



# P-DUKE POWER

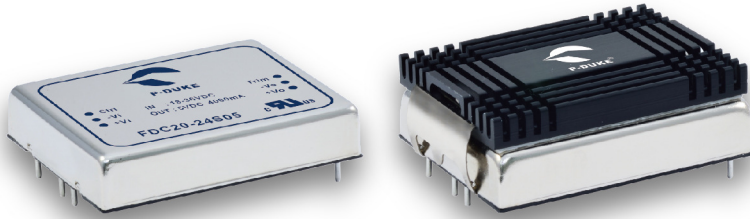
## FDC20 • FDC20W Series

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

UL<sup>®</sup> CB CE

1600  
VDC  
Isolation  
Voltage

4 : 1  
Wide  
Input  
Range

2 : 1  
Input  
Range

6 sided  
Shielding

REMOTE  
ON  
OFF

OCP

OVP

SCP

### PART NUMBER STRUCTURE

FDC20 -	48	S	05	W	-	HC
Series Name	Input Voltage (VDC)	Output Quantity	Output Voltage (VDC)	Input Range		Assembly Option Options
	12:9~18 24:18~36 48:36~75	S:Single	3P3:3.3 05:5 12:12 15:15	□: 2:1		□:None HC:Heat-sink & Clamp
		D: Dual	05:±5 12:±12 15:±15			
		T: Triple	3312:3.3 / ±12 3315:3.3 / ±15 0512:5 / ±12 0515:5 / ±15			
	24:9~36 48:18~75	S: Single	3P3:3.3 05:5 12:12 15:15	W: 4:1		□:None HC:Heat-sink & Clamp
		D: Dual	05:±5 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 VDC	Output Voltage VDC	Output Current		Input Current @ No Load mA	Efficiency %	Maximum Capacitor Load μF
			Min. Load mA	Full Load mA			
FDC20-12S33	9 ~ 18	3.3	280	4000	40	77	13000
FDC20-12S05	9 ~ 18	5	280	4000	15	80	6800
FDC20-12S12	9 ~ 18	12	134	1670	40	83	2200
FDC20-12S15	9 ~ 18	15	106	1330	20	84	755
FDC20-12D05	9 ~ 18	±5	±140	± 2000	15	82	±3400
FDC20-12D12	9 ~ 18	±12	±67	± 833	35	83	±680
FDC20-12D15	9 ~ 18	±15	±53	± 666	35	83	±450
FDC20-12T3312	9 ~ 18	3.3 / ±12	300 / ±30	3000 / ±300	20	79	4700 / ±220
FDC20-12T3315	9 ~ 18	3.3 / ±15	300 / ±25	3000 / ±250	35	79	4700 / ±220
FDC20-12T0512	9 ~ 18	5 / ±12	200 / ±30	2000 / ±300	20	80	4700 / ±220
FDC20-12T0515	9 ~ 18	5 / ±15	200 / ±25	2000 / ±250	40	80	4700 / ±220
FDC20-24S33	18 ~ 36	3.3	280	4000	10	79	13000
FDC20-24S05	18 ~ 36	5	280	4000	10	81	6800
FDC20-24S12	18 ~ 36	12	134	1670	10	86	2200
