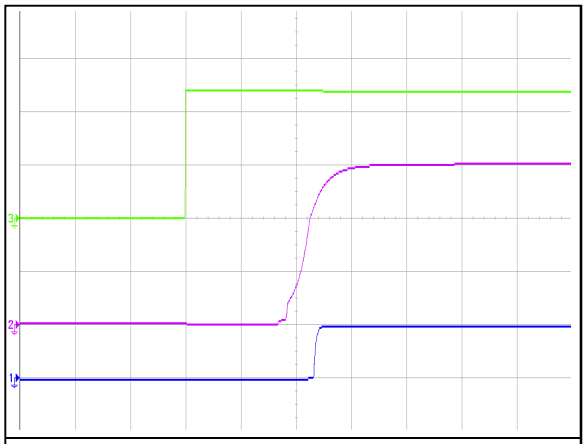


Figure 3: AGF800-48D3005 Output Voltage Startup Characteristic

Ch 1: Vo=5V (5V/div) Ch 2: Vo=30V (10V/div) Ch3: Vin (20V/div)

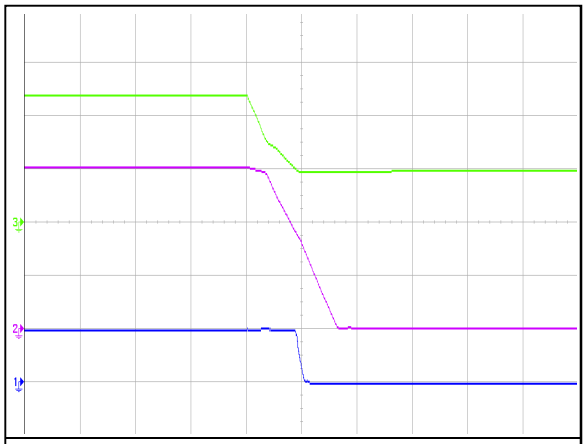


Figure 4: AGF800-48D3005 Turn Off Characteristic

Ch 1: Vo=5V (5V/div) Ch 2: Vo=30V (10V/div) Ch3: Vin (20V/div)

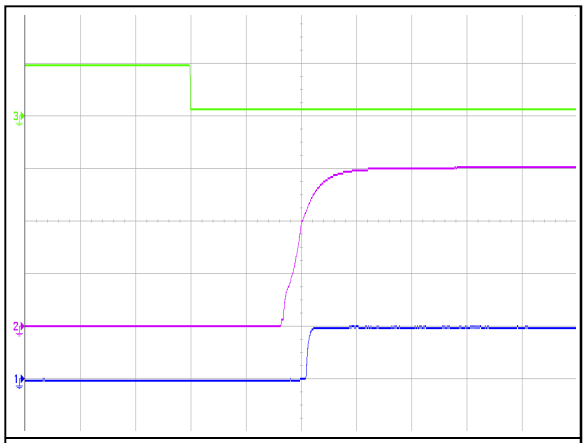


Figure 5: AGF800-48D3005 Remote ON Waveform

Ch 1: Vo=5V (5V/div) Ch 2: Vo=30V (10V/div) Ch3: Remote ON (50V/div)

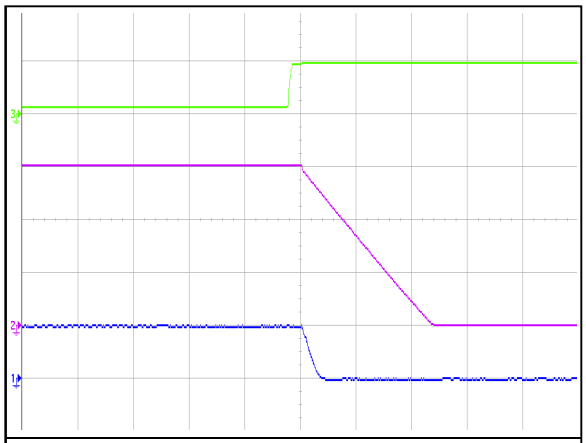


Figure 6: AGF800-48D3005 Remote OFF Waveform

Ch 1: Vo=5V (5V/div) Ch 2: Vo=30V (10V/div) Ch3: Remote OFF (50V/div)

AGF800-48D3005 Performance Curves

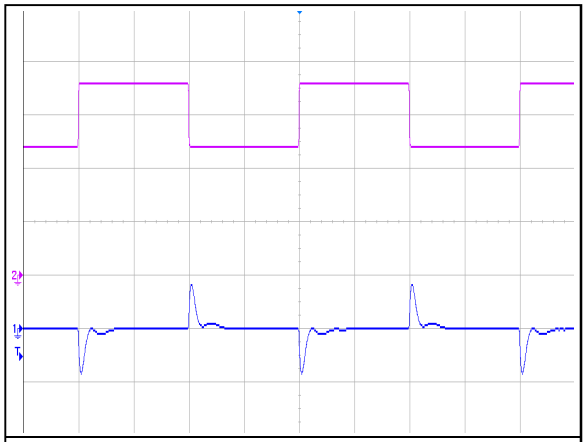


Figure 7: AGF800-48D3005 Transient Response
25%~50%~25% load change, 0.1A/uS slew rate,
Ch 1: Vo (500mV/div) Ch 2: Io (5A/div)

