



## 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
- UL60950-1, EN60950-1, & IEC60950-1 SAFETY APPROVALS
- CE MARKED
- COMPLIANT TO RoHS II & REACH

## 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 25°C otherwise noted

OUTPUT SPECIFICATIONS		
Output power		60 Watts, max.
Voltage accuracy		± 1%
Minimum load		0%
Voltage adjustability (Note 6)	24Vout	+ 20% -10%
	Others	±10%
Line regulation	LL to HL at Full Load	± 0.2%
Load regulation	No Load to Full Load	± 0.5%
Ripple and noise	20MHz bandwidth	See table
Temperature coefficient		±0.02% / °C, max.
Transient response recovery time	25% load step change	250µs
Over voltage protection (Voltage clamped)	3.3VDC output	3.7VDC~5.4VDC
	5VDC output	5.6VDC~7.0VDC
	12VDC output	13.8VDC~17.5VDC
	15VDC output	16.8VDC~20.5VDC
Over load protection	24VDC output	30.0VDC~33.0VDC
	% of FL at nominal input	150%, max.
Short circuit protection	Continuous, automatic recovery	
GENERAL SPECIFICATIONS		
Efficiency	See table	
Isolation voltage (Basic insulation)	Input to Output	1600 VDC, min. 1minute
	Input(Output) to Case	1600 VDC, min. 1minute
Case grounding	Connect case to -INPUT with decoupling Y Cap	
Isolation resistance	500VDC	10 <sup>9</sup> ohms, min.
Isolation capacitance	1500pF, max.	
Switching frequency	300kHz±10%	
Safety approvals	IEC60950-1, UL60950-1, & EN60950-1	
Case material	Nickel-coated copper	
Base material	FR4 PCB	
Potting material	Epoxy (UL94 V-0)	
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)	MIL-HDBK-217F	4.089 x 10 <sup>5</sup> hrs

