



# P-DUKE POWER

## FED40W Series

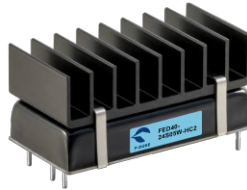
DC-DC Converter  
Up to 40Watts

### 3

YEARS  
WARRANTY

ROHS  
COMPLIANT

REACH  
COMPLIANT



Railway



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Medical



PV



3000  
VDC  
Isolation  
Voltage

1600  
VDC  
Isolation  
Voltage

4 : 1  
Wide  
Input  
Range

6  
sided  
Shielding

LOW  
Standby  
Power

NO  
Min. Load  
Required

REMOTE  
ON  
OFF

OCP

OTP

OVP

SCP

UVP

### PART NUMBER STRUCTURE

FED40	-	48	S	05	W	-	M3	N	HC
Series Name		Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range		Operating Temp. Options	Remote Control Options	Assembly Options
		24:9~36 48:18~75 110:43~160	S:Single  D:Dual	3P3:3.3 05:5 12:12 15:15 24:24  12:±12 15:±15 24:±24	4:1		□: Standard -40~+105°C With derating M3: M3 Version -55~+105°C With derating	□: Positive logic N: Negative logic	□: None HC: 7G-0020C-F; H=0.22" (※NRND) HC1: 7GA0120P01-F; H=0.3" HC2: 7GA0121P01-F; H=0.5" HC3: 7GA0122P01-F; H=0.8"  ※NRND: Not recommended for new designs

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

Model Number	Input Range	Output Voltage	Output Current @Full Load	Input Current @No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	mA	mA	%	μF
FED40-24S3P3W	9 ~ 36	3.3	10000	15	90	26600
FED40-24S05W	9 ~ 36	5	8000	15	91	20000
FED40-24S12W	9 ~ 36	12	3333	15	92	3900
FED40-24S15W	9 ~ 36	15	2666	15	92	2600
FED40-24S24W	9 ~ 36	24	1666	15	91	1300
FED40-24D12W	9 ~ 36	±12	±1666	15	90	± 2600
FED40-24D15W	9 ~ 36	±15	±1333	15	90	± 1600
FED40-24D24W	9 ~ 36	±24	±833	15	91	±650
FED40-48S3P3W	18 ~ 75	3.3	10000	10	90	26600
FED40-48S05W	18 ~ 75	5	8000	10	92	20000
FED40-48S12W	18 ~ 75	12	3333	10	92	3900
FED40-48S15W	18 ~ 75	15	2666	10	92	2600
FED40-48S24W	18 ~ 75	24	1666	10	91	1300
FED40-48D12W	18 ~ 75	±12	±1666	10	90	± 2600
FED40-48D15W	18 ~ 75	±15	±1333	10	90	± 1600
FED40-48D24W	18 ~ 75	±24	±833	10	91	±650
FED40-110S3P3W	43 ~ 160	3.3	10000	10	88	26600
FED40-110S05W	43 ~ 160	5	8000	10	89	20000
FED40-110S12W	43 ~ 160	12	3333	10	90.5	3900
FED40-110S15W	43 ~ 160	15	2666	10	91	2600
FED40-110S24W	43 ~ 160	24	1666	10	90	1300
FED40-110D12W	43 ~ 160	±12	±1666	10	89	± 2600
FED40-110D15W	43 ~ 160	±15	±1333	10	89	± 1600
FED40-110D24W	43 ~ 160	±24	±833	10	91	±650

**INPUT SPECIFICATIONS**

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating input voltage range	24Vin(nom)	9	24	36	VDC
	48Vin(nom)	18	48	75	
	110Vin(nom)	43	110	160	
Start up voltage	24Vin(nom)			9	VDC
	48Vin(nom)			18	
	110Vin(nom)			43	
Shutdown voltage	24Vin(nom)	7	8	8.8	VDC
	48Vin(nom)	15	16	17.5	
	110Vin(nom)	37	40	42	
Start up time	Constant resistive load	Power up	60		ms
		Remote ON/OFF	60		
Input surge voltage	1 second, max.	24Vin(nom)		50	VDC
		48Vin(nom)		100	
		110Vin(nom)		170	
Input filter				Pi type	
Remote ON/OFF	Referred to -Vin pin	Positive logic	DC-DC ON	Open or 3 ~ 12VDC	
		(Standard)	DC-DC OFF	Short or 0 ~ 1.2VDC	
		Negative logic	DC-DC ON	Short or 0 ~ 1.2VDC	
	(Option)	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		-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 With a 0.1µF/50V X7R MLCC	3.3Vout, 5Vout		75	100	mVp-p
		12Vout, 15Vout		100	125	
		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			

