POWER MATE TECHNOLOGY CO.,LTD.

# FEC60 SERIES

## FEATURES

- 60 WATTS MAXIMUM OUTPUT POWER
- SINGLE OUTPUT UP TO 14A
- STANDARD 2.0 X 2.0 X 0.4 INCH PACKAGE
- HIGH EFFICIENCY UP TO 90%
- 2:1 WIDE INPUT VOLTAGE RANGE
- SIX-SIDED CONTINUOUS SHIELD
- FIXED SWITCHING FREQUENCY
- APPROVED FOR BASIC INSULATION
- NO MINIMUM LOAD REQUIRED
- CE MARK MEETS 2006/95/EC, 93/68/EEC AND 2004/108/EC
- UL60950-1, EN60950-1 AND IEC60950-1 LICENSED
- ISO9001 CERTIFIED MANUFACTURING FACILITIES
- COMPLIANT TO RoHS EU DIRECTIVE 2002/95/EC

## APPLICATIONS

Wireless Network
Telecom/Datacom
Industry Control System
Measurement Equipment
Semiconductor Equipment

## OPTIONS

Negative logic Remove On/Off

## DESCRIPTION

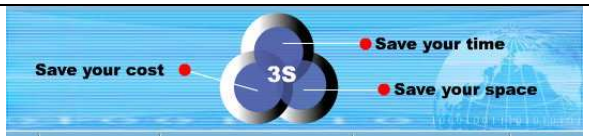
The FEC60 series offer 60 watts of output power from a 2.00 x 2.00 x 0.4 inch package. The FEC60 series with 2:1 wide input voltage of 18-36VDC and 36-75VDC and features 1600VDC of isolation, short-circuit and over-voltage protection.

## TECHNICAL SPECIFICATION

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

| OUTPUT SPECIFICATIONS | | |
|---|---|---|
| Output power | | 60 Watts, max. |
| Voltage accuracy | FL and nominal Vin | ± 1% |
| Minimum load | | 0% |
| Voltage adjustability (Note 6) | | ± 10% |
| Line regulation | LL to HL at Full Load | ± 0.2% |
| Load regulation | No Load to Full Load | ± 0.5% |
| Temperature coefficient | | ±0.02% / ºC, max. |
| Transient response recovery time | 25% load step change | 250µS |
| Over voltage protection (Voltage clamped) | 3.3V output<br>5V output<br>12V output<br>15V output | 3.7VDC-5.4VDC<br>5.6VDC-7.0VDC<br>13.8VDC-17.5VDC<br>16.8VDC-20.5VDC |
| Over load protection | % of FL at nominal input | 150%, max. |
| Short circuit protection | | Hiccup, automatics recovery |

| GENERAL SPECIFICATIONS | | |
|---|---|---|
| Efficiency | | See table |
| Isolation voltage (Basic insulation) | Input to Output<br>Input(Output) to Case | 1600VDC, min.<br>1600VDC, min. |
| Case grounding | | Connect case to –Vin with decoupling Y Cap |
| Isolation resistance | | $10^9$ ohms, min. |
| Isolation capacitance | | 1500pF, max. |
| Switching frequency | | 300KHz, typ. |
| Approvals and standard | | IEC60950-1, UL60950-1, EN60950-1 |
| Case material | | Nickel-coated copper |
| Base material | | FR4 PCB |
| Potting material | | Epoxy (UL94-V0) |
| Dimensions | | 2.00 X 2.00 X 0.40 Inch (50.8 X 50.8 X 10.2 mm) |
| Weight | | 60g (2.11oz) |
| MTBF (Note 1) | BELLCORE TR-NWT-000332<br>MIL-HDBK-217F | $1.093 \times 10^6$ hrs<br>$1.096 \times 10^5$ hrs |




| INPUT SPECIFICATIONS | | | |
|---|---|---|---|
| Input voltage range | 24V nominal input<br>48V nominal input | | 18 – 36VDC<br>36 – 75VDC |
| Input filter | | | Pi type |
| Input surge voltage 100mS max | 24V input<br>48V input | | 50VDC<br>100VDC |
| Input reflected ripple current | Nominal Vin and full load | | 20mAp-p |
| Start up time | Nominal Vin and constant resistive load | Power up<br>Remote ON/OFF | 20mS, max.<br>20mS, max. |
| Start-up voltage | 24V input<br>48V input | | 17V, typ.<br>34V, typ. |
| Shutdown voltage | 24V input<br>48V input | | 15V, typ.<br>32V, typ. |
| Remote ON/OFF (Note 7)<br>Positive logic (standard) | DC-DC ON<br>DC-DC OFF | | Open or 3V < Vr < 12V<br>Short or 0V < Vr < 1.2V |
| Negative logic (option) | DC-DC ON<br>DC-DC OFF | | Short or 0V < Vr < 1.2V<br>Open or 3V < Vr < 12V |
| Input current of Remote control pin | | Nominal Vin | -0.5mA~1.0mA |
| Remote off state input current | | Nominal Vin | 4mA |

