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POWERBOX Industrial Line 150
PAF(D)150 Series
150W 4:1 Single Output
DC/DC Converter
Manual

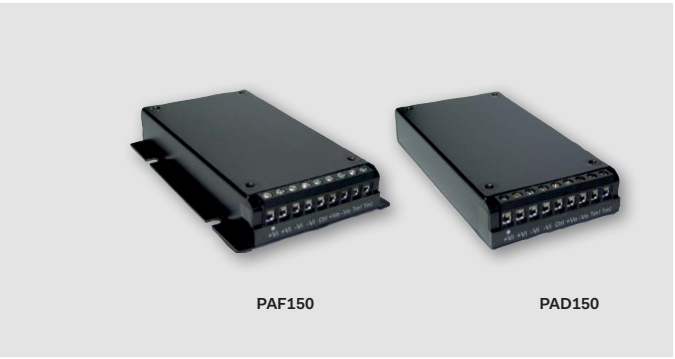


Table of Contents

Features

- 4:1 ultra wide input range
- High efficiency up to 89%
- CV+CC mode
- No minimum load required
- Adjustable output voltage
- Input under-voltage lockout
- Input reverse protection
- Meets EN55022 class A without external components
- CE mark meets 2006/95/EC, 93/68/EEC and 2004/108/EC
- UL60950-1, EN60950-1 and IEC60950-1 licensed
- Six-sided metal shielding
- Wall mount application
- Top side and bottom side heat dissipation

Options

- Heat-sinks available for extended operation
- Negative logic remote on/off
- PAD150 with EMI filter module

General Description

PAF(D)150 Series DC/DC converters provide up to 200 watts of output power. All model features a ultra wide input range, adjustable output voltage and constant current mode output limit. The PAF(D)150 converters are especially suited to telecom, networking and industrial applications.

Output Specification

Parameter	Device	Min	Typical	Max	Unit
Output voltage (Vin = Vin(nom) , Full Load , TA = 25°C)	XXS12W	11.88	12	12.12	VDC
	XXS15W	14.85	15	15.15	VDC
	XXS24W	23.76	24	24.24	VDC
	XXS28W	27.72	28	28.28	VDC
	XXS48W	47.52	48	48.48	VDC
Voltage adjustability	All	0		+20	% Vo
Output regulation	All				
Line (Vin(min) to Vin(max) at full load)		-0.2		+0.2	%
Load(0% to 100% of full load)		-0.4		+0.4	%
Output ripple & noise (Vin = Vin(nom) , full load , TA=25°C)	XXS12W		100	125	mVp-p
Peak to peak (5Hz to 20MHz bandwidth)	XXS15W		100	125	mVp-p
	XXS24W		200	250	mVp-p
	XXS28W		200	250	mVp-p
	XXS48W		350	400	mVp-p
Temperature coefficient	All	-0.02		+0.02	%/°C
Output voltage overshoot (Vin=Vin(min) to Vin(max), full load, TA=25°C)	All		0	5	%Vout
Dynamic load response (ΔIO / Δt = 1A/10μS , Vin = Vin(nom) , TA=25°C)	XXS12W		900		mV
Load step change between 75% to 100% of full load	XXS15W		900		mV
Peak dviation	XXS24W		1400		mV
	XXS28W		1400		mV
	XXS48W		1400		mV
Setting time (Vout<10% peak deviation)	All		200		μS
Output current	XXS12W	0		12.5	A
	XXS15W	0		10.0	A
	XXS24W	0		6.3	A
	XXS28W	0		5.4	A
	XXS48W	0		3.2	A
Output capacitor load	XXS12W			40000	μF
	XXS15W			26000	μF
	XXS24W			10000	μF
	XXS28W			7600	μF
	XXS48W			2600	μF
Output over voltage protection (non-latch hiccup)	XXS12W	15.0		16.80	VDC
	XXS15W	18.75		21.0	VDC
	XXS24W	30.0		33.60	VDC
	XXS28W	35.0		39.20	VDC
	XXS48W	60.0		67.20	VDC
Output over current protection (CC Mode)	All	105	110	120	% Io

Input Specification

Parameter	Device	Min	Typical	Max	Unit
Operating input voltage	24SXXW	9	24	36	VDC
	48SXXW	18	48	75	VDC
	110SXXW	43	110	160	VDC
Input voltage continuous, transient (1sec maximum)	24SXXW			40	VDC
	48SXXW			80	VDC
	110SXXW			160	VDC
	24SXXW			50	VDC
	48SXXW			100	VDC
	110SXXW			185	VDC
Input standby current (typical value at Vin = Vin(nom), no load)	24S12W		70		mA
	24S15W		80		mA
	24S24W		95		mA
	24S28W		120		mA
	24S48W		130		mA
	48S12W		50		mA
	48S15W		50		mA
	48S24W		60		mA
	48S28W		60		mA
	48S48W		70		mA
	110S12W		25		mA
	110S15W		25		mA
	110S24W		25		mA
	110S28W		25		mA
	110S48W		35		mA
Input reflected ripple current (5 to 20MHz)	24SXXW		100		mAp-p
	48SXXW		150		mAp-p
	110SXXW		250		mAp-p
Start up time (Vin = Vin(nom) and constant resistive load)	All				
Power up			25	35	mS
Remote ON/OFF			25	35	mS
Remote ON/OFF	All				
(The CTRL voltage is referenced to -VIN)					
Positive logic (Standard) : Device code without suffix					
DC-DC ON (open)		3		12	VDC
DC-DC OFF (short)		0		1.2	VDC
Negative logic (option) : Device code with Suffix “-N”					
DC-DC ON (short)		0		1.2	VDC
DC-DC OFF (open)		3		12	VDC
Remote off input current			3.5		mA
Input current of remote control pin		-0.5		1.0	mA
Under voltage lockout turn-on threshold	24SXXW			9	VDC
	48SXXW			18	VDC
	110SXXW			43	VDC
Under voltage lockout turn-off threshold	24SXXW	7.9		8.5	VDC
	48SXXW	15.6		16.8	VDC
	110SXXW	33.0		36.0	VDC

General Specification

Parameter	Device	Min	Typical	Max	Unit
Efficiency (Vin = Vin(nom) , full load , TA=25°C)	24S12W		86		%
	24S15W		86		%
	24S24W		87		%
	24S28W		87		%
	24S48W		86		%
	48S12W		88		%
	48S15W		89		%
	48S24W		89		%
	48S28W		89		%
	48S48W		88		%
	110S12W		88		%
	110S15W		89		%
	110S24W		89		%
	110S28W		89		%
	110S48W		88		%
Isolation voltage (1minute)	All				
Input to output		2250			VDC
Input to case		1600			VDC
Output to case		1600			VDC
Isolation resistance	All	1			GΩ
Isolation capacitance	All			3500	pF
Switching frequency	XXS12W	270	300	330	KHz
	XXS15W	270	300	330	KHz
	XXS24W	270	300	330	KHz
	XXS28W	270	300	330	KHz
	XXS48W	248	275	303	KHz
	110SXXW	203	225	248	KHz
Weight	PAF150		225		g
	PAD150		220		g
MTBF MIL-HDBK-217F	All		4.954×105		hours
Over temperature protection	All		110		°C
Case material	All		Aluminum		
Base material	All		Aluminum		
Potting material	All		Silicone (UL94 V-0)		
Dimensions	PAF150	3.86X2.560X0.67 Inch (98X65.0X17 mm)			
	PAD150	3.86X2.067X0.67 Inch (98X52.5X17 mm)			

Environmental Specification

Parameter	Device	Min	Typical	Max	Unit
Operating case temperature	All	-40		100	°C
Operating case temperature	All			100	°C
Storage temperature	All	-55		125	°C
Over temperature protection (case temperature)*	All		110		°C
Thermal impedance					
Only mount on the iron base-plate				2.55°C /Watt	
Mount on the iron base-plate and top side with 7 G-0058A heat-sink				2.0°C /Watt	
Thermal shock	MIL-STD-810F				
Shock	EN61373, MIL-STD-810F				
Vibration	EN61373, MIL-STD-810F				
Relative humidity	5% to 95% RH				

* Thermal test at WAF(D)150 mount on the iron base-plate. (The iron base-plate dimension is 19" * 3.5" * 0.063" The height is EIA standard 2U.) Heat-sink is optional and P/N is "7G-0058A-F".

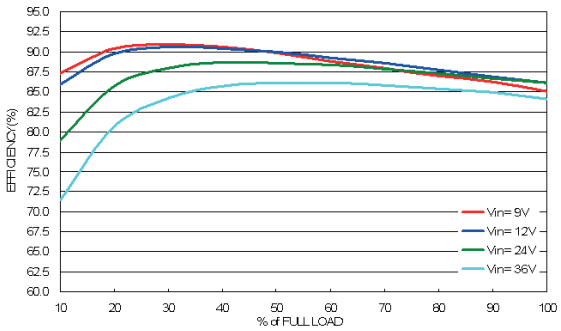
EMC Characteristics

EMI	EN55011, EN55022			Class A
ESD	EN61000-4-2	Air	± 8KV	Perf. Criteria A
		Contact	± 6KV	Perf. Criteria A
Radiated immunity	EN61000-4-3		10 V/m	Perf. Criteria A
Fast transient*	EN61000-4-4		± 2KV	Perf. Criteria A
Surge*	EN61000-4-5	EN55024	±1KV	Perf. Criteria A
		EN50155	±2KV	Perf. Criteria A
Conducted immunity	EN61000-4-6		10 Vr.m.s	Perf. Criteria A

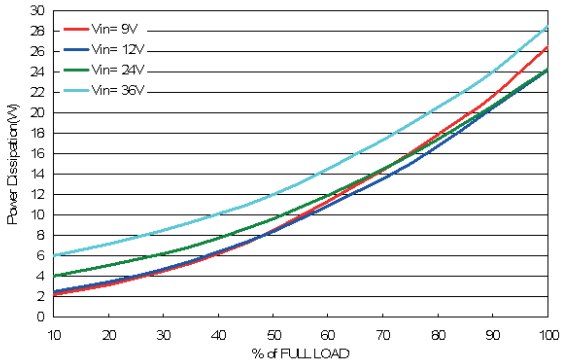
* An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5.
The filter capacitor Powerbox suggest: 24Vin : Nippon chemi-con KY series, 470μF/50V.
48Vin : Nippon chemi-con KY series, 220μF/100V.
110Vin : Nippon chemi-con KXJ series, 150μF/200V.

Characteristic Curves

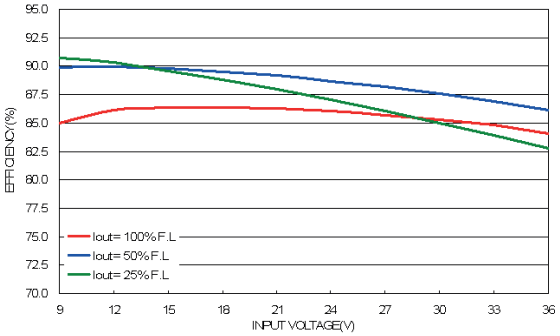
All test conditions are at 25°C.The figures are identical for PAF(D)150-24S12W



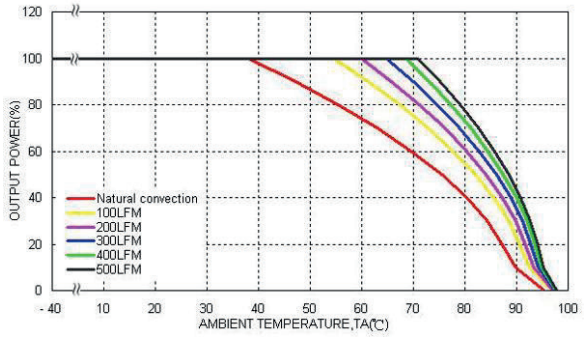
Efficiency versus output current



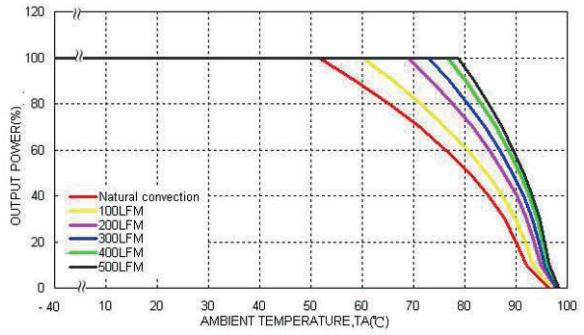
Power dissipation versus output current



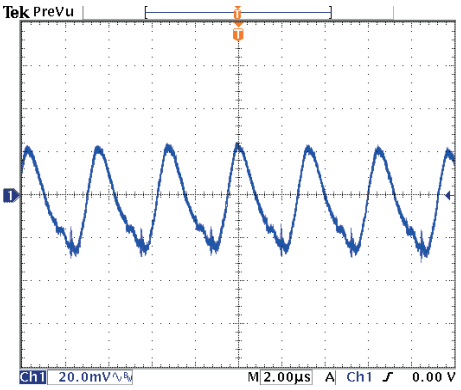
Efficiency versus input voltage, full load



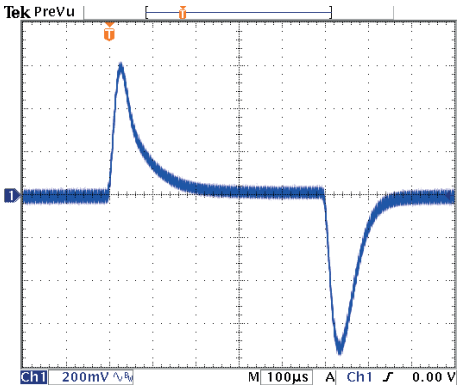
Derating output current versus ambient temperature with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



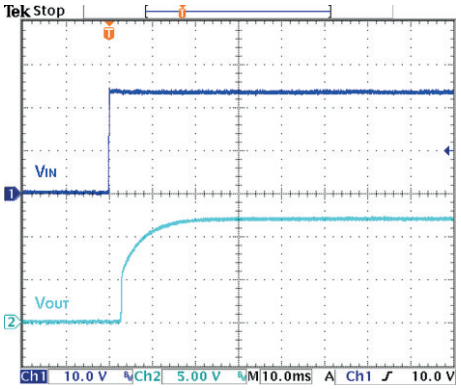
Derating output current versus ambient temperature with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-sink is optinal and P/N:



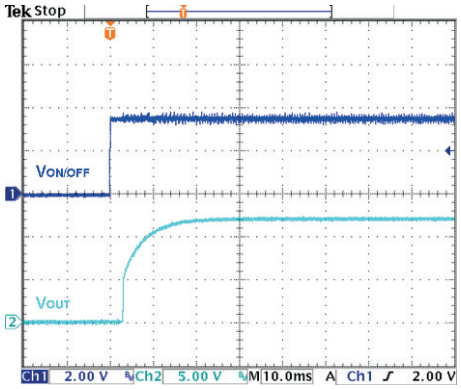
Typical output ripple and noise,
Vin = Vin(nom), full load



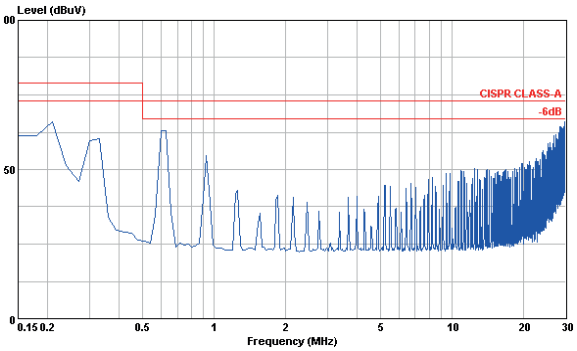
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



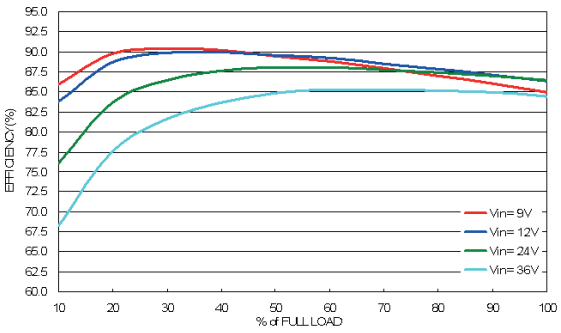
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



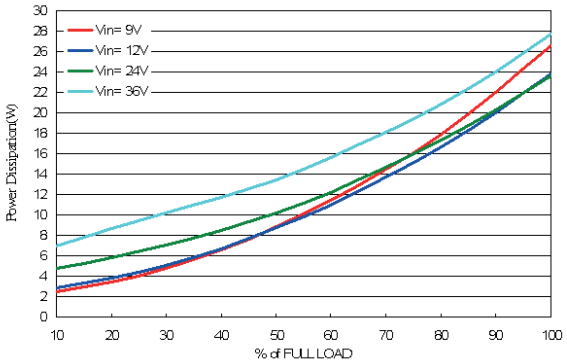
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

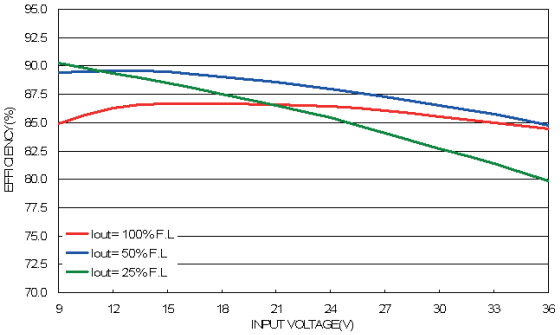
All test conditions are at 25°C.The figures are identical for PAF(D)150-24S15W