FDC20-24S15	18 ~ 36	15	106	1330	15	86	755
FDC20-24D05	18 ~ 36	±5	±140	± 2000	20	85	±3400
FDC20-24D12	18 ~ 36	±12	±67	± 833	25	86	±680
FDC20-24D15	18 ~ 36	±15	±53	± 666	30	86	±450
FDC20-24T3312	18 ~ 36	3.3 / ±12	300 / ±30	3000 / ±300	20	82	4700 / ±220
FDC20-24T3315	18 ~ 36	3.3 / ±15	300 / ±25	3000 / ±250	20	79	4700 / ±220
FDC20-24T0512	18 ~ 36	5 / ±12	200 / ±30	2000 / ±300	25	83	4700 / ±220
FDC20-24T0515	18 ~ 36	5 / ±15	200 / ±25	2000 / ±250	10	83	4700 / ±220
FDC20-48S33	36 ~ 75	3.3	280	4000	10	79	13000
FDC20-48S05	36 ~ 75	5	280	4000	10	82	6800
FDC20-48S12	36 ~ 75	12	134	1670	15	86	2200
FDC20-48S15	36 ~ 75	15	106	1330	25	86	755
FDC20-48D05	36 ~ 75	±5	±140	± 2000	15	85	±3400
FDC20-48D12	36 ~ 75	±12	±67	± 833	15	87	±680
FDC20-48D15	36 ~ 75	±15	±53	± 666	20	87	±450
FDC20-48T3312	36 ~ 75	3.3 / ±12	300 / ±30	3000 / ±300	10	82	4700 / ±220
FDC20-48T3315	36 ~ 75	3.3 / ±15	300 / ±25	3000 / ±250	10	82	4700 / ±220
FDC20-48T0512	36 ~ 75	5 / ±12	200 / ±30	2000 / ±300	15	84	4700 / ±220
FDC20-48T0515	36 ~ 75	5 / ±15	200 / ±25	2000 / ±250	15	84	4700 / ±220
FDC20-24S33W	9 ~ 36	3.3	280	4000	20	76	13000
FDC20-24S05W	9 ~ 36	5	280	4000	10	79	6800
FDC20-24S12W	9 ~ 36	12	134	1670	20	81	2200
FDC20-24S15W	9 ~ 36	15	106	1330	20	81	755
FDC20-24D05W	9 ~ 36	±5	±140	± 2000	15	79	±3400
FDC20-24D12W	9 ~ 36	±12	±67	± 833	20	82	±680
FDC20-24D15W	9 ~ 36	±15	±53	± 666	25	82	±450
FDC20-48S33W	18 ~ 75	3.3	280	4000	15	77	13000
FDC20-48S05W	18 ~ 75	5	280	4000	10	80	6800
FDC20-48S12W	18 ~ 75	12	134	1670	10	82	2200
FDC20-48S15W	18 ~ 75	15	106	1330	10	82	755
FDC20-48D05W	18 ~ 75	±5	±140	± 2000	10	81	±3400
FDC20-48D12W	18 ~ 75	±12	±67	± 833	15	83	±680
FDC20-48D15W	18 ~ 75	±15	±53	± 666	20	83	±450