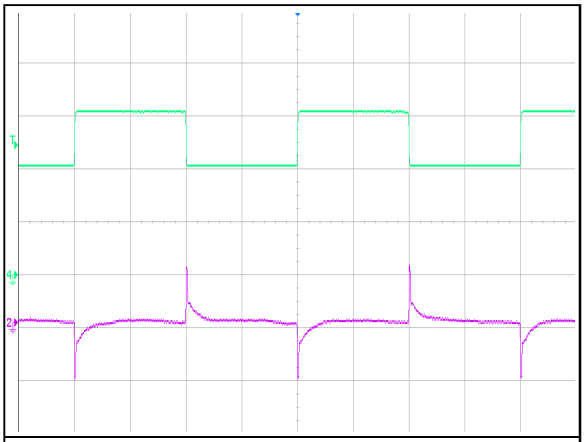


Figure 8: AGF800-48D3005 Transient Response
50%~75%~50% load change, 0.1A/uS slew rate,
Ch 1: Vo (500mV/div) Ch 2: Io (5A/div)

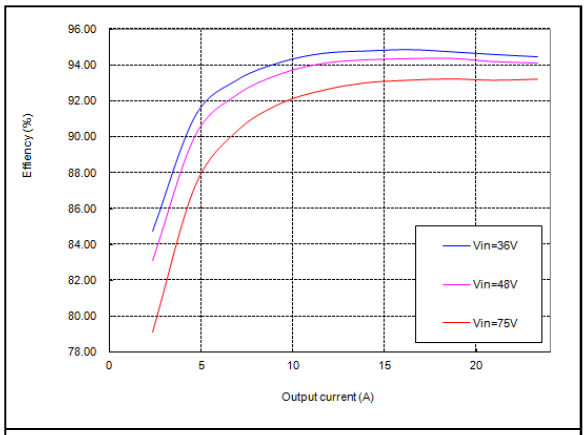


Figure 9: AGF800-48D3005 Efficiency Curves with no load at 5V

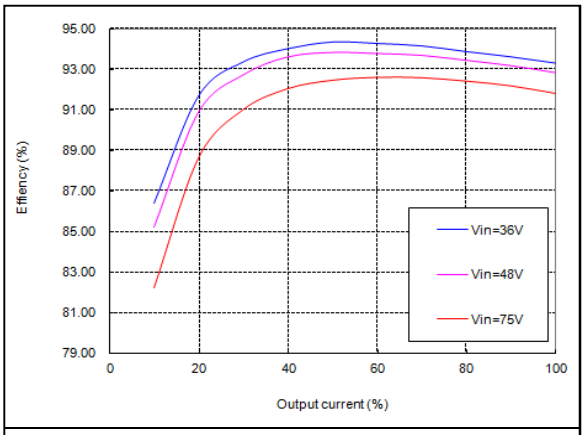


Figure 10: AGF800-48D3005 Efficiency Curves with both load at 5V

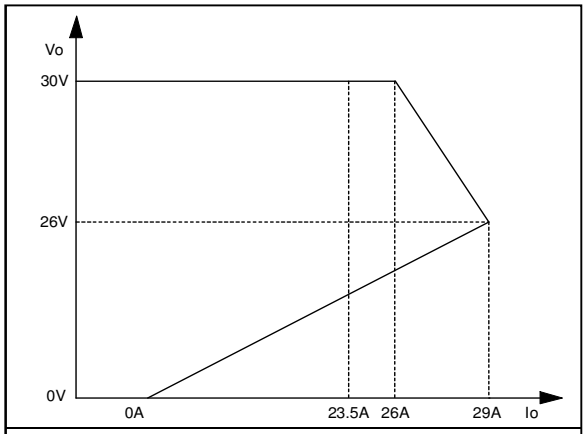
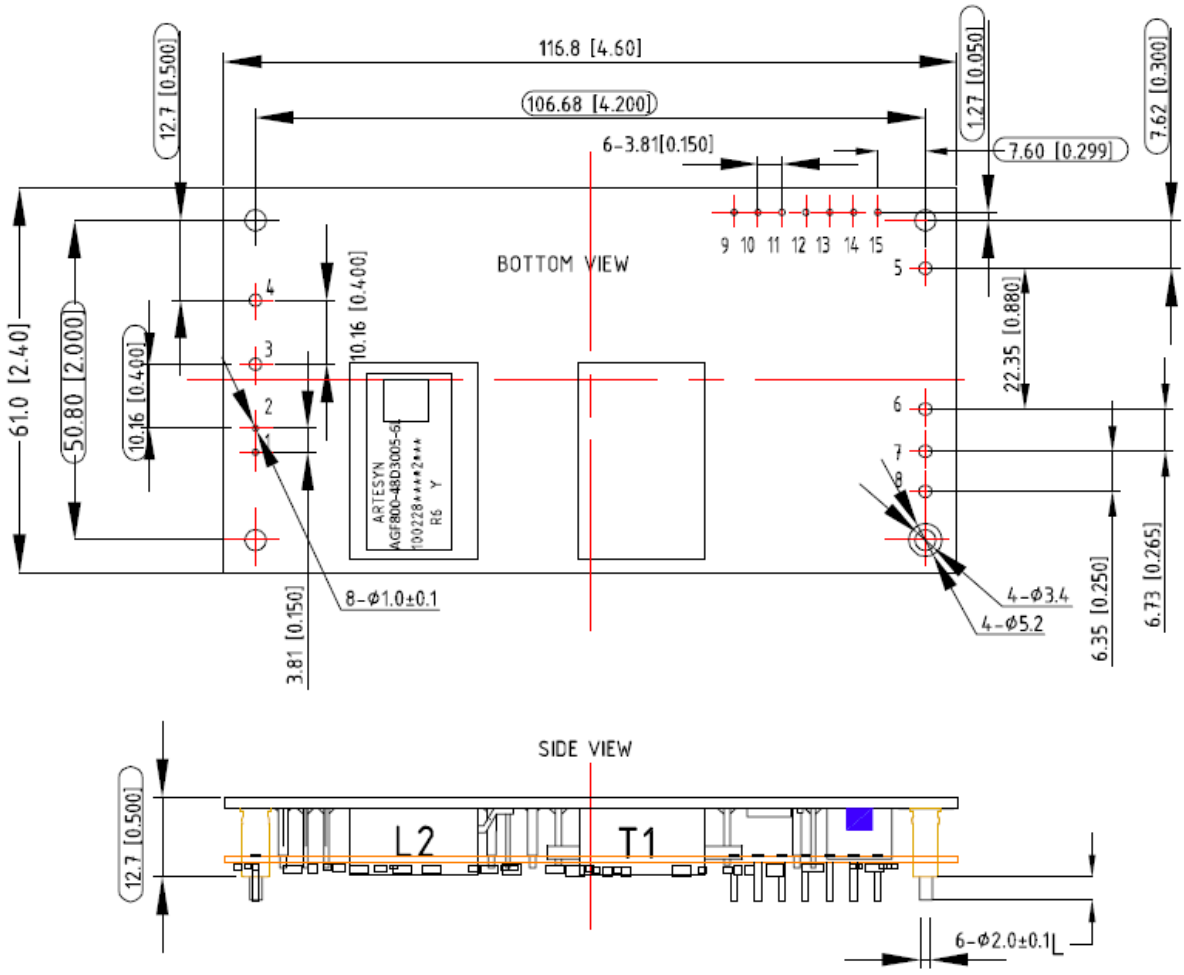


