



# P-DUKE POWER

## FEC30 Series

DC-DC Converter  
Up to 30 Watts

**3**  
YEARS  
WARRANTY

ROHS  
COMPLIANT

REACH  
COMPLIANT



Automation



Datacom



IPC



Industry



Measurement



Telecom



Automobile



Boat



Charger



Medical



Railway



PV

UL US CB CE UK CA

1600  
VDC  
Isolation  
Voltage

2 : 1  
Input  
Range

NO  
Min. Load  
Required

REMOTE  
ON  
OFF

OCP

OVP

SCP

UVP

OTP

### PART NUMBER STRUCTURE

FEC30 - 48 S 05 - HC

Series Name

Input  
Voltage  
(VDC)

Output  
Quantity

Output  
Voltage  
(VDC)

Assembly  
Options

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

□: None  
HC: Heat-sink with Clamp

D: Dual

12:±12  
15:±15

**TECHNICAL SPECIFICATION** All specifications are typical at nominal input, full load and 25°C unless otherwise noted

Model Number	Input Range	Output Voltage	Output Current @Full Load	Input Current @ No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	A	mA	%	μF
FEC30-12S1P5	9 ~ 18	1.5	6	100	78	85800
FEC30-12S1P8	9 ~ 18	1.8	6	100	81	65000
FEC30-12S2P5	9 ~ 18	2.5	6	110	83	33000
FEC30-12S3P3	9 ~ 18	3.3	6	115	85	19500
FEC30-12S05	9 ~ 18	5	6	95	87	10200
FEC30-12S12	9 ~ 18	12	2.5	35	88	3240
FEC30-12S15	9 ~ 18	15	2	45	88	1100
FEC30-12D12	9 ~ 18	±12	±1.25	60	87	±1020
FEC30-12D15	9 ~ 18	±15	±1	40	87	±675
FEC30-24S1P5	18 ~ 36	1.5	6	50	80	85800
FEC30-24S1P8	18 ~ 36	1.8	6	35	82	65000
FEC30-24S2P5	18 ~ 36	2.5	6	45	84	33000
FEC30-24S3P3	18 ~ 36	3.3	6	50	86	19500
FEC30-24S05	18 ~ 36	5	6	50	88	10200
FEC30-24S12	18 ~ 36	12	2.5	30	89	3300
FEC30-24S15	18 ~ 36	15	2	30	89	1100
FEC30-24D12	18 ~ 36	±12	±1.25	30	88	±1020
FEC30-24D15	18 ~ 36	±15	±1	30	88	±675
FEC30-48S1P5	36 ~ 75	1.5	6	20	81	85800
FEC30-48S1P8	36 ~ 75	1.8	6	20	83	65000
FEC30-48S2P5	36 ~ 75	2.5	6	25	85	33000
FEC30-48S3P3	36 ~ 75	3.3	6	30	87	19500
FEC30-48S05	36 ~ 75	5	6	35	89	10200
FEC30-48S12	36 ~ 75	12	2.5	25	90	3300
FEC30-48S15	36 ~ 75	15	2	25	90	1100
FEC30-48D12	36 ~ 75	±12	±1.25	20	88	±1020
FEC30-48D15	36 ~ 75	±15	±1	20	88	±675

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	
Start-up voltage	12Vin(nom)					9	VDC
	24Vin(nom)					17.8	
	48Vin(nom)					36	
Shutdown voltage	12Vin(nom)			7	8	8.8	VDC
	24Vin(nom)			15	16	17.5	
	48Vin(nom)			32.5	34.5	35.5	
Start up time	Constant resistive load	Power up		25			ms
Input surge voltage	100 ms, max.	Remote ON/OFF					
		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 DC-DC OFF			Open or 3 ~ 12VDC 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			-1.0		+1.0	%
Line regulation	Low Line to High Line at Full Load	Single	-0.2		+0.2	%
		Dual	-0.5		+0.5	
Load regulation	No Load to Full Load	Single	-0.5		+0.5	%
		Dual	-1.0		+1.0	
Cross regulation	Asymmetrical load 25%/100% FL	Dual	-5.0		+5.0	%
Voltage adjustability			-10		+10	%
Ripple and noise	Measured by 20MHz bandwidth With a 0.1 $\mu$ F/50V MLCC	Single		50		mVp-p
		Dual		75		
		Others		100		
Temperature coefficient			-0.02		+0.02	%/°C
Transient response recovery time	25% load step change			300		$\mu$ s
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		15		
		15Vout		18		
Over load protection	% of Iout rated				150	%
Short circuit protection			Continuous, automatics recovery			