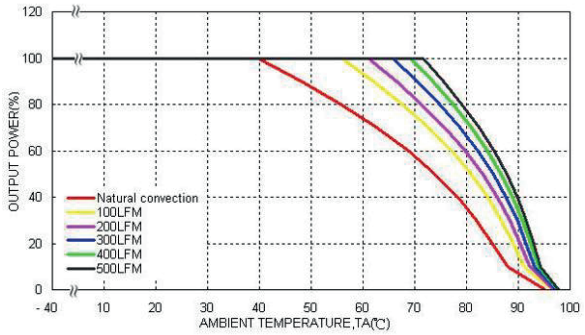
Efficiency versus output current



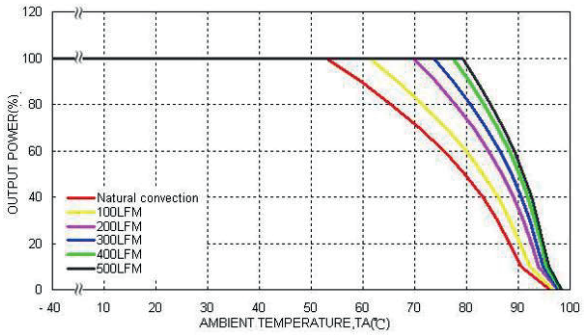
Power dissipation versus output current



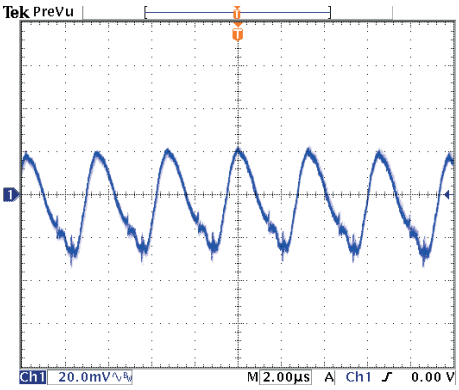
Efficiency versus input voltage, full load



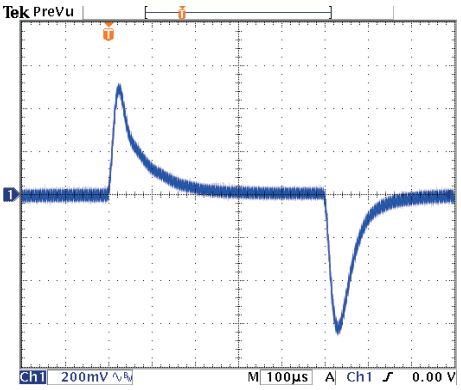
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



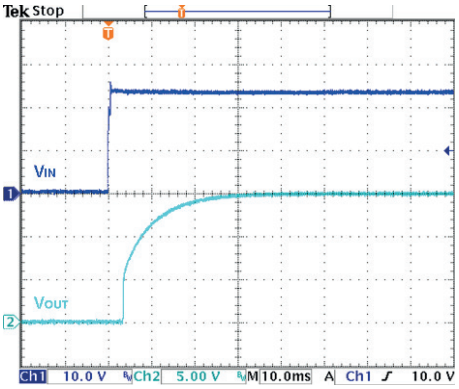
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



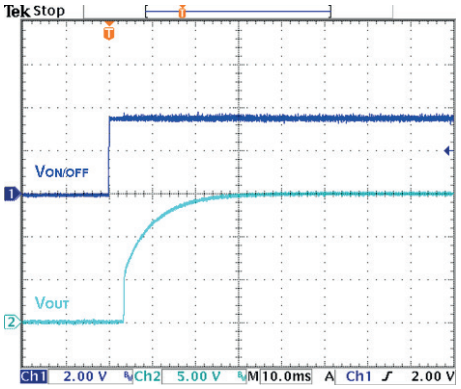
Typical output ripple and noise
Vin = Vin(nom), full load



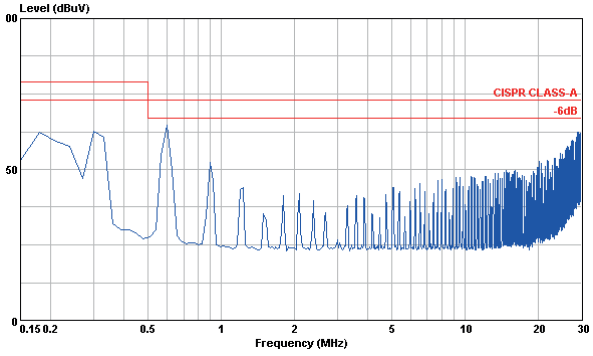
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



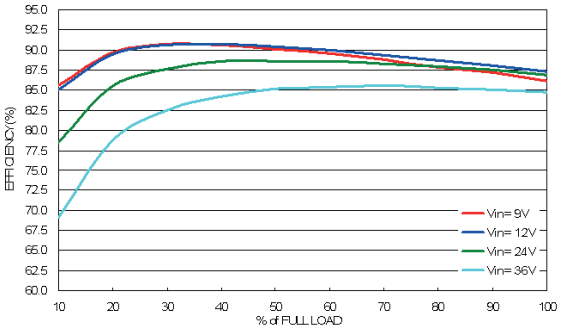
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



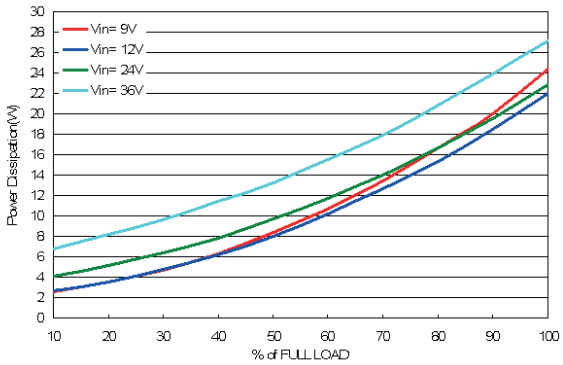
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

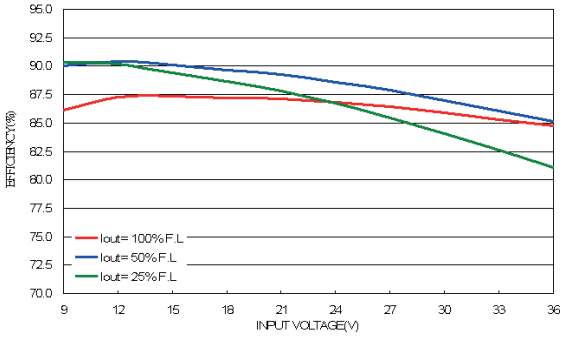
All test conditions are at 25°C.The figures are identical for PAF(D)150-24S24W



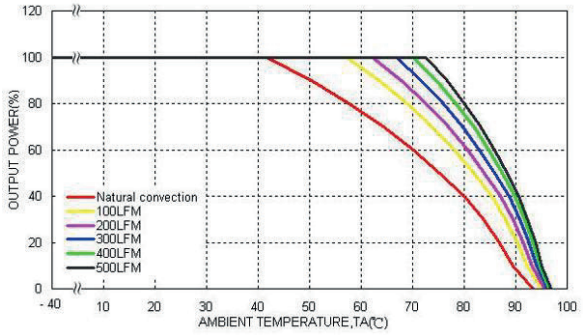
Efficiency versus output current



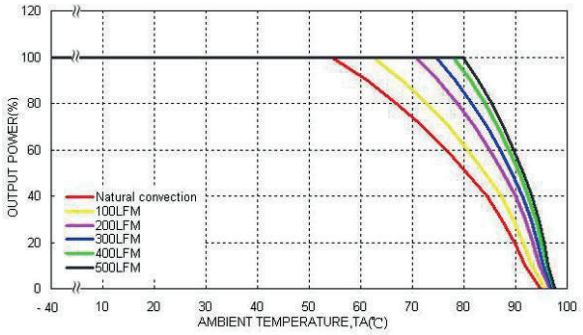
Power dissipation versus output current



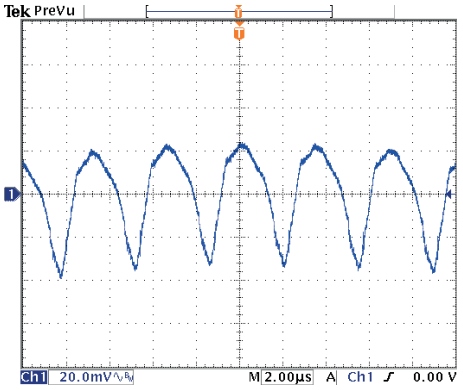
Efficiency versus input voltage, full load



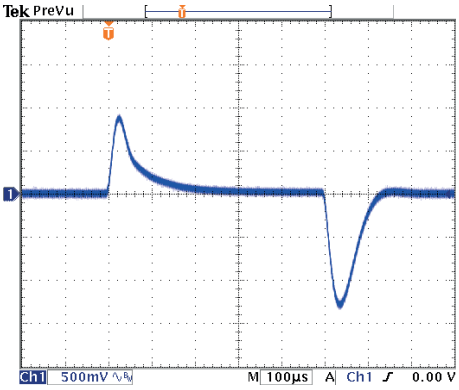
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom)
(The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



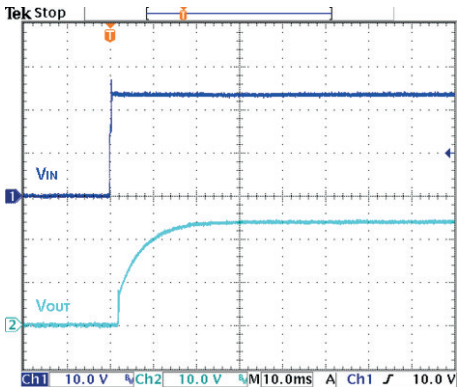
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom)
(The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



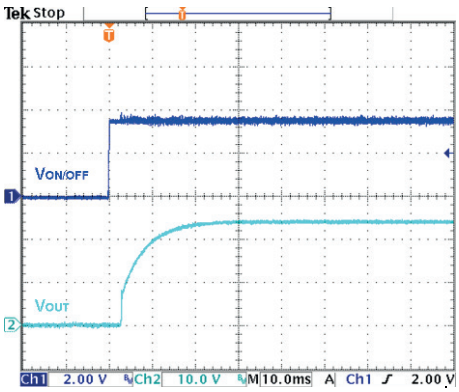
Typical output ripple and noise
Vin = Vin(nom), full load



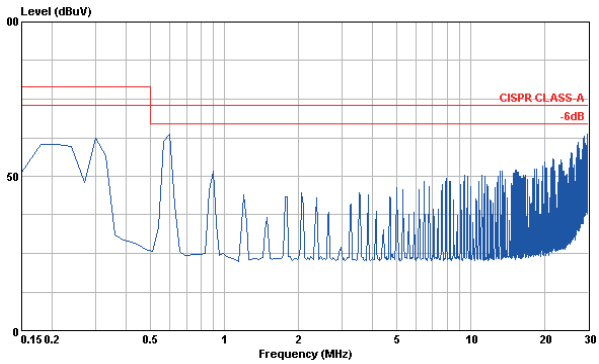
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



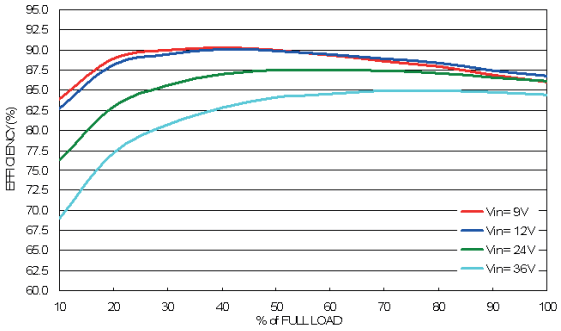
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



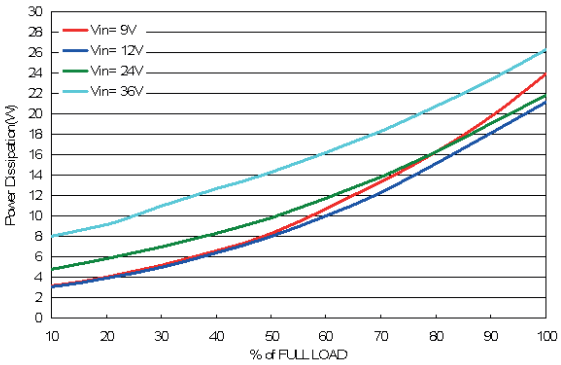
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

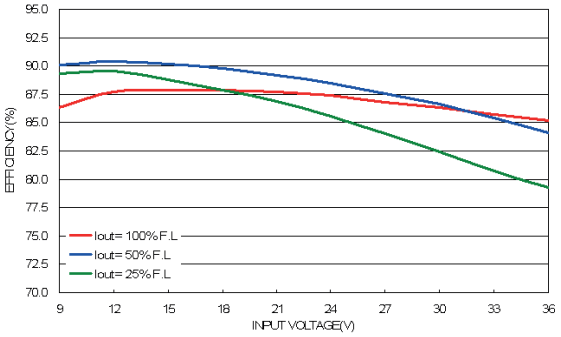
All test conditions are at 25°C.The figures are identical for PAF(D)150-24S28W



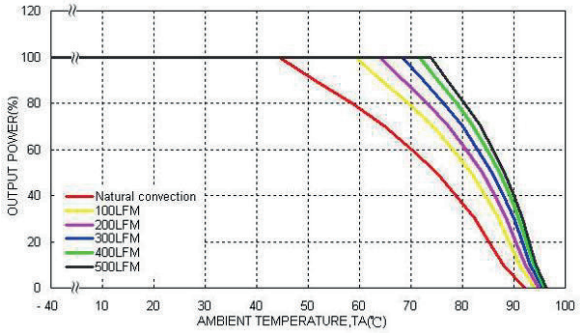
Efficiency versus output current



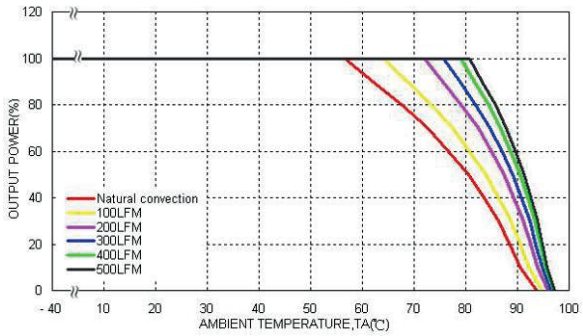
Power dissipation versus output current



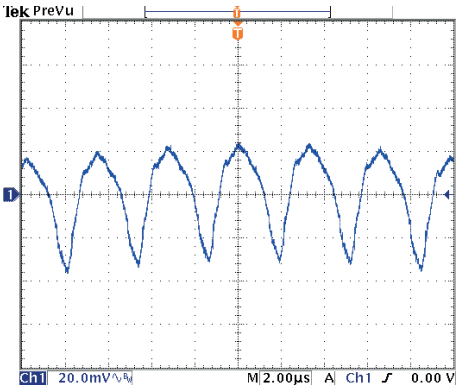
Efficiency versus input voltage, full load



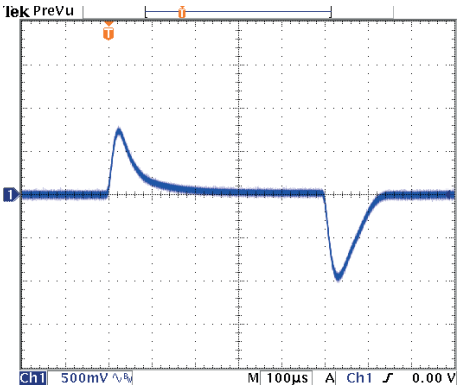
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



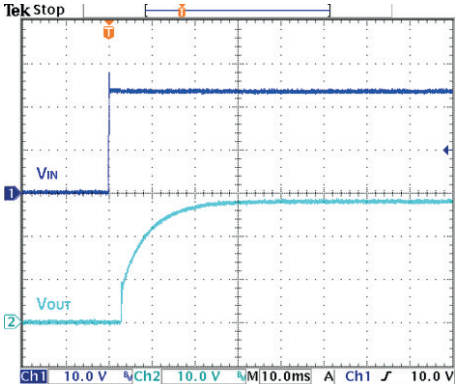
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



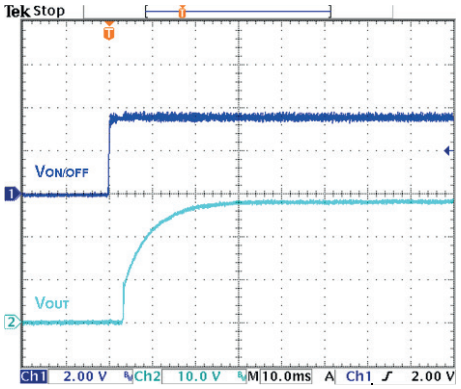
Typical output ripple and noise
Vin = Vin(nom), full load



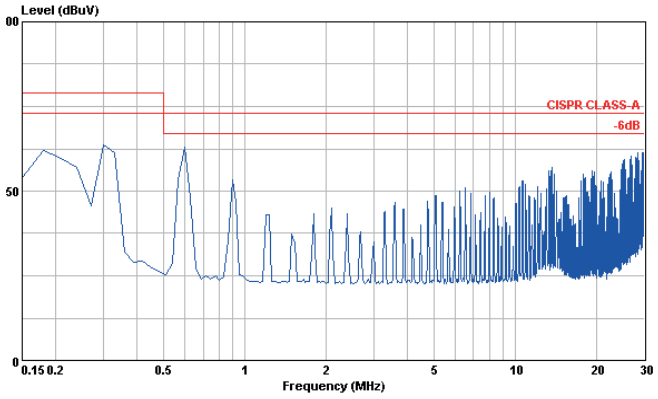
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



