

FEC60 SERIES

DC / DC Single Output: 60 Watts



Features

- 2:1 input range
- 24V and 48V input options
- Single output
- 60 watts output power
- Six-Sided continuous shield
- High efficiency up to 90%
- Industry standard package
- Fixed switching efficiency
- High isolation 1600VDC
- Output voltage trim
- Overload & Overvoltage protection
- Remote ON/OFF

Specifications

| | |
|---|--|
| Input Voltage | 24VDC (18 ~ 36) 48VDC (36 ~75) |
| Input Filter | Pi type |
| Input Surge Voltage. (100mS) | 24V: 50VDC, 48V: 100VDC |
| Input Reflected Ripple Current | 20mA pk-pk (@ nominal input & 100% load |
| Start Up time | Typically 20mS constant resistive load |
| Start UP Voltage | 24V input typ 17V, 48V input: typ 34V |
| Shutdown Voltage | 24V input: 17V, 48V input: 32V. |
| Remote ON/OFF Positive logic -Standard | DC-DC ON Open or $3.5V < V_r < 12V$ DC-DC OFF Short or $0V < V_r < 1.2V$ Input current of remote control pin: 30mA |
| Remote ON/OFF Negative logic - Option | DC-DC ON Short or $0V < V_r < 1.2V$ DC-DC OFF Open or $3V < V_r < 1.2V$ Input current of remote control pin: 4mA |
| Output power | 60 watts |
| Voltage Accuracy | $\pm 1\%$ |
| Voltage Trim | $\pm 10\%$ (24V output: +20% -10%) |
| Minim Load | Zero |
| Line Regulation | $\pm 0.2\%$ |
| Load Regulation | $\pm 0.5\%$ (0% to 100% load) |
| Ripple & noise | 750 ~ 100mV. 20MHZ bandwidth |
| Temp. Coefficient | $\pm 0.02\%$ / °C |
| Transient Response | 250uS (25% load step change) |
| Over voltage Protection (Zener Diode Clamp) | 3.3V: 3.7 ~ 5.4V 5.0V: 5.6 ~ 7.0V 12V: 13.8 ~ 17.5V 15V: 16.8 ~ 20.5V 24V: 30 ~ 33V |
| Overload Protection | Typically 150% of load |
| Short Circuit Protection | Hiccup, with auto recovery |

| | |
|---|--|
| Efficiency | 907% |
| Isolation | 1600VDC |
| Case Grounding | Connect case to -Vin with decoupling Cap. |
| Isolation Cap. | 1500pF |
| Switching Freq. | 300KHz |
| Safety | EN60950-1, UL60950-1 |
| Case Material | Nickel-coated copper |
| Base Material | Non-conductive black plastic |
| Potting | Epoxy UL94-V0 |
| Dimensions | 50.8 x 50.8 x 10.2mm |
| Weight | 60g |
| MTBF | 1.096 x 105 Hrs |
| Operating Temp (see note 8) | -40°C to +40°C (without derating) -40°C to +110°C (with derating) |
| Case Temp | +110°C maximum case temperate |
| Thermal Shutdown | At approximately 120°C |
| Thermal Impedance | 10.5°C / watt without Heat sink 8.4°C / watt without Heat sink |
| Thermal shock | MIL-STD-810F |
| Vibration | 10-55Hz, 10G, 30min along X, Y,Z |
| Humidity | 5-95% RH |
| EMC | EN55022 Class A |
| ESD | EN61000-4-2 $\pm 6KV$ contact |
| Radiated Immunity | EN61000-4-3 |
| Fast Transients | EN61000-4-4 $\pm 2KV$ |
| Surge | EN61000-4-5 $\pm 1KV$ |
| Conducted Immunity | EN61000-4-6 |

