

# 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

<b>Input Voltage</b>	<b>24VDC</b> ( 18 ~ 36 ) <b>48VDC</b> ( 36 ~75 )
<b>Input Filter</b>	Pi type
<b>Input Surge Voltage.</b> ( 100mS )	24V: 50VDC, 48V: 100VDC
<b>Input Reflected Ripple Current</b>	20mA pk-pk ( @ nominal input & 100% load
<b>Start Up time</b>	Typically 20mS constant resistive load
<b>Start UP Voltage</b>	24V input typ 17V, 48V input: typ 34V
<b>Shutdown Voltage</b>	24V input: 17V, 48V input: 32V.
<b>Remote ON/OFF</b> 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
<b>Remote ON/OFF</b> 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
<b>Output power</b>	60 watts
<b>Voltage Accuracy</b>	$\pm 1\%$
<b>Voltage Trim</b>	$\pm 10\%$ ( 24V output: +20% -10% )
<b>Minim Load</b>	Zero
<b>Line Regulation</b>	$\pm 0.2\%$
<b>Load Regulation</b>	$\pm 0.5\%$ ( 0% to 100% load )
<b>Ripple &amp; noise</b>	750 ~ 100mV. 20MHZ bandwidth
<b>Temp. Coefficient</b>	$\pm 0.02\%$ / °C
<b>Transient Response</b>	250uS ( 25% load step change )
<b>Over voltage Protection</b> ( 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
<b>Overload Protection</b>	Typically 150% of load
<b>Short Circuit Protection</b>	Hiccup, with auto recovery

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

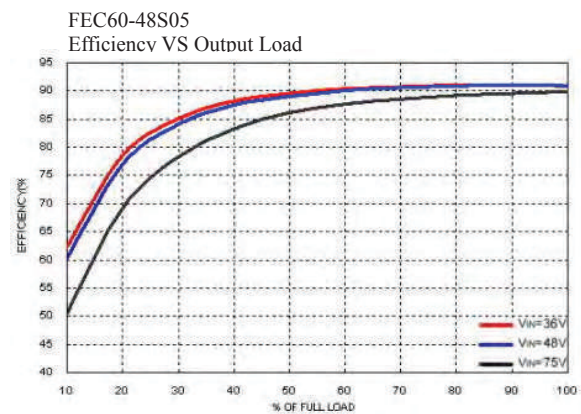
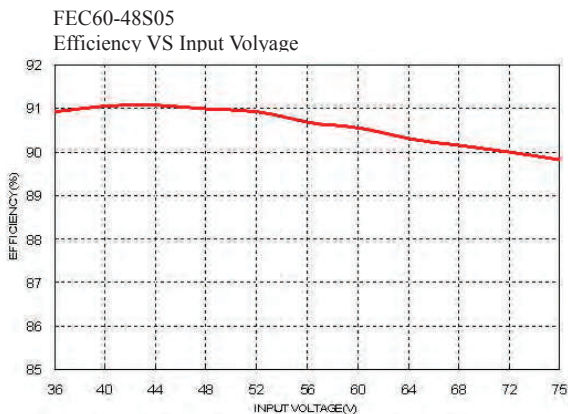
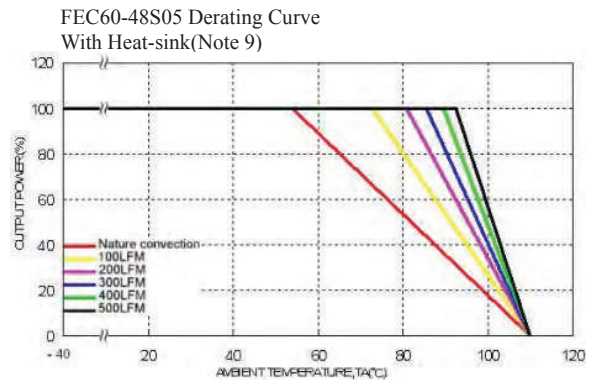
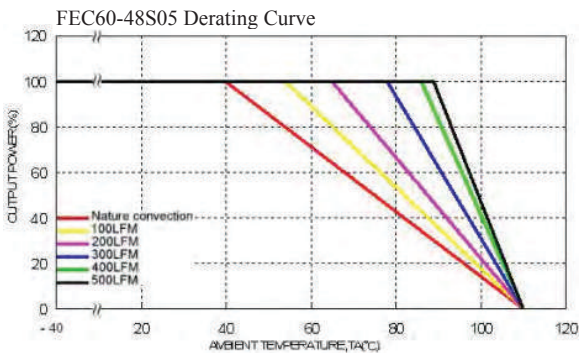
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Model Number	Input Range	Output Voltage	Output Current		Output <sup>(4)</sup> Ripple & Noise	Input Current		Eff <sup>(4)</sup> (%)	Capacitor <sup>(5)</sup> Load max
			Min. load	Full load		No load <sup>(3)</sup>	Full load <sup>(2)</sup>		
FEC60-24S3P3	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**

