

### Typical Features

- ◆ Wide input voltage range (4:1)
- ◆ Efficiency 86% (Typ.)
- ◆ Stand-by Power Consumption 0.12W (Typ.)
- ◆ Reinforced insulation, Dielectric 6000VDC from Input to output
- ◆ Compliant with medical standard EN60601-1, 2MOPP Isolation
- ◆ Leakage current <5uA @240VAC/60Hz
- ◆ Creepage distance 8mm, clearance distance 5mm
- ◆ Operating Temperature from -40°C to +85°C
- ◆ Input under-voltage protection, output over-voltage, short circuit, over current protections
- ◆ International standard pin-out



### Application Field

**PFD6-XXSXXE2N6 series** ---- Modular DC-DC converters with output power 6W, wide input voltage range of 4:1, high isolation voltage 6000VDC, output over-voltage & short circuit protections and compliance with medical standard EN60601-1. This series of products can be widely used in the fields of medical, electric power and energy storage, etc.

### Typical Product List

Certificate	Part No.	Input Voltage Range (VDC)		Output Voltage/Current (Vo/Io)		Input Current (mA) Typ. Rated Voltage		Max. Capacitive Load	Ripple & Noise		Efficiency (%) @full load	
		Rated	Range	Vo (VDC)	Io(mA) Max/Min	Full load	No load		uF	mVp-p		Min
								Typ		Max		
-	PFD6-18S05E2N6	24	9-36	5	1200/0	308	5	3000	100	150	79	81
-	*PFD6-18S06E2N6			6	1000/0	305	5	2500	100	150	80	82
-	*PFD6-18S09E2N6			9	667/0	298	5	2000	100	150	82	84
-	PFD6-18S12E2N6			12	500/0	294	5	1500	100	150	83	85
-	*PFD6-18S15E2N6			15	400/0	291	5	1200	100	150	84	86
-	*PFD6-18S18E2N6			18	333/0	291	5	1200	100	150	84	86
-	PFD6-18S24E2N6			24	250/0	294	5	680	100	150	83	85
-	PFD6-36S05E2N6	48	18-75	5	1200/0	152	4	3000	100	150	80	82
-	*PFD6-36S09E2N6			9	667/0	149	4	2000	100	150	82	84
-	PFD6-36S12E2N6			12	500/0	147	4	1500	100	150	83	85
-	*PFD6-36S15E2N6			15	400/0	145	4	1200	100	150	84	86
-	PFD6-36S24E2N6			24	250/0	147	4	680	100	150	83	85

Note 1 - \* marked part has been developed in process

Note 2 - The typical value of efficiency is based on the product tested after half an hour burn-in at full load.

Note 3 - The maximum capacitive load is the capacitance allowed to be used when the power supply operates at full load. The converter may not start if the capacitor exceeds this value.

Note 4 - The control chip could work at lower frequency at no load or low load to decrease the no load power and improve the efficiency.

Note 5 - Please contact Aipu sales for other output voltages requirement in this series but not listed in this table.

## Input Specifications

Item	Operating conditions	Min	Typ.	Max	Unit
Standby power consumption	Rated input voltage, no load	/	0.12	/	W
Input inrush voltage (1sec.max)	24V Input	-0.7	/	50	VDC
	48V Input	-0.7	/	100	
Start-up voltage	24V Input	9	/	/	
	48V Input	18	/	/	
Input under-voltage protection	24V Input	5.5	6.5	/	
	48V Input	12	15.5	/	
Hot-plug	/	Unavailable			
Input filter	/	π filter			
Reflected ripple current	Refer to the recommended test circuit at rated input voltage	20mA (Typ.)			