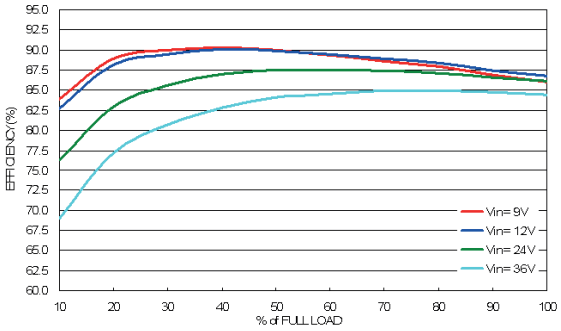
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



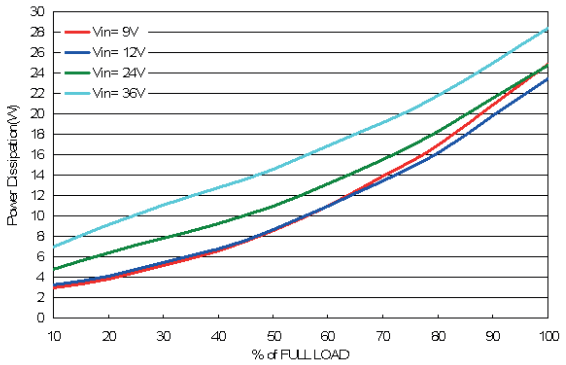
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

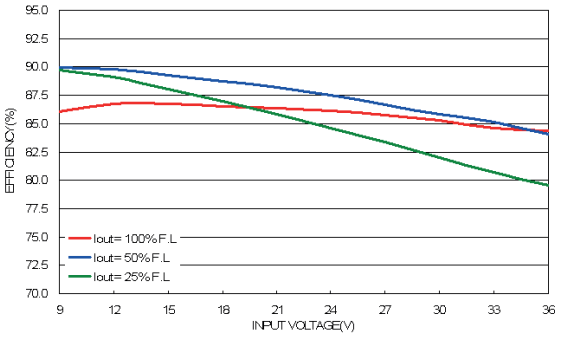
All test conditions are at 25°C.The figures are identical for PAF(D)150-24S48W



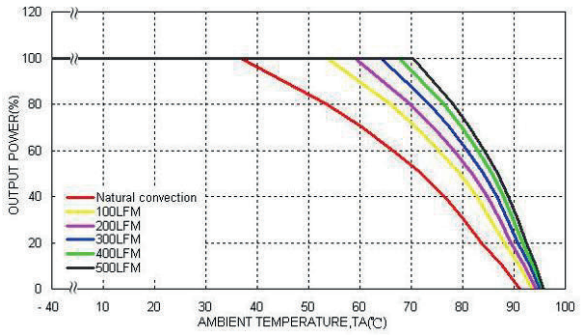
Efficiency versus output current



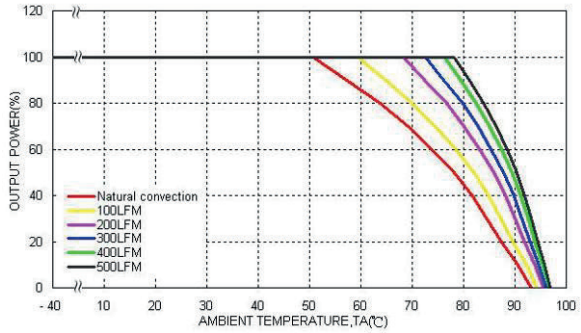
Power dissipation versus output current



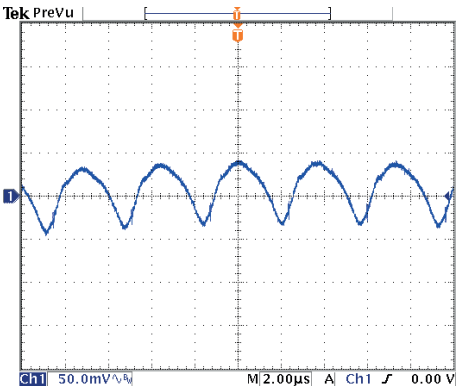
Efficiency versus input voltage, full load



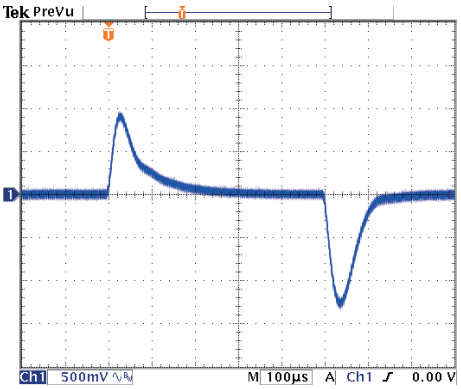
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



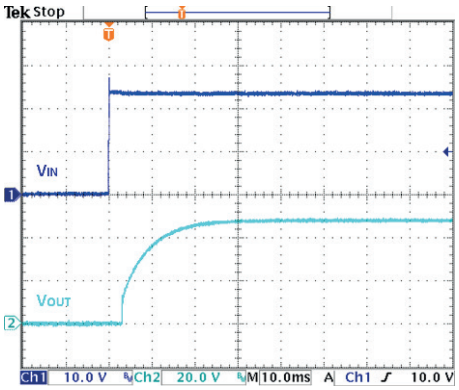
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



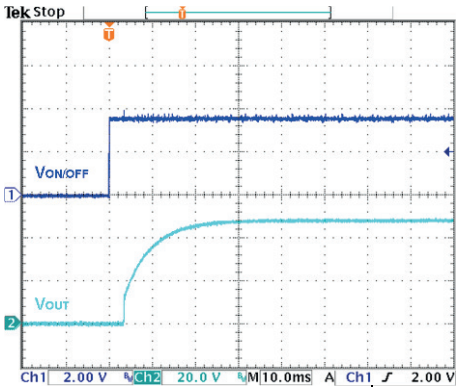
Typical output ripple and noise
Vin = Vin(nom), full load



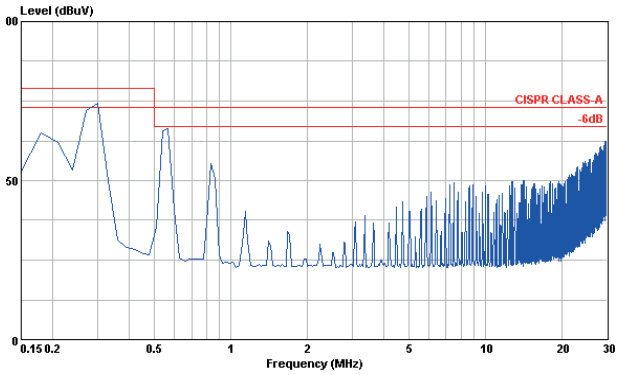
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



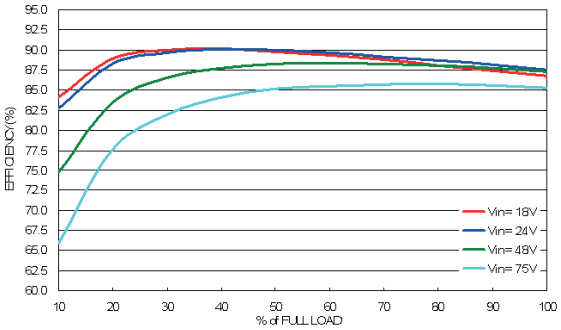
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



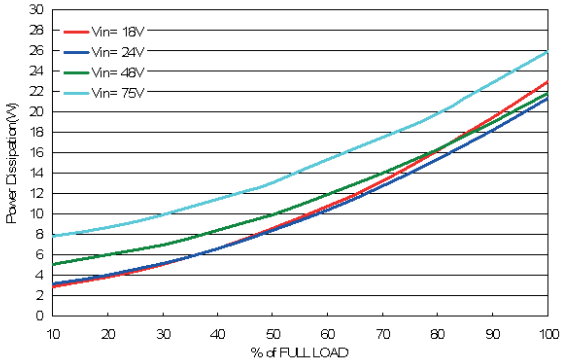
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

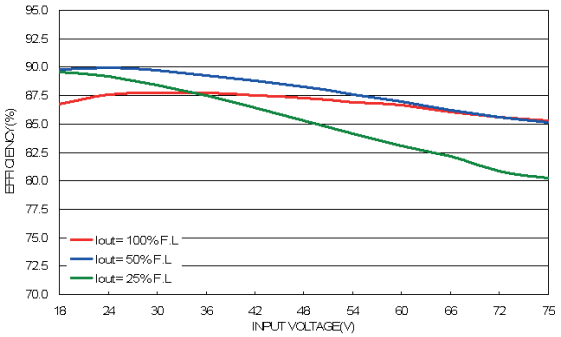
All test conditions are at 25°C.The figures are identical for PAF(D)150-48S12W



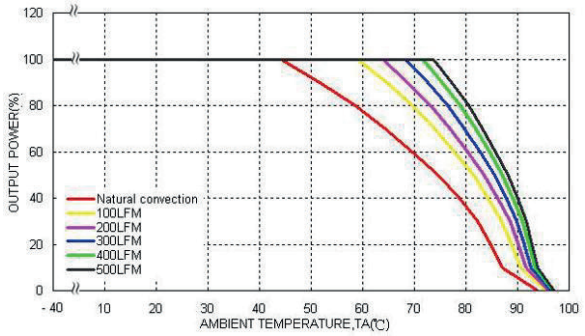
Efficiency versus output current



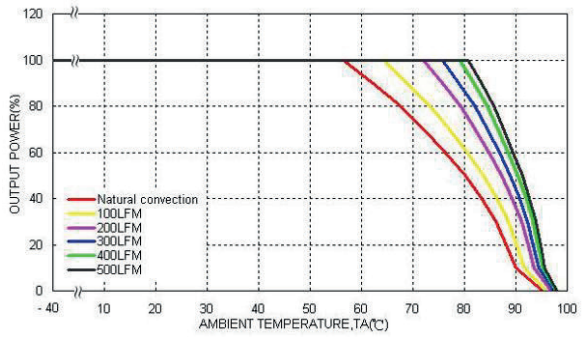
Power dissipation versus output current



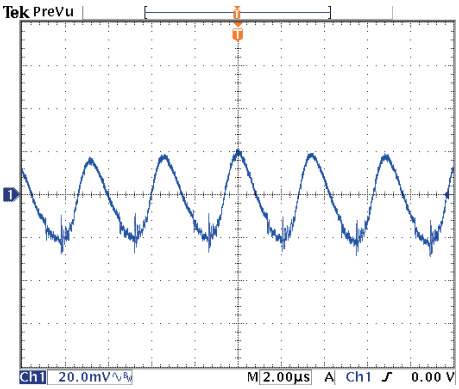
Efficiency versus input voltage, full load



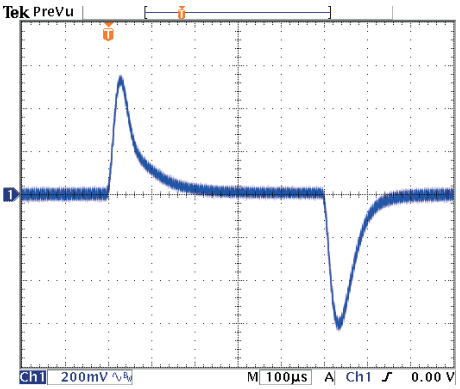
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



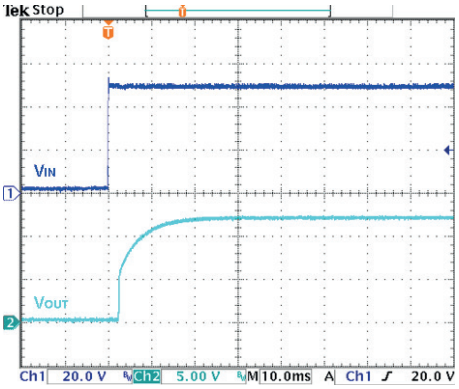
with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



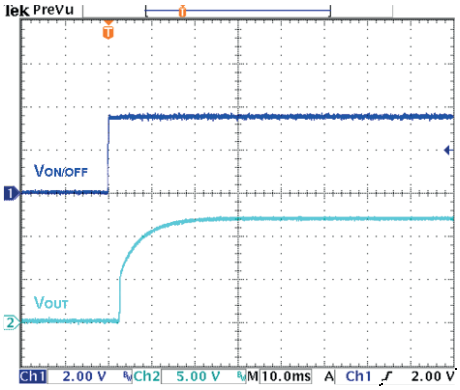
Typical output ripple and noise
Vin = Vin(nom), full load



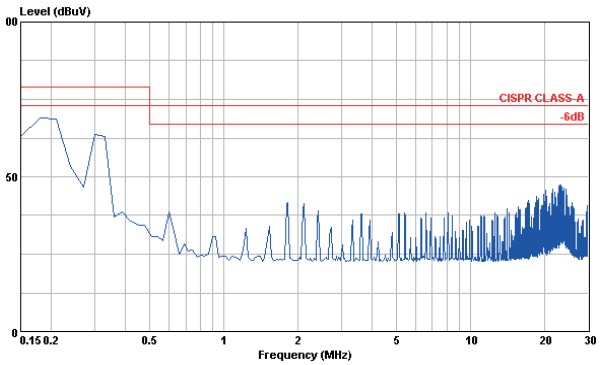
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



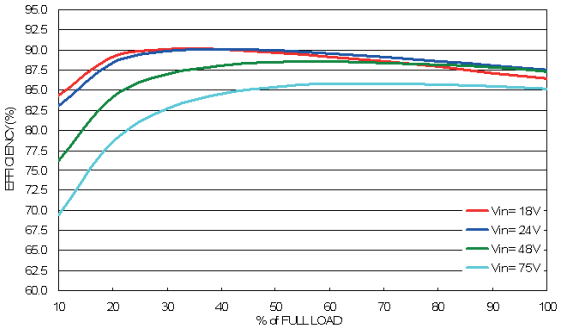
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



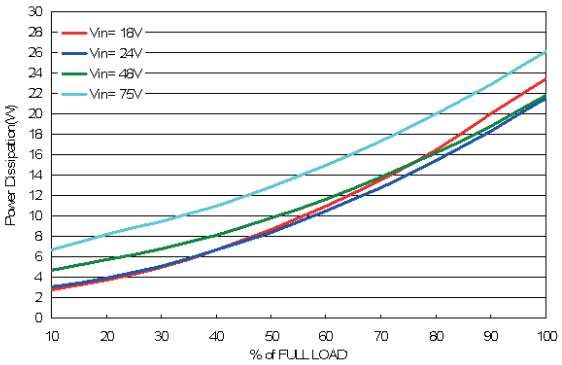
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

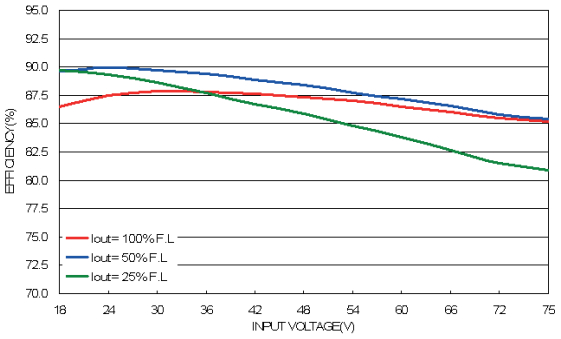
All test conditions are at 25°C.The figures are identical for PAF(D)150-48S15W



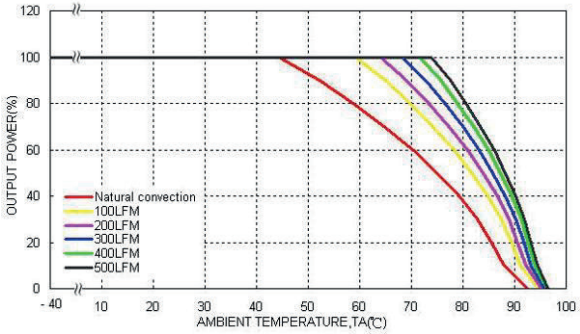
Efficiency versus output current



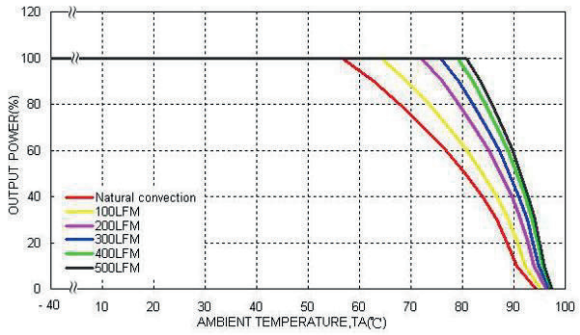
Power dissipation versus output current



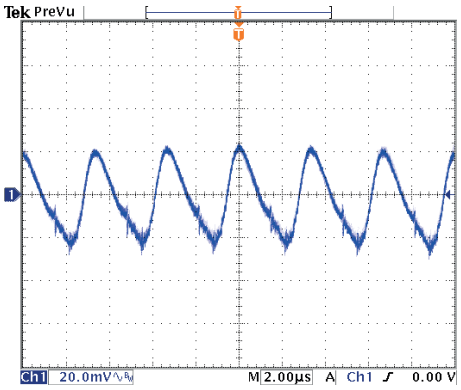
Efficiency versus input voltage, full load



