P-DUKE POWER

FED20 Series

DC-DC Converter
Up to 20 Watts

3 YEARS WARRANTY

RoHS COMPLIANT

REACH COMPLIANT

Automation | Datacom | IPC

Industry | Measurement | Telecom

Automobile | Boat | Charger

Medical | PV | Railway

1600 VDC Isolation Voltage | 2 : 1 Input Range | 6 sided Shielding | NO Min. Load Required | REMOTE ON OFF | OCP | OVP | SCP

PART NUMBER STRUCTURE

FED20 - 48 S 05 - M3 N HC

Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Operating Temp. Options	Remote On/Off Options	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	**□:**Standard -40~+100℃ With derating **M3:**M3 Version -55~+100℃ With derating	**□:**Positive logic **N:**Negative logic	**□:** 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℃ unless otherwise noted

Model Number	Input Range	Output Voltage	Output Current @Full Load	Input Current @ No Load	Efficiency	Maximum Capacitor Load
	VDC	VDC	mA	mA	%	μF
FED20-12S1P5	9 ~ 18	1.5	6000	70	78	65000
FED20-12S1P8	9 ~ 18	1.8	6000	75	79	65000
FED20-12S2P5	9 ~ 18	2.5	6000	80	83	33000
FED20-12S3P3	9 ~ 18	3.3	5000	115	85	13000
FED20-12S05	9 ~ 18	5	4000	75	87	6800
FED20-12S12	9 ~ 18	12	1670	90	86	2200
FED20-12S15	9 ~ 18	15	1330	35	86	755
FED20-12D12	9 ~ 18	±12	±833	45	86	±680
FED20-12D15	9 ~ 18	±15	±667	50	86	±450
FED20-24S1P5	18 ~ 36	1.5	6000	35	80	65000
FED20-24S1P8	18 ~ 36	1.8	6000	45	81	65000
FED20-24S2P5	18 ~ 36	2.5	6000	40	84	33000
FED20-24S3P3	18 ~ 36	3.3	5000	30	86	13000
FED20-24S05	18 ~ 36	5	4000	35	89	6800
FED20-24S12	18 ~ 36	12	1670	55	87	2200
FED20-24S15	18 ~ 36	15	1330	40	87	755
FED20-24D12	18 ~ 36	±12	±833	30	87	±680
FED20-24D15	18 ~ 36	±15	±667	30	88	±450
FED20-48S1P5	36 ~ 75	1.5	6000	15	80	65000
FED20-48S1P8	36 ~ 75	1.8	6000	20	82	65000
FED20-48S2P5	36 ~ 75	2.5	6000	30	84	33000
FED20-48S3P3	36 ~ 75	3.3	5000	15	87	13000
FED20-48S05	36 ~ 75	5	4000	20	89	6800
FED20-48S12	36 ~ 75	12	1670	35	88	2200
FED20-48S15	36 ~ 75	15	1330	50	87	755
FED20-48D12	36 ~ 75	±12	±833	20	88	±680
FED20-48D15	36 ~ 75	±15	±667	20	88	±450