## Output Specifications

Item	Operating conditions	Min	Typ.	Max	Unit
Output Voltage Accuracy	Full input voltage range, 0% to 100% load	/	±1	±3	%
Voltage Regulation	Full input voltage range, full load	/	±0.2	±0.5	
Load Regulation	5% ~ 100% load	/	±0.5	±1	
Ripple & Noise	5% ~ 100% load, 20MHz bandwidth	/	100	150	mVp-p
Dynamic Response Deviation	25% step change of rated load	/	±3	±5	%
Dynamic Response Time	25% rated load step, full input voltage range	/	300	500	μs
Temperature Drift Coefficient	Full load	/	/	±0.03	%/°C
Turn-on Delay Time	Rated input voltage and constant resistance load	/	10	/	mS
Over-voltage Protection	Full voltage range	110	/	160	%Vo
Over-current Protection		110	150	260	%Io
Output Overshoot		/	/	10	%Vo
Short Circuit Protection		Continuous, Self-recovery			

Note – the ripple & noise ≤5%Vo at 0% - 5% load, it is tested by the twisted pair test method, refer to the following test instruction.

## General Specifications

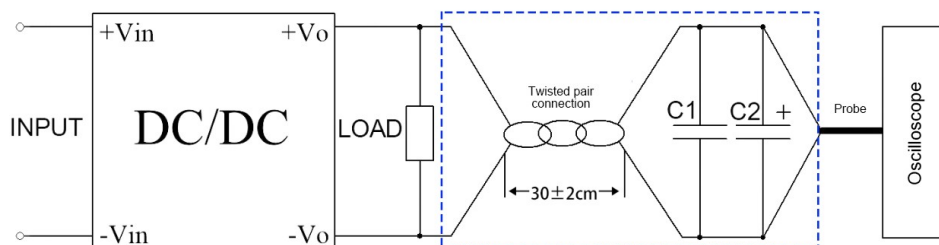
Item	Operating conditions	Min	Typ.	Max	Unit
Switching Frequency	Operating Mode (PWM)	/	300	/	KHz
Operating Temperature	Refer to the Temperature Derating Curve	-40	/	+85	°C
Storage Temperature	/	-55	/	+125	
Pin Soldering Temperature	1.5mm from the case, 10 seconds	/	/	300	
Relative Humidity	No condensing	5	/	95	%RH
Isolation Voltage	Input to output, test 1min, leakage current <1mA	6000	/	/	VDC

Insulation Resistance	Input to output, @500VDC	10000	/	/	MΩ
Isolation Capacitance	Input to output, 100KHz/0.1V	/	13	20	pF
Leakage Current	Input 240VAC/60Hz	/	3.6	5	uA
Application	/	CF Type			
Reinforced insulation	Creepage distance of transformer	8	/	/	mm
	Clearance distance of transformer	5	/	/	
	Clearance & creepage distances of PCB	8	/	/	
	Optocoupler clearance distance	8	/	/	
Safety standards	/	EN60601-1: 2006+A1: 2013			
Insulation protection level	240VAC/60Hz	2 MOPP			
MTBF	MIL-HDBK-217F@25°C	1000	/	/	K hours
Vibration	/	10-55Hz, 2G, 30 Min. along X, Y, Z			
Cooling Method	Nature air				
Case Material	Plastic in black, flame class UL94 V-0				
Weight/Dimensions	Part No.	Weight (Typ.)	Dimensions L x W x H		
	PFD6-XXSXXE2N6	12g	31.6x20.30x10.2 mm	1.244x0.799x0.402 inch	