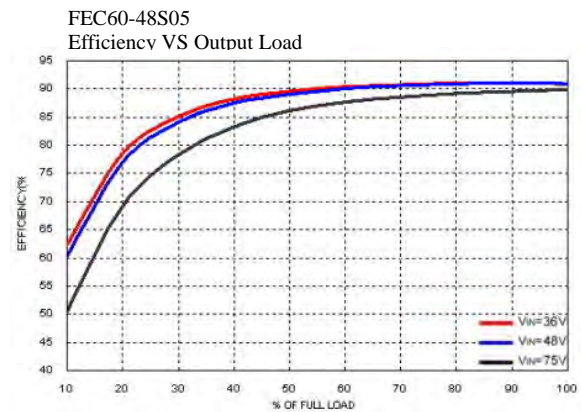
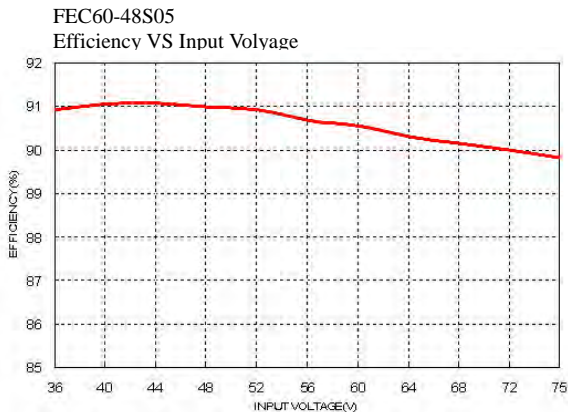
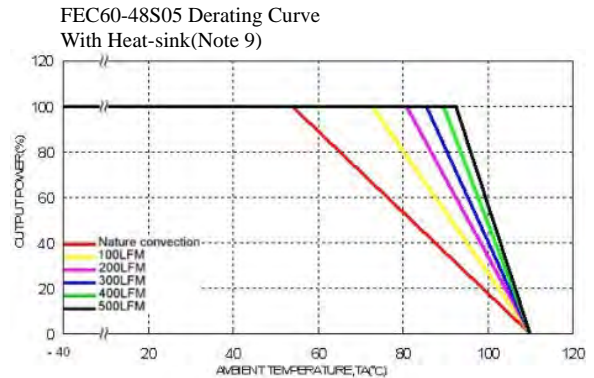
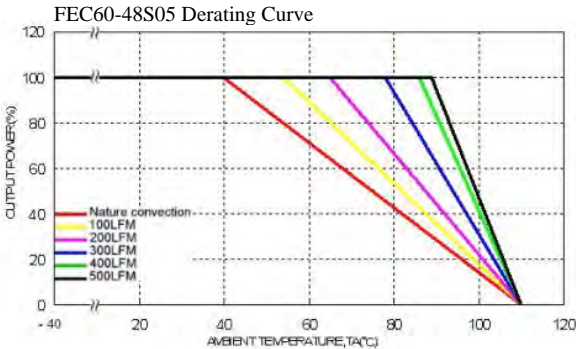
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| Model Number | Input Range | Output Voltage | Output Current | | Output ⁽⁴⁾ Ripple & Noise | Input Current | | Eff ⁽⁴⁾ (%) | Capacitor ⁽⁵⁾ Load max |
|--------------|-------------|----------------|----------------|-----------|---|------------------------|--------------------------|---------------------------|--------------------------------------|
| | | | Min. load | Full load | | No load ⁽³⁾ | Full load ⁽²⁾ | | |
| FEC60-24S3P3 | 18 ~ 36 V | 3.3 V | 0mA | 14000mA | 75mVp-p | 100mA | 2264mA | 89 | 36000μF |
| FEC60-24S05 | 18 ~ 36 V | 5 V | 0mA | 12000mA | 75mVp-p | 130mA | 2941mA | 90 | 20400μF |
| FEC60-24S12 | 18 ~ 36 V | 12 V | 0mA | 5000mA | 100mVp-p | 50mA | 2907mA | 90 | 3550μF |
| FEC60-24S15 | 18 ~ 36 V | 15 V | 0mA | 4000mA | 100mVp-p | 50mA | 2907mA | 90 | 2300μF |
| FEC60-24S24 | 18 ~ 36 V | 24V | 0mA | 2500mA | 200mVp-p | 50mA | 2942mA | 89 | 885μF |
| FEC60-48S3P3 | 36 ~ 75 V | 3.3 V | 0mA | 14000mA | 75mVp-p | 80mA | 1132mA | 89 | 36000μF |
| FEC60-48S05 | 36 ~ 75 V | 5 V | 0mA | 12000mA | 75mVp-p | 90mA | 1453mA | 90 | 20400μF |
| FEC60-48S12 | 36 ~ 75 V | 12 V | 0mA | 5000mA | 100mVp-p | 30mA | 1453mA | 90 | 3550μF |
| FEC60-48S15 | 36 ~ 75 V | 15 V | 0mA | 4000mA | 100mVp-p | 30mA | 1453mA | 90 | 2300μF |
| FEC60-48S24 | 36 ~ 75 V | 24V | 0mA | 2500mA | 200mVp-p | 30mA | 1470mA | 89 | 885μF |