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 time	Constant resistive load	Power up		10		ms
		Remote ON/OFF		10		
Input surge voltage	100 ms, max.	12Vin(nom)			36	VDC
		24Vin(nom)			50	
		48Vin(nom)			100	
Input filter				L-C type		
Remote ON/OFF	Referred to –Vin pin	Positive logic (Standard) DC-DC ON		Open or 3 ~ 12VDC		
		Positive logic (Standard) DC-DC OFF		Short or 0 ~ 1.2VDC		
		Negative logic (Option) DC-DC ON		Short or 0 ~ 1.2VDC		
		Negative logic (Option) DC-DC OFF		Open or 3 ~ 12VDC		
		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			-0.2		+0.2	%
Load regulation	No Load to Full Load			-0.5		+0.5	%
Cross regulation	Asymmetrical load 25%/100% FL	Dual		-5.0		+5.0	%
Voltage adjustability	Single output			-10		+10	%
Ripple and noise	Measured by 20MHz bandwidth With a 0.1μF/50V MLCC	Single Dual	Others 5Vout, 12Vout, 15Vout All		60 75 100		mVp-p
Temperature coefficient				-0.02		+0.02	%/℃
Transient response recovery time	25% load step change				250		μs
Over voltage protection	Zener diode clamp	1.5Vout 1.8Vout 2.5Vout 3.3Vout 5Vout 12Vout 15Vout			3.9 3.9 3.9 3.9 6.2 15 18		VDC
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 Input(Output) to Case	1600 1600			VDC
Isolation resistance	500VDC		1			GΩ
Isolation capacitance					1000	pF
Switching frequency			450	500	550	kHz
Safety approvals	IEC/ EN/ UL 62368-1				UL:E193009 CB: UL(Demko)	
Case material					Nickel-coated copper	
Base material					Non-conductive black plastic	
Potting material					Epoxy (UL94 V-0)	
Weight					27g (0.95oz)	
MTBF	MIL-HDBK-217F, Full load				1.583×10^6 hrs	

ENVIRONMENTAL SPECIFICATIONS

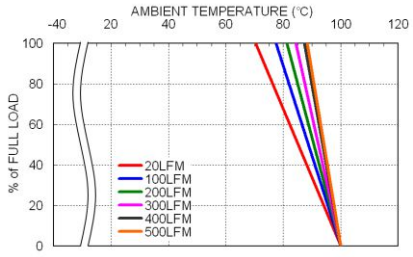
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating ambient temperature	Standard M3	With derating With derating	-40 -55		+100 +100	℃
Maximum case temperature					100	℃
Storage temperature range			-55		+125	℃
Thermal impedance		Without heat-sink With heat-sink		12 10		℃/W
Thermal shock					MIL-STD-810F	
Vibration					MIL-STD-810F	
Relative humidity					5% to 95% RH	

EMC SPECIFICATIONS

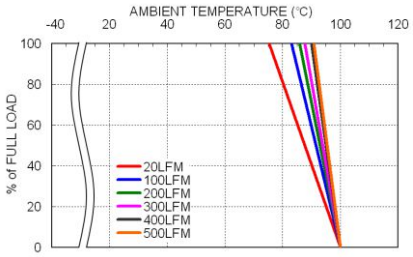
Parameter	Conditions		Level
EMI	EN55032	With external components	Class A, Class B
EMS	EN55035		
ESD	EN61000-4-2	Air ± 8kV and Contact ± 6kV	Perf. Criteria B
Radiated immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	±2kV With an external input filter capacitor (Nippon chemi-con KY series, 220μF/100V)	Perf. Criteria A
Surge	EN61000-4-5	±1kV With an external input filter capacitor (Nippon chemi-con KY series, 220μF/100V)	Perf. Criteria B
Conducted immunity	EN61000-4-6	10 Vr.m.s	Perf. Criteria A
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.