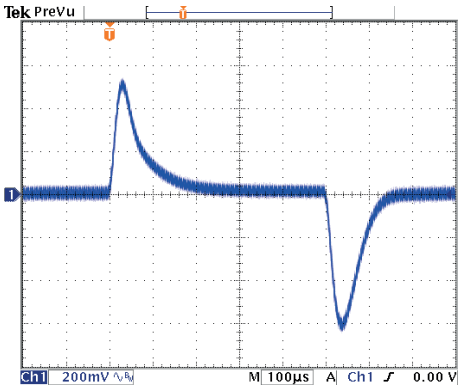
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



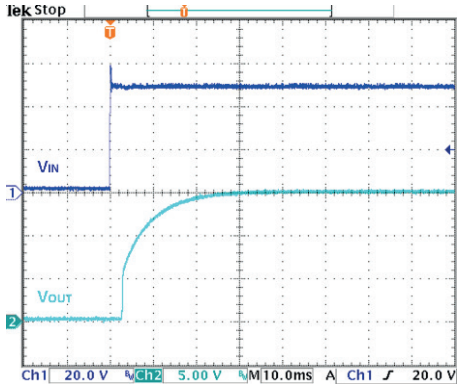
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



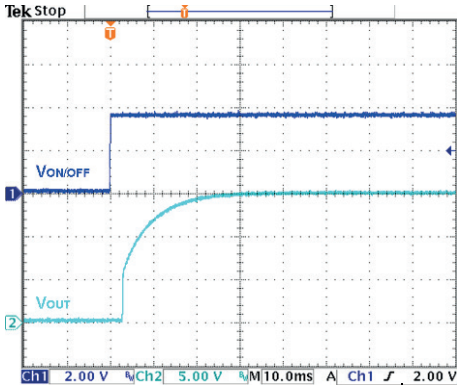
Typical output ripple and noise
Vin = Vin(nom), full load



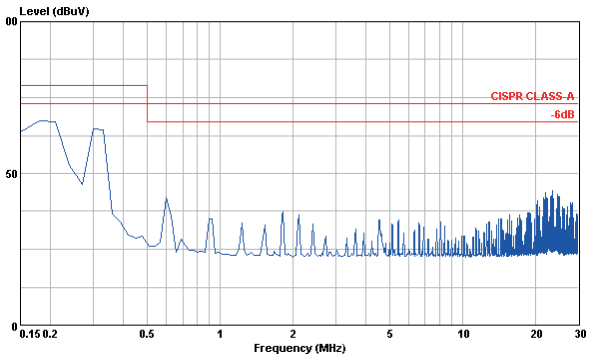
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



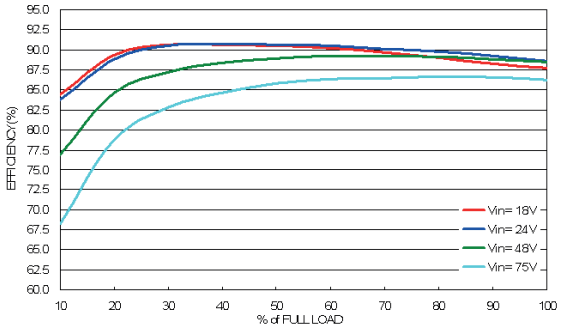
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



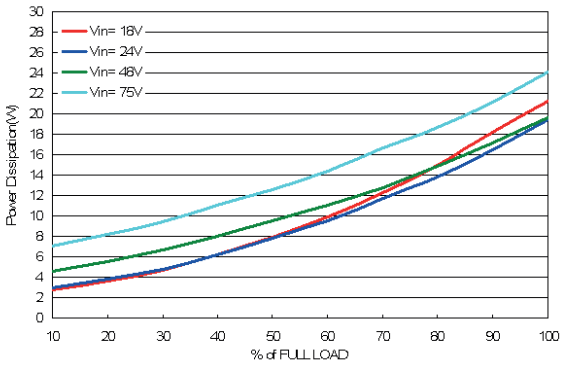
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

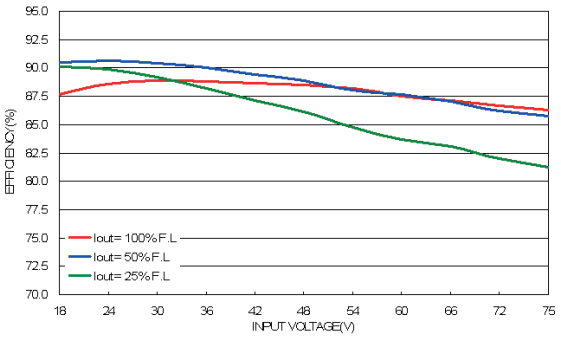
All test conditions are at 25°C.The figures are identical for PAF(D)150-48S24W



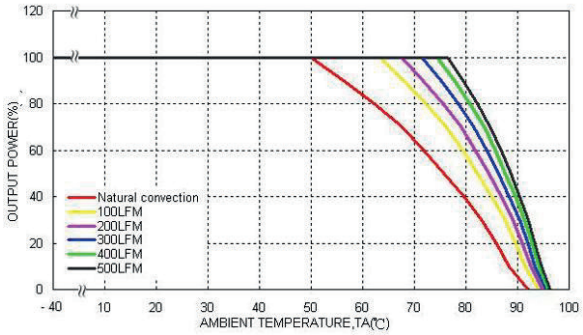
Efficiency versus output current



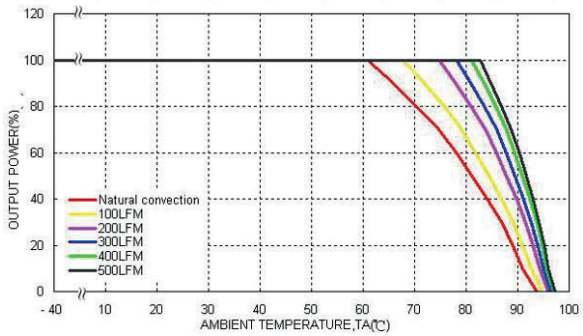
Power dissipation versus output current



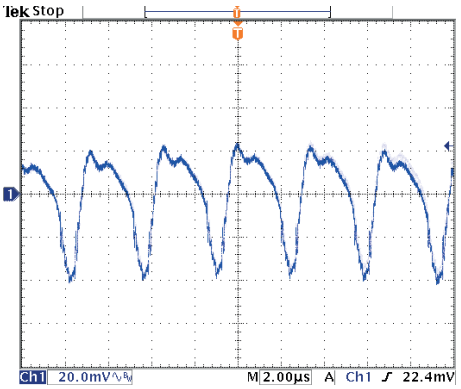
Efficiency versus input voltage, full load



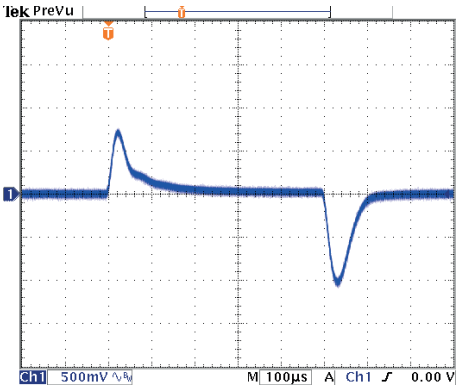
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



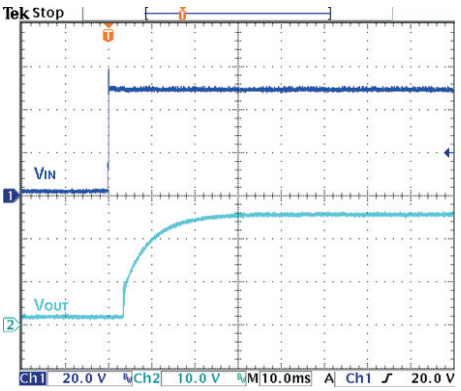
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



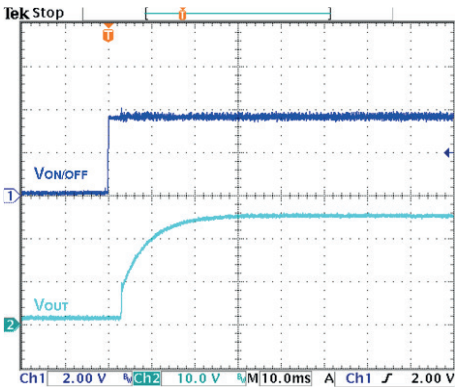
Typical output ripple and noise
Vin = Vin(nom), full load



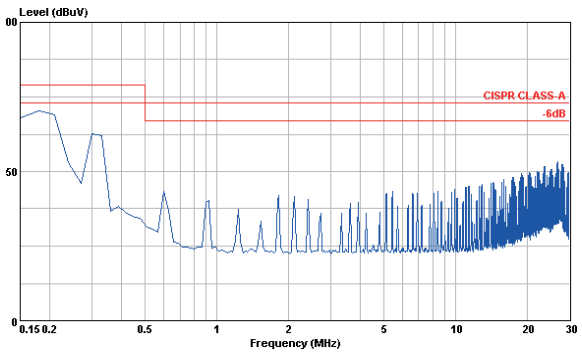
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



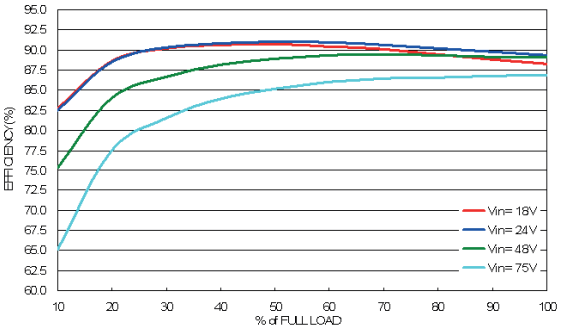
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



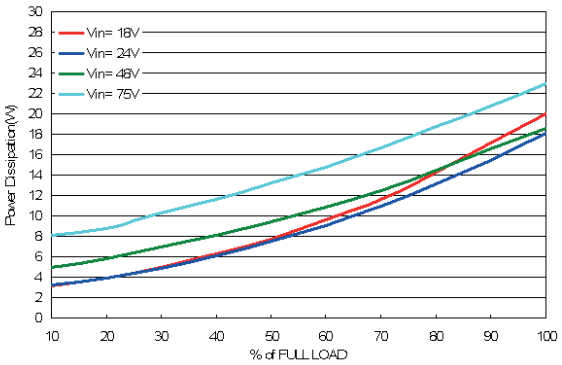
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

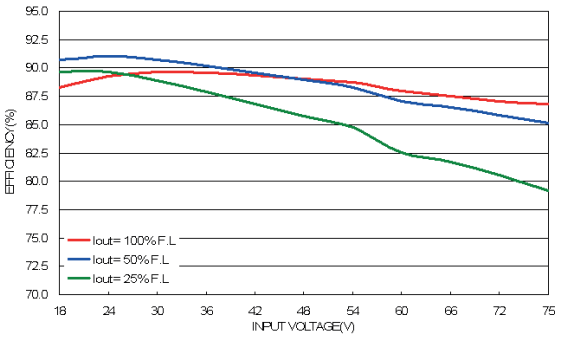
All test conditions are at 25°C.The figures are identical for PAF(D)150-48S28W



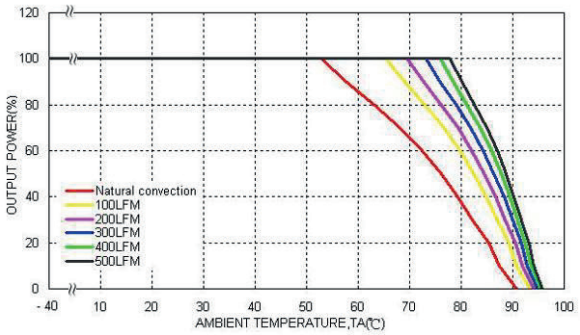
Efficiency versus output current



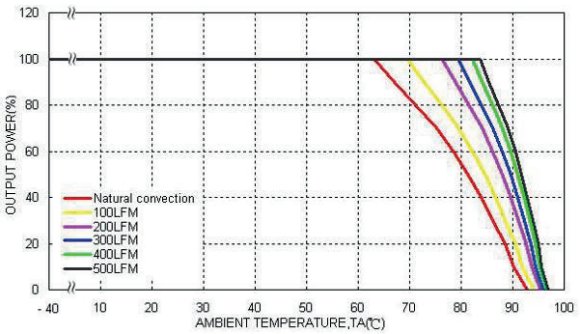
Power dissipation versus output current



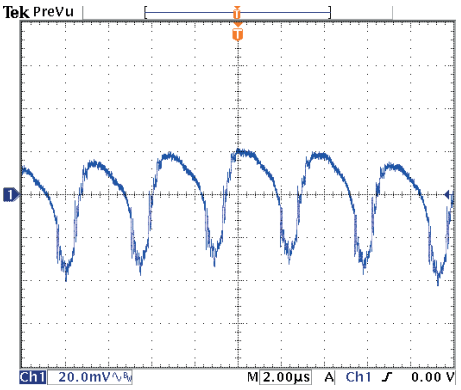
Efficiency versus input voltage, full load



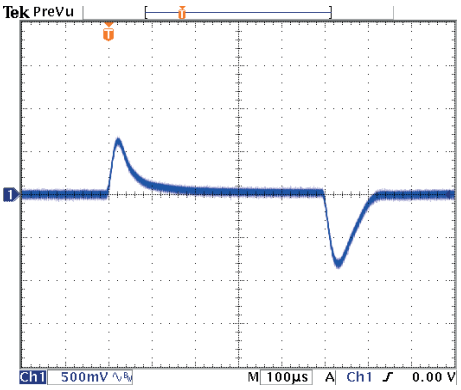
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



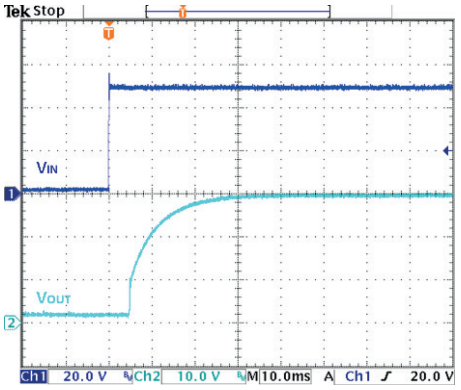
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



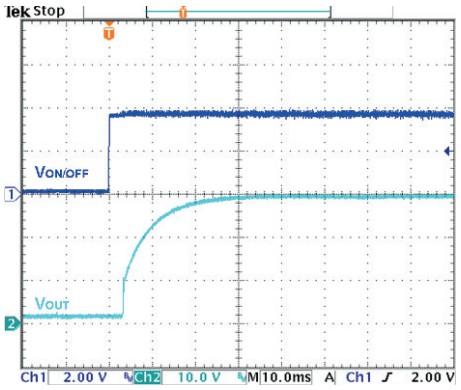
Typical output ripple and noise
Vin = Vin(nom), full load



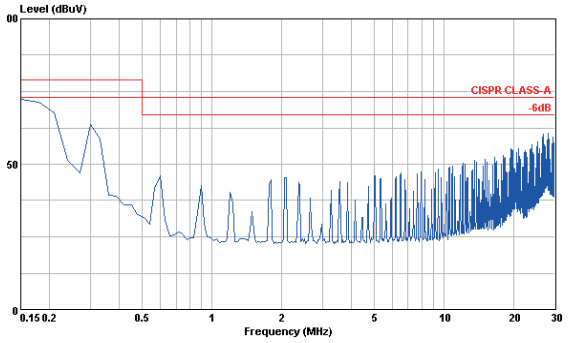
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



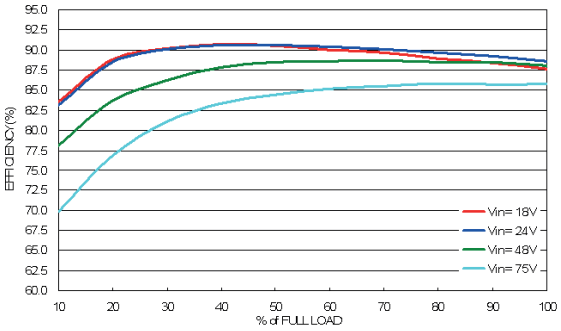
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



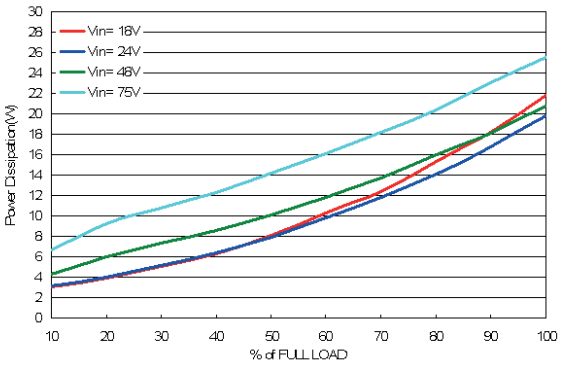
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