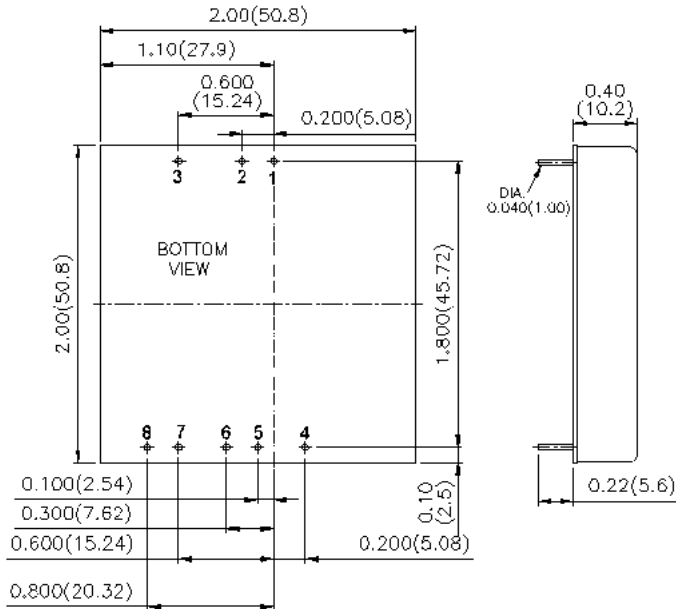
- BELLCORE TR-NWT-000332. Case 1: 50% Stress, Temperature at 40°C. MIL-HDBK-217F Notice2 @Ta=25 °C, Full load(Ground, Benign, controlled environment)
  - Maximum value at nominal input and full load.
  - Typical value at nominal input and no load.
  - Typical value at nominal input and full load.
  - 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:

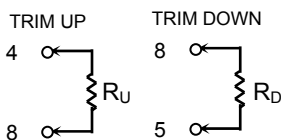


1. All dimensions in Inch (mm)  
Tolerance: X.XX±0.02 (X.X±0.5)  
X.XXX±0.01 (X.XX±0.25)
2. Pin pitch tolerance ±0.01(0.25)
3. Pin dimension tolerance ±0.004 (0.1)

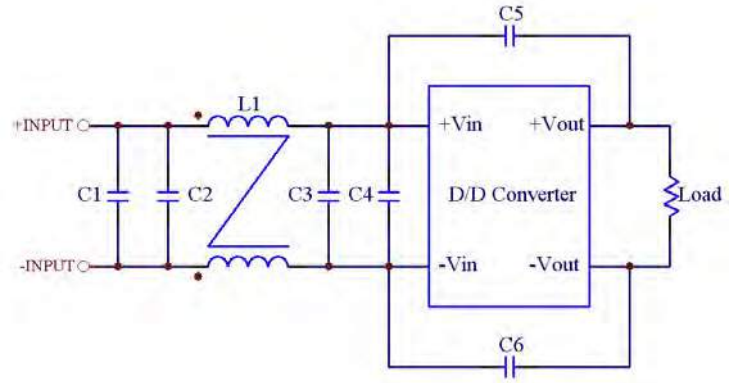
PIN CONNECTION	
PIN	SINGLE
1	+INPUT
2	-INPUT
3	CTRL
4	-SENSE
5	+SENSE
6	+OUTPUT
7	-OUTPUT
8	TRIM

## EXTERNAL OUTPUT TRIMMING

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



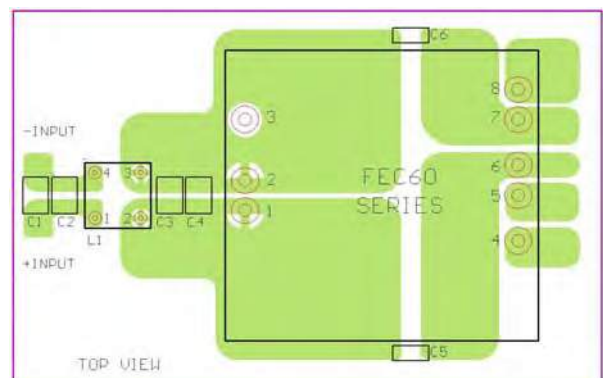
## Recommended EMI Filter:



## 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