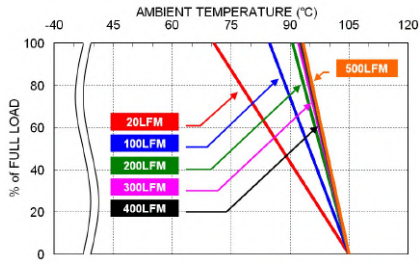
GENERAL SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	110Vin(nom) Input to Output	3000			VDC
		Input (Output) to Case	1600			
		Others Input to Output	1600			VDC
Isolation resistance	500VDC		1			GΩ
Isolation capacitance					1500	pF
Switching frequency			225	250	275	kHz
Safety approvals	IEC/ EN/ UL62368-1				UL:E193009 CB:UL(Demko)	
Standard approvals	EN50155 EN45545-2					
Case material			Copper			
Base material			FR4 PCB			
Potting material			Silicone (UL94 V-0)			
Weight			32g (1.13oz)			
MTBF	MIL-HDBK-217F, Full load.		9.073 x 10 <sup>5</sup> hrs			

ENVIRONMENTAL SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating ambient temperature	Standard M3 Version	With derating	-40		+105	°C
		With derating	-55		+105	
Maximum case temperature					105	°C
Over temperature protection				115		°C
Storage temperature range			-55		+125	°C
Thermal impedance		Without Heat-sink		10.8		°C/W
		With Heat-sink	HC		10.3	
			HC1		9.3	
			HC2		7.7	
			HC3		6.2	
Thermal shock			MIL-STD-810F			
Shock			EN61373, MIL-STD-810F			
Vibration			EN61373, MIL-STD-810F			
Relative humidity			5% to 95% RH			

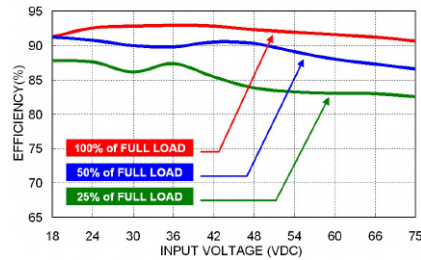
EMC SPECIFICATIONS		
Parameter	Conditions	Level
EMI	EN55032,EN50121-3-2 With external components.	Class A, Class B
EMS	EN55035,EN50121-3-2	
ESD	EN61000-4-2 Air $\pm$ 8kV and Contact $\pm$ 6kV	Perf. Criteria A
Radiated immunity	EN61000-4-3 20 V/m	Perf. Criteria A
Fast transient	EN61000-4-4 $\pm$ 2kV	Perf. Criteria A
	FED40-24□□□W With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220 $\mu$ F/100V) and a TVS(SMDJ58A, 58V, 3000Watt peak pulse power) in parallel.	
	FED40-48□□□W With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220 $\mu$ F/100V) and a TVS(SMDJ120A,120V, 3000Watt peak pulse power) in parallel.	
	FED40-110□□□W With 2pcs aluminum electrolytic capacitor (Nippon chemi-con KXJ series,150 $\mu$ F/200V in parallel) and 2pcs TVS(SMDJ90A, 90V, 3000Watt peak pulse power in series connection) in parallel	
Surge	EN61000-4-5 $\pm$ 2kV	Perf. Criteria A
	FED40-24□□□W With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220 $\mu$ F/100V) and a TVS(SMDJ58A, 58V, 3000Watt peak pulse power) in parallel.	
	FED40-48□□□W With an aluminum electrolytic capacitor (Nippon chemi-con KY series, 220 $\mu$ F/100V) and a TVS(SMDJ120A,120V, 3000Watt peak pulse power) in parallel.	
	FED40-110□□□W With 2pcs aluminum electrolytic capacitor (Nippon chemi-con KXJ series,150 $\mu$ F/200V in parallel) and 2pcs TVS(SMDJ90A, 90V, 3000Watt peak pulse power in series connection) in parallel	
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

