

FEC40 SERIES

DC-DC CONVERTER

2:1 WIDE INPUT RANGE
UP TO 40Watts



FEATURES

- 1600VDC INPUT TO OUTPUT ISOLATION
- STANDARD 2.00 X 2.00 X 0.40 INCH
- SIX-SIDED CONTINUOUS SHIELD
- UL60950-1, EN60950-1, & IEC60950-1 SAFETY APPROVALS
- 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 |
|-------------------|----------------|-----|-----|-----|-----|-----|

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 (2) |
|---------------|-------------|----------------|----------------------------|-----------------|-------------------------|------------|----------------------------|
| | VDC | VDC | Min. Load (1) mA | Full Load mA | mA | % | µF |
| FEC40-12S1P5 | 9 ~ 18 | 1.5 | 0 | 8000 | 110 | 84 | 45000 |
| FEC40-12S1P8 | 9 ~ 18 | 1.8 | 0 | 8000 | 110 | 82 | 37700 |
| FEC40-12S2P5 | 9 ~ 18 | 2.5 | 0 | 8000 | 110 | 84 | 27000 |
| FEC40-12S3P3 | 9 ~ 18 | 3.3 | 0 | 8000 | 175 | 86 | 21000 |
| FEC40-12S05 | 9 ~ 18 | 5 | 0 | 8000 | 225 | 86 | 13600 |
| FEC40-12S12 | 9 ~ 18 | 12 | 0 | 3333 | 255 | 86 | 2360 |
| FEC40-12S15 | 9 ~ 18 | 15 | 0 | 2666 | 310 | 87 | 1510 |
| FEC40-12D12 | 9 ~ 18 | ±12 | ±144 | ±1800 | 30 | 85 | ±1200 |
| FEC40-12D15 | 9 ~ 18 | ±15 | ±112 | ±1400 | 35 | 85 | ±750 |
| FEC40-12D3305 | 9 ~ 18 | 3.3 / 5 | 0 | 4000 / 4000(3) | 325 | 85 | 11000 / 6800 |
| FEC40-12T3312 | 9 ~ 18 | 3.3 / ±12 | 600 / ±40 | 6000 / ±400 | 215 | 84 | 13000 / ±330 |
| FEC40-12T3315 | 9 ~ 18 | 3.3 / ±15 | 600 / ±30 | 6000 / ±300 | 230 | 84 | 13000 / ±110 |
| FEC40-12T0512 | 9 ~ 18 | 5 / ±12 | 600 / ±40 | 6000 / ±400 | 280 | 86 | 6800 / ±330 |
| FEC40-12T0515 | 9 ~ 18 | 5 / ±15 | 600 / ±30 | 6000 / ±300 | 255 | 86 | 6800 / ±110 |
| FEC40-24S1P5 | 18 ~ 36 | 1.5 | 0 | 8000 | 40 | 81 | 45000 |
| FEC40-24S1P8 | 18 ~ 36 | 1.8 | 0 | 8000 | 40 | 83 | 37700 |
| FEC40-24S2P5 | 18 ~ 36 | 2.5 | 0 | 8000 | 40 | 86 | 27000 |
| FEC40-24S3P3 | 18 ~ 36 | 3.3 | 0 | 8000 | 60 | 87 | 21000 |
| FEC40-24S05 | 18 ~ 36 | 5 | 0 | 8000 | 80 | 89 | 13600 |
| FEC40-24S12 | 18 ~ 36 | 12 | 0 | 3333 | 70 | 88 | 2360 |
| FEC40-24S15 | 18 ~ 36 | 15 | 0 | 2666 | 85 | 89 | 1510 |
| FEC40-24D12 | 18 ~ 36 | ±12 | ±144 | ±1800 | 20 | 87 | ±1200 |
| FEC40-24D15 | 18 ~ 36 | ±15 | ±112 | ±1400 | 20 | 87 | ±750 |
| FEC40-24D3305 | 18 ~ 36 | 3.3 / 5 | 0 | 4000 / 4000(3) | 80 | 86 | 11000 / 6800 |
| FEC40-24T3312 | 18 ~ 36 | 3.3 / ±12 | 600 / ±40 | 6000 / ±400 | 65 | 85 | 13000 / ±330 |
| FEC40-24T3315 | 18 ~ 36 | 3.3 / ±15 | 600 / ±30 | 6000 / ±300 | 65 | 85 | 13000 / ±110 |
| FEC40-24T0512 | 18 ~ 36 | 5 / ±12 | 600 / ±40 | 6000 / ±400 | 60 | 87 | 6800 / ±330 |
| FEC40-24T0515 | 18 ~ 36 | 5 / ±15 | 600 / ±30 | 6000 / ±300 | 75 | 87 | 6800 / ±110 |
| FEC40-48S1P5 | 36 ~ 75 | 1.5 | 0 | 8000 | 25 | 82 | 45000 |
| FEC40-48S1P8 | 36 ~ 75 | 1.8 | 0 | 8000 | 25 | 84 | 37700 |
| FEC40-48S2P5 | 36 ~ 75 | 2.5 | 0 | 8000 | 25 | 86 | 27000 |
| FEC40-48S3P3 | 36 ~ 75 | 3.3 | 0 | 8000 | 35 | 88 | 21000 |
| FEC40-48S05 | 36 ~ 75 | 5 | 0 | 8000 | 40 | 90 | 13600 |
| FEC40-48S12 | 36 ~ 75 | 12 | 0 | 3333 | 50 | 89 | 2360 |
| FEC40-48S15 | 36 ~ 75 | 15 | 0 | 2666 | 50 | 89 | 1510 |
| FEC40-48D12 | 36 ~ 75 | ±12 | ±144 | ±1800 | 15 | 87 | ±1200 |
| FEC40-48D15 | 36 ~ 75 | ±15 | ±112 | ±1400 | 15 | 87 | ±750 |
| FEC40-48D3305 | 36 ~ 75 | 3.3 / 5 | 0 | 4000 / 4000(3) | 45 | 88 | 11000 / 6800 |
| FEC40-48T3312 | 36 ~ 75 | 3.3 / ±12 | 600 / ±40 | 6000 / ±400 | 35 | 86 | 13000 / ±330 |
| FEC40-48T3315 | 36 ~ 75 | 3.3 / ±15 | 600 / ±30 | 6000 / ±300 | 35 | 86 | 13000 / ±110 |
| FEC40-48T0512 | 36 ~ 75 | 5 / ±12 | 600 / ±40 | 6000 / ±400 | 30 | 88 | 6800 / ±330 |
| FEC40-48T0515 | 36 ~ 75 | 5 / ±15 | 600 / ±30 | 6000 / ±300 | 40 | 88 | 6800 / ±110 |