Figure 11: Over-current protection characteristics

Mechanical Specifications

Mechanical Outlines – Baseplate Module

AGF800-48D3005



UNIT: mm[inch] PIN: L=3.8±0.25mm

TOLERANCE: X.Xmm±0.5mm[X.XX in.±0.02in.]
X.XXmm±0.25mm[X.XXX in.±0.01in.]

Figure 12 Mechanical diagram

Pin length option

Device code suffix	L
-4	4.8mm±0.5mm
-6	3.8mm±0.5 mm
-8	2.8mm±0.5 mm
None	5.8mm±0.5 mm

Pin Designations

Pin NO.	Name	Function
1	+On/Off	Remote control
2	-On/Off	Remote control
3	Vin+	Positive input voltage
4	Vin-	Negative input voltage
5	Vo1+	Positive output voltage of output 1
6	Vo1-	Negative output voltage of output 1
7	Vo2-	Negative output voltage of output 2
8	Vo2+	Positive output voltage of output 2
9	Trim 2	Trim terminal of output 2
10	AUX	Auxiliary voltage
11	IOG	Inverter operation good of output 1
12	+S2	Remote sensing + of output 2
13	Trim 1	Trim terminal of output 1
14	+S1	Remote sensing + of output 1
15	-S1	Remote sensing - of output 1

Noted: The rated voltage of output1 is 30V. The rated voltage of output2 is 5V.

Environmental Specifications

EMC Immunity

AGF800-48D3005 power supply is designed to meet the following EMC immunity specifications:

Table 4. Environmental Specifications:

Document	Description
EN55022, Class B Limits	Conducted and Radiated EMI Limits

EMC Test Conditions

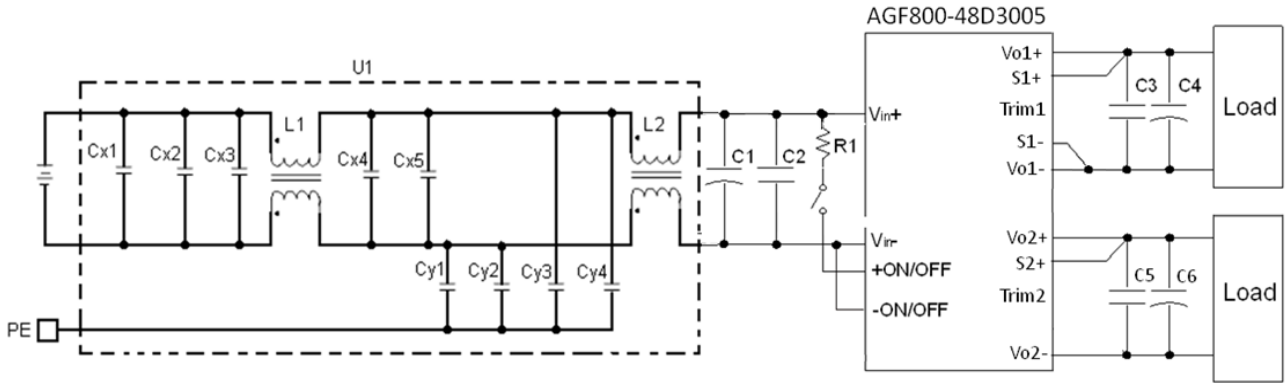


Figure 13 EMC test configuration

CX1, CX2, CX3, CX4, CX5: 1000nF/100V/X7R capacitor
Cy1, Cy2, Cy3, Cy4: 0.1μF/1000V/X7R, Y capacitor
L1, L2: 473μH, common mode inductor
C1： 1500μF/100V electrolytic capacitor
C2 ~ C6: See Figure 17

Safety Certifications

The AGF800-48D3005 power supply is intended for inclusion in other equipment and the installer must ensure that it is in compliance with all the requirements of the end application. This product is only for inclusion by professional installers within other equipment and must not be operated as a stand alone product.