\* The output requires a minimum loading on the output to maintain specified regulation. Operation under no-load condition will not damage these devices, however they may not meet all listed specification.

INPUT SPECIFICATIONS						
Parameter	Conditions		Min.	Typ.	Max.	Unit
Operating input voltage range	FDC20 series	12Vin(nom)	9	12	18	VDC
		24Vin(nom)	18	24	36	
		48Vin(nom)	36	48	75	
	FDC20W series	24Vin(nom)	9	24	36	VDC
		48Vin(nom)	18	48	75	
Start up time	Constant resistive load	Power up	20			ms
Input surge voltage	100 ms, max.	12Vin(nom)				36
		24Vin(nom)				50
		48Vin(nom)				100
Input filter	Pi type					
Remote ON/OFF	Referred to -Vin pin	Positive logic	DC-DC ON			mA
		DC-DC OFF	Open or 3.5 ~ 12VDC			
		Input current of Ctrl pin	-0.5	Short or 0 ~ 1.2VDC		
		Remote off input current	20			mA

OUTPUT SPECIFICATIONS								
Parameter	Conditions		Min.	Typ.	Max.	Unit		
Voltage accuracy	Single / Dual		-1.0	+1.0		%		
	Triple: 3.3Vout, 5Vout		-1.0	+1.0				
	Triple: 12Vout, 15Vout		-5.0	+5.0				
Line regulation	Low Line to High Line at Full Load	Single	-0.2	+0.2		%		
		Dual	-0.5	+0.5				
		Triple: 3.3Vout, 5Vout	-1.0	+1.0				
		Triple: 12Vout, 15Vout	-5.0	+5.0				
Load regulation	Min. Load to Full Load	Single	-0.5	+0.5		%		
		Dual	-3.0	+3.0				
		Triple: 3.3Vout, 5Vout	-2.0	+2.0				
		Triple: 12Vout, 15Vout	-5.0	+5.0				
Cross regulation	Dual: Asymmetrical load 25%/100% FL Triple: Main output:(3.3Vout, 5Vout) 100% load, auxiliary 100%, other auxiliary 25% to 100% load.	Dual	-5.0	+5.0		%		
		Triple: 3.3Vout, 5Vout	-2.0	+2.0				
		Triple: 12Vout, 15Vout	-5.0	+5.0				
Voltage adjustability						-10	+10	%
Ripple and noise	Measured by 20MHz bandwidth	Single	75			mVp-p		
		Dual	100					
		Triple: 3.3Vout, 5Vout	50					
		Triple: 12Vout 15Vout	120 150					
Temperature coefficient						-0.02	+0.02	%/°C
Transient response recovery time	25% load step change	Single / Dual	250			µs		
		Triple	500					
Over voltage protection	Zener diode clamp	3.3Vout	3.9			VDC		
		5Vout	6.2					
		12Vout	15					
		15Vout	18					
Over load protection	% of lout 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				300	pF
Switching frequency		270	300	330	kHz
Safety approvals	IEC/ UL/ EN60950-1			UL:E193009 CB: UL(Demko)	
Case material				Nickel-coated copper	
Base material				Non-conductive black plastic	
Potting material				Epoxy (UL94 V-0)	
Weight				48g (1.69oz)	
MTBF	MIL-HDBK-217F, Full load			1.922 x 10 <sup>6</sup>	hrs

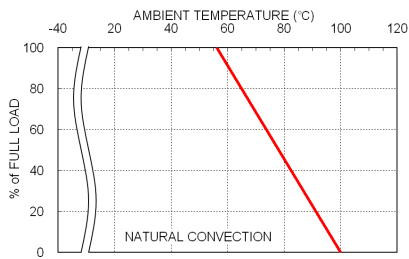
**ENVIRONMENTAL SPECIFICATIONS**

Parameter	Conditions	Min.	Typ.	Max.	Unit
Operating ambient temperature	With derating	-40		+85	°C
Maximum case temperature				+100	°C
Storage temperature range		-55		+125	°C
Thermal impedance	Natural convection Without heat-sink With heat-sink		10 8.24		°C/W
Thermal shock					MIL-STD-810F
Vibration					MIL-STD-810F
Relative humidity					5% to 95% RH

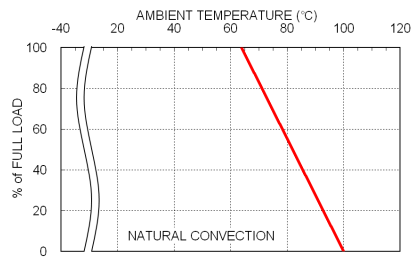
**EMC SPECIFICATIONS**

Parameter	Conditions	Level
EMI	EN55032 With external components	Class A, Class B
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	Perf. Criteria B
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 With an external input filter capacitor (Nippon chemi-con KY series, 220μF/100V)	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8 100A/m continuous; 1000A/m 1 second	Perf. Criteria A

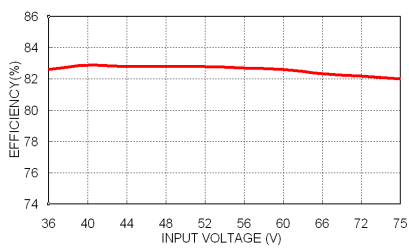
**CAUTION:** This power module is not internally fused. An input line fuse must always be used.