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

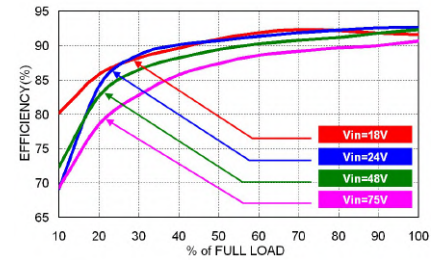
## CHARACTERISTIC CURVE



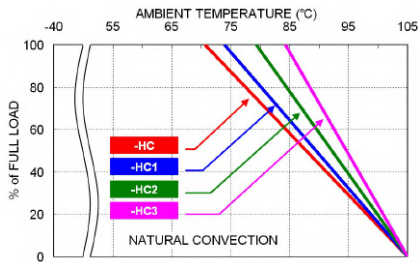
FED40-48S05W Derating Curve



FED40-48S05W Efficiency vs. Input Voltage



FED40-48S05W Efficiency vs. Output Load



FED40-48S05W Derating Curve With Heat-sink

## FUSE CONSIDERATION

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.

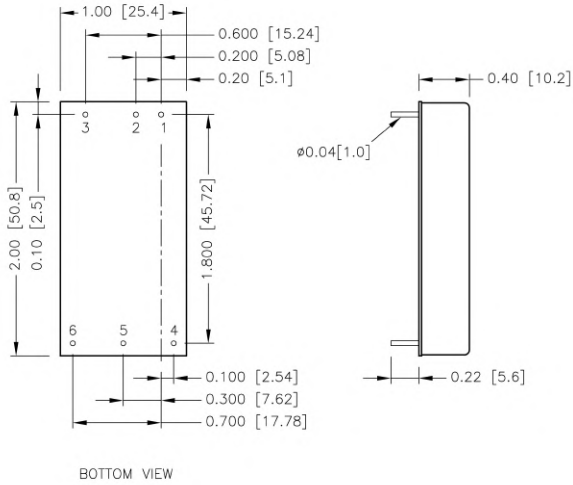
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below :

Model	Fuse Rating (A)	Fuse Type
FED40-24□□□W	8	Fast-Acting
FED40-48□□□W	4	Slow-Blow
FED40-110□□□W	3.15	Slow-Blow

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin.

## MECHANICAL DRAWING



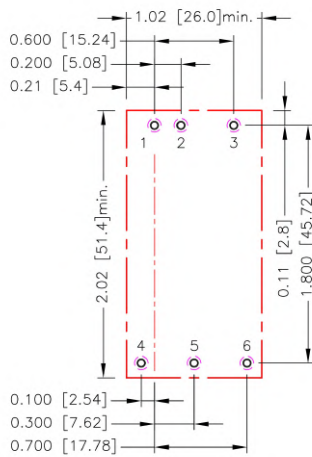
### PIN CONNECTION

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

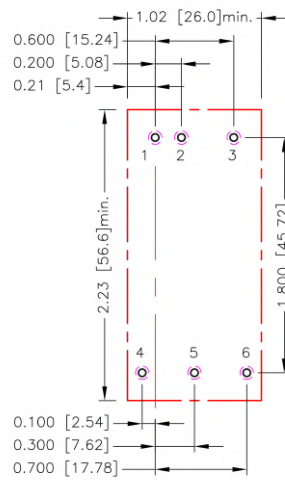
- All dimensions in inch [mm]  
Tolerance :x.xx±0.02 [x.x±0.5]  
x.xxx±0.010 [x.xx±0.25]
- Pin dimension tolerance ±0.004[0.10]