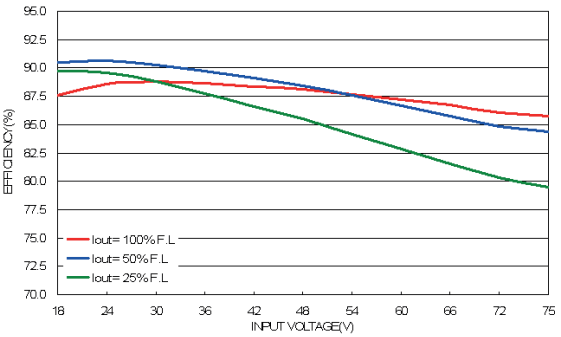
All test conditions are at 25°C.The figures are identical for PAF(D)150-48S48W



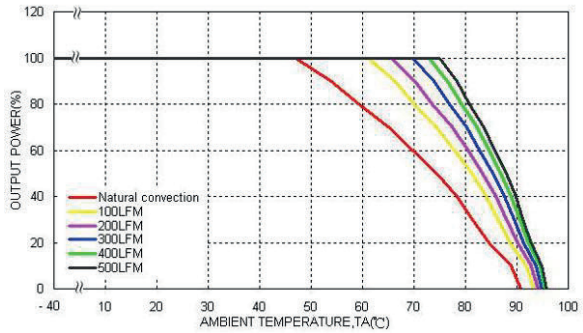
Efficiency versus output current



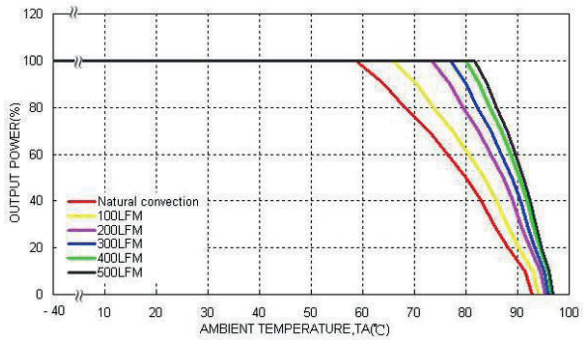
Power dissipation versus output current



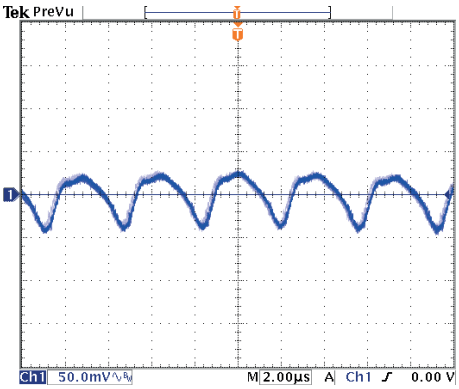
Efficiency versus input voltage, full load



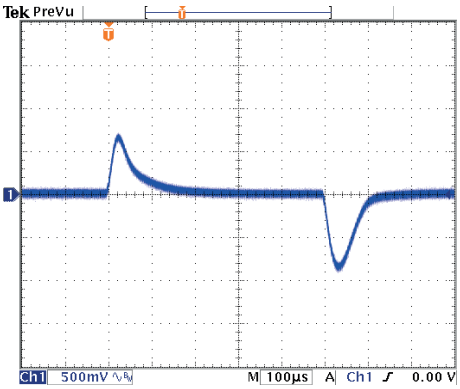
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



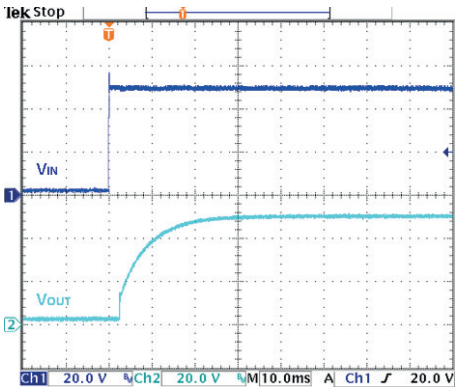
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



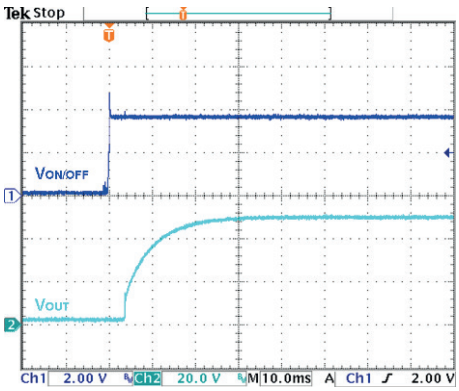
Typical output ripple and noise
Vin = Vin(nom), full load



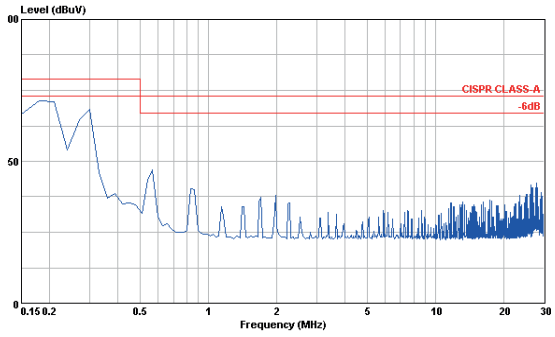
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



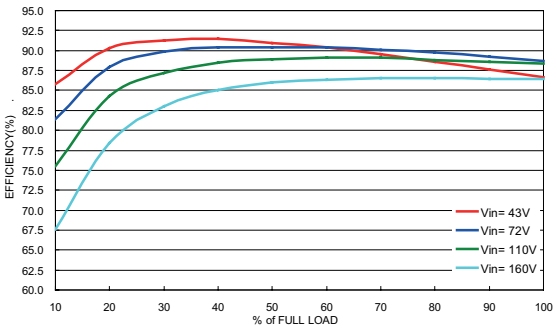
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



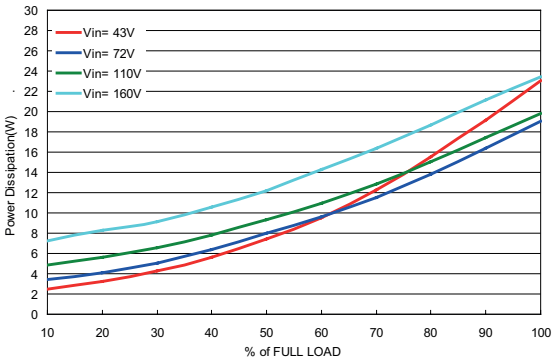
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

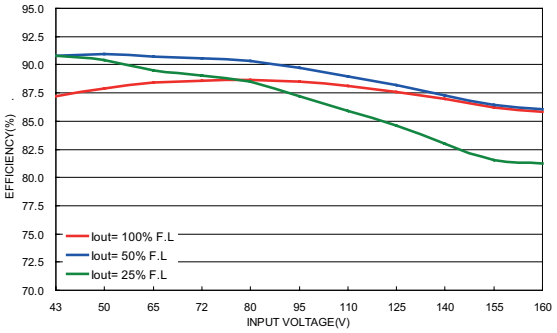
All test conditions are at 25°C.The figures are identical for PAF(D)150-110S12W



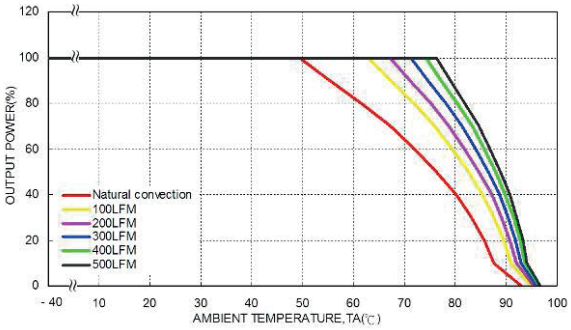
Efficiency versus output current



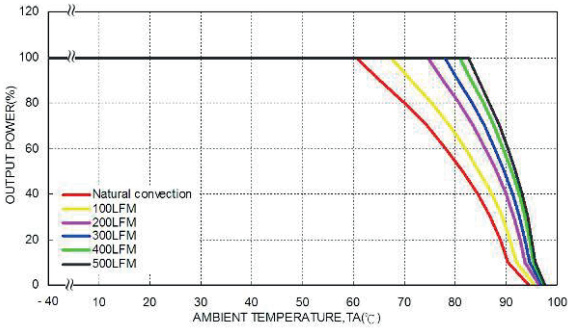
Power dissipation versus output current



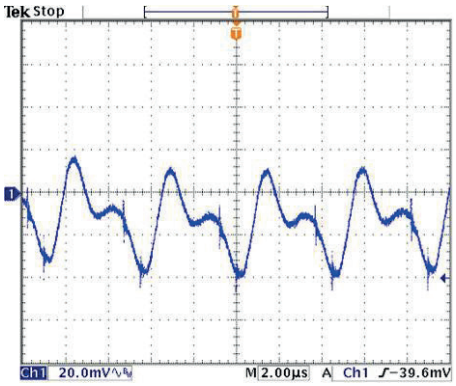
Efficiency versus input voltage, full load



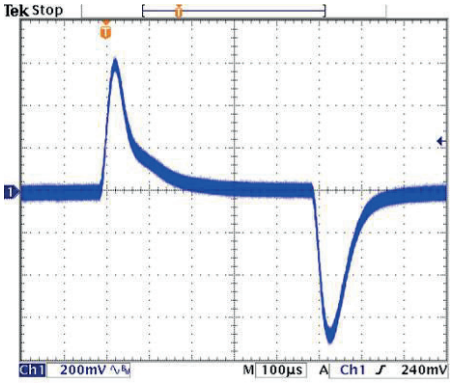
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



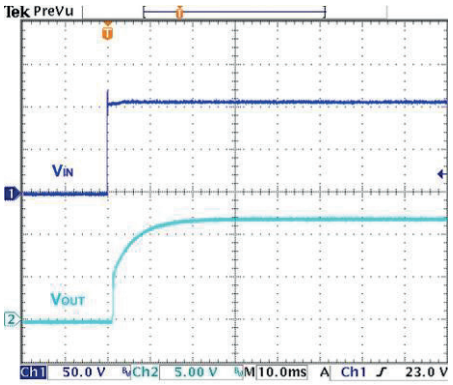
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



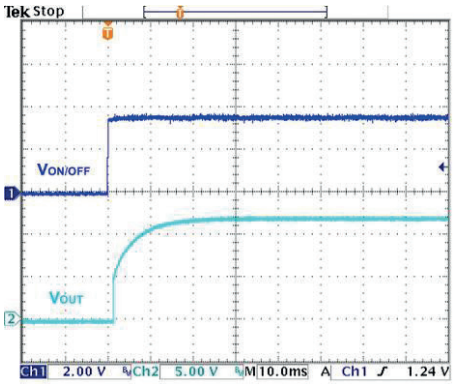
Typical output ripple and noise
Vin = Vin(nom), full load



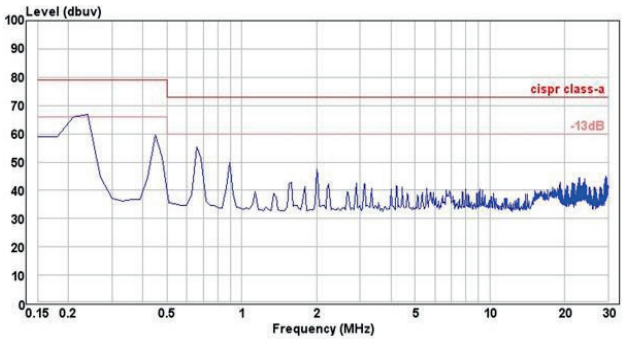
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



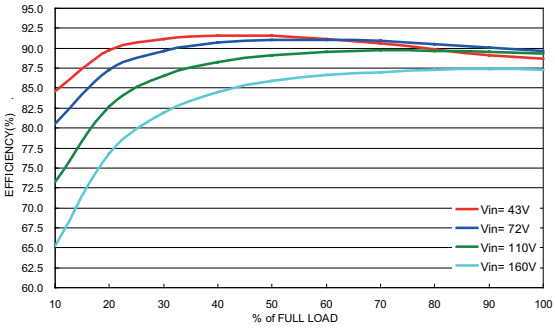
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



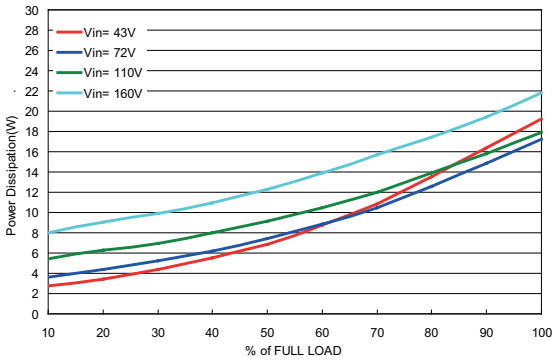
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

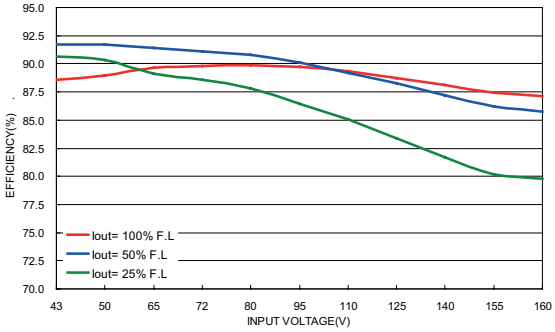
All test conditions are at 25°C.The figures are identical for PAF(D)150-110S15W



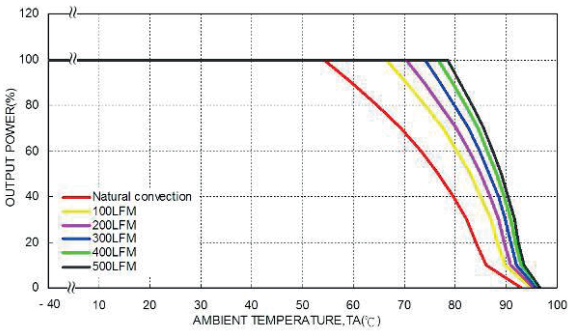
Efficiency versus output current



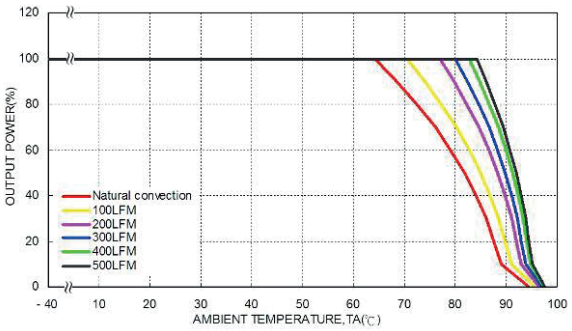
Power dissipation versus output current



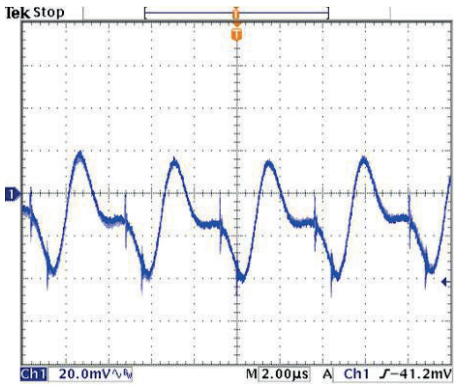
Efficiency versus input voltage, full load



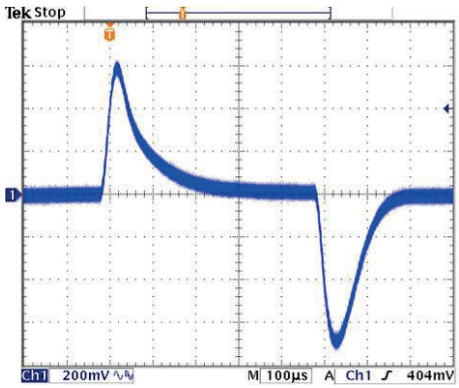
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



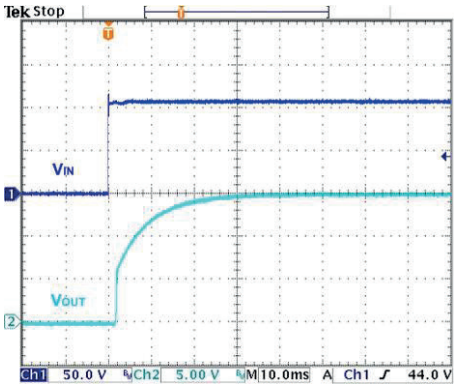
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



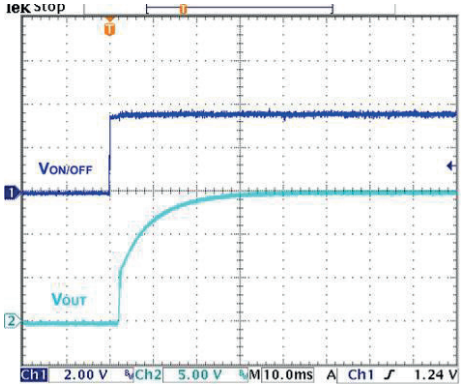
Typical output ripple and noise
Vin = Vin(nom), full load



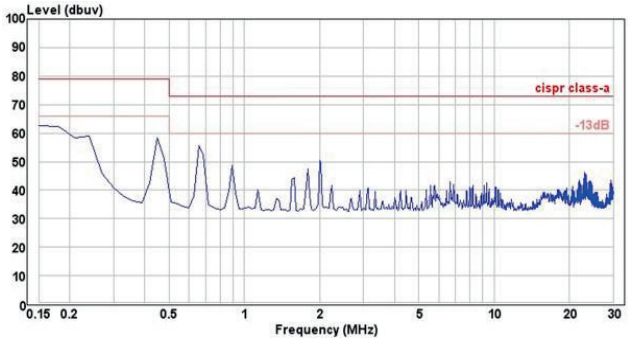
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



