



P-DUKE POWER

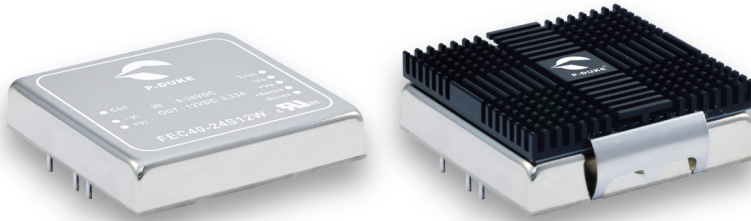
FEC40W Series

DC-DC Converter
Up to 40 Watts

3
YEARS
WARRANTY

ROHS
COMPLIANT

REACH
COMPLIANT



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Medical



PV



Railway

UL US CB CE UK CA

1600
VDC
Isolation
Voltage

4 : 1
Wide
Input
Range

6
sided
Shielding

REMOTE
ON
OFF

OCP

OTP

OVP

SCP

UVP

PART NUMBER STRUCTURE

| FEC40 - | 48 | S | 05 | W - | N | HC |
|-------------|---------------------|-----------------|-----------------------------------|-------------|--------------------------------------|-------------------------------------|
| Series Name | Input Voltage (VDC) | Output Quantity | Output Voltage (VDC) | Input Range | Remote On/Off Options | Assembly Options |
| | 24:9~36 48:18~75 | S:Single | 3P3:3.3 05:5 12:12 15:15 | 4:1 | □:Positive logic N:Negative logic | □: None HC: Heat-sink with Clamp |
| | | D: Dual | 12:±12 15:±15 | | | |

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

| Model Number | Input Range VDC | Output Voltage VDC | Output Current @Full Load | | Input Current @No Load mA | Efficiency % | Maximum Capacitor Load μF |
|---------------|--------------------|-----------------------|---------------------------|----------------|------------------------------|-----------------|------------------------------|
| | | | Min. Load mA | Full Load A | | | |
| FEC40-24S3P3W | 9 ~ 36 | 3.3 | 0 | 10 | 75 | 87 | 25750 |
| FEC40-24S05W | 9 ~ 36 | 5 | 0 | 8 | 95 | 88 | 13600 |
| FEC40-24S12W | 9 ~ 36 | 12 | 50 | 3.33 | 50 | 87 | 2360 |
| FEC40-24S15W | 9 ~ 36 | 15 | 50 | 2.67 | 50 | 87 | 1510 |
| FEC40-24D12W | 9 ~ 36 | ±12 | ±65 | ±1.67 | 60 | 86 | ±1200 |
| FEC40-24D15W | 9 ~ 36 | ±15 | ±50 | ±1.33 | 70 | 86 | ±750 |
| FEC40-48S3P3W | 18 ~ 75 | 3.3 | 0 | 10 | 55 | 87 | 25750 |
| FEC40-48S05W | 18 ~ 75 | 5 | 0 | 8 | 60 | 89 | 13600 |
| FEC40-48S12W | 18 ~ 75 | 12 | 50 | 3.33 | 30 | 87 | 2360 |
| FEC40-48S15W | 18 ~ 75 | 15 | 50 | 2.67 | 25 | 88 | 1510 |
| FEC40-48D12W | 18 ~ 75 | ±12 | ±65 | ±1.67 | 30 | 87 | ±1200 |
| FEC40-48D15W | 18 ~ 75 | ±15 | ±60 | ±1.33 | 30 | 86 | ±750 |

* The output requires a minimum loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.

| INPUT SPECIFICATIONS | | | | | | |
|-------------------------------|--------------------------|--|---|----------|-------------|----------|
| Parameter | Conditions | | Min. | Typ. | Max. | Unit |
| Operating input voltage range | 24Vin(nom) 48Vin(nom) | | 9 18 | 24 48 | 36 75 | VDC |
| Start up voltage | 24Vin(nom) 48Vin(nom) | | 9 18 | | | VDC |
| Shutdown voltage | 24Vin(nom) 48Vin(nom) | | 7 15 | 8 16 | 8.8 17.5 | VDC |
| Start up time | Constant resistive load | Power up Remote ON/OFF | 20 20 | | | ms |
| Input surge voltage | 100 ms, max. | 24Vin(nom) 48Vin(nom) | 50 100 | | | VDC |
| Input filter | Pi type | | | | | |
| Remote ON/OFF | Referred to -Vin pin | Positive logic DC-DC ON (Standard) DC-DC OFF Negative logic DC-DC ON (Option) DC-DC OFF Input current of Ctrl pin Remote off 24Vin(nom) input current 48Vin(nom) | Open or 3 ~ 12VDC Short or 0 ~ 1.2VDC Short or 0 ~ 1.2VDC Open or 3 ~ 12VDC -0.5 10 5 | | | mA 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 | Min. 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 | | | | -10 | | +10 % |
| Ripple and noise | 20MHz bandwidth | Single | 3.3Vout, 5Vout | | 50 | mVp-p |
| | | | 12Vout, 15Vout | | 75 | |
| | | Dual | 12Vout | | 120 | |
| | | | 15Vout | | 150 | |
| 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 | | 18 | |
| Over load protection | % of Iout rated | | | | | 150 % |
| Short circuit protection | | | | Continuous, automatic recovery | | |