Table 5. Safety Certifications for AGF800-48D3005 series power supply system

Document	File #	Description
UL 60950		US Requirements
EN60950		European Requirements
IEC60950		International Requirements
GB4943		China
CE		CE Marking

Operating Temperature

The AGF800-48D3005 power supplies will start and operate within stated specifications at an ambient temperature from -40 ^{O}C to 85 ^{O}C under all load conditions. The storage temperature is -55 ^{O}C to 125 ^{O}C.

Thermal Considerations

The converter can operate in an enclosed environment without forced air convection. Cooling of the converter is achieved mainly by conduction from the baseplate to a heatsink. The converter can deliver full output power at 85 ^{O}C ambient temperature provided the baseplate temperature is kept below the max values 100 ^{O}C.

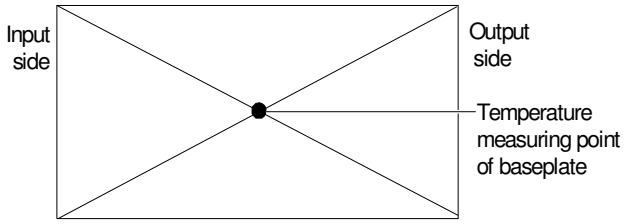


Figure 14 Temperature test point on base plate

Table 6. Temperature limit of the test point

Test Point	Temperature Limit
Test point on baseplate	105 ^{O}C

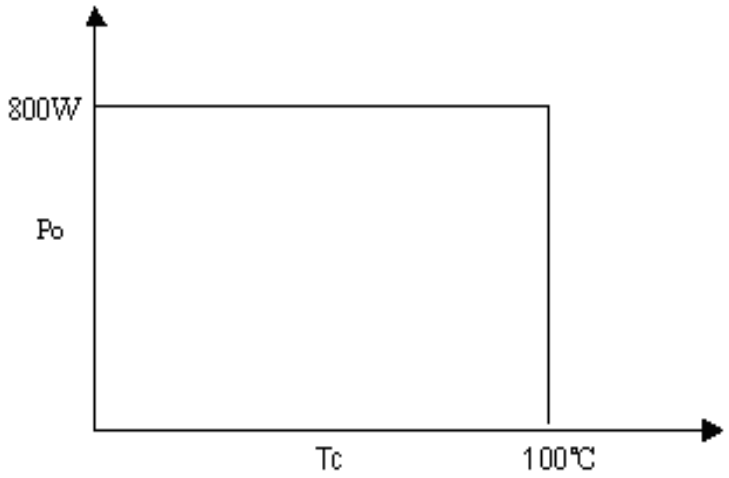


Figure 15 Output power derating curve,

Tc: temperature test point on baseplate, see Figure 14 for test configuration

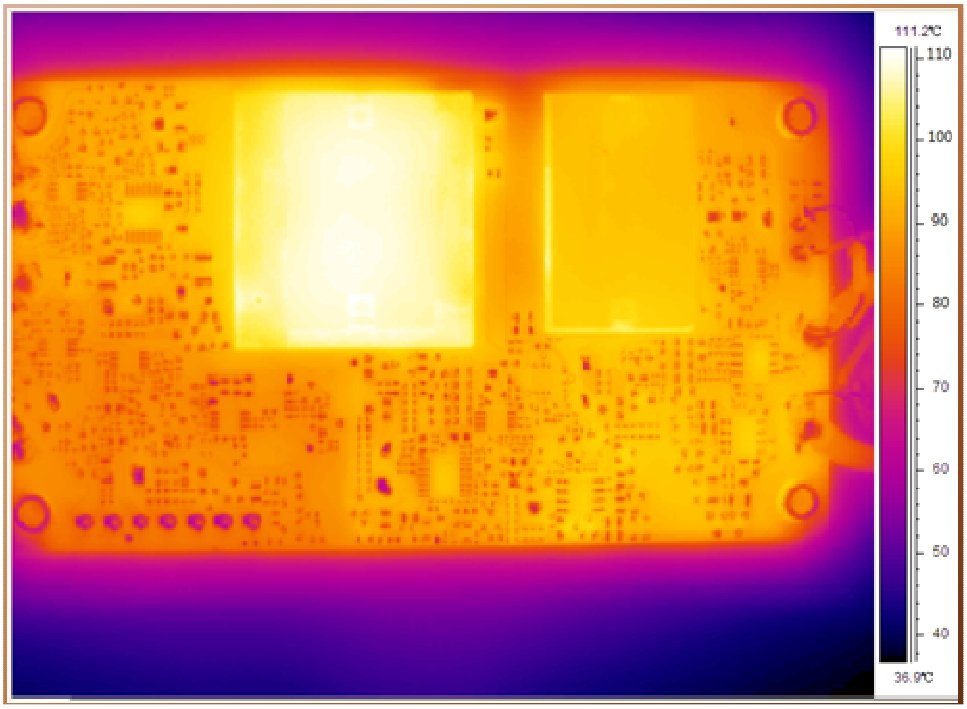


Figure 16 Thermal image, 48Vin, 30Vo and 5Vo, full load, room temperature

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Qualification Testing

Parameter	Unit (pcs)	Test condition
Halt test	4-5	$T_{a,min}$-30 ^{O}C to $T_{a,max}$+25 ^{O}C, V_{in} = min to max, 0 ~ 100% load
Vibration	3	Frequency range: 5Hz ~ 20Hz, 20Hz ~ 200Hz, A.S.D: 1.0m^2/s^3, -3db/oct, axes of vibration: X/Y/Z. Time: 30min/axes
Mechanical Shock	3	30g, 6ms, 3axes, 6directions, 3time/direction
Thermal Shock	3	-40 ^{O}C to 125 ^{O}C, unit temperature 20cycles
Thermal Cycling	3	-40 ^{O}C to 85 ^{O}C, temperature change rate: 1^{O}C/min, cycles: 2cycles
Humidity	3	40 ^{O}C, 95%RH, 48h
Solder Ability	15	IPC J-STD-002C-2007

Application Notes

Typical Application

Below is the typical application of the AGF800 series power supply.