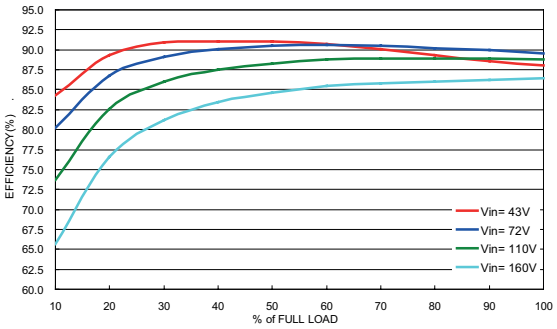
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



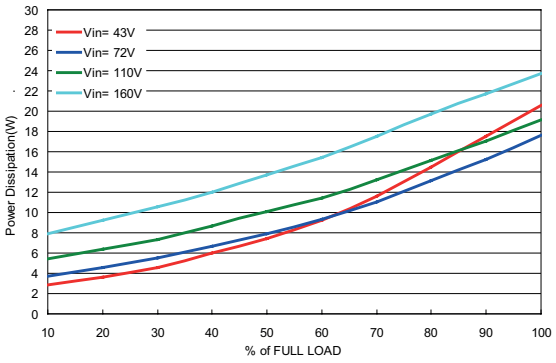
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

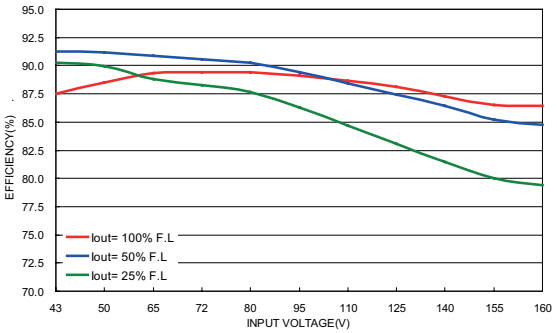
All test conditions are at 25°C.The figures are identical for PAF(D)150-110S24W



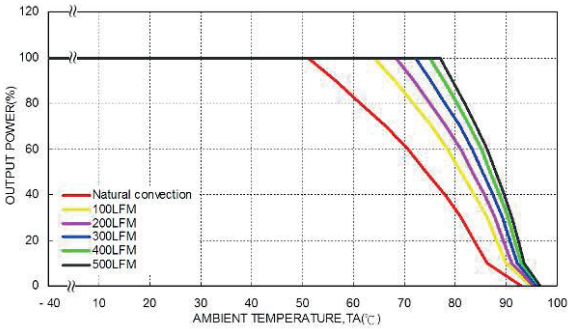
Efficiency versus output current



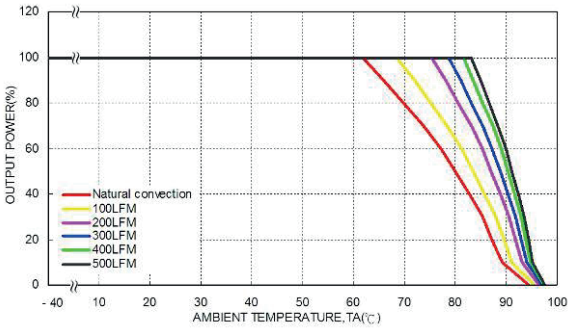
Power dissipation versus output current



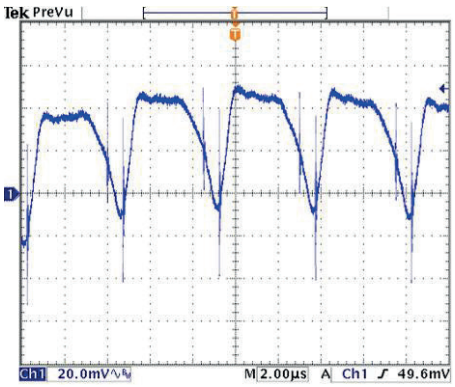
Efficiency versus input voltage, full load



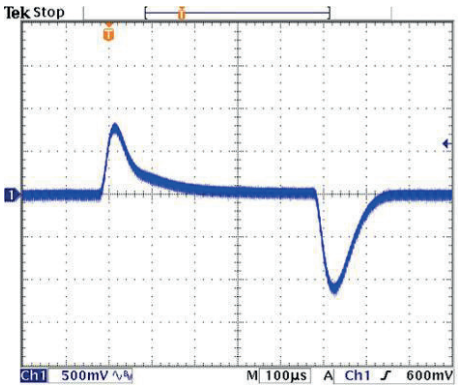
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



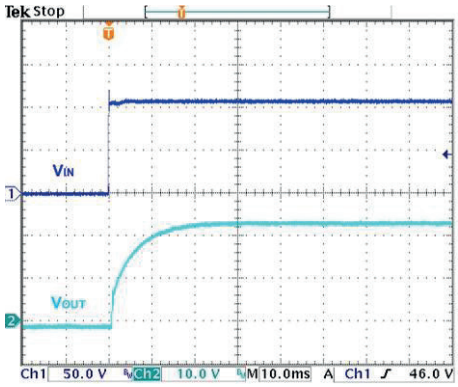
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



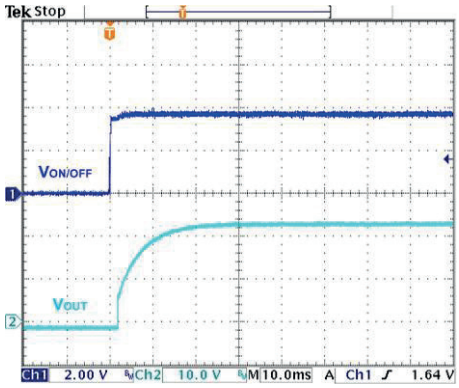
Typical output ripple and noise
Vin = Vin(nom), full load



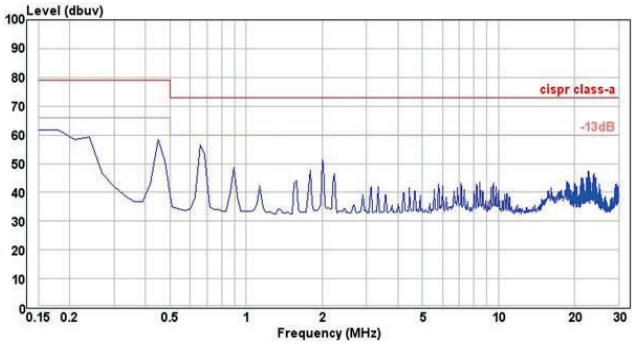
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



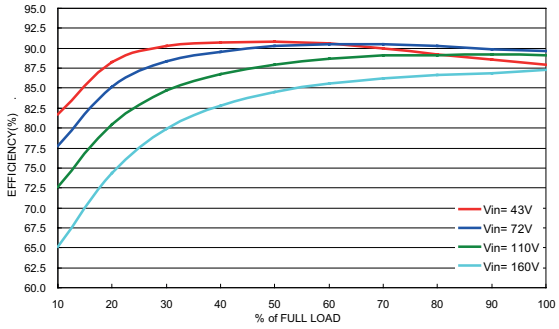
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



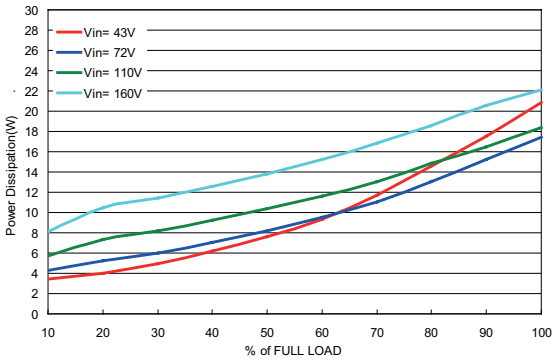
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

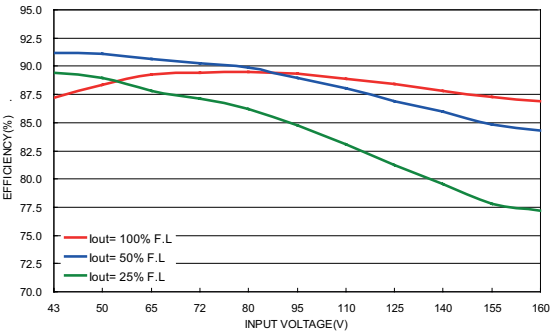
All test conditions are at 25°C.The figures are identical for PAF(D)150-110S28W



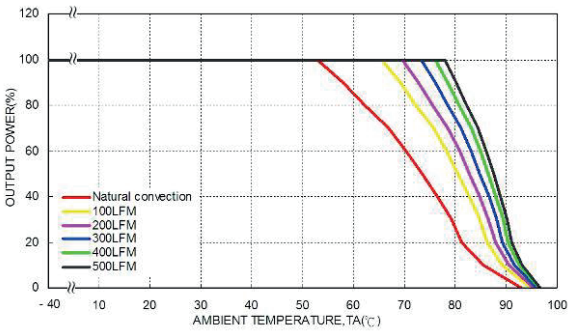
Efficiency versus output current



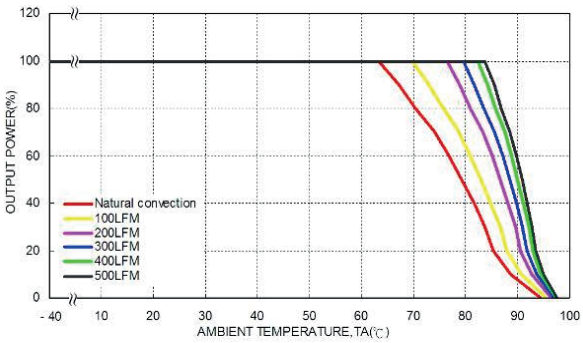
Power dissipation versus output current



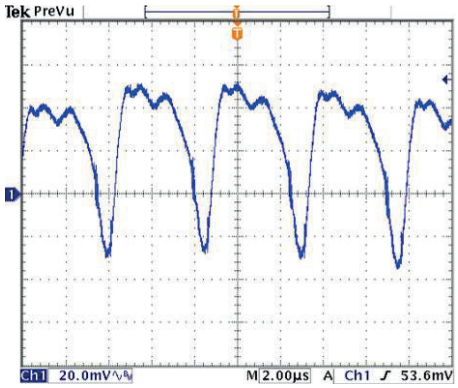
Efficiency versus input voltage, full load



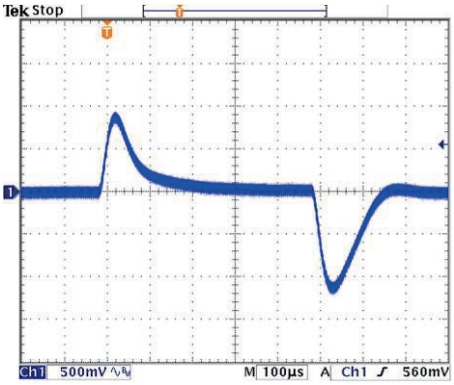
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



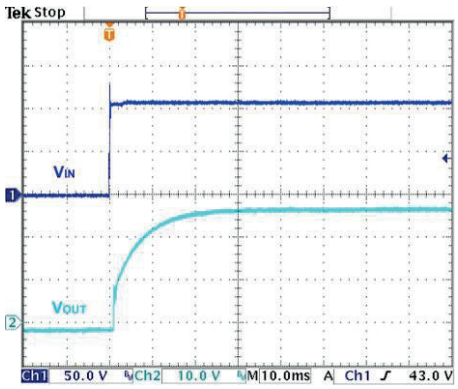
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



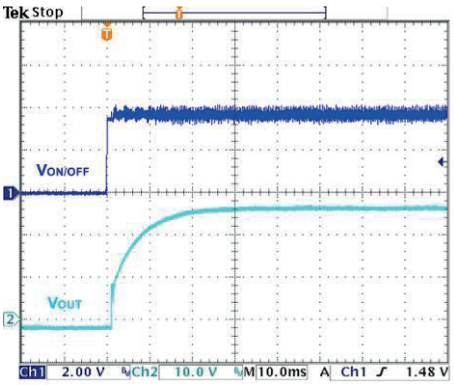
Typical output ripple and noise
Vin = Vin(nom), full load



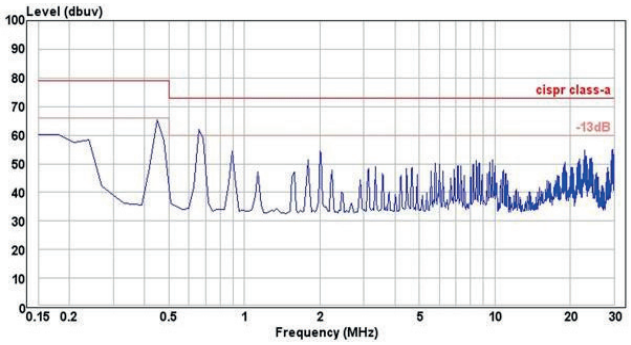
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



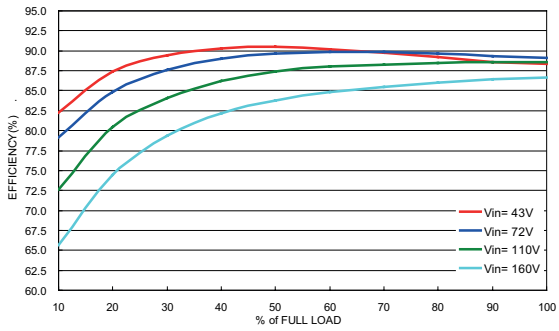
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



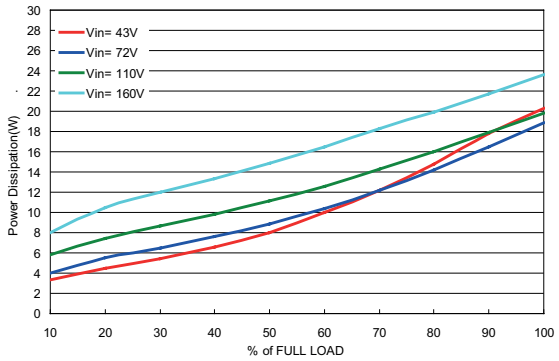
Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Characteristic Curves

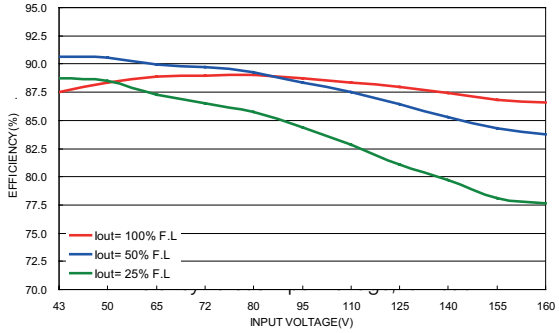
All test conditions are at 25°C.The figures are identical for PAF(D)150-110S48W



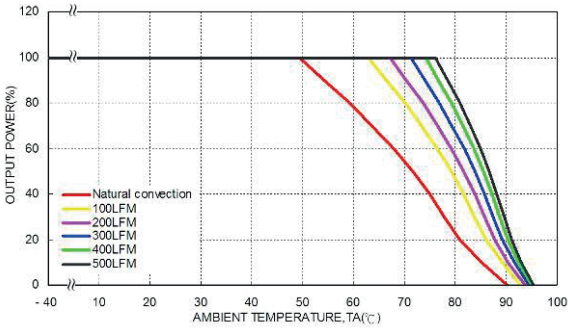
Efficiency versus output current



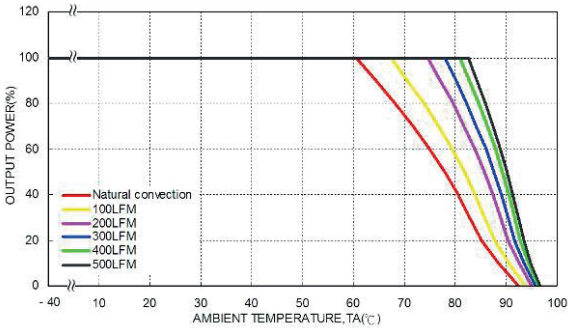
Power dissipation versus output current



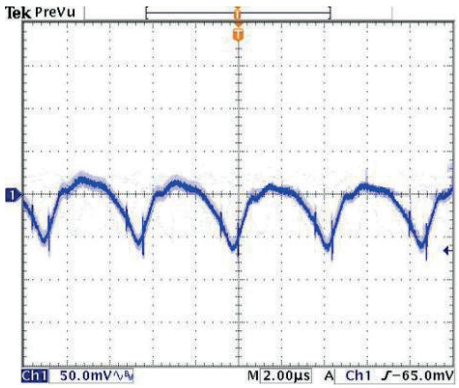
Efficiency versus input voltage, full load



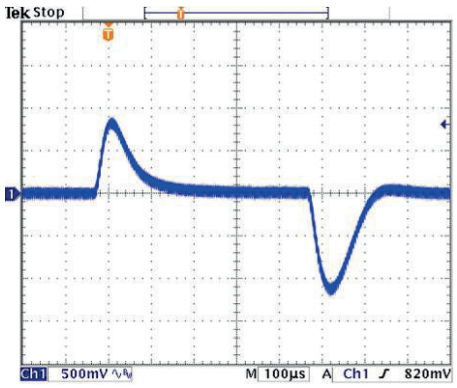
Derating output current versus ambient temperture with iron base-plate and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U.)