PART NUMBER STRUCTURE

FEC40 - 48 S 05 - HS

| Series Name | Input Voltage (VDC) | Output Quantity | Output Voltage (VDC) | Assembly Option |
|-------------|------------------------------------|-----------------|---|--|
| | 12: 9-18 24: 18-36 48: 36-75 | S: Single | 1P5: 1.5 1P8: 1.8 2P5: 2.5 3P3: 3.3 05: 5 12: 12 15: 15 | <input type="checkbox"/> : None HS: Heat-sink HC: Heat-sink with Clamp |
| | | D: Dual | 12: ±12 15: ±15 | |
| | | Dual Positive | 3305: 3.3 / 5 | |
| | | T: Triple | 3312: 3.3 / ±12 3315: 3.3 / ±15 0512: 5 / ±12 0515: 5 / ±15 | |

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 | |
| Input reflected ripple current | Nominal input and Full load | | 40 | | mAp-p |
| Start-up voltage | 12Vin(nom) | | | 9 | VDC |
| | 24Vin(nom) | | | 17.8 | |
| | 48Vin(nom) | | | 36 | |
| Shutdown voltage | 12Vin(nom) | | 8 | | VDC |
| | 24Vin(nom) | | 16 | | |
| | 48Vin(nom) | | 34 | | |
| Start up time | Constant resistive load | | 25 | | ms |
| Input surge voltage | 12Vin(nom) | | | 36 | VDC |
| | 24Vin(nom) | | | 50 | |
| | 48Vin(nom) | | | 100 | |
| Input filter | | | L-C type | | |
| Remote ON/OFF | Referred to -Vin pin | Positive logic DC-DC ON | | Open or 3.5 ~ 12VDC | |
| | | DC-DC OFF | | Short or 0 ~ 1.2VDC | |
| | | Input current of Ctrl pin | -0.5 | +0.5 | mA |
| | | Remote off input current | 2.5 | | mA |