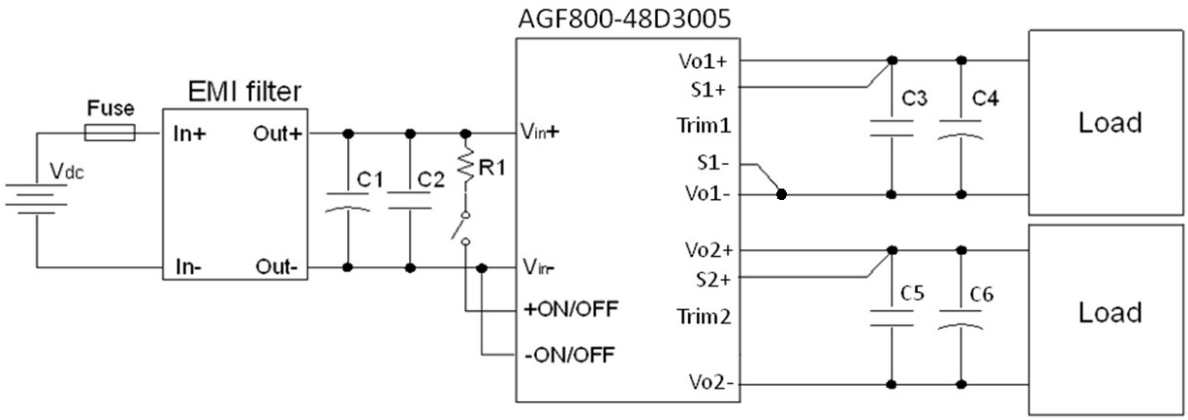

Figure 17 Typical application

C1: 470μF/100V electrolytic capacitor, P/N: UVZ2A471MPD (Nichicon) or equivalent
C2, C3,C5: 1μF/100V X7R ceramic capacitor, P/N: C3225X7R2A105KT0L0U (TDK) or equivalent
C4:2200uF electrolytic capacitor, P/N: UPM1H222MHD(Nichicon) or equivalent
C6: 680μF electrolytic capacitor, P/N: UPM1E681MHD (Nichicon) or equivalent
External fast-acting fuse with a rating of 40A should be used in the application. The recommended fuse model is 0314040 or 0324040 from LITTELFUSE.
Double minimum input/output capacitance is necessary for normal operation and performance in case of Ta<0 ^{O}C.

Sense Characteristics

If the load is far from the unit, connect S+ to the terminal of the load respectively to compensate the voltage drop on the transmission line. See Figure 17.
If the sense compensation function is not necessary, short S+ to Vo+ and S- to Vo- respectively.

Remote ON/OFF

A remote ON/OFF control circuit is provided which is isolated from the input side, as well as, the output side. (Isolation withstand voltage: 1.5kVdc).

Connection of remote ON/OFF terminal is as follows. As shown in the figure below, output voltage turns remote ON when current is made to flow through remote ON/OFF terminal. Remote ON/OFF terminal can be controlled by opening or closing connections (with switch or relay).

Maximum source current for remote ON/OFF terminal is 5mA. Therefore, set current limiting resistor value such that this maximum source current value is not exceeded. Also, the allowable maximum reverse current flow is 5mA.

Controlling the remote ON/OFF terminal from the input side

Connect current limiting resistor R1 is shown in the following figure.

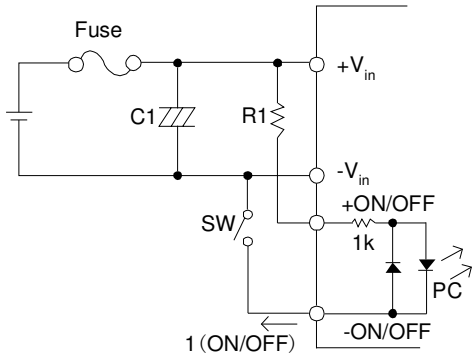

Figure 18 Connection of remote ON/OFF control (A)

R1: Recommended resistor value: 20kΩ (1/2W)

Controlling the remote ON/OFF terminal from the output side

Connect the current limiting resistor R1 is shown in the following figure.

