

# P R B X

## POWERBOX Industrial Line PED40W Series 40W 4:1 Single and Dual Output DC/DC Converter

### Features

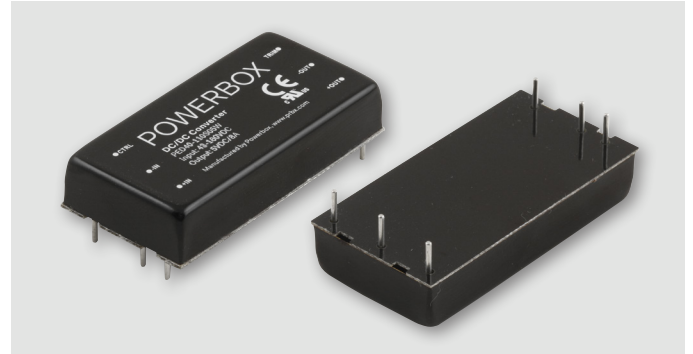
No minimum load required
1600VDC input to output isolation for 24vin and 48vin
3000VDC input to output isolation for 110vin
Standard 2.00 x 1.00 x 0.40 inch
Six-sided continuous shield
UL60950-1, EN60950-1, & IEC60950-1
UL62368-1, EN62368-1, & IEC62368-1 safety approvals
Compliance to EN50155 and en45545-2 railway standard

### Input

Voltage range	24V nominal input	9-36VDC
	48V nominal input	18-75VDC
	110V nominal input	43-160VDC
Start up voltage	24V nominal input	9VDC max
	48V nominal input	18VDC max
	110V nominal input	43VDC max
Shutdown voltage	24V nominal input	8VDC typ
	48V nominal input	16VDC typ
	110V nominal input	40VDC typ
Start up time	Power up	60mS typ
	Remote ON/OFF	60mS typ
	Constant resistive load.	
Input surge voltage 1 second max	24V nominal input	50VDC max
	48V nominal input	100VDC max
	110V nominal input	170VDC max
Input filter	Pi type.	
Remote ON/OFF	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	±0.5mA
Remote off input current	3mA	

### Output

Voltage accuracy	±1% max.	
Line regulation	LL to HL at full load	±0.2%
Load regulation	Single	±0.5%
	Dual	±1.0%
	No load to full load.	
Cross regulation (dual)	±5%, asymmetrical load 25% / 100% FL.	
Voltage adjustability	Single output	
	3.3Vout, 5Vout, 12Vout	±10%
	15Vout, 24Vout	-10 +20%.
Ripple and noise	Measured by 20MHz bandwidth	
	With a 0.1µF/50V X7R MLCC	
	3.3Vout, 5Vout	100mVp-p max
	12Vout, 15Vout	125mVp-p max
	24Vout	200mVp-p max
Temperature coefficient	±0.02%/°C max.	



Transient response	250µS, recovery time 25% load step change.	
Overvoltage protection	3.3Vout	3.9VDC typ
	5Vout	6.2VDC typ
	12Vout	15VDC typ
	15Vout	20VDC typ
	24Vout	30VDC typ
Overload protection	150% of Iout rated, hiccup mode.	
Short circuit protection	Continuous, automatic recovery.	

### Environmental

Operating ambient temp. Standard with derating	-40°C to +105°C
	M3 version with derating -55°C to +105°C
Max case temperature	+105°C max.
Over temp. protection	+115°C typ.
Storage temperature	-55°C to +125°C.
Thermal impedance	10.8°C/W without heat-sink.
	10.3°C/W with heat-sink.
Thermal	MIL-STD-810F.
Shock	EN61373, MIL-STD-810F.
Vibration	EN61373, MIL-STD-810F.
Relative humidity	5-95% RH.

### General

Isolation voltage 110Vin	Input to output	3000VDC min
	Input (output) to case	1600VDC min
Isolation voltage others	Input to output	1600VDC min
	Input (output) to case	1600VDC min
Isolation resistance	500VDC	1GΩ min
Isolation capacitance	1500pF, max.	
Switching frequency	275KHz max.	
Case material.	Copper.	
Base material	FR4 PCB.	
Potting material	Silicon (UL94-V0).	
Dimensions	50.8 x 25.4 x 10.2 mm.	
Weight	32g.	
MTBF	9.073 x 10 <sup>5</sup> MIL-HDBK-217F.	