**EMC Performance**

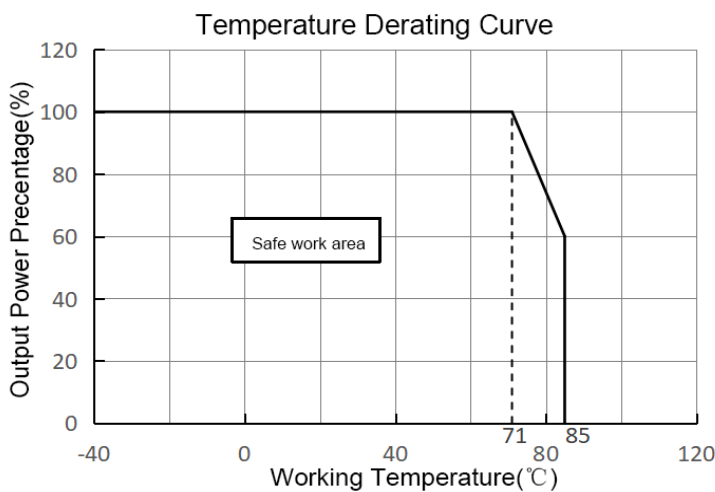
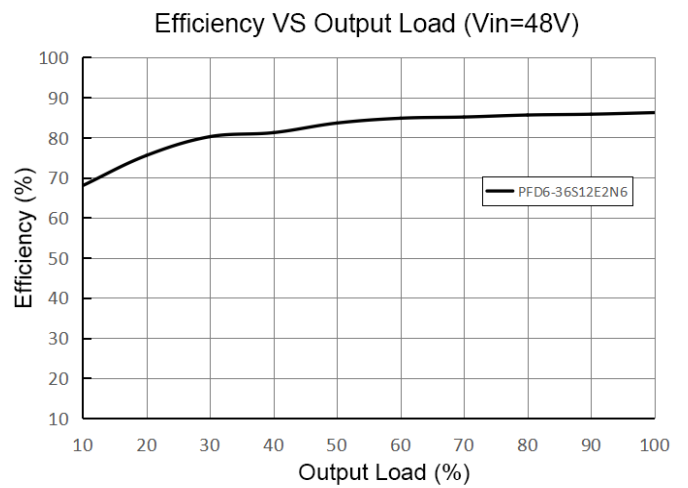
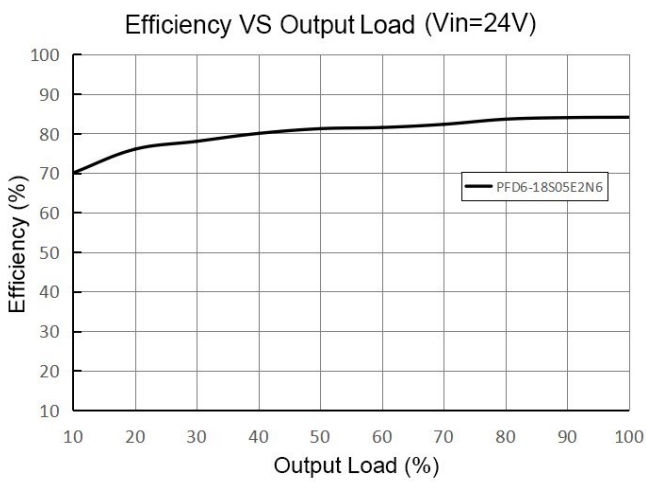
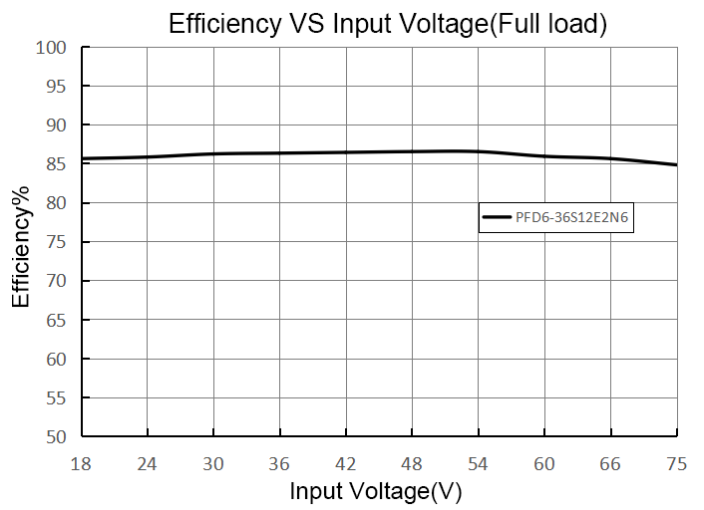
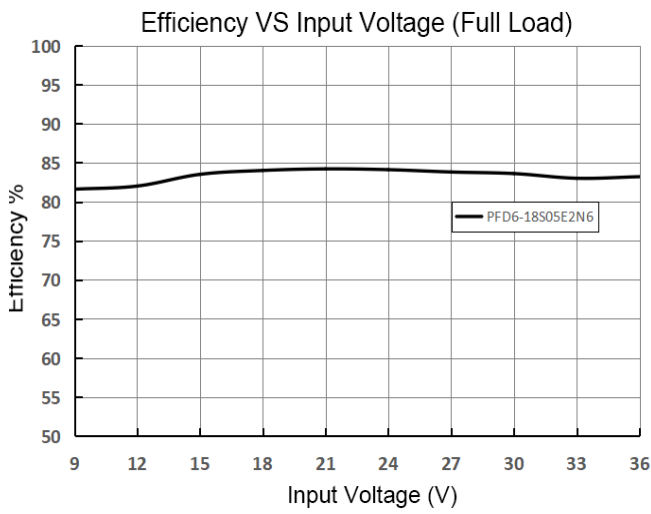
Total Items	Sub items		Test standard	Performance/Class
EMI	CE	Others	CISPR32/EN55032	CLASS A
		PFD6-18S18E2N6	CISPR32/EN55032	CLASS B (with recommended EMC circuit)
EMC	EMS	CS	IEC/EN61000-4-6	3Vr.m.s Perf.Criteria A
		ESD	IEC/EN61000-4-2	Contact ±6KV Perf.Criteria B
		Surge	IEC/EN61000-4-5	±2KV (with recommended EMC circuit) Perf.Criteria B
		EFT	IEC/EN61000-4-4	±2KV (with recommended EMC circuit) Perf.Criteria B
		Voltage dips, short interruptions and voltage variations	IEC/EN61000-4-29	0%~70% Perf.Criteria B