| ENVIRONMENTAL SPECIFICATIONS | | |
|---|---|---|
| Operating ambient temperature (Note8) | | -40ºC ~ +40ºC (without derating)<br>+40ºC ~ +110ºC (with derating) |
| Maximum case temperature | | +110ºC |
| Storage temperature range | | -55ºC ~ +125ºC |
| Over temperature protection | | 120ºC, typ. |
| Thermal impedance (Note 9) | Without Heat-sink<br>With Heat-sink | 10.5ºC/Watt<br>8.4ºC/Watt |
| Thermal shock | | MIL-STD-810F |
| Vibration | | MIL-STD-810F |
| Relative humidity | | 5% to 95% RH |

| EMC CHARACTERISTICS | | | |
|---|---|---|---|
| EMI (Note 10) | EN55022 | | Class A |
| ESD | EN61000-4-2 | Air ± 8KV<br>Contact ± 6KV | Perf. Criteria A |
| Radiated immunity | EN61000-4-3 | 10 V/m | Perf. Criteria A |
| Fast transient (Note 11) | EN61000-4-4 | ± 2KV | Perf. Criteria A |
| Surge (Note 11) | EN61000-4-5 | ± 1KV | Perf. Criteria A |
| Conducted immunity | EN61000-4-6 | 10 Vr.m.s | Perf. Criteria A |

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# 60WATTS DC-DC CONVERTER

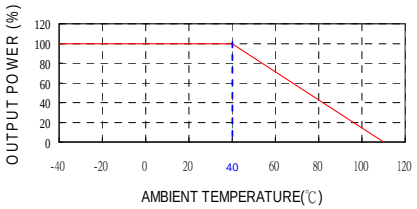


| Model Number | Input Range | Output Voltage | Output Current | | Output [4] Ripple & Noise | Input Current | | Eff [4] (%) | Capacitor [5] Load max |
|---|---|---|---|---|---|---|---|---|---|
| | | | Min. load | Full load | | No load[3] | Full load[2] | | |
| FEC60-24S3P3 | 18 – 36 VDC | 3.3 VDC | 0mA | 14000mA | 75mVp-p | 100mA | 2264mA | 89 | 36000μF |
| FEC60-24S05 | 18 – 36 VDC | 5 VDC | 0mA | 12000mA | 75mVp-p | 130mA | 2941mA | 90 | 20400μF |
| FEC60-24S12 | 18 – 36 VDC | 12 VDC | 0mA | 5000mA | 100mVp-p | 150mA | 2907mA | 90 | 3550μF |
| FEC60-24S15 | 18 – 36 VDC | 15 VDC | 0mA | 4000mA | 100mVp-p | 150mA | 2907mA | 90 | 2300μF |
| FEC60-48S3P3 | 36 – 75 VDC | 3.3 VDC | 0mA | 14000mA | 75mVp-p | 80mA | 1132mA | 89 | 36000μF |
| FEC60-48S05 | 36 – 75 VDC | 5 VDC | 0mA | 12000mA | 75mVp-p | 90mA | 1453mA | 90 | 20400μF |
| FEC60-48S12 | 36 – 75 VDC | 12 VDC | 0mA | 5000mA | 100mVp-p | 100mA | 1453mA | 90 | 3550μF |
| FEC60-48S15 | 36 – 75 VDC | 15 VDC | 0mA | 4000mA | 100mVp-p | 100mA | 1453mA | 90 | 2300μF |