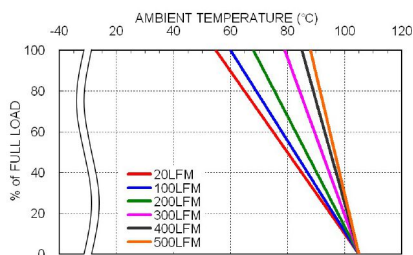
| GENERAL SPECIFICATIONS | | | | | | | |
|------------------------|--------------------------|------------------------|--|--|------|-----------|----|
| Parameter | Conditions | | | Min. | Typ. | Max. Unit | |
| Isolation voltage | 1 minute | Input to Output | | 1600 | | VDC | |
| | | Input (Output) to Case | | 1600 | | | |
| Case grounding | | | | Connect case to -Vin with decoupling Y Cap | | | |
| Isolation resistance | 500VDC | | | | 1 | | GΩ |
| Isolation capacitance | | | | | | 2500 pF | |
| Switching frequency | | | | 270 | 300 | 330 kHz | |
| Safety approvals | IEC/ EN/ UL62368-1 | | | UL:E193009 CB: UL(Demko) | | | |
| Case material | | | | Nickel-coated copper | | | |
| Base material | | | | FR4 PCB | | | |
| Potting material | | | | Epoxy (UL94 V-0) | | | |
| Weight | | | | 60g (2.11oz) | | | |
| MTBF | MIL-HDBK-217F, Full load | | | 6.617 x 10 ⁵ hrs | | | |

| ENVIRONMENTAL SPECIFICATIONS | | | | | | |
|-------------------------------|-------------------|--|--|--------------|------|-----------|
| Parameter | Conditions | | | Min. | Typ. | Max. Unit |
| Operating ambient temperature | Without derating | | | -40 | | +50 °C |
| | With derating | | | +50 | | +105 °C |
| Maximum case temperature | | | | | | 105 °C |
| Over temperature protection | | | | | 110 | °C |
| Storage temperature range | | | | -55 | | +125 °C |
| Thermal impedance | Without heat-sink | | | | 9.2 | °C/W |
| | With heat-sink | | | | 7.6 | |
| Thermal shock | | | | MIL-STD-810F | | |
| Vibration | | | | MIL-STD-810F | | |
| Relative humidity | | | | 5% to 95% RH | | |

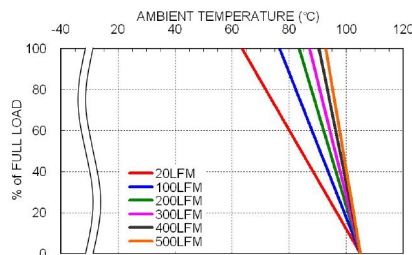
| EMC SPECIFICATIONS | | |
|--------------------------------|-------------|---------------------------------------|
| Parameter | Conditions | Level |
| EMI | EN55032 | With external components |
| EMS | EN55024 | |
| ESD | EN61000-4-2 | Air ± 8 kV and Contact ± 6 kV |
| Radiated immunity | EN61000-4-3 | 10 V/m |
| Fast transient | EN61000-4-4 | ± 2 kV |
| Surge | EN61000-4-5 | ± 1 kV |
| Conducted immunity | EN61000-4-6 | 10 Vr.m.s |
| Power frequency magnetic field | EN61000-4-8 | 100A/m continuous; 1000A/m 1 second |

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

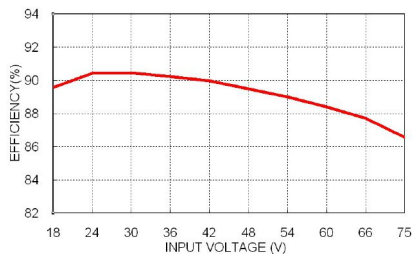
CHARACTERISTIC CURVE



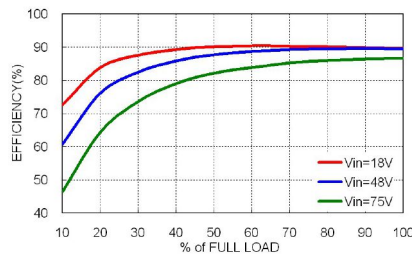
FEC40-48S05W Derating Curve



FEC40-48S05W Derating Curve With Heat-sink



FEC40-48S05W Efficiency vs. Input Voltage



FEC40-48S05W Efficiency vs. Output Load

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.