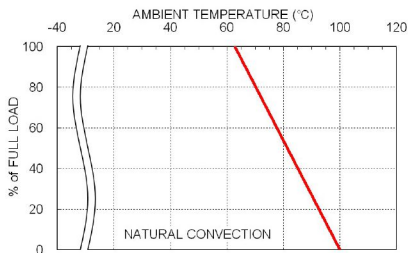
GENERAL SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	Input to Output	1600			VDC
		Input(Output) to Case	1600			
Isolation resistance	500VDC		1			G $\Omega$
Isolation capacitance					1000	pF
Switching frequency			270	300	330	kHz
Safety approvals	IEC/ EN/ UL 62368-1				UL:E193009 CB: UL(Demko)	
Case material					Nickel-coated copper	
Base material					FR4 PCB	
Potting material					Epoxy (UL94 V-0)	
Weight					48g (1.69oz)	
MTBF	MIL-HDBK-217F, Full load				1.283 x 10 <sup>6</sup> hrs	

ENVIRONMENTAL SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating ambient temperature	With derating		-40		+100	°C
Maximum case temperature					100	°C
Over temperature protection				115		°C
Storage temperature range			-55		+125	°C
Thermal impedance	Without heat-sink			10		°C/W
	With heat-sink			8.24		
Thermal shock					MIL-STD-810F	
Vibration					MIL-STD-810F	
Relative humidity					5% to 95% RH	

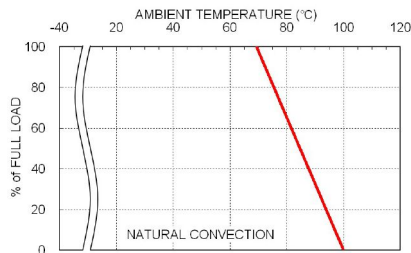
EMC SPECIFICATIONS			
Parameter	Conditions		Level
EMI	EN55032	With external components	Class A, Class B
EMS	EN55024		
ESD	EN61000-4-2	Air $\pm 8kV$ and Contact $\pm 6kV$	Perf. Criteria B
Radiated immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	$\pm 2kV$	Perf. Criteria B
Surge	EN61000-4-5	With an external input filter capacitor (Nippon chemi-con KY series, 220 $\mu$ F/100V)	Perf. Criteria B
		$\pm 1kV$	
Conducted immunity	EN61000-4-6	10 Vr.m.s	Perf. Criteria A
		With an external input filter capacitor (Nippon chemi-con KY series, 220 $\mu$ F/100V)	
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second	Perf. Criteria A

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

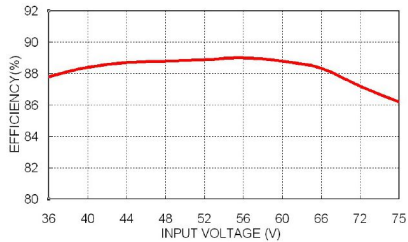
## CHARACTERISTIC CURVE



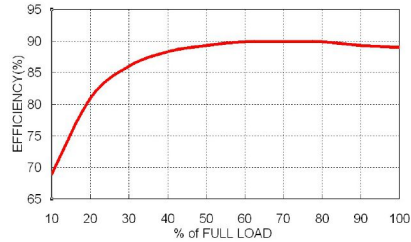
FEC30-48S05 Derating Curve



FEC30-48S05 Derating Curve With Heat-sink



FEC30-48S05 Efficiency vs. Input Voltage



FEC30-48S05 Efficiency vs. Output Load

## FUSE CONSIDERATION

This power module is not internally fused.

An input line fuse must always be used.

This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.

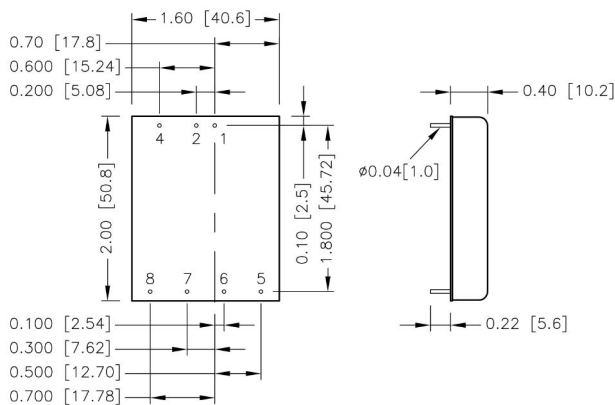
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below :

Model	Fuse Rating (A)	Fuse Type
FEC30-12□□□	6.3	Slow-Blow
FEC30-24□□□	3.15	Slow-Blow
FEC30-48□□□	1.6	Slow-Blow

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin.