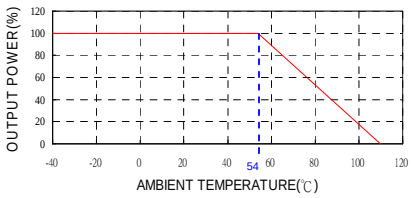
Note

1. BELLCORE TR-NWT-000332. Case 1: 50% Stress, Temperature at 40ºC.
   MIL-HDBK-217F Notice2 @Ta=25 ºC, Full load(Ground, Benign, controlled environment)
2. Maximum value at nominal input voltage and full load.
3. Typical value at nominal input voltage and no load.
4. Typical value at nominal input voltage and full load.
5. Test by minimum Vin and constant resistive load.
6. 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 +OUTPUT and likewise the -sense should be connected to its corresponding –OUTPUT.
7. The ON/OFF control pin voltage is referenced to –Vin.
   To order negative logic ON/OFF control add the suffix-N (Ex: FEC60-48S05-N).
8. Test condition with vertical direction by natural convection.
9. Heat sink is optional and P/N：7G-0026C-F.
10. The FEC60 series can meet EN55022 Class A with parallel an external capacitor to the input pins.
    Recommend: 24Vin : 6.8μF/50V 1812 MLCC
    48Vin : 2.2μF/100V*2 PCS 1812 MLCC.
11. An external input filter capacitor is required if the module has to meet EN61000-4-4, EN61000-4-5.
    The filter capacitor Power Mate suggest: Nippon chemi-con KY series, 220μF/100V, ESR 48mΩ.

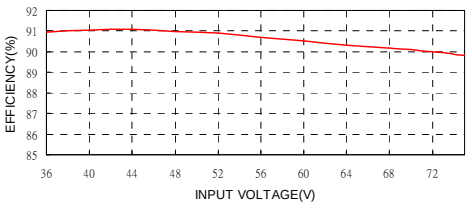
FEC60-48S05 DERATING CURVE



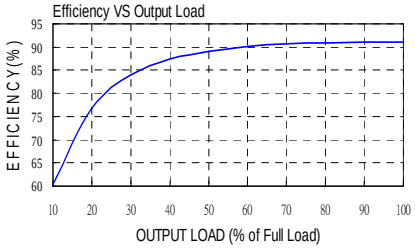

FEC60-48S05 DERATING CURVE
WITH HEATSINK (Note 9)




FEC60-48S05
Efficiency VS Input voltage




FEC60-48S05
Efficiency VS Output Load



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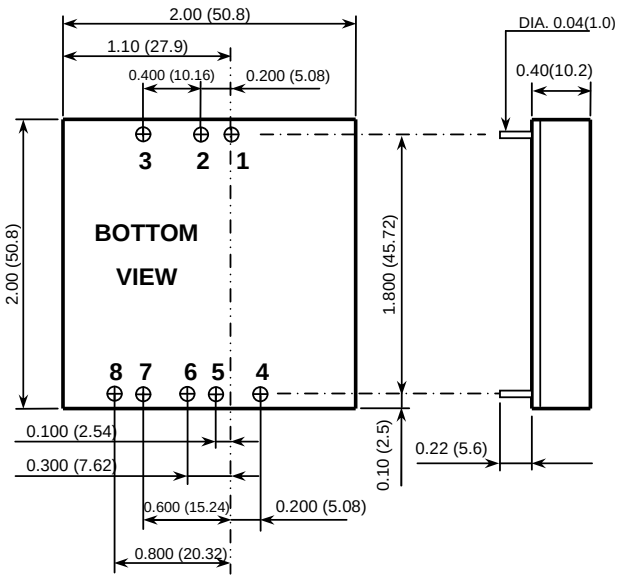
# 60WATTS DC-DC CONVERTER



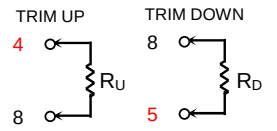


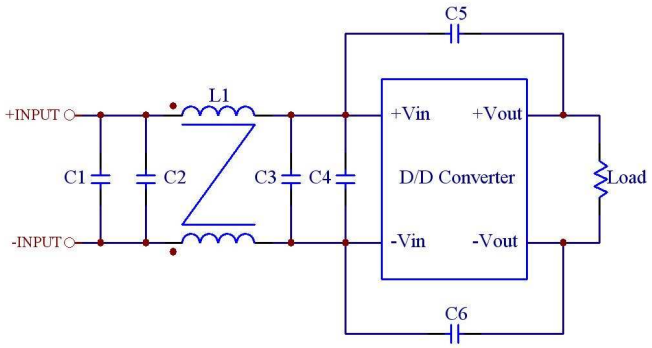

1. All dimensions in Inches (mm)
   Tolerance: X.XX±0.02 (X.X±0.5)
   X.XXX±0.01 (X.XX±0.25)
2. Pin pitch tolerance ±0.01(0.25)
3. Pin dimension tolerance ±0.004 (0.1)

| PIN CONNECTION | |
|---|---|
| PIN | SINGLE |
| 1 | +INPUT |
| 2 | -INPUT |
| 3 | CTRL |
| 4 | -SENSE |
| 5 | +SENSE |
| 6 | +OUTPUT |
| 7 | -OUTPUT |
| 8 | TRIM |