### Standards

Safety standards	IEC/UL/EN60950-1, UL:E193009.	
	IEC/UL/EN62368-1, CB:UL(Demko).	
	EN50155, EN45545-2.	

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EMC Parameter		Conditions	Level
EMI	EN55011, EN55032	With external components.	Class A, Class B
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
	PED40-24W	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.	
	PED40-48W	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.	
	PED40-110W	With an aluminum electrolytic capacitor (Ruby-con BXF series, 68 $\mu$ F/200V 3pcs in parallel) and a TVS(SMDJ90A, 90V, 3000Watt peak pulse power 2pcs in series connection ) in parallel	
Surge	EN61000-4-5	EN55024 $\pm$ 2kV and EN50155 $\pm$ 2kV	Perf. Criteria A
	PED40-24W	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.	
	PED40-48W	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.	
	PED40-110W	With an aluminum electrolytic capacitor (Ruby-con BXF series, 68 $\mu$ F/200V 3pcs in parallel) and a TVS(SMDJ90A, 90V, 3000Watt peak pulse power 2pcs 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

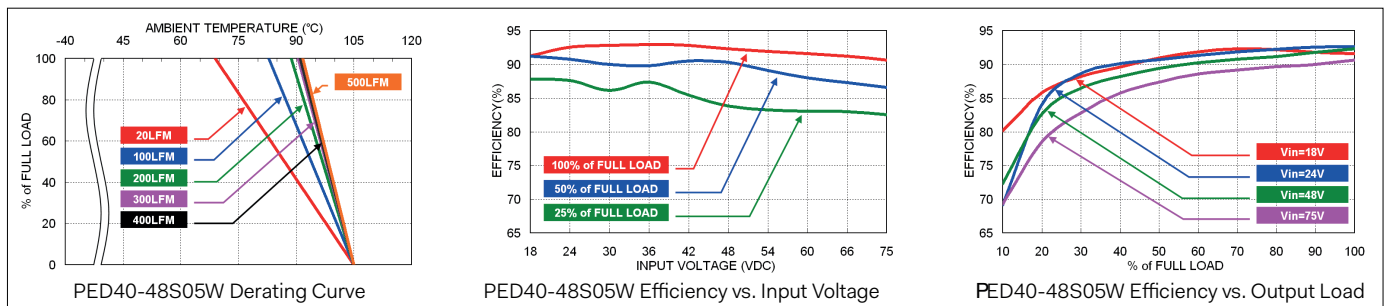
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Model Number	Input Range	Output Voltage	Output Current @ Full Load	Input Current @ No Load	Efficiency	Max Capacitor Load
PED40-24S3P3W	9 ~ 36 VDC	3.3 VDC	10000 mA	15 mA	90 %	26600 µF
PED40-24S05W	9 ~ 36 VDC	5 VDC	8000 mA	15 mA	91 %	20000 µF
PED40-24S12W	9 ~ 36 VDC	12 VDC	3333 mA	15 mA	92 %	3900 µF
PED40-24S15W	9 ~ 36 VDC	15 VDC	2666 mA	15 mA	92 %	2600 µF
PED40-24S24W	9 ~ 36 VDC	24 VDC	1666 mA	15 mA	91 %	1300 µF
PED40-24D12W	9 ~ 36 VDC	±12 VDC	±1666 mA	15 mA	90 %	± 2600 µF
PED40-24D15W	9 ~ 36 VDC	±15 VDC	±1333 mA	15 mA	90 %	± 1600 µF
PED40-24D24W	9 ~ 36 VDC	±24 VDC	±833 mA	15 mA	91 %	±650 µF
PED40-48S3P3W	18 ~ 75 VDC	3.3 VDC	10000 mA	10 mA	90 %	26600 µF
PED40-48S05W	18 ~ 75 VDC	5 VDC	8000 mA	10 mA	91 %	20000 µF
PED40-48S12W	18 ~ 75 VDC	12 VDC	3333 mA	10 mA	92 %	3900 µF
PED40-48S15W	18 ~ 75 VDC	15 VDC	2666 mA	10 mA	92 %	2600 µF
PED40-48S24W	18 ~ 75 VDC	24 VDC	1666 mA	10 mA	91 %	1300 µF
PED40-48D12W	18 ~ 75 VDC	±12 VDC	±1666 mA	10 mA	90 %	± 2600 µF
PED40-48D15W	18 ~ 75 VDC	±15 VDC	±1333 mA	10 mA	90 %	± 1600 µF
PED40-48D24W	18 ~ 75 VDC	±24 VDC	±833 mA	10 mA	91 %	±650 µF
PED40-110S3P3W	43 ~ 160 VDC	3.3 VDC	10000 mA	10 mA	88 %	26600 µF
PED40-110S05W	43 ~ 160 VDC	5 VDC	8000 mA	10 mA	89 %	20000 µF
PED40-110S12W	43 ~ 160 VDC	12 VDC	3333 mA	10 mA	90.5 %	3900 µF
PED40-110S15W	43 ~ 160 VDC	15 VDC	2666 mA	10 mA	91 %	2600 µF
PED40-110S24W	43 ~ 160 VDC	24 VDC	1666 mA	10 mA	90 %	1300 µF
PED40-110D12W	43 ~ 160 VDC	±12 VDC	±1666 mA	10 mA	89 %	± 2600 µF
PED40-110D15W	43 ~ 160 VDC	±15 VDC	±1333 mA	10 mA	89 %	± 1600 µF
PED40-110D24W	43 ~ 160 VDC	±24 VDC	±833 mA	10 mA	91 %	±650 µF