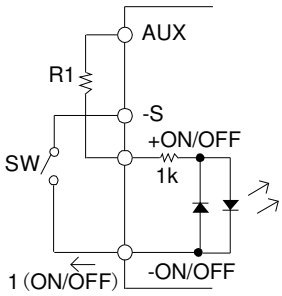

Figure 19 Connection of remote ON/OFF control (B)

R1: Recommended resistor value: 2kΩ (1/2W)
Note:
1. When wiring becomes long, connect a capacitor of about 0.1μF value between the +remote ON/OFF terminal and –remote ON/OFF terminal at a nearest distance.
2. Current limiting resistor can also be connected to the –remote ON/OFF terminal side.
3. The remote ON/OFF control mode is shown in the following table.

Remote ON/OFF level	Output status
Open （<100uA）	Remote OFF
1.5mA ≤ I (ON/OFF) ≤ 5mA	Remote ON

Trim Characteristics

Vout1 (30V):

Connecting an external resistor between Trim1 pin and Vo1- pin will decrease the output Voltage. While connecting it between Trim1 and Vo1+ will increase the 30V output Voltage. The following equations determine the external resistance to obtain the trimmed output Voltage.

$$R_{adj\_down} = -5.97\left(\frac{V_o}{V_o - V_e}\right)k\Omega$$

$$R_{adj\_up} = 173.13\left(\frac{V_o}{V_o - V_e}\right)k\Omega$$

Ve is the rated output Voltage and Vo is the goal Voltage.
For example, to get 33V output, the resistor is:

$$R_{adj\_up} = 173.13\left(\frac{33}{33-30}\right) = 1904k\Omega$$

The output Voltage can also be trimmed by potential applied at the Trim pin, see Figure 21.

V_{trim}=1+kΔ%

K=(R_trim+5.97)/5.97

Δ%=(Vo-Ve)/Ve ×100%

Where V_{trim} is the potential applied at the Trim pin, and Vo is the desired output Voltage, and V_e is 30V, have a range of -50%~110%. The unit for R_{trim} is.

When R_{trim}=5.97k

V_{trim}=Vo/15-1

The corresponding relationship between V_{trim} and Vo is shown in Figure 20.

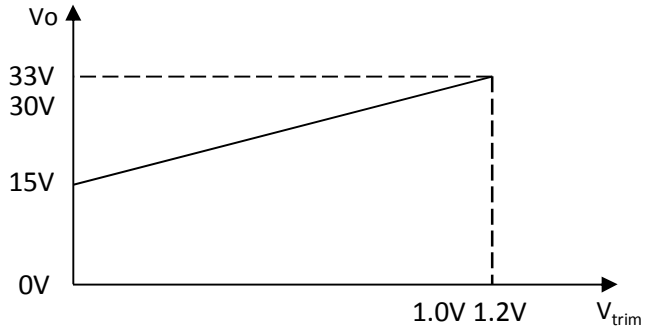

Figure 20 V_{trim} Voltage vs. output Voltage (R_{trim}=5.97k)

Considering the real resistor value, R_{trim}=5.1k is recommend, the equation is shown as below.
Vtrim=0.062Vo – 0.854
The corresponding relationship between Vtrim and Vo is shown in Figure 21.

Trim Characteristics

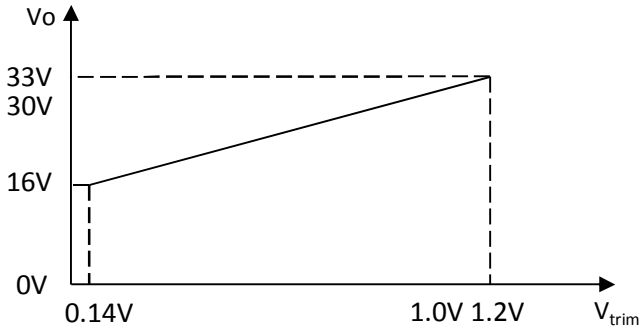

Figure 21 V_{trim} Voltage vs. output Voltage (R_{trim}=5.1k)

When trimming up, the output current should be decreased accordingly so as not to exceed the rated output power 700W, The minimum input Voltage should be increased as shown in the following figure 22.

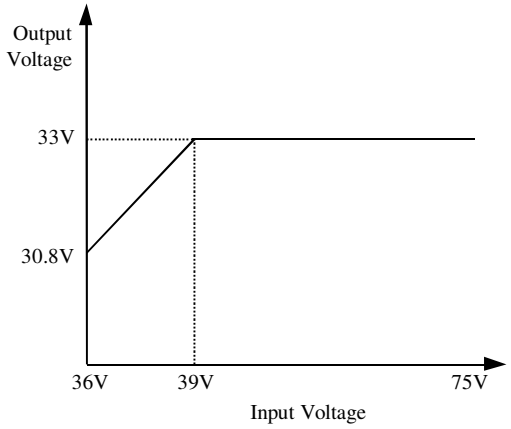

Figure 22 Max. adjustable output Voltage vs. input Voltage

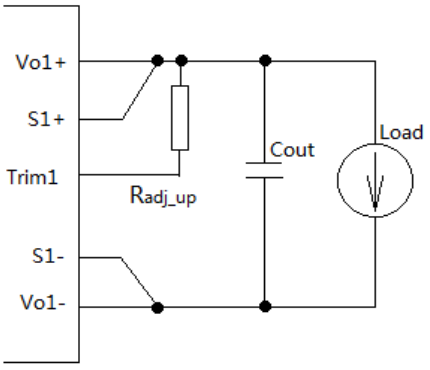

Figure 23 Trim up (30V)