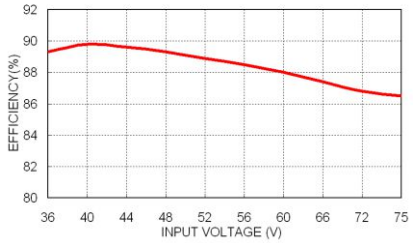
CHARACTERISTIC CURVE



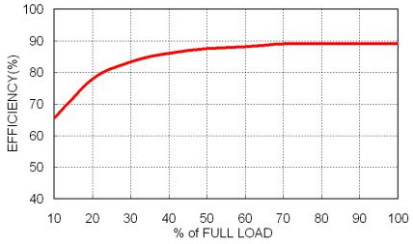
FED20-48S05 Derating Curve



FED20-48S05 Derating Curve With Heat-sink



FED20-48S05 Efficiency vs. Input Voltage



FED20-48S05 Efficiency vs. Output Load

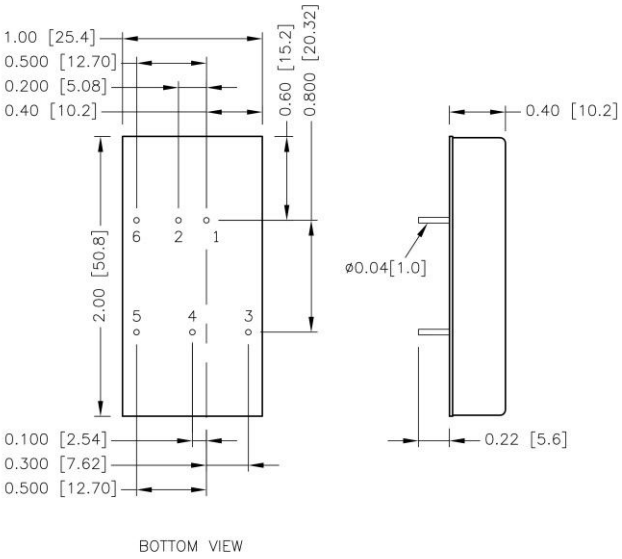
FUSE CONSIDERATION

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
FED20-12S□□、FED20-12D□□	4	Slow-Blow
FED20-24S□□、FED20-24D□□	2	Slow-Blow
FED20-48S□□、FED20-48D□□	1.25	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



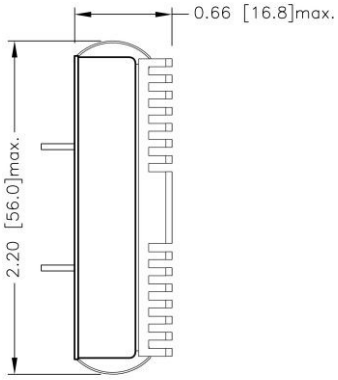
PIN CONNECTION

PIN	SINGLE	DUAL
1	+Vin	+Vin
2	-Vin	-Vin
3	+Vout	+Vout
4	Trim	Common
5	-Vout	-Vout
6	Ctrl	Ctrl

1. All dimensions in inch [mm]
2. Tolerance :x.xx±0.02 [x.x±0.5]
   x.xxx±0.01 [x.xx±0.25]
3. Pin pitch tolerance ±0.01 [0.25]
4. Pin dimension tolerance ±0.004[0.10]

HEAT-SINK OPTIONS

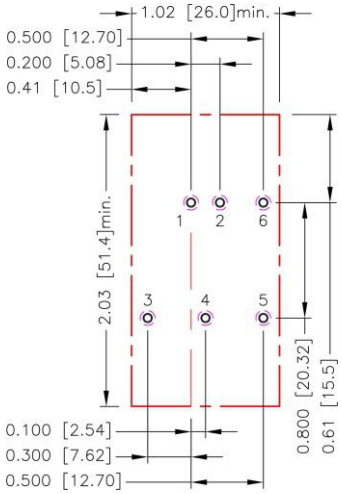
-HC (Heat-sink with clamps)



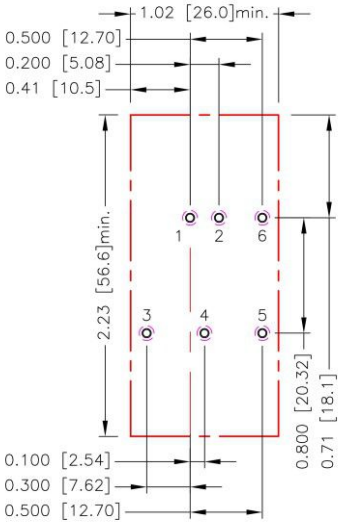
* All dimensions in inch [mm]

RECOMMENDED PAD LAYOUT

Standard



-HC

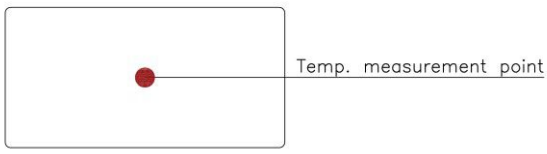


All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.3.4.5.6: ∅0.051[1.30]
Top view pad 1.2.3.4.5.6: ∅0.064[1.63]
Bottom view pad 1.2.3.4.5.6: ∅0.102[2.60]

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).