## RECOMMENDED PAD LAYOUT

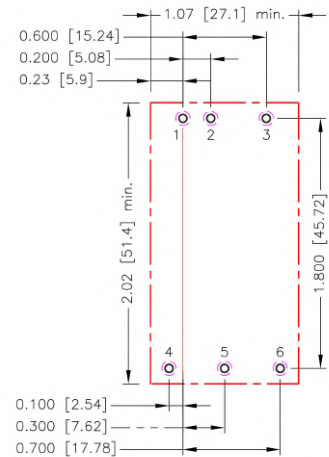
### Standard



### -HC



### -HC1、-HC2、-HC3

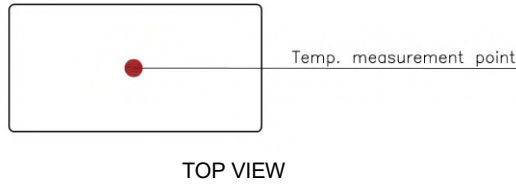


All dimensions in inch[mm]  
Pad size(lead free recommended)  
Through hole 1.2.3.4.5.6:  $\Phi 0.051 [1.30]$   
Top view pad 1.2.3.4.5.6:  $\Phi 0.064 [1.63]$   
Bottom view pad 1.2.3.4.5.6:  $\Phi 0.102 [2.60]$

## THERMAL CONSIDERATIONS

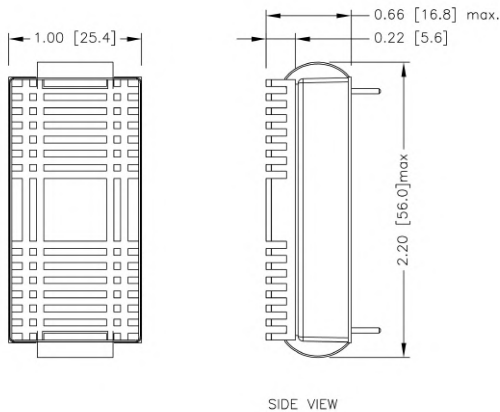
The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the point as the figure below. The temperature at this location should not exceed "Maximum case temperature". When operating, adequate cooling must be provided to maintain the test point temperature at or below "Maximum case temperature". You can limit this temperature to a lower value for extremely high reliability.

- Thermal test condition with vertical direction by natural convection (20LFM).

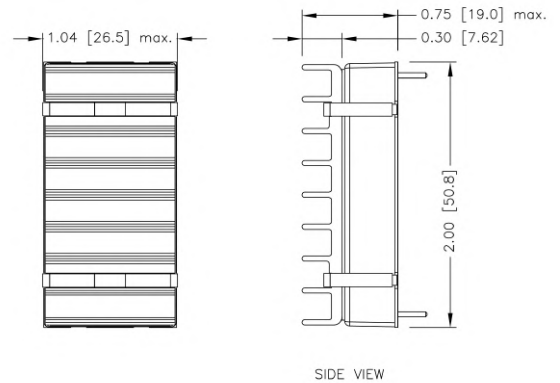


## HEAT-SINK TYPE OPTIONS

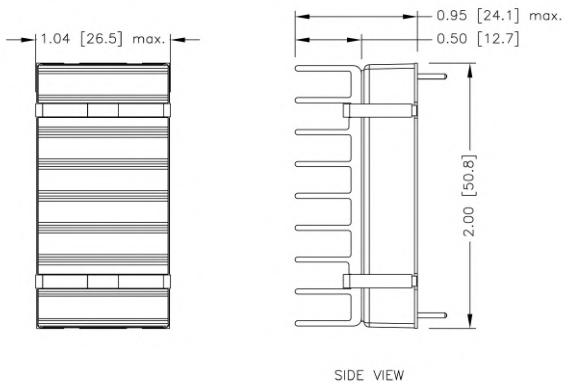
FED40-□□□□□W-HC  
7G-0020C-F



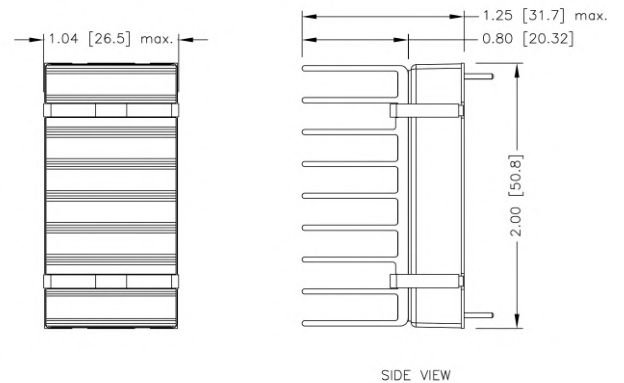
FED40-□□□□□W-HC1  
7GA0120P01-F



FED40-□□□□□W-HC2  
7GA0121P01-F



FED40-□□□□□W-HC3  
7GA0122P01-F



- All dimensions in inch [mm]
- Tolerance :x.xx±0.02 [x.x±0.5]  
x.xxx±0.010 [x.xx±0.25]