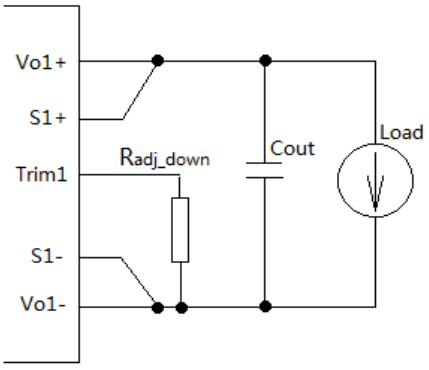

Figure 24 Trim down(30V)

Trim Characteristics

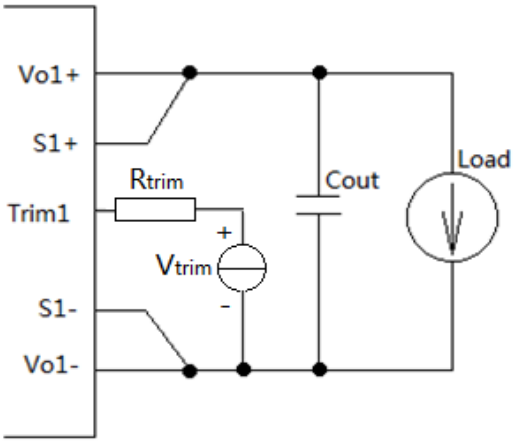

Figure 25 Trim function circuit

Vout2 (5V):
Connecting an external resistor between Trim2 pin and Vo2+ pin will increase the output Voltage. While connecting it between Trim2 and Vo2- will decrease the output Voltage. The following equations determine the external resistance to obtain the trimmed output Voltage.

$$R_{down} = \frac{5.1}{\Delta} - 10.2$$

$$R_{up} = \frac{20.56 \times (1+\Delta)}{\Delta} - \frac{5.1}{\Delta} - 10.2$$

$$\Delta = \left| \frac{V_o - V_e}{V_e} \right|$$

V_e is the rated output Voltage and Vo is the goal Voltage.
For example, to get 5.5V output Voltage, the trimming resistor is

$$\Delta = \left| \frac{5.5-5}{5} \right| = 0.1$$

$$R_{up} = \frac{20.56 \times (1+0.1)}{0.1} - \frac{5.1}{0.1} - 10.2 = 164.96k\Omega$$

The output Voltage can also be trimmed by potential applied at the Trim pin.

$$V_{trim2} = (1+2\Delta) * 1.24$$

Where V_{trim2} is the potential applied at the Trim2 pin.
When trimming up, the output current should be decreased accordingly so as not to exceed the rated output power 100W.

Trim Characteristics

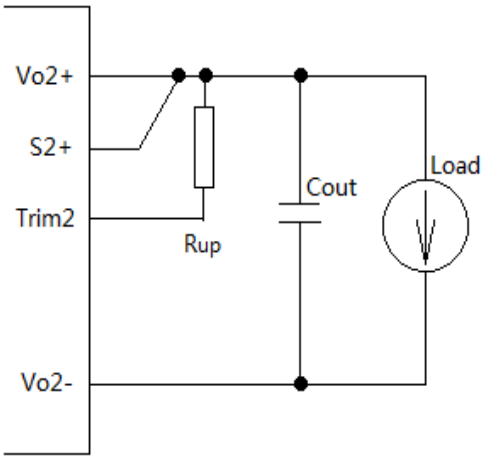

Figure 26 Trim up (5V)

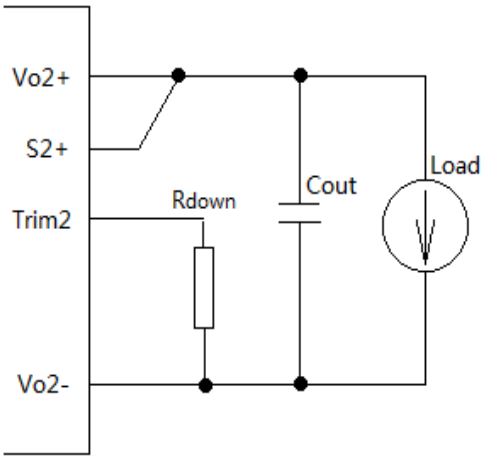

Figure 27 Trim down (5V)

AUX

AUX is built in to operate the output side RC. If AUX is not used for RC, AUX can also be used for IOG signal output by opto-coupler. Output voltage value is within 7~10Vdc range, maximum output current is 20mA. Ground for the AUX terminal is –S terminal. AUX can be used for IOG signal output by opto-coupler.

*Note: Avoid short circuit of AUX terminal with other terminals as this would lead to power module damage.

IOG

IOG signal turns 'H' from 'L' within 1s when the output of the module is shut down. The specification of IOG is shown in the following table.