## MECHANICAL DRAWING



BOTTOM VIEW

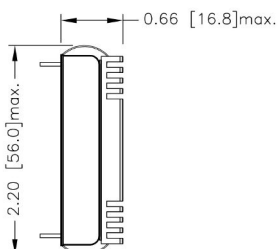
### PIN CONNECTION

PIN	SINGLE	DUAL
1	+Vin	+Vin
2	-Vin	-Vin
4	Ctrl	Ctrl
5	No pin	+Vout
6	+Vout	Common
7	-Vout	-Vout
8	Trim	Trim

- All dimensions in inch [mm]
- Tolerance :x.xx±0.02 [x.x±0.5]  
x.xxx±0.01 [x.xx±0.25]
- Pin dimension tolerance ±0.004[0.10]

## HEAT-SINK OPTIONS

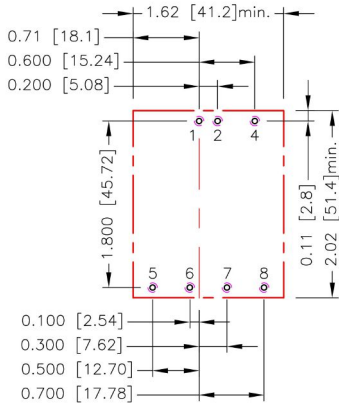
-HC (Heat-sink with clamps)



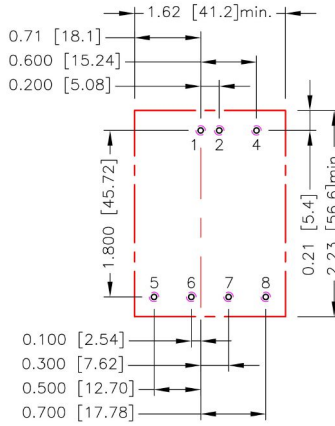
\* All dimensions in inch [mm]

**RECOMMENDED PAD LAYOUT**

**Standard**



**-HC**

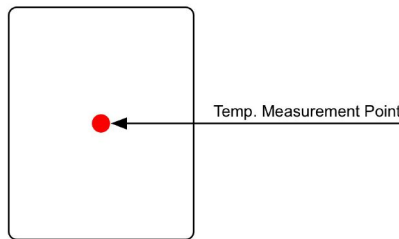


All dimensions in inch[mm]  
 Pad size(lead free recommended)  
 Through hole 1.2.4.5.6.7.8:Φ0.051[1.30]  
 Top view pad 1.2.4.5.6.7.8:Φ0.064[1.63]  
 Bottom view pad 1.2.4.5.6.7.8:Φ0.102[2.60]

**THERMAL CONSIDERATIONS**

The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding Environment. Proper cooling can be verified by measuring the point as the figure below. The temperature at this location should not exceed “Maximum case temperature”. When Operating, adequate cooling must be provided to maintain the test point temperature at or below “Maximum case temperature”. You can limit this Temperature to a lower value for extremely high reliability.

- Thermal test condition with vertical direction by natural convection (20LFM).



TOP VIEW

## OUTPUT VOLTAGE ADJUSTMENT

Output voltage is adjustable for 10% trim up or -10% trim down of nominal output voltage by connecting an external resistor between the Trim pin and +Vout or -Vout pins.

With an external resistor between the Trim and +Vout pin, the output voltage set point decreases.

With an external resistor between the Trim and -Vout pin, the output voltage set point increases.

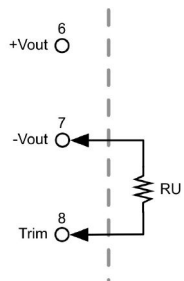
The external trim resistor needs to be at least 1/8W of rated power.

### EXTERNAL OUTPUT TRIMMING

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

#### Trim-up

##### Single Output



##### □□S1P5

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	1.515	1.53	1.545	1.56	1.575	1.59	1.605	1.62	1.635	1.65
RU (k $\Omega$ )	4.578	2.605	1.227	0.808	0.557	0.389	0.27	0.18	0.11	0.054

##### □□S1P8

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	1.818	1.836	1.854	1.872	1.89	1.908	1.926	1.944	1.962	1.98
RU (k $\Omega$ )	11.639	5.205	3.06	1.988	1.344	0.915	0.609	0.379	0.2	0.057

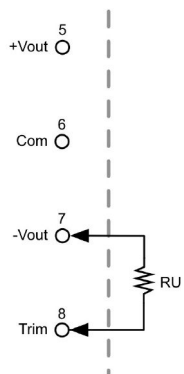
##### □□S2P5

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	2.525	2.55	2.575	2.6	2.625	2.65	2.675	2.7	2.725	2.75
RU (k $\Omega$ )	37.076	16.675	9.874	6.474	4.434	3.074	2.102	1.374	0.807	0.354

##### □□S3P3

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	3.333	3.366	3.399	3.432	3.465	3.498	3.531	3.564	3.597	3.630
RU (k $\Omega$ )	57.930	26.165	15.577	10.283	7.106	4.988	3.476	2.341	1.459	0.753