Note

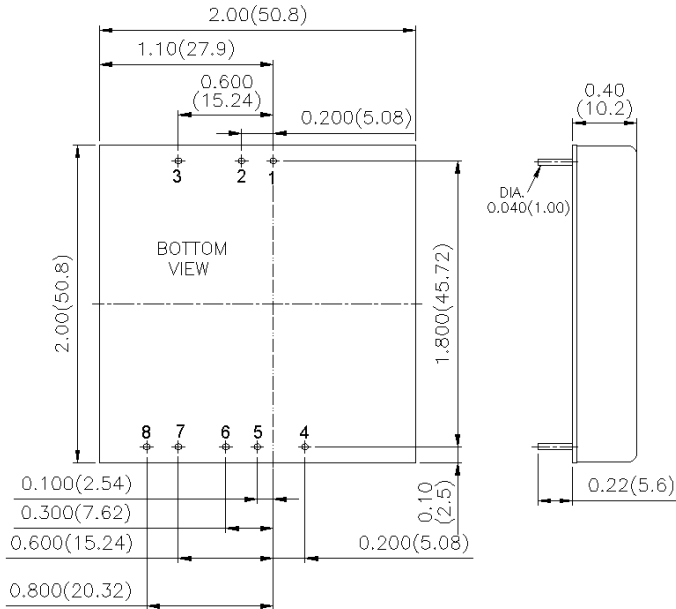
- BELLCORE TR-NWT-000332. Case 1: 50% Stress, Temperature at 40°C. MIL-HDBK-217F Notice2 @Ta=25 °C, Full load(Ground, Benign, controlled environment)
 - Maximum value at nominal input and full load.
 - Typical value at nominal input and no load.
 - Typical value at nominal input and full load.
 - Test by minimum input and constant resistive load.
 - 24VDC output maximum output deviation is +20%,-10% inclusive of remote sense and trim. Others 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.
 - The CTRL pin voltage is referenced to -INPUT.
To order negative logic ON/OFF control add the suffix-N (Ex: FEC60-48S05-N).
 - Test condition with vertical direction by natural convection.
 - Heat-sink is optional and P/N : 7G-0026C-F.
 - The FEC60 series can meet EN55022 Class A with parallel an external capacitor to the input pins.
Recommend: 24VDC input : 6.8μF/50V 1812 MLCC
48VDC input : 2pcs of 2.2μF/100V 1812 MLCC.
 - 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, 220 μ F/100V, ESR 48mΩ.
 - FEC60-24S24 and FEC60-48S24 safety approvals are pending.
- CAUTION:** This power module is not internally fused. An input line fuse must always be used.



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Mechanical Drawing:

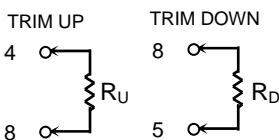


1. All dimensions in Inch (mm)
Tolerance: X.XX±0.02 (X.X±0.5)
X.XXX±0.01 (X.XX±0.25)
2. Pin pitch tolerance ±0.01(0.25)
3. Pin dimension tolerance ±0.004 (0.1)

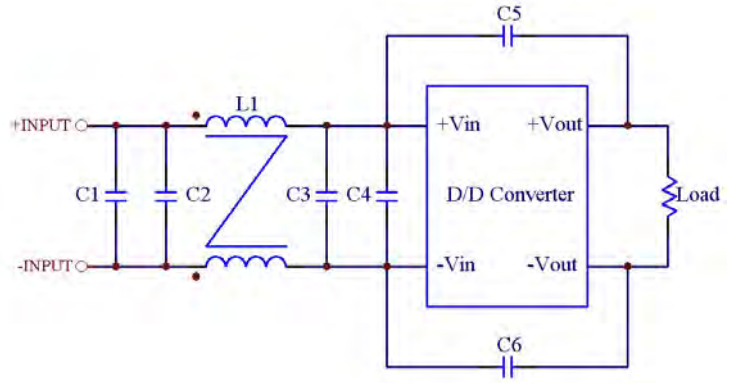
| PIN CONNECTION | |
|----------------|---------|
| PIN | SINGLE |
| 1 | +INPUT |
| 2 | -INPUT |
| 3 | CTRL |
| 4 | -SENSE |
| 5 | +SENSE |
| 6 | +OUTPUT |
| 7 | -OUTPUT |
| 8 | TRIM |

EXTERNAL OUTPUT TRIMMING

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



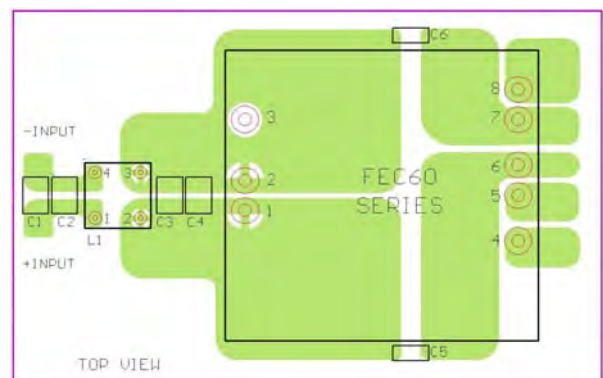
Recommended EMI Filter:



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