

# FED60 SERIES

DC-DC CONVERTER

2:1 WIDE INPUT RANGE  
UP TO 60Watts



## FEATURES

- NO MINIMUM LOAD REQUIRED
- 1600VDC INPUT TO OUTPUT ISOLATION
- STANDARD 2.00 X 1.00 X 0.40 INCH
- SIX-SIDED CONTINUOUS SHIELD
- SAFETY MEETS UL60950-1, EN60950-1, IEC60950-1, & EN50155
- CE MARKED
- COMPLIANT TO RoHS II & REACH

## APPLICATIONS

- WIRELESS NETWORK
- TELECOM/DATACOM
- INDUSTRY CONTROL SYSTEM
- DISTRIBUTED POWER ARCHITECTURES
- SEMICONDUCTOR EQUIPMENT

1600VDC ISOLATION	REMOTE CONTROL	UVP	OCP	SCP	OVP	OTP	LOW STANDBY POWER
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## TECHNICAL SPECIFICATION

All specifications are typical at nominal input, full load and 25°C otherwise noted

Model Number	Input Range	Output Voltage	Output Current @Full Load	Input Current @ No Load	Efficiency	Maximum Capacitor Load (1)
	VDC	VDC	A	mA	%	µF
FED60-12S3P3	9 ~ 18	3.3	12	15	89	32000
FED60-12S05	9 ~ 18	5	12	15	90	30000
FED60-12S12	9 ~ 18	12	5	15	90	5850
FED60-12S15	9 ~ 18	15	4	15	91	3900
FED60-12S24	9 ~ 18	24	2.5	15	92	2000
FED60-12D12	9 ~ 18	±12	±2.5	15	90	±3900
FED60-12D15	9 ~ 18	±15	±2	15	90	±2400
FED60-12D24	9 ~ 18	±24	±1.25	15	91	±1000
FED60-24S3P3	18 ~ 36	3.3	12	10	90	32000
FED60-24S05	18 ~ 36	5	12	10	92	30000
FED60-24S12	18 ~ 36	12	5	10	91	5850
FED60-24S15	18 ~ 36	15	4	10	92	3900
FED60-24S24	18 ~ 36	24	2.5	10	91	2000
FED60-24D12	18 ~ 36	±12	±2.5	10	90	±3900
FED60-24D15	18 ~ 36	±15	±2	10	90	±2400
FED60-24D24	18 ~ 36	±24	±1.25	10	91	±1000
FED60-48S3P3	36 ~ 75	3.3	12	10	90	32000
FED60-48S05	36 ~ 75	5	12	10	92	30000
FED60-48S12	36 ~ 75	12	5	10	92	5850
FED60-48S15	36 ~ 75	15	4	10	92	3900
FED60-48S24	36 ~ 75	24	2.5	10	92	2000
FED60-48D12	36 ~ 75	±12	±2.5	10	91	±3900
FED60-48D15	36 ~ 75	±15	±2	10	91	±2400
FED60-48D24	36 ~ 75	±24	±1.25	10	91	±1000

## PART NUMBER STRUCTURE

FED60	-	48	S	05	-	N	HS
Series Name		Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)		Remote Control options	Assembly Option
		12: 9-18 24: 18-36 48: 36-75	S: Single  D: Dual	3P3: 3.3 05: 5 12: 12 15: 15 24: 24  12: ±12 15: ±15 24: ±24		<input type="checkbox"/> Positive logic N: Negative logic	<input type="checkbox"/> None HS: Heat-sink HC: Heat-sink with Clamp

## INPUT SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit	
Operating input voltage range	12Vin(nom)		9	12	18	VDC	
	24Vin(nom)		18	24	36		
	48Vin(nom)		36	48	75		
Start-up voltage	12Vin(nom)				9	VDC	
	24Vin(nom)				18		
	48Vin(nom)				36		
Shutdown voltage	12Vin(nom)			8		VDC	
	24Vin(nom)			16			
	48Vin(nom)			32			
Start up time	Constant resistive load	Power up Remote ON/OFF		60 60		ms	
Input surge voltage	1 second, max.	12Vin(nom)			25	VDC	
		24Vin(nom)			50		
		48Vin(nom)			100		
Input filter				Pi type			
Remote ON/OFF	Referred to -Vin pin	Positive logic (Standard)	DC-DC ON		Open or 3 ~ 12VDC		
			DC-DC OFF		Short or 0 ~ 1.2VDC		
		Negative logic (Option)	DC-DC ON		Short or 0 ~ 1.2VDC		
		DC-DC OFF		Open or 3 ~ 12VDC			
		Input current of Ctrl pin	-0.5		0.5	mA	
		Remote off input current		3		mA	