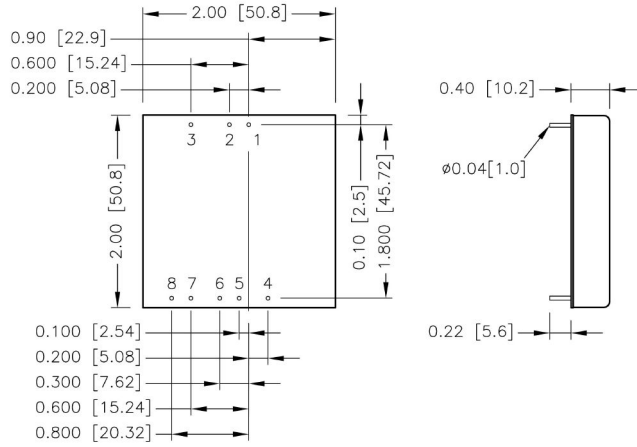
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below :

| Model | Fuse Rating (A) | Fuse Type |
|-----------------------------|-----------------|-------------|
| FEC40-24S□□W · FEC40-24D□□W | 8 | Fast-Acting |
| FEC40-48S□□W · FEC40-48D□□W | 4 | 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



BOTTOM VIEW

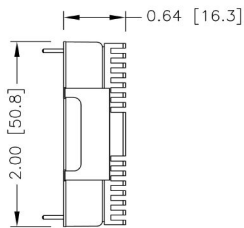
PIN CONNECTION

| PIN | SINGLE | DUAL |
|-----|--------|--------|
| 1 | +Vin | +Vin |
| 2 | -Vin | -Vin |
| 3 | Ctrl | Ctrl |
| 4 | -Sense | +Vout |
| 5 | +Sense | Common |
| 6 | +Vout | Common |
| 7 | -Vout | -Vout |
| 8 | Trim | Trim |

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 dimension tolerance ±0.004[0.10]

HEAT-SINK OPTIONS

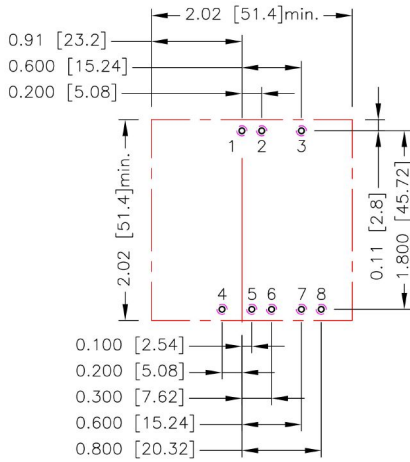
-HC (Heat-sink with clamps)



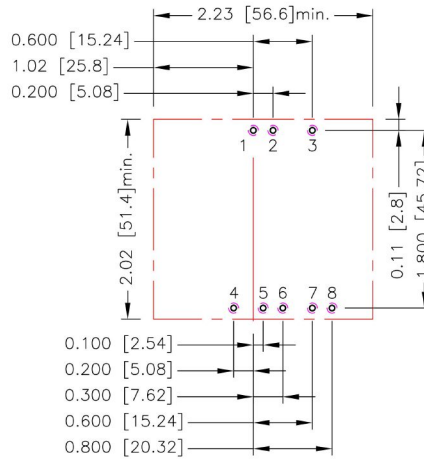
* All dimensions in inch [mm]

RECOMMENDED PAD LAYOUT

Standard



-HC

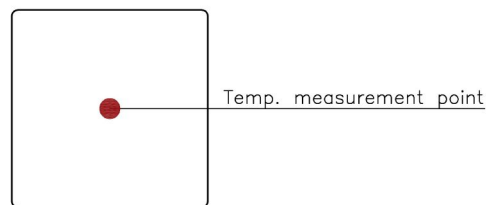


All dimensions in inch[mm]
 Pad size(lead free recommended)
 Through hole 1.2.3.4.5.6.7.8: $\varnothing 0.051[1.30]$
 Top view pad 1.2.3.4.5.6.7.8: $\varnothing 0.064[1.63]$
 Bottom view pad 1.2.3.4.5.6.7.8: $\varnothing 0.102[2.60]$

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).