**CHARACTERISTIC CURVE**


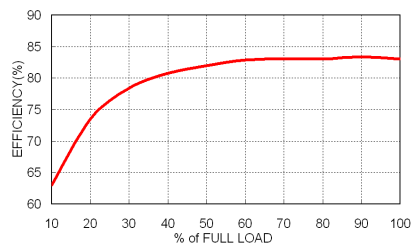
FDC20-48S05 Derating Curve



FDC20-48S05 Derating Curve With Heat-sink



FDC20-48S05 Efficiency vs. Input Voltage



FDC20-48S05 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.

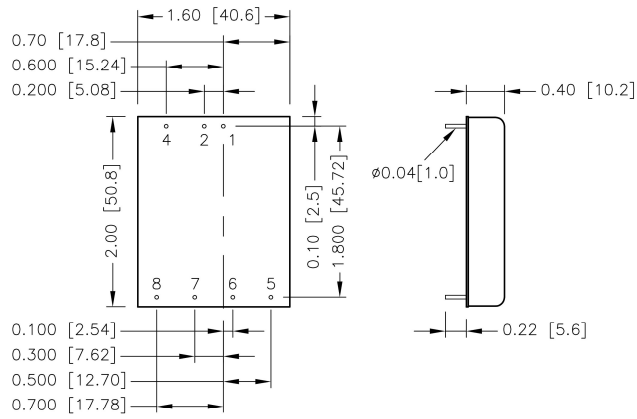
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

The input line fuse suggest as below :

Model	Fuse Rating (A)	Fuse Type
FDC20-12□□□□	4	Slow-Blow
FDC20-24□□□□	2	Slow-Blow
FDC20-48□□□□	1	Slow-Blow
FDC20-24□□□□W	4	Slow-Blow
FDC20-48□□□□W	2	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

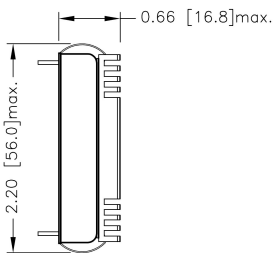
**PIN CONNECTION**

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

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**

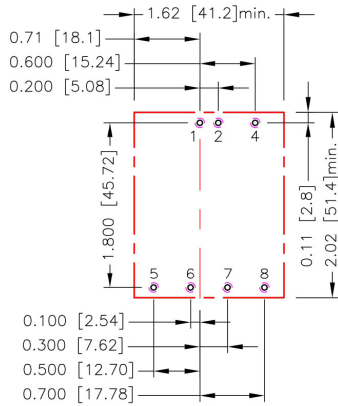
**-HC** (Heat-sink with clamps)



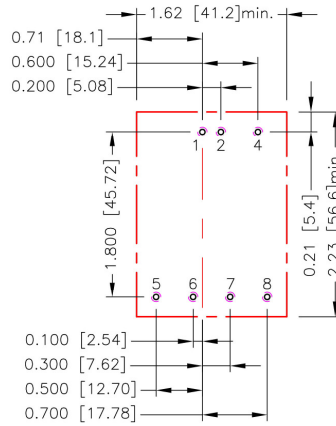
\* All dimensions in inch [mm]

**RECOMMENDED PAD LAYOUT**

**Standard**



**-HC**



All dimensions in inch[mm]  
 Pad size(lead free recommended)  
 Through hole 1.2.4.5.6.7.8: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.

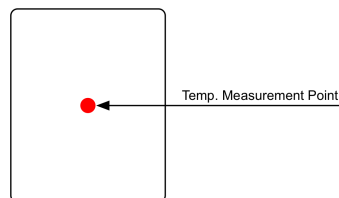
Proper cooling can be verified by measuring the point as the figure below.

The temperature at this location should not exceed 100°C.

When Operating, adequate cooling must be provided to maintain the test point temperature at or below 100°C.