##### Dual Output



##### □□S05

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	5.050	5.100	5.150	5.200	5.250	5.300	5.350	5.400	5.450	5.500
RU (k $\Omega$ )	36.570	16.580	9.917	6.585	4.586	3.253	2.302	1.588	1.032	0.588

##### □□S12

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200
RU (k $\Omega$ )	367.910	165.950	98.636	64.977	44.782	31.318	21.701	14.488	8.879	4.391

##### □□S15

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	15.150	15.300	15.450	15.600	15.750	15.900	16.050	16.200	16.350	16.500
RU (k $\Omega$ )	404.180	180.590	106.060	68.796	46.437	31.531	20.883	12.898	6.687	1.718

##### □□D12

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	$\pm 12.12$	$\pm 12.24$	$\pm 12.36$	$\pm 12.48$	$\pm 12.6$	$\pm 12.72$	$\pm 12.84$	$\pm 12.96$	$\pm 13.08$	$\pm 13.2$
RU (k $\Omega$ )	218.21	98.105	58.07	38.052	26.042	18.035	12.316	8.026	4.69	2.021

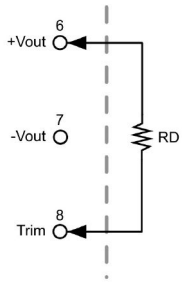
##### □□D15

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	$\pm 15.15$	$\pm 15.3$	$\pm 15.45$	$\pm 15.6$	$\pm 15.75$	$\pm 15.9$	$\pm 16.05$	$\pm 16.2$	$\pm 16.35$	$\pm 16.5$
RU (k $\Omega$ )	268.29	120.64	71.429	46.822	32.058	22.215	15.184	9.911	5.81	2.529

**OUTPUT VOLTAGE ADJUSTMENT**

Trim-down

Single Output



□□S1P5

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	1.485	1.47	1.455	1.44	1.425	1.41	1.395	1.38	1.365	1.35
RD (k $\Omega$ )	5.704	2.571	1.527	1.005	0.692	0.483	0.334	0.222	0.135	0.065

□□S1P8

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	1.782	1.764	1.746	1.728	1.71	1.692	1.674	1.656	1.638	1.62
RD (k $\Omega$ )	14.66	6.57	3.874	2.525	1.716	1.177	0.792	0.503	0.278	0.098

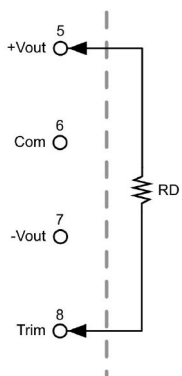
□□S2P5

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	2.475	2.45	2.425	2.4	2.375	2.35	2.325	2.3	2.275	2.25
RD (k $\Omega$ )	49.641	22.481	13.428	8.902	6.186	4.375	3.082	2.112	1.358	0.754

□□S3P3

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	3.267	3.234	3.201	3.168	3.135	3.102	3.069	3.036	3.003	2.970
RD (k $\Omega$ )	69.470	31.235	18.490	12.117	8.294	5.745	3.924	2.559	1.497	0.647

Dual Output



□□S05

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	4.950	4.900	4.850	4.800	4.750	4.700	4.650	4.600	4.550	4.500
RD (k $\Omega$ )	45.533	20.612	12.306	8.152	5.660	3.999	2.812	1.922	1.230	0.676

□□S12

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	11.880	11.760	11.640	11.520	11.400	11.280	11.160	11.040	10.920	10.800
RD (k $\Omega$ )	460.990	207.950	123.600	81.423	56.118	39.249	27.199	18.162	11.132	5.509

□□S15

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	14.850	14.700	14.550	14.400	14.250	14.100	13.950	13.800	13.650	13.500
RD (k $\Omega$ )	499.820	223.410	131.270	85.204	57.563	39.136	25.974	16.102	8.424	2.282

□□D12

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	$\pm 11.88$	$\pm 11.76$	$\pm 11.64$	$\pm 11.52$	$\pm 11.4$	$\pm 11.28$	$\pm 11.16$	$\pm 11.04$	$\pm 10.92$	$\pm 10.8$
RD (k $\Omega$ )	273.44	123.02	72.874	47.803	32.76	22.732	15.568	10.196	6.017	2.675

□□D15

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	$\pm 14.85$	$\pm 14.7$	$\pm 14.55$	$\pm 14.4$	$\pm 14.25$	$\pm 14.1$	$\pm 13.95$	$\pm 13.8$	$\pm 13.65$	$\pm 13.5$
RD (k $\Omega$ )	337.71	152.02	90.126	59.178	40.609	28.23	19.387	12.756	7.598	3.471