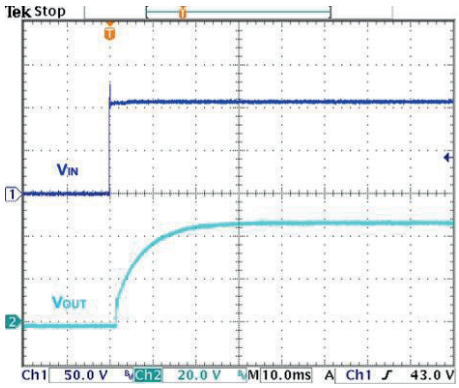
Derating output current versus ambient temperture with iron base-plate, heat-sink and airflow, Vin = Vin(nom) (The base-plate dimension is 19" * 3.5" * 0.063". The height is EIA standard 2U. Heat-snik is optional and P/N: 7G-0058A-F.)



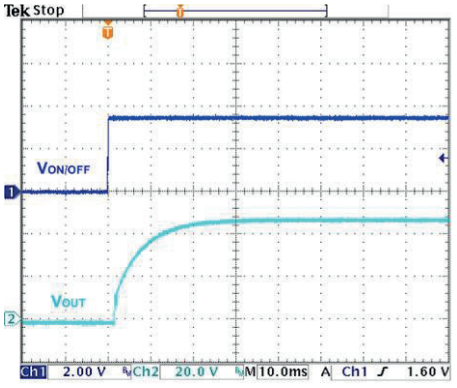
Typical output ripple and noise
Vin = Vin(nom), full load



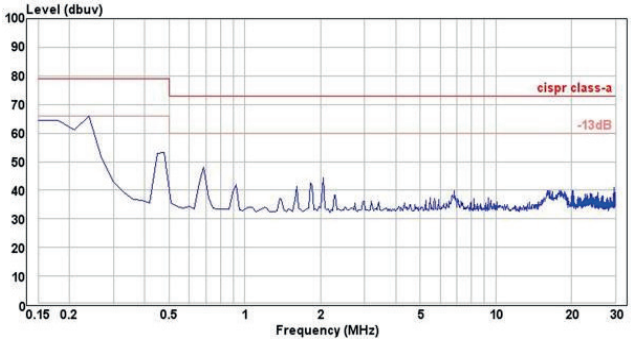
Transient response to dynamic load change from
100% to 75% to 100% of full load, Vin = Vin(nom)



Typical input start-up and output rise characteristic
Vin = Vin(nom), full load



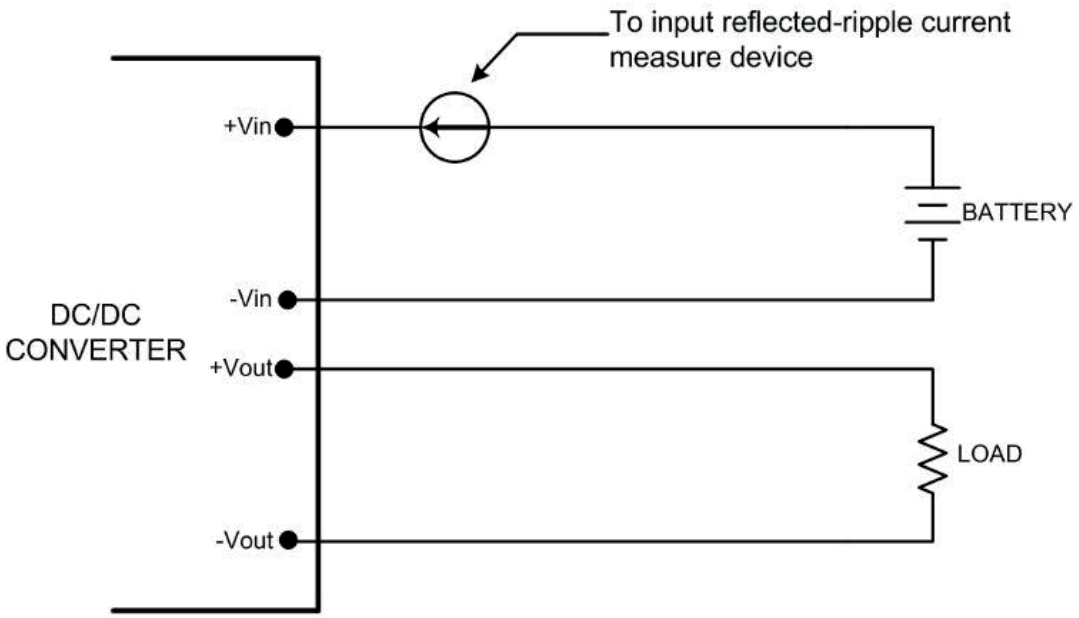
Using ON/OFF voltage start-up and Vo rise characteristic
Vin = Vin(nom), full load



Conduction emission of EN55022 Class A
Vin = Vin(nom), full load

Input Reflected Ripple Current

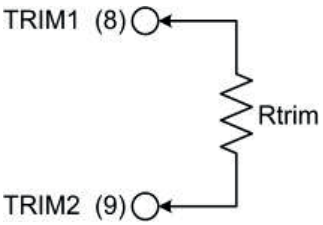
Input reflected ripple current measurement test up



Note: PAF(D)150 series test Input reflected-ripple current measurement without external filter.

Output Voltage Adjustment

The output voltage is adjustable from 0% to +20% trim up of nominal output voltage by connecting an external resistor between the TRIM1 and TRIM2 pins. With an external resistor between the TRIM1 and TRIM2 pins, the output voltage set point increases. The maximum output deviation is +20%. The value of external resistor can be obtained by trim table shown in next page. The external TRIM resistor needs to be at least 1/16W resistors



Trim Table

PAF(D)150-XXS12W

Trim up (%)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Vout (Volts)=	12.12	12.24	12.36	12.48	12.6	12.72	12.84	12.96	13.08	13.2
RU (K Ohms)=	222.64	105.09	66.35	47.06	35.51	27.83	22.34	18.23	15.03	12.48
Trim up (%)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Vout (Volts)=	13.32	13.44	13.56	13.68	13.8	13.92	14.04	14.16	14.28	14.4
RU (K Ohms)=	10.39	8.65	7.18	5.91	4.82	3.86	3.02	2.27	1.60	0.99

PAF(D)150 – XXS15W

Trim up (%)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Vout (Volts)=	15.15	15.3	15.45	15.6	15.75	15.9	16.05	16.2	16.35	16.5
RU (K Ohms)=	238.62	113.62	71.95	51.12	38.62	30.29	24.33	19.87	16.40	13.62
Trim up (%)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Vout (Volts)=	16.65	16.8	16.95	17.1	17.25	17.4	17.55	17.7	17.85	18
RU (K Ohms)=	11.35	9.45	7.85	6.48	5.29	4.25	3.33	2.51	1.78	1.12

PAF(D)150 – XXS24W

Trim up (%)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Vout (Volts)=	24.24	24.48	24.72	24.96	25.2	25.44	25.68	25.92	26.16	26.4
RU (K Ohms)=	212.47	106.69	68.79	49.30	37.43	29.44	23.70	19.37	15.99	13.28
Trim up (%)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Vout (Volts)=	26.64	26.88	27.12	27.36	27.6	27.84	28.08	28.32	28.56	28.8
RU (K Ohms)=	11.06	9.20	7.63	6.28	5.11	4.08	3.18	2.37	1.65	1.00

PAF(D)150 – XXS28W

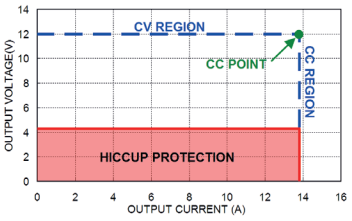
Trim up (%)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Vout (Volts)=	28.28	28.56	28.84	29.12	29.4	29.68	29.96	30.24	30.52	30.8
RU (K Ohms)=	255.65	121.72	77.08	54.76	41.36	32.44	26.06	21.28	17.56	14.58
Trim up (%)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Vout (Volts)=	31.08	31.36	31.64	31.92	32.2	32.48	32.76	33.04	33.32	33.6
RU (K Ohms)=	12.14	10.11	8.40	6.93	5.65	4.53	3.55	2.67	1.89	1.19

PAF(D)150 – XXS48W

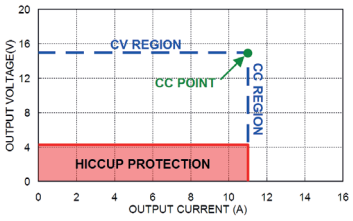
Trim up (%)	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Vout (Volts)=	48.48	48.96	49.44	49.92	50.4	50.88	51.36	51.84	52.32	52.8
RU (K Ohms)=	268.86	127.44	80.57	57.19	43.17	33.84	27.17	22.18	18.29	15.18
Trim up (%)	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Vout (Volts)=	53.28	53.76	54.24	54.72	55.2	55.68	56.16	56.64	57.12	57.6
RU (K Ohms)=	12.64	10.52	8.73	7.20	5.87	4.70	3.67	2.76	1.94	1.21

Output Over Current Protection

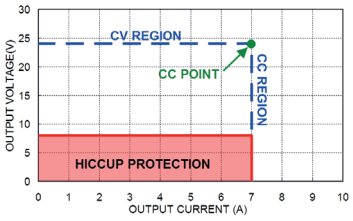
PAF(D)150 series employ a fixed current limit to prevent damage to components within the converters, and will also protect the load provided that the current limiting crossover point is set at a current value that the load can handle without damage. Normally, the current limit is maintained at approximately 105~120 percent of rated current for PAF(D)150 series. If the output load current is over rating, the output current will keep in a constant value. And the output voltage will fall. All of the PAF(D)150 series's current limiting supplies are self restoring, that is, when the overload is removed or corrected, the output voltage is automatically restored to the previously set value. Otherwise, if the output resistance is become short, it will operate in hiccup protection. The details are shown below.



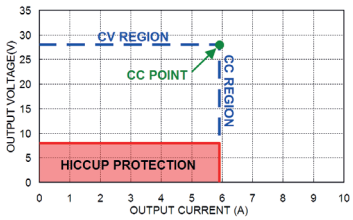
PAF(D)150-XXS12W
Vout & Iout cure



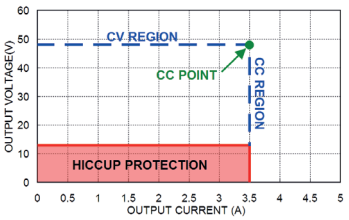
PAF(D)150-XXS15W
Vout & Iout cure



PAF(D)150-XXS24W
Vout & Iout cure



PAF(D)150-XXS28W
Vout & Iout cure



PAF(D)150-XXS48W
Vout & Iout cure

Notes:
CV Region: In normal operation. The output current in spec.
Condition: Resistance Load > Vout / Iout (CC Point)
CC Region: If the output load current is over rating, the output current will keep in a constant value. And the output voltage will fall.
Condition: Resistance Load < Vout / Iout (CC Point)
Hiccup Protection: If the output resistance is become short. It will operate in hiccup protection.
Condition: V out < 4.3V (typ.) to Output Short. (PAF(D)150-XXS12W, PAF(D)150-XXS15W)
Vout < 8.0V(typ.) to Output Short. (PAF(D)150-XXS24W, PAF(D)150-XXS28W)
Vout < 13V(typ.) to Output Short. (PAF(D)150-XXS48W)

Short Circuit Protection

Continuous, hiccup and auto-recovery mode. During short circuit, converter still shut down. The average current during this condition will be very low and the device can be safety in this condition.

Output Over Voltage Protection

The output over-voltage protection consists of circuitry that monitors the voltage on the output terminals. If the voltage on the output terminals exceeds the over-voltage protection threshold, then the module enter the non-latch hiccup mode.

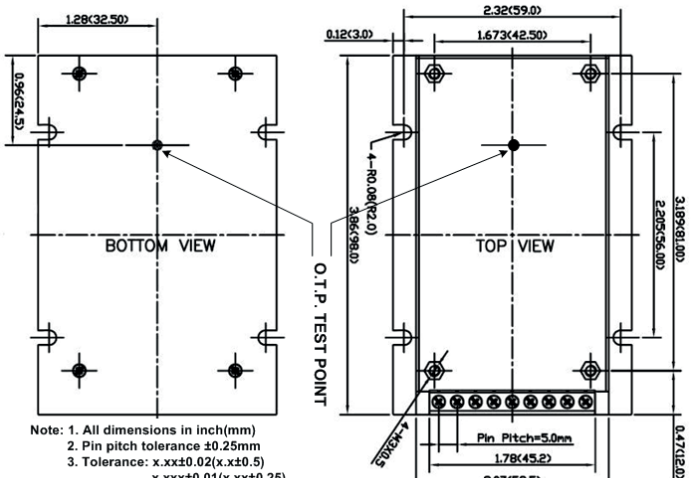
Over Temperature Protection

Sufficient cooling is needed for the power module and provides more reliable operation of the unit. If a fault condition occurs, the temperature of the unit will be higher. And it will damage the unit. For protecting the power module, the unit includes over-temperature protection circuit. When the temperature of the case is to the protection threshold, the unit enters “Shunt Down” mode. And it will auto restart when the temperature is down.

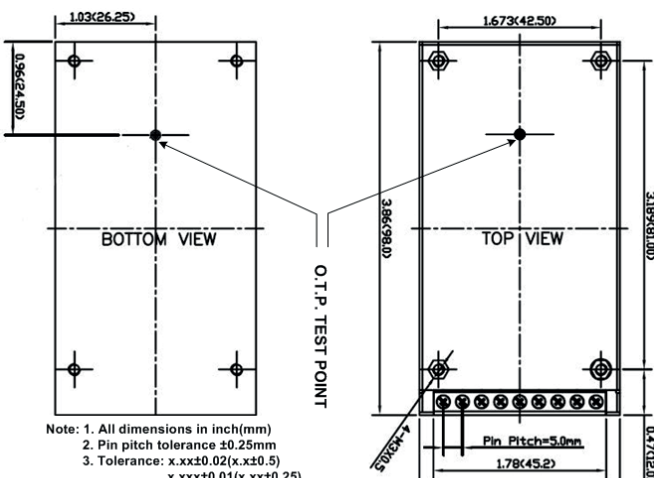
Thermal Considerations

The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the point as the figure below. The temperature at this location should not exceed 110°C. When Operating, adequate cooling must be provided to maintain the test point temperature at or below 100°C. Although the maximum point temperature of the power modules is 100°C, you can limit this temperature to a lower value for extremely high reliability. The O.T.P test point are shown as follows, you can choose top or bottom side to measure temperature in PAF(D)150 series.

PAF150 Series



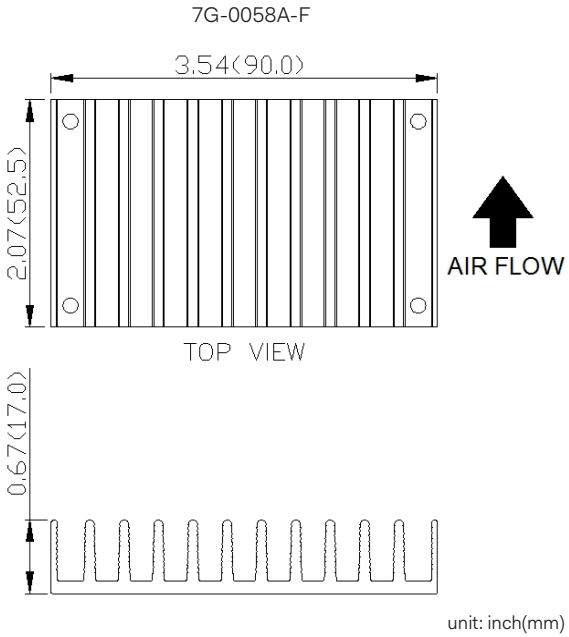
PAD150 Series



Heat-sink

Equip heat-sink for lower temperature and higher reliability of the module. Considering space and airflow is the way to choose which heat-sink is needed. Heat-sink is optional and part number as the table below.

Heat-sink	P/N	
Horizontal	H=0.670" (17.0mm)	7G-0058A-F

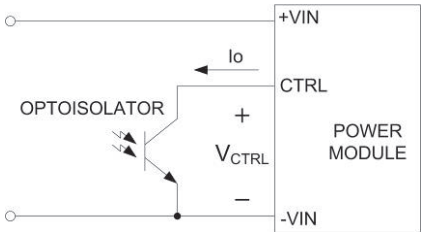


unit: inch(mm)

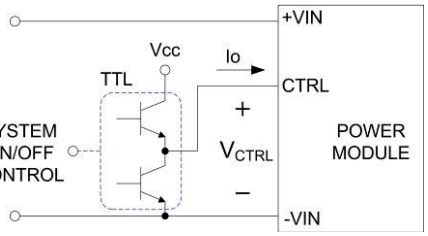
Remote ON/OFF Control

The CTRL pin is controlled DC/DC power module to turn on and off, the user must use a switch to control the logic voltage high or low level of the pin referenced to -VIN. The switch can be open collector transistor, FET and Photo-Couple. The switch must be capable of sinking up to 1 mA at low-level logic voltage. High-level logic of the CTRL pin signal maximum voltage is allowable leakage current of the switch at 12V is 0.5 mA.