**Ripple & Noise Test Instruction (Twisted Pair Method, 20MHz bandwidth)**



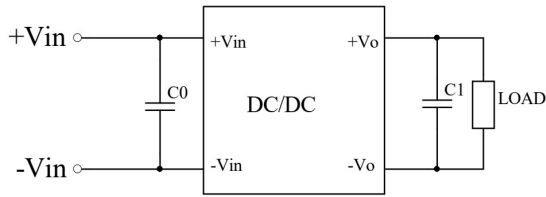
1. The Ripple & noise test needs 12# twisted pair cables, an oscilloscope which should be set at the Sample Mode, bandwidth 20MHz. 100M bandwidth probe with cap and ground removed. C1(0.1uF) polypropylene capacitor and C2(10uF) high-frequency low-resistance electrolytic capacitor are connected in parallel with the probes and one side of the twisted pair.
2. The power supply output connects to the load by the cables. The other side of the twisted pair (length 30cm±2 cm) should be connected in parallel with the load, the polarity of the output and the oscilloscope probe should not be reversed. The test can be started after input power on.

**Product Performance Curves**



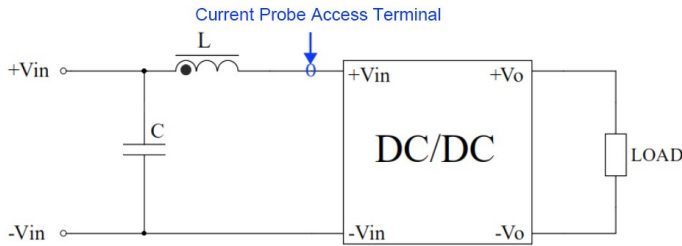
### Recommended Circuits for Application

1. This series of power supplies will be tested according to this circuit below before shipping. Increasing C1 capacitances can decrease the output ripple, but it must be less than the maximum capacitive load.



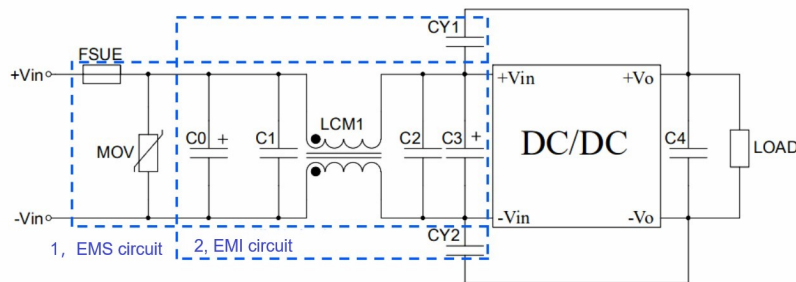
Components	Parameter
C0	100uF/100V
C1	10uF/50V