## OUTPUT SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Voltage accuracy			-1.0		+1.0	%
Line regulation	Low Line to High Line at Full Load		-0.2		+0.2	%
Load regulation	No Load to Full Load	Single	-0.5		+0.5	%
		Dual	-1.0		+1.0	%
Cross regulation	Asymmetrical load 25%/100% FL	Dual	-5.0		+5.0	%
Voltage adjustability	Single output	3.3Vout, 5Vout, 12Vout	-10		+10	%
		15Vout, 24Vout	-10		+20	%
Ripple and noise	Measured by 20MHz bandwidth					mVp-p
	With a 10µF/25V X7R MLCC	3.3Vout, 5Vout		75	100	
	With a 10µF/25V X7R MLCC	12Vout, 15Vout		100	125	
	With a 4.7µF/50V X7R MLCC	24Vout		150	200	
Temperature coefficient			-0.02		+0.02	%/°C
Transient response recovery time	25% load step change			250		µs
Over voltage protection	Zener diode clamp	3.3Vout		3.9		VDC
		5Vout		6.2		
		12Vout		15		
		15Vout		20		
		24Vout		30		
Over load protection	% of Iout rated; Hiccup mode			150		%
Short circuit protection			Continuous, automatic recovery			

## GENERAL SPECIFICATIONS

Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	Input to Output	1600			VDC
		Input (Output) to Case	1600			
Isolation resistance	500VDC		1			GΩ
Isolation capacitance					2200	pF
Switching frequency			225	250	275	kHz
Safety meets						UL60950-1 EN60950-1 IEC60950-1
Case material						Copper
Base material						FR4 PCB
Potting material						Silicone (UL94 V-0)
Weight						33g (1.16oz)
MTBF	MIL-HDBK-217F, Full load.					8.804 x 10 <sup>5</sup> hrs

**ENVIRONMENTAL SPECIFICATIONS**

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating ambient temperature	With Derating	-40		+105	°C
Maximum case temperature				+105	°C
Over temperature protection			+115		°C
Storage temperature range		-55		+125	°C
Thermal impedance	Vertical direction by natural convection (20LFM) Without Heat-sink With Heat-sink		10.8 10.3		°C/W
Thermal shock					MIL-STD-810F
Vibration					MIL-STD-810F
Relative humidity					5% to 95% RH

**EMC SPECIFICATIONS**

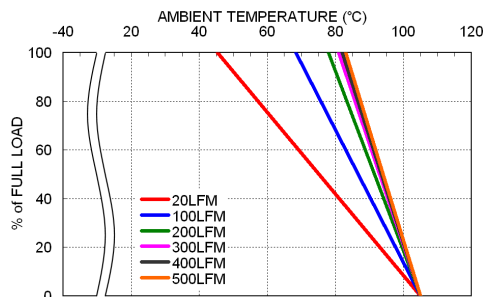
Parameter	Conditions	Level
EMI <sup>(2)</sup>	EN55022	Class A
ESD	EN61000-4-2 Air ± 8kV and Contact ± 6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3 20 V/m	Perf. Criteria A
Fast transient <sup>(3)</sup>	EN61000-4-4 ± 2kV	Perf. Criteria A
Surge <sup>(3)</sup>	EN61000-4-5 ± 2kV	Perf. Criteria A
Conducted immunity	EN61000-4-6 10 Vr.m.s	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8 100A/m continuous; 1000A/m 1 second	Perf. Criteria A