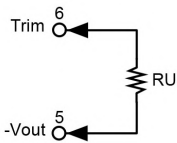
## OUTPUT VOLTAGE ADJUSTMENT

Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of the module. This is accomplished by connecting an external resistor between the Trim pin and either the +Output or -Output pins. With an external resistor between the Trim and -Vout, the output voltage set point increases. With an external resistor between the Trim and +Vout, the output voltage set point decreases. The external Trim resistor needs to be at least 1/16W of rated power.

### EXTERNAL OUTPUT TRIMMING

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

Trim-up



#### □□S3P3W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.630
RU (k $\Omega$ )	57.93	26.165	15.577	10.283	7.106	4.988	3.476	2.341	1.459	0.753

#### □□S05W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.050	5.100	5.150	5.200	5.250	5.300	5.350	5.400	5.450	5.500
RU (k $\Omega$ )	36.57	16.58	9.917	6.585	4.586	3.253	2.302	1.588	1.032	0.588

#### □□S12W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200
RU (k $\Omega$ )	367.91	165.95	98.636	64.977	44.782	31.318	21.701	14.488	8.879	4.391

#### □□S15W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	15.150	15.300	15.450	15.600	15.750	15.900	16.050	16.200	16.350	16.500
RU (k $\Omega$ )	419.81	199.91	126.60	89.95	67.96	53.30	42.83	34.98	28.87	23.98

$\Delta V$ (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	16.650	16.800	16.950	17.100	17.250	17.400	17.550	17.700	17.850	18.000
RU (k $\Omega$ )	19.98	16.65	13.83	11.42	9.32	7.49	5.87	4.43	3.15	1.99

#### □□S24W

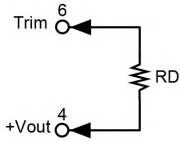
$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	24.240	24.480	24.720	24.960	25.200	25.440	25.680	25.920	26.160	26.400
RU (k $\Omega$ )	1275.2	606.60	383.73	272.30	205.44	160.87	129.03	105.15	86.58	71.72

$\Delta V$ (%)	11	12	13	14	15	16	17	18	19	20
Vout (V)	26.640	26.880	27.120	27.360	27.600	27.840	28.080	28.320	28.560	28.800
RU (k $\Omega$ )	59.56	49.43	40.86	33.51	27.15	21.57	16.66	12.29	8.38	4.86



## OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

Trim-down



### □□S3P3W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.970
RD (k $\Omega$ )	69.47	31.235	18.49	12.117	8.294	5.745	3.924	2.559	1.497	0.647

### □□S05W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	4.950	4.900	4.850	4.800	4.750	4.700	4.650	4.600	4.550	4.500
RD (k $\Omega$ )	45.533	20.612	12.306	8.152	5.66	3.999	2.812	1.922	1.23	0.676

### □□S12W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	11.880	11.760	11.640	11.520	11.400	11.280	11.160	11.040	10.920	10.800
RD (k $\Omega$ )	460.99	207.95	123.6	81.423	56.118	39.249	27.199	18.162	11.132	5.509

### □□S15W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	14.850	14.700	14.550	14.400	14.250	14.100	13.950	13.800	13.650	13.500
RD (k $\Omega$ )	284.89	128.68	76.61	50.58	34.96	24.55	17.11	11.53	7.19	3.72

### □□S24W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	23.760	23.520	23.280	23.040	22.800	22.560	22.320	22.080	21.840	21.600
RD (k $\Omega$ )	838.15	376.78	222.98	146.09	99.95	69.19	47.22	30.74	17.93	7.68