**EXTERNAL OUTPUT TRIMMING**

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

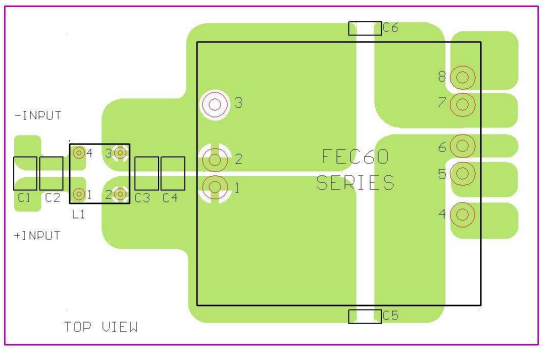



**Recommended Filter for EN55022 Class B Compliance**

The components used in the above figure, together with the manufacturers' part numbers for these components, are as follows:

| | C1 | C2 | C3 | C4 | C5 & C6 | L1 |
|---|---|---|---|---|---|---|
| FEC60-24xxx | 4.7μF/50V 1812MLCC | N/A | 4.7μF/50V 1812MLCC | N/A | 1000pF/2KV MLCC | 450μH Common Choke PMT-048 |
| FEC60-48xxx | 2.2μF/100V 1812MLCC | 2.2μF/100V 1812MLCC | 2.2μF/100V 1812MLCC | N/A | 1000pF/2KV MLCC | 830μH Common Choke PMT-053 |




**Recommended EN55022 Class B Filter Circuit Layout**

PEWATRON
a member of the Angst + Pfister Group

# We are here for you. Addresses and Contacts

## Sales Switzerland

Postcode 3000 – 9999
Liechtenstein

Matthias Rüegg
Ruhbergstrasse 32
CH-9230 Flawil

Phone + 41 44 877 35 18
Mobile + 41 76 491 66 66
Fax + 41 44 877 35 19

matthias.rueegg@pewatron.com

Postcode 1000 – 2999

Raffael Favaretto
Route d'Oron 124
CH-1673 Promasens

Phone + 41 44 877 35 22
Mobile + 41 76 444 63 14
Fax + 41 44 877 35 23

raffael.favaretto@pewatron.com

## Sales Germany

Postcode 60000 – 79999

Dieter Hirthe
Mühlweg 23
D-71554 Weissach i.T.

Phone + 49 719 149 60 58
Mobile + 49 163 762 74 30
Fax + 49 719 193 31 88

dieter.hirthe@pewatron.com

Postcode 10000 – 59999
Postcode 80000 – 99999

Kurt Stritzelberger
Neumarkter Str. 86a
D-81673 Munich

Phone + 49 89 260 38 47
Mobile + 49 171 803 41 35
Fax + 49 89 43 10 91 91

kurt.stritzelberger@pewatron.com

Key Accounts
Aerospace and Defence

Claus Wübbena
Vogelkamp 26
D-26655 Westerstede

Phone + 49 4488 5204 614
Mobile + 49 173 9700 691
Fax + 49 4488 5204 616

claus.wuebbena@pewatron.com

## Sales Austria

Kurt Stritzelberger
Neumarkter Str. 86a
D-81673 Munich

Phone + 49 89 260 38 47
Mobile + 49 17 18 03 41 35
Fax + 49 89 43 10 91 91

kurt.stritzelberger@pewatron.com

## Sales Other Countries / Product Management

### Sensors

Physical Sensors
Data Acquisition

Peter Felder
Phone + 41 44 877 35 05
peter.felder@pewatron.com

Geometrical Sensors

Eric Letsch
Phone + 41 44 877 35 14
eric.letsch@pewatron.com

### Power Supplies

DC-DC Converters
Switching Power Supplies
DC-AC Inverters

Sebastiano Leggio
Phone + 41 44 877 35 06
sebastiano.leggio@pewatron.com

### E-Components

Current Sensors
Man Machine Interface
Measurement Probes

Sebastiano Leggio
Phone + 41 44 877 35 06
sebastiano.leggio@pewatron.com

PEWATRON AG
Thurgauerstrasse 66
CH-8052 Zurich

Phone + 41 44 877 35 00
Fax + 41 44 877 35 25

www.pewatron.com
info@pewatron.com