**Part Number Structure**

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range	Operating Temp Option	Remote Control Options	Heat-Sink
PED40	24: 9-36	S: Single	3P3: 3.3	4:1	□: Standard	□: Positive logic	□: None
	48: 18-75		05: 5		-40-+105°C	N: Negative logic	HC Heat-sink with clamp
	110: 43-160		12: 12		With derating		
			15: 15		M3: M3 version		
		D: Dual	24: 24		-55-+105°C		
			12: ±12		With derating		
			15: ±15				
			24: ±24				

**Derating Curve**



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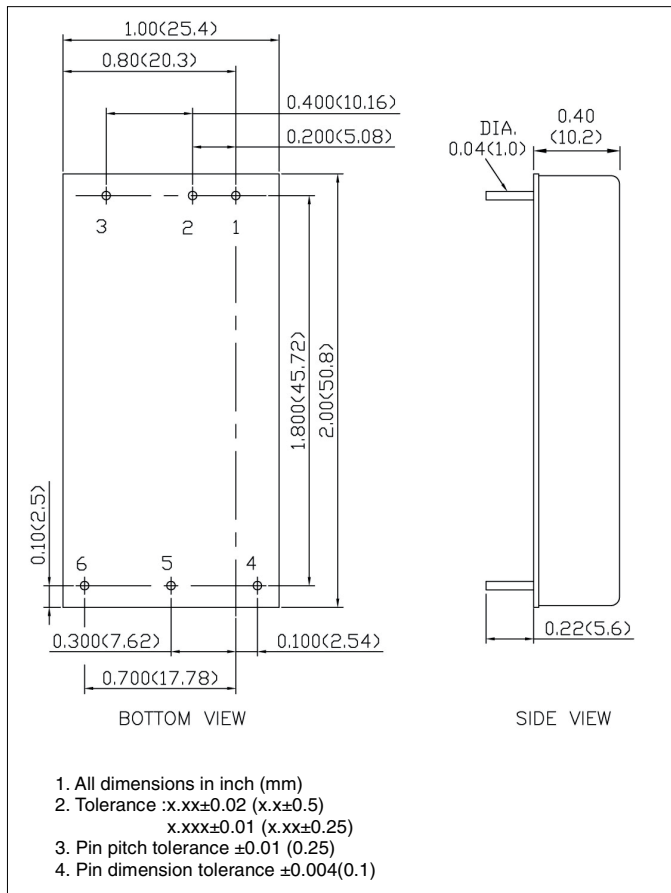
**Fuse Consideration**

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
PED40-24□□□W	8	Fast-Acting
PED40-48□□□W	4	Slow-Blow
PED40-110□□□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.