Although the maximum point Temperature of the power modules is 100°C, 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

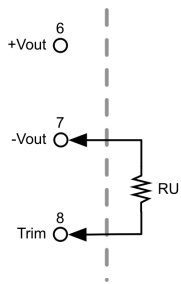
Output voltage set point adjustment allows the user to increase or decrease the output voltage set point of the module. This is accomplished by connecting an external resistor between the Trim pin and either the +Vout or -Vout pins. With an external resistor between the Trim and -Vout pin, the output voltage set point increases. With an external resistor between the Trim and +Vout pin, 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

##### Single Output



##### □□S3P3/ □□S3P3W

$\Delta V$ (%)	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

##### □□S05/ □□S05W

$\Delta V$ (%)	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

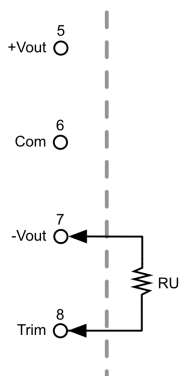
##### □□S12/ □□S12W

$\Delta V$ (%)	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 $\Omega$ )	367.91	165.95	98.636	64.977	44.782	31.318	21.701	14.488	8.879	4.391

##### □□S15/ □□S15W

$\Delta V$ (%)	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 $\Omega$ )	404.184	180.592	106.061	68.796	46.437	31.531	20.883	12.898	6.687	1.718

##### Dual Output



##### □□D05/ □□D05W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	10.100	10.200	10.300	10.400	10.500	10.600	10.700	10.800	10.900	11.000
RU (k $\Omega$ )	90.303	40.602	24.034	15.751	10.781	7.467	5.100	3.325	1.945	0.840

##### □□D12/ □□D12W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	24.240	24.480	24.720	24.960	25.200	25.440	25.680	25.920	26.160	26.400
RU (k $\Omega$ )	218.210	98.105	58.070	38.052	26.042	18.035	12.316	8.026	4.690	2.021

##### □□D15/ □□D15W

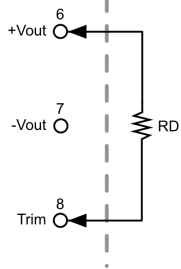
$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	30.300	30.600	30.900	31.200	31.500	31.800	32.100	32.400	32.700	33.000
RU (k $\Omega$ )	268.288	120.644	71.429	46.822	32.058	22.215	15.184	9.911	5.810	2.529



**OUTPUT VOLTAGE ADJUSTMENT (CONTINUED)**

## Trim-down

## Single Output


 S3P3W

$\Delta V$ (%)	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

 S05W

$\Delta V$ (%)	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

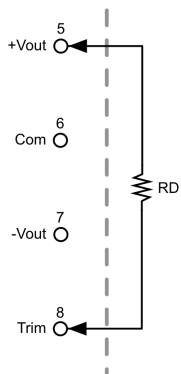
 S12W

$\Delta V$ (%)	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	207.95	123.6	81.423	56.118	39.249	27.199	18.162	11.132	5.509

 S15W

$\Delta V$ (%)	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 $\Omega$ )	499.82	223.41	131.27	85.204	57.563	39.136	25.974	16.102	8.424	2.282

## Dual Output


 D05/  D05W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	9.900	9.800	9.700	9.600	9.500	9.400	9.300	9.200	9.100	9.000
RD (k $\Omega$ )	109.297	48.998	28.899	18.849	12.819	8.799	5.928	3.775	2.100	0.760

 D12/  D12W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	23.760	23.520	23.280	23.040	22.80	22.560	22.320	22.080	21.840	21.600
RD (k $\Omega$ )	273.442	123.016	72.874	47.803	32.760	22.732	15.568	10.196	6.017	2.675

 D15/  D15W

$\Delta V$ (%)	1	2	3	4	5	6	7	8	9	10
Vout (V)	29.700	29.400	29.100	28.800	28.500	28.200	27.900	27.600	27.300	27.000
RD (k $\Omega$ )	337.712	152.022	90.126	59.178	40.609	28.230	19.387	12.756	7.598	3.471