2. Input reflected ripple current test circuit



Components	Parameter
C	100uF/100V
L	4.7uH

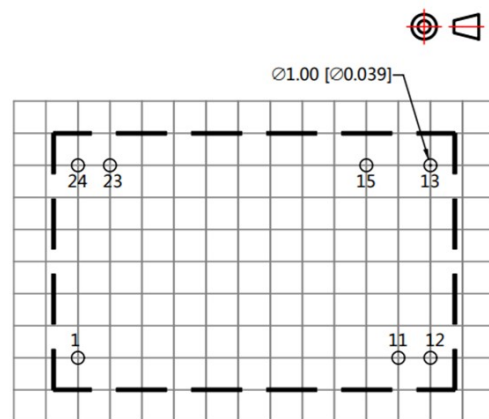
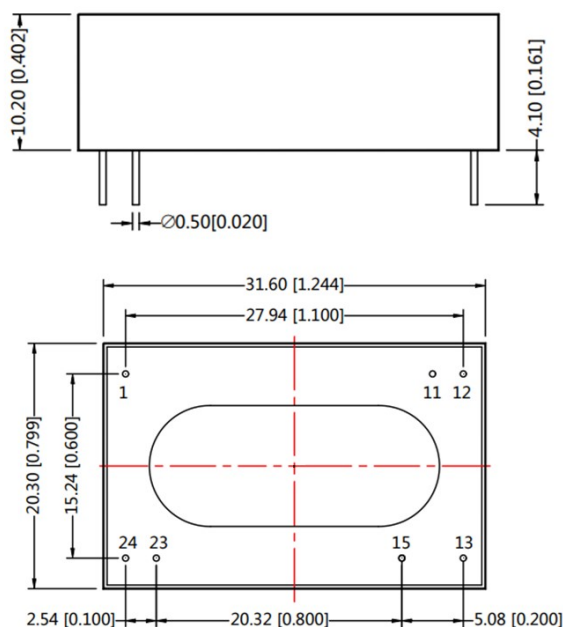
3. Recommended EMC circuit



Components	24VDC Input	48VDC Input
FUSE	TBD by customer	
MOV	20D470K	14D101K
C0, C3	330uF/50V	330uF/100V
C1, C2	10uF/50V	10uF/100V
C4	10uF/50V	
LCM1	15mH	
CY1, CY2	1nF/6KV	

Note - Part 1 in the circuit is for EMS test, part 2 for EMI filtering, both can be adjusted according to the actual situation.

### E2 Mechanical Dimensions



PCB layout vertical view  
Grid 2.54x2.54 [0.10x0.10]

Unit: mm[inch]  
Pin diameter tolerance  $\pm 0.10[\pm 0.004]$   
General tolerance  $\pm 0.50[\pm 0.020]$

### Pin Definition

Pin No.	1	11	12	13	15	23	24
Pin definition	+Vin	NP	GND	+Vout	NP	-Vin	-Vin
Description	Input V+	No Pin	Output V-	Output V+	No Pin	Input V-	Input V-

#### Application Notice

1. The products should be used according to the specifications in this datasheet, otherwise it could be permanently damaged.
2. It is not recommended to connect the converters in parallel to achieve a bigger power output.
3. The product performance in this datasheet cannot be guaranteed if it works at a lower load than the minimum load defined.
4. The product performance in this datasheet cannot be guaranteed if it works at over-load condition.
5. Unless otherwise specified, all values or indicators in this datasheet are tested at  $T_a=25^{\circ}\text{C}$ , humidity < 75%RH, rated input voltage and rated load
6. All values or indicators in this datasheet had been tested based on Aipupower test specifications.
7. The specifications are specially for the parts listed in this datasheet, any other non-standard model performances could be out of the specifications. Please contact our technician for specific requirements.
8. Aipupower can provide customization service.
9. The product specifications may be modified without prior notice. Please refer to the published data sheet at Aipupower website.

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