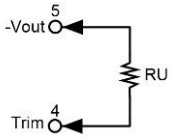
TOP VIEW

OUTPUT VOLTAGE ADJUSTMENT

Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of the module.
This is accomplished by connecting an external resistor between the Trim pin and either the +Output or -Output pins.
With an external resistor between the Trim and -Vout, the output voltage set point increases.
With an external resistor between the Trim and +Vout, the output voltage set point decreases.
The external Trim resistor needs to be at least 1/16W of rated power.

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

Trim-up



□□S1P5

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	1.515	1.530	1.545	1.560	1.575	1.590	1.605	1.620	1.635	1.650
RU	(kΩ)	4.578	2.065	1.227	0.808	0.557	0.389	0.270	0.180	0.110	0.054

□□S1P8

△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	(kΩ)	11.639	5.205	3.060	1.988	1.344	0.915	0.609	0.379	0.200	0.057

□□S2P5

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	2.525	2.550	2.575	2.600	2.625	2.650	2.675	2.700	2.725	2.75
RU	(kΩ)	37.076	16.675	9.874	6.474	4.434	3.074	2.102	1.374	0.807	0.354

□□S3P3

△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	(kΩ)	57.930	26.165	15.577	10.283	7.106	4.988	3.476	2.341	1.459	0.753

□□S05

△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	(kΩ)	36.570	16.580	9.917	6.585	4.586	3.253	2.302	1.588	1.032	0.588

□□S12

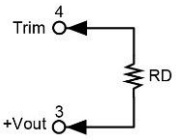
△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	12.120	12.240	12.360	12.480	12.600	12.720	12.840	12.960	13.080	13.200
RU	(kΩ)	367.910	165.950	98.636	64.977	44.782	31.318	21.701	14.488	8.879	4.391

□□S15

△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	(kΩ)	404.180	180.590	106.060	68.796	46.437	31.531	20.883	12.898	6.687	1.718

OUTPUT VOLTAGE ADJUSTMENT(CONTINUED)

Trim-down



□□S1P5

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	1.485	1.470	1.455	1.440	1.425	1.410	1.395	1.380	1.365	1.350
RD	(kΩ)	5.704	2.571	1.527	1.005	0.692	0.483	0.334	0.222	0.135	0.065

□□S1P8

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	1.782	1.764	1.746	1.728	1.710	1.692	1.674	1.656	1.638	1.620
RD	(kΩ)	14.66	6.57	3.874	2.525	1.716	1.177	0.792	0.503	0.278	0.098

□□S2P5

△V	(%)	1	2	3	4	5	6	7	8	9	10
Vout	(V)	2.475	2.450	2.425	2.400	2.375	2.350	2.325	2.300	2.275	2.250
RD	(kΩ)	49.641	22.481	13.428	8.902	6.186	4.375	3.082	2.112	1.358	0.754

□□S3P3

△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	(kΩ)	69.470	31.235	18.490	12.117	8.294	5.745	3.924	2.559	1.497	0.647

□□S05

△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	(kΩ)	45.533	20.612	12.306	8.152	5.660	3.999	2.812	1.922	1.230	0.676

□□S12

△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	(kΩ)	460.990	207.950	123.600	81.423	56.118	39.249	27.199	18.162	11.132	5.509

□□S15

△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	(kΩ)	499.820	223.410	131.270	85.204	57.563	39.136	25.974	16.102	8.424	2.282

P-DUKE

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