OUTPUT SPECIFICATIONS

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---------------------------|---|--|------------------------|------|-------|
| Voltage accuracy | Single / Dual | -1.0 | | +1.0 | % |
| | Triple: 3.3Vout, 5Vout | -1.0 | | +1.0 | |
| | Triple: 12Vout, 15Vout | -5.0 | | +5.0 | |
| Line regulation | Low Line to High Line at Full Load | Single / Dual | -0.5 | +0.5 | % |
| | | Triple: 3.3Vout, 5Vout | -1.0 | +1.0 | |
| | | Triple: 12Vout, 15Vout | -5.0 | +5.0 | |
| Load regulation | Single / Dual: Min. Load to Full Load | Single | -0.5 | +0.5 | % |
| | | Dual | -1.0 | +1.0 | |
| | | Triple: Main output: (3.3Vout, 5Vout) 10% to 100% with 10% to 100% balanced on auxiliaries. Auxiliary outputs 10% to 100% balanced on all outputs. | Triple: 3.3Vout, 5Vout | -2.0 | |
| | | Triple: 12Vout, 15Vout | -5.0 | +5.0 | |
| Cross regulation | Dual: Asymmetrical load 25%/100% FL Triple: Main output:(3.3Vout, 5Vout) 100% load, auxiliary 100%, other auxiliary 25% to 100% load or main output:(3.3Vout, 5Vout) 25%, auxiliary 25%, other auxiliary 25% to 100%. | Dual | -5.0 | +5.0 | % |
| | | Triple: 3.3Vout, 5Vout | -1.0 | +1.0 | |
| | | Triple: 12Vout, 15Vout | -5.0 | +5.0 | |
| Voltage adjustability (4) | Single and Dual output (not including Dual Positive and triple) | -10 | | +10 | % |
| Ripple and noise | Measured by 20MHz bandwidth With a 0.1µF/50V MLCC | Single | Others | 50 | mVp-p |
| | | | 12Vout, 15Vout | 75 | |
| | | Dual | 12Vout | 120 | |
| | | | 15Vout | 150 | |
| | | Triple | 3.3Vout, 5Vout | 50 | |
| | 12Vout, 15Vout | 75 | | | |
| | With a 1µF ceramic output capacitors | Dual Positive | 3.3Vout, 5Vout | 100 | |

OUTPUT SPECIFICATIONS

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|----------------------------------|----------------------|--------------------------------|------|----------|------|
| Temperature coefficient | | -0.02 | | +0.02 | %/°C |
| Transient response recovery time | 25% load step change | | 250 | | µs |
| Over voltage protection | Zener diode clamp | 1.5Vout | | 3.9 | VDC |
| | | 1.8Vout | | 3.9 | |
| | | 2.5Vout | | 3.9 | |
| | | 3.3Vout | | 3.9 | |
| | | 5Vout | | 6.2 | |
| | | 12Vout 15Vout | | 15 18 | |
| Over load protection | % of lout rated | | | 150 | % |
| Short circuit protection | | Continuous, automatic recovery | | | |

GENERAL SPECIFICATIONS

| Parameter | Conditions | Min. | Typ. | Max. | Unit | |
|-----------------------|--------------------------|---------|------|------|--------------------------------------|-----|
| Isolation voltage | 1 minute | 1600 | | | VDC | |
| | | 1600 | | | | |
| Isolation resistance | 500VDC | 1 | | | GΩ | |
| Isolation capacitance | | | | 1000 | pF | |
| Switching frequency | Others Dual Positive | 5Vout | 270 | 300 | 330 | kHz |
| | | 3.3Vout | 270 | 300 | 330 | |
| | | | 450 | 500 | 550 | |
| Safety approvals | | | | | UL60950-1 EN60950-1 IEC60950-1 | |
| 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 | | | | 9.224 x 10 ⁵ hrs | |

ENVIRONMENTAL SPECIFICATIONS

| Parameter | Conditions | Min. | Typ. | Max. | Unit |
|-------------------------------|--|-------------------------|------|------|--------------|
| Operating ambient temperature | With derating | -40 | | +85 | °C |
| Maximum case temperature | | | | +100 | °C |
| Over temperature protection | | | +115 | | °C |
| Storage temperature range | | -55 | | +125 | °C |
| Thermal impedance | Vertical direction by natural convection (20LFM) | Without heat-sink | | 9.2 | °C/W |
| | | With heat-sink | | 7.6 | |
| | | With heat-sink (500LFM) | | 2.8 | |
| Thermal shock | | | | | MIL-STD-810F |
| Vibration | | | | | MIL-STD-810F |
| Relative humidity | | | | | 5% to 95% RH |

EMC SPECIFICATIONS

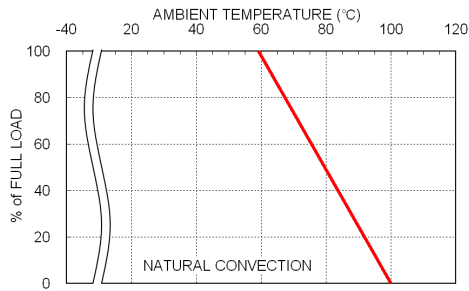
| Parameter | Conditions | Level |
|--------------------------------|---|------------------|
| EMI ⁽⁵⁾ | EN55022 | Class A, Class B |
| ESD | EN61000-4-2 Air ± 8kV and Contact ± 6kV | Perf. Criteria B |
| Radiated immunity | EN61000-4-3 10 V/m | Perf. Criteria A |
| Fast transient ⁽⁶⁾ | EN61000-4-4 ± 2kV | Perf. Criteria B |
| Surge ⁽⁶⁾ | EN61000-4-5 ± 1kV | Perf. Criteria B |
| 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:

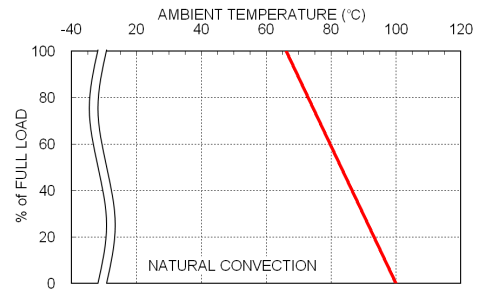
- The output requires a minimum loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.
- Test by minimum input and constant resistive load.
- Any condition of dual output (3.3Vout, 5Vout) rated lout current, not to exceed 8A of total output currents.
- For the single output: Maximum output deviation is 10% inclusive of remote sense and trim. If remote sense is not being used, the +Sense should be connected to its corresponding +Vout and likewise the -Sense should be connected to its corresponding -Vout.
- The standard module meet EN55022 Class A and Class B with external components. For further information, please contact with P-DUKE.
- An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5. The filter capacitor P-DUKE suggest: Nippon chemi-con KY series, 220µF/100V.

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

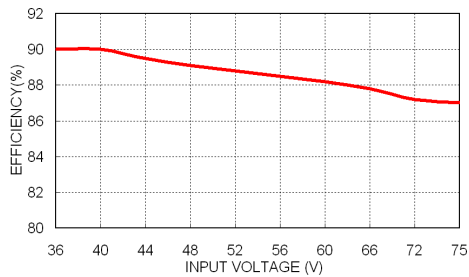
CHARACTERISTIC CURVE



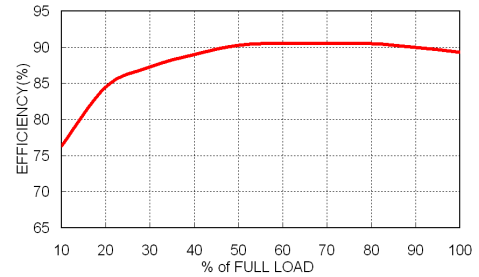
FEC40-48S05 Derating Curve



FEC40-48S05 Derating Curve With Heat-sink

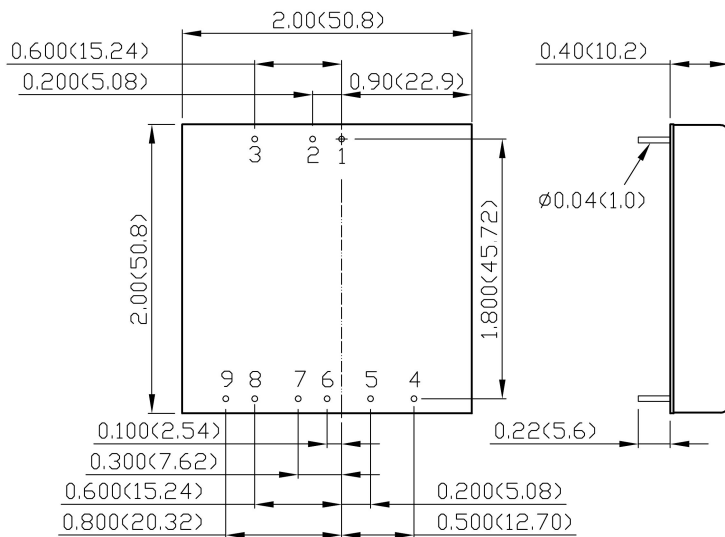


FEC40-48S05 Efficiency vs. Input Voltage



FEC40-48S05 Efficiency vs. Output Load

MECHANICAL DRAWING



BOTTOM VIEW

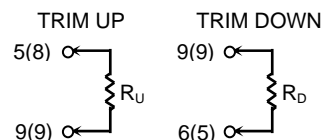
PIN CONNECTION

| PIN | SINGLE | DUAL | DUAL POSITIVE | TRIPLE |
|-----|-----------------------|--------|---------------|--------|
| 1 | +Vin | +Vin | +Vin | +Vin |
| 2 | -Vin | -Vin | -Vin | -Vin |
| 3 | Ctrl | Ctrl | Ctrl | Ctrl |
| 4 | NC | No pin | 3.3Vout | +Aux |
| 5 | -Sense ⁽⁴⁾ | +Vout | Common | Common |
| 6 | +Sense ⁽⁴⁾ | Common | NC | -Aux |
| 7 | +Vout | Common | NC | +Vout |
| 8 | -Vout | -Vout | 5Vout | Common |
| 9 | Trim | Trim | Common | NC |

* NC : No Connection

EXTERNAL OUTPUT TRIMMING

Output can be externally trimmed by using the method shown below. () for dual output trim.



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