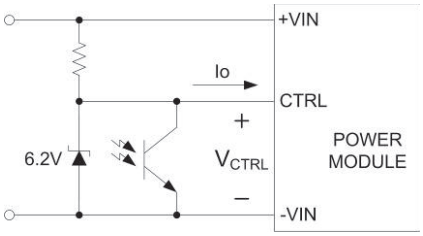
Remote ON/OFF Implementation Circuits



Isolated-closure remote ON/OFF



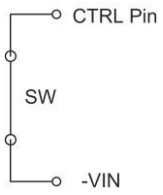
Level control using TTL output



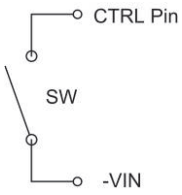
Level control using line voltage

There are two remote control options available, positive logic and negative logic.

a. The Positive logic structure turned on of the DC/DC module when the CTRL pin is at high-level logic and low-level logic is turned off it.

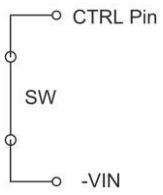


When PAF(D)150 module is turned off at Low-level logic

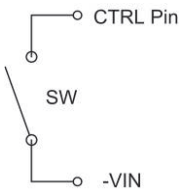


When PAF(D)150 module is turned on at High-level logic

b. The Negative logic structure turned on of the DC/DC module when the CTRL pin is at low-level logic and turned off when at high-level logic.



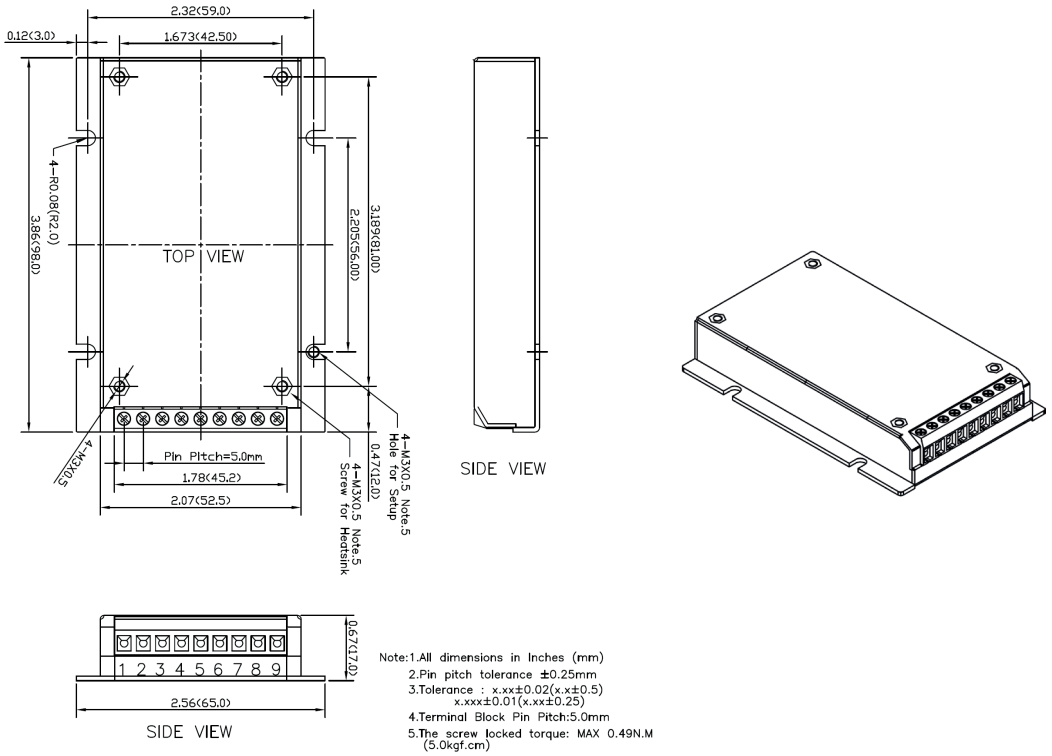
When PAF(D)150 module is turned on at Low-level logic



When PAF(D)150 module is turned off at High-level logic

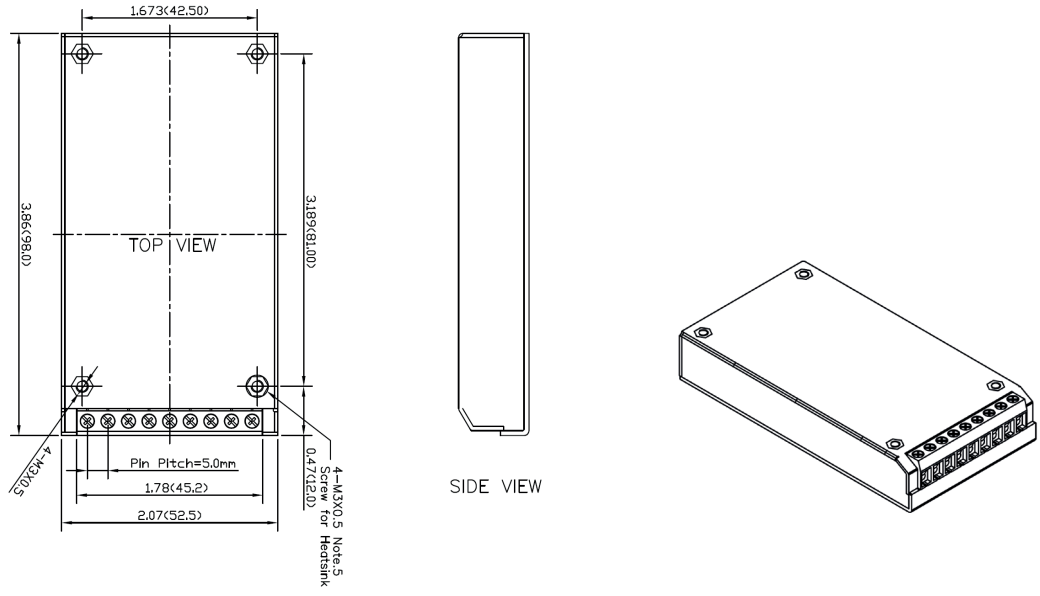
Mechanical Data

PAF150 dimensions



Note:1.All dimensions in Inches (mm)
2.Pin pitch tolerance ±0.25mm
3.Tolerance : x.xx±0.02(x.x±0.5)
x.xxx±0.01(x.xx±0.25)
4.Terminal Block Pin Pitch:5.0mm
5.The screw locked torque: MAX 0.49N.M
(5.0kgf.cm)

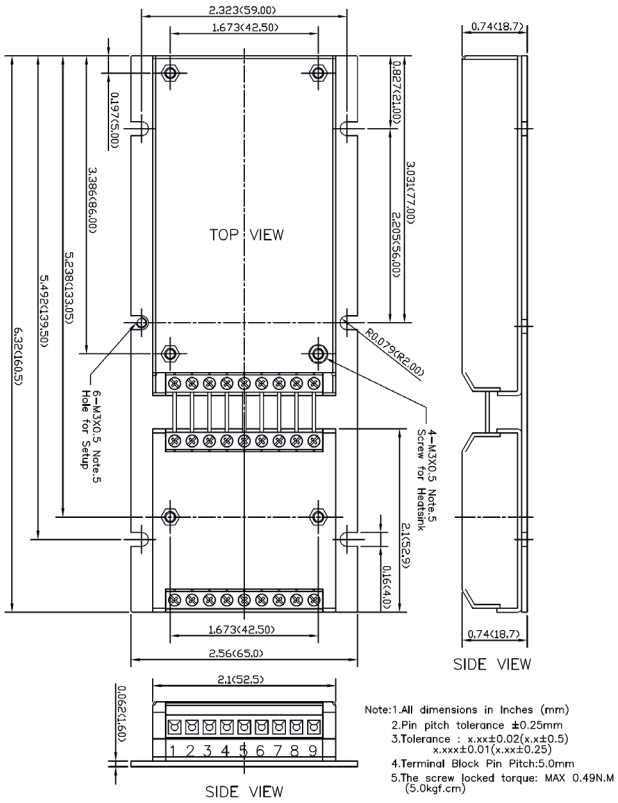
PAD150 dimensions

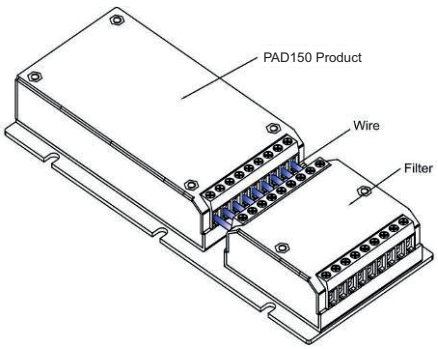


Note:1.All dimensions in Inches (mm)
2.Pin pitch tolerance ±0.25mm
3.Tolerance : x.xx±0.02(x.x±0.5)
x.xxx±0.01(x.xx±0.25)
4.Terminal Block Pin Pitch:5.0mm
5.The screw locked torque: MAX 0.49N.M
(5.0kgf.cm)

Mechanical Data (continued)

PAD150 with EN55022 class B filter module dimensions





Pin Connection

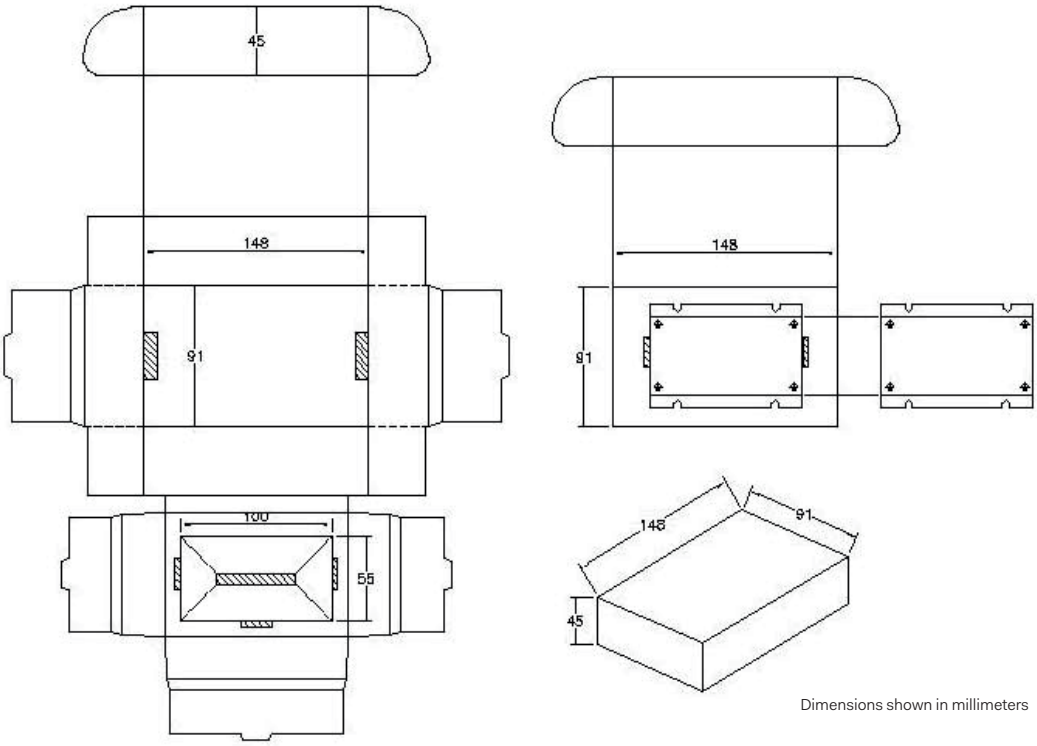
PIN	Define	Wire Range	Recommend Screwing Torque
1	+VIN	14 AWG to 16 AWG	0.25N-M(2.5kgf-cm)
2	+VIN	14 AWG to 16 AWG	0.25N-M(2.5kgf-cm)
3	-VIN	14 AWG to 16 AWG	0.25N-M(2.5kgf-cm)
4	-VIN	14 AWG to 16 AWG	0.25N-M(2.5kgf-cm)
5	CTRL	14 AWG to 24 AWG	0.25N-M(2.5kgf-cm)
6	+VOUT	14 AWG to 16 AWG	0.25N-M(2.5kgf-cm)
7	-VOUT	14 AWG to 16 AWG	0.25N-M(2.5kgf-cm)
8	TRIM1	14 AWG to 24 AWG	0.25N-M(2.5kgf-cm)
9	TRIM2	14 AWG to 24 AWG	0.25N-M(2.5kgf-cm)

Product Options Table

Option	Suffix
Positive remote ON/OFF logic	-
Negative remote ON/OFF logic	-N
With 7G-0058A-F Heat-sink	-HC
With meet EN55022 class B Filter Module*	-F

* This EMI filter is used for PAD150-24SXXW and PAD150-48SXXW only, not for the other item.
Example:
PAF150-48S12W
PAD150-48S28W
PAF150-24S24W-N
PAF150-48S24W-HC
PAD150-24S24W-F

Packaging Information



Dimensions shown in millimeters

Part Number Structure

PAF(D)	150	-	24	S	12	W	-	N	F	HC
Series Name	Max Output Voltage		Input Voltage	Single Output	Output Voltage	Wide Input Voltage Range		Product Option	Product Option	Product Option
	150W		24: 9-36VDC		12: 12VDC	4:1		Suffix -: Positive logic remot	Suffix -F:	Suffix -HC:
			48: 16.5-75VDC		15: 15VDC			ON/OFF logic	Meet EN55022	Heat-sink 0.670"
			110: 43-160VDC		24: 24VDC			Suffix -N: Negative logic remote	Class B filter	Horizontal
					28: 28VDC			ON/OFF logic	module	7G-0058A-F
					48: 40VDC					

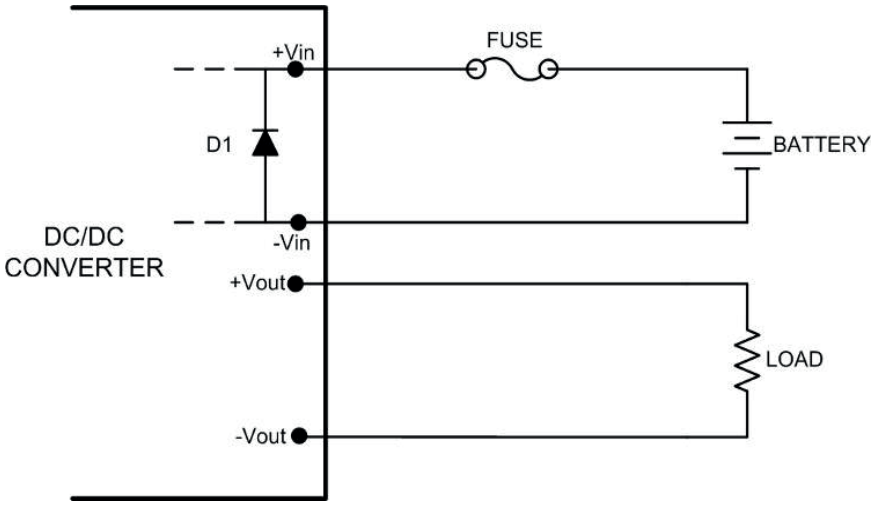
Note:
The EN55022 Class B filter module (suffix –F) is used for PAD150-24SXXW and PAD150-48SXXW only, not for the other item. (Ex: PAD150-24S24W-F).

Model Number	Input Range	Output Voltage	Output Current Max Load	No Load(1) Input Current	Eff (2) (%)
PAF(D)150-24S12W	9 – 36 VDC	12VDC	12.5 A	70mA	86
PAF(D)150-24S15W	9 – 36 VDC	15VDC	10.0 A	80mA	86
PAF(D)150-24S24W	9 – 36 VDC	24VDC	6.3 A	95mA	87
PAF(D)150-24S28W	9 – 36 VDC	28VDC	5.4 A	120mA	87
PAF(D)150-24S48W	9 – 36 VDC	48VDC	3.2 A	130mA	86
PAF(D)150-48S12W	18 – 75 VDC	12VDC	12.5 A	50mA	88
PAF(D)150-48S15W	18 – 75 VDC	15VDC	10.0 A	60mA	89
PAF(D)150-48S24W	18 – 75 VDC	24VDC	6.3 A	60mA	89
PAF(D)150-48S28W	18 – 75 VDC	28VDC	5.4 A	70mA	89
PAF(D)150-48S48W	18 – 75 VDC	48VDC	3.2 A	70mA	88
PAF(D)150-110S12W	43– 160 VDC	12VDC	12.5 A	25mA	88
PAF(D)150-110S15W	43– 160 VDC	15VDC	10.0 A	25mA	89
PAF(D)150-110S24W	43– 160 VDC	24VDC	6.3 A	25mA	89
PAF(D)150-110S28W	43– 160 VDC	28VDC	5.4 A	25mA	89
PAF(D)150-110S48W	43– 160 VDC	48VDC	3.2 A	35mA	88

Note 1.
Typical value at nominal input and no load.
Note 2.
Typical value at nominal input and full load.

Safety and Installation Instruction

The PAF(D)150 Series has built in the protection function of the polarity reverse as the following figure.



Fusing Consideration

Caution: This power module is not internally fused. An input line fuse must always be used.
This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture. To maximum flexibility, internal fusing is not included, however, to achieve maximum safety and system protection, always use an input line fuse. The safety agencies require a slow-blow fuse with maximum rating of 30A for PAF(D)150–24SXXW, 15A for PAF(D)150–48SXXW and 7A for PAF(D)150–110SXXW. Based on the information provided in this datasheet on Inrush energy and maximum dc input current, the same type of fuse with lower rating can be used. Refer to the fuse manufacturer's data for further information.

MTBF and Reliability

The MTBF of PAF(D)150 Series of DC/DC converters has been calculated using MIL-HDBK 217F @Tc=70°C, full load. The resulting figure for MTBF is 4.954×105 hours.