TOP VIEW

OUTPUT VOLTAGE ADJUSTMENT

Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of the module.

Single Output

This is accomplished by connecting an external resistor between the Trim pin and either the +Sense or -Sense pins.

With an external resistor between the Trim and -Sense, the output voltage set point increases.

With an external resistor between the Trim and +Sense, the output voltage set point decreases.

The external Trim resistor needs to be at least 1/16W of rated power.

Dual Output

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 -Output pin, the output voltage set point increases.

With an external resistor between the Trim and +Output pin, the output voltage set point decreases.

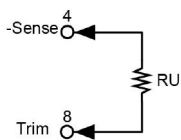
The external TRIM resistor needs to be at least 1/16W resistors.

EXTERNAL OUTPUT TRIMMING

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

Trim-up

Single Output



□□S3P3W

| ΔV (%) | 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 Ω) | 57.930 | 26.165 | 15.577 | 10.283 | 7.106 | 4.988 | 3.476 | 2.341 | 1.459 | 0.753 |

□□S05W

| ΔV (%) | 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 Ω) | 36.570 | 16.580 | 9.917 | 6.585 | 4.586 | 3.253 | 2.302 | 1.588 | 1.032 | 0.588 |

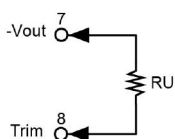
□□S12W

| ΔV (%) | 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 Ω) | 367.910 | 165.950 | 98.636 | 64.977 | 44.782 | 31.318 | 21.701 | 14.488 | 8.879 | 4.391 |

□□S15W

| ΔV (%) | 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 Ω) | 404.180 | 180.590 | 106.060 | 68.796 | 46.437 | 31.531 | 20.883 | 12.898 | 6.687 | 1.718 |

Dual Output



□□D12W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|-------------|------------|
| Vout (V) | ± 12.12 | ± 12.24 | ± 12.36 | ± 12.48 | ± 12.6 | ± 12.72 | ± 12.84 | ± 12.96 | ± 13.08 | ± 13.2 |
| RU (k Ω) | 218.21 | 98.105 | 58.07 | 38.052 | 26.042 | 18.035 | 12.316 | 8.026 | 4.69 | 2.021 |

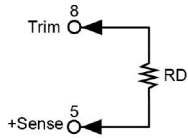
□□D15W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|
| Vout (V) | ± 15.15 | ± 15.3 | ± 15.45 | ± 15.6 | ± 15.75 | ± 15.9 | ± 16.05 | ± 16.2 | ± 16.35 | ± 16.5 |
| RU (k Ω) | 268.29 | 120.64 | 71.429 | 46.822 | 32.058 | 22.215 | 15.184 | 9.911 | 5.81 | 2.529 |

OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

Trim-down

Single Output



□□S3P3W

| ΔV (%) | 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 Ω) | 69.470 | 31.235 | 18.490 | 12.117 | 8.294 | 5.745 | 3.924 | 2.559 | 1.497 | 0.647 |

□□S05W

| ΔV (%) | 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 Ω) | 45.533 | 20.612 | 12.306 | 8.152 | 5.660 | 3.999 | 2.812 | 1.922 | 1.230 | 0.676 |

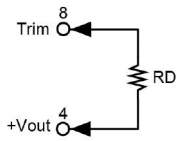
□□S12W

| ΔV (%) | 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 Ω) | 460.990 | 207.950 | 123.600 | 81.423 | 56.118 | 39.249 | 27.199 | 18.162 | 11.132 | 5.509 |

□□S15W

| ΔV (%) | 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 Ω) | 499.820 | 223.410 | 131.270 | 85.204 | 57.563 | 39.136 | 25.974 | 16.102 | 8.424 | 2.282 |

Dual Output



□□D12W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|-------------|-------------|-------------|-------------|------------|-------------|-------------|-------------|-------------|------------|
| Vout (V) | ± 11.88 | ± 11.76 | ± 11.64 | ± 11.52 | ± 11.4 | ± 11.28 | ± 11.16 | ± 11.04 | ± 10.92 | ± 10.8 |
| RD (k Ω) | 273.44 | 123.02 | 72.874 | 47.803 | 32.76 | 22.732 | 15.568 | 10.196 | 6.017 | 2.675 |

□□D15W

| ΔV (%) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|------------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|-------------|------------|
| Vout (V) | ± 14.85 | ± 14.7 | ± 14.55 | ± 14.4 | ± 14.25 | ± 14.1 | ± 13.95 | ± 13.8 | ± 13.65 | ± 13.5 |
| RD (k Ω) | 337.71 | 152.02 | 90.126 | 59.178 | 40.609 | 28.23 | 19.387 | 12.756 | 7.598 | 3.471 |