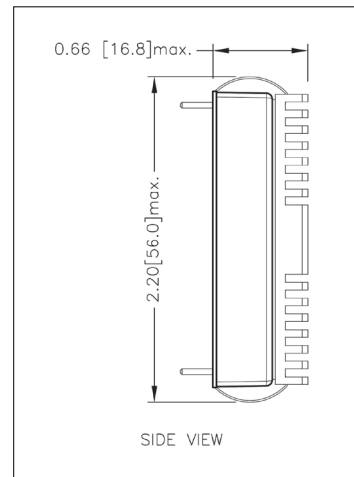
**Mechanical**



**Pin Connection**

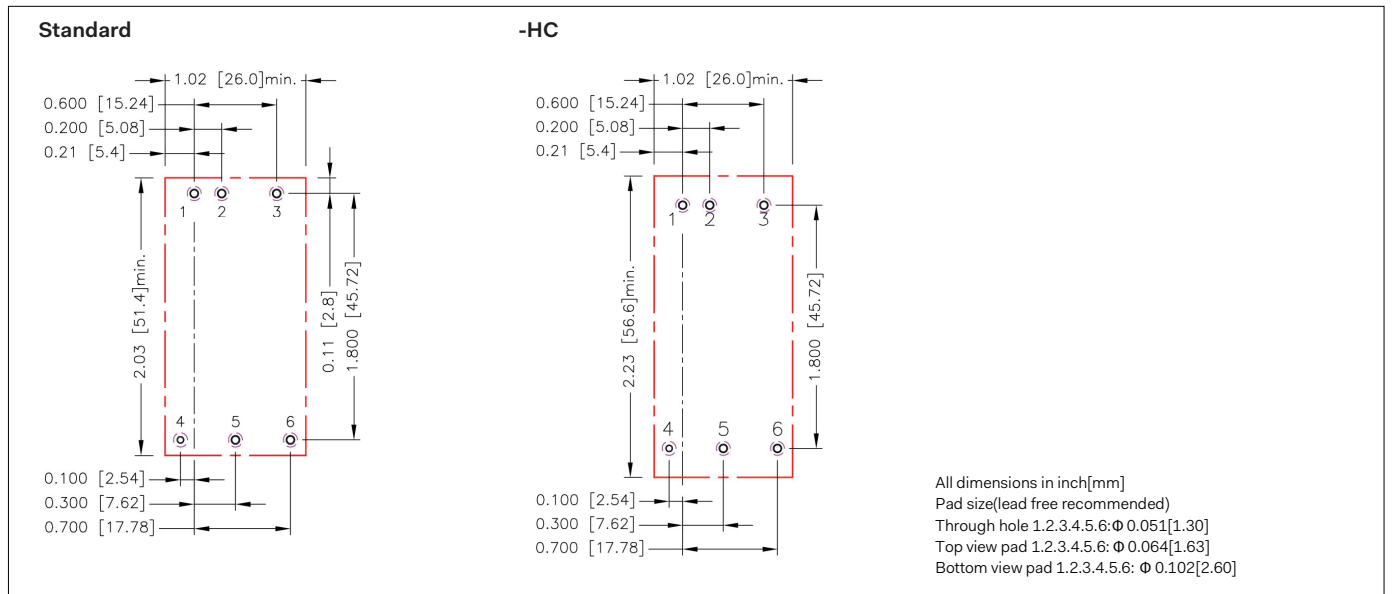
Pin	Single	Dual
1	+ Vin	+ Vin
2	- Vin	- Vin
3	Ctrl	Ctrl
4	+ Vout	+ Vout
5	- Vout	Common
6	Trim	- Vout

**Heat-Sink Options**



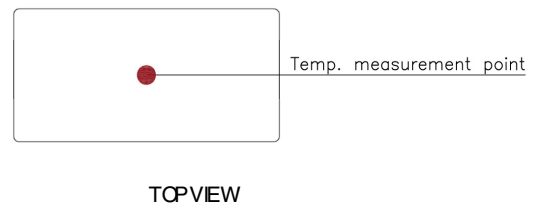
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Recommended Pad Layout



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 105°C. When Operating, adequate cooling must be provided to maintain the test point temperature at or below 105°C. Although the maximum point Temperature of the power modules is 105°C, you can limit this Temperature to a lower value for extremely high reliability. Thermal test condition with vertical direction by natural convection (20LFM).

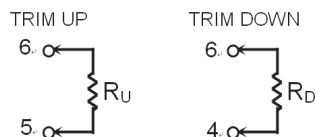


### Output Voltage Adjustment

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

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**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

Specifications are subject to change without notice.