**Note:**

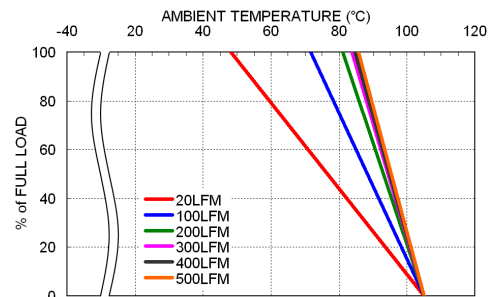
1. Test by minimum input and constant resistive load.
2. The standard module meets EMI Class A or Class B with external components. For further information, please contact with P-DUKE.
3. The external input components are required if the module has to meet EN61000-4-4, EN61000-4-5.  
 The FED60-12□□□ and The FED60-24□□□ recommended an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220µF/100V) and a TVS (SMDJ58A, 58V, 3000Watt peak pulse power) to connect in parallel.  
 The FED60-48□□□ recommended an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220µF/100V) and a TVS (SMDJ120A, 120V, 3000Watt peak pulse power) to connect in parallel.

**CAUTION:** This power module is not internally fused. An input line fuse must always be used.

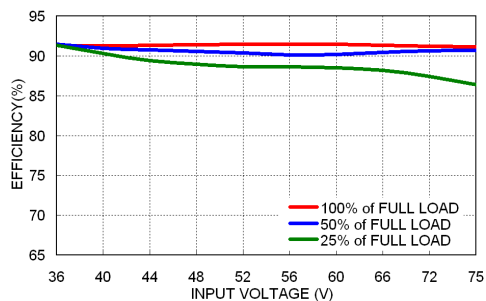
**CHARACTERISTIC CURVE**



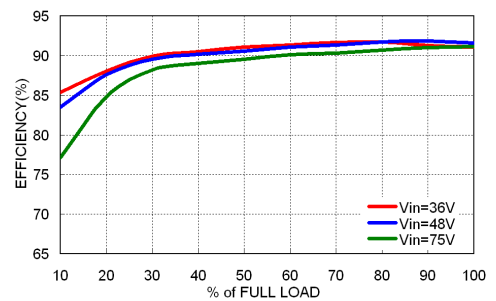
FED60-48S12 Derating Curve



FED60-48S12 Derating Curve with Heat-sink

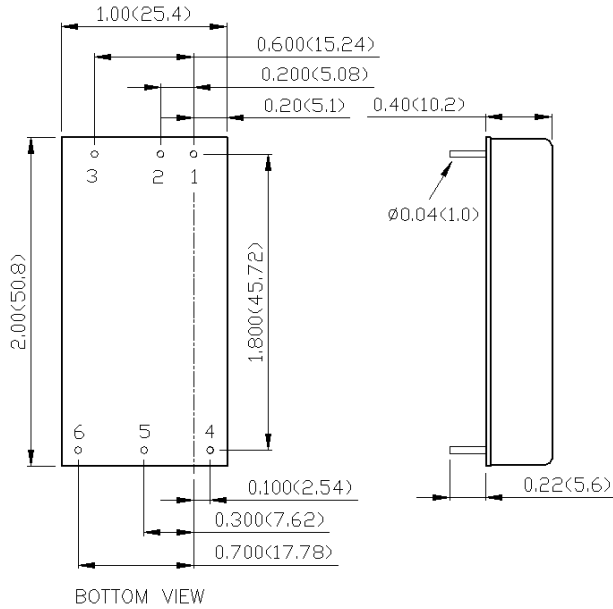


FED60-48S12 Efficiency VS Input Voltage



FED60-48S12 Efficiency VS Output Load

**MECHANICAL DRAWING**

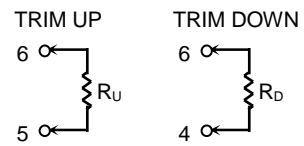


**PIN CONNECTION**

PIN	SINGLE	DUAL
1	+Vin	+Vin
2	-Vin	-Vin
3	Ctrl	Ctrl
4	+Vout	+Vout
5	-Vout	Common
6	Trim	-Vout

**EXTERNAL OUTPUT TRIMMING**

Output can be externally trimmed by using the method shown below.



1. All dimensions in inch (mm)
2. Tolerance :x.xx±0.02 (x.x±0.5)  
x.xxx±0.01 (x.xx±0.25)
3. Pin pitch tolerance ±0.01 (0.25)
4. Pin dimension tolerance ±0.004(0.1)