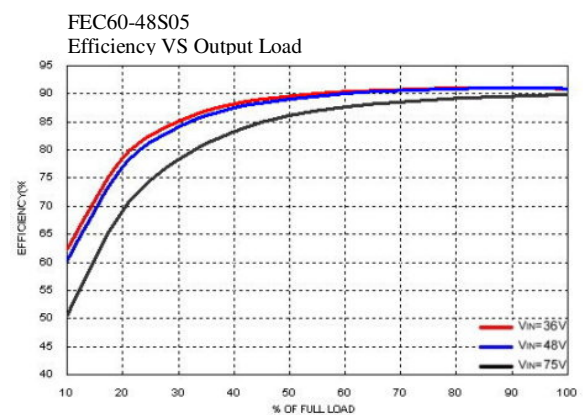
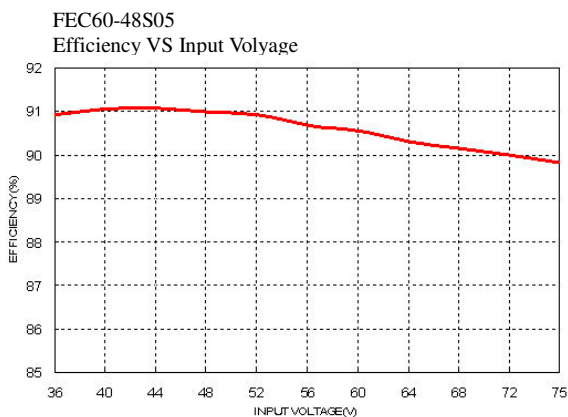
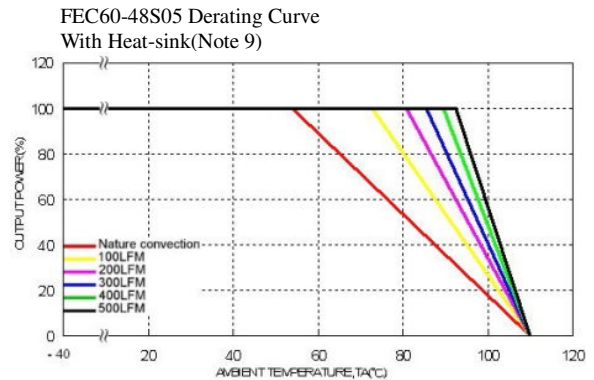
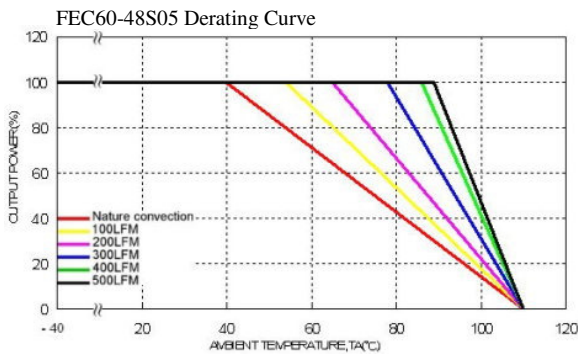
INPUT SPECIFICATIONS			
Input voltage range	24VDC nominal input	18 ~ 36VDC	
	48VDC nominal input	36 ~ 75VDC	
Input filter	Pi type		
Input surge voltage	24VDC input	50VDC 100ms, max.	
	48VDC input	100VDC 100ms, max.	
Input reflected ripple current	20mA <sub>p-p</sub>		
Start up time	Nominal input and constant resistive load	Power up	20ms, max.
		Remote ON/OFF	20ms, max.
Start-up voltage	24VDC input	17VDC	
	48VDC input	34VDC	
Shutdown voltage	24VDC input	15VDC	
	48VDC input	32VDC	
Remote ON/OFF (Note 7)			
Positive logic (standard)	DC-DC ON	Open or 3V < Vr < 12V	
	DC-DC OFF	Short or 0V < Vr < 1.2V	
Negative logic (option)	DC-DC ON	Short or 0V < Vr < 1.2V	
	DC-DC OFF	Open or 3V < Vr < 12V	
Input current of Remote control pin	Nominal input	-0.5mA~1.0mA	
Remote off state input current	Nominal input	4mA	
ENVIRONMENTAL SPECIFICATIONS			
Operating ambient temperature (Note8)	-40°C ~ +40°C (without derating)		
	+40°C ~ +110°C (with derating)		
Maximum case temperature	+110°C		
Storage temperature range	-55°C ~ +125°C		
Over temperature protection	+120°C		
Thermal impedance (Note 9)	Without Heat-sink	10.5°C/Watt	
	With Heat-sink	8.4°C/Watt	
Thermal shock	MIL-STD-810F		
Vibration	MIL-STD-810F		
Relative humidity	5% to 95% RH		
EMC CHARACTERISTICS			
EMI (Note 10)	EN55022	Class A, Class B	
ESD	EN61000-4-2	Air	± 8kV Perf. Criteria A
		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

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

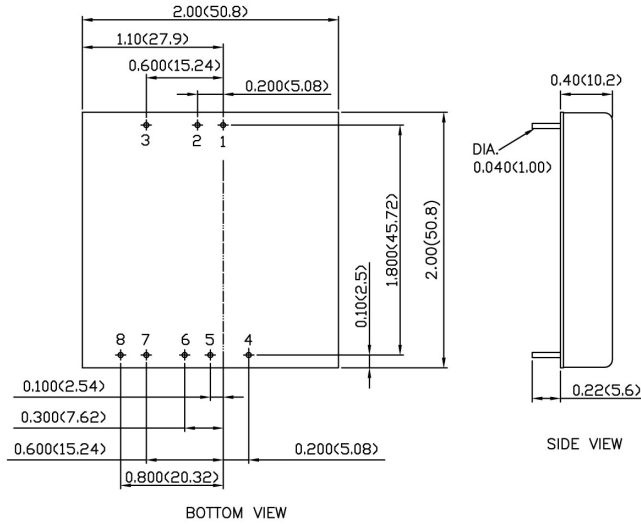
### Note

- MIL-HDBK-217F @Tc=70 °C, Full load.
- Typical value at nominal input and full load. (20MHz BW.)
- 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 standard module meets EN55022 Class A and Class B with external components.  
For more detail 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 Power Mate suggest: Nippon chemi-con KY series, 220μF/100V.

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



**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