Item	IOG
Function	Normal operation 'L'
	Malfunction 'H'
Base pin	-Sense
Level voltage 'L'	0.5V max at 5mA
Level voltage 'H'	5V typ
Maximum sink current	5mA max
Maximum applicable voltage	35V max

There are two methods to use the IOG. The level from IOG can be used directly to monitor the operation of the module, as shown in Figure 23(A). An external power supply, which is no more than 35V, can also be used for IOG, and a current limiting resistor (R1) must be added to ensure the sink current less than 5mA, as shown in Figure 23(B).

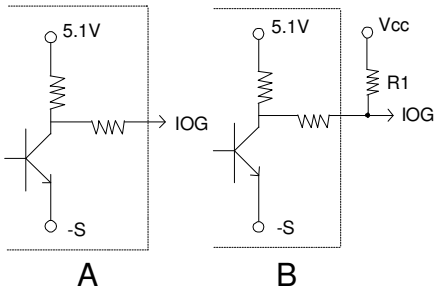

Figure 28 The application of IOG

Input Current , Input and Output Ripple & Noise Test Configuration

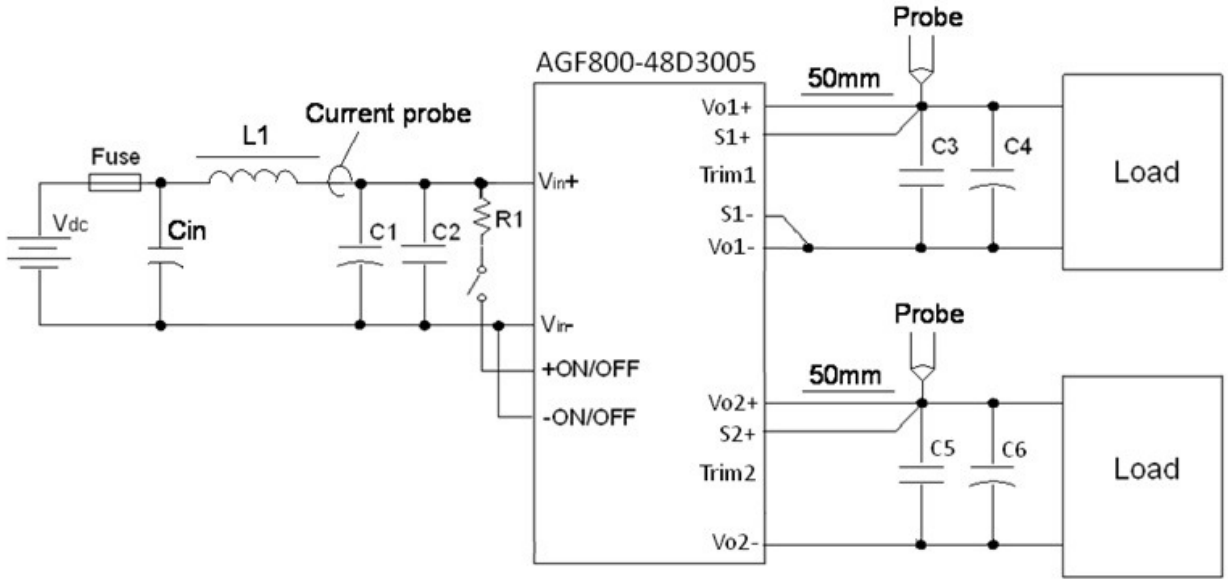

Figure 29 Inrush current, input and output ripple&noise test configuration

Vdc: DC power supply.
L1: 12μH inductor.
Cin: 220μF/100V electrolytic capacitor.
C1 ~ C6: See Figure 17.
Note: Using a coaxial cable with 50Ω resistor and 0.68μF ceramic capacitor or a ground ring of probe to test output ripple & noise is recommended.

Weight

The AGF800-48D3005 series weight is 160g maximum.

Soldering

The product is intended for standard manual or wave soldering.
When wave soldering is used, the temperature on pins is specified to maximum 260 ^{O}C for maximum 7s.
When soldering by hand, the iron temperature should be maintained at 300 ^{O}C ~ 380 ^{O}C and applied to the converter pins for less than 10s. Longer exposure can cause internal damage to the converter.
Cleaning of solder joint can be performed with cleaning solvent IPA or similative.

Hazardous Substances Announcement (RoHS of China)

Parts	Hazardous Substances					
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
AGF800-48D3005	x	x	x	x	x	x

x: Means the content of the hazardous substances in all the average quality materials of the part is within the limits specified in SJ/T-11363-2006

√: Means the content of the hazardous substances in at least one of the average quality materials of the part is outside the limits specified in SJ/T11363-2006

Artesyn Embedded Technologies has been committed to the design and manufacturing of environment-friendly products. It will reduce and eventually eliminate the hazardous substances in the products through unremitting efforts in research. However, limited by the current technical level, the following parts still contain hazardous substances due to the lack of reliable substitute or mature solution:

1. Solders (including high-temperature solder in parts) contain plumbum.
2. Glass of electric parts contains plumbum.
3. Copper alloy of pins contains plumbum

Record of Revision and Changes

Issue	Date	Description	Originators
1.2	03.01.2016	Pin 15 should be: Remote sensing - of output 1	S. Dong
1.3	07.14.2016	Swapped the trim up and trim down	K. Wang
1.4	08.22.2016	Update the picture	K. Wang
1.5	11.02.2016	Update the pin length tolerance	K. Wang

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